

The Evolution toward heterogeneous high speed mesh networking

Matteo Cesana

Assistant Professor @ Politecnico di Milano

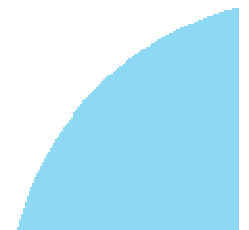
matteo.cesana@polimi.it

<http://antlab.elet.polimi.it>

Co-Founder of MobiMESH

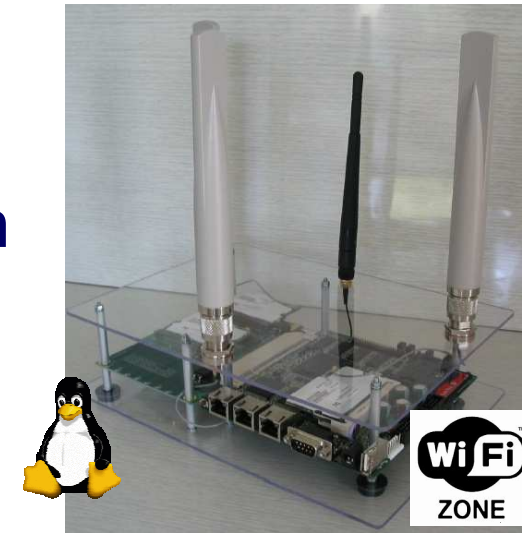
matteo.cesana@mobimesh.it

<http://www.mobimesh.it>

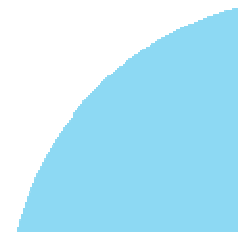
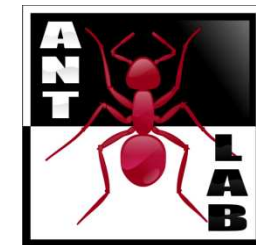


MobiMESH Project

- Started at ANTLab, Politecnico di Milano in 2004
- Initial goal:
 - Create an experimental platform for testing innovative solutions for routing, mobility management, network configuration and management
- Soon coupled with the goal of:
 - Designing advanced mesh networking solutions and products for the market
 - Thanks to the interest and support of VoiSmart

