

Changing business models for Europe's mobile telecommunications industry: The impact of alternative wireless technologies

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Abstract

The exploitation of third-generation mobile networks in Europe may be challenged by the deployment of so-called Alternative Wireless Technologies (AWTs). This article presents an overview of the availability and usage of AWTs in the 25 EU member states. It identifies the main drivers and bottlenecks for AWTs and analyses to which extent established mobile operators are active in this market. The article concludes that the convergence and integration of cellular technologies and AWTs is high on the telecommunications industry's agenda, implying a gradual shift in business models for mobile operators towards mobile service providers that manage network heterogeneity and complexity on behalf of the user. © 2007 Elsevier Ltd. All rights reserved.

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1. AWTs introduced

The current deployment and exploitation of so-called third-generation (3G) mobile systems and services in Europe emulates the coordinated, sequential migration path that Europe's mobile telecommunications industry introduced with great success with the second-generation (2G) systems over 10 years ago. This migration is intended to mark the transition from the voice-centric GSM to the data-centric UMTS world, while remaining anchored around the established mobile operators (Bohlin et al., 2003; Ballon, 2004).

However, the cellular mobile technologies as well as their associated business models, put forward by Europe's mobile industry, are increasingly being challenged by wireless technologies, often championed by other actors from different parts of the world. Due to their potentially disruptive effect on existing technologies and business models, these competing (and complementing) wireless technologies and solutions are denoted alternative wireless technologies (AWTs).

The objectives of this article are to map the availability and use of AWTs in Europe, to identify the current trends in their development and to analyse their impact on the strategies and business models of the European

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mobile telecommunications industry. The AWTs covered here are existing in the market today and/or on their way towards standardisation or in advanced R&D stages, as well as potentially presenting a challenge to traditional business models in the mobile market. AWTs such as DVB-H, Bluetooth, NFC or satellite technologies are not treated because of various characteristics (e.g. lack of uplink, small range or narrowband) that limit their presumed impact on the presently dominant cellular paradigm. Specifically, the following types and technologies are considered:

- Short-range protocols:
 - UWB (IEEE 802.15.3a standard): Ultra-Wide Band (UWB) is intended for short range high bandwidth transfer. The impact on cellular technologies is expected to be limited as long as UWB is restricted to low power usage, but it could be higher when high power usage is allowed;
 - WLAN/WiFi (IEEE 802.11 family of standards): Wireless Local Area Networks (WLAN), in the form of WiFi, is the most mature AWT, and aimed at relatively short-range broadband access. The impact on cellular technologies is estimated as moderately high, because of increasingly high bandwidth, mobility (albeit limited) and maturity of standards and products;
- Longer-range protocols:
 - WiMAX (IEEE 802.16 family of standards): WiMAX is intended for fixed wireless (early version), nomadic and mobile access (later versions). Potentially high impact on cellular technologies, especially in its mobile implementation (IEEE 802.16e);
 - Flash OFDM (Linked to the IEEE 802.20 standard): IP Packet-based protocol for wide metropolitan area networks. It may have a high impact owing to high data rates and high mobility supported, but acceptance is still uncertain as it is a proprietary technology;
 - UMTS-TDD (Packet data implementation of 3GPP UMTS standard): As an alternative mode of operation of the common UMTS-FDD standard and being able to operate in unlicensed spectrum, UMTS-TDD is considered here as an AWT with potentially considerable impact, especially in situations when there is high asymmetry between up-and downstream traffic;
- Mesh and ad hoc networking (IEEE 802.11s, IEEE 802.16f standards): These network topologies are aimed at cost-efficient, “operator-less”, wireless local loop (fixed meshed networks) or temporary event networks (ad hoc networks). They have a potential impact in niche markets, and in the long term as a potential replacement of mobile cellular networks.

The article is structured as follows. Following this introduction, Section 2 presents an analysis of the availability and usage in the EU of the AWTs listed here, as well as the main trends and drivers for their diffusion. Section 3 assesses the potential impact of AWTs on the strategies and business models of the European mobile telecommunications industry.

2. AWT availability and usage in Europe

This section brings together our observations regarding AWT activities in Europe. The extent of AWT diffusion for all 25 EU member states, as well as, to a smaller extent, for the four accession countries, was mapped out. Data sources for the targeted information were non-confidential, publicly available or publicly verifiable. To gather them, extensive desk research activity was carried out throughout 2005, involving academic and consultancy sources, official country- and region-specific data, the business press, specialized web information, and corporate information provided by the main AWT providers in each country. In addition, a series of in-depth telephone interviews were conducted with country experts for each of the EU25 countries. Table 1 overviews at country level the phase of AWT development, i.e. (market) trial, deployment, non-commercial use and commercial availability.¹

¹ Obviously, in countries where there are already commercial offerings of a specific AWT, there can be deployment or other activities going on at the same time. This table presents the “most advanced use” of an AWT in each country, with commercial use for the purposes of this article being considered as most advanced.

