A Simple Example of Viewpoints & Perspectives

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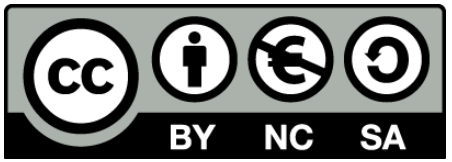


Content

- Introducing Viewpoints and Views
  - Many Dimensions of Software Architecture
  - Definitions
  - An Example Viewpoint Set
- An Example Application
  - Viewpoints
  - Applying Perspectives

Introducing Viewpoints and Views

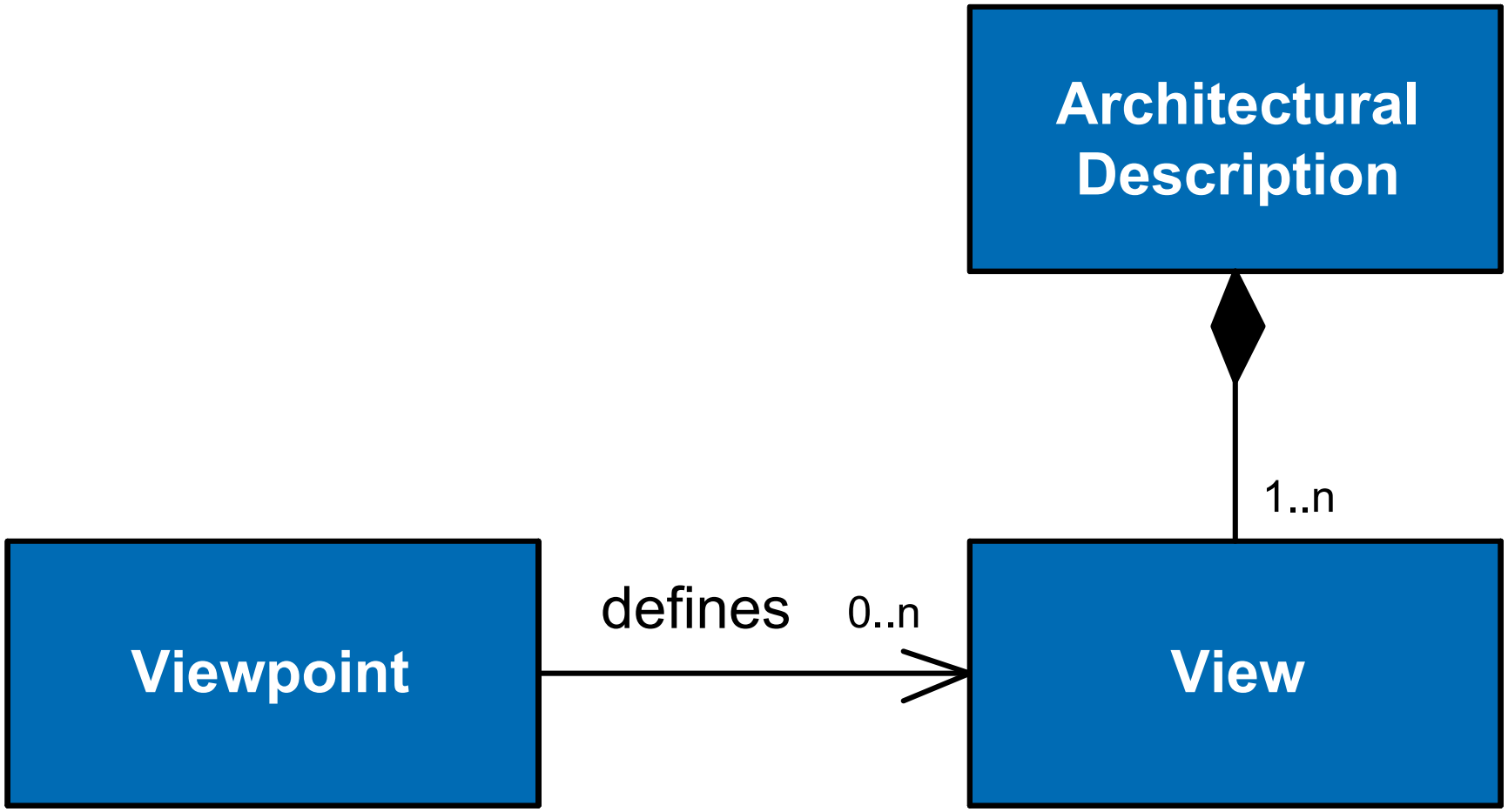
Many Dimensions of Software Architecture

- A system's architecture has many dimensions
  - Runtime component structure
  - Design time module structure
  - Location, ownership and structure of data
  - Deployment environment
  - ... and so on
- Putting these into one architectural artefact creates a mess
  - Tangles concerns
  - Doesn't communicate to anyone well
- Software architecture viewpoints are an attempt to fix this
  - Originally introduced in Philippe Kruchten's "The 4+1 View Model of Architecture" article in IEEE Software
  - Many other sets created since including Rozanski & Woods and C4

Definitions

- Standard IEEE 1471 provides standard definitions
  - A viewpoint is a collection of patterns, templates and conventions for constructing one type of view. It defines the stakeholders whose concerns are reflected in the viewpoint, and guidelines and principles and template models for constructing its views.
  - A view is a representation of all or part of an architecture, from the perspective of one or more concerns which are held by one or more of its stakeholders.
  - from IEEE Standard 1471 – Recommended Practice for Architectural Description (2000)

