



TC184/SC5 Ad Hoc meeting
Oct. 30, 2003, Washington DC

PSLX-02

APS Agent models

Yasuyuki Nishioka, Prof. Dr.

Hosei University,

PSLX Consortium

nishioka@k.hosei.ac.jp



Outline

- Define APS by means of clarifying relations and interactions with the relative business components
- Define an appropriate architecture to represent an APS, considering loose connections among autonomous agents
- How to define industrial business function and collaboration by means of specification of agent interfaces

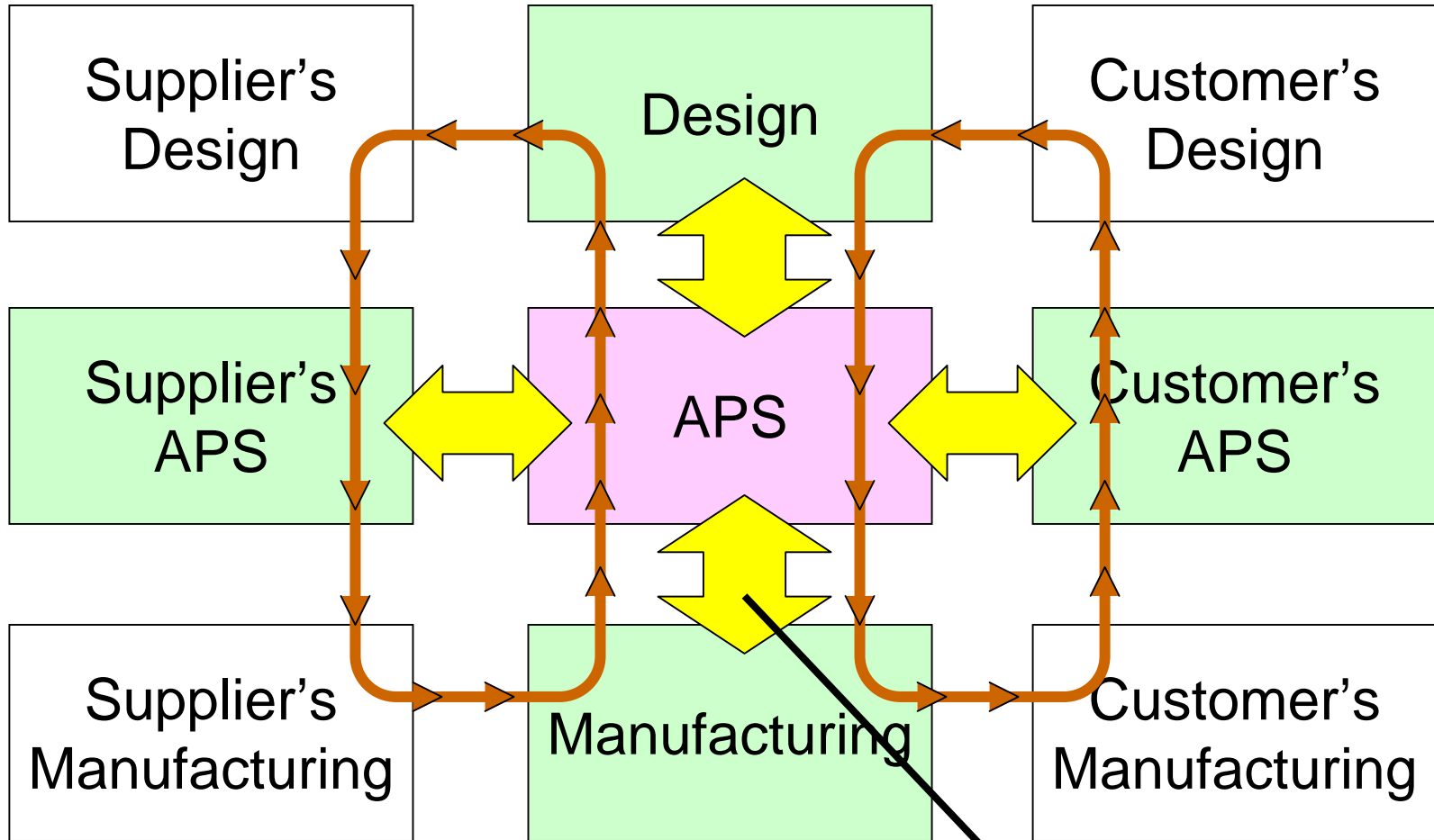


Terms and definitions

- **Planning**
To find suitable goals and operations to fulfill the gap between desires and facts, by clarifying their well-formed structures and parameters
- **Scheduling**
To clarify relationship among production items and manufacturing resources in the time horizon, considering various constraints and objectives
- **APS (Advanced Planning and Scheduling)**
a system architecture of planning and scheduling integration to dynamically and synchronously achieve the goal of each manufacturing enterprise



Definition of APS



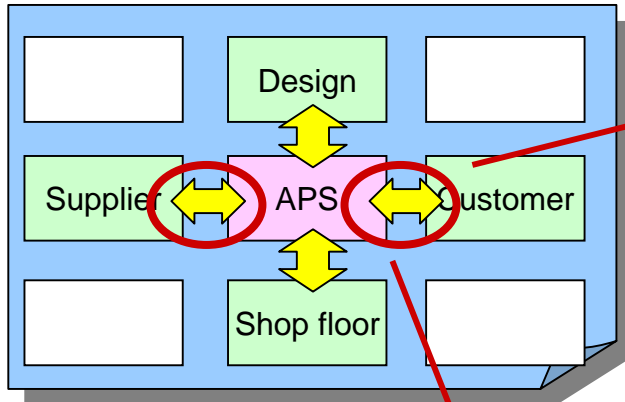
Relations / interactions



Requirements to APS

- Coordination and synchronization of various activities of different business components by planning and scheduling
- Capability of continuous improvement as an autonomous system according to the changing business environment
- Responsibility to produce additional value of a supply chain by communicating not only an order but also other production data

