Software Engineering
Week 8

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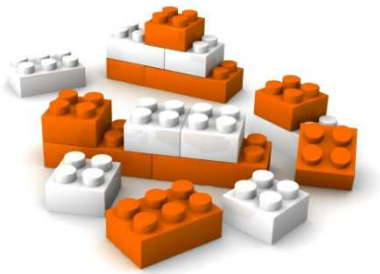
Schedule

- Software architecture
  - Representation
  - Design

Software architecture

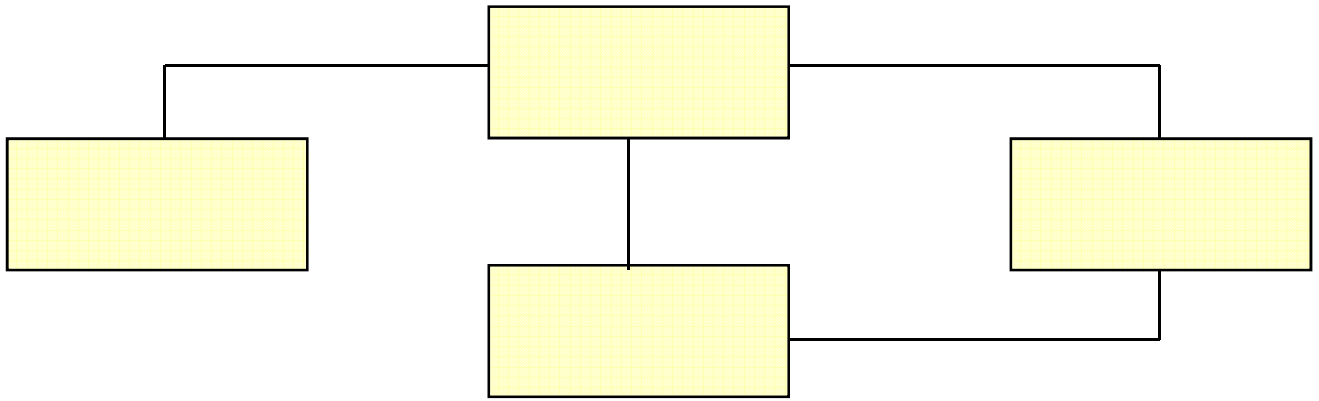
- Refers to the high level structures of a software system
- Discipline of
  - creating such structures, and
  - documenting of these structures



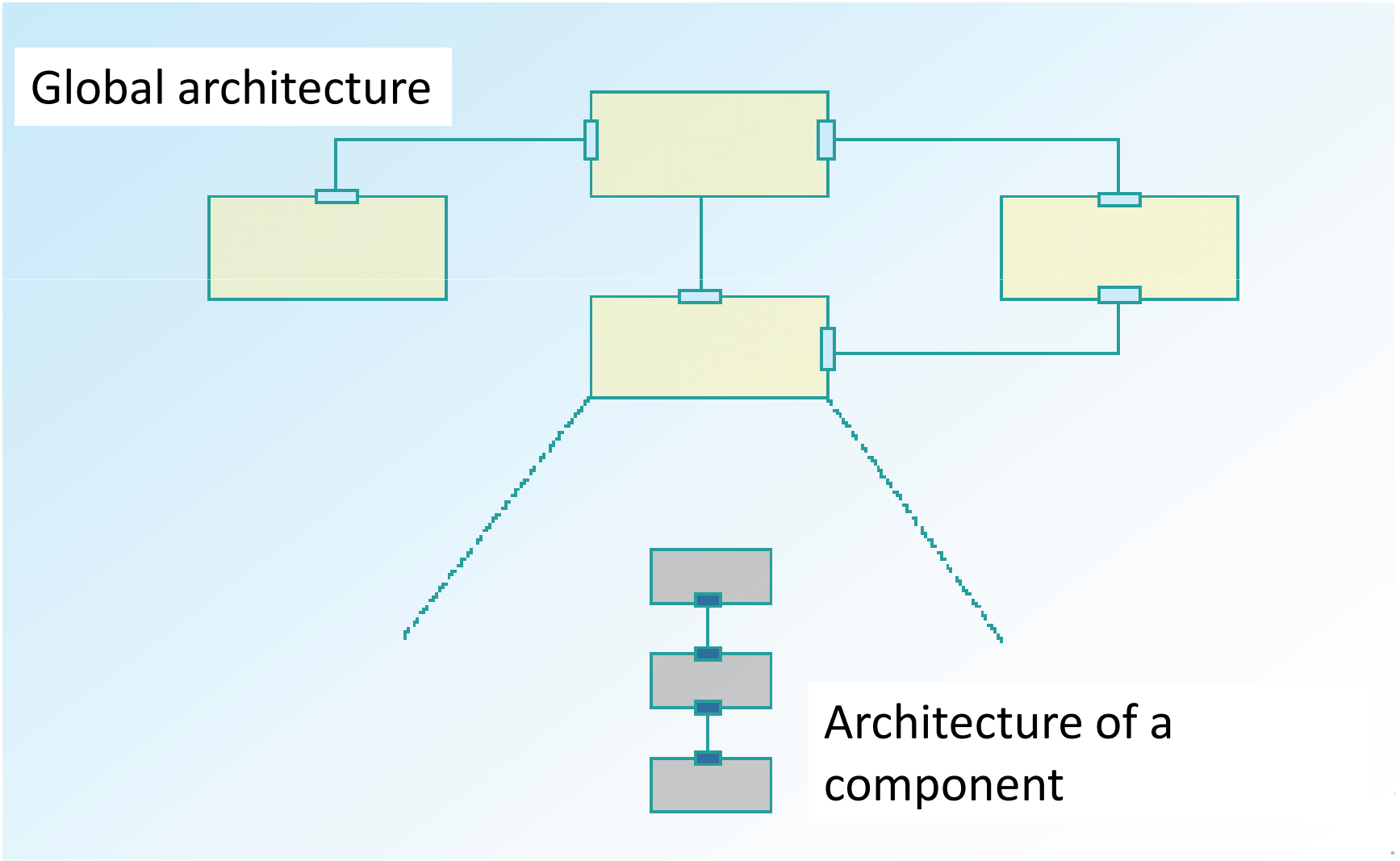
- Advantages
  - facilitates communication between stakeholders,
  - captures early decisions about the high-level design,
  - allows reuse of design components between projects

Software architecture definition

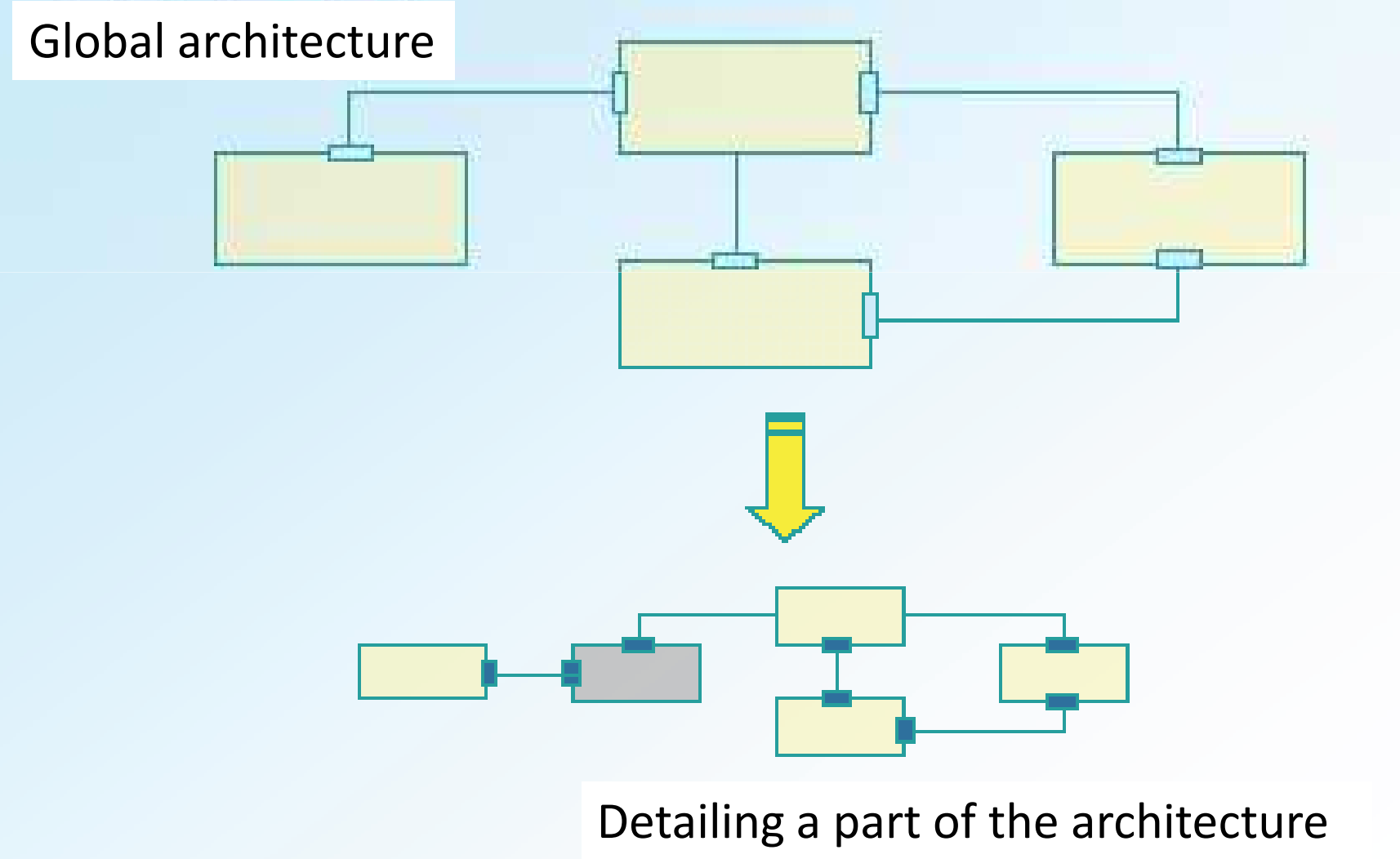
- Abstract representation of the final system as components and connectors
  - First decomposition of the problem/solution



