



# The Activity Domain

## - A New Paradigm for Enterprise Architectures

Lars Taxén  
Linköping University  
[lars.taxen@telia.com](mailto:lars.taxen@telia.com)  
[www.neana.se](http://www.neana.se)

# Who am I?



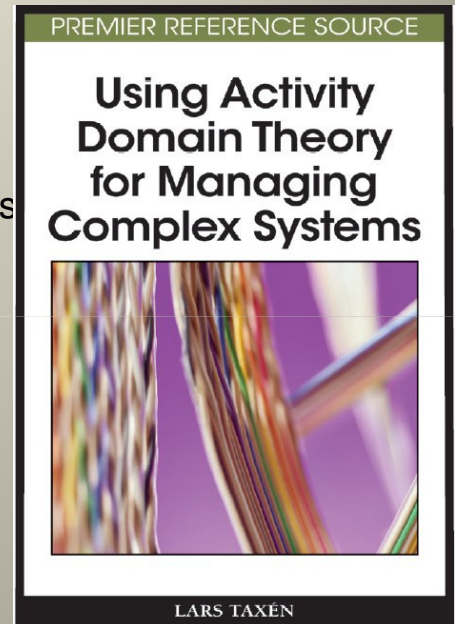
**ERICSSON** 

- 1968 - 1983 Methods and Tools developer, Ericsson AB
- 1983 - 1989 Line manager CAD Transmission, Ericsson AB
- 1989 - 1990 Department Specialist, CAD Transmission, Ericsson AB
- 1990 - 1990 Project Manager VHDL Pilot project, Ericsson AB
- 1990 - 1994 Process Designer HW, Ellemtel AB
- 1994 - 1995 Technical Manager, HW, Ellemtel AB
- 1995 - 1996 Process Designer SW & HW, Ellemtel AB
- 1996 - 1998 Method Developer of Incremental dev. SW, Ericsson AB
- 1998 - 2000 Technical Manager Matrix PLM support for Incr. dev. SW Ericsson AB
- 2001 - 2002 Information System Coordinator, Core Network Ericsson AB
- 2002 - 2003 Process Developer PLM, Ericsson AB



- 1998 - 2003 PhD studies, Linköping Univ.
- 2003 - 2007 Associated Senior researcher, Linköping University
- 2007 - Associate professor, Linköping University

- 2003 - Consultant
  - PLM work for Siemens PLM Teamcenter PLM at Kockums, Aalborg Industries, FMC Foodtech, Wärtsilä
  - PLM work for Siemens PLM Teamcenter PLM at Sandvik Coromant
  - PLM Information architecture work for Huawei Technologies
  - Member of FinES Expert Committee on Interoperability (EU)



# Outline

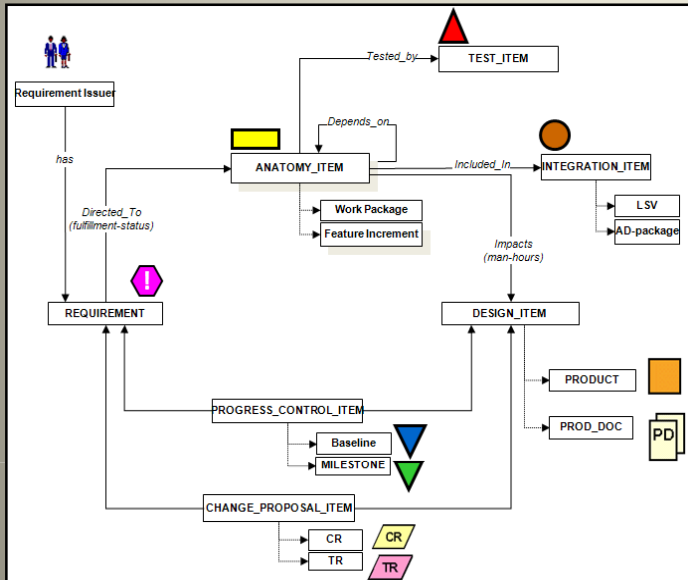
- **Some issues in Enterprise modeling**
- **A paradigm shift**
  - The Activity Domain at “the centre of the world”
- **An alternative approach**
  - Enterprise modeling
  - Enterprise System (ES) development
- **Summary**

# Issues

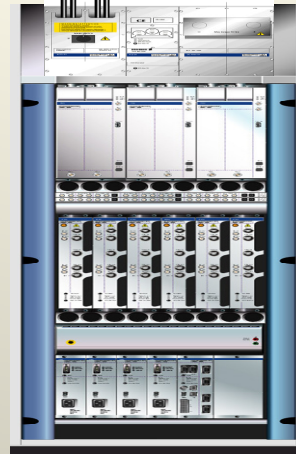
# Complexity of enterprise management



## Information, data



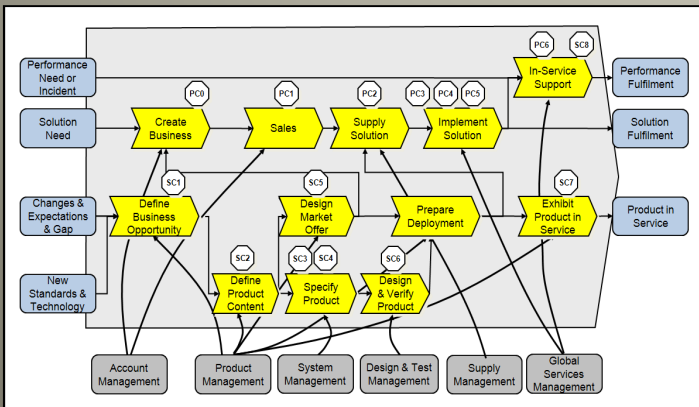
## Products



## Enterprise systems

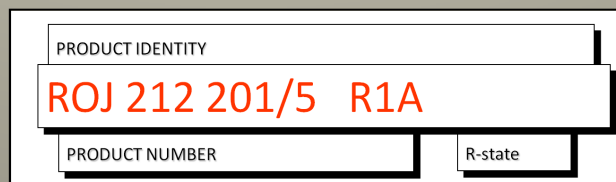
Object	State	Owner	Revision
Work Package WP1	RFSy	uablx	-
Source Program Information 190 55 190 55-CAAZ 107 3937 PB1	CHKD	uablx	PB1
Source Program Information 190 55 190 55-CAAZ 107 5577 PC2	PREL	uablx	PC2
Block (CNT) A R1	PREL	uablx	R1
Block (CNT) B R1	PREL	uablx	R1
Increment Milestone wP1-MS8 A	Not Passed	uablx	A
LSV A P1A	PREL	uablx	P1A
Work Package WP2	IND	uablx	-
Detailed Req C-100 A	AGREED	uabesen	A

## Processes



People

Business rules

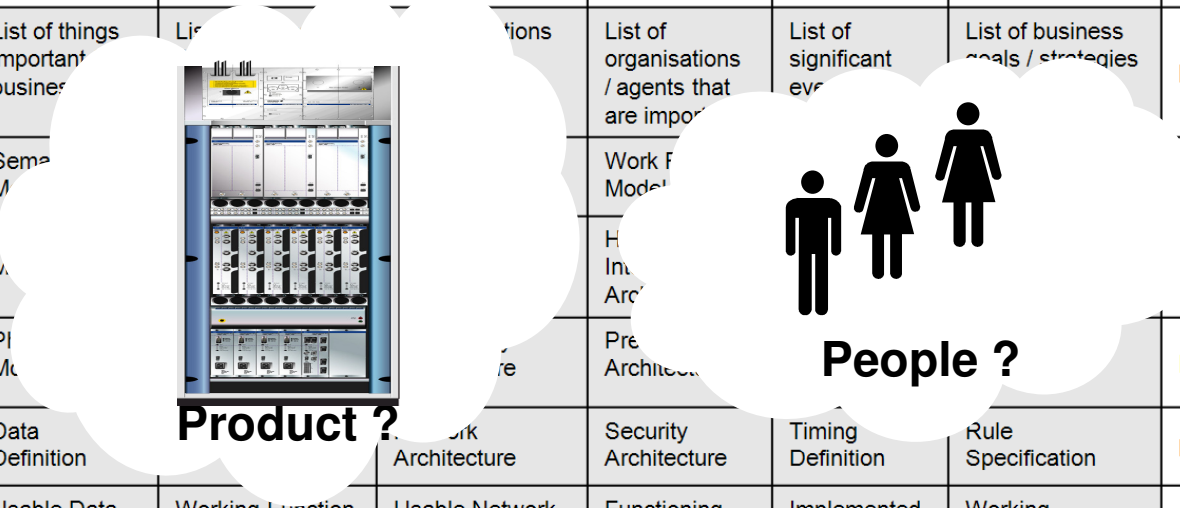


## Collaboration



# Zachman EA

	WHAT A	HOW B	WHERE C	WHO D	WHEN E	WHY F	
<b>SCOPE</b>	1 List of things important to business	List of functions	List of locations	List of organisations / agents that are important	List of significant events	List of business goals / strategies	<b>Planner</b>
<b>BUSINESS MODEL</b>	2 Semantic Model			Work Function Model			<b>Owner</b>
<b>SYSTEM MODEL</b>	3 Logical Model			Human Interaction Architecture			<b>Designer</b>
<b>TECHNOLOGY MODEL</b>	4 Physical Model			Physical Architecture			<b>Builder</b>
<b>DETAILED REPR.</b>	5 Data Definition		Network Architecture	Security Architecture	Timing Definition	Rule Specification	<b>Programmer</b>
<b>FUNCTIONING ENTERPRISE</b>	6 Usable Data	Working Function	Usable Network	Functioning Organization	Implemented Schedule	Working Strategy	<b>User</b>
	<b>DATA</b>	<b>FUNCTION</b>	<b>NETWORK</b>	<b>PEOPLE</b>	<b>TIME</b>	<b>MOTIVATION</b>	



Each cell must be modeled (30)  
 Transitions between cells must be defined (60)  
 Stakeholder must agree on this

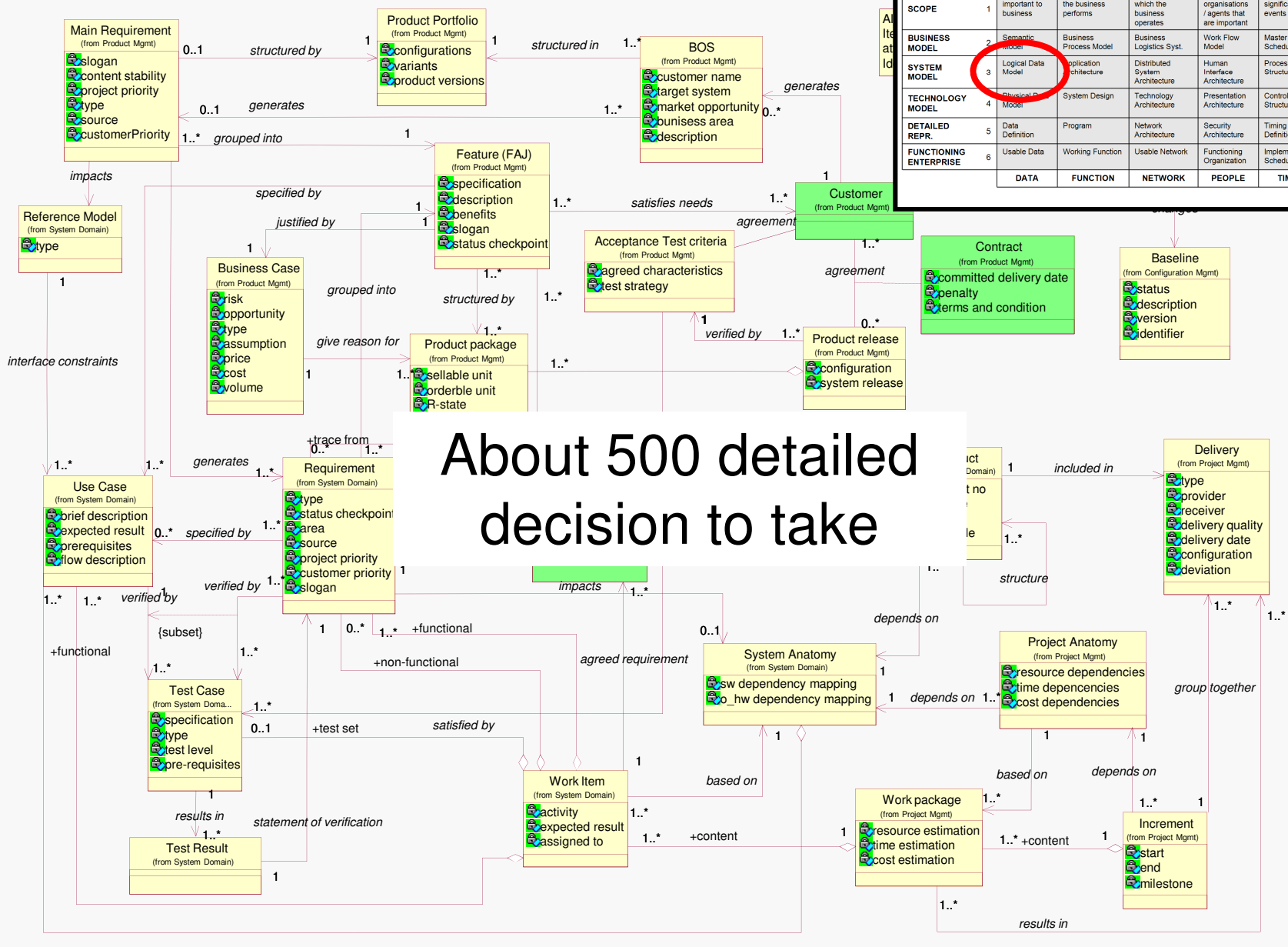
Simply not doable; more like a checklist

