Smart City: To IOT or Not to IOT?

Connecting the Campus and the City

John Madey, RCDD / University of Florida

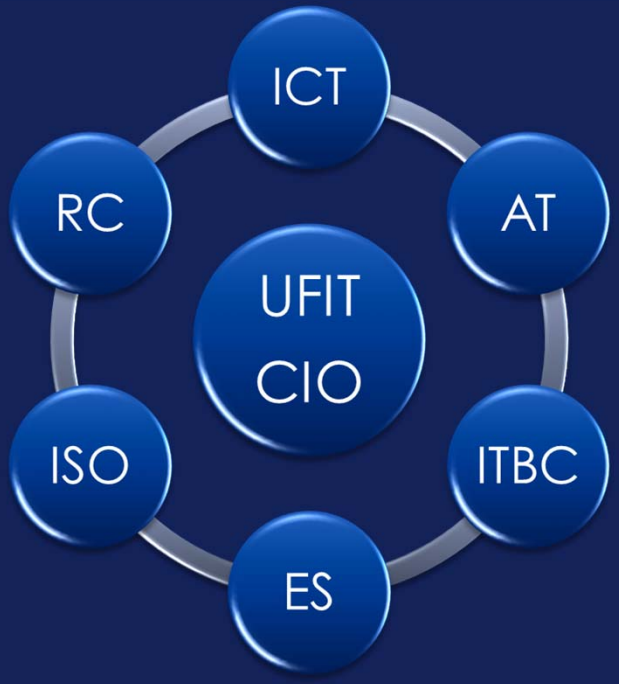
Today's Roadmap

- UF Overview
- IOT – example from GPD
- Smart City – wireless pilot with Gainesville
- Evolution of Campus Outdoor Wireless
- Smart City – the other opportunities

UF Fast Facts

- 56,500 students
- #7 Public University
- #1 Biotech Incubator
- Research Focused: $838M in Awards
- 2,000 Acres
- 1,000 Buildings

UF Information Technology



- Vice-President / Chief Information Officer
- Infrastructure and Communications Technology
- Academic Technology
- Business Center
- Enterprise Systems
- Information Security Office
- Research Computing

UFIT Overview

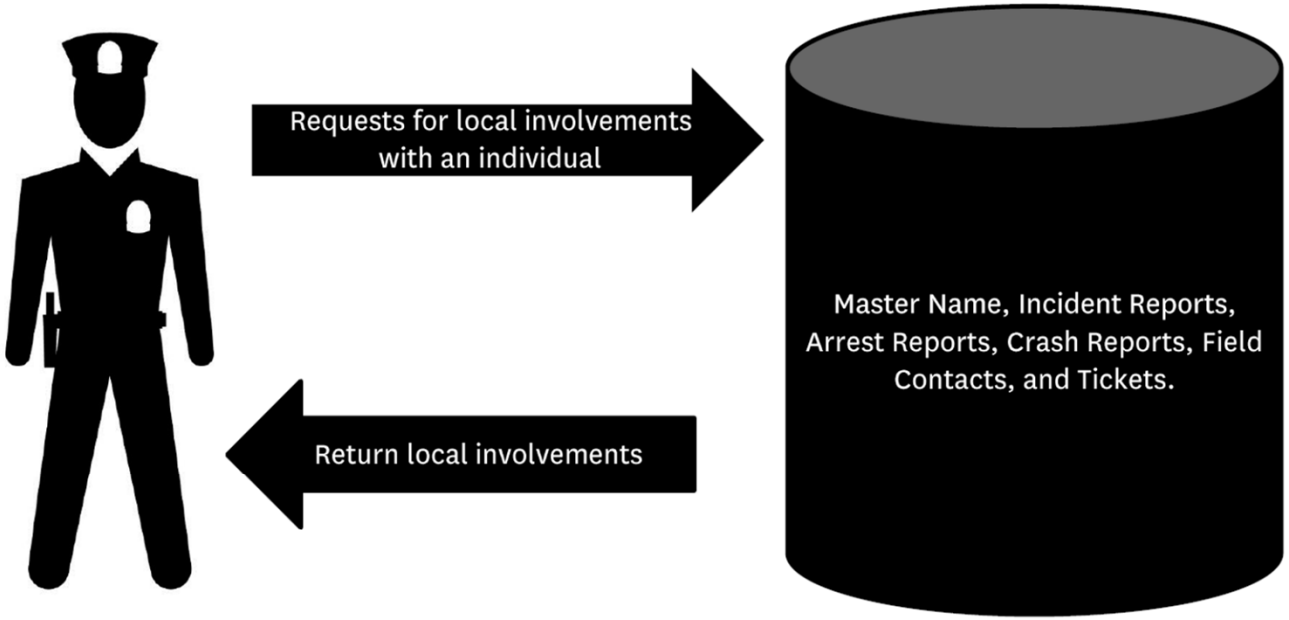
Communication & Construction Services

- Network Infrastructure: Field Engineers and Techs – Building network support
- Telecom: VoIP Infrastructure, Cisco Call Managers, IP Contact Center, Voicemail
- Emergency Communications: InformaCast, Blue Lights, E911
- Engineering: Design reviews, Telecom standards
- ISP: Inside Plant Cabling
- OSP: Outside Plant Fiber

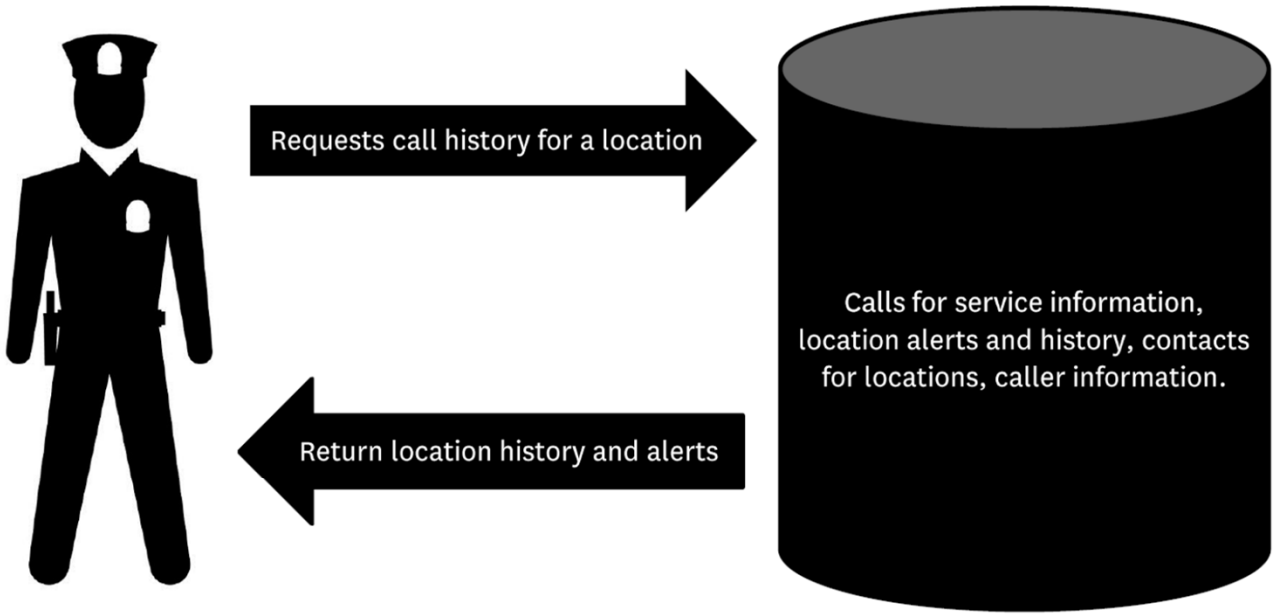
IOT Data Collection

- An example of the vast amount of data collected through IOT
- Provided by Gainesville Police Department at City Commission request (10 FEB 2020)

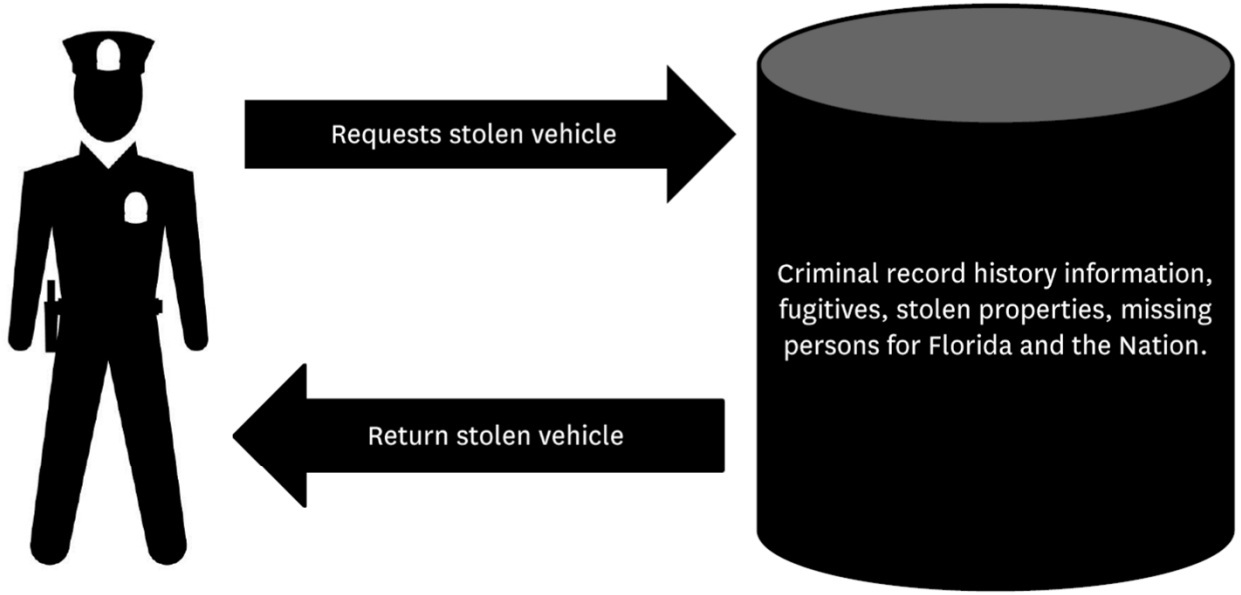
Local RMS (Records Management System)



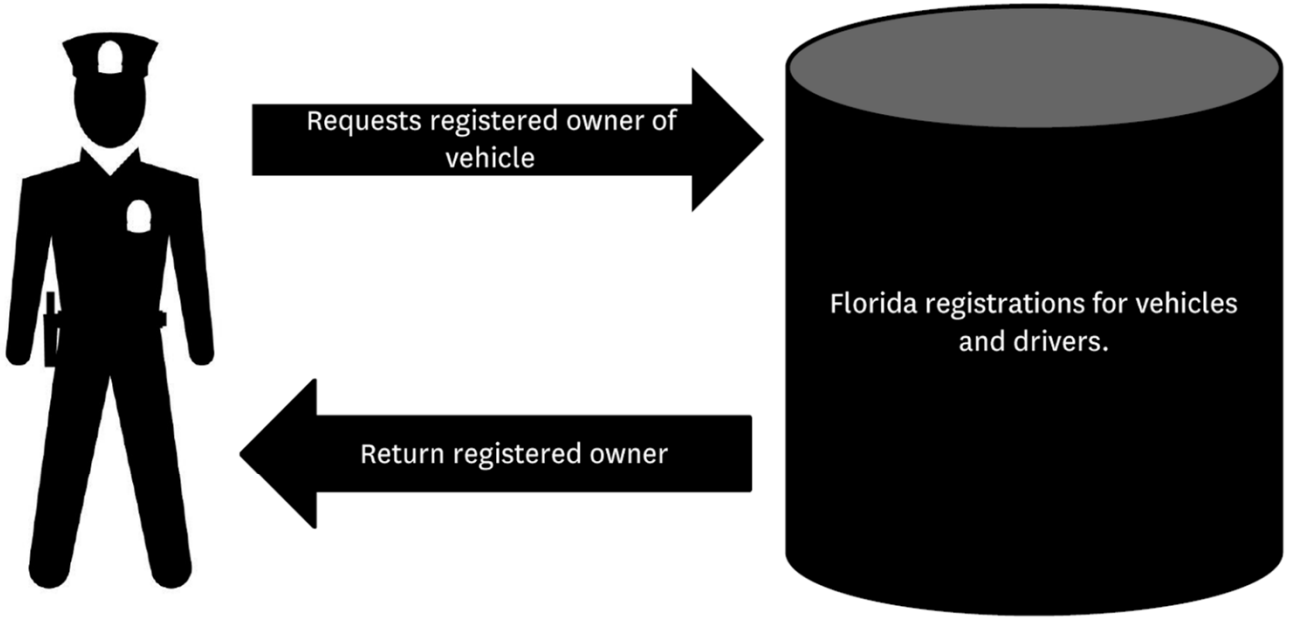
Local CAD (Computer- Aided Dispatch)



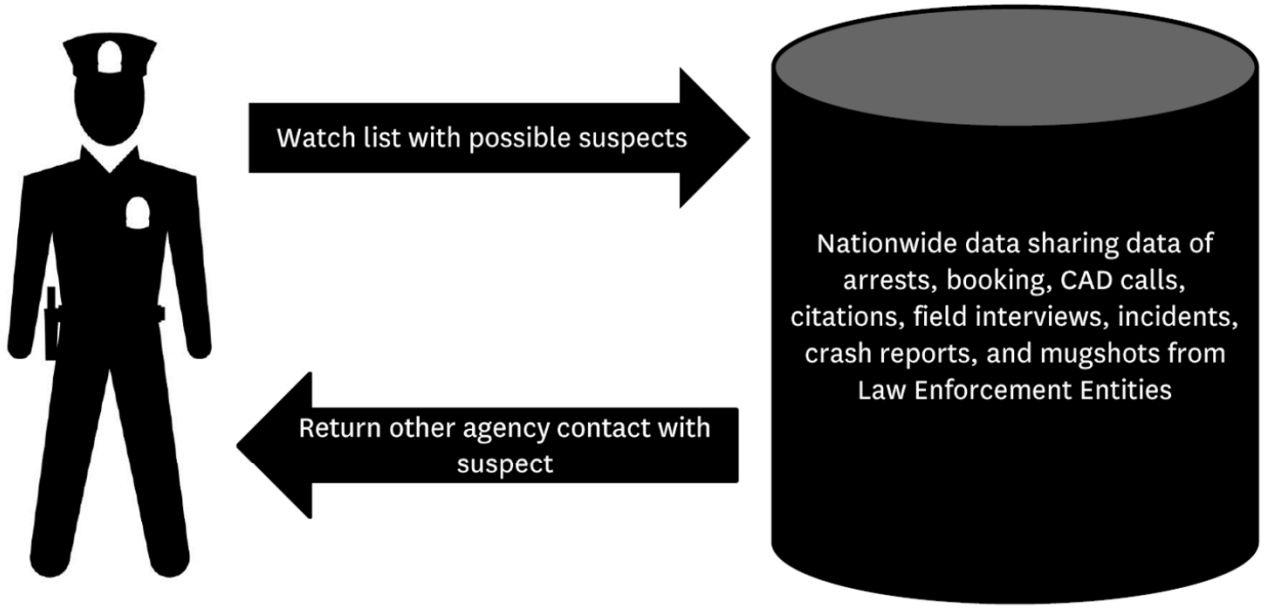
FCIC/NCIC (Florida Crime Information Center/National Crime Information Center)



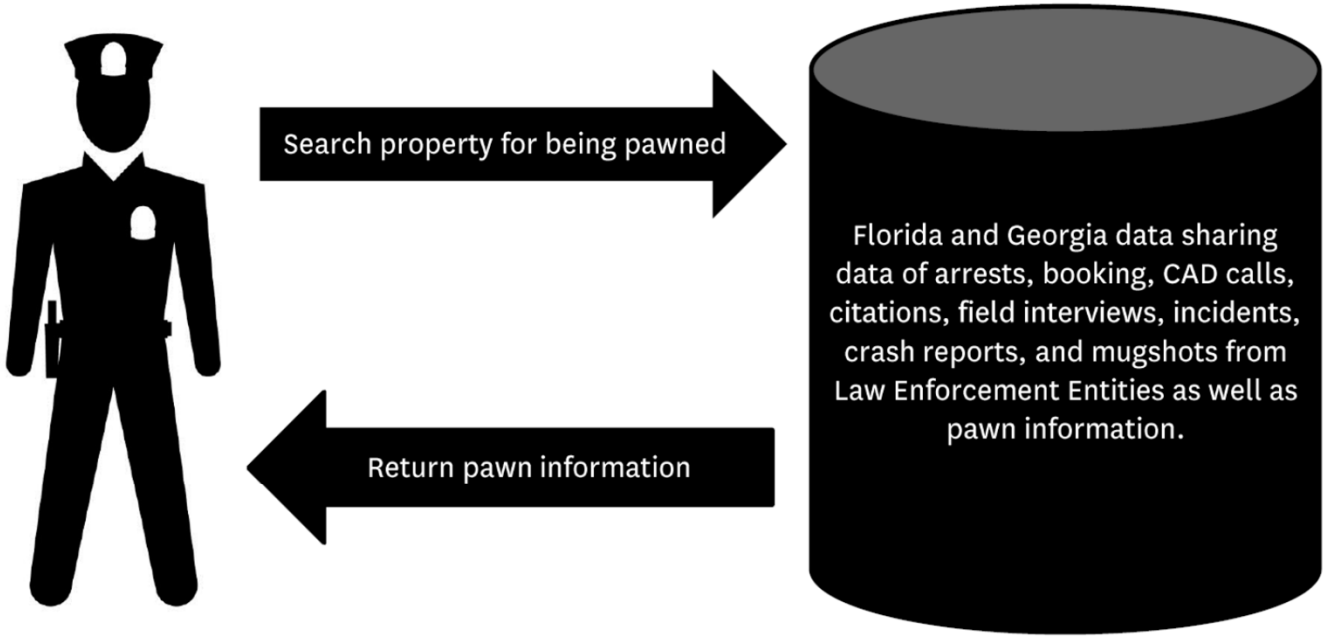
DAVID/DHSMV (Driver and Vehicle Information Database/Dept. of Highway Safety and Motor Veh.)



