

Clouds in Community Networks

Felix Freitag

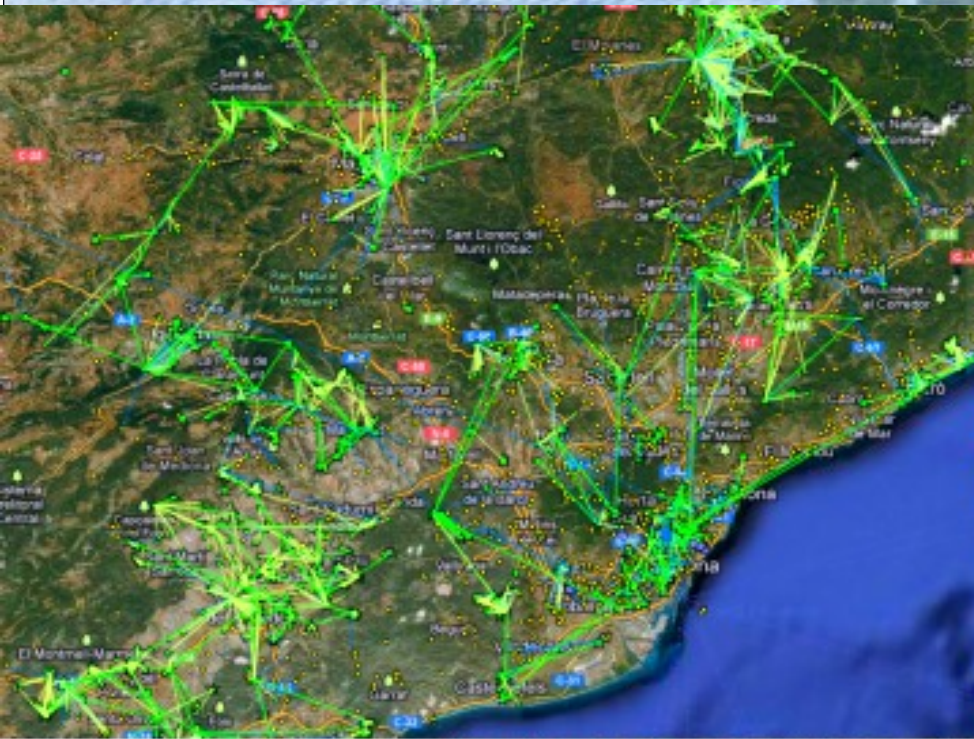
Technical University of Catalonia, BarcelonaTech

2nd GAIA Workshop

Cambridge, UK, October 20, 2014



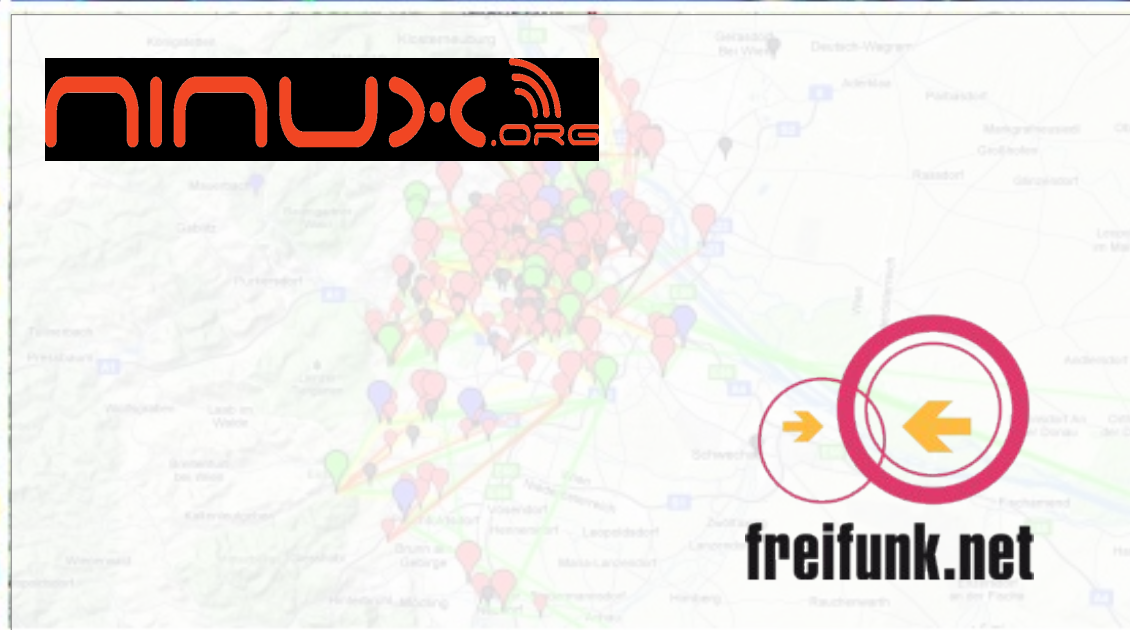
Some operational community networks



A collection of logos for various community networks, overlaid on a faint map background. The logos include:

- ninu.org**: A logo with the text "ninu.org" in orange and a signal icon.
- AWMN**: A logo with the text "AWMN" in orange and a signal icon.
- OXFF FUNKFEUER FREE NET**: A logo with the text "OXFF FUNKFEUER FREE NET" in black and white.
- guifi.net**: A logo with the text "guifi.net" in black and red.
- freifunk.net**: A logo with the text "freifunk.net" in black and a signal icon.

