



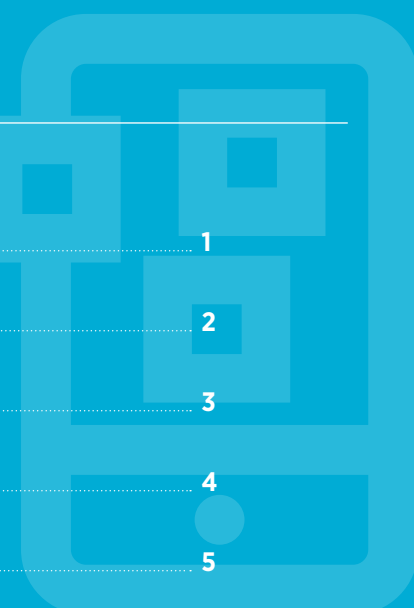
Mobile IoT

LPWA: MAKING PARKING SMARTER

Mobile IoT = **TRUSTED IoT**



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1 EXECUTIVE SUMMARY



As urbanisation continues apace and the number of cars on the roads rises steadily, finding a place to park can be a major headache for business and leisure travellers alike. If drivers knew in advance which spaces are vacant, they would spend less time and waste less fuel searching for a place to park.

Using new low power wide area (LPWA) mobile technologies, it will become cost-effective for telecoms operators to relay real-time information on parking availability to drivers' smartphones or dashboard computers. Deutsche Telekom has tested a prototype LPWA - based parking system on its campus in Bonn in Germany, and trialled it on its commercial network in the Netherlands.



2 FINDING SPACE TO PARK

Every year, tens of millions of people buy their first car. By 2013, there were about 1.8 billion registered vehicles globally, up from less than 900 million in 2001, according to the World Health Organization¹. In 2014, a further 67 million new passenger cars arrived on the world's roads.

As the number of vehicles grows, drivers increasingly struggle to find somewhere to park, even in relatively spacious countries with a well-developed road infrastructure, such as the US. A study by urban-planning professor Donald Shoup of the University of California, Los Angeles (UCLA), found that cars seeking a parking space in Westwood Village, a commercial district next to the UCLA campus, in aggregate drive an excess 950,000 miles each year —equivalent to 38 trips around the earth, or four trips to the moon. Driving these additional miles wastes people's time, increases fuel usage and adds to greenhouse gas emissions.

In many cities, urban planners have alleviated the problem by building large multi-storey car parks, capable of holding thousands of vehicles, but it can still take time for a driver to track down a free space and then find their car again on their return.

However, new low power wide area (LPWA) mobile technologies could help drivers to find free spaces quickly and easily both within car parks and city centres. These technologies, which are designed to enable large numbers of devices to transmit small amounts of data over

long distances, can be used to monitor whether a parking space is occupied or not. That information can be aggregated in servers in the cloud, which can then direct drivers towards the nearest vacant space.

By reducing the time cars spend emitting greenhouse gases, smart parking could help to curb climate change. A smart parking system, which would be part of the broader Internet of Things, can also be used to garner insights into consumer behaviour, raise more revenue and invest in better infrastructure. If connected sensors indicate specific parking spaces tend to be unoccupied at certain times of the day, the provider could cut parking charges for these hours in the hope of enticing more drivers to use the facilities. Similarly, if the connected sensors show there are no free spaces at certain times of the day, the provider could raise charges for those hours. Analysts at Analysys Mason forecast there will be more than 100 million regulated, monetised parking spaces worldwide by 2023, with over 30 million of these spaces connected.

¹ According to a 2015 report, http://www.who.int/violence_injury_prevention/road_traffic/death-on-the-roads/en/#trends/vehicles

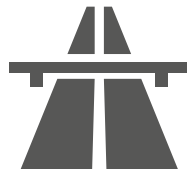
3 SMART PARKING TRIALS HIGHLIGHT POTENTIAL

Telecoms operator Deutsche Telekom (DT) has tested LPWA-enabled smart parking services on its campus at its headquarters in Bonn. Each parking space was equipped with an ultrasonic sensor, which can detect whether the space is occupied. The sensor then used a LPWA connection to transmit the data, via a network gateway, to a server in the cloud, which then aggregated the information and made it available to drivers arriving at the campus via a smartphone app. That means the driver knows immediately where to find a free parking space, so they don't have to drive around looking for one.

For the trial, DT employed a LPWA technology called Narrowband Internet of Things (NB-IoT) - initially the pre-standard version and most recently based on the 3GPP Release 13 standard, with the support of equipment vendor Huawei, which upgraded the software in existing commercial base stations to make them NB-IoT capable.



