PUSH-TO-TALK OVER CELLULAR
Push-to-talk over cellular (PoC) technology enables subscribers to make one-to-many calls to different groups of people at the same time over a mobile operator’s network. One person can be in continuous half-duplex PTT communication with one or more active call groups with a single push of a physical button or touch screen. There is no need for the caller to dial a phone number.

The connection is made almost instantly providing a low latency to rival private PTT calls on Professional Mobile Radio (PMR) networks, also known as Land Mobile Radio (LMR). Unlike most PMR networks (unless they are national networks) subscribers also benefit from an almost unlimited coverage range as they can talk to anyone within the mobile network’s national coverage footprint.

The first commercial PoC service was introduced in the USA in 1996. However, it was not until the release of the first set of specifications by the Open Mobile Alliance (OMA) in June 2005 that an open standard for PoC became available. PoC really only established itself in any significant numbers in the USA where it was adopted by the utilities, transportation and business sectors.

Take up was relatively slow as cellular 2G and 3G networks did not provide the data speeds and low latency calling to make PoC a really compelling option. However, the arrival of 4G LTE networks has changed all that. PoC is beginning to take off exponentially in countries with mature 4G networks, as they are capable of providing the fast data speeds and low latency required by customers for PoC to become an attractive proposition.

PoC technology is made up of hardware equipment, software and services. Equipment includes PoC devices, accessories and chargers. Services include a PoC platform to provide the network services, the interface with the mobile operators’ networks, deployment and integration with other systems, maintenance and on-going support services. Software includes the development of the OMA standard and software developed by the PoC platform provider and third party application providers.

Essentially, PoC provides two-way radio services over 4G LTE technology. That means it is able to deliver a much wider range of services and higher levels of quality than a normal consumer subscriber would get from their mobile smartphone contract. For organisations and businesses for whom communications are not mission or perhaps even business critical, PoC provides an alternative to private two-way radio technology.
Growth in PoC services is being driven not just by the technology, but also by the increase in mobile workforces around the globe and the global adoption of the Internet. North America is expected to remain the biggest PoC market for some time yet. The build out of the FirstNet 4G LTE network for US first responders by mobile carrier AT&T is providing PoC with a major boost. Services from rival carrier Verizon are providing a competitive market, which is helping to stimulate take up.

The OMA PoC standard has been picked up by international cellular standards body 3GPP, which is using it as the basis for developing Mission Critical Push-to-Talk (MCPTT) services, along with MCDATA and MCVideo services. The 3GPP MC standards are still being worked on with most of the outstanding specification design due for completion in March 2020 when work on LTE Release 16 is due to finish. However, work on some aspects is likely to continue into Release 17 and beyond.

MCPTT will provide an ultra-secure service fully integrated into the carrier’s network for use by public safety professionals and other critical communications users with guaranteed Quality of Service (QoS). However, many business subscribers will not require such high service level agreements and can opt for less exacting service levels and consequently less expensive tariffs.
**HOW PoC WORKS**

There are several ways to access a PoC service. One way is to use a third party PoC platform provider, which provides a PTT service by simply 'piggy backing' on one or more mobile network operators' (MNO) infrastructure. The PoC platform provider supplies the SIMs and all the services and uses the MNOs' physical networks to make the calls and data transmissions.

However, if the third party PoC provider is integrated to some extent into the MNO's operating system then it can offer a wider range of services with guaranteed higher levels of service.

Yet another option is for the MNO to offer its own fully network-integrated PoC service. For example, US carriers AT&T and Verizon are building their own fully integrated PoC platforms with different tiers of service, while also hosting third party PoC providers such as ESChat.

In the UK, the market is dominated by independent third party PoC platform providers. None of the MNOs are building their own PoC platforms with the exception of EE, which is providing the infrastructure to support the new 4G Emergency Services Network (ESN). However, when ready ESN's services will only be available to the emergency services and other specific mission critical communications users - at least for the time being.

