

MANTICORE II: Integrated logical IP network, a step beyond point to point links

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Virtualisation of network resources

- Why HEAnet pilots virtualisation...
- Layer 0 WS: pure optical switches (2006)...
- Layer 1: SONET circuits (2003)...
- Layer 2 WS: ethernet and L2 MPLS VLL (2005)...
- Layer 0/1/2/3 WS: MANTICORE I, II (2007) and III...
- Layer 3+ WS: FEDERICA (2008)...

Why HEAnet pilots virtualization (1/2)

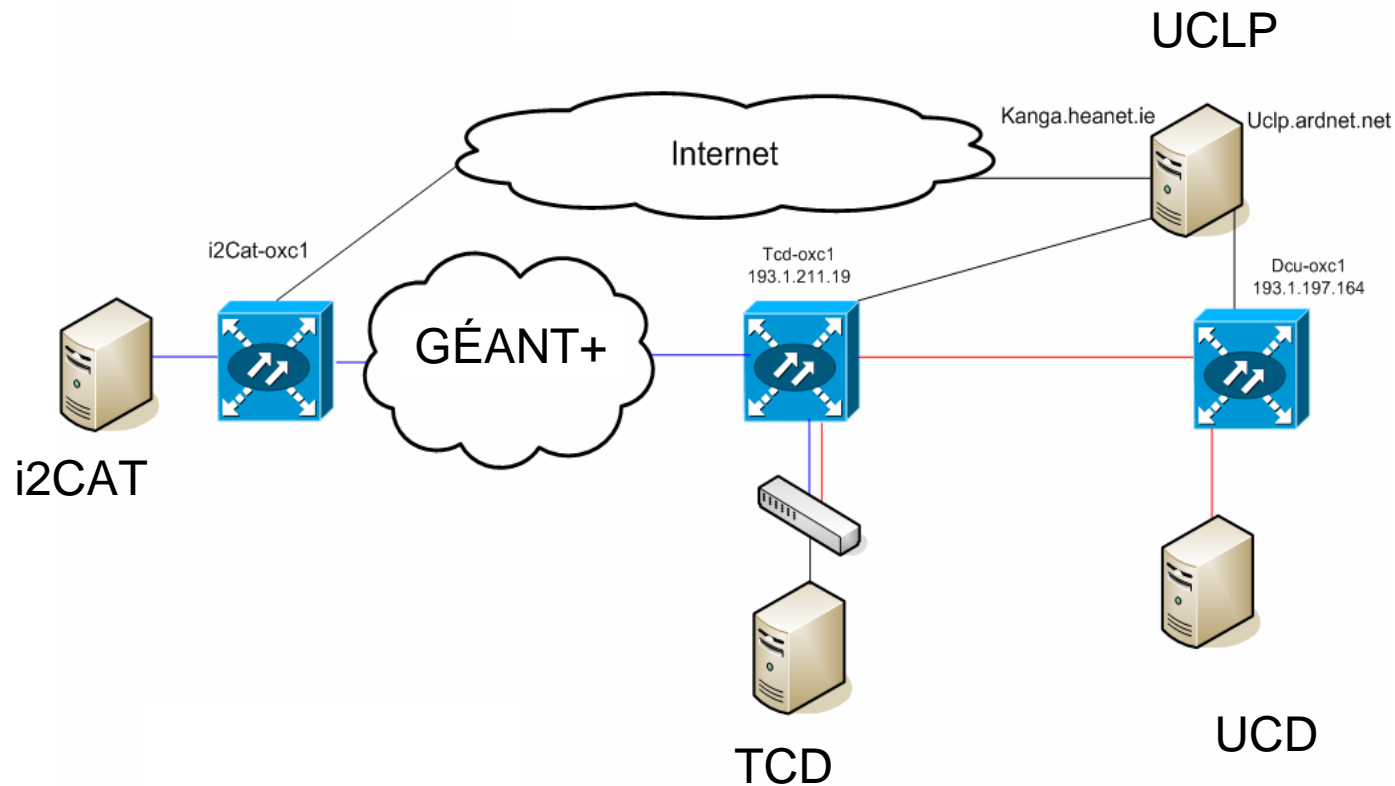
- Work is done by many on GMPLS or L2 MPLS VPN so no need to repeat/extend
- Seeing the network (layer 0 to 3) as a resource is the paradigm change (comparable with Grid resources: layer 4+)
- User control and ownership of resource is essential (except perhaps for fault management)
- Bundling of resources (APN: Articulated Private Network) allows value added service generation (WebServices: UCLP)
- NREN is catering for all User types A (low - many), B and C ('very' high - a few).
- Sometimes C-Users are not really present, but see your own NOC as a C-User!

