

Basic User Information

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1 Information about FEDERICA for users

1.1 An EC project to ‘slice up’ networks for research

Researchers who would like to conduct disruptive experiments, that shape the future Internet and other network infrastructures related topics, have a safe and flexible 'environment' for their work. An European Community co-funded project called FEDERICA can create 'slices' of its network infrastructure, which can be allocated to researchers as a virtual resource for their experiments.

The Federated E-infrastructure Dedicated to European Researchers Innovating in Computing network Architectures project – otherwise known as FEDERICA – started on 1 January 2008 and runs until 30 June 2011.

1.2 Unique Approach

The combination of virtualisation techniques with network control/management mechanisms is a unique aspect of the FEDERICA project. The concept of running virtual overlay networks (for example, Virtual Private Networks (VPNs)) is well established, but FEDERICA also allows researchers to access the lower network layers (L2) in order to allow specific parts of the physical substrate to be allocated as virtual resources.

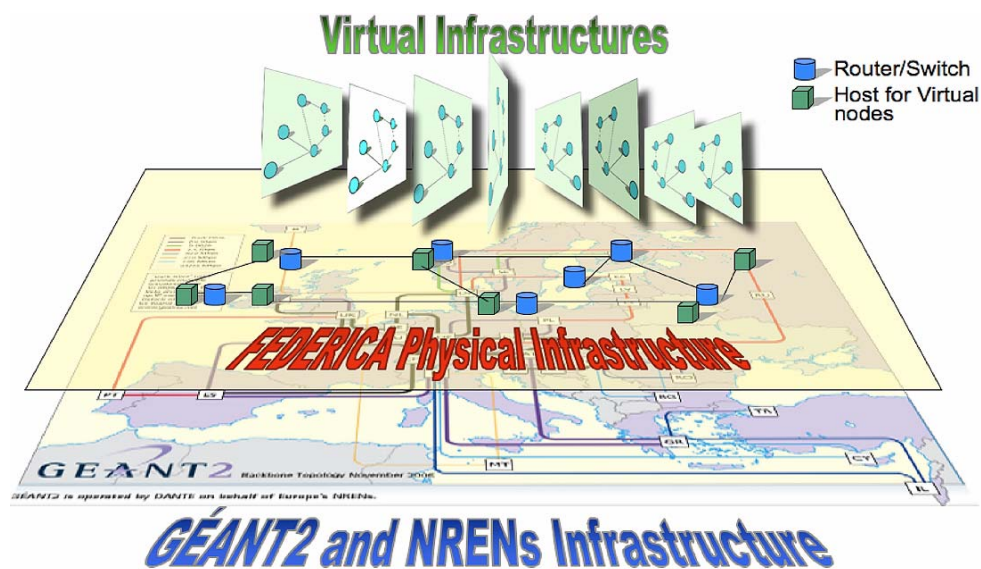


Fig. 1 FEDERICA concept

In the first phase, the project will focus on creating the Europe-wide infrastructure, and on developing and testing mechanisms that achieve virtualisation, or ‘slicing’, of the network resources, as well as mechanisms to control these processes. The project infrastructure is operational since end of November 2008.

The second phase of the project will implement a ‘tool-bench’ that will integrate these mechanisms in order to provide more automated and on-demand allocation of ‘slices’ to researchers.

In the last phase, the tool-bench will study to ultimately enable control of resources across multiple domains, allowing the FEDERICA concept to be extended to communities other than Europe's research and education sector, which is the primary target user group.

1.3 Experimental users

Users of the FEDERICA infrastructure will include individual researchers, PhD students, groups in universities or research centres, EC project participants and equipment manufacturers' research laboratories. Their research is expected not just to use the network as a tool, but as primary subject of their work. Training for users is included in the project.

FEDERICA's experimental network infrastructure is neutral as to the types of protocols, services and applications that may be trialled, while allowing disruptive experiments to take place without adverse effect on existing production networks.

1.4 Summary of the objectives of the project

- Support the research on new Internet architectures and protocols
 - create a European wide 'technology agnostic' infrastructure based on a mesh of 1 Gb/s MPLS and Gbps circuits from NREN/GÉANT and virtualization nodes providing virtualized network/computing facilities (in form of 'slices') to end-users, allowing disruptive emulations
 - open to host researchers' hardware and applications
 - Simultaneous use by more than one research group
 - provide full control of the network up the data link layer (later lower layers) and access to monitoring data
- Develop experience and a model for managing and using virtual infrastructures as a combination of networks and systems
- Exploit at their best the existing NREN/GÉANT networks and tools
- Facilitate technical discussion amongst specialists, in particular when based on experimental results, and disseminate knowledge and NREN experience

1.4.1 Goals In Scope

- Act as a forum and support for researchers/projects on 'Future Internet'
- Support of experimental activities to validate theoretical concepts, scenarios, architectures, control & management solutions; users have control of their virtual slice
- Provide network and system agnostic e-infrastructure on European scale to be deployed in phases. Provide its operation, maintenance and on-demand configuration
- Validate and gather experimental information for the next generation of research networking also through basic tool validation
- Dissemination and favour cooperation of NRENs and User community
- Contribution to standards in form of requirements and experience

