

(d) 2. INTERNET of THINGS (IoT) STRATEGY UPDATE

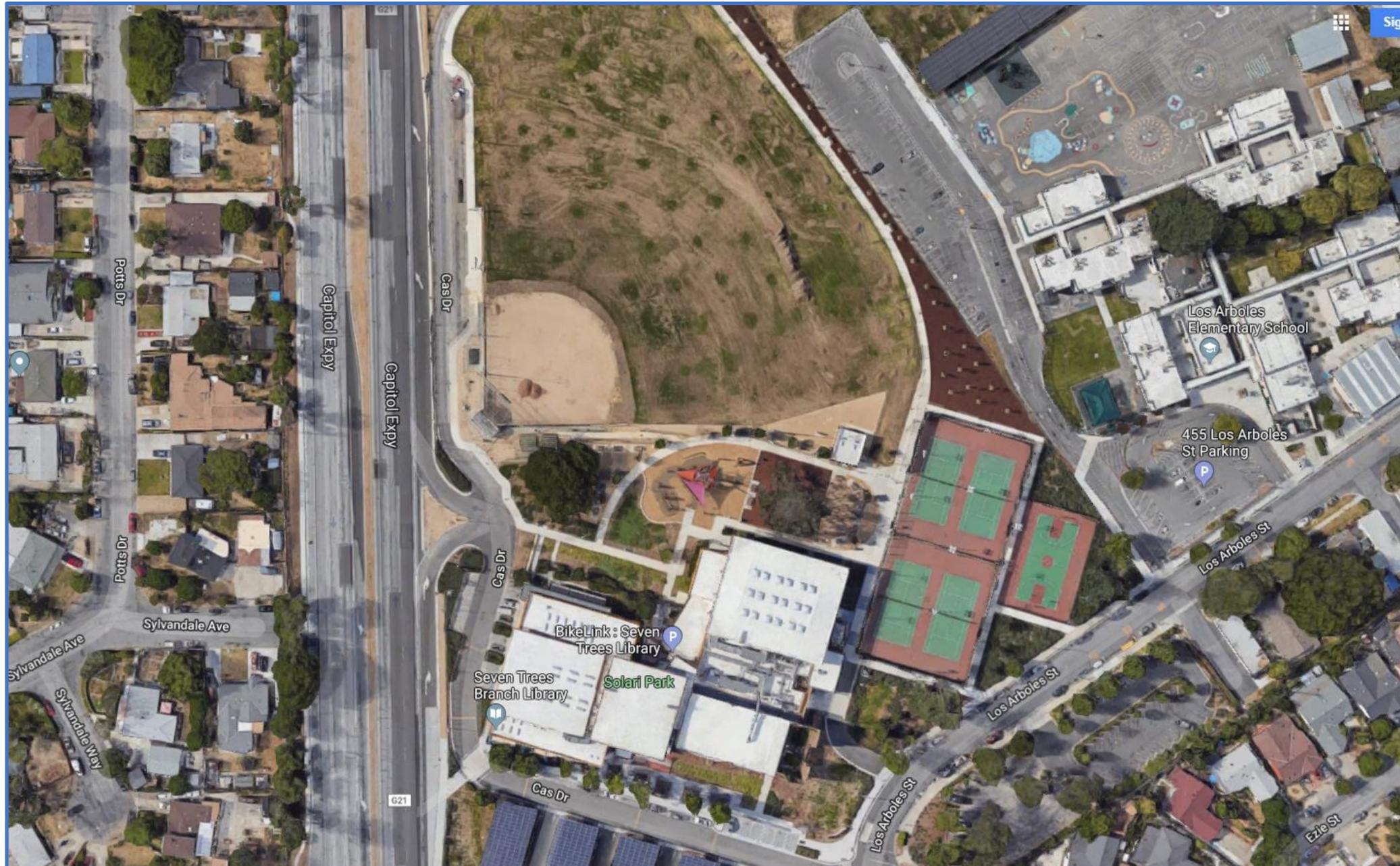
Dolan Beckel, Civic Innovation
Keshav Gupta, Civic Innovation

Smart Cities and Services Improvements Committee
May 2nd, 2019

AGENDA

- San Jose IoT Journey
- Recap of IoT Strategy
- Perspectives on IoT Platforms
- IoT Reference Architecture Update
- Smart City Public Private Partnerships: Pilot Projects
- Project Spotlight: Smart Controllers & Community Wi-Fi in Parks
- Perspectives on Smart Controller Based IoT Solutions

JUST LIKE SEVEN TREES PARK & COMMUNITY CENTER, IoT SHOULD BE PEOPLE CENTERED



SAN JOSE MODEL FOR BUILDING AN IoT SOLUTIONS ECOSYSTEM

Vendor Led

City/ People Driven

Opportunistic

Characterized by taking a singular use case that a city needs to address immediately

- + Short implementation
- + Demonstrable benefits
- + High visibility for stakeholders
- Low potential for replication
- Scalability and integrations

Experimental

Being a city thriving on experimentation and gaining hands-on experience

- + Resident engagement
- + Start-up experience
- + High visibility for stakeholders
- Operational efficiencies from scalability
- Long term deployment potential



Intentional

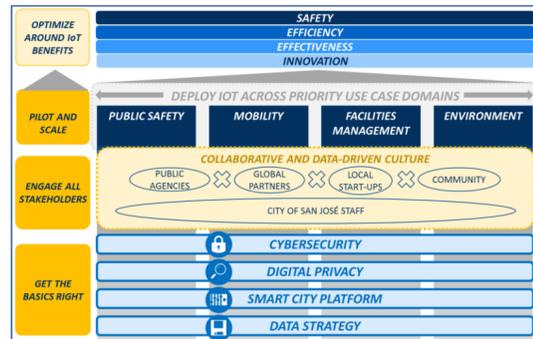
Take deliberate steps towards a people and platform centric & a smart city foundation building approach

- + People centered
- + Planned for scaling
- + Data integration/ Open API for development
- + Capability prioritization
- + Incremental ROI
- Challenging for program scope management

