# Cisco Smart+Connected Connected Digital Platform

**The Connected Digital Platform is an open, extensible data platform that integrates solutions, applications, and devices to help communities enrich constituent engagement, gather and share data more efficiently, and generate new revenue and job opportunities.**

## Product Overview

Communities and cities worldwide are increasingly aware of the growing digital technology revolution. Many have already begun their own digital transformation journeys as they recognize the enormous potential and the unprecedented opportunities made possible by the rapid adoption of network connectivity and the Internet of Things (IoT).

Digital innovation requires a combined understanding of government, citizen, and business processes to apply the appropriate networking technology strategies and architectures that connect everything—people, data, actions, devices, machines—as well as embrace analytics and take a holistic approach to data security and privacy that spans technology, operations, and culture.

## Solution Framework for a Digital Journey

Digital transformation is complex. There are many challenges along this journey, some of which include:

- Breaking down siloed management of networks and data
- Reaching consensus across a wide range of stakeholders in both public and private sector organizations to best serve the community
- Integrating new and legacy IT systems
- Addressing increased data vulnerability and security while adhering to privacy concerns
- Automating the extraction of insights and resulting actions to address data overload

To address the evolving challenges that cities face, Cisco developed a framework to address and solve these challenges as they are reflected in the milestones along their digital journeys. We want to help you tap in to lessons learned from a wide variety of smart city projects while preserving each community's uniqueness in how solutions are implemented and supported. Digital transformation—when done well—can benefit government leaders, urban operators, local businesses, city residents, and visitors alike by easing the delivery and management of public services and creating vibrant, lively cities.

The Smart+Connected Digital Platform is an application-enabled platform that helps improve service delivery to communities and their constituents. The platform aggregates and organizes data from city infrastructure sensors and other data sources in a consistent, easy-to-use format and optimizes services delivery to engage residents and improve overall quality of life.

The platform:

- Collects and integrates sensor data from multiple sensors and sensor types
- Normalizes the aggregated data to a common data model to make comparisons more meaningful so that city operators can construct working digital models of their communities
- Exposes APIs through which local and global independent software vendors (ISVs) and city applications developers can plug in to the city management infrastructure and provide public service capabilities

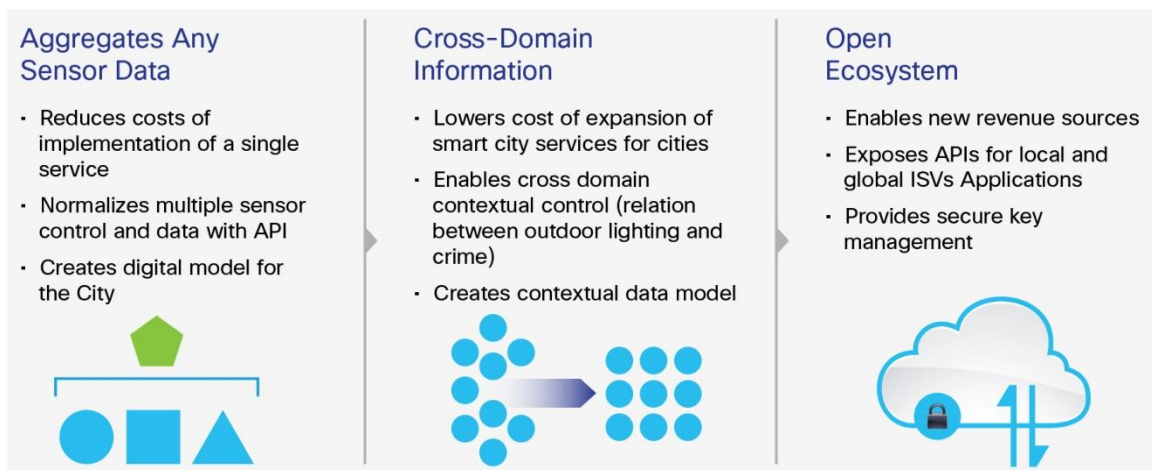The platform includes APIs for the following urban service domains:

- Outdoor lighting
- Parking
- Urban mobility
  - Crowd
  - Traffic
- Environment

## Cisco Smart+Connected Digital Platform

This platform is delivered as a cloud-based service charged on a per-sensor or per-device basis. The platform collects data from city systems and third-party devices, using network connectivity—both wired and wireless—to transmit this data to the cloud. With the platform's ability to capture data through standardized APIs, the specific protocols that each sensor uses are rendered irrelevant to the network. While some data analytics are conducted at the gathering point at the edge of the network to make data actionable more quickly, the platform stores the information securely and then makes it available through the APIs for third-party applications to further analyze, respond, package, and present it.

