

Endringsdyktige og troverdige systemer

- Modellering av avhengigheter for å evaluere systemkvalitet

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Aida Omerovic
SINTEF IKT/UiO

Outline

- Motivation
- PREDIQT method
- Practical application of the method

Background

- System change is inevitable, due to:
 - Maintenance, system evolution
 - Organisational change
 - New collaboration patterns, functionalities, users, regulations, standards, technologies...
- Dynamics of systems/components in collaboration with varying QoS

Objectives

- Trustworthy architecture **over time, inspite of adaptions.**
- Preserve both adaptability and trustworthiness.
- Reduce the time and risk of enabling and deploying more/additional types of collaborations.

Approach

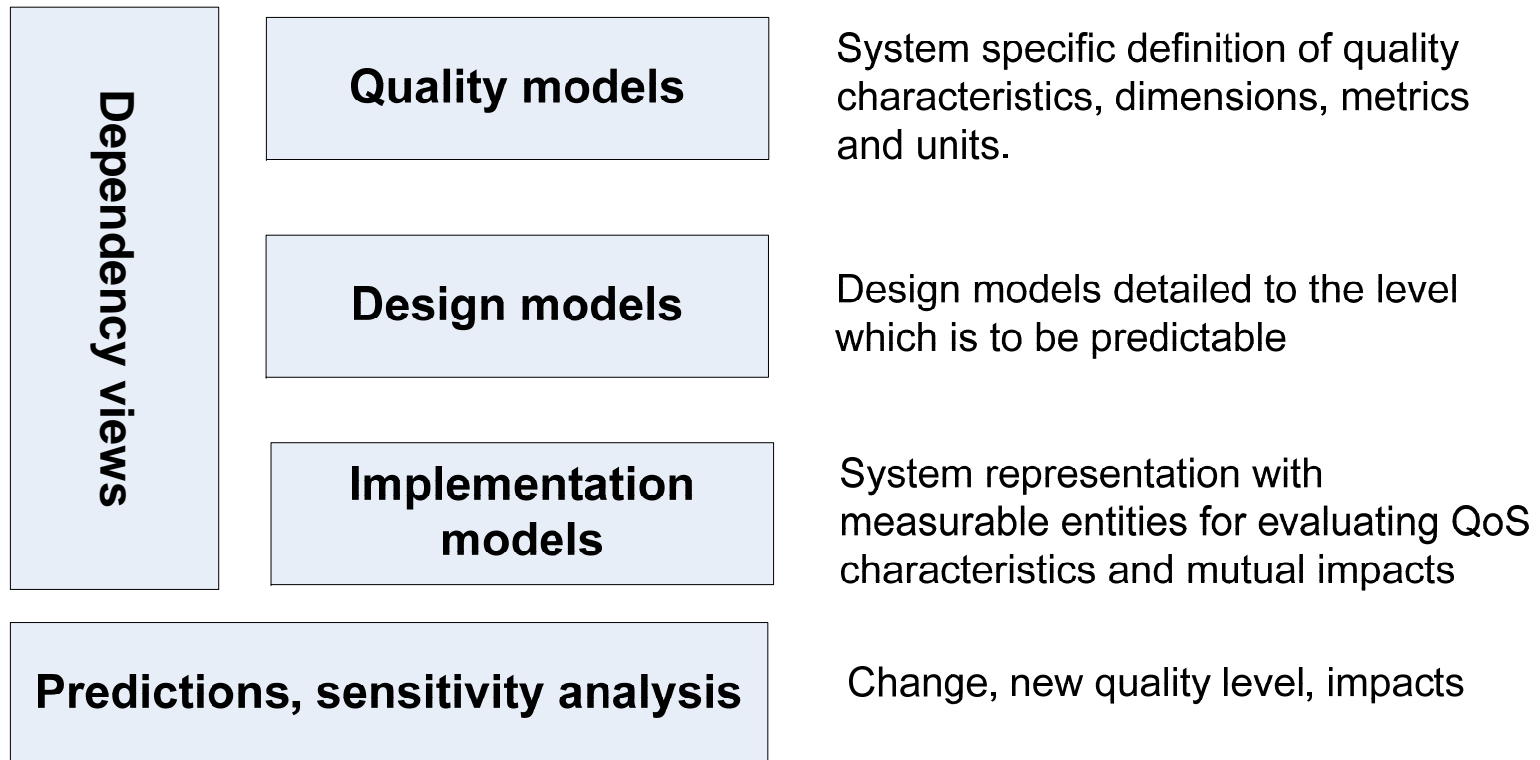
- Only technical, objective and quantifiable aspects
- Modeling and simulation
- Predicting architectural change impacts on relevant quality characteristics

PREDIQT:

“Model Based Prediction of Change Impacts on Architecture Quality”

- Enables prediction of architectural change-impacts on the quality characteristics.
 - Prior to change deployment
 - Preventative or adaptive, rather than a corrective approach
- Based on
 - Quality models
 - Design models
 - Dependency views

Method overview: the output levels



Applying the method

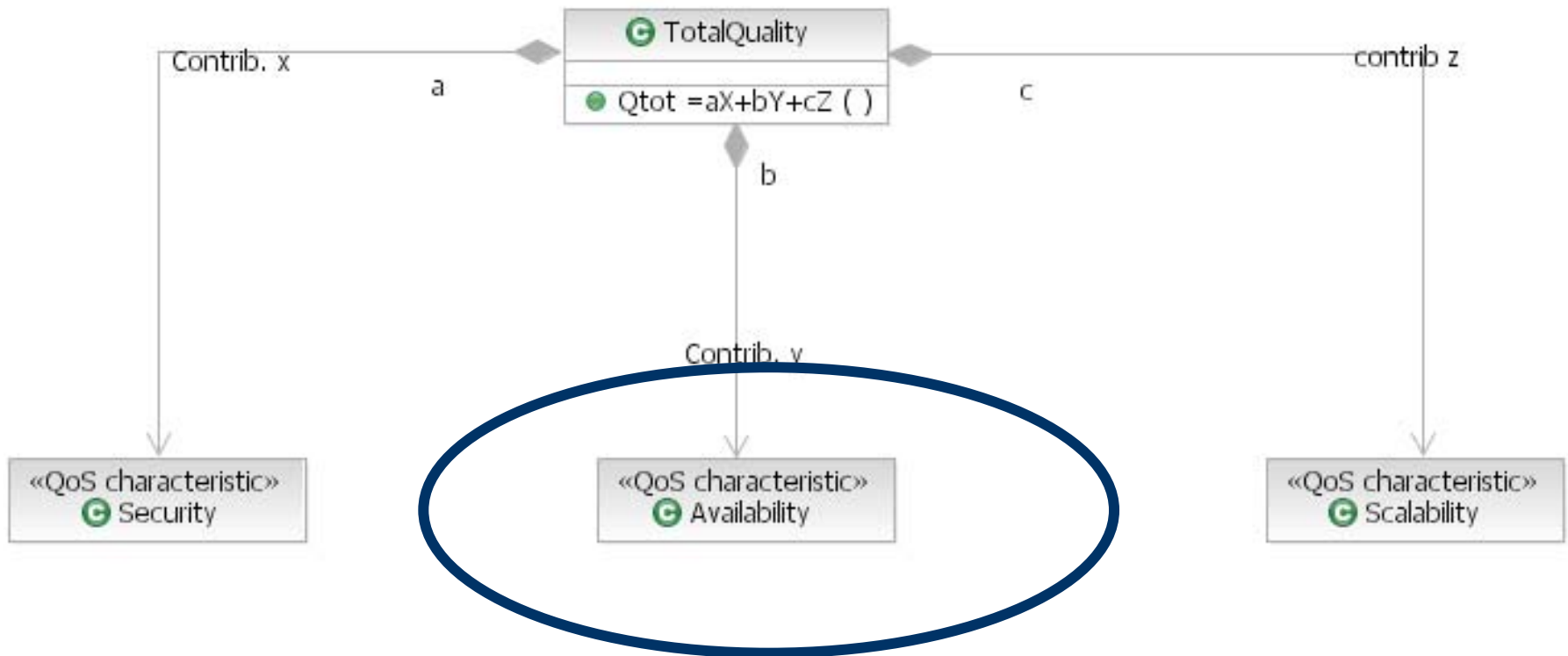
A case study addressing
quality prediction of “Validation Authority service” (DNV)

