

# Smart Cities and Communities

## GDT Smart City Solutions on Intel®-based Dell EMC infrastructure

### ABSTRACT

As cities move to embrace smart city technologies and Internet of Things (IoT) solutions, they need to understand the new data challenges associated with these projects. In this white paper, we explore the drivers and reasons to implement a Smart City Data strategy and architecture for tangible city and community improvements, not just a science experiment. We review the challenges and how some cities are preparing to manage the data coming from sensors and IoT devices. Going even further, we review how the data can be leveraged to provide actionable intelligence and predictive insights. Lastly, we review some of the software and Dell EMC infrastructure needed to support smart city solutions along with recent innovations from Intel that makes a smart city possible.

October 2017

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## THE OPPORTUNITIES FOR SMART CITIES

The continued advancement of technology driven by the Internet of Things (IoT), always-connected mobile devices, social networks and cloud computing is resulting in an exponential growth of data and the creation of digital citizens who have access to the information at their fingertips. For cities, these mega-trends create the opportunity to manage the urban environment in new, smarter ways, and to create cities that are dramatically more:

- **Livable** — in terms of a safer, cleaner, healthier, more convenient environment
- **Workable** — thanks to a powerful digital infrastructure that is a magnet for companies, jobs and talent
- **Sustainable** — in terms of a resilient city powered by clean, renewable energy

That's the idea behind the smart cities movement. Smart cities leverage digital technologies to better manage end users' expectations, optimize and better allocate their resources, provide a safer and more sustainable environment, foster innovation, and give residents a personalized, always-on end-user experience.

### HIGH-VALUE USE CASES

In more specific terms, today's array of sensor-based capabilities available for smart cities can solve numerous pressing problems in our growing municipalities. Consider these smart city opportunities:

**Smart Lighting:** Smart street lights can transform the way people manage cities, while delivering enormous savings. Switching from halogen to LED luminaires can deliver immediate savings of 50 to 80 percent to the cities' energy bill through reduced energy use. Installing smart LEDs can generate an additional 10 to 20 percent savings by adjusting output to ambient light levels, dimming or brightening as needed.<sup>1</sup> What's more, the "vertical real estate" on light poles is ideal for environmental sensors, video monitoring, shot spotting, advertising kiosks, electric vehicle (EV) charging, telecommunications modules and more.

**Traffic control:** Data from embedded sensors, video cameras, crowd-sourced traffic information and other sources can help cities better understand traffic and pedestrian patterns and make improvements, as well as route emergency response vehicles around congested areas.

**Parking control:** Smart parking can lead drivers right to open spots, reducing congestion from circling vehicles. Sensors or cameras can monitor vehicles for parking violations without sending personnel out on the street. Smart cities typically see an increase in parking revenues and in retail tax revenues, since shoppers spend less time circling and more time buying.

**Crime detection and prevention:** Video cameras can aid police in solving crimes after they happen, as well as deter new crimes from occurring. With sound sensors, police can pinpoint specific information, such as gunshots, and rapidly secure an area. Atlanta, Georgia, for example has reduced crime through its use of smart street lights with crime detection capabilities.<sup>2</sup> What's more, hundreds of cities now use smart policing to predict when and where crime is most likely to occur.

<sup>1</sup> Navigant Research, "[Smart Street Management](#)," 4Q 2015.

<sup>2</sup> The Swedish National Council for Crime Prevention, "[Improved Street Lighting and Crime Prevention](#)," 2007.



## THE GARTNER VIEW

“Urban challenges such as safety and security, traffic congestion, aging infrastructure, and even responses to events like climate change and disasters, have often been addressed by silo-based departments. However, more and more city governments are moving toward smart city solutions that leverage IoT technologies. Smart city strategists and urban planners need to implement the solutions that make it possible to utilize the data collected from various kinds of devices for holistically optimizing city operations.”<sup>4</sup>

**Emergency response:** Emergency response operators can activate street lights to help guide emergency workers to specific locations. Lights can also be flashed in sequence, or the color can be changed, to indicate emergency evacuation routes during natural disasters, such as floods and tornados.

**Environmental monitoring:** Neighborhoods can be equipped with sensors that identify toxic chemicals, pollen counts or air pollution levels. Air pollution is the single largest environmental health risk, according to the World Health Organization.<sup>3</sup>

**Warnings and alerts:** Speaker-equipped devices can be used to warn people in the vicinity of storms or other imminent dangers. And smart city applications can send automatic text messages about problems, but also about programs, benefits and opportunities.

**Public kiosks:** Digital signs — mounted to light poles or to buildings — can serve as public aids that provide directions to area shopping or public transit schedules. Some cities also use kiosks to provide free WiFi hotspots. Digital signage can be used to promote activities in the city or generate revenue through paid advertising. For example, a city might lease its poles to a company that equips them with digital signs and smart cells and collect advertising and subscriber revenue.

