

Reaching the mass market with 3G Femto Home Access

Nokia Siemens
Networks



1. Executive Summary

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Empowered by a growing variety of handsets and mobile broadband enabled networks, 3G and mobile Internet access are reaching the consumer mass market. At the same time fixed mobile convergence heats up the battle for the home, with Internet Service Providers (ISPs), and cable, fixed and mobile network operators aiming to reach a controlling position on the households' expenditure for telecommunications and media content.

When entering the battle for the home, mobile operators can capitalize on their unique position of providing users with a ubiquitous and personal service experience, based on ownership of licensed spectrum and a high level of control over the users' most personal device, the mobile phone. In order to leverage this proposition, mobile network operators need a means to ensure excellent 3G radio coverage and capacity at the users' home.

In contrast to indoor coverage solutions for large public and office buildings, 3G home access is a solution for the consumer mass market, which can only be accessed by a plug and play approach similar to residential broadband. By bringing a dedicated low-power radio cell, the 3G Femto cell, directly in the home and connecting it via existing residential broadband access to the network, 3G Femto Home Access affords users excellent 3G service experience in their homes.

The volume and price points which enable a truly mass market of 3G Femto Home Access require a common and open solution architecture which enables a mass market ecosystem of 3G Femto customer premises equipment. This entails an architecture based on open lu interfaces and the introduction of a new network element, the Femto gateway, which enables 3G Femto Home Access rollout independently of the macro coverage network and minimizes the impact on the existing radio and core network.

The Nokia Siemens Networks 3G Femto Home Access Solution is based on an open lu-based architecture. It is independent from the macro radio access network and highly scalable. Nokia Siemens Networks is committed to an open 3G Femto Customer Premises Equipment (CPE) market and runs a certification program for CPE suppliers to ensure hassle-free deployment. As of September 2007, Thomson and Airvana have announced that they will support the open Nokia Siemens Networks 3G Femto Home Access Solution with their upcoming 3G Femto cell equipment. These and additional upcoming agreements as well as continuous dialogue with leading network operators ensure high reliability and innovation rate of the Nokia Siemens Networks 3G Femto Home Access Solution, enabling mobile network operators to deliver a new 3G user experience at home.

2. The third wave of indoor solutions

In Western Europe, roughly five years after initial 3G service launches one out of five mobile subscriptions is expected to be used with a 3G device. With increasing variety of 3G mobile phones, WCDMA is becoming the technology not only for business and tech-savvy users but also for large segments of the consumer market.

Following the history of 3G rollout, two waves of indoor coverage initiatives can be observed.

3G coverage in large buildings with high mobile phone user density has been built up alongside macro coverage. Individually planned and implemented Distributed Antenna Systems (DAS) provide coverage at airports, shopping malls and many large hotels and office buildings.

Aiming to provide businesses with excellent 3G service in terms of coverage, capacity and mobility support, many mobile operators have extended their radio access macro cell networks by Pico cells which serve office buildings. The Pico cell layer needs to be carefully planned and integrated into the overall radio access network to provide an always-available user experience for demanding business users, who make many calls while on the move from one meeting to the next and who expect their push e-mail systems to be continuously connected.

With the broadening of the 3G market towards the consumer segment, mobile operators need to make sure that consumer users will benefit from real 3G experience wherever they are and especially in the place where they spend a significant part of their time: at home. In order to reach all 3G phone users, the air interface must be 3G and can not be WLAN, as this is not supported by many phones. The transition of the consumer segment from a voice-centric 2G model towards a voice plus data model hinges on the 3G service quality at home.

Considering the prevailing 3G spectrum allocation at 2.1GHz in Western Europe this service quality, in many cases, can not be assured by indoor coverage from the outside provided by the macro cell. The straightforward approach to overcome the problem is to locate a small, low-output power base station, now commonly called Femto Access Point or Femto CPE, within the residential building. The third wave of indoor coverage implementation has started. The challenge is to do this in a way which can be applied in a cost-efficient manner in millions of households. There is a need for a mass market approach to 3G Femto Home Access.

