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The Subscriber You Have Dialed is not Reachable

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ABSTRACT : In the mobile communication the network problem has been become a major problem due to this the mobile subscriber is feeling very uncomfortable with it and mobile service operators are also facing difficulties to sort out this problem. Here in this article we are concentrating on network problem inside the indoor premises because according to telecom survey 70% mobile calls are originating or terminating inside the indoor premises.

Keywords: Femtocell, GSM, Micro cells, Network Congestion.

I. INTRODUCTION

This is the dialogue we listen very frequently in our daily life, whenever we want to make a call to mobile subscriber from our mobile phone or from basic land line phone. The wireless capacity has doubled every 30 months since 1957

- 25X improvement from wider spectrum
- 5X improvement by dividing the spectrum into smaller slices
- 5X improvement by designing better modulation schemes
- 1600X gain transmit distance.

Mobile communication means wireless communication from any point to any point with full freedom to move anywhere. This is very practical phenomena that full mobility over the earth is very difficult with currently used technologies but geographical wide range is not the reason for being subscribe out of network most of the time. The main problem of current cellular network [7].

- The expensive deployment cost of network infrastructure
- Low signal strength received from an outdoor BS inside a building

According to one Telecom survey 70% calls for mobile subscribes are generated from indoor to the subscriber sitting somewhere inside the indoor premises. Some studies on wireless usage shows more than 50% voice calls and more than 70% data traffic are originated indoor. This survey indicates that we have to concentrate more on managing our GSM cells inside the buildings of malls, offices and apartments etc. instead of increasing or relocating the BTSs. and the solution is Femtocell [3, 9]. A femtocell is a small cellular base station, typically designed for use in a home or small business. It connects to the service provider's network via broadband (such as DSL or cable), current designs typically support 2 to 5 active mobile phones in a residential premises, and 8 to 16 active mobile phones in enterprise premises. A femtocell allows service providers to extend service coverage indoors, especially where access would otherwise be limited or unavailable [1,3, 6].

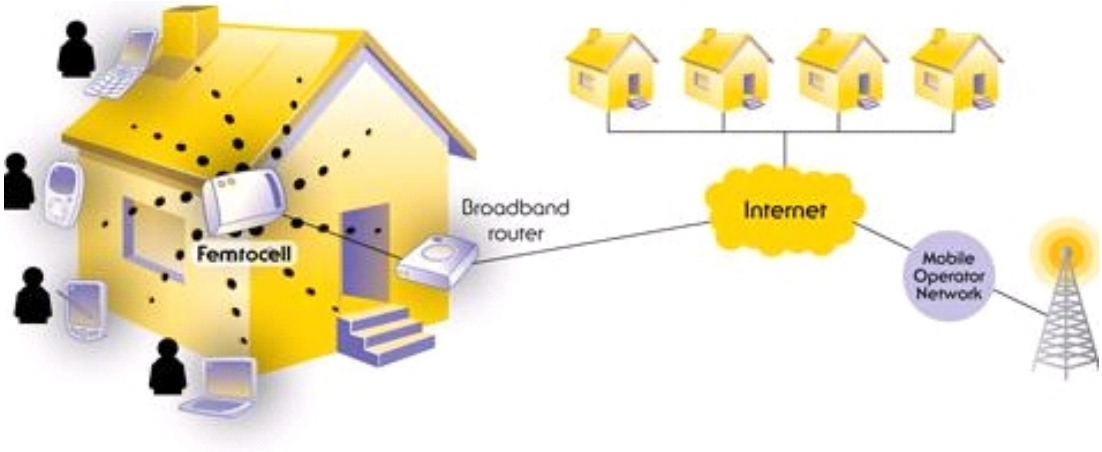


Fig.1. Femtocell.