Table 1
Overview of selected AWT activity in EU25 (2005)

Country	UWB	WLAN	(pre) WiMAX	Flash OFDM	Mesh/Ad hoc	UMTS TDD
Austria		Commercial	Deployment		Use	
Belgium		Commercial	Commercial		Use	
Cyprus		Commercial			Trial	
Czech Republic		Commercial	Trial		Use	
Denmark		Commercial	Commercial		Use	
Estonia		Commercial	Trial			
Finland		Commercial	Trial	Deployment	Use	
France		Commercial	Commercial		Commercial	Trial
Germany		Commercial	Commercial		Commercial	Commercial
Greece		Commercial			Use	
Hungary		Commercial	Deployment			
Ireland		Commercial	Commercial		Deployment	Deployment
Italy		Commercial	Commercial			
Latvia		Commercial	Commercial			Commercial
Lithuania		Commercial	Trial			Deployment
Luxembourg		Commercial				
Malta		Commercial				
Netherlands		Commercial	Commercial	Trial	Use	
Poland		Commercial	Commercial			
Portugal		Commercial				Commercial
Slovakia		Commercial		Deployment		
Slovenia		Commercial	Commercial			
Spain		Commercial	Commercial		Use	
Sweden		Commercial	Trial		Use	Deployment
UK		Commercial	Commercial		Commercial	Commercial

Clearly the most dynamic markets, in terms of the variety of AWTs being used or deployed, are situated in Western Europe and Scandinavia. Finland, France, Germany, Ireland, the Netherlands, Sweden and the UK present the most diverse European markets in terms of AWTs, with at least four AWTs under review being deployed or used in these countries. Southern and Eastern European countries, as well as small countries, have less diversity in the AWTs being implemented.

Unsurprisingly, WLAN is the most mature AWT on the market. The availability and usage of AWTs other than WiFi is far more incidental. However, despite the limited and fragmented nature of the diffusion of these AWTs, there is a certain dynamism related to them in many countries. Table 1 demonstrates that, while deployment of UWB is non-existent on the EU market, Flash OFDM, UMTS-TDD, Mesh/Ad hoc technologies and (pre)WiMAX are available or being deployed in several, or even most, of the EU (in 3, 8, 14 and 19 member states, respectively). In the following sections, our observations are presented technology-wise, starting with WLAN.²

2.1. WLAN/WiFi

2.1.1. WLAN diffusion

Mapping the diffusion of WLAN, Table 2 presents aggregated data on the number of hotspots in the EU25, as well as in the four candidate countries.³

From the table it is apparent that in absolute terms most hotspots are deployed in Western Europe, with peaks in the UK, France and Germany, each of these countries counting around 10,000 hotspots. This is visualised in Fig. 1.

² For full country and technology details, please refer to Ballon and Wehn de Montalvo (2006).

³ The mapping of WLAN availability was based on around 15 hotspot directories, provider websites and expert interviews. An extensive analysis and compilation was performed of a large number of hotspot directories and 'local' hotspot directories, i.e. those operating with a more national or regional focus, as well as informed expert estimates, business and operator websites. For methodological details concerning the rest of the data presented in this section, please consult Bohlin et al. (2006).

Table 2
Aggregated hotspot data for EU25 + 4 accession countries (2005)

Country	Austria	Belgium	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia
Total	702	553	2	42	5	250	894	516
Relative	8.6	5.3	0.0	0.9	0.6	2.4	16.5	38.5
Country	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia
Total	400	8 000	7 838	188	529	430	2 600	165
Relative	7.7	13.2	9.5	1.8	5.3	10.8	4.5	7.2
Country	Lithuania	Luxemburg	Malta	Netherland	Poland	Portugal	Romania	Slovakia
Total	22	36	39	1 300	346	650	10	50
Relative	0.6	7.8	9.8	8.0	0.9	6.2	0.0	0.9
Country	Slovenia	Spain	Sweden	Turkey	UK	EU25+		
Total	55	1 072	600	161	9 689	37 144		
Relative	2.7	2.7	6.7	0.2	16.1	6.6		

Note. “Total”: Total number of hotspots. “Relative”: Number of hotspots per 100,000 inhabitants.

