

# Modeling Information Systems Architectures

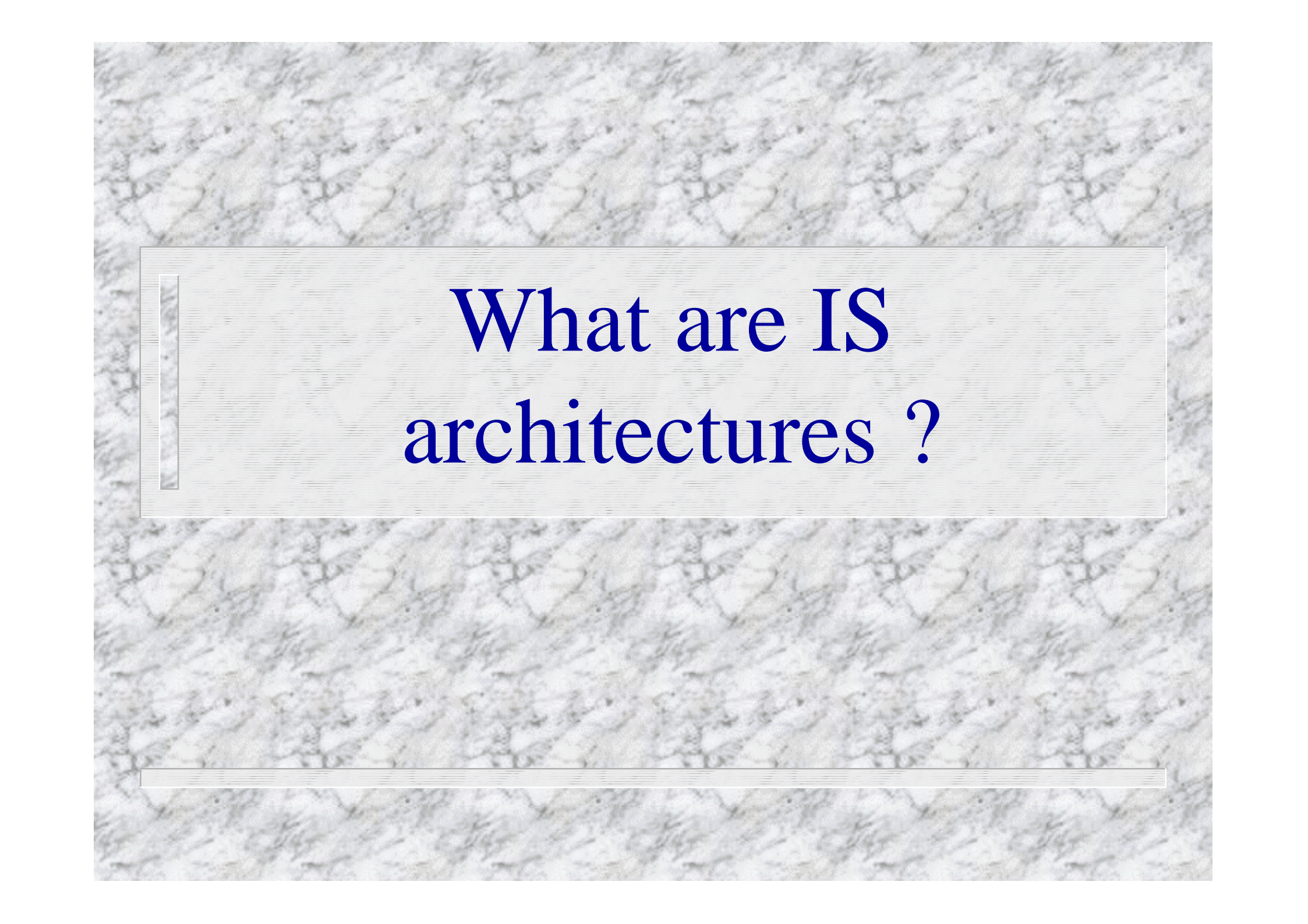
Paul Grefen  
(DB|MA-IS-CS)|CTIT-UT  
grefen@cs.utwente.nl

## Purpose of this lecture

*The purpose of this lecture is not to present pre-cooked solutions to architectural problems, but rather to clarify architectural issues and discuss a number of important topics in this context.*

## Table of contents

- What are IS architectures ?
- Aspects of IS architectures
- Types of IS Architectures
- Reference Architectures
- Designing IS architectures
- Architectural platforms
- Conclusions

The background of the slide is a light-colored, marbled paper with a complex, organic pattern of veins in shades of beige, cream, and light brown. A central rectangular area is highlighted with a thin white border, containing the main text. On the left side of this central area, there is a vertical white bar. At the bottom of the slide, there is a horizontal white bar.

**What are IS  
architectures ?**

## General architecture

**architectuur'** (**architektuur**), v.,

1. bouwkunst, de kunst en de leer van het ontwerpen en uitvoeren van bouwwerken;

- toepassing daarvan: *onder architectuur gebouwd*, naar de plannen van een bekend architect; - 2. bouwstijl: *Griekse architectuur*;

- 3. (fig.) bouw, constructie: *de architectuur van de kaak* (Vestdijk); - 4. (meton.)

bouwsel(s), bouwwerk(en): *voorbeelden van moderne architectuur*;

*Van Dale*

## Software architecture

The architecture of a software system defines that system in terms of computational components and interactions among those components.

*Software Architecture; Shaw & Garlan;  
Prentice Hall, 1996*

# Example architecture



## Information system architecture

The architecture of an information system defines that system in terms of components and interactions among those components, from the viewpoint of specific aspects of that system, and based on specific structuring principles.

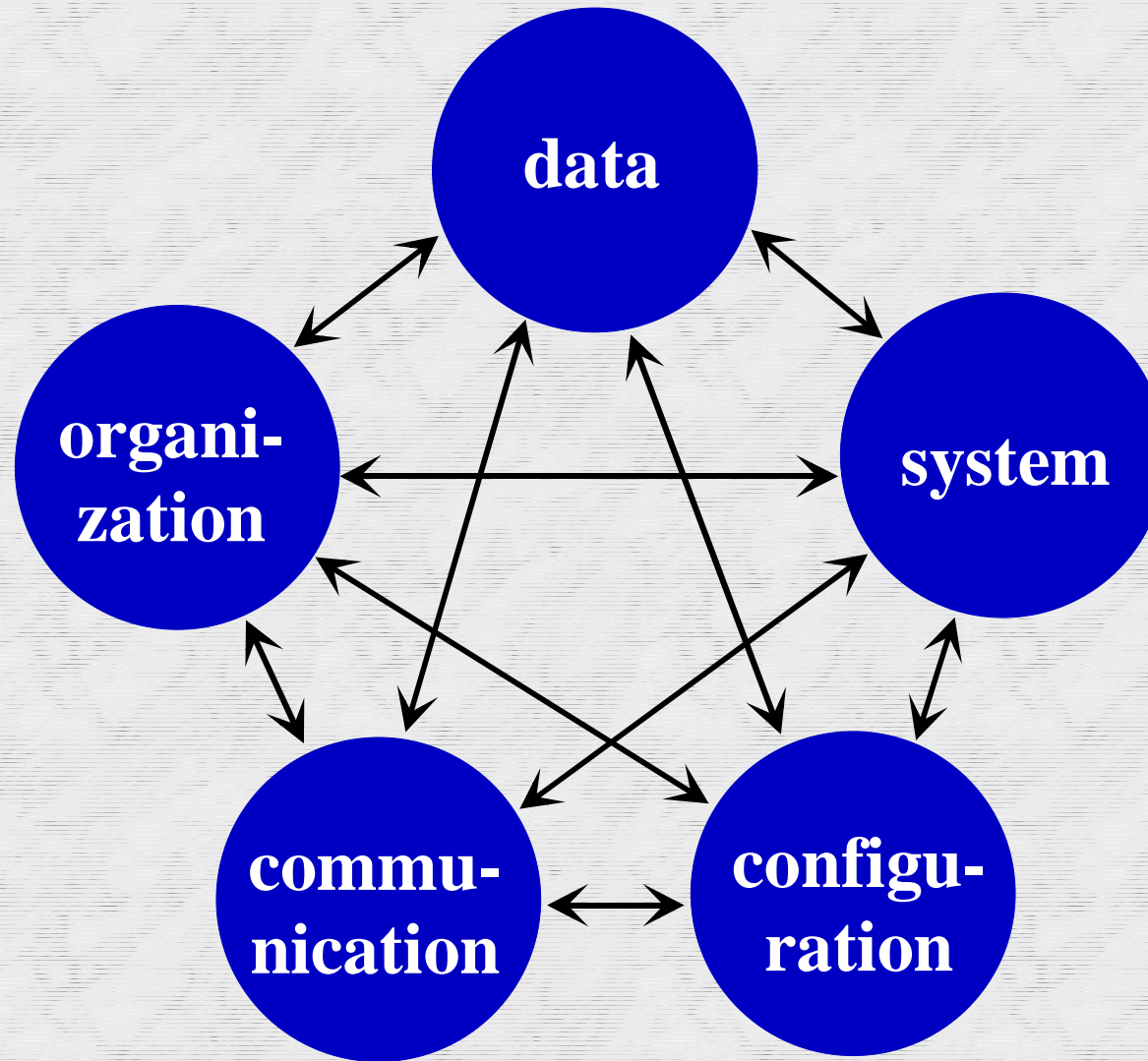
# Interpreting IS architectures

- **Syntax:**  
structure of the architecture
- **Semantics:**  
meaning of components and interactions
- **Pragmatics:**  
reasons behind structure & meaning

The background of the slide is a light-colored marbled paper with a complex, organic pattern of veins in shades of beige, cream, and light brown. A white rectangular frame is centered on the page, containing the title text. The frame has a thin border and a small vertical bar on the left side.

