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i2cat FUNDACIO

INOCYBE TECHNOLOGIES INC.

Université d'Ottawa
University of Ottawa

GLIF: Joint Session of Technical and Control Plan Working Groups UCLPv2

6th GLIF meeting, Tokyo
Sept 11th, 2006

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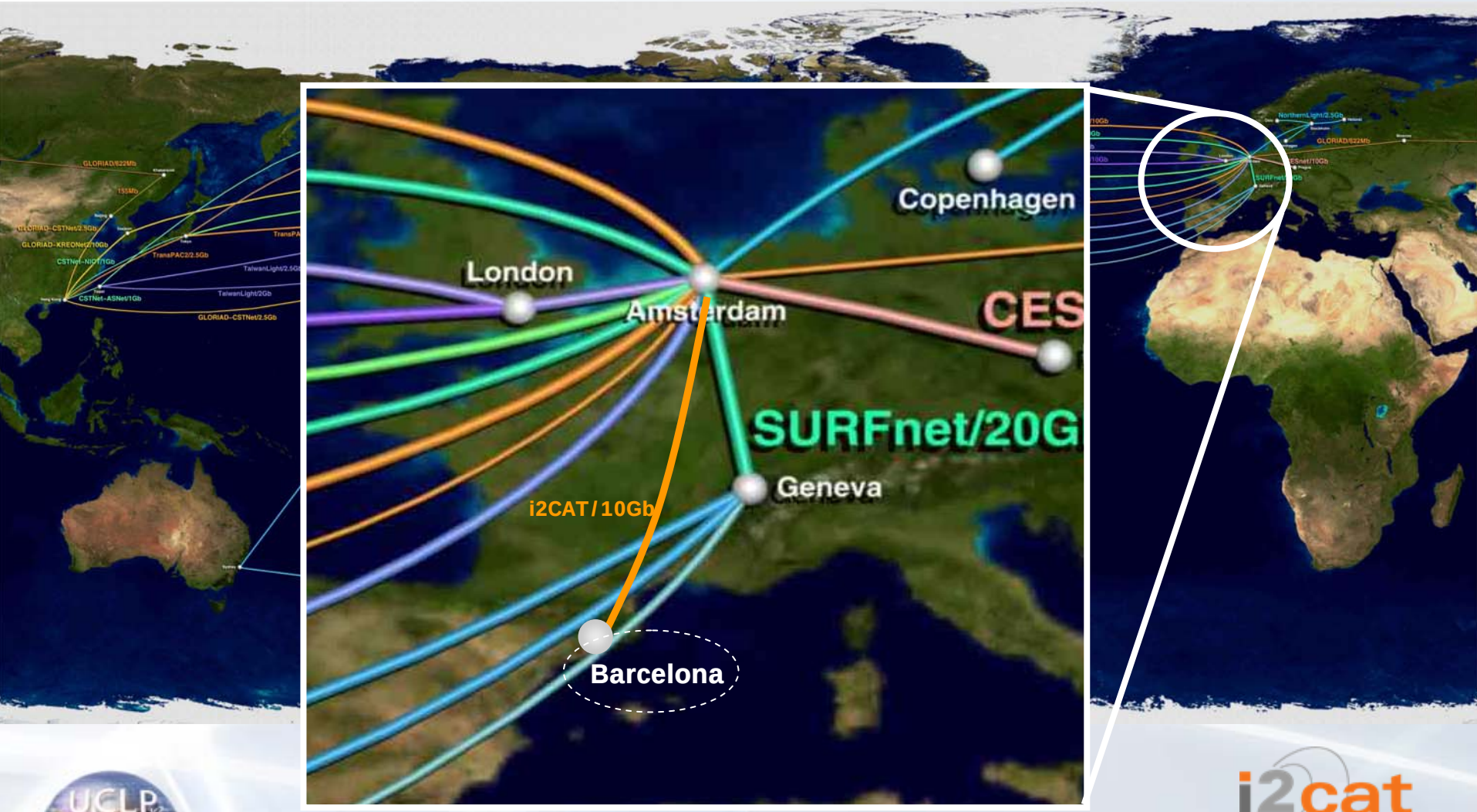
i2CAT connected to Netherlight with a 10Gb λ



i2CAT objectives

- Be an active participant in the GLIF community
- Involve the i2CAT experimental users community to the GLIF community
- Participate in experimental demonstration to validate proof of concepts
- Interested topics:
  - Networking technologies
  - Media tech. and uncompressed HD applications with cultural content
  - e-health applications and technologies
- Interested in participating in: Optiputer, CineGrid,…
- i2CAT connection to Netherlight: Nov-Dec 2006

What is User Controlled Networks?

- Networks that allow users to do their own network configuration and management.
- By giving control of physical network to users, they can manage virtual routers, switches, server nodes and do their own routing and topology.
- In essence , it is an extension of peer to peer overlay networks to the physical domain thus creating “underlay” networks.
- UCLP in addition allows users to manage virtual routers, switches , server nodes so that they can do their own routing and topology.

UCLP misconceptions

- UCLP was intended as a network virtualization middleware management tool for network resources
- Dedicated users may control, configure and interconnect these virtualized network resources allowing condominum management
- For single management domains there already exist many CNM – Customer Network Management tools. But UCLP uses web services objects which allows much tighter integration and coupling into customer's applications. (as opposed to carrier's)
- UCLP is not either a control plane and cannot be compared to GMPLS.

Some inputs received

- Decline to put into production networks anything that is not **commercially** supported
- See biggest value in having a **multiplatform** control and management system (not tied to a single vendor)
- Interested in **network virtualization**
- Regional networks comments:
  - Still learning about lightpath provisioning before considering any automation or user empowerment.
- End users (grid world,…):
  - Some say it would be preferable if a single tool/middleware manages all type of resources (computational, storage, network, …).
- Some NREN say they see no market for UCLP right now (but maybe in a few years time), however it is worth to be aware of the technology to be prepared for the future
- UCLP lacks of tools for monitoring and testing the connectivity once lightpaths/APNs are in place

