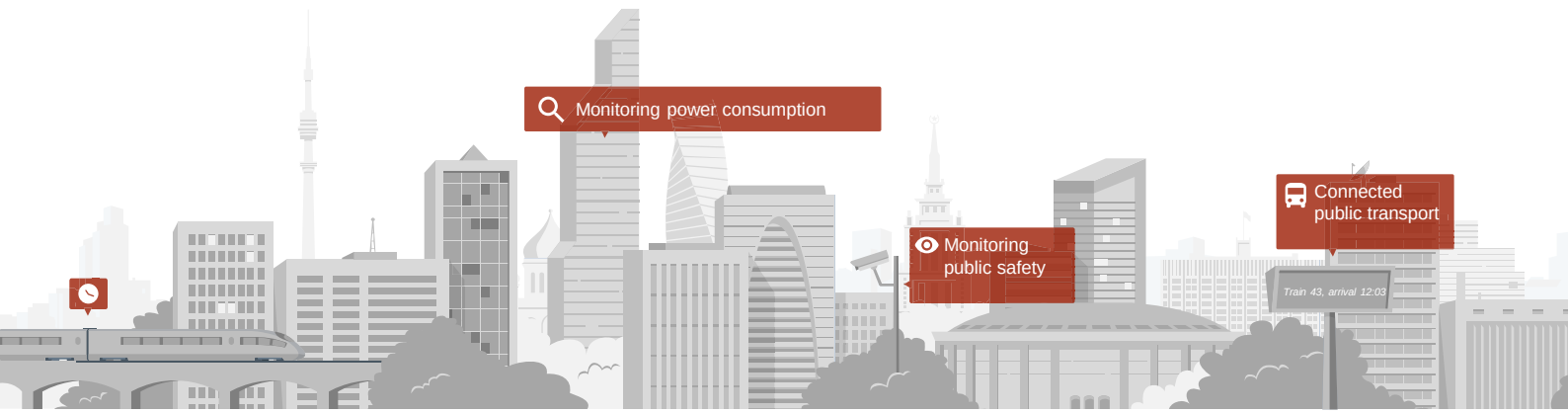
www.pwc.ru/en/IoT

The Internet of Things for Smart Cities

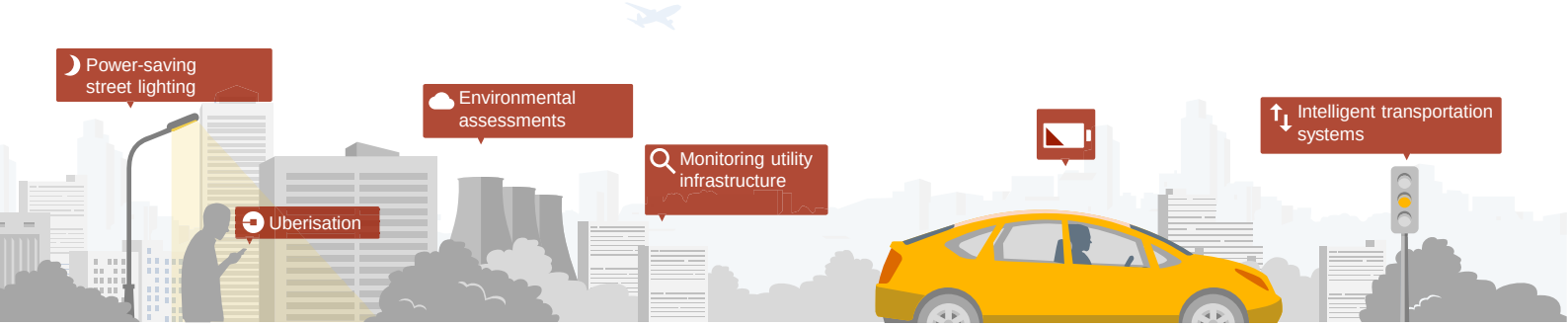
pwc

The Internet of Things

Applying technologies of the Internet of Things (IoT) to urban environments is part of the development of smart cities. The resulting step-change in urban economics, living standards and safety comes from the improved management of public utilities, transportation and services for citizens.



Developing IoT projects to create modern cities is beneficial to the state, the business community and residents, thereby a number of such projects has already been implemented across Russia.



Contents

Big cities are increasingly competing to utilise the best human and financial resources available. IoT technologies implemented in urban environments enable the creation of so-called "smart cities" and improve budget efficiency, the quality of life and the investment appeal of any city.

The main areas of application for IoT solutions in urban environments are public utilities, transportation and services for residents.