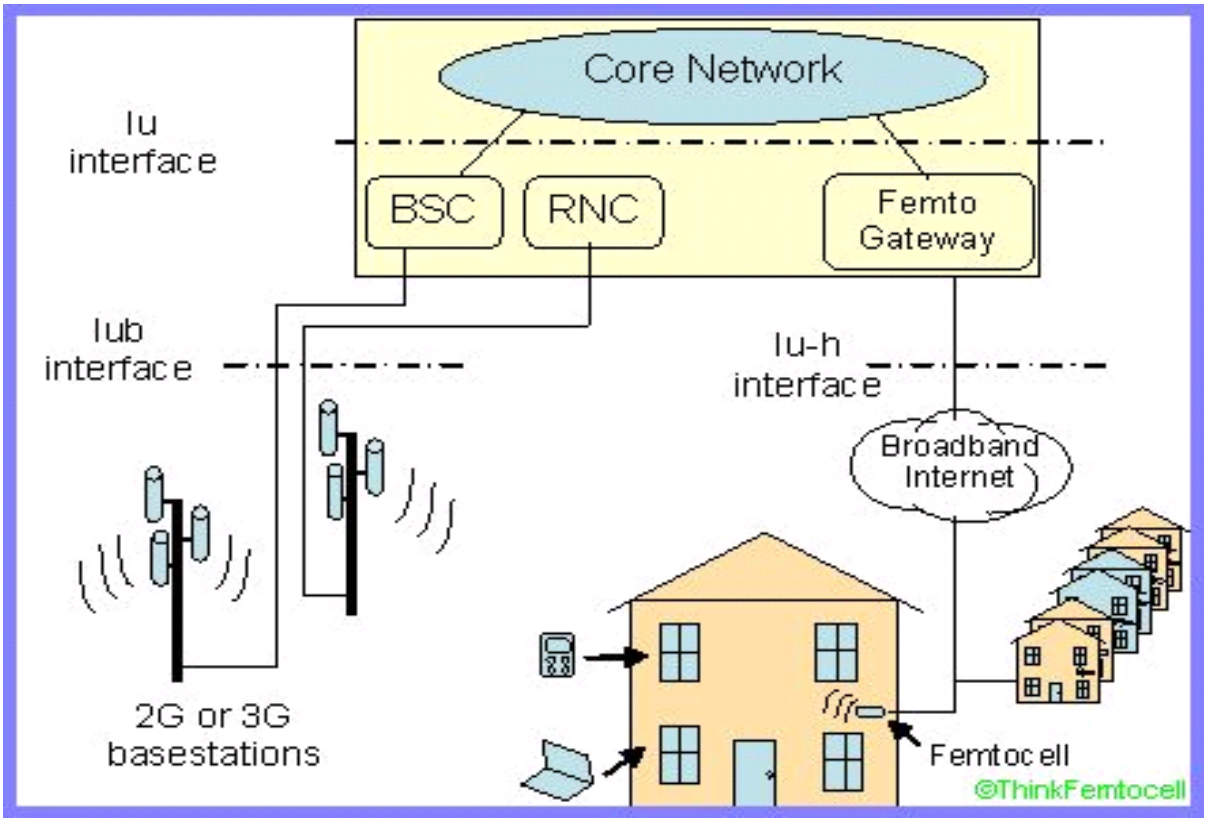


Fig. 2. Femtocell Architecture.

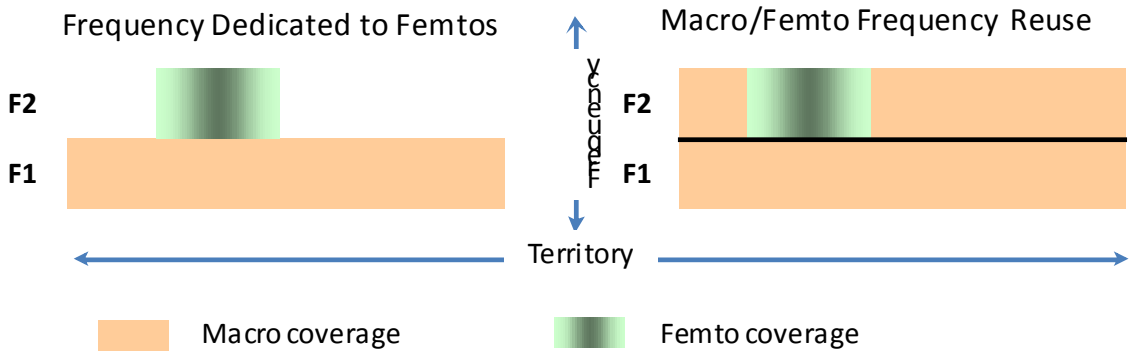


Fig. 3. RF deployment scenarios for femtocell systems.

For a mobile operator, the attractions of a femtocell are improvements to both coverage and capacity, especially indoors. This can reduce both capital expenditure and operating expense. There may also be opportunity for new services. Consumers benefit from improved coverage and potentially better voice quality and battery life. Depending on the carrier they may also be offered more attractive tariffs e.g. discounted calls from home.