Fall 2008

Extracts from VAS specific quality models

Conceptual VA quality model - overall

Quality: "The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs" [ISO 8402]

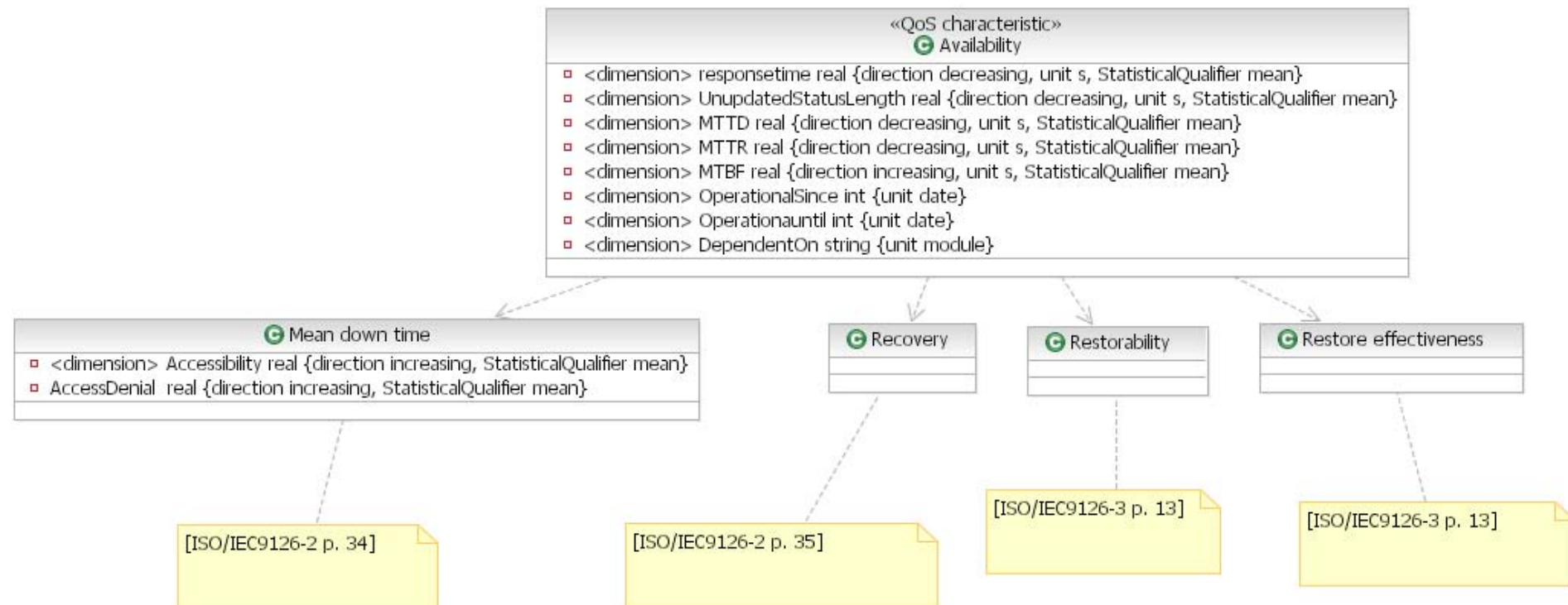


Conceptual VA quality model - availability

Def.: “the capability of the software product to be in a state to perform a required function at a given point in time, under stated conditions of use.” [ISO/IEC 9126-1]”

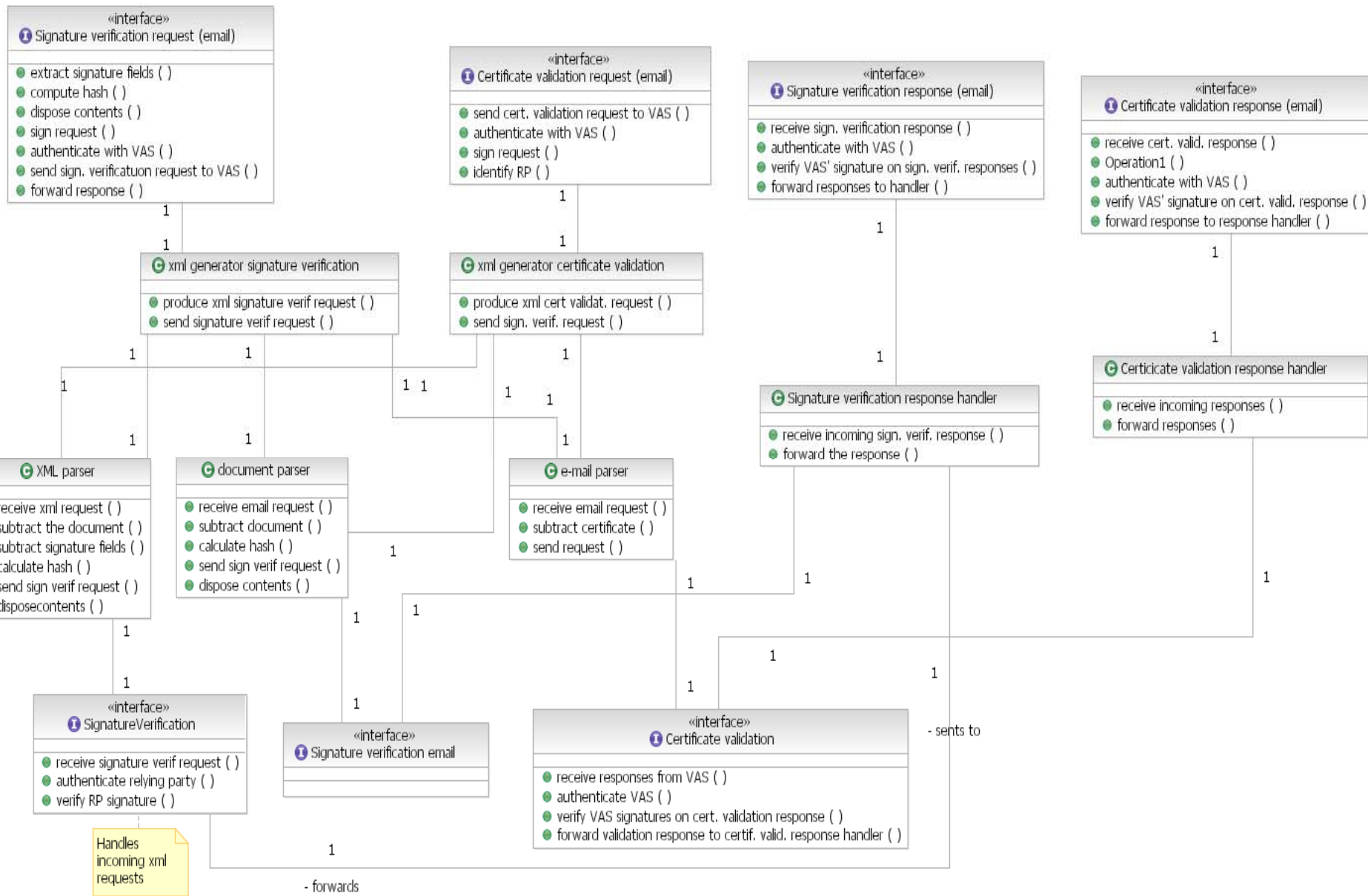
Rating: Availability
$$\frac{\text{uptime}}{\text{uptime} + \text{downtime}}$$

