

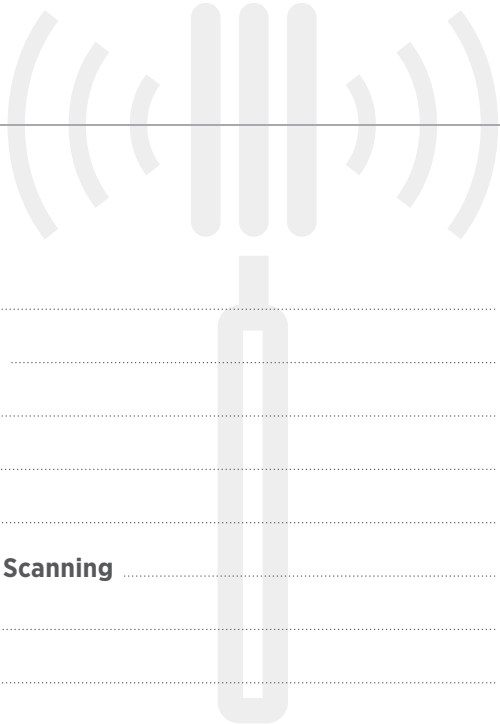


CRITICAL COMMUNICATIONS IoT

Concepts Paper



CONTENTS



- 1 Introduction** 1
- 2 Critical Communications and Internet of Things** 2
- 3 Smart Glasses for Events Security Management** 3
- 4** Description 3
 - Concept Implementation 3
 - Connected Ambulance with Remote Ultrasound Scanning** 6
 - Description 6
 - Concept Implementation 7
- 5 Anti-Fire Drones** 8
 - Description 8
 - Concept Implementation 9
- 6 Early Warning Earthquake App** 10
 - Description 10
 - Concept Implementation 11
- 7 Conclusion** 12

1 Introduction

This document brings together a number of Internet of Things concepts from a mission critical communications perspective, specifically on public safety, and illustrates how IoT can be used in real-world scenarios to help solve problems.

This document is targeted at network operators and network and device equipment vendors. The document may also be useful for the public safety community to understand how IoT can be utilized for their own purposes.

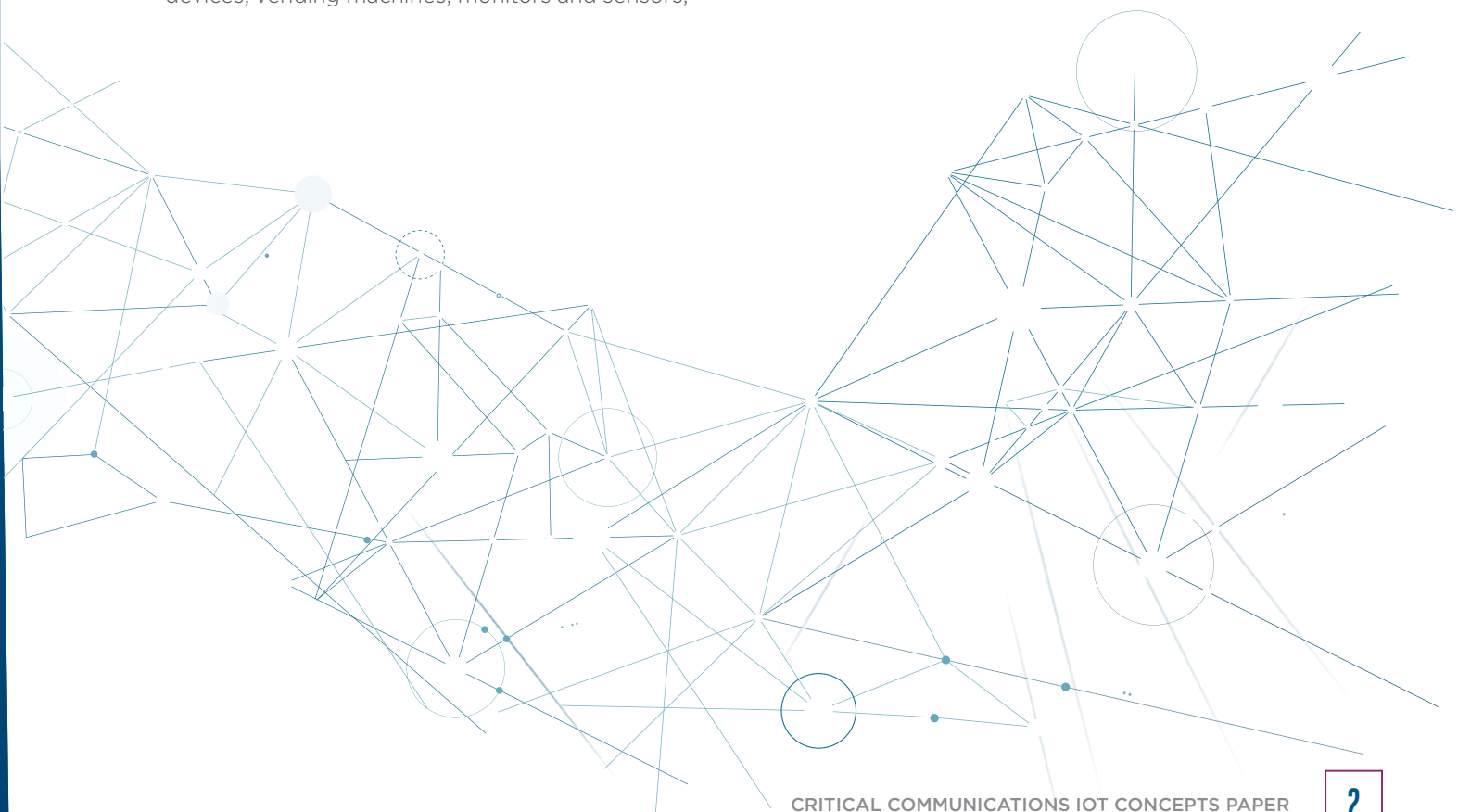
2 Critical Communications and Internet of Things