Femto cells for home access need less capacity than Pico cells for office buildings. On the other hand, for profitable business, the network operator has to put installation and operation of the Femto CPE largely in the hands of the consumer, similar to the common practice with WLAN Access Points and DSL routers. In other words, the third wave of indoor coverage, 3G Femto Home Access, depends on a plug and play user experience.

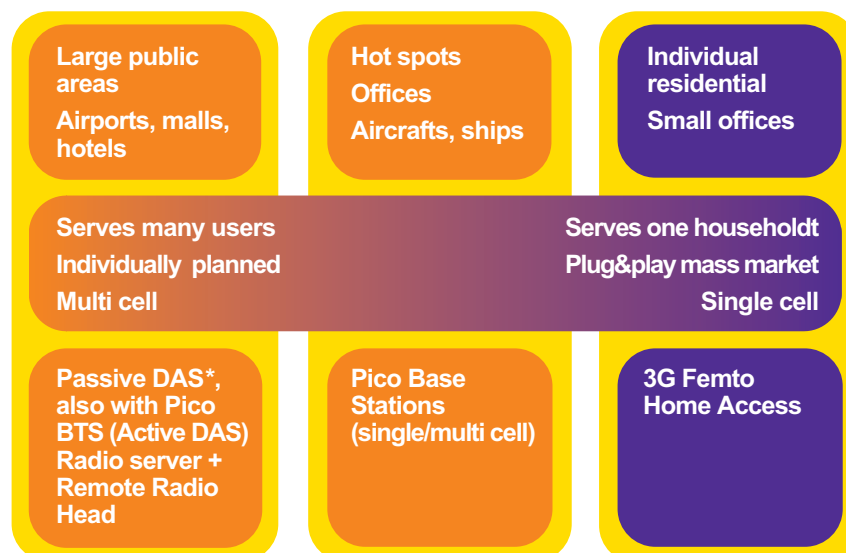


Figure 1: Femto cells. The third wave of indoor coverage. * Distributed Antenna System

3. Consumer needs at the center of the battle for the home

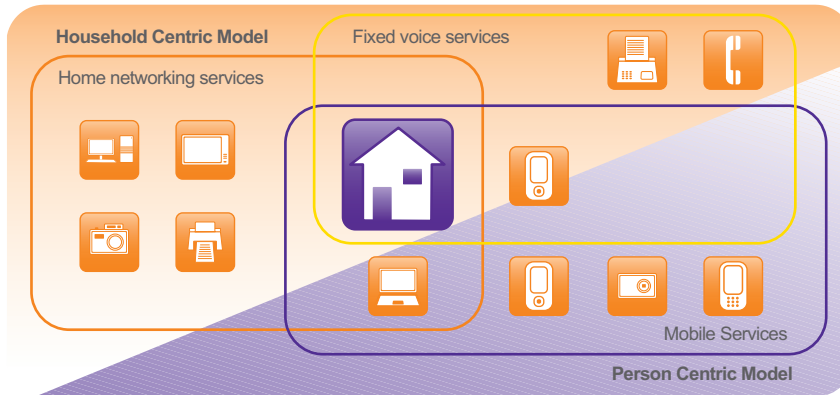


Figure 2: The battle for the home.

For many decades the household telecommunications and media entertainment environment was limited to a fixed line telephone, recorded media player, broadcast radio and television receivers. Broadband Internet access changed the rules of the game, adding Internet access and enabling alternatives for voice calls, music and video entertainment. The battle for the home began. With triple-play offers operators and ISPs aim to increase their share of the households' total telecoms and media expenditure and to increase subscriber loyalty. Extension of the triple-play offers by mobile subscriptions gave birth to quadruple-play.

With home zone tariffs mobile operators aim to drive the substitution of mobile services for voice. Recently, mobile operators entered the scene by offering residential broadband packages – based on DSL – on top of their consumer mobile subscription business. With DSL lines being typically shared among all members of a household, this step is a move from a purely person-centric mobile subscription model to a new household-centric model which bears the potential to win all members of a household for a combined residential broadband and personal mobile subscription.

