What Makes a City's Data Smart?

OST's Data Analytics Approach for Smart Cities

OST®
CONVERGING MISSION,
INNOVATION, AND TECHNOLOGY

Background

At its core, a Smart City is a socio-economic concept aimed at improving citizens' Quality of Life (QoL) and city economic vitality by applying advanced, intelligent Information and Communications Technology (ICT), built on four key pillars

Sustainability:
Managing climate change, urbanization, and population growth.

Strategic Positioning:
Improving the city's competitiveness and creating jobs.

Resource Management:
Delivering enhanced public services to citizens and businesses.

Security:
Enhancing public safety, protecting key infrastructure, and ensuring cyber security.

An effective Smart City implementation can result in a secure, intelligent infrastructure, delivering enhanced public services, business and job growth, investment capital, and improved public safety and security. A successful Smart City implementation requires a well-designed business model and the ability to effectively mine Big Data.

Fundamentally, Smart Cities both produce and consume Big Data. To derive the full benefits of a Smart City implementation, a city must develop the appropriate data analytics to convert Big Data to Smart Data – often in real time. The insights provided from data analytics can enhance economic value by enabling city managers and stakeholders to improve efficiency and create new services that improve the lives of citizens.

The fundamental technology behind successful Smart City initiatives is the Internet of Things (IoT). The IoT is a network that enables connected physical devices (e.g., vehicles, home appliances, cellphones, and sensors) to exchange data. This creates never-seen-before opportunities for data analytics to converge the digital data from multiple devices, increasing efficiency, driving economic benefits, and improving citizen quality of life.

Unlocking the capabilities of IoT and data analytics to gather, aggregate and normalize information from siloed city applications will pave the way for the cities to be "smart" in everything from lighting, parking, traffic and waste management, citizen engagement, safety and security, in a new and comprehensive ecosystem that enables city managers to make better, data-driven decisions.

Role of Data Analytics in Smart Cities

Data analytics plays a pivotal role in creating a Smart City, which depends on how well organizations can analyze and share vast amounts of data constantly being generated by new technologies. Intelligent automation and data analytics, especially advanced predictive and prescriptive analytics, is what makes a city "smart." The data generated by multiple sources has no benefit unless it is turned into actionable information by analytic methods and tools. In smart cities, ***data conveys the message; data analytics provides the meaning.***

Predictive Analytics can leverage state-of-the-art platforms and technologies to solve complex city problems by evaluating past and current performance to predict future requirements and potential problems. Cloud computing and technologies such as Hadoop/HDFS, Spark, Hive, and other proprietary tools are used to capture, manage, and analyze immense amounts of Big Data. Artificial Intelligence and Machine Learning (AI/ML) algorithms evaluate this data and create effective situational models related to traffic, parking, waste management, facility management, energy, water, and emergency management. These models and predictive forecasts help city managers to improve the efficiency of city operations and services.

OST Data Analytics Approach for Smart Cities

OST's data analytics approach is based on tightly woven disciplines of Data Science and Design Thinking, as shown in Figure 1 right. Design Thinking fosters creative problem solving by understanding known problems and identifying unknown aspects of the issue.

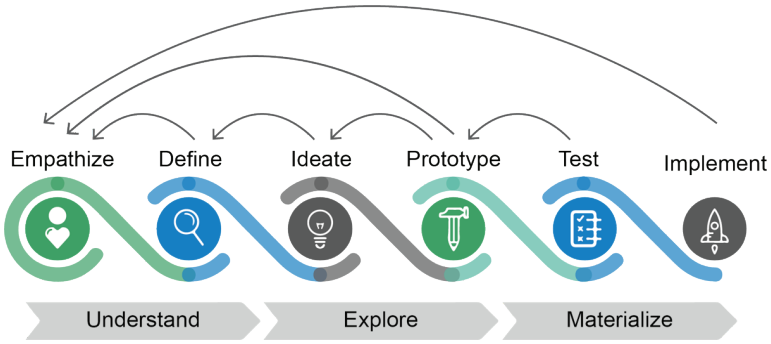

Figure 1: Design Thinking in Data Analytics

OST combines traditional off-line and in-stream Big Data analytics for Smart Cities. Infrastructure sensors such as water meters, transportation vehicles, street lights, parking spots, drones, and other devices generate an enormous amount of data. Today's computing technology can analyze this data in real time, as shown in Figure 2 below, providing city officials and citizens the opportunity to make decisions based on the latest data analysis. This new paradigm delivers a variety of analytics such as intelligent filtering and data transformation. As shown in the red-dashed box in Figure 2, off-line data analytics is employed in cities after the data is collected.

