PTT Over Cellular and its Impact on LMR

Augmentation or Displacement?

ideas & insights

September 2019 - Track 5, Topic 2

By David Krebs, Executive Vice President

WHAT QUESTIONS ARE ADDRESSED?

- What is the installed base and shipments of digital land mobile radios in the US?
- What is the installed base and shipments of PoC-enabled solutions/devices in the US?
- What is the current market share of carrier organizations offering PoC solutions?
- What are some pockets of opportunity outside of the US when it comes to PoC solutions?
- What are the current gaps, limitations, and outlook around FirstNet and the standardization of MCPTT?
- What are the primary factors and benefits driving organizations to augment their existing LMR systems with PoC solutions?
- What are the primary differences when comparing carrier-integrated and OTT PTT solutions?
- What is the outlook for PoC solutions when it comes to both commercial and public safety sectors?
- What is the TCO comparison vs PoC solutions and traditional LMR systems/solutions?
- What are some of the key solution requirements/investment drivers for organizations evaluating and implementing PoC solutions?
- Who are the key vendors operating in PoC space when it comes to carrier organizations, LMR manufacturers, OTT PTT solution providers, as well as device manufacturers?

KEY FINDINGS

- VDC estimates that in 2018 the installed base of PTT users in the US was 13 million, and is expected to reach 20 million by 2023 at a CAGR of 8.5%.
- In 2018 approximately 52% of the installed base of PTT devices was in the commercial market, while the remaining 48% was in the public safety, security and defense sector.
- The installed base of PoC devices in the US in 2018 was 3.95 million units and is expected to reach 7.47 million by 2023. Total spend on PoC solutions is expected to grow from $2.6 billion in 2018 to $3.83 billion by 2023 for a CAGR of 8.0%.
- AT&T and Verizon hold a combined 75% market share when it comes to carrier-integrated PoC solutions being offered in the US.
- Some of the key advantages of leveraging a carrier-integrated PoC solution include end-to-end performance optimization and reliability, fast call-setup time, and low latency. The one distinct disadvantage that is still present in the market today with carrier-integrated solutions is cross-carrier support.
- OTT PTT solutions can be used on a variety of wireless networks, and can have integrated capabilities like data sharing, photos, messaging, and video since they don't have to abide by the standards & restrictions of the network. On the flip side, while an OTT PTT solution has the benefit of being carrier-agnostic the majority of them aren't 100% fully optimized to each carrier's network, meaning they aren't designed with Quality of Service (QoS) in mind.
- Some of the primary factors driving organizations to augment their existing LMR solutions with PoC solutions include the high costs of maintain LMR systems, access to mobile broadband data applications, and extending coverage of an LMR network beyond its traditional reach.
- The transition to widespread use of LTE-based MCPTT is expected to be a long, slow one, with land mobile radio (LMR) systems continuing to be the go-to technology for public safety voice communications for the foreseeable future.

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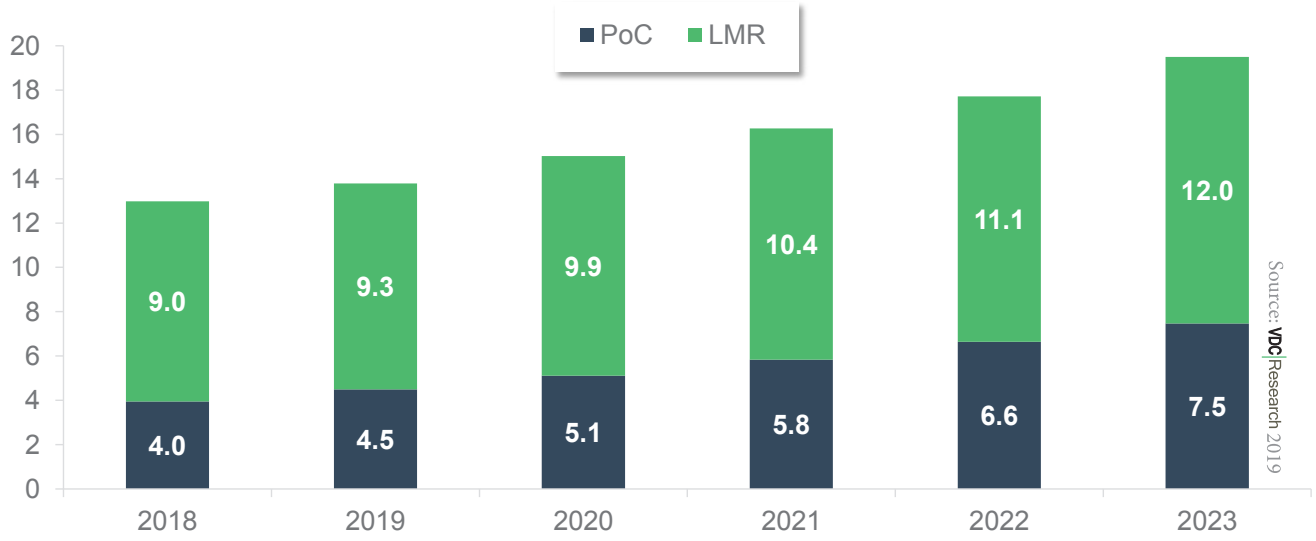
MARKET AND FORECAST OVERVIEW (2018 - 2023)

Exhibit 1: US PTT Users by Network



VDC estimates that in 2018 the installed base of PTT users in the US was 13 million, and is expected to reach almost 20 million by 2023 at a CAGR of 8.5%. In 2018 approximately 52% of the installed base of PTT devices was in the commercial market, while the remaining 48% was in the public safety, security and defense sector. Within the public safety sector, first responders only account for about 20% of the overall PTT installed base while extended primary public safety users account for around 28% of the total installed base. Despite commercial users accounting for more than half of the PTT installed base in the US, growth for legacy LMR solutions is expected to slow down in the coming years and by 2023 as PoC solutions augment and also displace commercial LMR deployments. This decrease in growth of the commercial LMR installed base can be contributed to both the decline in commercial LMR shipments as well as many of these users replacing their existing LMR systems with PoC offerings. However, the total number of LMR-based PTT users is not expected to decline in total. The total number of PTT LMR users is expected to grow from 9 million to 12 million users by 2023 for a CAGR of 5.9%. The LMR public safety market as a whole has seen strong demand driven by aging legacy systems requiring digital upgrades coupled with incremental state and local government funding which has opened up due to the stronger economy. This strong growth of land mobile radio shipments in the public safety sector will be primarily driven by large P25 system deployments by tier 2 cities as well tier 2/3 municipalities and counties. Some of the more notable deployments that occurred recently includes cities like Dallas, Memphis, and Los Angeles.

Exhibit 2: US PTT Market Revenue by Network

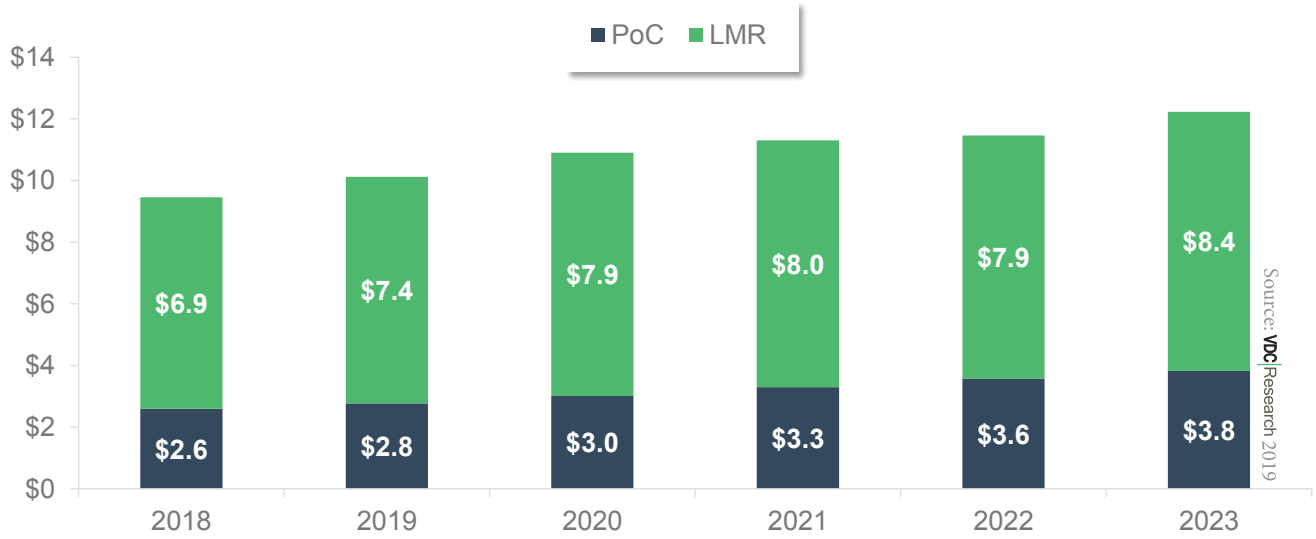


Exhibit 3: US PoC Market by Application
(Number of Users)

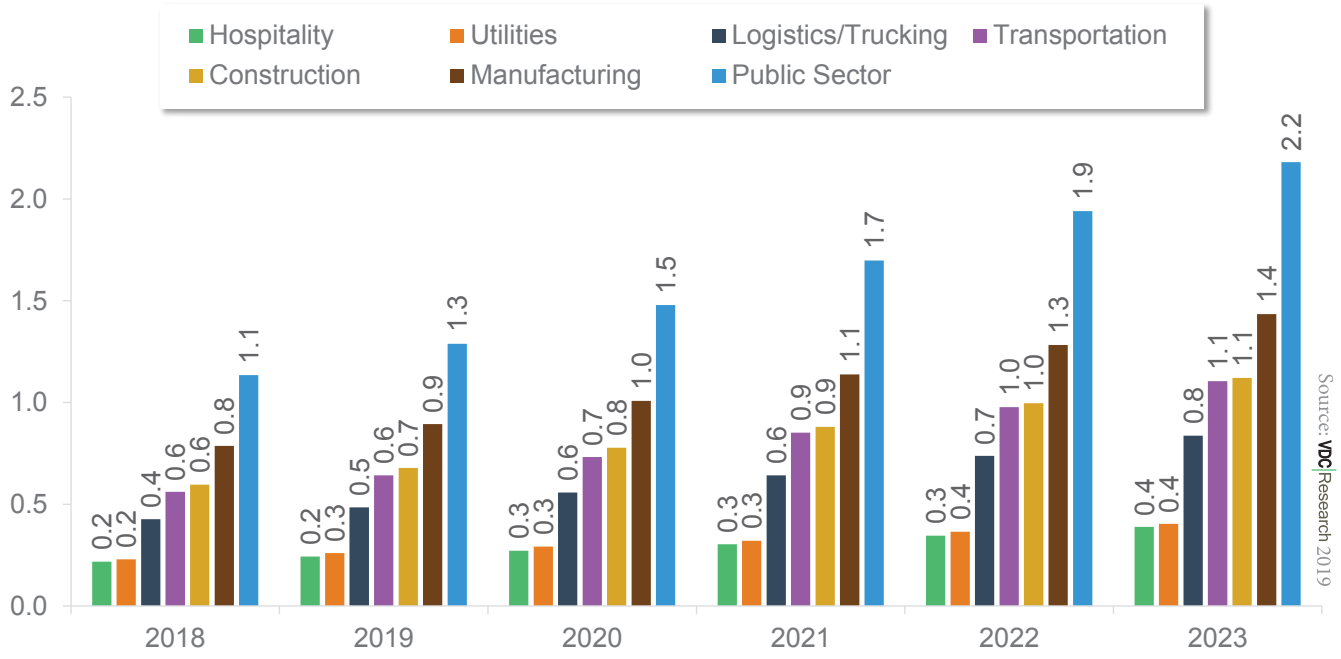
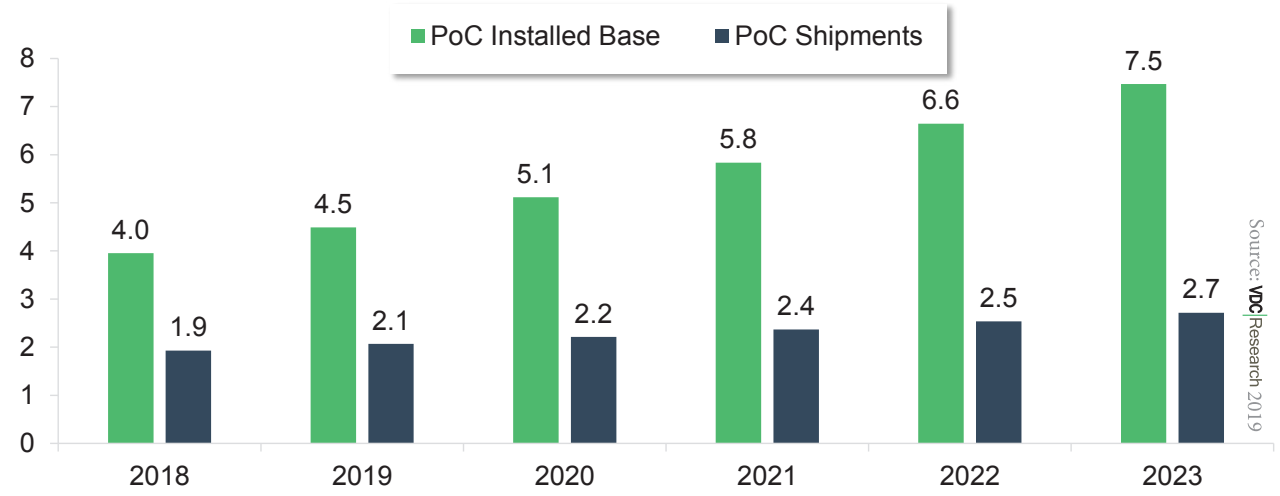
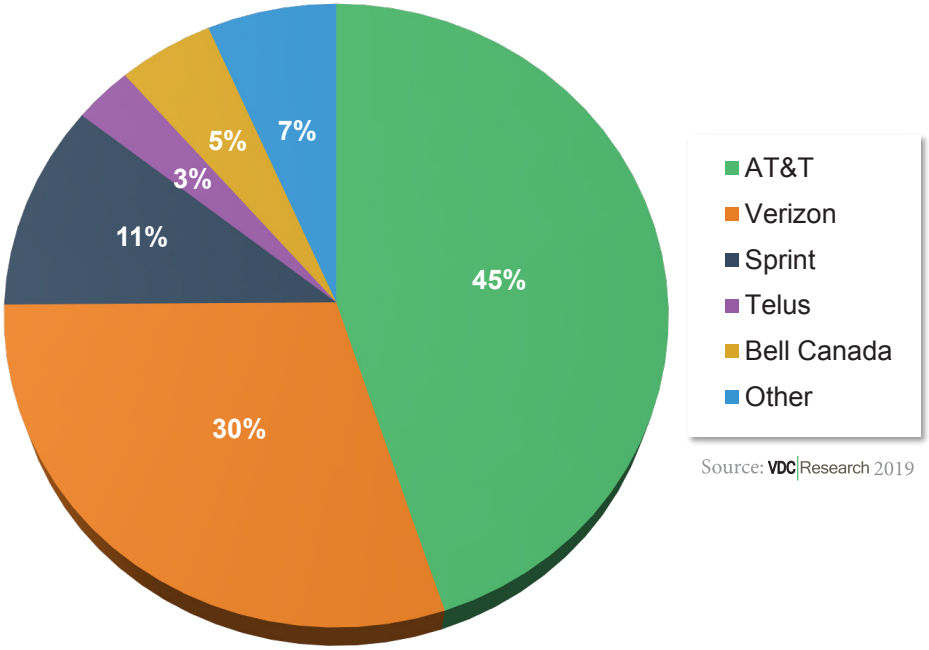


Exhibit 4: US Installed base and Shipments of PoC Enabled Solutions/Devices
(Installed base includes Carrier-Integrated PTT users, OTT PTT users, & Legacy iDEN users)



The opportunity for PoC-enabled solutions and devices in the US in 2018 was 1.9 million unit shipments and is expected to reach 2.7 million by 2023 growing at a CAGR of 7.0%. Over this forecast period, the installed base of PoC-enabled solutions and devices is expected to grow from 3.95 million users in 2018 to 7.5 million users by 2023 at a CAGR of 13.6%.

Exhibit 5: Market Share of Carrier-integrated Solution in US and Canada



Source: VDC Research 2019

Looking at exhibit 5 above, when it comes to the installed base of carrier integrated PTT solutions in the US and Canada, VDC estimated the total in 2018 to be approximately 1.8 million. Of these 1.8 million carrier integrated solutions implemented within the market today, AT&T holds an estimated share of around 45% with their Enhanced PTT solution, while Verizon holds an estimated share of around 30% with their PTT + solution. Sprint holds the #3 spot with an estimated share of around 11%, while Telus and Bell Canada hold a combined estimated share of 8%.

AT&T and Verizon are the clear market leaders when it comes to carrier integrated PTT solutions in the US, and stand to gain the most growth in the public safety sector via AT&T's FirstNet contract and the launch of Verizon's dedicated public safety LTE-core. While this growth is uncertain and very much dependent on the evolution and standardization process of MCPTT, once MCPTT standards are finalized expect carrier integrated PTT offerings from both Verizon and AT&T to grow at a significantly fast rate. One key use case of AT&T's Enhanced PTT solution being used in the government space was in Fairfax County, VA, where they replaced their aging analog LMR system in their public service division with AT&T's EPTT solution, resulting in the county saving more than $16 million in upfront costs and more than $2 million annually. Both AT&T and Verizon are rolling out MCPTT capabilities through 2019. Both are clear in their public positioning that these solutions are targeting non-mission critical voice today as a complement to existing LMR solutions. However, they are also suggesting that - once fully implemented - the solutions could "prove to be transformative to public safety".

In the commercial market the opportunity for PoC solutions also has a strong outlook. Both PoC offerings from vendors like Verizon and AT&T have made their way into industries that include hospitality, transportation/logistics, field service, utilities, as well as construction. VDC estimates the total mobile worker population in target PoC markets at over 60 million. Verizon with their PTT+ solution has seen particular success in sectors like utilities and construction where LMR as a primary means of communication has been decreasing and users want more access to capabilities like messaging, videos, alerts, etc. AT&T with their Enhanced PTT solution has specifically seen a lot of growth opportunity with smaller businesses in the industries mentioned above where many of them have less than 10 radios in place and want to replace these with more cost effective PoC solutions. The opportunity to roll out broadband data applications to support greater productivity and collaboration among target mobile workers is especially compelling for many organizations investing in PoC solutions.

Exhibit 6: What Are the Leading Factors Driving Investments in Broadband Mobile Applications?

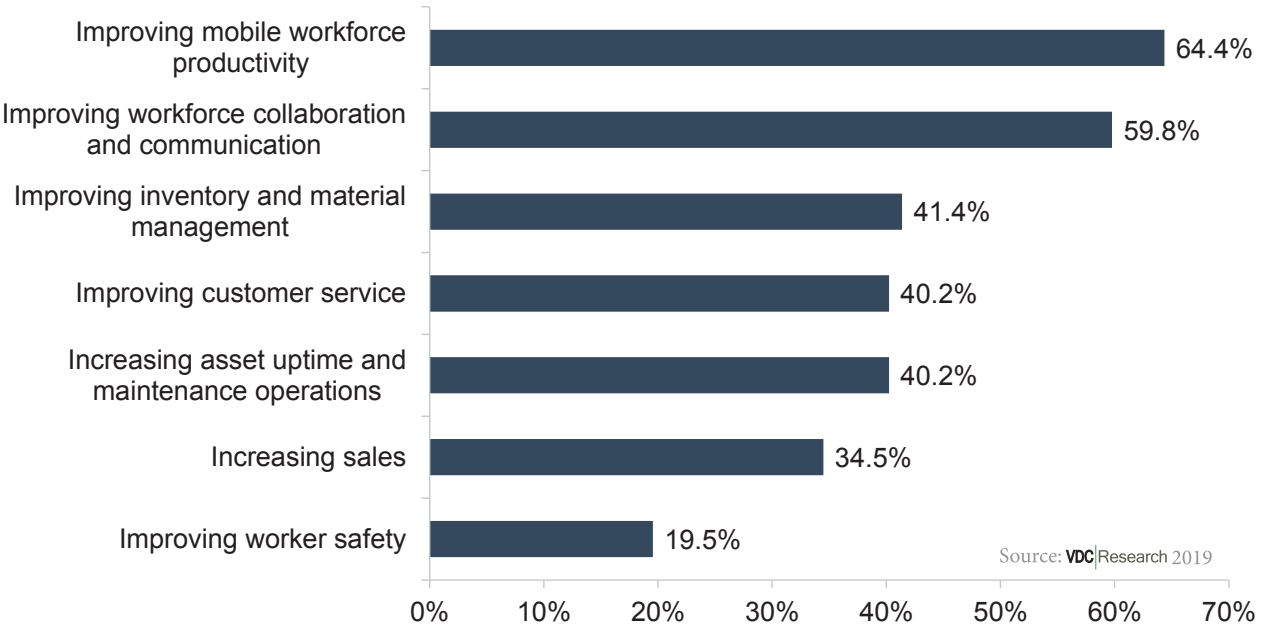
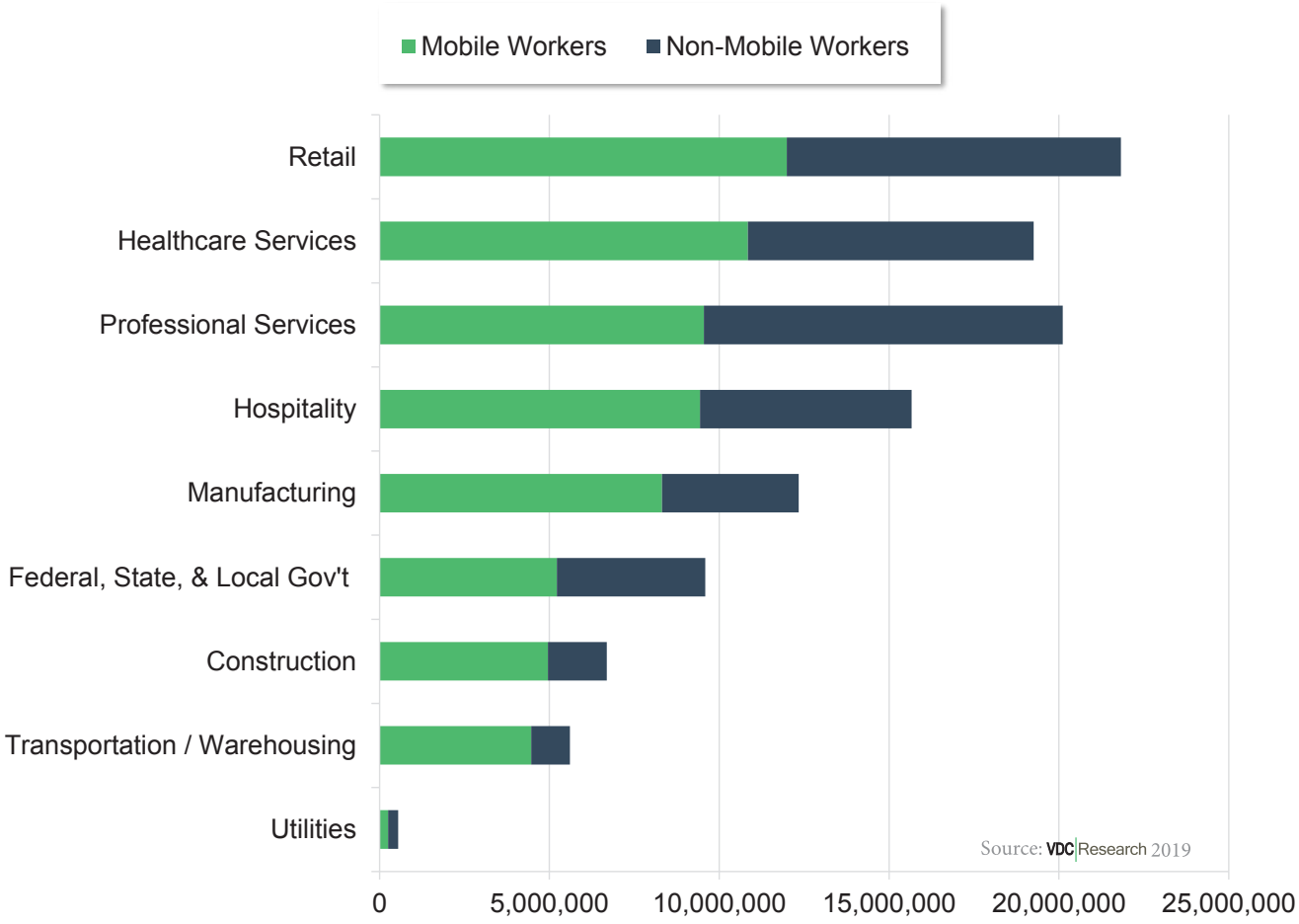