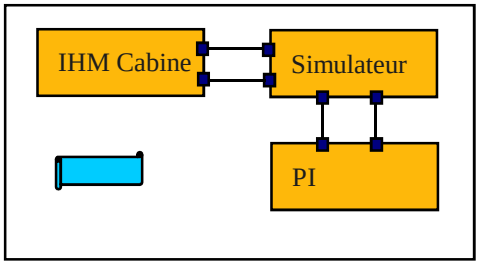
A sequence of abstractions



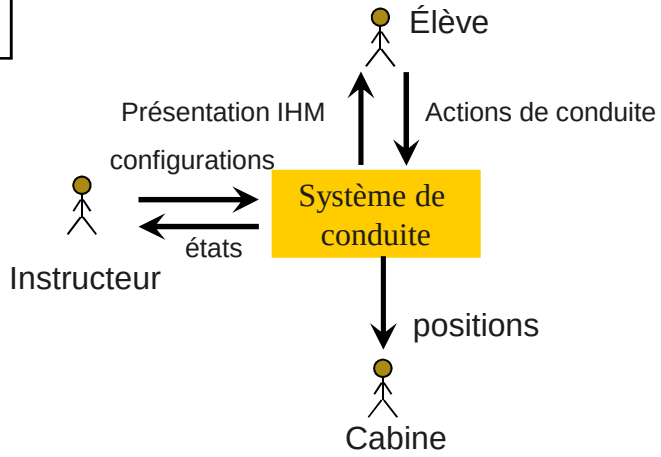
A sequence of abstractions

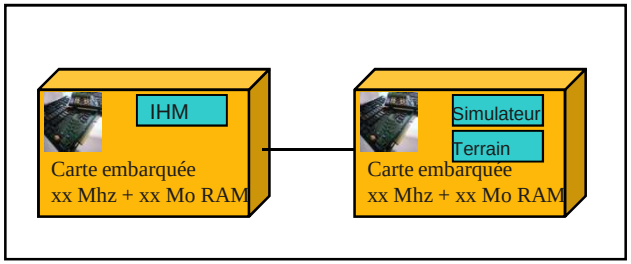


Architectural desctiption
a set of views

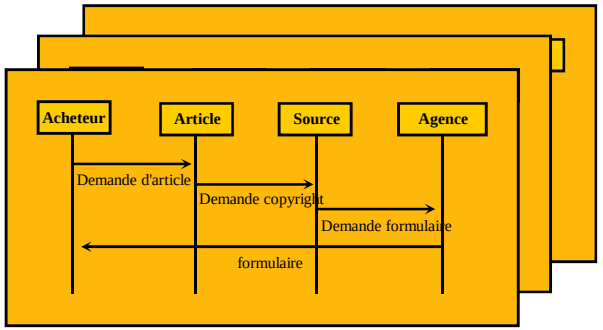


Logical view(s)



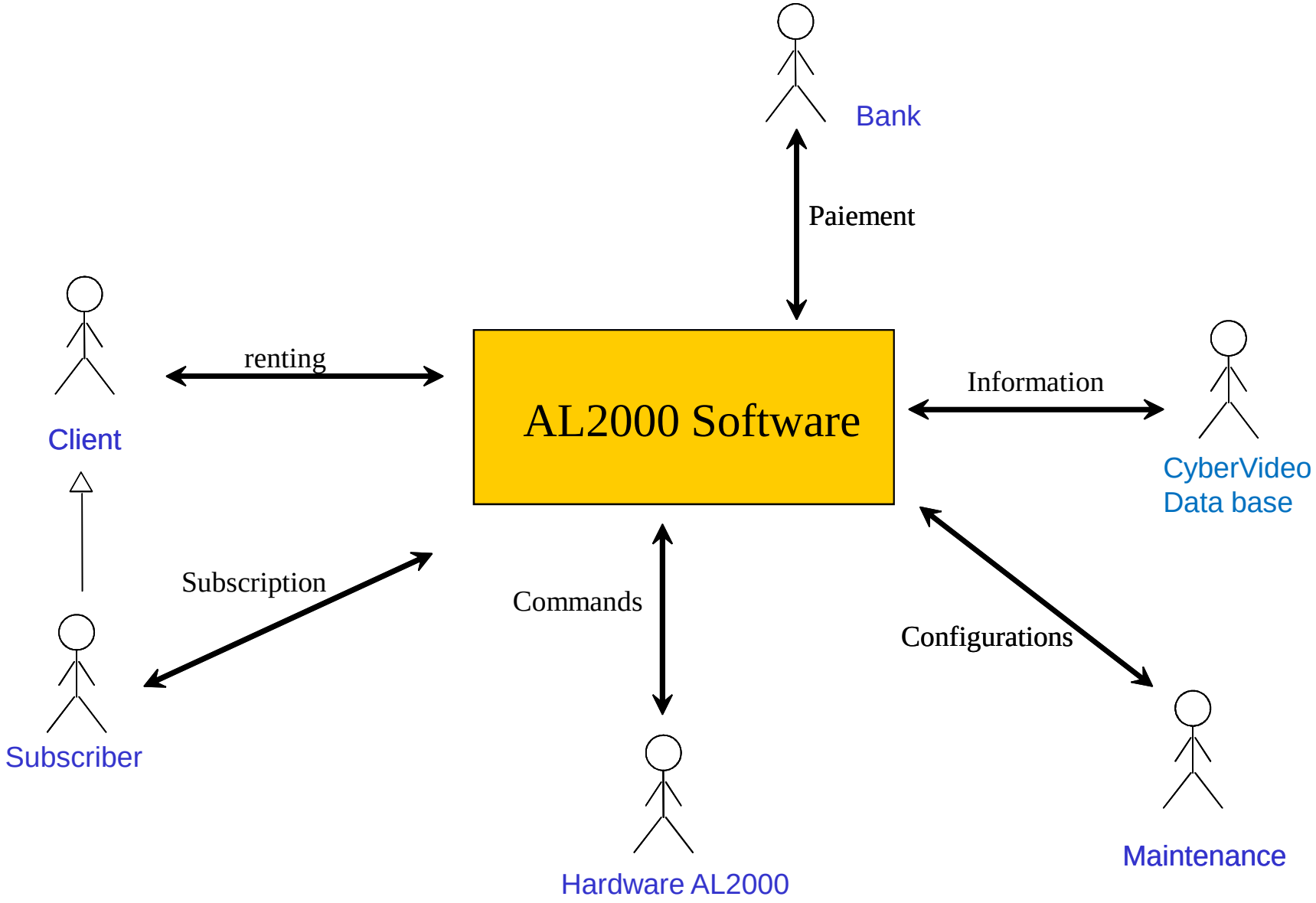


Physical views



Dynamical views

Cyber Video: Context



Cyber Video Exercise

- Propose an architecture of Cyber Video software

- Why is it difficult ?

Architecture and difficulties

- Architecture = first step(s) of conception
- You are in the process of **choosing a solution**
  - Choosing a set of component
  - Choosing how to connect them
- That is why it is difficult
- Any methods?
  - Is there any universal method to solve a problem?

Architecture design
some clues

- Identify a set of components
  - Method CBSP (University of Southern California)
  - Organize requirement into thematic groups
  - Make components emerging from these groups
  - Use abstraction if necessary
- Organize the components

Cyber Video Exercise

- Organize the following set of components as a possible architecture (logical view)
  - GUI
  - Link to hardware
  - Renting management
  - Subscription management
  - Communication Libraries
  - Transaction management

Logical View(s)

Physical view

Dynamical views

Architecture design
some clues

- To organize the component, it is possible to use “architectural patterns”
- Architectural patterns are classical solutions for component organization
  - MVC (model-view-controller)
  - Client-server
  - 3 tiers
  - Layers…

Architectural patterns - 1

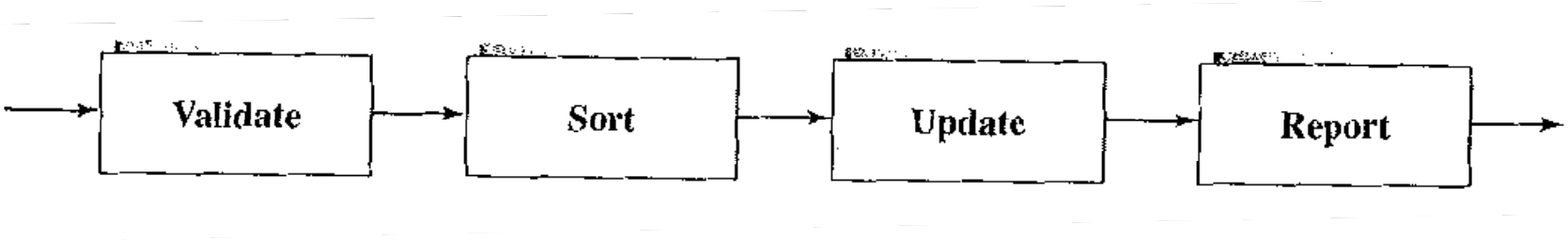
- Solution to a classical problem
  - Abstract
  - Well-known behaviors
  - Well-known advantages and drawbacks
- Helps
  - Starting the architectural design
  - Communication among stakeholders
  - Evaluation of the architecture

