FEDERICA

CAPACITIES

e-infrastructure

Consortium GARR

Federated E-infrastructure Dedicated to European Researchers Innovating in Computing network Architectures

Mauro Campanella - GARR

Phosphorus Workshop

Bruges, May 18th, 2008

FEDERICA at a glance

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www.fp7-federica.eu

What: European Community co-funded project in its 7th Framework Program in the area "Capacities - Research Infrastructures"

3.7 MEuro EC contribution, 5.2 ME budget, 461 Man Months

When: 1st January 2008 - 30 June 2010 (30 months)

Who: 20 partners, based on stakeholders on network research and management:

11 National Research and Education Networks, DANTE (GÉANT2), TERENA, 4 Universities, Juniper Networks, 1 small enterprise (MARTEL), 1 research centre (i2CAT) - Coordinator: GARR (Italian NREN)

Where: Europe-wide e-Infrastructure, open to external connections

FEDERICA Vision

- Support research in virtualization of e-Infrastructures integrating network resources *and* nodes capable of virtualization (V-Nodes). In particular multi-virtual-domain control, management and monitoring, including user oriented control in a federated environment

- Create an e-Infrastructure for all researchers on Future Internet, allowing disruptive emulations in a short time frame (similar to the Global Environment for Network Innovation - GENI - initiative in US, which is in the definition phase).

- Pave the way, research and create experience for the next generation of the European Research and Education Networks.

Partners' Location

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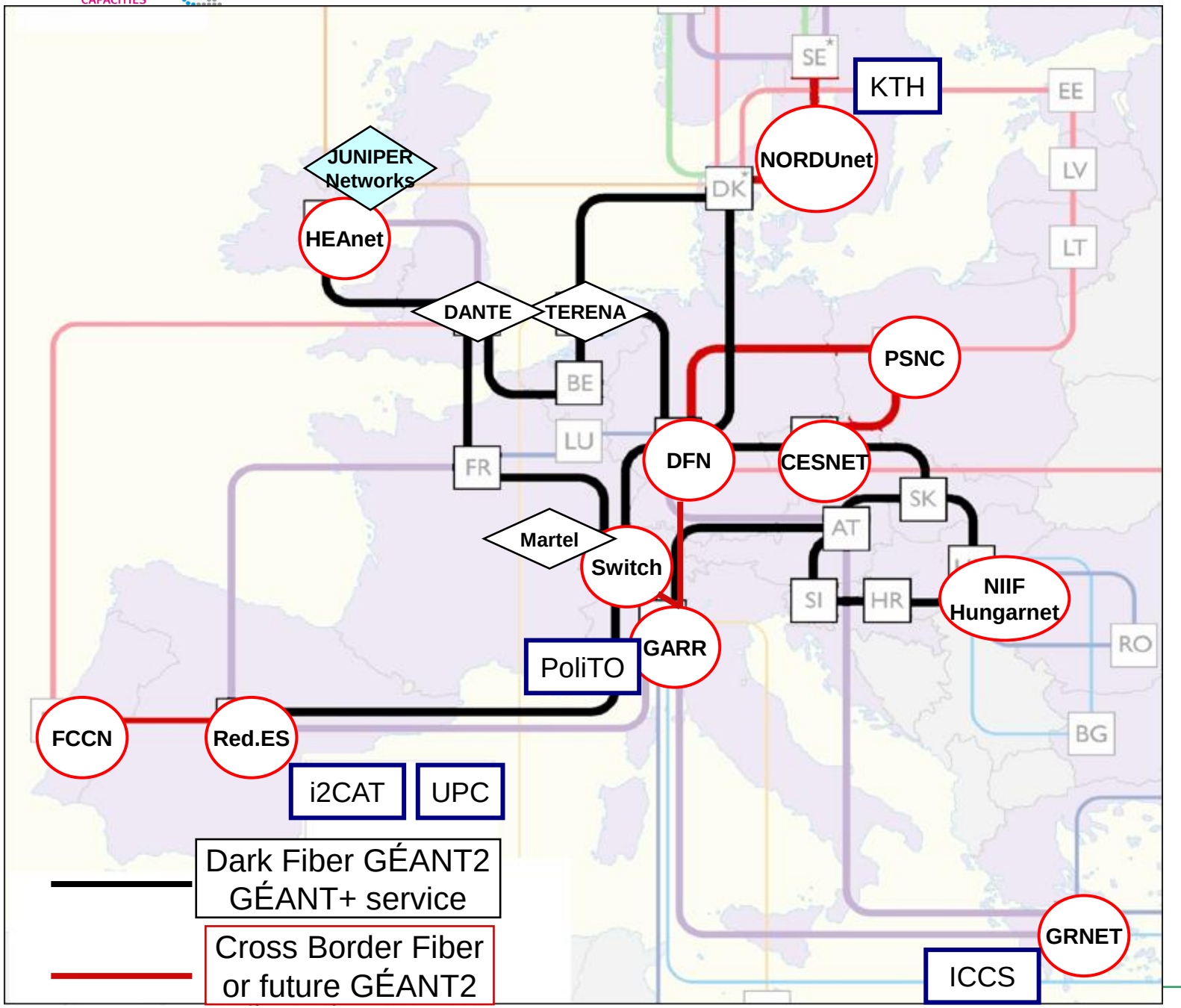

