Internet of Things Case Studies

LEADING THE WORLD OF INNOVATION
IN ASIA-PACIFIC

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1 Foreword

In the technology and telecommunications sectors, 5G is the new golden child. And rightly so. Now coming of age, this highly versatile and capable technology will transform entire industries, while enriching the lives of people around the world.

In fact, as this report shows, that transformation is already happening and the Asia-Pacific region is leading the way. An integral part of the 5G standards, Mobile IoT networks are delivering on their promise to make it viable to reliably and securely connect vast numbers of devices to the existing cellular infrastructure. The case studies in this report highlight how cellular networks across Asia-Pacific are now bringing everything from utility meters and poultry feed stations to refuse trucks and drones online. The diversity and breadth of the case studies is particularly striking, underlining how almost every sector of the economy can benefit from better connectivity, comprehensive data analytics and new insights.

The GSMA's APAC IoT Partnership Programme, which has doubled in size since its launch in October 2018, is playing a pivotal role in the expansion of the IoT in the region. It is bringing the region's operators together with scores of IoT developers, innovators and systems integrators to create end-to-end solutions that can fully address the needs of a wide range of organisations, as well as individual consumers.

Now the largest regional IoT community in the world, the GSMA's APAC IoT Partnership Programme is much, much more than a talking shop. I am heartened to see the programme enjoying strong support, engagement and commitment from the mobile operator community who are developing tools and providing labs to drive IoT innovation across the region. The IoT labs, in particular, are a vibrant conduit for collaboration, facilitating the joint development of new use cases, services and applications.

The partnership programme complements the work of the GSMA's global Mobile IoT Initiative, which is playing a critical role in standardising networks across the world, and the GSMA's Mobile IoT Innovators community, which now has over 2,600 members from more than 1,700 companies.

As compelling as they are, the case studies in this report are just the tip of a very large iceberg. As 5G networks expand and acquire new capabilities, there will be even more scope for innovation and progress. I look forward to helping operators and their partners realise this potential, creating a better future for people in the Asia-Pacific region and beyond.

Julien Gorman,
Head of Asia-Pacific, **GSMA**

2 Introduction

Produced by the GSMA's APAC IoT Partnership Programme, this report consists of 17 case studies showing how mobile operators are expanding the Internet of Things (IoT) into many more sectors of the economy. Drawing on interviews with mobile operators and their partners, it shows how a combination of off-the-shelf and customised IoT products and services are meeting the very specific needs of use cases in the following sectors:

AGRICULTURE   **MANUFACTURING**   **UTILITIES**   **SMART BUILDINGS**   **SMART CITIES**   **TRANSPORTATION**

The report explains how 16 mobile operators, their partners and their customers are harnessing new technologies, such as LTE-M, NB-IoT, edge computing and artificial intelligence, to generate better insights into the way the world works and enable remote control over a wide range of assets. In almost every case, mobile operators are supplementing their connectivity with additional capabilities, such as device management, IoT platforms, data analytics and machine learning capabilities.

Covering IoT deployments in nine countries, the report focuses on the Asia-Pacific region, which is the largest IoT market in the world. GSMA Intelligence expects the APAC IoT market to encompass 11 billion connections by 2025 and be worth US$386 billion in that year.

11bn CONNECTIONS **by 2025** = **$386bn**

GSMA Intelligence

About the GSMA's APAC IoT Partnership Programme

Now supporting 35 mobile operators across 17 countries, the GSMA's APAC IoT Partnership Programme accelerates the delivery of new connected devices and services. It supports the development of new initiatives and the sharing of best practice from across the Asia-Pacific region to enhance industry collaboration, fuelling the growth of the IoT.

The largest IoT community in the Asia Pacific region, the programme brings together operators and their partners, including developers, manufacturers and system integrators, to share best practice, discuss challenges and progress updates on the development of IoT across the region. As part of the initiative, seven operators have opened nine IoT Labs to help develop new IoT-based solutions.

Participating operators include AIS, Axiata Group (Axiata Robi, Celcom, Dialog Axiata, Ncell, Smart Axiata, XL Axiata and Xpand), Globe, Indosat Ooredoo, Jazz, M1, Maxis, Mobitel, Smartfren, Singtel Group (Singtel, Optus), StarHub, Telenor Group (Digi, DTAC, Grameenphone, Telenor Connexion, Telenor Myanmar, Telenor Pakistan), Telstra, TM ONE, True, Rakuten, Viettel Group (Metfone, Mytel, Unitel, Telemor, Viettel), Vodafone Idea, YTL

MANUFACTURING & UTILITIES

CAPTURING REAL-TIME OPERATIONAL DATA -
DIALOG AXIATA

Operator: Dialog Axiata ● **Technologies: 3G, 4G, Edge Computing & NB-IoT** ● **Country: Sri Lanka**

MAKING AUTOMATION AFFORDABLE AND FLEXIBLE

In industry, operational managers are looking for real-time data and analytical information to inform timely decision making. However, many companies in emerging markets manually process data from their monitoring and control devices, such as energy consumption, using logbooks. To automate these processes, they need flexible IoT solutions at a price point that provides a return on investment to all the players in the value chain.

Generally, IoT devices, platforms and applications are tightly coupled to a vendor's proprietary systems, which for the users can be cumbersome to manage and costly to maintain. To address this issue, mobile operator Dialog Axiata has developed a device-agnostic solution, where any type of device can be seamlessly integrated via a simple plugin. As well as being flexible and scalable, this approach is designed to enable the customer to mash-up different types of devices. "By lowering the product costs and offering custom-built solutions, Dialog aims to leapfrog industries in emerging markets towards the fourth industrial revolution," says Anthony Rodrigo, Chief Innovation officer and Chief Architect at Dialog Axiata.

Dubbed iMoni, Dialog's general-purpose industrial IoT gateway can transmit alarm conditions and sensory data to a central system. It is equipped with digital and analogue I/O ports and a Modbus interface enabling it to be integrated with existing industrial systems and equipment. Working with Dialog-University of Moratuwa Mobile Communications Research Laboratory (UOM) and the Lanka Electricity Company (LECO), Dialog has also created a smart modem module (SMM) to support smart metering for utilities and enterprises, and a network monitoring device (NMD) for low voltage electricity distribution networks. Meter-independent, the SMM supports remote meter readings, remote disconnection/reconnection and pre-paid charging, while transmitting data that utilities can use to generate a load profile of customers.

REAL-WORLD DEPLOYMENT – IMPROVING POWER DISTRIBUTION IN SRI LANKA

In Sri Lanka, Dialog's IoT solutions are supporting multiple use cases, including remote base station site monitoring for mobile operators, energy monitoring for utilities and enterprises, factory automation and surveillance of bank ATMs. In 2019, LECO deployed 150 NMDs to monitor its power distribution network in real-time. It has also installed more than 3,000 SMM devices and plans to deploy 25,000 more units, as it rolls out smart metering. As well as allowing for remote meter readings, the new solution is enabling LECO to offer electricity customers a prepaid facility.

Today, the installed SMM devices use conventional cellular connectivity, but Dialog and UOM have designed a NB-IoT-connected SMM, which they are now testing. The project partners are also developing next generation NMDs with advanced features.

While scaling up iMoni deployments in the utility, telecoms and industry automation sectors, Dialog is looking to apply the solution in other industries and other countries in the APAC region via the Axiata Group. The operator is also integrating new peripheral devices into iMoni to enable it to support a wide range of industrial automation applications.
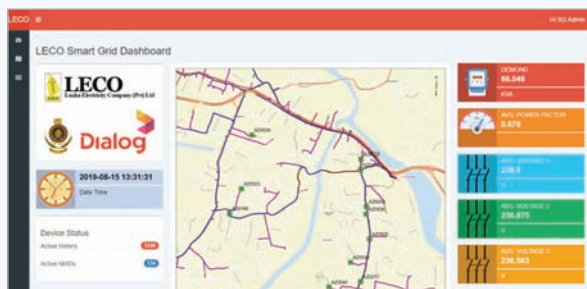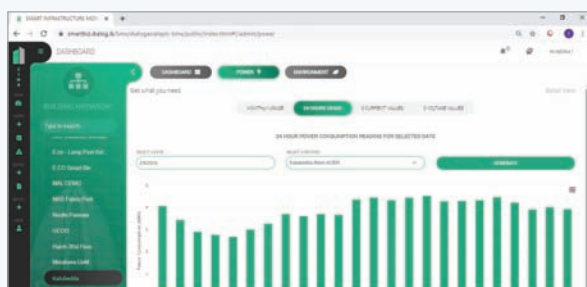

Smart meter with SMM

NMD
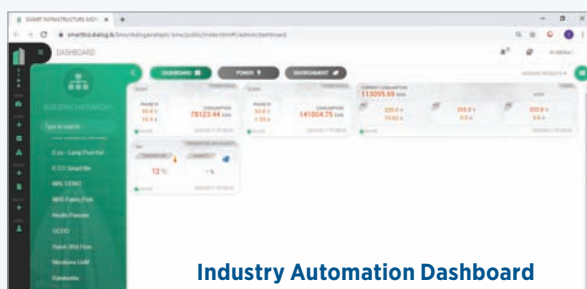
Industry Automation Dashboard

iMoni IoT Gateway

REDUCING ELECTRICITY THEFT AND SYSTEM LOSSES – **CISNR & PESCO**

Operator partner: Jazz ● **Technologies: 3G, AI and Edge Computing** ● **Country: Pakistan**

KEEPING THE COST OF POWER DOWN

In Pakistan, households and businesses face rising electricity tariffs and frequent power outages. The main causes are power theft, inefficient deployment and configurations of the distribution equipment and line losses across the country. The Pakistani Senate Committee on Circular Debt estimates power theft during 2017–18 cost the country more than Rs53 billion (US$340 million).