Architectural patterns - 2

- More and more important
- But emerging catalogues
  - Not well organized
  - With different levels of abstractions
- Example of architectural pattern families / style
  - data-flow
  - data-centered
  - hierarchical
  - for distributed architectures
  - for UI

Data-flow style example: Pipes and filters

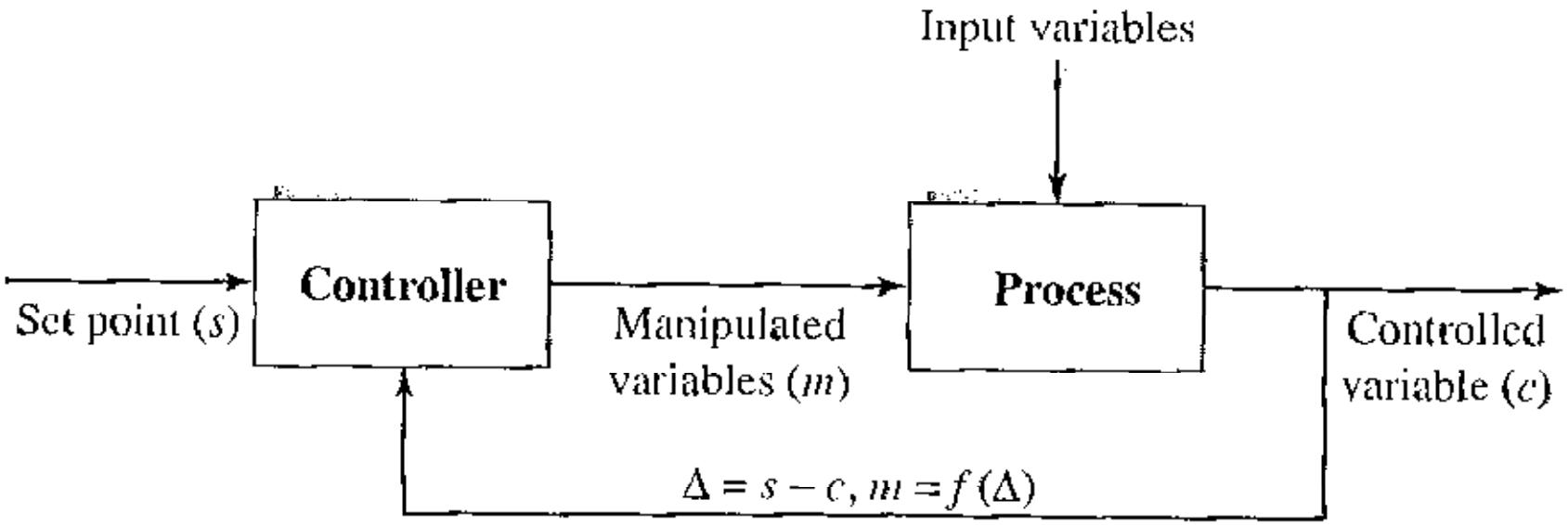
- Architecture is organized as a set of transformations
  - Filters are the components dedicated to transformations
  - Pipes are dedicated to the communication



19

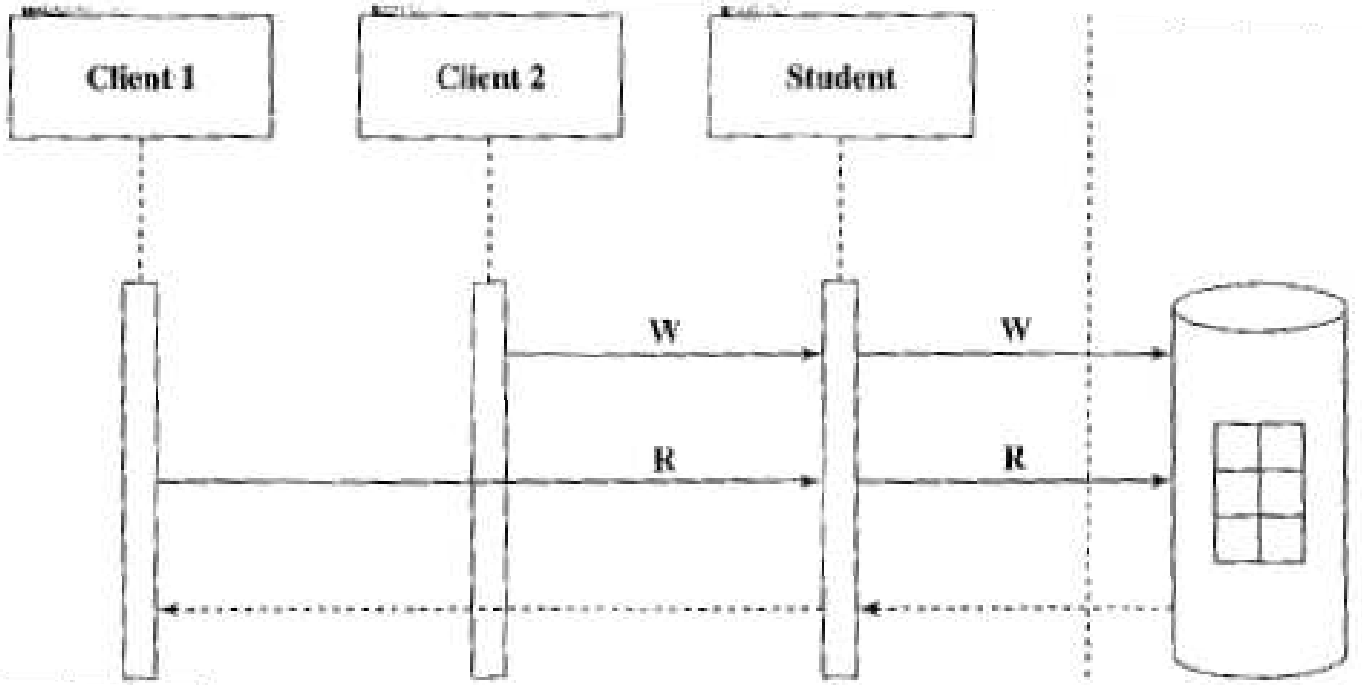
Data-flow style example: Process-Control Architecture

- For systems that have to
  - maintain an output to a specific value
  - reach a specific objective



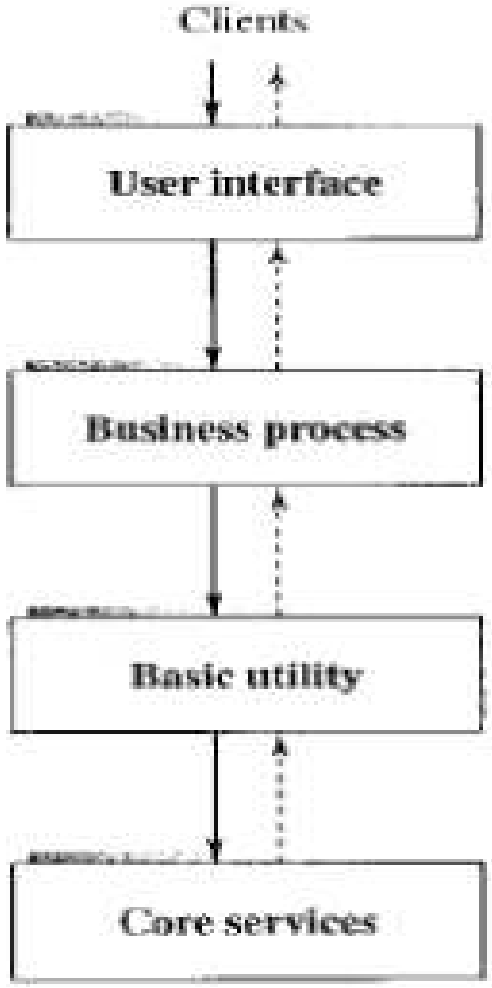
Data-centered style example: Repository-style

- Architecture is organized around a repository (data-base)



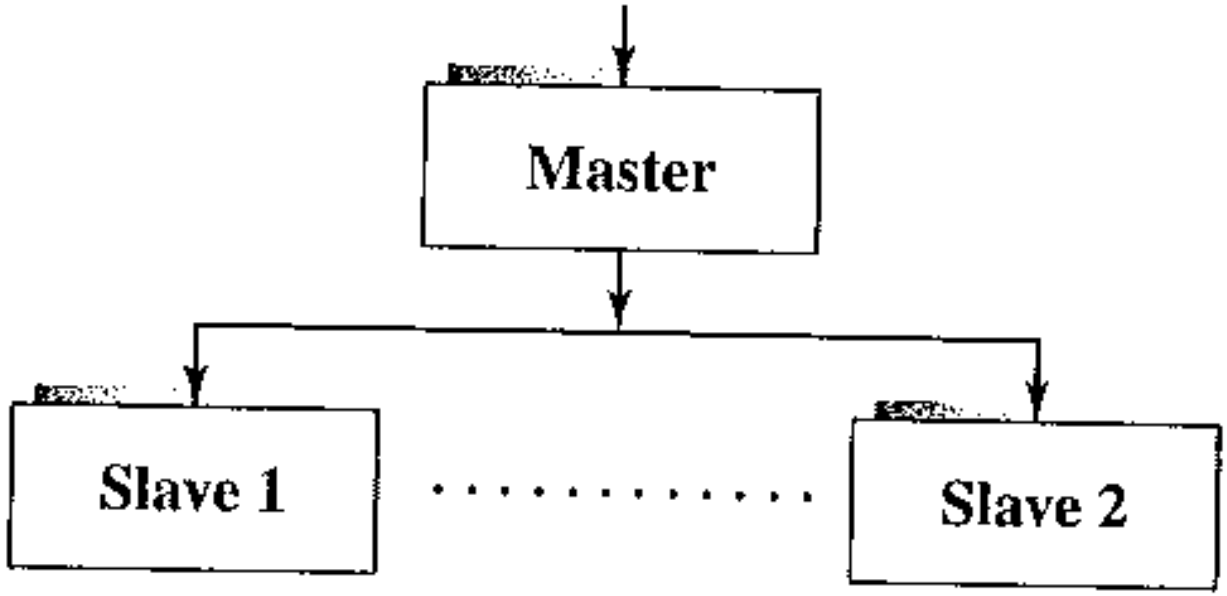
Hierachical style example: Layered

- Components are organized into layers
- Each layer is deal with a **level of abstraction**
- Each layer communicates with its **immediate neighbors**



Hierarchical style example: Master-slave

- A component (master) controls the execution of the others (slaves)



Distributed architecture style example Client-server (two-tier)

- Involve a separate client and server system, connecting through a network.