SAN JOSE IoT JOURNEY

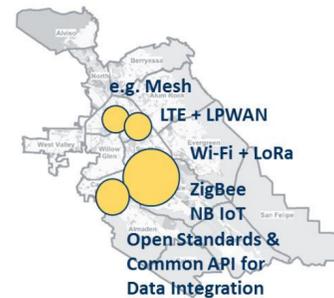
COMPLETED

Strategy to Guide



IN-PROGRESS

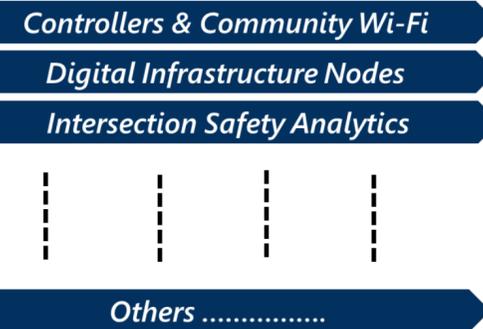
Architecture for Standards



Privacy Policy & Cybersecurity



Pilot Use Cases to Iterate and Learn

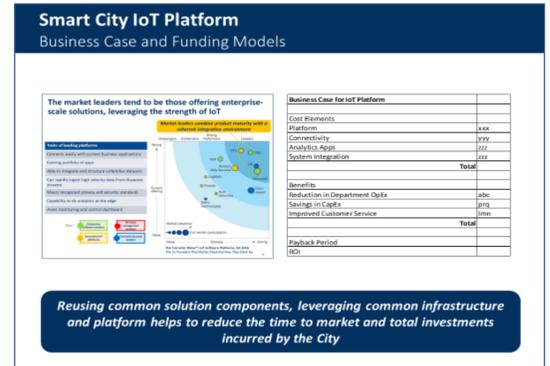


Backlog of Additional Pilots/ Demo Projects

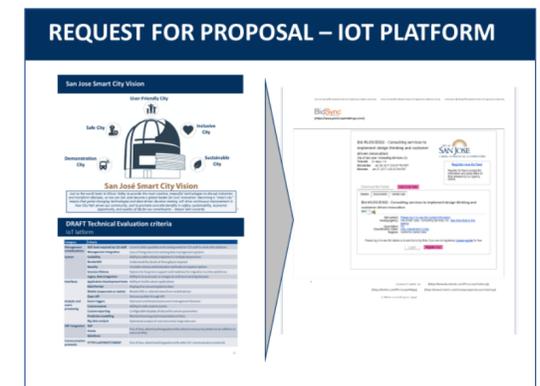


FUTURE

IoT Policy and Investment Model



RFP for IoT Platform Procurement



IoT STRATEGY DEVELOPMENT

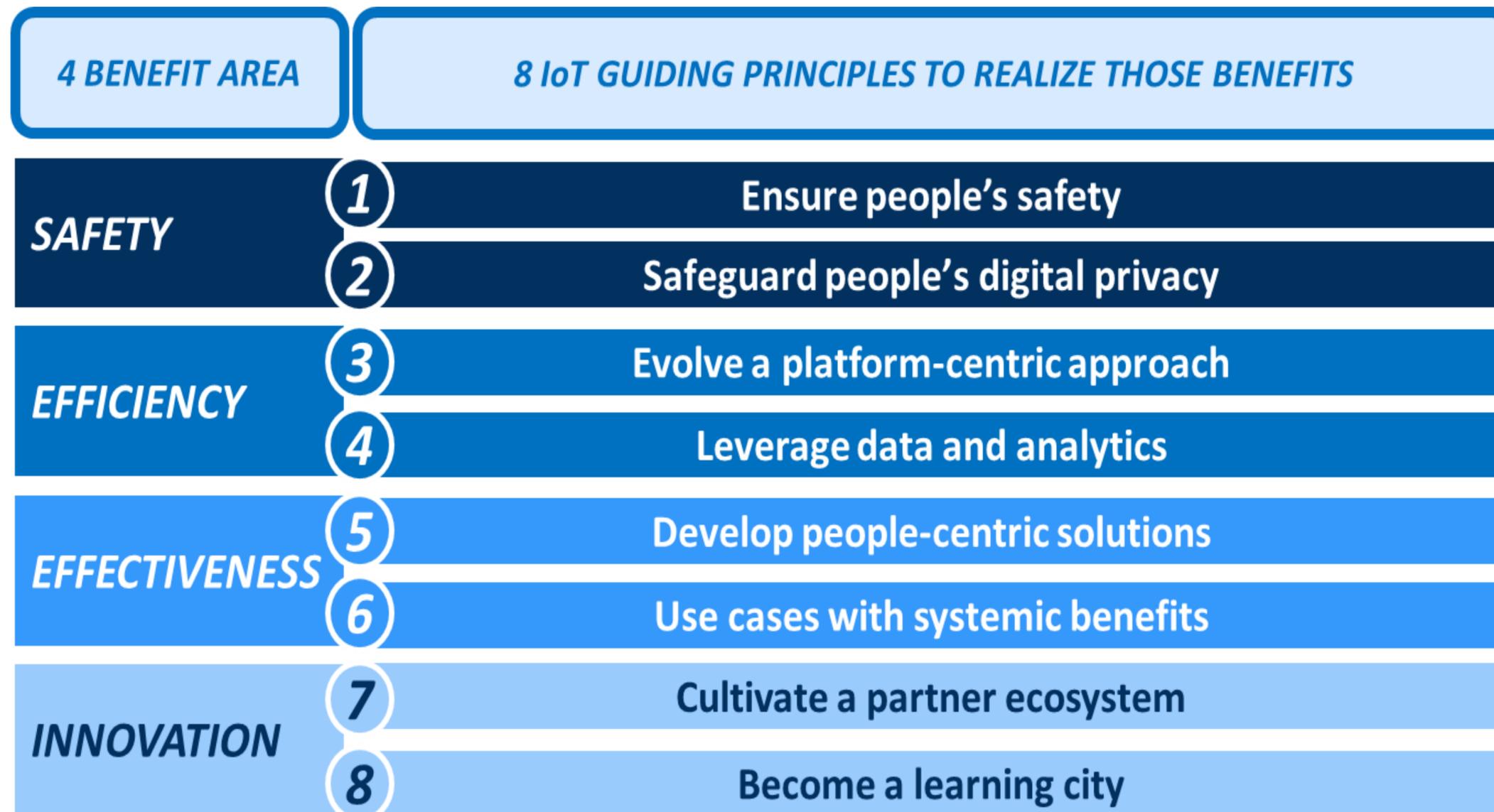


**KNIGHT
FOUNDATION**

- The City developed its first ever IoT Strategy in 2018, working closely with PricewaterhouseCoopers as its consulting partner
- This work was funded through a \$200,000 Knight Foundation Grant