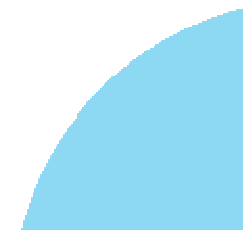


MobiMESH first prototype



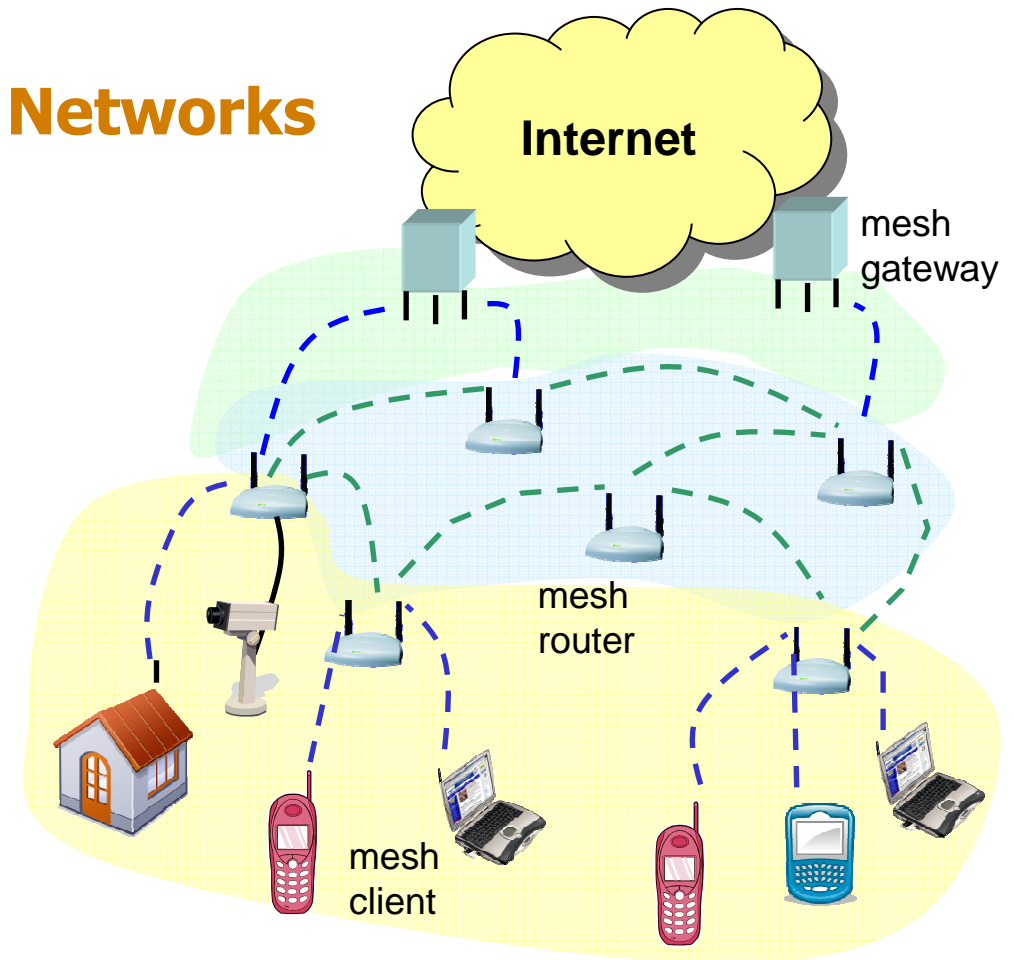
MobiMESH Project

- Mobimesh nowadays sells Wireless Mesh Products/Solutions:
 - Multi-Radio Wireless Routers, Wireless Gateways, CPEs, Indoor Gateways
 - Node automatic configuration
 - Fast adaptive routing
 - Full support of multi-radio multi-frequency operation
 - Frequency aware and quality-aware route selection
 - Mobility management
 - Network management
 - Security



The "true" Wireless Mesh Networks

- Mesh routers (MRs) manage routing automatically based on ad hoc network technologies
- Devices are flexible and self-configuring
- All or a subset of MRs act as access points (Wi-Fi hot spot)
- Some devices are the gateways to the Internet



- Access Link
- Backhaul
- Gateway Link

Applications

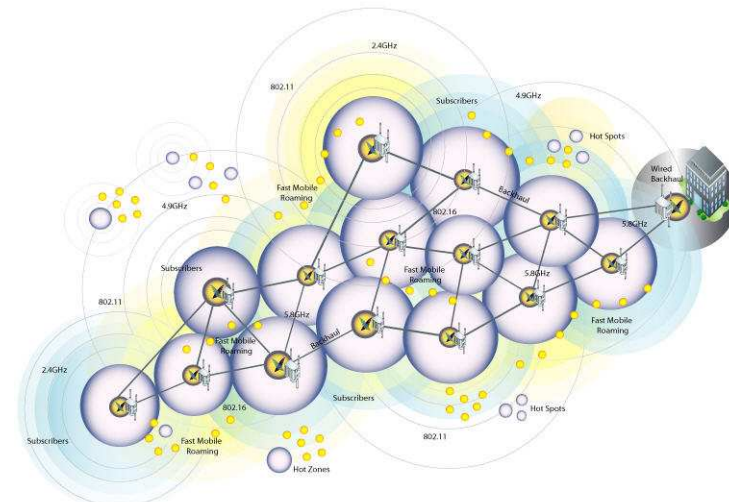
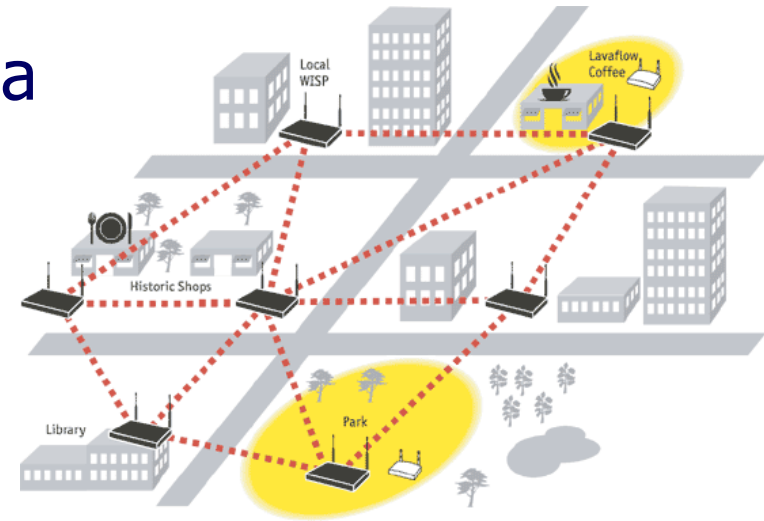
- **Many scenarios where creating a wired infrastructure is not possible or cost effective**
 - Municipal wireless networks
 - Temporary networks
 - Industrial networks
 - Surveillance
 - Environmental monitoring
 - Traffic control



