

Addressing **smart city** and **campus outcomes** using a platform approach

Platform reference architecture for Wipro WSiC platform



Abstract

This white paper describes a platform approach to implementing smart city or campus solutions, a Dell Technologies joint reference architecture with Wipro.

The information in this publication is provided as is. Dell Inc. makes no representations or warranties of any kind with respect to the information in this publication, and specifically disclaims implied warranties of merchantability or fitness for a particular purpose.

Use, copying, and distribution of any software described in this publication requires an applicable software license.

Copyright © 2022 Dell Inc. or its subsidiaries. All Rights Reserved. Dell Technologies, Dell, EMC, Dell EMC and other trademarks are trademarks of Dell Inc. or its subsidiaries. Intel, the Intel logo, the Intel Inside logo and Xeon are trademarks of Intel Corporation in the U.S. and/or other countries. Other trademarks may be trademarks of their respective owners. Published in the USA May 2022 White Paper H19178.

Dell Inc. believes the information in this document is accurate as of its publication date. The information is subject to change without notice.

Contents

Introduction	4
Business challenges	5
Solution overview	7
Partner or technology overview	9
Solution architecture	10
Conclusion	15



The concept and vision of a digital city can be achieved through the creation of an open, data-rich, and people-centric platform that fosters innovation.

01 Introduction

The world's urban population is expected to double by the year 2050, and this will only serve to increase the demand on already stretched resources of the cities. City governments are adopting “digital city” initiatives to explore innovative ways of leveraging technologies to become more efficient, manage resources better, and develop new services towards enhancing the lives of their citizens and the communities.

The “digital city” concept has gained significant importance as a means of making information and communication technology (ICT) enabled services available to citizens, authorities, and businesses in order to improve quality of life, enhance efficiency, reduce costs and waste, increase sustainability, and promote transparency.

Maintaining and improving citizens' quality of life in the megacities of tomorrow needs a fresh approach. At Dell Technologies, we're pioneering solutions to empower cities to thrive in the next phase of their evolution. Dell Technologies shares the view that the concept and vision of a digital city can be achieved through the creation of an open, data-rich, and people-centric platform that fosters innovation and accelerates the pace at which innovation is created in today's digital world. The Dell Technologies vision is rooted in the fact that the world of technology will continue to evolve and that a digital system must be designed to absorb and leverage these technology changes, dynamically and continuously. A people-centric open data access system should not be constrained and limited to the technologies and applications of today, but that it should be based on open standards and be built on a foundation that integrates solutions from a robust ecosystem of partners and open-source frameworks.



02 Business challenges

Market environment

As cities grow, the ability to have a seamless situational awareness capability is critical to be able to deal with all aspects of citizen services. Apart from realizing a wide range of benefits around citizen safety, health, and other parameters, digital city solutions can also influence a positive impact on the sustainability and environment of the cities. Use cases like real-time air quality monitoring, real-time tracking, optimization of resources like water and electricity, and smart waste management can help reduce greenhouse emissions as well as help save precious natural resources. Some of the key challenges faced by cities are highlighted in the next sections.

Public safety

Situational awareness has moved from simple image recording to AI-powered abilities to analyze, understand, and respond to data, almost instantaneously. Visual sensors offer ever greater resolution, with correspondingly large data volumes – 110 Gb/hour for one 4K camera, for example. And this data must be managed, protected, and retained for longer than ever before.



This is a challenge for city administrators and others responsible for public safety in the growing cities. From higher education institutions, transport companies and law enforcers to retailers, stadia, schools and prisons, all need to make far-reaching decisions on their long-term safety and security infrastructure.

Urban mobility

Big cities with large population growth generate increasingly complex issues in the fields of transportation and mobility. Additionally, with new modes of urban mobility, new complex issues on how to manage these are surfacing. The increase in the number of vehicles on the roads is leading to traffic congestions, shortage of parking spaces, and pollution, thereby impacting the quality of life as well as productivity of citizens. Though city governments are investing in improving infrastructure and public transport systems, they are finding it hard to keep up with the growing demand. The adoption of simulation tools, intelligent traffic management systems, automated violation detection systems and automated traffic data collection, along with the integration of these systems help the city officials tackle transportation issues better.