Have to take into account overall availability, as well as service continuity.
Downtime: incorrect operation time, downtime (planned or unplanned) etc.



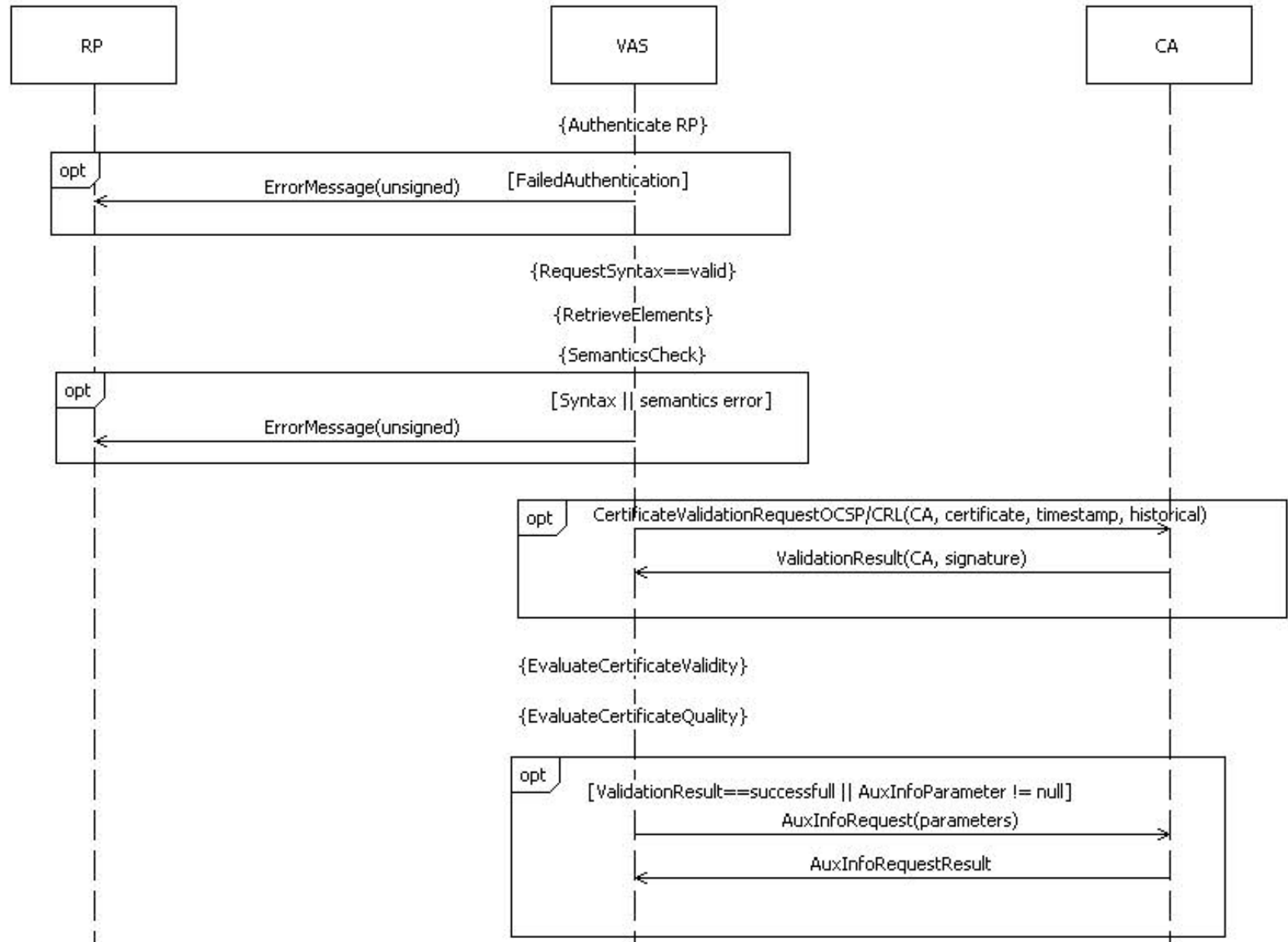
Extracts from **design models** of Validation Authority Service

