



CONNECTED COMMUNITIES

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Community Networks Testbed for the Future Internet

<http://confine-project.eu/>

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Project coordinator



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Community Networks Testbed





Concept: Community-owned Open Local IP Nets (COPLAN)

- Experimental Facility for experimentally-driven research in COPLAN



(Bottom-up broadband, FFTF)

- **Scenario:** on the edge, but not small ...
 - Commoditization of tech, open spectrum, open fibre
 - Community-owned, bottom-up, open channels, self-managed (self-owned, self-growing, self-served),
 - Not just local “access”: network, services, content
- COPLAN vs traditional telecom, underserved people
- **Challenges:** large scale, dynamic (low cost, self-man)

Digital Agenda
2020



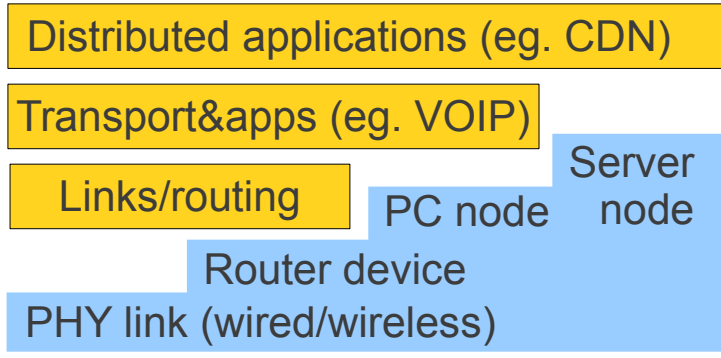
What is CONFINE

- *An Integrated Project* on Community networking
- Construction and operation of a new “experimental testbed” for research in Community Networking
- Uses:
 - Experimentally-driven research on CN
 - Evaluation of the CN model for the Future Inet
- Dissemination
- Socio-technical-economic-legal evaluation of the testbed and model → sustainability

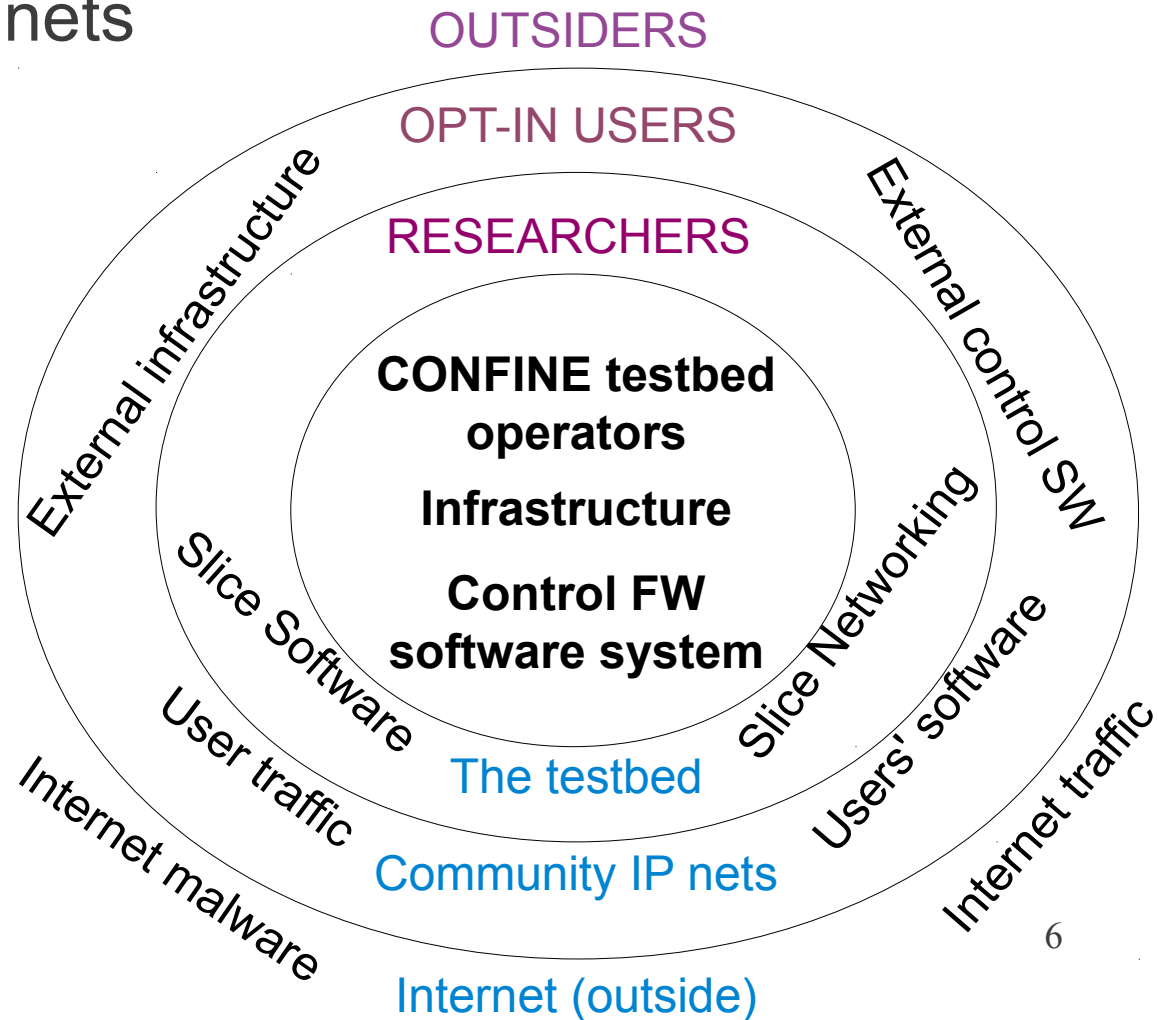


The testbed

- **Challenge:** build and operate the testbed, running in the community nets



Resources: hundreds nodes, links
large end-user community
Slices of resources: virtual labs





