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In an otherwise wireless world filled with smartphones, laptops, and tablets, the wired desk phone is a throwback. Never mind that today’s desk phones are IP based, have LCD displays, and possibly a video camera — they’re still tethered by a wire. In fact, in a growing number of enterprises today the desk phone is the only office tool with a wired connection.

The longevity of the wired phone can be attributed to the lack of a wireless analogue with comparable form, fit, and function. A corded handset is convenient to use and enhances privacy. Desk phone voice quality is typically at or near toll-quality, and video-enabled phones are close to jitter-free. Desk phones interface seamlessly with unified communications features like hands-free conferencing, messaging and e911 emergency services. Lacking a wireless alternative with the same combination of convenience and features, the desk phone has lived on.

Longevity has come at a steep price. IP desk phones are very expensive, costing several hundred dollars apiece, more with video. Every IP phone requires a wired Ethernet connection and typically also a power over Ethernet (PoE) port on a closet data switch. Those ports consume electricity and generate heat, so you pay twice: first to power them, and then to cool them. Fewer IP desk phones would reduce both the number and size of closet switches, lowering capital and on-going maintenance expenses.

When user preferences shifted from desktop to laptop PCs, it heralded the first wave of enterprise mobility. Wi-Fi network adoption grew, starting in conference rooms and then spreading through the enterprise or institution. Since fewer wired ports were needed to support wireless devices, enterprises reaped low-hanging fruit by rightsizing the physical Ethernet ports and switches and replacing them with more affordable Wi-Fi coverage. A single enterprise-class 802.11 access point – driven by a single Ethernet port – served multiple laptops. Consolidating ports and slashing closet switches decreased operating and refresh costs, and lowered the enterprise's carbon footprint.

The advent of Aruba’s Mobile Virtual Enterprise (MOVE) high-speed 802.11n networks led to a further set of savings. Equipped with the ability to set quality of service (QoS) separately for each running application (referred to as “fingerprinting”) and unique network access and usage policies for each user and device, MOVE enabled the creation of multi-use networks. That is, instead of building separate networks for employees, guests, and even telemetry in the case of hospitals and factories, all three could be combined into a single MOVE Wi-Fi network that dynamically adapted to the needs of each user, device, and application. This allowed for further rightsizing of IT infrastructure by consolidating systems, switches, and wired ports. Except for wired IP phones. Lacking a wireless equivalent they stubbornly remained tethered to wired infrastructure.

And so before us stands the third rightsizing opportunity — replacing the wired IP phone with a wireless contender. The potential savings are huge on both the telephony and IT infrastructure fronts. In 2010 Goldman Sachs anticipated this when they noted that wireless LAN (WLAN) technologies were soon expected to migrate IP phones over to Wi-Fi. “We expect growth in the WLAN market to reaccelerate over the intermediate term as higher penetration of notebooks and smartphones in the enterprise increases demand for wireless connectivity, and as more enterprises substitute traditional wired infrastructure with WLAN networks.”1 Building on that point, Gartner predicts that by 2016 the only wire needed in an employee’s workspace will be a power connector.2

The driving question is what will stand as an alternative to the wired desk phone? For a hint let’s examine what’s driving fixed-line substitution in the residential market.

**Fixed-line substitution**

When cellular phones and later smartphones hit the consumer market, the new technology had a profoundly negative impact on traditional fixed line voice usage. Consumers reasoned that they were mobile and their phone and service connection should be, too. Fixed lines with dedicated wired phones didn’t fit that model, and many consumers crossed over to cellular-only service starting early in the 2000s. The younger the user, the less likely it is that they’ve ever had a fixed-line account.
The graph below shows fixed versus mobile penetration rates in the Americas from 1996-2006, with fixed-lines declining starting in 2001 despite a steadily rising population. In mature voice markets such as North America, Europe and Japan, Gartner expects the number of voice lines to continue to drop up to five percent per year.3

![Fixed vs. mobile penetration rates, Americas region, 1996-2006](http://www.itu.int/ITU-D/ict/statistics/ict/index.html)


**Fixed Lines vs. Mobile Subscriber Growth – Americas Region**

The introduction of smartphones, and in particular the iPhone in 2007, accelerated the rate of fixed-line substitution. As shown in the Morgan Stanley graph below, it took five years for the NTT Docomo i-mode smartphone to hit 40 million users, but only two years for iPhone subscriptions to top 57 million users. Many of those users made the iPhone their only phone, opting out of fixed-lines altogether.