The interplay between all these connected elements is critical to creating a smart city digital infrastructure that is dynamic and responsive. The Connected Digital Platform bridges the network-connected devices, people, and processes from end to end with a broad framework approach.

**Figure 1.**     Smart+Connected Digital Platform: What is Does



**Aggregates Any Sensor Data**
- Reduces costs of implementation of a single service
- Normalizes multiple sensor control and data with API
- Creates digital model for the City

**Cross-Domain Information**
- Lowers cost of expansion of smart city services for cities
- Enables cross domain contextual control (relation between outdoor lighting and crime)
- Creates contextual data model

**Open Ecosystem**
- Enables new revenue sources
- Exposes APIs for local and global ISVs Applications
- Provides secure key management

The Smart+Connected Digital Platform uses secure cloud technology to provide storage, virtualization, adaptability, and analytics to boost data value and transmission speeds while reducing costs.

Benefits include:

- **Dynamic visibility** into your community's day-to-day activities, as well as the ability to perform data analytics quickly on the information
- **Rich, up-to-date information** so various departments and organizations can uniquely address situations quickly and efficiently
- **Data analytics** to enable efficient, effective scenario assessments that provide the basis for more reliable, long-term planning

## Smart+Connected Digital Platform Architecture

The cloud architecture of the Connected Digital Platform simplifies the inclusion of additional solutions to address a wider range of urban service domains. The platform supports services across domains by allowing data to trigger alerts or actions in other domains based on the criteria established by and for your community. This functionality draws from the ability to combine data from many devices, regardless of their individual protocols, and communicate it securely while also tapping in to geospatial mapping for many important uses across your community. So, for example, by combining features from both parking and lighting domains, you can achieve features like parking space–specific lighting. Figure 2 Software Architecture.

**Figure 2.**    More About the Components of Smart+Connected Digital Platform
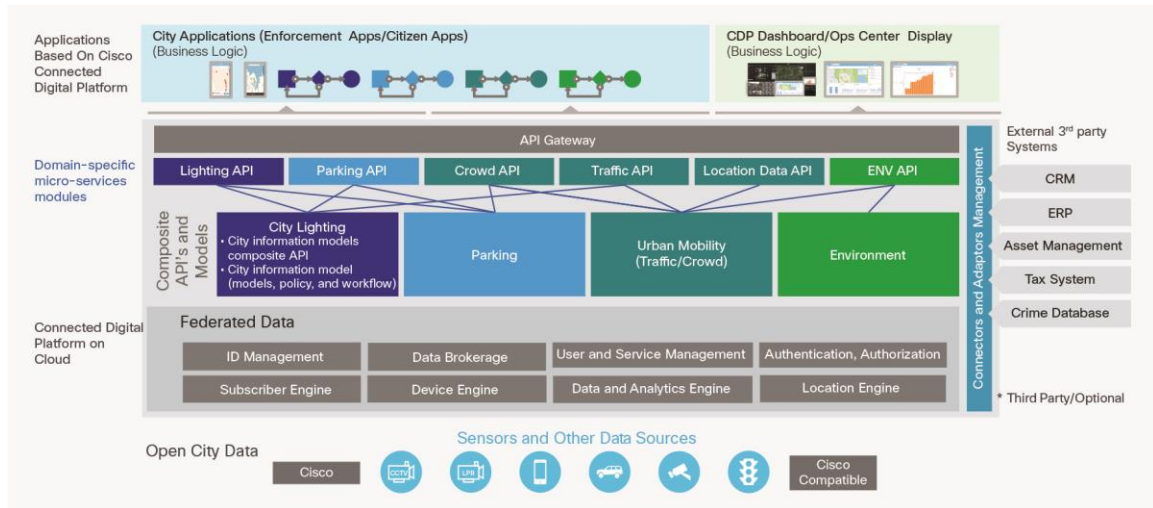
## Platform Technology

The digital platform leverages industry standard responsive web design technologies, platform centric native libraries, server side scripting languages, object relational database systems, distributed file system, markup languages to support platform core and extended functionalities.

