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MODELLING ASPECTS IN SOFTWARE ENGINEERING

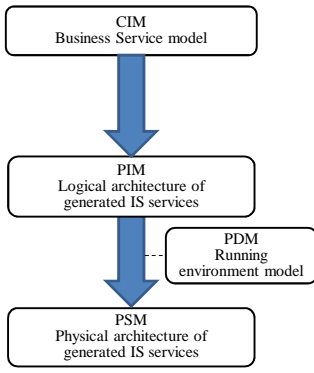
SERVICE GENERATION AND DESIGN CONTEXTUALIZED BY INFORMATION SYSTEM ARCHITECTURE

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CONTEXTUALIZATION OF MDA APPROACH : EA RECOMMENDATIONS 2

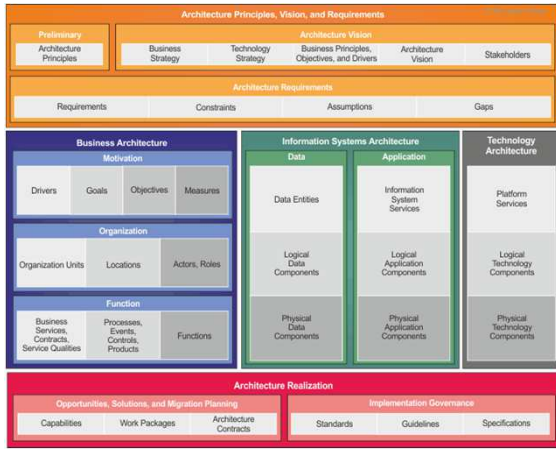
Software engineering
Model Driven Architecture




```

graph TD
    CIM[CIM Business Service model] --> PIM[PIM Logical architecture of generated IS services]
    PIM -.-> PDM[PDM Running environment model]
    PIM --> PSM[PSM Physical architecture of generated IS services]
    
```

