Either live your DREAMS or kill yourself
Never Compromise
Wimax Femtocell: Requirements, Challenges, and Solutions

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AGENDA

- Introduction
- Key futures of Femtocell
- Requirements and Technical challenges
- Deployment of Femtocell standards
- A Network frame work to support Femtocells
- Deployment Model
- Air Interface Support for Femtocell
- SUMMARY AND CONCLUSIONS
- References
INTRODUCTION

- **Femtocell:** A small cellular base station, designed for use in residential or enterprise. Connects to the service provider’s network via broadband. Support 2 to 5 mobile. Allows service providers to extend service coverage indoors.

- **Wimax:** Wimax (Worldwide Interoperability for Microwave Access) is a telecommunication protocol that provides fixed and fully mobile Internet access.
Key futures of Femtocell

- Small and low cost BS’s
- Plug and user-installed self configured devices
- Low power BS’s
- Operating in licensed spectrum compatible with wide area cellular network and MS’s
- Load sharing, infrastructure cost reduction, and signal quality enhancement
Requirements and Technical challenges

Requirements

- Local area coverage
- Standalone Femtocell network operation
- Self/Organization and configuration
- Operator control remote integration, activation and deactivation
- Synchronization and interference management
- Exclusive of Preferential access
- Differentiating accounting
- Scalability and Density
- Handover
Requirements and Technical challenges

Technical challenges

1. Interference to/from other Femtocell and Macro BS’s
   - Regulatory issues
   - Intra and inter system interference

2. Seamless handover between Femtocell and a Macrocell or other Femtocells

3. Plug and play interoperability and standardization

4. Synchronization and location

5. Security an QOS control over a Thirty party backhaul
Deployment of Femtocell standards

Phase 1 IEEE 802.16-2009
Phase 2 IEEE 802.16m
Network Framework
- Wimax forum
- NWG(network working group)

Femtocells are expected to play an important role in terms of cost effective delivery of new services, such as multimedia, gaming, social networking, and other demanding applications with the high QoS level that is expected by users in an indoor environment.

Figure 1. The two phases of WiMAX femtocell evolution.
A Network frame work to support Femtocells

- Network Access provider (NAP)
- Network service provider (NSP)
- Femto Network Service provider
- TR-069 or Doc SIS Standard

**Figure 2. WiMAX femtocell system (high-level architecture).**
Deployment Model

- A single operator with both Macro - and Femtocells
- A single operator with Femtocell only
- A Femtocell operating provide access only
- Operates one among the 3 modes
  - Open access mode
  - CSG(Closed subscriber group) Closed mode
  - CSG Open mode
Air Interface Support for Femtocell

1. Adjustment to dynamic range of transmitted and received RF power levels
2. Cell type indication using Cell Type parameter
3. Interference management and downlink power control

• Phase 1: Consideration and plans in the Wimax forum

![Synchronization timing difference](image-url)
Air Interface Support for Femtocell

1. **Synchronization**
2. **Mobility Management**
3. Storing the List of Neighboring Macrocells
4. Interworking Signal Assisted Scanning
5. Snooping
6. **Interference Management**
7. Self-Configuration
8. Inter-BS Coordination
9. (Semi-)Static Radio Resource Utilization

- **PHASE 2: IEEE 802.16M PROPOSED SOLUTIONS**

*Figure 5. Femto BS detection methods.*
SUMMARY AND CONCLUSIONS

• Femtocell systems are drawing the attention of wireless service providers more than ever due to their advantages such as cell coverage extension, capacity increase, and service quality enhancement in indoor environments.

• Wimax Femtocells offer the same benefits for Wimax operators as for other technologies - providing higher capacity, higher performance services in the home and small office environment. The technology shares the same issues as 3G and 4G cellular - there is a limit to the data capacity of each cell site, and if high volume usage can be offloaded to Femtocells, then outdoor performance improves - benefitting all users.
References

Any Queries ?????

THANK YOU
Dedicated to

• *Ronny Yongho Kim and Jin Sam Kwak*, LG Electronics, Inc
• *Kamran Etemad*, Intel Corporation
## IEEE 802.16 Standards

### IEEE 802.16 Projects and Standards

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Handover
NAP AND NSP

Network Access provider

- Provides and manages Wimax radio access infrastructure
- NAP is deployed as one or more access service network (ASN)

Network service provider

- Manages user Subscription and provides IP connectivity and Wimax service to subscribers
- NSP includes a home agents, authentication, authorization and accounting (AAA)
- AT&T: based in the USA
- Verizon: based in the USA
- BT: based in the UK
- NTT Communications Corp: based in Japan
- SingTel: based in Singapore
TR-069 Standards