# Aspects of IS Architectures

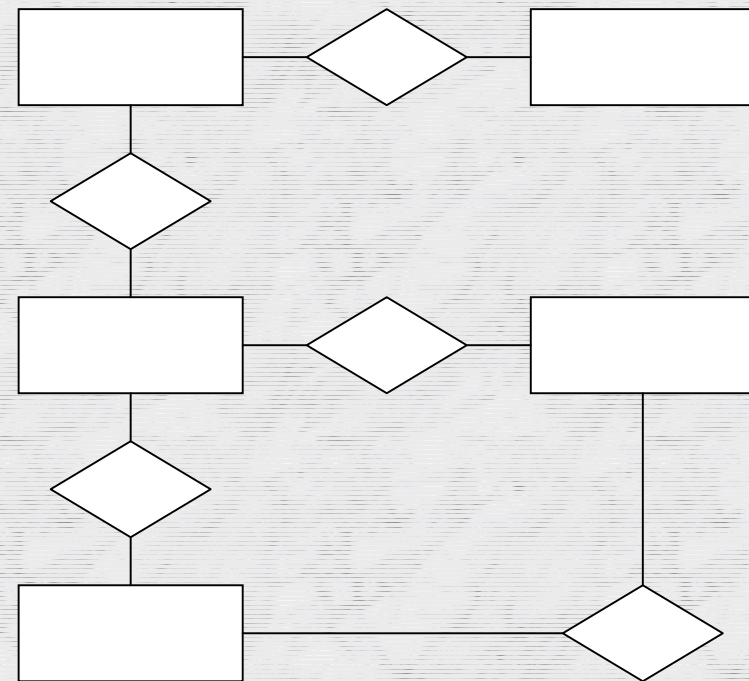
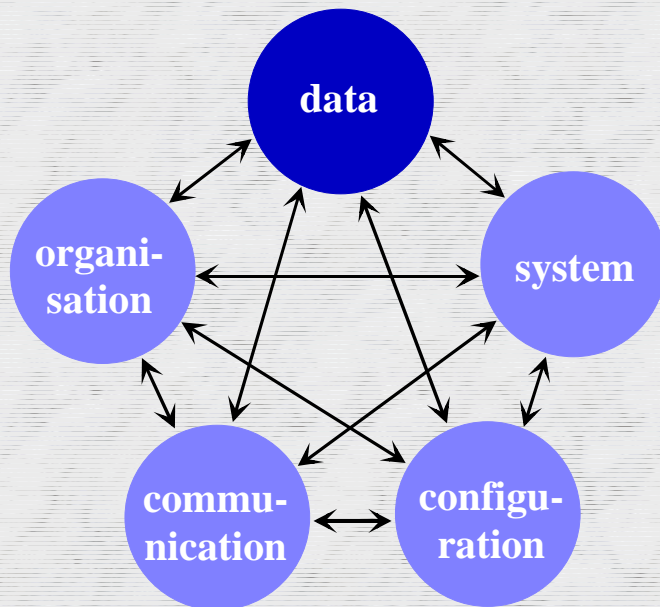
# Aspects architecture



*Truyens  
et al.;  
1990*

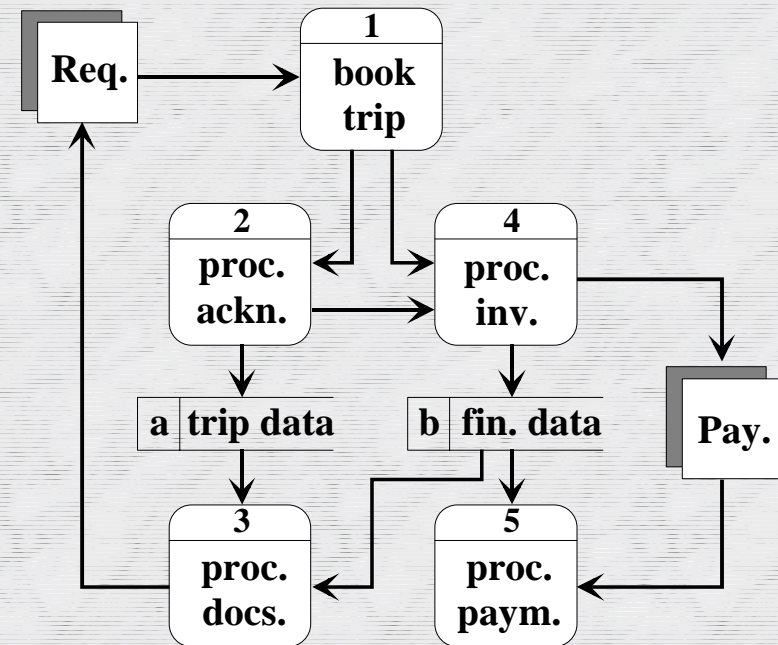
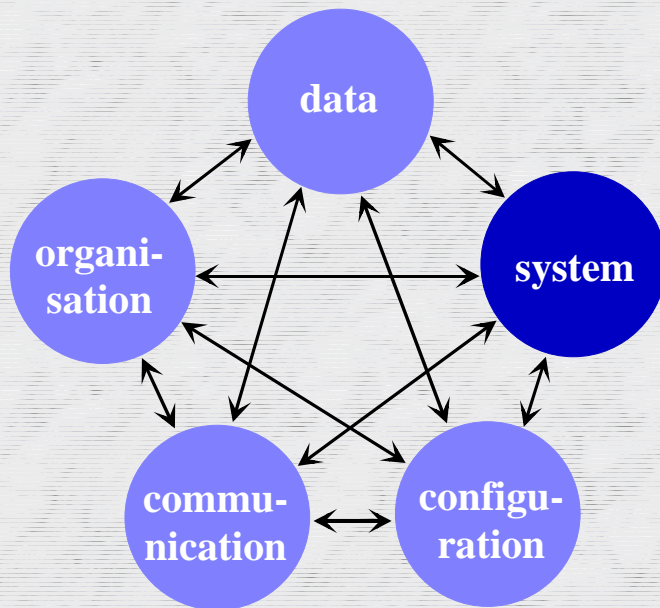
# Data aspect architecture

Architecture of data managed by systems,  
e.g. using (E)ER diagrams.



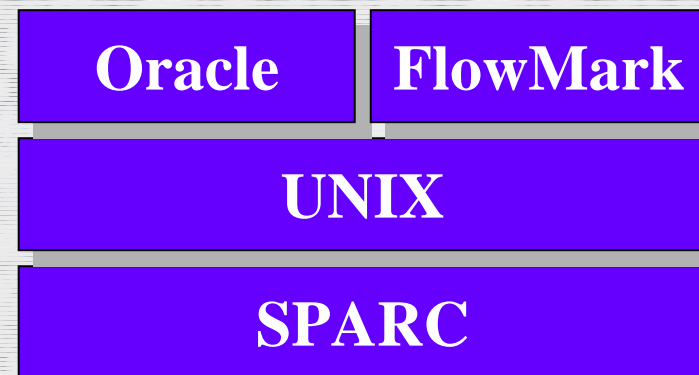
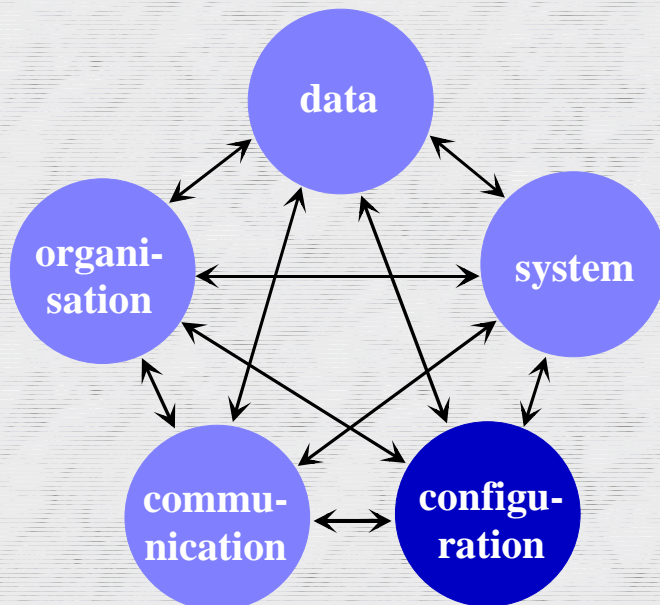
# System aspect architecture

Architecture of application software,  
e.g. using data flow diagrams or  
module diagrams.



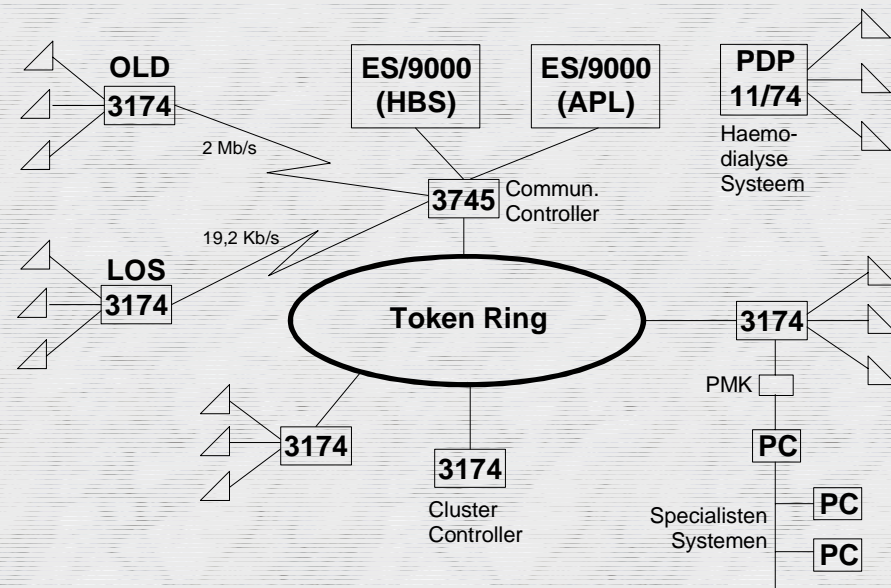
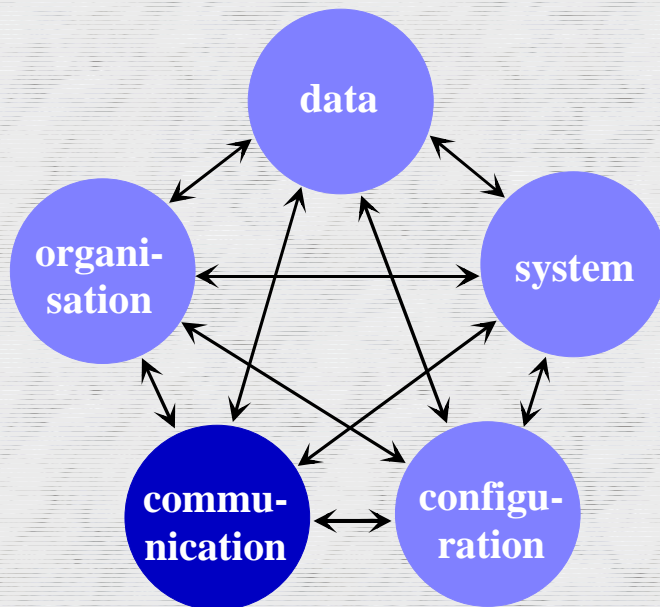
# Configuration aspect architecture

Architecture of hardware and low-level software (e.g. OS, DBMS),  
e.g. using configuration diagrams.