Communications needed to achieve a specific mission, for public safety purposes and business-critical functions, are critical and need a higher priority over other communications in the networks, and require some means of enforcing this priority. From a confidentiality, integrity and availability perspective, the requirements exceed those of other communications. This type of communication is known as “Mission Critical Communications”.

Generically, Internet of Things (IoT) describes the coordination of a network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment, i.e. sensors and actuators. These connected objects include everyday appliances and machines from many vertical industries such as vehicles, utility meters, tracking devices, vending machines, monitors and sensors,

consumer electronics and wearable technology, as well as smart phones and tablets.

IoT from a Critical Communications perspective, the term “Critical Communications IoT”, applies to connected objects that fulfil a public safety or business critical function.



3

Smart Glasses for Events Security Management

DESCRIPTION

One of the main challenges of managing security and safety at large events and crowds in stadiums or other venues is sharing relevant information, such as photos or videos of any incidents, and the precise location within the venue, in a timely manner to the event control room and to other security personnel onsite. This is critical to ensure that any incidents or potential dangerous overcrowding situations can be dealt with as quickly as possible.

A trial was held to assess the feasibility of using IoT technologies to complement other common communications technologies used in stadiums,

such as body-worn cameras and radios, to improve incident information sharing and incident response times. The trial was part of an EU safety and security Project called MONICA¹ where G4S security personnel at Emerald Headingley Stadium were equipped with smart glasses.

The smart glasses included a connected camera functionality and a simple way to input commands to allow the security personnel to share pictures and videos of potential incidents easily with the control room. In the trial, the data from the smart glasses were used in conjunction with CCTV camera feeds throughout the venue.



¹ The MONICA project, Management Of Networked IoT Wearables – Very Large Scale Demonstration of Cultural Societal Applications, has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732350

The smart glasses were used to help security personnel monitor crowd safety and security, to flag incidents and potential issues in a quick and easy way. The technology also helps identify what has happened visually and locate incident in the venue easily. The video and photos from the secu-

rity personnel using the smart glasses were shared with the control room in order to help others in the team evaluate if there is a problem and whether additional security personnel should be directed to the scene.

CONCEPT IMPLEMENTATION

The pilot took place during Leeds Varsity 2019, an inter-university sports competition between arch rivals University of Leeds and Leeds Beckett University, with events throughout the year, hosting over 60 fixtures across 25 different sports and finishing with one final day on 2nd October. The event culminated with the Men's Rugby Union Grand Finale at the Emerald Headingley Stadium in the evening where the winning University was crowned 2019 Leeds varsity champion. The final attracted an audience of over 10,000 students, family and friends.

