



Interactive Realtime Multimedia Applications
on Service Oriented Infrastructures

3rd EU ICT IRMOS

Public Seminar

University of Oslo

16th September 2010

Modeling Interactive Real-time Applications on Service Oriented Infrastructures

Application Modeling

Luís Costa

SINTEF

luis.costa@sintef.no

- What to model?
- Our approach
- Modelling applications and components in IRMOS
- Application Service Level Agreement
- Summary

What to model?



- Characteristics of distributed real-time applications on service oriented infrastructures. These may include information about:
 - the application itself: parameters, workflow, configurations, QoS
 - application components: parameters, configurations
 - links between components

Our approach

- Use UML modelling tool
- Develop a UML profile for modelling IRMOS scenarios
- PapyrusUML was chosen
 - Supports all required diagram types we need
 - Class Diagram/Composite Structure
 - State Machine Diagram
 - Activity Diagram
 - Open Source
 - Free
 - Availability
 - Extensibility

Our approach

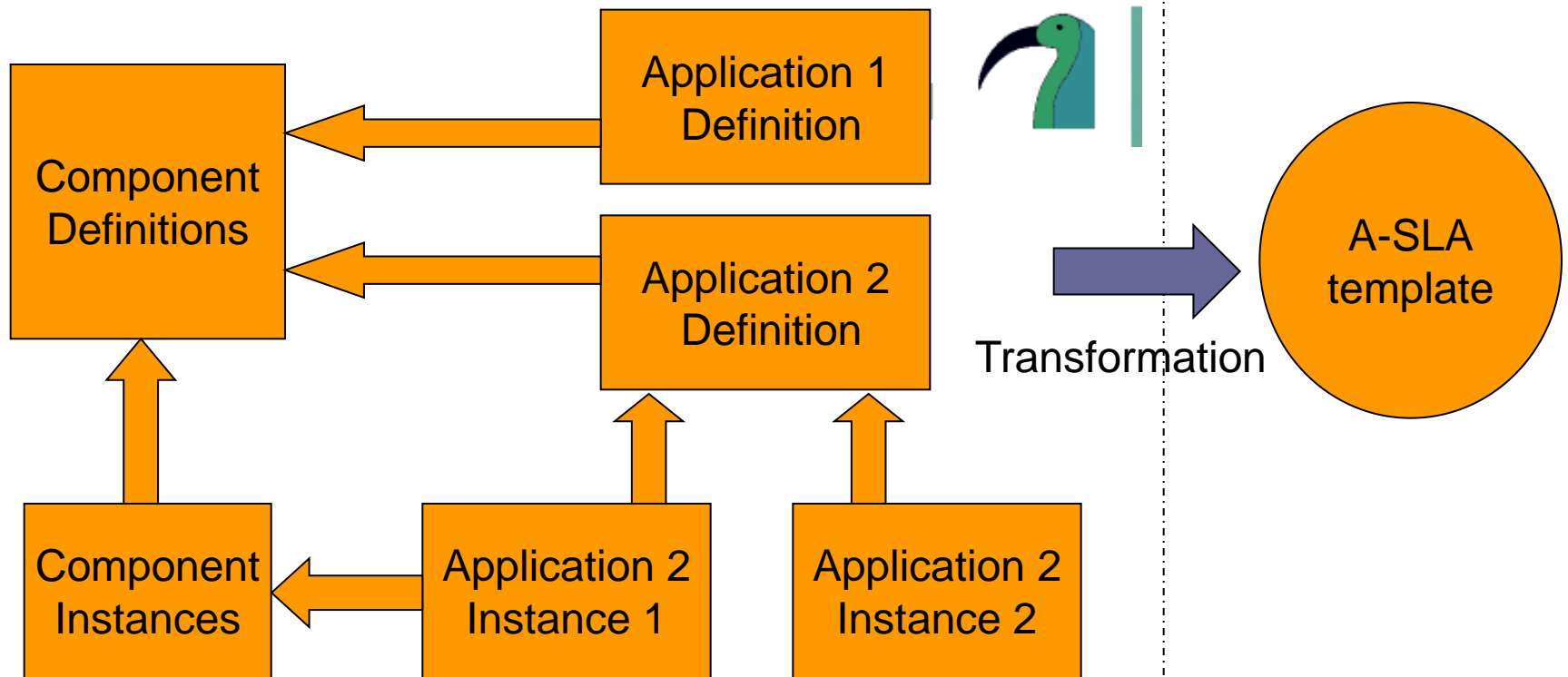
- UML Standard means what we do (i.e. transformations, methodology, et al) should be applicable to other UML tools
 - Enterprise Architect
 - MagicDraw
 - Etc.