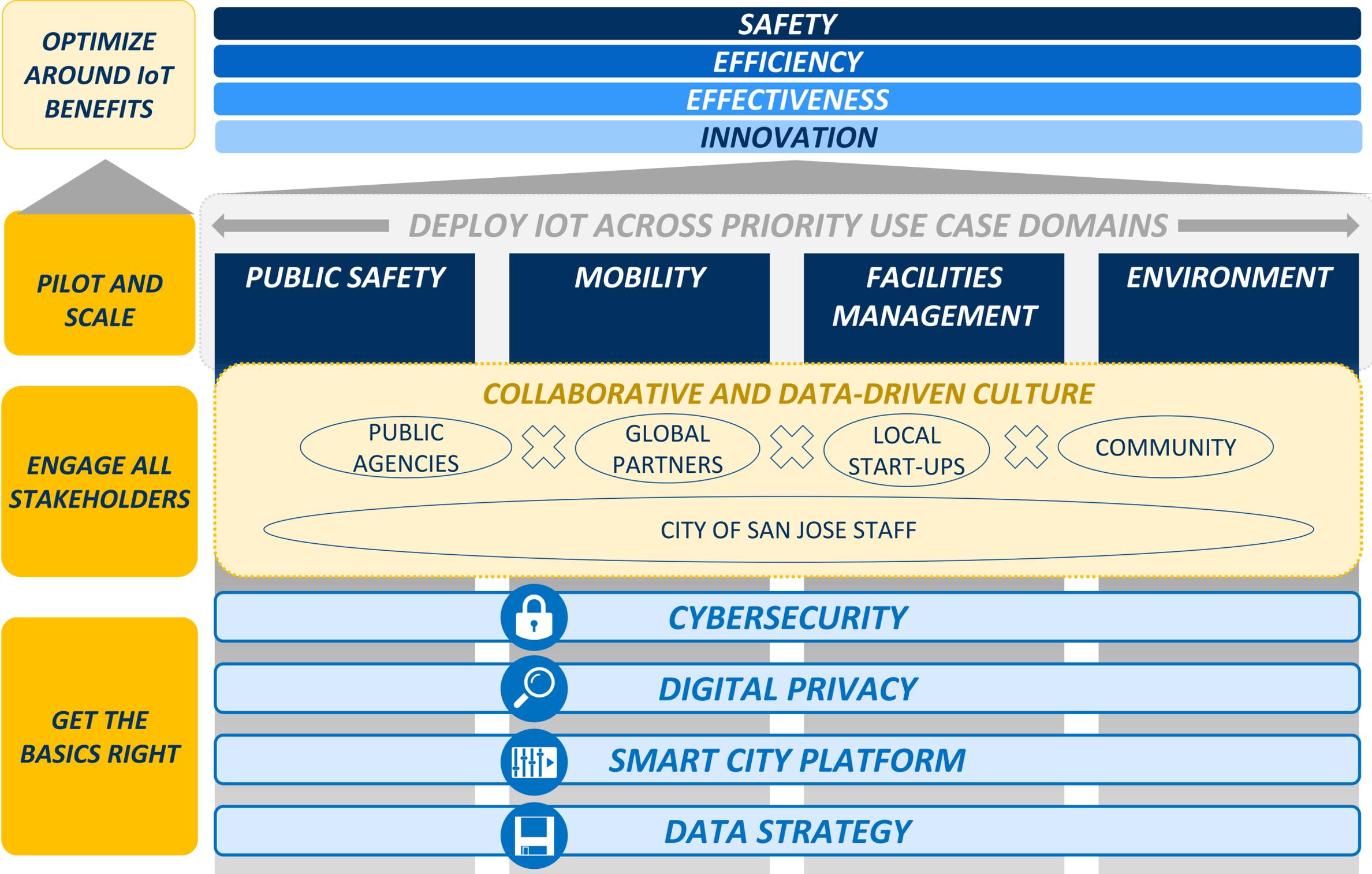
- ✓ Current State Analysis
- ✓ Benchmarking with 12 peer cities
- ✓ San Jose IoT Guiding Principles
- ✓ San Jose IoT Strategy
- ✓ IoT Target Architecture
- ✓ IoT Platform Analysis
- ✓ IoT Use Case Catalog