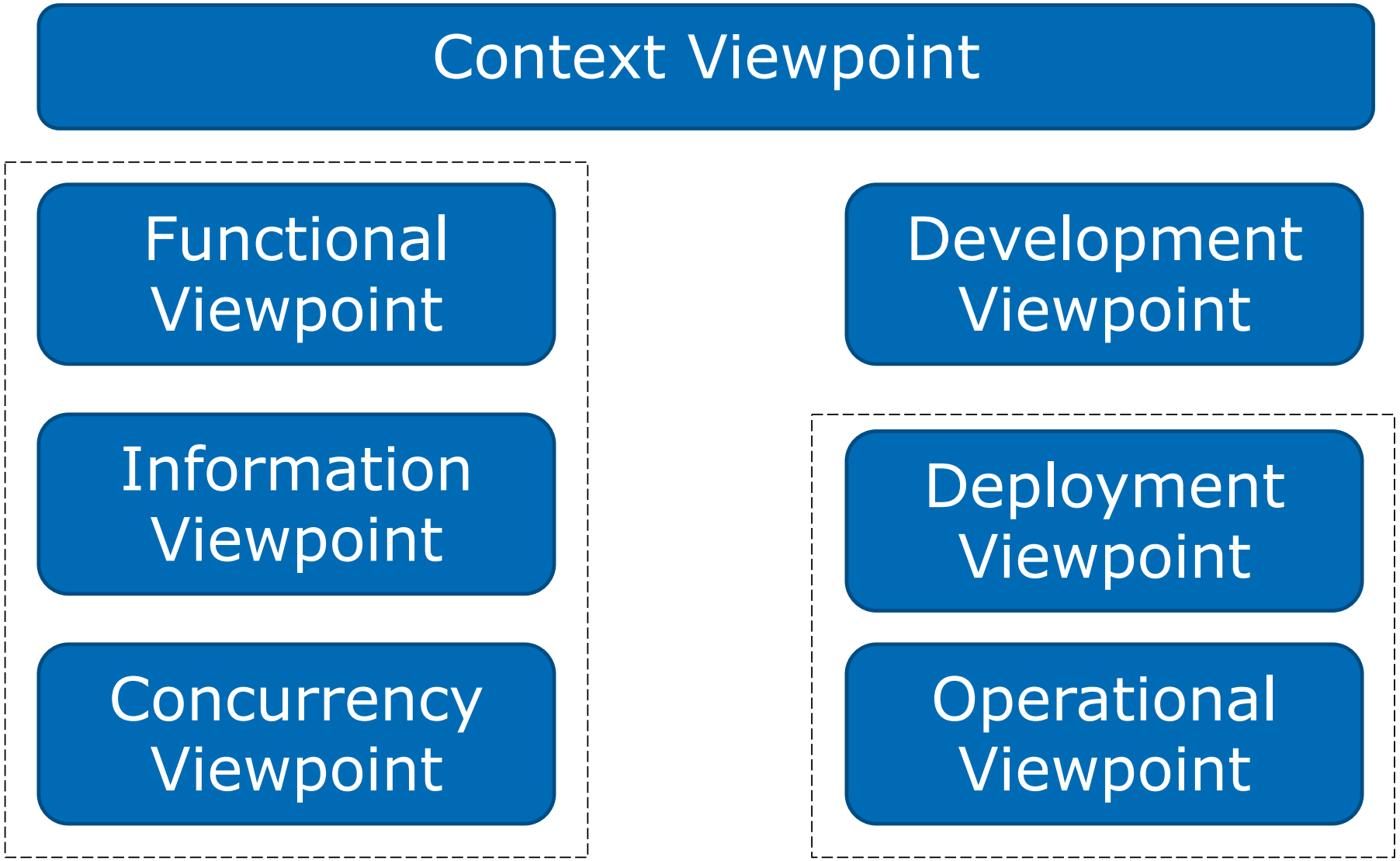
Definitions



An Example Viewpoint Set

- Rozanski/Woods Viewpoint Set
- Aimed at large scale information systems
- Extension and refinement of the “4+1” set
  - renamed “Logical”, “Process” and “Physical”
  - added “Context”, “Information” and “Operational”
- Standard content for viewpoints
  - applicability, concerns, models, stakeholders, problems & pitfalls, solutions, checklists

Example Viewpoint Set



[Rozanski and Woods – 2011]

An Example Viewpoint Set

- Setting the scene
  - Context
    - scope, relationship with external environment
- Core architectural structures
  - Functional
    - elements, connectors, interfaces, responsibilities, interactions
  - Information
    - entities, constraints, relationships, timeliness, usage, ownership
  - Concurrency
    - processes, threads, coordination, element to process mapping

An Example Viewpoint Set

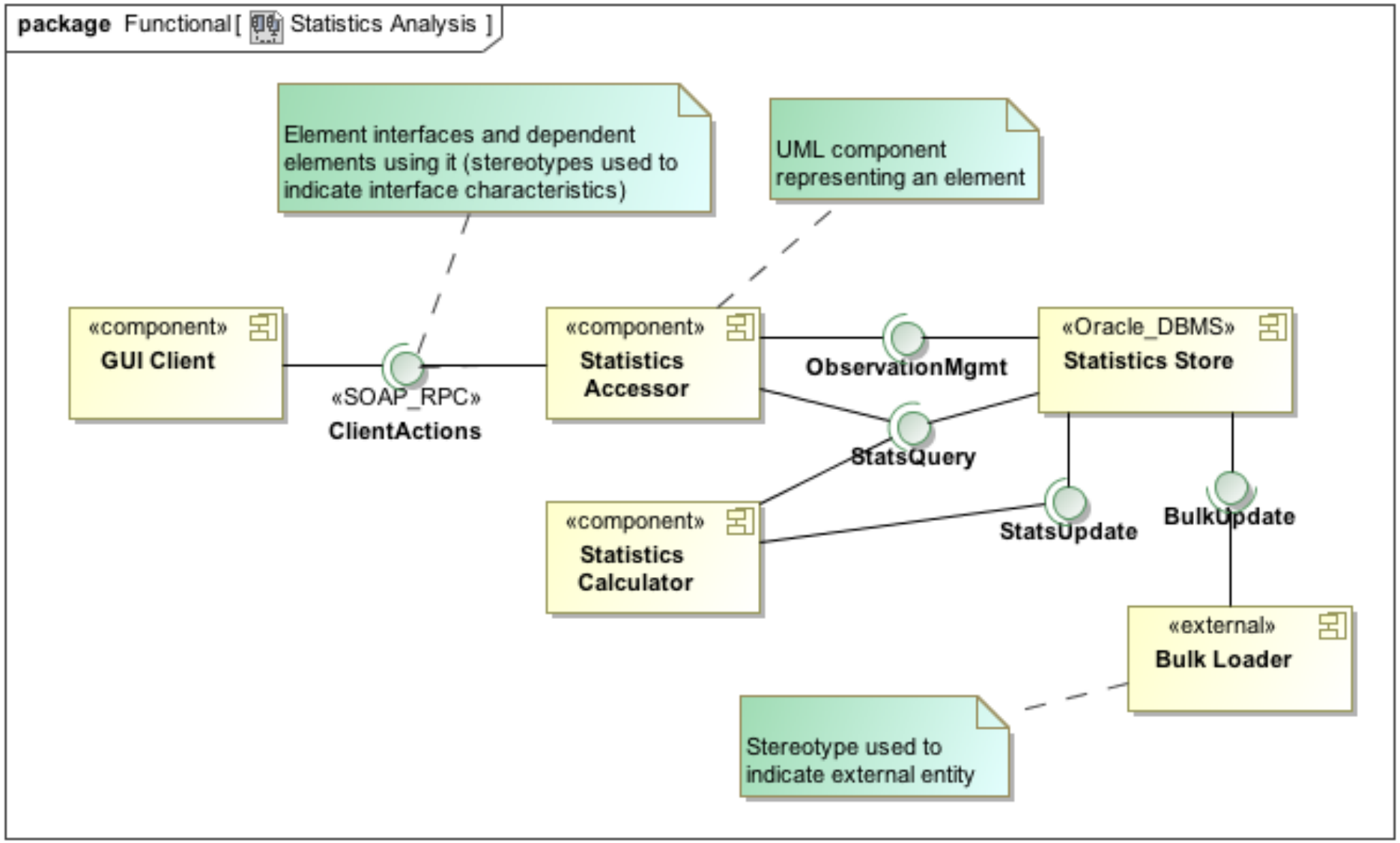
- Building the system
  - Development
    - layers, module structure, standard design, codeline
- Moving towards deployment
  - Deployment
    - hardware, network, software dependencies, process to node mapping
  - Operational
    - installation, migration, administration, support

