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José Barateiro*

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José Borbinha

Aligning OAIS with the Enterprise Architecture

8th European Conference on Digital Archiving, 2010
Geneva, Switzerland





- Digital Preservation as a Problem
- Context
- The Enterprise Architecture Perspective
 - Zachman Framework
 - TOGAF
- Reference Architecture
 - Shaman RA
- OAIS Reference Model
 - Modelling OAIS
- Conclusions





Generic and common requirements:

- **Integrity:** Effective preservation requires that the informational content of objects remains unchanged through its lifetime.
- **Reliability:** A copy (or representation) of any preserved object must survive over its system's lifetime.
- **Authenticity Assurance:** A future consumer may require the accessed information to be trustworthy.



Digital Preservation as a Problem (2/2)

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- Provenance: A future consumer may require information concerning the origins of the object.
- Dealing with Obsolescence: Digital objects should be able to be exploited independently of any technological context (ideally...).
- Scalability: Digital preservation systems might be required to face technological evolution through the addition of new components.
- Heterogeneity: Digital preservation system's components should be heterogeneous due to technology disruption.



Approaching Problems

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Systems Engineering

	What	How	Where	Who	When	Why	
Scope	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	Scope
Business Model	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	Business Model
System Model	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	System Model
Technology Model	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	Technology Model
Detailed Representations	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	Detailed Representations
Functioning Enterprise	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	[Icon]	Functioning Enterprise

Enterprise Architecture



Risk Management



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Instituto de Engenharia de Sistemas e Computadores Investigação e Desenvolvimento em Lisboa

Aligning OAIS with the Enterprise Architecture



(<http://grito.intraneia.pt>)



- National project
- **Exclusive storage** clusters (dedicated to digital preservation)
- **Extended storage** clusters (using surplus resources of computing clusters)

SHAMAN - Sustaining Heritage Access through Multivalent ArchiviNg

(<http://shaman-ip.eu/shaman>)



- European project
- Three domains of focus: memory institutions, **engineering** and **e-Science**
- Strong focus on authenticity and integrity
- Definition of frameworks and architectures for digital preservation

Common ground: use of data grids (massive data sets, file management, user management, networking etc.)



Reference Architecture – The concept

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A reference architecture presents a way of recording a specific body of knowledge, with the purpose of making it available for further practical reuse.

According to the ANSI/IEEE Std. 1471-2000:

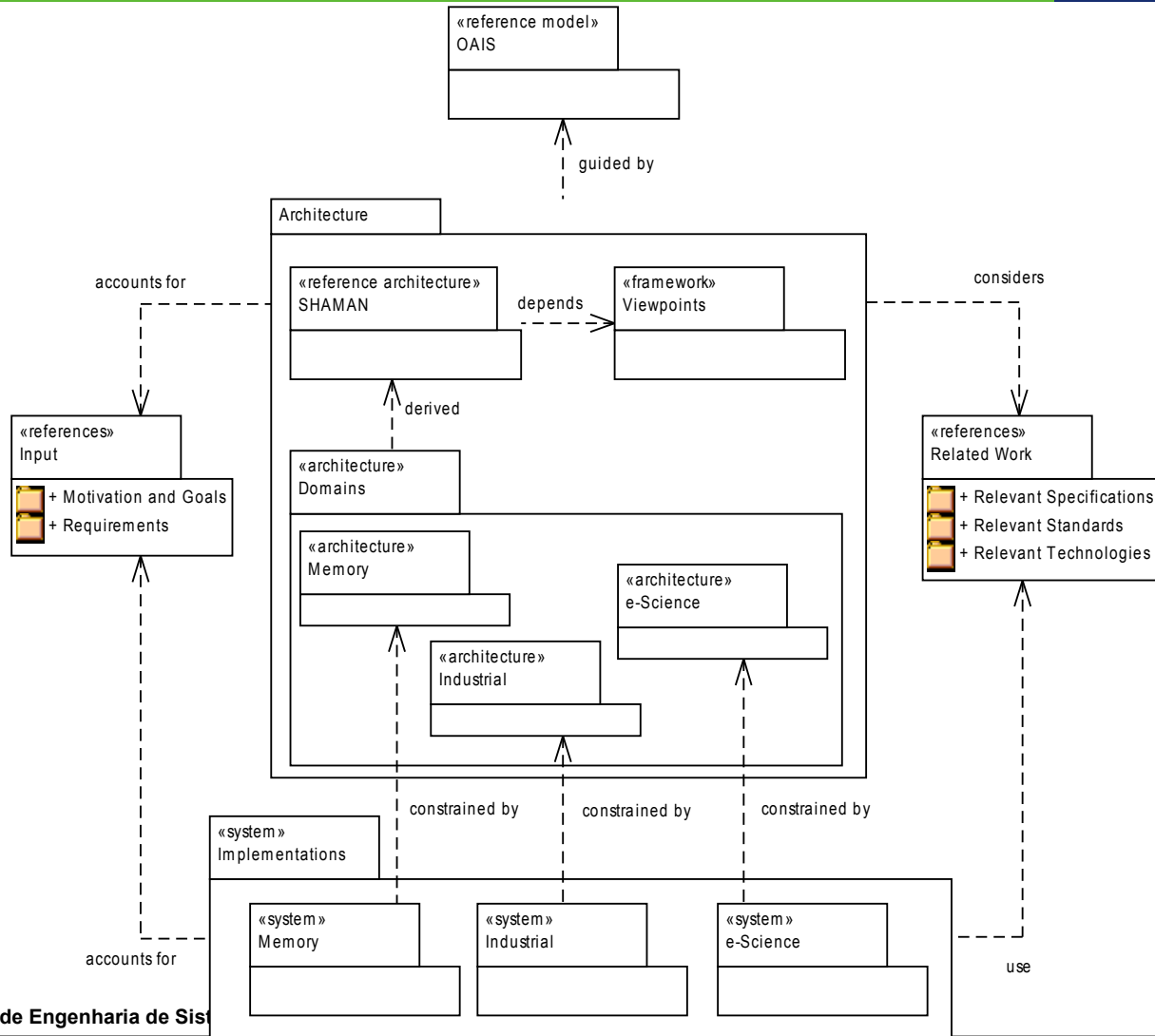
architecture is **”the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”**

Therefore, a reference architecture for digital preservation must provide a way to capture the knowledge in the domain, so that it can be instantiated in concrete architectures for real system implementations!



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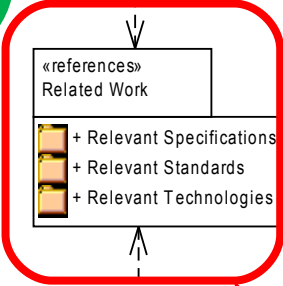
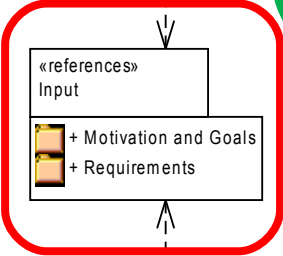
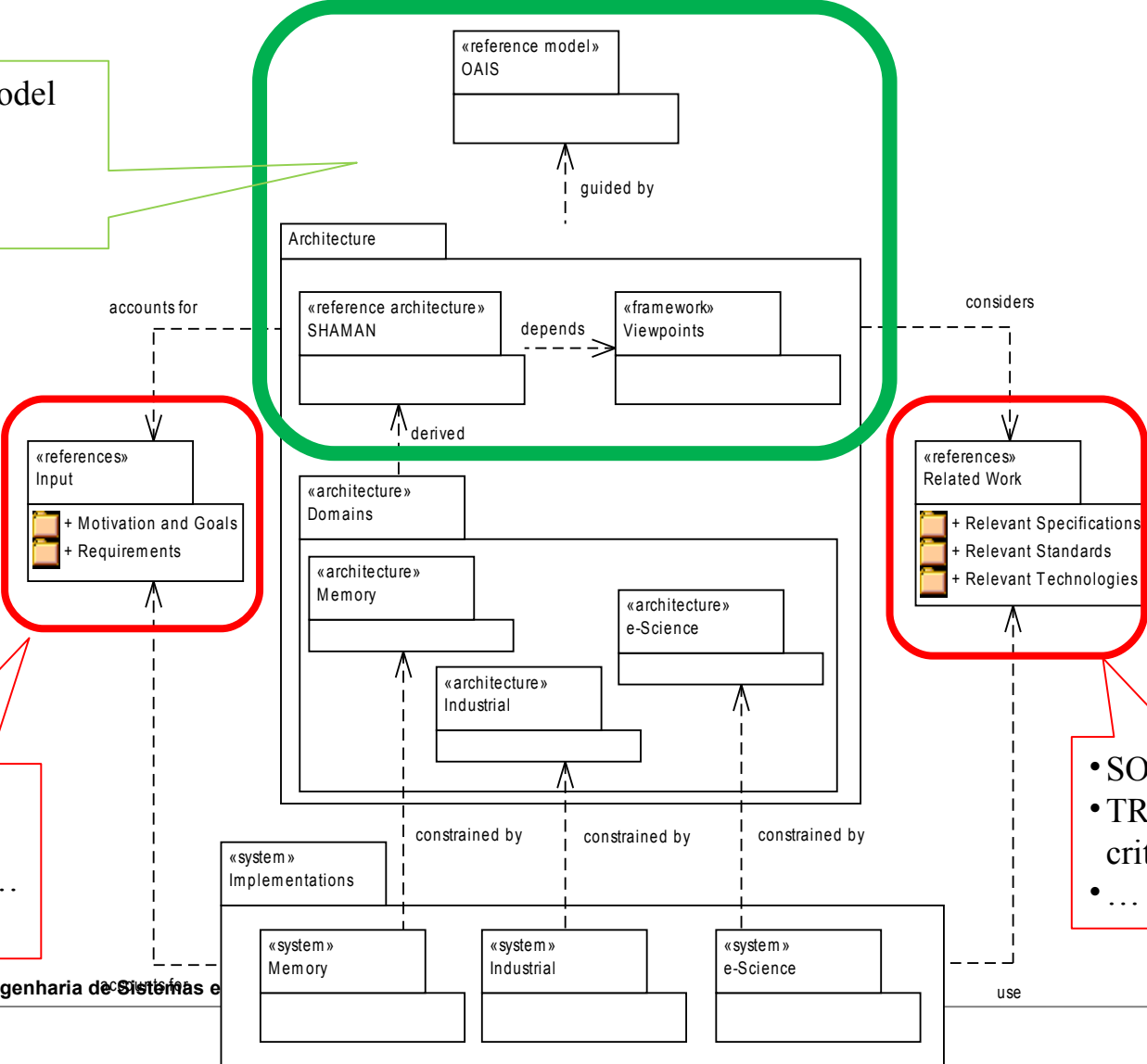
Initial global view (1/2)



