Introduction to IT Architecture

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Architectural Thinking

Think about the following questions on IT Architecture and the IT Architect's role

- What is definition of IT Architecture?
- Why is IT Architecture important? Why do projects need it?
- What is the role of the IT Architect?
- Who is responsible for the solution's architecture in a project?
- Who is responsible for the architectural documentation in a project?
- What is Architectural Thinking?

Who is Architect and What is Architecture

An architect is a person trained to **plan** and **design** buildings, and **oversee** their construction. To practice architecture means to provide services in connection with the design and construction of buildings and the **space within the site surrounding the buildings**, that have as their **principal purpose human occupancy** or use.

Architecture is both the **process and product** of planning, designing and construction.

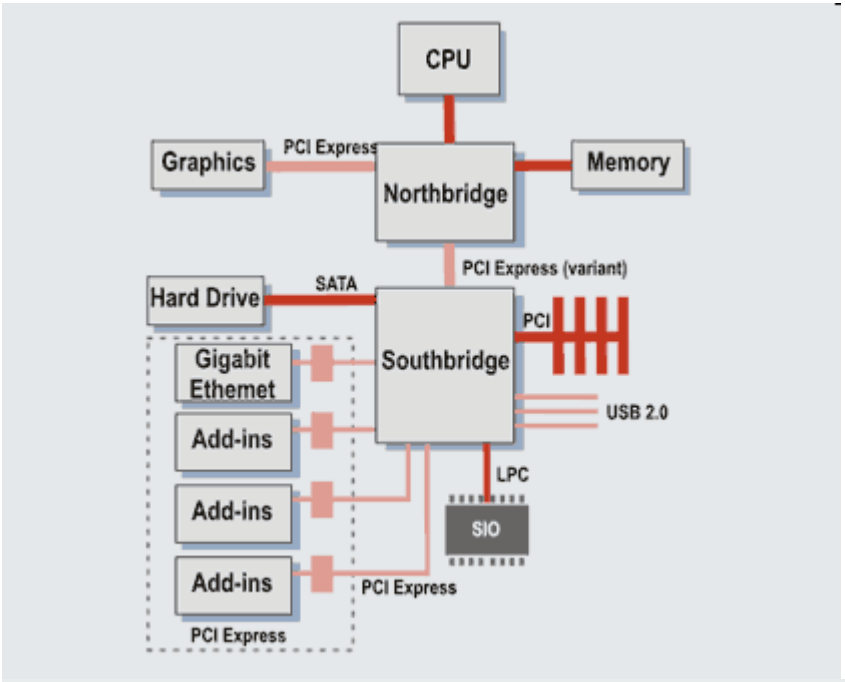
Wikipedia Dictionary

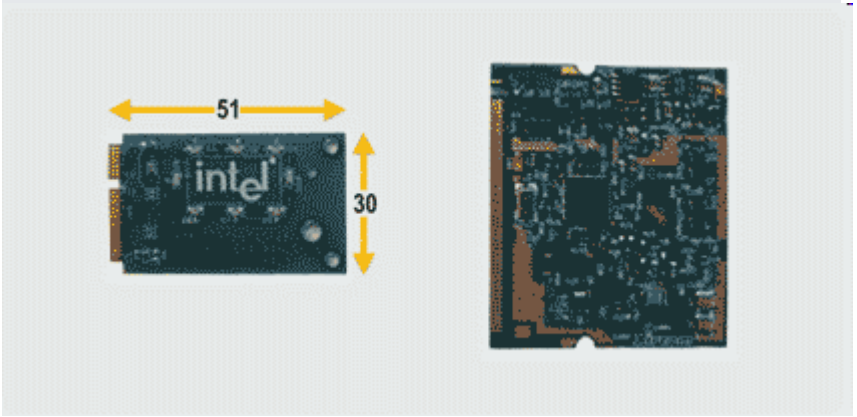
What is an IT Architecture

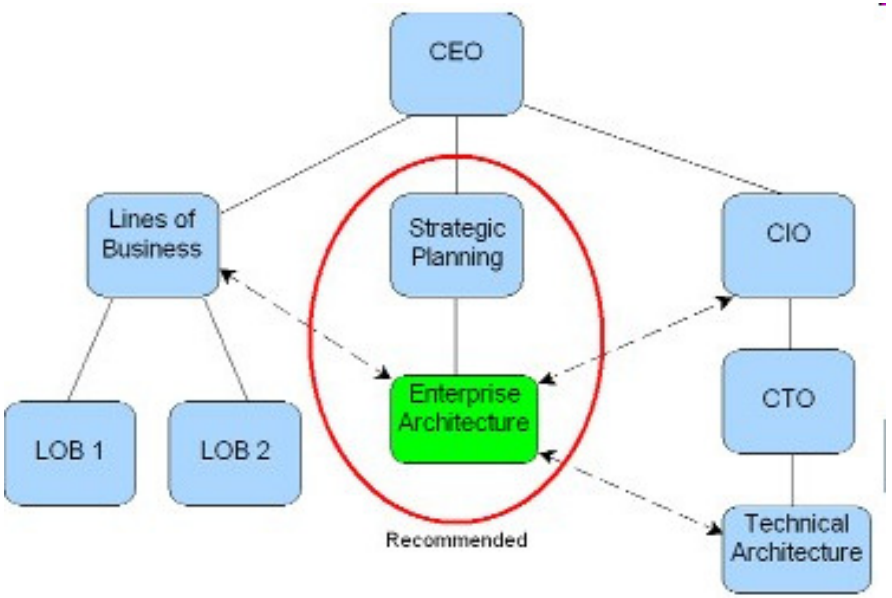
IT Architecture defines the hardware and software structures of an IT **System** solution

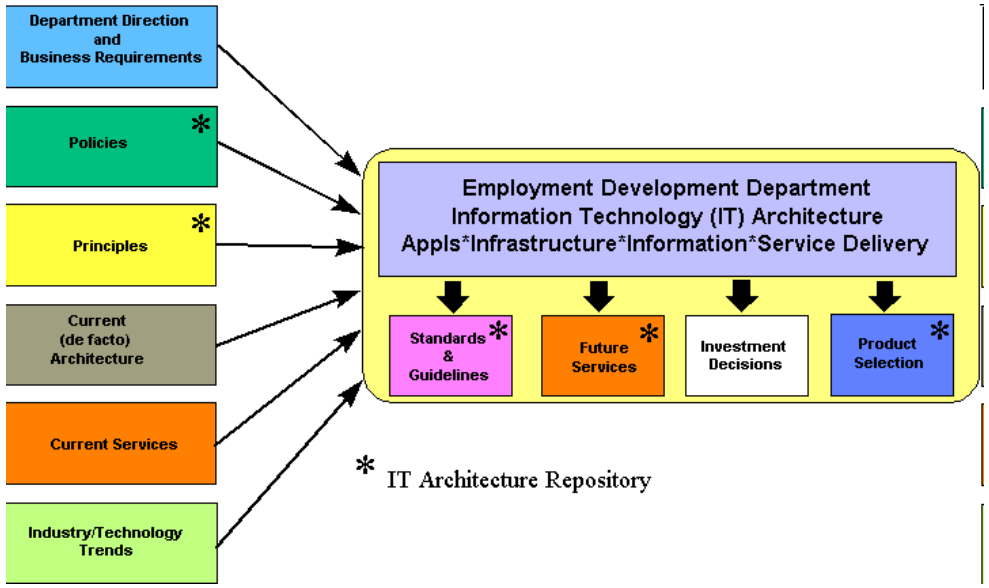
- The components that will be reused, developed or purchased
- The externally visible properties of those components
- The relationships among components
  - Placement of components on nodes
  - Distribution geographically
  - Network connections and topology
  - How will they be managed
- How the components interact
  - Operational signatures
  - Interfaces
  - Protocols

Levels of IT architecture



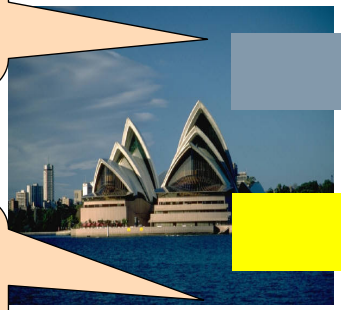




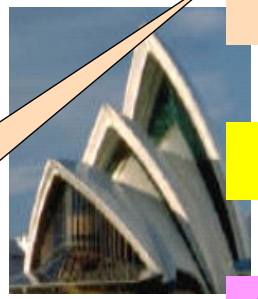


Architecture provides a context and guidance, keeping everyone “on the same road”...

Enterprise Architecture



Application Architecture



Solution Architecture

Strategy

Architecture

Development Program

Architecture

Project

P

P

Architecture

Design

Design

D

D

Technology Architecture

Infra. Proj

Arch

D

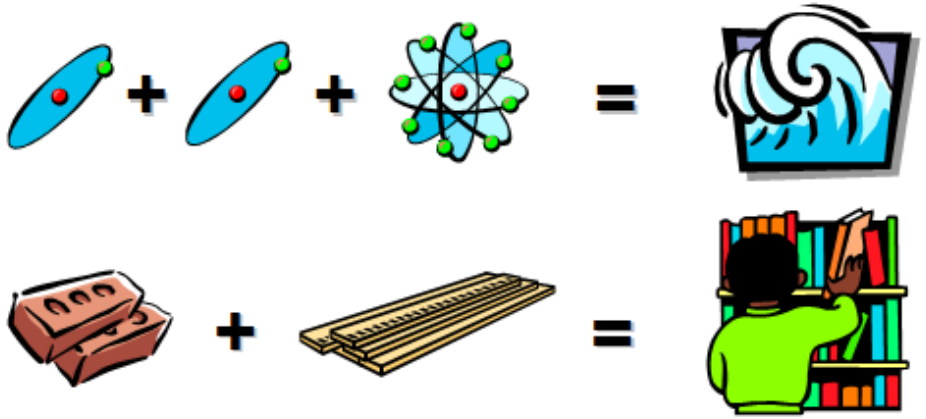
D

D

Architectural thinking and Systems thinking...

