EDX WIRELESS

Vision. Productivity. Connection.

SMART PLANNING FOR SMART CITIES

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CONTENTS

INTRODUCTION

Consider this:

A city decides to upgrade the irrigation system of its parks and open green areas using an IoT-Platform to implement a Smart City project: Smart Water and Smart Irrigation System. You would be surprised to know that a drastically lower overall water consumption was observed to maintain the same amount of greenery in the city.

Image[1]

KEY VERTICALS TO BUILD A SUSTAINABLE SMART CITY

- Autonomous vehicles in a smart city:
  Rob starts his self-driving car that relies on V2X communication. While sitting in the car, Rob initiates an HD video streaming service through the infotainment system already available in the car.
- Healthcare robot: A robot taking care of patients at home. The robot sends a regular report of health status to the healthcare operator. The robot also enables the patients to use Internet based services e.g., web-surfing, streaming music, watching a video or even something as important as making a call to their doctor directly in an emergency.
- A video camera/recorder is installed and activated on a street corner. The camera includes on-board processing capability, as well as the ability to send information to the traffic police.
- The camera records continuous video, storing the content for some period of time.
- The device periodically sends a status update to public safety personnel.
- When an accident occurs at the intersection, the device sends high quality video of the accident and ensuing traffic congestion.

The above quoted examples were discussed by the **3GPP for the Feasibility Study on New Services and Markets Technology Enablers** and are fast turning into reality by smart city technology implementation.

A smart city uses a combination of new vertical services, such as sensors, gateways, smart parking management, smart transportation, smart utilities, e-Health and smart wearables etc. to streamline these tasks as well as improve the quality of life for citizens.

Image[2]

Urban cities today are under extreme pressure to improve public safety and transportation, provide good quality and more sustainable services, address pollution and environmental issues, and increase the scope of local economic competitiveness. The cities and municipalities need to turn towards technology in order to solve these issues and improve the lifestyle of their citizens.

Advances in 5G, Internet of Things (IoT), edge computing, Artificial Intelligence (AI), Information Technology, and data analysis methods offer cities an excellent opportunity to accomplish these goals and build a secure and sustainable urban environment to support the economy.

One of the initial challenges faced during deployment of a smart city project is to plan, design and validate the connectivity layer for the Enterprise, Smart City and public cellular operators.

With this white paper we explore our holistic connectivity planning solutions for any one or a combination of technologies – LoRa, private LTE, 5G, NB-IoT and smart city projects to improve network performance, and maximize returns.

CHARACTERISTICS OF SMART CITIES

A Smart city uses Information and communication technologies to:

1. Efficiently use physical infrastructure like roads, water, and gas pipelines, with the help of artificial intelligence and data analysis for better economic, social and cultural development.
2. Respond more effectively and promptly to changing circumstances by improving the intelligence of the city.
3. Electronically govern the city (e-governance).

Smart cities are built using a solid integration of human, collective, and artificial intelligence within the city. This involvement of all types of intelligence helps to gain information and use it for the enhancement of city life and the economy.

These forms of intelligence can be demonstrated in 3 ways:

INSTRUMENTATION INTELLIGENCE

Here, city infrastructure is made using real-time data collection, with analysis and predictive modeling.

EMPOWERMENT INTELLIGENCE

Open platforms, experimental facilities, and city infrastructure are provided to citizens to get innovations.

ORCHESTRATION INTELLIGENCE

Institutions get established for community-based problem solving and better engagement of citizens.

According to David K. Owens, the former executive vice president of the Edison Electric Institute, two key elements that a smart city must have are an integrated communications platform and a "dynamic resilient grid."

USE CASES OF SMART CITY

A variety of smart city use cases are described in 3GPP Feasibility Study on New Services and Markets Technology Enablers for Massive Internet of Things and smart cities chronicles[3].

PUBLIC SERVICES

Smart health care
Education
Citizen livability

TRANSPORTATION

Connected vehicles
Smart parking
Smart traffic

PUBLIC SAFETY

Smart lighting
Video surveillance
Emergency response

SUSTAINABILITY

Smart energy
Smart water
Smart waste management

INFRASTRUCTURE

Smart buildings
Smart irrigation
Smart roads

A few outlined use cases are:

- **SMART TRANSPORTATION**

Intelligent transportation is one of the key features of smart cities. Technologically advanced airports, buses, and train terminals can provide a better customer experience for passengers. Tracking vehicles and passenger movement in real-time with the help of 5G can be used to avoid delays and unexpected events.

- **SMART IRRIGATION**

Technological involvement in the water infrastructure could be very beneficial to the citizens and the economy of the city. IoT sensors and gateways could be used to improve the efficiency of water usage to maintain the green spaces of the city.

INTELLIGENT ROAD INFRASTRUCTURE

5G can be used for better connectivity between vehicles, infrastructure, and other road users to promote safe mobility. Smart traffic and parking system can be used for better traffic management.

SMART SPACES

Entertainment venues, commercial and institutional campuses, and public spaces in smart cities are safer and have better facilities for citizens.

PUBLIC SAFETY

Public safety can be assured using the following methods:

1 Incident detection: Smart cities with low-latency video cameras and connected devices empower public safety officials to respond quickly.

3 Sensor Monitoring: A sensor network in the city could be helpful in the detection of anomalies, potential hazards, malfunction, and more.

2 First Responder and Emergency Management: In case of any emergency the systems can trigger several pre-decided emergency-respond actions.

4 Crowd Management: Smart cities can inspect video feeds for enforcement of any restricted zone and can help in anticipation and management of potential trouble spots.

DIGITAL MARITIME

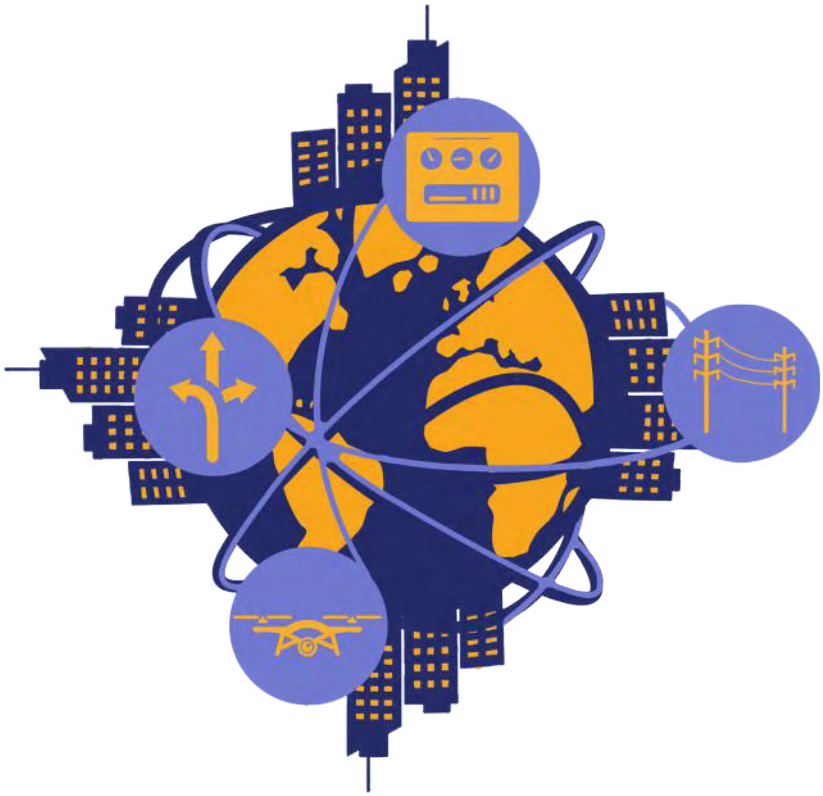
5G and high-performance networks enable critical applications, agility at the edge and cloud, and faster, better-informed decision-making in marine transport. Improved connectivity between marine transport and ports could provide a safer working environment for marine workers.

