Infrastructures modeling

The solution to interoperability?
Who am I?

- Assistant Professor in the SNE group
- Italian
  - Graduated at the University of Turin (Italy)
- ... but leaving outside Italy since 14 years
  - Stanford Linear Accelerator Center (USA)
  - University of Amsterdam (NL)
- p.grosso@uva.nl
- http://staff.science.uva.nl/~grosso/
Before I start….

WHY AM I HERE?
OSDC and PIRE

- **OSDC**: an open-source, cloud-based \textbf{infrastructure} that allows scientists to manage, analyze, integrate and share medium to large size scientific datasets.

- **PIRE**: an international research and education experience.
Infrastructures

- Network
- Computing
- Storage

Putting it all together

and....

- Data
Holistic approach and cloud approach?

- Holistic approach: solving it all together, with a combined and optimal use of network, computation and storage

- Cloud approach: map-reduce, get the network out of the way
  - (mis?)-quoting Ian Sommerville

Are they different or not?
SNE

- **System and Network Engineering**
  - Lead by prof. Cees de Laat
  - ~30 researchers working in the group
  - Strong tie to education with own master program
  - Many national and international projects

- More information at the website: [http://sne.science.uva.nl/](http://sne.science.uva.nl/)
SNE main research question

- **quality of service** and **on-demand creation** of virtual infrastructure including the underlying network

- managing **sustainability** and **privacy** in a distributed, heterogenous infrastructure
What is happening?

DEVELOPMENT IN NETWORKS
Hybrid networks

Packet switching

Circuit switching
Dynamic lightpath switching

- How do we move from static to dynamic lightpaths?
- How do we achieve fast switching times?

**WSS - Wavelength-Selective Switches**

- **DAS-3+StarPlane**

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**P. Grosso, D. Marchal, J. Maassen, E. Bernier, L. Xu and C. de Laat**

*Dynamic photonic lightpaths in the StarPlane network*


**P. Grosso, L. Xu, JP Velders, C. de Laat**

*StarPlane - A National Dynamic Photonic Network Controlled by Grid Applications*

Many scientific applications have a distributed nature:
• Data are collected from many places, see radio-astronomy eVLBI/SCARlue.

• Data are sent to multiple locations for computation, see cosmological simulation – CosmoGrid.

Dynamic lightpaths have proven to support this type of applications.

D.Groen, S.Rieder, P.Grosso, C.de Laat, S.Portegies Zwart
A light-weight communication library for distributed computing
In: IOP journal Computational Science & Discovery 3 (2010) 015002 (14pp)
Software defined networks

- Move the intelligence out of the network hardware: application/software programmable networks.
Open Flow

http://www.internet2.edu/network/ose/

http://www.fp7-ofelia.eu/

Grid on demands

- If computing is ‘infinite’ and movable, then workflows and applications can *program* the network.

<table>
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<th>Running time</th>
<th>Pending time</th>
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R. Strijkers, W. Toorop, A. van Hoof, P. Grosso, A. Belloum, D. Vasuining, C. de Laat, R. Meijer

AMOS: Using the Cloud for On-Demand Execution of e-Science Applications
In: Proc. eScience2010 conf, Dec. 2010
User programmable networks
Virtual networks

- Virtualization in networking equipment
  - Virtual routers
  - Virtual switches
  - Virtual links
How do you describe the underlying (network) infrastructure?

MODELING
Intermezzo: without a data model
Finding a common language

- **Information model**
  - An information model describes resources at a conceptual layer.

- **Data model**
  - A data model describes protocols and implementation details, based on the representation of concepts and their relations provided by the information model.
The Semantic Web

- **RDF - Resource Description Framework** - provides a way to categorize information:
  - resources are described by URIs;
  - triples define the relations between resources:

- **OWL – Web Ontology Language** - has stronger support for classes, attributes and constraints
  - Operations (unions, intersections, complements, cardinality constraints)
Ontologies

- An **ontology** is a formal representation of a set of concepts within a domain and the relationships between those concepts.

- It is used to reason about the properties of that domain, and may be used to define the domain:
J. van der Ham, F. Dijkstra, P. Grosso, R. van der Pol, A. Toonk, C. de Laat

A distributed topology information system for optical networks based on the semantic web

Path finding in multi-layer multi-domain networks

F. Dijkstra, J. van der Ham, P. Grosso and C. de Laat. 

A. Taal, P. Grosso, J. van der Ham and C de Laat
*Path finding strategies for multi-domain multi-domain network architectures* 
In: Proceedings of the Cracow Grid workshop 2010
Resource ontology: base classes
Resource ontology: object relations
Resource ontology: network connectivity
Ontology editor

http://novi-im.appspot.com/
NML and NSI

- Standardization effort in Open Grid Forum – OGF
  - NML – Network Markup Language working group
  - NSI – Network Service Interface working group
CineGrid

- http://www.cinegrid.org
- http://cgdev.uvalight.nl/home/
From infrastructure to services

R.Koning, P.Grosso and C.de Laat
Using ontologies for resource description in the CineGrid Exchange
QUESTIONS?