zühlke
DIE DENKFABRIK.

Software Engineering Today
SET 2005
Profit from Proven Experience

Software Architecture Using Viewpoints and Perspectives

SET2005 - Zurich

11th May 2005

Eoin Woods
Zuhlke Engineering Ltd
49 Great Cumberland Place
London W1H 7TH
ewo@zuhlke.com

Content

- Defining Software Architecture
- The Software Architecture Problem
- Viewpoints to Guide Structure
- Perspectives to Guide Qualities
- Summary

Defining Software Architecture

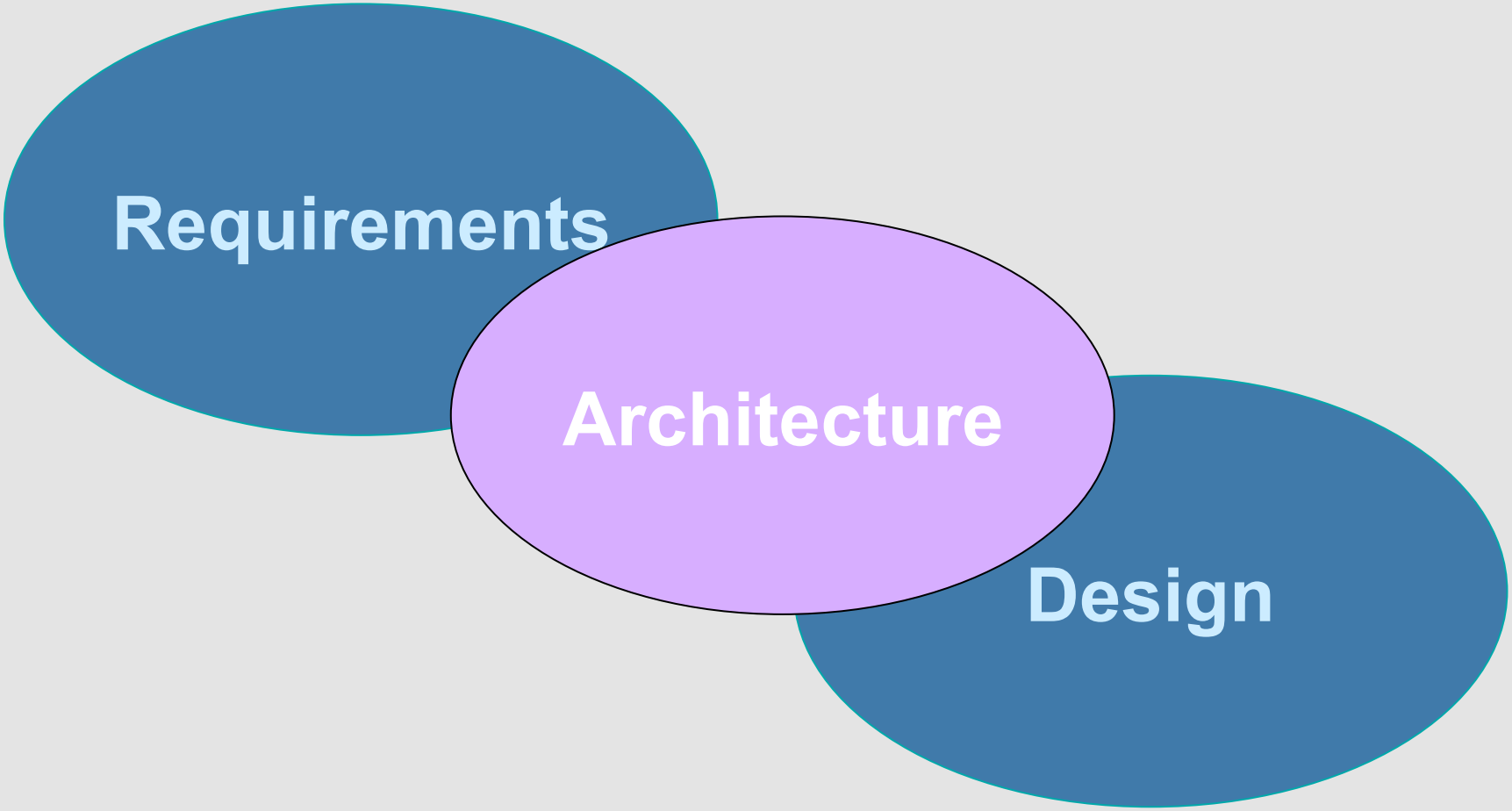
A common definition …

*The software architecture of a program or computing system is the **structure** or structures of the system, which comprise software **elements** the externally visible **qualities** of those elements, and the **relationships** among them*