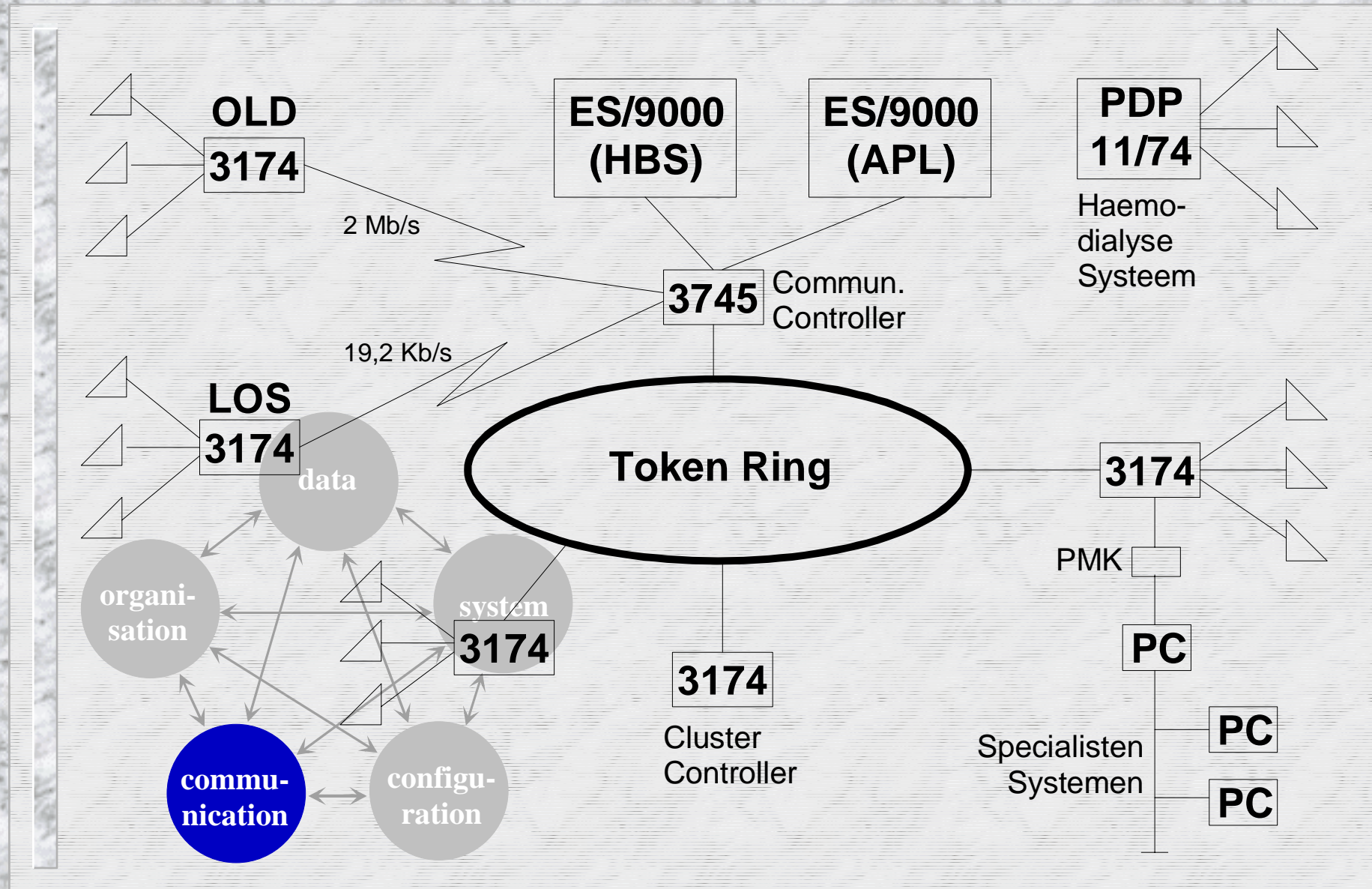


# Communication aspect architecture (I)

Architecture of communication infrastructure (networks, communication software), using e.g. topology diagrams.

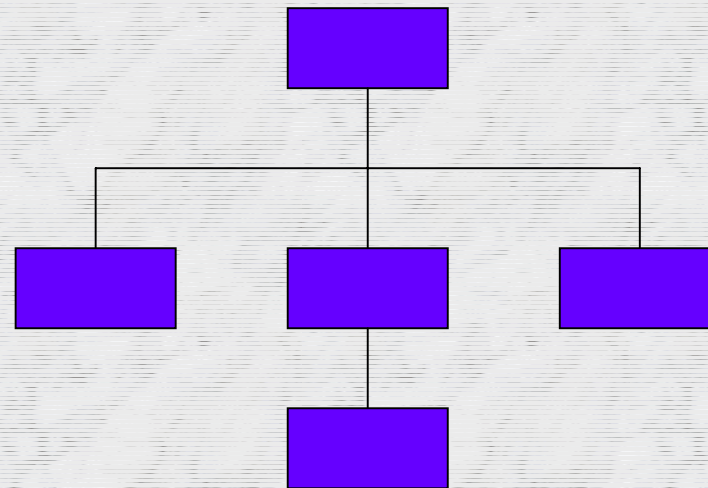
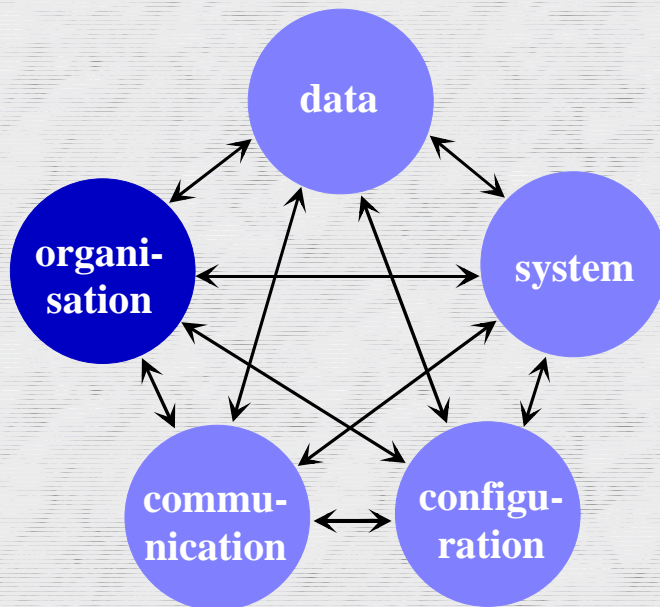


# Communication aspect architecture (II)

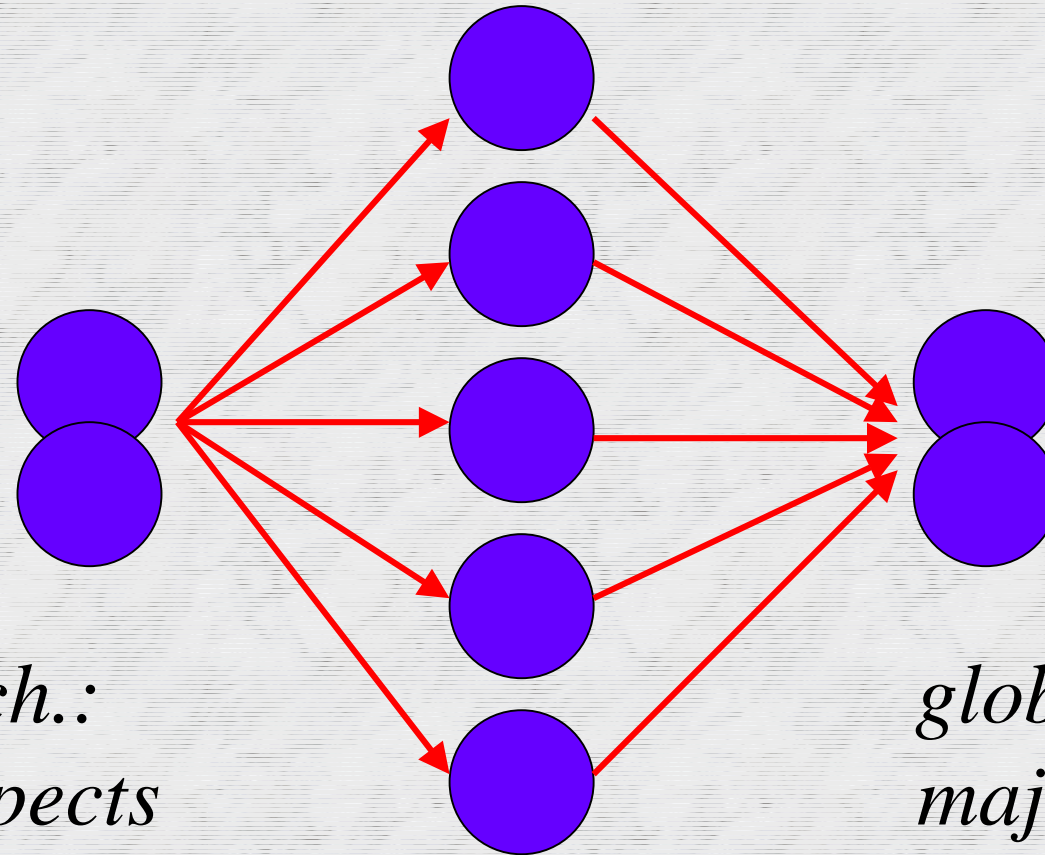


# Organization aspect architecture

Architecture of organization structure and processes related to administration and maintenance of systems, using e.g. organigrams and procedure handbooks



## A design path with aspects



*start arch.:  
major aspects  
combined*

*global arch.:  
major aspects  
combined*



# Types of IS Architectures

## Type of IS architectures

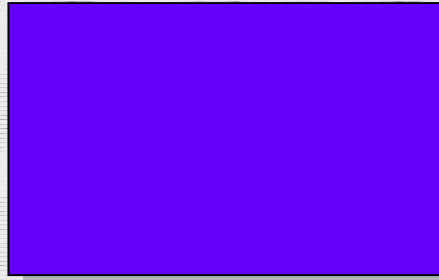
*Based on structuring principles:*

- Monolithic / Layered / Columned / OO
- Single-Level versus Multi-Level

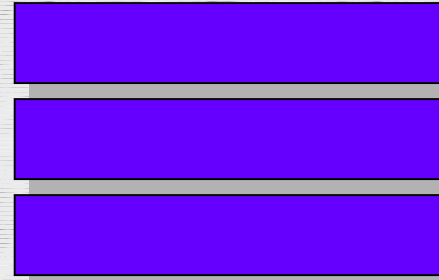
*Based on purpose:*

- Conceptual versus Technical
- Application versus General System
- Reference versus Concrete

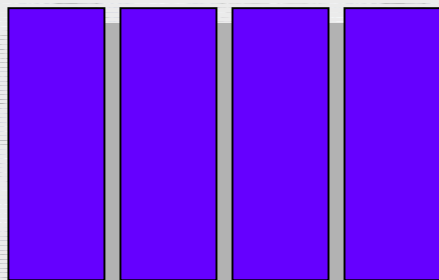
# Structuring principles (I)



