LAST

Long term data Archive Study on new Technologies

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Introduction

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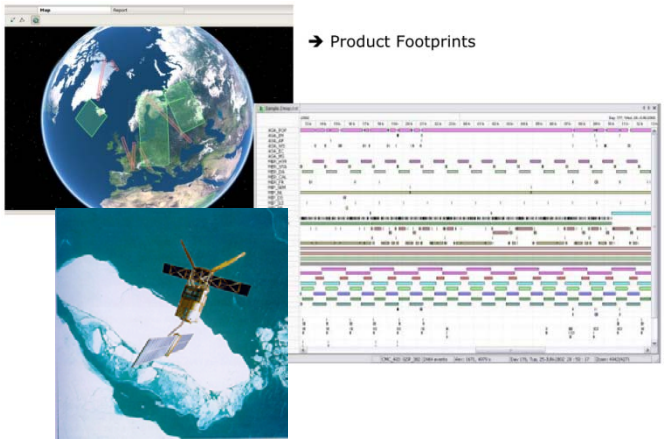
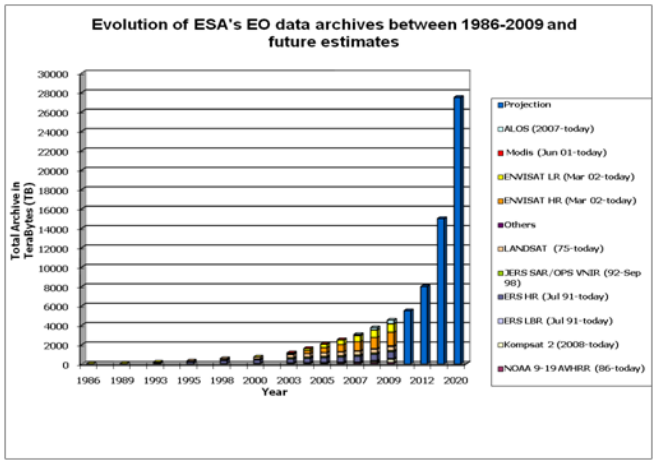
Introduction: EO Long Term Archiving





The need for accessing historical Earth Observation data strongly increased in the last ten years. The trend will increase much more in future due to the urgency of global change monitoring. Therefore we need to preserve, access and exploit all available data.

Users Perspective

- Missions Increase
- Products Increase
- Product Resolution Improvement (High Resolution)
- New Users and Applications (Climate Change studies)
- Increase of the demand of products in the long term
- Demand for major interoperability

Systems Perspective

- Storage Capacity Increase
- Performance Improvement
- Continuous capacity to Migrate from old to new technologies
- Safety and security of stored data
- Open and distributed architectures
- Capacity of multiple interfaces
- Use of standards for a better interoperability
- Efficient search and catalogue services

Introduction: Technologies Evaluated

STORAGE ARCHITECTURES
SERVER-CENTRIC IT ARCHITECTURE
STORAGE-CENTRIC IT ARCHITECTURE
BASIC DISTRIBUTED ARCHITECTURES
CLIENT-SERVER
PEER-TO-PEER
INTEGRATION ARCHITECTURES
MULTI-TIER
SERVICE ORIENTED
CLOUD

Operating Systems
Linux commercial (Red Hat)
HP-UX
Solaris
BSD
MS Windows
Linux Open
IBM AIX
OpenIndiana
…

Unix Servers
HP Integrity SuperDome
IBM Power 780
HP Integrity SuperDome 2
IBM Power 795
IBM Power 770
HP Integrity rx6600
IBM Power 750 Express
SPARC M4000
SPARC M9000
HP Integrity rx7640
SPARC M8000
HP Integrity rx8640
…

X86 Servers
Dell PE R815
Dell PE R915
Dell PE R6R7
HP DL300
HP DL500
Dell PE R2R3R4R5
IBM x3850 & x3950 x5
Fuj-Primergy rx900s
Fuj-Primergy rx600
Sun Fire x4000
HP DL700
Sun Fire x6000
SGI Altix 4700
SGI Altix UV
…

Hard Disks
Netapp FAS 3210
Netapp FAS6200
HP StorageWorks P9000
Hitachi Universal Storage Platform® V
Oracle Sun ZFS Storage 7740
Fujitsu Storage Systems ETERNUS DX8400
HP StorageWorks 6400/8400
Symmetrix DMX-4
Sun Storage 6780 Array
IBM System Storage DS8800
EMC CLARiiON CX4 Model 240
Huawei Symantec OceanspaceTM S8100
…

Tape Libraries
Oracle StorageTek SL8500 Modular Library System
Quantum scalar i6000
IBM System Storage TS3500 Tape Library
Spectra T-finity
HP StorageWorks ESL E-series Tape Library
ETERNUS LT270 Tape Library (Fujitsu)
…

