

FMC & IMS: Does the former require the latter?

Service providers search for near-term solutions

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Fixed Mobile Convergence (FMC) promises to be a central theme of any successful subscriber retention strategy. For landline operators, it may hold the key to reversing alarming trends as residential subscribers continue to abandon their landlines in favor of their mobile phones. For wireless carriers, FMC has the potential to address the shortcomings of weak indoor signal strength and network resource strains due to the growing demands of cellular data access.

The IP Multimedia Subsystem (IMS) defines a clear and highly-anticipated architecture for supporting advanced applications for both fixed and mobile network architectures.

But network operators with major investments in existing infrastructure are eager to avoid major network overhauls in their pursuit of application-centric converged fixed and mobile networks. This, then, begs the question: How critical to a successful FMC offering is IMS?

One problem, two solutions

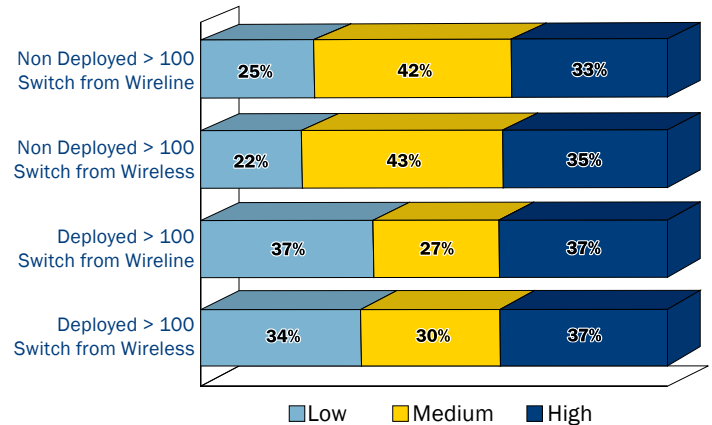
The term “fixed mobile convergence” (FMC) is responsible for a longstanding buzz in telecommunications circles. Yet implementation and uptake have been slower than anticipated for a variety of reasons, including subscriber preferences and technological implementation. According to a research study conducted by Savatar in October 2007, nearly eighty percent of respondents in small and medium businesses (SMBs) expressed a medium to high level of interest in an FMC offering.

Responding to this trend, recently, major players have begun rolling out services delivering some form of FMC. For example, at CTIA in April 2008, Verizon announced a new PBX Mobile Extension offering, allowing any enterprise that already has a PBX installed on its premises to enable PBX capabilities for mobile subscribers. Features include providing a subscriber with “one number” to ring all wireless and landline devices, the ability to seamlessly transfer a call from a wireline to a

wireless device, and an online system that lets users manage all of their devices.

Additionally, users can add any mobile device to the PBX regardless of the wireless network. Embarq, an earlier entrant in the FMC business market, added a residential offering in 2007 that notifies subscribers on their mobile phones when they have a voicemail on their home phones.

If the pricing were acceptable to you, how likely would you be to switch from your company's current provider to purchase a system with FMC?



In evaluating the best approach to FMC, it is useful to consider the evolution of the problem it seeks to solve. Today's subscriber has grown accustomed to a variety of options for making phone calls. These include feature-rich office desk phones, traditional home phones, mobile phones accessing a variety of wireless networks, and voice over IP (VoIP) phones that connect calls over the Internet. This environment, while offering the unprecedented flexibility to make calls from virtually anywhere, poses some new challenges. By enabling subscribers to maintain calls while moving between access networks at work, at home and on the go, service providers stand to deliver higher value services, improved coverage, and greater control of the subscriber experience.

Telecommunications equipment vendors developed a variety of approaches to making FMC a reality. As a result, today, FMC

can be considered as two quite different solutions: a mobile handset-centric approach and a landline-centric approach.