Relations to customer



- Estimation information (customer \leq APS)
- Unofficial information (customer $= >$ APS)
- Order information (customer $= >$ APS)
- Option data (customer $= >$ APS)
- Duetime information (customer \leq APS)
- Complaint (customer $= >$ APS)
- Shipping notification (customer \leq APS)
- Receipt notification (customer $= >$ APS)
- Product information (customer \leq APS)
- Inventory information (customer \leq APS)
- Plan information (customer \leq APS)
- Booking-type production (customer \leq APS)
- Inventory information (customer $= >$ APS)
- Plan information (customer $= >$ APS)
- Demand information (customer $= >$ APS)



Use cases for Customers

- Answer the information, such as a sum of money, the due time, and the quantity of products, to the estimation request.
- Accept an order and answer the information about acceptance, reservation and rejection
- Answer or promise the due time to the inquiry about due time
- Accept the order of which options are not decided yet.
- Send the shipping notification when shipping products, if necessary
- Handle the inquiry about the plan or inventory information
- Show the booking-type production and execute reservation and so on

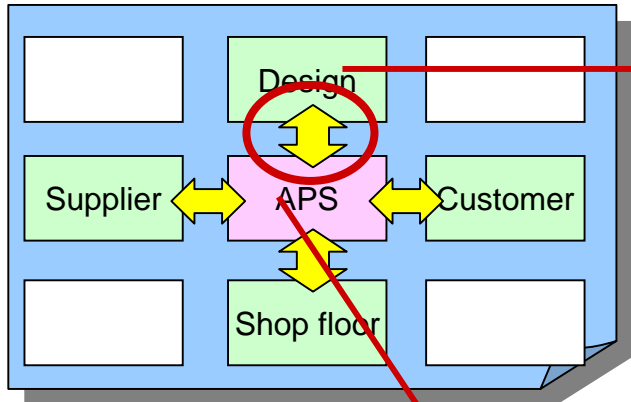


Use cases for Suppliers

- Send the unofficial information regularly
- Send the answer, such as acceptance, reservation and rejection, to an order.
- Receive the shipping notification, and prepare for receiving and accepting products.
- Receive the production information to be irregularly sent
- Receive the plan information to be sent regularly or irregularly
- Open the plan, demand, and inventory information or deal with the inquiry



Relation to Designer



- Manufacturing method (design = > APS)
- Production facility information (design = > APS)
- Manufacturing person hour (design = > APS)
- Design information (design = > APS)
- Quality information (design < = APS)
- Manufacturing BOM information (design < = APS)
- Individual product request (design < = APS)
- Individual product option (design = > APS)

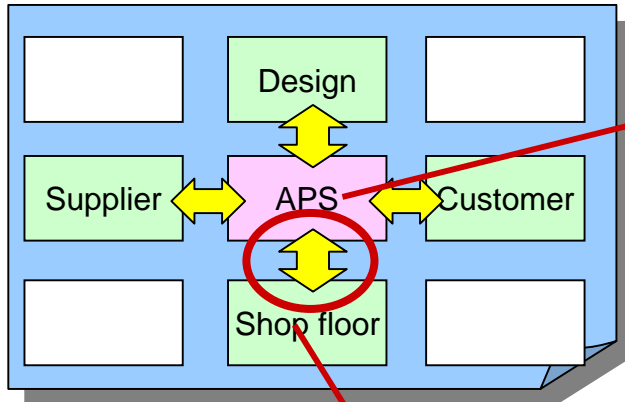


Use cases for Designers

- Receive the manufacturing method (including the changed information) to be sent irregularly
- Receive the production facility information (including the changed information) to be sent irregularly
- Receive the manufacturing person hour (including the changed information) to be sent irregularly.
- Receive the design information (including the changed information) to be sent irregularly.
- Handle the inquiry about the quality information.
- Handle the inquiry about the contents of manufacturing BOM information.



Relation to Shop floor



- Production progress (manufacturing = > APS)
- Completion progress (manufacturing = > APS)
- Operation progress (manufacturing = > APS)
- Inspection progress (manufacturing = > APS)
- Facility abnormality (manufacturing = > APS)
- Quality abnormality (manufacturing = > APS)
- Progress abnormality (manufacturing = > APS)
- Manufacturing schedule (manufacturing < = APS)
- Shipping schedule (manufacturing < = APS)
- Issue schedule (manufacturing < = APS)
- Maintenance schedule (manufacturing < = APS)
- Maintenance request (manufacturing = > APS)
- Process specification (manufacturing < = APS)