Why HEAnet pilots virtualization (2/2)

- Have experience with layer 0 and 2 WebServices (UCLPv1)
- Relatively long lived services (months, years)
- Supporting multi-domain environment
- Layer 0, 1 and 2 service are nice, but most Users perhaps don't want these highly flexible WebServices; more interested in value added APNs; like layer 3 APNs
- (most?) Users want IP connectivity as part of their service
- An APN, providing a combination of layer 0, 1, 2 and 3 resources, might be ideal for a lot of Users
- Having an integrated logical IP network service might solve the issues around routing integrity
- Important: UCLP allows visibility of individual resources and APNs

Layer 0 WS

UCLP with CTVR, Glimmerglas, HEAnet and i2CAT



Layer 1

**UCLP with HEAnet, TWAREN, Uni of Waterloo
(first intercontinental UCLP SONET link)**

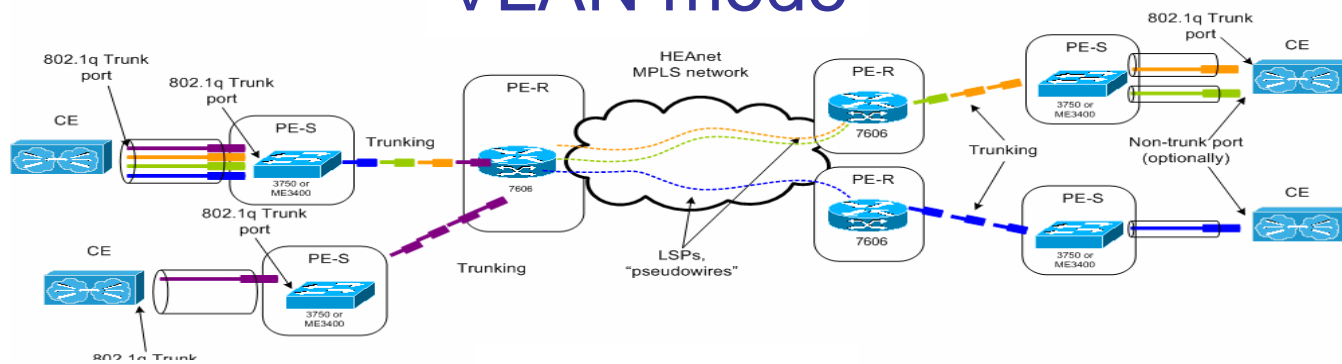


Layer 2 WS

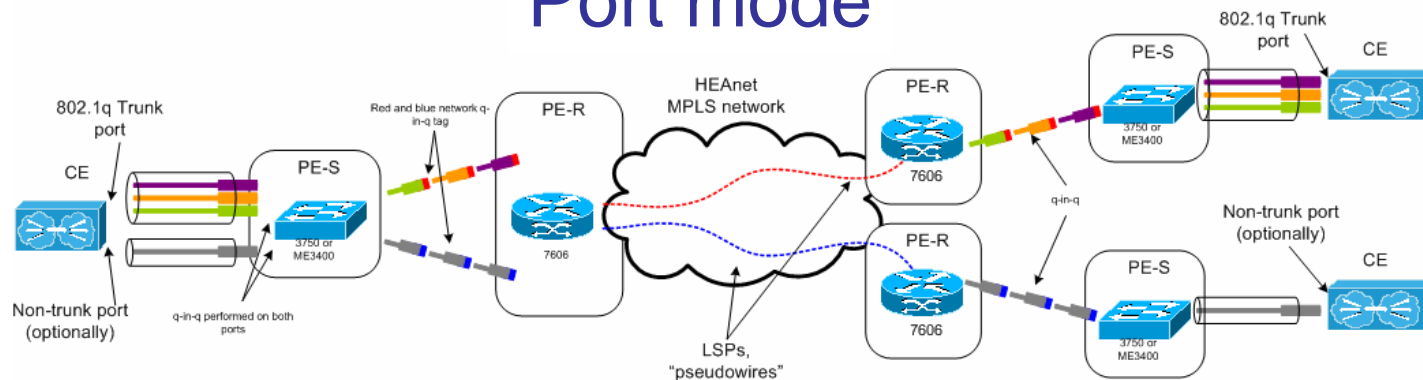
ULCP with Cisco, HEAnet and i2CAT

(L2 MPLS VLL and native ethernet)

