

A K-Based Specification of Web Services

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Manel Amel DJENOUHAT

Laboratories : LIRE,team :GLSD ,UC2,Algeria,Cédric,team :VESPA

CNAM-Paris ,France

Pr.F.Belala , Pr.K.Barkaoui

djenouhat.manel@gmail.com

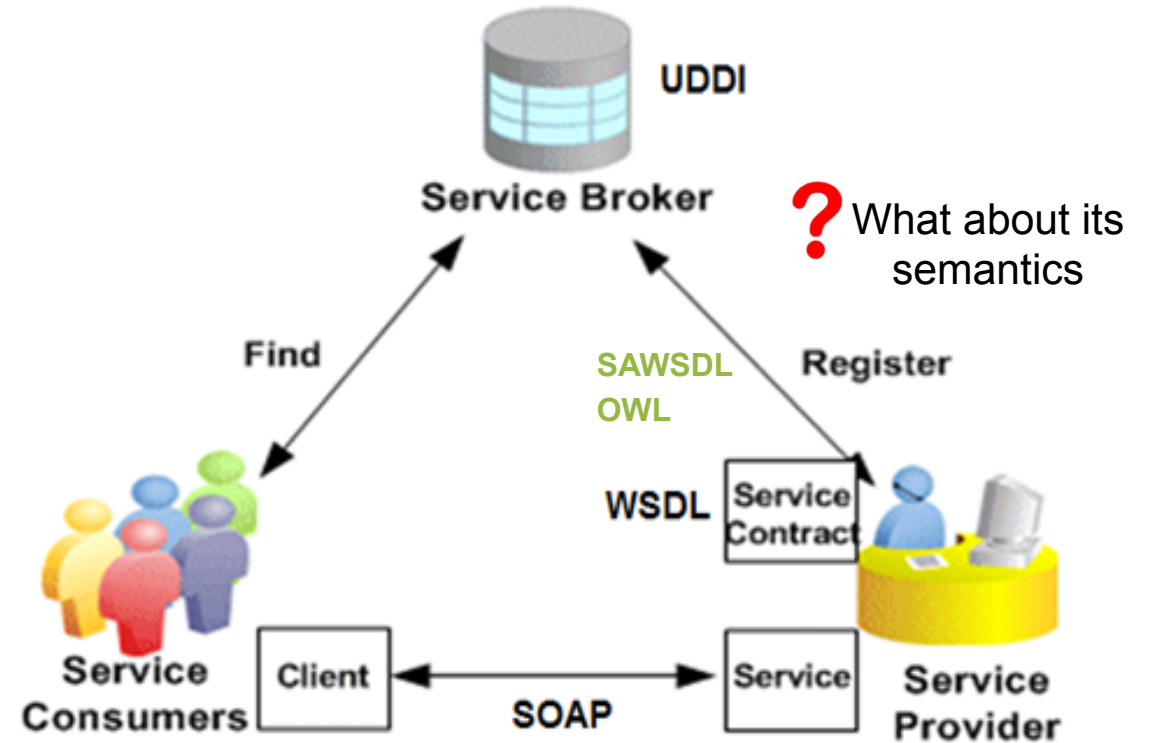
Outline

- Problematic
- Objectives
- Overviews
- Contributions
- Conclusion and Perspectives

SOA Conceptual Model

Standards :

- Service discovery-**UDDI**
Universal Description Discovery Intergration
- Service Description-**WSDL**
Web Service Description Language
- Service Invocation-**SOAP**
Simple Object Access Protocol



? Did the protocol describe the results of invocation

Problematic

Intervene at each phase of the Web service development process to solve problems

Objectives

❖ Infer an operational semantic to service contracts written in WSDL

Overviews

❖ Formalize the Interactions between services

Contributions

❖ Optimize the Web services selection algorithm

*Conclusion &
Perspectives*

❖ Test the compatibility between services and try to adapt them to the context-aware