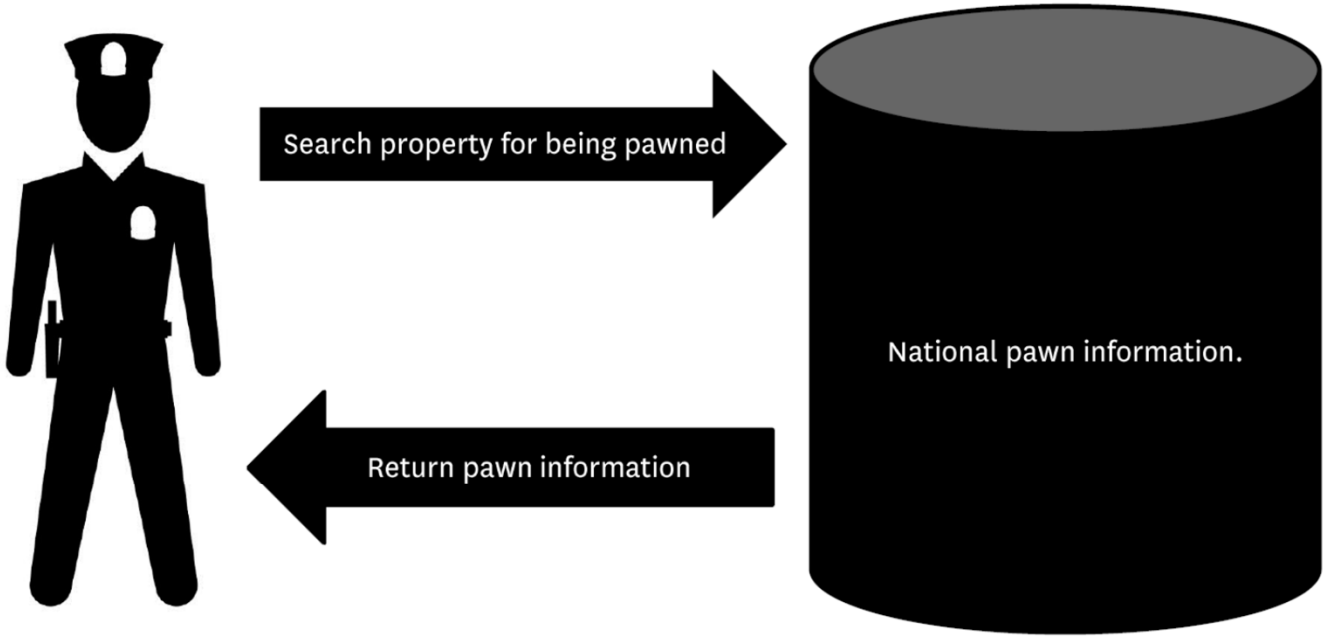
LInX (Law enforcement Information eXchange)



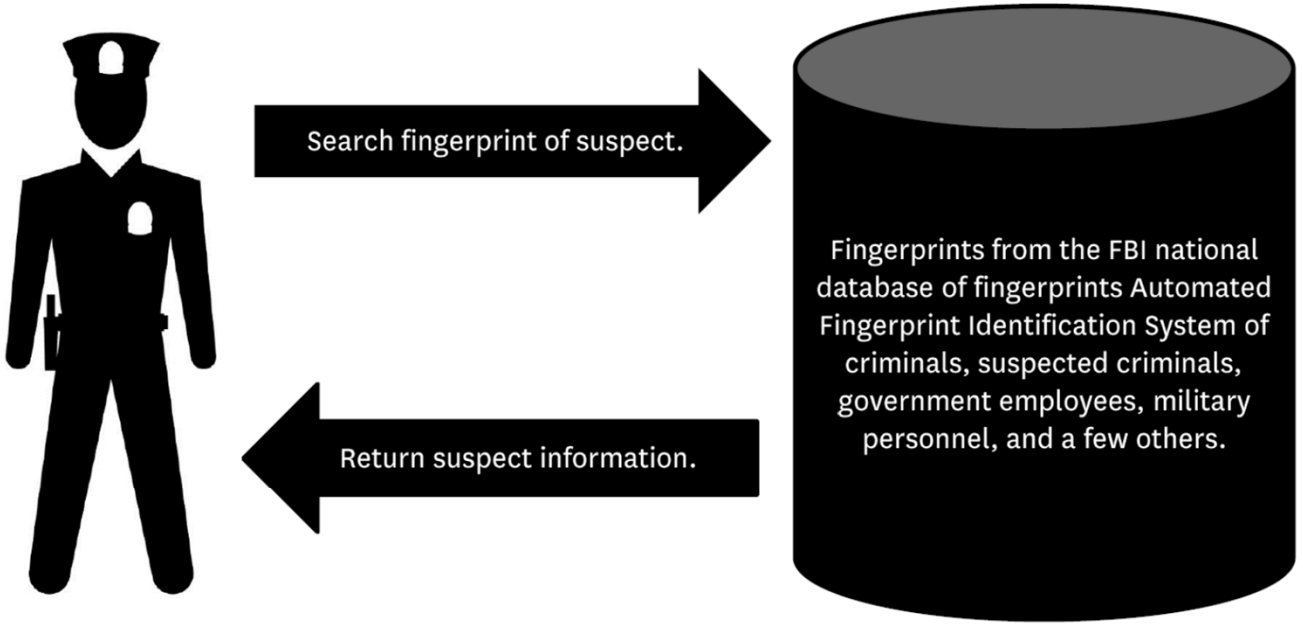
FINDER (Federated Integrated Network for Data Exchange & Retrieval)



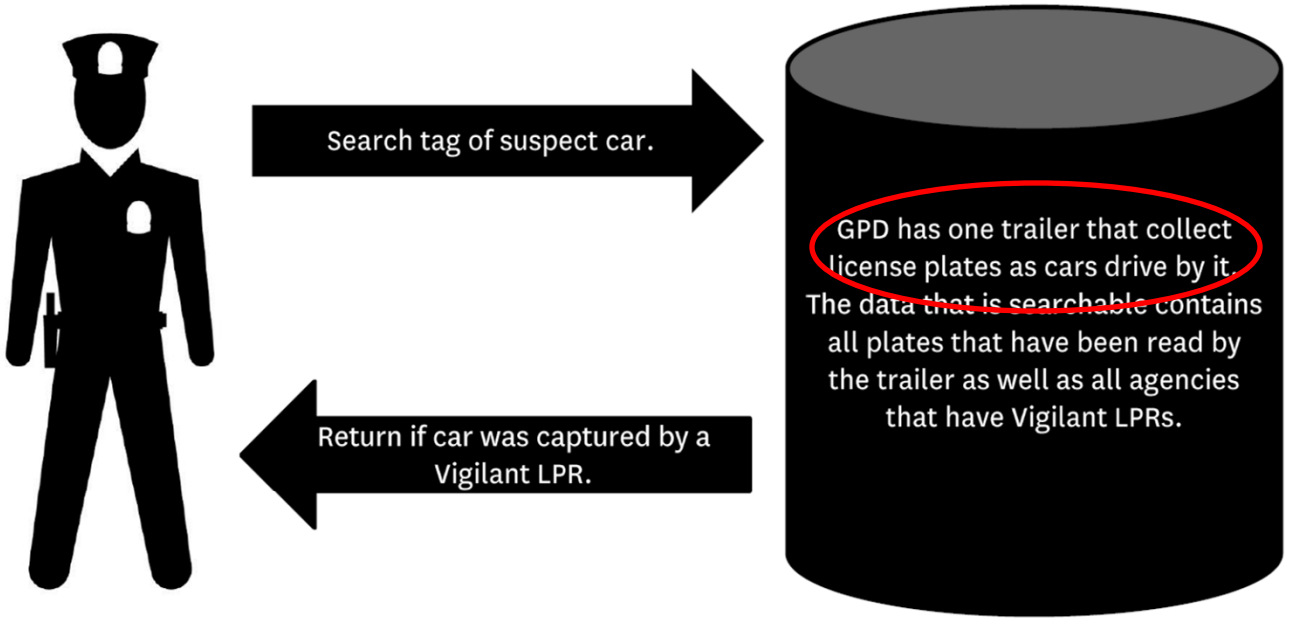
LeadsOnline



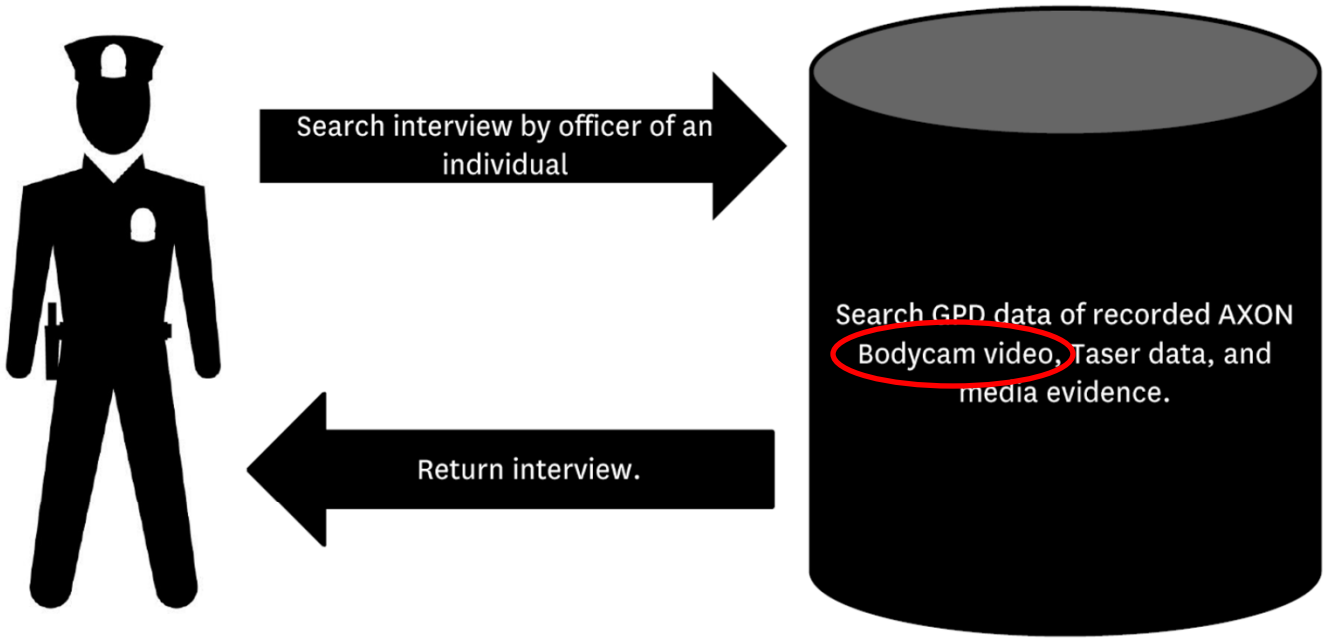
AFIS (Automated Fingerprint Identification System)



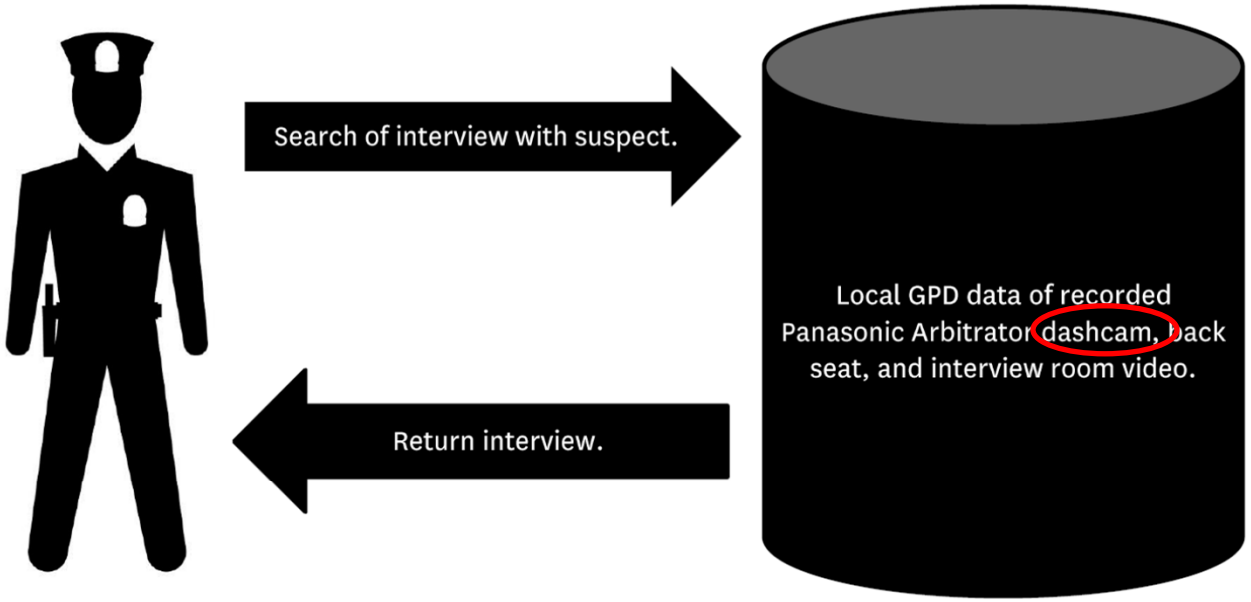
Vigilant LPR (License Plate Reader)



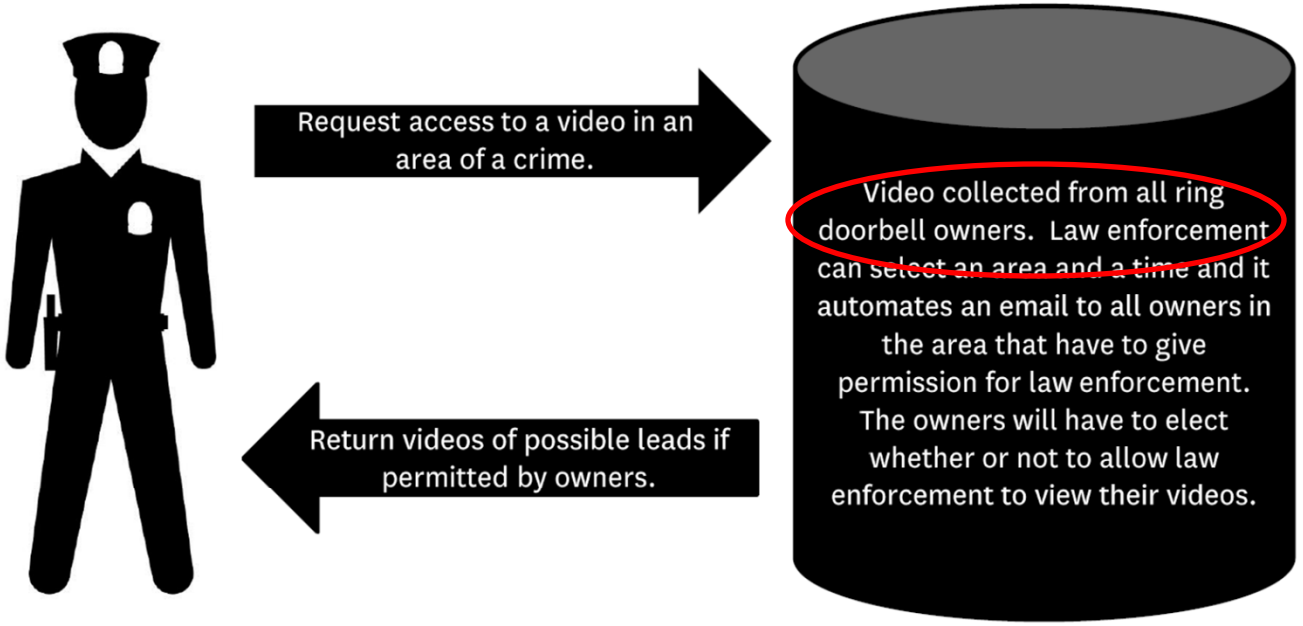
Taser Evidence.com



Panasonic Arbitrator System

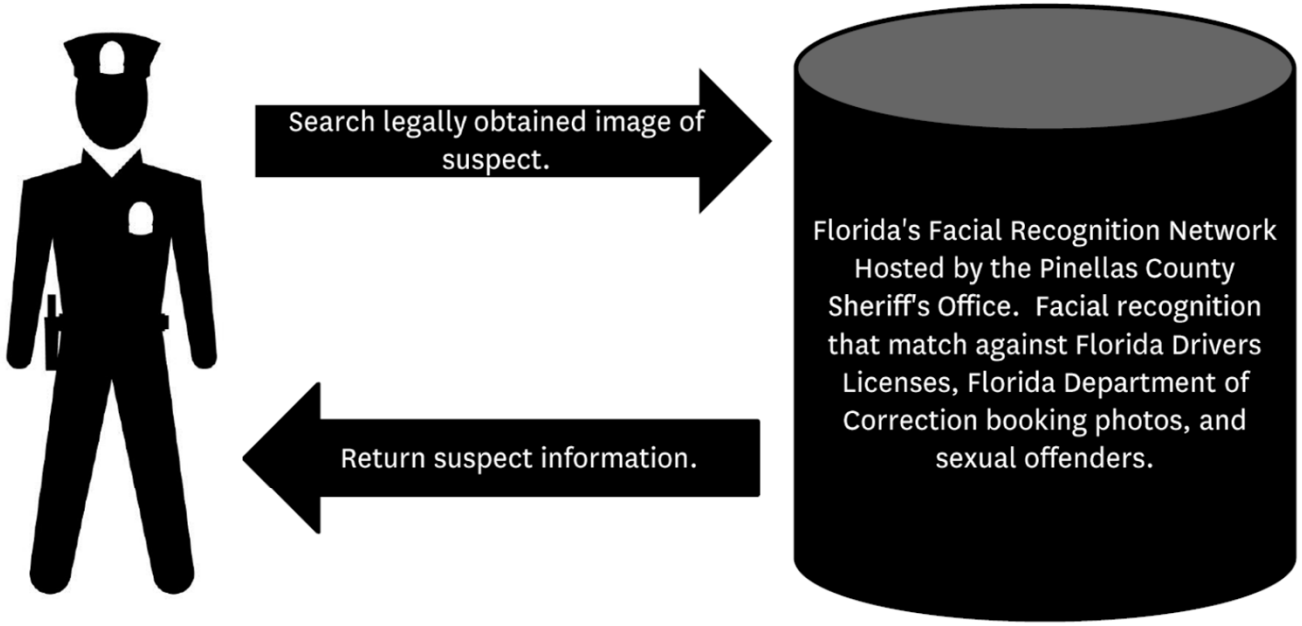


ring Neighborhoods Portal

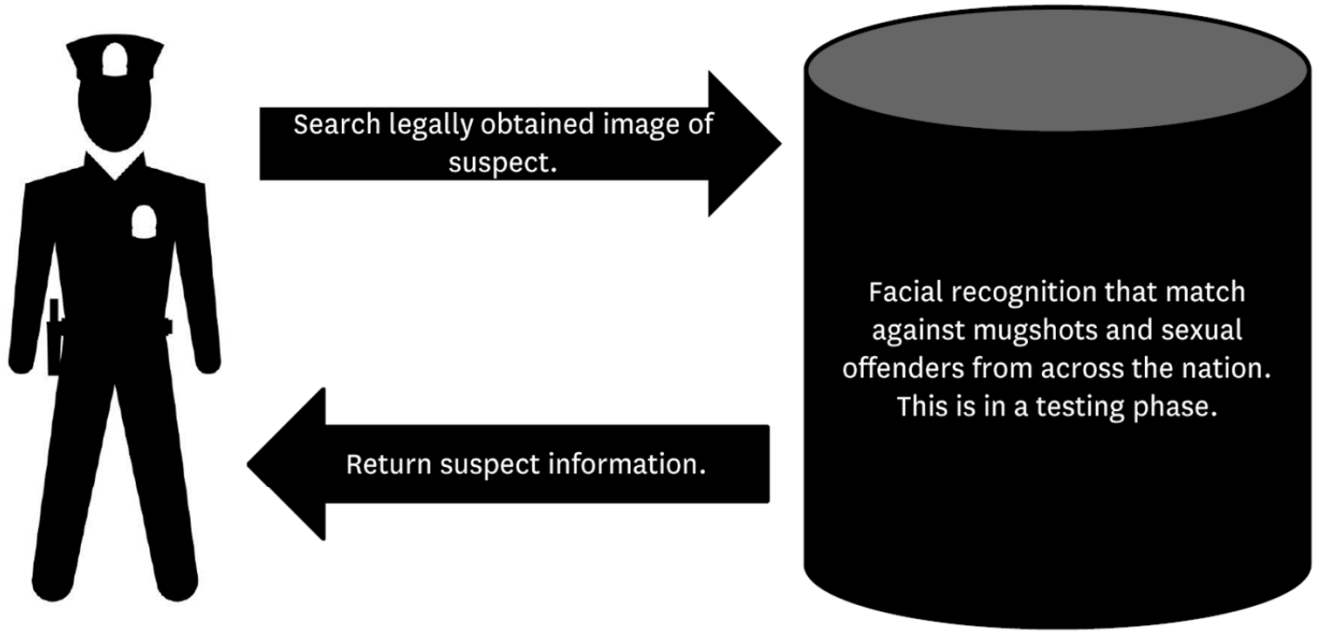


Source: https://support.ring.com/hc/en-us/articles/360031595491-How-Public-Safety-Agencies-Use-Neighbors

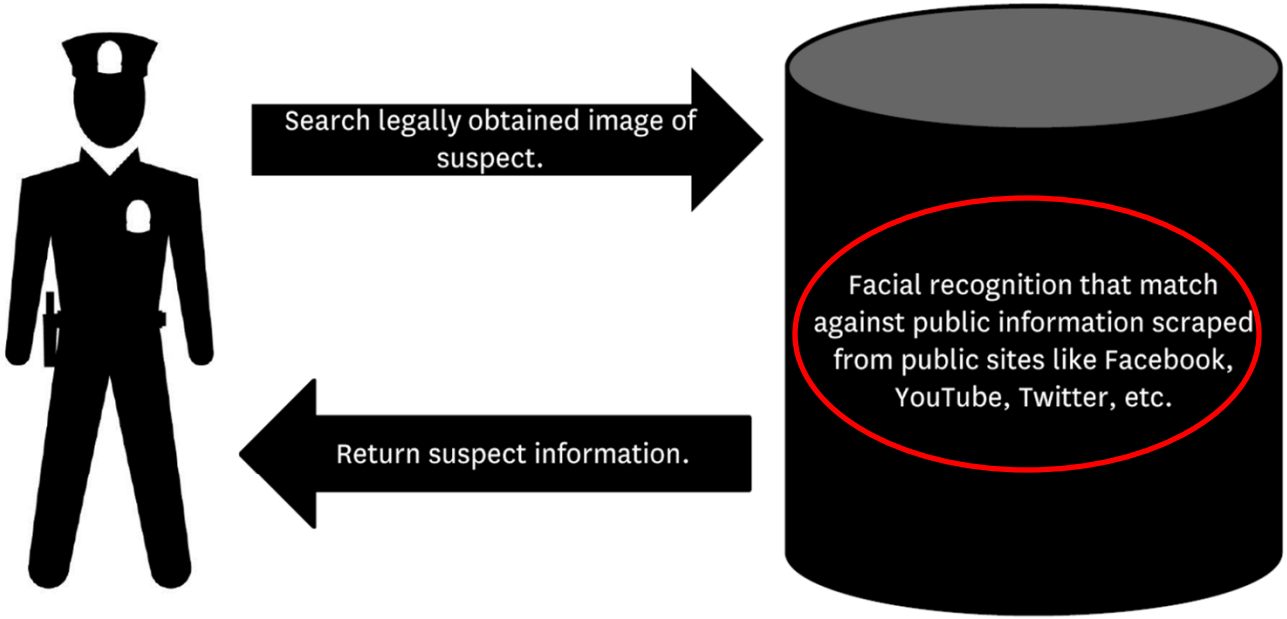
FACES (Face Analysis Comparison & Examination System)



VIGILANT FACESEARCH



ClearviewAI



Successful examples of ClearviewAI by Gainesville Police Department

Countless Retail theft cases solved...Several thousands in losses

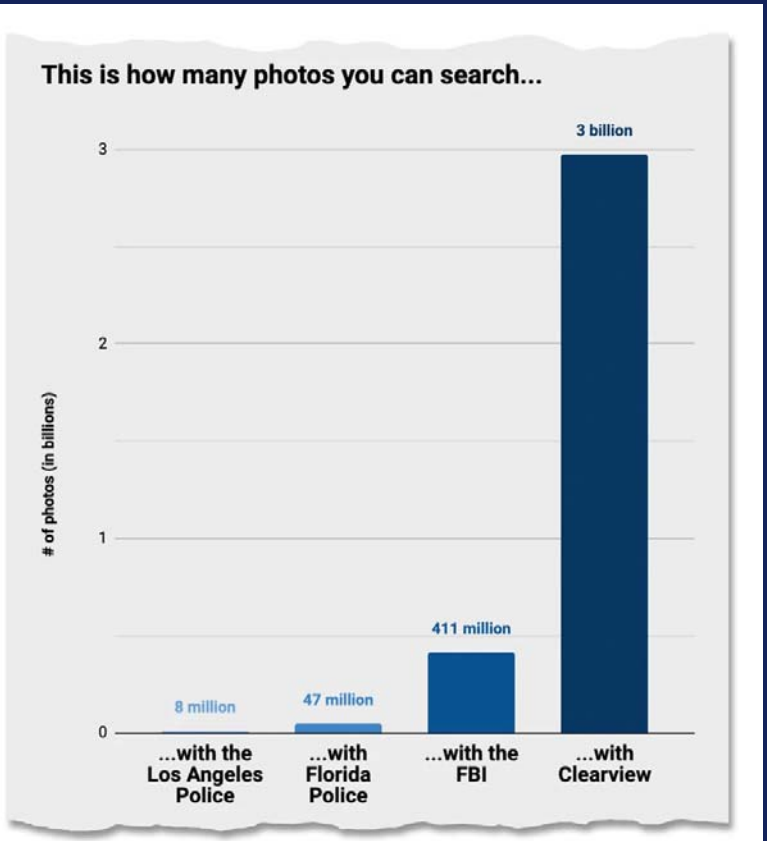
Successful examples of ClearviewAI by Gainesville Police Department

South American Theft Group- Professional Pickpocket who targets Panera Bread customers and uses stolen credit card to purchase gift cards, high end electronics. Eventually located in Illinois. GPD Case Report- 19-009712, 19-12477, 19-13977, 19-13994

Facebook hit on a friends page.

