

The Future of Mobile Networks

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There is no doubt: The world has gone mobile. More than 85 percent of the world's population now enjoys access to a mobile phone; in 105 countries around the world, there are more mobile devices than there are people.¹ According to Strategy Analytics, the number of smartphones in use globally has topped 1 billion.² Further research from the Cisco® Internet Business Solutions Group (IBSG) reveals that entertainment has shifted to the palms of our hands, as almost half of all mobile users are consuming video, music, books, and games on their mobile devices on a regular basis.³

The Cisco Visual Networking Index (VNI) predicts that these trends will cause global mobile data traffic to increase 13-fold from 2012 to 2017.⁴ Global mobile traffic will continue to explode, growing at a rate three times faster than that of fixed IP traffic over this same time period. This outlook is great news for mobile network operators (MNOs), as revenues from global mobile data services reached US\$320 billion in 2011—more than the combined revenues of the music, movie, ISP service, and cable television industries.⁵

While the demand for mobile is unquestionable, the definition of mobile is rapidly changing. A number of key changes in technology, the market, and customer behavior are beginning to redefine what a mobile network is and what it needs to deliver:

1. **Ubiquitous Wi-Fi-enabled devices:** All mobile devices, except for smartphones, are now Wi-Fi-enabled and have limited cellular connectivity.
2. **Mobile now means “nomadic”:** Mobile is increasingly less about an “on-the-go” lifestyle such as walking or driving, and more about the convenience of a “nomadic” lifestyle—moving, sitting/stopping, connecting, and then moving on again. Mobile devices are now used on average 2.5 hours per day in the home and 1 hour per day at work compared with less than 0.5 hours while on the go.⁶
3. **Wi-Fi is everywhere:** The majority of homes and businesses now use Wi-Fi, and there are more than 5 million public hotspots throughout the world.⁷
4. **People are happy with Wi-Fi:** Given the near-pervasive availability and improvements in Wi-Fi, mobile device users—including smartphone users—actually prefer Wi-Fi to mobile cellular to connect to the web.⁸
5. **Mobile pricing:** Tiered mobile data pricing and caps are encouraging people to connect to the Internet at a lower cost or via “free” Wi-Fi.
6. **Technology advances:** The Next-Generation Hotspots⁹ initiative greatly improves the Wi-Fi experience and enables seamless integration with mobile networks.
7. **The rise of small cells:** To solve coverage, capacity, and spectrum issues, there are now more licensed small cells deployed globally than macro cells.¹⁰

As we witness the rise of Wi-Fi and small-cell networks, the fundamental question becomes: How do these networks relate and interact with existing macro cellular and newer long-term evolution (LTE) networks? Are they complementary, compatible, or competitive? Specifically, what should an existing mobile operator do given this future outlook? Alternatively, is there an opportunity to become a next-generation mobile operator without huge investments in a macro cellular network?

Scenarios for the Future of Mobile Networks

Given the changes occurring in the mobile marketplace, Cisco IBSG has identified four possible scenarios of how networks could evolve to deliver mobility.

1. **Mobile Only**—Devices connected only to licensed-spectrum mobile networks
2. **Wi-Fi Only**—Devices connected only to unlicensed Wi-Fi single-access points and broadly available Wi-Fi networks
3. **Mobile Maximum (Max), Wi-Fi Minimum (Min)**—Devices connected predominantly to licensed-spectrum mobile networks; limited Wi-Fi network connection for capacity (such as in stadiums) and coverage (such as in buildings/homes)
4. **Wi-Fi Max, Mobile Min**—Devices connected primarily to unlicensed Wi-Fi networks; also includes limited licensed mobile connection for on-the-go mobility (such as when driving/walking), coverage in remote areas and places where Wi-Fi is inaccessible, and QoS/security (such as for video conferencing/voice)

Scenarios 1 and 2 are viable solutions for specific situations. A **Mobile Only** solution is feasible for a world of connected smartphones, where voice, near-ubiquitous coverage, and quality connections are essential. Mobile networks are renowned for being “just works” networks—that is, networks that assure connectivity, the use of applications, and the ability to make voice calls from virtually anywhere with minimal effort. Despite the universal success of mobile networks, mobile alone is not ideal for connecting the growing range of new, predominantly Wi-Fi-only enabled devices.

A **Wi-Fi Only** solution is acceptable for devices that predominantly are used in a finite number of places where good Wi-Fi connectivity is assured, such as in the home, office, or coffee shop. In addition, Wi-Fi Only provides a cost-effective way for mobile users to connect their Wi-Fi-enabled devices. However, this solution can never match the near-ubiquitous coverage of mobile networks.