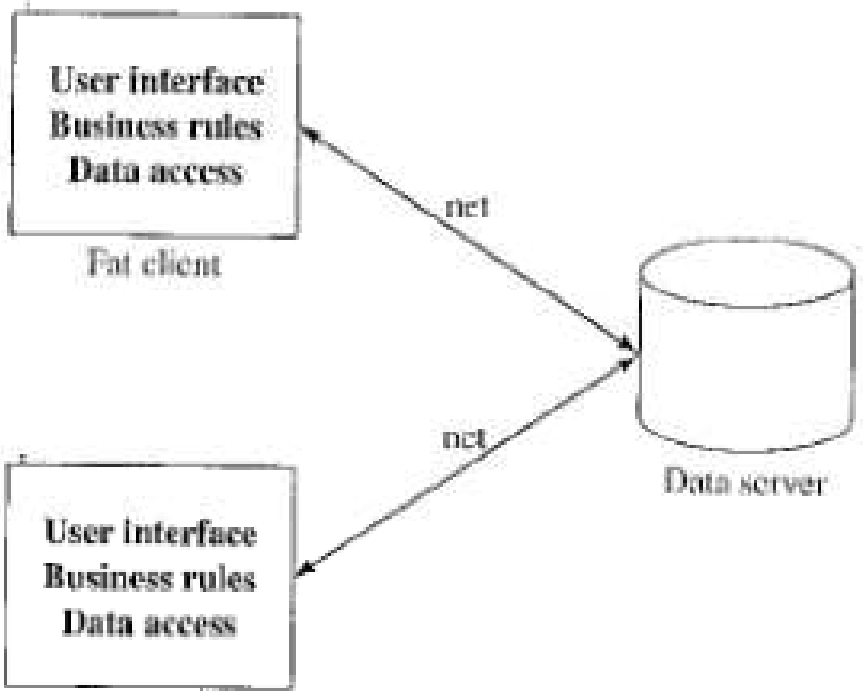
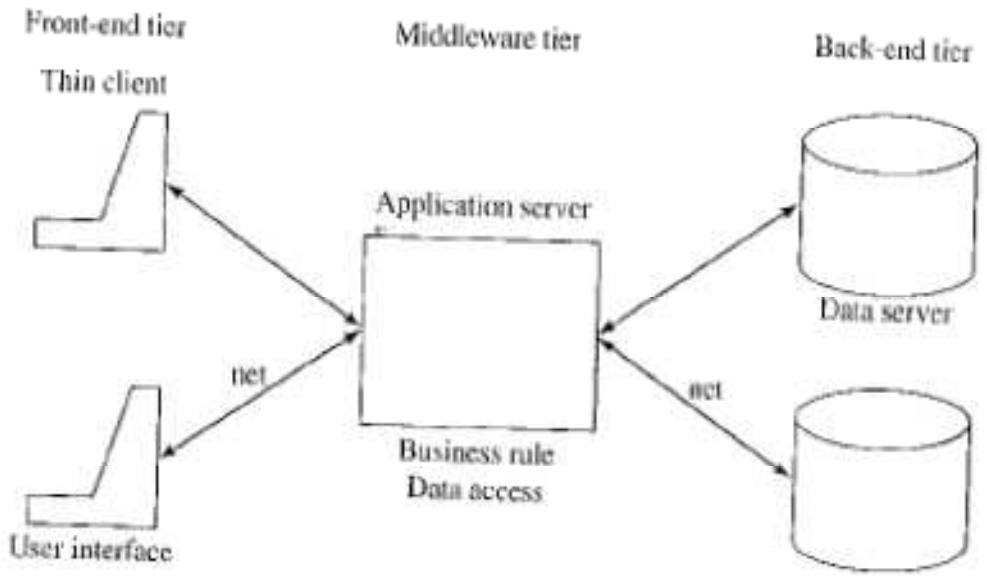


Figure 10.1
Two-tier client-server architecture

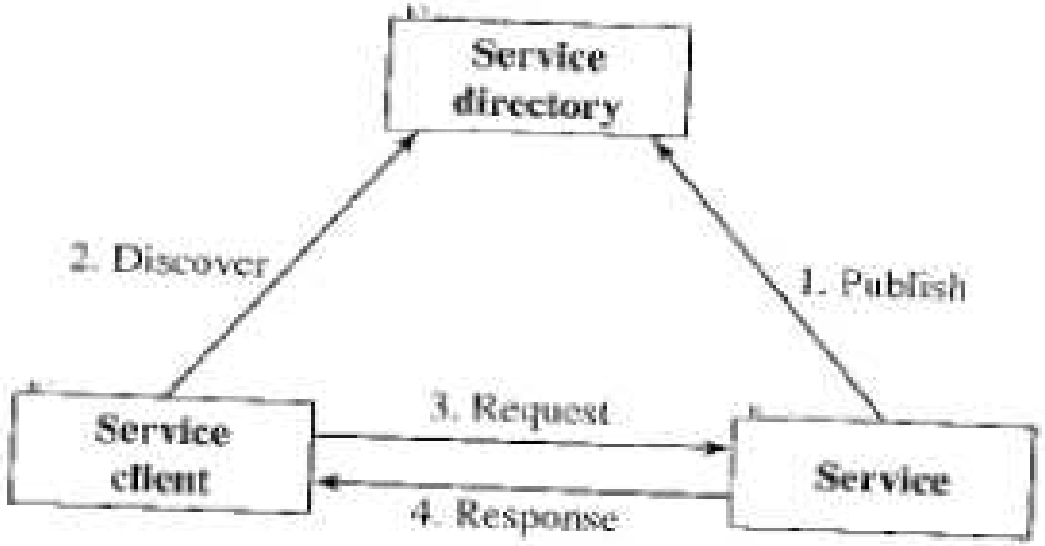
Distributed architecture style example three-tiers

- Separation of **functionality** into segments
  (different from abstraction layers)
- Segment (tier) can be located on a physically separate computer.

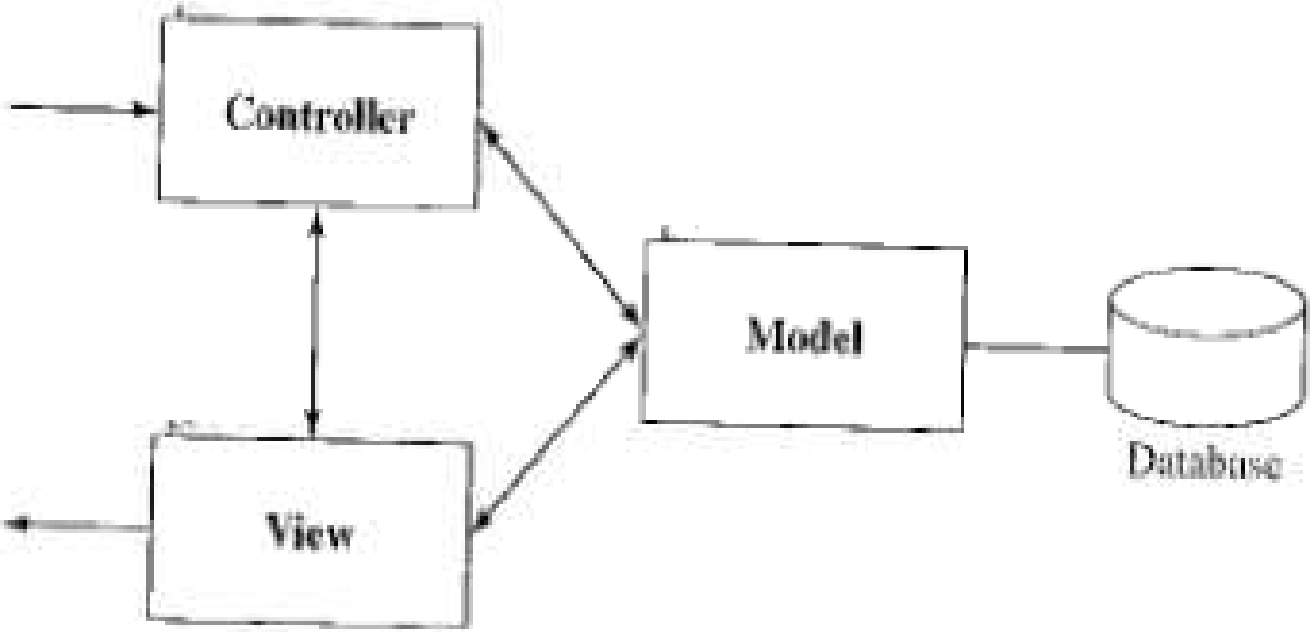


Distributed architecture style example
Service-oriented architecture

- Functionalities embedded in “services”
- Available services are “published”
- A service looks for what it needs through the “service directory”