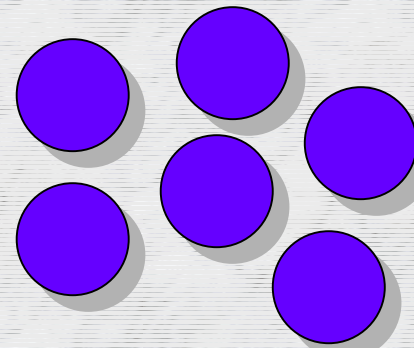
Monolithic



Layered



Columned

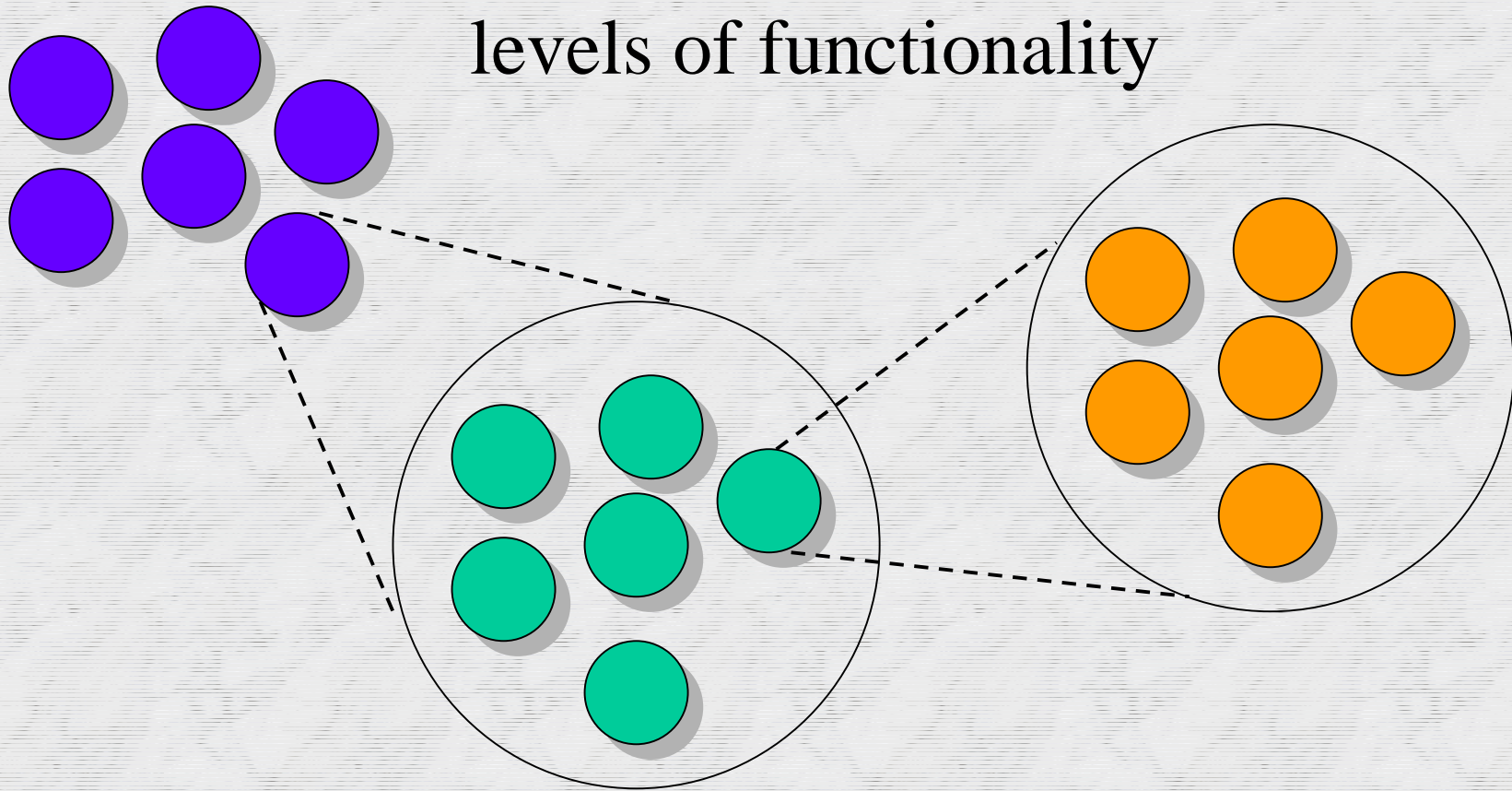


Object-Oriented

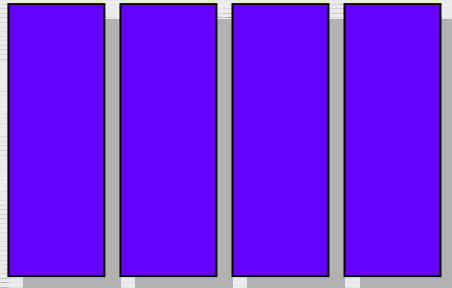
*and combinations*

## Structuring principles (II)

Multi-level architectures:  
allow for multiple aggregation  
levels of functionality



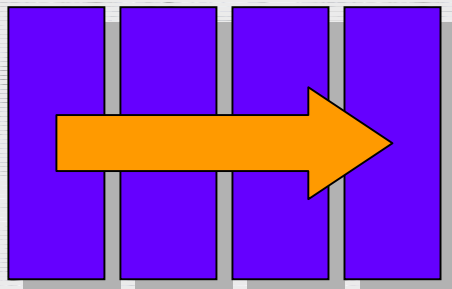
## Structuring principles (III)



Columned

**Syntax:** several system modules in the same layer.

**Semantics:** multiple subsystems at the same abstraction level using each others functionality.



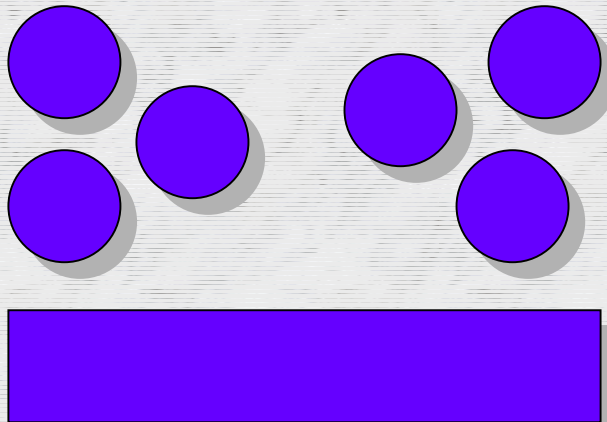
Pipe

**Pragmatics:** separation of concerns (system arch.) or distribution (conf. arch.).

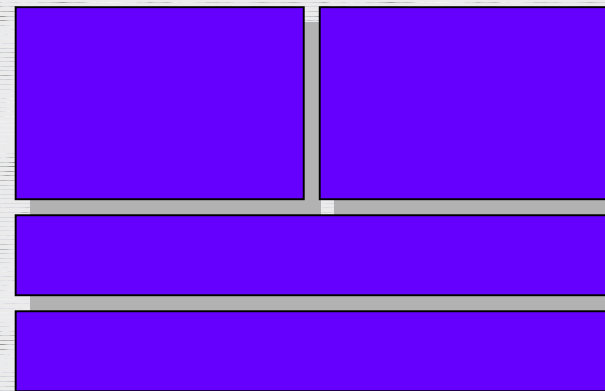
## Purpose of architecture (I)

**Conceptual architecture:** describes structure of conceptual design of system

**Technical architecture:** describes structure of implementation of system



*conceptual*



*technical*

## Purpose of architecture (II)

**Application:** describes architecture for specific application and context

**General system:** describes architecture for general application and context

**Concrete:** describes architecture of a specific system to be directly applied

**Reference:** describes blue-print of abstract system to be “concretized” before application

The background of the slide is a light-colored marbled paper with a complex, organic pattern of veins in shades of beige, cream, and light brown. A central rectangular area is highlighted with a thin, light gray border. Inside this border, on the left side, there is a vertical decorative bar with a similar marbled pattern. The text "Reference Architectures" is centered within the main rectangular area.

# Reference Architectures

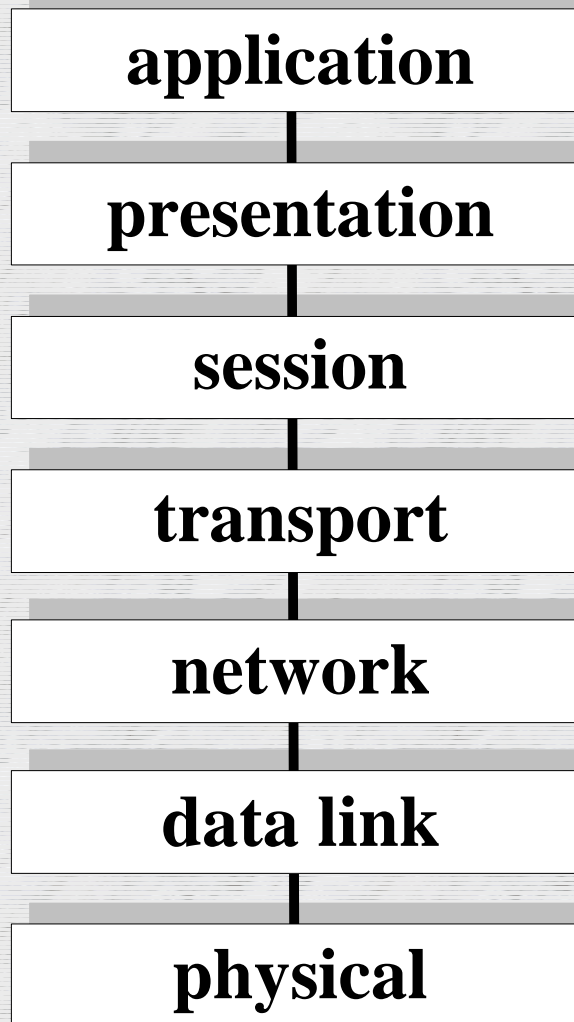
## Reference architecture

A reference architecture is a general, abstract architecture that can be instantiated for specific situations.

