

Is your city ready to go digital?

How 5G use cases will unleash your city's full potential



Today, cities face a multitude of challenges originating from societal and technological changes: population growth, urbanization, infrastructure provision, crime and cyber-crime, and environmental pollution. These challenges necessitate new digital use cases. A variety of use cases based on 5G, the next generation of mobile network technology, help to overcome these challenges and enhance economic development across industries.

5G is thus fundamentally changing how cities can shape urban life for their citizens, as well as the ecosystem for corporations. Although the name might suggest a simple upgrade of 4G, its technical capabilities, infrastructure requirements and a variety of digital use cases, make it radically different from its predecessor. In particular, 5G is essential for a multitude of industrial, business-related and public use cases. But the new standard also brings new infrastructure requirements, which demand an appropriate response from cities. Cities which are defining well-grounded 5G strategies will significantly increase the quality of life of their citizens, as well as their attractiveness to businesses.

A good 5G strategy must address two main points: Firstly, the city must decide which 5G use cases are of strategic importance and whether they should be provided by the city itself. Secondly, it must find a way to solve the infrastructural challenges of 5G rollouts, by either reducing hurdles to telecom operators building up infrastructure or building their own 5G infrastructure.

Why 5G use cases are key

Population growth and urbanization put a significant strain on city infrastructure, which often is not designed to withstand the challenges of increased demand for healthcare and public services, higher energy consumption, heavy traffic, shortages in housing, and other factors.

Residents and businesses might resort to relocation as an answer to declines in quality of life and competitiveness caused by insufficient technological infrastructure coverage. This hampers cities' growth by draining their talent pools and slowing the development of their business ecosystems.

New applications based on 5G aim at tackling these problems. The following overview depicts a selection of upcoming, cutting-edge 5G use cases:

Selected 5G use cases

Mobility & public transport Autonomous driving Remote monitoring of infrastructure Real-time traffic management	Public safety HD real-time video surveillance Improved disaster alert and response Vulnerable road user (VRU) discovery	Healthcare Telemedicine and telerehabilitation Remote patient monitoring Connected ambulance	Energy & utilities* Remote operation of smart grid Intelligent traffic-light systems Virtual power plant
Education Virtual reality/augmented reality Remote tutoring/learning Virtual classrooms	Tourism & retail Augmented reality guided tours Automatic delivery robots and drones Virtual reality visits	Media & entertainment 4k/8k mobile streaming Smart stadium Virtual reality multiplayer games	Industry & agriculture Extended IoT and M2M Autonomous plants Drones in agriculture and maintenance

Source: Arthur D. Little

*Energy & utilities use cases are already in use based on advanced LTE technology

For instance, real-time traffic management allows optimizing heavy traffic by analyzing traffic flows in real time, and thereby improvements in routing, traffic-light phases and even lane usage. A road with four lanes, for instance, could be used based on current demand, such as making three lanes into town available in the case of increased traffic to the city center.

As another example, connected ambulances offer vast potential to increase efficiency in healthcare. While providing first aid, first responders gather critical information and data on patients, which can be transferred to the hospital in real time via technologies such as HD video transmission. This allows the physician in the hospital to prepare for the patient beforehand and thus save the time that would have been spent exchanging information when the patient arrived.

On the solution provider side, the appetite for offering solutions based on 5G is clearly there. When the City of Vienna organized a challenge for 5G use cases to be piloted in Vienna (see also the case study on Vienna), it received applications from all over the world, from players ranging from university incubators to classic start-ups and established global tech players.

Why 5G features matter

This real-time communication between systems, however, poses higher technological requirements to the underlying infrastructure. These cannot be covered by existing 4G (LTE) mobile network technology. Time-critical applications such as those mentioned above require lower latency for data transmission, need to interconnect a much higher amount of sensors for data collection, and necessitate high area-traffic capacity to allow large-scale data consumption by many users.

Additional requirements for 5G use cases are outlined below:

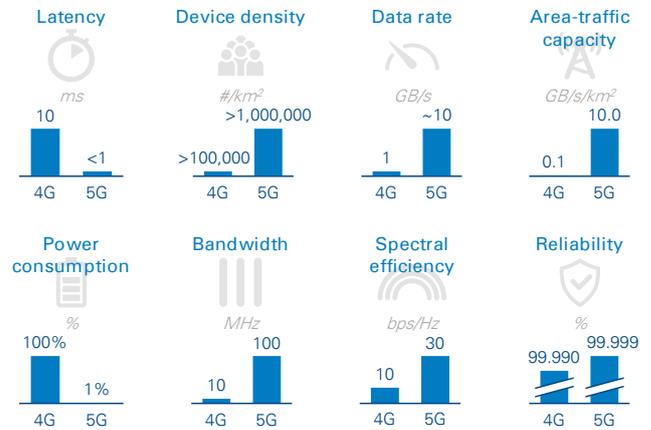
Technical feature requirements of 5G-based solutions