New York Times Article

By Kashmir Hill
Published Jan. 18, 2020
Source: https://www.nytimes.com/2020/01/18/technology/clearview-privacy-facial-recognition.html



A chart from marketing materials that Clearview provided to law enforcement. Credit...Clearview

Source:
https://www.nytimes.com/2020/01/18/technology/clearview-privacy-facial-recognition.html

Detective Sgt. Nick Ferrara in Gainesville, Fla., said he had used Clearview's app to identify dozens of suspects.
Credit...Charlotte Kesl for The New York Times

"…. "With Clearview, you can use photos that aren't perfect," Sergeant Ferrara said. "A person can be wearing a hat or glasses, or it can be a profile shot or partial view of their face."

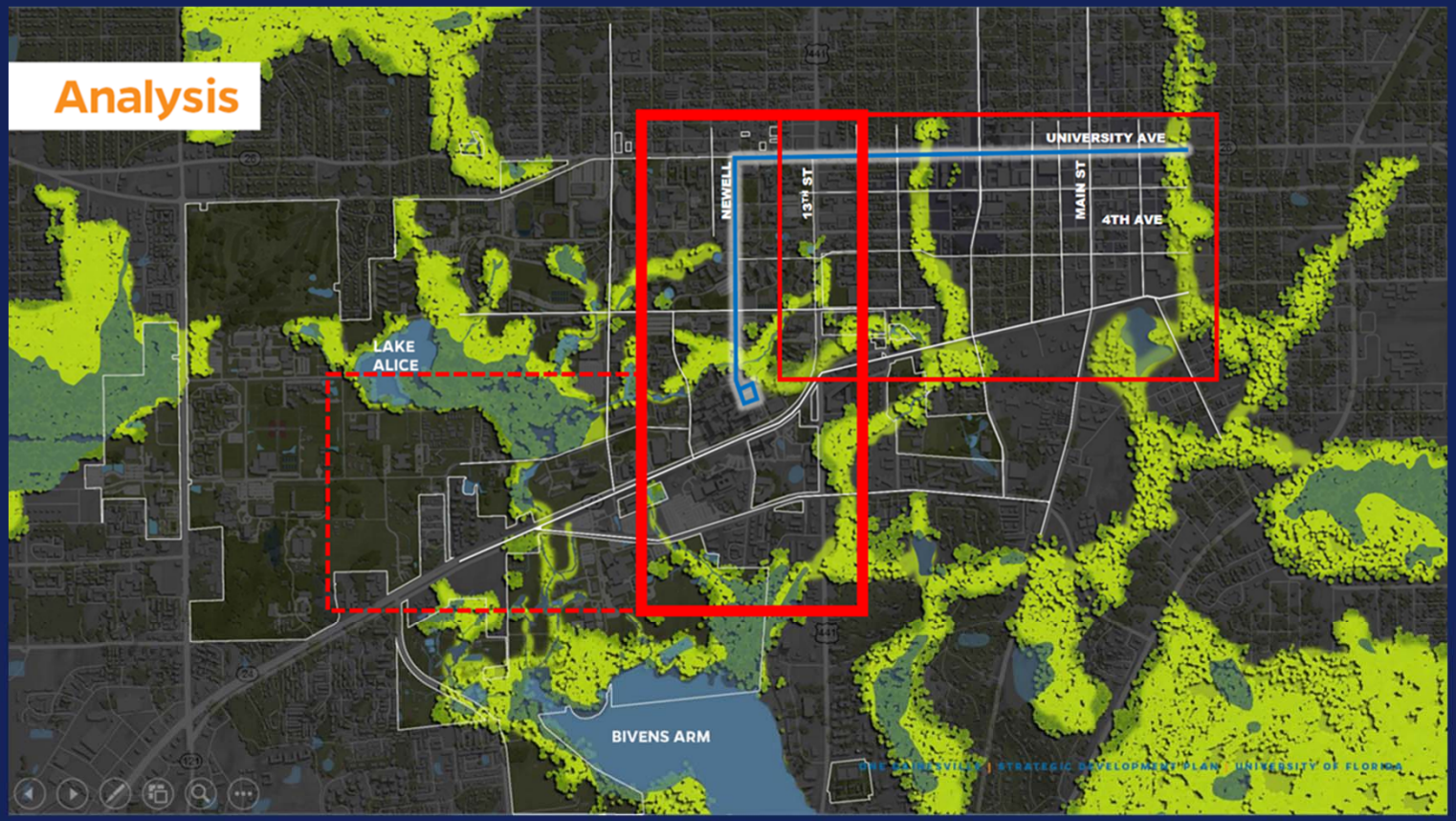
He uploaded his own photo to the system, and it brought up his Venmo page. He ran photos from old, dead-end cases and identified more than 30 suspects.

In September, the Gainesville Police Department paid $10,000 for an annual Clearview license…."

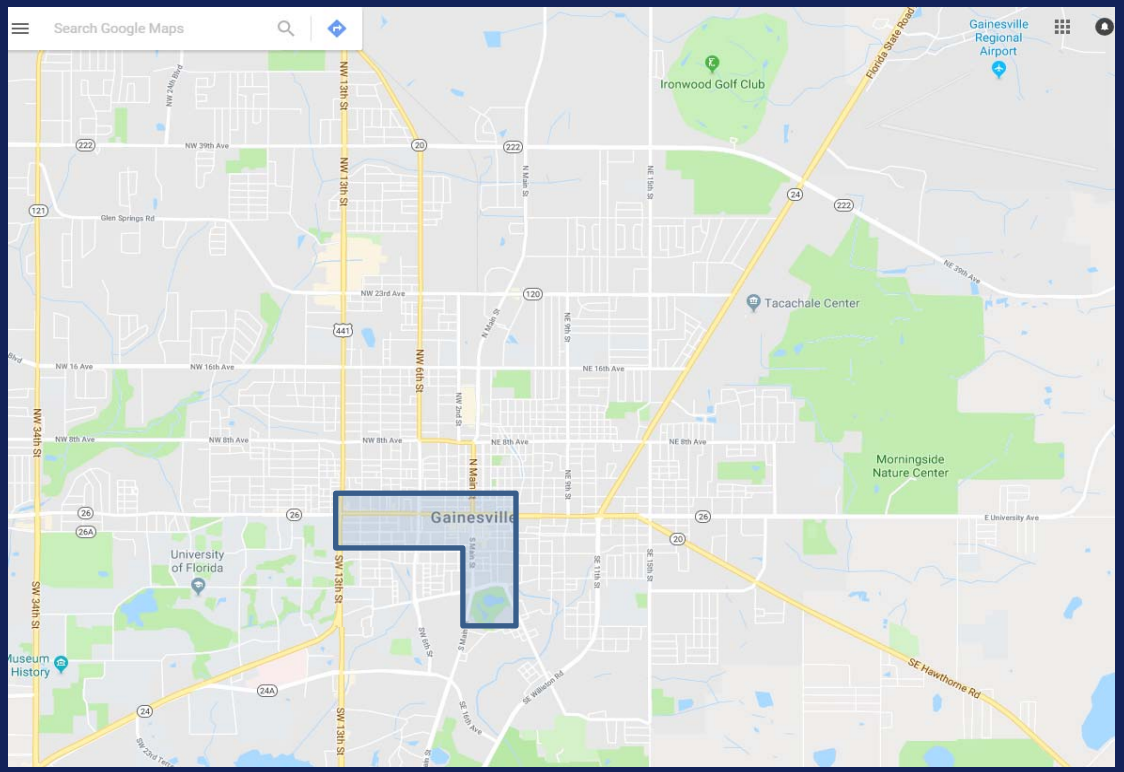
IOT Considerations

- Privacy
- How is the data secured
- Who owns the data
- How used / shared
- Legality

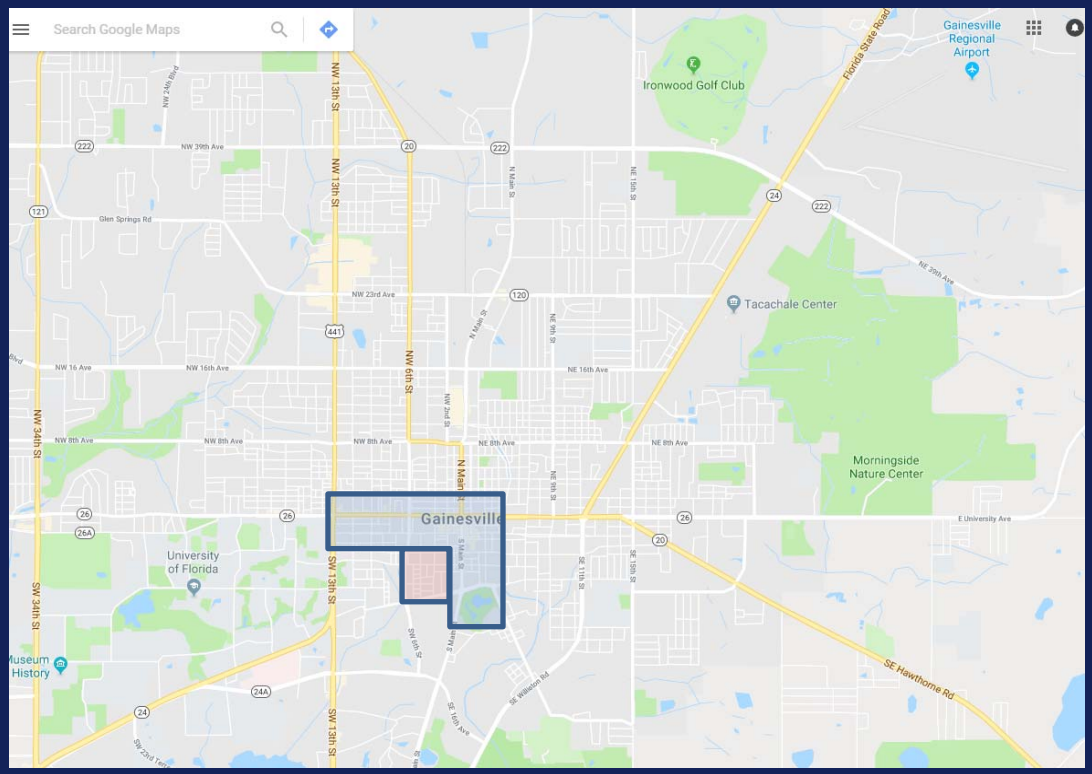
Gainesville A Smart City


Analysis
UNIVERSITY AVE
NEWELL
13TH ST
MAIN ST
4TH AVE
LAKE ALICE
BIVENS ARM

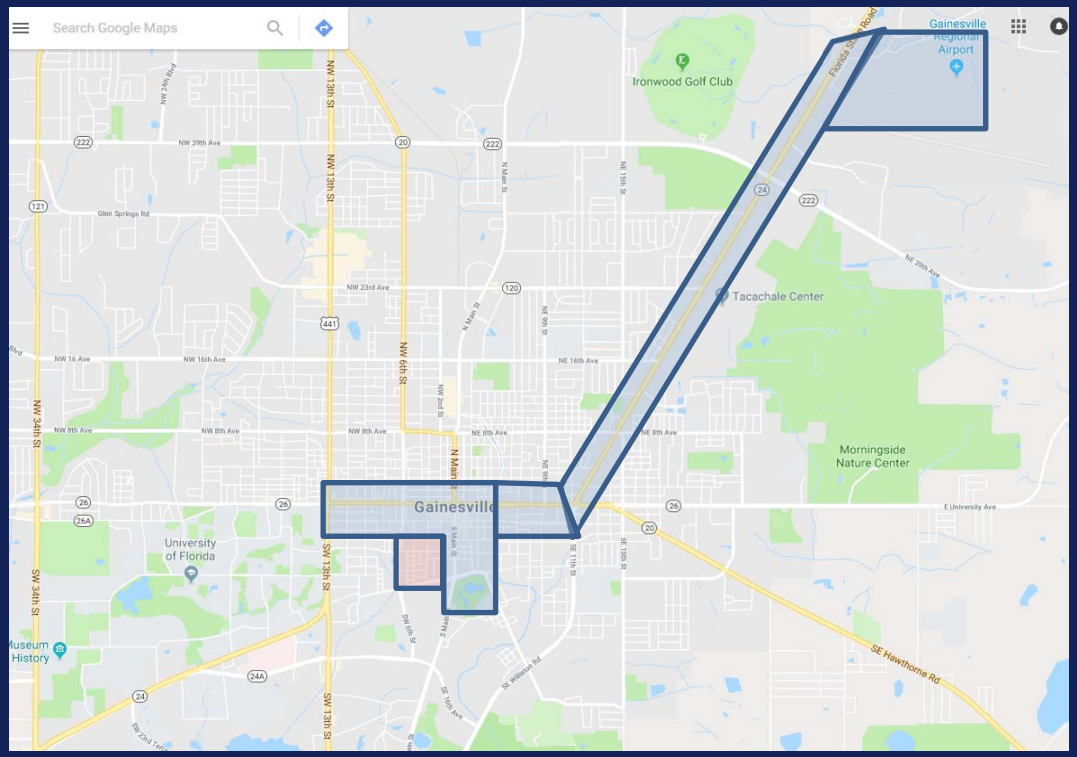
Gainesville Connect Phase 1



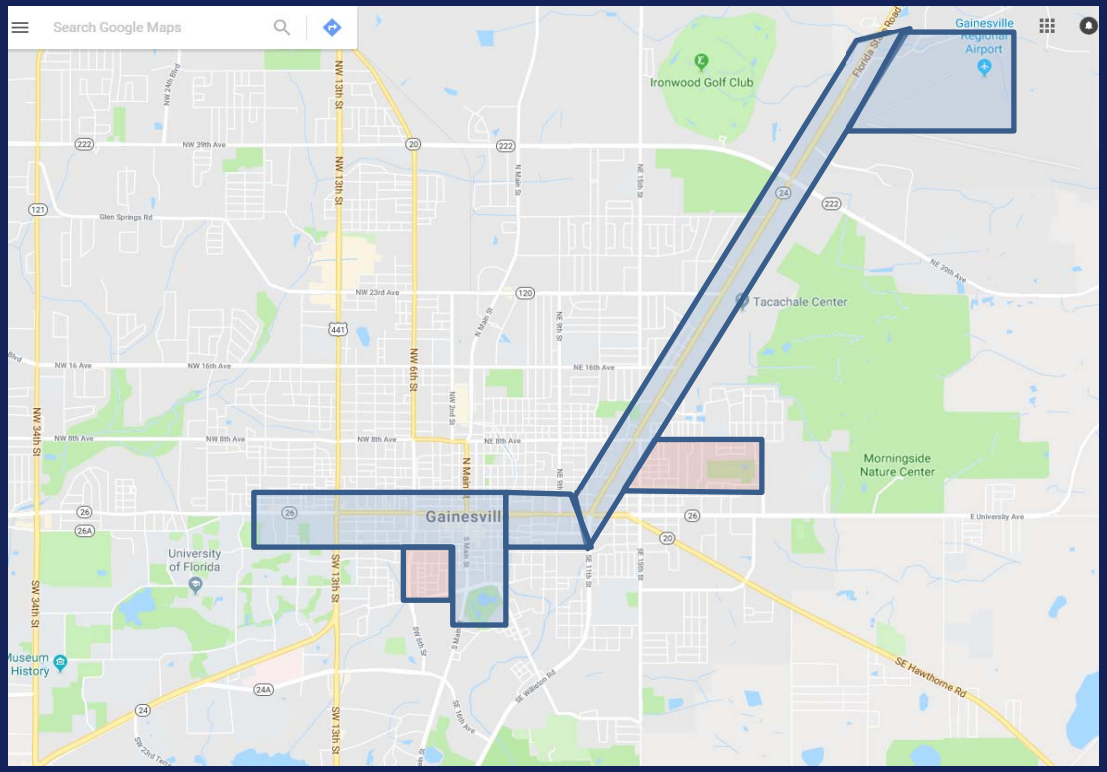
Gainesville Connect Phase 1 & Community Benefit Zone



Gainesville Connect Phase 2



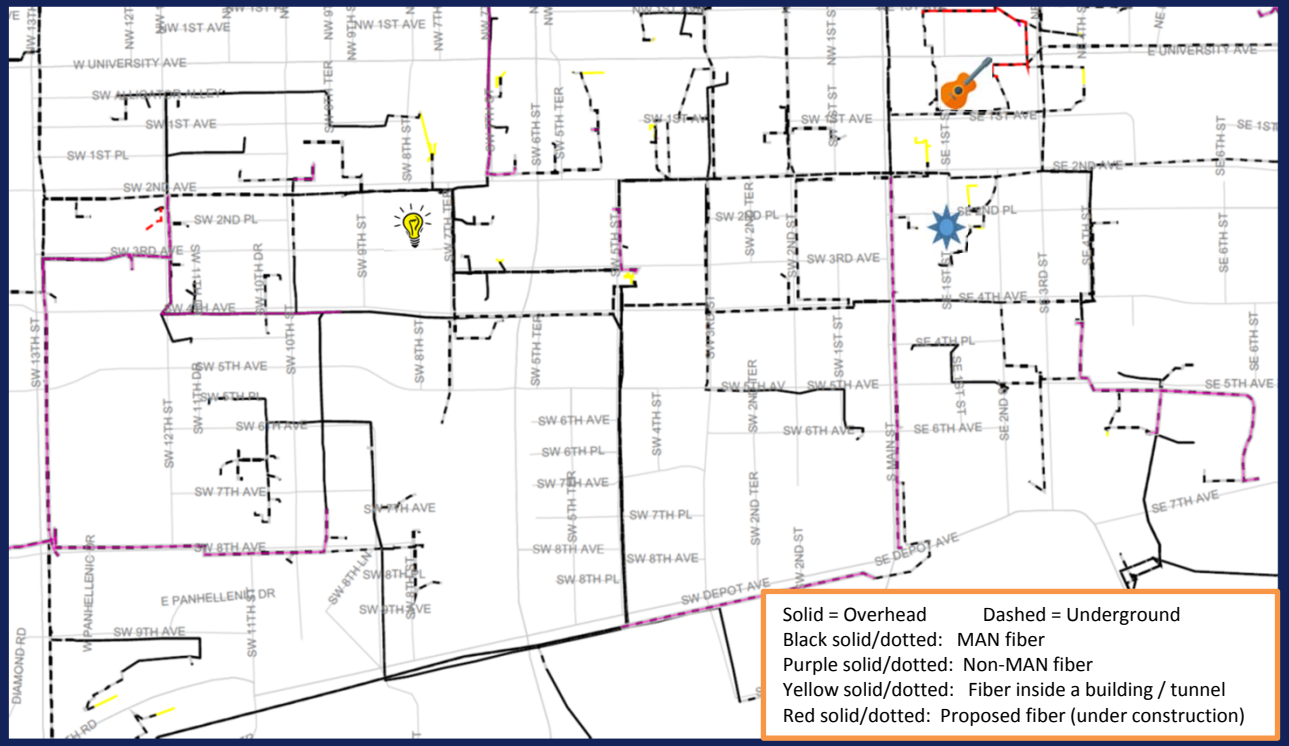
Gainesville Connect Phase 2 & Community Benefit Zone