Exhibit 7: Mobile Worker Analysis and Breakdown for Target PoC sectors



POCKETS OF OPPORTUNITY OUTSIDE NORTH AMERICA

EMEA Region

In the EMEA region, when it comes to broadband PTT technology the market is far less mature than in North America. The market is very different from North America in the sense that there is a significantly lower base of legacy LMR PTT users, most countries are running on the TETRA standard, and much of the interest for broadband technology is being generated through Greenfield opportunities. As of recently many European organizations (especially public safety) have been making big investments to upgrade their existing TETRA systems, which will stall the evolution/growth of broadband PTT technology. Given these investments it will be quite some time until broadband PTT technology is fully adopted into the European market, but once these new licenses do run out VDC expects the market to make a full transition to broadband technology as the 3GPP standards will most likely be finalized. Although adoption of broadband PTT technology will be slow to evolve, there are currently carrier organizations in Europe evaluating and even implementing broadband PTT technology. Organizations like Kodiak are taking a safe approach to the market with European carriers, and are partnering with companies like Ericsson in order to bring their solutions to the market. Kodiak has worked with Ericsson on a number of different carriers, and Ericsson acts as the delivery partner on the surface while Kodiak is the one who physically implements the technology. Some example of carriers currently leveraging the Kodiak platform include KPN, Vodafone, Simyo, and Proximus.

In Africa specifically, many organizations have started to implement PoC solutions into their operations due to their cost effectiveness compared to LMR equipment/infrastructure. Countries like South Africa and Kenya in particular have seen an increase in the amount of people leveraging a PoC solution primarily behind cost and the ability for the solution to have a better coverage edge than LMR when users go outside of populated areas. South Africa by far has been the biggest proponent of PoC solutions in terms of adoption, and many hospitals/ambulances have implemented PoC solutions into their operations and are broadly used across the country. The two major carrier organizations in South Africa (MTN and Vodacom) have been working with vendors around implementation of PoC, and with both combining for a total wireless subscriber base of around 71 million there is a lot of opportunity for the total PoC user base in South Africa to increase over the next few years.

Another country in the EMEA region that is well ahead of others in terms of PoC adoption is Israel. Two of the larger mobile network operators, Hot Mobile and Partner Group (formerly known as Orange), have partnered with PoC vendors and device manufacturers over the last 2 years to start offering their existing customer base these types of solutions. Partner Group has teamed up with Mobile Tornado to offer their service via their Partner PTT application on a wide range of rugged devices with dedicated PTT functionalities, while Hot Mobile has been migrating customers from its iDEN network to PoC on their 4G LTE network with the help of Kodiak as their PoC software provider.

APAC Region

There remains opportunity for PoC solutions to make an impact in places like Australia, Western Asia, and Southeast Asia as well. China in particular has been a big focus market for these types of solutions and many Chinese organizations have been asking for PoC solutions to be delivered through SDKs/APIs so resellers/distributors can resell the PTT functionalities rather than the whole solution. Vendors offering PoC solutions certainly see a lot of opportunity in this region, and the biggest challenge for them in this area with their SDKs is around language translation tools, user experience, and documentation.

LATAM Region

The opportunity for growth in Latin American countries will be quite strong moving forward in the next few years. Carrier organizations like America Movil and Claro (part of America Movil) who operate in countries like Mexico, Brazil, Ecuador, Argentina, as well as Colombia have begun to evaluate offering and implementing PoC solutions for their existing customer base. The iDEN platform which has been widely used in the last decade in South America has finally reached its end of life, and it is anticipated that many of these customers will be looking to switch their voice communications requirements over to PoC. Two organizations that have started to make progress in Latin America with their PoC offerings include Mobile Tornado and Azetti Networks. Both of these organizations are working with tier 1 mobile network operators in the region to assist and ensure that customers transitioning of the iDEN network are provided with a highly quality and robust solution that still meets their voice communication requirements.

LARGE SCALE NATIONWIDE PUBLIC SAFETY LTE ROLLOUTS OUTSIDE OF US

United Kingdom

In the UK the Home Office is currently in the process of rolling out the Emergency Services Network (ESN), which will be the new communication system used by the 3 emergency services and other public safety users in the UK. The network is intended to reach about 97% coverage of the UK and there is a number of different private organizations playing a role in this public safety network rollout, which include the likes of Motorola, Samsung, as well as the mobile network operator EE. EE will be tasked with building out the new infrastructure, Motorola will provide the user services, while Samsung has signed a contract to deliver specific geared towards the ESN. One of these is an unnamed device that is based off the smartphone S platform and has additional hardware features like a dedicated PTT button, an officer-down button, LED indicators, and water/dust/drop resistant capabilities. While the ESN was originally projected to be deployed by the end of 2019 at the same time Airwave (existing public safety communications network) was expected to be shutdown, there has been a number of delays in the ESN resulting in a lot of controversy and concern around the deployment. The £1.2 billion project originally designed to result in significant cost savings for the UK has been delayed by 9 months already, and any further delays could not only pose a serious threat to these cost saving but more importantly the communications system used by public safety agencies across the UK. The UK Home Office originally stated that the Airwave contract would be extended on a month to month basis to accommodate for these delays, but as of 2018 Motorola announced that they believe given their talks with the Home Office that the contract will be extended by at least 5 more years. This extension signals even further delays in the ESN resulting in lost cost savings, and even if the Home Office was able to negotiate more favorable terms with Motorola around Airwave (say a 50% reduction in payments) this would result in the UK government spending more than £1 billion for TETRA services over the next five years that were originally supposed to end by 2019.

South Korea

Back in 2014 the South Korean government adopted plans to build out a dedicated public safety broadband network referred to as SafeNet, in 3 different phases. The network was originally designed after the Sewol ferry disaster which resulted in hundreds of deaths and serious issues around responding agencies having a lack of interoperability communications. The full deployment of the network began in October of 2017 and was just finalized towards the end of 2017. The network is being operated by the two largest carriers in South Korea, KT and SK Telecom. By the end of the final deployment which took place in 2017, there are more than 200,000 users across more than 300 agencies leveraging the network for critical voice communications.

PTToC OVERVIEW, TRENDS, & DEVELOPMENTS

Introduction and Evolution of PTT (From LMR to IDEN to Broadband PTT)

While PTT technologies have seen a number of different changes over the past 10 years and have evolved to incorporate more capabilities, the core benefits of leveraging PTT technologies have primarily stayed the same. The key/core benefits that have remained with PTT include instantaneous communication/voice delivery, group call capabilities, hands-free receipt of barge calls, and no dialing/ringing necessary. While these PTT core benefits have stayed the same, the method in which PTT has been delivered has evolved significantly through technologies that include Land Mobile Radio, Integrated Digital Enhanced Networks (iDEN), and now the emerging broadband PTT.

LMR - LMR was the first technology developed for PTT communications, and is still widely used today in both commercial and public safety settings. LMR is typically deployed over a private network, has high reliability/durability, direct mode (talk-around) capabilities, and is leveraged/relied on by public safety agencies for their mission-critical voice communications.

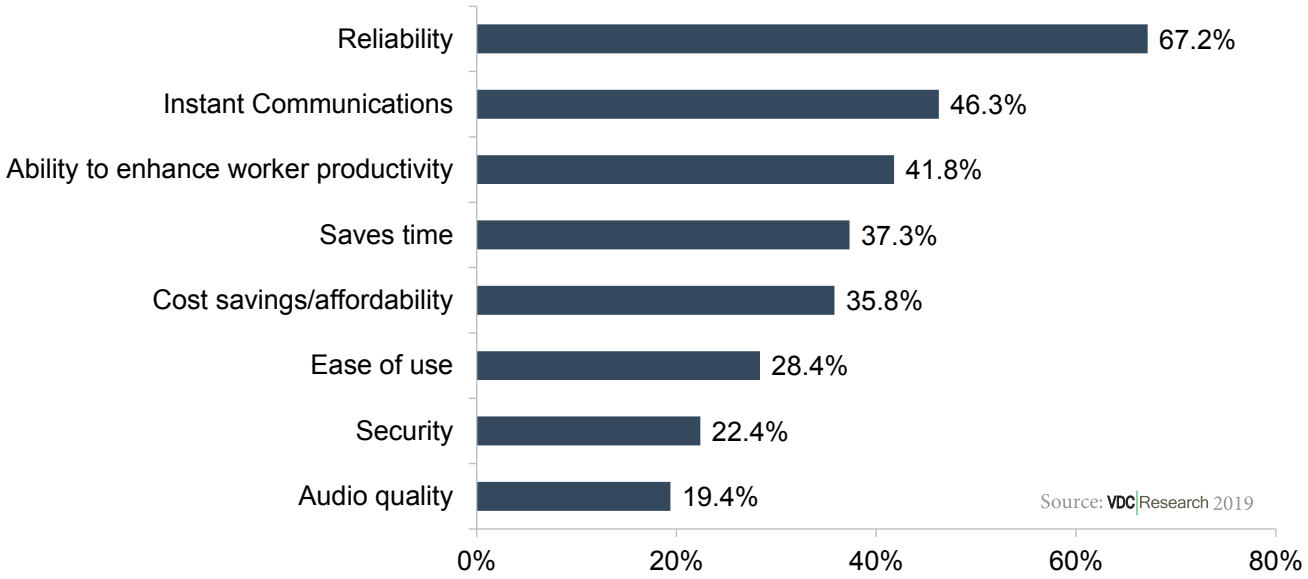
iDEN – iDEN was first launched as a commercial network by Nextel in 1996 in the US. It is still used in a few markets primarily in Latin America and is a narrowband 2G technology that enables PTT communications. At the peak of Nextel's iDEN network there was an estimated 15-20 million subscribers, and when this was decommissioned in 2013 a variety of carrier organizations and OTT PTT solution providers entered the market attempting to capture these legacy subscribers. Ultimately many of the offerings that carriers initially rolled out missed the mark in terms of functionality and performance, but this has changed as of recently as broadband PTT has started to become more viable option for these legacy users.

Broadband PTT – Initial PoC systems were introduced to the market in the early 2000's, but ultimately many of these offerings that carriers rolled out missed the mark in terms of functionality and performance, but this has changed as of recently as broadband PTT has started to become more viable option. With the rapid pace of development of wireless networks and the massive proliferation of smart mobile devices, opportunities for PoC solutions are emerging in business-critical and operations-critical use cases. While PoC solutions are currently being evaluated and implemented in the commercial market, they are still a long ways away from being a true mission-critical solution. The commercial and public safety market have very different requirements for PTT, and first responders need to be able to leverage a mission-critical PTT solution that has direct mode and multicast capabilities, as well as QoS (Quality of Service). One of biggest drivers we have seen behind this PoC resurgence is LTE and the fact that networks can handle the throughput while providing a good suite of features/high quality voice. This has resulted in carrier organization's getting more serious about targeting PoC solutions to the commercial market.

Classifications of PTT Services

Push to talk (PTT) communications solutions have been ubiquitous among mission and business critical mobile frontline workers with the technology first introduced in the 1930s. From police officers to construction workers and from customer service agents to hospitality coordinators, the benefits provided by instant one-to-one and one-to-many communications represent a vital and irreplaceable mode of communication. Today, PTT communication is primarily supported over private LMR (Land Mobile Radio) networks. Although PTT solutions over public commercial cellular networks have been available since 1996, thanks to the robustness, reliability, and reach of LMR solutions, these continue to represent the primary network for mission critical communications, in particular among first responders. However, with the rapid pace of development of wireless networks and the massive proliferation of smart mobile devices, broader opportunities for PTT over cellular (PoC) solutions are emerging. Today this opportunity is manifesting itself primarily as an augmentation to existing LMR-based PTT solutions. PTT services can be broken down into 3 different customer segments – business critical, operations/process critical, and mission critical. Business critical PTT refers to customers typically found in business/enterprise communities.

Exhibit 8: Leading Considerations When Selecting a Communication Tools for Workers

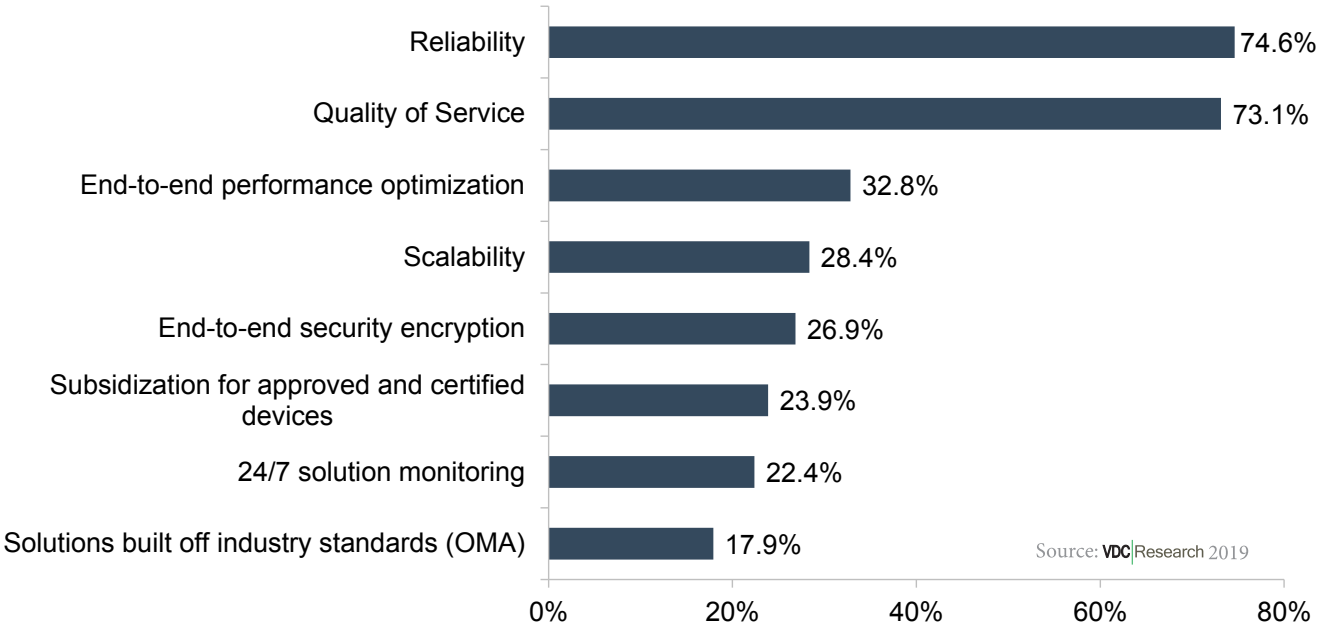


This could be anyone in an administrative/management type role that has access to a smart device/OTT PTT application, and needs to be able to communicate with mobile/field workers on LMR channels. Operations/process-critical refers to users of PTT in environments like transportation/logistics, utilities, construction, hospitality, facilities management, etc. These users typically leverage PTT as a means of to organize workflows/processes for employees as well as ensure worker safety. Lastly, mission-critical PTT is typically used in public safety sectors with first responders being the primary user. The primary form of workforce communication in a mission-critical environment remains LMR systems, and this will continue to be the case until the 3GPP standards around MCPTT are finalized and public safety users become comfortable/trust using this type of solution.

Carrier-integrated PoC Solutions vs. OTT PTT Solutions

In the PoC space, solutions are broken down into carrier-based PTT and OTT PTT. Carrier-integrated PTT solutions typically are designed with Quality of Service (QoS) and to create the most efficient experience for users on that specific network. OTT PTT solutions typically support more features, have more flexibility, and are carrier-agnostic meaning that they designed to support a variety of end users rather than end users on a specific wireless network. While the majority of OTT PTT solutions in the market today aren't designed with QoS in mind, there are a select amount of advanced applications, like ESChat, that have this capability. The sections below go into more detail around both carrier-integrated and OTT PTT solutions.

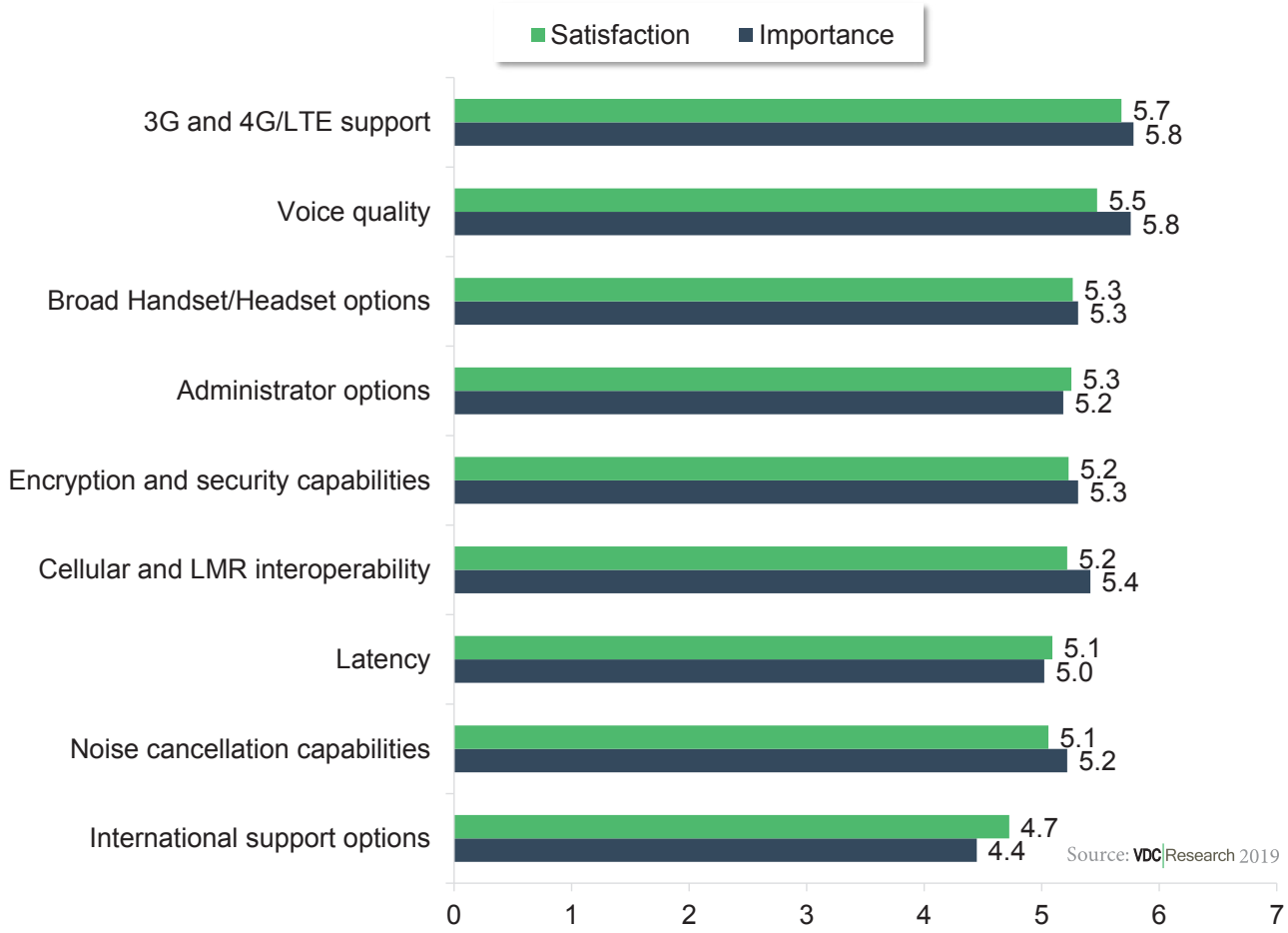
Exhibit 9: When Looking at Carrier-Integrated PTT Solutions, What Do You Perceive as Some of the Major Benefits?



Growth of OTT PTT Applications

OTT (Over the top) PTT refers to an architecture where the PTT application/system is independent of a carrier's wireless network, and essentially is agnostic. The OTT PTT landscape is currently made up of a wide array of carrier-agnostic applications that work across different networks. These apps have seen success primarily in the commercial space where they have experienced decent growth over the past 2 years. Given that this a market that is still in the early stages of development, it is surprising to see the amount of OTT app suppliers who have entered this market. About 5 years ago there was only a select amount of vendors in the market who were offering OTT PTT applications, but as more organizations have started to evaluate/implement PoC solutions we have seen more vendors aggressively targeting these customers with their solutions.