Sustainability

Global warming and the environmental problems arising from it are posing a serious threat to the peaceful co-existence of the human and the natural worlds. This has made it imperative that we find efficient and alternative ways of development and sustainability that can support existing and upcoming cities with optimized usage and management of scarce resources.

Population and economic growth along with rapid urbanization drive a massive demand for buildings wherein two thirds of the structures that will exist by the year 2030 are yet to be built. On an average, buildings within a city can consume about 40% of a city's total energy and therefore have significant potential for energy savings with a wide range of

options. With Internet of Things (IoT) devices and smart sensor technology becoming more common and available, this offers planners a great opportunity to make cities green and sustainable. As cities expand with more infrastructure, the corresponding impact on environmental characteristics like air quality, noise pollution, etc. needs to be thoroughly understood and factored in as part of the planning.

Cities need enterprise-class solutions that combine computation, storage, and network capacity with top-flight security, reliability, scalability, and overall system resilience. Meeting these demands with one solution is not a trivial task. Making it easy to deploy and scale is all the more difficult to achieve.



03

Solution overview

Most of the cities have different departments responsible for the implementation and maintenance of their respective services. The effect of accelerated developments and rapid growth problems makes it difficult to maintain the same level of services. However, the emerging technological growth of IoT is causing a shift to a more dynamic approach to address new challenges in the future.

The vision of a smart city involves enriching quality of life by gaining insights from the data collected from interconnected sensors, devices, systems, and people. Perpetual urban issues such as security, waste management, transportation, traffic, utility services and emergencies can be addressed by utilizing data to improve efficiencies. To do this, all the data needs to be stored in a location from where it can be easily accessed and used by all stakeholders.