An Example Application

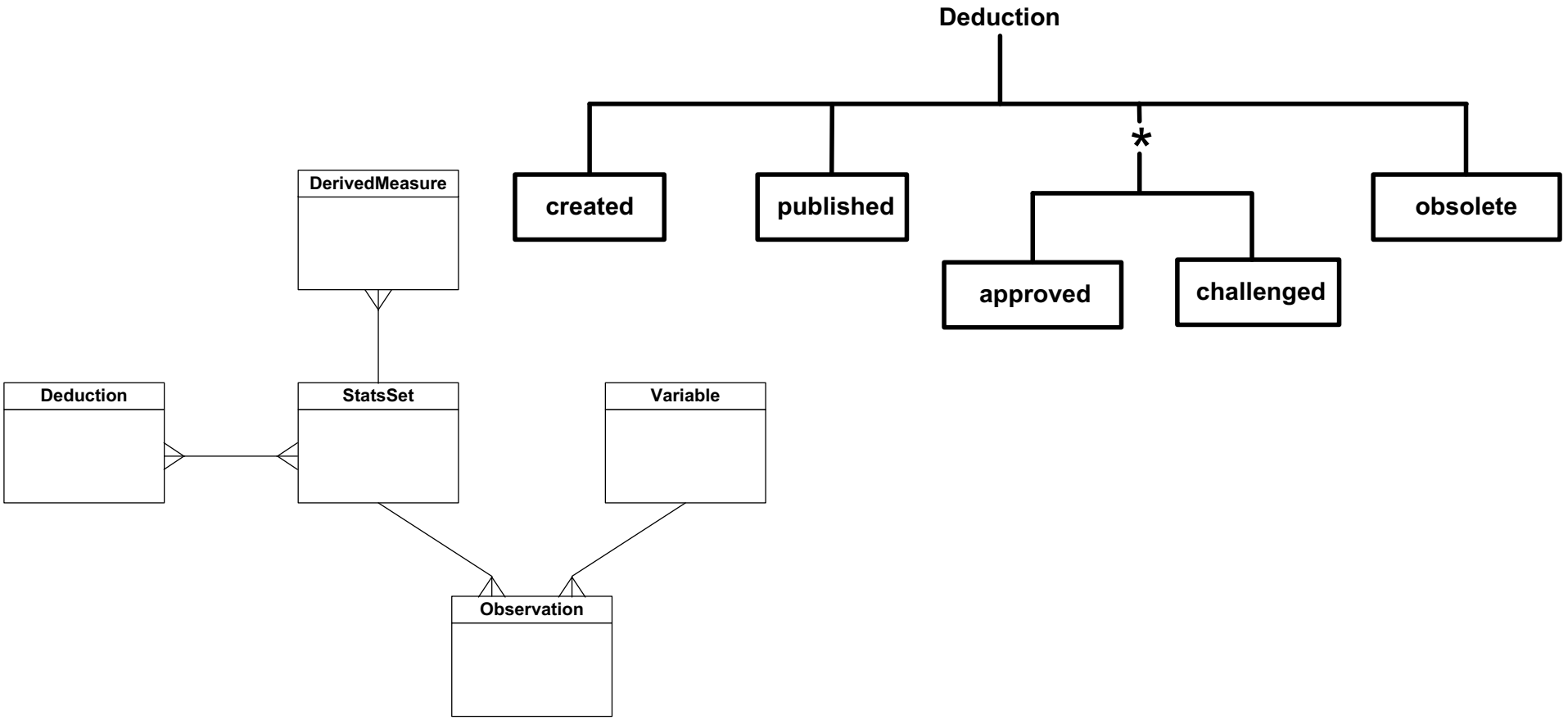
Example Application

- A simple example of using viewpoints and perspectives
- Problem domain is statistics storage and processing
  - Data must be loaded into the database
  - Derived measures are calculated automatically
  - Statisticians view and report on the data
  - Deductions from statisticians are recorded and reviewed manually

