Navigating the chasm

Accelerating towards next-generation mission-critical services

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Cities today are aspiring to become cognitive to improve urban living. A key pillar of a cognitive city is the safety of its citizens and public safety agencies (PSA). Robust and advanced mission-critical communication systems are at the heart of a city's safety.

Traditionally PSAs across the globe rely on narrowband mission-critical communication that is robust and effective in meeting its needs. However, there are some limitations in terms of limited data sharing, interoperability, and functionality.

Therefore, mission-critical communication systems are moving towards adopting next-generation broadband-based solutions that allow enhanced situational awareness and mission-critical Quality of Service (QoS) – priority, pre-emption, availability, security, and resilience – that first responders demand.

This paper outlines how the PSAs are faring in their broadband adoption journey and the key accelerators that will further propel them towards maximising the benefits of a full-scale next-generation broadband mission-critical communication system.

Ramzi Khoury
Partner
Strategy&

Around the world, lives are often lost and properties damaged in the absence of a faster first response.

Governments and enterprises need broadband networks, and mission-critical communications, with a high degree of reliability, accessibility and security to ensure fast and effective response times to such events. Specific mission-critical networks are necessary for public protection and disaster relief (PPDR) units and critical national infrastructure (CNI) operators. Such mission-critical communication networks differ significantly from commercial networks, constructed for the mass market and not designed to handle peak traffic and support real-time group communications.

Existing telecom operators, well acquainted with 4G and 5G networks, are ideally placed to deliver mission-critical communications for governments with their mobile high-speed data services. Since mission-critical network deployments require heavy investment and mainly target governments and enterprises that manage critical infrastructure, telecom operators should consider public-private partnerships (PPP).

Peter Clemons
Founder & President
Quixoticity-EU

Although the worst of the COVID-19 pandemic is now behind us, the global phenomenon has highlighted existential dangers and the importance of using modern technology to tackle public safety and security issues.

Many government agencies worldwide are moving away from restrictive narrowband Private Mobile Radio (PMR) solutions towards more feature-rich mobile broadband capabilities based on 3GPP technology.

This paper, launched at Critical Communications World 2023 in Helsinki, looks closely at the global best practices and key accelerators being adopted by pioneer public safety agencies, focusing on the rapidly evolving Middle East region.

PwC and Quixoticity-EU look forward to continuing our engagement with all relevant stakeholders to agree on the ideas, insights and actions required to successfully navigate the chasm between the past and the future of first responder mobile broadband communications.

Introduction

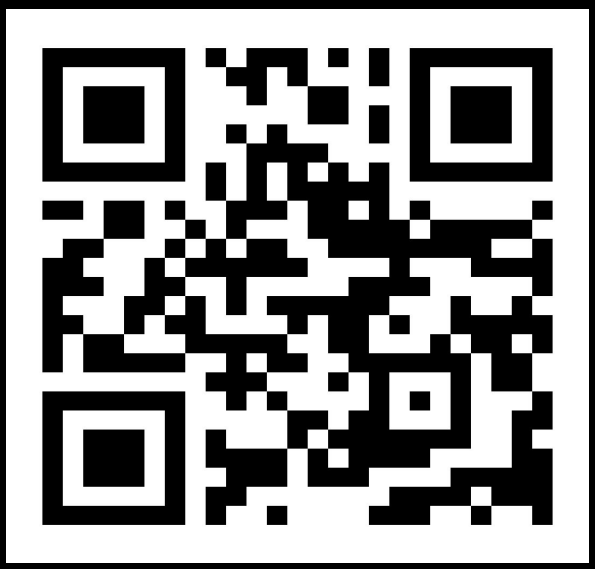
Continuing our series "Navigating the chasm" on global mission-critical communication programmes, we present the second paper focusing on next-generation mission-critical communications programmes and their journey.

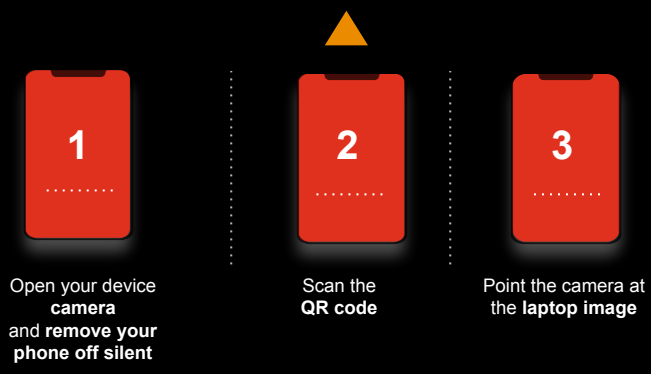
The first paper highlighted the strategy, key drivers and framework for programme owners to move from traditional narrowband-based mission-critical communication systems to next-gen broadband-based systems. While mapping the movement of countries along the chasm, the importance of broadband mission-critical communications is evident, with most countries embarking on initiatives ranging from strategy and design to on-ground implementation.

