



The LEADing Practice Risk Ontology

This white paper is being shared with OMG as a part of their strategic partnership between OMG and Leading Practice Enterprise Standards to develop joint and more integrated standards. This document has the ID number:

LEAD # ES10023ALL

OMG# BMI/2015-02-01

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Key Words: Risk Definition, Risk analysis, Risk modelling, Risk engineering and Risk architecture, Risk concepts, Risk relations, Risk semantics, Risk categories, Risk Objects, Risk Meta Objects, Risk Meta Model, Risk Meta-Meta Model,

Abstract

The Risk Ontology presented in this publication has taken over a decade to research and develop, with hundreds of ‘man years’ involved to create the product you have in your hands now. This publication elaborates on the journey to research and develop this risk ontology as well as it described in detail of what it is. It explains the need for a risk ontology, helps to remedy the inconsistent use of risk objects, terms and models. It provides researched benchmarked risk terms and definitions, enabling practitioners to map them to their various ways of working and modelling. Standards bodies like ISO, CEN, OMG, OASIS, and other practitioner organisations have documented vast amounts of business knowledge as frameworks (e.g., TOGAF, ITIL and COBIT), methods and or approaches (e.g. LEAN, Six Sigma, BPR, TQM, BPMN, BPMS, VDML). Each of these standards, frameworks, methods, and approaches have their own vocabulary, and hence definition of terms like activities, events, role, actors, owner, measure or even rule. This semantic heterogeneity might hamper mutual understanding, communication and artefact integration between standards bodies and organisations applying their standards¹. What is needed is a unified ontology and vocabulary for business that is rigorously built according to academic and industry standards and at the same time sufficiently detailed to be immediately applicable by practitioners in areas such as business modelling.

This paper introduces a Risk Domain Ontology, which from now on will be referred to as the ‘Risk Ontology’, which incorporates various constructs that can be found in risk standards and frameworks. As ontologies, of which a vocabulary is an immature stage, can be constructed rigorously, the artefact presented below is a domain ontology. By providing benchmark terms and definitions and mapping those terms and definitions to the terms in other existing framework’s vocabularies, this risk ontology is expected to help remedy the inconsistent use of terms around risk management, risk modelling, risk engineering, and risk architecture disciplines. As these mappings demonstrate the shared use of terms in the risk ontology and several business standards and reference frameworks, we could argue that the risk ontology documents the

¹ Jung, J. J. (2009). Semantic business process integration based on ontology alignment. Expert Systems with Applications, 36(8), 11013-11020. doi: <http://dx.doi.org/10.1016/j.eswa.2009.02.086>

dominant business vocabulary, while mitigating semantic heterogeneity, identifying vocabulary overlap (e.g., the same word that is used in both standards) and signalling complementarity (e.g., a concept that is present in one standard and not in another) between business standards.

The risk ontology is being formalised using the Global University Alliance risk research, the LEADing Practice Risk Standards and communicating it in the Object Management Group's (OMG) Meta-Object Facility (MOF)² concept, and structure, of which the core is also available as an ISO standard. MOF provides a framework for defining meta-models for data, modelling and programming languages as well as describing concepts. The several ontology definition formats (e.g. RDF, OWL, Common Logic) have been defined in MOF through the Ontology Definition Meta-model (ODM)³. As MOF has also been used to define UML, it allows for the creation of ontology-based domains-specific modelling languages. As MOF also defines the XML Metadata Interchange (XMI) standard recognised by ISO, it allows for a transformation of any instance of MOF to an XML format for online exchange and digital sharing. Like XML, RDF and OWL, which are W3C web standards⁴. Through the Interface Definition Language (IDL), MOF also integrates with programming languages (e.g., C++, Java), which would allow for ontology-based programming⁵. As many other business modelling specifications (e.g., VDML, BPMN, SBVR⁶) have been formalised in MOF a formalisation of the risk ontology will facilitate the mapping between them. This will be present in the following way in this publication. Firstly, how the research and findings came about through the Global University Alliance. The research team, the research questions as well as the risk framework, methods, approaches and concepts studies. The publication and papers researched and how folksonomy concepts where used to define risk, identify and describe the most common meta objects used within Risk concepts. This includes what are the most common terms around the risk object classes, stereo types and subtypes. In addition, we will discuss how Semantic concepts where used to capture and define the most common structure and

² <http://www.omg.org/spec/MOF/2.0/>

³ OMG, Ontology Definition Metamodel (ODM), Version 1.1

⁴ W3C. (2008). Extensible Markup Language (XML) 1.0 (Fifth Edition), from <http://www.w3.org/TR/2008/REC-xml-20081126/>

W3C (Producer). (2012). OWL 2 Web Ontology Language Retrieved from <http://www.w3.org/TR/2012/REC-owl2-quick-reference-20121211/>

W3C. (2014). RDF Schema 1.1, from <http://www.w3.org/TR/2014/REC-rdf-schema-20140225/>

⁵ OMG. (2006). MOF To IDL Mapping (MOF2I).

OMG. (2008). IDL To Java Language Mapping (I2JAV).

OMG. (2014). IDL To C++11 Language Mapping.

OMG. (2014). Interface Definition Language (IDL) 3.5.

⁶ OMG. (2013a). Business Process Model And Notation (BPMN).

OMG. (2014d). Value Delivery Modeling Language (VDML).

relationships. Enterprise Modelling, Engineering and Architecture concepts were applied to identify the most common Risk Models. This includes using the LEADing Practice decomposition and composition standard⁷ to identify where do the objects and the specific relations appear in various models. This is seen as a huge benefit as the risk concepts can then be applied back to various modelling standards such as process modelling, value modelling, rule modelling as well as enterprise architecture concepts such as business architecture, application architecture and technology architecture. It is also in the risk model that the objects involved with 'possible risk' and those with 'actual risk' are specified. After that the risk meta models are presented, with clear defined hierarchic relationships that allow of a polymorphic inheritance of properties in the meta models. Followed by the outlining and description of the meta meta model, with all its objects, relations which all the risk ontology aspects conform to. The Risk Ontology lessons learned and its advantages are summarized in the final section. We hope you have as much joy reading it as we have had writing it.

⁷ LEADing Practice Categorization & Classification Standard - Reference Content LEAD-ES30008ES

Chapter 1: Background Information around the Global University Alliance

Before we start exploring the risk analysis and research we would like to introduce who we are and what we do in the Global University Alliance (GUA). After 5 years of collaboration, we founded in 2004, the GUA as a non-profit work and international consortium of university lecturers and researchers whose aim it is to provide a collaborative platform for academic research, analysis and development and to explore leading practices, best practices as well as to develop missing practices. The GUA currently consists of over 450 universities, lecturers and researchers from across the world and is growing rapidly in size and scope. The aim is to align intellectual resources across the academic world to:

- **RESEARCH:** Address research concerns and questions that span around enterprise ontology and thereby the enterprise concepts, design, functions, tasks, information handling and governance and the relationships between those concepts within enterprise modelling and enterprise architecture disciplines.
- **UNIVERSITY CURRICULA:** Develop university curricula for both Bachelor and Master level (existing BPM, Risk Modelling, Ontology, Business Model, SOA, Enterprise Architecture, Sustainability, Information Management and Project Management).
- **DEVELOP STANDARDS:** Package applied academic research and findings into Enterprise Standards that can be used by industries and universities alike.
- **COMMUNITY SHARING:** Share and publish the findings either in publications or to this open standard community.

The Global University Alliance structured way of working

The Global University Alliance promotes a new way of thinking, working and modelling combining the much needed connection between academic research and practitioner usage. In the following we would like to elaborate on the structured way we work in the GUA. In this context we realize that when academics, based on their research, build concepts and artefacts for practitioners, these artefacts need to be constructed **rigorously** to meet up to academic standards and need to be **relevant** for practitioners. Construction rigor is typically considered to be the domain of academia, although practitioners have also acknowledged too create knowledge and artefacts relevant to

themselves and others⁸. Academic artefact design methodologies have considered academia as a source of rigorously designed knowledge and artefacts, of which the relevance can be tested in practice. However, we observe an ever growing involvement of practitioners in academic design science (DS). March & Smith⁹ hint towards an evaluation of academic artefacts in a real world setting, as in natural science. Hevner et al.¹⁰, consider the organisational context in which academic artefacts need to serve as a mayor influence on relevance and explicitly mention the possibility to evaluate in academic artefacts in the real world through case studies and field studies. Peffers et al¹¹ identify practitioner feedback as an essential aspect of artefact evaluation in a real world setting. Sein et al¹². model the design of rigorous and relevant artefacts as a collaborative process between academics and practitioners. In a first phase of their action-design-research (ADR) methodology academics give the initial version of the artefacts to a small group of practitioners (e.g., a community/panel of experts), who provide feedback that helps the mature the artefact. In a second phase, this improved artefact is applied by a larger group of practitioners, whose feedback will allow the academic to improve his artefact further. If this feedback requires no further modifications of the artefact, a final version of the artefact is published. Although ADR is a very mature methodology in academia-driven artefact design, it could be made more generic (generally applicable) by alleviating (eliminating) two implicit constraints (biases) present in all DS and ADR publications:

- 1) Academia is the single source of rigorously constructed knowledge
- 2) User requirements are invariable.

To the mentioned point 1) Although practitioners typically create knowledge (artefacts) that is (are) relevant for them in a specific organisational context, this does not necessarily imply that this knowledge cannot be generalised and applied in other organisational contexts. This generalisation (and evaluation) would typically be the role of academia in this kind of knowledge creation scenario. There are multiple instance of such artefacts existing today. For example the BCG matrix

⁸ Nonaka, I., From Information Processing to Knowledge Creation, Pergamon. Technology In Society, Vol. 18. No. 2, pp. 203-218, Published by Elsevier Science Ltd, 1996.

⁹ March, S. T., Smith, G. F., Design and natural science research on information technology. Decision Support Systems, 15(4), pp. 251-266., 1995

March, S. T., Storey, V. C., Design Science in the Information Systems Discipline: An introduction to the special issue on design science research, MIS Quarterly, Vol. 32(4), pp. 725-730. 2008

¹⁰ Hevner AR; March ST; Park J & Ram S. "Design science in information systems research". MIS quarterly. 2004;28(1): 75-105.

¹¹ Peffers, K., Tuunanen, T., Rothenberger, M., and Chatterjee, S., A design science research methodology for information systems research, Journal of Management Information Systems 24 (3), ME Sharpe, 2008

¹² Sein, Maung K.; Henfridsson, Ola; Purao, Sandeep; Rossi, Matti; and Lindgren, Rikard. 2011. "Action Design Research," MIS Quarterly, (35: 1) pp.37-56.

which was created by the Boston Consulting Group in 1970 to help analyze organizations product lines. Enabling organizations to allocate resources as well as use it as an analytical tool in brand marketing, product management, strategic management, and portfolio analysis. While widely used, several academic evaluations have given feedback on its usage as a growth–share matrix^{13,14}. A detailed academic study from Slater and Zwirlein¹⁵, analyzed 129 organizations, concluded that those who follow the BCG matrix as a portfolio planning model for growth success, had lower shareholder returns. The study concluded, that the BCG matrix is a relevant and useful artefact it was applied wrong and it should be applied in other general contexts. Such an evaluation would typically be the role of academia in this kind of knowledge creation scenario.

To the mentioned point 2) In ADR, an academic artefact is handed over to practitioners as soon as they accept it. This approach does not account for new feedback when user requirements have changed and the artefact is no longer relevant in its current form.

From requirement engineering, requirement modelling as well as requirement architecture it is a known fact that user requirements continuously change^{16,17}. Therefore, what in reality is needed is an approach that allows continuous artefact improvement/modification through continuous user feedback, and values user knowledge as valid (relevant) input (which could be made more rigorous).

From the above discussion points, we can conclude that the interlink between academia and practitioners the following:

- **Rigor versus Relevance:** we can determine that Academia does Rigor best, while Practitioners do Relevance best
- **Abstraction level:** Academia typically design solutions at the type level (solution for a type of problem) while Practitioners typically design solutions at instance level (solution for a particular problem)

¹³ Armstrong, J. Scott and Brodie, Roderick J. (1994). "Effects of portfolio planning methods on decision making: experimental results". *International Journal of Research in Marketing (Science Direct)* 11 (1): 73–84. doi:10.1016/0167-8116(94)90035-3.

¹⁴ Competitor-oriented Objectives: The Myth of Market Share
http://cogprints.org/5196/1/myth_of_market_share.pdf See discussion on page 14.

¹⁵ Slater, Stanley F. and Zwirlein, Thomas J., Shareholder Value and Investment Strategy Using the General Portfolio Model, *Journal of Management* December 1992 vol. 18 no. 4 717-732

¹⁶ Gotel, O., Finkelstein, A. An Analysis of the Requirements Traceability Problem Proc. of First International Conference on Requirements Engineering, 1994, pages 94-101

¹⁷ Ralph, P., and Wand, Y. A Proposal for a Formal Definition of the Design Concept. In, Lyytinen, K., Loucopoulos, P., Mylopoulos, J., and Robinson, W., (eds.), *Design Requirements Engineering: A Ten-Year Perspective*: Springer-Verlag, 2009, pp. 103-136

- **Knowledge creation processes** should interlink between rigor and relevance, of which the rigor aspect can be analyzed in theory best and the relevance can be tested in practice best. Therefore:
 - Combining explicit knowledge to develop new explicit knowledge. Academia typically combines explicit knowledge at type or instance level to create new knowledge at type level. Whereas the practitioners typically combine explicit knowledge at type or instance level to create new knowledge at instance level
 - Internalization: converting explicit knowledge (e.g. books, standards) to tacit knowledge (e.g. personal knowledge). Academia typically teaches explicit knowledge to be transformed into tacit knowledge of students (e.g. practitioners). Whereas practitioners typically study academic and non-academic material to develop competencies (tacit knowledge).
 - Socialization: Sharing tacit knowledge through interaction. Academia research share tacit knowledge in doing research and publications together. Whereas practitioners share tacit knowledge by doing things together (and learning from each other while doing)
 - Externalization: The need to convert tacit knowledge into explicit knowledge. Academia study in this context, what practitioners do (at instance level) to create new knowledge at type level. Whereas practitioners sometimes document what they do, and sometimes share this content (e.g. industry standards, best practices)
 - Continuous feedback loop: There should be an infinite loop of sharing and feedback between academia and practice

In the following we will present how the Global University Alliance as a group of Academics work with practitioners:

1) [The Global University Alliance Risk Ontology key Team](#)

The Global University Alliance currently consists of over 450 universities, lecturers and researchers from across the world. The aim it is to provide a collaborative platform for academic research, analysis and development and to explore de-facto standards in terms of researching leading practices and best practices as well as to develop missing aspects/concepts. To manage the size of a complex research topic like Risk and better network across universities, lecturers and researchers, we have defined research responsibilities in key areas. It is the aim that the key research responsible provides the international platform where universities and thought leaders can interact to conduct research in the key aspect of the overall research. The Risk research and analysis started in 2004 and additional focus areas of identifying the risk objects, develop meta object where added in 2009. With the practical testing within organizations in 2011,2012 and 2013,

the meta models ontology was updated in 2014. Many hundreds of people have been direct involved over the many years in researching, comparing, identify pattern, peer reviewing, categorizing and classifying, again peer reviewing, developing models and meta models, again peer reviewing, specify a meta meta model with an additional peer review and at last but not least developing the Global University Alliance Risk Ontology with a LEADing Practice standard and all its reference content, included a tremendous academic and practitioner peer review process. Over a decade has past, with hundreds of man years involved to develop the Risk Ontology that you have in your hands now. The key people involved in this process where among others the following persons:

- **Risk Ontology research responsible:** Professor Mark von Rosing, Global University Alliance, Chairman-Board of Directors
- **Ontology research responsible:** Professor Wim Laurier, Saint-Louis University Brussels & Ghent University, Belgium
- **Semantic research responsible:** Professor Simon Polovina, Sheffield Hallam University, UK
- **Enterprise Architecture research responsible:** John A. Zachman, Inventor and Father of Enterprise Architecture, Zachman International
- **Business Process research responsible:** Professor August W. Scheer, Inventor and Father of Business Process Management, Scheer Group
- **Information Systems research responsible:** Professor Hans Scheruhn, Harz University, Germany
- **Role Oriented Modelling research responsible:** Professor Maxim Arzumanyan, St. Petersburg University, Russia
- **Enterprise Agile research responsible:** Professor Asif Gill, University of Technology, Sydney, Australia
- **Business Model research responsible:** Maria Hove, Global University Alliance, Researcher & Business Analyst
- **Enterprise Sustainability research responsible:** Prof. David Coloma Guerrero, Universitat Politècnica de Catalunya, Spain
- **System of Systems Dynamics research responsible:** Adam D.M. Svendsen, PhD, Copenhagen Institute for Futures Studies (CIFS)
- **Value Model research responsible:** Joshua von Scheel, Global University Alliance, Researcher & Value Analyst
- **System Engineering research responsible:** Jonnro Erasmus, Enterprise Engineer at the Council for Scientific and Industrial Research (CSIR)
- **Product Engineering research responsible:** Jonnro Erasmus, Enterprise Engineer at the Council for Scientific and Industrial Research (CSIR)

- **Measurement & Reporting research responsible:** Ulrik Foldager, Global University Alliance, Researcher & Business Innovation & Transformation Analyst
- **Social Media research responsible:** Prof. Zakaria Maamar, Zayed University, United Arab Emirates
- **Social Machine research responsible:** Prof. Vanilson Buregio, Federal University of Pernambuco, Recife, Brazil
- **Insurance Industry research responsible:** Prof. Michael Koller, Universitätsklinikum Regensburg, Germany, Prudential, UK
- **ERP & Analytics research responsible:** Prof. Karin Gräslund, RheinMain University-Wiesbaden Business School, Germany
- **Meta Model responsible:** Neil Kemp, LEADIng Practice
- **Enterprise Standard responsible:** Henrik von Scheel, LEADIng Practice, CEO

2) Standard Bodies

- LEADIng Practice (LEAD) – an Enterprise Standard Body
- International Organization for Standardization (ISO)
- European Committee for Standardization (CEN)
- Institute of Electrical and Electronics Engineers –IEEE
- Object Management Group (OMG) – a Software Standard Body
- Energetics – an Oil & Gas Standard Body
- Information Security Forum (ISF)
- Standards Coordinating Council (SCC)
- Council for Scientific and Industrial Research (CSIR)

3) Government organizations

- US Government
- Government of Australia
- Government of Canada
- Canada Boarder Service Agency
- Canadian Defense
- German Federal Employment
- German Government
- Northern Health
- MITRE
- European Patent Office

- North Atlantic Treaty Organization (NATO)
 - Danish Defense
 - French Defense
 - Swiss Defense
 - National Aeronautics and Space Administration (NASA)
- 4) **Organizations**, among the hundreds of industry organizations we worked with, some of them are listed in appendix 1

Together it was a mix of academics, researches, standard bodies, governments, research institutes and industry. In this context the **Global University Alliance is responsible for rigor** (making sure the artefacts meet academic standards):

- GUA has or develops standards and artefacts based on academic knowledge and teaches them to practitioners (standard ADR)
- 5) GUA studies pattern practitioners content to create reference content (Accepting Practitioner input, and incorporating it in content of academic level)
- 6) GUA distributes new reference content among LEAD practitioners (Like ADR, but originating in practitioner content)
- 7) GUA studies what practitioners have developed and link it to other academic knowledge in order to standardize (improve) it (Unique in LEAD x GUA)

The **LEADing Practice Enterprise Standard Body focusses on relevance for practitioners**:

- LEAD practitioners learn the standards and learn to use the artefacts and apply them in practice (standard ADR)
- 8) LEAD practitioners create content according to the standards and artefacts and share it with GUA members
- 9) LEAD practitioners learn to use reference content, apply it and provide feedback (Like ADR, but original knowledge comes from practice (leading practices))
- 10) LEAD practitioners develop new approaches and artefacts that are shared with GUA (Sharing is unique in LEAD x GUA)

After years of research (starting in 2004), in 2009, the first risk ontology was published within the 'LEADing Practice' Enterprise Standard organization. As mentioned before, through its ties with the LEADing Practice community, which includes large firms and governments, the GUA was able to evaluate and valorize its scientific output. Where the risk standard was packed as "Reference Content" and is both agnostic and vendor neutral. Designed to be tailored and implemented by any

organization, both large and small, regardless of its various frameworks, methods, products/services or activities. In the following we will elaborate on the risk analysis and research

Chapter 2: The Risk Research & Analysis

We are for the most asked why we developed a Risk Ontology and the answer is actually quite basic. We saw the confusion in the market around the subject and especially the need. For example, all the various Risk frameworks, methods, approaches and or concepts have their own vocabulary. Each of these vocabularies have their own definition of terms, like what is Risk, objects related to risk or even how does compliance and rules apply to risk. The lack of standard Risk terms, definitions, and concepts was the starting point of the Global University Alliance¹⁸ (GUA) interest around the topic. We in the GUA, which is an international consortium of universities, professors, lecturers and researchers whose aim it is to provide a collaborative platform for academic research, analysis and development and to explore leading practices, best practices as well as to develop missing practices, believed that Risk was worthy of further investigation. With currently over 450 universities, lecturers and researchers from across the world the risk analysis was coordinated with a research team¹⁹, chosen by the GUA Board . The first analysis and research in 2004, identified that the lack of repeatable standards around risk in the concepts of enterprise modelling, engineering and architecture concepts, results in unnecessary threats, danger, jeopardy, vulnerabilities, endangerment and safety issues. The need to identify relevant aspects, reusable/replicable pattern and develop models that can be used by any organization, both large and small, regardless of its products/services, activities or industry, became apparent. In September 2004, the research and analysis on how organizations apply risk within various enterprise modelling, engineering and architecture concepts was initiated. Throughout this process of analyzing and identifying the de-facto way of modelling, engineering and architecting risk in various concepts was the basis of specifying which objects are involved with risk.

The underlying research questions where among others:

- What is risk?
- How is risk being modelled, engineered and architected?
- What are the most common risk meta objects?
- What are the most common risk object classes?

¹⁸ www.globaluniversityalliance.net

¹⁹ See GUA Risk Leadership Research team in the end of the document

- What are the most common risk object stereo types?
- What are the most common risk object subtypes?
- What are the most common Risk terms used?
- Which semantic relationships do the objects have between each other?
- Which is the most common Risk Models?
- Where do the objects and the specific relations appear in various models?
- Which objects are involved in the 'possible risk' modelling, engineering and architecture?
- Which objects are involved in the 'actual risk' modelling, engineering and architecture?

The Global University Alliance used the concept of ontology as both a shared vocabulary and the very definition of its objects and concepts. In order to go the next steps and fully use the potential of developing the risk ontology. The Risk Ontology, includes all the above mentioned research findings and developed based on them the following:

- Define a Risk Object overview
- Develop a Risk categorization and classification
- Specify a Risk Taxonomy
- Describe a Risk Model with specific representation of the real world objects.
- Develop a Risk Meta Model describing the objects within the Models.
- Create a Risk Meta-Metamodel that defines and describes the various Risk Metamodel and their relations.

The main body of research and analysis was structured in the following ways:

- Research and analyse what works around risk modelling, engineering and architecture, again and again (best practice), and what are unique practices applied by leading organizations (leading practices).
- Identify common and repeatable patterns which provide the basis for the Risk Ontology.
- Develop "Reference Content" in terms of risk objects, risk semantic relations, risk taxonomy, risk models, risk meta model etc., that increase the level of re-usability and replication within the field of risk modelling, risk engineering and risk architecture.
- Extended with accelerators that adopt and reproduce the identified risk best practices and leading practices.

Framework and concepts studied:

Surrounded by multiple different risk frameworks, methods, approaches, concepts and even more publications on the subject, did we do an intensive research on the existing body of knowledge. Among the many relevant, here are the 27 framework/concepts we used most, followed by the 114

publications we quoted or used most from. The list does not reflect importance of subject or that other framework or publications are not relevant, they were chosen as these having the information we used (in addition to the market research). Simply stating that due to space limit we could not list the hundreds of framework, methods, approaches, concepts and publications on the subject. We therefore only mention the most used framework/concepts and publications and believe they cover the subject discussed from various angles:

Framework/Concept	Organization
Risk Management Working Group	International Council on System Engineering (INCOSE)
Project Management Institute (PMI) Risk Management Specific Interest Group (RiskSIG)	Risk Management Specific Interest Group (RiskSIG)
Environmental Risk Management Authority	ERMA
Institute of Risk Management	IRM
ISO 31000 - standards relating to risk management	ISO-International Organization for Standardization
RiskAoA - Risk Analysis of Alternatives	United States Department of Defense (USDoD)
Risk Management Agency (RMA)	U.S. Department of Agriculture
US Farm Policy and Risk Assistance	ICTSD Programme on Agricultural Trade and Sustainable Development
Standard Risk Taxonomy	The Open Group
ISO/IEC Guide 73:2009. Risk management - Vocabulary	ISO-International Organization for Standardization
Guide for Applying the Risk Management Framework to Federal Information Systems	NIST-National Institute of Standards and Technology
Federal Emergency Management Risk concepts	Federal Emergency Management Agency
Information Systems Security Risk concepts	Information Systems Security Association - Risk concepts
Risk Governance	International Risk Governance Council
Risk concepts	Global Risk Forum
The United Nations Office for Disaster Risk Reduction	UNISDR
Supply Chain and Transport Risk Concepts	World Economic Forum Supply Chain and Transport Risk Initiative

Framework/Concept	Organization
Risk Governance	International Risk Governance Council
ISO/PAS 28000:2007 - Specification for security management systems for the supply chain	ISO-International Organization for Standardization
Risk Management	Risk Management Authority
Integrated risk	Government of Canada
Corporate risk profiles	Government of Canada
Risk statements	Government of Canada
Risk taxonomies	Government of Canada
Risk management capability model	Government of Canada
A Taxonomy of Threats for Complex Risk Management	Cambridge Centre for Risk Studies
Cambridge Risk Framework	Cambridge Centre for Risk Studies

Table 1 Overview of the key Risk Framework and Concept analyzed

Title	Author(s)	Year
Risk, Uncertainty and Profit, Chicago	Knight, F. H.	1921
Man and Society in Calamity: The Effects of War, Revolution, Famine, Pestilence upon Human Mind, Behavior, Social Organization and Cultural Life	Pitirim Sorokin	1942
The environment as hazard	Ian Burton, Robert Kates, and Gilbert F. White	1978
Judged frequency of lethal events.	Lichtenstein, Sarah; Slovic, Paul; Fischhoff, Baruch; Layman, Mark; Combs, Barbara	1978
Judgment under uncertainty: heuristics and biases	Daniel Kahneman, Paul Slovic, and Amos Tversky	1982
Risk and culture: An essay on the selection of technical and environmental dangers	Mary Douglas, and Aaron Wildavsky	1982
A Philosophical Introduction to the Theory of Risk Evaluation and Measurement	Rescher, Nicholas	1983
Acceptable risk	Baruch Fischhoff, Sarah Lichtenstein, Paul Slovic, Steven L. Derby, and	1984

Title	Author(s)	Year
	Ralph Keeney	
Normal accidents. Living with high-risk technologies	Charles Perrow	1984
Lateral Asymmetry of Risky Recommendations	Drake, R. A.	1985
Cognitive risk-taking after frontal or temporal lobectomy—I. The synthesis of fragmented visual information	Miller, L.	1985
(1985). "Cognitive risk taking after frontal or temporal lobectomy II. The synthesis of phonemic and semantic information." <i>Neuropsychologia</i> , 23, 371–379.	Miller, L., & Milner, B.	1985
Human System Response to Disaster: An Inventory of Sociological Findings	Thomas E. Drabek	1986
An Introduction to Risk Management (2 ed.).	Crockford, Neil	1986
An introduction to risk management	Crockford, Neil	1986
Perception of Risk http://www.uns.ethz.ch/edu/teach/0.pdf	Paul Slovic	1987
Seven Cardinal Rules of Risk Communication.	Covello, Vincent T.; Allen., Frederick H.	1988
Planning for earthquakes: Risks, politics, and policy	Philip R. Berke, and Timothy Beatley	1992
Earth shock: Hurricanes, volcanoes, earthquakes, tornadoes and other forces of nature	W. Andrew Robinson	1993
Taxonomy-based risk identification in software industry. http://resources.sei.cmu.edu/library/asset-view.cfm?assetid=11847	Marvin Carr , Suresh Konda , Ira Monarch , Clay F. Walker , F. Carol Ulrich	1993
At risk: Natural hazards, people's vulnerability and disasters	Piers Blaikie, Terry Cannon, Ian Davis, and Ben Wisner	1994
RISK	John Adams	1995
Against the Gods: The Remarkable Story of Risk	Peter L. Bernstein	1996
Reduction and predictability of natural disasters	John B. Rundle, William Klein, Don L. Turcotte	1996

Title	Author(s)	Year
Evolutionary hypotheses of risk-sensitive choice: Age differences and perspective change	X. T. Wang	1996
Modern Society Shocked by Its Risks	Niklas Luhmann	1996
Regions of risk: A geographical introduction to disasters	Kenneth Hewitt	1997
The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA	Diane Vaughan	1997
Who takes risks? Daring and caution in foreign policy making.	Kowert, P.A., & Hermann, M.G.	1997
Dangerous earth: An introduction to geologic hazards	Barbara W. Murck, Brian J. Skinner, Stephen C. Porter	1998
Paying the price: The status and role of insurance against natural disasters in the United States	Howard Kunreuther, and Richard J. Roth	1998
Against the Gods: The Remarkable Story of Risk	Peter L. Bernstein	1998
The Onset of the East Asian Financial Crisis	Radelet, Steven; Sachs, Jeffrey	1998
Disasters and democracy	Rutherford H. Platt	1999
Natural hazard mitigation: Recasting disaster policy and planning	David Godschalk, Timothy Beatley, Philip Berke, David Brower, and Edward J. Kaiser	1999
Probabilistic Risk Assessment: What Is It And Why Is It Worth Performing It?	Dr. Michael Stamatelatos	2000
Behaviour Research and Therapy, An International Multi-Disciplinary Journal	Joseph I. Constans	2001
Acceptable Risk Processes: Lifelines and Natural Hazards.	Craig Taylor and Erik VanMarcke	2002
"Environmental Risk Analysis: Problems and Perspectives in Different Countries"	Gurjar, Bhola Ram; Mohan, Manju	2002
Risk, Uncertainty and Profit	Frank Hyneman Knight	2002
The social amplification of risk	Nick Pidgeon, Roger E. Kasperson, and Paul Slovic	2003
Megaprojects and Risk: An Anatomy of Ambition	Flyvbjerg, Bent	2003
Enterprise Risk Management: From Incentives to Controls	Lam, James	2003
Social Risk Management: The World Bank	Holzmann, Robert; Lynne Sherburne-	2003

Title	Author(s)	Year
Approach to Social Protection in a Globalizing World	Benz and Emil Tesliuc	
Targeted Transfers in Poor Countries: Revisiting the Trade-Offs and Policy Options	Ravallion, Martin	2003
Mapping vulnerability: disasters, development, and people	Greg Bankoff, Georg Frerks, and Dorothea Hilhorst	2004
Dread Risk, September 11, and Fatal Traffic Accidents	Gerd Gigerenzer	2004
When All Else Fails: Government as the Ultimate Risk Manager	David A. Moss	2004
Defining Risk, Financial Analysts Journal, 60 (6), 19–25. A paper exploring the foundations of risk. (PDF file).	Holton, Glyn A.	2004
Risk and Financial Management: Mathematical and Computational Methods	Charles, Tapiero	2004
Advanced Financial Risk Management: Tools and Techniques for Integrated Credit Risk and Interest Rate Risk Management	van Deventer, Donald R., Kenji Imai and Mark Mesler	2004
Mitigation of hazardous comets and asteroids	Michael J.S. Belton, Thomas H. Morgan, Nalin H. Samarasinha, Donald K. Yeomans	2005
Natural disaster hotspots: a global risk analysis	Maxx Dilley	2005
What is a disaster? New answers to old questions	Ronald W. Perry, and Enrico Quarantelli	2005
Personality and domain specific risk taking". Journal of Risk Research 8 (2)	Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P.	2005
Trust Us and Be Scared: The Changing Nature of Risk	John Handmer and Paul James	2005
Economic Capital and Financial Risk Management for Financial Services Firms and Conglomerates (Finance and Capital Markets)	Bruce Porteous, Pradip Tapadar	2005
Project Manager's Spotlight on Risk Management	Kim Heldman	2005
Quantitative Risk Management. Concepts, Techniques and Tools, Princeton Series in Finance, Princeton, NJ	McNeil, Alexander J.; Frey, Rüdiger; Embrechts, Paul	2005

Title	Author(s)	Year
Global Risk Governance	Ortwin Renn	2005
Quantitative risk management: concepts, techniques and tools	McNeil, Alexander J.; Frey, Rüdiger; Embrechts, Paul	2005
Essentials of financial risk management. John Wiley and Sons	Horcher, Karen A.	2005
Natural hazards: Earth's processes as hazards, disasters, and catastrophes	Edward A. Keller, and Robert H. Blodgett	2006
Socially Responsible Engineering: Justice in Risk Management (ISBN 978-0-471-78707-5)	Daniel A. Vallero, and P. Aarne Vesilind	2006
"An Introduction to Factor Analysis of Information Risk (FAIR)"	Jack A. Jones, CISSP, CISM, CISA	2006
The Role of Risk Avoidance in Anxiety	Jon K. Maner, Norman B. Schmidt,	2006
Introduction to Risk Management and Insurance (9 ed.)	Dorfman, Mark S.	2007
Understanding and Managing Risk Attitude.	David Hillson; Ruth Murray-Webster	2007
Dispositional anxiety and risk-avoidant decision-making, Personality and Individual Differences	Jon K. Maner, J. Anthony Richey, Kiara Cromer, Mike Mallott, Carl W. Lejuez, Thomas E. Joiner, Norman B. Schmidt,	2007
Practical Project Risk Management: The Atom Methodology	David Hillson, Peter Simon	2007
Towards the development of an evolutionarily valid domain-specific risk-taking scale	Kruger, Daniel J.; Wang, Xiao-Tian; Wilke, Andreas	2007
"Risk is a combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s)" (OHSAS 18001:2007).	EMC Europe	2007
Risk analysis: a quantitative guide	David Vose	2008
Swimming with Crocodiles: The Culture of Extreme Drinking	Marjana Martinic and Fiona Measham (eds.)	2008
Governance, Risk, and Compliance Handbook	Anthony Tarantino	2008
The ABCs of Governance Risk and Compliance, SAP GRC For Dummies	Denise Vu Broady, Holly A. Roland	2008

Title	Author(s)	Year
A Guide to the Project Management Body of Knowledge (4th Edition)	Project Management Institute, , Inc.	2008
"Market Risk, Interest Rate Risk, and Interdependencies in Insurer Stock Returns: A System-GARCH Model", The Journal of Risk and Insurance	James M. Carson; Elyas Elyasiani; Iqbal Mansur	2008
Gender differences in financial risk aversion and career choices are affected by testosterone	Sapienza P., Zingales L. and Maestriperi D.	2008
Testosterone and financial risk preferences	Coren L. Apicellaa, Anna Dreberb, Benjamin Campbelld, Peter B. Graye, Moshe Hoffmanf, Anthony C. Littleg	2008
Catalogue of Risks, Natural, Technical, Social and Health Risks	Dirk Proske	2008
Risk and Safety	Aaron Wildavsky and Adam Wildavsky	2008
ICFAI Journal of Financial Risk Management	Conti, Cesare & Mauri, Arnaldo	2008
Building Safer Communities. Risk Governance, Spatial Planning and Responses to Natural Hazards	Urbano Fra Paleo	2009
The Failure of Risk Management: Why It's Broken and How to Fix It.	Hubbard, Douglas	2009
Security Risk Management Body of Knowledge	Julian Talbot and Miles Jakeman	2009
"The Failure of Risk Management: Why It's Broken and How to Fix It	Douglas Hubbard	2009
Identifying and Managing Project Risk: Essential Tools for Failure-Proofing Your Project	Tom Kendrick	2009
Contradictory approaches? On realism and constructivism in the social sciences research on risk, technology and the environment	Andreas Metzner-Szigeth	2009
Building Safer Communities. Risk Governance, Spatial Planning and Responses to Natural Hazards.	Urbano Fra Paleo	2009
A frame of reference for research of integrated Governance Risk and Compliance	Racz, N., Weippl, E. & Seufert, A	2010

Title	Author(s)	Year
Leadership Risk: A Guide for Private Equity and Strategic Investors.	David Cooper	2010
Combating Poverty and Inequality - Structural Change, Social Policy and Politics	United Nations Research Institute for Social Development (UNRISD)	2010
Why Your IT Project May Be Riskier Than You Think	Bent Flyvbjerg and Alexander Budzier	2011
Risk Types. OP Matters No 14 February 2012	Geoff Trickey	2011
A Practical Guide to Delivering Personalisation	Jaimee Lewis, Helen Sanderson	2011
Beyond our imagination: Fukushima and the problem of assessing risk	M. V. Ramana	2011
Fukushima: Consequences of Systemic Problems in Nuclear Plant Design	Diaz Maurin, François	2011
Practical Project Risk Management: The ATOM Methodology	David Hillson and Peter Simon	2012
Practical Risk Management: The ATOM Methodology	Peter Simon and David Hillson	2012
Risk as Feelings in the Effect of Patient Outcomes on Physicians' Subsequent Treatment Decisions: A Randomized Trial and Manipulation Validation	Joshua A. Hemmerich, Arthur S. Elstein, Margaret L. Schwarze, Elizabeth Ghini Moliski, William Dale,	2012
9/11, Act II: a fine-grained analysis of regional variations in traffic fatalities in the aftermath of the terrorist attacks.	Gaissmaier W, Gigerenzer G.	2012
The Risks We Dread: A Social Circle Account	Rocio Garcia-Retamero, Mirta Galesic	2012
Fundamentals of Risk Management, 2nd edition	Hopkin, Pau	2012
Measuring risk literacy: The Berlin Numeracy Test. Judgment and Decision Making	Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R.	2012
Dealing with supply chain risks: Linking risk management practices and strategies to performance	Wieland, A., Wallenburg, C.M.	2012
Common Vulnerability and Exposures list. Cve.mitre.org. Retrieved on 2012-04-17.	Mitre	2012
Floods: From Risk to Opportunity (IAHS Red Book Series)	Ali Chavoshian, and Kuniyoshi Takeuchi	2013

Title	Author(s)	Year
Resisting hybridisation between modes of clinical risk management: Contradiction, contest, and the production of intractable conflict	Fischer, Michael Daniel; Ferlie, Ewan	2013
Resisting hybridisation between modes of clinical riskmanagement: Contradiction, contest, and the production of intractable conflict	Fischer, Michael Daniel; Ferlie, Ewan	2013
When Dread Risks Are More Dreadful than Continuous Risks: Comparing Cumulative Population Losses over Time	Nicolai Bodemer, Azzurra Ruggeri, Mirta Galesic	2013
The Risk Factor: Why Every Organization Needs Big Bets, Bold Characters, and the Occasional Spectacular Failure	Deborah Perry Piscione	2014
"Risk"	Hansson, Sven Ove; Edward N. Zalta,	2014
Introduction to Risk and Failures: Tools and Methodologies	D. H. Stamatis	2014
Risk Oriented Process Modelling	Koller, M. von Rosing, M., Elsevier Publication	2015

Table 2 Overview of the key Risk publications analyzed

What the various threat and risk framework, method and approaches as well as all the great publications on the subject can't tell you the same way, as a research and analysis does, is what works good and what doesn't work so good around threat & risk concepts in the various organizations. Identifying the patterns of what the Outperformers and Underperformers do differently, reveals both worst practices, best practices and leading practices in the field.

Our threat and risk research actually proofed that certain concepts around risk initiatives indeed performed better than others. While some might be skeptical to such an approach, academic studies in such areas are very common. Already a decade ago did Professor Malone at Massachusetts Institute of Technology (MIT) prove that there is a connection to an organizations concepts of models in the business and the overall performance.²⁰ Our research clearly showed the difference of how organizations understood and worked with risk management concepts to potential threats and actual risk.

²⁰ Thomas W. Malone, Do Some Business Models Perform Better than Others? A Study of the 1000 Largest US Firms, Sloan School of Management Massachusetts Institute of Technology 2004.

Lesson #1: Risk Strategy Matters

Our study highlights the importance of having a risk strategy to achieve the organizational objectives and goals. 93 percent of executives with a defined risk strategy view their performance as meeting or exceeding their expectations, while just 50 percent of those without a risk strategy say the same (Figure 1). Refining the risk strategy was three times more likely to be driven by near-term events (financial risk, current compliance issues, direct vulnerabilities or competitor moves) than by long-term factors (long-term economic outlook or the imminent risk of the end of a product life-cycle etc.).



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Figure 1: Organizations with a risk strategy are more likely to meet or exceed their business goals and objectives

Lesson #2: There is a connection between Risk and organizations Business Model

Our research revealed that actual risk that has manifested itself always impacts one of the following business modelling domains:

- Service Model
- Value Model
- Revenue Model
- Cost Model

- Operating Model
- Performance Model

The studies also revealed that organizations re-active risk counter initiatives are mostly centered on operating model, the cost model and the performance model. While the pro-active threat analysis of possible risk happening, was mostly centered on value model, revenue model and service model.

Lesson #3: Having clear defined Risk Management concepts is important

Our study highlights the importance of having a clear defined risk management concept. As a matter of fact, the same organizations that had the risk strategy discussed in lesson # 1, are those that had a clear defined risk management concept. As part of this research, we compared these organizations performance over a 10-year period. We sorted the organizations with publicly available financial information and compared revenue and profit track records with the averages for those in the same industry. When comparing it, the organizations with the risk strategy and the risk management concepts where the differences between the responses of financial outperformers and those of underperformers clear. Organizations that performed above average on the particular financial benchmark were those with the risk strategy and the risk management concepts.

Lesson #4: leading practices around Risk concepts

The outperforming organizations applying risk management aspects, had the following 5 components:

- 1. Risk Measure**
 - 1.1. Historical Predictors
 - 1.2. Statistical Measures
 - 1.3. Vulnerability Analysis
 - 1.4. Volatility Measure
 - 1.5. Risk Benchmark
 - 1.6. Severity Measure
 - 1.7. Impact Rating
 - 1.8. Damage Assessment
- 2. Risk Monitor**
 - 2.1. Risk Identification
 - 2.2. Risk Assessment
 - 2.3. Risk Evaluation
 - 2.4. Risk determination
 - 2.5. Risk Qualification
 - 2.6. Risk Quantification
 - 2.7. Monitoring Risk Activities
- 3. Risk Reporting**
 - 3.1. Risk Scorecard
 - 3.2. Vulnerability report
 - 3.3. Impact Report
 - 3.4. Intelligence Report
 - 3.5. Arrest Report
 - 3.6. Suspicious Event Report
 - 3.7. Activity Report

- 3.8. Risk Status report
- 4. **Risk Rule**
 - 4.1. Risk Programs
 - 4.2. Risk Policies
 - 4.3. Risk Directives
 - 4.4. Risk Standards
 - 4.5. Risk Procedures
 - 4.6. Risk Advice
 - 4.7. Risk Guidelines
 - 4.8. Risk Techniques
- 5. **Risk Compliance**
 - 5.1. Risk Compliance evaluation
 - 5.2. Risk Compliance audit
 - 5.3. Risk Contract
 - 5.4. Risk Governance

The 5 components where applied around risk analysis and risk control as shown in table 3

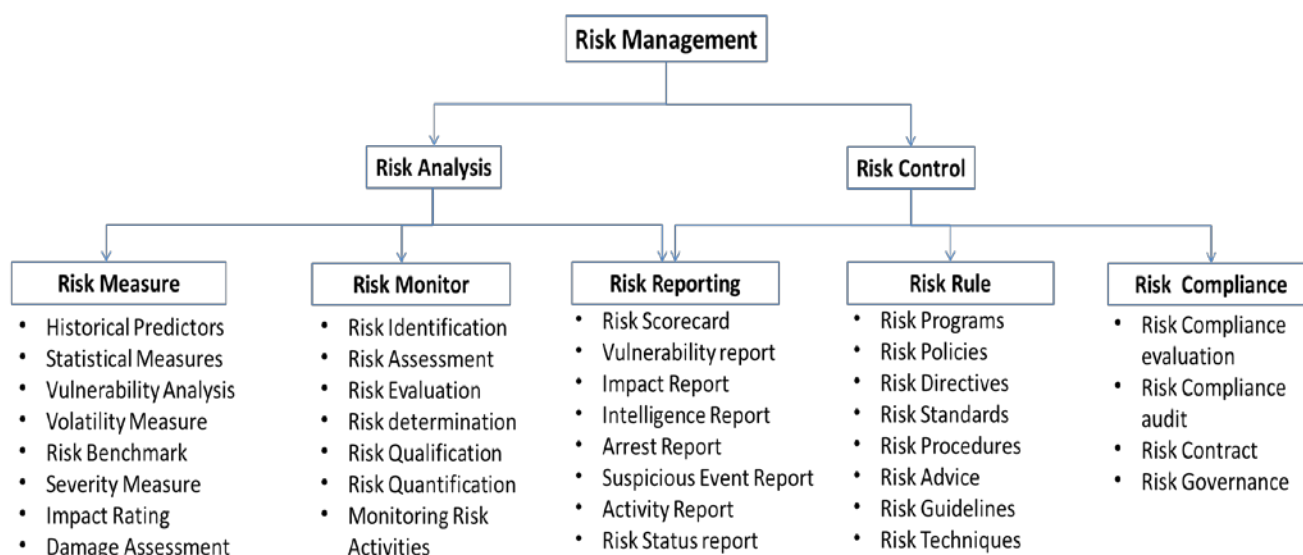
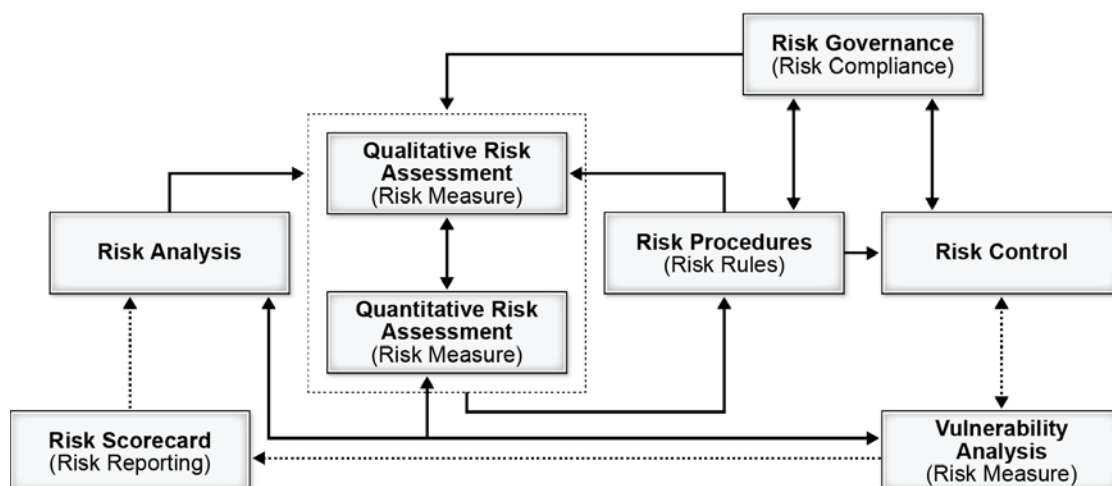


Table 3: Leading practices of Risk Management

It however has to be noted that the flow of how the organizations applied it within their various constructs varied. The most common risk management pattern identified is the one shown in the matrix diagram 1



Matrix diagram 1: The most common risk management pattern

Lesson #5: Having a common terminology around risk matters

When asking the organizations what the biggest issues and problems were around risk concepts where the top 3 answers centred around challenges of different terminology, descriptions and approaches. Leading to a different way of modelling, engineering and architecting risk aspects across the organization. Therefore, despite the huge investments in risk concepts, the nature of a siloed approach led to the lowest maturity level.

Lesson #6: Integrated Risk Models Matters

A remarkable finding was how much integrated risk models i.e. artefacts matter within the organizations. While contrary to many software vendors marketing propaganda that risk is much about data and analytics of data, did we find that the biggest pain point was not only getting knowledge but applying the knowledge to something meaningful. The lack of ability to model, engineer and architect the concepts around risk, was mentioned by nearly all organizations. Therefore, fully integrated and standardized Risk models and artefacts are needed to enable the various subject matter expert/practitioner, or architect (from business to technology) to work with the relevant Risk meta-objects throughout all the architectural layers. Advanced Risk modelling and relating the relevant objects throughout the concepts of role, process, service and value mattered.

Additional findings in terms of what is risk, the most common risk objects, risk description, risk models, the semantic relationships etc. as well as the development of meta model and meta meta model based on those findings are shared in chapter 3-8

Chapter 3: What is Threat and Risk

While not all risk concepts, frameworks, method and approaches have a controlled vocabulary. Ontology should have a controlled vocabulary as a foundation. We will therefore define 'Risk' and then identify the objects involved with risk and specify their meaning.

The concept of threats and risk, is not a new one, the Oxford English Dictionary²¹ cites the earliest use of the word in English in the spelling of *risqué* from its Arabic original " **فزر**", which mean working to gain income gain and profit as of 1621, and the spelling as *risk* from 1655. It defines risk as: (Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility. "(Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility."

While the concept of threat and risk developed over the years, so did the definition of risk. While we don't see the value of listing all, here are some of them:

- OHSAS (Occupational Health & Safety Advisory Services): Risk is the combination of the probability of a hazard resulting in an adverse event, times the severity of the event²².
- The Open Group: Risk can be seen as relating to the probability of uncertain future events²³
- ISO 27005: In information security risk is defined as "the potential that a given threat will exploit vulnerabilities of an asset or group of assets and thereby cause harm to the organization"²⁴.
- The ISO 31000/ ISO Guide 73:2002 definition of risk is the 'effect of uncertainty on objectives'²⁵.
- Financial risk is often defined as the unpredictable variability or volatility of returns, and this would include both potential better-than-expected and worse-than-expected returns²⁶.
- Security risk is any event that could result in the compromise of organizational assets i.e. the unauthorized use, loss, damage, disclosure or modification of organizational assets for

²¹ Oxford English Dictionary

²² OHSAS 18001:2007.

²³ Technical Standard Risk Taxonomy ISBN 1-931624-77-1 Document Number: C081 Published by The Open Group, January 2009.

²⁴ ISO/IEC 27005:2008

²⁵ ISO 31000, ISO-International Organization for Standardization, 2009

²⁶ "Financial Risk: Definition". Investopedia. Retrieved October 2011.

the profit, personal interest or political interests of individuals, groups or other entities constitutes a compromise of the asset, and includes the risk of harm to people²⁷.

So while there are multiple definitions, also to very specific usage, Aven and Renn, have in their research on risk in 2009 in the Journal of risk research²⁸, defined that the two prevailing definitions of risk are: (1) risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain; (2) risk is an uncertain consequence of an event or an activity with respect to something that humans value. According to these definitions, risk expresses an ontology (a theory of being) independent of our knowledge and perceptions. In their paper, they analysed these two types of definitions and concluded that the definitions provide a sound foundation for risk research and risk management, but compared to common terminology, they lead to conceptual difficulties that are incompatible with the everyday use of risk in most applications. Therefore, while a good definition, it was not usable in terms of modelling, engineering or architecting risk aspects. They (Aven and Renn) went so far to proof that by considering risk as a state of the world, one cannot conclude, for example, about the risk being high or low, or compare different options with respect to risk. Making it very difficult to quantify or work with it. Therefore, Aven and Renn proved that the existing definition is adequate definition for understanding risk, but an inadequate definition to model, engineer or architect risk aspects. Their clear conclusion is that a rephrasing of the definition of risk is needed²⁹. Risk both needs to refer to aspects of:

- uncertainty
- severity
- consequences
- the value at stake

The GUA research made the same findings as Aven and Renn, we did however identify an additional six aspects that need to be considered:

- uncertainty
- vulnerability (e.g. weakness)
- severity
- **impact** (e.g. effect)
- consequences

²⁷ Julian Talbot and Miles Jakeman Security Risk Management Body of Knowledge, John Wiley & Sons, 2009.

²⁸ Aven, T., Renn, O. - Journal of risk research, Volume 12, Issue 1, Publisher Taylor & Francis, 2009

²⁹ Aven, T., Renn, O. - Journal of risk research, Volume 12, Issue 1, Publisher Taylor & Francis, 2009

- the value at stake
- **conditions** (e.g. economics, political, social)
- **events** (e.g. disaster, attack, incident)
- **factors** (e.g. cultural, religion, economic, political, social)
- **potential** (e.g. likelihood, probability)

The Global University Alliance definition is therefore the following: “Risk refers to uncertainty in terms of vulnerability and is about the severity and impact of the consequences (or outcomes), with respect to something that is valued. It is the combined impact of any conditions, events or factors that can affect the potential for keeping or achieving desired objectives.”

This definition has proven to be not only adequate as a description for understanding risk, but also adequate for quantifying it according to the widely used Risk Analysis of Alternatives (RiskAoA) from the United States Department of Defense (US DoD)³⁰.

³⁰ Joint Capabilities Integration Development System and (JCIDS) Manual, DODD 5000.1 & DODI 5000.2, United States Department of Defense

Chapter 4 The Value of Ontology

An *ontology* is an manufactured item, more precisely an intentional semantic structure that encodes the set of objects and terms that are presumed to exist in some area of interest (i.e. the universe of discourse or semantic domain), the relationships that hold among them and the implicit rules constraining the structure of this (piece of) reality³¹. In this definition, *intentional* refers to a structure describing various possible states of affairs, as opposed to extensional, which would refer to a structure describing a particular state of affairs³². The word *semantic* indicates that the structure has meaning, which is defined as the relationship between (a structure of) symbols and a mental model of the intentional structure in the mind of the observer. This mental model is often called a *conceptualization*³³. Semantics are an aspect of semiotics, like syntax, which distinguishes valid from invalid symbol structures, and like pragmatics, which relates symbols to their meaning within a context (e.g., the community in which they are shared)³⁴.

Ontologies can be categorized and classified according to several criteria (e.g., context, maturity)³⁵. When ontologies are classified according to their universe of discourse, we distinguish foundational, domain, task and application ontologies³⁶. *Top-level or foundational ontologies* cover a very broad area of interest as they describe very general concepts as space, time and matter that are needed in any field or domain. *Task* and *domain ontologies* all relate to a specific semantic domain (e.g., business process, infrastructure, data) or task (e.g., analysis, design). Domain and task ontology terms reuse or specialize top-level ontology terms or terms used in a domain or task ontology. Finally, *application ontologies* relate to a very specific universe of discourse (e.g. business process design in a particular company, data analysis in a specific department). Their vocabulary can be built from scratch or defined as specializations of both domain and task

³¹ Genesereth, M., & Nilsson, N. (1987). Logical foundations of artificial intelligence. Los Altos, CA: Morgan Kaufmann.

Guarino, N., & Giaretta, P. (1995). Ontologies and Knowledge bases: towards a terminological clarification. In N. Mars (Ed.), Towards Very Large Knowledge Bases: Knowledge Building and Knowledge Sharing (pp. 314): IOS Press.

³² von Rosing, M., Laurier, W., Polovina, S., (2014) Conceptual Structures in LEADiNg and Best Enterprise Practices, Springer Publishing

³³ Gruber, T. R. (1993). A translation approach to portable ontology specifications. Knowledge Acquisition, 5(2), 199-220.

³⁴ Cordeiro, J., & Filipe, J. (2004). The Semiotic Pentagon Framework -- A Perspective On The Use of Semiotics within Organisational Semiotics. Paper presented at the 7TH INTERNATIONAL WORKSHOP ON ORGANISATIONAL SEMIOTICS, Setúbal, Portugal.

³⁵ von Rosing, M., Laurier, W., & Polovina, S. M (2015). The Value of Ontology. In M. v. R.-W. S. v. Scheel (Ed.), The Business Process Management Handbook (pp. 91-99). Boston: Morgan Kaufmann.

³⁶ Guarino, N. (1997). Semantic Matching: Formal Ontological Distinctions for Information Organization, Extraction, and Integration SCIE (pp. 139-170).

ontology terms³⁷. For example, if 'event' were an ontology construct for the business process domain and 'forecasting' would be a task ontology construct for analysis, 'event forecasting' could be an application ontology construct for business process analysis. This combination approach is expected to promote reuse, standardization and mutual understanding between applications, as the same domain and task construct definitions are reapplied across applications. Enterprise ontology is an intentional semantic structure that has business as its universe of discourse. Enterprise ontology research has long been focussing on two distinct axes. The first axis concentrated on the development methods for ontology engineering (from scratch) by practitioners (e.g., METHONTOLOGY, On-To-Knowledge, DOGMA, SENSUS), which enabled them to build their own corporate or enterprise ontologies³⁸. The second axis was dominated by the development of domain ontologies (e.g., REA, e3value, BMO, TOVE) by academics³⁹. Standards bodies, which are mainly practitioner organisations, have recently started to build their own domain ontologies (e.g. FIBO)⁴⁰.

