Concept
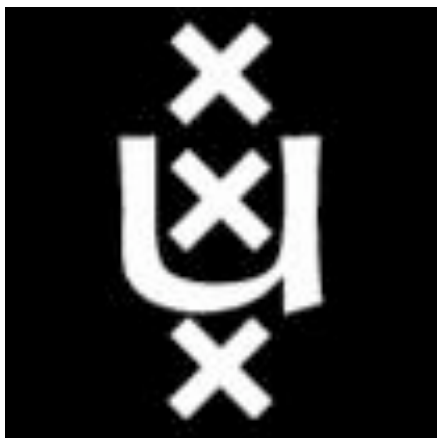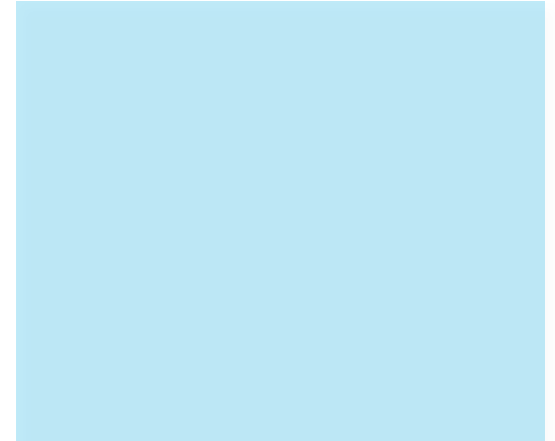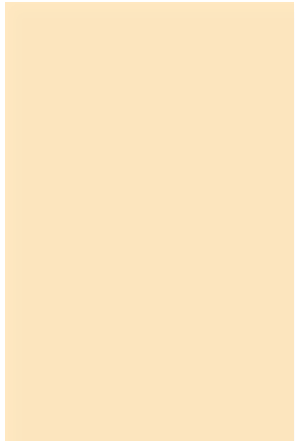# *Storage Area Network Health Status Monitor*

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Research Project 2

Content

- The organisation
- The project
- Storage infrastructure, physical and logical
- Problem conditions and indicators
- Health status levels
- Instant and historical status reports
- Conclusions
- Future work
- Questions

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The organisation

- KLM IS delivers ICT-services to KLM's business processes

    - Electronic booking, online check-in, …

        - Primarily database and web applications

- Different platforms (UNIX, Linux, Windows) are managed by their own departments

- A central Fibre Channel Storage Area Network (SAN) with connected storage systems is managed by the SAN department

The project

- Each department monitors its own systems to support their own daily operations

- Therefore the SAN department does not see storage related problems experienced by hosts

- A better understanding of the storage infrastructure's health is desired

Problem definition

How can an alarm system be created that monitors the long term as well as immediate health of a Fibre Channel fabric?

- What indicators are relevant for the health of the Fibre Channel fabric, and where can they be found?

- What are the important interrelations between such indicators, and how can they be quantified?

- What kind of health status levels can be defined, and by which indicators and thresholds should they be reached?

