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Development of Modelling Frameworks and Viewpoints with Kitalpha

The 14th Workshop on Domain-Specific Modeling – Oct. 21st, 2014

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SPLASH
PORTLAND 2014

OPEN

THALES

Why

Motivation to use DSLs in Kitalpha

How

Solution

Practices

Lessons Learned

Motivation

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Collective intelligence for a safer world

Whenever critical decisions need to be made, Thales has a role to play. In all its markets — aerospace, space, ground transportation, defence and security — **Thales solutions help customers to make the right decisions at the right time and act accordingly.**

World-class technology, the combined expertise of **65,000 employees** and operations in **56 countries** have made **Thales a key player in keeping the public safe and secure**, guarding vital infrastructure and protecting the national security interests of countries around the globe.

Employees


 **65,000** (workforce under management at 31 Dec. 2012)

Global presence

 **56** countries



Research and development

 **2.5** billion euros (approx. 20% of revenues)

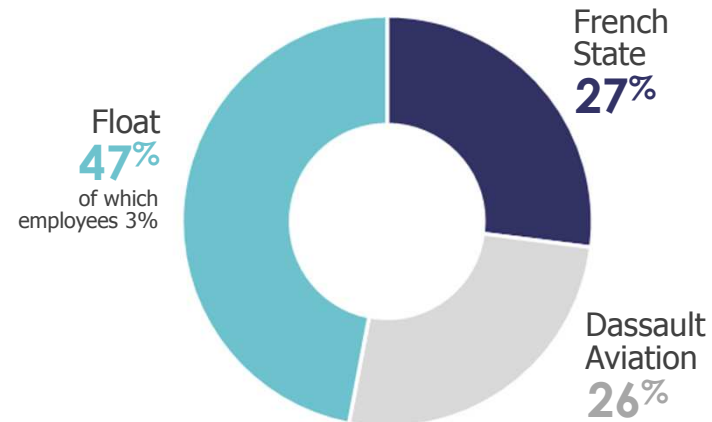
A balanced revenue structure



Revenues in 2012

 **14.2** billion euros

Shareholders (at 31 May 2013)



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Dual markets Military & Civil

AEROSPACE



SPACE



GROUND TRANSPORTATION



DEFENCE



SECURITY



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Thales : A Wide Spectrum of Complex Systems

N¹
worldwide



Payloads for telecom satellites



Air Traffic Management



Sonars



Security for interbank transactions

N²
worldwide



Rail signalling systems



In-flight entertainment and connectivity



Military tactical radiocommunications

N³
worldwide



Avionics



Civil satellites



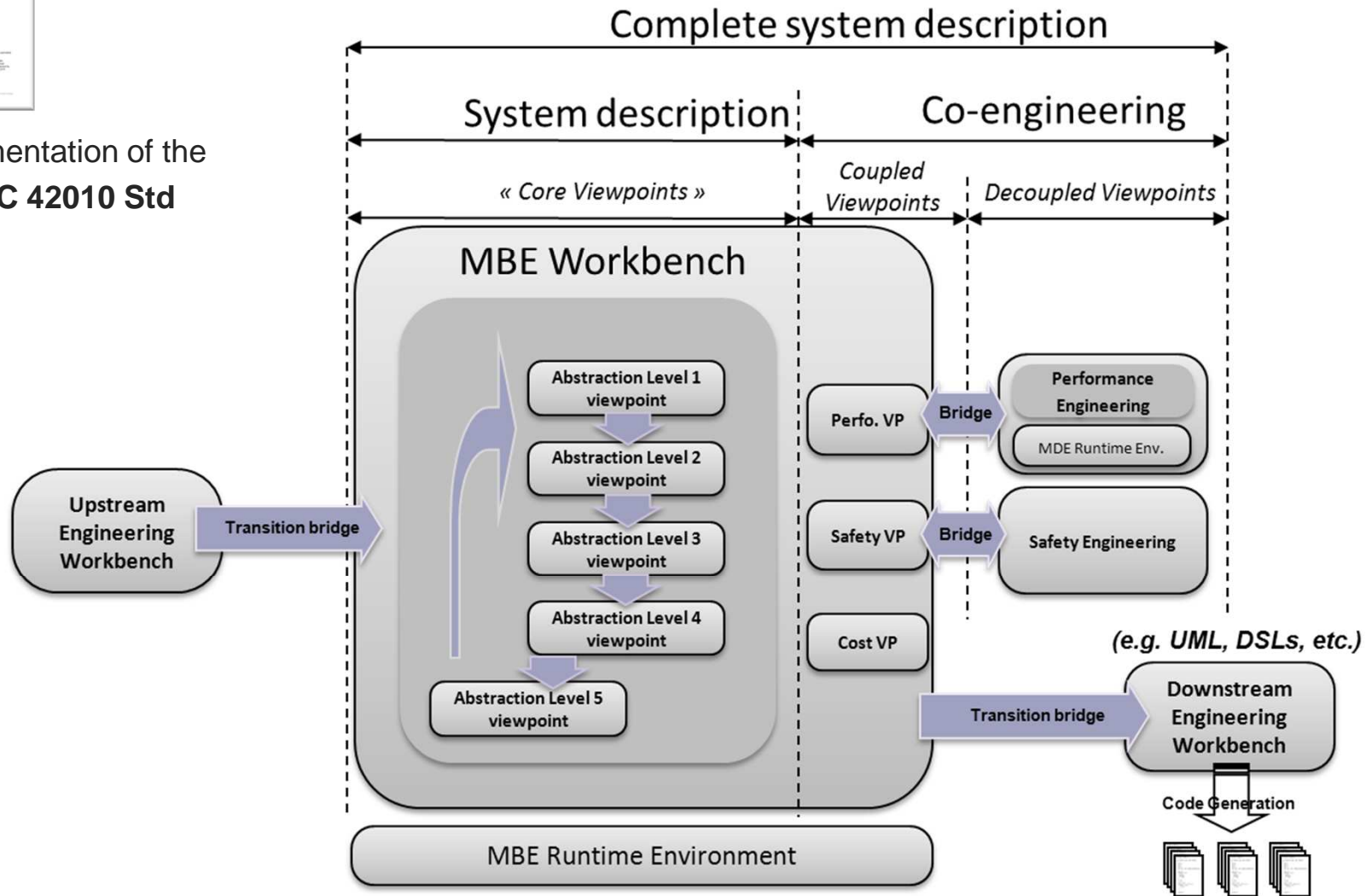
Surface radars

€14 billion in revenues

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Implementation of the
ISO/IEC 42010 Std