NREN

SME, Associations, Vendors

Univ. or Res. Centre

NREN partners provide a European coverage using the GN2+ service and

- allow *connection* to Univ. and Research Center partners
- Provide "*HUB*" functionalities and possibility extend the e-Infrastructure to other countries and projects using physical or logical circuits
- Contribute with *tools and specific expertise*

FEDERICA Partners

National Research & Education Networks (11)

CESNET	Czech Rep.
DFN	Germany
FCCN	Portugal
GARR (coordinator)	Italy
GRNET	Greece
HEAnet	Ireland
NIIF/HUNGARNET	Hungary
NORDUnet	Nordic countries
PSNC	Poland
Red.es	Spain
SWITCH	Switzerland

Small Enterprise

Martel Consulting	Switzerland

NREN Organizations

TERENA	The Netherlands
DANTE	United Kingdom

Universities - Research Centers

i2CAT	Spain
KTH	Sweden
ICCS (NTUA)	Greece
UPC	Spain
PoliTO	Italy

System Vendor

Juniper Networks	Ireland

FEDERICA Principles

1. Create an agnostic and neutral (transparent) infrastructure
2. Create "slices" which are a set of (virtual) network and computing resources according to user's request and are "disruptible"
3. Provide to the user complete control within a slice up to the lowest possible layer (in particular allow any application and protocol)
4. Strive for reproducibility of experiments, i.e. given the same initial conditions, the results of an experiment are the same
5. Allow slices (if requested) to connect to general Internet, to access external services/nodes (e.g. for content/delivery, specialized HW)
6. Ensure isolation between slices mantaining the possibility to cross-connect slides on request
7. Allow simultaneous use without conflict
8. Force/be exposed to topology changes (various level of resiliency)
9. Open to interconnect / federate with other e-Infrastructures
10. Access granted through a User Policy Board

