



Introduction

As wireless network users drive demand for greater coverage and higher capacity, the cellular sites expand and increase further stress on the cellular site backhaul connectivity. There are several situations where conventional wireless or wired solutions like microwave & fiber-optics network are impractical and costly, but high capacity 802.11n standard base wireless backhauled can play an important role.

Challenges

There are several challenges involved when providing carrier class mobile broadband services. One is that wireless connections have inherently limited capacity compared to wire-line approaches. One fiber connection has much greater capacity than the entire RF spectrum to 100 GHz. This is a problem as bandwidth intensive applications, such as video streaming, become widely used on wire-line networks and set user expectations that similar operations should be possible on their mobile connections. But it only takes a small number of such users to consume the capacity of an entire cell sector.

Second being multiple access and shared spectrum of mobile wireless connections. Although new technologies on the horizon such as LTE can deliver more bandwidth than any previous wide - area wireless network, many users may be simultaneously using that bandwidth.

A more recent scenario is the fast adaptation of new platform such as wireless internet tablet computers. These devices will arguably consume even more bandwidth than smart phones due to the larger screens and the likelihood of users spending longer periods interacting with them. For instance, a smart phone user may watch a short sports segment on their phone but a tablet user is more likely to watch an entire movie. So even as more users enjoy e - mail, Web browsing, social networking, and video streaming on their smart phones and tablets, the impact on the network is significant. The trend is for users to keep consuming more bandwidth.

Due to the competitive nature of the mobile service market, the amount that operators can charge for this bandwidth will not continue to rise. Deploying more efficient technologies such as long term evolution (LTE) is one approach, but is not enough. New spectrum will also eventually become available and will also help, but also will not be sufficient. Allowing network capacity to saturate is something operators must aggressively avoid. AT&T experienced significant damage to its reputation when widespread use of the iPhone resulted in unreliable user experiences. Even after fixing the problem and boosting performance above its competitors, negative perceptions linger. Users demand not only ubiquitous coverage, but reliable connectivity. Congested networks are anything but reliable. Operators must continue to augment capacity aggressively, and have to do so in the most cost effective manner. In this context, Wi - Fi will play an increasingly important role.



Wireless Load sharing requirement

Initiatives and opportunities for carriers and service providers include using Wi - Fi access point networks for 3G/4G data offload and also new applications such as managed wireless LAN services, using Wi - Fi for broadband service across high - density user areas in parts of the world where there are no wire-line alternatives, and offering rich content and multimedia communications.

Data load sharing

Ever since wireless companies instituted data caps and started charging expensive data overage fees Wi-Fi offloading has been becoming more popular. People are flocking to their favorite places that offer free Wi-Fi to reduce their 3G and 4G data usage. Most people who are the least bit smartphone savvy already have their favorite places to sit and enjoy free Wi-Fi and maybe some coffee or a breakfast sandwich. This is an excellent application of Wi - Fi for operators because the technology can deliver much higher throughput in small coverage areas to more people than is possible with cellular technologies. Not only is there more unlicensed Wi - Fi spectrum available than the amount of spectrum licensed to any individual cellular operator, but since coverage areas are much smaller, frequency reuse is much higher, and thus there is more bandwidth available to each subscriber. And it is not enough to just provide high - speed access to Wi - Fi.

Load sharing of cellular traffic onto Wi - Fi access point networks may be done by the operator, but such service could also be offered on a wholesale basis through third - party organizations. Second - or third - tier operators in particular may prefer to partner with a wholesale provider whom can provide branded internet services seamlessly.

Managed ISP through Wi-Fi

As operators gain more experience in managing Wi - Fi networks for network load sharing, they benefit to replicate the success of their deployment to other business models.

One such example is managed hotspot services. Examples include providing Wi - Fi service in hotels or on university campuses. The operator can provide the service under their brand or as purely a managed service. Another is Wi - Fi service for business environments. Deploying Wi - Fi over large coverage areas with many access points is a formidable challenge requiring careful attention to operating frequencies, radio - channel selection, interference management, determination of coverage areas, where and how to use directional beams, and centralized authentication and security administration. Larger businesses may have the skills to manage this complexity, but increasingly businesses will seek to outsource these deployments. In addition to providing Wi - Fi coverage to enterprises, operators can also offer voice operation through fixed - mobile convergence



solutions in which the operator's voice service integrates with the company's PBX. This type of solution enables a wide range of features. One is simultaneously ringing both desktop and mobile phones for an incoming call. Another is four - digit dialing with which a call can reach a mobile phone using a Wi - Fi connection when the device is on premises and via the cellular network when the device is off premises.

