

# Quality Management Activities in Software Architecture Process

Quality Management of Enterprise and Software Architectures

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# Study Description

- *The goal:* To identify SA management related activities that could be suggested to promote the achievement of high quality architectures.
- *Research data:* literature and practitioners' experiences
- *Research method:* literature review, constructive approach, group interview
- *The application of the results:*
  - The identified activities are proposed to be taken into account in the software architecture management process design, development and capability assessment.



# Current State of Architecture Management

## (1/2)

- Architecture management is spread out to many processes in organisations.
  - Architecture management processes are not so clearly separate processes in organisations.
  - Architecture and architectural quality controlling and driving activities may be included in, for example, in investment planning, project management, the organisation's processes management and system development process.
- A need to move from architectures driven by investment planning and system development towards architectures driven by architecture management
  - Single investments on software or a system (e.g. ERP investments) and single system development projects in organisations may drive the organisations' architectures and architectural quality more than organisations' architectural designs and visions (e.g. enterprise architecture).
- A need of architecture management practices and process models that aim at high-quality architectures
  - This study gives answers to the question what activities should or could be executed in architecture management that would focus on the architectural quality.



# Current State of Architecture Management

## (2/2)

- A need to advance the maturity of architecture management processes
- A need for agility in architecture management and development
  - Architecture processes cannot be too heavy (e.g. require a lot of time and resources) although those processes could produce ideal architectures.
- A need for metrics and metric programs for architectural maturity and quality



# Results: Quality Management Activities of SA

The QM activities of SA can be divided as follows:

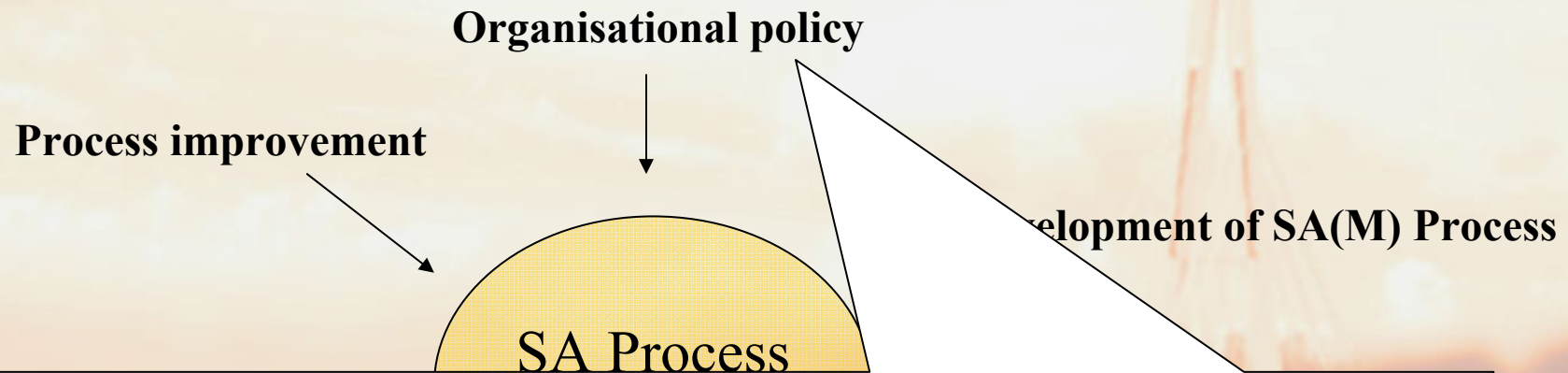
- 1) Activities that relate to the quality management of SAM process.  
These activities are included in the organization's processes and project management and concentrate on the quality of SAM-process (*process quality aspect*)  
.
- 2) Activities that relate to the quality management of SA.  
These activities are included in the SAM-process phases and concentrate on the achievement of software architecture of good quality (*product quality aspect*).



