



Research in Community Networking: the Community-Lab.net testbed

<http://confine-project.eu>
<http://community-lab.net>

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7G

- 7G = Digital Society for 7B people
- Everyone can participate
- From a feudal to a democratic system
- Multiple models can coexist !
- Bottom-up networking to bootstrap local digital infrastructures, participation, businesses
- Then Internet connectivity, services, data, ...

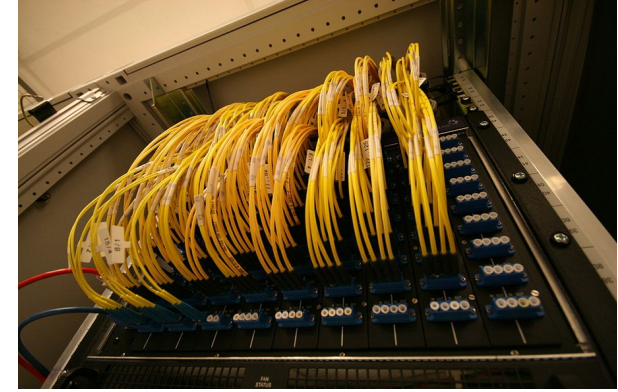


Local participation





Local development of (Inet) infra/service



- Internet eXchange Points (IXP) or transit exchanges
 - Local development of traffic exchanges
 - Lower latency, cost, increasing efficiency
- A socio-economic model: Development of a local ecosystem, maturity → scaling up, everywhere, everyone
- Community Networks: digital infra for local access



Community networks?

What: A cooperative development of net infrastructure

Where: local, community (city, region, area)

Who: You, and your neighbors, your town, build up you own network → Commons

“Don't buy the network, be the network!”

Scalable, self-organized and decentralized IP networks and services built and operated by citizens for citizens

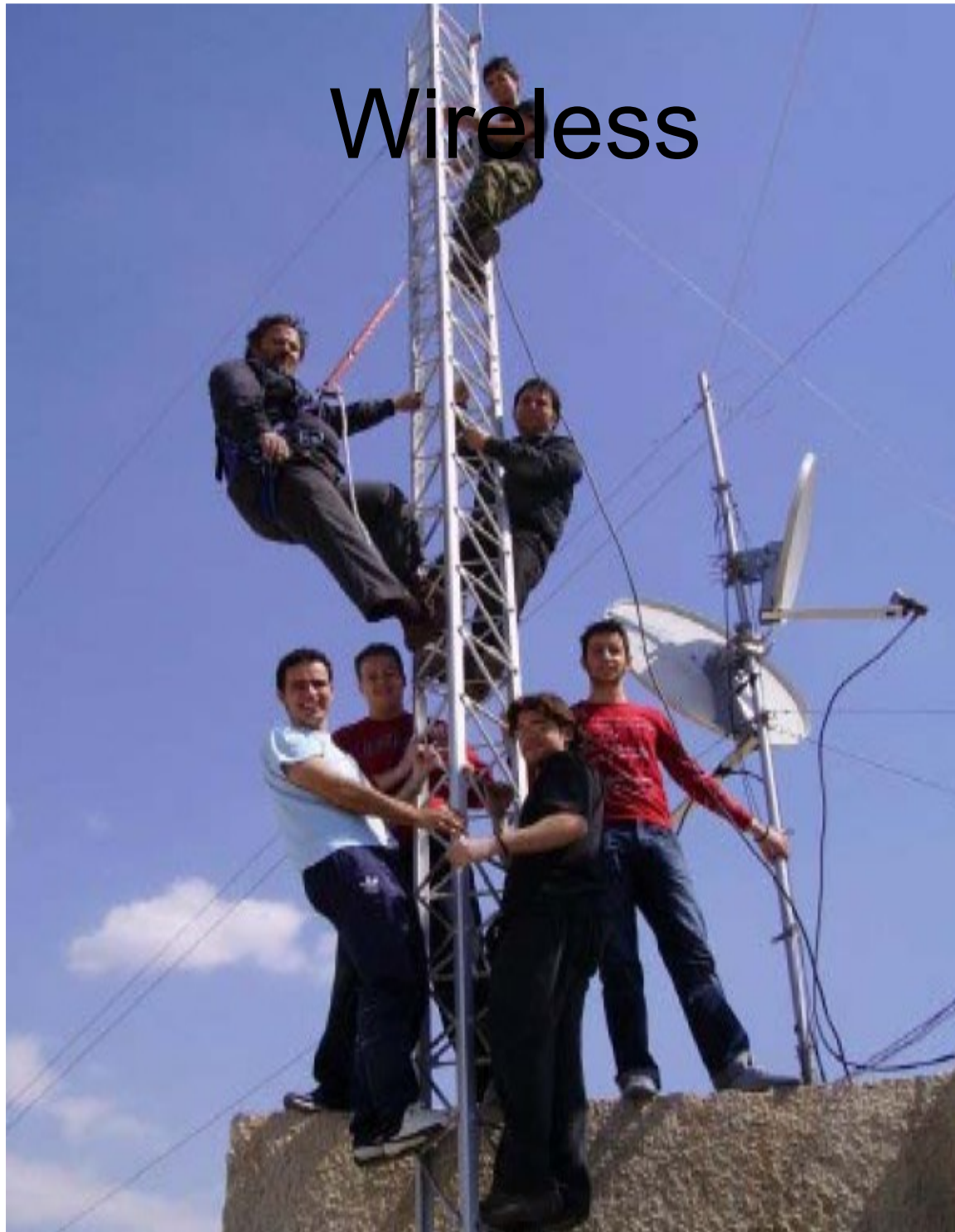
Self-provisioned, self-operated network: U want network?
Get a **node**, accept **license**, link up to a **network** ++



Why: openness

- Freedom
 - We can talk freely in the acoustic space
 - Censorship resistant nets
 - Surveillance, 3 strikes, politics, ...
 - Independence of running your own network
- Your own self-sustaining network
 - Lack of, local development, fun, learn, participation, social, ...
- Enablers: Open spectrum, commodity WiFi devices, optical fiber, software, knowledge