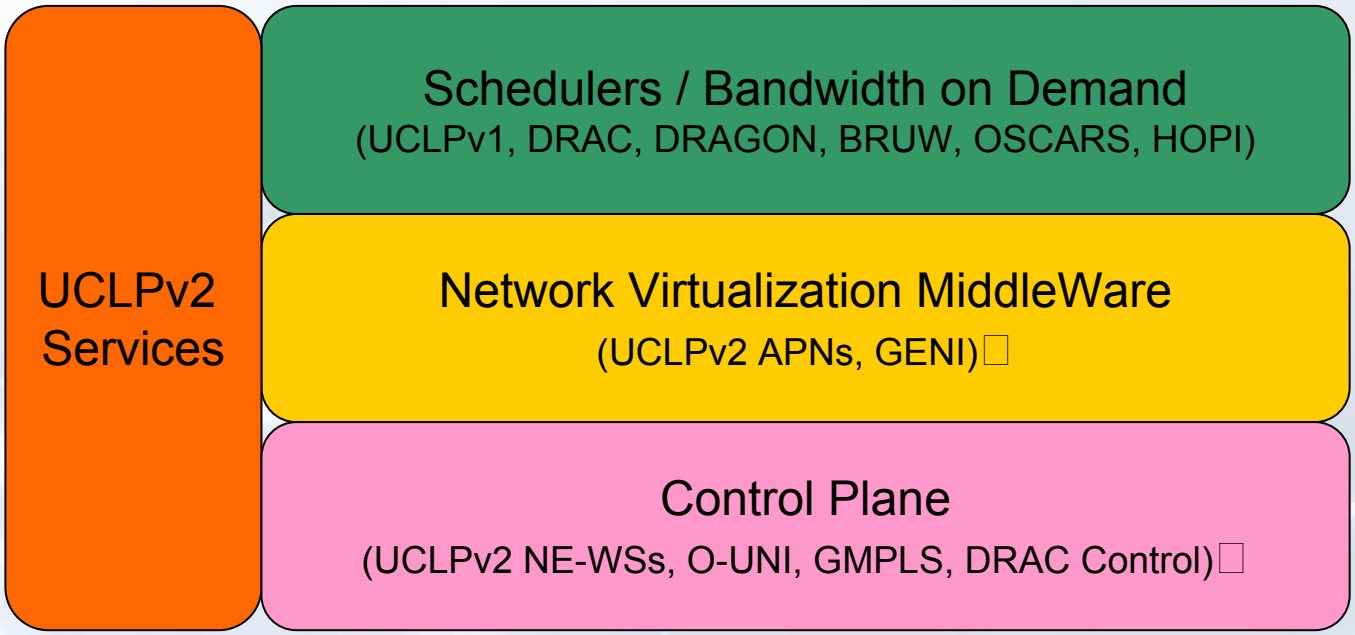
What is UCLPv2?

- User Controlled LightPaths – a network virtualization management tool built using web services. (Choose what resources you want to virtualize as a web service and who will have access to it)
- Allows administration of networks resources and their respective web services.
- Resources can be grouped and given to dedicated indivuals or organisations creating Articulated Private Networks (APN).
- Via the service interface, APN owner can establish cross-connections, change bandwidth or lease their resources.
- Allows network resources to be integrated with applications.

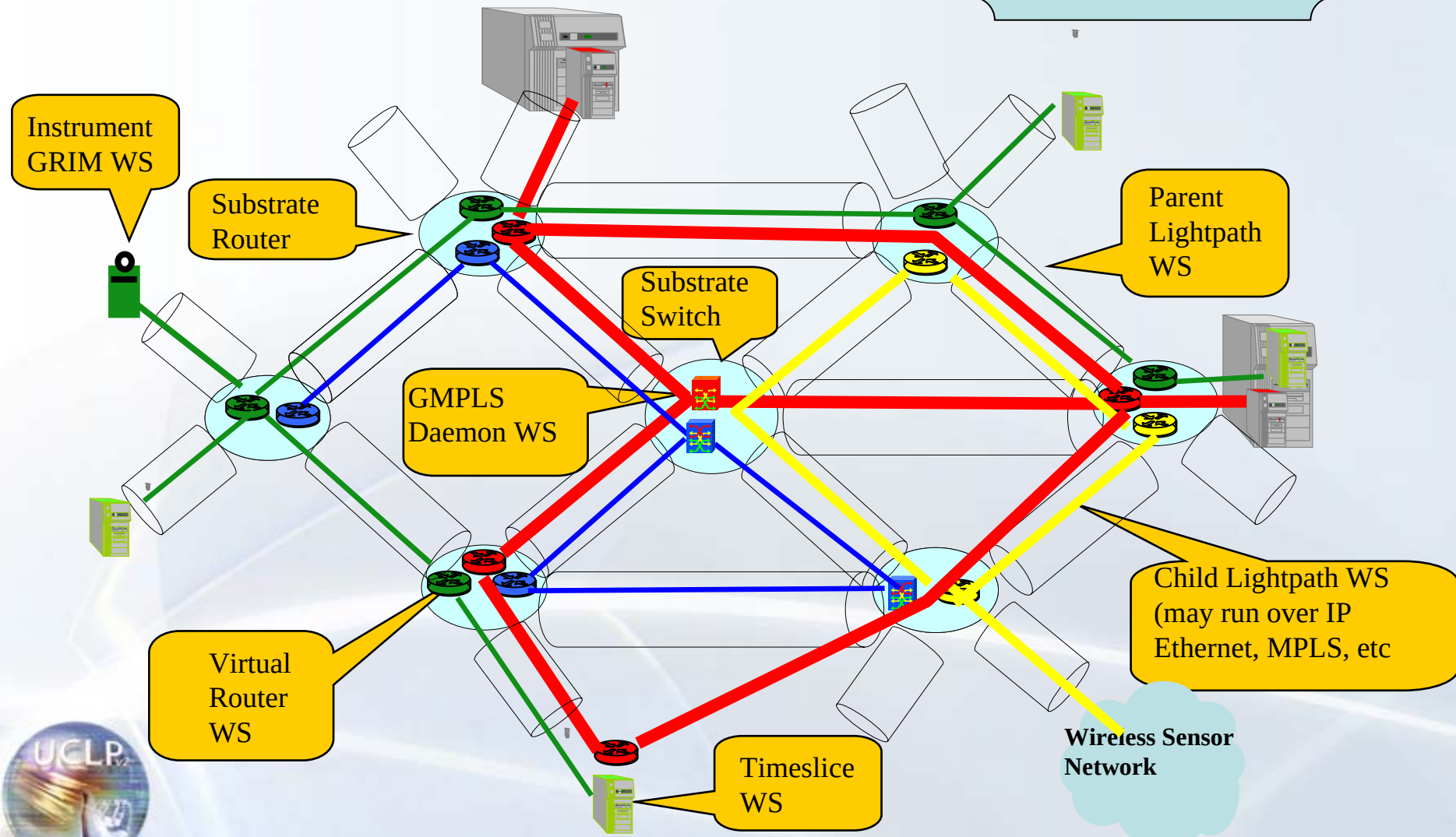
UCLPv2 and other Technologies

- UCLPv2 primary purpose is not about setting up end to end wavelengths.
- UCLPv2 primary purpose is not about bandwidth on demand.
- UCLPv2 primary purpose is about dynamic circuit switching.

