



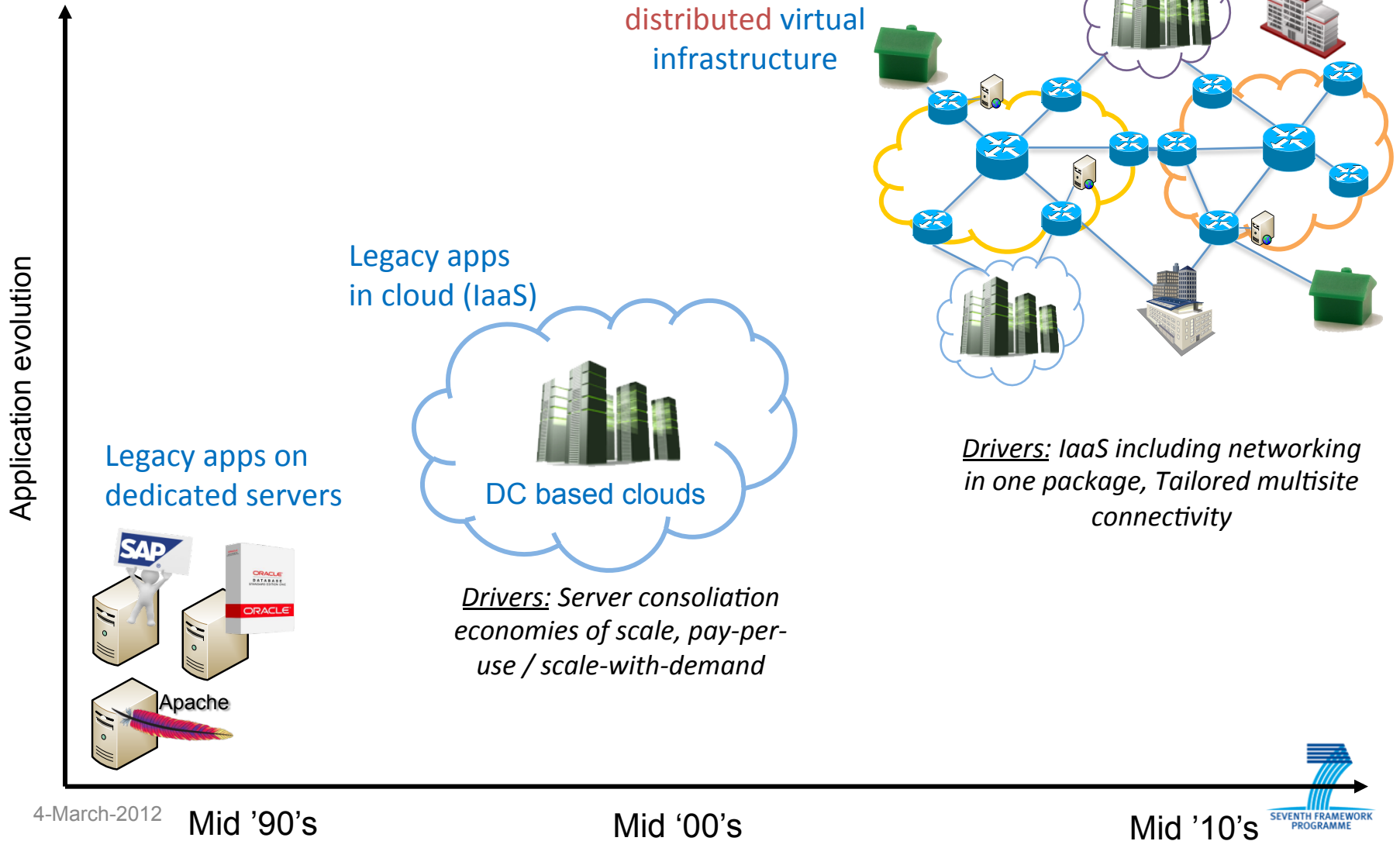
# *Cloud meets WAN:* *In-Network Support for Distributed Services*