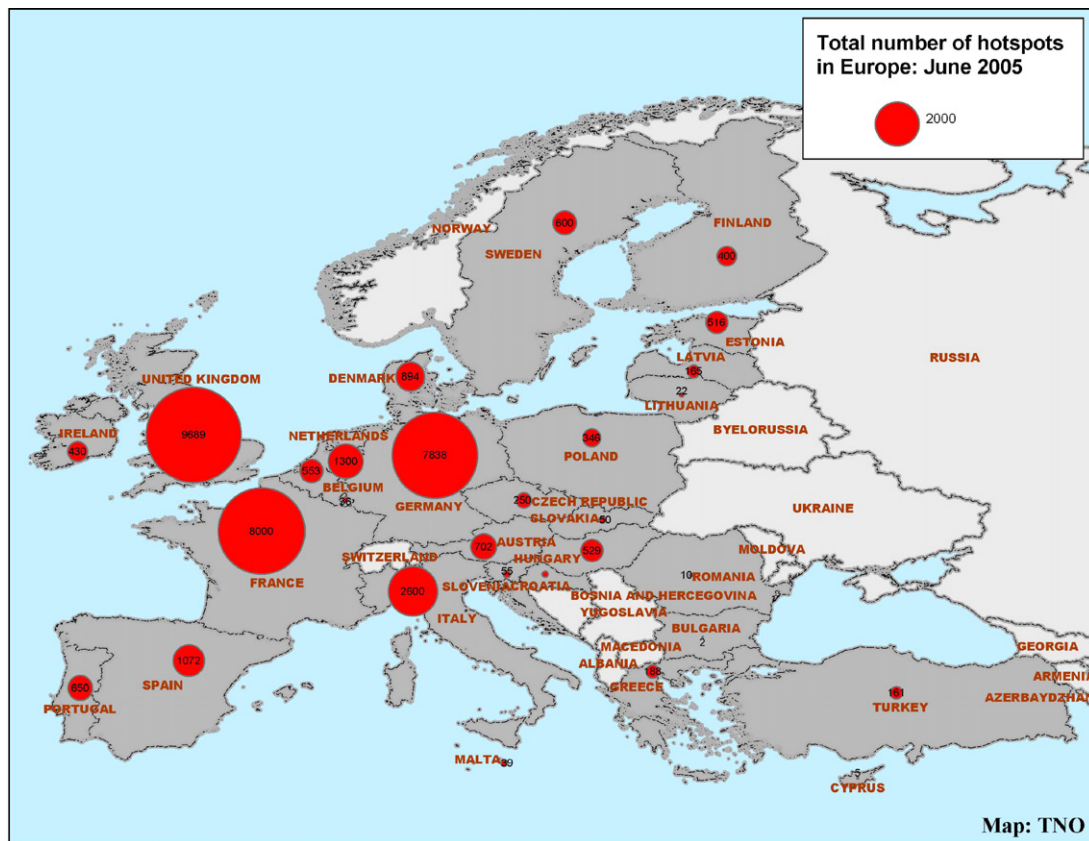


Fig. 1. Hotspots in EU25+ (june 2005).

However, in relative terms, the diffusion is somewhat more equally spread. This is illustrated by Fig. 2. In relative terms, Estonia is clearly the most developed hotspot market in Europe with almost 40 hotspots per 100,000 inhabitants. Denmark, the UK, France and Ireland constitute a second group of countries with the most developed and dynamic hotspot markets in the EU, counting over 10 hotspots per 100,000 inhabitants. Malta, Germany, Austria, Finland, Latvia, Luxemburg, the Netherlands and Sweden can be said to be in

An emerging phenomenon that can be witnessed in a number of European countries is the establishment of wireless clouds or zones. Based on Shamp (2004), we define them as follows: (1) a WiFi zone is an aggregation of cooperating hotspots. However, the area covered by the zone need not be continuous. (2) WiFi clouds offer continuous and unified coverage over a significant portion of a city's or town's geographic area, usually using multiple hotspots. Examples of WiFi clouds and zones being established in Europe today include Zonet, a cooperative of Finnish Wireless Internet Service Providers (WISPs) that has established WiFi zones and clouds in nine cities in Finland. It claims to have one of the largest WiFi zones in the world, covering 400 km² in total. Besides this, various municipal and community initiatives have established or aim at establishing WiFi zones and clouds e.g. in the Netherlands, Germany, Greece, Poland and the UK. In some cases there is a link with the use of meshed and ad hoc topologies.

A cursory overview of WiFi offerings throughout Europe shows that WiFi and traditional telecommunications access are being combined on a subscription level in 10–15 European countries. In several EU countries, this study has found evidence of attempts or plans to combine mobile (2G/2.5G/3G) and AWT connectivity on a technical level. As an illustration, in 2004, Austrian mobile operator Mobilkom announced the introduction of a fully integrated WiFi-cellular platform offering seamless UMTS/EDGE/WiFi access. We will come back to this issue below.

The main applications for WLAN are internet and intranet access. In addition, but far more marginally, some specific WLAN services are being developed, mainly on a local level. For instance, in the UK, municipal WLANs have been established with objectives varying from transferring noise pollution data that is continually captured throughout the municipality to developing interactive media services for local communities (Informal, 2004). The primary target user group for public hotspots consists of business travellers. Other major target groups are tourists, students and other consumer segments characterised by heavy (fixed) internet usage in general. Finally, some niche deployments of public WiFi (e.g. by municipalities) are targeted to Small and Medium-sized Enterprises (SMEs) and Small Office Home Offices (SOHOs) in rural or remote areas, disadvantaged segments of the population and so on. The predominance of the target groups mentioned above is reflected in the locations where WiFi hotspots are being deployed and used. Public hotspots in the EU are rolled out primarily in cities and towns (i.e. in hotels, restaurants, cafes and at public institutions) and at transport hubs (i.e. at petrol stations, airports, and railway stations). For example, in 2004, 51% of all Italian hotspots were located at airports, hotels and conference centres, and accounted for 66% of all usage (PECForum, 2004).

