Cisco Kinetic for Cities

Cisco® Kinetic for Cities is the foundational platform for comprehensive, secure data sharing across community infrastructure, solutions, applications, and devices to increase safety, manage resources more effectively, and deliver services when and where they are needed.

Product overview

Communities and cities around the world are turning to technology innovations to help them overcome the growing challenges of urbanization. Many have already begun their own digital transformation journeys as they recognize the vast potential and growing number of opportunities made possible by secure network connectivity and the Internet of Things (IoT).

However, change is complex. Digital innovation requires a disciplined understanding of the urban landscape to bring in the right technologies and strategies that securely connect everything—people, data, devices, and processes—for maximum benefit. Cisco Kinetic for Cities offers a holistic and specialized approach to help solve problems, meet unique goals, and achieve desired outcomes.

Platform approach: The model for success

As more and more things are connected, challenges for cities continue to manifest and evolve. Some of these challenges include:

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

To address the growing list of challenges that cities face, the Cisco solutions portfolio offers a specialized approach to help solve problems, meet unique goals, and achieve desired outcomes. Cities around the world are being made smarter and are connected more securely through Cisco Kinetic for Cities, together with its solutions across a number of city use cases. We want to help each and every city leader, urban operator, local business, city resident, and visitor in their respective journeys toward creating vibrant, lively communities.

Cisco, with its industry-leading expertise in secure networking infrastructure, collaborates with a trusted ecosystem of partners to deliver Cisco Kinetic for Cities, which:

- Collects and integrates sensor data from multiple sensors and sensor types
- Makes sense of the aggregated data by constructing a common data model that enables more meaningful analysis
- Exposes APIs through which local and Global Independent Software Vendors (ISVs) and application developers can meet the needs of an urban service marketplace
- The platform includes APIs for the following urban service domains:
  - Outdoor lighting
  - Parking
  - Urban mobility
    - Crowd
    - Traffic
  - Environment
  - Safety and security
  - Waste management

Cisco has developed a framework to help cities digitize (Figure 1). 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. This framework enables sensors and other city devices to connect through a common wired and wireless network infrastructure. With the platform, the data is aggregated, normalized, and analyzed. Through representational state transfer (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.

**Figure 1. Solution framework**
Cisco Kinetic for Cities

The Cisco Kinetic for Cities platform is delivered as a cloud-based service or on-premises deployment model. The platform collects data from city systems and citywide devices, using secure network connectivity—both wired and wireless—to transmit this data to the cloud. The platform’s ability to capture data through standardized APIs means that the specific protocols that each sensor uses are irrelevant to the network. While some data analytics are conducted on the device at the edge of the network to enable informed action to occur more quickly, the platform also stores the information securely, making it available to other applications and services so they can further analyze, respond, package, and present it.

The interplay between all these connected elements is critical to creating a digital infrastructure that is dynamic and responsive. Cisco Kinetic for Cities bridges the disparities between network-connected devices, people, and processes to simplify operations, allow leaders to be more responsive to citizen needs, inspire new revenue sources, and much more (Figure 2).

Figure 2. Cisco Kinetic for Cities: What it does

Cisco Kinetic for Cities 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 digital infrastructure
- Rich, up-to-date information that is easy to share across different departments and organizations to manage incidents quickly and effectively
- Data analytics to increase situational awareness and provide the basis for cost savings and more reliable short-term and long-term planning

Cisco Kinetic for Cities uses secure cloud technology to provide storage, virtualization, adaptability, and analytics to boost data value and transmission speeds while reducing costs.
Cisco Kinetic for Cities architecture

The open architecture of the platform makes it easy to add solutions to address a wide range of urban service needs. The platform unlocks citywide data, enabling it to be used by devices, applications, and services across domains to trigger alerts or actions based on criteria established by and for your community. This functionality derives from the ability to combine data from many sources, regardless of their individual protocols, and communicate it securely while also tapping into geospatial mapping for many important uses across the city (Figure 3). For example, by combining data from both the parking and lighting domains, you can achieve features such as parking space–specific lighting based on time of day, weather conditions, etc.