- Use MOFScript to transform the UML models into an XML representation (model to text transformation).

- MOFScript supports generation of implementation code or documentation from models. It provides a metamodel independent language that allows to use any kind of metamodel and its instances for text generation.

Modelling applications and components in IRMOS

Papyrus UML modelling tool

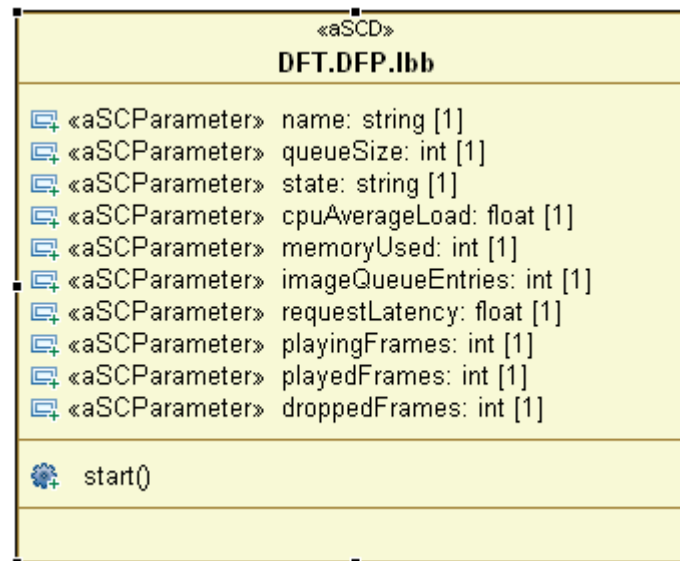


ASCD

- Describes an Application Service Component
- Holds a set of parameters that make sense for the ASC developer
 - Name
 - Type
 - Range
 - Enumerations

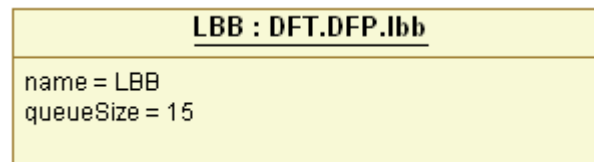
ASCD

- Specified using UML class diagrams with the ASCD stereotype.



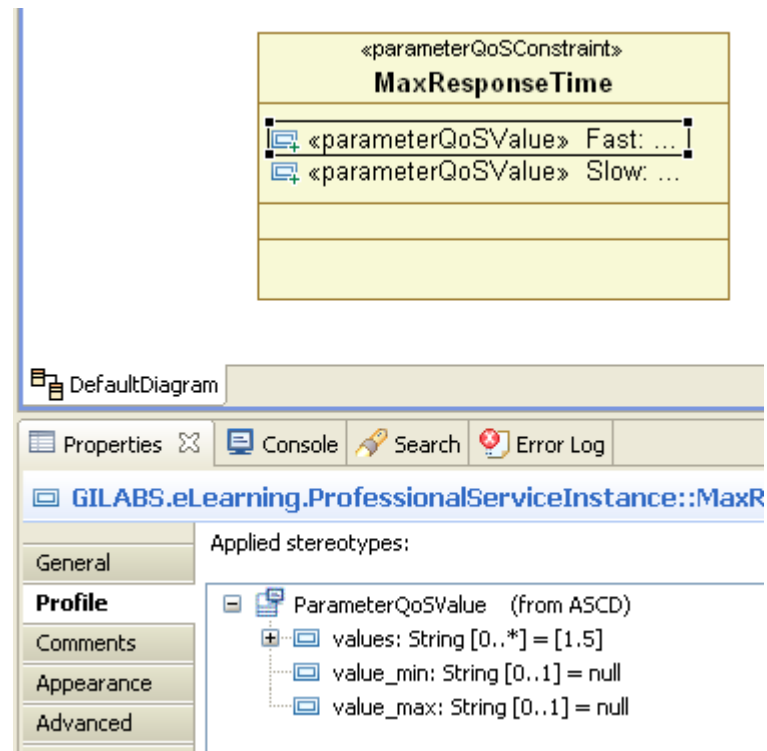
ASCD instances

- ❑ Specified using UML class diagrams
- ❑ The ASCD can be viewed as defining the Schema for ASCD instances
- ❑ Actual values are set for the parameters according to the "schema" defined