VA interfaces



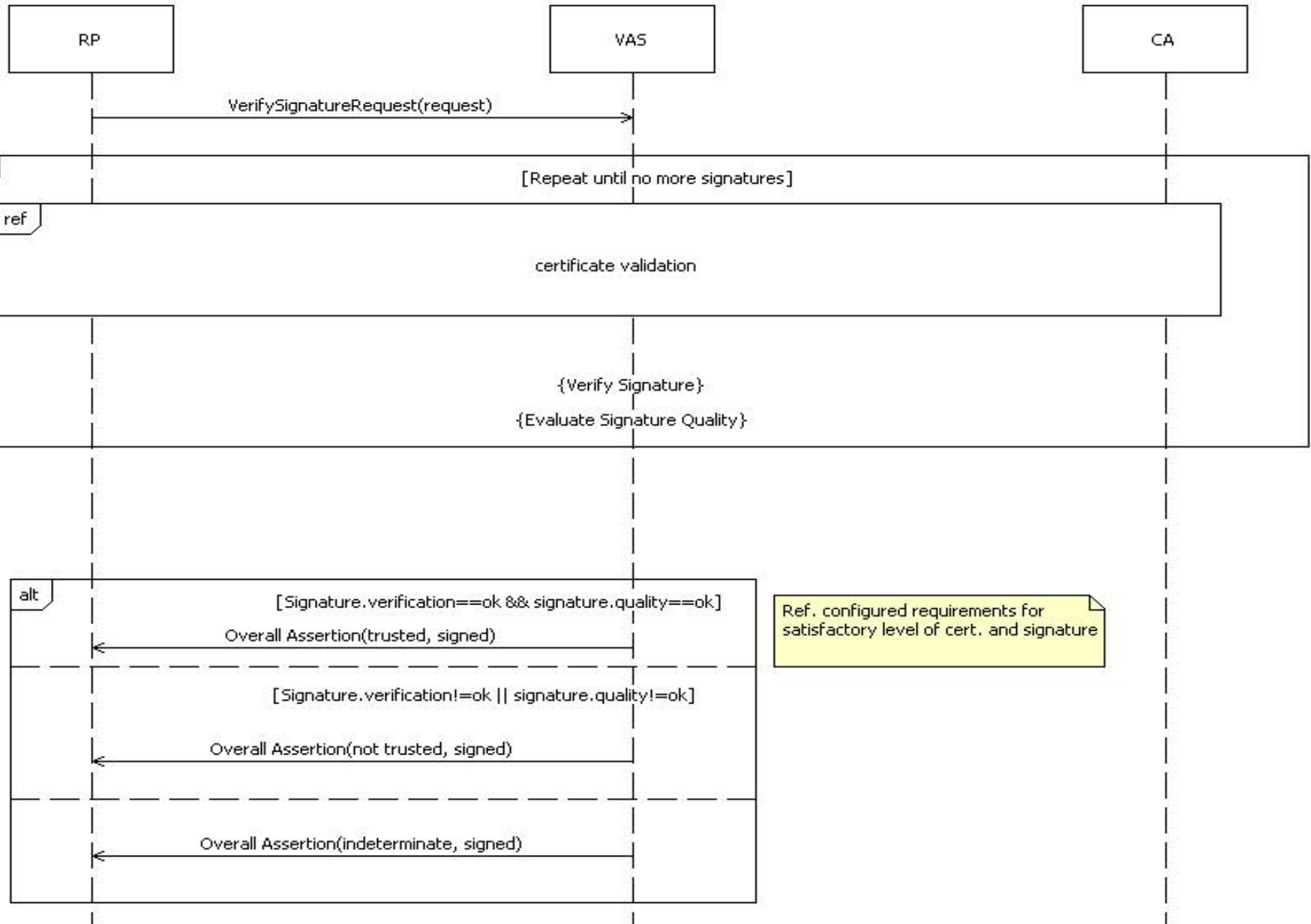
Certificate validation

sd CertificateValidation

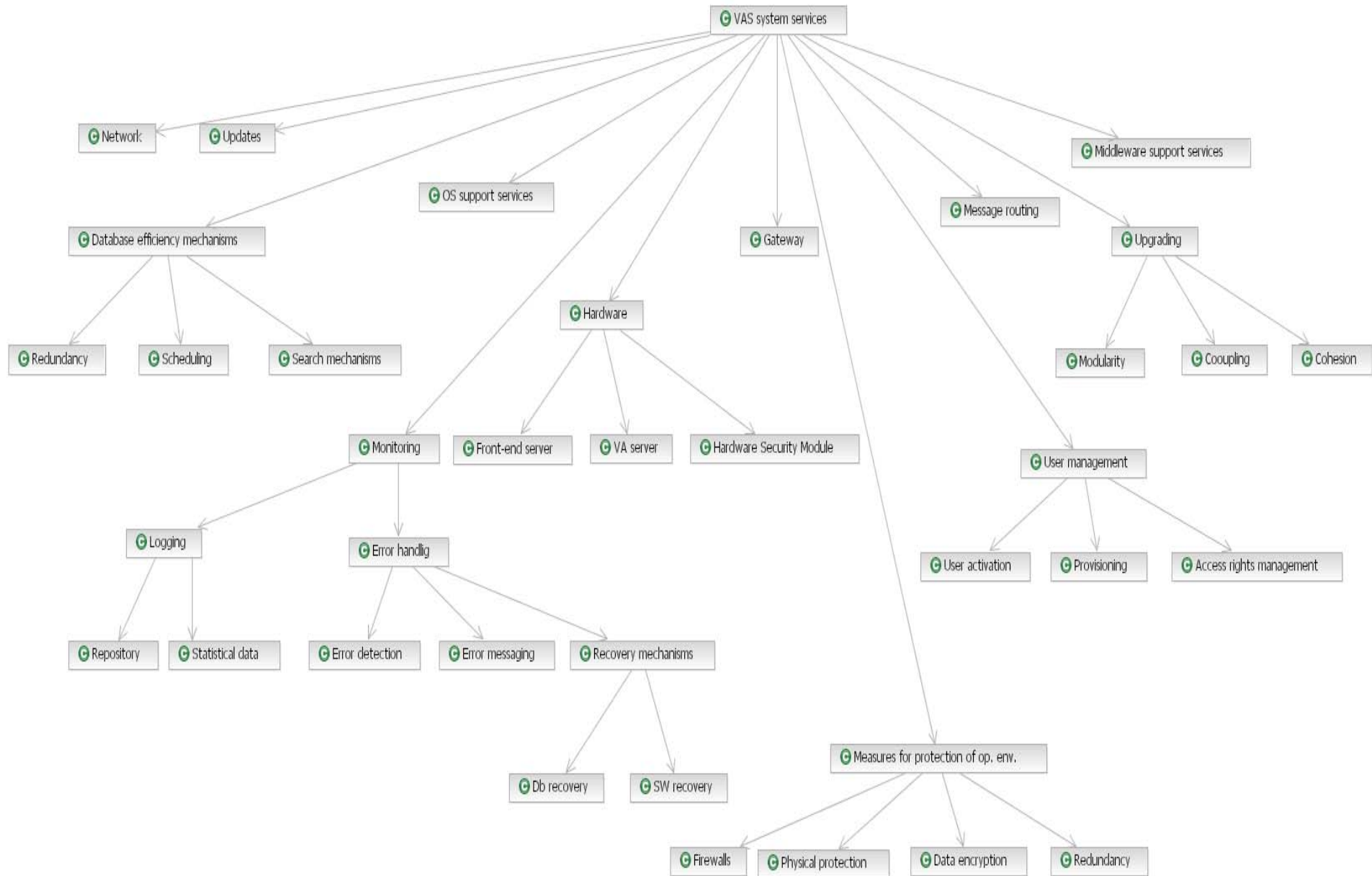


Signature verification

sd Signature verification



A general dependency view



Dependency views

- Based on quality and design models we derive attribute specific dependency views.
- Decomposition is carried on until estimates can be assigned with acceptable certainty.
- Nodes on the views: modules, subsystems, services and aspects.