The world has seen many different models for implementing these technologies. In Russia, the number of successful implementations increases every year.

However, there have been a number of unsuccessful projects as well. The failures usually stem from an inadequate assessment of the required resources and benefits during the planning phase, the complex structure of the market of technology providers and inefficient implementation.

PwC offers a comprehensive approach to IoT implementation in an urban environment. Our approach takes into account the needs of residents, funding options, long-term development goals, and current and emerging technologies. We carefully plan and provide support during all of the key IoT implementation stages.

IoT applications for creating Smart Cities and their benefits

Public Utilities

Smart lighting

Automated lighting control and dimming in streets and residential areas adapted to weather conditions and occupancy based on data collected from illuminance sensors and motion detectors.

Reduction of street lighting costs up to 30%.

Reduction of lighting network maintenance costs up to 20%.

Smart meters

Automated meter reading, transmitting hot/cold-water, electricity and gas consumption data to consumer and supplier for remote monitoring and billing in near real-time mode.

Reduction of households energy consumption up to 20%.

Increase in utility service payments collection rate.

Waste collection

Monitoring of waste containers fill levels to optimize waste collection schedule and routes: vehicles arrive upon full container load, eliminating clearance of unfilled containers and overfilling of containers.

Reduction of waste collection costs up to 20%.

Maintaining cleanness of waste collection sites.

Municipal vehicles monitoring

Tracking of municipal and sweeping vehicles fleet, equipped with sensors, enabling real-time control of its optimal route, operation mode and fuel consumption, detection of violations and technical issues.

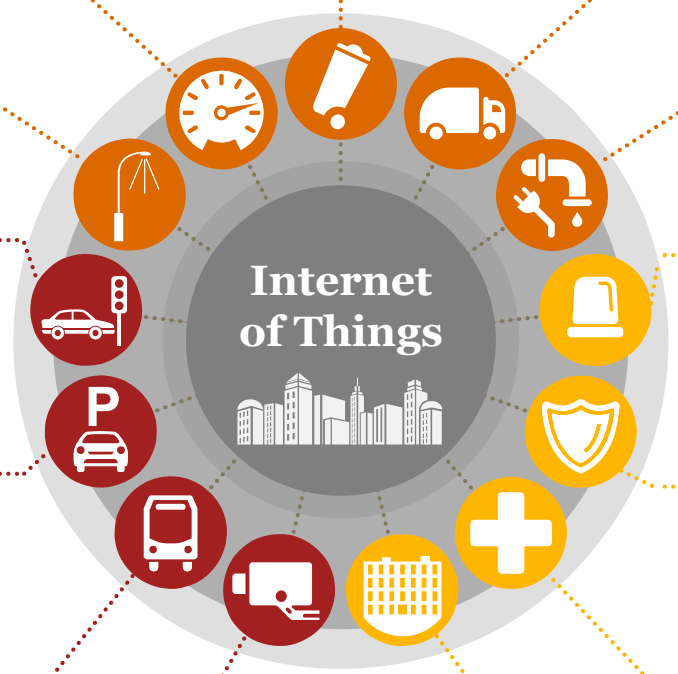
Reduction of fuel costs up to 10%.

Improvement of street cleaning efficiency.

Utility infrastructure monitoring

Monitoring of water supply pipes and heating network indicators (temperature, pressure, vibrations) to identify divergencies, resist overheating, prevent and timely respond to accidents, predictive maintenance.

Reduction of heating costs up to 20% through prevention of overheating (heating above normal) and heat losses.



Transportation

Intelligent transportation system

Adaptive vehicle traffic management based on dynamic traffic modelling, using real-time data from detectors and cameras to prevent congestion.

Increase in road traffic capacity up to 30%.

Smart parking

Monitoring of parking spaces, informing drivers of space availability, detection of parking violations, online parking payment.

Increase in road traffic capacity up to 10%.

Connected public transport

Fitting public transport with route tracking devices and enabling Internet access, informing passengers of arrival time via mobile apps and electronic information boards at public transport stops.

Decrease in passenger waiting time up to 30%.

Video surveillance of traffic violations

Automatic issue of traffic fines for drivers.

Decrease in number of traffic violations up to 20%.

Services for residents

Support for emergency services

Automatic allocation of emergency teams to calls depending on their location, remote consultations.

Increase in response (arrival) time by up to 10-15%.

Monitoring of public safety

Monitoring of streets by cameras, facial recognition technologies.

Decrease in number of street crimes up to 10%.

Telemedicine

Online doctor appointment scheduling, remote transmission of patient health data, remote consultations.