Figure 3. Software architecture

Platform technology

Cisco Kinetic for Cities uses platform-centric native libraries, server-side scripting languages, object relational database systems, a distributed file system, and markup languages to support the platform’s core and extended functionalities (Table 1).

Table 1. Platform specifications for core components

<table>
<thead>
<tr>
<th>Location engine</th>
<th>● Map services and geospatial coordinates: Provides the geographical coordinates of specific facilities, roads, and city infrastructure assets, as well as unmapped facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Geospatial calculation: Calculates distance between two or more locations on the map</td>
</tr>
<tr>
<td></td>
<td>● Location-based tracking: Locates and tracks devices on the map</td>
</tr>
<tr>
<td>Real-time device engine</td>
<td>● Aggregation and abstraction of sensors: Provides aggregation of sensors from a diverse sensor cloud</td>
</tr>
<tr>
<td></td>
<td>● Normalization of sensor data: Organizes sensor data and assigns attributes based on relations; raw data is removed and passed to the data engine</td>
</tr>
</tbody>
</table>
### Time series data engine and analytics engine
- **Data archive and logging:** Stores data feeds from the device engine and external data sources
- **Analytics:** Provides time-shifted or offline analytics on the archived data
- **Reporting:** Delivers reports based on events triggered by device engine data and external notifications

### Service management
- **Data brokerage and ID management:** Performs service management

### Support services
- Performs user authentication, authorization, management, and role-based access control

### Subscription engine
- **User management:** Provides unique user roles, authentication, and access based on user subscriptions
- **Application management:** Provides user-based application access and viewing

---

**Multitenancy architecture**

The Cisco Kinetic for Cities platform architecture provides full multitenancy for improved tenant configuration and ease of operation (Figure 4). With this approach, the platform is segregated into logical instances. Users of each instance are completely segregated and cannot access other instances in any way. The respective users access unique dashboards for each segregated, logical instance. The platform supports high availability and a highly responsive user experience, all on a secure network, with reliability and operational availability that operators can trust.

**Figure 4.** Multitenancy architecture

### Standard operating procedure support

A standard operating procedure, or SOP, is a set of step-by-step instructions compiled by a city council to help workers, operators, and agencies carry out complex routine operations without any ambiguity. SOPs aim to achieve efficiency, quality output, and uniformity of performance while reducing miscommunication and failure to comply with industry regulations.
The Cisco Kinetic for Cities dashboard allows unlimited SOPs to be created and mapped to different types of incidents so that the mapping preferences are persistent.

- The dashboard GUI provides seamless control over incidents and alerts that happen within the region of focus. It allows the operator to trigger appropriate SOPs for the type and priority of the incidents, enabling the operator to handle incidents efficiently.
- Cisco Kinetic for Cities supports complex SOP workflows that have:
  - Multiple levels of approvals
  - Multiple departments that need to be contacted by phone, SMS, or text-to-speech capabilities
  - Automated escalation paths of communication
- Alerts and alarms can be seen on the dashboard with location information.
- SOPs can automatically be picked up based on the incoming alarm’s type and severity; the mapping is configurable so that the same response need not be repeated every time.
- If no actions or resolutions are provided within a predefined SLA, an SOP can escalate to the next authority in line for resolution.
- SOPs are graphically depicted in the SOP repository for better understanding.

Reference applications

Cisco Kinetic for Cities provides three reference applications: a dashboard web app for urban operators; a mobile parking app for residents, visitors, and others; and an app for parking enforcement officers (Table 2).