**Smart grid:** Smart meters and sensors can create ultra-reliable “self-healing” power grids that minimize outages. They can also give users far more control over their power usage and bills. And self-contained microgrids can make campuses, hospitals, neighborhoods and city facilities more resilient against natural disasters.

**Smart buildings:** Sensors and building information systems can dramatically improve safety, health and convenience, while slashing electricity and water usage.

**Digital city services:** More and more cities are making their services available via web browser and smartphone. The cost of a digital transaction can be as much as 50 times less expensive than face-to-face. And even though cities spend less to do things digitally, their citizens are happier thanks to 24x365 access.

These and other IoT-based smart city applications have the potential to bring enormous benefits to citizens and city administrators alike. They build a compelling case for smart city initiatives in municipalities of all sizes.

And here is where the story gets harder. To realize these benefits, cities need overcome a number of technical and organizational challenges that come with managing cities.

## BARRIERS ON THE ROAD TO THE SMART CITY

Municipalities that want to become smart cities face steep challenges. These challenges begin at an organizational level. The typical city is organized in siloed departments. This fragmentation leads to inefficiencies, and it impedes collaborative city services and management approaches.

Data from different departments, which is often in different formats, is not easily combined. That makes it difficult for cities to gain the analytics-driven insights that come from data comparisons. In addition, there is no easy way to integrate sensor and application data into other city systems.

The path to a smart city is also blocked by a lack of real-time information. Typically, only first responder groups deal with real-time incidents. Most information in cities is at best a monthly view, if not longer. That means city managers are forced to make decision based on historical information, rather than real-time data.

<sup>3</sup> World Health Organization, “[7 million premature deaths annually linked to air pollution](#),” March 25, 2014.

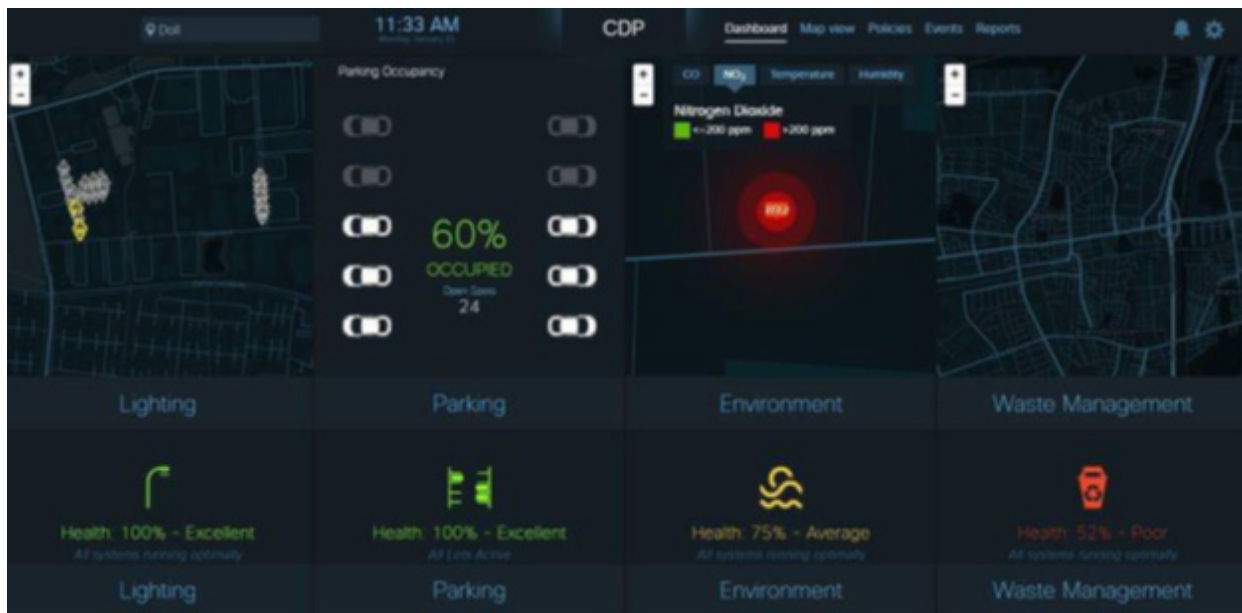
<sup>4</sup> Gartner, “[Smart Cities Look to the Future](#),” March 27, 2017.

Today, cities can overcome all of these challenges with a comprehensive connected digital platform for the smart city, delivered by Dell EMC, Intel, SAP and GDT, an award-winning technology integrator with a track record for designing, building and delivering complex solutions.

## THE SOLUTION: A CONNECTED DIGITAL PLATFORM

A connected digital platform for the smart city breaks down the walls between city departments. It provides a common information model between disparate systems, making it easier for multiple city departments to share and leverage the data they generate and collect.