Decrease in patient waiting time at medical centers.

Smart schools

Electronic grade books, online meal payments, monitoring of school attendance using data from electronic access badges, online courses.

Increase in educational service satisfaction level.

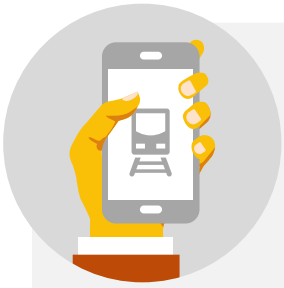
Global cases of IoT implementation in urban environments

San Diego, US

Smart street lighting are one of the most popular uses cases of IoT in smart cities.

San Diego has taken a step further by setting up a network of connected IoT devices that feature lighting, sound and weather meters based on the street lighting system, which feed data into an open cloud platform. The data collected by these devices is available to external developers, who find unexpected ways to use it. For example, sound meters and triangulation algorithms immediately locate any breach of public order, and the relevant data is transferred to the police. Other uses provide information on the availability of parking spaces and changes in the local weather.

The cost of setting up the system was around USD 30m, but optimising lighting control and replacing 35,000 light sources with advanced LED bulbs will **decrease power consumption by 60% and save up to USD 2.5m annually**.



Atlanta, US

In 2017, Atlanta implemented a street traffic control system that uses data from multiple sources and AI elements. Not only common city infrastructure elements like traffic lights and CCTV cameras can serve as data sources, but the smartphones of drivers, pedestrians and cyclists can also serve such a purpose.

The system's functions include automatic green corridors for emergency vehicles, automated traffic lights for drivers and pedestrians, warnings for pedestrians and cyclists about vehicles driving erratically, and warnings for drivers about the risk of driving through red lights and speed limits when passing through school zones.

Seoul, South Korea

To improve the efficiency of waste management, Seoul piloted Clean, a programme in which garbage containers with fill-rate trackers are connected to the Clean City Networks cloud platform.
The automated planning of garbage truck routes based on the fill-rate data eliminates the possibility of overfilling containers.

Eliminating visits to empty containers **reduced daily mileage by 66% and related costs by 83%.** Moreover, residents have become more aware of waste-sorting rules **and have increased the share of recycled waste by 46%**.

Successful cases of IoT implementation in urban environments in Russia

Moscow

All utility vehicles in Moscow are equipped with devices (e.g. geolocation trackers and motion sensors) that control their speed, fuel consumption and operating mode (e.g. turning on and off street-cleaning equipment).

As a result, **fuel consumption and maintenance costs have dropped**. Moreover, the implementation of these technologies reduced the number of deviations from routes and work schedules almost from scratch, therefore improving the effectiveness of city cleaning.

Tyumen

Tyumen implemented a joint project with Ericsson, Centr2M, Vzlet and Teplo Tyumeni to set up a system to manage the infrastructure for supplying heat. Existing meters at heating units, water pumping stations, building-level heat meters and other elements of the heating grid were connected to an IoT cloud platform. The large-scale installation of new meters was not needed, which contributed to leaner CAPEX.

The system provides a **detailed analysis and the tracking of grid operating conditions** based on temperature, pressure and consumption. Apart from monitoring the functionality of the infrastructure, this solution facilitated **the streamlining of maintenance and repair planning,** and **reduced general maintenance costs**.

Voronezh

In Voronezh, 145 smart traffic lights were installed (for drivers and pedestrians). The equipment was installed at ten intersections and will channel traffic flows to alleviate traffic jams.

According to preliminary estimates, the smart traffic lights will **reduce travel time and the time spent waiting at intersections by 20%, as well as reduce exhaust emissions by 5-10%**.