<table>
<thead>
<tr>
<th>Table 2. Reference apps</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dashboard</strong></td>
<td>An operational and informational overview of selected city assets represented in a simple graphical form. The visibility into all system functionality aids city operators' decision-making and coordinated citywide response. The dashboard web app provides a single view of urban infrastructure connected through the platform. It displays events, policies, and reports.</td>
</tr>
</tbody>
</table>
| **Parking enforcement app** | The Android and iOS enforcement officer mobile app provides access to the following infrastructure data and workflows from mobile devices:  
  - Color-coded (red, yellow, green) icons showing parking violations  
  - System messages that notify the officer of potential violations  
  - GPS and self-updating map views that provide turn-by-turn directions  
  - Workflows for recording photo and/or video evidence |
| **Citizen parking app** | The Android- or iOS-based citizen parking application enables users to:  
  - Display parking spots and rates on a map  
  - Reserve and pay for an available parking space  
  - Tap GPS and self-updating map views that provide turn-by-turn directions  
  - Receive parking time alerts from the system 10 minutes before the prepaid parking period expires  
  - Share a parking location with others by email |

Domain-specific language for application developers

Cisco Kinetic for Cities uses 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 sensor can be unified through a parking API that allows for a unique parking model regardless of the different attributes of sensors provided by different vendors.
• **Cross-domain use cases, possibilities, and revenue channels:** Cross-domain use cases can create entirely new solutions to address community and city challenges while also simplifying and improving existing processes without requiring further infrastructure investments.

• **Fast, efficient application development:** A ground-up systems development lifecycle is not needed, because the domain-specific language does not require compilation and byte-code generation. Therefore, the application development lifecycle is fast and efficient, and its industry applicability is vendor agnostic.

• **Backward compatibility and shorter development work:** The domain-specific language addresses current city requirements and scales to meet new and future challenges with little development work.

**Security designed to work together**

Traditionally, network deployments use a disparate approach and do not follow open security standards. Organizations run applications, servers, and tools on the public cloud with limited security protections. There’s an imminent need for a more effective security posture to address the needs of all users.

Our security evolves with each technology. And our trusted network partners can use their own complementary compliance standards, security policies, and governance requirements. Cisco Kinetic for Cities is secure at each layer of the architecture to protect data, reduce complexity, and help IT be more productive. We use an OAuth 2.0 framework and an identity-based key management mechanism that detect and stop threats to protect data across the platform.

The following functionalities and approaches are used to assure the platform’s end-to-end security:

• **Oauth 2.0 framework:**
  ◦ Provides clients “secure delegated access” to server resources on behalf of a resource owner.
  ◦ Allows an authorization server to issue access tokens to third-party clients, with the approval of the resource owner.

• **Cloud perimeter security guidelines:**
  ◦ Enable secure virtual private clouds.
  ◦ Establish dynamic perimeters around applications, clients, hosts, and shared resources.

• **User ID management:**
  ◦ Protects users, data, and applications through centralized automated identity management.
  ◦ Provides different tiers of user categorization and services based on subscriptions (such as anonymous users, named users, registered users, and enterprise users).
  ◦ Provides application management: user-based application access and view.

• **Key management mechanism:**
  ◦ Enables certified users to access and collaborate on ecosystem partner data in a secure and safe manner.
  ◦ Validates stakeholders using role-based keys and workflows, helping assure security.
  ◦ Allows certified users to leverage data, service, and domain capabilities based on their subscriptions. Appropriate information is available for collaboration.
Data sovereignty

Your city or community owns all data produced by the Cisco Kinetic for Cities platform. The owner of the device, who in turn grants Cisco a license to provide our services, owns the data. Because the platform shares information, our partners must complete a certification process before they are qualified to use it.

Cisco Kinetic for Cities securely stores all data, and increased capacity is available as needed. We comply with regulations on data storage and management for the respective location of the data center.

Features and benefits

Cisco Kinetic for Cities delivers:

- More coordinated and effective incident response across different city agencies and organizations
- A pay-as-you-grow model; pay only for services consumed
- Federated, consistent data across an extensible platform, available to multiple stakeholders
- Rapid, reliable and flexible deployment using vendors through a Cisco certified partner ecosystem, paired with unmatched Cisco expertise
- Greater trust and security with Cisco security standards
- Improved monetization that inspires new revenue opportunities through application development, data analytics and modeling, and optimized asset use
- Better public engagement and responsiveness to citizen needs
- Innovative partnerships for continued growth and success
- Better understanding of how resources are used to generate cost savings and enable greater efficiency

Licensing

Cisco Kinetic for Cities offers two licensing models:

- Cloud-hosted deployment model: The digital platform will be deployed on a cloud owned by a Cisco certified cloud partner and will be hosted and managed by a Cisco team.
- On-premises deployment mode: The digital platform will be deployed on a cloud to be managed by the customer. The initial deployment will be handled by the Cisco team, and thereafter the customer will manage the digital platform on their cloud.