VLAN mode



Port mode



Layer 0/1/2/3 WS

MANTICORE project

- Provide integrated logical IP networks (APNs)
- Users will be able to integrate logical routers/networks into their own resources
- WebService based system (UCLP)
- Manages logical routers, peerings and layer 0/1/2 WS
- Project partners...

MANTICORE II

Project partners



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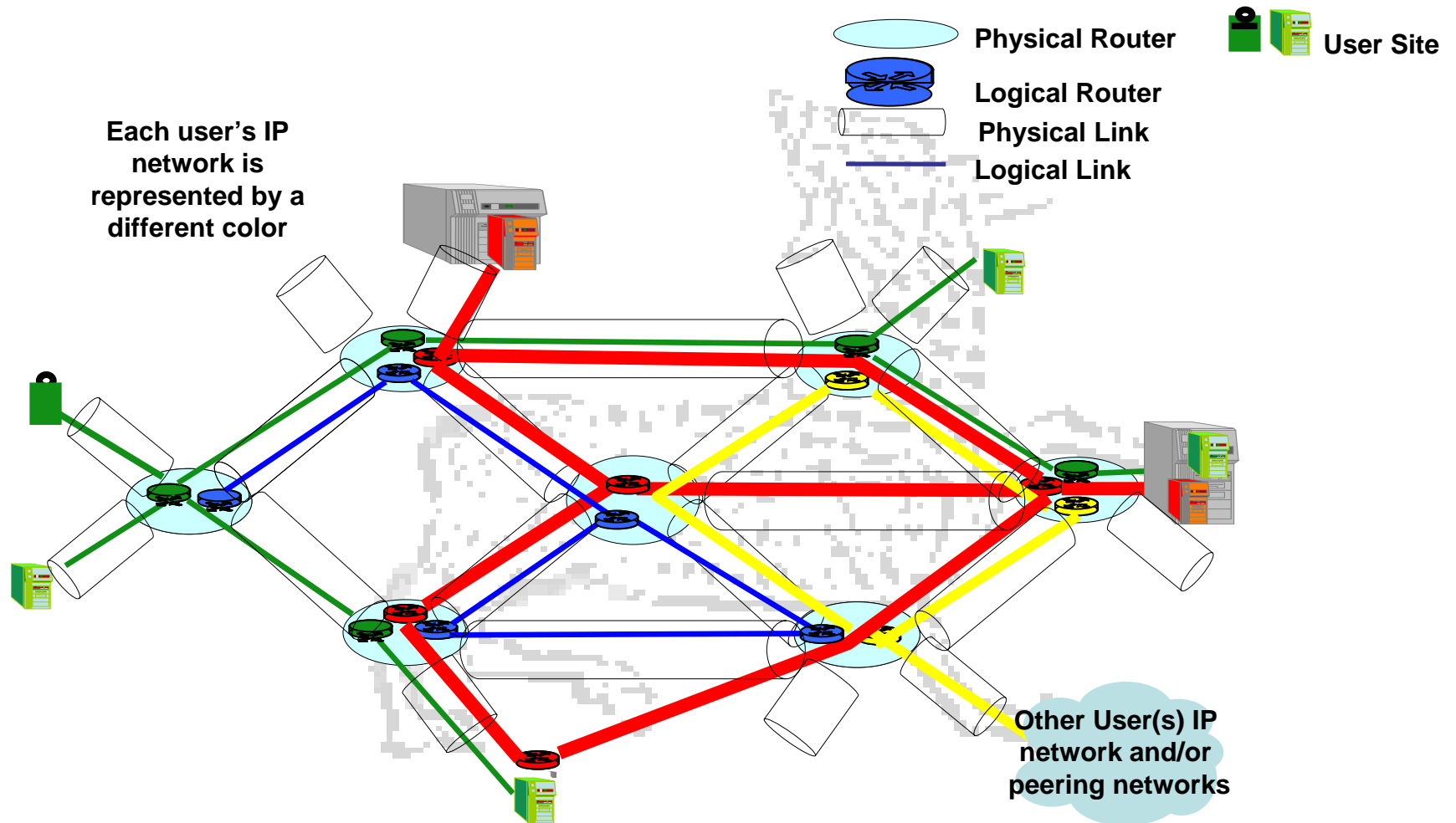