SHAMAN RA

Initial global view (22)

Generic focus (a model based on generic requirements and assumptions...).



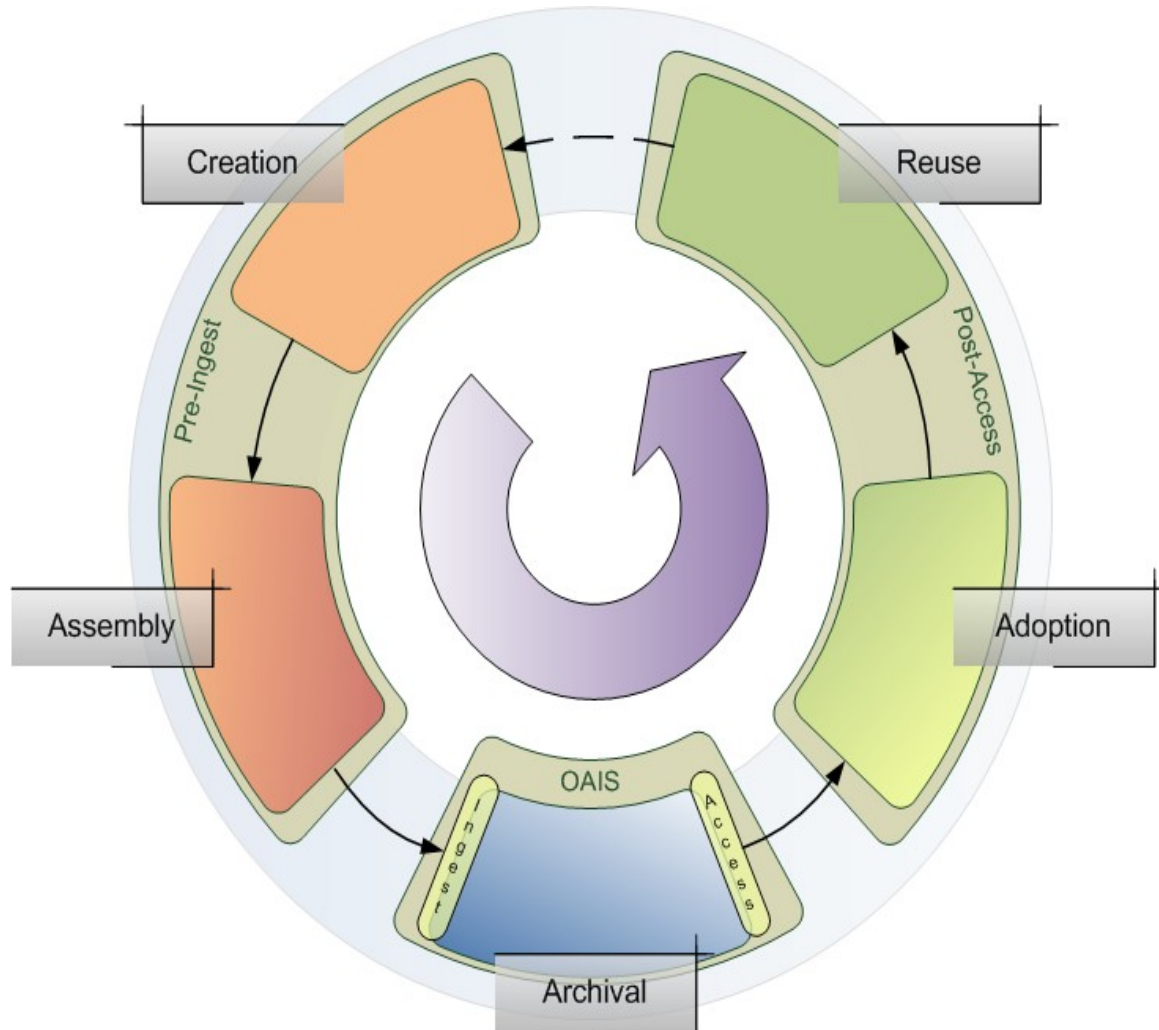
- The SHAMAN DoW
- The initial work...
- ...

- SOA...
- TRAC criteria...
- ...

SHAMAN RA

Information Lifecycle (1/2)

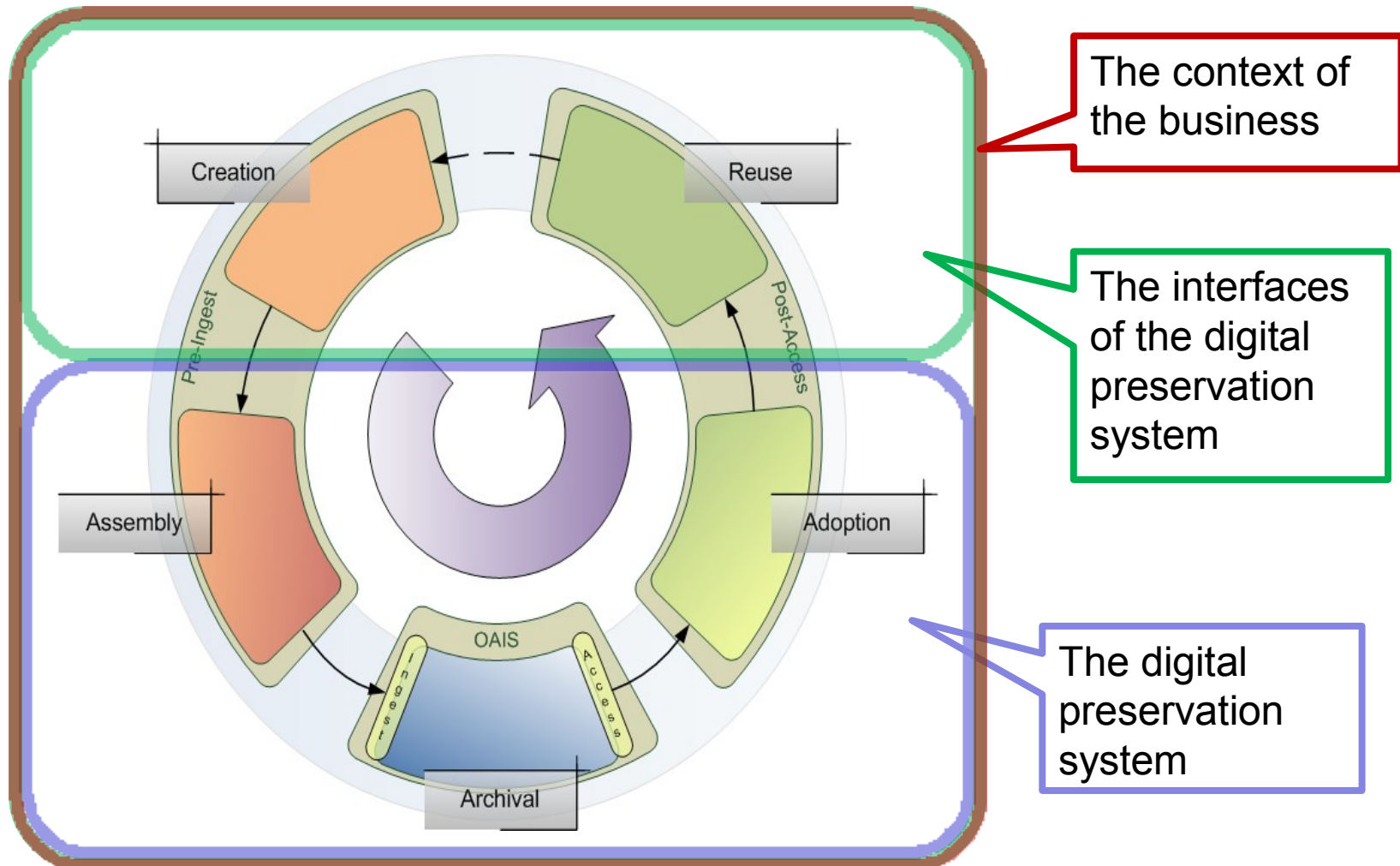
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Information Lifecycle (2/2)