Instantiated =

- filled in, detailed
- parameterized, adapted
- extended, selected

# ISO-OSI reference architecture



**Structure:**

layered

**Aspects:**

system

configuration

communication

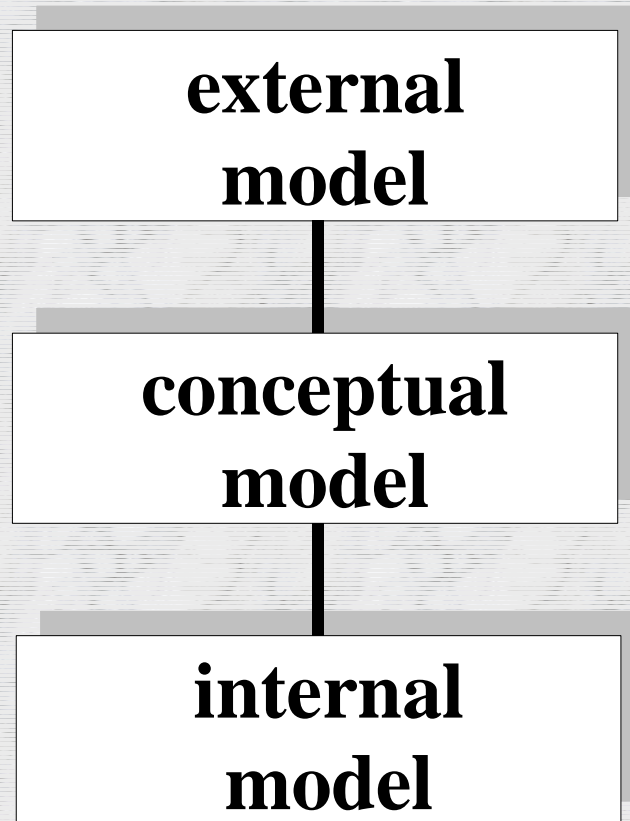
**Pragmatics:**

standard interface

levels for horizontal

communication

# ANSI/SPARC reference architecture



## Structure:

layered

## Aspects:

system

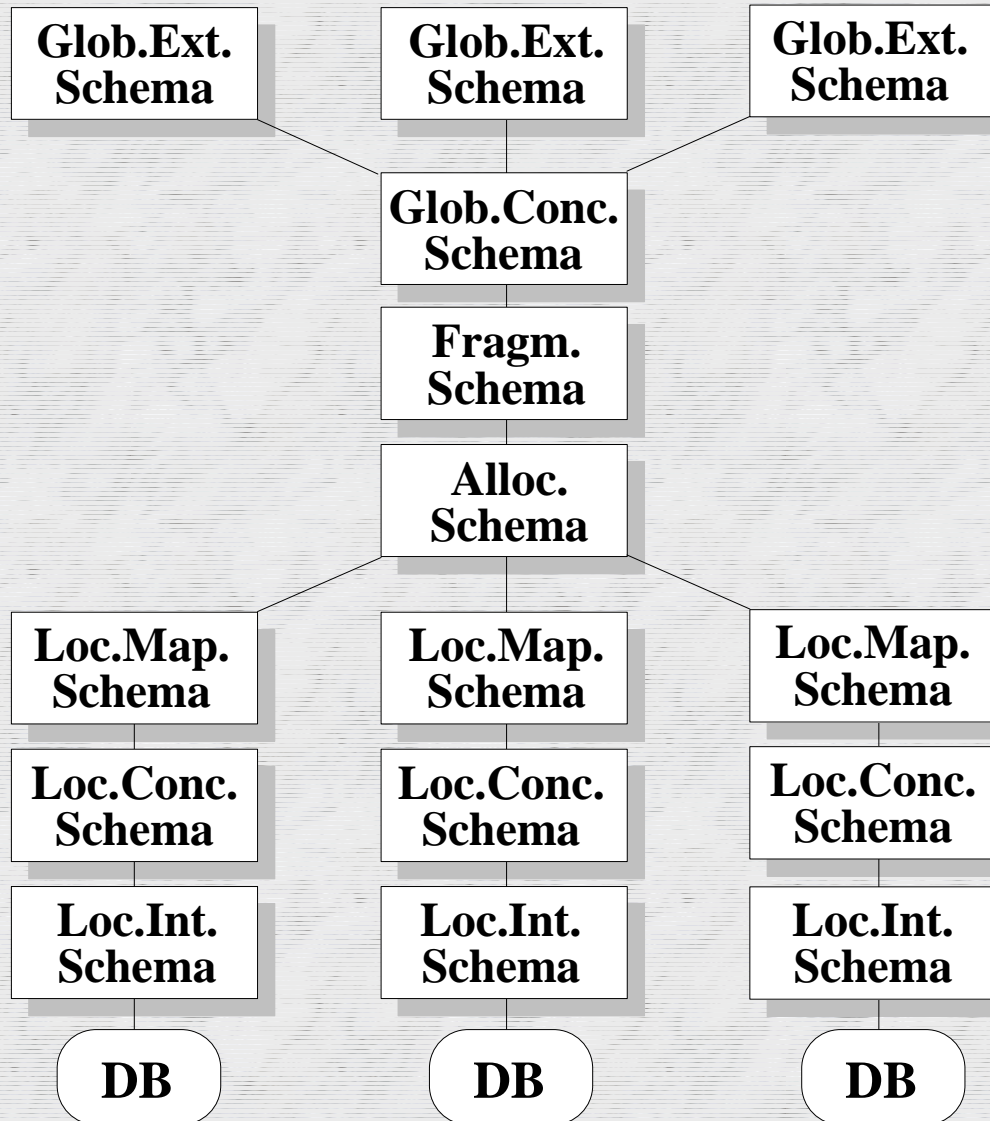
data

organization

## Pragmatics:

separation between  
database levels for  
different purposes

# ANSI/SPARC in DDBS



**Structure:**

idem

**Aspects:**

idem +

communicat.

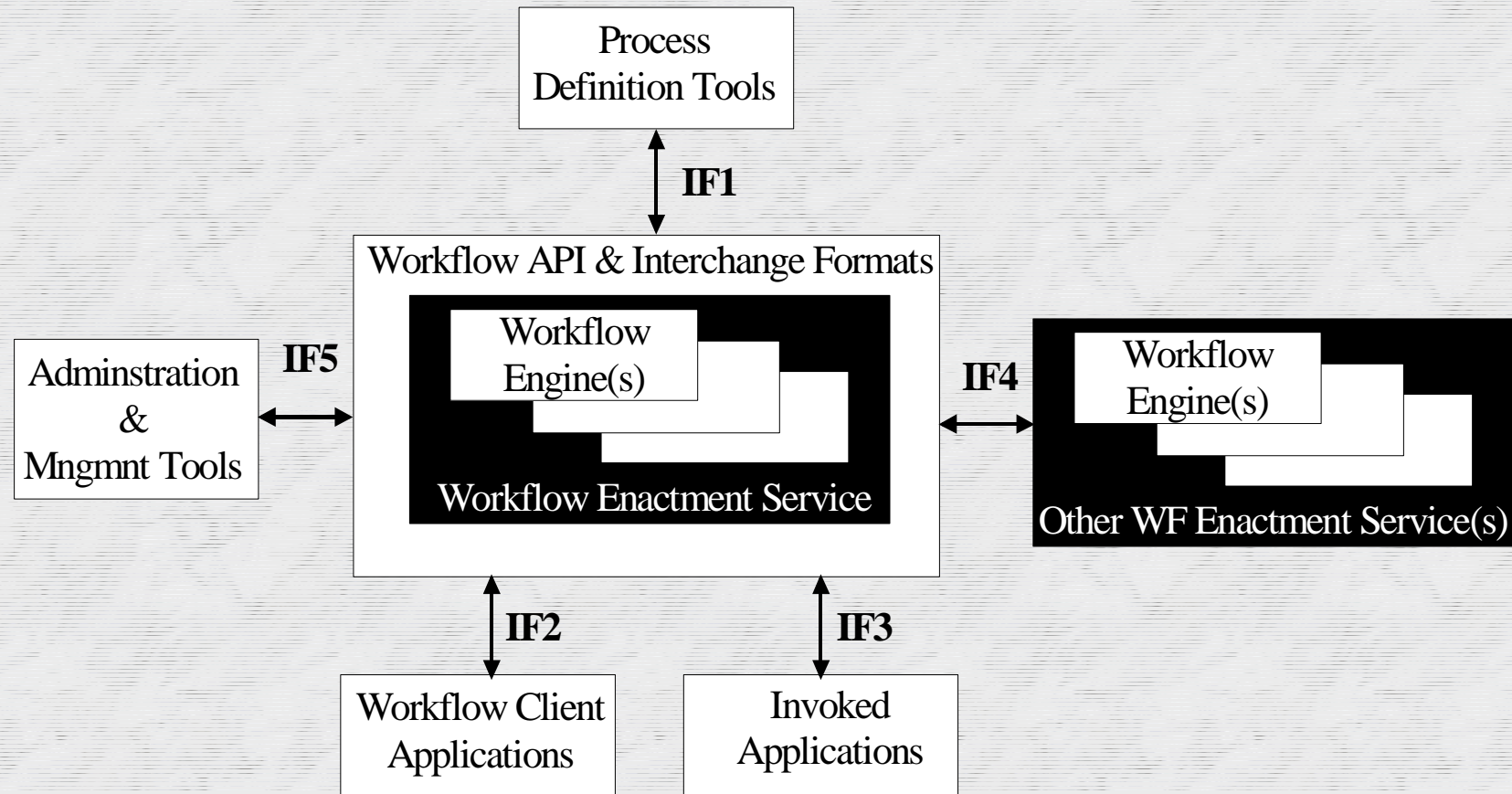
**Pragmatics:**

idem

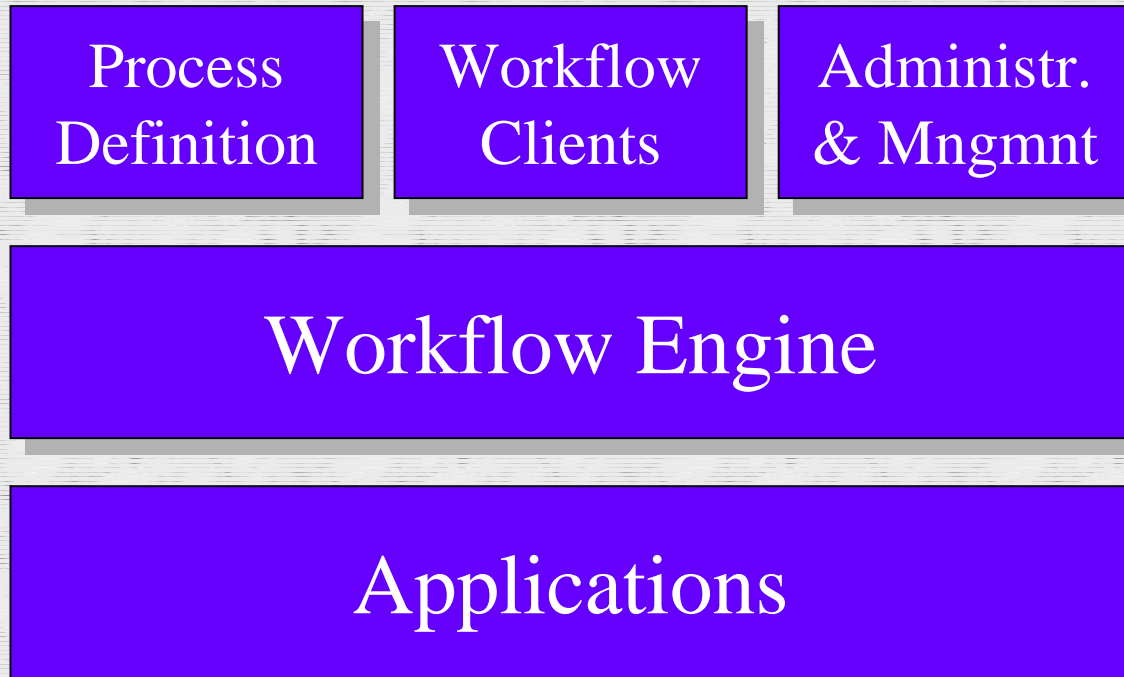
+ distribution

*Connolly, Begg &  
Strachnan, 1995*

# WfMC reference architecture (I)



## WfMC reference architecture (II)



Structure:

first layered, then columned



# Designing IS Architectures

## Example architecture design

- Mercurius initiative (1995)
- Purpose:  
specification of reference WFMS
- Focus:  
detailed system architecture
- Participants:  
2 universities, polytechnic  
consultancy firm,  
financial institution

# Mercurius architecture design principles

## *Flexibility (detail, aspect)*

- Top-down architecture design strategy
- WF design versus WF enactment
- Kernel versus additional functionality

