White paper

3G Wireless – Assumptions and Considerations for Potential Users

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Introduction
This white paper is for those individuals who want to understand more about the latest evolution of cellular or wireless wide area technology, commonly referred to as "3G" or third generation, or who are considering making a mobile computing investment that offers a 3G radio option.

The cellular industry is in a state of constant and rapid change. Readers are urged to consult with their wireless carrier or mobile operator of choice for the latest information regarding their network and wireless technology plans and offers.

Wireless wide area or cellular technologies have been available as an integrated radio offering in rugged mobile computers for some time now. The most popular technologies offered were either of the GSM / GPRS or CDMA / 1XRTT variants. Until most recently those technologies were said to be at a 2.5 G capability.

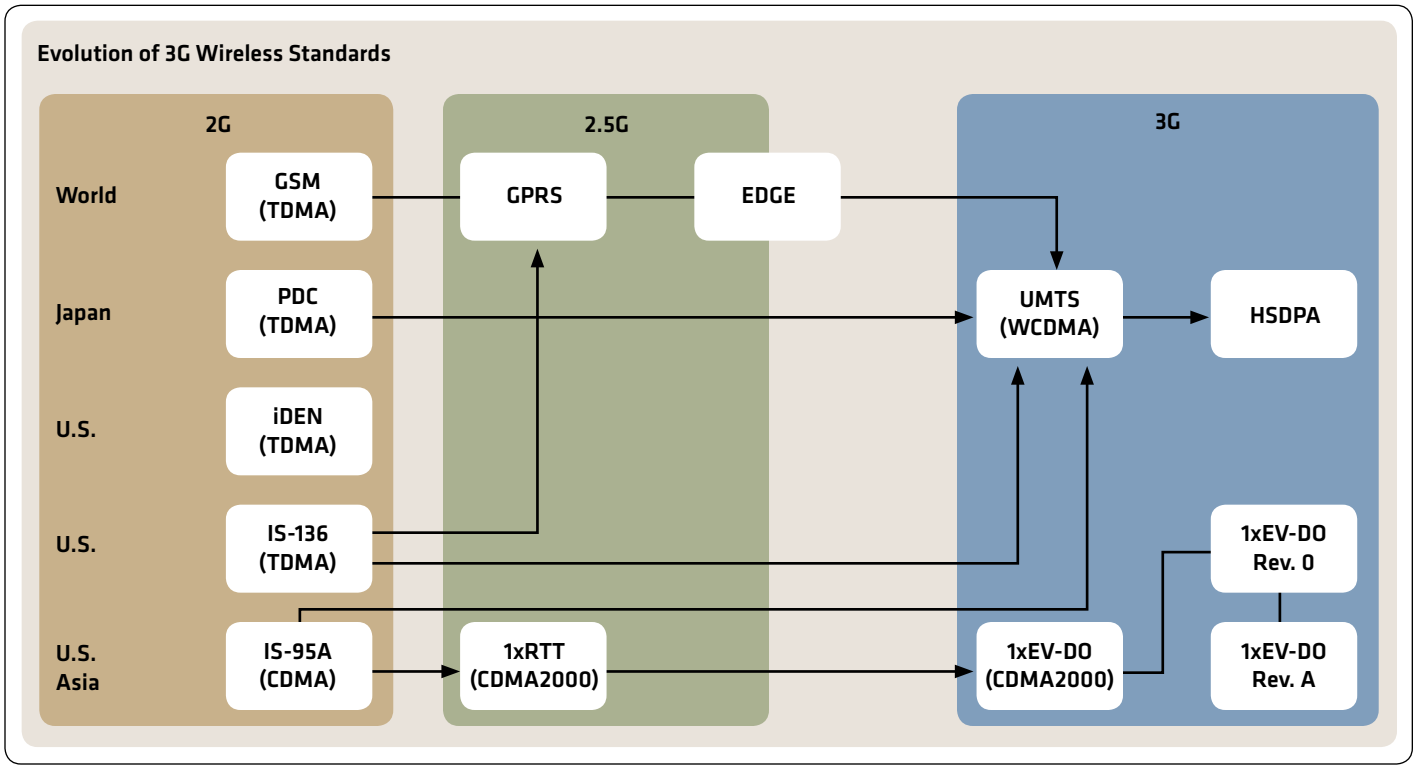
3G WWAN Defined – Understanding the Key Details
Cellular WWAN or wireless wide area technology infrastructure and device technologies have continued to evolve since the early days of analog cellular to present day 3G (see the chart below). 3G is the continuation of digital based WWAN technologies. It was designed primarily to increase data speed and to increase the subscriber capacity of towers and wireless network infrastructure. Deployment of these technologies allows the wireless carriers to provide for faster data transmission throughput and to increase access by subscribers to their network. This allows the mobile operator to more efficiently use their limited bandwidth. For customers it means more can connect to a single tower reducing busy signals.