A connected digital platform also provides a real-time city view of sensors and systems to give city managers immediate insight and context to drive better, more timely decisions. The platform brings all of the key system components together in a central command center that provides different dashboard-based views to different departments and users.



**Figure 1.** The connected digital platform offers a unified view. A single pane of glass lets administrators view and manage data from the lighting, parking, traffic, waste management and Wi-Fi deployments around the city.

## SOLUTION OVERVIEW

Smart city solutions from Dell EMC, Intel, SAP and GDT are built on software and hardware products that are available today. These offerings leverage the proven GDT Smart City Framework, a data platform from SAP, and Dell EMC hardware based on Intel® Xeon® processors. These components come together in solutions that can be deployed now to create a sturdy yet dynamic foundation for the smart city.

## THE IDC VIEW

“Smart City solutions leverage ICT [information and communication technology] not only to deliver higher-quality services more efficiently but also to realize significant operational cost savings and effect behavior change in government workers, city businesses, and the community.”<sup>5</sup>

<sup>5</sup> IDC, “[IDC Government Insights: Smart Cities Strategies](#),” 2017.

## THE GDT SMART CITY FRAMEWORK

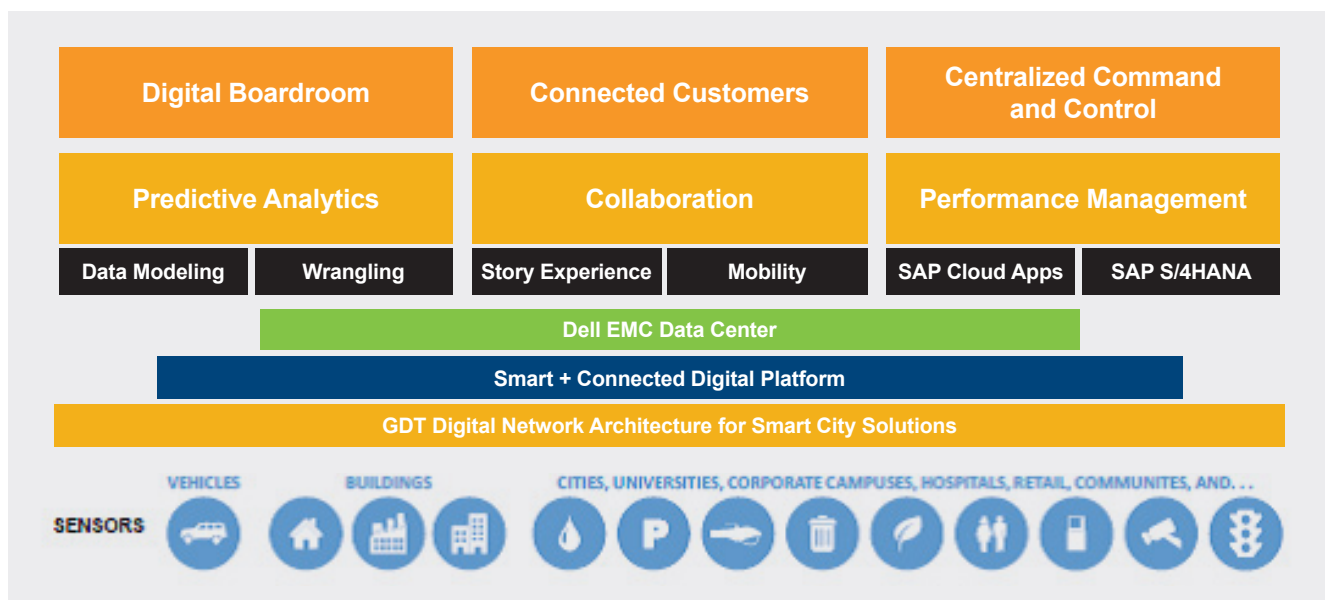


Figure 2. The GDT Smart City Framework includes capabilities for predictive analytics, collaboration and performance management.

### SOFTWARE COMPONENTS

#### SAP HANA PLATFORM

SAP HANA is an in-memory data platform that enables municipalities to accelerate business processes, deliver more city intelligence and simplify IT environments. By providing the foundation for all data needs, SAP HANA removes the burden of maintaining separate legacy systems and siloed data, so the city can run live and managers can make better business decisions in the new digital world.

#### SAP HANA STREAMING ANALYTICS

SAP HANA Streaming Analytics adds real-time streaming analytics to the SAP HANA platform. This makes it easy for developers to incorporate smart stream capture and active event monitoring, alerting and event-driven response capabilities to their SAP HANA applications.