❖ Verify and check the service properties

WSDL Web Service Description Language

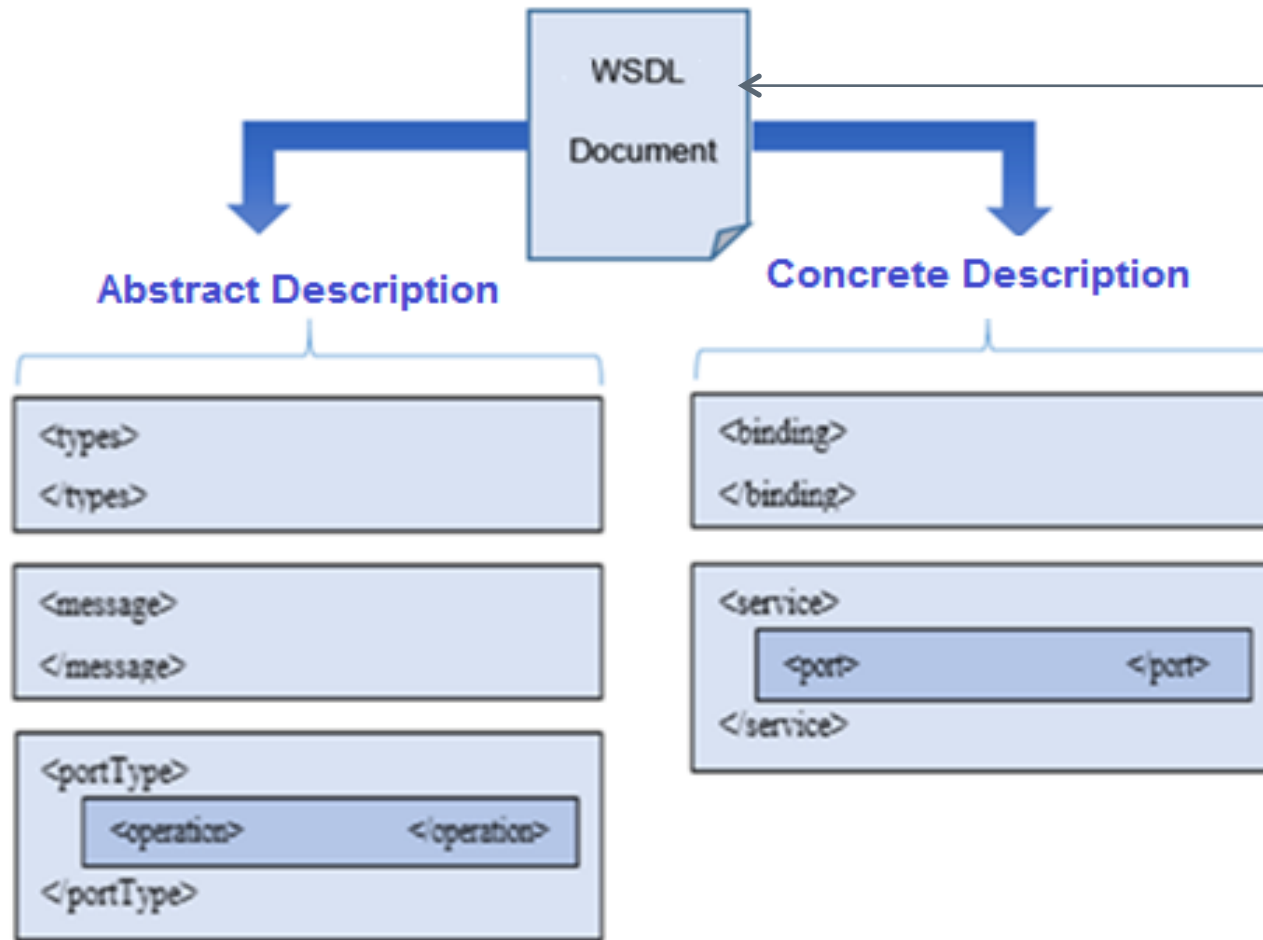
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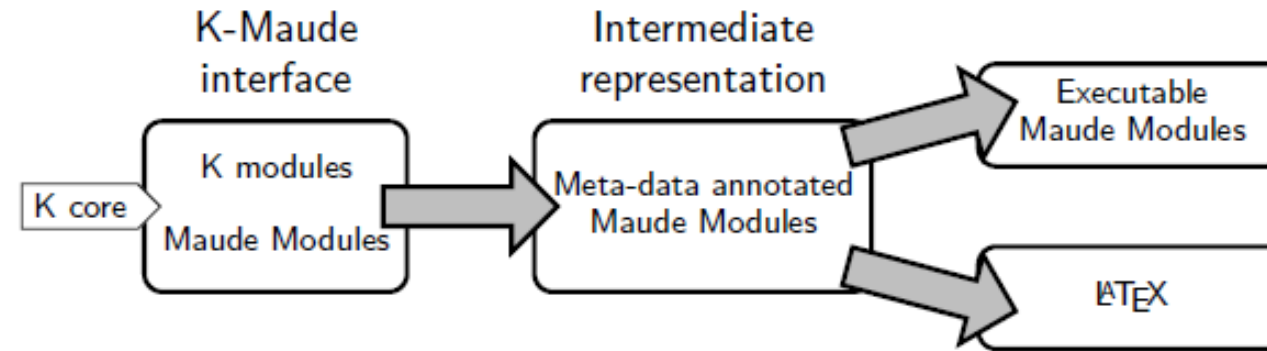
Conclusion & Perspectives



```
<?xml version="1.0" encoding="UTF-8" ?>
<definitions name="AktienKurs"
  targetNamespace="http://localhost:8080/aktienkurs"
  xmlns:xsd="http://schemas.xmlsoap.org/XMLSchema"
  xmlns="http://schemas.xmlsoap.org/wsdl" >
  <service name="AktienKurs">
    <port name="AktienSoapPort" binding="AktienKursSoap"
      soap:address location="http://localhost:8080/aktienkurs" />
    <message name="Aktie.HoleWert">
      <part name="body" element="xsd:TradingData" />
    </message>
  </service>
</definitions>
```

WSDL

The K-Tool



K module \equiv *Maude module (meta-data ,K semantic)*

K- syntax = *syntax of the language in K*

K- semantic = *(import) Ksyntax +Ksemantic (Evaluation strategies, Configuration, Rules)*

The K-Tool

$K\text{-semantic} = K\text{syntax} + K\text{semantic}$ (*Evaluation strategies , Configuration , Rules*)

- ❑ **Evaluation strategies :**

Link between the syntax and the semantic.

Gives the order in which the arguments of a construction must be evaluated.

