SIDE WALK LABS

US DOT Smart City Challenge MoU for Flow & Kiosk

The Flow Platform (including Analytics) and its first applications (Parking and Transit) will be offered free-of-charge during the demo period, with the goal of partnering to find a sustainable, outcome driven funding models after the demo ends. 100 Kiosk units will also be given to the city.

During the demo period, the City will be responsible for a) any fixed integration costs spent on City specific infrastructure or upgrades, b) clearing policy hurdles in order to make implementations possible, and c) the co-development of outcome-driven revenue models that support continued deployment post-demo.

Sidewalk and the City's Responsibilities

Flow Data Platform and Analytics:
- **Sidewalk** will provide a public-private data exchange for transportation data as described below, including analytics capabilities, ability to store city data on the platform, and to share data with third-parties via open APIs.
- Use of the data exchange will be governed by the description of the data platform as described below; Sidewalk and the City will work to draft a set of mutually agreeable privacy principles that covers any PII information collected.

Flow Parking:
- Parking availability, booking and demand management tools in a single platform
  - **Sidewalk** will provide a single parking platform for parking available and payments available via API to third-parties (like Apple or Google Maps), in order for potential drivers to understand available parking options in real-time
  - **Sidewalk** will provide a web-based dashboard for the city to understand its parking supply and demand, and to help set appropriate policy for the curb
  - **Sidewalk** will work to onboard local private suppliers of parking inventory into the platform
  - **Sidewalk** will provide occupancy information (primarily at metered areas) based on its data sources combined with city data sources
  - **Sidewalk** will provide basic data about parking regulations, approximately once per year (aiming for 80% coverage)

- ○ The **city** is asked to fund city workers to correct and label misunderstood or missed regulations to achieve higher accuracy for the city and users of Flow Parking data
  - ○ Requires **city** to ensure that payment status from its meters/pay-by-mobile provider can be sent in realtime to Flow, as well as occupancy data from municipally owned garages.
  - ○ Requires **city** to provide compatibility with existing payment functionality or allow Sidewalk to provide payment functionality via its API for on-street or off-street spaces
  - ○ Requires **city** to enable policy to trial demand-based pricing for on-street and off-street municipally owned parking
- ● Dynamic Enforcement
  - ○ **Sidewalk** will provide the software for recommended enforcement routes, and ticket giving/payment receiving software
  - ○ Requires **city** to provide necessary hardware to run Flow Dynamic Enforcement
  - ○ Requires the **city** to ask parking enforcement officers attend training on how to use new equipment
  - ○ Requires the **city** to participate in any necessary integration with existing enforcement
- ● Virtual Parking lots:
  - ○ **Sidewalk** will provide the software to understand supply and demand of parking supply, and set appropriate parking minimum opt-out rates
  - ○ **Sidewalk** will work to trial this model with local businesses
  - ○ The **city** is required to help establish policies that allow minimum parking requirements to be reduced depending on developer/business buy-in to transit fund

Flow Transit:
- ● Transit analysis
  - ○ **Sidewalk** will provide the software and demand-side data required to understand overall transit demand, and the operating performance of existing and emerging shared mobility modes.
  - ○ Requires **city** to provide ridership and/or the permission for Sidewalk to deploy and collect ridership tracking processes for existing fixed-route transit services.
  - ○ Requires financials for operating expenses for existing fixed-route services at route level.
  - ○ Requires **city** to provide ridership data and financials for operating expenses for existing demand response services.
- ● Targeted Subsidies / Account-based payments system
  - ○ **Sidewalk** will provide an account-based system for delivery of end-user subsidies for fixed route transit and emerging shared mobility modes. Sidewalk will develop web-based user interface for on-boarding users and creating accounts.

Subsidies will be distributed through mobile payments integration and the issuance of single purpose Visa/MasterCard payment instruments.
- ○ Requires **city** to distribute subsidy dollars through Sidewalk provided payments platform.
- ○ Requires **city and public and private transit providers** to ensure that mobile and/or Visa/MasterCard payment instruments are interoperable with existing provider payment systems (e.g. ticket vending for fixed route, in-app payments for shared mobility providers).
- ● Mobile fare payments for transit / Account-based payments system
  - ○ **Sidewalk** will provide integration account-based payments integration with mobile wallets in support of transit fare collection.
  - ○ Requires **city** to ensure acceptance of mobile payments on existing fixed route transit services and orientation of transit fare model to support mobile ticketing models.
- ● Shared-mobility marketplace
  - ○ **Sidewalk** will provide public APIs for surfacing shared mobility modes in existing end-user interfaces (e.g. Google Maps).
  - ○ Requires **public and private transit providers** to participate in marketplace and support booking handoff (via provider app/ticketing mechanism or via third-party booking integration where feasible).