The main aim was to test the functionality of the smart glasses from a police / security personnel work perspective.

The Optinvent ORA-2 smart glasses² used in the trial have an inbuilt camera with a facility to send images and live video feeds to a control room, to receive texts and alerts and to send acknowledgements.



The smart glasses have a number of functions:

- + Record video and send to the control room monitor as a real-time visual
- + Take pictures and send to the control room monitor as a visual
- + Record audio and send to the control room screen in real-time
- + Communication with control room - receive and send messages or instructions and display as a visual

² www.optinvent.com

The smart glasses are operated by either a hand-held joystick or using a touch pad on the side of the glasses. To speed up communication, the glasses were pre-programmed with set messages under the following sections:

- + **‘Action’ sections:** Emergency, Incidents, Response, Answers
- + **‘Storage’ sections:** Store messages / pictures / videos / audio

10 smart glasses were used by several volunteers from among the security personnel. The volunteers were required to attend a 30-minute training

session to familiarise themselves with the operating procedures. Each volunteer was assigned a specific 1-2 hour time period to use the glasses during the event to monitor the venue for incidents and to report to the control room as needed.

A dummy control room with a Common Operational Picture (COP) dashboard was set up alongside the real control room.

The purpose of the dummy control room was to review data from the stadium and where decisions and further instructions can be made.



The messages, images and footage from the smart glasses, including their location, were displayed on the control room dashboard along with camera and other information received from the various technologies, such as CCTV cameras, being deployed around the grounds on an interactive Stadium map.

4

Connected Ambulance with Remote Ultrasound Scanning

DESCRIPTION

Finding new ways of improving patient care by making existing procedures more efficient, reducing the time for patients to get treated and making the best use of clinicians' expertise are the main long term objectives in the field of healthcare. Looking into new technologies enabled by 5G and how they can be used to improve patient care, will help to deliver the next generation of healthcare technologies and deliver holistic specialist advice in real-time via virtual multi-disciplinary teams.

BT worked with University Hospitals Birmingham (UHB), an NHS foundation trust, and its research

partners including Ericsson, King's College London and Voysys, to trial new technologies that can transform healthcare services in the UK. The trial was organised by the UK government as part of a multi-city 5G testbed hosted in the West Midlands.

Using BT's EE 5G network in Birmingham, the trial demonstrates how 5G can enable real-time services to deliver significant cost savings by either reducing the number of patient trips to hospitals, ensuring patients are sent to the right hospital or unit for their condition or expediting the triage and admission processes once they arrive to hospital.



This digital transformation enables real-time collaboration between clinicians at hospitals or medical centres with paramedics in the field.

Early access to information from ambulances can support the care the patients receive on arrival at

hospital and the patient's journey through departments. This is already what is happening today in cases such as heart attacks where hospital staff can view the patient's ECG, but this could become a live data stream in future.

CONCEPT IMPLEMENTATION

The latest demo, of a 5G connected ambulance and remote ultrasound, is hosted by the Medical Devices Testing and Evaluation Centre (MD-TEC) in UHB's simulation lab, in the Institute of Translational Medicine. The 5G connected ambulance is provided by South Central Ambulance NHS Foundation Trust.

The aim of the demo is to show how the latest technologies can be combined with clinical expertise to enable remote diagnostics and link field practitioners with surgeons or consultants in 'real time', allowing clinicians to remotely assess and diagnose a patient, view medical records, vital signs and ultrasounds.

The demonstration simulates a paramedic in the field performing an ultrasound scan on a patient in an ambulance, under the remote guidance of a clinician based at a medical centre 2 miles away at MD-TEC, who is able to interpret the ultrasound image in real-time.

The ultrasound sensor is manipulated locally by the paramedic under the remote direction of the clinician. This is done using a joystick operated remotely by the clinician which sends control signals over the live 5G network to a robotic or 'haptic' glove worn by the paramedic.

The glove creates small vibrations that direct the paramedic's hand to where the clinician wants the ultrasound sensor to be moved. This allows the clinician to remotely control the sensor position, whilst seeing the ultrasound images in real-time.

