Service Provider Mobility: WiFi vs. Femtocell

Posted by Anton Okmyanskiy Aug 11, 2009

Recently, in a comment to another post, Mike Demler asked about what benefit a femtocell would provide vs. VoIP via WiFi. This is a long standing debate, and I thought I'd chime in. Please comment!

Generally, comparing WiFi and 3G is really comparing apples and oranges. WiFi throughput is about 100x bigger with current technology. 3G is optimized for battery life and QoS. Both are here to stay and Cisco is smart to sell both!

Nothing should prevent people from using VoIP or VoIP-over-WiFi (VoWLAN) at home. Skype is a good thing. Services like this will be very hard for large SPs to compete with on cost. Especially on international calls or PC-to-PC calls. In fact, Mobile SPs started to allow VoWLAN even from their phones, e.g. Skype on iPhone in WiFi mode only. But remember people with iPhones are not mass market! Not yet, anyway.

When talking about *mobile* communications though, cellular technologies and Mobile SPs rule and will likely continue to rule with 4G/LTE. This has to do with ubiquitous coverage from a single provider, quality of service in licensed spectrum and very sophisticated handover when you are on the move (e.g. soft-handover when handset talks to multiple base stations which combine the signals). WiFi cannot compete on any of these today.

Mobile SPs are uniquely positioned to provide you service both at home and on the go. They can win you over with simple/integrated single-bill service. Much harder to do with just WiFi. Consider Amazon Kindle which uses 3G access. It has always on internet without any configuration or extra cost. This is huge! There will be many more devices like this -- or so SPs hope. As a customer with Kindle and similar devices, you would not want your home to be a blackhole. Why does not Kindle offer a WiFi option? Battery, extra cost, configuration complexity => not as suitable for mass market.
Mobile SPs can cover you well on the go, but have a hard time within walls where data demands are even bigger. They want to improve coverage while also offloading traffic from macro coverage onto your internet connection. Win win for them. So, why should they deploy a femtocell instead of WiFi hotspots at your house?

SPs have WiFi-based technology for this called UMA. This securely tunnels signalling and voice/data traffic through WiFi hotspot all the way to the SP back-end. T-Mobile USA, France Telecom and British Telecom offer such services. UMA was an easy choice initially because it required very basic/cheap WiFi hotspot, while femtocells were in their infancy. But there are a few drawbacks usually quoted:

1. Limited number of dual-mode phones and cost. As an example, AT&T has around 80mln mobile customers and pundits estimate about 5 mln iPhone subscribers. Most people still use a pretty dumb/cheap phone. The selection of dual-mode phones is comparatively small and cost is higher due to less competition and more components/complexity. It may change over time, but today, this is an obstacle when a customer calls SP and says they have bad coverage at home. I do believe most phones will be dual-mode down the road because “data wants to be free”.

2. Battery life. WiFi consumes more power. Apparently, this is quickly improving, but may require new base stations and new phone models. Also, if you wanted seamless hand-in/out from/to macro network, you’d need both WiFi and 3G radios operating at the same time. Certainly, this would consume more power than 3G alone and some smart technology would be needed to minimize this to be negligible.

3. Quality of service. First, WiFi is an unlicensed spectrum. You can't completely control quality if you can't control what your neighbor does. Second, it operates at higher frequencies which offers weaker penetration. Third, if customer wants to use their own WiFi base station, it is a huge headache for SP to support configuration and quality issues with zillion different vendor devices (half of which don't work reliably based on my personal experience at home anyway).
By contrast, the biggest benefits of femtocell are that (a) it works with existing phones, (b) improves battery life, (c) provides managed quality of service. Albeit, many SPs may limit femtocells to 3G where they may have more spectrum, so it would only work with 3G phones (and not 2G). But in time for mass femtocell roll outs, most customers should renew subscriptions and get new phones with 3G. Since the phone requires no WiFi, you get better battery power and no extra headaches to manage quality of yet another radio network, unlicensed to boot. It is also a no brainer that SPs would prefer to leverage their investment into spectrum and proliferate the coverage of 3G services with more base stations rather than prompte the "dump pipe"

On the downside, the femtocells are still expensive devices because the market is still small and their deployment is a lot more complicated because of the licensed spectrum, handover, FCC rules, etc. So vendors are developing all sorts of automated means to provision, tune and periodically re-tune femtocell radio parameters such that each provides quality service and a population of femtocells interfere as little as possible. It is not easy, but feasible.