**Table 1.**     Platform Specifications for Core Components

| Location engine | <ul><li>**Map services and geospatial coordinates:** provides the geographical coordinates of specific facilities, roads, and city infrastructure assets, as well as unmapped facilities</li><li>**Geospatial calculation:** calculates distance between two, or more, locations on the map</li><li>**Location-based tracking:** locates and traces devices on the map</li></ul> |
|---|---|
| Device engine | <ul><li>**Aggregation and abstraction of sensors:** provides aggregation of sensors from diverse sensor cloud</li><li>**Normalization of sensor data:** organizes sensor data and assigns attributes based on relations; raw data removed and passed to data engine</li></ul> |
| Data and Analytics engine | <ul><li>**Data archive and logging:** stores data feeds from the device engine and external data sources</li><li>**Analytics:** provides time-shifted or offline analytics on the archived data</li><li>**Reporting:** delivers reports based on events triggered by device engine data and external notifications</li></ul> |
| Service management | <ul><li>**Data brokerage, ID Management:** Performs service management</li></ul> |
| Authentication, Authorization | <ul><li>Performs Authentication, Authorization</li></ul> |
| Subscription engine | <ul><li>**User management:** provides unique user roles, authentication, and access based on user subscriptions</li><li>**Application management:** provides user-based application access and viewing</li></ul> |

## Reference Applications

The digital platform provides three reference applications: a dashboard web app for urban operators, a mobile app for residents, visitors, etc., and an app for law enforcement officers.

**Table 2.**     Deeper look at Reference Apps

| Dashboard | An operational, informational overview of selected city assets, or module, is represented in a simple or graphical form. The visibility of all system functionality aids an operator's decision-making and citywide response. <br><br>The dashboard web app provides a single viewing center of urban infrastructure connected through the platform. <br><br>It displays events, policies, and reports. |
|---|---|
| Parking enforcement app | The Android and iOS **enforcement officer mobile app** provides access to the following infrastructure data and workflows from mobile devices: <ul><li>Color-coded (red, yellow, green) icons showing parking violations</li><li>System messages that notify the officer of potential violations</li><li>GPS and self-updating map views that provide turn-by-turn directions</li><li>Workflows for recording photo and/or video evidence</li></ul> |
| Citizen parking app | Android or iOS based citizen parking application: <ul><li>Display parking spots and rates on a map</li><li>Reserve and pay for an available parking space</li><li>Tap GPS and self-updating map views that provide turn-by-turn directions</li><li>Receive parking time alerts from the system 10minutes before the prepaid parking period expires</li><li>Ability to share a parking location with others with email</li></ul> |

**Domain-Specific Language for Application Developers**

The digital platform uses the Things Query Language (TQL), powered by Atomiton, an XML-based domain-specific language built for smart city and urban service applications. Its primary benefits are as follows:

- **Ease of development:** Application developers can model sensors and business logic with varying attributes to functionally align as unified APIs "north" of the platform. For example, an in-ground parking sensor, a wireless parking sensor, and a camera-based parking sensors can be unified through a parking API that allows for a unique parking model regardless of the different attributes of sensors provided be different vendors.

- **Cross-domain use cases, possibilities, and revenue channels:** Cross-domain use cases can create entirely new solutions to community and city challenges without requiring further infrastructure investments.

- **Fast, efficient application development:** A ground-up systems development life cycle (SDLC) is not needed because TQL does not require compilation and byte-code generation. Therefore, the application development lifecycle is fast and efficient, and its industry applicability is agnostic.

- **Backward compatibility and shorter development work:** TQL addresses current city requirements and scales to meet new and future challenges with little development work.

## End-to-End Security

Traditionally, network deployments use a siloed approach and do not follow open security standards. Organizations run applications, servers, and tools on the public cloud with limited security protections implemented. Hence, there's a need for a centralized, cloud-based security mechanism to address the needs of service providers and end users.

