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Google goes shopping

On August 15, Google announced its $12-billion plans to acquire Motorola Mobility, the ailing spin-off of Motorola's cell phone division. Once the leading manufacturer of cell phones in the United States after the smash hit RAZR phone, Motorola's mobile fortunes declined as users switched to smart phones with larger screens and better data capabilities, as well as to cheaper basic handsets manufactured by rivals like Nokia. Motorola failed to innovate beyond the RAZR in a rapidly evolving marketplace. It was not a surprise when the mobility division was carved out and spun off from Motorola's core business, nor that Moto Mobility was up for sale. Given that Motorola Mobility was running at an annual loss of nearly $80-million, Google's offer of $12-billion seems like a lot. Why would Google spend so much?

Google's purchase of the phone manufacturing company is certainly a step in a different direction for the advertising, search and software giant, although not a wild departure, given Google's massive push into the mobile phone business through its Android operating system. The synergies between the phone maker and the Android OS are obvious, but it is likely that there is more to Google's purchase than just vertical integration.

Android OS and handsets

Although Google's Android OS has been wildly successful in gaining widespread adoption across the industry (there are now as many Android OS devices in use as there are Apple iPhones) the Android OS provides Google only a circuitous route to revenue: Google gives away the OS to phone manufacturers, and receives no direct revenue from the software. Google only has a chance at earning real cash from Android as individuals use Google's search and other applications on their phones–hopefully more than they would otherwise. Google's acquisition of Motorola Mobility provides an opportunity to monetize the Android OS directly.

Google probably also hopes to gain more control over the integration of device and operating system, as well as basic device design. Although Android now rivals Apple's iOS in terms of adoption, Android has only achieved this scale through its widespread adoption by many handset manufacturers (driven by Google's generous offer to give Android away for free), whereas Apple has managed to grow its mobile OS market share with the sale of just a single, now ubiquitous, handset model. Apple's success with the iPhone, both in terms of adoption and (almost comical) revenue growth, is driven by Apple's trademark ability to ensure that the OS and handset operate in harmony. While there are some excellent mobile phones running the Android OS, there are many others that are laughably poor implementations. Google has to be interested in duplicating Apple's success of tuning handset and OS to maximize the user experience.

More than just cell phones...

GoogleTV Take II

While Google's interest in mobile phones is obvious, its Motorola Mobility takeover could be motivated by several other factors. Tucked away inside Motorola Mobility is another interesting line of business: Motorola's cable set-top box division. Motorola is one of the major US manufacturers of the ubiquitous set-top boxes found attached to nearly every TV in the country. Earlier this year, Google announced GoogleTV with much fanfare but limited success. Set-top box integration is notoriously difficult (when was the last time you used a cable box with a smooth, functional interface?) Google may be hoping to leverage this division to take another crack at bringing Internet content to the TV set, and Motorola certainly has the infrastructure to build and distribute such a device.

This would be a bold move, as Google would almost certainly disrupt Motorola's existing relationships with cable companies that purchase millions of these boxes to rent back to their captive consumer base (the FCC's effort to introduce competition for set-top boxes by requiring that cable operators accommodate so-called Cable Cards for use in compatible TV sets and other devices has gotten off to a rather rocky start). Given that there are other major set-top box manufacturers, the cable companies could easily drop Motorola boxes from their lineup if Google were to rock the boat. But Google has clearly been looking to disrupt the video industry for some time (YouTube or another Google platform seems poised to join the likes of Hulu and Netflix) and bringing that sort of service to the TV screen without relying on a third party device (web-enabled DVD players, laptops, video game consoles, and tailor made devices like the Roku) would seem to fit Google's model.

Intellectual Property

Another potential motivation for the purchase is intellectual property. A stalwart company like Motorola Mobility clearly has developed a large book of IP, including thousands of mobility-related patents. Although Google is no slouch as a generator of new IP, as a relatively young company it lacks the stable of patents that could be used as it negotiates IP deals and licenses with other players in the market, or as a defense in patent infringement

litigation where settlements often involve patent licensing deals wherein both parties agree to license each other's patents. Even if acquiring intellectual property was not a primary factor in Google's purchase decision, Motorola's IP certainly sweetened the deal.