In the first scenario, all calls are handled by a combination of the handset and the mobile operator's network. The handset accesses the mobile operator's network via a combination of conventional radio access (cell towers) paired with either femtocells (in-building cell signal extenders) or Wi-Fi. The handset operates on whichever wireless network offers the highest availability and lowest cost. For example, a subscriber with a dual-mode handset might select a stronger Wi-Fi signal indoors, but rely on the cellular network while driving. This solution may additionally feature voice call continuity (VCC): the ability to automatically and seamlessly roam between the various mobile networks.

The alternative scenario is landline-centric and emphasizes manual subscriber selection. Unlike the first solution, this scenario offers integration with any handset and approaches the problem with the perspective that subscribers may in fact prefer to use multiple devices. In addition, it does not require that the service provider also be a wireless operator, or create a partnership with one.

With this solution, calls may be handled either at a mobile handset or at a landline handset, according to the needs of the subscriber. Calls may be pushed or pulled between handsets, under the subscriber's control. For example, a subscriber on a business line at the office could press a couple of keys to transfer that call to a mobile device for the car ride home and then, once home, transfer that same call to the home phone, again by simply pressing the appropriate keys. Similarly, the subscriber can unify all of his devices with a "one number" approach. This enables all calls to appear to originate from the same number with identical caller ID. Conversely, one number can be used to reach the subscriber regardless of location, network or device.

Mobile-centric approach

For mobile operators, femtocells provide greatly improved in-building coverage and offer a potentially much less expensive alternative to further investment in 3G macrocells. Essentially a femtocell can be thought of as a small cell network tower that is located in the home or office, has a short range and support for only a few handsets. A femtocell extends a service provider's signal and becomes a part of that service provider's radio access network. Advantageously, conventional handsets (not dual mode) may be used with this solution, as the femtocell coverage relies on the same CDMA or GSM radio

technology as a cell tower. In addition, voice call continuity occurs naturally with this solution, since the handset hands off between cell tower and femtocell just as it would between two outdoor cell towers.

Femtocells offer some compelling advantages in certain deployment scenarios for wireless carriers. However, because a femtocell transmits on licensed frequencies, it can only be deployed by operators in areas where they hold rights to provide coverage. They are also currently more expensive than Wi-Fi base stations – around US\$200 per unit. They are therefore most likely applicable to business and campus environments in the near term, although as adoption increases and prices drop, they may in future prove to be a functional solution for residences.

In contrast to the approach using femtocells with conventional handsets, mobile carriers may look to incorporate dual mode handsets in an FMC solution that integrates Wi-Fi with traditional cellular coverage. In this scenario, the handset is essentially "two phones in one" and includes a SIP client to make calls via the Wi-Fi network. If the handset is reasonably sophisticated, it will attempt to use the Wi-Fi network to make outbound calls whenever possible, to offload the carrier's cellular network. The network will try to route inbound calls both over the cell network and via SIP over the broadband connection to the home, and if the phone detects both inbound call legs it will answer the one over Wi-Fi. Voice call continuity is not built in to this kind of FMC – it requires sophisticated servers in the network to support the handover from the SIP / Wi-Fi connection to the cell phone connection, adding significant cost to the overall deployment (although this is at least partially offset by the much lower cost of Wi-Fi access in the customer premises).

Both variants of the mobile-centric FMC solution rely on a broadband connection (typically DSL) to backhaul the voice traffic to the operator's core mobile network. Essentially the service provider leverages the customer's broadband line, usually provided by a terrestrial operator (competitor) for over the top (OTT) access. As a result, the service provider can choose to structure pricing to encourage subscribers to reduce the number of cellular minutes accrued. Paradoxically, while femtocells may lead to a loss in voice subscribers for fixed line service providers, the solution may ultimately bolster DSL uptake.