FEDERICA e-Infrastructure

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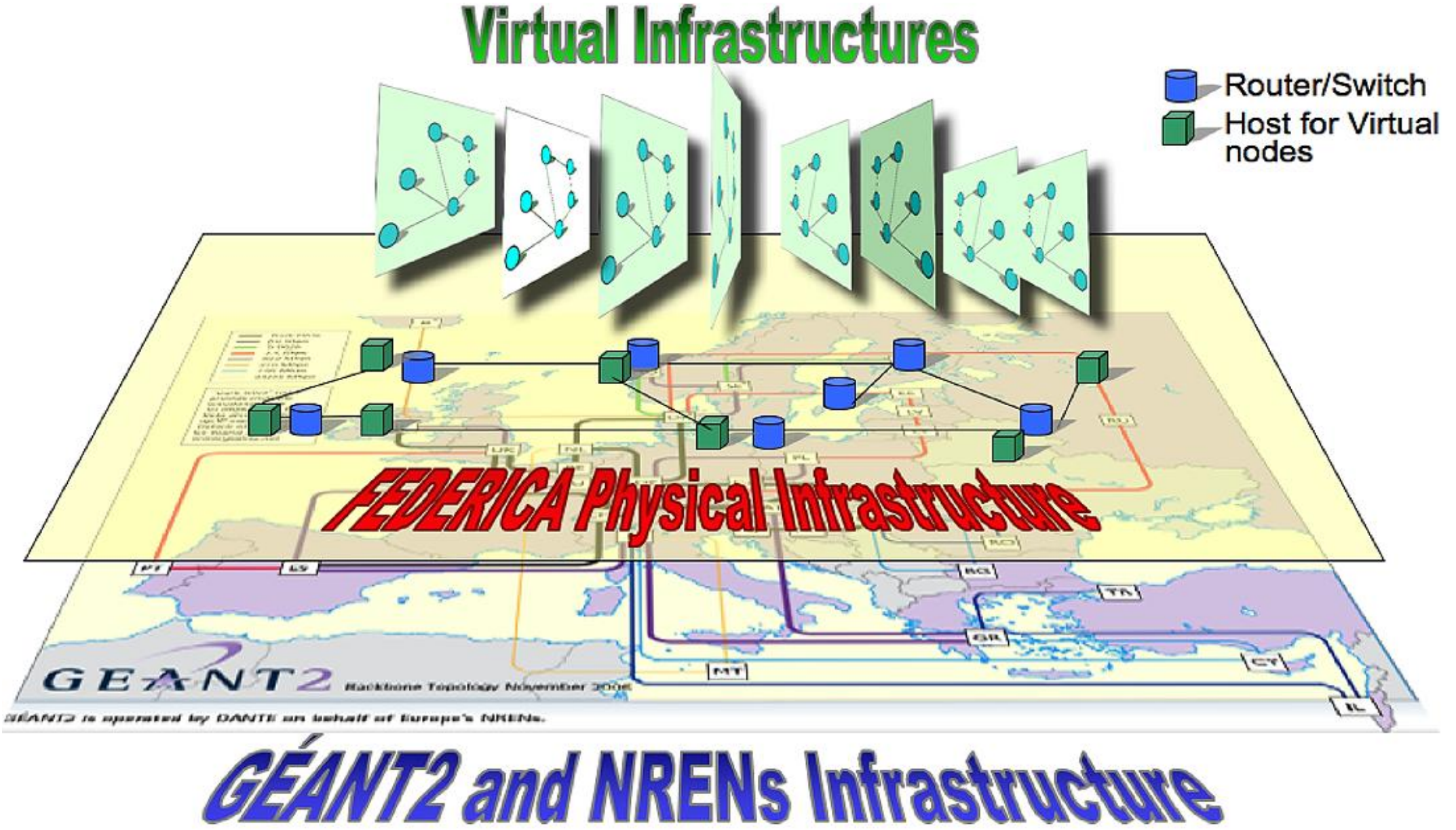
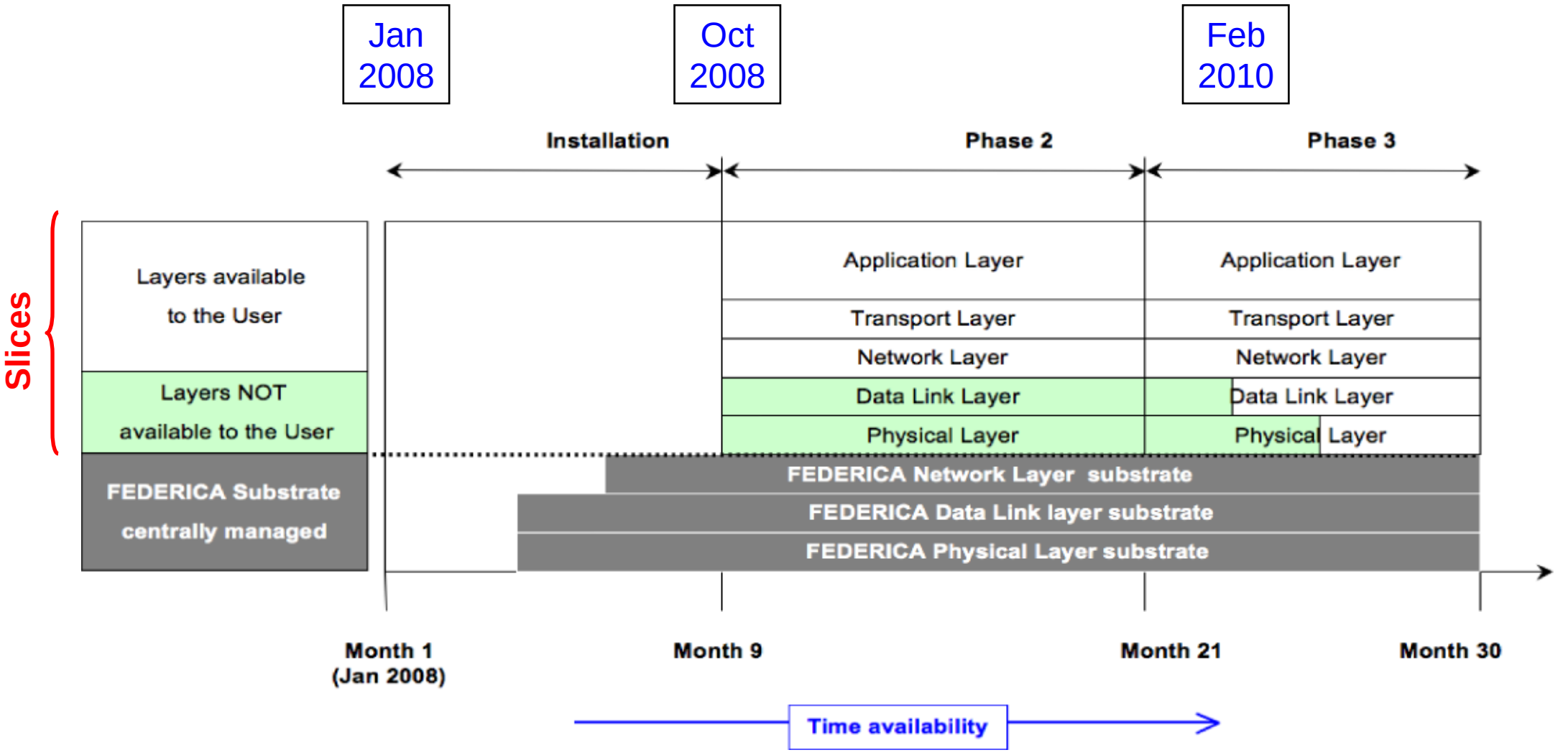


The Enabling Elements

1. Virtualization in computing systems and in network is available. It creates "resources", given a supporting physical substrate, which :
   - Have a looser or none dependency from a specific physical location or entity (computing, data, circuits may migrate)
   - On-the-fly reconfiguration, cancellation and creation of resources in the e-Infrastructure (e.g. a routing element)
   - off-the-shelf components offers embedded virtualization functionalities.
2. The European NRENs are managing owned hybrid infrastructures and actively performing network research, starting from users' needs. The federated NREN architecture scenario offers now significant interdomain services and research capabilities.
3. The traditional testbed, focused on a small number of technologies has a usefulness limited to the specialized nature of users. It also implies a along set-up time and a fast obsolescence.