IoT GUIDING PRINCIPLES

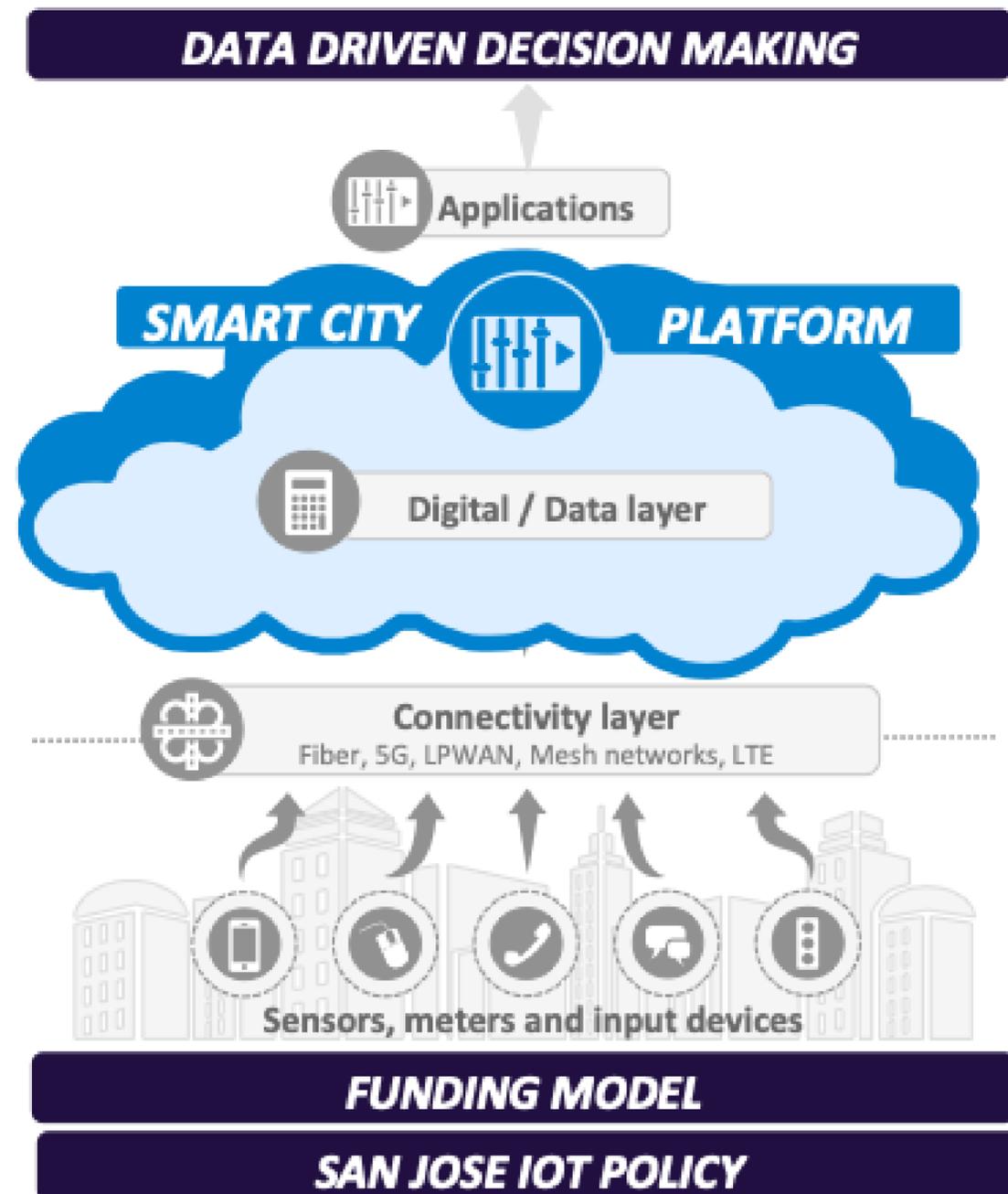


- San Jose IoT Guiding Principles are intended to be the North Star for IoT solutions planning and deployment.
- The overall goal is to have IoT solutions that are people-centric & benefits-driven and are visible to the community.

IoT STRATEGY: THE SAN JOSE MODEL



SMART CITY IOT PLATFORM: COMMON CHARACTERISTICS



- Ability to rapidly ingest high velocity data from disparate streams and normalize it.
- Enables common framework and language for integration of multiple data sources.
- Provides standardized rules/ guidelines for custom or third-party applications.
- Builds platform-based collaboration across City departments.
- Need to factor in integration costs that can be 50% - 60% of the total solution costs.
- Need to develop a city infrastructure tiered usage fee based model, and also explore alternate funding model like data monetization.
- Evolve the talent pool to sustain operations and IT

SMART CITY IOT PLATFORM: VENDOR ECOSYSTEM

Enterprise Software Platform Vendors

- Extension of cloud hosting and enterprise services
- Strong data management and analytics capabilities

Generalist IoT Platform Vendors

- Software vendors provide a broad array of functionality
- Extensive need for customization and integration

Vertically Focused Platform Vendors

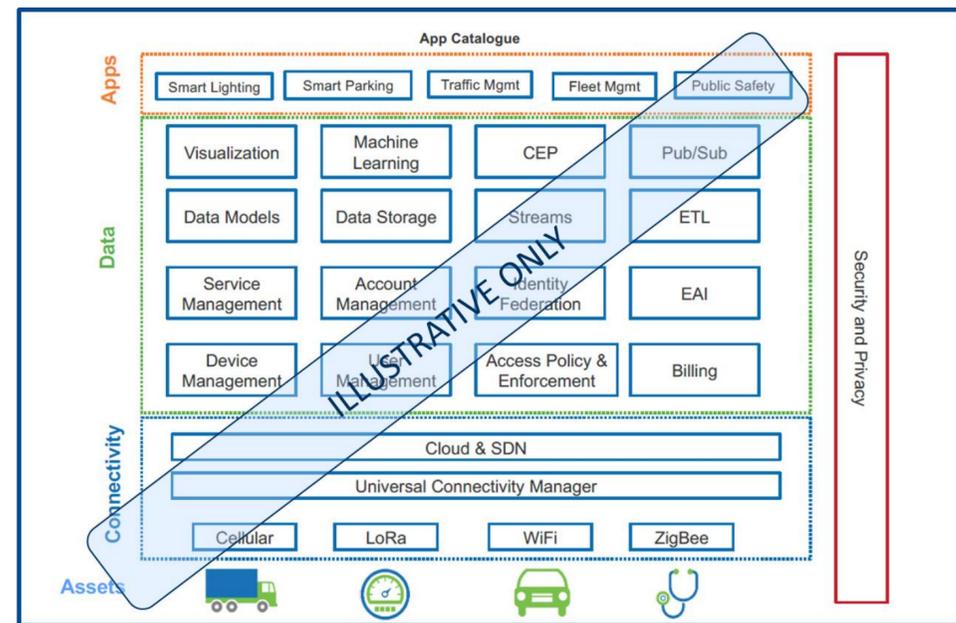
- Address the needs of specific use cases or markets
- Does not provide strong set of cross-functional use case solutions

Connectivity Focused Platform Vendors

- Legacy Telco or networking solutions providers
- Good foundational connectivity & sensor data aggregation tools

Platform technology is still evolving with more than 750 platform providers in the market – need to experiment to understand usage, integration, benefits and City's (TCO) Model

IoT REFERENCE ARCHITECTURE: AERIS PLAYBOOK



Illustrative IoT Reference Architecture

- Aeris is providing pro-bono advisory services to develop the IoT Reference Architecture.
- The final deliverable is a "Playbook" that includes a set of standards and protocols for the City across various layers of the "IoT Stack".

IoT REFERENCE ARCHITECTURE: CONNECTIVITY LAYER



	Bluetooth ¹	Zigbee ¹	Wi-Fi ¹	Mesh ¹	Private LoRa	Proprietary LPWA	Cellular LPWA	4G Cellular	5G / 4G-LTE	Terragraph (& similar)	Satellite
LED Lighting	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓	✓	✓	✓	✓	✓	
Trash Mgmt	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓	✓	✓	✓	✓	✓	
Energy Mgmt	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓	✓	✓	✓	✓	✓	
Building Mgmt	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓	✓	✓	✓	✓	✓	
Traffic Lights				✓ ¹	✓	✓	✓	✓	✓	✓	
Utilities				✓ ¹	✓	✓	✓	✓	✓	✓	
Disaster Resp							✓ ^{2,3}	✓	✓	✓	✓ ³
Emer. Vehicle V2I, V2X							✓ ^{2,3}	✓	✓	✓	✓
City Vehicles							✓ ²	✓	✓	✓	✓ ^{3,4}
Consumer Cars								✓	✓		✓ ^{3,4}

¹ Requires back-haul. Range dependent between devices (dense urban vs. suburban / rural).
² Depends on desired application features and technology.
³ Latency times may preclude providing all application features.
⁴ Cost may preclude providing all application features.