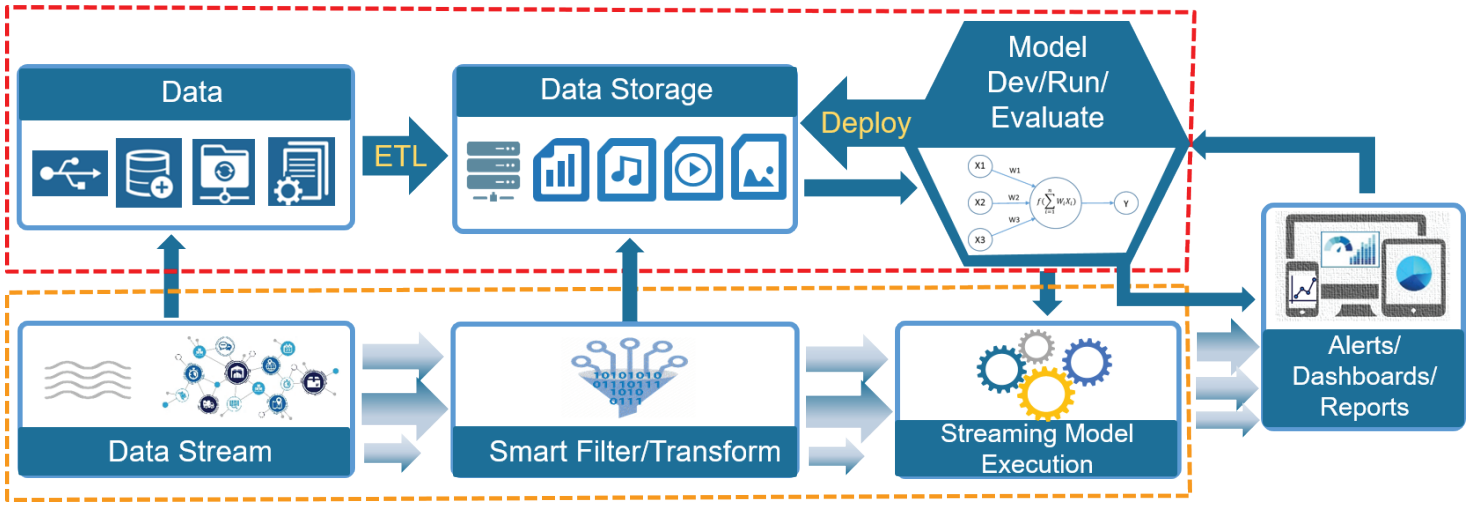

Figure 2: Data Analytics Model for Smart Cities

Combined with off-line analytic model development, streaming model execution delivers analytic decision-making capabilities to operational devices at the sensor gateway. This enables a variety of use cases such as real-time parking management.

Smart Cities employ IoT sensors that collect large amounts of data from different systems and locations that need to be synchronized to provide a comprehensive real-time picture of the city environment. In this regard, geospatial visualizations provide interactive spatial context for this data to improve and streamline situational awareness in the cities. Timely and simple, yet powerful data visualizations developed by OST's Design Thinking approach, provide actionable insights to city officials for improvement of response times for critical services, and optimization of resource allocations. Also these data visuals translate real-time data into easily digestible information that can be accessible to the public via mobile applications to increase the overall experience of the citizens.

Our high-level solution architecture is provided in Figure 3 below. The technology stacks used in our solution for Smart Cities can incorporate any platform or tool. We can tailor the solution stacks based on each city's capabilities and requirements.

Data governance is necessary for Smart Cities to optimize data. For this reason, OST leverages its Lean-Agile data governance experience to establish a seamless data integration with the highest quality for consumption in a fast and economical way.