Some operational community networks

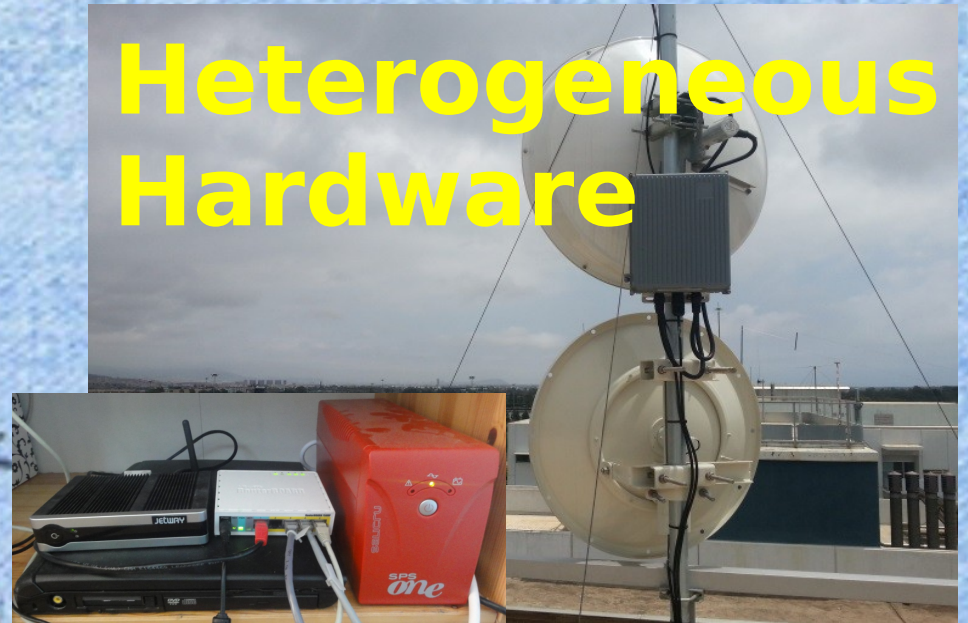


Community **network** characteristics

Collaboration



Heterogeneous Hardware



IP Network



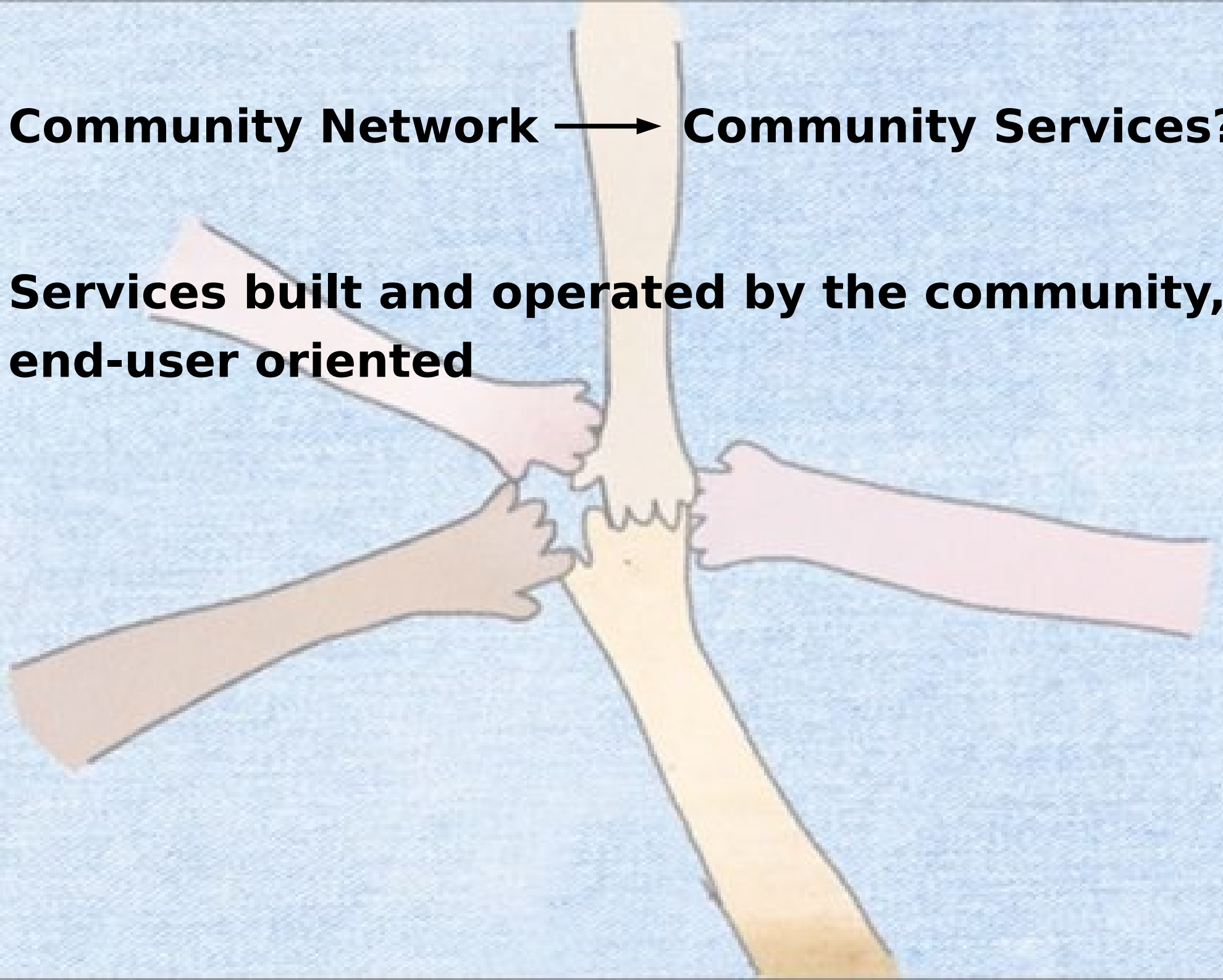
A cooperative development of a **network**

Don't buy the **network**, be the **network**!



Community Network → Community Services?

**Services built and operated by the community,
end-user oriented**



Community networks are socio-economic-technical system



Social skills



Hardware contribution



Technical skills

Can we extend to the next level?

Cloud Services in Community Networks?

Community network clouds: A Community Cloud !