Storage infrastructure (physical)
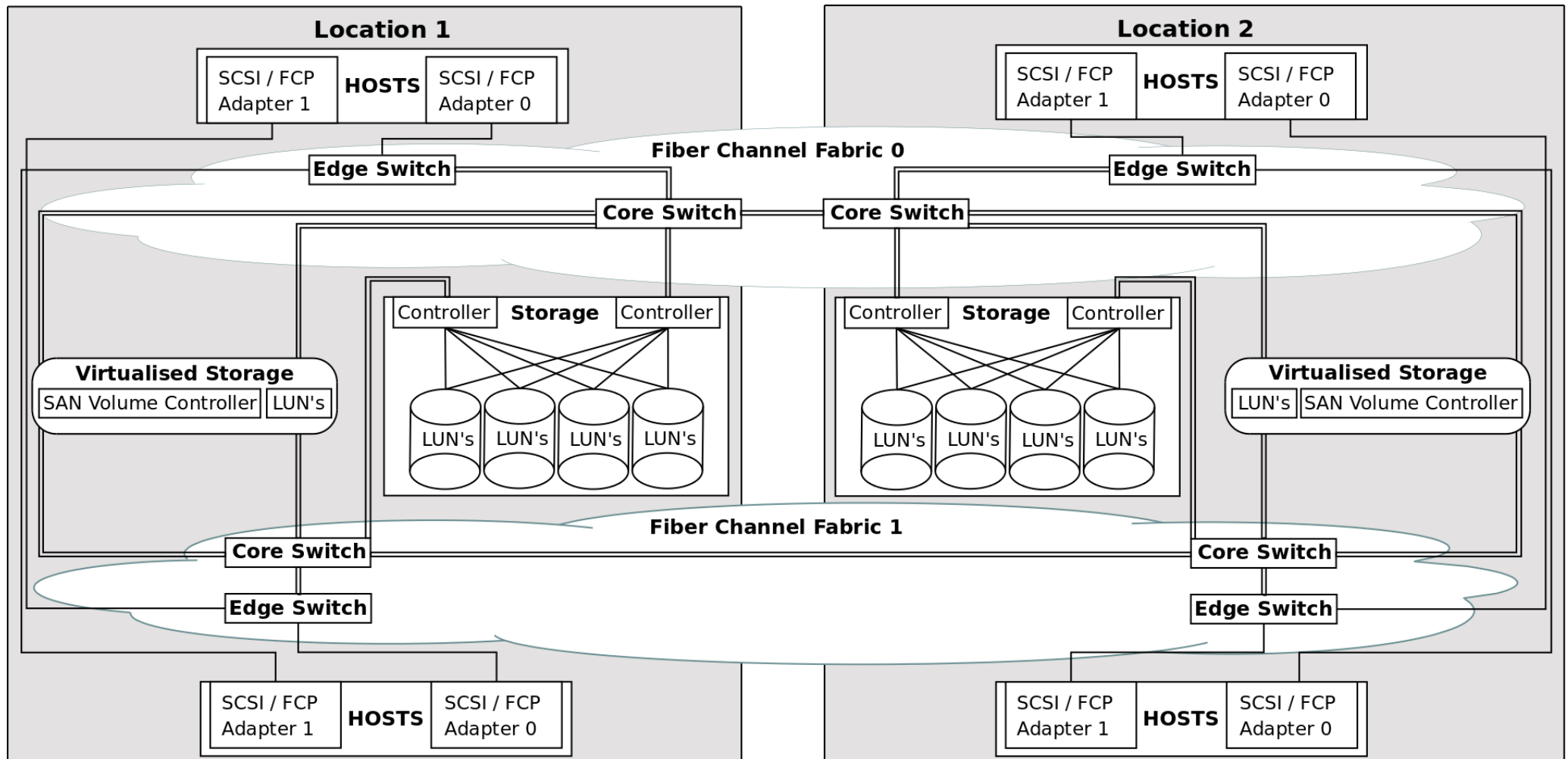
Storage infrastructure (logical, 1)

- One or more **hosts** can share one or more **HBAs**, and each **HBA** can have one or more **host ports** connected to a **switch port**. Such a connection is a **host link**.

- One or more **hosts** share one or more **LUNs**.

- A **fabric** consists of one or more interconnected **switches** and includes all connected **host ports** and **storage ports** as well.

- A **switch** has one or more **switch blades**, which each contain one or more **switch ports**.

- An **ISL** is a link that connects a **switch port** to a **switch** port from another **switch**, both **switches** are by definition in the same **fabric**.