Len Bass, Paul Clements and Rick Kazman (SEI)
Software Architecture in Practice, 2nd Edition

Role of Software Architecture

A crucial bridge between requirements and design



Software Architecture and Quality Properties

The non-functional system characteristics ("-illities")

- Performance, Efficiency, Security, Availability, …

Quality properties are crucial to stakeholders

- Slow functions don't get used
- Unavailable systems cause business interruption
- Security problems cause headlines

Yet quality properties are often an after-thought

Addressing quality properties is a *key* architectural task

- Understanding "real" stakeholder needs & required tradeoffs
- Often expensive to "retro-fit"

The Software Architecture Problem

Why software architecture is difficult

- Multi-dimensional problem
- Diverse stakeholder community to serve
- Making trade-offs inherent in the process
- Often no one “right” answer

Architecture practice today is largely ad-hoc

- Little standardisation in description
- Difficult to compare and discuss alternatives
- Unclear how to structure architectural activities
- No framework for handling quality properties

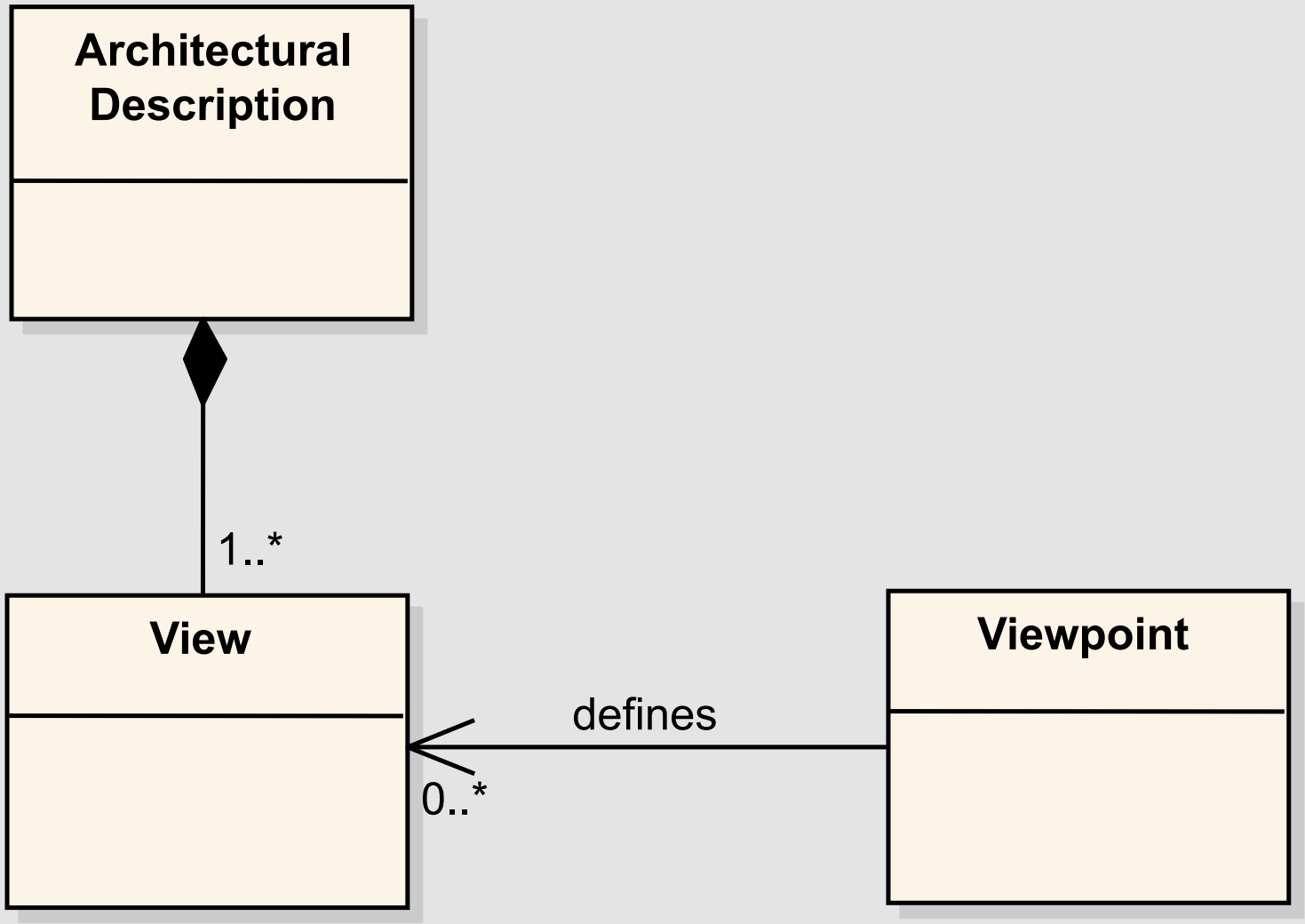
Architectural Viewpoints

Dealing with architectural structure

- Decompose the architectural description into ***views***
  - Each view addresses one aspect of the architectural structure
- Guide the development of each view via a ***viewpoint***
  - The viewpoint contains proven practice, pitfalls, etc.