Formalising a Domain Ontology

All ontologies have a controlled vocabulary as a foundation⁴¹. As the risk ontology is an extensive ontology that has the ambition to cover the various aspects of risk management, risk modelling, risk engineering and risk architecture, its terms are organized in a top-level domain and multiple intersecting subdomains (e.g., Business Competency, Business Process, Business Service, Data,

³⁷ Guarino, N. (1998). Formal Ontology and Information Systems. Paper presented at the Proceedings of FOIS'98, Trento, Italy.

³⁸ Cardoso, J. (2007). The Semantic Web Vision: Where Are We? *Intelligent Systems, IEEE*, 22(5), 84-88. doi: 10.1109/mis.2007.4338499

Corcho, O., Fernández-López, M., & Gómez-Pérez, A. (2003). Methodologies, tools and languages for building ontologies. Where is their meeting point? *Data & Knowledge Engineering*, 46(1), 41-64. doi: [http://dx.doi.org/10.1016/S0169-023X\(02\)00195-7](http://dx.doi.org/10.1016/S0169-023X(02)00195-7)

Lima, J., Amaral, C. G., & Molinaro, L. (2010). Ontology: An Analysis of the Literature. In J. Quintela Varajão, M. Cruz-Cunha, G. Putnik & A. Trigo (Eds.), *Enterprise Information Systems* (Vol. 110, pp. 426-435): Springer Berlin Heidelberg.

³⁹ Fox, M. (1992). The TOVE project towards a common-sense model of the enterprise. In F. Belli & F. Radermacher (Eds.), *Industrial and Engineering Applications of Artificial Intelligence and Expert Systems* (Vol. 604, pp. 25-34): Springer Berlin Heidelberg.

Geerts, G. L., & McCarthy, W. E. (2002). An ontological analysis of the economic primitives of the extended-REA enterprise information architecture. *International Journal of Accounting Information Systems*, 3(1), 1-16.

Gordijn, J., & Akkermans, H. (2001). Designing and Evaluating E-Business Models. *IEEE Intelligent Systems*, 16(4), 11-17. doi: <http://dx.doi.org/10.1109/5254.941353>

⁴⁰ EDM council, (2014). Financial Industry Business Ontology, from <http://www.edmcouncil.org/financialbusiness>

⁴¹ Lassila, O., & McGuinness, D. L. (2001). The role of frame-based representation on the semantic web. Nokia Research Center.

Platform etc.). Figure 2 shows that the risk ontology's top-level has been formalised into the following four levels

- The Risk Ontology Objects.
- The Risk ontology models
- Risk ontology meta model
- Risk ontology meta-meta-model

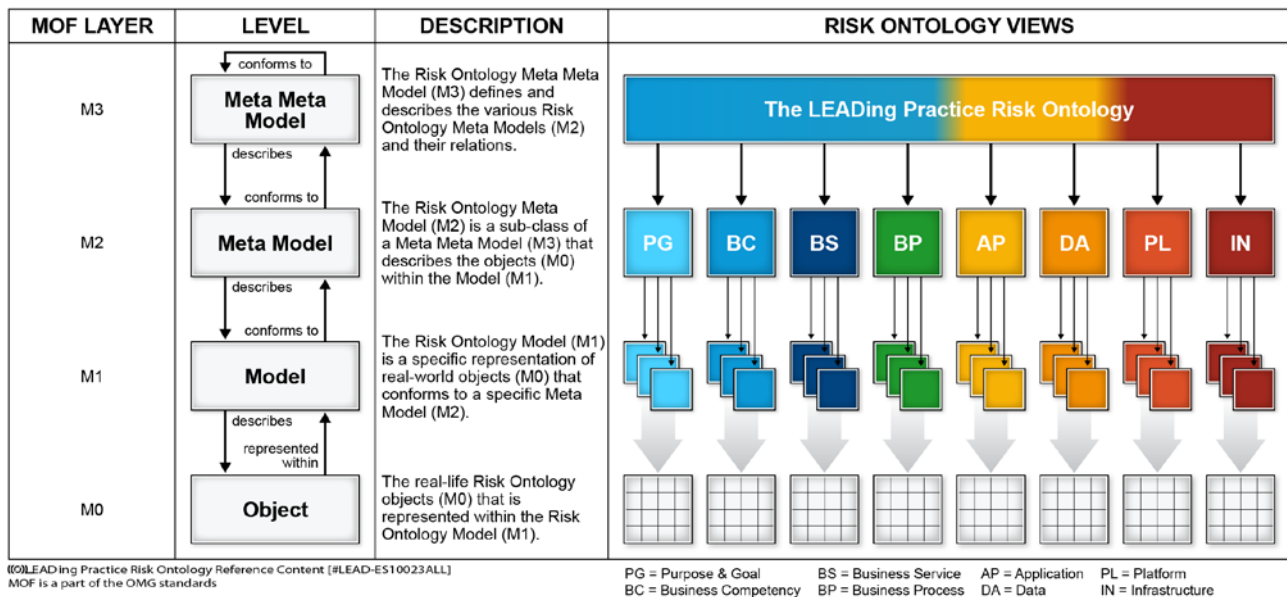


Figure 2: The Risk ontology levels

In the following, we will elaborate on the levels and how they are described, documented and structured. Starting with the object level, the models, meta models and then the meta meta model level.

Chapter 5 The Risk Ontology Objects

Objects refer to something that is within the grasp of the senses and that which a subject relates to. They represent a piece of reality in a model or a document. *Meta-objects* create, describe, or equip objects. A meta-object defines an object's type, relation attributes, functions, control structures, etc. *Object Groups* group objects with a common purpose, goal, an aim, target, objective and sets. In the Risk Ontology, object groups collect meta-objects related to a subdomain. *Object Meta-Models* are precise definitions of meta-objects, the semantics⁴² of the relationships they are involved in and the rules that apply to them.⁴³

Risk Ontology terms are assembled in 2 categories in terms of object stereo types and subtypes.

The object stereotypes are presented in table 2 and allow modellers to structure Risk's.

Categorisations assemble heterogeneous groups, classifications assemble objects into order (e.g., through the use of strict part-whole or sequencing semantics).

Object-Stereo Type	Description	Object - Subtype	Description
Risk Driver	Risk Drivers are the factors which disproportionately influence the risk to materialise.	Risk Likelihood	The chance that a risk might happen
		Risk Areas influenced	The scope of the risk
		Risk Appetite	The amount and type of risk that an organization is willing to take to meet their strategic objectives. Influence how risks are assessed and addressed. An organization's attitude towards risk influences whether or not risks are taken, tolerated, retained, shared, reduced, or avoided, and whether or not risk treatments are implemented or postponed.
		Risk Manifestation	How the risk actualizes/will actualize
Risk Performance Indicator	Any of a series of metrics used to indicate and track risk.	Risk Performance Indicators	Any of a series of metrics used by an enterprise to indicate the status of a risk

⁴² A Cloud Ontology & Cloud Semantic Description, Views, Stakeholders and Concerns.

⁴³ Rosing, M. v. (Producer). (2014). Objects and Object Relations Around Business Modelling and Business Architecture. Retrieved from <http://www.leadingpractice.com/wp-content/uploads/presentations/LEADing%20Practice%20&%20OMG%20Business%20Architecture%20and%20Business%20Modelling.pdf>

Objective (Critical Success Factor)	Time bound milestones to measure and gauge the progress towards a strategy or goal. Objectives drive the assignment of prioritizing risks.	Targeted objective (Threat actor)	The result to be achieved by the attack.
		Intent of Attack (Threat actor)	The motivation or desire to commit an act or achieve something.
		Plan of Attack	A detailed proposal for doing or achieving something to impact the ability of something to perform to it achieve its Objective
		Targeted Objective	The result to be achieved by the attack.
		Impact on Objective	The consequence of the actualized risk on the target
		Impact on Schedule	The impact of the risk on the planned operations
		Recovery and Resolution Plan	A detailed proposal for preventing the impact of something on the ability for it to perform to achieve its Objective by restoring it to its full capacity
		Response Plan	A detailed proposal for reducing the adverse effects of an risk should it actualize.
		Risk Mitigation Objective	The extent to which the impact of a risk is intended to be lessened
Risk (quantified)	Uncertainty in terms of vulnerability and is about the severity and impact of the consequences (or outcomes), with respect to something that is valued. It is therefore the combined impact of any conditions, events or factors that can affect the potential for keeping or achieving desired objectives.	Trade Dispute	Events causing widespread change or disruption to international trading conditions
		Geopolitical Conflict	Military Engagement or diplomatic crisis between nations having global implications
		Political Violence	Acts or threats of violence by individuals or groups for political ends
		Natural Catastrophe	Naturally occurring phenomena causing widespread damage or disruption
		Climatic Catastrophe	climatic anomalies or extremes causing severe weather conditions
		Environmental Catastrophe	Crisis leading to significant and widespread change to environmental or ecological equilibriums
		Technology Catastrophe	Accidental or deliberate industrial events affecting local or global stakeholders

		Externality	Threats coming from outside the earth's atmosphere, including astronomical objects and space weather
		Disease Outbreak	Disease outbreak affecting humans, animals, and / or plants
		Humanitarian Crisis	Impact of conditions on mass populations of people
		Operational Risk	risk arising from execution of a company's business functions
		Financial Risk	risk associated with financing, including financial transactions that include loans in risk of default Events in the financial system causing short-run fluctuation and/ or significant changes in long run growth
Security	The objects or tools that secure, make safe and protect through measures to prevent exposure to danger or risk.	Vulnerability	Susceptibly to being exploited or damaged so as to impact the ability to operate as intended
		Location Security	The body of technologies, processes, and practices designed to protect a physical site from attack, damage or unauthorized access.
		Cyber Security	The body of technologies, processes and practices designed to protect networks, computers, programs and data from attack, damage or unauthorized access.
		Resource Security	The capacity of a population to safeguard sustainable access to adequate quantities of resources for sustaining objectives
		Security Clearance	A special status granted to individuals allowing them access resources or locations
Risk Measure	Any type of measurement used to gauge some quantifiable component of risk.	Cost Risk Analysis	The process of quantifying the cost impacts of risks associated within a specific setting or context.
		Statistical Measure	A summary (means, mode, total, index, etc.) of the individual quantitative variable values for the statistical units in a specific group (study domains).

		Risk Benchmark	identify a risk management program's strengths and weaknesses.
		Historical predictor	the use of Patterns in World History to Predict the Future
		Severity Measure	The forecast or actual measure of the impact of a risk
		Vulnerability Analysis	The process of identifying, quantifying, and prioritizing (or ranking) the potential weaknesses or deficiencies in a system.
		Damage Assessment	The evaluation of damage or loss caused by an event
		Volatility Measure	A measure of the uncertainty in a specific system or variable.
		Likelihood Measure	The measure of probability that something is true (or false)
Risk Monitoring	Risk monitoring is the ongoing process of tracking symptoms of risks. Enabling an awareness of the risk state, through observation, assessment or evaluation.	Risk Identification	The process of determining risks that could potentially prevent the program, enterprise, or investment from achieving its objectives.
		Risk Analysis	The process that is used to understand the nature, sources, and causes of the risks that you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine the controls that currently exist.
		Risk Evaluation	Determination of possible risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.
		Risk Assessment	A systematic process of evaluating the potential risks that may be involved in a

			projected activity or undertaking.
		Risk Determination	Selection of risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks
		Risk Quantification	The process of attaching a probability to the happening of a negative event.
		Oversee Risk Investigation	The process of ensuring risk monitoring process are performed to the required standard.
		Risk Track	Collection of information of the status of risks and how that status is changing
		Risk Qualification	The process of Prioritization and classification of risk
Organization	The components of the organization and how they are assembled.	Law enforcement Organization	an organized body of police officers responsible for a specific jurisdiction
		Defence organization	An organization charged with protecting the sovereignty and interests of a nation by means of force
		Emergency Organization	An organization charged with provided services or capabilities during an incident where normal capabilities have been degraded
		Hospital Organization	an institution providing medical and surgical treatment and nursing care for sick or injured people
		Enterprise	Two or more organizations working in a coordinated manner within the shared value chain
Organizational Unit	A self-contained unit of resources with objectives, plans and measures.	Response Unit	An international standardized disaster relief unit established to respond to a negative event.
		Special Weapons and Tactics Team	a group of elite police marksmen who specialize in high-risk tasks such as hostage rescue. also commonly

			any group of specialists brought in to solve a difficult or urgent problem
		Patrol	A group of personnel, such as police officers or soldiers, that are assigned to monitor a specific geographic area.
		Task Force	An armed force organized for a special operation. Also commonly, a unit specially organized for a task
Capability	A capability is an abstraction that represents the ability to perform a particular skillset i.e. directional capabilities, organisational capabilities, resource capabilities, personnel capabilities, process capabilities, service capabilities, location capabilities, information capabilities, information system capabilities, platform capabilities and infrastructure capabilities.	Directional Capability	The extent of Strategy, Objectives, plans Command and Management direction (guidance, instructions, publications, doctrine, procedures, & preparedness documents) required to support decision-making, administration, and operations.
		Resource Capability	The extent to which all nonexpendable items needed to outfit or equip an individual or organization to perform its mission are in place
		Personal Capability	The personal abilities of an individual.
		Process Capability	The extent to which the enterprise has the ability to execute on business processes, steps, and events.
		Threat Actor Capability	The net effect of the total capabilities the attacking actor possesses.
		Service Capability	The service construct and the service delivered
		Intelligence Capability	The extent of the ability to organize and synthesize information about opposition motivation cognition Strategy and behavior
		Location Capability	The extent and utility of buildings, structures, property, plant, training areas and facilities (Real Property)
		Information Capability	The extent of or quality of Information including the ability to achieve timely access to authoritative information to support decisions.

		Information System Capability	The extent and alignment of Major Systems e.g. application components, modules and application tasks. Enabling automation designed to enhance the ability to deliver outcomes.
		Platform Capability	The extent and alignment of Platform technology e.g. platform components, platform devices and platform services available to the organization
		Infrastructure Capability	The extent and capacity of Network Communications infrastructure and devices available to the enterprise
		Management Capability	The overall ability of the management team of an enterprise to align the organization to strategic intent and to accelerate results.
		Command Capability	The extent of written guidance (regulations, instructions, publications, directions, doctrine, tactical level procedures and preparedness documents) required to support decision making, administration and operations.
		Organizational Capability	The extent to which organizational units e.g. business areas, business groups, business function with an appropriate balance of competency, structure and command and control to accomplish their tasks.
Resource	A specific person, expertise, data, information, material, machine, land, capital or organization that is required to accomplish an activity or as a means to act on behalf of the enterprise to achieve a desired outcome.	Machine	An apparatus using or applying mechanical power and having several parts, each with a definite function and together performing a particular task
		Materiel	Apparatus, and supplies used by an organization or institution
		Computer	an electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

	Fence	a barrier, railing, or other upright structure, typically of wood or wire, enclosing an area of ground to mark a boundary, control access, or prevent escape.
	Gate	a movable barrier used to close an opening in a wall, fence, or hedge.
	Keycard	a small plastic card that can be used instead of a door key, bearing magnetically encoded data that can be read and processed by an electronic device.
	Mobile Phone	a telephone with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network.
	EMP Device	A device capable of generating a pulse in the form of a radiated, electric or magnetic field or conducted electrical current
	Personal Weapon	small arms weapon, as a rifle or pistol, from which a projectile is fired for the purpose of inflicting bodily harm or physical damage
	Melee Weapon	A martial arts or other non ballistic hand weapon
	Nuclear Weapon	a bomb or missile that uses nuclear energy to cause an explosion
	Gas Agent	Lethal or debilitating agents that attack the nervous, respiratory, or circulator system
	Card Reader	an electronic sensor that reads a magnetic strip or bar code on a credit card, membership card, etc.
	Explosive	a package of a substance that can be made to explode
	Biologic Weapon	Living organisms or replicating entities (viruses, which are not universally considered "alive") that reproduce or replicate within their host victims and that are lethal or debilitating

Actor	Any person, organization, or system that may be assigned one or more roles. Actors may be internal or external to an organization.	Person	A single human being.
		Organization	An arrangement or formation of resources that has a set of collective goals.
Role	A part that something or someone has the rights, rules, competencies, and capabilities to perform. A resource and/ or actor may have a number of roles i.e. process role, service role or application role and many actors may be assigned the same role.	Police	A member of the civil force of a national or local government, responsible for the prevention and detection of crime and the maintenance of public order.
		Victim	A person harmed, injured, or killed as a result of a crime, accident, or other event or action
		Threat Actor	Any person intent on or who has committed a crime
		Criminal	a person who has committed a crime
		Hacker	a person who uses computers to gain unauthorized access to data
		Terrorist	Any person intent on or who has committed violence against targets for the purpose of fomenting fear or terror by intimidating or coercing a civilian population so as to influence the policy of a government by intimidation or coercion; or to affect the conduct of a government.
		Intelligence Agent	Any person charged with obtaining intelligence, or information, especially for to assess threats or vulnerabilities
		Risk Owner	A person or entity that has been given the authority to manage a particular risk and is accountable for doing so.
		Guard	A person who keeps watch, especially a soldier or other person formally assigned to protect a person or to control access to a place

		Employee	A role performed by a person employed for wages or salary, especially at nonexecutive level.
Revenue	The risk The realized monetary or financial income of an enterprise or part thereof.	Customer Risk	a potential risk found in all consumer-oriented products, that a product not meeting quality standards will pass undetected though the manufacturer's quality control system and enter the consumer marketplace.
		Revenue Risk	Uncertainty within the revenue stream
		Revenue Risk Estimate	The assessment of uncertainty within the revenue stream
		Risk Forecast	The estimate of future revenue risk
		Competitive Risk Factor	The measure of risk due to competition
Risk Contract	An agreement between two or more parties that establishes conditions for interaction.	Security Contract	A written or spoken agreement, especially one concerning protection of capabilities that is intended to be enforceable by force or other means of protection or intervention
Risk Rule	A statement that defines or constrains some risk aspect of behaviour and always resolves to either true or false.	Risk Policy	a course or principle of action adopted or proposed by a government, party, business, or individual
		Risk Directive	An official or authoritative instruction
		Risk Procedure	An established or official way of doing something
		Risk Standard	Something considered by an authority or by general consent as a basis of comparison;
		Tax Law	limiting the amount of losses an investor (usually a limited partner) can claim. Only the amount actually at risk can be deducted.
Compliance	The process or tools for verifying adherence to rules and decisions.	Risk Compliance Evaluation	An assessment of the effectiveness or risk treatment strategies
		Risk Compliance Audit	A comprehensive review of adherence to risk guidelines
		Risk Plan Evaluation	The assessment of the risk management plan to detect flaws
		Risk Compliance Governance	The process, decisions and actors necessary influence the

			risk compliance process
		Risk Control (incl. Weakness Control)	The method by which potential losses are evaluated and action taken to reduce or eliminate such threats.
Location	A point, facility, place or geographic position that may be referred to physically or logically.	Geographic Feature	A landform comprises a geomorphological unit, and is largely defined by its surface form and location in the landscape
		Legal Property	Any real property that is owned by a person or entity
		Business Location	A space accessed for the purpose of conducting business
		Political Jurisdiction	The defined area of responsibility of a legally constituted government body
		Nuclear Facility	A device in which the energy released by the fission of nuclei of uranium or another element is used to produce steam to run an electrical generator or other device.
		Medical Facility	a place where people get medical help
		Government Office	An office where government employees work
		Military Base	A facility directly owned and operated by or for the military or one of its branches that shelters military equipment and personnel, and facilitates training and operations.
		Border Point	A location used to ensure that persons, including their means of transport and the objects in their possession, may be authorized to enter the territory
		Airport	A complex of runways and buildings for the takeoff, landing, and maintenance of civil aircraft, with facilities for passengers.
		Sea/Water Port	A port, or harbor accessible to seagoing ships or other water vessels
Mail Facility	A sortation plant or collection and delivery point for physical mail (parcels or letters)		
Police Station	the office or headquarters of a local police force.		

		Biological Facility	A biosafety level is a level of the bio containment precautions required to isolate dangerous biological agents in an enclosed laboratory facility
		Chemical Facility	An industrial process plant that manufactures (or otherwise processes) chemicals, usually on a large scale.
		Intelligence Facility	an office where workers are responsible for providing and producing the intelligence
Business Channel	A means of access or otherwise interacting within an enterprise or between an enterprise and its external partners (i.e. customers, vendors, suppliers, etc.).	Mail	The system whereby physical messages are transmitted via the post office.
		Face to Face	The system by which interaction is accomplished in person
		Internet	A global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to link devices worldwide.
Business Media	The material or matter used to store information (i.e. printed page, digital tape, CD, disk as well as non-volatile storage, screen, or memory).	Printed	Security material (printed page)
		Digital Tape	A signal recording and playback medium where the contents can only be accessed sequentially
		Compact Disk	A small plastic disc on digital information is stored, and from which the information can be read using reflected laser light
		Memory Stick	a type of electrically erasable programmable memory
Business Service	The externally visible [logical] deed or effort performed to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.	Threat Prevention	The provision of effort to prevent, disrupt, or mitigate a threat so as to allow the enterprise to continue to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.
Activity (Business Process)	A part of the actual physical work system which specifies how to complete the change in the form or state of	Course of Action	A procedure adopted to deal with a situation.
		Attack Pattern	Any sequence of activities that an individual or unit may follow when setting upon a target.

	<p>an input, oversee or even achieve the completion of an interaction with other actors which results in the making of a decision based on knowledge, judgment, experience, and instinct.</p>	<p>Risk Response</p>	<p>Any sequence of activities that an individual or unit may follow when responding to an attack.</p> <p>Risk response is a risk modification process. It involves selecting and implementing one or more treatment options. Once a treatment has been implemented, it becomes a control or it modifies existing controls. You have many treatment options. You can avoid the risk, you can reduce the risk, you can remove the source of the risk, you can modify the consequences, you can change the probabilities, you can share the risk with others, you can simply retain the risk, or you can even increase the risk in order to pursue an opportunity.</p>
Event	A state change that recognizes the triggering or termination of processing.	Suspicious Event	Behavior that changes the level of trust
		Attack	<p>A change whereby an aggressive or violent actions is recognized as occurring.</p> <p>Resulting from sequence of activities that an individual or unit may follow when setting upon a target and the defence of the target.</p>
		Incident	A change of enough significance to impact the ability of some part of the business to perform in a material manner
		Alarm	A signal (as a loud noise or flashing light) that warns or alerts
		Shutdown	The initiation of closure of a component system within an enterprise due to a malfunction, disruption, or for maintenance.
		Warning	An indication of a possible change in terms of the impending level of danger, problem, or other unpleasant situation.

		Arrest	A change in the state of someone by legal authority, who takes them into custody
		Disaster	A sudden event that causes great damage or loss of life.
		Response	A reaction to impending and apprehended danger, problem, or other unpleasant situation.
		Non Event	an anticipated or required event that fails to occur
		Cyber	A change in the level of confidence in the integrity of a computer system due to the apprehension of a deliberate exploitation of computer systems, technology-dependent enterprises and networks.
		Terrorism	The recognition of the initiation of an act of violence committed against targets for the purpose of fomenting fear or terror by intimidating or coercing a civilian population so as to influence the policy of a government by intimidation or coercion; or to affect the conduct of a government.
		Natural Disaster	A natural event such as a flood, earthquake, or hurricane that causes great damage or loss of life
		Economic Disaster	An economic collapse where an economy is in complete distress for months, years or possibly even decades. A total economic collapse is characterized by economic depression, civil unrest and highly increased poverty levels
Gateway	Determines forking and merging of paths depending on the conditions expressed.	Decision Making	the action or process of deciding something or of resolving a question.
		Risk Prioritization/ Triage	Classification of risk to determine which should be addressed first when allocating resources
		Assessment	the evaluation or estimation of the nature, quality, or ability of someone or something.

Information Object	Information about real world objects that can be in any medium or form.	Factor Analysis of Risk Information	A taxonomy of the factors that contribute to risk and how they affect each other. It is primarily concerned with establishing accurate probabilities for the frequency and magnitude of loss events
		Cyber Profile	A real-time picture of an enterprise's information technology security posture
Application/System Report	Reports that are defined and implementable or implemented within or by an application.	Suspicious Event/Activity Report	A report made regarding suspicious or potentially suspicious activity
		Risk Scorecard	A report that shows through the use of appropriate scores the operational risk profile of part of all of an enterprise.
		Intelligence Report	A specific report of information, usually on a single item, made at any level of command in tactical operations and disseminated as rapidly as possible in keeping with the timeliness of the information showing analysis of the current threat landscape
		Vulnerability Report	A record of a weakness or gap in part of all of an enterprise.
		Impact Report	A record of the impact of an actualized risk
		Arrest Report	a record of a law enforcement agency of an arrest and of any related detention or confinement incident together with the connected charge
		Risk Report	A record of a risk

Table 3: The Risk meta-objects

These objects included in the risk ontology are as discussed defined in the following ways, **stereo types** and the real world **subtypes**. In the risk ontology, the object groups collect meta-objects related to a subdomain and the models are specific representation of the real world objects (subtypes), which again are conforming to the specific Metamodels⁴⁴. The Risk ontology objects

⁴⁴ von Rosing, M., Laurier, W., Polovina, S., (2015) Business Ontology – a basis for comprehensive business modelling, engineering and architecture concepts, International Journal of Conceptual Structures and Smart Applications, IGI Global

are therefore assembled in eight groups presented in table 3 and allow modellers to structure Categorisations assemble heterogeneous groups, classifications assemble objects into order (e.g., through the use of strict part-whole or sequencing semantics). It is these Risk ontology objects that are represented within the risk ontology model

practitioners to think about the risks associated with each process step object they identify⁴⁶. The objects shown in table 3 intersect with several subdomains of business (e.g. forces, strategy, events, gateways, information objects etc.). Consequently, they can be reused for the elicitation of the risk model, the BPMN models or a service or value model. For example, the decomposed risk objects of table 4, relate to various models. These relationships between decomposition and composition meta-objects are considered an essential part for any practitioner working with and around innovation and transformation across various relevant subjects (versus siloed risk modelling, engineering and architecture view).

It should be noted that the same object can be a decomposition meta-object in one context and a composition object in another context i.e. model. For example, a 'business process' is a decomposition meta-object in the context of a process map, and a composition meta-object in the context of a business model or risk matrix. The following section will the elaborate on the Risk model shown in figure 3, the objects within the model and its semantic relations.

⁴⁶ LEADing Practice Process Standard - Reference Content #LEAD-ES20012BC

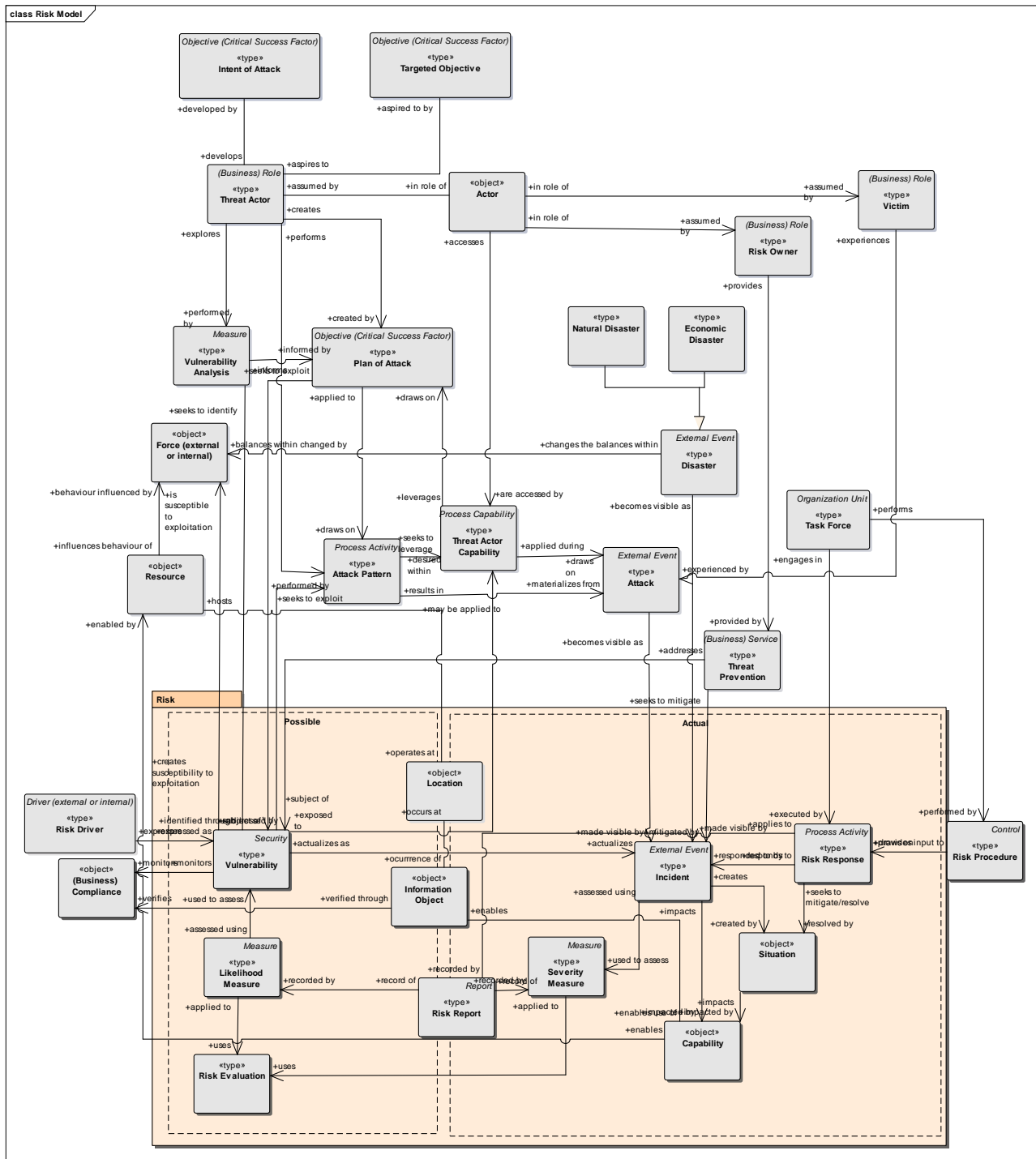
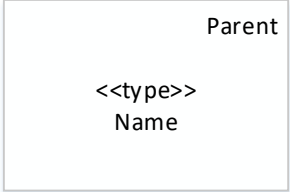





Figure 1 :The Risk Model (M1)

Parts of the Risk Model (M1)

The above figure uses the notation detailed in the following table to capture ideas about risk, and how we think and work with this subject.

Name	Representation	Description
Class		<p>A Class is a standard construct used to detail some semantic component of the domain of interest represented by a rectangle.</p> <p>The Name of the class captures the concept which is expressed by the item</p> <p>At this level, a class may be a Risk Meta Meta Model Object or a specialization of an M3 object, which will be its Parent (and identified by name in the upper right hand corner of the rectangle. By enforcing this, every item placed in the model maintains its context.</p> <p>If a class is a Risk Meta Meta Model item, it will be “typed” as a (meta) object. On the other hand, if it is a specialization or part of an M3 object, it while be a “part” of the larger concept expressed at M3 and recognized as being a category or classification of type “part”.</p>
Relationship		<p>Objects may then be connected to each other in the semantically meaningful way. These connections are recognized through named arcs that link one class item to another to form a meaningful relationship.</p> <p>The nature of the semantic relationship may be read as the source class (the class the arrowhead on the relationship arc points from) is connected to the destination class (the class arrowhead on the relationship arc points to) and may be read, as the name of the source class, the text on the “to” part of the relationship with the name of the “to” class. Similarly, the semantic relationship in the reverse direction by read the name of the class at the arrow head of a relationship, the “from” text on the arc and the name of the item at the start of the arc.</p>
Domain		<p>This item is simply intend to show that all the items within its boundary are part of what makes up risk</p>
Risk State		<p>These items are intended to show the two states of risk and how the items within these two states participate in how we must think about the subject</p>

Contents of the Model

In the following section, each item from the Figure 3 is listed alphabetically, its description is provided and the nature of its semantic relationship to other items is identified.

In the table titled “Relationships”, the nature of each relationship from the figure and the name of the related item is identified. In each case the rows within this table can be read as Item Name, has a relationship to Related Item Name. By way of example within (Business) Compliance, we see that (Business) Compliance monitors Information Object(s), and (Business) Compliance monitors (for) Vulnerability. This also applies for all other objects, their description and the semantic relations.

Compliance

Description: The process or tools for verifying adherence to rules and decisions within the business in order to determine whether something is a suitable, adequate, and effective way of achieving established objectives.

Relationships

Relationship	Related Item Name
Monitors	Information Object
Monitors	Vulnerability

Actor

Description: A person, organization, or system that has a role that initiates or interacts with activities. Actors may be internal or external to an organization.

Relationships

Relationship	Related Item Name
In role of	Victim
accesses	Threat Actor Capability
in role of	Threat Actor
In role of	Risk Owner

Attack

Description: A change whereby an aggressive or violent actions is recognized as occurring. Resulting from sequence of activities that an individual or unit may follow when setting upon a target and the defence of the target.

Relationships

Relationship	Related Item Name
experienced by	Victim
materializes from	Attack Pattern
becomes visible as	Incident
draws on	Threat Actor Capability

Attack Pattern

Description: Any sequence of activities that an individual or unit may follow when setting upon a target.

Relationships

Relationship	Related Item Name
performed by	Threat Actor
seeks to exploit	Vulnerability
draws on	Plan of Attack
results in	Attack
seeks to leverage	Threat Actor Capability

Capability

Description: A capability is an abstraction that represents the ability to perform a particular skill set i.e. organizational competencies, personal competencies, business function, processes, services and technology.

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
enables use of	Information Object
Enables	Resource
impacted by	Incident
impacted by	Situation

Disaster

Description: A sudden event that causes great damage or loss of life.

Relationships

Relationship	Related Item Name
Generalization	Natural Disaster
Generalization	Economic Disaster
becomes visible as	Incident

Economic Disaster

Description:

An **economic collapse** where an **economy** is in complete distress for months, years or possibly even decades. A total **economic collapse** is characterized by **economic** depression, civil unrest and highly increased poverty levels

Relationships

Relationship	Related Item Name
Specialisation of	Disaster

Force (external or internal)

Description: An external or internal factor that forces or pushes some aspect of an enterprise in a specific direction.

Relationships

Relationship	Related Item Name
is susceptible to exploitation	Vulnerability
influences behaviour of	Resource

Incident

Description: A change of enough significance to impact the ability of some part of the business to perform in a material manner

Relationships

Relationship	Related Item Name
Actualizes	Vulnerability
made visible by	Disaster
made visible by	Attack
responded to by	Risk Response
assessed using	Severity Measure
Impacts	Capability
mitigated by	Threat Prevention
Creates	Situation

Information Object

Description: Information about real world objects that can be in any medium or form.

Relationships

Relationship	Related Item Name
Enables	Capability
monitored through	Compliance

Intent of Attack

Description: The motivation or desire to commit an act or achieve something.

Relationships

Relationship	Related Item Name
developed by	Threat Actor

Likelihood Measure

Description: The measure of probability that something is true (or false)

Relationships

Relationship	Related Item Name
applied to	Risk Evaluation
used to assess	Vulnerability
recorded by	Risk Report

Location

Description: A point, facility, place, or geographic position that may be referred to physically or logically.

Relationships

Relationship	Related Item Name
hosts	Resource

Natural Disaster

Description: A natural event such as a flood, earthquake, or hurricane that causes great damage or loss of life

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Disaster

Plan of Attack

Description: A detailed proposal for doing or achieving something to impact the ability of something to perform to it achieve its Objective

Relationships

Relationship	Related Item Name
created by	Threat Actor
seeks to exploit	Vulnerability
applied to	Attack Pattern
draws on	Threat Actor Capability
informed by	Vulnerability Analysis

Resource

Description: Any person, organization, or system that may be assigned one or more roles. May be internal or external to an organization.

Relationships

Relationship	Related Item Name
operates at	Location
enabled by	Capability

Risk Driver

Description:

Risk Drivers are the factors that disproportionately influence the risk to materialize.

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
expresses	Vulnerability

Risk Evaluation

Description: Determination of possible risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.

Relationships

Relationship	Related Item Name
uses	Likelihood Measure
uses	Severity Measure

Risk Owner

Description: A person or entity that has been given the authority to manage a particular risk and is accountable for doing so.

Relationships

Relationship	Related Item Name
assumed by	Actor
provides	Threat Prevention

Risk Procedure

Description: Step-by-step instructions on how to address risk situations

Relationships

Relationship	Related Item Name
provides input to	Risk Response
performed by	Task Force

Risk Report

Description: A record of a risk

Relationships

Relationship	Related Item Name
record of	Severity Measure
record of	Likelihood Measure
risk report	Risk Response

Risk Response

Description: Any sequence of activities that an individual or unit may follow when responding to an attack.

Risk (response) is a risk modification process. It involves selecting and implementing one or more treatment options. Once a treatment has been implemented, it becomes a control or it modifies existing controls. You have many treatment options. You can avoid the risk, you can reduce the risk, you can remove the source of the risk, you can modify the consequences, you can change the probabilities, you can share the risk with others, you can simply retain the risk, or you can even increase the risk in order to pursue an opportunity.

Relationships

Relationship	Related Item Name
executed by	Task Force
responds to	Incident
applies to	Risk Report
draws on	Risk Procedure
seeks to mitigate/resolve	Situation

Severity Measure

Description: The forecast or actual measure of the impact of a risk

Relationships

Relationship	Related Item Name
applied to	Risk Evaluation
used to assess	Incident
recorded by	Risk Report

Situation

Description: The combination of circumstances at a given moment; a state of affairs impacting the ability to create the desired value.

Relationships

Relationship	Related Item Name
created by	Incident
impacts	Capability
resolved by	Risk Response

Targeted Objective

Description: The result to be achieved by the attack.

Relationships

Relationship	Related Item Name
aspired to by	Threat Actor

Task Force

Description: An armed force organized for a special operation. Also commonly, a unit specially organized for a task

Relationships

Relationship	Related Item Name
engages in	Risk Response

Relationship	Related Item Name
Performs	Risk Procedure

Threat Actor

Description: Any person intent on or who has committed a crime

Relationships

Relationship	Related Item Name
Explores	Vulnerability Analysis
aspires to	Targeted Objective
Creates	Plan of Attack
Develops	Intent of Attack
Performs	Attack Pattern
assumed by	Actor

Threat Actor Capability

Description: The net effect of the total capabilities the attacking actor possesses.

Relationships

Relationship	Related Item Name
desired within	Attack Pattern
may be applied to	Vulnerability
applied during	Attack
leverages	Plan of Attack
are accessed by	Actor

Threat Prevention

Description: The provision of effort to prevent, disrupt, or mitigate a threat so as to allow the enterprise to continue to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.

Relationships

Relationship	Related Item Name
seeks to mitigate	Incident
provided by	Risk Owner
Addresses	Vulnerability

Victim

Description: A person harmed, injured, or killed as a result of a crime, accident, or other event or action

Relationships

Relationship	Related Item Name
Experiences	Attack
assumed by	Actor

Vulnerability

Description:

Susceptibly to being exploited or damaged so as to impact the ability to operate as intended

Relationships

Relationship	Related Item Name
subject of	Plan of Attack
actualizes as	Incident
subject of	Attack Pattern
exposed to	Threat Actor Capability
creates susceptibility to	Force (external or internal)

Relationship	Related Item Name
exploitation	
identified through	Vulnerability Analysis
used to assess	Likelihood Measure
expressed as	Risk Driver
addressed by	Threat Prevention
Monitored by	Compliance

Vulnerability Analysis

Description: The process of identifying, quantifying, and prioritizing (or ranking) the potential weaknesses or deficiencies in a system.

Relationships

Relationship	Related Item Name
performed by	Threat Actor
seeks to identify	Vulnerability
Informs	Plan of Attack

Risk Model Stereo Objects and Subtypes

The RISK MODEL (M1)

The following section details the classification of the standard concepts for use in thinking about and working with ideas directly related to risks and threats.

Purpose of the Risk Model (M1) objects and semantic relations

The Risk Model (M1) semantic Items and the associated models provide the specific language used to think about and work with ideas to do with **risks and threats**. These ideas both connect to the real work in which **risks and threats** occurs and must be addressed (M0) and to the standard sub classes of meta meta objects making up the LEADing Practice Ontology (M2). While there are many models, concepts and relationships in the Risk Meta Meta Model, only a subset are relevant to risk. This subset makes up the items that are members of the LEADing Practice Risk Ontology and it is these items that are classified and categorized to first create the M2 items and then further classified and typed within the context of risk to create the Risk Model (M1) objects. This approach therefore assures alignment between the generic knowledge about how we describe the enterprise and the specific vocabulary and relationships of the single specific view necessary for addressing aspects of risk and threats.

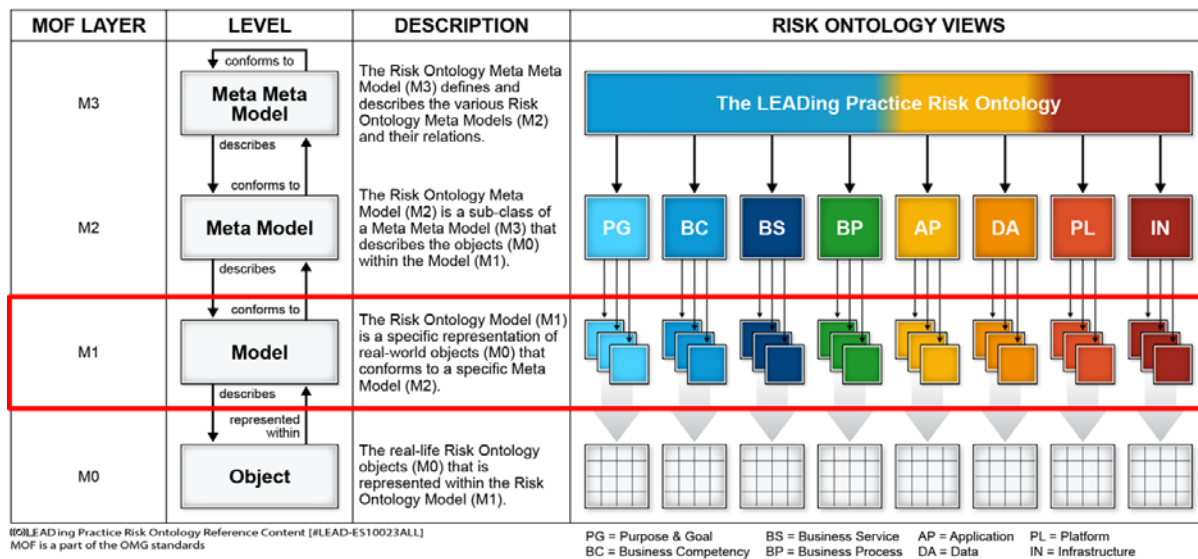


Figure 2 – Position of the Risk model within the MOF

How this section is organized

This section details a set of items derived by classifying the items within LEADing Practice Ontology that is relevant to risk (Risk Meta Meta Model), to create context specific concepts that are first employed at M2 and then arranged to formulate the risk specific, Risk Model (M1) items. It should be noted that within this white paper that the Risk Model (M1) classifications is within the following groups:

The following is the set of Risk Model objects relevant to Risk concepts. These objects are structured according the meta model relevant groups listed in figure 4:

- Purpose and Goal
- Business Competency
- Business Service
- Business Process
- Application
- Data
- Platform
- Infrastructure

The examples provided in this Risk Model M1 layer are not intended to be definitive, but rather are examples that may be tailored and customized, based on the circumstances and their applications.

Risk Model (M1) Objects

The following is the set of Risk Model (M1) objects relevant to risk. Each item from Risk Model (M1) is listed alphabetically by name; a figure is also provided showing how its parts exist within the context of risk are organized. Each of these parts is then described and the nature of the semantic relationship between these items is identified.

In the table titled “Relationships”, the nature of each relationship from the broader context is identified and described. In each case the rows within this table can be read as “Item Name”, “has a relationship to” “Related Item Name”. By way of example within (Business) Compliance, we see that (Business) Compliance monitors Information Object(s), and (Business) Compliance monitors (for) Vulnerability

Business Layer

This section contains the business objects needed to capture and describe the nature, form, and relationships of the business.

PURPOSE AND GOAL GROUP

Contains the business objects that capture the scope and value of the business

RISK DRIVER

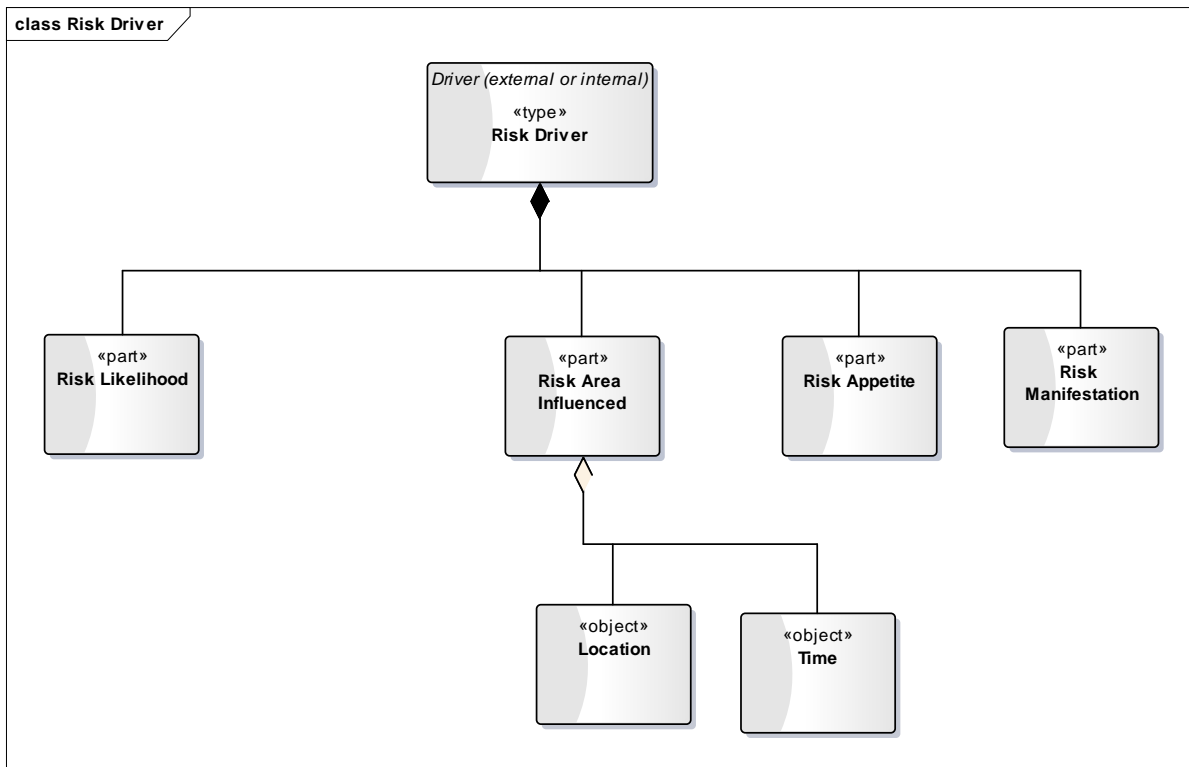


Figure 3 : Risk Driver

Risk Appetite

Description: The amount and type of **risk** that an organization is willing to take to meet their strategic objectives. Influence how risks are assessed and addressed. An organization’s attitude towards risk influences whether or not risks are taken, tolerated, retained, shared, reduced, or avoided, and whether or not risk treatments are implemented or postponed.

Relationships

Relationship	Related Item Name
Part of	Risk Driver

Risk Area Influenced

Description: The scope of the risk

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Pat of	Risk Driver
Contains	Time
Contains	Location

Risk Driver

Description: The factors that disproportionately influence the risk to materialize.

Relationships

Relationship	Related Item Name
Contains	Risk Likelihood
Contains	Risk Manifestation
Contains	Risk Appetite
Contains	Risk Area Influenced

Risk Likelihood

Description: The chance that a risk might happen

Relationships

Relationship	Related Item Name
part of	Risk Driver

Risk Manifestation

Description: How the risk actualizes/will actualize

Relationships

Relationship	Related Item Name
part of	Risk Driver

RISK PERFORMANCE INDICATOR

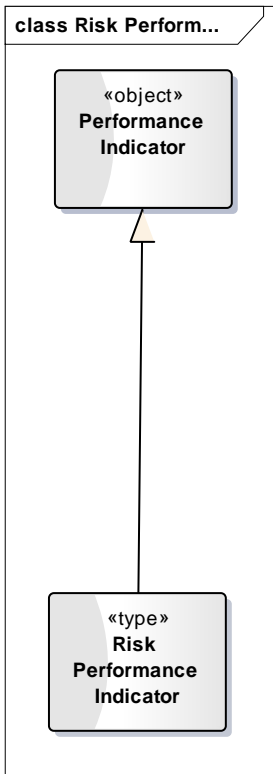


Figure 4 : Risk Performance Indicator

Performance Indicator

Description: Any of a series of metrics used by an enterprise to indicate its overall success or the success of a particular area in which it is engaged.

Relationships

Relationship	Related Item Name
Generalization of	Risk Performance Indicator

Risk Performance Indicator

Description: Any of a series of metrics used by an enterprise to indicate the status of a risk

Relationships

Relationship	Related Item Name
Specialisation of	Performance Indicator

Risk Objective (Critical Success Factor)

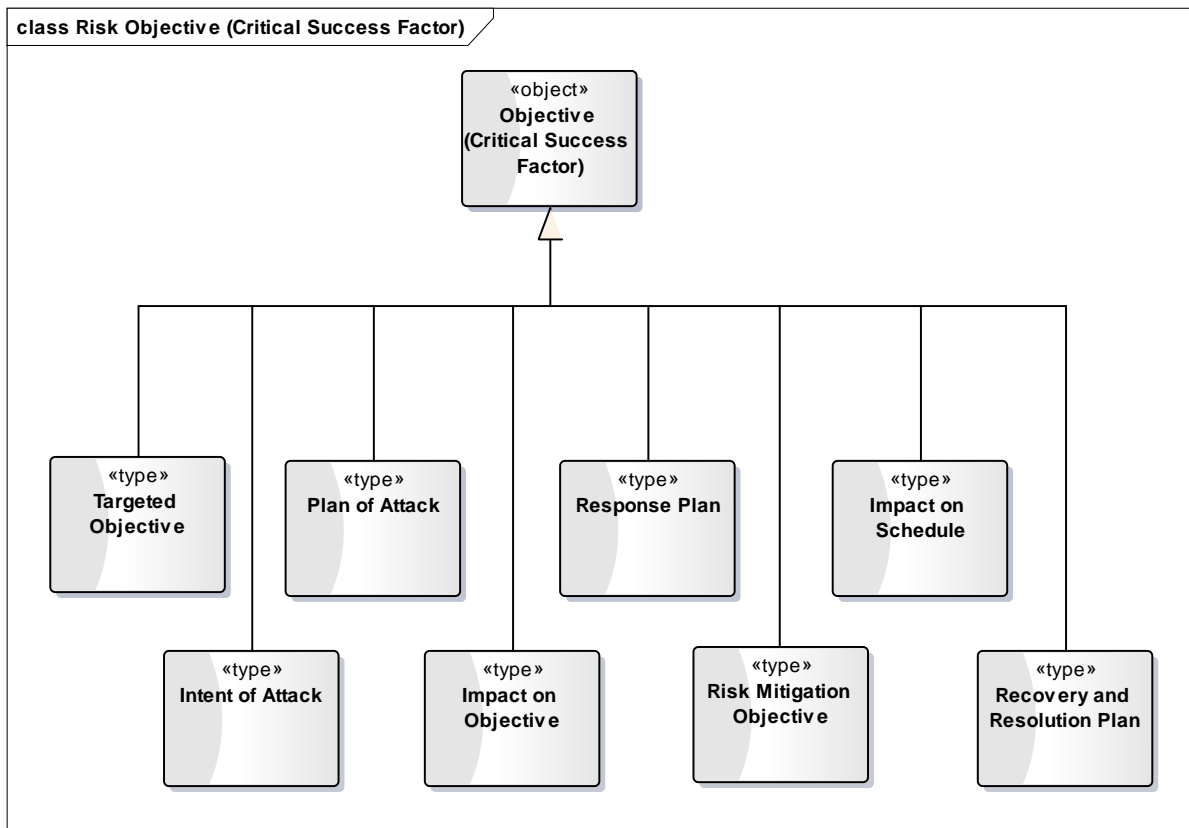


Figure 5 : Risk Objective (Critical Success Factor)

Impact on Objective

Description: The consequence of the actualized risk on the target

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Impact on Schedule

Description: The impact of the risk on the planned operations

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical

Relationship	Related Item Name
	Success Factor

Intent of Attack

Description: The motivation or desire to commit an act or achieve something.

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Objective (Critical Success Factor)

Description: Time bound milestones to measure and gauge the progress towards a strategy or goal.

Relationships

Relationship	Related Item Name
Generalization of	Targeted Objective
Generalization of	Plan of Attack
Generalization of	Intent of Attack
Generalization of	Impact on Schedule
Generalization of	Response Plan
Generalization of	Impact on Objective
Generalization of	Risk Mitigation Objective
Generalization of	Recovery and Resolution Plan

Plan of Attack

Description: A detailed proposal for doing or achieving something to impact the ability of something to perform to it achieve its Objective

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Recovery and Resolution Plan

Description: A detailed proposal for preventing the impact of something on the ability for it to perform to achieve its Objective by restoring it to its full capacity

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Response Plan

Description: A detailed proposal for reducing the adverse effects of a risk should it actualize.

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Risk Mitigation Objective

Description: The extent to which the impact of a risk is intended to be lessened

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Targeted Objective

Description: The result to be achieved by the attack.

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

Risk

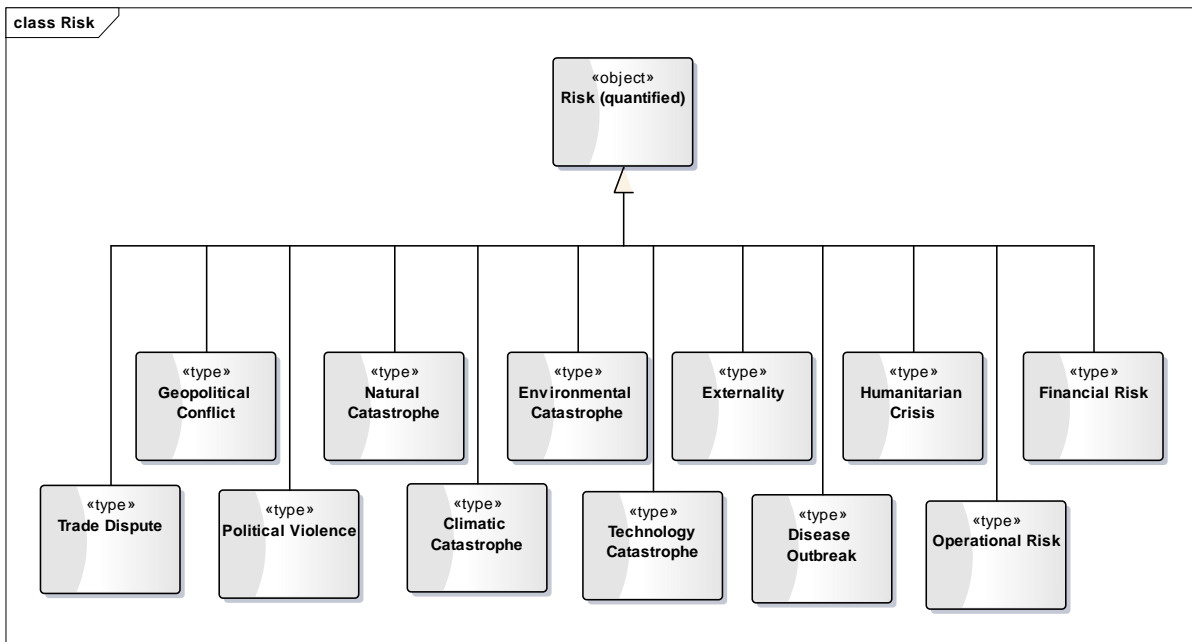


Figure 6 : Risk

Climatic Catastrophe

Description: Climatic anomalies or extremes causing severe weather conditions

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Disease Outbreak

Description: Disease outbreak affecting humans, animals, and / or plants

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Environmental Catastrophe

Description: Crisis leading to significant and widespread change to environmental or ecological equilibriums

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Externality

Description: Threats coming from outside the earth's atmosphere, including astronomical objects and space weather

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Financial Risk

Description: Risk associated with financing, including financial transactions that include loans in risk of default

Events in the financial system causing short-run fluctuation and/ or significant changes in long run growth

RelationshipsRelationship	Related Item Name
Specialisation of	Risk (quantified)

Geopolitical Conflict

Description: Military Engagement or diplomatic crisis between nations having global implications

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Humanitarian Crisis

Description: Impact of conditions on mass populations of people

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Natural Catastrophe

Description: Naturally occurring phenomena causing widespread damage or disruption

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Operational Risk

Description: Risk arising from execution of a company's business functions

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Political Violence

Description: Acts or threats of violence by individuals or groups for political ends

Relationships

Relationship	Related Item Name
Specialisation of	Risk (quantified)

Risk (quantified)

Description: Uncertainty in terms of vulnerability and is about the severity and impact of the consequences (or outcomes), with respect to something that is valued. It is therefore the combined impact of any conditions, events or factors that can affect the potential for keeping or achieving desired objectives.