Mobile operator Jazz, in collaboration with technology partner CISNR, has developed a 3G/4G-connected solution that can perform household electricity metering at a centralised street level distribution point. The solution removes the need to install connected meters in each household, which would be prohibitively expensive. Whereas a conventional digital smart meter costs Rs13,000 per unit and a separate meter is deployed for each household, Jazz's Electrocure device costs Rs24,000 and can serve up to 24 households per deployment.

Moreover, sensors can be installed at transformer and grid level to provide a real-time centralised view of the complete distribution network. "With the smart utilities initiative, Jazz seeks to present a low cost indigenous alternative for digitalising the way power is distributed and charged across the country," says Ali Fahd Ahmed, Head of B2B Marketing at Jazz. "We are confident that this will prove to be a testimony of our commitment towards playing a bigger role as a catalyst for digital society and economy in Pakistan."

REAL-WORLD DEPLOYMENT – POWER DISTRIBUTION COMPANIES IN PAKISTAN

In May 2018, Jazz and CISNR unveiled the new solution for electricity theft and loss prevention at distribution network level. With CISNR having already implemented some limited proof of concepts in Pakistan, the two companies designed the solution to scale and address the electricity theft and loss issue at a national level.

Supported by an initial seed grant of £150,000 from the GSMA, under its Mobile for Development programme, the solution has been implemented by PESCO, a power distribution company operating in the north of Pakistan. Following the deployment, PESCO has identified a 25-30% gap in consumption data compared to the legacy equipment deployed by the distribution company itself.

PESCO, CISNR and Jazz are working together to quantify and document the overall positive impact of the new solution. They plan to present these results to the national authorities and power distribution companies nationwide. Jazz intends to put forward its solution as a low-cost and easily scalable alternative to conventional digital metering solutions. Even if it is only deployed by four of the 12 distribution companies in Pakistan, Jazz estimates that the proposed solution can help save Rs37 billion (US$240 million) per annum.

Watch an interview with Jazz:
https://youtu.be/_x0LJCL2HkA

BOOSTING THE PRODUCTIVITY OF PLASTICS PRODUCTION - **DAVITEQ**

Operator partner: Viettel ● **Technologies: 3G** ● **Country: Vietnam**

REDUCING DOWNTIME IN MANUFACTURING

Manufacturers can struggle to keep track of when production machines are down and why. In some cases, operators still manually record machine operation data, such as total load time, total stop time and total no-load time, each day and then produce weekly reports. To improve efficiency, manufacturers are looking for digital solutions that can help them monitor machine performance and thereby identify ways to reduce downtime.

To address such challenges, Daviteq of Ho Chi Minh City has developed an end-to-end solution, consisting of a process instrument, a wireless sensor, an IoT gateway and an IoT platform called Globiots. It says this machine monitoring solution is being adopted by customers in the energy, manufacturing and environmental sectors in Vietnam, as well as other countries in Asia, Australia and America. Daviteq has also developed IoT solutions for logistics, transportation, utilities and agriculture.

Main Components of IoT Machine Monitoring System

REAL-WORLD DEPLOYMENT – SUPPORTING A PLASTICS MANU-FACTURER IN VIETNAM

A plastics manufacturer in Vietnam wanted to understand the cause of the low efficiency of its 23 computer numerical control (CNC) machines, which are used to make moulds. CNC machines are high precision tools that are computer-controlled and make repeated, accurate movements. The manufacturer uses the portable machines, which are from different manufacturers and ages, in two workshops that lack Wi-Fi or Ethernet connectivity.

The manufacturer has now installed Daviteq monitoring boxes on their own frames next to each CNC machine. The boxes, which are wired into the machine controller, connect to a 3G gateway, and are equipped with an input/output module and 10 push buttons that the machine operator can use to input different machine downtime causes. The box collects data on the machine's load, no load, and alarm signals and then transmits that information to Daviteq's cloud server through Viettel's 3G network. "The available low-cost Viettel 3G cellular network enables us to not only deploy IoT projects in manufacturing quickly and simply, but also enables customers to become faster and more effective," says Nguyen Vinh Loc, Director of Daviteq.

The manufacturer can use Daviteq's Vizuo web application to see the status of each machine, historical trends, and analysis reports for machine usage, efficiency and downtime. The system's parameters, alarms, events, dashboards and reports can be remotely configured through a web inter-face. The information being captured by the solu-tion can be used to help the relevant department tackle the causes of downtime in a timely manner, and to identify and improve the less effective machines. It can also be used to help specify and design relevant solutions for the main causes of machine downtime problems.

Daviteq is now planning to expand its monitoring solutions to support plastics injection machines and encompass environmental factors.

Watch an interview with Daviteq:
https://www.gsma.com/iot/resources/m360ds19-daviteq/

SMART AGRICULTURE

SUPPORTING PRECISION AGRICULTURE - **MOMOKU**

Operator partner: Maxis ● **Technologies: NB-IoT** ● **Country: Malaysia**

MAKING FARMING MORE PRODUCTIVE

To feed the fast growing global population, traditional farming methods need to be supplanted by precision agriculture that can optimise the amount of food produced per hectare. In 2016, the United Nations reported that 11% of the world's population (815 million people) had insufficient access to food. With food demand set to rise by 60% by 2050, coupled with the risk that global warming and more disease outbreaks will hit farming, the disparity between food supply and demand could increase further, leaving many vulnerable communities to face starvation.

The cultivation of mushrooms can be an effective way to increase farmers' income in developing countries due to low production costs, high profits and quick returns on investment. Yet labour shortages, as well as undetected disease outbreaks within outdoor mushroom farms, have resulted in some farmers in Malaysia experiencing substantial losses, leading many of them to downscale operations. One possible solution to this issue is to deploy precision agriculture technology in an indoor urban farming environment.

According to research, there is a direct correlation between three key environmental factors - temperature, humidity and airflow - and the mushroom crop yield. Farmers are now able to remotely monitor and control these variables using an IoT solution developed by Momoku. The solution is connected to Maxis' NB-IoT network, which provides the deep indoor coverage suitable for urban farming. As a result, farmers can achieve higher returns through

savings on labour and fertilisation costs. They can also reduce the risk of disease outbreaks through continuous environment monitoring and control.

Cultivation of mushrooms using precision agriculture technology in an indoor urban farming environment

Watch an interview with Momoku:

https://www.gsma.com/iot/resources/m360ds19-momoku-maxis/

REAL-WORLD DEPLOYMENT – INCREASING ADOPTION OF PRECISION AGRICULTURE IN MALAYSIA

Taking this further, Maxis is collaborating with MARDI (Malaysian Agricultural Research and Development Institute) to implement precision agriculture for grape crops. The aim is to enable systematic sensing of environmental and soil conditions remotely enabling farmers to then fine tune the environmental variables. They can then proactively optimise input resources and potentially maximise yield output.

Maxis' NB-IoT network allows farmers to seamlessly scale up the deployment of the solution to wider areas as it can support millions of connected sensors while consuming very little power, enabling them to operate longer in the farms. Performing advanced analytics on the large volume of data collected will help businesses make better decisions to achieve cost savings, improve efficiency and create new business opportunities.

Field trials with MARDI (Malaysian Agricultural Research and Development Institute) to enable precision agriculture in grape vineyards.

Watch a video clip on the field trial with Mardi:
https://youtu.be/6OU1Y2Oarm0

HELPING LIVESTOCK FARMERS BECOME MORE PRODUCTIVE - **DYCODEX**

Operator partner: **XL Axiata** ● **Technologies:** **Artificial intelligence & NB-IoT** ● **Country:** **Indonesia**

MAKING CATTLE FARMING MORE EFFICIENT

Cattle farming in developing countries is mostly still a manual process that relies heavily on instinct, rather than actual data. As a result, farmers can be late in detecting potential disease and stress in their animals or the oestrous cycle for successful breeding, while the food and water supply is rarely optimised. They also rely on fences to prevent loss and theft of cattle, while animals generally have to be counted manually by someone in the field.

These inefficient practices could be addressed through the introduction of precision livestock farming, based on real-time data, which can be used to increase yield and reduce losses. Indonesia-based start-up DycodeX has developed SMARTer-nak, an IoT solution that uses artificial intelligence

(AI), to assist cattle farmers. XL Axiata's low power wide area NB-IoT network connects devices worn by the cattle with the cloud, where the SMARTernak AI continuously tracks the animals' behaviour, delivers insights, and recommends actions to the farmer via a smartphone app or web-based dashboard.

The compact SMARTernak cattle-wearable devices, which have solar cells to harvest energy, contain a GPS chip and sensors that can monitor the cattle's body temperature and activity levels. As well as indicating the health of the animal, this data can be used to determine how active it is and how much it is feeding, and when is the optimum time for insemination. Moreover, a built-in anti-theft system means SMARTernak will notify the farm owner or caretaker if the device is stolen or removed from their cattle without permission.