Databases
Oracle
DB2
Sybase
MarkLogic
msSQL Server
PostgreSQL
db4o
GemStone
Object Store
Cassandra
eXist
Monet DB Xquery
Sedna
…

Middlewares
CORBA
DCOM
JAVA/RMI
TIBCO
OSGi
Apache ServiceMix
Oracle JMS
Oracle Fusion
IBM Websphere
MuleSoft
Red Hat JBoss
FUSE
Tuscany
…

Switches
Cisco Nexus 7000 Series 48-Port Gigabit Ethernet Module
HP A12500 GbE module
Enterasys® X-Series module
Extreme Networks Black Diamond 10808 module
Juniper EX820 40XS
…

Mission

*The ultimate goal of **LAST** is to perform an independent study on the different archiving technologies and solutions helping on technological and architectural decision-making*

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Mission & Objectives (1/2)

- Look for the best technological solutions to satisfy the requirements and needs of **ESA**, **LTDP**, and other European and Canadian **EO partners**, in terms of digital information preservation

EVALUATION: To evaluate technologies and architectures that may suit with the System

SYSTEM: It is necessary to define the system Requirements

USE CASES: It is necessary to infer the system requirements from:

- Known archiving functions in ESA (ECV's)
- Known relationships with the archive in ESA
- Survey with EO partners
- Analysis of current EO and Archiving standards

Mission & Objectives (2/2)

- Identify solutions mature enough to be implemented (and be put in operation), in the short, mid, and long-term
- Provide a gap analysis between ESA's practices and the best practices in mainstream IT industry
- Consider the risks associated with the migration to the new technologies, from the solutions currently in use (and proposing solutions to reduce them)

Survey Results

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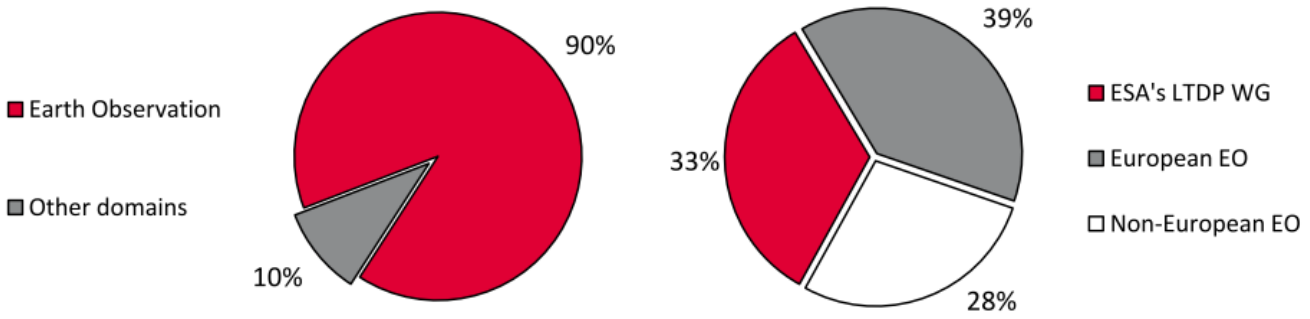
Survey Results – Introduction (1/5)

- Approximately 54 organizations of reference in LTA were contacted and twenty (20) replied to the whole questionnaires and interviews

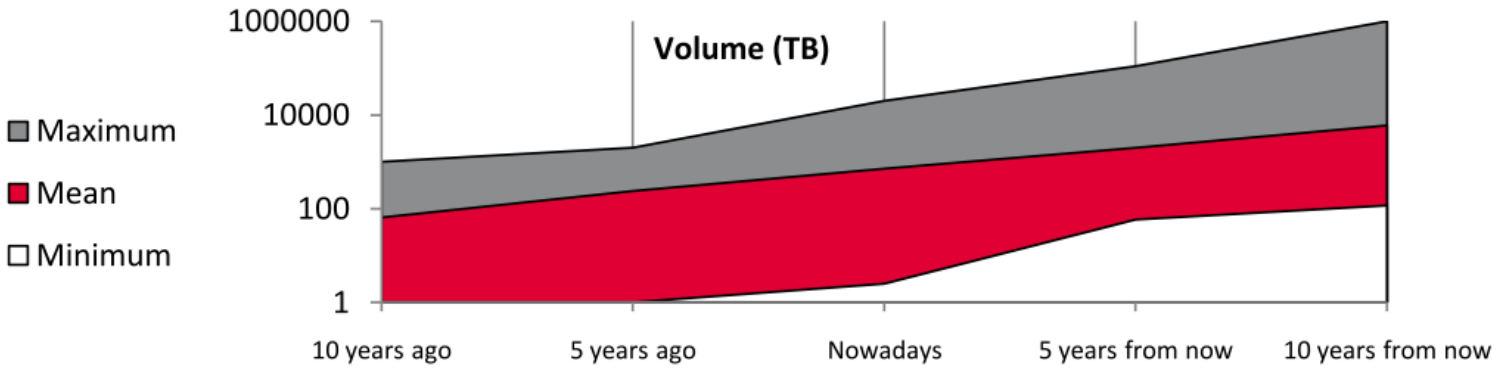


Survey Results – Storage Capacity (2/5)

