

Smart Cities – Smart Streetlights

Panel Discussion

September 23, 2014

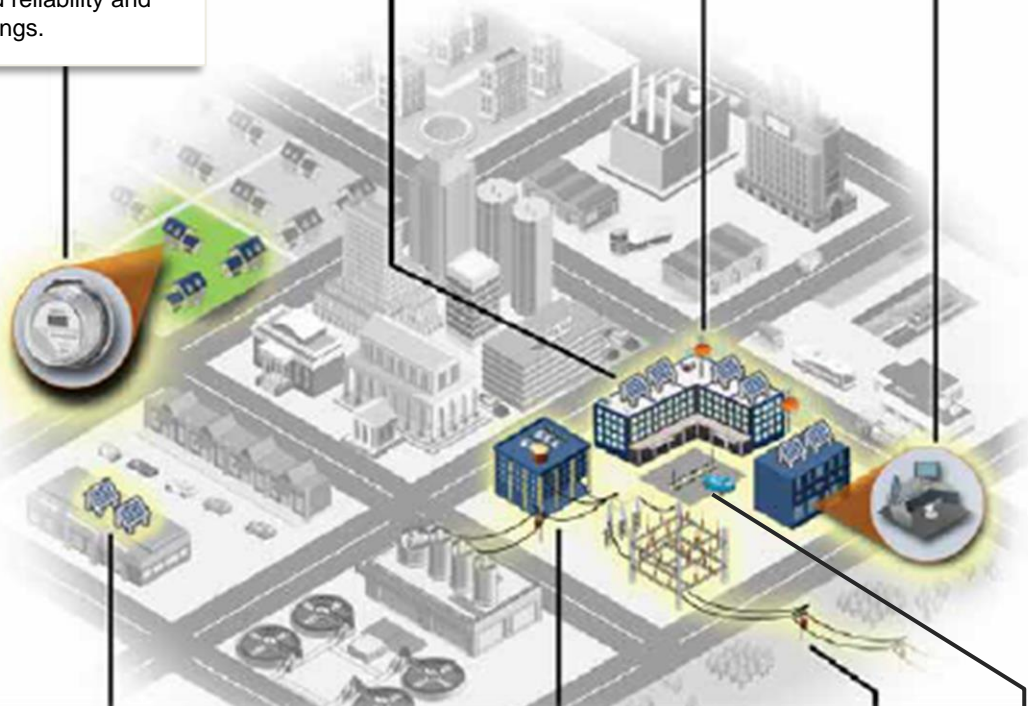
Smart Grid and the Smart City

Smart meters on every home and building give residents and the utility invaluable information about energy use, leading to greater efficiency, improved reliability and cost savings.

Alternative energy reduces the need for fossil-fuel generation.

The communications network that connects smart meters can often be used for other city purposes.

Visualization and analytics provide full situational awareness of what is going on with the electric power and gas systems.



Clearly defined interconnection standards make it easy for residents to plug solar and wind into the grid.

Automation equipment can execute protection schemes in microseconds, minimizing outages.

Automated outage management detects disturbances and isolates areas before they create a cascading blackout.

Electrical Vehicles (EVs) reduce fossil fuel consumption and increase energy independence. They can fortify the grid and increase the integration of renewable energy

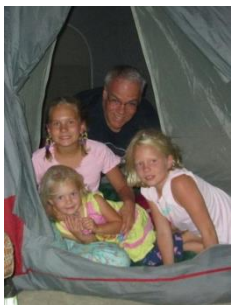
Smart Streetlight Panel



Robert L. Myers
Managing Deputy Commissioner
City of Chicago



Stephen L. Davis
CEO
The Will Group



Mel Gehrs
Data Scientist
Silver Spring Networks



Dan Gabel
Manager, Smart Grid &
Technology
ComEd

The City of Chicago's Outdoor Lighting Infrastructure

Robert L. Myers

Managing Deputy Commissioner

City of Chicago

The City of Chicago Aerial View



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GEOGRAPHIC

Photograph by Jim Richardson

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View of the City from the Willis Tower



Current Inventory

Over **2800** Intersections and **320,000** HPS/CMH lighting fixtures owned, operated and maintained by the City

- 100 year old infrastructure
- Vandalism
- Outages
- Day Burners
- Non-metered system
- Increasing Cost and decreasing budget – Do More with Less



CHICAGO DEPARTMENT OF TRANSPORTATION
Division of Electrical Operations - Completed Service Requests
August 31, 2013 to August 31, 2014