REAL-WORLD DEPLOYMENT – PILOT PROJECTS IN CATTLE FARMS IN WEST JAVA, INDONESIA

Supported by the Desa Digital (Digital Village) programme run by the government of West Java Province, DycodeX has tested its SMARTernak product in the field. The initial pilot involved a medium-size farm in the Majalengka region of West Java. The primary objective was to test NB-IoT connectivity. It found that an existing LTE base station using 900MHz spectrum could provide reliable coverage over a 3km radius, which is sufficient to cover the entire farm. The pilot confirmed that the SMARTernak wearable device was able to transmit and receive data via NB-IoT without any significant issues.

In December 2019, through the Digital Village programme, DycodeX began expanding the pilot deployment to three more farms in different regions of West Java province, starting from Cianjur region, to explore further how the solution can bring value to the livestock business and support government initiatives. "After all pilot deployments are finished, which is expected to be in April 2020, we'll present the result to the Governor himself as the Digital Village programme initiator," says Andri Yadi, CEO of DycodeX. "We are expecting to sign a MoU for government support for us to deploy the solution to more villages and farms. The plan is to deploy more than 1,000 devices in 2020, and more in the coming years."


Watch an interview with DycodeX:
https://www.gsma.com/iot/resources/m360ds19-dycodex/

SUPPORTING BETTER POULTRY FARMING – **SIERAD PRODUCE**

Operator partner: XL Axiata ● **Technologies: 3G, 4G & NB-IoT** ● **Country: Indonesia**

IMPROVING NUTRITION FOR CHICKENS

In Indonesia's fast-growing poultry industry, feed accounts for 67% of the average cost of running a broiler. But the provision of food and water to farmed chickens tends to be based on manually collected historical data, rather than actual conditions. Without proper monitoring tools, this data can be subjective and inaccurate. Moreover, this approach is labour intensive and can mean late interventions when environmental parameters bridge specific thresholds. The result is welfare-related issues, such as disease outbreaks that then require the administration of antibiotics, and vaccinations.

Mobile operator XL Axiata is looking to address these challenges using cellular-connected sensors to enable near real-time monitoring of the food and water levels in poultry sheds. Connected sensors can also be used to measure the weight growth of individual chickens and environmental parameters, such as temperature, humidity, wind speed, light intensity and concentrations of ammonia and CO_2. The data being collected can then be used to automate fans and heating and cooling pads, as necessary. The net result is an improvement in the health of chickens and lower mortality rates, as food and water supplies and environmental conditions are optimised. The solution can also reduce labour costs.
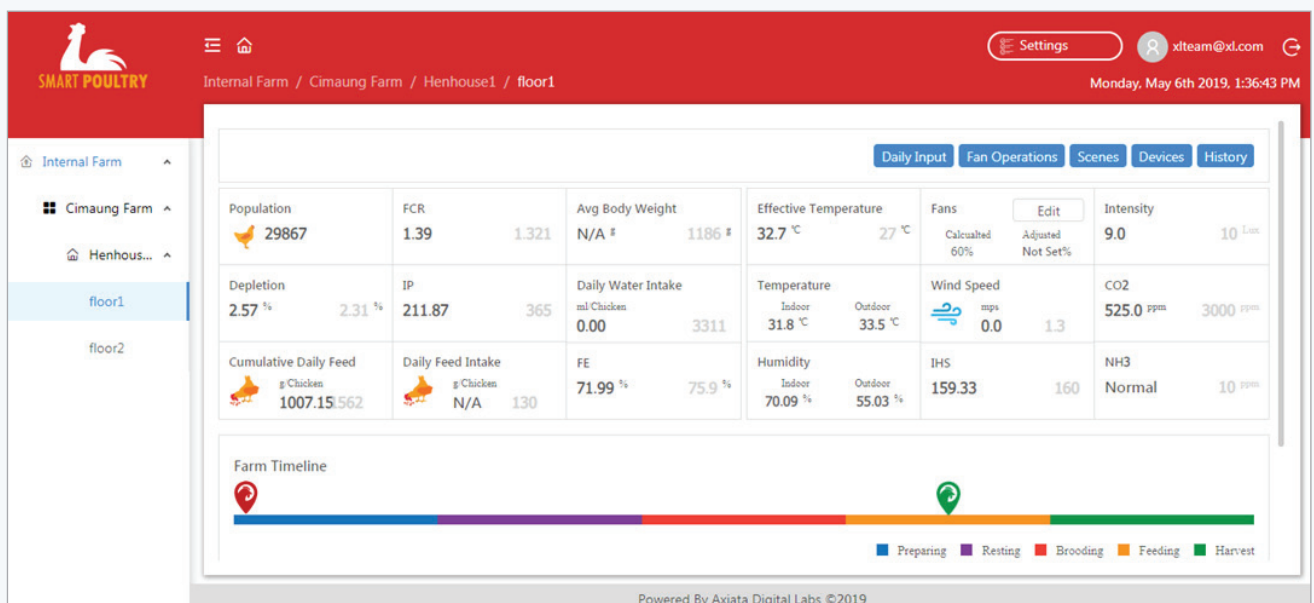
Smart Poultry Dashboard

REAL-WORLD DEPLOYMENT – POULTRY FARMS IN INDONESIA

Having run a proof of concept, XL Axiata and Sierad Produce, one of the largest integrated poultry companies in Indonesia, are now preparing for a commercial deployment of the Smart Poultry solution. The proof of concept, which monitored 60,000 chickens over two floors, ran in the second quarter of 2019. It improved food and water efficiency by 10%, while increasing the survival rate by 5% by improving environmental conditions for the chickens, according to XL Axiata. The introduction of automated monitoring and interventions also resulted in a 40% increase in labour efficiency.

In the fourth quarter of 2019, XL Axiata and Sierad plan to expand the Smart Poultry solution to cover nine floors and 270,000 chickens. They estimate that will require 152 IoT devices, including seven gateways, 42 smart switches and 105 sensors covering temperature and humidity, ammonia, CO2, wind speed, water meters, digital scales and lux meters. Ultimately, the mobile operator intends to provide a managed monitoring service to poultry farmers, which they could pay for via operating costs, rather than having to make an upfront investment. In future, farmers could also use the data captured by these monitoring solutions to help them secure loans and expand their business.

Watch an interview with XL Axiata:
https://www.gsma.com/iot/resources/m360ds19-xlaxiata/

SMART BUILDINGS

ENABLING SMART BUILDINGS AT SCALE –
SOFTHARD.IO

Operator partner: 3HK, CSL & SmarTone ● **Technologies: LTE-M and NB-IoT** ● **Country: Hong Kong, China**

STREAMLINING IOT DEPLOYMENTS IN BUILDINGS

For enterprises, deploying an IoT solution can be both complex and costly - they generally need a technical team to set up the infrastructure and integrate multiple sensors into their buildings. They can end up spending ten of thousands of dollars to install and maintain expensive network infrastructure. In some facilities, such as convention centres, the deployment can be further complicated by the presence of existing wireless networks, which could interfere with the IoT network.

To simplify the deployment of IoT infrastructure, Softhard.IO has combined devices, LTE-M and NB-IoT connectivity and IoT Enablement Platform

into a single solution for what it calls a "Snap-N-Go" installation. It aims to enable enterprises to begin a proof-of-concept project within two weeks, which can then be rapidly scaled up. Based in Hong Kong, Softhard.IO says its solution can be used to deliver data into the cloud for machine learning and big data analysis.

Working with telecom operators in Asia and the United States, Softhard.IO says it helps customers from many different sectors, including airports, facility management companies, hospitals, construction engineering, retail, utilities and government, to quickly deploy IoT technology.
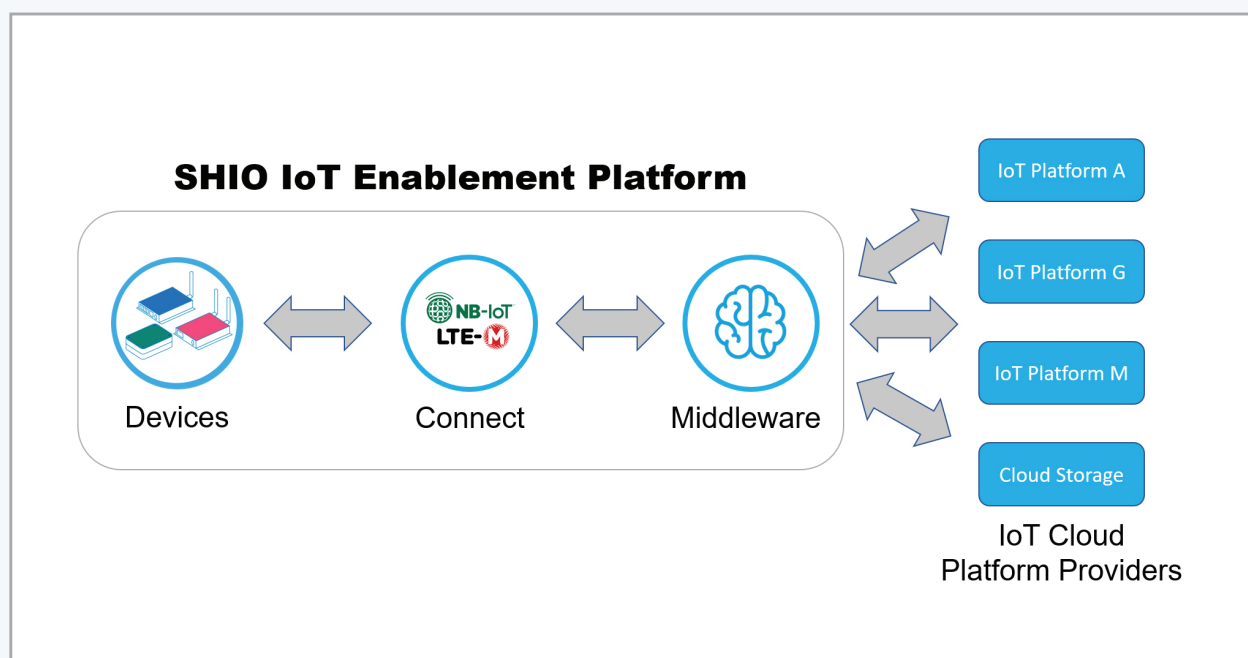
REAL-WORLD DEPLOYMENT – HELPING HONG YIP SERVICE MANAGE PROPERTIES

Hong Yip Service Company Ltd., a wholly owned subsidiary of Sun Hung Kai Properties Ltd., manages approximate 1,600 buildings from private estates and luxurious houses to commercial and industrial buildings, shopping centres and government facilities.

