



ULOOP Consortium

Alcatel-Lucent BellLabs (FR), COFAC/University Lusófona (PT), Huawei Technologies Duesseldorf GmbH (DE), ARIA S.p.A (IT), Caixa Mágica Software (PT), FON Wireless Ltd (ES), Technische Universität Berlin (DE), University of Kent (UK), Université de Genève (CH), Level 7 srlu (IT), University of Urbino (IT).

User-Centric Wireless Local Loop Use Cases and Socio-Economic Aspects

Alessandro Bogliolo (University of Urbino)





Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions



User centrality

- User-generated contents (e.g., Youtube, blogs, ...)
- User-generated applications (e.g., App Store, Android Market)
- User-provided services (e.g., Ask.com)
- User-attention (e.g., online ads)
- User-profiles (e.g., Facebook)
- Personal relationships (social networks)
- Spontaneous community-scale cooperation (p2p, Wi-Fi, ...)

- User-centric networking as an emerging research area



Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions

User-Centric Wireless Local Loop

Motivation

- Wi-Fi as the de-facto Internet access technology
 - Final hop to the user is in its majority wireless
- User-centric wireless architectures on the rise
 - Low-cost, Sharing due to incentives
- New opportunities for access stakeholders
 - New business models
- New opportunities for the end-user
 - Wider roaming, socially-driven services

Main Expected Results

- Low-cost wireless local-loop architecture
- User-centric business models, sustainability
- Analysis of the impact on telecommunications legislation
- Large-scale pilot, for wide demonstration

Project Details

- STREP, FP7 call 5, objective 1.1.1
- Duration: September 2010-August 2013
- Keywords: Dynamic spectrum management; cooperative networking; low-cost wireless architectures; user-centric

Concept and contribution

Concept & Vision

- To assist an autonomic proliferation of user-centric wireless architectures
 - Complementary to the access but user-friendly
- Reduce access network CAPEX/OPEX
 - Take advantage of the “personal hotspot” concept – optimize transmission opportunities
 - In cooperation with access operators - offloading
- Community-driven aspects analysis
 - Expected impact on telecommunications markets and legislation
 - Socio-economic potential