Our security evolves with each technology, and network partners can use their own compliance standards, security policies, and governance requirements. The platform's security protocols fortify each layer of the architecture to protect your data. We use OAuth 2.0 framework and an identity-based key management mechanism to protect data end-to-end across the system.

Following functionalities/approaches are used to assure platform end to end security

- Oauth 2.0 framework
  - Provides to clients a "secure delegated access" to server resources on behalf of a resource owner.
  - Allows access tokens to be issued to third-party clients by an authorization server, with the approval of the resource owner
- Cloud perimeter security guidelines:
  - Secure virtual private clouds
  - Dynamic perimeters around applications, clients, hosts, and shared resources
- User ID management:
  - Protects users, data and applications through centralized automated identity management
  - Provides different tier of user categorization and services based on the subscriptions (such as anonymous users, named users, registered users, enterprise users)
  - Provides application management: user-based application access and view

- Key Management mechanism:
  - Key management & provisioning mechanism enables certified users to access and collaborate on ecosystem partner data in a secure and safe manner
  - Stakeholders are validated by role based keys and workflows, assuring security
  - Certified users can leverage data, service & domain capabilities based on the subscription. Appropriate information is available for collaboration

## Data Ownership

Your community owns all data produced by Cisco Smart+Connected™ solutions. The owner of the device, who in turn grants Cisco a license to provide our services, owns the data. The digital platform uses the data to provide analytics, generate metadata, and aggregate anonymous information. Because the platform shares information, our partners must complete a certification process before they are qualified to use it.

We store all data securely and increase capacity as needed. We comply with regulations on data storage and management for the location of the data center.

## Features and Benefit

The digital platform delivers:

- Improved productivity and reduced emergency response time with real-time asset management
- A pay-as-you-grow model; only pay for services consumed
- Federated, consistent data across an extensible platform and available to multiple stakeholders
- Rapid, reliable and flexible deployment using vendors through Cisco certified partner ecosystem, using Cisco expertise in component and partner on-boarding and certification for open API compliance
- Greater trust and security with Cisco security standards
- Improved monetization and experience for entrepreneurs, civic agencies, or businesses building apps that engage citizens or visitors and have the potential to create revenue opportunities using data about city operations, current community activities, or environmental conditions
- Engaged residents who are seeking real-time information about their city, such as updates on recommended travel routes, available parking spots based on road activity, environmental conditions and other event and services information
- Improved economy conditions by creating new opportunities for revenue streams by using vehicle-and-foot-traffic heat maps to determine visibility for businesses and alliance marketing opportunities; unused parking spaces in businesses used for multiple purposes for a fee during nearby events

## Licensing

The digital platform is available as a cloud-hosted subscription model. There are three subscription categories:

- Things as a service (TaaS): base offering provides data from sensor assets from one vendor within one domain
- Domain as a service (DaaS): normalized sensor data across vendors exposed to the platform as API
- Business as a service (BaaS): normalized data across domains, enabling contextual relationships between two or more different domains; data also exposed to platform as API

The following Table 6 provides an overview of the pay-as-you-grow TaaS, DaaS, BaaS offering

| Subscription Categories | TaaS | DaaS | BaaS |
|---|---|---|---|
| **Core capabilities** | Base offering providing data from sensor asset from one vendor in one domain | Normalized data from different vendors from a single domain offered as a service | Normalized data enabling contextual correlations between domains. |
| | | | Event in one domain can trigger action in another: for example, lighting policies can be affected from parking data provided by a multitude of sensor types. |

## Ordering Information

The following Table 7 provides detailed ordering information for the platforms' TaaS, DaaS and BaaS offerings by domains with subsequent Solution Support SKUs