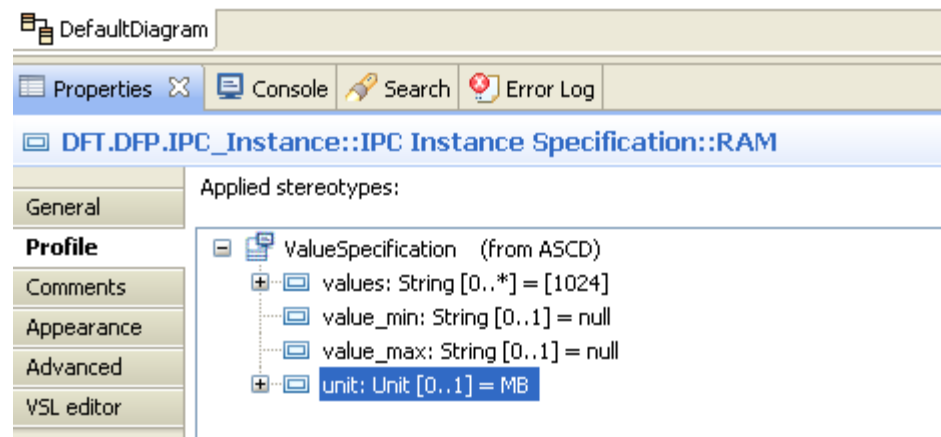
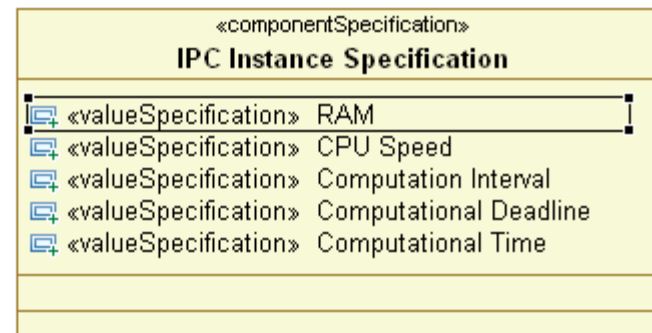
ASCD instances (QoS constraints)

- Specification of QoS values for application component parameters



ASCD instances (computing resources)

- ❑ Specification of the computing resources required by the components (e.g. CPU speed needed)



DefaultDiagram

Properties Console Search Error Log

DFT.DFP.IPC_Instance::IPC Instance Specification::RAM

General Applied stereotypes:

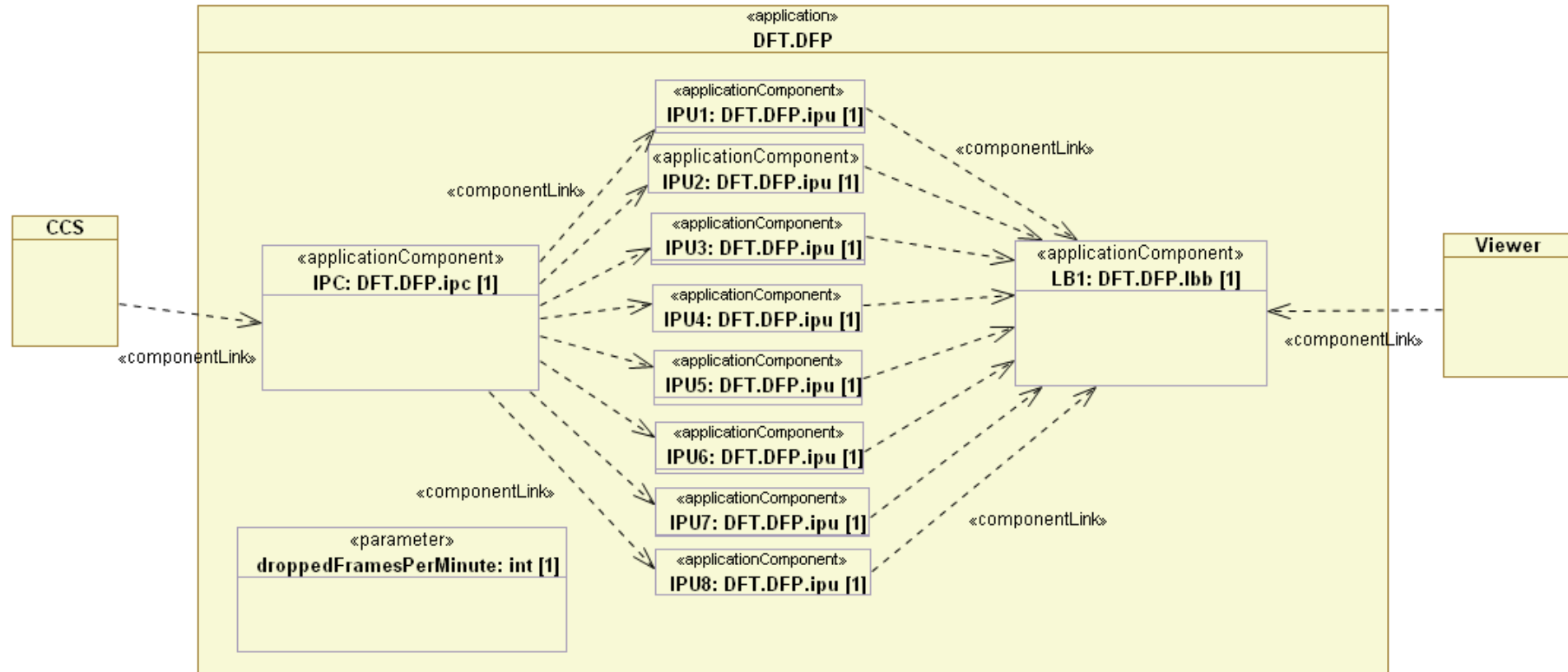
Profile

- ValueSpecification (from ASCD)
 - values: String [0..*] = [1024]
 - value_min: String [0..1] = null
 - value_max: String [0..1] = null
 - unit: Unit [0..1] = MB

Application model

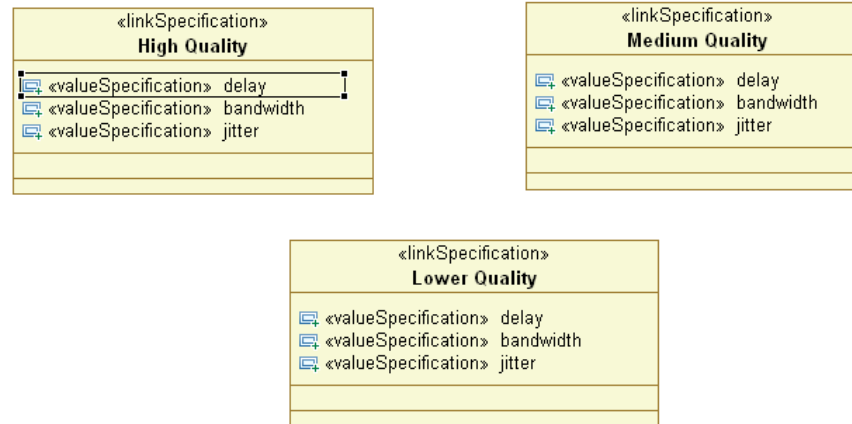
- Describes the 'topology' of the application (components involved, links between them) and application parameters.
- Specified using UML composite structure diagrams.
- Includes a workflow description (UML activity diagram) and specifications for the components in the context of the application (e.g. CPU speed needed)