**POC PLATFORM PROVIDERS OFFER A HIGHER LEVEL OF SERVICE AND BETTER QUALITY GUARANTEES COMPARED WITH NORMAL MOBILE PHONE CONSUMER PACKAGES.**

They are, however, obviously reliant on the performance of the MNO's network. There is nothing a provider can do if the MNO's network goes down or if there are coverage not-spots. But it can provide faster connection times and higher priority access to the network.

One way of doing this is to provide static or fixed IP (Internet Protocol) addresses to each PoC device and dedicated APNs (Access Point Name) - the gateway between 2G, 3G and 4G networks and the PoC platform provider's servers. By providing dedicated APNs (at a cost) the provider can negotiate priority access for that APN. Dedicated APNs offer greater security and resilience compared with the public APNs used by consumer mobile phone subscribers.

The PoC provider can then also access the MNO's QCIs (QoS Class Identifiers) and ARPs (Allocation Retention Priority) to provide dedicated data services to its PoC customers for both the uplink and downlink. In theory at least, not only does the request from the device get connected more quickly, but it delivers a guaranteed data service.

Thus, some PoC platforms can offer a faster and better quality of service, as well as access to group calling and a host of other applications normally only provided by private PMR networks. To do this the PoC provider will almost certainly have its own high redundancy protected servers with dedicated links into the MNOs.

Each customer gets its own dedicated space on the server and SIM numbers with individual IP addresses. It then negotiates the service levels, device authentication procedures, security solutions and policies it wants to put in place for its users.
THE CLOUD

Services are hosted in the Cloud. The Cloud services are usually located on privately hosted servers owned and operated by the PoC platform. PoC platforms can then offer a tiered service to business and organisations based on the desired level of reliability, availability and security they require or which fits their budget.

The customer also has the option of hosting PoC services in their own premises. They might want to do this to provide an additional level of security and the ability to carry out off-network operations by deploying an isolated PoC system completely 'air-gapped' from the Internet.

A privately customer premise hosted Cloud PoC system also makes sense for clients who already operate a PMR network and who have the infrastructure and space available to add a PoC system. Alternatively, publicly hosted Cloud services such as those offered by Amazon or Microsoft can be used.

The other approach to PoC is for the platform provider to offer multi-network roaming SIMs. If one network is down or out of coverage area, the device simply moves to another network with the next strongest signal. This option has the advantage of being able to be extended to other countries via operator international roaming agreements.

The downside of this approach is while it is possible to dynamically switch between mobile networks, it is not possible to access the advantages of using dedicated APNs as to do so the device has to be configured to a particular network. However, if subscribers have access to multiple networks they are less likely to encounter poor coverage areas, so the chances of being hit by dropped calls or data sessions are reduced.

Some platforms also offer higher QoS SIMs where dedicated software is installed on the phone enabling it to cycle faster through the networks to find the best and least congested signal, connecting the device more quickly. In this way, PoC platforms using multi-network roaming SIMs can also offer improved quality of service compared with consumer packages.

Different levels of security can also be provided well in advance of those available to consumer subscribers. Most PoC platform providers will offer VPN services to secure the PoC device to the network core and hosted server to deliver full encryption. Other options include embedding the SIM into the device so it can only be authenticated on that particular terminal. Any attempt to remove the SIM and use it in another device will trigger an alert and it can then be remotely locked down.
The great benefit of PoC is that it provides fast PTT services and the one-to-many group and individual calling services found on PMR systems, but not on normal mobile phone networks. Unlike PMR networks where channel capacity is finite, PoC platforms allow any number of virtual channels and as many call groups as required to be created, including the ability to create dynamic call groups.

The other major benefit with PoC is that the customer no longer has to acquire, operate and maintain any infrastructure, as this is all done by the MNOs. This gets rid of the day-to-day responsibilities of owning and maintaining the infrastructure, reduces operating costs and dispenses with the need for Ofcom licences for private PMR systems.

Conversely, one of the disadvantages of PoC is precisely the fact that it has no infrastructure. The customer is no longer in charge of his own network. It is entirely in the hands of the MNOs and there is nothing he can do if the mobile network goes down, a base station’s capacity becomes overloaded, or coverage is not available in a particular area, building or basement, for example.
The advantage of a PMR network such as Digital Mobile Radio (DMR) is that coverage, capacity, resilience, availability and security are entirely within the gift of the customer to decide and deploy. That said, the geographic coverage is limited to a defined area and expansions usually require investment in more physical infrastructure and additional radio licenses. The PoC geographic coverage on the other hand is as wide and as extensive as the MNO's national network.