- The capacity of the systems interviewed ranged from 2,5 TB to 20 PB

Parameter	Minimum	Maximum	Mean
Total volume	2,5 TB	20 PB	**716 TB**
Online storage	2 TB	4 PB	**80 TB**
Near-line storage	2,5 TB	15 PB	**385 TB**
Off-line storage	2,5 TB	5 PB	**279 TB**

- Capacity each 5 years, since 2000, and expected by 2020



Survey Results – Common System Requirements

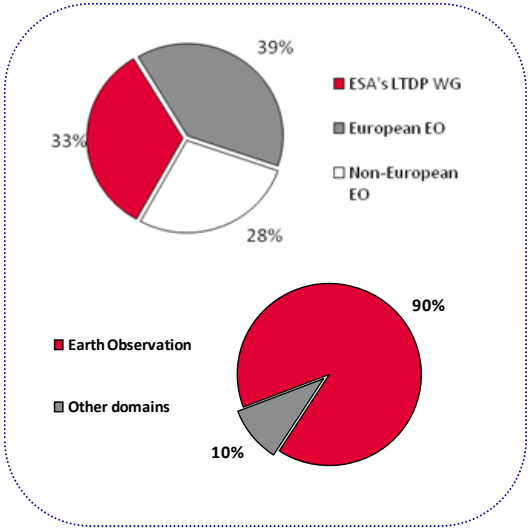
Survey

✓Big science (e.g. astronomy, high energy physics).

✓Supercomputing centers.

✓Digital libraries and repositories.

✓Online storage and services.



Standards Analysis

Identifier	Description
ESA LTDP	Long Term Preservation of Earth Observation Space Data (European LTDP Common Guidelines)
ISO 14721	Open archival information system (OAIS)
ISO 15489	Information and documentation (Records management)
ISO 19115	Geographic information (Metadata)
ISO 19119	Geographic information (Services)

Identification of ***Common System Requirements*** *Classified by main aspects:*

- ✓***Procurement***
- ✓***Operations***
- ✓***Security***
- ✓***Performance***
- ✓***Interface***
- ✓***Migration***
- ✓***Maintenance***
- ✓***Reliability***
- ✓***Standards***

Technological Evaluation

Once a set of Common System Requirements is defined, the next step is to perform an independent analysis of technologies to identify the best solutions and architectures that may be utilized

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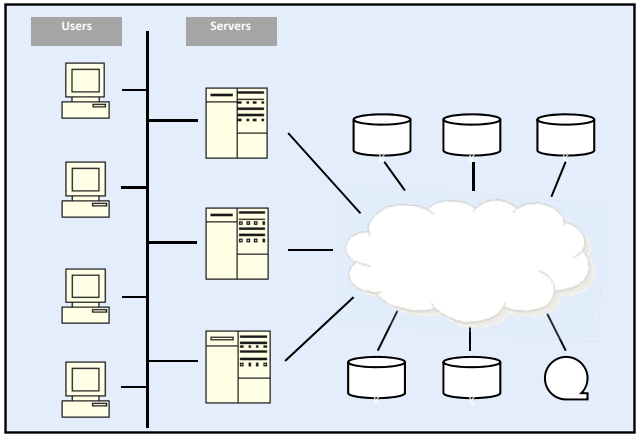
Technological Evaluation - Technological Areas

Operating Systems

Virtualization Technologies

Servers

Information Architectures



Storage Hardware Systems

- ✓ Magnetic Tapes
- ✓ Hard Disks
- ✓ Other Technologies

Databases:

- ✓ Relational Model
- ✓ Object-oriented Model
- ✓ Context Model
- ✓ XML Databases

Communications

- ✓Network Protocols
- ✓Middleware
- ✓Distributed Architectures (SOA, Cloud, N-Tier etc)
- ✓Network Infrastructure (Firewalls, Switches)

Technological Evaluation - Overview

EVALUATION METHOD - Analytic Hierarchy Process

Allows dealing with structured evaluation Attributes, allowing to assign a weight to each attribute in relation to its relevance