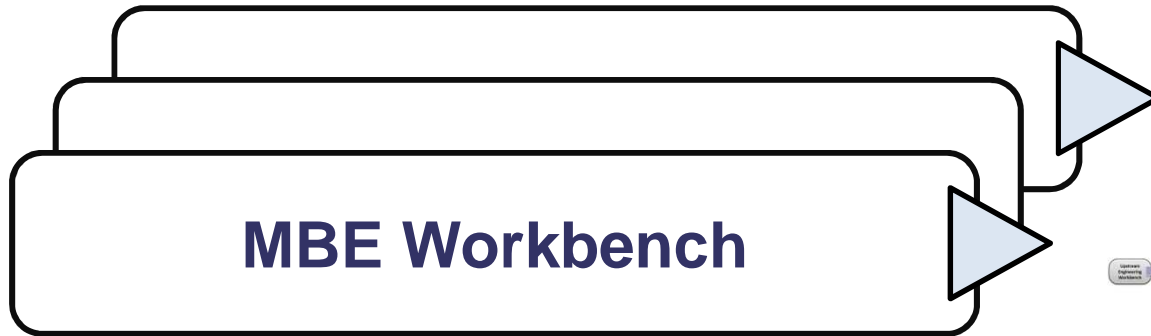
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MBE: Model-Based Engineering

TRN : 0001-0008969542 rev 001 - 17/03/2014
Thales Global Services / Template: 83150233-DOC-TGS-EN-002

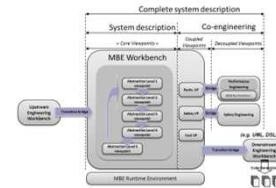
OPEN





examples

« Classic » DSMLs



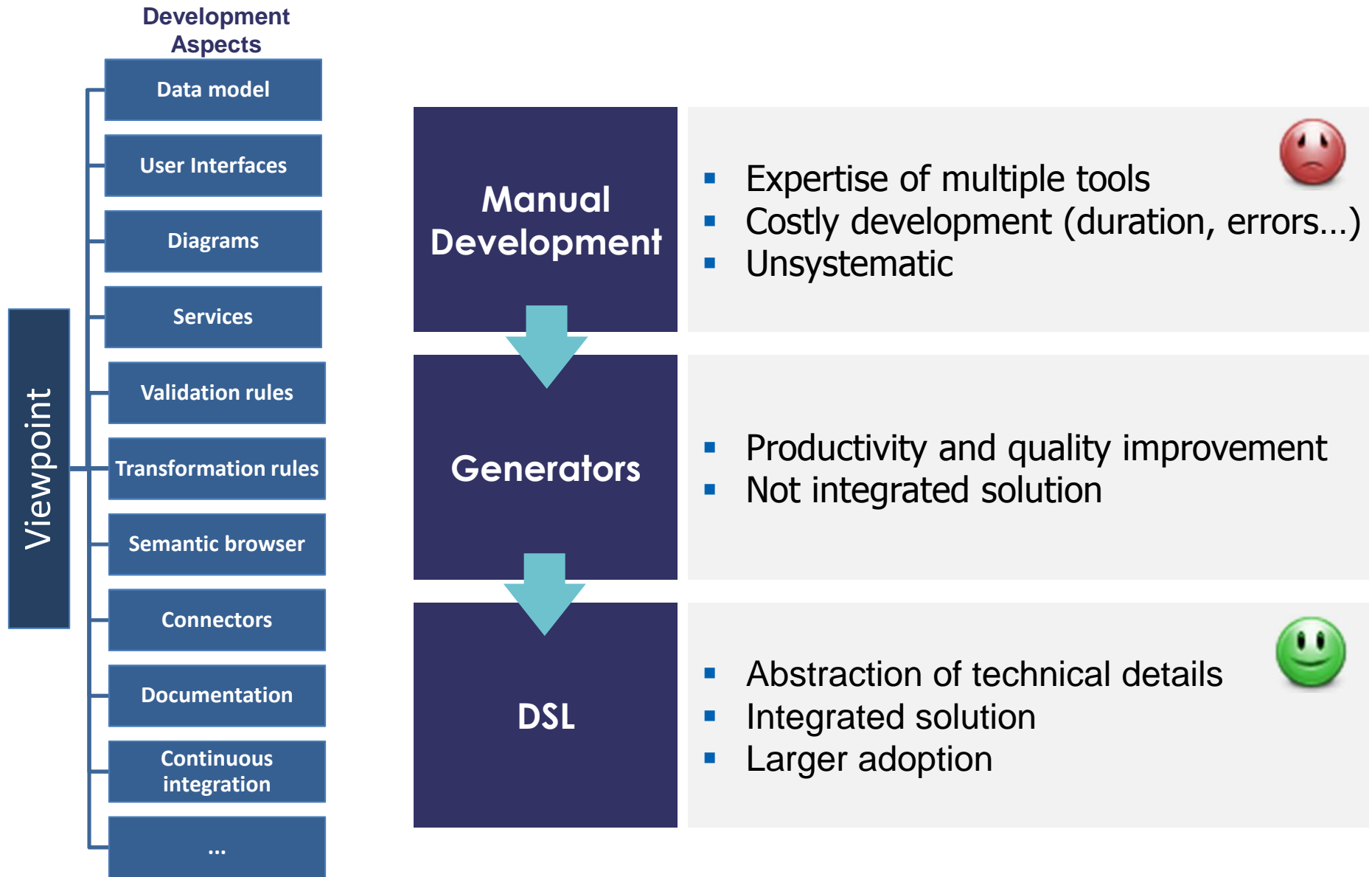
and its Viewpoints for System Engineering