By studying the progression of countries in their broadband mission-critical communications programmes, the envisaged journey can be broken down into key phases, from strategy to implementation, highlighting bottlenecks in each stage. Key learnings from global country programmes and their navigation through these challenges highlight critical accelerators that can benefit programme owners.

This paper offers a perspective on how owners of these nationwide mission-critical communications programmes can identify their position, pre-empt potential challenges, plan their mitigation strategies and accelerate their journey towards mature and optimised broadband mission-critical communication systems. It spotlights the Middle East as a region and what makes it primed for adopting next-generation broadband mission-critical communications.

Scan for a glimpse of the next generation mission-critical communication system



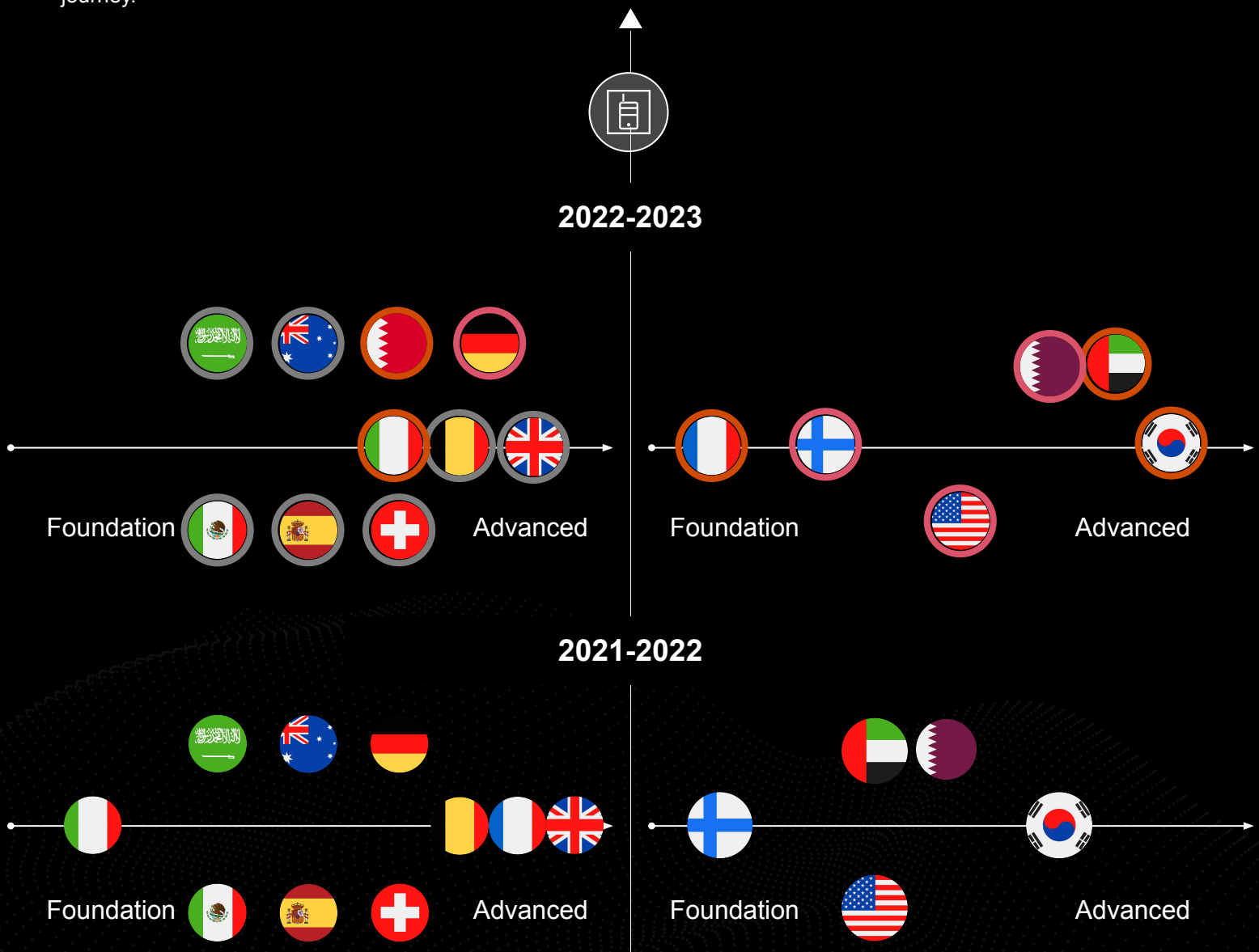


Overview

Narrowband mission-critical communication systems are reliable and have been used for decades but have limited bandwidth. It makes transmitting large amounts of data difficult, impacting the use of advanced applications and implementing innovative use cases. The future of public safety is to have data-rich, optimised and autonomous responses.