# An example...

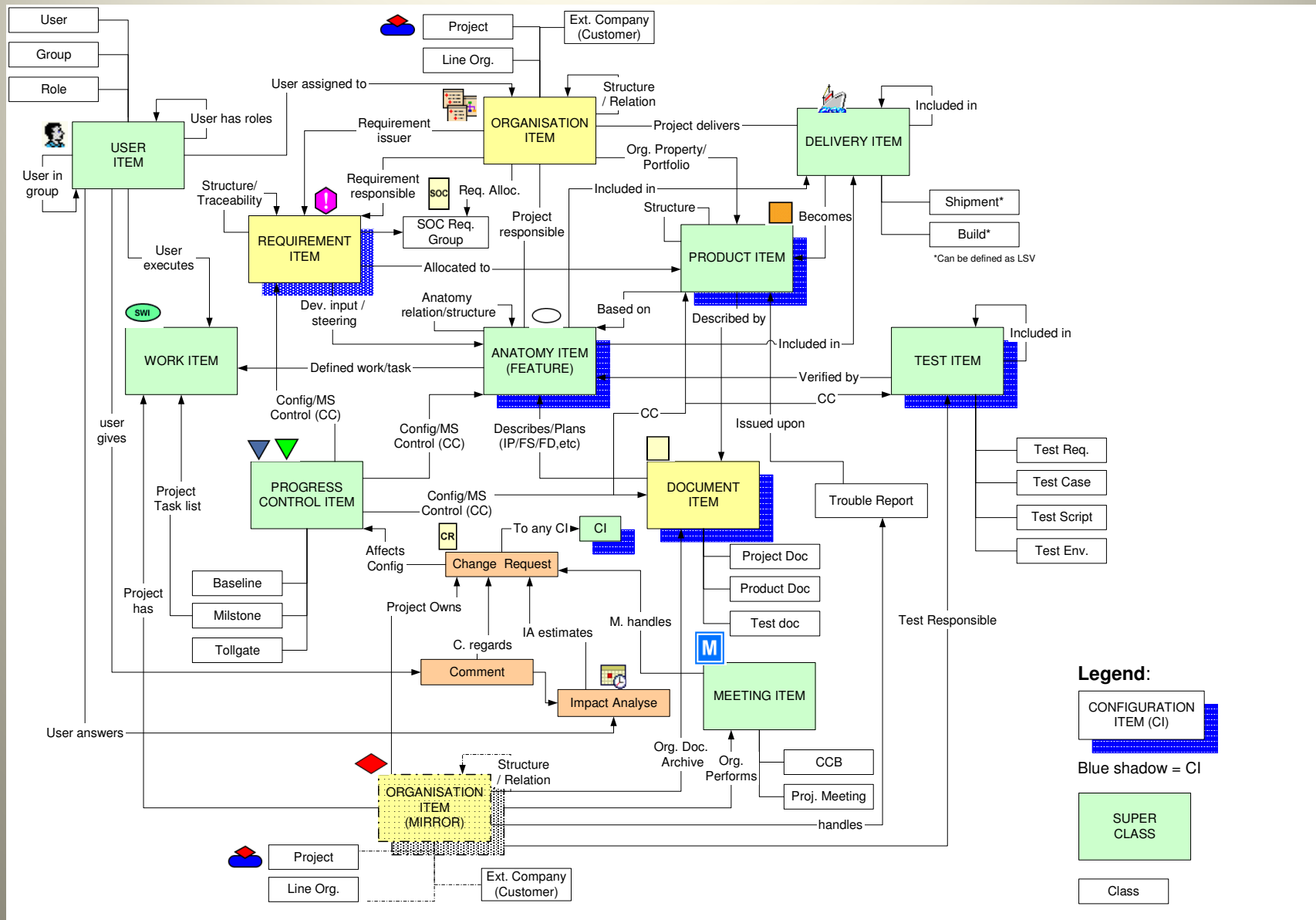
		WHAT	HOW	WHERE	WHO	WHEN	WHY	
		A	B	C	D	E	F	
<b>SCOPE</b>	1	List of things important to business	List of processes the business performs	List of locations which the business operates	List of organisations / agents that are important	List of significant events	List of business goals / strategies	<b>Planner</b>
<b>BUSINESS MODEL</b>	2	Semantic Model	Business Process Model	Business Logistics Syst.	Work Flow Model	Master Schedule	Business Plan	<b>Owner</b>
<b>SYSTEM MODEL</b>	3	Logical Data Model	Application Architecture	Distributed System Architecture	Human Interface Architecture	Processing Structure	Business Rule Model	<b>Designer</b>
<b>TECHNOLOGY MODEL</b>	4	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design	<b>Builder</b>
<b>DETAILED REPR.</b>	5	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification	<b>Programmer</b>
<b>FUNCTIONING ENTERPRISE</b>	6	Usable Data	Working Function	Usable Network	Functioning Organization	Implemented Schedule	Working Strategy	<b>User</b>
		<b>DATA</b>	<b>FUNCTION</b>	<b>NETWORK</b>	<b>PEOPLE</b>	<b>TIME</b>	<b>MOTIVATION</b>	

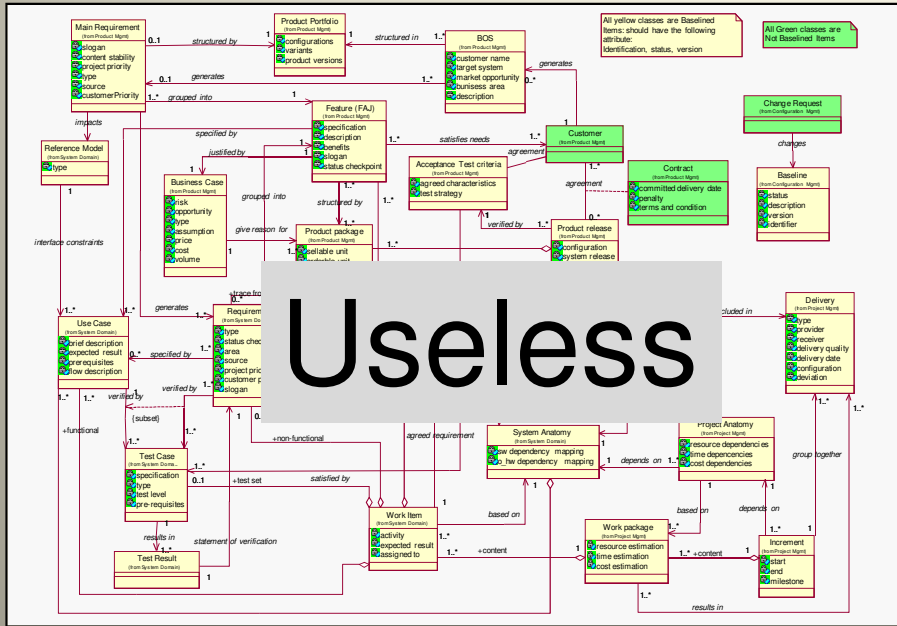
	WHAT	HOW	WHERE	WHO	WHEN	WHY		
	A	B	C	D	E	F		
SCOPE	1	List of things important to business	List of processes the business performs	List of locations which the business operates	List of organisations / agents that are important	List of significant events	List of business goals / strategies	Planner
BUSINESS MODEL	2	Semantic Model	Business Process Model	Business Logistics Syst.	Work Flow Model	Master Schedule	Business Plan	Owner
SYSTEM MODEL	3	Logical Data Model	Application Architecture	Distributed System Architecture	Human Interface Architecture	Processing Structure	Business Rule Model	Designer
TECHNOLOGY MODEL	4	Physical Data Model	System Design	Technology Architecture	Presentation Architecture	Control Structure	Rule Design	Builder
DETAILED REPR.	5	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification	Programmer
FUNCTIONING ENTERPRISE	6	Usable Data	Working Function	Usable Network	Functioning Organization	Implemented Schedule	Working Strategy	User
		DATA	FUNCTION	NETWORK	PEOPLE	TIME	MOTIVATION	