- ❑ **Configuration :**

Represents the current state of execution.

- ❑ **Rules :**

Describe how a configuration evolve during the execution and which is susceptible to change states of the system.

Problematic

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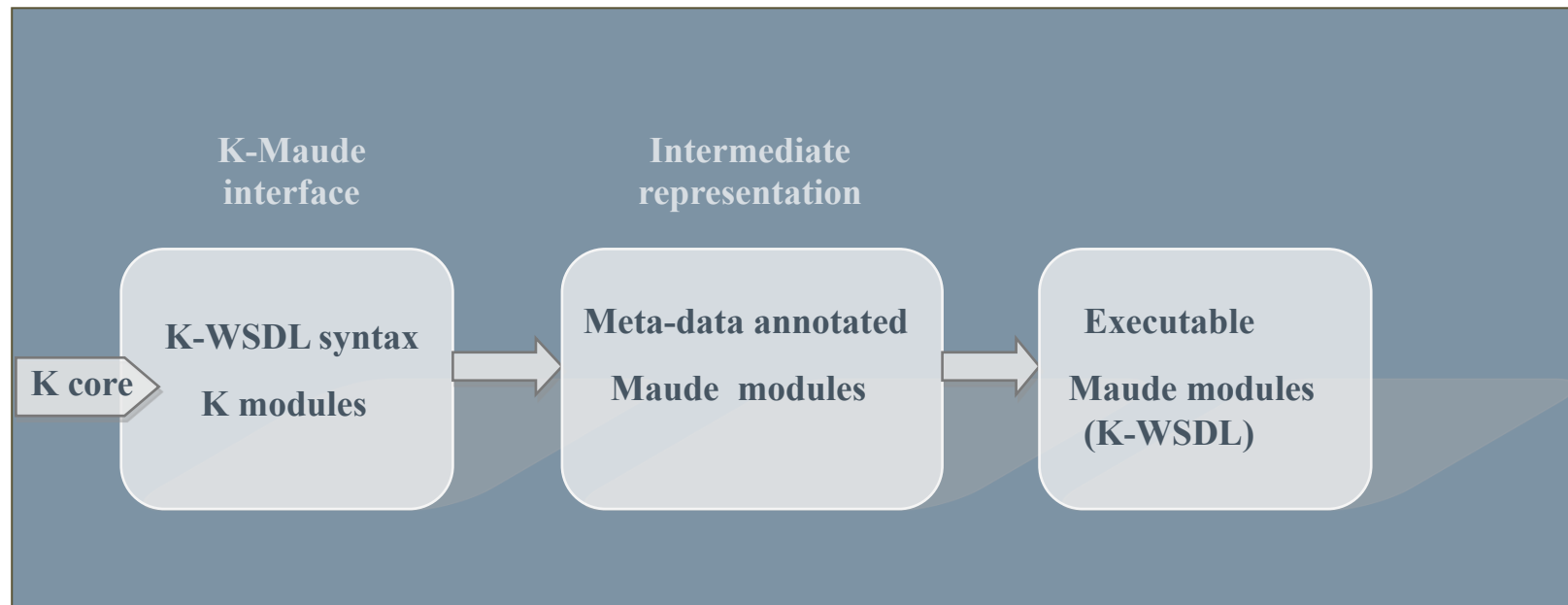
Contributions

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The K-Tool

A sound modeling methodology, to integrate WSDL into rewriting logic.

A high level specification of Web service without any encoding or translation process is given.



The K-Tool

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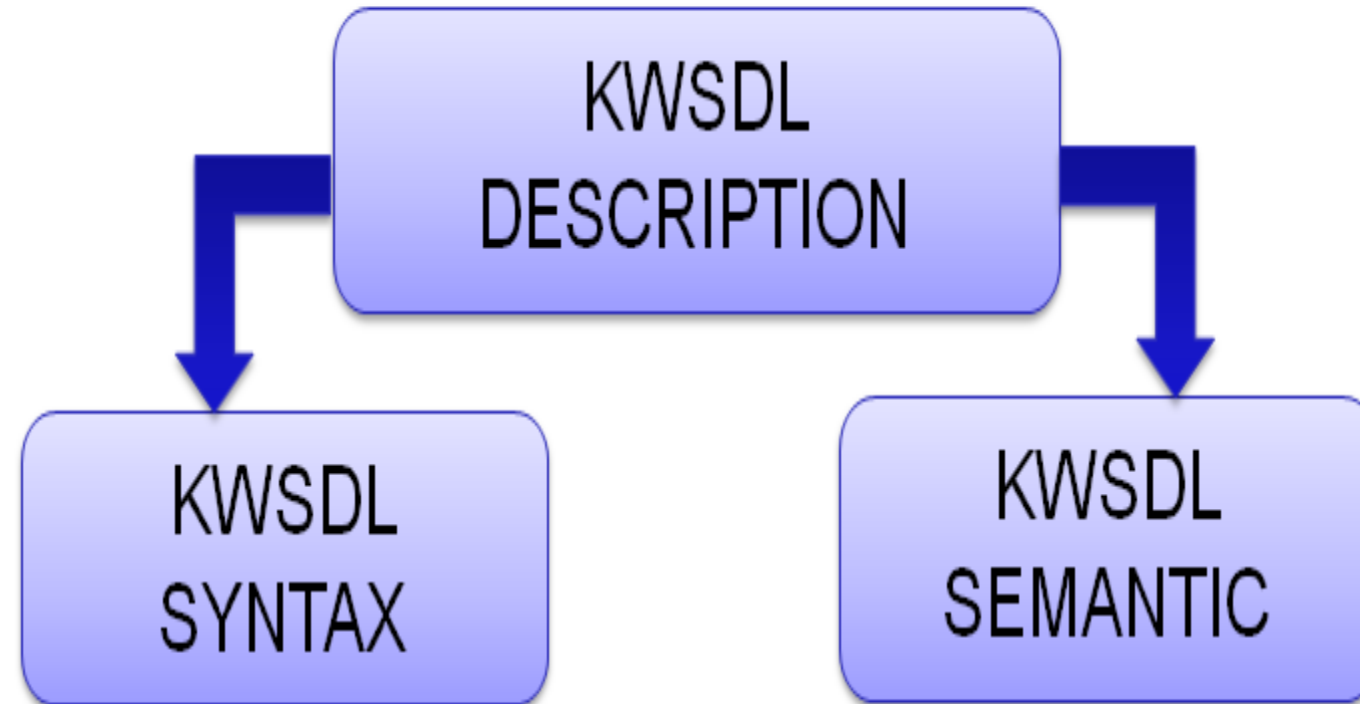
Advantages