1.4.2 Goals Out of scope

- Extended research, e.g. advanced optical technology developments
- Development and explicit support of Grid applications
- Offer computing power
- Offer transit capacity

1.5 Potential Use Cases for external users (examples)

Use Case 1: ‘User does research on networked applications’

- The user who wants to try his distributed application needs a set of physical and or logical routers and a set of virtual hosts interconnected on which to install his application.
- He would ask FEDERICA for a slice containing an IP routed network that best suits his needs (including capacity for each circuit).
- The user would ask FEDERICA to create VMs (Virtual Machines) and upload his application software, or provide preconfigured system images to be installed in the slice. Then he would be able to see how his application behaves in the slice, including a possible communication with nodes in Internet through the IP peering with the NRENs.
- At a certain point the user could decide to change the IP network topology or parameters to see how this affects the performance of his application.

Use Case 2: ‘User does research on Layer 3’

- The user wants to do research at the network layer 3 (with a new stack of routing protocols). He could get 5 Virtual Machines and some physical ports on Ethernet switches (the user can only execute the FEDERICA services over the resources he has received).
- He would ask FEDERICA to setup a slice with circuits that linked his 5 or 6 Virtual Machines creating a chosen topology (for instance a ring).
- He would upload his routing software; thus converting the 5 Virtual Machines into 5 routers. The user can also choose to install his preconfigured system images.

2 FEDERICA infrastructure

2.1 Capabilities

What FEDERICA proposes to offer to the users can be summarized as follows:

- **The possibility to request a virtual infrastructure composed by a combination of circuits (up to 1Gb) and V-nodes (the operating system default is Linux, or just a ‘placeholder’ for a user supplied ‘image’)**

The slice can contain: routed IP circuits (IPv4, IPv6 unicasting and multicasting) and/or system(s) and/or routers. Optional routed connection to Internet is possible.

- **The slice can be a set of L2 circuits and system images (no IP configuration, just Ethernet framing).**

FEDERICA is based on 1 Gbps Ethernet circuits from GÉANT2. Those can be sliced either using VLAN technology or using MPLS L2 LSPs. In both case the framing stays Ethernet. (SDH is out of scope in the first phase of FEDERICA)

- **Circuits may have capacity assurances on request.**

There are various options to provision capacity assurances:

- Plain 1 GbE dedicated link
 - Up to 4 classes (users) per interface with guaranteed capacity using 802.1p
 - Premium IP (3 classes, but with known capacity patterns so no packet loss can be assured)
 - Characteristics of 2 Line Cards in the Juniper MX240 (Q type) which have up to 4K shapers (optional only in Juniper)
- **Some basic monitoring on the slice can be provided (i.e. some statistics through a web page).**

FEDERICA will collect monitoring information when requested (to be defined in detail). The information can be exported raw or using the web via presentation tools. The web page is also a portal for user support.

- **The user will have initially access to the network and system using SSH.**

Access to the slice is provided through a gateway host which can connect both to the general Internet and the specific user's slice. The circuits provided should be seen as fixed pipes. The user can play 'inside' his pipes as much as he wants. In that case he has to instantiate a virtual node that plays the role of a router or switch (e.g., in some cases it is possible to configure logical routers in the Juniper physical routers and provide the user full access to it.)

2.2 Typical procedures

Typical defaults and procedures for the users to access FEDERICA:

- The user has to submit a proposal to the UPB (User Policy Board) and be approved and discuss technical details beforehand.
- The initial maximum time duration for the slice is 90 days.
- The user has to sign an AUP (Acceptable Use Policy) see Appendix III.
- There is an obvious scaling limit to be assessed.
- Slice configuration will initially be semi-automatic and will require a few days.

2.3 The FEDERICA Infrastructure Network footprint

Topology design principles:

- A highly physically meshed infrastructure to allow easier slicing in complex topologies
- Deploy a large number of circuits
- Define a full mesh core based on Juniper MX480 nodes and V-Nodes
- Distribute Juniper in NRENs which have management responsibilities
- Do not force the circuits to follow the physical hops, but use the possibility to directly interconnect distant NRENs
- MPLS L2 LSPs on GÉANT2 may be added in case native GbE is not available or to increase meshing
- Avoid more than 3 circuits for each PoP (4 for core nodes)

3 FEDERICA’s users

3.1 Classification of the users

The target users of the infrastructure are the researchers and the activities engaged in research ‘on’ networking, using networks not just as the ‘tool’ but primarily as the ‘subject’ of their work. User groups will include EC projects, research groups in universities or research centres, equipment manufacturers and telecommunications research labs or even individuals (e.g. PhD students).

Potential users:

- FEDERICA partners to initially contact research groups
- FEDERICA partners to later liaise with research groups and researchers in their communities
- EC projects: potential users, along with FP7 initiatives, e.g. FIRE test beds
- research groups in universities or research centres
- equipment manufacturers
- individuals (e.g. PhD students).

