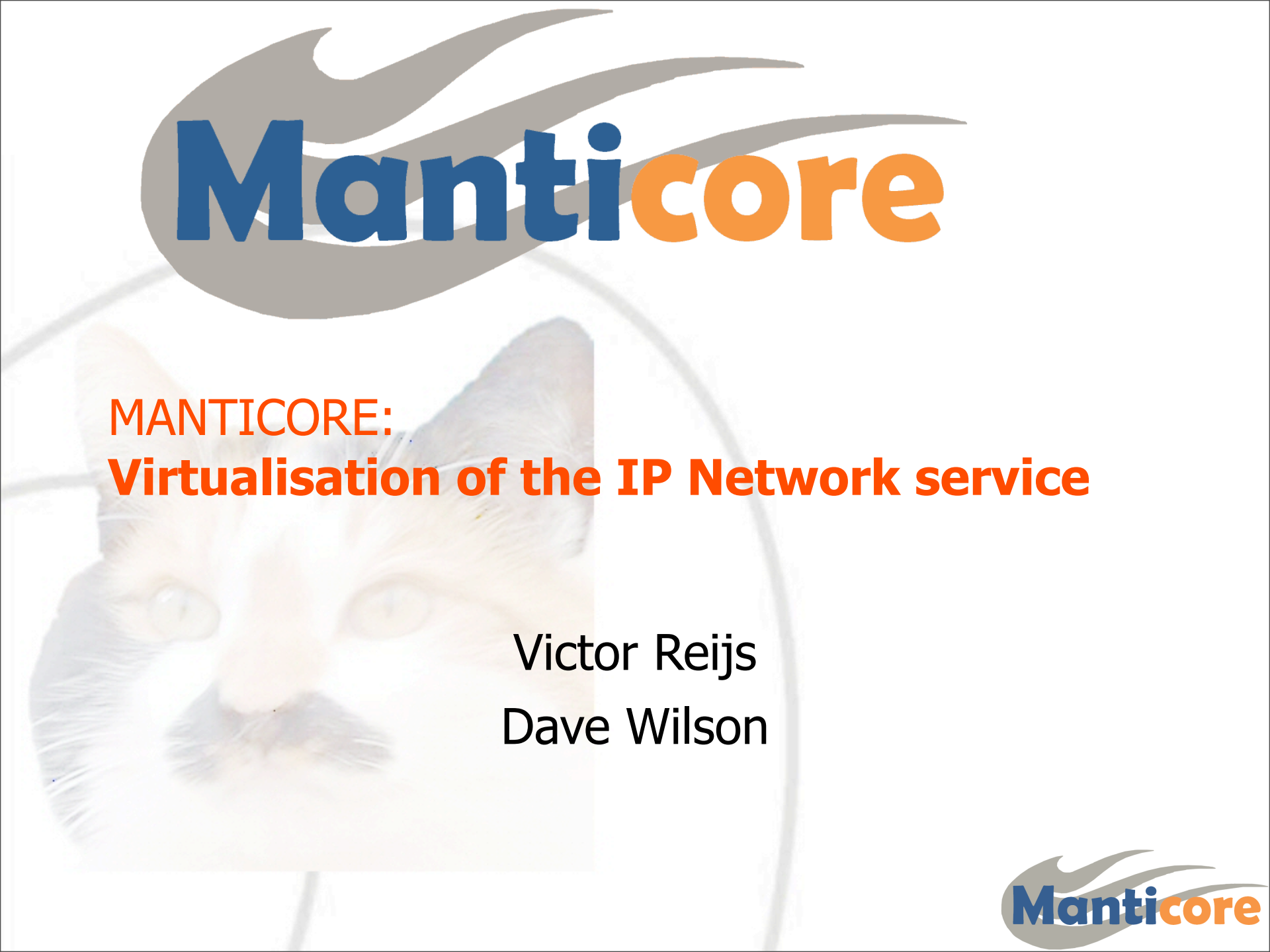


MANTICORE:
Virtualisation of the IP Network service

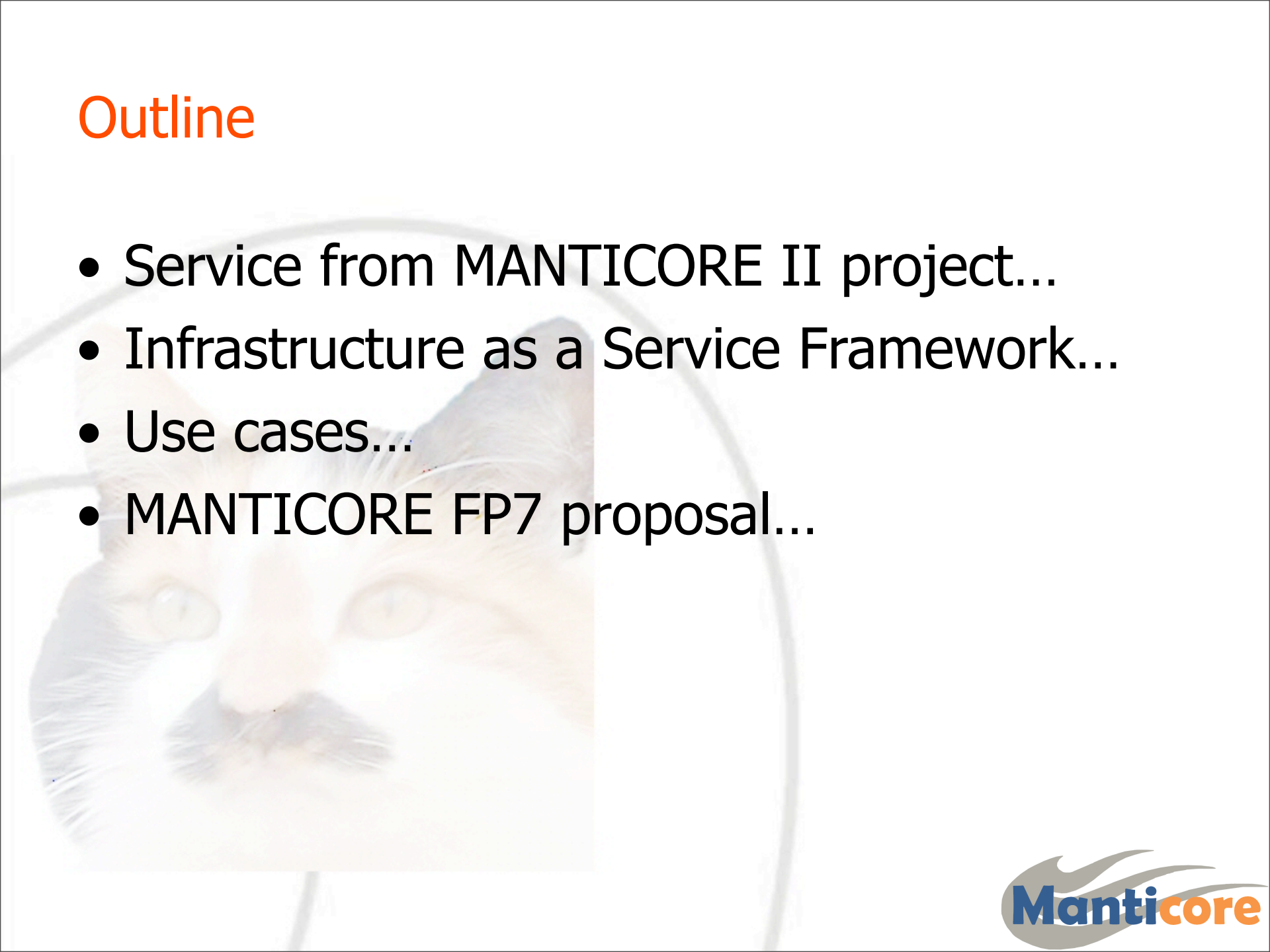
Victor Reijs

Dave Wilson

Manticore

Outline

- Service from MANTICORE II project…
- Infrastructure as a Service Framework…
- Use cases…
- MANTICORE FP7 proposal…



Service from MANTICORE II project

- Allow a Infrastructure Provider to offer its services as Infrastructure as a Service (IaaS)
  - This means a Infrastructure Provider can give permissions to an external party to control one or more of their Router Instance(s) for a period of time as if they were owning them
- Provide an IP Network service that helps Users create and configure one or more IP Networks with the Router Instances they got (as IaaS) from one or more Infrastructure Providers
  - This IP Network Service will assist in configuring the IP Network topology, addressing, internal and external routing, export routing policies to RIPE database, firewalls, creating VPNs (either immediate or in advance)
- The scope of the project is to build a system that can be deployed on operational networks and used in production by real life users
  - As part of the project activities, MANTICORE II will be deployed and tested over HEAnet, NORDUnet and RedIRIS

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Project	Official Partners	Goals
MANTICORE I 2007 - 2008	HEAnet, i2cat, JUNIPER NETWORKS, RedIRIS, NORDUnet	Validate the technology/ solution through a proof of concept prototype
MANTICORE II 2009 - 2010	HEAnet, i2cat, NORDUnet, Telefónica, JUNIPER NETWORKS, University of Essex, CISCO, RedIRIS	Modular implementation of the basic tool. Pilot deployment at the participating NRENs. Creation of a Business Plan (BP)
MANTICORE FP7 2010 – 2012/13	HEAnet, i2cat, NORDUnet, University of Essex, Telefónica	Enhance and robustify tools (based on the users requirements and NREN operational environment). Integration with layer 1 and layer 2, pre-operational trials with real users (3 use cases)

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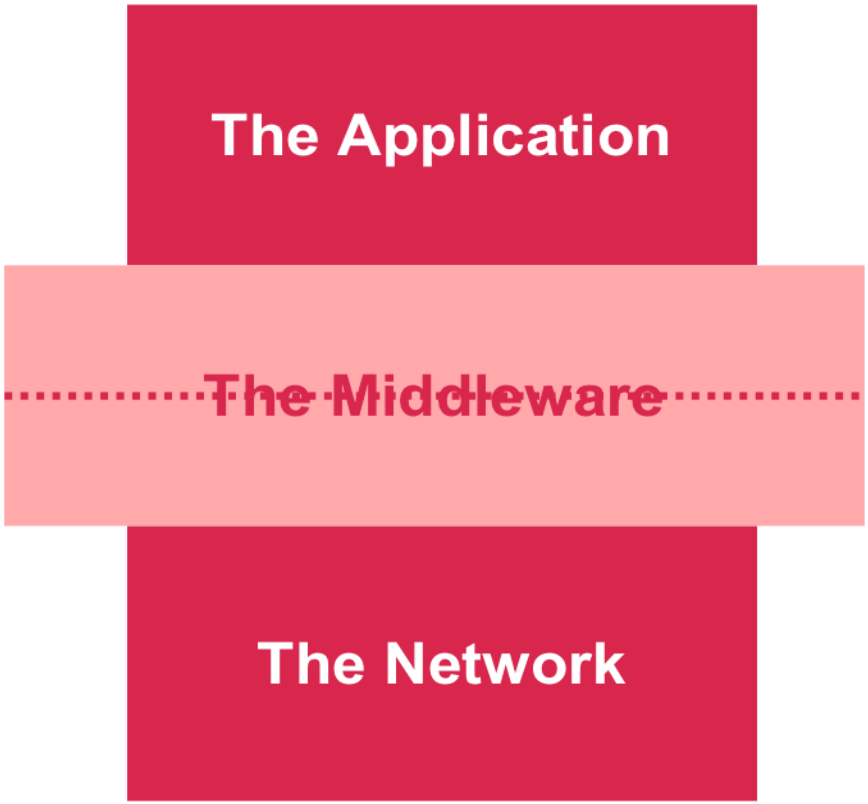
It's the services, stupid!