#### SAP HANA DATA ACCESS, INTEGRATION AND VIRTUALIZATION

Smart cities can get data from any source without sacrificing performance with built-in SAP HANA data access, integration and virtualization capabilities. SAP HANA supports federated queries, data replication, remote data sync and processes to improve data quality. These capabilities allow staff to access data from inside and outside the city for full visibility in a simplified IT landscape.

#### SAP ANALYTICS CLOUD AND SAP DIGITAL BOARDROOM

SAP Analytics Cloud combines all analytics capabilities — including planning, predictive analytics and business intelligence (BI) — in a single solution delivered under a software-as-a-service (SaaS) model. City staff can take advantage of a modern, intuitive user experience — and save time by planning, analyzing, predicting and collaborating in context.

SAP Digital Boardroom, in turn, equips city leaders with real-time contextual information, ad hoc reporting and what-if analysis so they can make better decisions for today and drive change for tomorrow. SAP Digital Boardroom helps managers:

## THE FIRST SAP-CERTIFIED IOT EDGE DEVICE

In July 2017, Dell EMC introduced the first SAP-certified Dell EMC Leonardo IoT Gateway edge device. By combining the Leonardo-certified Dell IoT Gateway with SAP solutions, organizations can integrate IoT edge devices in minutes, not hours or days.

[Learn more.](#)

- Gain visibility across the entire management chain
- Respond quickly to new business challenges and customer needs
- Support stakeholder expectations for innovation and growth

### SAP HANA IN A SMART CITY SOLUTION

Core to the smart city solution are SAP standards and SAP technologies. Using the SAP HANA application platform and its in-memory database technologies, sensory data from street lights, road intersections, city parks and emergency operations can be quickly turned to actionable insights. These insights can help save and protect lives and improve all aspects of a city's operations, including reducing costs.

With SAP HANA, the city data hub becomes the repository for all data, including structured and unstructured data sets, big data and streaming data from sensors and IoT devices. SAP HANA is designed to handle this type of data by processing transactions and analytics at significant speeds in-memory. In the process, SAP HANA transforms these types of data to deliver real-time analytical insights.

### HARDWARE COMPONENTS

#### DELL EMC INFRASTRUCTURE WITH INTEL XEON PROCESSORS

Dell EMC infrastructure components for smart cities and communities includes the compute power of Dell EMC PowerEdge™ servers with the latest Intel® Xeon® processors, in combination with Dell EMC software, storage and networking products. Dell EMC offers a portfolio of infrastructure options that include Ready Nodes, Ready Bundles and Ready Systems. To make it easier for a city's IT leaders to decide on a deployment model that is best for them, Dell EMC offers these certified SAP HANA Ready Solutions optimized for SAP analytics workloads.