Application model



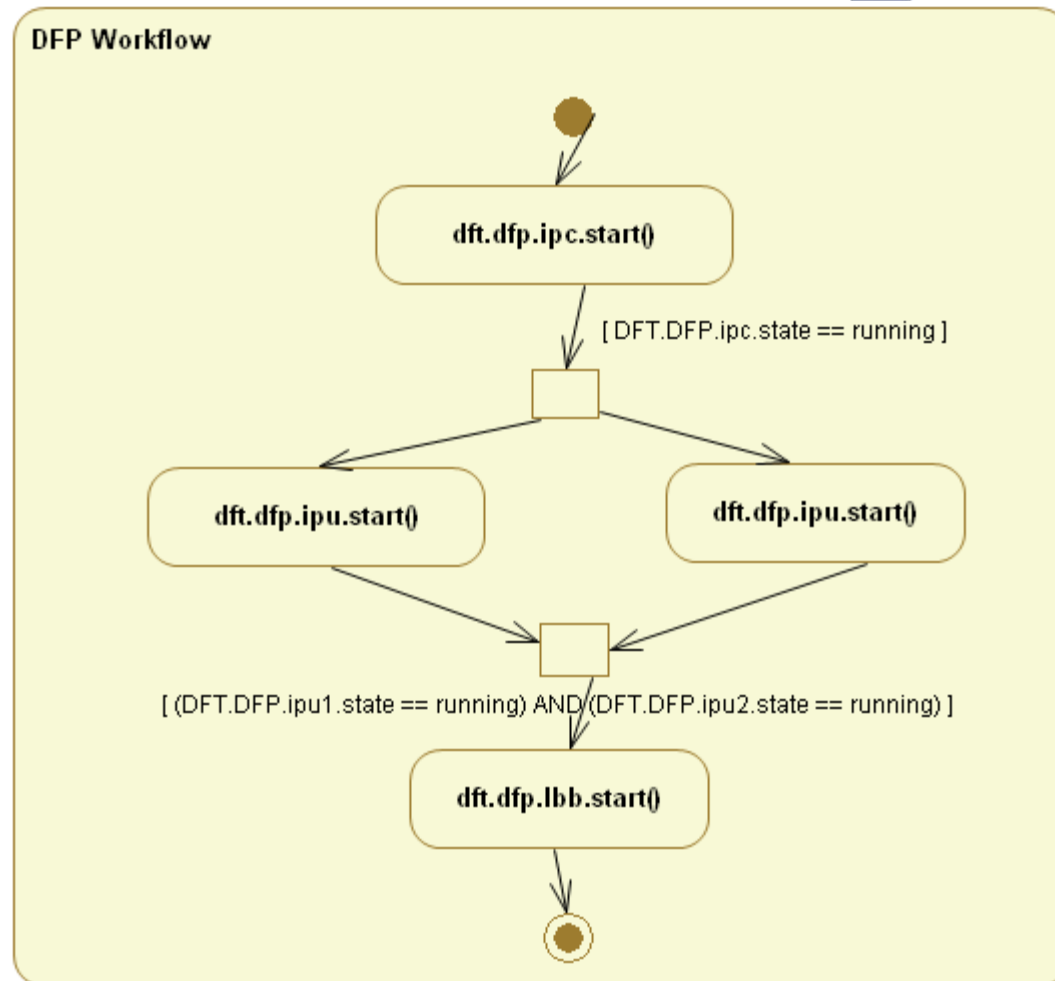
Component network links

□ Specification of QoS for component network links



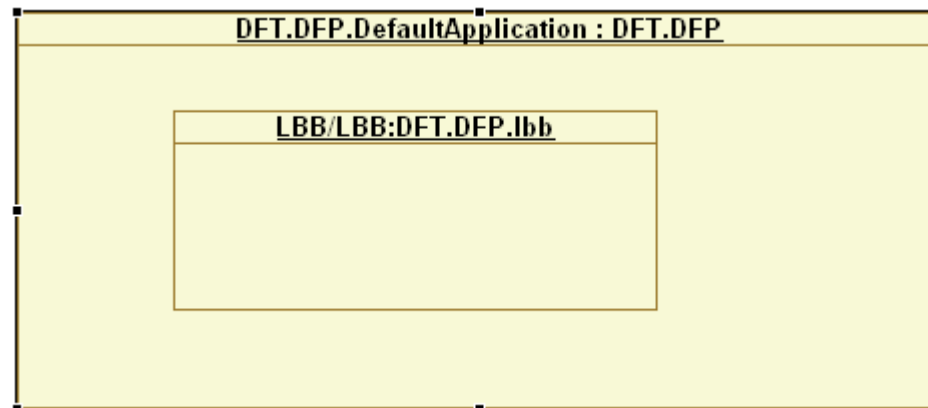
The screenshot shows a software interface for specifying properties. At the top, there are tabs for 'Console', 'Search', and 'Error Log'. Below this, the title bar reads 'h Quality::delay'. The main area is divided into two sections: 'Applied stereotypes:' and 'Property values:'. Under 'Applied stereotypes:', there is a tree view showing 'ValueSpecification (from ASCD)' with the following properties: 'values: String [0..*] = [20]', 'value_min: String [0..1] = null', 'value_max: String [0..1] = null', and 'unit: Unit [0..1] = msec'. Under 'Property values:', there is a single entry: 'Units::msec'.