At the same time the Internet has started to change from a rather static data repository to a dynamic Web 2.0 that invites user participation. User-generated content, social networks and virtual worlds catch the users' attention. The dynamic and participatory nature of Web 2.0 motivates users to be ideally always-on. Enabled by mobile broadband and multimedia phones, users will increasingly take photos and videos and share them immediately on the web. Mobile Internet access puts the web into real life context. People will track the latest news from their friends and some will be in continuous contact with their alter-egos in virtual worlds and online games. The small screen of the mobile phone, the users' most personal device, which is always at hand, will step up alongside the laptop or PC for Internet access. Nokia Siemens Networks predicts that by 2015 5bn people will have Internet access, many of them only by a mobile network. This means that the format of content and the user interface of more and more Internet applications as well as the technology evolution of mobile phones will provide an optimized Internet user experience on mobile phones.

As mobile phones are increasingly used as personal media players, applications such as direct music download are another driver for mobile Internet access: Why should a user prefer to first start-up a computer, then download a tune to it and finally transfer the tune to the mobile phone? A direct and fast music download to the mobile phone is much more convenient.

A look at consumer mobile voice usage reveals that people increasingly use their mobile phone at home. This is true even when they have a fixed line phone. The main reason for this behavior is convenience. Callers who want to reach the person on the first try, call the person's mobile phone. Calls are initiated at home from the mobile phone, thanks to the ease of use of a mobile phone's phonebook. The second most important reason is privacy: The mobile phone is the personal device, while the fixed line, including cordless phones, is typically shared among household members.

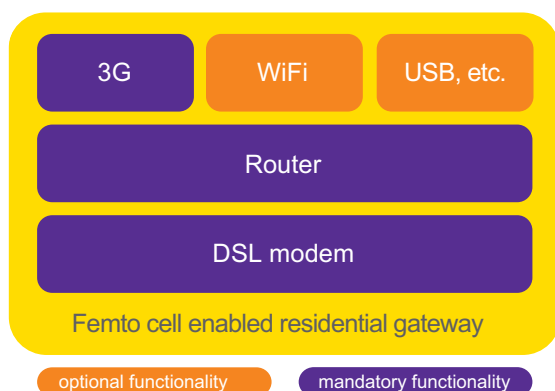
In synthesis, the experience of mobile phone usage for voice calls at home and the recent trends of Web 2.0 suggest that the mobile phone will be increasingly used also for Internet access at home. It will certainly not replace the laptop or PC, but it will become the preferred device for many applications. The dominance of SMS for simple and effective messaging may lead the way: Whenever text input demand is small, graphical output is limited and ubiquitous reach is valued, the mobile device may be first choice. This provides an outstanding differentiation opportunity for mobile operators for their fixed mobile convergence offerings.

4. Empowering mobile operators for the battle for the home

The service reliability and quality enabled by the licensed spectrum has established mobile operators as the unrivalled suppliers of mobile voice services. This entails an unmatched value proposition of an always and everywhere available service as well as unique business expertise in running a person-centric user relationship. Effective management of the users' most personal device, the mobile phone, is a key factor in this success.

The emergence of mobile broadband for consumers offers mobile operators the opportunity to reach a similar position for mobile Internet access. The always-on nature of the mobile phone and always-connected characteristics of the upcoming mobile broadband services will provide users with a new Internet experience: Mobile and everywhere, instantaneously available without the need to launch a computer for a quick look into the Web 2.0 world.

3G Femto cell Customer Premises Equipment (CPE) connects via existing residential broadband connections to the 3G network. 3G Femto cell CPE is similar to DSL-CPE with the addition of a 3G interface. In order to reach the consumer mass market, the same success factors apply as for traditional DSL-CPE: Operators need the choice of CPE with different functionalities, e.g. additional LAN and WLAN interfaces, USB interface or printer pool support to meet the preferences of the different user segments. Mass market capable delivery channels and support logistics need to be in place. These are the reasons why a 3G Femto Home Access solution that the mobile operator can base its home access strategy upon requires an open CPE ecosystem.