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From the lifecycle context

A taxonomy of vulnerabilities and threats to digital preservation (1/2)

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Vulnerabilities	Process	Software Faults Software Obsolescence
	Data	Media Faults Media Obsolescence
	Infrastructure	Hardware Faults Hardware Obsolescence Communication Faults Network Service Failures
Threats	Disasters	Natural Disasters Human Operational Errors
	Attacks	External Attacks Internal Attacks
	Management	Organizational Failures Economic Failures
	Business Requirements	Legal Requirements Stakeholders' Requirements



From the lifecycle context

A taxonomy of vulnerabilities and threats to digital preservation (2/2)

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Vulnerabilities	Process	Software Faults Software Obsolescence	T T	.	.
	Data	Media Faults Media Obsolescence	T T	.	.
	Infrastructure	Hardware Faults Hardware Obsolescence Communication Faults Network Service Failures	T T T T	.	.
Threats	Disasters	Natural Disasters Human Operational Errors	.	.	C
	Attacks	External Attacks Internal Attacks	t t	o o	C c
	Management	Organizational Failures Economic Failures	.	o o	.
	Business Requirements	Legal Requirements Stakeholders' Requirements	.	.	C C



Technology + Organization + Context = Enterprise Architecture

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The Zachman Framework™

What is The Zachman Framework™? Click for the Official Concise Definition and new graphic: [More info...](#)

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Courses

Our preliminary 2010 course schedule has just been announced! We are finalizing several more for the 2010 season and will post them just as soon as they come available.

These course offerings are part of our Education Services. They are designed to introduce the four Framework™ in order to enable the management, implementation and training in Enterprise Architecture.

More importantly, these courses form the foundation for the education portion of the Zachman Certified™ pro are now requiring applied knowledge of The Zachman Framework™ and legitimate, training certification- with Zachman International. For full details, see our Zachman Certified™ pages.

[Read more...](#)

The Zachman Framework™: The Official Concise Definition

By: John A. Zachman

The Zachman Framework™ is a schema- the intersection between two historical classifications that have thousands of years. The first is the fundamentals of communication found in the primitive interrogatives: What, Where, and Why. It is the integration of answers to these questions that enables the comprehensive, compound ideas. The second is derived from reflection, the transformation of an abstract idea into an instantiation that we ancient Greek philosophers and is labeled in The Zachman Framework™: Identification, Definition, Represent Configuration and Instantiation.

[Read more...](#)

The Zachman Framework™ Evolution

The Zachman Framework™ Evolution

By: John P. Zachman
April 2009

The Zachman Framework™ has evolved over time. While the fundamental concepts have not changed graphical representation in addition to more precise language embody what The Framework has become today its historical evolution...

[Read more...](#)

"If you want to synthesize your professional experiences... If you want to expand your understanding of Enterprise Architecture... If you want to interact with others who think and talk like you do, and learn from the very best, then the Zachman International courses are for you!"

-Michelle Pooler
Zachman Certified™...
Enterprise Architect
Mount Vernon Data Systems

Latest News

Courses

Yes, "Enterprise Architecture is Relative" BUT it is not Arbitrary

Popular

The Zachman eBook Order Instructions

The Zachman Framework™: The Official Concise Definition

THE ZACHMAN ENTERPRISE FRAMEWORK²™

	WHAT	HOW	WHERE	WHO	WHEN	WHY	
SCOPE CONTEXTS	Inventory Identification +2 Inventory Types	Process Identification +2 Process Types	Network Identification +2 Network Types	Organization Identification +2 Organization Types	Timing Identification +2 Timing Types	Motivation Identification +2 Motivation Types	STRATEGISTS AS THEORISTS
BUSINESS CONCEPTS	Inventory Definition +2 Business Entity Business Relationship	Process Definition +2 Business Transform Business Input	Network Definition +2 Business Location Business Connection	Organization Definition +2 Business Role Business Work	Timing Definition +2 Business Cycle Business Moment	Motivation Definition +2 Business End Business Means	EXECUTIVE LEADERS AS OWNERS
SYSTEM LOGIC	Inventory Representation +2 System Entity System Relationship	Process Representation +2 System Transform System Input	Network Representation +2 System Location System Connection	Organization Representation +2 System Role System Work	Timing Representation +2 System Cycle System Moment	Motivation Representation +2 System End System Means	ARCHITECTS AS DESIGNERS
TECHNOLOGY PHYSICS	Inventory Specification +2 Technology Entity Technology Relationship	Process Specification +2 Technology Transform Technology Input	Network Specification +2 Technology Location Technology Connection	Organization Specification +2 Technology Role Technology Work	Timing Specification +2 Technology Cycle Technology Moment	Motivation Specification +2 Technology End Technology Means	ENGINEERS AS BUILDERS
COMPONENT ASSEMBLIES	Inventory Configuration +2 Component Entity Component Relationship	Process Configuration +2 Component Transform Component Input	Network Configuration +2 Component Location Component Connection	Organization Configuration +2 Component Role Component Work	Timing Configuration +2 Component Cycle Component Moment	Motivation Configuration +2 Component End Component Means	TECHNICIANS AS IMPLEMENTERS
OPERATIONS INSTANCE CLASSES	Inventory Instantiation +2 Operations Entity Operations Relationship	Process Instantiation +2 Operations Transform Operations Input	Network Instantiation +2 Operations Location Operations Connection	Organization Instantiation +2 Operations Role Operations Work	Timing Instantiation +2 Operations Cycle Operations Moment	Motivation Instantiation +2 Operations End Operations Means	WORKERS AS PARTICIPANTS
	INVENTORY SETS	PROCESS TRANSFORMATIONS	NETWORK NODES	ORGANIZATION GROUPS	TIMING PERIODS	MOTIVATION REASONS	Narrative Projection on Version 2.01

Released October 2008

http://www.zachmaninternational.com/index.php/the-zachman-framework

“The Zachman Framework is not a methodology for creating the implementation (an instantiation) of the object. The Zachman Framework is the ontology for describing the Enterprise. The Framework (ontology) is a STRUCTURE whereas a methodology is a PROCESS. “

The Zachman Framework

What is The Zachman Framework™? Click for the Concise Definition and new graphic.
[More info.](#)

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"If you want to synthesize your professional experiences...
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Released October 2008	INVENTORY SETS	PROCESS TRANSFORMATIONS	NETWORK NODES	ORGANIZATION GROUPS	TIMING PERIODS	MOTIVATION REASONS	Motivative Projection or Version 2.0†

TOGAF - The Open Group Framework

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About TOGAF™

TOGAF is an industry standard architecture framework that may be used freely by any organization wishing to develop an information systems architecture for use within that organization.

TOGAF has been developed and continuously evolved since the mid-90's by representatives of some of the world's leading IT customer and vendor organizations, working in The Open Group's Architecture Forum. Details of the Forum, and its plans for evolving TOGAF in the current year, are given on the [Architecture Forum](#) web site.

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About TOGAF Version 9 Enterprise Edition

TOGAF Version 9 Enterprise Edition ("TOGAF 9" for short) is a detailed method and set of supporting resources for developing an Enterprise Architecture. Developed and endorsed by the membership of The Open Group's [Architecture Forum](#), TOGAF 9 represents an industry consensus framework and method for Enterprise Architecture that is available for use internally by any organization around the world - members and non-members of The Open Group alike - subject to license conditions - see [Downloading TOGAF 9](#)

As a comprehensive, open method for Enterprise Architecture, TOGAF 9 complements, and can be used in conjunction with, other frameworks that are more focused on specific aspects of architecture or for vertical sectors such as Government, Defense, and Finance.

Learn more about TOGAF 9 from the following white papers:

- TOGAF Version 9: Introduction
- TOGAF Version 9: Migration Overview

[→ visit the TOGAF\(tm\) information site](#)

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TOGAF Version 9: Migration Overview

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About TOGAF Certification

Certification from The Open Group

Certification from The Open Group provides customers with assurance that products and services conform to open standards. This assurance enables market growth, and benefits both customers and vendors alike.

In the Architecture field, The Open Group has added the **TOGAF 9 certification program**. The purpose of TOGAF certification in order to ensure the consistent application and usage of TOGAF throughout the industry, and so protect the value of TOGAF to its users.

An [introduction](#) to the TOGAF 9 certification program is available on the TOGAF 9 certification web site.

Why is TOGAF Certification Important?

IT customer organizations who wish to base their enterprise architecture work on the open, industry standard of TOGAF, will be able to procure tools, training, and professional services on the basis of certified conformance with the TOGAF standards.

The existence of a certification program for TOGAF provides an even stronger incentive for organizations (both private and public sector) to standardize on this open method for Enterprise Architecture, and so avoid lock-in to proprietary methods.

It is an important step in making Enterprise Architecture a well-recognized discipline, and in introducing rigor into the procurement of tools and services for Enterprise Architecture.

Find out more:

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- Upgrading from TOGAF 8 to TOGAF 9 Certification

Why Become Certified?