Leveraging Softhard.IO's Edge Lite solution, temperature and humidity sensors and NB-IoT connectivity, Hong Yip Service Company ran a pilot project to monitor rooftop door and water leakage across 50 buildings in different locations. The initial installation was completed within three weeks, enabling the property company to evaluate the new data quickly, while providing scope to rapidly scale up the solution. Hong Yip Service Company

found it can use the captured data to automatically alert maintenance teams, rather than relying on the occupants to report a leak. It now regards the solution as one of the essential tools to upgrade existing properties to smart buildings, increase work efficiency and improve the experience of occupants. Hong Yip Service Company and Softhard.IO continue to work closely together to further develop the smart building solution.

"The sensors can transfer all data to the cloud which forwards all events to our developed platform and let us monitor any situation for all different sites on single panel," says John Wong, Head of IT, Hong Yip Holdings LTD

Watch an interview with Softhard.IO:
https://www.gsma.com/iot/resources/m360ds19-nbiot-softhardio/

> " The sensors can transfer all data to the cloud which forwards all events to our developed platform and let us monitor any situation for all different sites on single panel, "

John Wong - Head of IT, Hong Yip Holdings LTD

ENABLING SMARTER MANAGEMENT OF STAFF ATTENDANCE - **GRAMEENPHONE**

Operator: Grameenphone ● **Technologies: 3G, 4G & NB-IoT** ● **Country: Bangladesh**

OPTIMISING WORKFORCE UTILISATION

The effective utilisation of employees is imperative for the success of any organisation. In particular, organisations need to plan efficiently to ensure they have the right number of employees in the right locations to deliver business results. Often, employers also need to monitor attendance of contractors or employees to determine their remuneration, as well as manage authorised vacation time and performance reviews.

To meet this burgeoning demand, Grameenphone Ltd., a mobile operator in Bangladesh, partnered with Inovace Technologies to launch the Grameenphone Smart Attendance IoT solution. The cloud-based system uses fingerprint authentication to identify employees when they enter the work site. The information is uploaded via Grameenphone's cellular network to a secure cloud server in real-time and can be integrated into the Organisation's enterprise resource planning (ERP) system via application programming interfaces (API). Currently, the solution uses GSM connectivity, but Grameenphone plans to use the low power wide area technology NB-IoT in the future.

Grameenphone says the attendance management solution is scalable and can be tailored according to the needs and structures of any type of organisation, including banks, enterprises, government departments and schools. The cloud-based software can be configured to generate various types of reports that can be easily accessed by managers via a web portal or smartphone app, according to the operator. The entire solution is designed to be plug-and-play, removing the need for any special installation support. In the event of a device fault, Grameenphone will replace the device and then load the previous configuration and user data from the cloud backup through the GSM/NB-IoT network.

REAL-WORLD DEPLOYMENT – MINISTRY OF PRIMARY EDUCATION IN BANGLADESH

In Bangladesh, Grameenphone has deployed the smart attendance solution for clients in both the public and private sectors. For example, the Ministry of Primary Education, which is working on a 22 project to digitise all 65,000 primary schools in Bangladesh, has already adopted the smart attendance solution across 1,000 primary schools.

Grameenphone says the solution has enabled the Ministry to monitor the regular presence of teachers in distant locations, ensuring that the students get access to the relevant teachers and a quality education. Furthermore, easy access to the hierarchy-based attendance reports has made the decision-making process more effective and faster, according to the operator. The headmaster of a particular school can now easily track the attendance of its teachers, while the district education officer can monitor the status of all the schools within that district. Moreover, the solution uses artificial intelligence to provide a critical analysis of class performance.

ENABLING HOUSEHOLDERS TO EASILY CONTROL SECURITY AND ENERGY USAGE - **ACIS**

Operator partner: Viettel ● **Technologies: 3G & 4G** ● **Country: Vietnam**

HELPING HOMEOWNERS LOOK AFTER THEIR PROPERTIES

Householders need a straightforward and affordable way to manage the energy consumption and security of their homes. They want to keep their properties safe from intruders, fire and other hazards, while being able to remotely control air conditioning and other home systems.

Supported by funding from Saigon HighTech Park in Vietnam, start-up ACIS Technology began developing a smart home solution in 2012. Two years later, it started to sell commercial products and solutions in Vietnam. ACIS's Easy Control solution is designed to make it straightforward for homeowners to control all the electronic devices in their apartment, house or villa remotely via a smartphone or tablet. The app gives the user a three dimensional view of their home, enabling them to easily control lights, air conditioning units and other appliances, while opening and closing blinds and doors.

By using wireless technologies "we can turn any existing home into a smart home without changing the structure of the house," explains Hieu Phan, International Business Development Director at ACIS. Once it has accumulated enough data, the solution can make suggestions to the homeowner on how to save energy, he adds.

ACIS works with mobile operator Viettel Telecom to design and manufacture the IoT devices for the Easy Control solution. As well as providing IT infrastructure, such as servers, the cloud platform and connectivity, Viettel is helping ACIS with commercialisation and distribution.

ACIS is now using artificial intelligence to enhance the Easy Control solution further, while also exploring opportunities to export its products and core technology to markets beyond Vietnam.

REAL-WORLD DEPLOYMENT – HOUSES AND APARTMENTS IN VIETNAM

ACIS says its Easy Control solution is installed in more than 3,000 houses and apartments across Vietnam. It is sold through more than 40 distributors, including Viettel Telecom. In most cases, the IoT devices use a mesh network inside the home to communicate with a local gateway device, which then uses 3G or 4G to connect to a cloud platform to enable the homeowner to remotely control their household using mobile devices. In addition, some specialised controllers, such as a smart light control cabinet, smart water valves and environment monitoring stations, connect directly to the cloud via 3G or 4G, bypassing the gateway devices.

ACIS is now using artificial intelligence to enhance the Easy Control solution further, while also exploring opportunities to export its products and core technology to markets beyond Vietnam.

SMART HOME | *Acis* | ACIS'S EASY CONTROL SOLUTION WILL CONNECT 14 ELECTRICAL EQUIPMENT SYSTEM BY SMART DEVICES

Watch an interview with ACIS:
https://www.gsma.com/iot/resources/m360ds19-acis/

SMART CITIES

# IMPROVING WASTE MANAGEMENT IN URBAN AREAS - **QLUE**

Operator partner: Telkomsel ● **Technologies: 2G, 3G & Artificial Intelligence** ● **Country: Indonesia**

REDUCING THE IMPACT OF WASTE ON CITY RESIDENTS

Cities in the developing world are looking for an efficient and effective way to deal with waste, which can have a major impact on citizens' quality of life. If refuse is allowed to accumulate, it can cause environmental damage and health problems for city residents. To prevent that happening, the local government needs a simple and straightforward way for people to report waste, together with a system to optimise the routing of refuse collection lorries.

Jakarta-based start-up Qlue has developed a smart city workforce management solution, which draws on reports from citizens filed using mobile apps. Once the data has been analysed by Qlue's artificial intelligence software, it can be presented in a dashboard and used to help allocate resources.
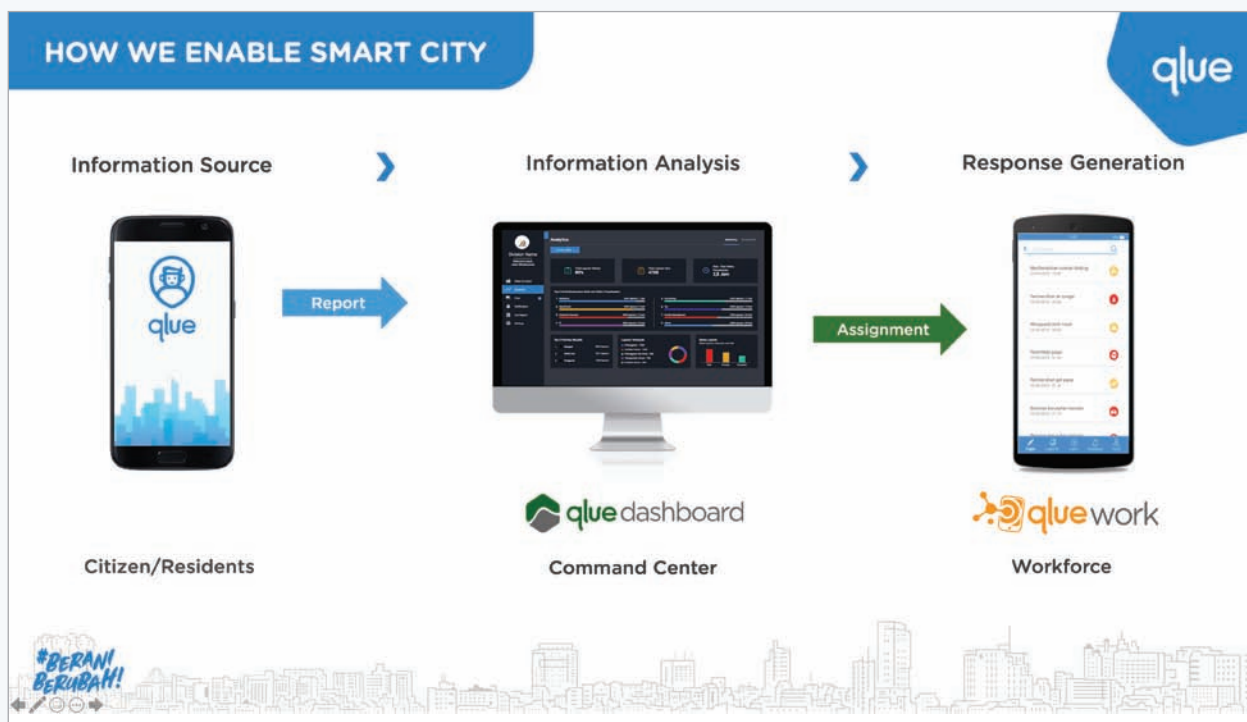
REAL-WORLD DEPLOYMENT – WASTE MANAGEMENT IN JAKARTA