These features all are applications that CAN run on TOP of UCLP providing these capabilities to APNs.

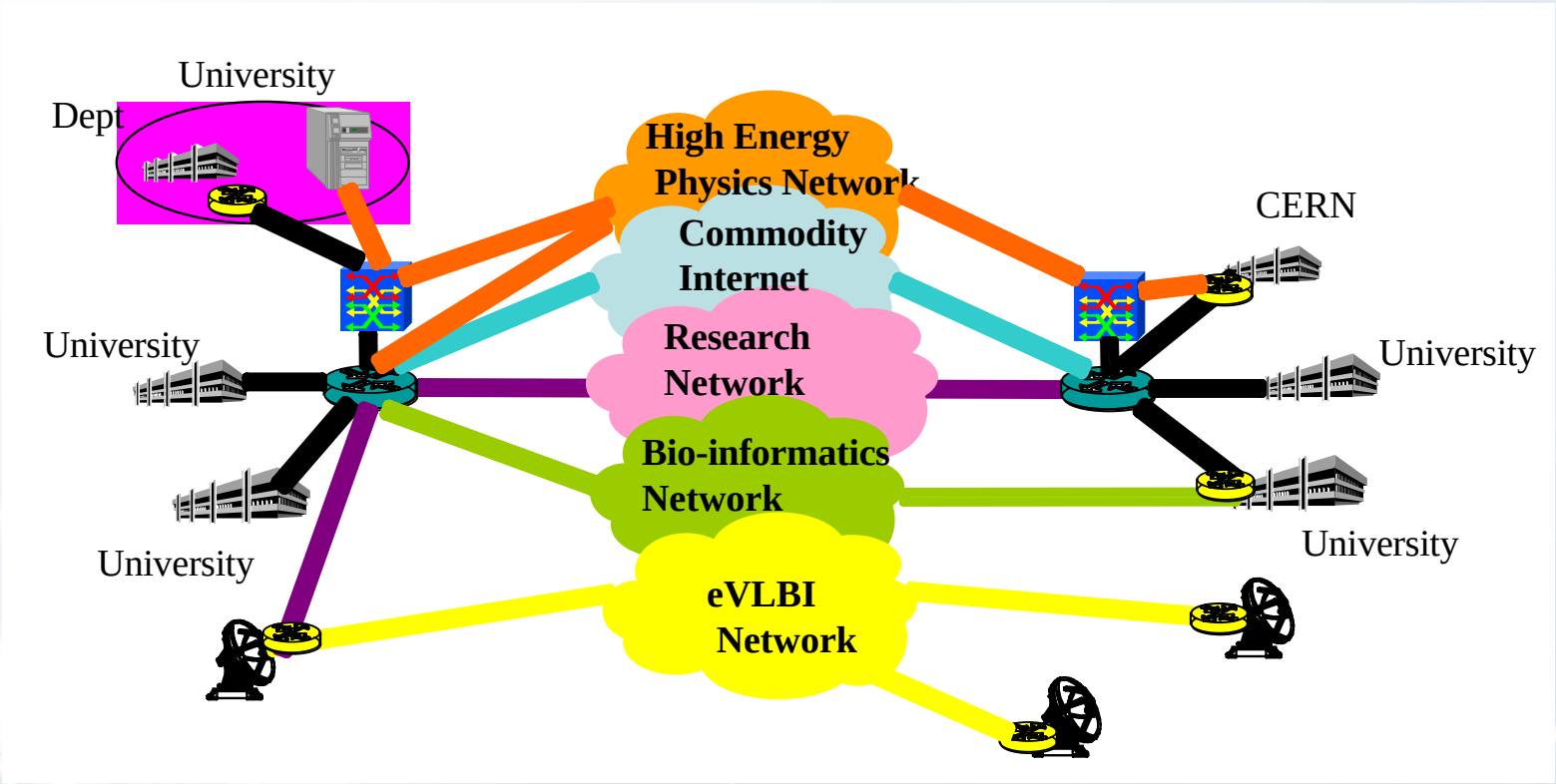


GENI and UCLP

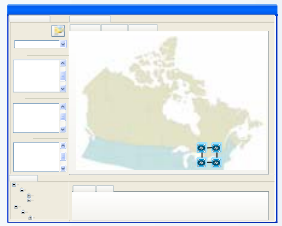


What is an Articulated Private Network?

- APN: Is a set of dedicated resources (Network, Instruments, Sensors) that can be manipulated
- Create several parallel application specific networks from a single physical network
- Network partitioning bringss benefits to the GLIF community (easy to manage,…)

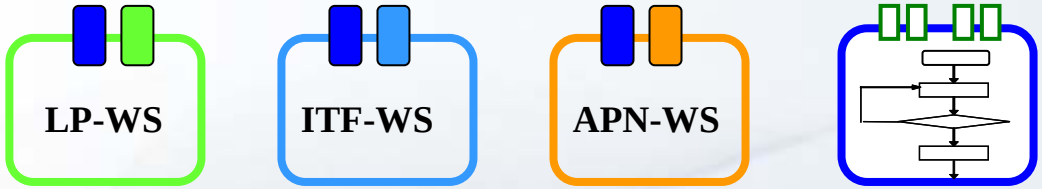


UCLPv2: High Level "Architecture"