Relationships

Relationship	Related Item Name
Generalization of	Geopolitical Conflict
Generalization of	Natural Catastrophe
Generalization of	Environmental Catastrophe
Generalization of	Externality
Generalization of	Humanitarian Crisis
Generalization of	Financial Risk
Generalization of	Trade Dispute
Generalization of	Political Violence
Generalization of	Climatic Catastrophe
Generalization of	Technology Catastrophe
Generalization of	Disease Outbreak
Generalization of	Operational Risk

Technology Catastrophe

Description: Accidental or deliberate industrial events affecting local or global stakeholders

Relationships

Relationship	Related Item Name
Specialization of	Risk (quantified)

Trade Dispute

Description: Events causing widespread change or disruption to international trading conditions

Relationships

Relationship	Related Item Name
Specialization of	Risk (quantified)

RISK SECURITY

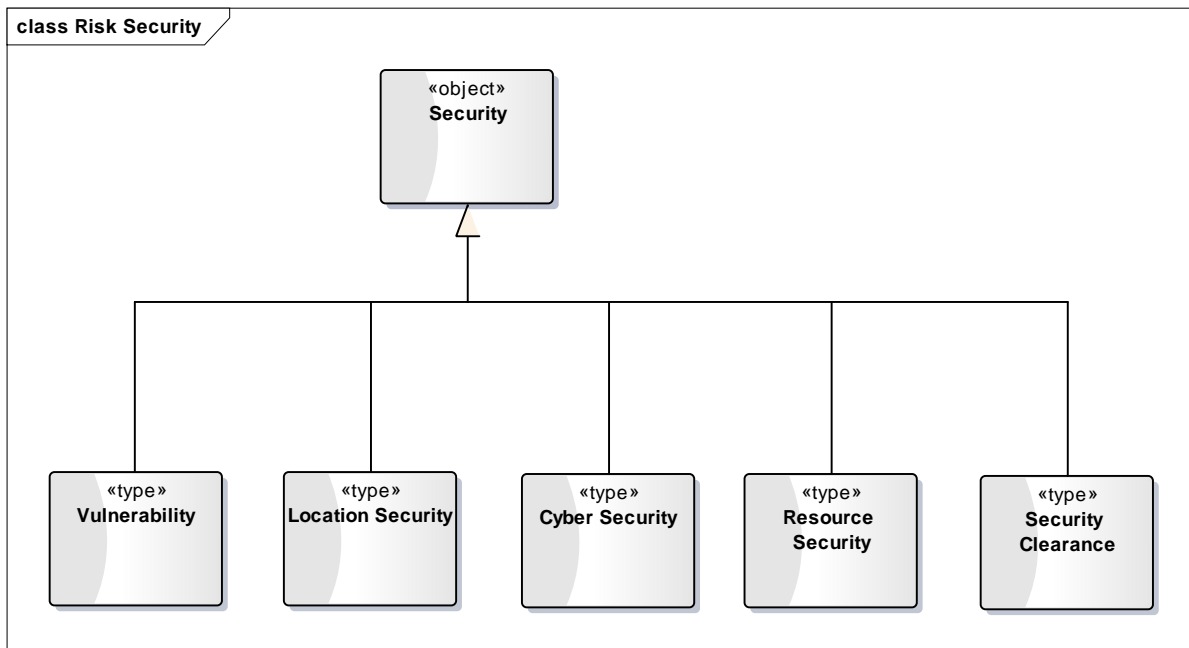


Figure 7 : Risk Security

Cyber Security

Description: The body of technologies, processes and practices designed to protect networks, computers, programs and data from attack, damage or unauthorized access.

Relationships

Relationship	Related Item Name
Specialization of	Security

Location Security

Description: The body of technologies, processes, and practices designed to protect a physical site from attack, damage or unauthorized access.

Relationships

Relationship	Related Item Name
Specialization of	Security

Resource Security

Description: The capacity of a population to safeguard sustainable access to adequate quantities of resources for sustaining objectives

Relationships

Relationship	Related Item Name
Specialization of	Security

Security

Description: The objects or tools that secure make safe and protect through measures to prevent exposure to danger or risk.

Relationships

Relationship	Related Item Name
Generalization of	Vulnerability
Generalization of	Location Security
Generalization of	Resource Security
Generalization of	Cyber Security
Generalization of	Security Clearance

Security Clearance

Description: A special status granted to individuals allowing them access resources or locations

Relationships

Relationship	Related Item Name
Specialization of	Security

VULNERABILITY

Description: Susceptibly to being exploited or damaged so as to impact the ability to operate as intended

Relationships

Relationship	Related Item Name
Specialization of	Security

Risk Measure

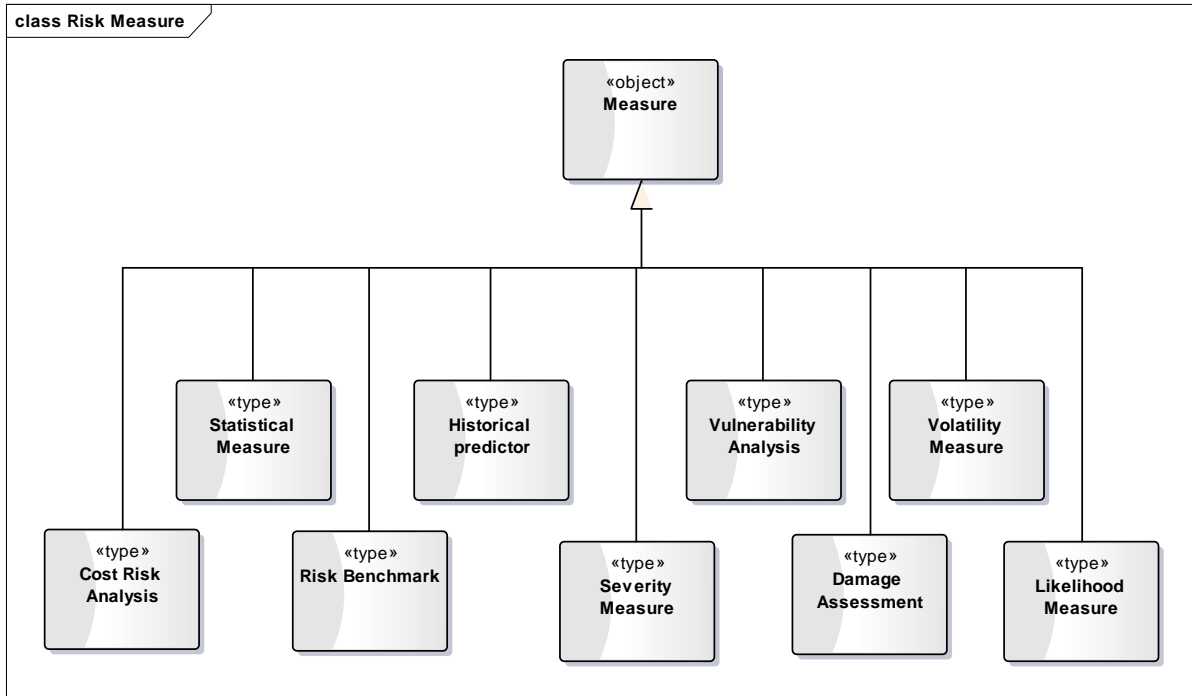


Figure 8 : Risk Measure

Cost Risk Analysis

Description: The process of quantifying the cost impacts of *risks* associated within a specific setting or context.

Relationships

Relationship	Related Item Name
Specialization of	Measure

Damage Assessment

Description: The evaluation of damage or loss caused by an event

Relationships

Relationship	Related Item Name
Specialization of	Measure

Historical predictor

Description: The use of Patterns in World History to Predict the Future

Relationships

Relationship	Related Item Name
Specialization of	Measure

Likelihood Measure

Description: The measure of probability that something is true (or false)

Relationships

Relationship	Related Item Name
Specialization of	Measure

Measure

Description: Any type of measurement used to gauge some quantifiable component of an enterprise's performance.

Relationships

Relationship	Related Item Name
Generalization of	Vulnerability Analysis
Generalization of	Volatility Measure
Generalization of	Statistical Measure
Generalization of	Historical predictor
Generalization of	Severity Measure
Generalization of	Damage Assessment
Generalization of	Risk Benchmark
Generalization of	Likelihood Measure
Generalization of	Cost Risk Analysis

Risk Benchmark

Description: Identify a risk management program's strengths and weaknesses.

Relationships

Relationship	Related Item Name
Specialization of	Measure

Risk Measure

Description: Any of a series of metrics used to indicate and track risk.

Relationships

Relationship	Related Item Name
Specialization of	Measure

Severity Measure

Description: The forecast or actual measure of the impact of a risk

Relationships

Relationship	Related Item Name
Specialization of	Measure

Statistical Measure

Description: A summary (means, mode, total, index, etc.) of the individual quantitative variable values for the statistical units in a specific group (study domains).

Relationships

Relationship	Related Item Name
Specialization of	Measure

Volatility Measure

Description: A measure of the uncertainty in a specific system or variable.

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Measure

Vulnerability Analysis

Description: The process of identifying, quantifying, and prioritizing (or ranking) the potential weaknesses or deficiencies in a system.

Relationships

Relationship	Related Item Name
Specialization of	Measure

RISK TIME

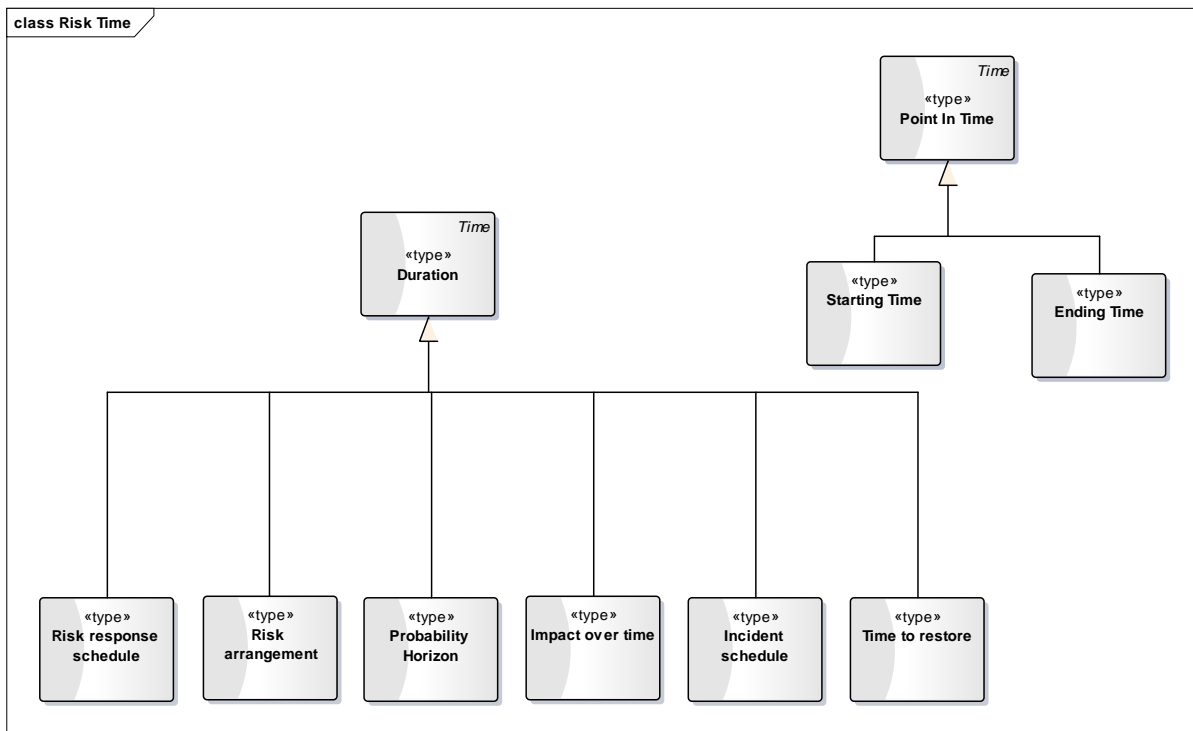


Figure 9 : Risk Time

Duration

Description: Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Generalization of	Risk response schedule
Generalization of	Risk arrangement
Generalization of	Probability Horizon
Generalization of	Impact over time
Generalization of	Incident schedule
Generalization of	Time to restore

Impact over time

Description: The cumulative consequence of the risk Relationships

Relationship	Related Item Name
Specialization of	Duration

Incident schedule

Description: The plan for addressing the incident Relationships

Relationship	Related Item Name
Specialization of	Duration

Probability Horizon

Description: The period over which the risk is evaluated as being a factor Relationships

Relationship	Related Item Name
Specialization of	Duration

Risk arrangement

Description: How risk is shared between two or more actors Relationships

Relationship	Related Item Name
Specialization of	Duration

Risk response schedule

Description: The planned time to respond to a triggered risk

Relationships

Relationship	Related Item Name
Specialization of	Duration

Time to restore

Description: The planned time between a disruptive event and when normal operations resume

Relationships

Relationship	Related Item Name
Specialization of	Duration

RISK MONITORING

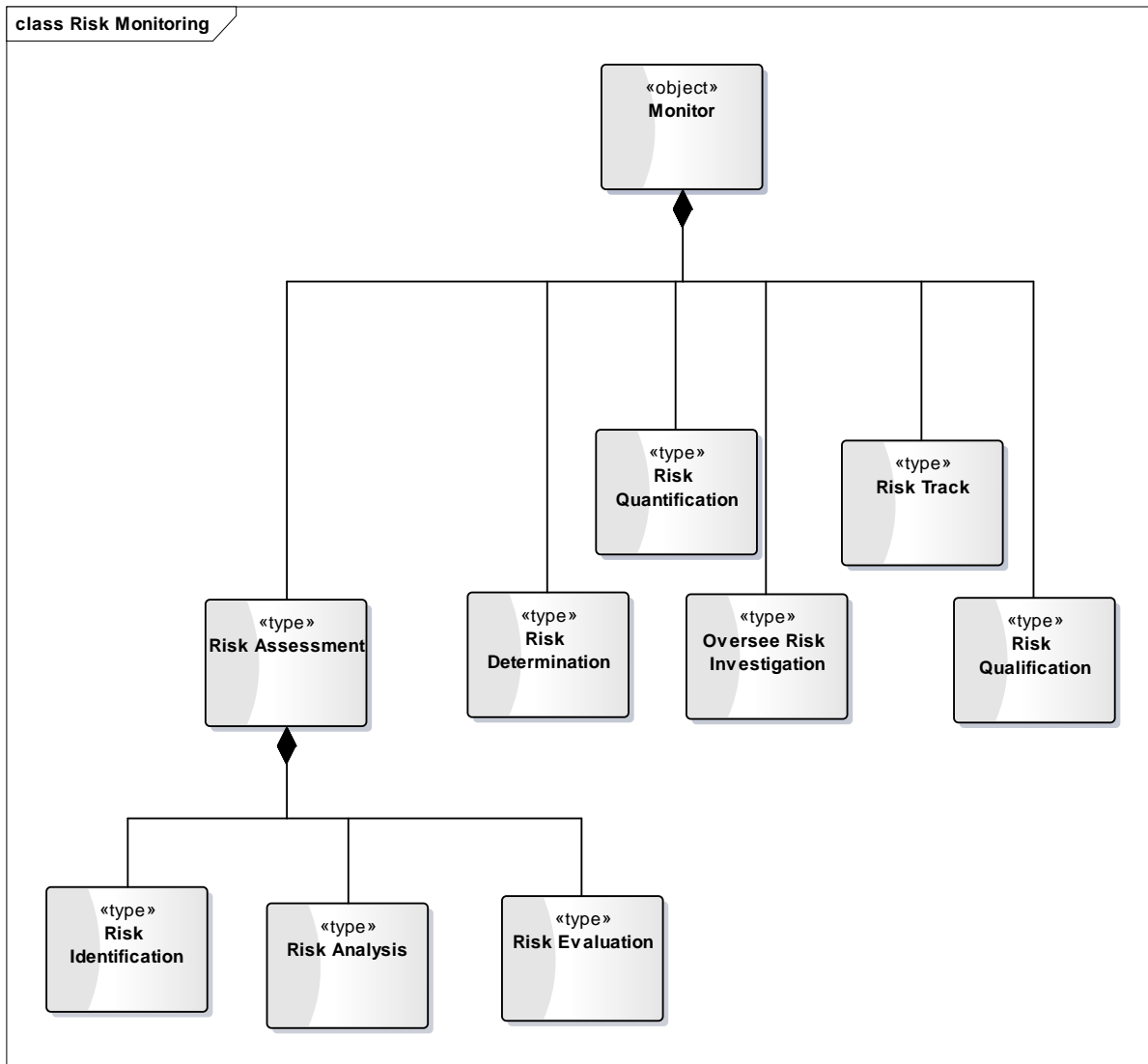


Figure 10 : Risk Monitoring

Monitor

Description: To be aware of the state, through observation or measuring.

To supervise and to continually check and critically observe. It means to determine the current status and to assess whether or not required or expected performance levels are actually being achieved.

Relationships

Relationship	Related Item Name	DGTVR_RiskRisk ModelObject
Contains	Risk Determination	True

Risk Analysis

Description: The process that is used to understand the nature, sources, and causes of the risks that you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine the controls that currently exist.

Relationships

Relationship	Related Item Name
Part of	Risk Assessment

Risk Assessment

Description: A systematic process of evaluating the potential risks that may be involved in a projected activity or undertaking.

Relationships

Relationship	Related Item Name
Contains	Risk Identification
Contains	Risk Evaluation
part of	Monitor
Contains	Risk Analysis

Risk Determination

Description:

Selection of risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks

Relationships

Relationship	Related Item Name
part of	Monitor

Risk Evaluation

Description: Determination of possible risk management priorities through establishment of qualitative and/or quantitative relationships between benefits and associated risks

Process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.

Relationships

Relationship	Related Item Name
Part of	Risk Assessment

Risk Identification

Description: The process of determining risks that could potentially prevent the program, enterprise, or investment from achieving its objectives.

Relationships

Relationship	Related Item Name
part of	Risk Assessment

Risk Qualification

Description: The process of Prioritization and classification of risk

Relationships

Relationship	Related Item Name
part of	Monitor

Risk Quantification

Description: The process of attaching a probability to the happening of a negative event.

Relationships

Relationship	Related Item Name
part of	Monitor

Risk Track

Description: Collection of information of the status of risks and how that status is changing

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
part of	Monitor

RISK CONTROL

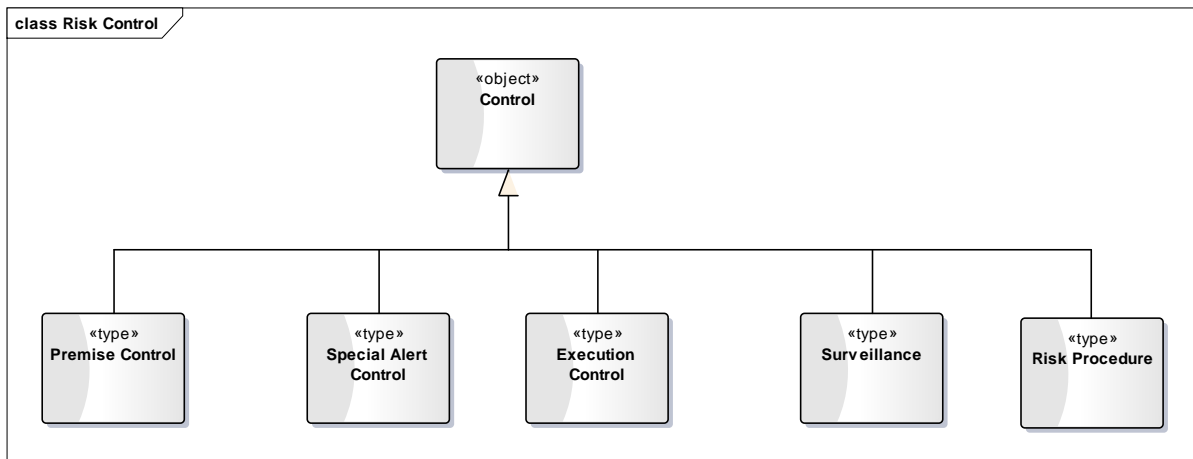


Figure 11 : Risk Control

Control

Description: To exercise restraint or direction, to hold in check as well as bro test or verify. It includes decision-making aspects with accompanying decision logic to ensure compliance.

Relationships

Relationship	Related Item Name
Generalization of	Risk Procedure
Generalization of	Premise Control
Generalization of	Special Alert Control
Generalization of	Execution Control
Generalization of	Surveillance

Execution Control

Description: Control to ensure the direction and/ or pace of activity is consistent with conditions

Relationships

Relationship	Related Item Name
Specialization of	Control

Premise Control

Description: Check methodically and constantly whether the basis of action is well grounded and are still valid.

Relationships

Relationship	Related Item Name
Specialization of	Control

Risk Procedure

Description: Step-by-step instructions on how to address risk situations

Relationships

Relationship	Related Item Name
Specialization of	Control

Special Alert Control

Description: The rigorous and rapid reassessment of an action because of the occurrence of an event.

Relationships

Relationship	Related Item Name
Specialization of	Control

Surveillance

Description: Observation of a wide range of events within and outside the area of concern to identify what may impact actions

Relationships

Relationship	Related Item Name
Specialization of	Control

RISK ORGANIZATION

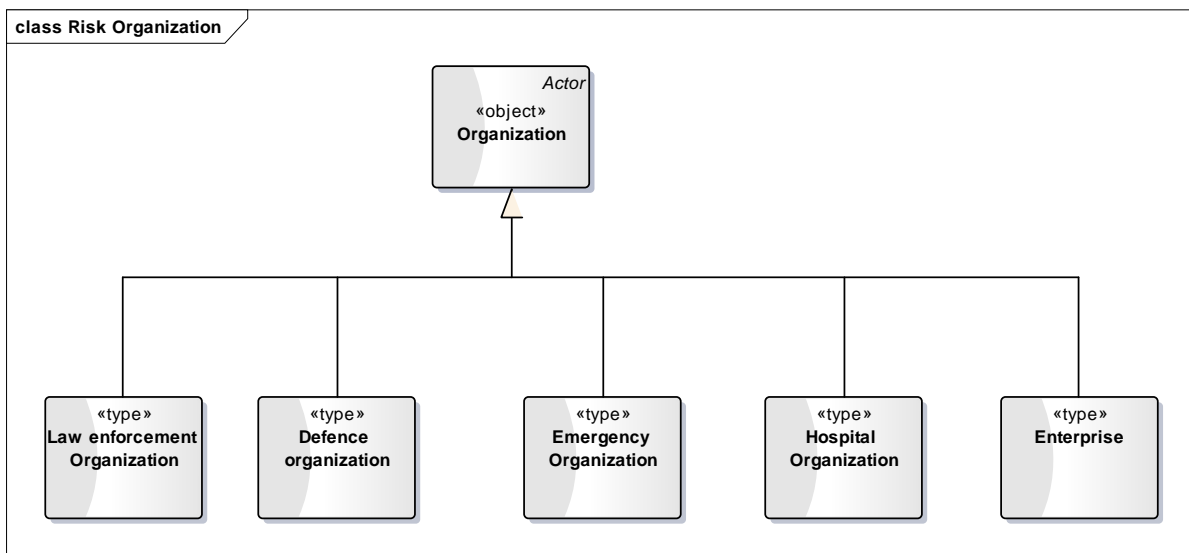


Figure 12 : Risk Organization

Defence organization

Description: An organization charged with protecting the sovereignty and interests of a nation by means of force

Relationships

Relationship	Related Item Name
Specialization of	Organization

Emergency Organization

Description: An organization charged with provided services or capabilities during an incident where normal capabilities have been degraded

Relationships

Relationship	Related Item Name
Specialization of	Organization

Enterprise

Description: Two or more organizations working in a coordinated manner within the shared value chain

Relationships

Relationship	Related Item Name
Specialization of	Organization

Hospital Organization

Description: An institution providing medical and surgical treatment and nursing care for sick or injured people

Relationships

Relationship	Related Item Name
Specialization of	Organization

Law enforcement Organization

Description: An organized body of police officers responsible for a specific jurisdiction

Relationships

Relationship	Related Item Name
Specialization of	Organization

COMPETENCY GROUP

This group contains the business objects that capture and describe the essential organizations skill and knowledge needed to fulfil the scope and purpose of the business

ORGANIZATION

Description: An arrangement or formation of resources that has a set of collective goals.

Relationships

Relationship	Related Item Name
Generalization of	Law enforcement Organization
Generalization of	Hospital Organization
Generalization of	Emergency Organization
Generalization of	Defence organization

Risk Organization Unit

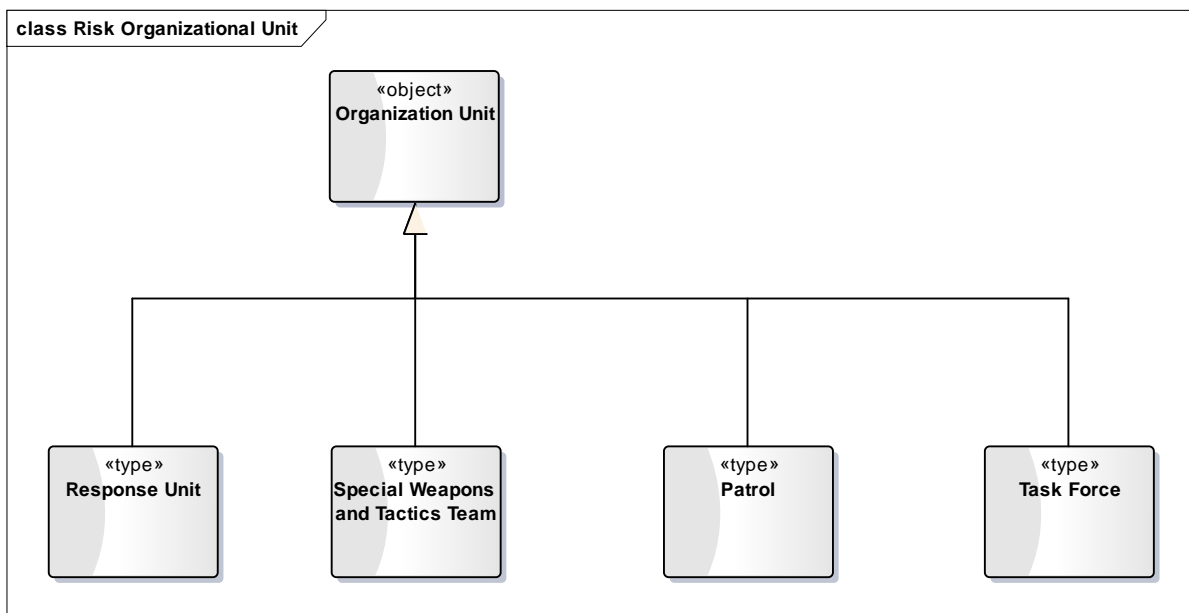


Figure 13 : Risk Organizational Unit

Organization Unit

Description: A self-contained unit of resources with strategic business objectives, critical success factors, goals, and measures.

Relationships

Relationship	Related Item Name
Generalization of	Special Weapons and Tactics Team
Generalization of	Response Unit

Relationship	Related Item Name
Generalization of	Patrol
Generalization of	Task Force

Patrol

Description: A group of personnel, such as **police** officers or soldiers that are assigned to monitor a specific geographic area.

Relationships

Relationship	Related Item Name
Specialization of	Organization Unit

Response Unit

Description: An international standardized disaster relief **unit** established to respond to a negative event.

Relationships

Relationship	Related Item Name
Specialization of	Organization Unit

Special Weapons and Tactics Team

Description: A group of elite police marksmen who specialize in high-risk tasks such as hostage rescue.

Also commonly

Any group of specialists brought in to solve a difficult or urgent problem

Relationships

Relationship	Related Item Name
Specialization of	Organization Unit

Task Force

Description: An armed force organized for a special operation. Also commonly, a unit specially organized for a task

Relationships

Relationship	Related Item Name
Specialization of	Organization Unit

RISK CAPABILITY

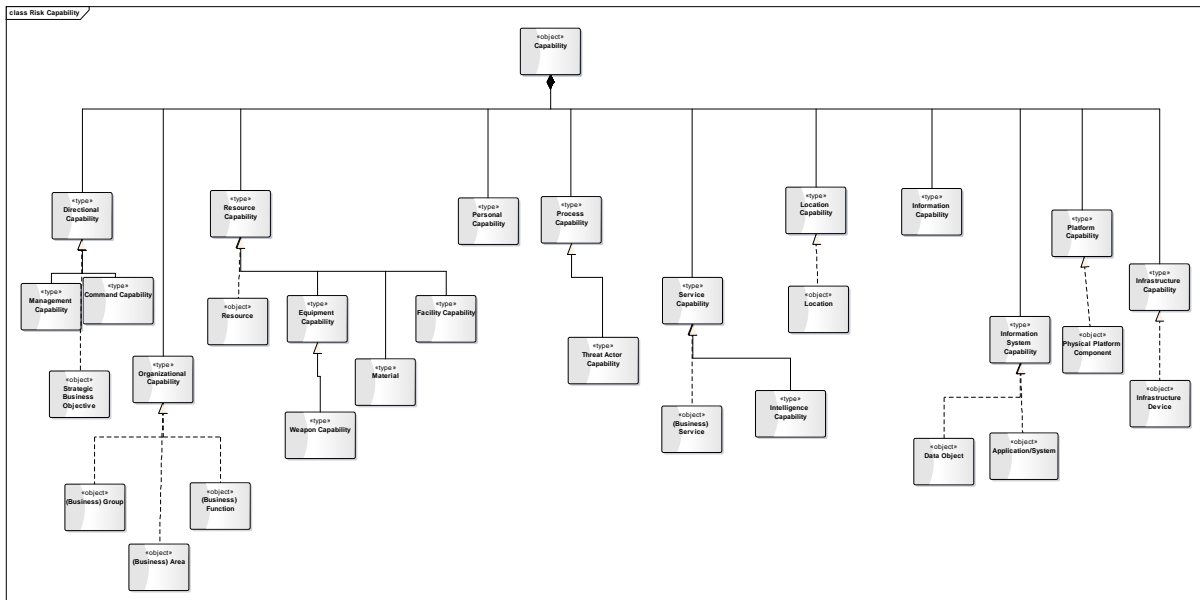


Figure 14 : Risk Capability

Material

Description: Relationships

Relationship	Related Item Name
Specialization of	Resource Capability

Capability

Description: A capability is an abstraction that represents the ability to perform a particular skill set i.e. organizational competencies, personal competencies, business function, processes, services and technology.

Relationships

Relationship	Related Item Name
composed of	Organizational Capability
composed of	Service Capability
composed of	Process Capability
composed of	Directional Capability
composed of	Resource Capability
composed of	Personal Capability
composed of	Location Capability
composed of	Information Capability
composed of	Information System Capability
composed of	Platform Capability
composed of	Infrastructure Capability

Command Capability

Description: The extent of written guidance (regulations, instructions, publications, directions, doctrine, tactical level procedures and preparedness documents) required to support decision making, administration and operations.

Relationships

Relationship	Related Item Name
Specialization of	Directional Capability

Equipment Capability

Description: The ability of a piece of equipment to perform Relationships

Relationship	Related Item Name
Generalization of	Weapon Capability
Specialization of	Resource Capability

Facility Capability

Description: The ability of a building (including its infrastructure and fittings) to perform Relationships

Relationship	Related Item Name
Specialization of	Resource Capability

Intelligence Capability

Description: The extent of the ability to organize and synthesize information about opposition motivation cognition Strategy and behaviour Relationships

Relationship	Related Item Name
Specialization of	Service Capability

Management Capability

Description: The overall ability of the management team of an enterprise to align the organization to strategic intent and to accelerate results. Relationships

Relationship	Related Item Name
Specialization of	Directional Capability

Organizational Capability

Description: The extent to which organizational units e.g. business areas, business groups, business function with an appropriate balance of competency, structure and command and control to accomplish their tasks.

Relationships

Relationship	Related Item Name
part of	Capability

Process Capability

Description: The extent to which the enterprise has the ability to execute on business processes, steps, and events.

Relationships

Relationship	Related Item Name
Contains	Threat Actor Capability
part of	Capability

Threat Actor Capability

Description: The net effect of the total capabilities the attacking actor possesses.

Relationships

Relationship	Related Item Name
Part of	Process Capability

Weapon Capability

Description: Characteristics of Tangible property used for combat

Relationships

Relationship	Related Item Name
Part of	Equipment Capability

RISK RESOURCE

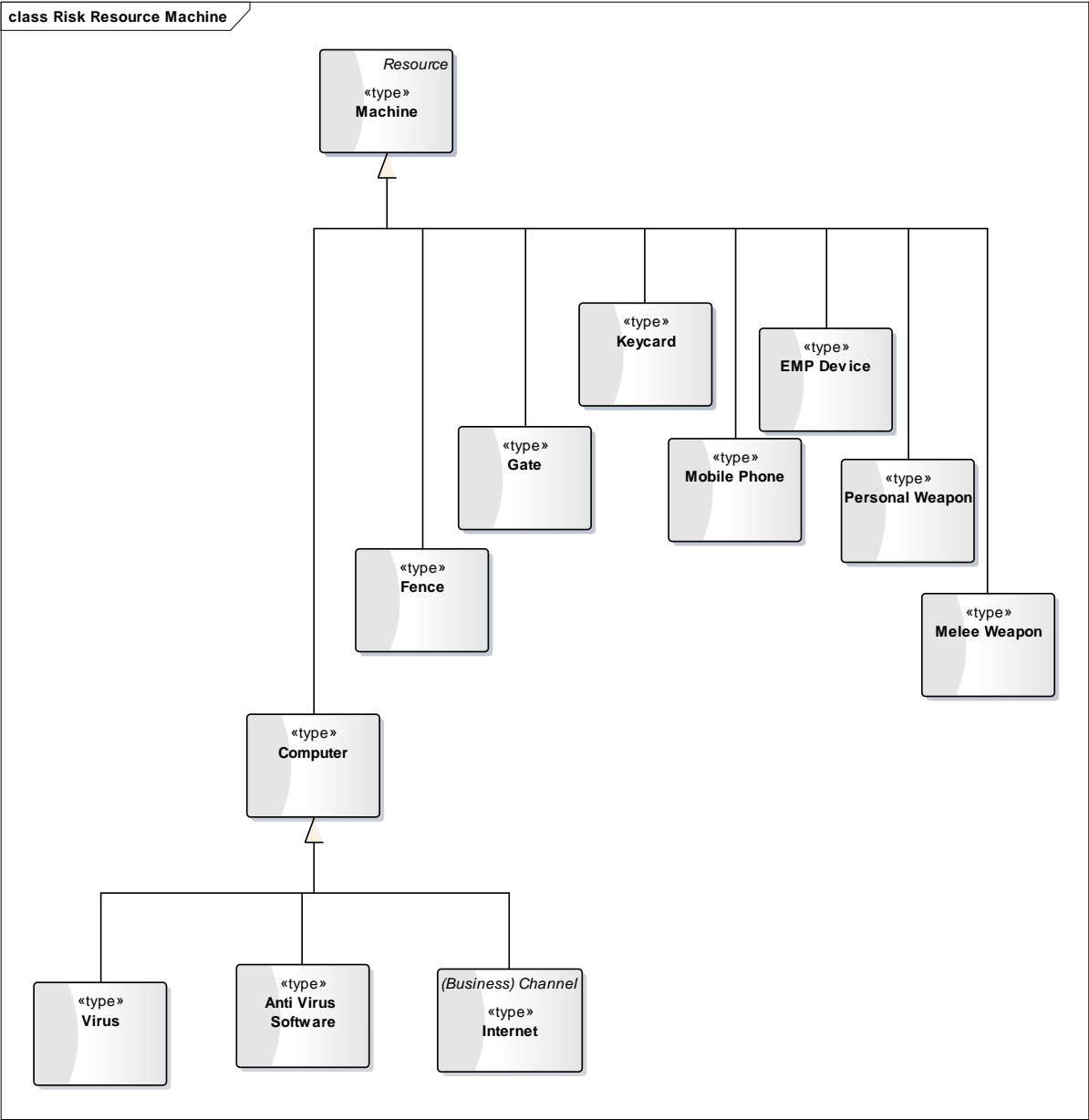


Figure 15 : Risk Resource Machine

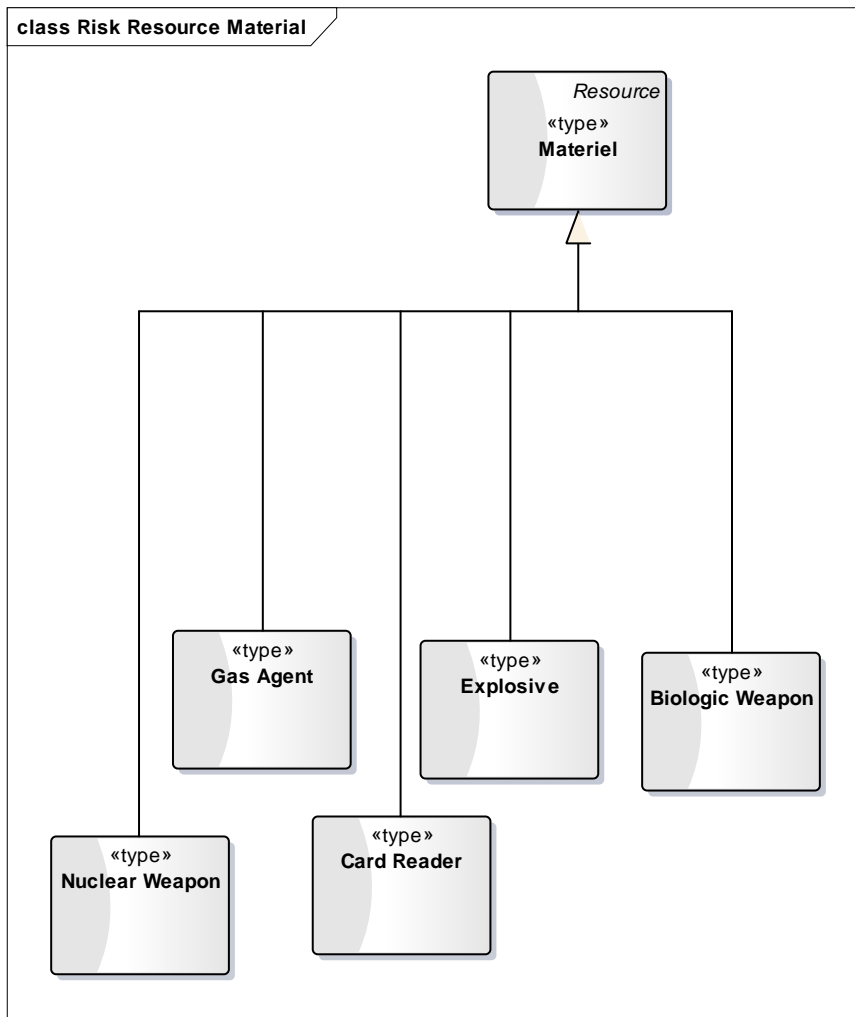


Figure 16 : Risk Resource Material

Anti-Virus Software

Description: Computer **software** used to prevent, detect and remove malicious **software**

Relationships

Relationship	Related Item Name
Specialization of	Computer

Biologic Weapon

Description: Living organisms or replicating entities (viruses, which are not universally considered "alive") that reproduce or replicate within their host victims and that are lethal or debilitating

Relationships

Relationship	Related Item Name
Specialization of	Materiel

Card Reader

Description: An electronic sensor that reads a magnetic strip or bar code on a credit card, membership card, etc.

Relationships

Relationship	Related Item Name
Specialization of	Materiel

Computer

Description: An electronic device for storing and processing data, typically in binary form, according to instructions given to it in a variable program.

Relationships

Relationship	Related Item Name
Generalization of	Virus
Generalization of	Internet
Generalization of	Anti-Virus Software
Specialization of	Machine

EMP Device

Description: A device capable of generating a pulse in the form of a radiated, electric or magnetic field or conducted electrical current

Relationships

Relationship	Related Item Name
Specialization of	Machine

Explosive

Description: A package of a substance that can be made to explode

Relationships

Relationship	Related Item Name	DGTVR_RiskRisk ModelObject
Specialization of	Materiel	True

Fence

Description: A barrier, railing, or other upright structure, typically of wood or wire, enclosing an area of ground to mark a boundary, control access, or prevent escape.

Relationships

Relationship	Related Item Name
Specialization of	Machine

Gas Agent

Description: Lethal or debilitating agents that attack the nervous, respiratory or circulator system

Relationships

Relationship	Related Item Name
Specialization of	Materiel

Gate

Description: A movable barrier used to close an opening in a wall, fence, or hedge.

Relationships

Relationship	Related Item Name
Specialization of	Machine

Keycard

Description: A small plastic card that can be used instead of a door key, bearing magnetically encoded data that can be read and processed by an electronic device.

Relationships

Relationship	Related Item Name
Specialization of	Machine

Melee Weapon

Description: A martial arts or other non-ballistic hand weapon

Relationships

Relationship	Related Item Name
Specialization of	Machine

Mobile Phone

Description: A telephone with access to a cellular radio system so it can be used over a wide area, without a physical connection to a network.

Relationships

Relationship	Related Item Name
Specialization of	Machine

Nuclear Weapon

Description: A bomb or missile that uses nuclear energy to cause an explosion

Relationships

Relationship	Related Item Name
Specialization of	Materiel

Personal Weapon

Description: Small arms weapon, as a rifle or pistol, from which a projectile is fired for the purpose of inflicting bodily harm or physical damage

Relationships

Relationship	Related Item Name
Specialization of	Machine

Virus

Description: An infective agent that typically consists of a nucleic acid molecule in a protein coat, is too small to be seen by light microscopy, and is able to multiply only within the living cells of a host

Also commonly

A piece of code that is capable of copying itself and typically has a detrimental effect, such as corrupting the system or destroying data.

Relationships

Relationship	Related Item Name
Specialization of	Computer

RISK ACTOR

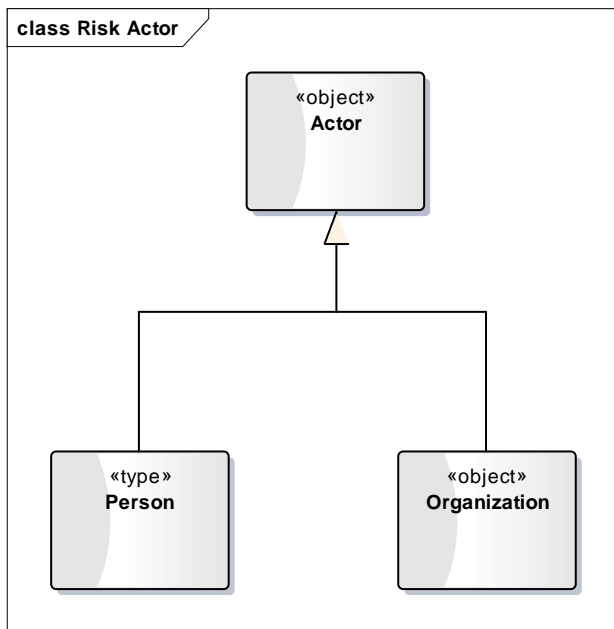


Figure 17 : Risk Actor

Actor

Description: A person, organization, or system that has a role that initiates or interacts with activities. Actors may be internal or external to an organization.

Relationships

Relationship	Related Item Name
Generalization of	Person
Generalization of	Organization

Person

Description: A single human being.

Relationships

Relationship	Related Item Name
Specialization of	Actor

Risk Role

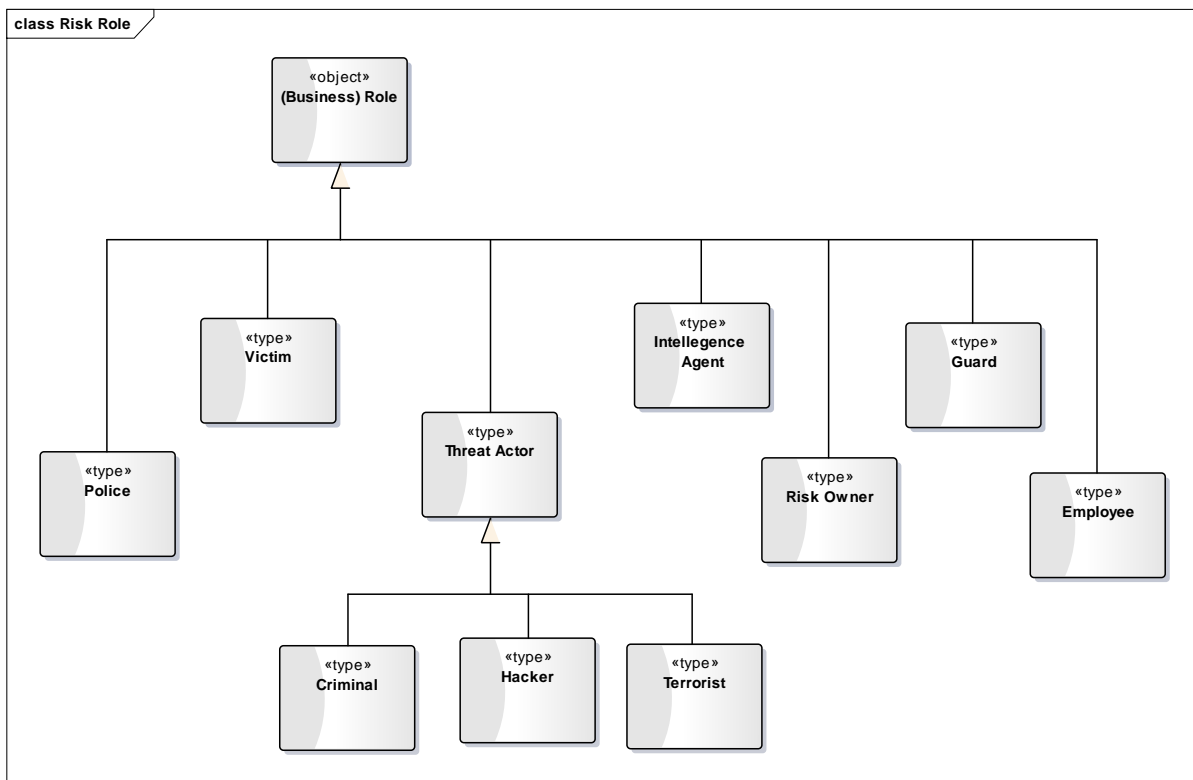


Figure 18 : Risk Role

ROLE

Description: A part that something or someone has the rights, rules, competencies, and capabilities to perform. A resource and/ or actor may have a number of roles i.e. process role, service role or application role and many actors may be assigned the same role.

Relationships

Relationship	Related Item Name
Generalization of	Victim
Generalization of	Threat Actor
Generalization of	Police
Generalization of	Risk Owner
Generalization of	Employee

Criminal

Description: A person who has committed a crime

Relationships

Relationship	Related Item Name
Specialization of	Threat Actor

Employee

Description: A role performed by a person employed for wages or salary, especially at nonexecutive level.

Relationships

Relationship	Related Item Name
Specialization of	Role

Guard

Description: A person who keeps watch, especially a soldier or other person formally assigned to protect a person or to control access to a place

Relationships

Relationship	Related Item Name
Specialization of	Role

Hacker

Description: A person who uses computers to gain unauthorized access to data

Relationships

Relationship	Related Item Name
Specialization of	Threat Actor

Intelligence Agent

Description: Any person charged with obtaining *intelligence*, or information, especially for to assess threats or vulnerabilities

Relationships

Relationship	Related Item Name
Specialization of	Role

Police

Description: A member of the civil force of a national or local government, responsible for the prevention and detection of crime and the maintenance of public order.

Relationships

Relationship	Related Item Name
Specialization of	Role

RISK OWNER

Description: A person or entity that has been given the authority to manage a particular risk and is accountable for doing so.

Relationships

Relationship	Related Item Name
Specialization of	Role

Terrorist

Description: Any person intent on or who has committed violence against targets for the purpose of fomenting fear or terror by intimidating or coercing a civilian population so as to influence the policy of a government by intimidation or coercion; or to affect the conduct of a government.

Relationships

Relationship	Related Item Name
Specialization of	Threat Actor

Threat Actor

Description: Any person intent on or who has committed a crime

Relationships

Relationship	Related Item Name
Specialization of	Role
Generalization of	Terrorist
Generalization of	Hacker
Generalization of	Criminal

Victim

Description: A person harmed, injured, or killed as a result of a crime, accident, or other event or action

Relationships

Relationship	Related Item Name
Specialization	Role

RISK RULE

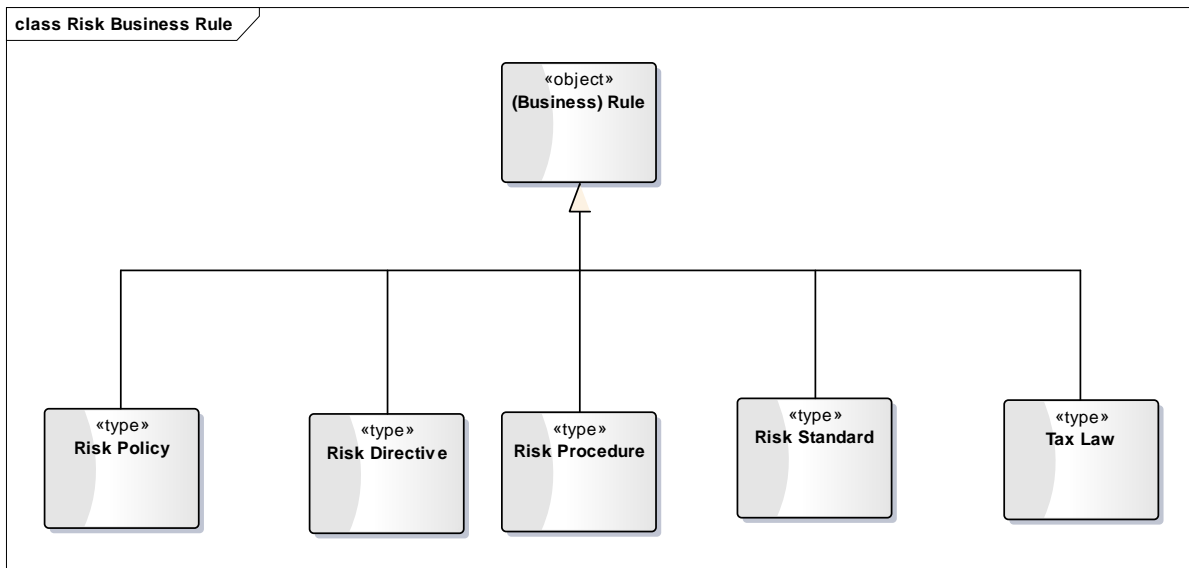


Figure 19 : RISK RULE

Rule

Description: A statement that defines or constrains some aspect of behaviour within the enterprise and always resolves to either true or false.

Relationships

Relationship	Related Item Name
Generalization of	Risk Policy
Generalization of	Risk Directive
Generalization of	Risk Standard
Generalization of	Risk Procedure
Generalization of	Tax Law

Risk Directive

Description: An official or authoritative instruction

Relationships

Relationship	Related Item Name
Specialization of	Rule

Risk Policy

Description: A course or principle of action adopted or proposed by a government, party, business, or individual

Relationships

Relationship	Related Item Name
Specialization of	Rule

Risk Procedure

Description: An established or official way of doing something

Relationships

Relationship	Related Item Name
Specialization of	Rule

Risk Standard

Description: Something considered by an authority or by general consent as a basis of comparison.

Relationships

Relationship	Related Item Name
Specialization of	Rule

RISK REVENUE

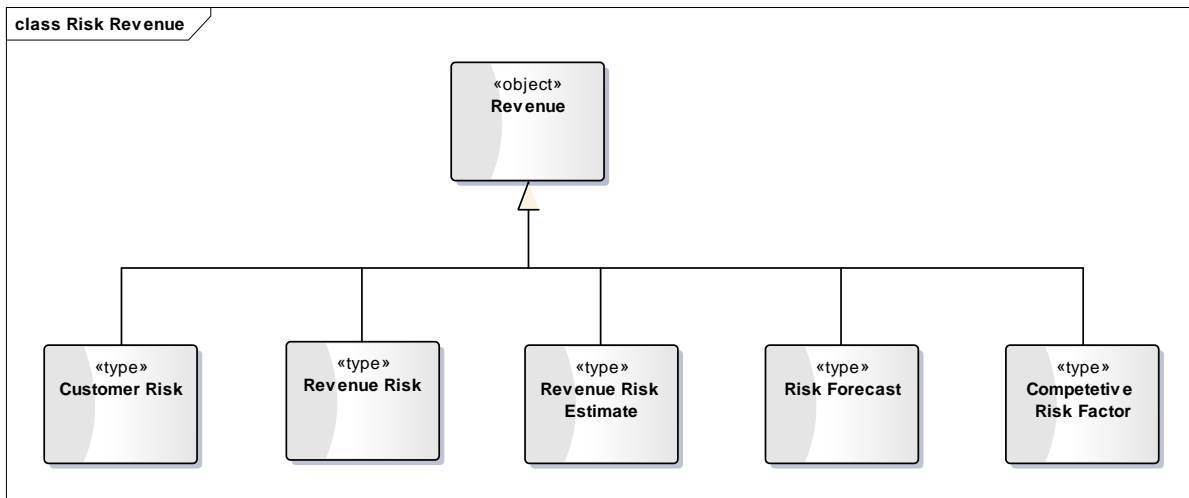


Figure 20 : Risk Revenue

Competitive Risk Factor

Description: The measure of risk due to competition

Relationships

Relationship	Related Item Name
Specialization of	Revenue

Customer Risk

Description: A potential risk found in all consumer-oriented products, that a product not meeting quality standards will pass undetected though the manufacturer's quality control system and enter the consumer marketplace.

Relationships

Relationship	Related Item Name
Specialization of	Revenue

Revenue

Description: The realized monetary or financial income of an enterprise or part thereof.

Relationships

Relationship	Related Item Name
Generalizations of	Competitive Risk Factor
Generalizations of	Risk Forecast
Generalizations of	Revenue Risk Estimate
Generalizations of	Revenue Risk
Generalizations of	Customer Risk

REVENUE RISK

Description: Uncertainty within the revenue stream

Relationships

Relationship	Related Item Name
Specialisation of	Revenue

Revenue Risk Estimate

Description: The assessment of uncertainty within the revenue stream

Relationships

Relationship	Related Item Name
Specialisation of	Revenue

Risk Forecast

Description: The estimate of future revenue risk

Relationships

Relationship	Related Item Name
Specialisation of	Revenue

Tax Law

Description: Limiting the amount of losses and investor (usually a limited partner) can claim. Only the amount actually at risk can be deducted.

Relationships

Relationship	Related Item Name
Specialisation of	Rule

RISK CONTRACT

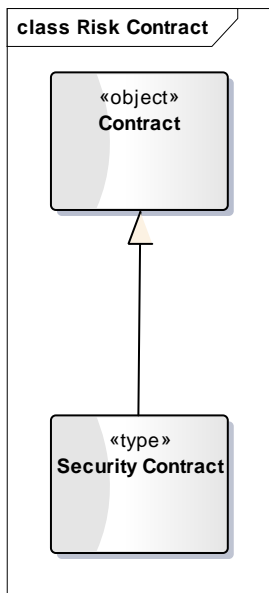


Figure 21 : Risk Contract

Contract

Description: An agreement between two or more parties that establishes conditions for interaction.