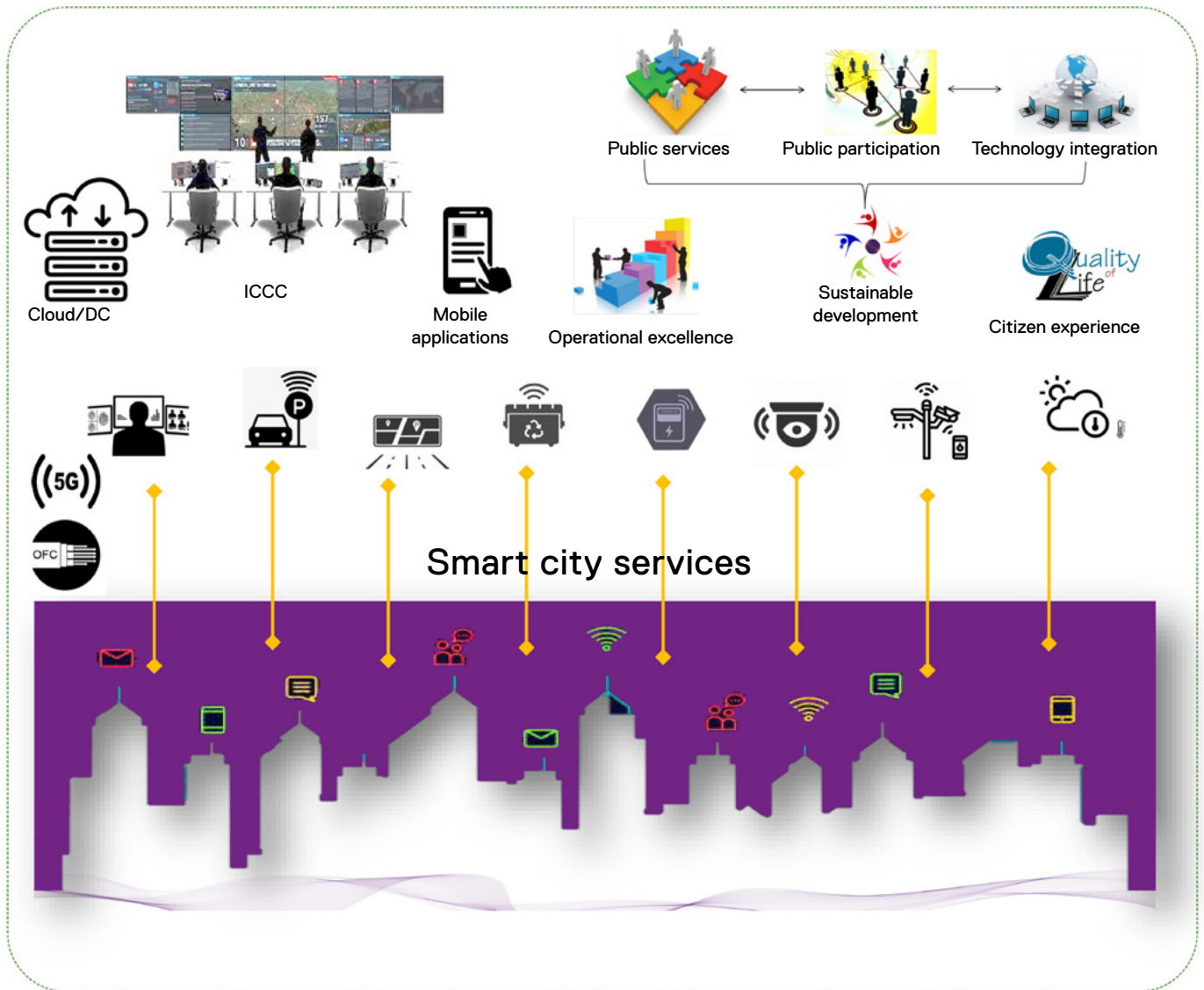


Having all the data go through a centralized system provides an opportunity to correlate different data sets to answer questions and discover insights not yet envisioned.



Whether it is different silo systems or intergovernmental silos, a common database creation on a cloud hosted service or a secured data center will enable different systems and departments to access valuable data for correlation and better interoperability. This will remove a major impediment that cities are facing today. The concept of smart cities focuses on a unified boundary-less architecture. Security is also a major aspect for adopting such integrated system as the city data can be protected in a single location, with

a disaster recovery facility created for resilience. The unified data platform and the comprehensive, secure, and efficient infrastructure does not only enable the existing smart city use cases, but they also help to future-proof the investment and enable the city to deploy additional use cases in the future. Having all the data go through the centralized system provides an opportunity to correlate different data sets to answer questions and discover insights not yet envisioned.



Smart city solution overview

04 Partner or technology overview



Wipro, a leading global information technology, consulting and business process services company, recognized for its comprehensive portfolio of services, uses emerging technologies to help clients adapt to the digital world. Together with Dell Technologies, Wipro's partnership in smart cities as a global system integration partner brings on board a strong portfolio of products and services to help discover new ideas and build smart and sustainable cities.

Smart cities are built on technologies, focused on outcomes. Cities can use IoT-driven smart city technologies to get new insights into equity and combine innovation with structural solutions while enabling inclusive processes to lead to inclusive outcomes. Data gathered from various use cases and correlated with other city data sources can be used to uncover insights around inequality and access that can be remedied with specific actions. Wipro combines extensive knowledge of all aspects of the smart cities space to provide unmatched innovative strategies, analytical visions, and quantifiable value creation for our clients. Wipro's information and communications technology (ICT) master plan and IoT services help understand how technologies can

improve a city, and elaborate the steps for putting your vision into action.

