



WiMAX enabler for Public WiFi Networks

Panel on "Ubiquitous Community Wireless Networks: Reality or pipedream? Opportunities, challenges, pitfalls"

What research studies are telling us?

- 3G/HSPA will be profitable
- The change-over to the next generation networks (LTE / SAE) will take more than 10 years
- Local Loop Unbundling did not bring the expected increase in competition
- FTTH is not expected to be viable for the coming 5 to 10 years
- WLAN developments will provide valuable add-on's to cellular operators
- Internet traffic will double every 1.25 to 2.5 years
- Huge investments in fiber optics will be necessary in the access networks to grow above the bandwidth available with today's ADSL
- The arrival of 3G and 3.5G handsets is strongly influencing the mobile market

Overview of Broadband Wireless Access

- Next wireless revolution, after cellphones (1990s) and WiFi (2000s)
 - Vital element in enabling next-generation quadruple play (voice, video, data and mobility) services
 - Mobile entertainment may be a key application for the future: success of ipod, iphone
- Unlike wired access (copper, coax, fiber), large portion of deployment costs incurred only when a customer signs up for service
 - Avoids underutilizing access infrastructure
 - Service and network operators can increase number of subscribers by exploiting areas not currently served by competitors
 - Ease of deployment may also lead to increased competition among multiple wireless operators – will ultimately drive costs down and benefit consumers

Overview of Broadband Wireless Access (cont.)

- Many countries are poised to exploit new wireless access technologies
 - Multiple standards: WiFi, WiFi mesh, WiMAX, LTE, DVB-H
- Many municipalities now believe that water, sewage systems, roads and wireless broadband are part of a city's essential infrastructure
 - City governments in over 30 countries plan to finance the deployment of WiFi mesh networks
 - Overall aim is to provide ubiquitous Internet access and enhanced public services (utility, emergency response, security, education)
- What are the right wireless access technologies that maximize ROI and tackle today's ever-changing consumer demands?
 - How should these networks be designed and developed with minimum overheads?
 - How do you provide different tiers of service cost-effectively?