User Access Layer

(Eclipse RCP) or Flex/Ajax



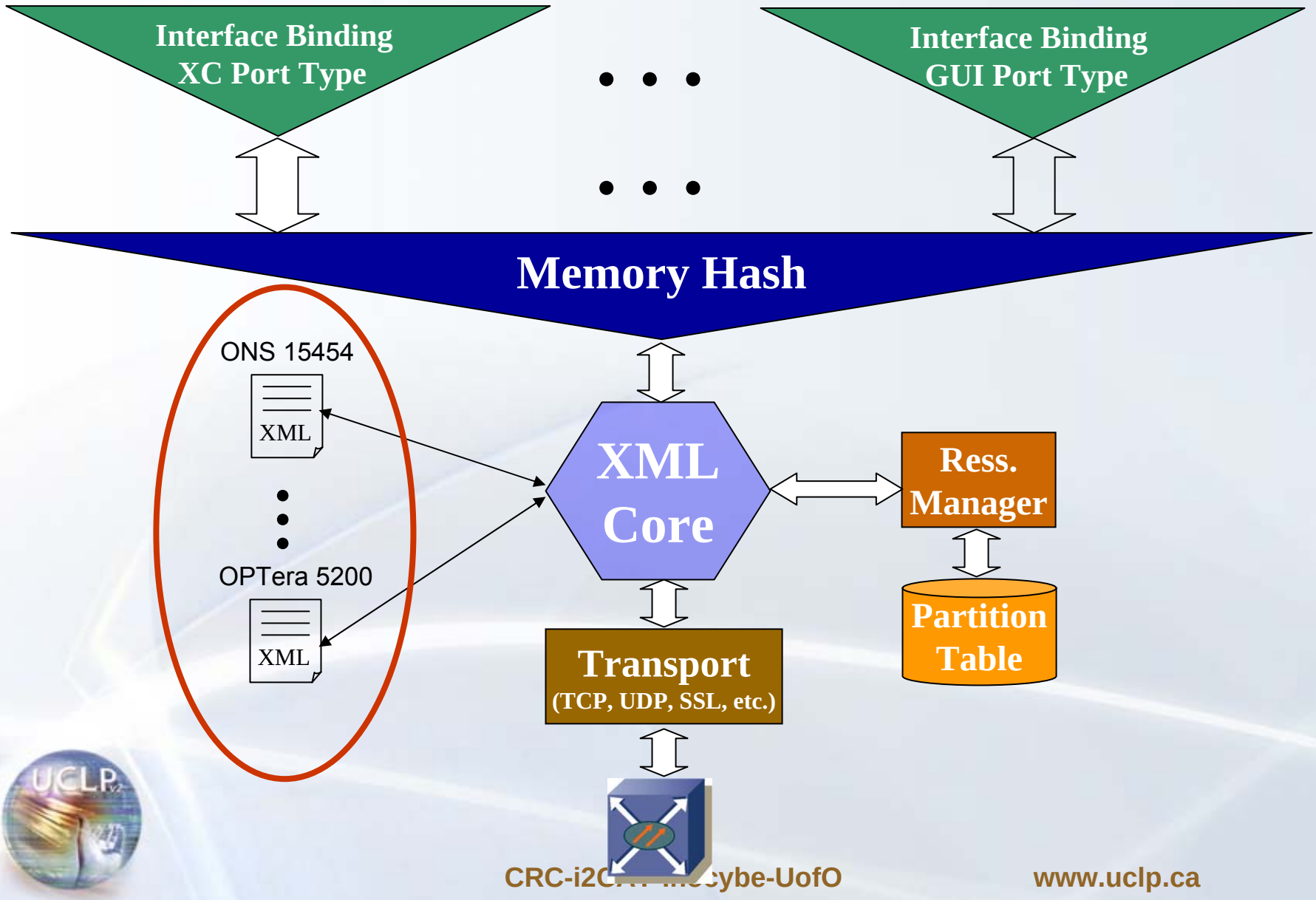
Service Orchestration Layer

(BPEL) or Compiled

Resource Management Layer

(Compiled Web Services)

Resource Management Layer: NE-WS



Why use BPEL to implement the LP, ITF and the APN Web Services?

- BPEL provide a means to add in policy checks + accounting easily using Third Party Services.
- BPEL compensation handlers provide a powerful Roll Back mechanism (in case something goes wrong).
- Implementing lightpaths and/or interfaces as BPEL process instances provides more flexbility (we don't care what services are used inside) then having LPs/ITFs as independent Axis Web Services.
- As long as the WSDL interface of a BPEL process remains the same, one can modify the BPEL script then re-deploy the process, without having to recompile or install anything.
- We can create custom APNs on-the-fly, by generating tailored BPEL scripts for the user, so that he can deploy and use the custom APNs outside the UCLP environment.

What is an Articulated Private Network-WS?

- An APN-WS is a workflow script (BPEL) that does a predefined set of operations on lightpaths, interfaces and instrument web services. In order to create a specific network topology.

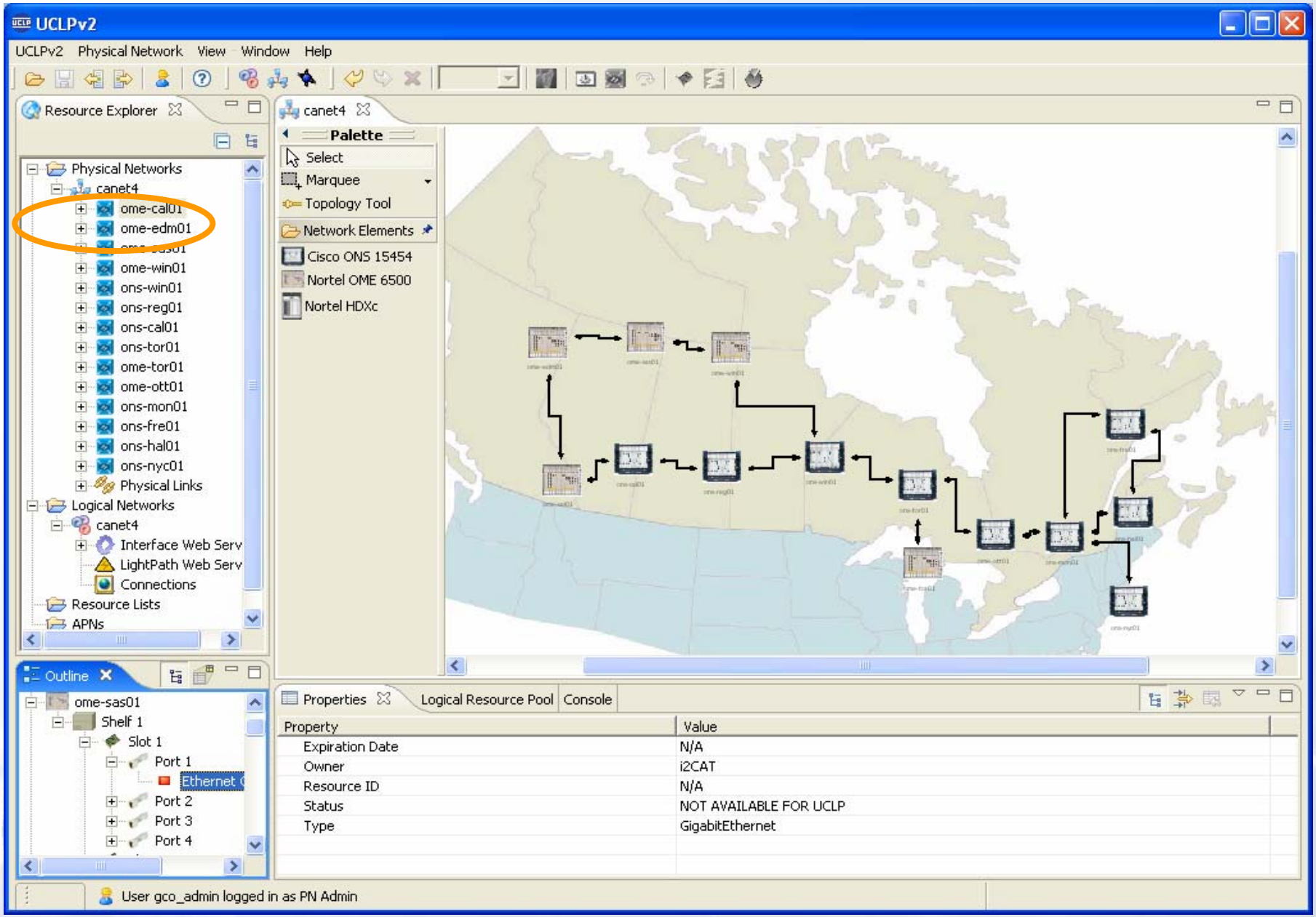
- Once an APN-WS is deployed and running, the topology and bandwidth are fixed
  - If the configuration of the network elements wants to be changed, the APN must be stopped, and a new APN must be created.