About 500 detailed decision to take

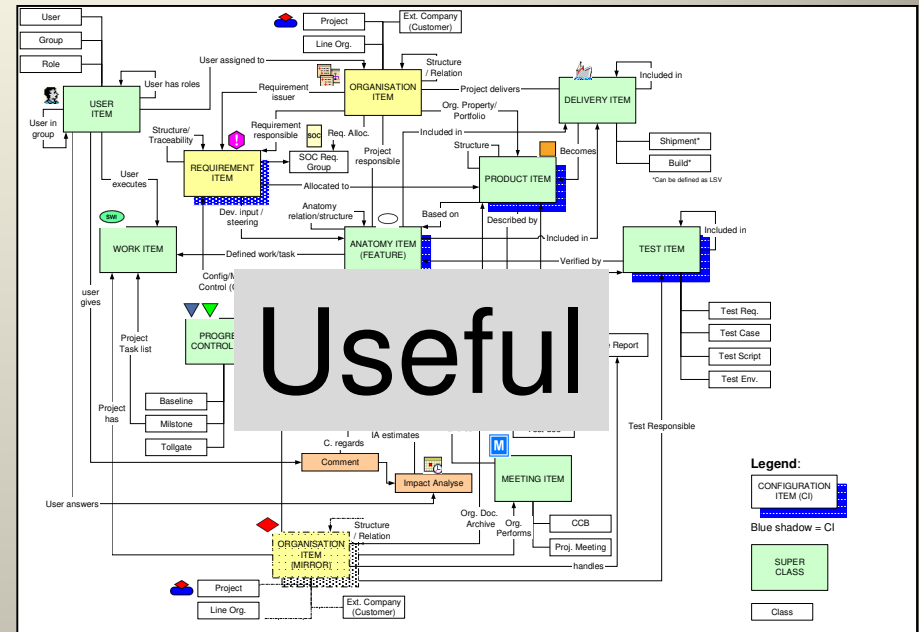




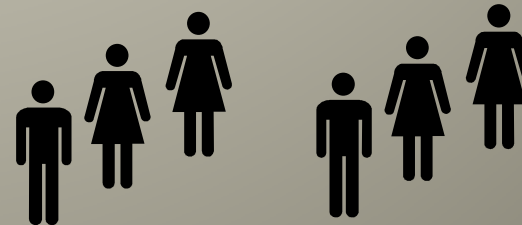




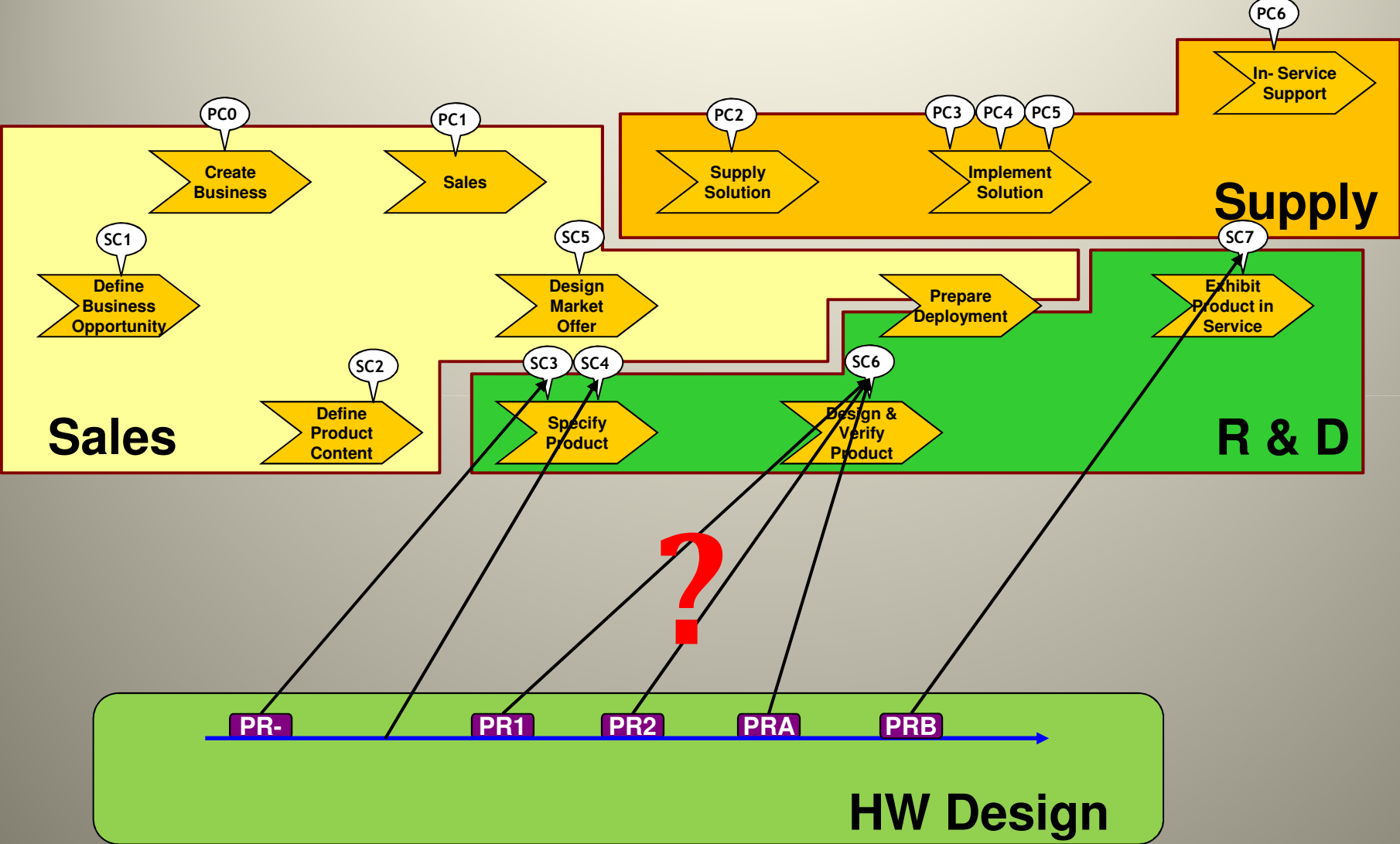
Defined by a consultant  
“in the chamber”



Chiseled out “on the combat field” between 1997 - 2003



# Crossing organizational borders



# Commonality?

## BPMN 2.0 - Business Process Model and Notation

<http://bpmb.de/poster>

### Activities

- Task**: A Task is a unit of work, the job to be performed. When marked with a [ ] symbol it indicates a Sub-Process, an activity that can be refined.
- Transaction**: A Transaction is a set of activities that logically belong together; it might follow a specified transaction protocol.
- Event Sub-Process**: An Event Sub-Process is placed into a Process or Sub-Process. It is activated when its start event gets triggered and can interrupt the higher level process context or run in parallel (non-interrupting) depending on the start event.
- Call Activity**: A Call Activity is a wrapper for a globally defined Sub-Process or Task that is reused in the current process.

- Activity Markers**  
Markers indicate execution behavior of activities:
- Sub-Process Marker
  - Loop Marker
  - Parallel MI Marker
  - Sequential MI Marker
  - Ad Hoc Marker
  - Compensation Marker
- Task Types**  
Types specify the nature of the action to be performed:
- Send Task
  - Receive Task
  - User Task
  - Manual Task
  - Business Rule Task
  - Service Task
  - Script Task

- Sequence Flow**: defines the execution order of activities.
- Default Flow**: is the default branch to be chosen if all other conditions evaluate to false.
- Conditional Flow**: has a condition assigned that defines whether or not the flow is used.

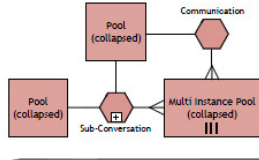
### Gateways

- Exclusive Gateway**: When splitting, it routes the sequence flow to exactly one of the outgoing branches. When merging, it awaits one incoming branch to complete before triggering the outgoing flow.
- Event-based Gateway**: is always followed by catching events or receive tasks. Sequence flow is routed to the subsequent event/task which happens first.
- Parallel Gateway**: When used to split the sequence flow, all outgoing branches are activated simultaneously. When merging parallel branches it waits for all incoming branches to complete before triggering the outgoing flow.
- Inclusive Gateway**: When splitting, one or more branches are activated. All active incoming branches must complete before merging.
- Complex Gateway**: Complex merging and branching behavior that is not captured by other gateways.
- Exclusive Event-based Gateway (instantiate)**: Each occurrence of a subsequent event starts a new process instance.
- Parallel Event-based Gateway (instantiate)**: The occurrence of all subsequent events starts a new process instance.

### Conversations

- Communication**: A Communication defines a set of logically related message exchanges. When marked with a [ ] symbol it indicates a Sub-Conversation, a compound conversation element.
- Conversation Link**: connects Communications and Participants.
- Forked Conversation Link**: connects Communications and multiple Participants.

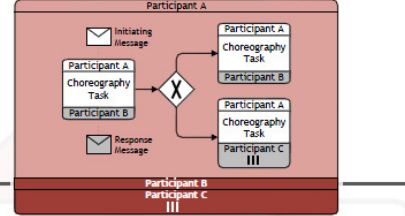
### Conversation Diagram



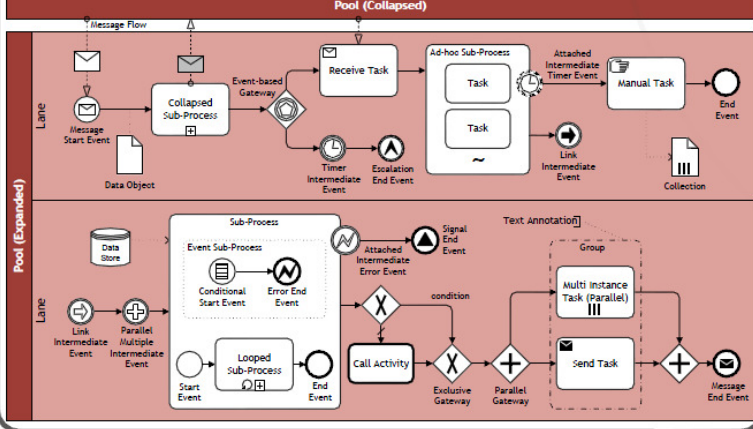
### Choreographies

- Participant A**, **Participant B**, **Participant C**: Participants in a choreography.
- Choreography Task**: A Choreography Task represents an interaction (Message Exchange) between two Participants.
- Multiple Participants Marker**: denotes a set of Participants of the same kind.
- Choreography Sub-Process**: contains a refined choreography with several interactions.

### Choreography Diagram



### Collaboration Diagram



### Swimlanes

- Pools (Participants) and Lanes**: represent responsibilities for activities in a process. A pool or a lane can be an organization, a role, or a system. Lanes subdivide pools or other lanes hierarchically.
- Message Flow**: symbolizes information flow across organizational boundaries. Message flow can be attached to pools, activities, or message events.
- Order of message exchanges**: can be specified by combining message flow and sequence flow.

### Events

	Top-Level	Start	Intermediate	End
None: Untyped events, indicate start point, state changes or final states.	○	○	○	○
Message: Receiving and sending messages.	✉	✉	✉	✉
Timer: Cyclic timer events, points in time, time spans or timeouts.	🕒	🕒	🕒	🕒
Escalation: Escalating to an higher level of responsibility.	⚠	⚠	⚠	⚠
Conditional: Reacting to changed business conditions or integrating business rules.	📄	📄	📄	📄
Link: Off-page connectors. Two corresponding link events equal a sequence flow.	↔	↔	↔	↔
Error: Catching or throwing named errors.	⚡	⚡	⚡	⚡
Cancel: Reacting to cancelled transactions or triggering cancellation.	✖	✖	✖	✖
Compensation: Handling or triggering compensation.	⏪	⏪	⏪	⏪
Signal: Signaling across different processes: a signal thrown can be caught multiple times.	📡	📡	📡	📡
Multiple: Catching one out of a set of events. Throwing all events defined.	⬢	⬢	⬢	⬢
Parallel Multiple: Catching all out of a set of parallel events.	⊕	⊕	⊕	⊕
Terminate: Triggering the immediate termination of a process.	⬤	⬤	⬤	⬤

### Data

- Data Input**: A Data Input is an external input for the entire process. It can be read by an activity.
- Data Output**: A Data Output is a variable available as result of the entire process.
- Data Object**: represents information flowing through the process, such as business documents, e-mails, or letters.
- Collection Data Object**: represents a collection of information, e.g., a list of order items.
- Data Store**: A Data Store is a place where the process can read or write data, e.g., a database or a filing cabinet. It persists beyond the lifetime of the process instance.
- Message**: is used to depict the contents of a communication between two Participants.

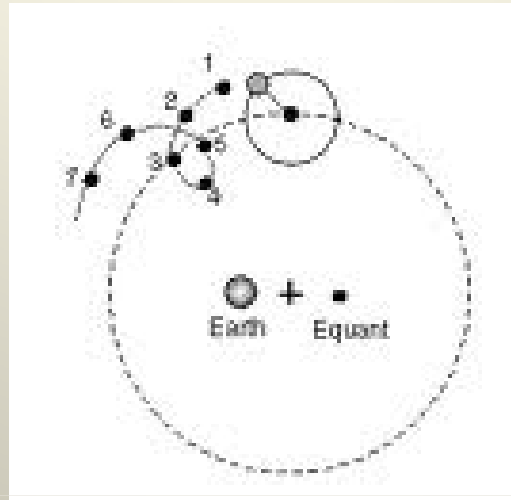
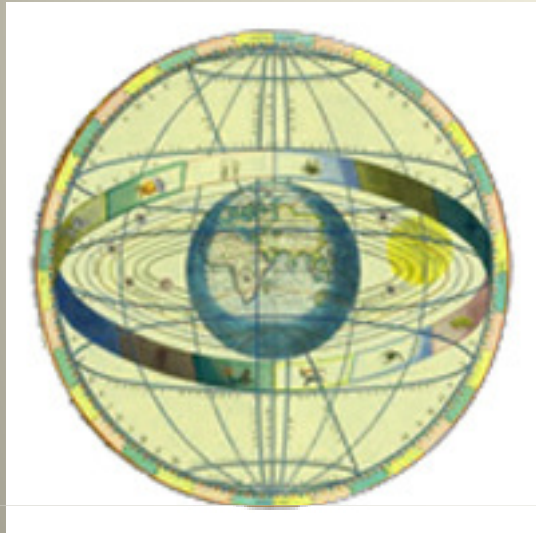


The significant problems we have  
cannot be solved at the same level of  
thinking with which we created them

– Albert Einstein

# A paradigm shift needed

# Paradigm shifts



Ptolemy: The earth at the center    Strange behavior!    Copernicus: The sun at the center

Suddenly, everything familiar took  
on a different interpretation!