Simulations

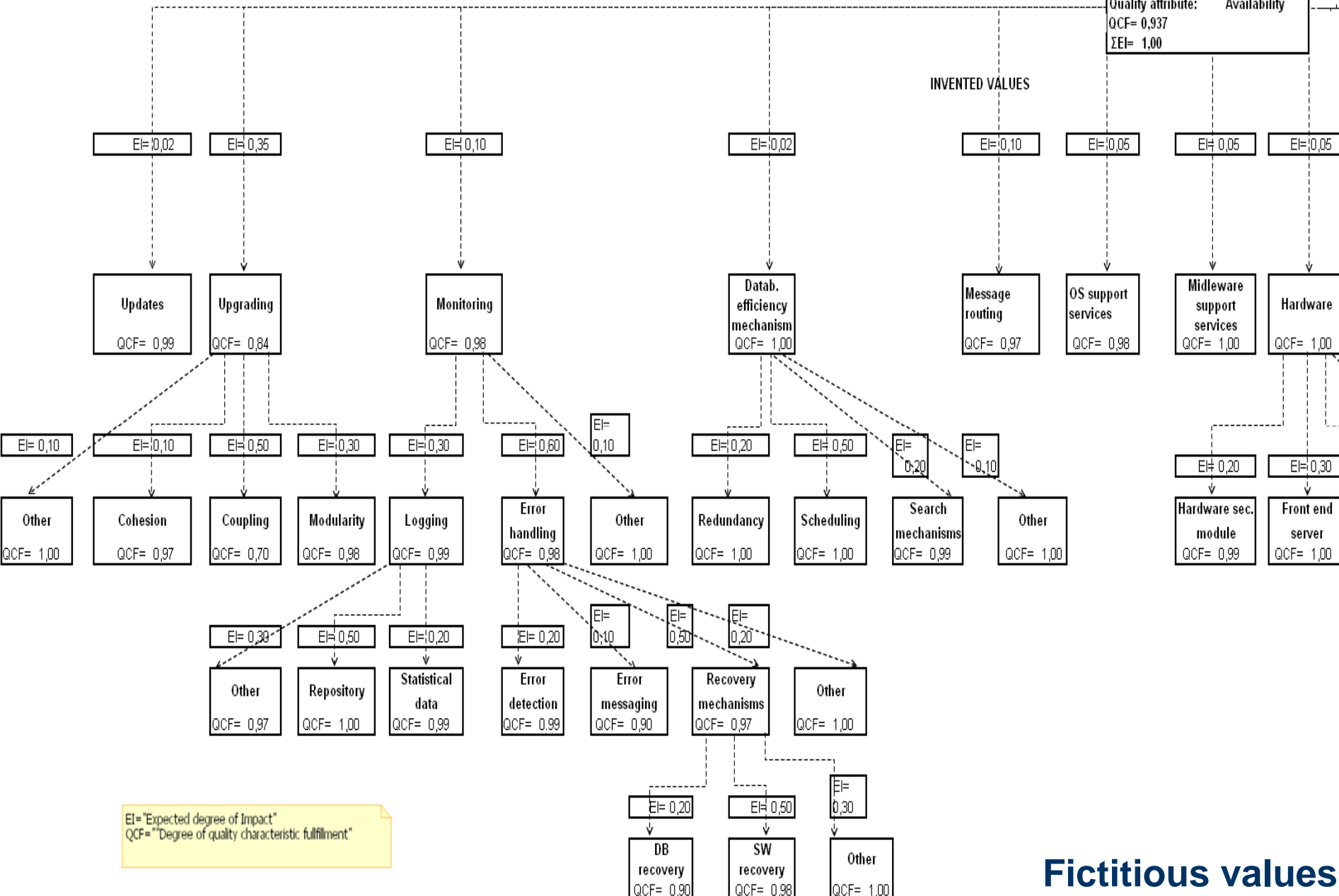
- Dependency views for each quality attribute
- Sensitivity analysis
- Tool supported simulation of change impacts
 - On ALL the dependency views, automatically

Next, live demos with an exemplary change

Fitted dependency views

Quality attribute: Availability
 QCF= 0,937
 $\Sigma EI= 1,00$

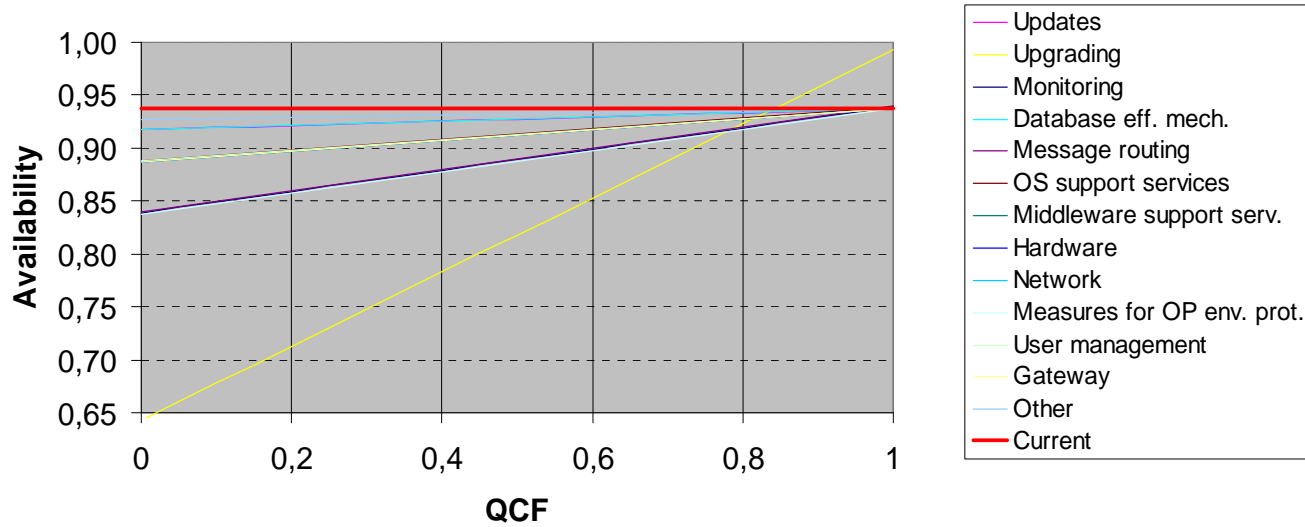
INVENTED VALUES



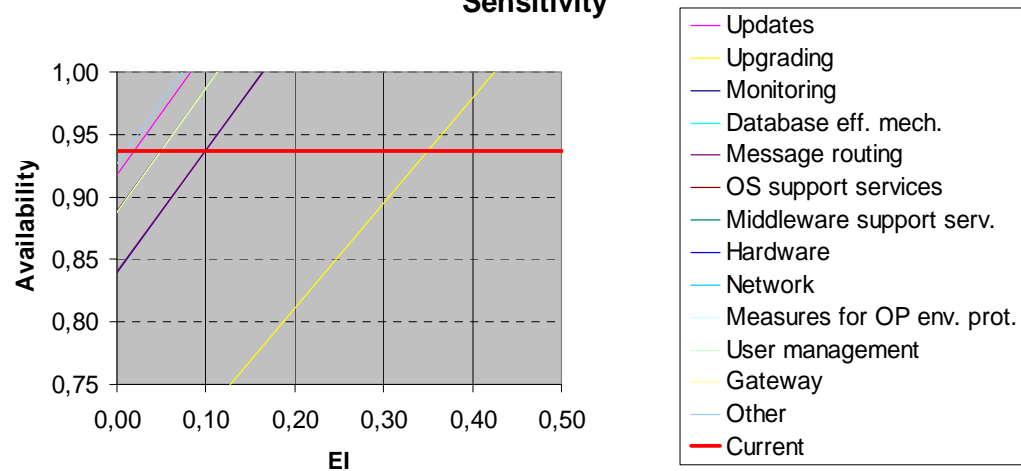
EI= "Expected degree of Impact"
 QCF= "Degree of quality characteristic fulfillment"