![Adoption Rate of New Communication Technology](morgan-stanley-graph)

*Source: Morgan Stanley, The Mobile Internet Report, 15 December 2009*
Smartphone usage has not been limited to consumers. Enterprise workers have brought their personal devices to work in droves, requesting — or demanding — permission to use them on enterprise Wi-Fi networks. IDC found that 40.7 percent of devices that people use to access business applications are owned by the workers, and 69 percent of workers surveyed used smartphones, whether personal or corporate-owned, for business applications.\(^4\)

Virtually all new smartphones built today incorporate Wi-Fi, which is increasingly the connectivity technology of choice for both consumers and enterprises. Indeed, smartphones currently lead Wi-Fi growth, followed by consumer electronics devices, and are expected to continue doing so thru 2013.\(^5\) By 2015 there are forecast to be over 200 million Wi-Fi enabled smartphones in service, with a healthy compound annual growth rate of greater than 67% from 2010-2015.\(^6\)

The cellular capability of smartphones might lead one to assume that Wi-Fi would take a back seat for network communications but that isn’t the case. Wi-Fi’s higher speeds make for a better user browsing experience. Capacity issues on cellular networks are driving carriers to offload data traffic to Wi-Fi. And inexpensive voice over Wi-Fi calling options make them attractive alternatives to cellular voice minutes.

The compact size, ease of use, and ability to switch between personal and business applications have also made smartphones a good fit for mobile knowledge workers, and blurred the line between personal and work time. As a result, Bring Your Own Device (BYOD) initiatives are underway at enterprises worldwide to give safe harbor to the rising tide of wireless devices. This, in turn, has propelled the use of Aruba’s MOVE architecture, Wi-Fi networks, and ClearPass mobile device access control, which were designed to address the connectivity, security, and management needs of BYOD programs.

### The smartphone platform

Smartphones’ success with consumers, and their transition into the enterprise, has occurred in part because they serve as platforms on which a wide variety of personal and business applications and services can run. The versatility of the smartphone platform - including the ability to run multimedia applications, communicate securely over enterprise Wi-Fi networks, and present a high resolution graphical user interface - makes it a potential rival to the IP desk phone. That is, provided that gaps between the two can be filled. Smartphones lack corded handsets. Smartphones have the potential to offer toll-quality voice and jitter-free video over wireless but only if the IT infrastructure can dynamically adapt to these services. And smartphones lack client applications that permit tight integration with unified communications service or e911 locationing.

Or at least that used to be true. The story is very different today than it was just a couple of years ago. New products and technology have bridged the gap and transformed Wi-Fi enabled smartphones into a potent rival for desktop telephony. Let’s review why the scene is so different today.

### Corded handset

When consumers and knowledge workers made the transition from desktop PCs to laptops, they gained mobility but lost large monitors, expanded keyboards, and extra ports. Enter the docking station. Docking stations connected laptops to popular peripherals and provided access to extra ports and a power supply. Docking station features were tied to the native capabilities of each compatible laptop, leading to a large proliferation of models. Still, a well-designed docking station could transform a laptop into a desktop machine, and at the end of the work day liberate the laptop for home or mobile use.

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The docking station concept has now been adapted to smartphones, the iFusion from AltiGen Communications being a case in point. The iFusion includes a full duplex speakerphone, corded handset, battery charger, Bluetooth audio interface, and USB port for data synchronization with a Mac or PC. All accessible by simply sliding a smartphone into the dock’s connector. At the end of the work day simply unplug the smartphone and you’re mobile once again. Already compatible with the iPhone and iTouch, iPad docking stations are in the works, too.