| Domain | Cisco SKU for Platform Service Provisioning (Data Plan) | Cisco SKU for Layer 1 Solution Support (SSPT) (Mandatory) | Description of as-a-Service Offering |
|---|---|---|---|
| **Lighting** | SC-CIM-LT-TAAS | CON-SSPTS-CMLTTAAS | Lighting as a service for 1 year per node |
| | SC-CIM-LT-DAAS | CON-SSPTS-CMLTDAAS | Lighting domain API as a service for 1 year per light |
| | SC-CIM-LT-BAAS | CON-SSPTS-CMLTBAAS | Lighting business API as a service for 1 year per light |
| **Parking** | SC-CIM-PK-TAAS | CON-SSPTS-CMPKTAAS | Parking as a service for 1 year per sensor |
| | SC-CIM-PK-DAAS | CON-SSPTS-CMPKDAAS | Parking domain API as a service for 1 year per spot |
| | SC-CIM-PK-BAAS | CON-SSPTS-CMPKBAAS | Parking business API as a service for 1 year per spot |
| | SC-CIM-PK-CAM-TAAS | CON-SSPTS-PKCMTAAS | Parking as a service for 1 year per camera |
| | SC-CIM-PK-CAM-DAAS | CON-SSPTS-PKCMDAAS | Parking domain API as a service for 1 year per camera |
| | SC-CIM-PK-CAM-BAAS | CON-SSPTS-PKCMBAAS | Parking business API as a service for 1 year per camera |
| **Traffic** | SC-CIM-TR-TAAS | CON-SSPTS-CMTRTAAS | Traffic as a service for 1 year per sensor |
| | SC-CIM-TR-DAAS | CON-SSPTS-CMTRDAAS | Traffic domain-as-a-service for 1 year per sensor |
| | SC-CIM-TR-BAAS | CON-SSPTS-CMTRBAAS | Traffic business API as a service for 1 year per sensor |
| | SC-CIM-TR-CAM-TAAS | CON-SSPTS-TRCMTAAS | Traffic as a service for 1 year per camera |
| | SC-CIM-TR-CAM-DAAS | CON-SSPTS-TRCMDAAS | Traffic domain API as a service for 1 year per camera |
| | SC-CIM-TR-CAM-BAAS | CON-SSPTS-TRCMBAAS | Traffic business API as a service for 1 year per camera |
| **Environment** | SC-CIM-EV-TAAS | CON-SSPTS-CMEVTAAS | Environment as a service for 1 year per sensor |
| | SC-CIM-EV-DAAS | CON-SSPTS-CMEVDAAS | Environment domain API as a service for 1 year per sensor |
| | SC-CIM-EV-BAAS | CON-SSPTS-CMEVBAAS | Environment business API as a service for 1 year per sensor |

| Domain | Cisco SKU for Platform Service Provisioning (Data Plan) | Cisco SKU for Layer 1 Solution Support (SSPT) (Mandatory) | Description of as-a-Service Offering |
|---|---|---|---|
| Crowd and location | SC-CIM-CRWD-TAAS | CON-SSPTS-CRWDTAAS | Crowd as a service for 1 year per sensor |
| | SC-CIM-CRWD-DAAS | CON-SSPTS-CRWDDAAS | Crowd domain API as a service for 1 year per sensor |
| | SC-CIM-CRWD-BAAS | CON-SSPTS-CRWDBAAS | Crowd business API as a service for 1 year per sensor |
| | SC-CIM-LOC-TAAS | CON-SSPTS-CLOCTAAS | Location analytics as a service for 1 year per AP |
| | SC-CIM-LOC-DAAS | CON-SSPTS-CLOCDAAS | Location analytics domain API as a service for 1 year per AP |
| | SC-CIM-LOC-BAAS | CON-SSPTS-CLOCBAAS | Location Analytics Business API as a service for 1 year per AP |

## Support

This section describes the digital platform support services, which must be purchased concurrently with the platform. Customers must purchase a platform service provisioning SKU and technical support (TS) SKU. TS-PID is separate for each service subscription. TS-PIDs are listed in previous section, "Ordering Information."

For more information about support, see Cisco's Solution Support for the Internet of Everything (IoE) cloud service description: http://www.cisco.com/c/en/us/about/legal/service-descriptions.html.

- Cisco Technical Assistance Center (TAC) access 24 hours per day, 5 days per week to assist by telephone, fax, electronic mail or the Internet with the digital platform use, configuration, and troubleshooting issues. Cisco will respond within one (1) hour for all calls received during standard business hours and for Severity 1 and 2 calls received outside standard business hours. For Severity 3 and 4 calls received outside standard business hours, Cisco will respond no later than the next business day. Manage problems according to the Cisco Severity and Escalation Guideline.