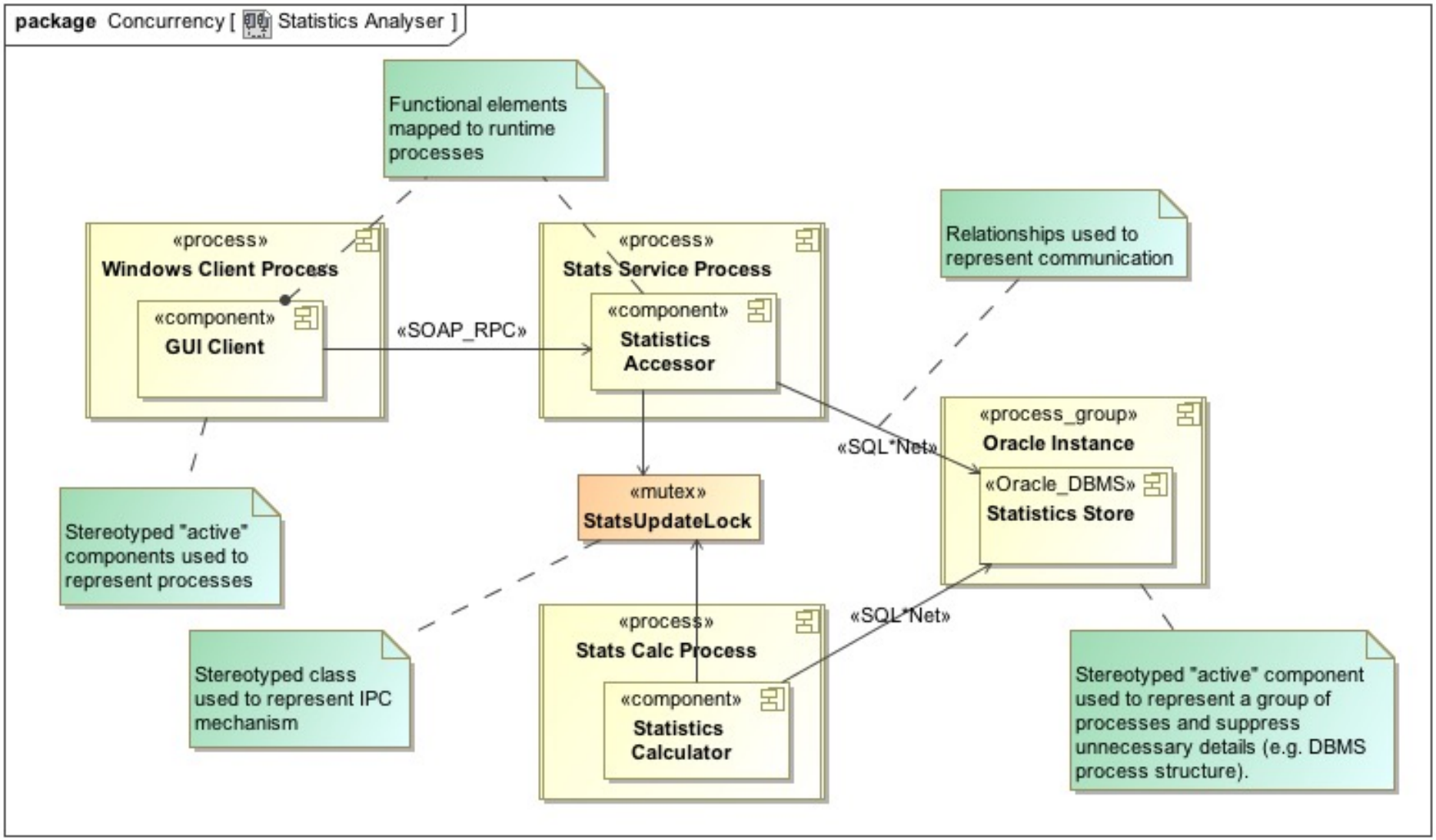
Functional View



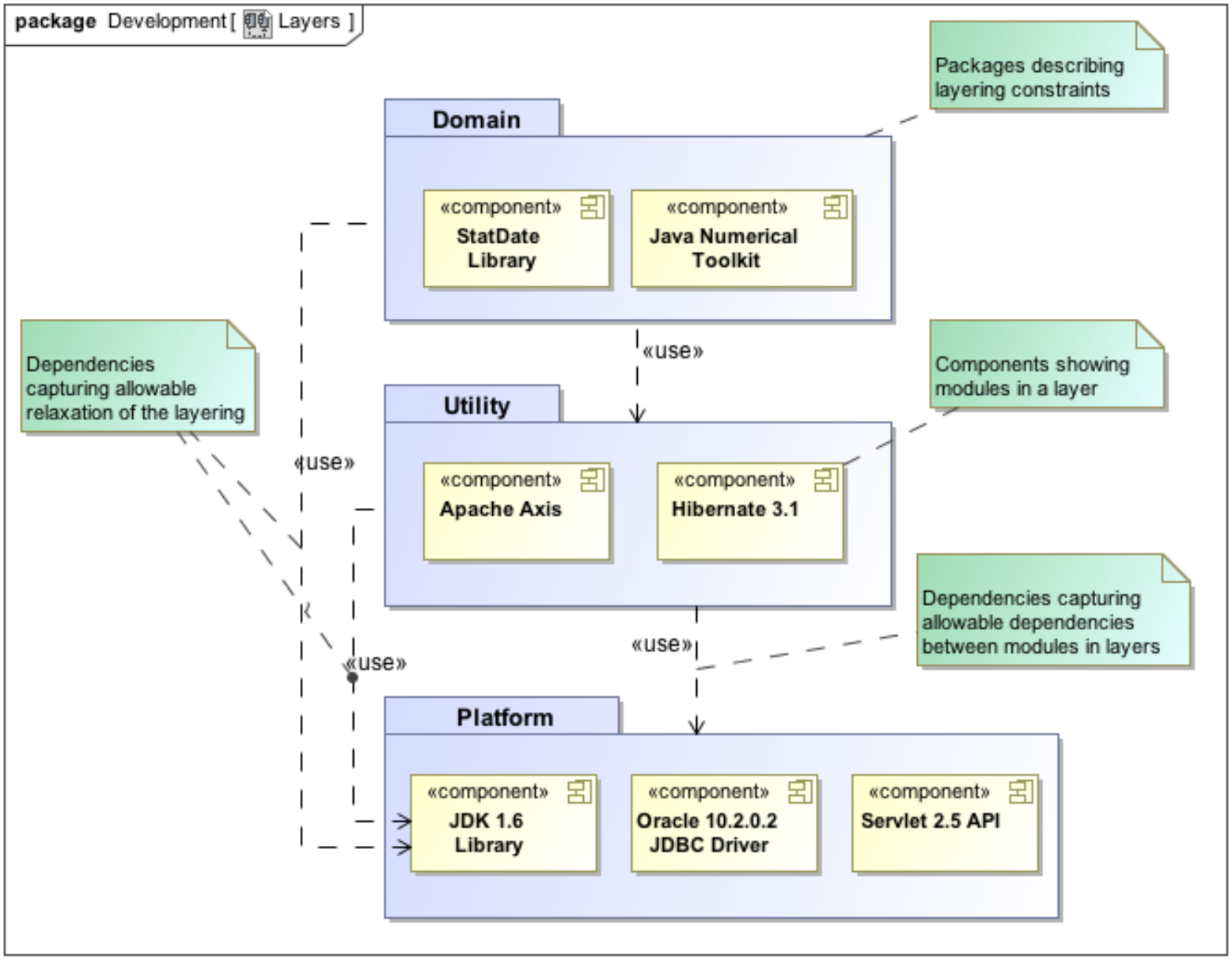
Information View



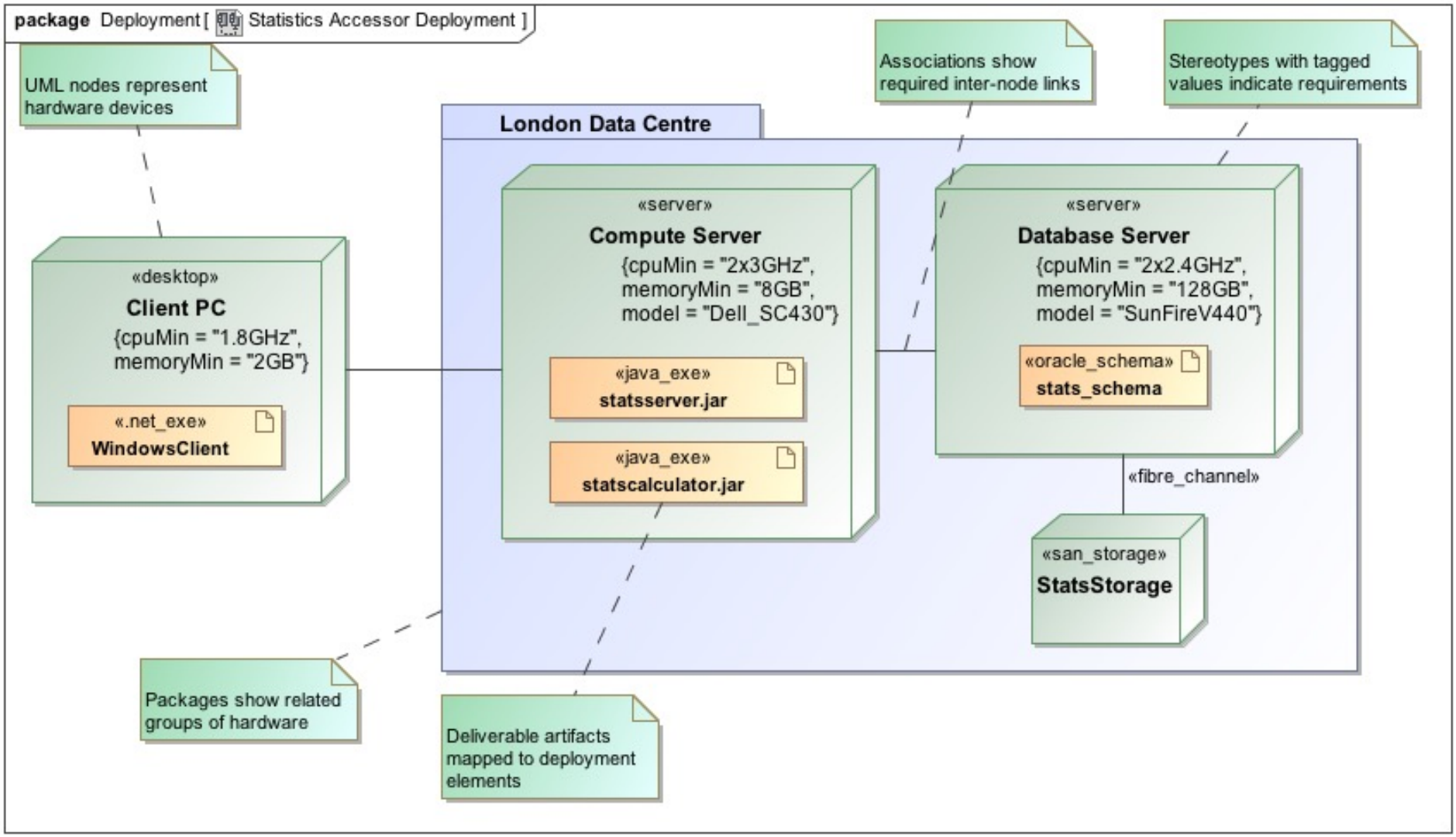
Concurrency View



Development View



Deployment View



Deployment View (ii)

Client PC	▪ Windows XP SP1 ▪ Java JRE 1.4.2_06 or later ▪ Internet Explorer 6.0 SP1
Primary Server	▪ Windows 2003 server, w/sec patches ▪ Java SDK 1.4.2_06 or later ▪ Apache Tomcat 5.5.9 or later

Database Server	▪ Solaris 9.0 w/Aug05 patch cluster
	▪ Oracle 9.2.0.2 Std Edition
	  ▪ 10GB buffer cache, auto sized SGA
	  ▪ auto storage management, 2 table spaces