Wireless



Optical Fibre

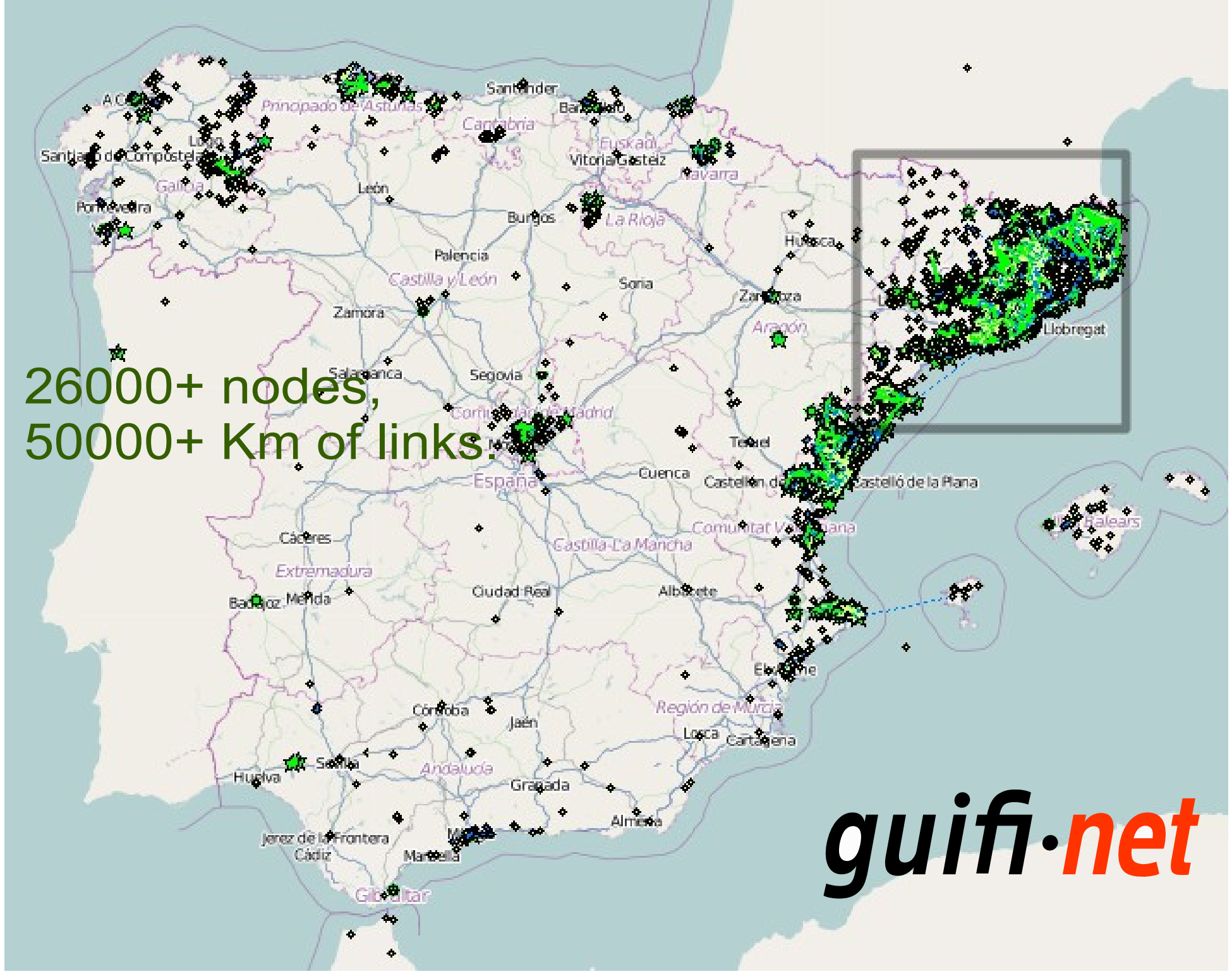


Community nodes



26000+ nodes,
50000+ Km of links.