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Solution

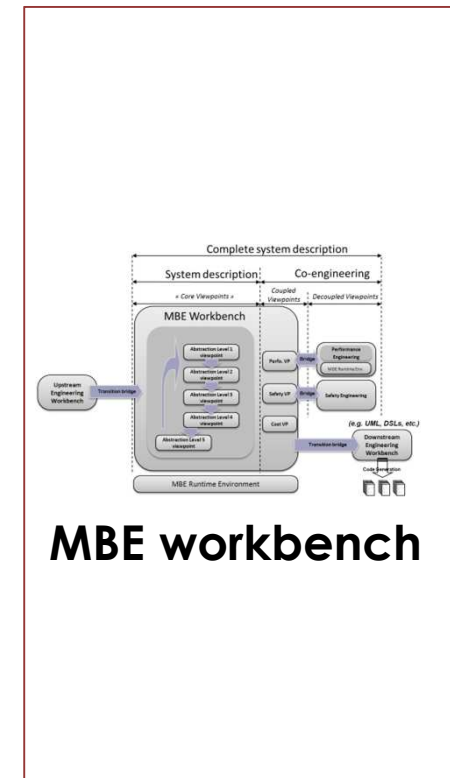
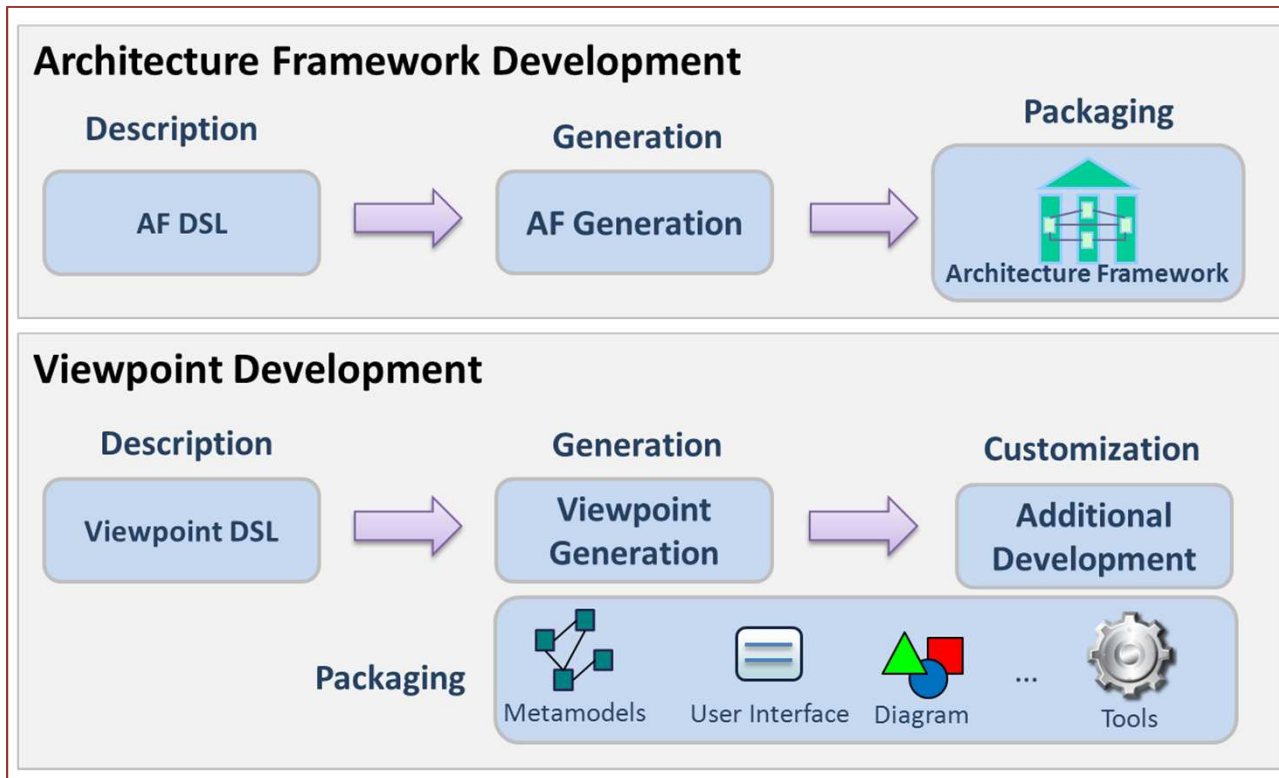
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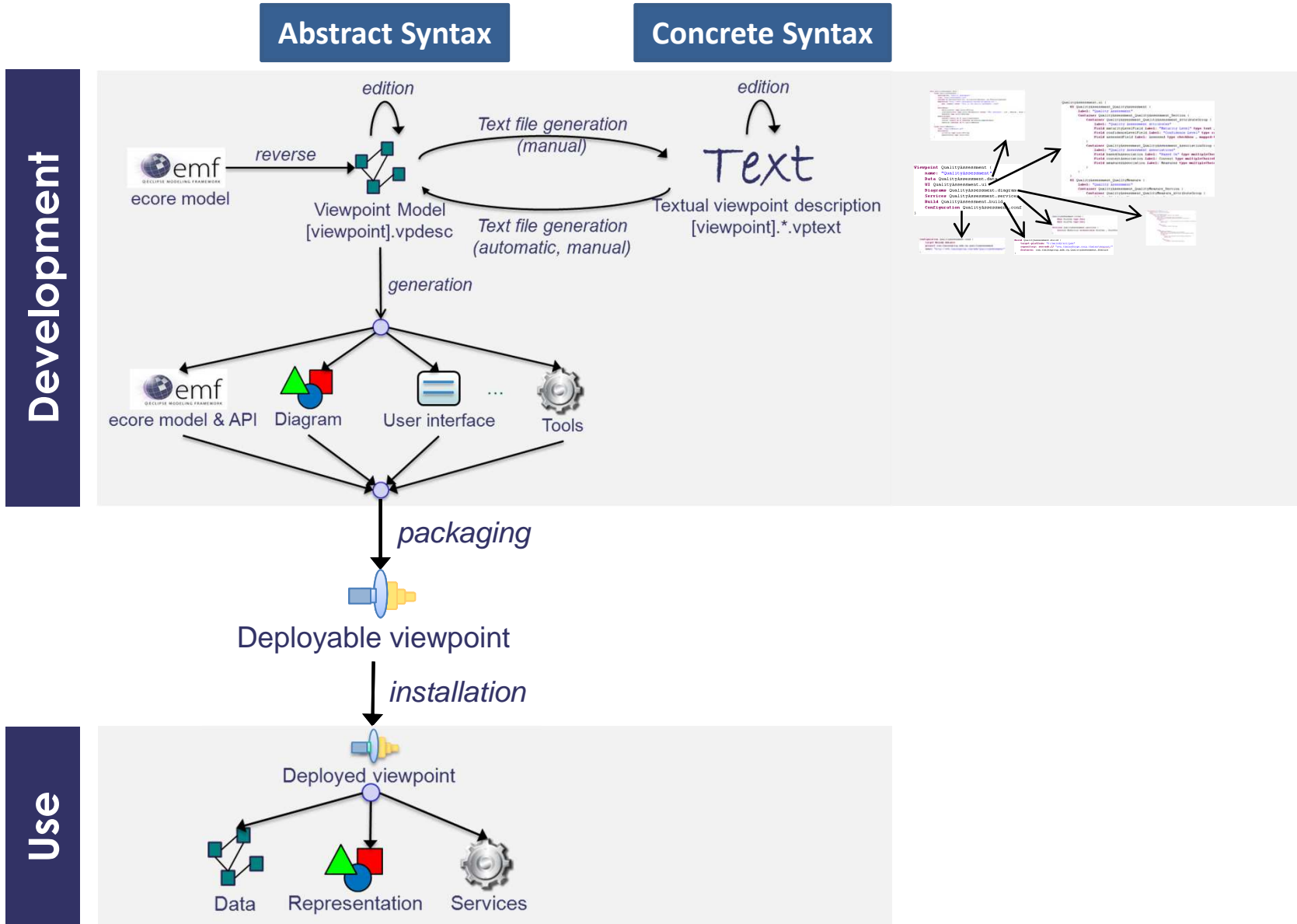
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Development