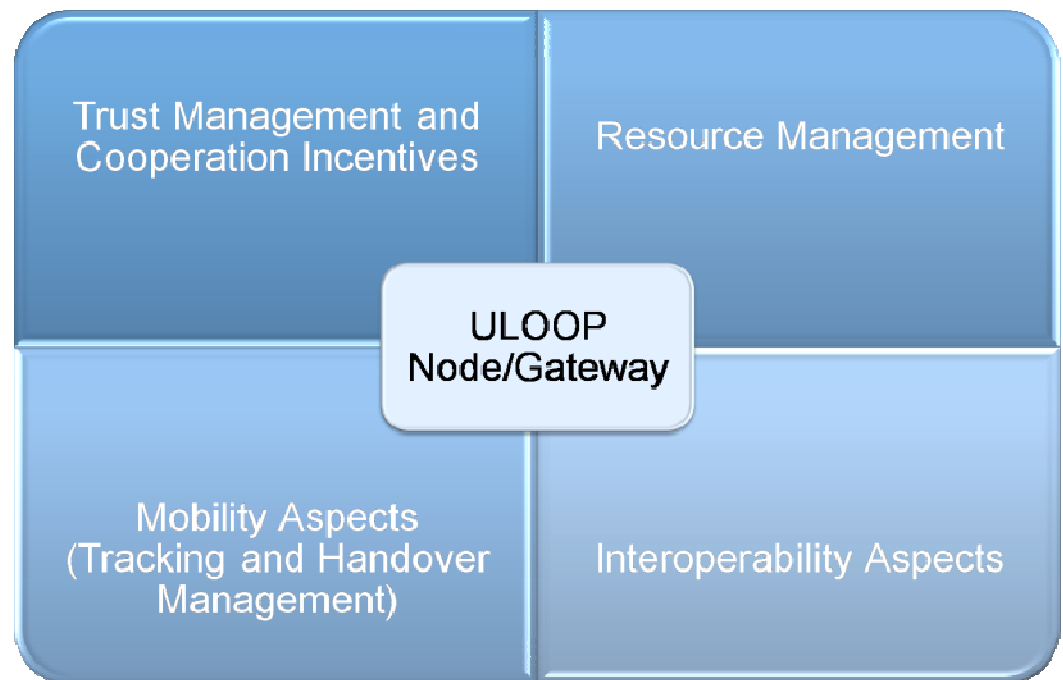
Innovation Contribution

- User as a key component of networking services in future Internet architectures.
 - Regulation implications, new services and business opportunities
- Contributes to a better definition of network neutrality and of future Internet wholesale models.
- Explores cooperative diversity based on OSI Layer 2 and OSI Layer 3 mechanisms
- Combines user-centricity both from the access and from the end-user perspective.
- Trust management as a main aspect to sustain on-the-fly wireless local-loops.

Functionalities

Architectural Aspects

- **ULOOP is about software functionality**
 - One architectural design, several roles
 - ULOOP nodes and gateways