	Completed CSRs	Average Response (days)
Alley Light New	17	2.06
Alley Light Out	11,733	22.63
Cable Cut	358	3.45
CDOT Electrical Operations Construction Complaints	2,352	6.47
City Electrical Vault	121	18.12
Gym Shoe/Object On Electrical Wire	166	49.29
Legal Report	128	177.26
Small Gang Project	792	16.59
Street Light Out	16,618	11.52
Street Light Pole Damage	2,615	16.54
Street Light Pole Door Missing	382	32.02
Street Lights - All/Out	20,352	3.85
Street Lights On Days	786	21.17
Traffic Signal Out	12,768	1.06
Traffic Truck - Non Emergency	1,790	60.68
Wire Down	2,455	1.12
Total Number of CSRs Completed:	73,433	
	Average:	27.74

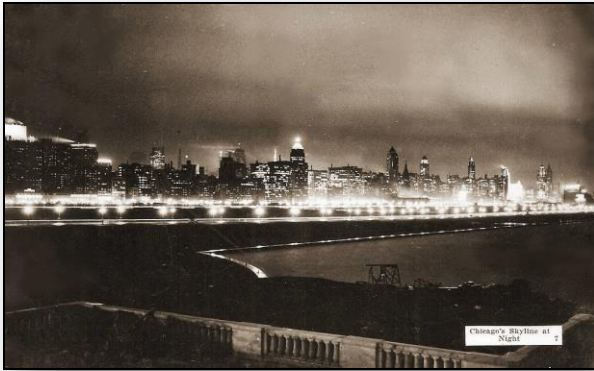
Advance Metering Infrastructure Outdoor Lighting Network

Stephen L. Davis

CEO

The Will Group

Evolution



Pre 1960's

- Beginning elimination of "Archaic" ornamental lighting
- Beginning move to engineered function Cobra Head
- Move to Energy efficient and longer lasting lamp design
- Primary light source – Mercury Vapor

1970's through late 1980's

- Ornamental designed almost 100% replaced by Cobra Head
- Chicago becomes the first major US city to fully convert to HPS
- IES standards becomes adapted practice; Chicago exceeds RP8 in all categories except veiling luminance (glare)
- More light = less crime approach; Glare = Safety

Late 1980's through Today

- Reintroduction of ornamental lighting in "Streetscape"
- Introduction of Smart Fixture Technology
- Technology improvements – White light source; Metal Halide, Induction lamps, CMH, LED's
- Federal guide lines include RP8 design criteria (Chicago does not follow)
- IDA increases influence in lighting design
- Right of Way, structures and power become building block to "Smart Cities"



Federal Stimulus Money Benefits Chicago, Environment, Local Workers, Sustainable communities

1. sustainability
2. In more general terms, **sustainability** is the endurance of systems and processes. The organizing principle for **sustainability** is **sustainable** development, which includes the four interconnected domains: ecology, economics, politics and culture.



The high-pressure sodium streetlights that currently line the majority of Chicago's roads are more costly, less efficient and emit more carbon dioxide and light pollution than the CMH lights being installed thanks to stimulus dollars.



Stimulus money has helped provide jobs and job training for individuals who have struggled to find work in these trying economic times.



Federal Stimulus Money Benefits Chicago, Environment, Local Workers



White Lights for Chicago Mean Green Jobs for Chicagoans

Thanks to 1982 stimulus dollars, the city of Chicago now makes the streets safer, more secure and more efficient. The city is installing 100,000 high-pressure sodium (HPS) streetlights. The city is also installing 100,000 compact fluorescent (CMH) streetlights. The city is also installing 100,000 compact fluorescent (CMH) streetlights. The city is also installing 100,000 compact fluorescent (CMH) streetlights.




White Lights for Chicago Mean Green Jobs for Chicagoans

Through this Stimulus project alone, the assembly team at The Will Group will have assembled over 30 thousand CMH lights for the city of Chicago.

Sustainable Benefits

1. Green House Gases (CO₂) Removed (lbs.) = 595,424,000



Which is Equivalent to...