Execution



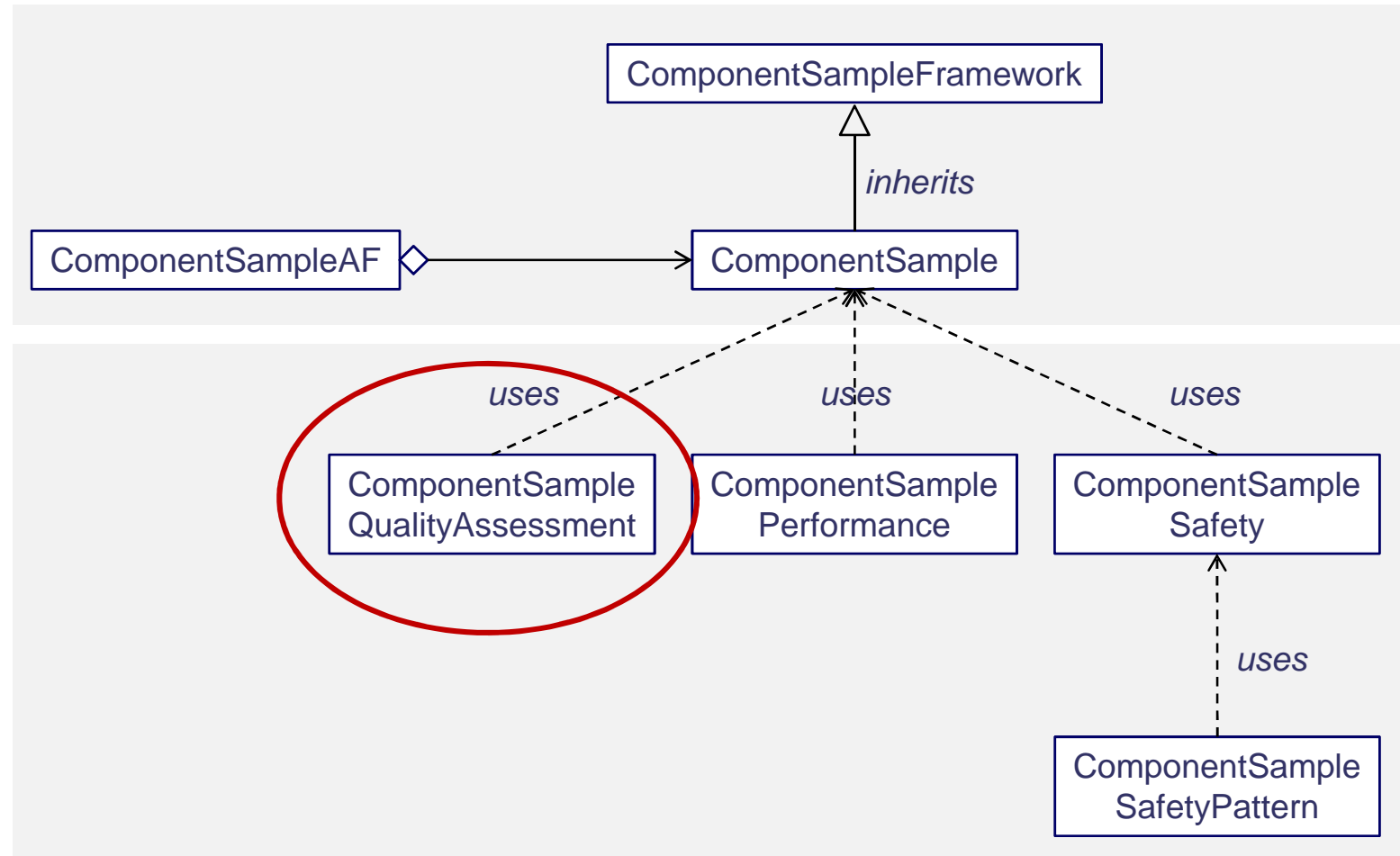
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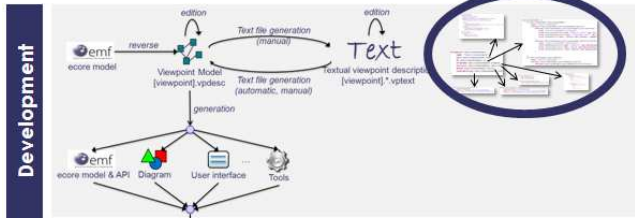
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Architecture
Description