Fictitious values

Sensitivity



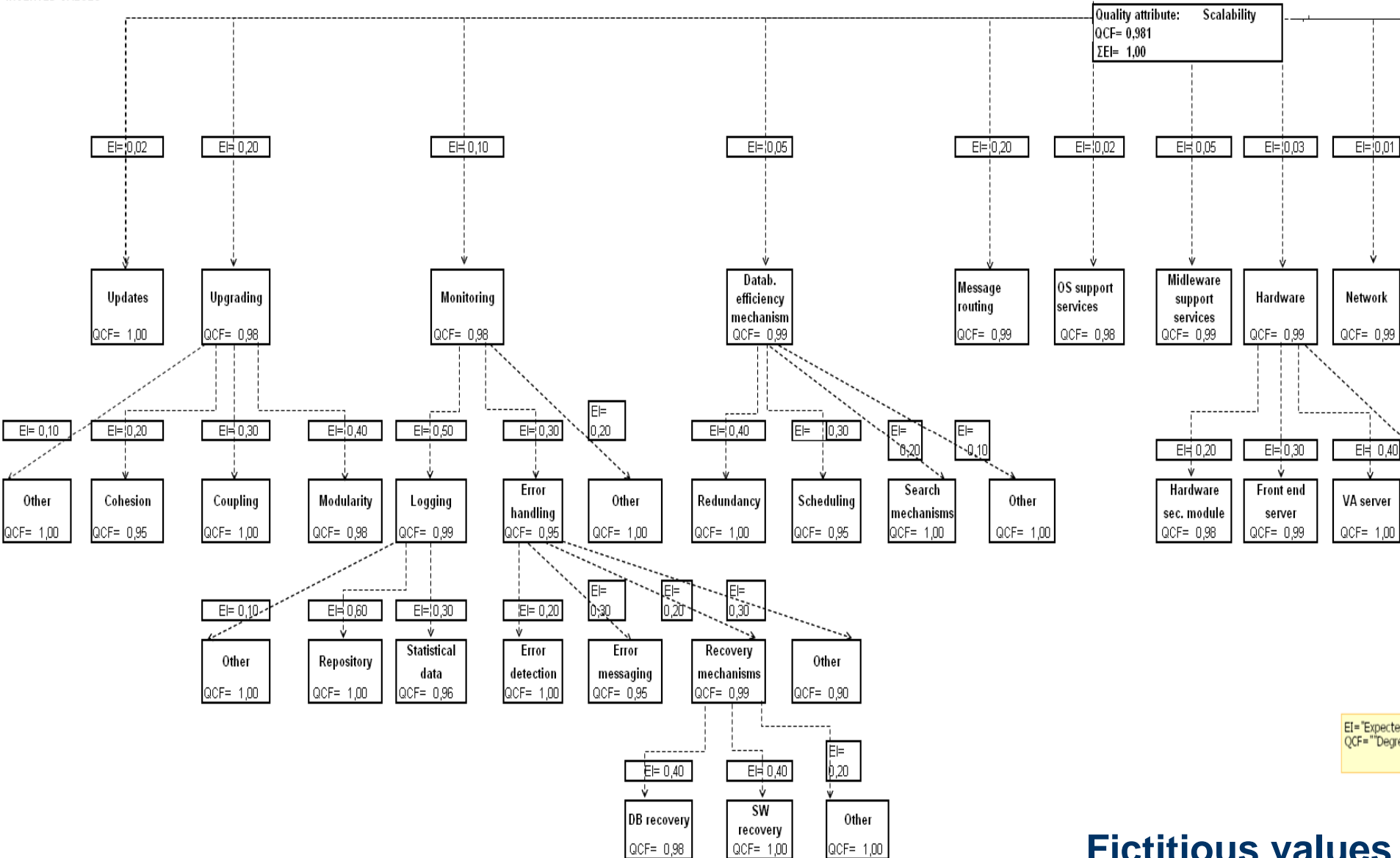
Sensitivity



Fictitious values

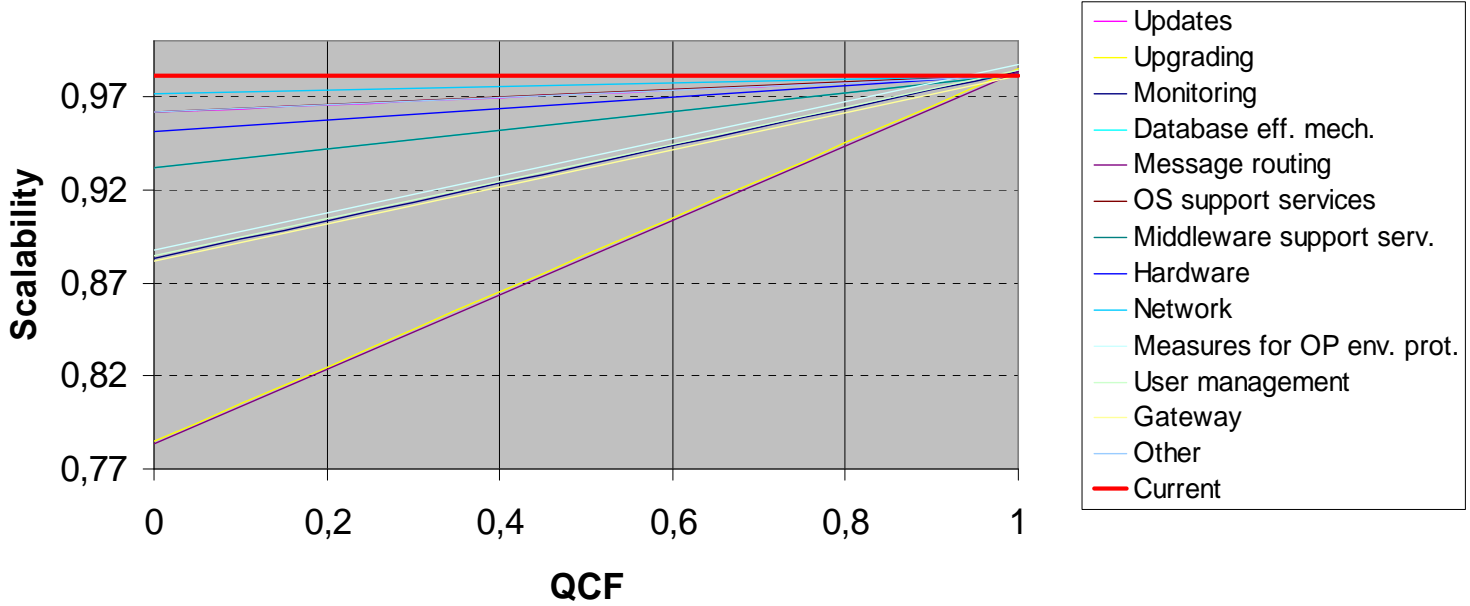
Fitted dependency views

INVENTED VALUES