- Big pipes are only half of the equation
  - Applications fill the pipes
  - Many applications require IP Network services
  - So include the IP Network itself
- Network needed by applications as a (core) service
  - IaaS: The MANTICORE promise
  - A middleware layer that can be thoroughly integrated with other middleware components
- Offer Users the experience of a seamless network service ecosystem.

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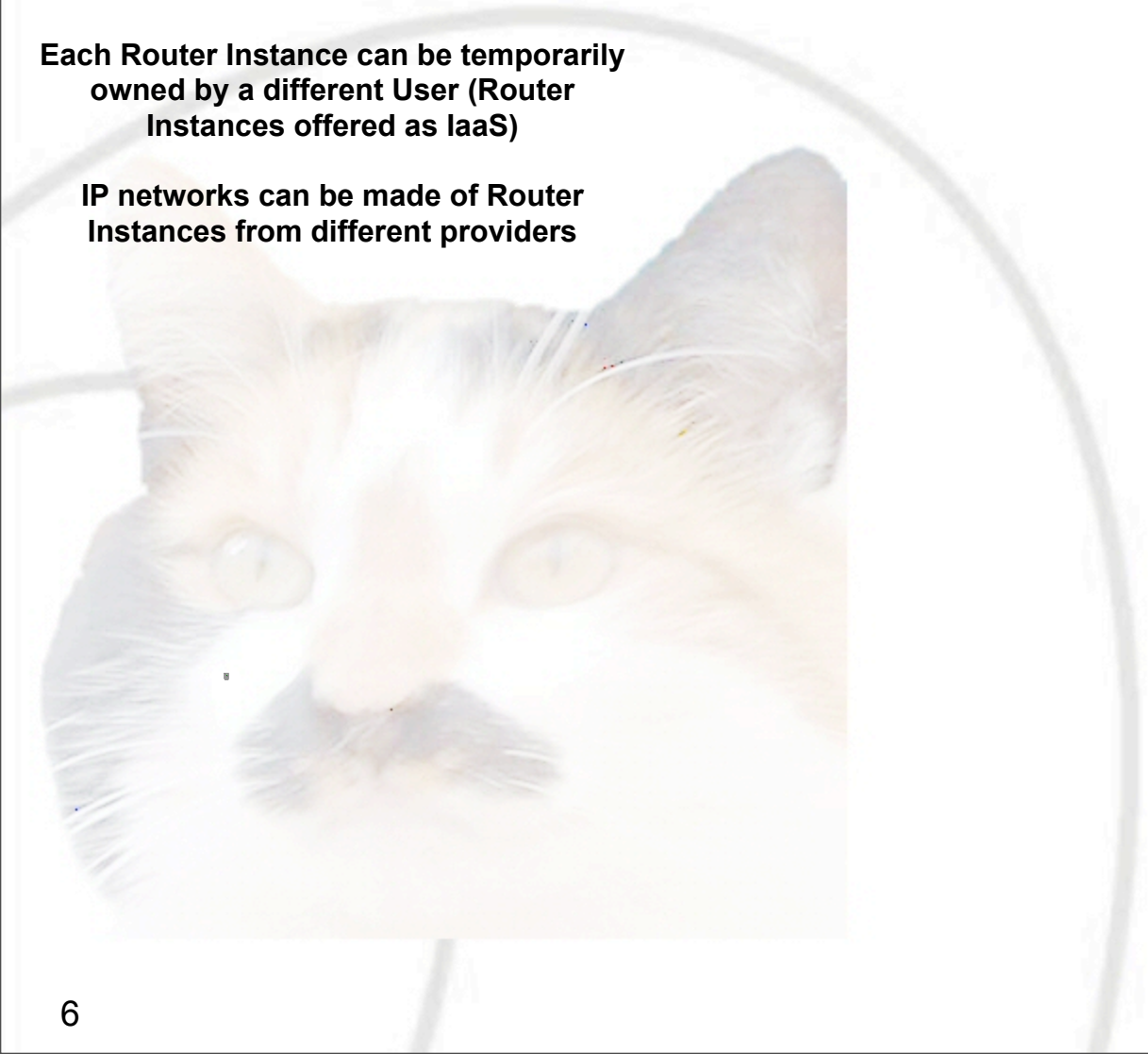
IP Networks sharing the same substrate

Each User's IP Network is represented by a different color

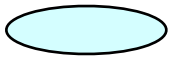
Each Router Instance can be temporarily owned by a different User (Router Instances offered as IaaS)

IP networks can be made of Router Instances from different providers



Manticore

IP Networks sharing the same substrate



Physical Router

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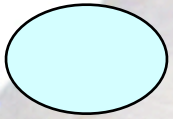

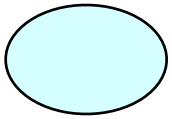

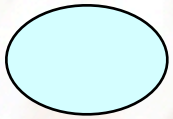

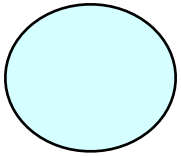

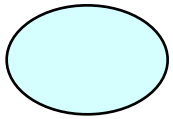

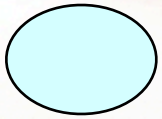

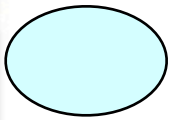

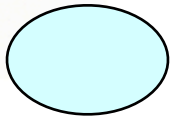

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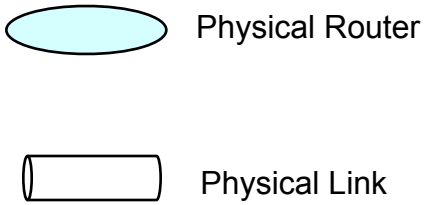

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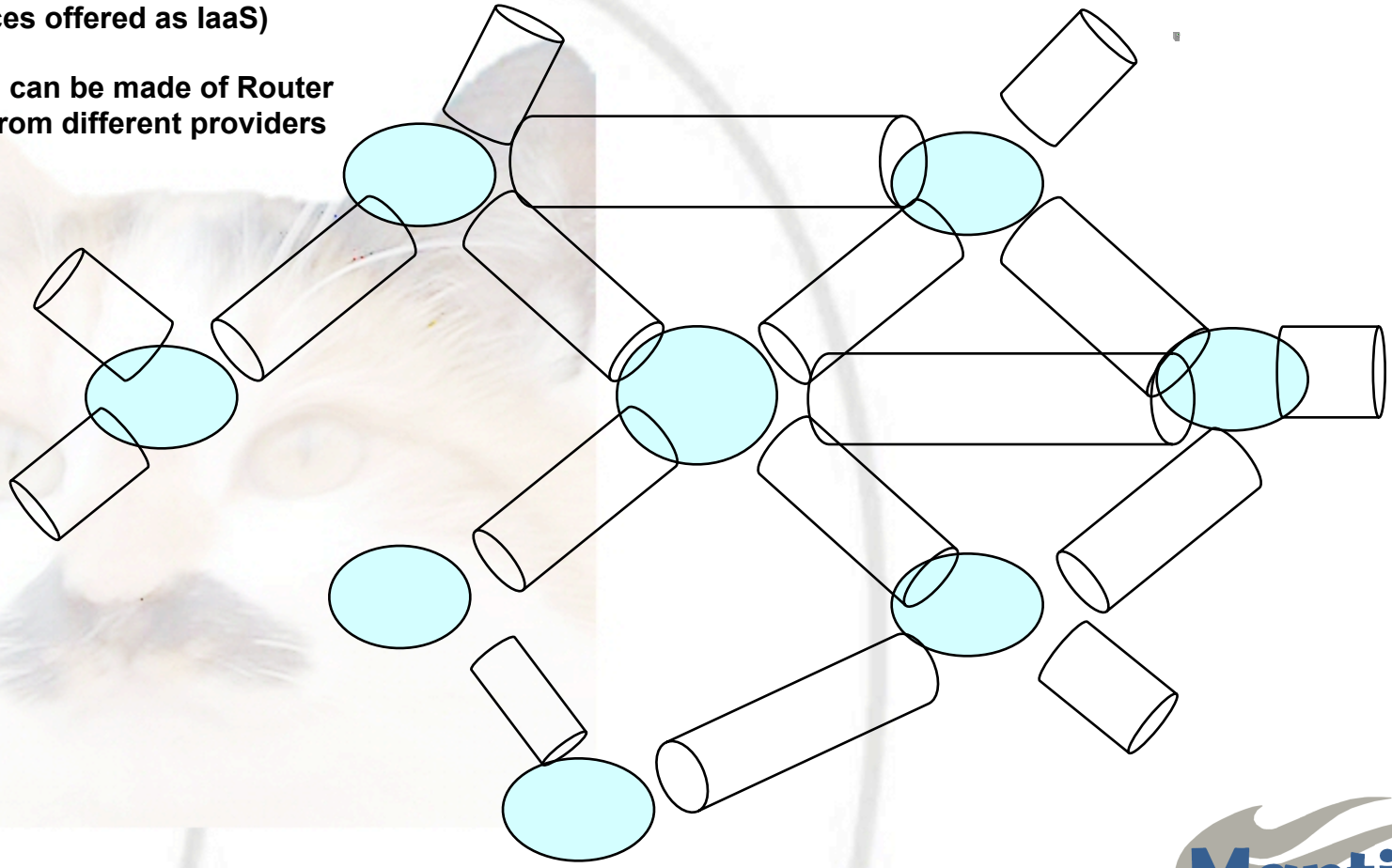