Kiosk
- ● **Sidewalk** will provide 100 Kiosk units without ads to the city. If the city chooses to use Kiosk with ads, Sidewalk will finance the upgrade to a Kiosk with ads.
- ● The city is responsible for any installation costs associated with the Kiosk, including labor and connection to fiber, power, etc., as laid out below and in the attached spreadsheet.

Product Details

Sidewalk Labs' Flow is an open, extensible transportation data platform and set of applications (including Parking, and Transit) that help cities innovate across policy and service delivery to achieve key equity, access and environmental outcomes.

To do this, Flow brings together a Data platform and exchange combining public and private data (like Google Maps and Kiosk), Analytics enabling third-party developers and researchers to create new applications and new ways to communicate directly with travelers.

Flow Parking

Flow Parking uses new techniques that provide high quality parking information without expensive hardware, helping cities set policy and helping potential drivers make more efficient travel decisions. Flow Parking helps decrease the congestion, emissions and distracted driving that results from circling for parking. It encourages transit use, while easing parking when needed.

Sidewalk will provide Flow Parking to the winning city during the DOT demo period. Cities are responsible for paying for system integration (on-street, off-street, citation management) during the demo period. Sidewalk will work with the city to identify a sustainable business model after the demo.

Flow Parking offers:

Automated inventory and regulation collection, making it easier to understand existing policy and supply.

Reliable occupancy estimates without expensive per space sensors in order to understand demand.

Simple, powerful dashboard for the city to understand supply and demand of parking, and manage all curbspace & inventory holistically.

**Communication with drivers** through navigation apps by encouraging transit, and

Demand-responsive management tools such as variable rates and time limits are suggested based on occupancy results.

Virtualized parking inventory that incorporates private and public spaces into one pool for the user.

Optimized enforcement that deploys personnel where most needed.

Bike/car share placement recommendations to maximize your curb space.

sending drivers directly to a parking space.
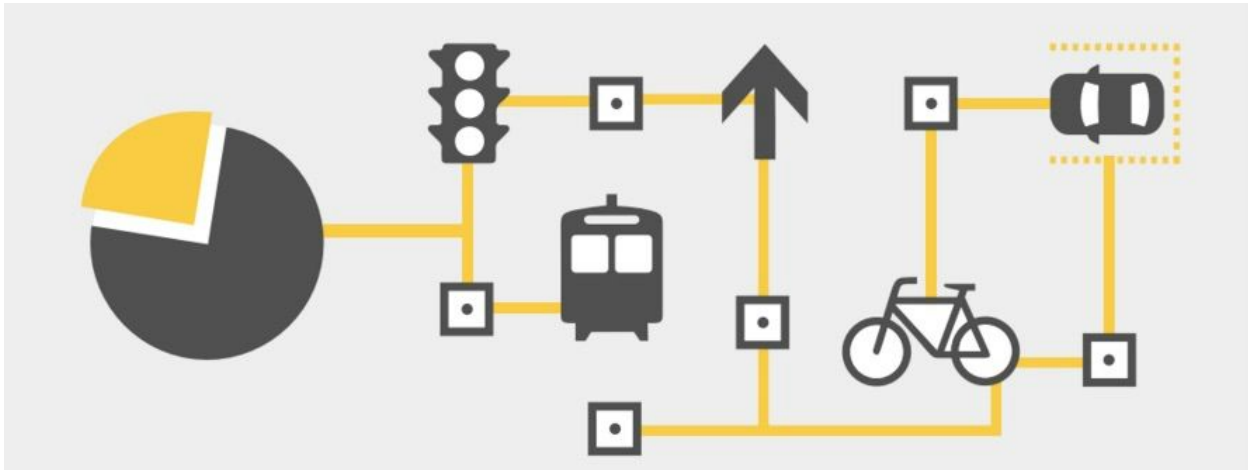
Better data for cities

Automated inventory and regulation data
Gone are the days when cities' only record of their curbs exist in paper drawings - if they exist at all. Flow Parking will provide a low-cost, yearly update of curbside regulations and parking spaces. Flow Parking's inventory module will be fed by Google's image data and machine learning techniques that can read signs and count parking spaces, automatically. Users will be able to view Flow Parking's generated results and manually update the inventory on a map-based interface.