1 Acres of Trees Planted = 61,523



2 Cars Off Road = 49,358



3 *Estimated Jobs Created (direct and indirect) = 8,794



Source: www.epa.gov/cleanenergy/energy-resources/calculator.html

* (Direct and Indirect 1B Hwy Construction = 26,000 Jobs Source FHWA)

Project Summary

ASSUMPTIONS:

kwh Charge	\$0.0425
Annual Burn Hours	4015
Fixture Count	482,634

SAVINGS INFORMATION:

Total Watts Saved	72,782,000
Total kWh Saved	347,591,000
Annual Energy Savings	\$15,289,000
Annual Maintenance Savings	\$20,509,000

Total Savings	\$35,798,000
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PROJECT INVESTMENT:

Material & Labor (The Will Group)	\$338,000,000
Recycling	\$0
ComEd Rebate (estimated)	\$70,000,000
Estimated tax deduction value (based on - sq ft at \$0.60/sf at a 35% tax bracket)	

Total Investment	\$268,000,000
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ECONOMIC ANALYSIS:

Simple Payback (years)	7.3
ROI	14%
Lease Option Per Year (4.5%) (rates will be verified upon receipt of order)	\$33,330,000
Total Operating Savings per year	\$35,798,000
Cash Flow per year	\$2,468,000