Whatever Google has in mind for Motorola Mobility, simply trying to turn around the unprofitable manufacturer at a $12-billion, 63% market price premium couldn't possibly be the whole story. Google must be looking at a much bigger picture and its ability to exploit synergies that Motorola could not have brought to the table on its own.

3G, 4G, LTE, WiMAX: what do they all mean?

When shopping for technology products, consumers typically have at their disposal a wide array of technical specifications that allow for meaningful side-by-side comparisons of competing products. Shopping for a computer? Compare processor speeds, hard drive capacity, quantity of RAM and the number of USB ports. Looking at digital cameras? Check out the number of megapixels, memory card capacity, and the optical zoom. It's true that you cannot simply assume a "bigger is better" mentality and get the best product by grabbing the device with the largest specs – any informed shopping requires consumer education. But these metrics make product comparisons, at least across any single feature, relatively easy and transparent.

Now try shopping for mobile phones and cell phone service. 3G, 4G, LTE, WiFi, WiMAX – the "technical" acronyms are certainly plentiful, and seem to denote some qualitative or quantitative differences across services and devices – 4G is better than 3G, right? But is there actually any meaning behind these terms? Most of them actually have no specific technical underpinnings, at least not in the eyes of US wireless carriers, but the terms do carry some meaning.

International Telecommunications Union

First and foremost, understanding these terms as used by US wireless carriers requires, first, a recognition that they typically refer to marketing/advertising gimmicks, not to any technical specifications. In many countries around the world, *but not in the US*, wireless service is subject to a set of standards set by the International Telecommunications Union (ITU). The ITU describes itself as "the United Nations specialized agency for information and communication technologies – ICTs. [The ITU] allocate[s] global radio spectrum and satellite orbits, develop the technical standards that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to underserved communities worldwide."

When examining terms like "4G" in the US, it is critical to understand that the standards-based meaning for that term that exists elsewhere in the world simply does not apply in this country. The US wireless industry has adopted the terminology of the international standards body, but not their precise ITU meanings. These concepts are used mainly for marketing purposes, and in the US, are not analogous to technical terms with precise meanings, like megapixels, bits per second, gigahertz, and kilobytes. In general, it is thus safer to assume that any standardized international meaning of a wireless term, at least in a technological sense, does not apply here, although there are exceptions.

3G vs. 4G Networks

A casual observer would be correct to assume that a 4G network is supposed to be better than a 3G network, but there is no easy way to translate the incremental increase in speeds and quality as a network switches over from 3G to 4G. In this case, 3G simply stands for "Third Generation" and 4G is, you guessed it, "Fourth Generation." 4G networks are presumed to be faster and more robust than 3G networks. However, the increase from 3 to 4 does not imply a direct quantitative increase (4G is not simply 33% better than 3G). The terms 3G and 4G also don't have a technical meaning from the standpoint of network construction. 3G and 4G don't imply any specific type of tower or antenna, radio technology in handsets, service type (such as GSM or CDMA), cell site capacity, specific spectrum allocation, or an industry standard bandwidth capacity. Consumers are on their own to investigate how each US carrier provisions its advertised 3G and 4G services, and how that will affect their end-user experience.

One thing is clear: all of the US carriers are advertising 4G as the latest and greatest service, and are making efforts to transition from 3G to 4G service. Accordingly, we will focus just on the major 4G network rollouts in the US. But before we look at each of these technologies, it is helpful to understand the network architecture inherent in any wireless network, and the constraints that this architecture can impose upon bandwidth regardless of 4G technology.

