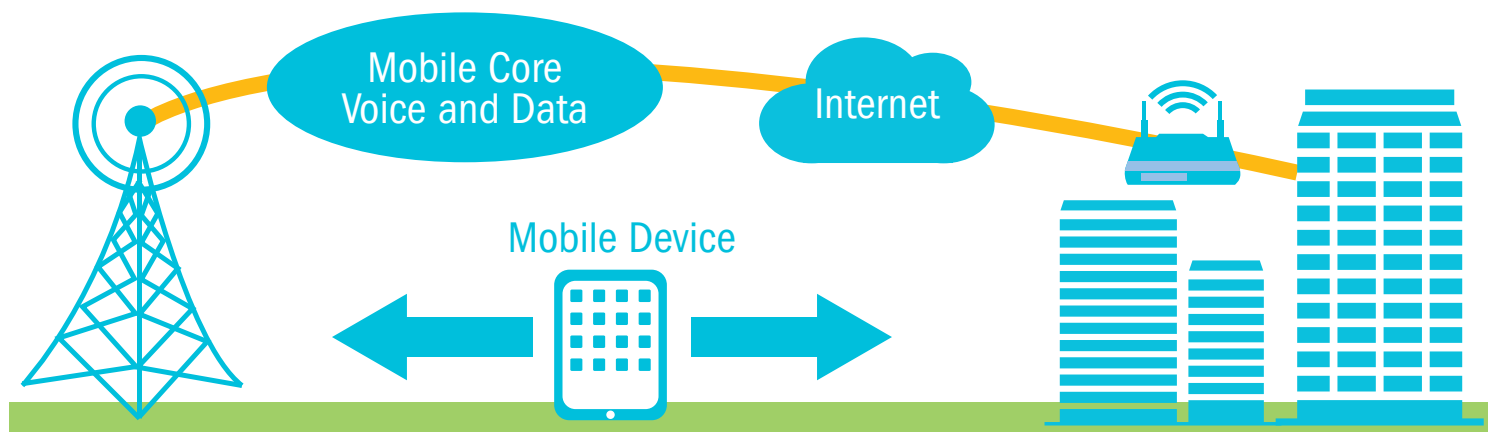


TECHNOLOGY APPLICATION GUIDE

LTE-U and VoWiFi: Mobile on the Unlicensed Spectrum



WHAT IS IT?

An ever increasing number of people using mobile broadband services is driving the explosive growth in wireless usage. However, mobile operators are facing the challenge of soaring traffic and keeping up with demand. They can meet this demand by using unlicensed spectrum, and two new technologies—LTE-U and VoWiFi—are using this unlicensed spectrum to boost mobile connectivity and performance.

LTE-U

LTE-U works by supplementing a carrier's LTE service with Wi-Fi, which can add twice as much capacity and 20 to 30 times faster roaming. This happens by using the 700 MHz to 2.1 GHz frequencies found in LTE (currently called 4G) as the anchor service and supplementing it with the unlicensed 5 GHz spectrum to provide greater capacity and coverage. By using small cells in multiple areas, LTE-U is able to provide seamless connectivity and performance.

There is a potential conflict with LTE-U: the fact that Wi-Fi and Bluetooth already play in the unlicensed 5 GHz spectrum. In Wi-Fi, there is a "politeness protocol" that LTE lacks, which means that Wi-Fi will back off if it senses interference from other users. If LTE is allowed in this frequency, it might bully Wi-Fi and take over the band.

Though, LTE-U might benefit strict Wi-Fi users, because LTE technology has a

performance edge over Wi-Fi. With more sophisticated modems and efficient scheduling technologies, a Wi-Fi user can have more spectrum to use because LTE is around three times more efficient than Wi-Fi in some cases. LTE is superior to Wi-Fi, and LTE-U coupled with Wi-Fi will allow operators to increase the efficiency of the spectrum, extend the coverage of a small cell/Wi-Fi AP beyond the range of a typical Wi-Fi AP, and still capitalize on the ubiquity of Wi-Fi devices.

However, a control channel must be implemented in a licensed band. This allows mobile operators to offer high speeds by tapping into the immense spectrum resources of the 5 GHz band. Base stations are likely to cost more than traditional Wi-Fi and operators will have to bear the backhaul costs. The seamless voice and data roaming may not prove more valuable than those offered by new Wi-Fi technologies.

VoWiFi

VoWiFi is a Wi-Fi based VoIP service. VoIP consists of the hardware and software that enables people to use the Internet as the transmission medium for telephone calls. VoWiFi is the wireless version of this technology. VoWiFi is the industry standard approach for mobile service providers seeking to deliver voice and SMS/MMS services over Wi-Fi. With VoWiFi, mobile subscribers receive a seamless voice and messaging

experience as they move between macro cellular networks and existing Wi-Fi networks such as those at the home and office. One concern is the necessary authentication on a Wi-Fi network. How this is addressed with enterprise-owned devices is not a concern, but it is when someone visits a new location. Having to authenticate every time could prove time consuming. Also, the hand off between a VoWiFi call and the mobile network is a challenge.

Wireless network operators see VoWiFi as a means of fulfilling an important need for the 20 to 30 percent of end-users who can't use their phones for voice calls in their homes because of poor coverage issues. Smart phones can place calls over Wi-Fi without using a separate number.

WHY IS IT IMPORTANT?

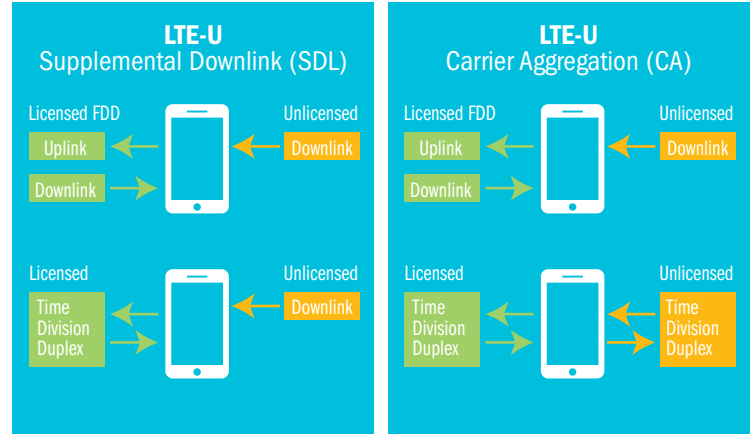
This is an era where connectivity is invisible—users don't know what technology is being used to connect them to the network. Wi-Fi, LTE, it's all the same to them. As the world moves toward 5G, devices will need to be able to work together. Spectrum is a limited commodity, and LTE-U gives operators the ability to integrate their existing disparate unlicensed and LTE networks and provide the opportunity to minimize costs, maximize network resources and improve user experiences.

TECHNOLOGY APPLICATION GUIDE

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	LTE-U	VoWiFi
What is it?	A supplement to LTE service using Wi-Fi	An industry standard approach for mobile service providers seeking to deliver voice and SMS/MMS services over Wi-Fi
Supplements	Unlicensed 5 GHz spectrum	Poor cell coverage
Benefits	LTE-U can be up to three times more efficient than Wi-Fi with twice the capacity and 20-30 times faster roaming.	Smart phones can place calls over Wi-Fi in areas where cell coverage is poor or unavailable without using a separate number.
Challenges	LTE-U can potentially override Wi-Fi and take over the band	Wi-Fi network authentication when visiting new locations



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