- **Autonomic behavior to boost the rise of user-centric wireless networks**
 - Dynamic trust and resource management
 - Mobility estimation and optimized handovers
 - Cooperation incentives
 - Fully backward compatible to current





Partnership

ULOOP Consortium

Alcatel-Lucent BellLabs (FR)
COFAC/University Lusófona (PT)
Huawei Technologies Duesseldorf GmbH (DE)
ARIA S.p.A (IT)
Caixa Mágica Software (PT)
FON Wireless Ltd (ES)
Technische Universität Berlin (DE)
University of Kent (UK)
Université de Genève (CH)
Level 7 srlu (IT)
University of Urbino (IT)



UNIVERSIDADE LUSÓFONA
Escola de Comunicação,
Artes e Tecnologias da Informação



Caixa Mágica
software



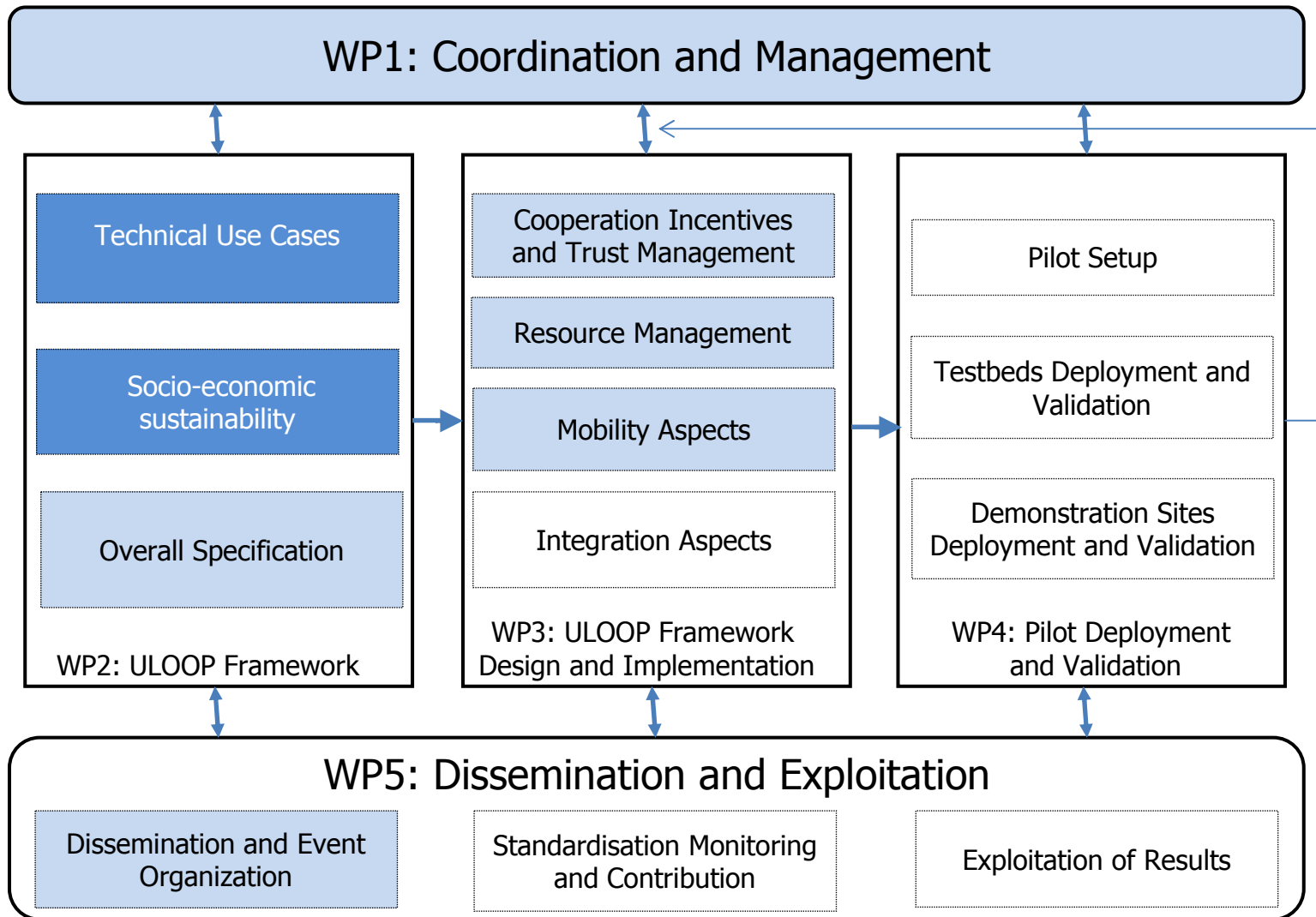
1506
UNIVERSITÀ
DEGLI STUDI
DI URBINO
CARLO BO