# Quality Management Activities for SAM Process



# Quality Management Activities for SAM Process



E  
p  
Q  
a

<b>Organisational Policy</b>		
Establishing and maintaining an organisational policy for planning and performing the software architecture management (SAM) process.	[5], [FGI] according focus interview	= to group



# Quality Management Activities for SAM Process

Organisational policy

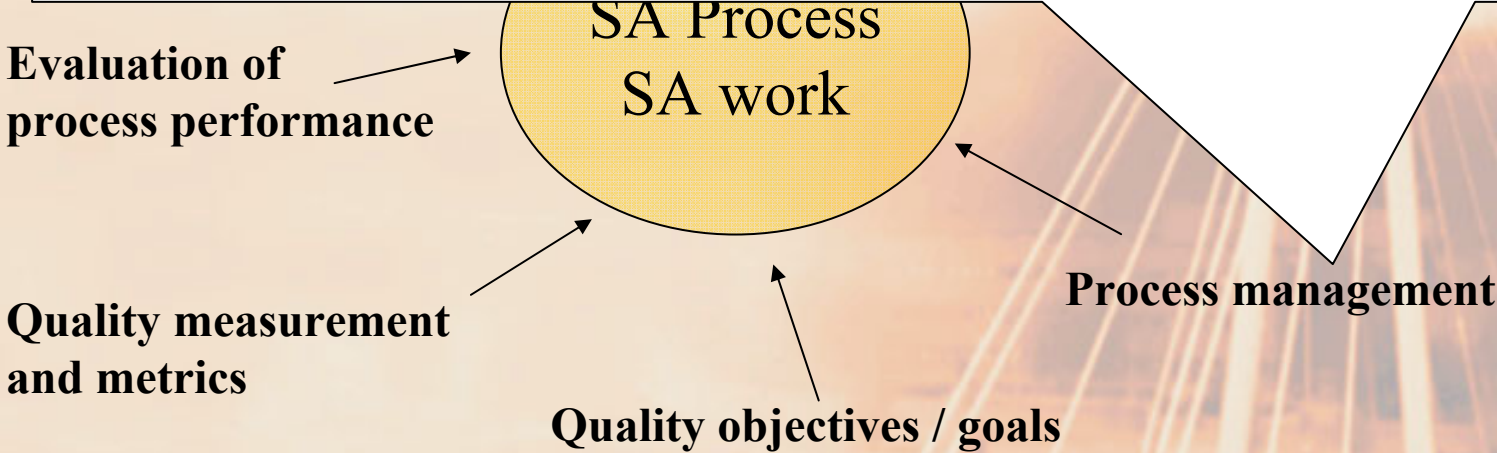
Process improvement

Development of SA(M) Process

<b>Development of SAM Process</b>		
Planning and developing a process which is able to produce and manage the software architecture in the operating conditions.	[5], [12], [FGI]	Paying attention especially to: <ul style="list-style-type: none"> <li>• the change management of requirements and architectural designs and</li> <li>• the document management of architectural documents.</li> </ul>
Proving then that the process can produce, develop and manage software architectures under operating conditions.	[12], [FGI]	
Optimizing the process features and goals.	[12], [FGI]	
Maintaining the plan for performing the SAM process.	[5]	
Establishing and maintaining the description of the SAM-process.	[5]	
Transferring the SAM-process to operations.	[12]	Implementing the plan for transfer and validating transfer.



<b>Process management</b>		
Providing resources (e.g. staff, time, funding) and assigning responsibility and authority for performing the SAM-process, developing the architecture related work products, and providing the services of the SAM-process.	[5]	
Identifying and involving the relevant stakeholders of the SAM-process as planned.	[5]	
Training and advising the people performing or supporting the SAM-process as needed.	[5], [FGI]	



# Quality Management Activities for SAM Process

## **Quality Objectives / Goals**

Establishing and maintaining quantitative quality objectives for the SAM-process that address quality and process performance based on customer and stakeholder needs and business objectives.

[5],  
[FGI]

Establishing general (no project-specific) optimal quality goals for the SAs that are produced by SAM-process.