Extensions



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Data

```

Data QualityAssessment.data {
  Class QualityAssessment {
    description: "Quality Assessment"
    icon: "QualityAssessment.gif"
    extends fa.AbstractFunction, la.LogicalComponent, pa.PhysicalComponent
    Annotation "http://www.thalesgroup.com/mde/documentation" {
      key: summary value: "This is the Quality Assessment Class"
    }
  }
  Attributes:
    maturityLevel type ecore.EString
    confidenceLevel type ecore.Enumeration values ("Not Assessed", Low, Medium, High)
    assessed type ecore.EBoolean
  Associations:
    basedOn refers [0,*] QualityAssessment
    context refers [0,*] external.metamodels.NamedElement
    measures contains [0,*] QualityMeasure
  }
  Class QualityMeasure {
    icon: "QualityMeasure.gif"
  }
  Attributes:
    criterion type ecore.EString
    measureValue type ecore.EInt
  }
}
    
```

User interfaces

```

QualityAssessment.ui {
  UI QualityAssessment_QualityAssessment {
    Label: "Quality Assessment"
    Container QualityAssessment_QualityAssessment_Section {
      Container QualityAssessment_QualityAssessment_AttributeGroup {
        Label: "Quality Assessment Attributes"
        Field maturityLevelField label: "Maturity Level" type text ,
        Field confidenceLevelField label: "Confidence Level" type text ,
        Field assessedField label: Assessed type checkbox , mapped-1
      }
      Container QualityAssessment_QualityAssessment_AssociationGroup {
        Label: "Quality Assessment Associations"
        Field basedOnAssociation label: "Based On" type multipleChoice ,
        Field contextAssociation label: Context type multipleChoice ,
        Field measuresAssociation label: Measures type multipleChoice
      }
    }
  }
  UI QualityAssessment_QualityMeasure {
    Label: "Quality Measure"
    Container QualityAssessment_QualityMeasure_Section {
      Container QualityAssessment_QualityMeasure_AttributeGroup {
        ...
      }
    }
  }
}
    
```

```

Viewpoint QualityAssessment {
  name: "QualityAssessment"
  Data QualityAssessment.data
  UI QualityAssessment.ui
  Diagrams QualityAssessment.diagram
  Services QualityAssessment.services
  Build QualityAssessment.build
  Configuration QualityAssessment.conf
}
    
```

Services

```

QualityAssessment.rules {
  Rule RuleOne type Java
  Rule RuleTwo type Java
}
Services QualityAssessment.services {
  Service MyService orchestrates RuleOne , RuleTwo
}
    
```

Diagrams



Generation configuration

```

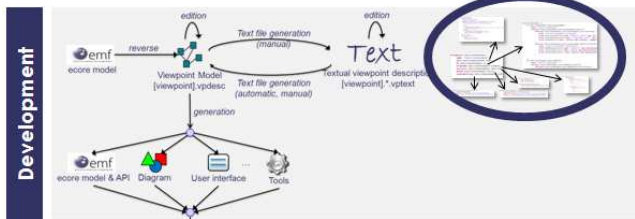
Configuration QualityAssessment.conf {
  target Melody Advance
  project com.thalesgroup.mde.vp.qualityassessment
  nsuri "http://www.thalesgroup.com/mde/QualityAssessment"
}
    
```

Continuous integration

```

Build QualityAssessment.build {
  target-platform: "D:/melody/eclipse"
  repository: svn+ssh://svn.thalesforge.corp.thales/synroot/"
  features: com.thalesgroup.mde.vp.QualityAssessment.feature
}
    
```

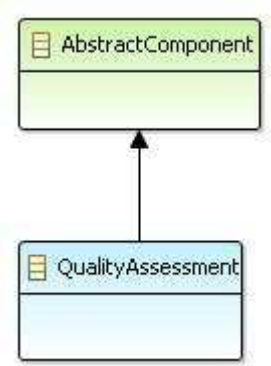
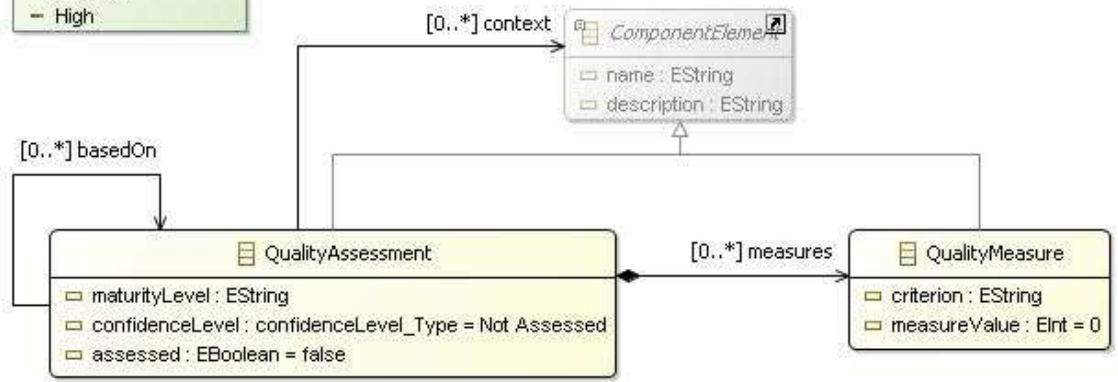
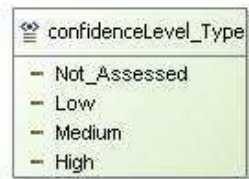
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```