MOU Development

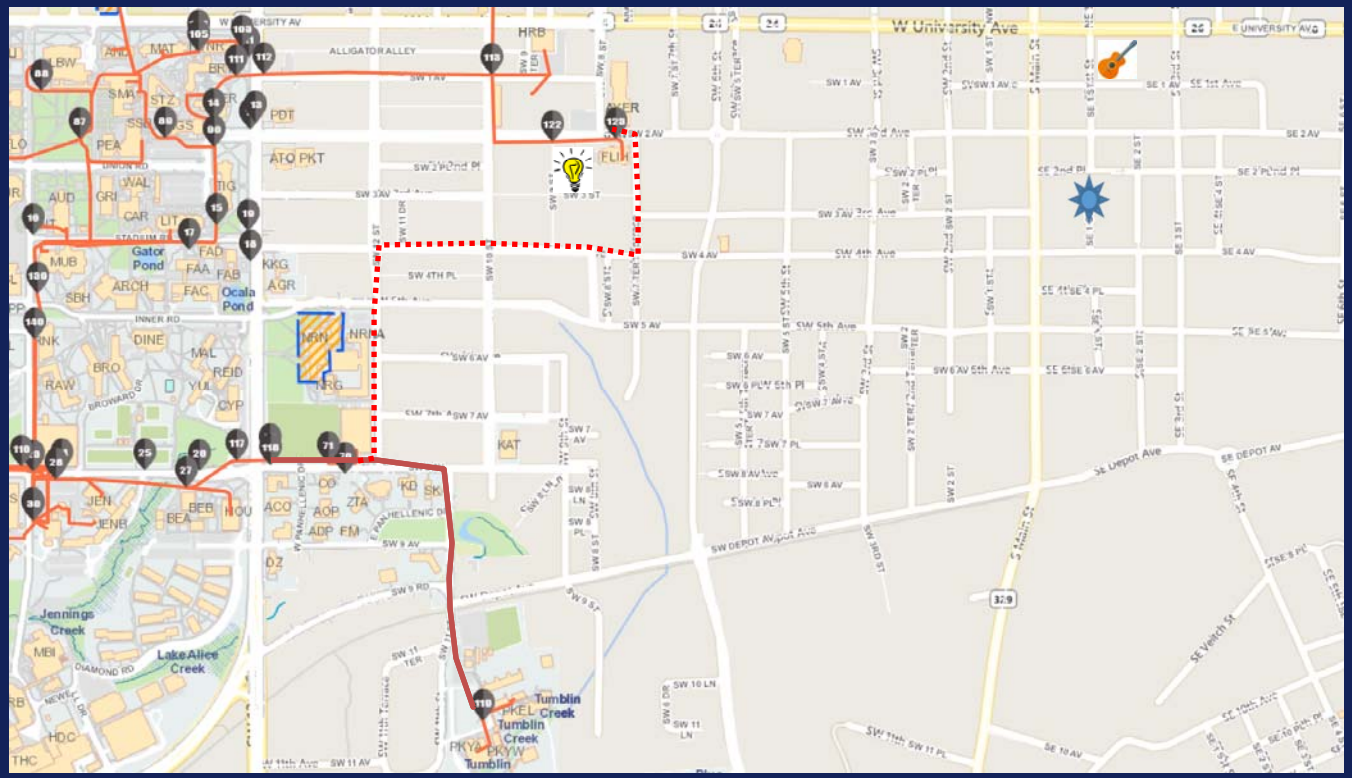
- Review of Current Service Footprint
- Infrastructure Overlay
- Smart City Lighting Project Overview
- Next Steps

Current Services - City

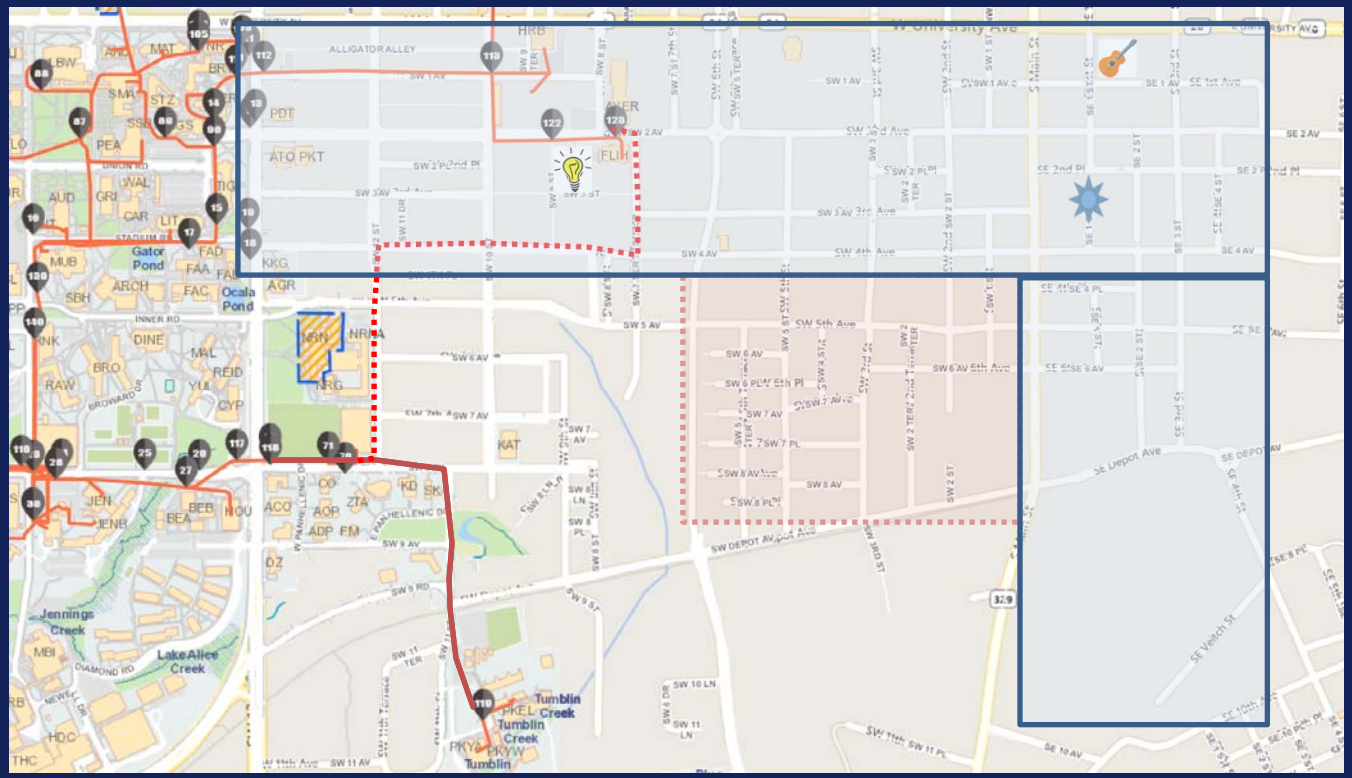


Solid = Overhead Dashed = Underground
Black solid/dotted: MAN fiber
Purple solid/dotted: Non-MAN fiber
Yellow solid/dotted: Fiber inside a building / tunnel
Red solid/dotted: Proposed fiber (under construction)

Current Services - UF


W University Ave
ALLIGATOR ALLEY
Gator Pond
Ocala Pond
Jennings Creek
Lake Alice Creek
Tumblin Creek
St Depot Ave
SW DEPOT AV
SW 4TH PL
SW 5 AV
SW 6 AV
SW 7 AV
SW 9 AV
SW 9 RD
SW 9 ST
SW 11 AV
SW 11 TER
SW 11 LN
SW 10 LN
SW 11 PL
SW 11th
SE 10 AV
SE 1st Ave
SE 2 AV
SE 4 AV
SE 5 AV
SE DEPOT AV
SE Veitch St
SW 1 AV
SW 2 AV
SW 3 AV
SW 4th Ave
SW 5th Ave
SW 6 AV 6th Ave
SW 7 PL
SW 8 AV Ave
SW 8 PL
SW 6 PL 5th PL
SE 11 SE 4 PL
SE 6 SE 6 AV
SW 2 PL PL
SE 2nd PL
SW 3 AV 3rd Ave
SW 2 PL Ave
SE 2 PL PL
SE 2 ST
SE 4 ST
SW 1 ST
SW 2 ST
SW 5 ST
SW 7 TER
SW 10 DR
SW 11 DR
SW 2nd PL
SW 2nd SW 2 ST
SW 1 ST SW 1 AV
SW 2 TER
SW 3 ST
SW 5 ST SW 5th Ave
SW 7 AV
SW 7 AV PL
SW 7th
SW 7th Ave
SW 7th Ct
SW 7th Terrace
SW 8 LN
SW 8 PL
SW 8 ST
SW 9 ST
SW 9 TER
SW 11 TER
SW 11 LN
SW 11th Ave
SW 11th Terrace
SW 2 TER 2nd TERRACE
SW 5 ST SW 5th Ave
SW 6 AV 6th Ave
SW 7 TER 2nd TERRACE
SW 8 AV Ave
SW 8 PL
SW 6 PL 5th PL
SW 7 AV PL

Current Services – Connected City Overlay



MOU Elements

University of Florida

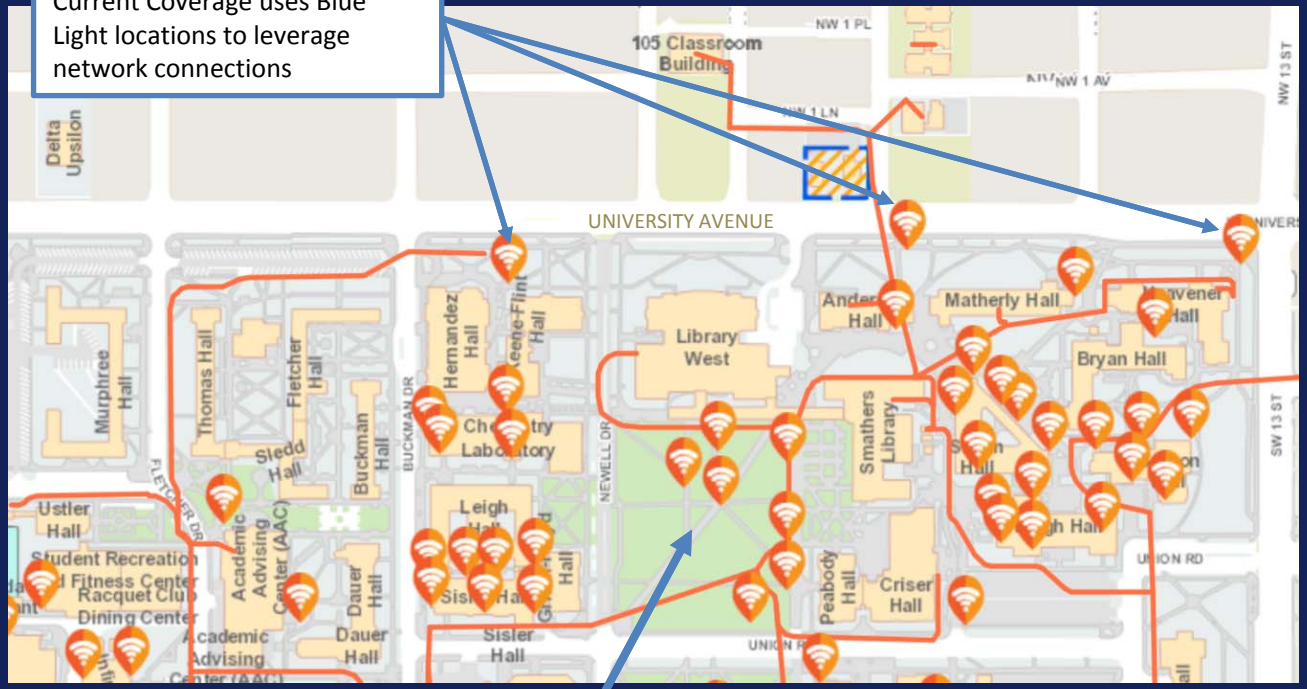
- Networking equipment: routers, switches, controllers
- Access points
- SSID: **Eduroam** **City assigned**
- Monitoring and maintenance
- Security

City of Gainesville

- Conduit pathways
- Fiber & Cabling
- Equipment mounting
- Power
- Installation access and coordination

Outdoor Wireless Coverage

Outdoor Access Points: Current Coverage uses Blue Light locations to leverage network connections



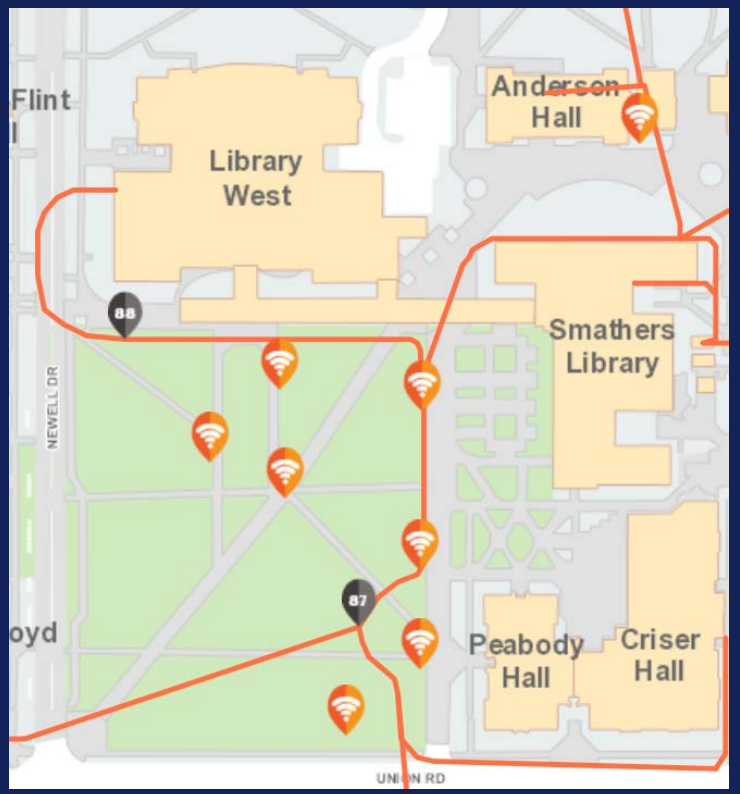
Plaza of the Americas

Outdoor Wireless Coverage

Currently Use Blue Light Locations for Outdoor Access Point Installations

Outdoor Wireless Coverage

Plaza of the Americas



Outdoor Wireless Coverage

Plaza of the Americas

Outdoor Wireless Coverage

Plaza of the Americas

Outdoor Wireless Coverage

Wireless Access Points
& RF Mesh

Outdoor Wireless Coverage

Wireless Mesh Antennas

Next Steps

Next Steps

- Proof of Concept
- Design
- Support Model(s)
- Budget Estimates
- Schedule

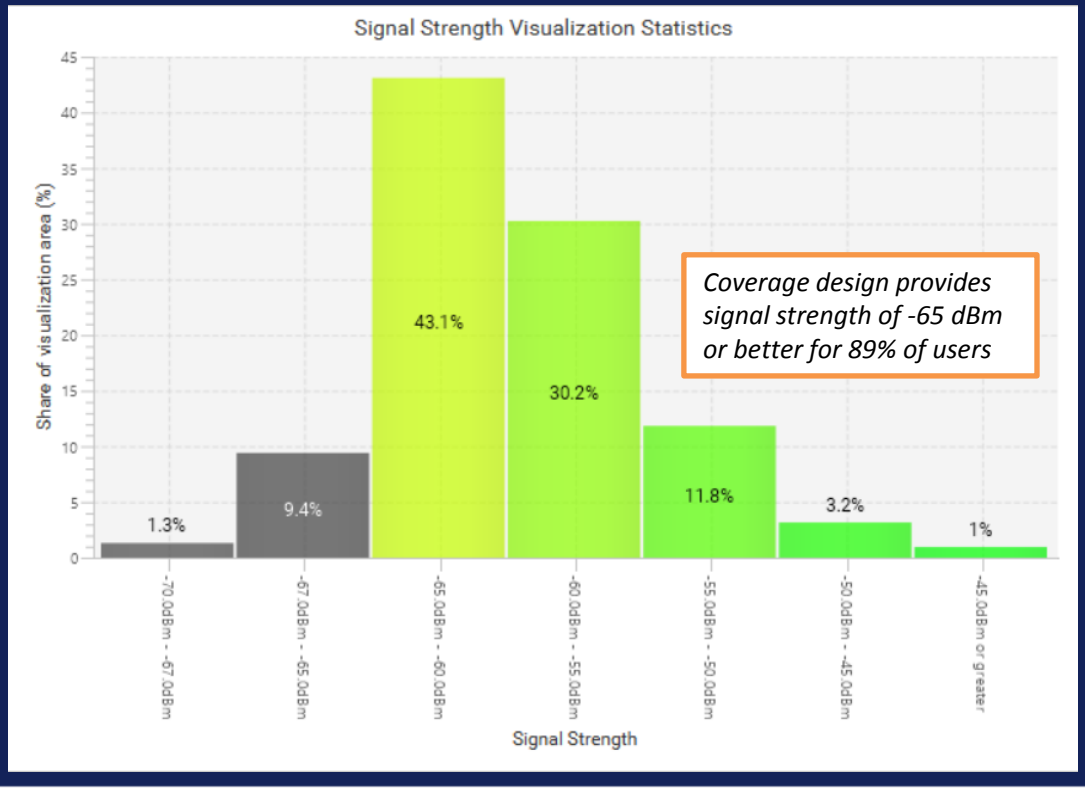
Project Overview

- Proposed wireless design:
  - University Avenue to 13th Street (Extending outdoor coverage)
  - SW 13th Street to Museum Road (Extending outdoor coverage)
  - Union Road / SW 2nd Avenue to Innovation Square (Proof of Concept)
- Budget Estimates
- Schedule

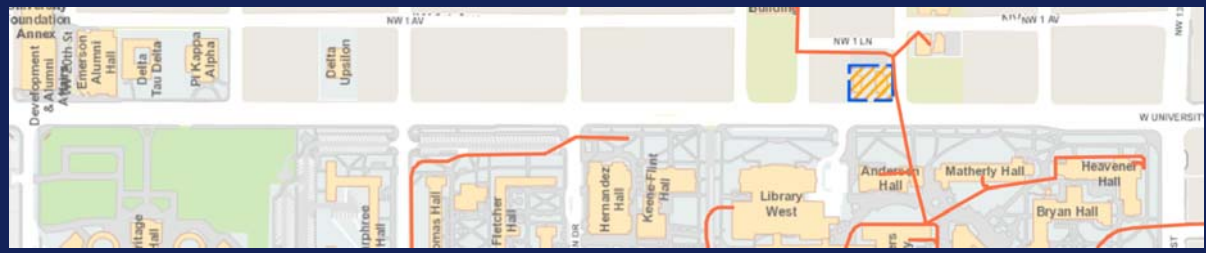
Wireless Survey

Wireless Design

Wireless Design



Wireless Design



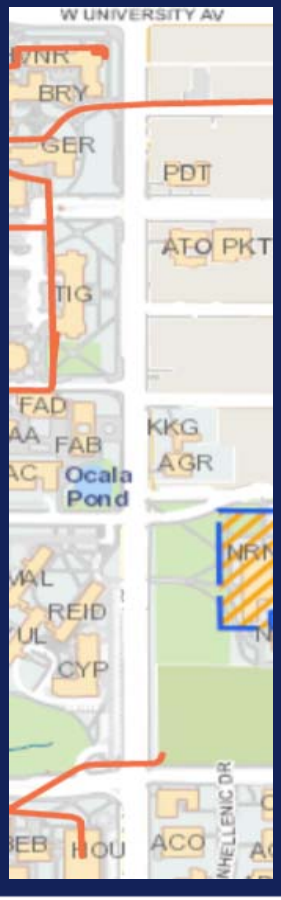
Wireless Design

University Avenue coverage proposed wireless design = 14 Access Point Locations

Wireless Design

SW 13th Street to Museum Road proposed wireless design =

12 Access Point Locations



Wireless Design

Smart City Pilot Project: Union Road / SW 2nd Avenue to SW 6th Street = 10 Access Point Locations

Wireless Budget Estimate

Area	AP Quantity	Cost / AP	Total
University Avenue	14	$5,650	$79,100
SW 13th Street	12	$5,650	$67,800
Pilot Project / 2nd Avenue	10	Electronics Only	$50,100
		Total Project Investment:	$197,000