Exhibit 10: Level of Importance/Satisfaction of the Following PoC Communication Criteria on a Seven Point Scale



To put this into perspective, applications from Google Play offering PTT functionality have grown from 16 to over 150 in the last few years. There is a number of advantages/characteristics for organizations who are thinking of or already have implemented an OTT PTT application into their operations.

- Most OTT PTT solutions can be used on multiple broadband technologies (Wi-Fi, LTE, 3G, 4G)
  OTT PTT solutions are carrier independent, and can be used on a variety of wireless networks where the carrier simply acts as the data provider.
- While cross network communication currently isn't feasible with a carrier-integrated solution, OTT PTT solutions aren't subject to restrictions and can be used on many networks.
- With OTT PTT, customers have the ability to host the PTT servers in their own facility or can use a 3rd party like Amazon Web Services.
- The majority of applications in the market today can integrate with existing LMR/DMR/P25 systems
  OTT PTT applications can be used on different device form factors and carrier networks since they have application-layered systems
- OTT PTT apps can integrate capabilities like data sharing, photos, messaging, and video since they don't have to abide by the standards & restrictions of the network.

While OTT PTT is growing in popularity, there is still a number of disadvantages that currently exists with these applications today. One is that most vendor's OTT PTT solutions can only communicate with the vendors existing LMR system. So in other words, a user leveraging the Harris BeOn application can only communicate with Harris LMR users, and can't communicate with a MOTOTRBO radio user. Another big barrier is while an OTT solution has the benefit of being carrier-agnostic the majority of them aren't 100% fully optimized to each carrier's network, meaning they aren't designed with QoS in mind. In many public safety environments enhanced QoS is required and becomes a key issue when there is poor network coverage or saturated networks. In these scenarios, public safety users can't rely on basic OTT PTT solutions, and need to be able to leverage a more effective solution. Currently, the only OTT PTT solution that incorporates QoS options from carrier organizations and can be leveraged by users who need priority on an LTE network is ESChat. In addition to these disadvantages, OTT PTT users may be required to make multiple touch-screen actions on a smartphone to initiate a PTT conversation, and this can be a big disadvantage depending on the environment they are operating in.

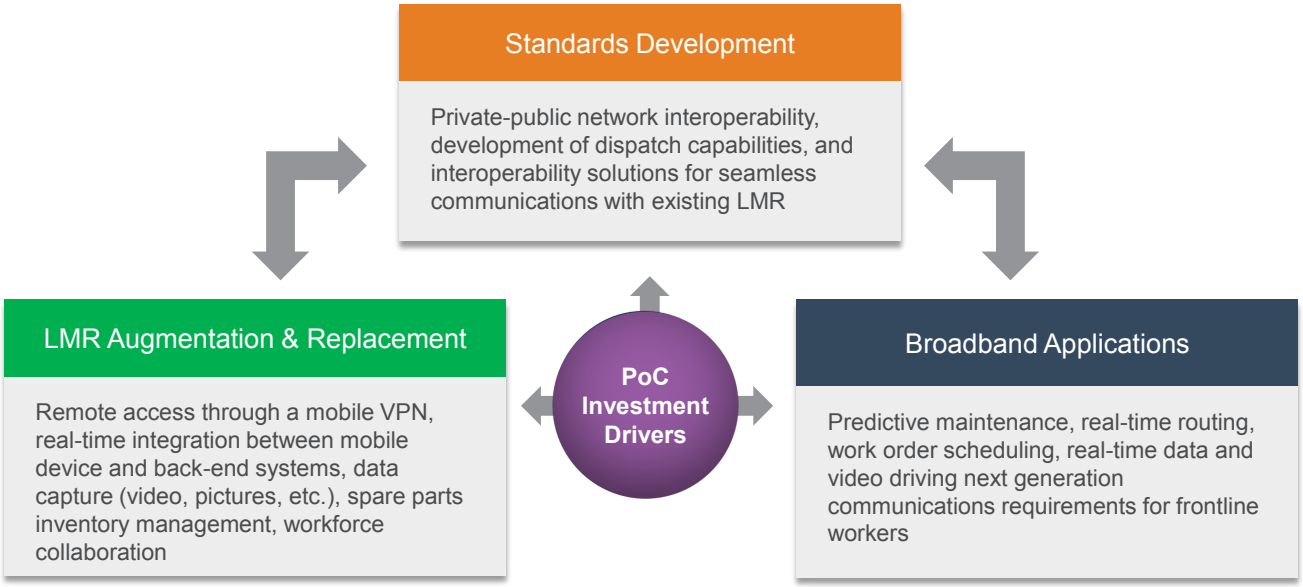
Carrier-integrated PTT Solutions

In carrier-integrated broadband PTT, the current market leader is Kodiak Networks (acquired by Motorola Solutions in 2017) whose platform is currently being used by leading carriers in North America like AT&T, Verizon, Sprint, and Bell Canada. Bell Canada was actually the first carrier to commercially deploy Kodiak's broadband PTT platform in 2012. Despite carrier integrated PTT growing over the last few years, the one disadvantage that is still present in the market today is cross-carrier support. While the assumption is that carrier-integrated PTT can't be cross-carrier, this is actually false and since leading carriers in North America like AT&T and Verizon are partnered with Kodiak there is no reason why the Kodiak platform can't support cross-carrier PTT. This interoperability restriction is purely a business decision rather than a technical limitation/hurdle, and AT&T doesn't want their PTT users talking to Verizon users because this translates to less business for them. Seamless interoperability between carriers like AT&T and Verizon currently isn't possible, but in 2016 both carriers collaborated so that Enhanced PTT users on an AT&T network could communicate with Verizon PTT+ users via a downloadable Verizon PTT client. This method was not very successful, and eventually the offering was removed. The major downsides to this alternative method was that it was limited to a single model of a Verizon phone and QoS couldn't be offered on the Verizon network. Some other headwinds associated with carrier-integrated PTT solutions are that they only work on a limited amount of compatible devices, and when used over Wi-Fi networks (very rare) they lose their QoS capabilities. Despite these limitations around carrier-integrated broadband PTT, there is still many advantages for carrier-integrated PTT solutions as well.

- Carrier-integrated PTT was built on industry standards developed by the OMA (Open Mobile Alliance). These same standards then became a key foundation of the 3GPP MCPTT standard.
- Carrier-integrated PTT delivers end-to-end performance optimization and reliability.
- Supported devices for carrier-integrated PTT are thoroughly tested and certified before they can used by end users.
- 24/7 live solution monitoring and support from carriers, the downside to this is many carrier organization's don't always archive PTT conversations/messages.
- Carrier-integrated PTT solutions are designed with QoS (Quality of Service) in mind which is ideal for users that need priority for LTE when there is poor network coverage/saturated networks.
- Carrier-integrated PTT solutions have fast call-setup time and low latency.

PoC SOLUTION REQUIREMENTS AND INVESTMENT DRIVERS

When it comes to PoC solutions in the market today, there is a number of different requirements and investment drivers to consider for organizations evaluating/implementing these solutions. While not every PoC solution is created equally, the baseline requirements for an efficient PoC solution include things like quality of service (QoS), speed/setup time, scalability, and low latency. These requirements are critical for any organization implementing a PoC solution within their operations today, and need to be addressed in every scenario/use case where a PoC solution can be applied.



Source: VDC Research 2019

What is MCPTT?

MCPTT refers to “mission-critical-push-to-talk”, and is a PTT product that meets the requirements of mission-critical public safety voice communication. In public safety today, P25 systems remain the go-to solution for mission-critical voice communication. While P25 systems will be the primary form of public safety voice communication in the near to mid-term, in the long term broadband PTT solutions will slowly make their way into the market and eventually become truly mission-critical. The 3GPP over the last 5 years has been updating these standards via multiple releases, but they are still quite a long way from completing all the standards work required to make broadband PTT truly mission critical. While broadband PTT solutions in the market today are complimentary to commercial LMR and can be used to augment/replace these technologies, they can’t provide 100% mission-critical capabilities yet preventing them from fully replacing mission critical LMR. There has been a number of augmentation use cases in the public safety sector when it comes to broadband PTT technology, primarily as a way for public safety users/agencies to extend coverage of an existing LMR network and add more capacity.

Current Gaps/Limitations

There is essentially 5 gaps that need to be addressed for MCPTT today: Multicast, Direct Mode, Interoperability, Quality of Service, and Vendor Adoption.

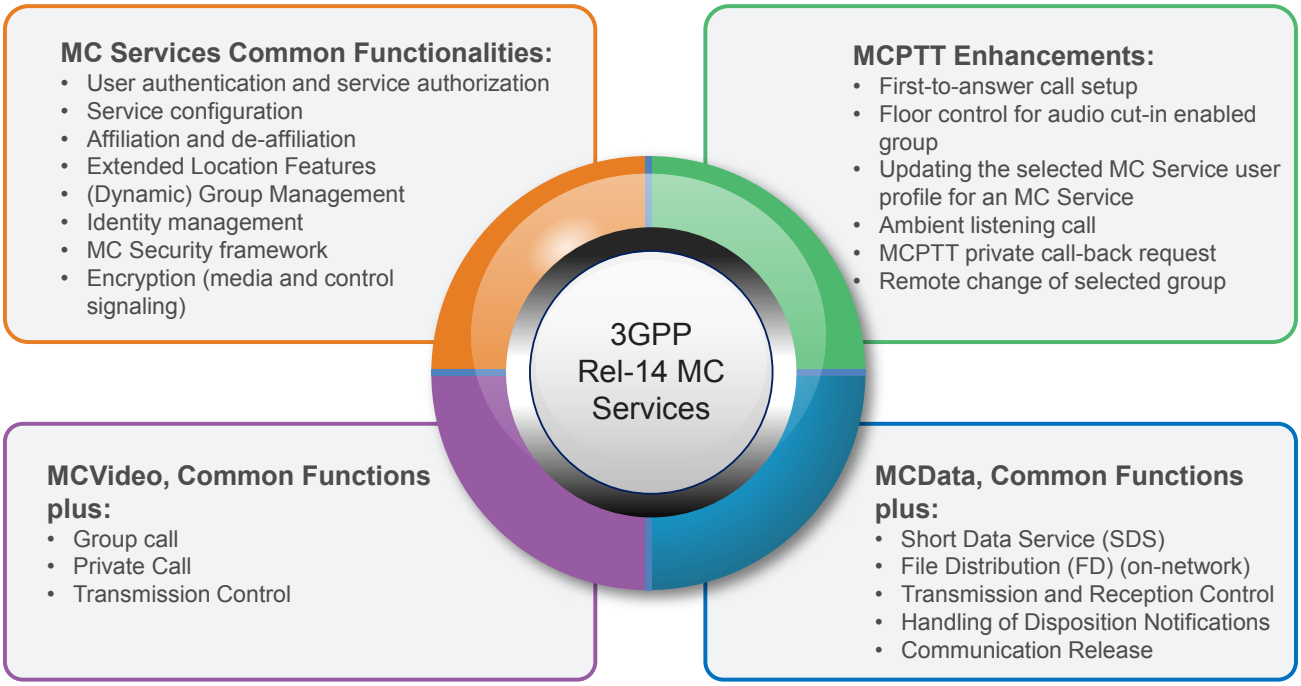
- **Direct Mode** – This is one of the most critical features of MCPTT, especially for front-line first responders. In the event of loss of LTE network connectivity, MCPTT users have to be able to communicate directly with other devices. While vendors like Sonim Technologies do have a module to enable direct mode communication, their implementation is not based on ProSe standards. Vendors have to be able to achieve the ProSe standards of the 3GPP before they can provide a true mission critical solution.
- **Multicast** – It was outlined in FirstNet that the band 14 network would be tuned for multicast, and having the ability for multiple MCPTT users to share the same LTE channel is critical because otherwise there wouldn't be enough user capacity for MCPTT. The other area that comes into play is the LTE network needing to be hardened in order to achieve parity with LMR.
- **Cross-Carrier Interoperability** – One of the most important capabilities of MCPTT is the ability to operate across different carrier networks. The current FirstNet PTT solution won't be interoperable with any users not on the AT&T network. This would make interoperability more difficult for MCPTT, especially public agencies who are on the Verizon network. From a pure coverage perspective Verizon is the clear market leader for tier 2 & 3 cities and counties in the US, and having said this, there is a lot of uncertainty among these agencies who are currently evaluating signing up for FirstNet.
- **Quality of Service (QoS)** – Making sure MCPTT users have the necessary bandwidth in order to maintain the same reliable and high quality voice communication they had with their LMR system.
- **Vendor Adoption** – Once a new standard is published by the 3GPP vendors need time to for the implementation of these new specifications, and this likely takes 1-2 years for the majority of vendors in the market today.

LMR to LTE interoperability for MCPTT Networks

Given the full transition from LMR to LTE PTT technology is expected to take many years in mission-critical environments, it's crucial that public safety organizations today have a temporary method to ensure that LMR and PoC users can interoperate/communicate with each other. The switch from LMR to LTE in the coming years won't be a smooth transition, and it's important that while this transition takes place interoperability between these 2 technologies is done right and as efficient as possible. While full adoption/replacement of LMR with PoC solution is not likely in the near/mid-term, there are a handful of public safety agencies augmenting their existing LMR systems with these solutions. The most common interface VDC sees being used in the market today for augmentation is the ISSI (Inter Sub-System Interface), which is ideal for agencies who are currently leveraging P25 systems.

Standards Evolution and Outlook

The MCPTT standard essentially began with release 12 in 2015, but significant progress was not made until release 13 where they officially standardized MCPTT. In September of 2017, Release 14 came out and included further enhancements to the MCPTT standard as well as addressed standards around mission critical video and data which can be seen in the chart below. In June 2018, Release 15 is expected to come out, which will highlight the first release of the 5G system. Release 16 is expected to be released towards the end of 2019.



Source: VDC Research 2019

As reiterated throughout the report, the MCPTT standardization efforts have been and will continue to be a journey over the next 5-10 years. There is a lot of uncertainty around MCPTT and how this will play out, leaving public safety agencies with many questions and concerns. While the standardization of MCPTT will legitimize the public safety/ first responder market and will create the basis for a dedicated public safety network, this adoption will take quite some time and will ultimately come down to public safety users becoming comfortable using this type of solution and trust that broadband PTT technology will be as reliable as LMR when it comes to workforce communication. Even if the majority of public safety agencies in the US begin to adopt MCPTT standards into their operations in the next 5-10 years, VDC expects LMR systems/solutions to always be present as public safety users trust this technology and can rely on it for communication in the event of an emergency, national crisis, and/or natural disaster.

FirstNet Outlook and Developments

FirstNet, which was established to modernize communication for public safety agencies across the US and provide them with a dedicated high speed/reliable broadband network, will legitimize the first responder market and ensure varying agencies can seamlessly interoperate with each other in the event of an emergency or national crises. The primary reason FirstNet was originally established was due to bandwidth issues, and having reliable bandwidth is a critical priority when it comes to workforce communications in the public safety sector. There has been a significant amount of developments occurring around FirstNet the past year, and this is expected to continue after some key announcements were made at IWCE in 2018. At the end of March in 2018, Firstnet announced that AT&T had delivered on their promise to launch the FirstNet LTE core. While the launch of the FirstNet network LTE core is a significant milestone for both AT&T and FirstNet, it only represents the end of the first year of a 25 year contract in which AT&T should receive payments totaling around $6.5 billion. In the first year of the contract AT&T has already exceeded FirstNet's expectations, and their partnership has more than 30,000 connections from over 350 public safety agencies running on the network. AT&T also announced that they are adding Band 14 coverage to about 1/3 of their cell sites this year, so first responders have solutions available to them that will make their jobs faster and safer as well.

There will be two classifications to determine FirstNet members. One is primary subscribers which includes agencies like law enforcement, firefighters, EMS, etc., while the other is extended primary subscribers like gov't, healthcare, transportation, and utilities personnel. AT&T will plan on having two carrier-grade MCPTT options for FirstNet subscribers and will release a RFP later this year. Since FirstNet views open standards and competition as a high priority and there is likely to be multiple MCPTT solutions on the market, AT&T decided it would be in their best interest to offer multiple carrier-grade options for their customers because of this. While the progress of FirstNet going into 2018 has lived up to expectations so far, there is still a lot of uncertainty and unknowns around the development and buildout of the FirstNet network by both public safety agencies across the US and vendors offering solutions in this space. While almost every state in the US has subscribed to FirstNet so far, this doesn't mean that every agency within that state will be mandated to sign up for the FirstNet service. States are signing up for the adoption of the polices around FirstNet, but the rubber hits the road with respect to agencies who actually sign up for the service and representatives within each agency ultimately are the ones who make the decision to sign up and receive/pay invoices as being part of FirstNet.

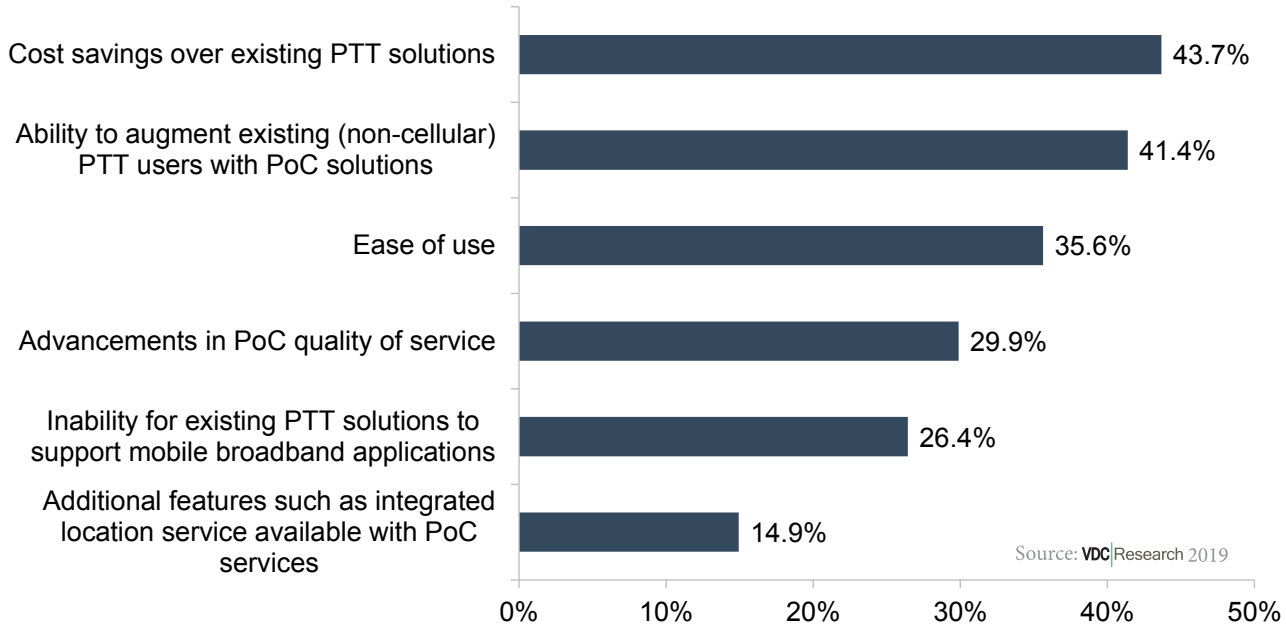
Many of these public safety entities pride themselves on being independent/flexible in what solutions they can/can't use for their operations, and many of them hate the idea of a national standard and being force fed options. States can't mandate agencies to sign up for the service and the final decision comes down to decision makers in each respective agency. This is an important aspect of FirstNet given the fact that the majority of public safety agencies leverage Verizon as their network operator, and they are the clear market leader when it comes to the public safety space. Many agencies currently leveraging the Verizon network want to enable PTT functionality in the context of FirstNet, but there is a lot of uncertainty/concerns around interoperability between Verizon users and FirstNet subscribers and as of right now adopting FirstNet would require Verizon users to change their carrier to AT&T which is a complicated and long process. We have also seen a number of these agencies wanting to go on FirstNet in the event of an emergency/disaster but then stay on Verizon for their normal operations given they are comfortable/using this network.

While AT&T representatives have said that interoperability issues won't be a factor with FirstNet, Verizon has echoed different statements and just recently announced the launch of their dedicated public-safety LTE core as a response to FirstNet. With this launch, first responders subscribed on the Verizon network will have access to services like traffic segmentation, priority and preemption, and end-to-end security encryption. Given that Verizon is the market leader when it comes to tier 2 and 3 public safety municipalities/agencies, VDC does expect a decent volume of customers to leverage Verizon's dedicated public safety LTE core. Currently conversations around interoperability between Verizon and AT&T haven't begun yet, and realistically it will be take a lot of dialogue and brainstorming between the two to develop and create a single interoperable platform that can seamlessly provide PTT solutions. It will take quite a bit of time for FirstNet to shake out, and as of right now it is hard to have a sense of how much of the first responder community that go into FirstNet will be using PoC solutions within their operations.

TCO Comparison Between PoC Solutions and LMR

When comparing the TCO (Total Cost of Ownership) between LMR and PoC solutions, the differences can be significant. LMR deployments require an organization to buy the equipment/devices (typically in the form of two-way radios), build out the narrowband network that will be used to enable communication between the various LMR users, as well realize costs around maintenance, value-added services, and system/device upgrades. The biggest costs associated with an LMR deployment is in the building out of the narrowband network, and depending on the size of the organization/volume of users this cost can be anywhere from hundreds of thousands to millions of dollars. The devices are also a significant cost to organizations and while you can obtain basic analog/digital radios from anywhere in between $100-$700, a P25 radio can have a price range as high as $7,000.

Exhibit 11: What Are the Leading Priorities Driving Your Organizations Investment in PoC Services?