- built in community network
- hosted on community-owned computing and communication resources
- providing services of local interest
- collaborative deployment and maintenance by citizens for citizens

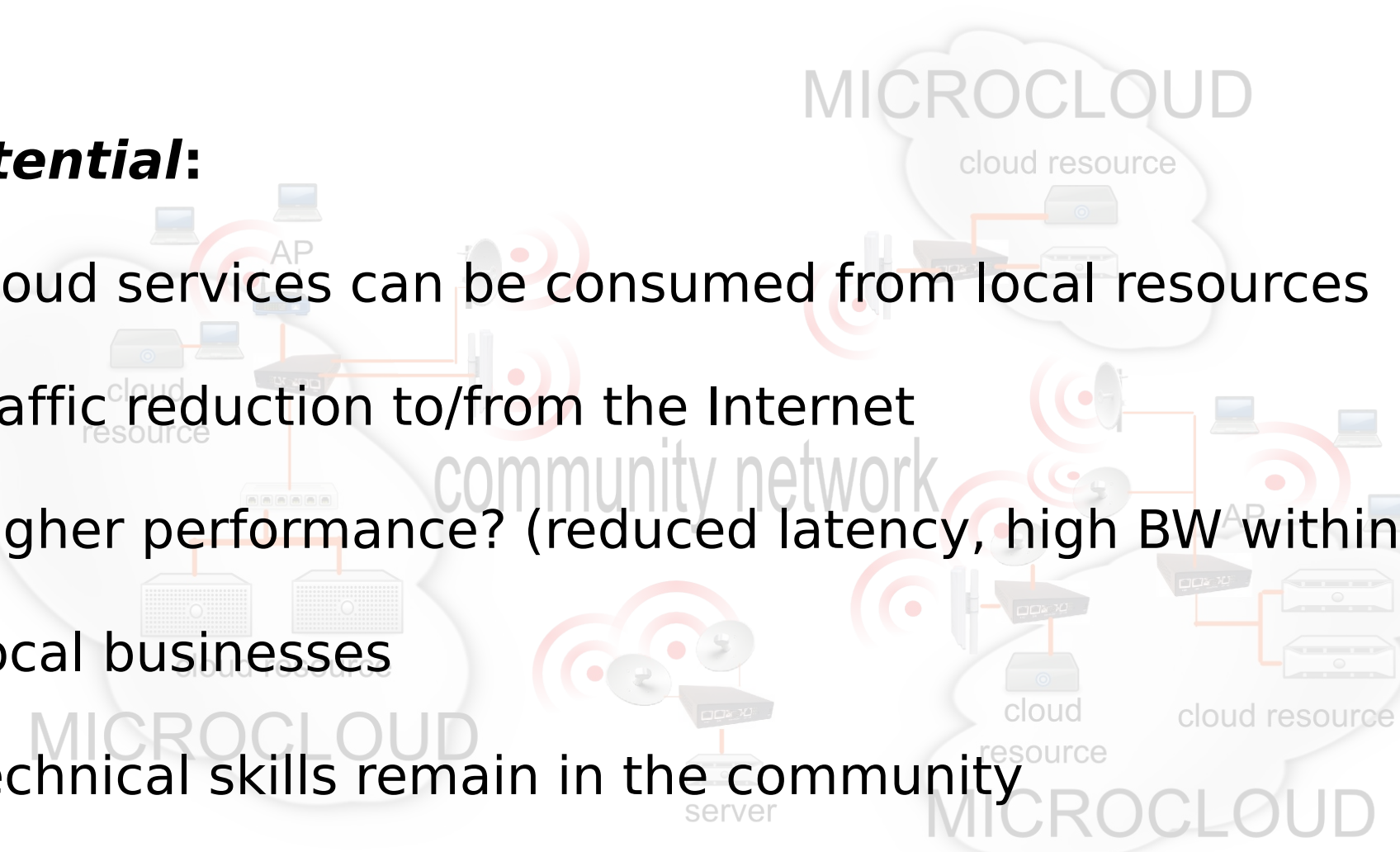


NIST Definition

Community cloud. The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.