Wireless Network Architecture: Backhaul

Most mobile phone users only directly see mobile telephony as a wireless experience between their handset or data card and the end point of their communications. In reality, the wireless portion of "wireless" service is actually quite small; calls and data are transmitted wirelessly for only a short distance to the nearest cell tower, at which point the call is sent over *wired* backhaul transmission lines to a switching center and ultimately routed over wireline transmission and switching facilities to its ultimate destination. The wireless network is *critically* dependant upon these traditional wireline telecom services, which typically consist of high capacity "Special Access" services (e.g., DS-1, DS-3, or higher) provided by wireline incumbent local exchange carriers.

Even as wireless technologies evolve to make more efficient use of spectrum and to provide better and faster wireless transmission between the end user and the cell tower, each tower must see corresponding upgrades to the *wireline* backhaul facilities, which can easily bottleneck traffic between the tower and the ultimate destination of the data. For example, even if a 4G device is capable of providing wireless transmission at speeds of 100 mbps, its effective data rate would be limited to that of the backhaul facility interconnecting the cell site transceiver with the cellular switching office.

As such, 4G wireless network upgrades must be accompanied by corresponding advanced wireline backhaul upgrades in the 4G coverage area in order to provide noticeable service improvements. Carriers such as AT&T often footnote their advertisements about their need to upgrade backhaul facilities to achieve their advertised speeds and, as such, do not actually *guarantee* that 4G speeds will, in practice, be available.

One other element needs to be considered when evaluating the

claims of the wireless carriers. Radio technologies of all kinds represent a tradeoff between transmission speed and possible transmission distances. The greater the transmission distance (i.e., the distance between the end user and the closest cell site), the slower the service must be to provide quality transmission. So the maximum speeds theoretically possible using any given technology will almost never be achievable unless the end user is immediately adjacent to the site antenna. As the user moves farther away from the cell site, data speeds will necessarily decrease, resulting in average experienced speeds of well below the maximum possible.

WiMAX and Sprint

Sprint was, at least in a chronological sense, the frontrunner of the major US wireless carriers for 4G deployment. Sprint announced its adoption of "WiMAX" in early 2007, with plans to build a network capable of reaching 100-million users by the end of 2008. In 2008, Sprint, along with a coalition of other companies, pooled spectrum to be used by Clearwire to launch a nationwide WiMAX network. WiMAX, short for "Worldwide Interoperability for Microwave Access" is one of several competing standards for both fixed wireless backhaul and advanced mobile data services. At the time that Sprint announced its commitment to WiMAX and forged ahead to be first to market with 4G service provided using WiMAX, a classic VHS vs. Betamax "format war" was brewing, with AT&T and Verizon making ovations about a competing wireless standard known as LTE (discussed in depth below). Sprint committed to its WiMAX choice both because it was, at least in its view, the superior technology, and also to gain the first mover advantage.

Sprint's WiMAX launch was marred by setbacks, and initial plans to cover 100-million people by the end of 2008 were replaced with the reality that the first 4G/WiMAX handset, the HTC EVO, didn't hit the market until mid-2010, and then only worked in test markets. The original WiMAX standard calls for download speeds of as fast as 40 mbps, and currently calls for potential end-user speeds of as much as 100 mbps. ETI has tested a Sprint 4G data card at numerous locations across the country, and has yet to identify any location on Sprint's network where such speeds can be achieved in practice.

Although Sprint achieved its goals of being first to market with a true 4G network, it has struggled to expand the coverage nationwide, and WiMAX has not lived up to its potential, at least for the mobile applications launched by Sprint. In the time since Sprint's 2007 adoption of WiMAX, other clearly superior alternatives for providing 4G service have emerged, and Sprint has announced partnerships to migrate to one such alternative, LTE, over the coming years. Customers currently buying a WiMAX device should expect to experience only moderate coverage, slower than anticipated speeds, and the likely orphaning of the technology as Sprint migrates to LTE.

LTE: AT&T and Verizon

LTE, short for Long Term Evolution, is an upgrade to current UMTS (Universal Mobile Telecommunications System) 3G standards being marketed in the US as 4G, even though it does not meet international standards for 4G service. Nonetheless, LTE is a major upgrade over existing 3G data services, and ranks well above WiMAX in consumer tests. The "Evolution" portion of LTE does include a roadmap (called LTE-A "Advanced") to eventually get up to true 4G speeds, but several important steps — further radio advancements and massive backhaul upgrades — will be required in order to achieve these goals. LTE relies as much on backhaul upgrades as it does on new technology to improve end user speeds.