Relationships

Relationship	Related Item Name
Generalization of	Security Contract

Security Contract

Description: A written or spoken agreement, especially one concerning protection of capabilities that is intended to be enforceable by force or other means of protection or intervention

Relationships

Relationship	Related Item Name
Specialization of	Contract

Risk Compliance

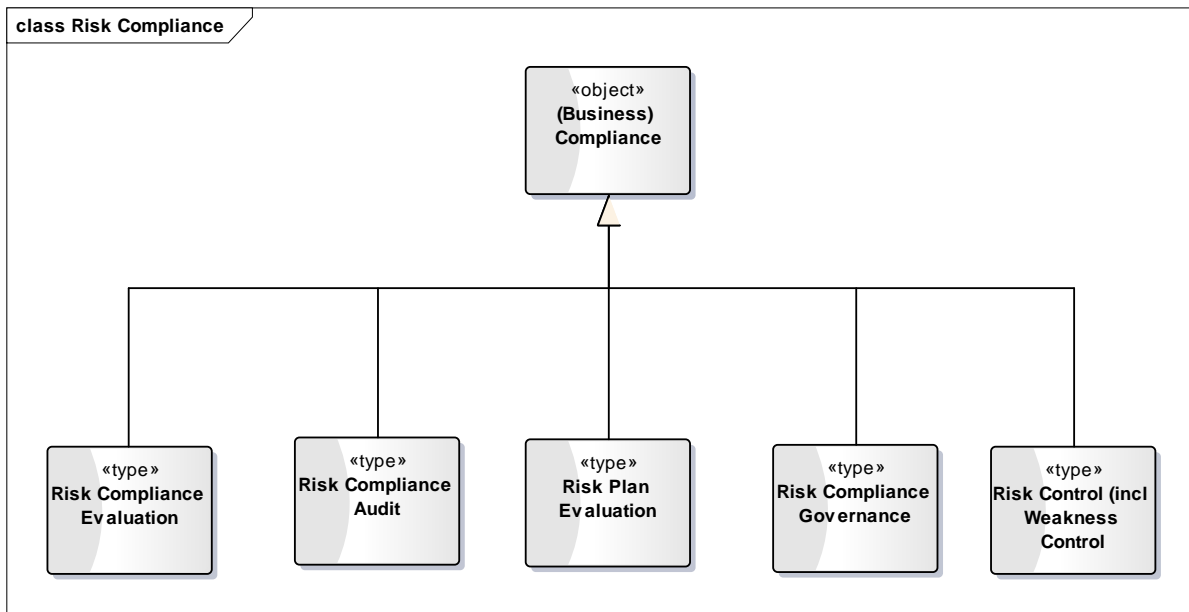


Figure 22 : Risk Compliance

COMPLIANCE

Description: The process or tools for verifying adherence to rules and decisions within the business in order to determine whether something is a suitable, adequate, and effective way of achieving established objectives.

Relationships

Relationship	Related Item Name
Generalization of	Risk Compliance Evaluation
Generalization of	Risk Compliance Audit
Generalization of	Risk Compliance Governance
Generalization of	Risk Control (incl Weakness Control)
Generalization of	Risk Plan Evaluation

Risk Compliance Audit

Description: A comprehensive review of adherence to risk guidelines

Relationships

Relationship	Related Item Name
Specialization of	Compliance

Risk Compliance Evaluation

Description: An assessment of the effectiveness or risk treatment strategies

Relationships

Relationship	Related Item Name
Specialization of	Compliance

Risk Compliance Governance

Description: The process, decisions and actors necessary influence the risk compliance process

Relationships

Relationship	Related Item Name
Specialization of	Compliance

Risk Control (incl Weakness Control)

Description: The method by which potential losses are evaluated and action taken to reduce or eliminate such threats.

Relationships

Relationship	Related Item Name
Specialization of	Compliance

Risk Plan Evaluation

Description: The assessment of the risk management plan to detect flaws

Relationships

Relationship	Related Item Name
Specialization of	Compliance

RISK LOCATION

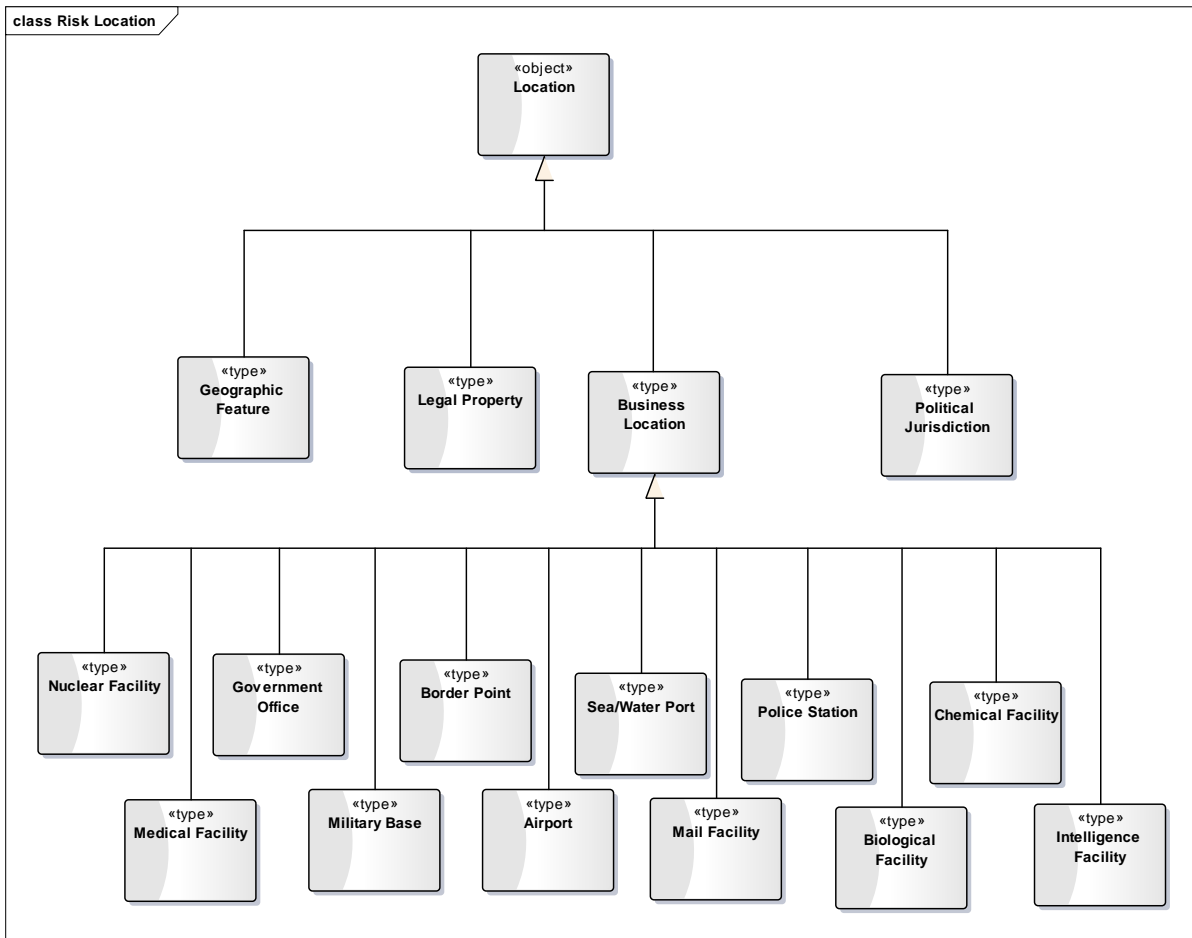


Figure 23 : Risk Location

Airport

Description: A complex of runways and buildings for the take-off, landing, and maintenance of civil aircraft, with facilities for passengers.

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Biological Facility

Description: A biosafety level is a level of the biocontainment precautions required to isolate dangerous *biological* agents in an enclosed laboratory *facility*

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Border Point

Description: *A location used to ensure that persons, including their means of transport and the objects in their possession, may be authorized to enter the territory*

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Chemical Facility

Description: *An industrial process plant that manufactures (or otherwise processes) chemicals, usually on a large scale.*

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Government Office

Description: *An office where government employees work*

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Intelligence Facility

Description: *An office where workers are responsible for providing and producing the intelligence*

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Location

Description: A point, facility, place, or geographic position that may be referred to physically or logically.

Relationships

Relationship	Related Item Name
realizes	Location Capability
Generalization of	Business Location
Generalization of	Geographic Feature
Generalization of	Legal Property
Generalization of	Political Jurisdiction

Mail Facility

Description: A sortation plant or collection and delivery point for physical mail (parcels or letters)

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Medical Facility

Description: A place where people get *medical* help

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Military Base

Description: A facility directly owned and operated by or for the **military** or one of its branches that shelters **military** equipment and personnel, and facilitates training and operations.

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Nuclear Facility

Description: A device in which the energy released by the fission of nuclei of uranium or another element is used to produce steam to run an electrical generator or other device.

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Police Station

Description: The office or headquarters of a local police force.

Relationships

Relationship	Related Item Name
Specialization of	Business Location

Sea/Water Port

Description: A **port** or harbour accessible to seagoing ships or other water vessels

Relationships

Relationship	Related Item Name
Specialization of	Business Location

RISK CHANNEL

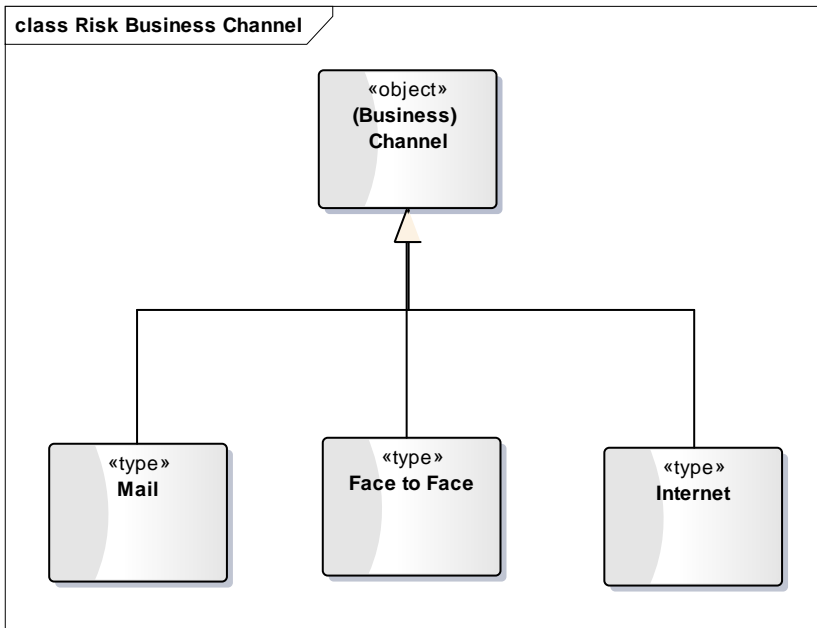


Figure 24 : RISK CHANNEL

Channel

Description: A means of access or otherwise interacting within an enterprise or between an enterprise and its external partners (customers, vendors, suppliers, etc.).

Relationships

Relationship	Related Item Name
Generalization of	Mail
Generalization of	Internet
Generalization of	Face to Face

Face to Face

Description: The system by which interaction is accomplished in person

Relationships

Relationship	Related Item Name
Specialization of	Channel

Internet

Description: A global system of interconnected computer networks that use the standard **Internet** protocol suite (TCP/IP) to link devices worldwide.

Relationships

Relationship	Related Item Name
Specialization of	Channel
Specialization of	Computer

Mail

Description:

The system whereby physical messages are transmitted via the post office.

Relationships

Relationship	Related Item Name
Specialization of	Channel

RISK BUSINESS MEDIA

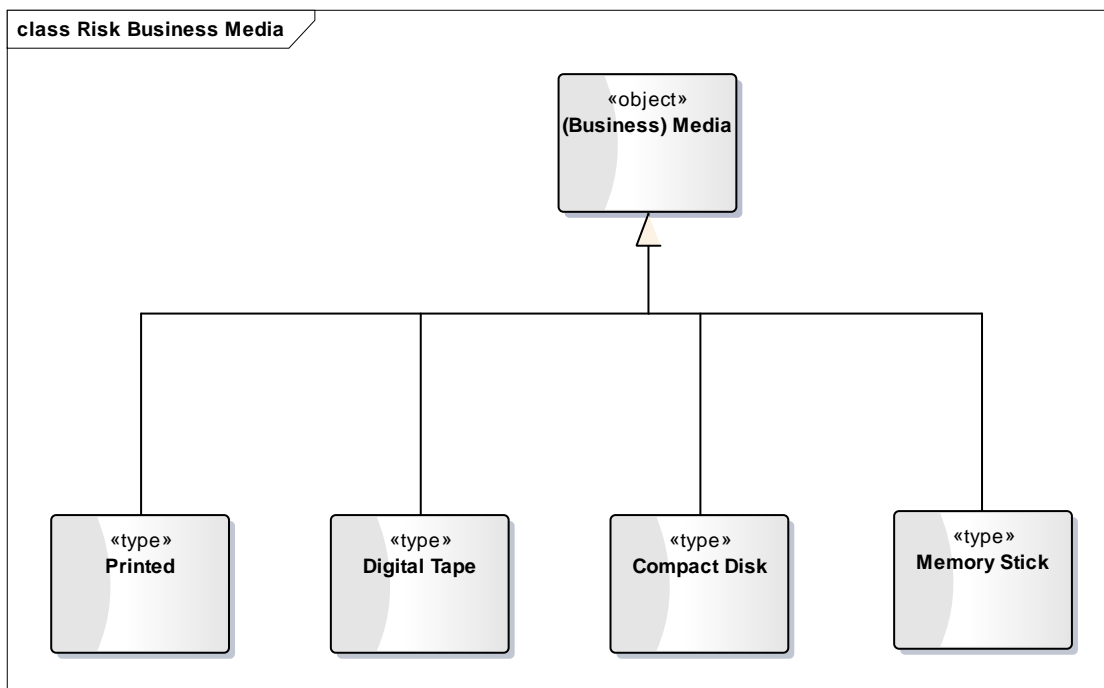


Figure 25 : Risk Business Media

Media

Description: The material or matter used to store information (. printed page, digital tape, CD, disk as well as non-volatile storage, screen, or memory).

Relationships

Relationship	Related Item Name
Generalization of	Printed
Generalization of	Memory Stick
Generalization of	Digital Tape
Generalization of	Compact Disk

Compact Disk

Description: A small plastic disc on digital information is stored, and from which the information can be read using reflected laser light

Relationships

Relationship	Related Item Name
Specialization of	Media

Digital Tape

Description:

A signal recording and playback medium where the contents can only be accessed sequentially

Relationships

Relationship	Related Item Name
Specialization of	Media

Memory Stick

Description: A type of electrically erasable programmable memory

Relationships

Relationship	Related Item Name
Specialization of	Media

Printed

Description: Security material (printed page)

Relationships

Relationship	Related Item Name
Specialization of	Media

BUSINESS SERVICE GROUP

Contains the business objects that realize behaviour

RISK SERVICE

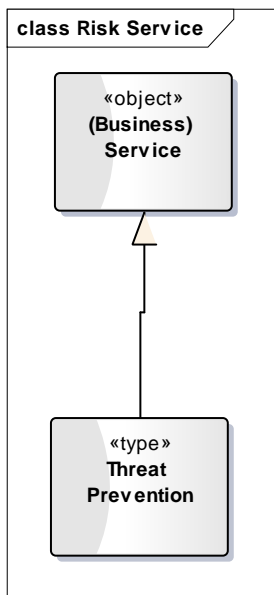


Figure 26 : Risk Service

Service

Description: The externally visible [logical] deed or effort performed to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.

Relationships

Relationship	Related Item Name
Generalization of	Threat Prevention

Threat Prevention

Description: The provision of effort to prevent, disrupt, or mitigate a threat so as to allow the enterprise to continue to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.

Relationships

Relationship	Related Item Name
Specialization of	Service

PROCESS GROUP

Contains the business objects necessary to execute work and create value

PROCESS ACTIVITY

Description: A part of the actual physical work system which specifies how to complete the change in the form or state of an input, oversee or even achieve the completion of an interaction with other actors which results in the making of a decision based on knowledge, judgement, experience, and instinct.

Relationships

Relationship	Related Item Name
Generalization of	Course of Action
Generalization of	Risk Response
Generalization of	Attack Pattern

Risk Response

Description: Any sequence of activities that an individual or unit may follow when responding to an attack.

Risk treatment is a risk modification process. It involves selecting and implementing one or more treatment options. Once a treatment has been implemented, it becomes a control or it modifies existing controls. You have many treatment options. You can avoid the risk, you can reduce the risk, you can remove the source of the risk, you can modify the consequences, you can change the probabilities, you can share the risk with others, you can simply retain the risk, or you can even increase the risk in order to pursue an opportunity.

Relationships

Relationship	Related Item Name
Specialization of	Process Activity

RISK EVENT

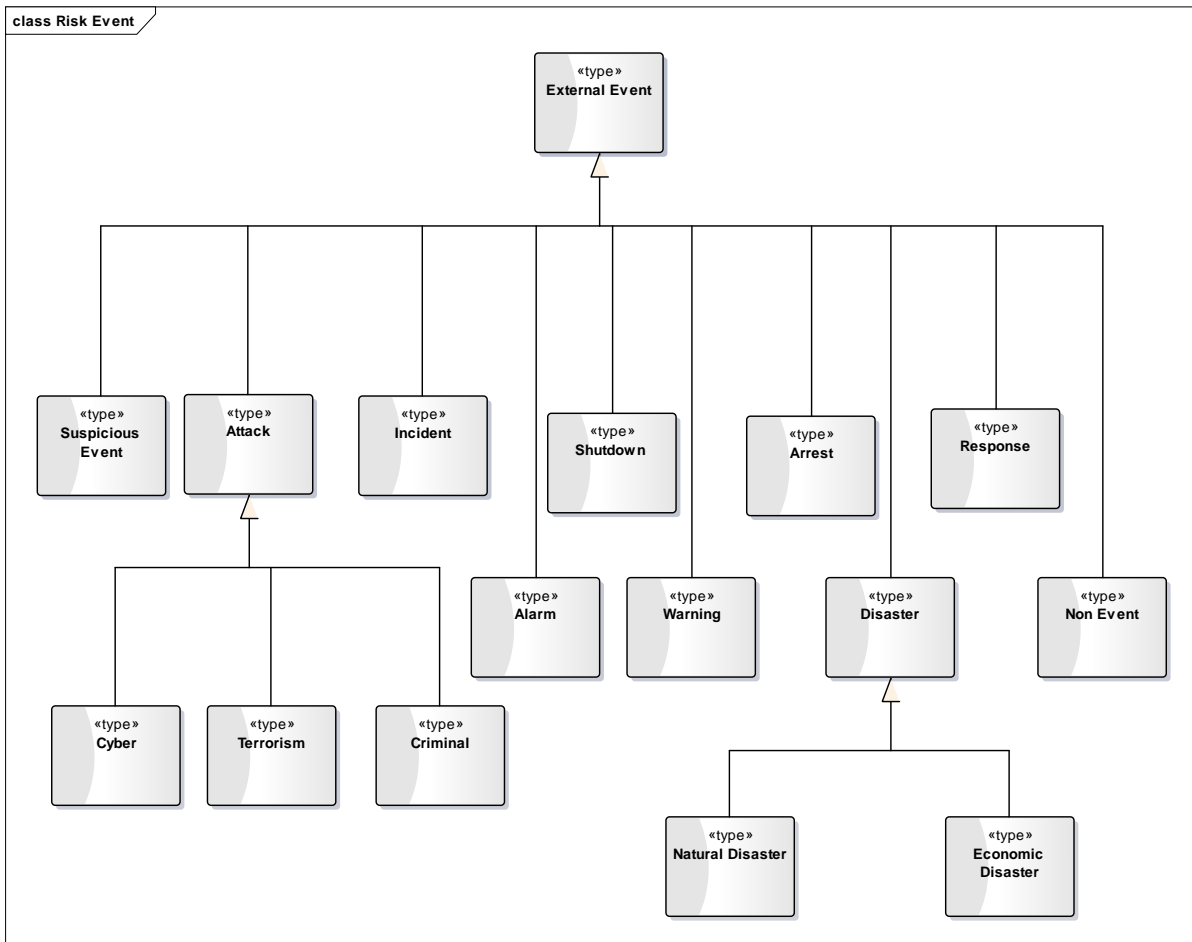


Figure 27 : Risk Event

Alarm

Description: A signal (as a loud noise or flashing light) that warns or alerts

Relationships

Relationship	Related Item Name	DGTVR_RiskRisk ModelObject
Specialization of	External Event	True

Arrest

Description: A change in the state of someone by legal authority, who takes them into custody
Relationships

Relationship	Related Item Name
Specialization of	External Event

Attack

Description: A change whereby an aggressive or violent actions is recognized as occurring.

Resulting from sequence of activities that an individual or unit may follow when setting upon a target and the defence of the target.

Relationships

Relationship	Related Item Name
Generalization of	Terrorism
Generalization of	Cyber
Generalization of	Criminal
Specialization of	External Event

Criminal

Description: The recognition of an act committed for the purpose of personal gain outside legally accepted methods and behaviour

Relationships

Relationship	Related Item Name
Generalization of	Attack

Cyber

Description: A change in the level of confidence in the integrity of a computer system due to the apprehension of a deliberate exploitation of computer systems, technology-dependent enterprises and networks.

Relationships

Relationship	Related Item Name
Generalization of	Attack

Disaster

Description: A sudden event that causes great damage or loss of life.

Relationships

Relationship	Related Item Name
Generalization of	Natural Disaster
Generalization of	Economic Disaster
Specialization of	External Event

Economic Disaster

Description: An **economic collapse** where an **economy** is in complete distress for months, years or possibly even decades. A total **economic collapse** is characterized by **economic** depression, civil unrest and highly increased poverty levels

Relationships

Relationship	Related Item Name
Specialization of	Disaster

External Event

Description: An event that occurs from outside the business

Relationships

Relationship	Related Item Name
Generalization of	Warning
Generalization of	Suspicious Event
Generalization of	Shutdown
Generalization of	Response
Generalization of	Incident
Generalization of	Disaster

Relationship	Related Item Name
Generalization of	Attack
Generalization of	Arrest
Generalization of	Alarm
Generalization of	Non Event

Incident

Description: A change of enough significance to impact the ability of some part of the business to perform in a material manner

Relationships

Relationship	Related Item Name
Specialization of	External Event

Natural Disaster

Description: A natural event such as a flood, earthquake, or hurricane that causes great damage or loss of life

Relationships

Relationship	Related Item Name
Specialization of	Disaster

Non Event

Description: An anticipated or required event that fails to occur

Relationships

Relationship	Related Item Name
Specialization of	External Event

Response

Description: A reaction to impending and apprehended danger, problem, or other unpleasant situation.

Relationships

Relationship	Related Item Name
Specialization of	External Event

Shutdown

Description: The initiation of closure of a component system within an enterprise due to a malfunction, disruption, or for maintenance.

Relationships

Relationship	Related Item Name
Specialization of	External Event

Suspicious Event

Description: Behaviour that changes the level of trust

Relationships

Relationship	Related Item Name
Specialization of	External Event

Terrorism

Description: The recognition of the initiation of an act of violence committed against targets for the purpose of fomenting fear or terror by intimidating or coercing a civilian population so as to influence the policy of a government by intimidation or coercion; or to affect the conduct of a government.

Relationships

Relationship	Related Item Name
Specialization of	Attack

Warning

Description: An indication of a possible change in terms of the impending level of danger, problem, or other unpleasant situation.

Relationships

Relationship	Related Item Name
Specialization of	External Event

RISK GATEWAY/RISK DECISION

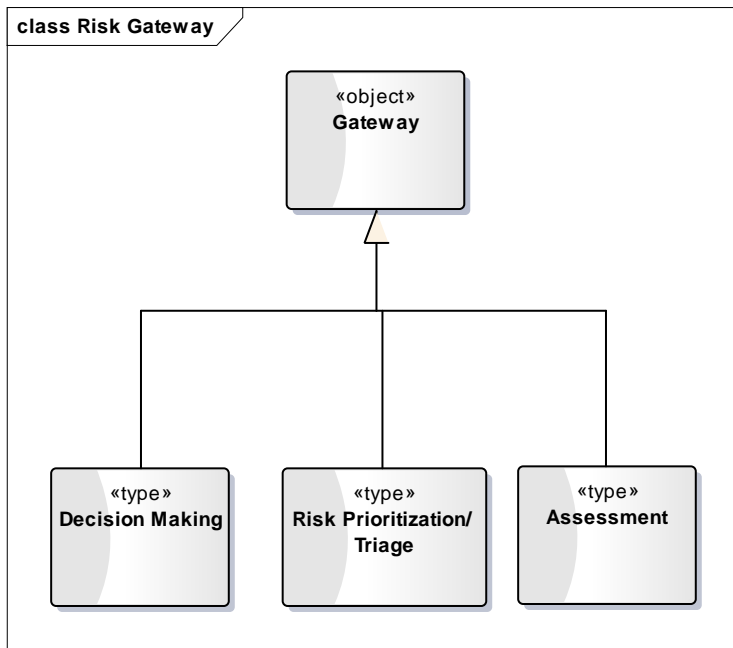


Figure 28 : Risk Gateway

Assessment

Description: The evaluation or estimation of the nature, quality, or ability of someone or something.

Relationships

Relationship	Related Item Name
Specialization of	Gateway

Decision Making

Description: The action or process of deciding something or of resolving a question.

Relationships

Relationship	Related Item Name
Specialization of	Gateway

GATEWAY

Description: Determines forking and merging of paths, depending on the conditions expressed.

Relationships

Relationship	Related Item Name
Generalization of	Decision Making
Generalization of	Assessment
Generalization of	Risk Prioritization/ Triage

Risk Prioritization/ Triage

Description: Classification of risk to determine which should be addressed first when allocating resources

Relationships

Relationship	Related Item Name
Specialization of	Gateway

RISK ACTIVITY

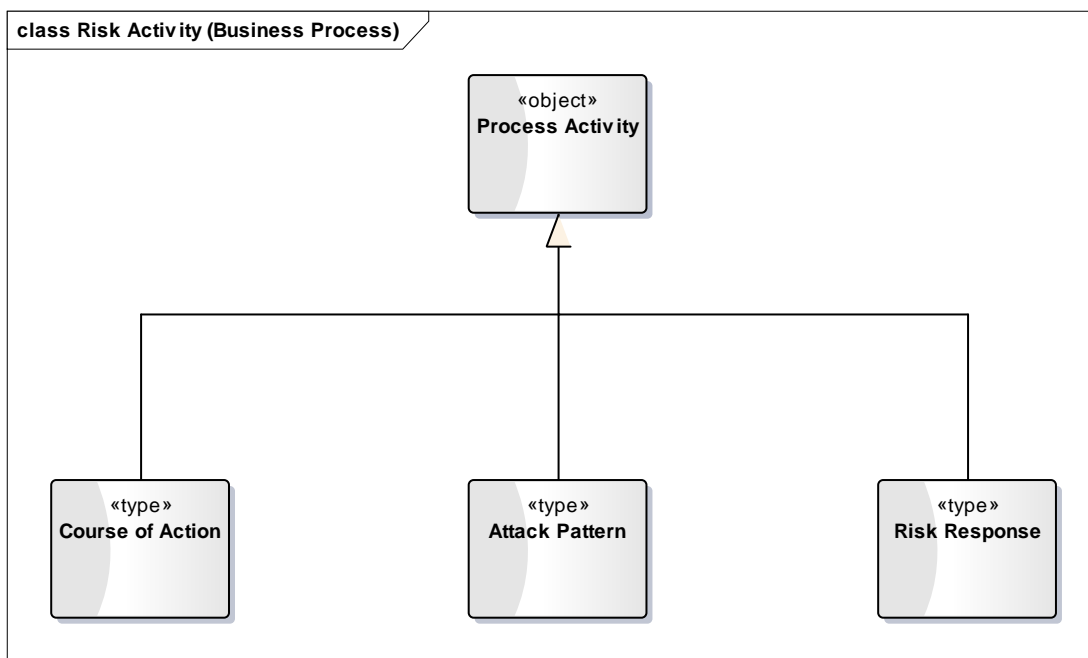


Figure 29 : Risk Activity (Business Process)

Attack Pattern

Description: Any sequence of activities that an individual or unit may follow when setting upon a target.

Relationships

Relationship	Related Item Name
Specialization of	Process Activity

Course of Action

Description: A procedure adopted to deal with a situation.

Relationships

Relationship	Related Item Name
Specialization of	Process Activity

Application Layer

Description: Contains the objects used to describe the structure and connections of the enabling technology of the software applications and how these objects interact with one other both within the layer and across the enterprise

INFORMATION SYSTEM GROUP

Contains the business objects necessary to describe the structure and behaviour of software that enables work

RISK INFORMATION OBJECT

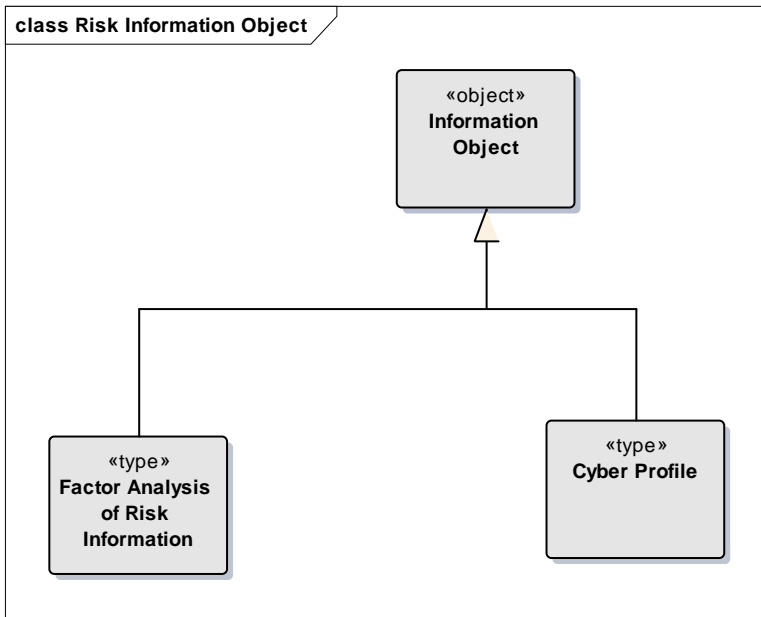


Figure 30 : Risk Information Object

Cyber Profile

Description: A real-time picture of an enterprise’s information technology security posture

Relationships

Relationship	Related Item Name
Specialization of	Information Object

Factor Analysis of Risk Information

Description: A taxonomy of the factors that contribute to risk and how they affect each other. It is primarily concerned with establishing accurate probabilities for the frequency and magnitude of loss events

Relationships

Relationship	Related Item Name
Specialization of	Information Object

RISK APPLICATION/ SYSTEM REPORT

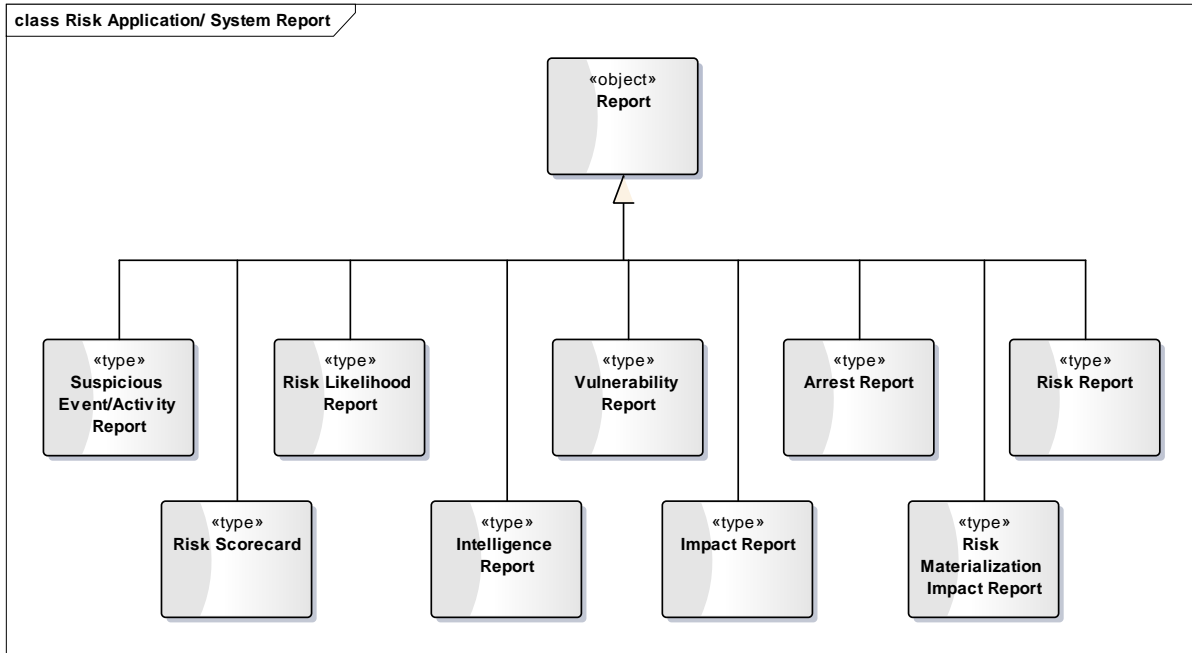


Figure 31 : Risk Application/ System Report

Arrest Report

Description: A record of a law enforcement agency of an *arrest* and of any related detention or confinement incident together with the connected charge

Relationships

Relationship	Related Item Name
Specialization of	Report

Impact Report

Description: A record of the impact of an actualized risk

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Report

Intelligence Report

Description: A specific report of information, usually on a single item, made at any level of command in tactical operations and disseminated as rapidly as possible in keeping with the timeliness of the information showing analysis of the current threat landscape

Relationships

Relationship	Related Item Name
Specialization of	Report

Risk Likelihood Report

Description: A specific report of information, usually on a likelihood of something happening to the current threat landscape

Relationships

Relationship	Related Item Name
Specialization of	Report

Risk Materialization Impact Report

Description: A specific report of information, usually on a the impact of the risk to the current threat landscape

Relationships

Relationship	Related Item Name
Specialization of	Report

Risk Report

Description: A record of a risk

Relationships

Relationship	Related Item Name
Specialization of	Report

Risk Scorecard

Description: A report that shows through the use of appropriate scores the operational risk profile of part of all of an enterprise.

Relationships

Relationship	Related Item Name
Specialization of	Report

Suspicious Event/Activity Report

Description: A report made regarding suspicious or potentially suspicious activity

Relationships

Relationship	Related Item Name
Specialization of	Report

Vulnerability Report

Description: A record of a weakness or gap in part of all of an enterprise.

Relationships

Relationship	Related Item Name
Specialization of	Report

Risk Meta Model Objects

Description: The follow section details the Risk Meta Model classifications of the Risk Meta Meta Model Objects relevant to risk

Purpose and Goal Group

FORCE

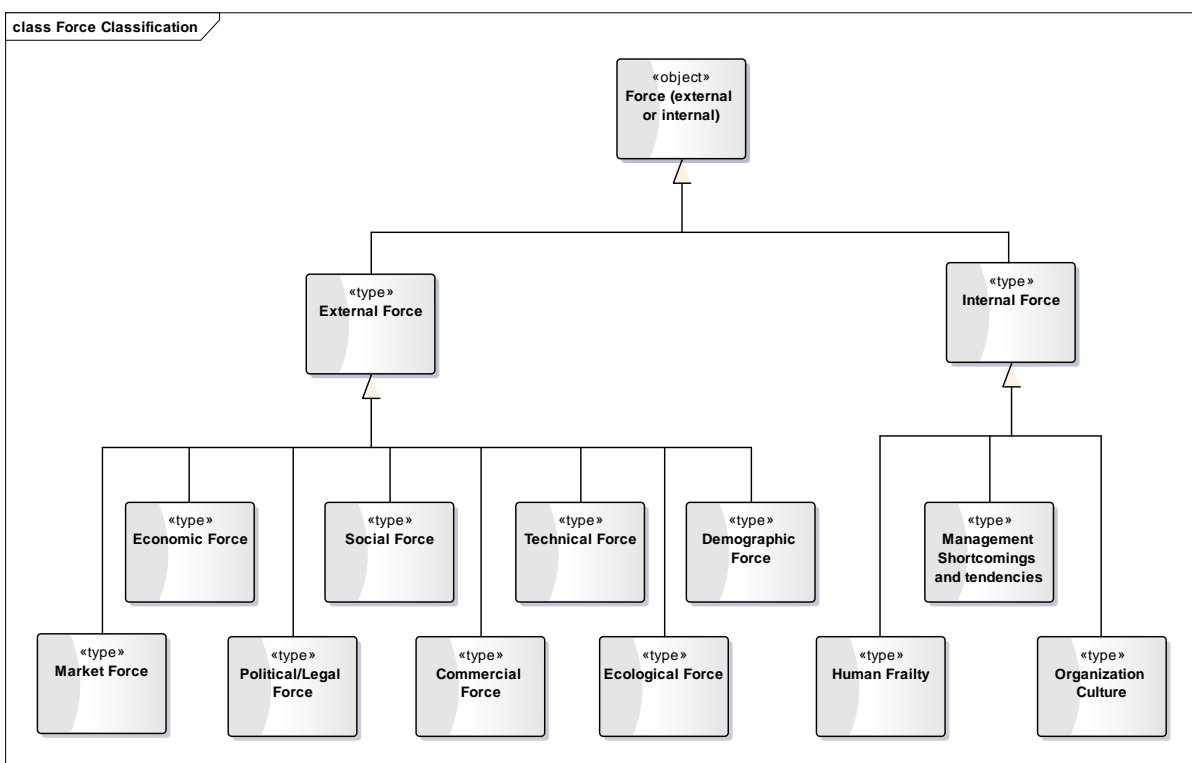


Figure 32 : Force Classification

COMMERCIAL FORCE

Description: The level of competition within an industry, as reflected its micro environment, including those caused by rivalry and commercial relationships and obligations.

Relationships

Relationship	Related Item Name
Specialisation of	External Force

DEMOGRAPHIC FORCE

Description: Factors that include gender, age, ethnicity, knowledge of languages, disabilities, mobility, home ownership, employment status, religious belief or practice, culture and tradition, living standards and income level.

Relationships

Relationship	Related Item Name
Specialisation of	External Force

ECOLOGICAL FORCE

Description: Factors include ecological and environmental aspects such as weather, climate, and climate change, which may especially affect industries such as tourism, farming, and insurance. Furthermore, growing awareness of the potential impacts of climate change is affecting how companies operate and the products they offer, both creating new markets and diminishing or destroying existing ones.

Relationships

Relationship	Related Item Name
Specialisation of	External Force

ECONOMIC FORCE

Description: Factors include economic growth, interest rates, exchange rates, and the inflation rate.

Relationships

Relationship	Related Item Name
Specialisation of	External Force

EXTERNAL FORCE

Description: A force coming from outside the enterprise

Relationships

Relationship	Related Item Name
Generalization of	Technical Force
Generalization of	Social Force

Relationship	Related Item Name
Generalization of	Political/Legal Force
Generalization of	Economic Force
Generalization of	Ecological Force
Generalization of	Demographic Force
Generalization of	Commercial Force
Specialisation of	Force (external or internal)
Generalization of	Market Force

FORCE (EXTERNAL OR INTERNAL)

Description: An external or internal factor that forces or pushes some aspect of an enterprise in a specific direction.

Relationships

Relationship	Related Item Name
Generalization of	External Force
Generalization of	Internal Force

HUMAN FRAILTY

Description: Moral weakness; liability to yield to temptation of humans

Relationships

Relationship	Related Item Name
Specialization of	Internal Force

INTERNAL FORCE

Description: A force that acts on the entire enterprise but comes from within

Relationships

Relationship	Related Item Name
Generalization of	Human Frailty
Generalization of	Management Shortcomings

Relationship	Related Item Name
	and tendencies
Generalization of	Organization Culture
Specialization of	Force (external or internal)

MANAGEMENT SHORTCOMINGS AND TENDENCIES

Description: Weaknesses or limitations of the management values and controls

Relationships

Relationship	Related Item Name
Specialization of	Internal Force

MARKET FORCE

Description: Forces of demand and supply representing the aggregate influence of self-interested buyers and sellers on price and quantity of the goods and services offered in a market. In general, excess demand causes prices and quantity of supply to rise and excess supply causes them to fall.

Relationships

Relationship	Related Item Name
Specialization of	External Force

ORGANIZATION CULTURE

Description: The values and behaviours that contribute to the unique social and psychological environment of an organization.

Relationships

Relationship	Related Item Name
Specialization of	Internal Force

POLITICAL/LEGAL FORCE

Description: The degree the government intervenes in the economy. Specifically, political factors include areas such as tax policy, labour law, regulations, tariffs, and political stability as well as the mechanisms to monitor and ensure compliance with these.

Relationships

Relationship	Related Item Name
Specialization of	External Force

SOCIAL FORCE

Description: Factors include the cultural aspects and include health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety.

Relationships

Relationship	Related Item Name
Specialization of	External Force

TECHNICAL FORCE

Description: Technological aspects such as R&D activity, automation, technology incentives and the rate of technological change. They can determine barriers to entry, minimum efficient production level and influence outsourcing decisions. Furthermore, technological shifts can affect costs, quality, and lead to innovation.

Relationships

Relationship	Related Item Name
Specialization of	External Force

DRIVER

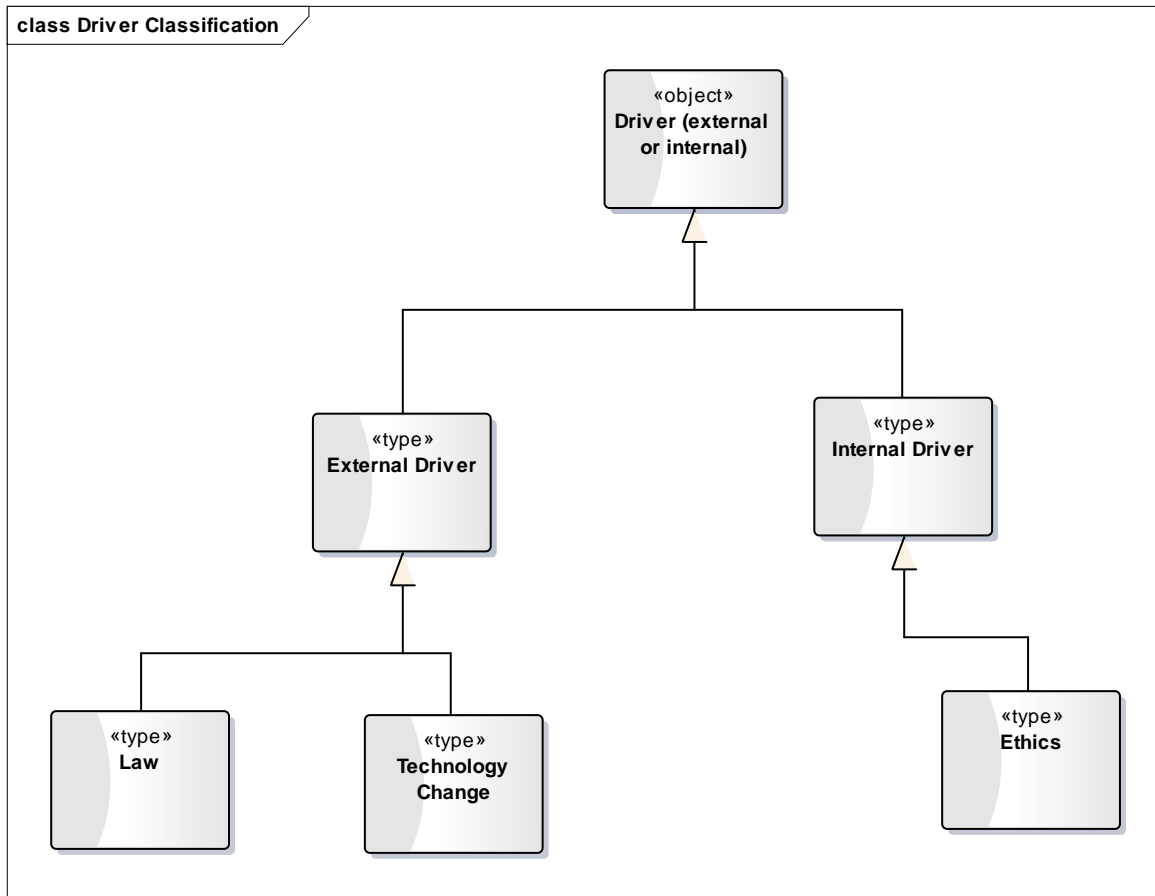


Figure 33 : Driver Classification

DRIVER (EXTERNAL OR INTERNAL)

Description: An external or internal factor that drives, establishes motivation for, or influences some aspect of an enterprise in a specific direction.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Internal Driver
Generalization of	External Driver

ETHICS

Description: Moral principles that govern a person or group's behaviour.

Relationships

Relationship	Related Item Name
Specialization of	Internal Driver

EXTERNAL DRIVER

Description: A driver coming from outside the organization

Relationships

Relationship	Related Item Name
Specialization of	Driver (external or internal)
Generalization of	Law
Generalization of	Technology Change

INTERNAL DRIVER

Description: A driver that acts on the entire enterprise but comes from within

Relationships

Relationship	Related Item Name
Specialization of	Driver (external or internal)
Generalization of	Ethics

LAW

Description: The system of rules that a particular country or community recognizes as regulating the actions of its members and may enforce by the imposition of penalties and therefore constrains permissible behaviour

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	External Driver

TECHNOLOGY CHANGE

Description: Overall process of invention, innovation and diffusion of **technology** or processes. The term is synonymous with **technological** development, **technological** achievement, and **technological** progress.

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	External Driver

OBJECTIVE

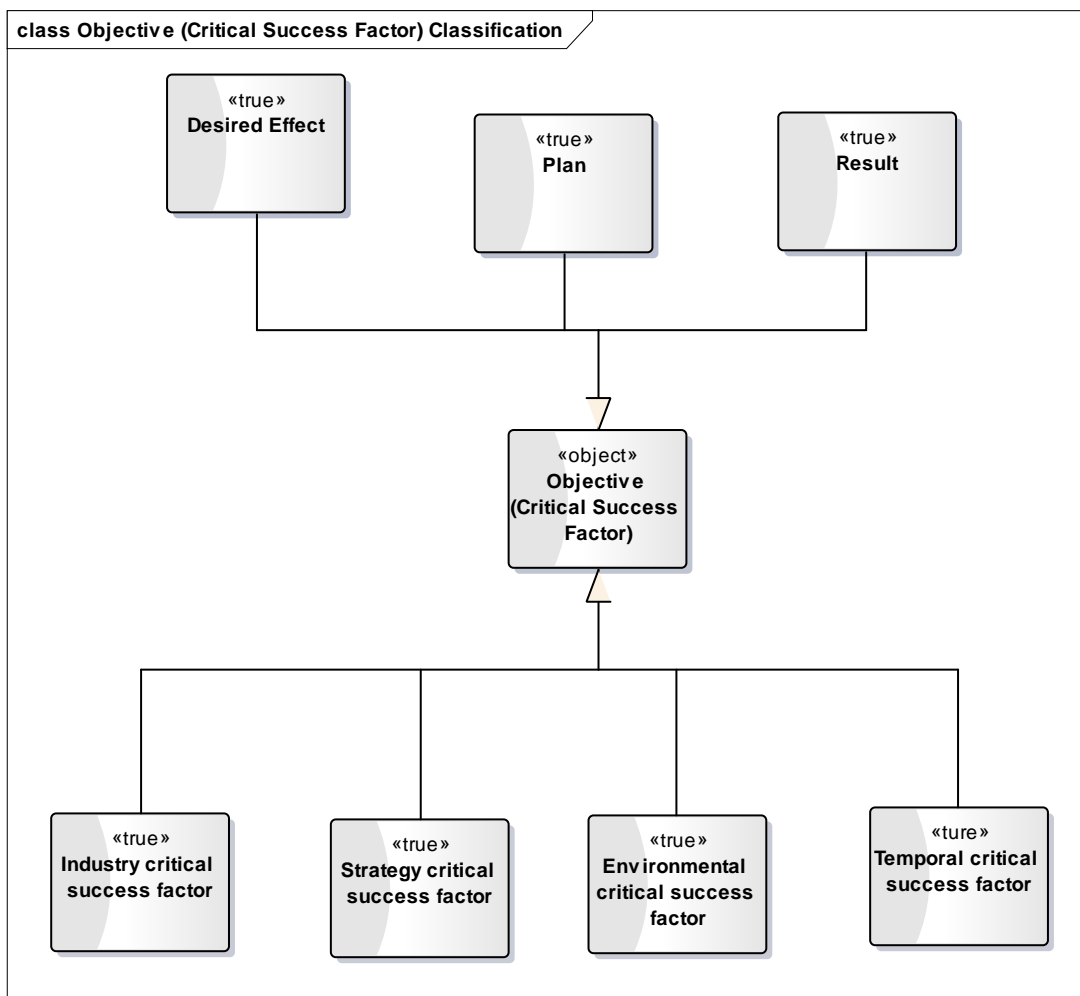


Figure 34 : Objective (Critical Success Factor) Classification

DESIRED EFFECT

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

ENVIRONMENTAL CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success in the face of an environmental/situation factor

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

INDUSTRY CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success in the context of the nature of the industry in which it operates

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

OBJECTIVE (CRITICAL SUCCESS FACTOR)

Description: Time bound milestones to measure and gauge the progress towards a strategy or goal.

Relationships

Relationship	Related Item Name
Generalization of	Industry critical success factor

Relationship	Related Item Name
Generalization of	Strategy critical success factor
Generalization of	Environmental critical success factor
Generalization of	Temporal critical success factor
Generalization of	Desired Effect
Generalization of	Plan
Generalization of	Result

PLAN

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

RESULT

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

STRATEGY CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success due to a unique feature of its strategy

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

TEMPORAL CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success due to the impact of time

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

STRATEGY

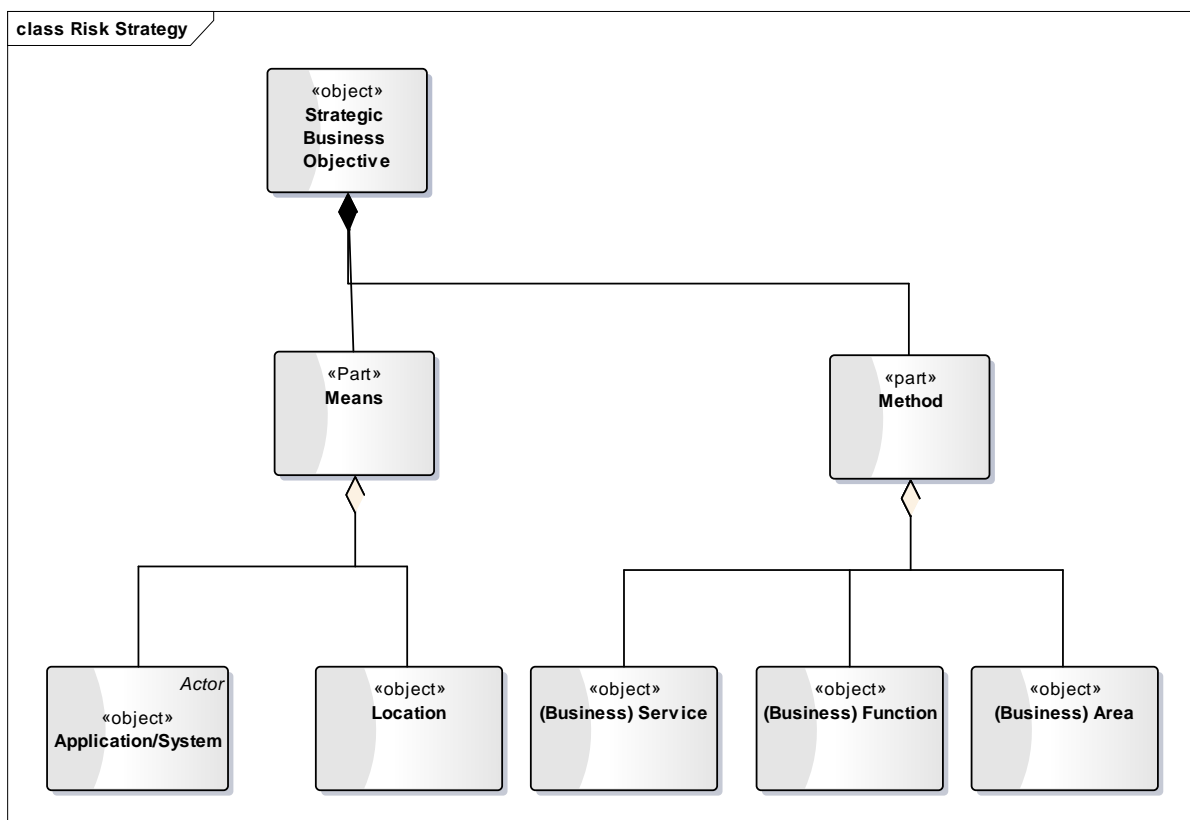


Figure 35 : Risk Strategy

MEANS

Description: Resources available to pursue the objectives

Relationships

Relationship	Related Item Name
Generalization of	Strategic Business Objective
Generalization of	Location

METHOD

Description: Are how the resources are organized and applied

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	Strategic Business Objective

STRATEGIC BUSINESS OBJECTIVE

Description: The direction and ends to which the enterprise seeks as well as the means and methods by which the ends will be attained.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Method
Generalization of	Means

TIME

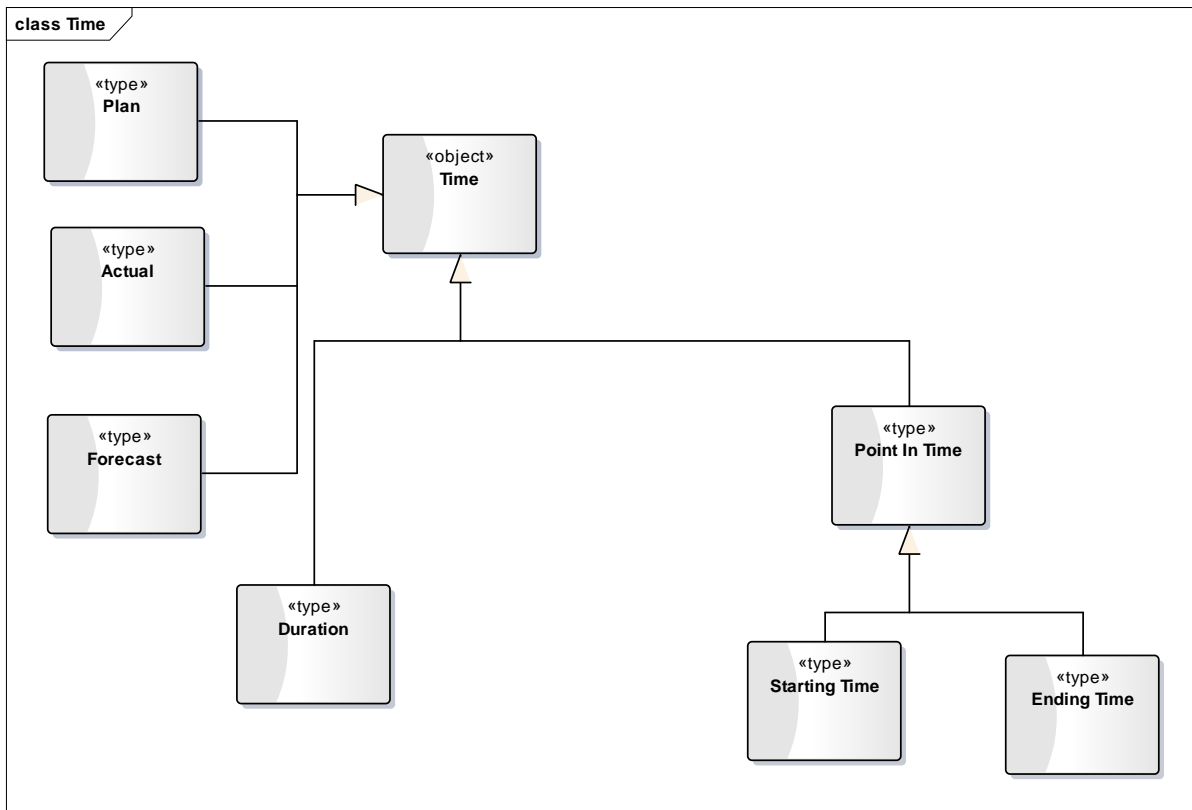


Figure 36 : Time

ACTUAL

Description: What really occurs?