The key to deciding which technology to adopt is really down to how critical the communications system is to the customer's operations. If the customer can live with the network being down for a while, with potentially patchy coverage or even no coverage in some areas, particularly rural ones, then PoC will be a perfectly suitable choice.

If, however, the organisation or business cannot afford for their communication system to be out of action for any length of time and it is therefore critical to the smooth and efficient running of the business, including safety considerations, then a PMR system is a much more reliable and safer choice.

**THIS IS LIKELY TO BE THE CASE FOR INDUSTRIES SUCH AS:**

- OIL & GAS
- TRANSPORTATION & LOGISTICS
- ENERGY & UTILITIES
- PUBLIC SAFETY AGENCIES
- MINING

However, PoC can provide many of the applications and services available to traditional digital two-way radios systems. This includes the addition of dispatcher services, real-time GPS location services such as tracking, monitoring and geolocation/geofencing. Other PMR type services such as late entry to group calls and remote over-the-air stun or kill of devices. Devices, subscriber IDs, software updates and so on can be remotely managed from a simple web-based interface.

Other typical PMR applications such as Man Down alerts and Lone Worker monitoring and alarms can also be provided, along with full call recording, logging and playback services. It is also possible for PoC devices to take on some of the traditional PDA roles such as workflow management, job ticketing, scanning items and proof of delivery services.

Some PoC platforms also enable the customer to integrate PoC services with existing PMR systems using gateways to provide a unified PMR/cellular network. This allows the customer to extend the range of their PMR network and enable those out of range of the PMR system or who do not have a PMR terminal to communicate with those that do using a PoC device.

Pricing and billing is the same as a consumer mobile phone contract. The PoC platform simply buys terabytes of data off the MNOs and then offers SIM cards with a specified amount of data usage (x hours of talk time and y Mb of data) often for a fixed fee per SIM, per annum.

The key thing is to work out how much talk time/data is right for the organisation's needs. Just as with a PMR network, it is also important to carefully plan fleet mapping and fleet management requirements before committing and what range of applications (such as types of alarm) the PoC service needs to support. The customer can then purchase PoC devices, chargers and accessories.
HYTERA'S PoC PORTFOLIO

Hytera unveiled a complete PoC solution in 2018 including the management platform, dispatch platform, server, PoC apps and terminals.

Hytera’s HyTalk offers a complete PoC software solution. It’s a public network PTT communication solution which provides PTT, full-duplex audio and video communication and instant messaging to meet requirements for different communication priorities. Hytalk also provides a complete set of clients, servers and management platforms to cover all service scenarios offering high-quality communication, ease of deployment and security.

P-PoC6000 is Hytera’s private push-to-talk over cellular solution providing one-to-one and one to many voice, video and data services via different wireless trunking access modes (3G, 4G or Wi-Fi). With the ability to connect to DMR Tier 3 it can also provide convergent services over narrowband and broadband networks.

PNC370

On the device side Hytera offers the PNC370, which comes in a traditional, compact two-way radio form factor with:
- External stubby antenna for better reception.
- IP55 rated for dust and moisture resistance.
- Comes with built-in GPS, Bluetooth and WiFi and runs on the Android 5.1 OS.

PNC550

A newer device is the PNC550, which takes a smartphone form factor with:
- 5-inch HD multi-touch Gorilla Glass display screen.
- Supports 3G, 4G, Wi-Fi, NFC, Bluetooth, GPS and uses the Android 8.1 OS.
- Built-in 2W speaker, is IP68 rated and it features a 13Mp rear camera and 8Mp front camera.
PoC services are also available on the Hytera PDC760.
• Multi-mode Advanced Radio.
• A hybrid device in a two-way radio form factor.
• Offers a platform for both critical voice and broadband data services.
• Supports DMR, LTE, Wi-Fi and Bluetooth.