guifi·net

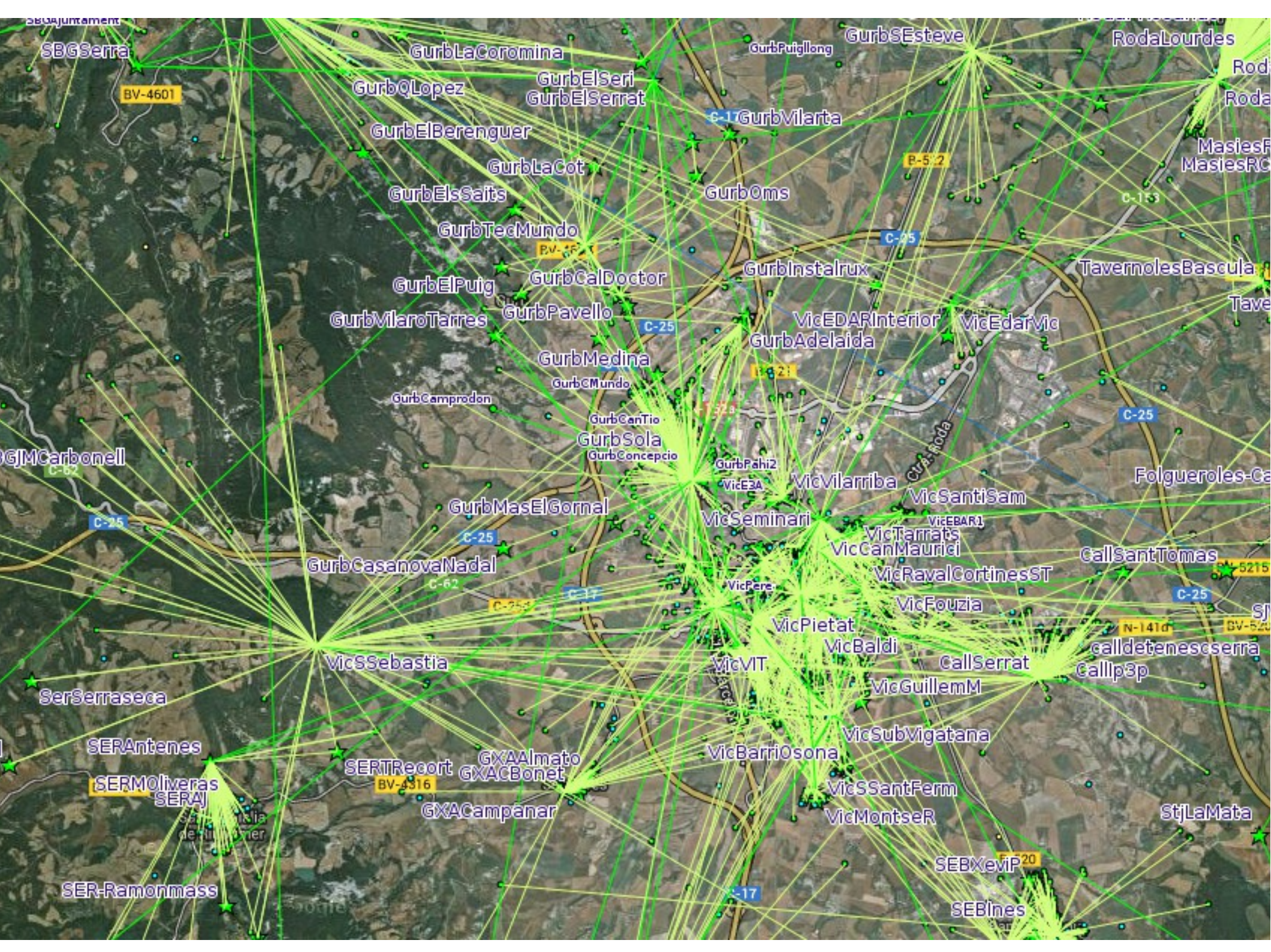




Guifi.net

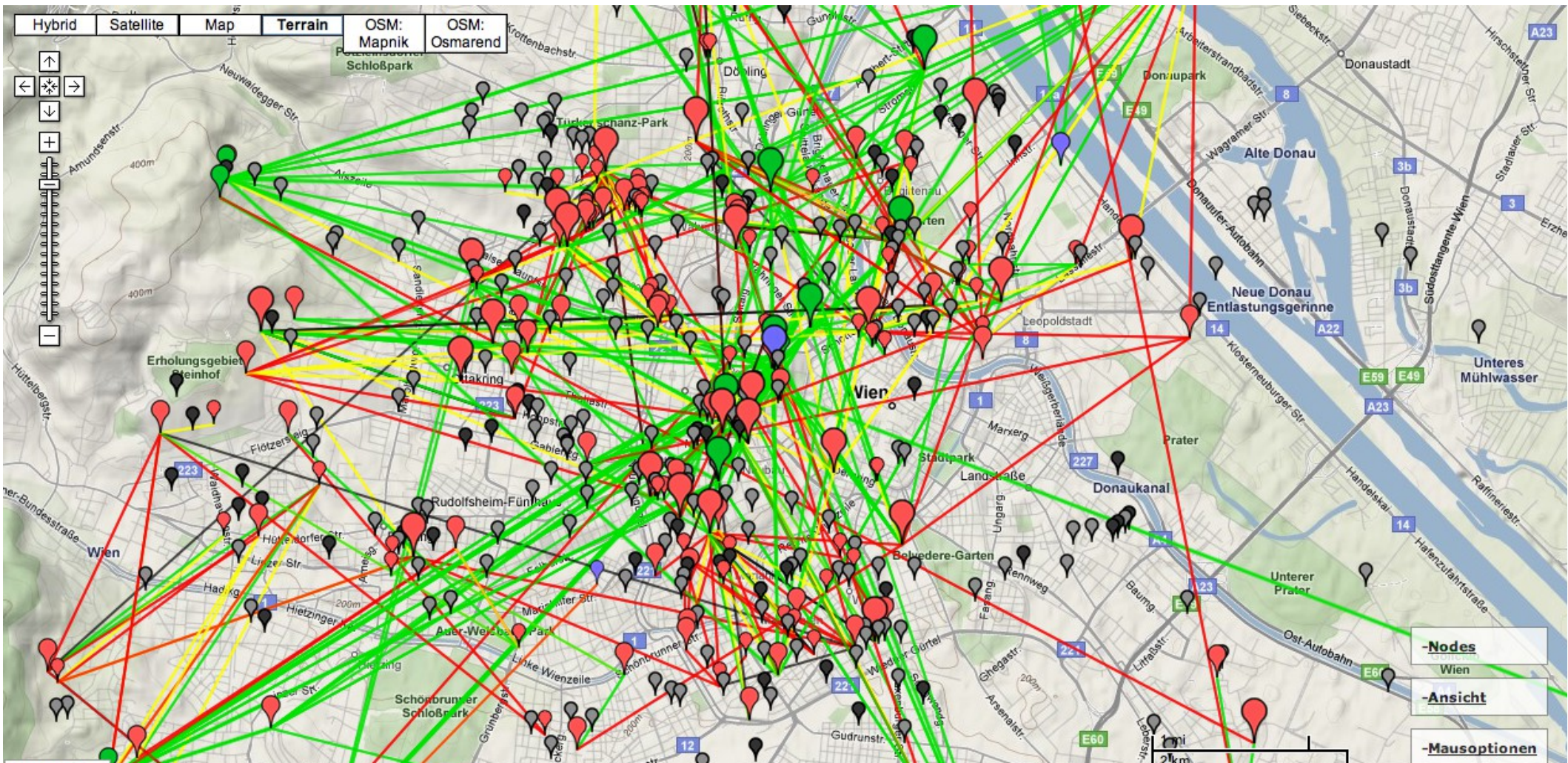


- Scalable open/cooperative model? 26K+ nodes
- Low-cost WiFi routers → Low-cost/complexity fibre
- Open knowledge (how-to-do), best practices, local workshops, software tools
- **Contact and plan w/neighbours, BYOD, accept license and enjoy!**
- Community: network (infra), node database (info), license (rules), arbitration (exceptions), legal fwk→open space
- Foundation: registered as network operator, active internal/external discussions on policies around access, neutrality, local economic development, etc.
- Geeks, citizens, lawyers, installers, SME (services), activists: relatively low entry barrier, low friction
 - SME: Competition in service, not in “ownership” or lock-in