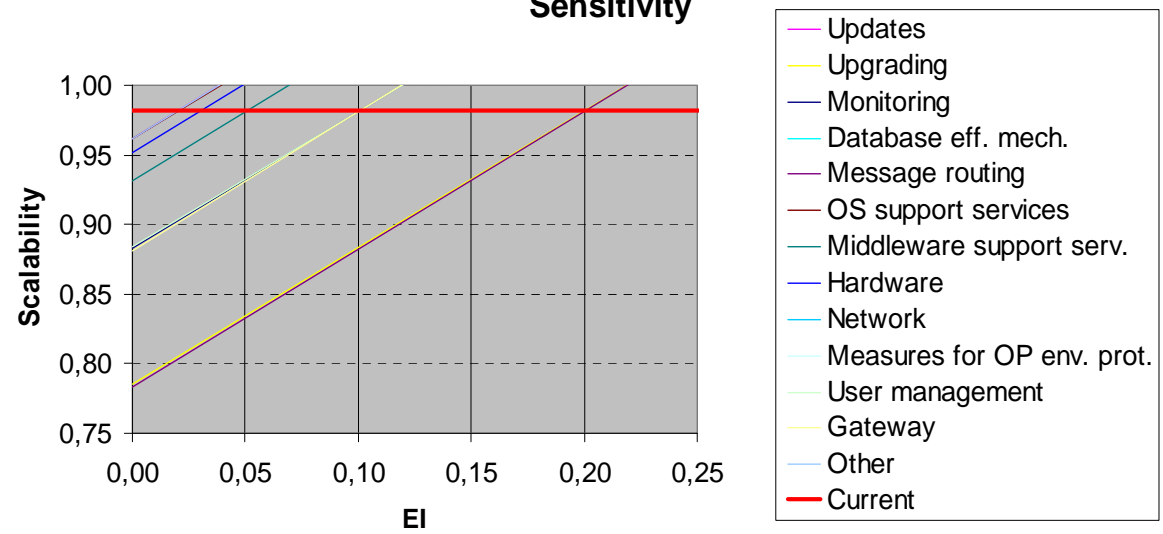


Fictitious values

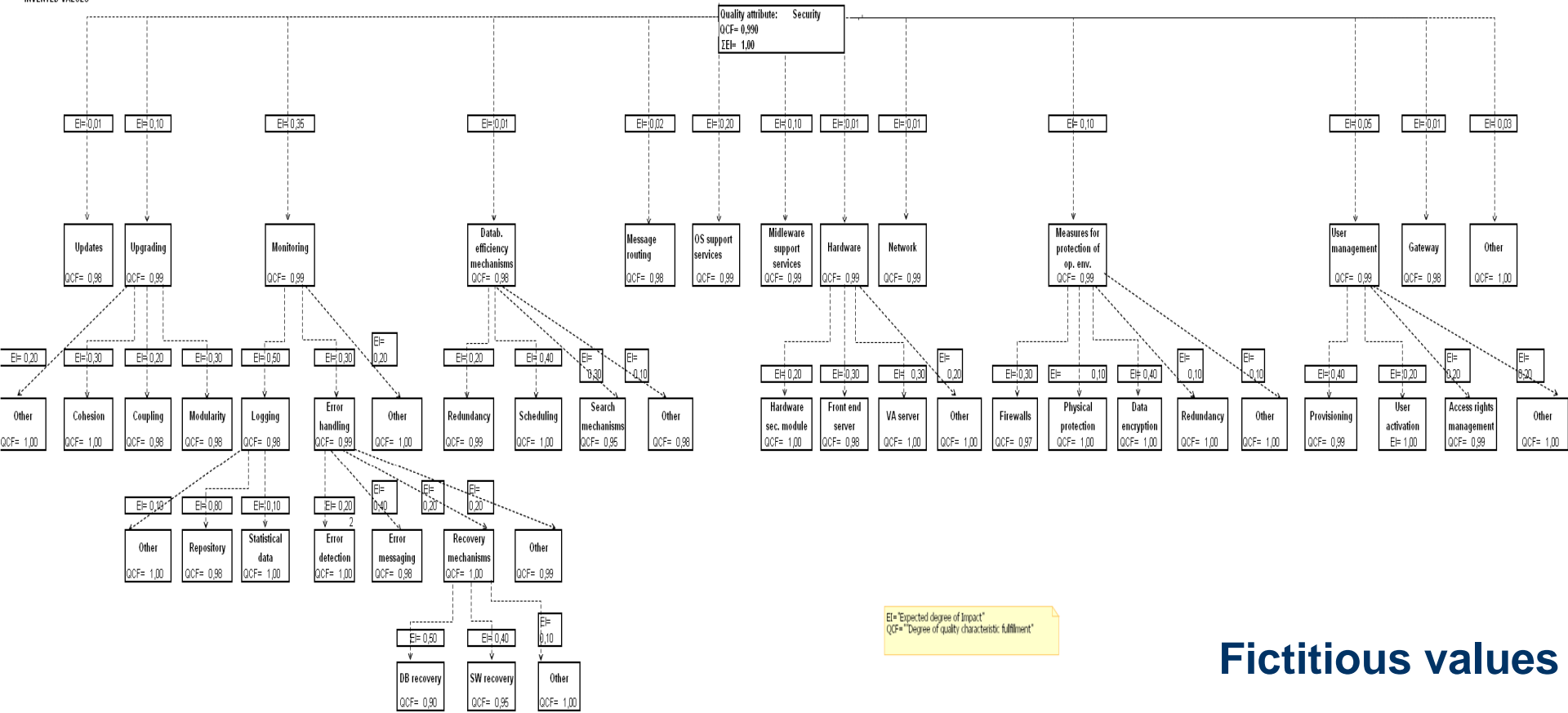
Sensitivity



Sensitivity

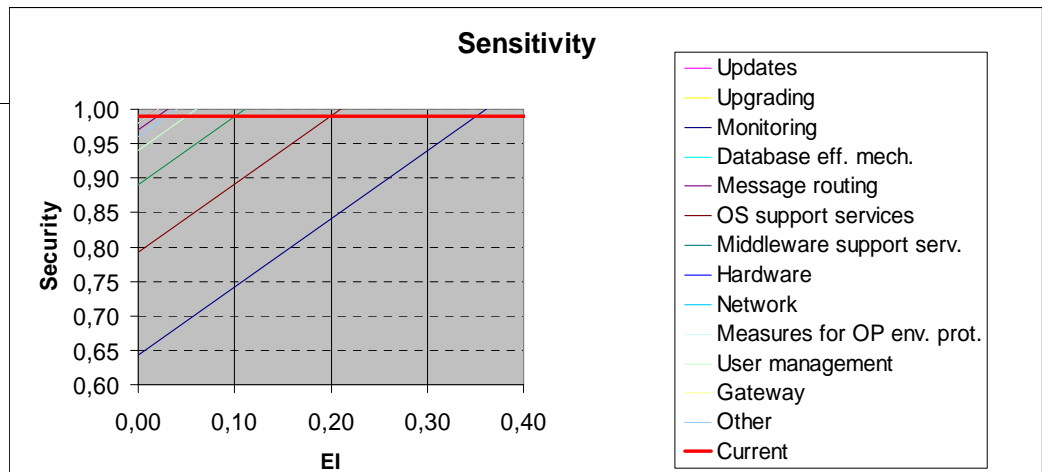
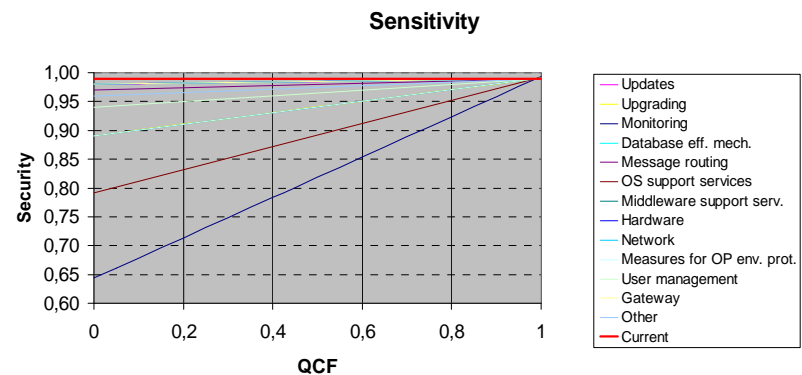