Main benefits: Metric for Technological GAP, The Weights can be modified in a comprehensive way by the final users

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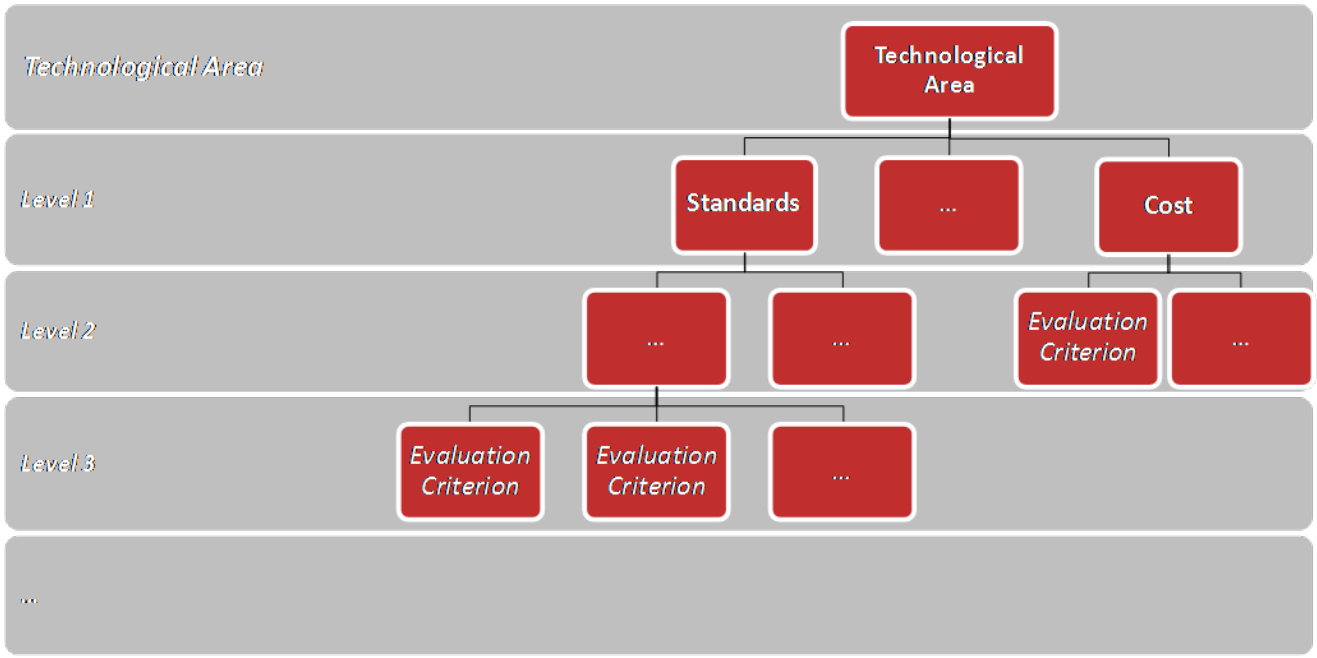
LTA EVALUATION MODEL