Work plan outline (I3)



FEDERICA Activities

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NA1: Project Management
NA2: Building and Consolidating the User Community
NA3: Standardization and Liaisons
NA4: Dissemination and Training

Network Activities

SA1: Infrastructure Support
SA2: Operational User support and Tool bench development

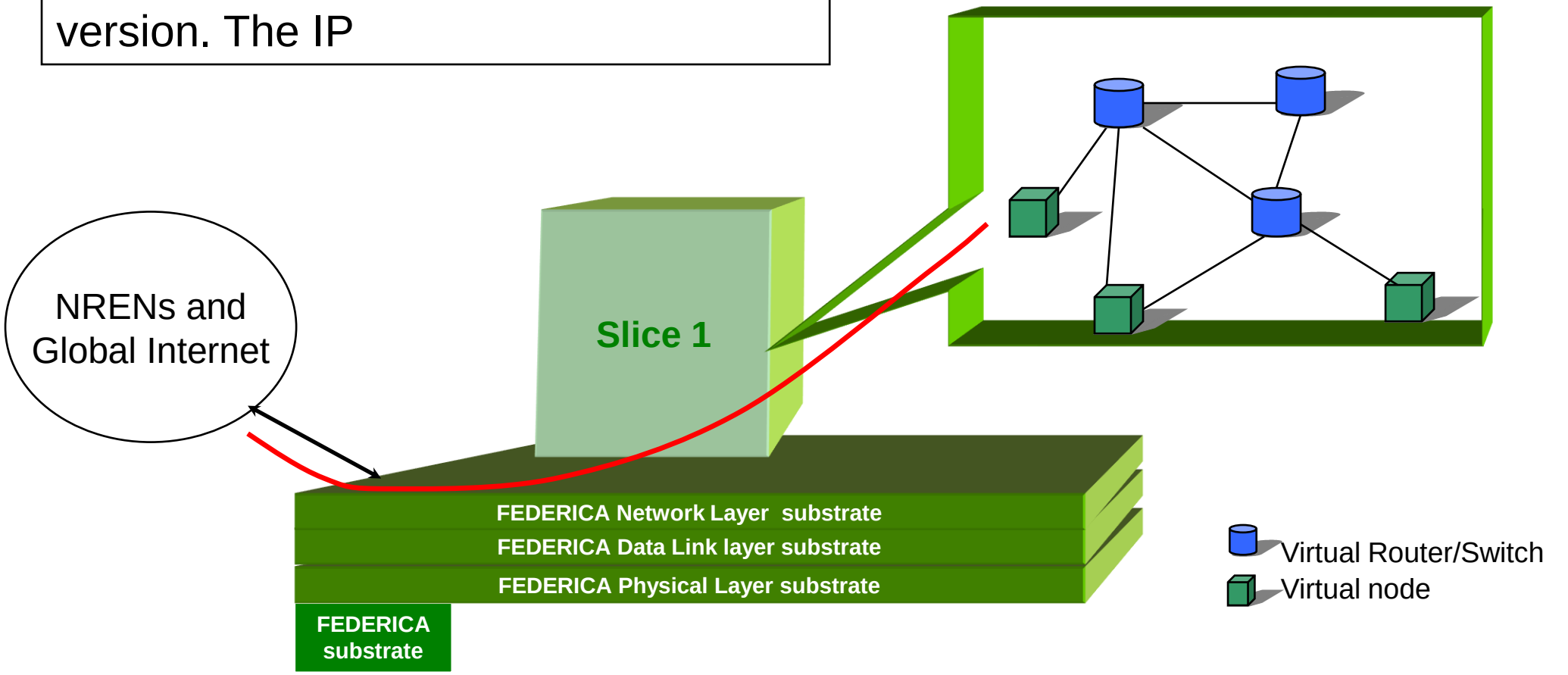
Service Activities

JRA1: Network Control and Management
JRA2: Novel Paradigms and User Control

Join Research Activities

Pictorial of “Slices” Creation

The user requests an Infrastructure made of L2 circuits, un-configured virtual nodes, to test a new BGP version. The IP