Thanks to the subsidies offered by cellular providers, most employees already have or could easily afford to get a smartphone. A personal phone that does double-duty as a business phone is one more expense the enterprise doesn’t have to bear. Cellular operators are also only too happy to sponsor employee purchase plans, too. Since cellular plans typically allow the subsidized purchased of a new smartphone every two to three years — a shorter period than an enterprise could write-off a capital purchase — users are assured of always having an up-to-date phone.

Priced at about one quarter the price of an IP telephone, and using shared Wi-Fi for network communications instead of dedicated Ethernet cabling, iFusion and other docking stations lower capital expenses and, by using Wi-Fi for calling instead of cellular minutes, lower operating expenses, too. Should the enterprise network go down for any reason, cellular calling remains available as a back-up — a survivability feature lacked by IP desk phones.

Unified communications integration

Unified communications encompass voice and video telephony, conferencing, messaging, presence, instant messaging, clients, and applications such as administrative tools, collaboration and notification applications, and contact center services. As a rule, enterprise customers favor unified communications systems running on standards-based infrastructure (in lieu of sole-sourced hardware) because they offer a greater range of client device options and are more competitively priced.

Microsoft Lync Server 2010 is the leading unified communications solution, and the best positioned Leader in Gartner’s Magic Quadrant for Unified Communications. In addition to integrating with Microsoft’s enterprise suite, Lync offers voice, video, instant messaging, presence, and multiparty collaboration and conferencing. Lync and its predecessor, OCS, were initially launched on PCs and laptops, but in a game-changing move the demand for BYOD has now brought Lync to smartphones. And that has changed the trajectory of smartphone opportunities in the enterprise.
Lync client and server software are now available that transform a smartphone into a wireless desk phone. Smartphones can register as native endpoints with a Microsoft Lync Server via SIP, UCMA, and trusted applications. The user interface screen has a familiar (if more colorful) desk phone-like look. Voice call controls, extension dialing, external dialing (VoIP over 3G or Wi-Fi), mid-call control (conferencing, call transfer, call record, and hold), Directory, Favorites, and presence are all supported.

Application server software provides native integration with Lync, Active Directory group provisioning, and extensive administrator configuration and provisioning features. Smartphones are viewed by the Lync Server as native SIP, controlled by the client interface, enabled with call control, instant messaging, and presence even for inbound calls. Outbound smartphone calls are automatically routed through the Lync Server and controlled by IT-defined Lync call routing rules. Called parties see the Lync-managed direct inward dialing (DID) number instead of the user’s smartphone caller ID — a must when a consumer’s own device is used for enterprise calls.

AltiGen — maker of the iFusion docking station — makes such software for iOS, Blackberry, Android, and Windows 7 smartphones, and application server software for use with Lync Server 2010. Damaka and other firms offer solutions as well.

The performance of smartphones and unified communications services is wholly dependent on the capabilities of the wireless LAN over which they operate. There are profound differences between Wi-Fi vendors, and it’s therefore essential to select a Wi-Fi network that delivers appropriate QoS for each and every application to achieve toll-quality voice and jitter-free video.
Port-based legacy networks from Cisco, HP, Juniper, and other vendors were intended to map applications to specific wireless SSIDs and VLAN with QoS tailored to that application. For instance, a wireless voice phone would be mapped to the voice VLAN, and data device to the data VLAN. This design fails to work correctly for many reasons:

- The VLAN’s QoS will be correct for only one application and performance of the others will suffer;
- Each wireless SSID generates traffic that consume otherwise usable bandwidth;
- The assignment of one priority profile makes it challenging to isolate and prioritize real-time traffic; and
- It’s not clear where you allow routing across VLANs when a device sourcing/sinking multiple traffic types joins one SSID/VLAN, and if you do allow routing it precludes using VLANs to segregate traffic for security purposes.

Aruba’s MOVE architecture is user-, device-, and application-aware. MOVE can identify individuals and put them into roles governed by specific policies, e.g., guests are assigned lower bandwidth than an employee. MOVE can also identify specific devices, differentiating, say, between laptops and iPhones, and apply policies based on a device’s capabilities. Finally, MOVE uses deep packet-inspection to identify, isolate, and prioritize real-time traffic, differentiating between multiple applications flows originating within a single device.