Manticore

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Router Instance (may be a physical router)

Physical Link

Logical Link (may be a full physical link)

User site

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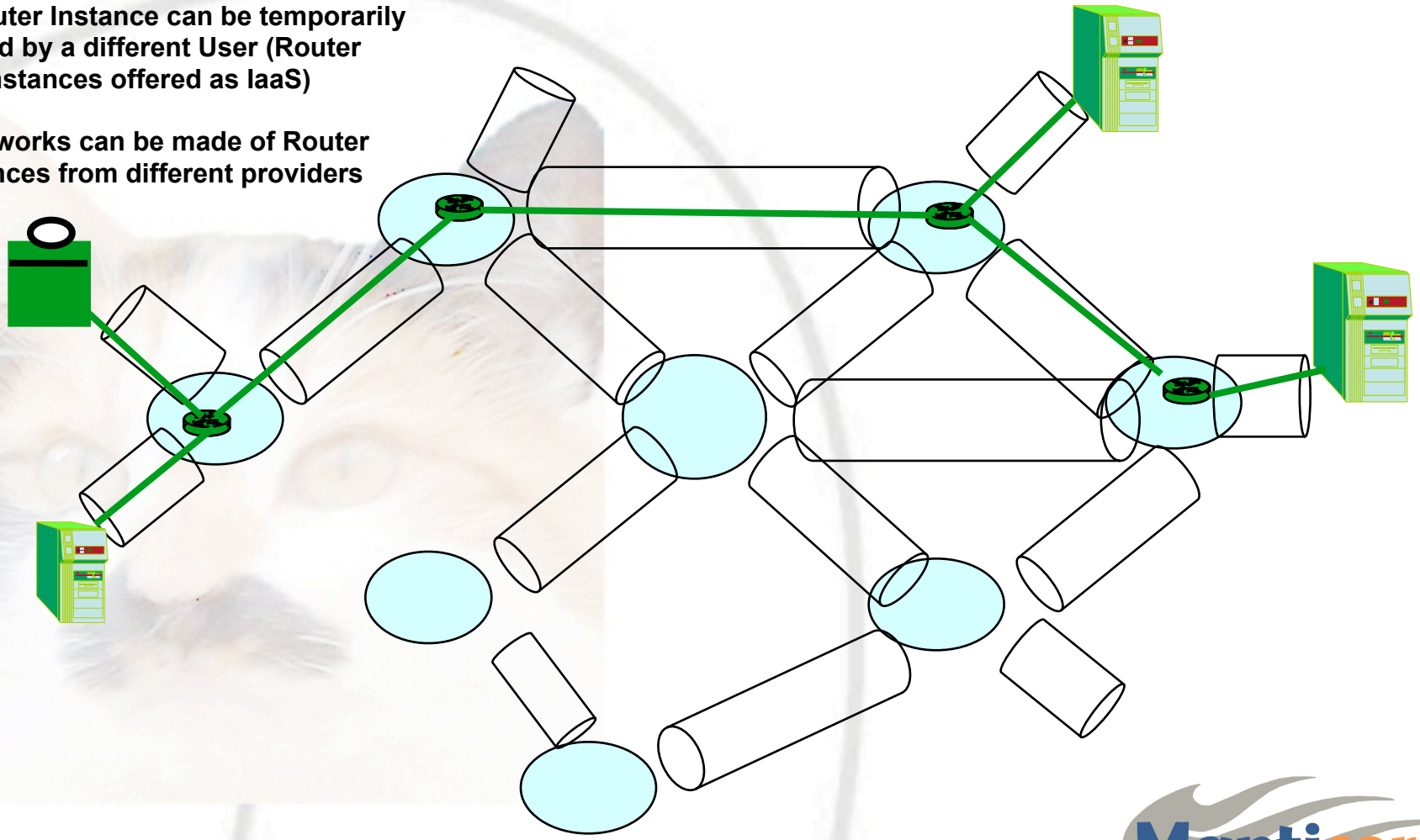

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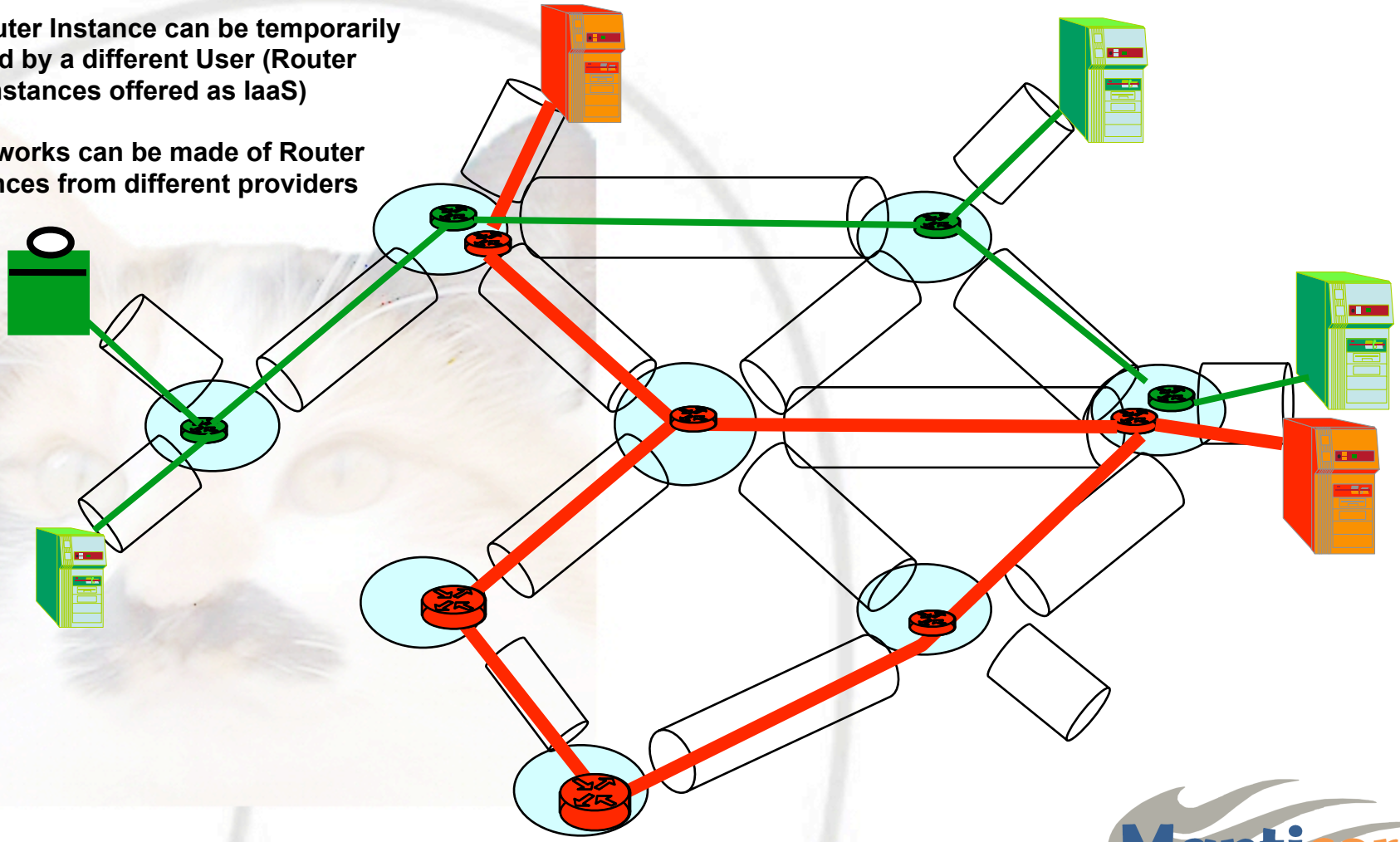

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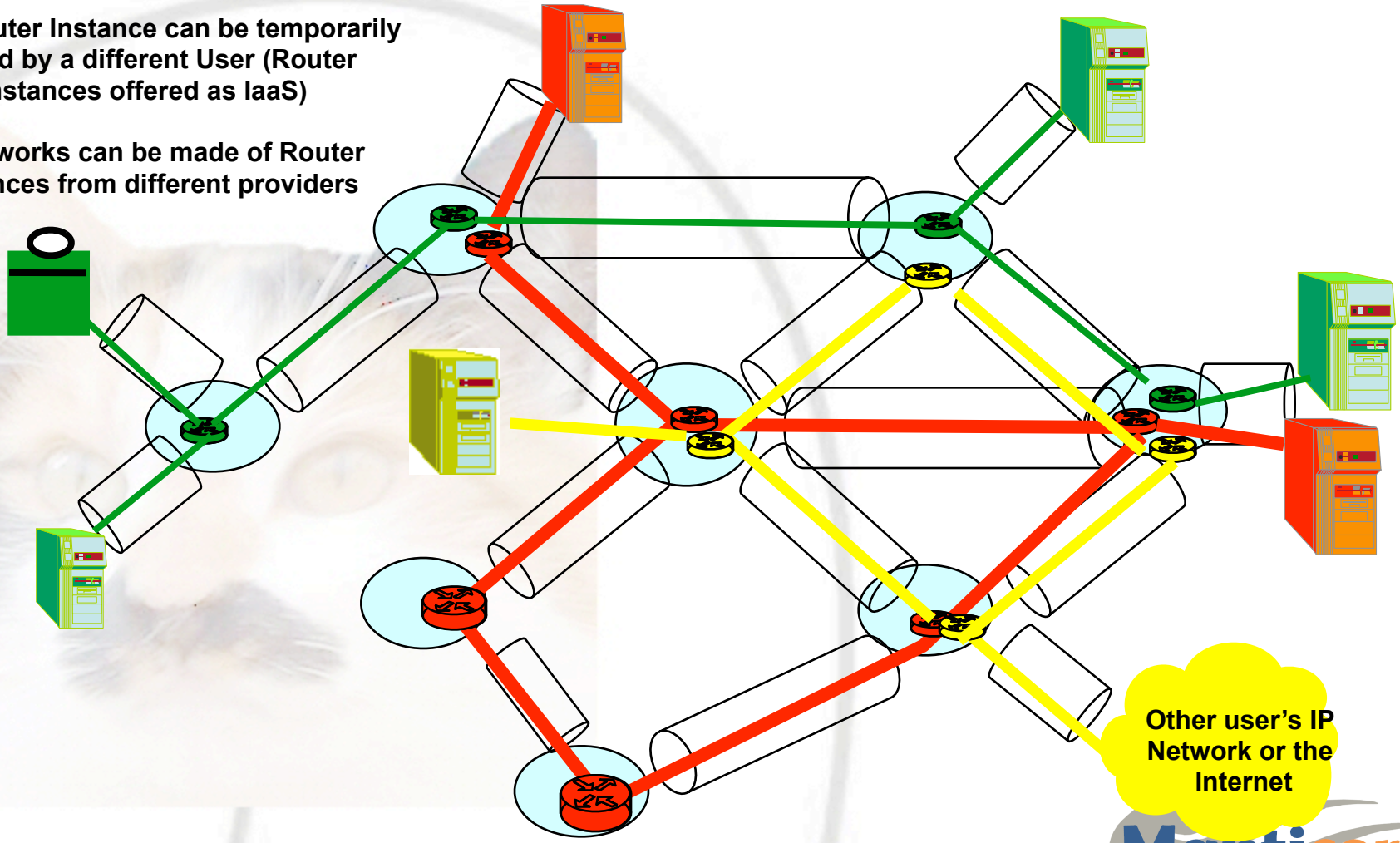