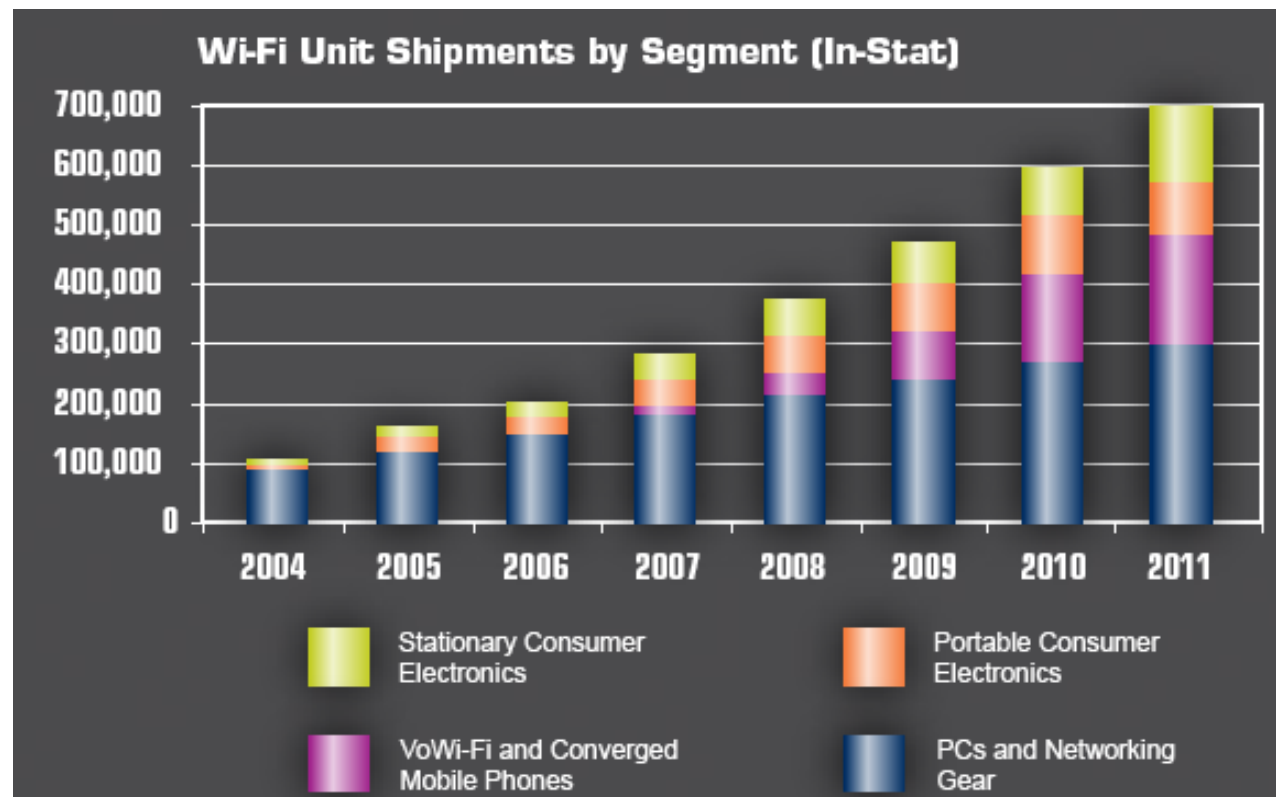


WiFi Technology

- Diverse applications in addition to enterprise WLANs
 - Trains, airplanes, parking/utility meters, sprinklers, RFIDs
 - Dual-mode cellular/WiFi handheld smartphones (iPhone)
- Data rates climbed from 11 to 54 Mbps
 - Data rates for 802.11n reaching 600 Mbps
 - May eventually displace wired Ethernet LANs
- APs, PC cards, chipsets from different vendors interoperate
 - End-users can access different networks without switching cards or laptops
 - WiFi enabled laptops can be used virtually anywhere (from office and public space to home) and in different countries
 - Unified network device management for building large-scale networks, including outdoor mesh networks supporting diverse end-

WiFi Technology (cont.)

- Exciting convergence of wireless communications and computing
 - Intel embeds WiFi in all microprocessor chips
 - Windows OS can search for 802.11 networks automatically
 - Silicon radio versus silicon chip
- iPhone



WiFi Mesh Technology

- Design to transform both enterprise and public networks
- The distinction between WANs and LANs is disappearing for the first time in the history of computer networking
- Routing can be done by both clients and access points
- Multiple connected paths
- Scalable network deployment
- Many cities building citywide WiFi networks
- Zero cost for CPE as many client devices now come with embedded WiFi chipsets
- Municipals provide right of way, makes it even cheaper to deploy
- Many operators failed in building public WiFi networks as they could not identify a sustainable business case
- Success depends largely on strength of private-public partnership



WiMAX Technology

- Specifies wireless metropolitan area network air interface for fixed, portable, mobile broadband wireless access
- Unlike WiFi, allows two-way simultaneous full duplex communications
- Data rate can be lowered if longer operating range is desired
- Essentially a cellular standard
- Key application likely to remain fixed wireless access
 - Initial deployments to focus on fixed wireless connections between enterprise buildings and backhaul operations
 - Also useful in places where there is no infrastructure (in order not to compete with DSL and cable), popular in developing countries
 - Some proprietary fixed wireless access products have enjoyed some measure of commercial success