- Access to Cisco.com. This system provides customer with helpful technical and general information on Cisco products. Notice that access restrictions identified by Cisco from time to time may apply.

- Work-around solutions or patches will be provided using reasonable commercial efforts. An advantage of the digital platform cloud-based solution is any patches or maintenance releases and/or updates for the digital platform users experiencing the problem in their subscriptions will be implemented automatically with little or no action on the customer's part.

- Minor and maintenance releases and updates. All paying customers will receive updates corresponding to the CDP package to which they subscribe ("Updates"). Such updates are limited to the digital platform components that have been validly licensed and paid for and that are covered under a current term subscription contract and whose account is in good standing order. Cisco may also release additional features or complementary services that are not included in the subscription and are available at an additional charge. Cisco may from time to time discontinue or remove some features that are deemed as depreciated or have low customer adoption. Applicable supporting documentation for the latest production version, if available, is on Cisco.com and is limited to only the current production instance of the digital platform.

## Why Cisco

Cisco Digital Platform aggregates data across department verticals and connects sensors to applications all around the city. This facilitates cross-domain use cases for a reactive, flexible city infrastructure. You benefit from:

- **Reduced TCO:** Our PaYG approach limits initial expenses and manages them over time. You get what you need—when you need it. This helps your city infrastructure evolve, and helps lower costly upgrades and integration efforts down the road.
- **Streamlined operations:** Any sensor and any application can operate in the infrastructure. Any device or application can integrate with the digital solution. You can plan implementations to suit your vision and budget, as well as avoid costly upgrades and integration efforts in the future.
- **Increased innovation and profit:** This platform allows for application development. Aspiring developers can address city issues and evolve technology on their own. The result is more innovation and creativity, as well as a new source of revenue; your city can charge for sensor data applications.
- **Future Proofing:** This platform's standards-based architecture allows for integration of sensors currently on the market, as well as sensors that are released in the future. All that's required in integration with our APIs, and any sensor and application will function within one integrated, cohesive infrastructure.

## Cisco Capital

### Financing to Help You Achieve Your Objectives

Cisco Capital® financing can help you acquire the technology you need to achieve your objectives and stay competitive. We can help you reduce capital expenditures (CapEx), accelerate your growth, and optimize your investment dollars and ROI. Cisco Capital financing gives you flexibility in acquiring hardware, software, services, and complementary third-party equipment. And there's just one predictable payment. Cisco Capital financing is available in more than 100 countries. Learn more.

### Digitize Your City

**Figure 3.**   Illustrates Cisco's Solution Framework
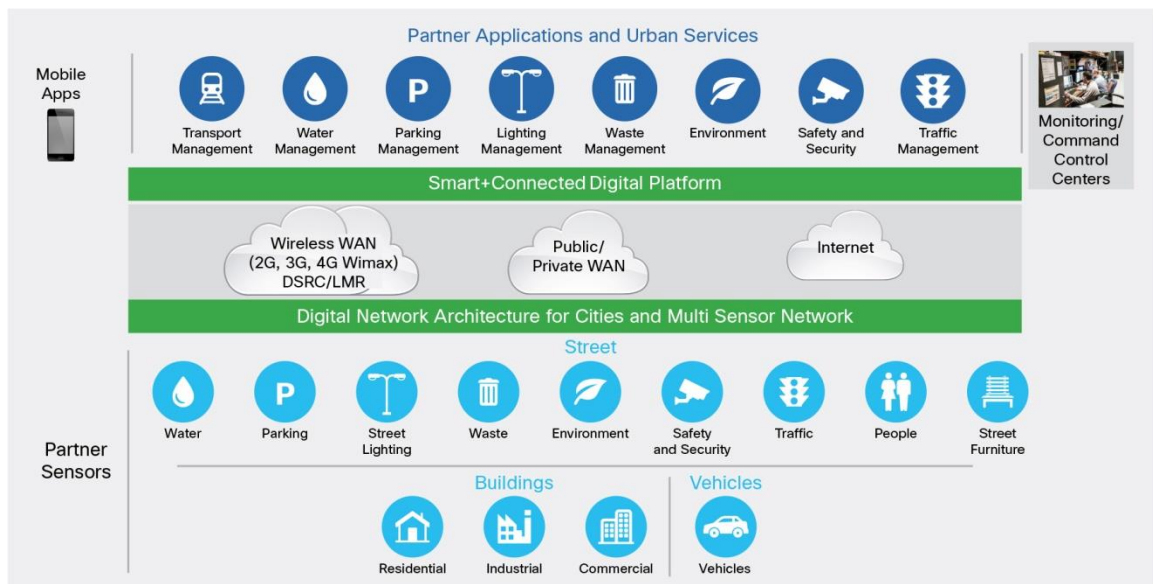
Cisco has developed a framework to help cities digitize. This approach addresses the needs of cities today and into the future, and uses the network as the infrastructure foundation for managed city and business services. It incorporates mobility, security, cloud computing, virtualization, collaboration, and video, and relies on a standards-based, open architecture and cross-functional applications running on a foundational network layer. Through this framework sensors and other city devices are connected through a common wired and wireless network infrastructure. With the Cisco Connected Digital Platform, the data is aggregated, normalized, and analyzed. Through REST APIs, app developers, as part of a certified partner ecosystem, can use this data to develop new urban services applications for city agencies, citizens, and businesses.