Wireless Cost Estimate

Outdoor Wireless Access Point Estimate				
Description	**P/N**	**Cost**	**QTY**	**Extended Cost**
Material:				
Access Point		$ 1,200.00	1	$ 1,200.00
External Antenna		$ 235.00	2	$ 470.00
Pole Mounting Kit		$ 70.00	1	$ 70.00
Power Adaptor		$ 170.00	1	$ 170.00
Cable Adaptors		$ 60.00	1	$ 60.00
POE Extender		$ 175.00	1	$ 180.00
			Material Subtotal:	**$ 2,150.00**
Installation:				
Conduit / Pathway	Lot	$ 2,000.00	1	$ 2,000.00
Fiber & Cabling	Lot	$ 1,000.00	1	$ 1,000.00
Enclosure / Pole Install	Lot	$ 500.00	1	$ 500.00
			Installation Subtotal:	**$ 3,500.00**
			Total Estimate per Access Point:	**$ 5,650.00**

*UF Furnished and Installed Estimate

Proposed Schedule

- January 2019:
  - Finalize design
  - Secure quotes and confirm budget
  - Order materials
- February – April 2019
  - Build: University Avenue Outdoor Wireless Expansion
  - Build: SW 13th Street Outdoor Wireless Expansion
- May 1, 2019
  - On-Air
  - Optimization and Network Segmentation

Project Assumptions

- UF provided access points served by network locations from campus buildings
- Sufficient power source readily available for use of DC power supplies and/or POE extenders
- Weather, building permits, UF inspections, material acquisition do not delay schedule significantly

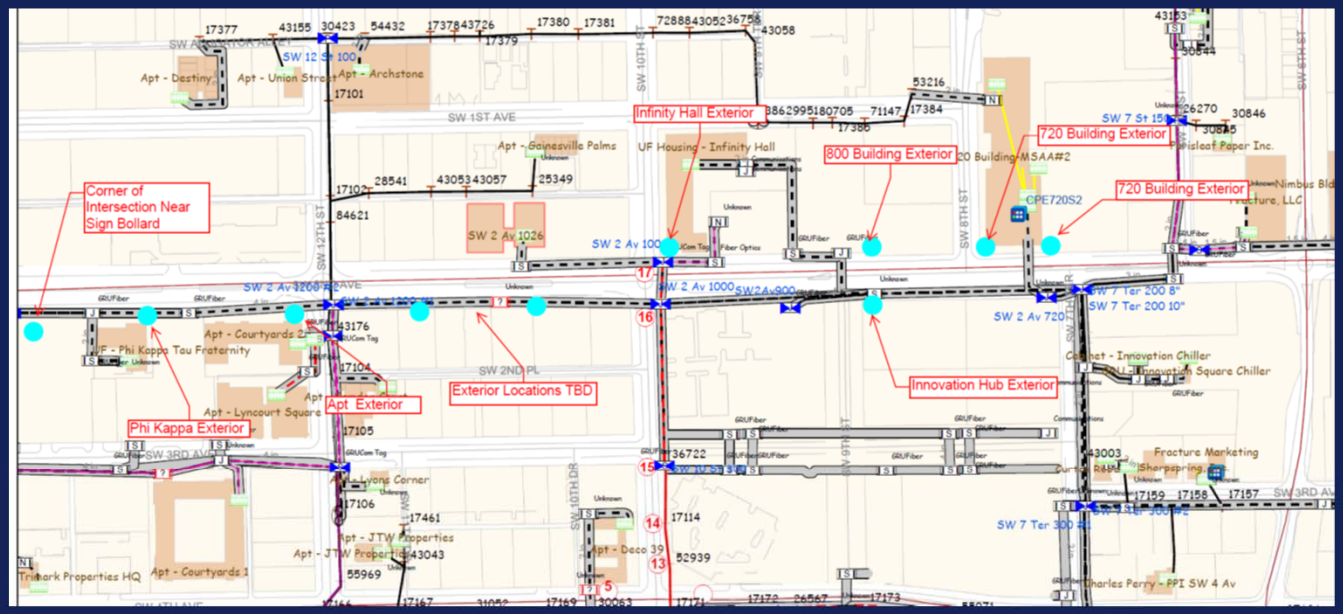
Next Steps

- Notice to Proceed
- PPM Project Creation
- Finalize Design
- Quotes for UF Install
- Coordinate AP Placement with Facilities Services
- Finalize Schedule
- Execute

Wireless Design

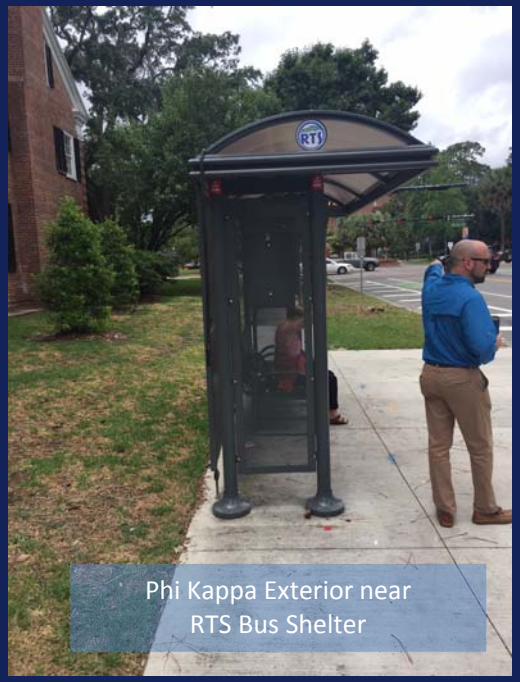
Smart City Pilot Project: Union Road / SW 2nd Avenue to SW 6th Street = 10 Access Point Locations

Wireless Design



Wireless AP Locations

Sign Bollard Near Intersection of SW 13th ST and SW 2nd AVE



Phi Kappa Exterior near RTS Bus Shelter

Wireless AP Locations

Along 1000 Block of SW 2nd AVE
Location TBD

Along 1000 Block of SW 2nd AVE
Location TBD

Wireless AP Locations

Infinity Hall
Exterior AP Mounting

800 Gateway Building
Exterior AP Mounting

Wireless AP Locations

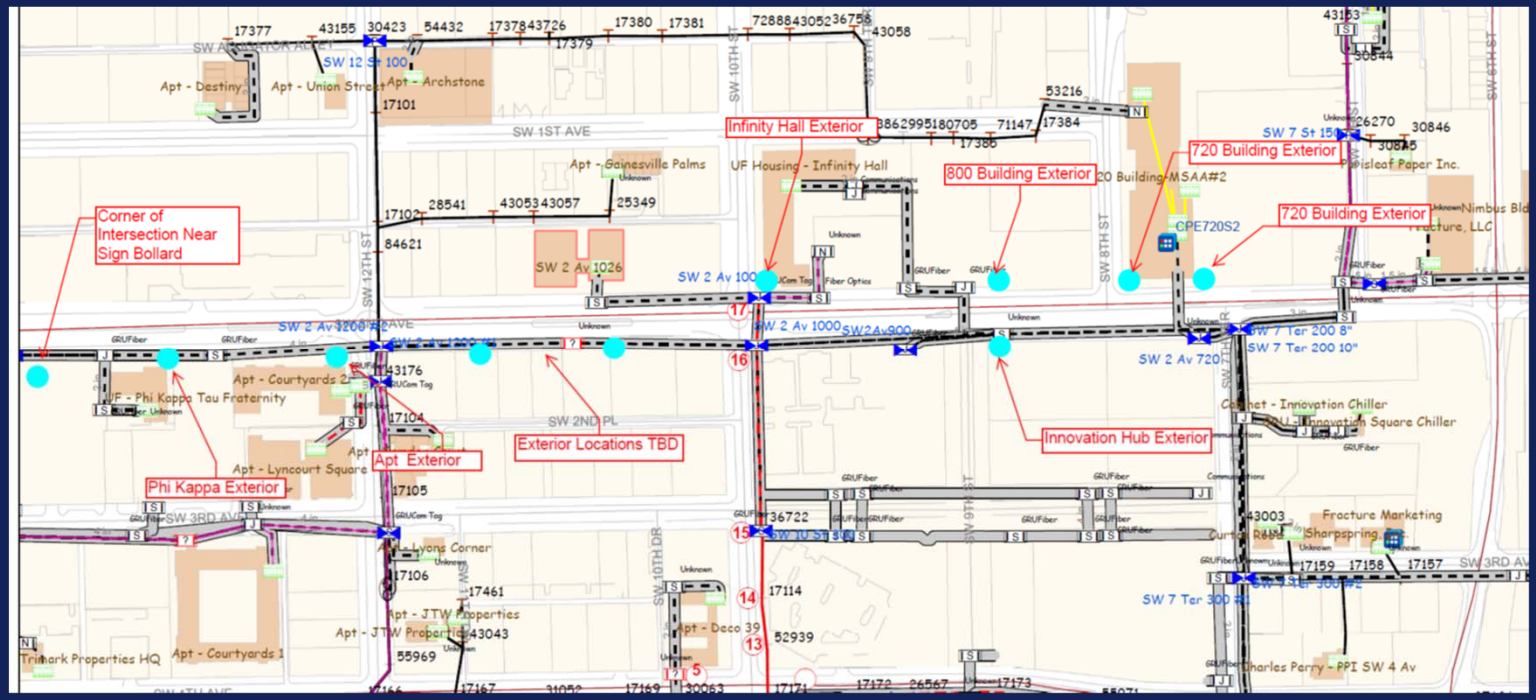
720 Building
Two Exterior APs

Wireless Cost Estimate

Outdoor Wireless Access Point Estimate				
SW 2ND AVE LOCATIONS				
Description	**P/N**	**Cost**	**QTY**	**Extended Cost**
Material:				
Electronics Estimate	Lot	$ 50,100.00	1	$ 50,100.00
			Material Subtotal:	**$ 50,100.00**
Installation:				
Conduit / Pathway	Lot	$ 2,000.00	10	$ 20,000.00
Fiber & Cabling	Lot	$ 1,000.00	10	$ 10,000.00
Enclosure / Pole Install	Lot	$ 500.00	10	$ 5,000.00
			Installation Subtotal:	**$ 35,000.00**
			Total Estimate:	**$ 85,100.00**

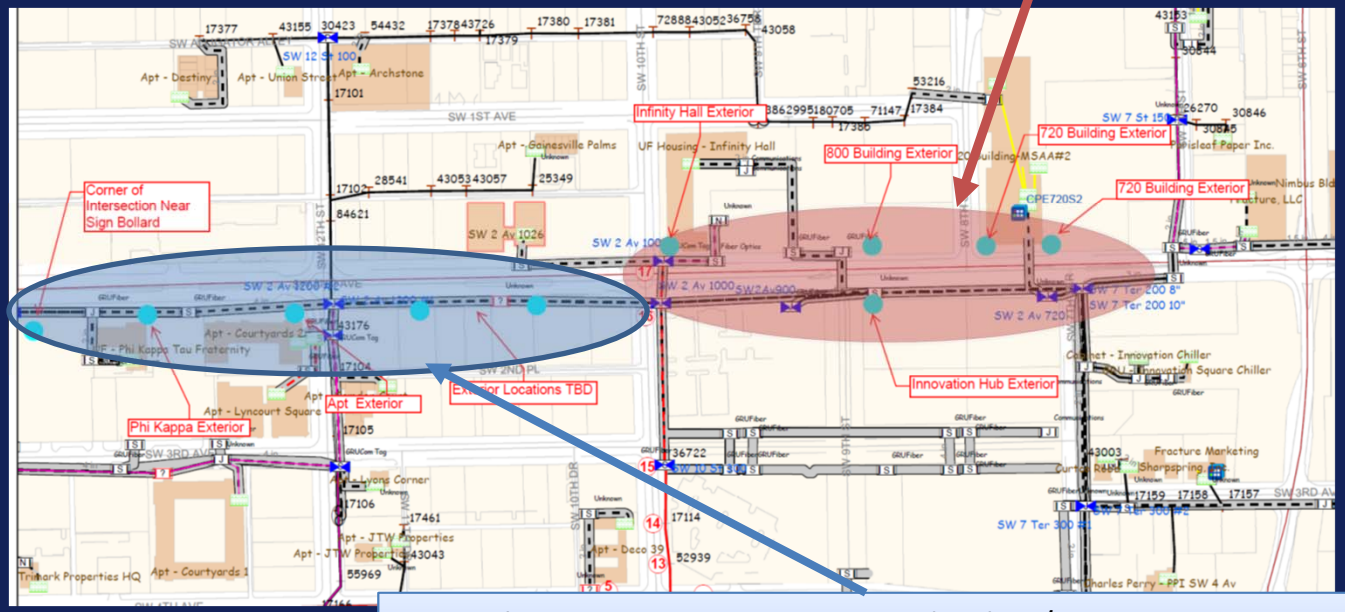
SW 2nd Avenue

Proposed Access Point Locations



SW 2nd Avenue

Install Access Points extended from UF Building Locations
Installation Work in Process



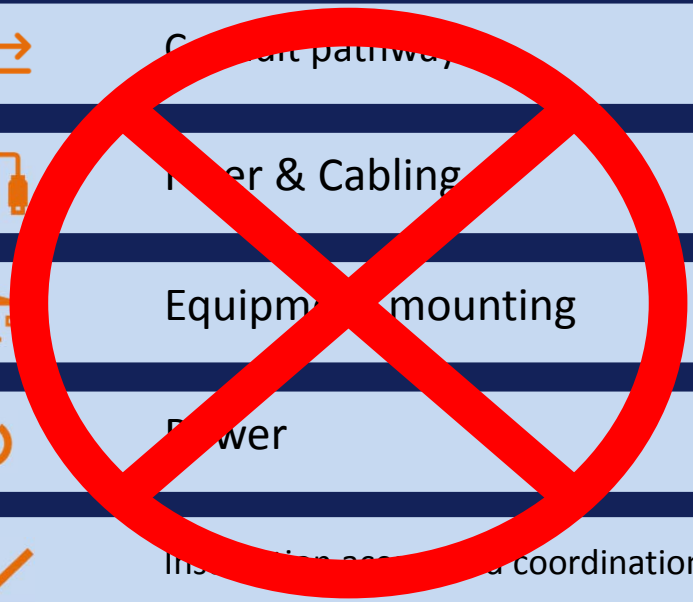
Original intent was to use city owned utility /communications infrastructure for pathway. City now investigating alternatives including Cable provider.

MOU Elements

University of Florida

- Networking equipment: routers, switches, controllers
- Access points
- SSID: **Eduroam** **City assigned**
- Monitoring and maintenance
- Security

City of Gainesville

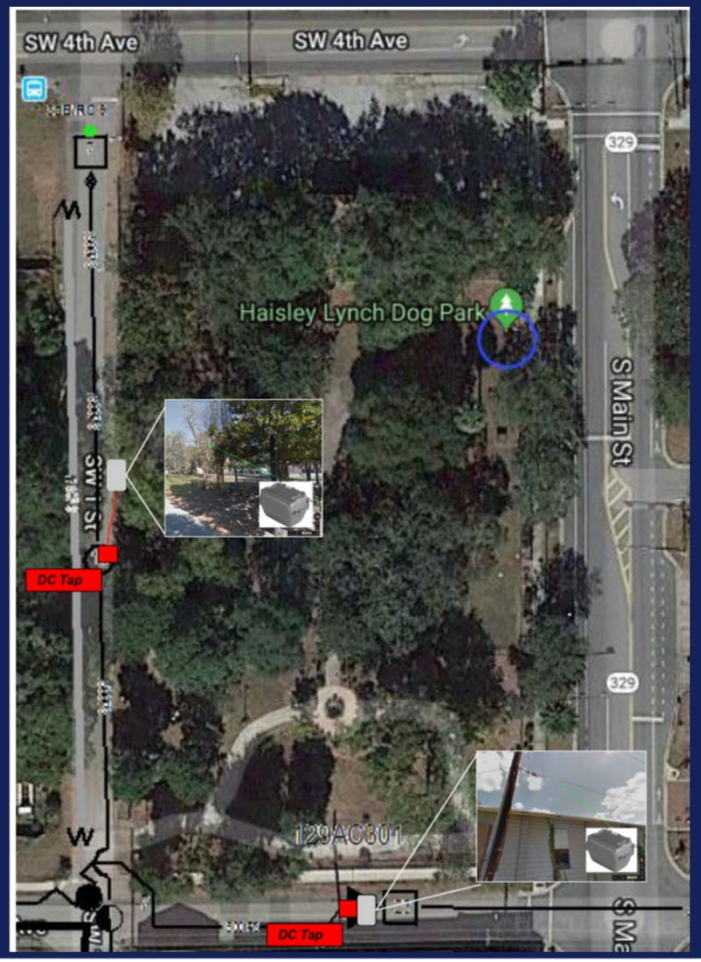


POC Action Items

- Cabling Contractor work in process
- Wireless Access Points for UF Buildings
  - Design complete and materials being received
  - 800 Building work bidding now
- Need to confirm how additional access points will be connected:
  - City owned utility and communications provider no longer an option
  - Can Cable Co. provide?
  - City pay for conduit?

Haisely Lynch Park

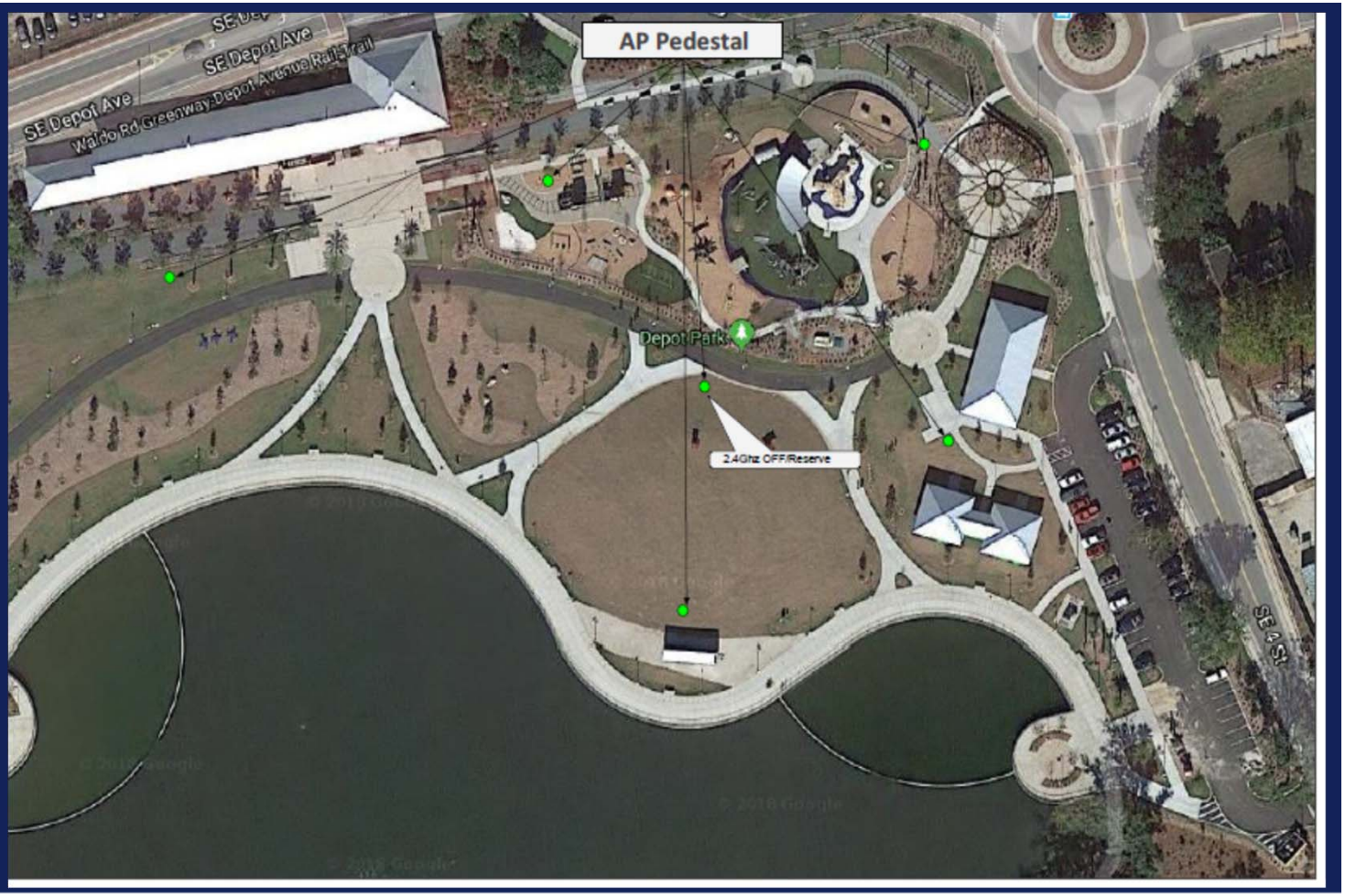
- Cox Communications collaboration
- UFIT:
  - Set up subnet and made DNS changes
  - Tested AP connectivity to wireless controllers in Lab
- Scheduling mounting APs