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Ericsson Research, Sweden

Paul Murray  
HP Labs, UK

WTC 2012  
Miyazaki– March 4, 2012

# Cloud & WAN

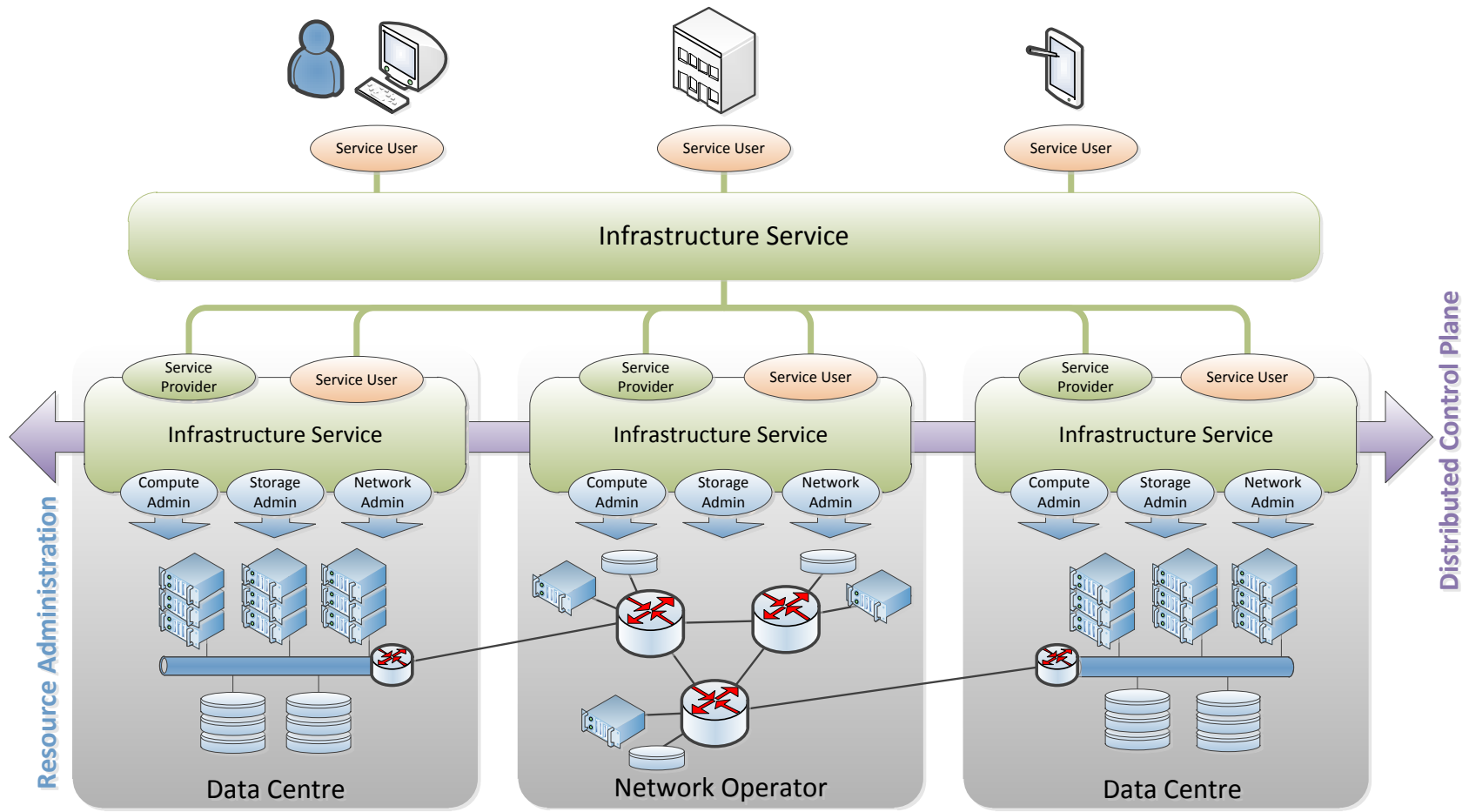


# *Cloud & WAN – Challenges*

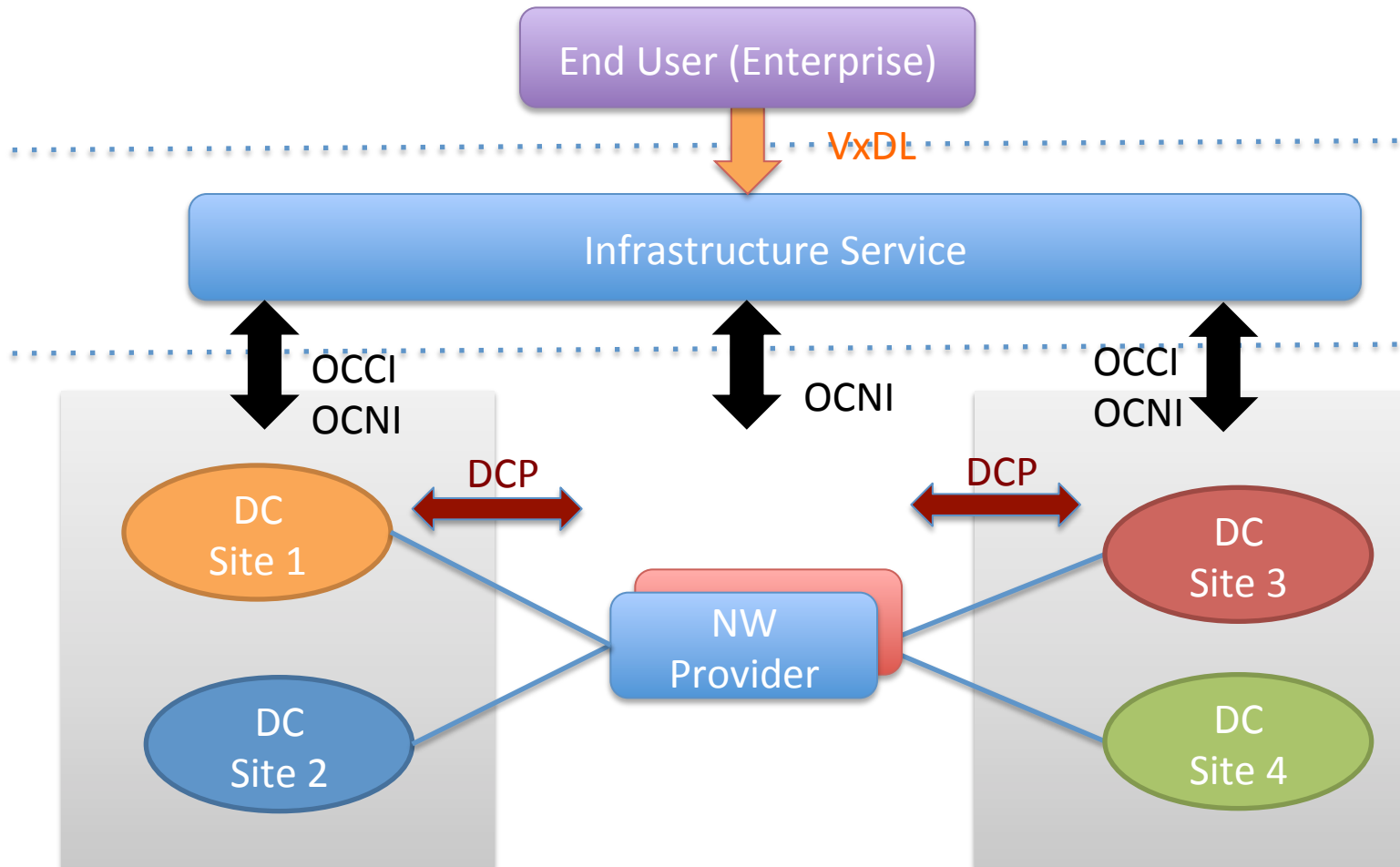


- Lack of suitable abstractions
- Non existent interfaces
- Non dynamic and relatively rigid
- Organizational boundaries
- Inter-provider issues

# Architecture



# Interfaces



# WAN Extensions



- Open Cloud Network Interface (OCNI)