In contrast, broadband mission-critical communication networks provide a larger bandwidth, ensuring seamless and faster data transmission, and facilitating ultra-reliable, low-latency communication. Therefore, on-field PSAs can promptly share critical information, such as live video feeds, telemetry, or GPS location data, with other responders in priority-talk groups. Broadband mission-critical communication systems improve overall situational awareness, operational efficiency and response times.

Overall, the initiation of mission-critical broadband programmes and their progression is driven by the need to disrupt public safety with innovative use cases and to provide PSAs with tools to respond to emergencies and other critical incidents effectively. Therefore, in the subsequent sections, the focus will be primarily on how countries navigate the various phases of their mission-critical broadband communications implementation journey.



Key phases in the broadband chasm movement

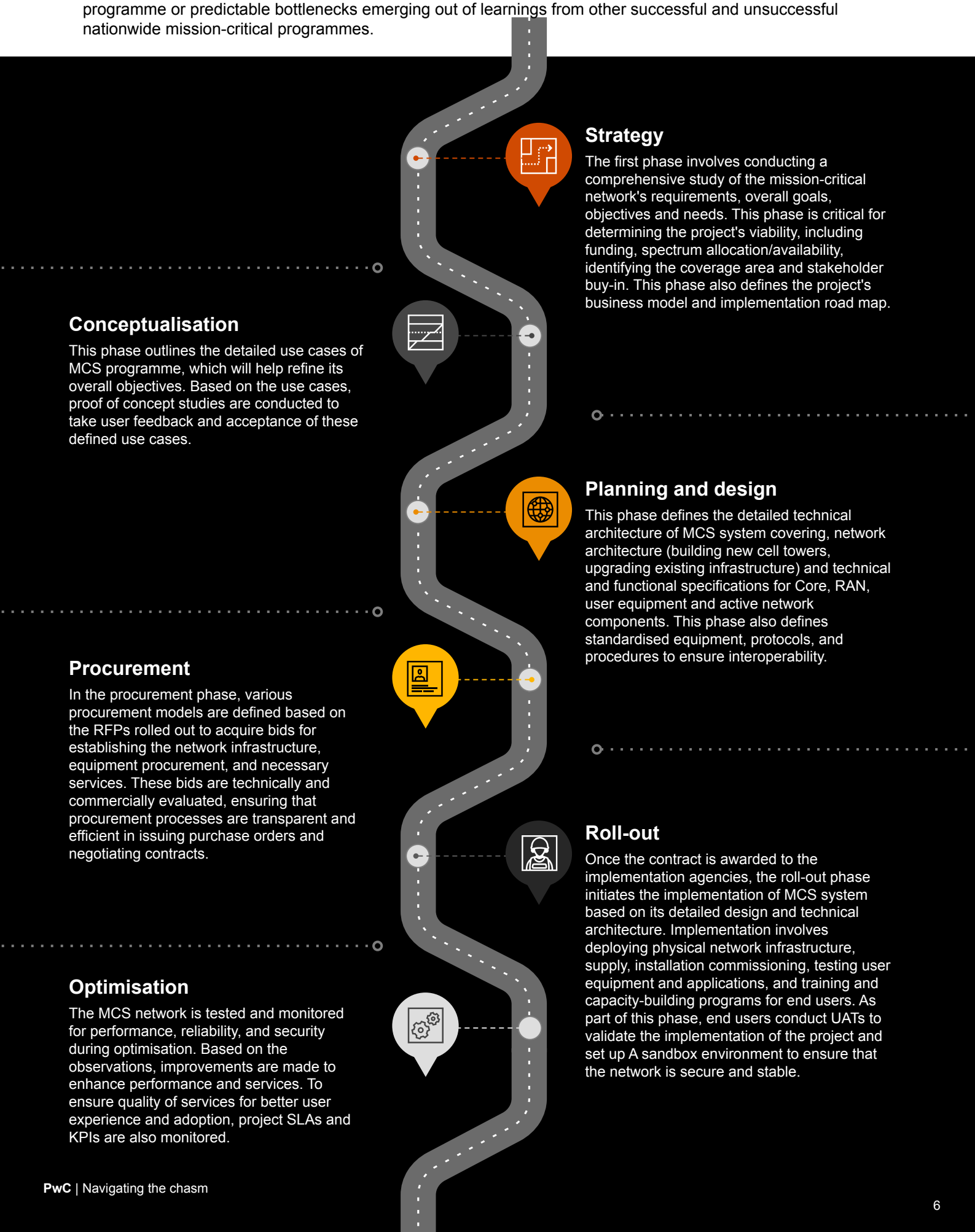
Broadband mission-critical communication systems (MSC) have been continuously improving, with a few countries finally beginning to extract the full potential through optimisation and the addition of innovative use cases. Developing and implementing broadband mission-critical communication systems involve using dedicated radio frequency spectrum, specialised devices and applications, and redundant network infrastructure. These technologies are combined with specialised protocols and procedures designed to ensure the communication network's reliability, availability, and security.

