



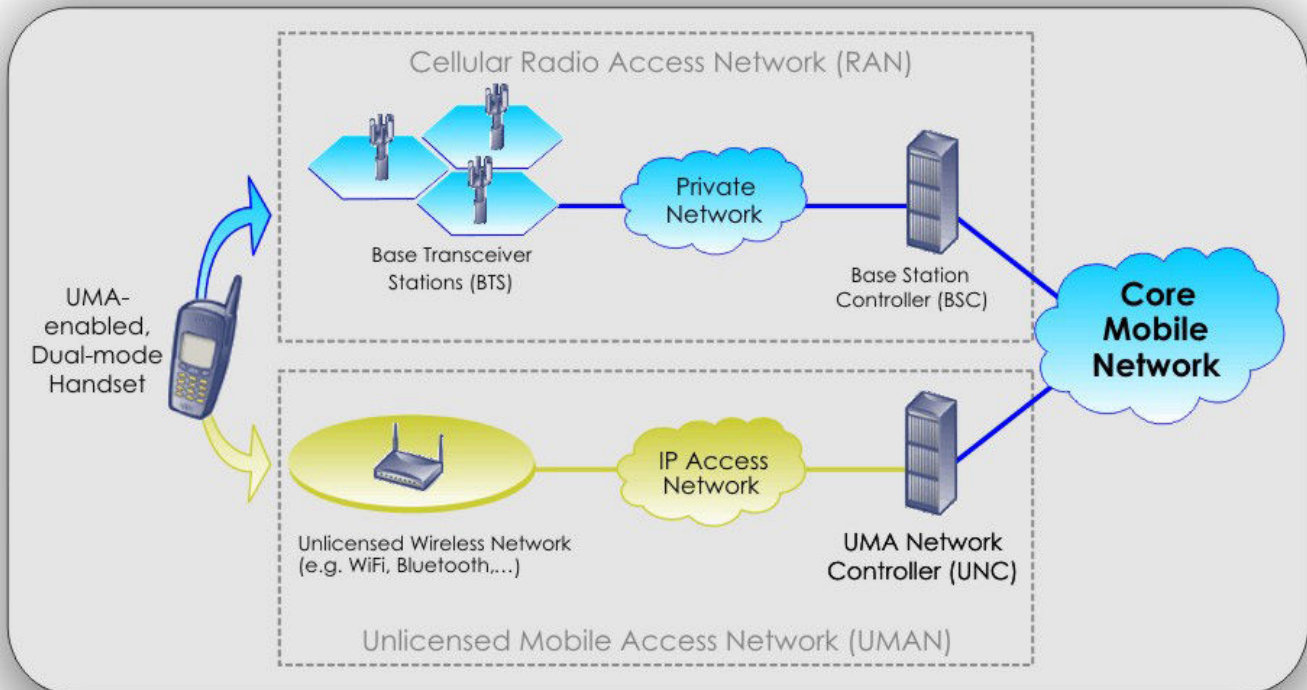
**IPaxiom Networks**

**2006: the Year of GSM and WLAN Integration**

**Market Driver for Scalable and High Capacity WLAN Mesh Architecture**

IPaxiom is a pioneer in WLAN Mesh Architecture Networks. Yet, most people have only recently – or not at all – heard about Mesh Architecture networks. Only a few professionals have fully understood why Architecture matters in telecom networks, and increasingly the industry is coming to accept that a Mesh Architecture is superior to point-to-point and point-to-multi-point architectures. IPaxiom has built Mesh Architecture WiFi networks since the firm’s inception in 2003, and is a pioneer in a very young industry segment. 2006 represents the breakpoint from being a curiosity for the Military and the Geeks – to mainstream and necessity for operator services delivery networks.

In the Appendix to this IPaxiom Operator Brief we feature two of the Market Drivers that will make 2006 the break point in the fortunes of Mesh Architecture networks, and in particular the WLAN (WiFi) Mesh Architecture Networks. Market leader in end user cellular network devices finally brings out devices that look and feel like traditional cell phones, but with a combined GSM and WLAN air interface. In Q2 2006, we expect these devices to reach the market, creating a consumer demand – and operator demand – for these dual air interface devices. Pricing packages will be re-designed to allow for flat rate programs in hot-zones and home and office environments. Fixed line replacement will accelerate as private and enterprise users move to VoIP over combo devices. Total cost of talking will be reduced for end users and enterprise road warriors. On top of this, data services like e-mail and browsing will be available on comfortable devices fitting in pockets of everyman.