Femtocells are an alternative way to deliver the benefits of fixed–mobile convergence (FMC). The distinction is that most FMC architectures require a new (dual–mode) handset which works with existing unlicensed spectrum home/ enterprise wireless access points, while a femtocell–based deployment will work with existing handsets but requires installation of a new access point that uses licensed spectrum [2, 5].

Many operators have launched femtocell service including Vodafone, AT & T, Sprint Nextel and Verizon.

Note that the 3GPP refers to 3G femtocells as Home Node Bs (HNBs).

Typically the range of a microcell is less than two kilometers wide, a picocell is 200 meters or less, and a

femtocell is on the order of 10 meters. Although AT & T calls its product, with a range of 40 feet (12 m), a "microcell".

II. FEMTOCELLS: WHY NOW?

Indoor coverage has been an industry problem for year and vendors have unsuccessfully tried to develop relevant technology solutions for the home. Most services to date involved micro or pico base stations and did not really have the price points to support residential users. Alternative approaches tried most recently involve dual mode devices based on Wi–Fi. While technically compelling, these solutions depend on adoption of new (and expensive) handsets.

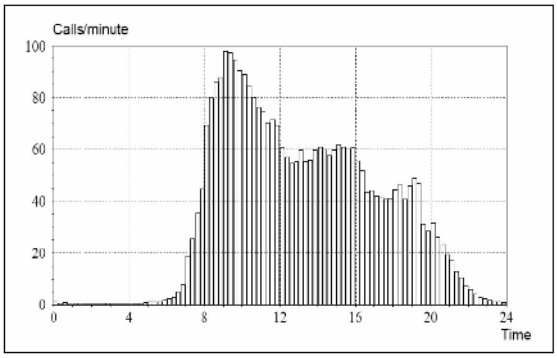


Fig. 4. A typical traffic profile for a 24 hour period.

A number of factors are coming together to enable femtocell based solutions:

(*i*) The high adoption of broadband connections allows the service providers to control the IP backhaul to reduce the backhaul costs for additional usage.

(*ii*) Advances in embedded technologies make it possible to offer a home base station at an acceptable price.

(*iii*) As 3G adoption increases, indoor coverage becomes a challenge even in otherwise good 2G coverage regions.

(*iv*) Operators who have trialed cell–site based home zone type services have seen the potential to control home zones for improved customer retention.

(*v*) New low power GSM spectrum has enabled new players to participate in mobile offerings based on licensed band femtocells.

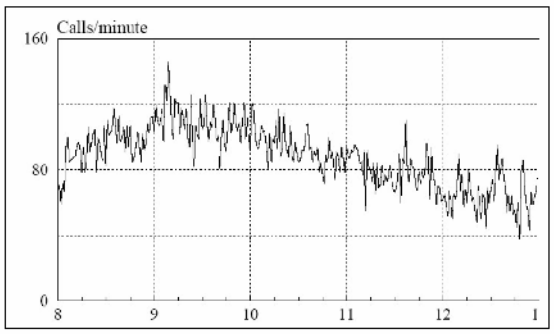


Fig. 5. An example of the call rate on a sampled Monday morning.

A. Femtocell Architectures

There are two broad femtocell architecture approaches within a mobile service provider'snetwork.

1. All–IP (SIP/IMS): The SIP/IMS based approach integrates the femtocell through a SIP or IMS based network. This approach leverages a SIP based VoIP network for cost–effective delivery, while interworking with a cellular core to extend legacy circuit switched services. In this approach, the CPE converts cellular signals to SIP and interfaces to a SIP–MSC inter–working function (IWF) which connects to the SIP (or IMS) network as well as the circuit switched network.

2. Radio Access Network (IP RAN): The IP RAN based approach effectively considers a femtocell an extension into the operator RAN network and ties the femtocell into the circuit switch core at the edge of the network. This typically involves transporting "Iub" messages over IP into a Radio Network Controller (RNC) or a modified RNC/concentrator. (The Iub is the interface used by an RNC to control multiple Node B's in a UMTS network.) [2]

There are three different variants of this approach being pursued by different vendors, however all three of these variants require either the introduction of or major modification to network elements at the RNC layer of the mobile core network:

(*i*) Modified RNC: This approach uses existing or modified RNCs to connect to the circuit switched core network. The CPE connects to the RNC via Iub over IP.