[12],  
[FGI]

E  
P

**Quality measurement  
and metrics**

**Quality objectives / goals**

**Process management**



# Quality Management Activities for SAM Process

<b>Quality Measurement and Metrics</b>		
Planning process measurements.	[12], [FGI]	Deciding what aspects of the SAM-process to measure and choosing the metrics.
Planning software architecture evaluation.	[12], [FGI]	Deciding what aspects of the software architectures to evaluate and choosing the metrics.

E  
P

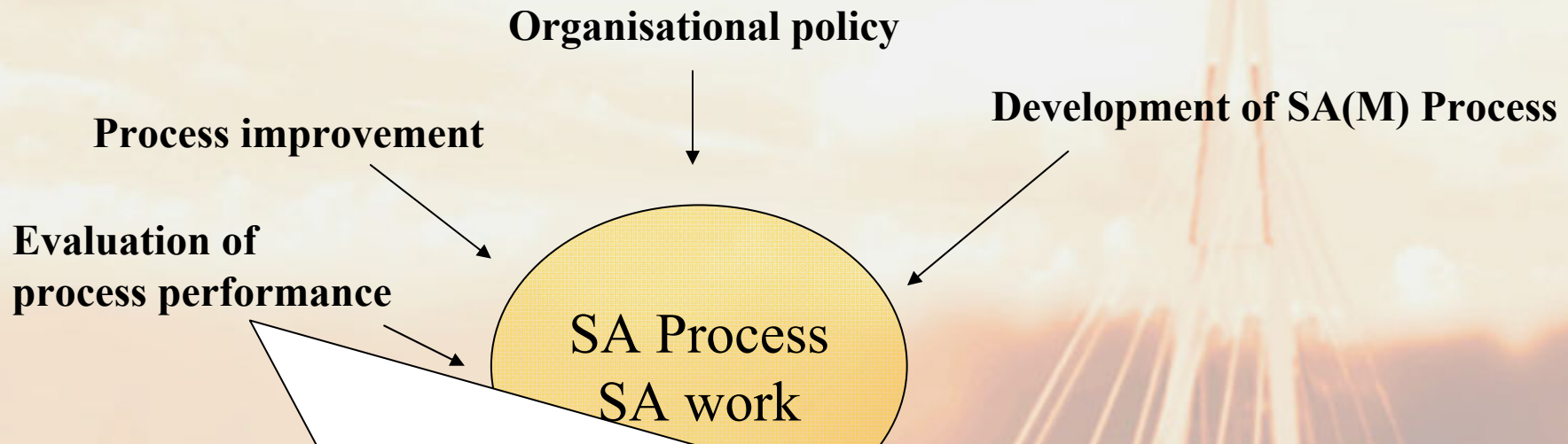
**Quality measurement  
and metrics**

**Quality objectives / goals**

**Process management**



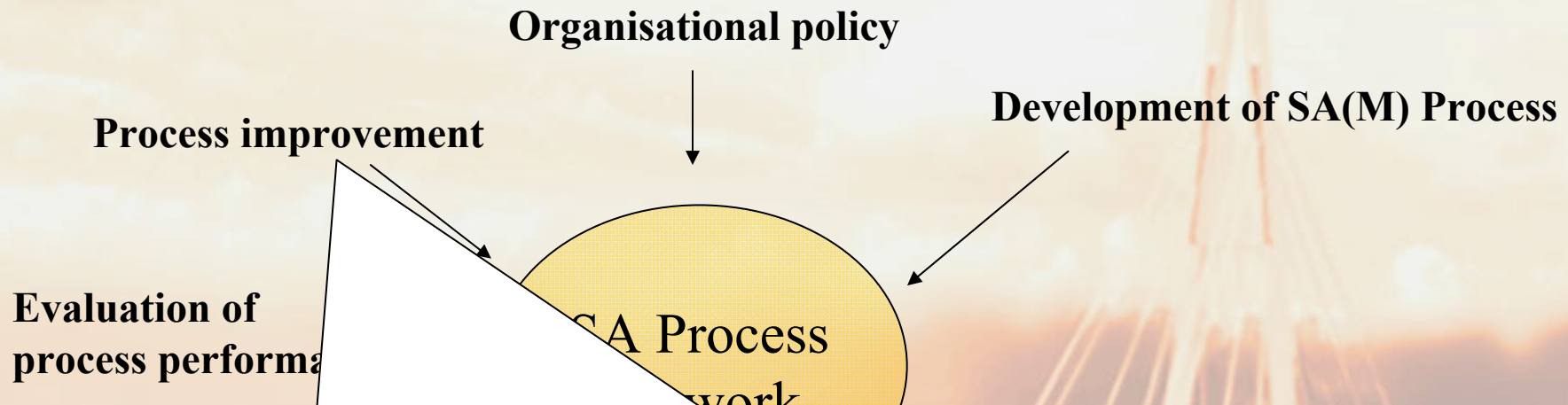
# Quality Management Activities for SAM Process