VM780
Hytera’s latest and most sophisticated body worn camera to date, the VM780.
• Supports 3G, 4G and Wi-Fi for real time video transmission anywhere.
• GPS built-in and PoC application compatibility (including Hytera HyTalk).
• IP67 and MIL-STD-810G rated.
• 2.8-inch touch display.
• Powerful battery life supporting up to eight hours continuous recording and 1080p HD video with a 216° rotatable lens and 256 Bit advanced encryption (AES256).

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WHO USES PoC?

The kinds of industries which use PoC services include transportation and logistics, retail, security, energy and utilities, construction, councils and local government organisations, hospitality, manufacturing and others. PoC provides long distance communications with a low start-up cost.

PoC is therefore particularly useful for businesses needing to communicate across widely dispersed sites or with mobile work forces, such as logistics firms, travelling long distances not just nationally but also internationally. It also provides a cost-effective solution for smaller organisations such as retail outlets or hospitality concerns for whom a PMR solution might be more than is required or too high an investment.

As discussed above, whether PMR or PoC is the right technology for users in these industries will depend on just how critical the communications system is to the organisation’s business operations and whether the local MNO 4G coverage is fit for purpose. However, some may choose to deploy both technologies.

The PMR network will ensure mission critical voice services are available at key locations, while PoC provides a major geographic coverage extension to the private PMR network, as well as providing staff with access to broadband data services.

Many public safety agencies around the globe are taking this approach by retaining mission critical voice services on TETRA, P25, DMR or PDT networks and then accessing broadband data services over cellular networks. However, with a few exceptions a full migration by public safety to 4G and later 5G PTT over cellular is unlikely to happen for quite some years yet.

The mobile networks need to offer both fully network integrated 3GPP Mission Critical PTT services and MCData and MCVideo services, and upgrade the physical robustness of the network infrastructure, so that it meets the much higher levels of resilience, failover redundancy and security required by mission critical communications users.
THE KINDS OF INDUSTRIES WHICH USE POC SERVICES INCLUDE:

- ENERGY & UTILITIES
- TRANSPORTATION & LOGISTICS
- RETAIL
- HOSPITALITY
- SECURITY
- COUNCILS & LOCAL GOVERNMENT
- CONSTRUCTION
- MANUFACTURING
For public safety, the migration from PMR to MCPTT on commercial (or private) LTE networks has only just begun with the USA, UK and South Korea leading the way. The current third party over-the-top PoC solutions and carrier-integrated enhanced PTT offerings already provide priority and pre-emption services for first responders in the USA. But many other sectors will also find PoC and MCPTT an attractive alternative to PMR.

Some critical communications users will want to take advantage of the higher quality of service of MCPTT when that is rolled out by commercial mobile operators. In addition to MCPTT, MCData and MCVideo on 4G networks, 5G is expected to introduce ultra-low latency services over ultra-reliable networks. This will support things like autonomous vehicles, but it will also support Internet of Things applications that require ultra-low latency connections.

Prior to the arrival of 5G it is possible that PoC/MCPTT devices may be enhanced with new sensor peripherals. At the moment applications such as gunshot and facial, recognition, hazardous chemical detection, infrared cameras tend to operate using multiple systems.

It is possible that in the future many of these applications could be packaged and customised for use on one primary communications device. Vehicle-mounted sensors can already communicate via an in-vehicle 4G LTE router. Later it may be possible for sensor applications to communicate directly with the 5G network, rather than via the portable PTT communication device or in-vehicle router.

For the present, PoC is providing a very useful, cost-efficient alternative to PMR for non-critical communications users, while also providing long range geographic extensions to private PMR networks and access to broadband applications such as video, the Internet and company databases with more applications being added all the time.

**FUTURE TRENDS**

For the present, **POC IS PROVIDING A VERY USEFUL, COST-EFFICIENT ALTERNATIVE TO PMR FOR NON-CRITICAL COMMUNICATIONS USERS.**
Hytera reserves the right to modify the product design and the specifications. In case of a printing error, Hytera does not accept any liability. All specifications are subject to change without notice.

Encryption features are optional and have to be configured separately. They are also subject to European export regulations.

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