On-Street occupancy
Flow Parking provides an estimate of on-street parking occupancy and usage. By combining parking meter transaction data from cities and proprietary data from anonymized drivers via Google, Flow provides the most accurate no-sensor occupancy estimates. View historical, current and projected on-street parking demand with recommended levers to spread parking demand across all available assets, and prepare for special events.

Off-Street inventory and occupancy combined in a single platform for drivers
Flow Parking will provide an estimate of off-street occupancy and usage by incorporating data from existing Parking Access Revenue Control Systems (PARCS). Flow Parking will also bring on privately-run public garages and lots, in a common platform for drivers to reserve and pay for parking at any facility in its network.

Virtualized parking inventory
Flow Parking will bring together municipal, public and as well as facilities usually reserved for employees or shoppers, to make use of all available parking spaces. Increases parking supply

without expensive new structures or lots, enabling local businesses to build fewer parking spaces. This module will be your public relations winner.

Optimized parking enforcement

Flow Parking will provide recommended enforcement routes so that personnel are deployed where needed the most. Updated at intervals defined by cities, dynamic routes will be based on algorithms comparing occupancy and meter transaction data, as well as integration with cities' citation management system.

…leads to better communication and policy management

Demand-management (rates and regulations)

Based on best practices from cities with demand-responsive parking programs, Flow Parking will assess the current on-street and off-street occupancy and usage and recommend changes to rates and regulations to shift demand where parking is available, or encourage faster turnover. The demand-responsive engine can even make predictions ahead of a sporting event or festival, or dynamically price in real-time in response to surging demand.
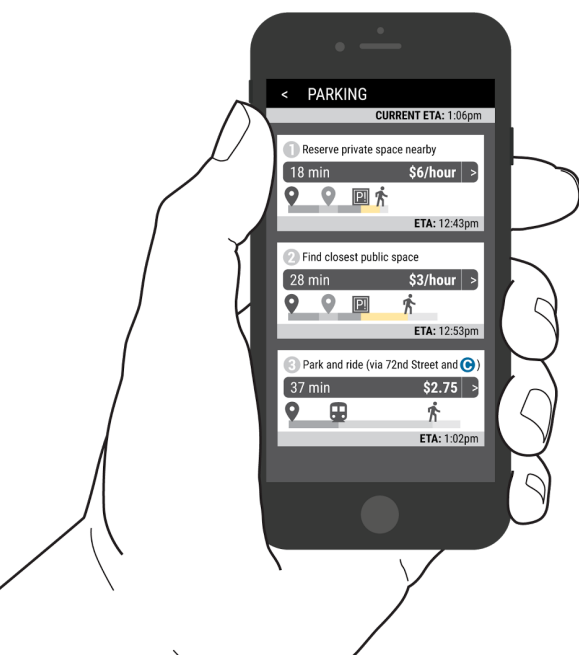
Demand-management (change in driver behavior)

With its navigation partners, Flow will push parking information in standard formats to drivers, including likelihood of finding a parking space, rates, time limits, distance from destination, average parking search time and difficulty. With this information before the trip, travelers may opt to take a different mode. During the trip, drivers will be directed to available parking spaces that suit their preferences, instead of circling for a space while adding to congestion and distracted driving. Drivers will receive the best information to make the best decision.

Flow Transit

Flow Transit helps cities use private sector innovation in shared mobility to expand the reach of public transit - enabling more citizens to get to work, school or other activities without the high costs of car ownership. Flow does this by providing a framework to implement hybrid public / private transit operating models, enabling fare collection across providers while measuring and driving improvements in equity and cost-effectiveness using real-world data and tools.

Sidewalk will provide Flow Transit modules for fare collection, shared multimodal clearinghouse and multimodal subsidies for free during the demo period.

Flow Transit includes:

Transit analytics platform, understand the economic and transport performance of current / emerging transit operating models.