UNIVERSITÉ
DE GENÈVE



Organization

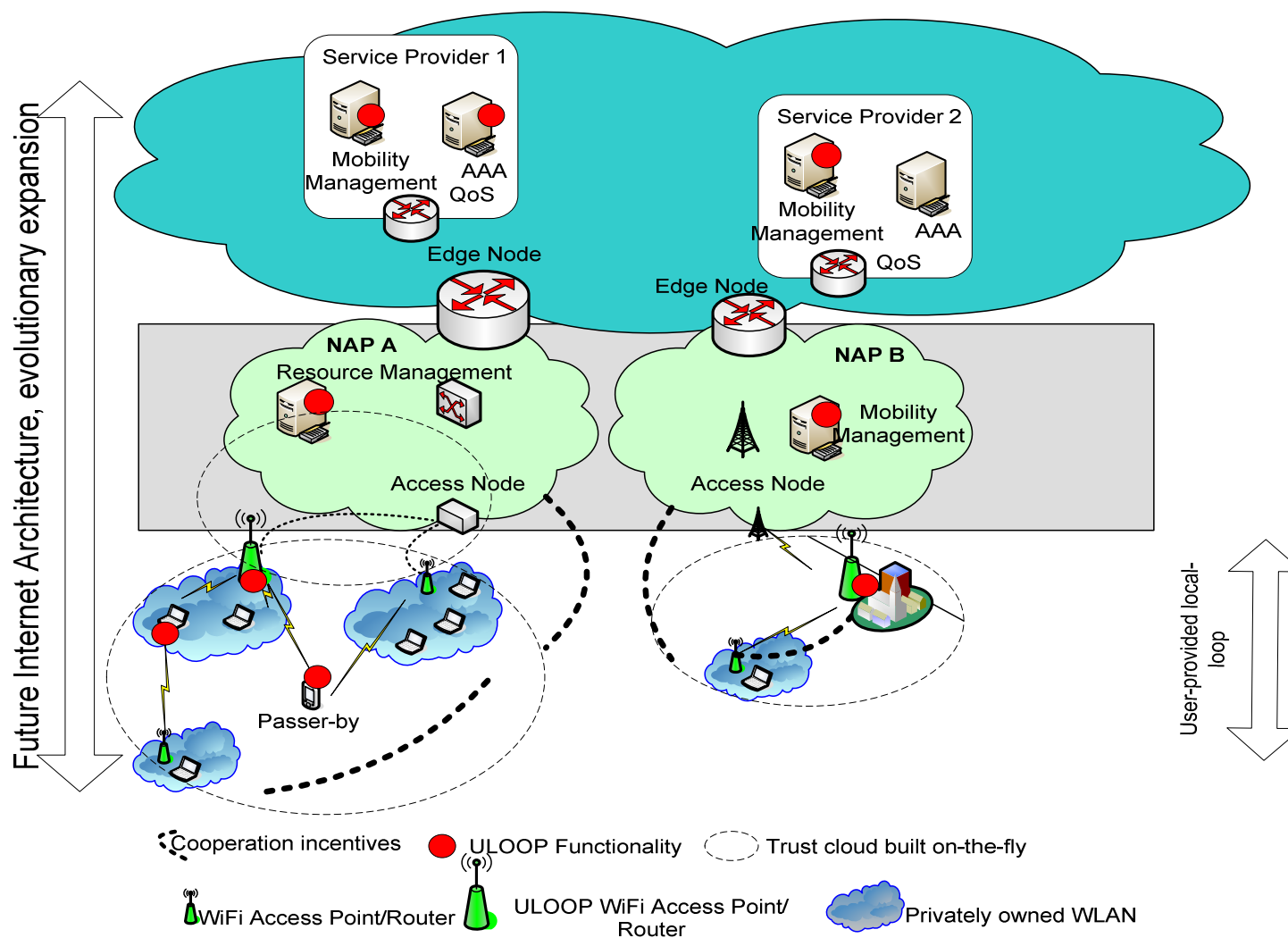




Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions

Reference architecture





Players

- ***ULOOP users*** equipped with ULOOP-enabled devices
- ***End-users***, recipients of the services
- ***Users***, providers of associated services/facilities
- ***Subscribers***, owners of a subscription with an operator, NTP
- ***Consumers***, owners of a subscription out of their main business
- ***Service providers***
- ***Operators***, established service providers

Definitions taken from EC Directives



Services

- ***Real-time sharing***
 - VoIP
 - Video streaming
- ***Asynchronous Sharing***
 - Multimedia (Video on demand, Near Video on Demand)
 - Data sharing based on User Interest
 - Context-aware sharing
- ***Network services***
 - Internet connectivity
 - Authentication, Authorization, and Accounting
 - Resource management
 - Mobility management
 - Trust management



Use Case 1

Expanded coverage and 3G offloading

- ULOOP-enabled devices interact and cooperate to complement broadband access by increasing capillarity/coverage and by providing 3G to ULOOP offloading and resource management
- A few ULOOP-enabled devices act as gateways between the ULOOP cloud and the Internet, used both to enable interactions between remote ULOOP communities and to allow local ULOOP users to gain access to the Internet.

Use Case 1

Representative scenes

- Scene 1.1 – Extended coverage
- Scene 1.2 – 3G offloading
- Scene 1.3 – Intra-ULOOP communication
- Scene 1.4 – Load balancing and adaptation
- Scene 1.5 – Trust-driven access control
- Scene 1.6 – Liability support

Use Case 2

Traceability and collaborative monitoring

- ULOOP functionality as an enabling technology platform for cooperative data gathering and dissemination
- In regular deployments, such data cannot be available, as they are the result of a cooperative effort based on a self-organizing system
- The territorial/local dimension of ULOOP communities is exploited



Use Case 2

Representative scenes

- Scene 2.1 – Collaborative monitoring
- Scene 2.2 – Proximity advertising
- Scene 2.3 – Tourist services
- Scene 2.4 – Attack detection by cooperation
- Scene 2.5 – Local coordination of group activities
- Scene 2.6 – Shared device



Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions

Evaluation instrument

- The impact of ULOOP on International, European, and Country-specific regulations is evaluated by means of an instrument consisting of:
 - A questionnaire on the relevant regulatory aspects
 - A table reporting the relevance of each aspect for the ULOOP use cases
 - A scoring sheet derived from the table
- The instrument can be applied to any regulatory framework

Questionnaire (1)

General principles

- **Q01.** Is network neutrality officially adopted/enforced as a principle?
- **Q02.** Is Internet access officially considered to be a “universal service”?