"A system is an entity which maintains its existence through the mutual **interaction of its parts**." Austrian biologist Ludwig von Bertalanffy

Key concept is emergence (the whole is greater than the sum of its parts)

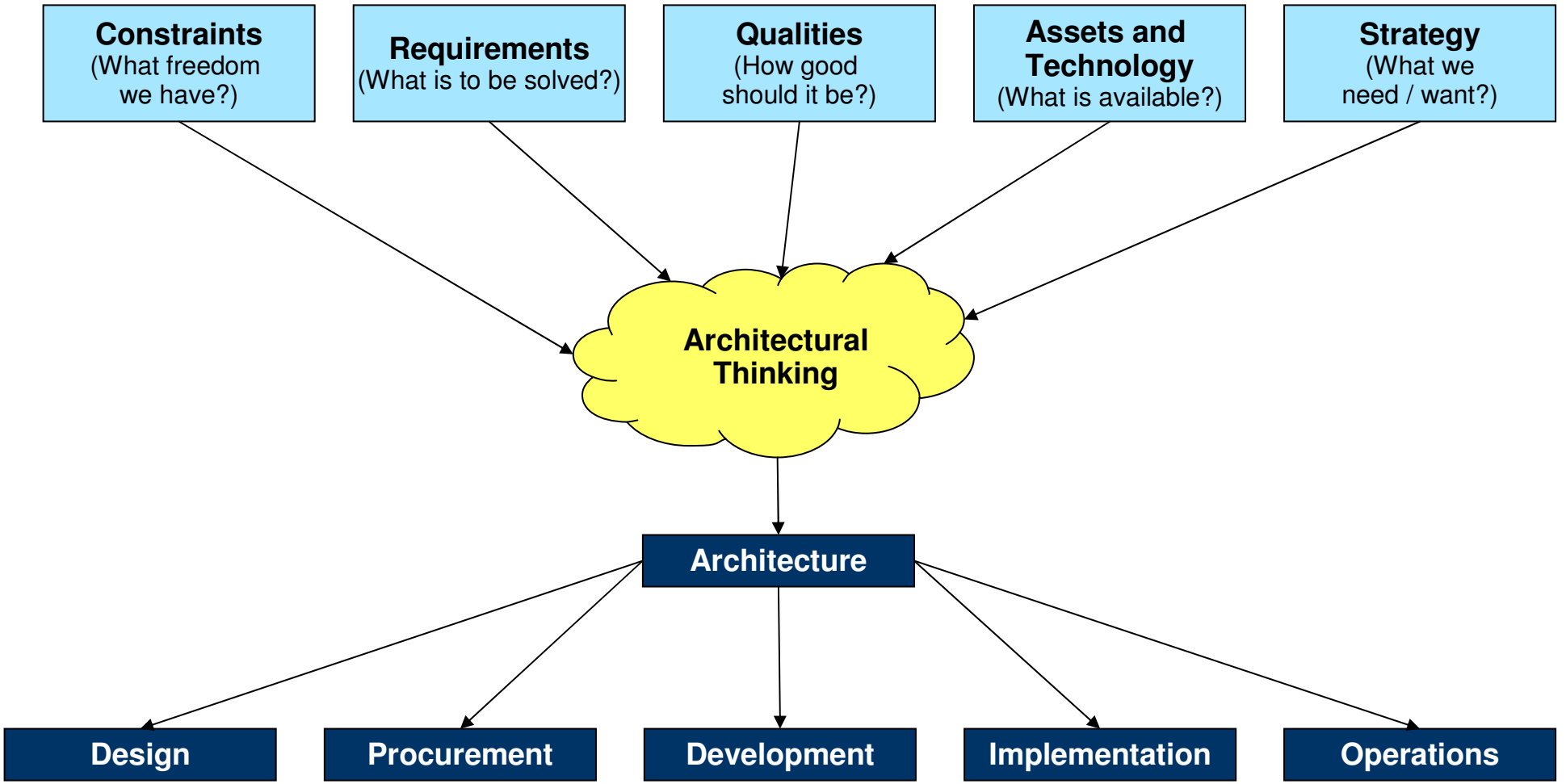


Note that a system exhibits properties that are not available in any of its parts.

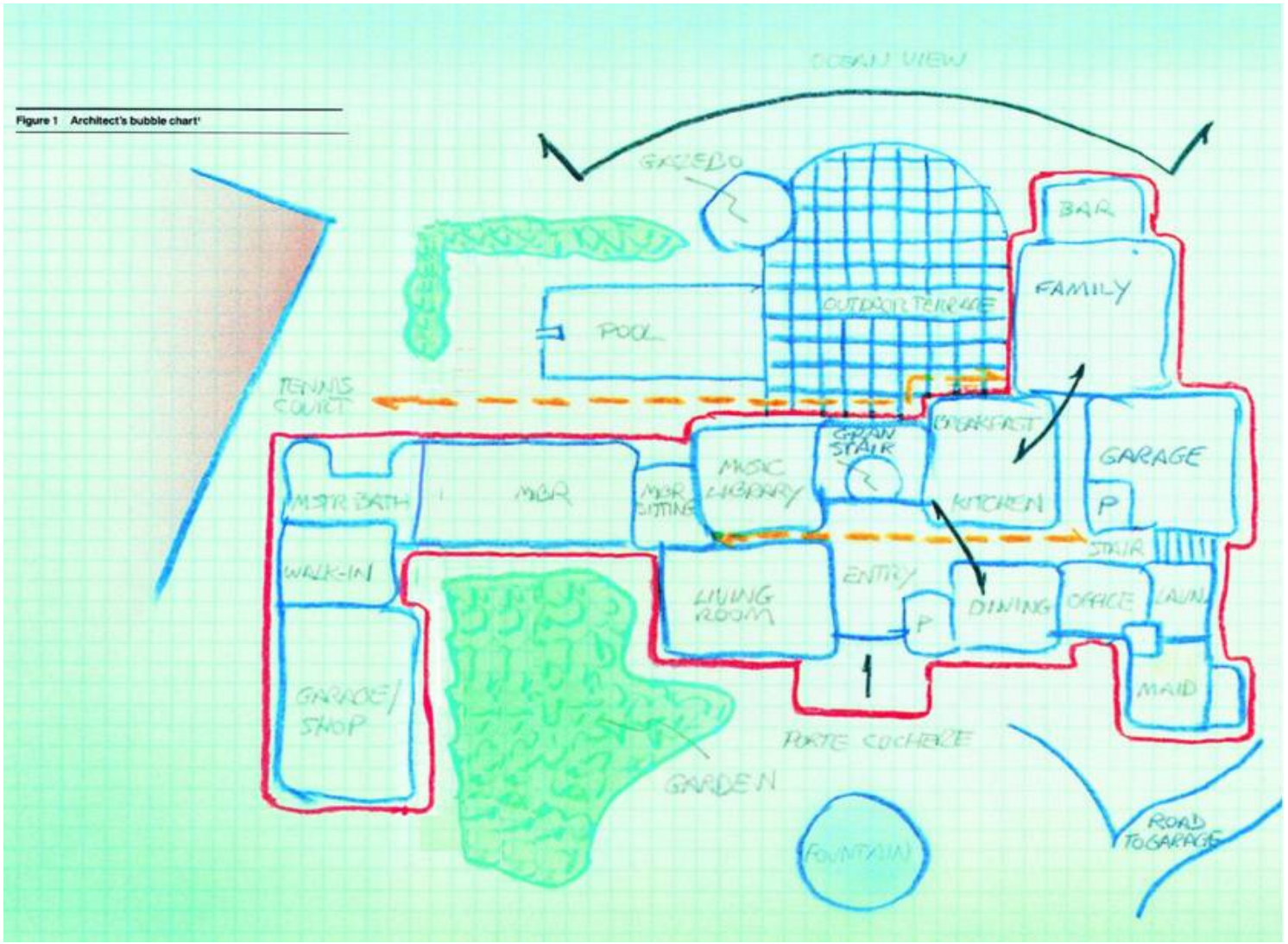
Architectural Thinking builds on Systems Thinking by using a structured approach to deliver results

Architectural Thinking ...

.. depends on the viewpoint and context to represent the architecture.
.. involves looking at the inputs, thinking process, and outputs.