### DELL EMC READY SOLUTIONS

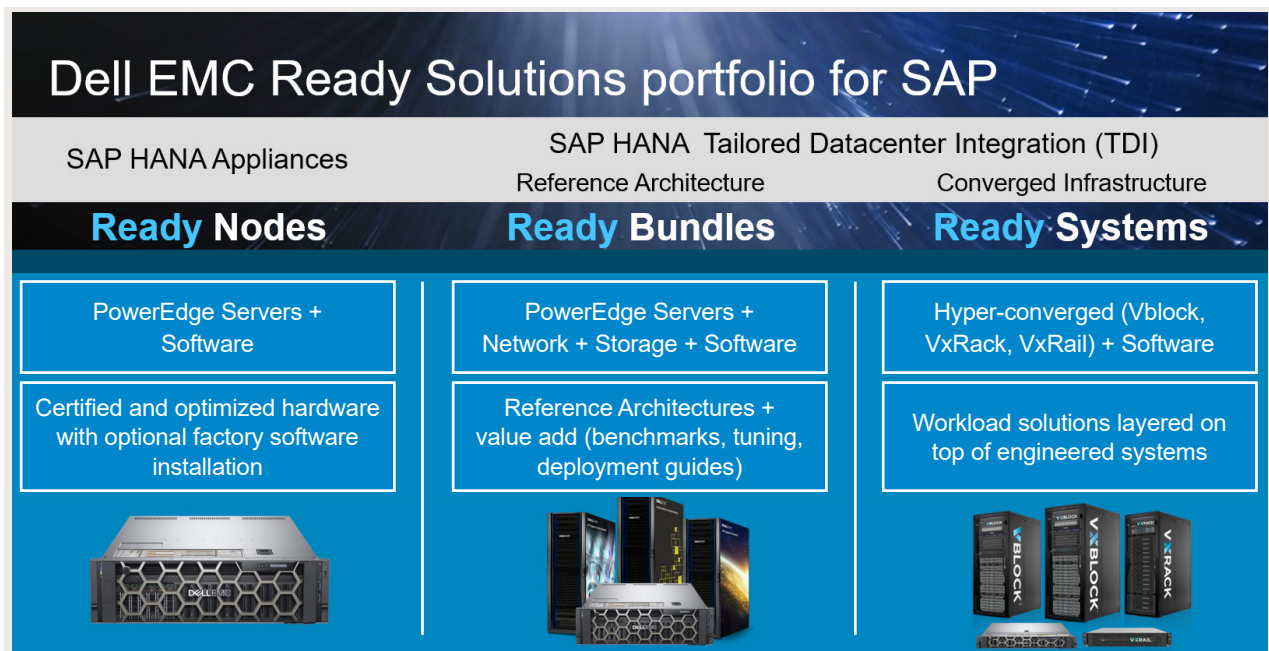


Figure 3. Dell EMC Ready Solutions provide choice and flexibility for smart cities deployments.

- Ready Nodes are built on Dell EMC PowerEdge™ servers with Intel® Xeon® processors, pre-built and delivered with SAP HANA software pre-loaded.
- Ready Bundles are SAP-certified Dell EMC servers, storage and networking, including support for SAP HANA Tailored Data Center Integration (TDI).
- Ready Systems are pre-built systems with the convenience of an appliance and the flexibility of TDI, including options that incorporate Dell EMC V[x]Block, VxRail and VxRack.

## DELL EMC DIGITAL COMMUNITIES DATA PLATFORM USING OPEN SOURCE SOFTWARE

The Dell EMC Digital Communities data platform is based on open source software libraries with many of the core components coming from Dell Technologies' open source software division. By using open source components, the platform does not become vendor-proprietary. It can be implemented using all open source components, if desired, to reduce the dependency on software licensing and maintenance costs.

### A 'FAST' DATA ENGINE

Smarter cities leverage data for several key benefits. The first is for real-time actionable intelligence. Streaming data from IoT sensors and devices generates data that can be used to immediately understand the current status of key indicators. Industry experts call this data "fast" data, because it comes into the data architecture in real time. As this data streams into the fast data engine, it is used to create meaningful dashboards that give operators a real-time view of current status.

For example, with the smart cities solution from Dell EMC, Intel and GDT, dashboards could be related to traffic and parking, or they might be used to monitor sensors related to flooding. Sensors monitoring a rising river could feed data to a dashboard that provides alerts to city operators in advance of potential flooding conditions. This is a great example of how IoT sensors and real-time data streams can benefit the city and its residents.

The fast data engine must be capable of ingesting large amounts of data with high speed and low latency. The GDT data architecture leverages SAP HANA for this component. In addition to SAP HANA, cities can add an open source data engine from Dell Technologies.

Another way cities gain benefits from data is through big data aggregation and the use of predictive analytics tools. With that thought in mind, a smart cities data architecture should have an integrated big data component that is capable of storing and managing massive amounts of data coming from sensors and IoT sources. An open source Hadoop-based data lake is the main component for big data storage enabling predictive analytics.

For modern artificial Intelligence, such as deep learning, data size matters. Simple algorithms with lots of data will outperform sophisticated algorithms with less data. In the Digital Communities platform, the data flows initially into the fast data engine (SAP HANA) and then moves into the data lake (Hadoop), where it remains accessible by the real-time dashboards. It also becomes available to the predictive analytics tools that are used with Hadoop-based big data clusters.

## DELL EMC DATA LAKE SOLUTIONS

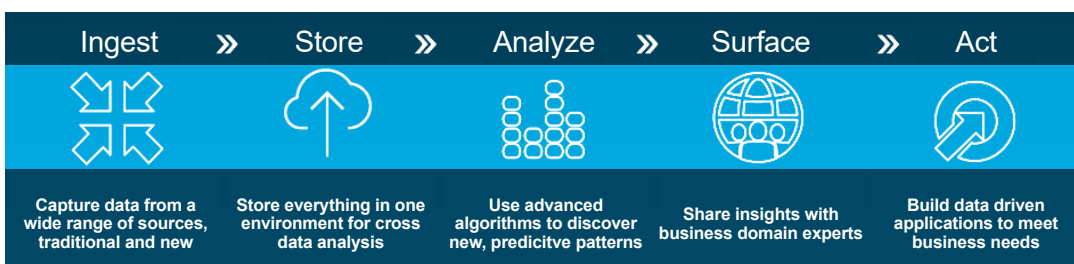


Figure 4. Dell EMC Data Lake Solutions cover the end-to-end data workflow.

A third requirement for smart city data is for it to be potentially shared as open data. By integrating the open source open data portal called CKAN into the Digital Communities platform, data sets can be exposed either to the public or to authorized persons as needed. This data sharing component completes the data-centric story for smart cities. From real-time data streams and dashboards, to data lakes and predictive analytics, to open data and data sharing, the data-driven city is now possible.