Mobile-centric FMC is possible in either pre-IMS or full IMS compliant networks. The pre-IMS variant transmits the voice call over unlicensed mobile access (UMA), which is essentially cell phone signaling tunneled over IP to a combination media

and signaling gateway. The full IMS variant uses SIP in much the same way a SIP business phone or integrated access device would, communicating with a serving call session controller (S-CSCF) that controls both the cellular and wireline sessions. In summary, while IMS may be seen as the architecturally “purest” mobile-centric FMC solution, it is also entirely plausible to use a pre-IMS approach as well.

Landline centric approach

While the mobile centric approach to FMC focuses on seamless roaming between networks and caters to mobile operators, the landline centric approach enables subscribers to manually select between devices (or networks) without dropping the call. This allows them the freedom to seamlessly integrate their home, office and cellular lines, but not converge all their services on one device. For example, a subscriber who receives a call in the office at 5:00 p.m. decides that he wants to leave for home. A feature called “in-call transfer” offers an attractive alternative to hanging up and redialing from his cell phone. He hits a couple of keys, transferring the call to his cell phone, and carries the call out the door on his mobile device. This differs from an office multi-line call transfer in that the FMC service has knowledge of the cell phone number, enabling a shortcut to be dialed — or even a single programmable key. At home, this solution similarly allows the subscriber to transfer a landline call to his mobile device.

This approach provides both inbound and outbound features without any changes to the existing wireless or wireline access networks. For inbound calls, the subscriber can specify beforehand, typically through a Web-based portal, which device should receive a call at which time. This call routing can be very granular, allowing the subscriber to specify different rule sets based on the caller’s ID, the time and date of the call, day of the week, holiday schedule, etc. In addition, the subscriber can even apply this call routing in real time, to break his pre-selected rule set and reroute a call to an alternate device or voicemail. For outbound calls, this approach allows the subscriber to make a call from the cell phone that appears to originate from the home or office phone. This can be particularly useful when making a call to an organization that authenticates users by their caller ID, like a bank, credit card company, or public utility. It also allows a subscriber to mask the caller ID of his mobile phone, replacing it with the landline number of his home or office. This preserves the subscriber’s identity where his landline number is recognized on the called party’s device. It also prevents the called party from calling the subscriber’s mobile phone directly, bypassing the sub-

scriber’s prescribed incoming call rule set. A single number for all callers to reach the subscriber regardless of location and device, combined with the ability to transmit a uniform caller ID from any location or device, is known as a “one-number” service capability.

To appreciate the value of this manual approach to FMC, it is useful to consider some real world usage scenarios. With landline centric FMC, the subscriber is able to specify:

- I want one number at work that my customers can always reach me on.
- When I’m in the office, I want to take and make calls on a desktop business phone, so I can take advantage of keys for transfer, three-way calling, etc. and so I can see who’s busy on other lines.
- When I’m away from the office, I want to take important inbound calls on my cell phone, so I need some means of screening callers — for example, I don’t want anonymous calls to come through to my cell phone.
- Occasionally, I’m speaking on my desktop business phone, and I need to leave the office while continuing the conversation, so I need to be able to hit a couple of keys to transfer the call to my cell phone.
- When I come out of a meeting I’d like to be able to see visually on my mobile phone any messages that have been left on my home voicemail, and selectively listen to the important one without having to listen to all messages sequentially (visual voicemail).

The primary technical issue for wireline operators is to maintain call control in the mobile domain, ensuring that all cell phone calls are routed via a “one number” application server. For outbound cell phone calls, this requires either close co-operation with the cellular provider, or the installation of a client application on the cell phone.

Weighing IMS’s merits

From an architectural perspective, a full IMS implementation linking both wireline and wireless networks is certainly possible though not required. Indeed, it presents an unlikely option because the wireline network operators aren’t migrating to full IMS implementations very quickly — and even if they were, it is far from clear that there would be open interoperability between their IMS networks and the cellular operators’. A more straightforward approach would be to use traditional

SS7 call routing techniques, leveraging wireless intelligent network (WIN) triggers, to integrate the two carriers' networks (although this might not work when the subscriber is roaming). While technically feasible, however, both of these approaches (IMS and SS7) require a commercial arrangement between wireline and wireless operators that is likely to be feasible only where a single company operates both networks, or where a particularly close mobile virtual network operator (MVNO) relationship exists.