The main objective of K is to prove that a formal specification language can be at the same time :

Simple, Comprehensive ,Analyzable ,Executable.

- ❖ Extend the syntax of an existing language by the possibility of enriching it by adding new concepts and elements in answer to susceptible appearing needs .
- ❖ Make a specification executable and consequently ,allow the concrete exploitation of the model.
- ❖ Offer a high level of abstraction by the definition of a meta-model including all the language concepts .
- ❖ Analyze and verify systems properties in a formal way by the use of the various mechanisms of analysis and check offered by the Maude language (K is implemented on the top of Maude).

Full proposed grammar of WSDL in K :



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The K-WSDL-SYNTAX Module

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```
Module KWSDDL-SYNTAX
Syntax K-WSDL ::= "KWSDDL" "ServiceName" ServiceId ":"
  "{" DescriptionPart "}"
syntax DescriptionPart ::= "messages" ":" {Message}"
  | "types" "=" {"Type"}"
  | "ports" "=" {"Port"}"
  | "bindings" "=" {"Binding"}"
  | "service" "=" {"Service"}"
  >DescriptionPart DescriptionPart [left]
syntax Message ::= MsgId TypeMsg ":" Msg
syntax TypeMsg ::= "request" | "response"
syntax Msg ::= String
syntax Type ::= TypeId ":" DataType
syntax Port ::= PortId ":" PortType TypeMsg ":" Msg
syntax PortType ::= "Input" | "Output"
syntax Binding ::= BindingId PortId Protocol Style "=" Body
syntax Service ::= ServiceId BindingId PortId Location
syntax Protocol ::= "SOAP" | "SMPT"
```

The K-WSDL Configuration

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```
configuration
<state color="yellow">
  <k color="green"> SPGM:WSDL </k>
  <definitions color="cyan">
    <message color="orange">.Map</message>
    <portType color="red" multiplicity="*">
      <PortName> "port" </PortName>
      <operation>.Map </operation>
    </portType>
    <binding color="Orchid" multiplicity="*">
      <bindingName>"binding"</bindingName>
      <bindingPortName>"bindingPortName"
      </bindingPortName>
      <protocol>"protocol"</protocol>
      <style>"style"</style>
    <inputOperations>.Map</inputOperations>
    <outputOperations>.Map</outputOperations>
    </binding>
    <service color="green" multiplicity="*">
      <serviceName>"nameservice"</serviceName>
      <bindingName>"binding"</bindingName>
      <bindingPortName>"bindingPortName"
      </bindingPortName>
      <location>.Map </location>
    </service>
    <Exchange color="red">.Map </Exchange>
  </definitions>
  ...</state>
```

The K-Rules

```

Module KWSDL
imports Module KWSDL-SYNTAX
rule <k>...port X = {O} => X ~> O ...</k>
( =><portType>
<PortName> X </PortName>
<operation>.</operation>
</portType> )
-a-
rule <k>... X ~> TP:Type T:TypeMsg : MS:Msg =>
X ~> . ...</k>
<portType>
<PortName> X </PortName>
<operation>Rho:Map ( => T P T |-> MS
)</operation>
</portType>
rule <k>... service S ~> U:Loc : AS:AdresseService => S
~> . ...</k>
-b-
<service> ...<serviceName> S </serviceName>
<bindingName>B</bindingName>
<bindingPortName>BP</bindingPortName>
<location>Rho:Map( => U |-> AS )</location>
</service> -c-

```

Semantics of Syntactic Declarations

```

rule <services>...
<serviceName>X</serviceName>
<PortName>P</PortName>
<Operations>...Out P:PortId |->(RequestMsg :String=>.)
...</Operations>
<binding>..
<BindingName>Y</BindingName>
<Binding>... In B:BindingPort |->
(Request:String=>Resquest+ResquestMsg)...</Binding>
<exchange> Rho:Map</exchange>
When ShasMapping(Rho,X.P)
andBool (Y.B==K Rho:Map (X.P))
andBool Request==String ""
.....