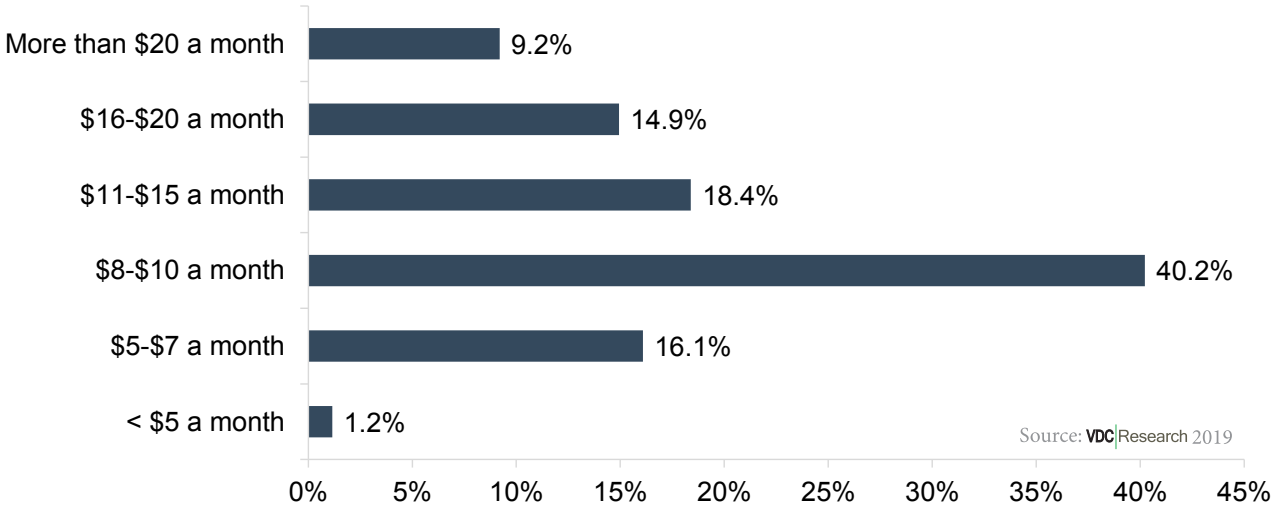
When looking at PoC solutions, the costs around these types of services are significantly lower than LMR since there is narrowband network required and organizations can leverage existing 3G, 4G, and LTE networks. Some devices that are dedicated specifically for PTT can be expensive, but it's beneficial that the majority of PoC solutions in the market today can be used on an existing smart device via a PTT application. It's also a huge advantage that carrier organizations provide device subsidies with multi-year contracts, making the device costs significantly lower than an LMR device. The traditional pricing model associated with PoC services is done on a cost per user per month basis, where specifically for carrier organizations a PTT solution like AT&T's Enhanced PTT can be added to their existing data plan.

Broadband PTT and LMR Interoperability/Augmentation

The integration/interoperability of broadband PTT with LMR offers a wide range of benefits to mobile workers who are leveraging PTT within their operations and for their workflows. In terms of PoC solutions that have been implemented by organization's today, the majority of them have leveraged PoC as an augmentation play to their existing LMR systems. Augmentation of LMR with PoC solutions has been occurring in both public safety and commercial environments, but the greatest opportunity for LMR augmentation with PoC lies in the commercial market. Some of the biggest factors that has driven LMR interoperability with PoC solutions today can be seen below.

- The cost of maintaining legacy LMR equipment/systems/infrastructure
- Extending network coverage of an existing LMR network beyond its traditional reach
- Increasing the number of PTT users within an organization (adding capacity to a network) without adding LMR infrastructure
- Consolidating LMR PTT & PoC features/functionalities into a single device
- Users wanting access to mobile broadband applications.

Exhibit 12: Average Cost per User per Month for PoC Solutions



An interesting trend VDC has seen within the market today is organizations approaching augmentation in a transitionary/ phased rollout. So in other words VDC isn't seeing rapid augmentation of an LMR system, but instead we are seeing augmentation occur in planned rollouts where full replacement will eventually happen. While the factors listed above are viewed as viable reasons for augmentation, there is still an argument to be made in certain commercial environment use cases as to how adding broadband PTT would beneficial. Low cost DMR/analog radios have fairly good economics in the market today and for commercial customers leveraging these specific technologies for PTT functionalities only, it makes more sense for them to just upgrade these radios when they need to rather than incurring the additional costs associated with a broadband PTT solution.

Exhibit 13: Key Factors Driving Organization to Augment LMR Systems with PoC Services

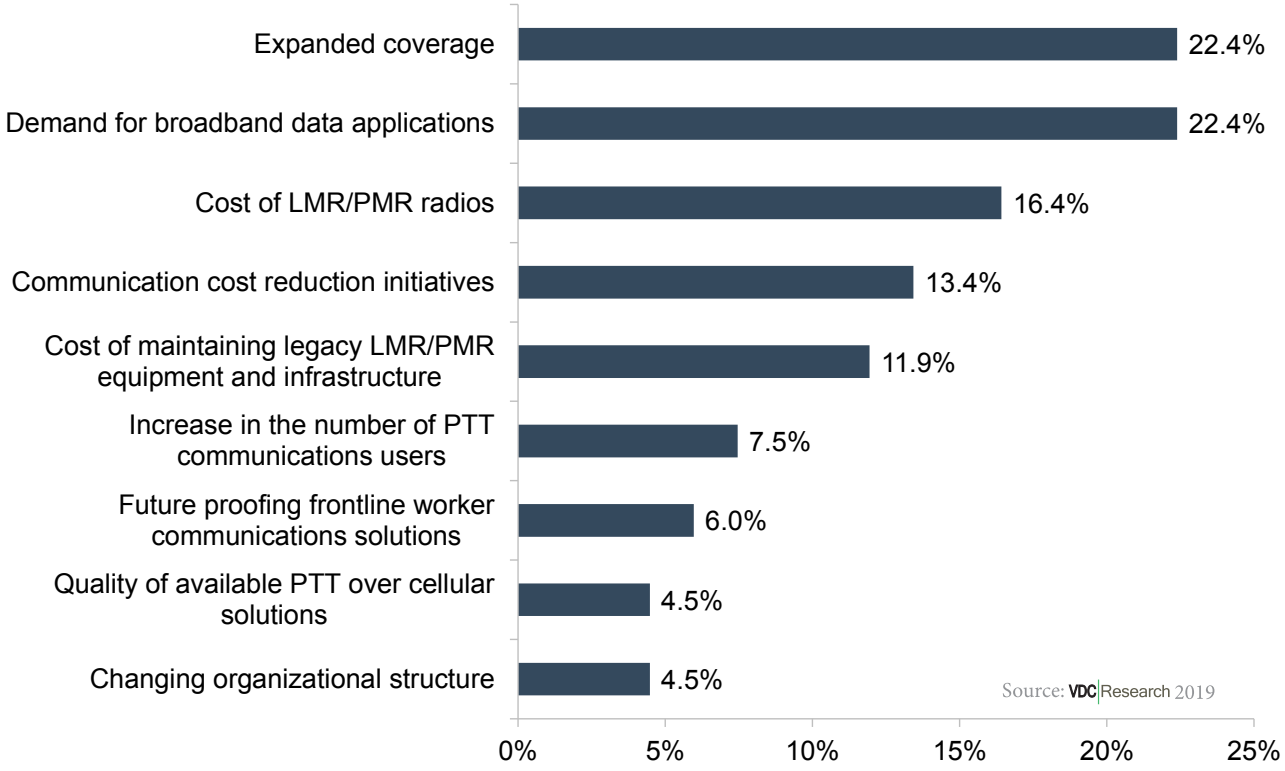
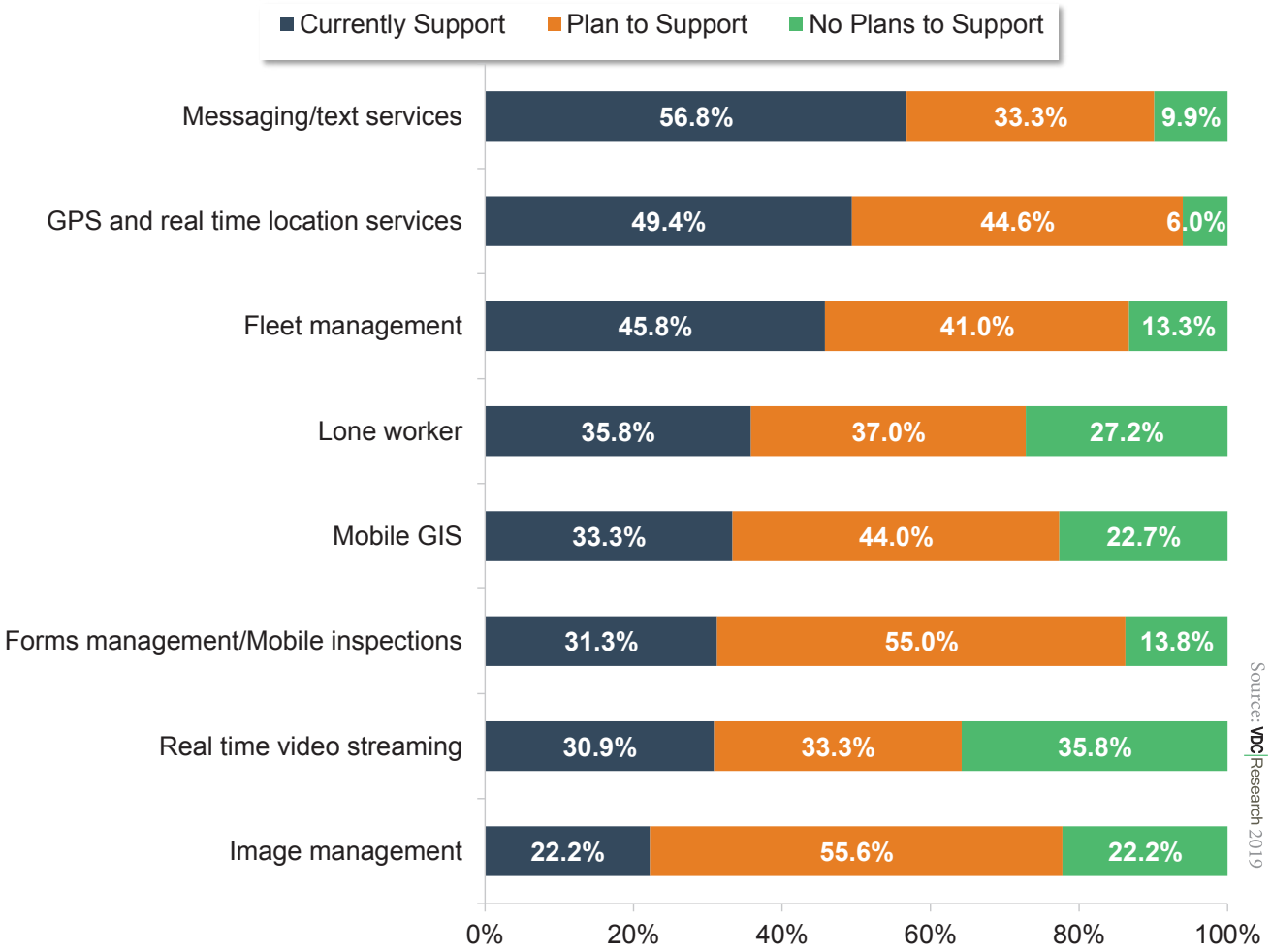
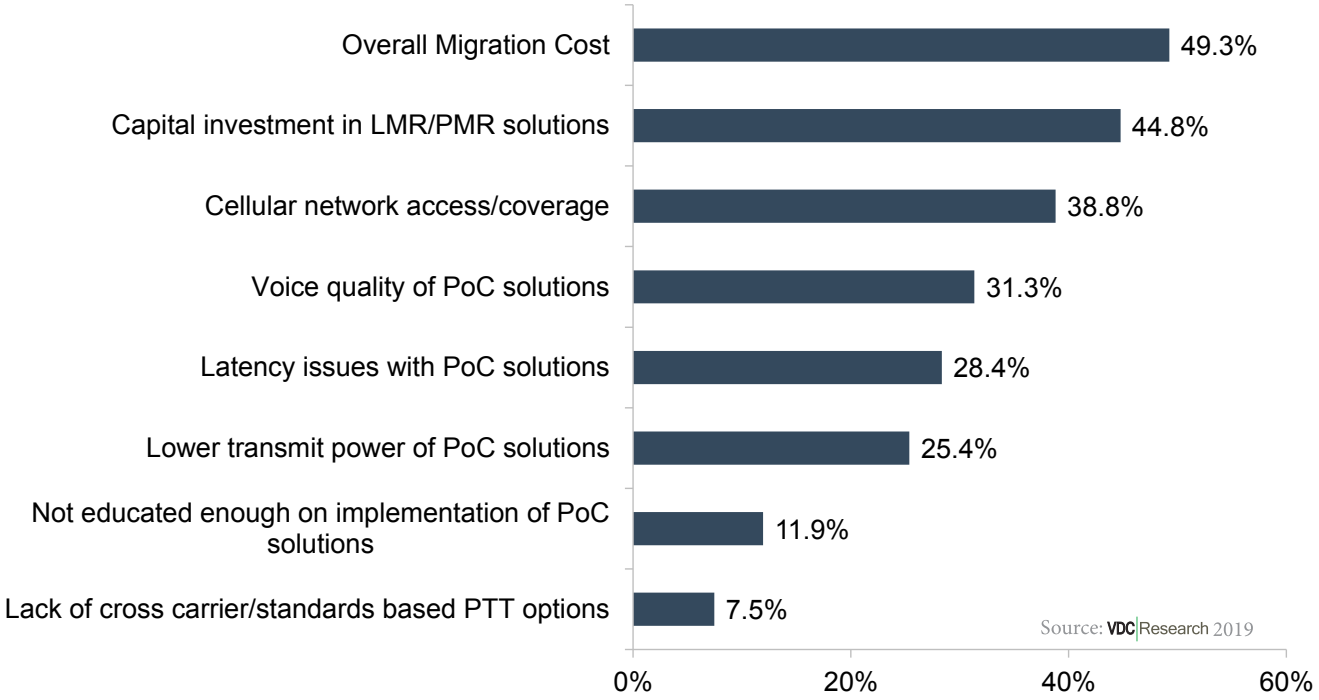


Exhibit 14: What Are the Leading Broadband Data Applications Your Organization is Currently Supporting or Planning to Deploy?



On the public safety side the full transition from LMR to broadband PTT is expected to be a very long process given that the 3GPP has yet to standardize on MCPTT and there is no vendor in the market today offering a true mission-critical PoC solution. This is why in the short term organizations instead have been augmenting LMR with broadband PTT to ensure users on each system can communicate with each other. The majority of public safety agencies have invested a large amount of money into their existing P25 systems, which is why augmentation rather than replacement is the most logical move at the moment. These agencies aren't willing to throw away the investments they have made in their LMR systems until EOL, MCPTT standards have been finalized, and the public safety community becomes comfortable/trusts using a cellular solution as form of critical workforce communication. A key selling point to public safety agencies evaluating augmentation of LMR with broadband PTT is the ability to consolidate capabilities into one device. The public safety community as a whole has been looking to move away from the traditional utility belt model for cost/worker safety reasons, and integration of broadband PTT allows these agencies to make this transition.

Exhibit 15: Key LMR Migration Barriers for Organizations Transitioning to a PoC Solution?



Interface Options (RoIP, ISSI, CSSI, AIS)

Looking at the interoperability solutions below, there is a number of reasons for an organization to augment/integrate their existing LMR system with LTE PTT systems. In healthcare and EMS, we have seen augmentation being used to expand the coverage of their existing LRM system. With first responders, augmentation with LTE PTT has been taking place primarily as a form of backup connectivity when an LMR system fails. Finally, we have seen augmentation of LMR and LTE PTT being used to avoid incurring high costs around expanding the capacity of an LMR network.

- **RoIP (Radio over Internet Protocol)** – The most basic interoperability option today is RoIP which can be used to interoperate broadband PTT with any LMR system. If a customer is looking for connectivity between broadband PTT and LMR, then they will most likely use RoIP due to its low cost and simplicity. The limitations of RoIP is that it doesn't support private calling and the transfer of device ID's between networks.
- **ISSI (Inter Sub-System Interface)** – ISSI is an interoperability option between LTE/broadband PTT and P25 systems. This option is ideal for customers that want verified performance and a lot of PTT features made available to them. This interoperability option doesn't require donor radios and can support features like private calling, group calling, emergency calling, and system-wide device ID's.
- **CSSI (Console Sub-System Interface)** – This is an additional interoperability option between LTE/broadband PTT and traditional consoles/P25 systems. This interface provides a seamless connection for dispatch workers, and requires a 3rd party dispatch console that can support CSSI.
- **AIS (Application Interface Specification)** – This is another interoperability option used primarily for integration of LTE PTT with DMR radio users in the commercial environment. Its primary intention is for integration around console systems. All the features included in a P25 via ISSI interface are the same as DMR via AIS, and these include things like priority, preemption, private calling, group calling, and emergency calling. Currently ESChat is the only vendor in the market offering this type of interface option/solution.

CONCLUDING THOUGHTS AND OUTLOOK FOR POC LANDSCAPE

Commercial Market Opportunity

While PoC offerings replacing LMR systems in the public safety sector is not practical, replacement/augmentation has been occurring in many commercial environments like transportation, field service, utilities, and hospitality. As evidenced by our research, a huge issue for companies is the cost of maintaining legacy LMR networks. LMR users have a sunk cost in their networks, and while some may be replacing them outright, most are using PoC solutions as an augmentation play. With the availability of viable carrier dependent and OTT solutions and demand for integration of PTT into modern workflows growing, the door is opening for more augmentation of PoC solutions to occur. Commercial users primarily in hospitality, private security, transportation/logistics, and utilities are becoming more viable PoC customers year after year, and this has been evident in the 30-40% decrease we have seen in commercial LMR users over the past 5 years. There is a natural migration that has been taking place in the commercial PoC space, and users are realizing that they want PTT solutions that maintain the same voice capabilities as an LMR system, have access to mobile broadband data applications, and can be consolidated into one PoC enabled device.

Transportation/Logistics – There remains a strong opportunity for PoC solutions to make an impact in the transportation sector. Fleet managers today want to know where their assets are being deployed, they want to be able to communicate with their drivers instantaneously, and they want to ensure driver safety to eliminate any type of company liability. One of the major issues that transportation companies have run into is the liability involved with contacting their drivers during the day via a two-way radio or voice phone. This is a very unsafe method of employee communication, and the ideal implementation would be a PoC-enabled in-vehicle device that removes all the clutter from the cabin and maintains the same ease of use/feeling as an LMR device. While a PoC enabled in-vehicle device is the ideal fit for fleets in the transportation sector, there are other transportation customers that require their employees to move in and out of vehicles making smartphones/ mounted tablets a more suitable device.

Hospitality – There has also been a lot of opportunity for PoC solutions in the hospitality sector. Regardless of the type of hospitality worker you are, having access to easy and instantaneous communication as well business data is crucial for enhancing customer experience. While we have seen full replacement of radios with PoC solutions in the hospitality sector, we have also seen a fair amount of augmentation where users with a PTT-enabled smartphone can now communicate with users on an LMR channel via an interoperability gateway. In the hospitality sector we typically see talk groups being used for communications, which eliminates the need to program individual devices.

Private Security – Over the past few years we have seen a slew of private security organizations abandoning their traditional two-way radio equipment and infrastructure with more modern PoC enabled devices and solutions. These solutions allow security workers to use their smartphone/tablet devices as walkie-talkie devices and help them realize benefits that include cost reduction, clear audio quality, flexibility and scalability, and access to mobile broadband applications like messaging/text while still being able to communicate with existing radio channels. Many large scale private security organizations have the resources and budget to make these types of investments, and organizations like G4S and Telemark Sikkerhet (Norwegian security company) have already began this implementation. Private security organizations across the globe can draw a number of different benefits from PoC services and expect in the near term many of these organizations to make the transition to PoC.

Utilities – Many utilities organizations have also been reevaluating their workforce communication needs and have been looking at implementing PoC solutions as a viable alternative. Some of the driving factors behind these organizations rethinking their communications strategy was the high costs around LMR even though some of their workers didn't access to a radio, certain FCC narrowband mandates requiring utilities organizations to upgrade/replace their old LMR systems/infrastructure, and the fact that by leveraging a PoC solution these workers could still communicate/connect to existing radio channels using just a smartphone or tablet device. In addition to these benefits associated with extending radio PTT to broadband devices/solutions, these utility workers could now also gain access to certain applications that weren't possible on a standard land mobile radio device.

There will be a number of opportunities of augmentation/replacement of LMR with a PoC solution to occur in the commercial market over the next few years. PTT demand is not what it used to be 5 years ago, and from an adoption standpoint carrier based solutions won't reach the 15-20 million users of the Nextel prime years. A big part of this is an awareness play, but also organizations not being educated enough on how to implement and leverage PoC solutions within their operations. Organizations are starting to change the way they view PTT, and integration of PTT with capabilities like messaging, alert notifications, and location services are being used more frequently to support workforce communication. The PoC market in general will continue to head in the right direction, over the next 5 years expect adoption numbers to increase significantly from where they are today. Moving forward, the greatest growth barrier for PoC solutions will be true carrier-based interoperability. While this is technically feasible because most tier 1 organizations are using the Kodiak platform, it is purely a business decision made by carriers like AT&T who don't want their Enhanced PTT users communicating with Verizon PTT + users.

Public Safety Market Opportunity

While PoC solutions are currently being used in mission-critical environments as of today, these solutions aren't based on the 3GPP standards (which hasn't been established yet) and have been used primarily as a form of augmentation to public safety agencies existing LMR systems. While the day will come when public safety agencies/users will rely on broadband PTT solutions as their primary form of communication, there is still a lot of work to be done in this area around standardization and for this reason LMR systems interfacing with PoC solutions via ISSI will be more prevalent in the near/mid-term. Public safety organizations that are currently in the process of upgrading or replacing their LMR systems with a new LMR system not only should be securing an ISSI upfront to ensure interoperability, but should also be adopting PoC solutions from vendors that have a long term plan in place for migration to MCPTT. There will definitely be more progress in the PoC space specifically around public safety over the next 5-10 year, and with FirstNet VDC believes this will cause the public safety sector to consider PoC in a more strategic way because of the requirement to have band 14 compatible devices. The demand for PoC will definitely be growing in this space, it's just a matter of how fast and when this demand will start to take off.

VENDOR PROFILES

Company Overview: AINA Wireless is headquartered in Salo, Finland, but also has offices in Boston, Massachusetts. The company develops rugged wireless communication devices for push to talk over IP. AINA Wireless addresses PTToC directly from a mobile device/user perspective instead of being a traditional LMR supplier. The company is most successful in sectors like transportation/logistics, manufacturing, and public safety. Other notable industries AINA Wireless operates in include construction, private security, hospitality, waste management, and airports. AINA Wireless does business in North America, Europe, Australia, and Japan. Their European business is quite scattered, but do particularly well in Nordics region. The company has also been seeing growth in Germany, Switzerland and France. Overall the bulk of AINA Wireless' business comes from the North American market with an estimated 80% of sales, and this specific market has seen growth of 3 to 4 times over the past year.

