

Cellular Internet of Things Connectivity

There has been a flurry of activities related to wide-area Internet of Things (IoT) connectivity. The market recognizes that existing technologies, and more importantly business models and cost structures do not scale to meet IoT application requirements. A number of competing solutions have emerged and are today vying for commercial validation which scales through standardization. Hence, there is a strong push in standard organizations such as 3GPP and GERAN to develop and adopt IoT connectivity techniques. Additionally, investors who recognize the opportunity created by potentially disruptive models and the need to hedge existing investments have embarked on making [strategic investments](#). It is against this background that we provide this brief with a summary of related opinions we developed based on multiple engagements in this space.

- The IoT connectivity market remains fragmented and will continue to be for the next few years while attempts at driving interoperability are accelerating through the establishment of new alliances and forums (e.g. LoRa Alliance, Wireless IoT Forum, and prior to that the Open Internet Consortium and AllSeen Alliance). This is characteristic of underlying applications that have different requirements.
- There are two main tracks to wide-area public-network connectivity. The first is the evolution of LTE to support IoT applications: longer battery life, longer range, lower cost in

exchange for lower throughput. The second track includes narrow-band (NB) technologies promoted as a clean slate solution for IoT connectivity. Mesh technologies (typically based on Zigbee) and Wi-Fi extensions (e.g. 802.11ah) have typically been used in private networks and have a separate evolution path that we are not addressing in this brief.

- Narrow-band technologies today operate primarily in unlicensed spectrum. There is a strong effort to standardize these technologies under GERAN for licensed spectrum operation (typically 850 and 900 MHz). The competing NB candidates at GERAN include Semtech (LoRa, spread spectrum), SigFox (ultra narrow-band - CNB), Qualcomm (narrow-band OFDMA), and Huawei/Neul (FDMA).
- LTE is in process of defining a sub-Cat0 device (3GPP Release 13) following the release of Cat0 specifications (3GPP Release 12). Cat0 devices cannot compete with NB technologies on battery life and range. This can change with sub-Cat0 device which we don't expect on the market before mid-2017 (today Cat1 devices are available commercially).
- There is a minimum 2-year period that is open for narrow-band technologies to make an impact. However, we believe spectrum availability will slow-down large scale deployments of narrow-band technologies, especially where reliability is a key requirement.

- There is a need for IoT specific spectrum. However, there has not been to date any movement in this direction for several reasons (it would take over 5 years to achieve such outcome). Sub 1 GHz spectrum is very expensive and favored for personal mobile applications. TV Whitespaces is only regulated in 4 countries (US, UK, Canada, and Singapore). Dynamic spectrum access regulations will soon be released by the FCC but it applies to 3.5 GHz which is not favorable for wide-area IoT connectivity.
- The spectrum situation strengthens the hand of mobile network operators (MNOs), but MNOs have been lagging in innovative IoT applications for several reasons including high cost structure and incompatibility between their service offering and many emerging IoT applications.
- MNOs recognize these shortcomings and some have embraced NB technologies as a path for competitive advantage (KPN, Bouygues), while others see standardized NB technologies

in licensed spectrum as the path to follow (e.g. Vodafone).

- Our survey of MNO IoT applications shows that MNOs remain focused on traditional applications such as fleet management, asset tracking and specific applications in the utilities sector propelled by their ability to provide global coverage which is a key advantage.
- The challenge for MNOs will be in developing new applications with scalable deployments and revenues. These new applications lie beyond the low-hanging fruit already exploited with GPRS technology that account for the majority of cellular IoT connectivity (77%).
- To meet the challenge, MNOs will need to streamline IoT connectivity where integration can be burdensome and complex. This is coupled with a high cost structure that needs to be addressed to improve the competitive positioning.

Wide-area IoT connectivity is a field rich with technology innovations, but has struggled to date in meeting the business case, operational and/or technology requirements for several major applications. New technologies and business models are emerging which is creating new opportunities for challengers and mobile network operators alike. Who will win is not a foregone conclusion with opportunities to all elements of the ecosystem.

Xona Partners (Xona) is a boutique advisory services firm specialized in technology, media and telecommunications. Xona was founded in 2012 by a team of seasoned technologists and startup founders, managing directors in global ventures, and investment advisors. Drawing on its founders' cross functional expertise, Xona offers a unique multi-disciplinary integrative technology and investment advisory service to private equity and venture funds, technology corporations, as well as regulators and public sector organizations. We help our clients in pre-investment due diligence, post investment life-cycle management, and strategic technology management to develop new sources of revenue. The firm operates out of four regional hubs which include San Francisco, Paris, Dubai, and Singapore.