- A **storage subsystem** contains one or more **LUNs** which can be made available via one or more **storage ports** that are connected to a **switch port**. Such a connection is a **storage link**

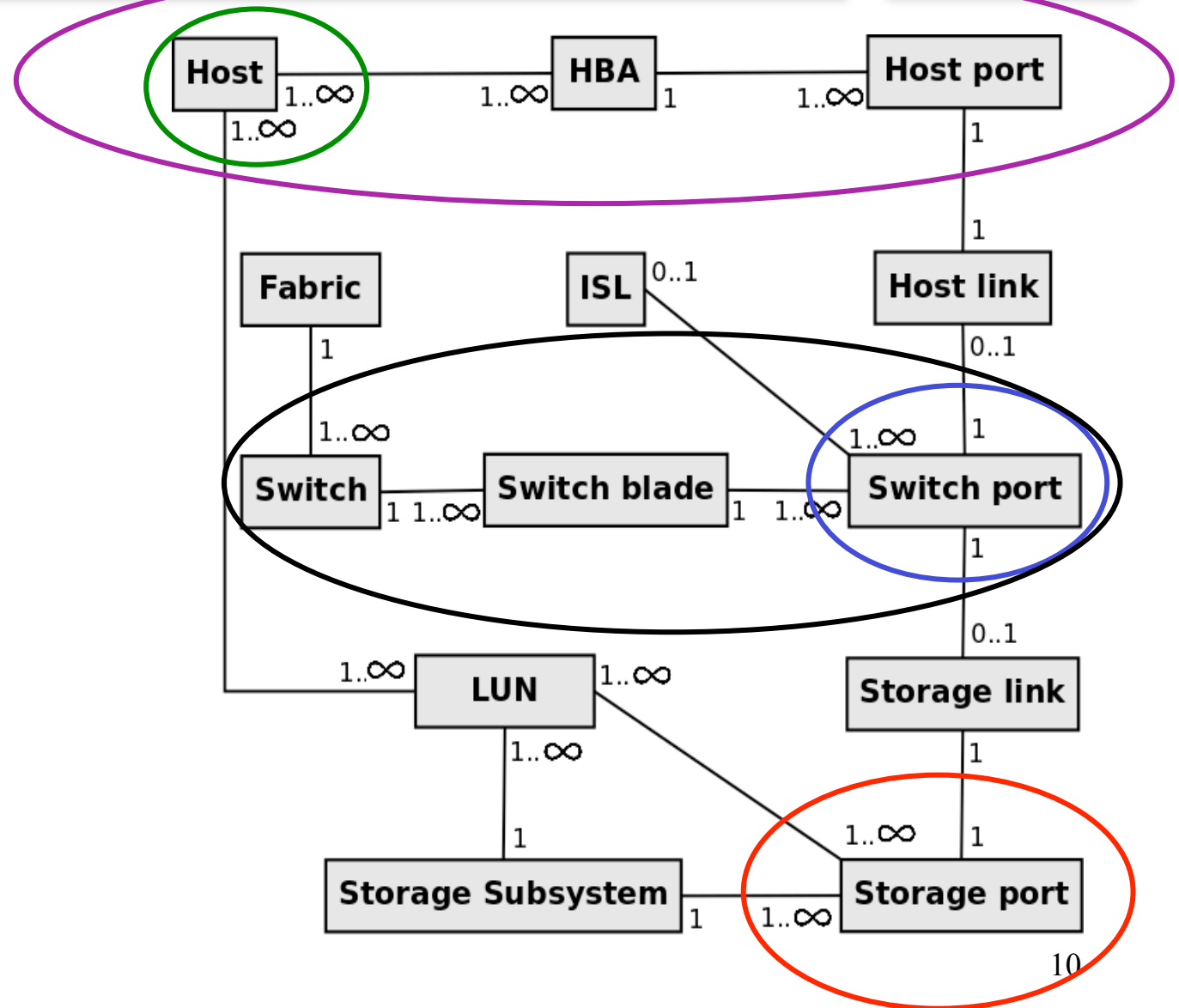# Storage infrastructure (logical, 2)
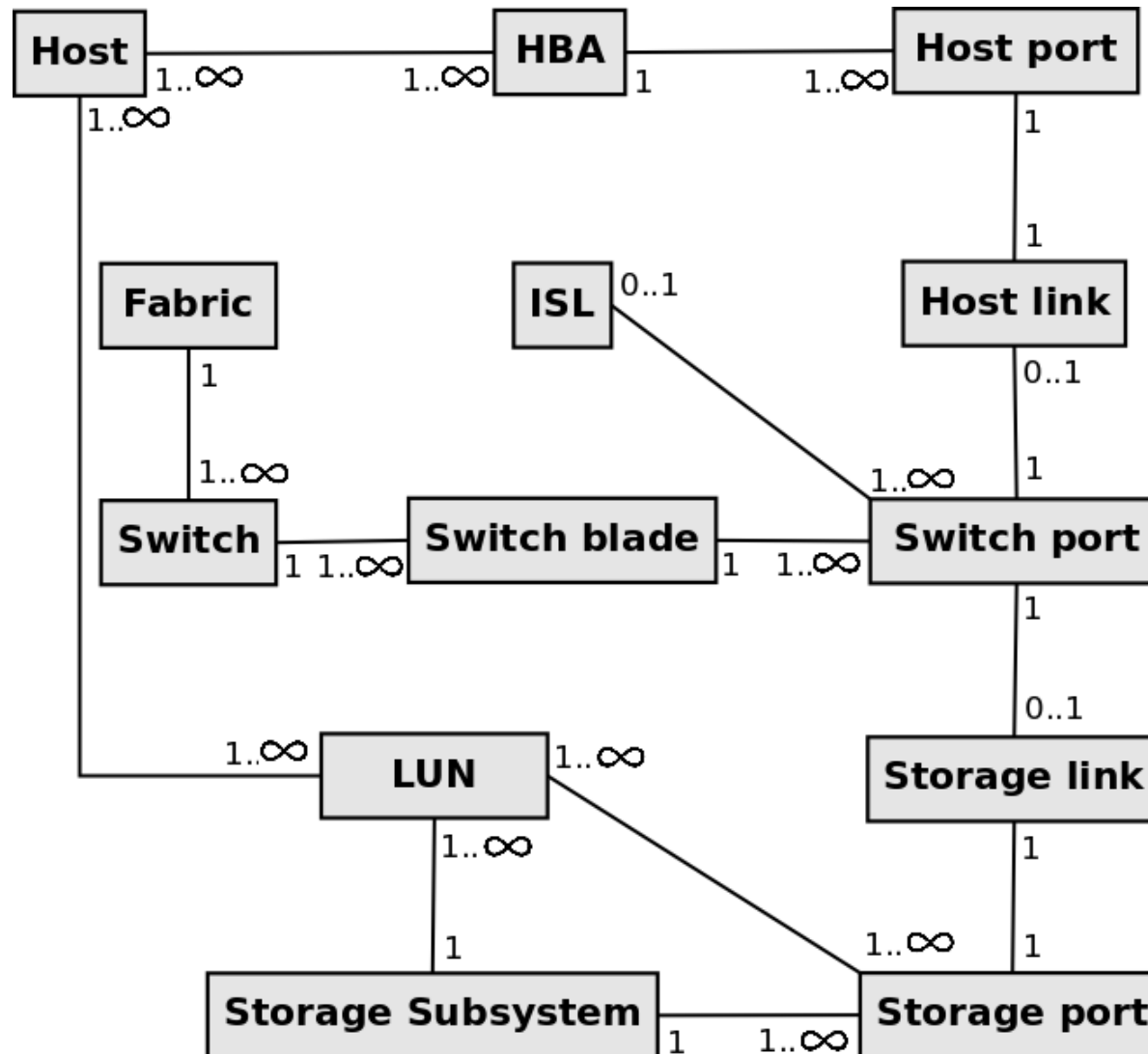
Problem conditions