-  **Low latency** is required for time-critical applications, e.g., in connected ambulances to transmit health data, including video streams, remote diagnosis, etc., in real time
-  **High device density** is needed for constant data collection and transmission for network-critical real-time applications, such as autonomous driving
-  **High data rate** is required to enable digital image processing of video information. This can, e.g., be used in sports to experience the event from the perspective of an athlete (multi-perspective imaging)
-  **High area-traffic capacity** is needed if, within a specific area, a high number of users consume large amounts of data and thereby limit usage by others
-  **Low-power consumption** is of ecological and economic importance. It is the basis for an interconnected city, in which a variety of sensors is installed to track data to, e.g., optimize traffic
-  **High bandwidth** forms the basis for the support of modern technologies and is necessary to meet the requirements of, e.g., broadcasting and video conferencing
-  **High spectral efficiency** enables more efficient use of transmitter sites. This, e.g., allows network operators to offer data packets at lower prices
-  **High reliability**, along with low latency and high area-traffic capacity, is necessary to, e.g., allow smaller safety distances from autonomous vehicles

Source: Arthur D. Little

Comparing these enhanced technological features of 5G to those of 4G clearly shows why 5G is a game changer.

Technological comparison of 4G/5G



Source: Arthur D. Little

Why cities' involvement matters

In order to capture the full potential of 5G use cases, each city should have a clearly defined 5G strategy – involving where, how and when it wants to play.

Where? The first decision a city has to take is which use cases are of strategic importance and whether its involvement is required in planning or a potential rollout.

How? The city has to decide if it wants to enable or shape the 5G rollout. As an enabler, the city should facilitate and deregulate (⚙️) to reduce hurdles for mobile operators in deploying 5G infrastructure, for instance, by facilitating the approval of new antennas or microcell installations. If the city decides to be a shaper, it can choose to provide infrastructure (🏠) by itself or in cooperation with telecom or neutral urban infrastructure providers. Additionally, it can acquire its own spectrum and act as an operator (📶). For city-owned enterprises, this is not necessarily about improving coverage in the city, but instead generating revenue or following a business case.

However, it is important to note that each city has to define a strategy tailored to its specific circumstances. This means offering more is not necessarily better. For some cities it is more reasonable to only facilitate and deregulate, while others see a clear business case in acting as operators through city-owned holdings or companies.

When? Globally, the race for a leading position has already started, with various cities providing support for 5G technologies and testing use cases to become 5G front-runners. Thus, the best time to define a city's 5G strategy is now.

Most countries have 5G strategies on a national level. However, they often develop 5G strategies as add-ons to nationwide efforts to promote, facilitate and deregulate 5G rollouts; this is

aimed at improving quality of life and location for businesses. As depicted in the figure below, various cities have already decided to act, implementing 5G strategies tailored to their unique circumstances.

Cities' roles in 5G rollout incl. selected examples



Source: Arthur D. Little

Building on national 5G strategies, Vienna and Manchester for instance, undertook additional efforts to facilitate 5G investments and rollouts. Based on their requirements, Dresden and Barcelona decided to provide infrastructure in cooperation with neutral urban infrastructure providers, and thereby want to become front-runners on a national level. In Graz, the Holding Graz invested in spectrum to provide a 5G network to safe-guard optimal location conditions for the dynamic economic area in and around the city.

The following four case studies depict how selected cities are paving the way for the rollout of 5G:

Vienna

The City of Vienna has defined a 5G strategy to find the right path to enter the 5G race. The city evaluated challenges and opportunities associated with a 5G rollout and reduced red tape for operators regarding approval of macro antennas. It also introduced measures to reduce the cost of developing 5G infrastructure. Additionally, the Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR) published a national directive exempting operators from monthly rent for small cells on public buildings. Instead, a one-time payment for the reduction of the building's value is paid to the landlord.

What is more, the City of Vienna conducted the **5G Vienna Use Case Challenge** to find start-ups and technology companies offering 5G-enabled solutions, which will be piloted in 2020. The focus was to find use cases in the fields of healthcare, education, mobility and public safety. More than 30 international start-ups, university incubators and global tech players applied with innovative use cases. Together with the four winners of the challenge, Vienna has started implementing the following pilot projects: (1) telemedical wound care, (2) increased safety at traffic lights, (3) augmented reality for virtual learning at Viennese historical buildings, and (4) autonomous drones helping the fire brigade.

According to the city councilor for digitalization, Mr. Hanke, "The quality and speed in the expansion of 5G technology are crucial for the economic development of our city. That is why we are working with full power – and together with private partners – to ensure that Vienna is at the forefront of implementing 5G. In Vienna, nobody is left behind on the way to our technological future – all Viennese citizens will benefit from our future digital life."

Dresden & DFMG Deutsche Funkturm

The City of Dresden has deployed a 5G network to lay the foundation for innovative solutions, such as intelligent energy systems and future mobility solutions. Robert Franke, head of the Office for Economic Development, emphasized that companies, the community, and ultimately all Dresden residents would benefit from the 5G network deployment.