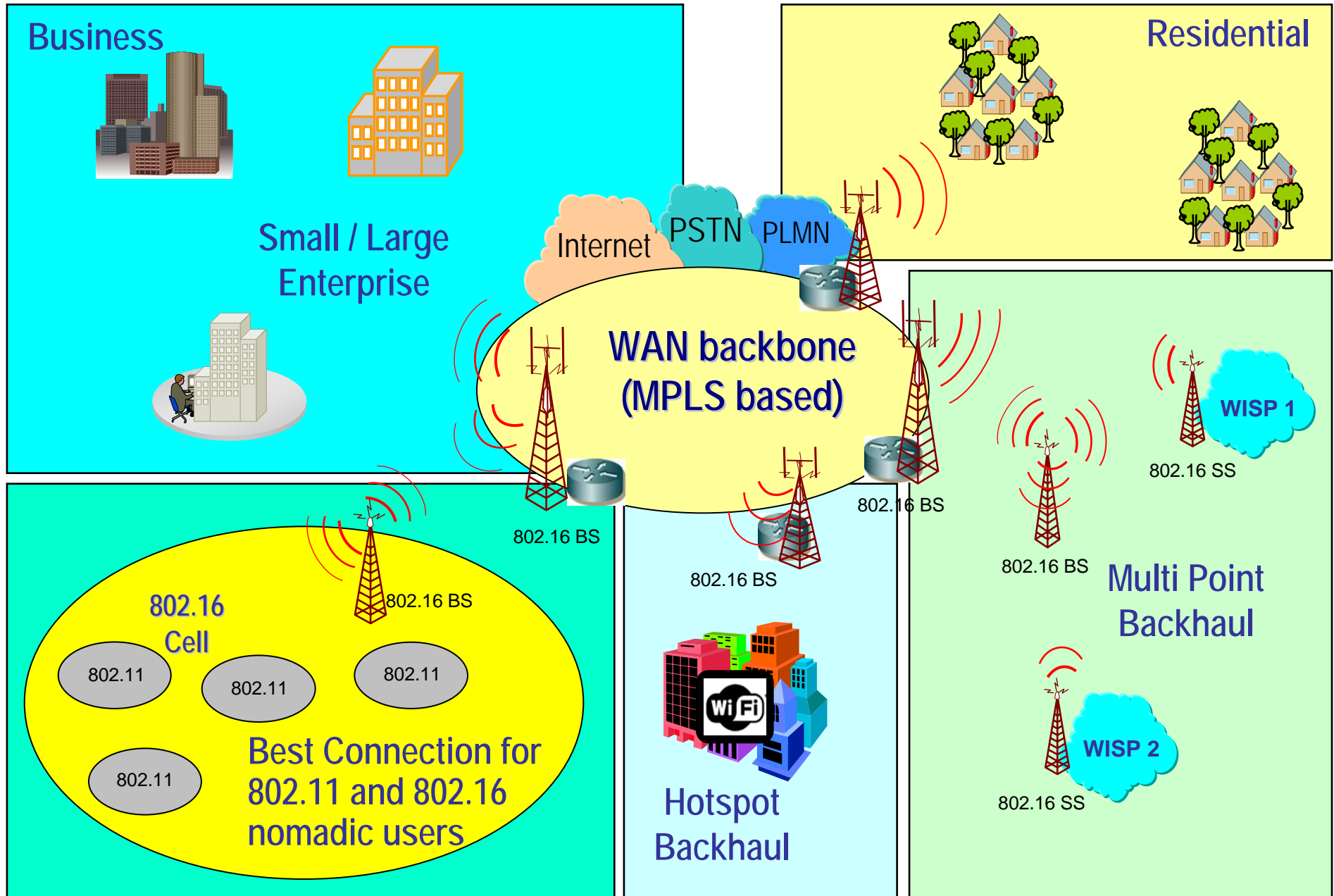


WiMAX Technology (cont.)

- BS serves Subscriber Stations (SSs)
- SS was first stationary (802.16a), then portable (802.16d) and in the end will be mobile (802.16e)
- Multiple services, with different QoS priority, simultaneously
- Uncertainty over viability of 802.16 for residential access
 - Strong emergence of outdoor municipal 802.11 mesh networks has clouded choices for wireless residential access
- Business model for 802.11e still unclear
 - Likely to compete more directly with 3G/HSPA cellular than WiFi
 - Cellular has strong existing subscriber base and incremental network evolution that facilitates subscriber upgrades
- WiMAX needs new infrastructure and new customers