An interesting new application of WiFi, sometimes in combination with (pre)WiMAX, is the offering of wireless connectivity on public transport vehicles, usually on trains. This is currently being planned or deployed in countries such as Belgium, France, Germany, Italy, the Netherlands and the UK. Another interesting application is wireless VoIP (sometimes also labelled Voice over Wireless or VOW). Some analysts are persistently referring to VOW as the so-called killer application for AWTs. However, most observers agree that a number of technological issues of using VOIP in the air interface (see, e.g. Northstream, 2005) as well as issues relating to the availability of terminals and expectations of end users in terms of QoS and mobility, limit the market prospects of VOW services in the short to medium term.

Based on the findings and estimations uncovered in this study, it is clear that in general, usage of WiFi hotspots throughout Europe is still generally below commercially sustainable thresholds (estimated as 5–10 uses per day). For instance, in 2004, on average a usage of 0.5 session/hotspot/day was reported in Italy. In Germany, average usage figures of between 1 and 2 users per hotspot per day have been reported. In the Scandinavian countries, Estonia, Ireland and the UK, WiFi usage is estimated to be the highest in Europe. In Ireland, one wireless ISP claimed 3.5 sessions/hotspot/day on average in 2005. Naturally, commercial sustainability varies greatly across hotspot locations. Hotspot operators in prime locations such as Schiphol national airport in the Netherlands have claimed 200 users per day throughout the year 2004. Swisscom Eurospot in Germany claimed to have anything between 0 and 100 users/day for its hotspots, 10% of hotspots being profitable. In spite of currently not being commercially sustainable, a number of European countries, such as Sweden and Greece, have witnessed the announcement of further large hotspot roll-out plans. A number of analysts have supported this by claiming that, even in more advanced countries in terms of WiFi penetration such as the Netherlands and Sweden, the number of hotspots is still well below thresholds that are needed to reach a commercially sustainable service.

2.2. Other AWTs

Turning to the other AWTs under review, this section summarizes the much more sparse data on their emergent deployment and exploitation. It will be illustrated that, even though Eastern Europe is often mentioned as the most promising AWT market because of a lack of fixed broadband infrastructures in many areas, this is not visible in the number and extent of AWT deployments today. A handful of new member states such as Estonia aside, most AWT dynamics currently appear to be taking place in Western Europe and Scandinavia. Also, it will be highlighted that regulatory conditions in Europe are generally still anchored around 3G.⁴

2.2.1. UWB

There are several national as well as EU-wide research projects and trials with UWB, demonstrating a marked interest in the concept of UWB from both a civilian and a military viewpoint. However, current deployment of UWB in Europe is non-existent, in terms of market trials or actual deployments (according to current public knowledge).

Reasons for this are regulatory bottlenecks – commercial deployment of the technology is currently prohibited by most, if not all, EU regulators – but also the persistent standardisation problems facing UWB and the reticence of operators towards potential interference caused by UWB.

The public announcement, in May 2005, of the Bluetooth Special Interest Group that it plans to integrate UWB into its Bluetooth standard, may facilitate the entry of UWB on the EU market, but most observers agree that this is not likely to materialise in the short term.

2.2.2. (Pre-)WiMAX

As ‘mobile WiMAX’ has only recently been standardised (December 2005) and is currently not permitted in most European countries, so-called ‘pre-WiMAX’ deployments that are using early WiMAX technology to deliver Fixed Wireless Access (FWA) were taken into account for this article. As argued by [Goldman Sachs \(2004\)](#), the more attractive spectrum bands for mobile or wireless broadband are those used by UMTS and planned for UMTS expansion, making actual available licences scarce. In Europe, the UMTS licenses awarded in 2000 and 2001 generally fixed a maximum number of competitors for high-speed mobile services per market. Originally, this coincided with the number of UMTS licenses in each market, though given the arrival of AWTs there is a scope to widen the definition of competitive services. However, the licences awarded for use with AWTs in general still restrict the service to portable, but non-mobile applications, preventing carriers from enabling cell handovers and thus preventing them from competing head-on with UMTS.

Our research has uncovered the following typical uses for (pre)WiMAX throughout Europe:

- Fixed wireless broadband Internet access in rural or remote areas for consumers and small businesses (sometimes marketed as ‘portable DSL’). Examples can be found in Austria, France, Ireland, Poland, Spain and the UK. In some countries such as Austria, WiMAX operators are also starting to offer voice telephony to their consumers.
- Alternative wireless broadband connectivity for consumers and small businesses in city and town centres. Usually in this case, basic Internet connectivity is being offered in very densely populated areas at competitive prices. Examples are current WiMAX offerings in France, Germany, Ireland, Spain and the UK.
- WiMAX as a solution to fill holes in WiFi hotspot coverage and thereby create wireless broadband access clouds or zones and the use of WiMAX to enable wireless connectivity on trains or buses. Examples are a number of current offerings or trials in France, Ireland, Sweden and the UK.
- Wireless broadband connectivity for large businesses or organisations, replacing fixed leased-line capacity and/or offering corporate services such as managed bandwidth services and VPN access. This is mostly in and around cities and sometimes only within a limited time frame. Examples can be found in Belgium, Latvia, Slovenia, the Netherlands and Spain.