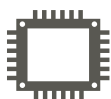
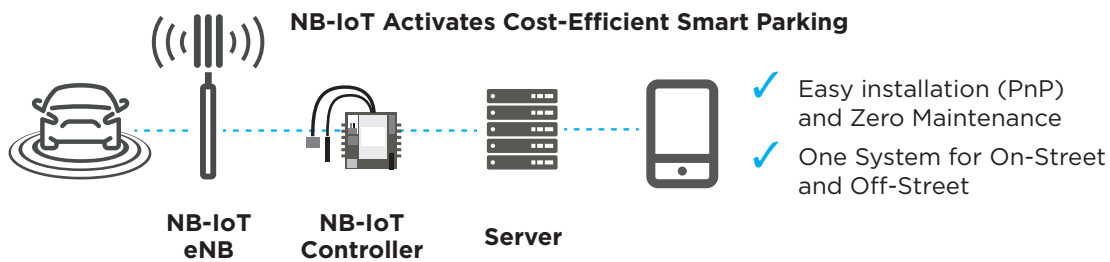
Open your Park App and click on Start Parking



Additional 4.5km for finding a available parking space



Additional resource for Parking Management



Parking sensor

- ✓ Geomagnetic Sensor
- ✓ Operating temperature: 40°C~+80°C
- ✓ Dimensions: Diameter 90mm, 81mm; Thickness 80mm

3GPP completed the standardisation of NB-IoT (Rel-13) in June 2016, paving the way for DT and other mobile operators to make plans to use the technology to expand the Internet of Things, enabling an array of applications that aren't cost effective or practical using fixed-line networks or conventional cellular networks. DT is a strong supporter of standardisation, which facilitates interoperability and economies of scale. Bruno Jacobfeuerborn, Chief Technology Officer at DT, says²: "We support the adoption of solutions for cellular-based IoT technology that are based on worldwide standards and not proprietary ones."

“ We support the adoption of solutions for cellular-based IoT technology that are based on worldwide standards and not proprietary ones.

Bruno Jacobfeuerborn, Chief Technology Officer at DT

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² Source: Deutsche Telekom press release: <https://www.telekom.com/media/company/291426>

4 WHY NB-IOT IS GAINING TRACTION

For DT, NB-IoT has a number of key strengths. The technology is affordable, energy efficient and designed specifically to transmit small amounts of data from large numbers of devices. Reporting whether a parking space is occupied, for example, requires just a couple of kilobytes per second of bandwidth. NB-IoT, which can be deployed in existing licensed spectrum, only needs a 200 KHz frequency band and offers a 20dB coverage gain compared to existing cellular-based solutions, according to DT.

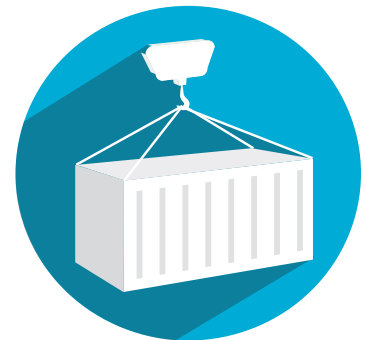
“ a dust-bin could signal when it is full, while a shipping container could send an alert if it gets too hot ”

As an NB-IoT device could have a battery life of up to 10 years, DT envisages using the technology to enable millions of things to send simple status updates, such as “on or off”, “open or closed”, “hot or cold” and “vacant or occupied”. For example, a dust-bin could signal when it is full, while a shipping container could send an alert if it gets too hot.

Huawei expects the first full commercial applications of NB-IoT to go live during 2017. “NB-IoT can be deployed by software upgrade SingleRAN network, which significantly reduces network deployment costs,” says David Wang, president of Huawei Wireless Network³. “Huawei supports all operators, chip manufacturers, terminal module suppliers, and device vendors, corresponding industry

cooperation partners in making a concerted effort to promote rapid standardization early 2016 and commercialisation late 2016.”

In October 2016, DT also ran a trial of NB-IoT smart parking on its commercial network in the Netherlands, and announced plans to offer smart parking and other applications across its European networks.



² Source: Deutsche Telekom press release: <https://www.telekom.com/media/company/291426>

5 PAVING THE WAY TO SMOOTHER CITIES

The technologies that underpin smart parking systems could also be used to help smooth out traffic flows across urban areas. LPWA-connected sensors could, for example, detect when vehicles are illegally parked, blocking a lane, or when the queue at a traffic light has reached a certain length. That information could be used to help transport police and the city administration to take remedial action.

About the **Internet of Things Programme**

The GSMA's Internet of Things programme focuses on enabling a world where consumers and businesses can benefit from rich new services across many different devices – securely connected to the Internet via ubiquitous mobile networks.

The Internet of Things programme's 'Mobile IoT Initiative' is designed to accelerate the commercial availability of Low Power Wide Area (LPWA) solutions in licensed spectrum. Backed by 30 of the world's leading mobile operators, OEMs, chipset, module and infrastructure companies, this Initiative will facilitate demonstrations, proofs of concept and trials of a selection of complementary LPWA licensed spectrum technologies. It will also provide analysis and feedback to assist 3GPP in standardising the technologies.

For more information, visit the programme's website at www.gsma.com/IoT.