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User view

- Define the edge ports of the IP Network
- Define (if needed) the external Routing Service (policy)
- Define (if needed) internal transport services: QoS and/or the internal Routing Service metric
- If available: provide ASN/IP address space

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Outline

- Service from MANTICORE II project…
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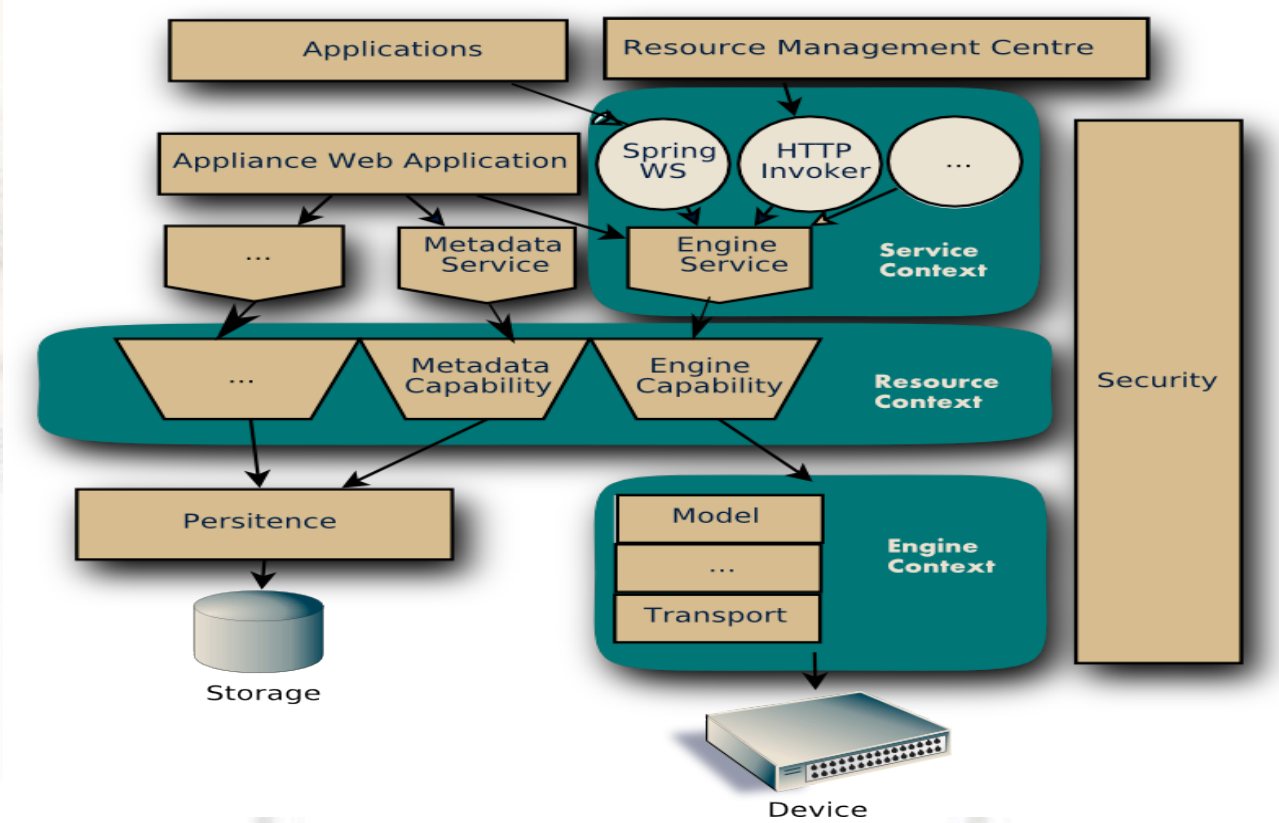
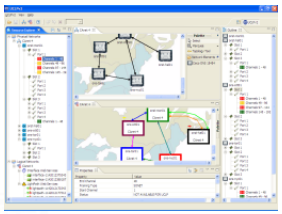
Infrastructure as a Service Framework

- IaaS Framework is an open source framework to quickly create modular and extensible management solutions (based on OSGi, Spring, WebServices, Java and Eclipse RCP and RAP).



MANTICORE-2 software 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)

Manage User accounts, get User credentials, authenticate

User Management WS

Transforms the routing configuration abstract description in high level operations that will be invoked in the Router WS over one or more virtual resources

IP Network WS

Policy Management WS

Manage permissions on resources and/or operations

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

Router-WS

Netconf

Netconf

Protocol Y

Juniper device

Cisco device

Software XORP router

Manticore

Outline

- Service from MANTICORE II project…
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Use cases

- Infrastucture Provider provides IP Network services to multiple institutes/projects…
- Overcome route integrity problems related to point to point links…
- MANTICORE could provide IP Network services which follow the energy availability…

Virtualization Paradigm in commercial ISPs

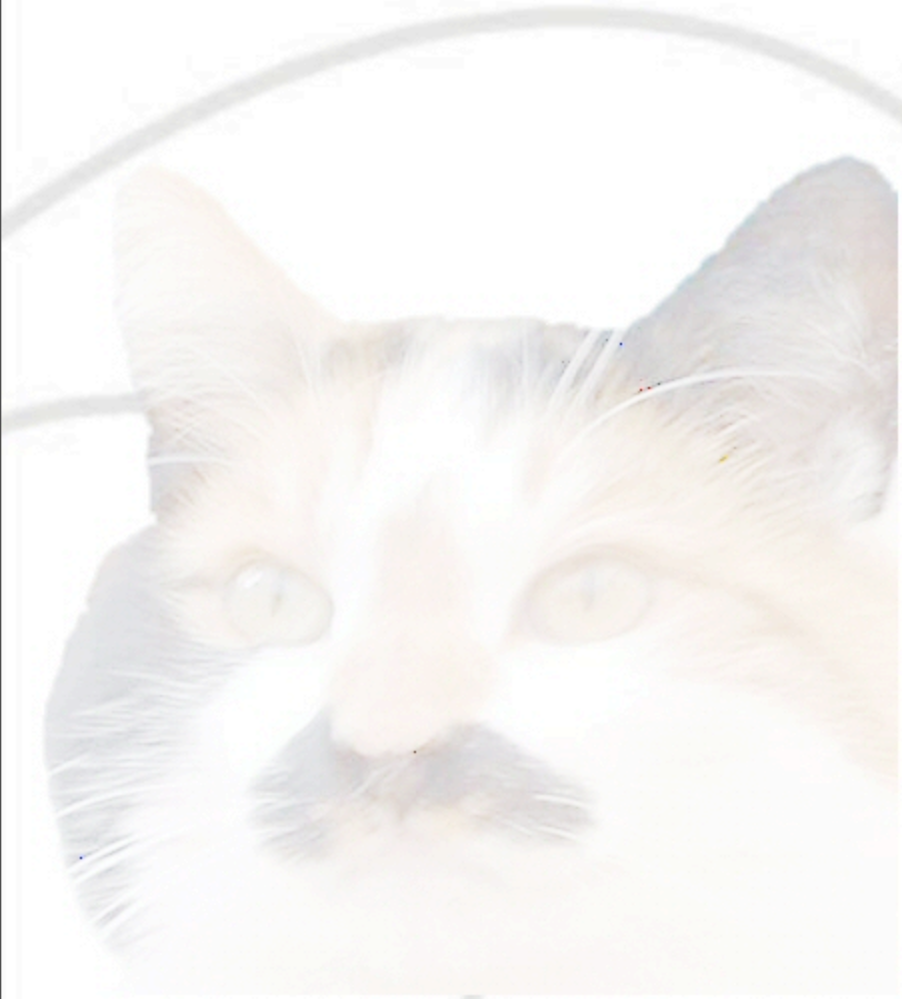
IP Overlay proliferation adds complexity and cost

Juniper NETWORKS

Manticore

Virtualization Paradigm in commercial ISPs

IP Overlay proliferation adds complexity and cost



- **Popular notion that convergence has happened is false**
  - Operational divisions with strict walls
  - Regulatory environment
  - Many networks with different growth rates, partnerships, business cases …
  - Equipment write-offs from 3 to 15 years
  - Lengthy planning, testing & deployment
  - Legacy applications refuse to go away
  - Each service has diverse requirements (TE, QOS, security, growth rates)

Juniper NETWORKS

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Virtualization Paradigm in commercial ISPs

