Technical Overview of the NearSky Smart City Platform

A SMART CITIES WHITE PAPER

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Introduction

NearSky is a smart city platform that simplifies the building of digital cities. It allows cities to deploy many sensors by leveraging their existing streetlight infrastructure without the expense and effort of building an additional network (fiber optics or Wi-Fi).

When introduced, NearSky was a first of its kind innovation that created a path forward for cities wanting to collect and use data to improve their city services and the quality of life for city residents. It provided a simple, highly flexible platform for cities that transformed the streetlight infrastructure into the eyes and ears of the city.

Today NearSky remains unique, collecting data at the edge of a city's IT network and solving some of the most difficult challenges that cities face as they undergo their digital transformation. The benefits of NearSky have already been proven in many real-world environments, causing a significant positive impact on the cities that already implemented NearSky.

This paper will review the technical architecture of the NearSky platform and outline the advantages it provides for cities that want to become more data-driven.

The Unique Value of the NearSky Platform for Smart Cities

Building a Digital, Data-Driven City

According to the Smart Cities Council, a smart city uses information and communications technology (ICT) to enhance its livability, workability, and sustainability. The reality for many cities is that many city services are delivered without the assistance of ICT and, therefore, are inefficient or ineffective and do not meet the expectations of their citizens. For example, many cities still send out crews to drive around to check the status of streetlights or catch basins, leading to higher costs and slow reaction times. Sensors and cameras can digitize the outdoor world and provide city leaders with the data and insights they need to make city services more responsive and efficient.

The challenge for city leaders is how to collect data and process it in an efficient way with limited fiscal budgets. This is why NearSky is more relevant than ever. It simplifies the deployment of sensors, cameras, and other devices, such as Wi-Fi access points, so cities can more easily build a digital, data-driven city.

Main Differences Between CIMCON's Smart City Platform and Others

NearSky holds a distinct place in the smart city technology stack between back-office-focused smart city platforms and individual sensors and cameras deployed at the edge.

Compared to many smart city platforms, NearSky offers unique capabilities at the edge for data collection and analysis. Many smart city platforms are focused on the back office and often act primarily as aggregators for city data. They do not reach effectively to the edge of the city to solve the data collection problem. NearSky is positioned at the edge of the city, however, to collect, aggregate, and analyze data from many different sensors and devices. A primary benefit of NearSky is that It makes it easier to deploy and maintain a diverse array of smart city technologies across the entire city. Plus, as an edge platform, NearSky is designed to perform in

non-optimal and changing conditions, including harsh weather conditions.

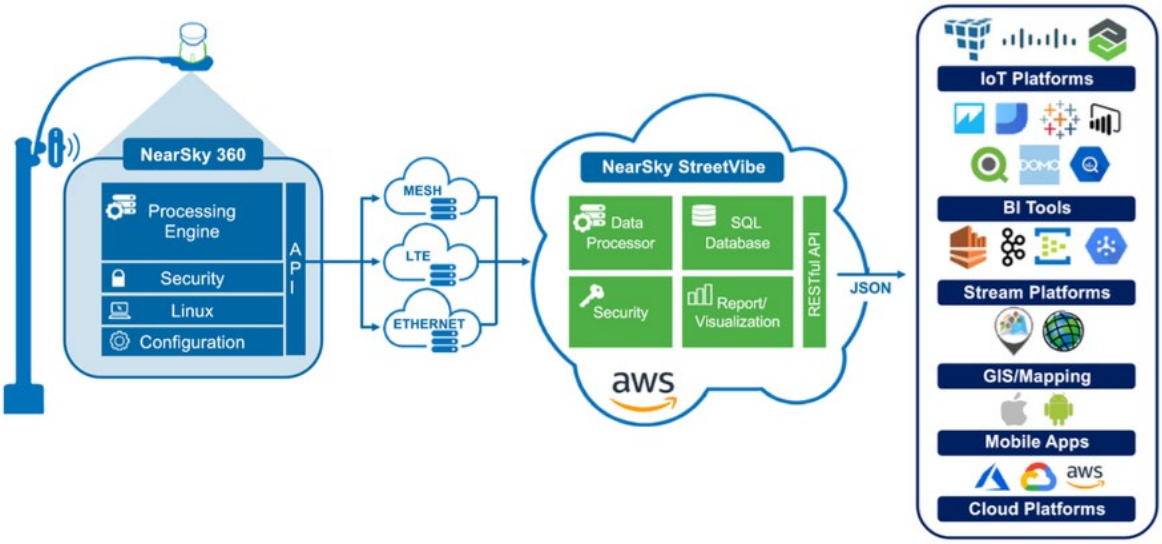
Compared to individual sensors and cameras deployed at the edge, NearSky offers substantial benefits that help cities scale their data collection and analysis efforts. Most individual smart city sensors and cameras can be costly to install and move. They are not designed for quick plug and play operation and, therefore, installations and moves require manual labor and can damage assets such as light poles or the sensors/devices themselves. Further, they do not offer data integration or analysis capability beyond their specific focus area. In contrast, NearSky is a general-purpose computing platform that simplifies the installation, maintenance, and movement of a city's entire collection of sensors and devices. NearSky also provides a comprehensive back end, with data storage capabilities, analysis tools, and APIs, that allow you to fully process the data that is collected across the city's network of sensors/devices, develop custom applications that use the data, or pass data to other back end systems that are part of the city's infrastructure.