ENVIRONMENTAL MONITORING

Recycling, waste management, air quality, and water quality monitoring could be managed more efficiently using smart city technology.

INFRASTRUCTURE MONITORING

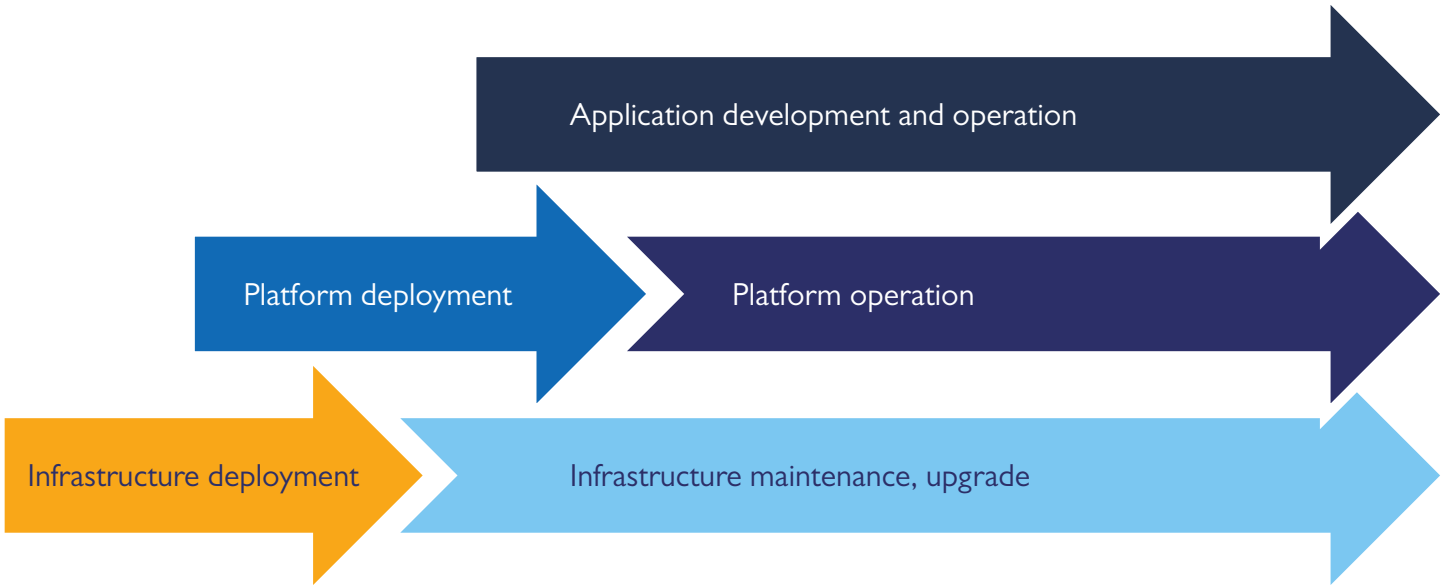
With the help of sensors and 5G or high-performance networks, the maintenance of the public infrastructure becomes much easier and faster. Building automation such as heating, cooling, ventilation, and lighting systems that help reduce energy consumption, enhance the comfort level, and provide failure management.



COST-BENEFIT ANALYSIS OF SMART CITY TECHNOLOGIES

The major challenge to implement any IoT or Smart City project is to justify its cost benefits. Analysis has been done in many smart cities to determine whether it is economically and ecologically beneficial to implement these technologies, and also compare the cost-effectiveness of individual technologies compared to each other. The initial cost of deployment for smart cities could be higher, therefore it is viable for the cities to access money for capital projects by leveraging the funds from public-private partnerships, cities' capital budgets or national funds.

At various stages of smart city deployments, different commercial options could be explored as depicted in the image below [5].



At the initial infrastructure deployment stage, heavy investment can be funded through government grants, city budgets or through the public partnership model (PPP). The maintenance of this infrastructure and its timely upgrade may be retained by the city if it owns the infrastructure, or subcontracted to a third party if it doesn't.

When it comes to platform deployment, typically partnerships or joint ventures are involved, we may also look at traditional supply relationships. The city may operate these platform(s) itself or may look at outsourcing to third parties.

The application development may be done by the city internally, but may also commission them. The city may also earn revenue from app developers that use city-data.

VARIOUS TYPES OF DATA COLLECTED IN SMART CITIES

It was rightly said by Clive Humby [4], a famous British mathematician, data is the new oil and by the virtue of smart city implementation, a huge amount of data is collected and aggregated at multiple sources that can be analysed and subsequently used in multiple domains of city activities.

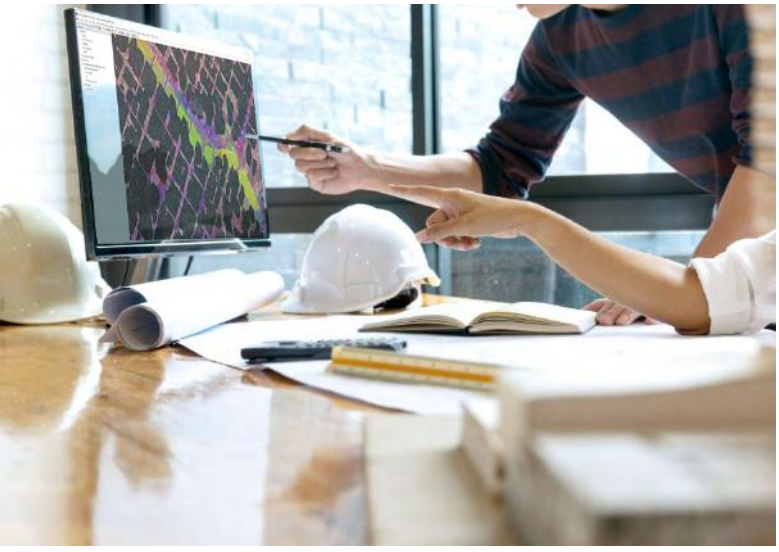
For example:

1 Street cameras connected in the city collect information and analyze daily data of vehicular flow and traffic, traffic collisions, human activity on sidewalks, etc. These sets of information assist urban planners to manage street spaces and extend or modify the urban space in tune with emerging requirements.