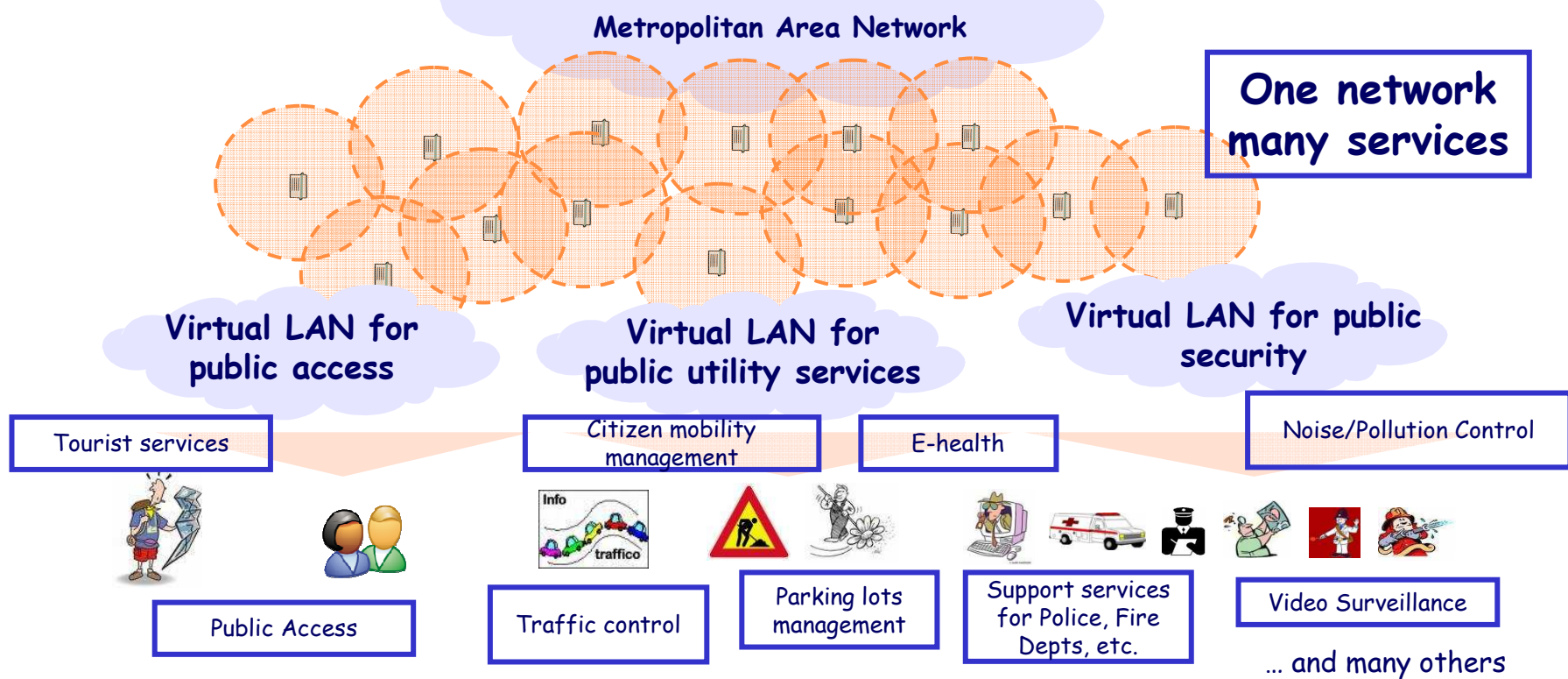
MuniWireless

- A new emerging application area of wireless networks
- Tremendous interest worldwide
- Public utility services as distinguishing feature
- Local governments and authorities as new actors for building up infrastructures and providing services