Modern fare collection system, improves user experience and allows flexibility to develop new payment and subsidies models tailored to specific users.

Means-tested multimodal subsidies, improve transport equity via account-based model to distribute transit subsidies across operators.

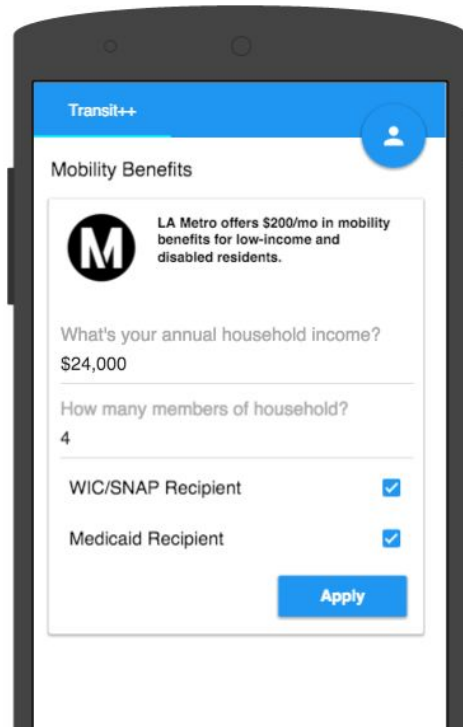**Improved coverage and operating cost** by leveraging the best mode for each trip, with seamless integration of public and private service providers.

Shared mobility clearinghouse, create a competitive and dynamic marketplace for emerging transport modes, while ensuring equity and performance goals are met.

Understand system-level performance across modes and operator boundaries
Leverage existing fare collection data sets in combination with Flow Transit's understanding of transportation demand. Know who's being served by transit and target new services based on real-world data, and measure performance without needing to do rider surveys.


Integrate transit with emerging shared mobility options
Encourage ride-sharing and the combination of public and private mobility services. Leverage existing end-user interfaces like Google Maps, along with integrated fare payment systems to encourage travelers to take advantage of all available services.

Prototype and deploy new subsidy models
Flow Transit provides a framework for developing more responsive systems for delivering transport subsidies. Use means-tested accounts to deliver public funds to user most in need, while ensuring they have access to the widest range of service providers. Use Flow Transit's analysis platform to measure the coverage and affordability of different transit operating models.
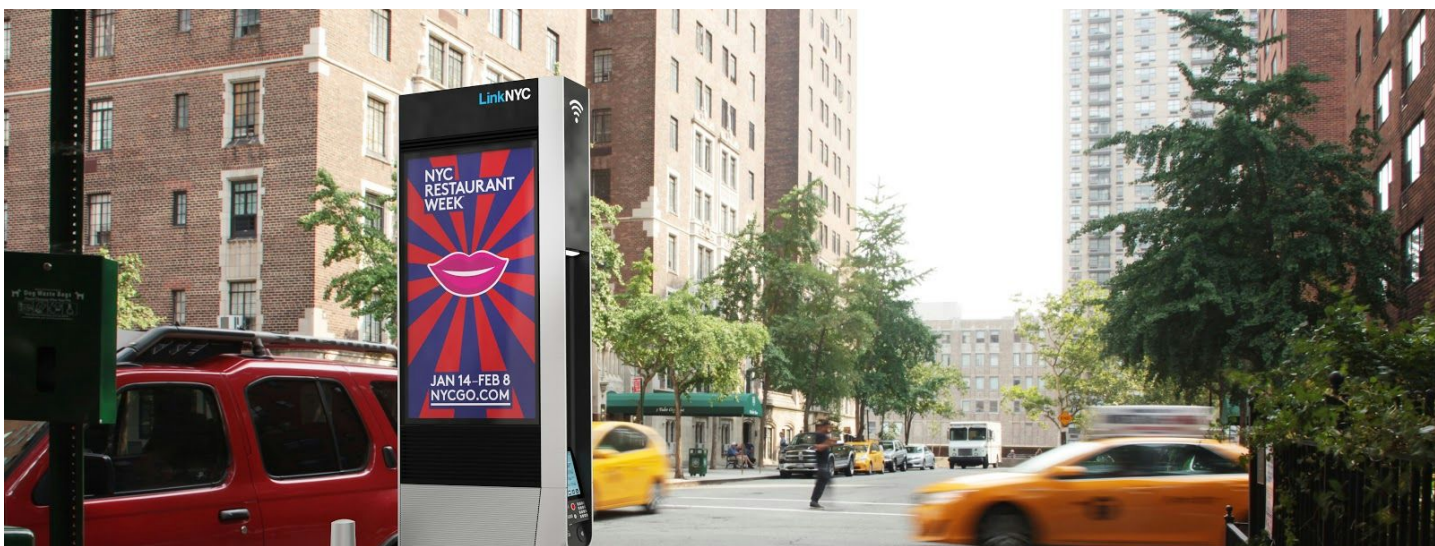
Kiosk

