

# Business Models of Mobile Operators for WLAN: Case Examples

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## Abstract

The WLAN are coming more and more significant factor in telecommunications business. The success of WLAN hotspot networks is increasing and the new GAN/UMA solution is being launched. It is very crucial time in WLAN business and especially for mobile operators. The question is, how they are going to gain from WLAN in most competent way.

In this paper is first analyzed some WLAN solutions in their technical aspect. Other part of the paper focuses on different kinds of WLAN services and case examples existing in markets today.

## 1 Introduction

At the moment the WLAN markets are facing a very interesting phase that may have very serious effect in telecommunication business. Not only the increasing number of users in public hotspot networks but also new opportunities and challenges are emerging. The new GAN/UMA solution that merges together WLAN networks and cellular networks gives very remarkable revenue opportunities to mobile operators. It also tightens up the cooperation with mobile operators and equipment manufacturers, because the solution is based on manufacturer's handsets. We can only guess how big business case WLAN is going to be in the future.

## 2 WLAN solutions

There are basically existing two kinds of WLAN solutions in the telecommunications markets today. The one is based on public hotspot networks and another is based on the Generic Access Network (GAN) solution that was formerly known as Unlicensed Mobile Access (UMA).

### 2.1 WLAN standards

A vast majority of the WLAN technique based standards are developed by IEEE 802.11 working group (Institute of Electrical and Electronics Engineers). In year 1997 has been defined the first WLAN standard 802.11. Since

then the standard has evolved as a basic standard for WLAN. The most of the WLAN products that currently are found in the market are based on the IEEE 802.1x extensions. [6]

There also exists other WLAN standards like European version HiperLAN developed by ETSI (European Telecommunications Standards Institute). Its functionality is much similar than IEEE 802.1x. It has not gained very big support though. [3]

Though almost all the WLAN equipment are based on IEEE 802.11x standard there always exist a risk for a equipment compatibility. To prevent this kind of risk an alliance called Wireless Fidelity (Wi-Fi) has been formed in year 1999. The alliance is formed to be neutral party that tests equipment compatibility and admits a validation to equipments succeed in testing. [15]

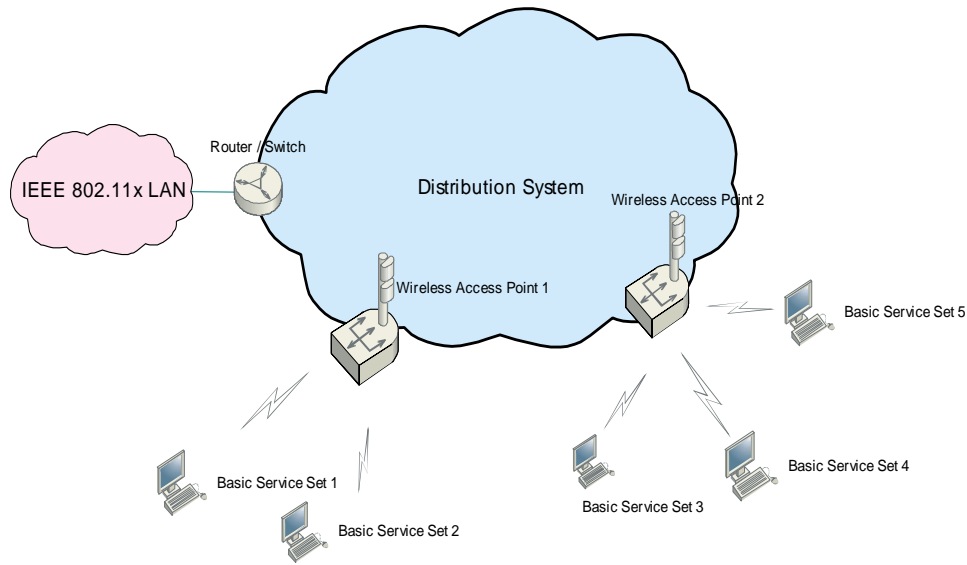
### 2.2 Hotspot Network Architecture

Public WLAN networks usually called hotspots have many different kinds of architectures depending on needs in every case. The basic functionalities however remain the same. [9]

In the picture 1 is presented the architecture of WLAN networks developed by IEEE. In the model is illustrated the Basic Service Set (BSS), which includes wirelessly communicating equipment in area of one base station. The equipments belonging in one base station area are sharing the capacity. BSS areas could be fully restricted from other areas or they can be connected with the distribution network (DS, Distribution System) through access point.

