Mobile operators want us to have basestations in our homes. **Chris Edwards** finds out what it will take for that to happen.

the future is femto

NOKIA, IP.ACCESS, PICOCHIP

WHILE THEIR neighbours campaign against cellular masts going up near their homes, consumers will soon be able to buy a basestation of their very own. Operators are lining up to launch home basestations next year as a way of providing better access to their wireless networks indoors.

One type of home basestation is already on the market in the form of Unlicensed Mobile Access (UMA) technology. This relies on the user's phone supporting voice calls over either Bluetooth or Wi-Fi. It's not a cellular basestation, but a Wi-Fi router with software to handle voice calls and pass the packets on to the mobile operator's network.

Many operators are backing a more ambitious plan: putting the guts of a cellular basestation into a small box that the user plugs into a broadband Internet connection. This is the femtocell, named for the progression from large outdoor 'macrocell' basestations through to picocells, which were designed to provide cellular coverage in shops and offices.

"It's not a complete basestation but it has a fair chunk of that capability," says Steve Shaw, associate vice president of marketing for Kineto Wireless. "Unfortunately, it needs a lot of the most complex processing."

He adds: "I actually believe both UMA and femtocells are required in the marketplace."

Shaw cites two reasons. One is that competition will help drive the idea of home basestations forward. The second is the availability of technology.

"It typically comes down to handsets and access points. With UMA, you need a handset not only with cellular but also Wi-Fi. On the femtocell side, that is contrasted with the cost of the femtocell and that not everybody has a 3G phone.

"Only 15 to 20 per cent of the population in Europe has a 3G phone today."

ROAD TO SUCCESS

Handset choice, or the lack of it, looks to be a problem for UMA. BT's Fusion was a flop: having only two handsets to choose from was one of the reasons analysts believe it failed. But France Telecom-Orange has made a success of its business, mostly in France, with a small selection of handsets, although this will expand to more than 25 choices by the end of the year. Because it bet early on UMA, the company is sticking with the technology for consumer basestation deployments. Orange, however, has asked potential suppliers to bid for a programme that will put femtocells into the office environment.

Coverage has driven deployment of home basestations in the US. One of the biggest complaints among consumers is that the one place they cannot get their cellphone to work is in the house. Sprint has made coverage such a priority that data access through the home basestation can be slower than when the phone is connected to the core network: the home unit only

'One of the biggest complaints among consumers is that the one place they cannot get their cellphone to work is in the house'

supports 2G rather than the 3G EVDO network that the main Sprint network handles.

Emin Gurdenli, chief technology officer of T-Mobile UK, says the operator launched a UMA-based product in the US to address the problem of coverage: "It is a good solution for that particular need. Now, we are moving to the femtocell: it provides a natural extension to the network."

GETTING IT OUT THERE

T-Mobile has three femtocell trials underway at the moment, in Germany, Poland and the UK.

Germany is the most advanced, having moved from technical trial to deployment with users. According to Gurdenli, the company will seek quotations from suppliers later this year with a view to a rollout in 2009.

Other carriers are likely to start rollouts next year. "Then, in 2010, the idea will be pretty familiar to most people," reckons Rupert Baines, vice president of marketing at femtocell-silicon vendor Picochip.

The big question is whether a wider range of consumers will buy into femtocells. The arguments for deploying femtocells are strong from the operators' perspectives.

Informa Telecoms & Media claims the deployment of femtocells could save operators worldwide more than $5bn, by restricting the amount of capacity they need to build into the macrocell network.

The analyst firm reckons 40 million femtocells will be in use by the end of 2013, with more than half of them sold that year. Getting to that point will take some effort and operators run the risk of subsidising femtocells but never gaining the savings.

"Deploying femtocells requires a good understanding of market segmentation of both mobile consumer and household markets, meticulous planning and targeted marketing campaigns, which mean operators will have to invest a substantial amount of money if they want femtocell services to gain popularity," says Malik Saadi, principal analyst at Informa. "If femtocells are sold to customers in sporadic fashion, then this may induce a huge scattering of femtocell deployment over large areas."