## ***Evaluation of Process Performance***

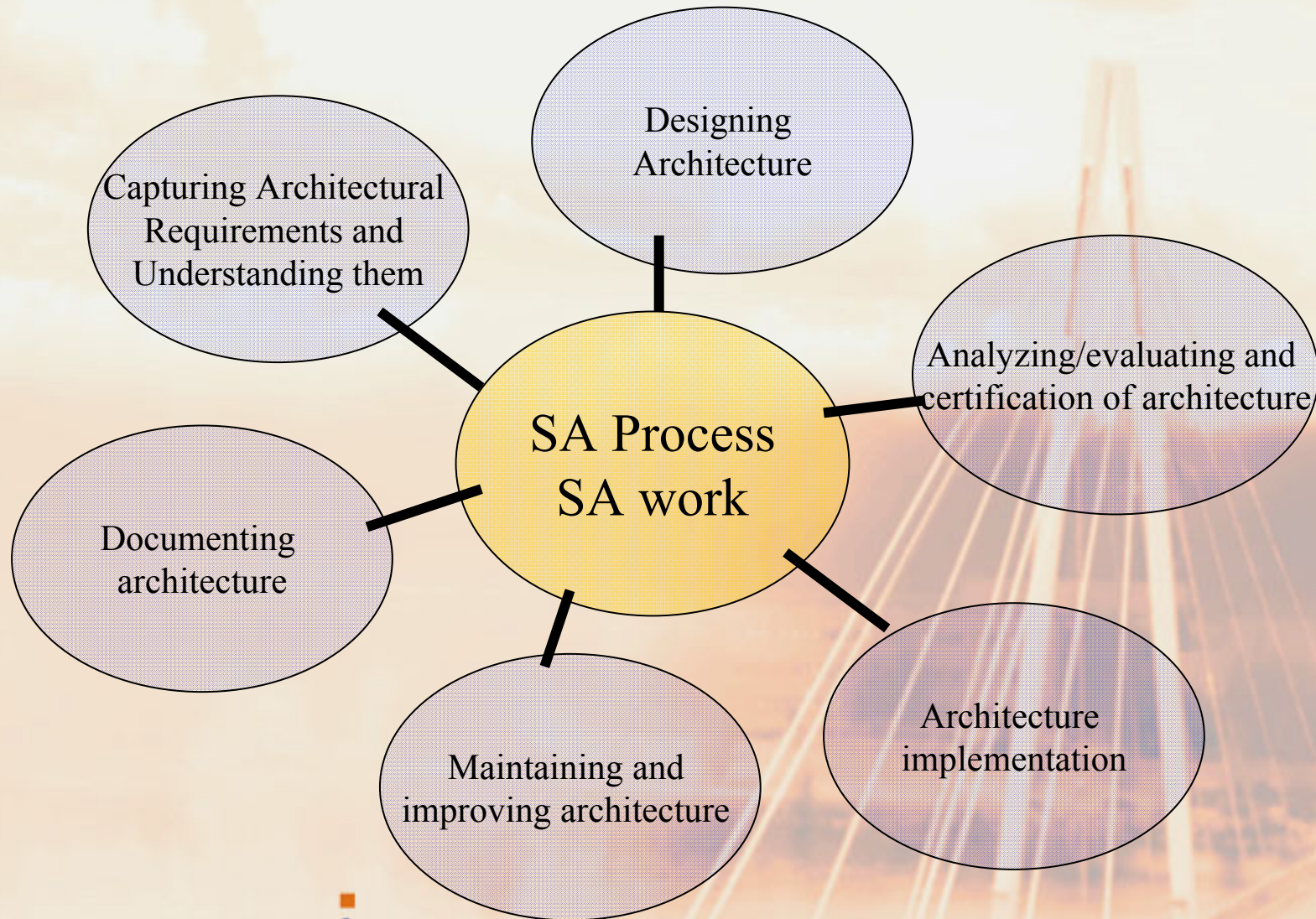
Evaluating the actual performance of the SAM-process, comparing the actual performance of the process with quality goals and acting on difference.	[5], [12]	
Monitoring and controlling the SAM process against the plan for performing the process and taking appropriate corrective action.	[5]	
Objectively evaluating adherence of the SAM-process against its process description, standards, and procedures, and addressing non-compliance.	[5]	
Reviewing the activities, status, and results of the SAM-process with higher level management and resolving issues.	[5]	