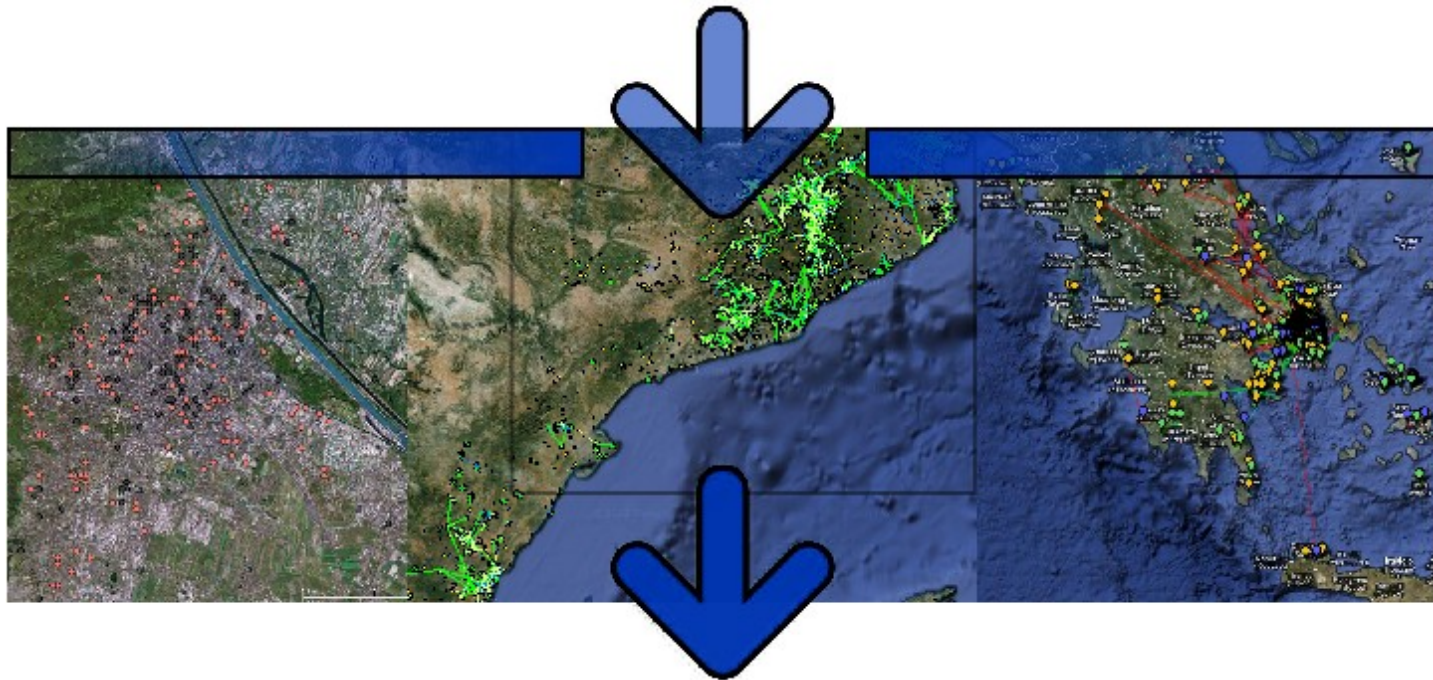
About Community Networking

- Among other, from the tech side:
 - Scale (size), heterogeneity (nodes, links, hosts), decentralized
 - Inter-dependency, limited resources (need for cross-layer optimizations)
 - Dynamics: need for self-config, self-healing, self-optimization, self-protection
- Open-up networks for researchers, federation