Use cases for Shop floor

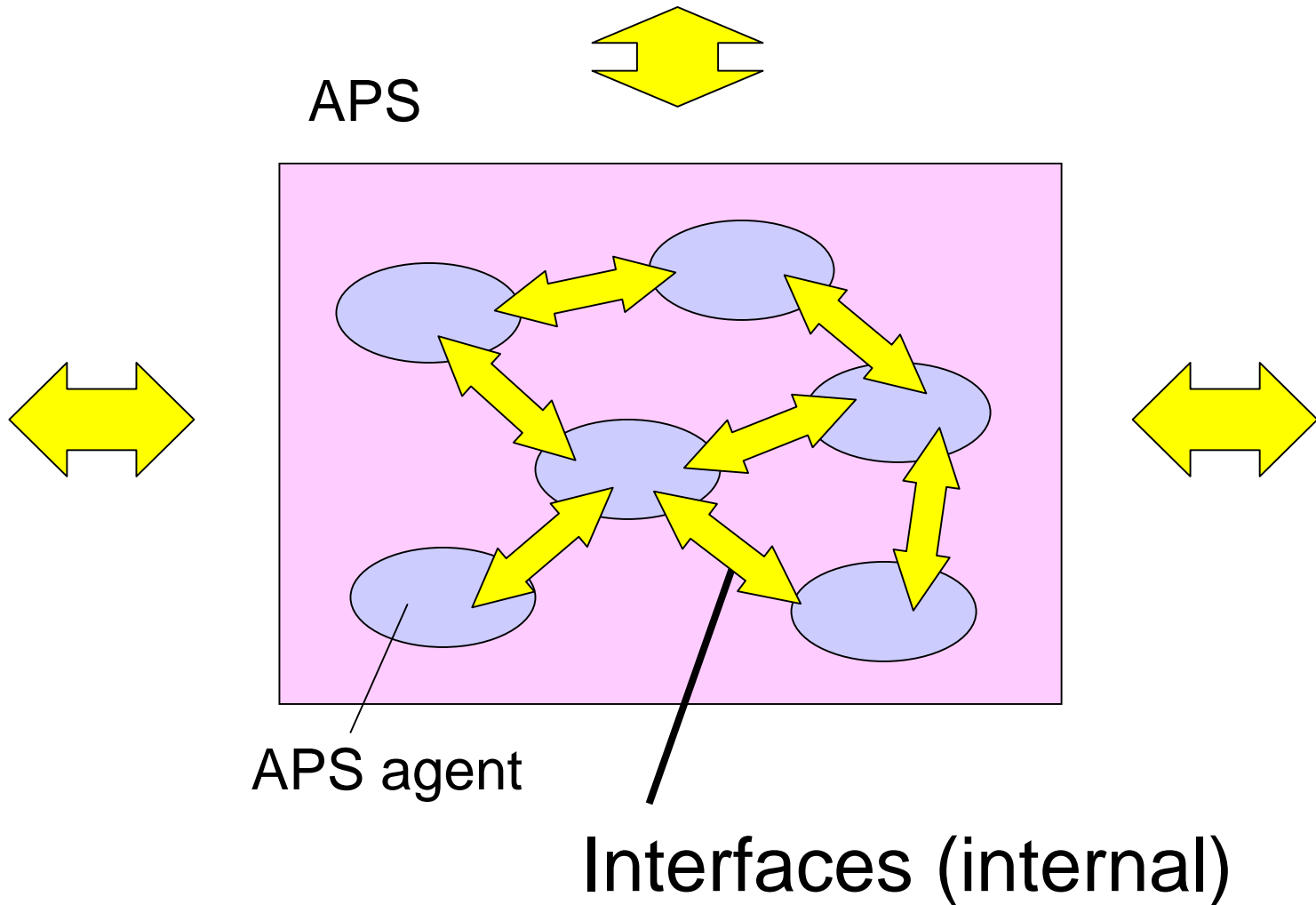
- Accept the production progress, completion progress, operation progress, and inspection progress.
- Accept the facility abnormality, progress abnormality, progress abnormality, and take the necessary measures.
- Send the manufacturing schedule.
- Send the shipping schedule
- Send the issue schedule
- Send the maintenance schedule
- Accept the maintenance request and reflect it on the schedule
- Send the process specification information



Outline

- Define APS by means of clarifying relations and interactions with the relative business components
- Define an appropriate architecture to represent an APS, considering loose connections among autonomous agents
- How to define industrial business function and collaboration by means of specification of agent interfaces

Internal interfaces



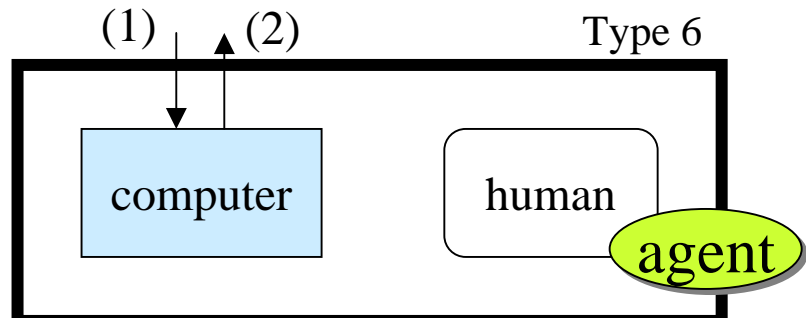
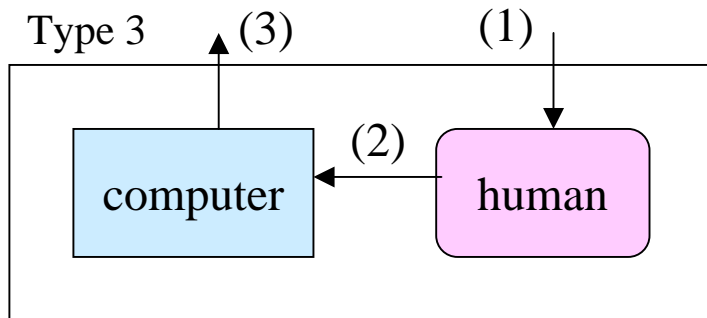
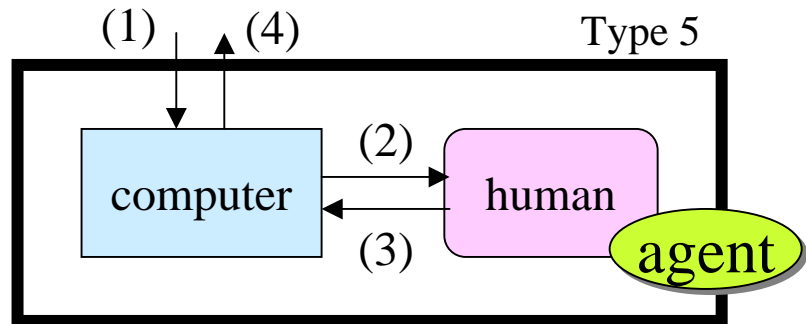
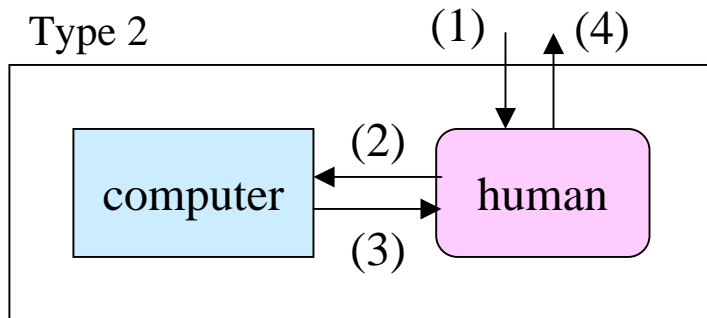
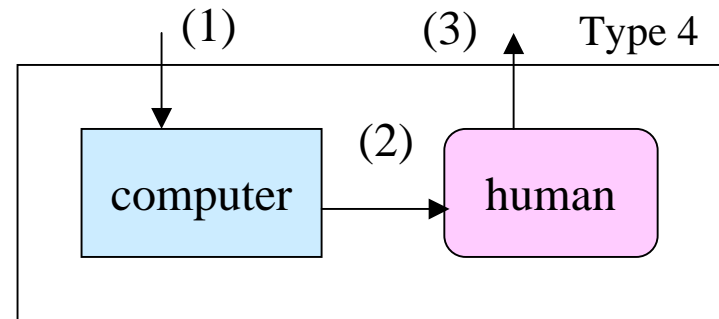
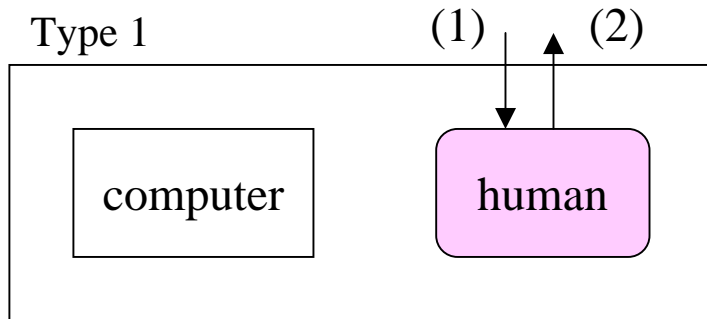