Go-to-Market Trends: In terms of GTM strategy, AINA Wireless leverages both a direct model (primarily to create awareness around brand/product) and utilizes the traditional distributor channel. They also leverage carrier organizations/channels in an attempt to leverage carrier subsidies for PTT solutions. One example of a distributor who they have worked with in North America is Allcan, who is also a distributor for Bell Canada. AINA focusses its sales efforts on large B2B customers, ODM and distributors, as well as serving small and medium sized customers via its reseller network. They are able to move and deliver product fairly quickly for an organization their size using their warehouses in the US, Netherlands, and Australia. They have also found their online web shop to be successful in enabling prospects to more easily access devices to test before making any larger deployments.

Product Portfolio:

- **PTT Voice Responder** – AINA's product portfolio includes the PTT Voice Responder, a speaker microphone which can be connected via Bluetooth to iOS and/or Android smartphones. The devices is designed to work with different walkie-talkie style PTT applications featuring multiple buttons where the application developer can assign different functions. Users are able to remotely control functions such as PTT, phone calls, channel switching and emergency alerts. Key capabilities include Bluetooth, long battery life, a 3.5mm audio jack, and a light weight design. It currently sells for around $200.
- **PTT Smart Button** – AINA's PTT Smart Button is a Bluetooth key that remotely controls a smartphone's PTT and other iOT applications. It features a PTT button, a multifunction button, an emergency button, enhanced grip. It also supports NFC touch pairing. It is currently priced at $80 for just the smart button (no headset).
- **Accessories** – AINA's accessories portfolio includes a variety of headsets and a vehicle charger. The company's headsets range from normal receiver kits to surveillance kits with a connected speaker and microphone. Meanwhile the vehicle charger is a charging cradle designed for the PTT Voice Responder and allows the device to charge while the user is driving.

Key Differentiators/Outlook: AINA wireless views themselves as a technology company rather than a manufacturer of ruggedized PTT devices and accessories. Their engineering teams have been at the core of the company's success, and they are in the unique position where they don't have to outsource certain manufacturing responsibilities and can continue to create innovative PTT products/solutions. In North America AINA wireless does see FirstNet as a growth opportunity for them given their speaker mic meets the requirements of FirstNet, and they actually have already been selling their solution to public safety agencies that include sheriffs, the DEA, the DOJ, and the FBI. In terms of outlook, they currently have a small sales network but are expanding this at a fast pace, and they would definitely be considered as an outperformer in this market. They specifically see a market for small/medium sized businesses, where no one vendor is targeting organizations with around 5-10 viable users of PTT technology. AINA wireless also holds the

distinct advantage in the fact that they don't undercut their partners, and can offer them margin that distributors view as desirable which is something their competitors like Savox and Pryme have struggled with. Looking at future product releases for AINA Wireless, the most notable one is their stand-alone LTE device called the MCPTT communicator which has an expected release date of 2019. It is essentially a handheld that can run on any PTT app directly loaded onto the speaker mic and can connect directly to a wireless network. This specific project has funding from the EU's Horizon 2020 program for about 2.5 million euros, of which AINA wireless is required to pay back only 30%.

Company Overview: Airbus Defense and Space offers communication solutions for industries that include public safety, transportation, utilities, and enterprise users as well. They are primarily focused on the high end users in public safety when it comes to these products, but have also started to see more growth commercial sectors as well. They develop, deploy, and maintain secure hybrid networks, PMR/LMR networks, and devices based on TETRA, Tetrapol, and LTE technologies. They have a heavy presence especially in the EMEA region where they generate most of the business/revenue for their communication solutions.

Go-to-Market Trends: With public safety (high end) users Airbus DS usually sells their products direct, where many of their customers are large agencies/ministry of interiors that require the manufacturer to work directly with them. In their other customer tiers they operate in like transportation and enterprise users they often leverage traditional resellers/ distributors, but in some cases will go direct depending on the size of the organization and volume of LMR users.

Product Portfolio:

- T**ETRA Network solution** – This is a large portion of Airbus DS solutions, and their TETRA network solution is a feature rich, reliable and secure platform for deployments from large nationwide systems to small single site solutions. The network solution includes radio acces, core network, dispatching solutions, network management solution, provisioning solution and gateways.
- **TETRAPOL solution including network and radios** – This is also a significant portion of Airbus DS solutions, and their TETRAPOL solution offers corresponding services to users than the TETRA solution.
- **TETRA Radios** – This is a considerable portion of Airbus DS solutions, and their TETRA radios have features that include (not limited to) large color display, an easy to use menu structure, voice feedback, and night vision mode. Their most popular TETRA handheld would be the TH1n slimline radio, which is ideal for customers in healthcare as well as law enforcement.
- **Tactilon Agnet** – This is a professional PTT application that that allows smartphone users to communicate with TETRA talk groups/radios. This is ideal for indoor coverage airport workers, miners, police officers, as well as medical professionals. It has features that include individual/group/emergency calling, location tracking, messaging capabilities, and can work on 3G, 4G, and Wi-Fi. It's compatible with devices from manufacturers like Samsung, Caterpillar, Bittium, and their own Taction Dabat device.
- **Tactilon Dabat** – This a smartphone developed by Airbus DS that has a TETRA radio incorporated into it. It has dedicated PTT buttons, a large touch screen, long battery life, loud/clear audio quality, man down/ emergency alarms, and messaging capabilities as well.

Key Differentiator/Outlook: Moving forward for Airbus DS, the European market in general is known for being slow around adoption of new technologies, and this has somewhat delayed the use of broadband PTT technology across the region. Many European countries the past few years have been making big investments into replacing/upgrading their TETRA and Tetrapol systems, which has also been a contributing factor. Despite this, broadband PTT has been growing slightly, and is starting to be evaluated/used in primarily commercial environments. Similar to North America, public safety users view LMR as the primary mode of workforce communication, and this won't change until the 3GPP finalizes standard and public safety users become comfortable/trust using a broadband solution as a means of workforce communication.

Company Overview: EF Johnson, founded in 1923, is a wholly owned subsidiary of the JVCKenwood Corporation that focuses on designing and manufacturing two-way radios and radio system infrastructure solutions geared toward the public safety sector. Today, EF Johnson is made up of 200 employees, and is headquartered in Irving, Texas. They focus primarily on P25 solutions in the public safety sector, while their parent corporation JVCKenwood is more in tune with the commercial LMR market.

Go-to-Market Trends: With their acquisition in 2014 by JVCKenwood, EF Johnson was able to gain access to JVCKenwood's channel in order to sell their product in the US and internationally. The acquisition also proved beneficial for EF Johnson because they were able to leverage JVCKenwood's manufacturing plants and associated global procurement supply chain by moving their manufacturing to Japan, where JVCKenwood is headquartered. EF Johnson's primary target market in the US for their products is tier 2/3 cities/counties with a population typically under 500K. They tend to stay away from tier 1 cities/counties in the public safety market as this is heavily dominated by the likes of Motorola and Harris.

Product Portfolio:

- **Portables** – EF Johnson's portable portfolio includes dual and single band radios. The company offers the VP900 Multi Band Radio, VP6000 Single Band Radio, VP 600 Single Band Radio, and VP5000 Single Band radio. All of the radios offer mixed protocol operation, mixed protocol zones, integrated GPS, Bluetooth, encryption and P25 authentication.
- **Mobiles** - EF Johnson's mobiles portfolio include dual, single and all band. Products offered are VM900 Dual Band, VM 700 All Band, VM6000 Single Band, VM5000 Single Band, and VM600 Hand Held Controller. All mobile radios come with mixed protocol operation, mixed protocol zones, external speakers, fixed control stations, and built in GPS.
- **Accessories** – Accessories from EF Johnson include holders, headsets, and chargers for their portable and mobile products.
- **ATLAS System Solutions** – EF Johnson's ATLAS P25 turnkey System Solutions include conventional, trunked, hybrid and simulcast systems.
- **ATLAS System Products** – EF Johnson's ATLAS P25 System Products include base stations and repeaters, network management systems, dispatch consoles, and gateways and interfaces.

Key Differentiator/Outlook- While the implementation of PoC solutions has had an impact on the commercial LMR market, the public safety LMR market remains strong and any EF Johnson customers adopting PoC are doing so as an augmentation play to their existing LMR operations. The LMR public safety market as a whole has seen strong demand driven by aging legacy systems requiring digital upgrades coupled with incremental state and local government funding which has opened up due to the stronger economy. From a PTT context, EF Johnson is focusing on areas that are primarily dictated by FirstNet and how this will evolve. Given that the market is a long way away from MCPTT standards being finalized and there is no true mission-critical PoC solution being offered, EF Johnson will continue to see a trend of P25 systems being adopted by public safety agencies and growth should remain stable for several more years.

Company Overview – ESChat, headquartered in California, is one of the leading OTT PTT providers in the market today. ESChat offers very robust PTT services, and is designed for use in both public safety and commercial environments. While they are heavily focused in public safety when it comes to their solution features, their solution also translates well into commercial environments like transportation/logistics, towing, hospitality, construction, utilities, and education where they have generated a decent portion of their revenues. Their product is a highly efficient/scalable solution, has reliable encrypted PTT voice communications, encrypted multi-media messaging, and both live and historical GPS tracking/mapping. They are a FirstNet Certified solution, and began field trials with FirstNet early builders in 2015, having worked with FirstNet Colorado, LA-RICS, Harris County, FirstNet New Mexico and FirstNet Ohio during events that include: the Alpine World Ski Championships, Rose Parade, Super Bowl, NCAA Football, New Mexico State Fair, Albuquerque Balloon Fiesta, Houston Livestock Show & Rodeo and numerous other large scale public events. Their solution has been leveraged by customers in the United States, including: AAA (Automobile Club of America) and AMR (American Medical Response). Internationally, ESChat is used by United Rescue, the largest EMS provider in Israel (used in conjunction with Bluebird's rugged PTT handheld – RP350). ESChat is used by all branches of the US Military, as well as federal, state and local public safety agencies. The ESChat brand is only marketed in the United States and Israel, while they use a partnership strategy for the remaining international markets.

Go-to-Market Trends-. In terms of GTM, ESChat deploys both a direct sales model and leverages partners to sell/market their solution. They prefer working with partners that have established distribution. They have a small sales/marketing team and while they do have some online campaigns, much of their business is generated through organic marketing (reputation, referrals, word of mouth). One area they have seen a good amount of business being generated is through referrals, where people who have used ESChat at one agency will move to another agency and recommend implementing the ESChat product into their operations. For their direct sales, they often sell through GSA where they work with a number of different public safety branches/agencies. In terms of pricing, their highest price point is $4.99 a month on a month to month no-contract basis and goes down from there depending on volume discounts. Annual subscribers of the service pay $4.49 a month. ESChat also has very close relationships with device manufacturers like Sonim, Kyocera, and Siyata Mobile. They have had a working relationship with Sonim since 2003, and have played an important role in developing/working on the direct mode module in Sonim's new XP8 device. They have also worked with Siyata around integration/certification of ESChat in their UR7 device. While primarily known as an OTT solution, ESChat has established relationships with numerous wireless carriers. Verizon Wireless offers its' customers the ability to add ESChat directly on their wireless bill, and AT&T has a supply agreement to sell ESChat. ESChat expects to have direct carrier billing available on T-Mobile by Q4 of this year. Internationally, ESChat is available through carriers including: Partner Communications (Israel) under the brand "Partner PTT" and through Rogers Wireless (Canada) under the brand "NovaTalk".

Product Portfolio –

- **Solution Features** – ESChat is a highly scalable and efficient solution that meets the needs of both public safety and commercial users. It has robust PTT features, live/historical GPS location tracking, and encrypted multi-media messaging capabilities as well. ESChat is FirstNet certified, carrier agnostic, has QoS rolled out on both Verizon's Private Network Traffic Management (PNTM) and AT&T's Dynamic Traffic Management (DTM) network, has fast call setup, clear voice quality, multiple talk group types, complete user account management, and presence for group/individual contacts.
- **Deployment Options** – ESChat is available as a service, hosted the Amazon AWS commercial cloud and AWS GovCloud environments. ESChat servers may also be deployed on the customer's premise where that model is desired. Common cases for customer hosted solutions include: portable or deployable PTT networks, fully secure (air-gapped) PTT networks, large-scale and geo-redundant networks for large scale customers that require or desire to maintain their own network infrastructure.
- **SDK's and API's** –The ESChat product is white labeled to a number of different partners, and they also license SDK's & API's to customer that want to implement ESChat functionalities into their own user interface. Some of their white labeled partners include JPS interoperability (VIA solution), Tait communications (UnifyVoice solution), Simoco (SimocoPush), JVCKenwood/EFJohnson (Kenwood PTT), Tango Tango, Fleetcom, Logic Wireless and Impulse Wireless.
- **LMR Integration** – LMR interoperability was first introduced with ESChat in 2009, and currently they offer basic RoIP interoperability, P25 interoperability via ISSI, and DMR interoperability via AIS. They are currently the only vendor in the market today that is offering DMR interoperability via AIS. While ESChat is marketed as an augmentation play to LMR first and foremost, they do have some customers that have implemented their solution as a replacement to existing LMR systems.
- **Other Integrations** – ESChat has published and/or contributed to numerous articles on the subject of 'Standards Based' interoperability, and has implemented a number of such interfaces to interoperate with complementary systems, including: Console Integration (CSSI and AIS) and Mission Critical Recording/ Logging (SIPREC). In 2017 they announced MC-ESChat, their next-generation solution that will support integration with the 3GPP Mission Critical Push-to-Talk (MCPTT) Standard.

Key Differentiator/Outlook-. In terms of outlook for ESChat, they are well positioned in the market to grow their existing user base and have seen month over month growth averaging 2%-6% (excluding 2-3 months) since they started tracking it in 2014. They have been able to generate solid business from their own customers via their sales/ marketing teams, and have been able to generate a good amount of revenue through white labeland SDK partners. In terms of differentiators, there biggest one is the fact that they are deeply entrenched/one step ahead of the market when it comes to technology developments, and they deploy/implement solutions based off of their customer's specific requests/needs. They are also the most widely known application that is FirstNet certified, and this a process that takes quite of bit of time when it comes to getting approval. Other key differentiators of ESChat include their high level of voice quality, high reliability, 24/7/365 live customer support and their uptime which is in many cases is better than the carrier-integrated PTT solutions offered today.

Company Overview- HipVoice, founded in 2003 and headquartered in Santa Monica, CA, is a SaaS network that provides companies with a reliable, robust, and scalable network. They were known as the first company in this market to do PTT over an enterprise device. HipVoice's has fortune 500 enterprise customers in sectors that include field service, maintenance, public safety, warehousing, transportation/logistics, and hospitality. Their biggest sector by far is field service where their solution is leveraged for both voice and messaging capabilities. In Hospitality they provide maintenance/housekeepers of a large international hotel group with their enterprise software, and also have a Defense company that licenses their enterprise technology. In terms of regional footprint North America currently accounts for 40-45% of HipVoice's revenue, while EMEA accounts 35-40% and APAC around 20-30%.

Go-to-Market Trends- HipVoice has a marketed price of $10 per user per month, but their customers usually pay for the service via a one-time per year cost. For companies that have a higher than normal amount of users , their service is usually more expensive due to them having to push more data through their servers and pay for more bandwidth. In terms of GTM, they leverage several tiers of channels in order to sell their solution. With the majority of their tier 1 and tier 2 clients they typically like to go direct, while with smaller companies they will leverage both distributors/VARs to sell their solution. Currently, approximately 95% of their customers are Fortune 500 companies with whom they go direct. This strategy is deployed across every region HipVoice operates in, which has been successful in these sense of maintain their core customer base.

HipVoice Product Features- HipVoice is a SaaS network that organizations leverage to enable both voice and messaging communication between field workers and their corporate offices. With HipVoice there is no need to setup any server infrastructure, and it can simply be installed onto any existing rugged device. HipVoice can run on over 40 cellular networks across the globe, and is developed so that each voice/messaging stream can be delivered on different networks with the same latency & voice quality. They have a marketed price of $10 per user per month but this number varies when accounting discounts and the size of the organization. The technology works in various models including WWAN, WLAN, and Interoperability. Key features include messaging (voice, chat, sticky, note, text, archived), a customizable PTT key, individual/group communication, and data encryption. HipVoice also supports a wide range of devices from both Zebra Technologies and Honeywell.

Key Differentiators/Outlook - For HipVoice, two of their key differentiators is the fact that they do deep integrations with their clients and are agnostic when it comes to choosing a device manufacturer. Everything they do is modified to customer requirements which is why they have been able to maintain their core base. They are not just highly integrated with customers around voice, but are integrated with them around capabilities like text, login systems, and material management systems. One trend that HipVoice has been seeing among their customer base is the younger workforce shifting from PTT to messaging. HipVoice has a wide array of messaging features, one of which includes predefined messages that field workers like to leverage because they are faster and easier to use. Currently about 40% of their enterprise customers use voice as the primary form of communication while 60% use messaging as the primary form. Moving forward for HipVoice while they will still put a high amount of focus on their voice capabilities, they will also start to market their messaging features more as they see a higher amount of growth opportunity here.

Company Overview- Icom designs, engineers and manufactures wireless radio communications equipment and products for marine, avionics, land mobile and wide band receiver industries. They were founded in 1954 and are headquartered in Japan. Icom America, a subsidiary of Icom Incorporated was founded in 1979 and is based in Kirkland, Washington. In the LMR space, the company offers portables, mobiles, IDAS (Icom's digital land mobile radio system using the NXDN™ common air interface), P25 networks/RoIP, and data/HF. Icom is heavily focused on the commercial LMR market with their products, and sell into industries that include transportation/ logistics, field service, construction, manufacturing, etc. They also have a strong presence in the public safety market, where they are releasing a new product to compete in the 700/800 Mhz spectrum. This product is expected to increase their presence even further. They are committed to both the commercial and public safety space, and have created a new division specifically geared toward public safety where they expect their products to grow their overall business.

Go-to-Market Trends- In terms of GTM, Icom in North America leverages both a direct sales model and dealer channel model. The direct sales model is a small portion of their business, and is typically used with lager entities like railways or government agencies who specifically require LMR manufacturers to work directly with them. Outside of direct, their preference is to funnel the business through their dealer channel so they can focus on supporting customers more efficiently. In this scenario, Icom is partnered with both VARs who put together different packages to sell the complete system and distributors who usually just have the stock. The largest dealer they work with currently in the US is BearCom, who is partnered with all their tier 1 LMR manufacturers.

Product Portfolio-

- **Amateur Radios** – Offers amateur base stations, mobile devices, handhelds, D-STAR, and Receivers. Mobile amateur radios include 1,000 regular channels, 4 call channels, 50 program scan edges and 1,200 repeater memories.
- **Avionic Radios**- Avionic radios include handheld, mobile, and panel mount radios. Handheld radios offer TX and RX frequencies, 300 channels, up to 10.5 hours of battery life, and large easy to use 2.3 inch LCD.
- **Land Mobile Radios**- LMR include portables, mobiles, IDAS, P25, Network/RoIP, and Data/HF. P25 land mobile radios include 1024 channels with 128 zones, 13 programmable keys, waterproof rating IP68, and high resolution color LCD.
- **Marine Radios**- Marine radios include handhelds, mounted VHF, COMMANDMIC, SSB, and Navigation. Handheld marine radios offer up to 16 hours of batter, waterproof rating IPX8, water draining function, and active noise canceling to reduce background noise.
- **Systems**- Systems include analog, iDAS, P25, Software, and Customized digital radio solutions. Software offers linking up to 16 IDAS Repeater, single site systems, multi-site systems, monitoring different user groups, and the ability to coordinate with in the field staff remotely.

Key Differentiator/Outlook – Moving forward for Icom America while the bulk of their business currently resides in the commercial space, they expect to see strong growth of their products behind their recently created public safety division. One area that will certainly be a growth opportunity for them in the commercial space is in LTE radios where they just announced the release of their new device, the IP501H. This new offering will allow Icom America to provide a mobile virtual network operator offering that leverages the AT&T wireless network for access. LTE radios have many benefits for both commercial/gov't organizations, some of which include unlimited talk groups, no license/infrastructure fees, broader spectrum, it can deployed immediately, and the audio quality is significantly better than analog/digital radios. One of the primary reasons this product was brought to market in North America was due the success it had in Japan, where currently there are about 30,000 users spread out primarily in railway and airport use cases. In North America, the IP501H is expected to be used a lot in transportation environments where the device is ideal for anyone that needs a wide area solution. They do not plan on targeting public safety users with the IP501H device.

Company Overview - Iridium Communications (IRDM) is a publicly traded company headquartered in McLean, VA, and has provided mobile voice and data communications services through its one-of-a-kind satellites to both commercial businesses and the U.S/ foreign governments since 2000. The company offers mobile voice and data communications, push-to-talk (PTT), broadband data, and IoT services through Iridium's constellation. The Iridium constellation is the world's largest commercial satellite constellation consisting of 66 Low-Earth- Orbit cross-linked satellites operating as a fully meshed network. Iridium products and services, sold through a network of value-added distributors and dealers, are ideally suited for industries such as maritime, aviation, government/military/emergency/humanitarian services, mining, forestry, oil and gas, heavy equipment, transportation and utilities. Iridium's subscriber base has ground from around 30,000 users to more than 1,000,000 users, with voice and data subscribers accounting for around 40%, while IoT data accounts for the remaining 60%. Iridium® has also been upgrading their legacy satellite constellation (which has been in service for 20 years) via a $3 billion replacement program building 81 new satellites. They are launching 75 of these satellites in conjunction with Space X and will have expected to launch 55 through May (and expect to have 66 operational satellites and 9 in orbit spares later this year). Iridium's PTT offering stemmed from a network originally built for the US DOD, called Netted Iridium, used with military grade radios for beyond line of sight communication.

Go-to-Market Trends (GTM) - In terms of GTM for Iridium, they deploy a few different models. They use their traditional model where they partner with service providers, like Telstra, who sell satellite as an extension of their LTE phone offerings for those users that need communication in remote areas. They also serve as a wholesaler where they provide wholesale pricing to their distribution partners, and let them deliver these solutions to their respective markets to sell and deal with the billing/support. Moving forward, Iridium definitely sees themselves moving towards the Value Added Reseller (VAR) route for PTT, and they see the most value in partnering with Land Mobile Radio (LMR) manufacturers, like Motorola, who can integrate Iridium PTT into their devices and sell the solution as a managed service offering. The benefit for Iridium here is that their offering would be added to Motorola's portfolio and leverage this distribution channel. In term of pricing, with the added PTT functionality/features, Iridium users pay around $60-$65 a month and enjoy unlimited phone calls and talk time. This pricing is obviously offered at a premium to other carrier-integrated/OTT PTT solutions in the market today, simply because it is a Satellite-based solution with reliable, global coverage.