Electronic communications

- **Q03.** Is there any specific definition/rule for “non-public networks”?
- **Q04.** Is there any requirement of logical/physical separation between public and private networks?
- **Q05.** Is it possible (and under which conditions) for a private network to transport third-party traffic?
- **Q06.** Is it possible (and under which conditions) to interconnect two private networks without going through a public network?

Questionnaire (2)

Operators

- **Q07.** Is there any specific definition of “operator”?
- **Q08.** Is there any authorization required to become an operator?
- **Q09.** Which rights and obligations come from the authorization?

Wi-Fi

- **Q10.** Is there any bureaucracy required to install a Wi-Fi hot spot in a public place?
- **Q11.** Is there any specific rule which applies to the management of public hot spots?
- **Q12.** How is criminal liability distributed between operators (IDP and/or SP) and subscribers?

E-commerce

- **Q13.** Is there any specific rule for electronic commerce?
- **Q14.** Is there any specific type of contract to be applied to exchange or provide electronic services?

4



Relevance grid and early results

	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
Use case 1	M	M	M	E	E	E	M	M	E	M	E	M	M	M
Use case 2			M	E	E	E				M		M	E	E

M=motivating E=enabling

EC	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	+	+	+	0		0	0	0	0			0	0

IT	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	-	-	-	-	-	0	0	0	-	0	-	0	0

ES	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	+	+				0	+	0	+	+	+	0	0

FR	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	+	-	-		+	0	+	0	-	0	+	0	

CH	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	+	+				0	+	0	+	0	0	0	+

FI	Principles		E-communications				Operators			Wi-Fi		E-commerce		
	Q01	Q02	Q03	Q04	Q05	Q06	Q07	Q08	Q09	Q10	Q11	Q12	Q13	Q14
	+	+	+	+	+		0		0	0	-	+	0	0

+ = in agreement - = in contrast 0 = neutral empty = NA



Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions



Methodology

1. Added value of the relevant ULOOP features
2. Mapping of Use-Cases and Scenes on the relevant features
3. Critical mass and penetration requirements



Relevant ULOOP features (1)

- **Resources** (e.g., Internet bandwidth, computational power, battery charge, printers)
 - **Offload** (e.g., traffic from 3G to WiFi, computation from a smart-phone to a PC, ...)
 - **Balance** (e.g., load balancing among ULOOP APs)
 - **Share** (i.e., resource sharing among peers interested both in providing and exploiting resources)
 - **Provide** (i.e., asymmetric provisioning of some kind of resource with non interchangeable provider/consumer)
- **Information** (e.g., Tourist information, advertising, traffic information, opinions, position, ...)
 - **Diffuse** (e.g., diffusion of an alarm, diffusion of an advertisement, ...)
 - **Collect** (e.g., collaborative environmental monitoring)
 - **Sharing** (i.e., information sharing among peers interested both in providing and receiving information, e.g., opinions)
 - **Provide** (i.e., asymmetric provisioning of some piece of information, e.g., positions provided by GPS-equipped devices, tourist information provided by inhabitants, ...)



Relevant ULOOP features (2)

- **Availability** (i.e., enhanced availability of computational resources, Internet connection, services, infos)
 - **Time** (i.e., enhanced availability in time, e.g., enhanced lifetime of battery-operated equipment)
 - **Space** (i.e., enhanced availability in space, e.g., nomadic computation)
 - **Mobility** (i.e., mobility support, e.g., transparent handover)
- **Protection** (e.g., data protection, device protection, ...)
 - **Trust** (i.e., support to individual's decision to interact with a peer, to connect, to grant access to a resource)
 - **Liability** (i.e., capability of making individuals financially and legally responsible for what they do in ULOOP)
 - **Security** (e.g., capability of preventing/detecting/blocking attacks)