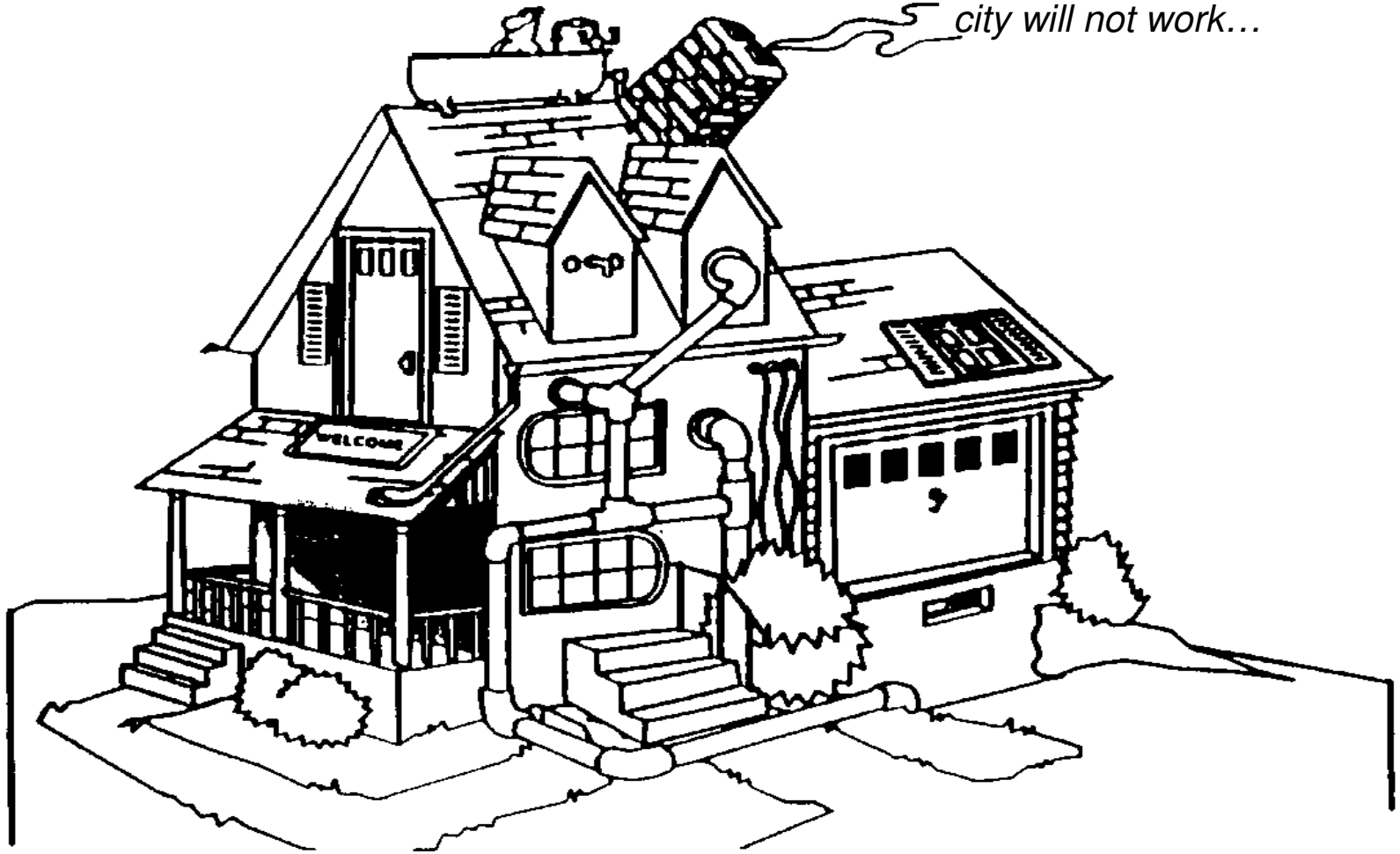


Architecture's all about creating and communicating good structure and behavior…



… with the intent of avoiding chaos…

… even if an individual house is well architected, if each house is different (e.g. different electricity voltage, water pressure) then the city will not work…



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Enterprise Architecture

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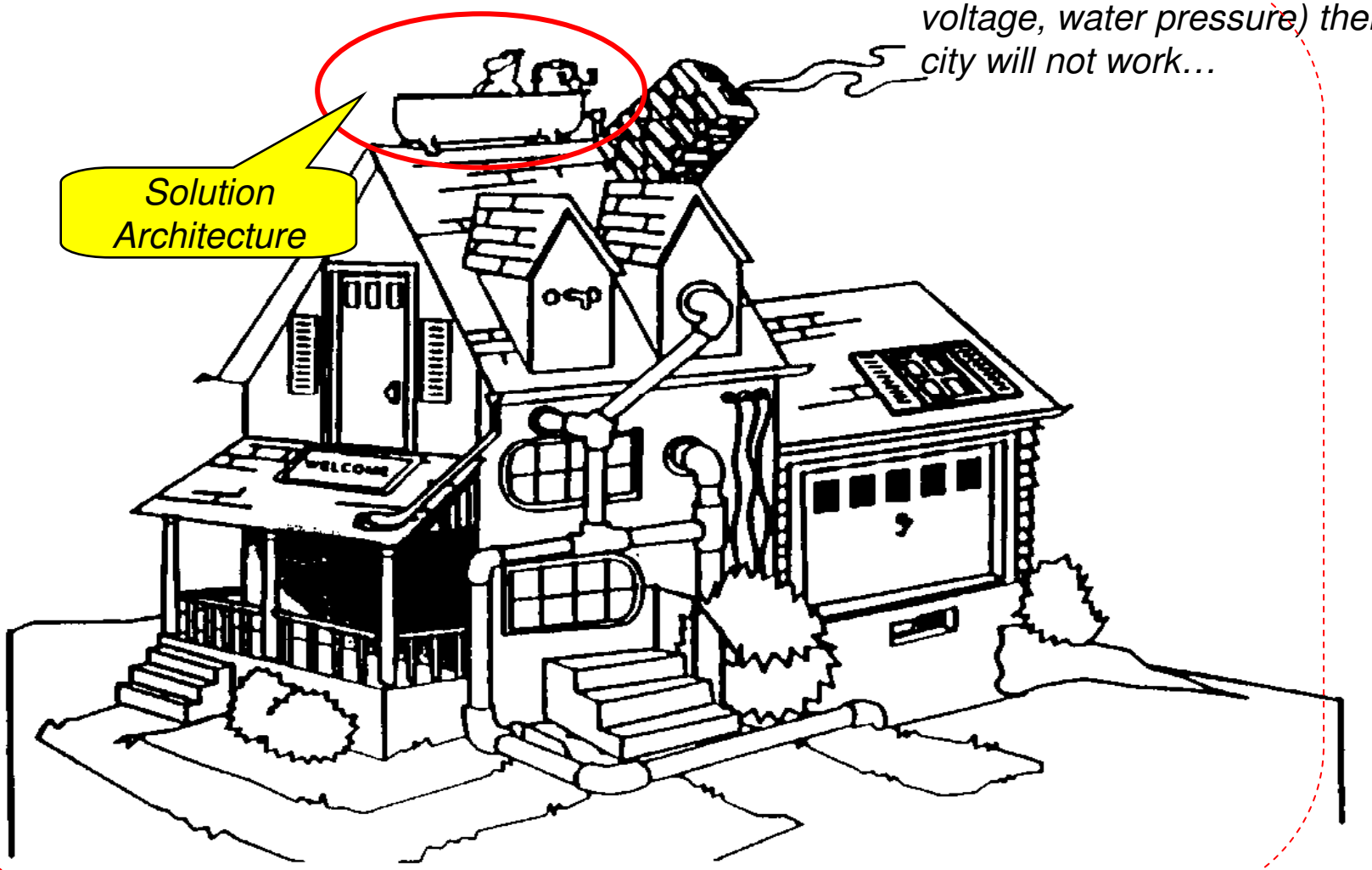
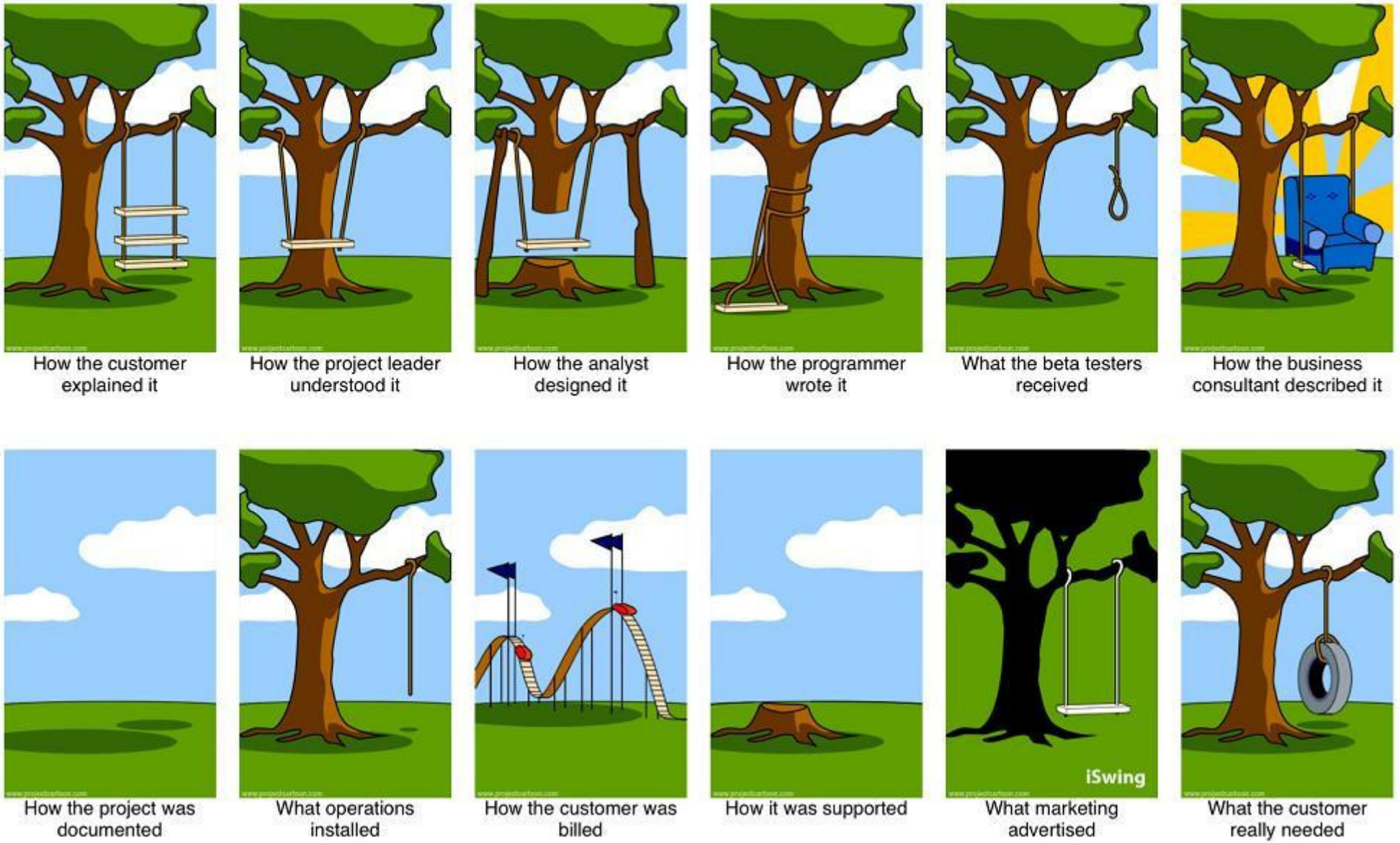
Solution Architecture



Architecture has key objectives ...