- Well understood approach
  - RUP/Kruchten “4+1”
  - Siemens set
  - RM-ODP set
  - Rozanski & Woods set
- Approach standardised by IEEE standard 1471 (2000)

Viewpoints and Views

Inter-relationships



Viewpoints and Views

Example viewpoint set

- **Functional**: elements, connectors, interfaces
- **Information**: entities, constraints, relationship, ownership, usage
- **Concurrency**: processes, threads, coordination, element mapping
- **Development**: layers, module structure, standard design, codeline
- **Deployment**: hardware, network, dependencies, process mapping
- **Operational**: installation, migration, administration, support

[Rozanski and Woods; "*Software Systems Architecture*" – Addison Wesley, 2005]

Viewpoints and Views

Viewpoints provide

- A store of knowledge and experience
- A guide to the architect
- Templates to guide the process

Views provide

- A structure for description
- A separation of concerns
- Improved stakeholder communication

Limitations of viewpoints

- Quality properties are critical
- Viewpoints typically don’t consider quality properties
- Quality properties usually need cross-viewpoint consideration
- Viewpoints may lead to late consideration of quality properties

Architectural Perspectives

Dealing with quality properties

- Use ***perspectives*** to guide the architect in achieving the required quality properties
  - Each perspective addresses one major quality property
- The perspectives guide changes to the ***views***

