Setting the Standard for Automation™

District 12
& Qatar Section

ISA-95/B2MML Tutorial: Integration practice from use cases to xml messages

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Standards
Certification
Education & Training
Publishing
Conferences & Exhibits

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Introduction

- This tutorial will first present successively:
  - A practical example of a fictitious industrial company to grasp basics of modeling patterns and interoperability realm of ISA-95 as well as B2MML messages content
  - A methodology for specifying information flows
  - The models from the recently updated ISA-95 part 2 and 4.
  - The standard information services defined in ISA-95 part 5
  - The structure of the XML messages based on B2MML

Introduction

- Objective :
  - A quick overview of interoperability related ISA-95 parts
  - be prepared to address integration between different manufacturing applications (ERP, control systems, MES, FCS, LIMS, CMMS…) in a consistent, efficient and documented manner.
- Participants
  - Industrial IT managers
  - Project managers for integration
  - Functional analysts involved in cross systems (i.e.ERP, MES, SCADA) business processes

Agenda

- Example
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

Objectives

- This section exemplifies ISA-95 usage for
  - describing manufacturing facilities and operations
  - Exchanging related information
- The different aspects of a fancy company and product serve as a basis for illustrating
  - Product industrialization
  - Involved facilities
  - Production planning
  - Production reporting
- It makes use of simplified ISA95 UML models and B2MML textual representation

Agenda

- Example
  - Product structure and Manufacturing strategy
  - Resources & Capability
  - Operations Schedule
  - Operations Performance
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

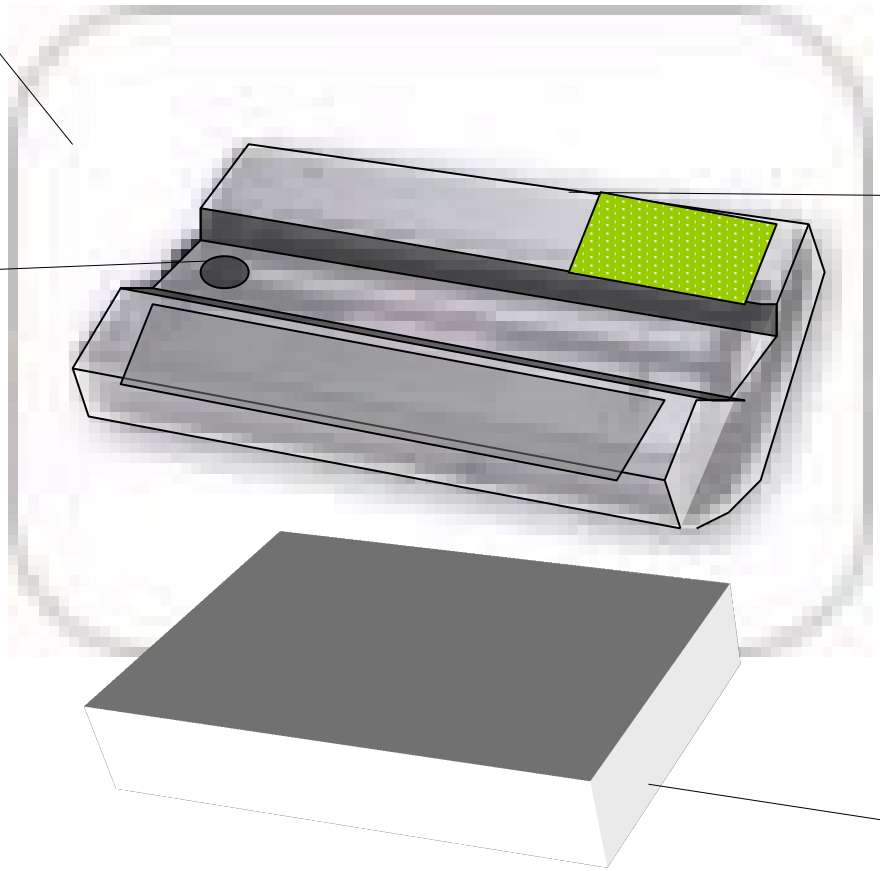
Products and Production organisation

- Understanding of product structure
  - Manufacturing stages
  - Their relationships
- Outline the manufacturing strategy
  - In-house manufacturing, mono/multi process cells- Sites
  - Synchronized contract manufacturing
  - Purchasing
- Introduce Production definition, product segment

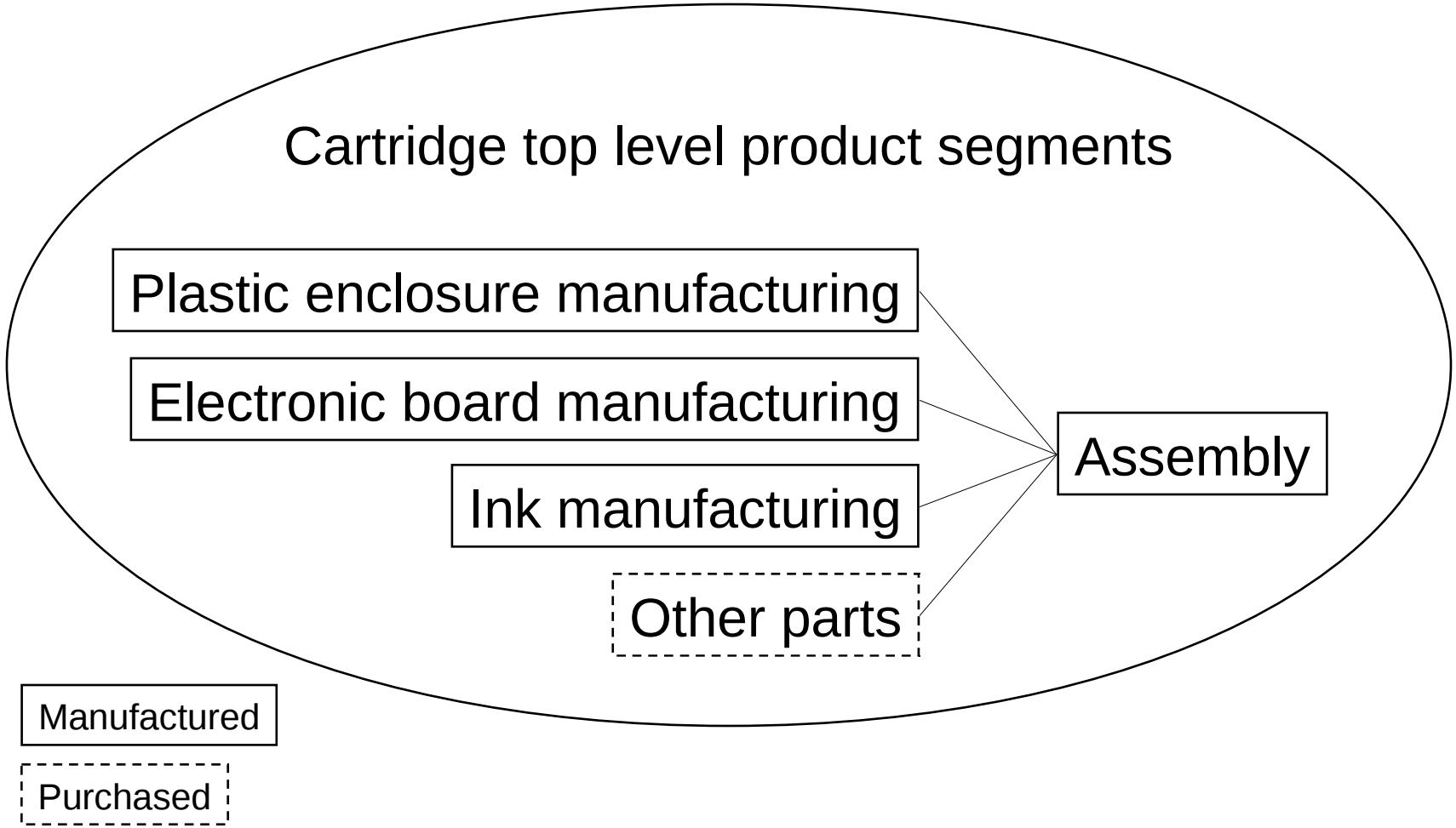
Product

- SuperToner – The world's first wireless Internet enabled laser printer cartridges
- Products are available for a selection of printers HP, Epson, Brother and Canon
- Manufactured in 3 plants located in USA
- The process includes the following stages:
  - Plastic molding
  - Electronic board assembly for wireless connexion
  - Printing ink manufacturing
  - Assembly, filling and test
  - Customizable packaging

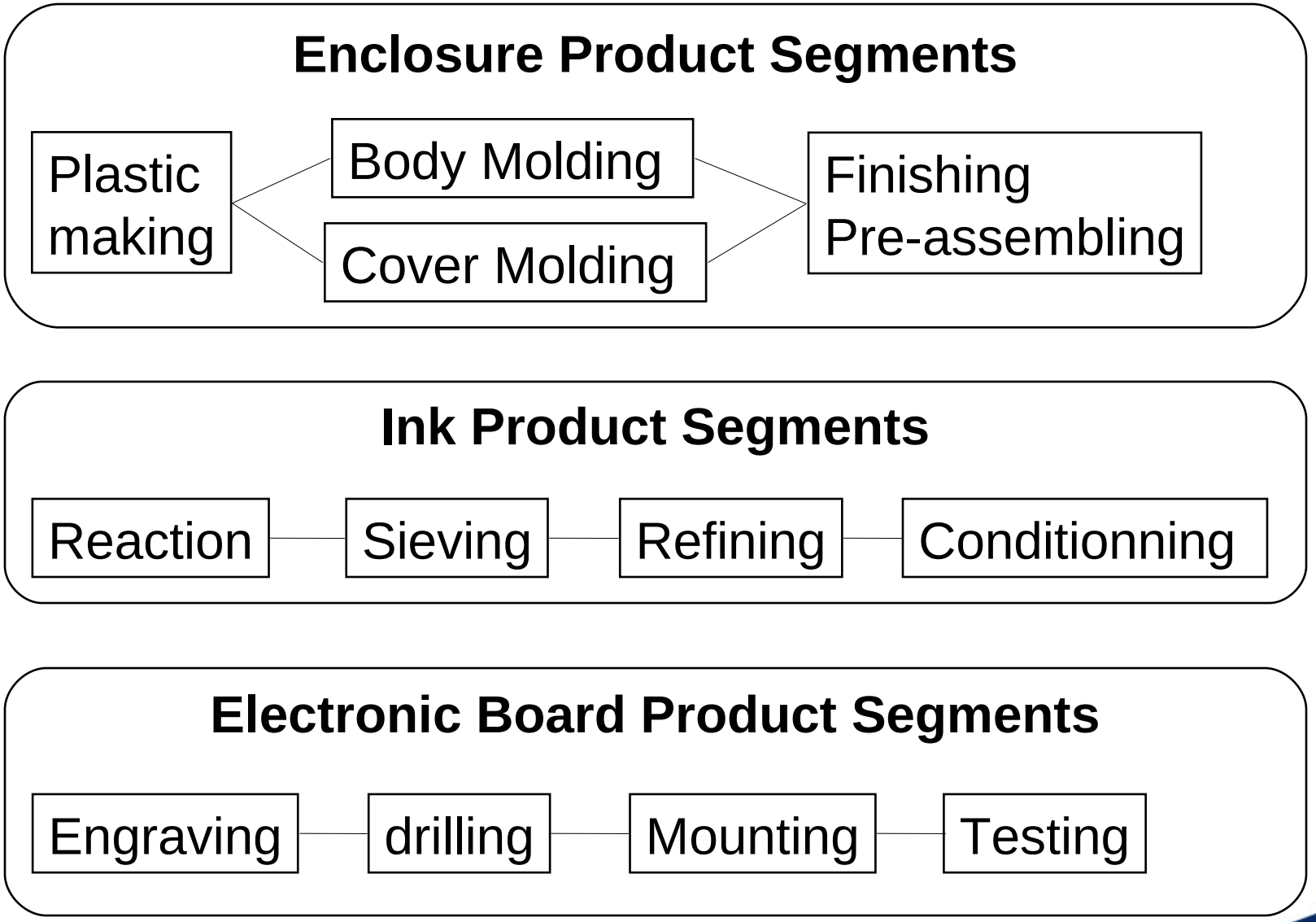
Bill Of Material - Top Level Items



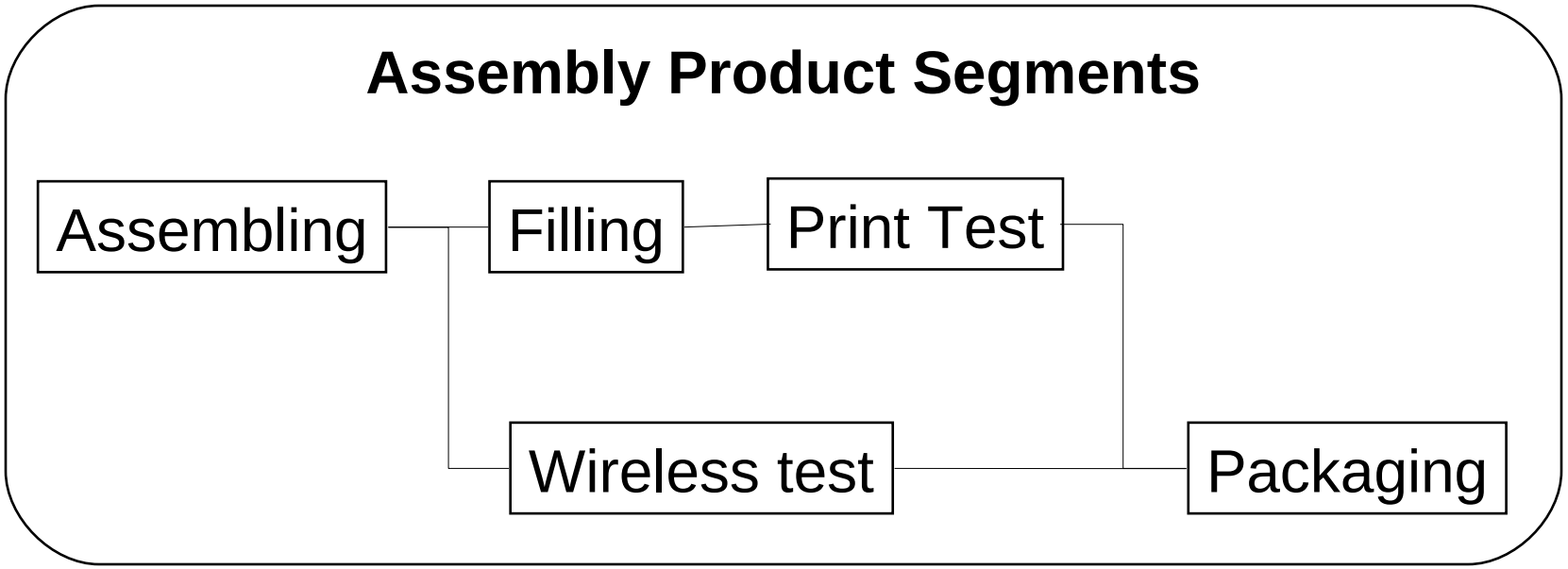
General product manufacturing structure



Manufactured items



Assembly


Assembly Product Segments
Assembling
Filling
Print Test
Wireless test
Packaging

Product segment structure

Cartridge	
S1	Enclosure
S2	Ink
S3	Electronic board
S4	Assembly

S1 Enclosure	
S1.1	Plastic making
S1.2	Body molding
S1.3	Cover molding
S1.4	Finishing – Pre-assembling

S2 Ink	
S2.1	Reaction
S2.2	Sieving
S2.3	Refining
S2.4	Conditionning

S4 Assembly	
S4.1	Assembling
S4.2	Filling
S4.3	Print test
S4.4	Wireless test
S4.5	Packing

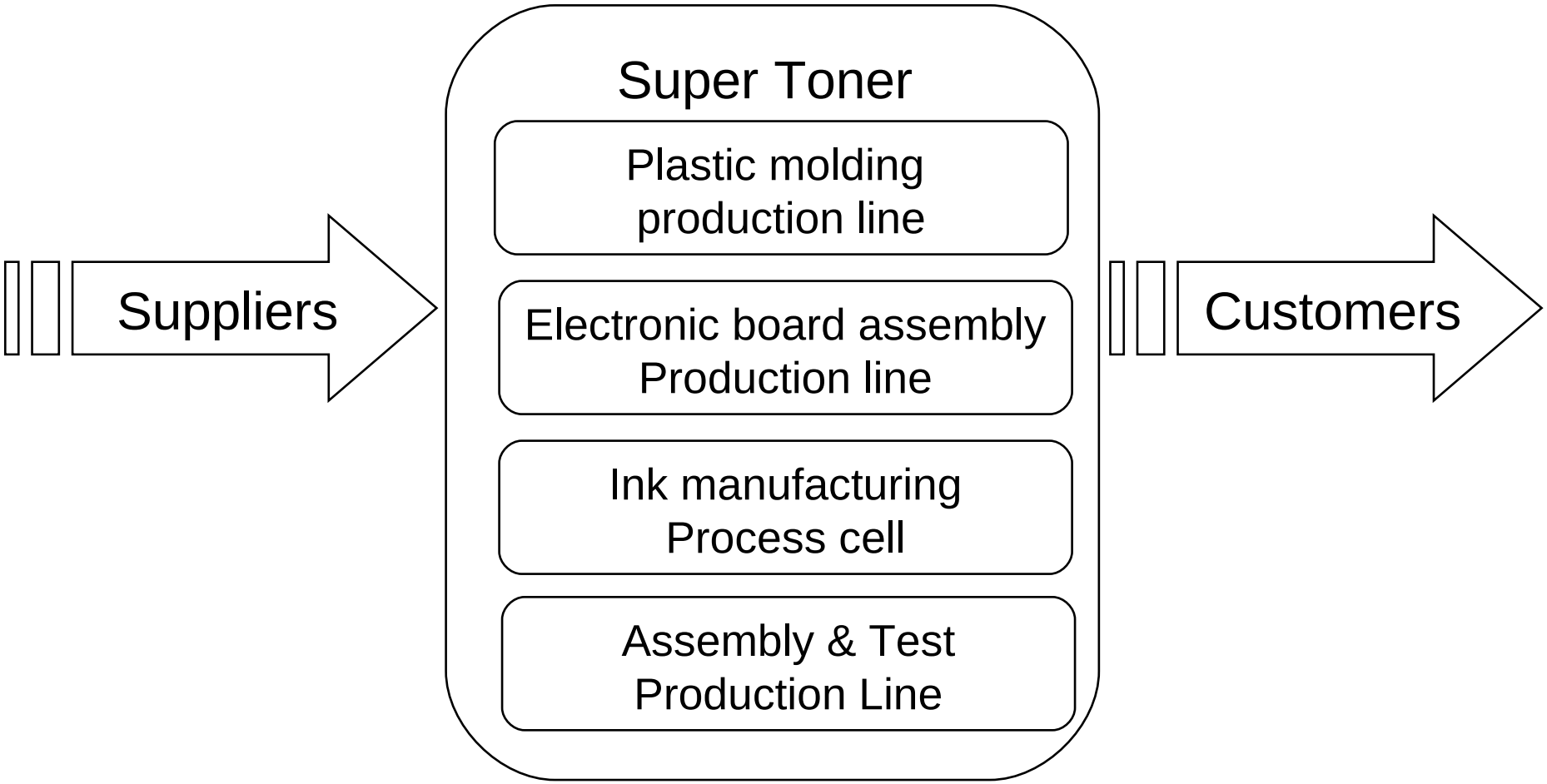
S3 Electronic board	
S3.1	Engraving
S3.2	Drilling
S3.3	Mounting
S3.4	Testing

Product Families and variants

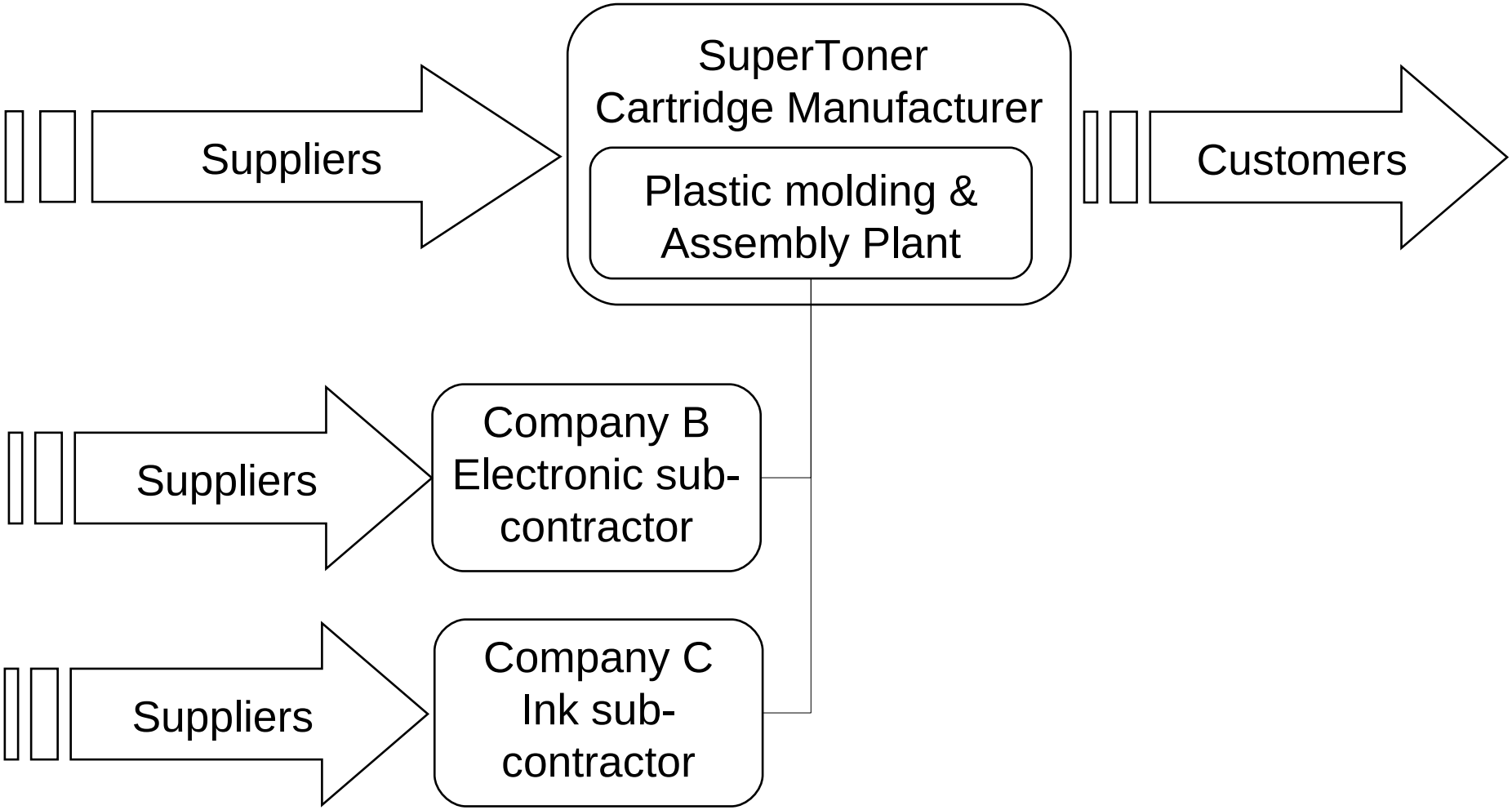
Families (one dimension)	
F1	Separable drum
F2	Embedded drum

Variants (multidimensional)		
V1	1	Canon Packing
	2	HP Packing
	3	Epson Packing
V2	1	TN6600 OEM model
	2	HX2200 OEM model

Simple manufacturing model



Cooperative manufacturing model



Product segment allocation

SuperToner

S1: Make Enclosure	
S1.1	Plastic making
S1.2	Body molding
S1.3	Cover molding
S1.4	Finishing – Pre-assembling

S4: Make Assembly	
S4.1	Assembling
S4.2	Filling
S4.3	Print test
S4.4	Wireless test
S4.5	Packing

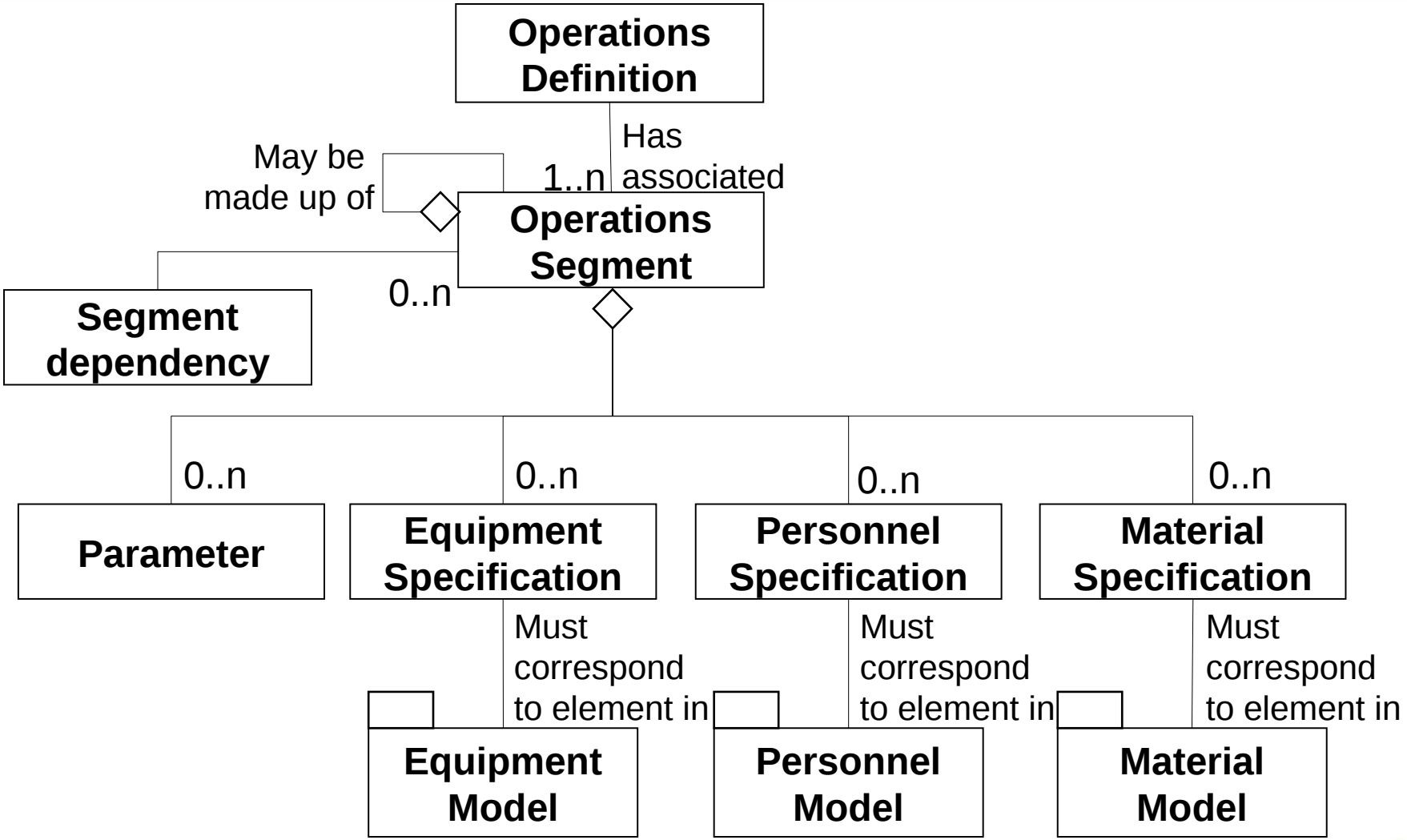
Company C

S2: Make Ink	
S2.1	Reaction
S2.2	Sieving
S2.3	Refining
S2.4	Conditionning

Company B

S3: Make Electronic board	
S3.1	Engraving
S3.2	Drilling
S3.3	Mounting
S3.4	Testing

Operations definition model



B2MML: Product Information – 1st level product segments

<OperationsDefinitionInformation>
<ID> **F2** </ID>
<Description> Embedded drum toner cartridges
<HierarchyScope>
<OperationsType>**Production**
<PublishedDate> **2012-12-08**
<OperationsDefinition>
<ID> **TN6600**
<Version> **V0**
<Description> **For Brother HL series**
<WorkDefinition> **TN6600**
<OperationsSegment>
<ID> **S1**
<Description> **Make Enclosure**
< OperationsSegment >
<ID> **S2**
<Description> **Make Ink**

B2MML : 2nd level product segments

< OperationsSegment >
<ID> **S1.2**
<Description> **Body molding**
<Duration> **1 H**
<ProcessSegmentID> **multi-mold workcell**
<ProcessSegmentID> **Body+cover molding**
<SegmentDependency> **Before S1.4**
<Parameter>
<ID> **MoldReference**
<Value> **M6600**
<PersonnelSpecification>
<PersonnelClassID> **Molder**
<Description>
<Quantity> **1**
<EquipmentSpecification>
<MaterialSpecification>
<MaterialClass> **Polyethylen**
<MaterialDefinitionID> **P22**
<Description> **Rigid Polymer**
<MaterialUse> **Consumed**
<Quantity> **234 G**

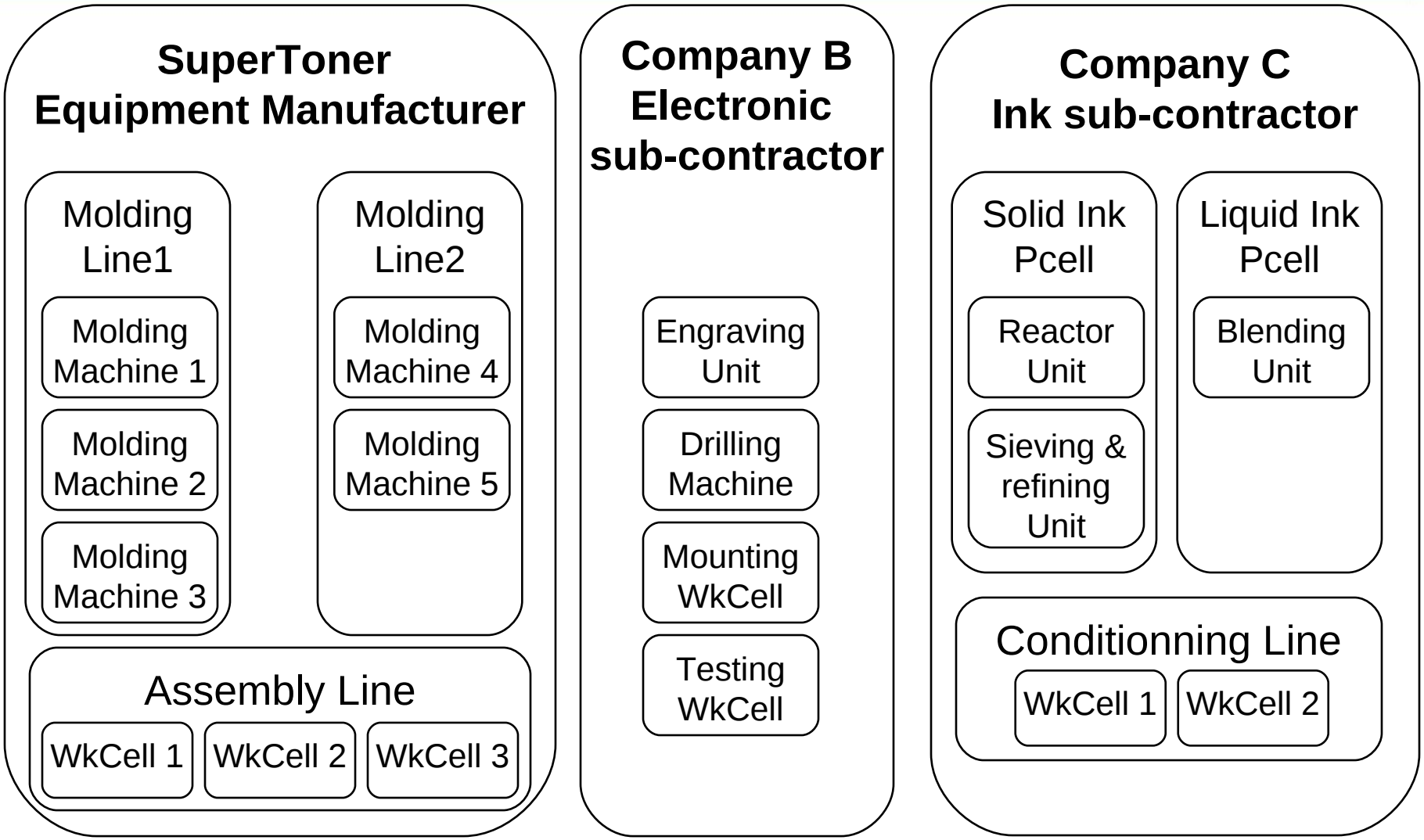
Agenda

- Example
  - Product structure and Manufacturing strategy
  - Resources & Capability
  - Operations Schedule
  - Operations Performance
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

Resources

- Identify the resources organisation:
  - Personnel
  - Equipments
  - Material & Energy
  - Process Segments