- Guarantee the system will support the users and the required business functionality
- Support system-wide requirements and qualities
  - Performance, availability, maintainability, portability, robustness, scalability
- Provide high-level structure for development effort
  - For design, buy and build
  - For work planning and allocation
- Allow for the development of reusable assets

What happens when we don’t?



There are many examples

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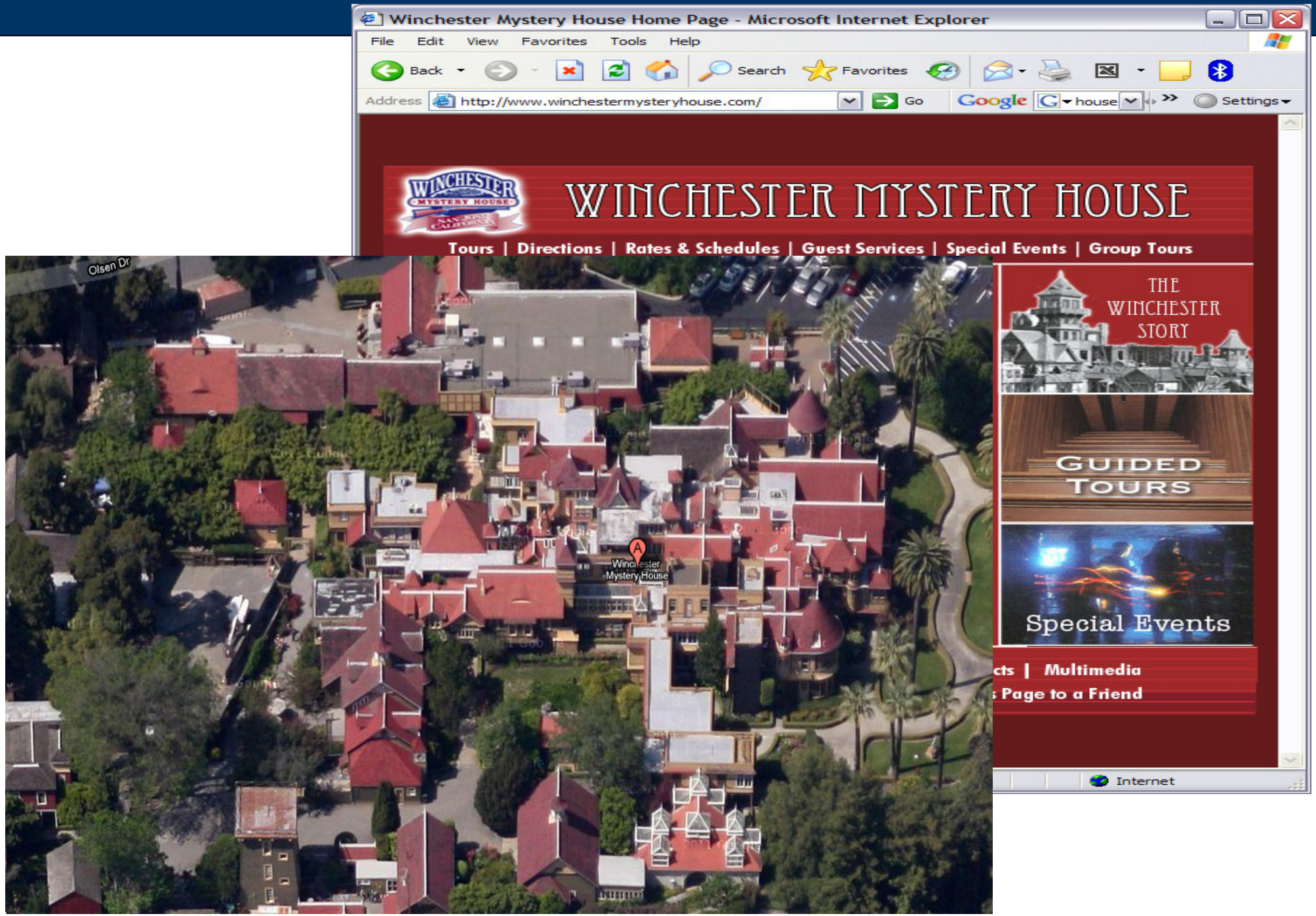
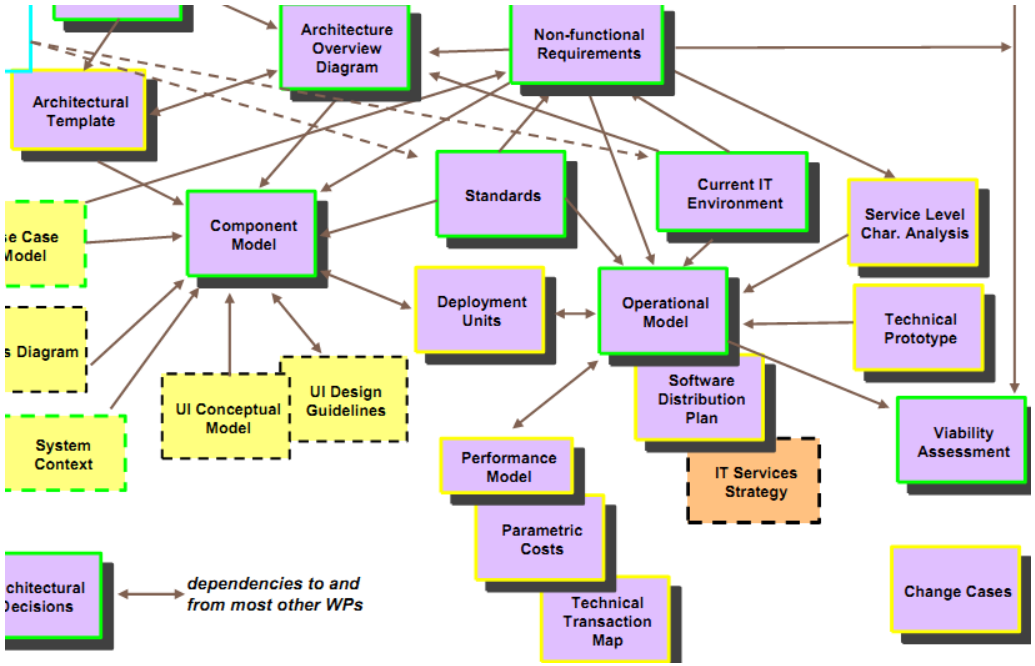


Common artifacts for communicating architecture

As the size and complexity of systems increase, design and specification of the overall system becomes more important. The Architecture artifacts help to analyze competing concerns and to manifest them as systems qualities. They evolve from an ad hoc, word-of-mouth approach to an integrated set of documents. Below table lists only very commonly used artifacts;

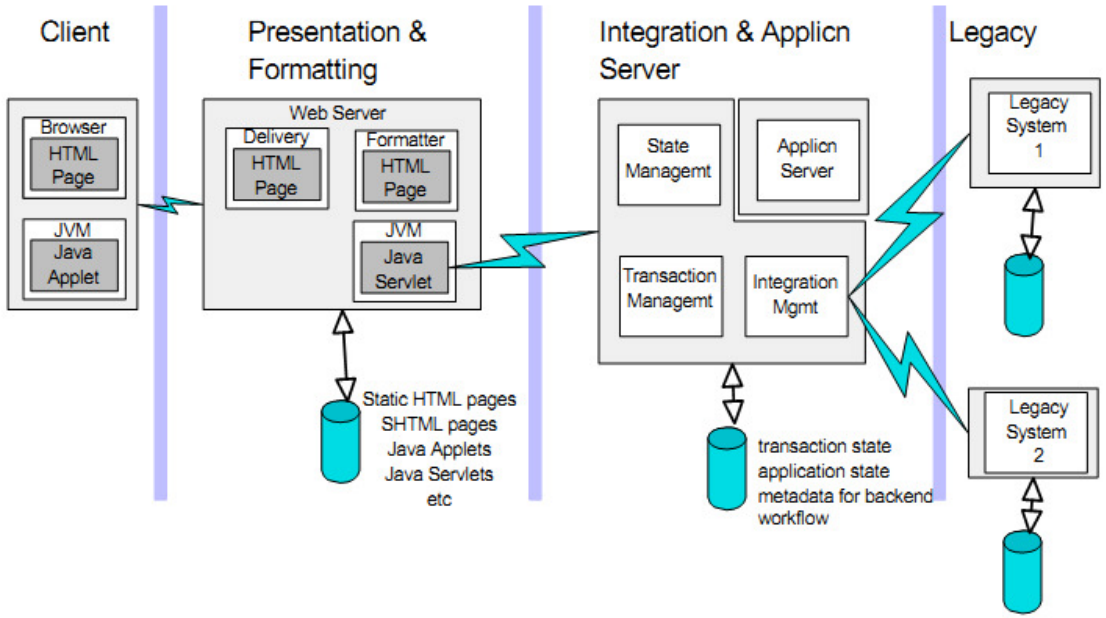
- Architectural Overview Diagram
- System Context Diagram
- Architectural Decisions
- Functional Requirements
- Non-functional Requirements (NFR)
- Component Model
- Operational Model