For architecture service providers and tools vendors, the new certification program provides a way to demonstrate clearly how their services and products support the Enterprise Architect using TOGAF .

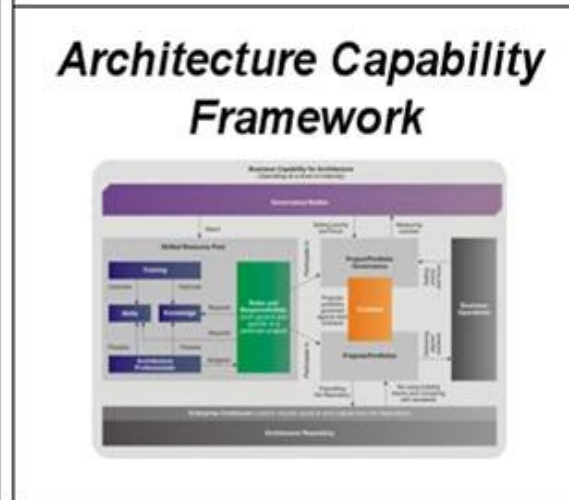
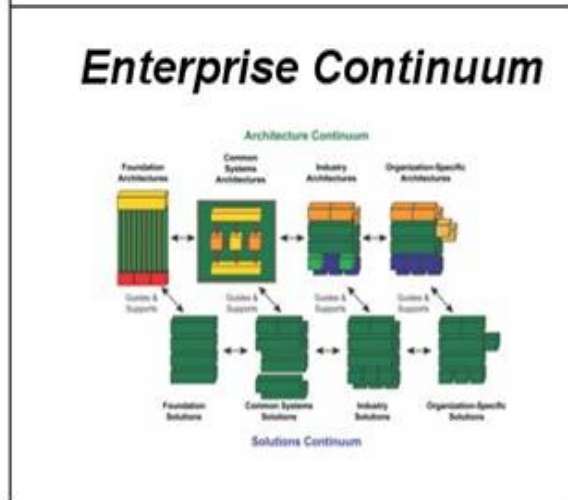
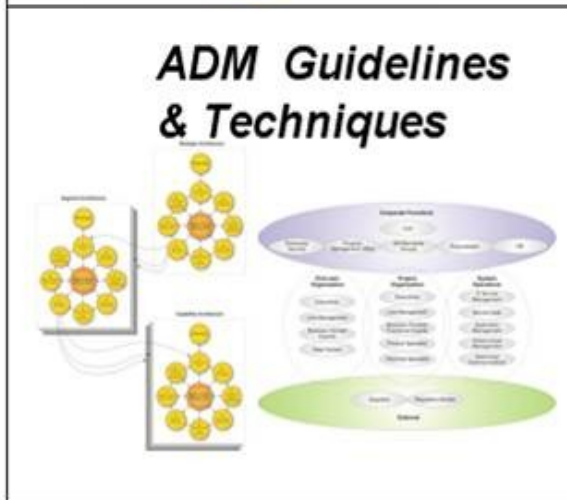
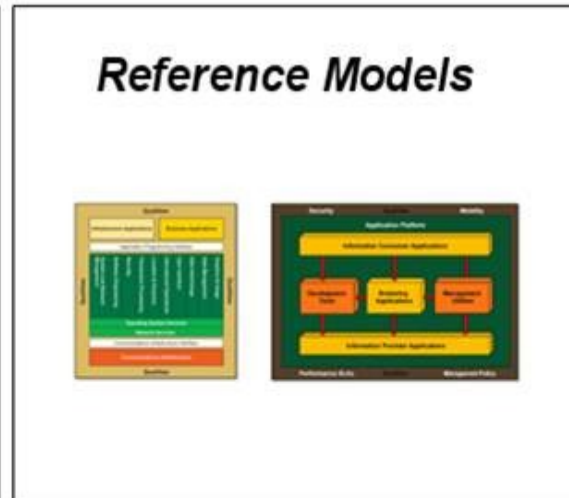
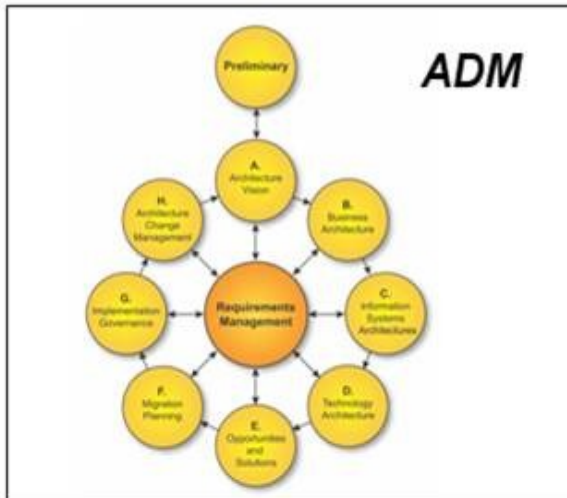
For individual Enterprise Architects, TOGAF certification demonstrates clearly to employers and peers their commitment to their profession as a discipline. In particular, it demonstrates that they possess a body of core knowledge about TOGAF as an open, industry standard framework and method for Enterprise Architecture.

The Open Group publishes the definitive register of TOGAF certified individuals, and certified service and product offerings, and issues certificates that can be used by vendors in promotion.

How to Become Certified for TOGAF 9?

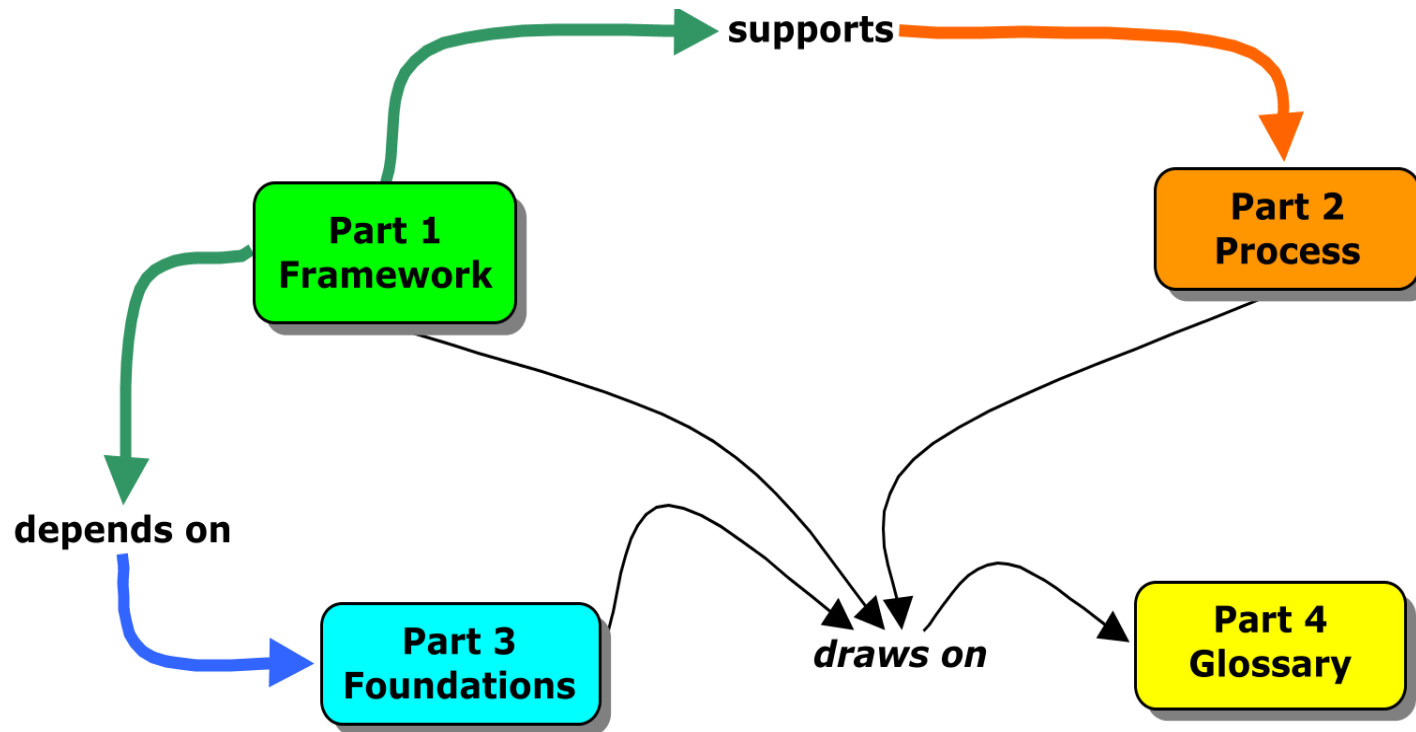
You can choose how to prepare for the TOGAF 9 certification examinations, whether that is by self-study, mentoring or attending a training course. The Open Group recommends attendance at an Accredited TOGAF Training course.

- View the register of Accredited TOGAF 9 Training Course Providers



The SHAMAN Reference Architecture

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The SHAMAN Reference Architecture

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he SHAMAN Reference Architecture Part 1 – Framework, which describes the architectural framework and respective viewpoints;

he SHAMAN Reference Architecture Part 2 – Process, which describes the process for the development of preservation architectures derived from the Reference Architecture;

he SHAMAN Reference Architecture Part 3 – Foundations, which describes the foundations of this work and provides references for the instantiation of concrete architectures;

he SHAMAN Reference Architecture Part 4 – Glossary, which contains definitions for the main terms used in this Reference Architecture.