Gurdenli initially believed that femtocells would be put in homes to improve coverage. "Then I started looking at it in a different light and more as a capacity tool. You can use them to offload very high levels of usage, so that the traffic flows down the broadband connection.

"And then my thinking evolved to where the concept of the femtocell comes closer to that of a home gateway or hub, where the user gets more benefit than just coverage and the operator gets more than just capacity."

Andy Tiller, vice president of marketing for IP.Access, agrees: "There was very strong demand in the US because of the coverage issue. Many people have bad coverage at home and they can't solve it by switching networks.

"It is different in Europe because coverage tends to be better. In Europe, femtocell use will be more to do with the explosion of mobile data. Curiously, a lot of that is happening at home."

Baines says: "Data traffic is growing incredibly fast. People want to be able to watch YouTube on their handsets.

"In Asia, high-speed data is ubiquitous, so then the femtocell becomes a way to add capacity. In Europe, better download speeds will provide more of a selling point. The business case depends very much on where you are."

Tiller reckons operators could go a long way beyond providing extra capacity for their network. "Femtocells create the opportunity for exciting new things that you can do at home. We see two types of service emerging. There are services that get triggered when the phone gets home.

"One example may be that your podcasts synchronise ▶

SHIFTING BOXES

If the operators can come up with services that they can offer through femtocells, it is likely to drive a retail market for the hardware. "There is some hope that this might occur. The situation is already near to that in the dual-mode market," says Steve Shaw, associate vice president of marketing at Kineto Wireless.

Emin Gurdenli, chief technology officer at T-Mobile UK, reckons: "Instead of the network operator paying for it or subsidising it, it becomes a different beast where it looks more like a Wi-Fi router."

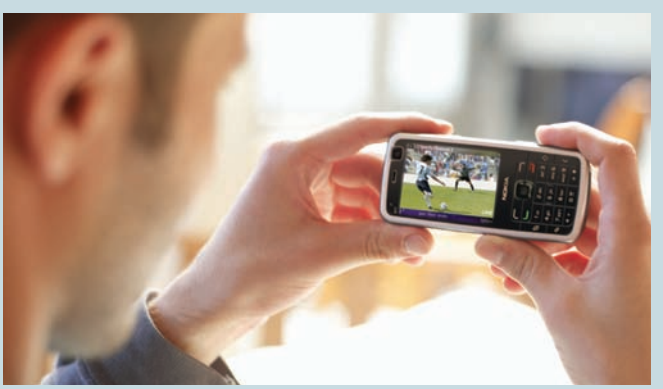
Initially, operators will supply the femtocell box using a similar model to that used to kickstart the DSL business. To go into retail, prices have to come down.

"For a consumer, it has to be in the $50 range," Gurdenli says.

Right now, you need around $50 to buy the chipsets, which puts the price for the box itself at $200, according to Sudhir Tangri, assistant vice president of marketing at Aricent.

Tiller says the sub-$100 box is achievable in the medium term. Tangri reckons the silicon cost has to be halved at least. "They need to bring the cost of the chipset to below $20," he says.

OPEN OR SHUT CASE



Although operators could use femtocells to bolster the macrocell network by providing access for subscribers who just happen to be passing by, it is an unlikely scenario.

"I probably don't want all my neighbours using my femtocell," says Steve Shaw, associate vice president of marketing at Kineto Wireless.

However, shops may install them to improve local coverage for customers. "It becomes a cheaper picocell, where operators couldn't put in a picocell previously," Shaw reckons.

Rupert Baines, vice president of marketing at Picochip, agrees: "From a spectrum efficiency point of view, an open basestation would allow for the optimum network. But what happens if you live next to a bus stop and you keep on getting an engaged tone from your own femtocell because of all the people queuing outside, talking on the phone? You also have the security issue."

The most likely scenario is that a femtocell will be able to register five or so handsets that belong to friends and family, but no more. However, calls to emergency services will be let through in the same way that macrocells allow 999 calls even from people with locked handsets.

network planning

WHAT'S THE FREQUENCY, KENNETH?