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Time

DURATION

Description: The time during which something continues.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Time

ENDING TIME

Description: The instant in time something ends

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Point In Time

FORECAST

Description: The predicted or estimated future event

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Time

PLAN

Description: The design or proposal for doing or achieving something

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Time

POINT IN TIME

Description: An instant in time

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Starting Time
Generalization of	Ending Time
Specialization of	Time

STARTING TIME

Description: The instant in time something starts

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Point In Time

TIME

Description: A plan, schedule, arrangement or measure for when something should initiate, take place, be completed or the amount of time consumed.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Duration
Generalization of	Plan
Generalization of	Actual
Generalization of	Forecast
Generalization of	Point In Time

MONITOR

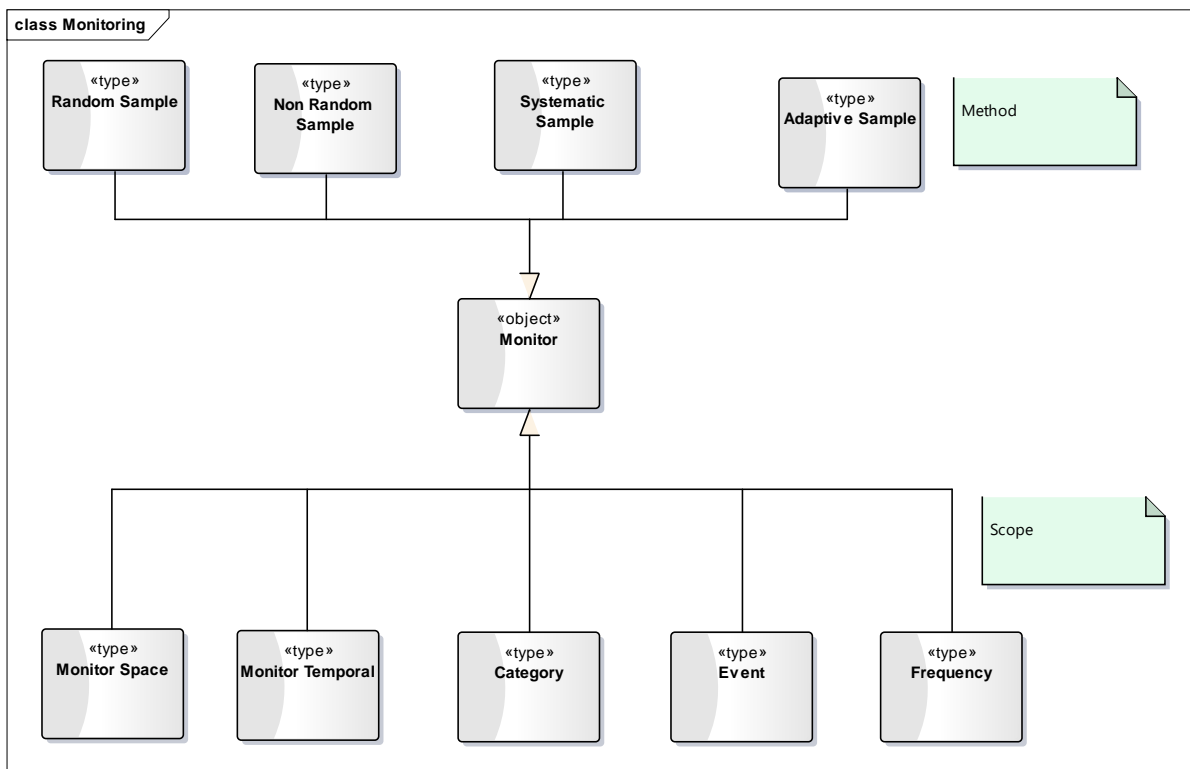


Figure 37 : Monitoring

ADAPTIVE SAMPLE

Description: *Sampling* design in which *sampling* regions, defined as "units", are selected based on values of the variables of interest observed during a *sampling* survey.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

CATEGORY

Description: Observe based on a categorization of a thing

Relationships

Relationship	Related Item Name
Specialization of	Monitor

EVENT

Description: Observe based on an event or trigger

Relationships

Relationship	Related Item Name
Specialization of	Monitor

FREQUENCY

Description: Observe based on a period

Relationships

Relationship	Related Item Name
Specialization of	Monitor

MONITOR

Description: To be aware of the state, through observation or measuring.

To supervise and to continually check and critically observe. It means to determine the current status and to assess whether or not required or expected performance levels are actually being achieved.

Relationships

Relationship	Related Item Name
Generalization of	Monitor Space
Generalization of	Monitor Temporal
Generalization of	Category
Generalization of	Event
Generalization of	Frequency
Generalization of	Random Sample
Generalization of	Non Random Sample
Generalization of	Systematic Sample
Generalization of	Adaptive Sample

MONITOR SPACE

Description: Observe based on location

Relationships

Relationship	Related Item Name
Specialization of	Monitor

MONITOR TEMPORAL

Description: Observe based on time

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Monitor

NON RANDOM SAMPLE

Description: A sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

RANDOM SAMPLE

Description: A subset of a statistical population in which each member of the subset has an equal probability of being chosen. A simple **random sample** is meant to be an unbiased representation of a group.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

SYSTEMATIC SAMPLE

Description: Statistical method involving the selection of elements from an ordered **sampling** frame. The most common form of **systematic sampling** is an equal-probability method. In this approach, progression through the list is treated circularly, with a return to the top once the end of the list is passed.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

RESOURCE

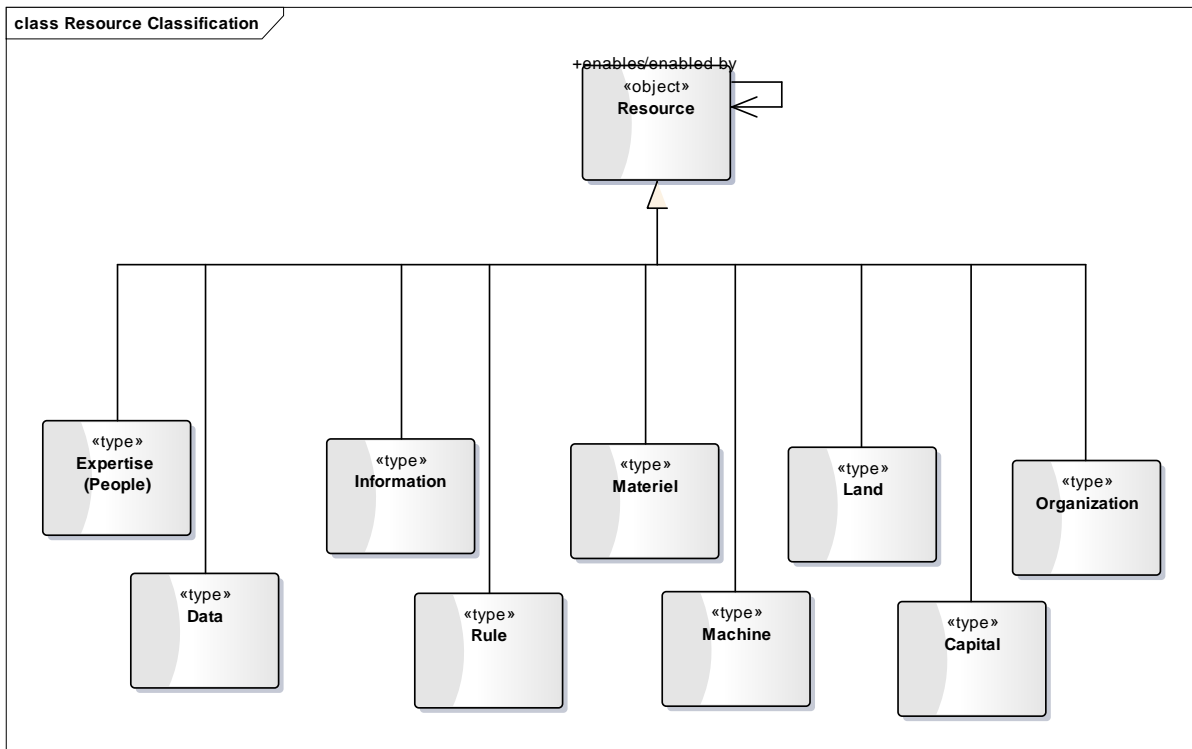


Figure 38 : Resource Classification

CAPITAL

Description: Wealth in the form of money or other assets owned by a person or organization or available or contributed for a particular purpose

Relationships

Relationship	Related Item Name
Specialization of	Resource

DATA

Description: The quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of electrical signals and recorded

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Resource

EXPERTISE (PEOPLE)

Description: Expert skill or knowledge in a particular field that is held by a person or group of people

Relationships

Relationship	Related Item Name
Specialization of	Resource

INFORMATION

Description: Resources that reduce uncertainty of decision making

Relationships

Relationship	Related Item Name
Specialization of	Resource

LAND

Description: A topographically or functionally distinct tract

Relationships

Relationship	Related Item Name
Specialization of	Resource

MACHINE

Description: An apparatus using or applying mechanical power and having several parts, each with a definite function and together performing a particular task

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Resource

MATERIEL

Description: Apparatus, and supplies used by an organization or institution

Relationships

Relationship	Related Item Name
Specialization of	Resource

ORGANIZATION

Description: Group of people who work together in a unit that is appropriated structured for the purpose

Relationships

Relationship	Related Item Name
Specialization of	Resource

RULE

Description: One of a set of explicit or understood regulations or principles governing conduct within a particular activity or sphere

Relationships

Relationship	Related Item Name
Specialization of	Resource

BUSINESS RULE

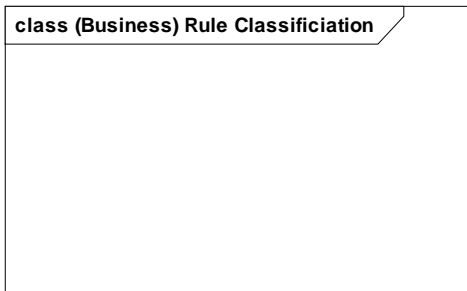


Figure 39 : Rule Classification

LOCATION

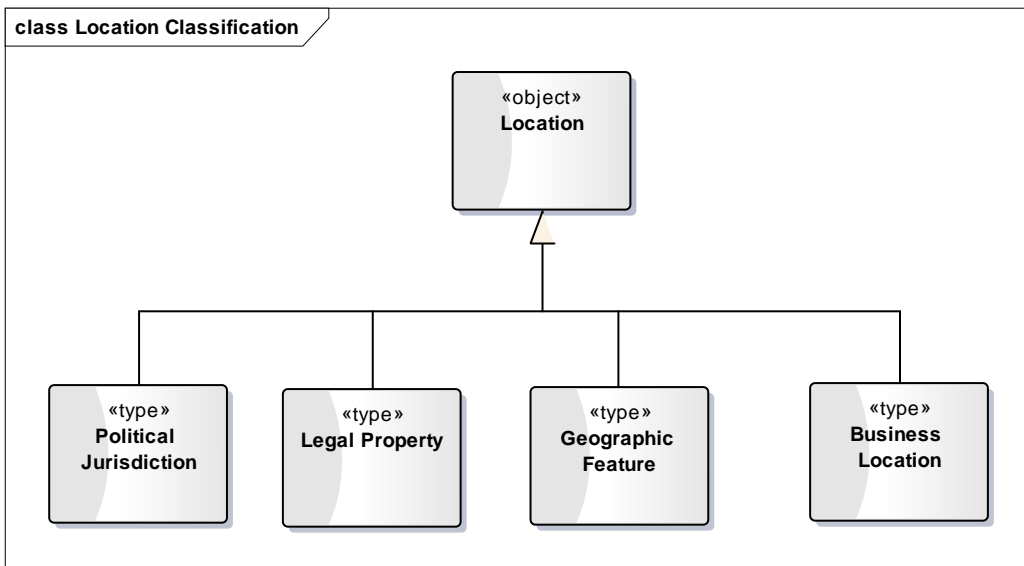


Figure 40 : Location Classification

BUSINESS LOCATION

Description: A space accessed for the purpose of conducting business

Relationships

Relationship	Related Item Name
Specialization of	Location

GEOGRAPHIC FEATURE

Description: A landform comprises a geomorphological unit, and is largely defined by its surface form and location in the landscape

Relationships

Relationship	Related Item Name
Specialization of	Location

LEGAL PROPERTY

Description: Any real property that is owned by a person or entity

Relationships

Relationship	Related Item Name
Specialization of	Location

LOCATION

Description: A point, facility, place, or geographic position that may be referred to physically or logically.

Relationships

Relationship	Related Item Name
Generalization of	Business Location
Generalization of	Geographic Feature
Generalization of	Legal Property
Generalization of	Political Jurisdiction

POLITICAL JURISDICTION

Description: The defined area of responsibility of a legally constituted government body

Relationships

Relationship	Related Item Name
Specialization of	Location

CAPABILITY

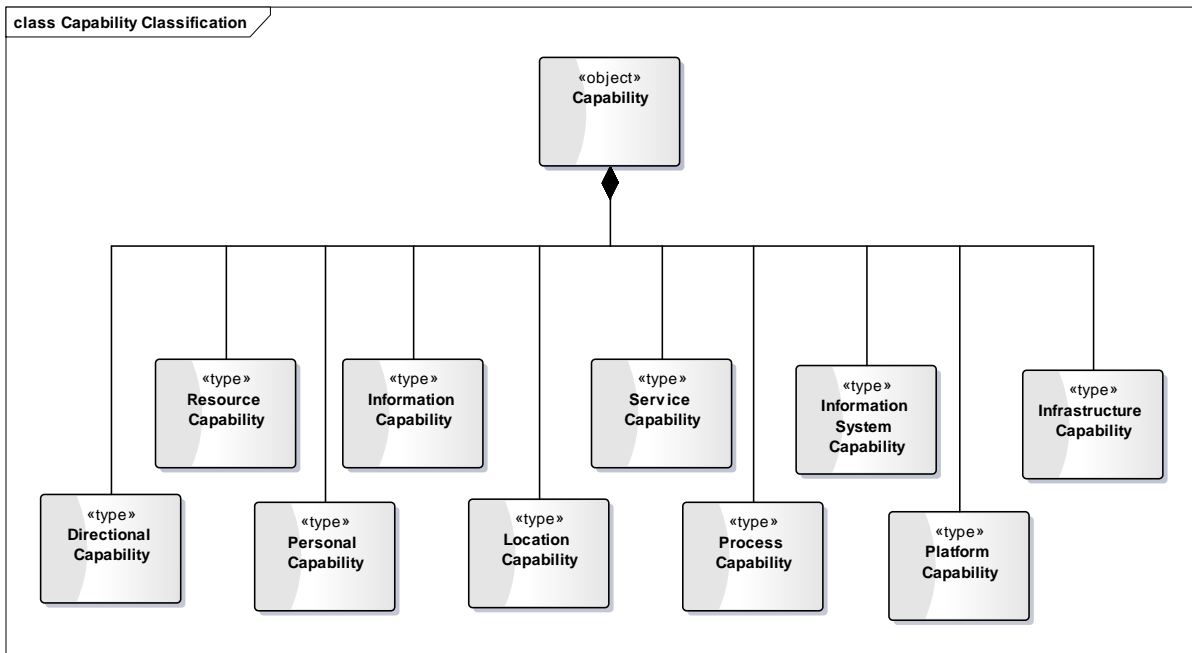


Figure 41 : Capability Classification

CAPABILITY

Description: A capability is an abstraction that represents the ability to perform a particular skill set i.e. organizational competencies, personal competencies, business function, processes, services and technology.

Business capability is the potential for action to achieve a goal via an action/series of actions in a process resulting from the interaction of 2 or more resources, in a transformation that produces business value for a customer. (Michell, 2011)

Relationships

Relationship	Related Item Name
composed of	Service Capability
composed of	Process Capability
composed of	Directional Capability
composed of	Resource Capability
composed of	Personal Capability
composed of	Location Capability

Relationship	Related Item Name
composed of	Information Capability
composed of	Information System Capability
composed of	Platform Capability
composed of	Infrastructure Capability

DIRECTIONAL CAPABILITY

Description: The extent of Strategy, Objectives, plans Command and Management direction (guidance, instructions, publications, doctrine, procedures, & preparedness documents) required to support decision-making, administration, and operations.

Relationships

Relationship	Related Item Name
part of	Capability

INFORMATION CAPABILITY

Description: The extent of or quality of Information including the ability to achieve timely access to authoritative information to support decisions.

Relationships

Relationship	Related Item Name
part of	Capability

INFORMATION SYSTEM CAPABILITY

Description: The extent and alignment of Major Systems e.g. application components, modules and application tasks. Enabling automation designed to enhance the ability to deliver outcomes.

Relationships

Relationship	Related Item Name
Part of	Capability

INFRASTRUCTURE CAPABILITY

Description: The extent and capacity of Network Communications infrastructure and devices available to the enterprise

Relationships

Relationship	Related Item Name
Part of	Capability

LOCATION CAPABILITY

Description: The extent and utility of buildings, structures, property, plant, training areas and facilities (Real Property)

Relationships

Relationship	Related Item Name
part of	Capability

PERSONAL CAPABILITY

Description: The personal abilities of an individual.

Relationships

Relationship	Related Item Name
part of	Capability

PLATFORM CAPABILITY

Description: The extent and alignment of Platform technology e.g. platform components, platform devices and platform services available to the organization

Relationships

Relationship	Related Item Name
part of	Capability

RESOURCE CAPABILITY

Description: The extent to which all nonexpendable items needed to outfit or equip an individual or organization to perform its mission are in place

Relationships

Relationship	Related Item Name
part of	Capability

SERVICE CAPABILITY

Description: The service construct and the service delivered

Relationships

Relationship	Related Item Name
composed of	Capability

RESOURCE

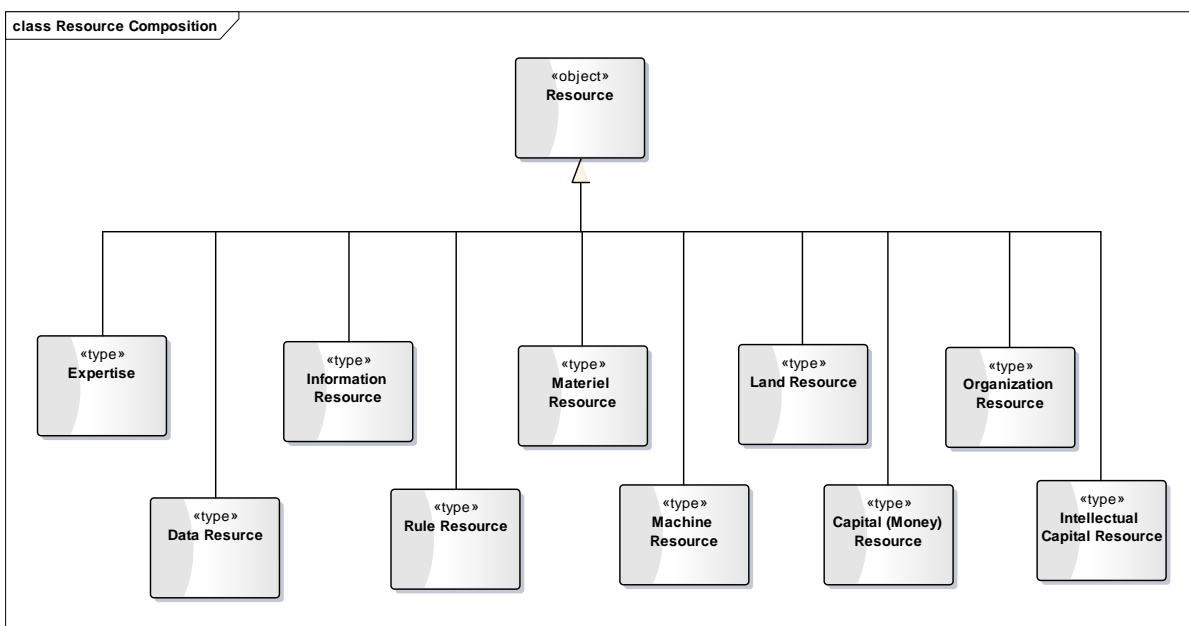


Figure 42 : Resource Composition

CAPITAL (MONEY) RESOURCE

Description: The financial resources available to the organization, including capital, cash, and access to debtors and creditors, and suppliers of money

Relationships

Relationship	Related Item Name
Specialization of	Resource

DATA RESOURCE

Description: All the data available to an organization

Relationships

Relationship	Related Item Name
Specialization of	Resource

EXPERTISE

Description: People with the ability to apply skill and knowledge

Relationships

Relationship	Related Item Name
Specialization of	Resource

INFORMATION RESOURCE

Description: The organized information available to the organization

Relationships

Relationship	Related Item Name
Specialization of	Resource

INTELLECTUAL CAPITAL RESOURCE

Description: Includes the patents, brands, and other indications of the values of these is that when businesses are sold, part of the value is goodwill. In a knowledge -based economy intellectual capital is likely to be a major asset of many organizations.

Relationships

Relationship	Related Item Name
Specialization of	Resource

LAND RESOURCE

Description: Broadly, all that nature provides, including minerals, forest products, and water and **land resources**.

Relationships

Relationship	Related Item Name
Specialization of	Resource

MACHINE RESOURCE

Description: Major mechanical devices to support work

Relationships

Relationship	Related Item Name
Specialization of	Resource

MATERIEL RESOURCE

Description: Expendable or other consumable supplies that are of interest.

Relationships

Relationship	Related Item Name
Specialization of	Resource

ORGANIZATION RESOURCE

Description: The structure of the organization and the alignment of the human decision making personal capability to the hierarchy

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Resource

RESOURCE

Description: Any person, organization, or system that may be assigned one or more roles. May be internal or external to an organization.

Relationships

Relationship	Related Item Name
Generalization of	Organization Resource
Generalization of	Land Resource
Generalization of	Materiel Resource
Generalization of	Information Resource
Generalization of	Data Resource
Generalization of	Rule Resource
Generalization of	Machine Resource
Generalization of	Capital (Money) Resource
Generalization of	Intellectual Capital Resource

RULE RESOURCE

Description: Constraints or guidance that allows for routine conditions or situations to be addressed with the minimum of cost and risk.

Relationships

Relationship	Related Item Name
Specialization of	Resource

ACTOR

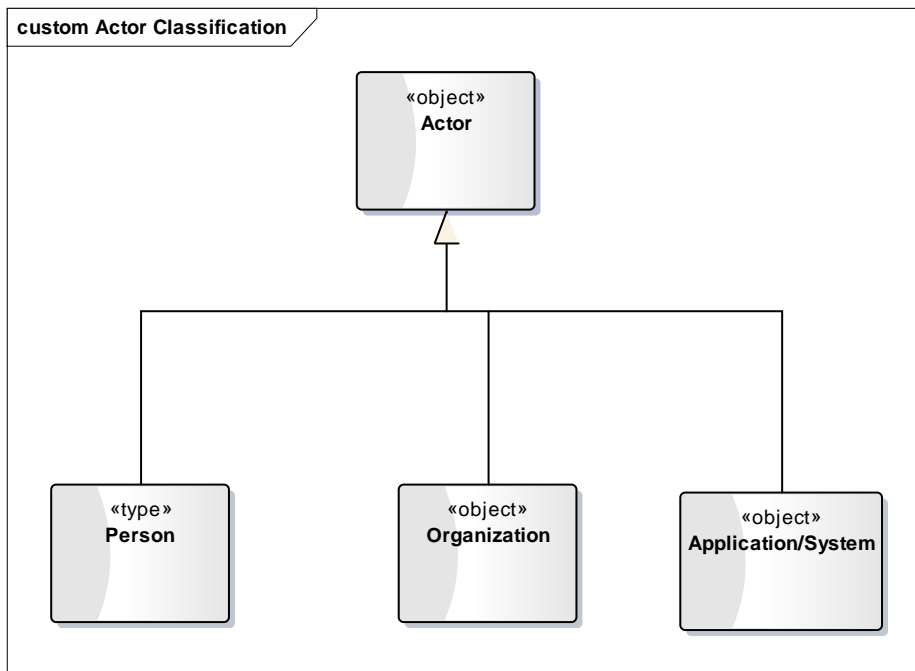


Figure 43 : Actor Classification

ACTOR

Description: A person, organization, or system that has a role that initiates or interacts with activities. Actors may be internal or external to an organization.

Relationships

Relationship	Related Item Name
Generalization of	Person
Generalization of	Organization
Generalization of	Application/System

PERSON

Description: A single human being.

Relationships

Relationship	Related Item Name
Specialization of	Actor

EVENT

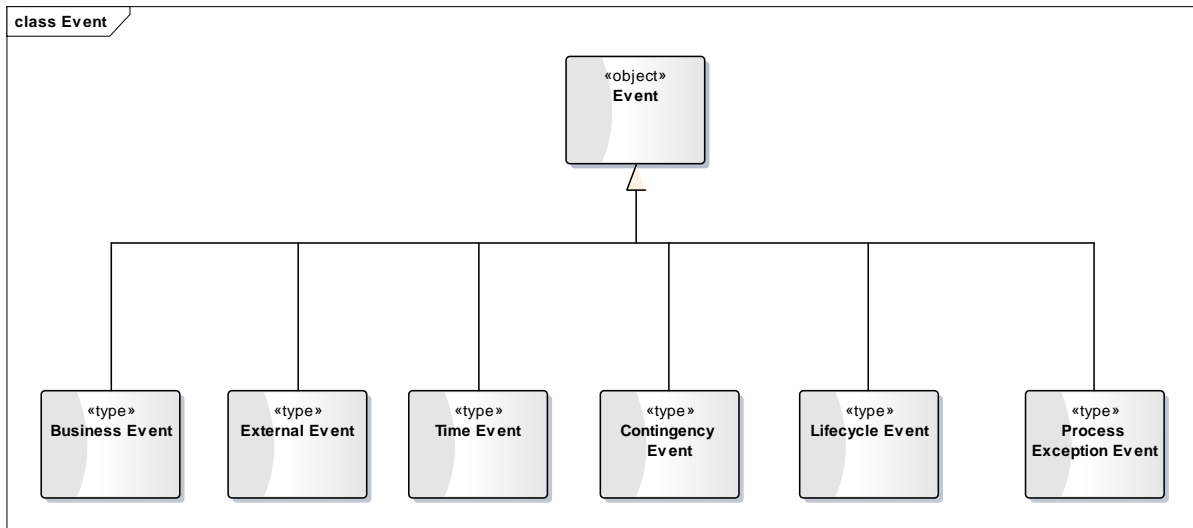


Figure 44 : Event

BUSINESS EVENT

Description: Events that take place in the course of normal operation for a business that reoccur as business processes are completed

Relationships

Relationship	Related Item Name
Specialization of	Event

CONTINGENCY EVENT

Description: An *event* that is part of normal operations of a business that may occur but that is not likely or intended

Relationships

Relationship	Related Item Name
Specialization of	Event

EVENT

Description: A state change that recognizes the triggering or termination of processing.

Relationships

Relationship	Related Item Name
Generalization of	Business Event
Generalization of	External Event
Generalization of	Time Event
Generalization of	Lifecycle Event
Generalization of	Contingency Event
Generalization of	Process Exception Event

LIFECYCLE EVENT

Description: An event that causes a transition in the state of an item used within a business

Relationships

Relationship	Related Item Name
Specialization of	Event

PROCESS EXCEPTION EVENT

Description: An *event* within a process that may occur but that is not likely or intended

Relationships

Relationship	Related Item Name
Specialization of	Event

TIME EVENT

Description:

An *event* within a business that occurs as a result of time

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Event

Chapter 7 The Risk Meta Model:

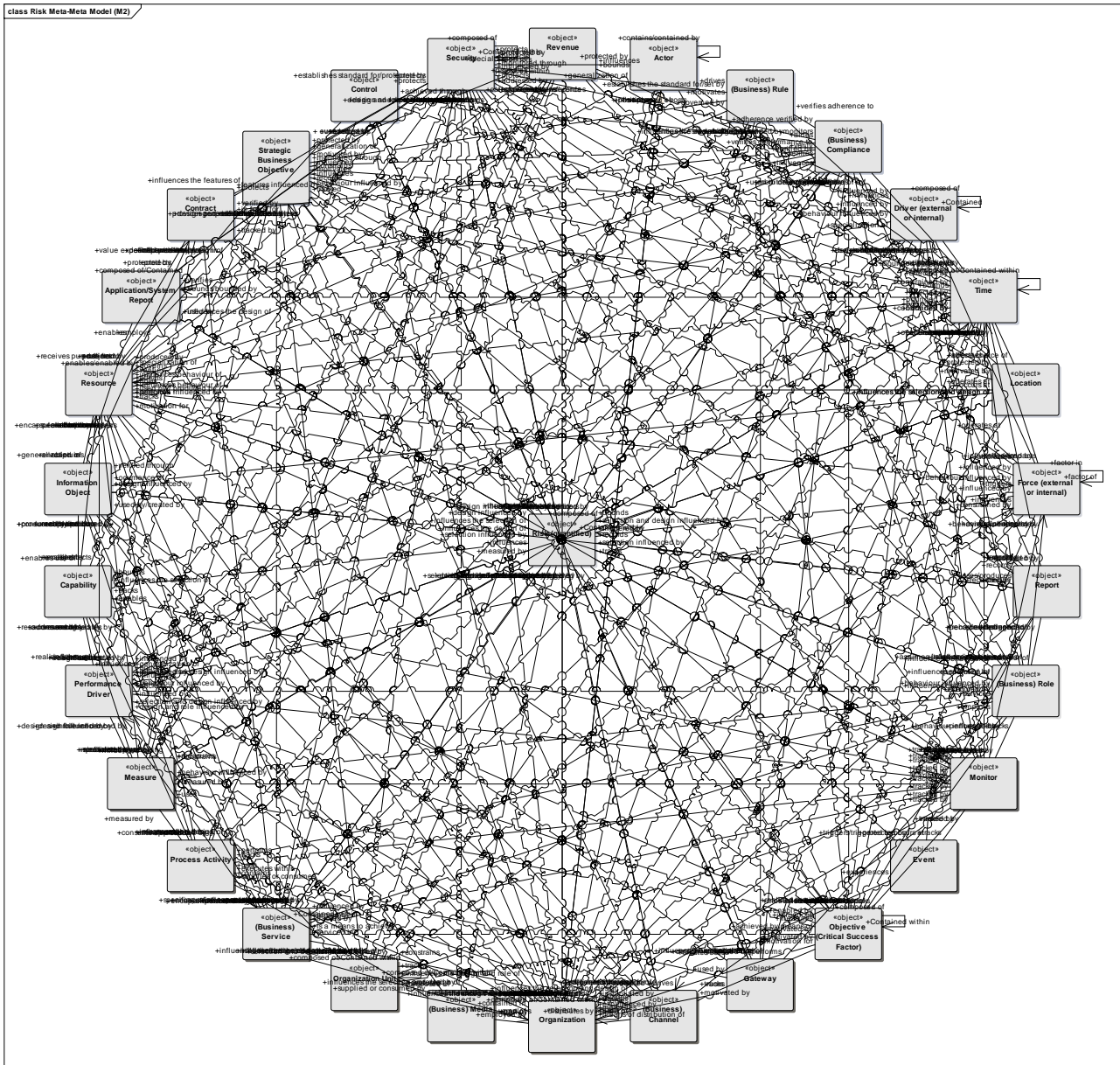


Figure 45- Risk Meta-Meta Model (M2)

Risk Meta Model

At this level, the model only draws on those items within the standard ontology that are relevant to risk. While these items are not domain specific, i.e. not specific to risk, they provide the linkage between the agreement about the shared, formal, explicit conceptualisation expressed in Risk Meta Meta Model and the domain specific rules that restrict the semantics and conceptual relationships of M1, in this case related to risk.

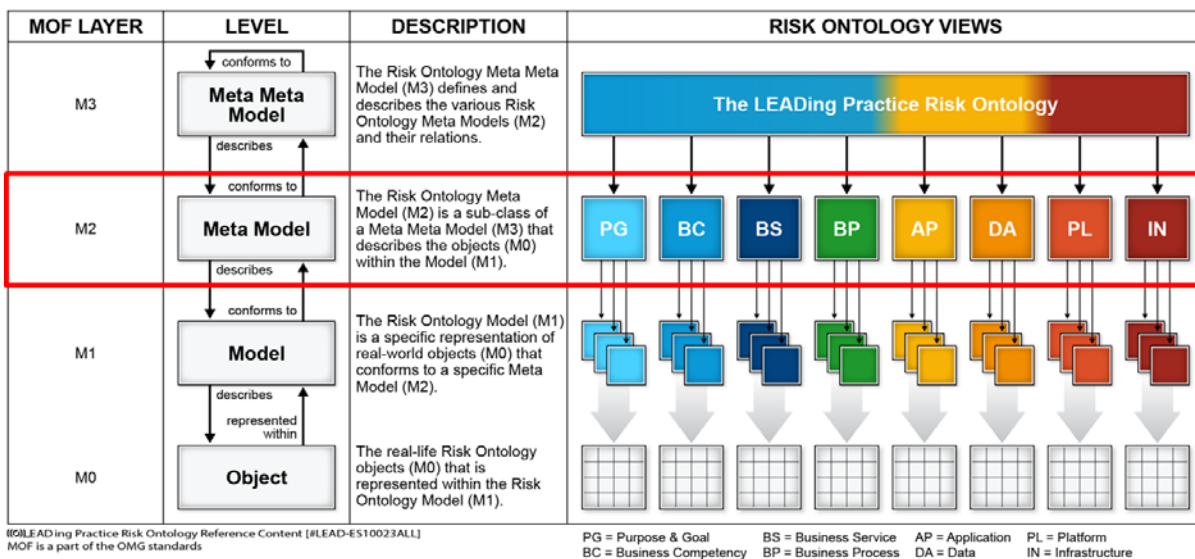


Figure 46 – Position of The Risk Meta Model within the MOF

Purpose of the Risk Meta Model Objects and Model

The purpose of these Objects and models is to establish the broad classification and categorization of the formal, universal vocabulary in Risk Meta Meta Model. This vocabulary provides a formal, universal vocabulary to which all other semantic relationships that participate in anchor, thus ensuring they conform to a common view.

Risk Meta Model Objects

The following is the set of Risk Meta Model objects relevant to risk. Each item from Risk Meta Model is listed alphabetically by name; a figure is also provided showing how its parts exist within the context of risk are organized. Each of these parts is then described and the nature of the semantic relationship between these items is identified.

In the table titled “Relationships”, the nature of each relationship from the broader context is identified and describe In each case the rows within this table can be read as “Item Name”, “has a relationship to” “Related Item Name”. By way of example within Risk Driver, we see that Risk Appetite is a part of Risk Driver, and that Risk Area Influenced is a part of Risk Driver

Purpose of the Risk Meta Model

Establish how to conform

How this section is organized

Risk Meta Model Objects

Description: The follow section details the Risk Meta Model classifications of the M3 Risk Meta-Meta Model Objects relevant to risk

Business Layer

Description:

Purpose and Goal

FORCE

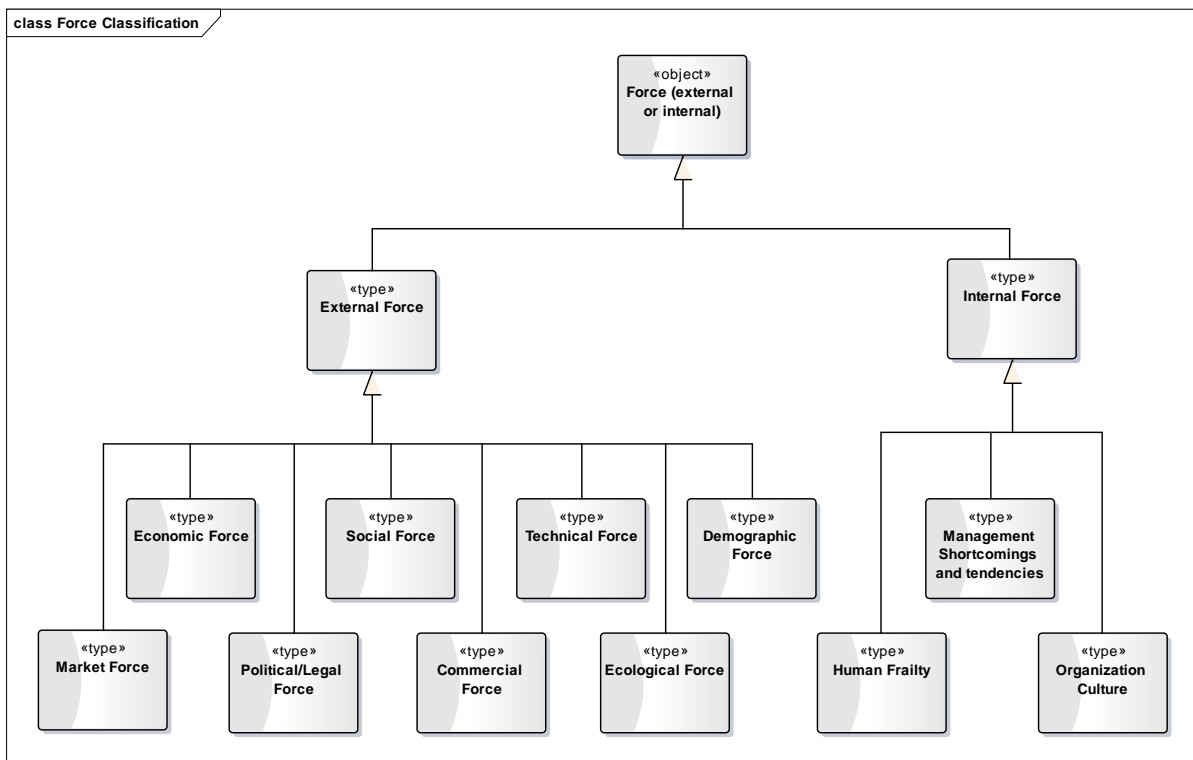


Figure 47 : Force Classification

COMMERCIAL FORCE

Description: The level of competition within an industry, as reflected its micro environment, including those caused by rivalry and commercial relationships and obligations.

Relationships

Relationship	Related Item Name
Specialisation of	External Force

DEMOGRAPHIC FORCE

Description: Factors that include gender, age, ethnicity, knowledge of languages, disabilities, mobility, home ownership, employment status, religious belief or practice, culture and tradition, living standards and income level.

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	External Force

ECOLOGICAL FORCE

Description: Factors include ecological and environmental aspects such as weather, climate, and climate change, which may especially affect industries such as tourism, farming, and insurance. Furthermore, growing awareness of the potential impacts of climate change is affecting how companies operate and the products they offer, both creating new markets and diminishing or destroying existing ones.

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	External Force

ECONOMIC FORCE

Description: Factors include economic growth, interest rates, exchange rates, and the inflation rate.

RELATIONSHIPS

Relationship	Related Item Name
Specialisation of	External Force

EXTERNAL FORCE

Description: A force coming from outside the enterprise

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Technical Force
Generalization of	Social Force
Generalization of	Political/Legal Force
Generalization of	Economic Force
Generalization of	Ecological Force
Generalization of	Demographic Force
Generalization of	Commercial Force
Specialisation of	Force (external or internal)
Generalization of	Market Force

FORCE (EXTERNAL OR INTERNAL)

Description: An external or internal factor that forces or pushes some aspect of an enterprise in a specific direction.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	External Force
Generalization of	Internal Force

HUMAN FRAILTY

Description: Moral weakness; liability to yield to temptation of humans

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Internal Force

INTERNAL FORCE

Description: A force that acts on the entire enterprise but comes from within

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Human Frailty
Generalization of	Management Shortcomings and tendencies

Relationship	Related Item Name
Generalization of	Organization Culture
Specialization of	Force (external or internal)

MANAGEMENT SHORTCOMINGS AND TENDENCIES

Description: Weaknesses or limitations of the management values and controls

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Internal Force

MARKET FORCE

Description: Forces of demand and supply representing the aggregate influence of self-interested buyers and sellers on price and quantity of the goods and services offered in a market. In general, excess demand causes prices and quantity of supply to rise and excess supply causes them to fall.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	External Force

ORGANIZATION CULTURE

Description: The values and behaviours that contribute to the unique social and psychological environment of an organization.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Internal Force

POLITICAL/LEGAL FORCE

Description: The degree the government intervenes in the economy. Specifically, political factors include areas such as tax policy, labour law, regulations, tariffs, and political stability as well as the mechanisms to monitor and ensure compliance with these.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	External Force

SOCIAL FORCE

Description: Factors include the cultural aspects and include health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	External Force

TECHNICAL FORCE

Description: Technological aspects such as R&D activity, automation, technology incentives and the rate of technological change. They can determine barriers to entry, minimum efficient production level and influence outsourcing decisions. Furthermore, technological shifts can affect costs, quality, and lead to innovation.

Relationships

Relationship	Related Item Name
Specialization of	External Force

DRIVER

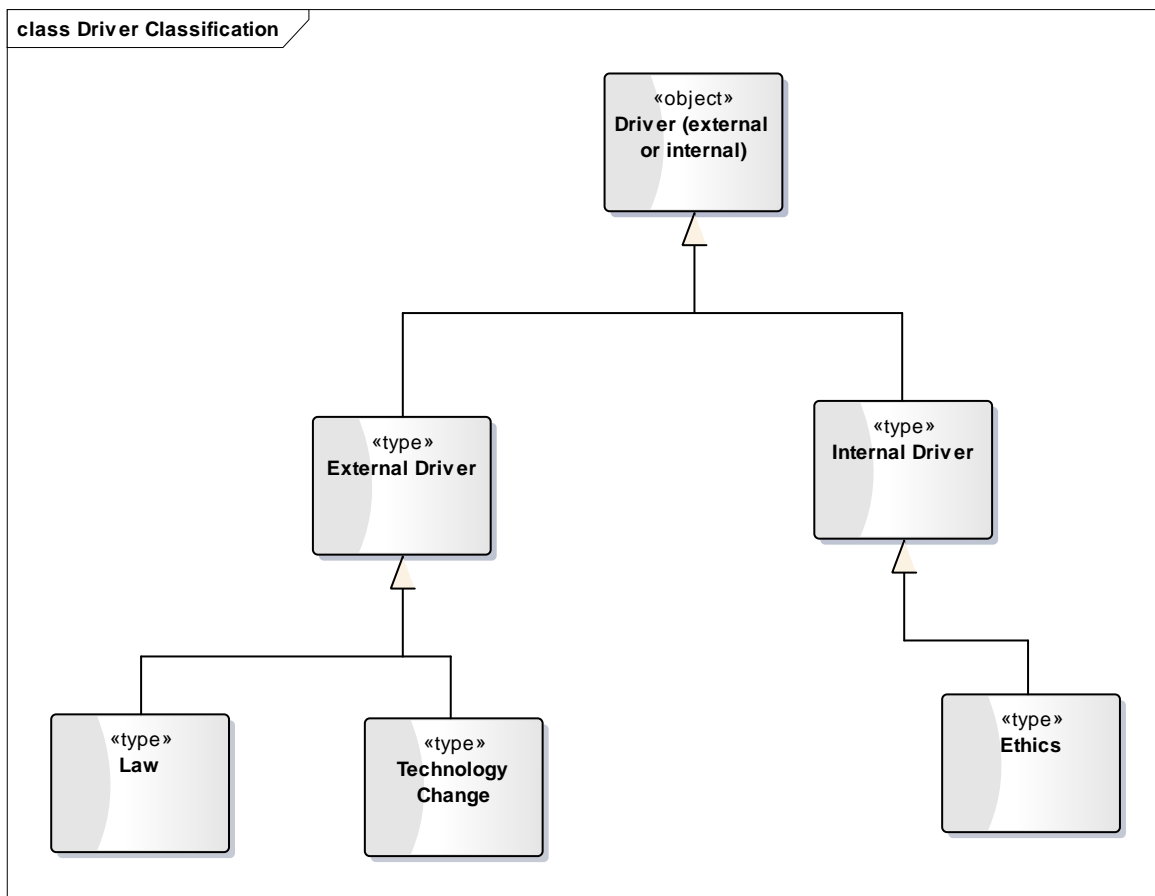


Figure 48 : Driver Classification

DRIVER (EXTERNAL OR INTERNAL)

Description: An external or internal factor that drives, establishes motivation for, or influences some aspect of an enterprise in a specific direction.

RELATIONSHIPS

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Generalization of	Internal Driver
Generalization of	External Driver

ETHICS

Description: Moral principles that govern a person or group's behaviour.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Internal Driver

EXTERNAL DRIVER

Description: A driver coming from outside the organization

Relationships

Relationship	Related Item Name
Specialization of	Driver (external or internal)
Generalization of	Law
Generalization of	Technology Change

INTERNAL DRIVER

Description: A driver that acts on the entire enterprise but comes from within

Relationships

Relationship	Related Item Name
Specialization of	Driver (external or internal)
Generalization of	Ethics

LAW

Description: The system of rules that a particular country or community recognizes as regulating the actions of its members and may enforce by the imposition of penalties and therefore constrains permissible behaviour

Relationships

Relationship	Related Item Name
Specialisation of	External Driver

TECHNOLOGY CHANGE

Description: Overall process of invention, innovation and diffusion of **technology** or processes. The term is synonymous with **technological** development, **technological** achievement, and **technological** progress.

Relationships

Relationship	Related Item Name
Specialisation of	External Driver

OBJECTIVE

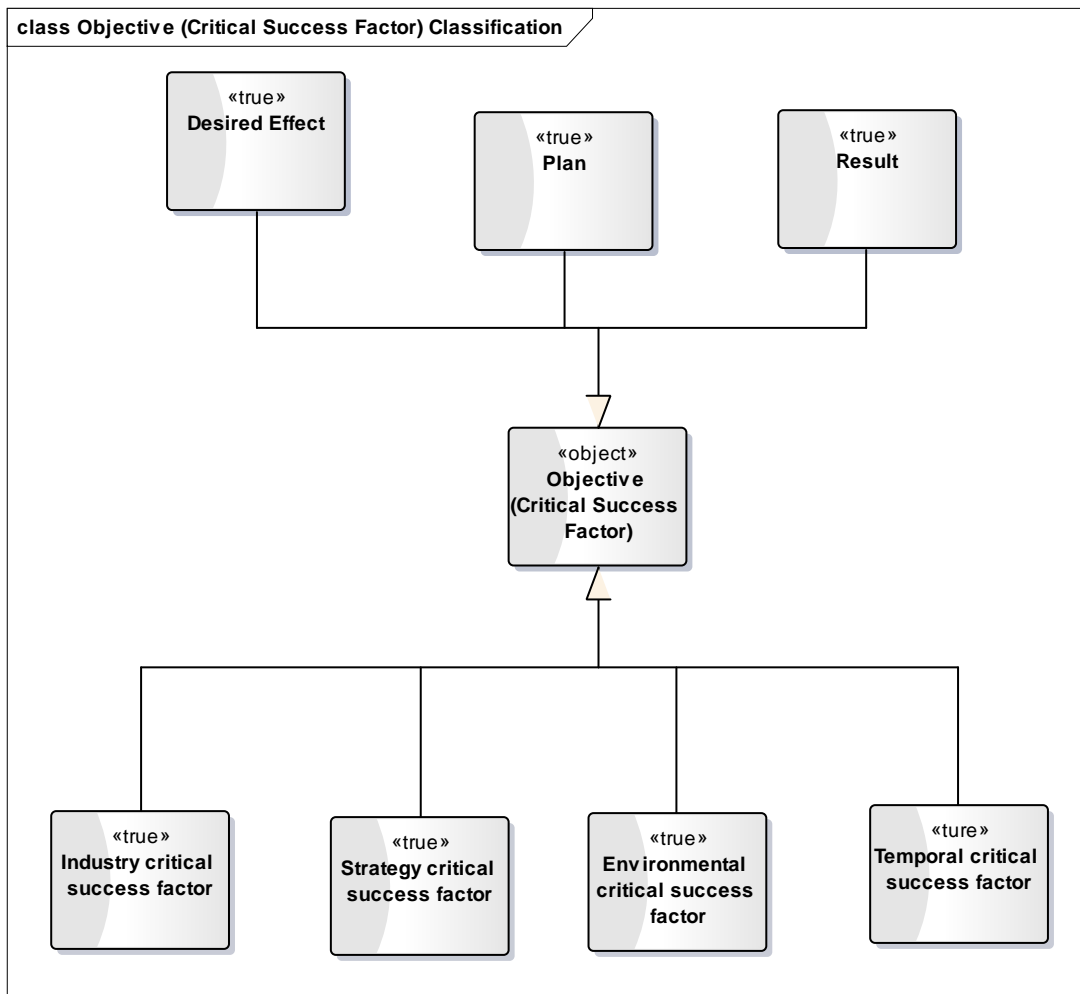


Figure 49 : Objective (Critical Success Factor) Classification

DESIRED EFFECT

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

ENVIRONMENTAL CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success in the face of an environmental/situation factor

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

INDUSTRY CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success in the context of the nature of the industry in which it operates

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

OBJECTIVE (CRITICAL SUCCESS FACTOR)

Description: Time bound milestones to measure and gauge the progress towards a strategy or goal.

Relationships

Relationship	Related Item Name
Generalization of	Industry critical success factor
Generalization of	Strategy critical success factor

Relationship	Related Item Name
Generalization of	Environmental critical success factor
Generalization of	Temporal critical success factor
Generalization of	Desired Effect
Generalization of	Plan
Generalization of	Result

PLAN

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

RESULT

Description: The intended result, outcome, or consequence of an action [activity].

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

STRATEGY CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success due to a unique feature of its strategy

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

TEMPORAL CRITICAL SUCCESS FACTOR

Description: A key area of performance essential to organizational success due to the impact of time

Relationships

Relationship	Related Item Name
Specialisation of	Objective (Critical Success Factor)

STRATEGY

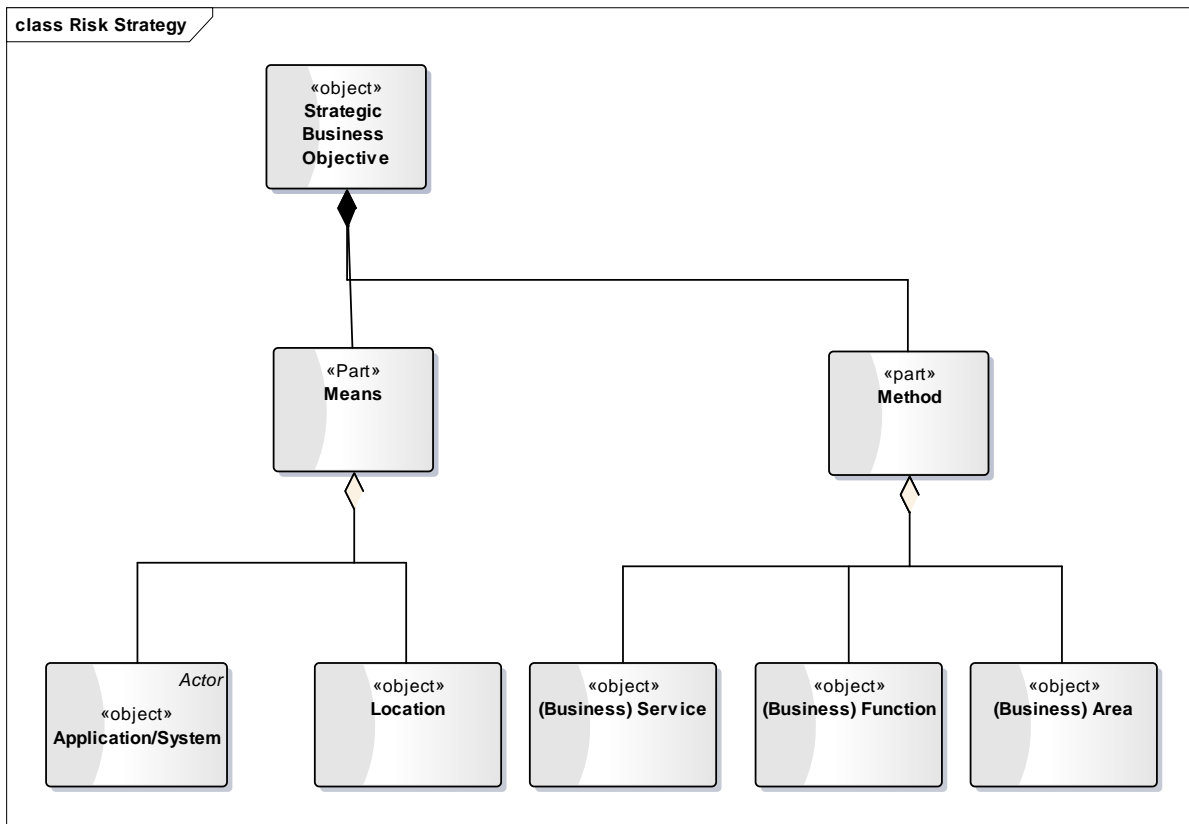


Figure 50 : Risk Strategy

MEANS

Description: Resources available to pursue the objectives

Relationships

Relationship	Related Item Name
Generalization of	Strategic Business Objective
Generalization of	Location

METHOD

Description:

Are how the resources are organized and applied

Relationships

Relationship	Related Item Name
Specialisation of	Strategic Business Objective

STRATEGIC BUSINESS OBJECTIVE

Description: The direction and ends to which the enterprise seeks as well as the means and methods by which the ends will be attained.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Method
Generalization of	Means

TIME

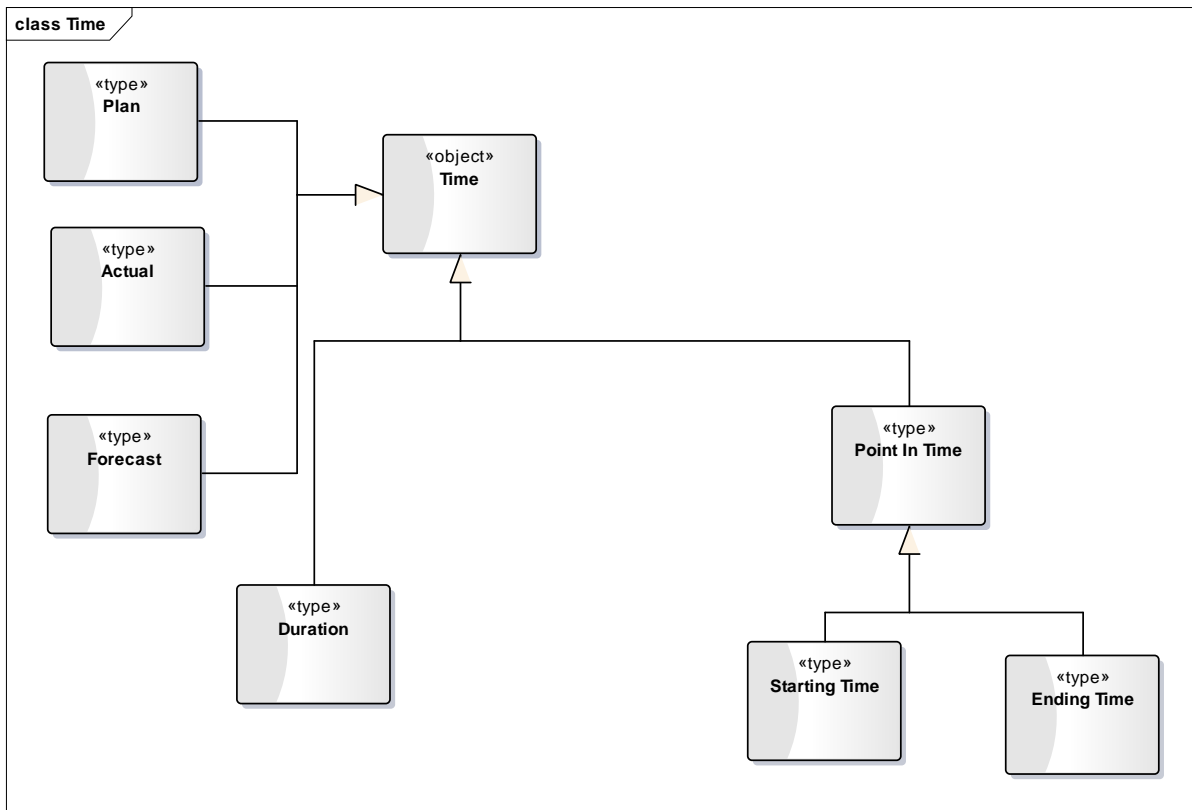


Figure 51 : Time

ACTUAL

Description: What really occurs?

Relationships

Relationship	Related Item Name
Specialization of	Time

DURATION

Description: The time during which something continues.

Relationships

Relationship	Related Item Name
Specialization of	Time

ENDING TIME

Description: The instant in time something ends

Relationships

Relationship	Related Item Name
Specialization of	Point In Time

FORECAST

Description: The predicted or estimated future event

Relationships

Relationship	Related Item Name
Specialization of	Time

Plan

Description:

The design or proposal for doing or achieving something

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Time

POINT IN TIME

Description: An instant in time

Relationships

Relationship	Related Item Name
Generalization of	Starting Time
Generalization of	Ending Time
Specialization of	Time

STARTING TIME

Description: The instant in time something starts

Relationships

Relationship	Related Item Name
Specialization of	Point In Time

TIME

Description: A plan, schedule, arrangement or measure for when something should initiate, take place, be completed or the amount of time consumed.