```

Operational Semantics



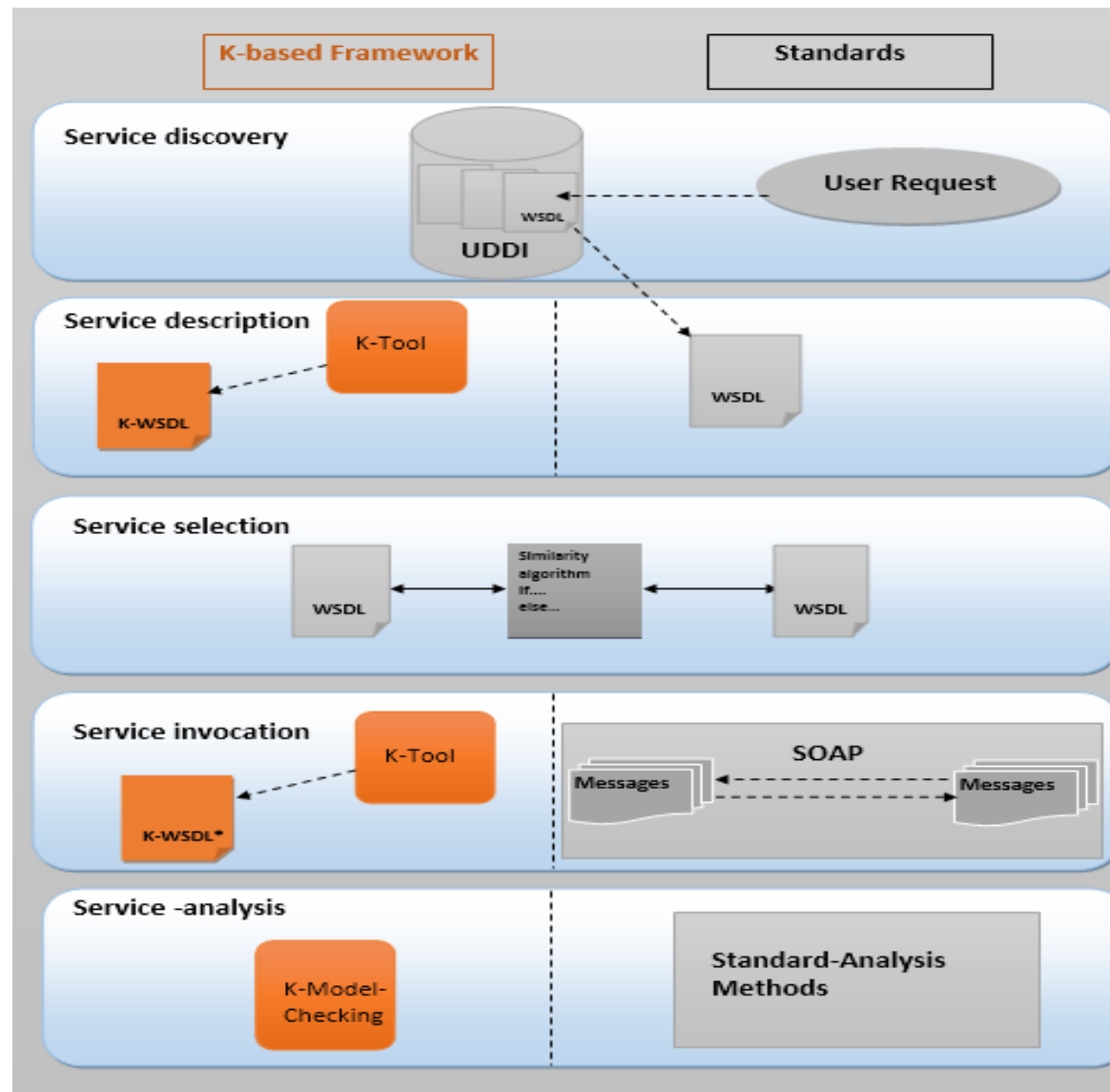
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