import external "http://www.polarsys.org/kitalpha/ComponentSample"

Data ComponentSampleQualityAssessment.data {
  Class QualityAssessment {
    description: "Quality Assessment"
    icon: "QualityAssessment.png"
    extends ComponentSample.AbstractComponent
    superClass external ComponentSample.ComponentElement
    Attributes:
      maturityLevel type ecore.EString
      confidenceLevel type ecore.Enumerator
        values ( "Not Assessed" , Low , Medi
      assessed type ecore.EBoolean
    Associations:
      basedOn refers [0,*) QualityAssessment
      context refers [0,*) external ComponentSamp
      measures contains [0,*) QualityMeasure
  }
  Class QualityMeasure {
    icon: "QualityMeasure.png"
    superClass external ComponentSample.ComponentE
    Attributes:
      criterion type ecore.EString
      measureValue type ecore.EInt
  }
}
    
```

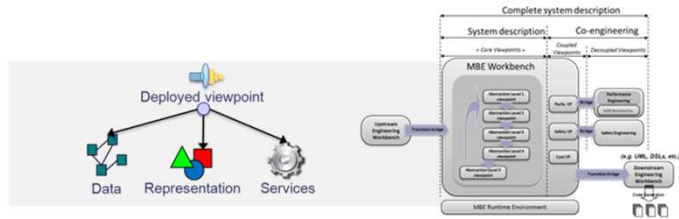


Extension

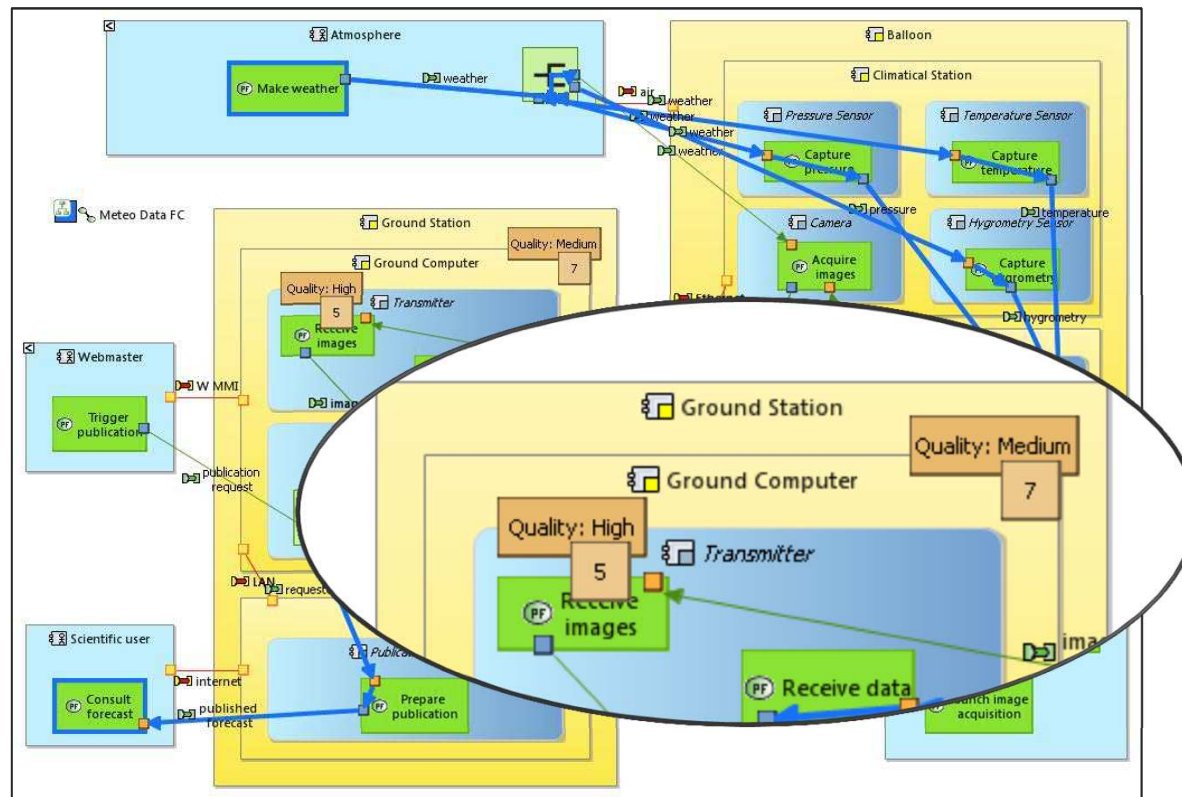
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Use



MBE workbench



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Lessons Learned

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Productivity and
Quality

Homogeneity of DSL-
based Workbenches

Achievement of the
Concrete Syntax

Aggregation and
Extensibility of
Grammars



 **Kitalpha**
and DSLs

Separation of
Description by Aspects

Adoption of viewpoint-
based development

Textual DSL for
Graphical DSL

Tool-Independence of
DSLs

<h2>Technically</h2>	<p>Use of DSLs and generators</p>
<h2>Development Duration</h2>	<p>For a basic viewpoint </p> <ul style="list-style-type: none"> Manually: 8-10 days With Viewpoint DSL: 5-8 hours <p>For a draft viewpoint: 10 minutes</p>
<h2>Expreience sharing</h2>	<p>Benefit from experience of a central team </p> <ul style="list-style-type: none"> Definition of common foundations Accurate knowledge of technologies and tools Correction and evolution <p>Network of expertise with Kitalpha users (needs, feedbacks, assistance, practices...)</p>

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Productivity and Quality	Homogeneity of DSL based ModelArchitect	Achievement of the Concrete System
Aggregation and Extensibility of Services	Kitalpha	Incremental Description by Aspects
Adaptation of aspect-based development	Normal DSL for graphical DSL	Test independence of DSL



Capella

and other workbenches / DSL(M)s