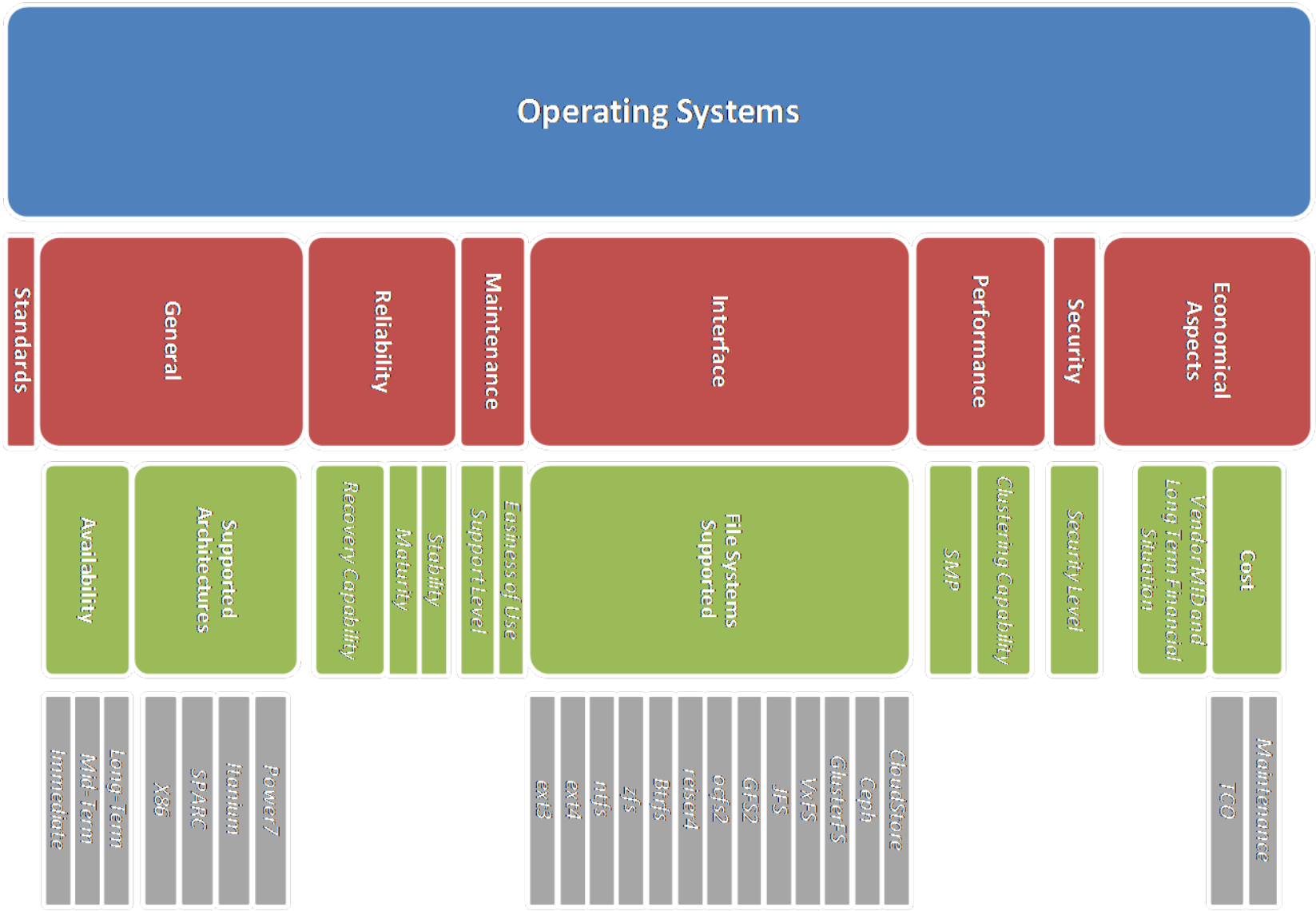
Identify Evaluation Attributes for each Technological Area.

Set each weight according to its relevance.

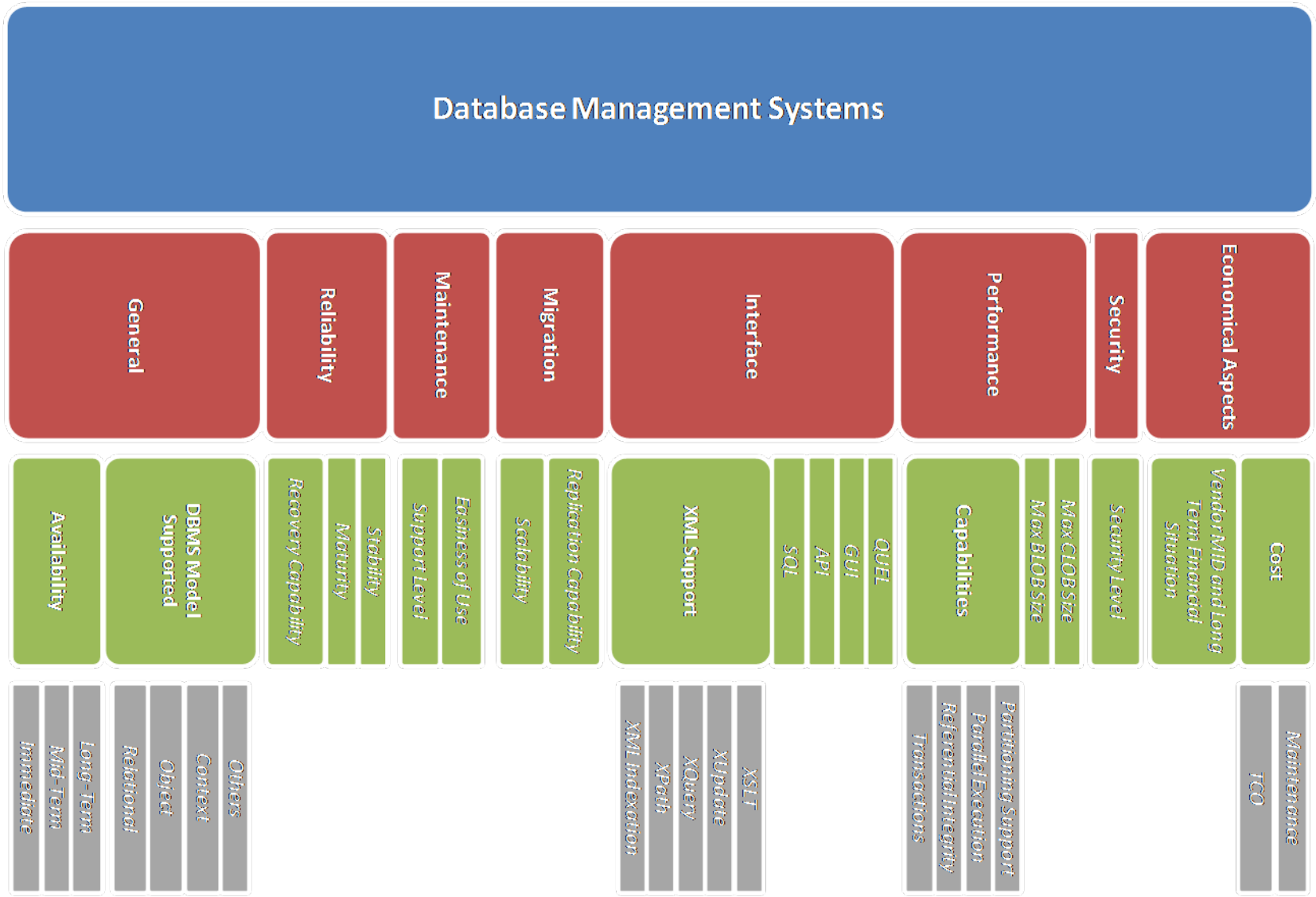
A specific evaluation tree is generated, with the aspects identified previously In the root (Standards ..)