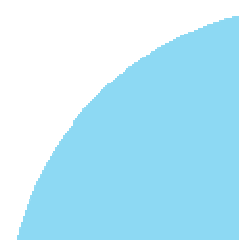
- ➔ Big cities
- ➔ Medium-small cities
- ➔ Solution to digital divide



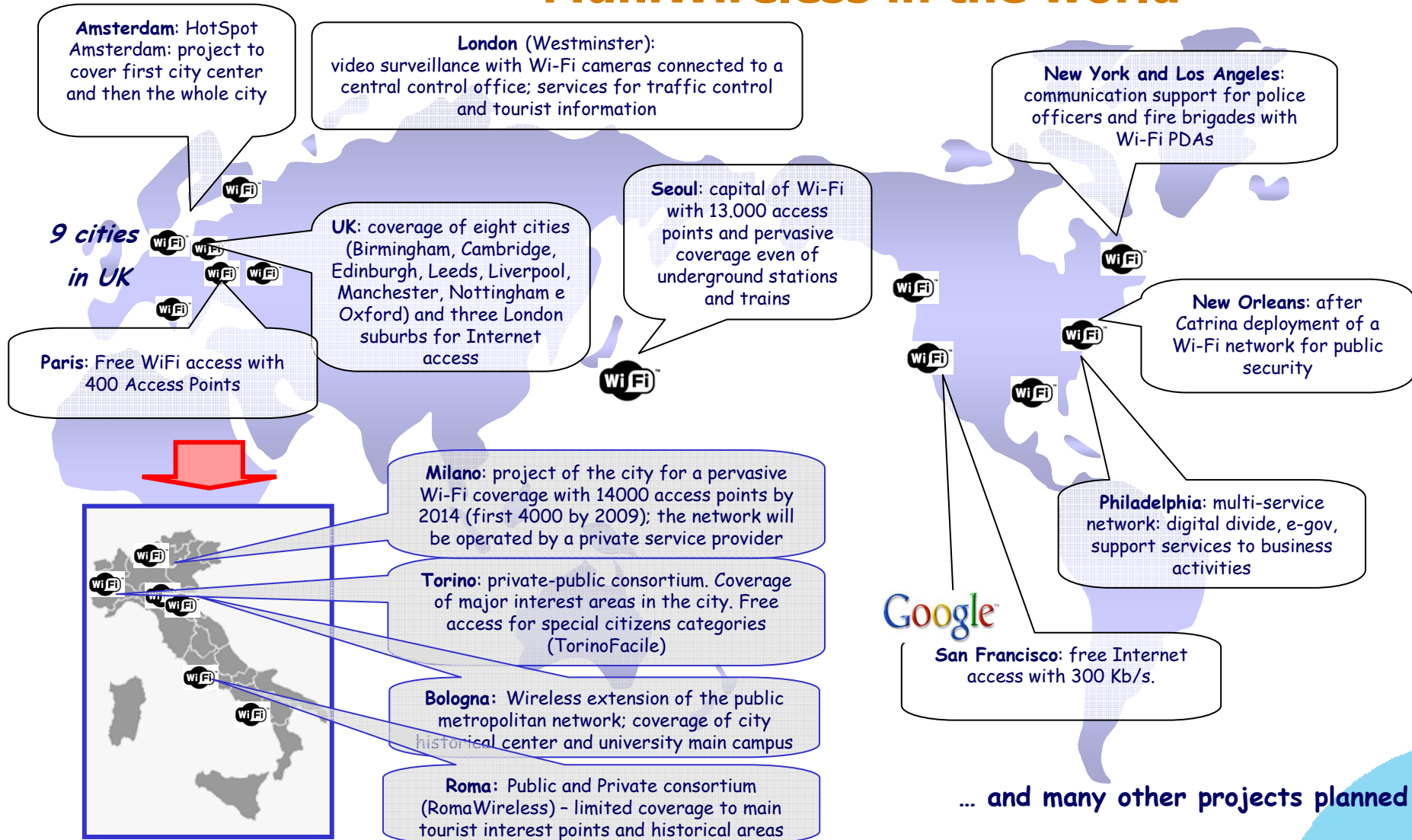
Deployment of a city-wide pervasive wireless network for offering a large set of services to public agencies, local police, fire dept, citizens, shops, local companies, and visitors.



The wireless network as a key enabler for a large set of value-added public-utility services for the community.



MuniWireless in the world



... and many other projects planned

Which technology for MuniWireless?