When more than one BSS are set together through DS, it is called Extended Service Set (ESS). ESS is illustrated in the figure 1.

The network which consist only wireless equipment belonging to the same BSS area is called independent BSS (IBSS). This kind of network is usually an ad hoc network and the equipments are communicating straight between. [10]



**Figure 1 Extended Service Set [10]**

### 2.3 Roaming

Roaming is a general term that refers to the extending of connectivity service in a location that is different from the home location where the service was registered. Roaming occurs when a subscriber of one wireless service provider uses the facilities of another wireless service provider. This second provider has no direct pre-existing financial or service agreement with this subscriber to send or receive information. [18]

### 2.4 Generic Access Network

WLAN coming more common at homes, in companies and in public the need for the continuous data connection using best connection in range is arising. For this purpose is developed a technique called Unlicensed Mobile Access (UMA), that in April 2005 was adopted by the 3GPP and the name was changed to Generic Access Network (GAN). [16]

GAN/UMA describes a telecommunication system allowing seamless roaming and handover between local area networks and wide area networks using the same dual-mode mobile phone. The LAN could be based on technologies like 802.11 and Bluetooth and the WAN could be GSM/GPRS or UMTS mobile services. [16]

The technique is based on the usage of GAN/UMA Network Controller equipment. When UMA compatible device using cellular network wants to change to use IP network the device takes connection through IP access

network to Network Controller on the carrier's network. After the device is authenticated and the location is updated in trunk network the device operates in GAN/UMA network. The NC translates signals coming from the handset to make it appear to be coming from another cellular base station. The GAN/UMA network architecture is presented in figure 2. [14] [16]

### 2.5 Authentication – RADIUS vs. SIM

In hotspot networks the authentication is usually been done with RADIUS server. RADIUS is an AAA (authentication, authorization and accounting) protocol for applications such as network access or IP mobility. When connecting to wireless connection username and password must be entered. This information is passed to RADIUS server over the RADIUS protocol. The server checks that the information is correct using authentication schemes like EAP. If accepted the server authorizes access to the system. [17]

Another technique for authentication is based on SIM (Subscriber Identity Module) card used in user equipments. It is a smart card that securely stores the key identifying an equipment service subscriber, subscription information, preferences and other information. The SIM stores network state information such as its current location area identity. SIM is a natural selection for Wireless LAN roaming tool, because roaming infrastructure and subscriber management systems exist, mobile operators have strong SIM based roaming agreements and strong SIM distribution channel. It is also reliable compared to password and username. [19]

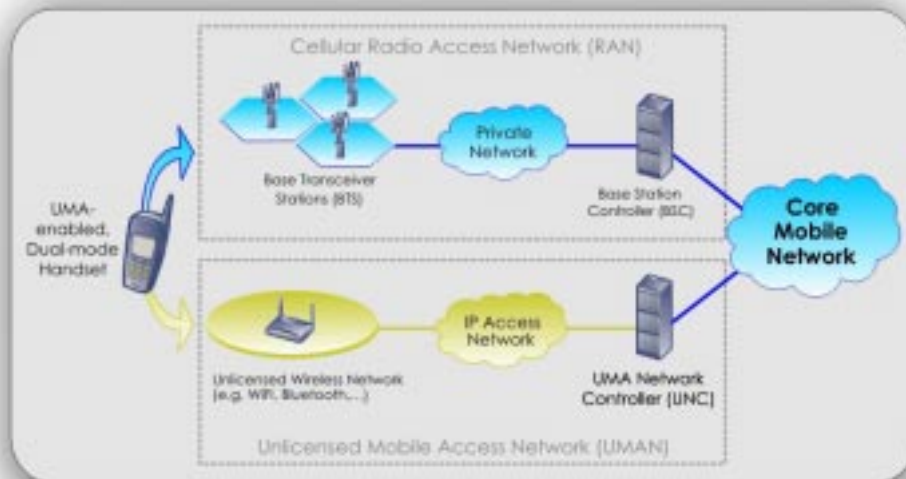


Figure 2 The UMA network architecture [14]