What is an Agent in PSLX?

- An autonomous sub-system that consists of humans and computers to produce some values for the total objectives of the system.
- An agent should have computers that can react to requests defined in the interface specifications.
- Those who request a work to an agent should not be care the inside processes of the agent.
- An agent can communicate with others using common ontologies and common business protocols.



Agents v.s. other subsystems





What is APS agent?

- APS agents should need or provide information in accordance with planning and/or scheduling
- APS agents should have interfaces defined using PSLX ontologies in its name and functional description
- APS agents should use PSLX ontologies in the messages used in the defined interface



Detect APS agents in manufacturers



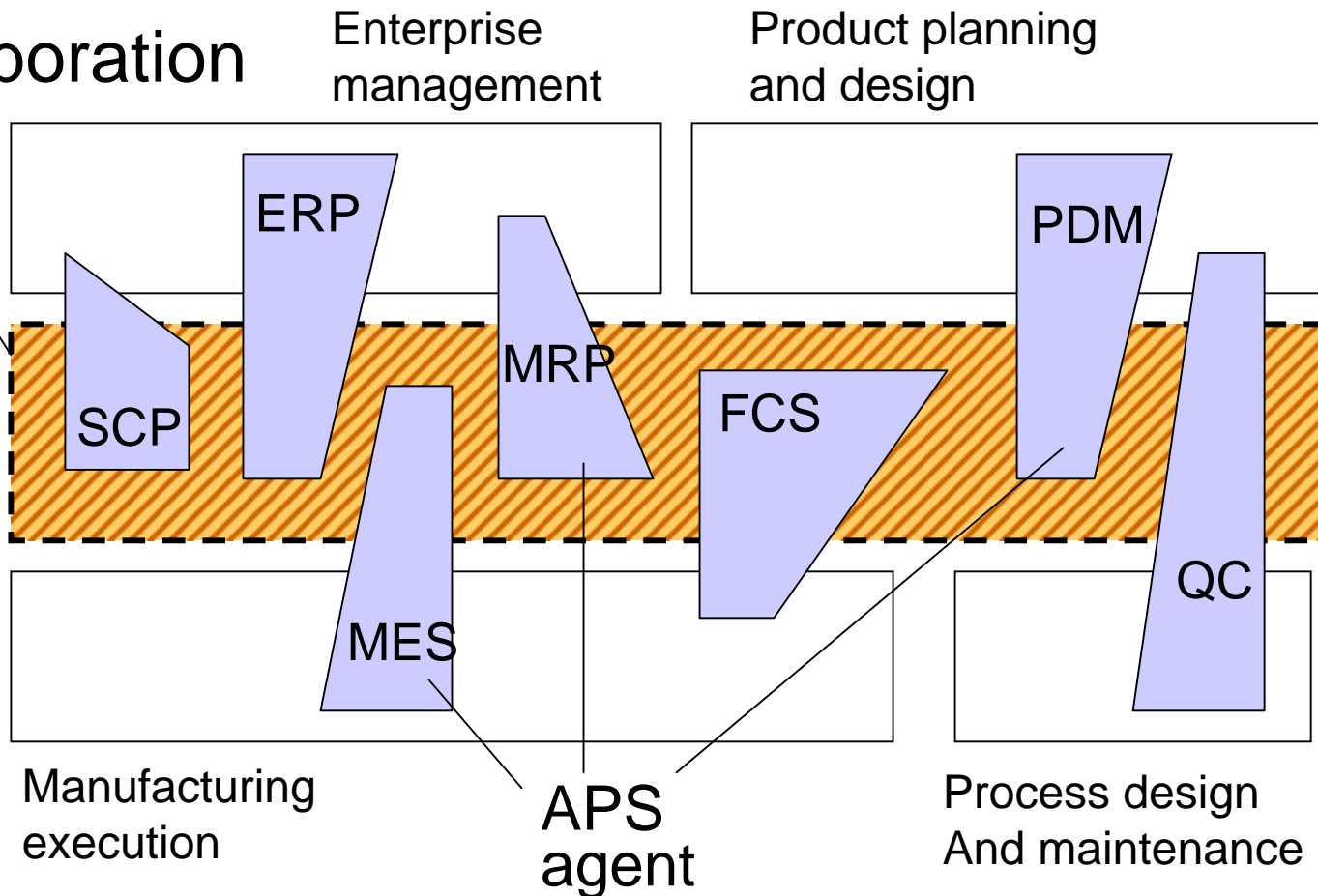
- Strategic agent
- Scheduling agent
- Planning agent
- Product design agent
- Process design agent
- Purchasing agent
- Sales agent
- Accounting agent
- SCM agent
- Transportation agent
- Capacity ctrl agent
- Inventory ctrl agent
- MES agent
- Maintenance agent
- BOM agent
- Option ctrl agent
- Pegging ctrl agent
- Federation mgmt agent