The driver for WLAN Mesh Architecture is simple to understand: with the introduction of these new devices to the broad market for the first time, the number of broadband devices in reach of a given WiFi Hotzone is going to accelerate exponentially. For the first time in history, WLAN networks will come under capacity pressure as end users grow like wildfire and their bandwidth requirements go through the roof. The combination means that:

- a. blind spots will be noticed, and coverage is going to take front seat for customer satisfaction. Mesh Architecture is superior in economically and architecturally providing required coverage.
- b. Hot Zones will grow, as the operators will compete for the business of this new powerful and economy-seeking segment. Mesh Architecture coverage will require multiple hops and operator economics will depend on the number of hops the network provides without going to fiber or high capacity wireless backhaul. IPaxiom Mesh Architecture products using advanced multi-radio technology will provide superior performance in terms of number of hops to fiber, providing for operator savings.
- c. Winners and losers among operators will increasingly be characterized by their choice of Architecture as the first distinguishing characteristic.
- d. End users will still prefer single device, handy in the pocket, as before but faster, better, cheaper services. Operators will deliver, and their distinguishing characteristic is that they will offer GSM and WLAN. The powerful, money-laden cellular operators, and WLAN operators going for MVNO on GSM networks will be winners. The rest will have difficulties, and be bought, or die.

2006 is a significant break-point for operators and vendors alike.

Are you Ready?

The fixed mobile convergence (FMC) era could be upon us. With unlicensed mobile access (UMA) technology, dual-mode GSM/Wi-Fi handsets deliver on the promise of a "one phone, one number" service.

A recent opinion piece in *Wireless Week* declared that 2006 will mark the beginning of the fixed mobile convergence (FMC) era. That prediction should come true thanks to the emergence of a new 3GPP technology standard called unlicensed mobile access (UMA). Mobile operators will begin deploying UMA-compliant dual-mode GSM/Wi-Fi (802.11) handsets with the objective of offering true "one phone, one number" service. Although this initially may be viewed as complementary to existing wireline service, the long-term result could be mobile substitution of wireline service.

The key components of a UMA solution are a UMA network controller (UNC) and a UMA compliant dual-mode (GSM/Wi-Fi) handset. The UNC is a new core mobile network element similar in functionality to a GSM base station controller (BSC). Where a BSC would interface with multiple base transceiver stations (BTS) in the GSM macro network, a UNC manages the UMA access network (UMAN) to provide mobile voice and data access via one or more WLANs. In addition, the UNC facilitates transparent roaming between networks using the licensed spectrum (GSM) and unlicensed spectrum (UMA). The goal is to deliver a seamless user experience no matter which access network the user is operating on, meaning GSM/GPRS core network services can be accessed via the UMAN and associated WLAN. This service transparency is essential to widespread acceptance of UMA technology.

In addition to seamless roaming and handoff between GSM and UMA calls, several basic concepts are unique to UMA deployment. For example, the handset must be able to autonomously move from the Wi-Fi to GSM environment (rove out) and GSM to Wi-Fi environment (rove in) via proper network registration procedures. Similarly, the user should be able to set network preferences such as GSM preferred or GSM only, and Wi-Fi preferred or Wi-Fi only.

**THE MACRO EFFECT** Mobile operators tend not to deploy new technologies unless they provide either a cost benefit or enhanced feature set/user experience. UMA technology delivers on both counts by providing improved voice quality and in-building coverage while offloading traffic from existing (higher cost) GSM radio networks.