Implementing a broadband mission-critical communications system requires meticulous planning, cost estimation, funding strategy outlining, and coordination among multiple stakeholders. The core objective is to ensure that the mission-critical communications system meets the needs of the end users and provides a robust and scalable infrastructure required for PSAs.

A broadband mission-critical journey involves several critical phases, each with its activities and objectives. It starts with strategy, followed by five other key phases which are explained in more detail on the following page.

In the overall lifecycle of a broadband mission-critical programme, each phase is significant, with distinct outcomes based on programme owners, stakeholders, implementation partners and Subject Matter Experts' (SMEs) expectations.

There are challenges in the successful completion of each phase which can be contextual to a specific country programme or predictable bottlenecks emerging out of learnings from other successful and unsuccessful nationwide mission-critical programmes.



Strategy

The first phase involves conducting a comprehensive study of the mission-critical network's requirements, overall goals, objectives and needs. This phase is critical for determining the project's viability, including funding, spectrum allocation/availability, identifying the coverage area and stakeholder buy-in. This phase also defines the project's business model and implementation road map.

Conceptualisation

This phase outlines the detailed use cases of MCS programme, which will help refine its overall objectives. Based on the use cases, proof of concept studies are conducted to take user feedback and acceptance of these defined use cases.

Planning and design

This phase defines the detailed technical architecture of MCS system covering, network architecture (building new cell towers, upgrading existing infrastructure) and technical and functional specifications for Core, RAN, user equipment and active network components. This phase also defines standardised equipment, protocols, and procedures to ensure interoperability.

Procurement

In the procurement phase, various procurement models are defined based on the RFPs rolled out to acquire bids for establishing the network infrastructure, equipment procurement, and necessary services. These bids are technically and commercially evaluated, ensuring that procurement processes are transparent and efficient in issuing purchase orders and negotiating contracts.

Roll-out

Once the contract is awarded to the implementation agencies, the roll-out phase initiates the implementation of MCS system based on its detailed design and technical architecture. Implementation involves deploying physical network infrastructure, supply, installation commissioning, testing user equipment and applications, and training and capacity-building programs for end users. As part of this phase, end users conduct UATs to validate the implementation of the project and set up A sandbox environment to ensure that the network is secure and stable.

Optimisation

The MCS network is tested and monitored for performance, reliability, and security during optimisation. Based on the observations, improvements are made to enhance performance and services. To ensure quality of services for better user experience and adoption, project SLAs and KPIs are also monitored.

Key considerations for a successful MCS journey

Further to the phases defined in the previous section, there are some critical considerations in progressing through the phases - from strategy to optimisation. If these are planned for at the initial stages, they can guide towards a successful broadband mission-critical project covering concerns such as stakeholder buy-in, funding, alignment with regulators and co-existence of technology, among many others.

Allocation of required funding

Securing adequate financial resources to implement broadband mission-critical communication network often impacts the implementation timelines

Stakeholder buy-in

Ensuring that all relevant stakeholders are supportive, invested and committed to the programme success and play their respective roles across phases

Standardisation of equipment and protocols

Compatibility and standardisation of all equipment and protocols are mandatory to avoid potential disruption of operations and enable use-cases

Coverage

Providing comprehensive network availability and coverage throughout the entire service area to potentially respond to crisis in remote areas

User adoption

Encouraging and facilitating the testing and use of mission-critical communications network by all PSAs is needed to maximise their effectiveness

Regulations

Complying with relevant in-country regulations and policies governing the implementation and use of the mission-critical communications network

Spectrum allocation

Obtaining the desired spectrum and bandwidth is key to the success of a mission-critical communication programme

Interoperability issues between multiple public safety agents

Facilitating seamless information exchange between multiple PSAs is necessary since each agency can be at a different maturity level of mission-critical communication systems

End to end security

End-to-end security of the mission-critical communication network is critical and paramount, including data encryption and protection against cyber attacks

Bid process

Managing the procurement process effectively to obtain the best value for the network is important to avoid unexpected costs and budget-related delays

Scaling

Ensuring the network is scalable to meet the needs as a result of the growing adoption of PSA users, to avoid service disruptions due to insufficient capacity and high load

Public acceptance

Ensuring that the public is aware of and accepts the mission-critical communication network to avoid potential delays or halts due to protests or revolts must be achieved in the early stages of implementation

How to accelerate the move?