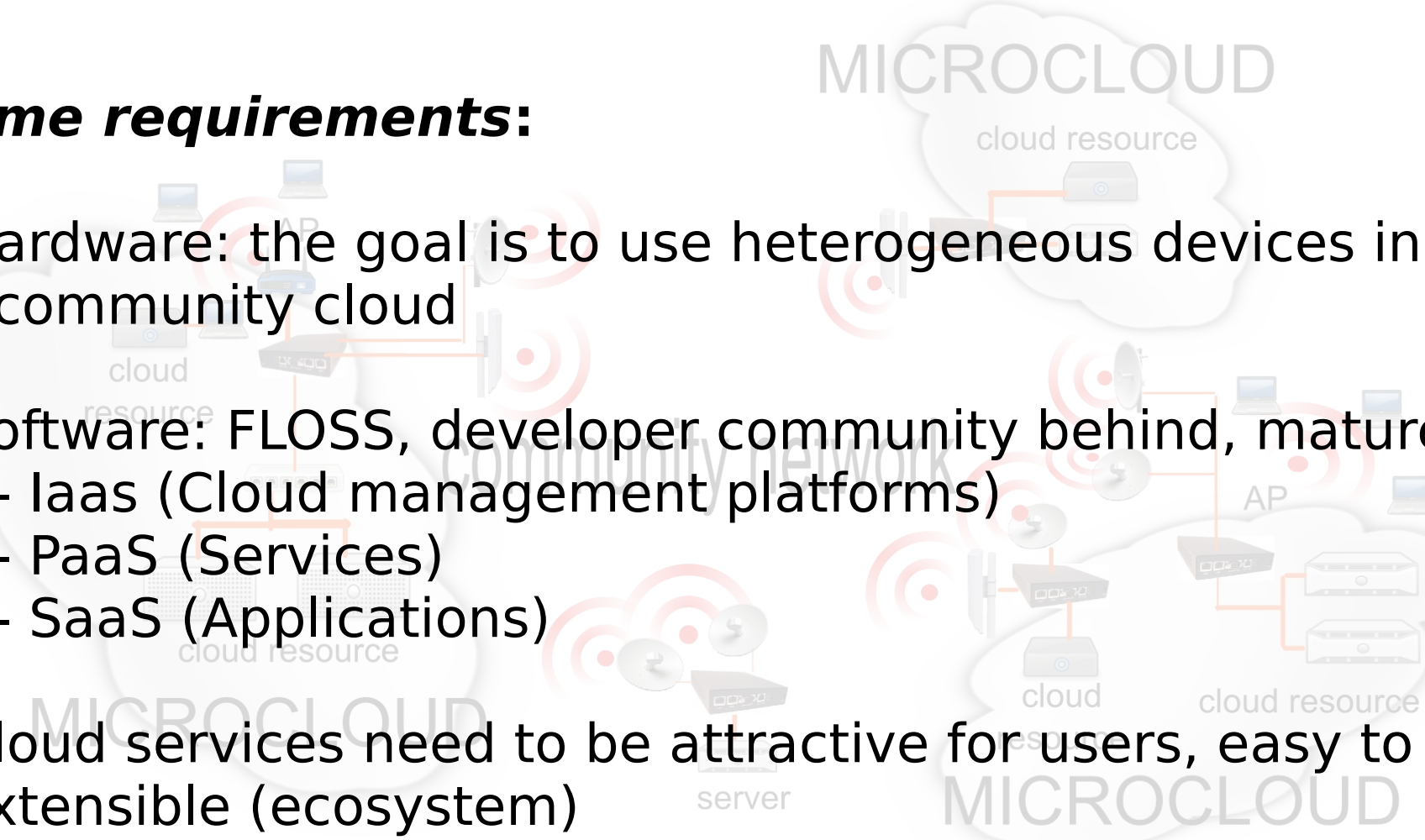
Cloud Services in Community Networks

Potential:

- Cloud services can be consumed from local resources
 - Traffic reduction to/from the Internet
 - Higher performance? (reduced latency, high BW within CN)
 - Local businesses
 - Technical skills remain in the community
- 
- The background features a faint, light-colored diagram of a community network. It shows several 'MICROCLOUD' nodes, each containing 'cloud resource' icons (servers and laptops). These microclouds are interconnected by a network of lines, with some nodes also connected to 'server' and 'AP' (Access Point) icons. The overall structure represents a decentralized network where local resources are used to provide cloud services.

Cloud Services in Community Networks

Some requirements:

- Hardware: the goal is to use heterogeneous devices in the community cloud
 - Software: FLOSS, developer community behind, mature
 - IaaS (Cloud management platforms)
 - PaaS (Services)
 - SaaS (Applications)
 - Cloud services need to be attractive for users, easy to use, extensible (ecosystem)
- 

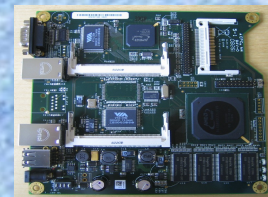
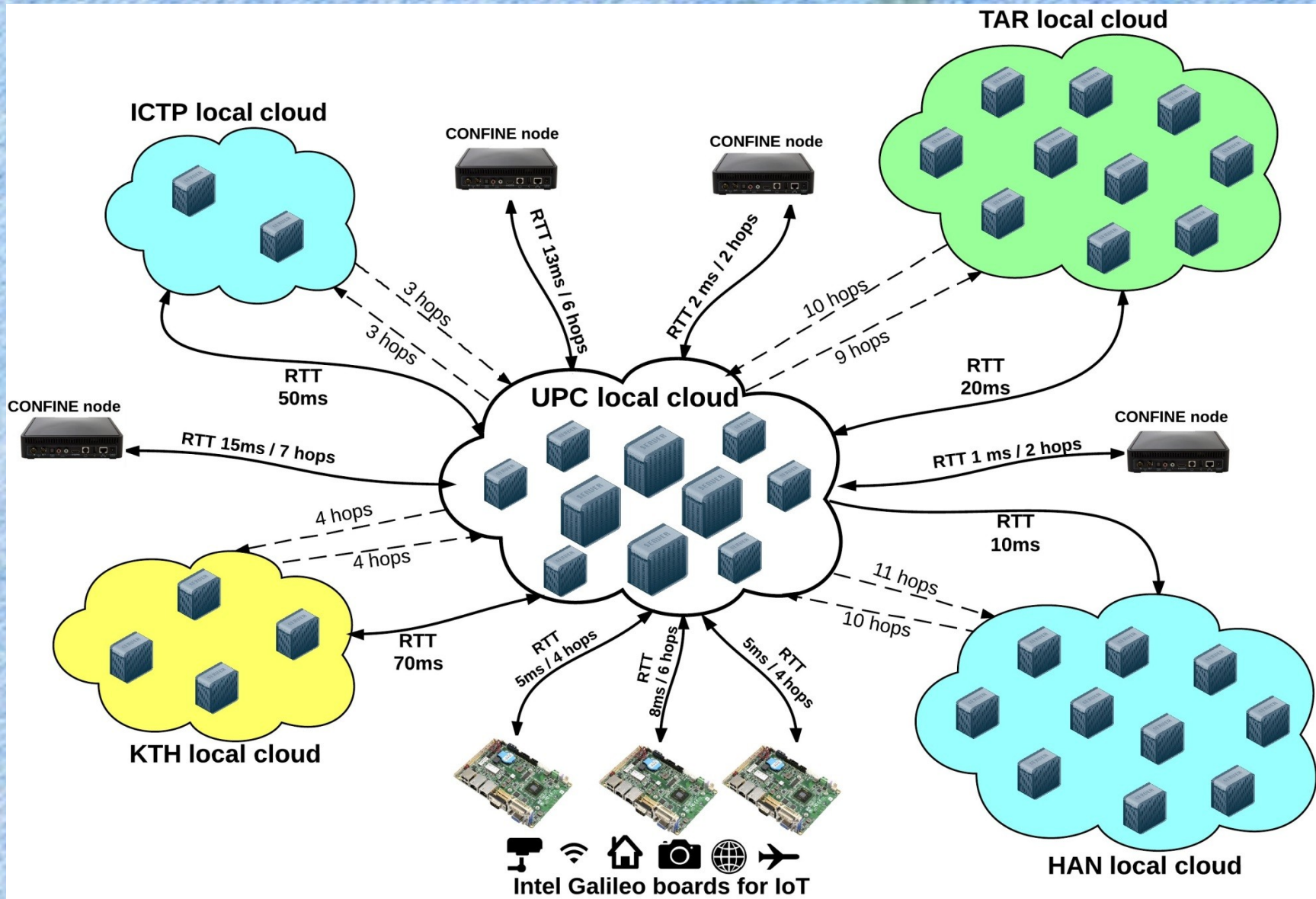
Experimental Research in Community Network Clouds