# Quality Management Activities for SAM Process

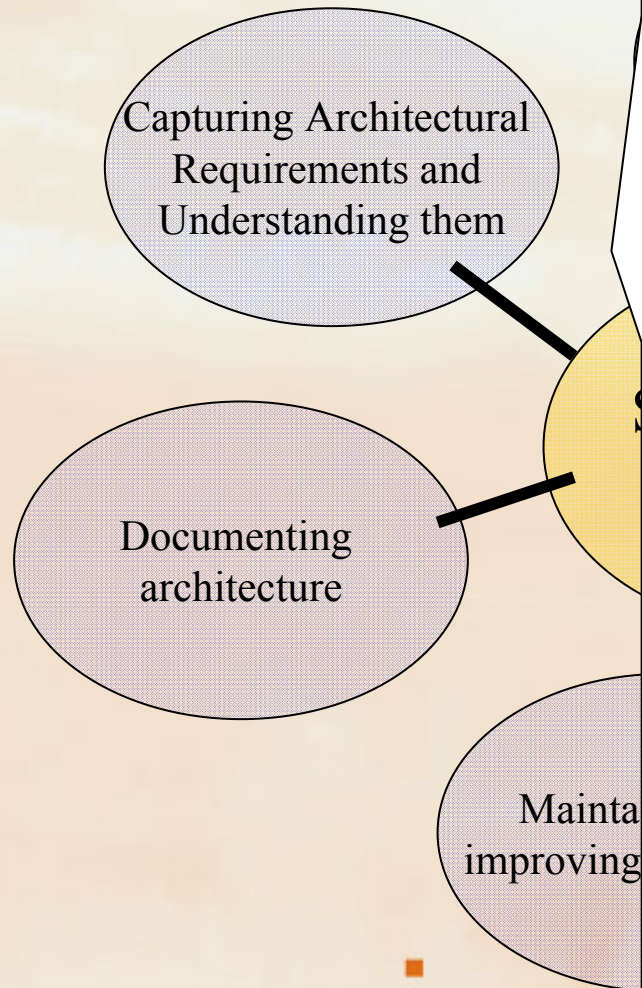


<b>Process Improvement</b>		
Ensuring continuous improvement of the SAM process in fulfilling the relevant business objectives of the organisation.	[5]	
Collecting work products, measures, measurement results and improvement information derived from planning and performing the SAM process and from architectures produced by the SAM process.	[5], [FGI]	Information can be used to support the future use and improvement of the organization's processes, process assets and architectures.
Identifying and correcting the root causes of defects and other problems in the SAM process.	[5]	

# Quality Management Activities of SA



# Quality Management Activities of SA



## **Requirements Collection**

- Planning the collection of requirements. Planning to collect customer and stakeholder needs (“af = adapted from [12]).
- Identifying customers and stakeholders. Identifying both internal and external customers and stakeholders (af [12]).
- Identifying what requirements and boundaries organisation’s strategy and ICT strategies set for the system [FGI].
- Identifying all relevant standards, regulations, and policies (af [12]).
- Describing the existing environment and identifying boundaries that the existing environment sets for the system [FGI].
- Identifying the possible change situations. Identifying how the company’s environment and the system operation environment may change. [FGI]
- Identifying also the long term requirements for architecture [FGI].
- Finally, collecting the requirements. Collecting a list of customers’ and stakeholders’ needs, expectations, constraints, and interfaces in their language (af [5, 12]).