Product Portfolio -

- **Iridium PTT** – Iridium PTT is a satellite-based trunked radio system that has flexible over-the-air talkgroup configurations, low latency, and reliable communications. Key benefits of Iridium PTT include fast LEO network speeds, AES-256 encryption standard, shared talkgroups, easy deployment, interoperability and no infrastructure costs.
- **Iridium Extreme® PTT Handset** – Offers PTT solution via phone that includes global PTT capabilities, configurable talkgroups, reinforced PTT button, SMS and email messaging capability, GPS location services, SOS access in Phone Mode, up to 16 hours of PTT mode standby, and 5 hours of PTT talk time.
- **Iridium 9523 Core Transceiver** – This is a robust development platform that allows Iridium partners to seamlessly integrate Iridium PTT service capabilities into their new/existing radio, voice, and data solutions. It's essentially a module for device integration.
- **Iridium PTT Command Center** – As part of the Iridium PTT solution, there is a drag and drop command center interface that easily configures talkgroups and devices. Users can subscribe to a certain amount of geographic coverage and can sub segment this in up to 10 service areas located across the globe. Up to 15 different talkgroups can be programmed onto the devices and within each talkgroup, a virtually infinite amount of devices can be dragged/dropped.
- **Qinetiq Bracer** – This is a product developed and designed by Qinetiq (UK based company) for use of Iridium PTT. It utilizes the Iridium 9523PTT transceiver core and is designed for deployed forces and militaries that need an enhanced level of security and ruggedness. It has a targeted availability date of Q3 2018 and is an ideal device for a variety of military agencies and ministries of defense.

Key Differentiators/Outlook - Looking at Iridium, three of their evident differentiators are global coverage, signal reliability, and their development platform which can integrate their solution into an organization's devices and ecosystem. In the past and even currently, Iridium PTT has been used primarily for cross-banding and as a stand-alone solution in use cases like emergency response, border security, land management, special/military forces, developing countries local governments, and remote transportation. As far as growth goes, they are very much in the infancy/integration phase where they have a good PTT product/solution, but have initially generated business via the low hanging fruit. Where they will hit mass adoption of their solution is as it is integrated into tier 1 LMR manufacturer's product lines. This is the ideal route they want to take and is very much in process right now.

Company Overview- JPS Interoperability Solutions, Inc., which acquired the assets of JPS communications from Raytheon in 2016, is a leader/manufacturer of communications interoperability equipment (tactically, locally, and wide area). They have a fairly large customer base across a number of different countries, and have a big presence in public safety/DOD as well as customers in commercial environments like education, utilities, oil & gas, etc. At the heart of their products is their ACU intelligent interconnect technology, which provides transparent and reliable communications interoperability between disparate radio systems, analog and digital telephony systems, cellular and satellite phones, dispatch consoles and other audio communication systems Their RoIP gateway is one of the most widely used solutions in the market today.

Go-to-Market Trends- JPS leverages a basic manufacturer/dealer network model as well as a direct sales model. They have agreements in place with hundreds of dealers/distributors in a number of different countries to resell their product, and have direct interactions with primarily larger accounts/public safety agencies, as well DOD customers.

Product Portfolio -

- **JPS VIA** – JPS offers integration of ESChat with their ACU technology. Referred to as JPS VIA, this is a white labeled solution of ESChat and offers voice and Data links between mobile devices and JPS gateways. The solution is offered as a hosted service running on commercial 3G.LTE/Wi-Fi networks, and ESChat has also added the JPS RoIP protocol, to their platform in order to communicate with existing/new JPS interoperability equipment. Key features of the solution include fast call setup, high voice quality, In-call preemption and priority-based call override, and group text communications.

Key Differentiator/Outlook- In 2016, JPS Interoperability Solutions was established as a new company with the acquired assets of JPS Communications. JPS Communications was a business unit of Raytheon, until Raytheon decided to close it as it no longer aligned with their overall business strategy. The biggest differentiator for JPS is the work they have continued to do around their technology/product developments. They are the most widely used vendor when it comes to interoperability solutions, and are always looking to add new product offerings and integration of video, data, and situational awareness capabilities to their communications interoperability technologies. Their overall focus as a company is to increase the functionality/performance of their solutions so it properly meets the demand of the market. In terms of outlook, given that JPS is deeply entrenched in the market when it comes to interoperability solutions they are well positioned from to continue to increase their share and expand their presence across both commercial and public safety environments.

Company Overview- Kodiak Networks, acquired by Motorola in 2017, is the industry leader of broadband PTT where they offer a cloud based/IP-based PTT technology platform. Kodiak has the largest footprint when it comes to carrier-integrated PTT, and they have deployments with carrier organizations across North America, Latin America, and EMEA. Since 2012 Kodiak has been working with a wide variety of mobile network operators around deploying broadband PTT services, and have been able to establish a strong global customer base in industries like transportation/logistics, construction, manufacturing, utilities, education, public safety, and government.

Go-to-Market Trends- Looking at Kodiak's partners & ecosystem, they have partnerships with carrier organizations, accessory vendors, device/handset vendors, system integrators, and interoperability organizations. Their carrier/reseller network is fairly comprehensive and they leverage a managed service model so there is no need to invest additional money into equipment/implementation. They are working with major carriers/resellers that include AT&T, Bell Canada, Verizon, KPN, Movistar, Sprint, Hot Mobile, Telefónica, Vodafone, and Ericsson. They partner/work closely with device manufacturers that include Apple, Samsung, Kyocera, Sonim, Siyata Mobile, and RugGear to ensure their solution work seamlessly on all these devices and operating systems. Lastly, given that interoperability is a critical factor of broadband PTT, they have partnered with organizations like Avtec, Zetron, JPS, and Mutualink around IP interface/CSSI and radio gateways.

Product Portfolio-

- **Kodiak broadband PTT platform** – The broadband PTT platform from Kodiak is based off industry standards from the Open Mobile Alliance, and has capabilities that include high/reliable performance, robust features, compatibility with rugged/CG devices, interoperability with two-way-radio systems, and APIs for integration into 3rd party applications. Kodiak has the largest installed user base of PTT services around the world, and is an ideal solution for communication between frontline mobile workers of an organization. Some key features of the Kodiak platform include fast call set-up, encryption based on AES 256, real-time presence, alert notifications, high voice quality, group calls/1 to 1 private calls, multimedia messaging, location mapping/geo-fencing, and high scalability.
- **APIs** – Kodiak also has APIs that enables integration of PTT functionalities into browser-based workforce managements or dispatch applications. The API extends features like one-to-one calls, pre-defined group call, ad-hoc group calls, presence information, and alert notifications. Examples of companies leveraging Kodiak's APIs include Actsoft and FleetComplete.

Key Differentiator/Outlook – One of biggest differentiators for Kodiak within the market today is the fact that they are deeply entrenched in partnerships with carrier organizations, device manufacturers, and system integrators. Their relationship with carrier organizations is extremely important, and the three major carriers in the US (AT&T, Verizon, Sprint) have all standardized on Kodiak. Kodiak certainly sees broadband PTT as a major growth market for them moving forward for in both the commercial and public safety market. While their commercial business is strong in sectors like transportation, field service, and hospitality, growth in the public safety space will be dictated by the 3GPP and their timeline for standards around MCPTT. Once the MCPTT standards have been solidified which is still quite a long ways away, Kodiak could potentially see an increase in their public safety business with agencies looking for interoperability with LMR networks. The primary drivers behind the growth of PoC solutions will be LMR augmentation, access to mobile broadband applications, and standards development.

Company Overview- Kyocera, a diversified Japanese manufacturing company, was founded in 1959 and is headquartered in Kyoto, Japan and is in all major markets including Japan, Korea, U.S, Canada, France, Germany, Columbia, Peru, Chile and Mexico. The company has one of the broadest portfolios of rugged devices, many of which are holdovers from when Kyocera was still targeting the consumer market. The company has significantly applied its R&D resources around expanding its line of rugged smartphones and feature phones and narrowing its specifications and performance gap with key competitors. They have done well to establish a strong position in the ruggedized device market and key verticals, in particular mission critical applications in the public safety/first responder sector. On the commercial side, Kyocera has been building out its partner portfolio to create solution bundles that target specific markets such as construction, trucking and public safety.

Go-to-Market Trends- Similar to Samsung and Sonim, Kyocera leverages their carrier partners' channels/dealer networks to sell their products. They have approval and are stocked in tier 1 organizations like AT&T, Verizon, Sprint, and T-Mobile. Kyocera has seen growth and success in the ruggedized smartphone market, as well as the PoC space. They have a close/strong relationship with Kodiak (EX: doing a number of PoC joint demos at trade shows), are strongly represented in the PTT device area with Verizon, AT&T and Sprint, have the accessory offerings to enable PoC, and are also working with PoC specialists like TangoTango. They will see a slight boost in business as a result of FirstNet and users going with their devices, but it won't account for a huge portion of their business.

Product Portfolio -

- Looking at Kyocera's list of devices, both their PTT-enabled smartphones and feature phones have done well for their overall business. With their PTT-enabled feature phones they have dominated this segment of the market and are doing very well from a volume perspective with a number of different carriers, in particular Verizon. Kyocera phones that are currently stocked with major carriers like Verizon and AT&T include the Dura XV/XE series, the DuraForce and DuraForce PRO, the DuraForce XD, the Hydro Series (SHORE, AIR, & ELITE), the Cadence LTE, and the Brigadier.
- Some of their most widely used devices when it comes to sales volumes/use cases would be the DuraForce PRO and the DuraForce XV/XE series. The DuraForce Pro is a 4g/LTE capable device and has features that include a super wide view HD action camera, long battery life, dedicated PTT buttons/keys, loud dual front speakers, fingerprint authentication, voice recognition, call waiting/forwarding, and even a touchscreen operation feature for workers using gloves throughout the day.
- The DuraForce XV series (LTE and +) is an ultra-rugged feature phone with an ergonomic design, powerful dual front speakers, dedicated PTT buttons/keys, has camera/non-camera version, and is ideal for use in hazardous work environments. The DuraForce XE is another one of their popular rugged feature phones with features that include a dedicated side button for AT&T's Enhanced PTT support, certification for HazLoc protection, a 5MP camera, loud dual front-ported speakers, and supports EAS for improved email synchronization/communication.

Key Differentiator/Outlook- Moving forward for Kyocera they recognize PTT as an opportunity for them in terms of capturing users who are transitioning from legacy LMR systems given all of their ruggedized device offerings have dedicated PTT buttons and an embedded PTT client. They have seen demand increasing in areas like transportation, construction, utilities, and public safety where many of their carrier partners are starting to request MCPTT capable devices, which is something they currently have in their roadmap. While adoption of PTT in construction has been slow in the short term, this adoption is expected to pick up in the long term as more organizations are looking to replace their legacy LMR systems and workers become more comfortable using other capabilities like messaging. This a trend Kyocera has seen in the PTT space, and many organizations have started to utilize more messaging applications rather than traditional PTT solutions. Kyocera has also been able to create strong relationships with carriers in the retail sector specifically. Competitors like Sonim Technologies and Caterpillar, Inc. don't have as a robust channel as Kyocera when it comes to retail, and it bodes well for them that about 60-70% of people buying phones to use for business are still buying them individually at retail. In terms of replacement, transportation has been a sector where Kyocera has seen school buses, fleets, taxis, etc. doing away with their LMR systems and transitioning to PTT-enabled devices with some type of car kit. Outside of PTT, adoption of Kyocera phones are driven by solutions such as MDM, fleet management, asset tracking with RFID, timekeeping, mobile forms, and accessories like barcode scanners and mounting solutions.

Mobile Tornado

Company Overview- Mobile Tornado, founded in 2000 and headquartered in the UK, is a leading provider of PTT solutions for Tier 1 mobile network operators focused on providing workforces with instant voice communications. Mobile Tornado is a key player in the Push to Talk over Cellular (PoC) space and their customers consist of primarily Tier 1 mobile carriers like TELUS, Vodacom, MTN, Telcel, Partner Group, and Claro (Colombia, Ecuador, Brazil). TELUS, who they have been working with for around 4 years, is one of their biggest customers and recently extended their contract with Mobile Tornado for another 3 years. Looking at their regional footprint, ~50% of Mobile Tornado revenue is coming from North and Latin America, ~20% from Africa and other 30% from Europe and Israel. As a company Mobile Tornado isn't as focused on the public safety market in the US but do have some large government and public safety customers in South America and Africa. They currently see more opportunity for them to grow in commercial markets like security, transportation, logistics, hospitality, , EMS services, and manufacturing. Private security is one of their biggest markets where they are working with G4S in several different countries and other medium-large security firms around the world. They also have a stronger than normal presence in waste management (Canada & Colombia) and EMS where the majority of ambulances in South Africa are leveraging their solution for better service.

Go-to-Market Trends - Given that the majority of Mobile Tornado's customers are carrier organizations they operate in these channels the majority of the time. For Mobile Tornado, creating these carrier relationships is seen as the most efficient method for creating awareness around their solution and being able to train and educate the carrier sales teams on operating the PTT business and selling the solution is critical for promoting the solution in certain sectors. In addition to this, they rely on VARs to sell their solution in certain regions where they don't have direct relationships with the carrier. They also have several VARs who have their own system (independent service providers) and will just buy the SIM cards from the carrier.

Product Portfolio-

- **Push-To-Talk** – A PTT application that runs on a wide range of devices (Android and iOS) and has global coverage over IP networks (cellular, Wi-Fi, LAN, others). Key features include ultra-fast setup time, very high voice quality, real-time sub second voice communication for large group calls, private & large group calls and user presence/status sharing.
- **Push-To-Message** – Real-time text messaging with individuals or groups. Features include private communications, queue management, communication interface and fast delivery of messages.
- **Push-To-Alert** – When users are in an emergency or at risk they can send an alert to dispatchers or control rooms by pressing an SOS button. Key features include automatic location identification when the SOS button is clicked, event management, high priority call with preemption, ambient listening option and voice recording.
- **Push-To-Locate** – Allows for tracking individual users, crew members, and dispatched workers on a map. Key features include global coverage, 24/7 real-time monitoring & tracking, and ability to audit logs of locations.
- **Dispatch Console** – Through an intuitive user interface, controllers and dispatchers can participate in multiple PTT sessions in parallel, manage call priorities, assist lone workers in imminent peril, manage emergency events, manage geo-fences on map for better tracking of individual users and provision users and talk group. Controllers can easily see recent activity around calls, messaging, alerts, location history, and audio recordings.
- **SDK** – The Software Development Toolkit for Android developers is designed for customers who want to easily incorporate PTT functionalities into their existing private applications and workforce management environments. The SDK enables the use of all the PTT functions offered by Mobile Tornado (Talk, Message, Alert, Locate) and it comes with reach documentation and example code.

Key Differentiator/Outlook –Mobile Tornado is focused on serving the private sector and governmental agencies with mission critical communications needs. Mobile Tornado also penetrated the public safety sector in South America, Africa and the UK. . While a big portion of their revenues is coming from North America, the biggest growth opportunities they see are in regions like South America and Africa where there are a lot of PTT users that want to either augment or replace their aging proprietary iDEN and LMR infrastructures and systems. They have also seen success with their new SDK offering that is being used by solution providers for workforce management. They typically will use the Mobile Tornado SDK to integrate PTT specific functionalities in their own applications. For example, several customers in South America are using Honeywell devices with the Mobile Tornado SDK and their own application on the front end. Looking at differentiators for Mobile Tornado, the biggest ones are their recently launched SDK which has seen success, their ability to create deeply entrenched relationships with carriers, and their ability to build relationships with device manufacturers like Sonim, Samsung, Siyata Mobile, Telo Systems and RugGear. Therefore, their solution is fully optimized for specific form factors. As a small company Mobile Tornado can make a significant market out of PoC over some of the bigger organizations operating in this space. Both existing LMR and iDEN users offer market opportunity in the PoC space, but Mobile Tornado views the iDEN users as the low hanging fruit while transitioning LMR users offers more opportunity for them in the long term.

Company Overview- Motorola Solutions, Inc., founded in 1928 and headquartered in Chicago, IL, provides communication infrastructure, devices, accessories, and software to a variety of industries across the globe. In the LMR space, Motorola has continued to see success over the past 2 years primarily behind their heavy presence in the public safety sector. In both commercial and public safety settings, they have a global installed base of around 12,000 LMR systems. Motorola is the clear leader in the public safety LMR space in the US, where they have a significant market share lead.

Go-to-Market Trends- In terms of GTM for Motorola, given they are an extremely large company they have a mix of both direct sales and indirect sales. For the indirect sales, they leverage their extensive dealer network in each specific region to sell their product. Some of their biggest dealer partners include BearCom, Mobile Communications, and Leading Edge Wireless. Motorola also does a good portion of their sales directly with the customer, and this usually occurs in the public safety space where they have a big presence and many gov't agencies require the manufacturer to work directly with them rather than using a VAR/dealer/distributor.

Product Portfolio-

- **APX Series P25 radios** – This is one of their most popular product lines, and they have seen particular success with the APX 8000. These series of radio are built for mission-critical communication, have good ergonomics, and can guarantee interoperability with other public safety agencies.
- **WAVE Solution** – This is Motorola's OTT PTT application that can connect to disparate systems so users can communicate between smartphones and radios. Most users leverage WAVE OnCloud, which is the subscription based PTT app that doesn't need traditional on-premise equipment. Key features of the WAVE solution include group/individual/private calling, real-time mapping, messaging capabilities, secure communications, and presence indication.
- **MOTOTRBO Solutions** – Motorola's line of professional two-way radios that can be geared towards primarily commercial users. MOTOTRBO offers a portfolio of analog and digital radio that enable voice and data communications. Key features include high audio quality, good coverage, long battery life, and durability/reliability.
- **ASTRO 25 systems** – Motorola offers ASTRO 25 systems, built on the P25 North American LMR standard for public safety. These systems are built with resilience, have multiple levels of redundancy, fallback modes, secure communications, and great coverage. ASTRO 25 offers single site systems, multi-site conventional systems (K Core), large trunked systems (L Core), and regional/statewide site systems (M Core). The G-Series hardware platform is the primary building block of ASTRO 25 radio site equipment.
- **Public Safety LTE** – Offer broadband LTE devices, applications, and solutions geared toward the public safety market. They have a key alliance with Ericsson in public safety LTE, to delivery efficient and reliable solutions to public safety users across the globe. They just released a new mission-critical LTE smartphone called the LEX L11. It was specifically designed to support operations on the Band 14 spectrum dedicated to FirstNet, and can integrate with existing P25 systems. The LEX L11 is an upgraded version of their original public-safety LTE phone, has a consumer-grade smartphone look, and has all the features and capabilities first responders anticipate in a device optimized for public safety. Some of these features include a PTT button, an emergency button, high quality screen resolution, a fast processor, and an increased amount of memory.

Key Differentiator/Outlook- Moving forward for Motorola, they continue to see solid growth on the public safety side behind tier 1 cities/counties upgrading/replacing their P25 systems. This continued growth in P25 systems and multi-year managed/support services contract has benefited Motorola, who reported that approximately 65% of the company's total services revenue came from LMR managed and support services contracts. With a serviceable addressable market around $16B in public safety LTE, LMR, and managed/support services Motorola is well positioned to capture additional share. Their key differentiators is the fact they are deeply entrenched in the market with their products/services/installed base of LMR systems, and put a high emphasis on seamless LMR-LTE interoperability which will be critical for their business moving forward. They have made some very promising moves over the past few years that has led to this LMR growth, some of which include rebalancing their R&D spend for LMR (from 2014 to 2017 reduced LMR spend from 75% of total R&D budget to 55% of total R&D budget), and outsourcing the majority of their manufacturing to Sanmima. While there has also been much discussion around how PoC solutions will impact the LMR market, Motorola is very well positioned to combat these concerns as they are focused on public safety LMR (good growth outlook) and have acquired Kodiak, the leader in broadband PTT, whose platform is being used by all the major carriers in North America.

Company Overview- Orion Labs, founded in 2013 and headquartered in San Francisco, provides wearable devices and a voice/messaging communication platform for people, group teams, bots, and intelligent agents. They take a platform level approach to the market and provide real-time person to person/ person to machine voice communication services across a secure platform that spans mobile apps and integration with 3rd parties. They are backed by investors that include Avalon Ventures, Argentum Capital, and Allen & Company LLC. Their latest round of funding (Series B) came in September of 2017 where they received financing of around $18.25 million. Orion Labs has done work and enterprise app integration in industries that include public safety, healthcare, hospitality, retail, mining/construction, transportation/logistics, and manufacturing. The first commercial customer for Orion was a small pediatric hospital in the US, and they are also working with a large mining/construction company that has over 50,000 employees.

Go-to-Market Trends- In terms of GTM strategy for Orion Labs in the commercial sector, they launched a new channel program in 2017 where they began leveraging a multi-channel strategy. They have been leveraging operators as one route to market, selling their wearable device through Amazon/Home Depot/ Orion web shop, and have been using the traditional IT channel where they have been teaming up with a broad range of partners. The key goal for Orion is to continue to look for focused partners who want to add Orion services to their portfolio, and are well versed around areas like voice communication, collaboration, and mobility. Orion is working with device manufacturers like Sonim and Kyocera where their app (on both Sonim XP7 or above & any Duraforce product) has complete integration with their dedicated PTT buttons. At a practical level they are also working with a variety of interoperability vendors, like JPS, around line level bridging. A two-tier distribution model is currently not implemented for Orion as of right now, but they do foresee themselves leveraging this as their channel continues to expand and grow. They aren't doing any specific vertical marketing given they have just entered this market, and for the most part are just processing inbound leads.

Product Portfolio-

- **Orion Pro** – Orion Pro is a subscription based PTT solution primarily aimed at businesses and costs $6 per user per month. This plan is ideal for business with multiple teams. Customers can also purchase the basic Orion plan which is free up to 5 users and is more suitable for individuals and smaller businesses.
- **Onyx** – Onyx is Orion Labs smart push-to-talk wearable device that is designed to provide a PTT experience on both enterprise grade devices and consumer grade smartphones (iOS and Android). It pairs using BLE as a network extension into their own application. It can operate in both cellular and Wi-Fi environments and currently costs $100. Onyx can be obtained by selecting either the Basic or Pro plan. Key features of the device include volume control, silent mode, 12+ hour battery life, LED display lights, and dual microphones. Onyx also comes with a charging cable and travel pouch.
- **AppTalk** – This is a secure walkie-talkie application for smartphones that is ideal for staff members who don't have an Onyx device and want to communicate with team members who are using the Onyx device in mobile/field-based environments. AppTalk is available on iOS and will be rolling out to android soon, and can be accessed by pressing the "Join and Talk without Onyx" button in the Orion app.
- **AppTalk Plus** – AppTalk Plus is essentially the same as AppTalk, but instead brings walkie-talkie style communications to businesses rugged smartphones across any distance, any carrier network, and over Wi-Fi. One of the unique features AppTalk Plus has over carrier PTT solutions is that it can instantly translate languages via the Orion Translator. It's works on devices that include the Kyocera DuraForce PRO, the Sonim DuraForce PRO XD, and the Sonim XP7/XP8.
- **Orion Radio Bridge** - Orion Radio Bridge integrates traditional land mobile radio (LMR) systems with Orion, to extend the range and reach of traditional communications without adding radios or signal-boosting equipment. It also gives traditional radio users all the superpowers of Orion without requiring an overhaul of existing radio setups. They are currently partnered with vendors like JPS and Mutualink around this product.
- **Orion + IFTT** – This allows users to get voice alerts from Onyx devices, and use those to set up phrases to initiate workflow automations. Users can setup IFTT applets that notify them when a phrase is said, a specific door is opened, an email is received, etc.