Both AT&T and Verizon have supported LTE, but to-date only Verizon has actually rolled out LTE service. In classic form, AT&T has announced its first LTE handset, though it will only work in LTE mode once AT&T makes the necessary network upgrades. Verizon meanwhile has rolled out LTE in earnest, covering 160-million potential users and offering a suite of LTE handsets and data cards.

ETI has tested a Verizon LTE data card, and has achieved download speeds in excess of 12 mbps (as advertised by Verizon) and LTE coverage in several metropolitan areas. LTE consumers can expect major upgrades from current Verizon 3G data speeds, and good and growing network coverage. AT&T's rollout is as yet unproven, but should be roughly equivalent to Verizon's from a technological standpoint, once AT&T deployment reaches parity with Verizon.

HSPA+: AT&T and T-Mobile

Both AT&T and T-Mobile have also rolled out an intermediate data product that is being marketed as 4G service but is actually only an upgrade to current 3G technologies. HSPA+ is better thought of as a 3G booster: it is powered by current hardware, but uses multiple antennas in a MIMO (multiple input, multiple output) array to boost speeds. HSPA+, like LTE, relies as much on major backhaul upgrades more than any major technological enhancement to achieve its performance boost.

However HSPA+ can only be viewed as a temporary "4G" solution—HSPA+ is the end of this particular road, with no direct roadmap to true 4G deployment. AT&T has already announced LTE 4G rollout plans, and has been using HSPA+ as a stopgap between more permanent network upgrades. T-Mobile, which has actually achieved astonishing speeds using this implementation, has acknowledged in its merger filings with the FCC that it too will need to migrate to another technology to make a full 4G transition, but claims not to have the spectrum available to accomplish this seamlessly.

Given that 3G coverage is ubiquitous in the US, consumers should expect to find such services nationwide, with HSPA+ services providing more than adequate speeds, especially on the T-Mobile network, at least in the current marketplace. Although HSPA+ is conceptually able to produce download speeds of at least 21 mbps, realistic peak download speeds fall into the 7 mbps range. As Verizon forges ahead with LTE-Advanced, and AT&T moves over to LTE, HSPA+ devices and coverage can be expected to be on the decline.

Is the iPhone 5 Sprint's silver bullet?

Sources close to Sprint have suggested that the number three wireless carrier in the US will begin selling Apple's newest iPhone sometime in mid-October. The release of the new iPhone is major news: searching for "iPhone 5" returns nearly 2-billion hits on Google, and this version of Apple's wildly successful smartphone will be the first to be released under Apple's new CEO Tim Cook. It is certainly big news for Sprint, which has, up until now, watched from the sidelines as first AT&T and then Verizon

added the device to already strong product lineups. Sprint has sat on this particular sideline for more than four years – four years marked by subscriber attrition, financial losses, and failed attempts at integrating the Nextel iDEN network. So while the iPhone is certainly "big" news for Sprint, it's unclear whether the new device will be Sprint's silver bullet, or even good news.

In the February 2011 issue of *Views and News* we discussed the announcement that Verizon would begin to carry the iPhone 4. Issues such as cross-carrier compatibility, 3G vs 4G speeds and the presence of successful Android handsets in the marketplace led us to believe that the only sure winner in expanding the iPhone handset market was Apple. Six months later, the same appears to be true. And some are speculating that the iPhone might even be a burden for Sprint as it challenges AT&T's proposed takeover of T-Mobile.

Sprint, the iPhone, and "unlimited" data

Even before Verizon gained access to the iPhone, AT&T had grandfathered its unlimited data plans, opting instead for capped plans with overage charges. When Verizon entered the market with the iPhone, it made it quite clear that unlimited data plans were still available at Verizon. This now appears to have been a short-lived ploy to steal market share away from AT&T, as Verizon's unlimited plans have already been axed. This gives Sprint a chance to become the only remaining carrier with iPhones and unlimited data plans. This might provide a small boost to Sprint, but AT&T didn't suffer catastrophic losses when Verizon advertised its unlimited iPhone deals just six months ago.