## **Analysis of Requirements**

- Analyzing, validating and prioritizing customers’ and stakeholders’ requirements and needs (af [12]). Grouping together related requirements and needs (af [12]).
- Developing a definition of required functionality and quality attributes for the system (af [5]).
- Identifying architecturally significant needs/requirements by identifying architecturally significant functionality and architecturally significant quality attributes of the requirements definition [FGI].
- Executing language transfer. Translating architecturally significant needs and requirements into the language of a software architecture development team (af [12]).

# Quality Management Activities of SA

Capturing Architectural Requirements and Understanding them

Designing Architecture

## ***Preparation for architectural design***

- Identifying what is needed so that the architectural designs can be delivered without deficiencies (af [12]). Defining design process and other practices.
- Determining methods for identifying architectural features (af [12]).

## ***Architectural design***

Designing and developing a software architecture that can respond to the needs and suit the environment (af [12]).

- Firstly, determining which architectural features and goals will provide the optimal benefit for the customer/stakeholders (af [12]).
- Selecting main structures of architecture by selecting high-level architectural features and goals (af [12], [FGI]).
- Selecting and designing detailed structures of architecture. Developing detailed architectural features and goals (af [12], [FGI]).
- Addressing all relevant standards, regulations, and policies (af [12]) in the design process.
- Optimising architectural features and goals. Optimising the software architecture features so as to meet stakeholder needs as well as customer needs (af [12]).
- Finally, setting and publishing the final architectural design.