Relationships

Relationship	Related Item Name
Generalization of	Duration
Generalization of	Plan
Generalization of	Actual
Generalization of	Forecast
Generalization of	Point In Time

MONITOR

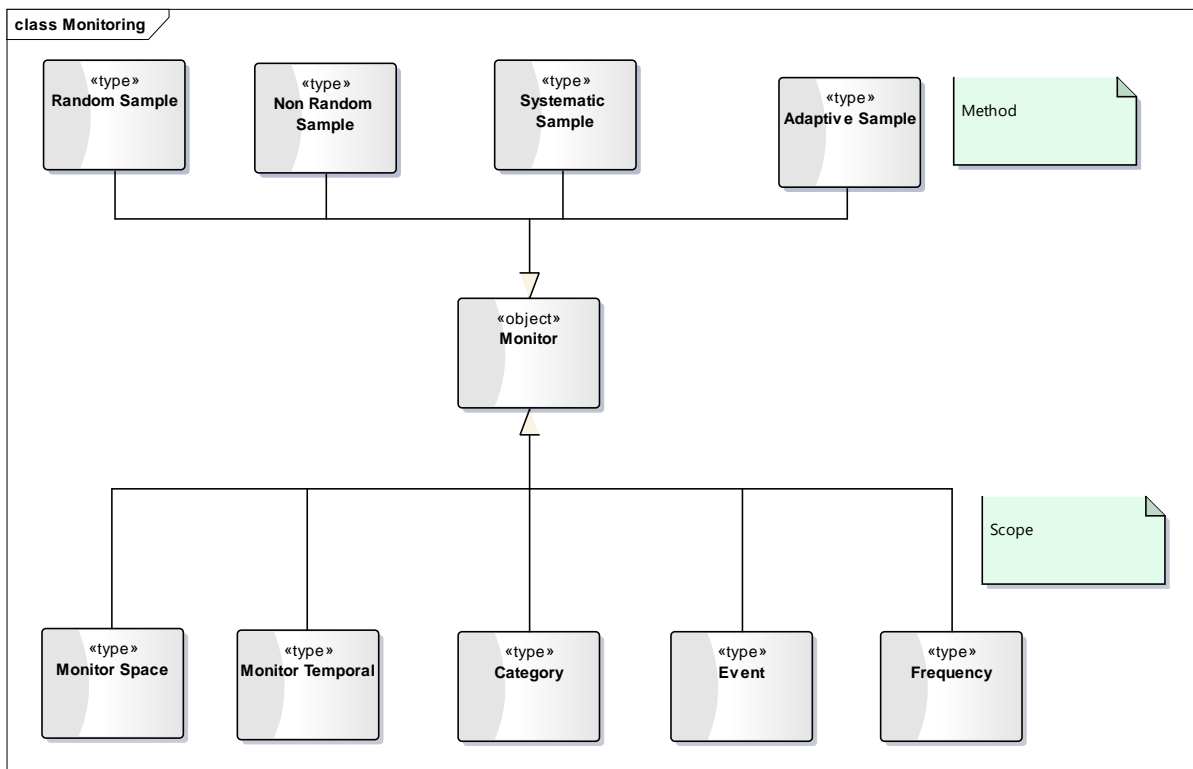


Figure 52 : Monitoring

ADAPTIVE SAMPLE

Description: *Sampling* design in which *sampling* regions, defined as "units", are selected based on values of the variables of interest observed during a *sampling* survey.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

CATEGORY

Description: Observe based on a categorization of a thing

Relationships

Relationship	Related Item Name
Specialization of	Monitor

EVENT

Description: Observe based on an event or trigger

Relationships

Relationship	Related Item Name
Specialization of	Monitor

FREQUENCY

Description: Observe based on a period

Relationships

Relationship	Related Item Name
Specialization of	Monitor

MONITOR

Description: To be aware of the state, through observation or measuring.

To supervise and to continually check and critically observe. It means to determine the current status and to assess whether or not required or expected performance levels are actually being achieved.

Relationships

Relationship	Related Item Name
Generalization of	Monitor Space
Generalization of	Monitor Temporal
Generalization of	Category
Generalization of	Event
Generalization of	Frequency
Generalization of	Random Sample
Generalization of	Non Random Sample
Generalization of	Systematic Sample
Generalization of	Adaptive Sample

MONITOR SPACE

Description: Observe based on location

Relationships

Relationship	Related Item Name
Specialization of	Monitor

MONITOR TEMPORAL

Description: Observe based on time

Relationships

Relationship	Related Item Name
Specialization of	Monitor

NON RANDOM SAMPLE

Description: A sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

RANDOM SAMPLE

Description: A subset of a statistical population in which each member of the subset has an equal probability of being chosen. A simple **random sample** is meant to be an unbiased representation of a group.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

SYSTEMATIC SAMPLE

Description: Statistical method involving the selection of elements from an ordered **sampling** frame. The most common form of **systematic sampling** is an equal-probability method. In this approach, progression through the list is treated circularly, with a return to the top once the end of the list is passed.

Relationships

Relationship	Related Item Name
Specialization of	Monitor

RESOURCE

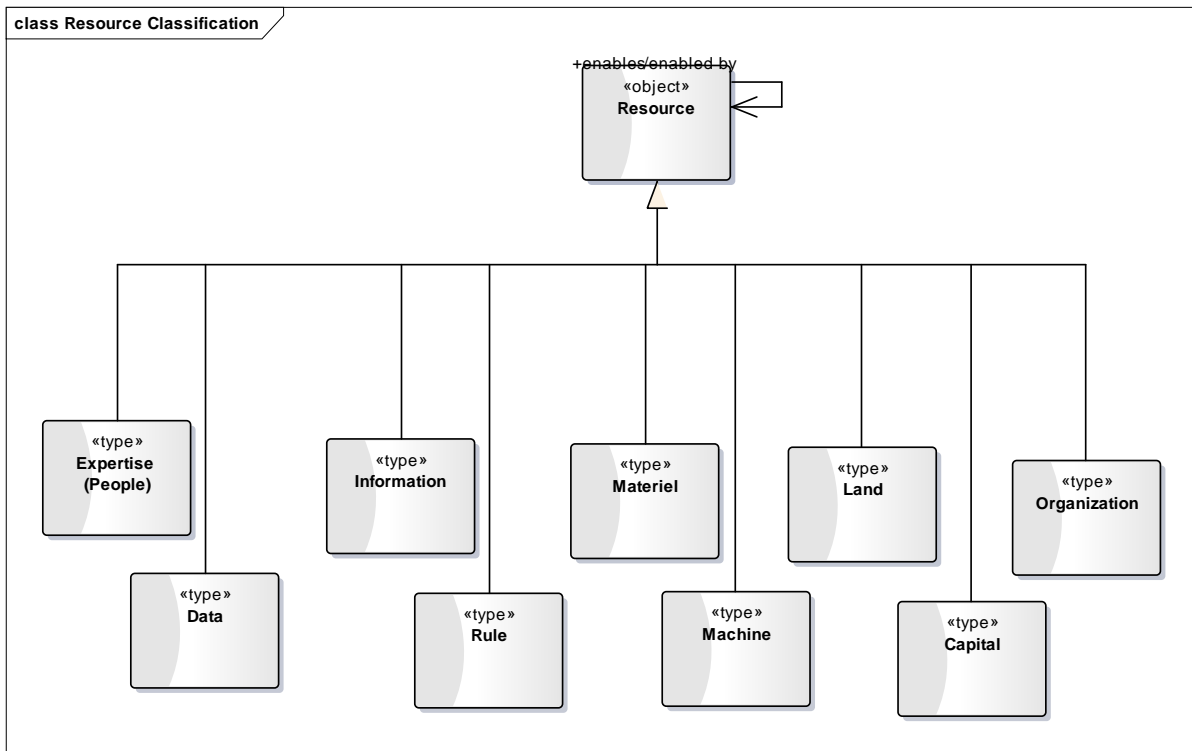


Figure 53 : Resource Classification

CAPITAL

Description: Wealth in the form of money or other assets owned by a person or organization or available or contributed for a particular purpose

Relationships

Relationship	Related Item Name
Specialization of	Resource

DATA

Description: The quantities, characters, or symbols on which operations are performed by a computer, being stored and transmitted in the form of electrical signals and recorded

Relationships

Relationship	Related Item Name
Specialization of	Resource

EXPERTISE (PEOPLE)

Description: Expert skill or knowledge in a particular field that is held by a person or group of people

Relationships

Relationship	Related Item Name
Specialization of	Resource

INFORMATION

Description: Resources that reduce uncertainty of decision making

Relationships

Relationship	Related Item Name
Specialization of	Resource

LAND

Description: A topographically or functionally distinct tract

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Resource

MACHINE

Description: An apparatus using or applying mechanical power and having several parts, each with a definite function and together performing a particular task

Relationships

Relationship	Related Item Name
Specialization of	Resource

MATERIEL

Description: Apparatus, and supplies used by an organization or institution

Relationships

Relationship	Related Item Name
Specialization of	Resource

Capability Group

ORGANIZATION

Description: Group of people who work together in a unit that is appropriated structured for the purpose

Relationships

Relationship	Related Item Name
Specialization of	Resource

RULE

Description: One of a set of explicit or understood regulations or principles governing conduct within a particular activity or sphere

Relationships

Relationship	Related Item Name
Specialization of	Resource

Business Rule

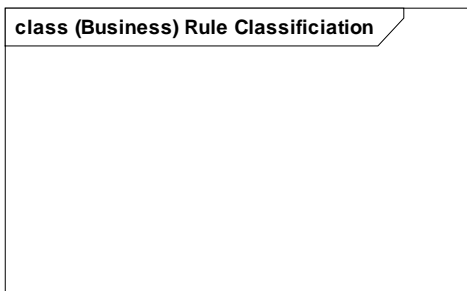


Figure 54 : (Business) Rule Classification

LOCATION

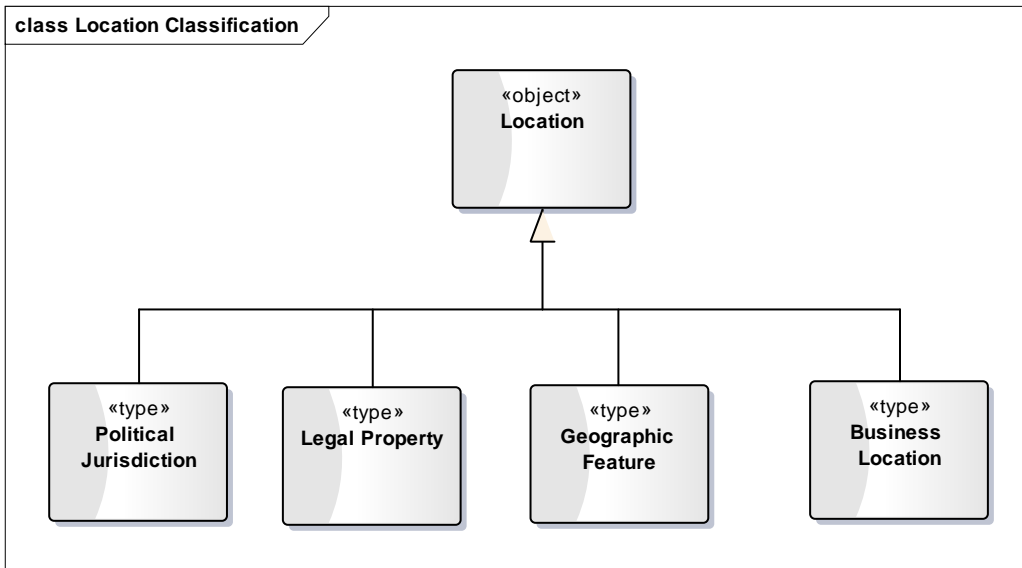


Figure 55 : Location Classification

BUSINESS LOCATION

Description: A space accessed for the purpose of conducting business

Relationships

Relationship	Related Item Name
Specialization of	Location

GEOGRAPHIC FEATURE

Description: A landform comprises a geomorphological unit, and is largely defined by its surface form and location in the landscape

Relationships

Relationship	Related Item Name
Specialization of	Location

LEGAL PROPERTY

Description: Any real property that is owned by a person or entity

Relationships

Relationship	Related Item Name
Specialization of	Location

LOCATION

Description: A point, facility, place, or geographic position that may be referred to physically or logically.

Relationships

Relationship	Related Item Name
Generalization of	Business Location
Generalization of	Geographic Feature
Generalization of	Legal Property
Generalization of	Political Jurisdiction

POLITICAL JURISDICTION

Description: The defined area of responsibility of a legally constituted government body

Relationships

Relationship	Related Item Name
Specialization of	Location

CAPABILITY

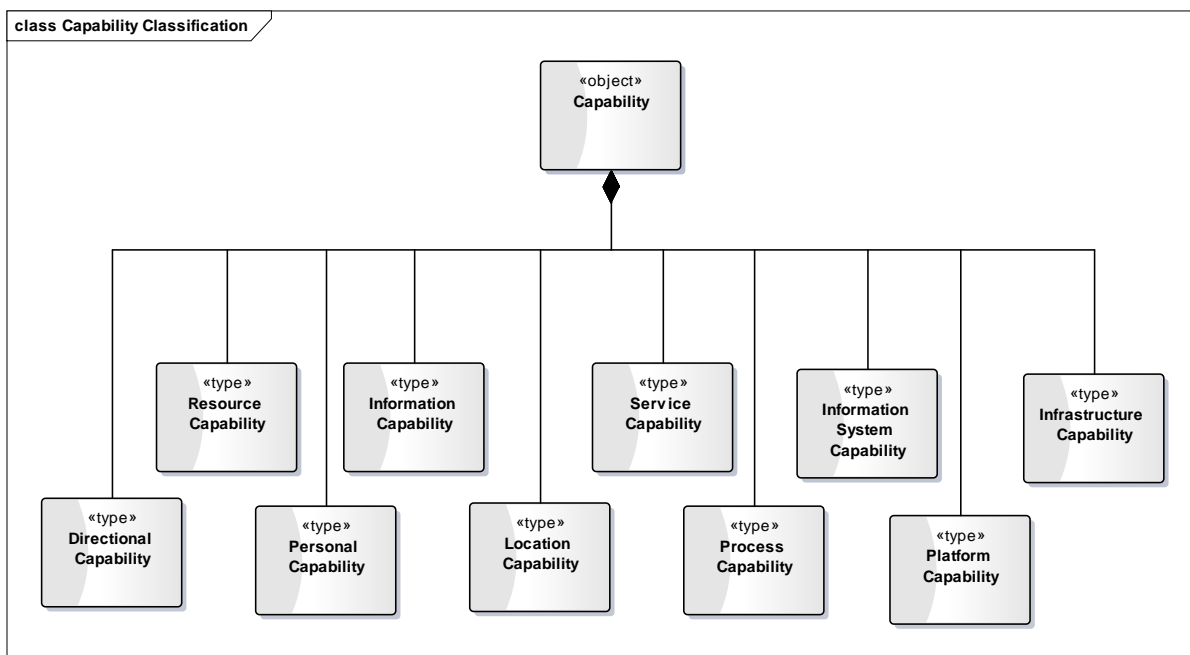


Figure 56 : Capability Classification

CAPABILITY

Description: A capability is an abstraction that represents the ability to perform a particular skill set i.e. organizational competencies, personal competencies, business function, processes, services and technology.

Business capability is the potential for action to achieve a goal via an action/series of actions in a process resulting from the interaction of 2 or more resources, in a transformation that produces business value for a customer. (Michell, 2011)

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
composed of	Service Capability
composed of	Process Capability
composed of	Directional Capability
composed of	Resource Capability
composed of	Personal Capability
composed of	Location Capability
composed of	Information Capability
composed of	Information System Capability
composed of	Platform Capability
composed of	Infrastructure Capability

DIRECTIONAL CAPABILITY

Description: The extent of Strategy, Objectives, plans Command and Management direction (guidance, instructions, publications, doctrine, procedures, & preparedness documents) required to support decision-making, administration, and operations.

Relationships

Relationship	Related Item Name
part of	Capability

INFORMATION CAPABILITY

Description: The extent of or quality of Information including the ability to achieve timely access to authoritative information to support decisions.

Relationships

Relationship	Related Item Name
part of	Capability

INFORMATION SYSTEM CAPABILITY

Description: The extent and alignment of Major Systems e.g. application components, modules and application tasks. Enabling automation designed to enhance the ability to deliver outcomes.

Relationships

Relationship	Related Item Name
Part of	Capability

INFRASTRUCTURE CAPABILITY

Description: The extent and capacity of Network Communications infrastructure and devices available to the enterprise

Relationships

Relationship	Related Item Name
Part of	Capability

LOCATION CAPABILITY

Description: The extent and utility of buildings, structures, property, plant, training areas and facilities (Real Property)

Relationships

Relationship	Related Item Name
part of	Capability

PERSONAL CAPABILITY

Description: The personal abilities of an individual.

Relationships

Relationship	Related Item Name
part of	Capability

PLATFORM CAPABILITY

Description: The extent and alignment of Platform technology e.g. platform components, platform devices and platform services available to the organization

Relationships

Relationship	Related Item Name
part of	Capability

RESOURCE CAPABILITY

Description: The extent to which all nonexpendable items needed to outfit or equip an individual or organization to perform its mission are in place

Relationships

Relationship	Related Item Name
part of	Capability

SERVICE CAPABILITY

Description: The service construct and the service delivered

Relationships

Relationship	Related Item Name
composed of	Capability

RESOURCE

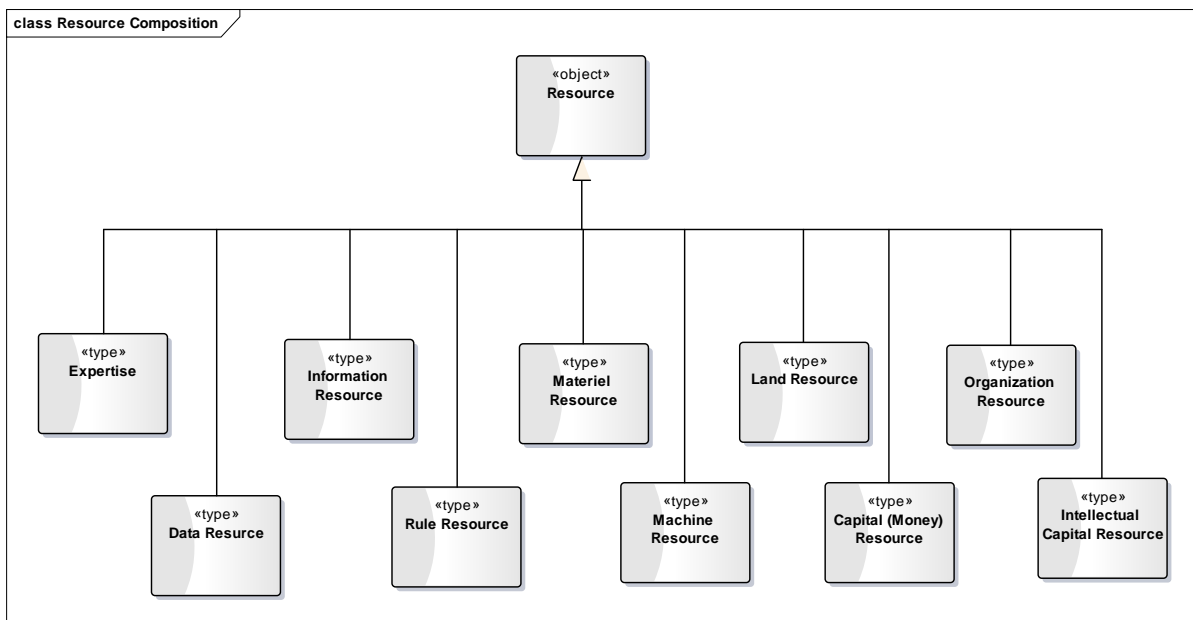


Figure 57 : Resource Composition

CAPITAL (MONEY) RESOURCE

Description: The financial resources available to the organization, including capital, cash, and access to debtors and creditors, and suppliers of money

Relationships

Relationship	Related Item Name
Specialization of	Resource

DATA RESOURCE

Description: All the data available to an organization

Relationships

Relationship	Related Item Name
Specialization of	Resource

EXPERTISE

Description: People with the ability to apply skill and knowledge

Relationships

Relationship	Related Item Name
Specialization of	Resource

INFORMATION RESOURCE

Description: The organized information available to the organization

Relationships

Relationship	Related Item Name
Specialization of	Resource

INTELLECTUAL CAPITAL RESOURCE

Description:

Includes the patents, brands, and other indications of the values of these is that when businesses are sold, part of the value is goodwill. In a knowledge -based economy intellectual capital is likely to be a major asset of many organizations.

Relationships

Relationship	Related Item Name
Specialization of	Resource

LAND RESOURCE

Description: Broadly, all that nature provides, including minerals, forest products, and water and **land resources**.

Relationships

Relationship	Related Item Name
Specialization of	Resource

MACHINE RESOURCE

Description:

Major mechanical devices to support work

Relationships

Relationship	Related Item Name
Specialization of	Resource

MATERIEL RESOURCE

Description:

Expendable or other consumable supplies that are of interest.

Relationships

Relationship	Related Item Name
Specialization of	Resource

ORGANIZATION RESOURCE

Description: The structure of the organization and the alignment of the human decision making personal capability to the hierarchy

Relationships

Relationship	Related Item Name
Specialization of	Resource

RESOURCE

Description: Any person, organization, or system that may be assigned one or more roles. May be internal or external to an organization.

Relationships

Relationship	Related Item Name
Generalization of	Organization Resource
Generalization of	Land Resource
Generalization of	Materiel Resource
Generalization of	Information Resource
Generalization of	Data Resource
Generalization of	Rule Resource
Generalization of	Machine Resource
Generalization of	Capital (Money) Resource
Generalization of	Intellectual Capital Resource

RULE RESOURCE

Description: Constraints or guidance that allows for routine conditions or situations to be addressed with the minimum of cost and risk.

Relationships

Relationship	Related Item Name
Specialization of	Resource

ACTOR

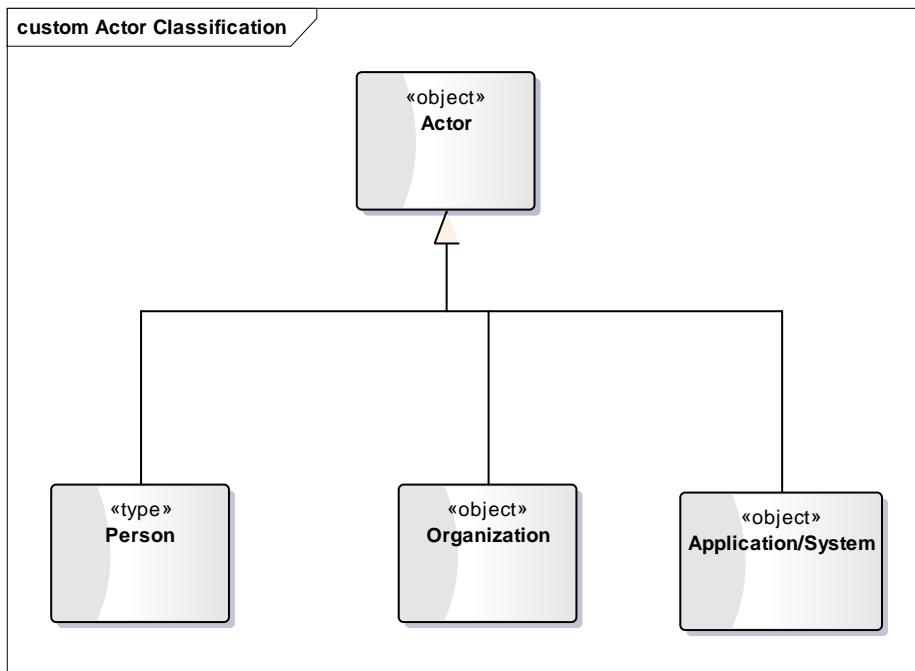


Figure 58 : Actor Classification

ACTOR

Description:

A person, organization, or system that has a role that initiates or interacts with activities. Actors may be internal or external to an organization.

RELATIONSHIPS

Relationship	Related Item Name
Generalization of	Person
Generalization of	Organization
Generalization of	Application/System

PERSON

Description: A single human being.

RELATIONSHIPS

Relationship	Related Item Name
Specialization of	Actor

EVENT

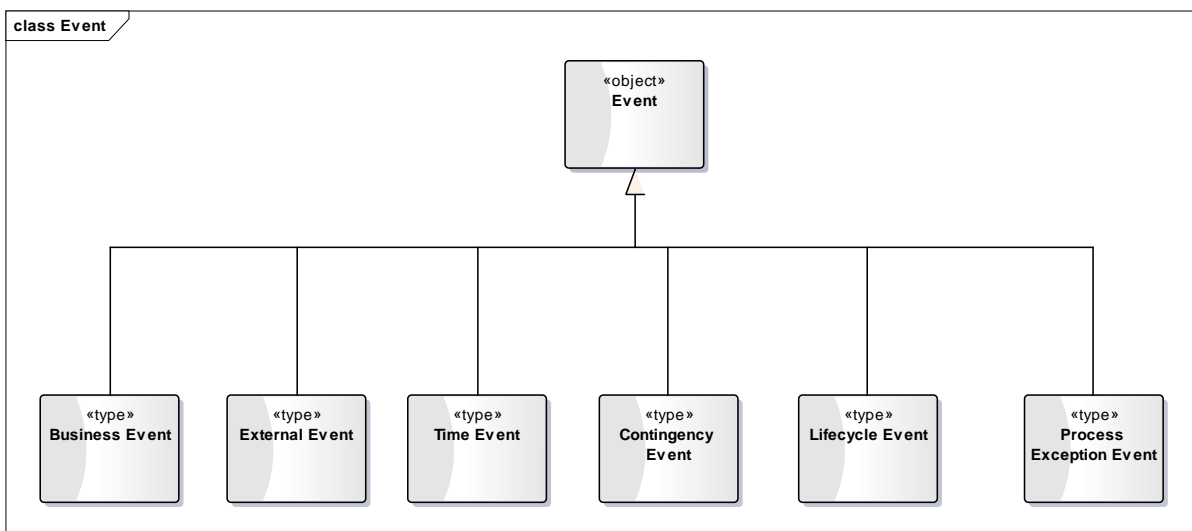


Figure 59 : Event

Business Event

Description:

Events that take place in the course of normal operation for a business that reoccur as business processes are completed

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
Specialization of	Event

CONTINGENCY EVENT

Description: An *event* that is part of normal operations of a business that may occur but that is not likely or intended

Relationships

Relationship	Related Item Name
Specialization of	Event

EVENT

Description: A state change that recognizes the triggering or termination of processing.

Relationships

Relationship	Related Item Name
Generalization of	Business Event
Generalization of	External Event
Generalization of	Time Event
Generalization of	Lifecycle Event
Generalization of	Contingency Event
Generalization of	Process Exception Event

LIFECYCLE EVENT

Description: An event that causes a transition in the state of an item used within a business

Relationships

Relationship	Related Item Name
Specialization of	Event

PROCESS EXCEPTION EVENT

Description: An *event* within a process that may occur but that is not likely or intended

Relationships

Relationship	Related Item Name
Specialization of	Event

TIME EVENT

Description: An *event* within a business that occurs as a result of time

Relationships

Relationship	Related Item Name
Specialization of	Event

Chapter 8 The Risk Meta-Meta Model:

Purpose of the Risk Meta-Meta Model (M3) Object

At the Risk Meta Meta Model level, the standard objects used to describe and enterprise exist. These are meta meta objects which capture the concepts and conceptual relationships of the enterprise. Unlike at M2, where the items are classified in the context of risk, these items use a standard classification scheme that is commonly applied to thinking and working at this level of abstraction. For this white paper only those items within the standard ontology that are relevant to risk

Purpose of the Risk Meta Meta Model Object

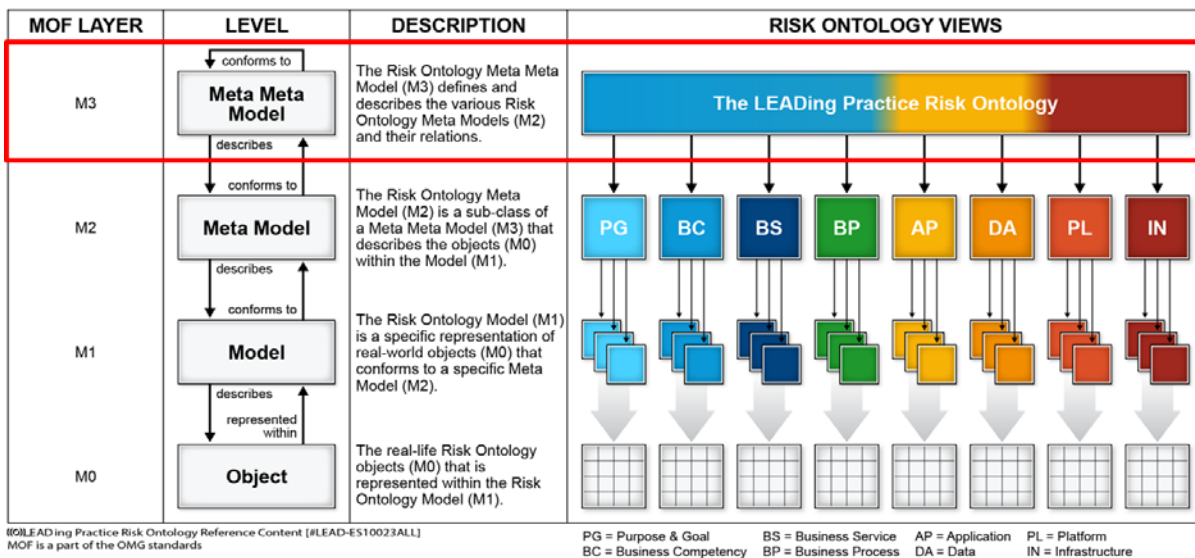


Figure 60 - Position of the Risk Meta Meta Model within the MOF

The Risk Meta Meta Model is a formal, universal vocabulary. For the purposes of this white paper, the Risk Meta Meta Model only contain those items and relationships that are relevant to risk. These items are classified and categorized to create a standard set of sub classes to which any domain may be aligned. In the case of this white paper, as we are only interested in risk, this is the focus of the concepts and relationship with which we work.

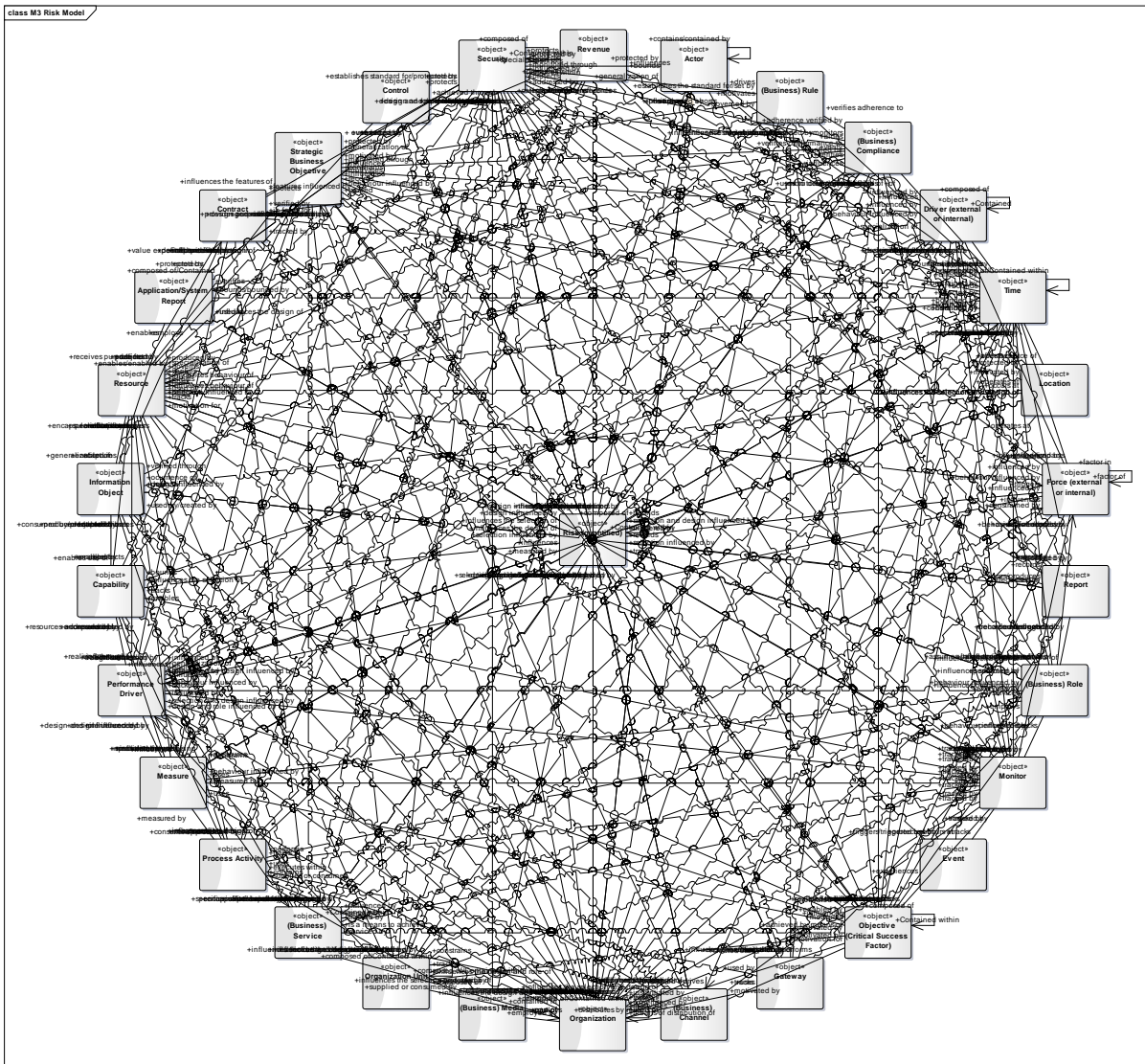


Figure 61 All Risk Meta Meta Objects and relations

Figure 61 shows all Risk Meta Meta Model concepts from the standard LEAD Ontology that have a conceptual relationship with risk and are therefore part of the LEAD Risk Ontology. Each concept is represented as a rectangle capturing a specific meta object. The model shows all the semantic relationships involved in governing risk. Obviously, this model cannot be either read or understood. For this reason in the following section the meta objects are evaluated one at a time

Risk Meta Meta Model Objects

The following is the set of Risk Meta Meta Model objects relevant to risk. Each item from Risk Meta Meta Model of interest is listed alphabetically by name; a figure is also provided showing how its parts exist within the context of risk are organized. Each of these parts is then described and the nature of the semantic relationship between these items is identified.

In the table titled “Relationships”, the nature of each relationship from the broader context is identified and describe In each case the rows within this table can be read as “Item Name”,

“has a relationship to” “Related Item Name”. By way of example within Force (external or internal), we see that Revenue has a connection to Force. In this case, the relationship that is expressed tell us that Force Influence Revenue.

FORCE (EXTERNAL OR INTERNAL)

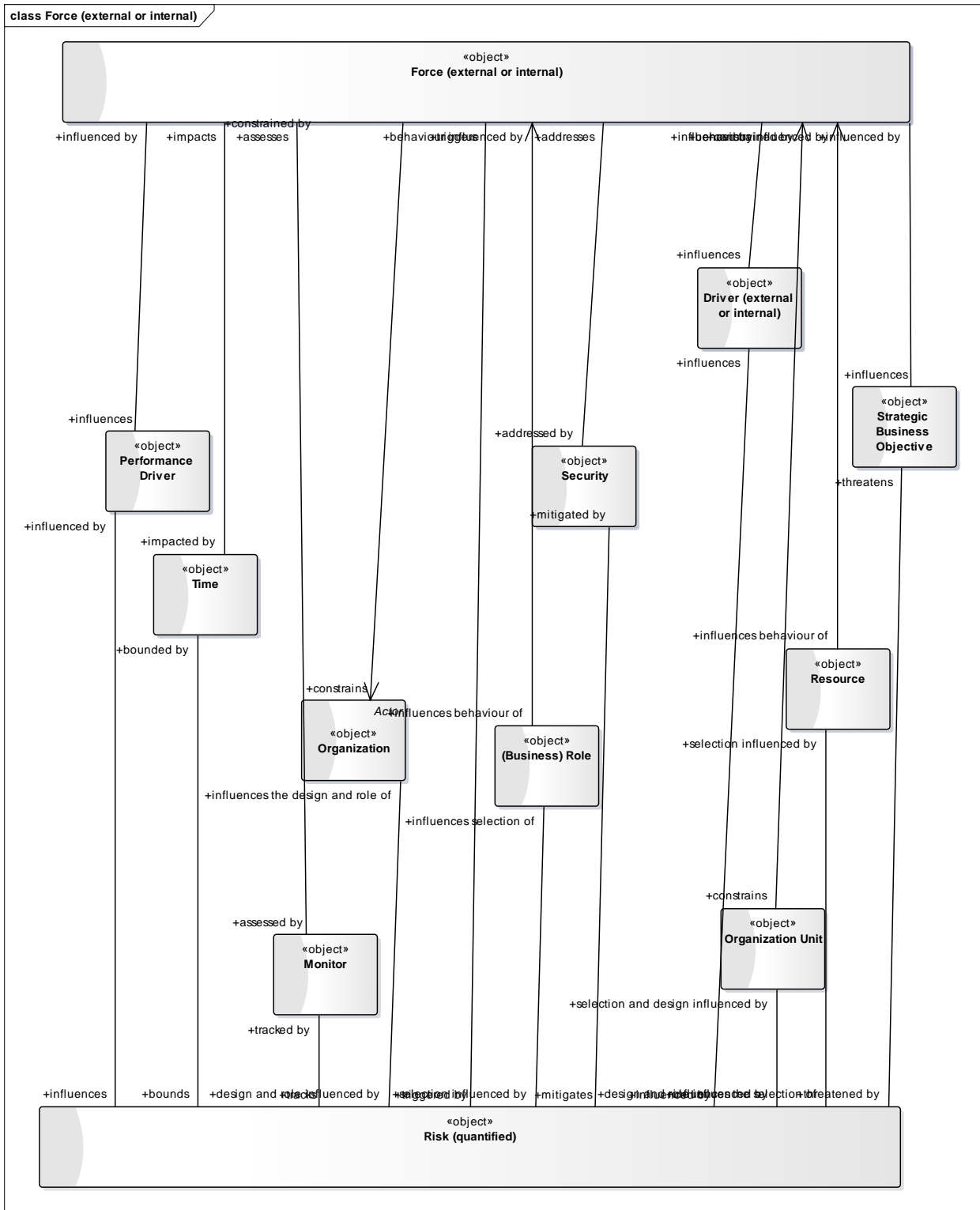


Figure 62 : Force (external or internal)

FORCE (EXTERNAL OR INTERNAL)

Description: An external or internal factor that forces or pushes some aspect of an enterprise in a specific direction.

Relationships

Relationship	Related Item Name
influences	Revenue
influences	Performance Driver
impacted by	Time
influenced by	(Business) Service
influences behaviour of	Resource
constrains	Organization Unit
addressed by	Security
constrains	Organization
influences behaviour of	(Business) Role
triggered by	Risk (quantified)
influences	Strategic Business Objective
influences	Driver (external or internal)

Relationship	Related Item Name
assessed by	Monitor

RISK (QUANTIFIED)

Description: Uncertainty in terms of vulnerability and is about the severity and impact of the consequences (or outcomes), with respect to something that is valued. It is therefore the combined impact of any conditions, events or factors that can affect the potential for keeping or achieving desired objectives.

Relationships

Relationship	Related Item Name
mitigated by	Security
influences the design of	(Business) Rule
influences the design of	Process Activity
influences the selection and design of	(Business) Media
bounded by	Time
threatens	Vision
influences the design of	Contract
selection and design influenced by	Organization Unit
influences the design of	(Business) Channel

Relationship	Related Item Name
influences the design of	Gateway
threatens	Strategic Business Objective
influences the selection of	Capability
influences the design of	(Business) Service
influences the design of	Application/System Report
influences selection of	(Business) Role
influences the design and role of	Organization
influences the selection and design of	Location
selection influenced by	Resource
influences	Actor
monitored through	(Business) Compliance
threatens	Revenue
recorded by	Report
influenced by	Performance Driver

Relationship	Related Item Name
threatens	Objective (Critical Success Factor)
triggers	Force (external or internal)
influences	Driver (external or internal)
tracked by	Monitor
triggers/triggered by	Event
design influenced by	Information Object
mitigates	Control
measures	Measure

DRIVER (EXTERNAL OR INTERNAL)

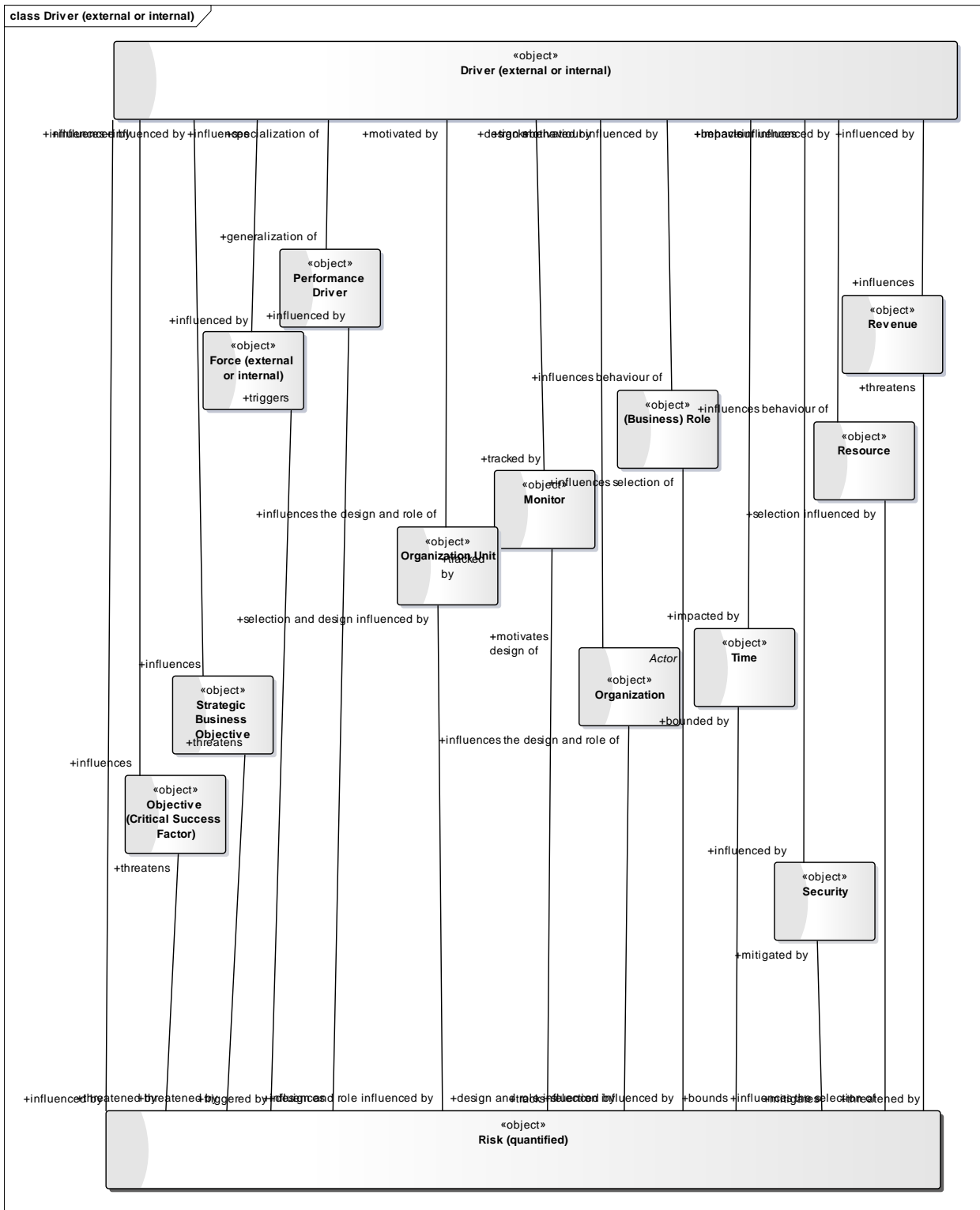


Figure 63 : Driver (external or internal)

DRIVER (EXTERNAL OR INTERNAL)

Description: An external or internal factor that drives, or establishes motivation for or influences some aspect of an enterprise in a specific direction.

Relationships

Relationship	Related Item Name
generalization of	Performance Driver
impacted by	Time
influenced by	(Business) Service
Influences	Strategic Business Objective
influenced by	Risk (quantified)
influences behaviour of	(Business) Role
influences behaviour of	Resource
Influences	Objective (Critical Success Factor)
motivates design of	Organization
influenced by	Force (external or internal)
Influences	Revenue
influences the design and role of	Organization Unit

Relationship	Related Item Name
influenced by	Security
tracked by	Monitor

PERFORMANCE DRIVER

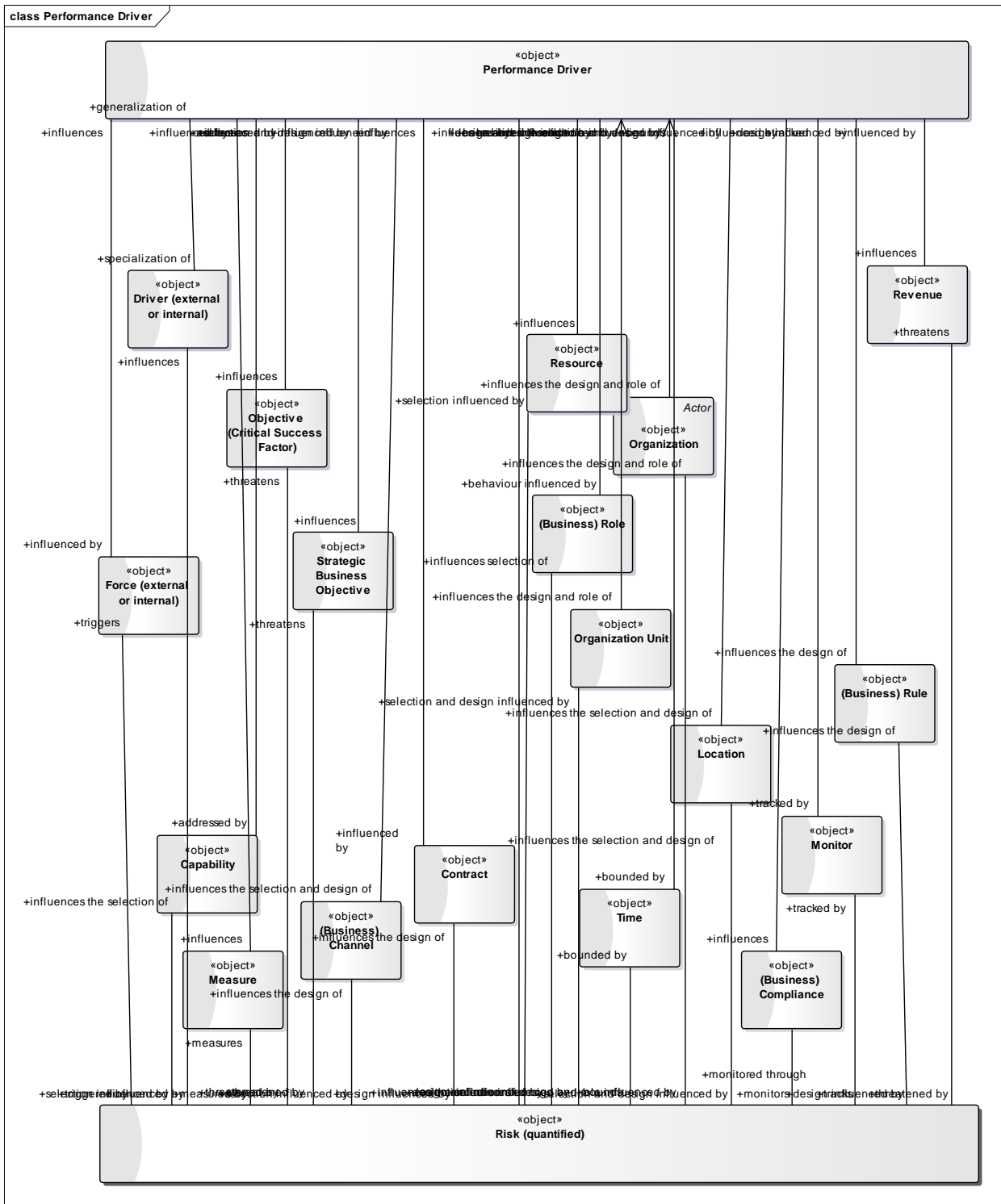


Figure 64 : Performance Driver

PERFORMANCE DRIVER

Description: A factor that is based on variables that are critical to develop the operational means and overall performance of an enterprise.

Relationships

Relationship	Related Item Name
influenced by	Contract
influences the selection and design of	(Business) Channel
addressed by	Capability
Influences	Strategic Business Objective
bounded by	Time
influences the selection and design of	Location
Influences	Risk (quantified)
Influences	Resource
influences the design of	(Business) Rule
behaviour influenced by	(Business) Role
influences the design and role of	Organization

Relationship	Related Item Name
Influences	Revenue
influences the design and role of	Organization Unit
influences	Objective (Critical Success Factor)
influences	Measure
influenced by	Force (external or internal)
specialization of	Driver (external or internal)

STRATEGIC BUSINESS OBJECTIVE

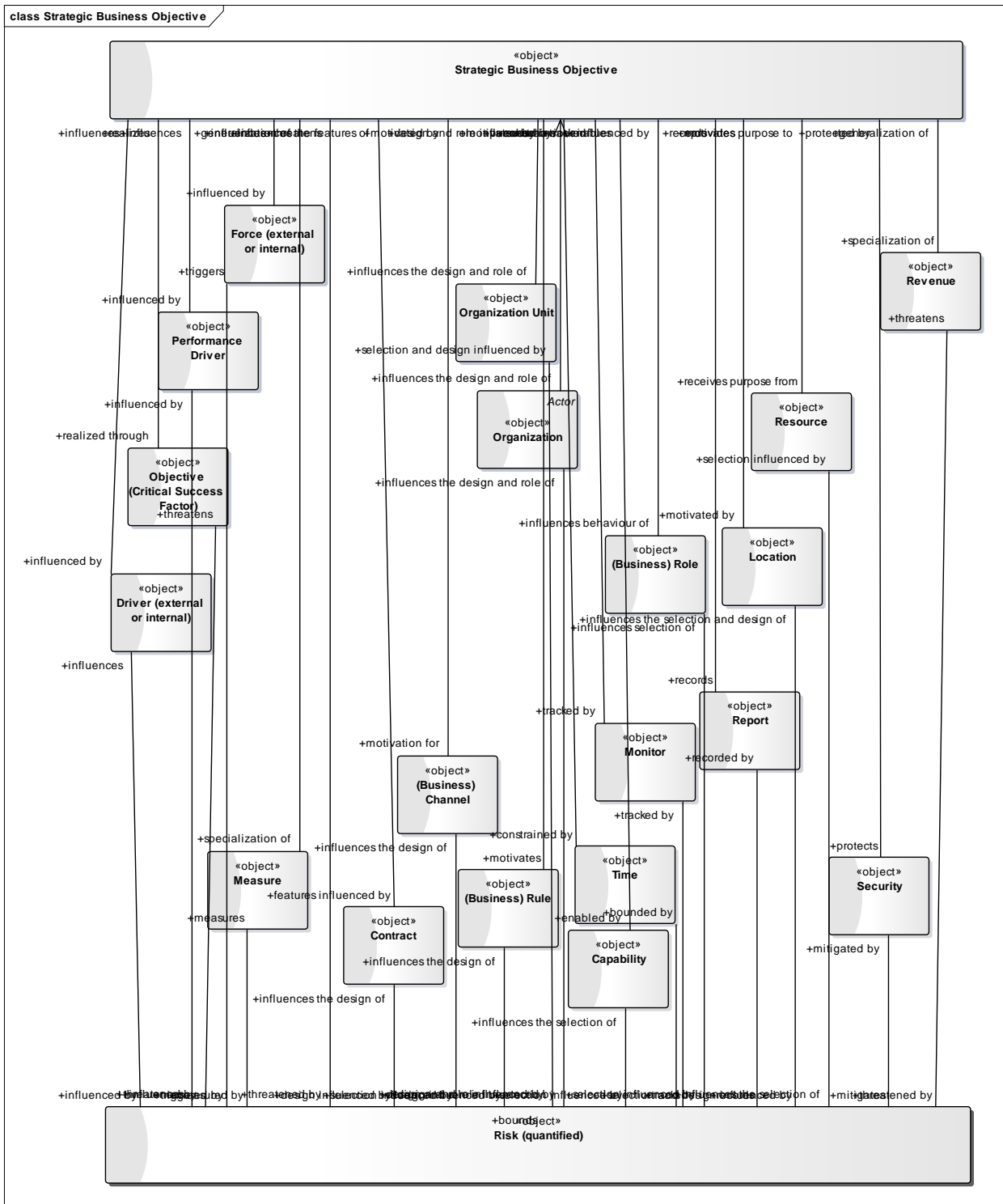


Figure 65 : Strategic Business Objective

STRATEGIC BUSINESS OBJECTIVE

Description: The direction and ends to which the enterprise seeks as well as the means and methods by which the ends will be attained.

Relationships

Relationship	Related Item Name
enabled by	Capability
influenced by	(Business) Service
specialization of	Revenue
receives purpose from	Resource
motivates	(Business) Rule
influences the design and role of	Organization
motivation for	(Business) Channel
influences the design and role of	Organization Unit
motivated by	Location
influences behaviour of	(Business) Role
constrained by	Time
features influenced by	Contract

Relationship	Related Item Name
protects	Security
threatened by	Risk (quantified)
records	Report
influenced by	Performance Driver
realized through	Objective (Critical Success Factor)
specialization of	Measure
influenced by	Force (external or internal)
influenced by	Driver (external or internal)
tracked by	Monitor

OBJECTIVE (CRITICAL SUCCESS FACTOR)

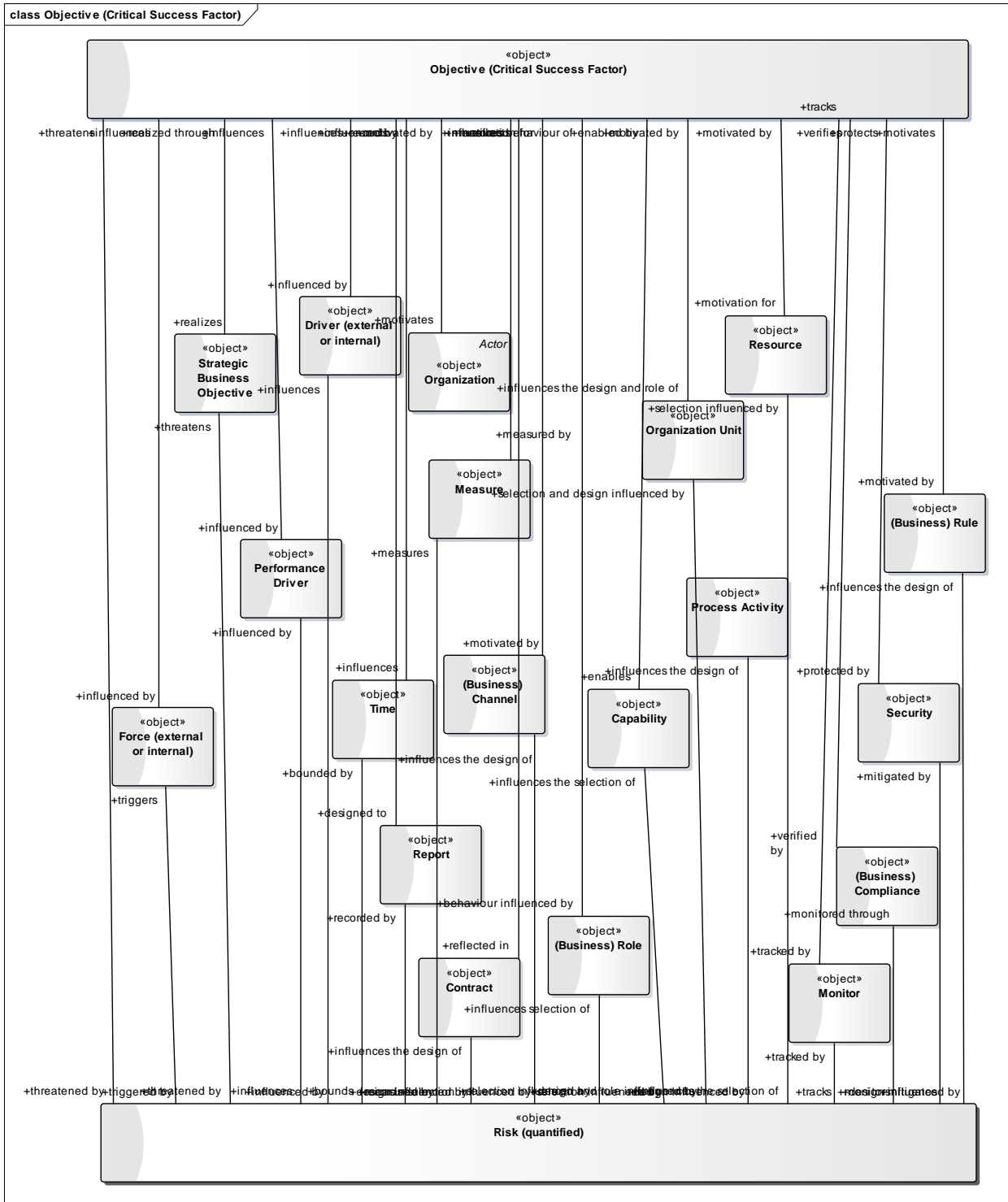


Figure 66 : Objective (Critical Success Factor)

OBJECTIVE (CRITICAL SUCCESS FACTOR)

Description: Time bound milestones to measure and gauge the progress towards a strategy or goal.