Identifying key accelerators helps to accelerate the movement from strategy to implementation. These accelerators might be relevant and adopted according to the country context, ranging from stakeholder involvement, ecosystem readiness, regulatory mandate, technology partners and other relevant parameters. It is crucial to take a strategic approach to expedite the conceptualisation, design, implementation and adoption of these networks. By leveraging six key categories of actions, organizations can optimise their efforts and expedite success.

Accelerators		Stages
User-centric approach	Placing users at the centre of the design process ensures their needs are taken into account. Following are the key accelerators under this category: Motivated Leadership Align user experience with requirements Training & capacity building programs for users	
Innovation in the DNA	Leveraging emerging technologies to fuse innovation and creativity and achieve optimality. Following are the key accelerators under this category: Setting up of Technical feasibility lab Setup sandbox environment	
Governance	Establishing a robust and comprehensive governance structure to oversee and manage the implementation. Following are the key accelerators under this category: Establishment of dedicated entity / SPV MOUs with different participating agencies Robust PMO setup Framework for KPI & SLA monitoring	
Repurpose over recreate	Reducing costs by renewing existing systems rather than building new ones. Following are the key accelerators under this category: Leverage lessons learnt from others (leading practices) Repurpose existing use cases over create Adoption of open international standards Leveraging proven design/ simulation tools	
Conducive environment	Ensuring the availability of a favourable environment for all needs of the implementation. Following are the key accelerators under this category: Enable wider tender participation Ensure market scan / EOI prior to procurement initiation Adoption of open international standards	
Collaboration	Fostering participative efforts of all involved stakeholders from all relevant sectors. Following are the key accelerators under this category: Deployment of a PPP model Co-creation with industry players Leverage global expertise Alignment with regulators	

The subsequent sections map a journey from strategy to implementation in detail, highlighting the key accelerators. It reinforces an understanding of these accelerators and their potential impact, with notable country examples, highlighting how it has expedited the progression of broadband mission-critical communications programmes.

Case studies

South Korea - SafeNet

Following a devastating ferry tragedy in 2014, Korea set up a multi-stakeholder initiative, SafeNet Forum, to develop a nationwide multi-sector, multi-agency critical mobile broadband network, with the government providing dedicated spectrum and funding for global standards and R&D.

By tapping into several key accelerators identified in this paper, the Korean public safety, maritime and railway communities have developed and delivered the world's most advanced public safety mobile broadband capability, serving as an inspiration to other nations.

Finland – Erillisverkot – VIRVE 2.0

Finland has a highly active and extended critical communications ecosystem across equipment suppliers, service providers and application developers. The Finnish Government passed laws and restructured itself to facilitate a next-gen broadband capability – VIRVE 2.0 – delivered by state operator, Erillisverkot and supported by all public safety agencies.

As no dedicated broadband spectrum was initially available in Finland, national roaming was implemented with priority and preemption to guarantee service availability and extended coverage, allowing a critical data service to be launched in early 2023.

France – ACMOSS – RRF

Following a series of deadly terrorist attacks carried out during 2015-16 on French soil, the French government set up its Future Radio Network (RRF) programme, driven by the Ministry of Interior with support from the Finance Ministry and strong representation from local, regional and national agencies and enterprises.
From the outset, a vibrant national public safety ecosystem was developed, aligned with global standards, to create a new public safety operator, Security and Public Safety Operational Mobile Communications Agency (ACMOSS) to drive forward RRF, with early capabilities already available for the 2024 Paris Olympic & Paralympic Games.

Window of opportunity in the Middle East

Vision-led economic growth

The Middle East today is on the cusp of a grand vision-led transformation. Particularly in the Gulf Cooperation Council (GCC)[1], countries have set ambitious targets to grow their non-oil economies.

National visions introduced across the GCC recognise the critical role that digital and emerging technologies play in achieving sustained economic growth, together with other enablers propelling the region's GDP from USD 1.7 tn in 2021 to a target of USD 3.2 tn in 2030 – an 83% growth rate.