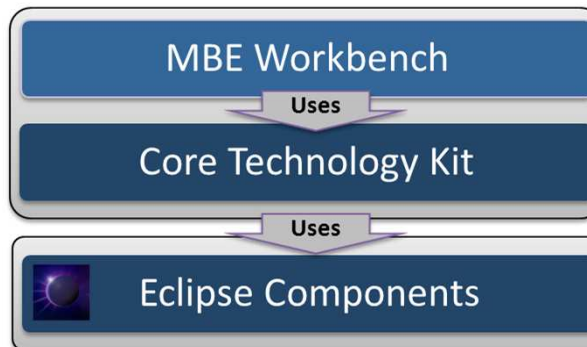
Capitalization



Tool infrastructure
Practices

Kitalpha

 **Sirius**



Engineering Level for development and execution of MBE Workbench and its viewpoints.

Technology Level with components for engineering needs not provided by Eclipse.


Productivity and Quality	Homogeneity of DSL-based Workbenches	Achievement of the Concrete System
Aggregation and Extensibility of Aspects	OK Kitalpha	Incremental Description by Aspects
Adoption of aspect-based development	Several DSL for graphical DSL	Tool independence of DSL

Expectations of Textual DSL Features

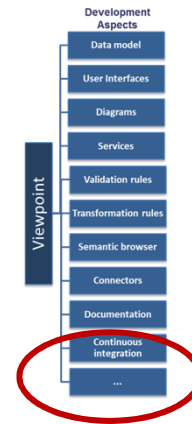
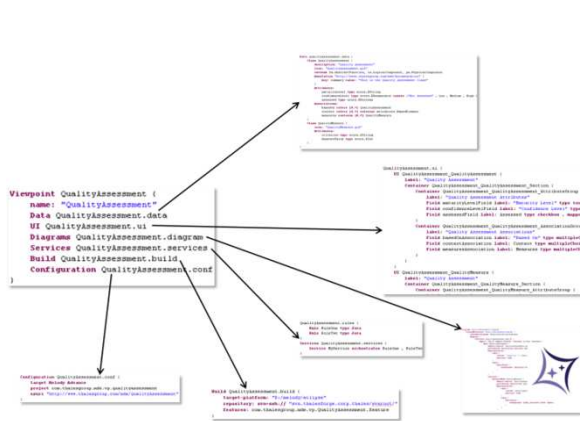


Risk

- Mature, simple
- Highlighting, completion
- Validation
- Smart assistance

- Time-consuming to achieve 
- As the entry point, risk of rejection of the tool when expectations are not met

Productivity and Quality	Reengineering of DSL based Model-driven	Achievement of the Concrete Syntax
Aggressiveness and Extensibility of Services	CoE KitAlpha	Integration of Description by Aspects
Adoption of enterprise-level development	Standard DSL for Graphical DSL	Test Independence of DSL



How to integrate a new development aspect?

Abstract Syntax

- Dynamic extensibility of the grammar
- Reflexivity: same technique than extensibility at the viewpoint data level



Textual Concrete Syntax

- With xText:
 - Dynamic extensibility for templates, commands, assistance
 - But aggregation of the textual concrete syntax
- Issue of dynamic extensibility of grammar with compiled DSLs



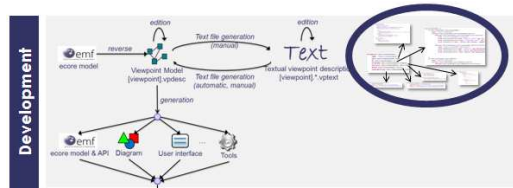
Productivity and Quality	Homogeneity of DSL based ModelBuilders	Abstraction of the Concrete Syntax
Aggregation and Extensibility of development	KitAlpha	Incremental of Description by Aspects
Adoption of aspect-based development	Normal DSL for Graphical DSL	Test independence of DSL

Adoption of viewpoint-based development

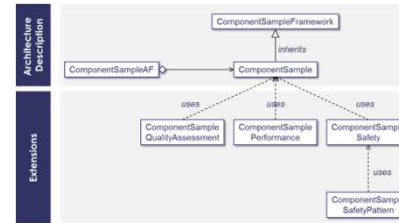
With focus on DSL



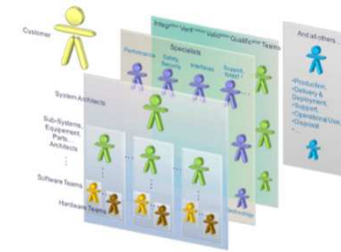
ISO/IEC 42010 Std



Kitalpha Team



Viewpoint Development Team



End Users



Tooling

- Requirement of specific DSL editors, generators, services
- Adoption of textual editors by the developments teams; no demand of graphical editors

Organization of the Kitalpha Team

- On interface: one person for requirements and validation
