NOVI
Federating Future Internet platforms

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NORDUnet conference – Sep.12 2012
NOVI

Networking innovations Over Virtualized Infrastructures
The project

• Project type: STREP

• Contract nr: FP7 – 257867

• Project website: www.fp7-novi.eu

• Project start date: September 2010

• Duration: 30 months
Towards a future where network, computing and storage are much more integrated.

Think of programmability.

The driver is:

*experimentally-driven research*, combining visionary academic research with the wide-scale testing and experimentation that is required for industry.
NOVI concentrates on:

1. efficient approaches to compose virtualized e-Infrastructures towards a holistic Future Internet (FI) cloud service;

2. methods, information systems and algorithms that will enable users with composite isolated slices, baskets of resources and services provided by federated infrastructures.
Provides virtualized computing resources:

- Virtual machines

Provides virtualized networking resources:

- Logical routers

Current NOVI platforms

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Experimentation environment
How can you identify, select and monitor federated resources without a common language?

NOVI INFORMATION MODEL
In lack of a common model

<table>
<thead>
<tr>
<th>How the customer explained it</th>
<th>How the Project Leader understood it</th>
<th>How the Analyst designed it</th>
<th>How the Programmer wrote it</th>
<th>How the Business Consultant described it</th>
</tr>
</thead>
<tbody>
<tr>
<td>How the project was documented</td>
<td>What operations installed</td>
<td>How the customer was billed</td>
<td>How it was supported</td>
<td>What the customer really needed</td>
</tr>
</tbody>
</table>
The role of the NOVI information model
We conducted an extensive overview of IM/DM in the Future Internet area:

- CIM
- DEN-NG
- NDL
- MOMENT

and the models used in various FI initiatives.

We started to build the NOVI IM using some of them.
NOVI IM Ontologies

- Base Ontology
  - Unit Ontology
  - Monitoring Ontology
  - Policy Ontology
Features of NOVI IM

• Support for Virtualization Concepts
• Semantics and Context – awareness
• Support for Vendor Independency
• Support for Monitoring and Measurement Concepts
• Support for Management Policies
NOVI IM – Resource Classes

Resource

Network Element
- Interface
- Link
- Path
- Virtual Node

Node
- CPU
- Memory
- Storage
- Disk Image
- Login Component

Switching Matrix

Group
- Location
- Lifetime
- Bidirectional Interface
- Bidirectional Link
- Topology
- Platform

Service
- Processing Service
- Storage Service
- Memory Service
- Switching Service
Challenges of an Information Model for Federating Virtualized Infrastructures: the NOVI usecase

Jeroen van der Ham, Chrysa Papagianni, Jozsef Steger, Peter Matray, Paola Grosso, Leonidas Lymberopoulos, Yiannos Kryftis

In: 5th International DMTF Academic Alliance Workshop on Systems and Virtualization Management: Standards and the Cloud

Towards an Infrastructure Description Language for Modeling Computing Infrastructures

Mattijs Ghijsen and Jeroen van der Ham and Paola Grosso and Cees de Laat,
In: 10th annual IEEE International Symposium on Parallel and Distributed Processing with Applications (ISPA 2012), Madrid July 2012
RESOURCE SELECTION

How does a NOVI user get the resources he wants?
How does NOVI finds the resource needed for the request?
Different types of control from the user when requesting resources:

• **Bound**
  – Mapping between virtual resources and physical resources is *explicit*.

• **Unbound**
  – No mapping specifies

• **Partially bound**
  – In between, some is free and some is defined.
Retrieving Information

1. Get a Topology
2. Extract the information...
3. Construct dynamically SPARQL Queries
4. Sesame RDF Triple Store
Retrieve the Data in RDF triples

Use Alibaba to translate the triples to Java objects

Use IMCopy to translate the Alibaba objects to the implemented Java classes

Deliver the results in the implemented Java objects

Sesame RDF Triple Store
SLICE CREATION

How does a slice gets created?
Slice creation: local resources

User clicks on send request
Create Slice
Split Request
[for each testbed]
Find Resources
Authorize Resources
[Request partially bound]
Map/Sub Request
Slice creation: federated resources
Goal is to support embedding user requests for virtual resources nested within a federated shared physical substrate.

Two phases:

- **Virtual Network Partitioning**
  
  Splits VN requests between testbeds - members of the NOVI federation

- **Virtual Network Embedding**
  
  Provides a mapping of Virtual Network requests to specific substrate nodes and links within a single administrative domain
  
  Different embedding strategy for each testbed.
C. Papagianni, A. Leivadeas, S. Papavassiliou, V. Maglaris, C. Cervello-Pastor and A. Monje.
“On the optimal allocation of virtual resources in cloud computing networks”,
Under Revision, IEEE Transactions on Computers
How do you provide feedback to users?
How do you monitor resources?
### User feedback

**Networking innovation Over Virtualized Infrastructures**

**User Feedback on Request ID: 41f8e220-af2a-4a72-9151-8d103e624d95**

<table>
<thead>
<tr>
<th>NOVI-API (CXF Accept)</th>
<th>IRM (ProcessGroups)</th>
<th>IRM Analyzing</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOVI-API (Request Listener)</td>
<td>IRM Checking type of virtual request...</td>
<td></td>
</tr>
<tr>
<td>NOVI-API (Request Producer)</td>
<td>IRM (Creating Slice) Checking virtual topology...</td>
<td></td>
</tr>
</tbody>
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- **RIS (findResources)**

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Resource Monitoring

Monitoring Plane

Testbed A

Monitoring Service

Neighbor Monitoring Interface

Testbed B

Monitoring Service

Neighbor Monitoring Interface

Virtual Layer

Slice #3
Slice #2
Slice #1

Physical Layer

Testbed A

Testbed B

Slice #1

Substrate Monitoring

Service Interface
What more we want to achieve in the project?
Using NOVI Software Layer

• Integration of software components
• Getting more experimenters using the software and the underlying platforms.

• The IM is available for other projects to experiment with.
The official project website:
• http://www.fp7-novi.eu/

• A summary publication:

*NOVI tools and algorithms for Federating Virtualized Infrastructures*

THANKS to all colleagues in NOVI

And in particular to my UvA colleagues:

• Jeroen van der Ham
• Chariklis PIttaras
• Adianto Wibisono