Available resources: Equipment



Available resources (at SuperToner plant)

Material

Material Def.	Class	Lot	Qté
P22	Polyethylen	PY2702	125 kg
P56	Polyethylen	PY2906	54 kg
ECPH	Ink	E456	253 kg
WLS25	Electronic board	W1257	49
Kit345	Accessories	L35123	56

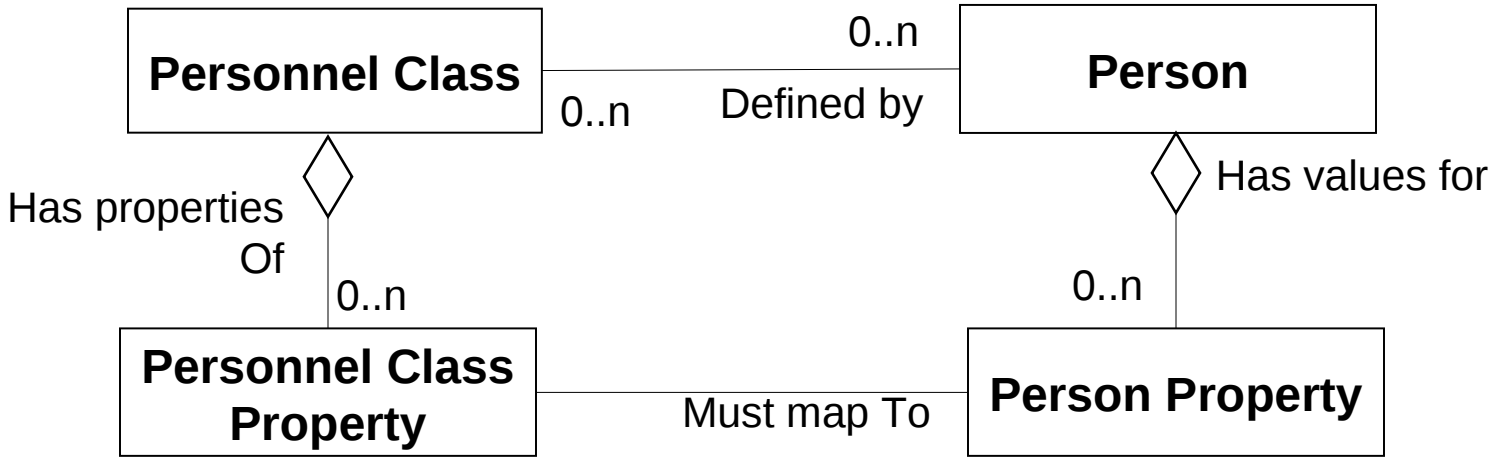
Equipment

ID	Equipt	Classe
E1	Machine1	Single molding
E2	Machine2	Single molding
E3	Machine3	Single molding
E4	Machine4	Double molding
E5	Machine5	Double molding
E6	WkCell1	Assembly station
E7	WkCell2	Assembly station
E8	WkCell3	Assembly station

Personnel

ID	Name	Classe	Lev.
P1	Albert	Molder	1
P2	Bob	Molder	1
P3	Chris	Molder	2
P4	David	Assembler	
P5	Eric	Assembler	
P6	Francis	Assembler	
P7	Greg	Printing Tester	
P8	John	Electronic Tester	

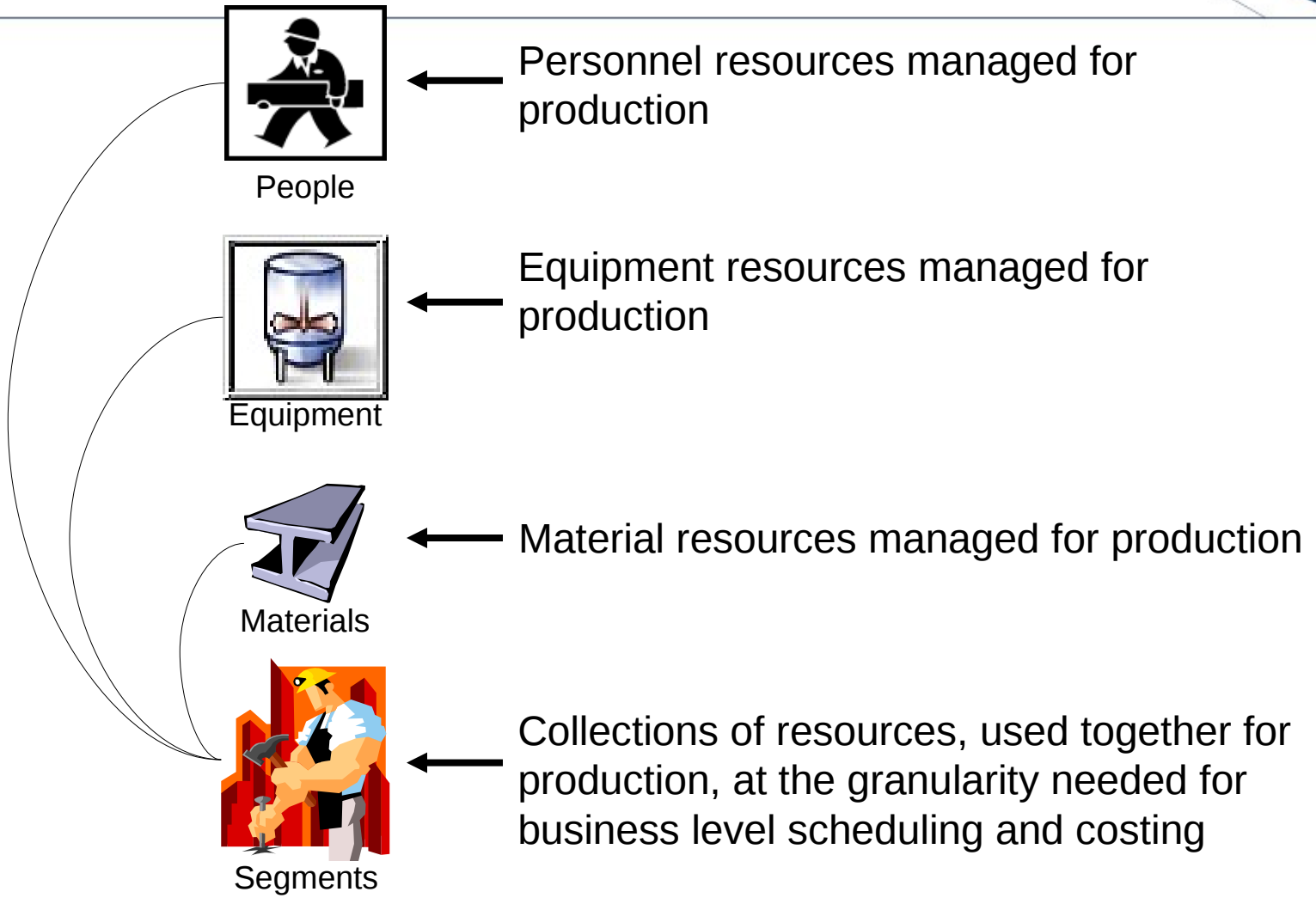
Personnel model



B2MML : Personnel

```
<PersonnelInformation>
    <Description> Personnel of SuperToner
    <PublishedDate> 2012-12-08
    <PersonnelClass>
        <ID>Molder
        <Description> Molder
        <PersonnelClassProperty>
            <ID> MolderQualif
            <Description> Molder Qualification test
            <Value> 1 or 2
            <QualificationTestSpecificationID> TestLevel
        <PersonID>
    <Person>
        <ID> P1
        <PersonName> Albert
        <PersonnelClassID> Molder
        <PersonProperty>
            <ID> MolderQualif
            <Value> 1
            <TestResult> Pass
```

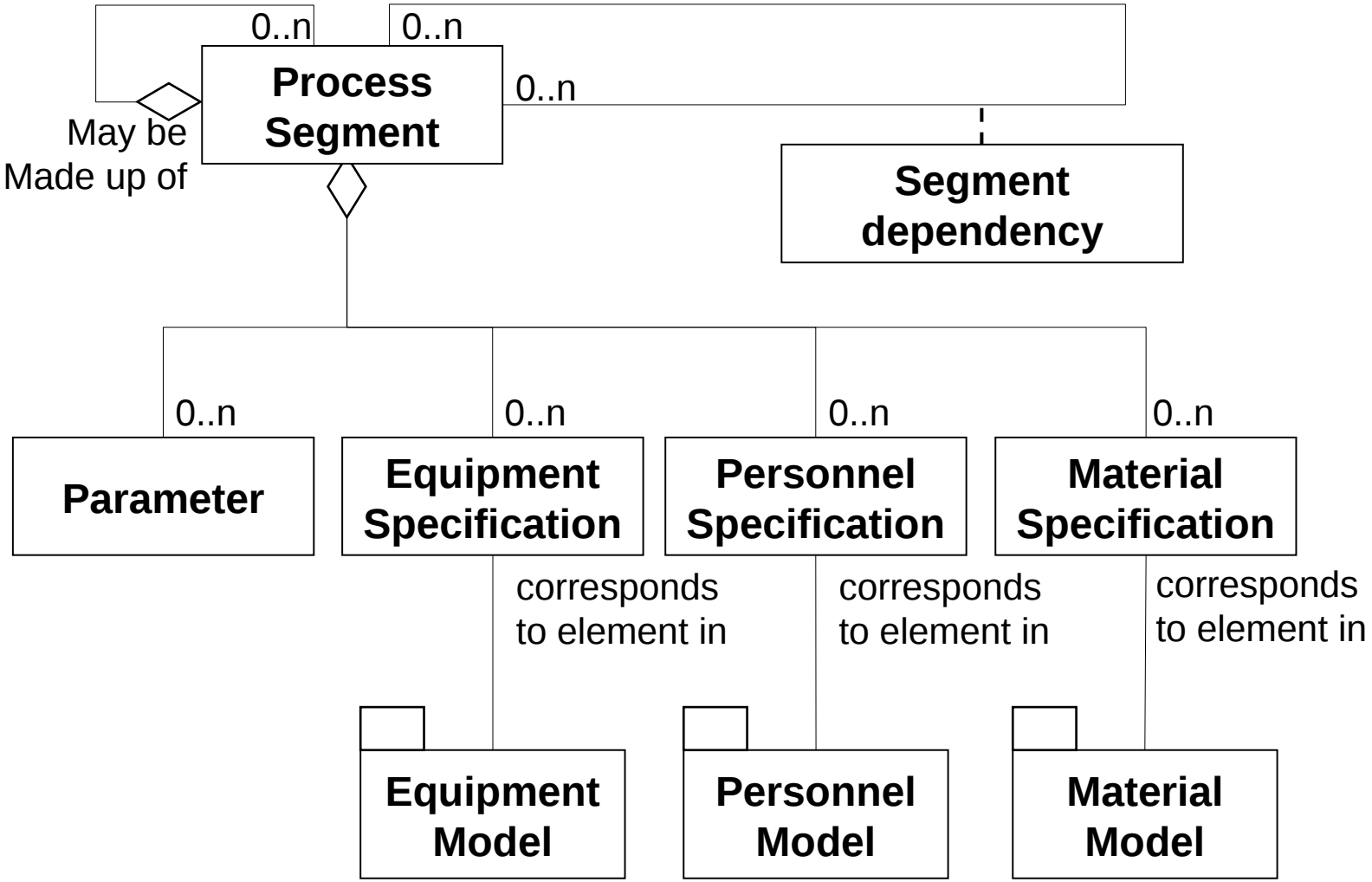
Process Segment Concept



Available Resources : Process Segments

Id	Process Segment	Personnel Class	Equipment Class	Material Class	Parameters
Sa1	Body molding	1 molder Duration=1 H	Single mold mach. Duration= 1H	Polyethyle n Q=?	MoldReference =M*
Sa2	Cover molding	1 molder Duration= 1H	Single mold mach. Duration= 1H	Q=?	MoldReference =M*
Sa3	Body + cover molding	1 molder Level=2 Duration= 1H	Double mold mach. Duration= 1H	Q=?	MoldReference =M*
Sa4	finishing + pre-assembly	1 assembler Duration= 30’	Assembly worlkstation Duration= 30’	ECPH Q=1 WLS25 Q=1	

Process Segment model



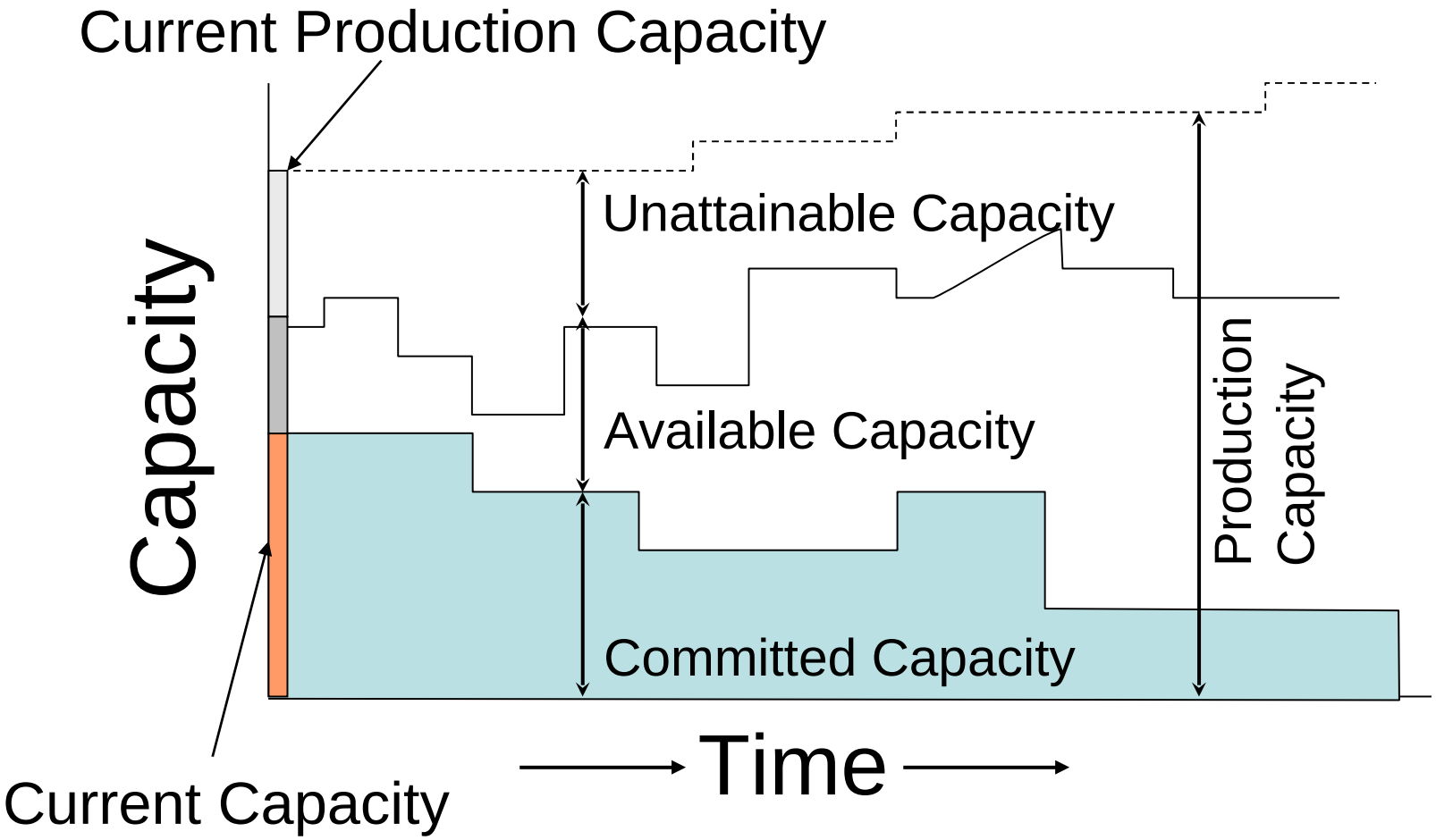
B2MML : Process Segments

```
<ProcessSegmentInformation>
    <ID>
    <Description> Available processes definition
    <HierarchyScope>
          <EquipmentID> SuperToner / Site
    <PublishedDate> 2012-12-08
    <ProcessSegment>
          <ID> Sa1
          <Description> Body molding
          <Duration> 1 H
          <PersonnelSegmentSpecification>
             <PersonnelClassID> Molder
          <EquipmentSegmentSpecification>
             <EquipmentClassID> Single mold. Mach.
          <MaterialSegmentSpecification>
             <MaterialClassID> Polyethylen
          <Parameter>
            <ID> MoldReference
            <Value> M*
          <ProcessSegment>
     <ProcessSegment>
```

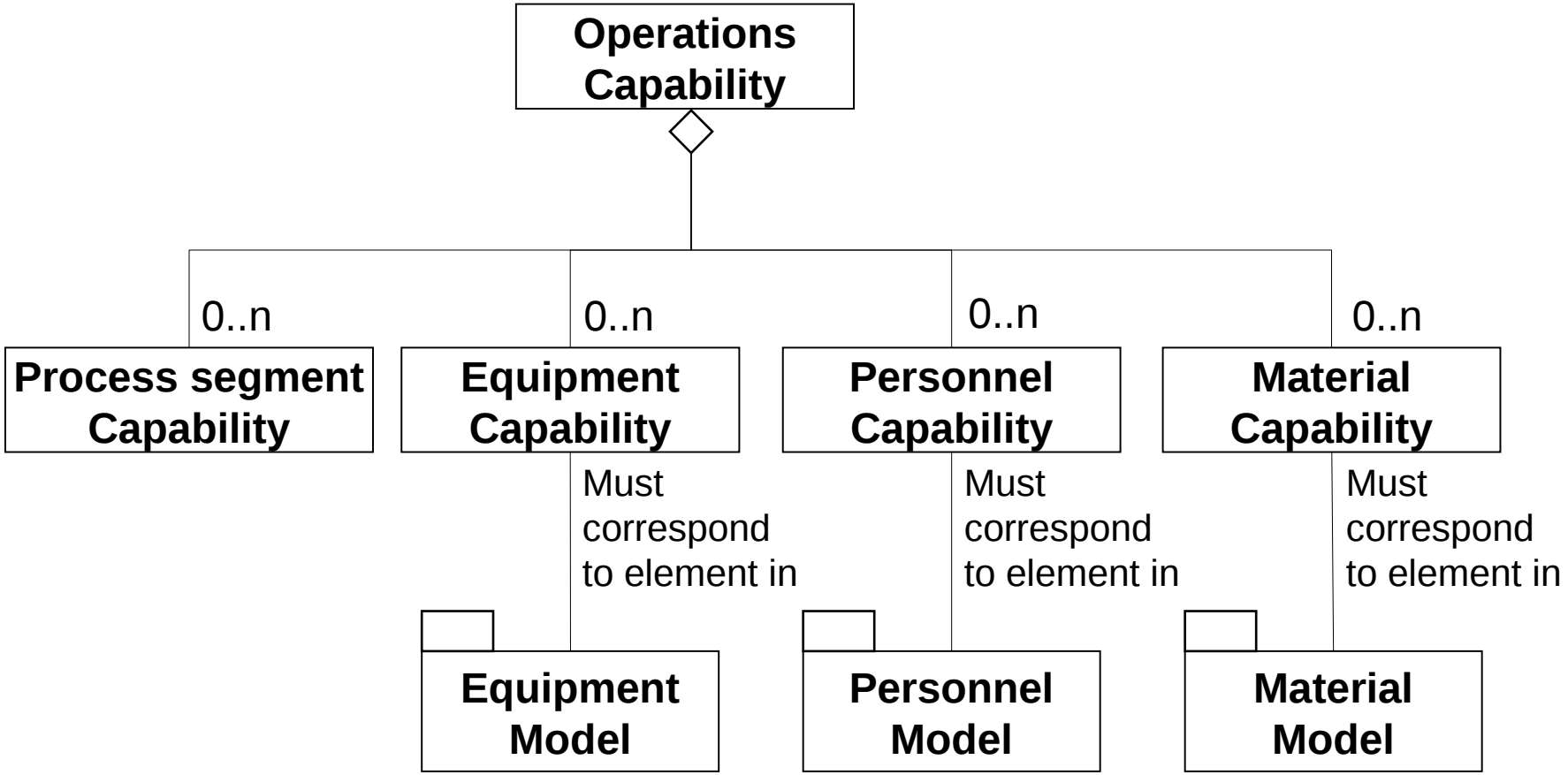
Production Capability

- Resources are now identified
- We have to provide information about allocation and availability
  - Within a given timeframe
  - At a particular location
  - For a type of capability: committed, available, unattaignable
- Caution :
  - The process segment capability overlaps the resource capability and those of other process segments
    - Risk of double use of the same resource

Production Capacity (cont'd)



Operations Capability Model



B2MML: Operations Capability - Header

< OperationsCapability>
<ID>
<Description> **Plant capability**
<HierarchyScope> **SuperToner / Site**
<PublishedDate> **2012-12-08**
<CapabilityType> **Committed**
<Reason> **On request**
<EquipmentElementLevel> **Site**
<StartTime> **2012-12-08**
<EndTime> **2002-12-24**
<PersonnelCapability>
<PersonID>
<EquipmentCapability>
<EquipmentID>
<MaterialCapability>
<MaterialDefinitionID>
<ProcessSegment>
<ID>

B2MML: Production capability - Personnel

<PersonnelCapability>
<PersonnelClassID> **Molder**
<CapabilityType> (default)
<Reason> (default)
< HierarchyScope > (default)
<EquipmentElementLevel> (default)
<StartTime> **2012-12-08**
<EndTime> **2012-12-18**
<Quantity> **5**
<PersonnelCapabilityProperty>
<ID> **MolderQualif**
<Value> **1**
<Quantity> **2**
<PersonnelCapabilityProperty>
<ID> **MolderQualif**
<Value> **2**
<Quantity> **1**

2+1 ≠5 ???

B2MML: Process segments capability

```
<ProcessSegmentCapability>
    <ID>
    <Description> Body molding
    <ProcessSegmentID> SA1
    <CapabilityType>
    <Reason>
    < HierarchyScope >
    <EquipmentElementLevel>
    <StartTime> 2012-12-08
    <EndTime> 2012-12-18
    <PersonnelCapability>
        <PersonnelClassID> Molder
        <Quantity> 1
        <PersonnelCapabilityProperty>
            <ID> MolderQualif
            <Value> 1
            <Quantity> 1
    <EquipmentCapability>
        …
    <MaterialCapability>
        …
    <ProcessSegmentCapability>
```

Agenda

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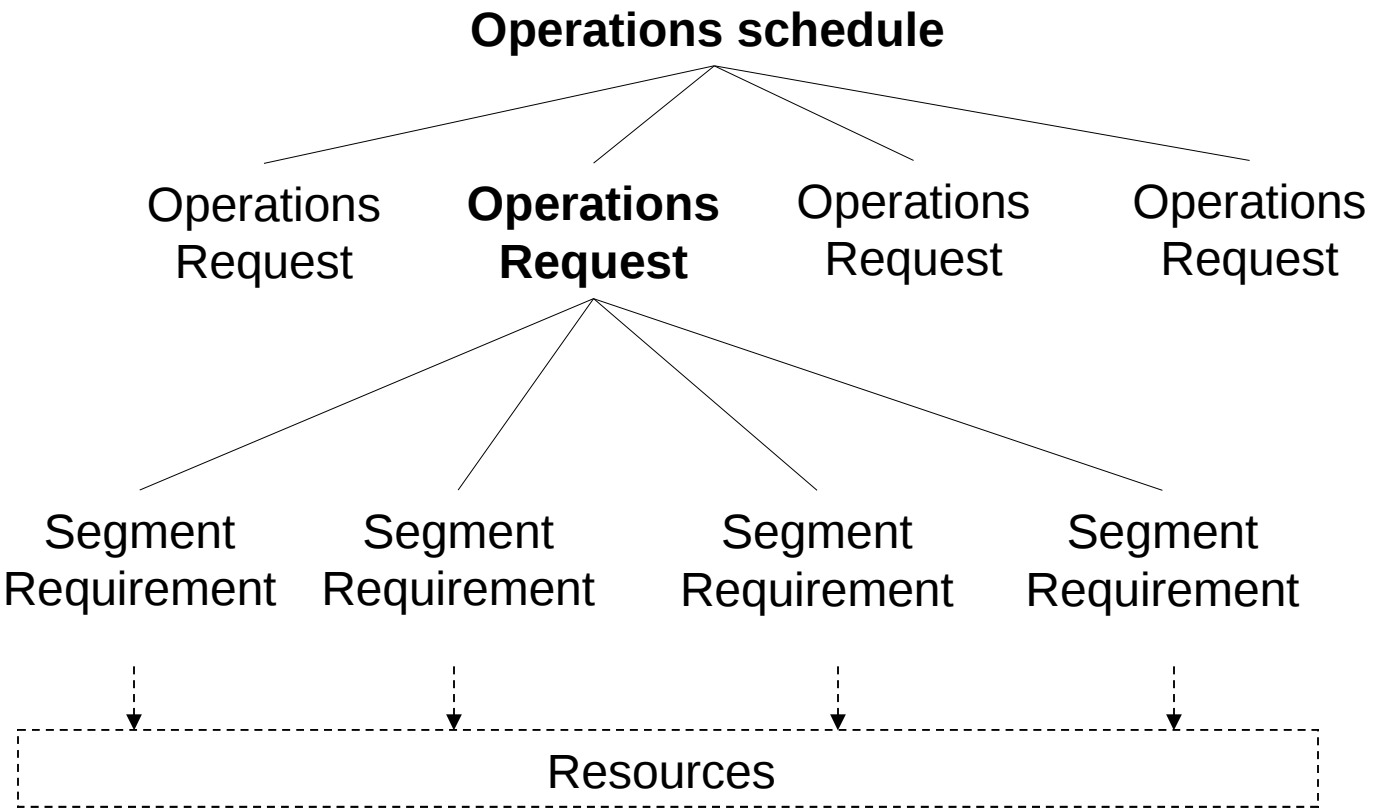
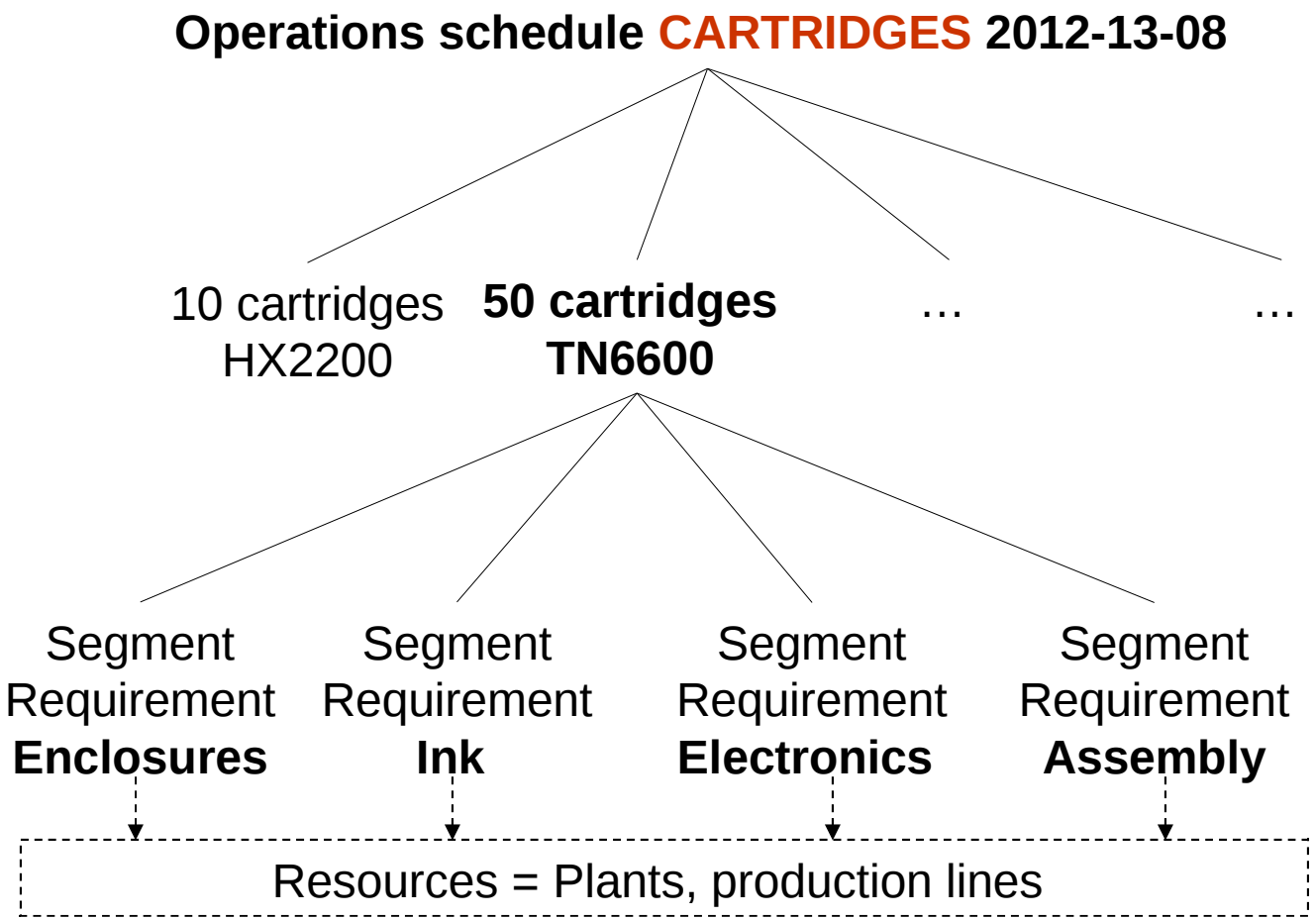
Operations schedule

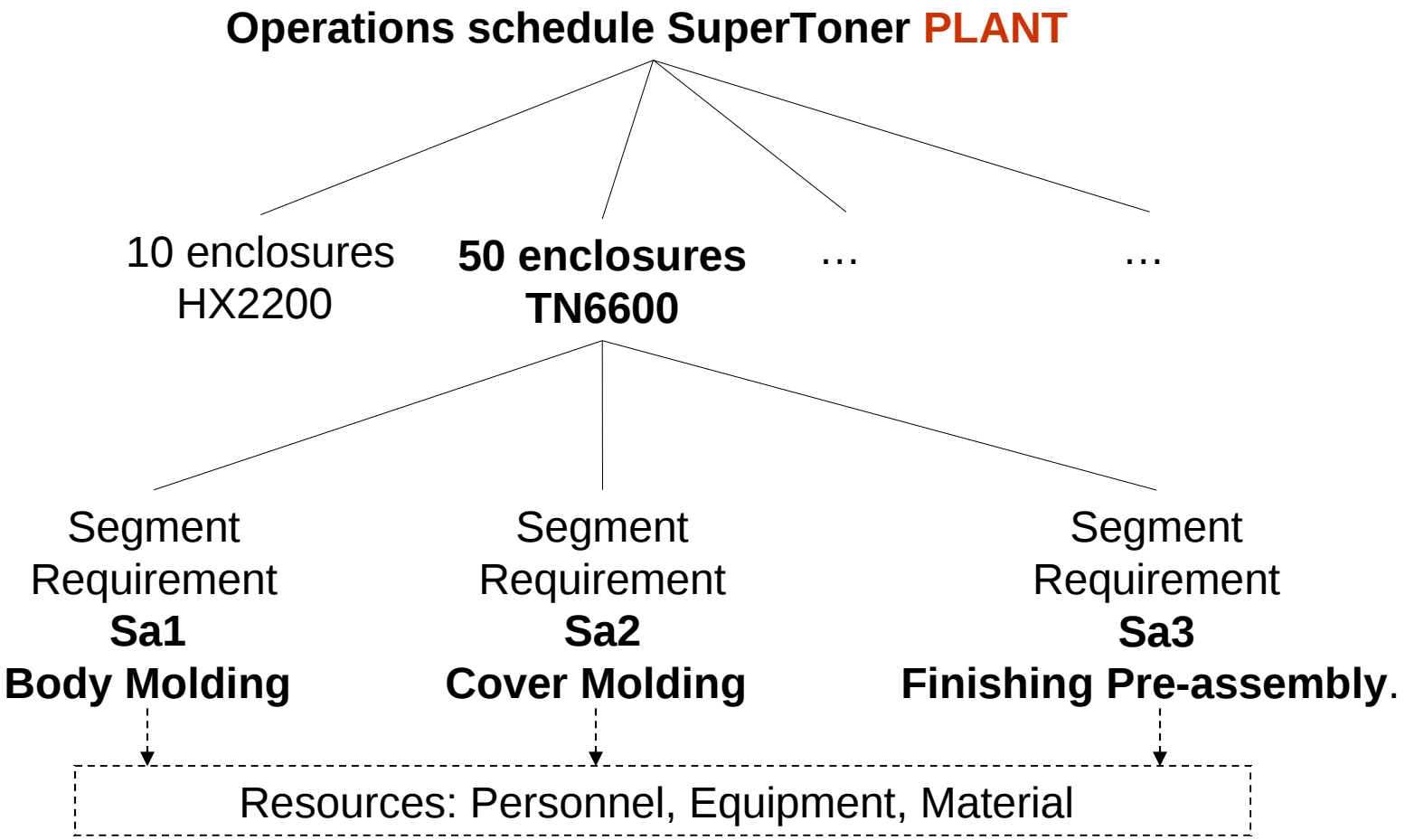
- The operations schedule relies on Operations and resources definitions