Depot Park

DOWNTOWN GAINESVILLE
N
E
S
W
S.E. DEPOT AVE
DEPOT BLDG
PLAY AREA
OPEN LAWN
HILL
STAGE
WEST OVERLOOK
POND
EAST OVERLOOK
S.E. 4TH ST
S. MAIN ST
CADE MUSEUM
NATURE PRESERVE
S.E. VETCH ST
DEPOT PARK EVENT & WEEKEND PARKING
S.E. 10TH AVE
6TH ST RAIL-TRAIL
S.E. 10TH AVE

Depot Park

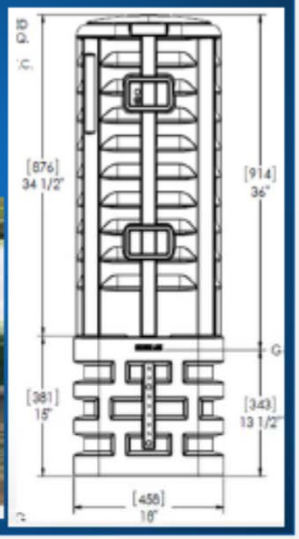

AP Pedestal
SE Depot Ave
SE Depot Ave
Waldo Rd Greenway-Depot Avenue Rail Trail
Depot Park
2.4Ghz OFF/Reserve
SE 4St

Depot Park

MODEL 3032
Light Weight Bollard

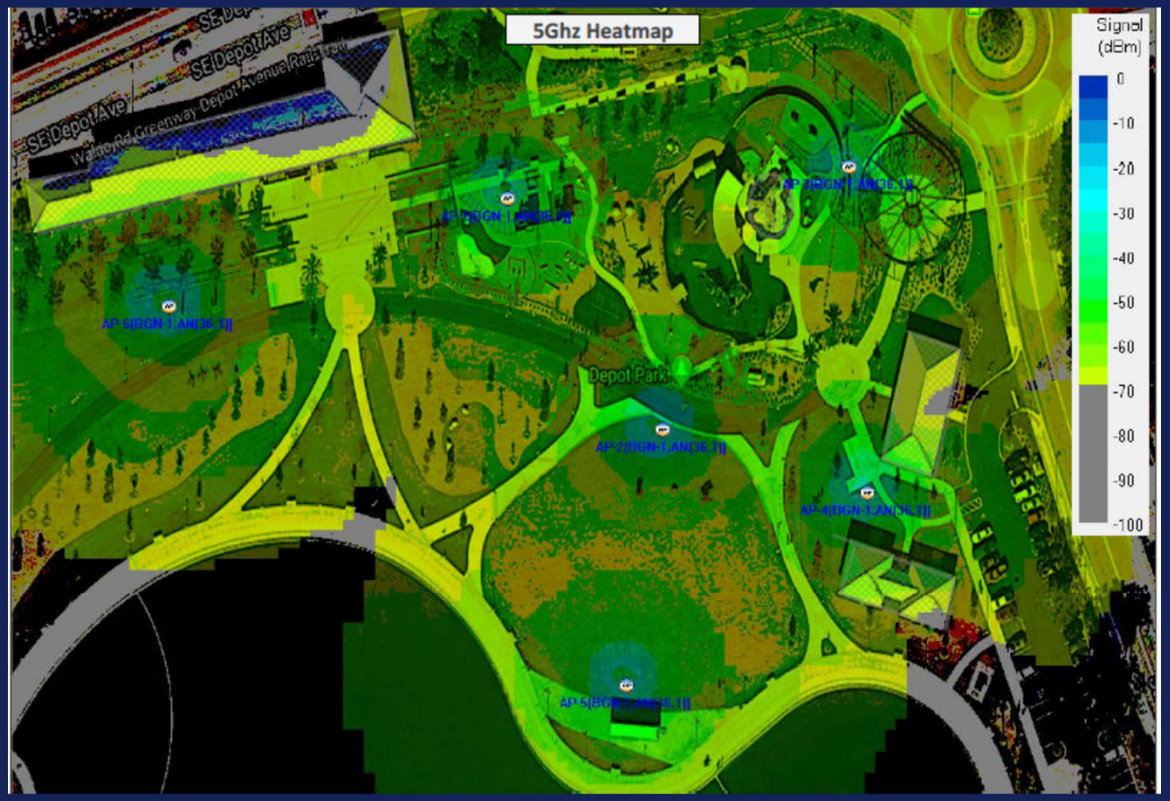
- Polyurethane plastic Bollard – 12" diameter, select height and color (15 standard colors)
- Anchor base
- Equipment stand, AP and antenna mount
- Economical
- Low-voltage powered gear only
- Temporary or permanent installation
- Weight 27 lbs

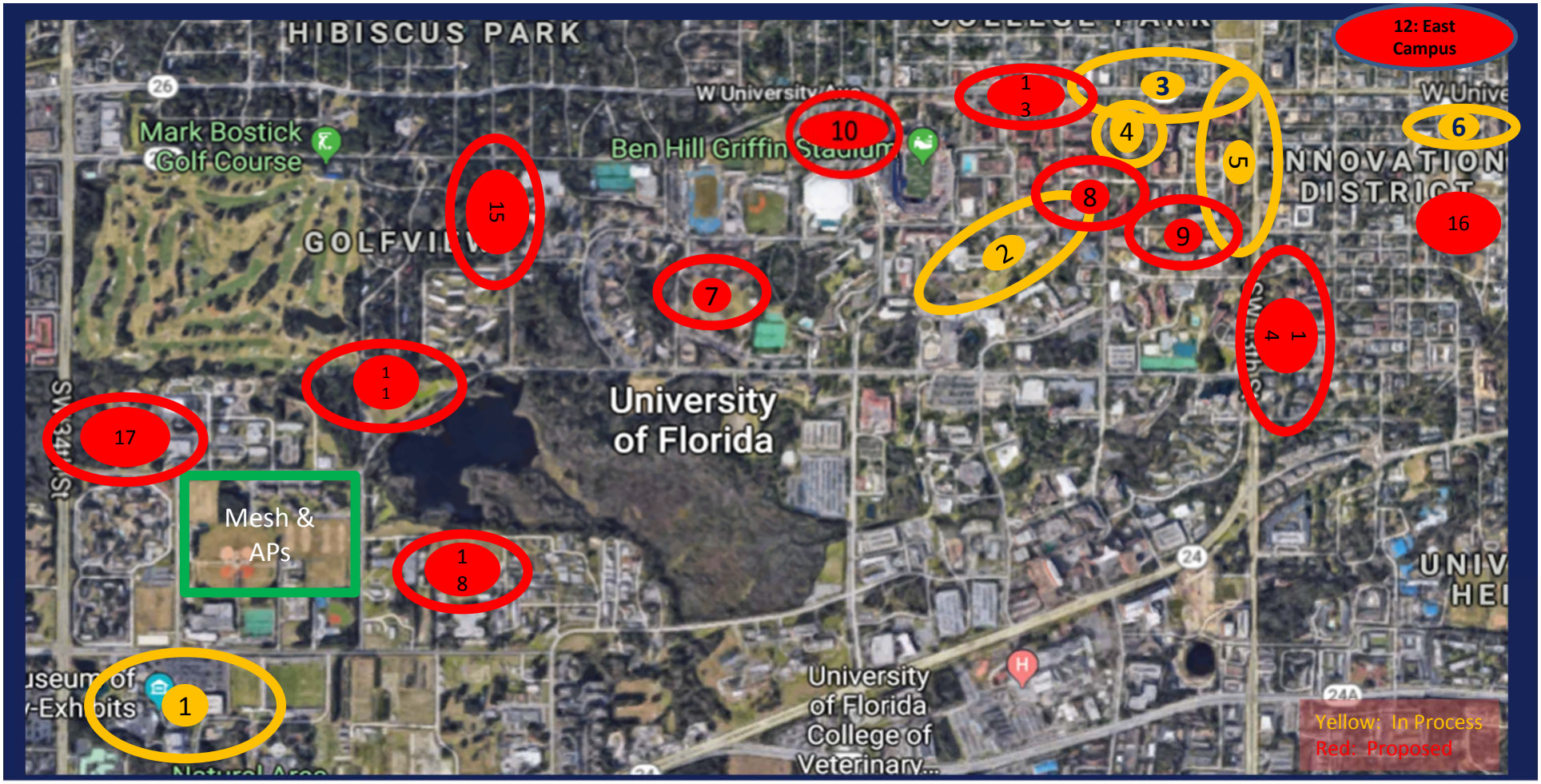
Cable Channel Pedestal -



Depot Park

NOT SO FAST
MY FRIEND
quickmeme.com


5Ghz Heatmap
Signal (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
SE Depot Ave
Depot Park


12: East Campus
HIBISCUS PARK
Mark Bostick Golf Course
Ben Hill Griffin Stadium
University of Florida
Mesh & APs
University of Florida College of Veterinary...
Yellow: In Process
Red: Proposed
1
2
3
4
5
6
7
8
9
10
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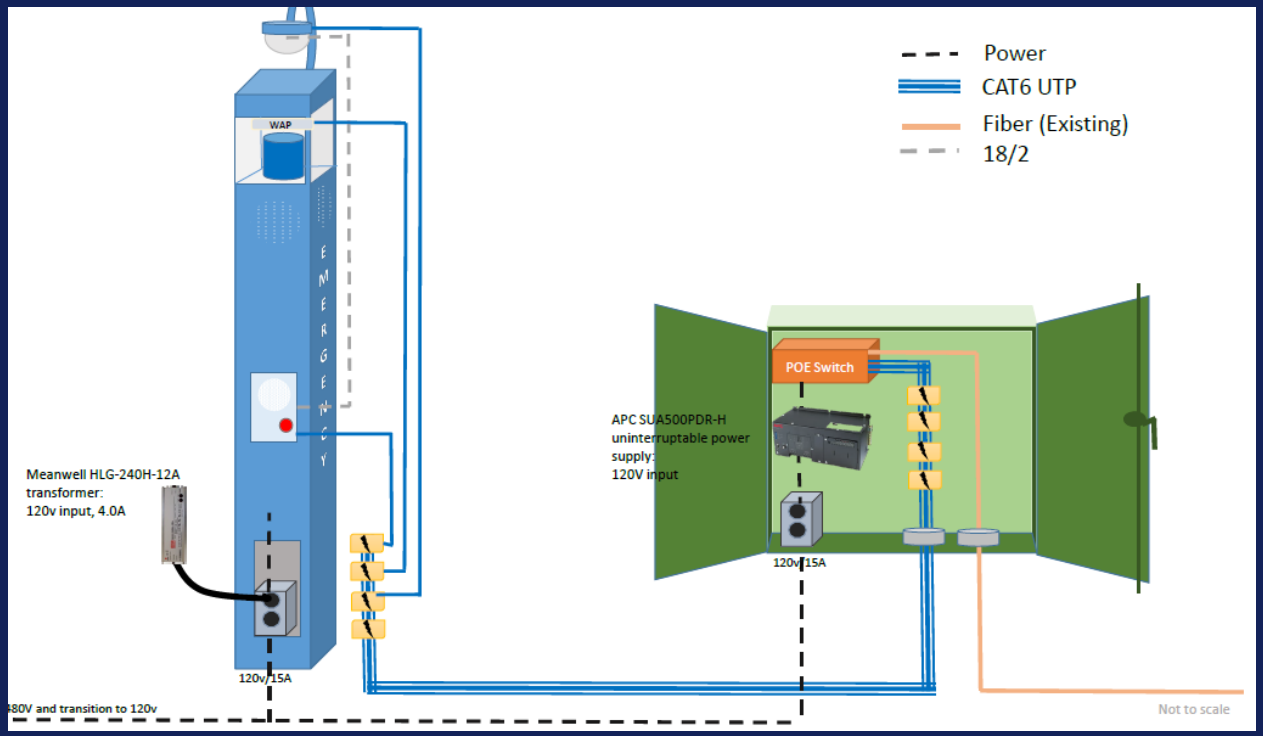
13
14
15
16
17
18

Area	Coverage	Status	Budget
1	Cultural Plaza: Outdoor areas of Harn, FL Museum and Performing Arts	In Process	$50,000
2	Reitz Union Plaza: Increased capacity and directional antennas	In Process	$8,000
3	University Avenue: Add outdoor coverage	In Process / Design	$30,000
4	Plaza of the Americas: Increase capacity and coverage	In Process	$10,000
5	SW 13th Street: Add outdoor coverage	In Process / Design	$25,000
6	SW 2nd Ave: Add outdoor coverage to Innovation Hub, 720, 800 & Infinity Hall	In Process / Design	$15,000
7	Flavet Field	Proposed	$79,000
8	Turlington / CSE Plaza	Proposed	$15,000
9	Steinbrenner, Architecture, College of Fine Arts Plaza Areas	Proposed	$40,000
10	O'Connell Center Parking Deck and Open Lot	Proposed	$60,000
11	Bat House Area / Lake Alice	Proposed	$25,000
12	East Campus: Outside area on south side of UF Data Center	Proposed	$10,000
13	University Avenue: Extend build out to Stadium / Emerson	Proposed	$45,000
14	SW13th Street: Extend buildout to cover Norman Field area	Proposed	$38,000
15	Law School: Front of Holland Law grounds / parking area	Proposed	$25,000
16	Innovation Square: Open spaces behind Innovation Hub	Proposed	$30,000
17	Facilities Services: Radio Road Area Parking / Outside Areas	Proposed	$25,000
18	Fifield Hall: Outdoor and Parking Area	Proposed	$15,000
		TOTAL PROPOSED:	$545,000

Frat Row Bluelight Design

UF UNIVERSITY of FLORIDA Information Technology



2020 BICSI FALL Conference & Exhibition

Bicsi

Frat Row Bluelight Design

UF UNIVERSITY of FLORIDA Information Technology

Switch

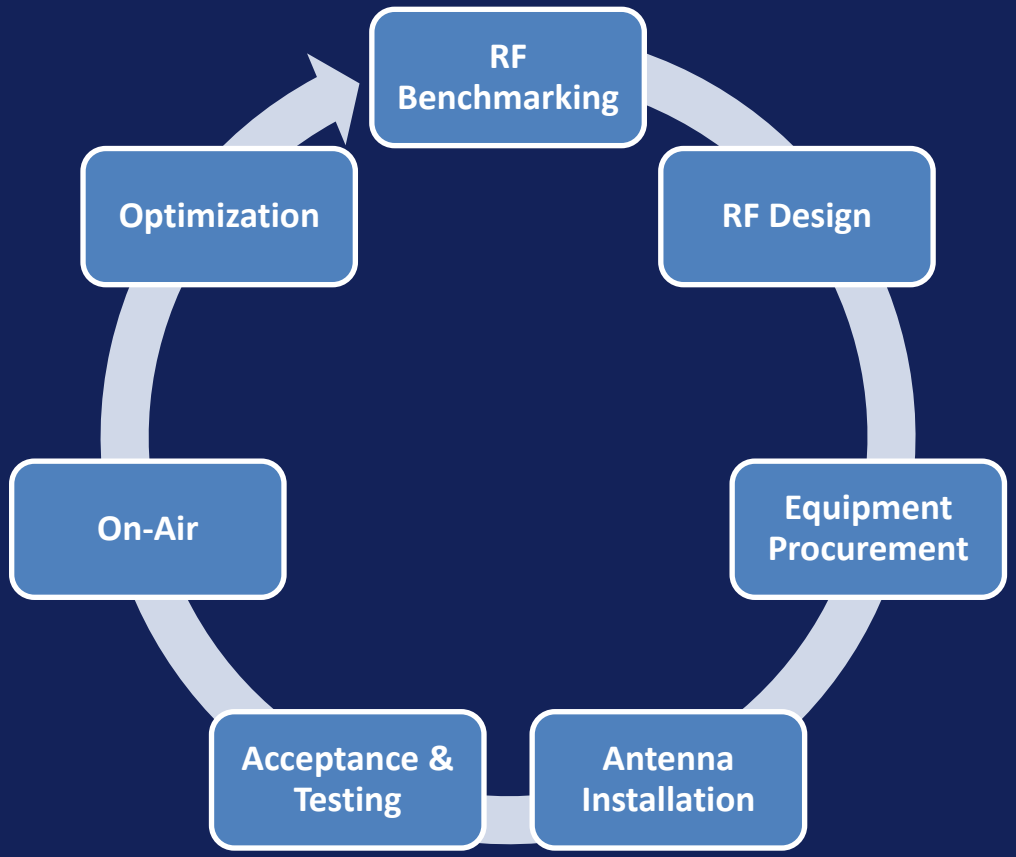
UPS

BICSI Tech

Surge Protectors

Workflow

1. Survey: RF Benchmarking
2. Design: Certified Ekahau wireless design engineers
3. Procurement: Longer lead times
4. Installation
5. Testing & Documentation
6. Tweaking
7. Re-survey: confirm coverage and capacity



Proposed Access Points -- Cultural Plaza

Currently Parking Garage-11 has 4 Cisco AP3802i access points. 1 access point in the Harn Museum Parking Booth and 1 Directional Access point in front of the Performing Arts center.

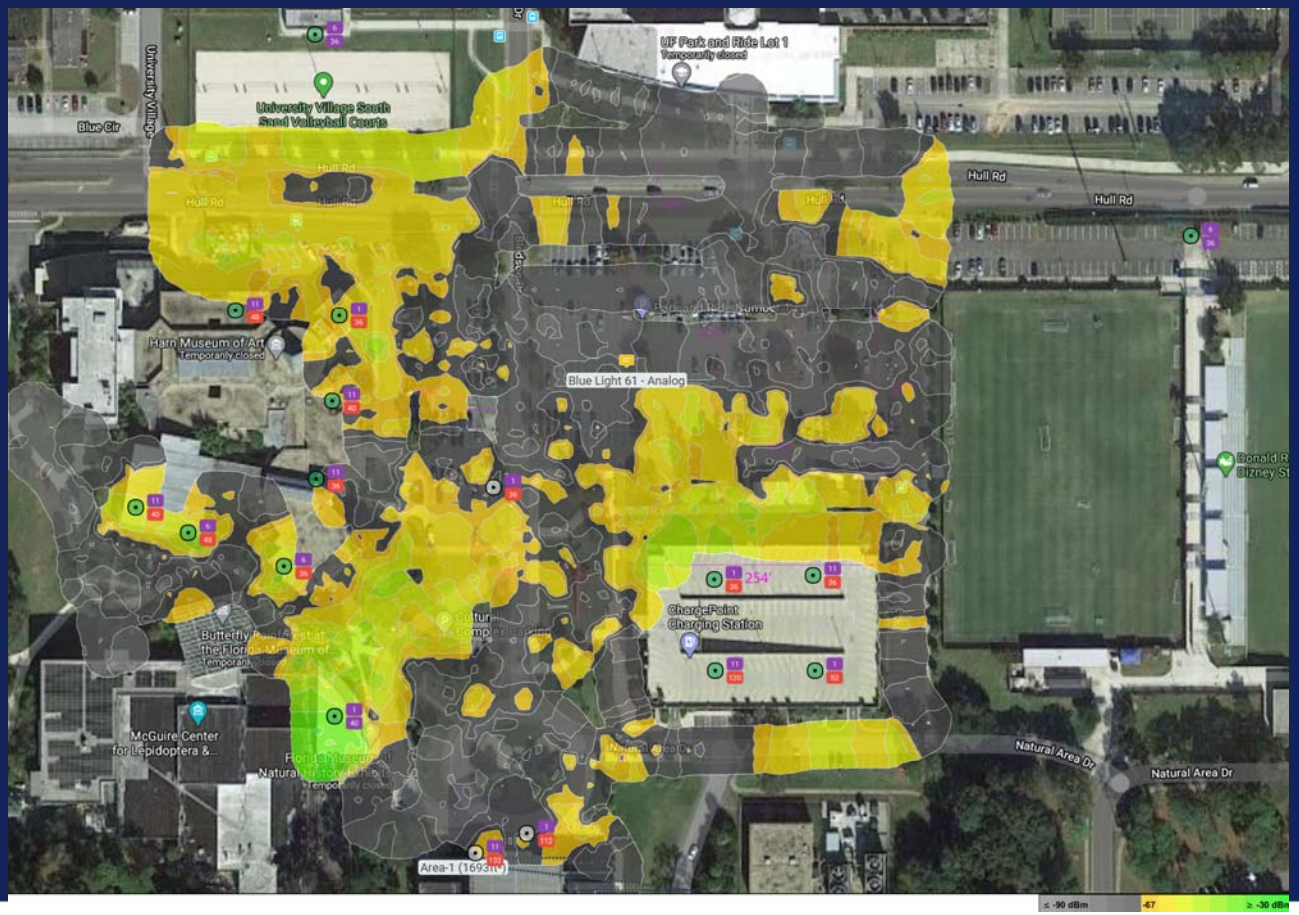
Coverage is limited use for Covid-19 Testing on the first floor of the garage, partial coverage of parking lot near the Harn Parking booth , and Front entrance of the Performing arts center.