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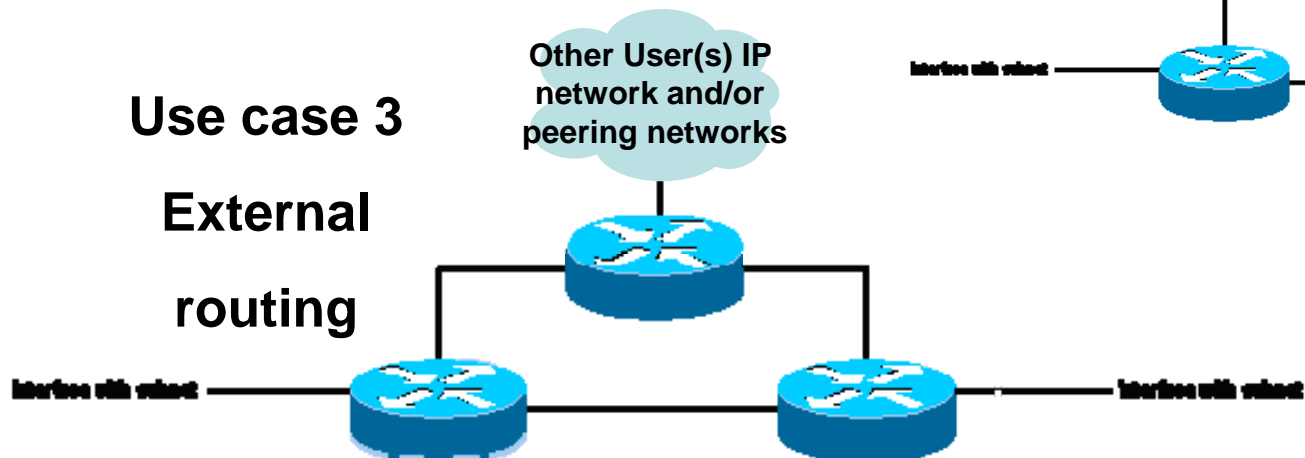
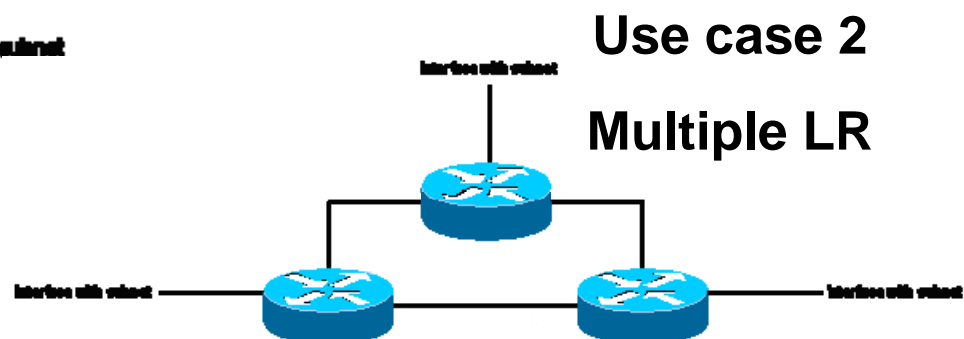
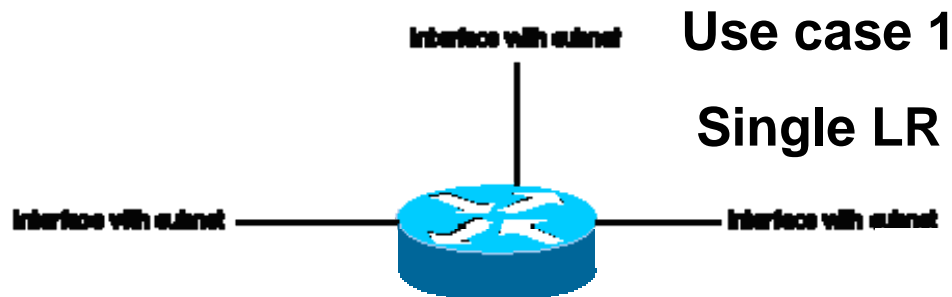
Beyond p2p