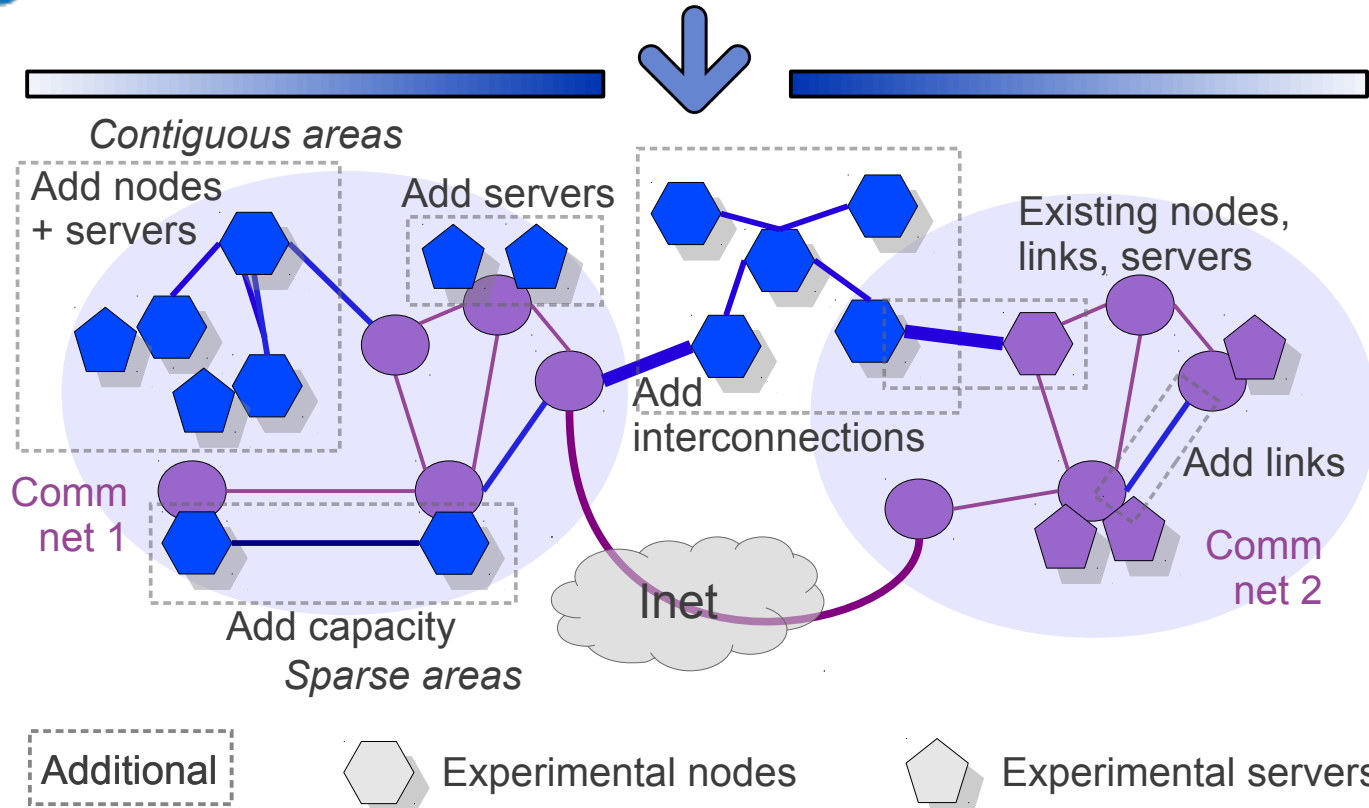
The testbed

- Unified access to a list-of→federation of CN
- Principles: federation, virtualization, decentralization, openness, unified access





The testbed



The project brings in additional users (researchers) with a common entry point and additional resources (nodes, servers, links) in contiguous and sparse areas



Additional resources

- New links, new nodes, new hosts
- 4 yearly iterations
 - Year 1: Initial set-up ←
 - Year 2: open call round 1
 - Year 3: open call round 2
 - Year 4: improvements, stabilization of operation



The testbed resources

- **Nodes:**

- **Hosts** (“normal” PC) w/Ethernet
- **Net devices** (router-class computer, low specs)
 - Interfaces: WiFi (one or several), Fibre, Ethernet, etc
 - CPU/Storage
 - Other requirements: Outdoors, no fan, PCU, ...

- **Links:** diverse

- Wireless, wired tech (fibre)
- Link characteristics and conditions
- Diverse deployments: sparse, dense, etc.