2 Modern information and communication technologies are powering IoT operations inside smart city landscapes. Specific sensors collect public safety information and process these through digital data processing platforms. These sensors build repositories of information and help law enforcers to curb civic violations and arrest criminal activity within city limits.

3 Similarly, data gathered from allied sensors allow civic planners to map the requirements of future infrastructure that will bolster the fundamentals of a modern smart city. In addition, social media platforms represent one form of digital technology that empowers governments to harvest public information with a view to promoting smart governance.

4 Connected infrastructure engineered into smart cities also collects data pertaining to public health in order to facilitate remote healthcare interventions. Sensors also enable planners to improve the comfort of residents and commercial users of smart buildings. Such information helps to optimize the use of public utilities such as electricity and water.



5 Data-powered waste management frameworks allow improvements in the efficiency of collecting, separating, and recycling waste generated inside modern smart cities. Further, intelligent water management systems are enabled to reduce the cost of usage, check leakages, and boost transparency in water distribution systems. Sensors installed in smart meters collect digital information pertaining to the use of energy with a view to monitoring energy consumption patterns in real-time.

It is very important to create the right framework to protect the data generated by various nodes of smart city deployments.

SMART CITY FRAMEWORK

To develop, integrate and adapt a smart city effectively, requires a unique set of frameworks to know about where and how to work in the project. The frameworks for the planning and development of smart cities can be divided into 5 major categories, mentioned below:

TECHNOLOGY FRAMEWORK

A smart city heavily relies on the deployment of different types of technologies. A smart city works through the collective efforts of technologies and humans where technology shoulders the bigger chunk of work responsibilities. The technology framework is based on the following technologies.

- **5G AND IOT**

An infrastructure is required to connect the citizens and devices in a smart city. This includes communication infrastructure. Having infrastructure for the latest technologies such as 5G can help to strengthen the digitalization of a smart city.

- **AI/ML**

Cognitive technologies like Artificial Intelligence and Machine Learning, can be trained on the basis of the data generated by connected devices across the city to study the patterns. This will help in the policy-making decisions for the people of a smart city.

- **UMBRELLA COVERAGE AND MASSIVE CONNECTIVITY**

A ubiquitous network makes it possible to access public services through any connected device in the city.

- **WIRED ELECTRONICS**

The hardware components of the electronic systems are crucial in the development of smart cities. Wired infrastructure is required to support the Internet of Things (IoT).

- **HYBRID**

A hybrid city is the combination of an actual physical city and a virtual city related to that physical space. This relationship can be one of virtual design or the presence of a critical mass of virtual community participants in a physical urban space. These hybrid spaces can serve to actualize future projects for smart city services and integration.

- **DATA ANALYTICS**

The interactive devices and systems generate a large quantity of data. How this data is utilized is critical to Smart city growth and security.

HUMAN FRAMEWORK

It is important to understand that innovation in smart cities does not aim to replace humans but to improve the quality of life of the people inhabiting these cities. An active human support system will always remain the key indicator of Smart cities' success alongside other factors like its economy, knowledge networks, innovation, science and technology, arts and culture, and access to basic facilities.

ART AND CULTURE

Intellectual curiosity and creativity are deeply associated with innovation, therefore art and cultural initiatives are focused on during the creation and promotion of smart cities, providing a diverse mix of such activities.

PUBLIC SERVICES

A number of Smart city projects aim to develop soft infrastructure such as increased access to voluntary organizations and clearly marked safe zones. Focusing on social and relational capital ensures diversity, inclusion and access to public services everywhere and at all times.

EDUCATION AND LEARNING

One of the key areas in Smart city development is mobility and hence initiatives in education, training, and cultural development.

KNOWLEDGE ECONOMY

Developing a knowledge economy is key to Smart city projects. We cannot stress enough the value innovation in emerging technology and sectors holds in city development, especially in smart cities that are aiming to become economic and financial hubs.

ENERGY EFFICIENCY FRAMEWORK

A smart city is powered by "smart connections" for various items such as street lighting, smart buildings, distributed energy resources (DER), data analytics, and smart transportation. Amongst these things, energy efficiency is paramount; this is why utility companies play a key role in smart cities. Electric companies, working in partnership with city officials, technology companies and a number of other institutions, are among the major players that helped accelerate the growth of America's smart cities.

A key concept in energy-efficient smart cities is that of Positive energy districts (PED). A PED typically creates at least as much energy as it consumes.

1. A PED has to minimise the local energy demand by using energy-efficient systems.
2. The surplus need for energy must be met by local generation through renewable or zero-emission energy.
3. Smart planning methods and smart control are required to make sure that energy production and consumption are close to each other.

Several cities in Europe are already performing intense R&D on PEDs as energy efficiency becomes more important every day.

DATA MANAGEMENT FRAMEWORK

Smart cities employ a combination of data collection, processing, and disseminating technologies in conjunction with networking/computing technologies and data security/privacy measures. This combination of applications encourage and promote the overall quality of life for citizens and cover dimensions that include: utilities, health, transportation, entertainment and government services.

WIRELESS TECHNOLOGIES COMPLIMENTING SMART CITIES

MULTI-ACCESS EDGE COMPUTING (MEC)

Multi-Access Edge Computing (MEC) offers cloud-computing capabilities and an IT service environment at the edge of the network. MEC and 5G provide an environment with ultra-low latency and high bandwidth which could be very helpful for application developers and content providers.

These technologies can positively impact some of the major smart cities' use cases, which involve automated mass transit, smart parking, crowd management, emergency response, environmental monitoring, and many more.

CLOUD COMPUTING

Cloud computing is a software-defined infrastructure that allows smart cities telecom providers to store and process data remotely in the data processing center, expand services quickly and react to changes. It is a keystone of telecom digital transformation from CSP to a digital service provider (DSP).