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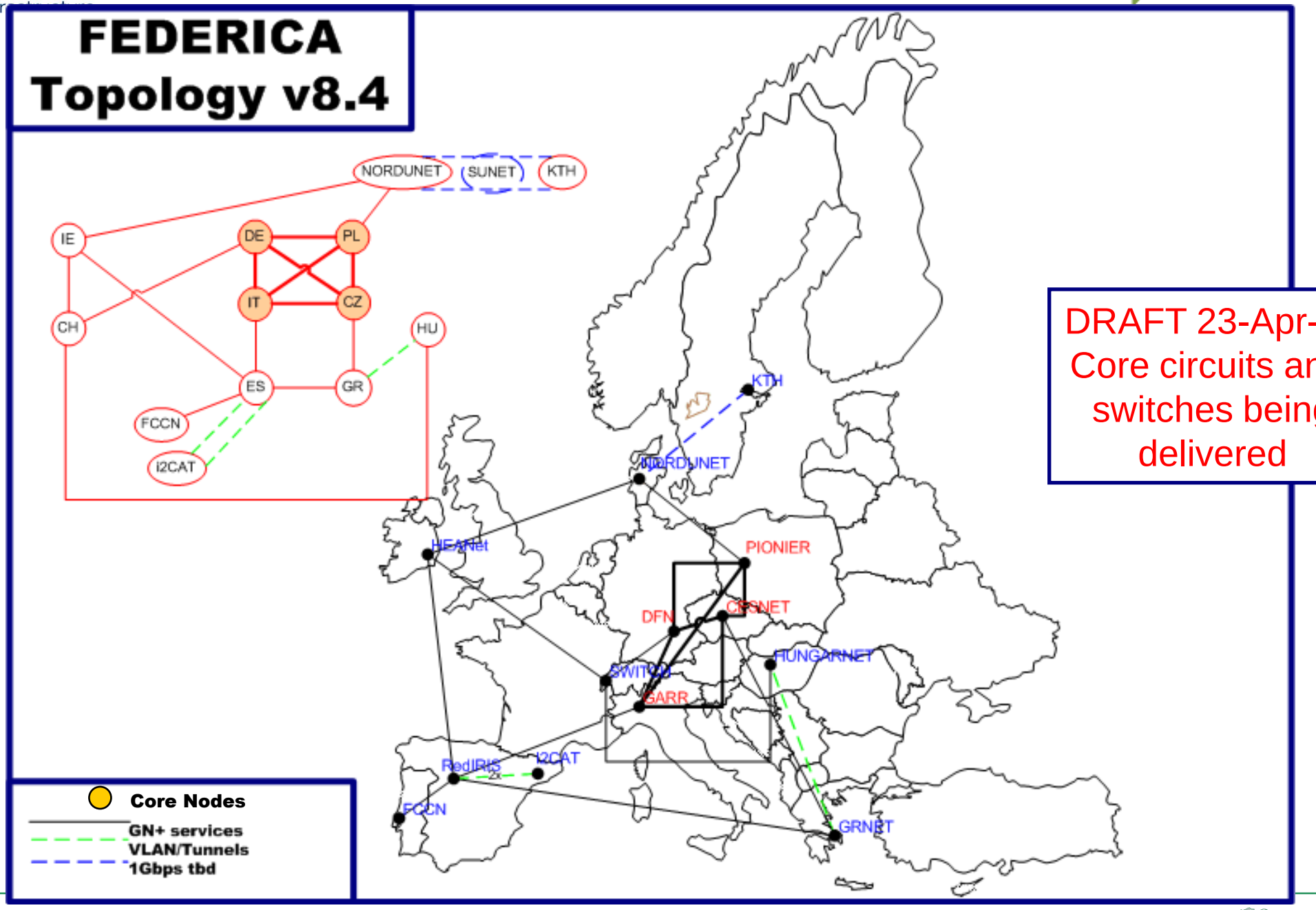
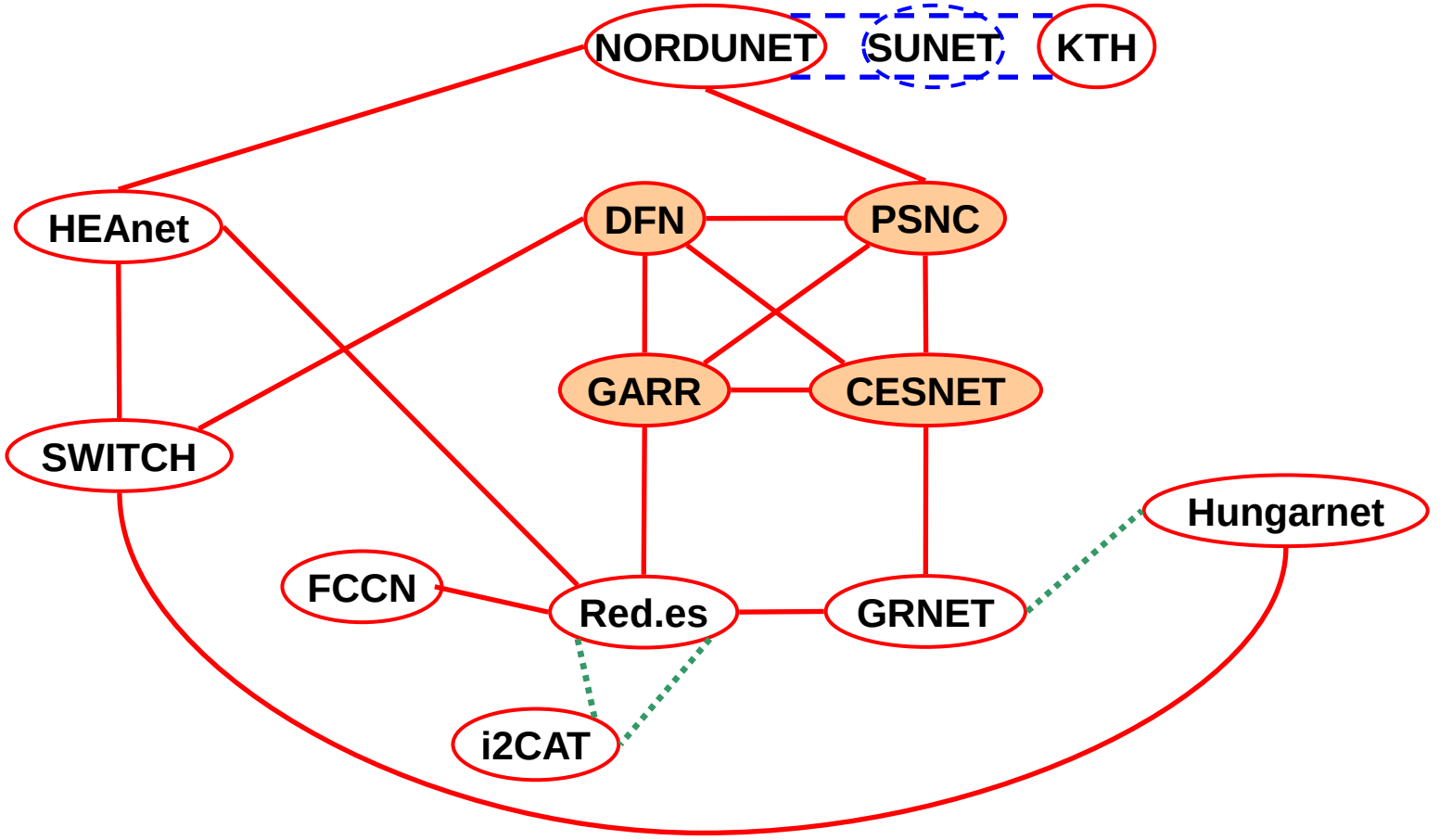