⁴ For an analysis of the regulatory and policy implications of the state-of-play regarding AWTs, see the original report ([Bohlin et al., 2006](#)) as well as ([Lindmark et al., 2006](#)).

As a rule, WiMAX is offered as a subscription service. Usually plain broadband Internet connectivity is offered, but there are also attempts to offer other services (e.g. VoIP for the consumer market, managed services for the business market). Speeds typically range between 512 kbps and 2 Mbps downstream and between 128 kbps and 512 kbps upstream for the consumer and small business market, and upwards from 2 Mbps for the business market. For WiMAX on trains, pay-per-use schemes have also been announced.

Currently WiMAX constitutes a small-scale, niche market. Little usage is being reported, typically a few 100 customers. However, this scale is expected to grow considerably as large trials and deployments on a regional or even national scale have been announced in several countries, following the allocation of 3.5 GHz licences throughout most of Europe. As the examples cited above demonstrate, current WiMAX trials and deployments are predominantly going on in Western Europe. So while most analysts (e.g. [Northstream, 2005](#)) mention Eastern Europe as the most promising market for WiMAX because of its general lack of fixed broadband infrastructure in many rural and remote areas, this is not immediately observable in WiMAX deployments today. In Eastern Europe, many new developments appear to centre around the 450 MHz band, which can be used by technologies such as Flash OFDM, as we will illustrate below, but which is more favourable to low capacity, wide area voice and data services than to mobile or wireless broadband ([Goldman Sachs, 2004](#)).

2.2.3. *Flash OFDM*

Not just in the US, but also in Europe, Flash OFDM has been touted as one of the most promising AWTs, citing its combination of high throughput, high mobility, and low latency as its major advantage. However, the deployment of Flash OFDM is currently not permitted by most European regulators. While most observers have characterised Flash OFDM's strategy as attempting to persuade operators and agencies in Europe to advocate a technology-agnostic view of licensing ([Dineen, 2004](#)), some analysts are observing a different European strategy, involving Flash OFDM trying to establish itself as part of the 3GPP family of standards. In any case, it is expected that there will be an uncertain and lengthy process involved. This uncertainty continues after the acquisition of Flash OFDM owner Flarion by Qualcomm.

Nevertheless, there has been at least one documented Flash OFDM market trial on the European market already. In September 2004, a Flash OFDM trial in the Dutch city of The Hague was started by T-Mobile. Since then, a number of other Flash OFDM developments have taken place. The Government of Finland has granted an operating licence to Digita Oy to build a new digital mobile communications network using Flash-OFDM. The network will be built using the frequency released from the analogue NMT 450 service. At the end of 2005, T-Mobile, using Siemens equipment, announced the commercial deployment of Flash OFDM in 19 Slovakian cities, including the capital, Bratislava. The Slovakian launch, with the T-Mobile Slovakia subsidiary, also uses Flarion's technology in the 450 MHz spectrum.

2.2.4. *Mesh/Ad hoc networks*

We have adopted a broad definition of Mesh/Ad hoc networking in this article. Different distinctions are commonly made between meshed networks ([Vance, 2004](#)), including pure client meshes (in which every device in the network, including laptops, PDAs and smart phones, can pass along traffic to other devices, and thus constitutes a 'multi-hop' node in the network), and infrastructure meshes (in which access points and wireless routers carry the traffic back to the wired node). The majority of meshes in Europe today seems to consist of non-ad hoc infrastructure meshes.

Mesh and ad hoc technologies in Europe are being used primarily by wireless communities of individuals linking and opening up their infrastructure on a voluntary basis. We have found few particular services being deployed within these networks. Another use of mesh and ad hoc technologies is to create more coherent wireless zones or clouds, for either commercial exploitation or non-commercial usage. This is done by specialised WISPs and/or by municipalities, regional governments and universities. Commercial exploitation, if any, is on a subscription basis, typically with flat fees of 10–30 € per month depending on data rates (typically 128 kbps to 1 Mbps), e.g. in cities, or, alternatively, in remote areas of France, Netherlands and Northern Ireland.

2.2.5. *UMTS-TDD*

Since recently, the trialling, deployment and usage of UMTS-TDD in Europe have clearly been on the rise. The fact that the technology is admissible by EU regulators because of its adherence to the 3GPP family of

standards is widely being regarded as the main advantage of this technology compared to other AWTs. In addition, many established mobile operators in most of the European countries have acquired UMTS-TDD frequency space and licences at the time of the UMTS licensing processes throughout Europe in 2000 and 2001. UMTS-TDD is also being deployed by new operators in other frequency bands, e.g. the 3.5 GHz band.