- ➔ Small cells with high capacity
- Traditional wireless access networks
 - ➔ Small Wi-Fi hotspots with wired infrastructure
 - ☹ In most cities there is no wired infrastructure capillary available to create small cells (100m)
 - ☹ Termination cost of available optical fibers for the connection of access points is not negligible (compared to mesh device cost)
 - ➔ Big cells (UMTS/HSDPA, WiMax)
 - ☹ Small transmission rate per user
- Wireless Mesh Networks (all-wireless)
 - Not only wireless access but also wireless infrastructure
 - The only viable solution in most of the application scenarios
 - Probably the best in all cases under the cost/flexibility perspective



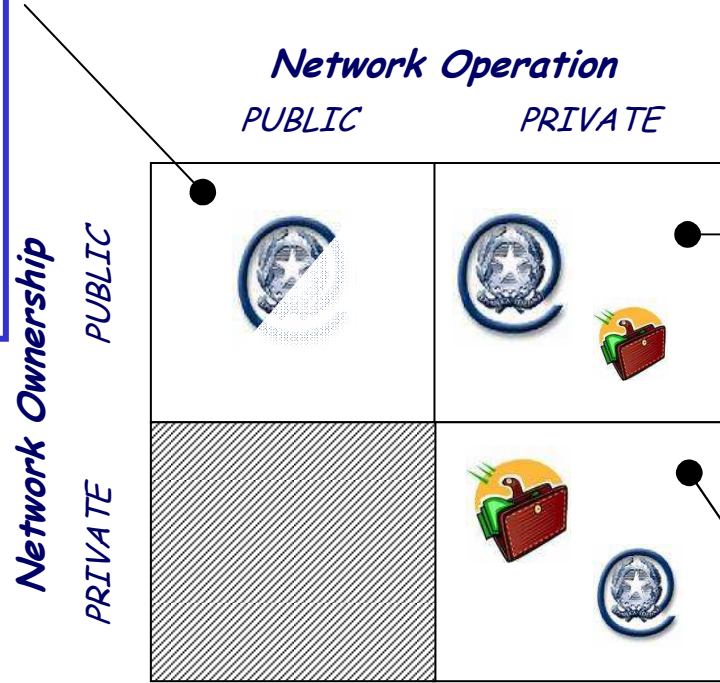
MuniWireless: Business Models

"PUBLIC"

Public Investments
 Savings for the migration of some services to the new wireless infrastructure
 Advanced services for the public administration

"HyBRID"

Governance (public ownership)
 Services to citizens and businesses
 Big investments but sharing of revenues with private service provider
 Possibility of attracting private investments