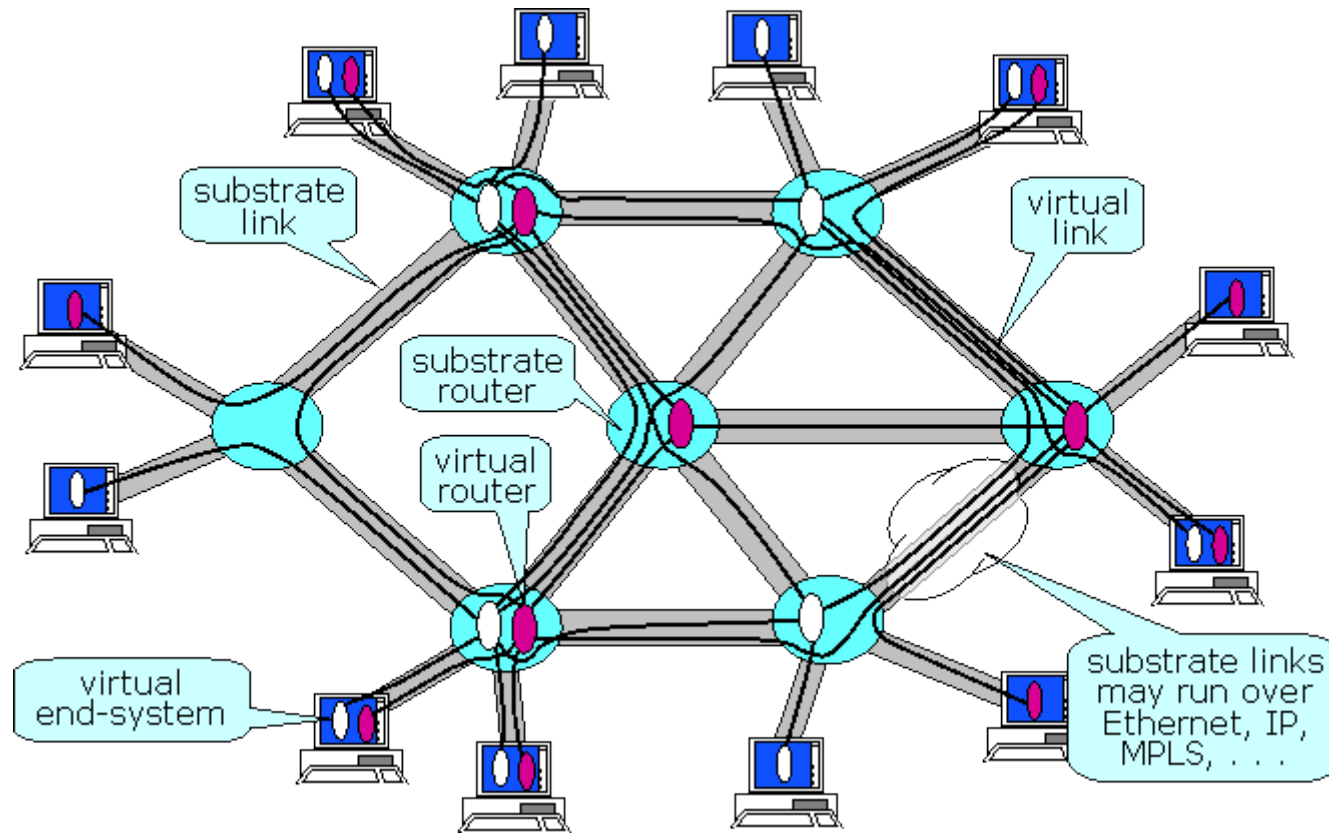


Testbed and experiments

- Realistic conditions (realism)
- Access at different levels (from phy up to apps)
- A large and representative sample of community networks (realistic)
- A shared network
(with “normal” traffic/use + new traffic/use) →
slices, virtualization