These capabilities enable the network to use a single SSID and still apply QoS based on the applications that run on each device instead of the SSID or VLAN. Even with encrypted traffic, MOVE’s heuristics pinpoint voice and video packets and apply the right network settings and policies. To ensure end-to-end QoS over both wired and wireless networks - since they’re normally used in concert - MOVE additionally assigns both wired DiffServ codepoint (DSCP) tags and Wi-Fi Multimedia (WMM) tags.

Let’s look at how application-awareness impacts a unified communications application running on a smartphone, using the market-leading Microsoft Lync Server to provide a single interface that unites real-time voice, instant messaging, audio, video and Web conferencing into a richer, more contextual offering.

- **Application Fingerprinting** – Microsoft Lync Server employs an encrypted version of the session initiation protocol (SIP) with transport layer security, called SIP-TLS, to secure communications between users. This encryption poses a major network challenge when trying to identify and prioritize traffic using traditional methods. Instead of snooping on the signaling exchange, MOVE’s application fingerprinting technology monitors packets as they flow through the network, detecting and identifying voice and video traffic based on real-time traffic analysis.

- **Call Admission Control (CAC)** – Load-balancing across access points (APs) does not consider the unique requirements of active voice and video sessions. Voice and video-aware call admission control addresses this challenge by preventing oversubscription. Compared to legacy CAC solutions that only look at a threshold of pre-designated, voice-capable clients, MOVE can actually determine the number of active voice and video sessions on a radio. If aggregate call bandwidth on an AP reaches a configured threshold, MOVE automatically load balances Microsoft Lync clients to adjacent APs. This provides a very effective way to maintain call quality for all users, even in congested Wi-Fi environments.

- **RF Spectrum Management** – The quality of real-time applications like voice and video can suffer under poor RF conditions. To mitigate this problem, MOVE’s Adaptive Radio Management (ARM) technology continually optimizes Wi-Fi client behavior and ensures that APs stay clear of interference. Without disconnecting clients or disrupting applications, ARM automatically adjusts power and channel assignments on Aruba APs, ensuring that Microsoft Lync clients associate with the best channel, best frequency, and best AP. ARM will even fairly distribute clients across available wireless airtime using a traffic-shaping feature called “airtime fairness.”

Another ARM feature, band steering, is particularly useful with Microsoft Lync. When ARM detects that a Wi-Fi client can operate in both the 2.4GHz and 5GHz radio bands, it steers the device to the 5GHz band to free more bandwidth in the already-congested 2.4GHz band. By efficiently allocating wireless capacity to Microsoft Lync clients, ARM ensures that real-time voice and video applications have sufficient network resources at all times.
Sounds good but what are the real world implications of MOVE’s application-aware features on Microsoft Lync performance? Using a test set-up with ten laptops, simultaneous video conferencing sessions, and background data transmission on one 802.11n access point, Lync performance demonstrated enterprise-quality on an Aruba application-aware wireless LAN. A Cisco VLAN-based network didn’t fare at all well.

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<td><strong>3x less</strong></td>
<td><strong>60% less</strong></td>
<td><strong>~75% better</strong></td>
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Source: Aruba Tests

*Performance Comparison of VLAN vs. Application-Aware Wireless LANs*

Application-awareness brings enterprise-class quality and performance to smartphones and other wireless clients, further leveling the playing field with desk phones. Tight integration between Aruba’s MOVE architecture, today’s leading unified communications solution — Microsoft Lync — and client software from AltiGen gives enterprises a forward-looking solution with the performance, mobility, usability, and convenience users expect.

There remains only one key distinguishing feature of the IP desk phone: pinpointing the location of an emergency call. Has that vantage fallen as well?