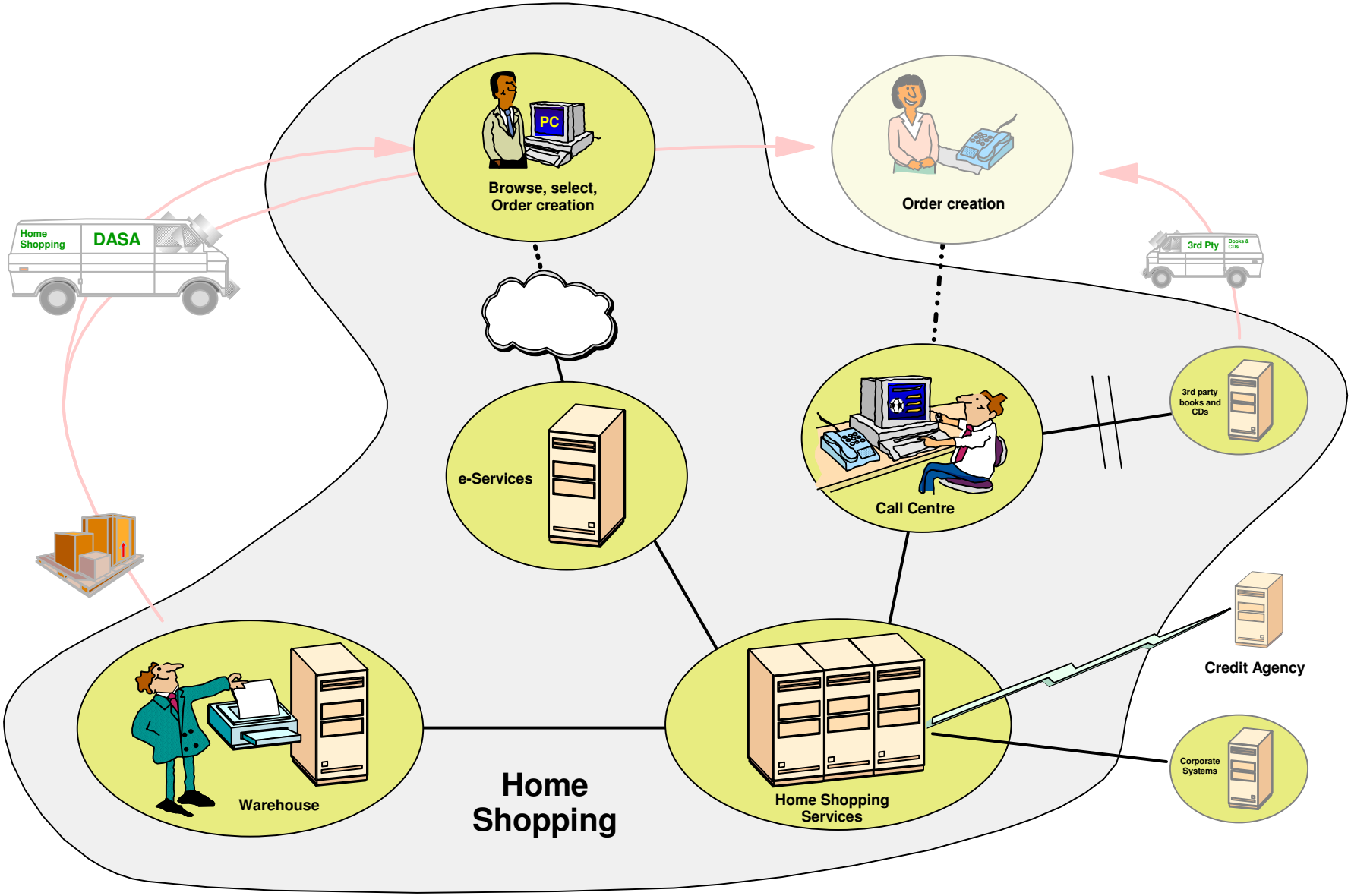
Architectural Overview Diagram (AOD)

• Description:
– The Architecture Overview Diagram work product contains **schematic diagrams that represent the governing ideas and candidate building blocks of an IT system**. It provides **an overview of the main conceptual elements and relationships**.

• Purpose:
— To communicate to stakeholders a **conceptual understanding of the intended IT system**
— To provide a **high-level shared vision** of the architecture and scope of the proposed IT system for the development teams

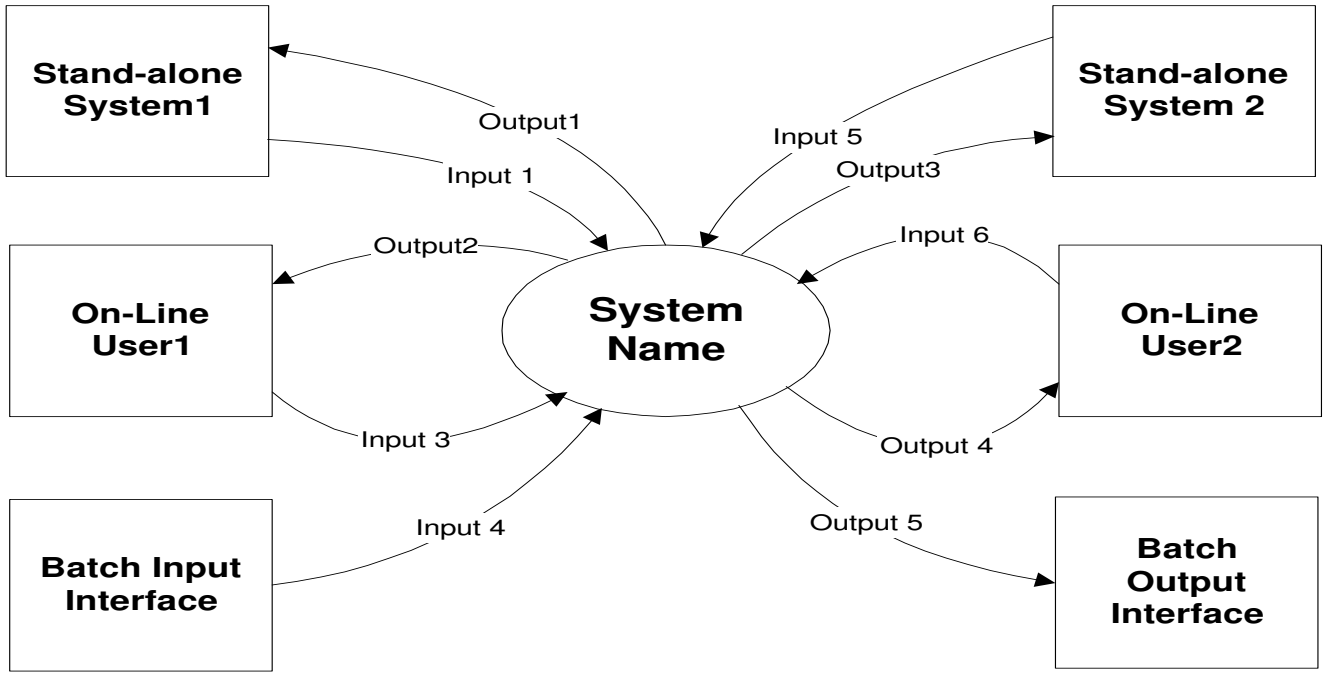


Example : Architectural Overview Diagram (AOD)

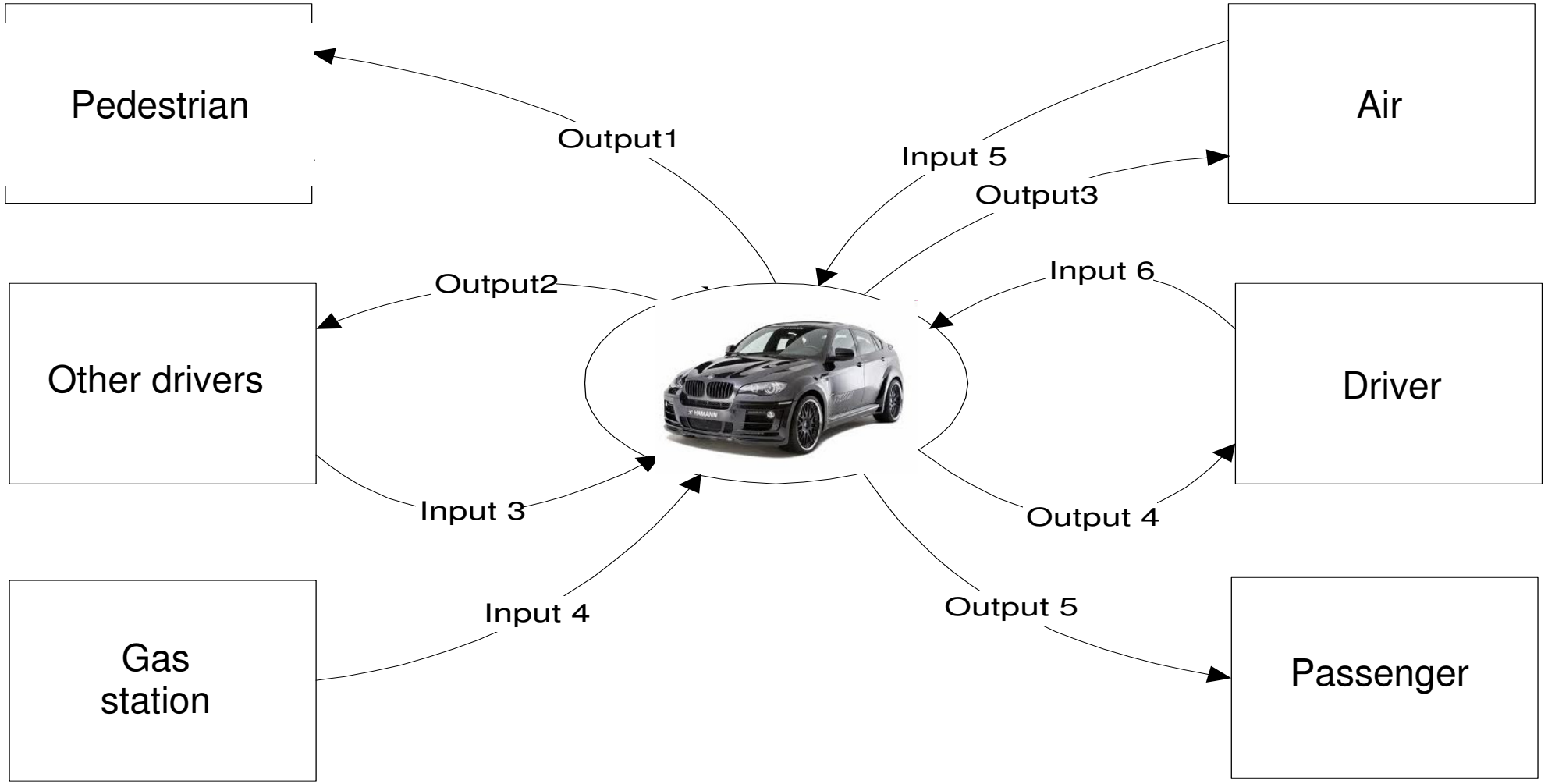


What is System Context Diagram

- **Usually shown as a diagram**, this representation **defines** the system and identifies the information and control flows that cross the **system boundary**.
- It **highlights** several important characteristics of the system: **users, external systems, batch inputs and outputs, and external devices**.
- The objects within the system boundary **define the scope over which the development team has some control**.