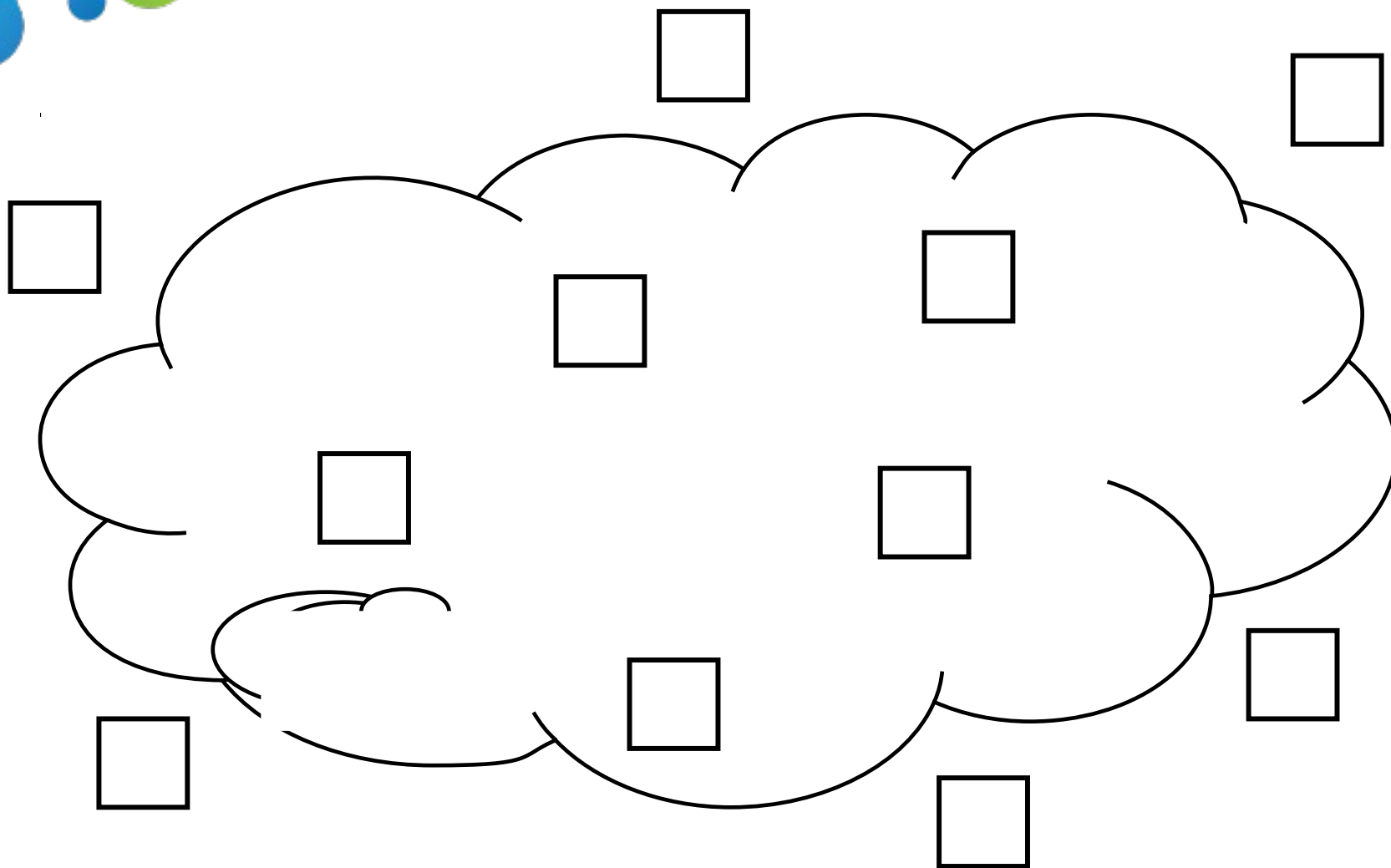


Slicing and virtualization



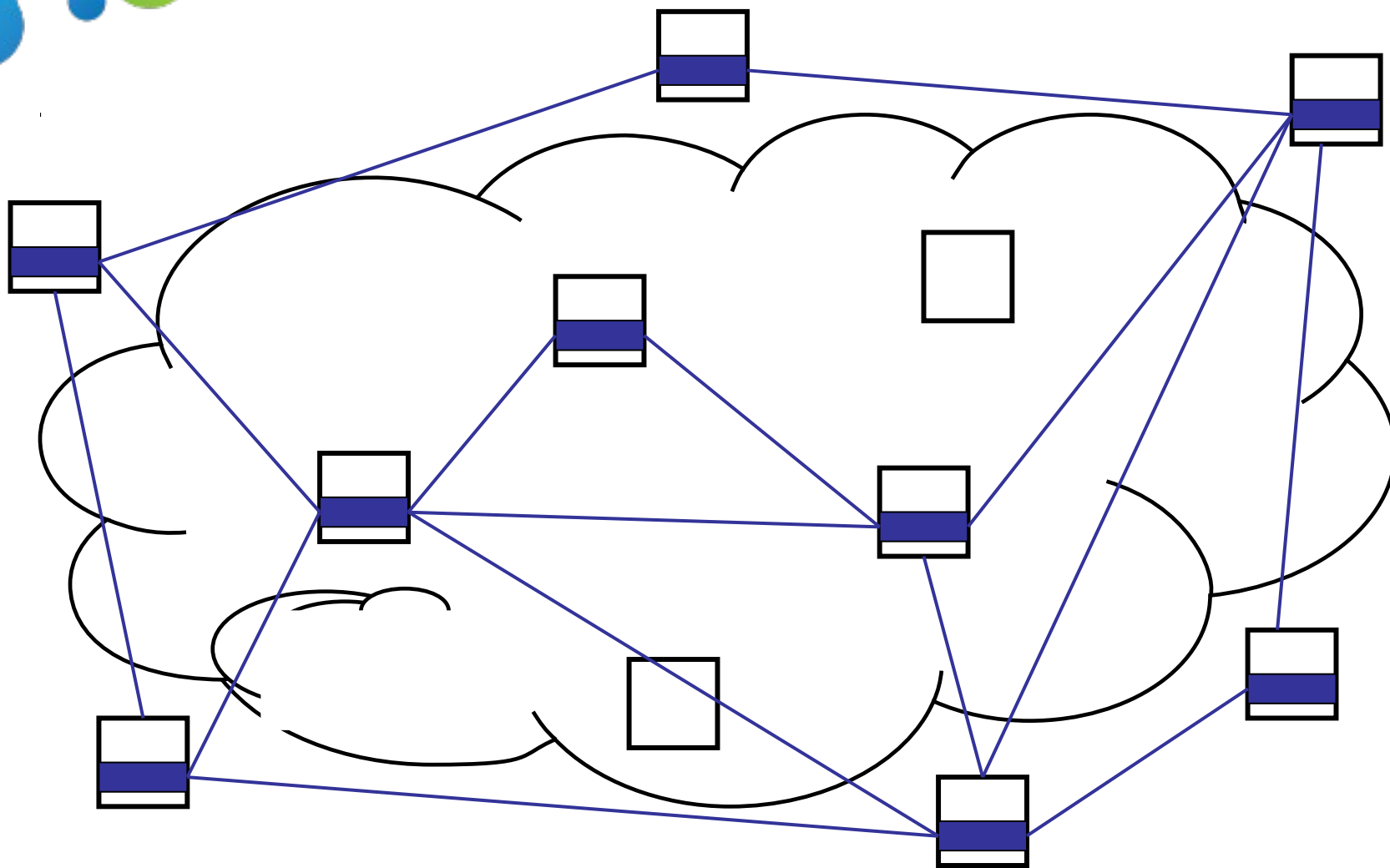


Slices



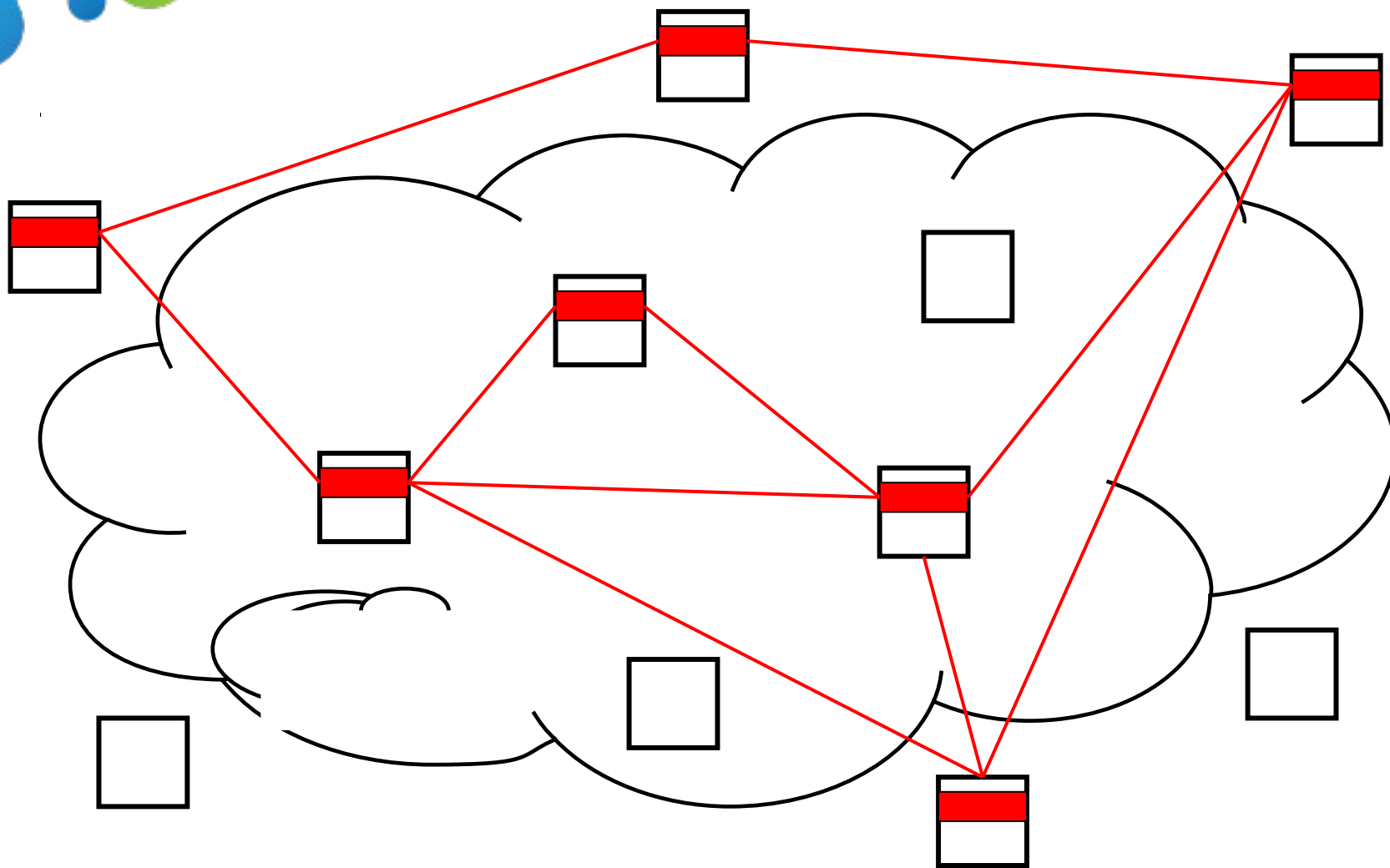