## *Positioning in context*

- Explicit interfaces to environment

# Mercurius overall WFMS architecture

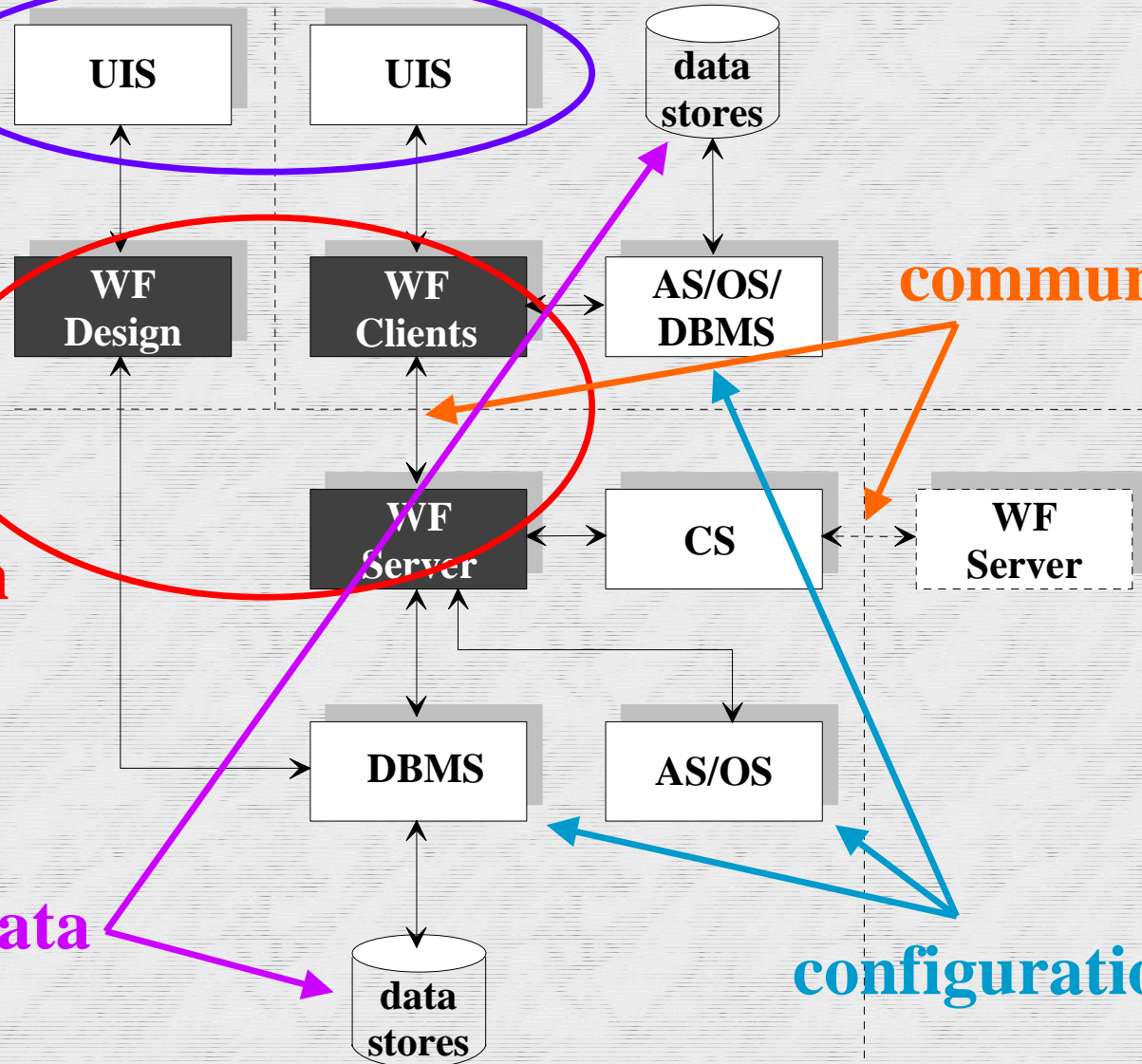
**organi-  
zation**

**system**

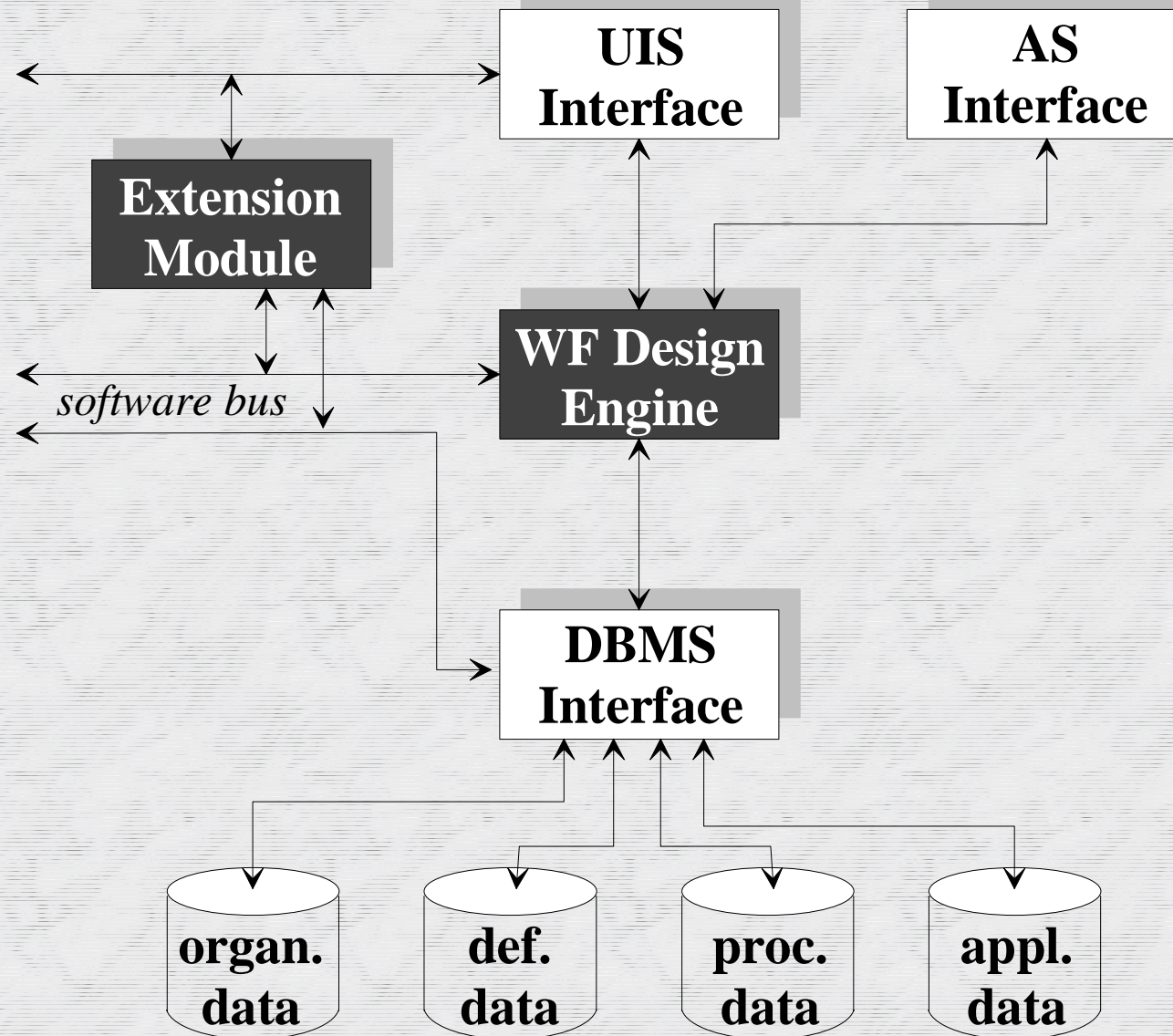
**communication**

**data**

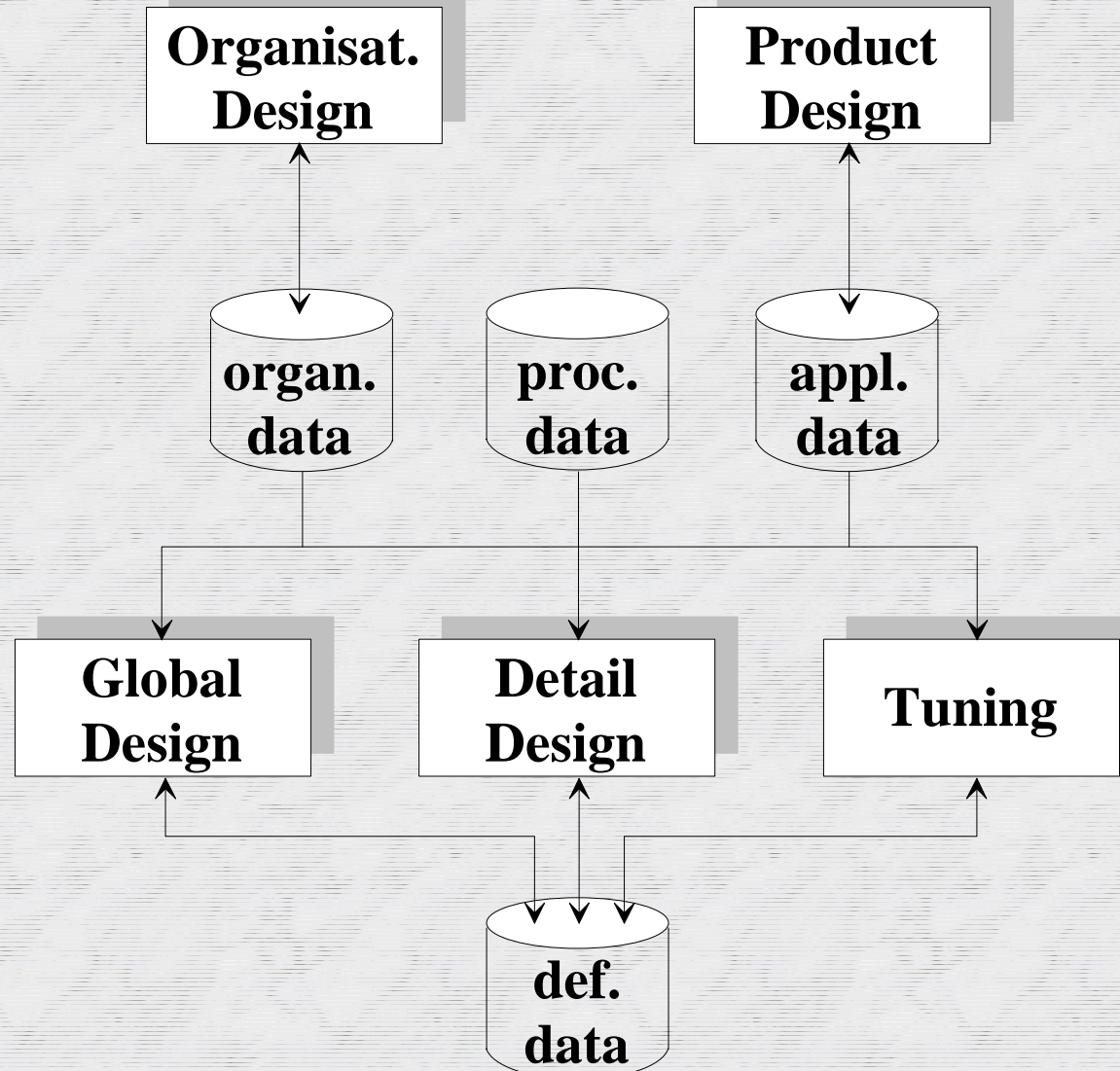
**configuration**



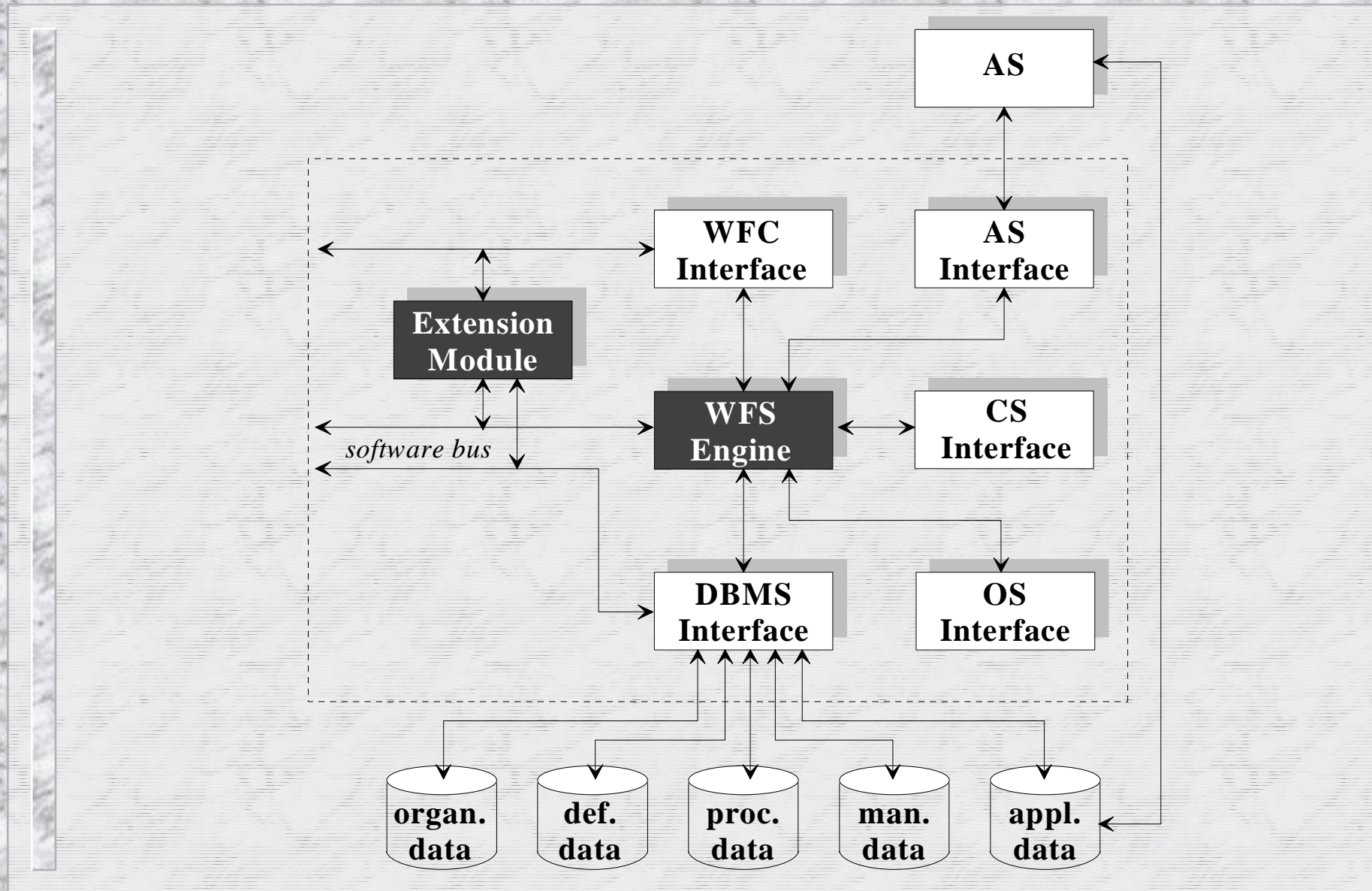
# Mercurius design module architecture



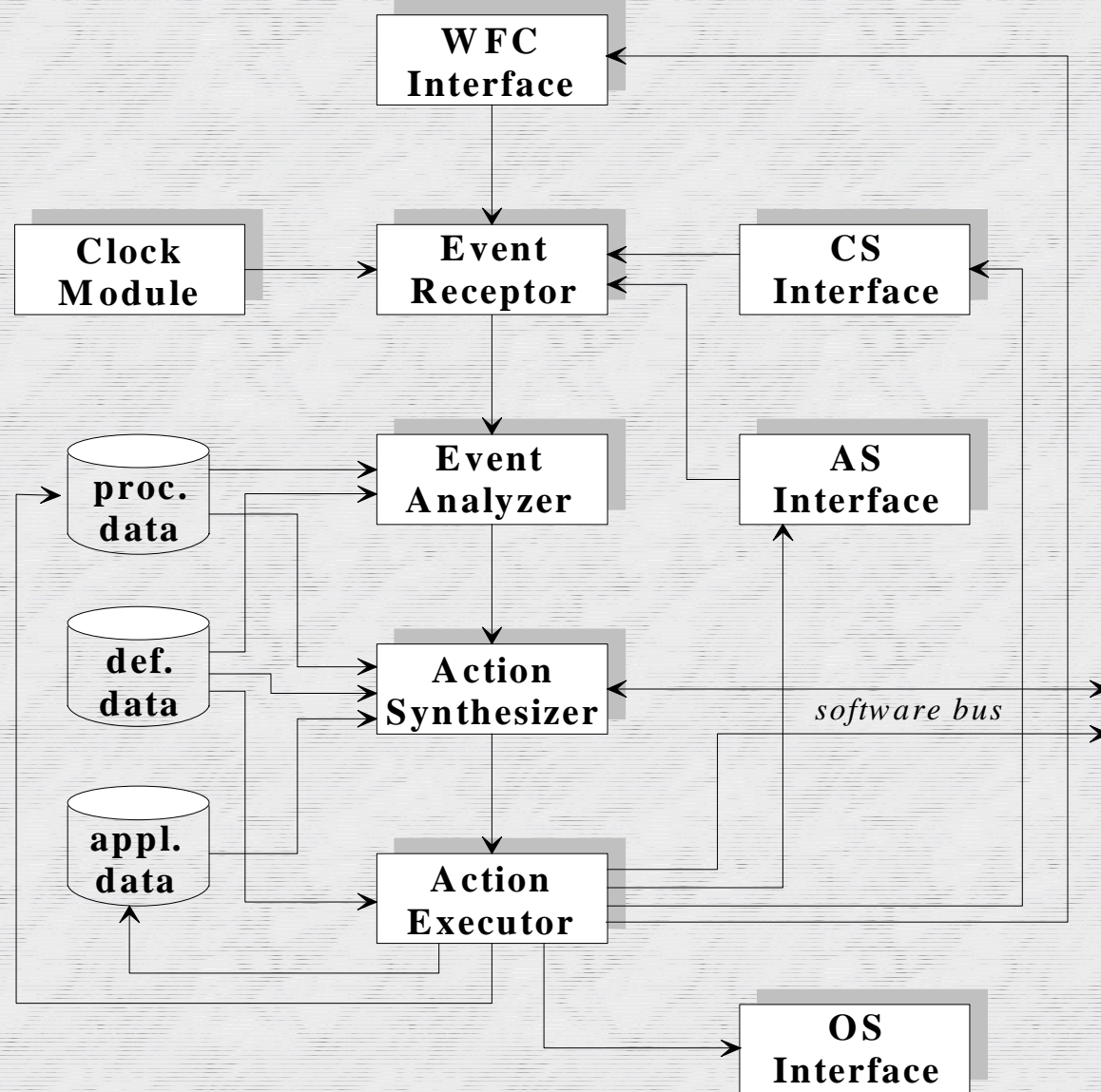