What is System Context Diagram



Why did it fail?

Architectural Decisions

• Architectural decisions capture precious knowledge that is worth sharing.

• Architectural decisions are significant because they may directly or indirectly determine whether a system meets its nonfunctional requirements.

• Architectural decisions, on the other hand, typically answer "why" questions, not just "what" and "how" questions.

Example : Architectural Decision (AD)

ID	Category	Decision Title	Question and Needs	Decision
001	AIX	User Logging Mechanism to Servers	How should users log on into the system?	ssh will be used. Telnet rlogin and rsh will be disabled.
002	AIX	Encryption for logging	How can we assure that the traffic between servers should not be sniffed and no user password shall be exposed?	SSL will be used for encryption.
003	AIX	AIX boot disk structure	Should every logical partition be booted from dedicated disks?	All logical partitions will have boot disks assigned from VIOS.
004	AIX	System p server database partition I/O allocation	Shall all I/O requirements be driven by VIOS?	Since database servers require high I/O demand, VIOS performance might be saturated by high I/O requirement. Therefore database servers will have dedicated host bus adapter and with external disk access without the use of VIOS.
005	AIX	VIOS Disk Availability	How should the VIO be implemented to ensure disk I/O high availability requirement?	Two VIOS will serve the same LUN. SDDPCM and MPIO will be used in the VIOS and in the LPARs.
006	AIX	CPU virtualization and free CPU utilization	The way that partitions use CPU must be defined. At System p CPU can be assigned to partitions either in dedicated or in shared mode – which is the preferred method?	Virtualization gives us an excellent opportunity to share the CPU and to utilize unused CPU cycles by different partitions that need for CPU power. Thus we need to use CPU in a shared mode.
007	AIX	CPU and priority setting	LPARs such as database servers should have priority over other servers in terms of CPU allocation. What will be the preferred mechanism to support it?	Weight will be defined each LPAR. CPU cycle operations will be done by the hypervisor based on the priority defined.

Why did it fail?

Requirements Definiton

Functional Requirements:

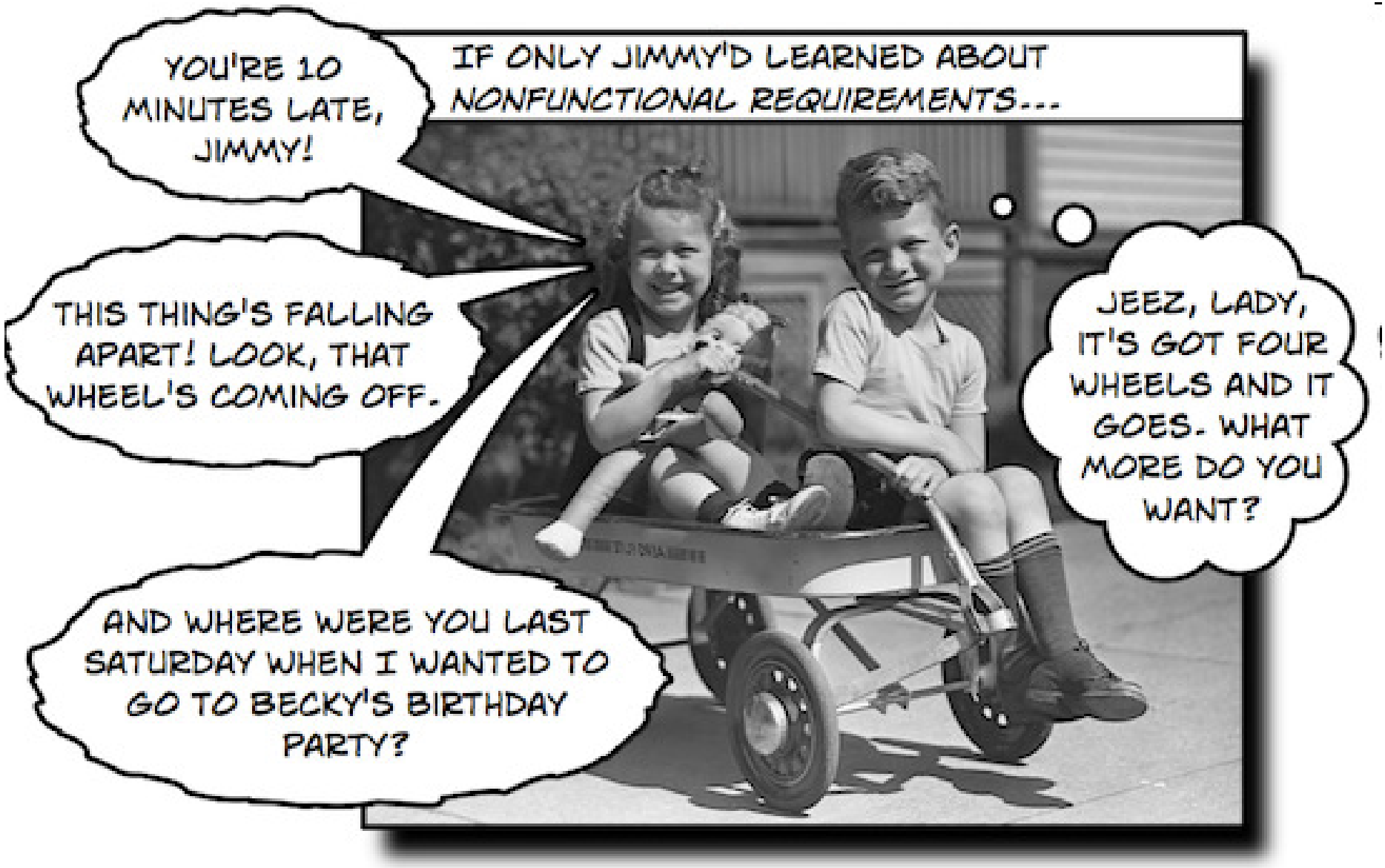
- Are capabilities needed by users to fulfill their job
Answers the question of "what" is wanted (but not "how" it is achieved)

Non-Functional Requirements :

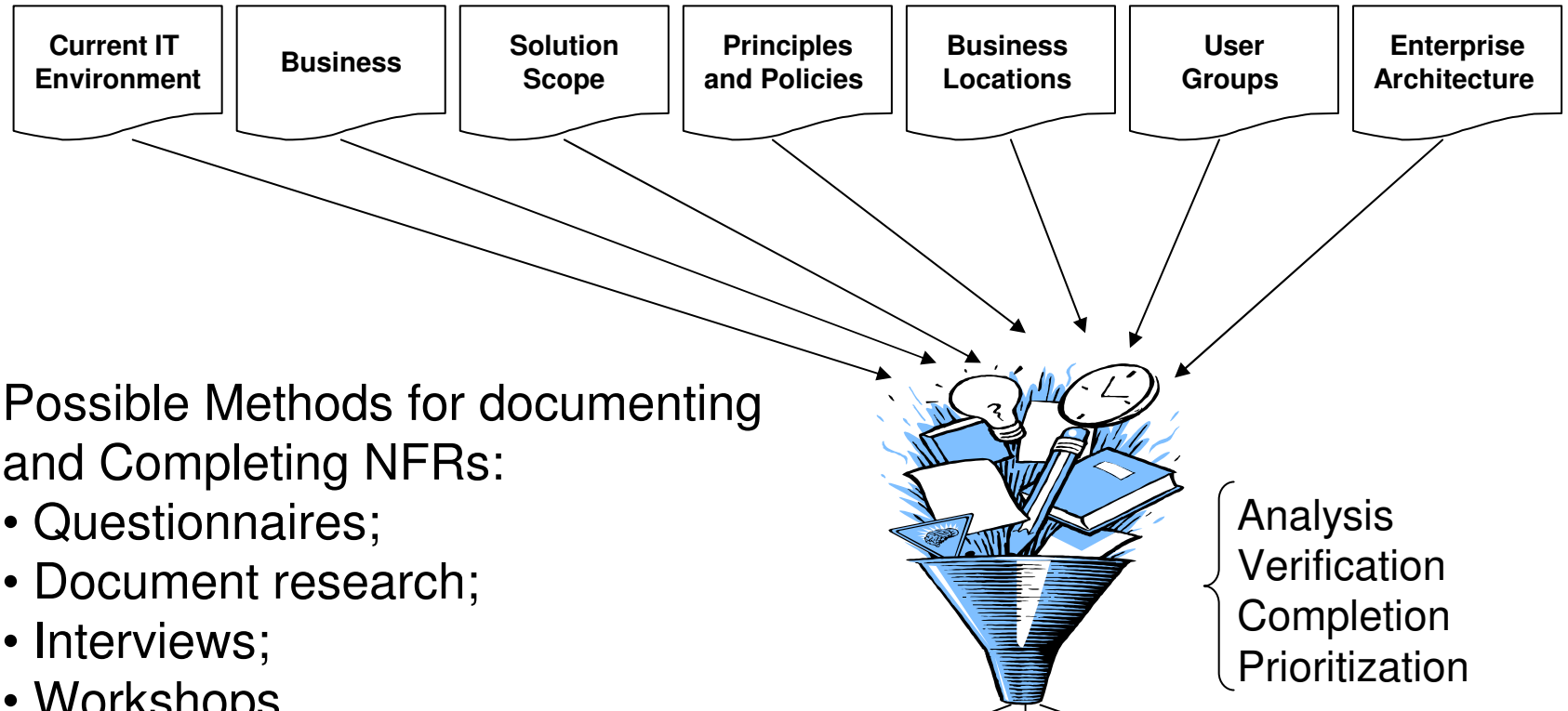
Qualities:
- Define the expectations and **characteristics that the system should support**
Might be runtime (for example, performance or availability) or non-runtime (for example, scalability or maintainability)