	▪ OEM 9.2.0.2 installed and working

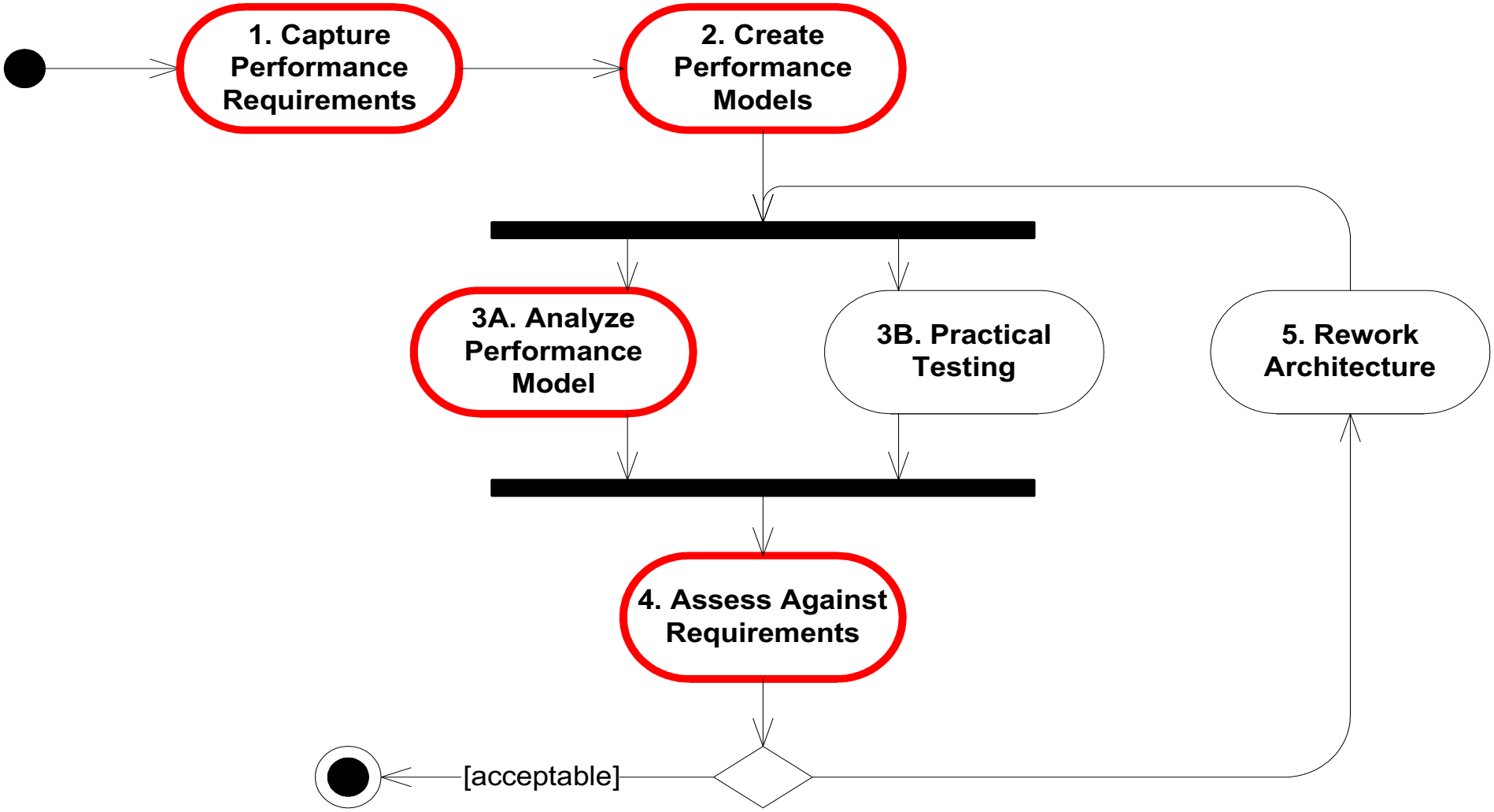
Operational View

- Omitted from the example for space reasons.
- Would include:
  - Operational CM approach
  - Monitoring and Control
  - Operational Needs
  - Installation / migration / backout strategies

Applying Perspectives

- Performance and Scalability
  - Capture P & S Requirements
  - Create Performance Models
  - Analyse Models
  - Perform Practical Testing
  - Assess Against Requirements
  - Rework Architecture (apply tactics)
- What affect will this have on our system?