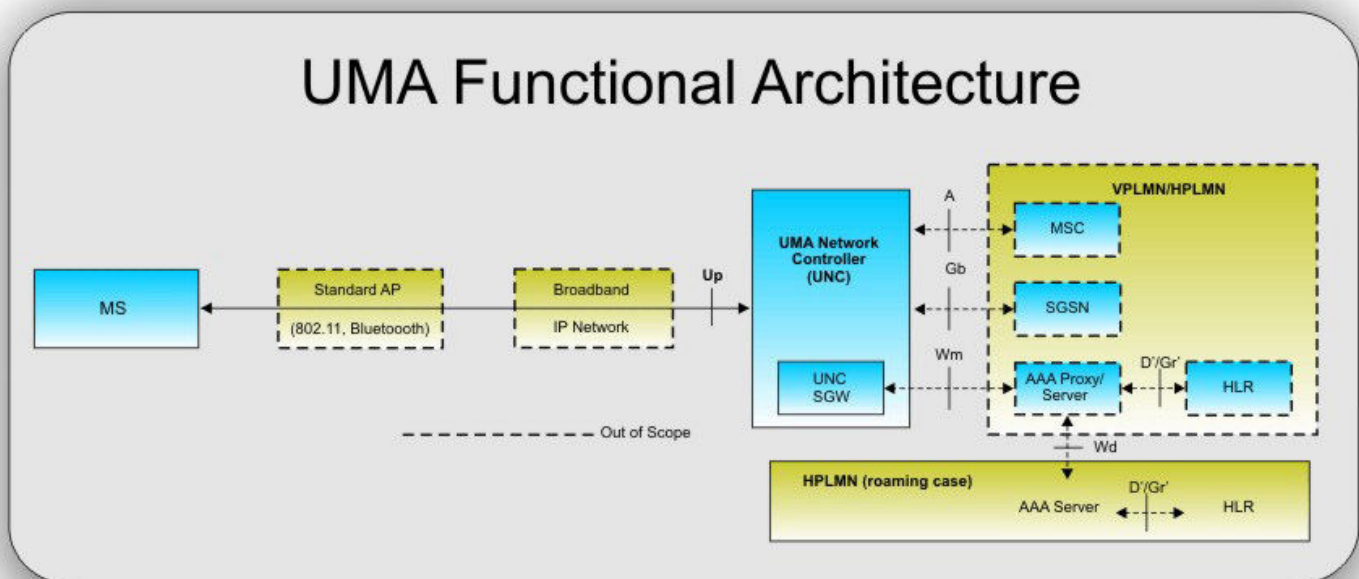
A typical GSM cell radius in suburban environments is around 2 km. This translates into an approximate coverage area of 12.5 km sq. In an ideal case, this could potentially cover more than 12,000 homes sitting on quarter-acre lots. Although this may sound like a lot, there's a catch: The macro network is not always engineered for full in-building coverage within a given cell. In fact, a 6dB to 10dB in-building penetration loss may reduce actual coverage by up to 70 percent, to less than 4,000 of the original 12,000 homes. The resulting reduction in radio access and voice quality ultimately will lead to a loss of potential revenue for the mobile operator. This is precisely where UMA technology can be a benefit to both operators and end-users.

With a UMA-enabled dual-mode phone, the ability to offload traffic to localized Wi-Fi networks potentially can recover "lost" macro-network revenue. Not only do mobile operators not have to invest in additional base station equipment to increase coverage or in-building penetration (with the associated spectrum and site maintenance costs), but they may not even have to provide the access points or Internet backhaul from individual homes due to the fact that this equipment is already in place and used for broadband Internet access. Of course, mobile operators may not realize any revenue from the cable or DSL backhaul, but they still benefit from any per-transaction downloads or mobile applications resident on the handset.

Similarly, the end-user benefits from a common feature set with the GSM network and the capability to make and receive calls via a single phone number.

**FIXED-MOBILE CONVERGENCE** Mobile operators have the distinct advantage of "owning the handset" in that it is an integral part of the wireless network; some would say they in turn "own the customer" in that they have substantial control over the end-user interface and feature set. From this viewpoint, UMA technology is an extension of FMC with the ultimate goal of mobile substitution in a converged world. A recent survey conducted by BrainJuicer, which targeted 1,000 customers in six European markets (France, Germany, Italy, Spain, Sweden and the United Kingdom), concluded that a UMA-enabled dual-mode phone would be positively received. In fact, if mobile calls in the home were priced the same as fixed line calls, then more than 50 percent of respondents said they would be likely to sign up for UMA service within 12 months. Furthermore, of the respondents who would probably buy the service, a third would make most or all of their calls at home on their mobile phone, a powerful case for mobile substitution. As initial deployments of UMA handsets begin with the movement toward "one phone, one number" service, the stage will be set for a more significant movement toward FMC.

## UMA Functional Architecture





Finally, IPaXiom's Xzone Wi-Fi Mesh and Unlicensed Mobile Access (UMA) technology enables operators to provide:

1. A mobile subscriber with a UMA-enabled, dual-mode handset moves within range of an unlicensed wireless network to which the handset is allowed to connect.
2. Upon connecting, the handset contacts the UMA Network Controller (UNC) over the broadband IP access network to be authenticated and authorized to access GSM voice and GPRS data services via the unlicensed wireless network.
3. If approved, the subscriber's current location information stored in the core network is updated, and from that point on all mobile voice and data traffic is routed to the handset via the Unlicensed Mobile Access Network (UMAN) rather than the cellular radio access network (RAN).
4. **ROAMING:** When a UMA-enabled subscriber moves outside the range of an unlicensed wireless network to which they are connected, the UNC and handset facilitate roaming back to the licensed outdoor network. This roaming process is completely transparent to the subscriber.
5. **HANDOVER:** If a subscriber is on an active GSM voice call or GPRS data session when they come within range (or out of range) of an unlicensed wireless network, that voice call or data session can automatically handover between access networks with no discernable service interruption. Handovers are completely transparent to the subscriber.