Sidewalk will fund the hardware and configuration for up to 100 Kiosks in 4 city zones in the winning city. City will fund Gigabit connectivity, permitting, installation and power hookup, as well as ongoing maintenance of Kiosk units. City can upgrade to advertising Kiosks, earning a revenue share.

Each Kiosk includes:

Ultra-fast WiFi. Gigabit for next-generation data needs.

Advanced public communications. For advertising, public safety messages and more. Each screen is fully addressable from a central location.

Phone and video calling. All free of charge to users; connect citizens to existing phone-based resources and enable next-generation video communications.

Local search, wayfinding, and listings. Connect citizens to public amenities and local businesses.

Data analytics. Better understand the urban environment via environmental sensors and

Emergency and civic services. Access to 911 and 311, existing Android- and web-based resources.

Groundbreaking design. Will blend into any city landscape; designed to be accessible for those with physical limitations.

Rapid phone charging. Providing Quick Charge capability for rapid charging of compatible personal devices and standard USB charging for all other devices.

A range of business model options. Including sponsorship (of features or as a whole), digital advertising sales, small cells and other ancillary services, and other revenue sources.

machine learning algorithms that integrate numerous data sources.

Upgrade opportunities. Including small cells, advertising and IoT. Flexibility in deployment requirements and potential for evolution as city digital services expand.

Kiosk Sensor Platform

Benefits

The Kiosk sensor platform will help address complex issues where real-time ground truth is needed: understanding and measuring traffic congestion, identifying dangerous situations like gas leaks, monitoring air quality, and identifying quality of life issues like idling trucks or aircraft noise.

In addition, we believe making aggregated views of this data public will contribute to the expanding startup community developing innovative products for shared public spaces.

Sensors

Working with academic and research institutions including the US Department of Energy's Argonne National Laboratory, we are testing a number of sensors and will evolve our approach as we determine the effectiveness of each sensor.

Environmental
- Temperature
- Relative humidity
- Atmospheric pressure
- Temperature of sidewalk/street

Air Pollutants
- Density of particulate matter
- Ethanol
- Nitrogen dioxide
- Ozone
- Hydrogen sulphide
- Total oxidizing gases
- Carbon monoxide
- Sulfur dioxide

Natural and Manmade Behavior
- Acceleration/vibration
- Magnetic fields
- Visible light
- Infrared light
- UV light
- Sound pressure

City Activity
- Anonymized wireless device sightings (similar to NYC's *Midtown in Motion*): Average roadway speed, travel times
- Video sensor: Pedestrian, bike and car traffic; Abandoned packages or objects; Clogged basins/on-street standing water

Data Privacy Policy

Aggregate, anonymized data will be made available to the city, academic researchers and the general public. No raw or personally identifiable data will be sold or shared with any third party for their own use.

All data is anonymized; any personally identifiable data is encrypted and routinely deleted after being aggregated and anonymized. We have designed a user-first experience that protects PII of Wi-Fi users as well as people who use our integrated public tablet. Sensor data is environmental in nature and we will never collect or use PII gathered through our sensor platform.

Analytics

Flow Analytics supports new approaches for planning and managing transport systems by leveraging data on real-time roadway conditions and transportation demand. It provides tools for roadway operation, transport impact assessments, and long-range transportation planning**.**

The winning city will be provided with analytics associated with provisioned products (Parking / Transit) during the demo period. Sidewalk will work with the city to identify uses for other analytics and appropriate business models.

Flow Analytics includes:

Real-time and historical access to origin-destination data, populate existing travel models with more complete and up to date travel data.