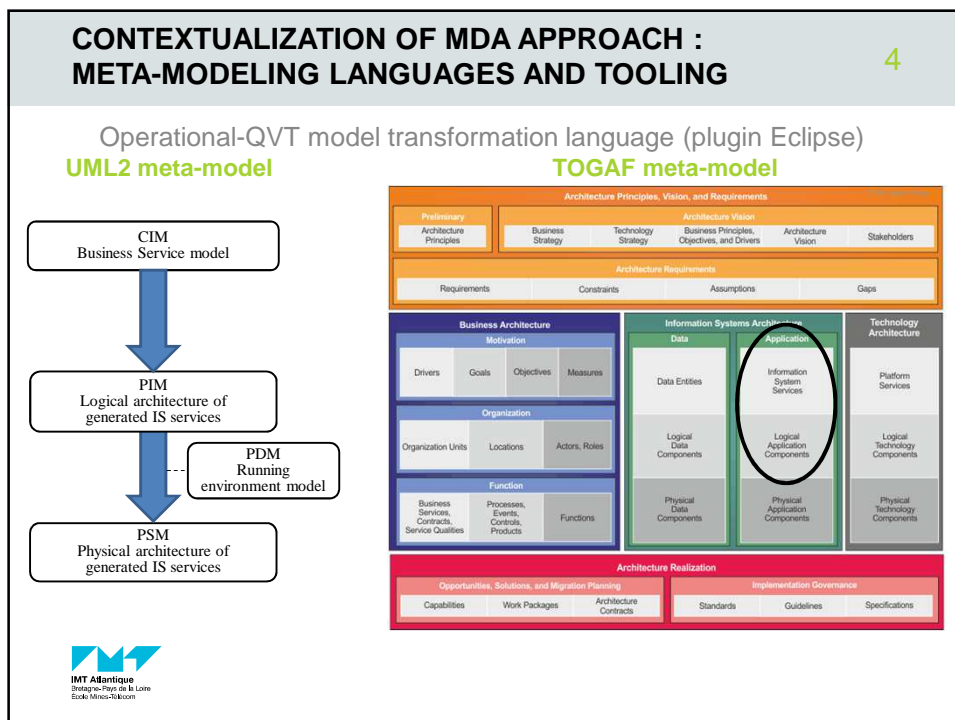
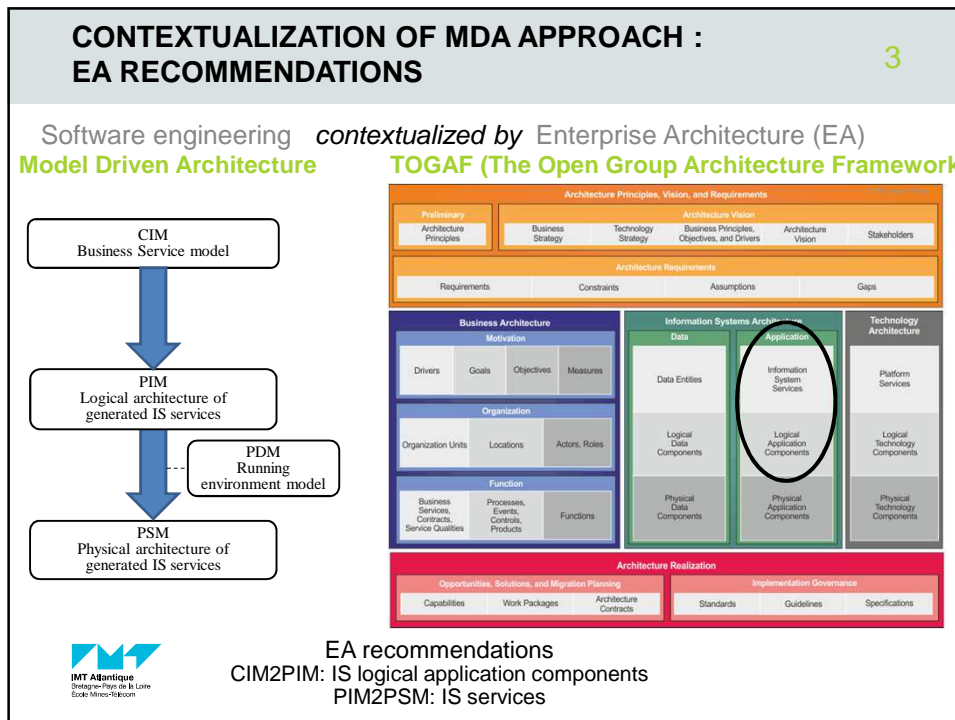
Enterprise Architecture (EA)
TOGAF (The Open Group Architecture Framework)



Architecture Principles, Vision, and Requirements					
Preliminary Architecture Principles	Business Strategy	Technology Strategy	Business Principles, Objectives, and Drivers	Architecture Vision	Stakeholders
Architecture Requirements					
Requirements	Constraints	Assumptions	Gaps		
Business Architecture		Information Systems Architecture		Technology Architecture	
Motivation		Data		Application	
Drivers	Goals	Objectives	Measures	Data Entities	Information System Services
Organization		Logical Data Components		Logical Application Components	
Organization Units	Locations	Actors, Roles		Platform Services	
Function		Physical Data Components		Physical Application Components	
Business Services, Contracts, Service Qualities	Processes, Events, Controls, Products	Functions		Logical Technology Components	
Physical Technology Components		Physical Application Components		Physical Technology Components	
Architecture Realization					
Opportunities, Solutions, and Migration Planning			Implementation Governance		
Capabilities	Work Packages	Architecture Contracts	Standards	Guidelines	Specifications




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CIM2PIM CONTEXT ILLUSTRATION IS LOGICAL APPLICATION COMPONENTS 5


Pattern *System-of-Services-Logical-Architecture-Design*
IS = System of Services


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CIM2PIM TRANSFORMATION CONTEXTUAL MODEL 6

CTe: enrich a business service model by a mapping with the IS functional (logical) model (TCMe)
Who: functional architect and business expert

ET: IS Service Generation Algorithm
Who: operational-QVT transformation


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CIM – BUSINESS SERVICE MODEL 7

```

classDiagram
    class BusinessService
    class BusinessTask
    class Loop
    class Verb
    class DataEntity
    class Condition
    class Attribute

    BusinessService "0..1" -- "0..*" BusinessTask : +isService
    BusinessTask "0..1" -- "0..*" Loop : +loop
    BusinessTask "0..1" -- "0..*" Verb : +verb
    BusinessTask "0..1" -- "0..*" DataEntity : +entity
    BusinessTask "0..1" -- "0..*" Condition : +condition
    BusinessTask "0..1" -- "0..*" Attribute : +attribute
    
```