To leverage these strengths and opportunities in the battle for the home, mobile operators need to provide excellent voice and broadband service quality on the mobile phone in the home environment. Mobile network operators need to deliver a 3G-quality experience at home, that is competitive with fixed line offerings. The 3G Femto Home Access solution needs to work seamlessly with existing 3G and GSM/EDGE networks.

Figure 3: 3G Femto cell CPE /
Modular extension of the residential gateway.

5. Optimizing 3G Femto Home Access

For the user, the 3G Femto Home Access experience starts with the CPE installation. Users expect a plug and play installation from their previous experience with other residential gateways. Femto cell equipment can be connected to a separate DSL-router, but this approach may cause additional complexity for the user. An integrated CPE that includes 3G Femto cell and DSL router and any other interfaces to the home network

is generally considered to be more user-friendly. They also seem to support an integrated services strategy better: One box – one communications service provider – all the services you need.

The 3G Femto Home Access Solution has to ensure that the same CPE can be used throughout the network, i.e. that it is not limited to the macro radio access network regions supplied by a particular vendor. In particular, it

needs to be independent of the RNCs in those network regions because of the proprietary aspects of IuB interface implementations. Instead the 3G Femto cell CPE needs to connect to the network via an open interface. The only feasible choice is the Iu over IP interface, which is well acknowledged as an open and standard interface between vendors. As for the Femto CPE O&M, the lessons from the IuB interface are learned and focus on Femto cell