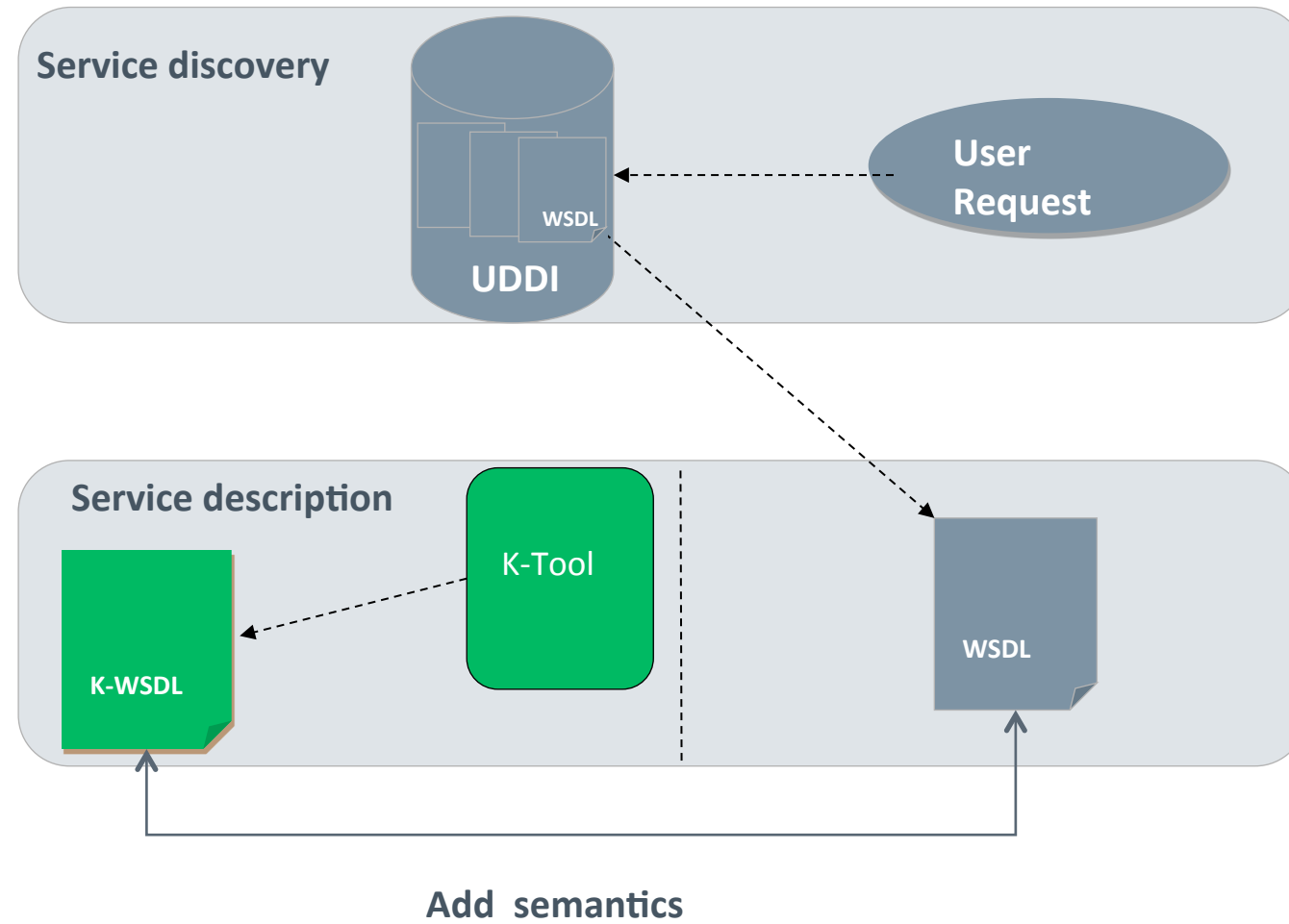
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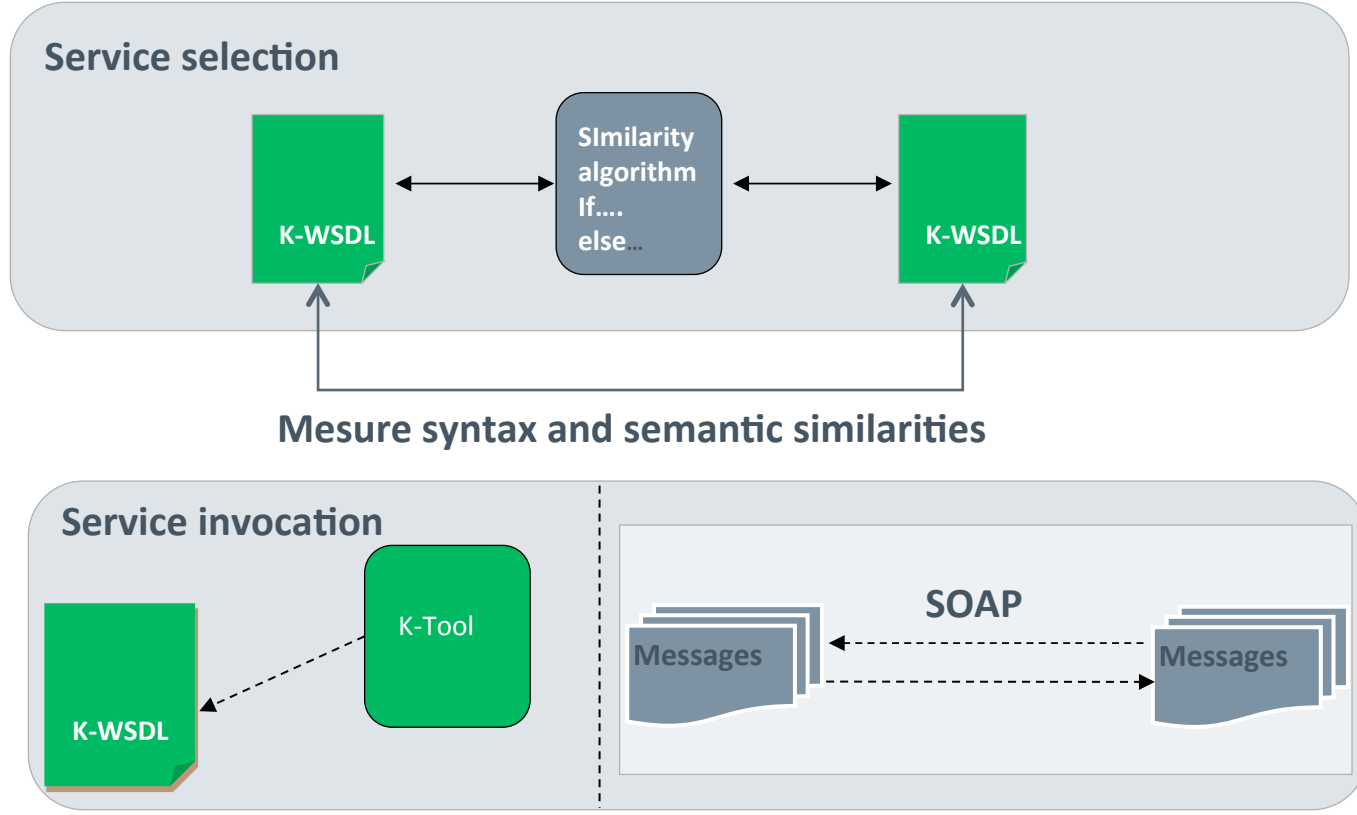