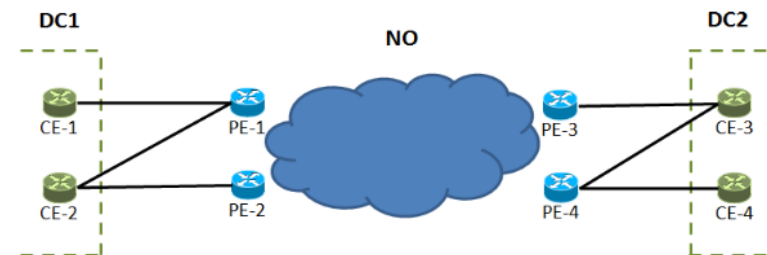
- Networking Extensions to OCCI
- HTTP RESTful
- L3VPN, L2VPN, Openflow

```
POST userID/CloNeLink HTTP/1.1
Host: localhost:80
Accept: application/ocni+json
User-Agent: curl/7.13.1 (powerpc-apple-darwin8.0) libcurl/7.13.1 Op

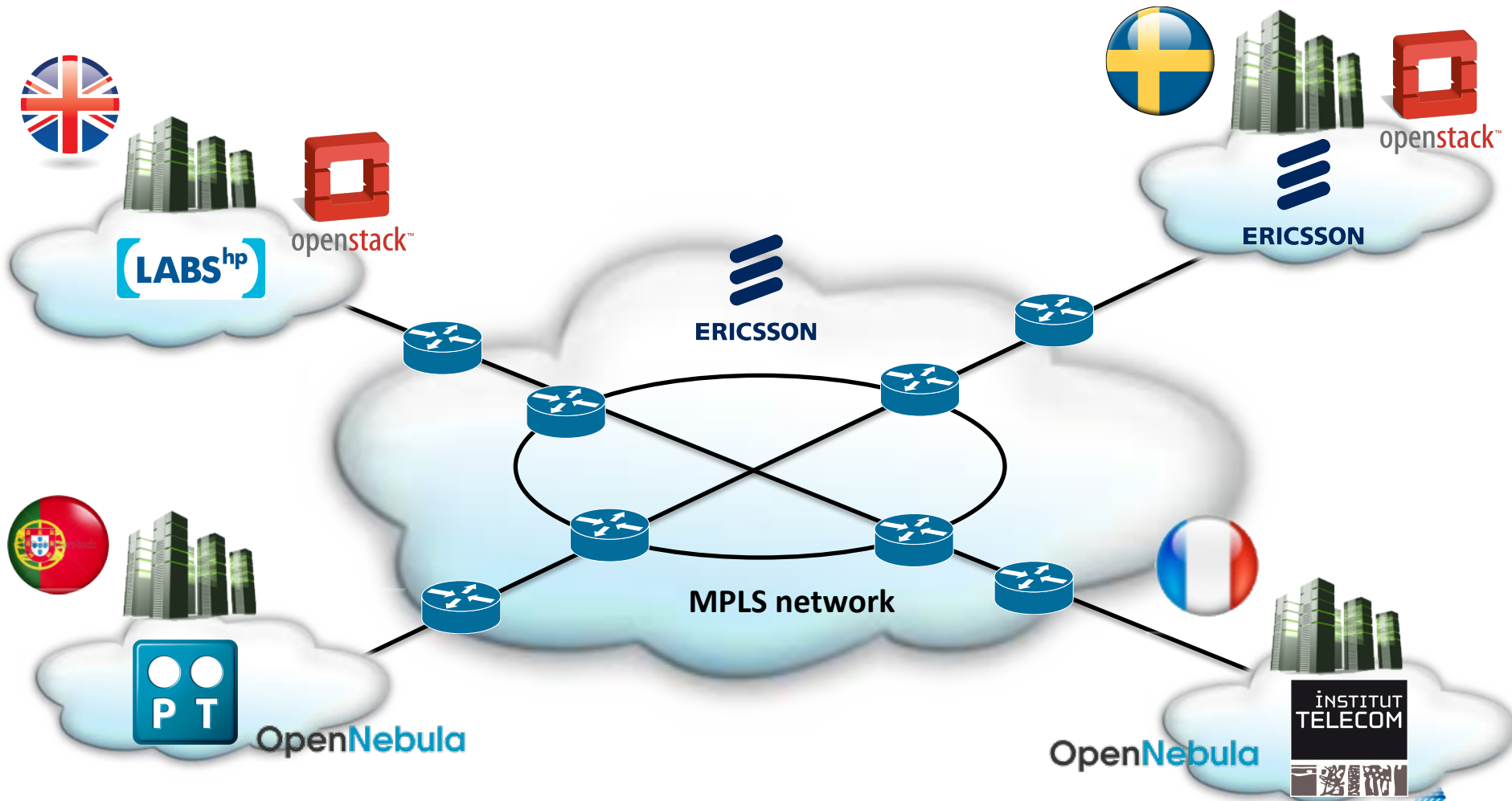
{
  "id": "ResourceID",
  "title": "CloNe Connectivity 1",
  "kind": {
    "term": "CloNeLink",
    "scheme": "http://schemas.ogf.org/occi/ocni#",
    "class": "kind",
    "title": "Cloud networking Link"
  },
  "mixins": [
    {
      "term": "L3VPNMixin",
      "scheme": "http://example.com/occi/ocni/l3vpn_mixin#",
    }
  ]
}
```

- Distributed Control Protocol (DCP)

- Configuration negotiation
- Link ,VLAN, Routing protocol etc..