To improve the efficiency of its refuse collection trucks and better integrate them into the recycling ecosystem, the city of Jakarta deployed Qlue's reporting system in 2018. It has integrated the information reported by citizens into a fleet management system developed by Indonesian mobile operator Telkomsel, which the city administration is using to improve the efficiency of the refuse truck collection and the utilisation of recycling facilities. The mobile operator's 2G and 3G connectivity enables the municipality to continuously track where its refuse vehicles are and direct them to where they are needed most.

"We analysed the data captured from citizen reporting apps, the routes of the lorries and their effectiveness (to see if any of the lorries are misused or having challenges), as well as the availability and

capacity of dumpsites and recycling sites around the neighbourhood," explains Maya Arvini, Chief Commercial Officer of Qlue. "After we overlaid the data, we found that there was inefficiency in the lorries' routes that didn't match the capacity of the truck, as well as the unequal distribution of performance of dumpsites in the region. Hence, our government clients can then reallocate their budget to solve the issue better, instead of just solving the problems every day, by creating a better route for the lorries and increasing the number of recycling sites."

As a result of these measures, the average time it takes for the municipality to respond to reports of waste has fallen from 300 hours to 24 hours, according to Qlue, which says that the improvement in government services has increased citizen trust by 41% in Jakarta. Qlue is now planning to build further solutions, such as smart CCTV surveillance, on top of its smart city dashboard.

> " clients can then reallocate their budget to solve the issue better, instead of just solving the problems every day, by creating a better route for the lorries and increasing the number of recycling sites "
>
> **Maya Arvini - Chief Commercial Officer** of Qlue

TRACKING ASSETS TO SAVE COSTS AND IMPROVE CUSTOMER EXPERIENCE - **TELSTRA**

Operator partner: **Telstra Global IoT Solutions** ● **Technologies:** **LTE-M** ● **Country:** **Australia**

COST-EFFECTIVE ASSET TRACKING

Each year, industrial companies misplace assets, including large expensive items, such as refrigerated trailers, vehicles and freight pallets. The use of manual tracking and stocktake processes can also result in operational inefficiencies. By using the IoT to reduce asset losses and improve efficiency, Australian companies could save AU$4.3 billion per year, according to the Telyste Telstra Track And Monitor Study 2019.

Traditional tracking solutions that use RFID tags only show if an asset has been checked in or out, and not its actual location. Now, low power connectivity is making it feasible to continuously track low value assets. Telstra's Track and Monitor® asset tracking solution combines IoT connectivity with analytics software in the cloud. It employs a variety of innovative IoT asset trackers to locate a wide range of business assets from large containers or trailers to small plant or freight.

Telstra's IoT network covers almost four million square kilometres - one of the world's largest. Telstra uses LTE-M for the tracking of critical assets, while lower value assets are monitored via the Bluetooth Finding Community, made up of Telstra customers, which connect to the Bluetooth network when in range. These Bluetooth asset trackers interact with the Bluetooth network to provide continuous tracking on a 'best efforts' basis. This approach drives down cost: Telstra charges a minimal service fee, which can be as low as AUS$1.50 per month per device.

REAL-WORLD DEPLOYMENT – SCT LOGISTICS ACROSS AUSTRALIA

SCT Logistics is using Telstra's solution to track non-powered assets across Australia and has added LTE-M solar-powered trackers to rail wagons and trailers. Whereas "we used to track our assets purely on paper and Excel spreadsheets, now we can track them and understand exactly where they are, every minute of every day," says SCT Logistics' CIO Sean Atchinson.

Before deploying the new tracking solution, SCT Logistics was losing about 3% of its wagons and trailers each year. With each asset costing an average of AU$100,000, the solution should help SCT Logistics save AU$3.8 million a year, based on tracking 1,500 wagons/trailers.

SCT Logistics is also using Telstra's solution to improve its operational efficiency. An application programming interface enables SCT Logistics to integrate the new location data into its existing IT systems. As a result, it has a single centralised view of data, reducing costs and enabling faster, better-informed decision-making. When a rail wagon or trailer enters its destination "geo zone", SCT Logistics can dispatch trucks for unloading, creating efficiencies and optimising resources. It is also

performing replacement/predictive maintenance for its trailers, wagons and containers based on the time they spend on the move, how far they have travelled and the nearest maintenance facility.

"The cost savings for us is about knowing where our assets are, so we can provision them in time, we can do a lot of preloading," explains Sean Atchinson. "We won't lose our assets anymore. We won't have to spend time looking for them, so the combined physical and human savings generate a lot of benefits for the business."

SCT Logistics is now working with Telstra to aggregate and analyse masses of disparate data from across their whole multi-modal supply chain network. The aim is to develop solutions which provide end to end freight visibility and insights to support their own operations and to add value to the suppliers and retailers who are their customers.

Find out more about Telstra tracking solutions:
https://www.telstra.com/trackandmonitor

> " We used to track our assets purely on paper and Excel spreadsheets, now we can track them and understand exactly where they are, every minute of every day "

Sean Atchinson - CIO SCT Logistics

CONNECTING PEOPLE WITH AVAILABLE PARKING SPACES - **TM ONE**

Operator partner: TM ONE ● **Technologies: 4G & Artificial Intelligence** ● **Country: Malaysia**

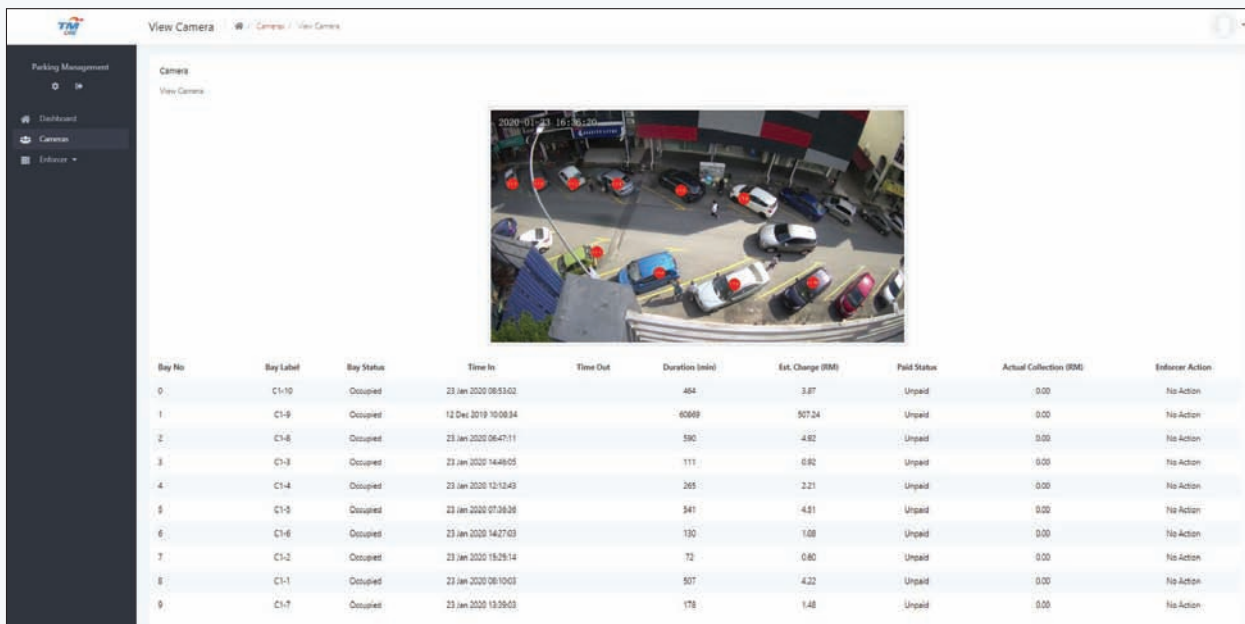## STREAMLINING PARKING FOR CITIZENS AND MUNICIPALITIES

Drivers can waste a lot of time looking for somewhere to park, making it hard to plan their journey and contributing to congestion. At the same time, municipalities can find it hard to collect payments: a parking attendant may have to scan number plates one-by-one to check each vehicle's payment status. This method consumes a lot of time and manpower. For both drivers and municipalities, the root cause of their parking problems is a lack of real-time data – drivers don't know where the empty spaces are and the authorities don't know the payment status of vehicles parked in ticketed bays.