Community Cloud Deployments

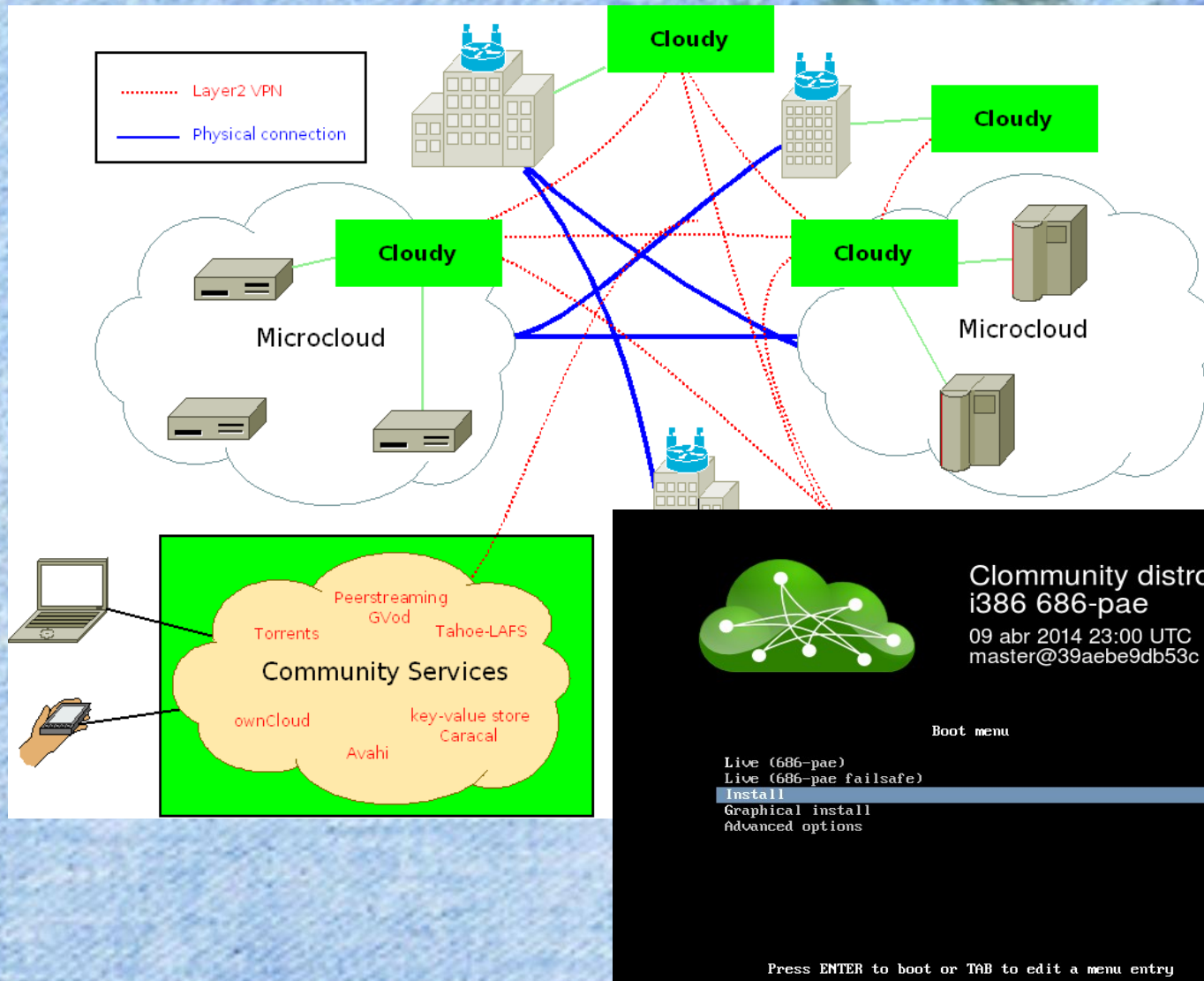
The CLOMMUNITY Project



CLOMMUNITY: Heterogeneous hardware, geographically distributed community clouds



Cloudy distro approach



Cloudy is:

Debian-based Linux distribution

Contains cloud services (Tinc&Avahi) and applications (Tahoe-LAFS, Peerstreamer, VoIP)

Contains some CN-specific tools

To be installed in VM or "bare metal"

Cloudy download <http://repo.clomcommunity-project.eu/images/>

Deployed Cloudy instances

Cloudy demo: <http://84.88.85.42/>

Logout

Cloudy System Language Avahi Clomunity Guifi.net

Login

Cloudy

Login

Username:

Password:

Login

Active services:

tincvpn

Cloudy © 2014, GPLv2 - Developed in the CLOMMUNITY project.

Avahi search

peerstreamer tahoe-lafs tincvpn

Description	Host	IP	Port	Action
TincVPN_System\032\03515	cloudy-db-2.guifi.local	10.139.40.87	665	View
TincVPN_System\032\03523	0000000016c_00a8.guifi.local	10.139.40.51	665	View
TincVPN_System\032\03525	cloudy-db-3.guifi.local	10.139.40.89	665	View
TincVPN_System\032\0352	baal.guifi.local	10.139.40.20	665	View
TincVPN_System\032\03514	cloudydemo.guifi.local	10.139.40.49	665	View
TincVPN_System\032\03511	000000002be_00a2.guifi.local	10.139.40.63	665	View
TincVPN_System\032\03517	0000000016c_0076.guifi.local	10.139.40.15	665	View
TincVPN_System\032\0356	cloudydemo3.guifi.local	10.95.0.18	665	View
TincVPN_System\032\0353	cloudydemo6.guifi.local	10.95.0.15	665	View
TincVPN_System\032\03513	peerstreamer-1.guifi.local	10.139.40.48	665	View
TincVPN_System\032\03518	CloudyKnitt.guifi.local	10.139.40.17	665	View
TincVPN_System\032\0357	0000000016c_00a7.guifi.local	10.139.40.52	665	View
TincVPN_System\032\03510	cloudydemo4.guifi.local	10.95.0.14	665	View
TincVPN_System\032\0354	cloudydemo5.guifi.local	10.95.0.16	665	View
TincVPN_System\032\03521	cloudytest.guifi.local	10.139.40.28	665	View
TincVPN_System\032\03512	cloudydemo7.guifi.local	10.140.224.61	665	View
TincVPN_System\032\03526	cloudydemo8.guifi.local	10.140.224.62	665	View
TincVPN_System\032\03522	0000000016c_00c6.guifi.local	10.1.2.188	665	View