Relationships

Relationship	Related Item Name
realizes	Strategic Business Objective
threatened by	Risk (quantified)
motivates	Organization
influenced by	Performance Driver
motivated by	(Business) Rule
influences the design and role of	Organization Unit
influences	Time
is a means to achieve	(Business) Service
designed to	Report
verified by	(Business) Compliance
reflected in	Contract
behaviour influenced by	(Business) Role

Relationship	Related Item Name
motivation for	Resource
measured by	Measure
influenced by	Driver (external or internal)
tracked by	Monitor

RISK

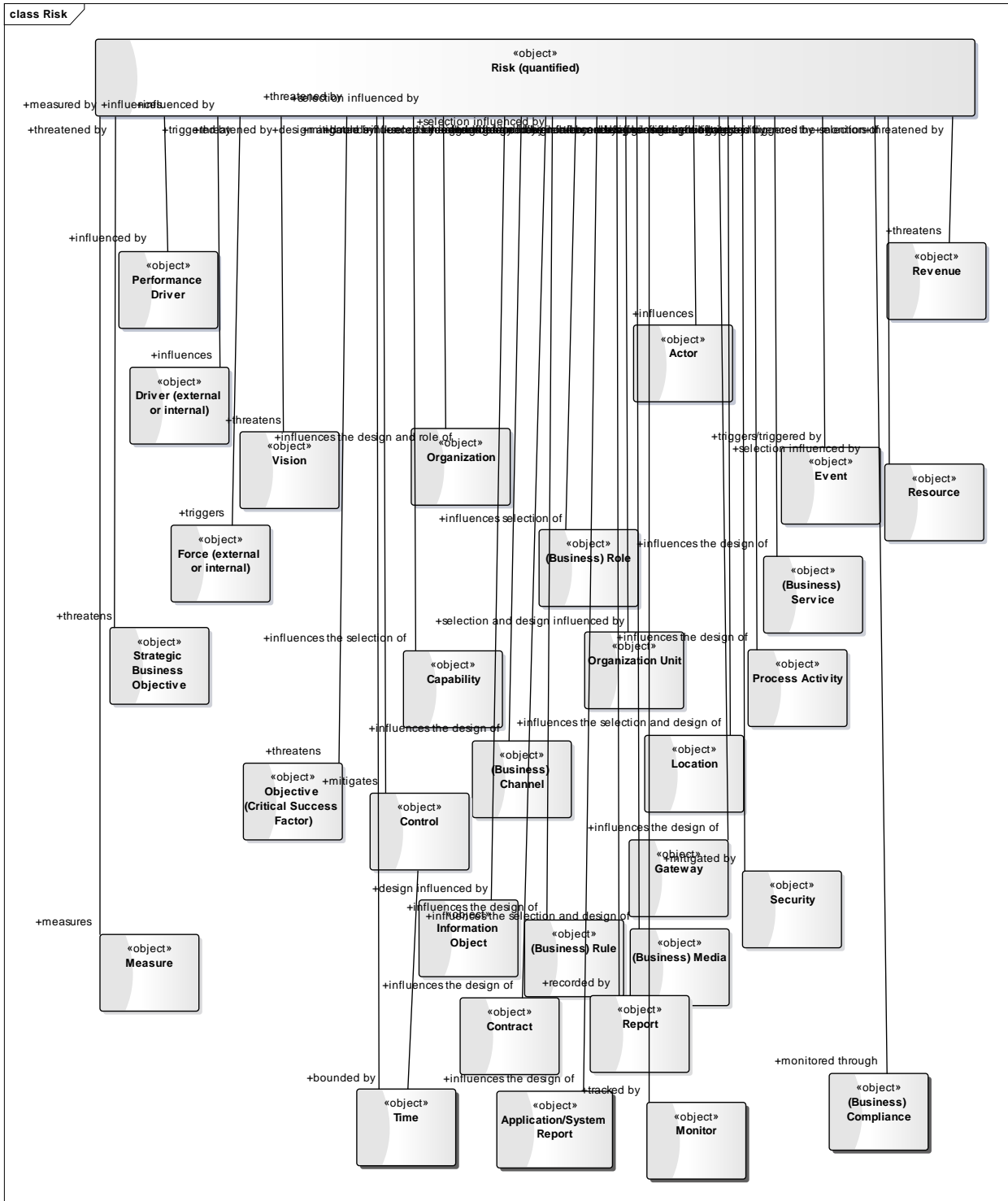


Figure 67 : Risk

RISK (QUANTIFIED)

Description: Uncertainty in terms of vulnerability and is about the severity and impact of the consequences (or outcomes), with respect to something that is valued. It is therefore the combined impact of any conditions, events or factors that can affect the potential for keeping or achieving desired objectives.

Relationships

Relationship	Related Item Name
mitigated by	Security
influences the design of	(Business) Rule
influences the design of	Process Activity
influences the selection and design of	(Business) Media
bounded by	Time
threatens	Vision
influences the design of	Contract
selection and design influenced by	Organization Unit
influences the design of	(Business) Channel
influences the design of	Gateway
threatens	Strategic Business Objective

Relationship	Related Item Name
influences the selection of	Capability
influences the design of	(Business) Service
influences the design of	Application/System Report
influences selection of	(Business) Role
influences the design and role of	Organization
influences the selection and design of	Location
selection influenced by	Resource
influences	Actor
monitored through	(Business) Compliance
threatens	Revenue
recorded by	Report
influenced by	Performance Driver
threatens	Objective (Critical Success Factor)
triggers	Force (external or internal)

Relationship	Related Item Name
influences	Driver (external or internal)
tracked by	Monitor
triggers/triggered by	Event
design influenced by	Information Object
mitigates	Control
measures	Measure

SECURITY

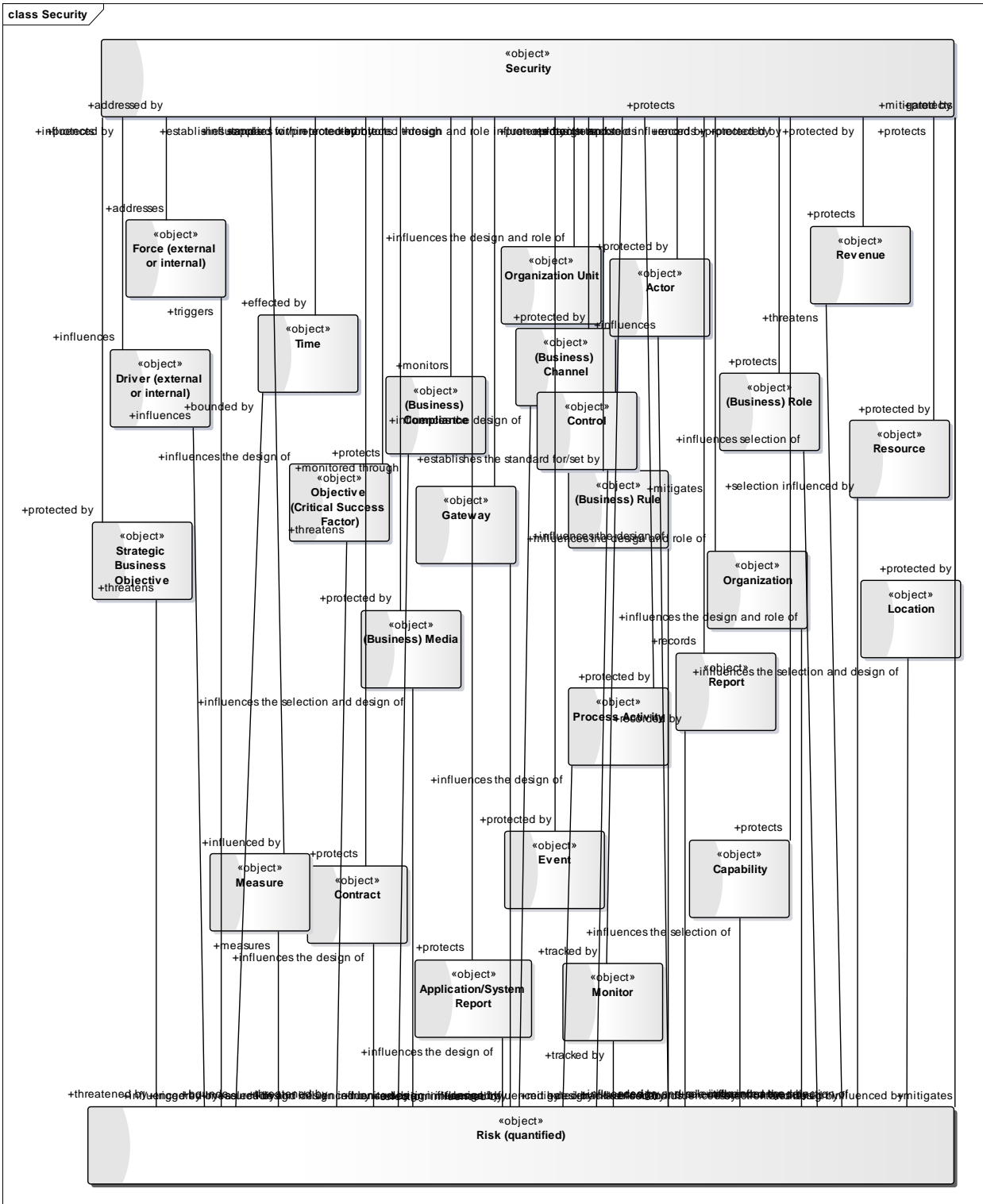


Figure 68 : Security

SECURITY

Description: The objects or tools that secure, make safe and protect through measures to prevent exposure to danger or risk.

Relationships

Relationship	Related Item Name
protects	(Business) Role
protected by	(Business) Channel
protects	Capability
monitors	(Business) Compliance
protects	(Business) Service
establishes the standard for/set by	(Business) Rule
protects	Contract
protected by	Location
protected by	Strategic Business Objective
protected by	Actor
protected by	(Business) Media
protected by	Resource

Relationship	Related Item Name
protected by	Process Activity
influences the design and role of	Organization
effected by	Time
protects	Application/System Report
protected by	Event
protects	Revenue
mitigates	Risk (quantified)
records	Report
influenced by	Measure
addresses	Force (external or internal)
influences	Driver (external or internal)
tracked by	Monitor
monitors	Gateway

MEASURE

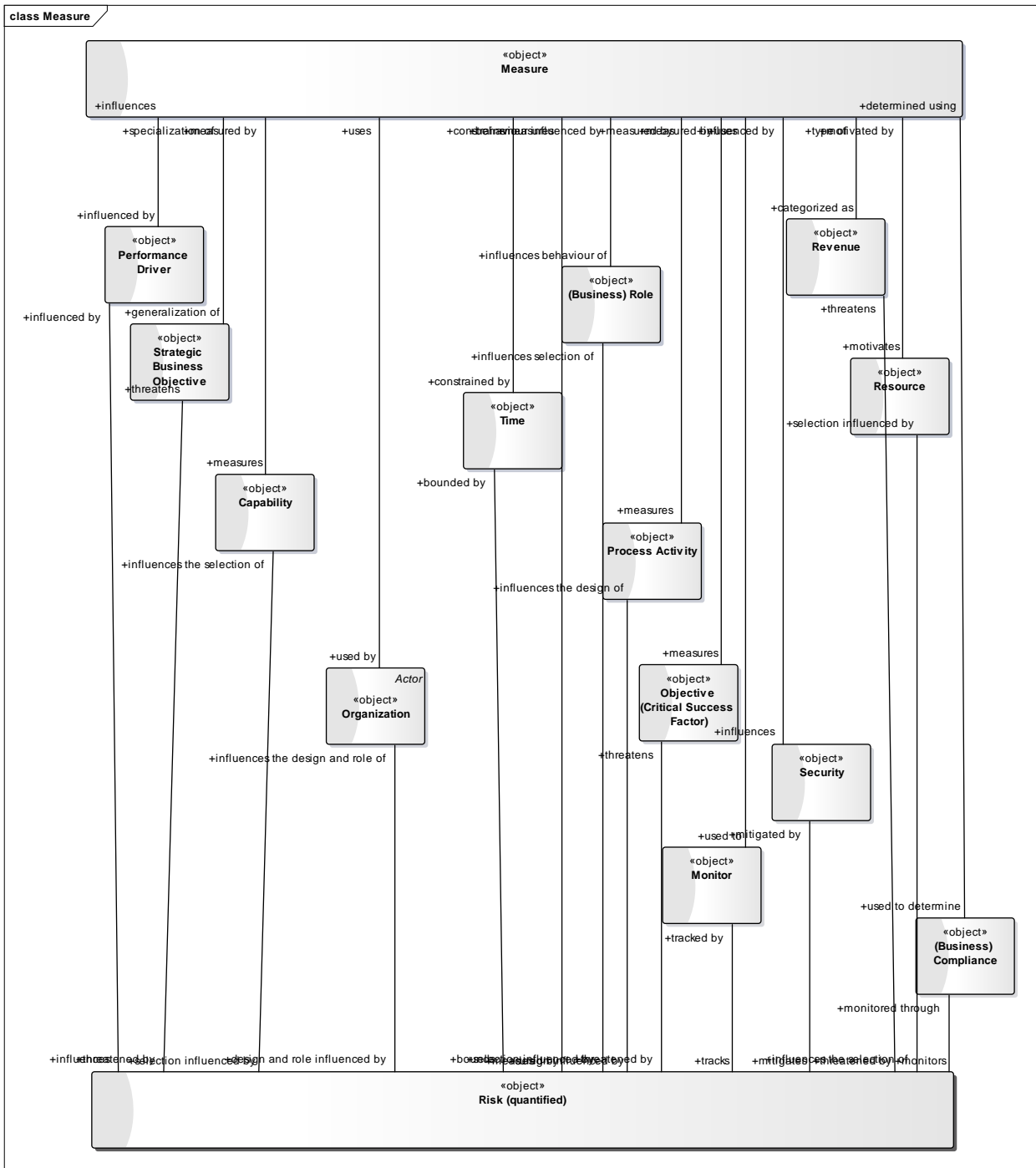


Figure 69 : Measure

MEASURE

Description: Any type of measurement used to gauge some quantifiable component of an enterprise’s performance.

Relationships

Relationship	Related Item Name
influences	Security
generalization of	Strategic Business Objective
influenced by	Performance Driver
measures	Objective (Critical Success Factor)
constrained by	Time
motivates	Resource
categorized as	Revenue
influences behaviour of	(Business) Role
measures	Capability
used to	Monitor
used by	Organization
measures	Process Activity
used to determine	(Business) Compliance
used to	Control

Relationship	Related Item Name
measured by	Risk (quantified)

TIME

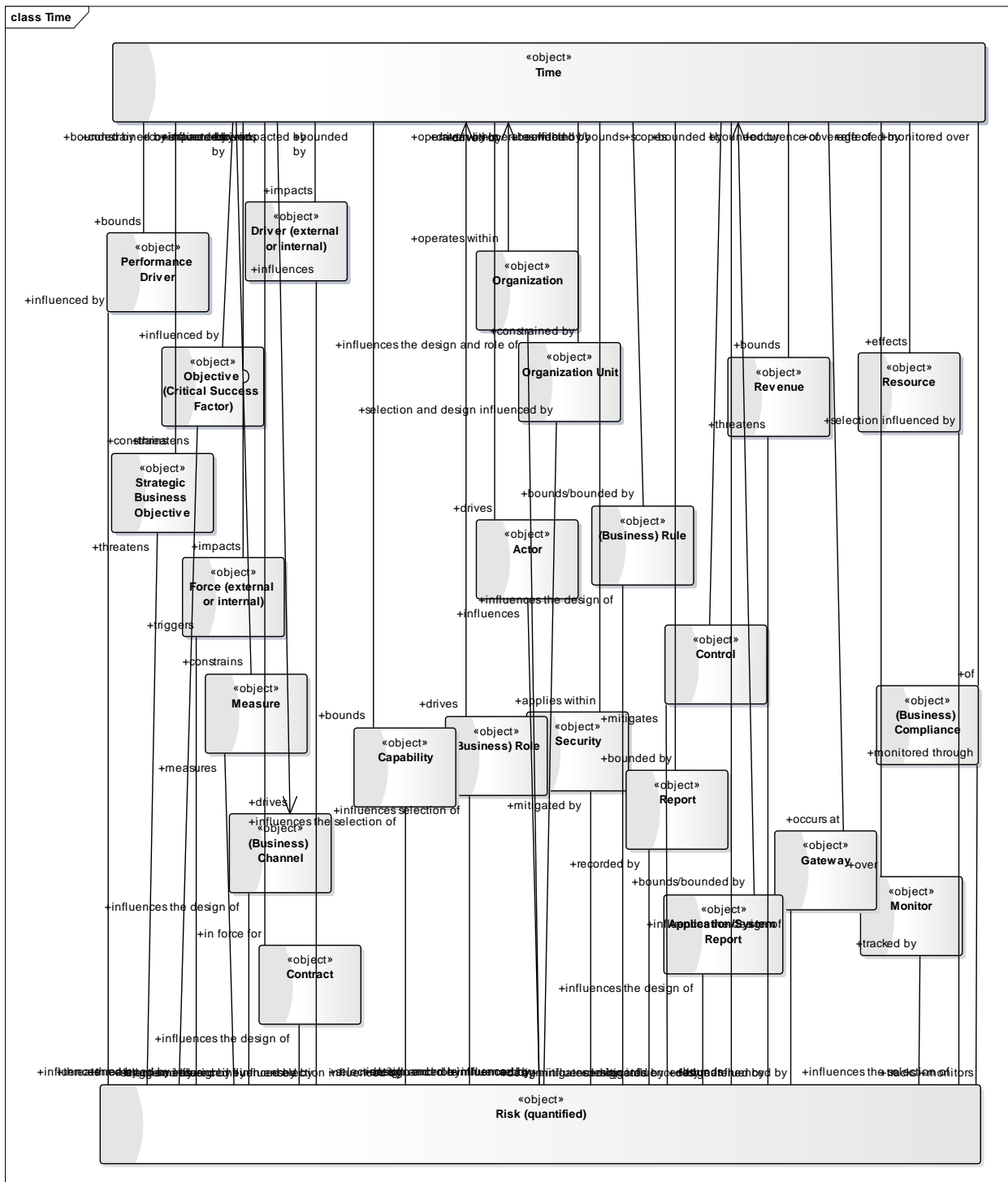


Figure 70 : Time

Time

Description:

A plan, schedule, arrangement or measure for when something should initiate, take place, be completed or the amount of time consumed.

Relationships

Relationship	Related Item Name
bounds	Capability
in force for	Contract
drives	(Business) Role
of	(Business) Compliance
drives	Actor
bounds/bounded by	Application/System Report
operates within	Organization
constrained by	Organization Unit
drives	(Business) Channel
constrained by	(Business) Service
bounds/bounded by	(Business) Rule
effects	Resource

Relationship	Related Item Name
bounds	Revenue
constrains	Strategic Business Objective
applies within	Security
bounds	Risk (quantified)
bounded by	Report
bounds	Performance Driver
influenced by	Objective (Critical Success Factor)
constrains	Measure
constrained by	Goal
impacts	Force (external or internal)
impacts	Driver (external or internal)
over	Monitor
Occurrence of	Gateway
affects choice of	Location

MONITOR

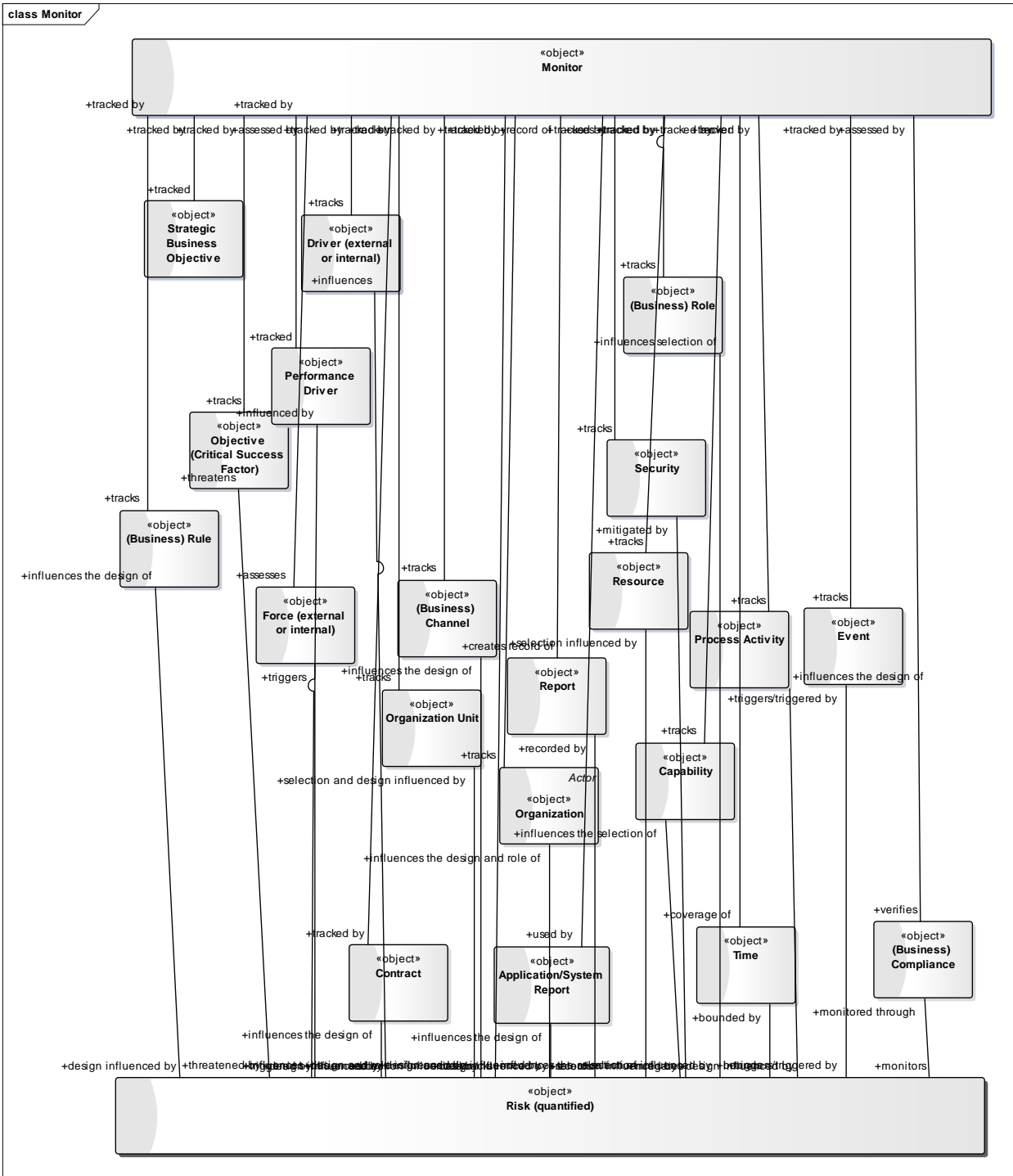


Figure 71 : Monitor

MONITOR

Description: To be aware of the state, through observation or measuring.

To supervise and to continually check and critically observe. It means to determine the current status and to assess whether or not required or expected performance levels are actually being achieved.

Relationships

Relationship	Related Item Name
tracked	Strategic Business Objective
tracks	Security
verifies	(Business) Compliance
tracks	Objective (Critical Success Factor)
tracks	Risk (quantified)
tracks	Resource
used by	Application/System Report
coverage of	Time
tracks	Process Activity
uses	Measure
tracks	Driver (external or internal)
assesses	Force (external or internal)

Relationship	Related Item Name
tracks	Event
tracked by	Contract
creates record of	Report
tracks	Capability
tracks	Organization Unit
tracks	(Business) Rule
tracks	Organization
tracks	(Business) Role
tracks	(Business) Channel

REPORT

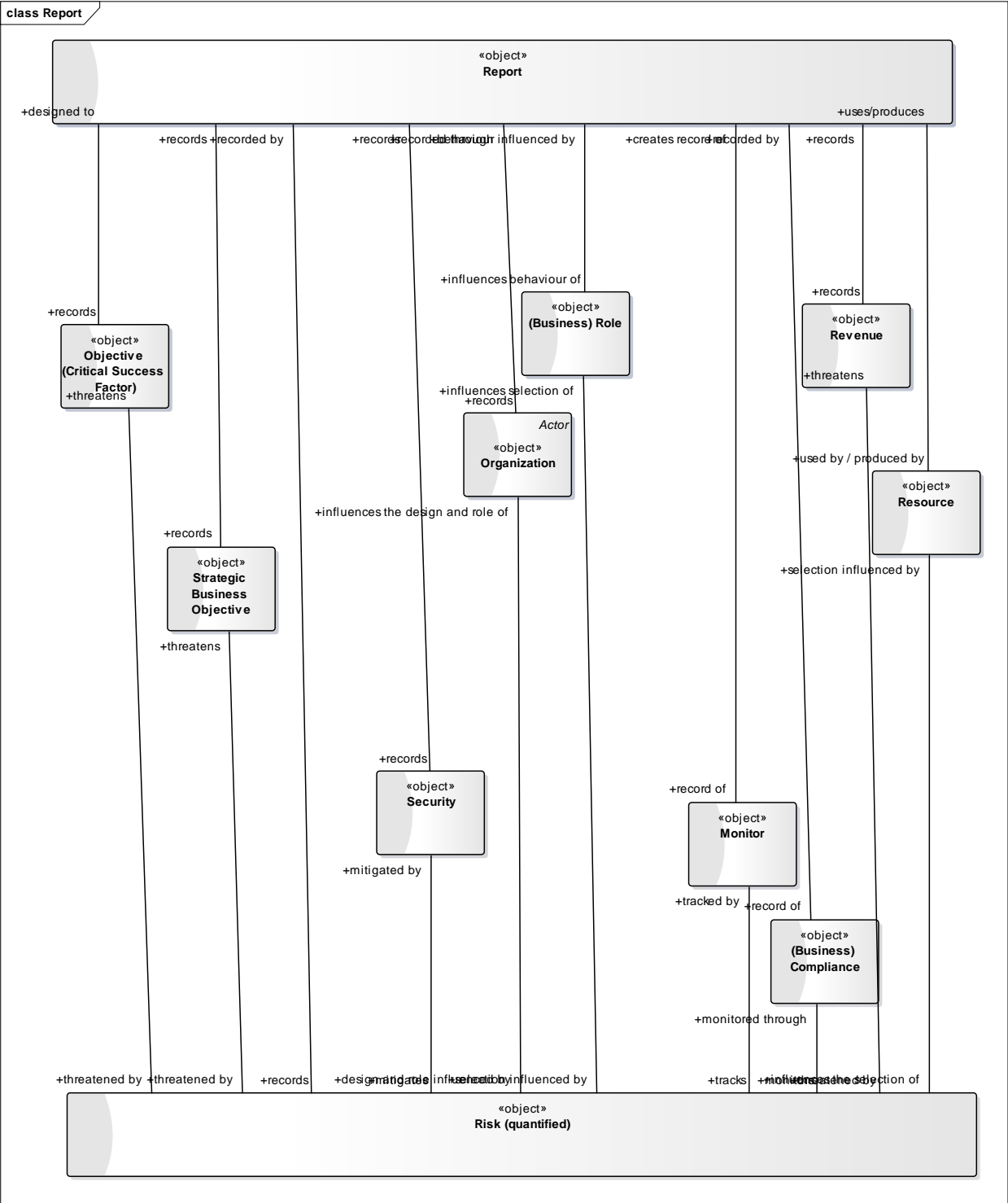


Figure 72 : Report

REPORT

Description: The exposure, description, and portrayal of information about the status, direction or execution of work within the functions, services, processes, and resources of the enterprise.

Relationships

Relationship	Related Item Name
Records	Revenue
Scopes	Time
Records	Strategic Business Objective
Uses	Information Object
used by / produced by	Resource
influences behaviour of	(Business) Role
Records	Security
Records	Risk (quantified)
Records	Objective (Critical Success Factor)
record of	(Business) Compliance
record of	Monitor
Records	Organization

Business Competency

ORGANIZATION

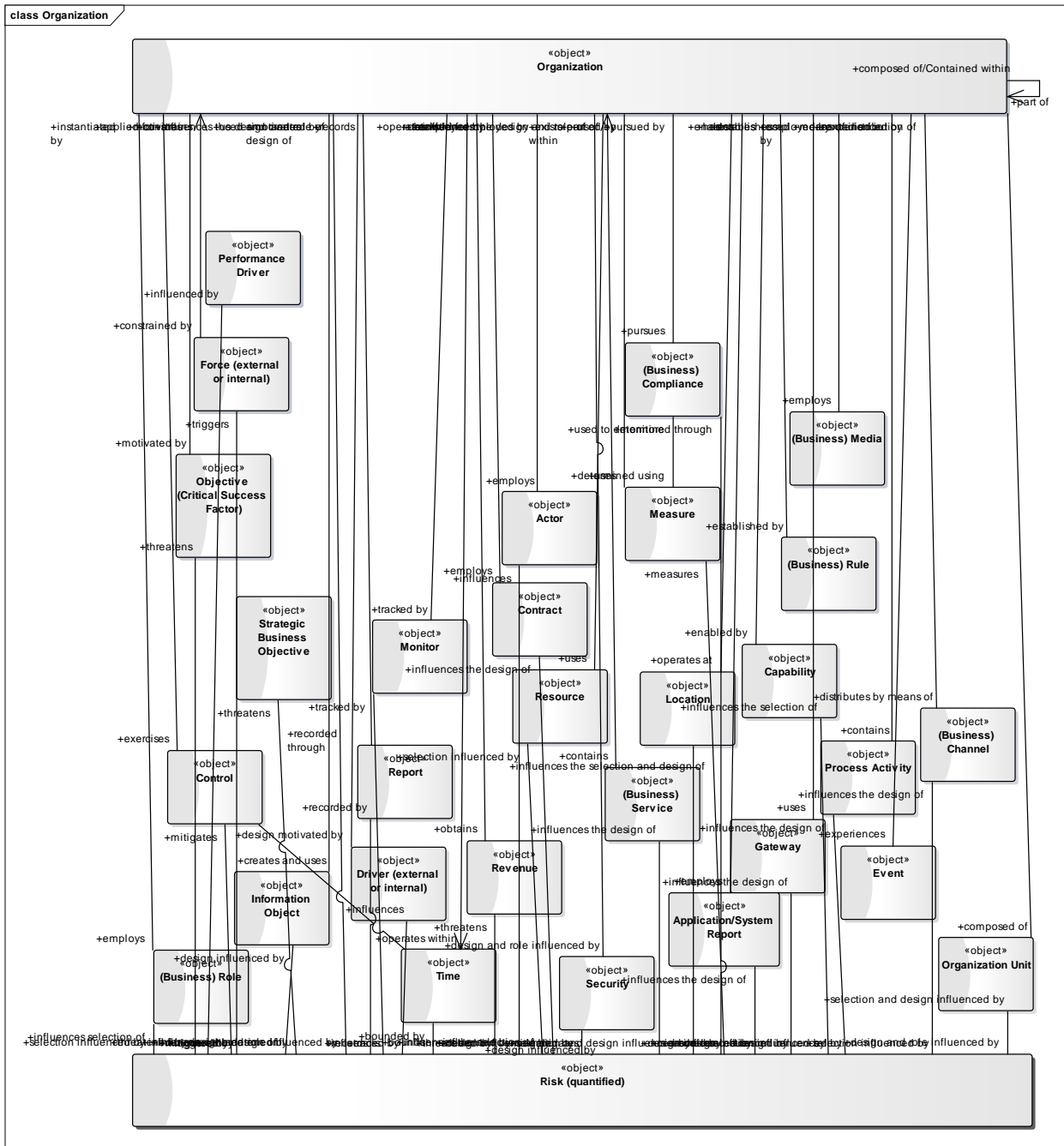


Figure 73 : Organization

ORGANIZATION

Description: An arrangement or formation of resources that has a set of collective goals.

Relationships

Relationship	Related Item Name
composed of	Organization Unit
Uses	Resource
Contains	(Business) Service
Contains	Process Activity
operates within	Time
design and role influenced by	Strategic Business Objective
design and role influenced by	Security
design and role influenced by	Risk (quantified)
design and role influenced by	Performance Driver
motivated by	Objective (Critical Success Factor)
constrained by	Force (external or internal)

Relationship	Related Item Name
design motivated by	Driver (external or internal)
tracked by	Monitor
uses	Gateway
pursues	(Business) Compliance
operates at	Location
enabled by	Capability
obtains	Revenue
employs	Contract
distributes by means of	(Business) Channel
exercises	Control
employs	(Business) Role
established by	(Business) Rule
experiences	Event
creates and uses	Information Object
employs	Actor

Relationship	Related Item Name
recorded through	Report
employs	(Business) Media
Employs	Application/System Report
Uses	Measure

ORGANIZATION UNIT

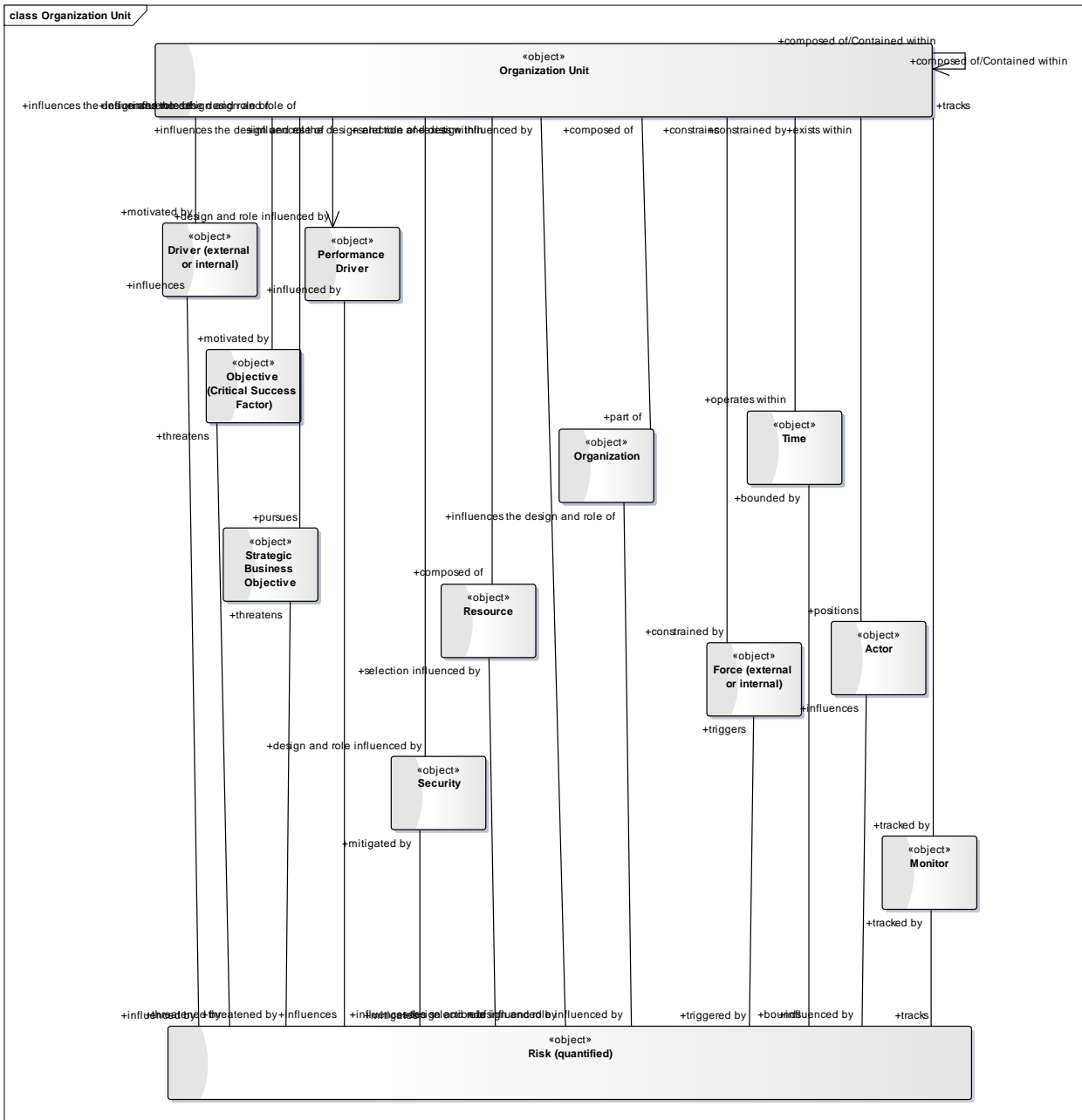


Figure 74 : Organization Unit

ORGANIZATION UNIT

Description: A self-contained unit of resources with strategic business objectives, critical success factors, goals, and measures.

Relationships

Relationship	Related Item Name
composed of	Resource
composed of/Contained within	Organization Unit
part of	Organization
positions	Actor
operates within	Time
pursues	Strategic Business Objective
design and role influenced by	Security
design and role influenced by	Risk (quantified)
design and role influenced by	Performance Driver
motivated by	Objective (Critical Success Factor)
constrained by	Force (external or internal)
motivated by	Driver (external or internal)
tracked by	Monitor

CAPABILITY

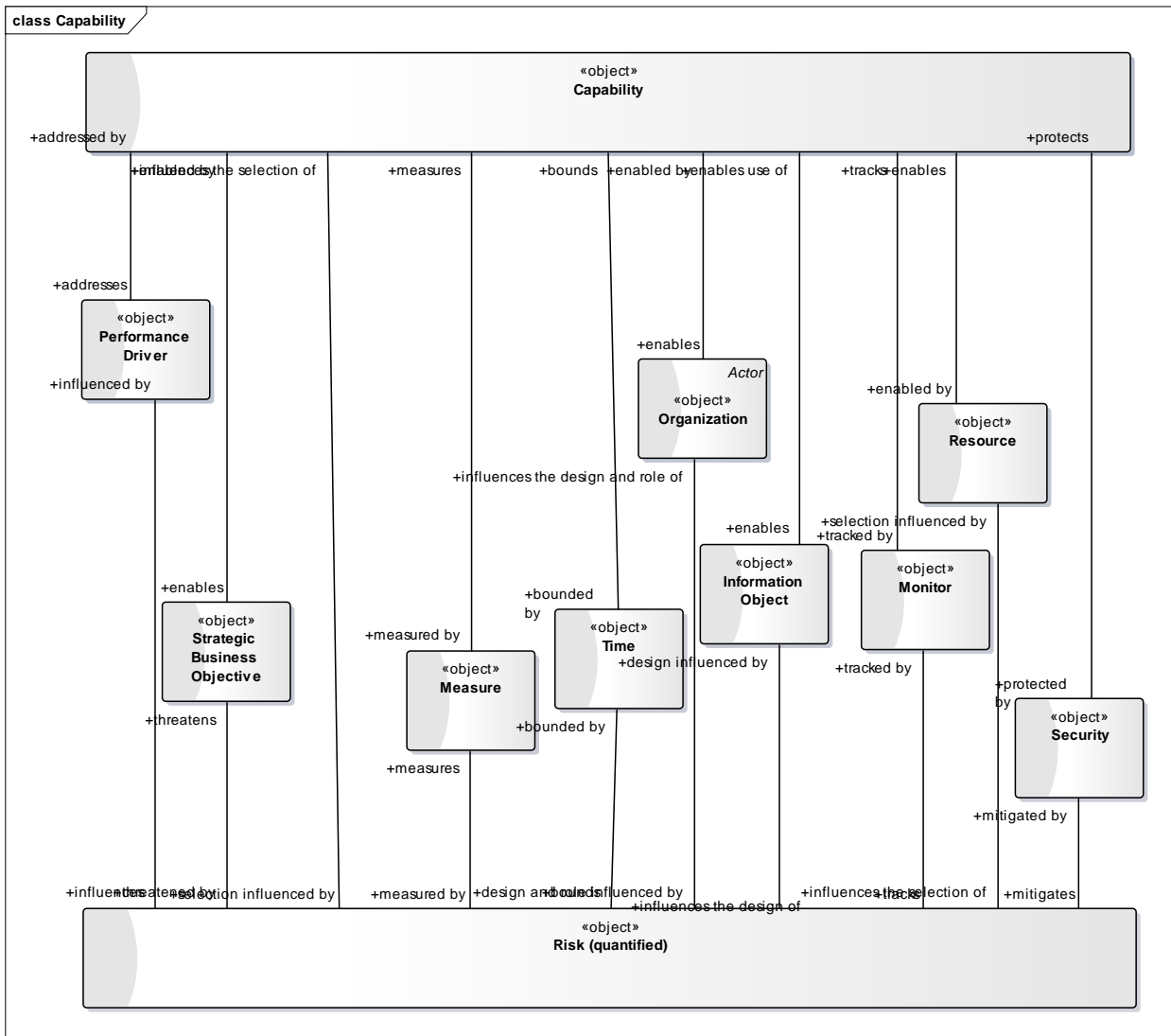


Figure 75 : Capability

CAPABILITY

Description: A capability is an abstraction that represents the ability to perform a particular skill set i.e. organizational competencies, personal competencies, business function, processes, services and technology.

Business capability is the potential for action to achieve a goal via an action/series of actions in a process resulting from the interaction of 2 or more resources, in a transformation that produces business value for a customer. (Michell, 2011)

Relationships

Relationship	Related Item Name
enables	Information Object
consumes	Process Activity
bounded by	Time
enables	Strategic Business Objective
protected by	Security
selection influenced by	Risk (quantified)
addresses	Performance Driver
measured by	Measure
tracked by	Monitor
enables	Organization

RESOURCE

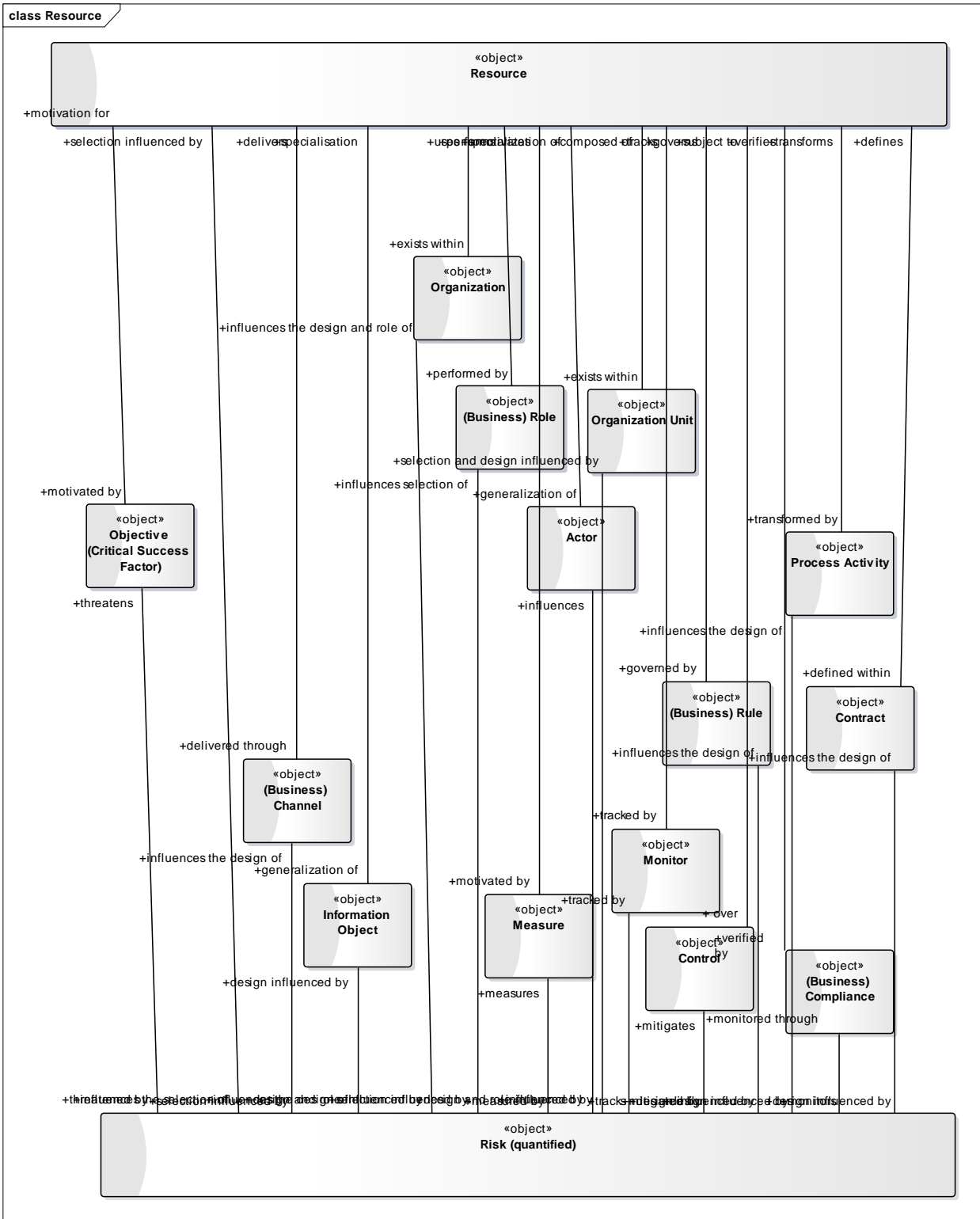


Figure 76 : Resource

RESOURCE

Description: Any person, organization, or system that may be assigned one or more roles. May be internal or external to an organization.

Relationships

Relationship	Related Item Name
transformed by	Process Activity
governed by	(Business) Rule
encapsulates/consumed by	(Business) Service
produces	Revenue
performed by	(Business) Role
exists within	Organization Unit
exists within	Organization
operates at	Location
defined within	Contract
verified by	(Business) Compliance
delivered through	(Business) Channel
generalization of	Actor
effected by	Time

Relationship	Related Item Name
provides purpose to	Strategic Business Objective
protects	Security
influences the selection of	Risk (quantified)
uses/produces	Report
realized through	Performance Driver
motivated by	Objective (Critical Success Factor)
motivated by	Measure
behaviour influenced by	Force (external or internal)
behaviour influenced by	Driver (external or internal)
tracked by	Monitor
over	Control
generalization of	Information Object

ACTOR

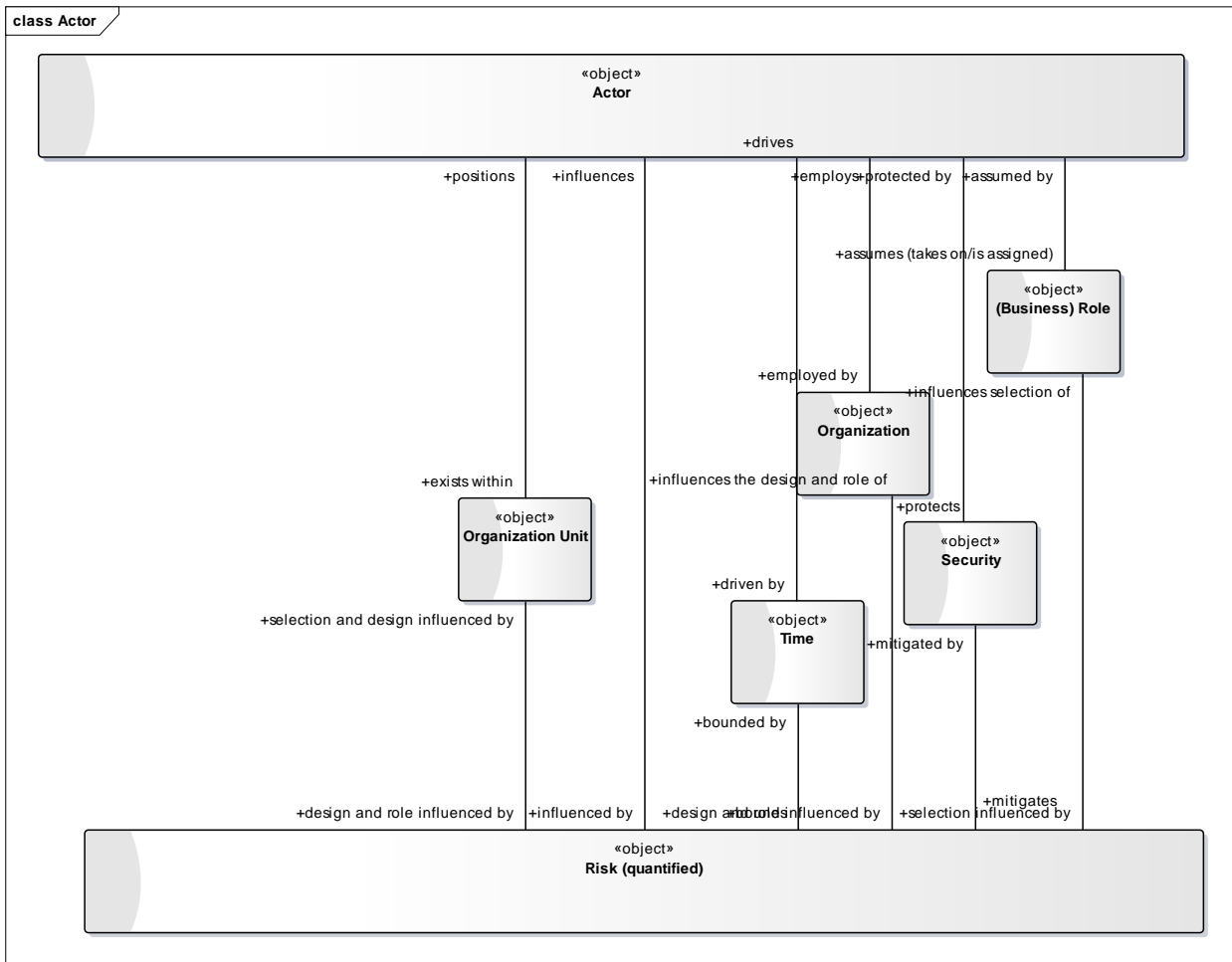


Figure 77 : Actor

ACTOR

Description: A person, organization, or system that has a role that initiates or interacts with activities. Actors may be internal or external to an organization.

Relationships

Relationship	Related Item Name
exists within	Organization Unit
assumes (takes on/is assigned)	(Business) Role

Relationship	Related Item Name
specialization of	Resource
driven by	Time
protects	Security
influenced by	Risk (quantified)
employed by	Organization

(BUSINESS) ROLE

Description: A part that something or someone has the rights, rules, competencies, and capabilities to perform. A resource and/ or actor may have a number of roles i.e. process role, service role or application role and many actors may be assigned the same role.

Relationships

Relationship	Related Item Name
performs	Process Activity
served by	(Business) Service
performs	Resource
assumed by	Actor
driven by	Time
behaviour influenced by	Strategic Business Objective
protected by	Security
selection influenced by	Risk (quantified)
behaviour influenced by	Report
behaviour influenced by	Performance Driver
influences behaviour of	Objective (Critical Success Factor)
behaviour influenced by	Measure

Relationship	Related Item Name
behaviour influenced by	Force (external or internal)
behaviour influenced by	Driver (external or internal)
performs	Gateway
tracked by	Monitor
instantiated by	Organization

REVENUE

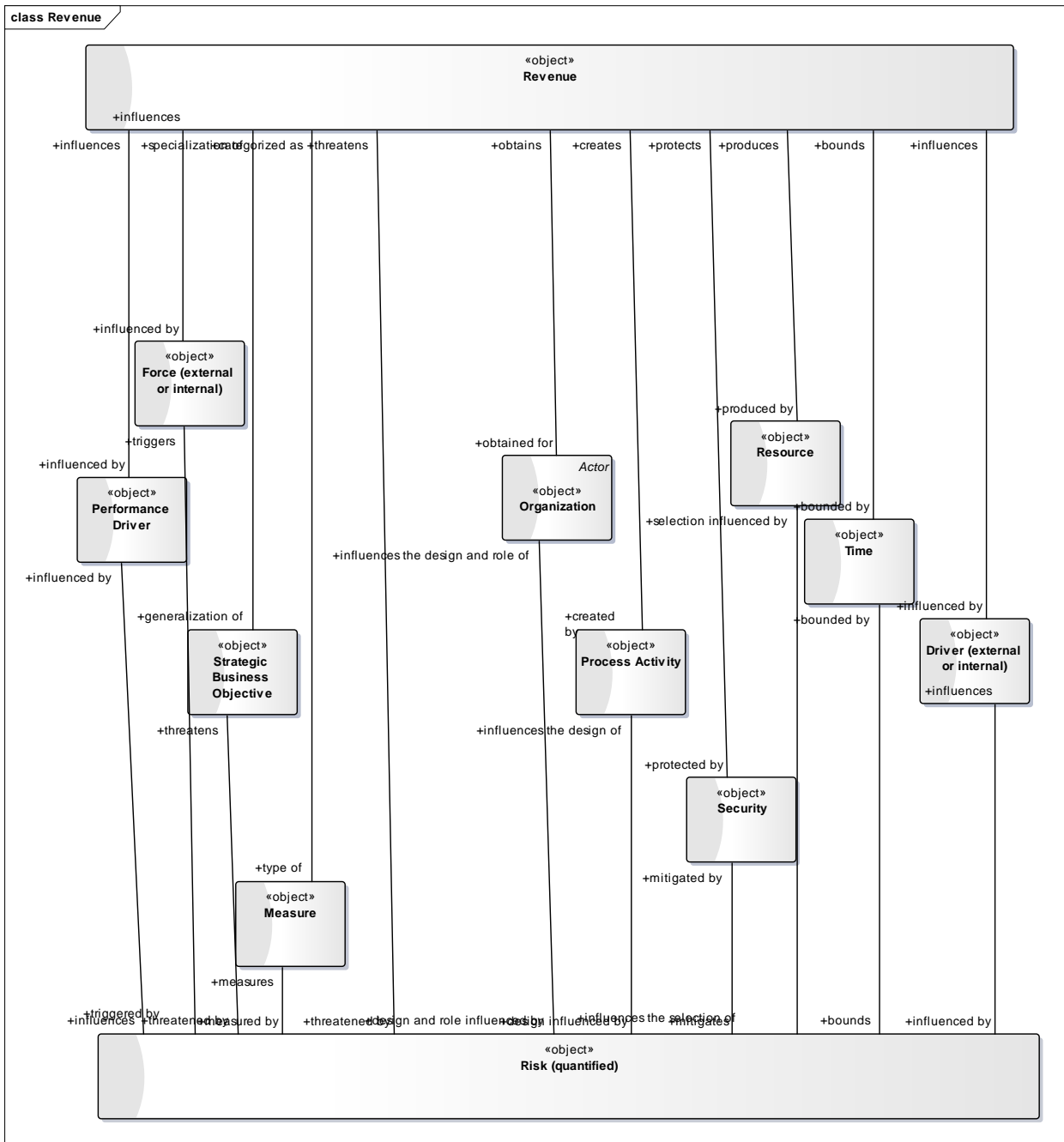


Figure 79 : Revenue

REVENUE

Description: The realized monetary or financial income of an enterprise or part thereof.

Relationships

Relationship	Related Item Name
produces	(Business) Service
created by	Process Activity
produced by	Resource
bounded by	Time
generalization of	Strategic Business Objective
protected by	Security
threatened by	Risk (quantified)
records	Report
influenced by	Performance Driver
type of	Measure
influenced by	Force (external or internal)
influenced by	Driver (external or internal)
obtained for	Organization

CONTRACT

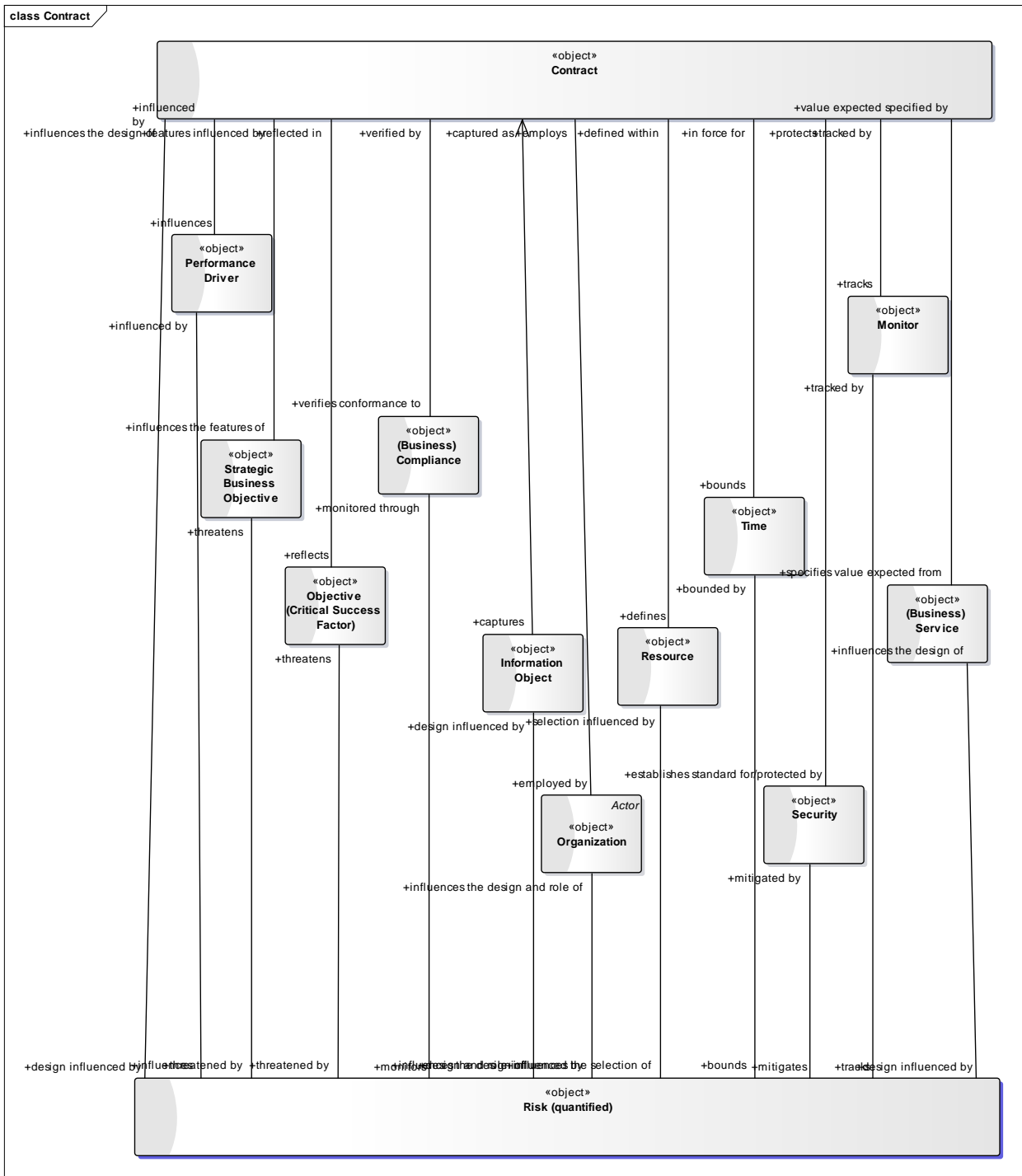


Figure 80 : Contract

CONTRACT

Description: An agreement between two or more parties that establishes conditions for interaction.