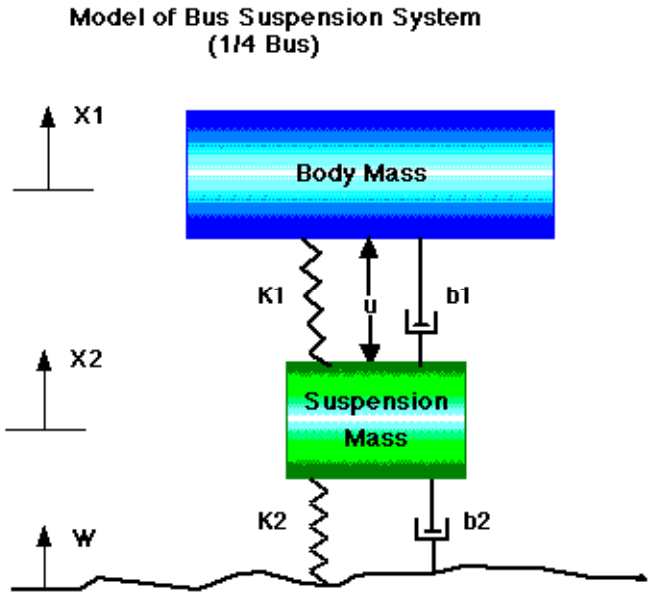


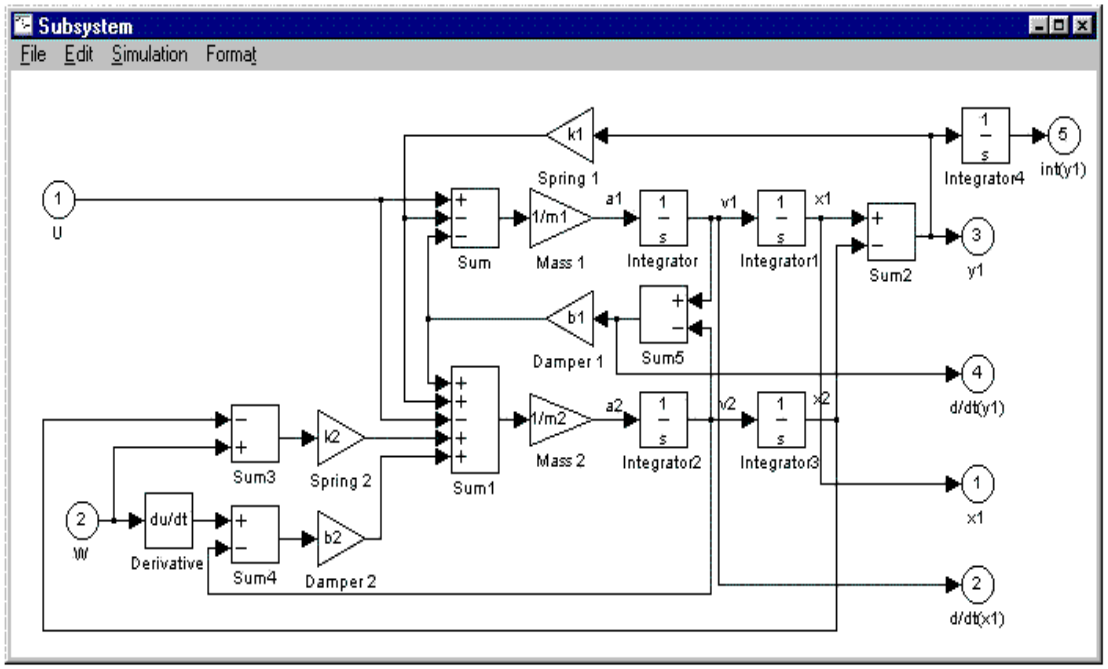
UI architectural style example
MVC



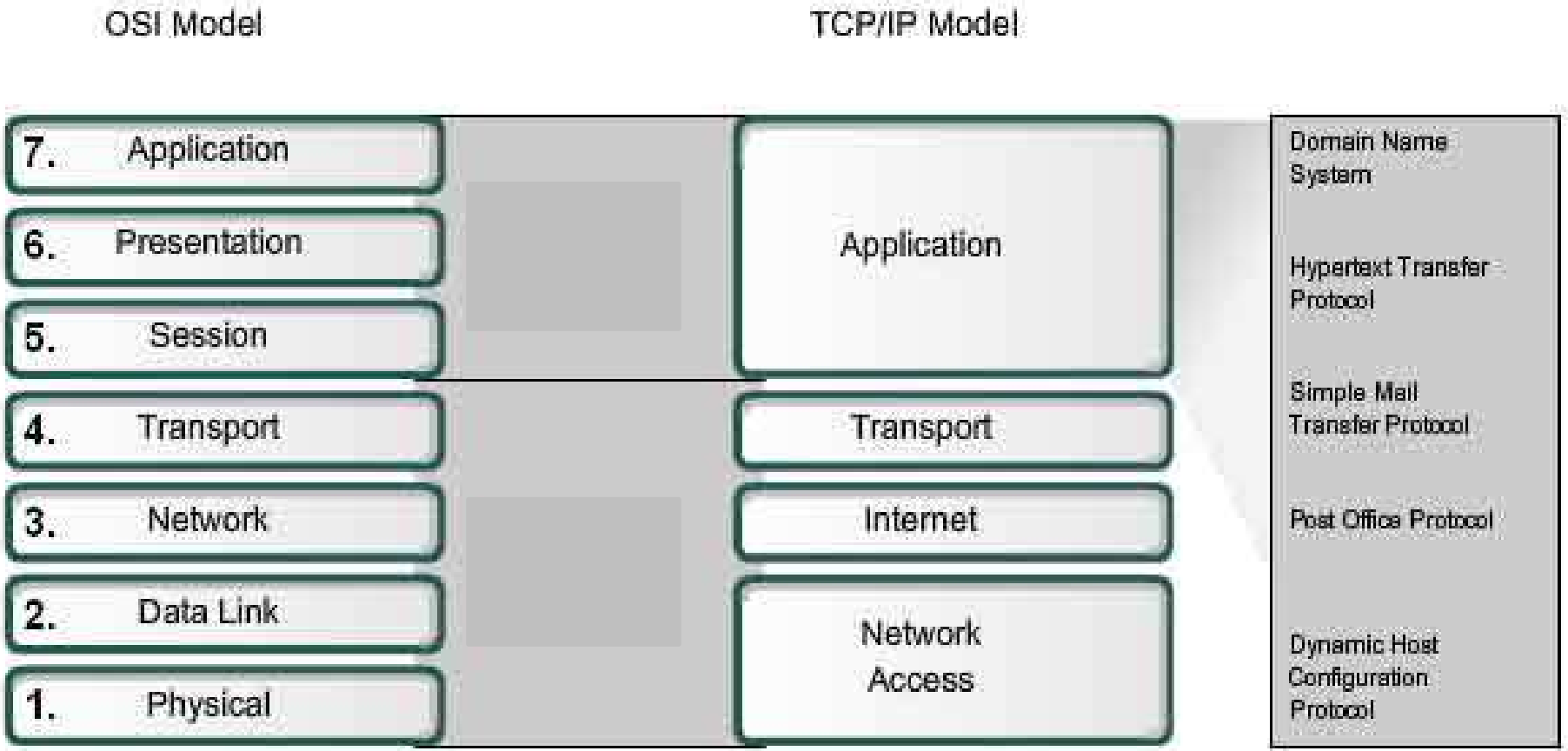
Can you recognize the following architectural styles?