Community cloud services

Avahi Clomunity Guifi.net

- Getinconf
- Peerstreamer
- Tahoe-LAFS
- WebDAV server

Network services

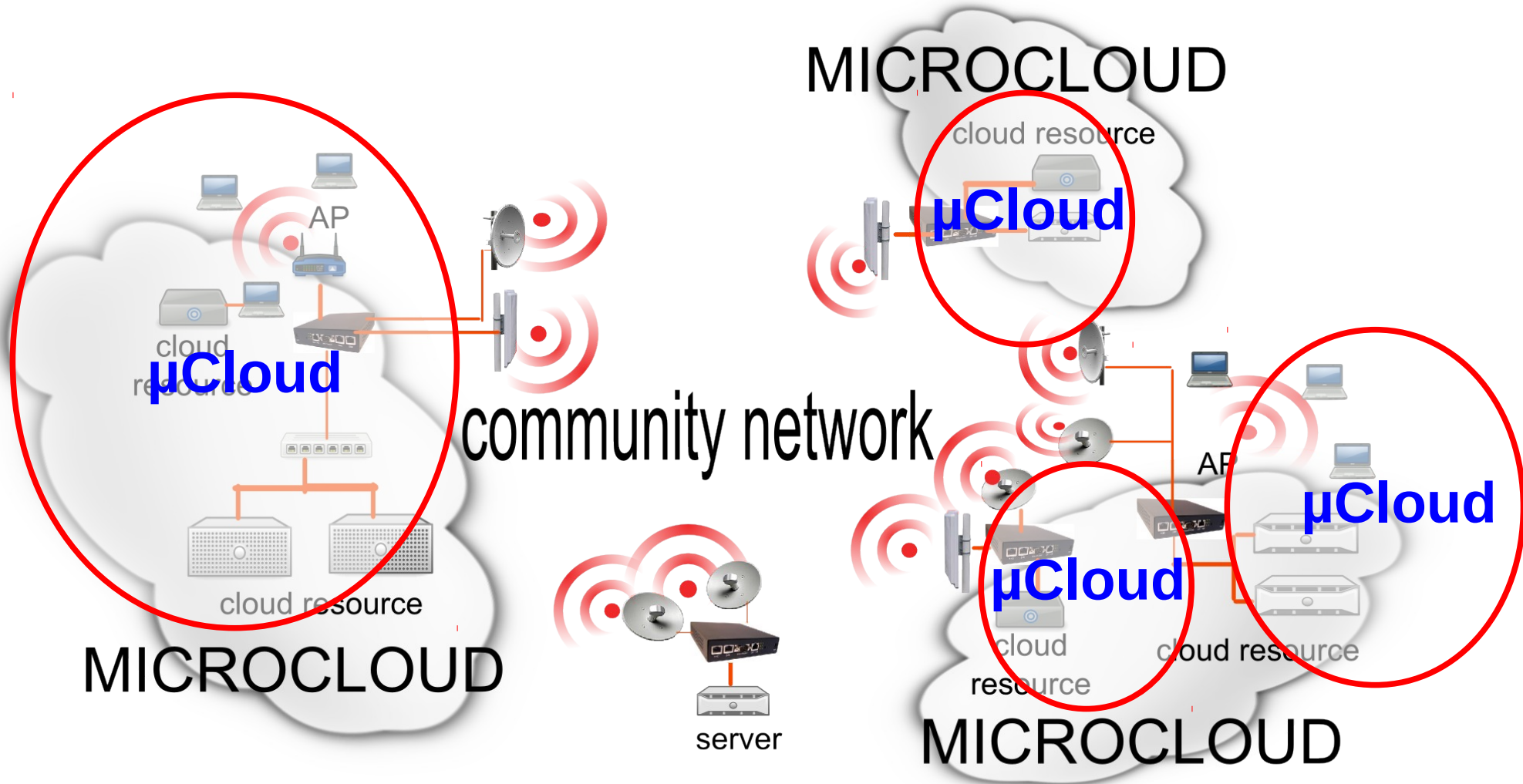
Avahi Clomunity Guifi.net

- Proxy3
- SNPServices
- DNSServices

Some of our current research challenges

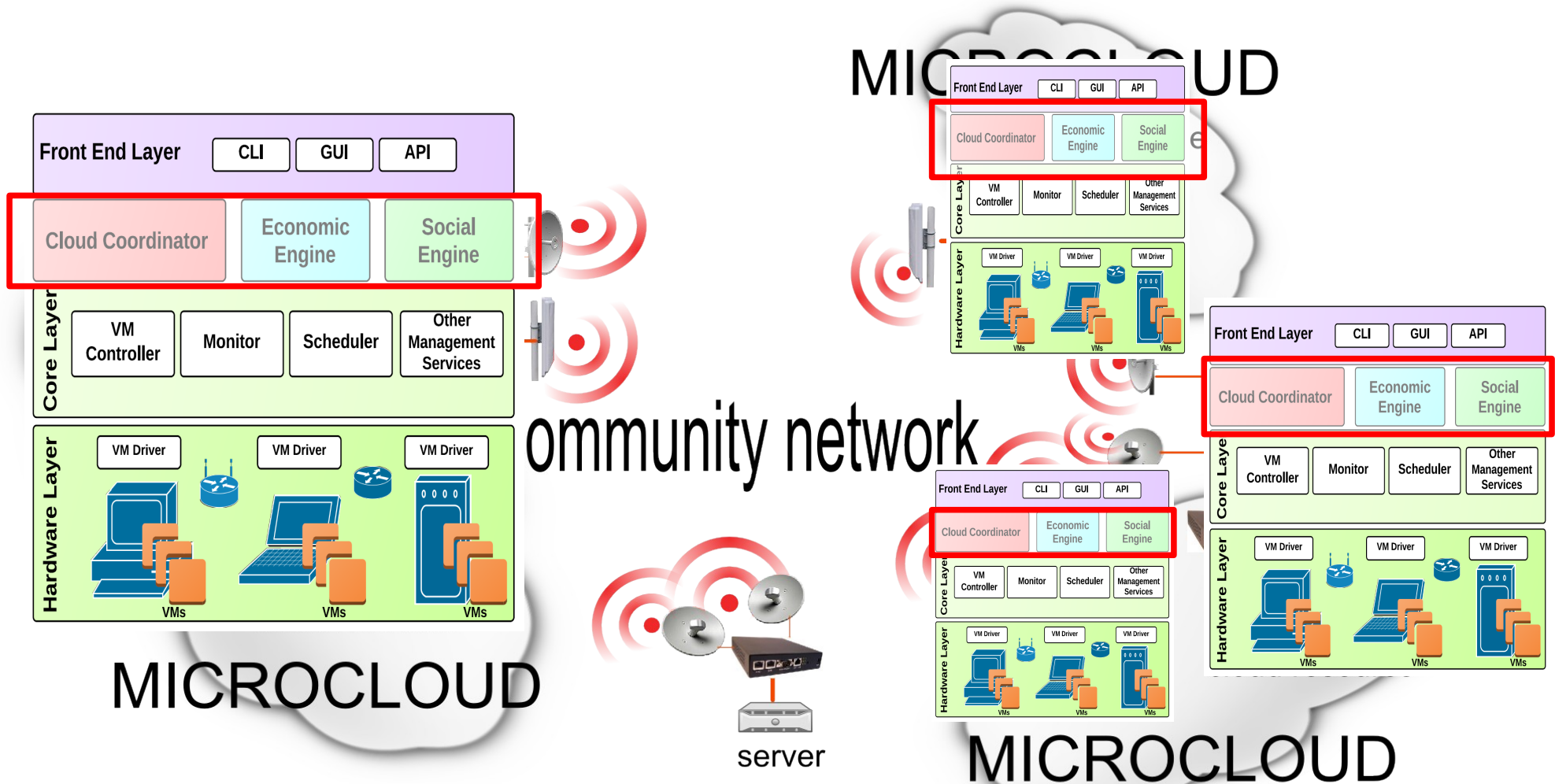