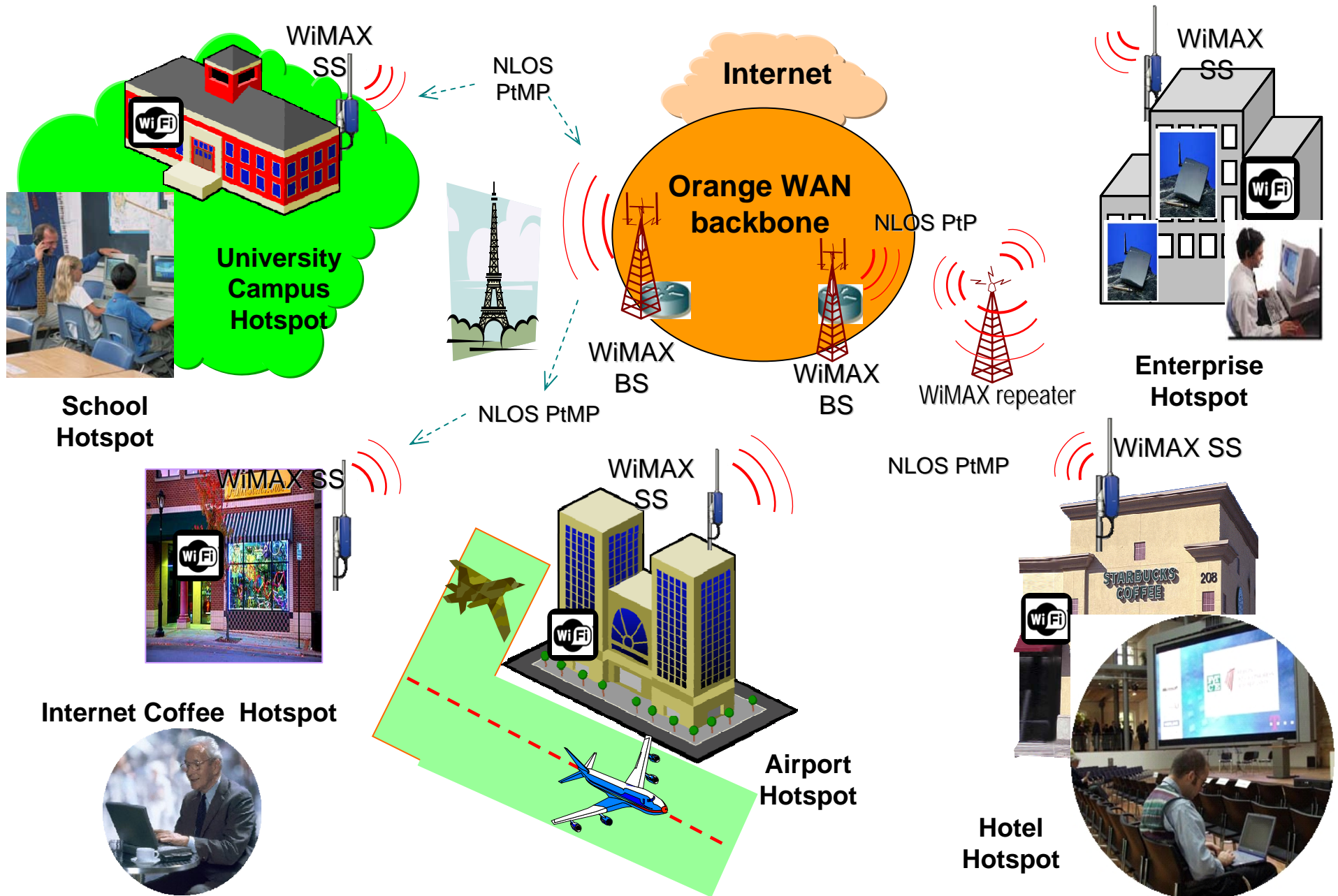
WiMAX Usage Models



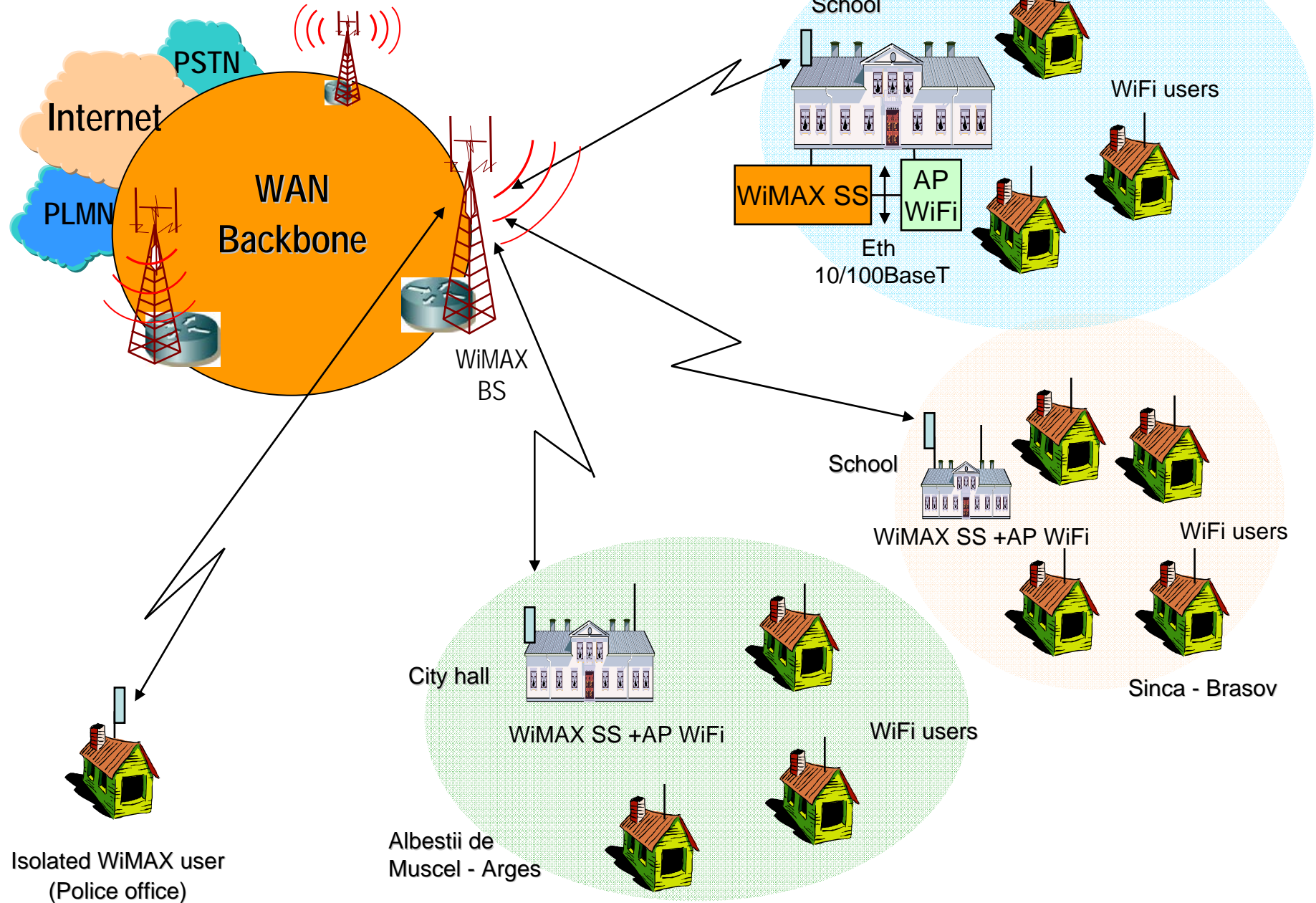
Combo WiMAX – WiFi

- Can be considered a concatenation of multiple hotspots in access side backhauled by a cellular WiMAX 802.16d network
- Fixed WiMAX – WiFi access points typically mounted on rooftop of homeowner or on streetlights or telephone poles
 - Creates small wireless coverage area called “hop”, each hop can serve a number of mobile wireless clients or wired clients within a home network
 - Topologies based on cellular WiMAX roll-out used as enabler for dense public WiFi hotspots
- There is also an optional mesh mode inside WiMAX standard