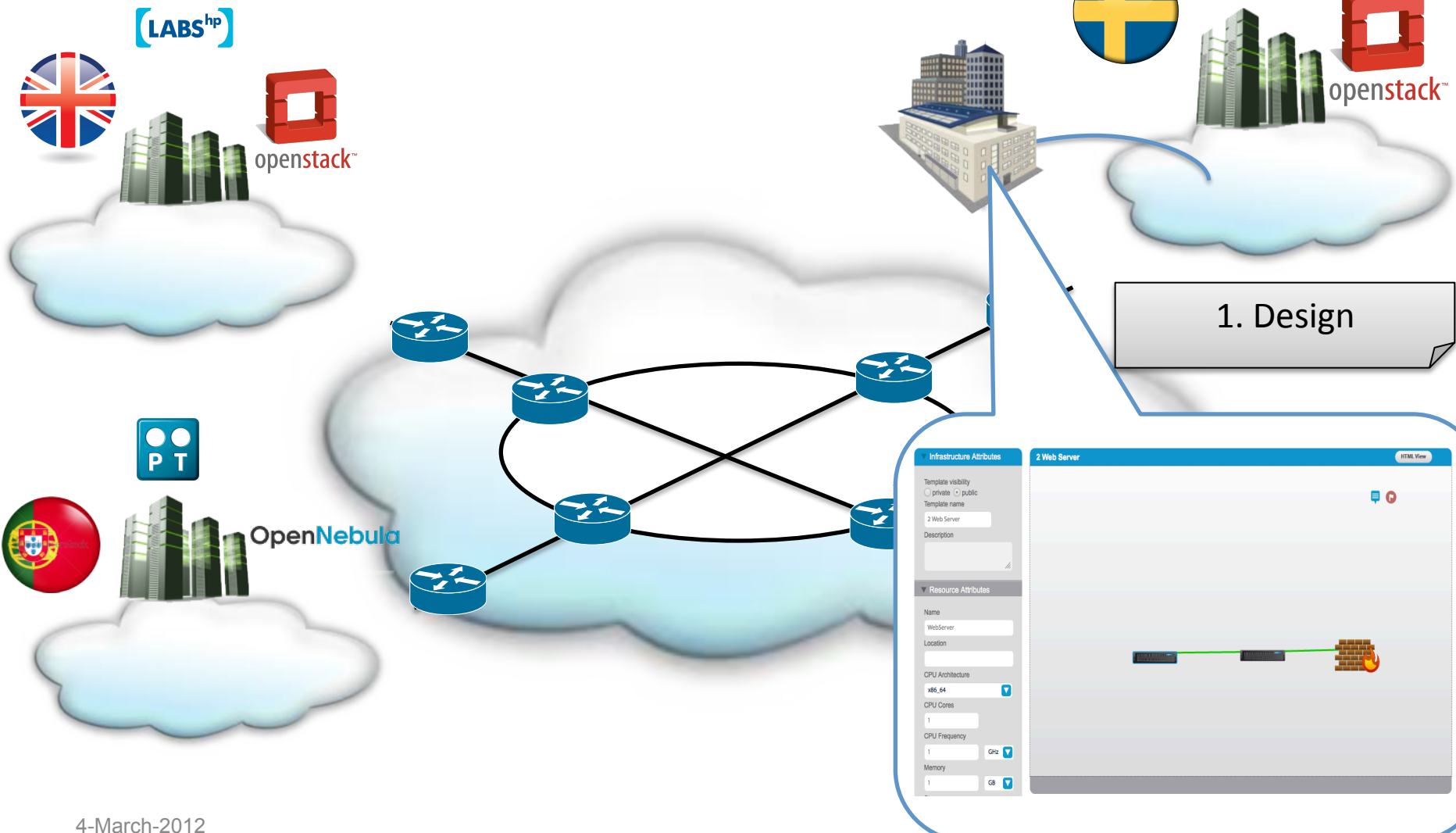
# European Spanning Testbed



4-March-2012



# Using the system : Enterprise scenario






# Using the system : Enterprise scenario




(LABS<sup>hp</sup>)