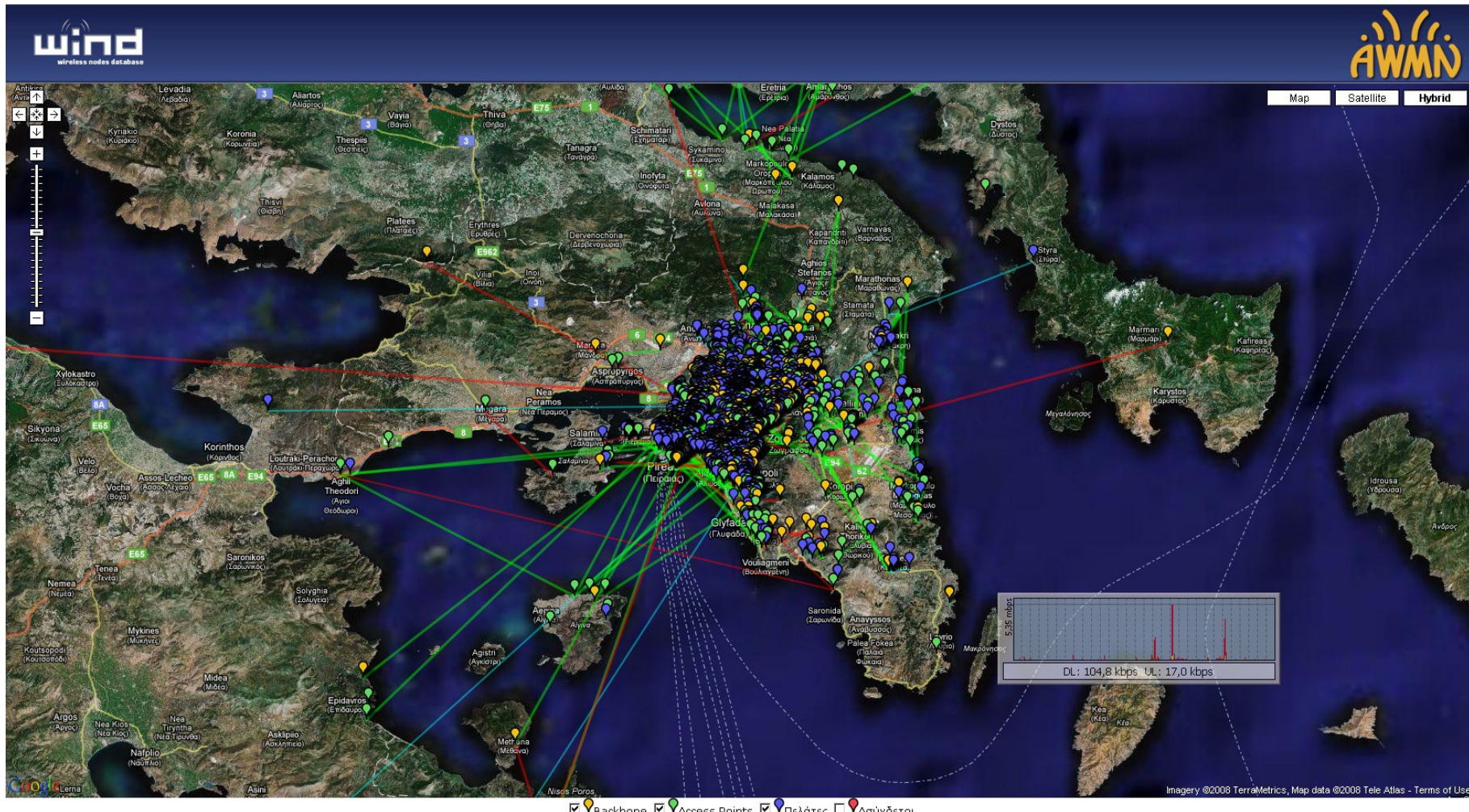


FunkFeuer

- Around Vienna and Austria



Athens Wireless Metropolitan Network





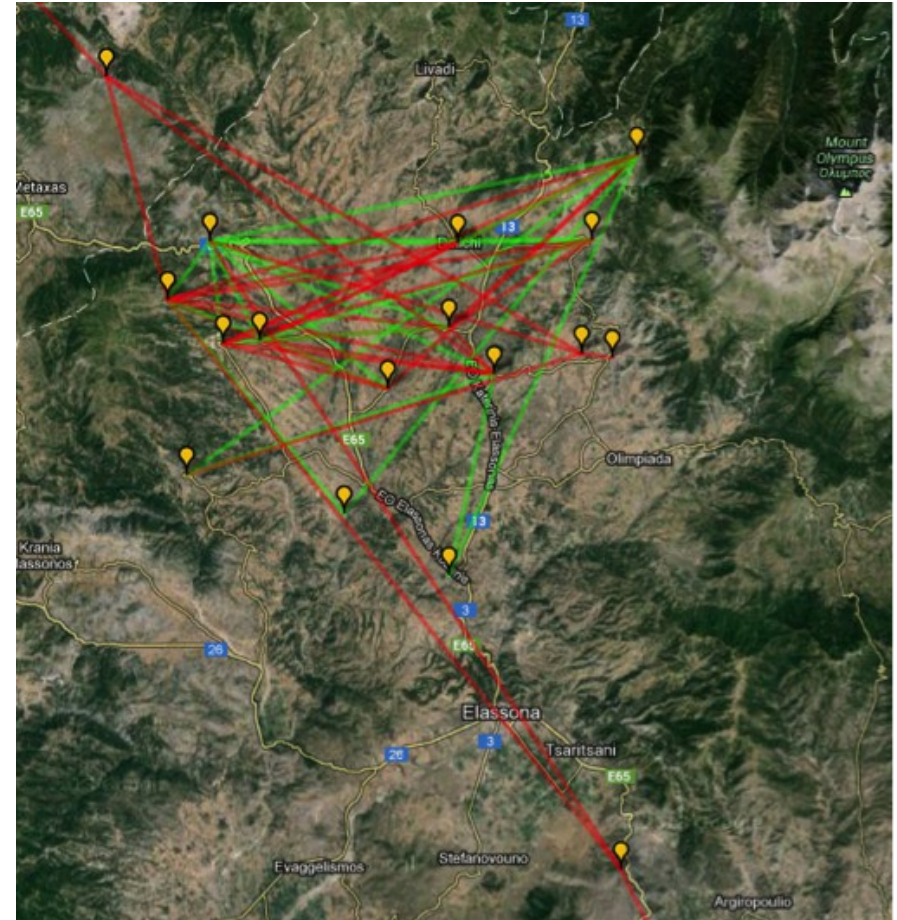
- A network of computers connected without wires, created by a community of geeks, radio amateurs and fans in Italy
- Stats: 242 nodes, 989 planned, 35 hotspots (March 10, 2014)





Sarantaporo.gr

- Sarantaporo village – and its fifteen surrounding villages, located in Elassona Municipality, Greece
- Since 2010, 15 municipalities, 160 nodes





Communities

- Guifi.net Spain, world
- AWMN Greece
- FunkFeuer Austria
- Wireless Belgie
- Ninux Italy
- Freifunk Germany
- Porto Maritime Portugal
- Digitalmerthyr.org.uk
- Sarantaporo.gr Greece
- Zenzeleni South Africa





Working quite smoothly ...

- Providing basic local net connectivity to members (point-to-point WiFi, fibre)
- Internet/web access using common or aggregated spare capacity
 - Web proxies (spare capacity),
 - free Access Points,
 - coops/SME for uplinks with tunnels
- Sustainable cost sharing model:
 - Node+link deployment and maintenance
 - Fibre FTF (FTTH) deployments
 - Full Internet connectivity
 - Local connectivity for regional transport
 - Small garage data centres
 - Starting in cloud services



Local cooperative net development

- From geeks to citizens, from net infra to local Inet ecosystem (individuals, social, commercial entities)
- Open knowledge, best practices, tools, trainings, procedures, bylaws, arbitration, cost sharing, create open spaces (to build and run infrastructure, services)
- Cooperation more effective than competition?
 - Reaches more, leaves margin from more, “takes-away less energy” ...
 - Cost sharing (among members/users = co-owners) vs revenue sharing (among investors) from user fees: more local impact
- Complementary: effective to bootstrap connectivity, to set a lower common base, even develop communities to co-exist with other models ...
- “Connected Communities” initiative !