Viewpoint Framework

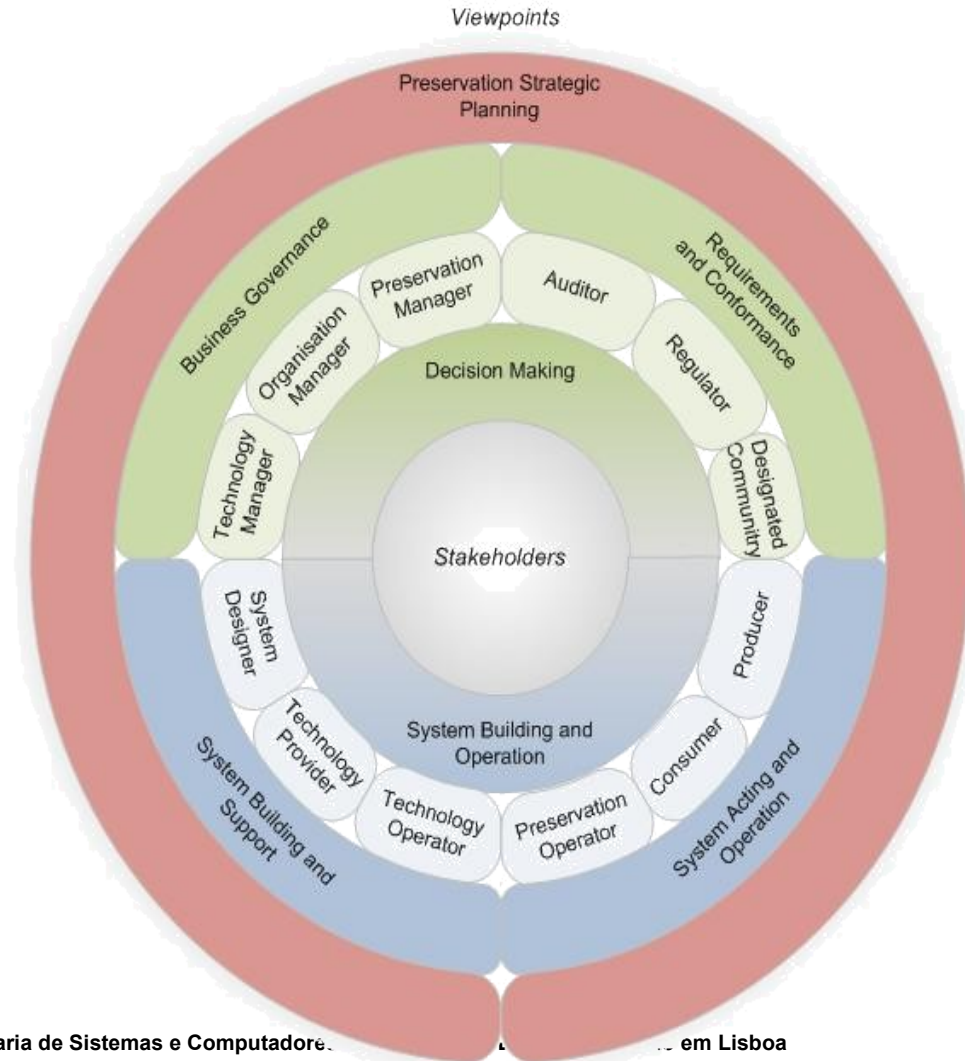
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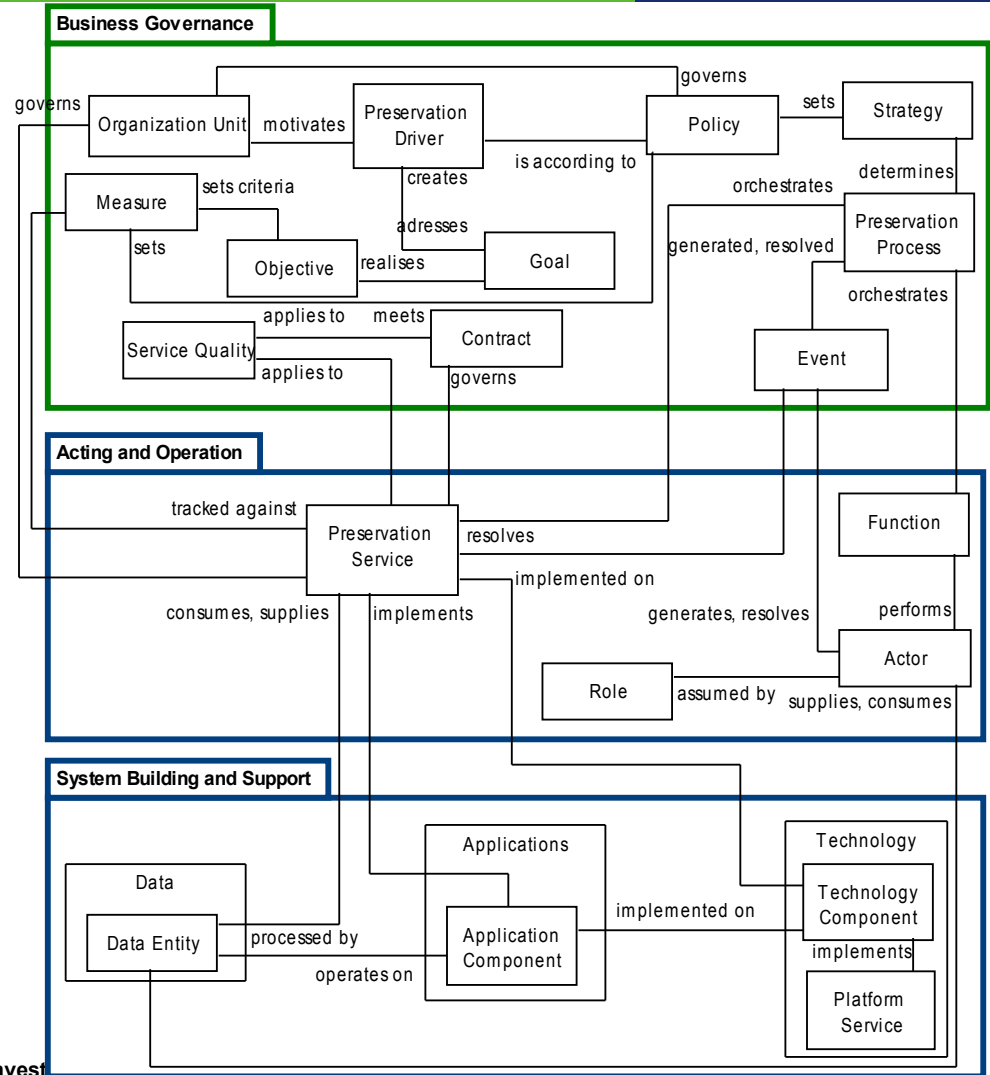
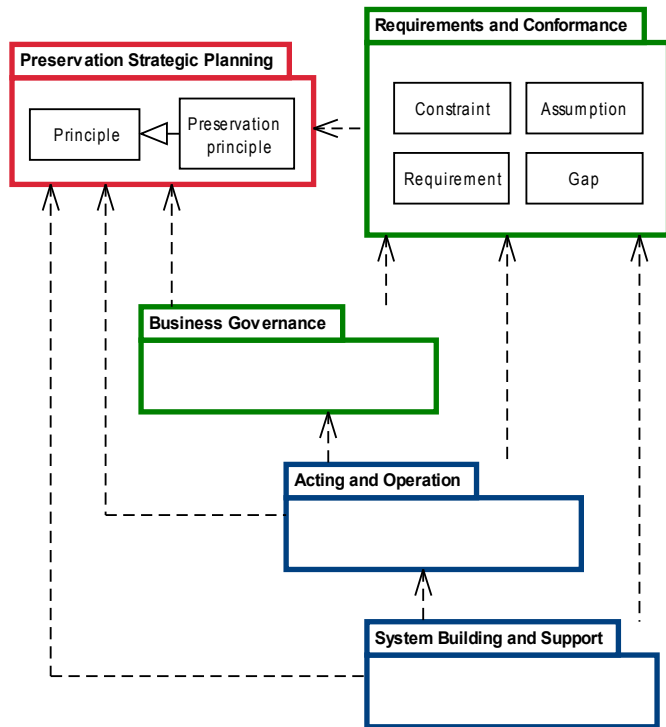
Stakeholders	Decision Making	Designated Community	Requirements and Conformance	Viewpoints
		Regulator		
		Auditor		
		Preservation Manager	Business Governance	
		Organization Manager		
		Technology Manager		
	System Building and Operation	System Designer	System Building and Support	
		Technology Provider		
		Technology Operator		
		Preservation Operator	Acting and Operation	
Producer				
Consumer				
		Preservation Strategic Planning		