In addition, there is a camera in the ambulance which transmits in high definition a view of the inside of the ambulance covering the patient and paramedic to a second screen located on the clinician's workstation.

As an additional enhancement to the system, the latest demo included the real-time transmission of a stereoscopic video view from a pair of 180 degree cameras located at the ambulance. The real-time video feed is combined with multiple additional streams of information, including the real-time ultrasound scan output, the patient's medical records and a close-up view of the patient (from a built-in camera from the paramedic's AR glasses), and then displayed in a VR headset for the clinician at the hospital to experience a full immersion into the scene at the ambulance, augmented by additional information to help deliver a better diagnosis.

The images are relayed over a high-bandwidth 5G connection, so the clinician is able to view both the ultrasound examination performed by the paramedic and keep an eye on the overall scene inside the ambulance. Together with live feeds of the patient's ultrasound scan, the clinician is able to recognise vital signs to determine whether the patient needs to go to an A&E department.

The superfast speeds of 5G ensure sharper and more reliable imagery for the clinician than could previously be achieved.

5

Anti-Fire Drones

DESCRIPTION

Unmanned Aerial Vehicles (UAVs) are already used for a multitude of applications, particularly where they can offer public value.

Telefónica IoT in collaboration with partners Dronitec, Divisek and the Intelligent Systems Lab, from Universidad Carlos III de Madrid, developed an anti-fire UAV solution to fight forest fires. The purpose of the IoT project was to support emergency teams to respond to fire rapidly and in a safe and efficient manner by providing real-time information and the condition of the fire. A demonstration of the pilot has been successfully achieved in Spain.

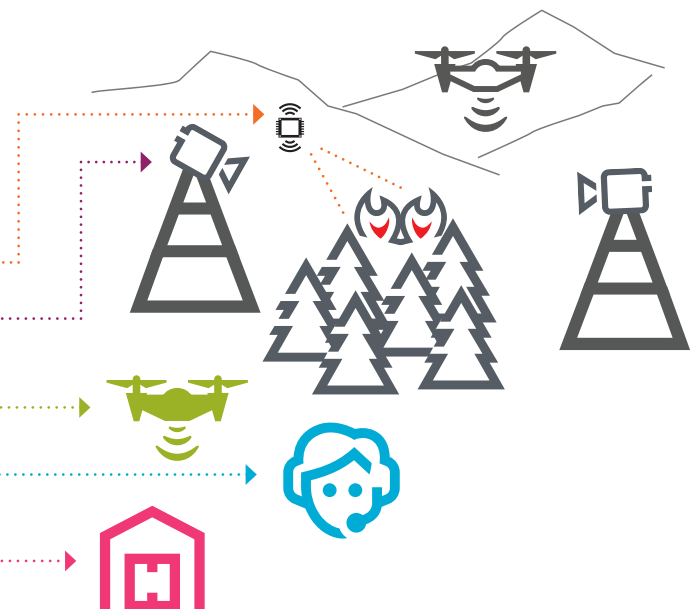
The problem of forest fires in Spain is considerable, and providing a quick response is limiting the impact on the ecosystem, the local economy and health of fauna and human beings.

Currently, the emergency team needs to estimate the manpower and equipment needed based on their experience, but without having much information about the actual fire condition and behaviour. This could lead to an inappropriate response or to an increased risk.

THE IoT SOLUTION

EFFECTIVE EARLY FIRE DETECTION AND INFORMATION SYSTEM BASED ON SENSORS IN TELECOM TOWERS AND IoT DRONES

- 1 **Distributed sensors** (thermal, smoke, wind) deployed in Telefónica communications towers detect a potential fire
- 2 An **alarm** is sent to the control centre and to the drone
- 3 The drone-hangar opens automatically, the drone **flies autonomously** to the area and **captures information** with camera and sensors
- 4 The information is sent in real time thanks to **IoT** to the **Control Centre**
- 5 The drone flies autonomously **back to the hangar** where it is charged automatically



CONCEPT IMPLEMENTATION

This IoT solution leverages the telecom towers infrastructure, real-time mobile connectivity and UAVs. In brief, the solution consists of:

- ✦ Several sensors (thermal, smoke, wind, etc.) are deployed on Telefónica communications towers. These sensors can detect a potential fire in a surrounding area up to 15 kilometres.
- ✦ A UAV equipped with a Telefónica IoT SIM, which is protected in a hangar collocated in the base station area, including a recharging station. The UAV is also equipped with cameras (thermal and optical) and sensors.
- ✦ A dashboard where the emergency team can see the real time information sent by the UAV and remotely send the UAV to a different location.