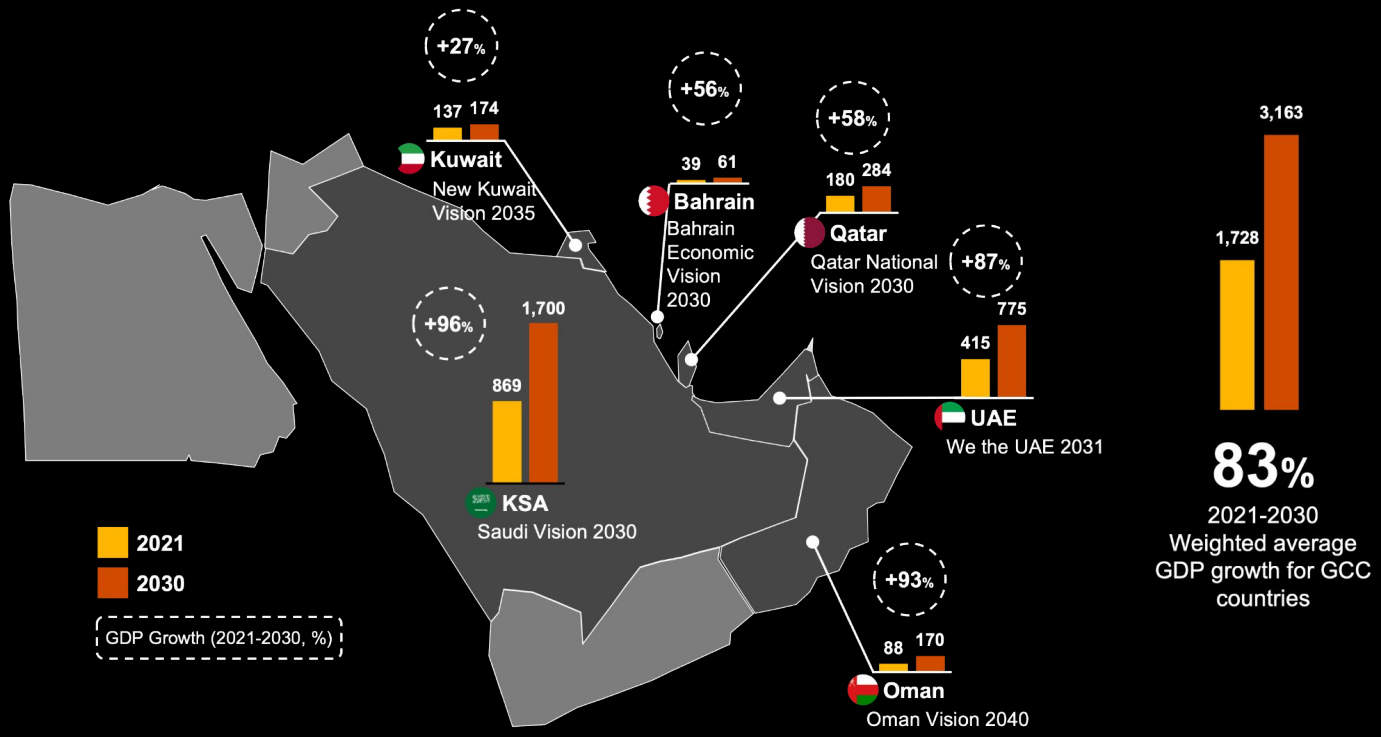


Figure: GCC Economic Growth by Country (GDP in USD bn, 2021 – 2030)

The bet on mega developments

In line with their National Visions and diversification strategies, GCC countries have launched plans to build new megacities – many of which are in entirely new geographies with no infrastructure. These large-scale projects are technology-driven, aiming to improve the quality of life while driving economic growth and promoting sustainable development.

- The largest of the megacities, NEOM in KSA, is set out to create a futuristic cognitive city, providing a high quality of life for its residents, utilising state-of-the-art technology and digital infrastructure, and fostering disruptive solutions through cutting-edge innovations (e.g., 5G hyperconnectivity, AI and advanced robotics, augmented, mixed and virtual reality).
- Part of the Dubai 2040 Urban Master Plan, Expo City is set to become a global business hub with an ecosystem combining international talents, technology, and digital advances. It features one of the largest cutting-edge cloud technology platforms enabling smart metering, augmented reality, big data, IoT, AI, and NLP applications.
- The Red Sea in KSA project is championing a new development model, leveraging innovative concepts and smart technologies to enhance the visitor experience and well-being of its communities and environment.
- AlUla in KSA aims to become a global tourist destination in KSA, augmenting its rich natural heritage with robust digital infrastructure and advanced digital services.

1. Includes KSA, UAE, Qatar, Kuwait, Oman, and Bahrain

The focus on safety and security

In many of their plans, GCC countries have prioritised safety and security as a key component of their national agendas – with ambitions for creating stable and prosperous societies and improving the overall quality of life for their citizens.

