

What are Femtocells and Picocells?



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Femtocells and Picocells are small indoor access points that provide dedicated mobile network coverage. They enable mobile operators to offer an improved service to their customers while changing the business case for building mobile networks.



Picocells = business market

Picocells are designed for the business market and provide high capacity, high quality solutions that can be tailored to the medium to large enterprise customer's needs



Femtocells = consumer market

Femtocells are designed for the consumer market where low cost of ownership is essential for the consumer and the operator

Femtocells and Picocells share the following key features:

>> Low hardware costs

Once volume delivery of femtocells is reached, they should cost under \$100. Picocells are forecast to cost slightly more as they will contain additional functionality.

>> Internet connectivity

Femtocells and picocells are designed to plug into any home/office network that is connected to the internet. The internet is used to connect the femtocell or picocell to rest of the mobile operator's network.

>> Plug and play installation

Femtocells and picocells are designed to be plugged into a router or DSL modem, the power to be turned on and for the devices to automatically configure themselves with no customer intervention.

>> Low cost operation

Femtocells and picocells are designed to have very low operational costs for the operator. They offer in most cases fully automated installation on the operator side as well as fully automated remote management capabilities.

Picocells differ from Femtocells in the following ways:

>> Enhanced capacity

Individual picocells are likely to be able to support a greater number of simultaneous users than a femtocell.

>> Expandability

Picocells can be intelligently chained together to increase capacity as well as connected to distributed antenna systems to improve coverage further.

>> More complex I.T. environment

Picocells will operate inside company IT networks. As a result, although installation will still be essentially plug and play there will be a need to tailor the installation in many cases to the business so as to fit the IT policies of businesses.

What can Femtocells and Picocells be used to deliver?

Femtocells and picocells can be used as part of a business strategy to deliver the following:

>> Basic coverage enhancement to facilitate customer acquisition and churn reduction

Femtocells and/or picocells are used to fill in areas of poor coverage so as to be able to acquire new customers or reduce churn amongst existing customers.

>> Fixed mobile substitution

Encourage customers to use mobile voice instead of fixed voice. Good coverage as well as low cost capacity are essential prerequisites in getting customers to give up their fixed phones. For the operator this protects/enhances revenue and creates a barrier to mobile churn.

>> Convergence

Incentivize customers to keep their fixed connection by offering enhanced mobile services. Femtocells and/or picocells are given to 2-play customers (*fixed line and mobile with same operator*) to encourage them to keep their fixed connection to benefit from an enhanced mobile proposition. This protects the fixed line business and combats full substitution.

>> Network capacity enhancement

As traffic grows, network operators have to expand network capacity. Femtocells and picocells represent a low cost alternative compared to traditional infrastructure for expanding network capacity.

>> New network build

The deployment of a new network traditionally demands a high capital outlay at the very beginning of operations. Femtocells and picocells can be used to reduce this outlay by concentrating indoor coverage where it generates revenue. For wide area coverage national roaming or a cheaper network optimized for outdoor coverage can be used. This can be used to improve the business case for all networks whatever the technology used.

>> @Home services

Femtocells can be used as enablers to offer new services that are linked to the home environment. Operators can use these service to develop new revenue streams, acquire new customers and/or reduce churn.

>> @Work services

Picocells can be used as a component in delivering a complete wireless PBX solution. Operators can use these service to develop new revenue streams, acquire new customers and/or reduce churn.

Coverage Enhancement

Improved Customer Acquisition and Retention

>> What is the issue?

Even in countries with very developed coverage, indoor coverage can still be an issue. **A recent study by Quocirca covering the UK, France, Germany and Sweden showed that 45% home workers experienced some coverage problems with their business phone.** Even in business premises where the provider was chosen by the business this only fell to 30% (*Quocirca 2008*).

Coverage therefore can be seen as a barrier to customer acquisition and mobile utilisation. A further negative impact of poor coverage is higher churn. **A recent US survey indicated that almost 21% of churn was caused by poor coverage** (*Telephia 2007*).

What is the proposition?

The simplest and most cost effective proposition targets small to medium businesses.

In this proposition, a picocell (or picocells) is provided to the business as part of the mobile contract. Some or all of the picocell cost is paid for by the acquisition of new customers and the reduction in coverage related churn.

The same principle could also be applied to femtocells for consumers.

>> How do picocells/femtocells help?

Where there is poor coverage, traditional network build solutions would require the placing of expensive new outdoor base stations or indoor base stations to resolve the coverage issue.