Application workflow



Application instances

- Specified using UML composite structure diagrams. ASCD instances are assigned to 'slots' in the application specification.



Application Service Level Agreement (A-SLA)



- Application definition wrapped in WS-Agreement container (agreement between a service provider and a service consumer about the terms in which the consumer will use the application)
- Starting point is the A-SLA template - a document that describes the application with some parameters left open for the user and the application provider to agree on (for example application completion time and application cost). When all the necessary parameters have been agreed it becomes an A-SLA.
- Conceptually the A-SLA will contain information about:
 - Identification
 - ASCD instances
 - Application level parameters and ASCD parameters
 - Workflow
- Some of the information will be automatically transferred from the UML model through a transformation.

A-SLA template

```

<?xml version="1.0" encoding="UTF-8" ?>
- <p:Template xmlns:p="http://www.ggf.org/namespaces/ws-agreement" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.ggf.org/namespaces/ws-agreement
wsagreement.xsd">
- <p:Context>
- <p:AgreementInitiator>
- <CustomerIdentification>
  <ID />
  <DN />
  <Name />
</CustomerIdentification>
</p:AgreementInitiator>
- <p:AgreementProvider>
- <ASPIentification>
  <Name />
  <DN />
  <ID />
</ASPIentification>
</p:AgreementProvider>
</p:Context>
- <p:Terms>
- <p:ServiceDescriptionTerm>
- <app:Application binaryUri="http://www.somewhere.com/appURI" version="0.5" xmlns:app="http://www.irmos-project.eu/application" xmlns:speclang="http://www.irmos-project.eu/speclang/1.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.irmos-project.eu/application application.xsd" id="XYZ" name="VARLowResApplication">
  <app:qoS mtbf="P1Y2M3DT10H30M" mtr="P1Y2M3DT10H30M" />
  <app:appParam name="serverTranscoding" paramRef="VarServer.transcoding" value="" />
  <app:appParam name="consumerTranscoding" paramRef="VarClient.transcoding" value="" />
- <app:components binaryUri="http://www.somewhere.com/ascURI" id="VARServer" version="0.1">
  <dependency>"0xFFFF"</dependency>
  <dependency>"389admin"</dependency>
- <parameters name="fps" type="int" isWorkload="false" isConfig="false" description="" monitorable="false">
  <speclang:BasicValue type="number" value="15" />
</parameters>
- <parameters name="resolution" type="string" isWorkload="false" isConfig="false" description="" monitorable="false">
  <speclang:BasicValue type="string" value="QVGA" />
  <valuesAllowed type="string" value="XGA" />
  <valuesAllowed type="string" value="QVGA" />
  <valuesAllowed type="string" value="SVGA" />

```

Summary

- ❑ UML profile and WS-Agreement specification for modeling the characteristics of distributed real-time applications on service oriented infrastructures.
- ❑ These specifications allow the creation of models containing a set of information enabling a SOI to use applications and their components regarding service level agreements, resource reservation, configuration, control, monitoring, benchmarking and modeling.



Interactive Realtime Multimedia Applications
on Service Oriented Infrastructures

Thank you!

Luís Costa
SINTEF

luis.costa@sintef.no

Further Information

<http://www.irmosproject.eu>

The research leading to these results has received funding from the EC Seventh Framework Programme FP7/2007-2011 under grant agreement n° 214777