To achieve this, the city signed a cooperation agreement with the independent tower operator Deutsche Funkturm GmbH "DFMG" in May 2019. Founded in 2002, DFMG is the number-one tower infrastructure operator in Germany. Already covering the entire value chain through comprehensive and state-of-the-art platforms, the company is established as a neutral and trusted partner regarding 5G rollouts. A similar cooperation was established with the city of Münster. There, a trial with over 70 sites is starting.

Additionally, Dresden intends to provide spaces on municipal buildings and in other locations for small-cell stations to deploy the network.

Barcelona & Cellnex

5G Barcelona is a public-private partnership that constitutes a neutral, open hub for testing and rollout of 5G technology and applications in a real city environment. It is sponsored by the Regional Government of Catalonia, Barcelona City Hall, the UPC (Universitat Politècnica de Catalunya) and others. It aims to transform Barcelona's metropolitan area into a leading 5G innovation laboratory with an open experimental structure for testing, creating prototypes and implementing new digital use cases.

Cellnex Telecom and 5G Barcelona have signed an agreement to collaborate on development and implementation of pilot projects with which to test the use of 5G technology in different sectors. The agreement covers the definition and development of new use cases, implementation of trials in real settings as pilot projects within the city of Barcelona, and creation of 5G technology prototypes.

One of the first projects to be performed is a pilot trial for analyzing connectivity in safety and emergency services through application of 5G in early detection of all types of incidents (fires, accidents, etc.). The trial is based on real-time data and image uptake and transfer to the security forces and/or emergency services. The objective is to encourage reduction in response times, remote and ongoing monitoring of situations, and adaptation and modulation of the resources necessary to attend to and resolve them.

Graz **GRAZ** & Citycom the compact city

During the Austrian 5G spectrum auction, the Graz Holding was able to secure spectrum in Styria through its subsidiary, Citycom. The 5G frequencies obtained will foster the Digital Agenda, a strategic plan by the city of Graz that guides the digital transformation of the city and its ecosystem. Over the past decades, the Graz Holding has built the second-largest urban communications and fiber-optic network in Austria for the city of Graz. With this strategic course, Graz offers optimal conditions for a modern, smart, safe and sustainable city.

Mayor Siegfried Nagl emphasized the opportunities for the internal and external services offered by the Holding Graz: "The City of Graz can now play a decisive role in the expansion of mobile data transmission for the digital infrastructure, namely the 5G network itself, via the Holding Graz. This new data transmission complements the fiber-optic networks operated by Citycom for internal and external services. We are thus making a significant contribution to modern services of general interest in our city, which is worth living in."

Use cases for the city of Graz include autonomous driving, real-time traffic information, city logistics, telemedicine, and many more, which rely on real-time transmission of data and high data rates of 5G.

Why cities need to act now

5G will enable many game-changing use cases in the near future. However, for that to happen, the necessary 5G infrastructure will need to be built and cities will need to act soon if they want to be forerunners. It is crucial that they formulate their strategies now so they can start working towards implementing them – whether they do this as enablers or shapers. Are you ready to lead the way?

A multitude of cities and city-owned corporates have already started developing 5G strategies, supported by Arthur D. Little. As a global frontrunner in advising telcos, Arthur D. Little brings valuable experience that helps cities formulate strategies to fit their unique circumstances.

Contacts

Austria

taga.karim@adlittle.com

Belgium

pankert.gregory@adlittle.com

China

harada.yusuke@adlittle.com

Czech Republic

vylupek.lukas@adlittle.com

France

duvaud-schelnast.julien@adlittle.com

Germany

baron.ralf@adlittle.com

India

kuruvilla.thomas@adlittle.com

Italy

nico.mario@adlittle.com

Japan

mitsuya.shota@adlittle.com

Korea

lee.kevin@adlittle.com

Latin America

casahuga.guillem@adlittle.com

Middle East

khoury.raymond@adlittle.com

The Netherlands

eikelenboom.martijn@adlittle.com

Norway

thurmann-moe.lars@adlittle.com

Poland

baranowski.piotr@adlittle.com

Russian Federation

ovanesov.alexander@adlittle.com

Singapore

izydorczyk.tomasz@adlittle.com

Spain

stella.carlos@adlittle.com

Sweden

lasku.agron@adlittle.com

Switzerland

opitz.michael@adlittle.com

Turkey

baban.coskun@adlittle.com

UK

johnson.nicholas@adlittle.com

USA

mcdevitt.sean@adlittle.com

Authors

Melanie Nimianu, Maximilian Scherr, Karim Taga

Arthur D. Little

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. ADL is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

For further information please visit www.adlittle.com or www.adl.com.

Copyright © Arthur D. Little Luxembourg S.A. 2020. All rights reserved.

www.adl.com/5GForCities