Bus suspension

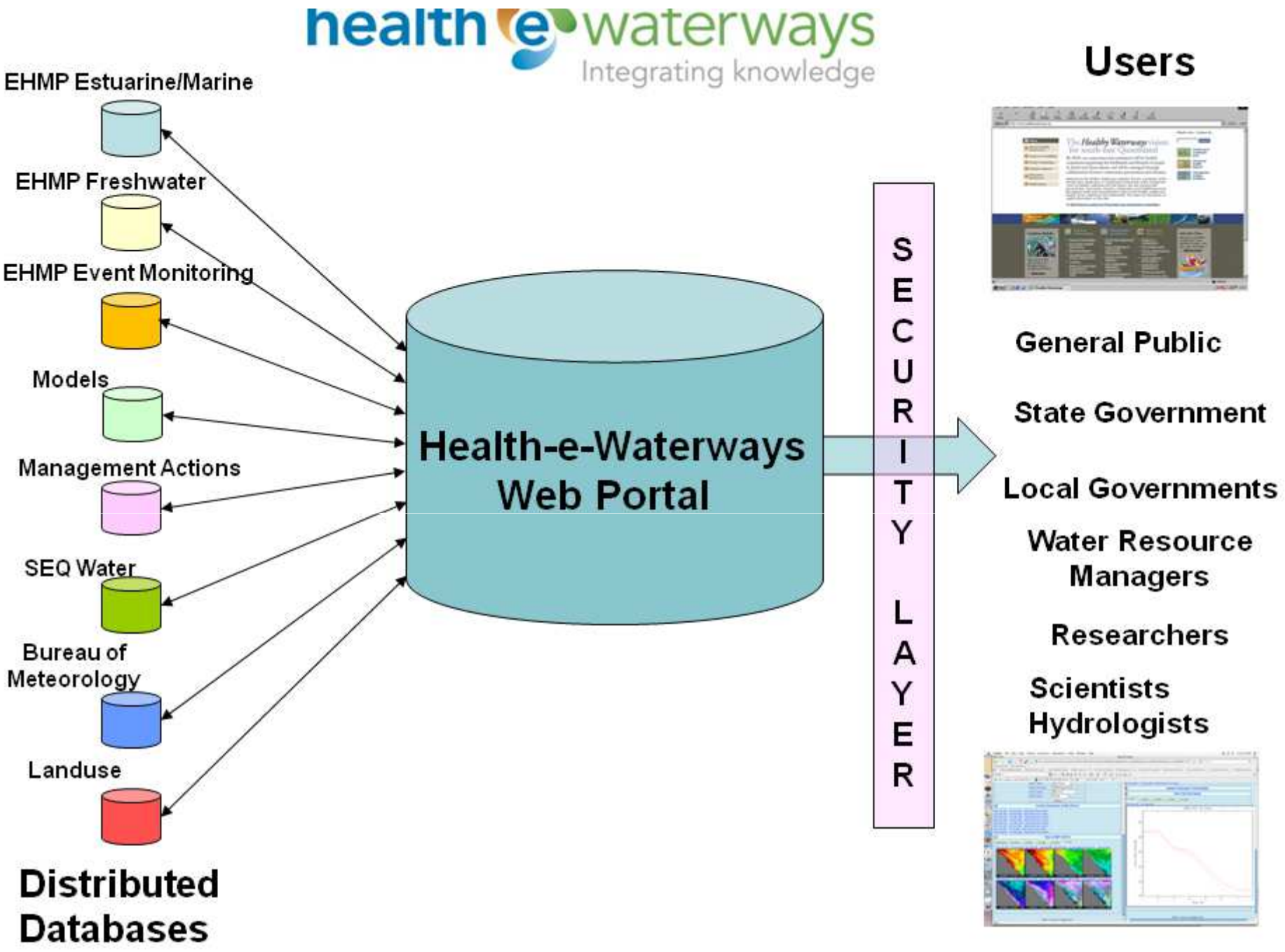




Communication protocole

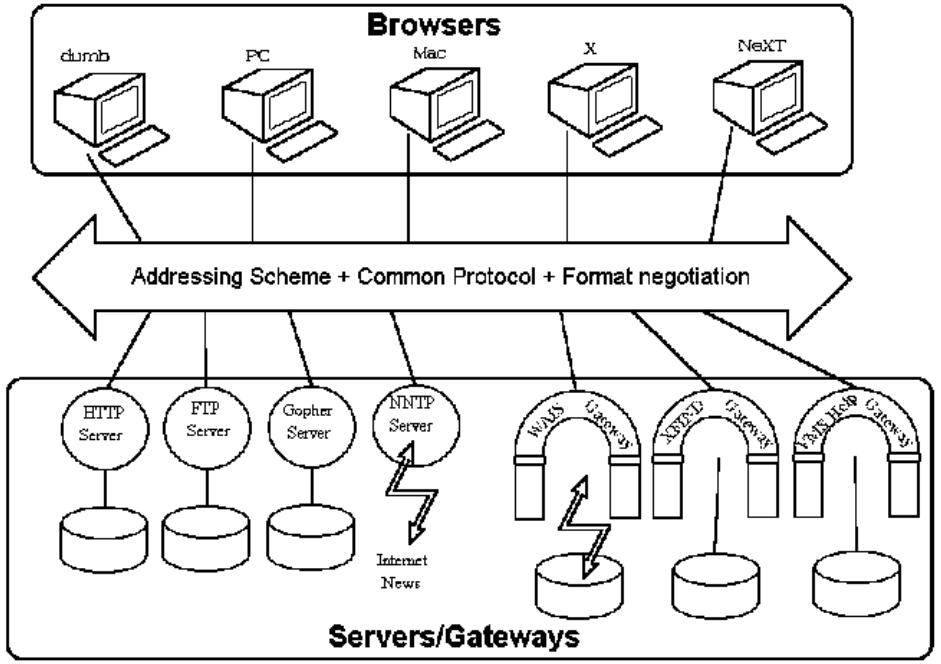


30


health e waterways
Integrating knowledge
EHMP Estuarine/Marine
EHMP Freshwater
EHMP Event Monitoring
Models
Management Actions
SEQ Water
Bureau of Meteorology
Landuse
Distributed Databases
Health-e-Waterways Web Portal
SECURITY LAYER
Users
General Public
State Government
Local Governments
Water Resource Managers
Researchers
Scientists
Hydrologists

Example : WWW

- Users can access the information from the WWW which is the front end software supported for on-line retrieval of information.