(*ii*) Concentrator: This is similar to modified RAN in that it connects to the CS core, but it does it through a new 'concentrator' device that interfaces with the CPE. The interface is again based on Iub over IP.

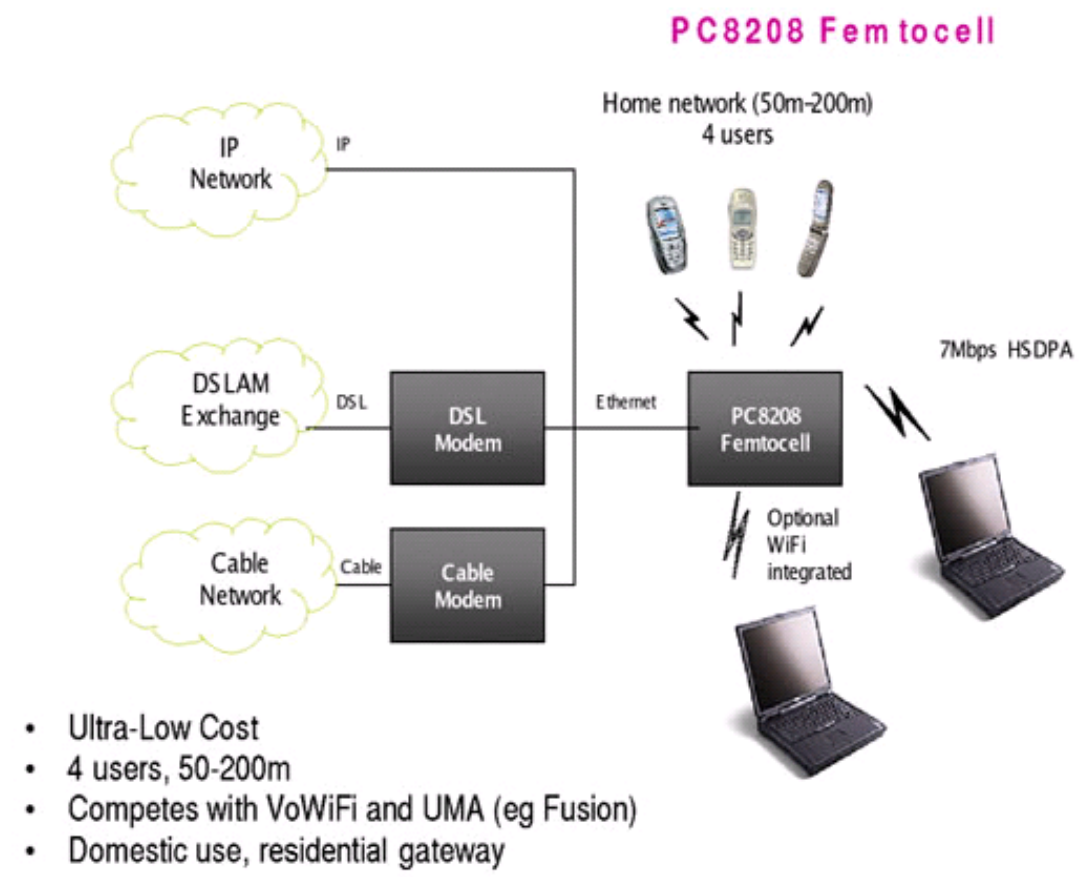
(*iii*) UMA: This approach incorporates a UMA client into the CPE and connects to the core network via a UMA UNC.

B. The Benefits of Femtocells

Due to the substantial benefits, femtocell technology is causing quite a "buzz" in the industry. ABI Research has forecasted that by 2011 there will be 102 million users of femtocell products on 32 million access points worldwide [9].

Femtocell Benefits to End Users

- Reduced "in home" call charges
- Improved indoor coverage
- Continued use of current handset
- Reduced battery drain
- One consolidated bill
- Multiple users/lines



- Landline support

Fig. 7. Femtocell Application.

(a) Femtocell Benefits to Mobile Operators

- Improves coverage
- Reduces backhaul traffic
- Provides capacity enhancements
- Reduces churn
- Enables triple play
- Addresses the VoIP threat
- Stimulates 3G usage
- Captures termination fees
- Allows for multiple users/lines
- Addresses the fixed mobile convergence market with a highly attractive and efficient solution.