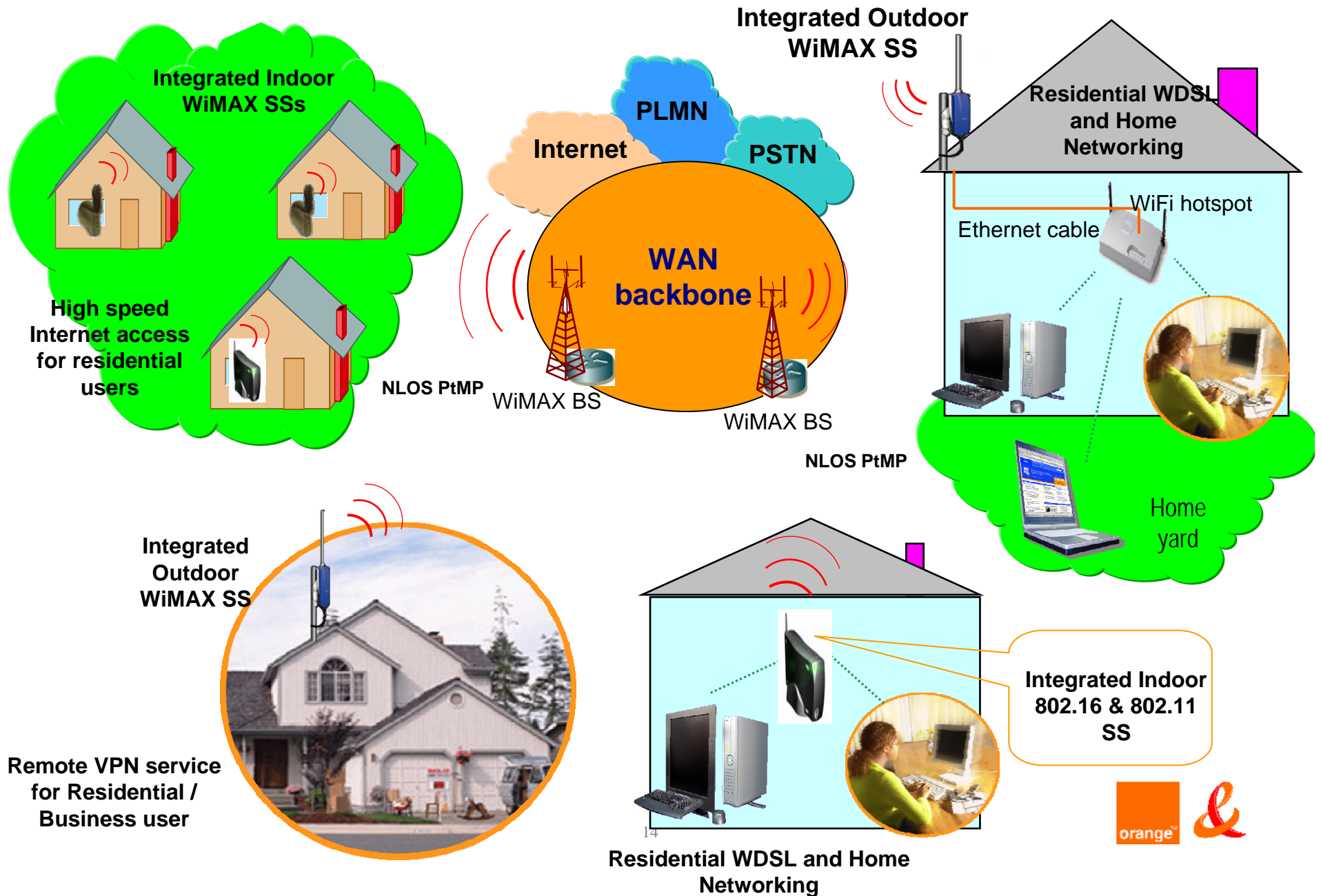
Public Hotspot Usage Model



Rural Usage Model



Community Usage Model



Combo HSPA – WiFi



- Can be considered a concatenation of multiple hotspots in access side backhauled by a cellular 3G/HSPA network
- with the HSPA box, enjoy the 3G+ benefits with immediate Broadband Acces and Voice Telephony Service at home or at work

50 kbps average usage per home user and is increasing => 16.2 GB/year/user for regular consumer usage profile

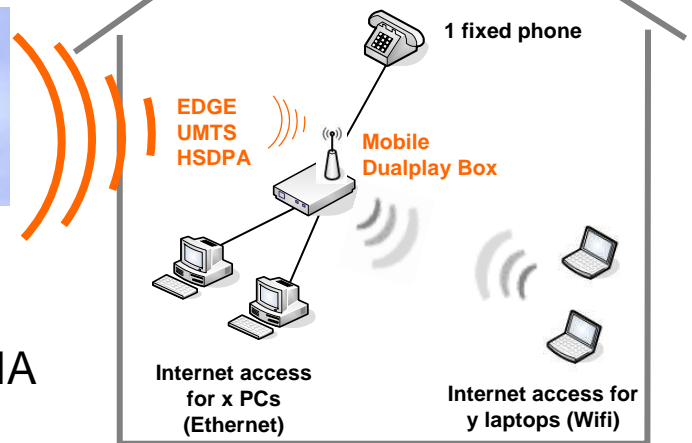
Voice :