openstack™




S A I L



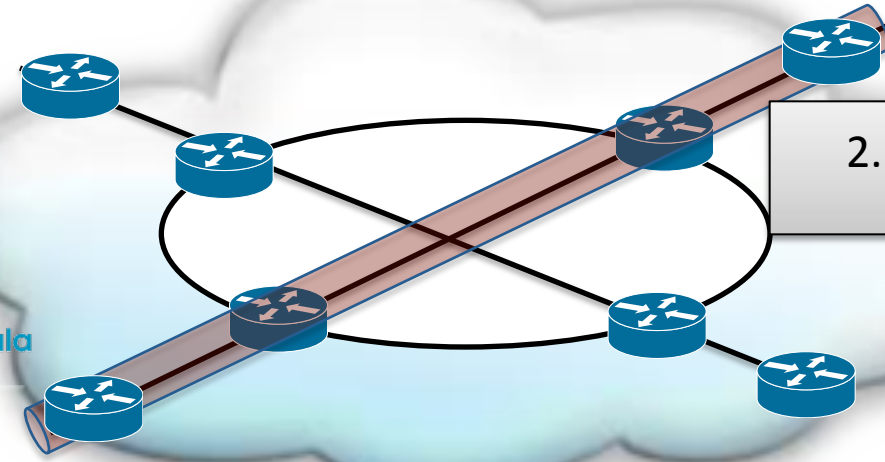

ERICSSON



openstack™



MySQL



2. Setup individual slices




PT



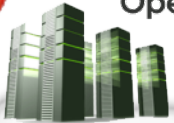


OpenNebula



Apache

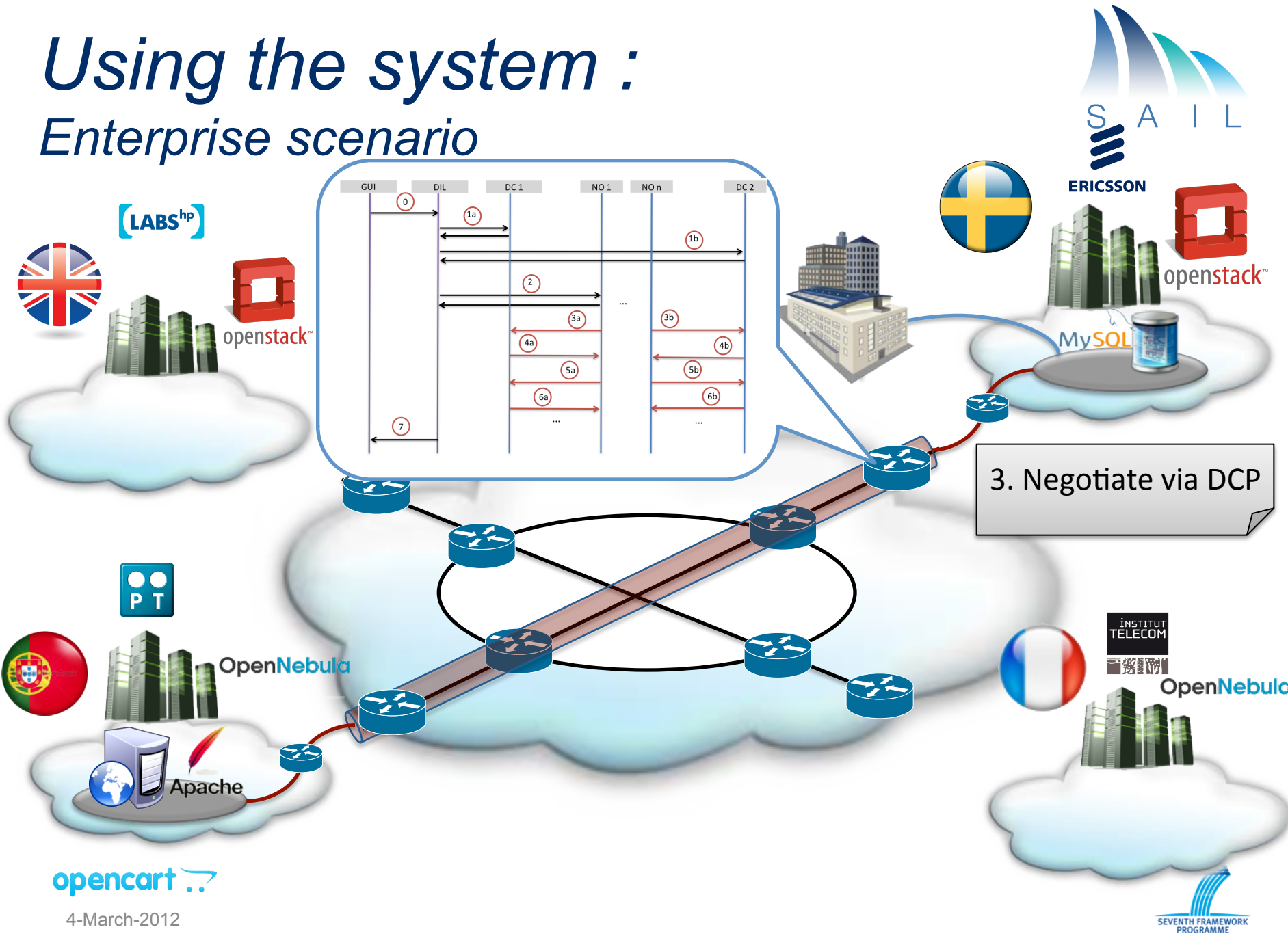


INSTITUT  
TELECOM



OpenNebula

# Using the system : Enterprise scenario



# Using the system : Enterprise scenario



ERICSSON



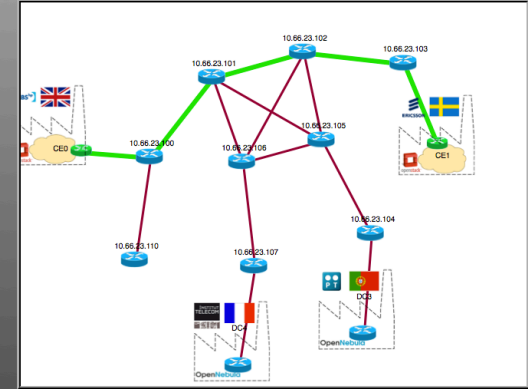
MySQL



LABS<sup>hp</sup>



## FNS VIEWER



FNS type: L3  
 FNS id: 1234  
 Attachment points  
 10.66.23.100   
 10.66.23.103



4. Access and Monitoring

PT



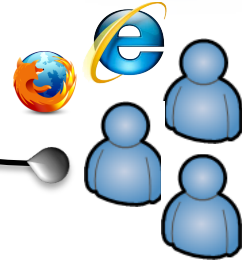
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# Distributed virtual infrastructure