# Point of departure - socially organized work

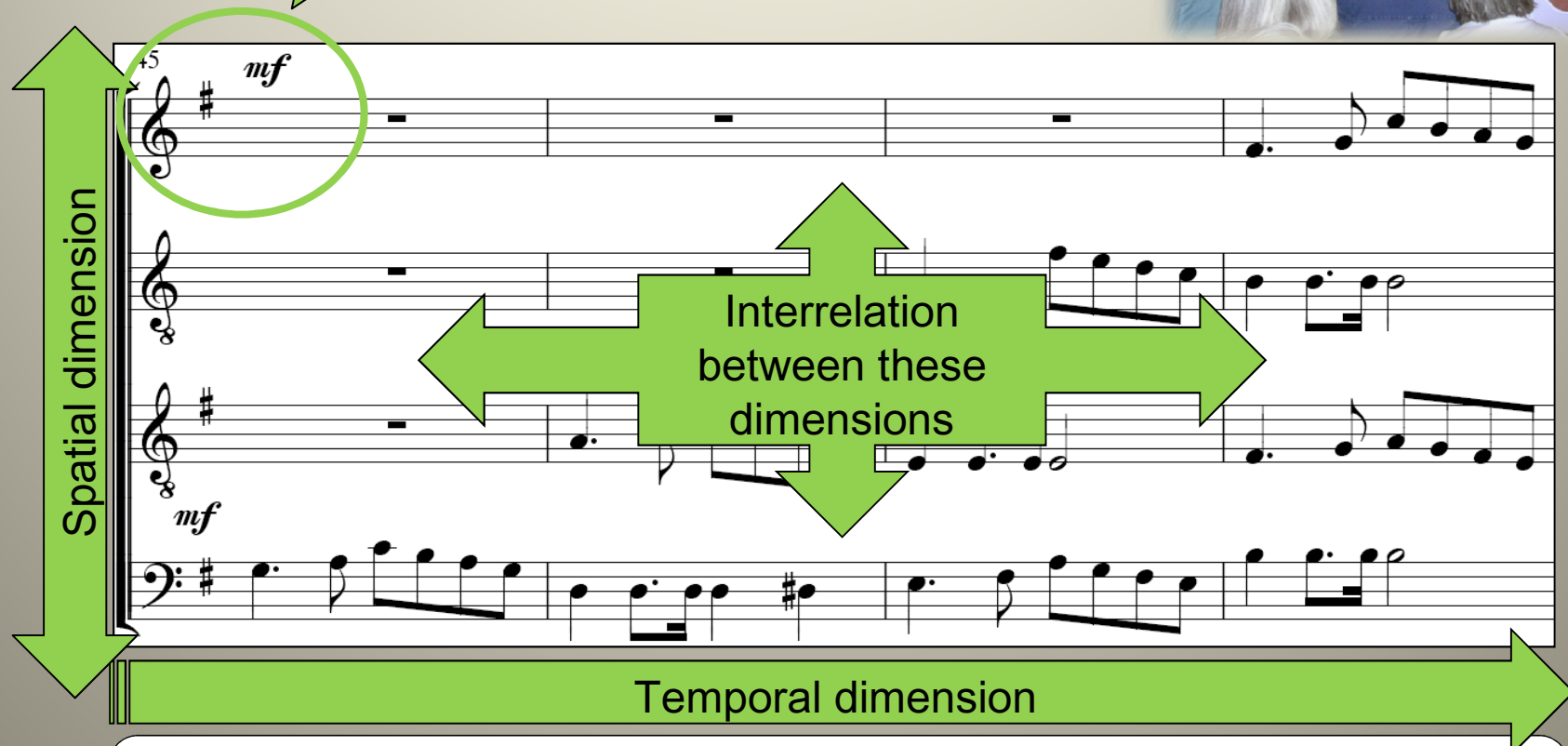




# Coordination of actions

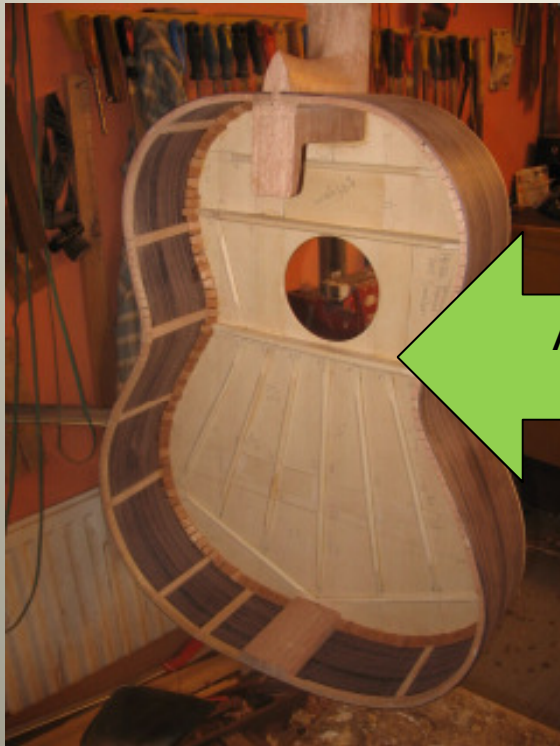


Normative dimension



This notation system is 800+ years old!  
It is plausible that it has evolved to fit human faculties

# Coordination between work contexts



# Socially organized work- the Activity Domain

Attending an object, driven by some motive

Framing a context

Spatial orientation

Sequence of actions

Relevant actions

Mediational means

Capable actors in different roles

Commonality

Changing context

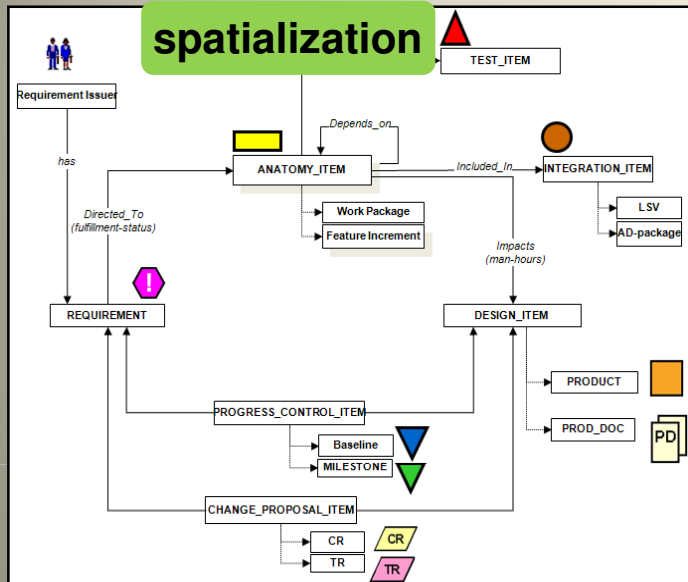
## Activity Modalities

- Attention
- Object orientation
- Contextualization
- Spatialization
- Temporalization
- Stabilization
- Transition

# Enterprise management



## Information, data

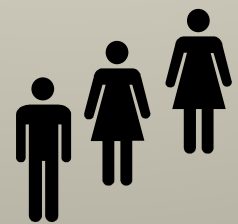


## Products

attention  
object orientation  
contextualization



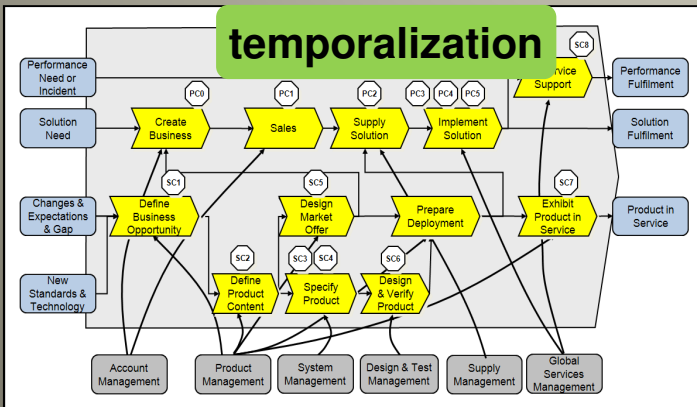
## Commonality Capabilities



## People

## Business rules

## Processes



## Enterprise systems

Mediational means

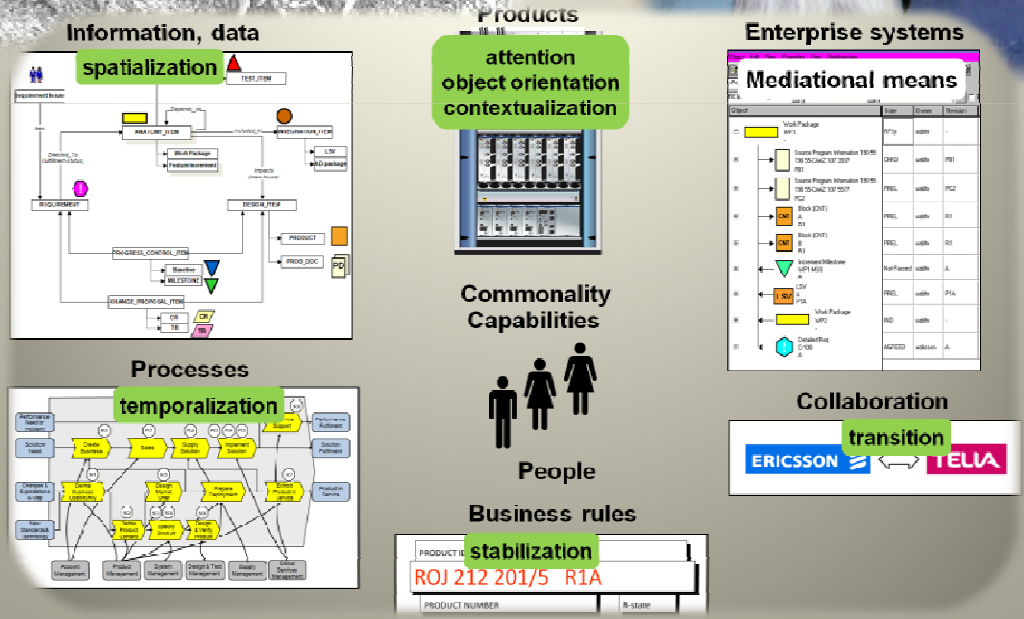
Object	State	Owner	Revision
Work Package WP1	RFSy	uabltx	-
Source Program Information 190 55 190 55-CAAZ 107 3937 PB1	CHKD	uabltx	PB1
Source Program Information 190 55 190 55-CAAZ 107 5577 PC2	PREL	uabltx	PC2
Block (CNT) A R1	PREL	uabltx	R1
Block (CNT) B R1	PREL	uabltx	R1
Increment Milestone w/P1-MS8 A	Not Passed	uabltx	A
LSV A P1A	PREL	uabltx	P1A
Work Package w/P2	IND	uabltx	-
Detailed Req C-100 A	AGREED	uabesen	A