- A single researcher can have multiple APN configurations defined (APN-WSs), and set/undo each configuration when different topologies are needed.

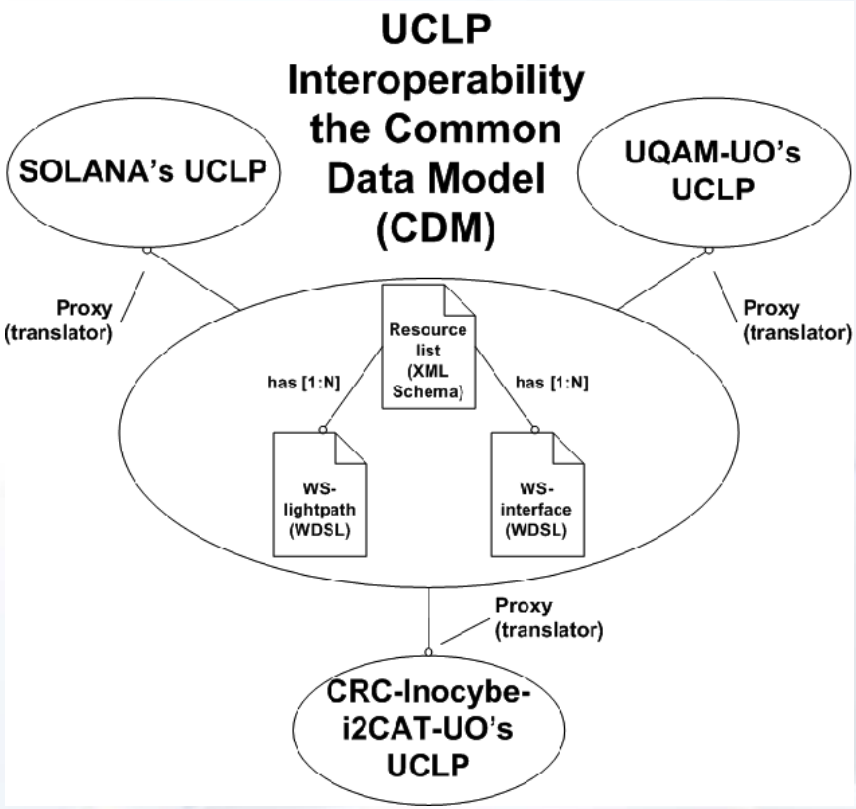
UCLPv2: User Roles

- Physical Network (PN) Admin (e.g. CANARIE Operator)
  - Responsible for provisioning the network and creating network resources (lightpath and interface web services) for APNs to use
- APN Admin (e.g. network administrator of CERN)
  - Receives Resource Lists from PN or other APN Admins
  - Responsible for creating the APN network configurations for the users
    - Can partition/bond network resources
    - Configurations could be automatically created (On-Demand) via a E2E Routing-WS. (Future work)
  - Can give or sublease its resources to other APNs
- Users (e.g. CERN scientist)
  - Can invoke APN configurations previously created by the APN Admin.
  - Cannot modify network topologies.

UCLPv2 GUI


UCLPv2
UCLPv2 Physical Network View Window Help
Resource Explorer
Physical Networks
canet4
ome-cal01
ome-edm01
ome-win01
ons-win01
ons-reg01
ons-cal01
ons-tor01
ome-tor01
ome-ott01
ons-mon01
ons-fre01
ons-hal01
ons-nyc01
Physical Links
Logical Networks
canet4
Interface Web Serv
LightPath Web Serv
Connections
Resource Lists
APNs
canet4
Palette
Select
Marquee
Topology Tool
Network Elements
Cisco ONS 15454
Nortel OME 6500
Nortel HDXc
Outline
ome-sas01
Shelf 1
Slot 1
Port 1
Ethernet
Port 2
Port 3
Port 4
Properties
Logical Resource Pool
Console
Property
Value
Expiration Date
N/A
Owner
i2CAT
Resource ID
N/A
Status
NOT AVAILABLE FOR UCLP
Type
GigabitEthernet
User gco_admin logged in as PN Admin

UCLPv2 Interoperability via CDM



- Strives also to a common "information model" between implementations similar to the Common Service Definition (CSD) from GLIF Control Plane.
- Simplify the actions done by only giving (Endpoint References) as parameters to most of the actions.