This leads us to consider the alternate approach of making a client available on the mobile device. This client registers the device with a softswitch or application server in the wireline carrier's network. For operators that maintain subscribers homed on legacy class 5 switches, AIN interfaces may be used to interface with the application servers that enable the FMC services. In either case, calls initiated via a mobile client, rather than the normal cellular call function, display the landline caller ID to the connecting party. One of the advantages of this approach, as opposed to an IMS-based implementation, is that it does not require mobile operator cooperation. Two types of mobile clients enable this functionality today: a SIP client and a thin client.

A SIP client operates in much the same way a softphone operates on the PC. Today's sophisticated mobile phones can now support a wide range of applications. Essentially, a SIP client on a mobile phone acts as a phone within a phone. Registering with the landline operator's softswitch, it connects the call via voice over IP (VoIP). This option can be fairly cumbersome; it typically works from within a Wi-Fi hot spot, though it is possible, thanks to today's unlimited data plans, that the client can initiate calls via the mobile operator's cellular data network.

Either option presents challenges. For instance, if the call is initiated via Wi-Fi, what happens to a subscriber once he leaves the hotspot or drives outside of range? If the call is initiated over the cellular data network, how does one enforce quality of service? In addition, some mobile operators disallow VoIP calls over their mobile data networks, either in the terms of their license agreements or by actively blocking VoIP packets.

A better method leverages a thin client application that is installed on the mobile phone. This application registers, via the mobile operator's data network, with the landline operator's softswitch. The mobile operator's cellular voice network is still used to conduct the call. When a subscriber wishes to initiate a call from his mobile phone that relays his landline caller ID, he selects his intended contact from an alternate contacts

menu, likely populated from his network-based contacts — or possibly integrated with the cell phone's own contacts list. After selecting from this list and initiating the call, the thin client notifies the network softswitch (call agent), via the device's data channel. The landline operator's softswitch then establishes both legs of the call. This process essentially means that the landline softswitch calls both the subscriber's mobile phone and the destination party's number, and then connects the two call legs together. Since the landline operator's softswitch actually controls both legs of the call, manual FMC features such as in-call transfer are possible, and the landline caller ID can be presented to the called party.

Such a thin client approach, while attractive, is not without its issues — primarily the question as to whether users will in fact use an application to place a call instead of the built-in functions of the mobile phone. One interesting trend is that mobile phone operating systems, and cell carrier networks, are getting increasingly open. Thus, it might be possible in the not-too-distant future for wireline carriers to deliver a cellular device with a customized operating system (say, based on Google's Android, or Openmoko) that will operate on another carrier's mobile network. It remains to be seen, however, whether mobile phone operating systems will truly provide sufficiently open application programming interfaces to enable the thin client approach to deliver a fully seamless, intuitive user experience.

In contrast, the inbound call component of a "one-number" service is relatively straightforward, requiring that calls to the one number (which is owned by the wireline carrier) get forked to both the landline and mobile device. This is made possible without IMS via a technique called "hybrid mobile forking." When a call comes through, the softswitch causes both the subscriber's fixed and mobile phones to ring simultaneously or sequentially based on the subscriber's preference. It then connects the call to whichever phone is answered first.

Subscribers will gravitate to connectivity solutions that offer both simplicity and ubiquitous coverage. FMC, in all its guises, addresses this desire and is set to become an important component of wireline as well as wireless operators' service offerings.

As for whether FMC requires IMS, the answer is a resounding "no." IMS may provide a simpler overall architecture, and is clearly the long-term direction for the industry. There are many good reasons for adopting IMS. However, given the array of implementation options described in this article, it isn't clear that the benefits of IMS outweigh the costs if the goal is just to deploy an FMC service.