To give drivers and authorities real-time information, mobile operator TM ONE has developed a smart parking solution, which can show drivers where spaces are via a smartphone app and a dashboard accessible through any device connected to the Internet. It also provides parking authorities with a single platform through which they can monitor all the spaces under their purview.

The solution combines cameras and sensors, connectivity, artificial intelligence (AI), data visualisation and analytics on a single platform. The data captured by sensors and cameras are processed by an AI system at the edge of the network, which then transmits the metadata via TM ONE's 4G network to the cloud to be analysed and displayed on the smart parking dashboard. As a result, drivers and municipalities can see all the information they need, including real-time availability and payment status. Drivers can even use the smartphone app to book a vacant parking space before they arrive.

For parking attendants, the solution can pinpoint vehicles with unpaid or expired parking fees, making enforcement fast and accurate. It can also be used to vary prices according to demand. TM ONE says that will translate into higher revenues and lower operation costs for the local councils or parking operators that run the outdoor parking spaces.

REAL-WORLD DEPLOYMENT – SMART PARKING IN SUBANG JAYA CITY IN MALAYSIA

TM ONE has deployed its smart parking solution for Majlis Perbandaran Subang Jaya, the local authority that manages the infrastructure and municipal services in Subang Jaya city in Malaysia. The end-to-end service includes the smart parking solution, a mobile app drivers can use to pay for a space, a round-the-clock service helpdesk and a monitoring and management centre.

TM ONE is now enhancing the smart parking solution further. For example, it is integrating parking space availability alerts with a navigation system

to guide drivers to the nearest empty parking spot. The operator also plans to provide parking attendants with a smartphone app and a compound ticket printer, which can be integrated with other parking systems.

As 5G connectivity becomes available in Malaysia, TM ONE has also piloted the solution over 5G in Subang Jaya as part of the field trial organised by the Malaysian Communication and Multimedia Commission (MCMC). The 5G-enabled smart parking supports real-time video streaming from AI-based cameras to enable the detection of irregular behaviour, thereby providing safety and surveillance capabilities.

ENABLING SMART TRAFFIC MANAGEMENT IN CITIES - TM ONE

Operator: TM ONE ● **Technologies: 3G, 4G & Edge Computing** ● **Country: Malaysia**

TACKLING TRAFFIC CONGESTION IN URBAN AREAS

In cities around the world, rising traffic congestion is curbing economic growth, increasing greenhouse gas emissions and impacting citizens' quality of life. One way to reduce congestion is to optimise the flow of vehicles through traffic lights.

TM ONE, the business solutions arm of Telekom Malaysia Berhad (TM), has developed a system that can programme traffic lights to respond to real-time data collected by connected cameras and sensors. The Smart Traffic Analytics and Recognition System (STARS) employs a combination of cloud and edge-based computing and analytics to automatically adjust traffic lights to optimise the traffic flow through a junction. Alternatively, engineers can remotely monitor real-time information via the STARS IoT dashboard on a laptop or mobile device and alter the sequence of the traffic lights accordingly. The solution leverages TM's mobile network to relay data from the traffic controller unit to the IoT platform.

The information collected by the system can also be analysed to identify any faults in the traffic signals, enabling field engineers to be deployed quickly to minimise traffic disruption. The municipality can predefine various events that will prompt STARS to trigger an alarm alerting the relevant teams, enabling any issues to be identified and resolved quickly and efficiently.
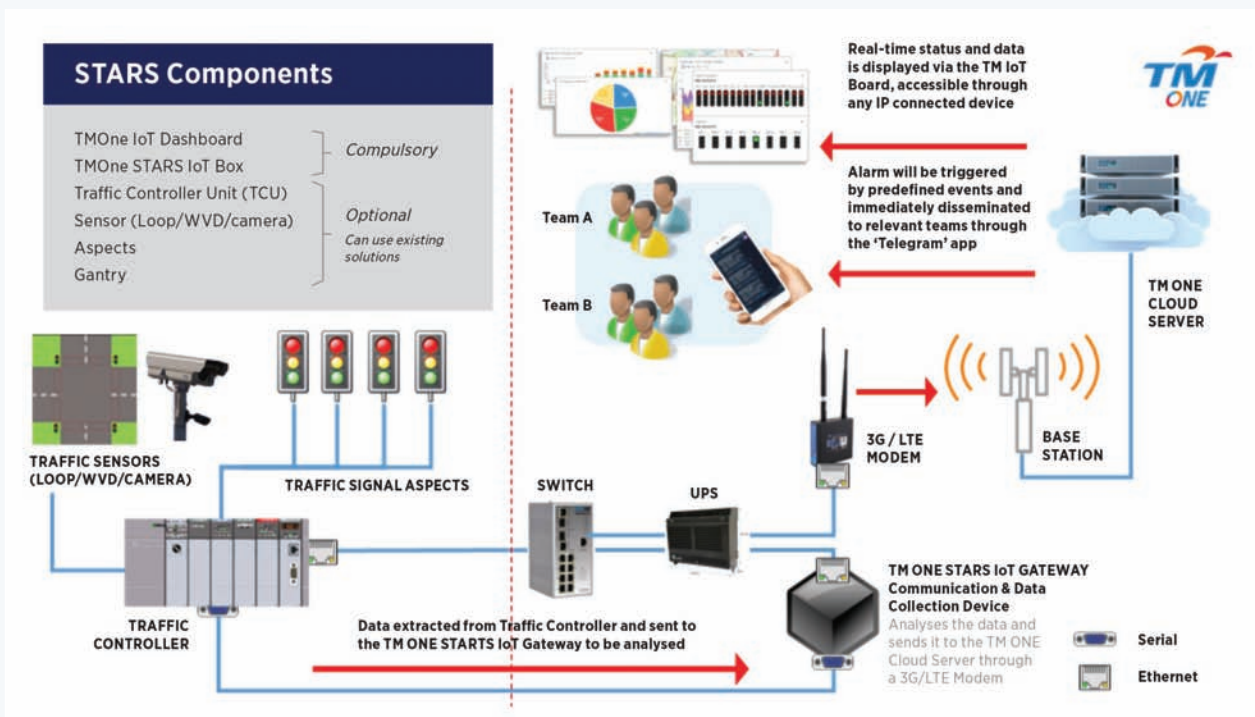
REAL-WORLD DEPLOYMENT – MUNICIPALITIES IN MALAYSIA

First launched in 2016 in Malaysia, STARS has been deployed by local municipalities in Cyberjaya, Kelantan, Pengerang and Penang. TM ONE believes it could ultimately be deployed at approximately 1,800 junctions nationwide across Malaysia.

For drivers, STARS is reducing travelling times. For example, in Cyberjaya, the waiting time for the traffic along Persiaran Multimedia was reduced by 65 per cent. During peak hours, it would take approximately 32 minutes to drive from one end of the Persiaran Multimedia to the other. However, with the new system, it takes only eight to 11 minutes.

TM ONE is now developing STARS 2.0, which will be able to analyse six months or more of traffic data to enable predictive analysis so that traffic lights can be programmed based on a range of external factors, such as weather, events and holidays, as well as real-time traffic data.

With the rollout of 5G connectivity in Malaysia, TM ONE is piloting the 5G-enabled smart traffic light solution in Subang Jaya city and Langkawi Island, as part of the Malaysian Communication and Multimedia Commission's (MCMC) Demonstration Project. The 5G capabilities allow real-time video to be streamed from road-side cameras to artificial intelligence systems that can estimate waiting times for each vehicle, count the number of vehicles, classify them according to type and recognise vehicle registration plates. Capable of detecting ambulances, police cars and fire engines, the system will be able to automatically adjust the operations of traffic lights to let these emergency vehicles drive through a junction safely.

Watch an interview with TM ONE:
https://www.gsma.com/iot/resources/m360ds19-tmone/

TRANSPORTATION: AUTOMOTIVE & AVIATION

BRINGING TAILORED CAR INSURANCE TO DEVELOPING MARKETS - **THAIVIVAT**

**Operator partner: AIS** ● **Technologies: NB-IoT** ● **Country: Thailand**

PROVIDING AFFORDABLE USAGE-BASED INSURANCE

As car ownership rises rapidly in developing markets, there is growing demand for affordable vehicle insurance. Ideally, a car insurance premium will reflect how often the vehicle is driven, where it is driven and the style of driving. Although there are now many IoT devices that can track how vehicles are used, they can be expensive both in terms of the hardware and the associated connectivity. As a result, they have not been widely adopted in developing countries. In Thailand, for example, where there are more than 17 million private cars, most drivers still pay car insurance as a lump sum for the whole year regardless of how much they drive their car.