Constraints:
-Givens, those **things that cannot be changed within the scope** and lifetime of the project
- Other factors, such as mandated technologies, available skills, and budget

Requirements Definiton



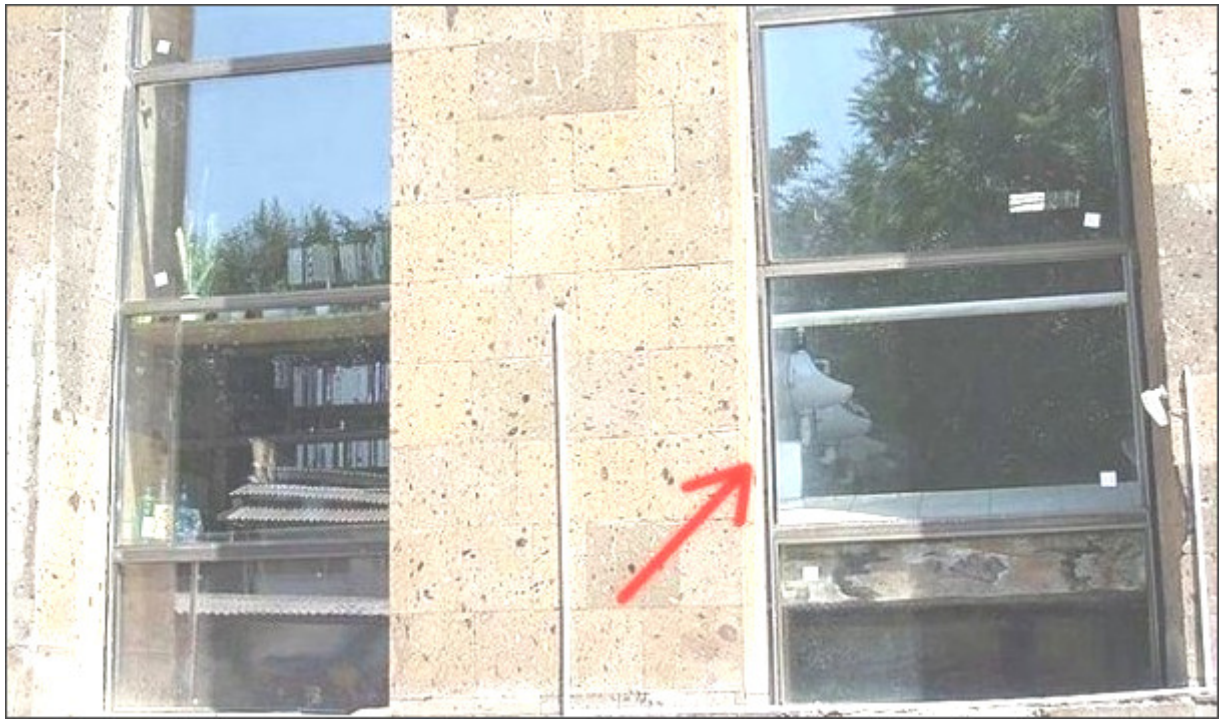
Where do Requirements come from?



Possible Methods for documenting and Completing NFRs:

- Questionnaires;
- Document research;
- Interviews;
- Workshops.

Why did it fail?

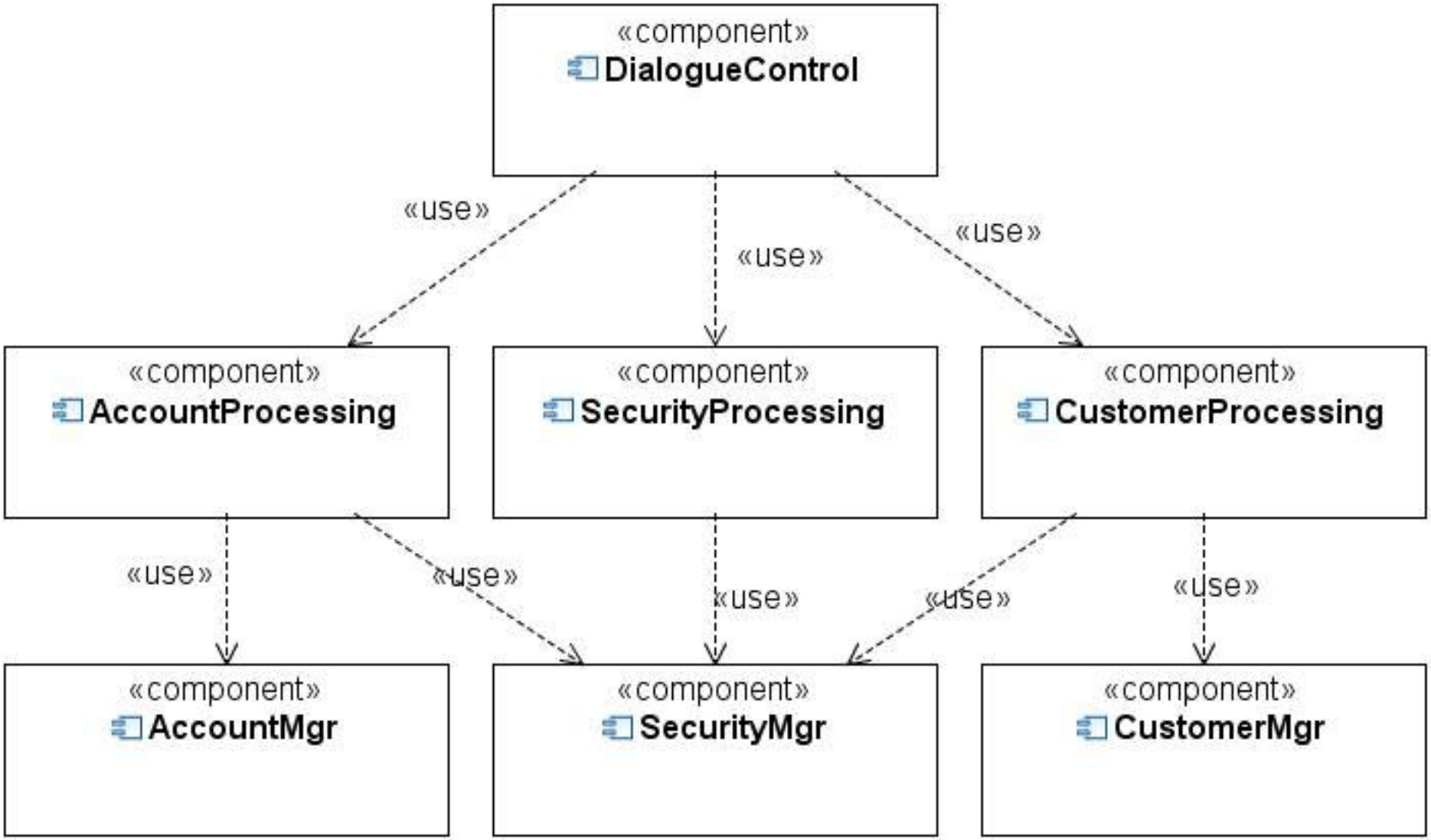


Two major aspects of Architecture

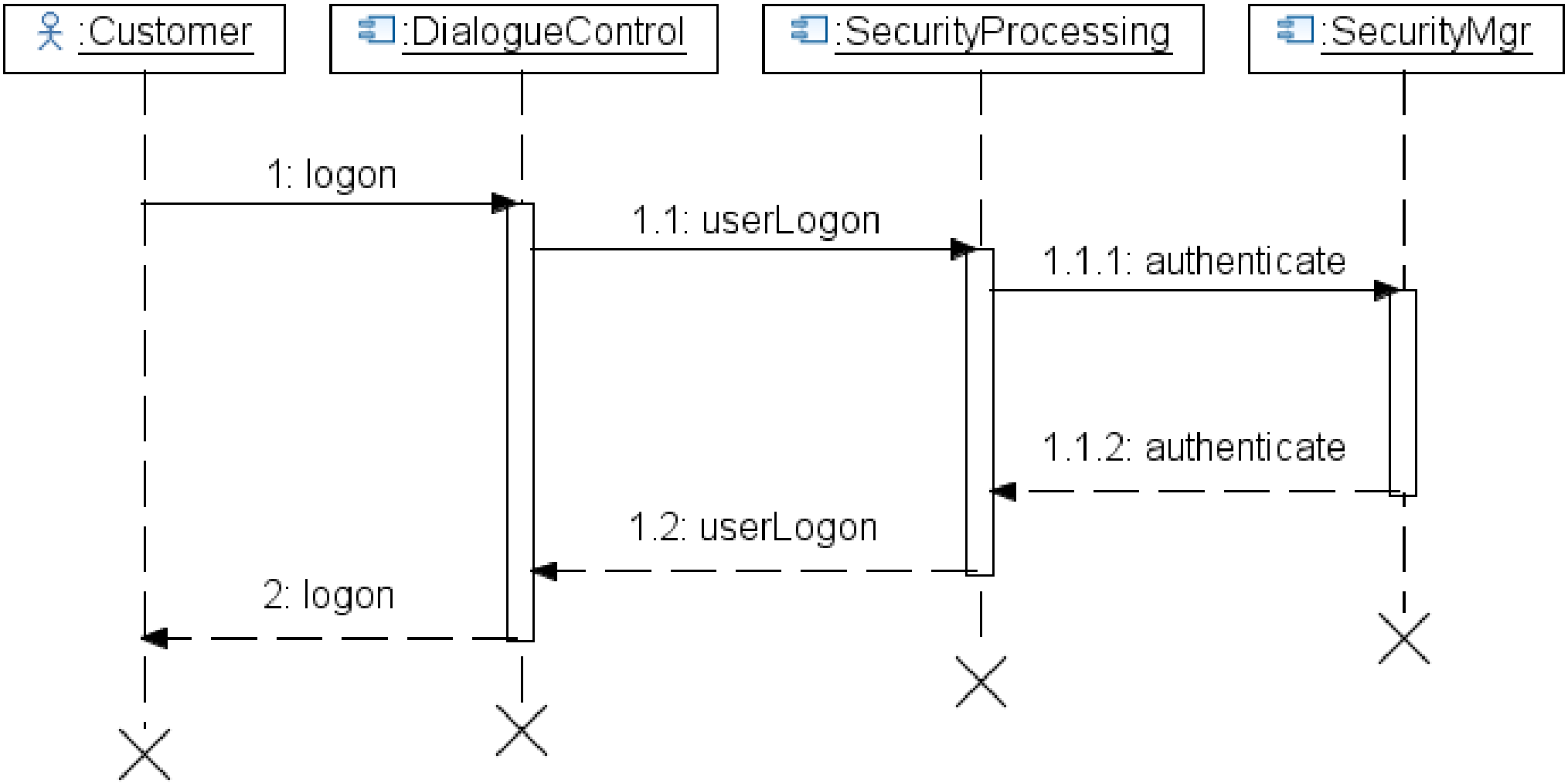
- Functional aspect
  - Structure of software
  - Dynamic behavior (collaboration) of software "modules"
  - Defined through Component Model