Fictitious values

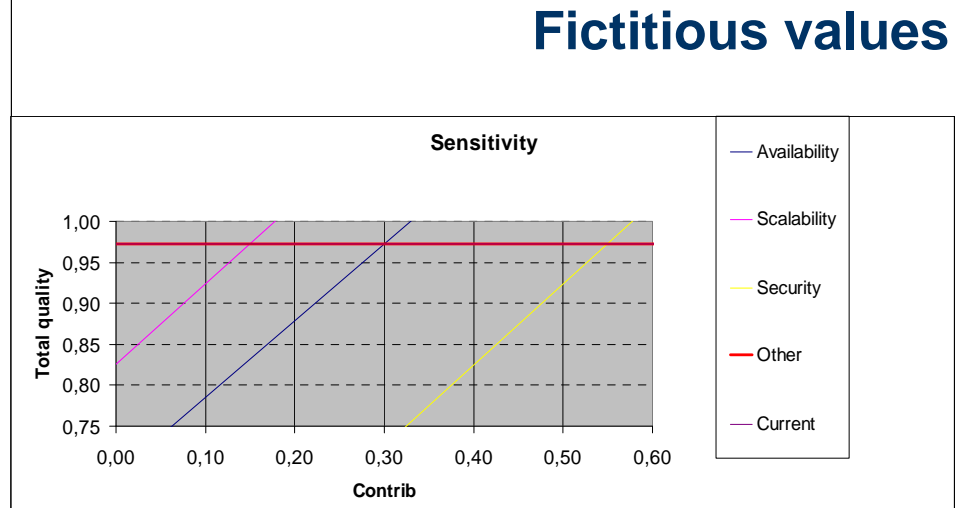
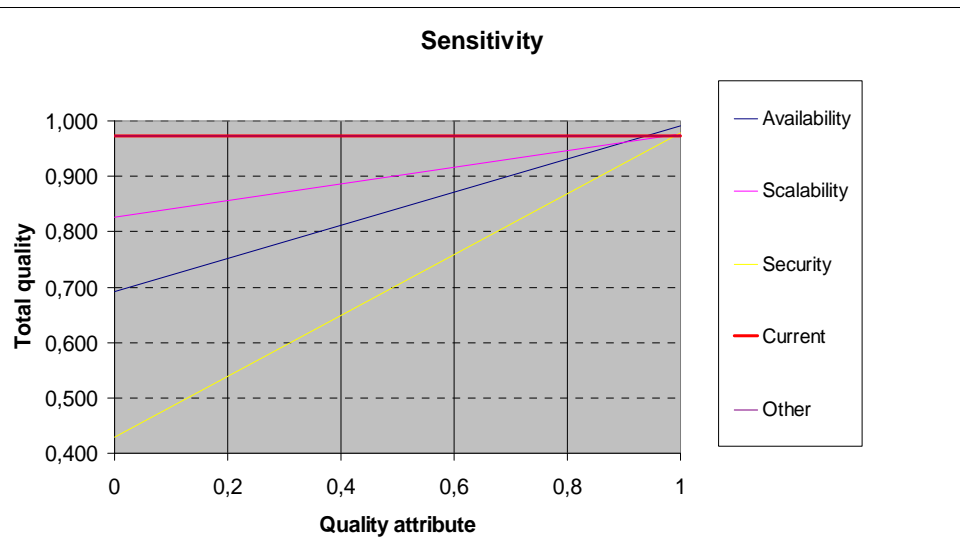
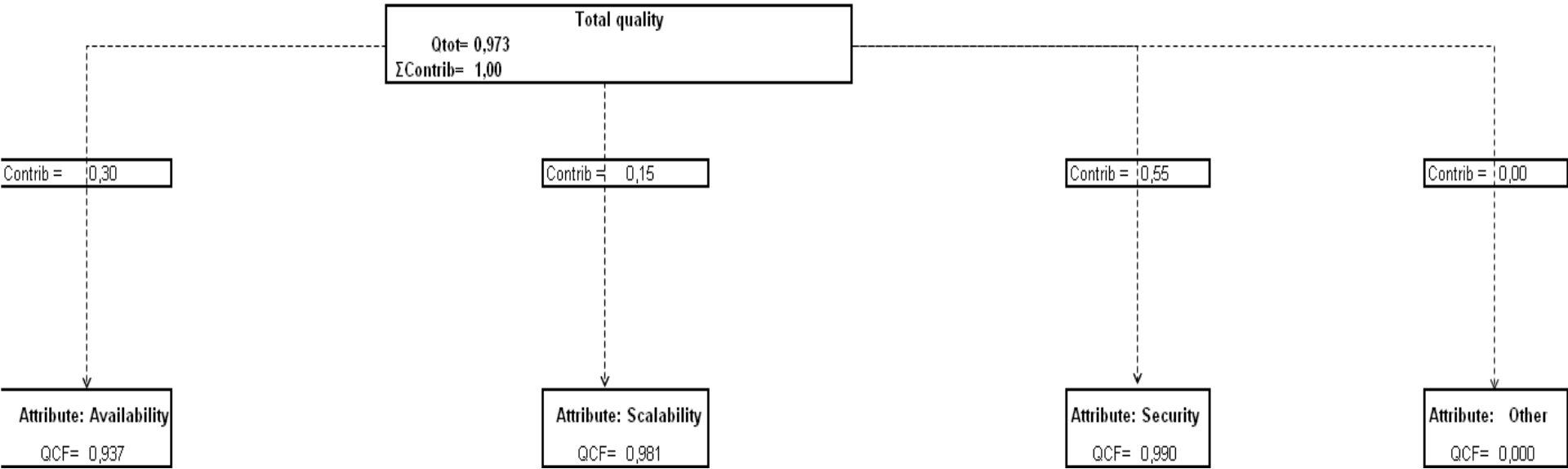


EI= "Expected degree of Impact"
QCF= "Degree of quality characteristic fulfillment"

Fictitious values



Fitted dependency views



Applying PREDIQT

1. Specify the change
2. Enforce the change on the prediction models
 - Design models, nodes (and arcs) of dependency views
3. Establish whether the change is within the prediction domain
 - If point 2 was feasible and sensitivity within the acceptable threshold
4. Simulate the impacts on the dependency views

Summary

- The method enables prediction of implications of architectural changes on the quality characteristics.
- Applicable as a preventative or adaptive approach at any lifecycle stage
- Reduces the time and risk of enabling and deploying adaptations
- Tried out in a major case study and evaluated empirically

Thank you!

Comments, questions?