Current Access Points -- Cultural Plaza

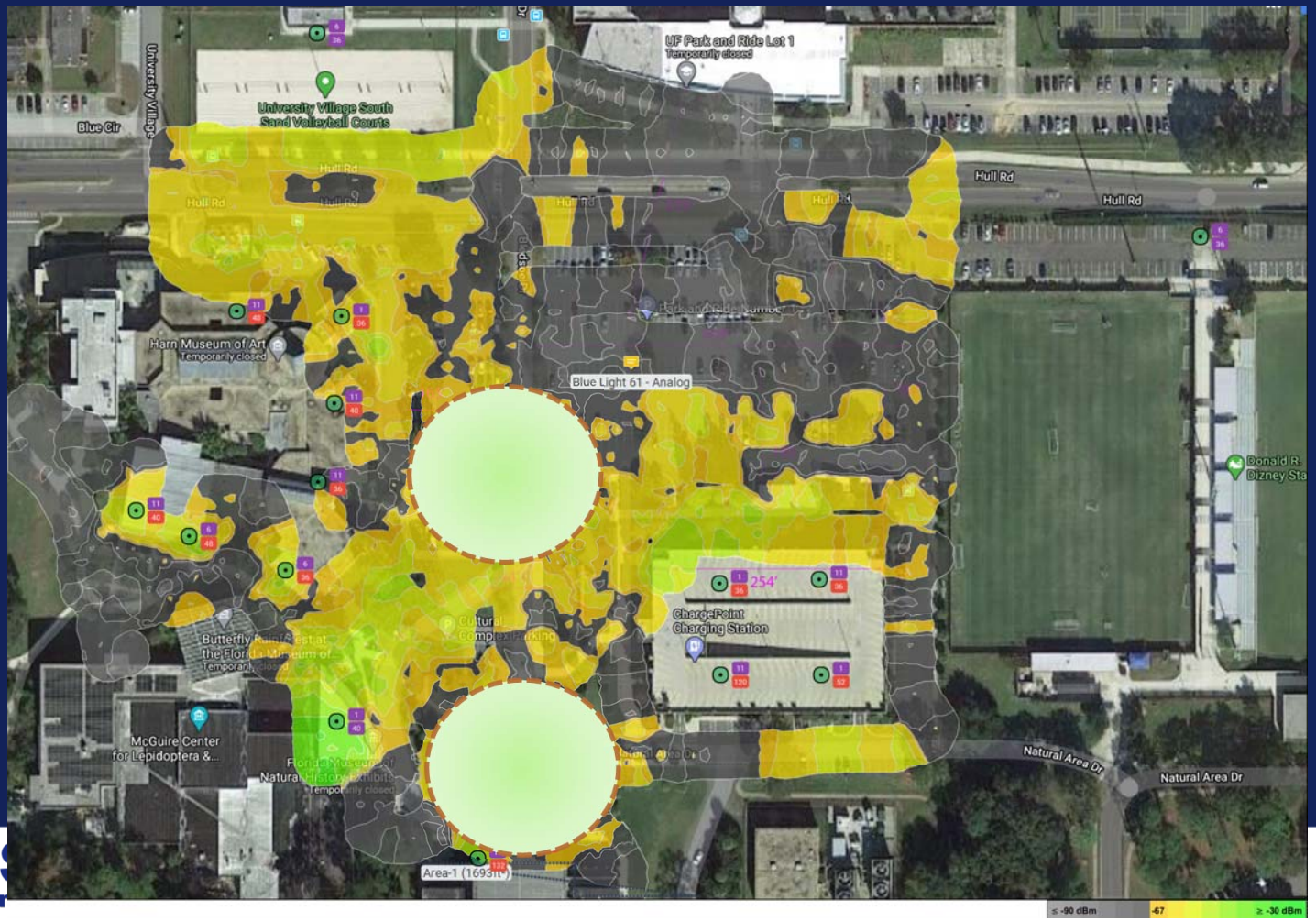
- Temporary wireless bridge from Harn to the parking booth.
- Temporary omni-directional wireless coverage at booth.
- Temporary directional wireless coverage at Performing Arts Center on a moveable stand.
- Permanently installed omni-directional wireless coverage in Parking Garage 11 hanging from 1st floor ceiling.

Wi-fi Survey Path – Cultural Plaza

Current Permanent Outdoor Coverage – Cultural Plaza



Current Outdoor Coverage including Temporary Stands for Covid-19



Proposed locations - Outdoor Wireless

Bus Stop or surrounding area

Location 12 - Possible Phase 2.

Harn Museum of Art – Side of building

Locations 1 , 2 - Cisco 3802e with Directional Antenna.

Locations 3 , 4 - Cisco 3802i with Omni-Directional Antennas.

Cultural Plaza Garage 11 – Side of building

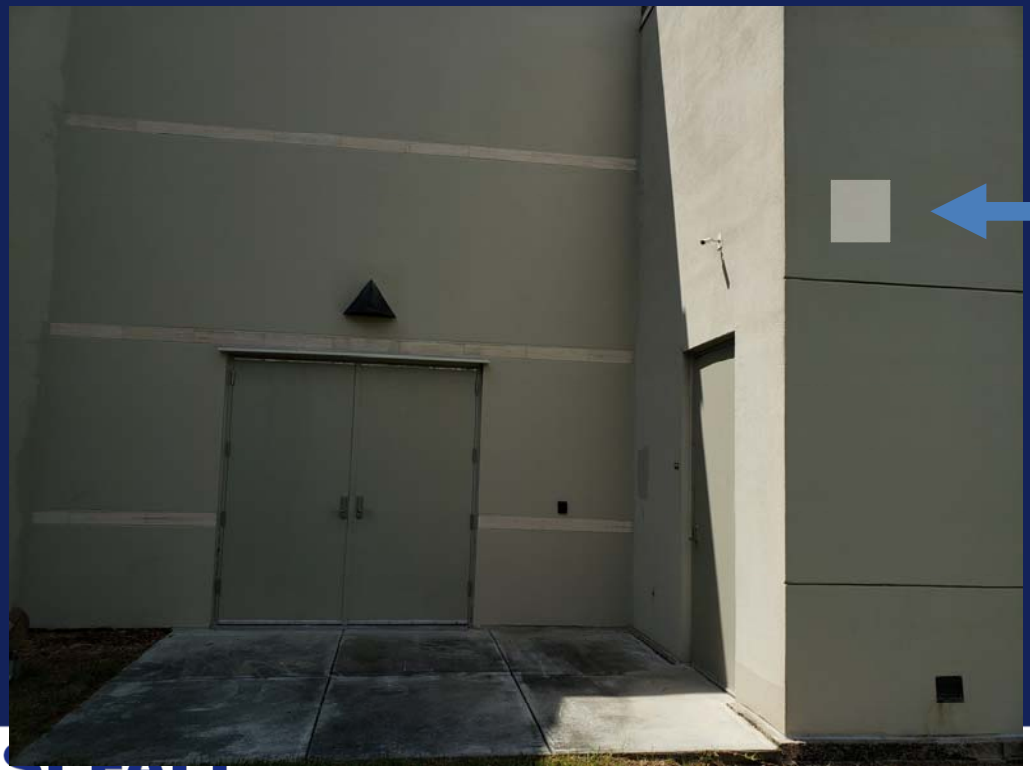
Locations 7– 11 - Cisco 3802e with Directional Antenna.

Phillips Center for Performing Arts – Side of building

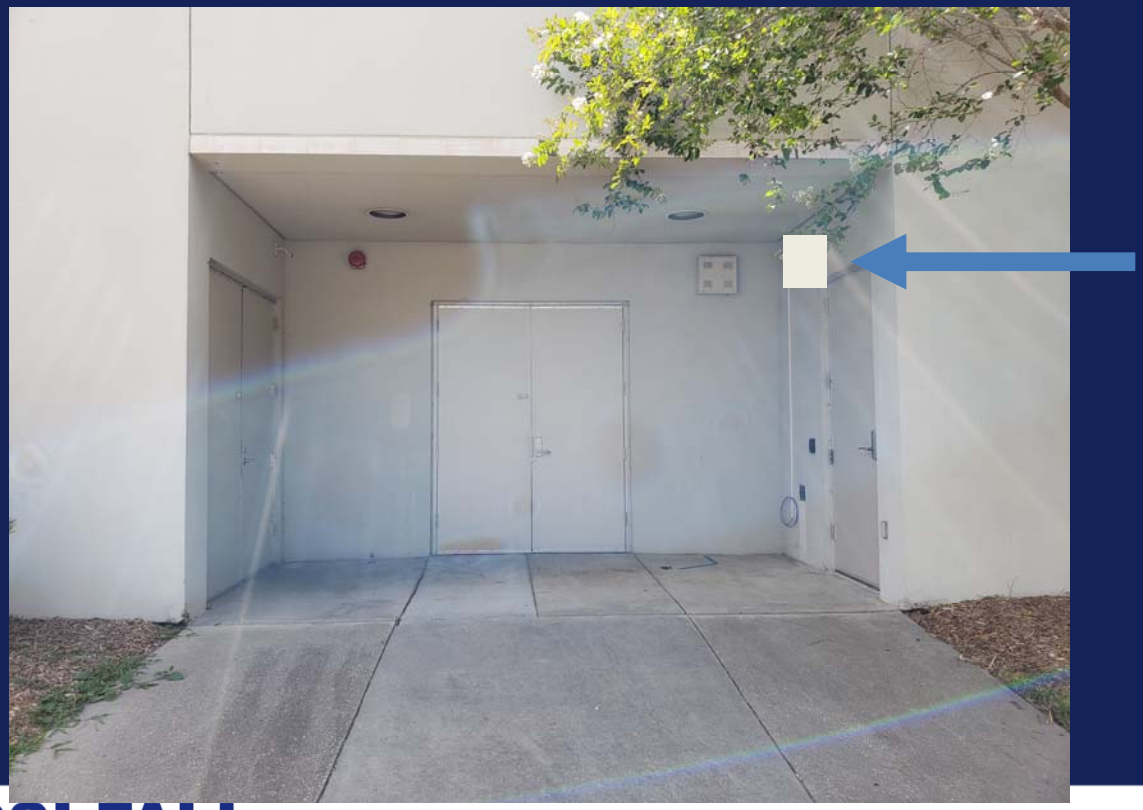
Location 5 - Cisco 3802e with Directional Antenna.

Location 6 - Cisco 3802e with Omni-Directional Antenna.

Proposed locations – Harn Museum – Location 1



Proposed locations – Harn Museum – Location 2



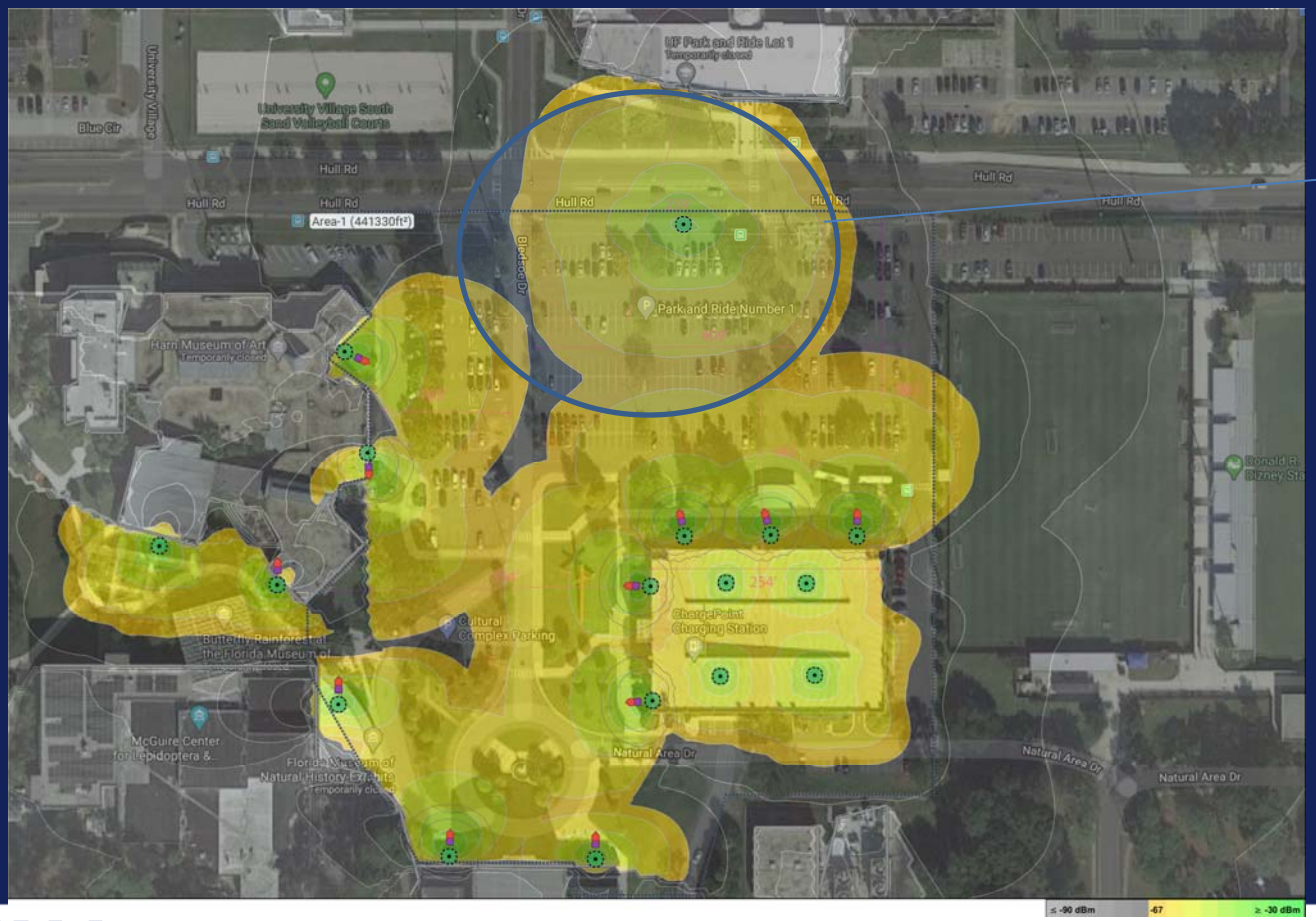
Proposed locations – Harn Museum – Location 4

Cisco Wireless AP 3802i omni-directional ceiling mount.

Proposed locations – Parking Garage 11– Location 7

Proposed locations – Parking Garage 11– Location 10

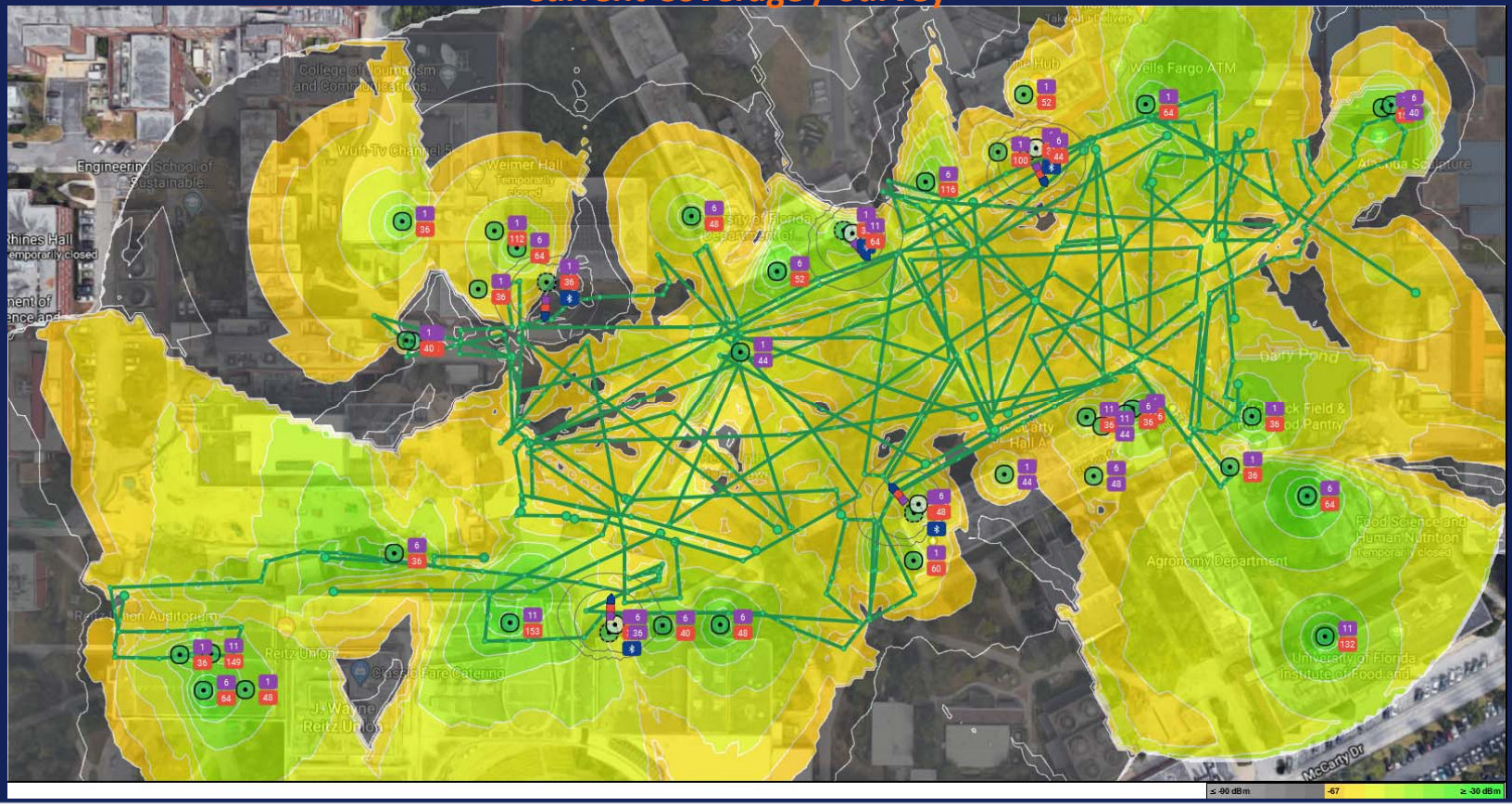
Proposed Coverage Plan



Current Access Points – Reitz Union Lawn

- Currently most Reitz Lawn Access points are in red boxes with Cisco 3600 and 3700 Omni-Directional Access Points.
- Most access points are facing outward with antennas facing more up and down .
- Wireless signal is being sent all over, including back into the buildings.