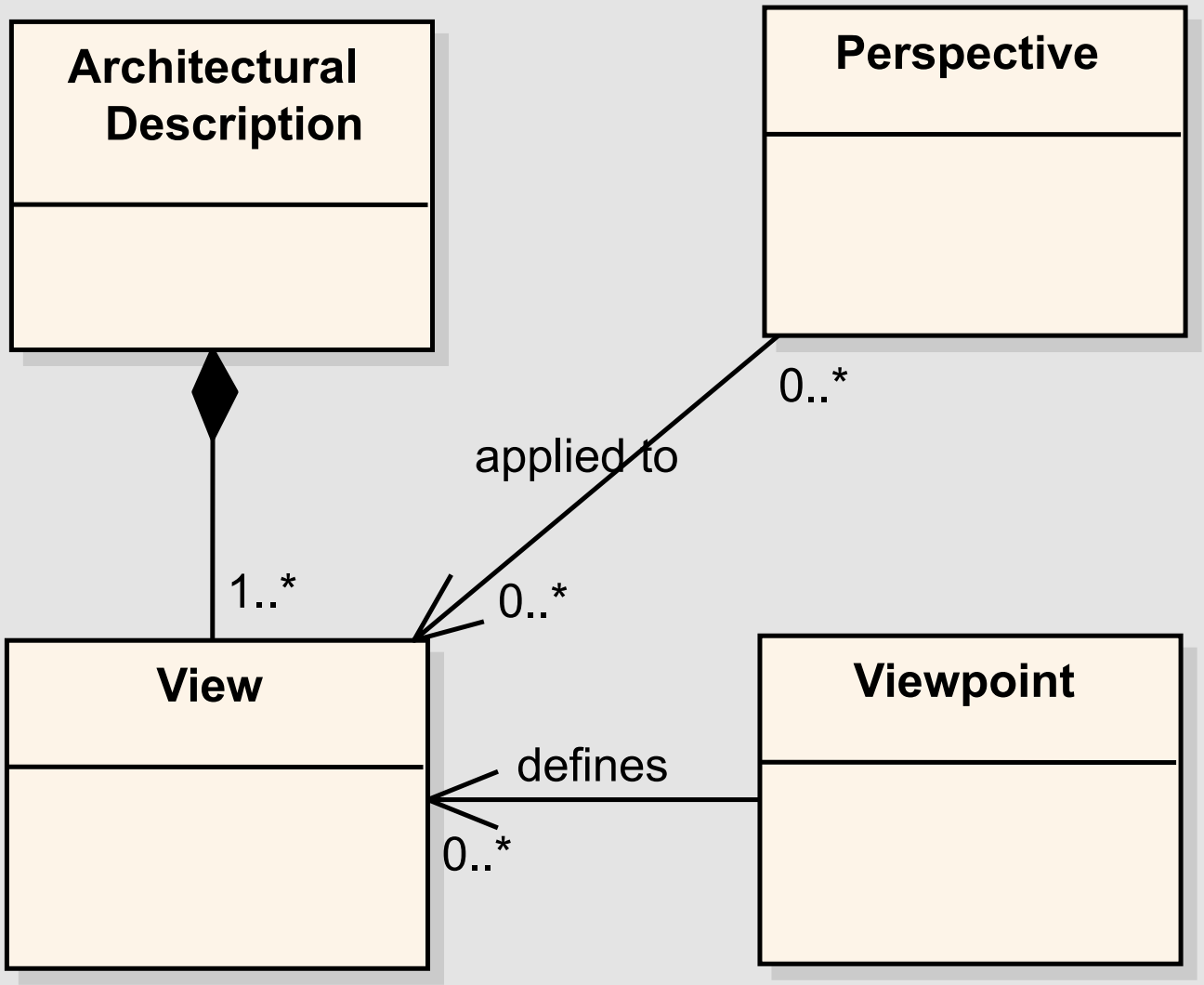
- A new approach, compatible with viewpoints
  - Related to SEI's "tactics" work