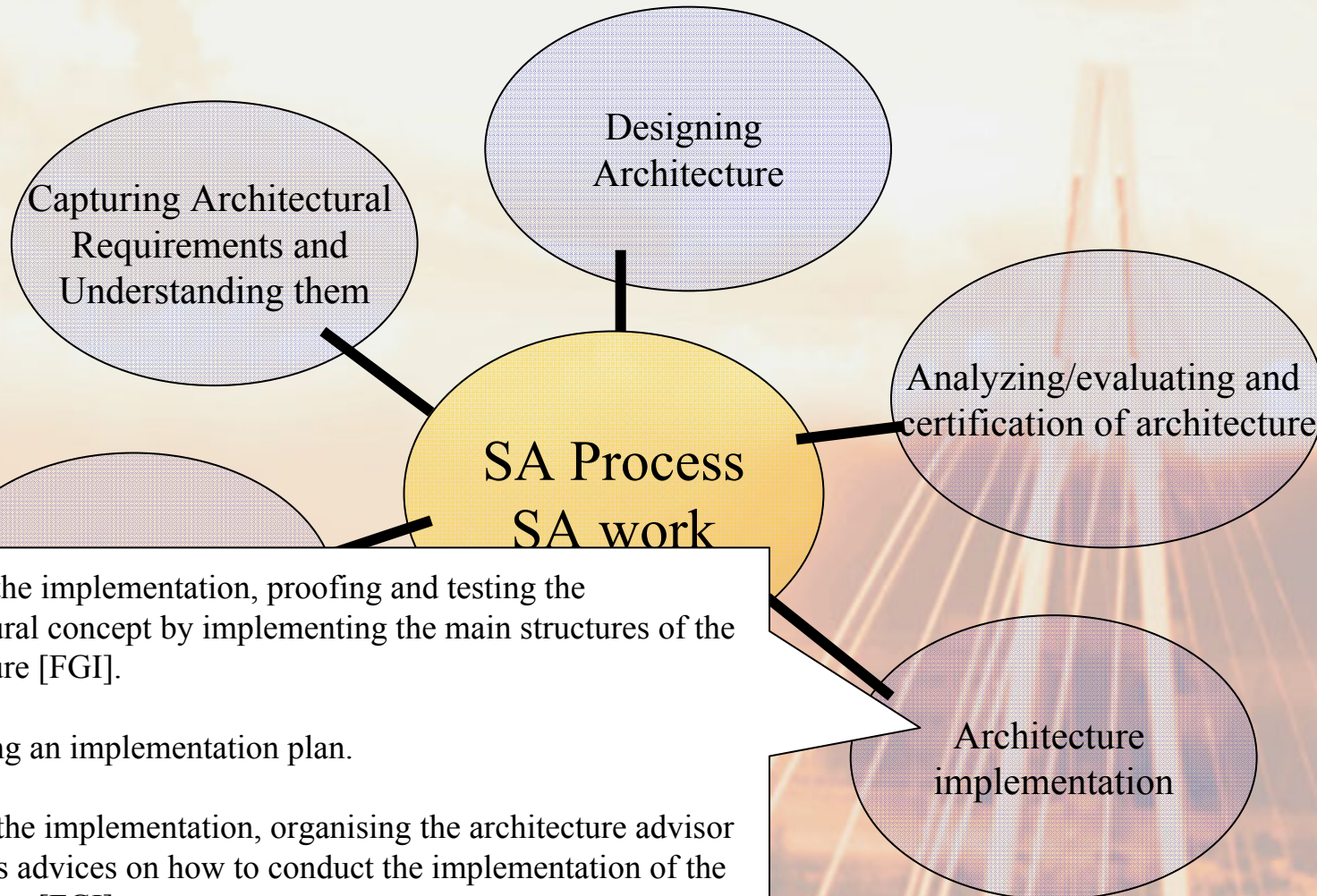
# Quality Management Activities of SA

- Establishing project-specific optimal quality objectives for software architecture (af [12], [FGI]).
- Deciding the evaluation criteria and metrics by creating project-specific measurements of quality for software architecture (af [12], [FGI]) and identifying the unit of measurement for each customer need [12].
- Deciding the explicit criteria to be used in evaluating alternative architectural designs and design features.
- Executing the evaluations. Evaluating and measuring architectural features in the suitable phases of the system life cycle (af [12], [FGI]).
- Executing the certification of architecture. Architecture certification can be seen as an act of attesting that the system will meet a certain standard or, generally, as an act of verifying conformance with certain requirements.

Analyzing/evaluating and certification of architecture

Architecture implementation

# Quality Management Activities of SA



- Before the implementation, proofing and testing the architectural concept by implementing the main structures of the architecture [FGI].
- Producing an implementation plan.
- During the implementation, organising the architecture advisor who gives advices on how to conduct the implementation of the architecture [FGI].
- Collecting feedback from the architecture implementation (e.g. problems occurring in the architecture implementation) [FGI].