All APS agents has relation to planning or scheduling

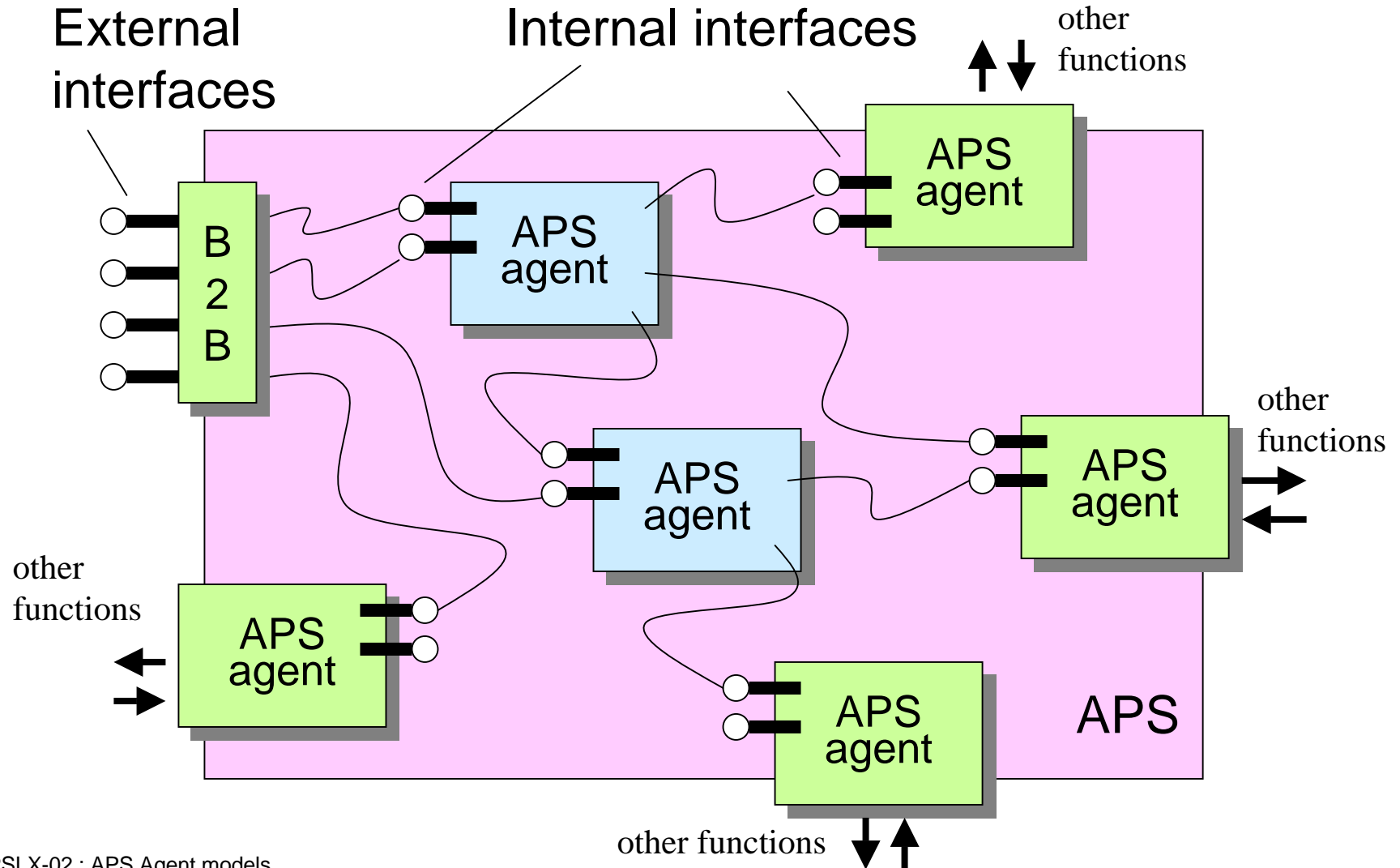


APS
collaboration
area

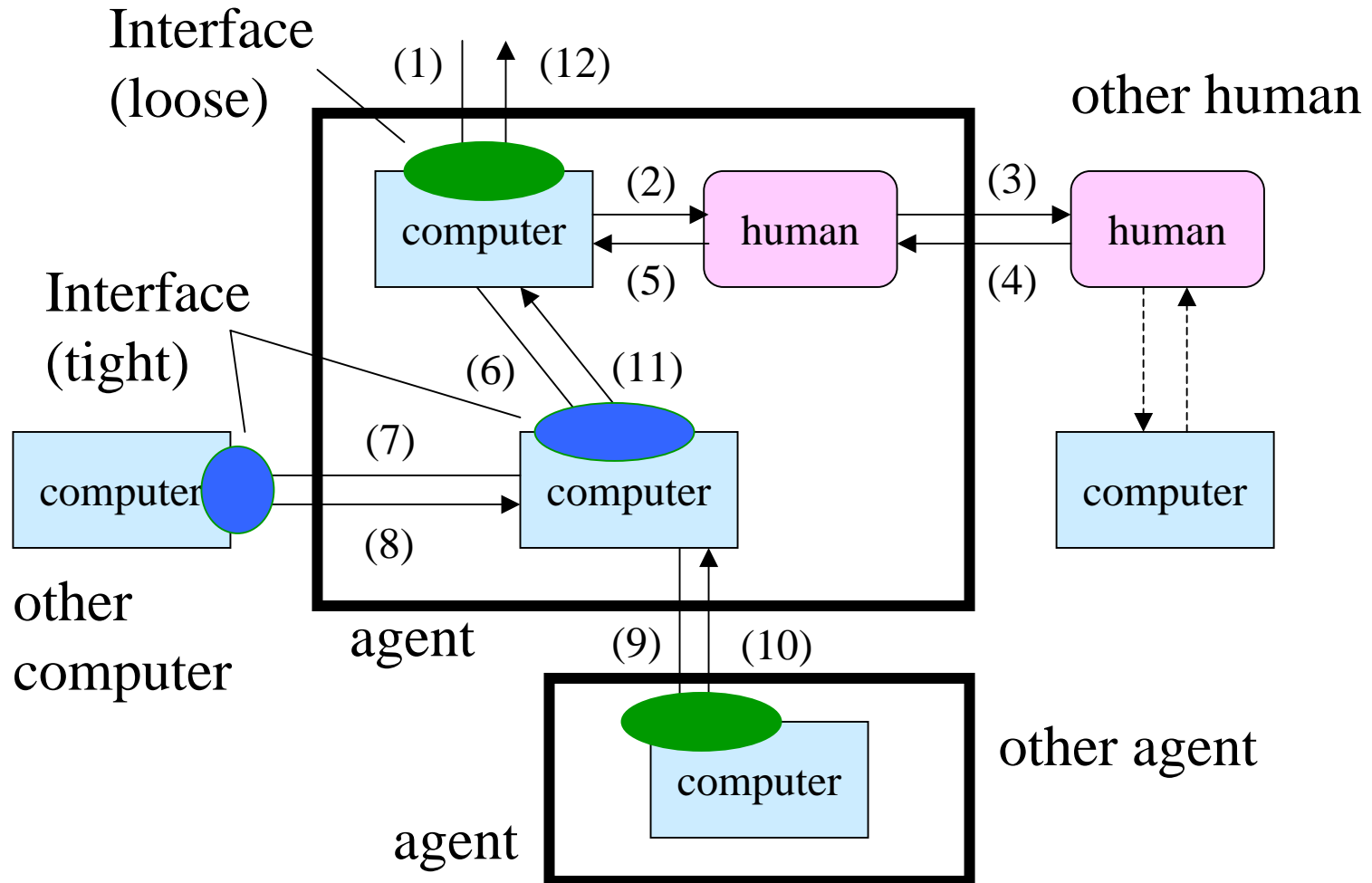




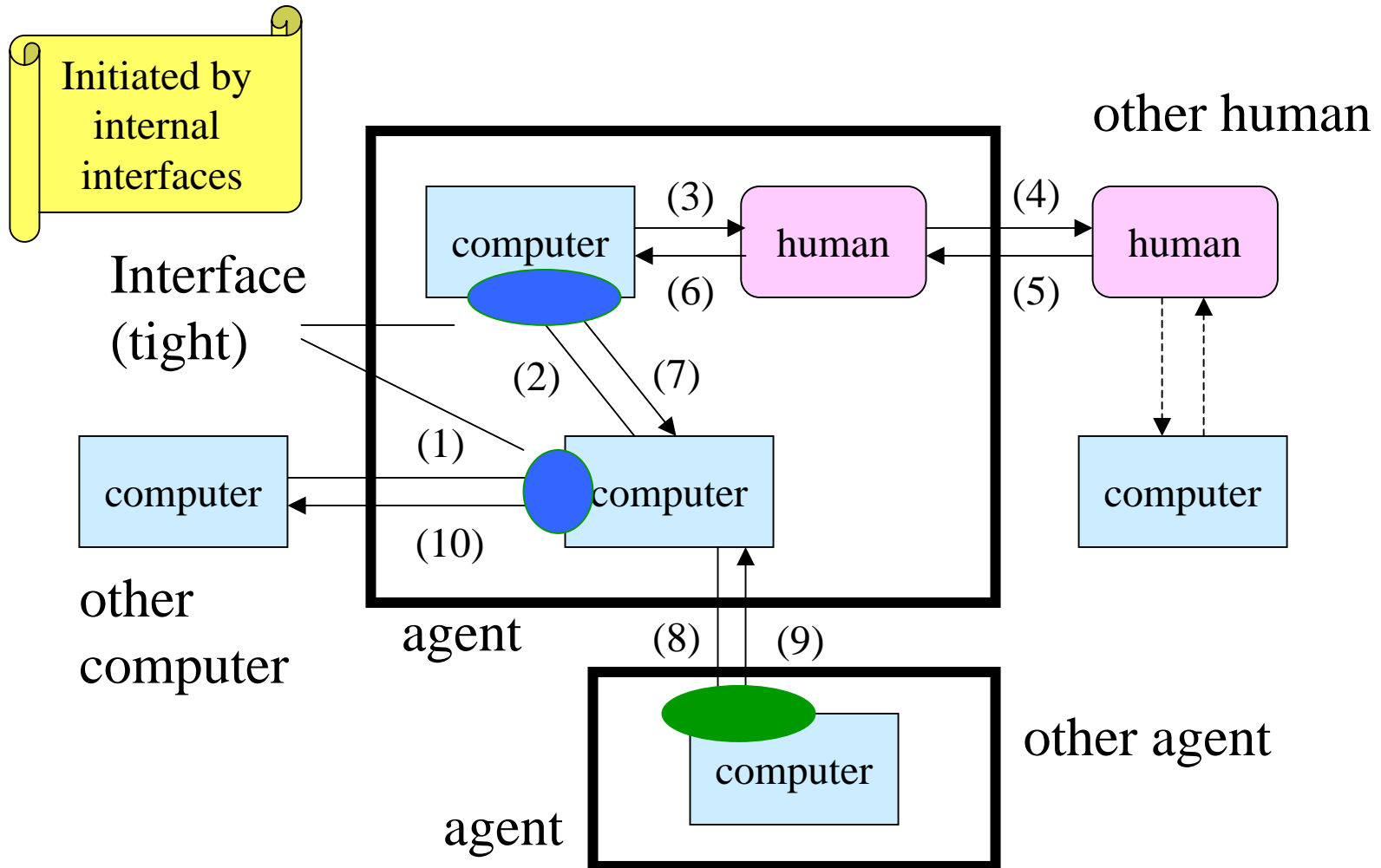
APS agent model architecture



Inside of an agent (1)



Inside of an agent (2)





Outline

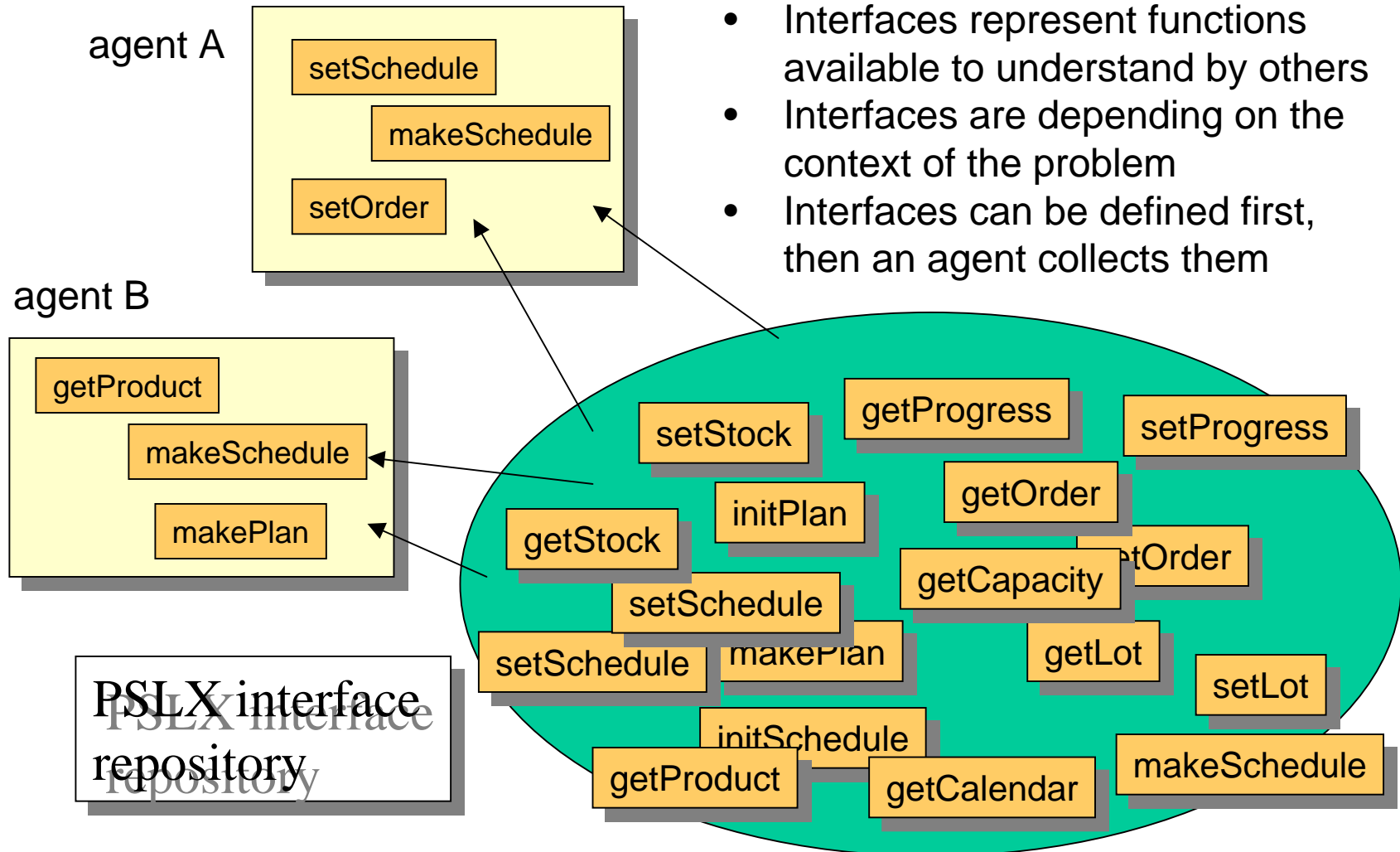
- Define APS by means of clarifying relations and interactions with the relative business components
- Define an appropriate architecture to represent an APS, considering loose connections among autonomous agents
- How to define industrial business function and collaboration by means of specification of agent interfaces



How to make an agent

- Choose interfaces from a PSLX interface repository that has candidates of interface names and corresponding message schemas
- Define an unique name for the agent and describe functionality of each interface in the context of the agent using formal description language
- Define each schema of the message used for communication through the interface
- Publish the information of agent name, interface name, message schema, and corresponding business functions