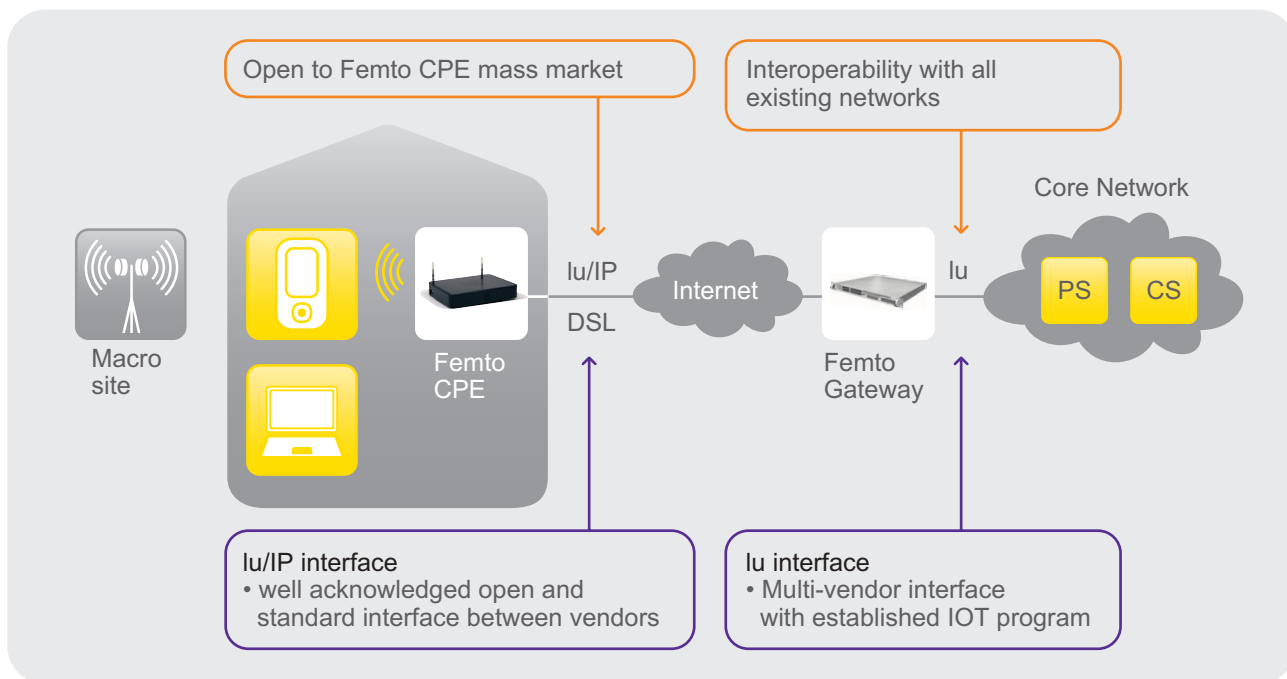


Figure 4: Open and Interoperable / lu-based solution architecture.

allows for significant simplification compared to macro base station object models. lu over IP is also more robust in respect to DSL line properties such as delay and jitter and causes less overhead data transport than lub. An lub-based interface of the 3G Femto cells would bear the advantage of reduced signaling load for handovers.

However, in contrast to office environments where business users are frequently using their mobile phones while moving in and out of pico cells, the residential use case is largely stationary: Handovers play no significant role as users remain within the Femto cell as long as they are at home.

The large number of 3G Femto CPE in a network – each household with 3G Femto home access has its own CPE – requires a highly scalable grooming function between CPE and the core network. Tens of thousands of CPE need to be connected via one lu interface to the core network. Being enabled by availability of broadband connections to the households and in the absence of regulatory 3G indoor coverage targets, the geographical distribution of the 3G Femto CPE will be different from that of macro Node Bs. In consequence the grooming function shall be implemented independently from RNC equipment as a standalone gateway. Nokia Siemens Networks refers to this function as Femto Gateway. To assure interwork with all core network implementations a Femto Gateway needs to support ATM and IP based lu interfaces. In this way, interoperability in multi-vendor networks is assured by established Inter-Operability Testing (IOT) programs.

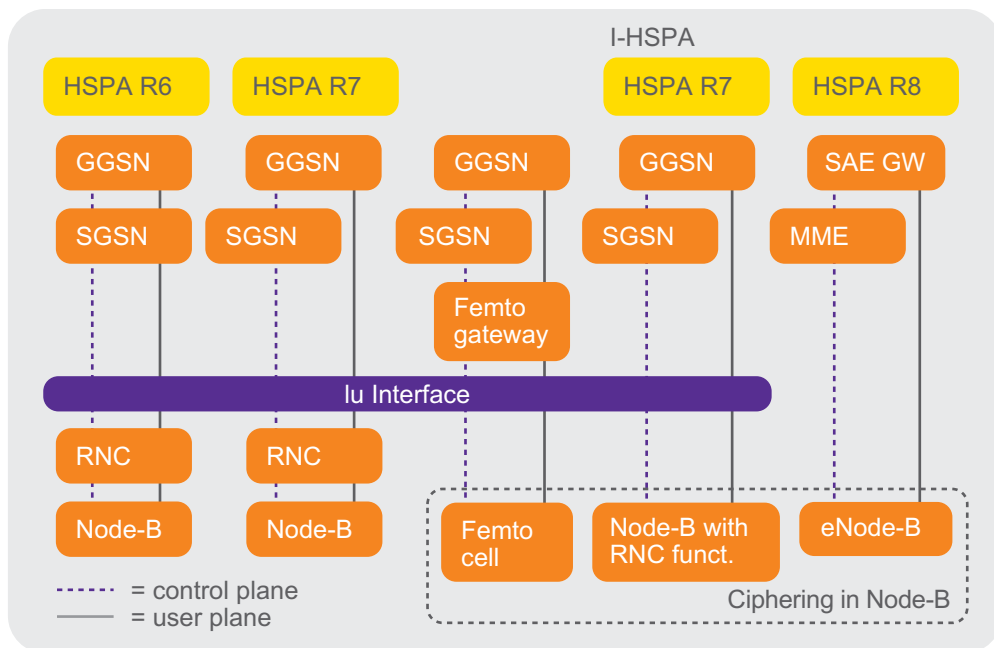


Figure 5: Flat, lu-based Femto Home Access architecture / In line with network evolution for mobile broadband.