- Presentation level: one person specialized for the development of the concrete syntax
- Logical level: one person specialized for the development of the abstract syntax and generators
- Agreement needed between those three persons

Architecture and Design (vp development team)

- Decoupling a workbench by viewpoints
- Need of clear viewpoint architecture
- Development based on the generated artefacts from the descriptions with DSLs (= backbone)
- Adoption of the viewpoints by the end users





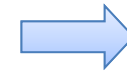
Textual DSL for diagram description



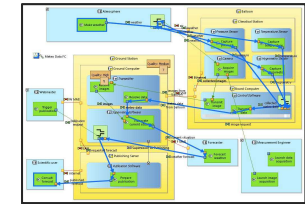
Generation



Edition of odesign files



Execution



Edition of diagrams

Motivation



Improvement

- Integration and coherence of diagram description with other aspects described by textual editors


- The real improvement is to generate textual diagram descriptions from the data description and with diagram description templates / patterns
- This will be a future work

Productivity and Quality	Reorganization of DSL based Workbenches	Achievement of the Concrete Syntax
Aggregation and Extensibility of Aspects	CX Kitalpha	Integration of Description by Aspects
Adoption of aspect-based development	Textual DSL for Graphical DSL	Text Independence of DSL

Observation



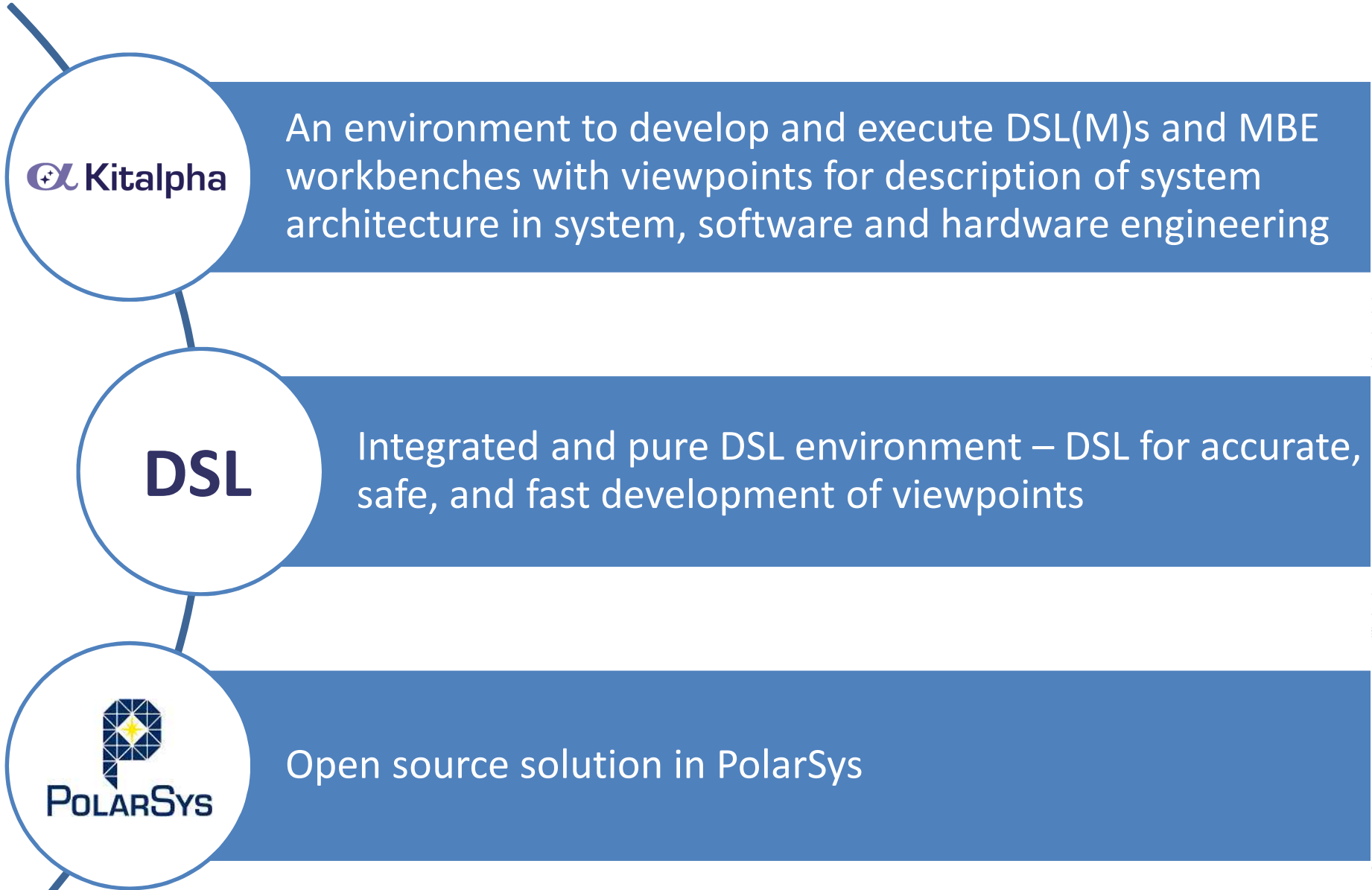
Risk

- The textual diagram description is close to Sirius
 - The textual data description is mapped to an (EMF) ecore model, but could be mapped into a UML profile
 - The textual description for continuous integration remains at high level of description because it uses an intermediary model down to generation of the final scripts
-
- Difficulty to target a tool *and* being tool-independent 
 - Alternative when a DSL becomes too dependent and limited: creating an alternate and more generic DSL

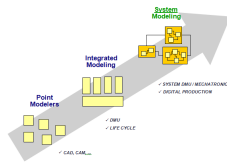
Productivity and Quality	Reengineering of DSL-based Model-driven	Achievement of the Concrete Syntax
Aggregation and Extensibility of Systems	CoK KitAlpha	Incremental Description by Aspects
Adaptation of aspect-based development	Normal DSL for Graphical DSL	Tool Independence of DSLs

Conclusion

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Thank You!

<https://www.polarsys.org/projects/polarsys.kitalpha>

<https://polarsys.org/wiki/Kitalpha>

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[#LangloisBenoit](#)