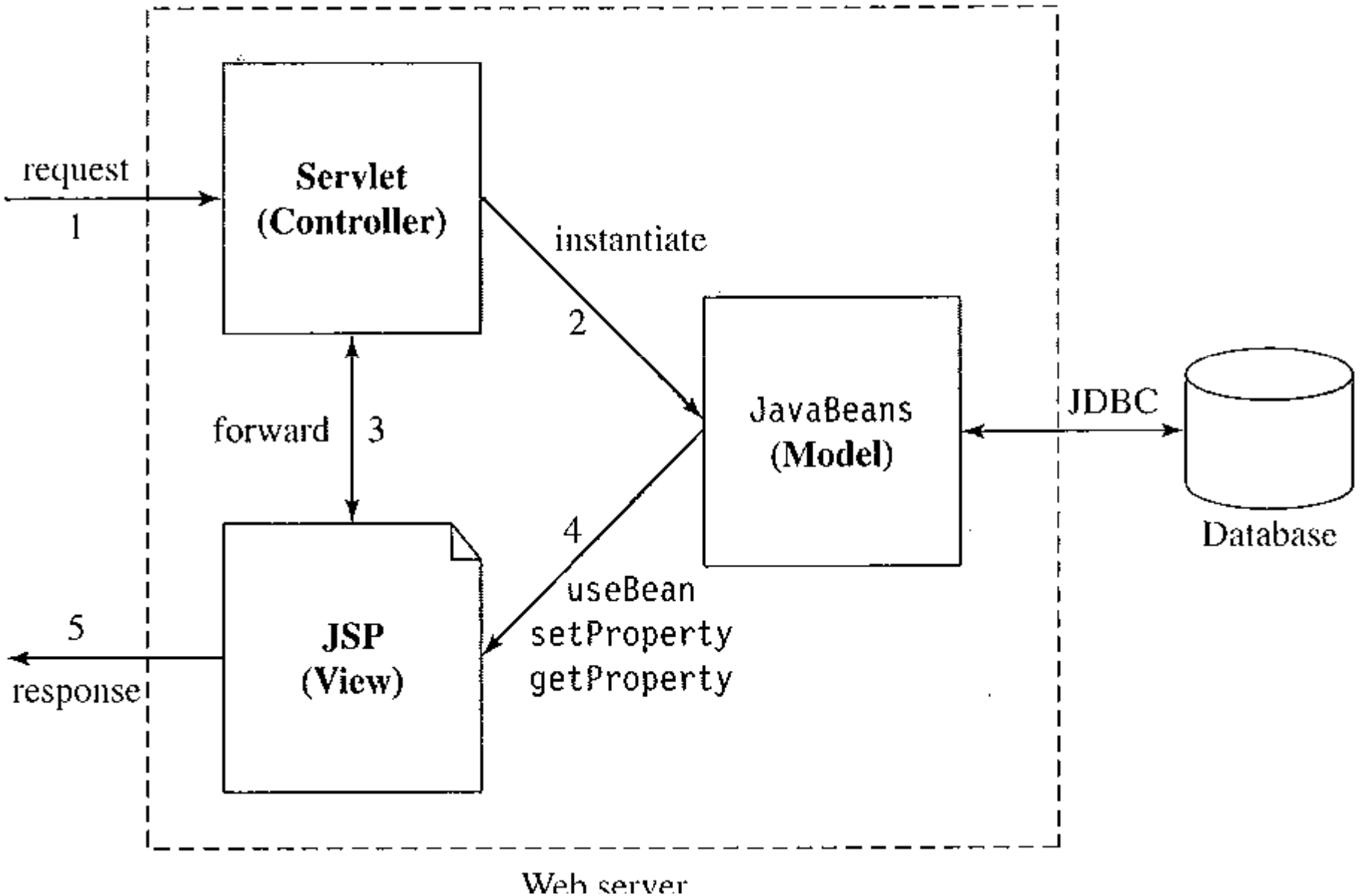


32

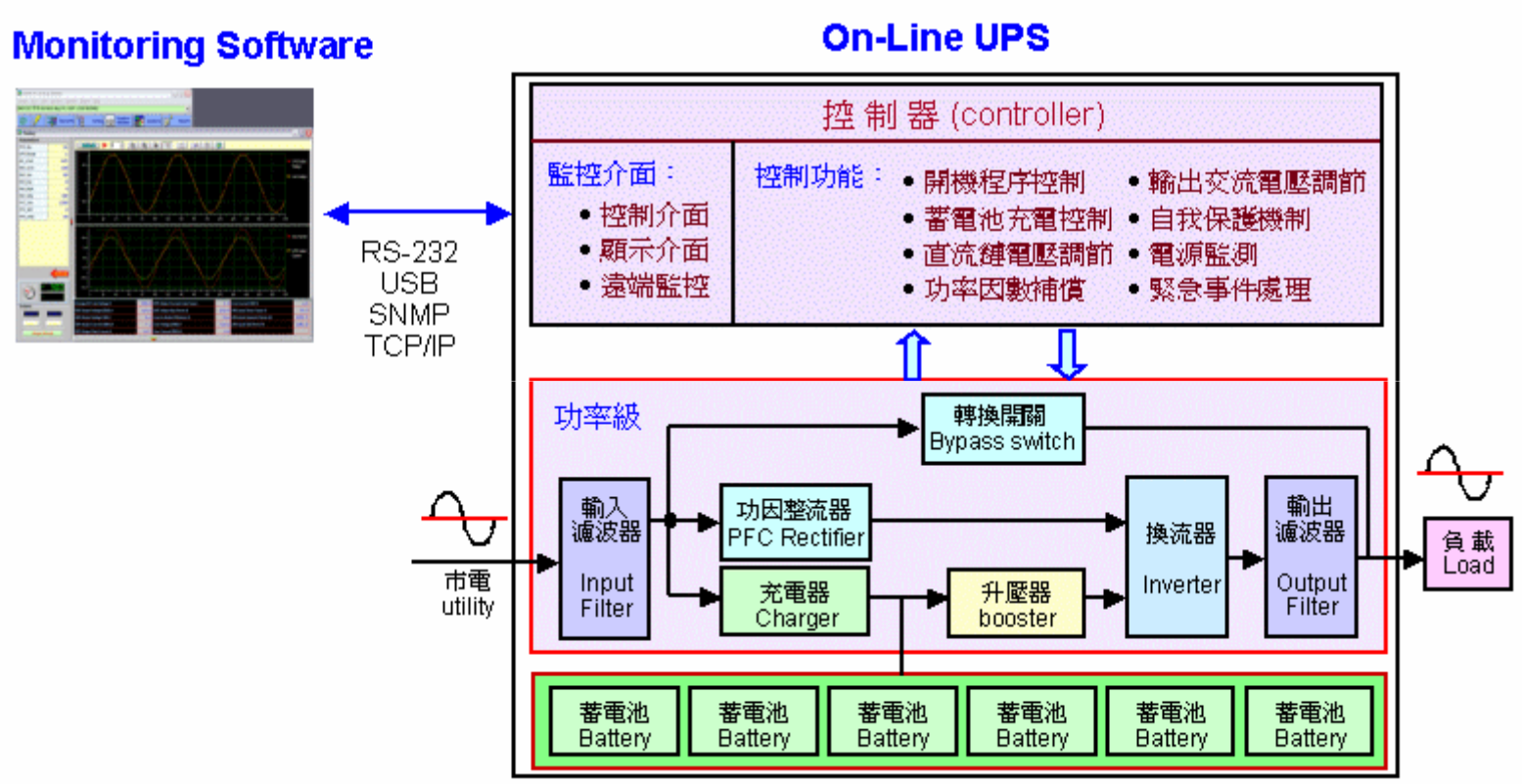
Example: JVM

- Code written in Java is transformed into platform-neutral binary code.
- JVM is platform-specific in that there are different implementations of the JVM for each operating system and processor.
- The Java binary code is delivered to the JVM for interpretation.
- This two-step translation process allows platform-neutral source code and the delivery of binary code, while maintaining platform independency.

33

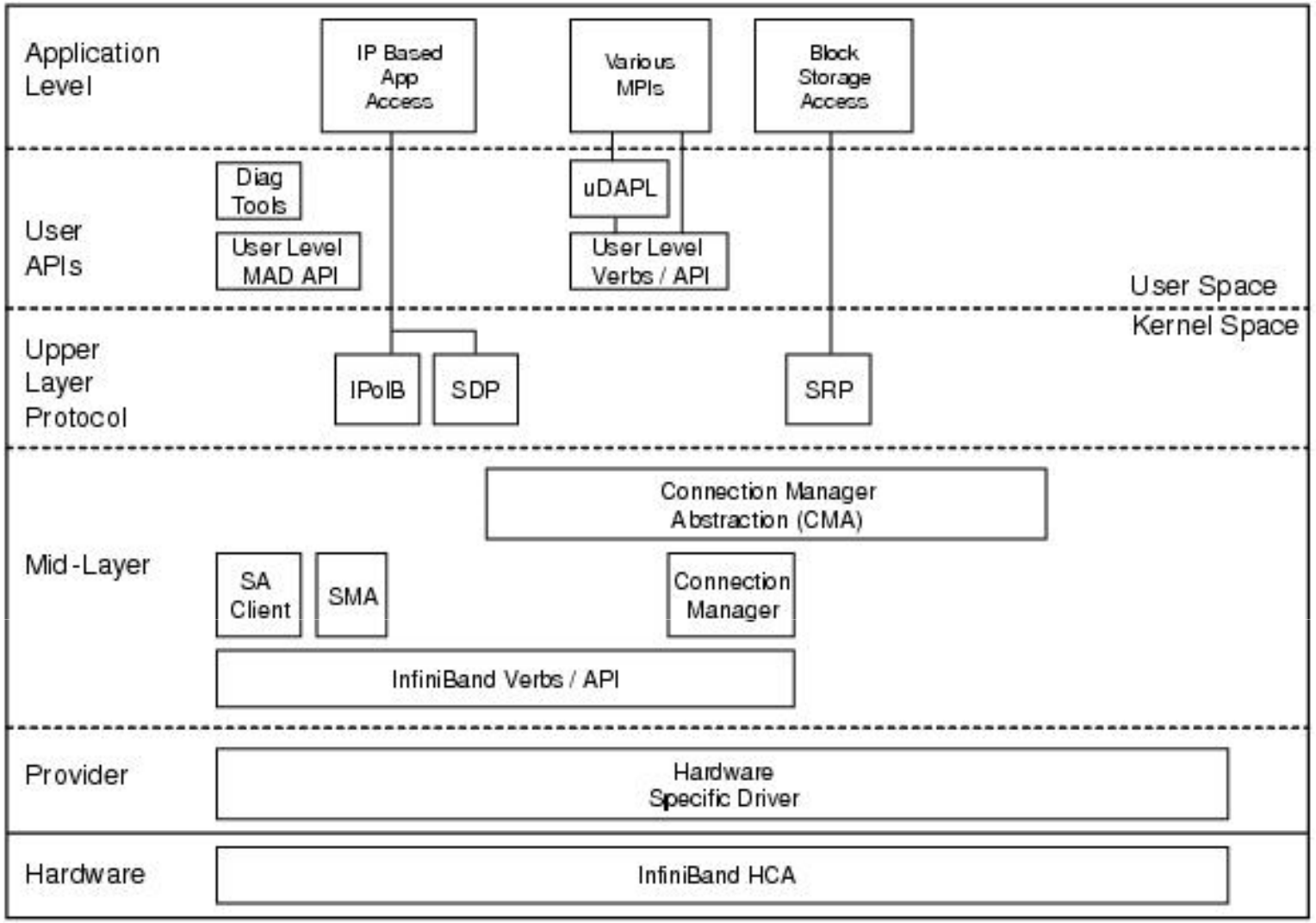

request
1
Servlet
(Controller)
instantiate
2
forward
3
JavaBeans
(Model)
JDBC
Database
4
useBean
setProperty
getProperty
5
response
JSP
(View)
Web server

DSP-Controlled UPS for Smart Power Supplying and Protection



A multiple rate digital controller generates all the PWM control signals for the power stage by using a set of synchronously detected feedback signals.

35



IPoIB	IP over InfiniBand
SDP	Sockets Direct Protocol
SRP	SCSI RDMA Protocol (Initiator)

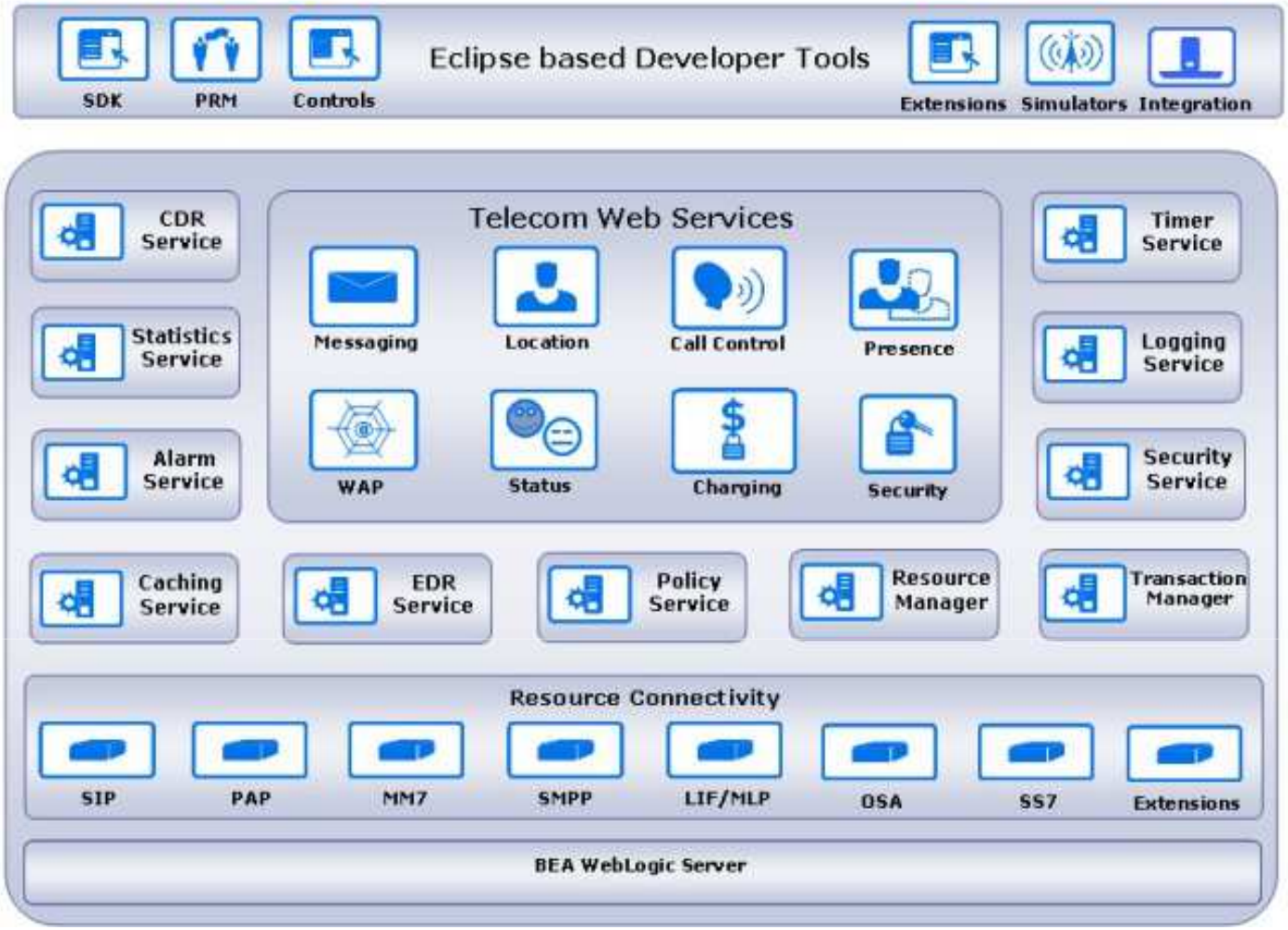
MPI	Message Passing Interface
UDAPL	User Direct Access Programming Lib
SA	Subnet Administrator