What is CONFINE

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

2012–2015, 5 M€ with 1 M€ for open calls

Diverse Partners

P#	Participant organisation name	Name	CC
1 C	Universitat Politècnica de Catalunya	UPC	ES
2	Fundació Privada per a la Xarxa Oberta, Lliure i Neutral gui	Guifi	ES
3	FunkFeuer	FuFe	AT
4	Athens Wireless Metropolitan Network	AWMN	GR
5	The OPLAN Foundation	OPLAN	UK
6	Comunicació per a la Cooperació - Pangea	PAN	ES
7	Fraunhofer-Gesellschaft zur Förderung der angewandten Fo	FKIE	DE
8	iMinds	IMINDS	BE
9 *+	Consorzio Nazionale Interuniversitario per le Telecomunicaz	CNIT	IT
10 *	Freie Universität Berlin	FUB	DE
11 *	INstituto de Engenharia de Sistemas e Computadores do Po	INESCP	PT
12 *	University of Luxembourg	UL	LU
13 *	University of Trento	UNITN	IT
14	University of Cambridge	UCAM	UK
15	University of the Western Cape	UWC	ZA
16	“Sarantaporo.gr Non Profit Association”	SAR	GR
17	Technische Universität Berlin / DAI-Labor	TUB	DE
18	Itinerarium, Localització, Multimèdia i Xarxes Socials SL	ITI	ES
19	New America Foundation	NAF	US
20	Routek S.L.	RTK	ES
21	Forschungszentrum Telekommunikation Wien GmbH	FTW	AT
22	Gottfried Wilhelm Leibniz Universität Hannover	LUH	DE
23	UNIDATA	UNI	IT
24	IGOPnet	IGOP	ES