There are three cloud computing models widely adopted by telcos to facilitate business growth:

1 Infrastructure-as-a-service (IaaS): when the telecom provider uses the computing resources of the provider (server, network infrastructure, data storage):

2 Platform-as-a-service (PaaS): when the PaaS supplier provides the telecom provider with access to the use of the software platform:

3 Software-as-a-service (SaaS): when a telecom provider can use a vendor's off-the-shelf solutions:

VIRTUALIZED RADIO ACCESS NETWORK (VRAN)

Key

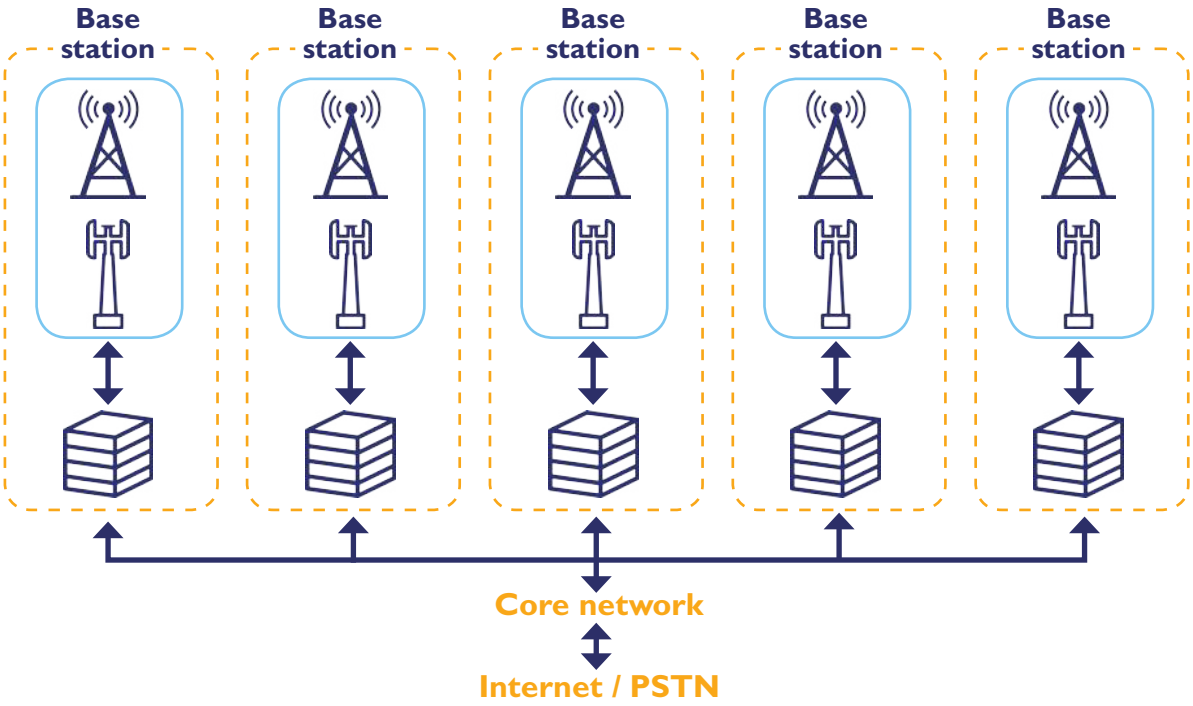
Antenna

Radio unit

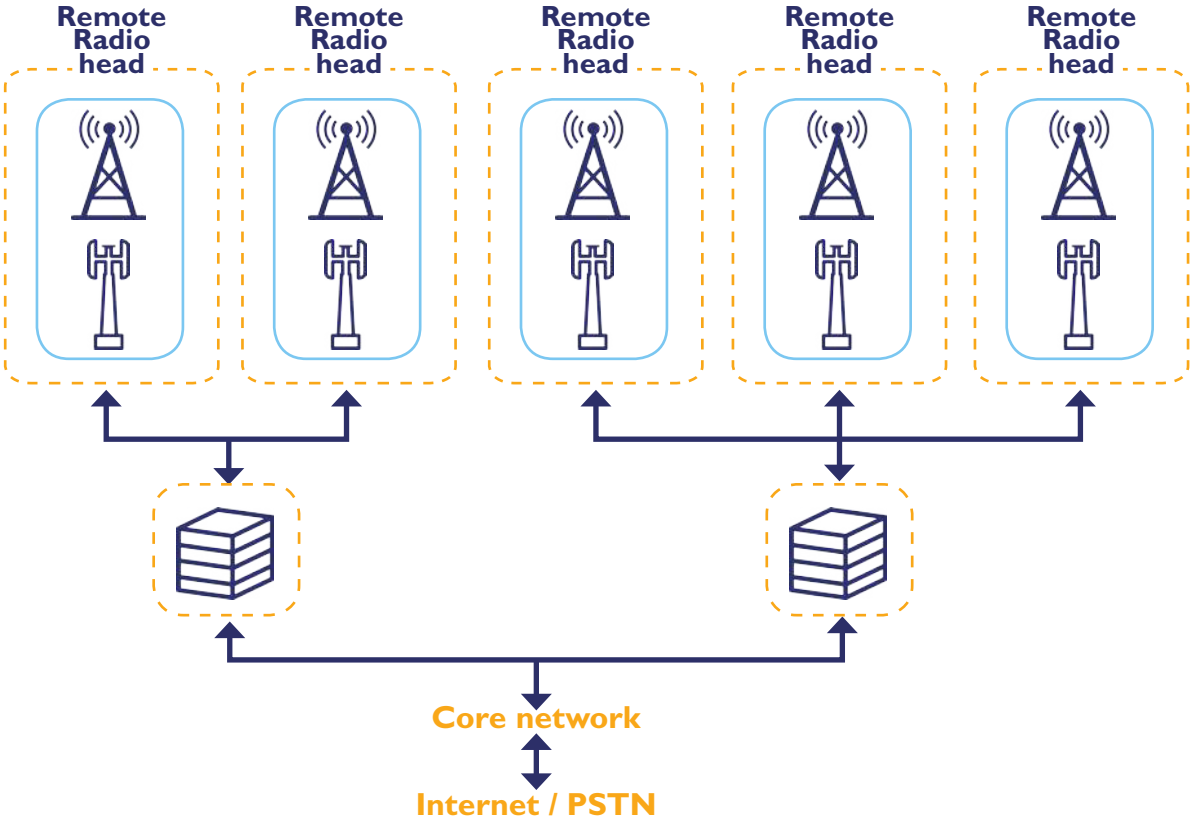
Baseband unit

Virtual baseband unit

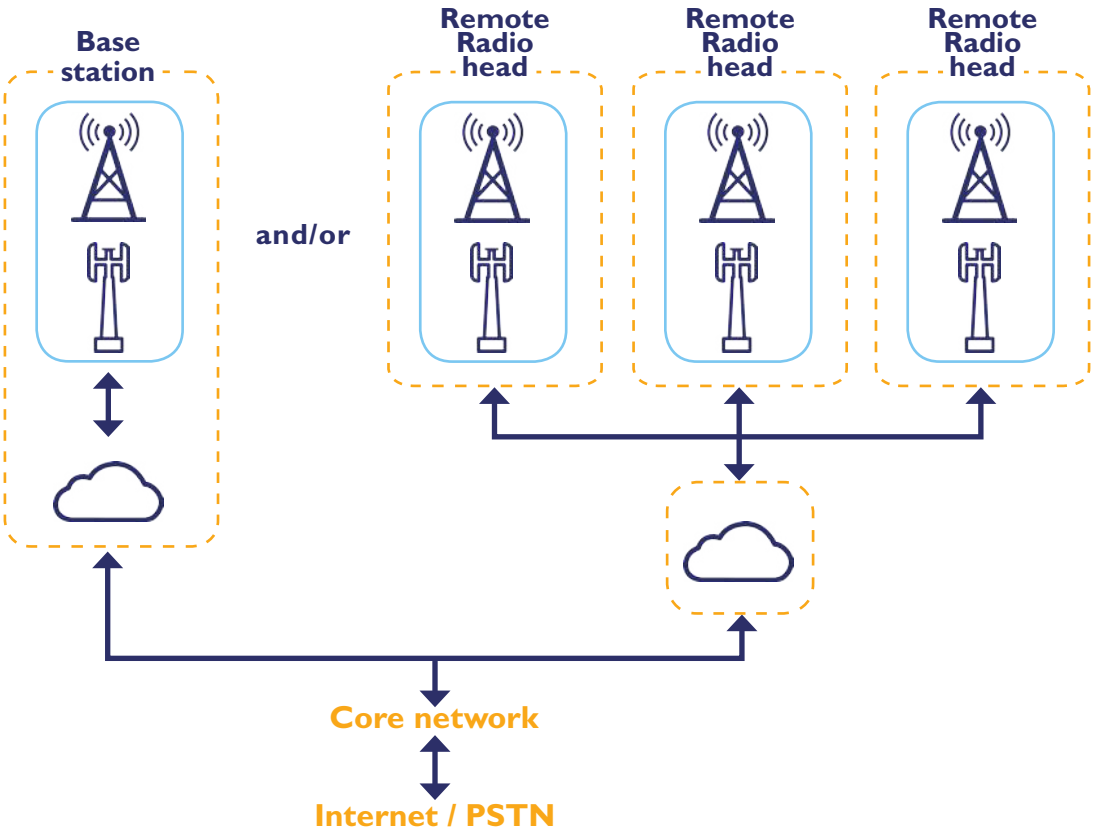
LEGACY RAN: Traditionally Radio Access Network had three basic components- Antenna, Radio Unit and the baseband unit. In Legacy RAN all of these three were installed at one physical location.



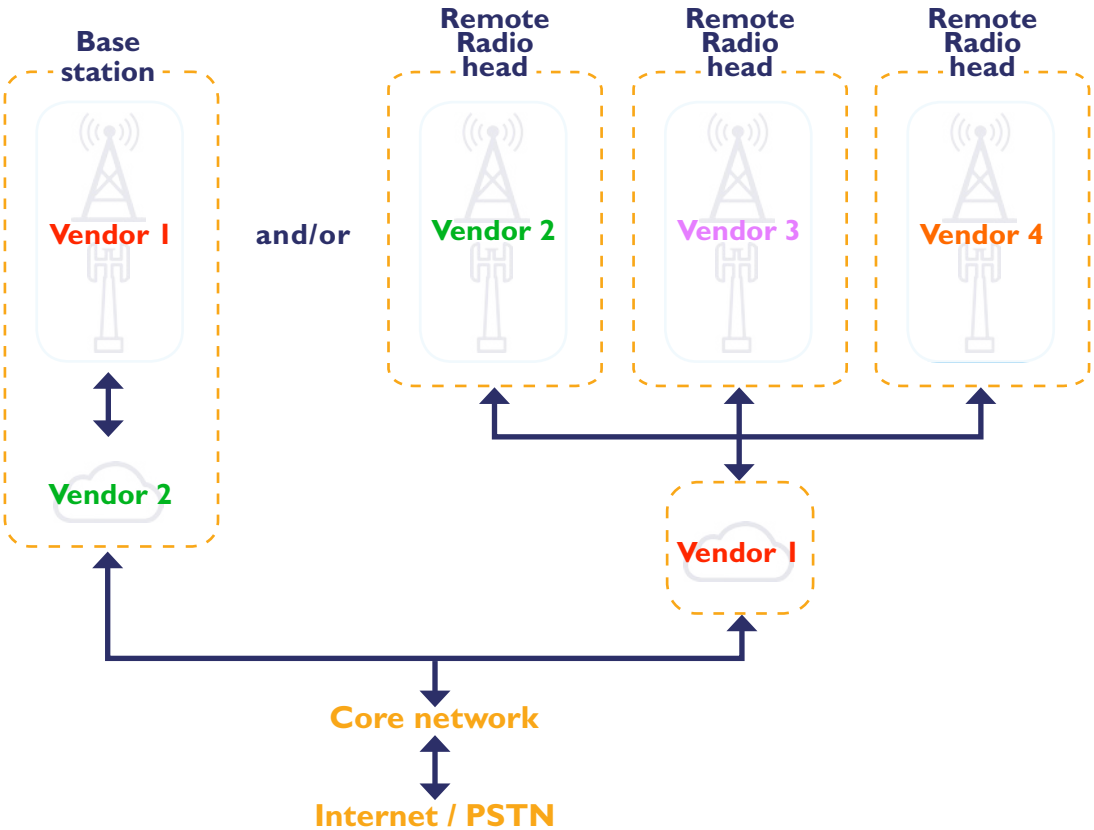
C-RAN: In Centralized RAN, the baseband units are assembled together. Due to advances in technology, we have enough processing capability that we are able to perform baseband processing at one location for multiple sites. The drawback in C-RAN is that all three, the antenna, radio unit and the baseband unit must be provided by the same vendor.



VIRTUALIZED RADIO ACCESS NETWORKS (VRANS): In vRANs, the baseband unit moved away from legacy hardware to software either VNF or CNF.



OPEN-RAN: In Open-RAN, we moved further away from vendor dependency, the baseband units and the radio+ antenna unit could now be purchased from different vendors, thus eliminating the monopoly of single vendors and promoting open standards.



NETWORK SLICING

Network slicing is a key feature for the next-generation network.

It is about creating multiple virtual networks using the physical resources of a single shared network domain, with appropriate isolation, resources and optimized topology to serve a particular purpose or service category (e.g. use case/traffic category, or for internal reasons) or even individual customers (a logical system created "on-demand").

For example: Self-automated car in a smart city: Rob starts his self-automated driving car that relies on V2X communication. While sitting in the car, Rob initiates a HD video streaming service through the infotainment system available in the car.

And both these services are provided by a single network service provider using network slicing.