## Collaboration



## stabilization

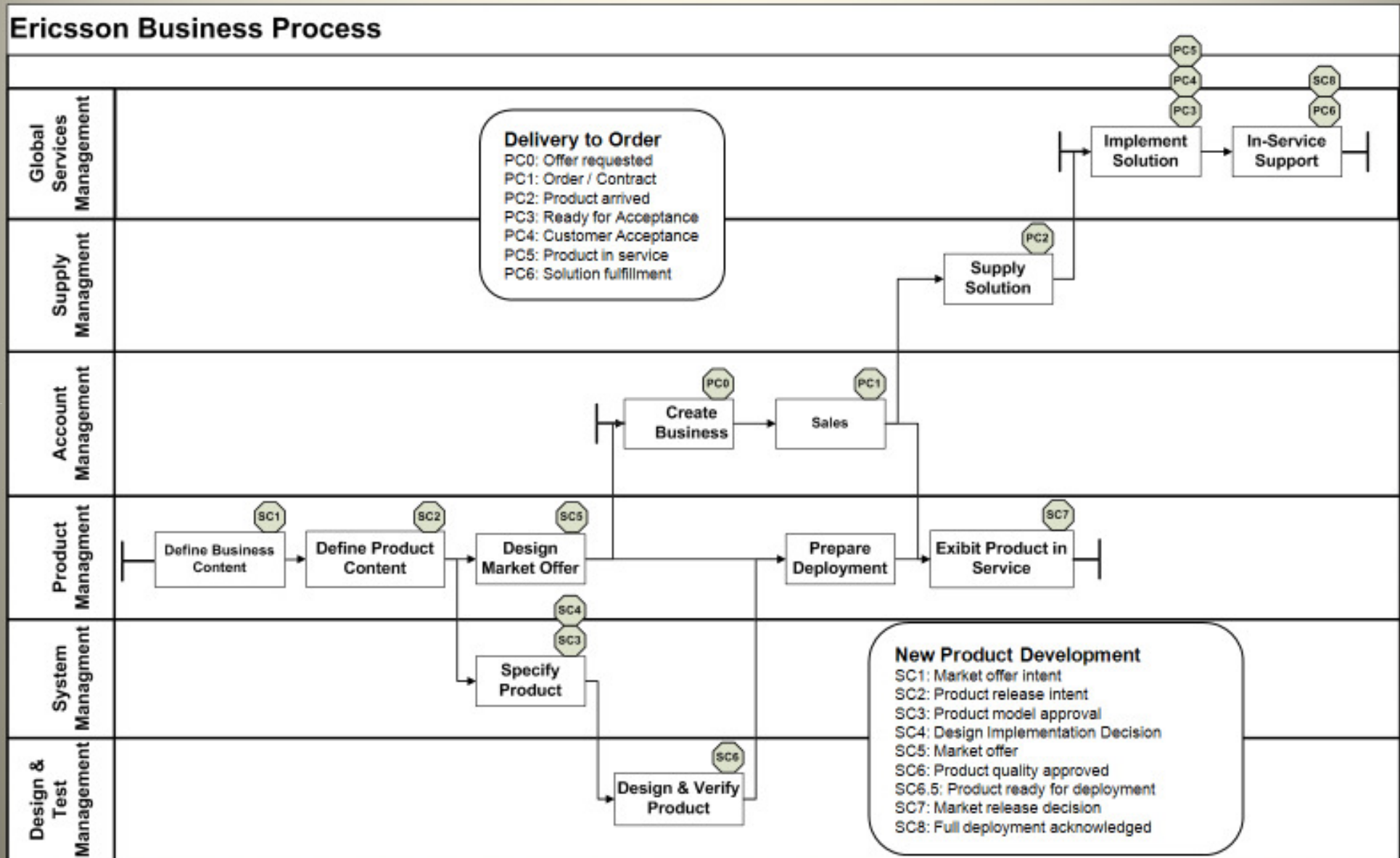




Same fundamental structure since historical times!

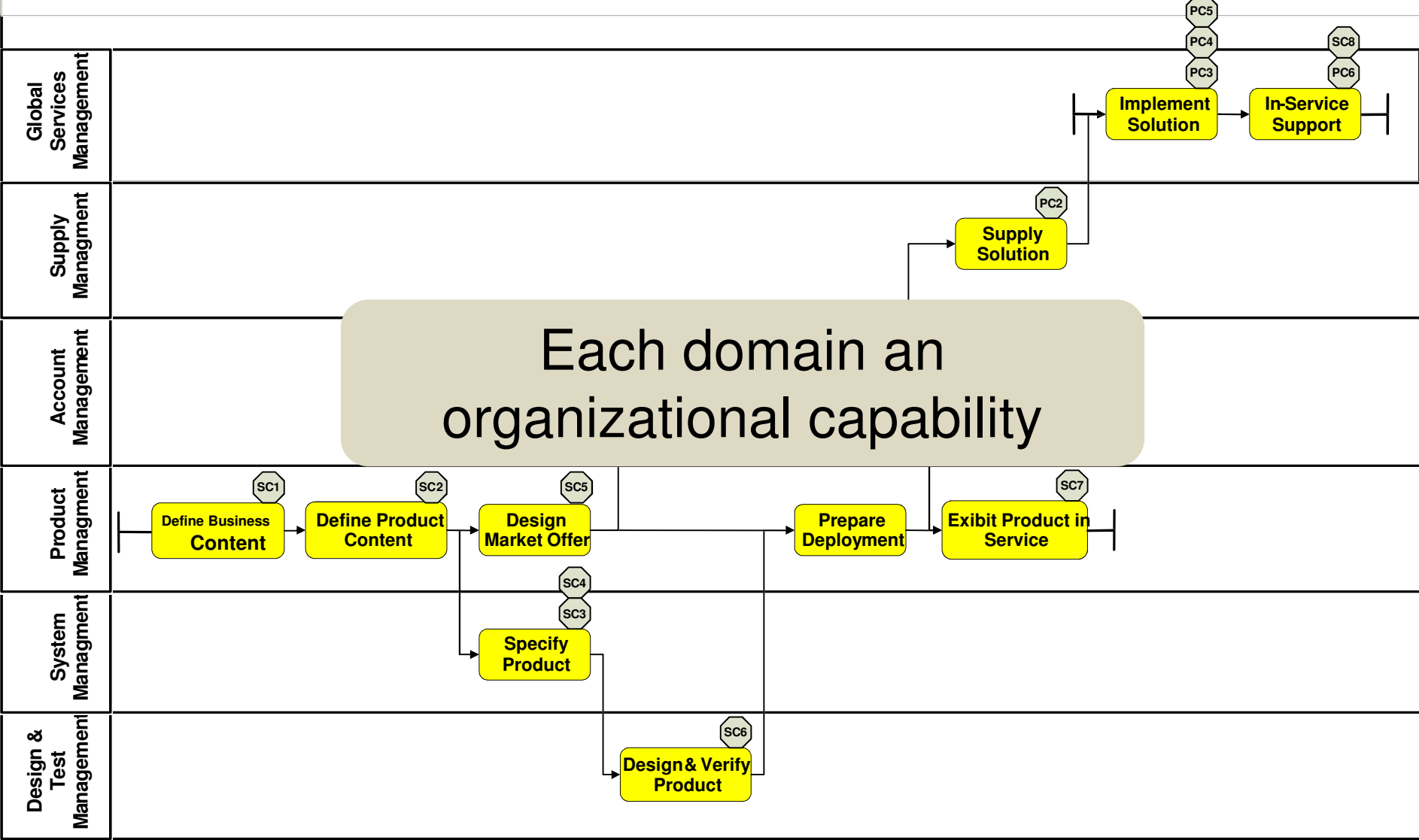
# Enterprise Modeling

# Traditional approach - business process modeling



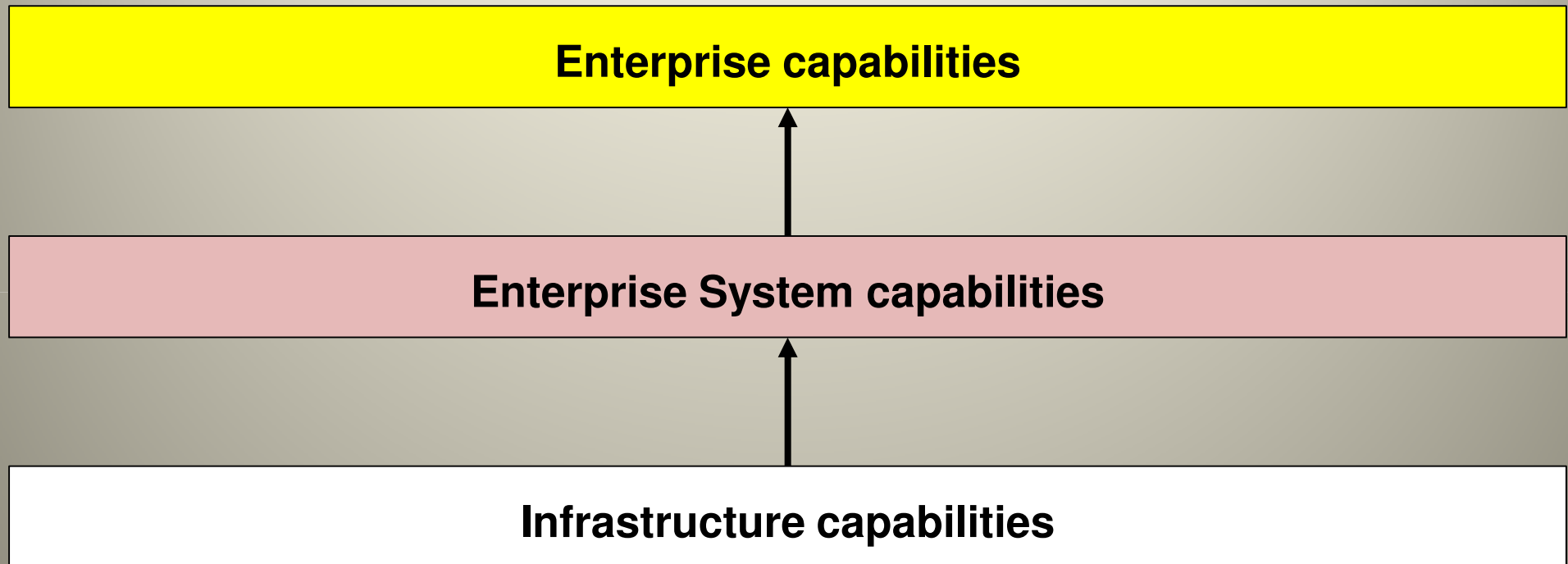
# Paradigm shift - from activities to activity domains

## Ericsson Business Process



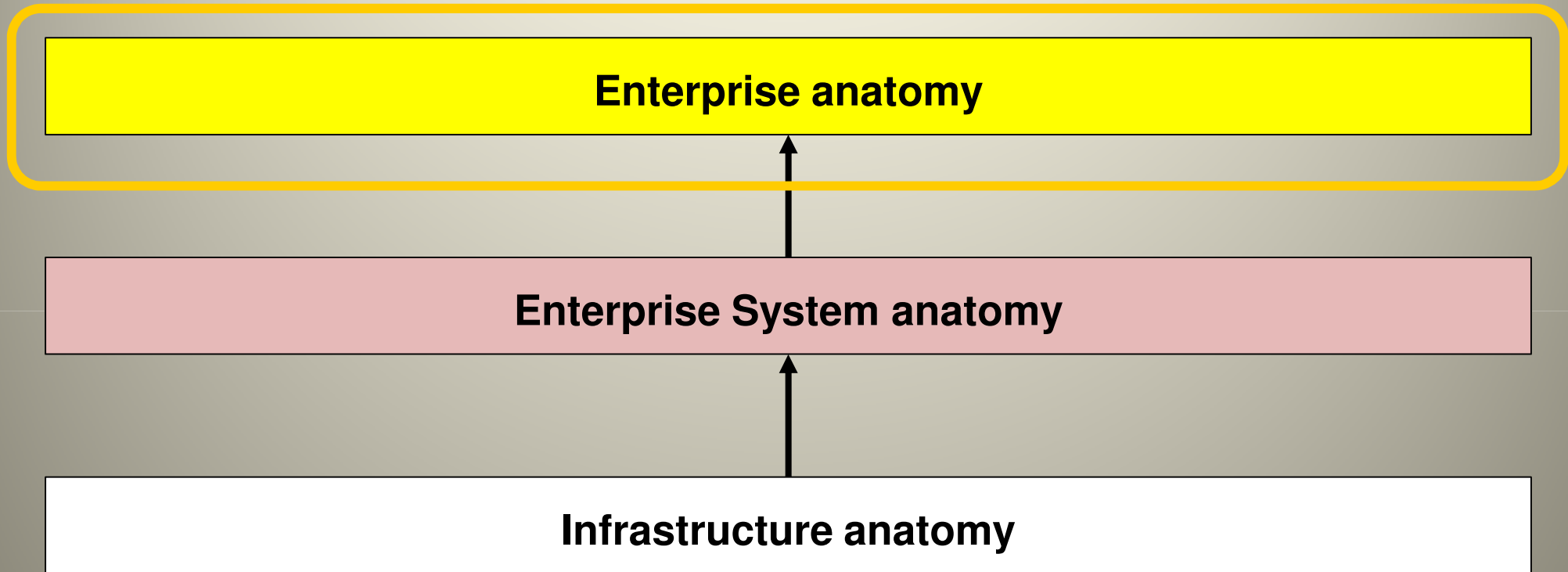


# Capability perspective





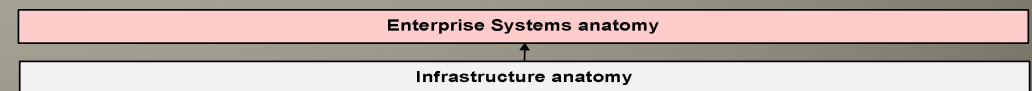
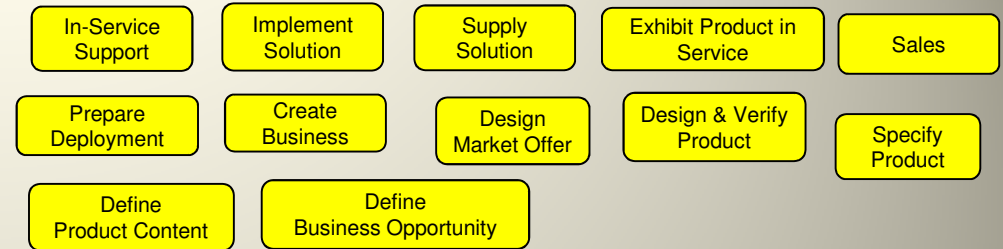
# Uniform modeling - dependencies between capabilities