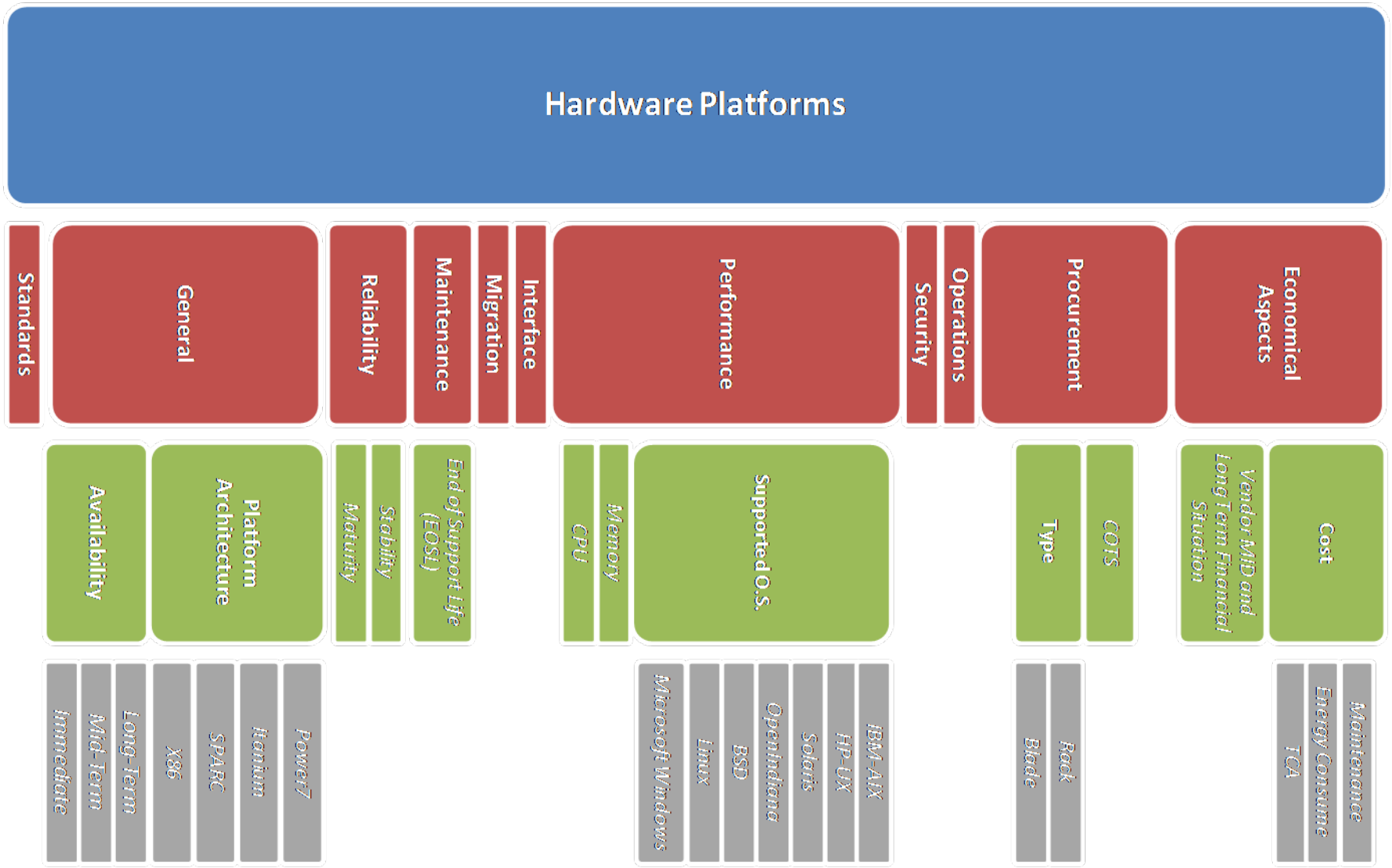
Technological Evaluation – Operating Systems