**Calling for help**

911 is the standard emergency number used in the United States and Canada. A Public Safety Answering Point (PSAP) is the ultimate destination of a 911 call, and it is from the PSAP that first responders are dispatched. An enhanced 911 call, referred to as “e911,” associates the user’s phone number (Automatic Number Identifier or ANI) and address (Automatic Location Identification or ALI) to a 911 call. The ANI and ALI are stored in a database that is created prior to a number entering service.
When an e911 call is made via an IP desk phone, first responders know the location of the caller because a pre-configured location (extracted from the Ethernet edge switch to which the phone is connected) is applied to the emergency call as it is dialed by the IP PBX. Calls initiated over Wi-Fi by smartphones present a challenge because they’re mobile: the phone connects to a Wi-Fi access point, which connects to the Ethernet switch, but once registered the Wi-Fi enabled phone can roam freely around a building or a campus. Identifying the location of an e911 call requires additional steps to extract location data from the Wi-Fi network and, through an intermediary application, pass it to the ALI database from which an address can be extracted for first responders.

Support for e911 location services has been a major factor in the longevity of wired IP desk phones, because until recently reliably pinpointing the location of calls originated over Wi-Fi has been challenging. No longer. Used in conjunction with an Aruba wireless LAN, Microsoft Lync Server 2010 can identify the location of a Wi-Fi originated call and report it to emergency services.

The Lync Location Information Server (LIS) is one of several servers that together comprise Lync. The LIS contains a reference of network identifiers to both civic addresses and in-building locations, and by default Lync clients query the LIS for location. The emergency dial string and route are defined by a policy, enabling Lync to accommodate different international emergency dialing requirements.

During set-up or adds/moves/changes, an administrator provisions the LIS with the location details of MAC address of the Wi-Fi access points. This address is commonly referred to as the Basic Service Set Identification or BSSID. Additionally, the Link Layer Discovery Protocol (LLDP) ports and switch, and the network subnet, are entered in the LIS data base. Entering BSSID and location information by hand can be time-consuming in larger Wi-Fi networks with hundreds or thousands of access points. Aruba’s AirWave Management Suite addresses this using APIs that automatically export access point BSSIDs and locations into the LIS data base via Microsoft PowerShell commands.

When an e911 call is made, the Lync client reports the BSSID of the Wi-Fi access point with which the smartphone is associated. The LIS tags the call with the previously entered access point location to identify the location. If location information has not been entered in the LIS data base, the user can manually enter location information into the Lync client or a request can be sent to an external database or location service offered by Connexon and Level 3.

Regardless of the routing method used, Lync works in concert with Aruba wireless LANs to alert and guide first responders quickly and efficiently to the source of a Wi-Fi phone originated call for help. And so falls the last exclusive province of the wired desk phone.

**Conclusion**

With the implementation of a robust and secure Aruba Wi-Fi network based on the MOVE architecture, smartphones can replace desk phones and save hundreds of dollars per phone in the process without sacrificing features or convenience. The jump from wired desk phones to wireless smartphones presents a fantastic opportunity for enterprises to reap low-hanging capital and operating cost savings, enhance user productivity, and drive the pace of communications innovation at minimal expense. Enabling technologies like Aruba’s MOVE architecture, AltiGen iFusion docking stations, and Microsoft Lync Server 2010 have at last leveled the playing field with wired phones, delivering smartphone users with a simple, secure, consistent, and familiar desk phone-like experience.

A technology with its roots in 19th century telephony, the wired phone has had an enduring and successful run. But at the end of the line it’s smartphones that are taking to the air, carrying us forward into the next hundred plus years of unified communications.
About Aruba Networks, Inc.

Aruba Networks is a leading provider of next-generation network access solutions for the mobile enterprise. The company’s Mobile Virtual Enterprise (MOVE) architecture unifies wired and wireless network infrastructures into one seamless access solution for corporate headquarters, mobile business professionals, remote workers and guests. This unified approach to access networks enables IT organizations and users to securely address the Bring Your Own Device (BYOD) phenomenon, dramatically improving productivity and lowering capital and operational costs.

Listed on the NASDAQ and Russell 2000® Index, Aruba is based in Sunnyvale, California, and has operations throughout the Americas, Europe, Middle East, and Asia Pacific regions. To learn more, visit Aruba at http://www.arubanetworks.com. For real-time news updates follow Aruba on Twitter and Facebook.