Moscow

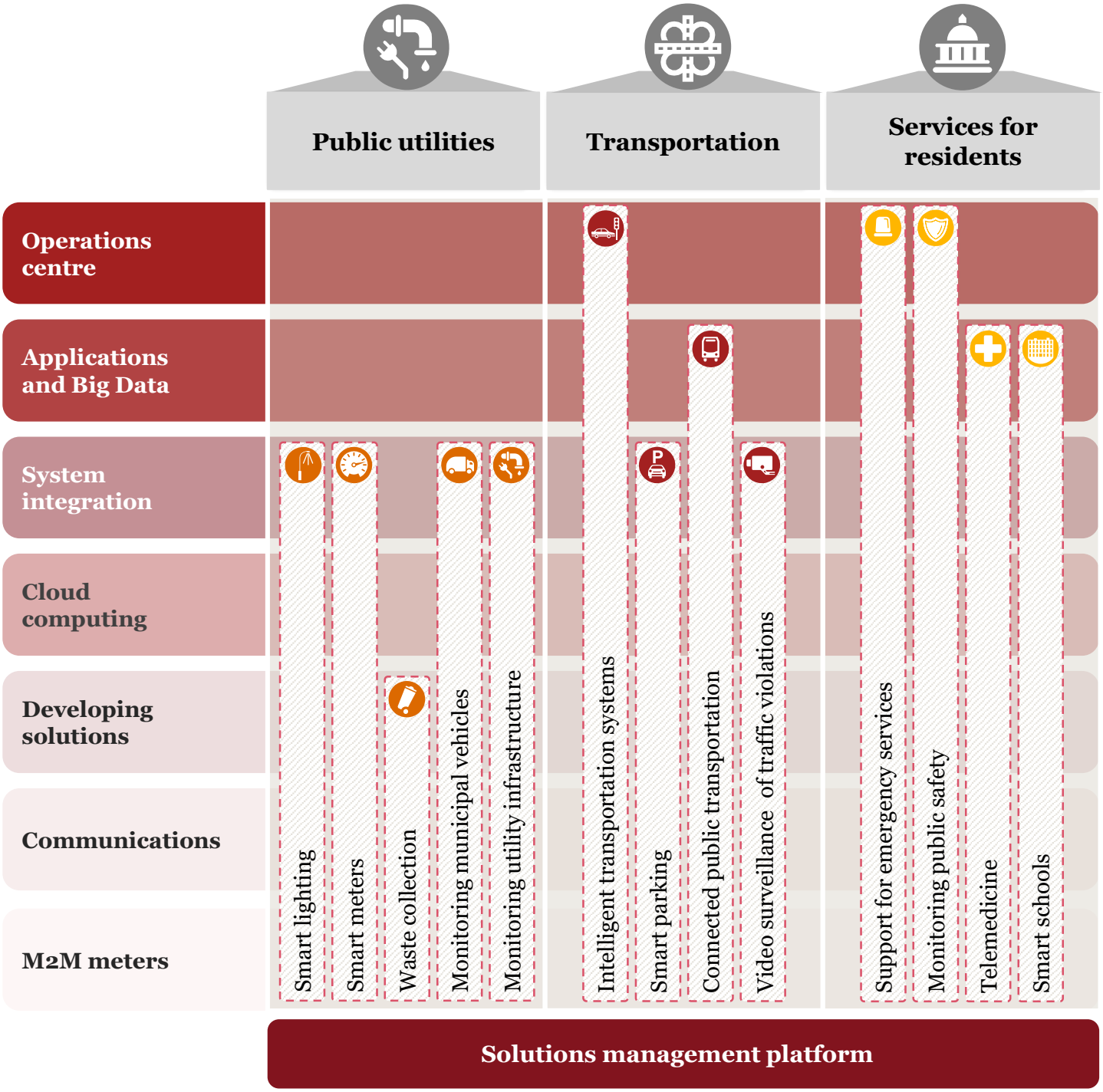
Technology that offers extended functionality to students and their parents is being implemented in Moscow.

In particular, Moskvyonok (Little Muscovite) cards, which automatically **monitor attendance** through entrance-exit controls and provide an option to **pay for lunch** in the school cafeteria, are being distributed among students enrolled in schools in Moscow. In addition, electronic gradebooks and planners provide online **updates on their current academic performance**.

The IoT solutions matrix for cities

Implementing IoT solutions in an urban environment entails **complex solutions** that involve **input from multiple stakeholders**, who range from the manufacturers of data-collection devices to telecom operators and system integrators.

To achieve the desired effect, **a single strategic approach to designing and implementing all of the components of a smart city** is required.



*The economic effect from IoT implementation in urban environments in Russia from 2018-2025 may be as high as RUB 375bn**

*This figure is from PwC Russia's report "IoT in Russia: The technology of the future available now" (https://www.pwc.ru/ru/publications/IoT.html).

Approaches to IoT implementation in urban environments

There is no silver bullet for IoT implementation in cities since the **range of technological solutions and the scale of implementation must correlate with a city's specific needs.**

We defined **three city types** based on population, each of which requires **a separately tailored approach** to implementing a smart-city model.

Big cities

> 1,000,000 residents

Challenges for big cities arise from their **scale**. Such challenges include an increased burden on the transportation system and complexities inherent to **urban infrastructure management**.

For this type of city, the most important solutions aim to enhance **transportation control, power consumption and the efficiency of public safety measures**.

In a big city, even small savings can have a **profound impact in absolute terms**.