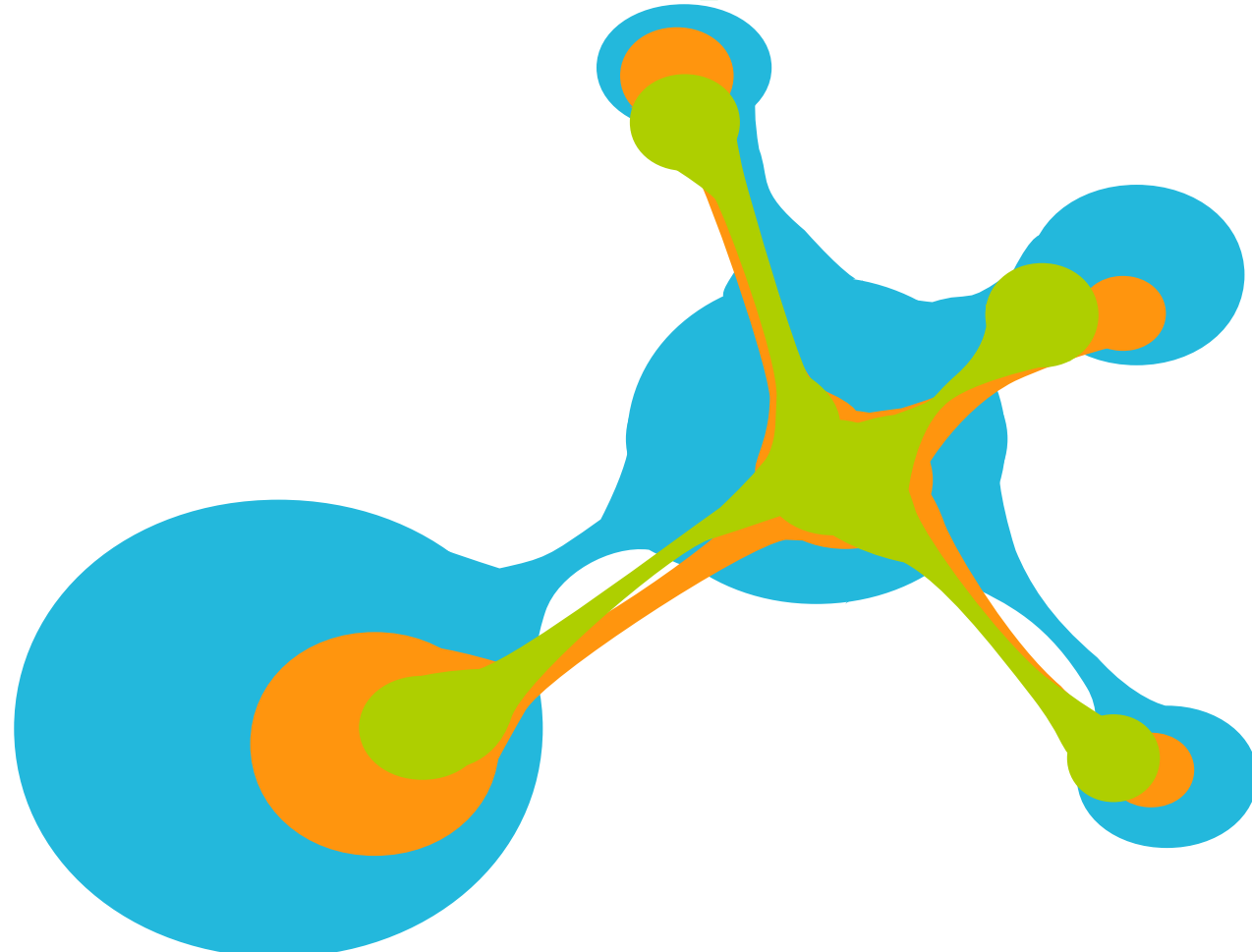
Routers, links, routing, PEOPLE

**Community Nets: commons, community license,
multiple local stakeholders, organisation**

Federation of Community Networks


Infra for experiments: A cloud of Research Devices

**Experiments: Slices, a set of shared virtual
machines for services or experiments**



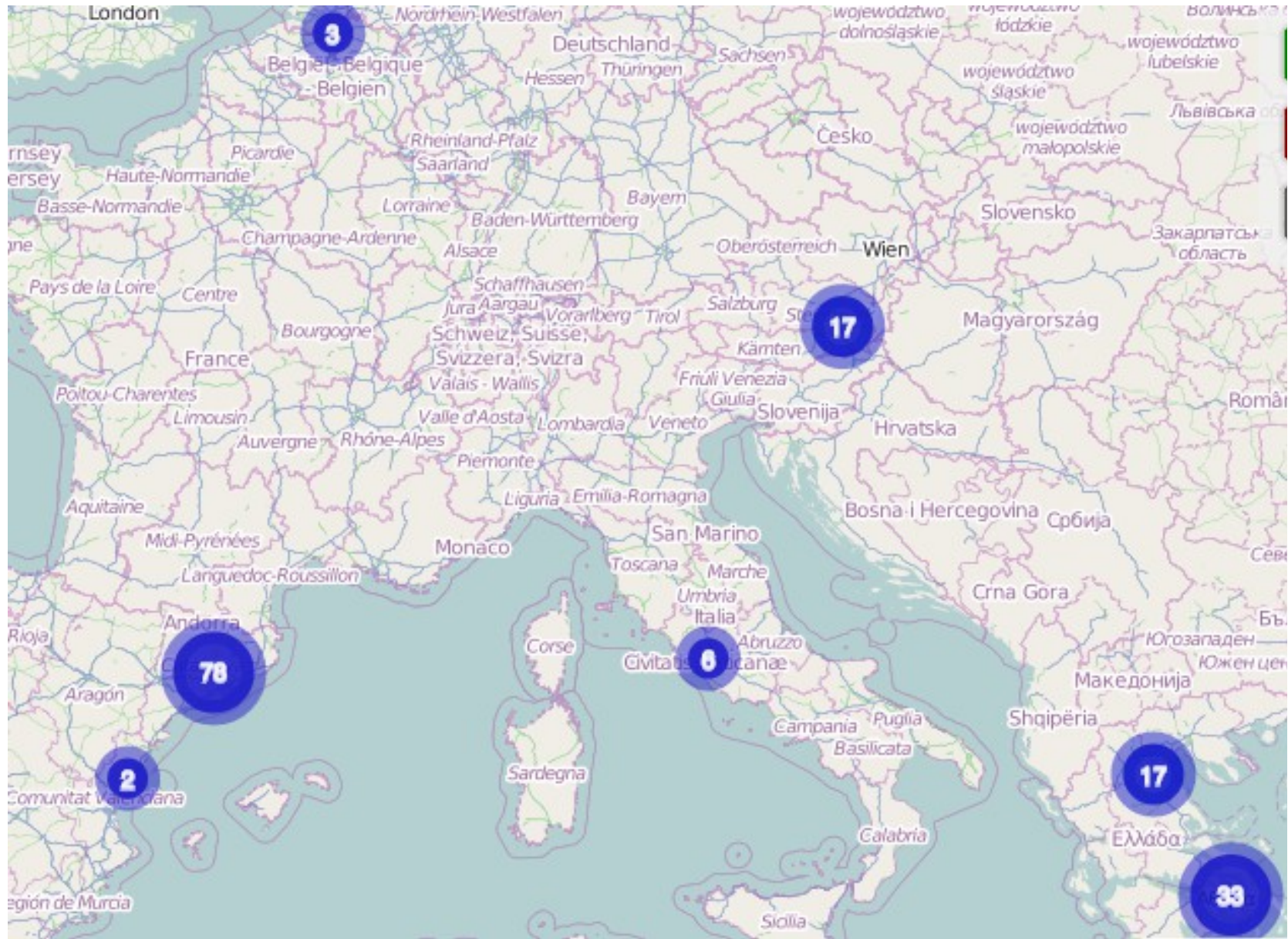


Community-Lab

- An open, distributed **infrastructure for experimentation** with Community Networks 
- An outdoor testbed with nodes and links **embedded in community networks**, with many people too
 - *Research Devices* connected to *Community Devices*
- A **realistic** environment for experimentation with the best and worst of real community networks



Community-Lab





CONFINE testbeds

- Community networks involved
- Initial:
 - AWMN (Athens, GR), contact Joseph Bonicioli
 - FunkFeuer (Wien, AT), contact Aaron Kaplan
 - Guifi.net (Catalonia, ES), contact Roger Baig, Pau Escrich
- 3/2014-:
 - Wireless Belgie (BE), contact Bart Braem
 - Ninux.org (IT), contact Claudio Pisa
 - Sarantaporo.gr (GR), contact George Klissiaris
 - Zenzeleni Networks (ZA), contact Carlos Rey
- Also involved in the testbed:
The communities: the people (members), the orgs,
hardware and software (when FOSS) (*production nets*)
- Social, technical experiments



Usage

Per nodes slices and groups

ffg-zotac-03	ffg-zotac-02	ffw-zotac-07	ffg-zotac-05	UPC-C6_E208_	UPC-lab104demo1	UPC-lab104H106	UPC-lab104lab104CASTF2VM06	BCNRocE	GB-MNAigues	GB-SLLTorre	GB-MNBufalm	Stack_A1	GB-MNUPC
ffg-zotac-06	ffg-zotac-01	ffw-zotac-08	ffg-zotac-04	UPC-D6-105-RD3	UPC-D6-105-1105	UPC-lab104lab104VM10	UPC-lab104lab104f107	GB-MNJoanX					
AWMN-CF-ipduh	AWMN-CF-7bpm	AWMN-NetTrapto	AWM-CF-7bpr3	AWMN-CF-djk604	AWMN-HQ-LAB-02	UPC-lab104-1102	UPC-lab104-1102	GB-MNSTigna	GB-SFBDipositSann	LLUperafit	BCNTopa2	BCNSjmall	outdoor
AWMN-dem-ilit	AWMN-Pamitha	AWMN-dem-ims				UPC-lab104-1102	UPC-lab104-1102	LLUsbgT		Stack_A2			
AWMN-CF-Ymitos	AWMN-CF-Wolfnack	AWMN-DA-GYM	AWMN-HQ-LAB-03	AWMN-dem-chem	AWMN-HQ-LAB-01	UPC-lab104-1102	UPC-lab104-1102	GB-MNPulgBe	BCNGranVia20	GB-MNPalauFira	GB-SLLVerdu	BCNJonc	LAH
AWMN-DA-KAPI	AWMN-DA-MEC	AWMN-CF-Infolex	AWMN-HQ-LAB-04			UPC-lab104-1102	UPC-lab104-1102	GB-MNPulgTe		GB-MNAgullaDes			
AWMN-CF-Wolfnack2	AWMN-CF-7bpm-Hall	AWMN-DA-Town				UPC-lab104-1102	UPC-lab104-1102	BCNBenl	HW-ermita11		LLUalpensaJ		

Slices per group

debian7.test	autobench	sources	monolle	ccn_strategy_ff	ccn_strategy_guifi
AdLeaks	Experiment				
TestSlice7	TestSlice6	monolle2		wsaas2	