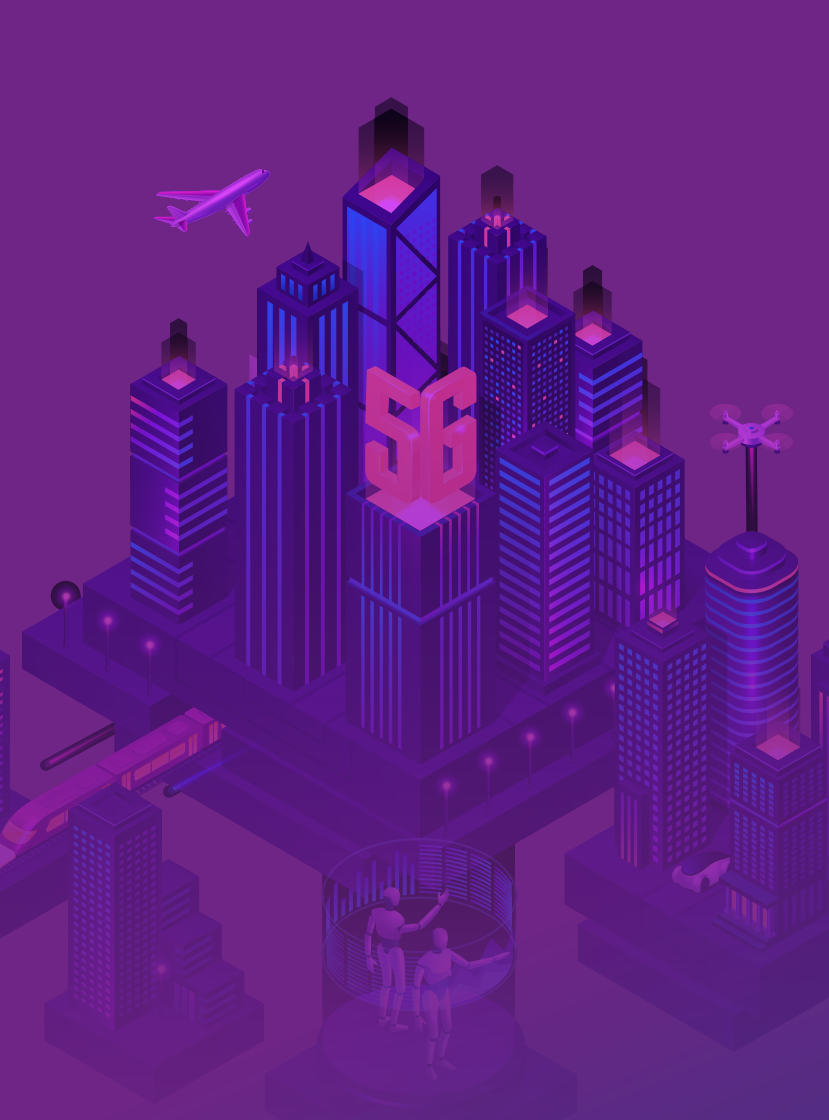
City operations center

City operation center, the nerve center of a smart city includes the following components:

- Integrated city command control center
- Integrated facility operation center
- Centralized incident monitoring center

City operation center integrates diverse set of data and drives meaningful and actionable outcomes. It also helps optimize usage of resources in a city. Typically, city authorities deploy multiple applications such as smart lighting, smart parking, waste management, and CCTV surveillance. In order to drive efficiencies and actionable outputs, it is very important that data from each of these domains interact with each other.





This solution includes the following components:

- WSiC IoT Platform
- Big data platform
- Smart services
- Integrated command & control center
- Dell Technologies infrastructure components

05 Solution architecture

Solutions components

Digital city platform will provide a holistic view of all city operations allowing monitoring, control, and automation of various functionalities at an individual system level along with enabling cross-system analytics. It is a single and dedicated platform for integrating, monitoring, controlling, implementing, and commanding all city-wide smart ICT for line departments.