CIM meta-model

```

<Business Service><name>BSCreateOrderExistingCustomer</name>
<Business Task><order number>1</order number>
<Verb><crud>read</crud></Verb>
<Data Entity><name>Customer</name></Data Entity>
<Attribute><name>name</name><type>String</type></Attribute>
<Attribute><name>address</name><type>String</type></Attribute>
<Condition><guard><>null</guard></Condition>
</Business Task>
<Business Task><order number>2</order number>
<Verb><crud>read</crud></Verb>
<Data Entity><name>Product</name></Data Entity>
<Attribute><name>name</name><type>String</type></Attribute>
<Attribute><name>cost</name><type>String</type></Attribute>
<Loop><list>true</list></Loop>
</Business Task>
<Business Task><order number>3</order number>
<Verb><crud>create</crud></Verb>
<Data Entity><name>Order</name></Data Entity>
<Attribute><name>date</name><type>String</type></Attribute>
<Attribute><name>reference</name><type>Integer</type>
</Attribute>
</Business Task>
</Business Service>
    
```

CIM model illustration

CICM – CONTEXTUALIZED BUSINESS SERVICE MODEL 8

Data Entity Attribute contextualized by IS Logical Application Component

```

<Business Service><name>BSCreateOrderExistingCustomer</name>
<Business Task><order number>1</order number>
<Verb><crud>read</crud></Verb>
<Data Entity><name>Customer</name></Data Entity>
<Attribute><name>name</name><type>String</type></Attribute>
<Attribute><name>address</name><type>String</type></Attribute>
<Condition><guard><>null</guard></Condition>
</Business Task>
<Business Task><order number>2</order number>
<Verb><crud>read</crud></Verb>
<Data Entity><name>Product</name></Data Entity>
<Attribute><name>name</name><type>String</type></Attribute>
<Attribute><name>cost</name><type>String</type></Attribute>
<Loop><list>true</list></Loop>
</Business Task>
<Business Task><order number>3</order number>
<Verb><crud>create</crud></Verb>
<Data Entity><name>Order</name></Data Entity>
<Attribute><name>date</name><type>String</type></Attribute>
<Attribute><name>reference</name><type>Integer</type>
</Attribute>
</Business Task>
</Business Service>
    
```

} LACCustomerManagement

} LACProductManagement

} LACOrderManagement

CICM model illustration

PIM LOGICAL ARCHITECTURE OF GENERATED IS SERVICES 9

```
<Business Service><name>SSCreateOrderExistingCustomer</name>  
<Business Task><order number>1</order number>  
<Verb><crud>read</crud></Verb>  
<Data Entity><name>Customer</name></Data Entity>  
<Attribute><name>name</name><type>String</type></Attribute>  
<Attribute><name>address</name><type>String</type></Attribute>  
<Condition><guard><null</guard></Condition>  
</Business Task>  
<Business Task><order number>2</order number>  
<Verb><crud>read</crud></Verb>  
<Data Entity><name>Product</name></Data Entity>  
<Attribute><name>name</name><type>String</type></Attribute>  
<Attribute><name>cost</name><type>String</type></Attribute>  
<Loop><list>true</list></Loop>  
</Business Task>  
<Business Task><order number>3</order number>  
<Verb><crud>create</crud></Verb>  
<Data Entity><name>Order</name></Data Entity>  
<Attribute><name>date</name><type>String</type></Attribute>  
<Attribute><name>reference</name><type>String</type></Attribute>  
</Business Task>  
</Business Service>
```