Applying Perspectives

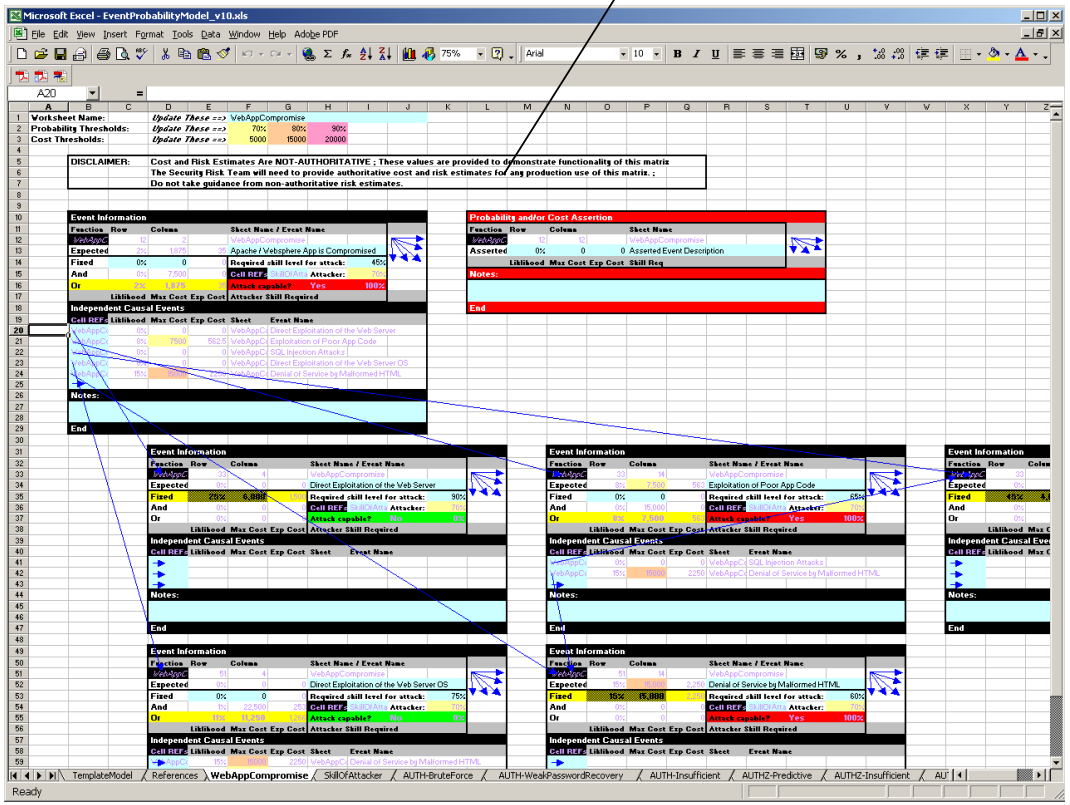


Applying Perspectives

Measure	*Value*
Network A	100Mb
DB access (ro)	20ms
DB access (rw)	50ms
Single derived calc	1400ms
Client network	10Mb
Bulk load 100K	2500ms
Online load users	100
Memory per user	1MB

Calibration measures

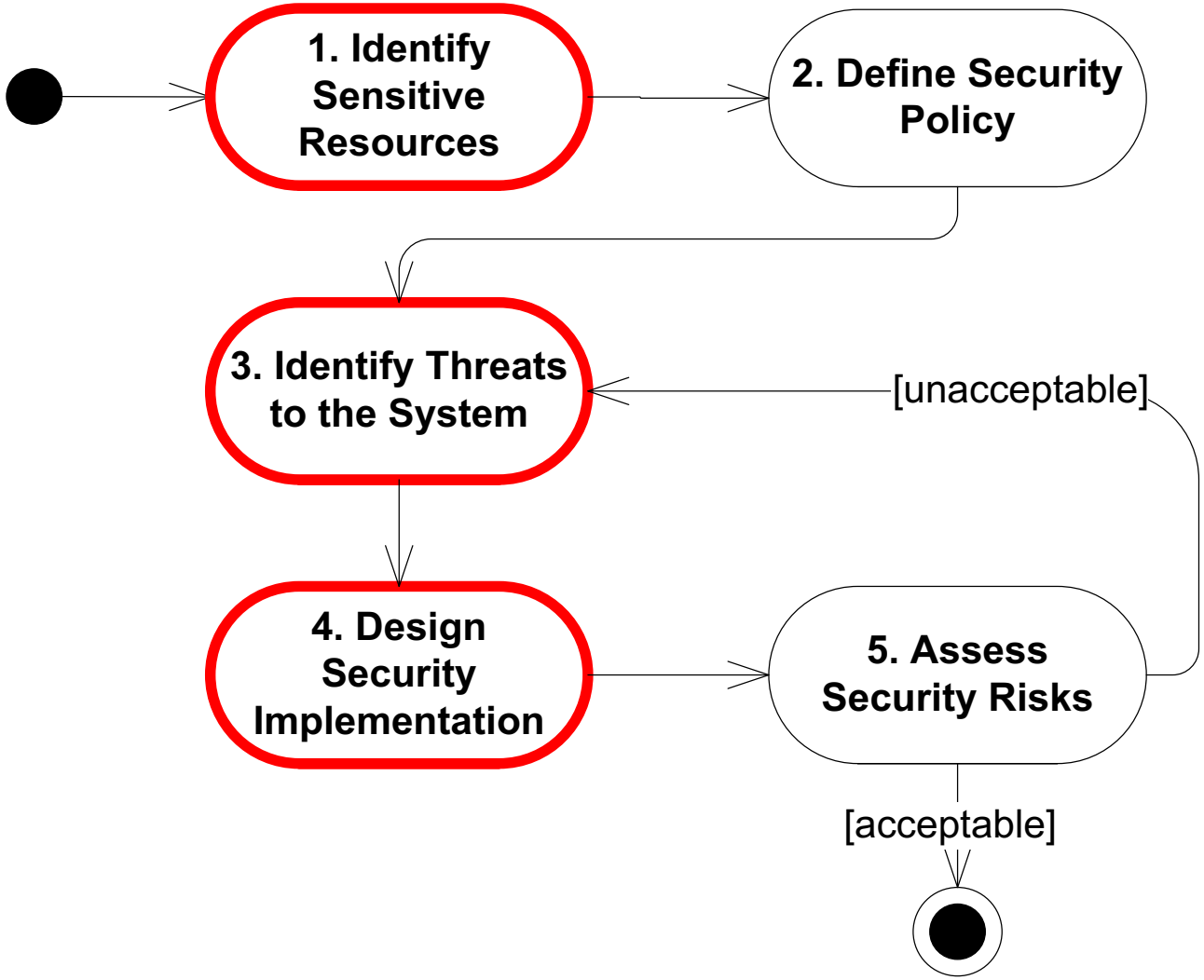
Performance model



Applying Perspectives

- Security
  - Identify Sensitive Resources
  - Define Security Policy
  - Identify Threats to the System
  - Design Security Implementation (apply tactics)
  - Assess Security Risks
- What affect will this have on our system?