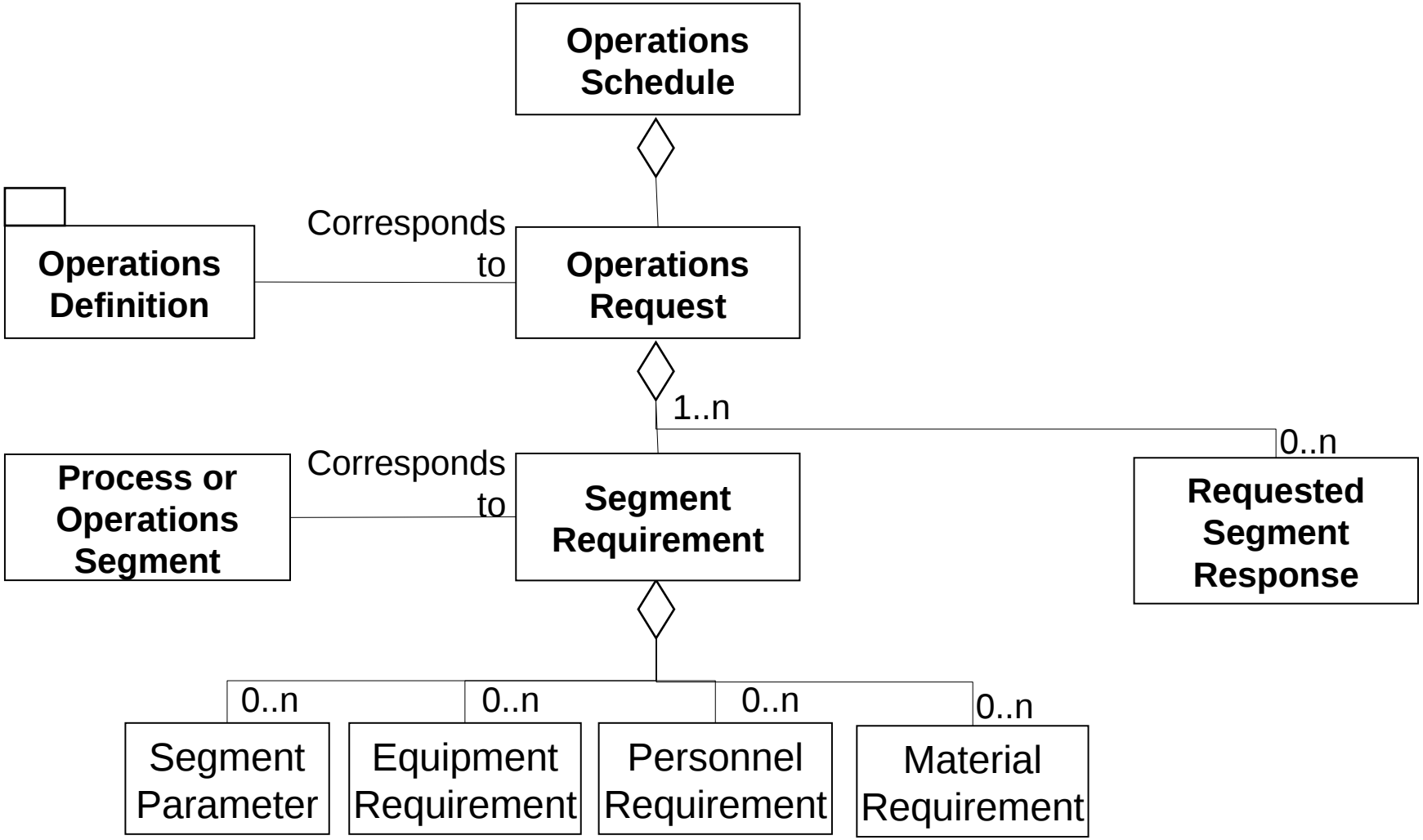
Operations schedule – Corporate level



Operations schedule – Plant level



Operations schedule



B2MML : Operations schedule

```
<OperationsSchedule>
    <ID> P020726
    <Description> Updated schedule / urgent order
    <HierarchyScope>  SuperToner / Site
    <PublishedDate> 2012-12-08
    <StartTime> 2012-12-08
    <EndTime> 2012-12-08
    <OperationsRequest>
        <ID > OF212
        <SegmentRequirement>
            <ID> Sa1
            <Description> Body molding
            <Duration> 1 H
            <PersonnelSegmentSpecification>
                <PersonnelClassID> Molder
            <EquipmentSegmentSpecification>
                <EquipmentClassID> Single mold. Mach.
            <MaterialSegmentSpecification>
                <MaterialClassID> Polyethylen
                <MaterialDefinition> P22
            <SegmentParameter>
                <ID> MoldReference
                <Value> M6600
```

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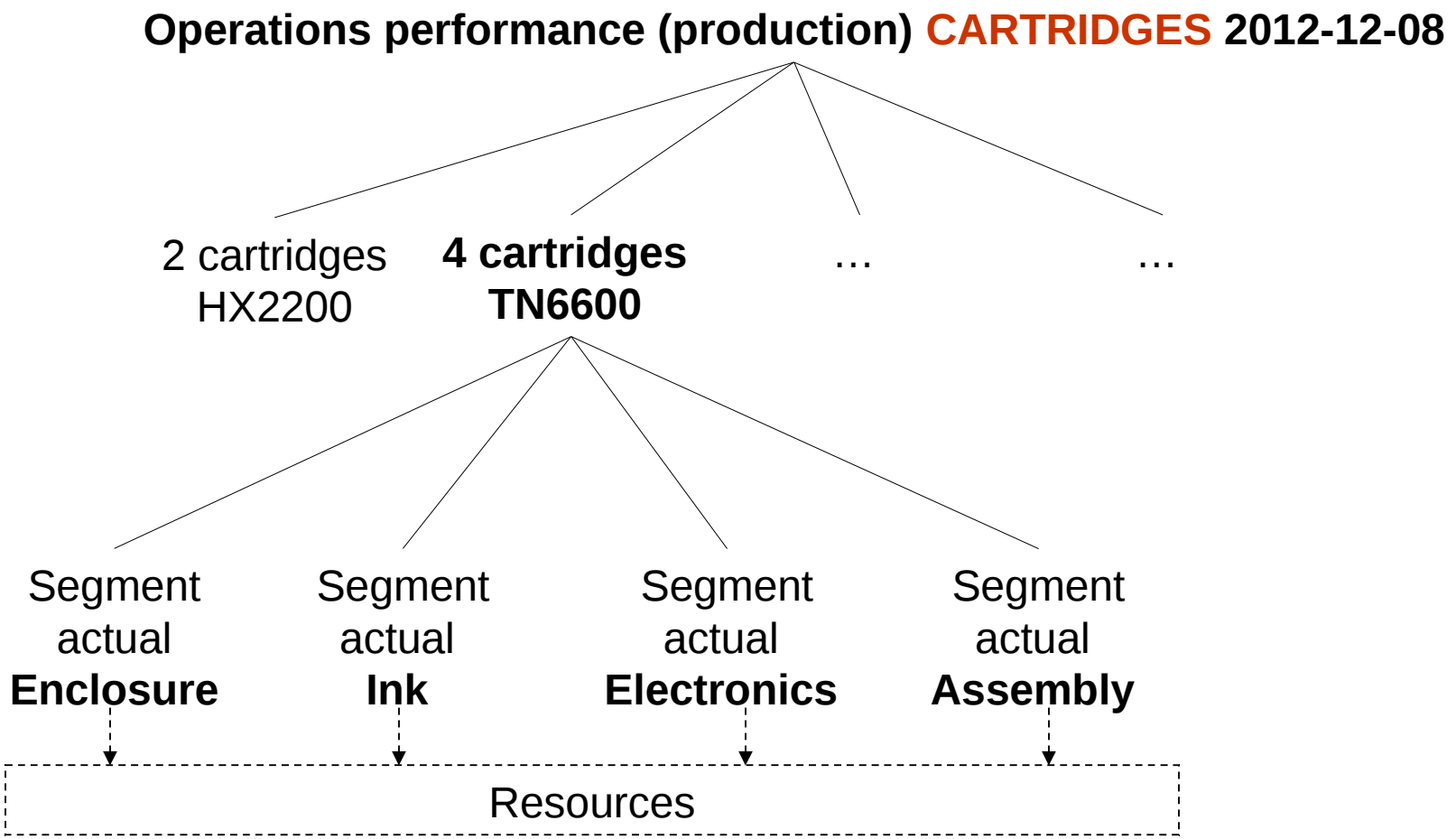
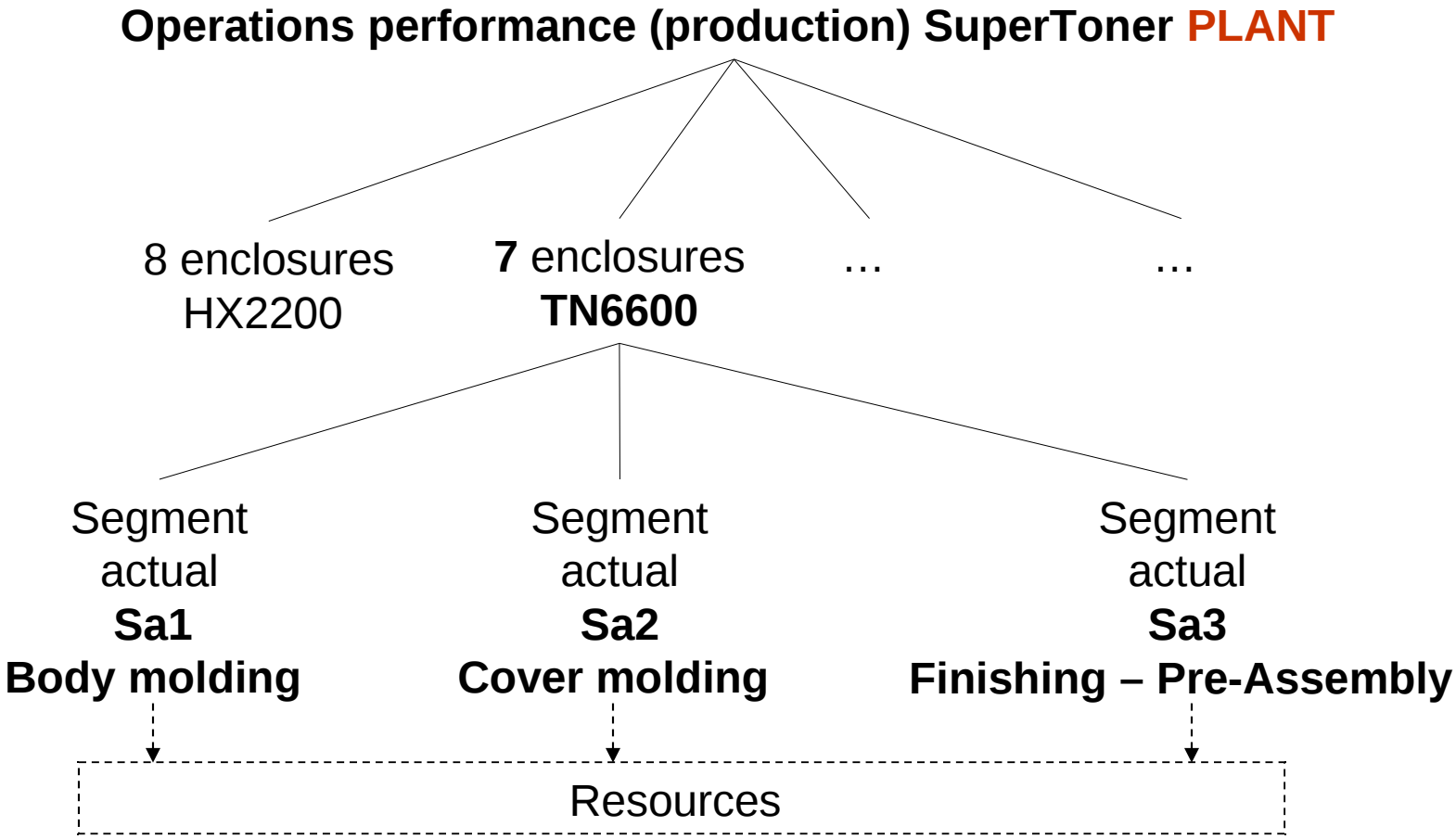
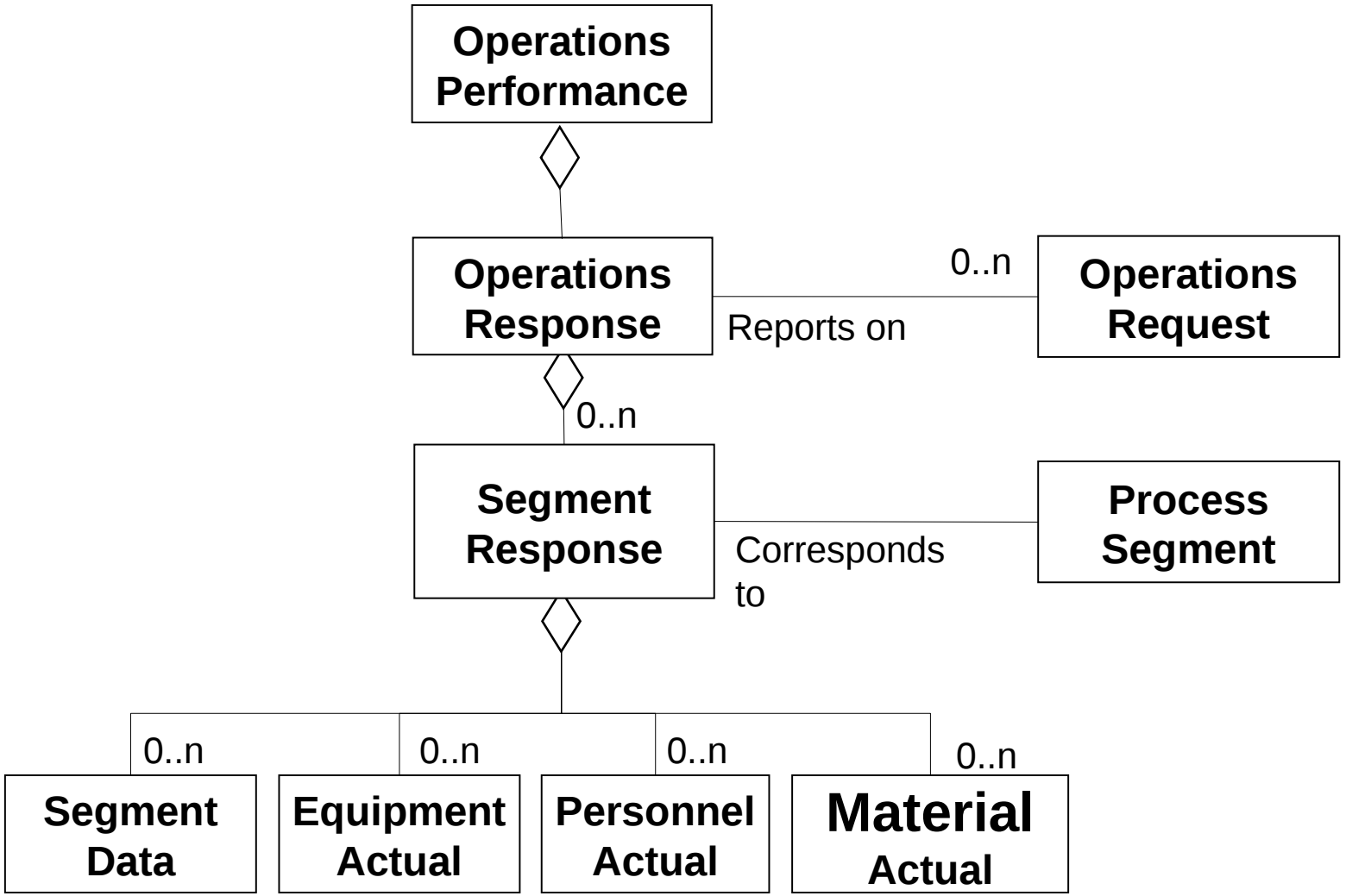
Operations performance – Corporate level



Operations performance – Plant level



Operations performance



B2MML : Production performance

<OperationsPerformance>
<ID> **R020726**
<Description> **Daily production report**
<HierarchyScope> **SuperToner / Site**
<PublishedDate> **2012-12-08**
<OperationsScheduleID> **P020726**
<StartTime> **2012-12-08 T00:00:00Z**
<EndTime> **2012-12-08 T24:60:60Z**
<OperationsResponse>
<ID>
<OperationsRequestID> **OF212**
<SegmentResponse>
<PersonnelActual>
<PersonnelClassID> **Molder**
<PersonID> **Alfred**
<Description>
<Quantity> **30min**
<EquipmentActual>
<MaterialActual>
<SegmentResponse>

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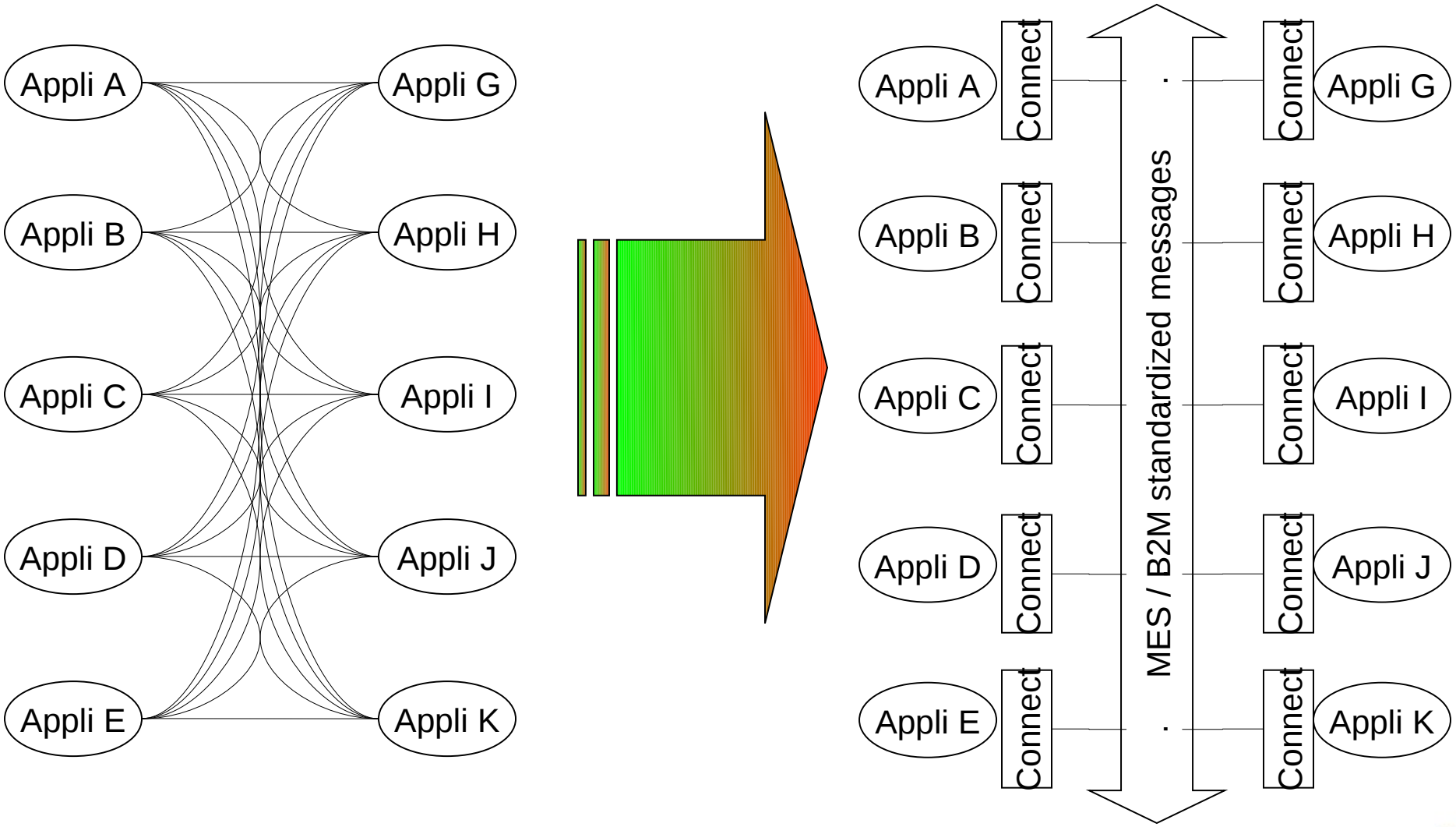
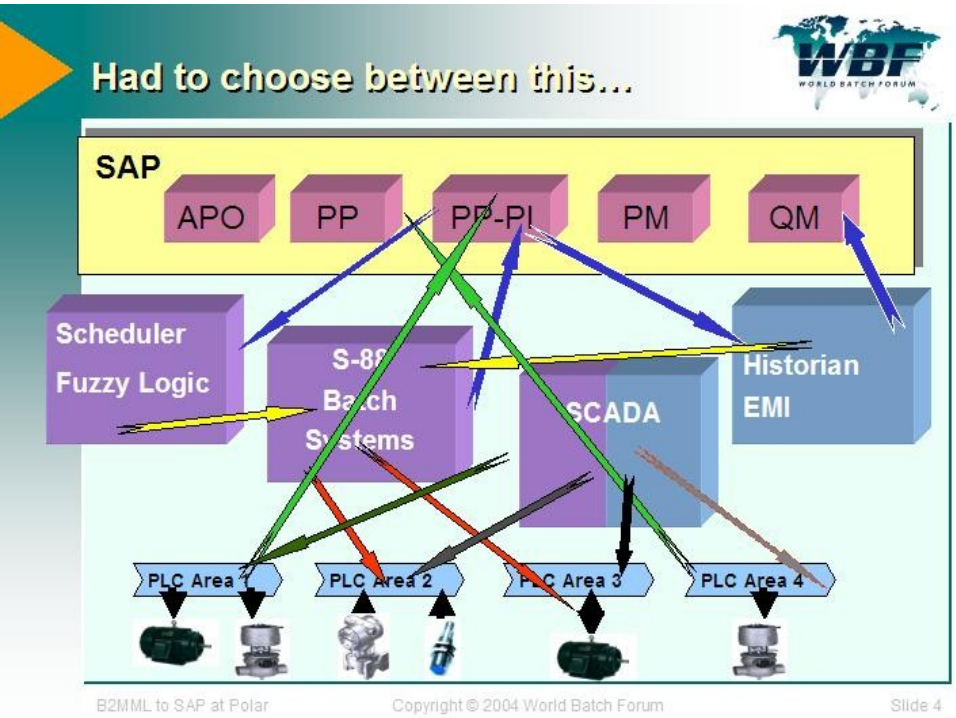
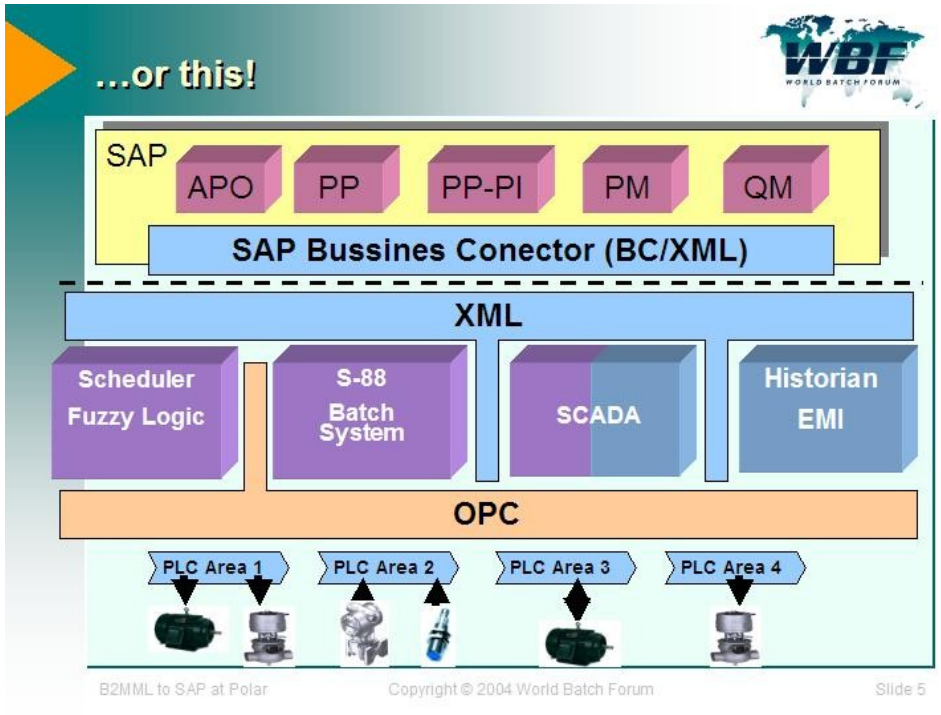
Peer-to-peer vs Information service bus

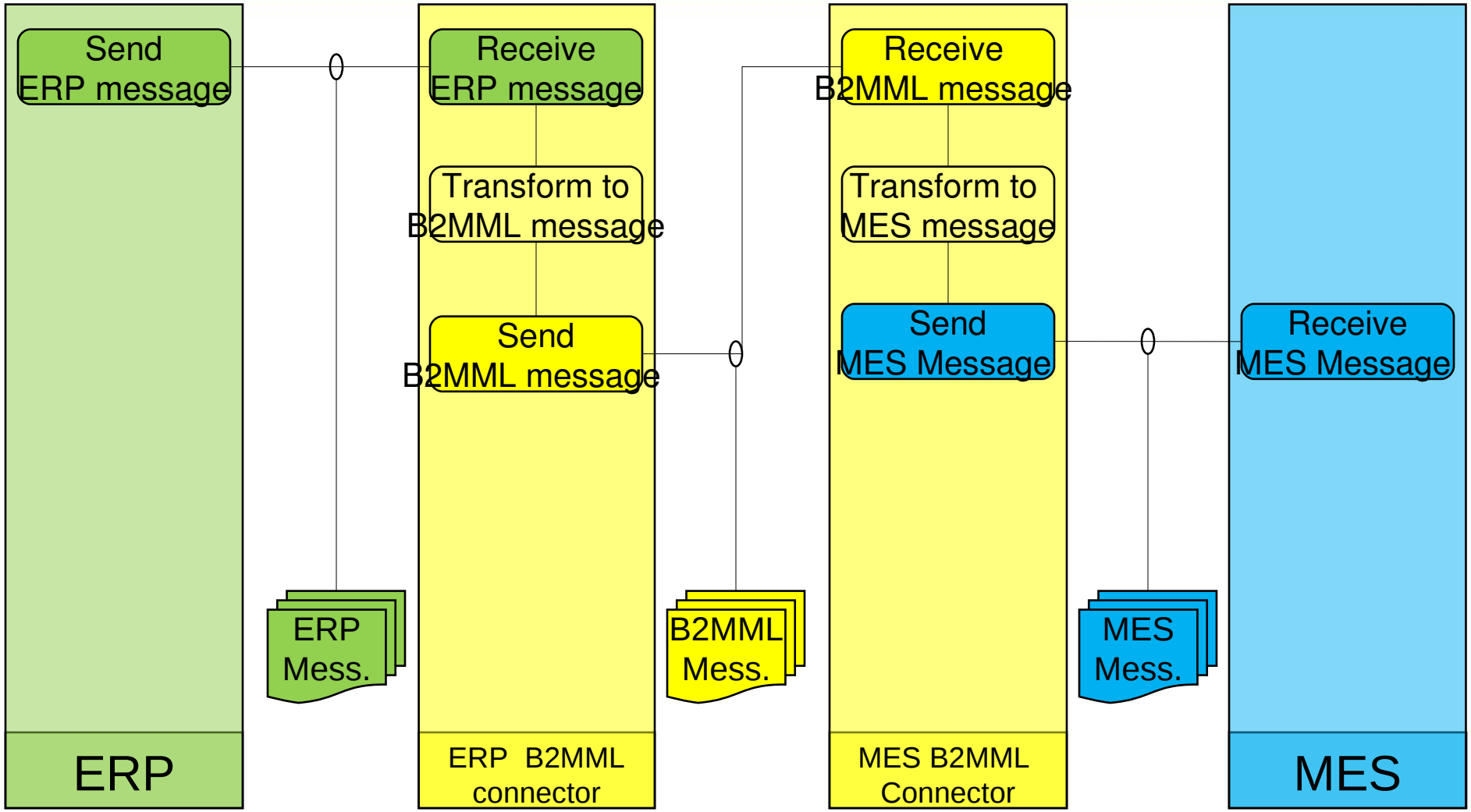


Exemple

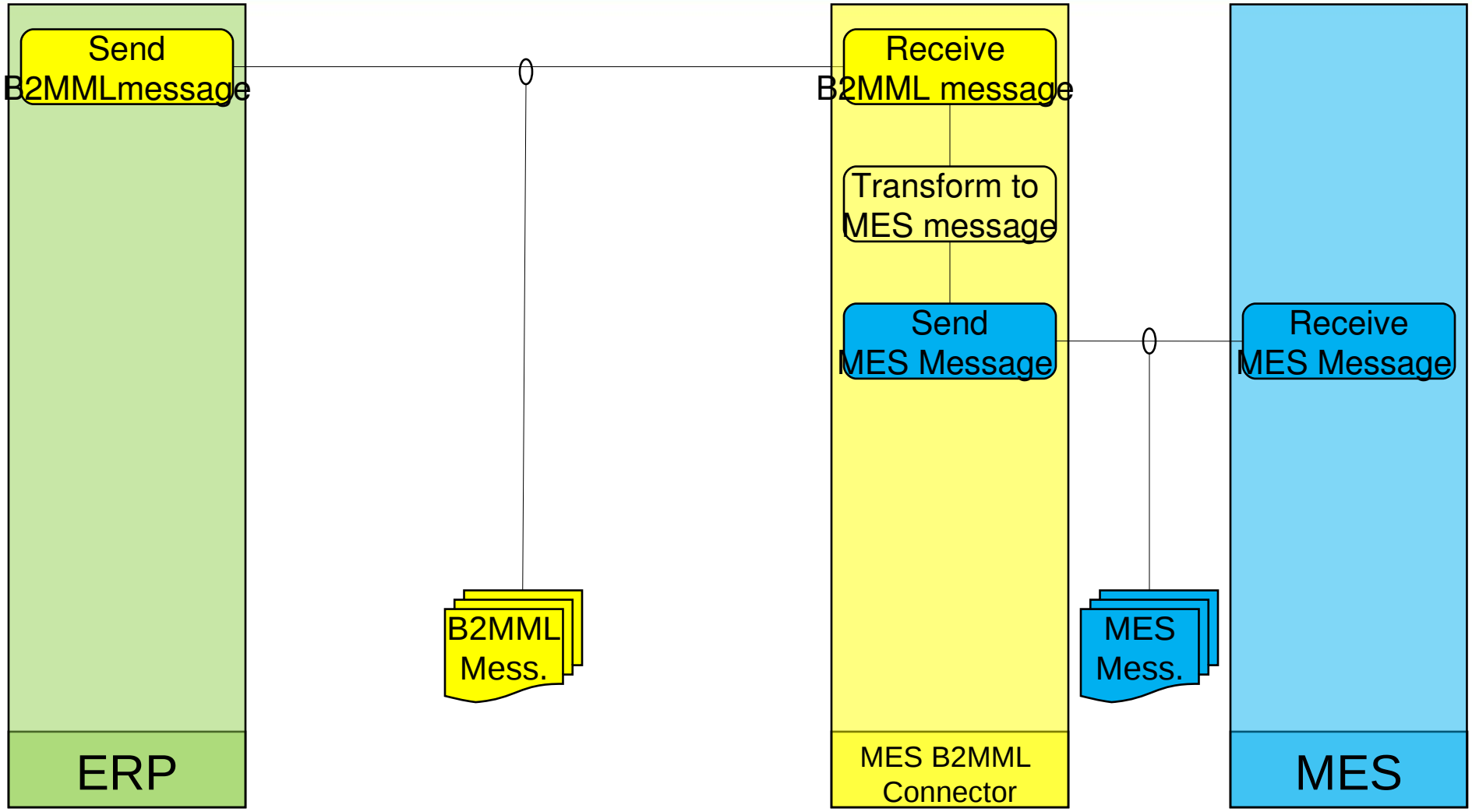

Had to choose between this…
SAP
APO
PP
PP-PI
PM
QM
Scheduler
Fuzzy Logic
S-88
Batch
Systems
SCADA
Historian
EMI
PLC Area 1
PLC Area 2
PLC Area 3
PLC Area 4
B2MML to SAP at Polar
Copyright © 2004 World Batch Forum
Slide 4


…or this!
SAP
APO
PP
PP-PI
PM
QM
SAP Bussines Conector (BC/XML)
XML
Scheduler
Fuzzy Logic
S-88
Batch
System
SCADA
Historian
EMI
OPC
PLC Area 1
PLC Area 2
PLC Area 3
PLC Area 4
B2MML to SAP at Polar
Copyright © 2004 World Batch Forum
Slide 5