# Enterprise anatomy

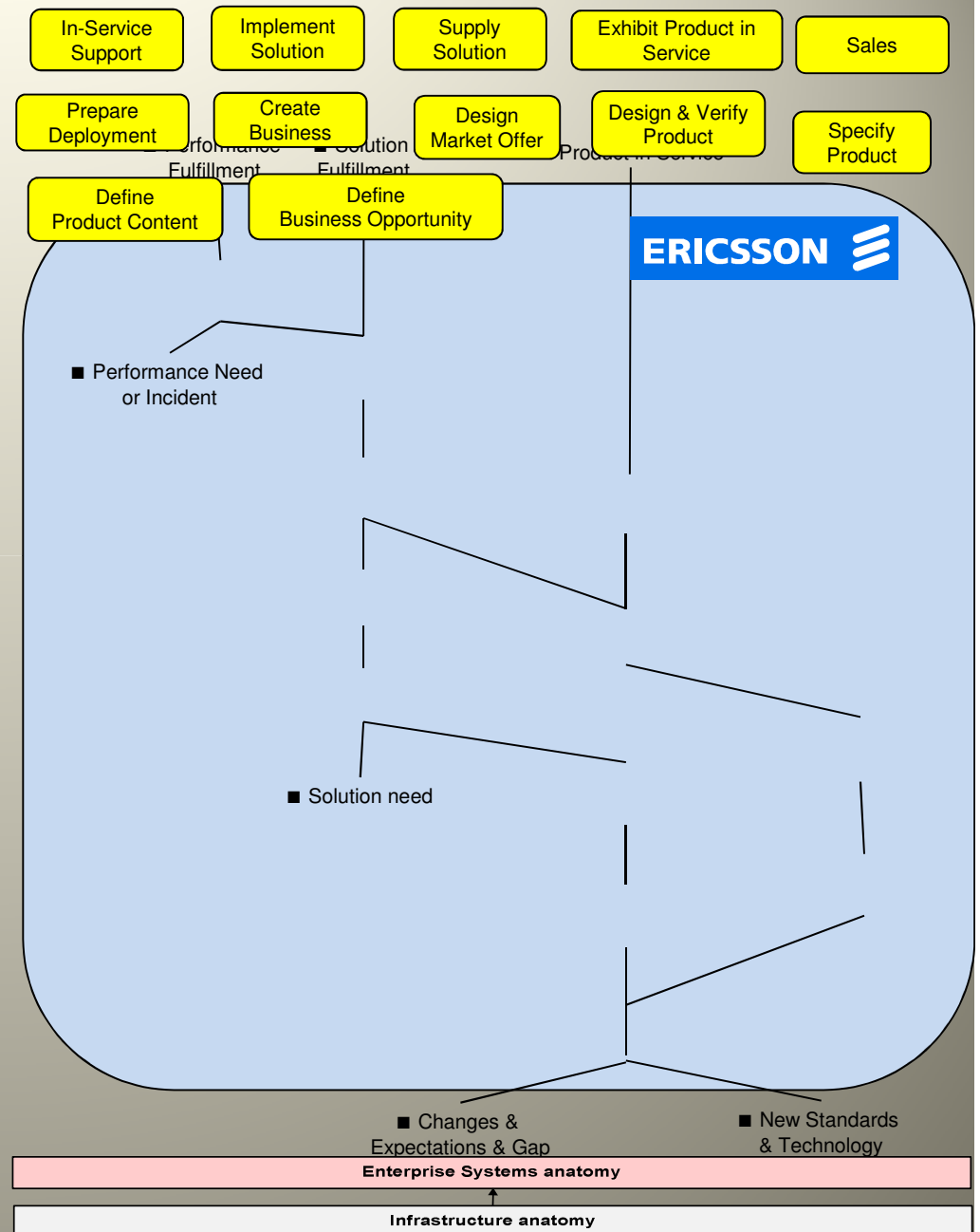
- **Activity Domains**

- Object
- Motive



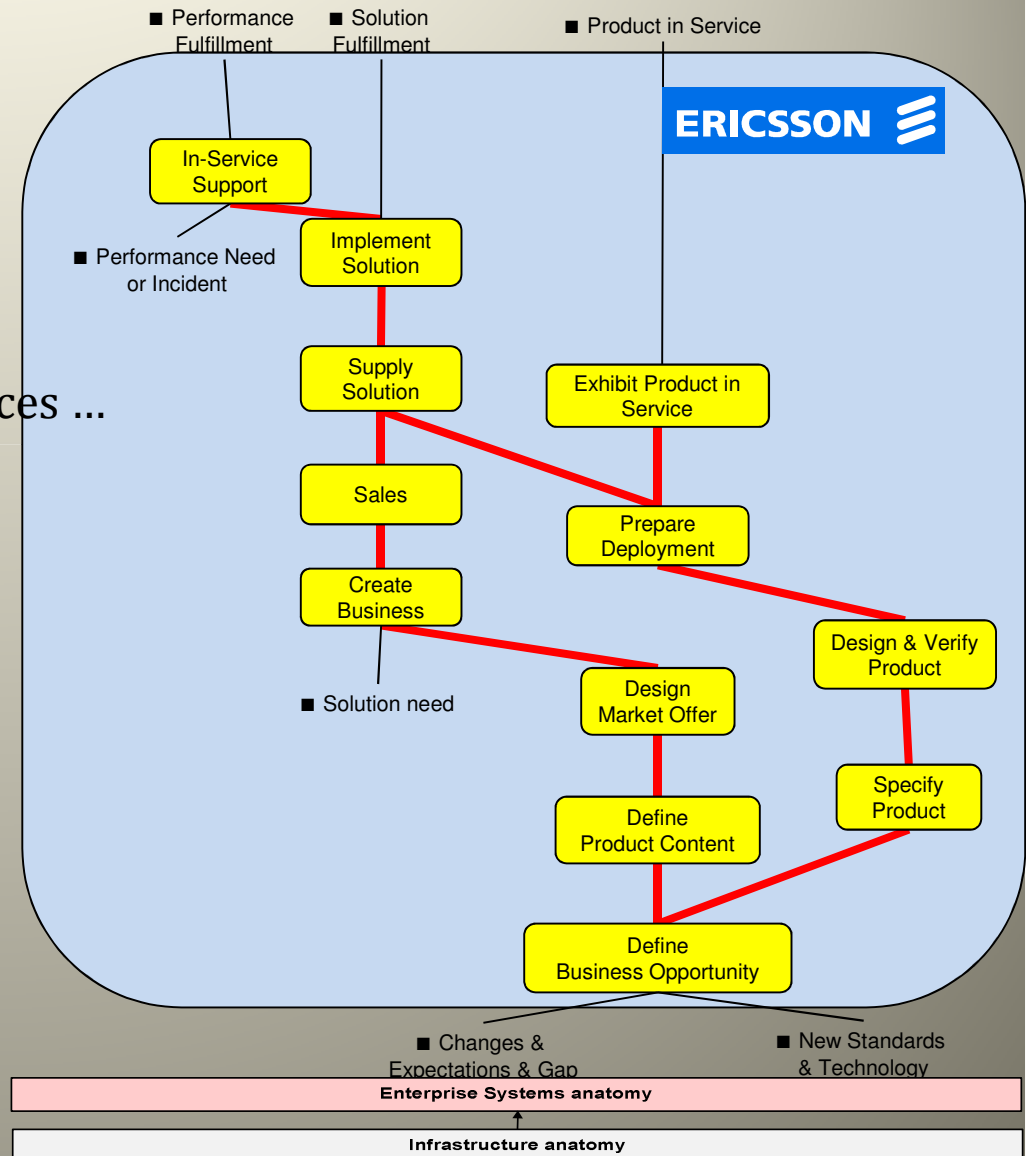
# Enterprise anatomy

- **Activity Domains**
  - Object
  - Motive
- **Dependencies between domains**



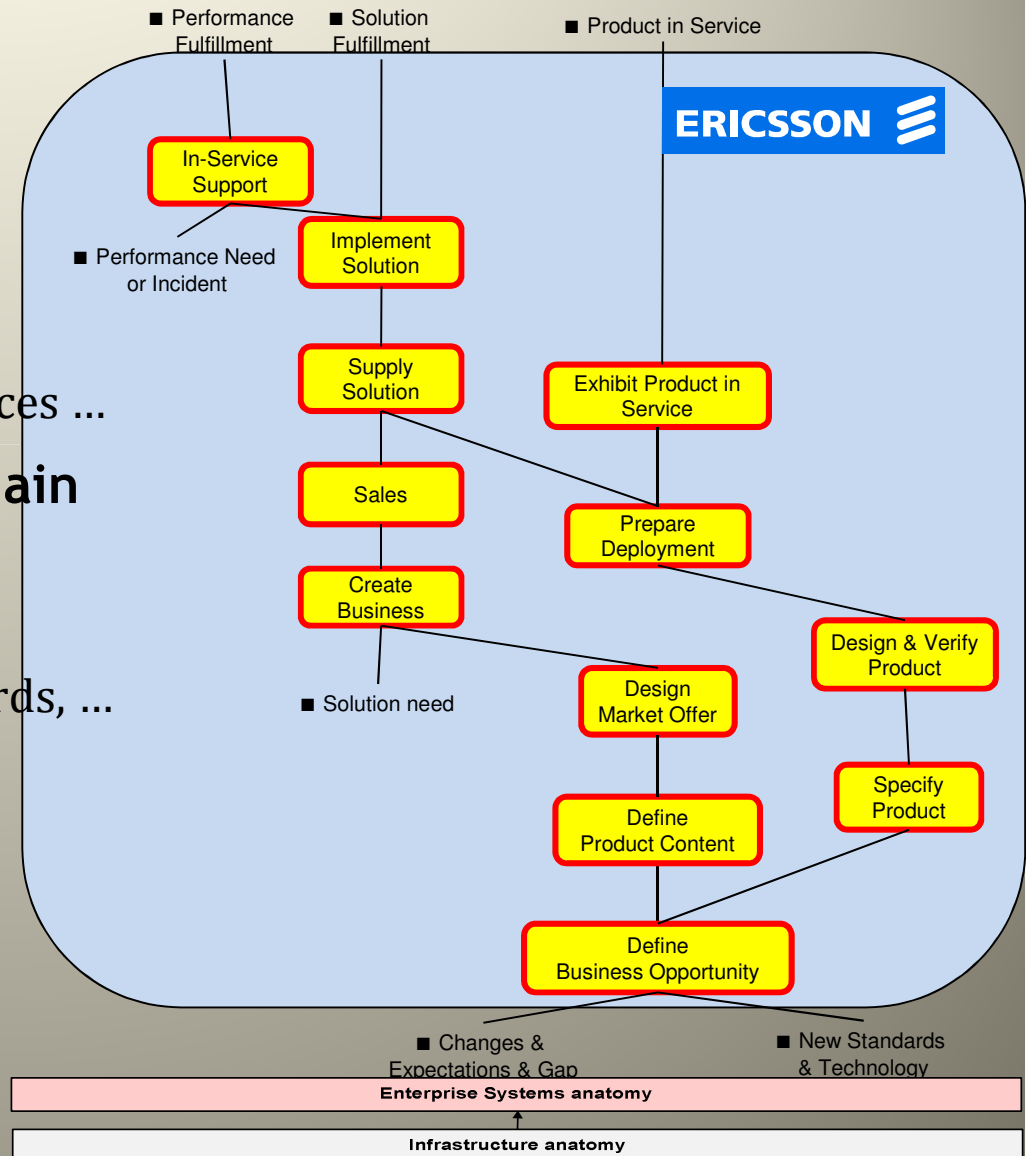
# Enterprise anatomy

- **Activity Domains**
  - Object
  - Motive
- **Dependencies between domains**
- **Transitions between domains**
  - Mapping rules, translations, interfaces ...