Illustrative IoT Use Case Mapping to Connectivity Layer

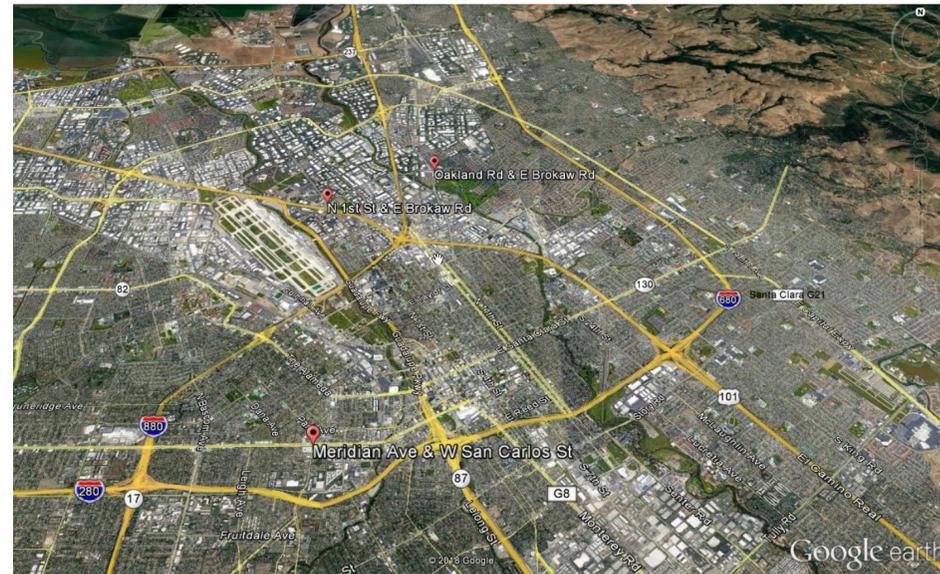
- Assets (Sensors & Devices)
- Connectivity Layer
- Data & Metadata
- Applications & Platforms

SMART CITY IoT SOLUTIONS ENABLED THROUGH TELCO PPP AGREEMENTS

- City Council approved the Telco Partnership Agreements in June 2018, that included in-kind contributions valued at \$4 Million for Smart City Solutions from AT&T and Verizon.
- Following Smart City Solutions are being piloted in the City over next 24 months

Partner	City Department	Smart City Solution	Community Benefits
Verizon	DOT and PW	<ul style="list-style-type: none"> a) Intersection Safety Analytics b) Traffic Data Services c) Fleet Telematics 	Vision Zero, Congestion Management, Asset Tracking
AT&T	PRNS, PW, and IT	<ul style="list-style-type: none"> a) Digital infrastructure b) LED Retrofit c) Smart Controllers d) Community Wi-Fi 	Public Safety, Energy Savings, Asset/ Facilities Management, Public Wi-Fi

VERIZON SMART CITY SOLUTION: INTERSECTION SAFETY ANALYTICS



Intersection Safety Analytics Pilot Locations

Solution Overview

- Provides information about traffic volume, speed, direction vehicle metrics.
- Creates insights for traffic related conflicts among motorists, pedestrians, and cyclists.

Solution Benefits

- Collects, processes, analyzes and correlates traffic data
- Supports San Jose's Vision Zero Goals.
- Provides analytics to derive insights to change potentially dangerous road behaviors.

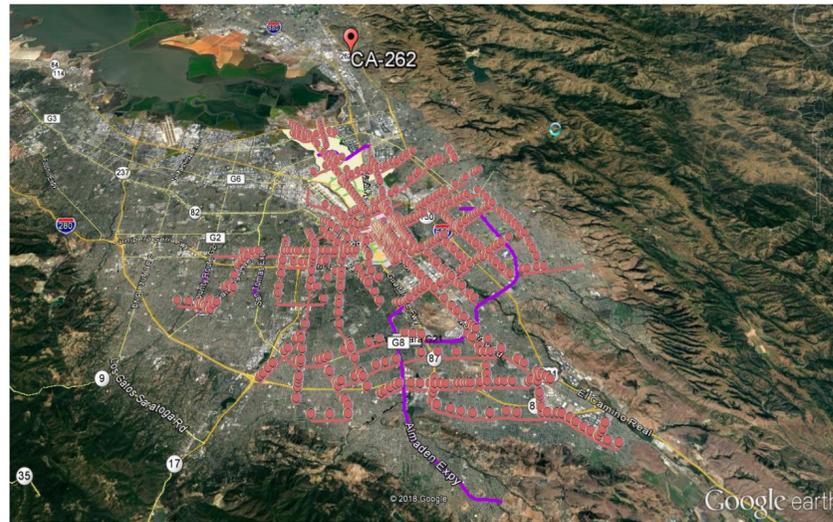
Location: This initial pilot will deploy the ISA Service at the following intersections:

- E Brokaw Rd and Oakland Rd.
- E Brokaw Rd and N 1st St.
- Meridian Ave and W San Carlos St.



Sample Intersection Safety Analytics dashboard showing the analysis of dangerous behavior patterns

VERIZON SMART CITY SOLUTION: TRAFFIC DATA SERVICES



San Jose Arterial Road Segments Scope

Solution Overview

- Provides information about traffic and population movement with high spatial and time resolution.
- Provides data feed through an Application Programming Interface (API) that can be integrated with the DOT e-Tracker solution.

Solution Benefits

- The service enables DOT to have access to near real-time, traffic speed, congestion information.
- City can better plan and manage transportation systems and traffic congestions.
- **Location:** This pilot will cover the following:
 - Total arterial road miles to be covered: 381 bidirectional miles.
 - Number of feeder miles to be covered for signature configuration: 174 miles.

Section number	10,456	10,457	10,458	10,459	10,460	10,461	Average	
Hour	From southwest						To northeast	
0	37.6	25.2	33.3	32.0	25.8	26.4	30.1	
1	31.2	22.9	28.0	31.1	29.8	28.8	28.6	
2	35.2	36.3	22.8	25.0	25.5	15.3	27.5	
3	31.7	27.7	24.0	24.9	26.7	23.7	27.0	
4	32.9	28.9	26.4	28.2	27.2	27.2	27.2	
5	36.2	36.2	33.3	29.2	31.4	34.1	34.6	
6	16.2	12.7	18.8	26.1	33.6	27.1	19.6	
7	8.4	8.9	14.1	20.8	27.3	28.0	14.2	
8	14.3	13.7	27.3	24.3	25.1	28.6	17.2	
9	16.1	15.3	33.1	25.5	21.0	25.4	17.1	
10	16.6	15.5	18.9	21.8	21.8	15.3	18.0	
11	16.4	14.8	19.9	21.5	22.6	21.8	17.5	
12	18.4	15.4	23.3	21.2	22.6	28.4	19.0	
13	15.2	14.2	26.3	25.4	26.5	20.1	17.4	
14	19.3	15.4	15.1	18.2	24.4	25.6	18.8	
15	13.8	13.9	11.6	15.1	20.6	15.9	14.9	
16	15.5	12.7	12.7	17.9	20.0	17.8	15.3	
17	17.5	14.0	16.1	14.2	22.5	36.7	17.1	
18	18.2	19.3	16.1	18.8	31.3	40.3	22.8	
19	19.8	16.5	22.5	25.8	25.3	16.6	20.9	
20	21.1	15.8	27.1	24.0	23.2	35.1	21.5	
21	16.0	16.0	26.5	27.8	27.7	25.2	22.5	
22	27.2	24.1	31.5	31.4	34.0	37.2	30.7	
23	30.8	27.1	27.7	27.0	27.0	38.3	27.9	