In contrast to some of the deployments of WiMAX and Mesh/Ad hoc networks, the current deployment and usage of UMTS-TDD in Europe is primarily in city centres and urban areas. While a number of offerings are aiming at the enterprise market (e.g. Orange trials in France and deployments in Latvia), most are aimed at the consumer market or at a mixture of both (e.g. Airdata's UMTS-TDD offering in Germany). Some of these companies, including Airdata, are rolling out UMTS-TDD networks with the intention of subsequently using independent WISPs as resellers. The proposition to the ISPs/retailers is in this case to exclude the incumbent from the customer relationship, as no fixed-line connection is required any more for broadband access.

Many operators are holding licences as well as having roll-out plans for much larger areas than city centres, including operators in Lithuania, Portugal, Sweden and the UK. While coverage of current UMTS-TDD networks is in many countries in the order of tens of thousands of potential customers, actual subscriber figures are in the order of several 100 of customers.

The main service currently offered is flat-fee 'portable DSL', priced at 15 €/month and up, depending on data rates (128 kbps up to 1 Mbps). As [Goldman Sachs \(2004\)](#) pointed out, the spectrum used by UMTS-TDD generally has been allocated by regulators as a non-mobile frequency, so the mobility aspect of the UMTS-TDD technology has been disabled. In addition to portable high-speed wireless broadband internet access, various operators plan to offer a voice service to replace subscribers' fixed subscriptions.

2.3. Drivers and bottlenecks

To conclude the overview of current and emerging developments related to AWTs, this section presents a generic overview of present and near-future drivers and bottlenecks for AWTs in Europe that were encountered during the research. These drivers are at the level of general developments in markets, technologies and regulations as highlighted by nearly 30 country and technology experts that were interviewed for this study. In general, the following drivers for AWTs were mentioned most frequently and highlighted as most important by EU experts:

- Poor fixed broadband infrastructure development in many small cities, towns, rural and remote areas across Europe.
- Government incentives, programs and public-private partnerships to stimulate broadband connectivity.
- Competition in WiFi markets, a.o. because of relatively low prices of WiFi deployment, driving prices down and ensuring relatively high coverage in a number of countries.
- Success of private in-house WLANs, which might stimulate the usage of public WLANs.
- Emerging integration of AWT and mobile capabilities in dual mode handsets.
- Falling hardware prices and backhaul costs.
- Limited number of licensed operators in some markets, creating incentives for new stakeholders to enter national markets using AWTs.
- New applications and possibilities such as VOIP over wireless, deployment of AWTs on trains, etc.
- Expected expansion of WiMAX with mobility characteristics.

In contrast to the main drivers, the following bottlenecks were identified as major inhibitors to AWT development by the European experts that were consulted:

- Lack of interconnection and roaming agreements, especially between new AWT operators.
- Pricing models of public hotspot access in many EU countries still oriented towards occasional use, limiting scope of AWTs to business market.
- Licensing regimes in many EU countries imposing limitations on spectrum availability, deployment, hand-off and integration of AWT cells, and generally allowing technical experiments with AWTs but no market experiments.

- Persistent standardization problems.
- Lack of user friendliness in access, authentication and billing procedures.
- Lack of structural advantages (in terms of speed or cost) over fixed broadband, and therefore a lack of incentives for AWTs in areas with well developed fixed broadband infrastructure.
- Potential saturation and congestion of unlicensed spectrum in prime locations.
- Limited amount of terminals and other certified equipment in the market.
- Lack of customer education, i.e. in terms of differences between mobile and various AWTs.
- Lack of content applications.

3. AWTs and business models in the mobile industry

The previous sections already demonstrated that AWTs are being used as substitutes for fixed broadband connectivity, i.e. in the case of being positioned as ‘wireless or portable DSL’, but also as substitutes for mobile or at least for nomadic internet connectivity, i.e. in the case of being used to establish wireless zones and clouds. They also illustrated that there are powerful drivers as well as important inhibitors at play in the development of AWTs in Europe.

However, the likelihood of AWTs actually having a considerable impact on established operators’ business models is very much dependent upon the types of actors driving the service offering, as well as on their strategies. First, this section will review shortly the main types of actors and strategies vis-à-vis AWTs encountered in the European market today. Finally, it will offer some indications about the envisaged impact of AWTs on changing business models for the mobile industry.