Equally, it is hard to provide good voice service over a Wi-Fi-only network. While voice-over-Wi-Fi is not a viable option, Cisco IBSG believes that voice-over-Wi-Fi will likely never reach the mass market due to quality, connectivity, and roaming issues. It is hard to compete with mobile voice—mobile voice just works.

Therefore, mobile operators should consider whether they need to provide a mobile cellular equivalent voice service and, if so, how much coverage is required. Cisco believes that the future of mobile networks lies in a heterogeneous network (“HetNet”) world where licensed and unlicensed mobile networks coexist and complement each other. And, users would agree. While they may not refer to this networked world as HetNet, according to Cisco IBSG research, mobile users definitely want networks that guarantee the best coverage and quality, providing the best user experience on their desired mobile device—all at the lowest possible price—in a seamless, non-apparent way. In addition, they expect the same level of security, policies, and control across all of the networks they are using.

The question for mobile operators then becomes, “Which network scenario—three or four—will dominate? The answer depends, for the most part, on your starting point.

“If you don't know where you're going, any road will get you there.”

—Paraphrasing from an exchange between Alice and the Cheshire Cat in *Alice's Adventures in Wonderland*, by Lewis Carroll

Traditional Mobile Networks Become More Diverse

The third scenario—**Mobile Max, Wi-Fi Min**—is the most viable strategy for mobile operators with extensive mobile cellular networks and investments in next-generation LTE networks. This scenario enables mobile operators to provide good coverage, quality, and “just works” ease of use, as well as enhance the customer experience through their existing network infrastructures. Unlike Wi-Fi, cellular mobile can provide true on-the-go, seamless mobility. Upgrades to LTE networks will enable better-than-Wi-Fi speeds to meet the insatiable demand for bandwidth-hungry applications.

While a Mobile Max strategy is most feasible for mobile operators, Cisco IBSG believes that Wi-Fi and small cells, or Wi-Fi Min, will increasingly become an integral part of the mobile network and enable operators to:

- **Provide coverage fill-in**—Provide coverage in challenging locations such as inside commercial buildings and homes
- **Address capacity issues**—Provide capacity in high-usage venues such as stadiums and public events
- **Improve network economics**—Selectively offload traffic to eliminate or defer additional investments in the mobile network with associated cost savings
- **Address spectrum challenges**—Split cells and offload traffic to provide quality service without additional spectrum
- **Tap new markets**—Offer new and bundled services for Wi-Fi-centric devices, and develop new Wi-Fi monetization models¹¹
- **Control the customer experience**—Offload traffic to the mobile core network rather than to the public Internet to ensure the same level of customer experience (for example, policies and parental controls) as when using mobile networks

The extent and importance of Wi-Fi in a predominately mobile network depends on the individual mobile operator and market dynamics. However, Cisco IBSG believes that all mobile operators must carefully evaluate how Wi-Fi and small cells play into their overall network strategies.

Building a Next-Generation Mobile Operator

Given the phenomenal demand for mobile connectivity and the fundamental changes in technology, consumer behavior, and the mobile marketplace, Cisco IBSG believes that there is a unique opportunity to build a new mobile network with Wi-Fi at its core: **Wi-Fi Max, Mobile Min**. This new network would not exclusively be Wi-Fi; it would selectively be supplemented with licensed mobile to combine the best of both worlds and to complement each network's strengths.

The economics of creating a Wi-Fi Max, Mobile Min next-generation mobile network are compelling. Access-point costs are a fraction of the costs for macro-cell equipment. In addition, Wi-Fi Max, Mobile Min requires only minimal purchase of very expensive spectrum. Equally, end users would find this strategy attractive because it provides 1) low-cost service, 2) connectivity to new Wi-Fi devices, and 3) a range of new services. At the same time, the Mobile Min component ensures constant connectivity and enables operators to guarantee quality, coverage, and the simplicity of voice calls—a mobile application that will continue to be important for a long time to come.

A next-generation mobile operator (NGMO) would not be a direct competitor to existing mobile operators. In most markets around the world, there are at least three to four incumbent players, and in many markets there are even more. Creating a fourth, fifth, or sixth competitor would be strategic suicide. A next-generation mobile network, on the other hand, would be an alternative to providing services to new markets such as Wi-Fi-centric devices, and could become an extension of existing business models such as “TV Everywhere” for current video providers.