Permit and license fees are not included in the cost of the project

LED Streetlights and Smart Grid Communications

Mel Gehrs

Data Scientist

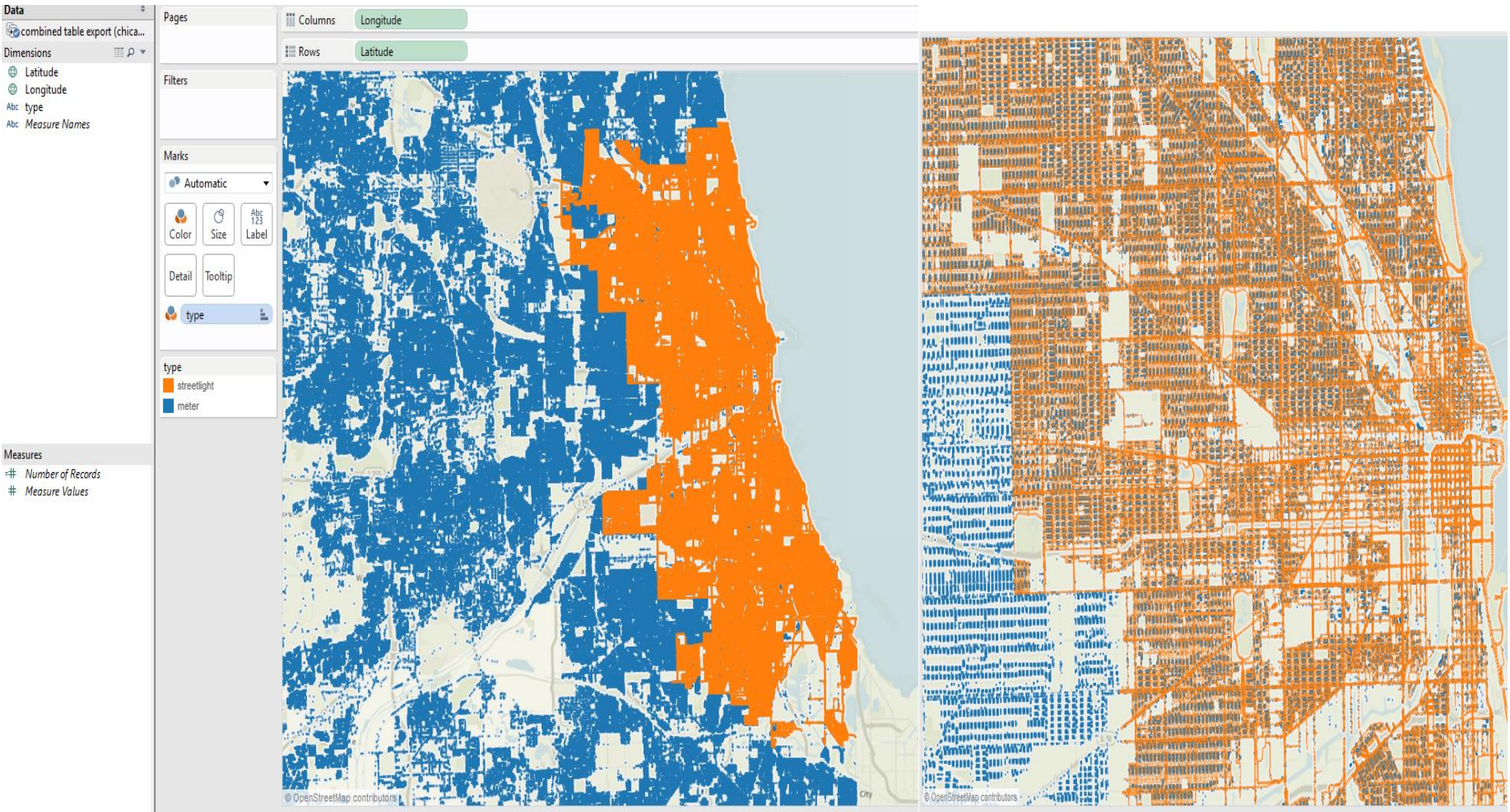
Silver Spring Networks



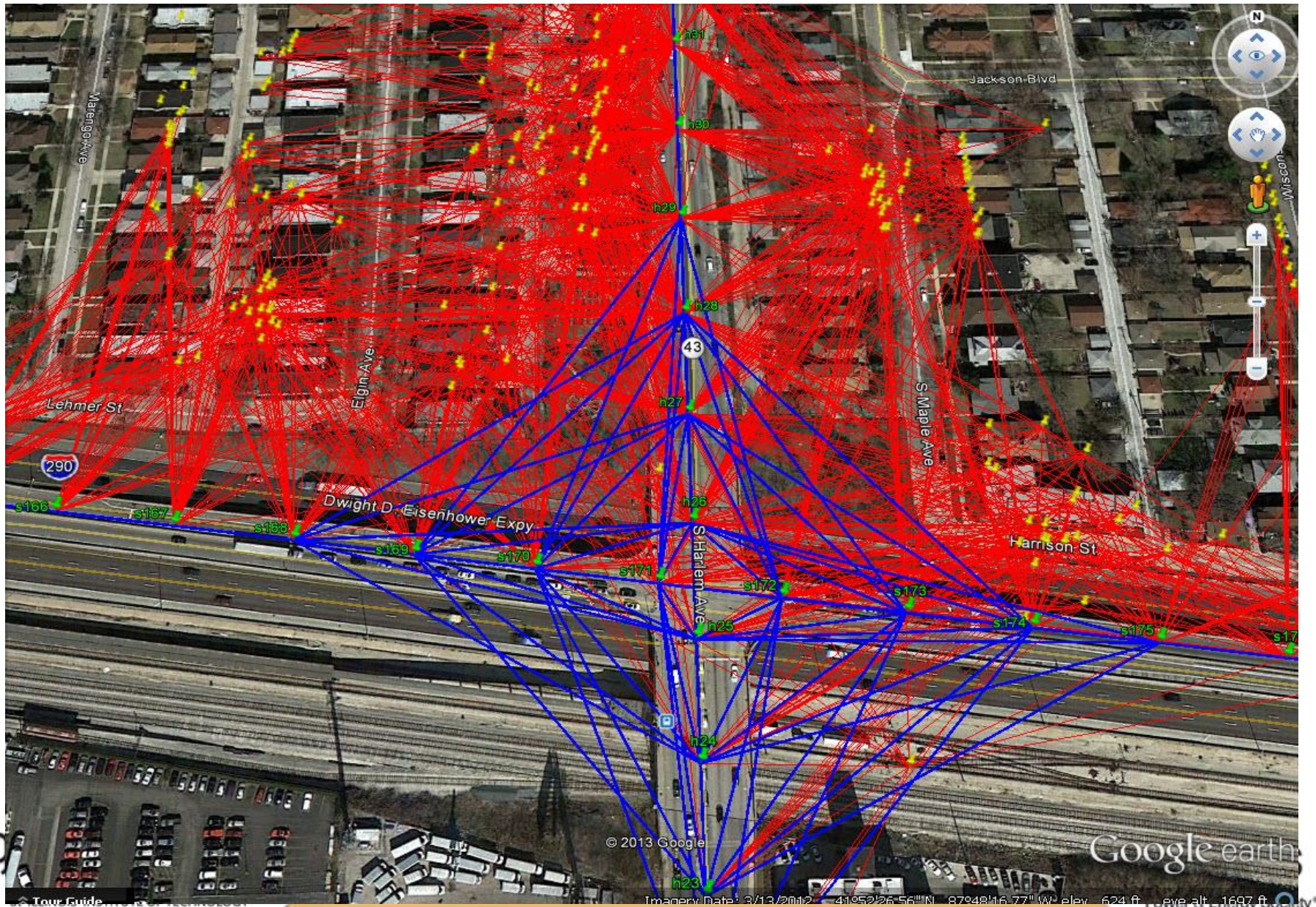
Photocell includes 900mhz FHSS mesh radio
Individually addressed devices using IPv6
Turn on/off and set brightness level
Download complex calendar of hours of operation
Read embedded meter – voltage, current, kwhr
Secure encrypted communications