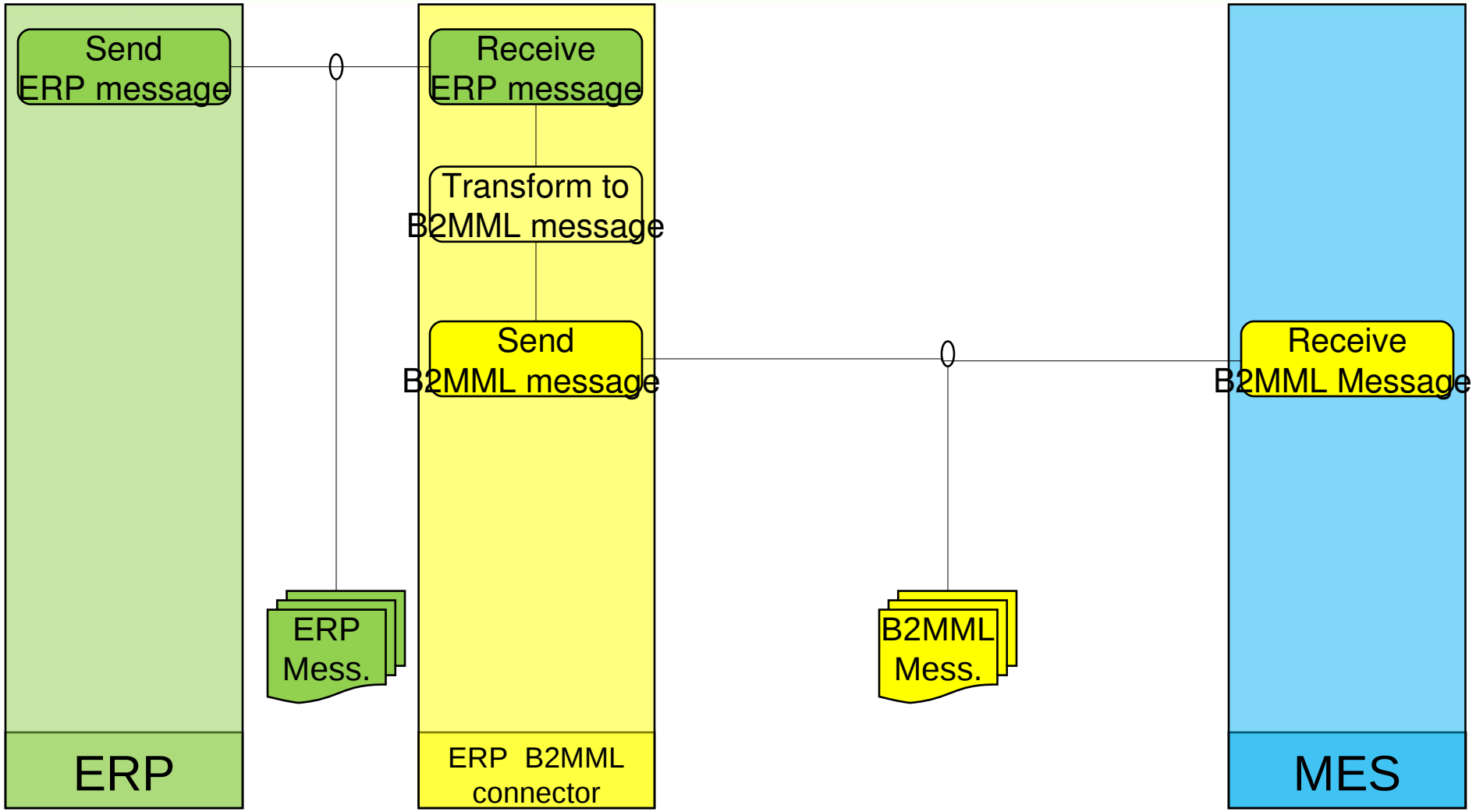
Case 1 : ERP and MES not ISA-95 aware



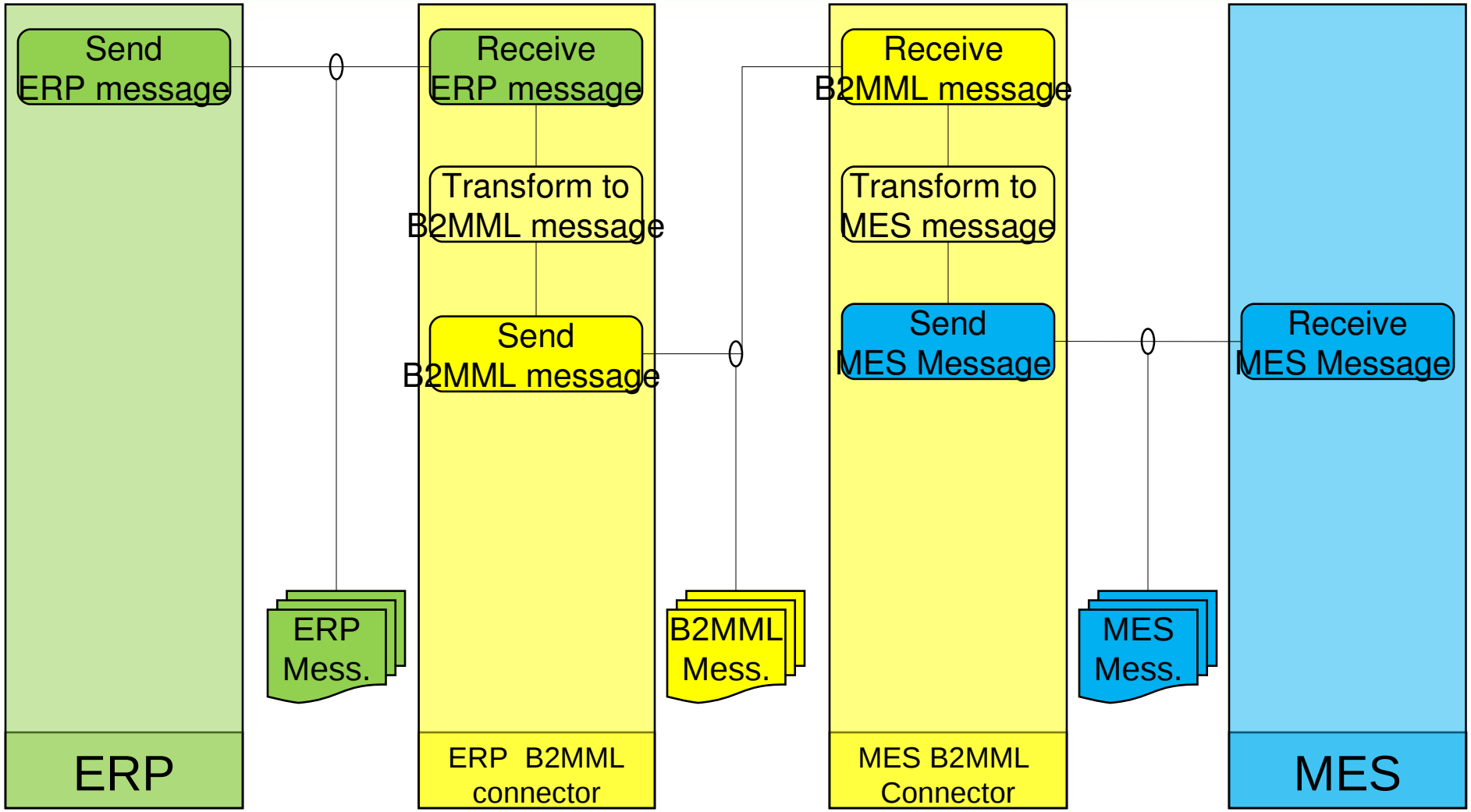
Case 2 : ERP is ISA-95 aware



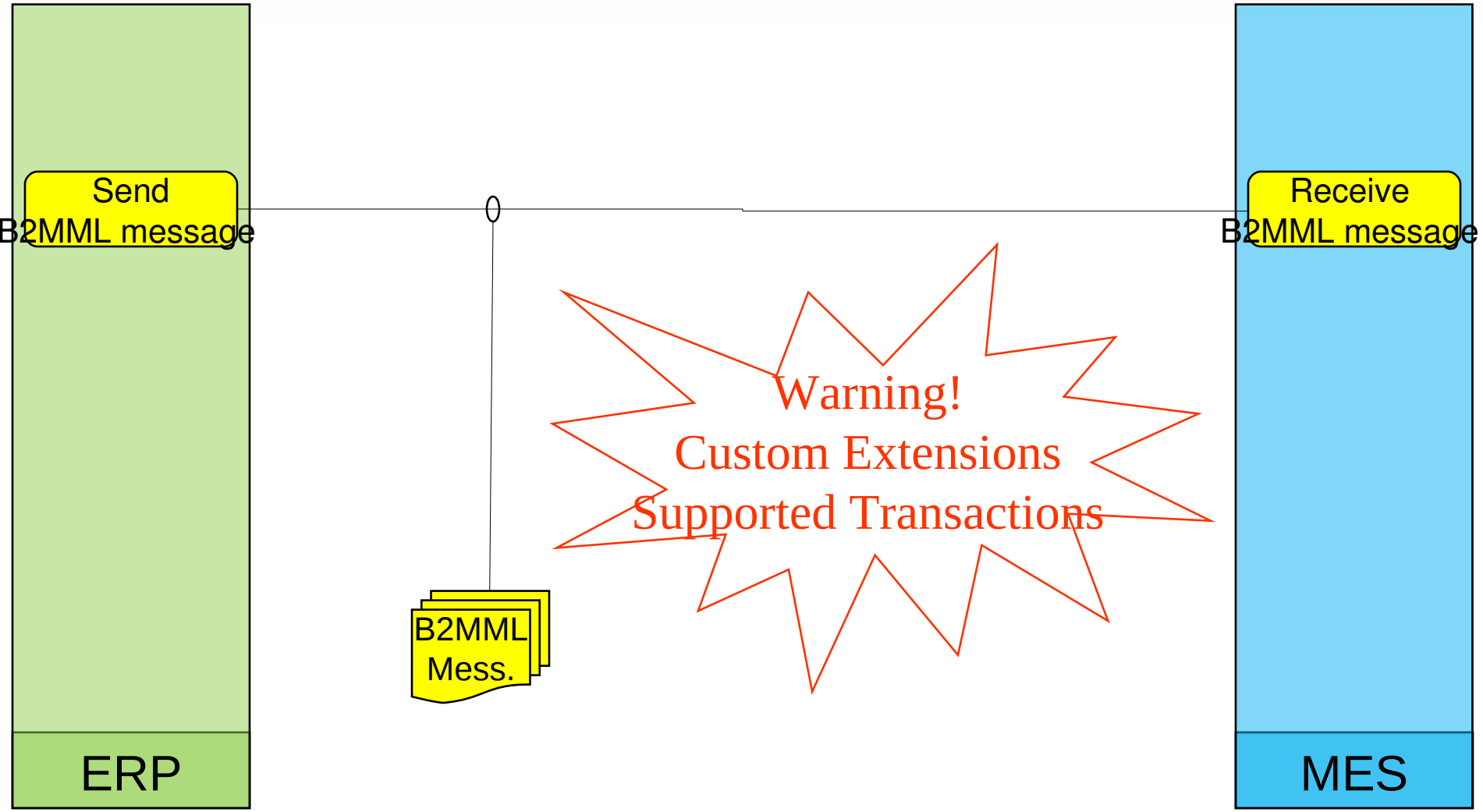
Case 3 : ERP and MES not ISA-95 aware



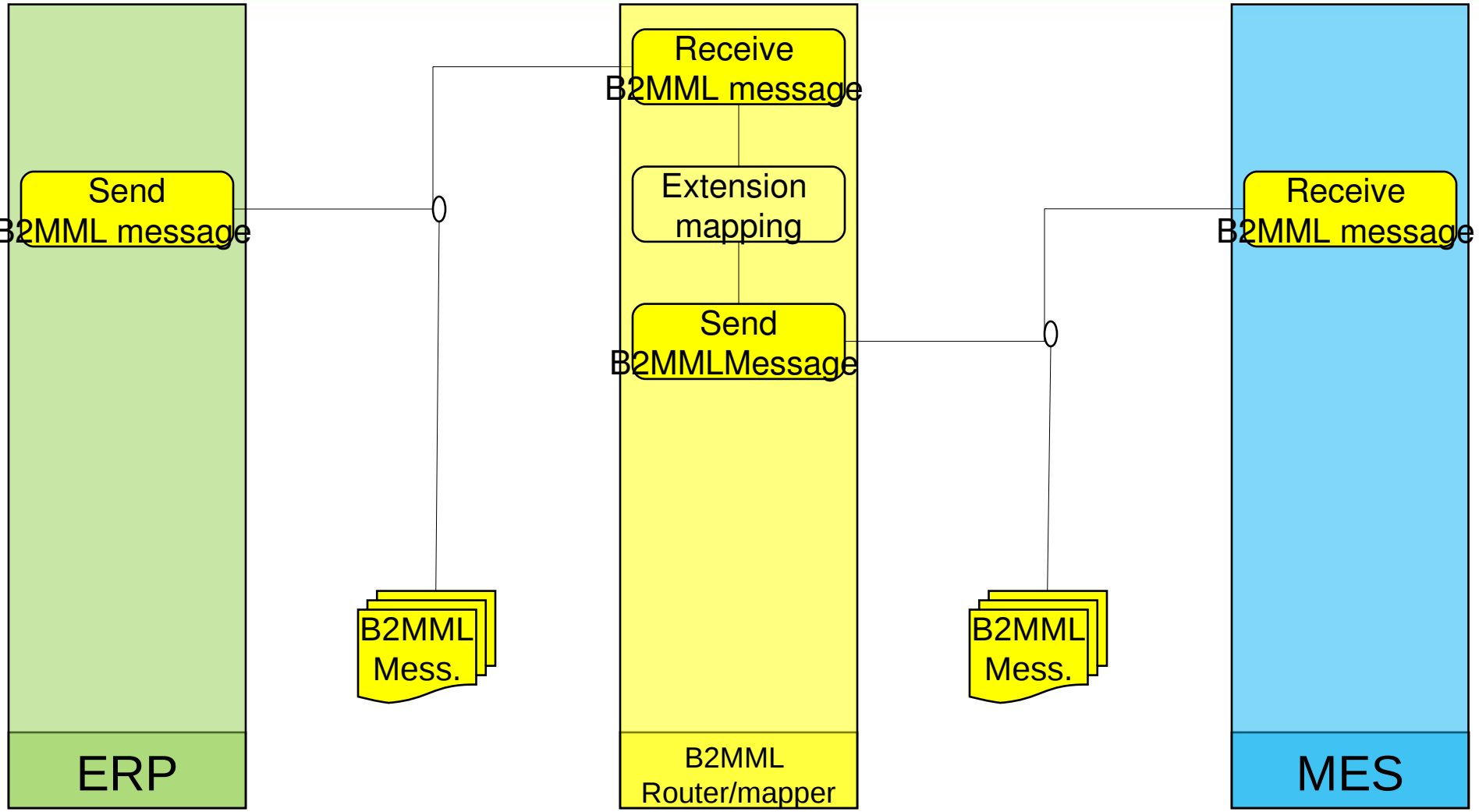
Case 4 : ERP and MES not ISA-95 aware



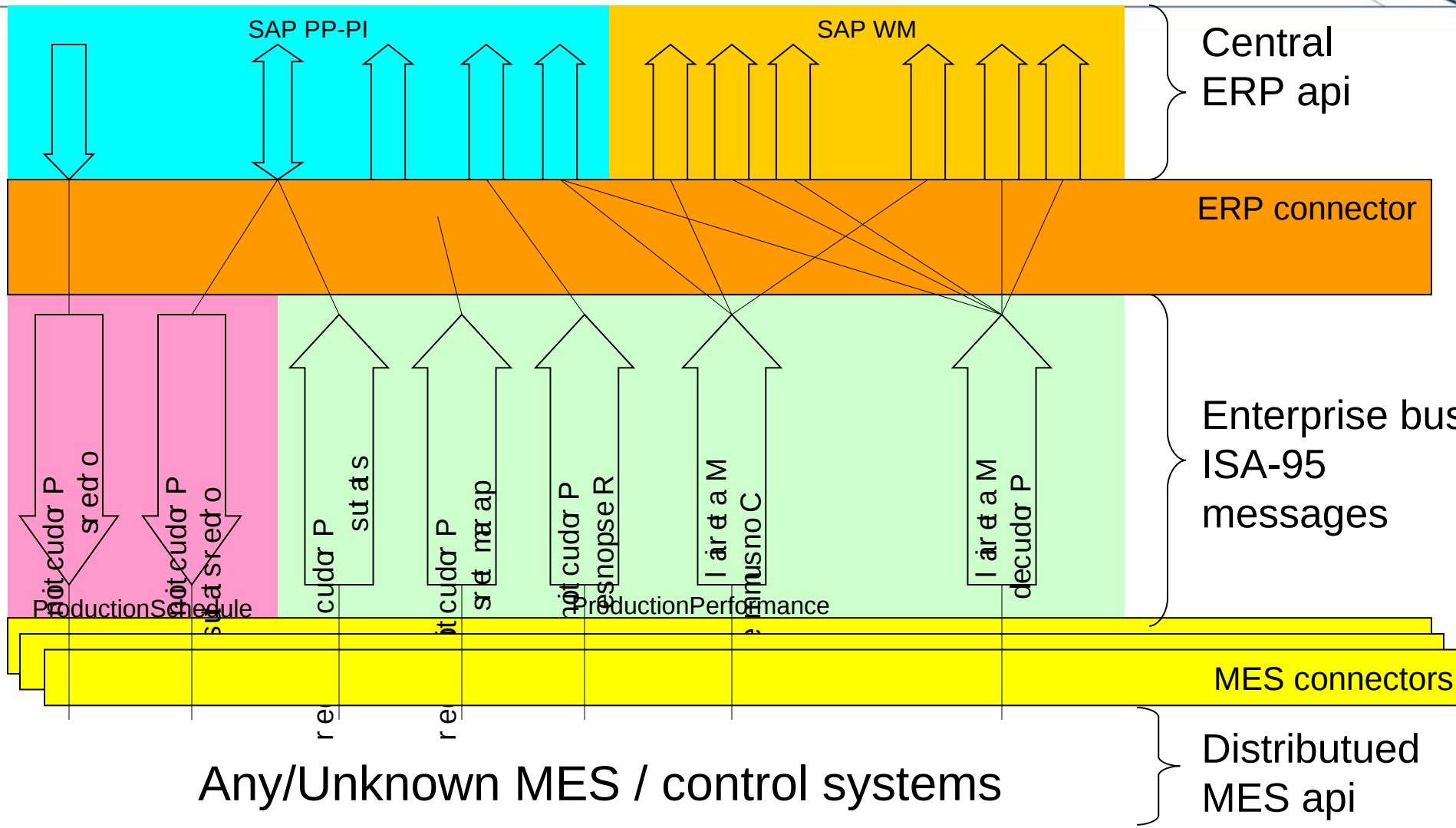
Case 4 : ERP and MES speak B2MML



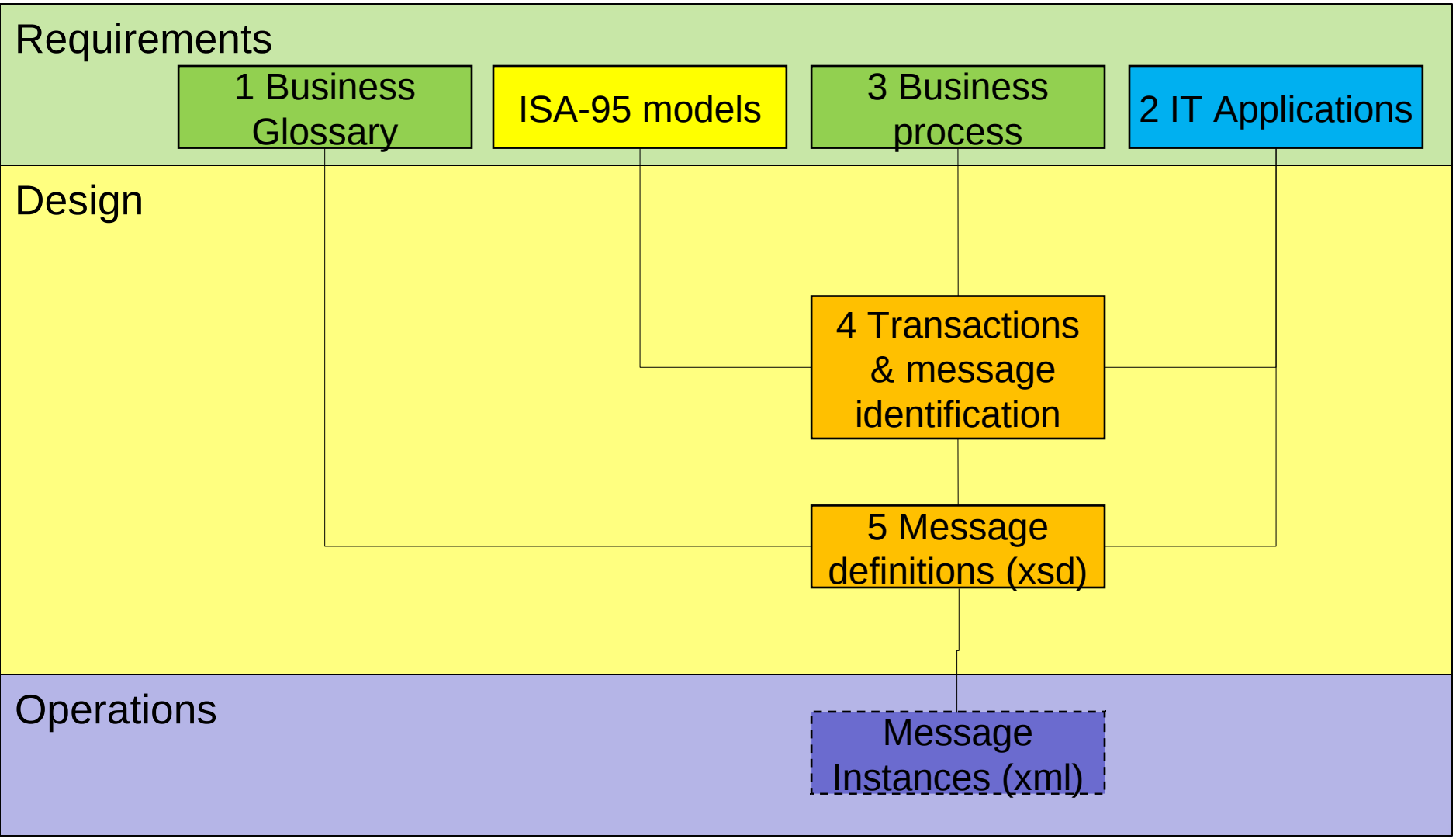
Case 4 : B2MML mapping



Example


SAP PP-PI
SAP WM
Central
ERP api
ERP connector
Enterprise bus
ISA-95
messages
MES connectors
Distributued
MES api
Any/Unknown MES / control systems

Methodology overview



1. Business Glossary

- Many « languages »
  - Each software solution has its own: « Batch » in ERP is « Lot » in MES, is SKU in warehouse system
  - People may use a terminology based on
    - A well established company wide glossary
    - the current software solution
    - An ancien sotware solution
    - An ancien plant owner
    - …
- ISA-95 brings an addiitonal one!
  - Can be an advantage: neutral language beyond possible political and personnal conflicts
  - Can be problematic is the company has established its own terminology

1. Business Glossary: an opprotunity

- Designing interface is the right time to establish a common understanding on company's meta-data
- ISA-95 is a semi-canonical standard
  - Imposes a given terminology for a limited set of terms
    - Standard structures and attributes: Production Request, Material Definition…
    - All other data have are custom extensions through properties or extension attributes
- The « Glossary » shall be built / maintained
  - Defining an appropriate definition
  - Matching the different terms with ISA-95 standard and extensions
  - can be part of a semantic meta data registration process in the concept of a company-wide MDM effort

1. Business glossary example

Business Term	Description	Range - Codes
BatchManagedIndicator	Allow the theoretical use of the component in quantity	Yes/No
ContainerWeight	Define the theoretical weight value of a container	
HasPotency	Titrisation	Yes/No
IsWeighed	The material has to be weighed	Yes/No
WeighingMode	List of authorized weighing methods	1. Net weighing 2. Double weighing 3. Forced input 4. Keyboard gross weighing 5. Lure gross weighing 6. Manual input 7. Authorization to mix different components 8. Counting weighing (capsule) 9. Pallet weighing 10.Laser weighing

2. IT applications

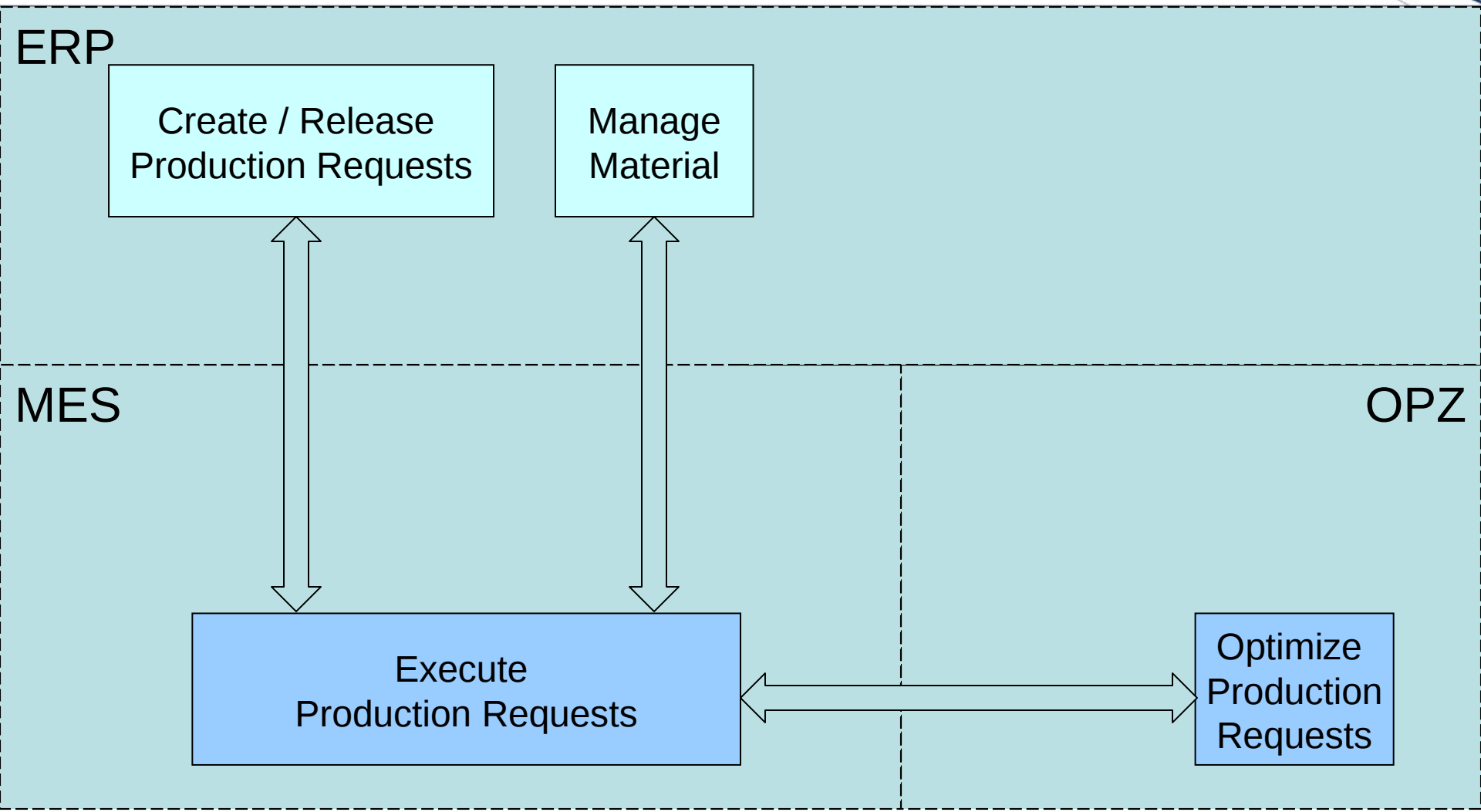
ID	Solution	Description
MES	FLEXNET	Inventory management
ERP	SAP	Production management
OPZ	Formula+	Formula optimizer

3. Business Processes

- Describe Business process workflows
  - Identify use cases involving inter-system communications
  - Describe workflows, identifies communication instances

- BP example: Process Order Optimization
  - Use case:
    - optimize the formula before executing a production order, taking into account the characteristics of raw material to be used
  - Simplified :
    - We only consider the part where interoperability is involved

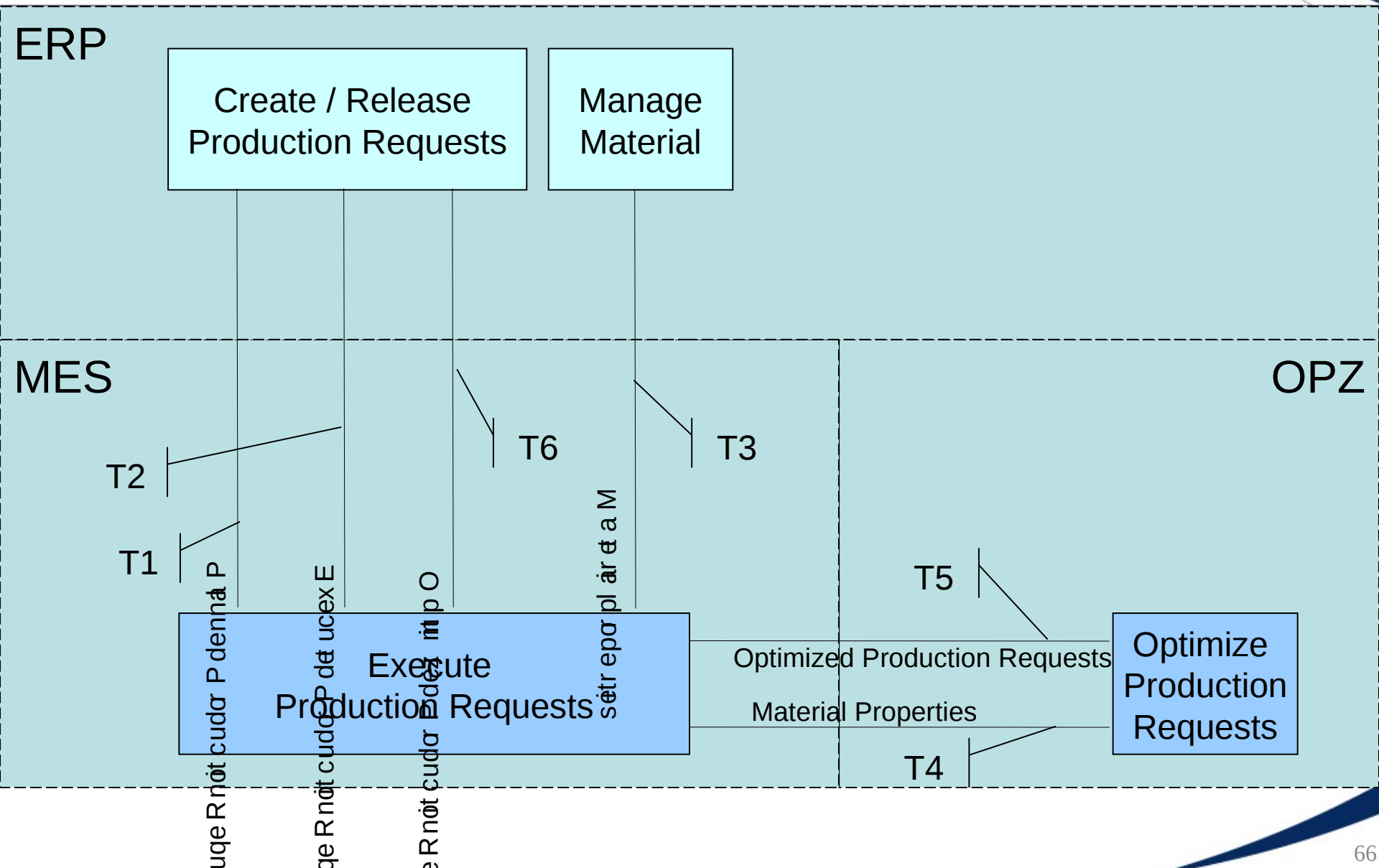
3. Business process



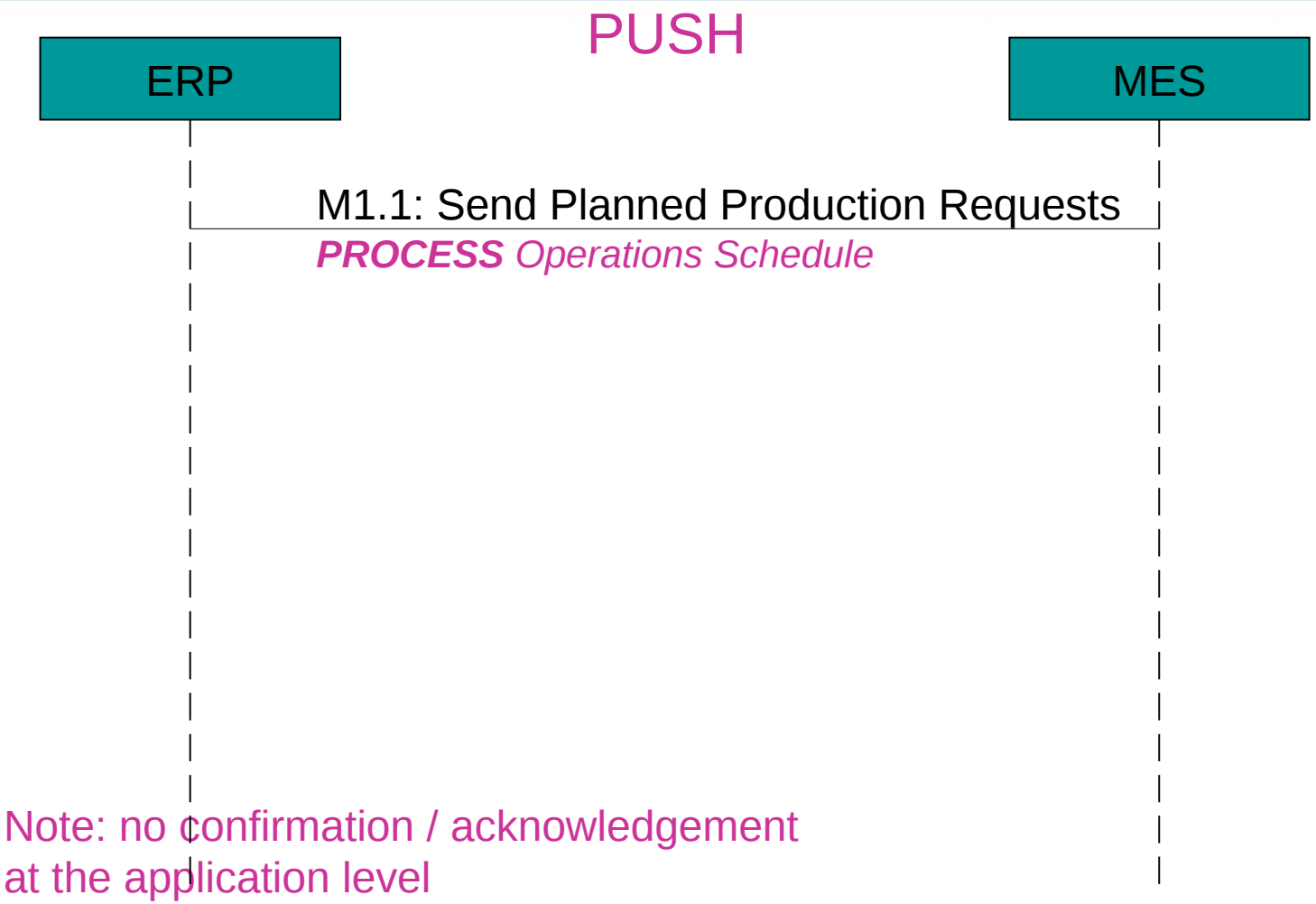
4. Transactions & message identification