The Dell EMC Digital Communities platform can be implemented using no-cost, open source, versions of the software components. It does require a modern data center infrastructure to be implemented successfully. Cities considering this type of solution should also consider the benefits of implementations that use modern hybrid cloud models and scale-out architectures designed for big data.

### DELL EMC CONVERGED AND HYPER-CONVERGED SYSTEMS

The Dell EMC converged and hyper-converged portfolio, including VXRail, VXRack and VXBlock, provides the ease of deployment and hybrid cloud deployment power to harness even the largest data analysis challenges. In addition, Dell EMC Isilon scale-out storage solutions provide native HDFS storage for big data that enables the Hadoop data lake. All of these components of the modern data center are powered by Intel processors and technologies.

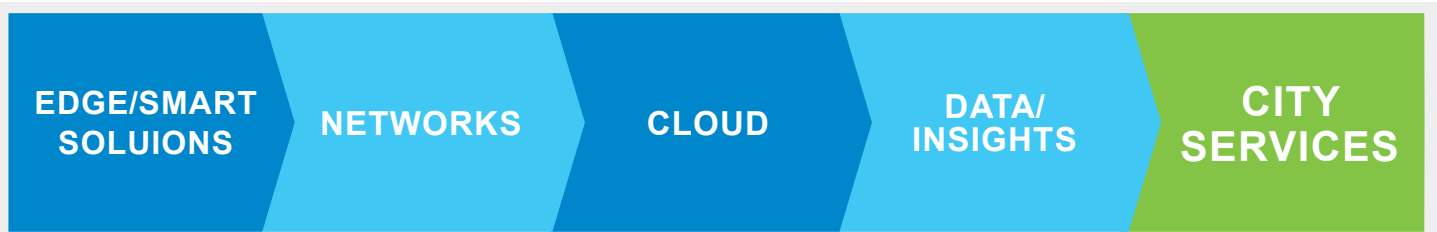
### HYBRID AND CLOUD OPTIONS

Most industries still employ on-premises solutions. However, organizations are progressively moving to cloud deployments, whether for sandbox explorations, testing, quality assurance (QA), or production environments. To meet customers' needs, Dell EMC offers a complete selection of fully managed cloud and hybrid cloud solutions for off-premises SAP HANA environments.

- **Hybrid cloud** — a mix of on-premises, private cloud and public cloud services, from Virtustream, a Dell Technologies company, with orchestration between the platforms. Such configurations enable workloads to move between private and public clouds as computing needs and costs change, giving businesses greater flexibility and more data deployment options. The Dell EMC Enterprise Hybrid Cloud solution consists of hardware, software and services from Dell EMC and VMware into a platform to deliver the foundation for infrastructure-as-a-service. Dell EMC and VMware engineering teams have designed, tested and proven the hybrid cloud solution in multiple workload settings, so organizations can avoid the risk and accelerate time to production value.
- **Off-premises managed cloud for SAP** — Virtustream offers private, hybrid and public cloud solutions, and offers an unparalleled platform for running SAP and SAP HANA workloads in the cloud. Virtustream cloud solutions are purpose-built to run complex, mission-critical, I/O-intensive applications like SAP with unmatched economics, application-level performance SLAs and integrated security and compliance. Virtustream pre-sales experts and consultants have extensive experience working directly with SAP applications. They have the expertise to seamlessly migrate SAP deployments to the cloud.

### INTEL-BASED SMART CITY INFRASTRUCTURE

#### SMART CITY INFRASTRUCTURE



**Figure 5.** Smart City Infrastructure enables cities to connect, secure, manage and analyze data for a seamless, efficient and thriving city.

Smart City Infrastructure is the information and communication technology (ICT) foundation and a vital growth engine for smart cities. It helps cities bring big ideas to life, with the potential to enable the most challenging smart city services, solutions and analytics to benefit citizens and city administrators alike.

Intel is delivering the advanced technology solutions and smart infrastructure that are the foundation for smart city services, applications and analytical insights. The Smart City Infrastructure, which enables agency services, IoT devices, multiple data types, applications and analytics, is designed with open standards. Ecosystem partners, including Dell EMC and SAP, use Intel product ingredients to provide leadership products, choice and end-to-end security.

A significant benefit of this integrated infrastructure is the ability to collect data and gather intelligence at the network edge, and to securely connect and share the data across a secured network into the data center and the cloud, where analytics tools transform data into actionable insights. It all comes together to support a seamless, efficient and thriving city.

Planning for a smart city is planning for the future, by embracing innovation to address the rapidly changing urban landscape. As the virtuous cycle of growth continues and expands to the smart city segment, Intel continues to strive to bring together connectivity, computing and cloud to help cities realize a seamlessly connected and powerfully smart 5G future.