The Cisco Kinetic for Cities platform has three subscription categories. Customers may choose the one that best meets their needs:

- 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 APIs
- Business as a Service (BaaS): Normalized data across domains, enabling contextual relationships between two or more different domains; data also exposed to the platform as APIs
Table 3 provides an overview of the pay-as-you-grow TaaS, DaaS, and BaaS offerings.

### Table 3. Subscription categories

<table>
<thead>
<tr>
<th>Subscription category</th>
<th>TaaS</th>
<th>DaaS</th>
<th>BaaS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core capabilities</td>
<td>Base offering providing data from sensor assets from one vendor in one domain</td>
<td>Normalized data from different vendors from a single domain offered as a service</td>
<td>Normalized data enabling contextual correlations between domains.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>An event in one domain can trigger action in another: for example, lighting policies can be affected by parking data provided by a multitude of sensor types.</td>
</tr>
</tbody>
</table>

**Kinetic for Cities solution approach**

Cisco offers the following solutions for city digitization.

**Cisco Digital Network Architecture for Cities and Communities**

Every smart city begins with its network. The Cisco Digital Network Architecture (Cisco DNA™) foundation enables digital transformation for cities and communities. Our software-driven, cloud-enabled approach makes network management fast, simple, flexible, and automated. Cisco DNA for Cities and Communities can help you deliver effective public services, share meaningful interactions with constituents, keep people safe and your data protected, innovate faster, and open unique opportunities for revenue generation, all while reducing IT costs and generating deeper network insights.

**Cisco Kinetic for Cities Lighting**

The Cisco Kinetic for Cities Lighting solution creates a powerful lighting infrastructure, or what we term a Light Sensory Network (LSN). LSNs have smart nodes that are embedded on light poles. The nodes are connected and 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 across a single common infrastructure, can inform many city services and initiatives, 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 Kinetic for Cities Parking**

The Cisco Kinetic for Cities 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 solution improves parking guidance, parking enforcement, and parking administration, as well as providing parking occupancy, utilization revenue, and enforcement reports through analytics.
Cisco Kinetic for Cities Urban Mobility

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 solution combines cameras, sensors, and applications, and it piggybacks on the Cisco DNA infrastructure to provide traffic management authorities with visibility into live traffic conditions in real time. The solution provides insight into urban traffic and people patterns so that traffic authorities can provide better immediate response and long-term incident response planning.

Cisco Kinetic for Cities Environment

With the Cisco Kinetic for Cities Environment solution, cities can improve existing early warning systems by deploying sensors to collect real-time environmental data to detect incidents as they develop. The moment a parameter crosses a threshold, automated notifications create inputs for a predictive model that estimates the spread and effects of the incident. Cisco collaboration tools are used to provide this information to all stakeholders for immediate response. Field response teams are connected to emergency management teams who are getting data from monitoring departments and sensors. All stakeholders are enabled to drive real-time action, with workflows and data flowing through a single platform.

When the Environment solution is combined with structural monitoring, smart sensing of vibrations and linear displacements that occur on flyovers, on bridges due to vehicular movement, and in various weather conditions is enabled. This capability helps city authorities monitor and take suitable actions if the vibrations or linear displacements reach configurable threshold values, to avoid any major incidents.

Cisco Kinetic for Cities Safety and Security

The Cisco Kinetic for Cities Safety and Security solution helps enable:

- Real-time crime mapping by using charting and graphing tools
- Incident planning

Cisco Kinetic for Cities Waste Management

With the Cisco Kinetic for Cities Waste Management solution, cities can improve existing waste collection and bin monitoring systems by deploying sensors to collect bin fill level data. Typically, up to 60 percent of waste bins in cities either do not get collected on time or get collected at very low fill levels. Waste pickup can be optimized by knowing bin fill levels and when bins are likely to reach capacity, reducing operational expenditures. The Cisco Kinetic for Cities Waste Management solution accurately monitors bin fill levels and creates insightful reports that enable waste collection managers to dynamically manage the waste collection cycles.
Support
Cisco Kinetic for Cities solutions are fully enabled by Cisco Solution Support.