IS Service Generation Algorithm (1/2)
PIM conforms to CICM

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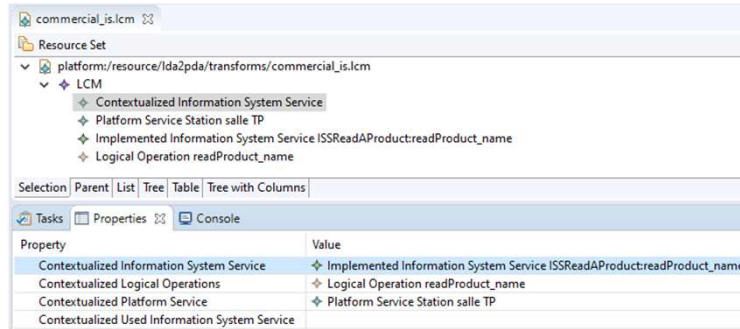
PIM LOGICAL ARCHITECTURE OF GENERATED IS SERVICES 10

IS Service Generation Algorithm (2/2)
PIM conforms to TCM

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PIM2PSM CONTEXT ILLUSTRATION EXISTING IS SERVICE

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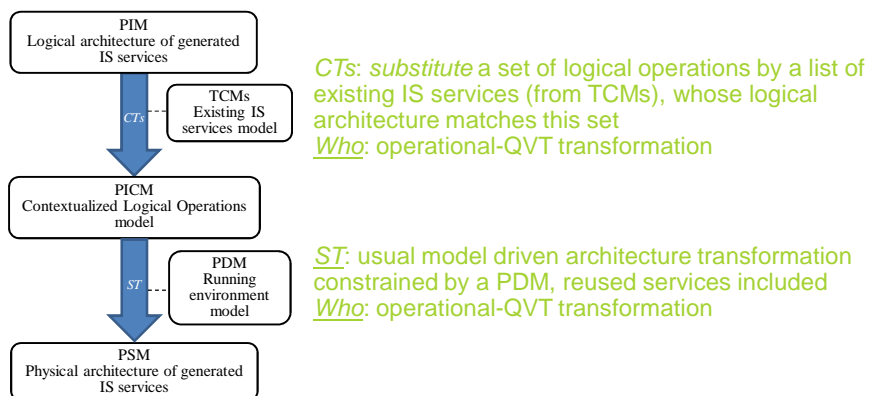


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PIM2PSM TRANSFORMATION CONTEXTUAL MODEL

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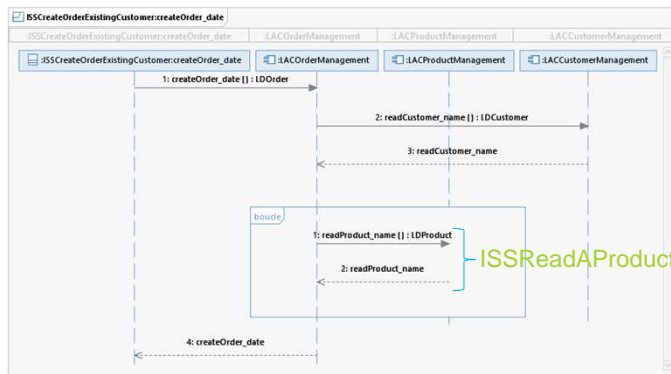
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PICM – CONTEXTUALIZED IS SERVICE MODEL

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Logical Operations contextualized by existing IS services