Webshop front-ends in geographically distributed clouds

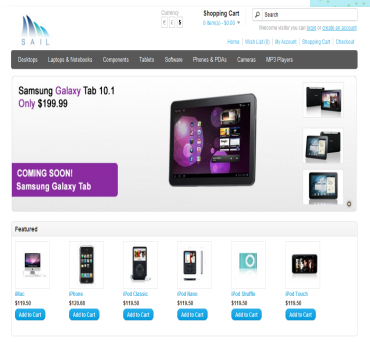
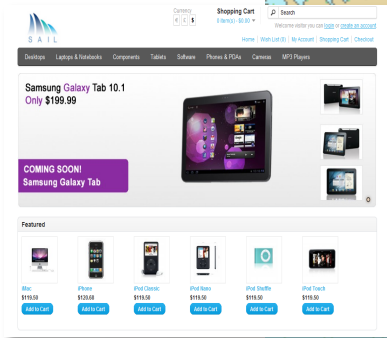


opencart ↗

Webshop database backend in home cloud

All cloud sites interconnected by dynamically established VPN

A single distributed virtual infrastructure



# Conclusion



- Operator network is a tremendous asset
- Operator network necessity for the Cloud

**Network can be 1<sup>st</sup> Class cloud citizen**

**Elastic**

**On-demand**

**Reliable**

**Simple Interfaces**

**Secure**

**Sellable**



<http://www.sail-project.eu/>

*Questions ?*



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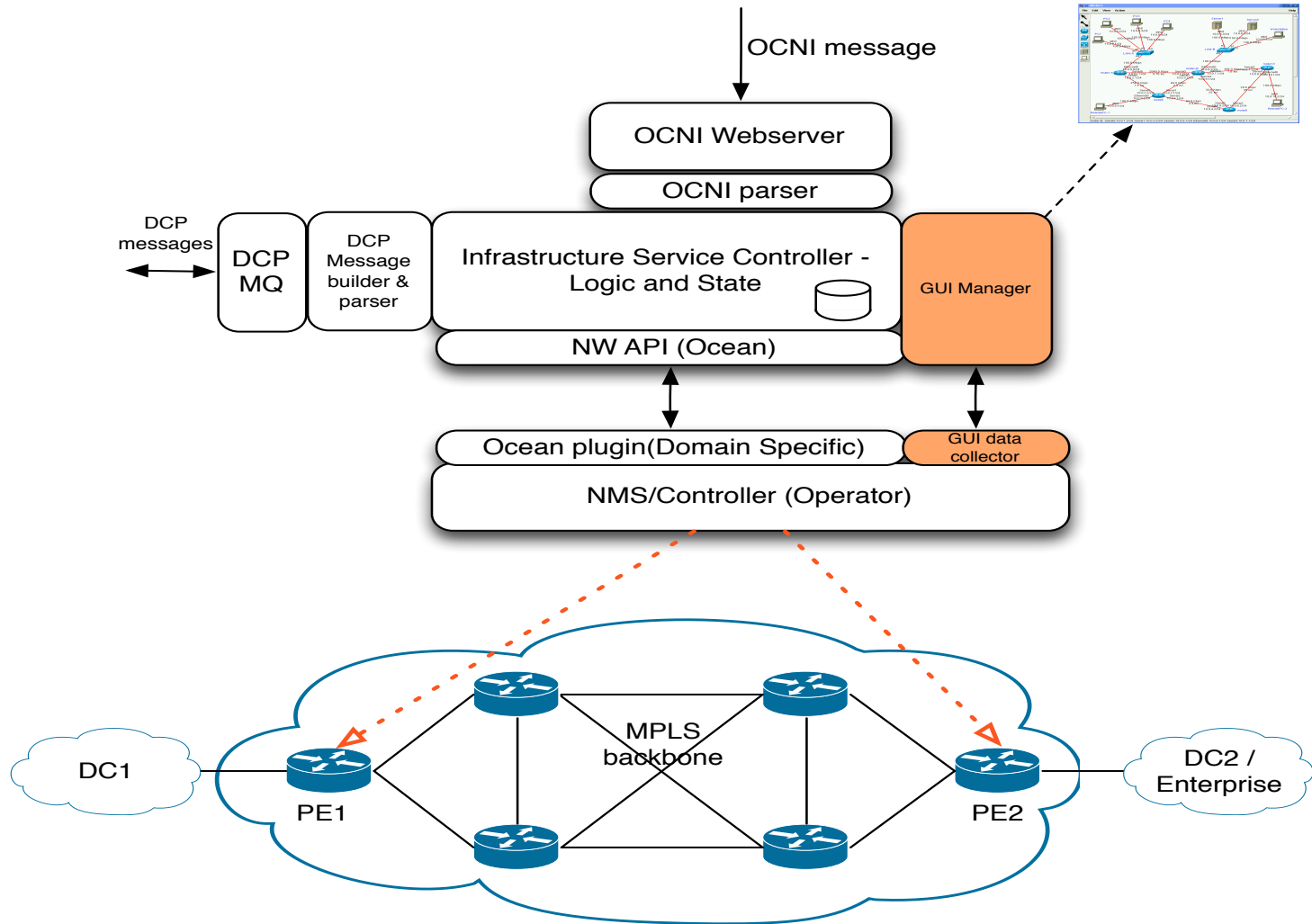
4-March-2012