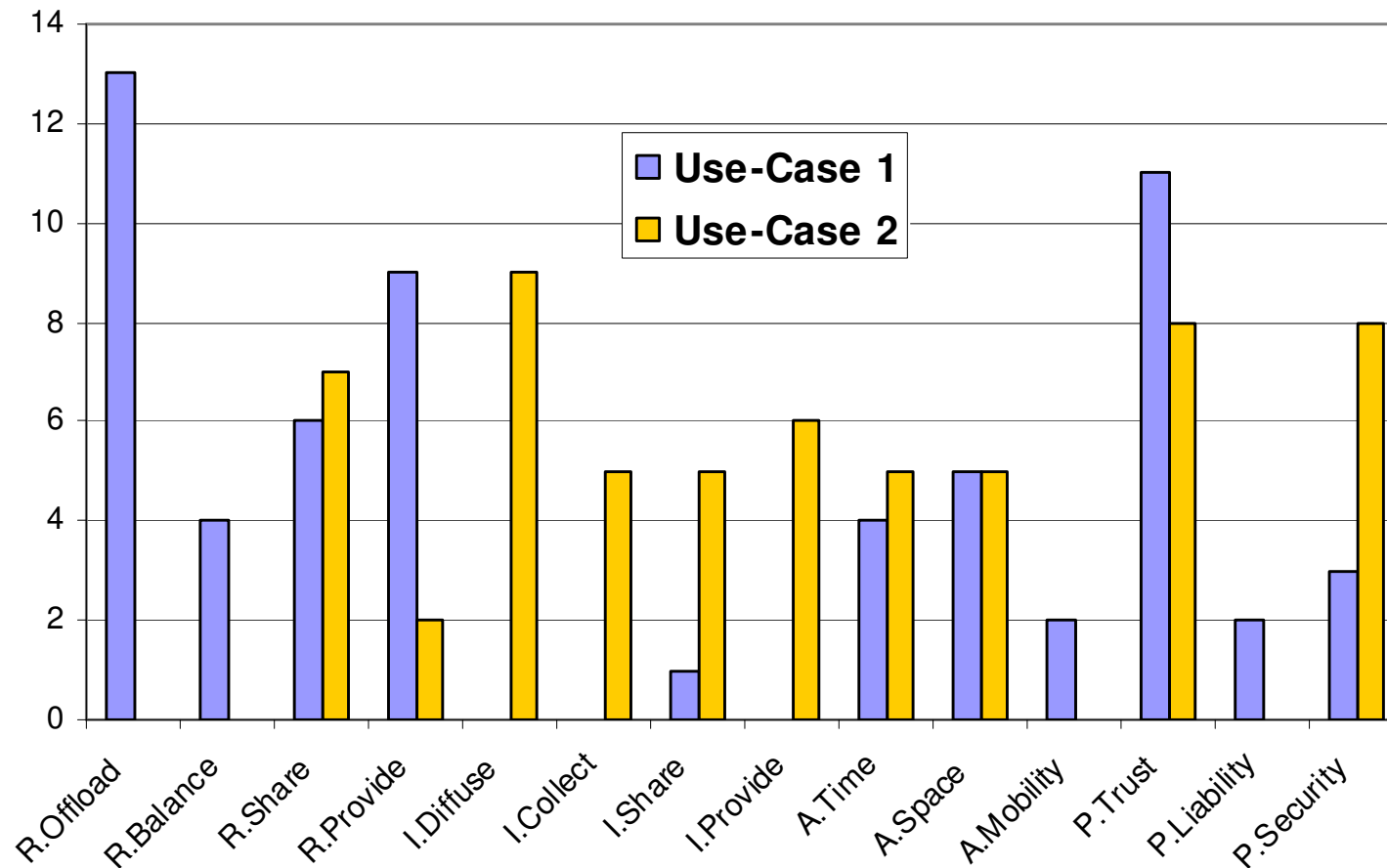
Mapping (1)