Overlay Chicago Meters and Streetlights



Simulation – Streetlights joining AMI Mesh



Streetlight Management Software

The screenshot displays the Streetlight Management Software interface. On the left is a search sidebar with a tree view of GeoZones including Australia, Melbourne City Council (with MCC-STL-001 to MCC-STL-004), Sunshine City Council, Demo (with Demo 1 - A and Demo 1 - B), PGE, and Square Louis XVI. The main area shows a map of a residential area with streetlights marked as orange icons. A control panel for MCC-STL-001 is open, showing a lamp status of 'On', a time stamp of '03/09/14 5:51:42 AM', and a metering bar at 00%. The panel also includes a list of status indicators such as 'Cycling', 'Day burner', 'Open circuit', 'Relay failure', and 'Lamp failure'. A notification box in the center of the map reads 'Invalid Credentials. Sign up for a developer account at: <http://www.microsoft.com/maps/developers>'. At the bottom right, a small dialog asks 'Would you like to refresh data values for this geoZone ATS San Ramon?' with 'Yes' and 'No' buttons.

Real-time Control Zoom: 16.24 Location ATS San Ramon

Search

GeoZones

- Australia
 - Melbourne City Council
 - MCC01
 - MCC-STL-001
 - MCC-STL-002
 - MCC-STL-003
 - MCC-STL-004
 - Sunshine City Council
 - Demo
 - Demo 1
 - Demo 1 - A
 - Demo 1 - B
 - Demo 2
 - Demo 3
 - Monitoring
 - PGE
 - ATS
 - ATS San Ramon
 - Square Louis XVI
 - Amko
 - Apanet
 - CarloEM24
 - CityloneSL30FD1
 - Cree
 - EchelonCPD300
 - GreenNode
 - OSRAM LED
 - Philips7035.OLC[0]
 - Philips7035.OLC[1]
 - PM3256.Counter
 - Rongwen
 - Rongwen LED
 - SLV_Demo1
 - VertexD1R0
 - SSN users
 - Training
 - Southern
 - Beach Controller

MCC-STL-001 | AUTOMATIC INFORMATION

Lamp Status On

Time Stamp
03/09/14 5:51:42 AM

Automatic Refresh Off

Metering

100%
75%
50%
25%
0% 00%

Mains voltage (V) ...
Voltage Max ...
Voltage Min ...
Mains current (mA) ...
Metered power (W) ...
Lamp energy (kWh) ...
Power factor ...
Frequency (Hz) ...
Temperature ...
Lux level (Lux) ...

Status

Cycling Day burner Lamp failure
 Open circuit Relay failure

Invalid Credentials. Sign up for a developer account at: <http://www.microsoft.com/maps/developers>