### 3 WLAN Hotspot Services

The WLAN hotspot networks offered by mobile operators are usually chargeable. The operators can bound the user charge in the billing of the mobile connection appending time usage or monthly payment. Also pre-paid and timely fixed, SMS and credit card payments are common. These hotspots are commonly built to places like hotels, restaurants and cafeterias, oil stations and airports and even airplanes, where people are ready to pay for the instant Internet access because of the easiness and time savings it brings. [12][5]

#### 3.1 WLAN Hotspot services - Case Examples

In Finland there are at least two mobile operators that offer WLAN hotspot network services: TeliaSonera and DNA. These example cases are presented in following.

##### Sonera Homerun [12]

TeliaSonera Finland Oyj has two WLAN based products. These products are quite similar compared to each other, but the purpose of use differs a lot. Sonera HomeRun product is developed for public use and Sonera WLanCare [13] is developed for corporation use. In this research is presented only Sonera Homerun service.

Sonera Homerun service is a wireless local area network for public areas. The usage requires buying a time fixed user card, credit card payment or taking the service to use within a mobile subscription. When Homerun is used through mobile subscription it can be timely charged or it can have monthly charge. The timely charge cards can be usually bought from hotels, cafeterias or other companies that have Homerun service. In companies the Homerun service is open to all users within the coverage area. It is open for everyone to use. The service area is

fully restricted from the company intranet and all traffic is going through dedicated ADSL connection to Sonera network. The network users are identified with Sonera's identification server before they are authenticated to access Internet. In both cases the authentication is performed through web browser using ID and password.

The Sonera Homerun service area is divided into two different types depending on target: public area or corporation. The public service area type implements public areas where there are lots of people moving every day. In public service area profit to the operator is based on large amount of end customers that are charged by the use. In corporation service area it is usual that the owner is charged for construction work and maintenance. The pricing of Sonera Homerun service differs also according to service area type. The pricing of Sonera Homerun is shown Table 1. In public service area the billing is based on the possible opening charge, which depends on the each case. The actual revenue is coming from charged end customers.

Table 1: Pricing of Sonera Homerun

Pricing Type	Price
Opening charge (€)	6,73
Monthly charge (€/month)	3,36
Usage charge in public service area (€/min or €/month/connection)	0,26 or 80
Usage charge in own company service area (€/min)	0

In the corporate service type billing is based on the coverage area wanted by company. Also the needed equipment and installation work affects the price.

## Dna WLAN [2]

DNA Finland Oy has brought to markets WLAN based product called Dna WLAN. It corresponds to the public service area type of Sonera Homerun service.

The pricing is based on three dna WLAN connection types: dna WLAN Gold, Silver and Base shown in Table 2. All types include a monthly charge and subscription activation charge and two last ones also include other charges. In all types the subscription activation charge is the same. The dna WLAN Gold connection type is the best solution for a person who travels a lot. The Gold monthly rate allows the connection to be used without any limit in all locations with a dna WLAN service. The dna WLAN Silver connection type is the solution for a person who does not transfer large amounts of data but wants to be always on the network. The Silver monthly rate which is less than half from Gold monthly charge allows user to stay online without limitations and transfer data up to one gigabyte. For additional usage is charged 0,05 €/MB in dna WLAN network. The dna WLAN Base connection type is more suitable for occasional use. Monthly charge is really small, but the user is also charged per usage time.

**Table 2: Pricing of dna WLAN**

Type	Monthly charge (€)	Subscr. activation charge (€)	Charge per minute (€)	Additional Usage Charge (€)
Gold	90	10	0	0
Silver	40	10	0	0 to 1GB; 0,05/MB
Base	5	10	0,25	0

The dna WLAN network is built on expense of operator. The operator also determines the service area and takes care of the maintenance. The profit to the operator is based to large amount of end customers that are charged for the usage.

