

# The femtocell grows up and leaves home

by Nigel Toon, CEO, Picochip

Due to limited spectrum availability and the air interfaces nearing maximum efficiency, small cells are one of the few options remaining to increase capacity. With femtocells chips getting more powerful and their cost greatly reduced in volume rollout, the residential femtocell becomes a viable proposition. Femtocells plug holes in coverage, which is the top-most cause of subscribers' churn. Now the 'metro' (that is, beyond residential) femtocell concept is also beginning to take hold and to shake up the conventional network. For Enterprise market, the integration of the femtocell with PBX brings many useful mobile-integration services. For all these reasons, this article declares that this is the year that femtocells come of age.



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As we move into the summer, it's interesting to note how the femtocell has grown up, from a device that operators were only starting to understand the need for, to a device whose potential is only starting to be realised across a wide range of applications from public access to home automation services. Analysts predict that 2011 will be the year the femtocell takes off, with more of them already in networks than traditional basestations. While numbers and forecasts may vary, the key point is that the shape of mobile networks has already changed - the transition from 'big iron' to 'smart edge' has happened.

At the forefront of this is the evolution of the femtocell. Most people think of this as a device that sits in our home providing

5-bar coverage - but the same technology can extend to something that helps network operators offload data in busy public spaces, solving the capacity crunch and providing coverage in rural areas where the macro network cannot reach.

Unfortunately, much like in the residential sphere, simply erecting more macrocells is an inefficient and expensive way for operators to boost coverage. In fact, as warned by Julius Genachowski, FCC Chairman, at his speech at CTIA in 2009, with operators limited by spectrum availability and air interfaces nearing maximum efficiency, small cells are one of the few options available for providing more network capacity to many users, particularly as the demand for data services explodes. While picocells have been

proposed to solve this need, the 'economics' have not worked out. However, femtocells deliver significant advantages to operators by providing a cost-effective and simple means, through self-configuration, to boost coverage and capacity for the enterprise and other non-residential sectors. This addresses the OPEX aspects of cost, while leveraging the economies of scale from residential volumes, meaning that the CAPEX of dense deployment becomes attractive.

## Femtocell market evolution

The first launches from Sprint & Verizon were relatively simple, with a 2.5G service and the rationale of providing better voice coverage to improve customer retention. Vodafone and AT&T's moves are more

sophisticated - with HSPA, femtocells reduce churn while improving voice and data coverage and provide higher capacity. In the Middle East operators are trialling femtocells in shopping centres and busy public spaces to deliver added capacity and Europe is following suit.

Now the femtocell market is maturing rapidly. The initial technical challenges of implementing the baseband and protocol stack in an integrated device with low power dissipation were essentially solved by 2007. The following year was about more subtle issues such as interference management and security. Just as important was the definition of standards that ensure that any femtocell can integrate with the network.

The year 2009 saw productisation of the femtocell and initial launches. It was the year the technology became real to consumers. As a consequence, the market moved into a different phase - that of becoming a consumer market with a value chain like those in the DSL and Wi-Fi sectors.

During 2010 and 2011 we saw the operator business cases established with widespread deployments and cost optimisation. As volumes increase, costs will be driven down. The target of US\$20 chipset requires technical excellence, but ever increasing functionality will be expected as well. The early pioneering spirit will need to be supplemented with less glamorous but no less important values of operational excellence. The femtocell ecosystem needs to ensure that it offers certified quality, a reliable supply chain and logistical support - in short that it delivers on its promises.

Now the femtocell is evolving into something that provides coverage not just in the home, but in places the macro network cannot adequately cover or reach. Building 'metropolitan' femtocells is a complete shakeup to the conventional network architecture of large cells deployed to cover areas measured in square miles. Femtocells - or, 'small cells' - offer a much cheaper and more accurately targeted model, enabling coverage and capacity to be deployed exactly where it is needed. That is critically important when the amount of data traffic grows exponentially, and the only way to serve the need is to have many more basestations serving smaller areas. This is also relevant in the developing world, where few people have a fixed line service and the mobile network is also used for banking services such as Kenya's M-PESA.

For network operators, these extended femtocells offer a range of new opportunities. Primarily, it greatly expands the addressable market for femtocell services and opens up the potential for a range of new revenue streams. However, perhaps the most significant of these opportunities, at least while the overall femtocell market is still in its relatively burgeoning stage, is the chance for operators to create a virtuous circle of demand. As more residential and enterprise users experience the benefits of femtocells, either at home or at work, they will be more inclined to want the same service wherever they are - at home, at work or in the town centre - thus broadening the demand for femtocells.

It is now possible to integrate a complete 3GPP Release 8 Local Area 42-Mbit/s HSPA+ basestation onto a single chip. This level of performance is something previously more associated with a traditional pico or even macrocell, and illustrates just how the femtocell has grown up into something operators can routinely deploy as part of their wider network rollouts.

New chips are now specifically designed for public access infrastructure rather than a closed home or office system, integrating all of the baseband processing needed for a femtocell, plus many of the requirements defined by the established standards for the femtocell industry. The device can deal with digital samples to and from RF (*Radio Frequency*), and provides a complete signal processing chain that enables them to be passed via a broadband connection to the operator network. The chip needs to support multiple-input multiple-output (*MIMO*), soft handover and to conform to the Local Area Basestation (*LABS*) standard. LABS is the 3GPP definition for systems with higher performance than home basestations, allowing higher capacity, 120 km/h mobility, and +24-dBm output power for greater than two km range.

Femtocells can solve many, different, problems for carriers. They can cure coverage holes and improve service to residential customers, which is particularly important considering that poor coverage is the number one reason for churn. They can deliver extra capacity in a cost-effective way, delivering high-quality data service just where it is needed.

Femtocells can be integrated with a PBX, to give seamless service for an enterprise

with mobiles as part of a complete offering, and enable a range of new services and new business models for carriers and others (e.g. retailers or hotels).

A recent report from Cisco highlighted a staggering statistic: the global data traffic for 2010 was the same size as the traffic of the entire Internet in the year 2000. We're expecting a network designed back in the 1990s to cope with a phenomenal amount of data traffic for which it was simply not designed. To put this into context, the CTO of UK operator O2 once said that watching an average video on YouTube was the equivalent of sending 500,000 text messages at once. This is why networks are struggling to cope and why this year will be the year that femtocells grow up and leave home. ●



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