# Enterprise anatomy

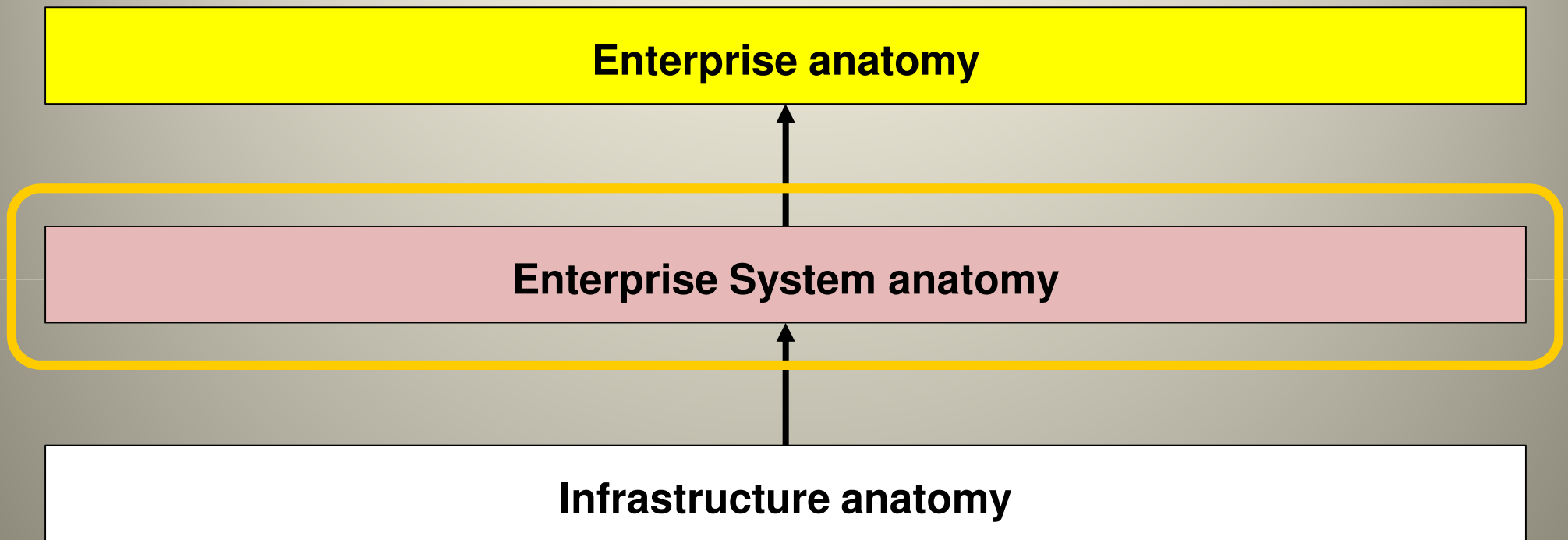
- **Activity Domains**
  - Object
  - Motive
- **Dependencies between domains**
- **Transitions between domains**
  - Mapping rules, translations, interfaces ...
- **Activity modalities for each domain**
  - Data            - Information Model
  - Actions        - Process Models
  - Rules           - business rules, standards, ...
  - Systems        - IS/IT, PLM, ERP, ...



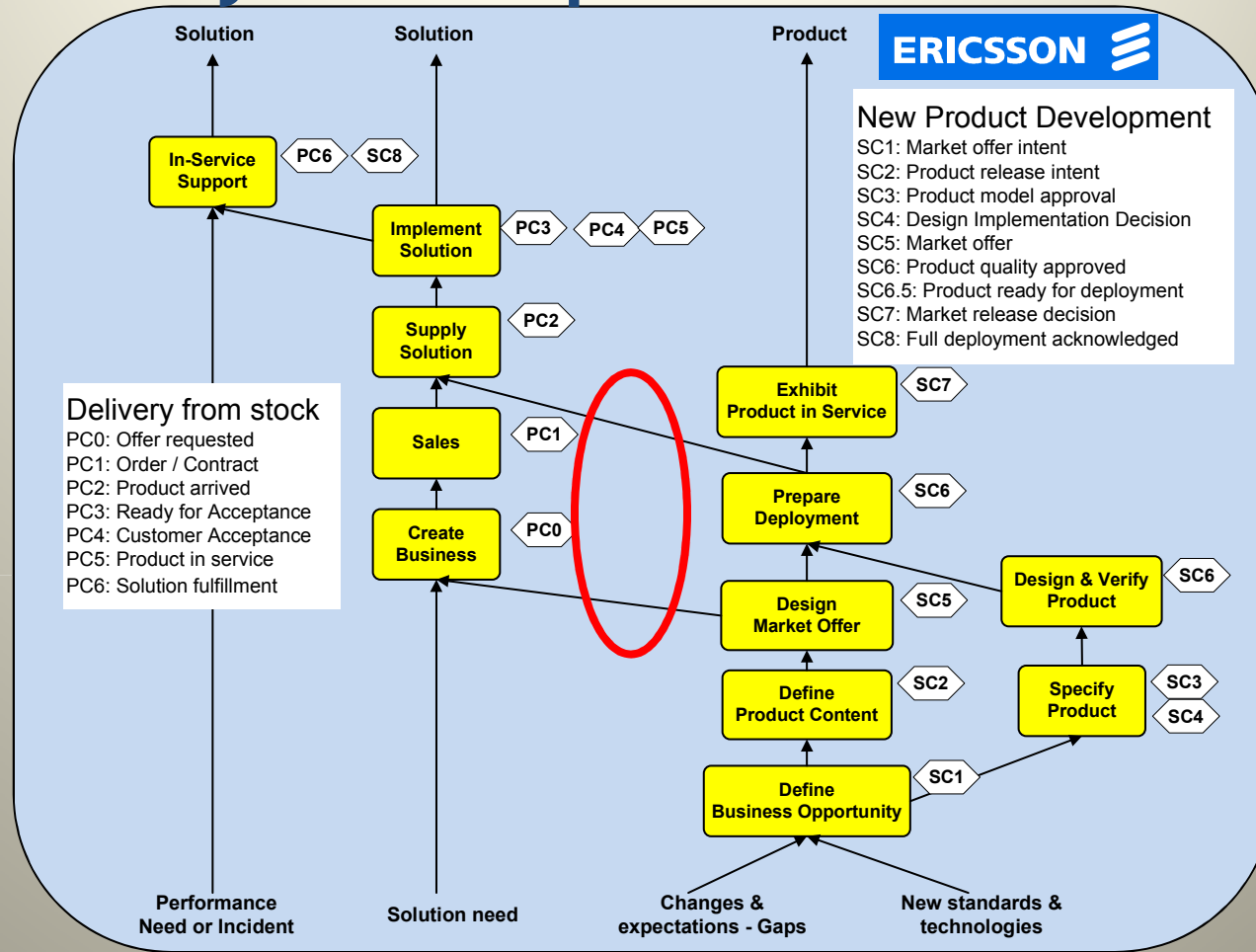
# Enterprise System Implementation



# Uniform modeling - dependencies between capabilities

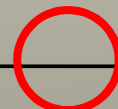
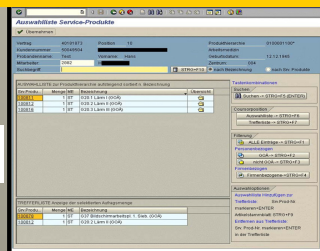