Relationships

Relationship	Related Item Name
specifies value expected from	(Business) Service
captures	Information Object
defines	Resource
bounds	Time
influences the features of	Strategic Business Objective
establishes standard for/protected by	Security
design influenced by	Risk (quantified)
influences	Performance Driver
reflects	Objective (Critical Success Factor)
verifies conformance to	(Business) Compliance
tracks	Monitor

Relationship	Related Item Name
employed by	Organization

(BUSINESS) RULE

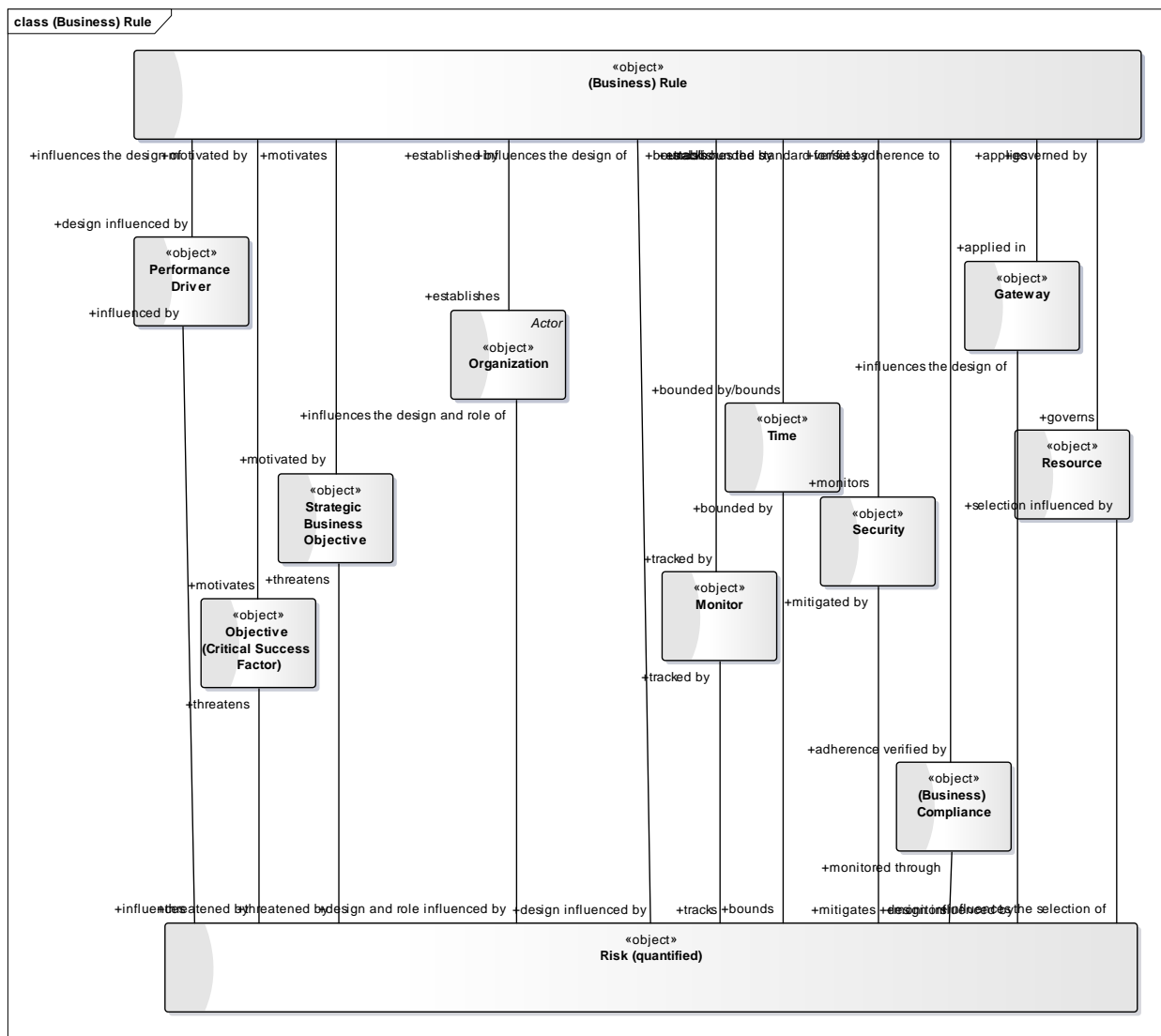


Figure 81 : (Business) Rule

(BUSINESS) RULE

Description: A statement that defines or constrains some aspect of behaviour within the enterprise and always resolves to either true or false.

Relationships

Relationship	Related Item Name
governs	Resource
bounded by/bounds	Time
motivated by	Strategic Business Objective
monitors	Security
design influenced by	Risk (quantified)
design influenced by	Performance Driver
motivates	Objective (Critical Success Factor)
adherence verified by	(Business) Compliance
applied in	Gateway
tracked by	Monitor
establishes	Organization

CONTROL

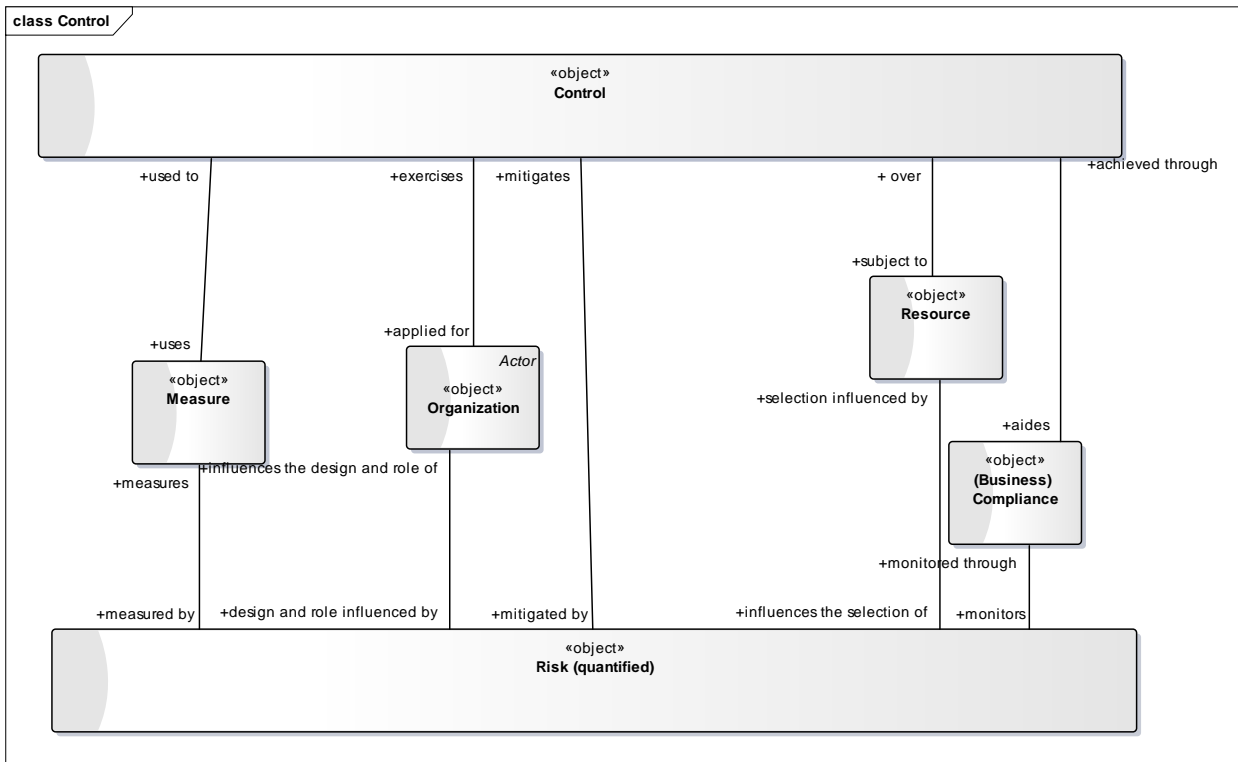


Figure 82 : Control

CONTROL

Description: To exercise restraint or direction, to hold in check as well as bro test or verify. It includes decision-making aspects with accompanying decision logic to ensure compliance.

Relationships

Relationship	Related Item Name
Aides	(Business) Compliance
exerted over	Gateway
subject to	Resource

Relationship	Related Item Name
applied for	Organization
mitigated by	Risk (quantified)
uses	Measure

(BUSINESS) COMPLIANCE

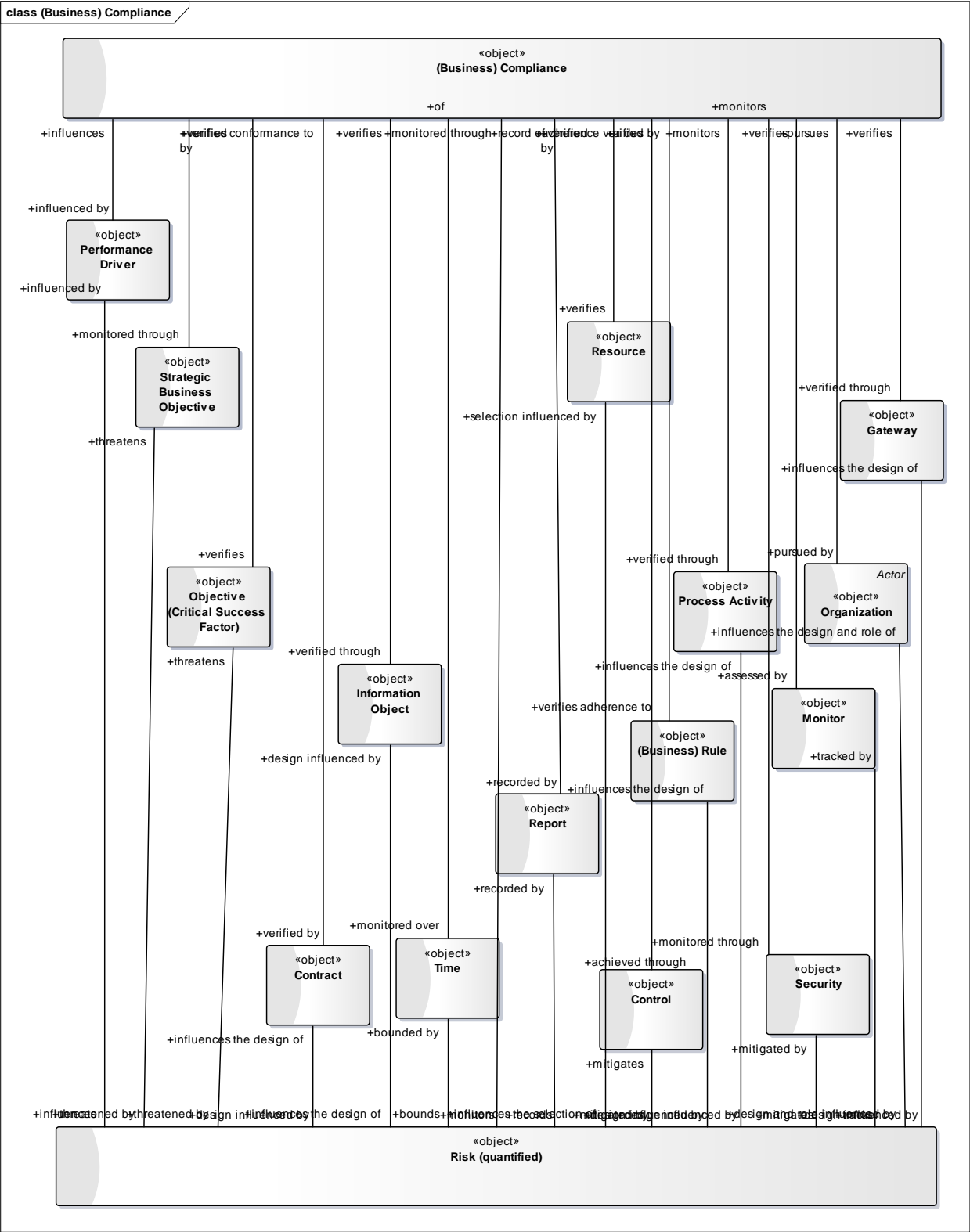


Figure 83 : (Business) Compliance

(BUSINESS) COMPLIANCE

Description: The process or tools for verifying adherence to rules and decisions within the business in order to determine whether something is a suitable, adequate, and effective way of achieving established objectives.

Relationships

Relationship	Related Item Name
Verifies	Application/System Report
Verifies	Resource
verified through	Process Activity
verified through	Information Object
monitored through	(Business) Service
monitored over	Time
monitored through	Strategic Business Objective
monitored through	Security
Monitors	Risk (quantified)
Verifies	Objective (Critical Success Factor)
assessed by	Monitor

Relationship	Related Item Name
verified by	Contract
achieved through	Control
recorded by	Report
verifies adherence to	(Business) Rule
verified through	Gateway
influenced by	Performance Driver
pursued by	Organization
determined using	Measure

LOCATION

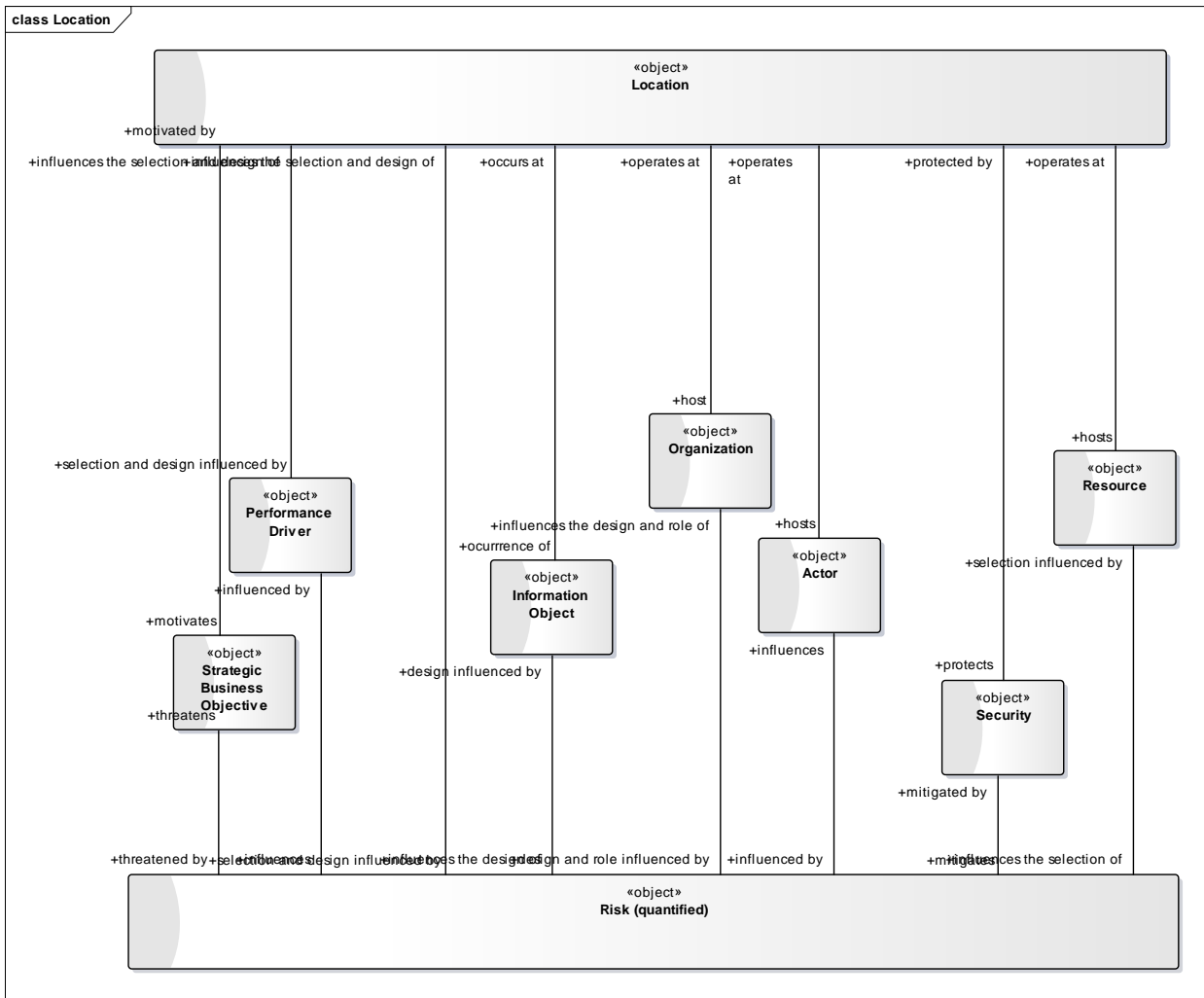


Figure 84 : Location

LOCATION

Description: A point, facility, place, or geographic position that may be referred to physically or logically.

Relationships

Relationship	Related Item Name
hosts	Resource

Relationship	Related Item Name
occurrence of	Information Object
hosts	Actor
motivates	Strategic Business Objective
protects	Security
selection and design influenced by	Risk (quantified)
selection and design influenced by	Performance Driver
host	Organization
choice affected by	Time

(BUSINESS) CHANNEL

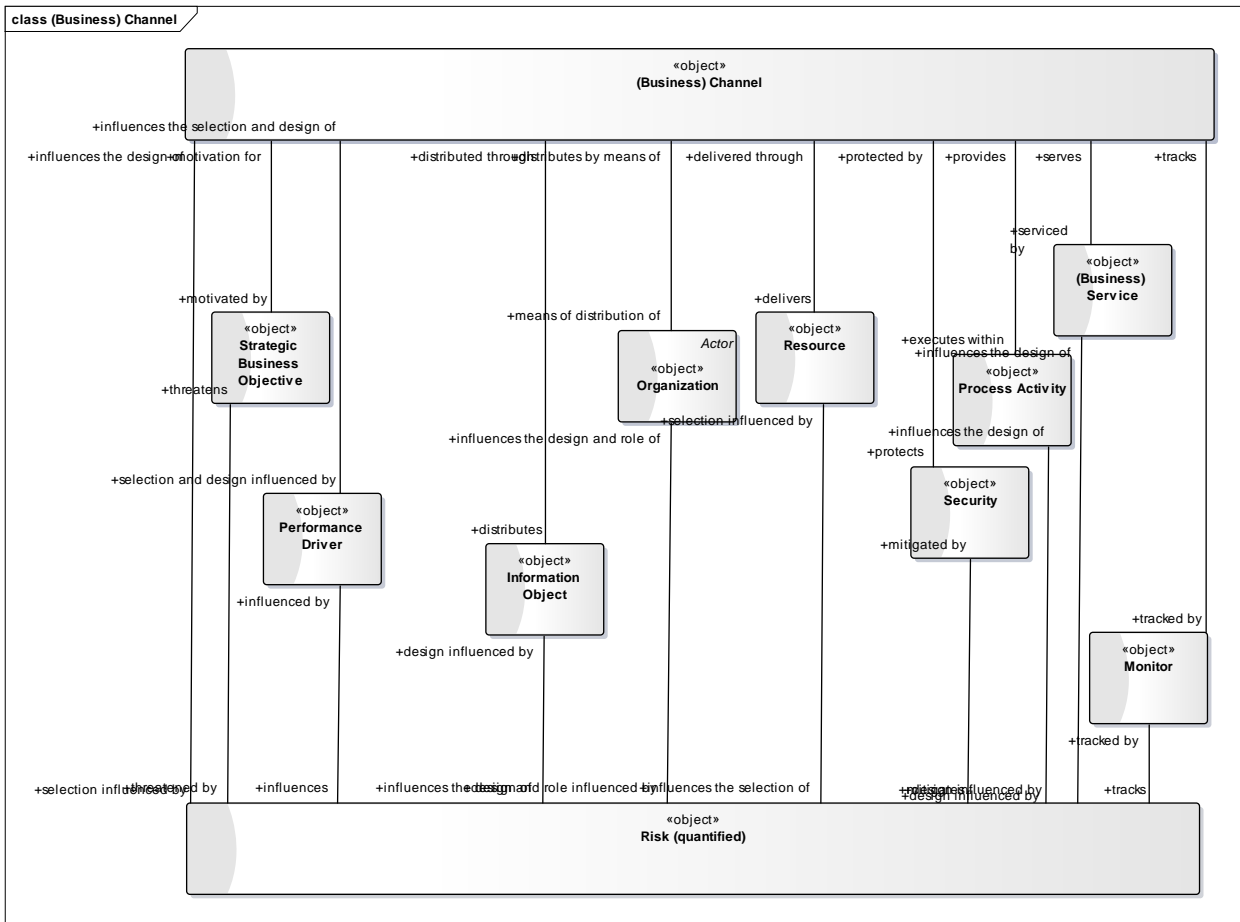


Figure 85 : (Business) Channel

(BUSINESS) CHANNEL

Description: A means of access or otherwise interacting within an enterprise or between an enterprise and its external partners (customers, vendors, suppliers, etc.).

Relationships

Relationship	Related Item Name
serviced by	(Business) Service
executes within	Process Activity

Relationship	Related Item Name
delivers	Resource
distributes	Information Object
driven by	Time
motivated by	Strategic Business Objective
protects	Security
selection influenced by	Risk (quantified)
selection and design influenced by	Performance Driver
tracked by	Monitor

(BUSINESS) MEDIA

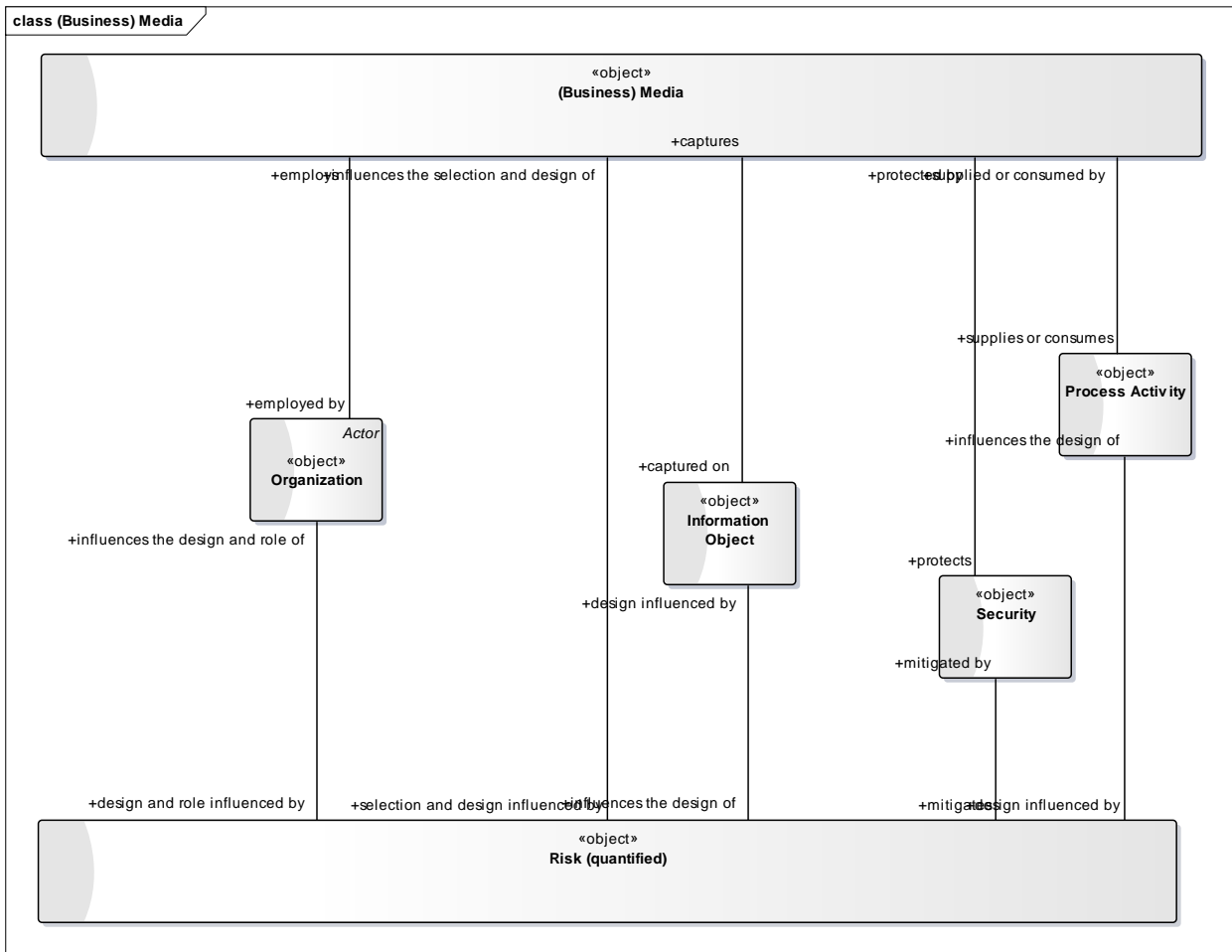


Figure 86 : (Business) Media

(BUSINESS) MEDIA

Description: The material or matter used to store information (. printed page, digital tape, CD, disk as well as non-volatile storage, screen, or memory).

Relationships

Relationship	Related Item Name
supplies or consumes	Process Activity
captured on	Information Object

Relationship	Related Item Name
protects	Security
selection and design influenced by	Risk (quantified)
employed by	Organization

(BUSINESS) SERVICE

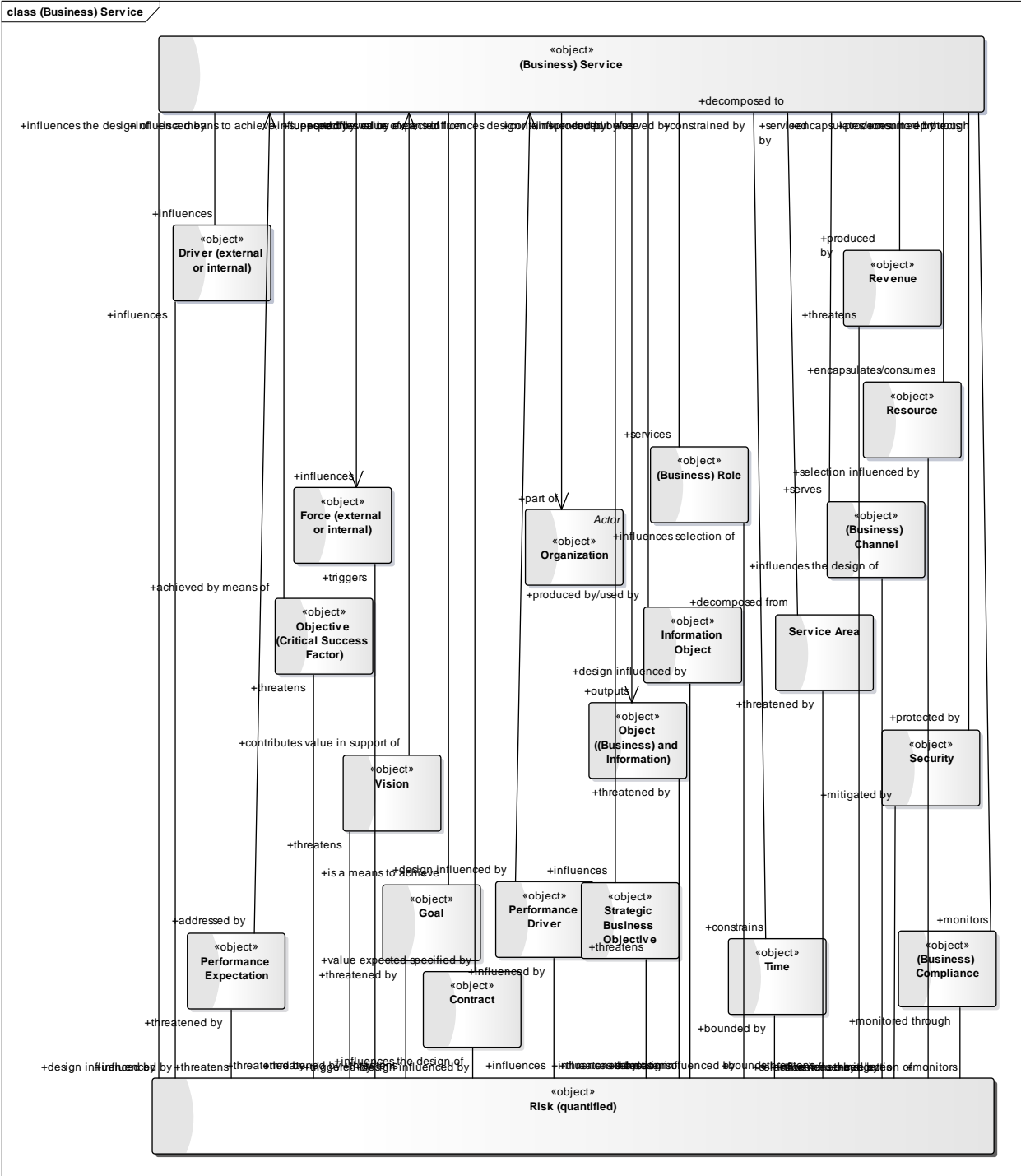


Figure 87 : (Business) Service

(BUSINESS) SERVICE

Description: The externally visible [logical] deed or effort performed to satisfy a need or to fulfil a demand that is meaningful to the [business] environment.

Relationships

Relationship	Related Item Name	DGTVR_RiskM3 Meta-Meta Model
outputs	Object ((Business) and Information)	True
produced by/used by	Information Object	True
services	(Business) Role	True
decomposed from	Service Area	True
produced by	Revenue	True
encapsulates/consumes	Resource	True
part of	Organization	True
value expected specified by	Contract	True
monitors	(Business) Compliance	True
serves	(Business) Channel	True
contributes value in	Vision	True

Relationship	Related Item Name	DGTVR_RiskM3 Meta-Meta Model
support of		
constrains	Time	True
influences	Strategic Business Objective	True
protected by	Security	True
design influenced by	Risk (quantified)	True
addresses	Performance Expectation	True
achieved by means of	Objective (Critical Success Factor)	True
influences	Force (external or internal)	True
influences	Driver (external or internal)	True

Business Process Group

Contains the business objects necessary to execute work and create value

PROCESS ACTIVITY

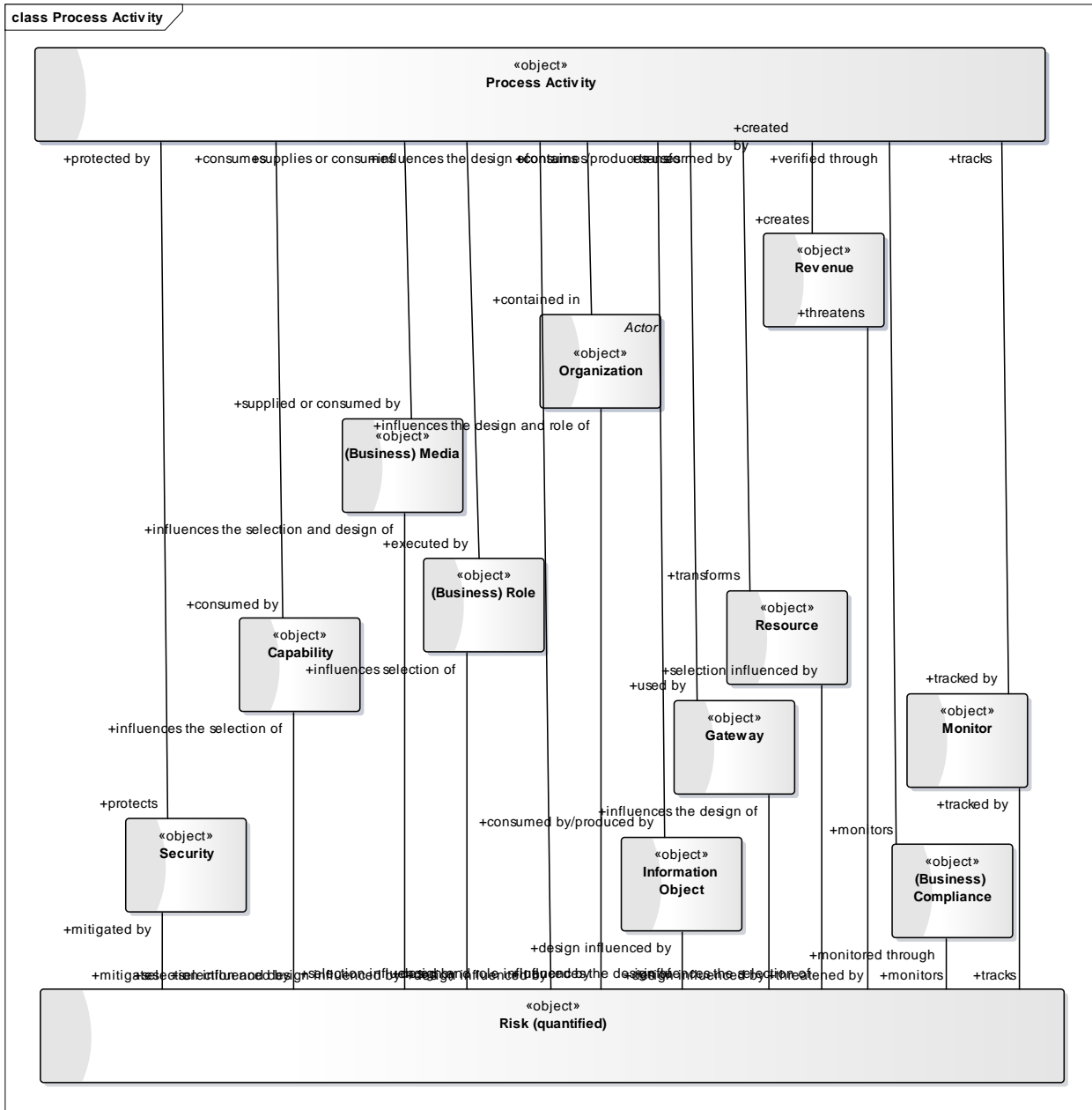


Figure 88 : Process Activity

PROCESS ACTIVITY

Description: A part of the actual physical work system which specifies how to complete the change in the form or state of an input, oversee or even achieve the completion of an interaction with other actors which results in the making of a decision based on knowledge, judgement, experience, and instinct.

Relationships

Relationship	Related Item Name
executed by	(Business) Role
consumed by/produced by	Information Object
used by	Gateway
creates	Revenue
transforms	Resource
contained in	Organization
consumed by	Capability
monitors	(Business) Compliance
supplied or consumed by	(Business) Media
provides	(Business) Channel
protects	Security
design influenced by	Risk (quantified)
tracked by	Monitor
measured by	Measure

EVENT

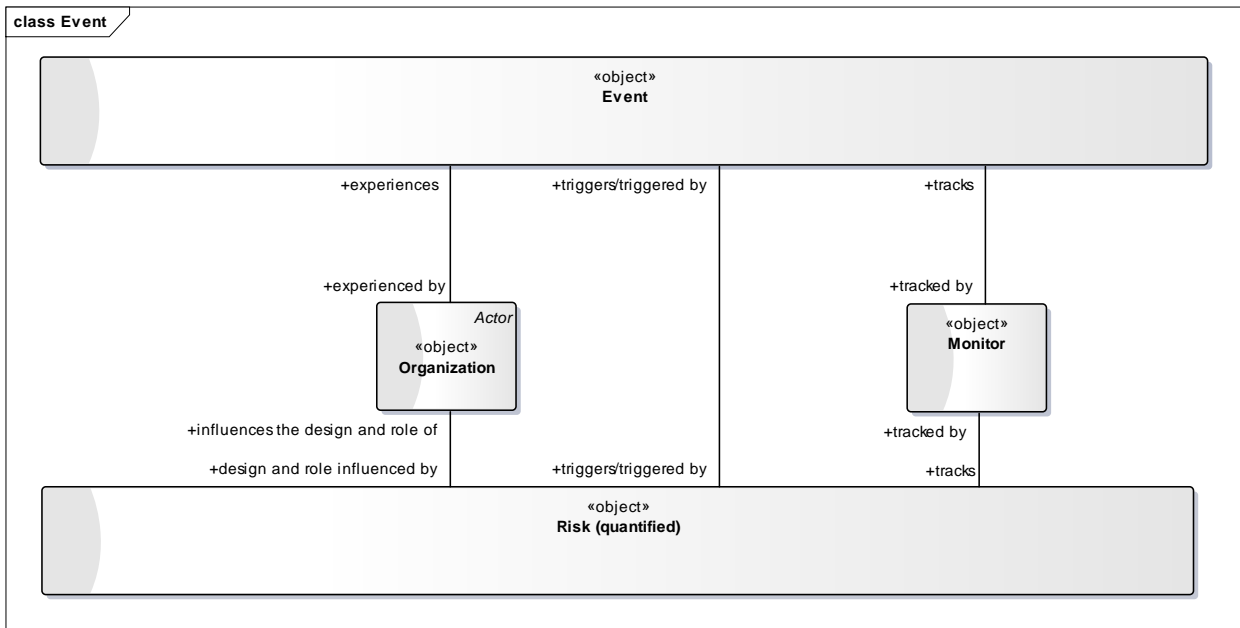


Figure 89 : Event

EVENT

Description: A state change that recognizes the triggering or termination of processing.

Relationships

Relationship	Related Item Name	DGTVR_RiskM3 Meta-Meta Model
Protects	Security	True
tracked by	Monitor	True
triggers/triggered by	Risk (quantified)	True
experienced by	Organization	True

GATEWAY

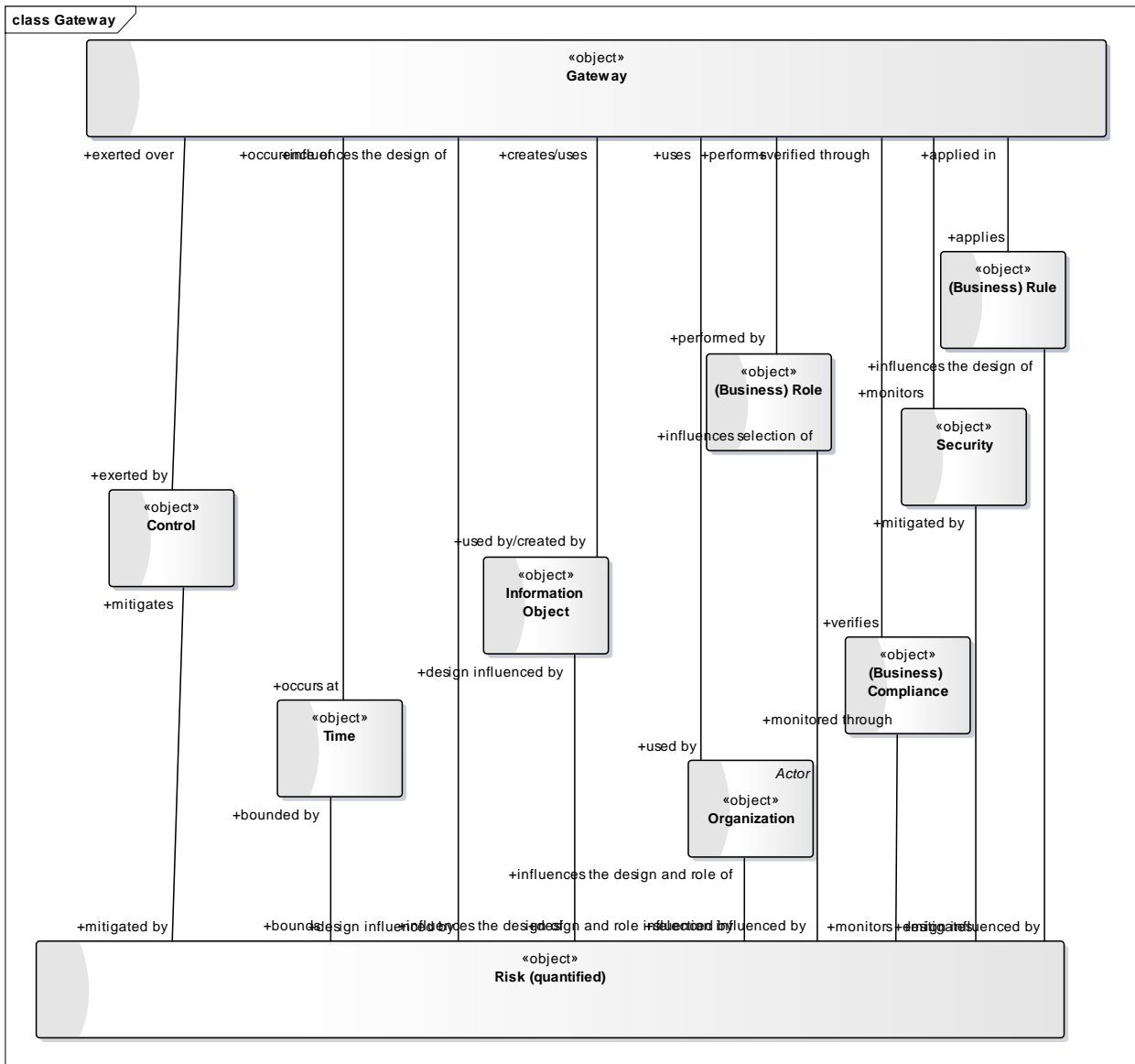


Figure 90 : Gateway

GATEWAY

Description: Determines forking and merging of paths, depending on the conditions expressed.

Relationships

Relationship	Related Item Name
--------------	-------------------

Relationship	Related Item Name
uses	Process Activity
design influenced by	Risk (quantified)
Applies	(Business) Rule
performed by	(Business) Role
exerted by	Control
occurrence of	Time
used by/created by	Information Object
Verifies	(Business) Compliance
used by	Organization
design influenced by	Security

Application Layer

Contains the objects used to describe the structure and behaviour of major software systems and how these objects interact with one other both within the layer and across the enterprise

Information System Group

Contains the business objects necessary to describe the structure and behaviour of software that enables work

APPLICATION SYSTEM REPORT

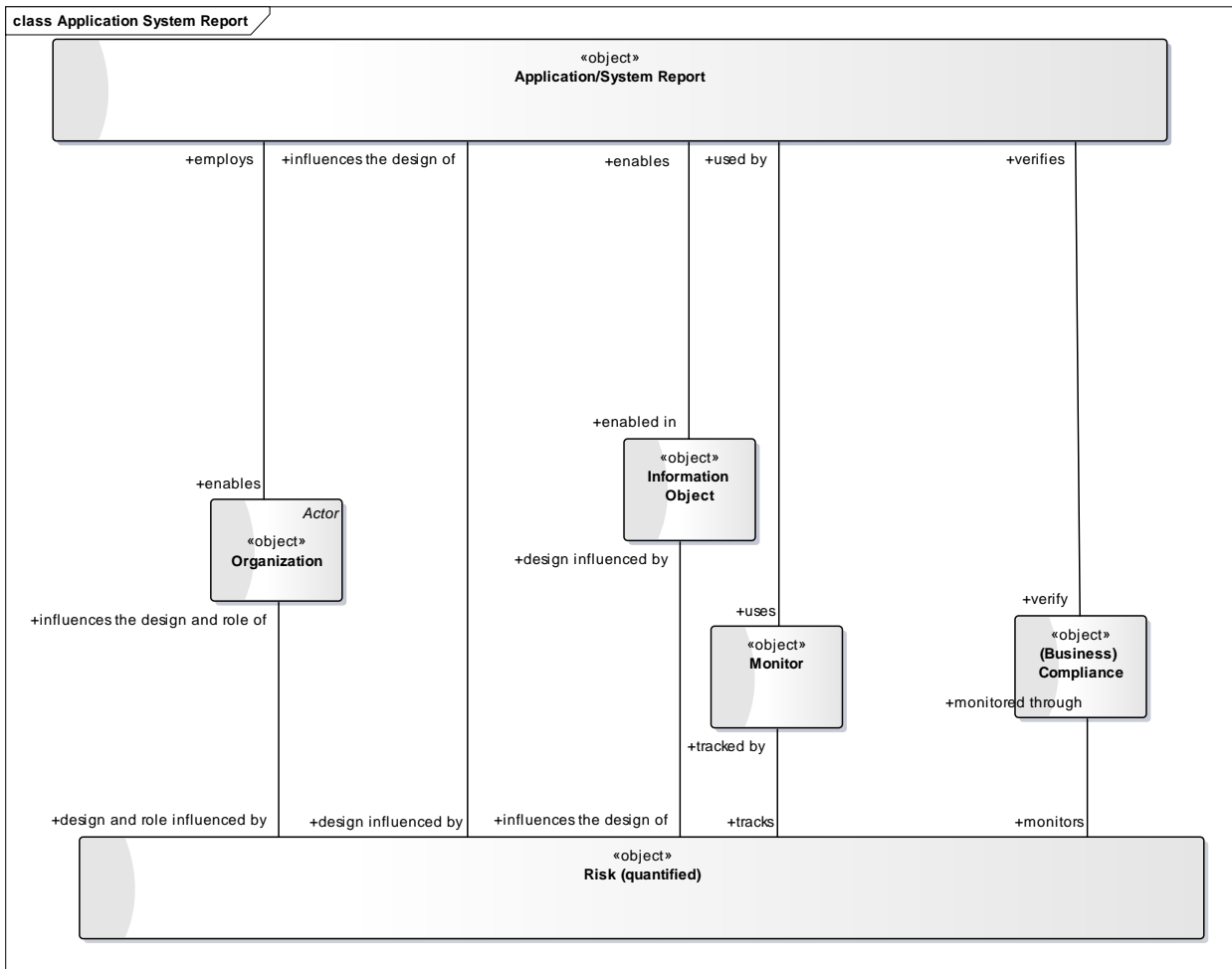


Figure 91 : Application/System Report

APPLICATION/SYSTEM REPORT

Description: Reports that are defined and implement able or implemented within or by an application.

RELATIONSHIPS

Relationship	Related Item Name
enabled in	Information Object
verify	(Business) Compliance

bounded by	Time
protects	Security
design influenced by	Risk (quantified)
uses	Monitor
enables	Organization

INFORMATION OBJECT

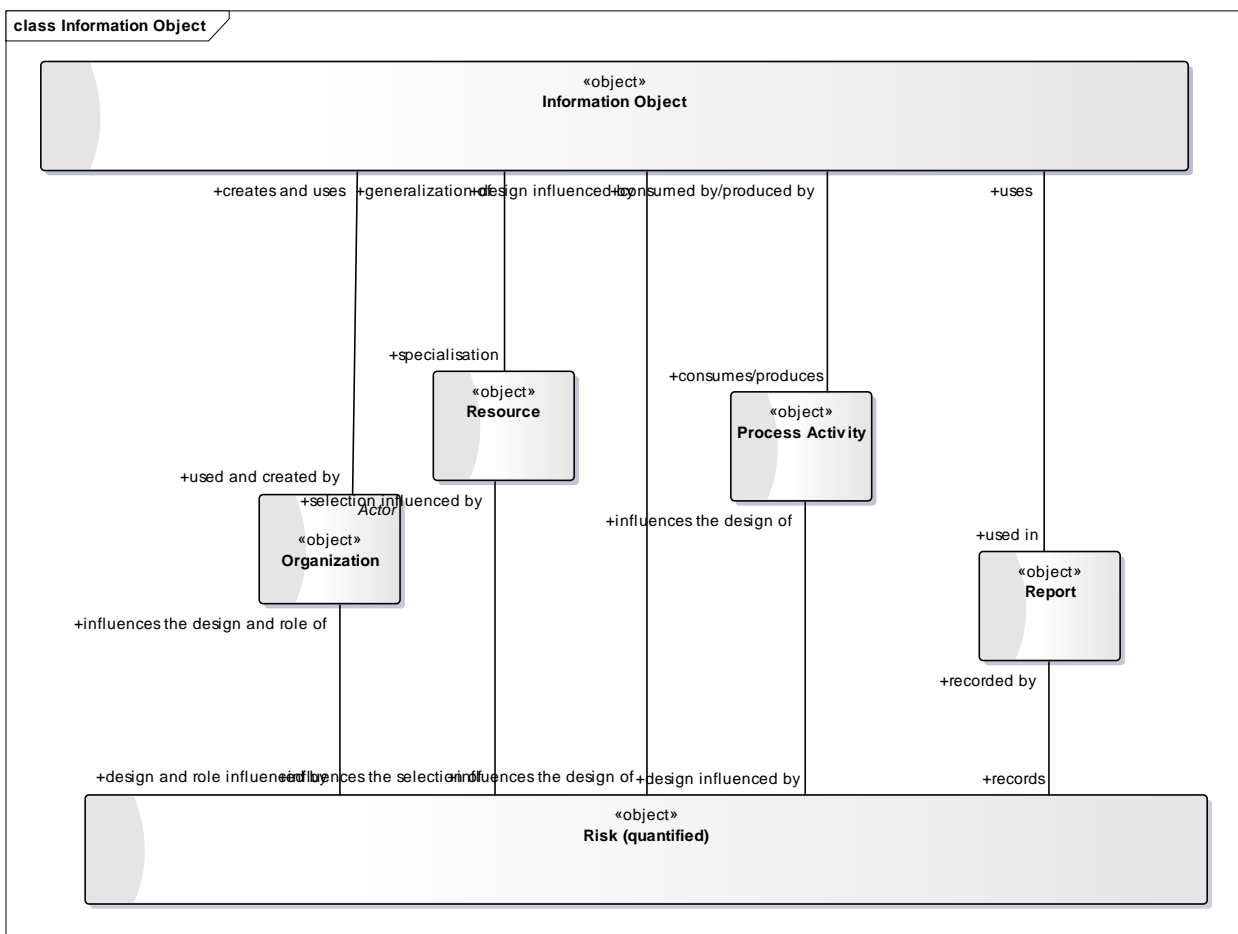


Figure 92 : Information Object

INFORMATION OBJECT

Description: Information about real world objects that can be in any medium or form.

RELATIONSHIPS

Relationship	Related Item Name
Enables	Application/System Report
consumes/produces	Process Activity
produced by/use	(Business) Service
occurs at	Location
enables use of	Capability
captured as	Contract
verifies	(Business) Compliance
captures	(Business) Media
distributed through	(Business) Channel
used in	Report
creates/uses	Gateway
specialisation	Resource
used and created by	Organization

Relationship	Related Item Name
influences the design of	Risk (quantified)

Chapter 9 Conclusions:

While this document should be seen and used as a detailed description of what the Risk Ontology is, this paper attempts to build a researched and proven taxonomy around threat and risk aspects, this includes the identification and description of the most common meta objects used within threat and risk concepts, the stereotypes and subtypes. In addition, we detailed how semantic concepts were used to capture and define the most common structure and relationships. We shared our main research questions, findings and how risk management, enterprise modelling, engineering and architecture concepts were applied to identify the most common risk concepts and risk models within organizations. We shared how we applied the LEADIng Practice decomposition and composition standard to identify where the risk objects and the specific relations appear in various models. While the focus of this paper does not allow for the description of how risk engineering, modelling, and architecture attached and related to the risk ontology, we did however point out that such integrated risk concepts across multiple domains, is seen as a huge benefit, especially since the risk concepts can then be applied back to various modelling standards such as process modelling, value modelling, rule modelling as well as enterprise architecture concepts (from business architecture, application architecture to technology architecture). It is also in the risk model that the objects involved with the threat aspects i.e. the 'possible risk' and those with the 'actual risk' are specified. After the risk meta models were presented, with clear defined hierarchic relationships that allow of a polymorphic inheritance of properties in the meta models we outlined and described the meta meta model.

While every story and every book has an ending, so does this, but we truly hope that with this work we have created a start of something that benefits your organization and you. With all of our heart we wish your luck in your journey of managing threat and risk.

Appendix 1

Risk Ontology Key Research Team

The Global University Alliance currently consists of over 450 universities, lecturers and researchers from across the world. The aim it is to provide a collaborative platform for academic research, analysis and development and to explore de-facto standards in terms of researching leading practices and best practices as well as to develop missing aspects/concepts. To manage the size of a complex research topic like Risk and better network across universities, lecturers and researchers, we have defined research responsibilities in key areas. It is the aim that the key research responsible provides the international platform where universities and thought leaders can interact to conduct research in the key aspect of the overall research. The Risk research and analysis started in 2004 and additional focus areas of identifying the risk objects, develop meta object where added in 2009. With the practical testing within organizations in 2011,2012 and 2013, the meta models ontology was updated in 2014. The following Risk Ontology was put together and peer reviewed by the following persons:

Risk Ontology Key Global University Alliance Research members

- **Risk Ontology research responsible:** Professor Mark von Rosing, Global University Alliance, Chairman-Board of Directors
- **Ontology research responsible:** Professor Wim Laurier, Saint-Louis University Brussels & Ghent University, Belgium
- **Semantic research responsible:** Professor Simon Polovina, Sheffield Hallam University, UK
- **Enterprise Architecture research responsible:** John A. Zachman, Inventor and Father of Enterprise Architecture, Zachman International
- **Business Process research responsible:** Professor August W. Scheer, Inventor and Father of Business Process Management, Scheer Group
- **Information Systems research responsible:** Professor Hans Scheruhn, Harz University, Germany
- **Role Oriented Modelling research responsible:** Professor Maxim Arzumanyan, St. Petersburg University, Russia
- **Enterprise Agile research responsible:** Professor Asif Gill, University of Technology, Sydney, Australia
- **Business Model research responsible:** Maria Hove, Global University Alliance, Researcher & Business Analyst

- **Enterprise Sustainability research responsible:** Prof. David Coloma Guerrero, Universitat Politècnica de Catalunya, Spain
- **System of Systems Dynamics research responsible:** Adam D.M. Svendsen, PhD, Copenhagen Institute for Futures Studies (CIFS)
- **Value Model research responsible:** Joshua von Scheel, Global University Alliance, Researcher & Value Analyst
- **System Engineering research responsible:** Jonnro Erasmus, Enterprise Engineer at the Council for Scientific and Industrial Research (CSIR)
- **Product Engineering research responsible:** Jonnro Erasmus, Enterprise Engineer at the Council for Scientific and Industrial Research (CSIR)
- **Measurement & Reporting research responsible:** Ulrik Foldager, Global University Alliance, Researcher & Business Innovation & Transformation Analyst
- **Social Media research responsible:** Prof. Zakaria Maamar, Zayed University, United Arab Emirates
- **Social Machine research responsible:** Prof. Vanilson Buregio, Federal University of Pernambuco, Recife, Brazil
- **Insurance Industry research responsible:** Prof. Michael Koller, Universitätsklinikum Regensburg, Germany, Prudential, UK
- **ERP & Analytics research responsible:** Prof. Karin Gräslund, RheinMain University-Wiesbaden Business School, Germany
- **Insurance Industry research responsible:** Prof. Michael Koller, Universitätsklinikum Regensburg, Germany
- **Meta Model responsible:** Neil Kemp, LEADIng Practice

Standard organizations

- **Enterprise Standard organization: LEADIng Practice:** Henrik von Scheel, CEO
- **ISO- International Organization for Standardization:** Rich Hilliard
International Organization for Standardization, Project editor, ISO/IEC/IEEE 42010
Institute of Electrical and Electronics Engineers – Editor of IEEE Std 1471:2000
- **Information Security Forum :** Steve Durbin, CEO
- **Council for Scientific and Industrial Research:** Rentia Barnard, Enterprise Architect
Director
- **OMG - Software Standard Organization:** Fred Cummins, OMG, BMI, Chairman

The following Key People from Government organizations where involved:

- **European Patent Office, Rod Peacock, Enterprise Architect**
- **NATO Coordinator:** Krzysztof Skurzak, NATO Architecture & Design
- **NASA:** Fatima Senghore
- **Boarder Service Agency Coordinator:** Ian Dumanski Canada Boarder Service Agency, Risk Architect & Business Architect, Travellers Portfolio
- **Danish Defense:** Jens Theodor Nielsen, Joint Chief Planning
- **French Ministry of Defense, NATO, ISO:** Régis Dumond
- **US DoD:** Ronald N. Batdorf, Joint Staff, Enterprise Engineer Lead
- **MITRE:** Fatma Dandashi, Development Lead
- **Government of Australia:** John M. Rogers
- **German Federal Employment Agency:** Klaus Vitt, Senior Director General
- **Northern Health:** Bonnie Urquhart, Operations Performance Director
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