# Mercurius design engine architecture



# Mercurius enactment module architecture



# Mercurius enactment engine architecture



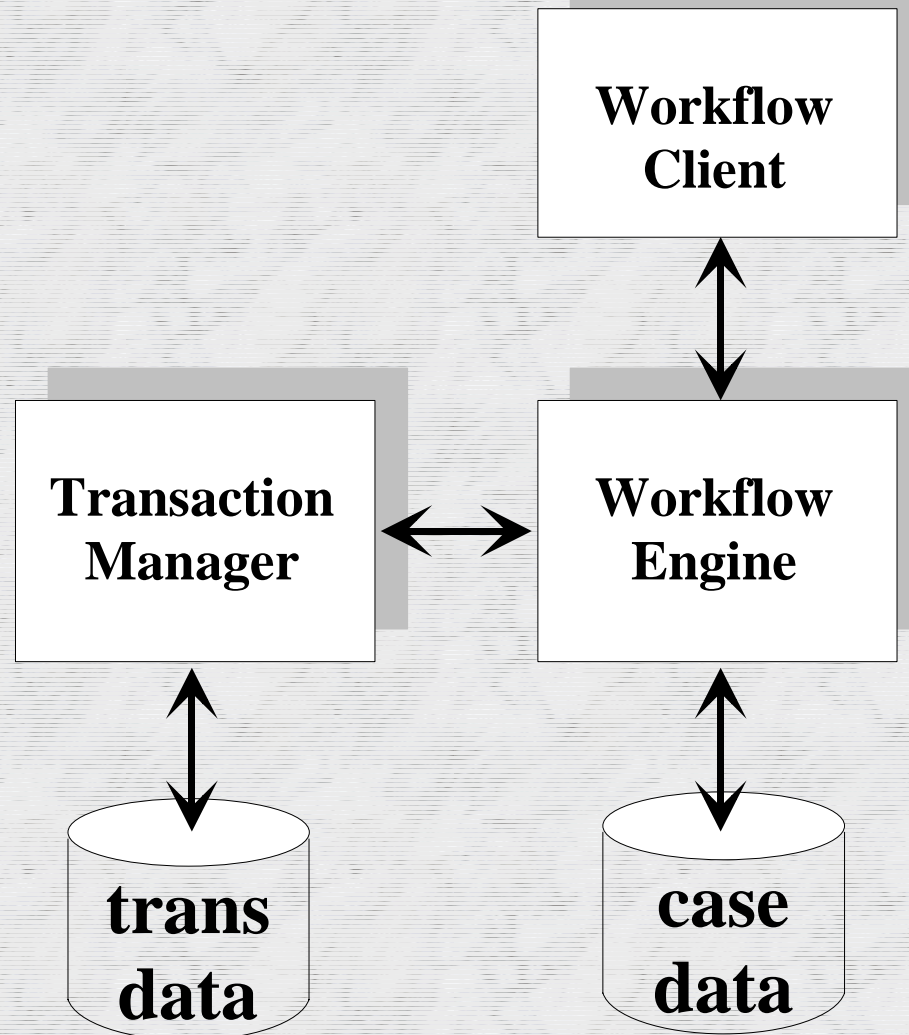
The background is a light-colored marbled paper with a complex, organic pattern of veins in shades of beige, cream, and light brown. A white rectangular frame is centered on the page, containing the title text. The frame has a thin border and a small vertical bar on the left side.