The industry standard practice of locking wireless customers into two-year contracts will likely keep customers locked-in to their current carrier. Facing early termination fees of as much as $350, customers may not find the appeal of unlimited data to be worth the expense of terminating their contract simply to switch carriers.

The prevalence of family plans may also make it difficult for consumers to switch to Sprint. While the carriers do not disclose such statistics publicly, ETI research has determined that a substantial portion of all non-business wireless subscribers are on family plans. Since termination fees are applied per phone, an AT&T or Verison family plan customer considering switching carriers could be hit with termination charges approaching $1,000. Limiting the defection to only the plan's iPhone user(s) would reduce termination charges, but splitting up the family across two carriers would mean higher monthly fees.

4G: LTE, WiMAX or both?

There are many rumors surrounding the potential technical specifications of the iPhone 5, but it seems hard to believe that Apple would release another device that was not 4G capable. The iPhone 4 was already late to the 4G party and Verizon has been quite successful with its 4G LTE rollout and device lineup. AT&T just announced its own first 4G handset in advance of AT&T's 4G LTE network debut. It seems likely that the iPhone 5 will have some sort of LTE capability. Sprint was first to market with 4G service, but had opted to adopt a different technology than LTE – WiMAX. Given that Apple already designed 3G CDMA functionality into its phone for Verizon, conversion of the 3G phone for Sprint should be relatively trivial. But no other major carrier has rolled out a WiMAX 4G network, so it would be a significant accommodation from Apple to include 4G WiMAX capability. If Sprint's iPhone does not come equipped for 4G, it might as well come dead on arrival. Otherwise, the only way to achieve 4G data speeds on the Sprint iPhone will be to have *additional* data service from Sprint on a 4G WiFi data card. This kludgey setup could hardly be a selling point for Sprint.

Some rumors have suggested that the iPhone 5 will be a so-called dual-mode device, running on both GSM and CDMA networks. If the phone came unlocked, that would certainly represent a democratization of consumer handsets. But it still remains unclear whether Sprint's version of the handset would fall into this category, if indeed WiMAX compatibility was more than just a software setting on the device.

Bigger picture: Sprint vs. AT&T/T-Mobile

The fate of AT&T's merger application at the FCC remains unknown, but Sprint has clearly been the biggest opponent of the merger. Sprint has suggested that the merger would lead to 1980s style monopoly conditions, and that under no circumstances should the merger be allowed to proceed. One of the many arguments that can be made against AT&T is that, for quite some time, it had foreclosed the other carriers, especially Sprint, from selling the iPhone (having struck a deal with Apple to be the exclusive provider of the iPhone in the US for more than three years), leaving the distant number three carrier with a gaping hole in its handset lineup. By gaining access to the iPhone 5 in October, this argument loses some of its steam at perhaps an inopportune moment as the FCC continues its analysis of the merger.

While Sprint's arguments that AT&T would have monopsony power in the handset market would remain true, the poster child of this market power, the iPhone, would land squarely in Sprint's lap – at least for now. Given Sprint's adamant concern over the merger, losing any talking point could do more harm than good.

And the winner is:

It seems hard to imagine that despite Sprint's best efforts to turn itself around, the only remaining stumbling block would be access to Apple's iPhone. Sprint may stand to gain from selling the device, along with more lucrative data plans, but long term success will not hinge on the sale of the iPhone, especially if Sprint was forced into any extraordinary financial concessions in order to even step up to the negotiating table with Apple.

As we concluded in February, there will be only one clear and unambiguous winner stemming from the wide, multicarrier release of the iPhone 5, and that is Apple. With a wider audience, upgraded OS, and new hardware, the maker of the $600+ device doesn't need Sprint to be wildly successful with the iPhone 5.

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