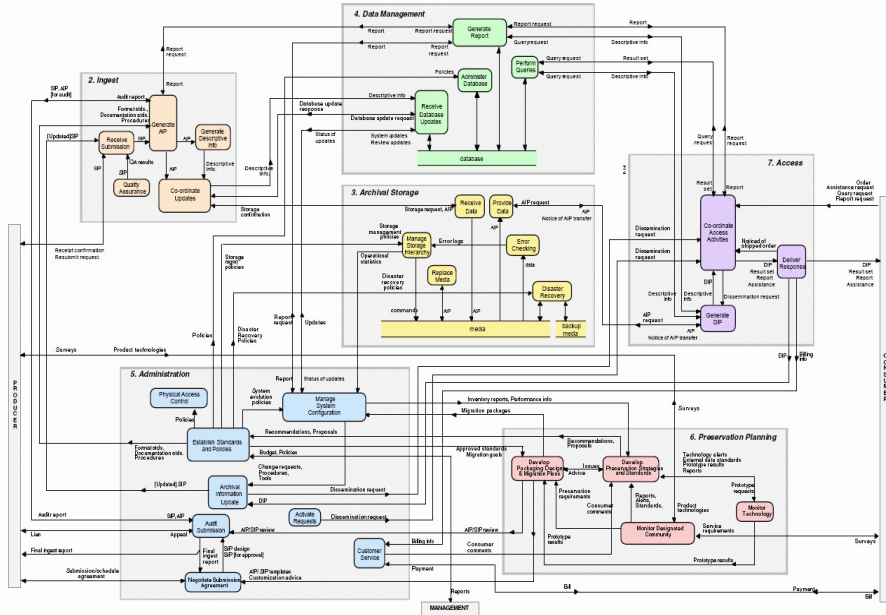
Structural View



Architectural Meta-model

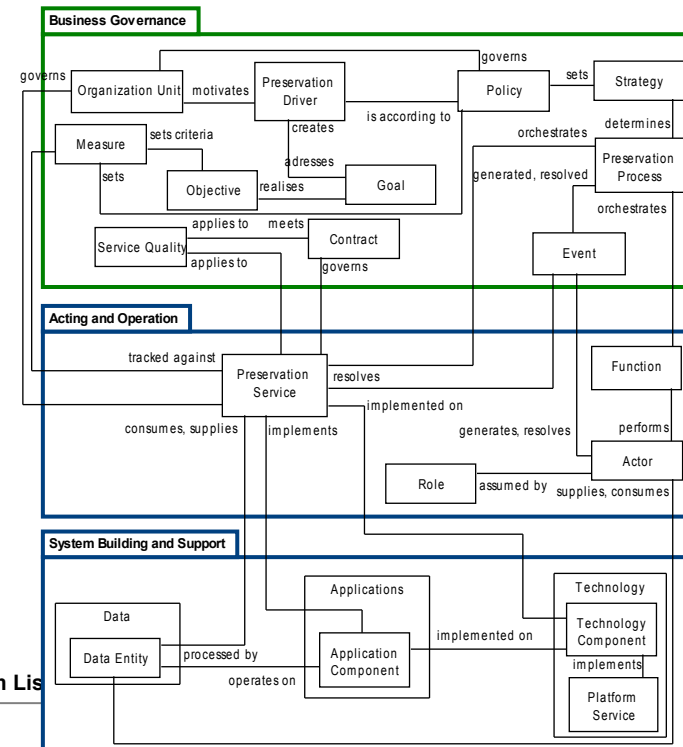
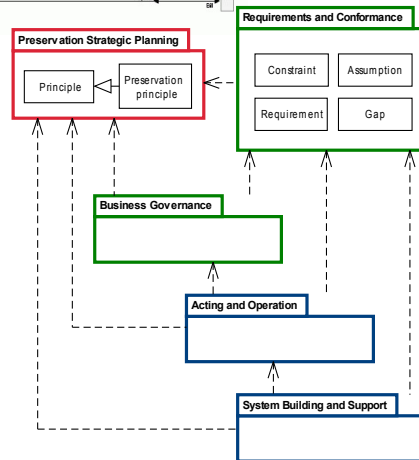


Moving beyond

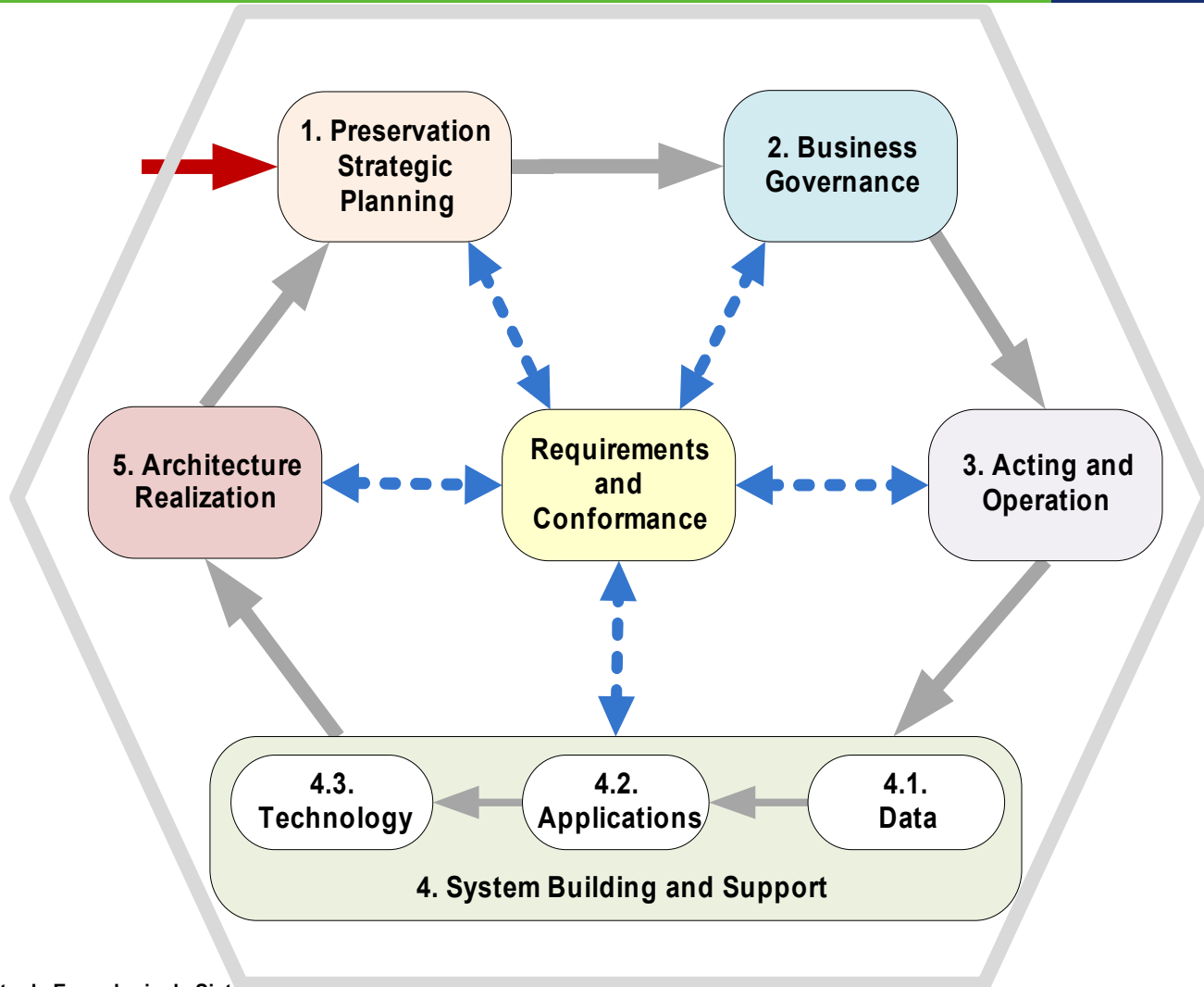


...moving from an informal way of expressing (OAIS Reference Model Figure F-1: Composite of Functional Entities)...

... to a more appropriately formal, traceable and objectively represented meta-model...