Picocells and femtocells cost much less than conventional radio solutions to install and operate. As a result, operators can now build a positive business case for providing dedicated in-fill coverage.



Fixed Mobile Substitution

Moving fixed traffic onto mobile network

>> What is the issue?

The mobile phone is rapidly becoming the phone of choice for many consumers and businesses. As a result there is a clear shift of voice calls away from fixed lines.

For example in Finland, 70% of all calls are made from mobile devices (Analysys 2008).

At the same time cost pressures for operators are rising and competition is pushing down the revenue per minute. To grow or protect revenue, operators are looking for new ways to increase utilisation but without proportionally increasing costs.

Key issues in enabling substitution are

- there must be good coverage as a pre-requisite
- cost of providing capacity should be low.

>> How do picocells/femtocells help?

Traditional network build solutions consisting of new outdoor base stations or indoor base stations are an expensive way to add both dedicated coverage and capacity.

Picocells and femtocells cost much less than conventional radio solutions to install and operate. As a result, operators can now build a positive business case for providing dedicated in-fill coverage and capacity for a number of propositions that would not have been cost effective in the past.

What is the proposition?

The simplest and most cost effective proposition targets small to medium businesses.

In this proposition, a picocell is provided free of charge to the business as part of the mobile contract. The business then receives an incentive to give up their fixed voice lines.

This incentive could be increased mobile bundle size or free business calls on site. The cost of the picocell or picocells is paid for by the increased voice traffic and revenue.

The same principle could also be applied to femtocells for consumers.



Convergence

Protecting fixed line business by leveraging mobile

>> What is the issue?

The mobile phone is rapidly becoming the phone of choice for many consumers and businesses. As a result there is a clear shift of voice calls away from fixed lines. For example in Finland, 70% of all calls are made from mobile devices (*Analysys 2008*).

At the same time the rise of wireless data services both through metropolitan wifi networks and through HSPA data bundles is leading to an increase in subscribers choosing wireless broadband solutions over DSL and cable broadband solutions. **For example, in Ireland 20% all broadband connections are mobile broadband connections** (*Comreg 2008*).

As a consequence in a number of countries, users are giving up fixed lines altogether and using mobile voice and wireless data. In some markets, this is leading to a rapid decline in the number of fixed lines. **For example the number of fixed lines in Czech Republic has fallen to 28%, from 36% in 2002** (*ITU 2007*). As fixed lines drop the cost per line rises which results in increased line rental costs. This results in more people giving their fixed lines and a vicious circle of less customers and higher prices forming.

Converged operators, with both fixed and mobile assets, are asking themselves how they can slow down or stop the decline and how could they leverage their mobile assets to protect their fixed.

>> How do picocells/femtocells help?

Many customers are driven by the utility of mobile voice and to a lesser extent wireless data. For these customers, an enhanced mobile service could be another reason to keep a fixed line. Picocells and femtocells allow mobile network service to be linked to fixed line retention as picocells and femtocells require a fixed line with cable or DSL to provide connectivity back to the mobile network.

What is the proposition?

The simplest proposition is to give mobile users extra mobile bundle minutes for keeping a femtocell installed.

This ensures that fixed lines are maintained for the benefits they give (*e.g. broadband and improved mobile tariffs*).

Further upside is gained from the fact that any regulatory intervention to force open sharing of backhaul would actually be positive for the fixed network business case.



New Network Build

Cost effectively build new networks

>> What is the issue?

New spectrum licenses continue to be awarded for 2G and 3G spectrum. In Europe, GSM guard band licenses are being auctioned in many countries; some remaining 2G and 3G spectrum is becoming available and 3G extension band spectrum will become available 2008-9. New entrants who will be looking to build new mobile networks will buy much of this new spectrum.

In parallel, the next iteration of radio interface technology called LTE is being developed and will be ready for deployment around 2010. The deployment of this technology is likely to at least a redesign of existing networks if not new spectrum. In most countries the mobile market is intensely competitive making it costly and risky to build networks.

However it is estimated that **upto 40% calls made today originate from inside buildings with a high proportion of calls originating in the home and at an individual's place of work**. Many operators building new networks are investigating how to build new networks more cheaply and how to better match capital outlay to revenue streams.

>> How do picocells/femtocells help?

Picocells and femtocells can enable operators to target low cost indoor coverage to those areas where revenue is being generated leaving the wide area to be covered by either national roaming agreements or by other radio technologies. E.g. LTE coverage indoors could be provided by femtocells and picocells with wide area coverage being provided by 3G.