- Voice transport through GSM or 3G
- Re-use of fixed analogue phone
- Non geographical fixed phone number
- Fixed tarif plan

Data :

- BB up to 7.2 Mbps DL / 1.46 Mbps UL
- Enhanced indoor performance as compared to PCMCIA card or USB modem
- Possibility to connect several PCs through WiFi or Ethernet
- "Take away" possibility for data service only

3G/HSPA Mobile network

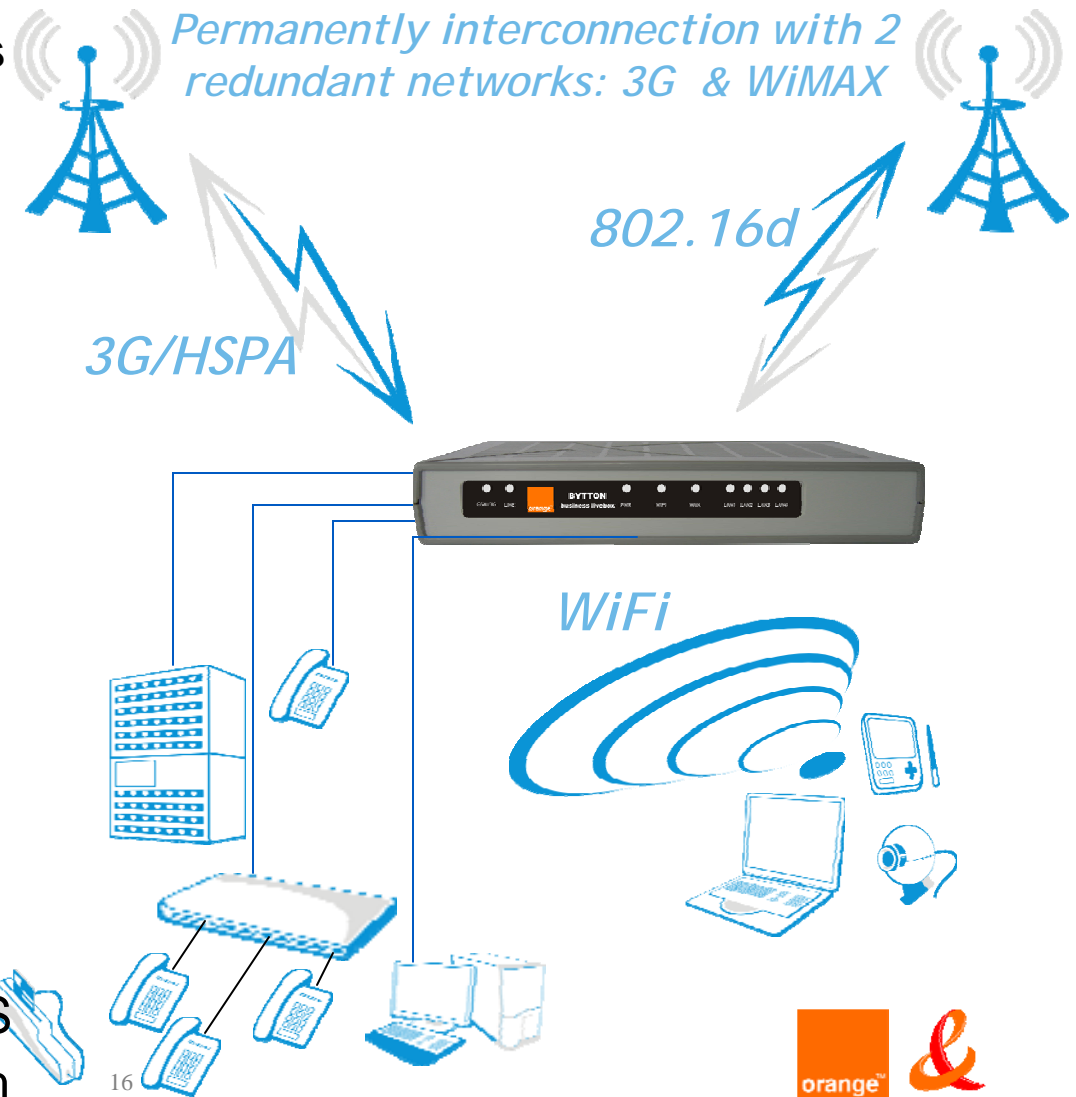


Home or Office

Combo WiMAX – HSPA – WiFi

customer benefits and advantages

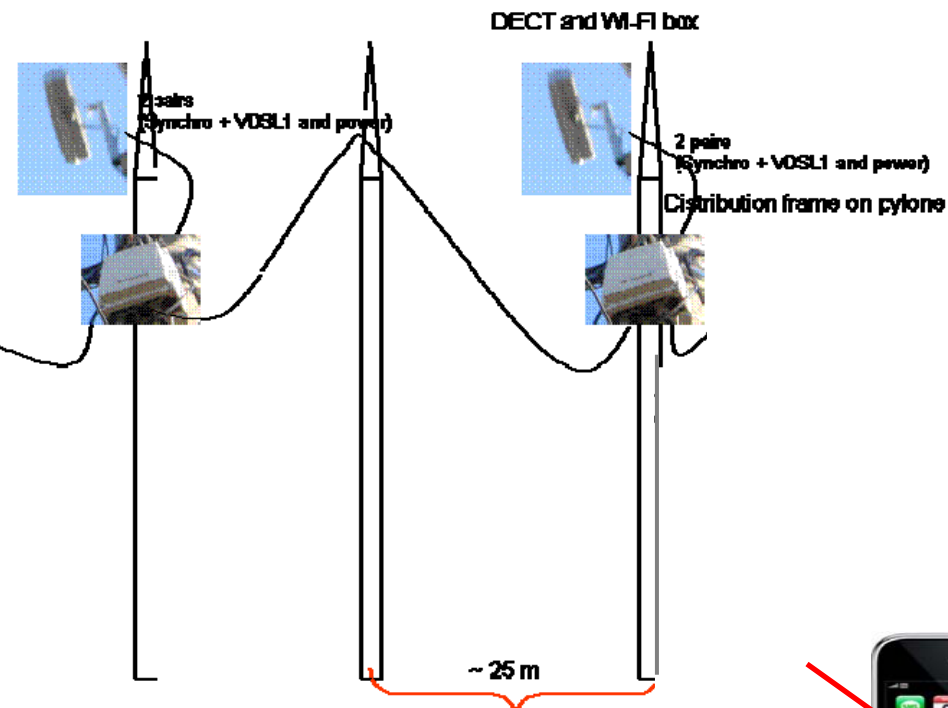
- The solution assures IP VPN back-up over the Wireless Networks with only one Service Provider
- The back-up is transparent to the customer
- The number of the needed devices is reduced so no overhead in administration
- The customer can use the WiFi access without the need of an additional equipment
- The customer can use the 3G-CS voice-channel of business kit with his existing PBX



Combo DECT – WiFi – FO

- Can be considered a concatenation of multiple hotspots backhauled by a optical fiber metropolitan network
- Patent for SWAN = Smart Wireless Access Network

Can be observed on Cluj
Napoca streetlights



Unfortunately it is not a free network !



Ubiquitous Community Wireless Networks: Facts and Open Issues ...

- Increasing deregulation of radio spectrum can potentially lead to unlimited wireless bandwidth: spectrum can be used and reused more efficiently and co-operatively by smart devices
- Spectrum management critical, device must learn when to operate and when to interrupt service specially in case of unlicensed