What do you do when you have a carefully planned wireless network, with basestations placed to minimise their impact on each other? Introduce a second entirely unplanned network of little basestations that use the same frequencies. That is what will happen as femtocells start to roll out.

"The original worry was that it might cause problems for the macrocell network. The whole idea was dead if that happened," says Rupert Baines, vice president of marketing at Picochip (below right).

Andy Tiller, vice president of marketing at IP.Access, says: "You could have people standing at a bus stop where the macrocell mast is far away, so the signal is weak. And you have a [nearby] femtocell signal that is much stronger, but people can't access the network through it."

Steve Shaw, associate vice president of marketing at Kineto Wireless, says: "The ideal way to do this is to dedicate a channel just for femtocells. But no-one planned their networks for that. Some operators are trying to clear off a channel and put femtocells on it. But there is a problem with doing that speculatively. What if you end up supporting only 20,000 femtocells? You could spend a lot clearing off channels just to find that it isn't worth it."

Emin Gurdenli, CTO of T-Mobile UK, reckons: "The effects are more pronounced towards the edges of cells. But you need a high penetration of femtocells before there are problems. I am confident that the technical challenges will be overcome."

Baines agrees: "The Femto Forum and 3GPP have been studying what happens. There are corner cases where there will be problems. But in those corner cases, things would not have worked anyway."

Tiller believes operators are already well prepared: "Operators are dealing with interference all the time. They just want to know what the issues are." One thing that will help with the femtocell expansion is that the units will typically transmit at very low levels because users are so close to them. The result is that effects will only be apparent at the edges of macrocells.

Potentially a bigger worry for the operators lies in femtocell management.

"People might use them to hack into your system," says Shaw. "There are a whole lot of issues that could go wrong there."

Gurdenli explains: "Set-up and management have got to be fully automated because, one day, you will have hundreds of thousands of these things around the network. Plug and play is an absolute must.

"There is some standardisation happening around this, so it is going in the right direction. Is the push strong enough? No. And not just for femtocells but in general.

"GSM and UMTS have both missed the boat when it comes to automation in operations and management. The issue is not unique to femto. But it will be more critical for the femtocell.

"I would like to see much more ambitious work in this area."

Rupert Baines, vice president of marketing at Picochip

◀ when the phone is in range of the femtocell. It will be more cost-effective for everybody and your battery won't run down because the phone has a local signal.

"Another example is providing presence updates, so you know when people are safely home or when their Facebook status changes.

"The other area is what we call connected-home services," Tiller continues. "When your phone is on the femtocell network, it provides access to home services. Through a protocol such as UPnP, you can have access to your whole music or video collection, for example. Or you could browse photos taken with your cameraphone on the TV. All of these things have the data flying around the home."

Research by Motorola indicated that people are more inclined to buy something like a femtocell box from their broadband supplier than from a mobile operator. As a result, operators with a broadband offering, such as Orange, or virtual operators such as Carphone Warehouse, could find they have an advantage.

And it might be coupling to broadband that rescues BT's Fusion. However, this has to be weighed against concerns consumers may have about putting all their communications eggs in one basket.

Tying femtocells into a broadband package would help with the problem of coexistence on a limited-bandwidth DSL connection. Today, the femtocell has to compete with traffic from computers.

"We find the biggest bottleneck is at the home router. Once you get into the core network, there is enough bandwidth that it doesn't matter," claims Shaw.

Although a call can move to the core network if congestion gets too bad on the broadband connection, operators want to avoid unnecessary handoffs. Some routers have heuristics in them to detect delay-intolerant traffic such as voice packets. Their regularity sets them apart from other packets, so the router can prioritise them automatically. But this does not apply to all routers and some of them may have to have this mode activated manually.

"The worst possible situation is asking the consumer to change something on their router," says Shaw.

By combining the DSL hub and femtocell into one package, operators can control how the traffic is prioritised, although it will leave them with the problem of how to sell a complex bundle of services in an environment where people are not necessarily looking to change their entire home-network plans.