What is the proposition?

The basic proposition is to offer new customers free of charge either femtocells, to cover their homes, or picocells, to cover their offices, in order to provide high quality indoor coverage and capacity. For wide area coverage, national roaming or an alternative radio technology would be used.

As mobile usage is highest in homes and offices covering either one or both of these environments reduces the money that has to be paid in national roaming.

For the national roaming case, the cost of the picocells and/or femtocells is offset by the reduction in national roaming fees.

For the alternative radio technology case, the new network should enable either the ability to charge more for service or to reduce the cost of providing service.



Capacity Enhancement

Build network capacity more cheaply

>> What is the issue?

Voice services continue to grow at 5-10% per year in most European markets (*Informa 2008*). At the same time, mobile broadband data services are growing rapidly. **Vodafone has reported that in busy areas that 3G now consumes 50-60% of 3G capacity and that 3G data usage is growing rapidly** (*Pusey 2008*). In Ireland, almost 20% of all broadband connections are using mobile broadband (*Comreg 2008*).

At the same time, revenue per minute and byte is falling as bigger voice and data bundles enter the market as a result of competitive pressures. As network traffic grows, there becomes pressure on capacity and operators need to cost effectively implement capacity enhancements. As revenue per minute or byte is falling this means that they need to cost effectively find new ways of adding new capacity.

Traditionally this has meant adding a new frequency, increased sectorization of sites or site splitting. While the first two methods are relatively low cost, the site splitting option is very expensive as new sites have to be found, built and operated. In densely populated areas finding new sites that are cost effective will at some point become extremely difficult as the pool of potential sites is exhausted. The issue faced by operators is how to cost effectively expand capacity?

>> How do picocells/femtocells help?

Picocells and femtocells can enable operators to build new capacity in doors. **As 40% of calls are estimated to originate in-building, picocells and femtocells can be used to capture this traffic and relieve pressure on congested outdoor cells.** This removes the need to build expensive new outdoor cell sites. However operators may choose to deploy additional frequencies and increase the number of sectors at existing sites to increase capacity initially.

What is the proposition?

The simplest proposition is that operators give their customers femtocells and picocells to install and in return they get a bigger voice and/or data bundle.

The picocells and femtocells cost substantially less than the equivalent outdoor network build to increase capacity.

The picocells and femtocells therefore represent the most cost effective way of expanding network capacity.



Services@Home

New revenue streams and increase operator brand in the home

>> What is the issue?

Mobile operators operate in an intensively competitive environment with a constant downward pressure on revenue and margins.

The home environment is the hub of consumer life and is where a large percentage of our lives are spent. Surveys have shown that not only are a high proportion of voice calls made within the home but that there is and will be a high proportion of media services used in the home. For example **a mobile TV trial by Telefonica O2 UK showed that 32% of TV programming was consumed in the home** (*Telefonica O2/Arqiva 2006*).

The home also represents the location of the vast majority of digital media that consumers own. Operators are considering how they could leverage the high utilisation in the home and the digital media repository to increase revenues and gain a service foothold in the home environment.

>> How do femtocells help?

Femtocells provide an operator presence in the home and provide a means for mobile devices to communicate with other consumer electronic devices in the home. This enables a whole plethora of potentially new mobile services.



What is the proposition?

The femtocell promises to support a number of novel new services that are desirable to consumers. Many of these services are yet to be imagined and hence developed but some key themes are already envisaged:

>> Wireless media transfer

Music, pictures and video are automatically synchronized between the mobile and home network for later consumption.

>> Wireless media viewing

Live programming streamed to wireless devices in the home.

>> Presence

The home network knows who is present in the home and who is not providing a base for new services (*e.g. virtual home line*).

>> Universal remote control

The mobile phone can be used to control other devices in the home (*e.g. lights, oven, etc*).

The proposition has two aims:

>> In the short term

To encourage consumers to start using services in the home so that they then use them more in the more lucrative wide area environment.

>> In the longer term

As part of a larger proposition whereby the operator builds a presence in the home environment which then can be leveraged in the future to offer a broader set of services to the home (*e.g. move from communications to general services*).

Services@Work

Better service high margin business customers

>> What is the issue?

Mobile operators operate in an intensively competitive environment with a constant downward pressure on revenue and margins. The business market is not a homogenous one. Large businesses deliver high revenue but normally at low margin. Small to medium businesses offer lower revenue but frequently at higher margin than bigger businesses.