MAD	Management Datagram
SMA	Subnet Manager Agent
HCA	Host Channel Adapter

180411

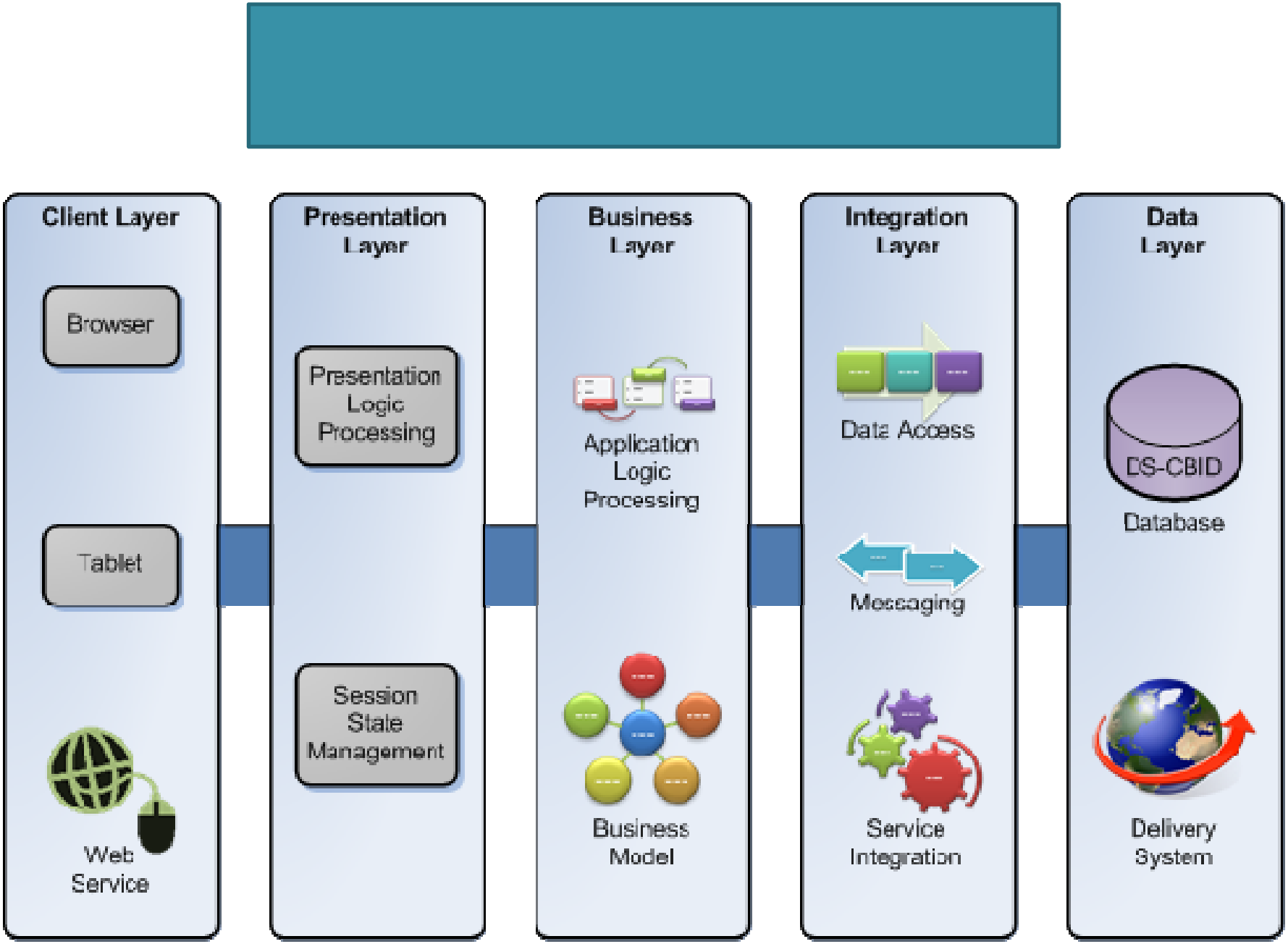
The Cisco IB HCA offers high-performance 10-Gbps InfiniBand connectivity to PCI-X and PCI-Express-based servers.

36

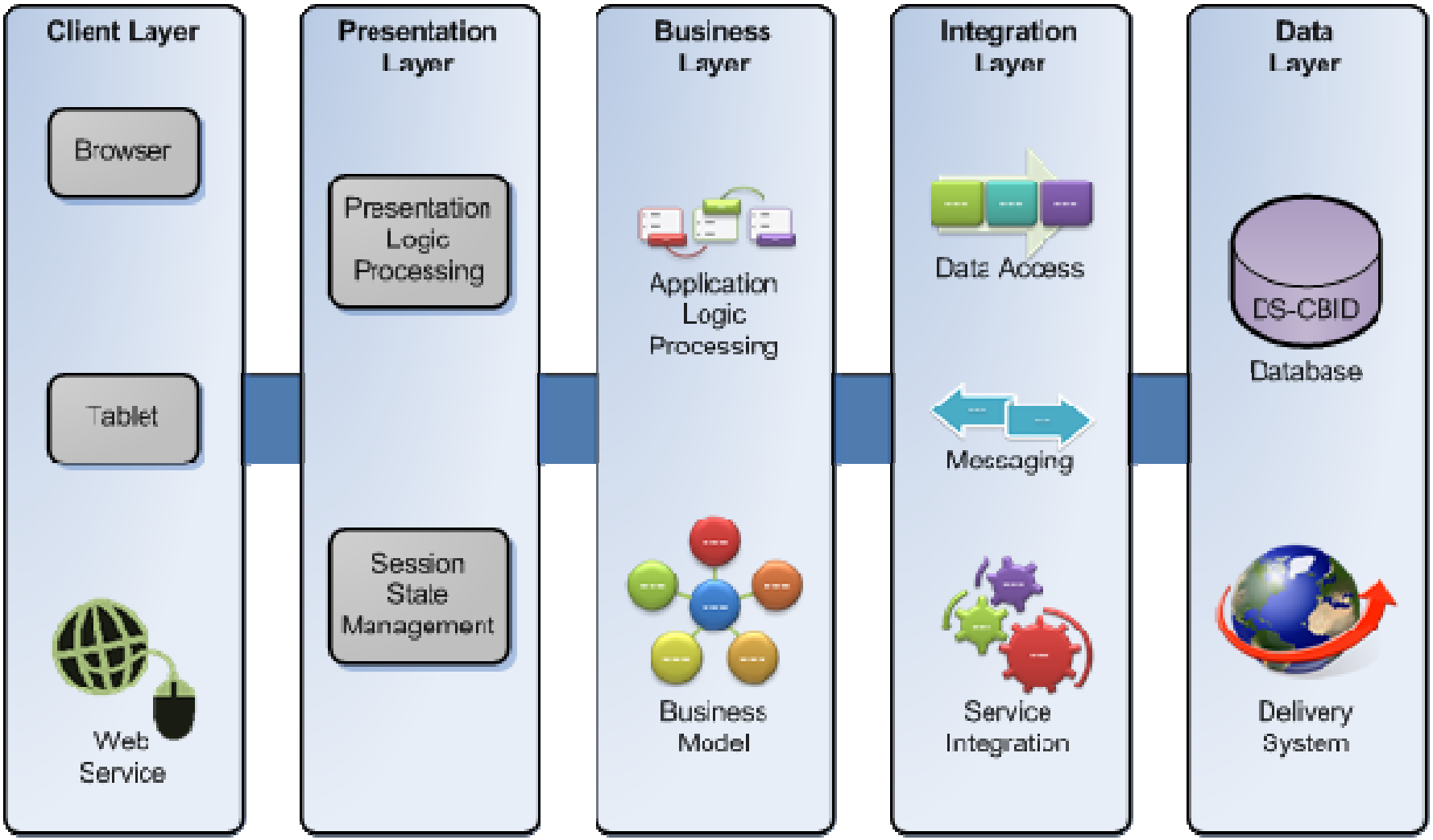


All traffic in Network Gatekeeper flows in traffic paths.
A traffic path consists of an application-facing interface, with Web Services Security enforcement, a Service Capability, and a network plug-in, where requests are translated between the application-facing interface and underlying network node protocols.

37


Client Layer
Browser
Tablet
Web Service
Presentation Layer
Presentation Logic Processing
Session State Management
Business Layer
Application Logic Processing
Business Model
Integration Layer
Data Access
Messaging
Service Integration
Data Layer
DS-CBID
Database
Delivery System

n-Tier Architecture



References

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  Len Bass, Paul Clements, Rick Kazman
  Addison Wesley, 2003

- Pattern-oriented software architecture
  Buschmann, Meunier, Rohnert, Sommerlad, Stal
  Wiley, 1996

- Applied software architecture
  Hofmeister, Nord, Soni
  Addison Wesley, 2000

- Design and use of software architectures
  Jan Bosch
  Addison Wesley, 2000

40

For the final evaluation

- You should know
  - Challenges and issues of software architecture
- You should be able to
  - Read/complete an architectural description
  - Recognize an architectural style (among those which were presented)