For more information about support, see Cisco’s Solution Support description for the cloud service: https://www.cisco.com/c/en/us/about/legal/service-descriptions.html.

- Cisco Technical Assistance Center (TAC) access is available 24 hours per day, 5 days per week by telephone, fax, email, or the Internet, to assist 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. Problems are managed according to the Cisco Severity and Escalation Guidelines.
- Access to Cisco.com: This system provides customers with helpful technical and general information on Cisco products. Notice that access restrictions identified by Cisco from time to time may apply.
- Workaround solutions or patches will be provided using reasonable commercial efforts. An advantage of the cloud-hosted deployment model is that any patches or maintenance releases and/or updates for digital platform users experiencing a problem in their subscriptions will be implemented automatically, with little or no action on the customers’ part.
- Minor and maintenance releases and updates. All paying customers will receive updates corresponding to the Cisco Kinetic for Cities package to which they subscribe. 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, for customers whose account is in good standing. 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 to have depreciated or to have low customer adoption. Applicable supporting documentation for the latest production version, if available, is on Cisco.com and is limited to the current production instance of the digital platform.

Why Cisco
Cisco Kinetic for Cities aggregates data across departments and connects sensors to applications throughout the city. This facilitates cross-domain use cases for a reactive, flexible city infrastructure. You benefit from:

- Reduced costs: Our offer limits initial expenses and helps you manage sustainable growth over time, helping you achieve what you’d like to accomplish in and for your city. This will help spur necessary city infrastructure evolution while avoiding costly upgrades and integration efforts in the future.
- Simplicity and effectiveness: Innumerable combinations of sensors, applications, devices, solutions, and public services can operate in and integrate within the platform framework. Implementations that suit unique visions, ever-changing goals, and restricted budgets have never been easier.
- Innovation and growth: Benefit from the wealth of your city data. Developers, businesses, and academics can become powerful partners to help you solve city challenges and evolve technology for unprecedented opportunities.
- A bright present and future: The standards-based open architecture allows for the integration of devices currently on the market, as well as those that will result from future innovation.
Cisco Capital financing

Smart cities offer great promise, but financing their development can be challenging. Success is realized by matching the right financial tool with each smart city project. The City Infrastructure Financing Acceleration Program (CIFAP) is an initiative that provides innovative financing options for cities and urban operators to drive the adoption of smart city technology. It enables city leaders to deploy cutting-edge solutions with minimal initial investment, while working with technology partners they can trust to support their most critical urban services.

In the case of revenue share financing, the program can also help to tie the cost of financing to the desired outcomes of that city’s smart infrastructure projects—from reducing energy usage and traffic to boosting public transportation ridership and revenues. Cities and investors then share the revenue streams or cost savings coming from the new services that develop from the new digital infrastructure, which is key to expanding future operating budgets and speeding returns on investment.

With financing, your investment can be viewed not as a cost, but as an opportunity to add operational value and receive these unique benefits:

- Conserve capital. Preserve cash, credit capacity, and/or budget.
- Total solution. Acquire Cisco and complementary third-party technology on one invoice.
- Flexible payments. Monthly, quarterly, or annual payments, deferred payments, or payment holidays, which are defined periods of time when you can temporarily stop making payments, to help you manage budget and cash flow.
- Pay as you use. Secure the technology you need to meet unanticipated demand spikes while paying only for what you actually use.
- Pay as you benefit. Pay only as you realize cost savings or incremental revenues.
- Technology lifecycle planning. Enjoy the benefits of flexible end-of-term options to return, purchase, or upgrade your technology.

For more information, see the following:

- City Infrastructure Financing Acceleration Program (CIFAP): https://cisco.com/go/cityfinancing
- Cisco Capital financing: https://www.cisco.com/web/ciscocapital/index.html