EDX'S SMART CITY SOLUTIONS

MESH STREET LIGHTING

EDX provides the industry leading solution for planning Street Lighting networks.

Used in the planning of networks of any size, including those that contain up to 1m devices across any geographic region, the solution contains automated processes that minimize the time to dimension these networks.

AUTOPLACEMENT

Evaluate all potential sites much more quickly than with independent area studies for area-wide or fixed-subscriber type networks. Engineers can import tower/pole information and the automated features within EDX's solutions determine site locations for best performance as well as properly dimensioned networks so you don't overspend on hardware.

Additionally, the automated features prevent the need to run coverage analysis for each site as well as the trial and error of trying each site individually.

TOPOLOGY

The topology report in SignalPro provides engineers thorough analytics on their network.

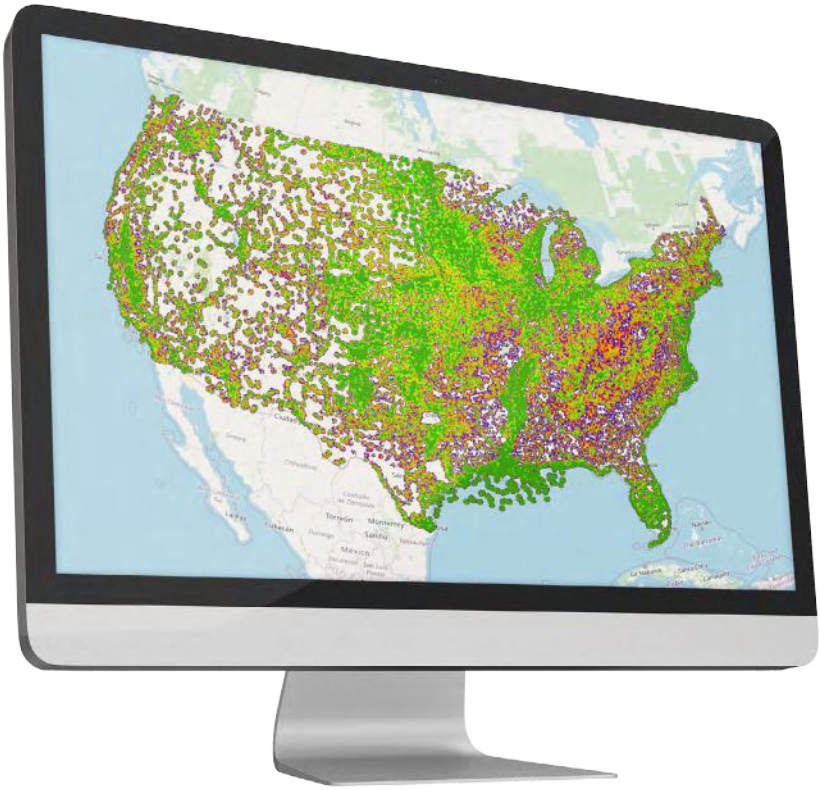
The report identifies cut nodes, vulnerable nodes and the number of alternative gateways for each meter to connect, among other things.

This provides insight into how redundant the network is and ensures there aren't any "choke points" in the network where the loss of a single device could isolate many downstream devices.

VARIATION STUDY

The Cirrus Platform provides the opportunity for greater network optimization since all map runs can be stored and mined later for performance analysis and "what if " scenarios.

These incremental changes for delta studies are calculated in minutes, not days, as changes to only one site require only re-running that one site.



COSTING

Using SignalPro + Mesh Network Module, engineers can input relative cost figures for site locations, different types of mesh equipment, and even a cost/loss value for leaving devices unconnected.

The total cost for the network is shown in the summary report as well as the individual Router View window. This allows network designers to see how cost-effective the network is overall and identify those areas where the network is most costly to install.

Smart planning means maximizing ROI and improving overall CAPEX for both greenfield and brownfield networks.

CLOUD SIMULATION

The Cirrus Platform is a Cloud SaaS offering that allows engineers to offload large studies to a cloud engine and run analysis for networks consisting of any number of devices and covering any geographic region - including nationwide.

This eliminates the need to run multiple studies, reset study grids and stitch maps together manually.

The Cirrus Platform automates this entire process by allowing you to offload large studies to the cloud engine and perform nationwide coverage analysis in a single run. You can plan networks of any number of sites and devices, and because it's done in the cloud, you are not tying up resources and can continue doing your work.

The resulting study results and maps can be used for presentations and stored for future runs and network optimizations.

ROLE OF 5G IN SMART CITIES AND ITS IMPACT

The continuous urbanization of the world is going to add a large number of new residents in the cities, with such a huge population and area, the management will be very tough, that's where the need for a 5G network came into the role. 5G will connect the residents to services, mobility, and each other.

The faster and more powerful network connectivity of 5G can make possible services that can help in the improvement of safety, efficiency, health, and security. 5G can also help cities to manage energy requirements and pollution by improving traffic management.

Some of the important factors which got positively impacted by 5G are as follow:

- Extreme real-time communications
- Lifeline communications
- Ultra-reliable communications
- Broadcast like services
- Broadband access in dense areas
- Broadband access everywhere
- High user mobility
- Massive IoT

ROADMAP

The three principles that are responsible for the success and good efficiency of any smart city are people, processes, and technology. The city developers should firstly study their people and communities, know the problems and loopholes, design the processes to improve, create policies, and objectives to meet the citizens' needs.

Technology can be implemented to meet the needs of the people of the city in order to improve the quality of life and create real economic opportunities.

Roadmap to smart cities consists of 3-4 major components:

1. Study the community: Here community refers to citizens for whom the smart city is getting developed. Before deciding to build a smart city, first, it is needed to know, why? Knowing the benefits and damages of the initiative on people can help to improve the efficiency of the project. Study the community to know the citizens, their business's needs, know the community's or the citizen's unique attributes such as their age, education, hobbies, etc., and based on this study the planning of the smart city should be done.

2. Develop a smart city policy: A proper and well-defined policy is a strong need to make an initiative successful. So, develop to drive the project, where roles, responsibilities, objectives, and goals can be defined. Create plans and strategies on how the tasks will be executed and goals will be achieved.

3. Engage the citizens: Engagement of the people in the initiative is a serious need. This can be done through the use of e-governance initiatives, open data contributions, sports events, etc.

GLOBAL POLICIES / STANDARDS

POLICY FRAMEWORK

The technology industry is based on three pillars: policy framework, standards, and technology research. Taking initiative in advocating policies, and creating standards bodies and international technology groups enables technology research and development teams worldwide to innovate across the ecosystem.