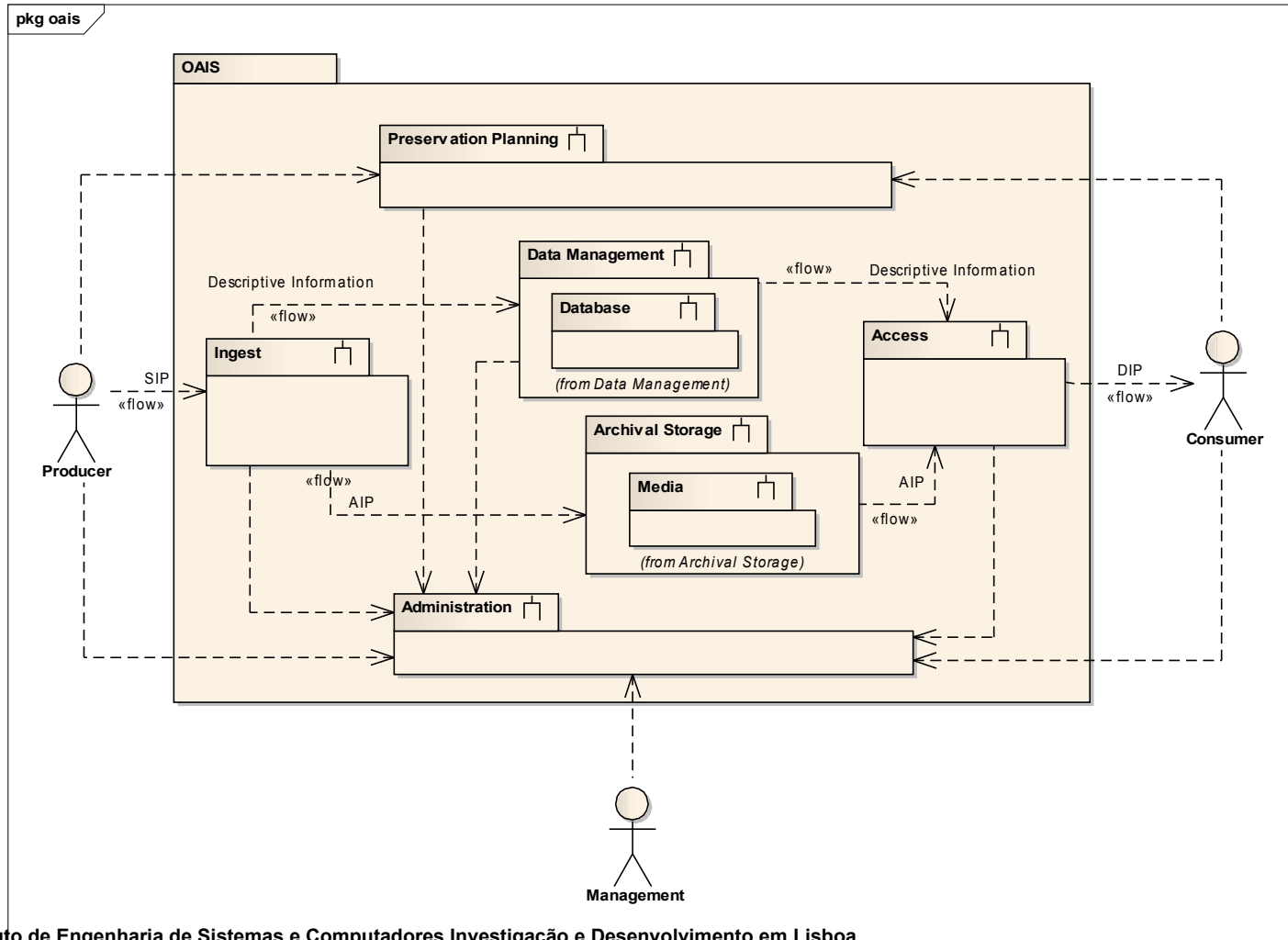
The process



Modelling examples (1/4)

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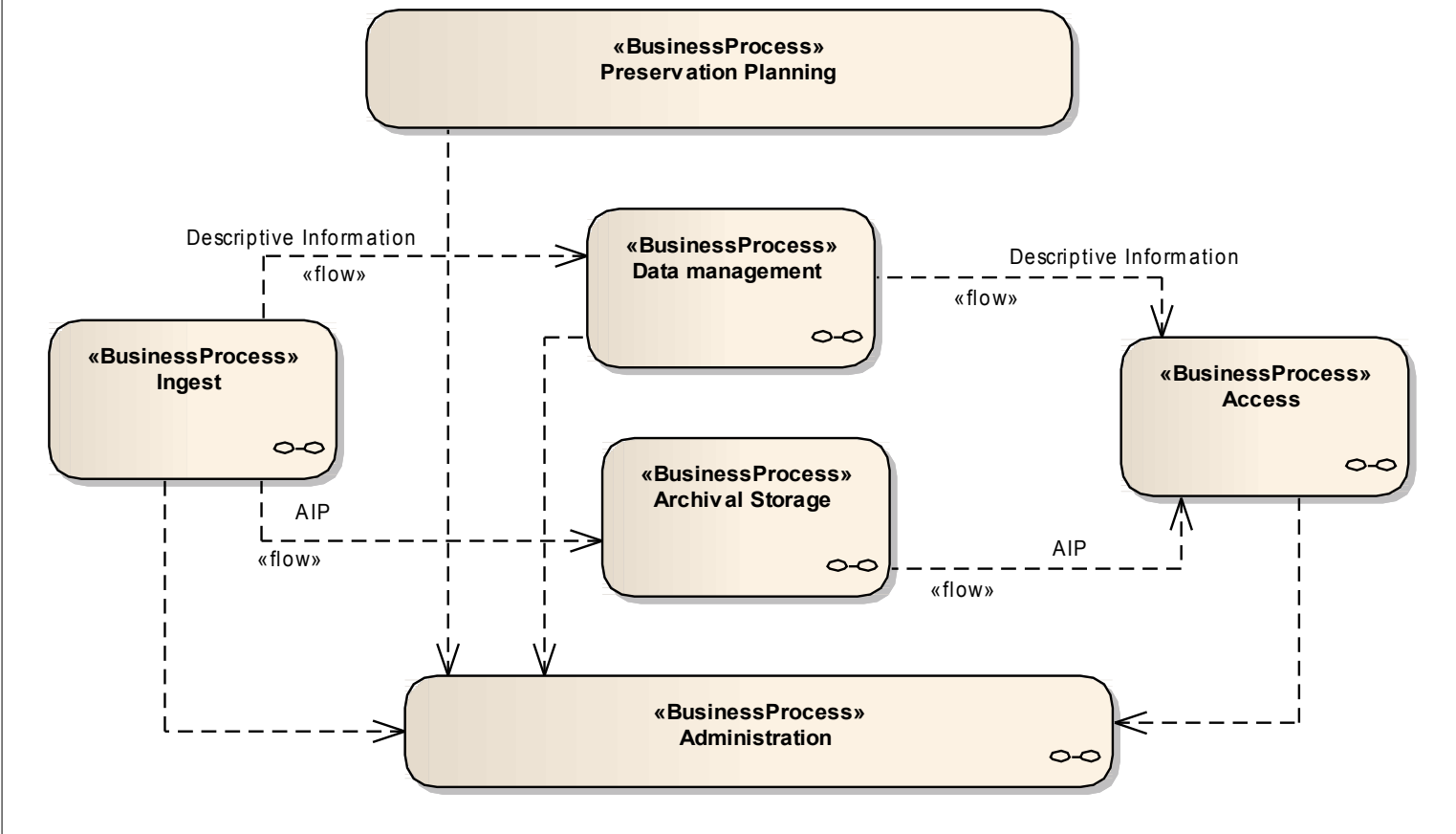


Modelling examples (2/4)