Defining perspectives

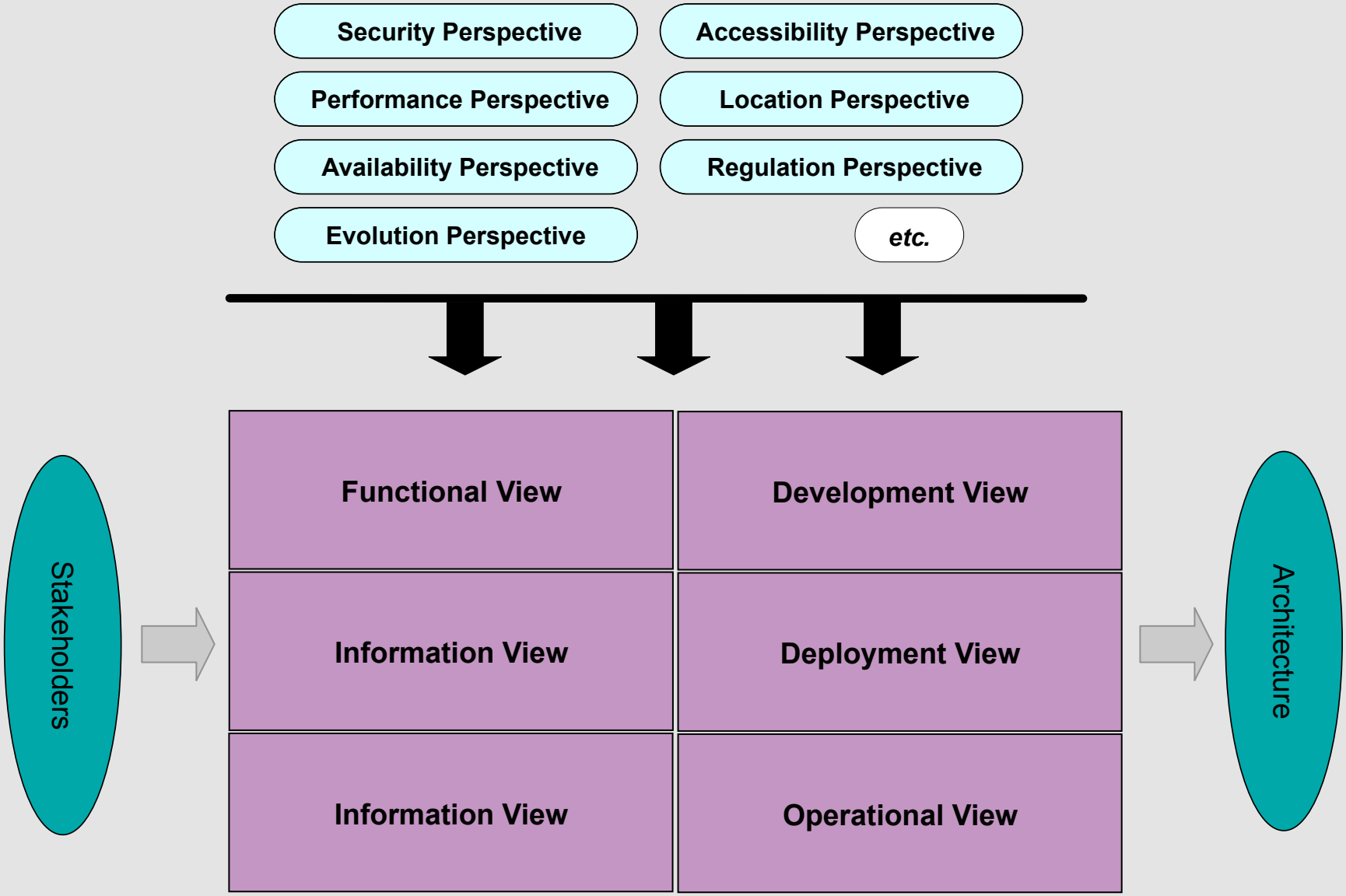
*Architectural **perspective** is a collection of **activities, checklists, tactics and guidelines** to **guide the process** of ensuring that a system **exhibits** a particular set of closely related **quality properties** that require consideration across a number of the system's architectural views.*

Rozanski and Woods, 2005

Adding perspectives to the inter-relationships



Using Viewpoints with Perspectives



Architectural Perspectives

Our initial core set

- Performance and Scalability
- Security
- Availability and Resilience
- Evolution
- Also: Location, I18N, Usability, Regulation, …

Different sets in different domains

Architectural Perspectives

Performance and Scalability

- ***Concerns***: processing volume, response time, responsiveness, throughput, predictability
- ***Techniques***: performance requirements definition, performance modelling, workload characterisation

Security

- ***Concerns***: authentication, authorisation, confidentiality, integrity, accountability, availability, intrusion detection, recovery
- ***Techniques***: threat identification, threat assessment, vulnerability analysis, application of security technology

Architectural Perspectives

Availability and Resilience

- ***Concerns***: classes of service, planned / unplanned downtime, mean time between failures, mean time to repair, disaster recovery, redundancy, clustering, failover
- ***Techniques***: MTBF and MTTR prediction, availability schedules, availability models, availability technology application

Evolution

- ***Concerns***: flexibility, extensibility, functional evolution, deployment evolution, integration evolution
- ***Techniques***: design for change, architectural assessment, configuration management, automated testing, build and release management

Summary

Viewpoints and Perspectives can

- Provide a framework for sharing knowledge
  - Viewpoints guide design of structures
  - Perspectives guide design for quality properties
- Act as a store of architectural knowledge
  - Document proven practice
  - Help standardise language and approach
  - Help to standardise languages and approaches
- Act as a tutorial for new architects
- Act as a guide for working architects
- Act as aide-memoir for experienced architects

More Information

Software Systems Architecture: Working With Stakeholders Using Viewpoints and Perspectives

Nick Rozanski and Eoin Woods
Addison Wesley 2005

http://www.viewpoints-and-perspectives.info