Instruments for UCLP: Grid Resource for Instruments Model (GRIM) OpenSource Software

- **Problems**
  - Need to provide plug and play behavior for instrument / sensors.
  - The generic model must not limit functionality.
  - The time needed to implement the model for new instruments must be short.
  - The instruments have different proprietary standards and protocols

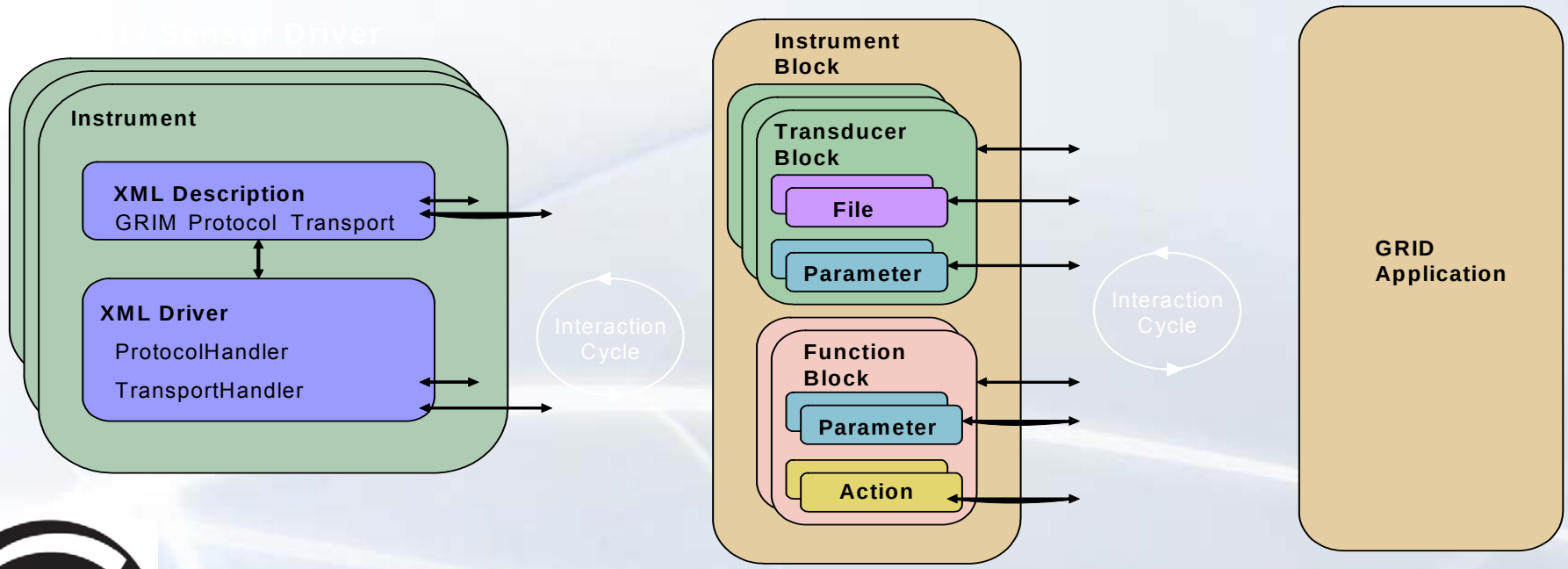
- **Solution**
  - Grid Resource Instrument model is based on the IEEE1451 entities to provide plug an play capabilities.
  - The model is design to accommodate any functionality and can easily be extended.
  - This model is provided as a « Toolkit » that can be used to model instruments quickly.
  - The proprietary protocol is abstracted by the implementation.
  - Uses Globus Toolkit 4 WSRF C/Java core

- **Benefits**
  - Scientifics can reuse existing GRIM services to compose various experiments.
  - GRIM can interoperate with Network resource management system like UCLP.
  - GRIM's lightweight description protocol (GRIMML) can be made to fit into embedded hardware.

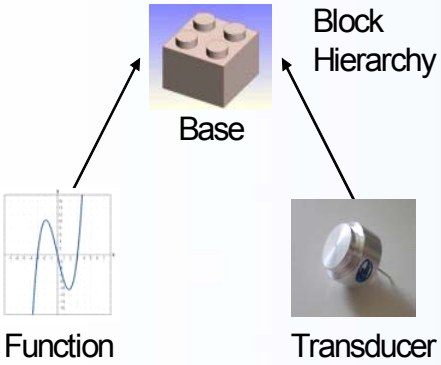
CRC-i2CAT-Inocybe-UofO

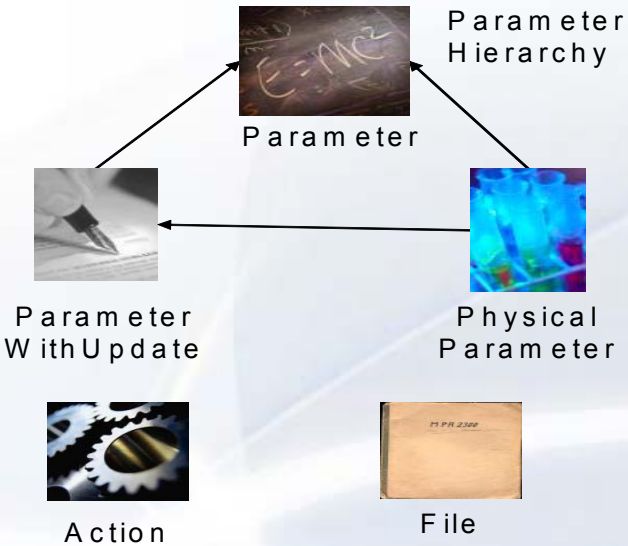
GRIM Standard's Heritage

- IEEE 1451
  - Instrument Segmentation
  - Functional Operations
- SensorML
  - Data Structures (Units, Phenomenon, GML Position)
- TML
  - Buffered Data Array



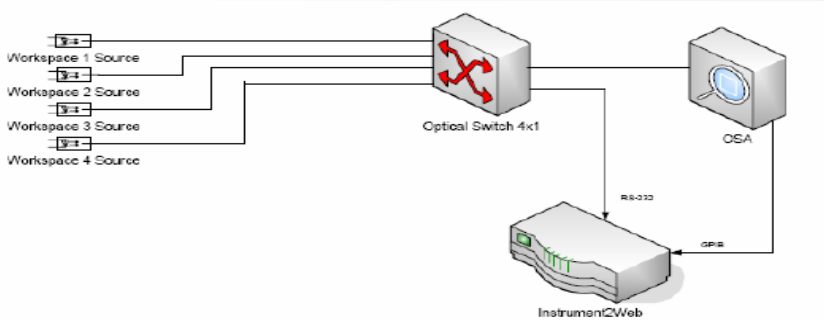
GRIM Services

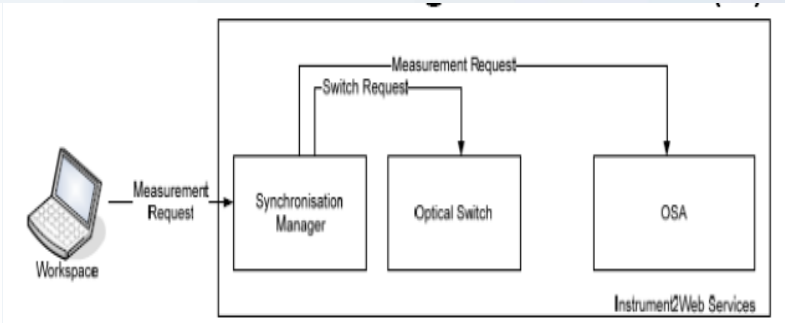




- **Blocks**
  - **Base**
    - The block hierarchy allows basic functionalities such as state management to be reused by all types of blocks.
    - Blocks are component containers and can be introspected.
  - **Transducer Block**
    - Transducer blocks are in charge of keeping updated values of their representation at all times.
  - **Function Block**
    - Function blocks provide specific functionalities.
- **Components**
  - **Parameter**
    - The parameters components are value containers with metadata describing this value (range, type, etc).
  - **File**
    - The file component allows binary file transfers.
  - **Action**
    - The action component is a transaction ticket for long operation that cannot return a response.
- **Other**
  - **Instrument / System**
    - Instrument or System services service as a block container and provide some basic facilities.