- Hardware failure
- Capacity shortage
  - Reduced redundancy of load balanced components poses an extra risk
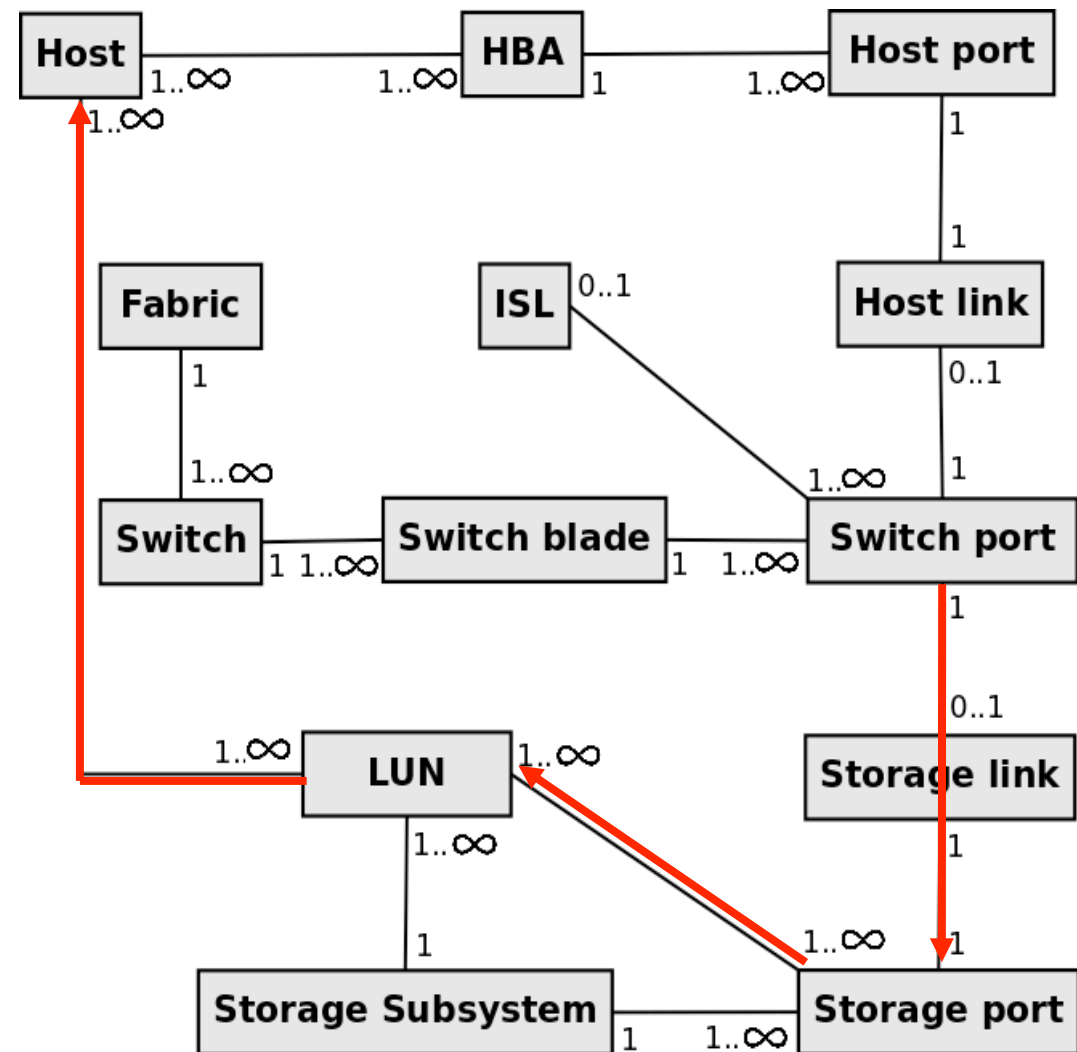   - Can be caused by hardware failure

