WiMAX Deployment Experiences

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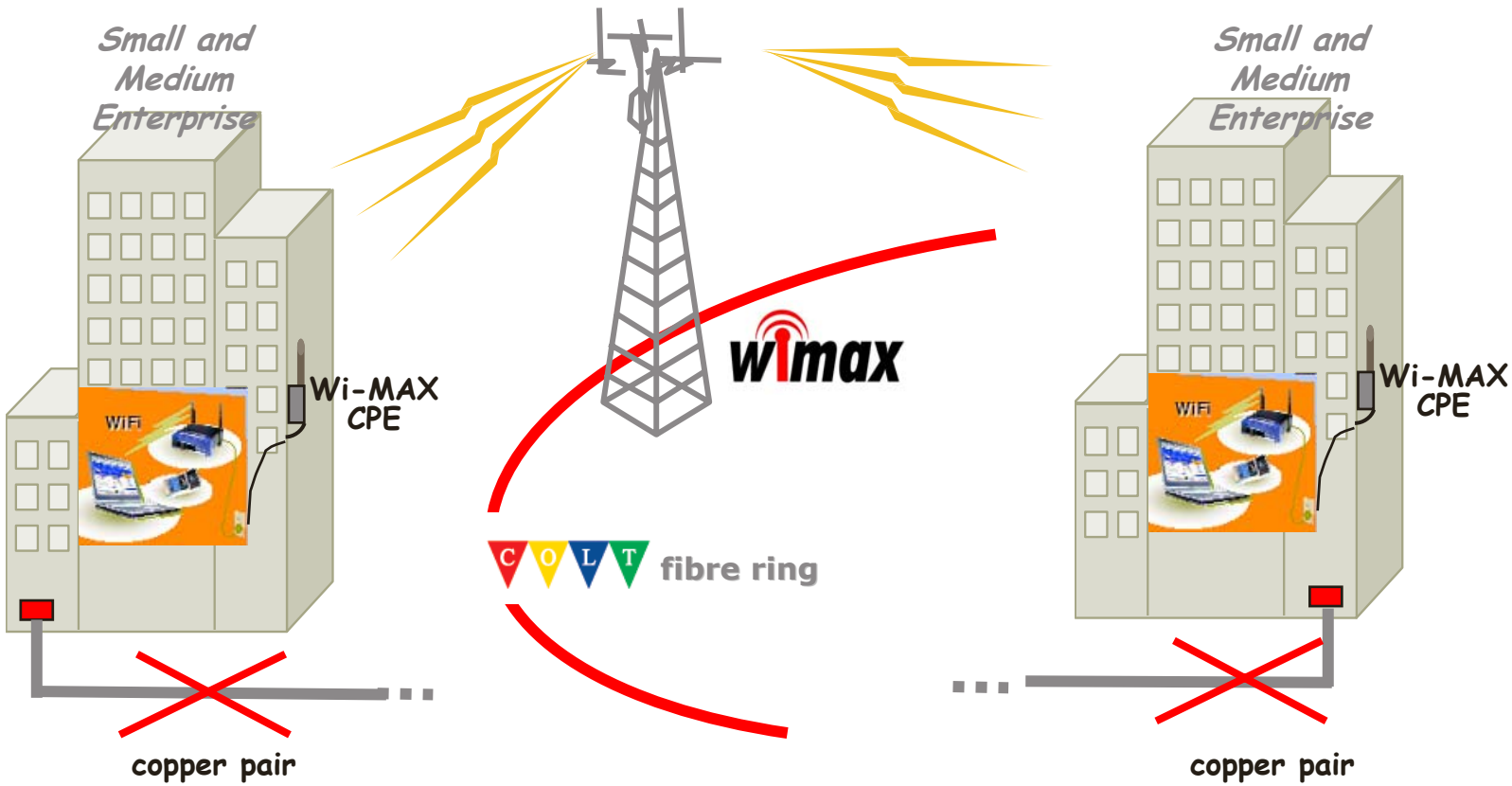
Network Architecture

Wi-MAX

- **What is Wi-MAX:**
  - Worldwide Interoperability for Microwave Access (WiMAX)
  - it's an effective broadband technology for enterprise customers that is easy to deploy
  - it's an alternative to local loop unbundling with wider bandwidth
  - it's NLOS (none line of sight) point-to-multipoint technology
- **How Wi-MAX will be delivered**:
  - licensed spectrum (3.4-3,6 GHz) and unlicensed spectrum (5.7GHz).
  - It depends on the county regulatory conditions
- **How is regulated**
  - Public Consultations are foreseen soon in different countries
  - Spectrum is being made available through auctions and unlicensed
  - In some countries there is a free access spectrum band for this application