REAL-WORLD DEPLOYMENT – TRACKING VEHICLE ENGINE USAGE IN THAILAND

Thailand-based mobile operator AIS, Thaivivat Insurance and their device partner have co-created a low-cost usage-based insurance solution for motor vehicles. Employing a plug-in device to detect when the car engine is on or off, the solution communicates with the insurance company via AIS's NB-IoT network and the AIS IoT platform. As a result, Thaivivat Insurance can start the cover when it is notified the car's engine is on and then stop it when it receives notification the engine is off. The device has an internal memory where it can store information about engine usage, in case it can't relay the data immediately due to a lack of NB-IoT coverage.
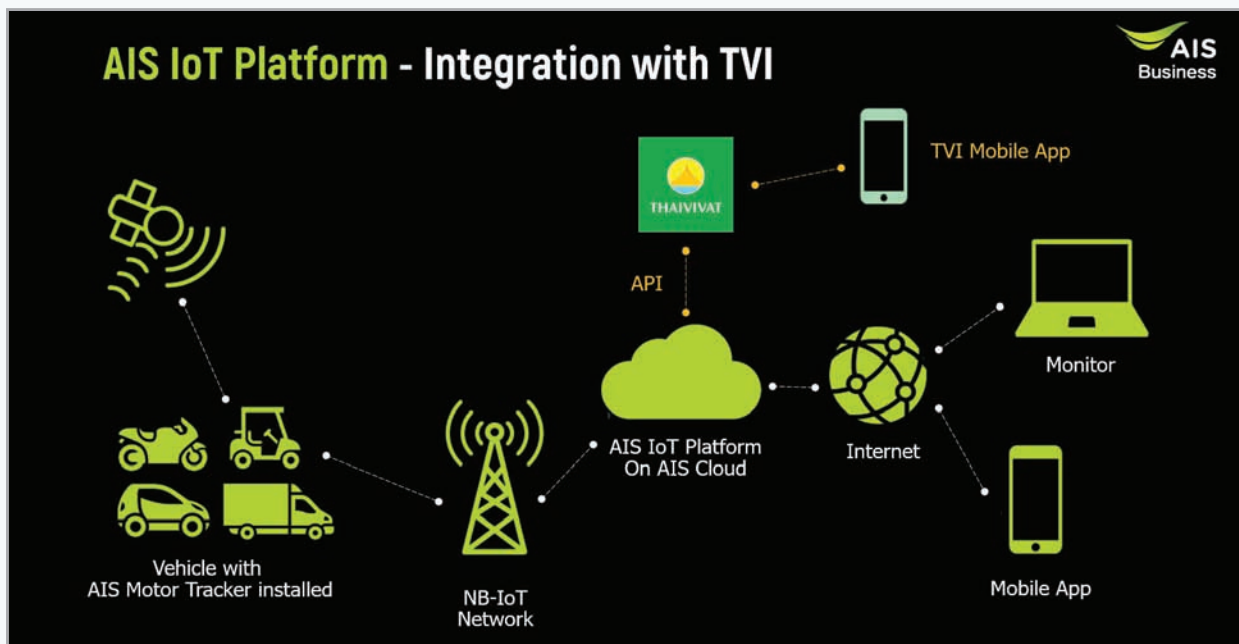
The vehicle owner then pays for insurance for the number of hours the car is used (has its engine on). The owner can track their usage in a mobile app, which notifies them as the insurance starts and stops. Simple to use, the NB-IoT-enabled device can be plugged into a USB port in the owner's vehicle or, if the car has no USB port, customers can buy an adapter to plug it into the car cigarette lighter instead.

Traditionally, usage-based insurance solutions have relayed data over conventional cellular networks, but AIS says using NB-IoT technology brings the cost down, both in terms of the device and the connectivity, making the solution more affordable for insurance companies and their customers.

Thaivivat Insurance has been using the solution to provide pay-as-you-drive policies to customers in Thailand since August 2019. As well as providing the device and NB-IoT airtime free of charge to its customers, the insurance company is able to offer premiums that can be up to 40% lower than those for traditional car insurance. AIS believes that differential will put pressure on other insurance companies to provide usage-based insurance, resulting in cost savings for Thai drivers and fair vehicle insurance premiums.
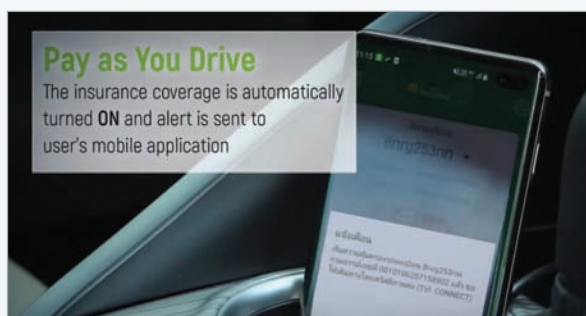
MANAGING URBAN AIRSPACE FOR UNMANNED AIRCRAFT – **GARUDA ROBOTICS**

Operator partner: Singtel ● **Technologies: 4G, 5G & Drones** ● **Country: Singapore**

ENABLING CITIES TO REALISE THE POTENTIAL OF DRONES

Guided by appropriate airspace management and infrastructure, unmanned aircraft could enhance urban life in many different ways. Drones could be used to transport people and goods across cities or to collect data using cameras and other sensors.

In Singapore, most people work and live in high-rise buildings, making aerial transport a very attractive option for urgent trips across a densely populated island. For example, automated external defibrillators (AEDs) can be flown to any part of Singapore in less than four minutes from a fire station, if the flight can be approved and commenced within one minute. The AED can then be used to save the life of the cardiac arrest patient when administered by the person who called the emergency services, which normally take an average of 11 minutes to arrive.

Similarly, security agencies would be able to deploy drones to respond rapidly to an incident, whether a fire, riots, or trespassers. Over time, drones could also be used to transport high value items, avoiding ground traffic by flying directly from building to building. For example, hospitals would be able to transport blood and cell specimens quickly to labs. But, in many urban areas, the usage of drones is hampered by the lack of low altitude airspace management and infrastructure.

REAL-WORLD DEPLOYMENT – EXTENSIVE TRIALS UNDERWAY IN SINGAPORE

In 2018, the Civil Aviation Authority of Singapore awarded grants to four consortia to develop beyond visual line of sight (BVLOS) technologies for unmanned aircraft in Singapore. Garuda Robotics leads the FutureFlight Consortium (FFC), a team of 13 companies employing 4G networks to underpin a connected urban airspace management system for drones flown BVLOS. Singtel, a member of the consortium, is providing providing reliable mobile connectivity over its public LTE network for FCC to operate drones up to 60 metres above ground level.

FFC has developed a solution to support both security drones and delivery drones, with first responders, hospitals, and security agencies trialling the system in 2019 and 2020. Garuda Robotics and other technology companies in the FFC created the necessary IoT device - the Garuda CoPilot, an on-board computer that securely liaises between the drone pilot at the drone operations centre, on-board detect-and-avoid sensors, and the drone's

flight controller, in a manner that ensures a high degree of reliability and safety when flying over densely populated areas of Singapore.

Now complete, the first version of the system underwent trials in 2019 with the Singapore Civil Defence Force (SCDF), Parkway Pantai Hospital, and the Security Industry Institute. In 2020, FFC plans to ramp up the number of trial flights to build confidence among regulators (both in aviation and communications) and the public. Pending regulatory approval, commercial deployments are likely to begin early in 2021 in less populated areas of the country.

FFC envisions the creation of "drone highways" in which the risk of operating drones BVLOS is minimised by re-engineering the available connectivity to ensure there is a fall-back option in the event of a network failure. To that end, FFC is building a privately-operated, redundant 4G LTE network at its test sites, using alternative frequency bands.

DELIVERING COST-EFFECTIVE VEHICLE TRACKING AND FLEET MANAGEMENT - **TELENOR PAKISTAN**

Operator: Telenor Pakistan ● **Technologies: 2G, 3G and LTE** ● **Country: Pakistan**

MAKING SOPHISTICATED VEHICLE TRACKING AFFORDABLE

There are now almost 14 million vehicles on Pakistan's roads, according to the Pakistan Automotive Association. However, the market for vehicle tracking and fleet management is immature, lacking well-built, yet affordable solutions, according to Telenor Pakistan, which says most of the existing offerings provide only basic functionality and limited reporting capabilities.

After running a pilot project, Telenor Pakistan built Auxo - a car tracking and fleet management solution designed to deliver usability, functionality, and affordability to almost all types of customers in Pakistan. In its simplest form, Auxo is a mobile app-based solution aimed at consumers. In its more comprehensive form, it is a complete fleet management platform for businesses. Built on Telenor Connexions' Managed IoT Cloud (MIC) platform, Auxo is hosted on Amazon Web Services' IoT platform, which supports high levels of capacity, scale and service availability.

Telenor says Auxo includes a "state of the art application" that can translate data on vehicles' movements into meaningful insights that companies can use to solve business problems, such as control and audit, and bring greater operational efficiency to fleets. As Telenor developed the software and connectivity, Auxo can also be customised to meet the individual needs and requirements of particular customers, according to the operator.

REAL-WORLD DEPLOYMENT – ENTERPRISES ACROSS PAKISTAN

Telenor Pakistan launched Auxo in July 2019. Within three months of the launch, it had signed up 27 large and medium enterprises, which are tracking more than 2,000 vehicles in aggregate. One customer, for example, is using the solution to track its ice-cream trikes, giving it real-time visibility of its operations and helping it with forecasting and planning of its sales cycle. After a pilot involving 700 trikes, the customer intends to use Auxo to track 5,000 vehicles across Pakistan.

Following what it describes as an "extremely healthy and positive response from the local

market", Telenor Pakistan envisions being able to grow Auxo sales 80% year-on-year. "Considering the overwhelming response from the local market and the potential in the vehicle industry, we plan to expand to 10,000 devices in the coming year," says Shahbaz Ali, Head of Products IoT, adding that the solution also has the potential to scale up in other Asian markets.