- For each communication link, identify transactions
- For each transaction,
  - Decide for a transaction model (Push, Pull, Publish)
  - identify the involved messages
- For each message
  - Give et business relevant name and unique ID
  - IT application origin and destination
  - ISA-05 applicable model
  - ISA-95 part 5 verb (action to perform)
  - ISA-95 par 2/4 noun (the conveyed information)

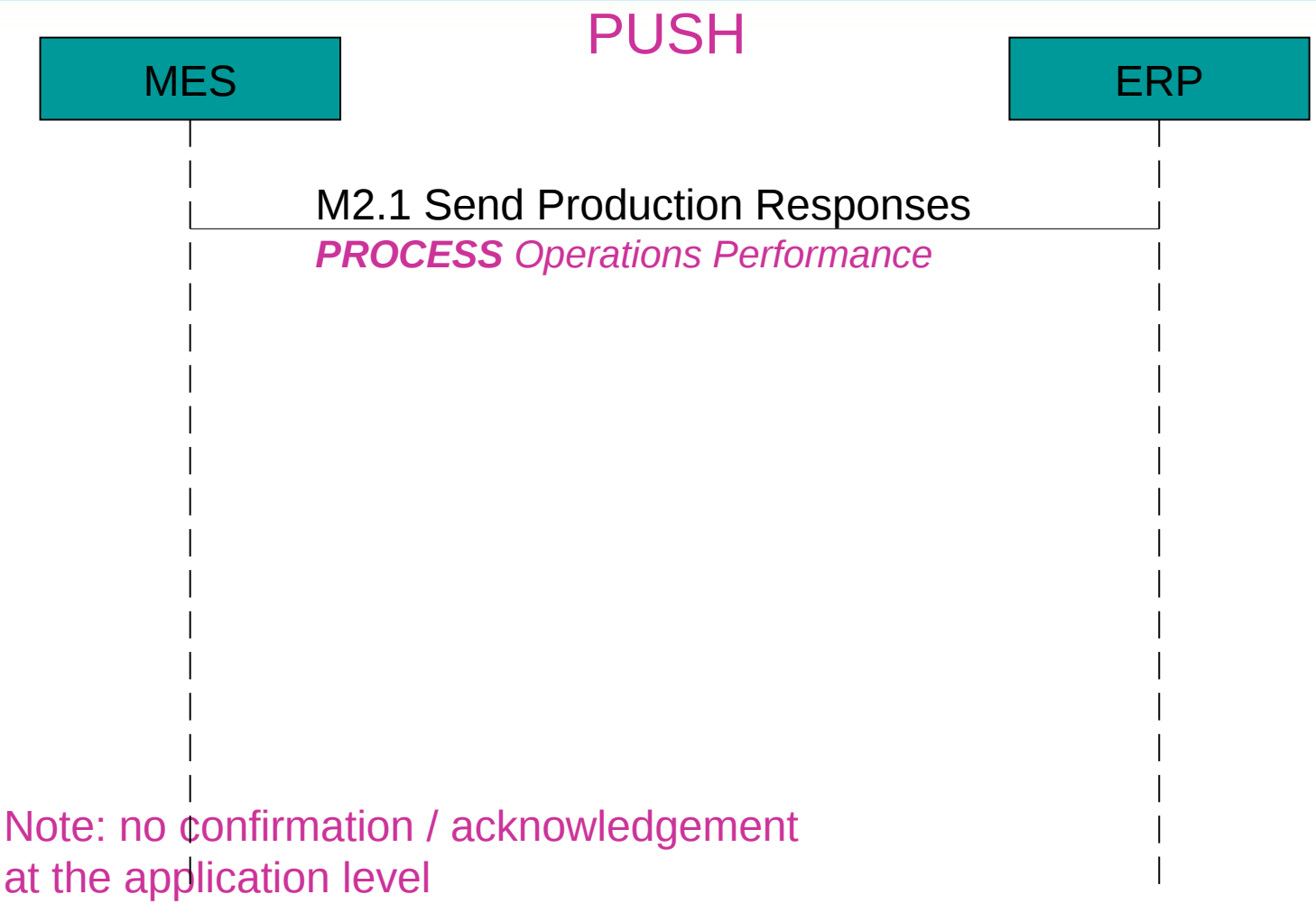
4. Transactions & message identification



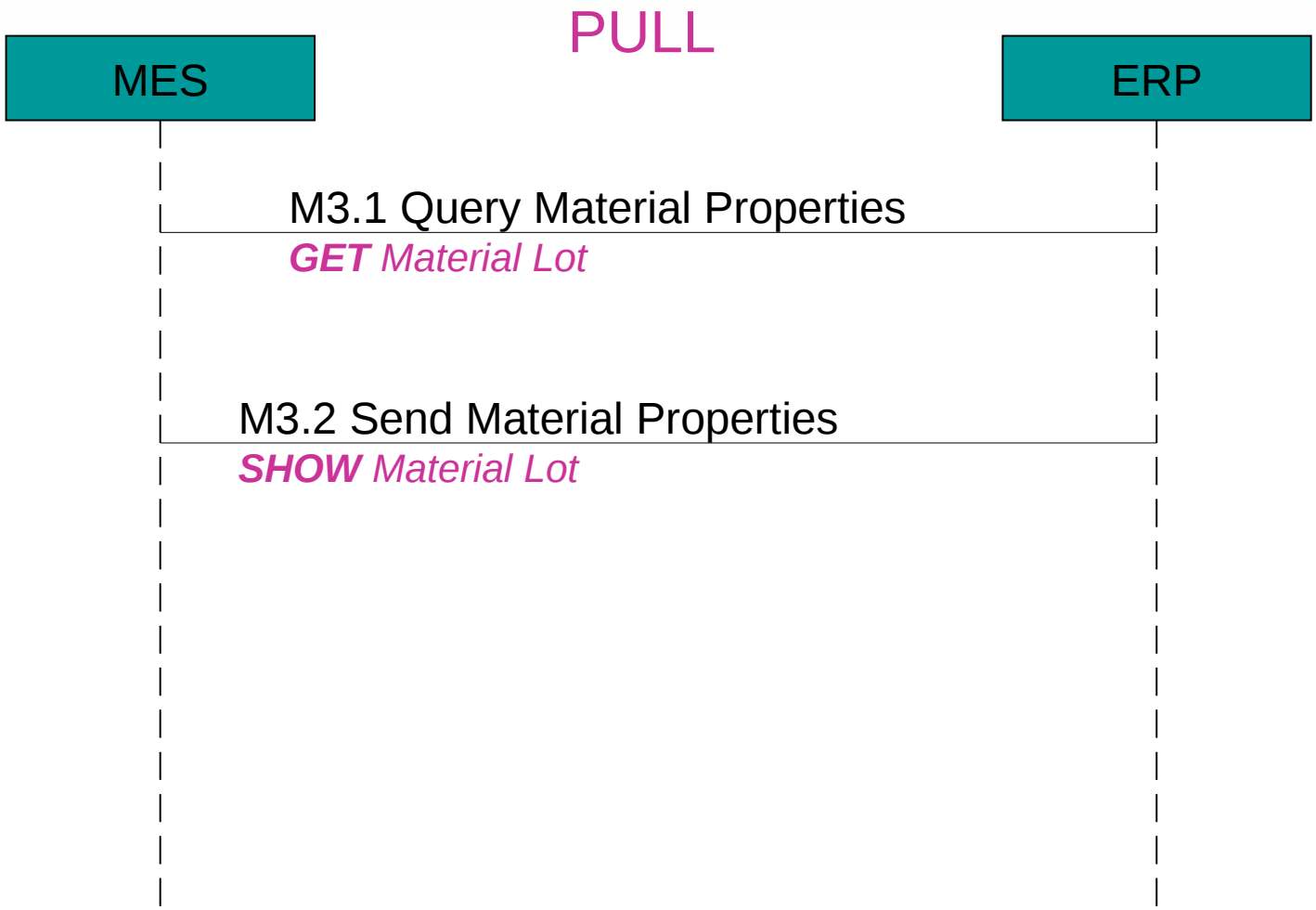
T1: Planned Production Requests ERP-> MES



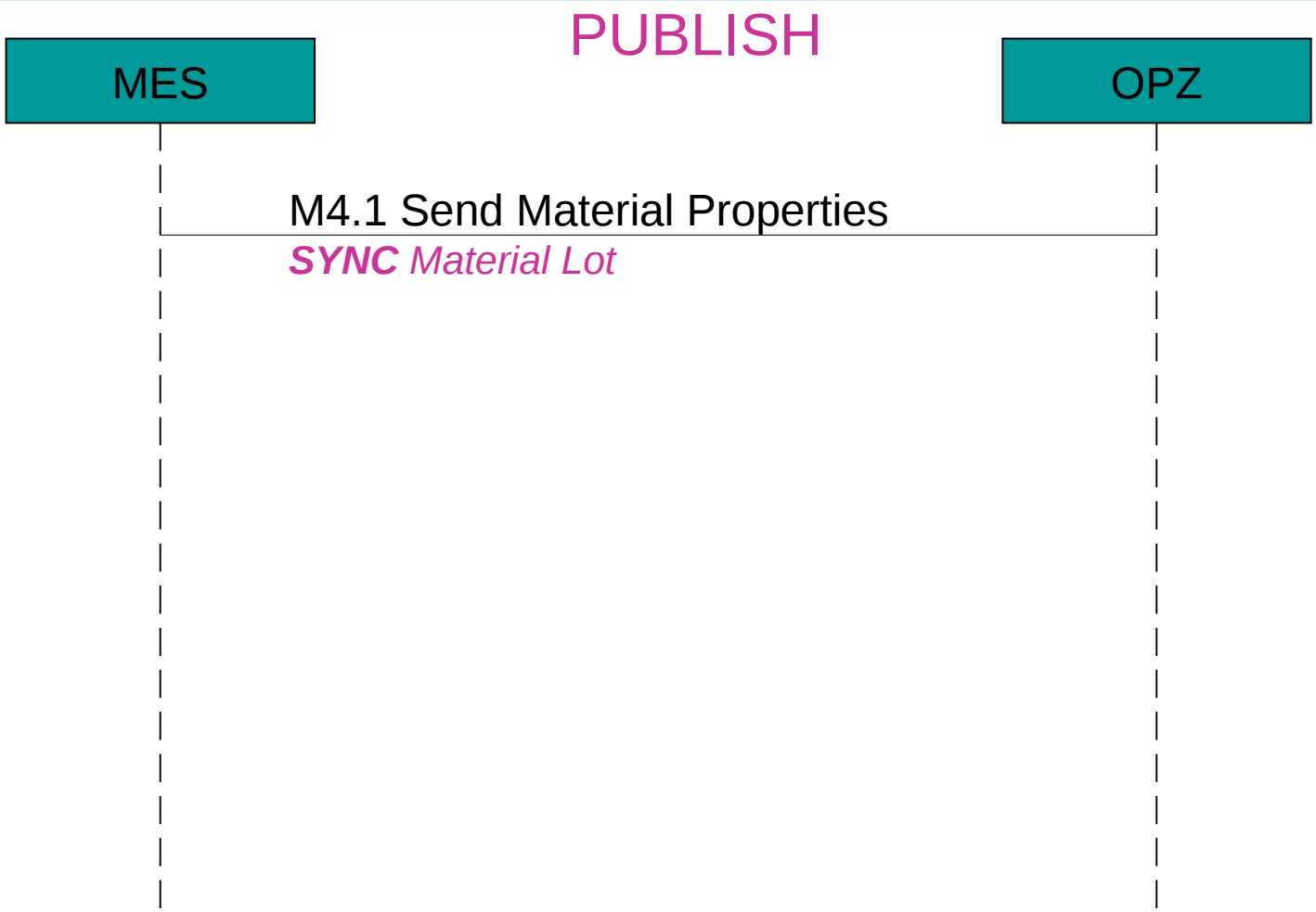
T2: Executed Production Requests MES -> ERP



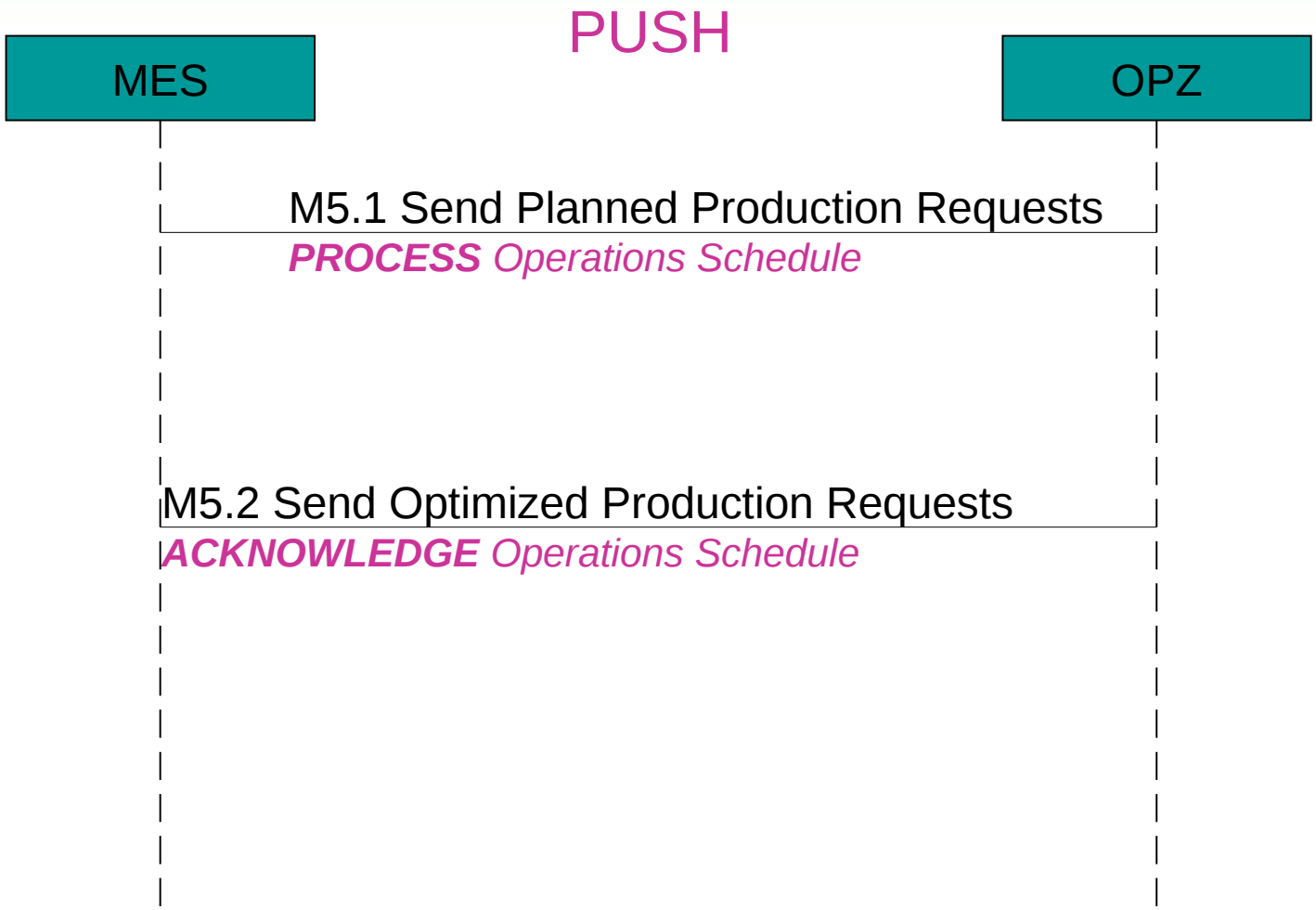
T3: Material properties ERP to MES



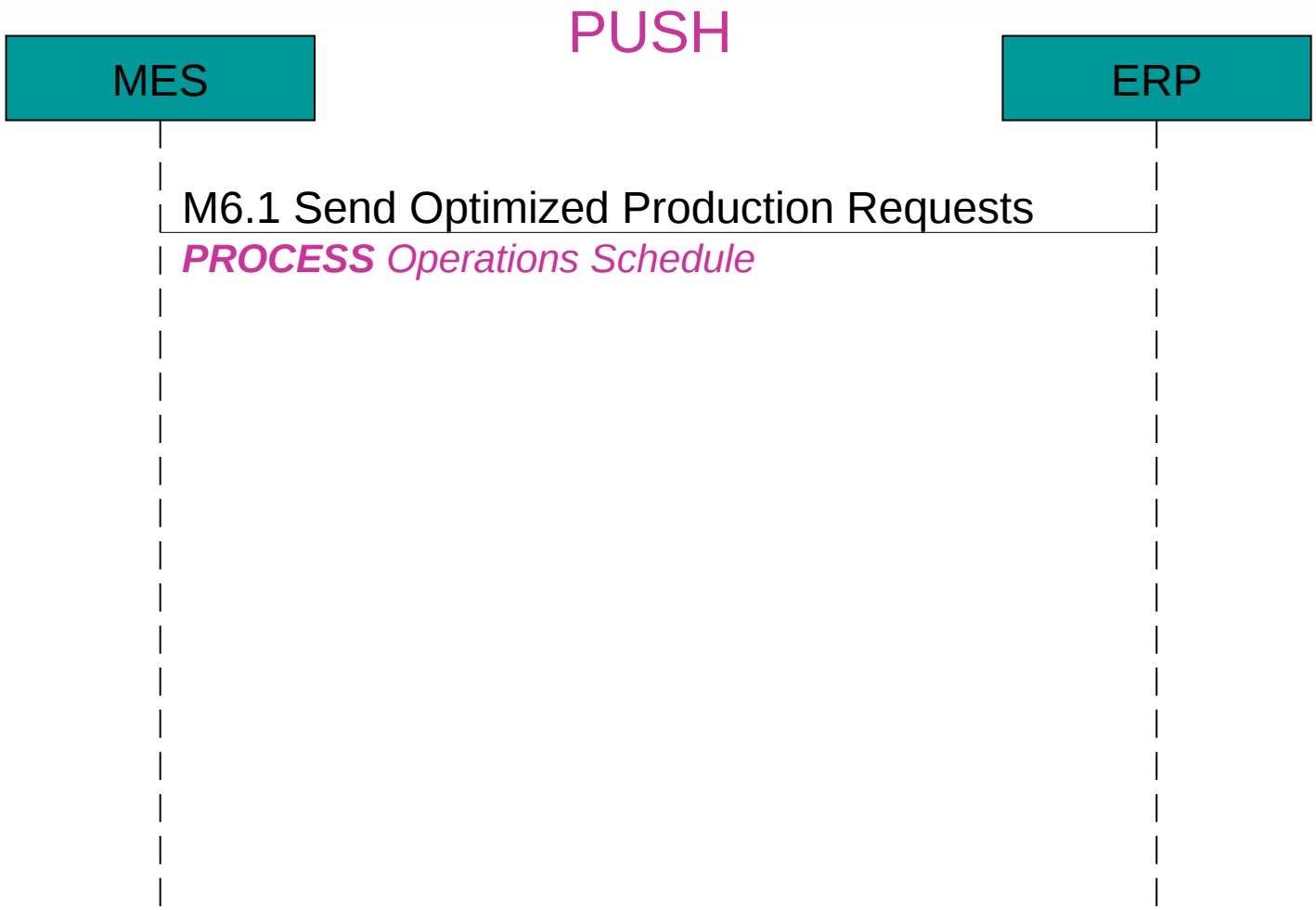
T4: Material properties MES -> Optimizer



T5: Optimized Production Requests MES <-> Optimizer



T6: Optimized Production Requests MES -> ERP



Message summary

#	Transaction	Mode	Mess. ID	Message name	ISA-95 Modèle	Verb	Noun	Origin	Dest.
T1	Planned Production Requests	PUSH	M1.1	Send Planned Production Requests	Operations Schedule	PROCESS	Operations Schedule	ERP	MES
T2	Executed Production Requests	PUSH	M2.1	Send Production Responses	Operations Performance	PROCESS	Operations Performance	MES	ERP
T3	Material Properties (MES)	PULL	M3.1	Query Material Properties	Material	GET	Material lot	MES	ERP
			M.3.2	Send Material Properties	Material	SHOW	Material Lot	ERP	MES
T4	Material Properties (OPZ)	PUBLISH	M.4.1	Send Material Properties	Mateiral	SYNC	Material Lot	MES	OPZ
T5	Optimized Production Requests	PUSH	M.5.1	Send Planned Production Requests	Operations Schedule	PROCESS	Operations Schedule	MES	OPZ
			M.5.2	Send Optimized Production Requests	Operations Schedule	Acknowledge	Operations Schedule	OPZ	MES
T6	Optimized Production Requests	PUSH	M.6.1	Send Optimized Production Requests	Operations Schedule	PROCESS	Operations Schedule	MES	ERP

5. Message definition

- Messages data mapping
  - Business data correspond to ISA-95 data
    - Existing attributes in the model tree structure
    - Custom attributes extending the appropriate objetcts
  - AND applications data

  As a consequence, a message row relates
  - ISA-95 concept (ex : SegmentRequirement.ID)
  - Business data (ex : Process Order)
  - SAP data (ex : Y_MES_H PPPI_CONTROL_RECIPE)
  - MES data (ex : PO_ID)
- Each message mapping is an independent sub-project
  - Interface projects can be split at will : per business process, per system..

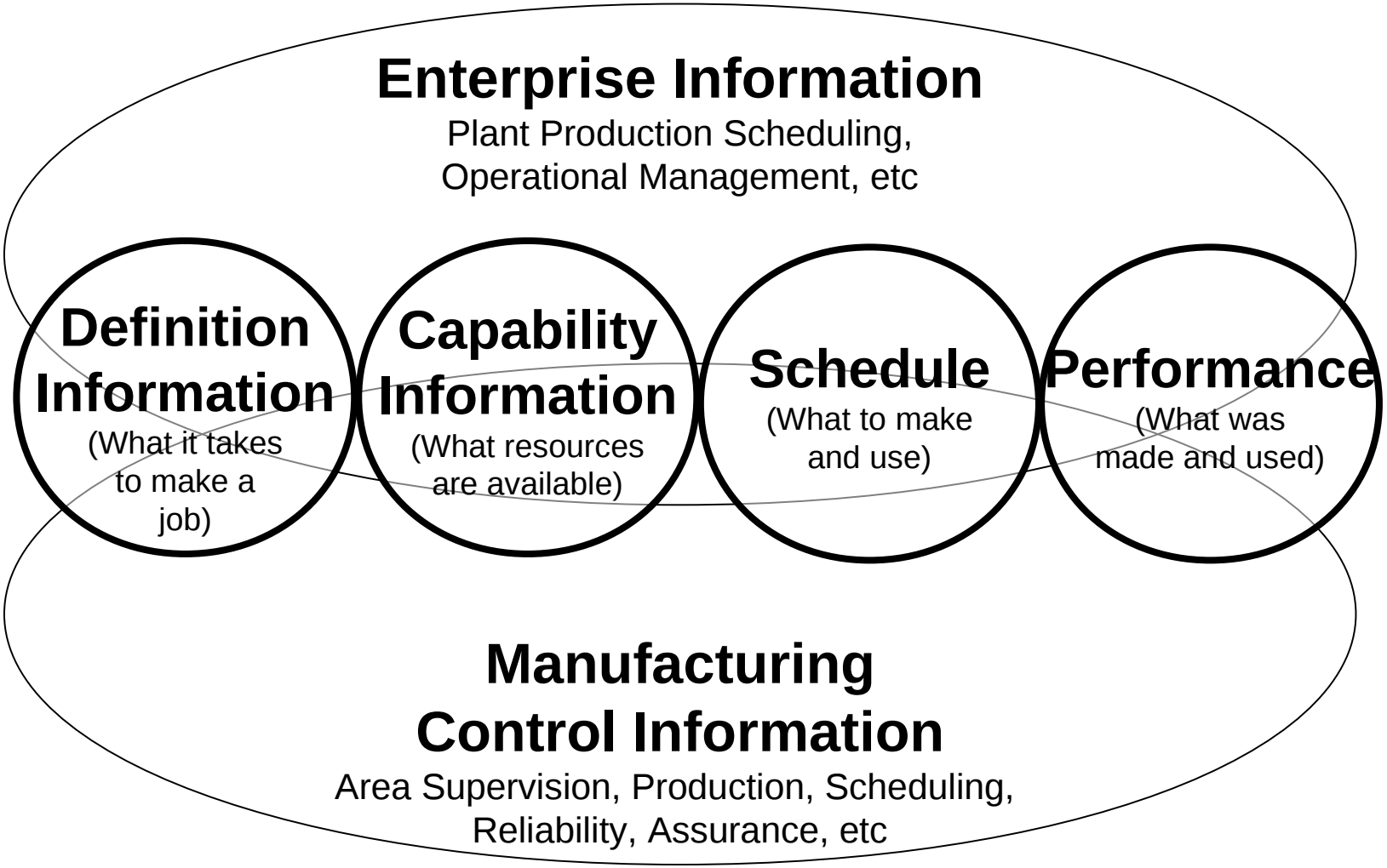
Feuille Microsoft
fice Excel 97-20

Note : The presented example is not included in the conference material (customer information)