Finally, let's close the loop on the original question of consumer benefit of femtocell vs. WiFi. If you have an advanced phone already + WiFi base station and are happy with Skype, you probably don't need a femtocell today. Just charge your phone nightly. Skype on iPhone even integrates with your phone book.

However, if you are a typical customer, you don't want to pay for iPhone and have little technical savvy. If you have bad coverage at home you either have to have a land line, switch mobile SP (churn) or call your SP for an option. Some will go the DIY route with something like iPhone + hotspot. If you are not so advanced or don't want big out of pocket expense, you will pay for SPs to offer you some bundle. And many SPs will choose to offer femtocells (or a hybrid device) rather than just hotspots because this can address the broadest market with existing or cheaper phones. They can provide better managed quality of service and strategically expand coverage by getting 3G/4G into more places and proliferate devices with always-on 3G internet access like Kindle.

At least on paper, there is a good bussiness case for Femtocells. Exhibit 1: even the strong proponents of ubiquitous WiFi like Google, early adopters of UMA like T-Mobile and leading vendors in enterprise WiFi like Cisco, are also investors in the various Femtocell start-ups. So my bet is that Femtocells will find a good market if SPs package them in appealing
fashion, but WiFi is also going to proliferate and improve. How about that for hedging the bets? Well, I like both oranges and apples. 😊 Thoughts?

658 Views  Tags: voip, wifi, 3g, femtocell

Aug 12, 2009 10:00 AM Mike Demler
Wow, thanks for that very informative response to my comment! It’s very interesting to see that you took your answer in a different direction than what I was thinking.

1. 3G vs. 4G deployment. Most of what I have been seeing on the pico/femto topic has been about the potential role in WiMAX and LTE deployment, not 3G.
2. Voice vs. data. I was primarily thinking of non-voice applications, which would also be the drivers for 4G deployment.

One of the answers that I heard on the value of femto vs. WiFi is the opportunity for SPs to offer vertically integrated services. As soon as consumers go "off-deck" to WiFi the providers are no longer in control. So is it a competitive (i.e. walled garden) strategy, or is there really more value for consumers to stay on the 3G/4G network? Looking at the current AT&T/Apple vs. Google Voice controversy, or AT&T blocking Sling but allowing MLB... you see where I’m going.

Regards,

Mike

Aug 12, 2009 11:52 AM Anton Okmyanskiy

Mike Demler in response to Mike,

1. 3G vs. 4G femtocells. The big difference is that 3G femtocells are relevant now. 4G is not here yet, except for WiMAX with Clearwire. The future of 4G Femtocells is not so clear and certainly more distant. WiMax is unique and lots of vendors are reluctant to bet on WiMAX given the small market. Unless it turns around and more SPs deploy WiMax, this lack of scale may eventually kill WiMax. In Clearwire public announcements, they left the door open to migration to another technology in the future...
For traditional cellular SPs, existing 3G+ HSPA / EV-VO data services support up to 3Mbps today and can increase this up to 10-14Mbps when they migrate to the latest 3G+ standards. So, even a 3G femtocell can saturate the bandwidth of most customers' broadband connections. Eventually, of course, it will be LTE everywhere including femtocells and pre-requisite cell phones. And 4G femtocell would be easier to deploy because standards have built-in support for them making self-optimization and handover is much easier. (I will talk about handover issues in future posts.) Deploying LTE infrastructure is no small task though -- will take years -- while 3G femtocells have a more immediate business case.

2. Voice vs. data. There are two key benefits of femtocells for SPs: coverage and offload of macro. When we talk about voice, they need femtocells primarily for coverage in order to reduce churn of unsatisfied customers and capture customers wishing to get rid of land line. When talking about data, they need femtocells for macro offload. Most data traffic occurs at home, after all. The voice scenario does not change much with LTE, but data offload becomes even more important because of increased bandwidth. So, both drivers are certainly at play.

Of course, it is all competitive, and every SP dreams about a walled garden. They are there to make money after all. They want to leverage their networks/investments, reduce churn/costs, provide a compelling offering to sell which is hard for small competitors to replicate and make it sticky (hard to switch). WiFi will survive though.

Anton.