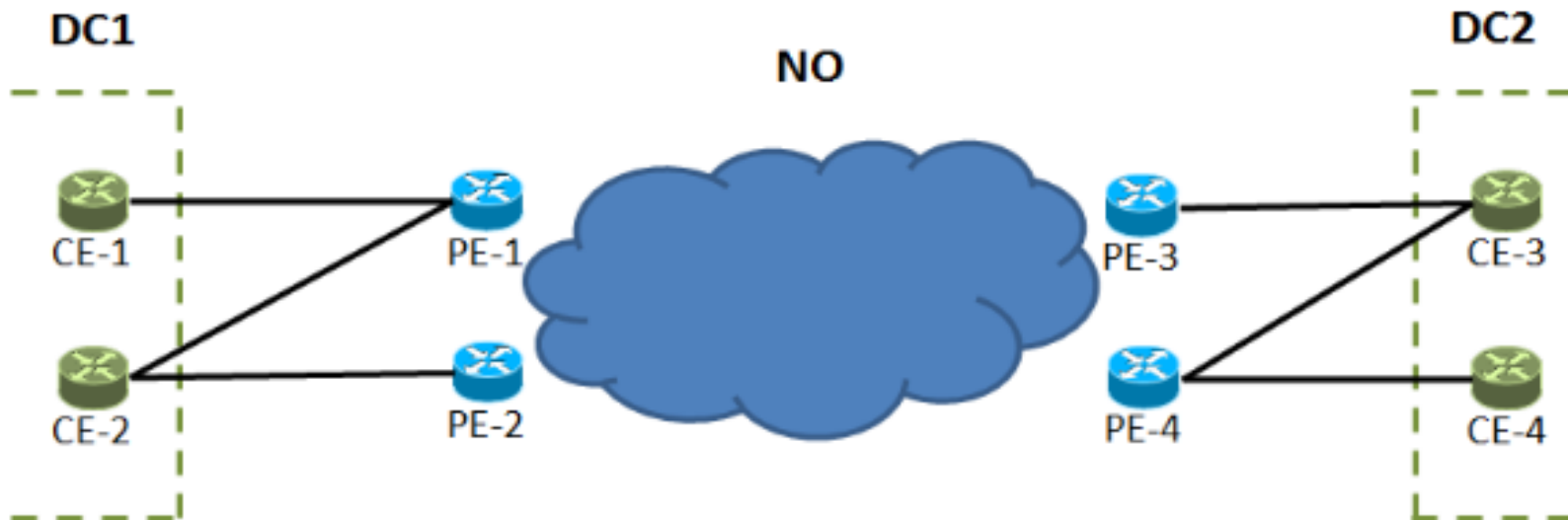
# ***BACKUP SLIDES***

# WAN functional architecture





# DC –NW-DC Setup



# DCP Messages