	Resources				Information				Availability			Protection		
	Offload	Balance	Share	Provide	Diffuse	Collect	Share	Provide	Time	Space	Mobility	Trust	Liability	Security
1.1	0	0	2	2	0	0	0	0	2	2	1	1	0	0
1.2	7	0	1	1	0	0	0	0	0	0	0	1	0	0
1.3	6	0	2	0	0	0	0	0	0	0	0	2	0	0
1.4	0	4	0	3	0	0	0	0	1	1	1	0	0	0
1.5	0	0	1	1	0	0	1	0	0	1	0	5	0	1
1.6	0	0	0	2	0	0	0	0	1	1	0	2	2	2
Use case 1	13	4	6	9	0	0	1	0	4	5	2	11	2	3

	Resources				Information				Availability			Protection		
	Offload	Balance	Share	Provide	Diffuse	Collect	Share	Provide	Time	Space	Mobility	Trust	Liability	Security
2.1	0	0	0	0	0	4	0	2	1	1	0	2	0	0
2.2	0	0	0	0	6	0	0	2	0	2	0	0	0	0
2.3	0	0	0	0	2	1	2	2	1	1	0	1	0	0
2.4	0	0	0	0	0	0	0	0	0	0	0	3	0	7
2.5	0	0	1	0	1	0	3	0	1	1	0	2	0	1
2.6	0	0	6	2	0	0	0	0	2	0	0	0	0	0
Use case 2	0	0	7	2	9	5	5	6	5	5	0	8	0	8

The value reported in each (*scene, feature*) entry denotes the relevance of that feature for that scene. Weights have been assigned in such a way that the entries in each row sum to 10.

Mapping (2)



Critical mass

		Density		
		Min	Target	Motiv.
Extended coverage	1.1	1	2	2
Offloading	1.2	1	2	2
Intra-community	1.3	2	2	3
Load balancing	1.4	3	3	3
Trust-driven access	1.5	1	2	3
Liability	1.6	1	1	1
<hr/>				
Use case	1	1.5	2	2.333

Density scale

- 1 = 1 ULOOP device
- 2 = 2 ULOOP devices
- 3 = 3 or more ULOOP devices

		Density		
		Min	Target	Motiv.
Monitoring	2.1	1	2	2
Proximity Ads	2.2	1	2	2
Tourist area	2.3	1	2	2
Attack detection	2.4	3	3	3
Coordination	2.5	2	3	3
Device sharing	2.6	1	1	2
<hr/>				
Use case	2	1.5	2.167	2.333

Density scale

- 1 = 1 ULOOP AP
- 2 = 2 ULOOP devices
- 3 = 3 or more ULOOP devices

Minimum, target, and motivational density of ULOOP-enabled devices (as seen from each node) required to support the use cases and their scenes.



Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions

Methodology

- Value chain analysis
- Classification of players based on the benefits/disadvantages they take from ULOOP in each scene
- Envisioning of incentive mechanisms to be put in place in order to compensate for the possible disadvantages or lack of benefits