Sample Report – Average Speeds for a Traffic Corridor

VERIZON SMART CITY SOLUTION: FLEET TELEMATICS

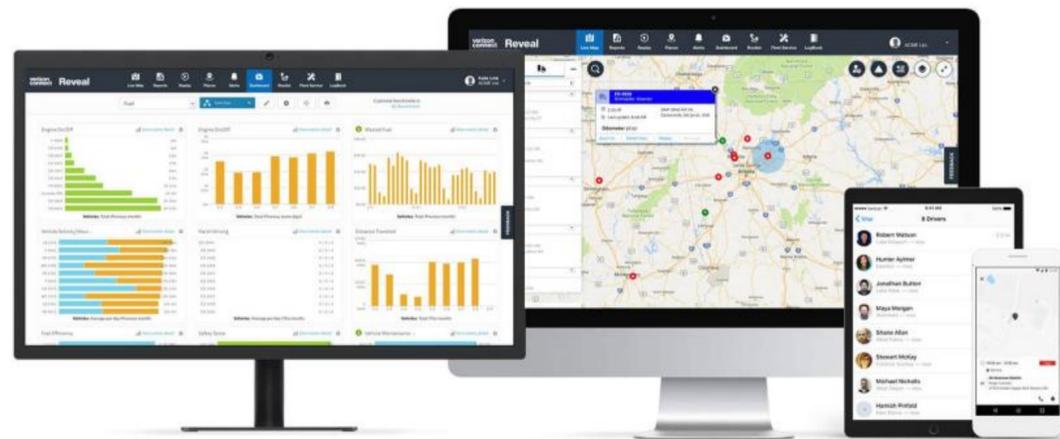


Solution Overview

- The Verizon Fleet Telematics solution allows the City to obtain vehicle information in terms of vehicle performance, location and operations.

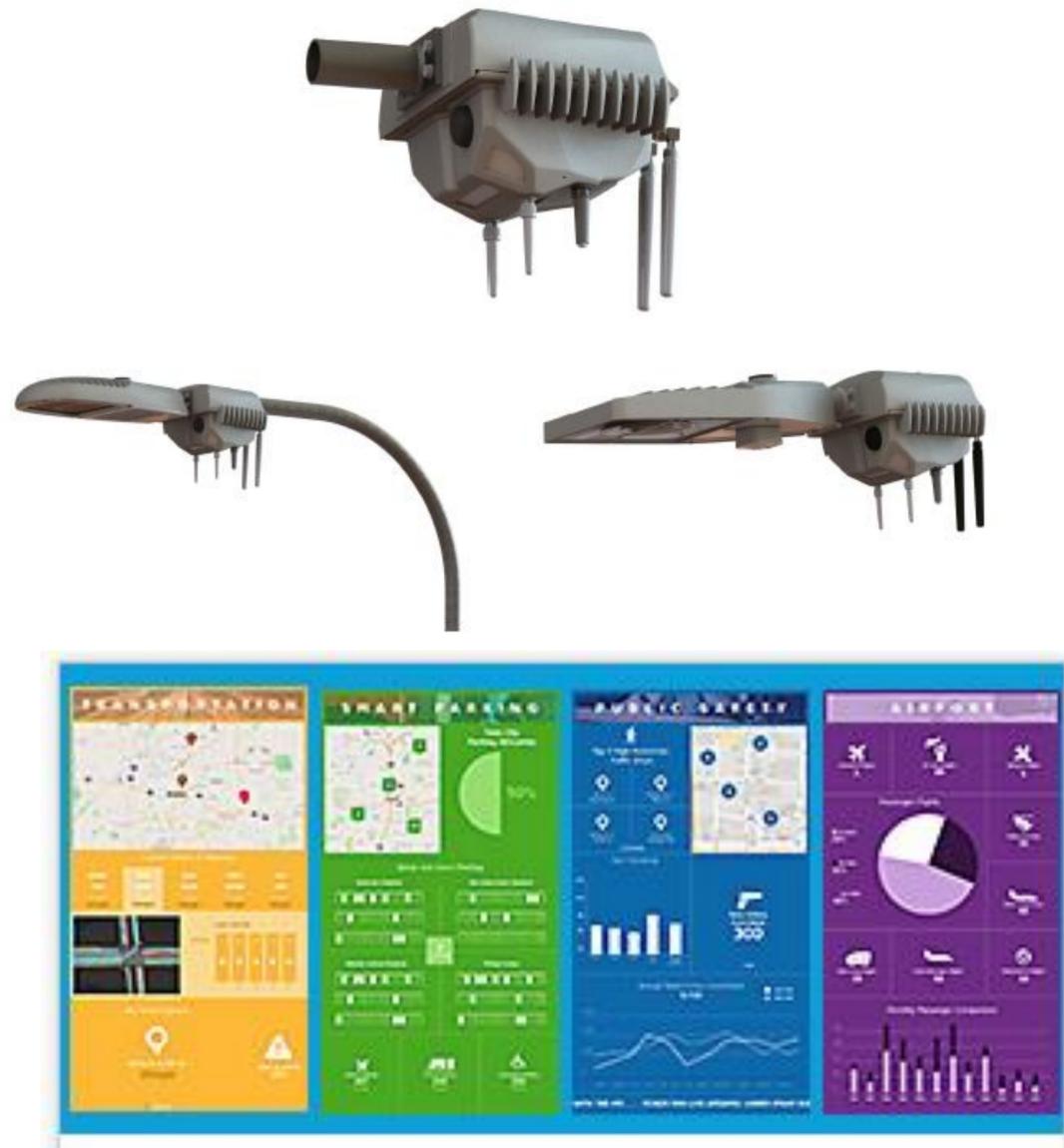
Solution Benefits

- Improved Safety.
 - Improved Fleet Maintenance.
 - Reduced Fuel Use.
 - Increased Productivity.
 - Reduced Impact on Environment.
 - Improved understanding of Vehicle Utilization.
- **Solution Deployment Scope:**
 - Currently installed on 535 City Vehicles.
 - The Pilot will expand it to another 1,100 Vehicles.