Telenor Pakistan is now planning to add further functionality to Auxo. "Our product teams are dedicatedly working on scrum and agile models for incorporating new feature sets into our solution with a defined roadmap," adds Shahbaz Ali.
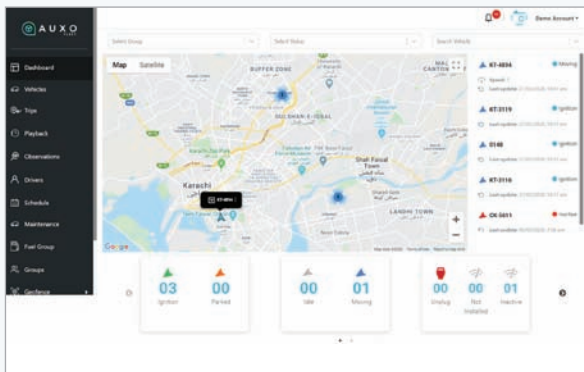
> " The real power of IoT Solution is when we are able to solve actual business problems. With "AUXO" using telematics, we solve those business problems which will help businesses to bring efficiency in their existing processes, plan their business decisions with backing of meaningful data or be more cost efficient "

Shahbaz Ali - Head of Products IoT, Telenor Pakistan

ENABLING COST-EFFECTIVE DELIVERIES BY DRONES - **FLING**

Operator Partner: True Corp. ● **Technologies: 4G, Artificial Intelligence & Drones** ● **Country: Thailand**

ALLOWING DRONES TO LAND SAFELY

To perform a drone delivery safely in a residential destination, such as a lawn in front of a condominium, an area several metres around the landing location needs to be clear of people. However, keeping an area fenced off may not feasible, and having a staff person supervising the delivery wouldn't be cost-effective.

To solve this challenge, Bangkok-based Fling has mounted cameras on its drones, which can use wireless connectivity to relay a real-time view of the landing area to a remote operator. Fling uses artificial intelligence to help the operator quickly identify any people or animals that might prevent the drone from landing safely.

Although drones typically use Wi-Fi for wireless connectivity, its range is insufficient to remotely operate delivery drones. Repeater stations would be required to ensure the signal isn't blocked by buildings and other structures between the drone and the operator.

To overcome these challenges, Fling chose to employ 4G cellular connectivity. Each drone is equipped with a 4G transceiver, connected to the on-board computer, meaning it has an IP address like any other endpoint on the Internet. Fling then uses a proprietary command and control system to transmit video from the drone to the operator, keeping the signal secure from spoofing or hacking. The service has been permitted by regulators to operate during daylight hours.

To develop and run Thailand's first drone delivery service, Fling partnered with several Thai government agencies, including the Digital Economy Promotion Agency, the Geo-Informatics and Space Technology Development Agency, and the Civil Aviation Authority of Thailand, as well as the Thai Resuscitation Council and Bangkok Pattaya Hospital.

## REAL-WORLD DEPLOYMENT – DELIVERIES OF MEDICINES AND FOOD IN THAILAND

After flying several test missions, Fling launched the drone delivery service in September 2019. It is available to residents of selected high-rise buildings along the beachfront areas of Pattaya, a popular resort town south of Bangkok. To use the service, residents download a smartphone app, from which they can select from a variety of items, such as food, pharmaceutical items, medical products, toys, cakes, and jewellery.
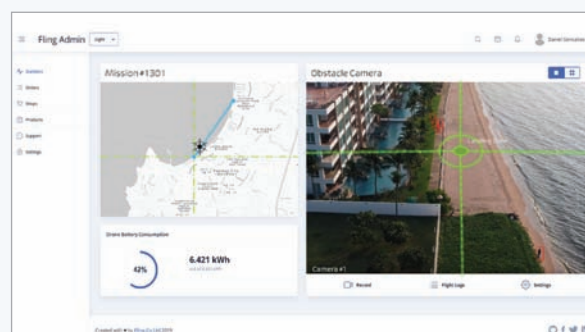
Via True Corp's 4G network, Fling can communicate with its drones over the entire service area in the city of Pattaya. Using boats on the sea, True's engineers have verified the 4G signal strength within the drone service areas. "The 4G LTE video connection has a latency of about five seconds, which is not enough to directly control the drone, but is enough to verify the landing area is clear of obstacles before performing a landing," says Michael Currie, CEO of Fling. "The 4G LTE data connection to the drone also allows Fling's mission control to track the drone without relying on telemetry relayed from a UAV pilot on the ground near the drone launch point."

Fling is now planning to expand the service to two other cities in Thailand in the first half of 2020, pending government approval.
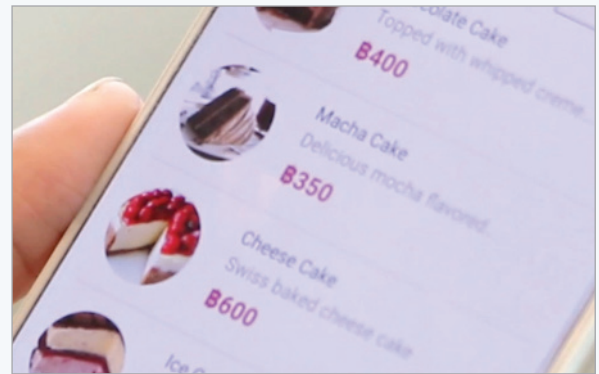
> " The 4G LTE data connection to the drone also allows Fling's mission control to track the drone without relying on telemetry relayed from a UAV pilot on the ground near the drone launch point. "
>
> **Michael Currie -** CEO of Fling

4 Conclusions

CONNECTIVITY EVERYWHERE

Smart factories, smart cities and smart buildings are becoming mainstream in the Asia-Pacific region. As climate change and population growth make consumers, companies and local authorities ever more conscious of waste, they want to exercise precise control over their assets and resources. To do that, they need cost-effective, reliable and secure connectivity and related capabilities, such as device management and data analytics.

Mobile operators are using a growing range of technologies to address this demand. Employing a combination of 3G, 4G and 5G connectivity, including Mobile IoT networks, they are well-placed to tailor their services precisely to the use case. Mobile IoT technologies are particularly well-suited to connecting large numbers of sensors in industrial and municipal settings, where their low power requirements make deployments and maintenance relatively straightforward and cost-effective.

The case studies in this report highlight how NB-IoT networks are now being used to connect large numbers of sensors and actuators, providing businesses with continuous information on environmental parameters and allowing them to fine-tune the conditions to boost productivity in agriculture and other sectors. In a similar vein, Mobile IoT connectivity is being used for extensive monitoring of buildings and infrastructure, enabling early detection of faults and leakage, reducing waste and downtime, improving productivity and ultimately prosperity.

Moreover, connected smart meters are enabling utilities to better match supply and demand, while attendance management systems can help organisations to optimise the use of their human resources in remote locations. Vehicle and drone routes

and deliveries can be optimised using regularly updated information relayed over cellular networks, while assets can be tracked closely to avoid losses and improve supply chains. This report also shows how mobile operators and their partners' solutions are yielding new insights into traffic congestion and parking bottlenecks, enabling municipalities to take remedial actions and enhance urban life.

Partnerships are crucial

While the provision of connectivity remains their core purpose, operators are now playing a pivotal role in the design and delivery of end-to-end solutions, encompassing machine learning, data analytics and intelligent automation. By working with partners, operators can lower one of the major barriers to wider adoption of the IoT. Businesses' greatest concerns about IoT tend to revolve around complexity – that there are too many diffuse elements to manage, meaning projects either fail or never commence in the first place. But this report shows that operators and their partners are able to deliver the management of data, networks and security via a single integrated solution. That paves the way for the IoT to scale rapidly in the Asia-Pacific region and beyond.

Indeed, the case studies show how effective part-nerships between mobile operators and specialist companies can be in the IoT market. They include numerous examples of mobile operators and solu-tion providers working together to build end-to-end solutions that provide the customer with a complete solution to a specific business or operational chal-lenge. "There's no way for us to go beyond connec-tivity without working with partners," notes Azrin Aris, Director of Emerging Solutions & Innovation at operator TM One. "We need to understand how to make our solutions sustainable…. If we cooperate, everybody wins, and that's our aspiration – to grow the industry, and take it forward."

❝ There's no way for us to go beyond connectivity without working with partners **❞**

Azrin Aris - Director of Emerging Solutions & Innovation at operator TM One

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.

GSMA Internet of Things Programme

The GSMA's Internet of Things Programme is an industry initiative to help operators add value and accelerate the delivery of new connected devices and services in the IoT. This is to be achieved by industry collaboration, appropriate regulation, opti-mising networks as well as developing key enablers to support the growth of the IoT in the longer term. Our vision is to enable the IoT, a world in which consumers and businesses enjoy rich new services, connected by an intelligent and secure mobile network.

For more information, visit gsma.com/iot or follow gsma.at/iot.

GSMA Asia Pacific

Headquartered in Hong Kong, GSMA Asia Pacific coordinates the efforts of the GSMA and its members to monitor relevant policy and legislative developments in the region, identify priorities for the mobile industry, and develop and communicate consensus positions on these priorities. It represents the GSMA's views and initiatives at regional institution meetings and events, with offices in Beijing, Hong Kong, New Delhi, and Shanghai. It also convenes the industry-leading MWC event held annually in Shanghai, as well as the Mobile 360 Series in the Asia Pacific.

For more information, visit gsma.com/asia-pacific.

INTERNET OF THINGS CASE STUDIES
LEADING THE WORLD OF INNOVATION IN ASIA-PACIFIC