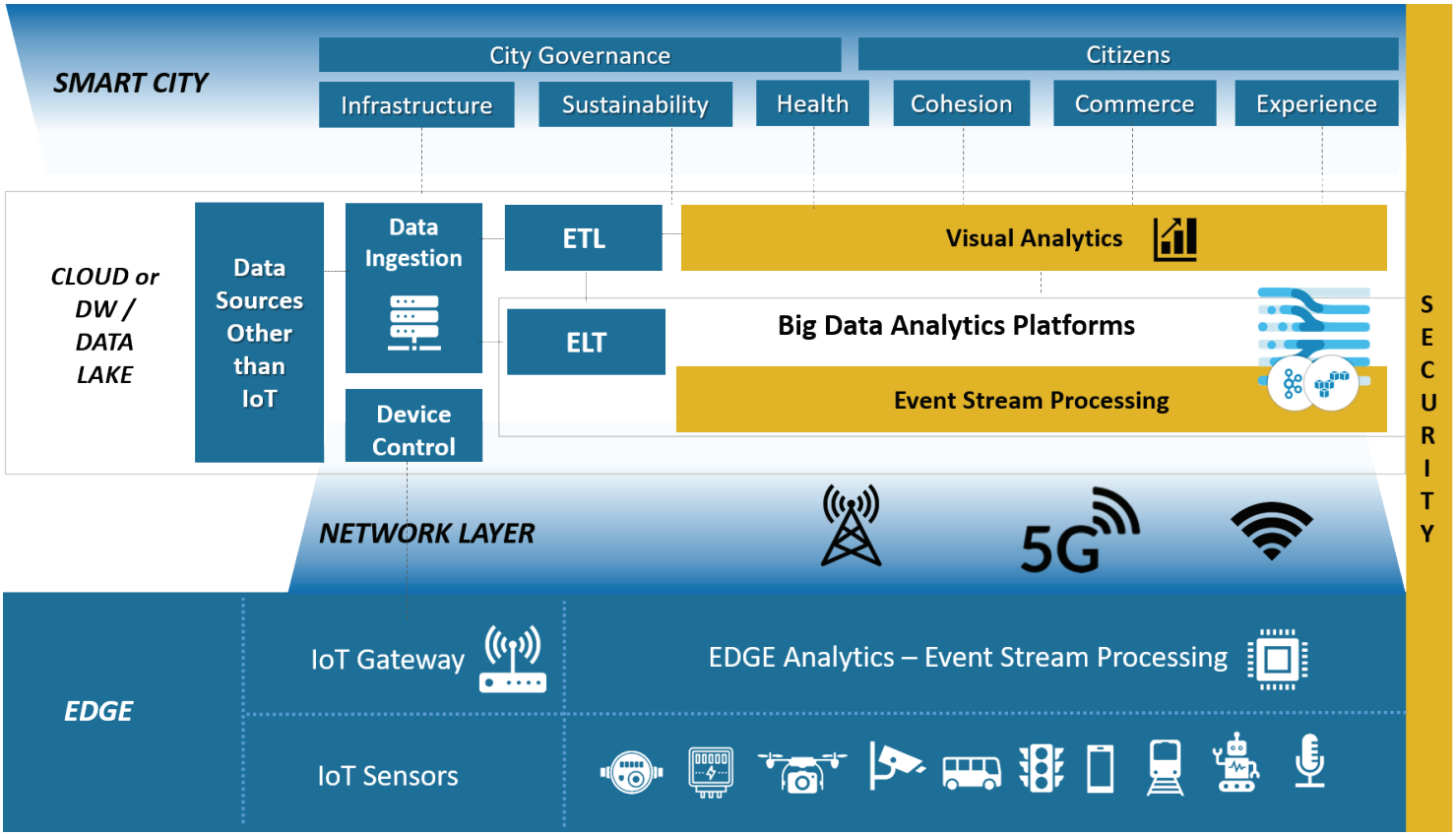

Figure 3: Smart City Integrated Data & Analytics Architecture

Benefits of Employing Data Analytics in Smart Cities

Applying data analytics enables cities to identify and remedy hidden inefficiencies to drive economic benefits and improve livelihoods. Advancements in connected devices and Big Data processing in real time allows cities access to information that has never been available before. A well-designed data analytics strategy enables city officials to access and analyze a massive amount of information to yield meaningful, actionable insights. *When a city can monitor desired metrics in real-time, service levels generally rise quickly.*

The IoT and analytics offer endless possibilities to enable stronger decision-making. For example, effective data analysis applications and strategies provide a city with information to identify and staff police in high-risk areas, forecast and plan for expansion in citywide population growth, and identify trends in citizen interests, concerns, or needs. This enhances the lives of residents by cutting costs and improving the services they care about most.

The products and services of data analytics (e.g., accessible government data, interactive maps, government performance dashboards, transparency into budgeting, live-streamed city hall meetings, and a strong social media presence) assist smart cities in creating closer relationships with citizens. These smart technologies also help increase civic engagement and trust in city officials. Analytics applications such as license plate and face recognition, gunshot location detection, and response resource optimization can give law enforcement an edge, and make cities safer.

Data analytics help city officials develop action plans for a cleaner city. For example, the analysis of environmental data can assist in creating effective strategies to reduce air pollution, water and soil contamination.

Smart transportation technologies such as intelligent traffic signals optimize traffic flow, relieving congestion during peak travel times. Smart parking management allows cities to optimize revenue generated by parking meters by resetting the timer to zero when each car leaves a space. Reduced congestion, growth in autonomous vehicles, and efficient vehicle routing all reduce

vehicle-related space needs in urban areas, potentially expanding the land use for development. Transportation efficiency also helps the environment by dramatically reducing the carbon footprint.

Smart city investments are playing an increasingly important role in attracting new residents and businesses, enhancing regional and global competitiveness. By providing an open data platform with access to city information, businesses are better able to make informed decisions through data analytics from integrated Smart City technologies.

Smart technologies can effectively provide cities predictive maintenance capabilities, effectively tracking scheduled maintenance requirements and identifying areas that need to be fixed before there is an infrastructure failure. This in turn conserves and reduces the inadvertent waste of water, prevents road and bridge incidents, and significantly reduces city expenditures.

Conclusion

Cities collect and store huge amount of data from IoT devices, but this data is not useful unless turned into actionable information via advanced analytics applications. Such analytics can help cities do more with less for their citizens, increasing efficiency and reducing expenditures.

The advancement of IoT technology and computing processing power in recent years provides city officials and entrepreneurs an opportunity to make data-driven decisions in real time for planning, budgeting, and operations. Big Data analytics helps to identify and target citizen concerns to improve services and the quality of life in Smart Cities.

OST and its Smart technology partners have the proven capability and experience to transform existing urban areas into the Smart Cities of the future.

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