- **The main goal:**
 - Create an innovative service that provides the network NOC and/or the User with the ability to customize the configuration of its own dedicated IP physical and/or logical network
 - Design the data model structures for layer 3 network abstraction including internal and external routing policies
- **UCLP philosophy is taken as a starting point.**
- **Several research challenges:**
 - **Virtualization of routing devices:** physical equipment from different vendors, routing software, multiple configuration protocols, APIs, ...
 - **Virtualization of routing policies:** Some mechanism must be created to provide the user with the ability to express potentially complex requests (such as BGP policies) in a simple way.
 - **Federation of user-defined Autonomous Systems:** Users can create their own IP domains and choose to what other IP domains they want to peer with.
 - **Integrate lower layer resources/APNs.**

MANTICORE II Services

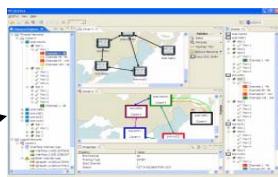


MANTICORE II Use cases

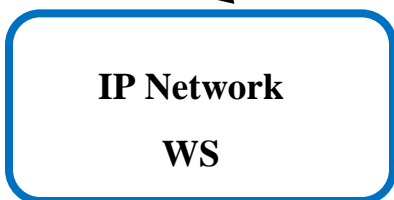


MANTICORE II Architecture

RPSL may be used to let the GUI specify high level routing policies (internal as well as external) to the IP Network WS



GUI client(s)



**IP Network
WS**

Transforms the RPSL policies in high level operations that will be invoked in the Router WS over one or more virtual resources



**Ethernet
Resource
WS**

**TDM
Resource
WS**

...

Virtual Resource Services

Represent the physical (ports) or logical interfaces (VLANs, TDM Channels) that users can access.

Transforms the high level operations over one or more virtual resources into specific commands that each particular routing device can understand



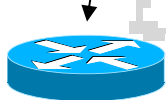
Router-WS

NETCONF

Protocol X

Protocol Y

Juniper device



Other vendor device



Software router



MANTICORE II Status

- **Current activities:**
 - Use case descriptions and definition of the abstract representation of the routing policies for internal and external routing (RPSLNg: RFC4012)...
 - Implementation of the two use cases:
 - use case 1: Single LR, no peering and
 - use case 2: Multiple LRs with internal routing, no external peering
 - Juniper's equipment, using the NETCONF API
 - Specifications and implementation of WSs and deploying.
- **Next phase of MANTICORE II**
 - use case 3: Multiple LRs with external peering
 - Juniper's equipment
 - determine deployment
- **MANTICORE III:**
 - Extension of the MANTICORE concept to other equipment (open source routers, other vendors/platforms) and use cases

Routing policy

- Describes what traffic goes where
 - Traffic engineering
 - AUP compliance (commercial vs. academic)
 - Keep performance up and packet loss down
- Every network has one, even simple ones
- Need to describe this in the abstract
 - Fortunately, this has been done for years...

RPSLng - WHOIS

```
davew@byron: ~$ whois as1213  
aut-num: AS1213  
as-name: HEANET
```

HEAnet will take all Internet routes from Transit provider

```
import: from AS3549 # Global Crossing  
        action pref=100;  
        accept ANY
```

HEAnet will only take the Client's AS

```
import: from AS2850 # UCD  
        action pref=50;  
        accept AS2850
```

... and HEAnet will only send its AS

```
export: to AS3549 # Global Crossing  
        announce AS-HEANET
```

```
export: to AS2850 # UCD [client]  
        announce ANY
```

... and HEAnet will send all its routes to Client

RPSLng

- Well known language: RFC4012
 - essential for external peering (use case 3: e.g. GÉANT2)
- Much more complexity available
 - can be used for internal routing (use case 2)
 - can specify down to per-interface level
- Spin-off implementations already exist
- May be able to use or modify for our use

MANTICORE II

Future

- Due to time constraints: will only deal with Juniper routers using the NETCONF JunOS XML API
- The implementation is a proof of concept, not a complete solution: working prototypes of the services will be implemented, but some features will be left for future work
- Proper AA and measurement infrastructures are essential
- MANTICORE III: Expected to be integrated in FEDERICA...

Acknowledgement

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Thanks for your
attention

Question time...