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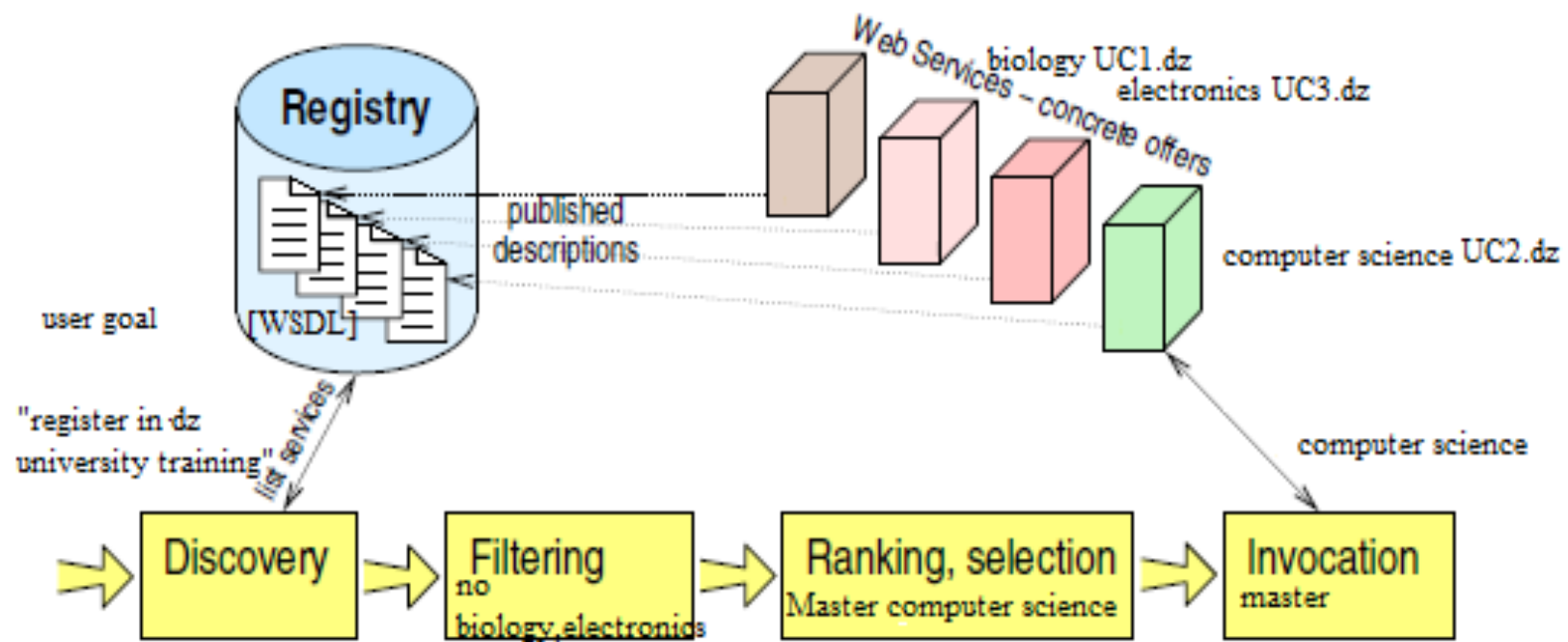
Example : Student registration