DRAFT 23-Apr-08
Core circuits and switches being delivered

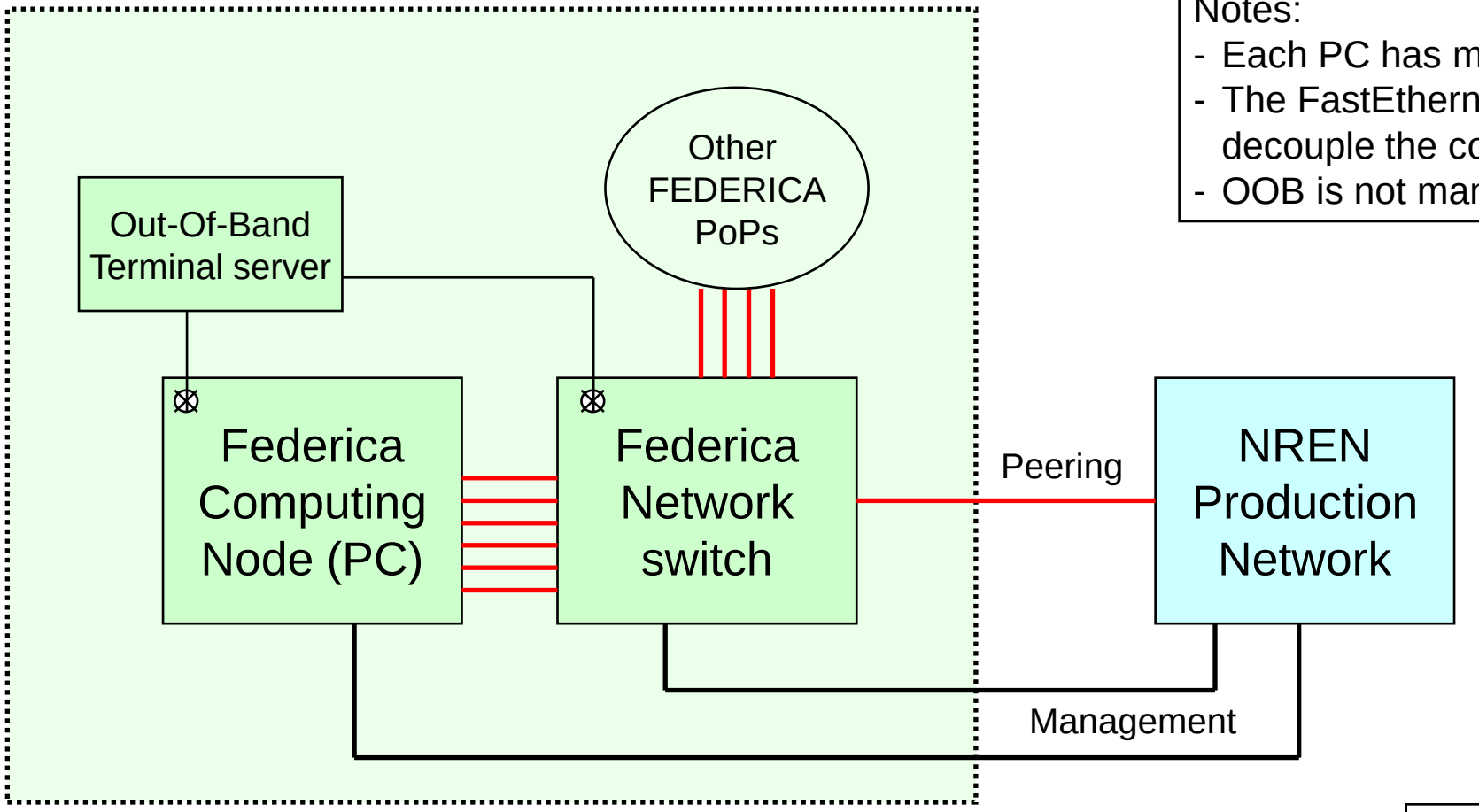
Topology version 8.4



Legenda

- Core Nodes
- 1 Physical GbE from GN2+
- 1 GbE VLAN or L2MPLS
- 1 Physical GbE tbd