Problem indicators

- DCB error
- Path failure
- Mirror out of sync
- Frame discard
- Over-utilisation
- Hardware failure
- Port latency

Relating problem indicators (1)

- An established problem can be related to other components
  - A failed storage port on the fabric can be related to a number of affected hosts

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Relating problem indicators (1)

- From some problem indicators, more specific relations can be found
  - A DCB error points to a storage port
    - A relation between DCB errors and frame discards on a storage port can be confirmed or denied
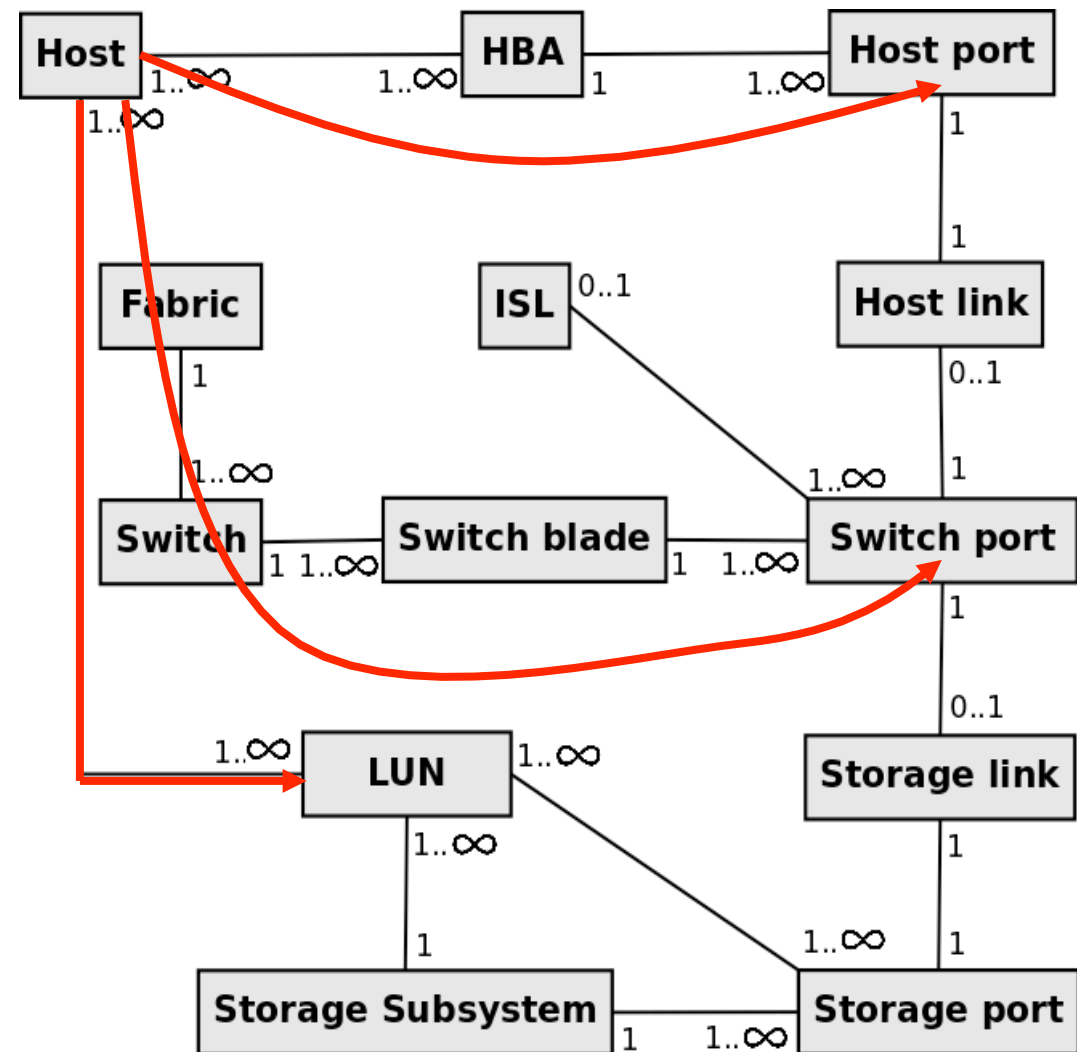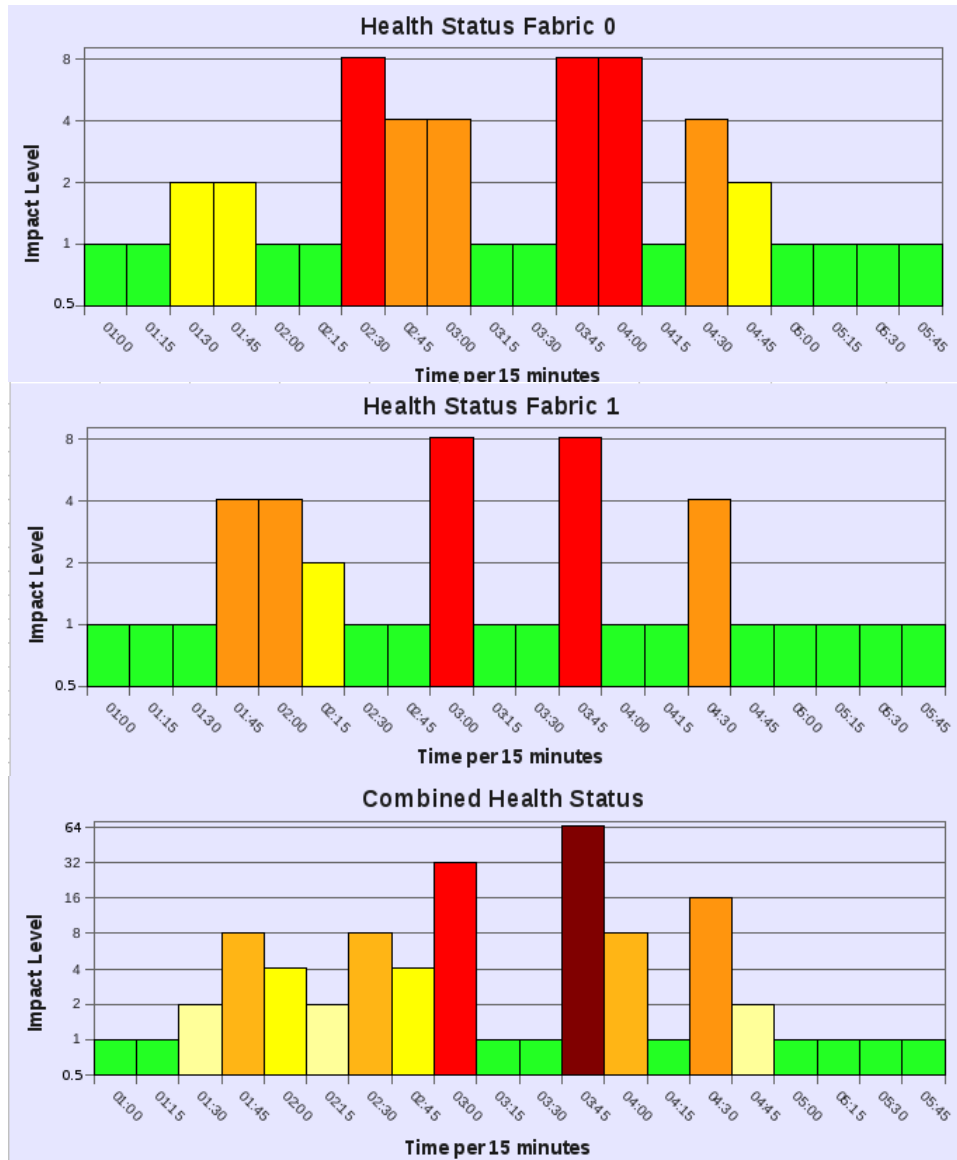
Health Status Levels (1)