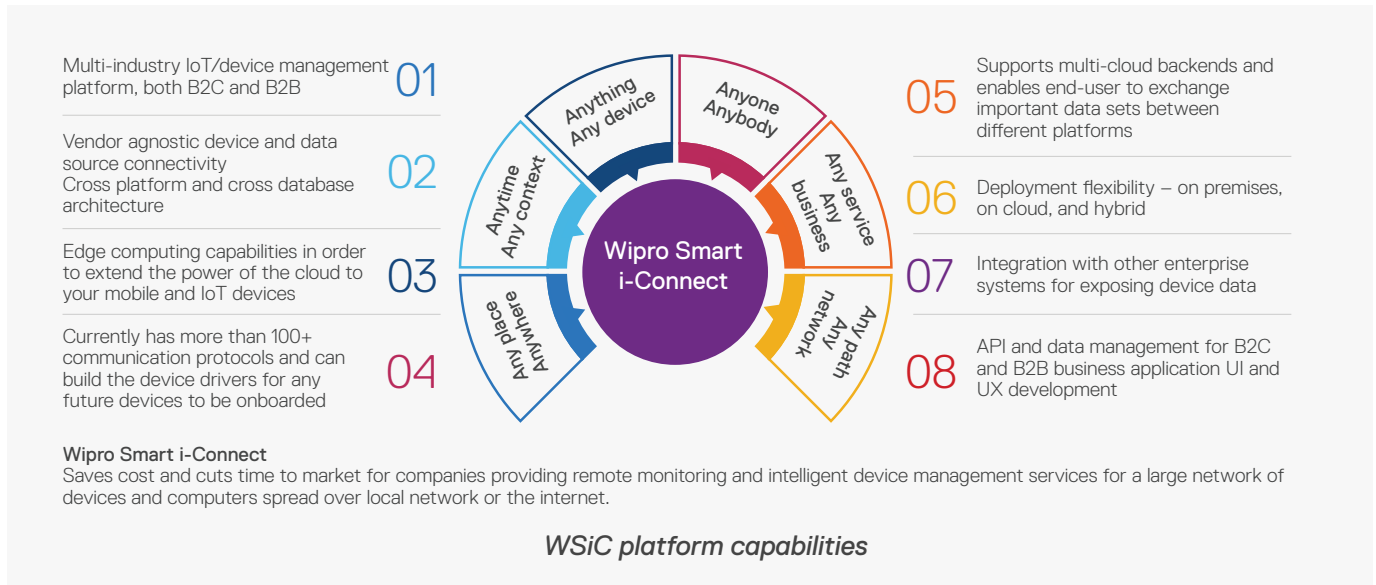
Given the complexity of applications involved and the corresponding workloads, having a reliable and scalable ICT infrastructure is critical. The core infrastructure that drives all these solutions needs to be robust and flexible to cater to a variety of workload needs, ranging from structured data to video streaming. The ability to store and process large amounts of data is key to support the scaling of the solutions to larger areas of the cities in multiple phases. This is where Dell Technologies' wide infrastructure portfolio and extensive experience in processing complex workloads for analytics use cases plays a critical role. The infrastructure solutions help deliver end-to-end validated solutions from edge to cloud with partner applications such as Wipro Smart i-Connect.