- Operational aspect
  - Network topology (hardware nodes, locations, etc.)
  - What runs where (placement)
  - Service level characteristics (performance, availability)
  - Management and operation of IT System
  - Defined through Operational Model

Component Model – *notation*
(structure described by relationship diagrams)

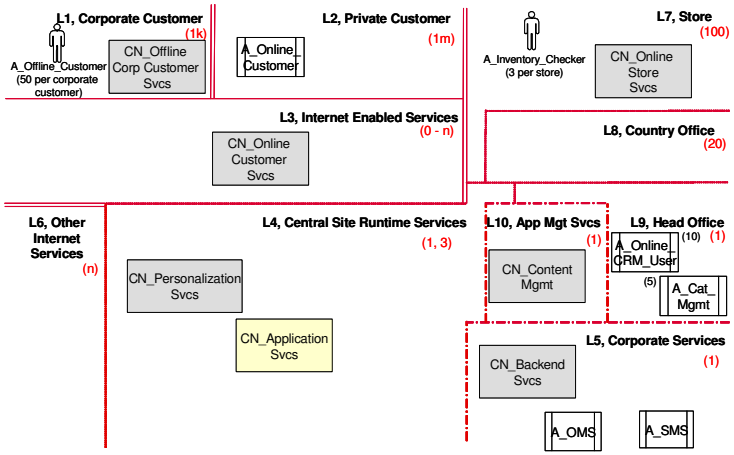


Component Model – *notation*
(behavior described by sequence diagrams)



Why did it fail?

Operational Model - *notation*



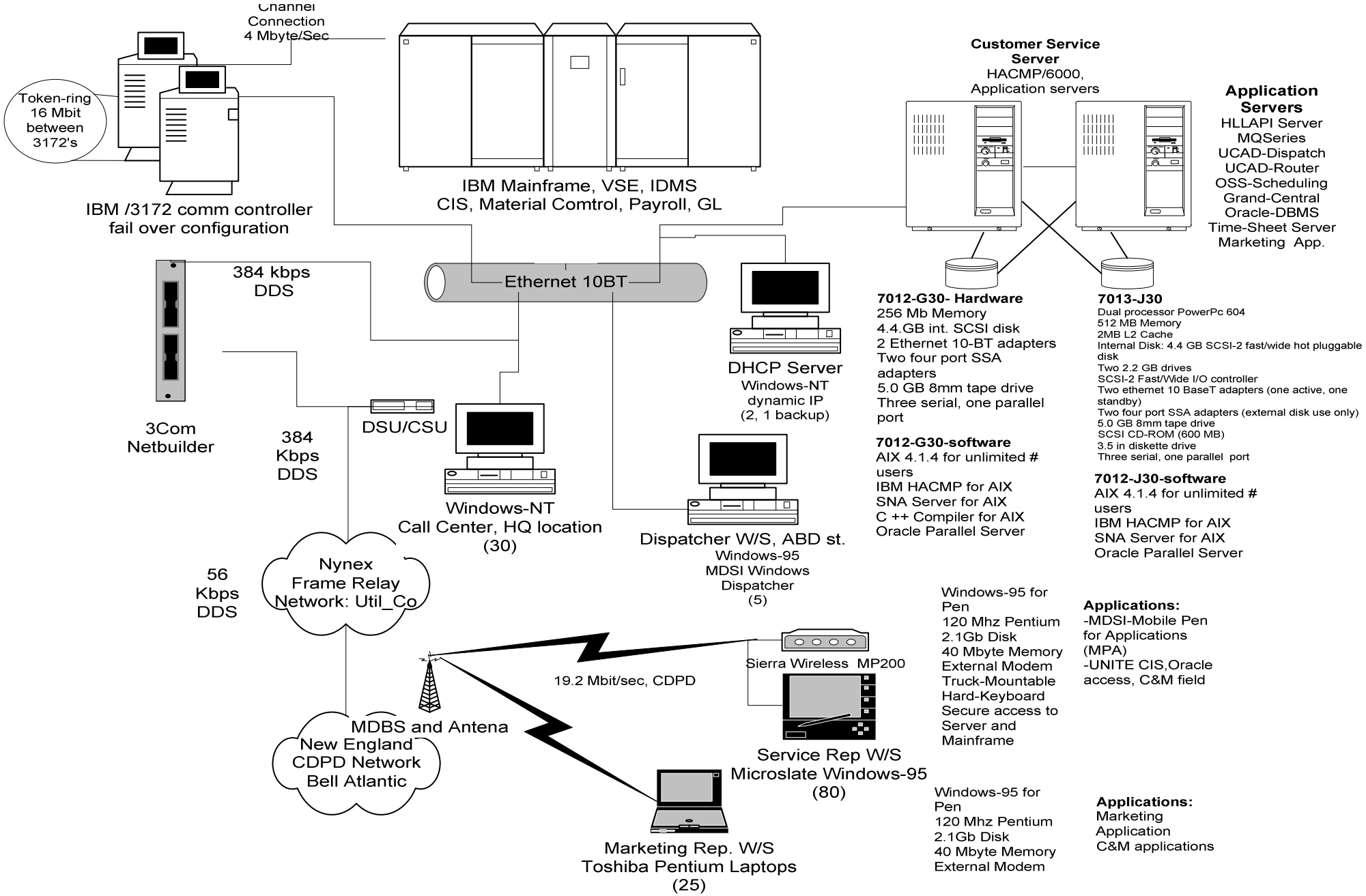
Operational model topology diagram

- For complex systems may need to divide into several pictures.
  - Network topology
  - Software services
  - Systems management
  - Location profiles

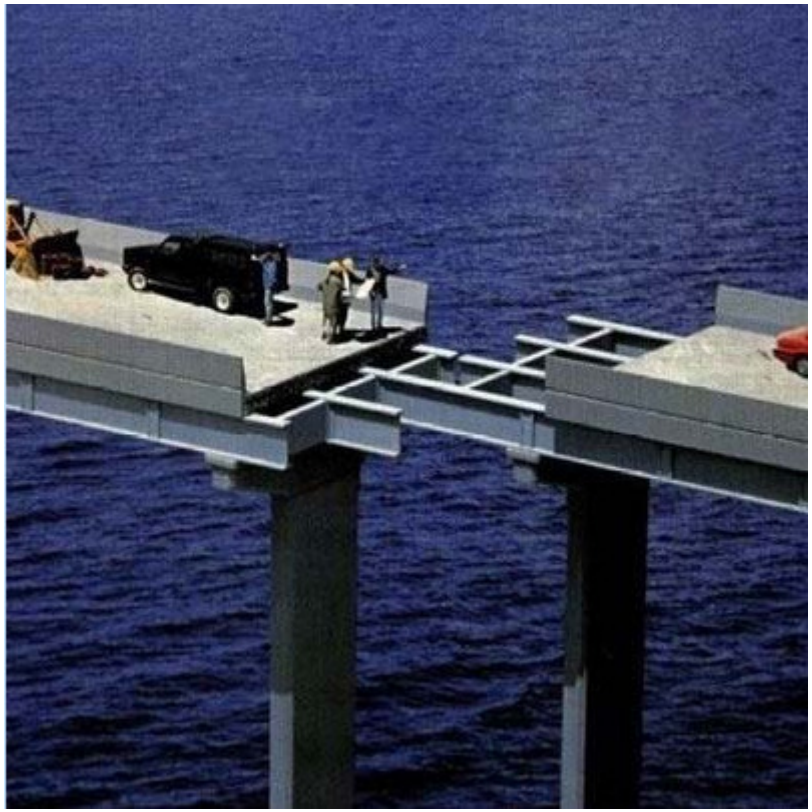
Supporting documentation

- Node descriptions
- Connection descriptions
- Node/deployment unit mapping
- Network description
- System management approach
- Middleware description
- Walkthrough descriptions

Operational Model - Example



Why did it fail?



Why did it fail?

Why Architectures Fail

- Responses are based on an informal and unscientific survey
- All similarities between the responses and any real architectures or people are purely coincidental

Top Ten List

10. **Too complex** and unable to be managed and operated
9. **Bleeding edge** or unproven
8. Vendor promises of **future capability** are vaporware
7. No one understands the **entire** system
6. Not **scalable**
5. Evolves to which it was **never designed**, prototype modified
4. **Unclear**, missing **requirements**, or force fit
3. Resources over-challenged, **lack of skills** and experience
2. Lack of technical leadership and **governance**
1. **Management's fault**

Questions !....