Cost-Effectively Delivering the Mobile Internet in Urban Areas

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The explosion of mobile Internet traffic is expected to continue, fueled by increased penetration and usage of smartphones and tablet devices. Wireless service providers (SPs) are starting to feel the pinch in urban areas, where cell sites are already densely deployed and running at high utilization levels. Continuing to meet user demand through traditional cellular technology (multiplying cell sites) will start to prove costly; failing to invest will degrade the user experience and may result in churn to a competitor providing a more satisfactory service.

> "If you want to download, stream, and watch video clips, save that stuff for your home broadband."
>
> Press release from U.K. wireless service provider
> January 10, 2011

One option that has seen much discussion but relatively little implementation by wireless SPs is a dual cellular/Wi-Fi strategy. The potential to offload cellular data traffic over Wi-Fi is significant since most smartphones, PCs, and tablets are now Wi-Fi enabled.

Complementary Economic Characteristics

Deploying Wi-Fi outdoors in urban areas brings a number of benefits. An access point is much less expensive to deploy and operate than a cell tower, and the bandwidth available to users is similar or greater. However, the range of a Wi-Fi access point is significantly lower than that of an urban cell tower, requiring precise deployment in high-traffic locations.

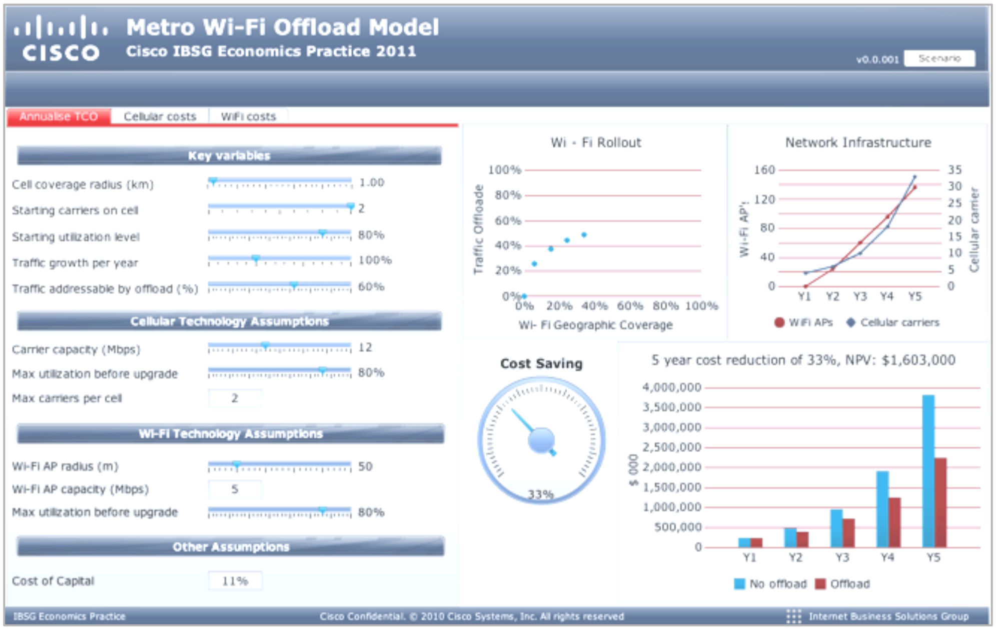
Figure 1. Typical Economic Characteristics of Wireless Technologies

	3G Micro Site	Wi-Fi Access Point, Mesh
One-off cost	$37,400	$3,700
Annual recurring cost	$15,700	$1,800
Coverage radius	1 km	50 m
Bandwidth delivered	4 Mbps	5 Mbps

Source: Cisco IBSG Research & Economics Practice, 2011

We have analyzed how these complementary techno-economic characteristics can be combined for financial advantage (see Figure 2). Our model allows different starting points in terms of loading and spacing of cell sites in the urban area being considered, and identifies the optimum mix of Wi-Fi and cellular given a number of demand parameters such as annual traffic growth.

Figure 2. Metro Wi-Fi Offload Model



Source: Cisco IBSG Research & Economics Practice, 2011

High Traffic Density and Zero-Touch Offload Are Key

Our analysis shows an attractive business case for mesh Wi-Fi: for a typical urban scenario, five-year costs could be reduced by approximately 35 percent with an appropriately staged rollout of Wi-Fi.

However, this result is dependent on four key conditions: (1) high initial cell site utilization, (2) high traffic growth, (3) small initial cell tower spacing (low radius), and (4) high proportion of traffic that can be offloaded to Wi-Fi.

- The first two of these (*utilization* and *traffic growth*) govern the time frame over which the decision to invest in Wi-Fi needs to be taken. Most urban areas are in the high-utilization, high-growth quadrant, indicating that Wi-Fi offload can have short-term benefits by deferring investment in additional cell sites. For example, if a cell site's capacity can be expanded by adding another radio carrier before an extra cell site is needed, the cost saving from Wi-Fi falls from 35 percent to 25 percent simply as a result of delayed build-out.
- *Cell tower spacing* is important, as it defines the density of demand. Fully loaded cell sites with a small coverage area will be more suitable for Wi-Fi deployment than similarly loaded sites with a large coverage area, given the relatively small radius of a Wi-Fi access point. A dense urban area (with small cell tower spacing) could see cost savings rise by more than 50 percent when Wi-Fi is employed.

- The *proportion of traffic that will be offloaded to Wi-Fi* depends on factors such as the proportion of 3G devices with Wi-Fi capability and the degree to which Wi-Fi devices actually use the Wi-Fi network when available. This latter aspect is crucial: if users have to manually choose between networks, the degree of offload is likely to be small; if devices automatically select and authenticate to the Wi-Fi network, then offload potential can be high. If users have to manually select the Wi-Fi network, our analysis shows that cost savings all but disappear. The opportunity is also low in Europe, where regulatory power limits for Wi-Fi severely limit the ability of outdoor access points to serve indoor demand; alternative options such as using licensed spectrum (femtocells or picocells) in conjunction with mesh Wi-Fi backhaul will be more attractive in those markets.

With urban environments now seeing high cell site loading, high traffic growth, and small cell tower spacing, the first three of these conditions are met in many cases. Service providers that can ensure the fourth condition—a high proportion of traffic offloaded to Wi-Fi—have the opportunity to use mesh Wi-Fi as a cost-effective complement to their cellular network in urban areas.

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