1. Microclouds and Intercloud



2. Community Cloud Management

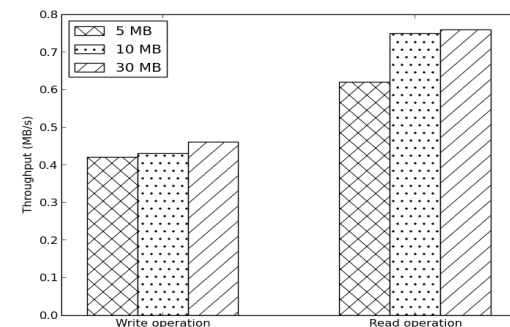
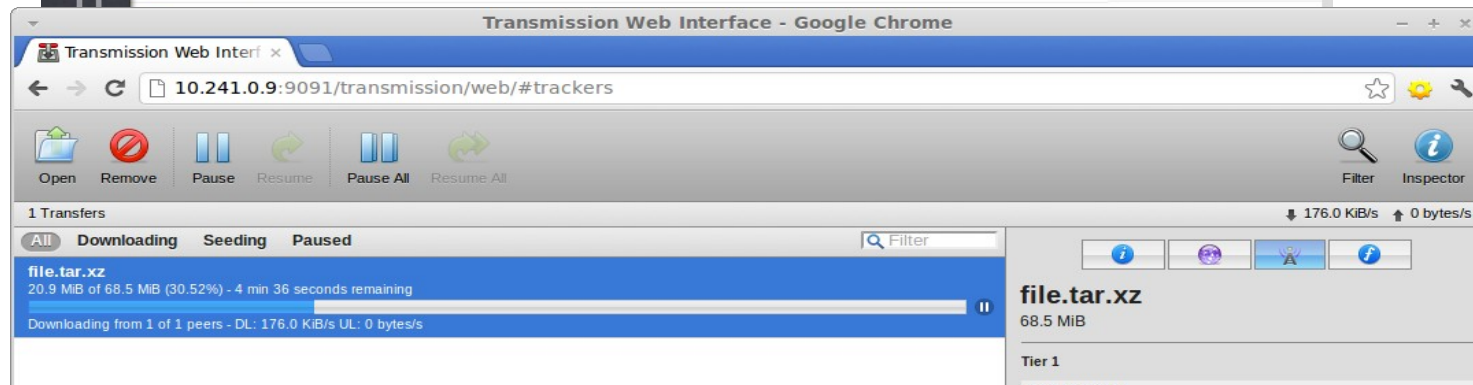
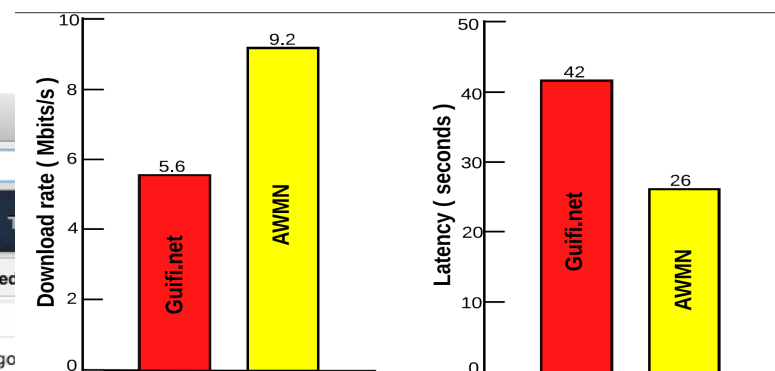
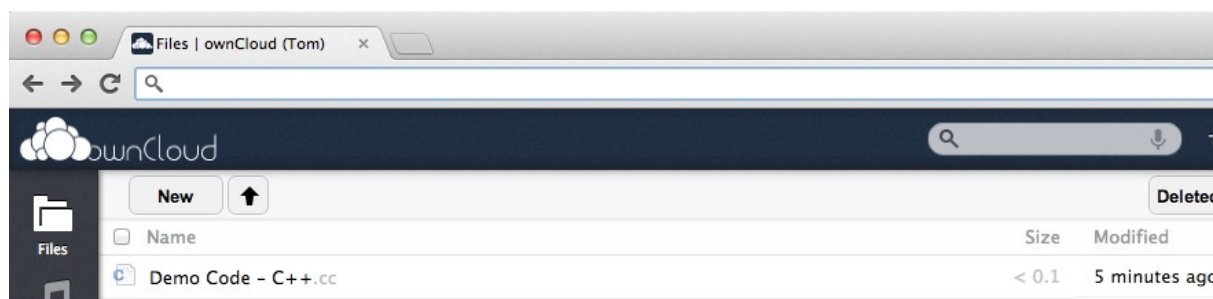
Understand social effort in communities. Design architecture.