GRIM Prototype for Instrument Sharing





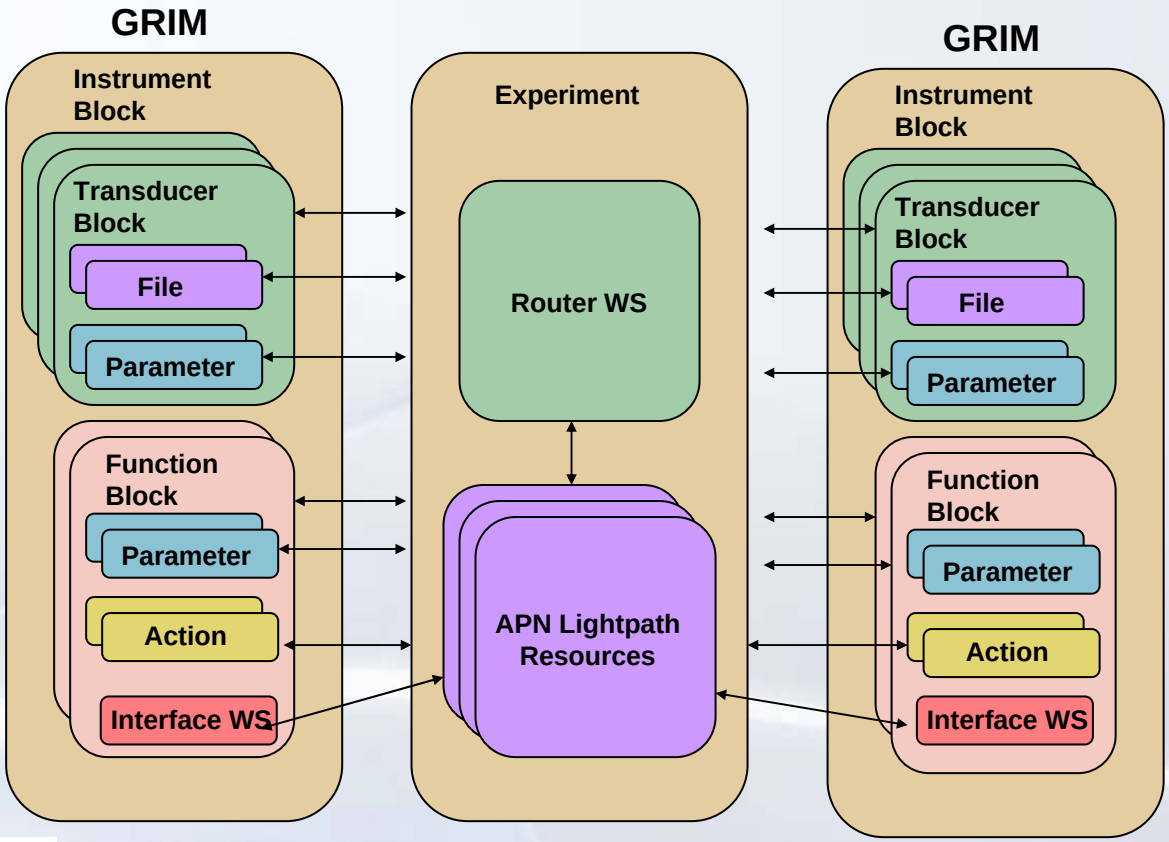
- **Sharing Optical Spectrum Analyser in a classroom.**
  - 4 Different Workstations for students are available with fibers where they can connect the DUT.
  - A GRIM Module (Inocybe's embedded platform GPIB/USB/RS232 Prototype) is used to connect all the instruments via GPIB or RS-232.
  - The GRIM module runs all the services.

- **The scheduler is invoked with the experiment to be performed.**
  - The experiment will be performed when all resources are available.
  - The physical connectivity is established (UCLP) and the experiment is performed.
- **Performance:**
  - OSA Sweep Time is between 1s and 10s depending on resolution.