In addition, Cisco IBSG has identified a number of new Wi-Fi business models such as churn management, advanced advertising, and business analytics that can be developed from investments in next-generation networks.¹² In many cases, NGMOs would complement incumbent mobile operators by wholesaling access to their extensive Wi-Fi networks to MNOs and integrating these Wi-Fi networks with existing mobile networks.

Next-generation mobile operators do not have to create duplicate networks that offer the same services as those of existing mobile operators to be successful. Rather, they can identify what makes economic, operational, and strategic sense in building their networks. NGMOs do not need to be all things to all mobile users: for example, they may not be able to ensure complete national or global coverage to provide streaming video services to people travelling in cars. Most likely, they could offer reasonable connectivity in more than three-quarters of the places where people typically spend their time, such as at home, work, retail venues, and other public locations. An NGMO could operate as a mobile virtual network operator (MVNO) and purchase a minimal amount of access from a mobile operator to provide the requisite “fill-in,” offering near-universal coverage for those few occasions when NGMO customers wander off the network (“off-net”). And, while an NGMO may not be able to provide streaming video on highways, it could provide service in all of its Wi-Fi locations, possibly even on trains and airplanes.

Next-Generation Network Strategy: Where to Start

Cisco IBSG recommends that mobile operators consider these key elements in their next-generation mobile network strategies:

- Create an extensive network of Wi-Fi hotspots to cover 70 percent to 80 percent of the places where people want to use their “nomadic” devices:
 - **Homes**—Bundle wireless application protocols (WAPs) as part of the home broadband service and make them available to all network subscribers through “community Wi-Fi” solutions such as the Fon¹³ global Wi-Fi network or other shared service.

- **Enterprises**—Bundle WAPs as part of enterprise/business broadband and telephony services. In addition, create a business community Wi-Fi solution through SSIDs open to all network subscribers.
- **Business community**—In addition to managed business Wi-Fi such as in coffee shops and retailer stores, operators can create community Wi-Fi solutions through SSIDs open to all network subscribers, such as Starbucks' Wi-Fi service and SSIDs from NGMOs.
- **Additional locations**—Fill in the gaps by using creative techniques to make NGMOs' SSIDs available in key coverage locations such as airports, stadiums, and parks.
- Acquire a minimum amount of spectrum to offer voice services, and provide fill-in coverage where Wi-Fi coverage does not exist.
- Bundle licensed small cells with WAPs as a single unit at all locations:
 - **Homes**—combined femto-Wi-Fi access points
 - **Enterprises**—combined enterprise Wi-Fi and small cell
 - **Managed businesses**—combined managed Wi-Fi and small cell
 - **Alternative locations**—combined Wi-Fi and small cell
- Deploy limited macro cell coverage in select locations with a high level of on-the-go mobile traffic (such as along major motorways); most likely “tower share” with existing mobile operators.
- Wholesale mobile capacity from MVNOs to fill in coverage gaps in places like rural areas where it may not make economical or operational sense to build-out.
- Invest in next-generation-compliant infrastructure to ensure seamless authentication and Wi-Fi mobile roaming.
- Build an efficient, effective Wi-Fi and small-cell infrastructure that enables extensive scalability, management/operations, and easy service creation.
- Develop an intelligent core network that seamlessly selects the best access network for the mobile user based on device, application, and location optimized for the lowest cost to serve.

A New Chapter for Mobile Networks

Cisco IBSG believes that the four scenarios described above will coexist. However, the heterogeneous network scenarios that will deliver true mobility in a way that is meaningful to mobile users (good voice service and guaranteed connectivity) are those that will seamlessly integrate licensed and unlicensed access through a converged network architecture. The big difference for mobile operators will be in choosing where to start.

Mobile operators are increasingly realizing that Wi-Fi and small cells must be part of their traditional licensed network. Equally, given changes in the mobile marketplace, technological advances, and the physical convergence of Wi-Fi and small cell into a single access point, Cisco IBSG believes that there is an opportunity to develop a viable next-generation mobile network with Wi-Fi at its core. Both of these HetNet approaches offer improved economics over traditional mobile networks, new market opportunities, better customer experience, and a means of successfully meeting the mobile data explosion.

The path to follow requires a good understanding of the marketplace, technical capabilities, and overall economics. Deploying large numbers of Wi-Fi and small-cell locations and the operational requirements of integrating the two types of networks will present challenges. However, given the huge demand for everything mobile and the fundamental shifts in the marketplace, there is no doubt that there is plenty of opportunity for all mobile players. The key to success lies in having the right vision, creativity, and technical and operational excellence to claim the prize of profiting from the explosive growth in mobility.

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Endnotes

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