Slices



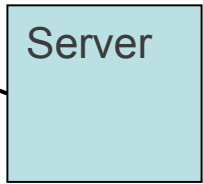
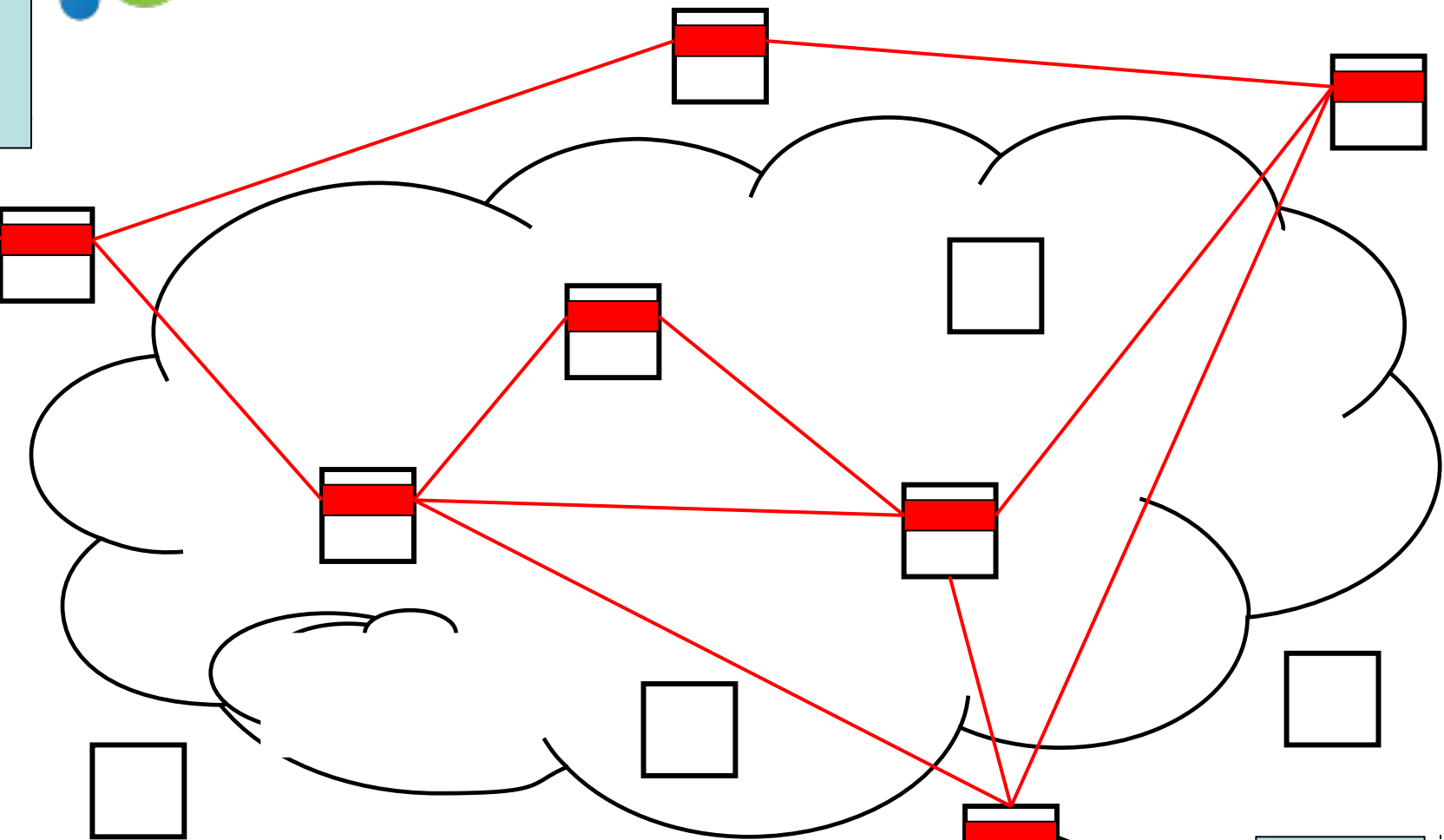
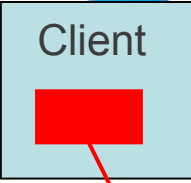