Wi-MAX Concept Architecture



Subscribers share a bandwidth access of around 50 Mbps per antenna after radio overhead

What is the benefit of WiMAX over other Wireless

WiMAX 256 carrier OFDM allows radio reflection providing better NLOS

Standards based solution

- Will allow market forces to drive down costs
- Will drive innovation in Equipment

WiMAX Fixed Access standard is IEEE 802.16d

- Ratified
- Supplier compatibility test Oct 2005
- Equipment End 2005, Pre-WiMAX available 1Q2005

WiMAX nomadic standard is IEEE820.16e

- Allows 0-50km/h movement
- Design for Chipset in Laptops
- Not COLT's current priority
- Available 2006

What is Pre-WiMAX?

Pre WiMAX are vendors' description of what they do today

Broadband Wireless Access using ODFM systems for None Line of Sight

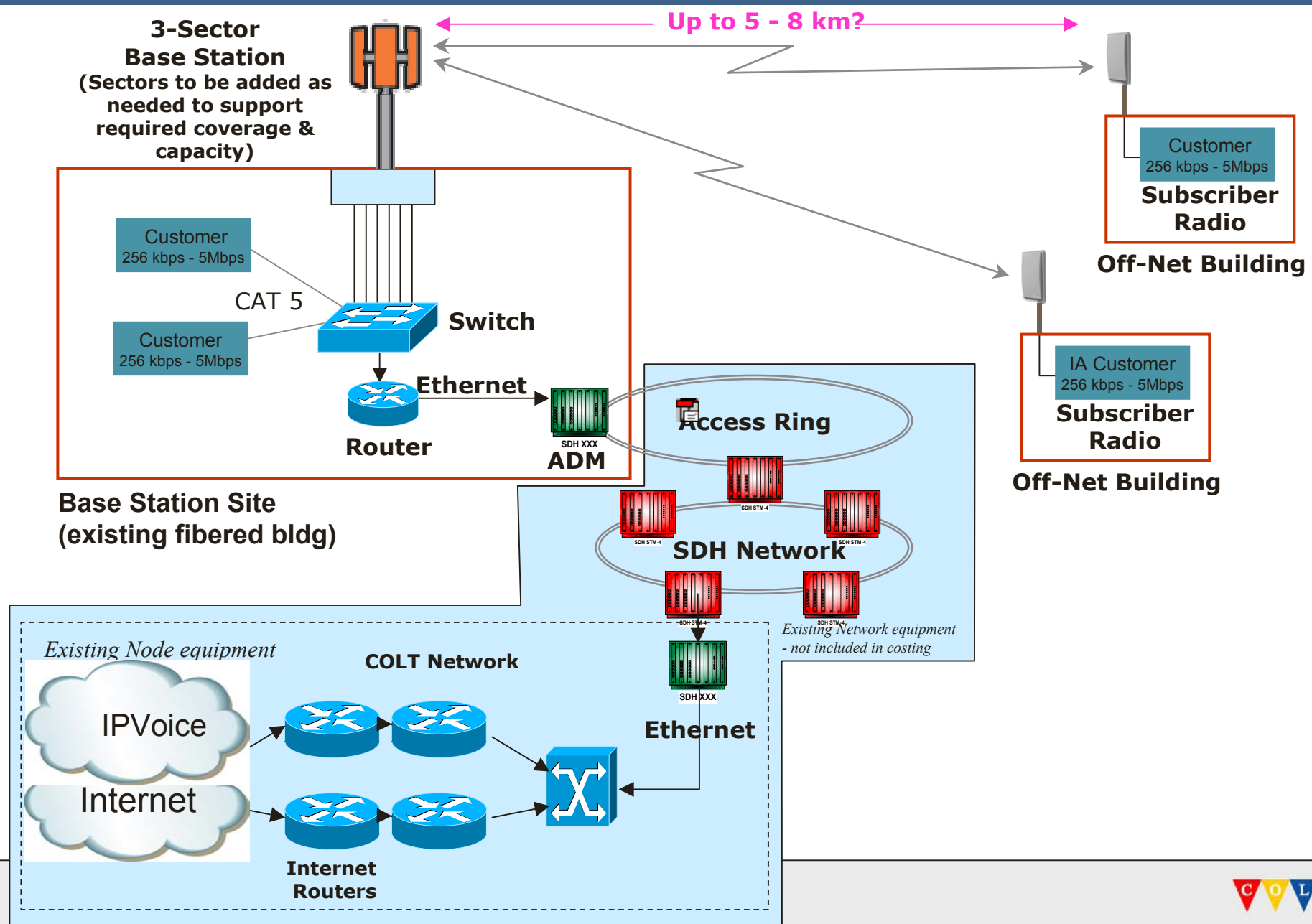
Uses Proprietary Radio Chip sets

Hardware upgrade to WiMAX

Used until WiMAX is Available

- WiMAX chipsets Beta release for bake-off tests July 2005
- Equipment with Standard WiMAX Sept 2005