In addition to providing exceptional benefits compared to back-office-focused smart city platforms and individual sensors/devices, NearSky stands out because of how it is deployed. NearSky simply plugs into any LED streetlight fixture, tapping into the electric power at the pole, providing power and standard connectors to sensors and devices and eliminating the need for custom wiring and resulting damage to the streetlight pole. By plugging into the streetlights, NearSky transforms a city's existing streetlight infrastructure into a robust internet of outdoor things (IoOT), making it easier and more cost effective to provide the smart city capabilities.

NearSky is also tightly integrated at the network and platform level with CIMCON's intelligent lighting technologies. Both use a standard socket to attach to LED light fixtures and to each other. That allows NearSky to tap into the power source at the pole and to the mesh-based network, or digital canopy that spans the city, formed by a collection of intelligent lighting controllers deployed on existing streetlights. This allows city leaders to deploy sensors and devices city-wide or at specific locations across the city and send data reliably back to NearSky's cloud-based management software using the mesh-based network and communications channel provided by the lighting controls. Together NearSky and the intelligent lighting technologies help a city or utility to monitor, meter, manage and monetize the streetlight and other assets affixed to or located near the streetlight pole. The smart city platform opens the door for cities to offer many next generation city services that can increase operational efficiency, reduce energy costs, improve environmental sustainability, enhance public safety and improve resident quality of life.

CIMCON's NearSky Platform Technical Overview

The NearSky platform is composed of the NearSky 360 edge data processor, the NearSky StreetVibe cloud-based management software, the NearSky Connect marketplace, and a software development kit.



1) **NearSky 360** – this edge data processing device is installed at the light pole and includes a 4-core processor, Linux operating system, and an API. Edge-based applications, such as video analytics for vehicle counting, can be installed and run on the device, allowing cities to minimize the data transferred and stored on the city's IT infrastructure. The device secures registration and application/service updates with cryptography, manages local user access with multi-factor authentication, and secures ports and protocols with an integrated firewall. The edge data processor can communicate data to StreetVibe using one of several communication paths, including an always-on low bandwidth (256 kbps) mesh network, optional high bandwidth data connections including an internal LTE modem and, 2 Power over Ethernet (PoE) ports.

2) **NearSky StreetVibe** – this cloud-based data management system allows cities to aggregate and analyze data from sensors and devices deployed across the city. The software uses industry-standard methods, including RESTful web services, and Message Queuing Telemetry Transport, or MQTT, to integrate with other software platforms and ensure scalable data distribution and availability. The software is robust and enterprise-class, providing end-to-end two-way supervision on communication links, local configuration storage, predictive analytics, content syndication, role- and attribute-based access control, active monitoring and alerting, and disaster recovery functions. Just as the NearSky 360 acts as an aggregator in the field to gather sensor data, NearSky StreetVibe acts as a disseminator of the sensor data to authorized consumers of the data.

3) **NearSky Connect Marketplace** – this collaborative partner network helps CIMCON, sensor/device manufacturers, and others to align their visions and product roadmaps and ultimately simplify the purchase, deployment and operations of smart city solutions. The marketplace is open to manufacturing and service partners from a broad array of functional areas including infrastructure and communications, energy sustainability, mobility, parking, traffic, public safety, cybersecurity, environmental/healthcare, engagement/community, economic development, systems integration, strategic funding, strategic consulting, and application development.