The ubiquity of mobile networks and the locations of the already existing towers fit very well for supporting this use case and for detecting forest fires. In addition, the existing tower infrastructure provides the system with an electrical supply, communications network and a secure installation protected by fences.

The usage of 3G or 4G provides required coverage and bandwidth needed for this use case.

When the sensors detect a potential fire, an alarm is sent to the UAV indicating the coordinates of the potential fire. These coordinates are calculated based on the location of the towers where the sensors are deployed. The alarm will trigger both the UAV-hangar to open automatically, and in the planned future solution, the UAV will autonomously fly to the indicated fire area to survey the location and capture information. The gathered information is sent, in real time, through the Telefónica mobile network connectivity (3G or 4G depending on availability) to the emergency control centre.

Thanks to that real-time information, the emergency team has the relevant data and characteristics of the fire (whether it is an actual fire or a false alarm, whether there are people trapped by the fire, and the entry and exit routes that they can take, whether there are natural water sources that can be used to extinguish the fire, etc.). With that information, the emergency team can take better decisions and send the perfect team with the correct equipment to extinguish the fire in an effective way and also improving the safety of the team by reducing human risks. In addition, the emergency team can remotely control the UAV to survey other surrounding areas outside of the prefixed route or geofence area. Once the UAV has finished its task, it flies autonomously back to the hangar where is charged automatically, to get ready for the next mission.

“ When the sensors detect a potential fire, an alarm is sent to the UAV indicating the coordinates of the potential fire. ”

6

Early Warning Earthquake App

DESCRIPTION

AT&T and the City of Los Angeles unveiled ShakeAlertLA, a unique mobile app designed to alert residents in Los Angeles County of an earthquake. The app is designed to send push notifications that an earthquake has occurred, potentially giving residents critical seconds of notice before shaking reaches them.

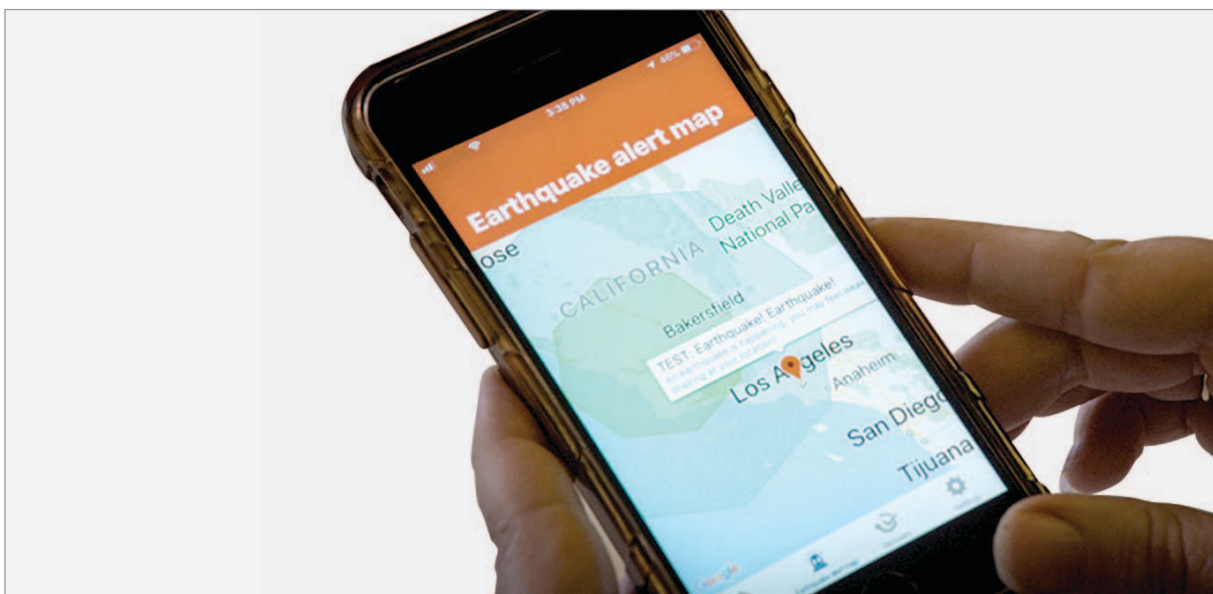
The app is designed to give citizens a head start when an earthquake occurs. When an earthquake happens, the app will send a notification that warns: EARTHQUAKE! EARTHQUAKE! Drop. Cover. Hold On. Protect Yourself Now!