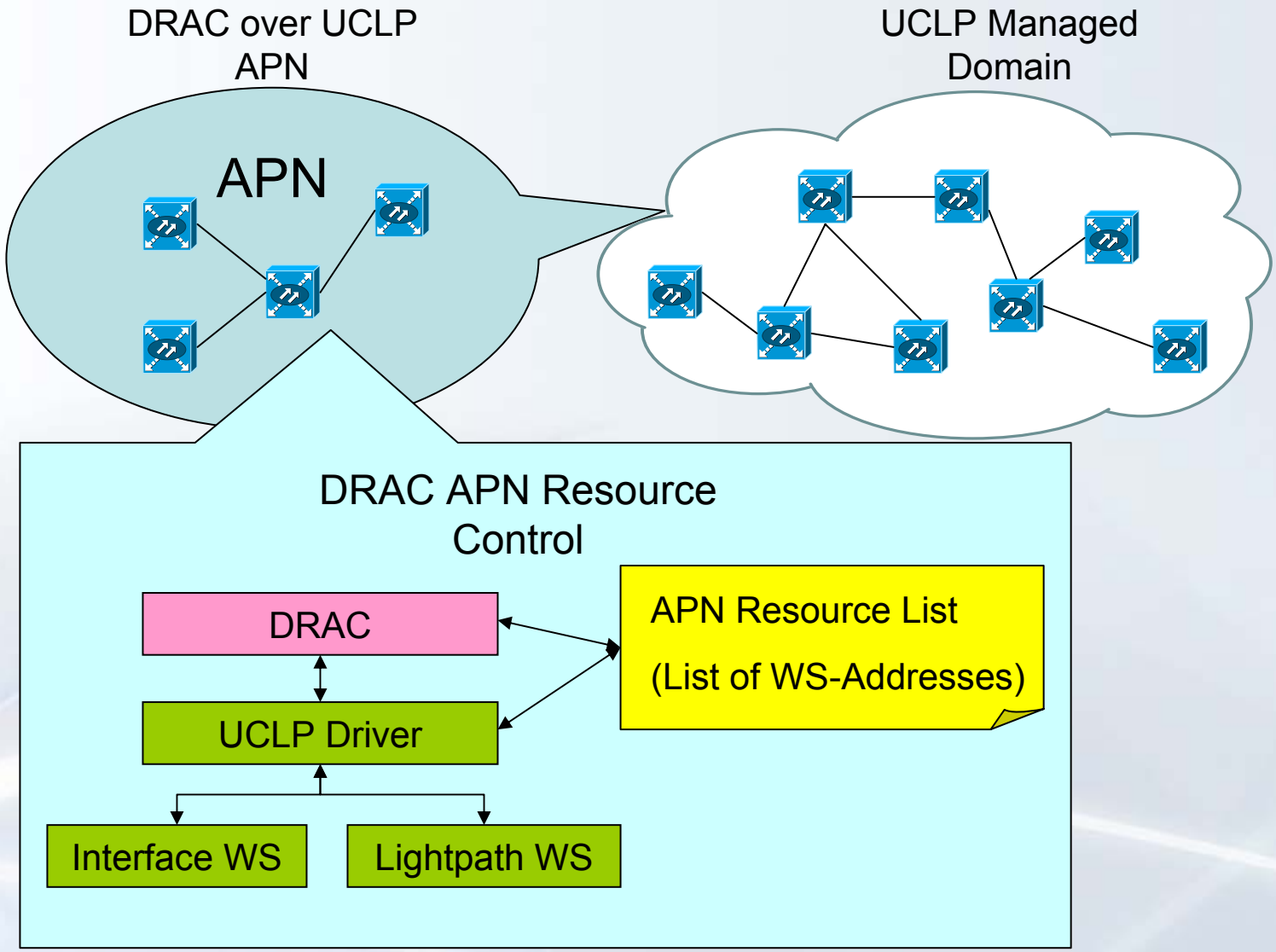
UCLP and GRIM

GRIM Function Block with Interface WS Components.

- Orchestrated by Experiment Scheduler and uses Routing WS to do end to end topology discovery in the APN from the Interface WS.



Nortel DRAC™ as a UCLP Scheduler



UCLPv2 Enterprise Edition

Funds UCLP Consortium for Community Edition Improvements

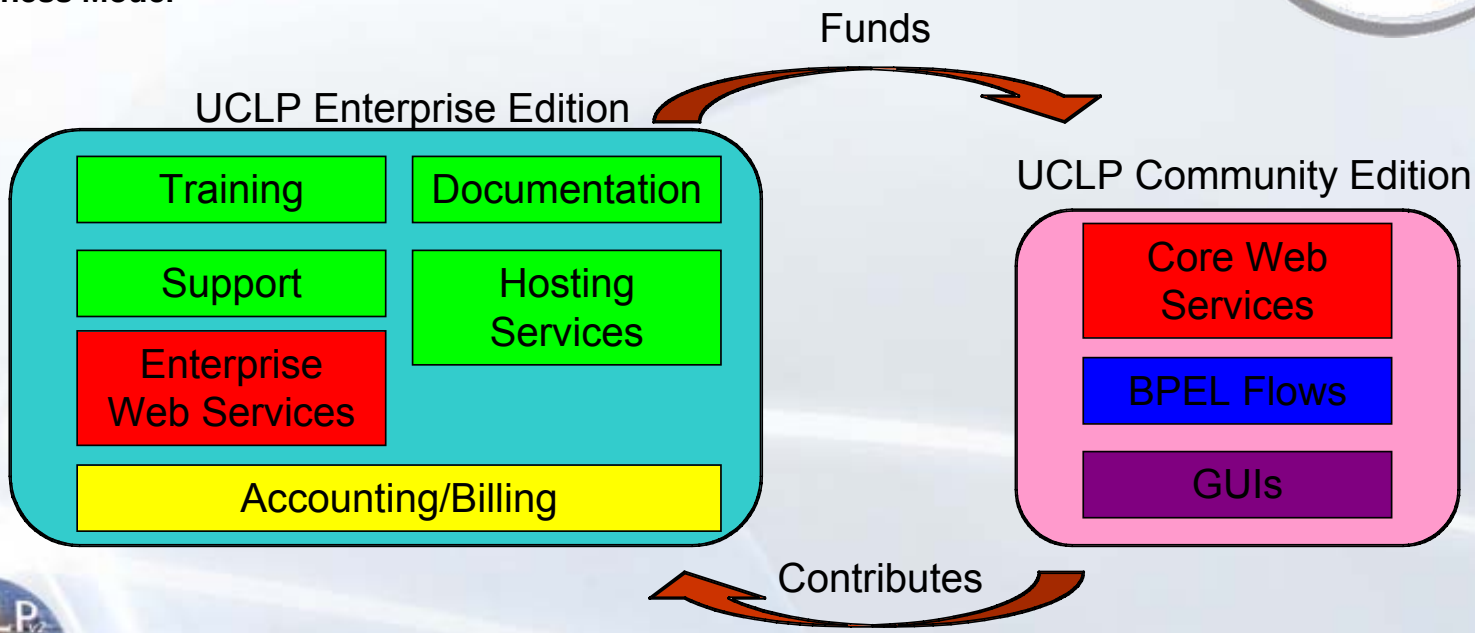
Features

- Provides appropriate support, training, documentation as well as enhanced security/stability.
- Improved XML Engine editor.
- Built-in Accounting, Billing and Reports.

Expected Release Date

Autumn 2007

Business Model



Future UCLP Developments

Application

- Flex and AJAX GUI Interface (Web Interface)
- Routing-WS: Enables E2E connections
- Policy-WS: Allows to enforce special policies on APN.
- Billing and Accounting: Has reporting and billing capacities
- Testing and Monitoring services
- Topology export to NDL

Middleware

- Layer 0/1: WDM Connections
- Layer 2/3: Tunnels, CoS, VLAN Connections

Network Elements Services

- ROADM-WS : Lambda switching web service.
- 802.1q-WS: VLAN enabled Ethernet switch.
- VirtualRouter-WS: Layer 3 Virtual Router.
- GMPLS-WS: GMPLS Network Cloud.
- MPLS-WS: MPLS Network Cloud.

More information:

www.uclp.ca

www.inocybe.ca (GRIM)

THANKS!!!

UCLPv2 support
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