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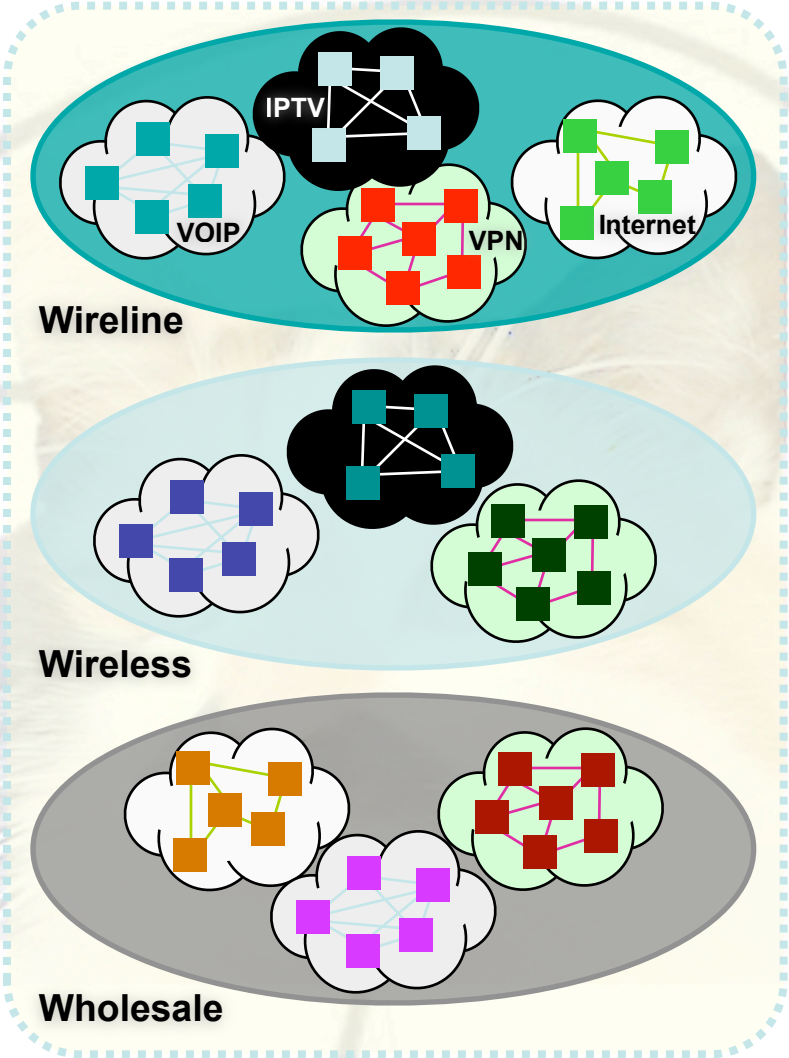

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  - Legacy applications refuse to go away
  - Each service has diverse requirements (TE, QOS, security, growth rates)
- **Service Providers are forced to roll out multiple overlay networks, or risk compromising scale, stability and/or security**
- **As more new services are introduced this leads to escalating CapEx and OpEx**

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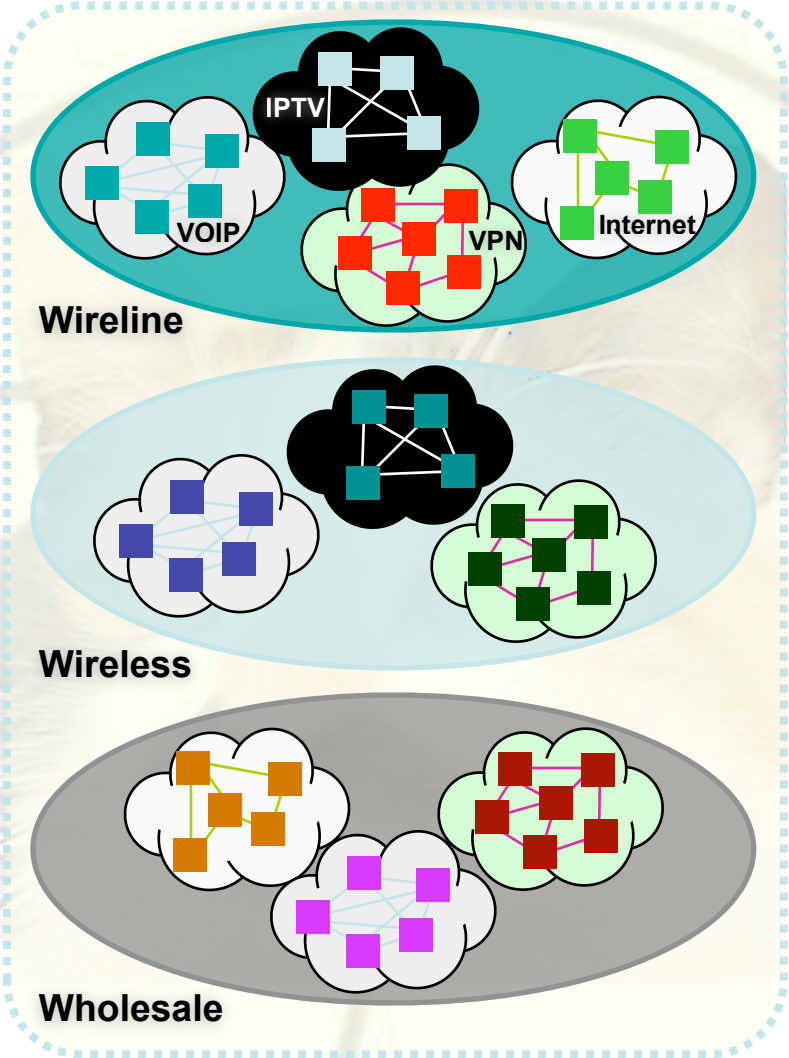
Virtualization Paradigm in commercial ISPs

IP Overlay proliferation adds complexity and cost

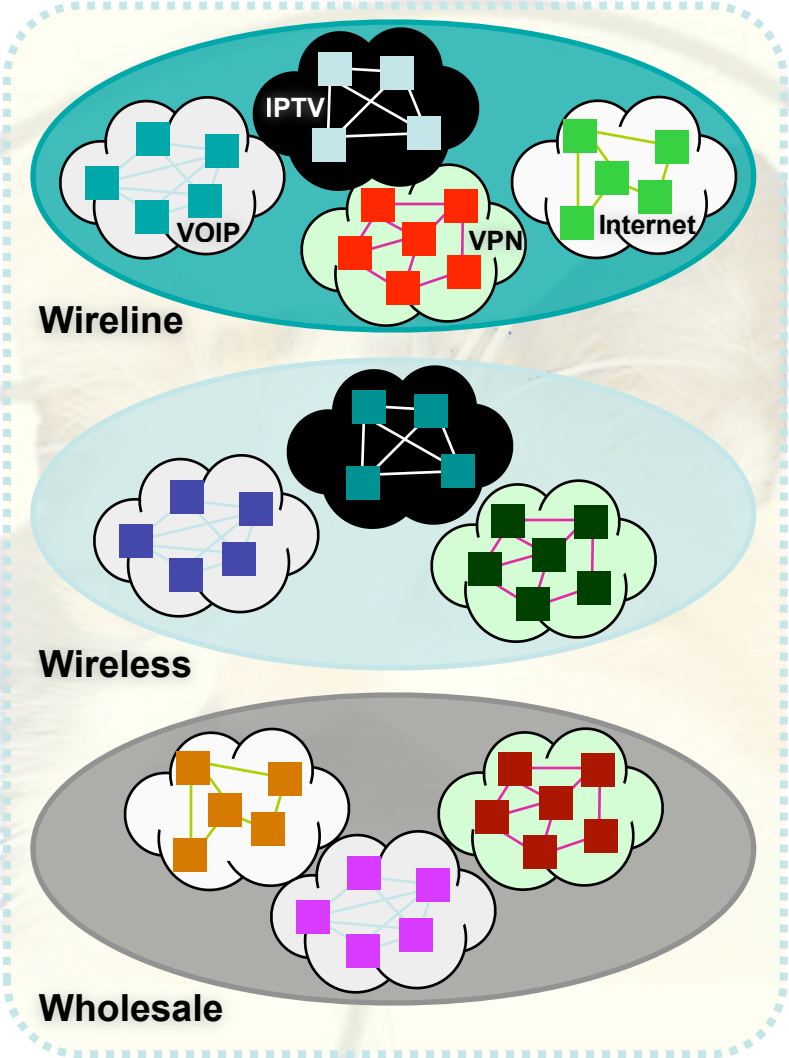


NETWORK VIRTUALIZATION

brings a new dimension of flexibility and scalability to the network infrastructure

Virtualization Paradigm in commercial ISPs

Service provider operational model of the future



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Virtualization Paradigm in commercial ISPs

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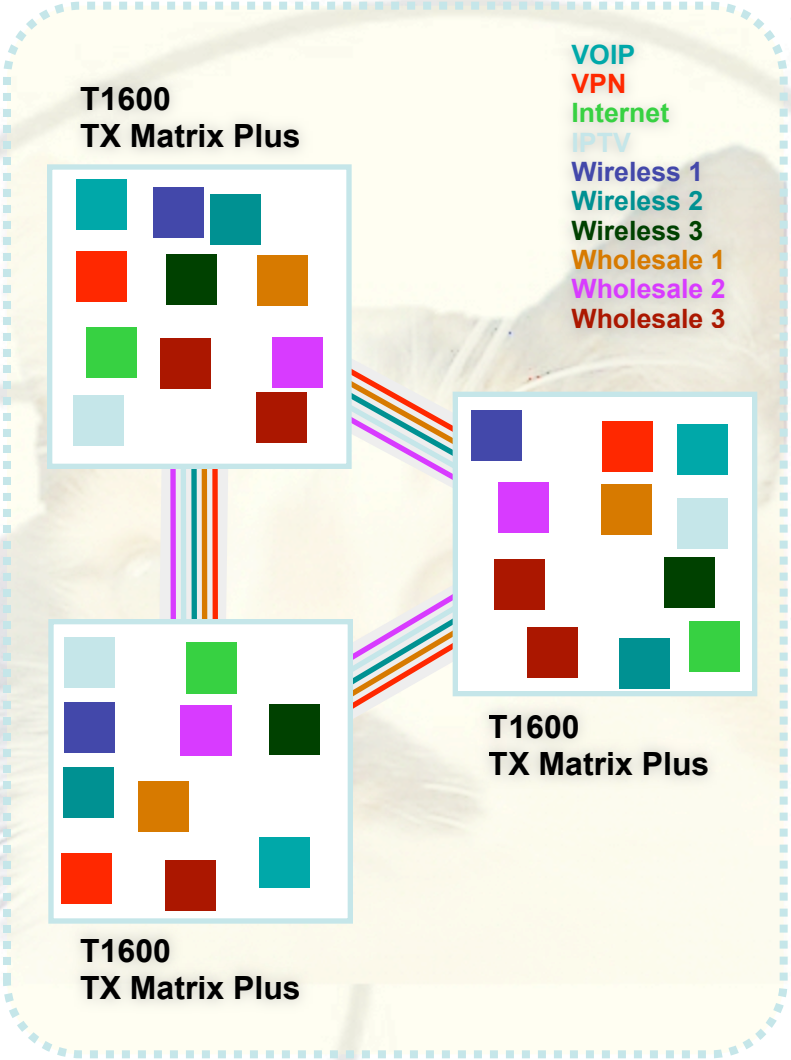