These alerts can help residents and city officials take protective actions like taking cover from falling

debris and halting public transit systems to limit damage and injuries.

After an earthquake, residents can use the app to find various emergency services like where to seek shelter if your home is damaged or unsafe.

“Angelenos should have every chance to protect themselves and their families when there’s a major earthquake,” said Mayor Eric Garcetti. “We created the ShakeAlertLA app because getting a few seconds’ heads-up can make a big difference if you need to pull to the side of the road, get out of an elevator, or drop, cover, and hold on.”



CONCEPT IMPLEMENTATION

ShakeAlertLA delivers alerts that are issued by the ShakeAlert Earthquake Early Warning (EEW) system which is operated by the United States Geological Survey (USGS). EEW begins with a West Coast-wide network of ground motion sensors (seismometers) distributed along faults, in cities, and other regions.

Once an earthquake is detected, the seismic data is sent to a USGS ShakeAlert processing center. If the earthquake meets certain criteria an alert is issued and made available for delivery. The City of Los Angeles then pushes the alert to active app subscribers. Generally, the farther a ShakeAlertLA user is from the epicenter of an earthquake, the greater the warning that user may receive, while a user who is located closer to the epicenter may receive less or no warning. Users may receive the alert before, during, or after shaking arrives.

AT&T and the city of Los Angeles are also exploring ways to use technology to solve problems that matter most to the community, such as traffic congestion and public safety. This includes deploying Internet of Things (IoT) solutions, ranging from digital kiosks to structural monitoring to digital infrastructure, across the city, including under-served neighborhoods.

Through this public-private collaboration, smart cities technology can help provide better connectivity to neighborhoods that have been traditionally left behind in the digital divide.

ShakeAlertLA is free and offers both English and Spanish versions. The app is available now for download on iOS and Android smartphones and can be used on any carrier's network.

Note: In Europe, Member States that already have a Public Warning System shall ensure that these warning are transmitted using means of electronic communication services (ECS), either location based SMS or cell broadcast, by June 2022 according to article 110 of the European Electronic Communications Code. Alternative means like apps could be used only if their effectiveness is equivalent in terms of coverage and capacity to reach end-users. Nevertheless, in most cases, complementary app and early warning system based on internet access service will complement ECS. In all cases, all these means will require a mission critical delivery to the public.



7 Conclusion

The proofs of concept, pilots and trials outlined in this paper provide a few diverse examples demonstrating the value of using IoT for mission critical communications. The featured case studies clearly demonstrate how the IoT solutions benefit public safety services and protect the public. The true potential of IoT lies in the creative ways the mission critical and public safety communities will use the basic building blocks of IoT to solve the practical problems and challenges they face in their day-to-day activities as well as in emergency situations.

About the GSMA

The GSMA represents the interests of mobile operators worldwide, uniting more than 750 operators with over 350 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces the industry leading MWC events held annually in Barcelona, Los Angeles and Shanghai, as well as the Mobile 360 Series of regional conferences.

For more information, please visit the GSMA corporate website at www.gsma.com.

Follow the GSMA on Twitter: [@GSMA](https://twitter.com/GSMA).

About PSC Europe

PSCE is a permanent autonomous organisation working to foster excellence in the development and use of public safety communication and information management systems by consensus building. PSCE is a forum where representatives of public safety practitioners, governmental organisations, industry and research institutes can meet to discuss and exchange ideas and best practices, develop roadmaps and improve the future of public safety communications. Dialogue is facilitated through 2 major conferences per year, and coordination of appropriate policy related activities with and for the European Commission. PSCE brings together those who procure, govern, develop, deliver and use public safety communication solutions across Europe.

For more information, please visit the PSCE website at www.psc-europe.eu.