Classification of players

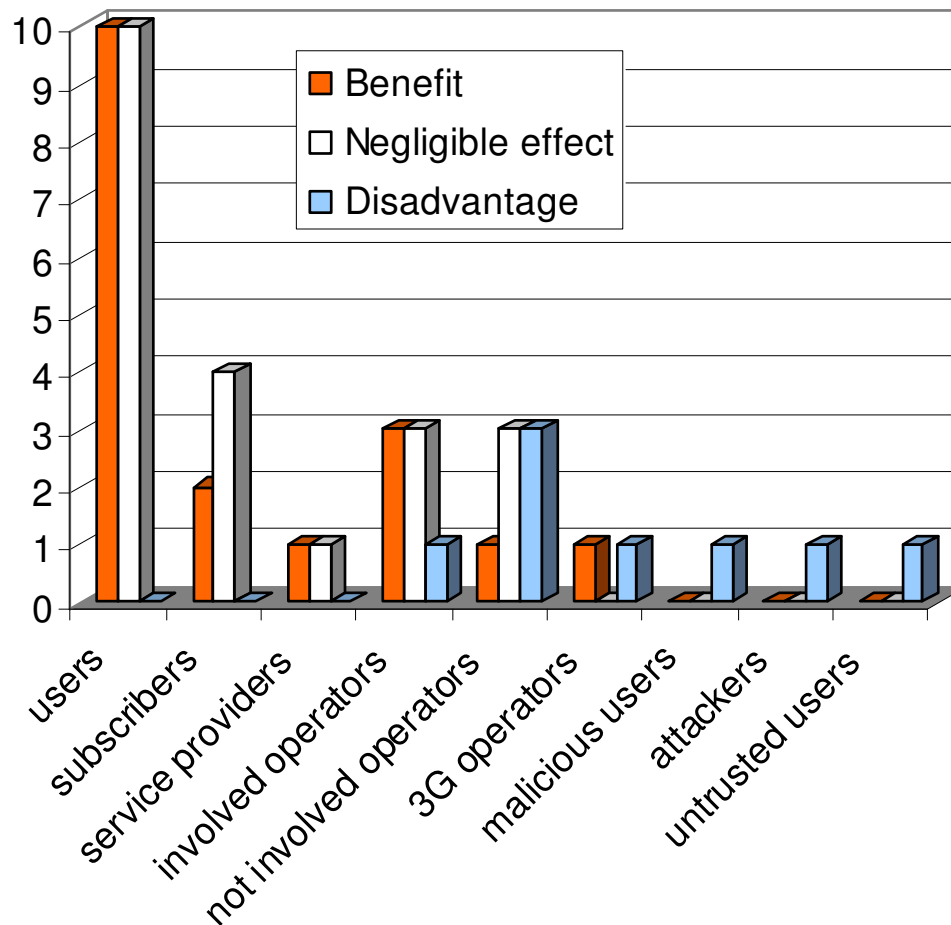
		Benefit	Negligible effect	Disadvantage
Extended coverage	1.1	end-users, involved operators	users, subscribers	not involved operators
Offloading	1.2	end-users, involved operators	users, subscribers	3G operators, not inv. operators
Intra-community	1.3	end-users	users, subscribers	operators
Load balancing	1.4	end-users, 3G operators	users, subscribers, operators	
Trust-driven access	1.5	end-users, users	operators	untrusted users
Liability	1.6	subscribers	users, end-users, operators	malicious users
Monitoring	2.1	community, service providers	end-users, users	
Proximity Ads	2.2	end-users	users	
Tourist area	2.3	end-users	users	
Attack detection	2.4	users, operators, subscribers		malicious users
Coordination	2.5	end-users	users	
Device sharing	2.6	end-users	service provider, users	

Classification of ULOOP players involved in each scene based on the benefits/disadvantages they take from ULOOP in that scene.



Subjective pros/cons balance

Number of scenes in which each player experiences pros or cons



Incentive mechanisms

1. Inherent incentives coming from the benefits directly taken from each scene
2. Involvement in the value chain
3. Role swapping within the ULOOP community
4. Reputation
5. Monetization



Agenda

1. User centricity in networking
2. ULOOP project
3. Use cases
4. Regulatory aspects
5. Socio-economic aspects
6. Cooperation incentives
7. Conclusions

Conclusions

- User-centricity is driving the Internet value chain
- User-provided networking is an emerging research area
- The early results of the ULOOP project provide instruments to evaluate:
 - the impact of user-provided networking on regulatory frameworks
 - its socio-economic benefits
 - the critical mass required to make it work
 - the cooperation incentives required to motivate people and reach the critical mass
- The application of the above analysis to representative use cases demonstrates the disruptive potential of user-centric wireless local loops



Contacts

Web: <http://www.uloop.eu/>

Twitter: #uloopproject

Linkedin: FP7 ULOOP Project (GID: 3760705)

Facebook: <http://www.facebook.com/pages/Uloop-Project/178955125474832>

References

D2.1 Technical Use Cases <http://www.uloop.eu/>

D2.2 Socio-Economic Sustainability Report <http://www.uloop.eu/>





Upcoming events

- **1st ULOOP Industrial Workshop**
27.09.2011, Berlin, Germany
Free entrance, requires registration
- **3rd User-centric Wireless Networking Workshop**
U-NET 2012, Ottawa, Canada
Jointly with ICC 2012

Agendas and details: <http://www.uloop.eu/>