- **Virtualization fulfils the true promise of convergence**
  - Shared infrastructure without changing organizational model
  - Service networks decoupled from infrastructure
  - New service networks introduced without new overlays
  - Each service network managed and controlled individually
  - Network expansion swift and with reduced risk
- **Each division and/or service now runs its own "Virtual Service Network"**
  - Reduced total cost of ownership
  - Risk mitigation
  - Streamlined asset utilization
  - Support of new business models
  - Improved profitability

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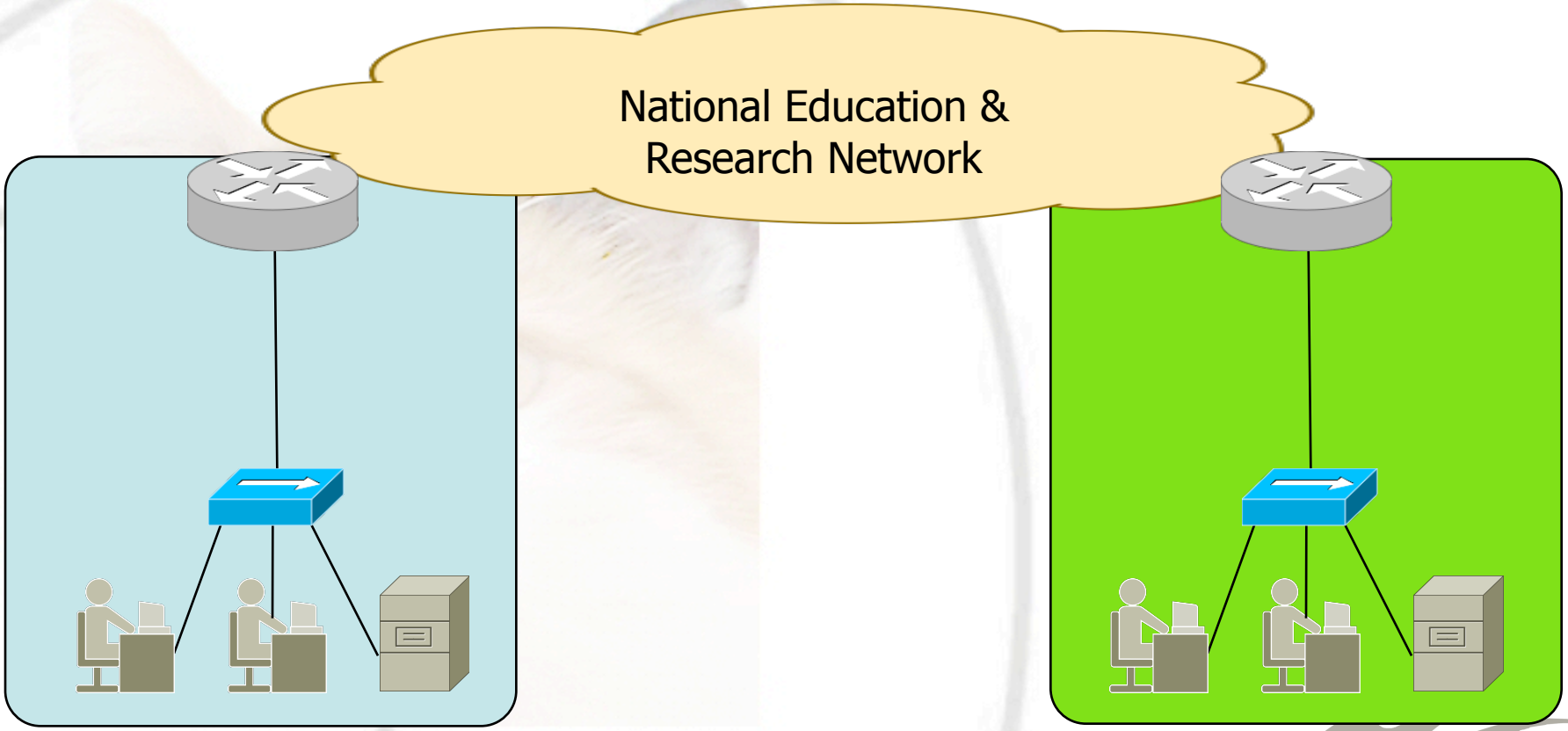
Connecting disparate networks

Academic networks are usually top down



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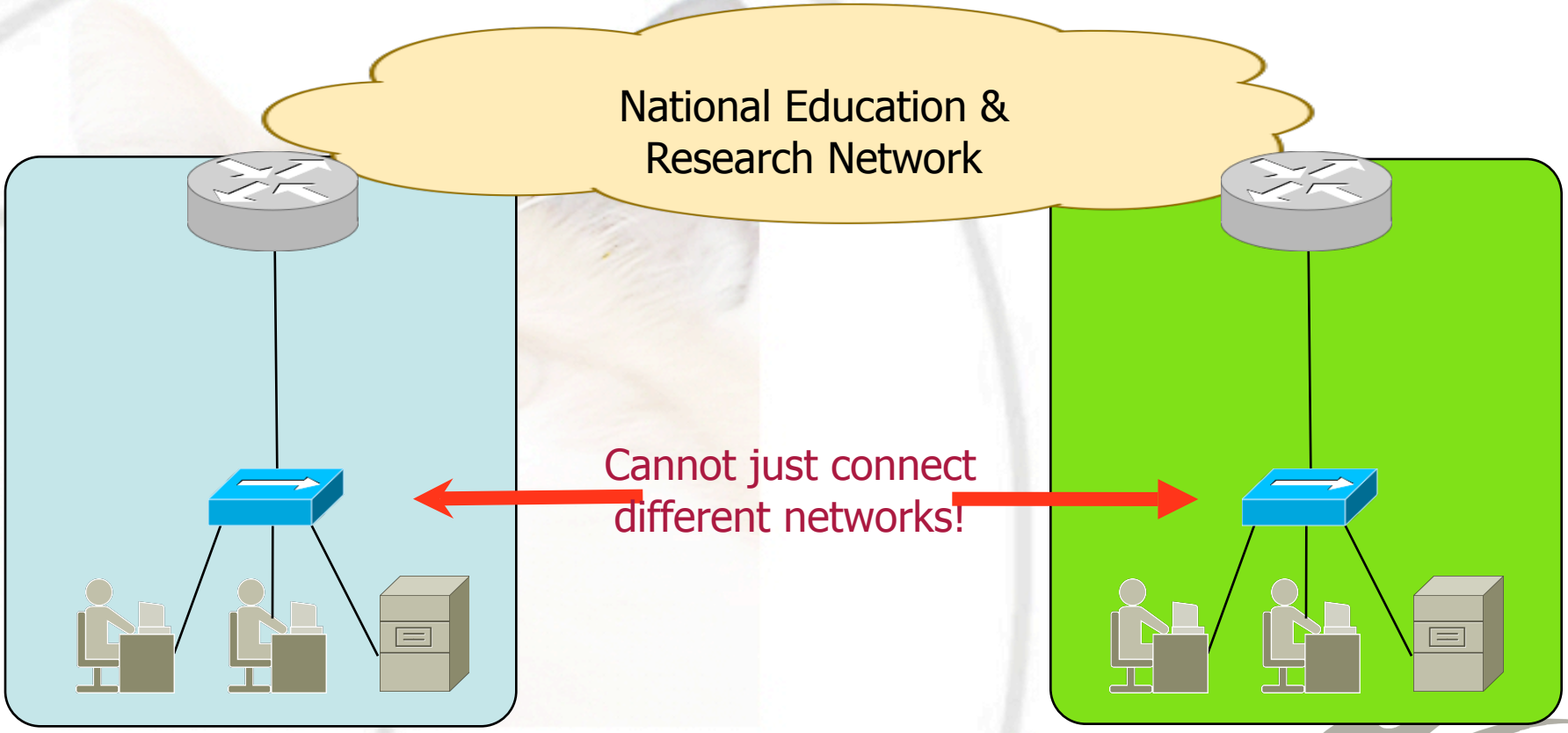