**An example of this continued innovation is the Intel® Xeon® Scalable Platform, delivering 1.65X the average performance boost over previous generations, and delivering an effective platform for smart city solutions, from the network edge to the cloud.<sup>6</sup>**

## TIPS FOR GETTING STARTED ON YOUR JOURNEY

When you're ready to begin your journey to the smart city, it's important to identify carefully targeted initial use cases that will generate measureable ROI, and then gain a clear understanding of how you will move forward.

Here are some things to keep in mind:

- Begin with a well-defined scope
- Establish clear metrics of success
- Pick a project that is small in scale — such as a project that is suitable for a few city blocks
- Identify and prepackage technology components from GDT, Dell EMC, Intel and SAP
- Identify on-site services, delivery, installation and managed services

Depending on the projects you chose, you might measure ROI in terms such as these:

- LED vs traditional lighting savings
  - 50 percent energy savings up to 70 percent savings with the use of smart lighting
- Traffic improvement
  - Reductions in congestion of 20 percent or more
- Benefits from data
  - Utilization of data for better city planning and services
- Security force multiplier
  - Reductions in crime of 20 percent or more
- Waste management savings
  - Savings rates of 47 percent from reduced collections
- Parking revenue
  - Increased city revenue by 30 percent

## THE DELL EMC IOT STRATEGY—BACKED BY \$1 BILLION IN R&D

In October 2017, Dell Technologies unveiled its Internet of Things vision and strategy, a new IoT division, and new IoT-specific products, labs, partner program and consumption models, along with a plan to invest \$1 billion in IoT R&D over the next three years. The announcement underscores Dell Technologies' commitment to helping organizations realize their digital future by safely navigating the complex and often fragmented IoT landscape.

[Read the new release.](#)

<sup>6</sup> Intel news release, "[Intel Unveils Powerful Intel Xeon Scalable Processors, Bringing Next-Generation Business and Consumer Experiences to Life](#)," July 11, 2017.

## EXAMPLES OF INITIAL USE CASES

| Solution                   | Phase 1   | Phase 2   |
|----------------------------|---|---|
| <b>Lighting</b>            | <ul style="list-style-type: none"> <li>Real-time monitoring and control</li> <li>Scheduling</li> <li>Daylight harvesting</li> <li>Energy savings reports</li> </ul>   | <ul style="list-style-type: none"> <li>Advanced multi-color lighting control based on security event depending upon LED fixture vendor capability</li> </ul>  |
| <b>Parking</b>             | <ul style="list-style-type: none"> <li>Parking occupancy and availability</li> <li>Utilization reports and trends for city officials/planner</li> </ul>   | <ul style="list-style-type: none"> <li>Payment/meter data integration</li> <li>Reference applications for citizen, enforcement officer</li> </ul>   |
| <b>Traffic</b>             | <ul style="list-style-type: none"> <li>Congestion visualization (travel times / average speed by segments)</li> <li>Bike counting</li> </ul>  | <ul style="list-style-type: none"> <li>Advanced analytics (origin / destination data)</li> <li>Adaptive signal control (LiDAR or otherwise, mid-block detection)</li> <li>Real-time alerting to drivers / signal control for pedestrian safety</li> </ul> |
| <b>Crowd</b>               | <ul style="list-style-type: none"> <li>Crowd counting</li> <li>People flow heat map</li> </ul>  |   |
| <b>Environment</b>         | <ul style="list-style-type: none"> <li>Real-time outdoor air quality (temperature, CO, CO2, SOx, Nox, PM2.5, PM10)</li> </ul>   | <ul style="list-style-type: none"> <li>Toxic gas detection</li> </ul>   |
| <b>Safety and Security</b> | <ul style="list-style-type: none"> <li>Real-time video surveillance</li> <li>Analytics: wrong-way detection, broken-down vehicle, restricted vehicle zone, license plate recognition (LPR), behavior analysis in crowd, advanced object detection, queue detection with privacy protection</li> </ul> |   |
| <b>Operations</b>          | <ul style="list-style-type: none"> <li>CDP dashboard</li> </ul>   | <ul style="list-style-type: none"> <li>Advanced visualization and operations center/analytics dashboard/both</li> </ul>   |

## BETTER TOGETHER: DELL EMC, GDT, INTEL AND SAP

The solution for smart city management from Dell EMC, Intel and GDT brings together all the hardware, software, services and expertise you need to design and deploy a comprehensive solution that spans a broad environment.

- Dell EMC provides a blueprint for industry-leading solutions that leverage proven infrastructure components and powerful hardware, including Intel Xeon processors, required to drive real-time analytics.
- Intel processors empower Dell EMC compute solutions to run at peak capacity and enable world-leading benchmark performance.
- GDT offers smart city applications and services using a real-time in-memory platform to support evidence-based decision-making.
- SAP SE is a multinational software corporation that makes enterprise software to manage business operations and customer relations, including SAP HANA for in-memory, high-speed computing. The company has more than 335,000 customers in over 180 countries.