3.1. (Non)operator centricity of AWTs

The assessment of the relative importance of the different types of AWT offerings was based on the expert interviews that were conducted for each country as well as upon an additional analysis of the available data on numbers of deployments, coverage and numbers of users for each type of initiative. First, so-called ‘non-operator centric’ initiatives are considered, i.e. initiatives that favour non-operator centric business models. In Europe, AWTs are being used in a non-operator centric way in the case of the individual provision of hotspots, and the establishment of (free) wireless zones and clouds using WiFi, WiMAX and/or Mesh and Ad hoc technologies. The rationales and strategies that were encountered can be characterised as follows:

- **Communitarian:** communities of individuals linking and opening up their wireless infrastructure on a voluntary basis.
- **Location-based:** municipalities and universities wishing to increase the attractiveness of their location or site, or wishing to speed up broadband deployment in their local environment without being dependent upon any operator.
- **Commercial:** given the relative high cost of administration and billing in for instance hotspot provisioning, it can be commercially more sound not to charge directly for wireless access but instead reap indirect returns from increased sales of other products or services in hotels, restaurants, bars, conference centers, shops, etc.

The importance of non-operator centric initiatives in Europe was estimated as limited for most member states. This is consistent with most analysts’ observations on the particularities of the European market for AWTs, for instance in comparison to the US market. In a relative small number of European countries, there is a moderate or even fairly strong involvement of non-operator centric initiatives. As examples such as Estonia, Spain, Poland and the UK demonstrate, this is usually related to a mixture of active local, regional or national governmental support for AWTs, active wireless communities, and individual commercial AWT offerings in which no operators are involved.

Secondly, so-called ‘new entrant operator initiatives’ are considered, i.e. initiatives driven by new entrants challenging established operators’ business models. In this case new operators, such as new generations of Wireless Internet Service Providers (WISPs), are involved in offering AWTs. The analysis shows that new entrants have a number of diverging strategies, i.e.:

- Niche players:
 - Providers targeting particular segments of the business market.
 - Operators providing small patches of rural and remote coverage.
- Mass market operators:
 - Operators serving consumer and small business markets in urban areas (strategies may include cream-skimming of most attractive segments, or competing head-on with existing mobile and fixed networks).
 - Operators serving consumer and business markets in large areas with underdeveloped existing telecommunications infrastructure.

All of these strategies are found among new entrants providing AWTs in Europe today, without any strategy clearly dominating. A cursory overview of the different strategies observed indicates that the strategy followed by new entrants appears to depend primarily upon the state of the market (i.e. penetration of existing broadband infrastructure, AWT strategies of established operators in the market), regulatory incentives (i.e. license provisions favoring the use of AWTs by new entrants) and the particular characteristics of specific AWTs (i.e. operator centric characteristics, cost structure and so on).

The involvement of new entrants in AWT provisioning is estimated as moderate in most countries. This reflects some dynamism in AWT markets today as to new market entry, but it also reflects the limited, and in some cases declining, impact of new operators. More specifically, while new AWTs such as WiMAX, Mesh/Ad hoc networks, and UMTS-TDD are often being introduced by new market entrants, most countries reveal consolidation by established operators (and thus diminishing importance of new operators), particularly in the WiFi hotspot markets. Only a few countries such as Ireland, Germany, Denmark and the UK, are witnessing a more significant presence of new operators. The extent to which this may be related to the existence of more favourable market or regulatory conditions in these markets, is currently unclear.

Finally, established operator involvement is considered. Reviewing the evidence on a country-by-country level, different (sometimes overlapping) strategies of established operators vis-à-vis AWTs are apparent:

- Pre-emption strategy: deployment of AWT activities by established operators, often by the acquisition of small new entrants, in order to discourage or preclude entry by other operators.
- Non-cannibalization strategy: deployment of separate AWT activities by established operators in small niches where no overlap exists with established activities.
- Integration strategy with small scope for AWTs: integration of AWTs into the overall operator offering e.g. by combining broadband subscriptions, with AWTs being positioned as services for niche or incidental use.
- Integration strategy with large scope for AWTs: integration of AWTs into the overall operator offering with AWTs constituting a considerable part of the value proposition.

While very ‘prudent’ approaches such as pre-emption and non-cannibalization strategies related to AWTs are clearly visible amongst established operators in many countries, even a very succinct overview of WiFi offerings throughout Europe showed that WiFi and traditional telecommunications access are being combined on both subscription level and on a technical level in several countries. This indicates that there are at least a number of established operators that are moving beyond defensive strategies as far as AWTs are concerned. Also, these are not limited to small existing operators attempting to extend their footprint, as demonstrated by the involvement of operators such as BT, T-Mobile and Orange with AWTs in some countries.

The involvement of established operators in AWT offerings is estimated as strong or moderate-to-strong by experts in almost all European countries. This confirms that established operators have taken the lead in the deployment and exploitation of AWTs throughout most of Europe. Obviously, it strongly limits the scope for AWTs being used in a non-(established) operator centric manner in the short to medium future.

3.2. *Changing business models: towards the integration of AWTs*

In conclusion, there is no definitive answer to the question: “How alternative are alternative wireless technologies in Europe?”. Confronting technological possibilities with actual market conditions, it can be argued

that a considerable number of current AWT service offerings are not directly in competition with mobile or fixed broadband, due to a lack of mobility features and to a lack of clear price or data rate advantages vis-à-vis fixed broadband, respectively. It was also illustrated that established telecommunications operators are leading AWT developments, while some additional market dynamism is being created by new operators and, in a limited number of countries, by non-operator centric initiatives.