6. Implementing 3G Femto Home Access with Nokia Siemens Networks

Voice and data support compatible with today's and tomorrow's handsets and networks requires support of lu-cs (circuit switched) and lu-ps (packet switched) interfaces. While almost all WCDMA voice traffic today is circuit switched, 3GPP, release 7 provides the basis for efficient VoIP over HSPA. In LTE (Long Term Evolution, defined in 3GPP, release 8) all voice traffic will run over IP.

In the context of growing data volumes, there is a trend among mobile broadband networks towards a flat architecture. This means that user plane traffic passes through as few network nodes as possible, which results in higher performance and better scalability of the network with traffic growth. Nokia Siemens Networks has been driving flat network architecture in the packet switched domain of 3G with its I-HSPA (Internet-HSPA) solution: RNC functionality is moved into the Node B. User plane functions of the packet switched core network are concentrated in the GGSN. I-HSPA is standardized in 3GPP, release 7. These two nodes interface via lu-ps. The same architectural approach is followed by LTE.

The above outlined 3G Femto Home Access architecture approach works well with today's WCDMA networks and fits neatly into the simplified network architecture of the coming mobile broadband networks.

Both the coverage improvement and the potential for outstanding service bundles make 3G Femto Home Access a very attractive proposition for implementing a successful strategy in the battle for the home. For mobile network operators this means a new way of doing business. The base station turned CPE is a consumer mass market device, not a part of the operator-owned network infrastructure. Analysts from ABI Research and Ovum estimate this market could reach ten to twelve million units by 2010.

Nokia Siemens Networks acknowledges that mobile network operators need a total solution for 3G Femto Home Access that provides for a variety of options for the 3G Femto CPE and ensures hassle-free end-to-end interworking.

The Nokia Siemens Networks 3G Femto Home Access Solution is a total solution based on the open lu-based architecture outlined in this paper. The Nokia Siemens Networks Femto Gateway is compact and highly scalable to enable solution deployment in all 3G network environments. Based on expertise in mobile radio and core networks as well as residential broadband access networks, Nokia Siemens Networks has a unique position in providing network integration and support services.

Nokia Siemens Networks is committed to an open 3G Femto CPE market. Nokia Siemens Networks runs a certification program for CPE suppliers to ensure interoperability. The certification ensures compatibility of Femto CPE and network. Its scope includes operation and maintenance aspects, where O&M extensions of the lu interface are not yet fully standardized.

Nokia Siemens Networks announced the first cooperation agreements on the 3G Femto Home Access Solution with Thomson and Airvana in July and September 2007 respectively. The companies will leverage their expertise and provide certified 3G Femto cell equipment that interwork with the Nokia Siemens Networks 3G Femto Home Access Solution. These and further agreements as well as continuous dialogue with leading network operators ensures high innovativeness and hassle-free operation of the 3G Femto Home Access Solution, enabling mobile network operators to deliver a new 3G user experience at home.

Glossary

ADSL	Asymmetric Digital Subscriber Line
ATM	Asynchronous Transfer Mode
CPE	Customer Premises Equipment
DAS	Distributed Antenna System
DSL	Digital Subscriber Line
HSPA	High-Speed Packet Access
I-HSPA	Internet HSPA
IOT	Inter-Operability Testing
IP	Internet Protocol
LAN	Local Area Network
LTE	Long Term Evolution
cs	circuit-switched
ps	packet-switched
UMTS	Universal Mobile Telecommunications System
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network

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Nokia Siemens Networks is a leading global enabler of communications services. The company provides a complete, well-balanced product portfolio of mobile and fixed network infrastructure solutions and addresses the growing demand for services with 20,000 service professionals worldwide. Nokia Siemens Networks is one of the largest telecommunications infrastructure companies with operations in 150 countries. The company is headquartered in Espoo, Finland.

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