Sample FEDERICA PoP



Notes:
- Each PC has many GbE interfaces
- The FastEthernet Interfaces are to decouple the control and data plane
- OOB is not mandatory

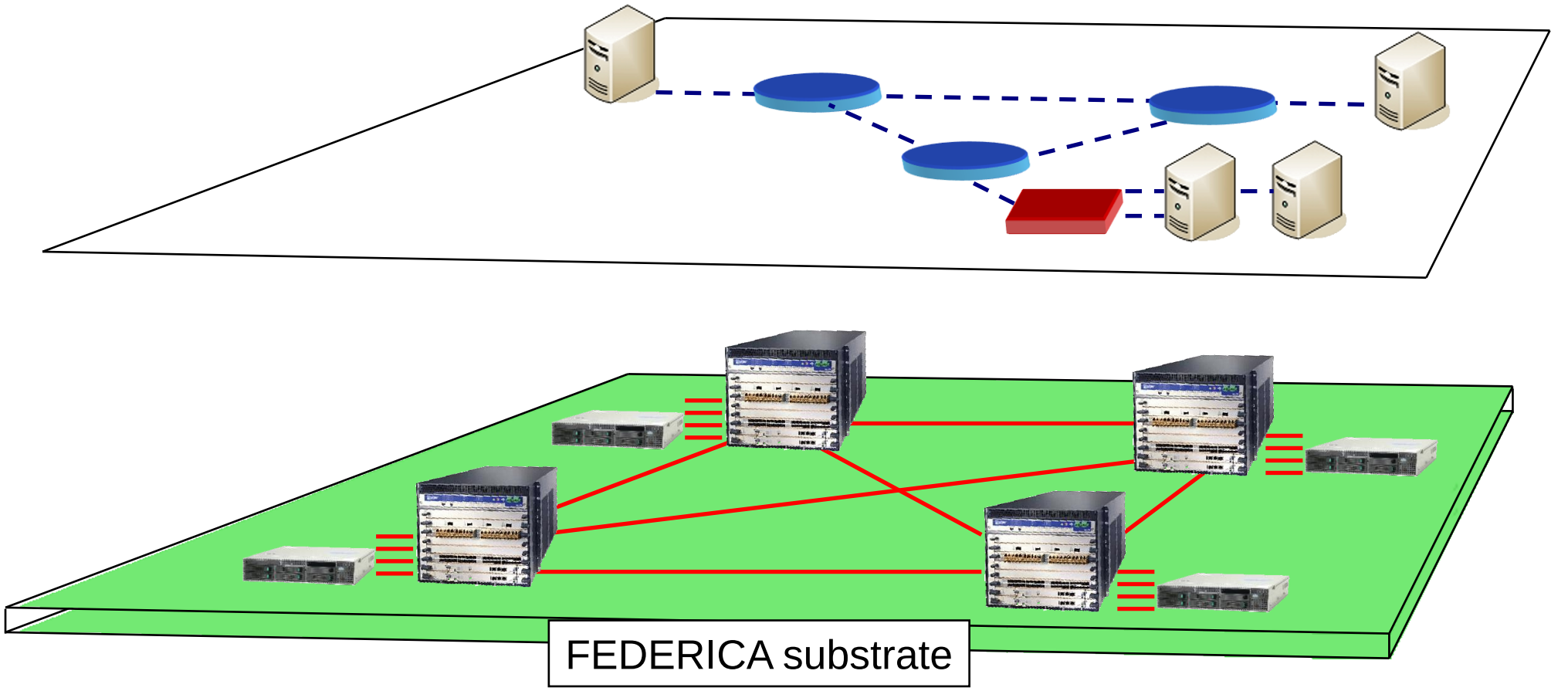
The FEDERICA substrate
(physical infrastructure and
Single IP AS public number)

Legenda

1 FastEthernet

RS-232

Slicing the Core (Substrate)



Switches: Juniper MX480, (virtual and logical routing, MPLS and VLANs IPv4, IPv6)

V-Nodes: Upto 8-16 images/node, Unix based, 4-8 Ethernet Interfaces, 1 TB disk

Access and Use Policies

- A User Policy Board will receive and approve project for the use of the infrastructure
- Access to the infrastructure is subject to the signature of an "Acceptable User Policy", which includes providing feedback
- The access to the core network will be free of charge if no additional equipment is requested
- Interconnection with other infrastructures, labs is possible the cost is to be defined/shared.
- The time duration of the project will be in principle limited to facilitate turnover
- Access is open to research groups from academia and private sector with priority to European Community funded projects.
- The code and tool bench produced will be Open Source

Users' requirements are fundamental and are being collected

Federating and Interconnection with other projects/groups

- "Soft" model
  - Act as a user of the project (hosting its virtual resources with possible interconnection to external resources using Internet)
  - Collaboration at the project/user group level to exchange intermediate results, perform joint developments