Applying Perspectives



Applying Perspectives

- Sensitive Resources
  - The data in the database
- Security Threats
  - Operators stealing backups
  - Administrators querying data, seeing names
  - Bribing investigating officers
  - Internal attack on the database via network

Applying Perspectives

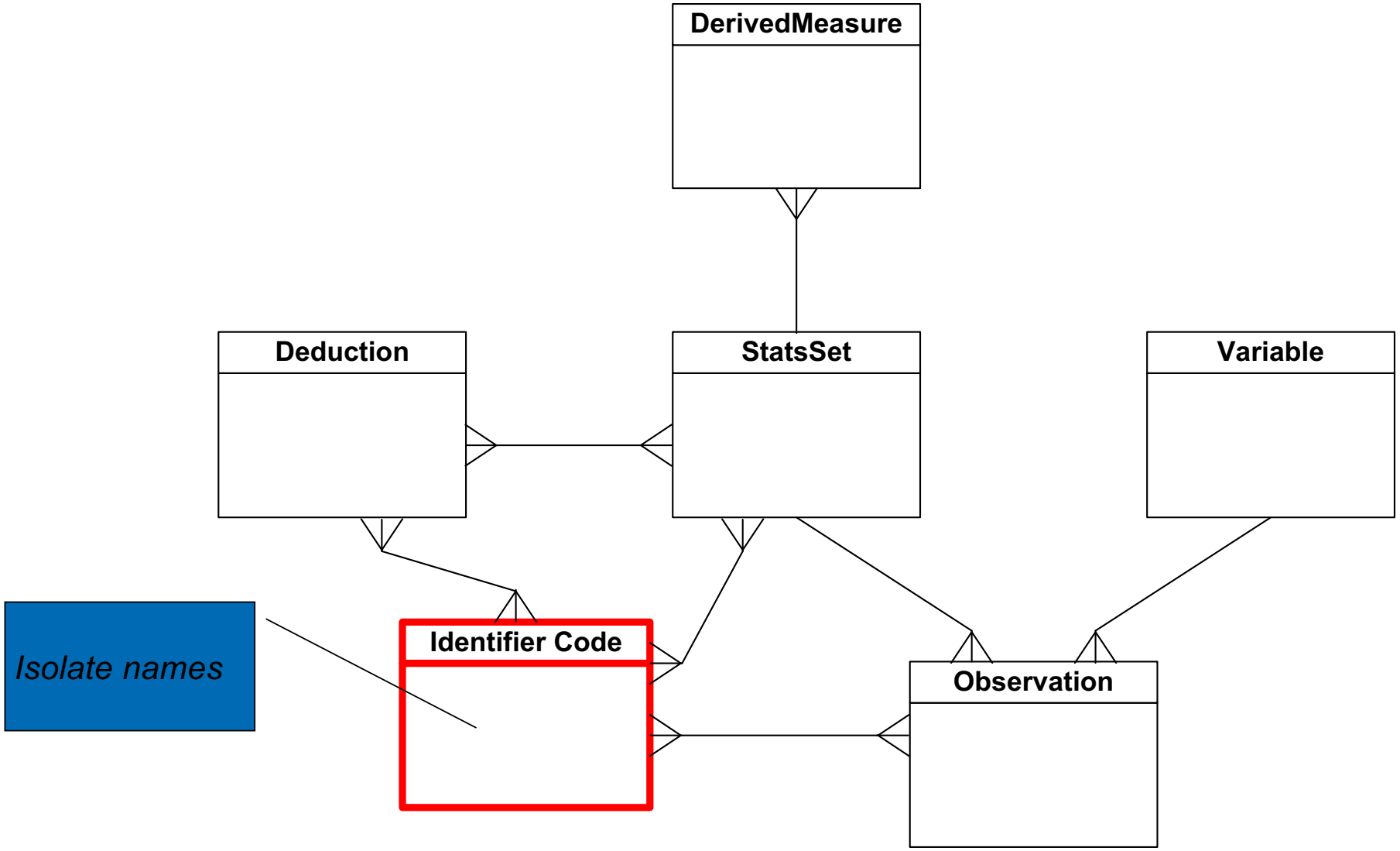
- Security Countermeasures
  - Backups: encrypt data in the database
    - How about performance?
    - Does this make availability (DR) harder?
  - Hiding names: use codes instead of names, protect the underlying names at a higher security level
    - More development complexity
    - Possible performance impact

Applying Perspectives

- Security Countermeasures
  - Bribery: add audit trail for data access
    - Possible performance impact
    - More complexity
    - Protecting / using the audit trail
  - Network Attacks: harden database, firewalls, IDS
    - More deployment & administrative complexity
    - More hardware and operational cost
    - Operational impact if IDS trips