Medium-sized cities

~500,000 residents

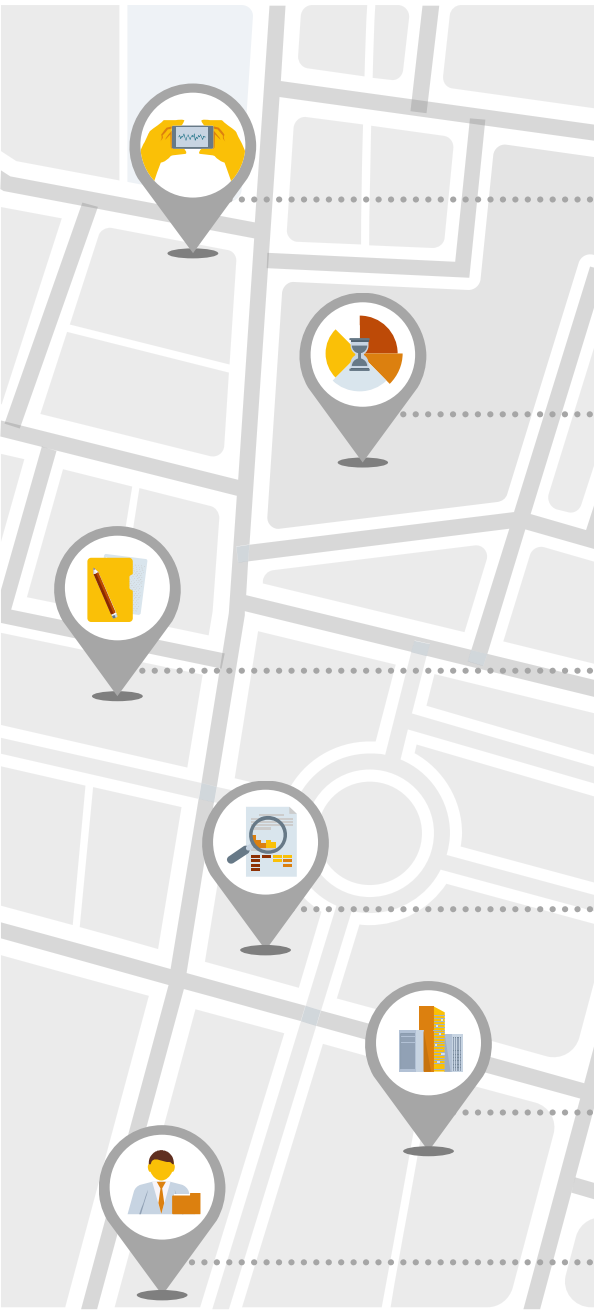
For medium-sized cities, solutions focus on improving the effectiveness of **utilities infrastructure** (which is often characterised by high rates of wear and tear), enhancing the power efficiency of lighting systems and streamlining waste management and the operation of utility vehicles.

Small towns

~100,000 residents or fewer

Small towns are mostly in need of **solutions for social services** to improve the quality of life and to provide access to the same kind of educational and healthcare services **that are available in big cities**.

We offer a comprehensive approach to IoT implementation. Our approach takes into account the needs of residents, funding options, long-term development goals, and current and emerging technologies.



We plan and provide support during the following steps in IoT implementation to help you build your smart city

Diagnose the current state of the urban environment to assess the potential for implementing IoT therein.

Prioritise solutions to take into account the city's medium- and long-term goals, the state of infrastructure and digitalisation, **and to define the funding structure** given budget constraints and available options for private investment.

Prepare a concept for developing the urban environment (including a feasibility study on the proposed initiatives and the costs and effects of implementation) for public discussion and agreement with all authorities.

Develop a roadmap for IoT-enabled urban development, including an implementation sequence, milestones, a funding schedule, technical requirements for the solutions to be used and risk management recommendations.

Establish and support the PMO overseeing the execution of the roadmap.

Analyse the interim and final deliverables to assess the effectiveness of the implementation.

Additional support

Organisational design of units responsible for operating and maintaining smart-city systems.

Legal support for the proposed and implemented changes, and the preparation of corresponding regulations.

Let's talk

Yury Pukha
Partner
IoT Leader
Tel.: +7 (495) 967 6499
Email: yury.pukha@pwc.com

Grigory Sidorov
Director
Strategy and Operations
Tel.: +7 (495) 223 5085
Email: grigory.sidorov@pwc.com

Sergey Khakhulin
Manager
Strategy and Operations
Tel.: +7 (495) 967 6000, ext. 5431
Email: sergey.khakhulin@pwc.com