Sample Fleet Management Dashboards

AT&T SMART CITY SOLUTION: DIGITAL INFRASTRUCTURE NODES



Sample Dashboard

Solution Overview

- Single IoT pod affixed on a pole with multiple sensors types: HDR color camera, GPS receiver, Microphone, Environmental sensors, 4G LTE connectivity, Bluetooth, Power over Ethernet (PoE), and USB.
- **Solution Benefits**
 - Solution can provide benefits across many use cases - mobility, economic development and public safety.
 - City staff has identified the following criteria for use case selection: community benefits and interest, privacy considerations, and opportunity to learn through data.
- **Potential Locations:** City will get 15 nodes & the staff is working on finalizing the Public Safety use case requirements. Possible locations: Discovery Meadow, Seven Trees and Starbird Park.
- **Deployment Approach:** This solution will not be deployed until a Privacy Policy has been fully developed and vetted.

PROJECT SPOTLIGHT: LED, SMART CONTROLLERS & COMMUNITY WI-FI IN PARKS

John Wildemuth, Public Works
Andrea Case, Public Works

May 2, 2019

AT&T SMART CITY SOLUTION:

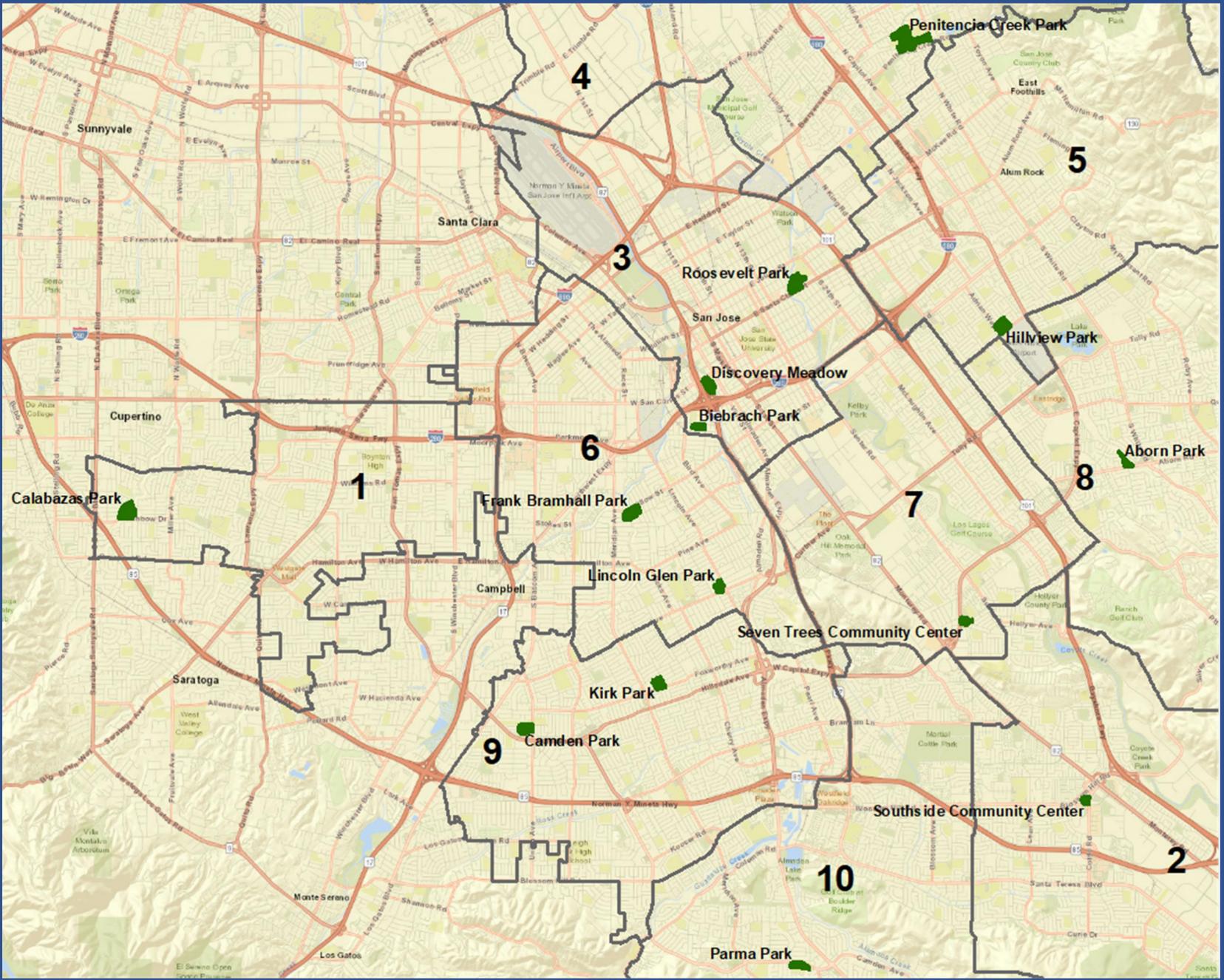
LEDs, CONTROLLERS & COMMUNITY WI-FI



- AT&T will install and deploy 550 LEDs and smart controllers in 11 parks.
- City will self-install another 120 smart controllers in additional 3 parks.
- The parks spread across Council Districts will have Community Wi-Fi.
- AT&T will provide installation, deployment and network commissioning services.
- AT&T will provide for connectivity and support for 24 months.

LEDs and UbiCell Smart Controller
Picture Credit: AT&T

SITE DEPLOYMENT & ROLLOUT



District	Park Site
1	Calabazas Park
2	Southside Community Center
3	Biebrach Park
3	Discovery Meadow
3	Roosevelt Park
4	Penitencia Creek Park
5	Hillview Park
6	Frank Bramhall Park *
6	Lincoln Glenn Park *
7	Seven Trees Community Center *
8	Aborn Park
9	Kirk Park
9	Camden Park
10	Parma Park

* Controllers Only – self installed by the City

POTENTIAL BENEFITS FOR SMART CONTROLLER IN SAN JOSE PARKS



LEDs and Controllers Deployment in the Seven Trees Park

- ✓ Energy savings from Day 1 (Metered usage in Parks).
- ✓ Improved **Asset Management** and **Ongoing Operations**.
- ✓ Opportunity to better address and react to **Copper Theft**.
- ✓ Better understanding of **Usage of Park Facilities**.
- ✓ Improved **Community Engagement** through Wi-Fi.
- ✓ Addresses **Public Safety** concerns.
- ✓ Supports **Digital Inclusion** goals.