There are several types of competing technology for the femtocell. Here are some direct competitors from the mobile network operator.

1. Dual mode Wi–Fi phones

Many smartphones (such as the iPhone, Blackberry and Google Android) have WiFi receivers built in. These automatically seek out and use WiFi where it is available, often providing a faster, more responsive data service than the outdoor mobile network. This can work well when visiting the same places (home, work, cafe etc.), but often requires entering a password for each new location. Battery consumption is much higher when using WiFi, resulting in much shorter battery life than a 3G femtocell [8].

Some smartphones can also use Voice over IP (VoIP) applications such as Skype, Truphone or Fring to make voice calls using WiFi. These applications may not integrate with the phone's built in address book, operate using a different phone number or identity or handle voicemail or messages differently when out of WiFi range.

Some operators actively encourage their smartphone customers to use WiFi where possible. Sprint mandate that all their new smartphone models have WiFi capability, and ATT Wireless provide free access to over 20,000 WiFi hotspots in public areas. This offloads large amounts of data traffic from their mobile network, improving performance for those who need it most.

2. UMA dual–mode phones

A special type of WiFi capable phone uses the UMA (Unlicenced Mobile Access) standard to operate seamlessly with the mobile phone system, effectively extending the same service over WiFi with the same phone number, text messaging, voicemail and other services.

These are already commercially available and offered in the USA by T–Mobile (HotSpot@Home) and in France by France Telecom/Orange (Unique). France Telecom report

good takeup of the service, which may be partly due to the heavy penetration of WiFi/DSL modems already sold, and the much larger geographic coverage (and thus potential poor coverage areas) of the country [5].

The system requires customers to use a special dual–mode GSM/WiFi phone which restricts the choice of phones significantly. The WiFi mode can be used both at home and at any T–Mobile or France Telecom hotspot when out and about. Calls can be handed over between the hotspot and the macrocellular network. T–Mobile allow access from any WiFi hotspot, even abroad, while France Telecom restrict access to their own hotspots (including domestic ones).

Known commercially live services include:

(*i*) T–Mobile, US

(*ii*) Orange Unik, France and other countries

(*iii*) Telecom Italia

(*iv*) Telia Denmark

(*v*) Saunalahti, Finland.

3. Improved microcellular coverage and capacity

If the service provided by the operator is adequate to meet customers needs, then they may not feel it necessary to install their own complex equipment and risk faults and errors. With many users happy to use only voice and text, there is considerable capacity within the existing mobile networks except in particularly dense tower blocks or remote rural areas.

The real benefit to the user comes where mobile data is used, and where the lower costs of providing this via the mobile network can be passed back to the end user.

3G technology has a roadmap with continuous improvements, including HSPA+ that could be deployed as a software upgrade to existing 3G networks. However, new handsets would be required to take full advantage of the improvements [6].

4. 3G at lower frequencies such as 850Mhz or 900Mhz

Part of the reason that 3G does not operate well indoors is that the global frequency allocated is around 2100MHz. Some countries, notably Australia, have deployed 3G systems at 850MHz (which is close to the 900MHz 2G GSM frequency commonly used). As a result, much longer distances can be reached in rural areas (claimed broadband service of 2Mbit/s at a distance of 120km using an ourdoor antenna), whilst inbuilding penetration is much improved in urban areas.

5. LTE (Long Term Evolution)

This is yet another radio interface, based on OFDM (Orthogonal Frequency Division Multiplexing), which is also used by WiMax. Trial equipment is already demonstrating data rates in excess of 100Mbit/s, and standardisation is proceeding quickly. Early uses are likely to be providing broadband data services in rural areas and relieving areas of high data demand. A wide range of handsets is unlikely to become available for some years.

Whilst LTE femtocell prototype designs exist, it is generally thought that the data performance of 3G femtocells will be more than adequate for the next few years. In many cases, the wireline broadband internet connection would be the limiting factor and prevent an LTE femtocell from delivering better performance than 3G. Instead, LTE femtocells have been proposed for use by network operators who want to provide very high data capacity in specific areas [6].

III. CONCLUSION

In order to sort out the network problem in mobile communication all the mobile service operator should concentrate on indoor network on priority basis and the Femtocell is the best option now a days due to its best performance and connectivity through internet means no need of connectivity to BSC directly and so many various services which can be provided through Femtocells.

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