Potential Wireless Architecture for \Customer



What products are enabled through this technology

COLT Total

> The data nature of this service, and the need to get a cheap cost connection for SMEs makes it ideal to be offered through this technology

VoIP/IP Centrex

> Due to the nature of this access method, TDM voice is not possible but we can offer VoIP to our customers

IP VPN

> The IPVPN extension is possible and fits well for this type of access technology

Internet Access

> As a pure IP application, WiMAX provides the connectivity support for the Internet services

Ethernet extension

> Ethernet services could be extended through the WiMAX network, the same than the development is being done for the DSL one

Spectrum issues for trials

UK

- 5.8GHz lite licence available Jan 2005 for Operational use
- 3.5 is owned by PCCW, trading in 2005. What Price?

Ireland

- 3.5-3.8 Bands allocated. Trading not yet allowed but will be promoted in 2005
- 5.8 Band in use and free for all

Italy

- 3.5 now available
- 5.4 available
- RFQ underway

Switzerland

- Trial license possible in 3.5GHz

Denmark

- 3.4-3.5GHz trial license under investigation

Objective of WiMAX Trials

- Understand how to integrate and to manage the wireless technology over fibre infrastructure
- Evaluate the quality of service delivered and the client perception compared with more DSL solution or fibre
- Measure, in terms of investment and opex, which could be the level of saving working on larger volumes
- Measure Throughput achieved in Metro and distance reached
- Anticipate the move of competitors in using this new access technology

Objectives of Trial

To enable COLT to make an informed decision about the suitability of WiMAX (IEEE 802.16) technology in the network

Understand

- Understand WiMAX and Pre-WiMAX technologies
- Assess characteristics and limitations
- Gain experience in both operational and regulatory stages
- Better able to pre-empt competitor action

Technical Focus

- Performance of COLT services and applications over the WiMAX platforms
- Assess WiMAX as viable access technology. To determine the fit within COLT's network and methodology
- Assess security issues.

Milan– Set-up and Results

Set-up

- 1 Base Station (BS) with 3 sectorial antennae
- 3 Ethernet channels segregated by VLAN addressing
- Backhauled with Lucent Metropolis to Cisco 7609 to GigE

Radio issues

- *None* of the 3 x target CPE sites (350m, 3.5km, 4.5km) were satisfactory
- NLOS was an issue. LOS better.

Traffic Performance

- Upto 30Mb/s Ethernet throughput achieved on Smartbits tester
- FTP using Iperf achieves upto 14M downstream
- Good MOS values for concurrent VoIP sessions (3.8 for 40 calls, 4.38 for 10)

Milan - Conclusions

Experience and Key Lessons

Satisfactory data rates achieved at pure LOS sites, NLOS not acceptable for typical COLT customer, although pre-pre-WiMAX

- **External antenna will require landlords way-leave**
- Radio planning at early stages are of *critical* importance
- *Valuable* experience gained in backhaul design and test methodologies
- Gaining approvals for licenses at right frequencies can be difficult
- Vendors assure that they have resolved this in newer products – additional trial now underway

Next Steps

Expect 802.16 Standards-based WiMAX to have better reach and NLOS capabilities

Dublin

> Planning and build in progress
> Solution based on Pre-WiMAX 802.16 from Wi-LAN

Milan

> New 3.4Ghz Trial licence awarded
> Solution based on Alvarion Pre-WiMAX 802.16 BreezeMAX system

Technical Activity

> Core design, Test Plans, Evaluations
> Assess WiMAX as a replacement for ISDN Back-Up service
> Add COLT IPVoice Gateway service to WiMAX platforms

Key issues to overcome

Spectrum Availability

- Licensed is better for SLAs
- Unlicensed bands are totally unattractive so far.

Equipment Availability

- True WiMAX with interoperability 3Q05
- Pre-WiMAX good for Trials but not production

Operational Issues

- Need WiMAX indoor Antenna to avoid roof right issues