Cisco offers the following solutions for city digitization:

## Cisco Digital Network Architecture for Communities

Cisco Digital Network Architecture for Communities is the foundational infrastructure for community digitization. It connects people, data, devices, processes, and even city services. These connections enable cities to address more effectively their most critical problems—parking, traffic, lighting, water and waste management, safety, and security—in new ways, drawing on data gathered by video cameras and sensors mounted across the city or embedded in machinery and equipment, and in handheld mobile devices carried by citizens, visitors, or city personnel. For instance, air, noise, and water quality sensors are already issuing alerts to responding agencies and providing insights in many cities to help agencies make better planning and resource management decisions. The Digital Network Architecture for Communities also provides citywide access to the Internet and to real-time information across a variety of service areas useful to navigating daily life.

## Cisco Smart+Connected Lighting

The Cisco Smart+Connected Lighting solution, when combined with Cisco Smart+Connected nodes, creates a powerful lighting infrastructure, or what we term a light sensory network (LSN). LSNs have Cisco nodes that are embedded on light poles and connected, which can be integrated with lighting infrastructures to gather a wide variety of data from the environment, including levels of humidity, carbon dioxide and oxygen, UVA and UVB waves, particulate matter, motion and seismic activity, video, sound, and more. This data, transmitted over the LSN, can inform many city services and initiatives across a single common infrastructure from law enforcement to environmental improvement, transportation oversight, and earthquake preparedness. Cities using LED technology combined with dynamic LSN systems can:

- Dramatically reduce energy consumption and costs for materials and maintenance
- Improve citizen vehicle compliance and provide increased violation detection and city revenue capture
- Enhance situational awareness, real-time collaboration, and decision making across city agencies, helping to optimize urban planning
- Add intelligence through sensor-based IoT innovations to transportation, utilities, public safety, and environmental monitoring without adding significantly more physical infrastructure

## Cisco Smart+Connected Parking

The Cisco Smart+Connected Parking solution provides intelligent parking services that address a city's parking issues through technology, such as public Wi-Fi networks, video cameras, video analytics, and sensor-enabled parking management. The solution provides citizens with real-time information about available parking and allows them to book spaces in advance using mobile applications. The results are less traffic congestion and a more effective partnership between cities, citizens, local businesses, and parking enforcement agencies. The Cisco Smart+Connected Parking solution improves parking guidance, parking enforcement, and parking administration, as well as provides parking occupancy, utilization revenue, and enforcement reports through analytics.

## Cisco Smart+Connected Traffic

According to the U.S. Federal Highway Administration, more than 25 percent of traffic congestion is caused by traffic incidents. Therefore, early incident detection and response make for safer roads, less congestion, and smoother traffic flow. The Cisco Smart+Connected Traffic solution combines cameras, sensors, and applications, and it piggybacks on the Cisco Smart+Connected Wi-Fi infrastructure to provide visibility of live traffic conditions for traffic management authorities in real time. The solution provides insight into urban traffic patterns so that traffic authorities can provide better immediate response and long-term incidence response planning.

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