Given the fact that “no operator wants to choose a non-orthodox migration path” (Goldman Sachs, 2004), this might lead to rather bleak prospects for AWTs in Europe. However, a number of compelling reasons to do so make it possible for at least some established operators to embrace AWTs. UMTS-TDD might be an obvious candidate, but established operators without UMTS-TDD licenses, operators with a stake in certain AWTs, operators wishing to connect and integrate their present WiFi hotspots, and operators aiming to develop in a so-called greenfield situation, may be inclined to consider other AWTs as well.

A powerful indication of the envisaged integration of AWTs into traditional cellular offerings is provided by the R&D endeavours of the European mobile industry towards what has been labelled “Beyond 3G”. Broadly speaking, Beyond 3G is seen as the evolution of 3G from 2008/2010 onwards (Ballon, 2004). A considerable number of industry consortia dealing with B3G have been formed over the past years. The ones coordinated by the main European telecom manufacturers and operators include the Wireless World Research Forum (WWRF), the Wireless World Initiative (WWI) and the eMobility Technology Platform. Obviously, it is uncertain to which extent the visions that drive current R&D efforts will end up shaping the actual marketplace, but at least the European mobile industry’s common R&D plans reveal the present consensus and common strategies towards future developments within the industry.

The Wireless World Research Forum was launched in 2001 as a ‘global and open initiative of manufacturers, network operators, SMEs, R&D centres and the academic domain’. Meanwhile, it has established itself as the main pre-standardisation organisation for B3G in Europe. The WWRF published its vision of B3G systems and services in 2005 (Tafazolli, 2005). This vision stresses user-centric services and seamless connectivity as the key issues for future mobile and wireless systems. To realise this vision, reusability of existing cellular and AWT networks, and ubiquitous coverage via heterogeneous access are emphasized. Specifically, in this respect, the creation of service platforms offering vertical supporting functions or ‘generic service elements’ to manage and hide the complexity of the heterogeneous network infrastructures, and the introduction of a cooperative network (CoNet) architecture that supports the coexistence, convergence and independent evolution of legacy as well as new networks are elaborated in great detail.

The first steps towards the realisation of this vision have been taken by the Wireless World Initiative, which is implicitly yet firmly related to the WWRF. As of 2006, the Wireless World Initiative (WWI) unites five so-called Integrated Projects within the sixth European Framework Programme (WWI, 2006). With that, it is one of the largest coordinated research consortia of the European mobile industry ever. One of the five WWI projects is dealing with new radio interfaces (i.e. WINNER), another one is dealing with end user applications (i.e. MobiLife). The remaining three projects, i.e. SPICE, Ambient Networks and E2R, can be said to have the vision of convergence of heterogeneous (both cellular and AWT) networks as the focus of their work, as they deal with service platforms for managing various network environments, cooperative networks, and reconfigurability of networks and devices, respectively.

The primary impact of the convergence and integration of cellular and wireless networks on business models and ‘user management’ that is foreseen relates to the fact that in heterogeneous network environments, users will no longer connect to a particular network, with an associated service and payment model, but that they will connect to a service, which can be mediated by various networks and platforms (Tafazolli, 2005). The value proposition for the consumer is seamless mobility support ‘anywhere, anytime’, with the additional proposition of being ‘Always Best Connected’, i.e. being connected to the network (provider) offering the best price/quality ratio for a particular service in a particular context. In this model, it is crucial to note that users will probably not be aware of the networks or even of the network provider that they are connected to. This implies that users will choose between mobile service providers rather than between mobile network operators. However, current mobile network operators appear to be well placed to take on this role of mobile service provider, as they have core competencies related to the management of networks, the establishment of service platforms, and managing the customer relationship (Kellerer, 2003).

This orientation is carried on and amplified in the mobile industry's eMobility Technology Platform, which takes part in preparing the seventh European Framework Programme. The eMobility Technology Platform recently published a Strategic Research Agenda outlining its priorities for the coming years (Tafazolli and Saarnio, 2005). In focusing on 'ubiquitous services' and 'ubiquitous connectivity', it puts forward a very similar vision to that of WWRF and WWI, with an additional emphasis on managing security, privacy and trust in a converged wireless environment.

To conclude, even though they are in general not yet commercially viable and are hindered by a number of important bottlenecks, AWTs in Europe present a certain dynamism, as they are being deployed and operated fairly widely, especially in patches of urban centres and in rural or remote areas in Western Europe and Scandinavia. They are currently not in direct competition with cellular mobile technologies, and this fact is, given the predominance of established operators in present-day AWT offerings, not likely to disappear soon. Moreover, on the basis of the R&D visions and efforts of the European mobile industry, it appears that the convergence and integration of cellular and wireless technologies is high on the industry's agenda, implying a gradual shift in business models from mobile operators to mobile service providers, managing network heterogeneity and complexity on behalf of the user.

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