

FEMTOCELL IS EDGING TOWARD THE ENTERPRISE

Growing vendor support and new standards will bring femto to more offices -- but support headaches and costs are still major issues.

1. EXECUTIVE SUMMARY

Femtocells are edging closer to the office. The technology provides a path to fixed-mobile convergence, in which one wireless phone can be used in the office and on the road.

Femtocells are small cellular base stations that are installed in homes and offices and connect to a service provider's network via broadband. They work with any kind of cell device and use the same standards and protocols as external "macro" cells. When users are indoors, their cell phone or data card connects to the femtocell instead of searching for an external base station. Calls are smoothly handed off between inside and outside cells as the user moves.

New standards, increasing vendor support, and new heavier-duty networks make femto more suitable for enterprise use. The questions now are how businesses will integrate femtocells, and how quickly. The answers will depend on the emphasis operators place on business deployments and how attractive they can make the price.

Although femtocells are simple architecturally, enterprise femto networks aren't. For network operators, management of femtocells, including cell provisioning and traffic prioritization, must be handled carefully. Customers must plan femtocell placement to avoid interference and may need to address issues with Wi-Fi and finicky VPN configurations in their existing networks.

Furthermore, the costs of a large-scale deployment will be much higher than a consumer plan, because businesses require higher quality of service from their Internet service providers, and providers must be able to carry more data as well as voice.

2. LOUD AND CLEAR

This makes femto very different from Wi-Fi-enabled handsets, which require not only the Wi-Fi radio, but also support of specific cellular tunneling protocols such as defined in Unlicensed Mobile Access (UMA). There are also some similarities between femto and Wi-Fi: A femtocell's backhaul connection is via the customer's Internet connection, be it DSL, cable modem, T1, or fiber.

The femtocell uses the Internet to communicate with a femto gateway managed by the ISP. This central gateway connects to the cellular operator core network, and the femtocells look like so many additional base stations on the operator network. A central configuration server performs management and security functions, including femtocell configuration.

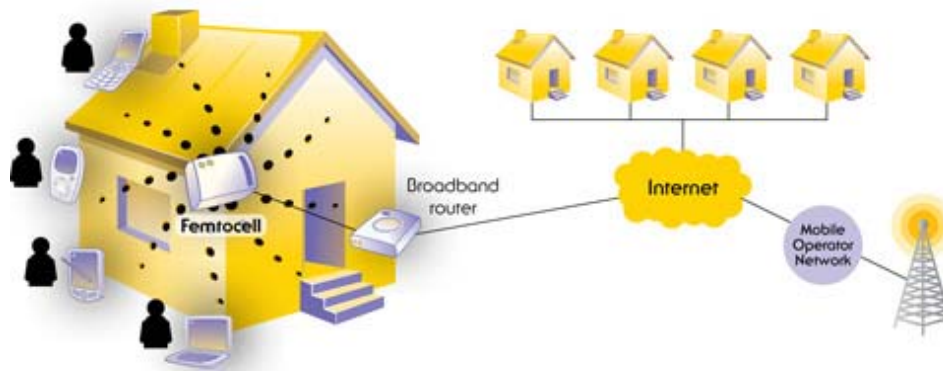


Figure 1 Femtocell Diagram

Femtocells transmit at very low power levels -- typically, tens of milliwatts versus multiple watts for a large cell -- so the same frequencies can be reused from one building to the next, and fewer users share bandwidth. This might not make much difference for voice quality, but it will mean a huge difference for data throughput. With mobile broadband traffic expected to more than double every year for the next five years (as projected in Cisco's "Approaching The Zettabyte Era" white paper), any capacity relief will be crucial to keep WANs humming.

New standards will aid network interoperability. Mobile specifications group 3GPP recently approved a standardized core network interface that's based on existing circuit-switched and packet-switched base-station-to-core-network standards. This interface will standardize communications between femtocells and the femtocell gateway.

Industry associations such as the Femto Forum also are weighing in. Femto Forum members have agreed to use the Broadband Forum's TR-069 CPE WAN management protocol -- the same protocol used for DSL equipment -- to manage customer femtocells in real time.

IMPACT ASSESSMENT		FEMTOCELL TECHNOLOGY	
		● BENEFIT	● RISK
IT organization	●●●○○○ IT staff benefits from improved indoor coverage within the organization, one phone number for both cellular and office phones, and potentially lower cellular bills.	●●●●●○ The technology is relatively immature. Early adopters must carefully consider cell placement and work with their providers to ensure quality of service for both data and voice.	
Business organization	●●●●●○ A femto network makes cell phones a seamless extension of business phone systems. Femto will also allow higher-speed data throughput without battering the WAN.	●●●●●○ Larger businesses will face complex integration of femto with existing PBX systems. Businesses also have to commit to a cellular operator, and changing providers will be difficult.	
Business competitiveness	●●●●●○ One phone number for desk/mobile will make it easier for clients and customers to reach your staff. Improved mobile broadband performance will move more data faster, boosting productivity.	●○○○○○ Enterprise femto networks may not move with a company if it relocates, but cell phone options are available everywhere.	
Bottom Line	●●●●●○ Femtocells can provide a path to fixed-mobile convergence, but larger organizations should wait for more business-oriented systems to come to market.	●●●●●○	

Table 1 Impact Assessment: Femtocell Technology

3. WHO'S DOING IT

As more vendors offer femtocell devices, more operators are ramping up femto networks. Globally, more than 20 such trials are under way, according to Yankee Group.