3. Performance of cloud-based services in community network clouds

Experimental evaluation of applications deployed in the real community clouds

- ownCloud+Tahoe-LAFS/XtreemFS (storage service)
- BitTorrent (file sharing)
- Avahi-Tinc (cloud support service)
- PeerStreamer (live streaming)



Join Community Network Extensions

1) *Services*

Cloudys worldwide at connected Guifi nodes in Sweden, UK, Colombia, Italy, Portugal, by the **CLOMMUNITY** project



You can easily contribute a new node and services.

2) *Connecting community networks*

Network federation Guifi.net, AWMN, Ninux interchange routes, by the **CONFINE** project

Connecting communities.



3) *New users*

Access for **researchers** to community networks, by the **CONFINE** and **FED4FIRE** project

Register at the portal and start experimenting.

Current Community Network Clouds needs

- attract **researchers** (by relevant challenges)
 - Cloud federations
 - **Socio-technical systems** cloud mgmt platforms
 - **edge clouds**
 - **Cloudy** distribution: open, extensible, customize ...
 - Huge potential for **innovative user-driven cloud-based services**, e.g. IoT.
- attract **users**
 - a critical mass for a self-sustained ecosystem
- attract **companies**
 - business models, success stories
- federate with multiple **stakeholders**
 - be an integrated offer

On-going efforts and approach

- attract **researchers**

1) Workshop on Community Networks and Bottom-up-Broadband (CNBuB)

2) Special Issue on Community Networks

The 1st International Workshop on Community Networks and Bottom-up-Broadband (CNBuB 2012)
Beijing, China, October 8th, 2012
In conjunction with the 9th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2012)

The 3rd International Workshop on Community Networks and Bottom-up-Broadband (CNBuB 2014)
Limassol, Cyprus, October 8th, 2014
In conjunction with the 11th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2014)

The 2nd International Workshop on Community Networks and Bottom-up-Broadband (CNBuB 2013)
London, UK, October 24th, 2013
In conjunction with The 9th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob 2013)

CNBuB 2015?

3) Try including Community* in European Research Agenda

- attract **users**

- initiated, stable services, need help

- attract **companies**

- in very early stage, large effort needed

- federate with multiple **stakeholders**

- in very early stage, need collaborations

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Computer Networks

Special Issue on Community Networks

Community networking is an emerging model for the Future Internet where communities of citizens build, operate and own open IP-based networks, forming a key infrastructure for individual and collective digital participation. Although community-based networks often extend or complement the coverage of networks of commercial ISPs, they differ in several key aspects. There is usually no central authority that is responsible for a precise network planning, a community network grows organically. Support is decentralized and open, provided by the community to the community. The network nodes are often inexpensive off-the-shelf equipment and the network elements exhibit a high degree of heterogeneity in the hardware, software, and capacity. The entire network infrastructure belongs to the users and is shared to build the network. The network is very dynamic: the number of nodes may rapidly grow and change as new members join the network, or when nodes overload or fail. These community networks are usually built with low cost point-to-point wireless links organised in mesh networks, with an increasing presence of optical fibre links.

In these scenarios, the networking and systems research community has the opportunity to contribute with more sustainable, adaptive, scalable, integrated, autonomic solutions for those common traits in community networks.

This special issue aims to collect publications addressing theoretical and practical challenges of community networks and services, including multi-disciplinary contributions that provide insights in the socio-technical-economic understanding of the community network operation and growth.

Topics of Interest

Topics of interest include but are not limited to the following:

1. Wireless mesh network protocols for community networks
2. Wireless MAC and routing protocols for heterogeneous community networks
3. Services and applications in community networks
4. Cross-layer designs and implementation in community networks
5. Hybrid community networks with wireless and optical fibre links
6. Tools for bootstrapping and running community networks
7. Clouds for community networks
8. Interoperation of cloud-based community services
9. Performance modelling and evaluation of community networks and services
10. Quality of service provisioning
11. Quality of experience in community networks

Further Reading

CLOMMUNITY project Web: <http://www.clommunity-project.eu/>

CLOMMUNITY project Wiki: <http://wiki.clommunity-project.eu/>

Cloudy demo: <http://84.88.85.42>

Cloudy Web: <http://cloudy.community>

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

Community-Lab Web: <http://community-lab.net/>

Portal Community-Lab: <http://controller.confine-project.eu>

Research paper: *A case for research with and on community networks*

Bart Braem, Chris Blondia, Christoph Barz, Henning Rogge, Felix Freitag, Leandro Navarro, Joseph Bonicioli, Stavros Papathanasiou, Pau Escrich, Roger Baig Viñas, Aaron L. Kaplan, Axel Neumann, Ivan Vilata i Balaguer, Blaine Tatum, Malcolm Matson, SIGCOMM Computer Communication Review, July 2013.

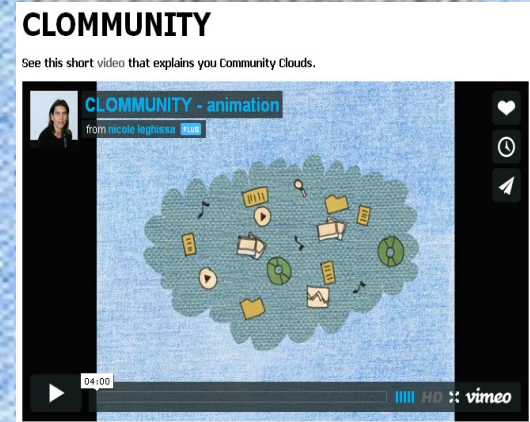
A Community networking Cloud in a box

CLOMMUNITY

clommunity-project.eu

Thank you

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