CONSUMER DEMANDS

"One of the challenges is that people don't go into the store looking for a low-cost calling package. They go in and ask: what phones are cool? And they work from there," says Shaw.

"One of the early lessons of the dual-mode space was to not make the service a new service plan in its own right."

Rather than being sold as a home basestation, the service simply becomes a $10 or so add-on for the main phone plan.

Getting to the point where a femtocell could take over from the broadband router will take some planning. "If the operators come up with compelling propositions that consumers understand, then the market looks good. If they fail to communicate the benefits, then that will be a problem.

"What the proposition should be will vary market by market. In some countries, offering cheap calls at home is a good proposition. In Germany, there is already a well-established home-zone tariff based on the macrocell system, so that won't work there," Tiller explains.

The nascent femtocell business has to face one other problem: its name. Many think that the current term will not work with consumers, and want something a bit snappier. 'Home basestation' might not work either: you don't want the neighbours on your doorstep when you arrive home from a shopping spree at Currys. ■

Home basestations could make it easier to share mobile phone pictures

femtocell

ONE STANDARD FOR ALL

When the concept of the femtocell was first developed, there was no standard way for the unit to talk to the core network.

However, work by the Femto Forum has led to almost all femtocell vendors getting behind one proposal that is now being worked on by 3GPP, the standards body behind wideband CDMA.

"There are lots of proposed ways to integrate femtocells into the operators' networks. But all of that is going away with the agreement that we are going to define the Iu-h interface. Everybody is going to migrate to that. The operators are asking for real commitment from vendors to support the standards," says Andy Tiller, vice president of marketing for IP.Access.

Rupert Baines, vice president of marketing at Picochip, says: "At the beginning of the year, there were 14 different proposals and now they are down to one."

The Iu-h standard will not arrive in time for the initial rollout of femtocells.

"The market will definitely move long before anyone has got Iu-h or interoperable gateways," says Tiller.

Tiller reckons Iu-h could be handled by a firmware upgrade. Although things could change, many vendors are already quite close to what is likely to be in the standard as they took their interfaces from existing Node B basestation specifications.

A shared standard would simplify the introduction of femtocells

Manish Singh, vice president of product-line management at software supplier Continuous Computing, says: "We expect 3GPP to have the standard ready by the end of the year.

"Some people are moving ahead with their own version of Iu-h based on what they expect to be included in the standard."

Steve Shaw, associate vice president of marketing for Kineto Wireless, says: "The plan is December, but I would not be surprised if it slips."

Sudhir Tangri, assistant vice president of marketing at Aricent, says: "Everybody is keeping their fingers crossed that Iu-h will be a winner.

"Whether it takes six months or a year remains to be seen."

Femto-aware handsets could offer new features

HANDSET CHANGES

A femtocell is designed to work with any 3G handset. However, hardware vendors and operators are looking at whether they could do more if the phone could understand that it is communicating with a home basestation, rather than a public mast.

"The original promise was that any existing handset would work seamlessly with a femtocell," says Manish Singh, vice president of product-line management at Continuous Computing.

"However, as the technology has developed and been put into more trials, it is becoming increasingly clear that, for better interface management and handoff, there is a need for some assistance from the handset."

Steve Shaw, associate vice president of marketing at Kineto Wireless, says: "If you want to deliver something to somebody when they are attached to the femtocell, you need to know when they are attached.

"You want, at least, a visual indication that you are connected."

The idea of a femto-aware handset was introduced in a report by Disruptive Analysis chief Dean Bubley. The industry has quickly got behind the idea.

"We are all violently agreeing. Things can work even better if we start to think about way to make tweaks to connection settings," says Andy Tiller, vice president of marketing at IP.Access

Emin Gurdenli, CTO of T-Mobile UK, says: "I think it will be desirable but it would have to be standardised, it could not be proprietary."

In practice, modifications to the handset would be minimal, requiring little more than some extra firmware. Some of the code would simply be user-interface changes, such as using a special logo for connections to a femtocell.

The work is now to define a standard for femto-aware handsets.

"Some proposals have been initiated and our expectation is that the next release from 3GPP will include it," says Singh.