Aug 12, 2009 1:02 PM Mike Demler
Anton Okmyanskiy in response to
Hi Anton,

I am enjoying this discussion. I recently published a report on The Emerging 4G Wireless Landscape in the U.S., which includes my in-depth analysis of Clearwire, WiMAX and LTE. I somewhat disagree on your assessment of WiMAX as "unique", or lacking in scale... especially when you examine the global footprint. One of the conclusions of my analysis is that WiMAX and LTE will co-exist for many years, and most experts agree that WiMAX has at least a 2-3 year lead over LTE. LTE will eventually have greater adoption by incumbent operators, but the two technologies are actually much more similar than different, which is why Clearwire said they could move to LTE without much difficulty if that is where things
eventually shake out. In Clearwire's Q2 earning call yesterday, they restated their plan to cover 120M POPs in U.S. by end of 2010.

The topic of self-optimized networks is very interesting, but also not limited to LTE. At the recent IEEE Mobile WiMAX Symposium there was much discussion of that, and I expect we will see 1st field deployment of self-optimized networks in WiMAX within the next 1-2 years.

Keep up the great posts!

-Mike

Aug 12, 2009 3:48 PM Anton Okmyanskiy Mike Demler in response to
Time will tell on WiMax. It could go either way. I was only speaking from experience of investigating WiMax femtocell potential where, so far, you have few chipset vendors to choose from, which obviously drives costs up, but does not mean that roll outs won't happen.

As for self-optimizing networks, it is hard to see a Femto deployment without it (WiMax or 3G or LTE). Various self-optimization schemes are in trials for 3G. Most 3G femtocell vendors have technology to auto-select radio parameters based on periodically scanning the neighborhood radio environment. But details differ. You have to dig deeper regarding what specific self-optimization people talk about. More advanced self-optimization involves APs exchanging information (directly or via some coordinator) in order to come up with more optimal settings for least interference, better handover, etc.

Aug 13, 2009 1:29 AM deanbubley
Some comments:

1) UMA has been an utter failure. I've been a constant & vocal critic since Day 1 in 2004, and I've been proven right. The only sizeable deployments have been T-Mobile US and Orange France. BT, Telecom Italia and others have dropped it. I won't go into depth, but lack of early 3G interoperability, poor fit with handset connection managers, regulatory and numbering questions, and a range of other problems made it unfit-for-purpose.
2) WiMAX isn't 4G, and doesn't compete with LTE except in Powerpoint-land. Its real rivals are HSPA and HSPA+, except where it's used for fixed-broadband to homes or businesses. LTE deployments will be patchy until at least 2013. The initial growth of femtos is from HSPA (eg Vodafone, Softbank), and to a lesser degree CDMA (Sprint, Verizon). Given that femtos need fixed broadband, WiMAX femtos obviously won't be much use in "unwired" markets like much of India.

3) For certain devices & usage scenarios, femtocells make it easier to support circuit voice and, critically, SMS than WiFi. Adding VoIP software to low-end handsets gives performance issues, impacts power consumption and causes integration headaches in applications like the dialler and phonebook. SMS is obviously used continually by 2bn+ people (including indoors!), and is also used internally by SPs for a whole range of operational tasks (eg roaming list management, advice-of-charge etc etc) and is also a nightmare to "get right" via a pure IP connection. VoIP+SMS integration is normally horrible and often gives a lousy user experience - I've seen some devices with two separate SMS clients.

4) While 3G handsets should all work with 3G femtos, they are not necessarily *optimised* for it. There are various femto-specific things in 3GPP R8 which will need to be implemented in handset platforms, plus also a bunch of stuff at the OS and application level which it would be desirable to add. (eg connection manager, whitelist-management app and so on). I wrote a full report on this some time back:

http://www.disruptive-analysis.com/femto-aware_handsets.htm

5) It's worth noting that a number of femto-centric applications are being developed, either in the network or in the femto itself, along with exposed APIs for 3rd-party developers. For example, Fedex might want to build an app which alerts them when their customer gets home, so they can schedule a delivery. WiFi will be complementary but not outright substitutive here.

6) I can think of various other femto-only business models, maybe best discussed offline.
You did hit on my 4G hot button though. The whole WiMAX vs LTE debate that you bring up ("WiMAX isn't 4G") was a primary motivation for my analysis in The Emerging 4G Wireless Landscape in the U.S..

What is your definition of 4G? Since both IEEE 802.16e mobile-WiMAX and LTE are 3G according to ITU, I am very interested to see your definition.

-Mike

So, picking up the "4G issue",...... if the first ~3-4 years of any LTE deployment is focussed on datacard/dongle/netbook propositions, then I'm assuming that such devices will already include integrated WiFi capability - so what is the benefit of LTE-femto? - One hypothesis is that we need to wait until LTE-voice is widely available before accelerating an LTE-femto proposition.