3G Applications And Relevant Technology Tradeoffs
The economics of wireless technologies are a lot like those of the transportation world. "*The faster you want to go, the more it is going to cost you*" or "*Higher speed always has a higher price*".

Wireless has to abide by laws of physics related to the wireless signal. For example, a high-bandwidth radio signal requires more wattage output to go the same distance as a narrower spectrum signal. In mobile devices, more wattage requires more battery capacity. This usually results in larger and heavier devices.

3G cellular signals often require more bandwidth in the allocated range of cellular frequencies within the radio spectrum. Because of this, they have to be more actively load balanced than other cellular overlays like GPRS or EDGE. Load balancing is the automated, dynamic process of changing the area of signal saturation of a cellular transmission at the tower level so that a proper device to tower ratio is maintained. This is accomplished by modifying the radio signal strength at the tower so the accompanying physical area of coverage known as *saturation* can be made smaller or expanded depending on the number of subscriber devices that are active on that tower. In short, the signal changes to match the use load. We have all experienced this phenomenon in real time when a mobile phone call suddenly drops. The call or cell phone signal was supposed to roam to the nearest tower with available capacity to handle the call or data transmission. Sometimes that transfer just doesn't happen.

Because of this adaptive signal, 3G coverage changes during different times of day. In one single spot, users may take advantage of 3G benefits during one time of the day but not later in the day due to current coverage and tower bandwidth limitations governed by the inherent design of cellular infrastructure.



UMTS / HSDPA are the 3G evolutions of the GSM / GPRS based WWAN networks.
Likewise EV-DO Rev 0, and Rev A are the 3G evolutions of CDMA / 1XRTT based WWAN networks.

Again, a user might confirm that they have 3G coverage at a certain time of day in a certain locale. Due to active load balancing, there is no guarantee that they will have the same level of coverage or user experience at a later time that same day in the same spot.

3G Application Capability And Subsequent Offers
In the earlier days of wireless LAN environments, before the Wi-Fi and 802.11 standards emerged, there were inherent limitations to the use of wireless LAN based technologies and applications. The first enterprise applications that made use of wireless LAN technology were most often deployed in controlled and fixed warehouse, distribution and manufacturing environments. In these application environments, typical file size and transactional messages were small (typically only a few hundred or thousand kilobits).

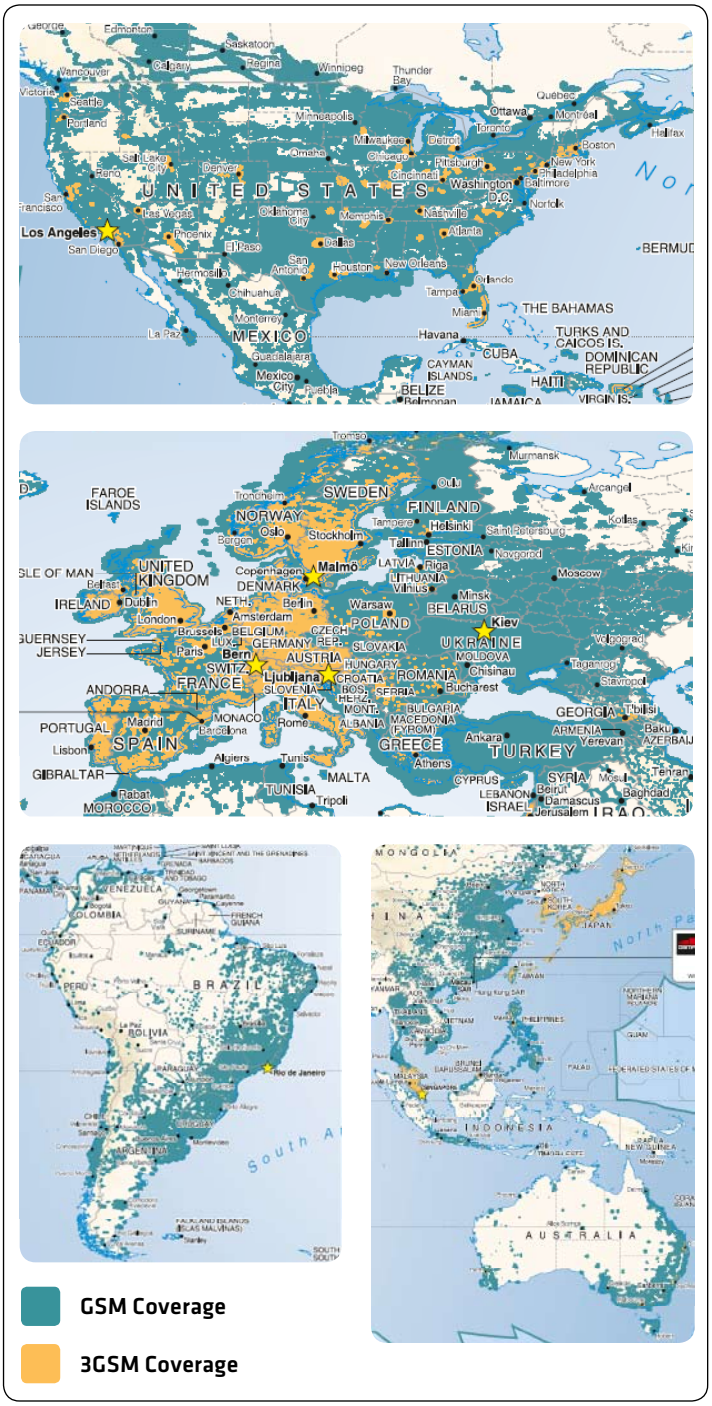
The IEEE 802.11 wireless LAN (WLAN) standard provided for the development of 2.4 GHz wireless technologies that could transmit at much faster data speeds and made use of technologies like frequency hopping that provided a good level of security for those data transactions. This evolution made it possible to move wireless LAN infrastructures to the carpeted areas and office spaces of most enterprises albeit with some limitations. At this point in WLAN evolution, wireless transmission can compete at equal data speeds in many use case scenarios with that of wired Ethernet network infrastructures.