Interface repository



- Interfaces represent functions available to understand by others
- Interfaces are depending on the context of the problem
- Interfaces can be defined first, then an agent collects them



Describe function of interface

- Interface name
- Actor
- Objectives
- Pre conditions
- Post conditions
- Procedure
- Alternative procedure
- Descriptions



PSLX Interfaces (example)

Interface name	Interface name	Interface name
initSchedule	setOrder	setCapacity
makeSchedule	getOrder	getCapacity
setSchedule	setOption	setLot
getSchedule	getOption	getLot
setParty	setProgress	setTask
getParty	getProgress	getTask
setProduct	setStock	
getProduct	getStock	
setProcess	setLoad	
getProcess	getLoad	

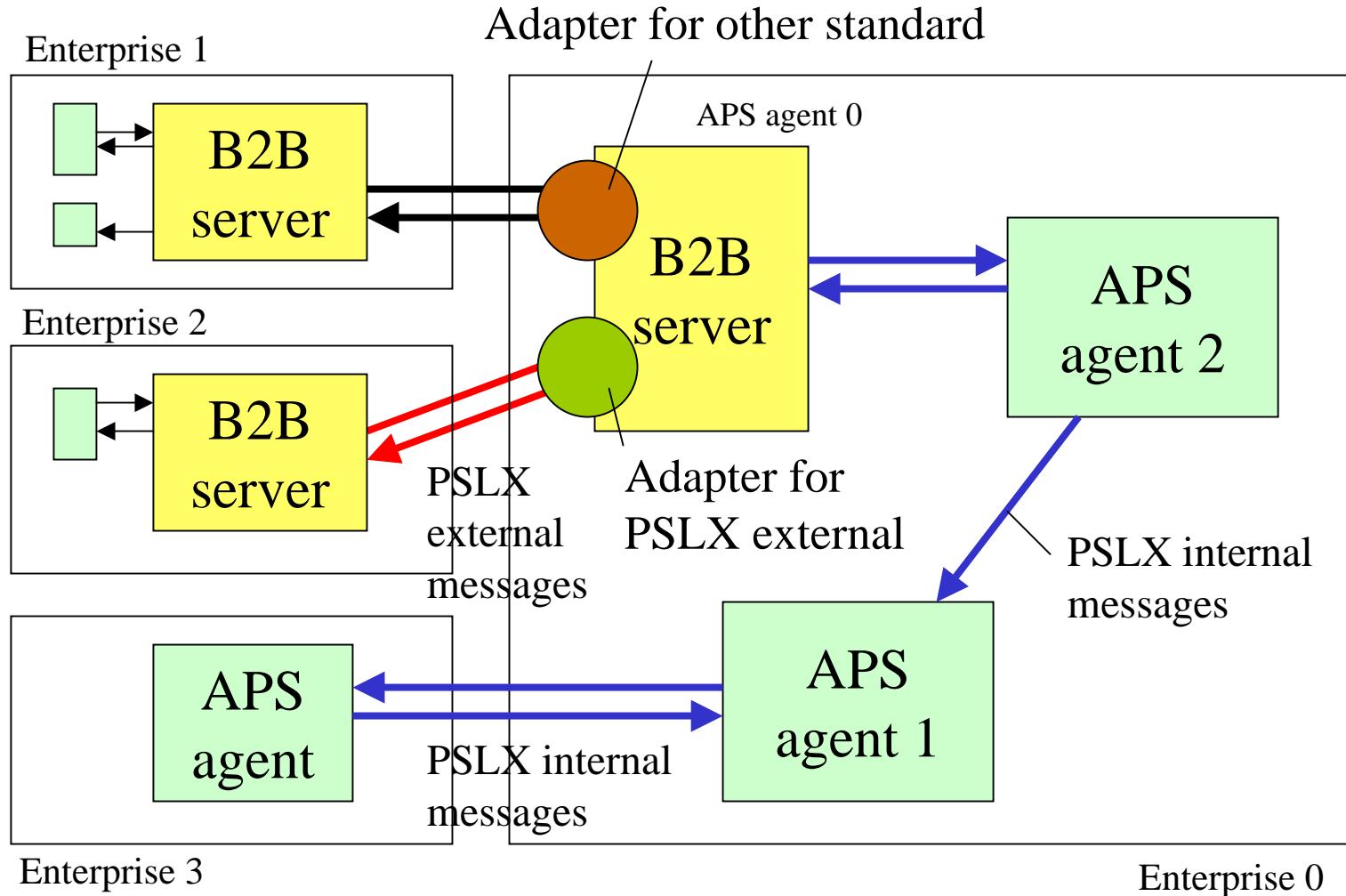


Using other interface

- External interface (B2B)
 - Business to Business environment requires secure and precise communication. This has a lot of redundant processes
 - RosettaNet PIP, OAGI BOD, OASIS UBL...
- Tight connection interface
 - Permanent and tight integrated system needs more efficient and flexible interface. Reconfiguration is much difficult.
 - COLBA, DCOM...



Adapter for B2B





PSLX externals

- Extensions of PSLX internal interfaces for B2B environment
- Security, accounting, and legal issues are additionally considered
- Collaboration protocol agreement (CPA) is required between partners in advance
- PSLX only deals with message specifications. Collaboration protocol and messaging services are from other standard



External interface

Interface name	Customer	Supplier
setPlan	0	0
getPlan	0	0
setSchedule	0	0
getSchedule	0	0
setProduct		0
getProduct	0	0
setProcess		0
getProcess	0	0
setOrder	0	
getOrder		0



External interface (cont'd)

Interface name	Customer	Supplier
setEstimation		0
getEstimation	0	
setProgress	0	0
getProgress	0	0
setStock	0	0
getStock	0	0
setLoad		0
getLoad	0	
setCapacity		0
getCapacity	0	



Thank you

<http://www.pslx.org>