Slices





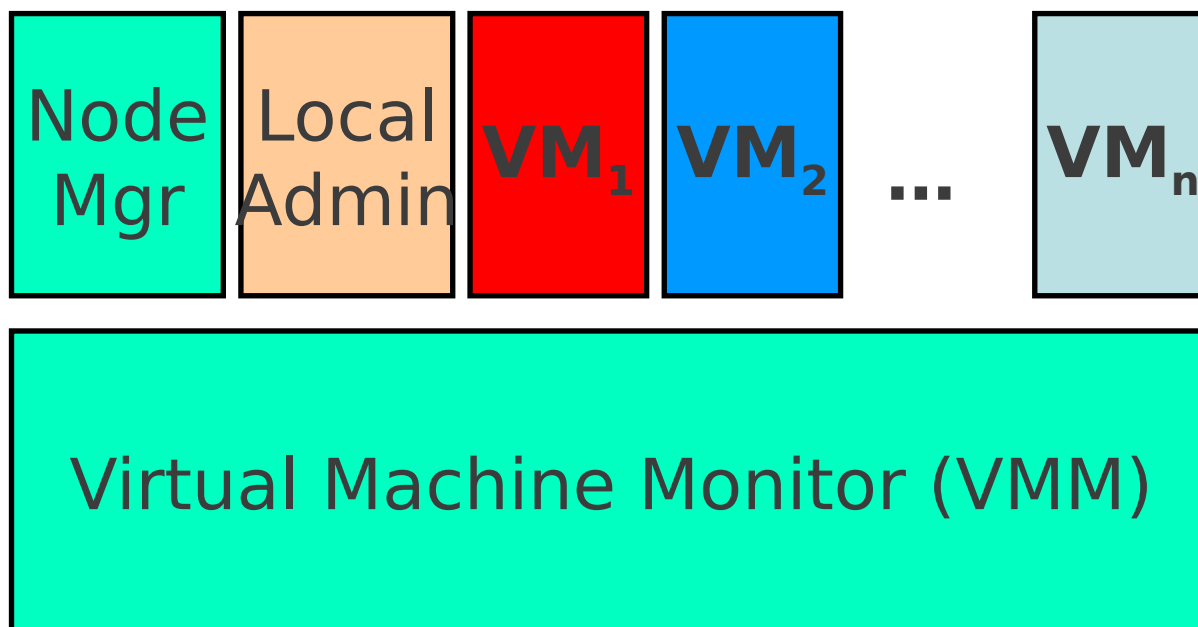
User Opt-in



Server

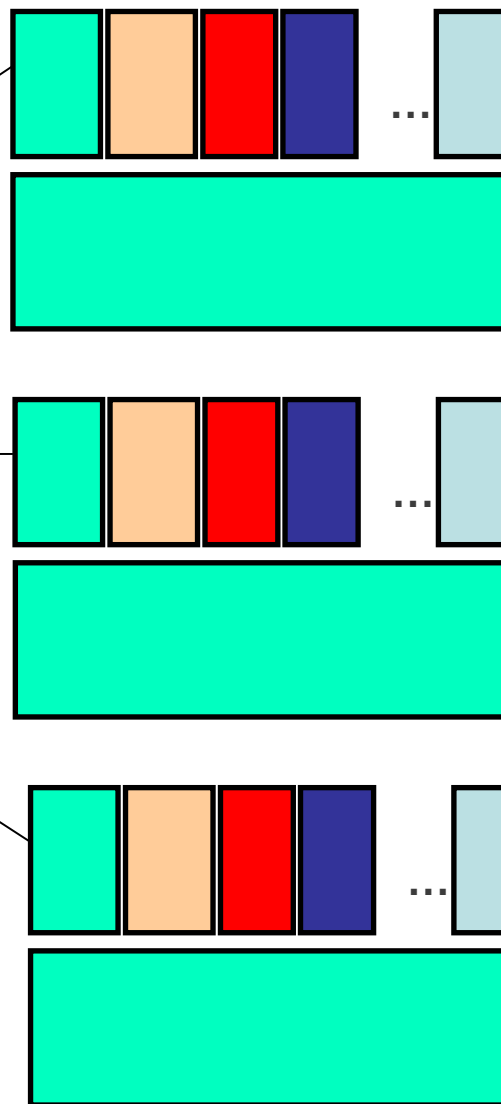
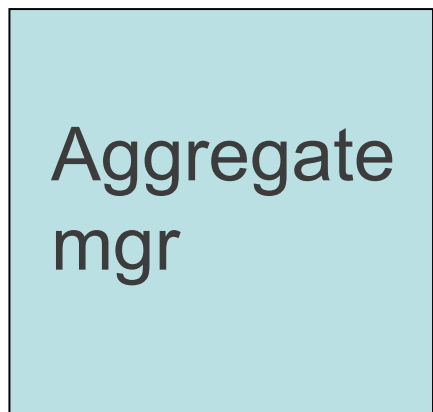