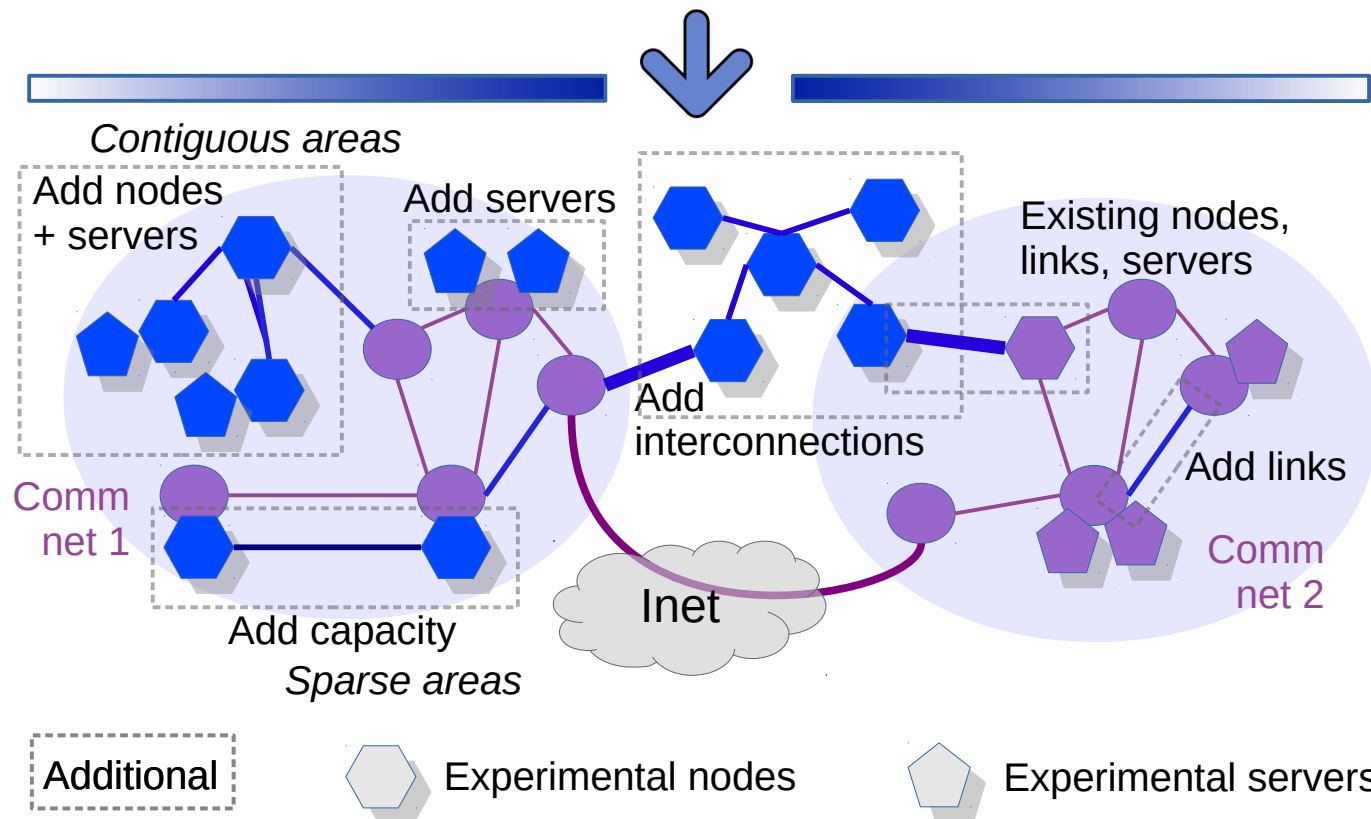
CONFINE testbeds

- Virtual testbed (**Virtual CONFINE Testbed = VCT**)
 - A network of virtual nodes + experiment controller “in a box”
 - Introductory, testing, build and development
- Community network testbed (**Community-Lab**)
 - A network of >100 “real” nodes and an experiment controller deployed and embedded in 3+ community networks
 - Realistic, “production” experiments, services
- Dense testbed (**WiBed**)
 - Raw access to WiFi interfaces, no virtualisation, low-cost CN hardware, “confined” to a campus during nights
- **Common software tools**



Community-lab.net

Run experiments inside several real community networks from your desktop





Testbeds



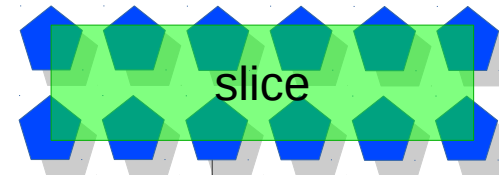
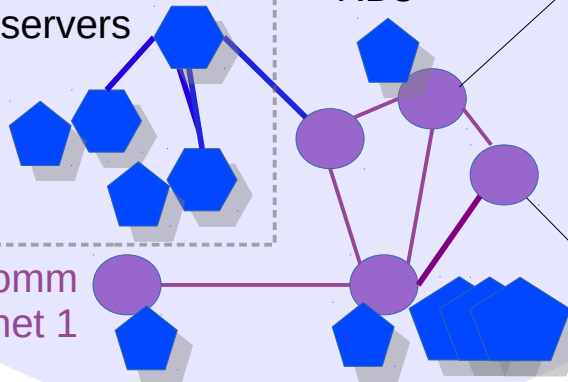
Federation (SFA)

Contiguous areas

Add nodes + servers

RDs

Comm net 1

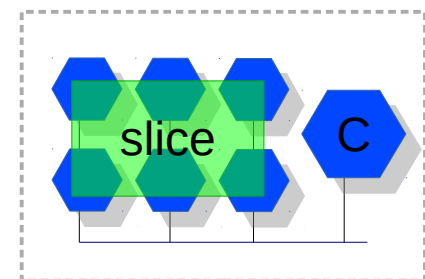


Campus (WiBed)

C

Inet

Single computer



Virtual (VCT)