- WiMAX will complement WiFi and 3G systems creating a complete fixed – mobile convergent WAN-MAN-LAN solution
- 802.11b/g drive demand for 802.16d
- The success in sustaining the BB revolution as it moves from dial-up to truly high speed has to be supported by concentrated effort and partnership among government, regulatory bodies and business leaders
- There is no “best” technology, the solution must be optimized for the Platform and the Usage Model
- Over 50% of backbone Internet traffic now start and end with wireless

Ubiquitous Community Wireless Networks: Facts and Open Issues ...

- P2P file sharing accounts for over 80% of Internet backbone traffic
- P2P voice applications such as Skype are challenging traditional VoIP
 - Skype captured a significant portion of international voice calling: 2 million users first 3 months, 1 million simultaneous subscribers 1 year later
 - Wireless Skype now emerging: partnered Boingo to provide voice over WiFi service for 18,000 hotspots
 - Skype now provides video support
 - Countries considering regulating VoIP but Skype remains unregulated
- TV moved from wireless to wired environment while computer networks and Internet access are moving in the opposite direction
- Supporting QoS provisioning may not necessarily lead to better service for all users of the access network
 - For instance, if some users start prioritizing the packets, then users with no prioritization will suffer in performance even with a BB connection
- Pricing is critical: Skype QoS can be terrible at times but many people

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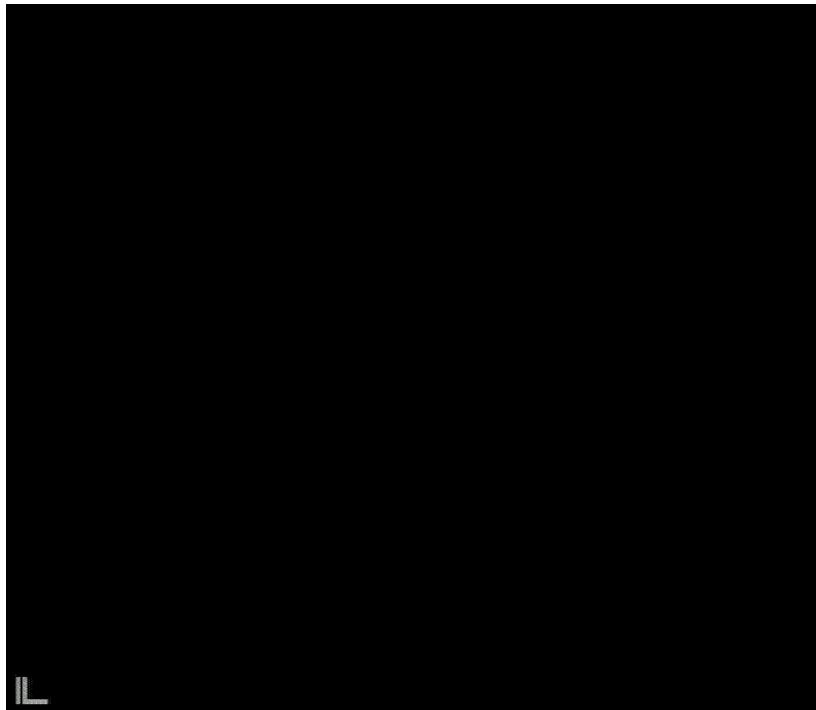
Tour de France