## 4 GAN/UMA Services

GAN/UMA is quite a new solution and it has not achieved its great breakthrough yet, but several operators already have joint a growing number of European network operators offering similar GAN/UMA services. It has so many possibilities and advantages that it is surely going to be a really remarkable business case in WLAN markets. It seems that at the moment operators are waiting for equipment manufacturers to do the GAN/UMA equipment releases. In the matter of fact it is really interesting that this technology is so equipment bounded. Therefore mobile operators and equipment manufacturers are also bounded to tight cooperation. [16]

### 4.1 GAN/UMA services - Case Examples

The first GAN/UMA service launch was British Telecom with their product Fusion in the fall 2005. The service is based on pre-3GPP GAN standard technology. After that TeliaSonera was the first to launch a Wi-Fi based UMA service called HomeFree on August 28th, 2006. Since then there has been other releases just a step behind. For Example in the second week of September, 2006, Telecom Italia announced Unico service and on September 25th, 2006 Orange announced their Unik service. Also Saunalahti in Finland has been planning to launch their GAN/UMA service any moment now. [16]

There are also interesting GAN/UMA pilots going on. For Example Nokia has been piloting UMA over WLAN in the city of Oulu during July 2006. Fifty families in Oulu test the technology over two months in real life circumstances with new Nokia 6136 handset. [14] [8] Also T-Mobile has planned to test the technology with public launch before the end of the year. [16]

In following is presented few GAN/UMA service solutions offered mobile operators mentioned before. What is common in all these cases is that they all are based on home use. When moving outdoors the services are all using basic cellular network. So nobody is secretly using other mobile operator's network or any other corresponding actions. This is quite an interesting fact. When somebody will have enough courage to do that? The solution is so new that it will probably take some time before those kinds of solutions will enter to markets.

#### Fusion - British Telecom [1]

With Motorola's devices British Telecom is offering service called Fusion. Fusion is just a special type of mobile service using UMA at home. It includes a selected Motorola RAZR V3B or V560 handset and BT Home Hub router. In home when in range of the BT Home Hub the subscriber can enjoy the low rates to UK landlines through BT's Broadband network. Outdoors Fusion is connected to BT Mobile network.

Fusion has three pricing categories: BT Fusion 100, 200 and 400. They all give free calls in mobile network depending on the type (100/200/400 min). The monthly charge grows by pricing type and it depends also the week time when using service. For example BT Fusion 100 has monthly charge of 22 £ (33,29€) during the weekdays and during evenings and weekends 25 £ (37,83€).

#### HomeFree – TeliaSonera Denmark [11]

TeliaSonera selected cooperation with Motorola for first GAN/UMA service in Denmark. With Motorola's A910 device and its UMA-based connected home solutions the service enables seamless access around the home. Outside home the service works in a normal cellular network.

HomeFree has two pricing categories: Home Free Par and Home Free Familie. Both have same opening charge 199DKK (27,18EUR). Home Free Par is for 2 users and it has monthly charge 149DKK(20,35EUR). Home Free Familie is for 5 users and it has monthly charge 189DKK (25,82EUR). There also exist specific timely charges according if subscriber is using WiFi network or not.

### Unik - Orange

Unik is the largest GAN/UMA services announcement to date. It covers more than 60 million of Orange's mobile subscribers in the UK, France, Poland, Spain and the Netherlands. [14]

Basically unik is a telephone that, as well as offering standard mobile communication, offers unlimited calls to fixed lines and Orange mobiles when you are near a Livebox at home or at work. When leaving at house a call started with unik via the Livebox switches automatically over to the Orange mobile network. [4]

The new service will be available to Orange customers who subscribe to both its GSM mobile phone network and its DSL broadband Internet access service. Using a special mobile phone costing from 99 €, they will be able to make unlimited calls from home, connecting via Wi-Fi to their Livebox DSL home router. When they are outdoors, calls will be carried over Orange's GSM network at the usual rates. [7]