A sound policy framework that utilizes the maximum potential of transformative Internet of Things (IoT) opportunities in sectors like automotive and transportation are critical to any region, country or area's economic and financial growth in the 21st century. EDX Wireless collaborates with organizations, governments, industries, standards bodies and other international partnership programs to advocate for policies that lead to innovation and promote open standards. Our advocacy initiatives continue to catalyse pro-IoT legislation in several countries and have been deployed the world over, including but not limited to :

1 China

In 2018, the Ministry of Industry and Information Technology issued the Administrative Regulations on usage of 5905-5925 MHz Spectrum for Direct Connected Communication on the Internet of Vehicles, allocating dedicated spectrum to LTE-V2X direct communication. In 2020, Intelligent Vehicles Innovation Development strategy was issued by 11 Chinese ministries, including MIIT and NDRC(National Development and Reform Commission) to speed up the implementation of intelligent transportation systems and other smart city infrastructure and facilities.

2 European Union

The 5.9 GHz band used for safety-related ITS spectrum has been successfully expanded from 30 to 40 MHz (out of the 80 MHz spectrum that is allocated for total ITS based applications.) Efforts are on to make sufficient spectrum available irrespective of the technology being implemented, with the help of European regulators and other ITS stakeholders.

3 The USA

A bipartisan infrastructure deal (IIJA) Infrastructure Investment and Jobs Act was passed by the US Congress. This legislation will help promote the following :

- Help ease the pressure on the economy due to price increases by strengthening the supply chain. This will be the largest investment of its kind in American history. IIJA will make improvements that have been pending for a long time in American ports, roads, rail, bridges and airports infrastructure.
- This will also have a positive impact on greenhouse emissions and will thus be helpful from the perspective of conservation of the environment.
- Ensure that high-speed internet connectivity reaches every American, no matter how remote geographically, physically or economically.
- Enable access to clean drinking water in all parts of the country.
- Advance justice to communities that have been ignored in the past.

STANDARDS

Creating technology standards is important for ensuring that we keep advancing the future of innovation in IoT, autonomous computing, cybersecurity technology, Artificial Intelligence, cloud computing and connectivity. It is through worldwide standards that we will be able to bring implementation of these technologies to markets worldwide, define corporate best practices, business operations, product safety guidelines and also address environmental justice simultaneously.

C-V2X

C-V2X is a 5G cellular-based standard that defines enhanced connectivity between vehicles, infrastructure and other road users to encourage safe mobility. Vehicle-to-Vehicle and Vehicle-to-Infrastructure(V2X) standards are at the forefront of Intelligent Transport Systems or ITS.

MEC

European Telecommunication Standardization Institute (ETSI) Multi-access Edge Computing (MEC) standardised by the ETSI ISG MEC has enabled an open market and new business models. ETSI is also working on standardizing CPS for connected vehicles and roadside infrastructure.

VRU AWARENESS BASIC ACCESS

According to WHO, close to 1.3 million people die in road crashes per year, out of which more than 50% are low-mobility, high-physical-impact VRUs (Vulnerable Road User) such as pedestrians, cyclists and bikers. Smart roadside units (RSUs) deployed at intersections can help to minimize road safety issues.

COMMERCIALIZATION

Big technology companies such as Apple, Baidu, Alibaba, Tencent, Huawei, Google, Microsoft, Cisco, IBM, and Schneider Electric launched market initiatives for intelligent cities. Several sensor developers and newbie companies are also working on smart city projects.

Microsoft's CityNext provides intelligent government solutions in the following space:

- Critical infrastructure, public finance, public health and social services, public safety and justice.
- Helping drive economic growth and development through empowering the workforce with training, upskilling, and providing new avenues.
- Providing inclusive, accessible platforms and enhanced digital services to individuals and businesses with government solutions.
- Building trusted government services by adopting the highest standards of security and compliance.
- Creating a better future by harnessing the power of new and emerging technologies to conserve.

China:

- Many governments are ramping up camera coverage in cities to stop "shadow maps" of crime hotspots from emerging and are using big-data-driven AI-like computer vision to cut crime. This has been made possible by Huawei's Safe City project.
- Baidu is working on a self-driving technology project named Apollo.
- Work is on at Tencent on medical technology, in projects like WeChat Intelligent Healthcare, Tencent Doctor work, and AI Medical Innovation System (AIMIS).
- Alibaba's ET City Brain project has been implemented in 23 cities across Asia, serving customers in 48 different specific application scenarios across 11 major areas of city life, including transportation, urban government, cultural tourism, and health.

Worldwide:

- Google's subsidiary Sidewalk Labs is making advances in its smart cities initiative.
- Global "Intelligent Urbanization" initiative was launched by Cisco which is an integrated city management system to integrate network as the fourth utility, in order to improve its citizens' quality of life, and further develop its economy.
- Smarter Cities Challenge has been announced by IBM to stimulate economic growth and quality of life in cities and metropolitan areas by taking a new perspective at the urban ecosystem.
- Schneider Electric's EcoStruxure is an IoT-enabled, plug-and-play, open, interoperable architecture and platform, which can be used in Homes, Buildings, Data Centres, Infrastructure and Industries promoting Innovation at Every Level from Connected Products to Edge Control and Apps, Analytics and Services.

MARKET ADOPTION

Several governments worldwide are converting existing cities into smart cities or even building entirely new smart cities from scratch.

NEOM

Neom is the name of a future Smart tourist destination being planned by the government of Saudi Arabia. It lies in the Tabuk Province of north-western Saudi Arabia.

BARCELONA

Under Barcelona's smart city Ecosystem, the public park irrigation systems have been fitted with sensors that automatically the water requirement for plants and send the collected data to the gardening crews.

AMSTERDAM

The Amsterdam smart city project was started in 2007 to improve public safety, reduce traffic, save energy. The city runs the Amsterdam smart city challenge every year inviting ideas and initiatives from the local population that fit within the framework.

BRISBANE

Brisbane City Council has installed smart poles all over the city that serve as street lights, provide outlets for charging, act as Wi-Fi hotspots, and collect information on air quality and environmental noise. It is used to make informed decisions by the City Council.

COLUMBUS, OHIO

The city of Columbus, Ohio started its smart city initiative in 2017 with a partnership with American Electric Power to create smart electric vehicle charging stations. Several other cities in Ohio are collaborating with technology firms to work on expanding their electric infrastructure, and move towards a greener public commute system by incentivising ride-sharing and converting existing public vehicle crews to electric car fleets.

The city of Columbus received a $40 million grant from the US Department of Transport and $10 million from Vulcan Inc. for this program.

DUBAI

In 2013, the Vice President of UAE started the Smart Dubai project with more than 100 initiatives to make Dubai a smart city by integrating public and private sectors by 2030. These include Dubai Autonomous Transportation Strategy to establish driverless transits, fully digitized government, business and customer information and transactions, and make available more than 5000 hotspots to access government applications to the citizens.