Empirical understanding of demand and its impact on infrastructure, move beyond modeling by measuring real-world travel flows and the demand placed on specific roadway and transit infrastructure.

Measure and predict impact of infrastructure changes, from improved **traffic light timing** to new **HOV and BRT lanes** using real-world data on both travel times and mode split.

Understand interplay between land use and transport - historical data on travel demand associated with specific buildings enables better informed prediction

Develop targeted travel demand management strategy - knowing the exact sources of demand that contribute to congestion open up new opportunities for

demand-side incentives and mitigation strategies.

Data Platform

The Data Platform provides a shared public / private broker for data providers to store information about a city and its resources in a consistent, open, and accessible way.

Making city data less fragmented and more uniform will enable the city to spend less time building technical glue across different data systems and more time building services. It can also magnify a city's impact by enabling the private sector to innovate more freely alongside city services.

During the demo period, the data platform includes free storage for Kiosk (subject to expiration of video data and ongoing aggregation) and data exchange with one party - starting with Google. The data platform includes:

Cloud-hosted, replicated storage makes the data platform reliable and accessible, regardless of local weather events.

Common, well-documented interfaces make integration easier for cities and data providers.

Geographically-aware storage that makes it easy for cities to map resources in real-time.

Flexible access controls for the city makes data sharing with researchers, city services, and third-parties simpler and more secure.

Privacy-focused data annotations allow cities to keep PII restricted to only city services or researchers who have been

Extensible, open data schemas for common data types ensure data uniformity that city services and third-parties can rely on.

Publish/subscribe infrastructure for informing authorized services about changes (e.g., traffic light outages) in real-time.

granted access.

Status dashboard to know quickly whether the data platform and related services are up and running.

Data platform overview

The data platform acts as a broker between public and private datasets, helping to keep them interoperable and manageable as apps and services build new experiences on top.


Example data platform components for a strongly connected city

<u>Data providers</u> are able to store data relevant to a city's day to day activities or operations. Some data providers may store raw / unstructured data (e.g., sensor data) which can be used by other services for machine learning or derivative work, while other data providers may choose to only provide higher-level structured data directly relevant to city systems.

Applications and services, whether offered by the city or by third-party vendors, can access data in the platform using common, well-documented REST APIs, allowing both municipalities and private companies to provide services across multiple markets without new engineering investment for each market. This gives private actors greater incentive and lower barriers to entry to build services for cities, and enables regional and state governments to provide more useful cross-region services.

Real-time data processing
In a connected city, the data platform would a variety of data from different sources. Noisy basic data sources like sensors can be combined to provide the basis for more complex data, such as street congestion, based on third-party, city, or research-based data pipelines.
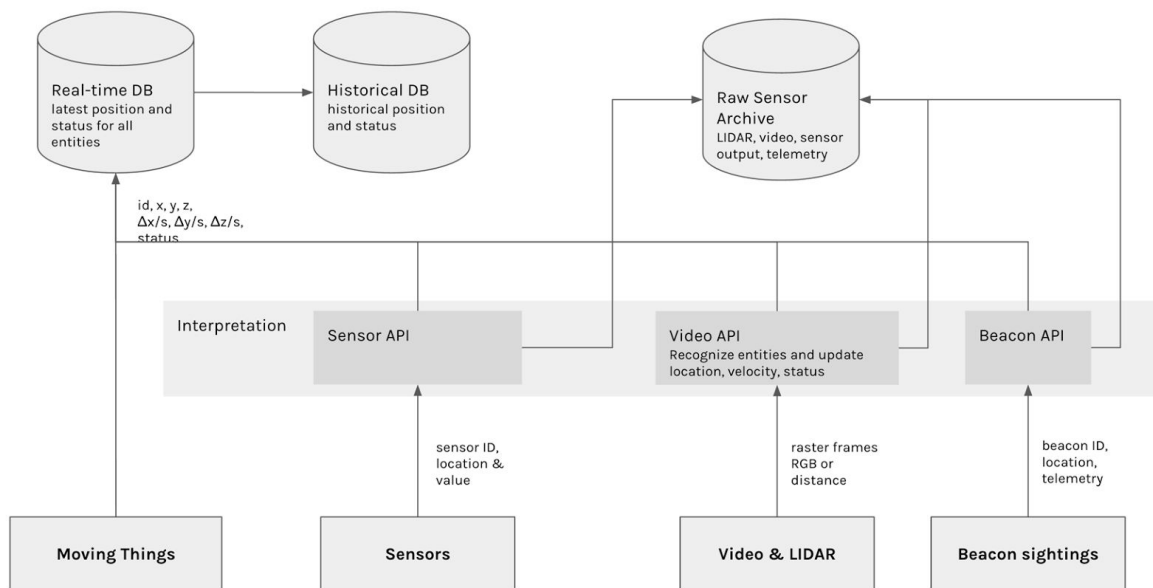
Data storage and processing for real-time geospatial data