Would you like to refresh data values for this geoZone ATS San Ramon ? Yes No

Powered by Streetlight.Vision

Smart Grid – Smart Cities

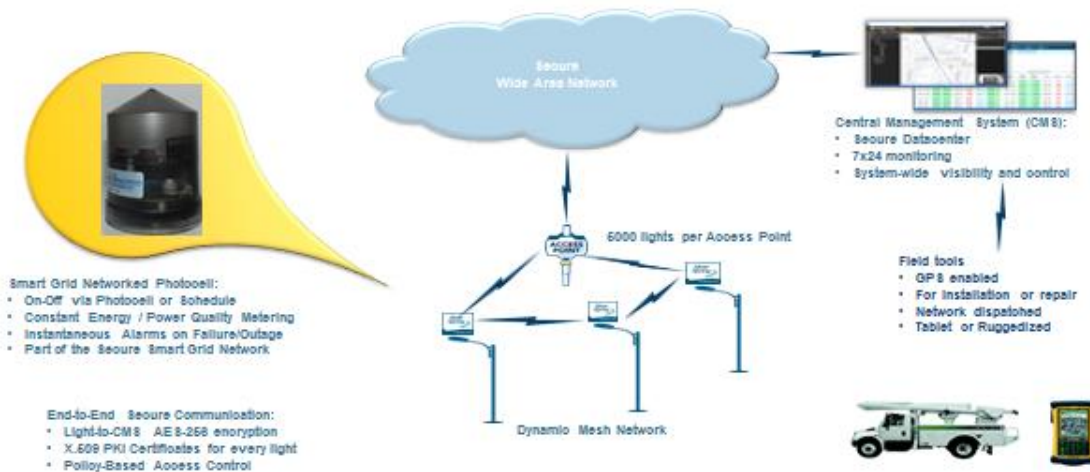
Dan Gabel

Manager, Smart Grid & Technology

ComEd

ComEd Smart Streetlight System Overview

- ComEd's wireless smart meter network is the backbone of the system
 - Two-way communications for monitoring and control of streetlights and future devices
- Streetlight control nodes installed on each fixture include the same wireless radios in ComEd's smart meters
 - Improved mesh density, last gasp outage notification, revenue grade metering
 - Revenue-grade metrology improves energy-use accounting and incents energy efficiency
- Web-based streetlight management software provides central management of streetlights and other "smart city" applications
 - Enables access portals for various users with specific functionality sets (e.g., emergency responders, maintenance personnel, event management)



Smart Streetlight System Architecture

Streetlight Management Software



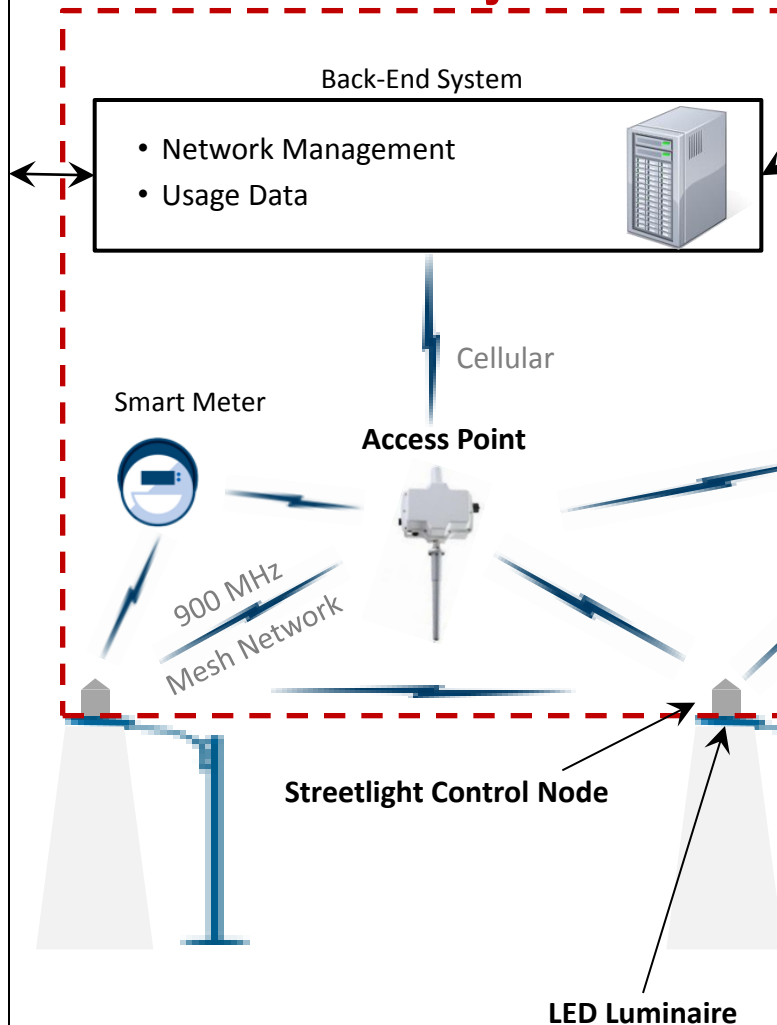
Maintenance

- Fixture Operation
 - Scheduled on/off & dimming
- Maintenance
 - Light Status
 - Location
 - Metrics

Customer Web Portal

- Ad-hoc luminaire operations
- User-specific portals
 - Emergency response
 - Maintenance
 - Other??
- Future device management

ComEd AMI System



Billing



Potential Future Devices

- Gas/water meters
- Sensors
- Traffic signals
- Smart street signs
- Others??

Benefits of Smart LED Streetlights

- Leverages & strengthens ComEd's smart meter communications network
- Highly efficient LED fixtures with remote control & monitoring
 - Increased energy savings
 - Reduced maintenance costs
 - Improved accounting of energy usage
- Improved security and safety
 - Fewer light failures, less vandalism
 - Web portals for police and emergency responders
- Network itself enables additional services
 - Security: Ad-hoc light control
 - Sensors: weather, traffic
 - Measurement: water meters
 - Messaging: Smart street signs