Saudi Vision 2030	We the UAE 2031	Qatar National Vision 2030
KSA	**UAE**	**Qatar**
Improve livability is Saudi cities and protect vital resources of the nation	Place the UAE globally as first in the “safety” index	Establish secure and stable society operating on the principles of justice, equality and the rule of law

New Kuwait Vision 2035	Oman Vision 2040	Bahrain Economic 2030
Kuwait	**Oman**	**Bahrain**
Develop and modernise the national infrastructure for the purpose of improving the quality of life for all	Develop smart, sustainable and vibrant cities and a vital countryside with a viable architecture that ensures high quality of life, work and leisure	Install a safe and secure environment, adopting the latest technologies, and modernisation of police services and community policing programs

Table: Safety and security in national aspirations

Many GCC countries have already made headlines for the high levels of safety and security they offer their citizens, residents, and visitors – vouched for by global indices. For instance, the UAE tops the Women, Peace, and Security (WPS) Index 2021 for women’s safety, while Qatar has ranked as the safest country in the world on the Numbeo Crime Index since 2019.

Data-driven societies and economies

With the growing reliance on digital and data-driven technologies in the GCC, data traffic is expected to nearly triple over the next five years, increasing from 1,100 Petabytes[1] per month in 2021 to over 3,000 in 2028, with the bulk of the growth driven by video application traffic.

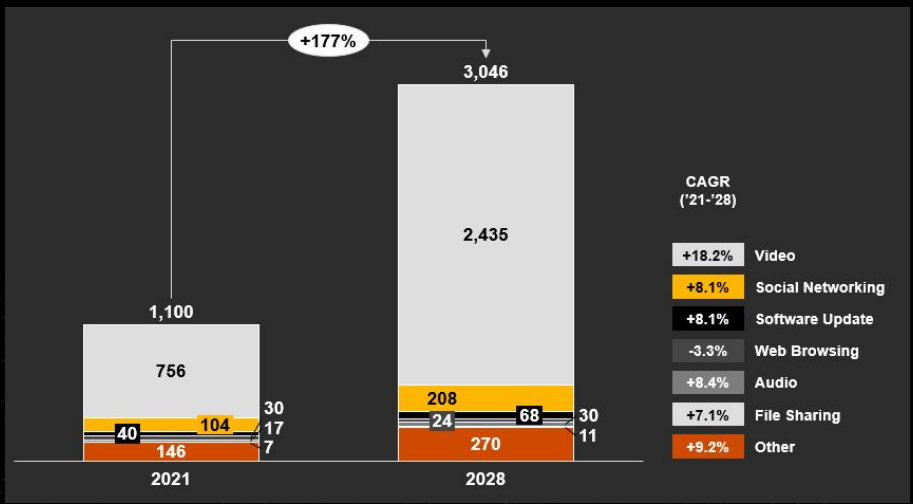


Figure: GCC Mobile Traffic by Application Category (Petabyte1/ Month)

Safety and security emerging applications are expected to contribute to the uptake in data traffic in the coming years with the large-scale adoption of emerging technology use cases, such as:

- **Smart wearables** exchanging critical information in real-time
- **Live video streaming** for surveillance and reconnaissance
- **Connected police cars** with advanced plate recognition and automated reporting
- **Drones** for intervention monitoring and disaster management

One petabyte is equal to one thousand terabytes

Conclusion

Today, mission-critical networks in the GCC rely largely on legacy narrowband technologies, supporting basic communications such as voice and text. Most network components are nearing their end of life and are not able to accommodate the exponential uptick in data traffic required by emerging safety and security use cases.

Additionally, few countries in the GCC have adopted a unified approach to mission-critical communications planning and delivery, putting pressure on interoperability across safety and security entities, network resilience, and duplication in investments and operational costs.

As a first in the region, the Emirate of Dubai in the UAE launched an emirate-wide unified mission-critical network under Nedaa. Similar large-scale projects are expected in the GCC – with the potential for even nationwide networks – as safety and security entities address the pressing need to upgrade to broadband-based mission-critical communications and to deliver on their National Visions.

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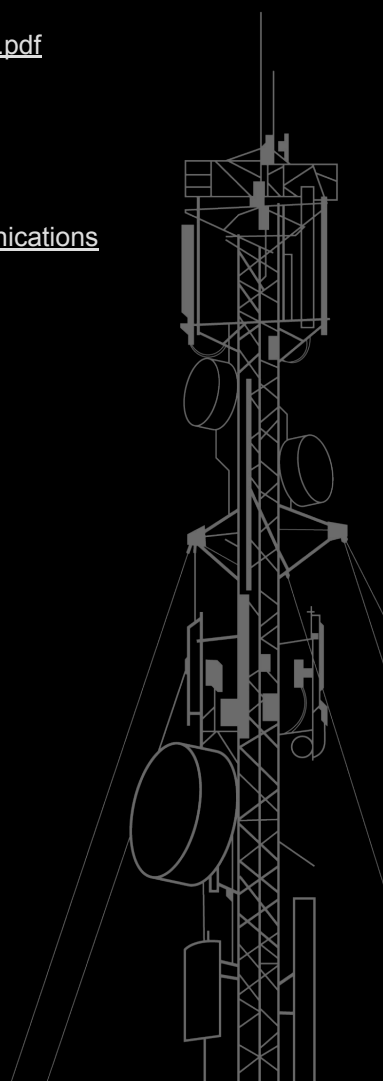