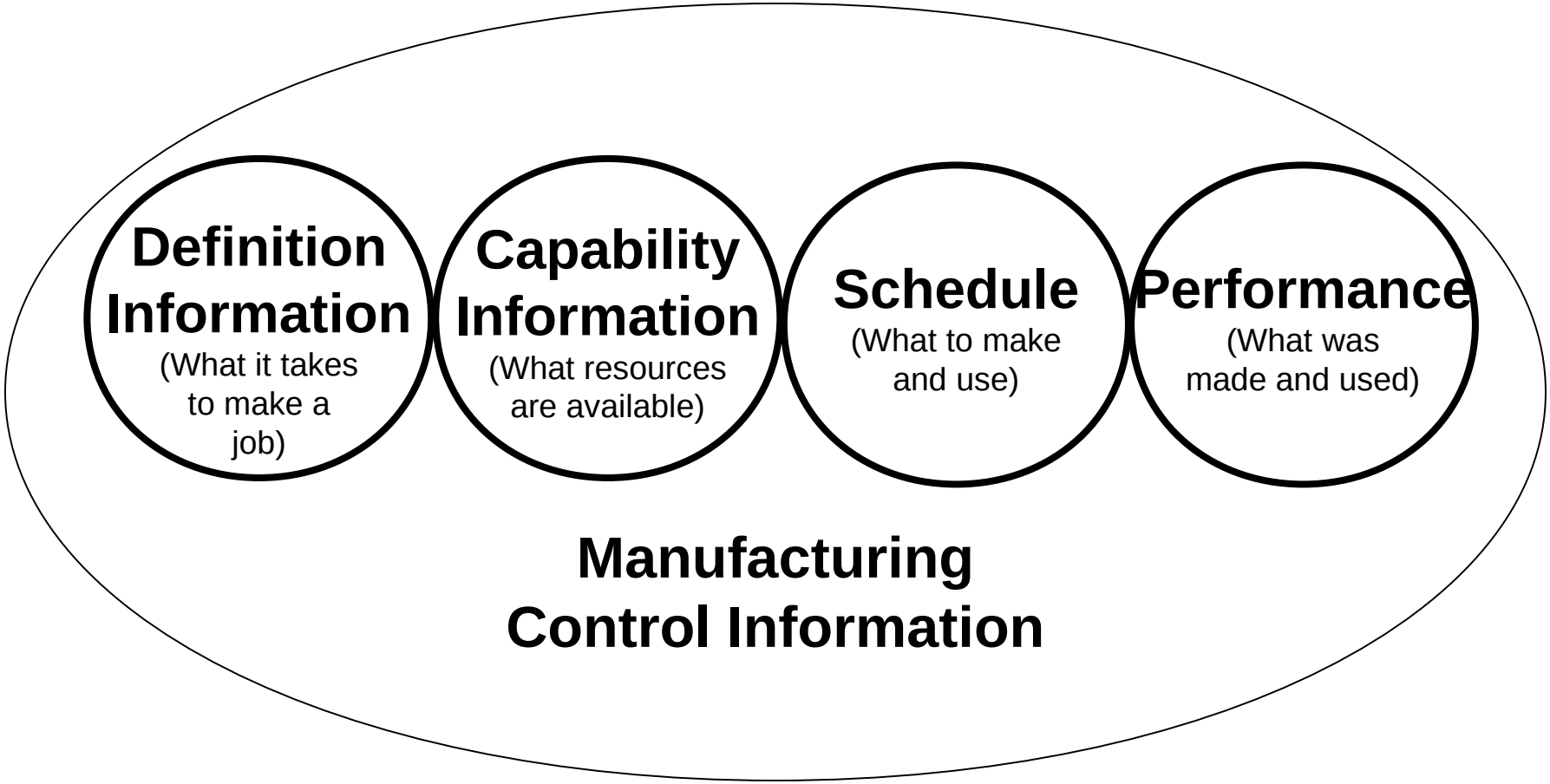
Agenda

- Example
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

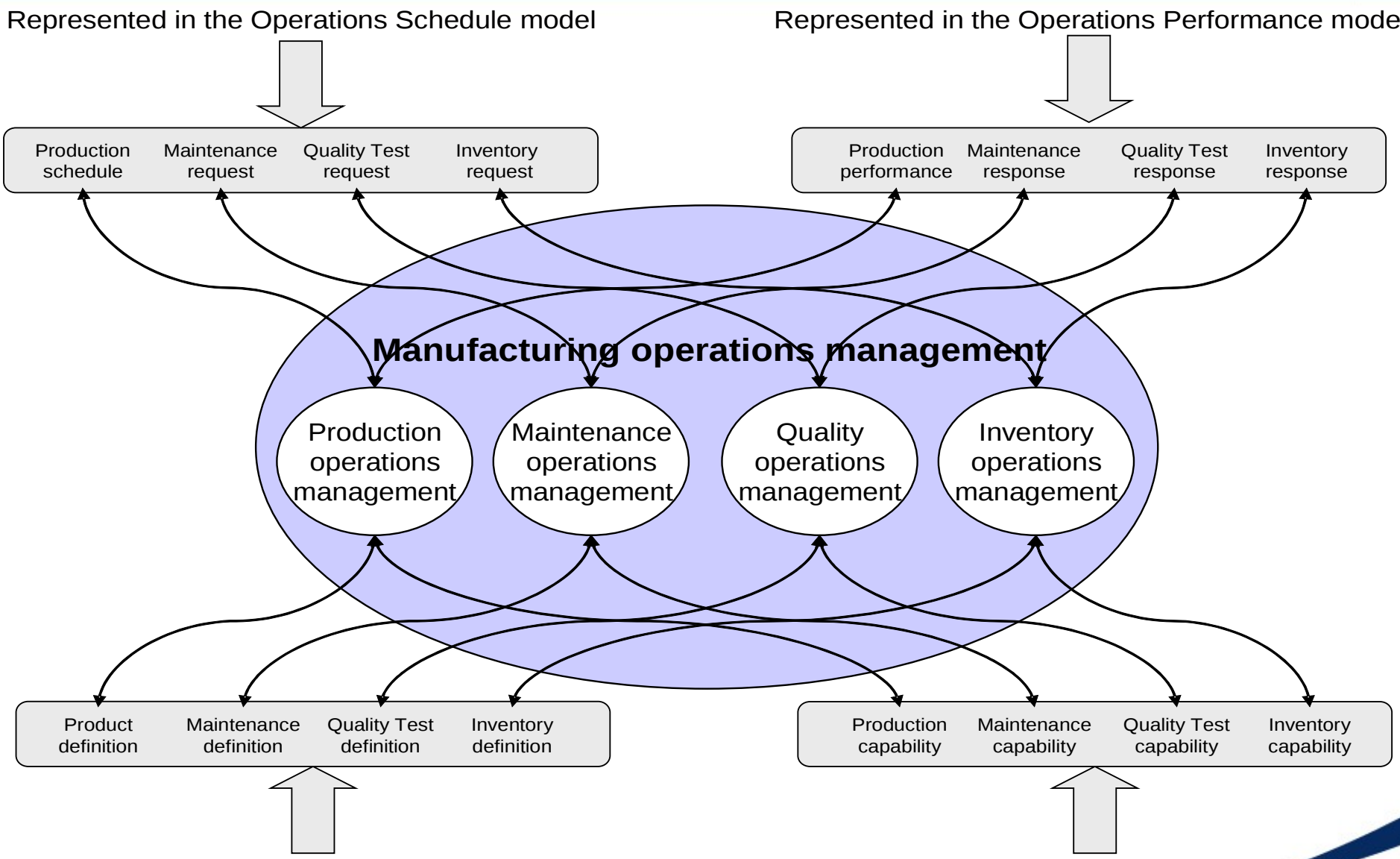
5. Categories of information / part 2



5. Categories of information / part 4



Extended interoperability domains



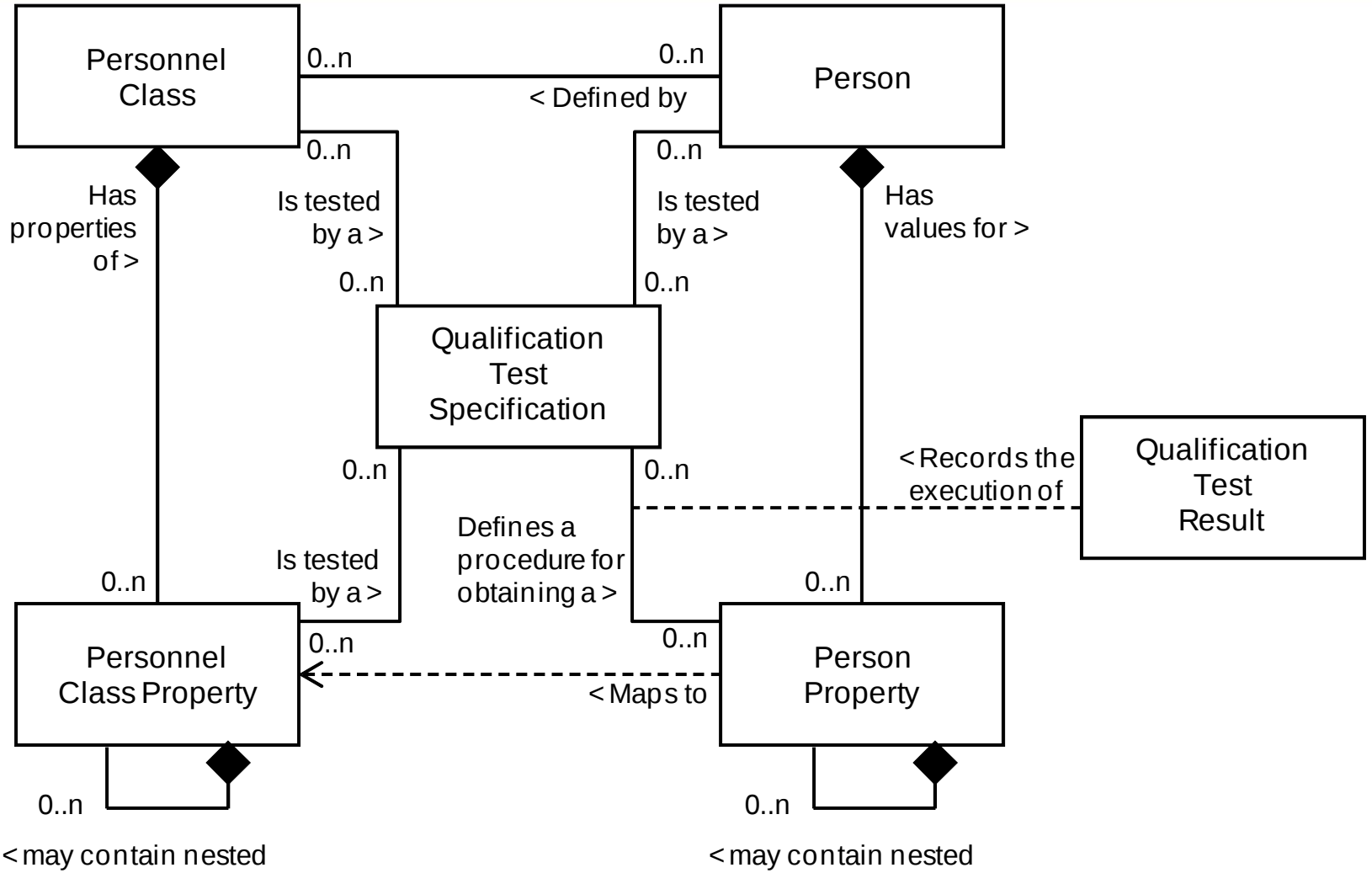
ISA-95 part 2/4 models

Category	ISA-95.02	ISA-95.04
Resource	Personnel	
	Role based equipment, Physical asset, physical model,	
	Material	
		Resource relationship network
Poential Knowledge	Process segment	
	Operations definition	Work definition
Operations / Kinetic knowledge	Operations schedule	Work schedule
	Operations performance	Work performance
	Operations capability	Work capability
	Work Alert	

Personnel (part 2)

- Includes
  - persons and personnel classes (categories)
  - properties as Skills and capabilities of individuals (persons) and groups (classes)
  - Qualification Tests associated to properties
  - Results associated to property, individual and test

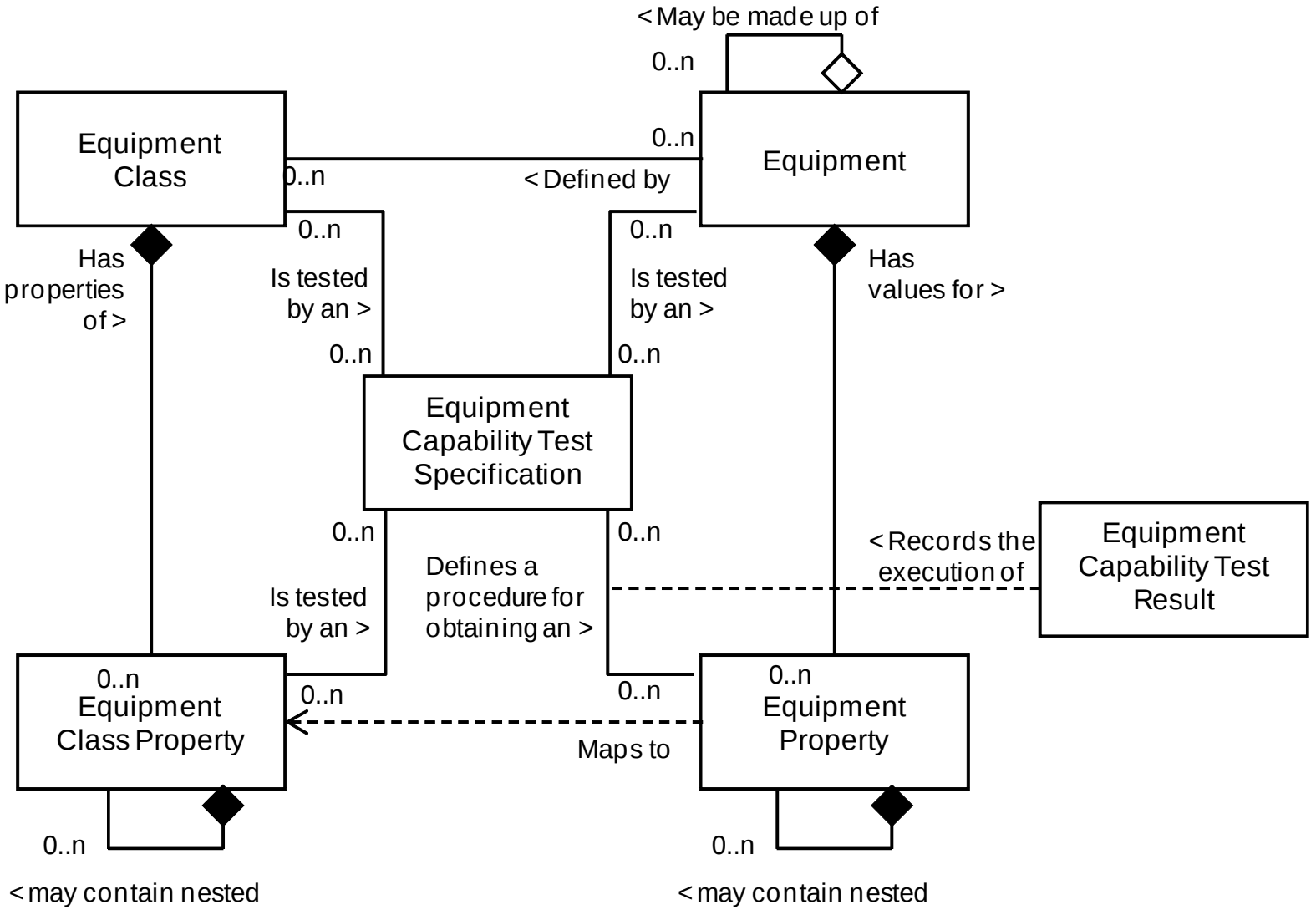
Personnel (part 2)



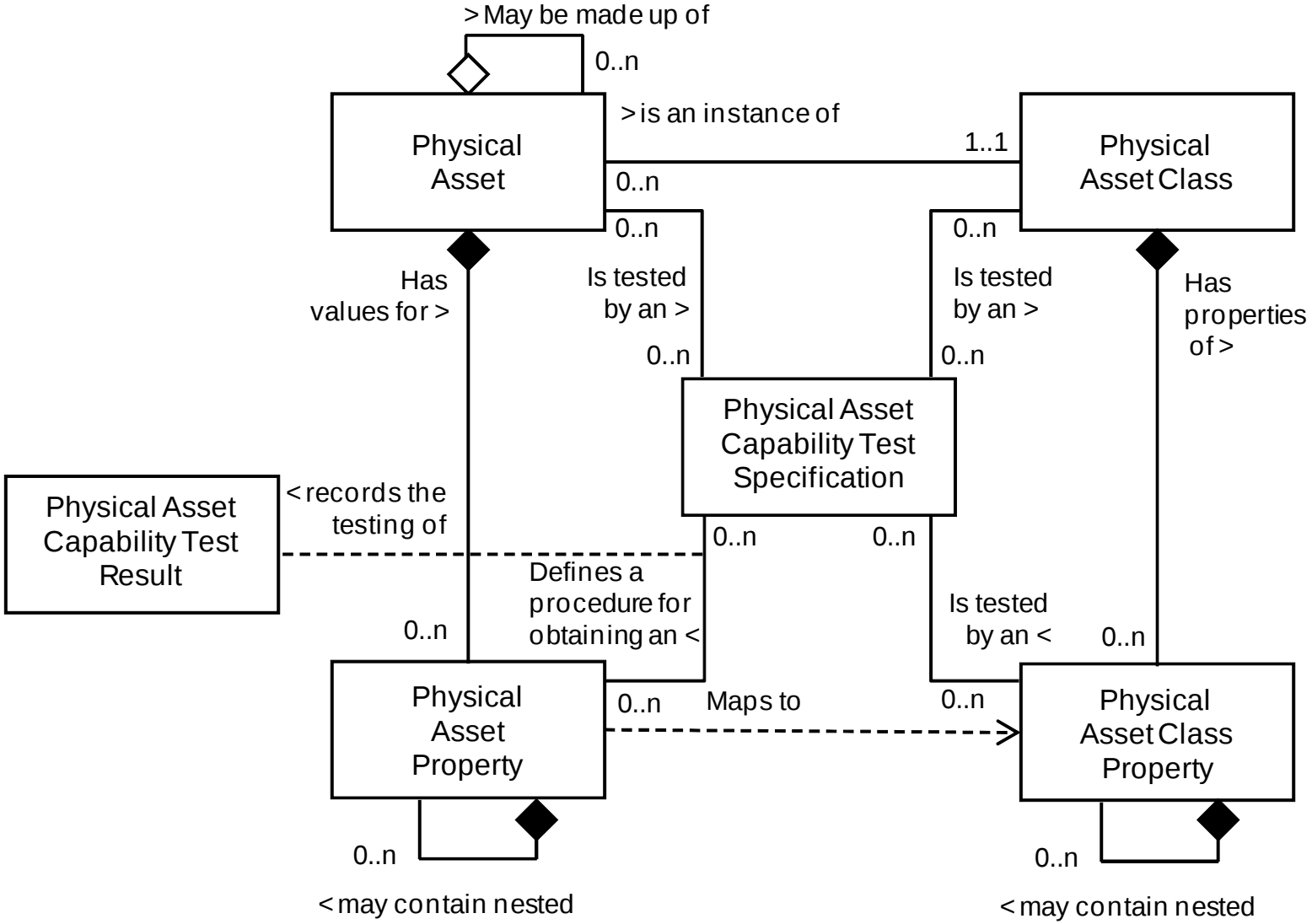
Equipment (part 2)

- Split in 2 view points
  - Role based equipment (that participates in a segment activity as a functional entity)
  - Physical Asset (that identifies a given specific equipment regardless its current function / status)
- Includes
  - equipment and equipment classes (type of equipment)
  - properties as characteristics / capabilities of equipment / equipment classes
  - Capability Tests associated to properties
  - Results associated to property, equipment and test

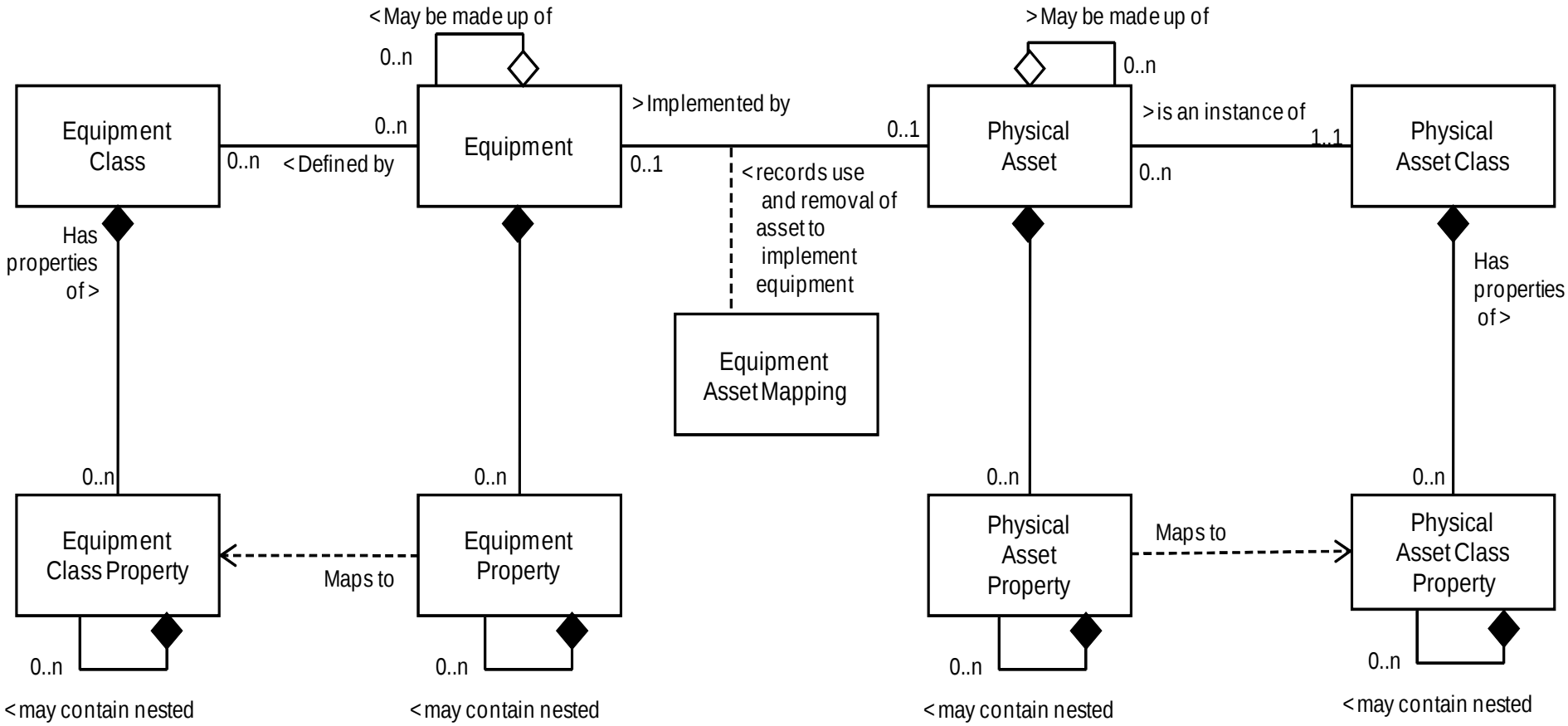
Role based equipment (part 2)



Physical asset (part 2)



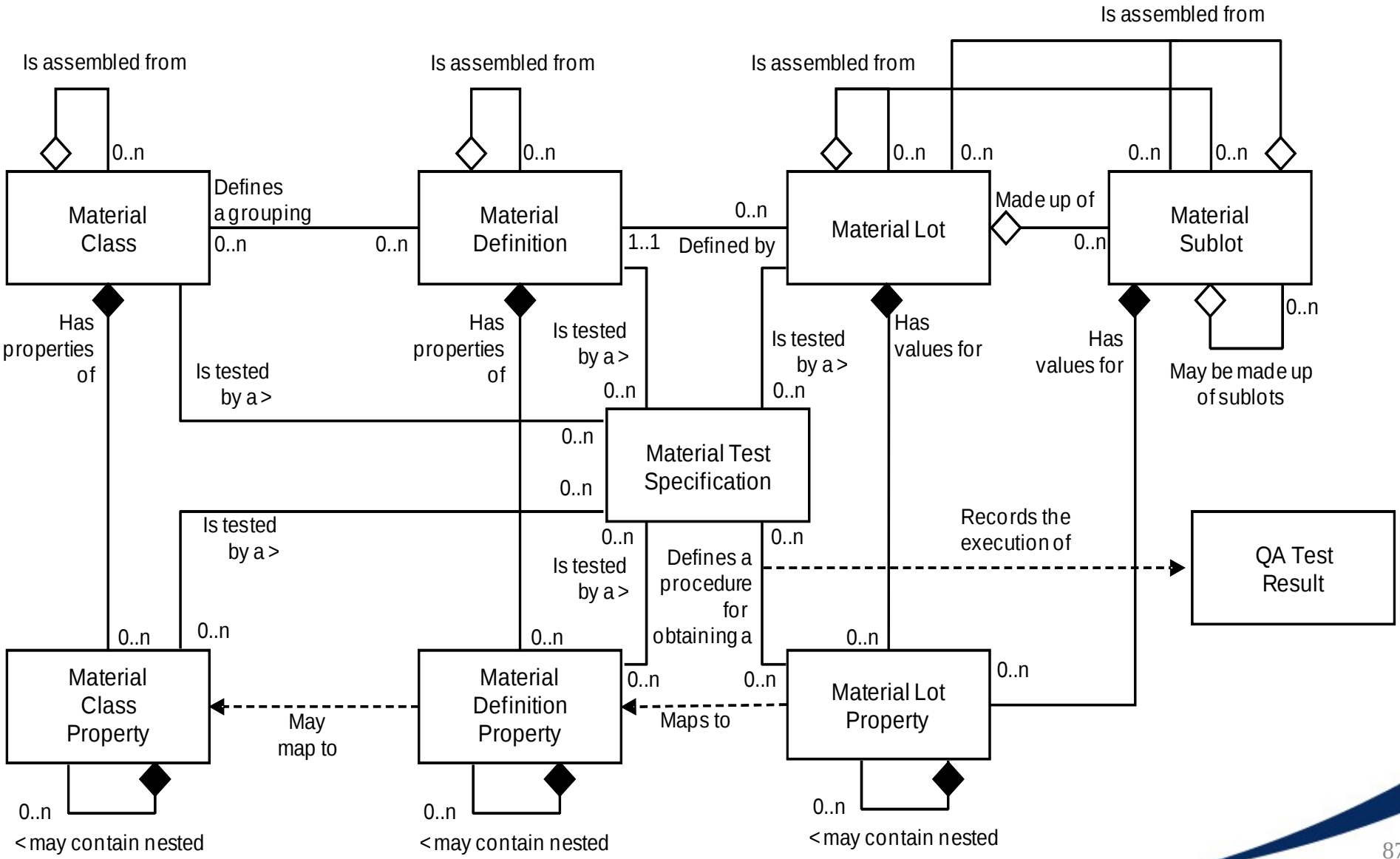
Role based equipment / physical asset relationship (part 2)



Material model (part 2)

- Includes
  - material definitions (article id) and material classes (categories of material)
  - Material Lots and Sublots with location information
  - Properties as characteristics of material definitions, classes, lots, sublots
  - Material Tests associated to properties
  - Results associated to property, material lot/sublot and test

Material model (part 2)

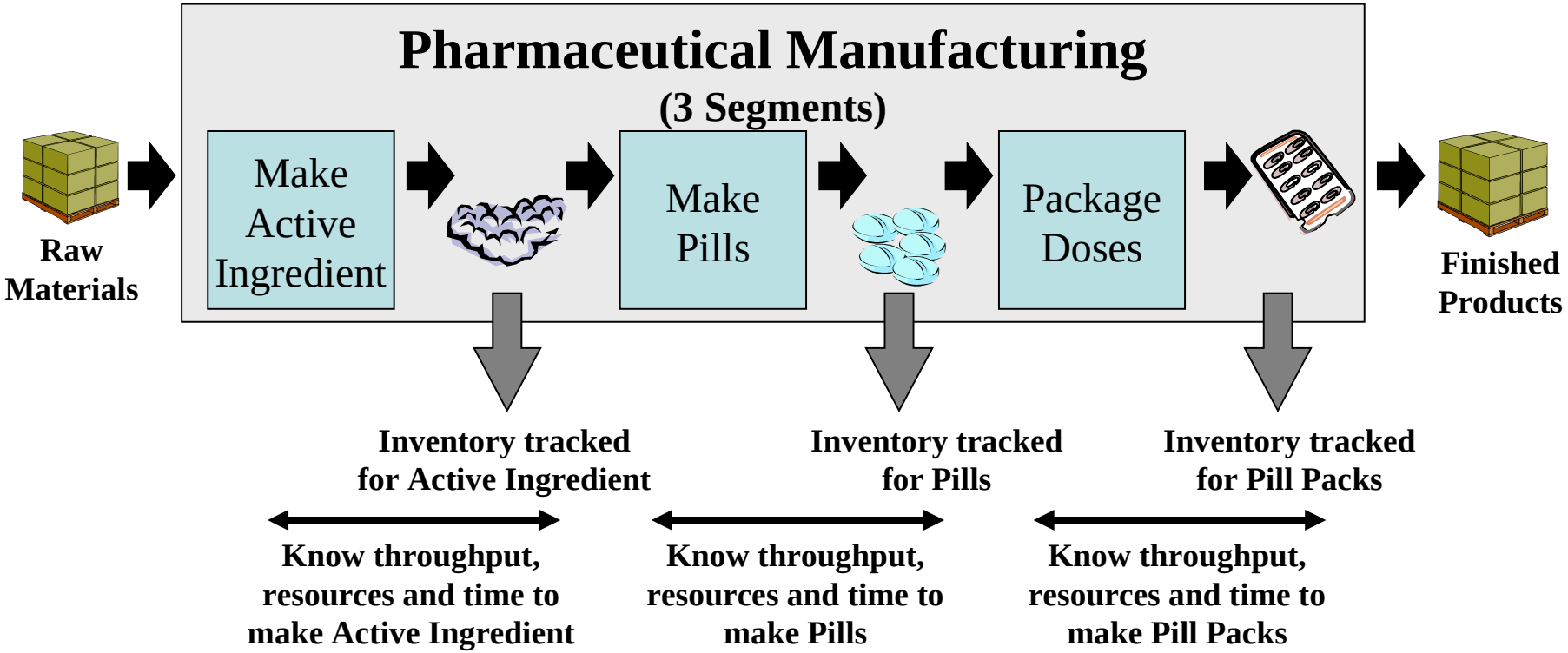


Process segment (part 2)

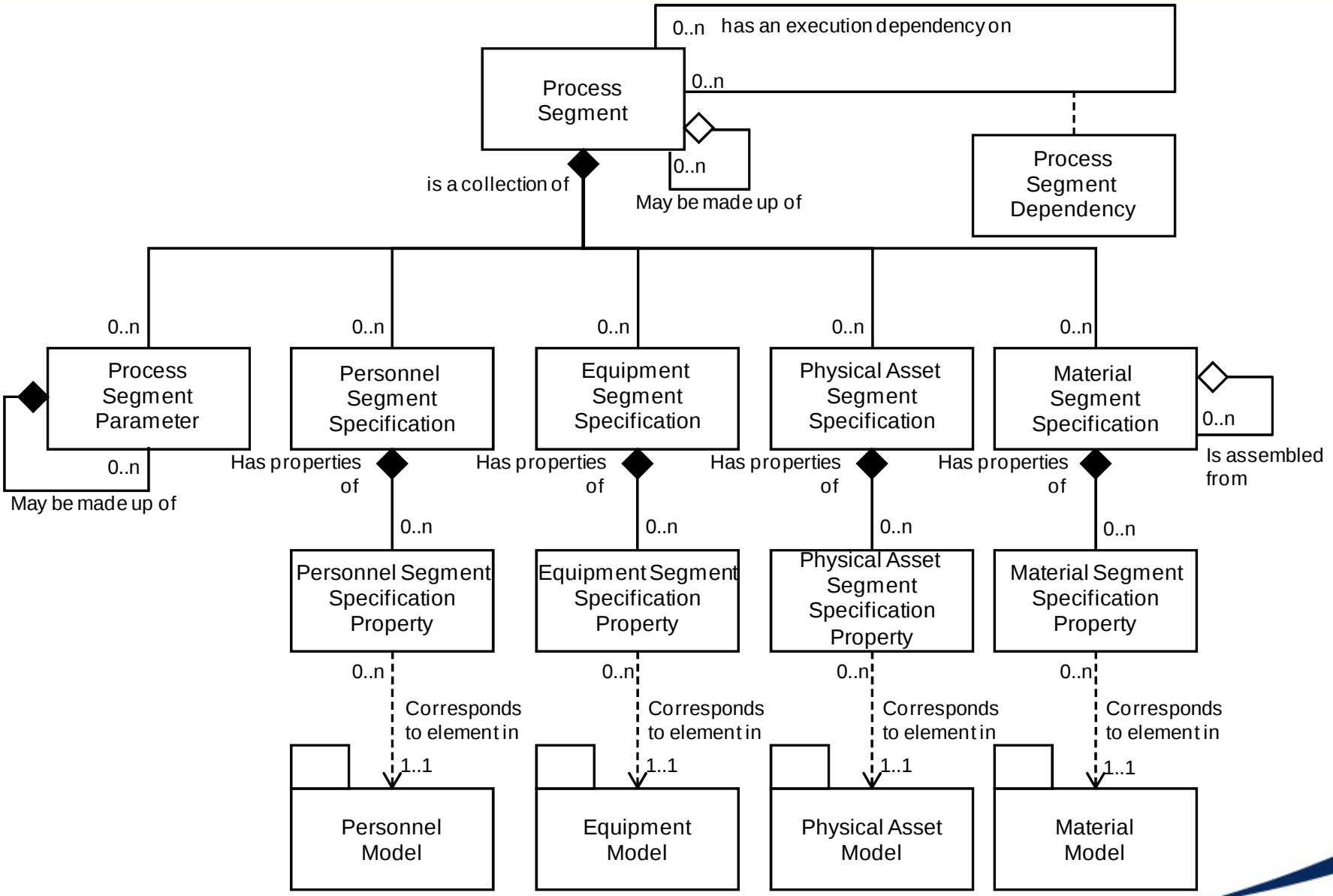
- A process segment:
  - the process view for the business system to control material, labor, resource usage, cost, and quality in order to control the production
  - can be more or less detailed and self contained providing a “telescopic” view of manufacturing capabilities of a given facility
- Also called:
  - Process stages, process operations, Unit operations, Assembly steps and assembly actions
- The model Defines Capability, Parameters & Resources used by the Segment (Personnel, Equipment & Materials)
- The Segment pattern appears in all subsequent models

Process segment (part 2)

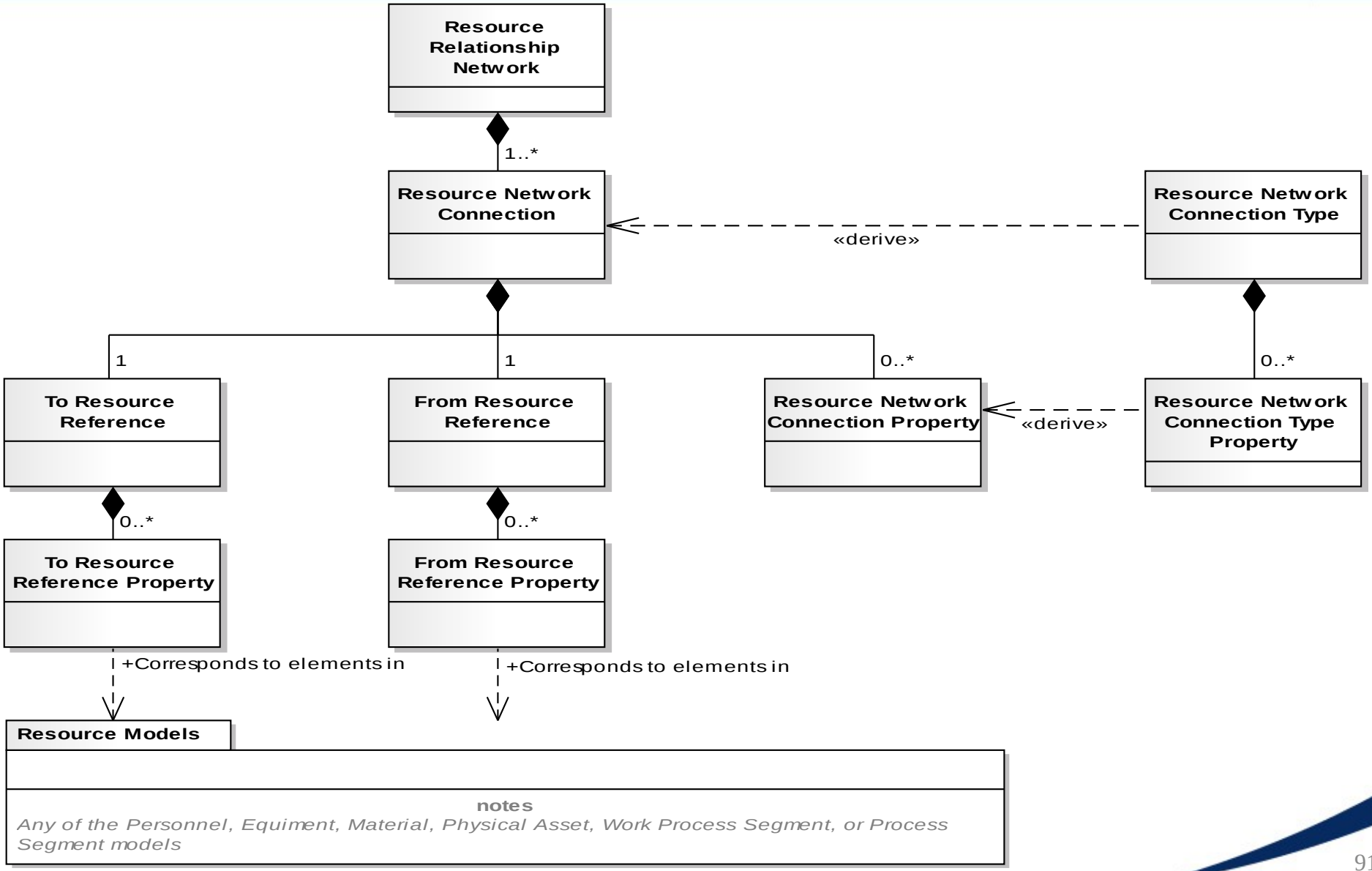
- Business view of production



Process segment (part 2)