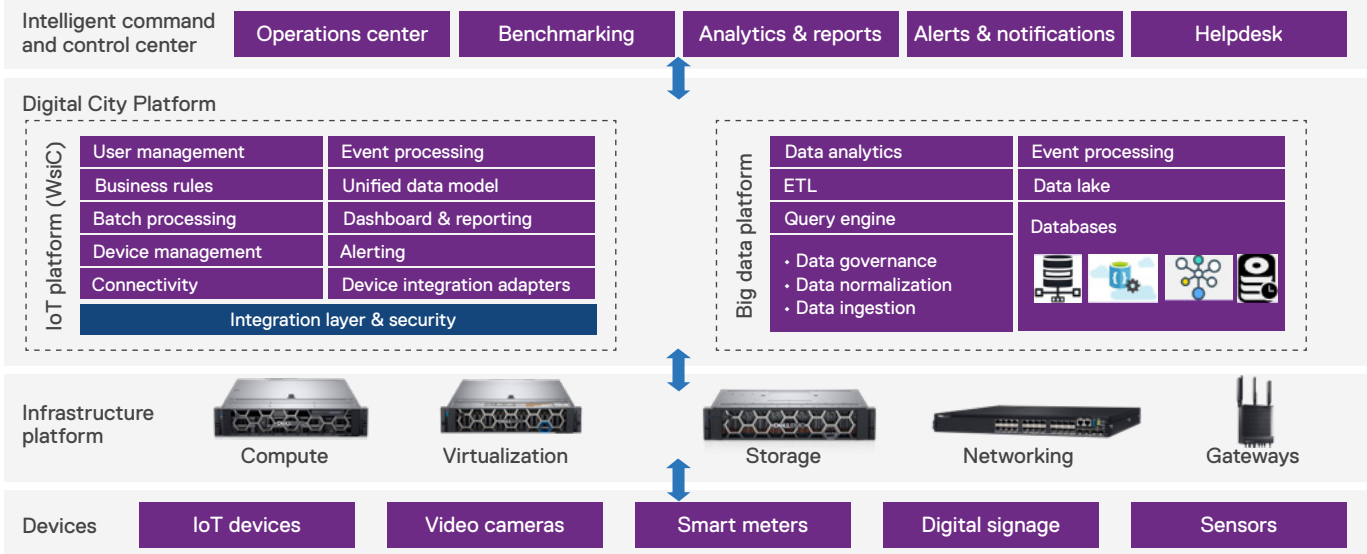
Wipro Smart i-Connect™

Wipro Smart i-Connect (WSiC) is an IoT integration platform that enables quick solution for five objectives of any IoT application: data acquisition, storage, processing, visualization, and enterprise application

integration, along with analytics capabilities. WSiC provides a rich set of features for managing/monitoring device networks processing & visualizing collected data, and it integrates with other enterprise systems using open-source APIs.



Integrated smart city architecture



Integrated smart city architecture

The digital city platform allows you to:

- Enable setting up of an integrated command and control center for 24x7 operations
- Enable cross-system and cross-agency coordination to monitor, operate and manage the city in an integrated manner
- Monitor and integrate various features to achieve intelligent city operations
- Integrate smart city infrastructure by managing multiple IoT solutions for city challenges

Digital core

Dell Technologies portfolio includes a wide variety of infrastructure solutions that can be leveraged for the optimal implementation of such platform-based solutions. This includes compute servers with flexible configuration options as well as hyperconverged solutions that help simplify the deployments. The following sections outline some of the infrastructure components that are well suited for deployment of a city-wide platform that is highly reliable and easily scalable.

Dell PowerEdge servers

Servers are the bedrock of the modern software-defined data center and the key to building a flexible, efficient, and cloud-enabled infrastructure. Dell PowerEdge servers deliver a worry-free infrastructure that is secure and scalable, with no compromises.

Dell PowerEdge servers provide a scalable business architecture, intelligent automation, and integrated security for your workloads from traditional applications and virtualization to cloud-native workloads. PowerEdge servers also incorporate the embedded efficiencies of OpenManage systems management that enable IT professionals to focus more on strategic business objectives and spend less time on routine IT tasks. With open standards-based x86 platforms, the PowerEdge portfolio of rack, tower, and modular server infrastructure can help you quickly scale from the data center to the cloud.

The Dell PowerEdge R750 is a full-featured enterprise server delivering outstanding performance for the most demanding workloads. It supports eight channels



Dell PowerEdge R750 Server

of memory per CPU, and up to 32 DDR4 DIMMs @ 3200 MT/s speeds. In addition, to address substantial throughput improvements, the PowerEdge R750 supports PCIe Gen 4 and up to 24 NVMe drives with improved air-cooling features and optional Direct Liquid Cooling to support increasing power and thermal requirements. This makes the PowerEdge R750 an ideal server for data center standardization on a wide range of workloads, including Database and Analytics, High-Performance Computing (HPC), traditional corporate IT, Virtual Desktop Infrastructure, and AI/ML environments that require performance, extensive storage and GPU support.