# Architectural Platforms

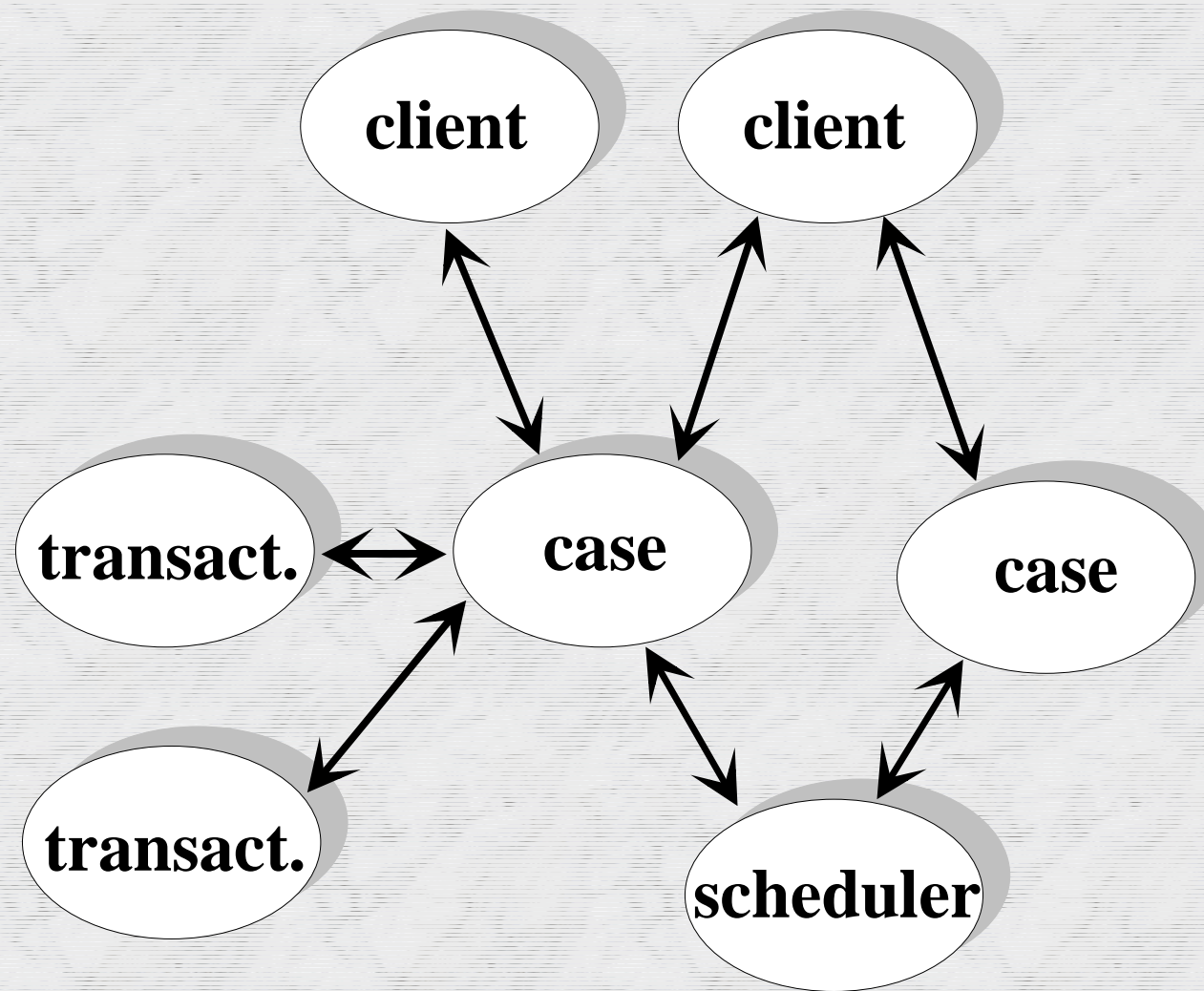
# Distributed Object Architectures

- object model architecture  
*vs. system model architecture*
- application object access  
*vs. server system access*
- fine grain computation  
*vs. coarse grain computation*
- transparent distribution  
*vs. no/explicit distribution*

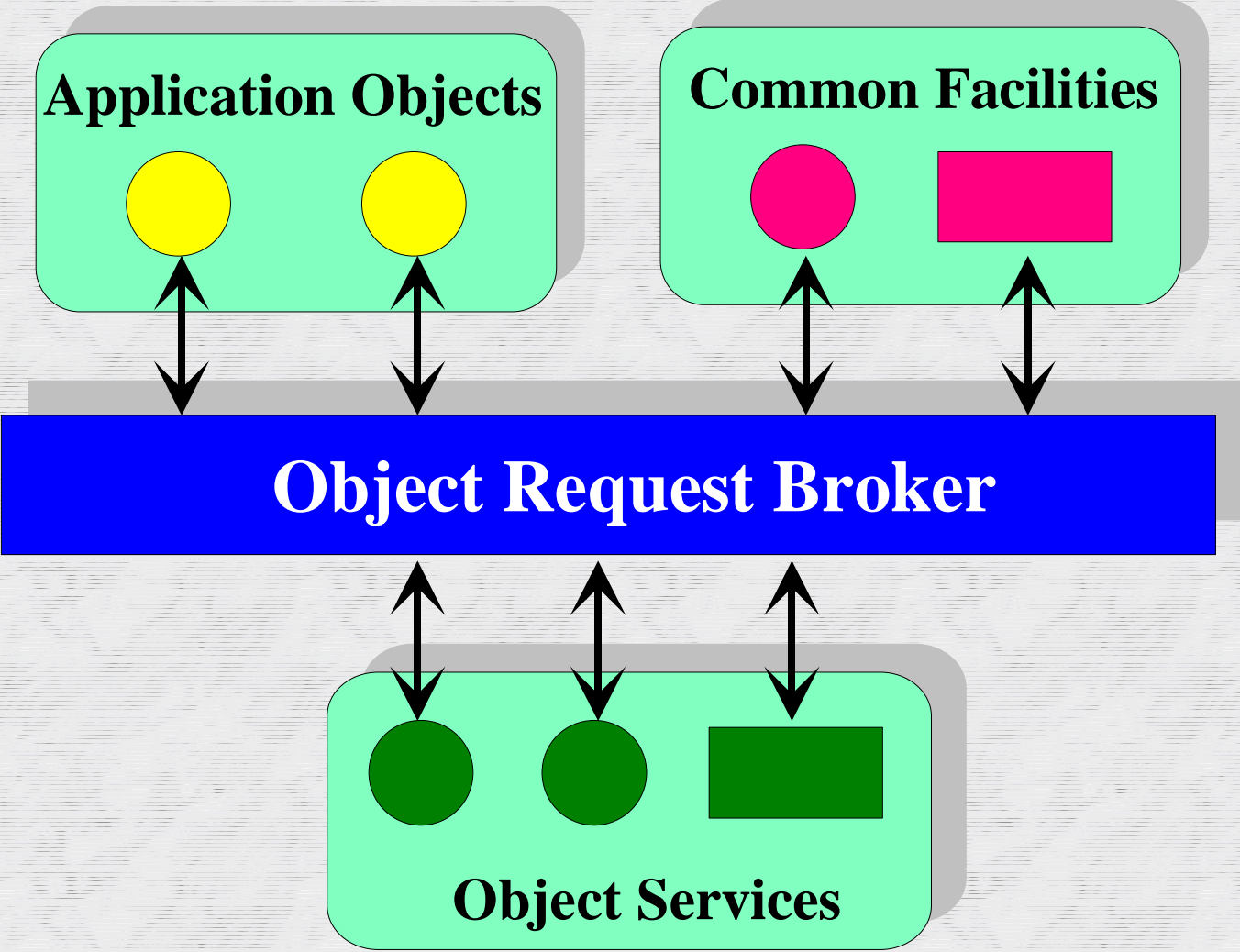
# Example architecture 'traditional'



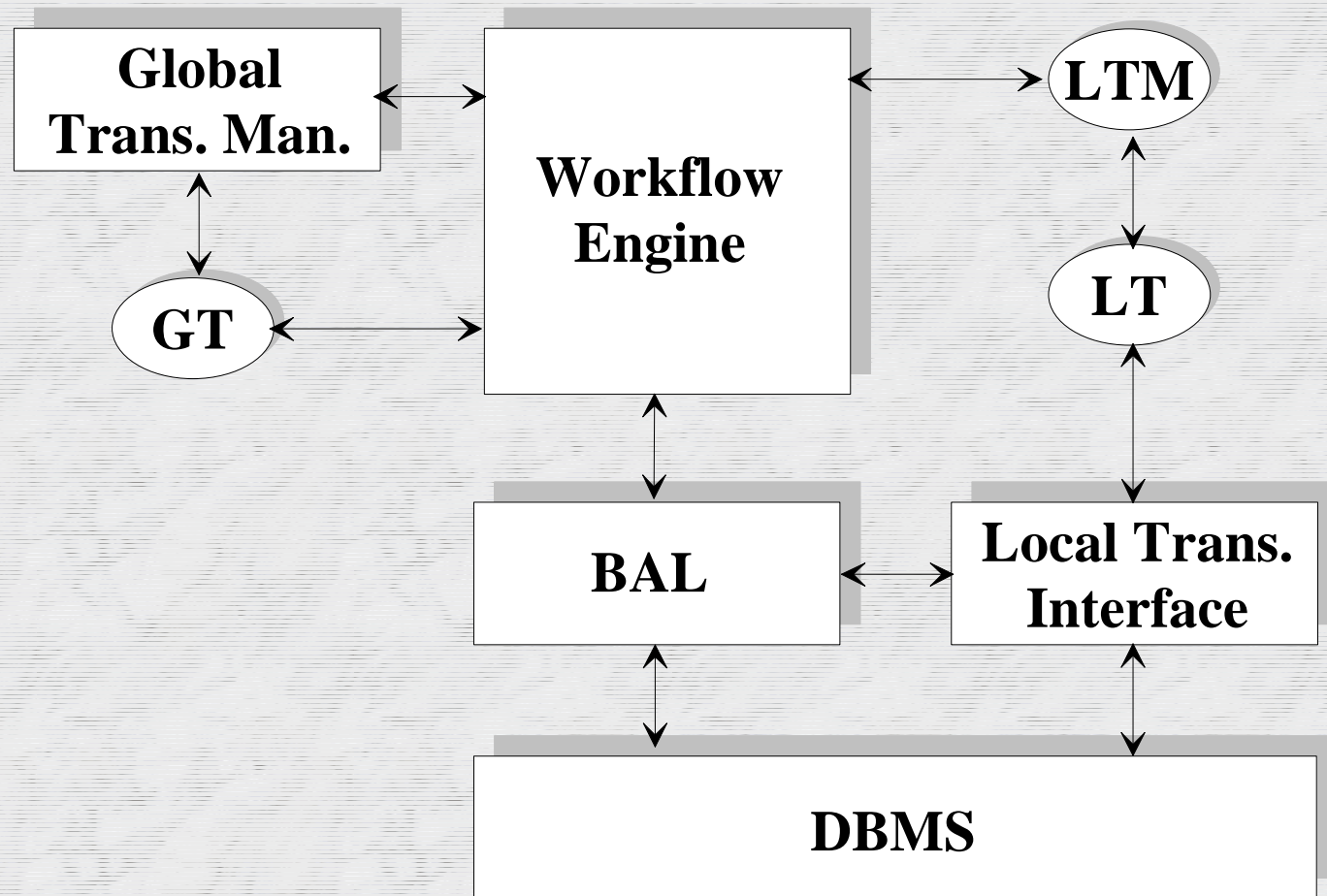
## Example architecture a la DOA



# OMG-OMA



# Example architecture: WIDE WFMS



The image features a background of marbled paper with a complex, organic pattern of light and dark grey and blue tones. A white rectangular frame is centered on the page, containing the word "Conclusions" in a blue, serif font. The frame has a thin white border and a small vertical bar on the left side.

# Conclusions

## Conclusions

- ★ Modeling of architectures of paramount importance CIS design
- ★ Modeling of CIS architectures has many aspects
- ★ Modeling of CIS architectures is a discipline that is in its infancy