- "Hard" model
  - Hosting in FEDERICA a physical resource
  - Interconnecting the testbeds using a dedicated network resource

Need for a resource/service description format (e.g. TMF, IPSphere, …)

FEDERICA - Goals Summary

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In scope

- Provide on European scale network and system agnostic e-Infrastructure to be deployed in phases for Future Internet research (and not only). Provide its operation, maintenance and on-demand configuration
- Act as a forum and support for researchers/projects on “Future Internet”. Support of experimental activities to validate theoretical concepts, scenarios, architectures, control and management solutions. Users have full control of their slice
- Validate and gather experimental information for the next generation of research networking also through basic tool validation
- Dissemination and cooperation between NRENs and researchers’ community
- Contribution to standards in form of requirements and experience

Out of scope

- Internal extended research, e.g. advanced optical technology
- Development of Grid applications (but open to hosting)
- Offer raw computing power
- Offer transit capacity

Initial Boundaries

• Ethernet framing (large MTUs) as data link	• Not considered a limiting factor, can be overcame later using WDM equipment
• Scalability	• Larger virtual slices can be obtained reducing the number of concurrent users, user's equip. may be added
• IPv6 ready, to be enabled according to users' requests	• Equipment is ready for IPv6
• Packet switching and statistical multiplexing assumed by default	• Hardware QoS is available on two Juniper MX480
• Less powerful switches outside the core	• Relay more on software emulation
• Manual provisioning	• Slower initial provisioning, compatible with decision process and overall management
• Not all technologies available (e.g. wireless, nomadic nodes)	• Equipment hosting, federation with other testbed

Control Plane and Virtualization: an additional challenge

- The main control plane is now tied to the “basic substrate”, its main and new function is to create “slices” made of “resources”. It implies the need to define:
  - user interface specification for request (UNI-type, but UNIs do not have currently the required parameters)
  - resources abstraction and specification (network part ongoing in GN2 (AutoBAHN) and DICE coollaboration)
  - signalling protocols for UNI communication
  - Interdomain communication specification
- Need to manage the basic substrate and one or more slices at the same time:
  - Control plane extensions in the layered framework
  - control plane capable of communication with one or more”hosted” control planes

CP and Virtualization (cont)

- Extension and definitions for naming, addressing, to allow the possibility of global reachability

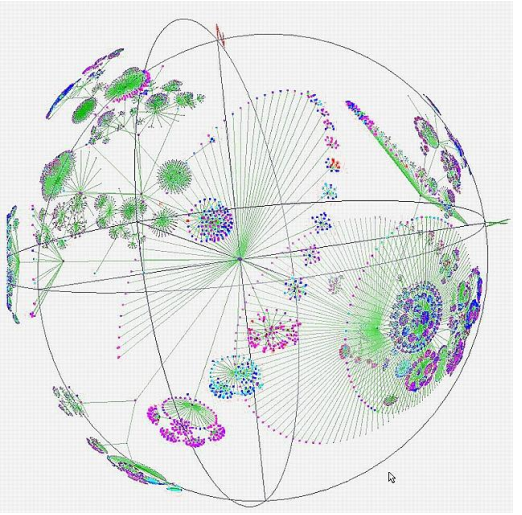
- Monitoring interaction,synergy between the substrate and the slices in sharing the physical elements

FEDERICA will start with manual provisionig of virtual resources, a single IP AS and public IP network addresses for the substrate.

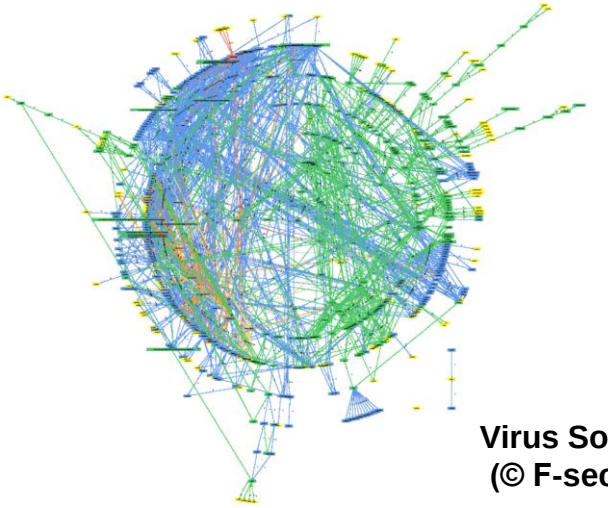
Overall nor the integrated model, nor the layered one may be adequate and further advances are required in HW and SW to allow virtualization capabilities with resource assurances.

BUT ….

Complexity



Internet as RTT Peerings (CAIDA)



Virus Sobig-F (© F-secure)

Internet as Circuits ?

The major risk is to create a system which is too complex.

Thank you for your attention

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e-infrastructure

CESNET

HEAnet
IRELAND'S NATIONAL EDUCATION & RESEARCH NETWORK

IRIS

SWITCH

DFN
Deutsches Forschungsnetz

NORDUnet

UPC

ΕΠΙΣΕΥ
ICCS

FCCN
Fundação para a Computação Científica Nacional

HUNGARNET

KTH
VETENSKAP
OCH KONST

POLITECNICO DI TORINO
1859
1906

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