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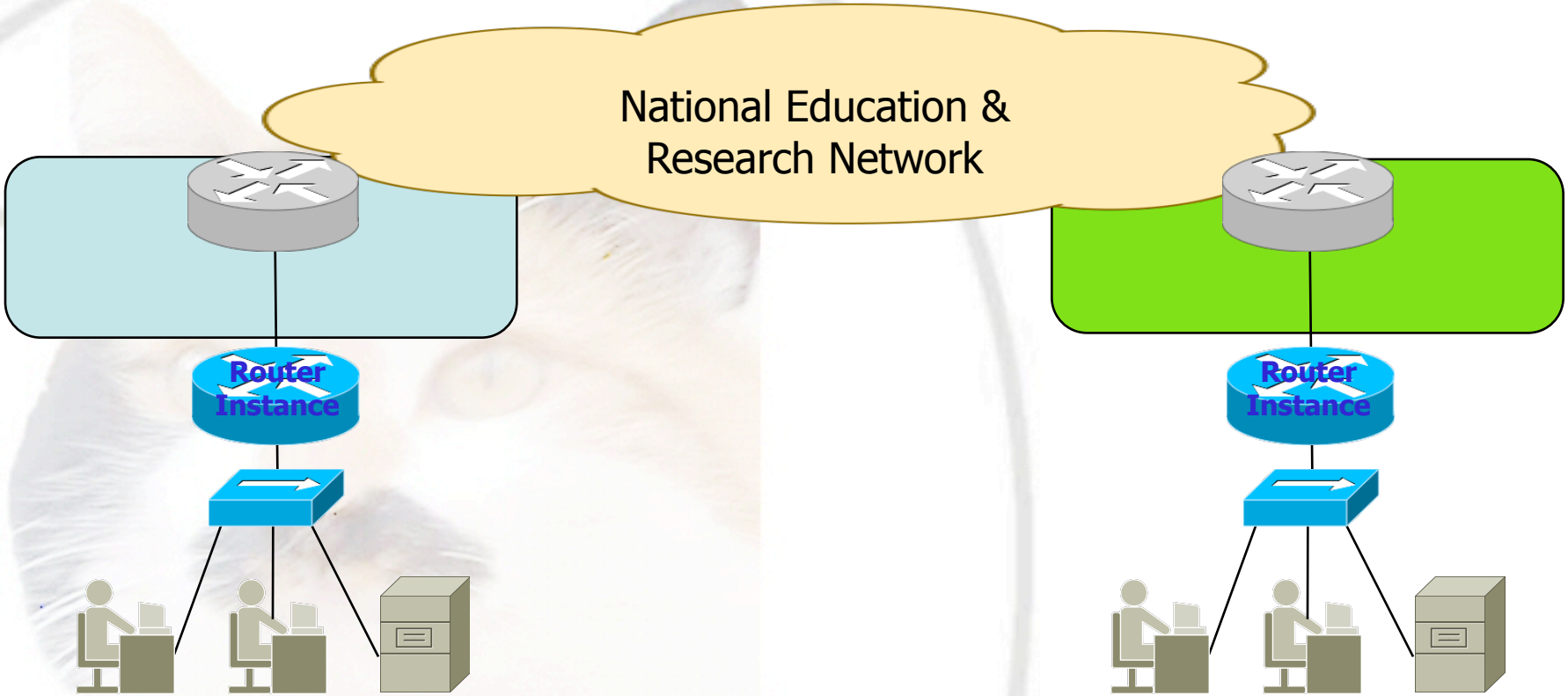

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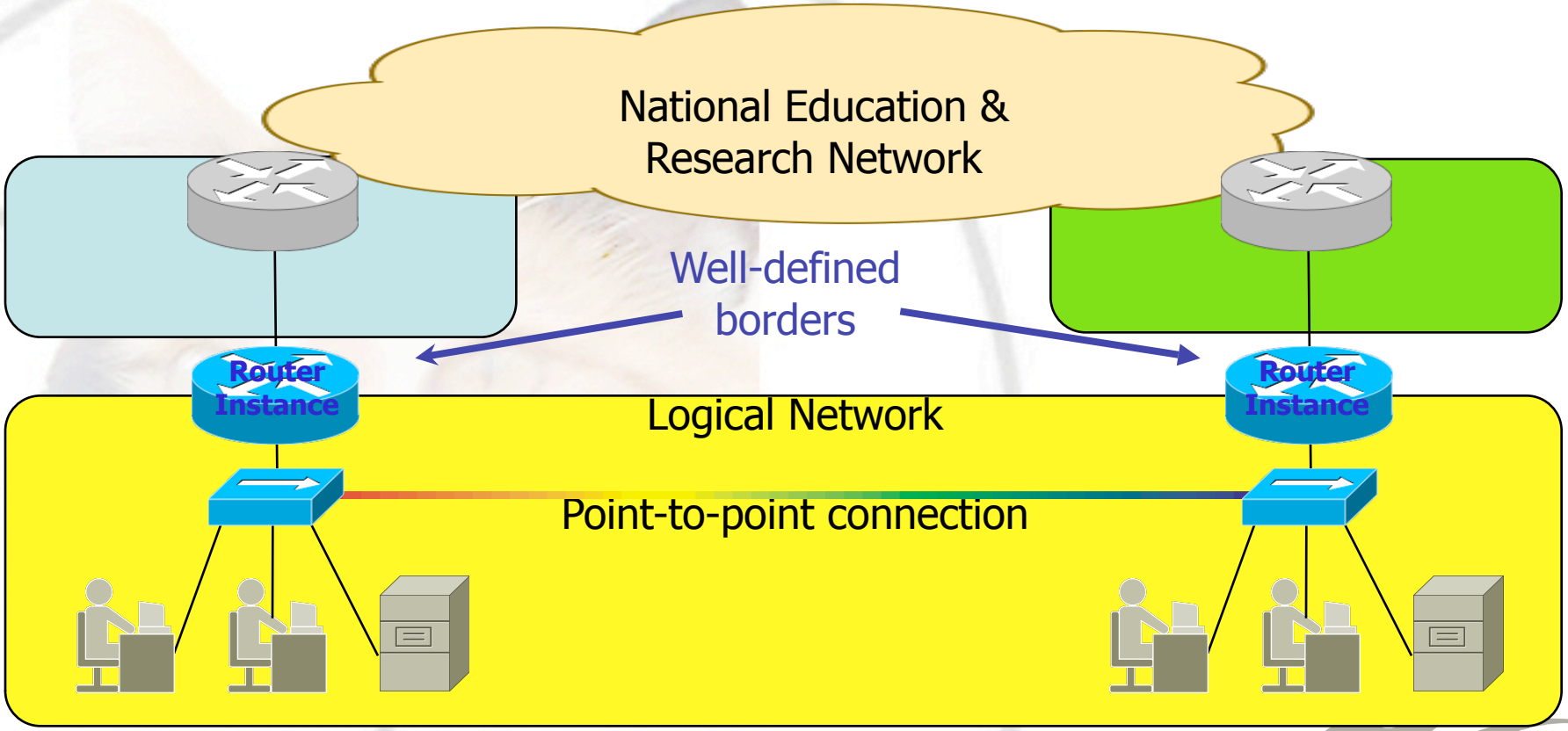
Connecting disparate networks

Create logical network with defined borders



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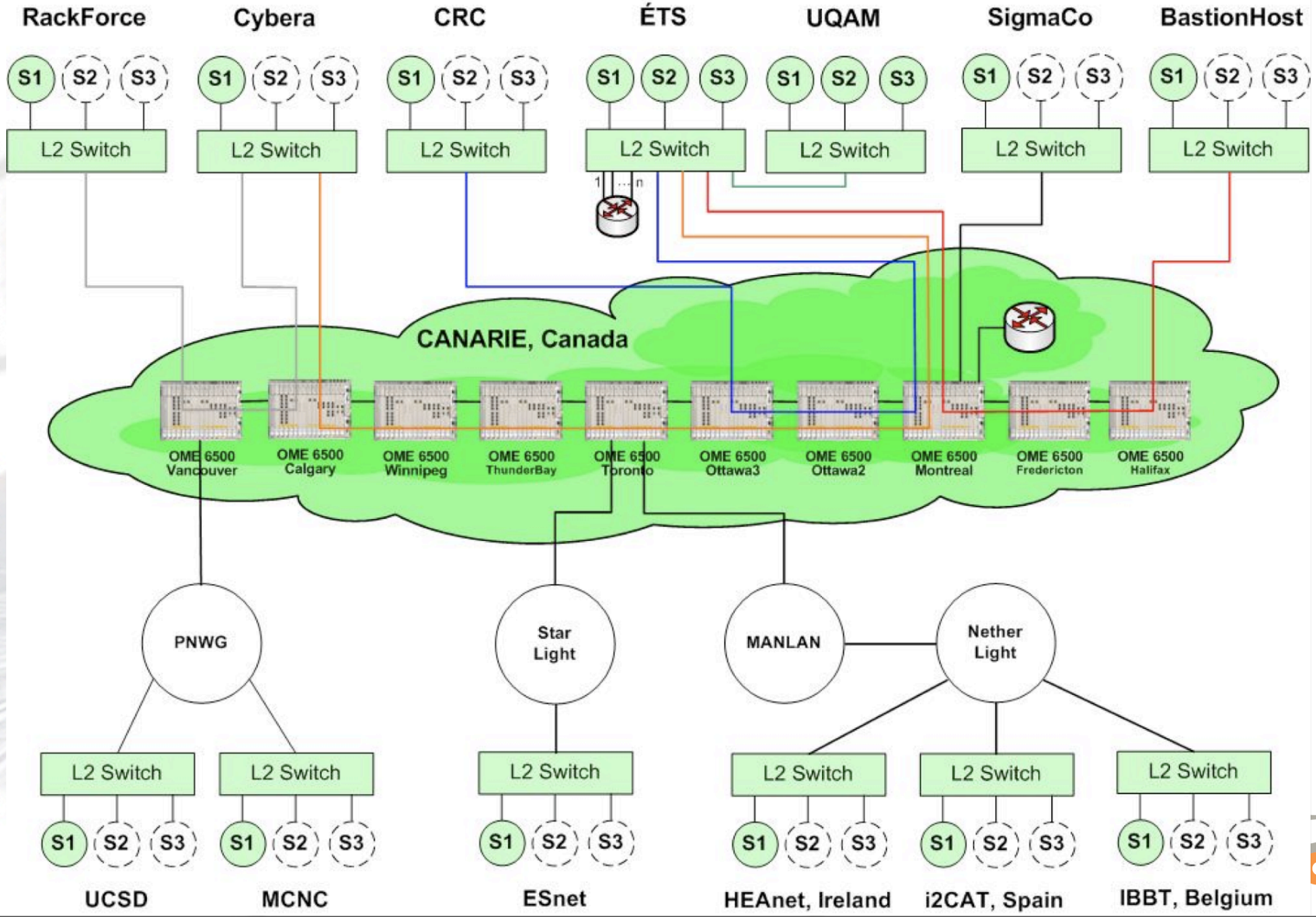
Connecting disparate networks

- Can’t connect existing IP Networks with just a point-to-point link
- Bring researchers’ networks together
- Define the border properly with the institution (including security and routing integrity)
- MANTICORE creates routing policy
- Logical network, no extra equipment