Objectives

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The K-WSDL description of the student service and its execution in K

Problematic

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```
WSDL Service Name Student:
{definitions Service Name = Student:
{TargetNamespace Tns = "http://www.UC2.dz/kwsdl/Student.kwsdl"
DefaultNamespace Dns ="http://schemas.xmlsoap.org/kwsdl"
message NumCardSearch request : "NumCardStudentRequest"
message NumCardFound response : "NumCardStudentresponse"
port StudentPort = Input request : "NumCardStudentRequest"
port StudentPort = Output response : "NumCardStudentresponse"
binding StudBinding StudentPort SOAP rpc =
    EncodingStyle = "http://schemas.xmlsoap.org/soap/encoding/"
    Tns = "http://www.UC2.dz/kwsdl/wiki.kwsdl"
    use = encoded
    service Student
    StudBinding
    StudentPort
    ServiceLocation : "http://www.UC2.dz/"

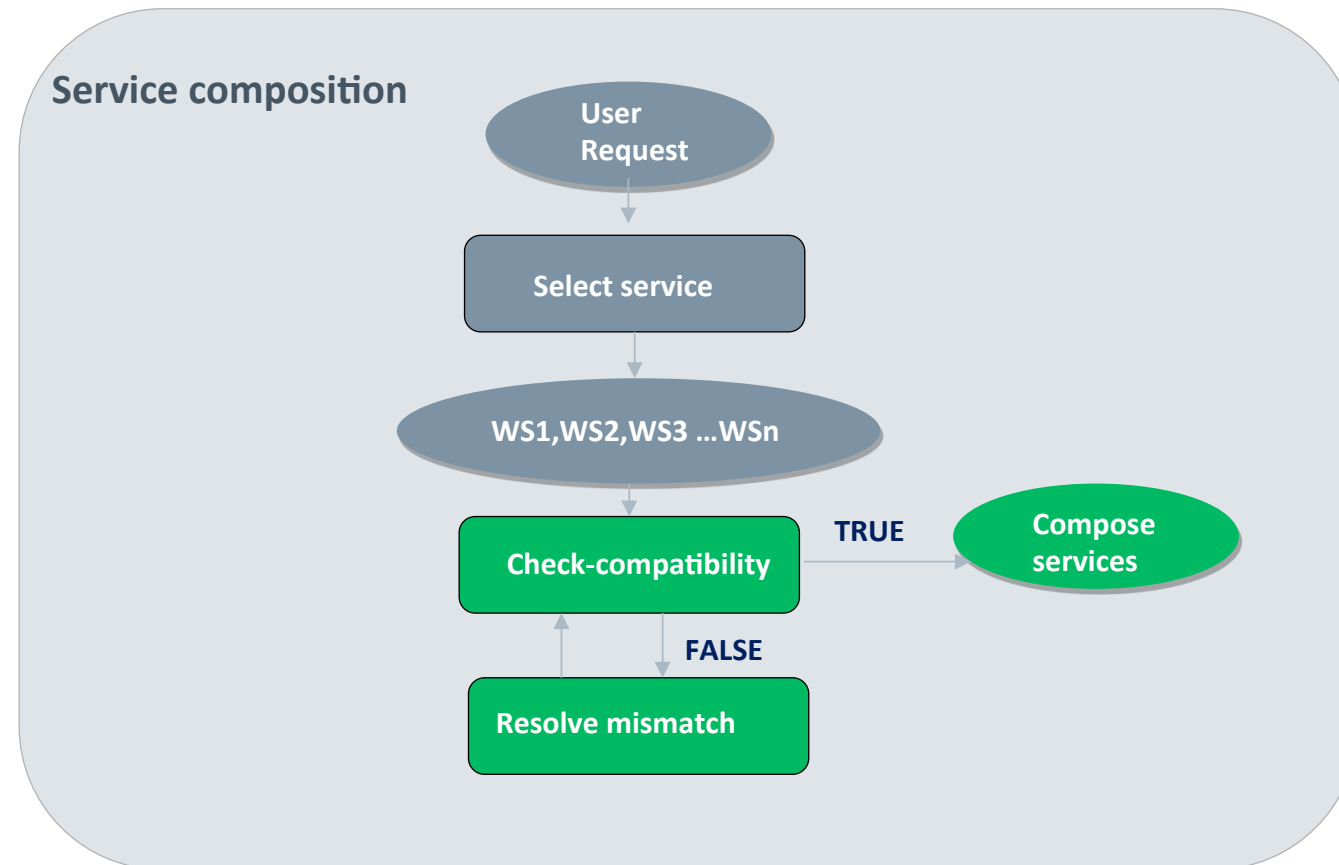
exchange UC2 . Studentport to StudBinding . SendnumCardStudentRequest
exchange Student .receiveNumCardStudentResponse to StudBinding .Studentport
}
}
```



```
192.168.0.128 - PuTTY
</binding>
<service>
  <bindingName>
    studentBinding
  </bindingName>
  <bindingPortName>
    StudentPort
  </bindingPortName>
  <serviceName>
    Student
  </serviceName>
  <location>
    ServiceLocation |-> "http://www.UC2.dz/"
  </location>
</service>
</definitions>
<Exchange>
  studentBinding . StudentPort |-> Student . sendNumCardStudentRequest
  UC2 . StudentPort |-> studentBinding . receiveNumCardStudentResponse
</Exchange>
</state>
cvm$
```



Service composition process



Contributions :

- ❖ Defining a generic syntax for Web service
- ❖ Integrating WSDL in Maude using K technique .
- ❖ Defining a complete formal execution framework for Web service
- ❖ K represents the overall SOA architecture in a formal semantic framework

Future Work :

- ❖ Enrich the K-WSDL specification based on various related work
- ❖ Exploiting the result model for executing more complex systems
- ❖ Describe formally the web service behavior (rewrite rules..)
- ❖ Check the compatibility and similarities between services to compose them
- ❖ Verifying the correctness of some properties :QoS, dynamic reconfiguration ...etc.
- ❖ Extending the proposed syntax of K-WSDL to deal with some others aspects (composition..)
- ❖ Exploiting the K2-tool (last release of K).

Thank you for your attention !