- No problems
- Problems with no impact
- Limited impact
- Severe impact
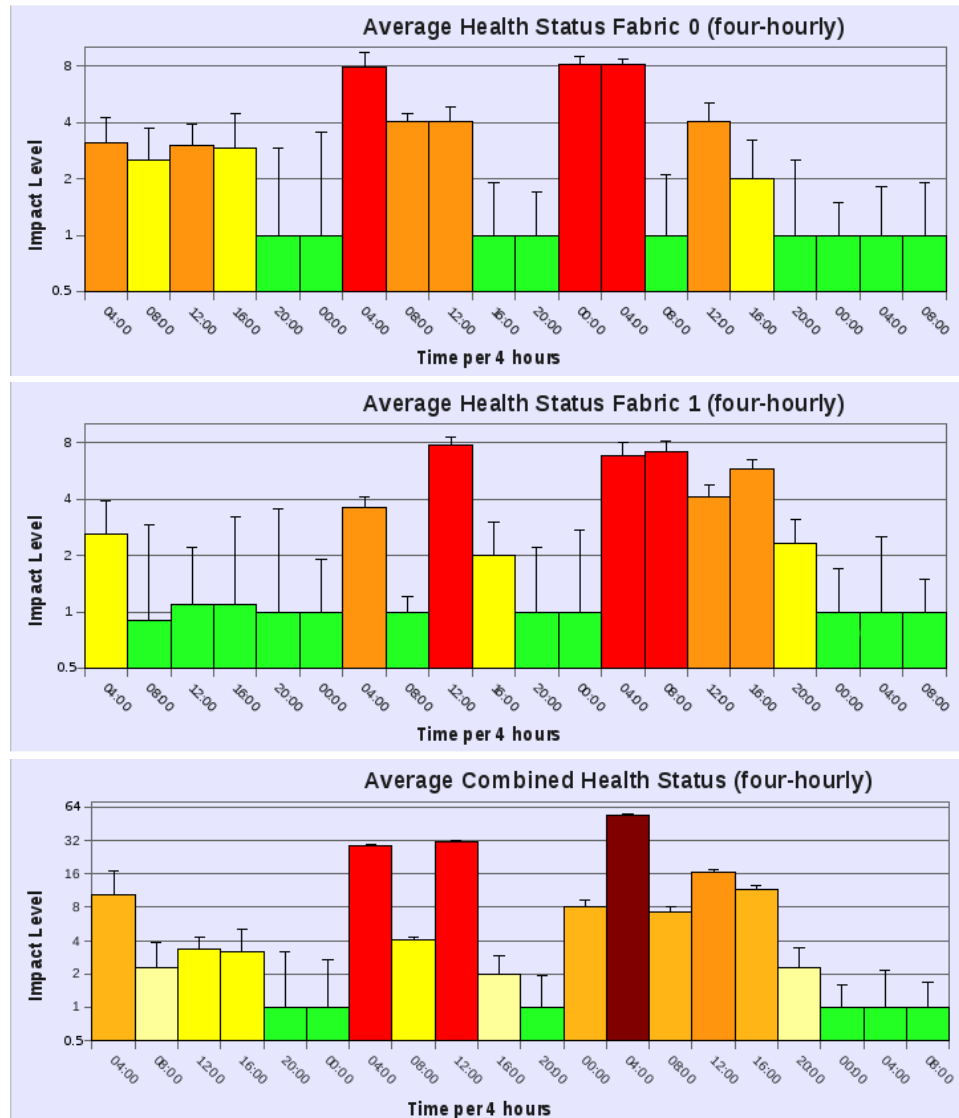
Per fabric, as well as in total

Health Status Levels (2)

Fabric 1 / Fabric 0	No problems	No impact	Limited impact	Severe impact
No problems	1	2	4	8
No impact	2	4	8	16
Limited impact	4	8	16	32
Severe impact	8	16	32	64

Instant Health Status

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Average Health Status

Conclusions

- A relational model of components relevant for the storage infrastructure has been developed

- Hardware failures, as well as (increased risks of) capacity shortages are indicators that affect the health status of the storage infrastructure

- Health status levels are determined by their impact, and the seperate fabric statuses are being combined

- Over longer time periods an average health status, and the amount of activity is presented

What's next?

- Implementation
- Evaluation
- Extra indicators and relations to enhance the system

Questions