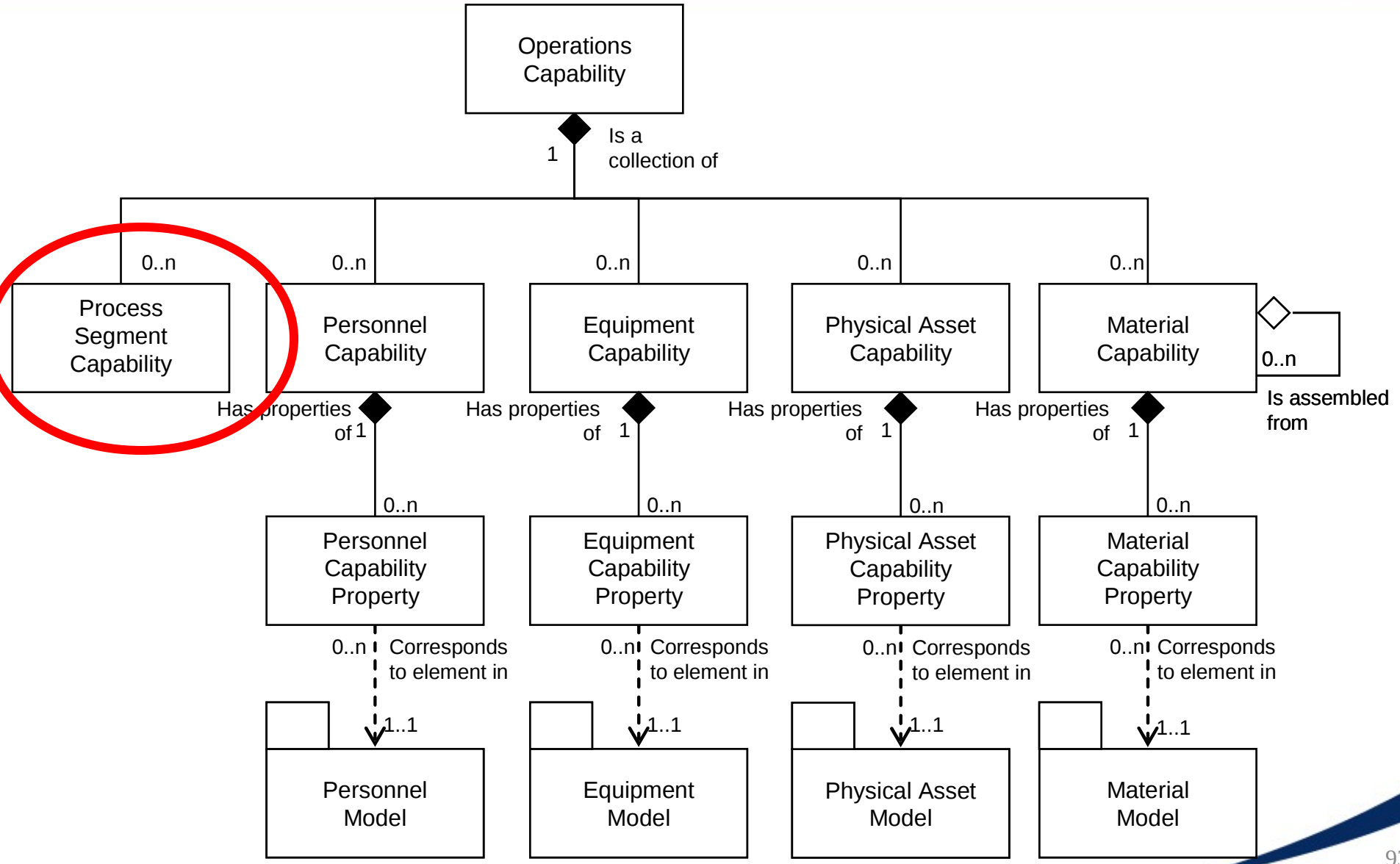
Resource relationship network (part 4)



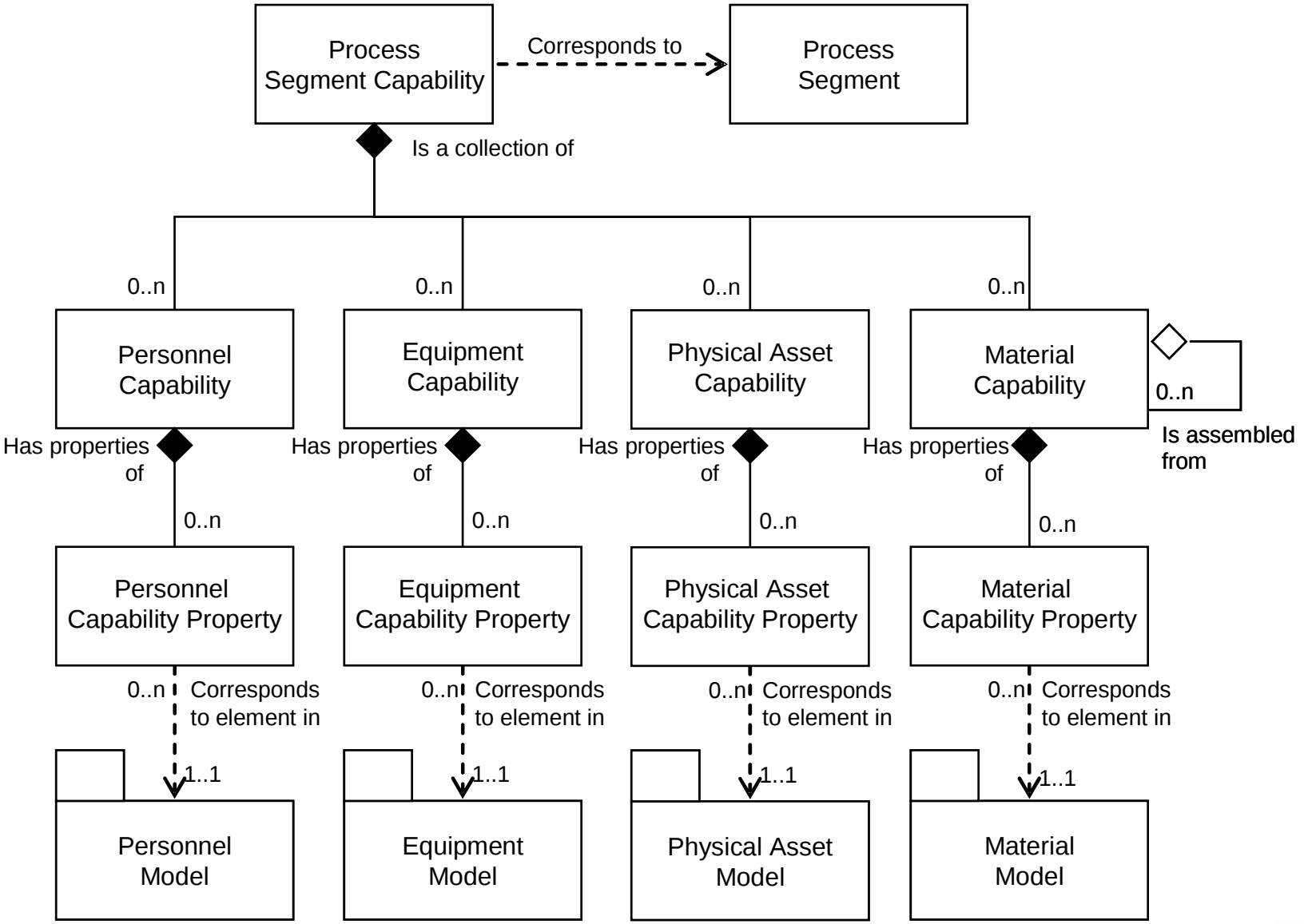
Capability

- Uniquely define the production capability for a specific element of the equipment model
  - Given for specific resources as well as segments
- Provide a description of - or other information about the production capability
- Provide current state of the capability (available, committed, or unattainable)
- Define a location for the capability
- Define the physical level of the capability (Enterprise, Site, Area, Process Cell…)
- Define a Start Time and End Time that defines the lifecycle time for the capability
- Document the publish date for when the capability was published or generated

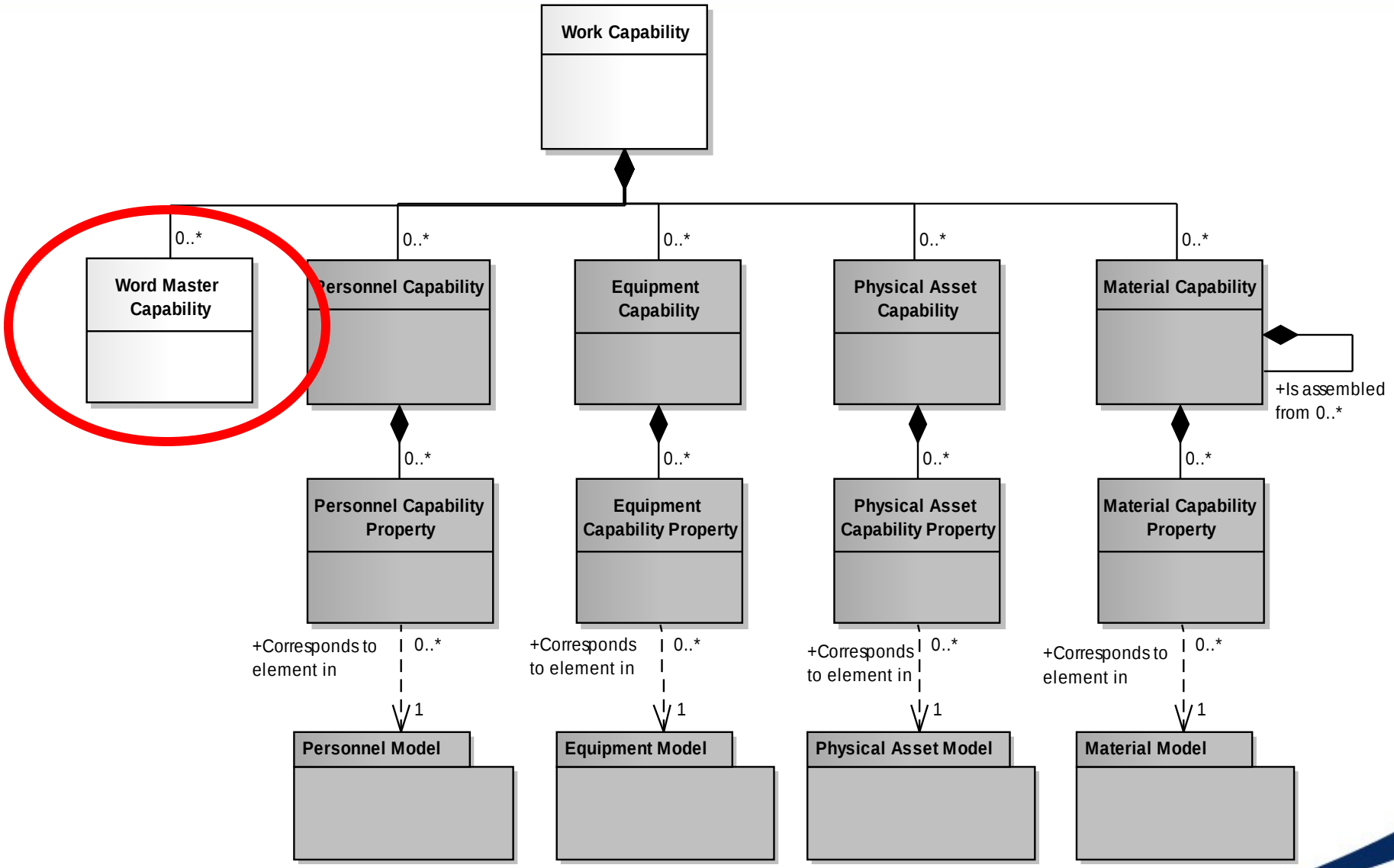
Operations capability (part 2)



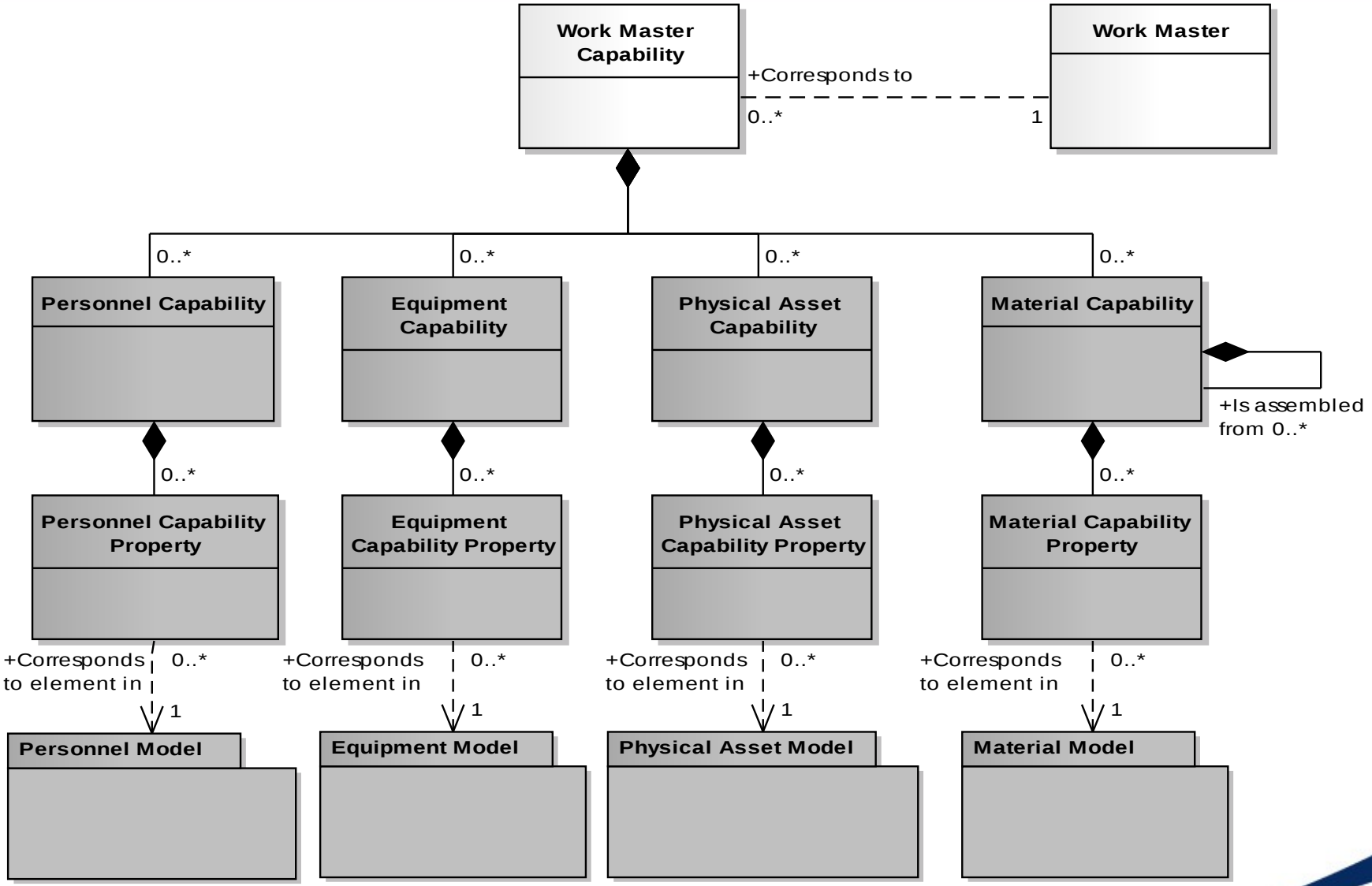
Process segment capability (part 2)



Work capability (part 4)



Work Master capability (part 4)

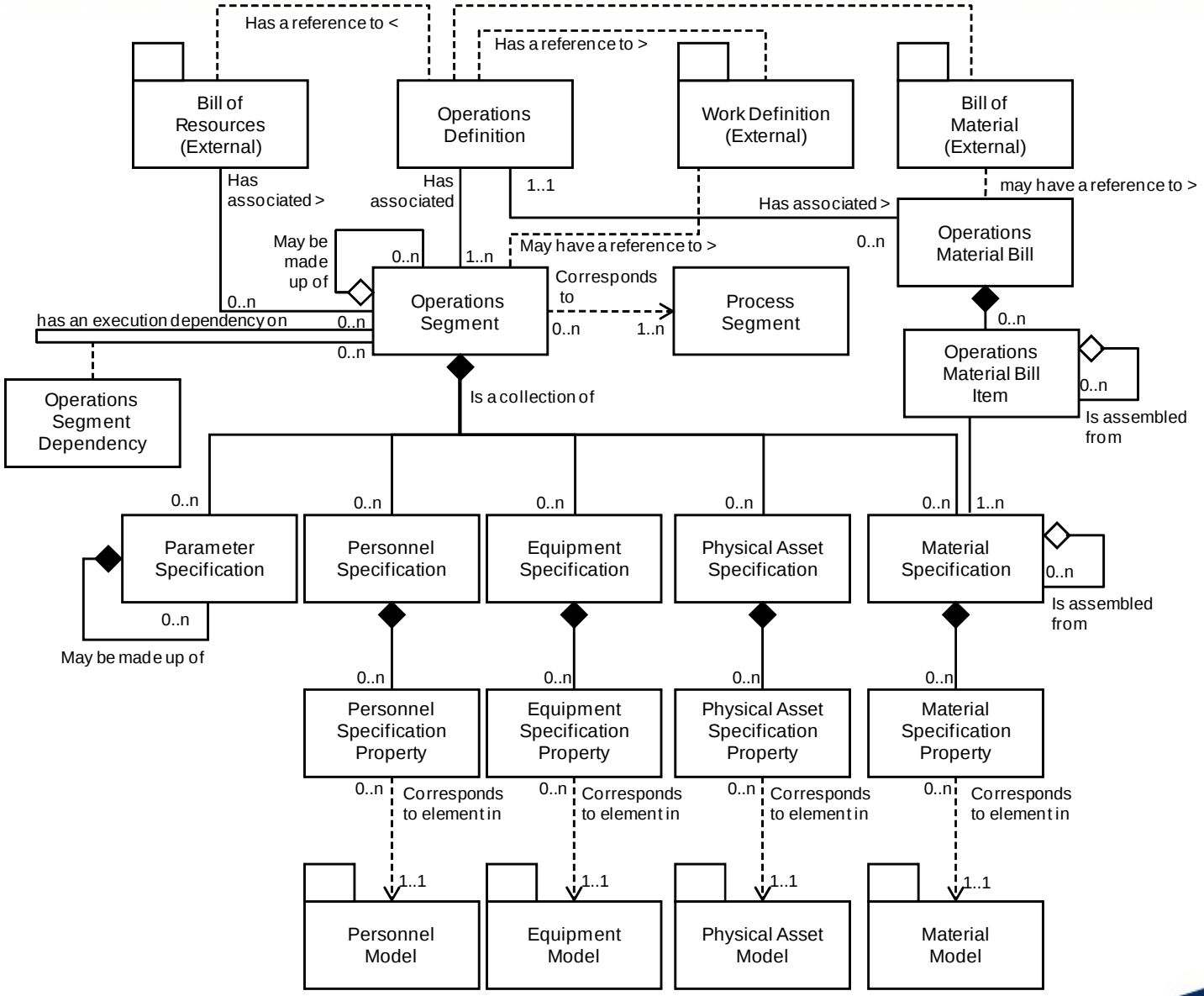


Definition

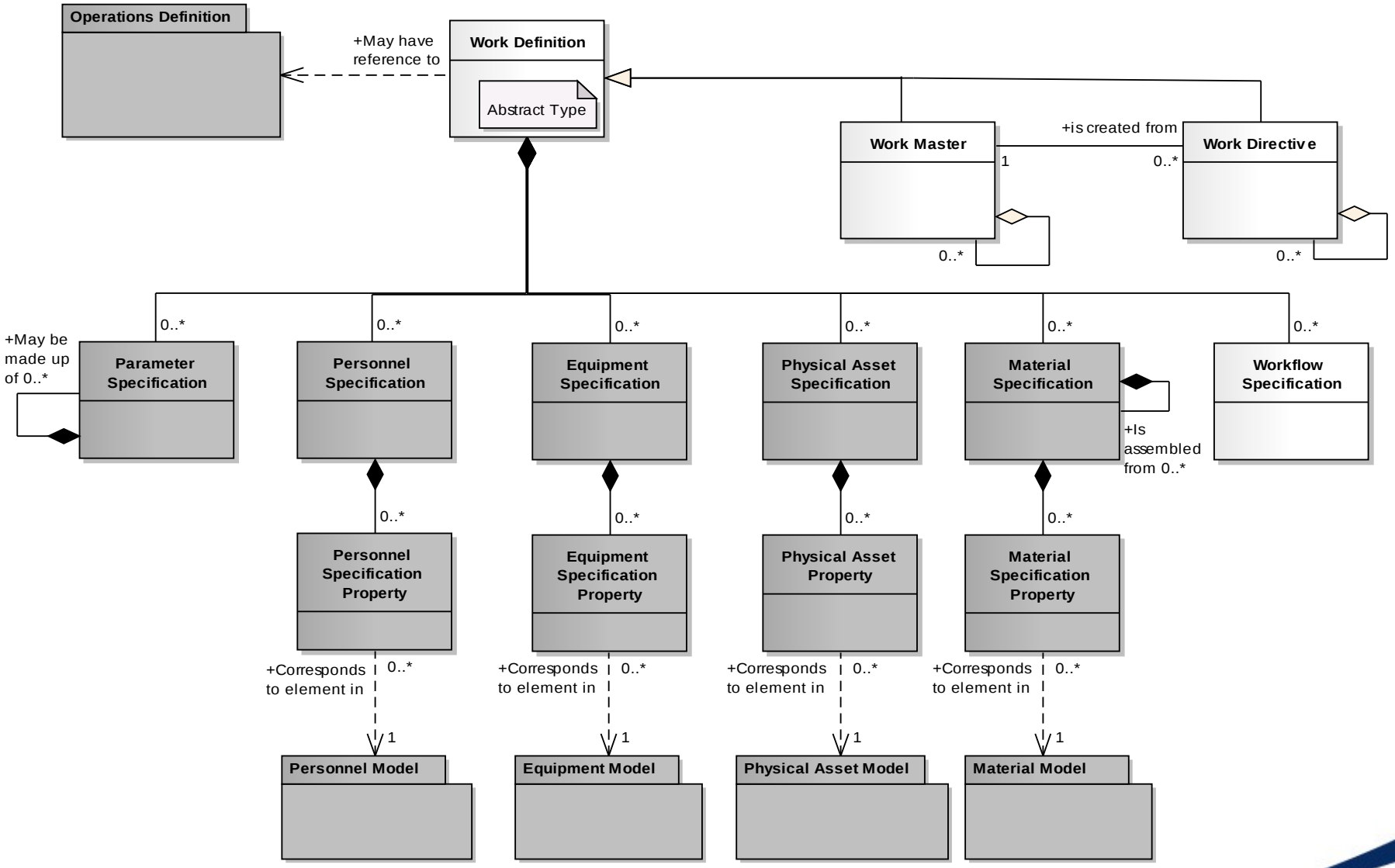
- A definition specifies the resources required to perform a specified operation such as making a product, maintaining an equipment, teaching an operator, executing a quality analysis or moving materials.
  - Defines a sequence of “Operations segments”
- It does not describes how to perform this work in detail, though this information can be handled as
  - general, site or master recipe (IEC 61512-1 and ANSI/ISA-S88.01-1995 definition),
  - standard operating procedure (SOP),
  - standard operating conditions (SOC),

  And attached to the Operations definition and its segments

Operations definition (part 2)



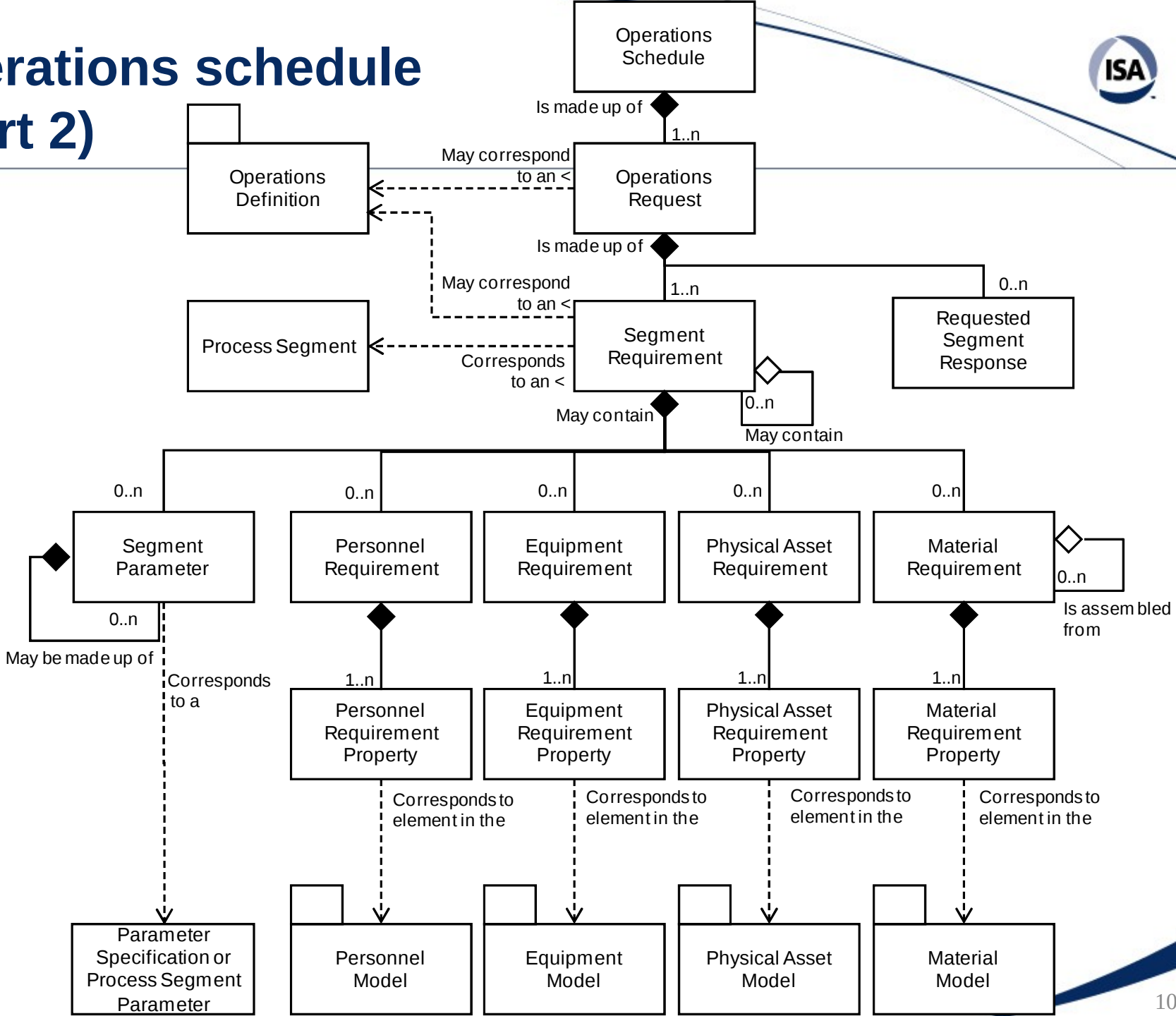
Work definition (part 4)



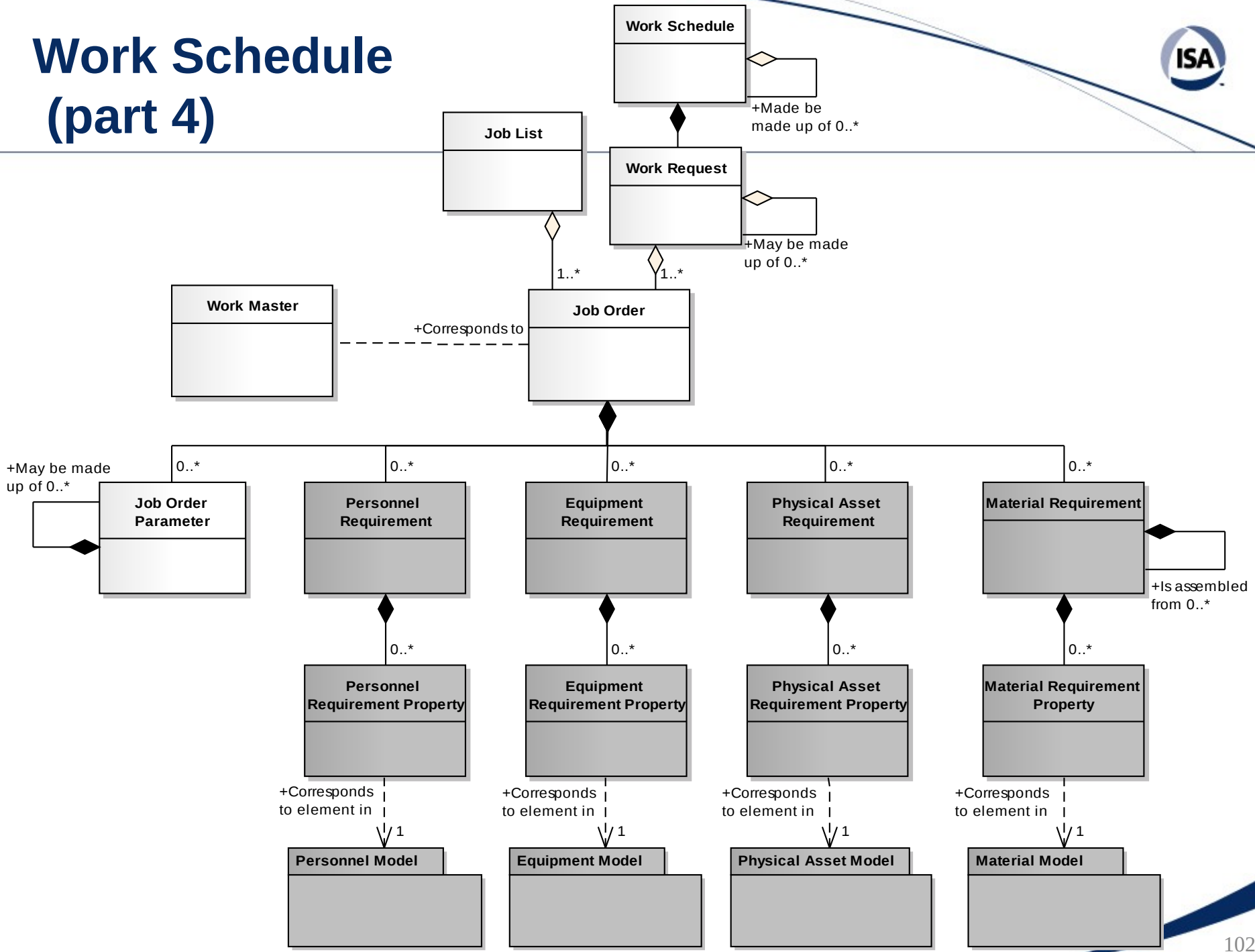
Schedule

- What to make and what to use
- Operations schedule information
  - Is a collection of Operations Requests
- Operations request
  - information required to fulfill the scheduled operation.
    - a collection of Segment Requirements
  - May reference the associated operations instructions
- A segment Requirement
  - Shall correspond to an existing operations or process segment
  - Defines specific Equipment, Personnel, Material requirements and Operations parameters
  - There may only be one production segment,
    - But at least one!