GSN network infrastructure



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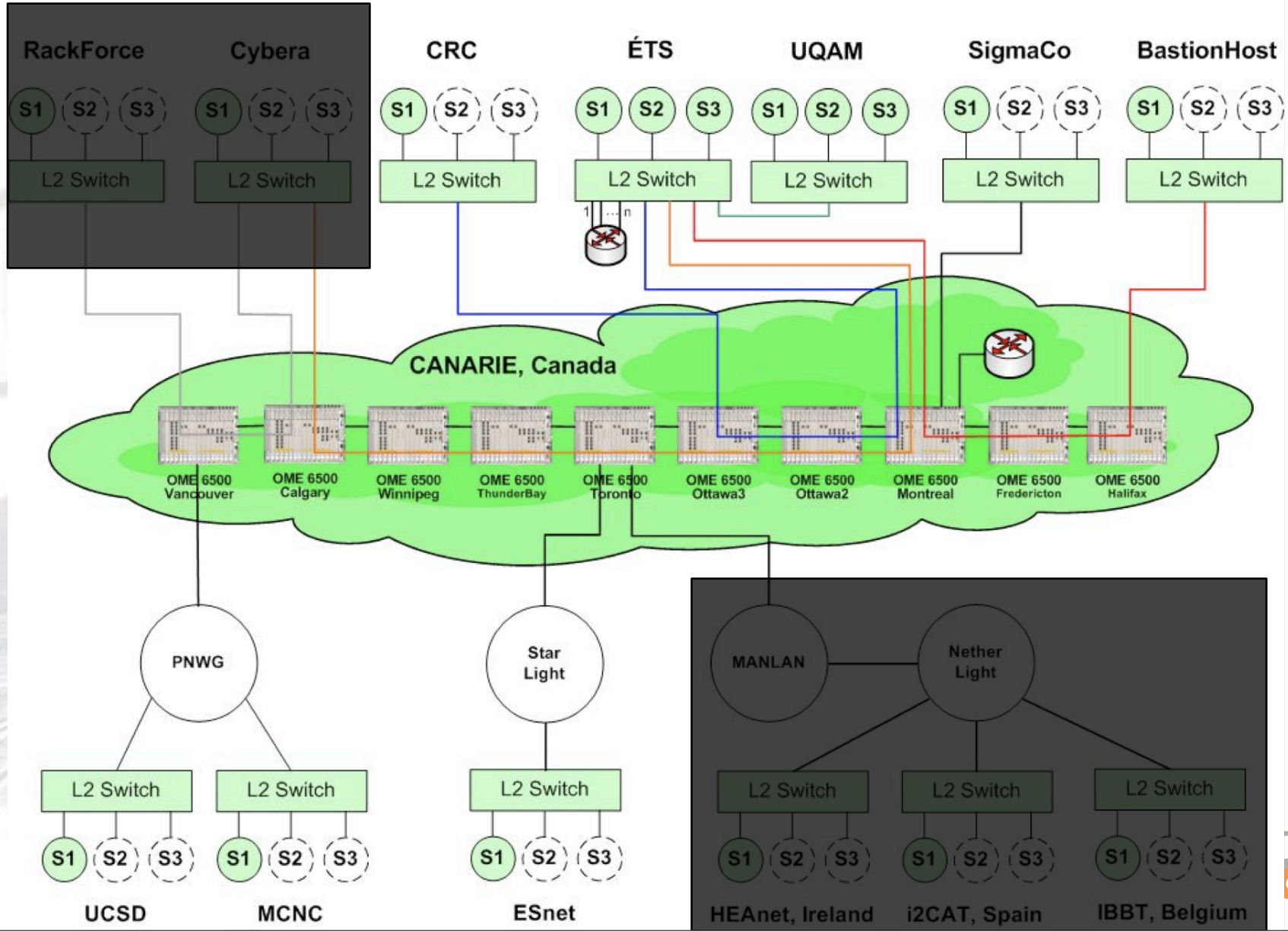

New business opportunities with network virtualization

"Welles/Open Garden" networks	Networks as a Service (NaaS)	Network sharing
• Video and voice run within carrier's "walled garden"	• Secure "private" IP backbones for other Service Providers	• Share infrastructure, maintenance, engineering and technology costs for network
• "Open garden" network treats partner traffic with the same level of service as walled garden traffic	• Ideal in today's downturn where access to capital is restricted	• Co-operation in managing network coverage

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Project Proposal Overview

- What? Main goal
  - Provide the European research community with IP Networks as a Service over the NRENs e-Infrastructure for the benefit of their research activities, enhancing the quality of the tools available for European Research and increasing the research capabilities and participation of researchers.
- Who? 7 partners
  - Project Coordinator and tool developer: i2CAT Foundation
  - 2 NRENs: HEAnet, NORDUnet
  - 3 users: UNI-C, University of Essex, Trinity College Dublin
  - 1 commercial operator: Telefónica I+D
- How? Requested to EC for funding to perform 7 activities
  - 3 NAs: NA1-Project Management; NA2-Dissemination, Exploitation, Standardization and Liaisons; NA3-Consolidating the user community and users training.
  - 2 SAs: SA1-MANTICORE software refinement; SA2-MANTICORE services for virtual research communities
  - 2 JRAs: JRA1-Infrastructure resources marketplace; JRA2-Zero Carbon emission virtual

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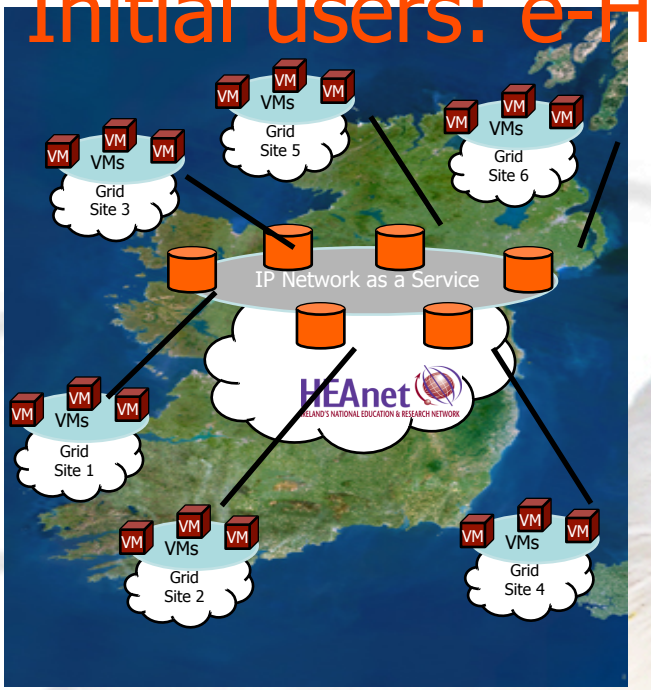
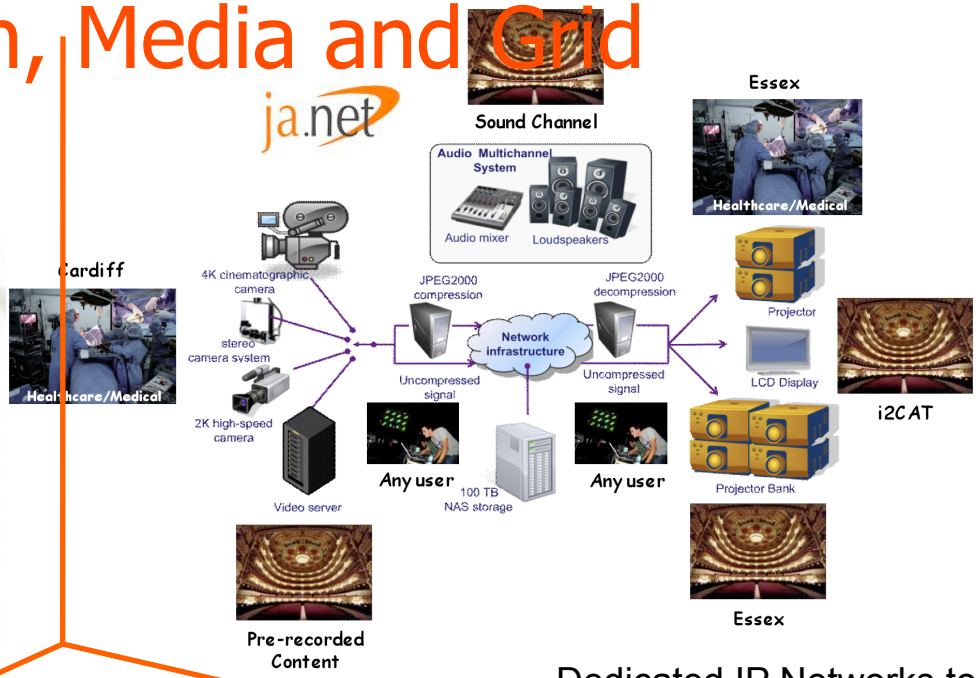
Initial users: e-Health, Media and Grid



Grid-Ireland "Cloud Layer", TCD



Dedicated IP Networks to support **media** services,

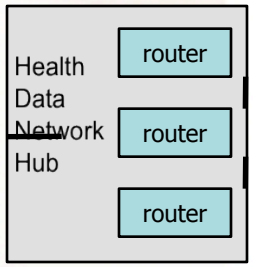
University of Essex

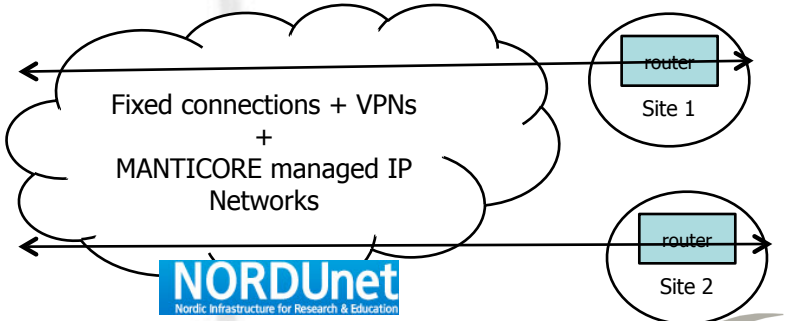
Improving the **Health** Data Network, UNI•C

Grid-Ireland

Authorized User

Connection Agreement System





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Project Outcomes

- MANTICORE Toolset (binaries + source code):
  - MANTICORE Server
  - Web application for administrators and users
- Operational experience on providing IP Networks as a Service in NRENs
- User experience and feedback on using the service in 3 different areas (e-Health, Media, Grid) and evaluation of the commercial potential of the service (Telefónica I+D)
- Research and Experimentation results:
  - Clean energy powered e-Infrastructures, energy metering, impact of virtual infrastructure relocation on the user experience.
  - Resource marketplaces as a mechanism for automatically negotiating and allocating infrastructure resources.

- Results delivered by a mature consortium that has been working since 2007 to deploy operational IaaS network services.
- IP Network as a Service fully encompasses the vision of a Future Internet built on services and virtualization technologies.

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Thank you for your attention

Questions?

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