Today while large businesses are well served by the mobile market with customised solutions being developed, the small to medium business market is relatively lightly served with a lack of tailored solutions for this market segment.

Demand for mobile services is however strong with a recent survey by Quocirca showing that **98% of companies viewed their mobile a valuable business tool and almost 60% looked to improve the efficiency and simplicity of their mobile and fixed solutions** (Quocirca 2008).

The issue that operators face is how to better serve this profitable market segment.

>> How do picocells help?

Picocells provide dedicated coverage and capacity in the office environment. Once coverage and capacity exists, a number of services can be laid on top to integrate mobile devices and fixed PBXs or to provide mobile PBX functionality.



What is the proposition?

The simplest proposition is to offer integrated fixed and mobile voice services both in the office and in the wide area.

In this proposition, mobiles are integrated with the fixed PBX and can support call transfer, hunt groups, virtual fixed lines and a plethora of other business services along with functionality to control costs.

As a result, this proposition offers businesses the opportunity to more efficiently handle voice calls within their organisation and allows dependency on the fixed lines to be reduced. Both the picocell and PBX integration components currently exist to support this service scenario. A more advanced proposition aims to replace the fixed PBX completely and provide a wireless PBX service. In this scenario the mobile network provides the majority of the PBX services.

This scenario is more complex as it requires a richer native service set to replace the fixed PBX and depends upon the replacement cycle of businesses. The technology in this space is maturing and requires businesses to relinquish control of their communications to a 3rd party which represents a considerable shift in attitudes for many businesses.

The final proposition layer supplements voice services with wireless data services. This is the most difficult proposition as it aims to supplant traditional LANs and WLANs which are already heavily established in the office environment.

The proposition aims to simplify communications for data users and to provide a base for new business services. Again this proposition is more difficult as it requires a change of attitudes within businesses with regard to how they provide IT services within their business. However on the positive side, the technology to deliver this solution is relatively simple.

The RadioFrame Networks Solution

In order to support the delivery of the propositions described in this booklet, RadioFrame Networks has developed a number of discrete service components.

Omnicell@Home

RadioFrame have developed a product specifically for the home market called the Omnicell@Home.

This product is:

- A standalone ultra-small form factor femtocell styled for the home environment.
- Designed to be able to meet operator target price points in volume.
- Fully self configuring and remotely manageable for low operating costs.
- Multi-band, multi-standard capable of evolving with customer and operator needs. The product can support 2G, 3G or Wimax radio.
- Capable of using any broadband backhaul: xDSL, cable or Wimax.

Omnicell@Work

For the business market, RadioFrame have developed the Omnicell@Work product.

This product is:

- A small form factor node designed to be easily placeable in the office environment.
- A high capacity node supporting multiple simultaneous calls and mobile data.
- Designed to provide high quality coverage. The product offers class leading adaptable transmit powers along with connectors for external antenna systems if required.
- Fully self configuring at the office site with assisted install on the operator side.
- Fully manageable remotely for low operating costs.
- Capable of using any broadband backhaul: xDSL, cable or Wimax.

>> Support services

RadioFrame understand that deploying a product requires many steps to be taken from moving from proposition to solution delivery to operations.

Having already deployed picocell solutions and having an active base station business, we experience delivering solutions into the business and home environment. As a result we have developed a suite of services that operators can choose from covering:

- Network design services
- Installation services
- 1st/2nd/3rd line maintenance
- Outsourced operations
- Swap services

These can be further customised to our customers exact needs.

>> Partners

RadioFrame understand that the delivery of high quality solutions requires partnerships with other industry leaders.

For this reason RadioFrame has partnered with mobile network solutions companies for the delivery of its Omnicell@Home and Omnicell@Work product, Home Gateway suppliers for the delivery of integrated service solutions in the home and application developers for mobile business services.

By working with leaders in their field, we aim to be able to create world class customisable solutions.

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RADIOFRAME[®]
N E T W O R K S

IRELAND

RadioFrame Networks Ireland Limited
27 Upper Fitzwilliam Street
Dublin 2
Ireland

Tel: +33 1 (0) 5830 6560
Fax: +33 1 (0) 5301 355

USA

RadioFrame Networks, Inc.
9461 Willows Road NE
Suite 100
Redmond, WA 98052

Tel: +1.425-278-2780
Fax: +1.425-278-2781

www.radioframenetworks.com