Operations schedule (part 2)



Work Schedule (part 4)

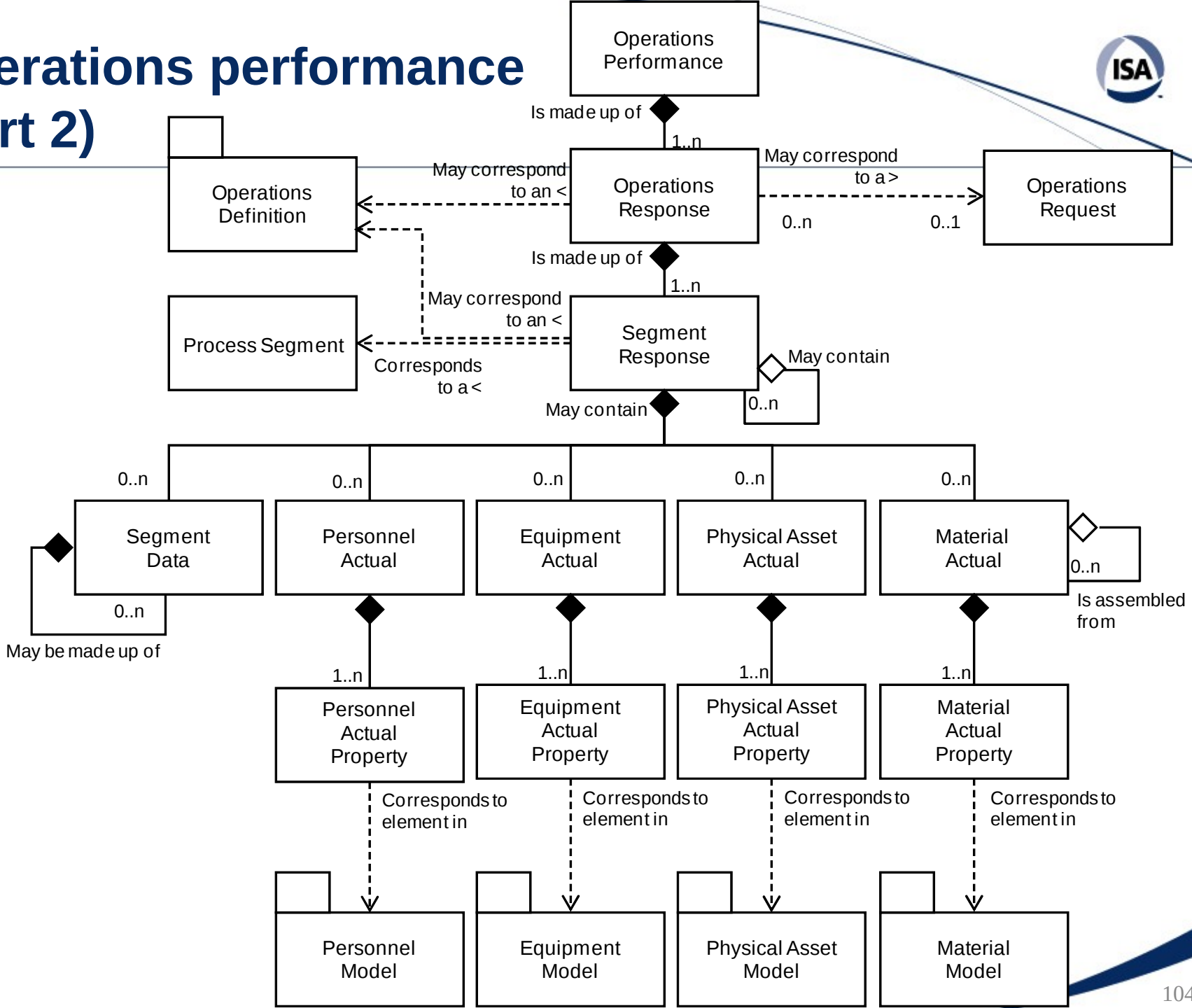


Performance

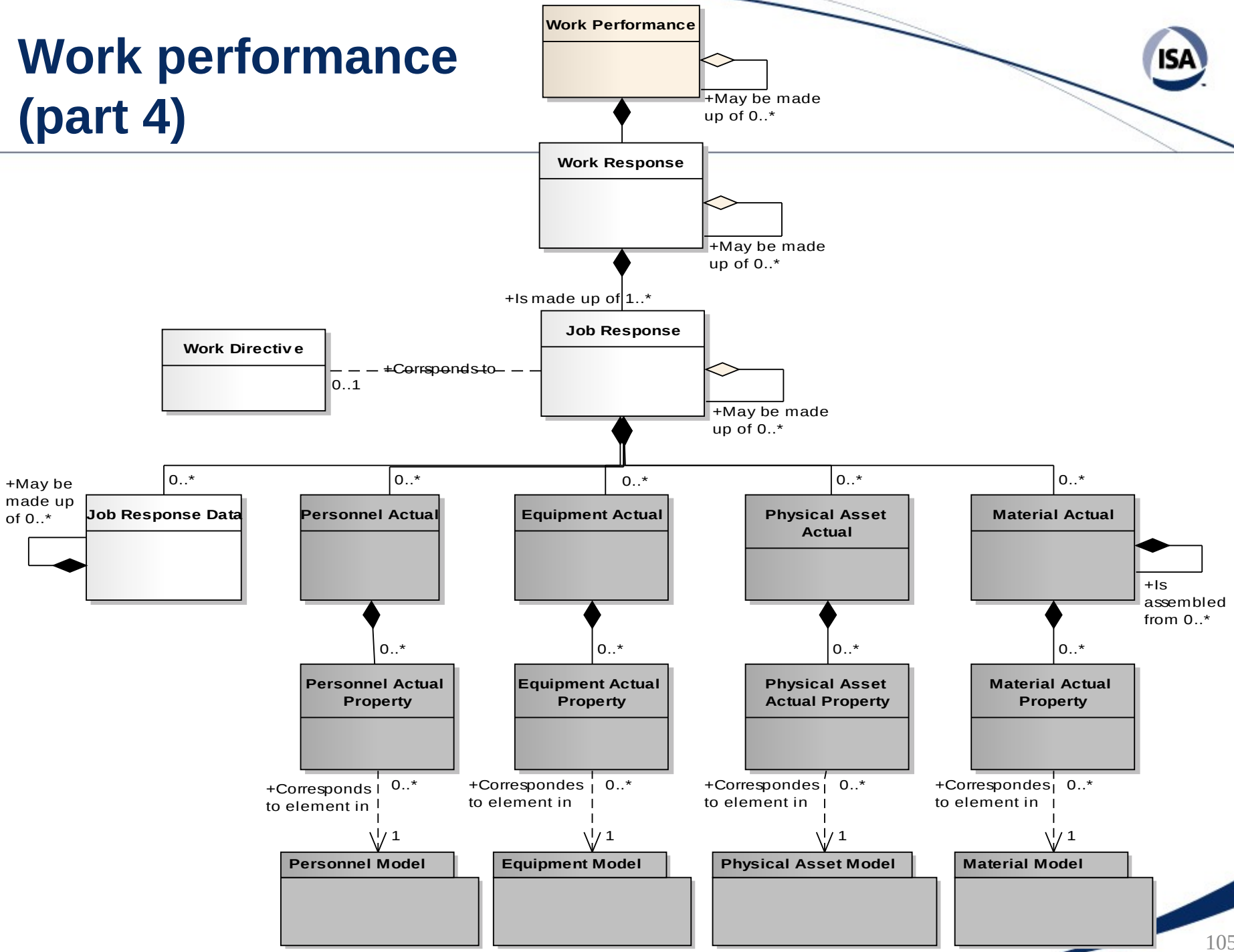
What was made and what was used - example

- A Operations Performance
  - Is a collection of Operations Responses
- A Operations Response
  - Is a collection of Segment Response
  - Corresponds to a specific Production Request
- A segment Response
  - Correspond to a specific segment requirement
  - Reports What resources were actually used, consumed, produced and other production data

Operations performance (part 2)



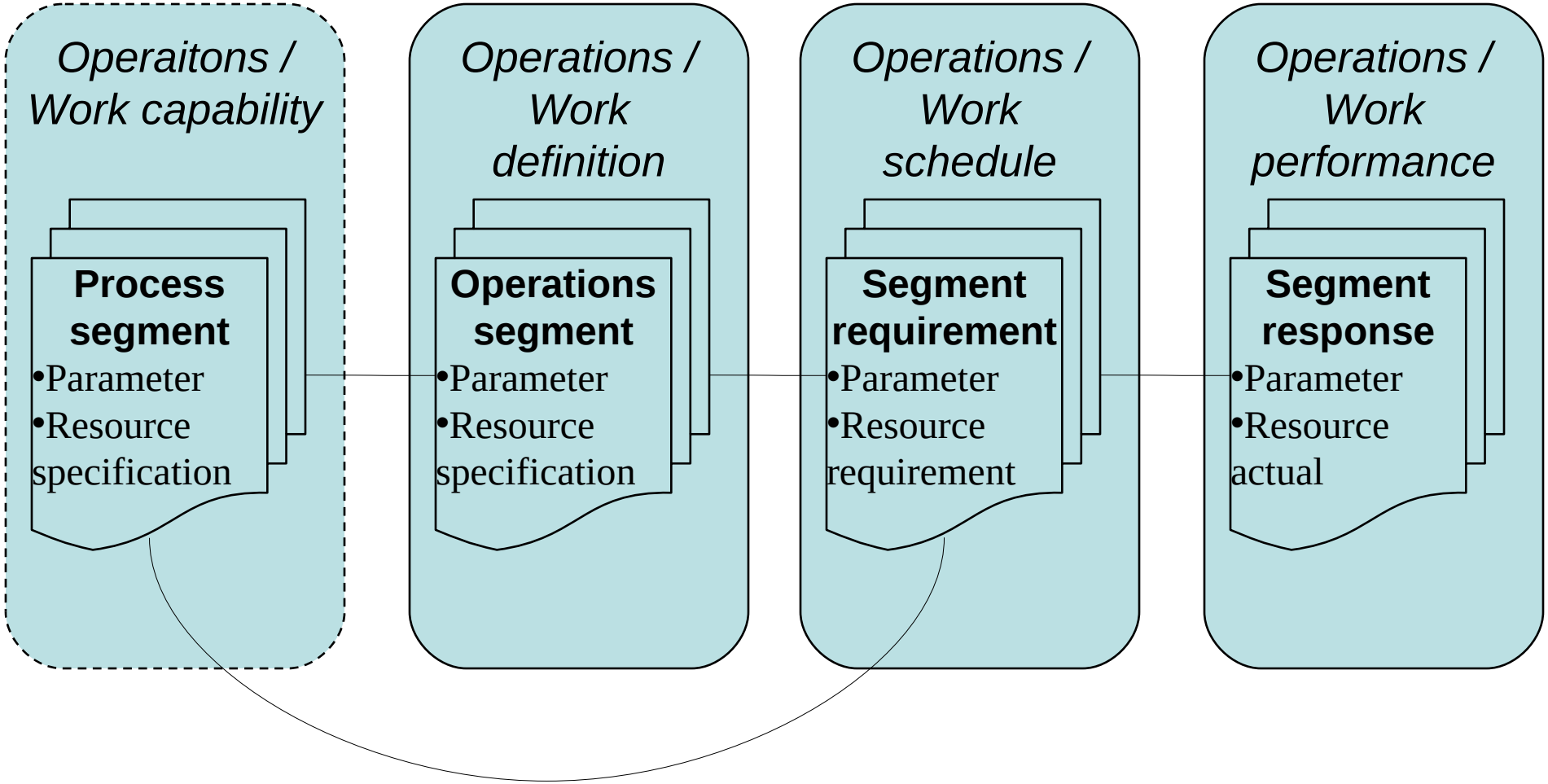
Work performance (part 4)



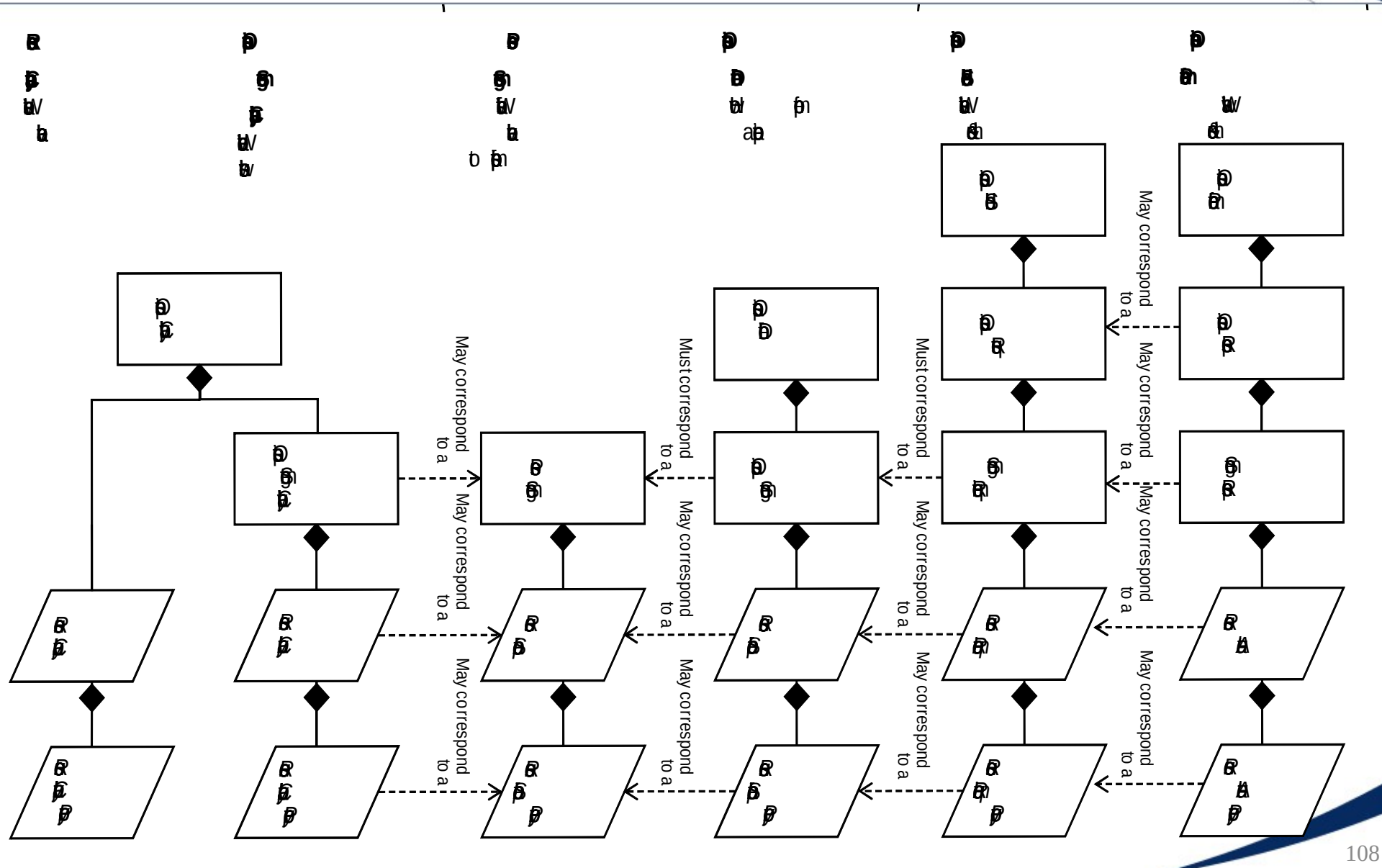
Segments, Segments, Segments…

- Process segment: manufacturing capability
  - Defines the manufacturing process available per segment
  - Gather the required resources to execute the defined operations segments
- Operations/Work Segment: manufacturing requirements
  - Defines the specifications per operations segment
  - Details the required resources for this operations segment
- Segment Requirement: run time requirements
  - Defines the specifics for an operations request
- Segment Response
  - Reports the actual happening

Segments, Segments, Segments…



Summary / part 2



Summary / part 4

AGENDA

- Example
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

ISA95 part 5

- The Open Application Group – OAG – publishes an extensive XML schema specification for exhanging information to/from/between business systems (ERP)
  - www.openapplications.org
  - It sometimes overlaps with ISA95
- Currently (04/2008) version 9.2, includes some ISA95 models
- OAGIS defines messages based on a VERB-NOUN combination to properly handle complete transactions
  - Allowing Push/Pull/Publish-Subscribe transactional modes
- The ISA95 part 5 standard extend part 1/2 to specify applicable transactions/messages
  - It only use a subset of the OAGIS VBERBS

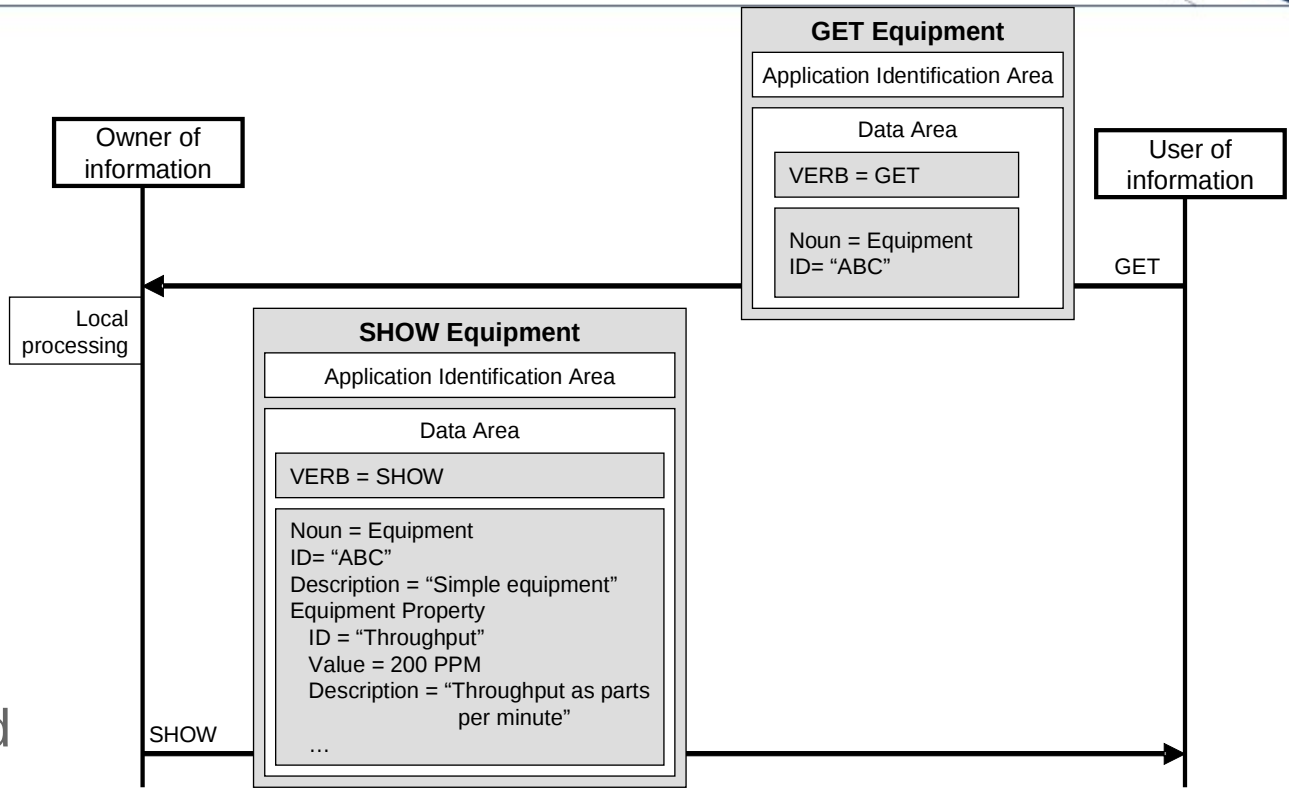
Messages et transactions

Message :

- a structured information unit conveyed in a one-way transfer of data from one sending application to one or more receiving applications

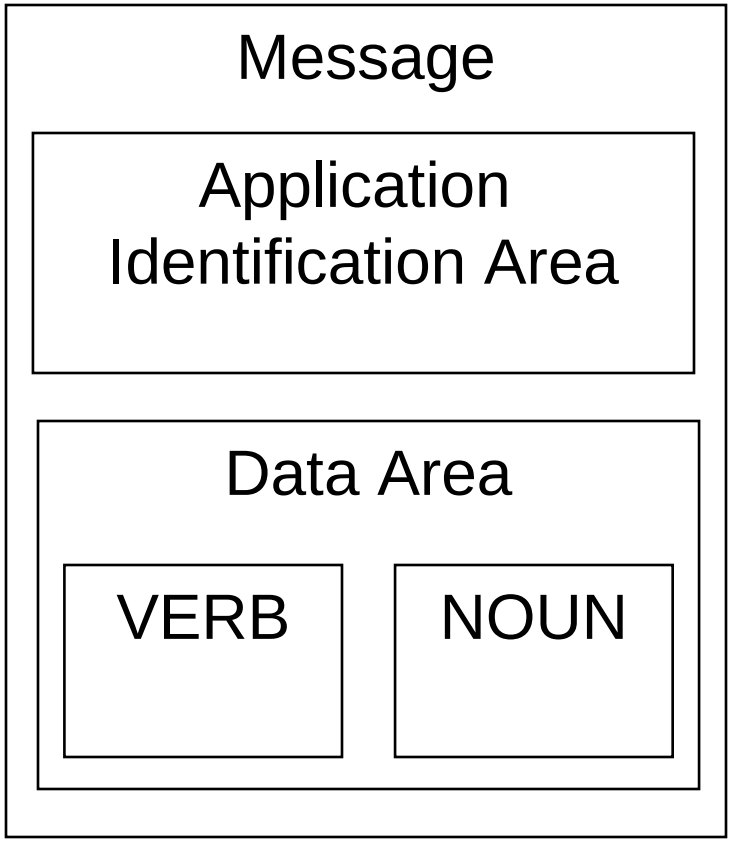
Transaction :

- a sequence of related messages that are exchanged among applications



Message Structure

- Content of a message:
  - Application identification area
    - typically includes the electronic address of the sender, an indication of the confirmation requirement, and the date and time the message was created …
  - Data Area – VERB
    - defines the action to be performed, or the response to a request
  - Data Area – NOUN
    - represents one or more objects, as defined in the Part 1 and Part 2 object models
- The above information defines a unique and unambiguous meaning of messages



Verb list

Verb	Description	Model
ACKNOWLEDGE	Acknowledgement of a PROCESS request.	PUSH
CANCEL	Request to a receiver to remove information.	PUSH
CHANGE	Request to a receiver to change information.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL PUBLISH
GET	Request to a receiver for information on one or more objects.	PULL
PROCESS	Request to a receiver to process new information.	PUSH
RESPOND	Response to a CHANGE message request.	PUSH
SHOW	Response to a GET message.	PULL
SYNC ADD	Request from the owner of the object to add information	PUBLISH
SYNC CHANGE	Request from the owner of the object to change information	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information	PUBLISH

Noun list

Personnel Class
Person
Qualification Test Specification

Equipment Class
Equipment
Equipment Capability Test Specification

Physical Asset Class
Physical Asset
Physical Asset Capability Test Specification

Material Class
Material Definition
Material Lot
Material Sublot
Material Test Specification

Resource Relationship Network Connection Type
Resource Relationship Network Connection

Process Segment

Operations Capability
Work Capability

Operations Definition
Work Directive
Work Master
Workflow specification

Operations Schedule
Work Schedule
Job list

Operations Performance
Work Performance
Work Alert

Transaction Service Profile

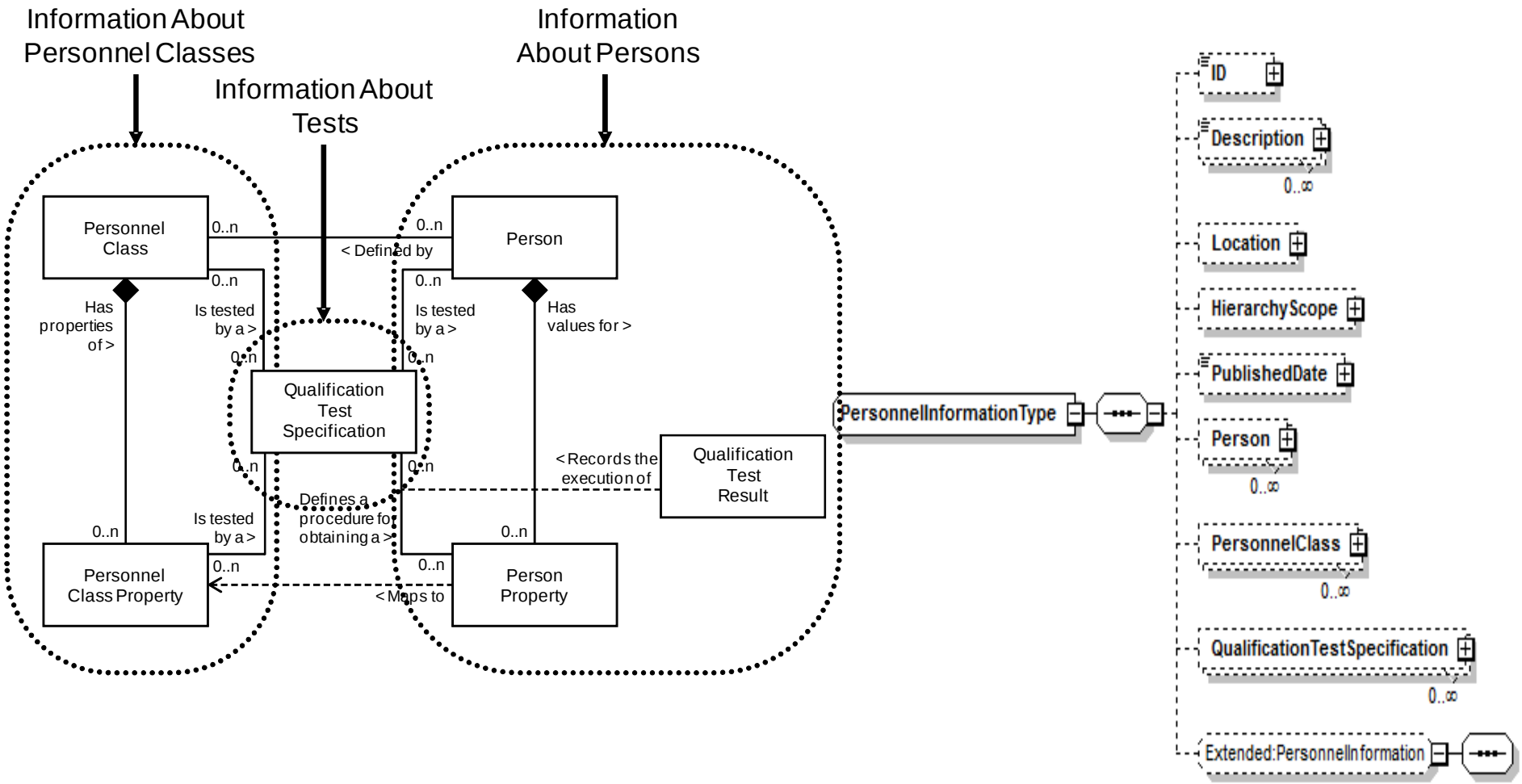
Agenda

- Example
- Methodology
- ISA95 part 2&4 models
- ISA-95 par 5
- B2MML

Overview

- The ISA95 object models may be used as the basis for formalized information exchange protocols
  - Such as SQL tables, XML internet files, or IDL object definitions
- B2MML is originally an XML implementation of ISA95
  - Along with BatchML for ISA88
- B2MML = ISA88+ISA95 data structures implementation
  - BatchML (ISA88 part 2) and new ISA88 models (Part 3 and 4) are now merged into B2MML
- B2MML is developed by the WBF
  - WBF is an ISA sponsored/supported organization
  - B2MML is for “Business To Manufacturing Markup Language”
  - Has become the *de facto* implementation standard for business to manufacturing information exchange
- B2MML benefit of a reactive development environment
  - About 1 version / year

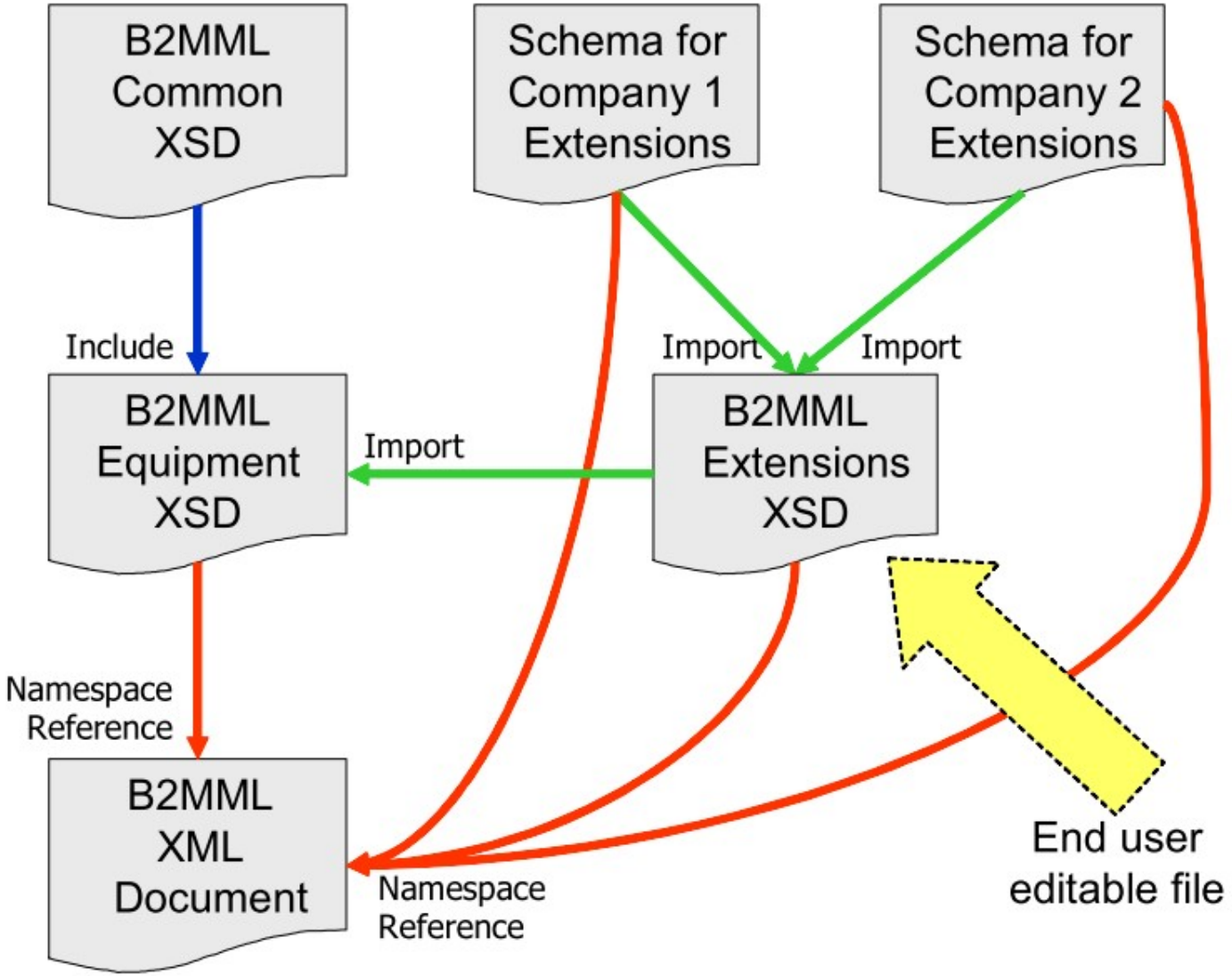
Example: Personnel schema



Example: Personnel schema - Header

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns="http://www.wbf.org/xml/B2MML-V06"
xmlns:Extended="http://www.wbf.org/xml/B2MML-V06-AllExtensions"
targetNamespace="http://www.wbf.org/xml/B2MML-V06"
elementFormDefault="qualified" attributeFormDefault="unqualified">
        <!-- Import the Extension Schema        -->
        <xsd:import namespace="http://www.wbf.org/xml/B2MML-V06-
AllExtensions" schemaLocation="B2MML-V06-AllExtensions.xsd"/>
        <!-- Include the Common schema   -->
        <xsd:include schemaLocation="B2MML-V06-Common.xsd"/>
```

Extension mechanism



Example: Personnel schema – root element

```
<xsd:element name="PersonnelInformation" type="PersonnelInformationType"/>
...
<xsd:complexType name="PersonnelInformationType">
    <xsd:sequence>
        <xsd:element name="ID" type="IdentifierType" minOccurs="0"/>
        <xsd:element name="Description" type="DescriptionType" minOccurs="0"
                     maxOccurs="unbounded"/>
        <!-- Location ELEMENT IS DEPRECATED ...-->
        <xsd:element name="Location" type="LocationType" minOccurs="0"/>
        <xsd:element name="HierarchyScope" type="HierarchyScopeType" minOccurs="0"/>
        <xsd:element name="PublishedDate" type="PublishedDateType" minOccurs="0"/>
        <xsd:element name="Person" type="PersonType" minOccurs="0"
                     maxOccurs="unbounded"/>
        <xsd:element name="PersonnelClass" type="PersonnelClassType" minOccurs="0"
                     maxOccurs="unbounded"/>
        <xsd:element name="QualificationTestSpecification" type="QualificationTestSpecificationType"
                     minOccurs="0" maxOccurs="unbounded"/>
        <xsd:group ref="Extended:PersonnelInformation" minOccurs="0"/>
    </xsd:sequence>
</xsd:complexType>
```

Download the latests

- This presentation (and many others)
  - http://www.syntropicfactory.com/node/3798
- B2MML
  - http://wbforg.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=
  - https://services.mesa.org/ResourceLibrary/ViewCategory/8c65bee5-db
- ISA95 committee
  - http://www.isa.org/isa95

Thank You

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