Per-Node View



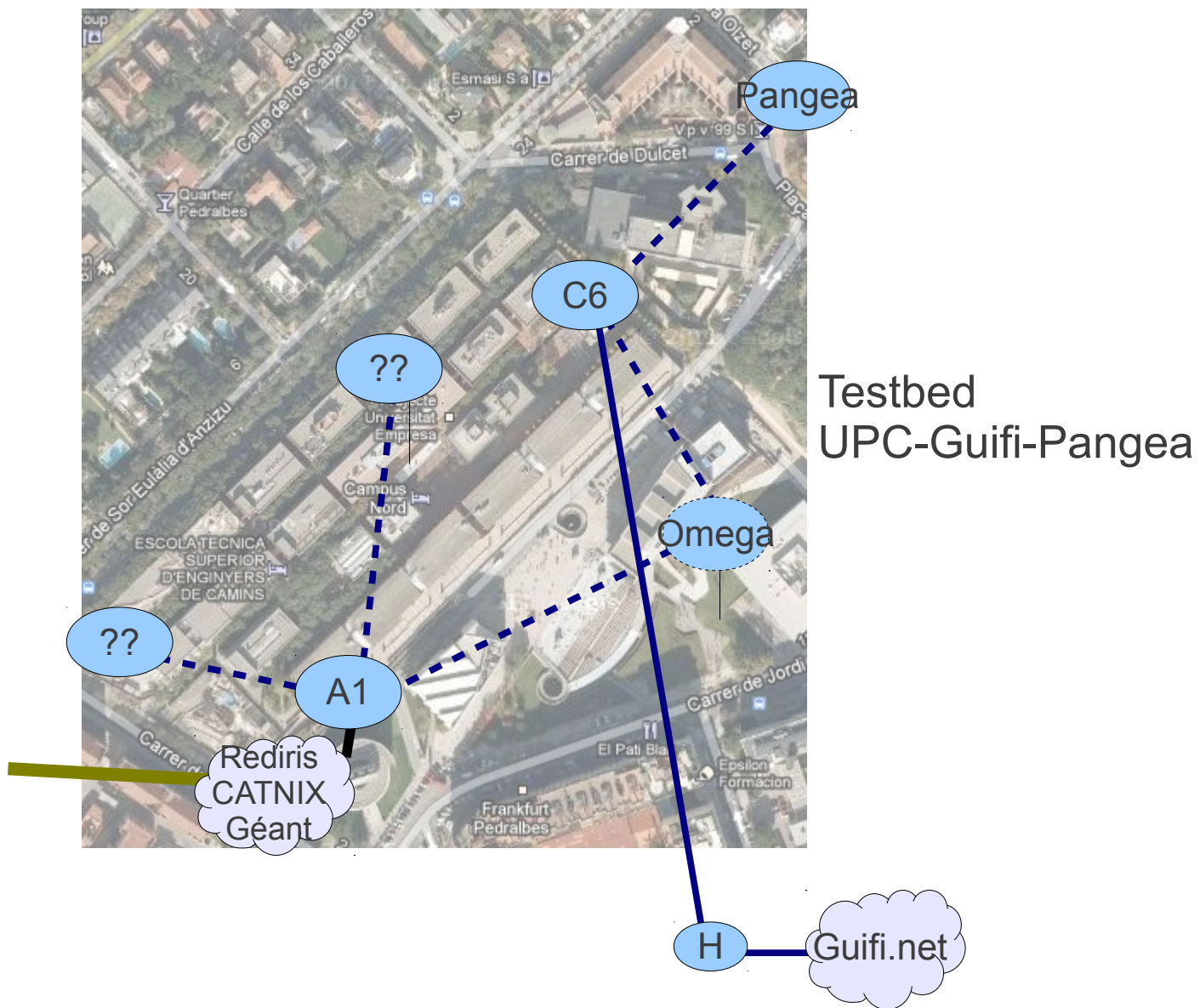


Global View





Testbed guifi.net-UPC





Testbed guifi.net-UPC





Testbed-EU





Experiments

- Nearly passive: working with traces or logs
- Active experiments
 - Intensive: explore limits
 - Disruptive: Testing a new allocation mechanism for frequencies, IP addresses, routing, service overlay
 - “Normal” traffic: Testing an application under realistic conditions
 - Long-term running services (crowdsourcing)
- Even social experiments
(Collective awareness and action)



The net

- So diverse ...
- Additional capacity:
 - New (sparse) nodes and links (extending coverage)
 - New (dense) regions (extending coverage)
 - Dup links and nodes (extending capacity)
- New additions:
 - Researchers as remote members (net friendliness)
 - Remote uses need new features:
selection, deployment, management, logging, isolation
 - Federation ...



Testbed: responsibility

- Software development: UPC
- Operation and support: Pangea
- Addition of new nodes: Guifi.net
- Research uses: IBBT
- Dissemination: OPLAN

- Responsibility, coordination, work, commitments, documentation



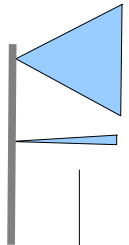
Testbed nodes

- Participació recollida de dades (guest/guest)
- Desplegament nodes/enllaços addicionals
 - Elecció d'ubicacions, contribució cost ($\leq 100\%$)
- Software dels nodes
 - A partir de OpenWRT
 - Contribuir al software de guifi.net (p. ex. QMP)
- Software de gestió



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Sectorial(s)

Point-to-point(s)

Ethernet (?)

Power

CPU: (x86) Alix, Atom

BootROM → OS amb self-* (bootMgr, nodeMgr, sliceMgr) →
→ virtualització de nodes i xarxa



Col·laboració de tothom

- Interès de la UE en el model
(+ Digital Agenda 2020)
- Internacionalització (I18ó) ++
- Més participants (investigadors)
- Més nodes i enllaços de la xarxa
- Extensió del software (lliure), millores,
 - Automatització, eines de gestió, facilitat d'us



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