Key Differentiator/Outlook – With Orion Labs their goal is not to go in and tell a business how they should be operating when it comes to workforce communications, but rather approach organizations by simply guiding/providing them with advice and insights on the types of new voice driven applications/next generation solutions they can deploy. With their latest round of funding Orion has used the money to expand their existing sales team, develop additional partnerships, and roll out new services like the translation voice bot. With the Onyx device and Orion's translation voice bots, users can translate voice messages into other languages in real-time. Orion has also already been deployed in some early FirstNet tests and while they don't expect to generate revenues from FirstNet in 2018, they do expect growth in come in 2019 and 2020.

Company Overview- RugGear, founded in 2006 and headquartered in Hong Kong, designs and manufactures ruggedized phones for customers in regions that include North America, South America, EMEA, and APAC. The company also offers handsets and accessories with rugged capabilities. The company currently has around 400 employees.

Go-to-Market Trends- RugGear views themselves as a rugged hardware player who offers a product portfolio from prosumer to enterprise. They are one of the few fully integrated players from engineering to manufacturing over to sales and distribution, and have done ODM for many brands in the past.

Product Portfolio-

- **Rugged Basic Phone**- RugGear offers the RG100, RG129, RG160, and RG310. These rugged basic phones include strong speakers for use in noisy environments, Bluetooth, water and dust proof according to IP68, and have military standard 810.
- **Rugged Smartphone**-RugGear's rugged smartphones include RG730 and RG740 that offer internal memory up to 32GB and 2GB of RAM, 13MP rear camera, 5MP front camera, waterproof for up to 30 minutes, and GPS location services.
- **Rugged Tablet**- The company offers the RG910 that is a tablet with an integrated battery and offers Bluetooth, 4GLTE, withstanding temperatures down to -20 degrees Celsius, IP68, military standard 810, GPS location services, PTT, and usable with gloves.
- **Rugged Crossover Device**- Offers crossover devices that include the RG720 and RG760 with IP68, private LTE band 31, 2-way radio capabilities, military standard 810G, industrial scanning camera, and android OS.
- **iSafe Phones** – RugGear has also partnered with a company called iSafe who focuses on devices geared toward sectors like utilities and oil & gas. This is an attempt to increase their presence in these sectors with 6 different offerings (Innovation 2.0, IS320.1, Challenger 2.0, IS310.2, IS730.2, and IS740.2)
- **Accessories**- Includes solar powered autonomous tracking devices, rugged speakers, rugged cases, and rugged chargers.

Key Differentiator/Outlook- RugGear has seen some success selling their devices into PTT specific use cases but it not a huge portion of their business. They have worked closely with organizations like Kodiak and Mobile Tornado around these integrations, and are continuing to expand in this area. While the US hasn't been their core focus market in the past they see more opportunity for PTT use cases/business given it is more mature market than Europe and even APAC. Despite APAC organizations still evaluating/implementing PTT for their workforces, RugGear is still working with customers around this and recently just did a PTT deployment with a hospitality customer in Singapore. Overall the biggest differentiators for RugGear is the fact they have deep ties in the ruggedized market, come from an ODM background, and have pretty much optimized their manufacturing processes and small SKU customization.

Company Overview- SafeMobile, a fully owned subsidiary of American International Radio, was founded in 2001 and created to deliver data and communication management solutions to commercial and gov't businesses across the globe. Their initial product offerings in this space were around AVL tracking for fleet management/ voice dispatch consoles in the LMR industry but have since introduced a new broadband PTT solution called LINX, which commercially released in April of 2018. Their focus is not just to be a siloed PTT app, but to provide a complete unified communications solution in one system. SafeMobile's corporate office in North America serves more than 250 dealers and an additional 14 offices throughout EMEA regions serve more than 225 dealers. The company also has 4 dealers throughout Latin America and several in the AU/ NZ/ APAC region as well. In terms of their business breakdown, about 40% of their revenues are from US markets while 60% is from international markets. They were also one of Motorola's first application development partners in this market and maintain this partnership today.

Go-to-Market Trends- SafeMobile plans on leveraging a SaaS model in North America for their LINX solution, similar to others in the marketplace. They will leverage some existing partners to sell their solution and are more focused on growing their channel of broadband partners rather than pursuing a direct sales model for LINX. It's expected that SafeMobile will have a more difficult time selling their solution into North America rather than EMEA due to carriers' heavy entrenchment in public safety use cases, which is not SafeMobile's core market. Another area they have been exploring is integration with enterprise specific equipment. They have partnered with Zebra, are resellers for purpose-built device manufacturers like Sonim and RugGear and can also run their solution via BYOD programs as long as the device spec is above Android 4.0.

Product Portfolio-

- **LINX Solution** – LINX is a broadband application that consolidates technologies like PTT, GPS, messaging, and security alerts into a single solution designed for both rugged and consumer grade devices. Their platform operates in a cloud environment but can do on-premises as well. Key features of the solution include instant PTT, live presence notifications, GPS tracking, text messaging, call recording/solution monitoring, worker's security alerts, data/image files transfers, and a desktop dispatching dashboard with PC PTT, Live Command & Control, messaging features and comprehensive analytics/reporting capabilities. To begin with, the LINX solution will be primarily marketed to enterprise customers. SafeMobile does plan on targeting public safety uses cases but tis not a driving focus as it involves a long certification/ documentation process. The key sectors SafeMobile has been doing the most business development & channel work for have been transportation/logistics, warehousing, hospitality/security/events, supply chain, and oil & gas.

Key Differentiators/Outlook- Given that the LINX solution was commercially released in April of 2018, they are very much still in the early adoption phase in North America. 2017 and 2018 have been the years of trials/pilots, and in 2019 they suspect to see more adoption and tenders for their LINX solution. The major points SafeMobile have been driving are that they are offering a complete unified communication solution rather than a siloed PTT app, and LINX can be customized to suit their customers' individual business needs and challenges.

Company Overview- SAVOX Communications was founded in 1982, with over 30-years of experience serving the Police, Security, Fire, Rescue, Military, Maritime and Industrial markets, Savox offers communications products designed for use in demanding and hazardous environments. With headquarters in Finland, SAVOX has over 300 employees with operations in United States (Lincoln, Nebraska), United Kingdom, Germany, and in the APAC Region The knowledge SAVOX has built around requirements set by the end-users, their working environments, governmental and industry standards used by these hard-core professionals allows the company to create the most innovative and end-user driven solutions available. Savox Communications, manufactures safety, rescue, and communication solutions that are used by various mobile workforces in government, public, and private sectors. The company entered the PTToC accessory market about 8 years ago and provides PTToC accessory products to a variety of organizations. Savox Communications most important markets include industrial, security, defense, transportation, logistics, warehousing, and oil and gas. Savox sees the most traction for their accessory products in North America.

Go-to-Market Trends- Savox leverages a mixed model where they sell accessories through traditional distribution and carrier channels as well. They have also seen a fair amount of success working with system integrators who will pitch the Savox accessory offering as part of a complete solution to the customer. They will be looking to expand their existing SI network given the success they have seen here over the past few years. They are also looking to expand their partnerships with both device manufacturers and application vendors. They do sell direct to the customer but this is a smaller portion of their business and is done with their larger accounts/customers.

Product Portfolio-

- **Savox Promate Lite/BT COM** – Savox offers both wired and wireless accessory devices. The Lite COM is a wired PTT accessory that is lightweight, robust, easy to use, built in microphone, and has long battery life. The BT COM is a wireless Bluetooth PTT accessory that has two 3.5mm headset connector options (standard and rugged), long battery life, volume control, on/off pairing, and multi-function button.
- **Remote Speaker Mics** – Savox offers both wired (RSM-30 and mobileRSM) and wireless (BTR-155) speaker mic accessories that have clear audio quality, ergonomic designs, volume control, long battery life, and duplex call functionality. The mobileRSM is ideal for trucks and fleets where it is specifically designed for in-vehicles use, complies with U.S. DOT regulations, and has a dash-mounted clip.
- **Headset/ Ear Accessories** – Savox offers both wired and wireless earphones/buds and headsets. The RWE-100 is an adjustable, fully rotating earbud with rubberised G shaped loop with coiled cord or straight cable. The RWE-101 is a high quality rugged wired earphone for people working in high noise environments. The RWE-102 is an acoustic tube earpiece designed for listen only semi covert applications.

Key Differentiator/Outlook – The biggest differentiator for Savox with their PTT accessories is audio quality. All of their accessories are built with very clear/high quality audio, regardless of the size of the accessory which plays an important factor. The sector that Savox has seen some of the most success in the past year has been transportation, where they have seen implementation in garbage trucks, fleets, taxis, buses, etc. In general PTT accessories are ideal/make a lot of sense for the transportation sector where factors like driver safety and regulations around the DOT come into play. Outside of transportation, they see growth/business coming from sectors like construction, industrial, the concrete industry, and public safety.

Company Overview – Siyata Mobile, Inc., headquartered in Montreal, Canada, is a global developer, designer and supplier of cellular communication systems for primarily enterprise customers in the transportation sector. Within transportation, they specialize in providing fleets, trucks, buses, etc. with a number of different connected vehicle devices. Outside of transportation, they cater their products to verticals that include waste management, Oil & Gas, and public safety.

Go-to-Market Trends – In terms of GTM strategy for Siyata, they sell their products and services through carrier partners, directly to end users as well as through partners. Siyata has entered into carrier relationships with AT&T to support its recently introduced in-vehicle LTE PTT solutions. Siyata recently received FirstNet certification from AT&T for its UV350 vehicle mounted device. FirstNet is built with AT&T in a public-private partnership with the First Responder Network Authority (FirstNet Authority) – an independent agency within the federal government. It is designed for first responders and those critical to their emergency response and strategically positions AT&T's communications solutions among primary and extended primary first responders. Siyata expects to sign on additional carriers in North America through the end of 2019, significantly expanding its market reach.

Product Portfolio: UV350 – Siyata Mobile recently launched the UV350, a uniquely differentiated LTE PTT solution designed for in-vehicle use among field-based frontline mobile workers. Siyata Mobile designed the UV350 to address many of the challenges workers have today with their current in-vehicle communications solutions. Compared with current in-vehicle communications solutions – including phones with 3rd party car-mount kits, tablets mounted in vehicles or LMR radios – the UV350 offers some distinct advantages. The table below illustrates some of the key benefits of the UV350 when compared to alternative in-vehicle communications options.

	UV350	Phone with 3rd Party Car Kit	Tablet Mounted in Vehicle	LMR Radio
Superior in-vehicle audio quality	✓			✓
External antennas providing superior cellular receptivity and GPS location	✓			
Dedicated easy to reach and use buttons designed for safe driver operation	✓			✓
Designed to withstand the environmental rigors of in-vehicle conditions (temperature extremes; vibration; excessive dirt and dust)	✓			✓
Fully integrated solution designed provide long lifecycle and low cost of ownership	✓			
Always-on and ready for use	✓			✓
Superior LTE and 3G Network Coverage	✓	✓	✓	
Support Modern Mobile Apps (AVL; Dispatch; Navigation; etc.)	✓	✓	✓	
Serve as Modem for IoT Devices and WiFi Hotspot	✓	✓	✓	

Key Differentiators/Outlook – Siyata Mobile's core value proposition is delivering communication solutions for today's business and mission critical workforce. This includes their ability to do audio in a vehicle in a very loud, clear, and reliable manner and addressing many of the other requirements – from driver safety to total cost of ownership – for this unique audience. While the majority of manufacturers struggle to get audio optimized in a vehicle, Siyata has a real differentiation in this area where their solution has clear audio quality and is the only LTE in-vehicle device (Uniden UV350) compatible with FirstNet frequencies. Moving forward for Siyata's core market focus for the UV350 will be any sector with fleet operations which in the United States alone represents over 24 million vehicles. This includes transportation/logistics, oil and gas, public sector/public safety and other sectors with commercial fleet operations. Public Safety represents a huge opportunity for Siyata not only with FirstNet, but also with secondary level personnel in town construction, waste management, and school/administrative roles.

Company Overview: Sonim Technologies is the only U.S. manufacturer that makes mission-critical smartphone-based solutions designed specifically for workers in extreme, hazardous and isolated environments. Sonim's portfolio of products includes ultra-rugged mobile phones, business-process applications and a suite of industrial-grade accessories collectively designed to increase worker productivity, accountability and safety on the job site. Sonim's industry-leading, three-year comprehensive warranty has redefined customer expectations for rugged technology. The company is headquartered in San Mateo, Calif., and offers its products via the world's largest mobile operators. In 2017, Sonim served the industrial verticals with its Sonim XP5 featurephone and Sonim XP7 smartphone devices through tier one mobile operators in North America, and continued to expand its focus to include the public safety and first responder community. The Company also recently launched the Sonim XP5s and Sonim XP8, devices that are designed by, and for, industrial users and public safety/first responder users alike. Both devices support the LTE Band 14 spectrum used by the FirstNet public safety broadband network in the U.S. In addition to public safety, Sonim operates in commercial markets like transportation & logistics, utilities, mining, oil & gas, construction, hospitality, forestry and manufacturing.

Go-to-Market Trends: In terms of GTM strategy, partnering with carrier organizations and leveraging their existing channels/dealer networks has been the primary model for Sonim – it is how they sell 90+ percent of their products. This will be the primary model for the FirstNet business, and they will heavily subsidize their devices for FirstNet users. While it is a very difficult task to get carrier approval as a stocked device, Sonim has been able to break these barriers and secure stocked positions for their devices at tier one carriers across North America, including AT&T, Verizon, Sprint, and Bell Canada.

Product Portfolio:

- **Rugged Basic Phones**: Includes CDMA, GSM, HSPA, and LTE Band Class 14 phones. Specifically, the new Sonim XP5s is an ultra-rugged Push-To-Talk (PTT) handset designed to survive and thrive in extreme environments. The XP5s couples clear, crisp communications with built-for-work features that are most beneficial to those workers who serve the public. The PTT handset is also a scalable platform that is easy to use with mission-critical applications, while featuring an innovative audio connector for secure connectivity to enterprise-grade accessories – all without the need for batteries. The XP5s integrates ultra-rugged features, including:
  - **Ingress Protection (IP)-68, Military Standard 810G** certifications for hazards and Non-Incendive Class I, II, and III Div 2 ratings, making it waterproof and dustproof and built to military specifications.
  - **Large, tactile and intuitive PTT, SOS and volume buttons**, controls and keys to support fumble-free communication.
  - **Extremely Loud & Clear Audio communication**, including 100dB+ speaker and noise cancellation, support for traditional voice calls and EPTT talk-groups.
  - **Dual-shift battery life** of up to 25 hours of talk time or 25 days of standby time.

- **Rugged Smartphones**: Includes GSM, HSPA, and LTE Band Class 14 phones. Specifically, the new Sonim XP8 is a new ultra-rugged Android smartphone that's designed to empower public safety workers to focus on protecting and serving our communities. It delivers exceptional toughness by meeting Ingress Protection (IP)-68/69 and Military Standard 810G certifications for hazards, making it waterproof, shockproof, scratchproof and dustproof. The XP8 also integrates a puncture resistant 5" touchscreen that works with gloves or wet fingers and is visible in direct sunlight, while providing up to 35 hours of talk time or 600 hours of standby time. The new XP8 features ultra-rugged functionality, including:
  - **Extremely Loud & Clear Audio** with a 100dB+ speaker and noise cancellation, supporting traditional voice calls, as well as Push-To-Talk (PTT) talk-groups.
  - **Sonim's XP and Interface**, which extends the capabilities of the handset through rugged attached peripherals, such as Direct Mode Modules.
  - **A Handset Powered Audio Interface with locking mechanisms**, which securely attaches mission-critical audio accessories that are powered by the handset.
  - **Gloved hand/Wet finger operation** for applications, such as initiating the camera or video. The XP8 also includes a large, dedicated button for PTT.
  - **A dedicated SOS red alert button** for 'lone worker down' solutions, allowing public safety workers to initiate an emergency voice call to responders when needed. The XP8 also includes intelligent accelerometer monitors to detect potentially hazardous events or situations.

The Sonim XP5s and XP8 devices were launched at the 2018 IWCE Show in Orlando, Florida, in March 2018. FirstNet, built with AT&T, was the first communications platform to announce support for both devices. Additionally, Sonim's XP5s is also currently available at Sprint. The XP8 and XP5s both come with built-in LTE Band 14 access. Band 14 is special spectrum licensed by the First Responder Network Authority that will be used to further build out FirstNet. This gives first responders access to even more coverage and capacity on the FirstNet platform. The XP8 device is also expected to be leveraged by primary users like first responders, EMS personnel, and law enforcement while the XP5s device is geared toward extended primary users like government, hospital, and school/education personnel.

Key Differentiator/Outlook: Sonim will continue to market and sell products to both the commercial and public safety sector which consists of over 40 million workers in North America alone. The Company sees the market for PoC solutions moving in the right direction and expects to see adoption numbers increase over the next several years. Specifically, Sonim expects to see significant revenue growth over the next 3-4 years. In terms of public safety, they will initially recognize revenue from FirstNet in 2018, but it will be significantly larger in 2019 and 2020 as adoption increases, standards are updated, and coverage is more readily available. The company also recently benefitted from two $10 million infusions from JVCKenwood and also Motorola Solutions. On the commercial side, the Company sees expansion with its existing customer base but will continue to focus on interoperability with narrowband systems in the market today, and will partner with application vendors (it currently has more than 500 application partners) around integration into existing and new Sonim devices. Sonim's key differentiator, which the Company will have to maintain moving forward, is strong established relationships with carrier organizations, as well as being the only U.S. manufacturer that makes mission-critical smartphone-based solutions designed specifically for workers in extreme, hazardous and isolated environments.

Company Overview- Sprint Corporation, founded in 1899 and headquartered in Kansas, provides wireless and wireline communications to consumers as well commercial/government businesses in the US, Puerto Rico, and U.S. Virgin Islands. In 2004, Sprint entered the PTT market with the acquisition of Nextel. At its peak the iDEN network had an estimated 20-25 million users, but with the emergence of 3G Sprint made the decision to shut down the iDEN network and migrate Nextel subscribers off onto their new 3G network. In preparation for the Nextel shutdown in 2013, Sprint launched their current Sprint Direct Connect solution with Qualcomm's Q-Chat platform. Sprint has now transitioned to Kodiak's platform for their new Sprint Direct Connect Plus solution which allows workforces to communicate instantaneously and in real-time. In addition to Sprint, the Kodiak platform is being leveraged by carriers like AT&T, Verizon, and Bell Canada. Sprint's Direct Connect Plus solution currently has customers in industries that include public safety, construction, logistics, healthcare, and retail.

Go-to-Market Trends- Sprint leverages their existing B2B sales channels in order to market and sell their Sprint Direct Connect Plus solution. In terms of pricing, Sprint leverages the traditional CPU per month model where customers have a monthly recurring charge and can buy pools of data/minutes (stand-alone PTT pricing). Sprint also allows customers to leverage the SDC platform on a per seat basis, which is essentially a license for a device that has the SDC application integrated into it. In terms of devices the SDC application can be used on, these include vendors like Apple, Samsung, Kyocera, and Sonim.

Product Portfolio- Sprint Direct Connect Plus is a push-to-talk solution that allows workforces to communicate instantaneously and in real-time. Key features of the solution include one to one PTT calling, group PTT calls of up to 250 users, broadcast calling of up to 500 users, real-time presence, alert notifications, and fast setup time. The solution has nationwide coverage where Sprint coverage is available, and also works where roaming is allowed with the user's data plan and Wi-Fi networks.

Key Differentiator/Outlook – The market for carrier-integrated solutions has continued to grow over the past few years and the Sprint Direct Connect solution has done well. There has been a lot of excitement around LTE and faster data speeds, and end users don't need to define themselves as one type of technology user, but rather a user of converged services.. Moving forward, Sprint specifically sees opportunity to expand with their SDC Plus solution outside of traditional PTT workgroups that are transitioning to smartphone form factors and are looking to enable PTT functionalities.

Company Overview- Tait Communications, founded in 1969 and headquartered in New Zealand, designs and manufactures a variety of land mobile radio equipment, systems and software for both the public safety and commercial environment. Today Tait has over 650 people around the world and exports about 95% of their products from their headquarters in Christchurch, New Zealand. The company has presence/existing customers in sectors that include public safety, utilities, oil & gas, transportation/logistics, as well as private security.

Go-to-Market Trends- In North America, Tait currently has a relationship with Harris where they are the exclusive distributor for them in the North America. The agreement in place allows Harris's distribution channel to sell Tait products that are complementary to the Harris portfolio, and allows the Tait distribution channel to sell Harris products that are complementary to Tait. This agreement has been in place since 2016 and has been beneficial for both companies who have been able to combine their dealer channels to deliver more product options to both their commercial and public safety customers. Tait has a significant channel partner network throughout the world to represent the company in all major countries. Tait also has a direct sales channel for key accounts in selected countries, such as Transport for London in the UK.