Offered services

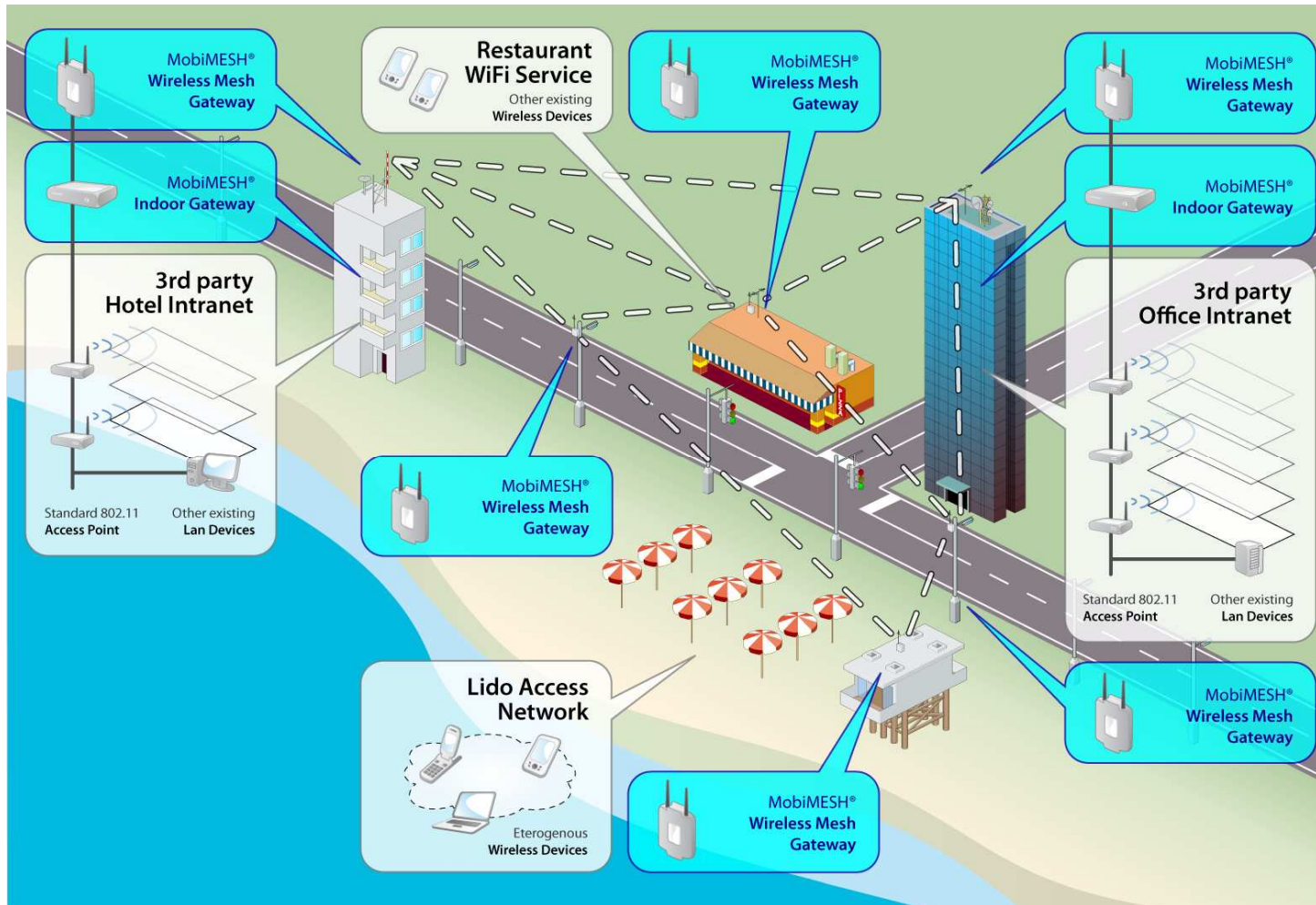
-  Only for public administrations
-  Public services
-  Commercial services

"PRIVATE"

No public money
 Large set of services
 No public control for public utility services

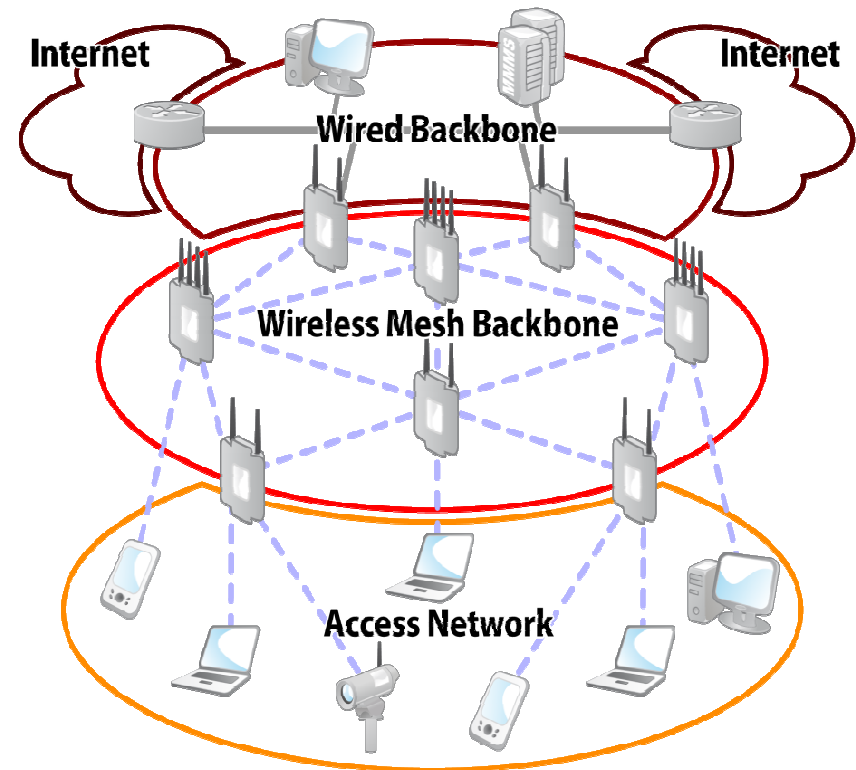
This model was unsuccessful in the first MuniWireless nets in the US