BPMN

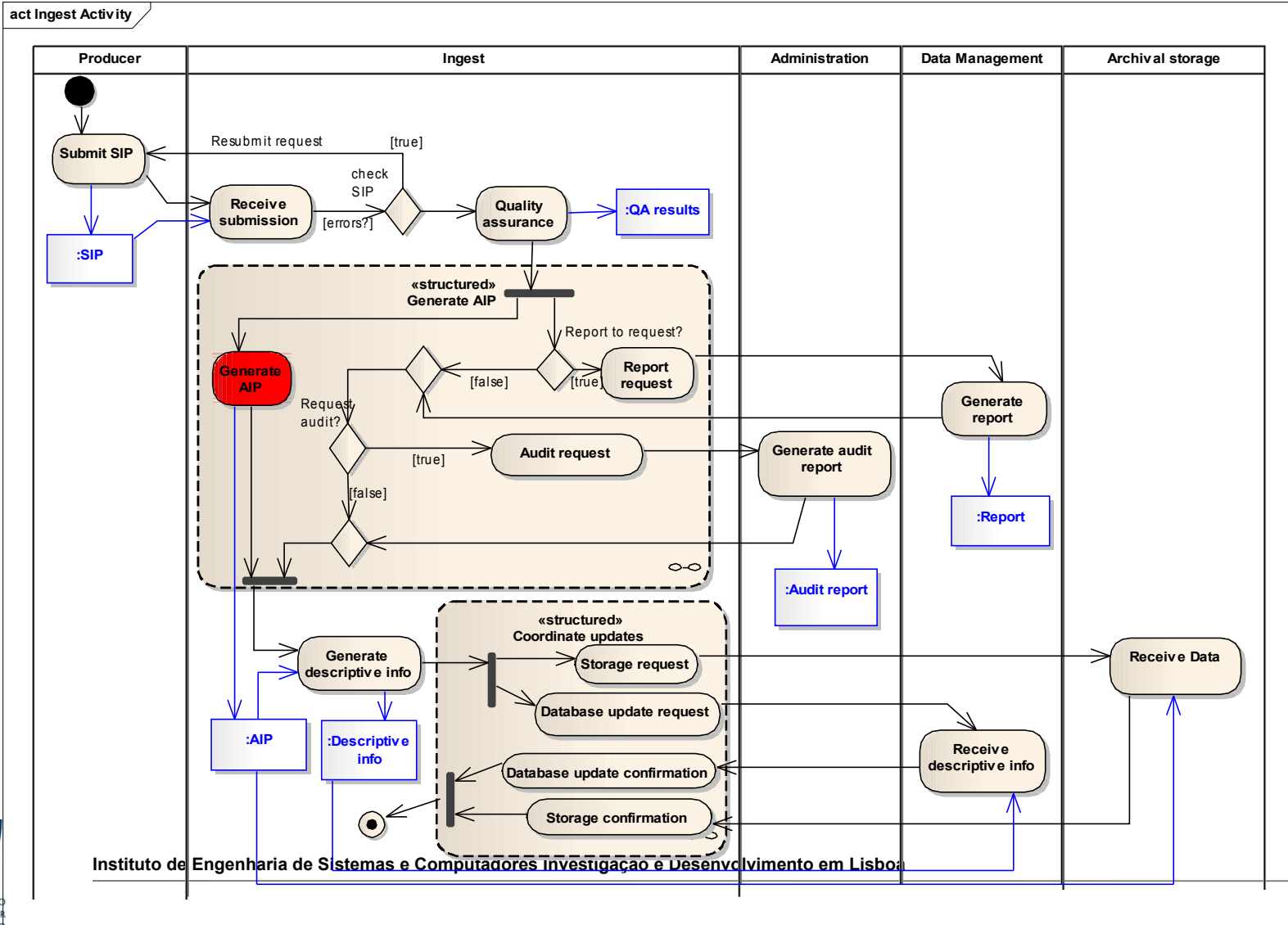


BPMN OAIS Core BP



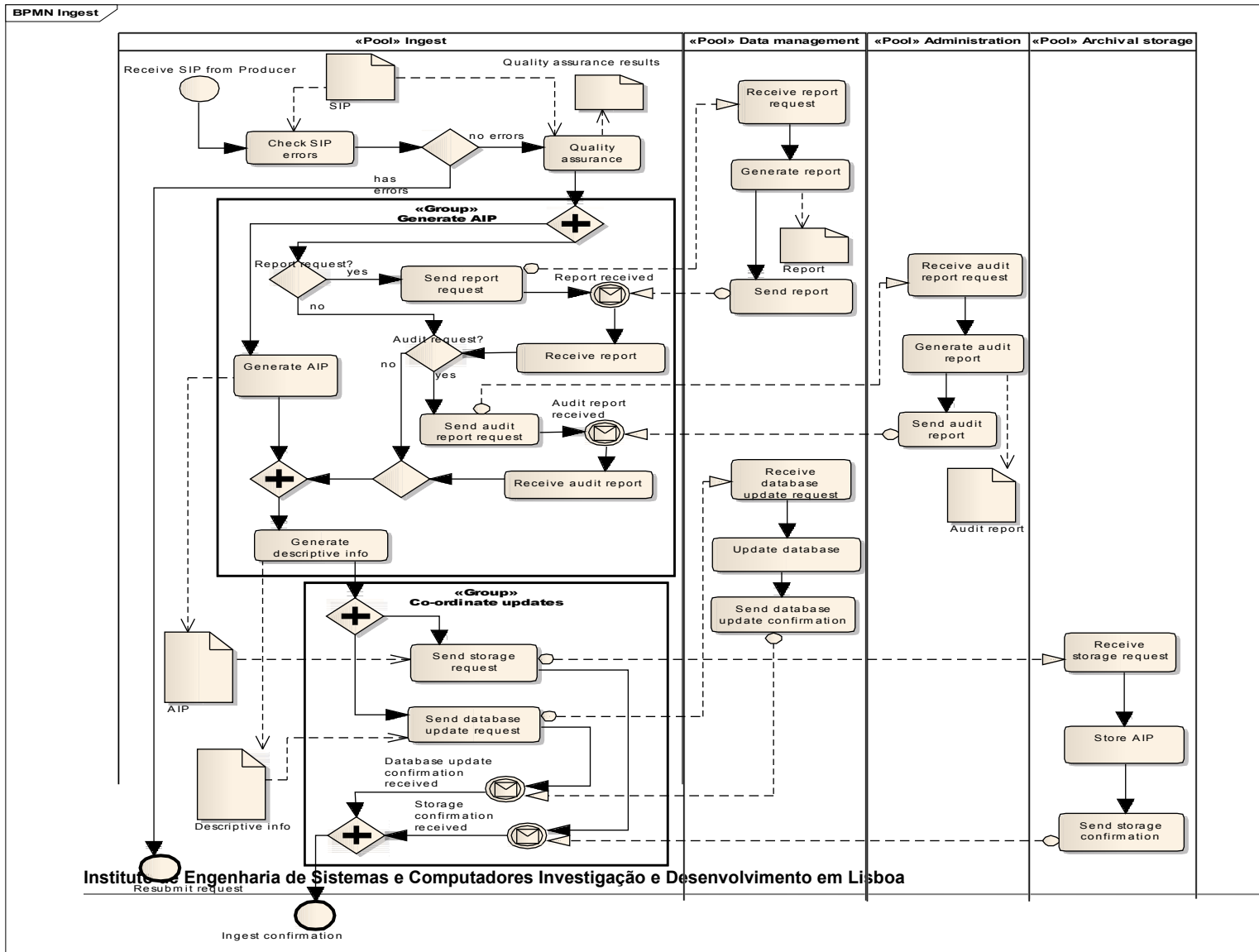
Modelling examples (1/4)

UML



Modelling examples (4/4)

BPMN



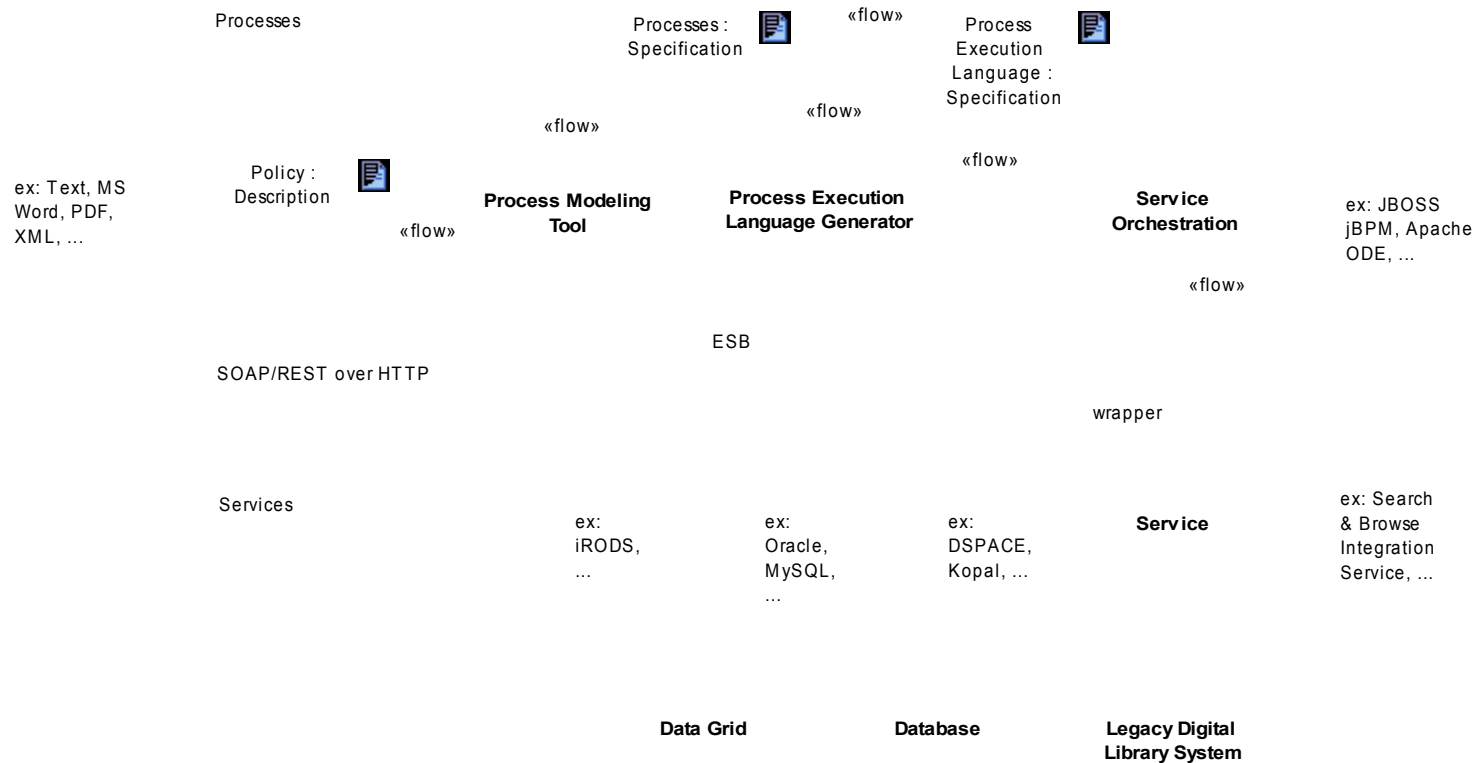
Deployment example



ex: Enterprise Architect, Eclipse BPMN, XML Editor, Text Editor...

ex: BPMN, AGWL, UML Activity Diagrams, Petri net, DAG...

ex: BPEL, C-GWL, jPDL, ...





- Digital preservation is a very complex problem!!!
Therefore:
 - We surveyed the main requirements to digital preservation and classified the threats and vulnerabilities that might endanger preservation using a taxonomy of threats and vulnerabilities.
 - We propose the alignment of OAIS with the Enterprise Architecture
 - We propose a process “inspired” by TOGAF to develop create preservation architectures.





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José Borbinha – jlb@ist.utl.pt



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