4) **Software Development Kit** – CIMCON offers a collection of development tools for accessing the data collected by NearSky and for developing applications that use the data.

Core Capabilities that Make NearSky Uniquely Suited For Smart City Applications

This section lists some of the most unique and important capabilities of the NearSky smart city platform.

Streetlight Installs Offer Street-level Resolution for Data Collection – NearSky can be deployed on any streetlight, giving cities the power to deploy sensors, cameras and devices city-wide or within a specific neighborhood or on a single street.

Controller and Network Agnostic

> NearSky can be deployed with a city's existing infrastructure, regardless of whether the infrastructure has lighting controllers and whether the lighting controllers are from CIMCON or another manufacturer.

> The NearSky platform has multiple ways, including an internal LTE modem, to send data back from the edge to the cloud-based management software.

> The combination of CIMCON lighting controllers and the NearSky platform is compatible with multiple networking protocols including Zigbee, Cisco IPv6 based 6LoWPAN, and cellular/narrowband-IoT (NB-IoT)/4G LTE.

> NearSky's StreetVibe software uses standards, such as RESTful web services, to integrate with numerous applications and platforms, including data integration platforms, smart city platforms (e.g., Cisco Kinetic for Cities), and IoT platforms.

Compatibility with Multiple Sensors

> The NearSky platform is compatible with a wide array of sensors and cameras. The NearSky 360 edge data processor has standard connectors for power, Ethernet, and analog/digital input, that simplify the installation and use of these devices.

> With multiple connectors, including power connectors for 2 power over Ethernet (PoE) devices, NearSky 360 allows cities to deploy multiple cameras and sensors on a single NearSky at a single light pole.

Power/Metering

> The NearSky 360 edge data processor taps into the power at the light pole and delivers AC (metered with 0.5% accuracy) and DC power to connected sensors and devices.

> The platform easily generates highly accurate reports of energy usage, showing electrical parameters such as current, voltage, frequency, power factor, kW and kWh of all the loads.

> Devices can be grouped into “virtual meters”.

Data Communication/Connectivity

> The NearSky platform offers multiple communication channels, such as RF Mesh, LTE, Wi-Fi, Ethernet, USB, and Bluetooth, for passing data from sensors and devices to the platform’s StreetVibe software. This allows for quick and secure sensor data transfer, storage, and syndication.

> The platform provides always-on data connections at low (RF mesh network, 256 kbps) and high (LTE/Ethernet/Wi-Fi) bandwidths.

> The communication channels that are part of NearSky are cost effective and eliminate the need for communications technologies to be embedded on sensors/ devices.

> Since NearSky leverages the existing streetlight infrastructure, it eliminates the need for expensive data plans for individual devices.

> With multiple communication channels available, communication paths for apps can be tailored based on the application needs.

Edge Computing Power

> The NearSky 360 edge data processor is a general-purpose computing device that includes a quad-core 1 GHz processor with 4 Gb of application memory. It provides processing capabilities at the edge, allowing applications, such as video processing, to move from the data center to the edge. This allows cities to use affordable IP cameras and reduce video data sent to the data center.

> NearSky shifts the processing power from specialized devices, such as cameras with embedded video analytics software, to the NearSky platform.

> The platform reduces the data needs of the network because the information is extracted from the video stream and sensor data at the edge.

Plug and Play Installs/Moves

> The platform's use of the 7-pin NEMA socket makes it exceptionally easy to install, remove and reinstall the NearSky platform and associated devices. This capability minimizes the labor that is required and simplifies the steps to integrate new sensors.

> Applications can be remotely installed on NearSky 360 devices, allowing cities to quickly develop and deploy new edge applications.

Analytics through a Single Console

> Data from sensors/devices across the city is aggregated in NearSky StreetVibe where it can be visualized and analyzed.

> Easily transfer data to your business intelligence tools for a deeper dive.

Asset Management and Life Cycle Management Capabilities

> Centralized management capabilities lower the cost of maintaining NearSky 360 processors and associated sensors and devices.

> Remote management capabilities including the ability to monitor system health status.

> NearSky 360 devices can be automatically registered and remotely configured and updates.

> Over-the-air updates allow cities to update NearSky 360 devices in the field with new system software and install or update applications running on NearSky 360 devices.