In France, unik will initially be a limited edition, reserved for the first 100,000 customers and It will be available with a mobile plan in two options. The first offers unlimited calls 24/7 from the mobile connected to the Livebox to fixed lines in France: EUR10/month and the second offers unlimited calls 24/7 from the mobile connected to the Livebox to Orange mobiles and fixed lines in France: EUR 22/month. [7]

## 5 Conclusions

The paper discussed about WLAN solutions and how the mobile operators have been implementing the solutions in their services. The axiomatic conclusion is that WLAN is more and more growing business opportunity to mobile operators. Just launched new services based on GAN/UMA are increasing WLAN's importance and its possible revenues. It will also tighten up the cooperation between mobile operators and equipment manufacturers. The equipment development will probably escalate the need of build more WLAN hotspot networks.

From an operator point of view, GAN/UMA provides a number of benefits. The operator's share of customers will increase, because GAN/UMA brings the ability to offer integrated fixed and mobile services. The use of mobile voice and data services in areas of poor network coverage will increase and also the average revenue per user by providing additional voice and data services utilizing broadband connection to mobile devices. [14]

## References

- [1] BT Fusion homepage, <http://www.btfusionorder.bt.com/default.aspx>
- [2] DnaWLAN service homepage, [www.dnafinland.fi/yrityksille/liittymat\\_ja\\_palvelut/wlan/](http://www.dnafinland.fi/yrityksille/liittymat_ja_palvelut/wlan/)
- [3] European Telecommunications Standards Institute homepage, HiperLAN. <http://portal.etsi.org/radio/HiperLAN/HiperLAN.asp>
- [4] France Telecom homepage: Press Release, [http://www.francetelecom.com/en/financials/journalists/press\\_releases/CP\\_old/cp060925.html](http://www.francetelecom.com/en/financials/journalists/press_releases/CP_old/cp060925.html)
- [5] Held, Gil "Data Over Wireless Networks" McGraw Hill 2001. 344 s.
- [6] IEEE 802.11 Standards, <http://standards.ieee.org/getieee802/802.11.html>
- [7] Kinet Wireless, "Orange plans to launch Unik mobile phone with Wi-Fi", Sept 21 2006, [http://www.kinetowireless.com/news/industry\\_articles/orange.html](http://www.kinetowireless.com/news/industry_articles/orange.html)
- [8] Reuters: "Nokia starts tests of Wi-Fi Internet mobile calls", Jul 27, 2006, [http://today.reuters.com/news/articleinvesting.aspx?view=CN&storyID=2006-07-27T143847Z\\_01\\_L27631896\\_RTRIDST\\_0\\_TECH-NOKIA-UMA.XML&rpc=66&type=qcna](http://today.reuters.com/news/articleinvesting.aspx?view=CN&storyID=2006-07-27T143847Z_01_L27631896_RTRIDST_0_TECH-NOKIA-UMA.XML&rpc=66&type=qcna)
- [9] Smura, Timo: "Interworking Between Wireless LAN and Cellular Networks", Networking Laboratory, Helsinki University of Technology
- [10] Stallings, W: "Wireless Communications & Networks", 2<sup>nd</sup> Edition, Prentice Hall, 2005
- [11] Telia homepage, France Telecom homepage, Press Release, <http://telia.dk/privat/produkter/mobilip/priser/>
- [12] TeliaSonera Homerun service homepage, [www.sonera.fi/homerun](http://www.sonera.fi/homerun)
- [13] TeliaSonera inner documentation of wLanCare Service
- [14] UMA Technology homepage, <http://www.umatechnology.org/overview/index.htm>
- [15] Wi-Fi alliance homepage, <http://www.wi-fi.org>
- [16] Wikipedia, definition for word GENERIG ACCESS NETWORK, [http://en.wikipedia.org/wiki/Generic\\_Access\\_Network](http://en.wikipedia.org/wiki/Generic_Access_Network)
- [17] Wikipedia, definition for word RADIUS, <http://en.wikipedia.org/wiki/RADIUS>
- [18] Wikipedia, definition for word ROAMING, <http://en.wikipedia.org/wiki/roaming>
- [19] Wikipedia, definition for word SIM, <http://en.wikipedia.org/wiki/SIM>