PERSPECTIVES ON SMART CONTROLLERS BASED IoT SOLUTIONS

Ian Aaron, CEO, Ubicquia

May 2, 2019

WHY IMPLEMENT STREETLIGHT CONTROLLERS?

- ▶ **Energy Savings**
Dimming and schedules reduce streetlight power usage by 10% to 15%
- ▶ **Streetlight Infrastructure Management**
Asset tracking and near real-time notification of outages and day burners
- ▶ **Maintenance Efficiencies**
Truck rolls only when necessary and with proper inventory and work order details
- ▶ **Eliminate Additional Installation Costs (one-touch install)**
Incremental cost for a controller is small when compared to having to replace a photocell

LTE ENABLED LIGHTING CONTROLLER



- ▶ **Advanced lighting control**
Turn on, off or dim lights remotely
- ▶ **Utility grade energy metering**
Measures energy usage at both the light and street
- ▶ **Tilt and vibration sensing**
Near real-time notifications for pole tilt and crashes
- ▶ **Inventory management**
Streetlights and poles with high accuracy GIS data
- ▶ **Location based services**
Using Wi-Fi and Bluetooth Beacon technology

EXPANDED POSSIBILITIES



Parking



Air Quality



Sewer Level

- ▶ **Wi-Fi coverage expansion**
Densify City's existing Access Points

- ▶ **Location Based Services**
Track aggregated crowd movement, dwell time and congestion
Every streetlight can provide Bluetooth beacon messages

- ▶ **Sensor connectivity**
Easy to deploy wireless and wired smart city sensors
Aggregate sensor and 3rd party controller data

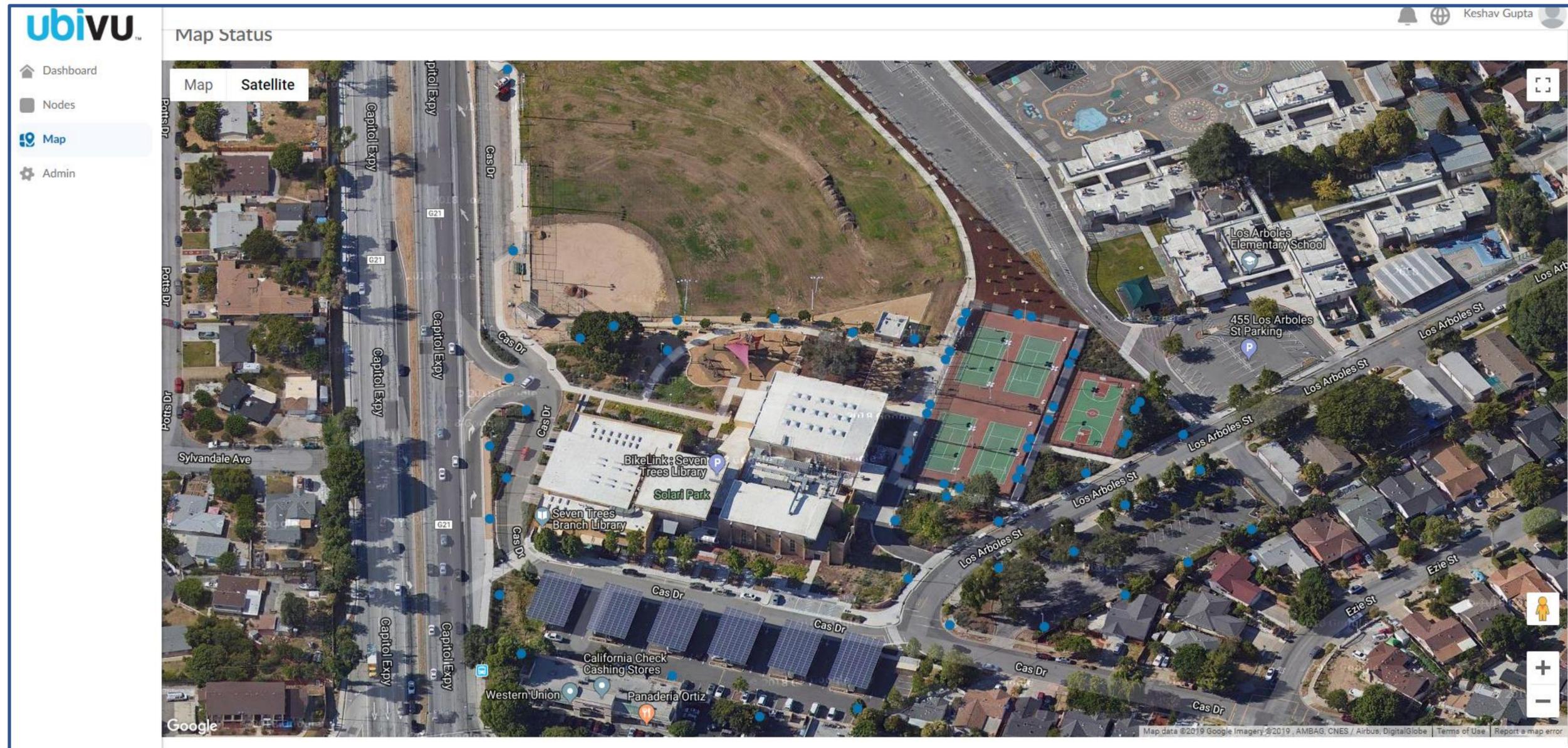
LIVE DEMO: AT&T UBIQUITA SMART CONTROLLERS IN SEVEN TREES PARK

The screenshot displays the ubiVU web interface for managing smart controllers. On the left, a navigation menu includes Dashboard, Nodes, Map (selected), and Admin. The main area shows a map of Seven Trees Park with numerous blue dots representing smart controllers. A popup window for node STA002 provides the following details:

- Node: [STA002](#)
- Group: N/A
- Zone: N/A
- Pole ID: N/A
- Luminaire Type: N/A
- 04/22/19
- Off 08:12:20 AM

The map also shows various landmarks such as KIPP Heritage Academy, Los Arboles Elementary School, Solari Park, and several businesses like Panaderia Ortiz and Nationalink, Inc. The interface includes a 'Map Status' section with 'Map' and 'Satellite' options, and a user profile for Keshav Gupta in the top right corner.

WHAT ARE THE POSSIBILITIES THROUGH IoT DEPLOYMENT IN THE PARKS?



Q&A