Data Syndication/Integration to Authorized 3rd Party Consumers

> APIs powered by RESTful web services allow the NearSky platform to integrate with other software applications and platforms used by the city.

> Data can be syndicated with other applications and platforms, including mobile applications that are used by system administrators or citizens.

Security

> Secure process for registering NearSky 360 devices.

> Secure, over-the-air application and service updates.

> Cryptographically hashed application and services packages to verify integrity.

> Integrated firewall to protect ports and protocols.

> Software control of external interfaces, including the NearSky 360's RJ45 Ethernet ports, USB port, and AC Out Auxiliary Power port.

> Secure cryptographic store for device certificates and keys.

> Applications are run in user-space with limited resource access.

> Multi-factor authentication for local user access.

Marketplace

> The NearSky Connect marketplace includes smart city technologies and services that are compatible with the platform and allows cities to accelerate the realization of smart city benefits.

Software Development Kit

> The software development kit allows cities to create mobile apps for citizens/users or applications that can be deployed on the NearSky edge data processors.

Business Outcomes

The NearSky smart city platform has been already implemented in the real world in cities such as Cape Coral, FL, North Andover, MA, Philadelphia, PA, and Kitchener, ON. Each of these cities has deployed one or more smart city solution with the platform, such as of the different applications listed in the table below.

Smart City Solution	Uses and Benefits
Air Quality	• Reliably monitor key pollutants at numerous points throughout your city • Actively monitor the pollution output from sources such as power plants, chemical plants, high-traffic zones, and more • Build healthier, safer communities
Pedestrian Analytics	• Improve walkability and pedestrian safety by using mobility data to inform decisions • Measure retail activity and use it to attract businesses and public funding • Measure the impact of economic or urban development projects • Understand mobility patterns at various points in the day and night • Create safer streets with zone intrusion or object left/ object taken applications
Traffic Analytics	• Create safer streets – Use traffic data to improve urban design and signage • Reduce vehicle congestion and improve traffic flow by using traffic data to optimize signal timing and traffic patterns • Fuel savings • Identify the causes of congestion, traffic patterns, turn movement, speed data • Reduce greenhouse gas emissions • Attract external investment – Present reliable and compelling data to attract businesses, public funding
Public Safety	• Use video analytics to detect zone intrusion or object left/ object taken applications • Improve the success of investigations and prosecutions • Improve the productivity of law enforcement and investigation teams by quickly identifying risks such as left packages and idling vehicles
Wi-Fi Access Points	• Accelerate the deployment of Wi-Fi access points with readily available metered power and connectivity options for Wi-Fi • Bridge the digital divide and empower citizens and business with reliable access to the internet • Enable IoT-based city services
Road Condition Monitoring	• Minimize the environmental impact of road maintenance chemicals • Reduce truck rolls and the chemical costs associated with road maintenance • Improve road safety by responding quickly to changing road conditions • Help citizens avoid hazardous roads • Make driving routes more efficient, shorten commutes • Improve routing

Smart City Solution	Uses and Benefits
Gunshot Detection/ Sound Analytics	• Reduce the response time of police and emergency responders • Detect crime-related noises such as gunshots, car alarms, glass breaking and aggressive behavior from people • Reduce instances of physical aggression by detecting and responding to increasing levels of fear and anger • Better prepare first responders
Flood/Water Level Sensors	• Quickly identify and respond to flooded areas and catch basins • Save lives and reduce disaster management costs with accurate advanced warnings of water level anomalies • Automate flood level assessment, freeing personnel to attend to residents in need

Next Steps

To begin to deploy smart city solutions, cities can take advantage of the StreetVantage Smart City Pilot Program. It provides everything a city needs to quickly evaluate the benefits of intelligent lighting and smart city applications.

The StreetVantage Smart City Pilot is designed to help cities deploy smart city solutions and get results within 90 days. Each pilot includes:

> Lighting controllers, an air quality sensor, and a camera that are pre-configured for easy installation

> Video analytics software for either the pedestrian or traffic analytics software

> A dedicated Customer Success representative to help you for the first 90 days of your pilot

> A series of pre-built reports to help you analyze the results of your trial

For additional information or to start your own pilot, please complete and submit the inquiry form on **https://www.cimconlighting.com/streetvantage-smart-city-pilot-program.**

To learn more about smart cities, download CIMCON's "Today's Cities – Getting to Smart" from www.cimconlighting.com

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