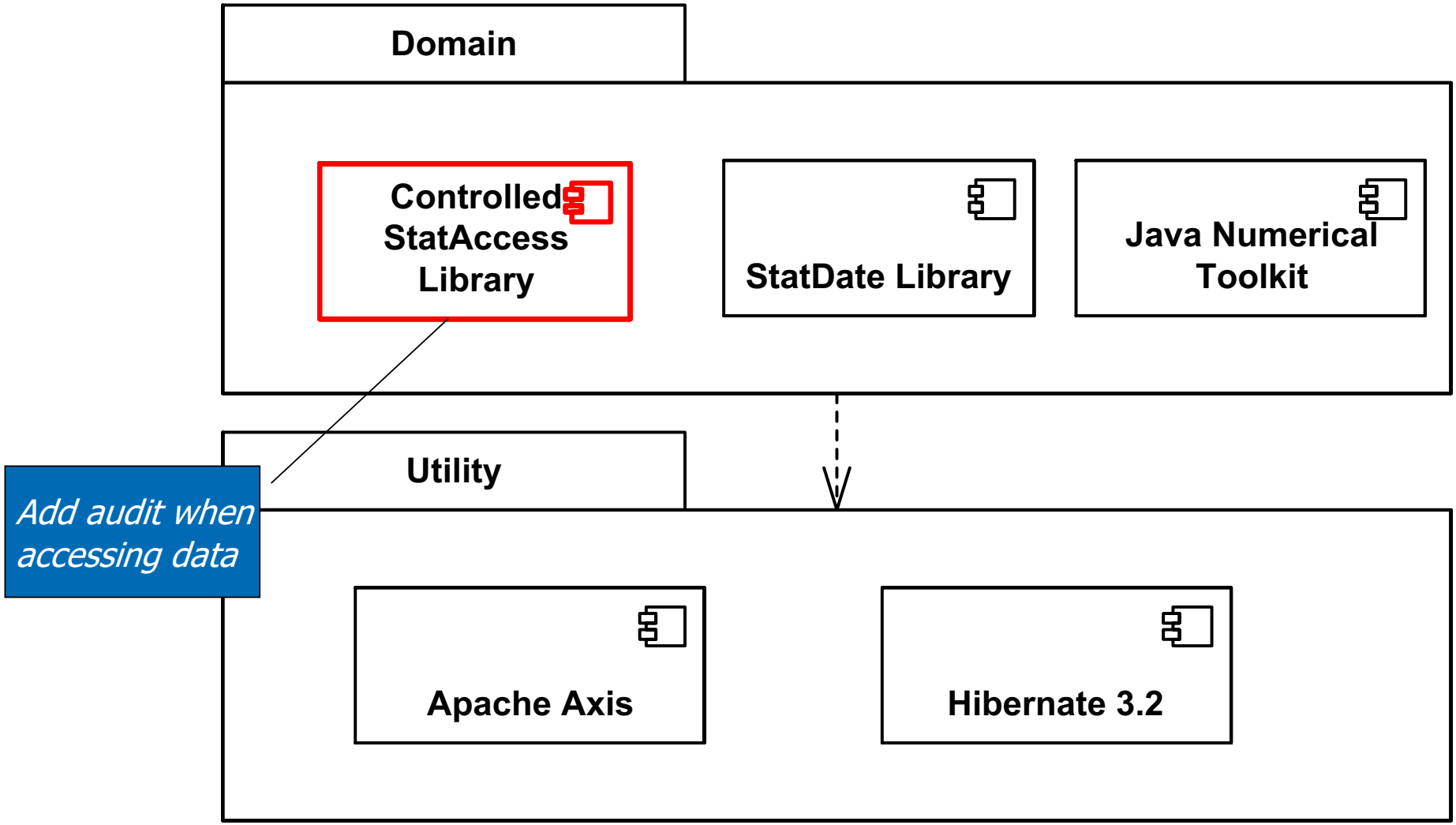
Applying Perspectives

Impact on information view …



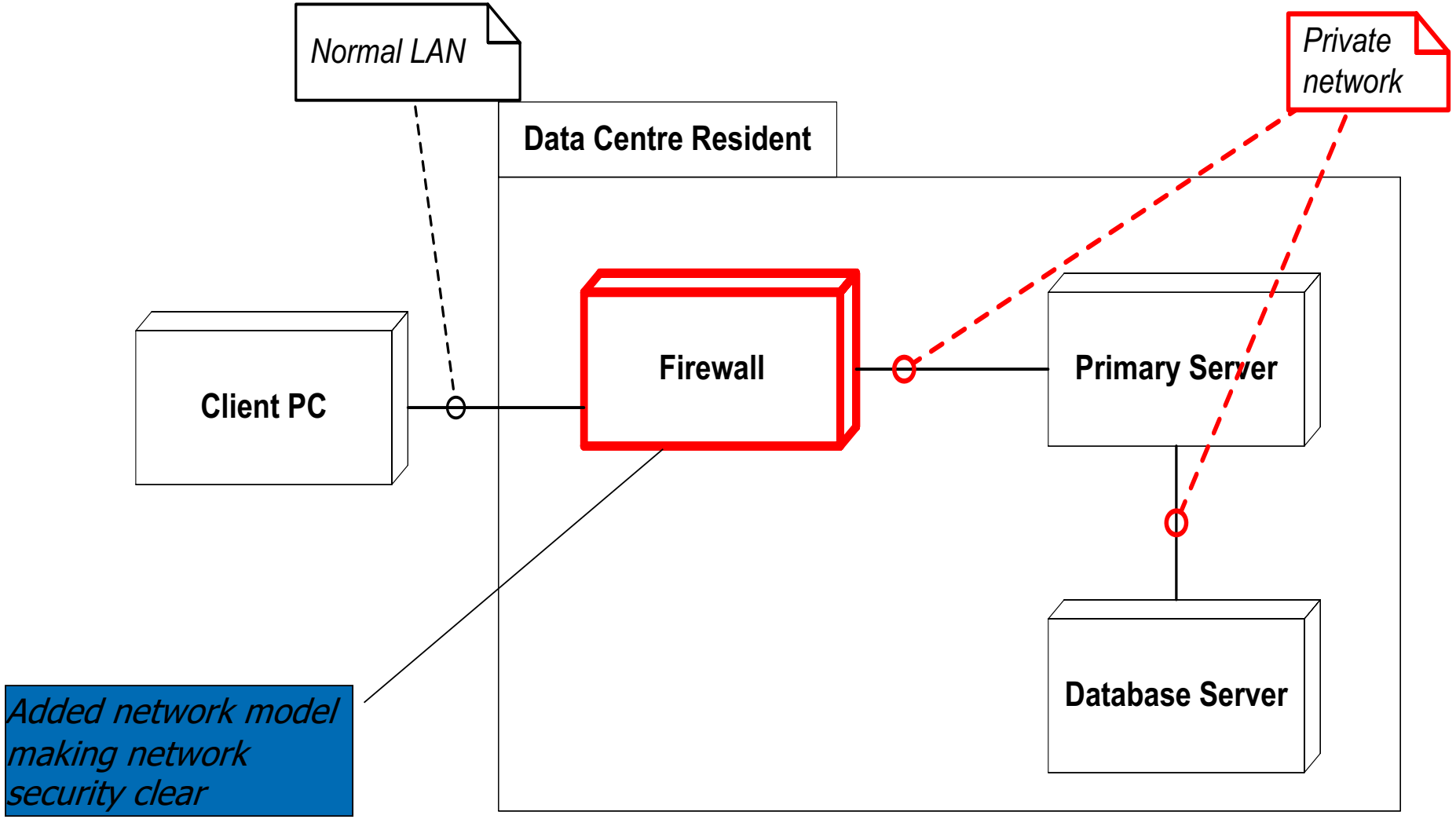
Applying Perspectives

Impact on development view …



Applying Perspectives

Impact on deployment view …



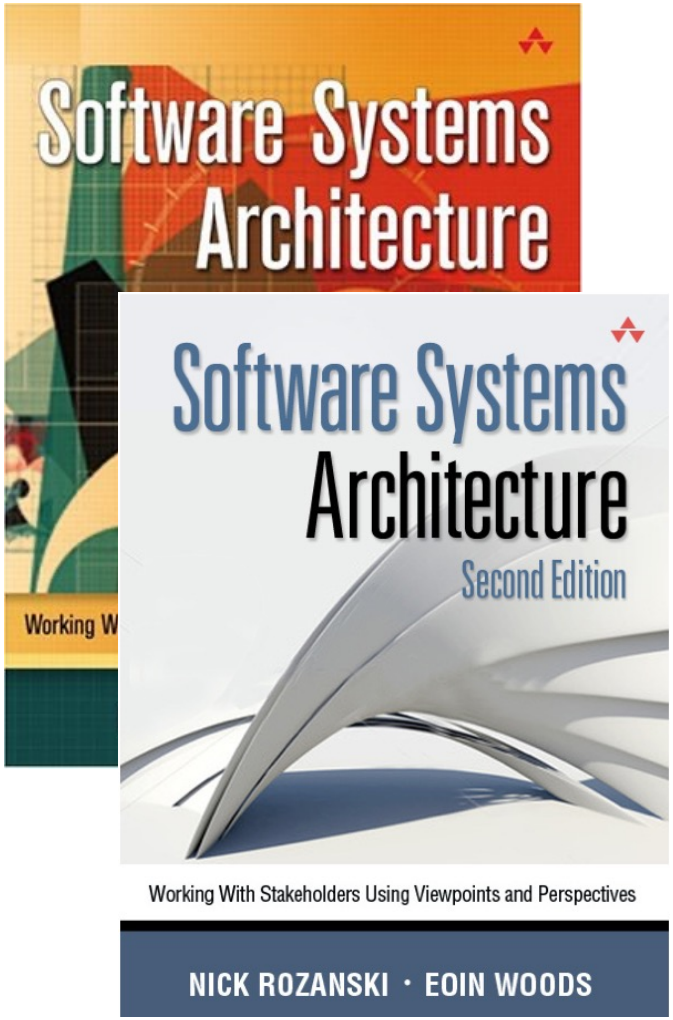
Applying Perspectives

- Other Impact
  - Need intrusion detection added to Development view
  - Database security
  - Need to capture impact on Operational view
  - Need to consider impact on availability
  - Need to re-work performance models to allow for database encryption, audit, …
- Note the need to change many views to address security needs

To Learn More

Software Systems Architecture
Working With Stakeholders Using Viewpoints and Perspectives

Nick Rozanski & Eoin Woods
Addison Wesley, 2011



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Comments and Questions?

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