



Smart Wi-Fi Turning Wi-Fi Access Points into the *Perfect Femtocell*

Kineto Wireless, Inc.

1601 McCarthy Blvd.

Milpitas, CA 95035

Tel: +1 408 546 0660

There has been a lot of excitement about femtocells in the mobile industry. The concept of a small, low-cost, customer-deployable home base station that leverages a subscriber's existing broadband connection for backhaul is an incredibly compelling proposition for mobile operators. Femtocells hold the promise of reducing churn by improving indoor coverage and saving costs by offloading the macro radio network.

However, as the initial femtocell service launches are completed and results fed back into the market, it's clear there are a number of technical, standards, business case and regulatory challenges that still need to be addressed if femtocells are to really take off in the consumer market.

High cost (for subscribers and network operators) and network interference/performance have dampened consumer interest in femtocells. Combine those issues with a consumer attitude that in-building coverage is something operators should address, and it's no surprise many femtocell deployments have received a tepid response.

Yet the need for increased network performance (data rates, coverage, capacity), particularly indoors, is only growing as smartphones become the dominant mobile device. There is now an opportunity to step back and consider: what are the requirements and capabilities that make the 'perfect' femtocell? And does this perfection already exist in the form of Wi-Fi access points?

→ The 'Perfect' Femtocell

Very Low Cost:

In a perfect world, operators would not need to provide all subscribers with a new access point.

Ideally, femtocell capability would be incorporated into existing home broadband routers, or subscribers would have already purchased and installed a femtocell for other reasons, like home network connectivity. Any pre-installed base would dramatically reduce an operator's financial and logistical burden of populating the network with new customer premise equipment (CPE), and would immediately improve the business case.

If consumers need to purchase and install new equipment, it must be dirt cheap, certainly below \$100 and likely closer to \$50—in the range of a Wi-Fi access point today.

No Macro Network Interference

The macro radio network is a finely tuned mesh of cell towers designed to maximize connectivity and minimize interference. The 'perfect' femtocell would be added into this mix without any detrimental effects on the performance of the macro network.

In addition, it would not detrimentally impact mobile customers who are within range of a femtocell. For example, if you and your neighbor receive service from the same operator and you have a femtocell, the femtocell should not interfere with your neighbor's handset.

Future-Proof Radio

Cellular radio technology is constantly evolving, and operators are continually upgrading their macro networks. The perfect femtocell would continue to function as the macro network evolves to include the next radio network technology.

In the last five to 10 years, many operators have evolved their macro networks from GSM to GSM+GPRS to GSM+EDGE to UMTS to UMTS+HSPA to UMTS+LTE and soon they'll evolve to LTE-A. The perfect femtocell would be able to support handsets no matter what macro radio technology they used (e.g. GSM/EDGE, UMTS, HSPA+, LTE and LTE-A in the future).

Predictable Indoor Coverage

The perfect femtocell would enable operators to provide a predictable wireless coverage range within a home. That coverage range would not fluctuate based on how near or far a subscriber lives from a macro cell tower. For marketing reasons, it's imperative operators are able to accurately set subscribers' expectations for the service.

Location Independence

People move, and the perfect femtocell would be able to provide services when and where needed—no matter where in the world subscribers may go.

Local Internet Offload

One of the biggest selling points for femtocells is their ability to offload rapidly growing mobile data traffic (think iPhone) from the macro network. However, the vast majority of that data is standard Internet traffic (e.g. YouTube, Facebook,...) and not operator-specific mobile-data services (e.g. MMS, visual voicemail,...). As a result, the perfect femtocell would allow mobile operators to let Internet related traffic route directly to the Internet and bypass their core data network.

→ What About Wi-Fi?

Reviewing the list above, there seems to be a glaring omission to this discussion. What about Wi-Fi access points?

Wi-Fi access points already exist in the places where people use their smartphones the most. A standalone Wi-Fi access point can be effective in offloading Internet traffic directly to the web. However, Wi-Fi alone would not meet the requirements of the perfect femtocell because mobile services (voice, SMS, MMS, RCS-e, IMS,..) remain on the cellular network.

The one thing that is needed is a mechanism to create a secure connection between the smartphone and the mobile core network – to actually authenticate a subscriber to the mobile core network over IP/Wi-Fi.

This mechanism exists. Years ago, 3GPP developed the GAN (or Generic Access Network) specification. GAN, implemented as a client on the smartphone, creates a secure, trusted relationship between the subscriber and the mobile core network over Wi-Fi. Once in place, GAN enables all mobile services (voice, SMS, MMS, RCS-e, IMS,...) to be extended securely and seamlessly over Wi-Fi.

A GAN-enabled smartphone can effectively turn any Wi-Fi access point into a femtocell—a mini-base station when and where coverage and capacity is needed. In fact, with GAN, Wi-Fi access points can become the new “perfect” femtocells.

Here is a comparison:

Requirement	UMTS Femtocell	Wi-Fi “Femtocell”
Very Low Cost	Current 3G access point cost estimates are in the \$100 to \$200 range. In addition, there is no installed based of UMTS access points for an operator to leverage.	Wi-Fi access points under \$50 are readily available from many large consumer electronics vendors. In addition, more than 50% of broadband households in many countries already have Wi-Fi.
No Macro Interference	By definition, UMTS access points will have some level of interference with the macro network, as well as with the handsets of non-femtocell users. However, much hard work is underway to try to minimize the detrimental effects.	By definition, Wi-Fi access points do NOT interfere with the macro network or with the handsets of non-“femtocell” users.
Future-Proof Radio	As the macro network evolves to support HSPA+ and LTE, UMTS femtocells will need upgrades. But by definition, UMTS femtocells will only be able to support UMTS handsets.	It is not necessary to upgrade a Wi-Fi “femtocell” access point as the macro network evolves to HSPA+ and even LTE. In addition, all new smartphones will ship with Wi-Fi capabilities.
Predictable Indoor Coverage	In order to mitigate interference with the macro network, the wireless coverage range for a UMTS femtocell will vary based on how close a subscriber lives to a macro radio tower. The closer to the tower, the smaller the effective access point range.	As Wi-Fi “femtocells” operate in a different spectrum range from the macro network, it provides predictable wireless coverage and doesn’t vary based on the proximity of a subscriber’s house to the nearest cell tower.
Location Independence	A UMTS femtocell can identify and route relevant traffic directly to the Internet, without going through an operator’s core network. However, in some countries, there may be regulations that require all traffic traveling over licensed spectrum to first be routed through a mobile operator’s core network prior to the Internet.	With Wi-Fi “femtocells,” handsets can route Internet-related traffic directly to the Internet and not through an operator’s core network.
Enabled Connected Home Services	A UMTS femtocell can function as a proxy to enable handsets to access resources on the home network.	A Wi-Fi “femtocell” enables handsets to directly access resources on the home network.
Provide Value to Other Devices in the Home	UMTS femtocells operate in a specific operator-licensed spectrum, so they can only support UMTS devices that also have a subscription with that mobile operator.	Wi-Fi “femtocells” are standard Wi-Fi access points and can be used by any Wi-Fi-equipped devices in the home for network connectivity.

➔ What’s Perfect?

Will the ‘perfect’ femtocell at the right price with the right features appear anytime soon? Or are Wi-Fi access points with 3GPP GAN technology actually the ‘perfect’ femtocells and already available and widely used around the world?

There is certainly a lot of debate from vendors and operators. Regardless of the technology choice, it’s clear that delivering a home offload and coverage service is a priority for mobile operators. The ‘perfect’ solution is poised to capitalize on this pent-up demand.