WBA

Expanding wireless broadband access (WBA) beyond current subscriber base of 1 billion represents a huge business opportunity, but must be done using increasingly cost - effective approaches because income levels of many possible markets are quite low. Wi - Fi is becoming increasingly more effective as a broadband access solution due to advances in the IEEE 802.11n wireless technology base. The IEEE 802.11n provides for extremely high throughputs at 600 mbps, high spectral efficiency, extended range, multi - band support, and operating flexibility in trading off between distance and throughput. Wi - Fi can be deployed at lower cost than most alternative technologies, especially in environments where little hard wireline infrastructure exists. Time to market is also much faster.

Over the air multimedia and communications

Operators can aggressively pursue opportunities of making rich content like video entertainment available to subscribers through careful integration of high - capacity Wi - Fi networks. Operators can further differentiate themselves by providing tools to automatically facilitate such content.

Users today are often reluctant to stream movies because they know this can result in a high bill at the end of a month. After all, one or two movies can consume more data than some of today's data plans. But users would likely feel much more comfortable if movies were automatically blocked when on the wide - area network but enabled when on Wi - Fi. Working with content providers, operators can make video streaming intuitive and glitch - free for users. This is just one example of the rich multimedia content Wi - Fi offers.

Challenges of License Exempt Wireless

Deploying license exempt wireless like Wi-Fi for commercial networks poses many challenges unlike licensed 3G/4G networks, but these are challenges that operators can address by making the right technology and deployment choices. One of the biggest issues carrier have had with Wi - Fi is its instability and inconsistency. The culprit is uncontrollable radio interference that causes packet loss and retransmissions. Mobile network designers need Wi - Fi technology that is able to mitigate environmental changes through both dynamic and proactive interference avoidance and rejection mechanisms.

Other challenge includes backend integration because Wi - Fi networks introduce many new nodes into the mobile operator's network. Seamless integration with the existing



cellular core and the services provided through that core must work flawlessly, without increasing the load on the 3G/4G infrastructure. Carrier - class Wi - Fi systems for 3G offload must be able to seamlessly bridge between the Wi - Fi network and the existing cellular infrastructure – providing consistent user policy, provisioning, security, roaming and authentication. One - touch or no - touch signon – regardless of the network being accessed – is also a critical features for subscriber satisfaction.

Intelligent, Rugged, and Reliable Wi-Fi

For carriers and mobile operators, next - generation Wi - Fi equipment must not only address the technical challenges discussed above, but must do so in a cost - effective manner that enables emerging strategic applications of Wi - Fi such as alternative broadband access and enterprise deployments.

Some of the significant capabilities that are needed include environmental specifications, wireless technology that adapts signal transmission and reception to extend range, and automatic RF interference rejection that decreases packet loss and increases throughput performance. Additional features include dynamic channel management, multimedia quality of service, and fast device authentication and deauthentication. Moreover, backhauls and broadband access points networks must be adaptive to enable the network to change how packets hop through nodes in the event of any disruptions. Capabilities like this are essential for carrier class resilient operation.

Conclusion

Many operators today are using Wi-Fi successfully to offload mobile data. More are forced to seriously consider the integration of Wi - Fi just to address capacity issues. A number of others, however, are moving beyond this basic entry point, incorporating Wi - Fi into their overall network strategy, with a focus on using the best available Wi - Fi technology in order to enable significant new business opportunities. It remains to be seen how operators evolve their solutions and cater to the 'always-on' devices that need broadband everywhere. Spectrum as we know is always a scarce resource but 'intelligent' use of unlicensed spectrum along with licensed spectrum will be the main play that operators would need to adopt and push the vendors to bring these solutions into the market fast enough to reap benefits. Given the significant competitive advantage of a well executed Wi - Fi deployment strategy can create, those considering, merits serious consideration.



Internal use only, References:

http://www.rysavy.com/Articles/2010_10_Strategic_Wi-Fi.pdf