Annex

Australia

New South Wales Telco Authority has now finished its PoC trial with Nokia, Optus, TPG Telecom and is assessing the results with Canberra, states and territories before deciding the best way forward for their public safety broadband network (PSBN).

Bahrain

Bahrain has been moving forward with new legislation and regulation in the areas of spectrum, security and critical services that will facilitate the future migration of Bahraini public safety agencies to next-gen broadband solutions.

Belgium

Belgium has changed its legal framework to guarantee priority and pre-emption to public safety (i.e. ASTRID). ASTRID intends to build a separate, dedicated network in limited 700 MHz spectrum (Bands 68 &/or 28A) using existing TETRA sites, but deployment has not yet begun.

Finland

Finnish critical operator, Erillisverkot, has completed its dedicated Ericsson mobile core, integrated the Airbus Agnet MCX app & has begun limited MCData service that will be rolled out further during 2023.

France

In October 2022, French Ministry of Interior awarded contracts to Airbus, Capgemini, Orange, Bouygues Telecom and Atos for its RRF programme, which will be rolled out across France between 2024 and 2027, with some basic services available in time for the Paris 2024 Olympics. A new, independent, government-owned, critical communications operator, ACMOSS, is being established during 2023 to manage the entire process.

Germany

BDBOS, Germany's public safety operator, has been awarded significant government funds to develop a broadband capability. BDBOS is searching for 2x30 MHz of dedicated spectrum in sub-1GHz to build a public safety 5G network during the second half of the decade.

Italy

The Italian government has awarded funds to complete a nationwide TETRA network rollout, while larger trials of public safety broadband are being conducted together with national mobile operator, TIM.

Mexico

Mexico continues to develop its shared 700 MHz network, Red Compartida, that can be used by MNOs and secure MVNOs, such as Airbus, to develop mission-critical services, complementing existing TETRA and Tetrapol networks.

Annex

Qatar

Qatar MoI was one of the first public safety agencies to deploy an LTE network back in 2011-14, mainly for non-MC data. Qatar is currently completing the second stage of its critical broadband capability, upgrading to more advanced features & deploying a full range of mission-critical services.

Saudi Arabia

Saudi Arabia is in the process of building two critical communications networks: one for public safety and government agencies in 800 MHz; and another for industries, including oil & gas, and enterprises in 450 MHz. As of March 2023, we are still awaiting final decisions regarding the rollout of the 800 MHz network and the awarding of 450 MHz spectrum.

South Korea

South Korea has one of the world's most advanced public safety LTE networks – in fact, three separate networks for public safety, railways & maritime – due to the SafeNet programme assigned dedicated spectrum in 700 MHz. This network is now live, and continues to add new users during 2023.

Spain

Spanish mobile operator, Telefonica, operates a Tetrapol network for Spanish MoI. As part of its latest contract, Telefonica must start offering a broadband capability during 2024 in limited, dedicated spectrum in 450 MHz and 700 MHz. A decision regarding the suppliers of this broadband capability is expected during first half 2023.

Switzerland

Switzerland's secure critical broadband programme, MSK, continues to move forward with the necessary legal and regulatory framework to enable next-stage pilot systems to be deployed in multiple cantons across the country.

United Arab Emirates

Dubai's critical communications operator, Nedaa, has completed rollout of its public safety LTE network, adding a 5G upgrade during 2023. Multiple trials have been conducted with different agencies and user groups, so significant progress is expected during 2023. Abu Dhabi Police have developed their Smart/Safe City concept which will also include an advanced mobile broadband solution.

United Kingdom

Following Motorola Solutions' decision to withdraw from UK Home Office ESN programme, ESN has started the process of re-tendering the critical mission-critical services component. Ongoing legal challenges are likely to delay the rollout of ESN even further, with the nationwide Airwave TETRA network now expected to continue operations until 2029 at the earliest.

United States of America

FirstNet continues to add more customers for its public safety broadband network in USA, reaching 4.4 million during early 2023. FirstNet is also adding new functionalities to its network including interworking and multicast solutions. There is also some progress towards offering a full replacement for mission-critical voice services, but a majority of P25 networks are still expected to run until at least the end of the decade & beyond.

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