Back to the dual mode handset debate, I recall a couple of years ago looking at Bluetooth adoption curves and predicting 2013 to be the year when handset WiFi goes mass market/down range. Of course that was before the recent acceleration of the smartphone market. So interested in any views folks have as to when dual mode will constitute 50% of yearly handset sales.

- Mark
Mark

> So interested in any views folks have as to when dual mode will constitute 50% of yearly handset sales.

Globally - never/10+ years

US - maybe 3-4 years

Europe - unclear, especially if you include Eastern Europe. Some countries also probably 3-4 years, although I see the ceiling more around 30-40%

A few things to bear in mind:

- no point having WiFi in phones sold to people with no home broadband, which cuts out most of the developing world. Also bear in mind that soon 50%+ of phones will be low-end devices, and WiFi has a lot of software & hardware costs and overheads, eg generally needs a smartphone OS.

- proposition is very difficult in prepay-centric markets, as this often means separate purchase of handset & SIM, meaning configuration of WiFi access and connection manager needs a lot of user intervention

- historically & counter-intuitively, Japan & Korea have always stayed clear of many dual-mode devices, and I haven't seen much evidence of recent change

- I've been told (unconfirmed) that China has some restrictions on dual-mode

Dean

Aug 14, 2009 11:11 AM Anton Okmyanskiy
Here is an odd thing about WiFi vs. Femtocell (3G/4G) access... I was recently shocked to discover that a lot of BlackBerry apps won't use the WiFi connection. In fact, they only work over 3G data connection! This is with latest BB Bold model/software. The apps include Google Sync, WorldMate, Weather Network, etc...
None of these vendors are affiliated with SP and don't care to drive up mobile data usage specifically. It must be just easier for them to do this on a BB platform, and it meets the needs because all people on BB have 3G data and don't meter individual apps to know the difference.

How odd is that! You have WiFi configured and working on your device. You are connected to WiFi, but many apps just won't use it. In fact, lots of things on BB don't work well if you don't have 3G data connection. Odd. The browser does use WiFi, so it is not technically infeasible on BB platform, obviously. I wonder if BB just makes it harder for these developers to make apps which work with both due to some SDK weirdness, so people stick to the one that's more ubiquitous...

Maybe just a BB oddity or maybe an example of subtle ways in which ubiquitous internet prevails. Thoughts?

Aug 17, 2009 12:16 PM ajay_sahai deanbubley in response to
Few months back saw an Nokia application where the WiFi on the handset could be turned into an access point, with backhaul over cellular. I also saw this recently on an new NEC phone. If it picks up it seems a useful way for users to create a (mobile) hotspot/PAN for other devices like cameras, in car GPS devices etc. Seems pretty cool from the consumer and consumer electronics makers point of view. Batteries and data plan restrictions may impede this.

Different topic - the lack of broadband in emerging countries is applicable for femto as well.

Aug 17, 2009 12:34 PM Mark Grayson ajay_sahai in response to
> Different topic - the lack of broadband in emerging countries is applicable for femto as well

so, since C/I improvements may be necessary to deliver the speeds anticipated for Mobile Internet access, then what are folks' opinion on the use of self-install consumer-repeaters for serving indoor users in emerging markets?
- Mark

Aug 17, 2009 6:32 PM Anton Okmyanskiy ajay_sahai in response to
Ajay, yes, interesting idea. Could indeed be useful on-the-go for things like uploading pictures from my WiFi-enabled camera over a 3G connection. Probably more of a niche market though.

What providers are dreaming about is more 3G/4G clients embeedded everywhere. Maybe with LTE, things get more standardized to the point were you plug an extra SIM card into a camera, and it gives direct access to your 4G provider. Or maybe someone can come up with a camera/service bundle where all picture uploads are automatic/free via a built-in 3G/4G client. The service is tied to your SP susbscription or bundled into photo-service price from 3rd party (ala Kindle).

Any device/service, which lets users buy something, is a very good candidate for this because it could be subsidised. For example, would it make sense for Apple to release an iPod Touch with free 3G access to iTunes? No contracts, no phone service... just buy tunes till you drop - "shipping is free".

Aug 18, 2009 6:55 AM Andy Tiller Mark Grayson in response to
Could be useful where there is an existing, albeit weak, macro network signal. No use for greenfield rural areas, of course, and might be too expensive for emerging markets (two boxes required for each installation).