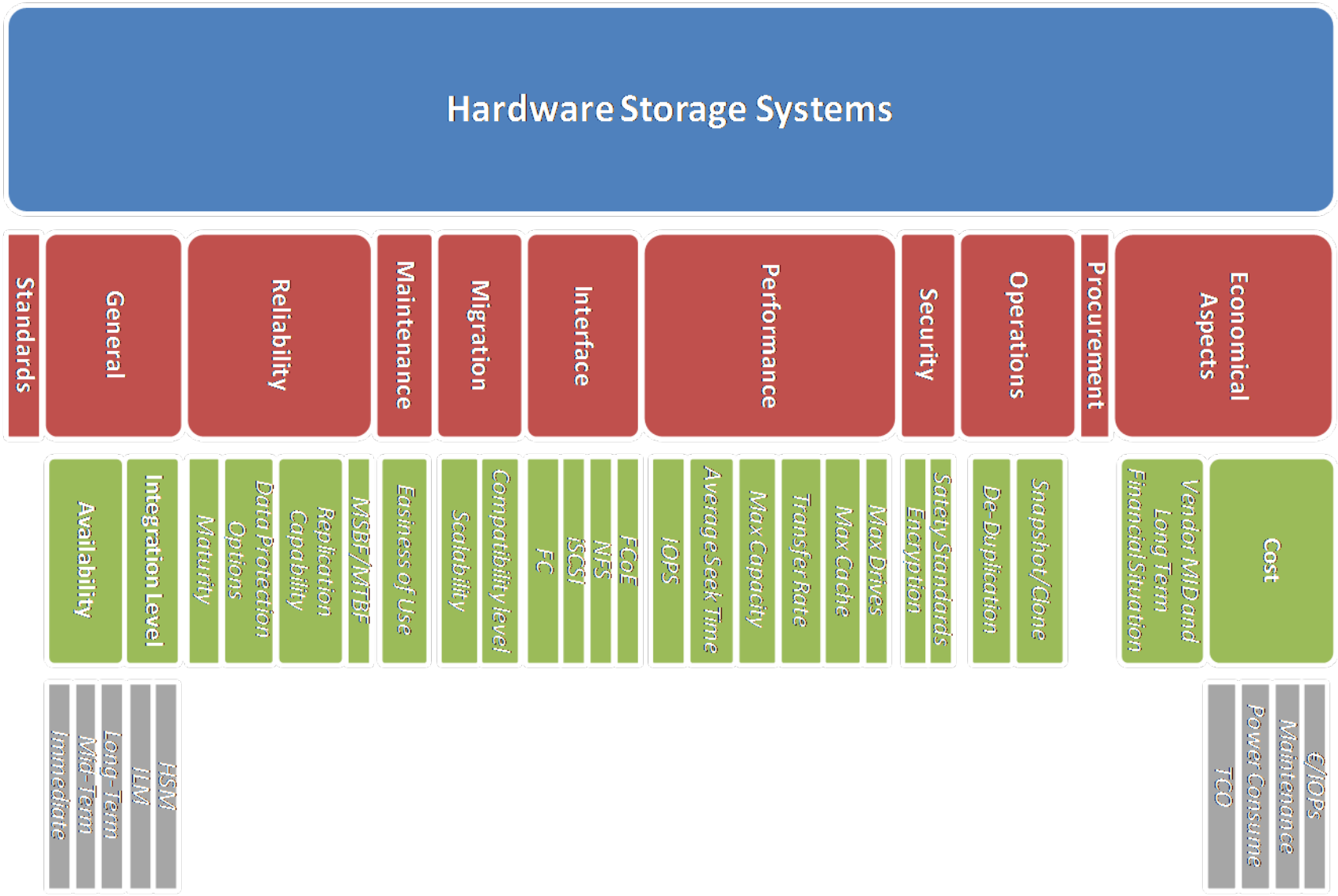
Technological Evaluation – Databases



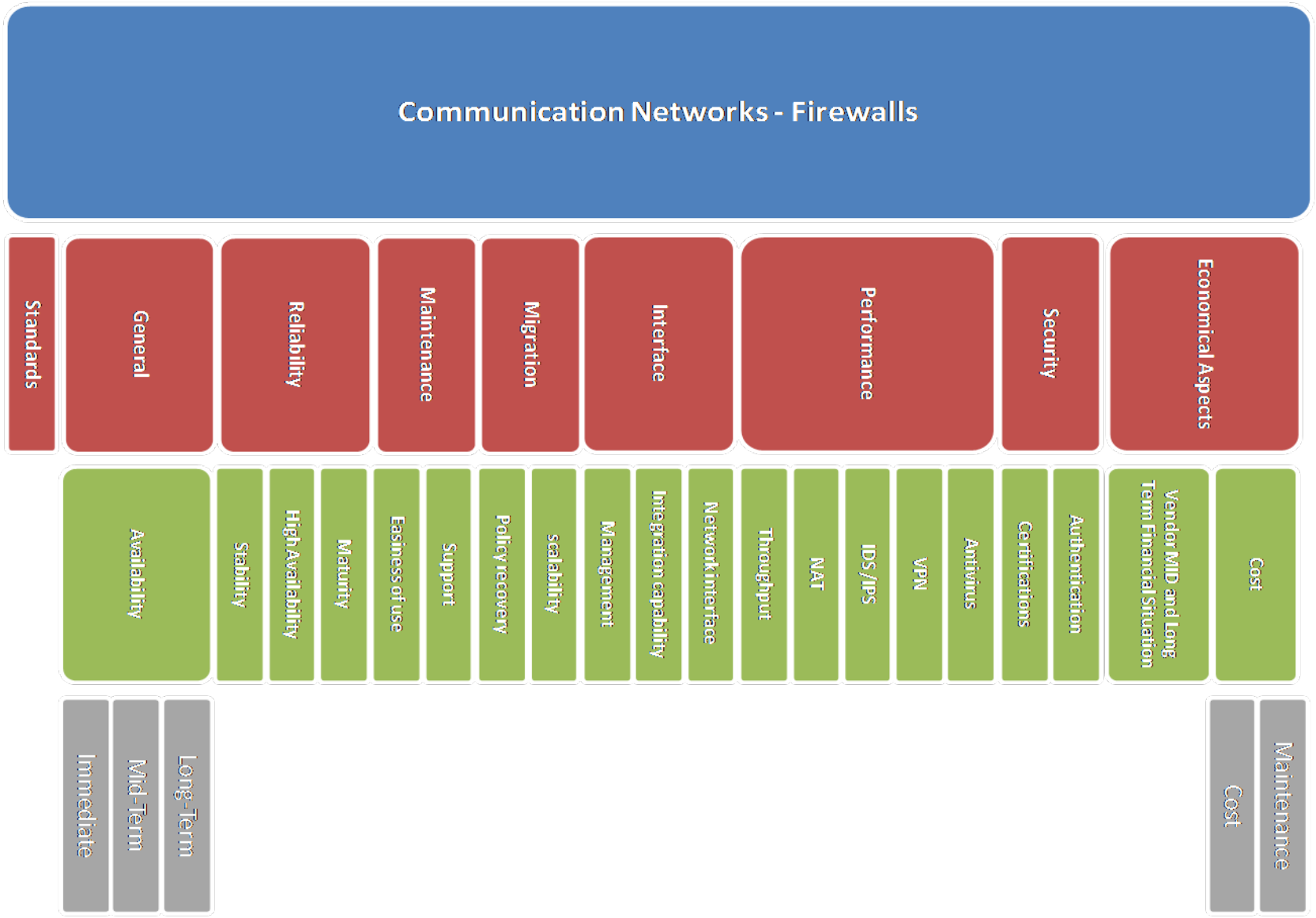
Technological Evaluation – Hardware Platforms



Technological Evaluation – Storage Systems



Technological Evaluation – Firewalls



Conclusions & Future Work

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Conclusions & Future Work

- An initial survey of LTA systems has helped to set a number of System Requirements, classified by main aspects of interest
- An evaluation method and specific model has been used to evaluate the technologies of each Technological Area, according to the different aspects concerning the System Requirements
- A list of most appropriated technologies has been selected in each technological area
- An analysis of compatibilities is being done in order to identify complete solutions that may be prototyped during the next phase of the project
- A gap analysis between ESA's practices and the best practices in mainstream IT industry is going to be provided

Thank you

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