Citizens can pay for utilities like education, health, business services and transport and pay fines using mobile apps like mPay and DubaiNow. A smart NoI Card can be used by citizens to recharge and pay for unified transport services like metro, buses, taxis, and water bus. Under the Dubai Municipality's Digital City initiative, all buildings have a QR code that can be scanned to get information about the building, plot, location, etc.

MADRID

Madrid Intelligente/Smart Madrid (MiNT) program runs in coordination with IBM's INSA making use of Big Data and analytics to integrate sustainable management of infrastructure, garbage collection and recycling, green spaces, public areas and other local services. Under the Madrid Digital StartUp program local issues are identified and taking a bottom-up approach, technologies and solutions pertinent to these are implemented.

COPENHAGEN

Copenhagen won the prestigious World smart cities Award in 2014 for its "Connecting Copenhagen" initiative. Air quality is high on the agenda and for that Copenhagen Solutions Lab has partnered with Google to install equipment in street view cars to produce a heatmap of air quality around the city, which helps joggers and cyclists plan their routes with the best available air quality.

This is a very progressive program that collects data from sensors and collates it with traffic data. In 2016, the Copenhagen Street Lab project was started in which the Copenhagen Solutions Lab collaborated with Cisco, Citelum, and TDC to find new solutions to the citizens' problems.

DUBLIN

Dublin is referred as the smart city capital of the world. The Smart Dublin initiative of the four Dublin local authorities works in parallel with leading technology providers, researchers and citizens to solve local city problems and improve the quality of life. Dublinked - is the city's open platform that hosts open-source data for smart city applications.

LONDON

Under the SCOOT, traffic management system, magnetometer and inductive loop data is feedback to a supercomputer in order to optimize the green light time at traffic intersections across the city.

MANCHESTER

The Manchester CityVerve project won a government-led technology competition in 2015 and was awarded 10 million to develop an IoT smart cities demonstrator. CityVerve is a platform of application tying together its four central themes: energy and environment, health and social care, transport and travel, and culture and public realm. A consortium of 22 public and private organizations are working with the Manchester City Council towards the city's devolution commitment.

MOSCOW

Moscow is among the pioneers in the smart city race. In 2018, McKinsey announced that with over 300 initiatives in the smart city project, Moscow is among the top 50 smart cities in the world. These projects have been deployed in transport, healthcare, education and municipal services sectors.

STOCKHOLM

In 1994, Stockholm started the Stokab dark fibre system which allowed private companies to rent out optic fibre in order to provide a universal fibre network to the city. Under the Green IT program, efforts are on to reduce the environmental impact using energy-efficient buildings that minimise heating costs, traffic monitoring to reduce the time spent on roads and development of e-services to minimise the usage of paper.

The e-Stockholm platform aims to provision e-services like political announcements, snow clearance and booking parking spaces. The Kista Science City Region is based on the triple helix concept of university, government and industry collaborating to develop ICT applications for various smart city strategies.

SANTA CRUZ, CALIFORNIA

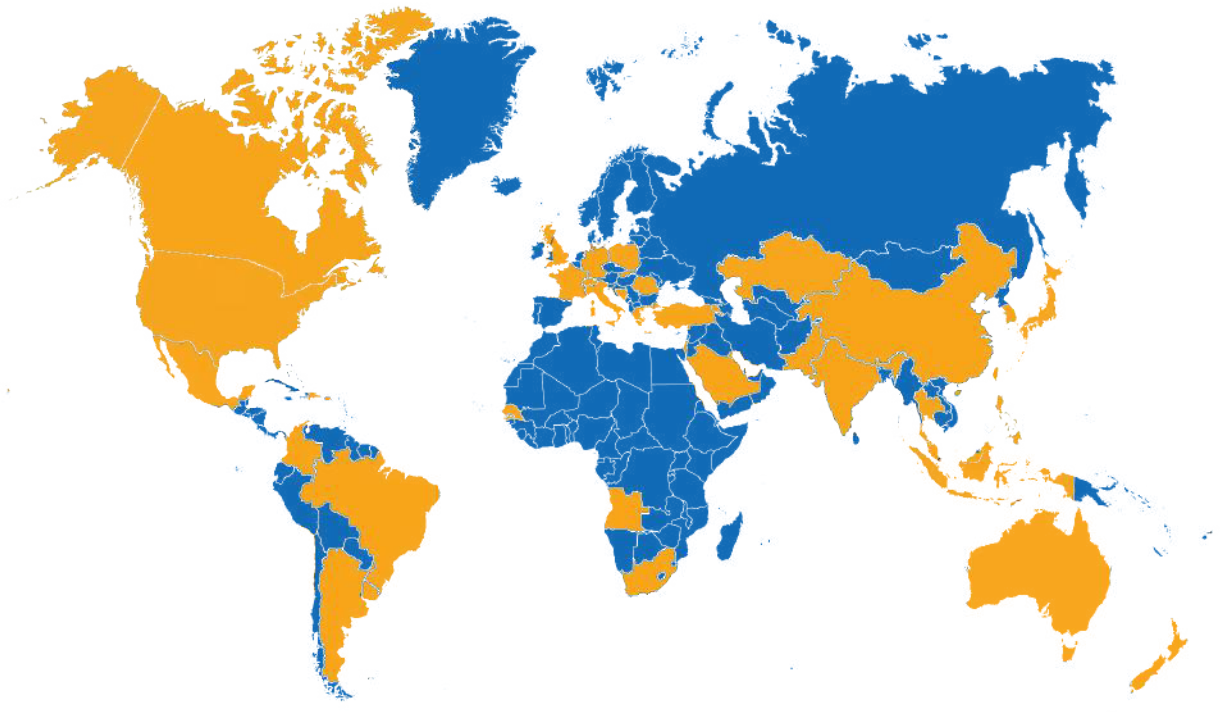
Santa Cruz, CA has found an alternative use for smart city applications. Local authorities use historical police data to predict requirements and analyse where maximum police presence is required. These tools predict the 10 most probable places for property crimes and place policing efforts in these regions during non-emergency.

TAIPEI

In 2016, the SmartTaipei project was started to change the city hall government concept and adopt a new bottom-up approach. The Taipei city government started the Taipei smart city Project Management Office (PMO) which invites PoC(Proof of Concept) from citizens and industry and provides a matchmaking platform for the same with the government resources to work out smart solutions for the city's problems, collaboratively.

TALLINN

In 2020, Tallinn, the capital of Estonia received the Netexpio smart cities 2020 Prize for digitally transforming the city. FinEst Centre for smart cities a collaborative research institution that investigates smart grid solutions and autonomous public transport is also hosted by Tallinn. Under the E-Estonia program residents are encouraged to vote electronically and also apply for transnational digital residency.



CONCLUSION

The smart city projects and initiatives world over in various stages of their development mainly depend on two factors for their success: the quality of the sensors and the RF network connecting them.

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