Beyond Nomadic End Users



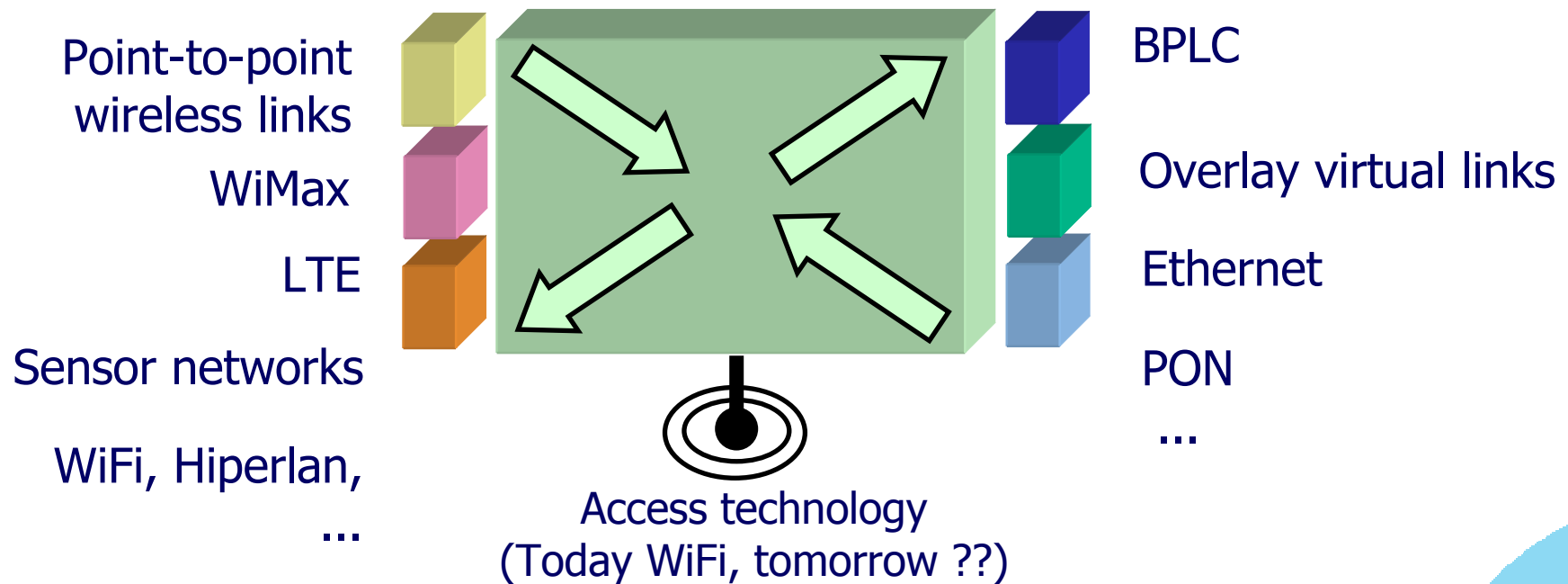
Evolution of WMN beyond WiFi MESH

- The concept of mesh networking is independent on the specific communication technology
- Core idea of creating a flexible and easy to use network able to self-configure and dynamically adapt to operation conditions
- Multi-Technology WMNs likely to be “the” solution
 - Access Network: The “best” technology depends on several issues (terminal availability, frequency assignment policies, etc.)
 - Mesh Backbone: we can use all the communication technologies that allow us to provide high capacity links to the huge number of small access cells



New generation mesh devices

- New mesh devices will be equipped with a large number of different interfaces and will be able to dynamically adapt to the application scenario



What is on the Agenda?

- Technology Push
 - Scalability: optimization of routing and mobility management for very large networks (thousands of nodes)
 - Self-Organization: network (re)-adjustment, Cognitive Networking
 - Improved and scalable mobility support
 - AAA
 - QoS Support and Differentiation
- Business & Political Aspects
 - Spectrum Allocation Policies
 - What about Community Networks? User-Owned Networks
 - Operators to attack the “iPhone Market”



Thanks

Matteo Cesana

Assistant Professor @ Politecnico di Milano

matteo.cesana@polimi.it

<http://antlab.elet.polimi.it>

Co-Founder of MobiMESH

matteo.cesana@mobimesh.it

<http://www.mobimesh.it>