The same is true of commercial wireless technologies, including 3G. Because 3G capability requires a large bandwidth for high throughput performance, wireless carriers have to make strategic infrastructure investments in tower locations where they have a high probability of earning a return on their investment. In other words, less densely populated areas of a country will experience saturated 3G signal capability from the cellular providers much later if ever, than urban or suburban areas. Likely, 3G infrastructure rollouts will occur in the major metropolitan areas and population centers. It is important to note that the 3G bandwidth or signal saturation in those areas must be managed for load balancing and signal saturation as the density of active subscribers continues to increase.

As a result, prospective users may want to consider new criteria of measurement for cellular WWAN infrastructures. Instead of simply judging a mobile operator on the geographical coverage that is provided by their infrastructure assets in a certain locale, potential users should also consider the percentage of time subscribers will fall back to 2.5G or 2G technology.

This percentage can be directly correlated to the level of signal saturation provided by mobile operators currently providing 3G technologies. Users in the larger the 3G coverage areas are less likely to have their coverage shrink away from their reach. The maps show there is good cellular coverage in many areas, but the level of 3G coverage overlaying those areas is in reality much smaller from a physical signal saturation standpoint.

These facts are relevant depending on the expected use case scenario of the various application offers surrounding the use of 3G. Remember, it costs money to go fast (additional cost of devices for new technology, bigger battery, possible variable coverage). You need to determine whether it will be available to you when you need it.



Conclusion

3G WWAN technology may be the appropriate choice for early adopters who right now need the higher data speeds on a limited basis. However, the user experience will be highly dependent upon the timing of WWAN infrastructure investments required to support consistent and reliable service levels. In other words, as the 3G subscriber base grows, carriers must make significant infrastructure investments to keep pace. We can also expect that technology manufacturing economies of scale will also have an impact on pricing of infrastructure components in the network and in mobile devices. Until then, some enterprise users will be able to justify the additional cost and complexity associated with being an early adopter while others will not. In order to benefit from a lower total cost of ownership, it may be better to wait for the technology to mature and the network consistency to support a much larger subscriber base.

Summary

- All 3G wireless wide area technologies have benefits and tradeoffs for use in vertical market mobile data application environments.
- Prospective users are cautioned to carefully investigate the use case scenarios that they have for 3G wireless applications and to make sure costs associated with their use have sufficient payback to warrant the cost associated with their deployment.
- Understand the technology dynamics that come into play with the use and interaction of 3G wireless wide area infrastructures. These include the potential for infrastructure and cellular signal load balancing, physical size and weight of devices, and the adequate power requirements needed for mobile device architectures that employ 3G radio modules.
- Be prepared to only pay for what you have the ability to use. Why pay a premium for a device or associated WWAN infrastructure if your application does not require the benefits it might provide?
- As the 3G technology matures, infrastructure support for an increasing level of subscribers should expand, thus making the investment worth while.

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