Sprint was the first vendor to try femto in the United States, launching its Airave femtocell program, now a nationwide service, in September 2007. However, Airave is voice-oriented and doesn't support the high-speed EV-DO data service, considered a key enabler of enterprise femtocell networks.



Figure 2 Verizon's Wireless Network Extender

AT&T is validating High Speed Packet Access (HSPA) femtocells, with broader scale deployment slated for the second quarter of 2009. AT&T is working with Cisco and Cisco's partner IP.access on a home integrated gateway. Meanwhile, Verizon has announced its CDMA femtocell product called Wireless Network Extender, and is also considering femtocells to accompany its LTE rollout. Comcast, as part of its investment in Clearwire, has indicated it will deploy WiMax femtocells, leveraging its cable network for backhaul.

The Verizon and Comcast developments highlight the use of femtocells with emerging wireless technologies where wide area deployment will be limited for some time. The theory is that users may tolerate wide area coverage limitations if they can get the service in key locations. Alcatel - Lucent, Cisco, Ericsson, Huawei, and Nokia Siemens Networks are some of the bigger vendors targeting this space, while the list of smaller specialists includes Airvana, AirWalk Communications, AirWave, IP.access, RadioFrame, and Ubiquisys. Expect major consumer networking gear players, such as Linksys (Cisco), Netgear, Sagem, Thomson, 2Wire, and Comtrend, to get in on the act.

Small offices and home offices will likely leverage consumer-oriented solutions, just as they do today with Wi-Fi access points. But now Alcatel-Lucent, AirWalk, Tango Networks, and Tata Systems, among others, are targeting the enterprise space. Enterprise systems are more complicated because most businesses want systems that integrate with their existing PBXs and IP-PBXs -- which are anything but standardized in their interfaces.

Policy management in enterprise-oriented femtocell systems will allow organizations to enforce rules such as keeping on-campus calling local to the enterprise network and controlling which users have access to long-distance networks, conferencing, messaging, and short-code dialing. Enterprise systems will use Session Initiation Protocol (SIP) for control.

Enterprise femtocells will support a larger number of simultaneous callers (e.g., 16 instead of four) and smooth handover between femtocells. They will enable a single number for both desk phones and mobile phones, along with PBX features such as abbreviated dialing from the mobile phone and a single voice mailbox. However, such tight integration will require specialized gateways between the enterprise PBX that communicate with matching gateways in the operator network.

You can also expect femtocells to incorporate Wi-Fi capability, providing a universal wireless gateway for homes. This will help address the issue of how and when to give voice traffic priority over data traffic on a user's Internet connection.

Quality of service will be needed to provide voice priority, and this will be problematic if there's a separate Wi-Fi access point soaking up capacity on the ISP connection. Trials have shown this to already be a concern. The quality of the broadband Internet connection will be paramount, because good voice quality will require low latency and few dropped packets, neither of which is guaranteed by ISPs today. Providing accurate location information for 911 calls is also tricky.

4. LAND LINES, AWAY

For small businesses, femtocells will make it that much easier to cut the cord entirely, since they can get reliable operation indoors and looser constraints on monthly voice minutes. For instance, the Sprint plan provides unlimited voice calling after paying a monthly charge fee of \$4.99 for the Airave femtocell service and \$10 for a single-line unlimited calling plan. The femtocell access point costs \$99.99. We'll have to wait and see what the AT&T and Verizon plans look like, but we expect them to be similar.

High-speed data networks such as HSPA and LTE provide the greatest throughput speeds when users don't have to share the radio with a lot of other users, and when there is a high-quality radio signal. Femtocells can provide both, although the location of the femtocell(s) in a building will be important. Moreover, the current typical 3G caps of 5 GB per month are unlikely to apply to femtocells. This makes using your laptop modem at work or at home much more attractive, and further facilitates mobile-broadband always-connected operation.

The benefits will apply to voice-centric mobile phones, smartphones, mobile-Internet devices, and laptops. Best yet, femtocell works with existing devices, and its low-power operation will extend their battery life. Operators benefit by offloading data-intensive traffic from their macro networks, meaning fewer macro cells are needed.

However, there are complications that operators and vendors have to overcome before femtocells really become prevalent.

5. SMALL CELLS, BIG HEADACHES

Management is perhaps the biggest issue that operators will face as enterprise femto networks come online. Operators today manage tens of thousands of cell sites, but femtocells will number in the millions, and each one will need to be provisioned correctly and given ongoing firmware updates. Femtocells must be simple enough that an average user can install them -- and as Wi-Fi has shown, this is a challenge in itself.

Operators will have to control where customers operate the femtocell, in case a user moves to a different city where the operator doesn't have a license.

Interference management for femtocells also will be complex, including femtocell-to-femtocell interference in adjacent buildings, and femtocell-to-macrocell interference. Operators will have to decide whether to dedicate radio channels to femtocells in a coverage area, or to use the same frequencies as the WAN.

Finally, although businesses will likely tolerate higher prices than consumers, operators will need to offer enterprise femtocell networks at a reasonable price point—possibly in the \$500 range, similar to enterprise Wi-Fi APs.

A small business using consumer-oriented equipment may be happy to switch femtocell access points if it changes carriers, but a larger business will be making a significant commitment to a specific cellular operator, with potentially a large number of femtocell APs throughout the organization.

In contrast, a Wi-Fi approach for voice delivers a more operator-independent infrastructure, although ultimately the gateways must integrate with specific operator services. Businesses will have to decide whether a femtocell plan makes more sense than a distributed antenna system (DAS) that extends the macro cellular signal into the enterprise environment. DAS is simpler, but femtocells provide higher capacity and potentially greater benefits for the cost.

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References:

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