# Enterprise System capabilities

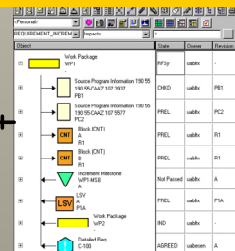


Enterprise Resource Planning

ERP



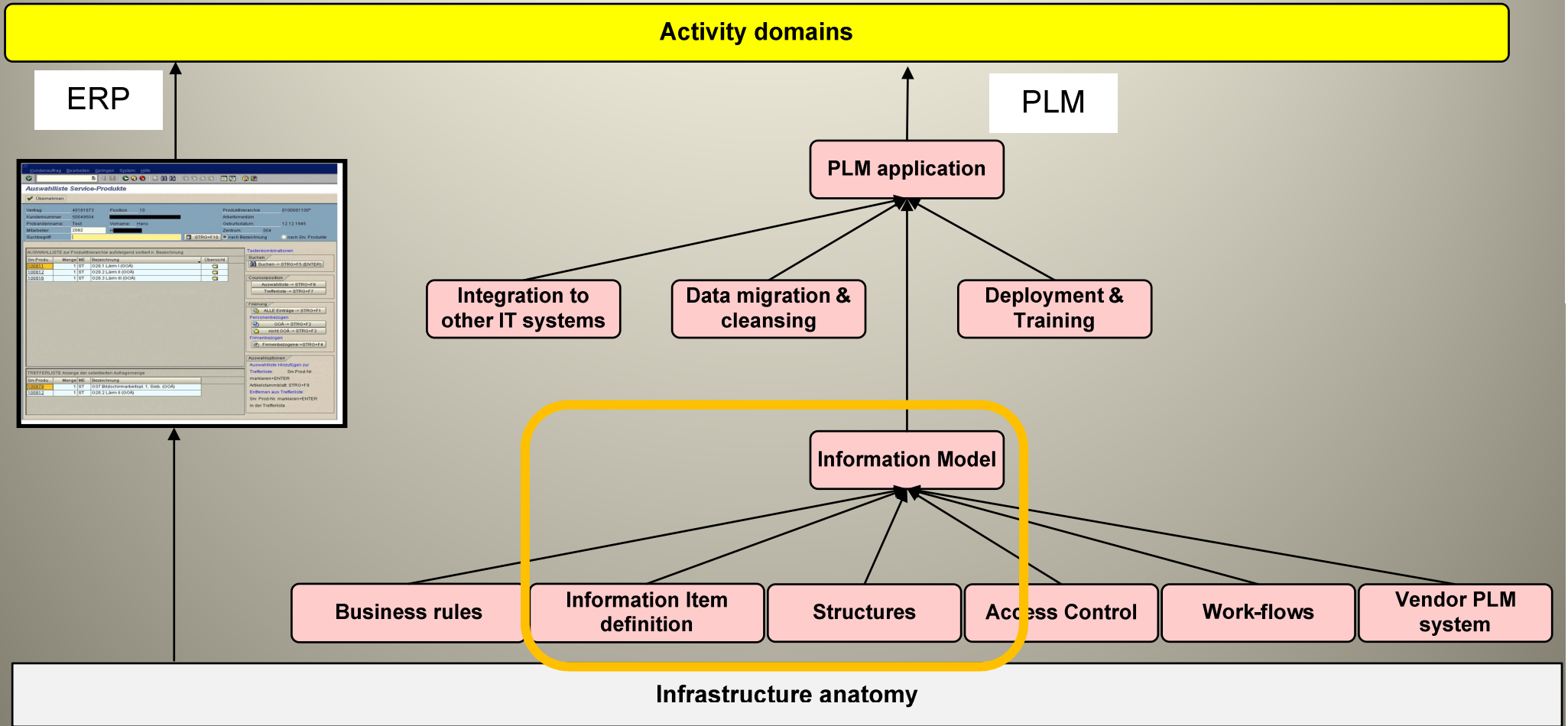
PLM



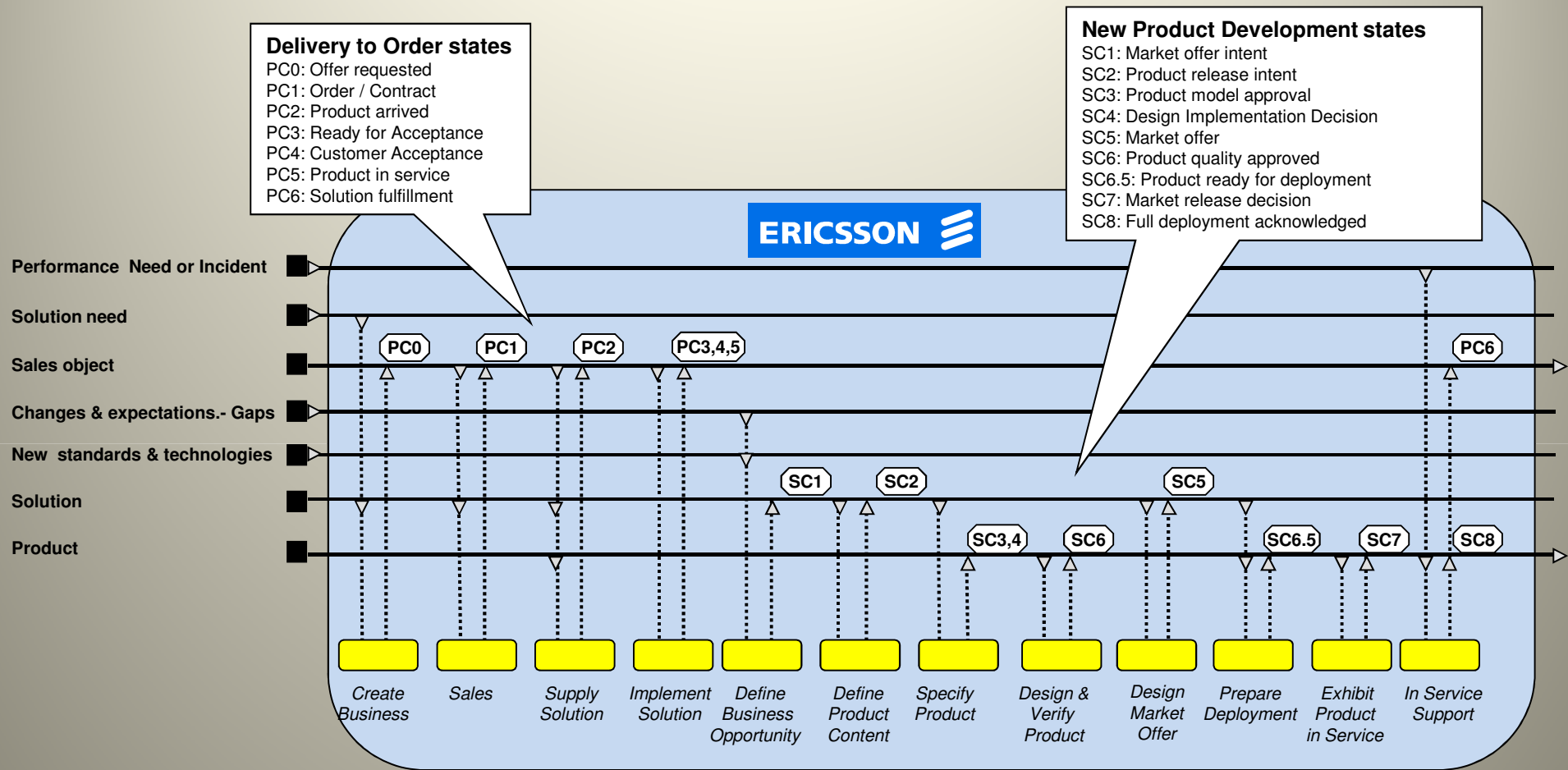
Product Lifecycle Management

Infrastructure anatomy

# The Enterprise Systems anatomy (PLM)

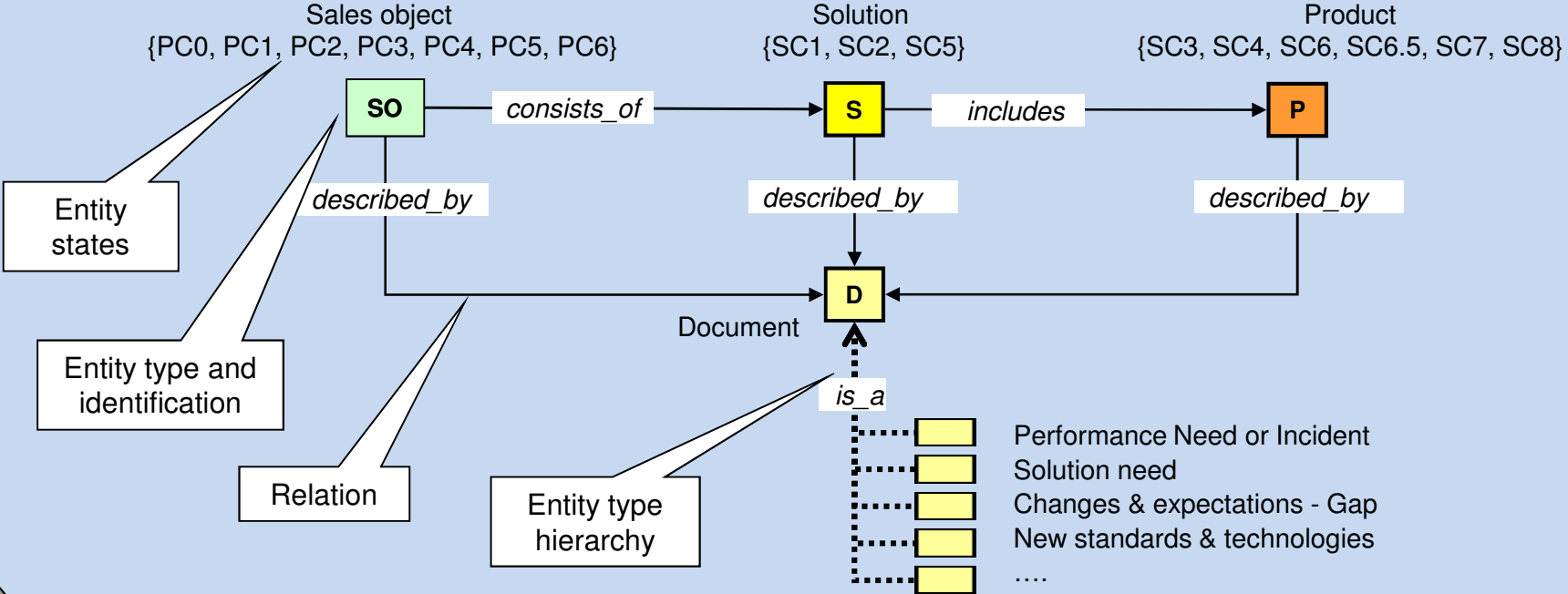


# Dynamic view of information



Temporalization modality in focus

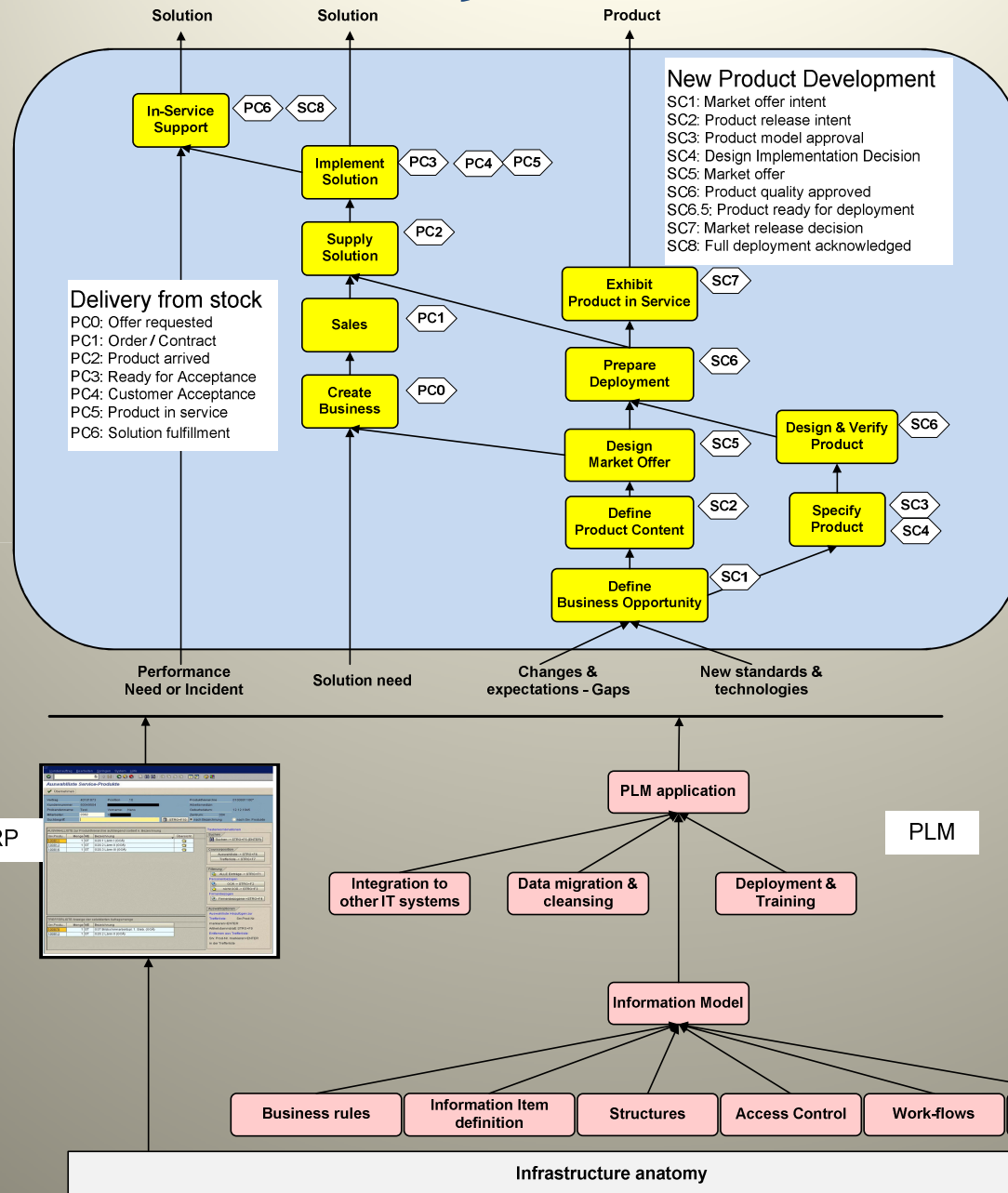
# Static view of information



Spatialization modality in focus

Continue with other modalities

# The overall anatomy



# Why bother?

## Activity Domain



## Activity in a process

- **Constituted by motive and object**
- **Integrative perspective**
  - Knowledge, information models, processes, rules, means, etc., internal to the domain
- **All modalities considered**
- **Transition between domains**
- **Commonality**

- **Temporalization modality focus**
- **One-dimensional view**
- **Interdependencies between modalities may be ignored**
- **Commonality may be ignored**



# The message

- **Business process modeling inadequate**
  - Captures only one dimension of a multi-dimensional complex
- **Our biological prerequisites must be acknowledged**
  - The activity modalities
- **Achieving commonality a foremost issue**
  - Anatomy - simple, yet powerful model
- **EA modeling approaches must be practical**
  - Model organizations and Enterprise Systems from the same perspective
- **The activity domain suggested as an alternative approach**