Comm net 2

RDs

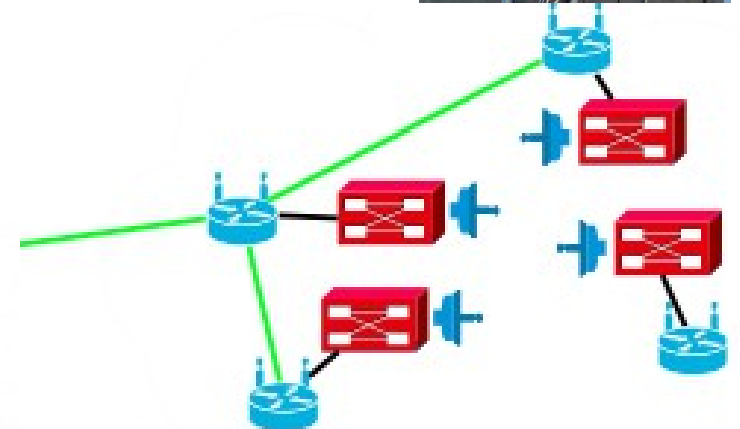
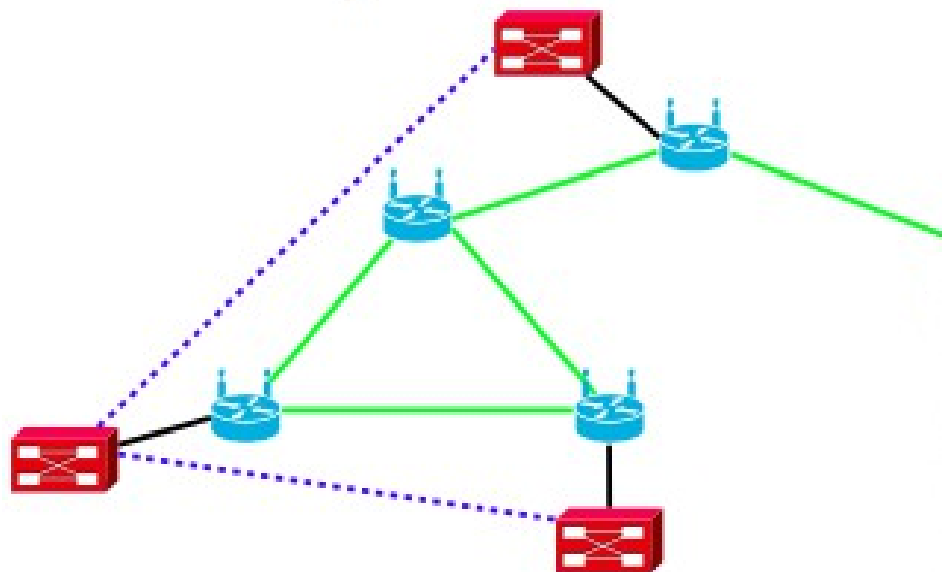
Overlay (IPv6 Tinc)

Comm net 3

RDs

Construction of the testbed

- Add research devices for experiments
 - Dense areas of research devices @Guifi.net @Funkfeuer @AWMN @UPC @iMinds @Fraunhofer
 - Sparse areas of research devices @home





Community-Lab portal

Community-Lab Testbed Management v0.10.2 Welcome, Leandro Navarro. Change password / Log out

DASHBOARD BOOKMARKS NODES SLICES TINC ADMINISTRATION API MONITOR

DOCUMENTATION **Dashboard** Modules

Welcome, Leandro Navarro

You can find the initial steps at Using Community-lab.net testbed

For reporting problems you can use:

1. Users mailing list users@lists.community-lab.net (Preferent)
2. Community-Lab issue tracking (Testbed operation related)
3. Confine project redmine (Software related)

Administration

Tasks Firmware config Tickets Operations

Notifications Groups Users

Tinc

Gateways Hosts Islands Tinc addresses

Nodes

Nodes Server

Slices

Slices Slivers Templates

v0.10.2 Welcome, Leandro Navarro. Change password / Log out

TINC ADMINISTRATION API MONITOR DOCUMENTATION

Add node +

Group	Ifaces	Slivers	Firmware version	Current state
uniroma2-ninux	0	0	No data	OFFLINE
Guifi.net	0	1	No data	OFFLINE
ION Guifi.net	0	3	master.r20140213	PRODUCTION
ION Guifi.net	0	3	master.r20140213	DEBUG
Guifi.net	0	1	No data	OFFLINE
DSG	0	1	No data	OFFLINE
ION iMinds	0	0	No data	CRASHED
iMinds VM 3 (FEDERICA)	193	i686	PRODUCTION	iMinds 0 0 No data CRASHED
Pangea test node (demos only)	192	i686	SAFE	Pangea 3 0 master.r20140213 OFFLINE
AWMN-Palini-VM	191	i686	PRODUCTION	AWMN 0 4 master.r20140213 PRODUCTION
AWMN-TEI-Pir-VM	190	i686	PRODUCTION	AWMN 0 2 master.r20140213 PRODUCTION
AWMN-Forthnet-VM	189	i686	PRODUCTION	AWMN 0 4 master.r20140213 PRODUCTION
AWMN-CloudNode-VM	188	i686	PRODUCTION	AWMN 0 4 master.r20140213 PRODUCTION
iMinds VM 2 (public)	186	i686	PRODUCTION	iMinds 0 0 No data CRASHED
iMinds VM 1 (public)	185	i686	PRODUCTION	iMinds 0 0 No data CRASHED
UPC-C6E206-VM03-CB	184	i686	SAFE	DSG 0 2 No data OFFLINE

Filter

- By Nodes
 - My Nodes
 - All
- By Architecture
 - All
 - i586
 - i686
- By set state
 - All
 - DEBUG
 - SAFE
 - PRODUCTION
 - FAILURE
- By group
 - All
 - AWMN
 - AdLeaks
 - DSG
 - Education
 - FractalFog
 - Funkfeuer
 - Guifi.net
 - KTH
 - Pangea
 - SICS
 - TestGroup



Testbed and experiments

- Realistic conditions
- Access at different level (limited phy up to apps)
- A large and representative sample of community networks (realistic scale), *also federated*
- A shared network
(with “production” traffic/use + new traffic/use) →
slices, virtualization



Experiments

- Nearly passive: working with large open data traces
- Active experiments
 - Disruptive: Testing a new mechanisms
 - “Normal” traffic: Testing realistic conditions
 - Long-term running services (crowdsourcing)
- Social experiments
 - A large social community active in communication, coordination, collaboration

Experiments

- Hybrid nodes with Ethernet attached radios (DLEP)
- Evolution of mesh routing: BMX6 receiver-driven routing, OLSRv2, multi-topology, power adaptation (MinstrelBlues), evaluation in large scale
- Resilience and Byzantine nodes in mesh routing
- Applications: Sharing Internet access, Video streaming (PeerStreamer), CN nodes (qMp), Clommunity/Cloudy ...
- Interference and anomalies in concurrent experiments
- Network virtualization/SDN for testbed and CN
- Privacy preservation (whistleblowing), Secure communication
- Social incentives
- Energy and resource allocation
- Analysis (topology, traffic, participation)
- Evaluation of diverse router devices and home servers
- Mobile and low-power networks in developing regions
- Social experiments: community building, schools for local community development, sustainability factors

Conclusions

- Community Networks: A cooperative local development of net infrastructure and services

Community → license, sustainable ecosystem

It works! You can join them or start one locally!

But there are research challenges

- Community-Lab: An open, distributed **infrastructure for experimentation** with CN

Research Devices embedded in several CN
(routers, links, people, services)

It works! You can join us! (or start one locally and federate)