Note that site visits are planned to key researchers to discuss requirements in-depth. In particular, the PlanetLab ‘slice’ database (<https://www.planet-lab.org/db/pub/slices.php>) will be used, along with personal contacts to sort-out the network research customer base within FEDERICA’s service area.

Users of the FEDERICA infrastructure will be distinguished between ‘configurators’ (i.e. being able to modify -in a controlled way- their allocated virtual slice or part of the slice properties, configuration, software) and ‘consumers’ (i.e. those who are simply using a FEDERICA slice or layer to do higher layer or application layer testing).

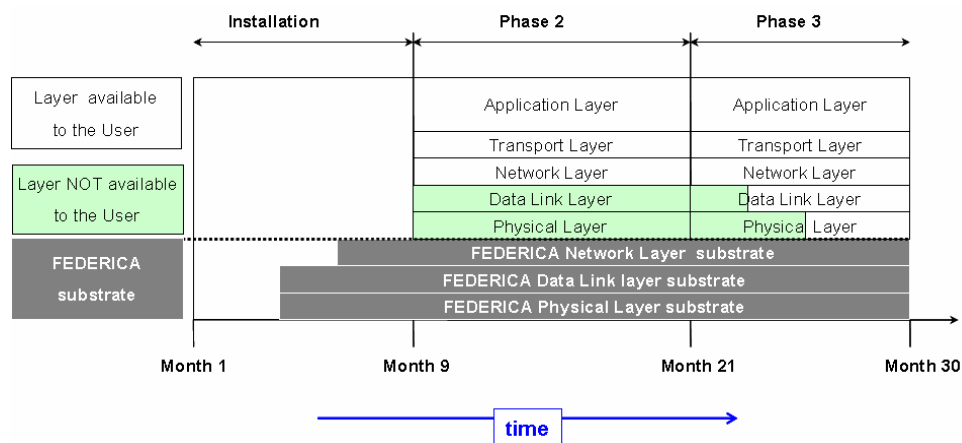


Fig. 3 Network layers (functions) available to the user

3.2 Type of users

The user communities will be segmented according to the level of use the infrastructure. The following four types of users are envisaged:

- Type 1: Researchers who request a stable network with standard protocols and IP connectivity. The topology might be of their choice, but they accept or are willing to share the network slice with other users and experiments.
- Type 2: Researchers who request a stable network with standard protocols and IP connectivity, but with dedicated and guaranteed capacity.

- Type 3: Researchers who want a network with standard protocols and IP connectivity and wish to experiment their own packet processing element and protocols in a private, or shared slice. The experimenter has complete control of how data is routed and processed over the network and the control plane of the virtual slice.
- Type 4: Researchers who want a topology made of circuits and computing elements, but without any configuration, as they would test new architectures and protocols. Bandwidths on demand within the topology may be setup and removed dynamically.

Further information about FEDERICA project

The FEDERICA infrastructure will use the Points of Presence (PoP) of the pan-European GÉANT2 network, as well as those of participating National Research and Education Networks (NRENs). Using the NRENs' and GÉANT2 networks will create a long-distance, multi-domain infrastructure that will provide a real-world environment for undertaking end-to-end network experiments.

The FEDERICA infrastructure will cover a significant part of Europe through participating NRENs, although access can be granted to any user with an Internet connection. Furthermore, FEDERICA will establish connections with other similar infrastructures such as the PlanetLab, EMUlab and OneLab overlay networks, the NSF GENI initiative in the United States, NREN testbeds, and telco experimental facilities. While the initial testing phase will be limited to selected users, the infrastructure will be made available to other EC projects during the final year of the project.

The FEDERICA project started on 1 January 2008 and runs until 30 June 2011.

The project represents a total investment of EUR 5,178,111. The European Union's Integrated Infrastructure Initiative (<http://cordis.europa.eu/infrastructures/i3.htm>) has funded 71% of this.

PARTNERS:

FEDERICA involves twenty-one partners from the academic, research and commercial sectors, coordinated by the Italian national research network organization Consortium GARR. More detailed information about the partners is available on the FEDERICA project website - <http://www.fp7-federica.eu/partners.php>

Consortium GARR (Italy); CESNET (Czech Republic); DANTE (based in UK); DFN (Germany); FCCN (Portugal); GRNET (Greece); HEAnet (Ireland); HUNGARNET (Hungary); Fundació i2CAT (Spain); ICCS (Greece); Juniper Networks, Inc.; KTH Royal Institute of Technology (Sweden); Martel Consulting (Switzerland); NORDUnet (based in Denmark); Politecnico di Torino (Italy); PSNC (Poland); RedIRIS (Spain); SWITCH (Switzerland); TERENA (based in Netherlands); UPC (Spain);

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FEDERICA-Web-Site:

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User Policy Board:

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FEDERICA Network Operation Center (NOC): federica-noc@fp7-federica.eu