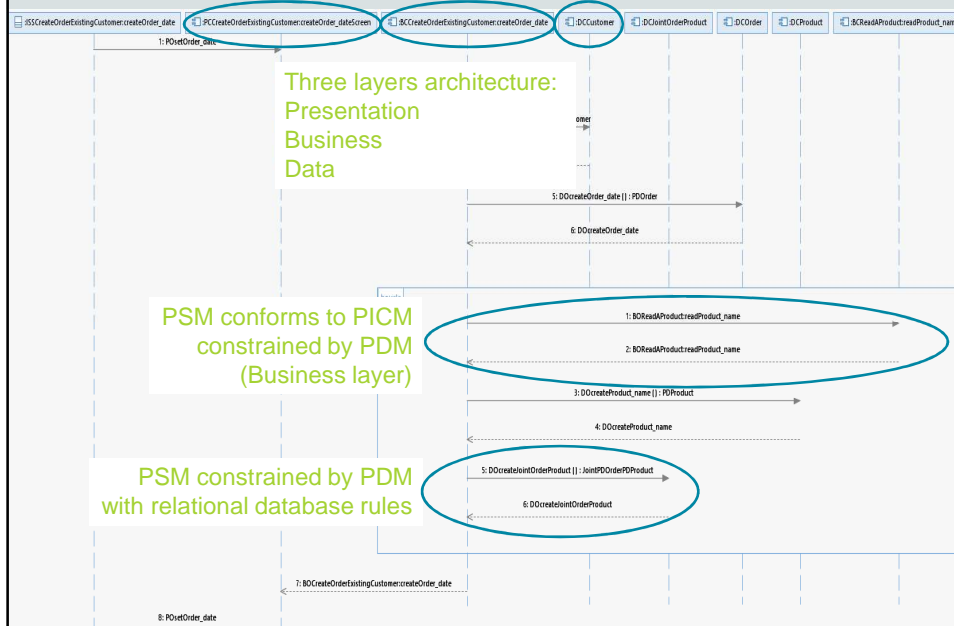


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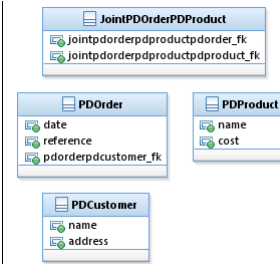
PSM PHYSICAL ARCHITECTURE OF GENERATED IS SERVICES

14



PSM - PHYSICAL DATA MODEL AND SCRIPT RESULTING FROM PHYSICAL ARCHITECTURE OF GENERATED IS SERVICES 15

```
-- Drop tables
drop table if exists "jointpdorderpdproduct";
drop table if exists "pdproduct";
drop table if exists "pdorder";
drop table if exists "pdcustomer";
-- Create tables
create table "pdcustomer"
(
  id          serial primary key,
  name       varchar(100) not null,
  address    varchar(100) not null
);
create table "pdorder"
(
  id          serial primary key,
  date       varchar(100) not null,
  reference  integer,
  pdorderpdcustomer_fk integer not null references
    "pdcustomer"
);
create table "pdproduct"
(
  id          serial primary key,
  name       varchar(100) not null,
  cost      varchar(100) not null
);
create table "jointpdorderpdproduct"
(
  id          serial primary key,
  jointpdorderpdproductpdorder_fk integer not null
    references "pdorder",
  jointpdorderpdproductpdproduct_fk integer not null
    references "pdproduct"
);
```



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PSM – SERVICE CODE SKELETON RESULTING FROM PHYSICAL ARCHITECTURE OF GENERATED IS SERVICES 16

```
@Override
public void
BOcreateOrderExistingCustomer:createOrder_date(String
nameCustomer, String addressCustomer, String dateOrder,
int referenceOrder, String nameProduct, String costProduct)
{
  /**
   * Exception if not: <>null
   */
  customerDAO.D0readCustomer_name(customer);
  /**
   * Exception if not: <>null
   */
  orderDAO.D0createOrder_date(order);
  /**
   * Loop start
   */
  Customer customer =
    this.B0ReadAProduct:readProduct_name(nameCustomer,
    addressCustomer)
    productDAO.D0createProduct_name(product);
    jointorderproductDAO.D0createJointOrderProduct
    (jointorderproduct);
  /**
   * Loop end
   */
}
```

Java code skeleton
results directly
from sequence diagram of
IS service designed during
physical architecture



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CONTEXTUALIZATION OF MDA APPROACH CONCLUSION

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Contribution of the respect of the Enterprise Architecture recommendations by a quasi automation of the development of IS services from a business service specification

Only the task of contextualizing of the CIM is in the hands of functional (logical) architect and business expert

The transition between the business requirements and the logical support of the IS remains critical



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CONTEXTUALIZATION OF MDA APPROACH PERSPECTIVE

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Is Dynamic Software Update a perspective for contextualized MDA approach?

Enhancement, Substitution and Removal for

CIM2PIM

IS logical application component
IS logical application dependency
Business service
Business task

PIM2PSM

IS service
Layer pattern
Layer framework



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REFERENCE

19

J. Simonin, P.-Y. Pillain, D. Gueriot, J. Vincent: "Information System Services Generation from Business Services Specification and Based on a System-Of-Services Logical Architecture Pattern". International Journal of Cooperative Information Systems, vol. 29, no 3, September 2020.



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