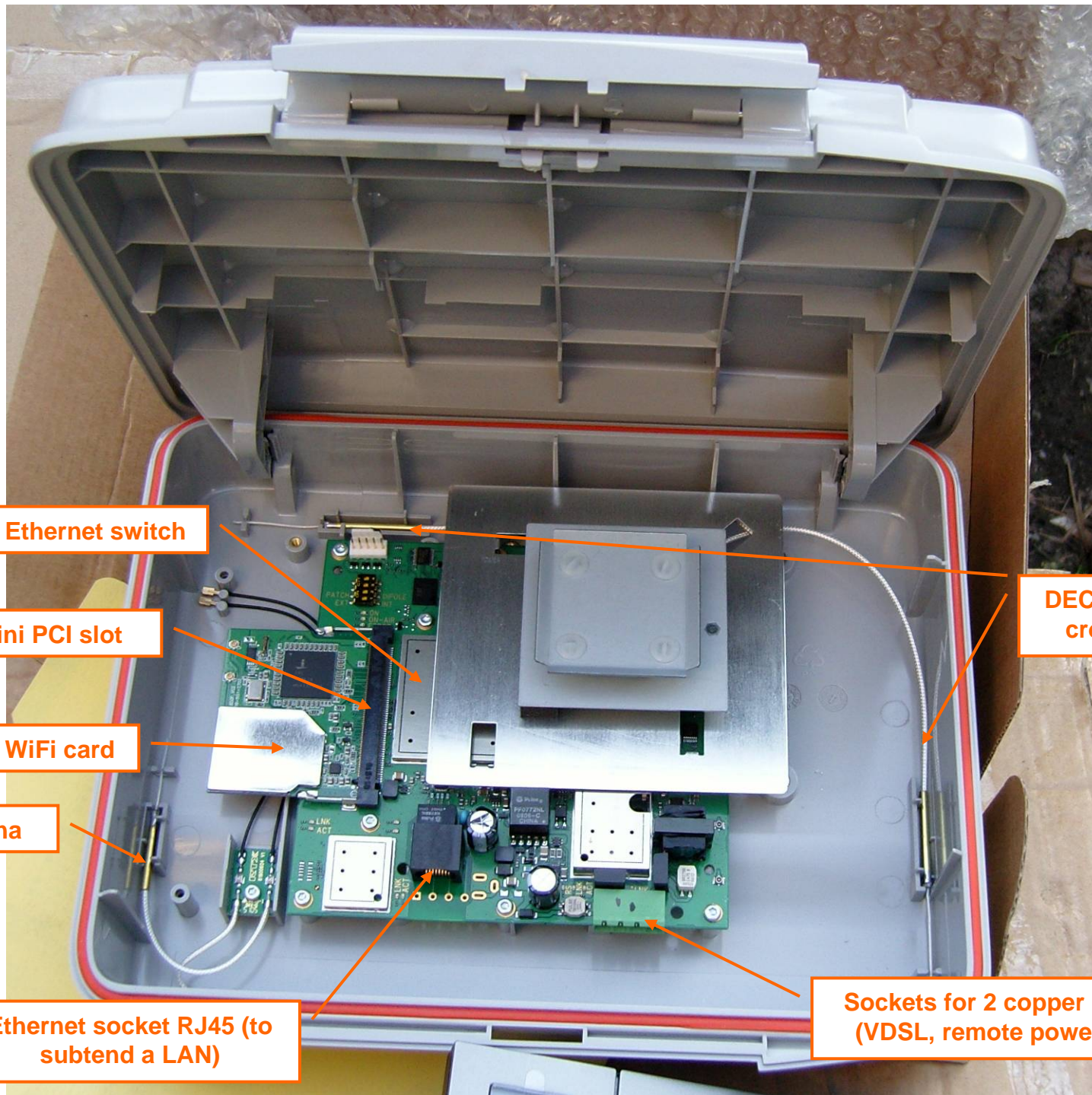


Fixed – WiMAX as backhaul for WiFi hotspot

⇒ **WiMAX based on:**
IEEE 802.16d-2004

⇒ **WiFi based on:**
IEEE 802.11g





Ethernet switch

Mini PCI slot

Mini PCI WiFi card

WiFi antenna

Ethernet socket RJ45 (to
subsume a LAN)

DECT antenna,
cross polar

Sockets for 2 copper pairs
(VDSL, remote powered)