# Quality Management Activities of SA

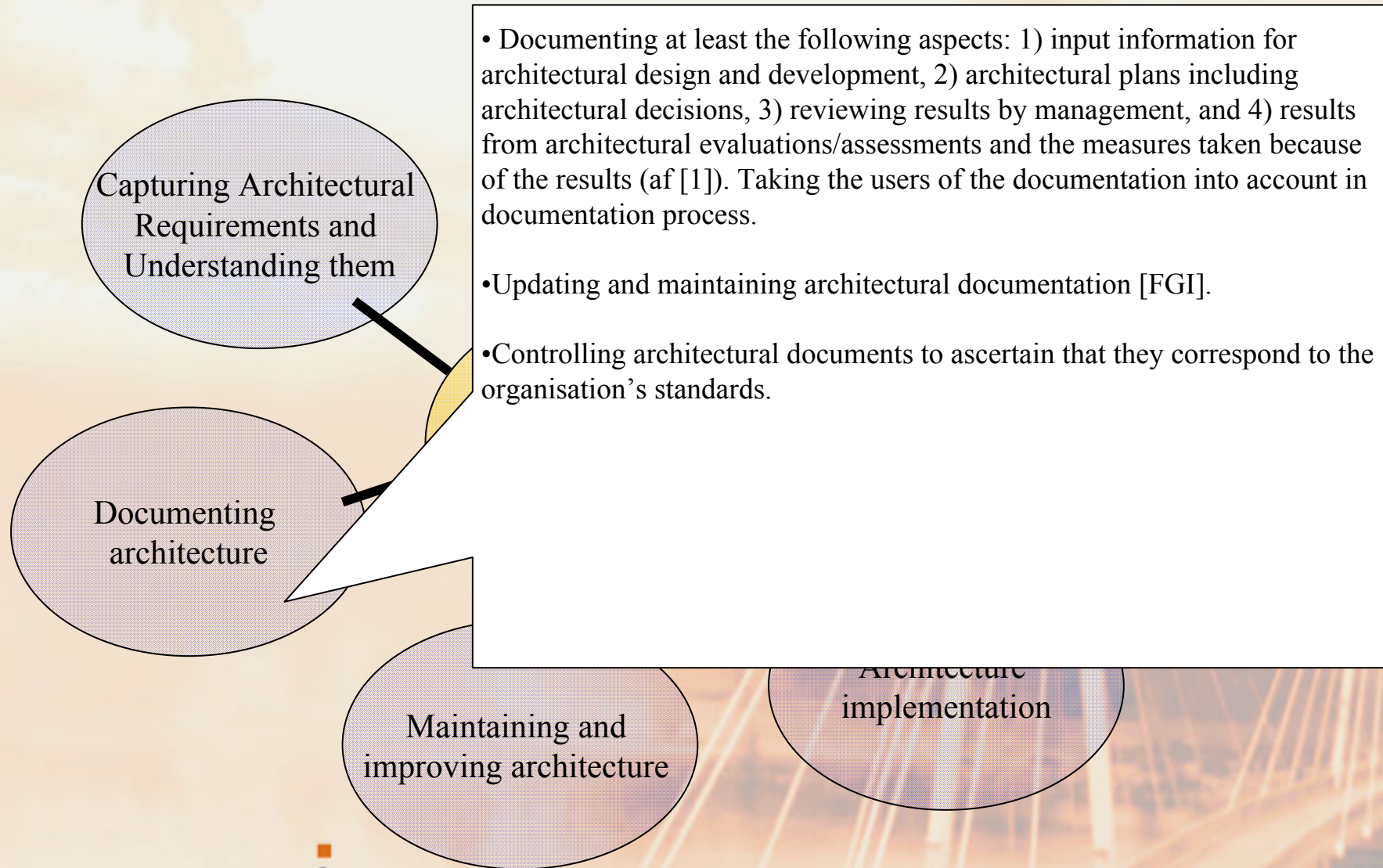
- During the system maintenance, identifying and correcting the causes of defects and other problems in the architecture (af [5]).
- Making other minor changes for the architecture (e.g. construction of a new interface to the system in the integration situation) [FGI].
- Identifying the development needs of the architecture.
- Proving the development or improvement needs of the architecture (af [12]).
- Establishing the infrastructure for improvement (af [12]). Identifying the improvement project(s) and establishing project team(s) (af [12]). Providing the teams with resources, training, and motivation to 1) diagnose the causes and 2) stimulate remedies (af [12]).
- Conducting a diagnostic journey from symptom to cause. This includes analyzing the symptoms, theorizing as to the causes, testing the theories and establishing the causes (af [12]).
- Conducting a remedial journey from cause to remedy. This includes developing the remedies, testing and proving the remedies under the operating conditions, dealing with resistance to change, and establishing controls to hold the gains (af [12]).
- Finally, implementing remedies and controls (af [12]).

Maintaining and  
improving architecture

Architecture  
implementation



# Quality Management Activities of SA



# Summary

- This study identified activities that are suggested to promote the achievement of high-quality architectures.
- Activities relate to the QM of SA process and QM of SA.
- The criticality and execution of these activities in system development need to be assessed based on surveys directed to ICT service providers and user organisations.



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