Across both noisy and processed data sources, several types of city data have real-time uses and implications - e.g., traffic accident detection, transit car locations, or parking availability.

The data platform supports real-time pub/sub infrastructure as well as time-series data storage, to allow for both real-time tracking of assets and incidents as well as historical data analysis.

Extensibility
Data comes in many shapes and sizes, and part of the purpose of the data platform is to help make the data stored in it consistent - the same city bus tracked across several services and systems is still just one bus.

But often there are reasons to add new information to common city resources (a pilot program to add environmental sensors to buses, for instance). Rather than be locked into a rigid schema, or build new data silos to store additional metadata, cities can just extend the data platform's model. Extensible data models make it easy to try new ideas without significant reinvestment in new systems.

Gray Line Bus	Gray Line Bus
Standard bus schema	*Extended bus schema*

Entirely new data types without a standard schema can also be added to the data platform, for instance if cities provide novel transportation systems or use third-party services to handle uncommon city resources.

Data ownership
A critical component to expanding the amount of data available for city services is the ability to store public and private data about cities in a consistent, secure way. The data platform provides infrastructure to facilitate this kind of storage and access without raising the same concerns of loss of control that existing data warehouses do.

Importantly, use of the data platform doesn't change the ownership of the underlying data - a data provider may store data that it owns in the platform and grant access (with or without licensing or other agreements) with the city, or with city services.

The city might store data in the data platform and make it openly available, or restrict access to particular services or researchers, or to only its own services.

In any case, the data owner always remains in control of it's data.

Access control
The data platform supports granular access controls for all stored data. It can enforce restrictions on data to specific users, services and applications, or based on tiers who have access to particular data.

This is enforced using a combination of the data platform user management system, concentric access roles, and OAuth2 authentication for external apps and services.

Availability and test infrastructure

The data platform will target 99.9% uptime during the initial pilot program, after which uptime targets will be raised.

The data platform and other Flow and Kiosk services can be monitored via a status dashboard, which will indicate when there are known issues. This can help to greatly reduce the investigation time needed for issues relating to city services.

Lastly, the data platform provides a public staging environment which city service developers and third-party services can run regular integration tests against. This can help services and providers to identify integration problems before they reach production and real users.

Infrastructure and ownership

The data platform has the potential to handle personally-identifiable information from a variety of city and private data sources. We will establish a framework that categorizes identified people and objects related to stored data, and maps them to public and private spaces. This framework will be used to guide the collection and management of data as either default open, available for limited access, or default closed.

For example, data-management policies might correspond to several types of sensors or controls as cities become more connected:

- Public I/O: data collected in public spaces or on district-operated infrastructure. Such data will receive the most permissive use for the proper operation and improvement of services.
- Mandated I/O: data, such as that from fire safety systems, that the city might collect in private spaces. The data platform might minimize data retention from these sources and provide it only to the city or relevant entities by default.
- Private I/O: data collected in private spaces, by privately owned devices, or from privately held data stores. Individuals should have reasonable control over when such data is shared and how it is used.

Security

All data is always encrypted in the data platform - data is encrypted when at rest on-disk, it's encrypted when in-flight between data platform components or apps and services.

To the best of its ability, the data platform will attempt to annotate data likely to contain PII. Cities can grant access to data likely to include PII, but must always explicitly acknowledge the risks of this access grant before proceeding. Extra safeguards are taken by the platform to ensure PII data does not make its way into long-term logging or system information.

Any time data is accessed in the data platform, the accessing application or service must present credentials, pass authentication and authorization checks, and be noted in an audit log entry before being provided with access. This helps improve transparency and any future incident investigations.

Flow Analytics and other services from Sidewalk never expose individual or user-identifiable data about end-users to operators.