Product Portfolio-

- **Tait P25** - Delivers P25 solutions with a range of both P25 phase 1 and phase 2 open standard based elements. Offers a variety of portable radios, mobile radios, base stations, and networks.
- **Tait DMR**- Offers digital mobile radios that are Tier 2 or Tier 3 along with a digital communications platform that can be used on portable radios, mobile radios, base stations and networks.
- **Tait UnifyVoice**- This is Tait's unified PTToC solution that provides employees with better/faster access to instant communication and information. It can be used to integrate with existing LMR systems to enhance coverage, expand capacity without adding infrastructure costs, and to add more PTT users within an organization. Key features of the solution include fast setup time, location tracking, security encryption, and ease of use. The UnifyVoice solution is powered by ESChat, one of the leading PTToC providers in the market today.
- **Tait UnifyVehicle**- This platform creates a vehicle area network by combining mobile radio/broadband connectivity with an on-board edge computing/application platform. Key features include API/SDK integration capabilities, an AppBuilder tool, OTAP over Wi-Fi, coverage mapping, Bluetooth tracking, and improved voice/data support.
- **Tait Enable** –This suite of software provides fleet and network management tools, providing customers with the ability to manage, monitor, protect and report on their radio communications assets. Solutions incorporated in the suite include EnableFleet, EnableMonitor, EnableProtect, and EnableReport.
  Analog Radios- Provides several options for analog radio with trunked and conventional options that are capable of simulcast. This includes analog simulcast over IP, MPT-IP, and analog conventional.

Key Differentiator- Tait is one the longest standing independent LMR players in the market, and their key differentiators include significantly tough devices and resilient networks that integrate critical communications across both LMR and cellular technologies with a significant commitment to open standards rather than proprietary technology.

Company Overview- TASSTA, founded in Germany, offers voice communications, messaging, and data solutions to the professional mobile radio market. Their flagship product is the T.FLEX, an innovative broadband PTT solution for PoC/IP users. TASSTA doesn't just operate as a pure PTT play, and they try to add as many unique and additional features on top of their existing customers basic PTT capabilities as they can. In terms of sectors TASSTA operates in, they go after the same market as traditional radio manufacturers (public safety, transportation, airports, utilities, oil & gas) and any sector that requires a radio gateway as well where they can bridge TASSTA with existing LMR/PMR networks via a middle ware solution. Currently, they have implemented their own full active gateways around 7 to 8 different LMR vendors (Motorola, Harris, Hytera, Icom, Tait, Sepura, JVCKenwood). TASSTA doesn't just focus on the voice aspect of professional communication, but have extended capabilities like GPS/indoor localization, task management, encryption, lone worker protection, and remote camera/mic control. They were originally started in Germany (where have about 30-40% of their revenues) but have offices in Atlanta and Dubai as well. The remaining 60-70% of TASSTA's business comes from international markets where they typically partner with organizations on the ground in that specific country. In terms of operating systems they support for their customer, approximately 85-90% are on android while the remaining 10-15% are on iOS.

Go-to-Market Trends- In their home country of Germany TASSTA primarily sells their solution directly to the customer, while in international markets they partner with VARs/distributors who operate on the ground of that specific country. In terms of their primary business/pricing model, they usually sell one time server licenses and client licenses, for which the customer then essentially has for life. While TASSTA has been in the market since 2005, they just recently started to expand their presence in the US. When they first entered the US market they decided to deploy a direct sales model, but found it very difficult and time consuming to generate and build up the business. Since then they have hired a US sales representative and are leveraging partners more effectively to create awareness around their solution. They also plan on leveraging a subscription based model (OPEX) in the US rather than their traditional pricing model.

Product Portfolio-

- **T.LION**- A communication server and the main component of the TASSTA Network. T. Lion is able to share resources on requests between clients and is available as a cloud or stand-alone Installation. Features include scalability, network security, data/voice encryption, and fleet management. .
- **T.FLEX**- Application running on portable touchscreen devices, smartphones, tablets and laptops. This application is also designed to run on IP networks including 2G, 3G, 4G, and WiFi. Features include group, individual, user priority, priority dynamic group and emergency call along with Text and Data exchange.
- **T.RODON**- This is TASSTA's command & control center solution. It can be setup as a desktop application that grants users a dispatch solution or can run in mobile environments.
- **T.BRIDGE**- Professional middle ware solution interconnecting TASSTA and PMR networks. Features include flexibility, compatibility, and scalability. The Solution can be bridge TASSTA with the top LMR manufacturers in the market today.
- **T.RECORDER** – A software solution for recording, voice replaying, and data communications in the TASSTA network. Features include GPS recording, channels activity, connection stats, login changing, individual and group calls recording, message recording, emergency calls recording, and data export.
- **TR.PRO** - TR.PRO Compact Dispatcher is a dispatcher from radio users for radio users. TR.Pro provides a dispatching solution with features of the radio to all radio users. It supports group and individual calls, messaging and status messages, GPS localization, voice recording, emergency calls and group changing.

Key Differentiators/Outlook – The 2 main differentiators for TASSTA would be the customization of solutions they can provide their customers, and the fact that they consider themselves a complete solution provider. In terms of overall business strategy their main goal is not to fully replace an existing LMR solution, but to augment it with TASSTA via a middle ware solution so the users can enjoy the benefits of both. Many of TASSTA's customers still heavily rely on their LMR systems and will continue to do so, which is why full replacement will never be a viable option for TASSTA. As of right now, TASSTA sees the most opportunity coming from their current customer base where people want to continue to add unique PTT functionalities to their existing solutions.

Company Overview- Verizon Wireless, founded in 1999 and headquartered in New York, provides wireless telecommunications services to customers, businesses, and government agencies across the United States. Verizon has had their PTT + product in their portfolio for a number of years, but has started to see more success with it over the past 1-2 years in both public safety and commercial environments. While their PTT subscriber base is estimated to be below 1,000,000, they have been able to market/sell the PTT+ solution into industries like manufacturing, construction, field service, utilities, hospitality, transportation/logistics, healthcare, oil & gas, and public safety.

Go-to-Market Trends- Given that Verizon has a very large wireless subscriber base, they have been able to leverage their existing channel to generate business for the PTT + solution as well as seek customers looking to augment their organizations LMR systems/solutions. They have a dedicated product team around PTT, and have been able to generate strong partnerships with both device manufacturers and accessory vendors so their PTT users have wide range of options when it comes to hardware. Verizon addresses interoperability in two ways. One is their LMR client which essentially simulates the LMR experience on a smartphone, or they can use an IP gateway (RoIP or ISSI) to bridge the gap between PTT+ and an LMR system. In terms of full replacement of an LMR system with PTT + they do have a few customers hospitality evaluating/having conversations around this, but have seen no specific trends on an industry by industry basis. Verizon has always been a strong competitor for larger deals in the U.S. and Europe for MNCs. The establishment of Verizon Business Markets in 2017, a division serving the needs of U.S.-based small to midmarket businesses, state and local governments, and education institutions, creates a structured approach to selling network, communications and security solutions to the small to midmarket. Verizon sells to targeted global multinational corporations (MNCs) through a direct sales force increasingly aligned by vertical markets, with the intent to provide all customers with a single source to efficiently and effectively manage a Verizon account. Pricing of the PTT+ solution is around $5 a month, and is compatible with devices from manufacturers like Apple, Google, Kyocera, Motorola, Samsung, and Sonim.

Product Portfolio- PTT + is a tool that helps collaborate and enable customers to have direct & instantaneous communication within their workforces. The key parameters that make PTT + such an attractive solution include speed, coverage, quality, capacity, and flexibility. Setup time for the PTT + solution is sub 1 second compared to the average OTT PTT setup time of around 2-3 seconds. Coverage is great and users have access to over 2.5 million square miles of Verizon's network, and it is also supported by Wi-Fi to reach beyond the existing Verizon network. From a quality standpoint PTT + has nearly HD voice quality, and they have enabled the solution to have the same prioritization levels as some of their IMS services. Capacity is solid and users can talk one to one, peer to peer, one to many, and they support up to 250 users on a single talk group and up to 500 in a broadcast group. Lastly, PTT + offers flexibility when it comes to device and can be supported on purpose-built rugged device, smartphones, basic 4G handsets, and tablets. Verizon also recently introduced Push to Connect in January of 2018, and it is the same product as PTT + but essentially gives the users PTT functionalities through one button. Push to Connect is an instant collaboration suite that allows a user to send text, files, pictures, videos and location all through the PTT+ applications. Users are no longer required to launch a multitude of apps for each function, and now with one click of the button they have a full comprehensive view of all their PTT capabilities. From an API standpoint, Verizon can also expand and work with customers to integrate their solution into more industry/vertical specific applications.

Key Differentiator/Outlook – In terms of outlook for Verizon with their PTT + solution, they foresee growth coming from commercial sectors like utilities and construction where LMR as a primary means of communication has been decreasing and users want more access to capabilities like messaging, videos, alerts, etc. On the public safety side, Verizon just recently announced the launch of their dedicated public-safety LTE core as a response to FirstNet. With this launch, first responders subscribed on the Verizon network will have access to services like traffic segmentation, priority and preemption, and end-to-end security encryption. Given that Verizon is the market leader when it comes to tier 2 and 3 public safety municipalities/agencies, VDC does expect a decent volume of customers to leverage Verizon's dedicated public safety LTE core. The biggest question that remains is whether or not these agencies that are subscribed with Verizon will be able to interoperate seamlessly with agencies subscribed on FirstNet. Currently these conversations around interoperability haven't begun yet, and realistically it will be take a lot of dialogue and brainstorming between AT&T and Verizon to develop and create a single interoperable platform that can seamlessly provide PTT solutions.

Company Overview- VoiceLayer, founded in 2013 and headquartered in San Francisco, CA, was created as a bottoms up PTT platform that enables 3rd party developers to integrate low latency and highly reliable PTT into their own applications. They have also developed their own PTT smartphone application called Modulo, but their PTT PaaS offering remains their core business. The VoiceLayer platform currently runs on the Erlang Run-Time framework, which was developed by Ericsson. In term of sectors where VoiceLayer has seen their platform being integrated, they have seen traction in areas like hospitality, field service, transportation/logistics, as well as 2nd tier government/public workers. They currently don't have any customer integrations in high risk environments like public safety/first responders and don't plan on entering this space over the near or medium term.

Go-to-Market Trends- So far VoiceLayer has been primarily marketing their platform organically, through channels like trade shows, conferences, and inbound leads from target customers interested in the platform. They currently don't have a full-time Business Development Representative, but moving forward this is an area they will be aggressively expanding. In terms of customer integrations with VoiceLayer, we have seen organizations like Zinc and Chariot leveraging their platform within their own applications. Zinc, who has an application geared toward communication for deskless workers, integrated the VoiceLayer PTT platform into their app and is being used quite a lot among their hospitality customers. Chariot, a transit company which was acquired by Ford Smart Mobility in 2016, has presence in about 5/6 U.S. Cities and has done a similar integration with VoiceLayer where they are leveraging their platform, including support for web-based PTT, and for use in PTT dispatch operations. The pricing for the VoiceLayer platform can vary depending on the size of the organization, but typically customers will purchase the SDK/APIs (available on iOS, Android, Javascript) on a cost per user per month subscription basis and then integrate into their existing application. Their new app, Modulo, is charged on a recurring basis where the CPU per month is around $3.99. Alternatively, if customers pay on an annual basis they will receive a 33% discount ($23.99 a year).

Product Portfolio-

- **Platform**- Built on the Erlang Run-Time System developed by Ericsson, VoiceLayer's infrastructure is fault tolerant, scalable and offers hot code swapping. The platform delivers low latency, works in low-connectivity conditions, and uses little data. It works when the phone is locked and is normally used via a wired or Bluetooth headset or similar accessory. There is also support for IP-Radio gateways. This enables end users to communicate via PTT between smartphones and traditional RF walkie-talkies. VoiceLayer also offers easy-to-use APIs for deep integration with any field app's user and group management, and most of the PTT behavior is controlled by the app using the VoiceLayer SDK.
- **Modulo App** –Modulo is a walkie-talkie app VoiceLayer built on its own platform. It is designed to be used on smartphones. Key features include real-time/low latency PTT, multimedia capabilities (text, videos, docs), ability to use any data network, encrypted message transport, low bandwidth, and team-management console.

Key Differentiator/Outlook – In terms of growth outlook for VoiceLayer, they see a lot of opportunity in the short term around hospitality, dispatch, and field service due to it being a less risk adverse environment. They have seen success here with their integrations, and the biggest challenge they face in this sector is keeping the latency low/reliable when employees find themselves in the worst of conditions (Ex: no Wi-Fi access). While they do have customer integrations in areas like construction, this large sector, in particular, is seen as more of a long-term opportunity for VoiceLayer. There are many challenges associated with bringing a PTT platform offering to the market, but VoiceLayer so far has created a robust Erlang-based platform and have customer case studies/examples that can prove their platform is efficient when used in the correct environment.

Company Overview- Smart Walkie Talkie, based in Singapore, builds a PTT app called VoicePing which is offered along with the PTT devices. They offer smartphone devices specifically designed for PTT, and their app allows business users to combine PTT functionality with these devices or a different carrier grade. VoicePing as a company focuses on sectors like logistics, hospitality, engineering, and private security where the users are particularly in need of fast and instant communication, while at the same time require access to mobile enterprise applications. They don't have any presence in public safety markets and plan on marketing their devices/apps for primarily the commercial market. They are currently expanding their market outside Singapore to other countries in the Asia Pacific.

Go-to-Market Trends- Smart Walkie Talkie does almost 100% of its business directly with customers in Singapore, primarily due to the fact it slower to expand out of their home country. Their model is a little different than the traditional OTT PTT provide like Zello, and they sell to their customers a complete solution consisting of SIM cards, hardware, software and MDM. The devices for their customers are subsidised, and they pay a monthly subscription per month of around $20-$30. If a customer wants the VoicePing app only but not the whole packages, it is around a $6 per month fee.

Product Portfolio-

- **VoicePing Consumer Edition**- Offers free VoicePing subscriptions with a group limit of 5 people, allows only one group to be created, and anyone can enter the group. Despite limited capabilities, the free app offers features, such as text and image messaging, paging, text-to-speech, easy contact add, and email auto-forwarding.
- **VoicePing Enterprise Edition**- Besides the features mentioned above, the Enterprise edition offers admin portal, unlimited groups, private domain, Bluetooth support, VP recordings, API Access, Support, SLA, desktop PTT, PTT Buttons, Location Tracking, Texting, Nationwide PTT, and Photo capabilities.
- **PTT Devices** – Offer several different devices (Tokie, VP-6, VP-3, and Ex-Handy 09). The VP-6 has a 4.7" screen, 2-watt speaker and dedicate PTT button. The Tokie is ideal for any environment and is easy to use. The VP-3 has an easy to use PTT button and is ideal for indoor environments like hospitality. The Ex-Handy 09 is more ideal for harsh environments like engineering/oil & gas and has a 48-hour battery life.

Key Differentiator/Outlook – As of right now the company has been marketing the VoicePing app for about 3-4 years, and they have approximately 5,000 users in Singapore spread out across 200 companies. They have been only targeting commercial customers and plan to stay on this path moving forward even as they expand to other countries. Given that Singapore is one of the few countries which still has an existing iDEN network, there remains an opportunity for Smart Walkie to migrate users to OTT PTT if they are looking for access to mobile broadband applications. Currently, they are the number 1 OTT PTT provider operating in Singapore and expect solid growth over the next 2-3 years. They do see some challenges being presented with Singapore carrier like M1, Singtel, and StarHub evaluating entering this market and expect some of these carriers to roll out PTToC soon. Despite this, Smart Walkie will see good growth in the near future and what really differentiates them is the fact that their VoicePing app can fit smoothly into a variety of different workflows and they have devices with robust PTT functionalities.

Company Overview- Zebra Technologies builds tracking technology and solutions that generate actionable information and insight, giving companies visibility into their businesses by giving physical things a digital voice. Founded in 1969 and headquartered in Lincolnshire, IL, is a market leader in thermal print, scanning, mobile computing, and location solutions technologies for retail, transportation and logistics, hospitality, manufacturing, healthcare, government, and sports vertical markets. In the PTT Space, Zebra offers a solution called Workforce Connect PTT Pro, which is a subscription-based enterprise grade PTT service. In terms of Zebra's PTT business with their workforce connect solution more than 60% is coming from the Americas market, about 30% from the EMEA market, and the remaining from the APAC market. From an industry point of view, about 70% of their PTT business comes from the transportation and retail/hospitality sector while the remaining 30% is spread out across industries like healthcare, manufacturing, and service providers.

Go-to-Market Trends- Right now with the solution Zebra is going to market through their traditional channels and resellers, but focusing on organizations who are more geared/specialized towards PTT. As of right now Zebra is doing the professional services piece of the solution themselves.

Product Portfolio-

- **Workforce Connect PTT Pro** – This is a subscription-based enterprise grade PTT service that can be used on both CG/ruggedized devices, works on Wi-Fi & cellular networks, and has features like audio talk (one-to-one, site-to-site, and group), secure messaging, and historical location tracking. With group communications on the solution users can talk to 250 people at once. Wi-Fi use cases of the workforce connect solution are typically seen inn retail and healthcare whereas cellular is used a lot in areas like transportation.
- **Interworking Gateway** – Zebra has also created an Interworking Gateway (IWG) to deliver audio, video or text content from external sources (stored, streaming or Land-Mobile-Radio) to Push-To-Talk (PTT Pro) users. Use Cases for the IWG include inter-networking LMR conversations and PTT Pro users, announcing Message-of-The-Day audio or video content to PTT Pro users, or enabling self-service kiosks with call-out assistance to a PTT Pro-enabled associate.

Key Differentiator/Outlook- Looking at growth outlook for Zebra and their Workforce Connect solution, they are currently focused on primarily the enterprise market and only a small portion of their business is in service providers. Sectors that have done well over the past year include ones like healthcare and retail/hospitality. Healthcare was not expected to be a big market for this solution, but has done very well as many hospitals have been looking to upgrade their workforce communication tools. Hospitality has been another area that has seen success with many customers asking for tools kits that can integrate PTT capabilities into more hospitality oriented applications. This has been a frequent ask by Zebra customers and they do plan on adding APIs and SDKs into their roadmap to make this functionality more available on a component basis. Customers asking for SDKs for PTT functionalities has been particularly strong in China which is expected to be the biggest growth market in the short term for Zebra with their solution. They certainly see a lot of opportunity in western Asian countries as well as Australia, and the biggest challenge for them in this area with their SDKs is language translation tools, user experience, and documentation. Moving forward Zebra also sees a heavy migration for their customers towards Android in the PTT space, as iOS is still considered closed for enterprise use. The biggest selection driver they see moving forward for PTT on ruggedized devices is the ability to deliver dependable, edge-to-edge enterprise experience with a solid ROI.

Company Overview- Zello, headquartered in Austin, Texas, is an OTT PTT app provider for primarily desk less workers. Zello as a company operates from 2 sides, the consumer side and the enterprise/business side. On the consumer side they have over 120 million registered free users across a variety of global and small organizations. Some examples of use cases where Zello has seen an uptick in their consumer app usage/downloads is in natural disasters like Hurricane Harvey, in political crisis (Turkey, Ukraine, Venezuela, Egypt), and in South Africa where Zello is the crowdsourced 911 system and is used broadly across the country. The Zello consumer app supports thousands of active users per channel, and beyond 20 users per channel organizations appreciate the central administration features included. They currently don't monetize on the consumer side at all, but are looking at possible revenue models (excluding advertising which they will not pursue). On the business side, about 70% of their revenue being generated with ZelloWork is coming from North American markets. More than 90% of their revenue is through the cloud hosted version while the rest is the server version. About 30% of Zello's users are primarily Wi-Fi based while the remaining 70% are cellular based. Wi-Fi based use cases tend to occur in primarily hospitality, warehousing, and retail. The server version is popular primarily with military customers. Industries that ZelloWork is used in include: waste management, transportation/logistics, hospitality, retail, construction, airlines, and healthcare.

Go-to-Market Trends- In terms of GTM strategy for Zello, so far it has been primarily organic where they leverage a small sales team and business is driven by inbound interest. They view their consumer success as an extremely important asset, and they leverage their high volume of users to create higher quality software and market awareness that helps grow the paid subscriber base. One interesting partnership they have been involved in was with Trimble around a workflow application for a cement mixer company. This has been a great partnership for Zello where their application has been integrated into a tablet with a rugged mic running through the dash, or essentially acting as a PTT feature.

Product Portfolio-

- **ZelloPersonal** - Zello offers a free version of a walkie talkie app for the consumer side of their business. Zello for personal use runs on most smartphones, tablets, and PCs with unlimited uses that runs on WiFi or any cellular data service. The company's personal app offers millions of public channels including open chat, police scanner, and learning various different languages.
- **ZelloWork**- ZelloWork is Zello's business PTT app that can be used for dispatch workers, team communication, a radio replacement, and as a carrier PTT replacement. For the cloud version it's $6 per user per month, while the on-premise version has a $5,000 one-time server license fee and a $2,000 one-time license fee per 20 users. ZelloWork also has additional features like Message Vault and Premium Maps. Message Vault is a central storage feature that can playback and retrieve any message, alert, and image. Premium Maps adds location history and Google Maps to the free bundled map feature. The cloud version of the Message Vault feature cost an additional $4 per user per month while Premium Maps costs an additional $3 per user per month. Key Features of ZelloWork includes built-in GPS, clear voice communication, messages saved on user device, customizable channels and roles, and administrative console for complete oversight.

Key Differentiators/Outlook – Zello is seeing organic growth on their business user base of around 3% per month, and they are starting to see a lot more demand for their solutions outside of North America. They have started to work with a couple different global retailers, and their most successful retail accounts currently are Restoration Hardware who has implemented Zello into all their stores and the UNIQLO Group (based in Tokyo) who has about 30,000 global users around their stores. Zello has also started to see more business in Latin American markets, specifically in Mexico where they have had a fair number of B2B deals with companies. Currently about 60% of their business user base is in dispatch/driver use cases (primarily transportation, construction, courier, waste management) while the remaining 40% is in work teams in industries like Retail, Hospitality and Healthcare. Moving forward for Zello, they will continue to build marketing and scale sales on the business user side where their solution has good coverage, is reliable, and can run on less expensive devices. While Zello has seen their app being used as a popular form of full radio replacement in sectors like hospitality and airlines, this hasn't been as high in the remaining industries they operate in and their app has been used more as an LMR augmentation play. Full radio replacements will offer the most profitable business opportunities for Zello in the future, but they will continue to focus on augmentation opportunities as well via leveraging third-party gateways.

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David Krebs has more than 10 years of experience covering the markets for enterprise and government mobility solutions, wireless data communication technologies, and automatic data-capture research and consulting. David focuses on identifying the key drivers and enablers in the adoption of mobile and wireless solutions among mobile workers in the extended enterprise. David's consulting and strategic advisory experience is far reaching and includes technology and market opportunity assessments, technology penetration and adoption enablers, partner profiling and development, new product development, and M&A due diligence support. David has extensive primary market research management and execution experience to support market sizing and forecasting, total cost of ownership (TCO), comparative product performance evaluation, competitive benchmarking, and end-user requirements analysis. David is a graduate of Boston University (BSBA).

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ABOUT VDC RESEARCH

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