Dell Hyperconverged VxRail

Dell VxRail, a jointly engineered hyperconverged infrastructure (HCI) system with VMware, is the easiest and fastest way to extend a VMware environment. Powered by VMware vSAN and managed through the VMware vCenter interface, VxRail provides a consistent operating experience. An HCI system includes, at a minimum, compute, software-defined storage, and virtualized networking and can run on commercial off-the-shelf servers. The underlying resources are abstracted and pooled together which allows them to be dynamically allocated to applications running in virtual machines (VMs) or containers.



Dell VxRail HCI

Dell PowerScale storage

Dell PowerScale, the world's most flexible scale-out NAS solution, is designed to be flexible and reliable at any scale. Regardless of the type of data, where it lives, or how big it gets, the data lake always stays simple to manage, simple to grow, simple to protect, and simple enough to handle the most demanding workloads of today and tomorrow.



Dell PowerScale storage

PowerScale NAS was designed and developed for storing, managing, and accessing digital content and other unstructured data. A PowerScale clustered storage system is composed of three or more nodes. Each node is a self-contained, rack-mountable device that contains industry-standard hardware such as disk drives, CPUs, memory, and network interfaces. These nodes are integrated with the proprietary OneFS operating system, which is a distributed networked file system that unifies a cluster of nodes into a single shared resource.

The reference architecture also provides a flexible, scalable infrastructure on which to build future smart city initiatives. At a time of rapid urban growth, this facilitates faster technology uptake and maximizes return on civic resources.



Dell PowerEdge XR ruggedized servers

Industrial-grade PowerEdge XR servers are built to withstand the extreme heat, dust, shock, and vibration of factory floors, construction sites, mobile command centers, and other extreme environments at the network edge. These ruggedized servers help cities capture and process more data at the edge with advanced customization and enterprise capabilities, and deliver performance that thrives in harsh edge environments across the city.

The PowerEdge XR series servers are built using a cyber resilient architecture and include comprehensive systems management solution. They also support multiple GPUs which help drive powerful analytics use cases at the edge, thereby reducing the time to insights.



Dell PowerEdge XR11 server



Dell PowerEdge XR12 server

Dell Edge Gateway

The new intelligent Dell Edge Gateway 5200 helps cities connect OT and IT environments and extract value from their edge-generated data without interruption to their infrastructure. The EGW-5200 enables the collection, consolidation, and performance of lightweight analytics on the vast data generated from multiple edge endpoints. With a rugged and fan-less design, the edge gateway is compact and robust enough to endure 24x7 and 365 days of operations at extended temperatures without compromising on reliability or endurance. It bridges the gap between legacy systems and modern sensors, thus enabling cities to collect and process data at the edge with ease while reducing response time and saving bandwidth.



Dell Edge Gateway 5200



06 Conclusion

Benefits

Smart cities that leverage connected technologies using IoT across their operations reap a host of benefits. From our extensive experience helping cities develop technology plans, here are 10 benefits we see cities derive from smart technologies.

- More effective, data-driven decision-making
- Enhanced citizen and government engagement
- Safer communities and improved quality of life
- Reduced environmental footprint
- Improved and integrated mobility
- Increased digital equity and accountability
- New economic development opportunities and revenue streams
- Efficient public utilities
- Improved infrastructure and asset monetization
- Effective workforce engagement

These benefits cascade directly to citizens and businesses that operate within the city. The world is becoming much more connected and open, enabling people with much wider choices of where to live and work. The pandemic has only accelerated these forces. As people realize the benefits of living in a cleaner, safer, more convenient, and exciting city, they're free to move and establish their new lives in new cities. Businesses looking out for great talent build their facilities in these cities, driving economic growth. Economic growth, in turn, attracts new business and new workforce talent.

For further information on Dell Digital Cities solutions, please reach out to us at DigitalCities@Dell.com.

© 2022 Dell Inc. or its subsidiaries. All rights reserved. Dell, EMC and other trademarks are trademarks of Dell Inc. or its subsidiaries. Other trademarks may be trademarks of their respective owners.