Ultimately, the combination of powerful hardware components, sophisticated software and a leading in-memory database enables cities and communities to offer smart city solutions that enhance citizens' lives and lower operational costs.

## GDT

GDT is an award-winning technology integration partner with expertise in the delivery of enterprise network, collaboration, mobility and data center technologies to service providers, large enterprises, and businesses of all sizes. In business since 1996, GDT has a successful track record in designing, building and delivering complex solutions.

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## DELL EMC

Dell EMC, a part of Dell Technologies, services its customers — including 98 percent of the Fortune 500 — with a broad, innovative infrastructure portfolio that spans from edge to core to cloud. A strategic SAP technology and software partner for more than 20 years, Dell EMC is a leader in server and storage performance benchmarks for SAP HANA and SAP applications.

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## INTEL

Intel is a world leader in the design and manufacturing of essential products and technologies that power the cloud and an increasingly smart, connected world. Intel delivers computer, networking and communications platforms to a broad set of customers, including original equipment manufacturers (OEMs), original design manufacturers (ODMs), cloud and communications service providers, as well as industrial, communications and automotive equipment manufacturers.

## LEARN MORE

To learn more about running smart city solutions:

- Contact your GDT or Dell EMC account representative
- Contact [allen.sulgrove@gdt.com](mailto:allen.sulgrove@gdt.com)
- Contact: [Rob.Silverberg@dell.com](mailto:Rob.Silverberg@dell.com) or [Morten.Loderup@dell.com](mailto:Morten.Loderup@dell.com)
- Or visit [DellEMC.com/sap](http://DellEMC.com/sap) or [www.gdt.com](http://www.gdt.com)
- To explore IoT solutions from Dell EMC, visit: [dell.com/en-us/work/learn/internet-of-things-solutions](http://dell.com/en-us/work/learn/internet-of-things-solutions)

## ABOUT THE AUTHORS



**Sajid M. Khan** is a tech sector stalwart with a broad range of sales and marketing experience. He has held key positions at Intel and Compaq focused on strategic planning, product marketing, business development and sales enablement across a range of technologies. He is currently Director of Smart Cities Marketing and Business Development with Intel's Internet of Things Group (IoTG). Sajid has a BSEE from Osmania University and an MBA from the University of Houston. Sajid is based in Portland, Oregon, where he resides with his wife and two daughters.



**Allen Sulgrove** has more than 20 years of technology experience in consulting with business executives, developing successful solutions, deploying, and managing IT. He has experience in many industries and has managed multiple IT groups. Currently Allen leads the Digital Business Unit at General Datatech to advance GDT's business objectives by optimizing technologies in the IoT and analytics space, specifically around SAP.



**Rob Silverberg** is currently the CTO for Dell EMC's Digital Communities focus. In this role, Rob works with government and education customers across the nation to help these agencies understand how Dell EMC's broad portfolio of technologies and solutions can help them achieve their goals. Rob has extensive experience with enterprise data management, content management, and in systems integration design. Most recently, Rob has worked extensively on Dell EMC's Digital Communities data architecture and public safety solutions. As a subject matter expert and thought leader in this space, Rob speaks at conferences and events sharing current projects, innovations, and advising on strategy.



**Morten Loderup** is Dell EMC's Alliance Manager responsible for driving SAP solution revenue with partners and direct sales in North America. Morten is responsible for SAP solutions pipeline growth and development, along with SAP and partner relationship development. His activities include customer target activities and messaging, partner go-to-market events and activities and joint message development. Morten offers a breadth of experience in this field having worked at Dell for over 15 years, with over half of those years working on SAP related projects as an SAP Solution Architect, SAP Services Program Manager for Dell's first SAP HANA launch, and now as an Alliance Manager for SAP. Morten has an Engineering Management degree from the University of Texas, Austin, and a Masters of Computer Information Systems degree from University of Phoenix, and an MBA from the University of Phoenix.



**Jesse Berst** is the founder and Chairman of the Smart Cities Council, a coalition of organizations that seeks to accelerate the move to smart cities with better livability, workability and sustainability. Jesse came to the smart city sector from the smart grid, where he was one of the pioneering thought leaders and the chief analyst of SmartGridNews.com, the Internet's oldest, largest and highest-ranked smart grid site. Jesse devotes a portion of his time to efforts to grow the industry. He was a co-founder of the Smart Grid Consumer Collaborative, a nonprofit that unites utilities, vendors, and consumer advocates with the goal of accelerating a consumer-friendly smart grid. He serves on the Advisory Board for Pacific Northwest National Laboratory. He also sits on the advisory boards of Smarter Illinois and TM Forum.

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