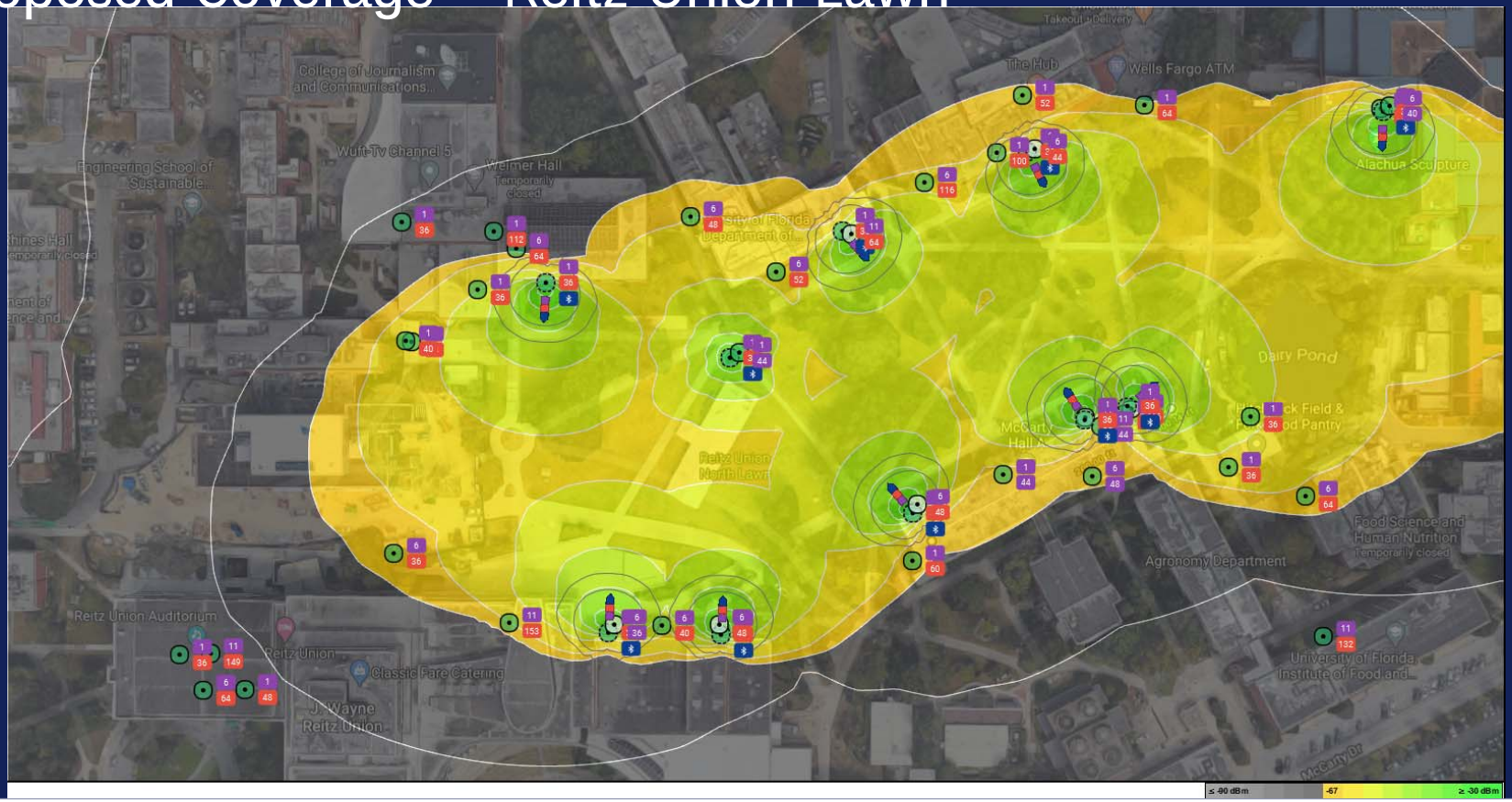
Current Coverage / Survey



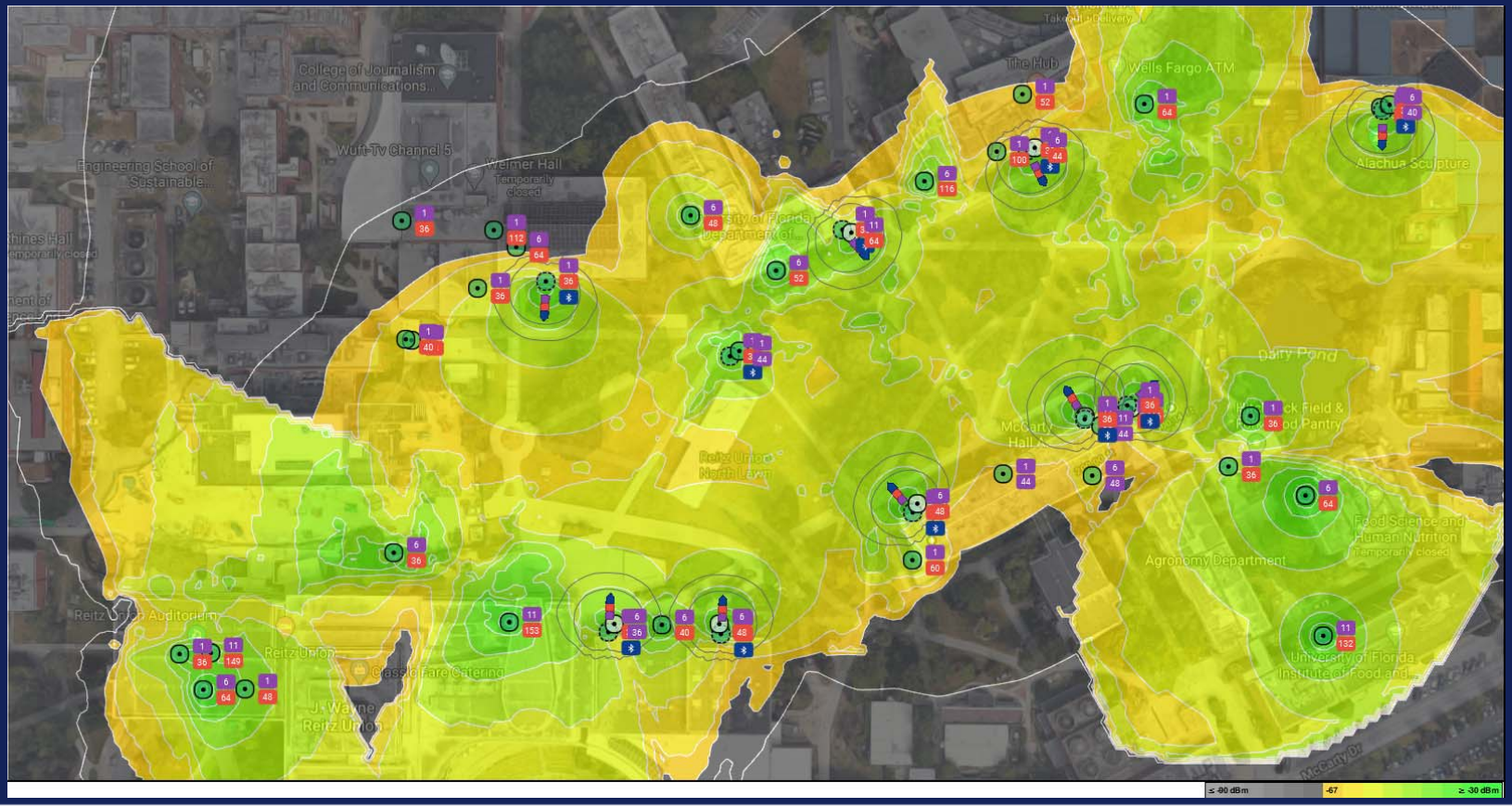
Proposed Access Points – Reitz Union Lawn

- Upgrade to Cisco 3800e with Patch Directional Antennas
- Quantity 10 - Access Points
- Quantity 9 - External Antennas and Enclosures
- Quantity 1 - Replace a blue light AP with Omnidirectional 3800i
- Direct Wi-Fi signal to areas on the lawn instead of inside buildings.
- Give added capacity and coverage using Cisco 3800i and Cisco 3800e Access points.

Proposed Coverage – Reitz Union Lawn



Overall Coverage with added capacity and focused energy.



Overall Coverage with added capacity and focused energy.

UF

Polycarbonate Enclosure
12x10x6 With Integrated Patch Antenna—White

The TerraWave 12" x 10" x 6" White Enclosure with integrated patch antenna is constructed of polycarbonate plastic, making it a durable, extremely affordable solution. The enclosure features a solid door, latching locks and pre-drilled backplate. In addition, this enclosure has integrated antenna installed on a wing out panel inside the enclosure making it more compact to allow more efficient deployment of your AP. This NEMA 4X enclosure is intended for indoor or outdoor use to protect popular Wi-Fi access points from corrosion, dust, rain, extreme temperatures and unauthorized access or inadvertent contact with the controls and wiring located inside the enclosure

Every TerraWave enclosure is covered by the company's two-year TerraNet warranty program. For questions and to

System Highlights

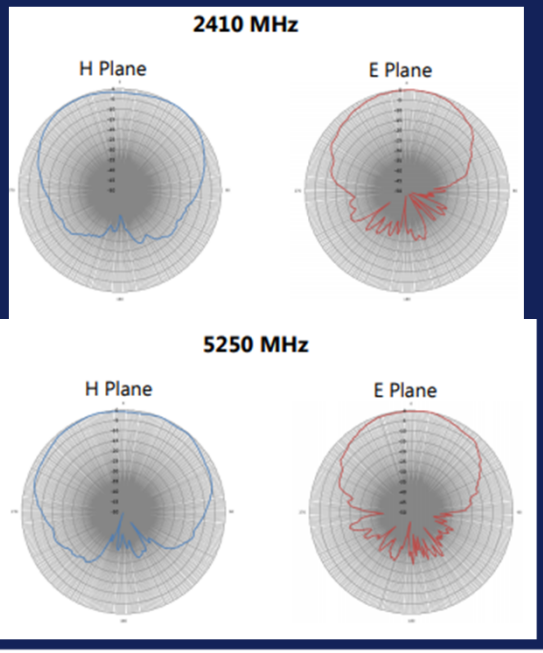
- Robust aluminum back plate that allows for seamless integration with access points.
- Integrated patch antenna allows you to expand your Wi-Fi coverage.

12x10x6 Basic Enclosure with Integrated Patch Antenna

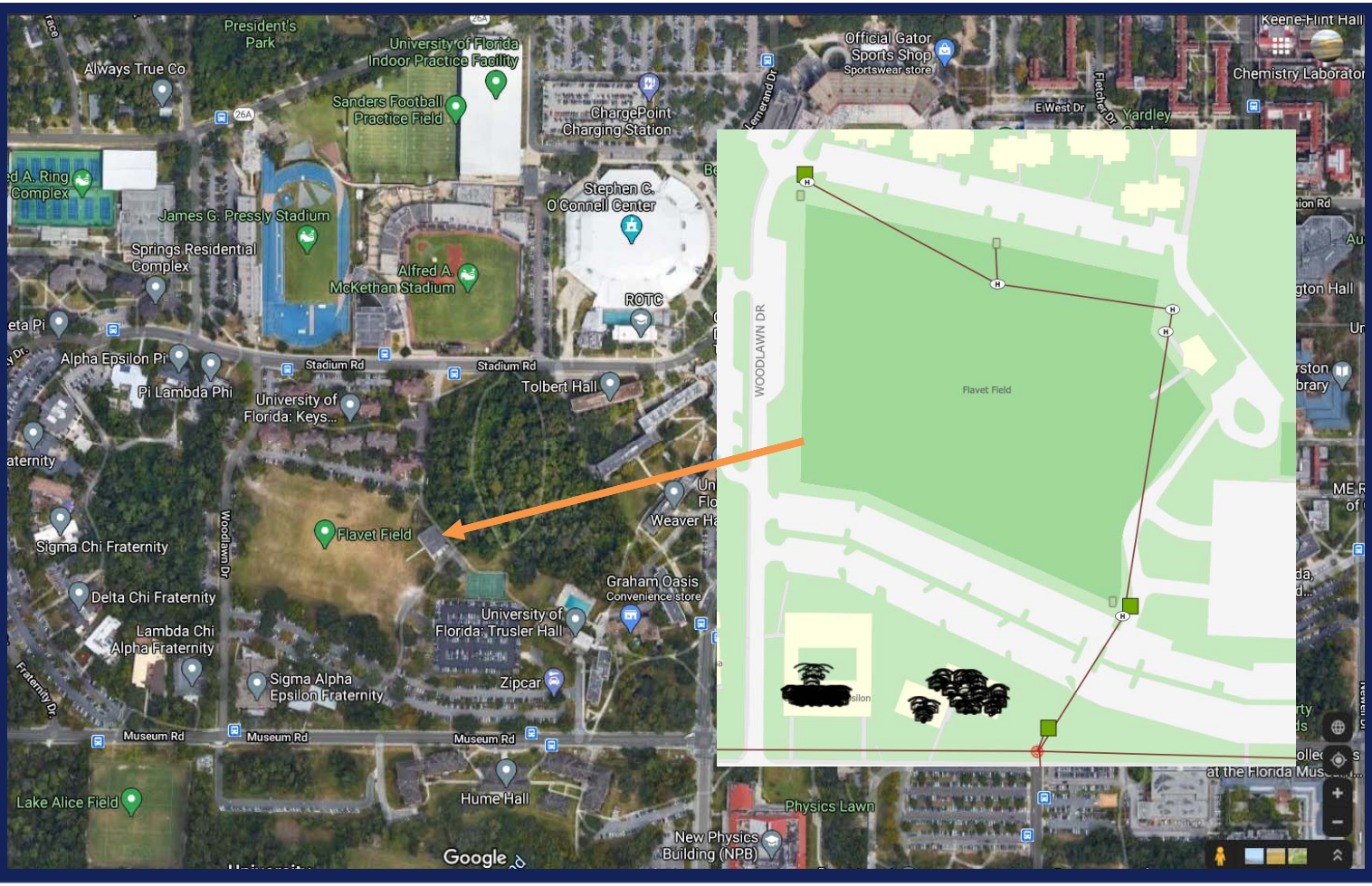
SKU # 508606
Part#: CV12106L0-0DP4T-W

Directional Antenna Specs

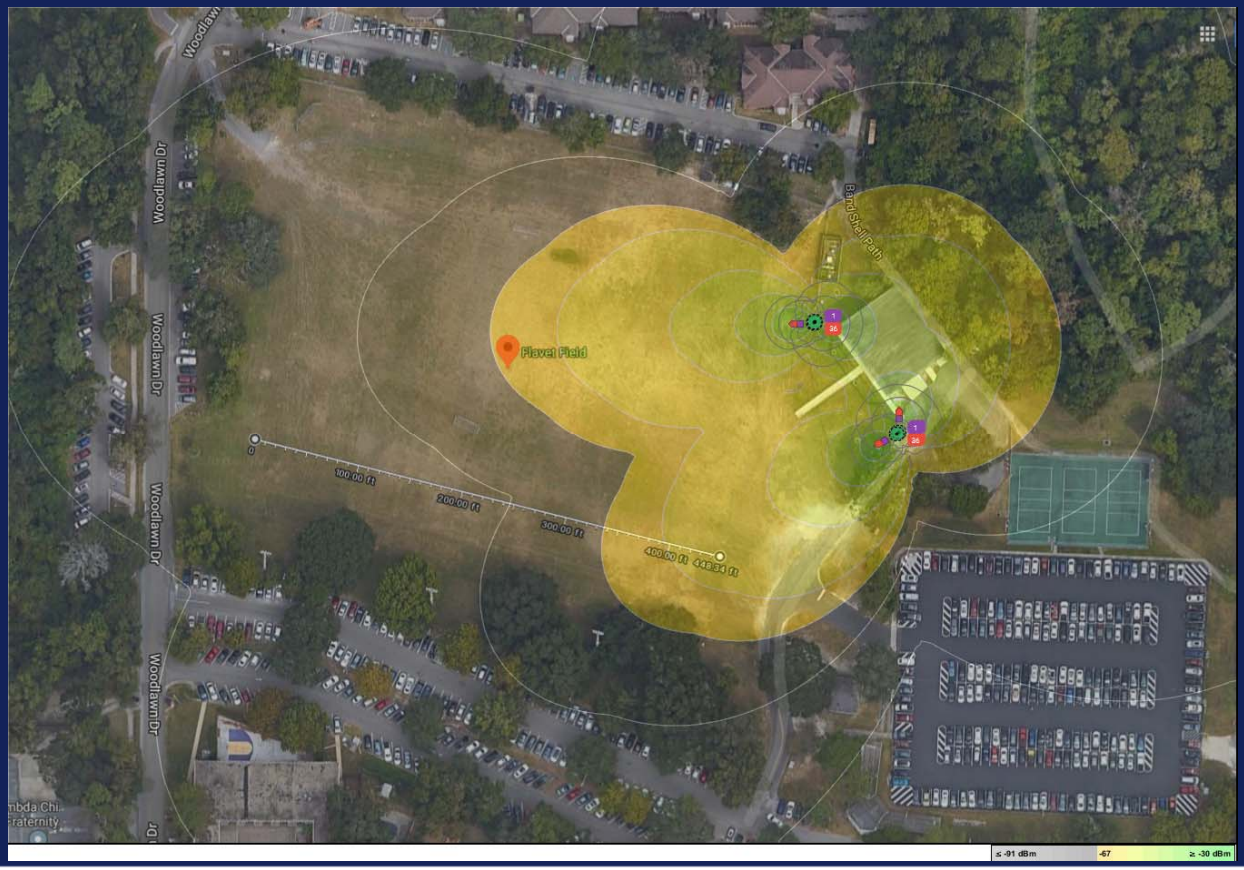
Specifications		
Model	M6060060P1D43602V	
Frequency Range	2400~2500	5150~5850
Bandwidth	100 MHz	700 MHz
Gain	6 dBi	6dBi
Horizontal Beamwidth	105	125
Vertical Beamwidth	60	70
VSWR	≤2.0	≤2.0
Isolation	≥20dB	
Nominal Impedance	50 Ohm	
Polarization	Vertical	
Maximum Input Power	20 W	
Lightning Protection	N/A	
Connector Type	4x RPTNC Plug	
Cable Length	36"	
Dimensions	10" x 5.6" x 1.4"	
Weight	1.2 lbs	
Operating Temperature	-40°F to 158°F	
Wind Load	60 mph	



New Outdoor Coverage – Flavet Field Bandshell


President's Park
University of Florida Indoor Practice Facility
Always True Co
Sanders Football Practice Field
ChargePoint Charging Station
Official Gator Sports Shop
Sportswear store
Keene-Flint Hall
Chemistry Laborator
E West Dr
Yardley
Stephen C. O'Connell Center
James G. Pressly Stadium
Springs Residential Complex
Alfred A. McKethan Stadium
ROTC
Alpha Epsilon Pi
Pi Lambda Phi
Stadium Rd
Tolbert Hall
University of Florida: Keys...
Flavet Field
Sigma Chi Fraternity
Woodlawn Dr
Weaver Ha
Graham Oasis
Convenience store
Delta Chi Fraternity
University of Florida: Trusler Hall
Lambda Chi Alpha Fraternity
Sigma Alpha Epsilon Fraternity
Zipcar
Museum Rd
Hume Hall
Lake Alice Field
Physics Lawn
New Physics Building (NPB)
Google
WOODLAWN DR
Flavet Field

Proposed Access Points and Poles -- Flavet Field



Pedestal Cabinet – Fiber and Switch Enclosure

Pedestal Cabinet – Fiber and Switch Enclosure

Proposed Access Points and Poles -- Flavet Field

2x Cisco AP 1562i – Omni Directional Antenna Facing “Band Shell” stage.

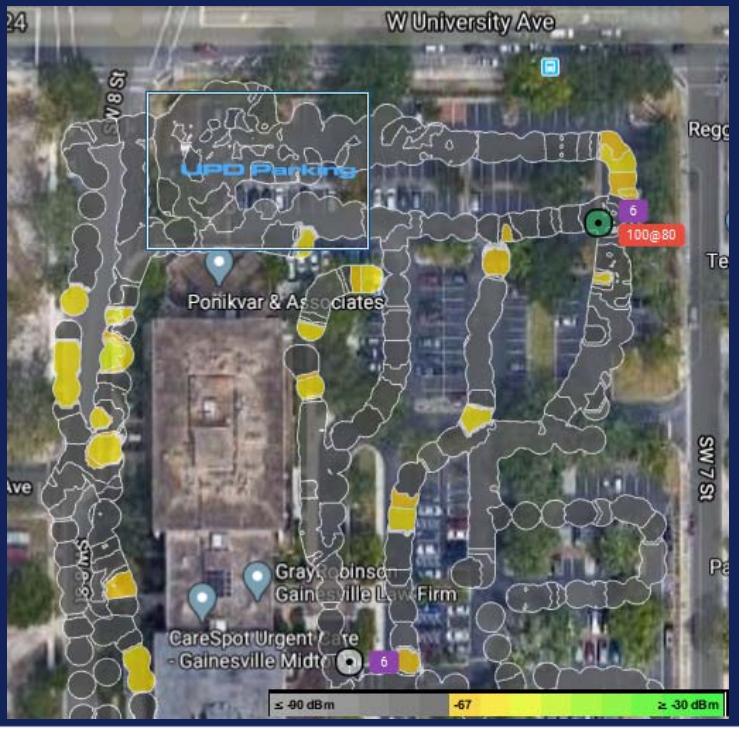
2x Cisco AP 1562d – Directional Antenna Facing field.

Poles and Equipment grounded. Surge Suppressors – PoE on both ends of Cabling – Inside pedestal cabinet and on pole inside enclosure.

Ethernet – CAT6a Outdoor Rated Run from poles to Pedestal Cabinet

University Police Department

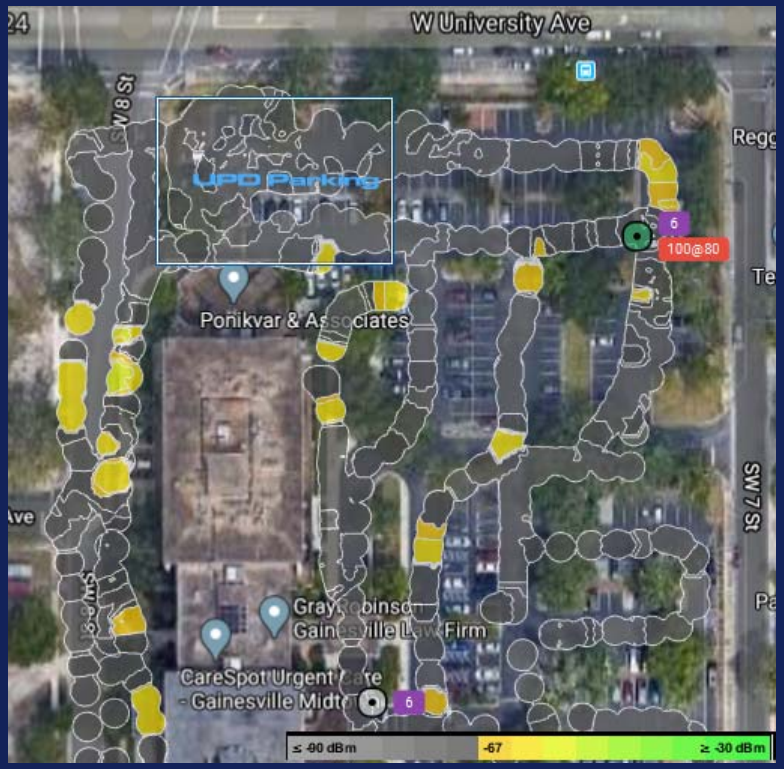
- Moved to lease space for construction of new Public Safety Building on Campus
- “Temporary”
- Mobilevision uploads from Police vehicles via wireless
- Initial survey shows no coverage



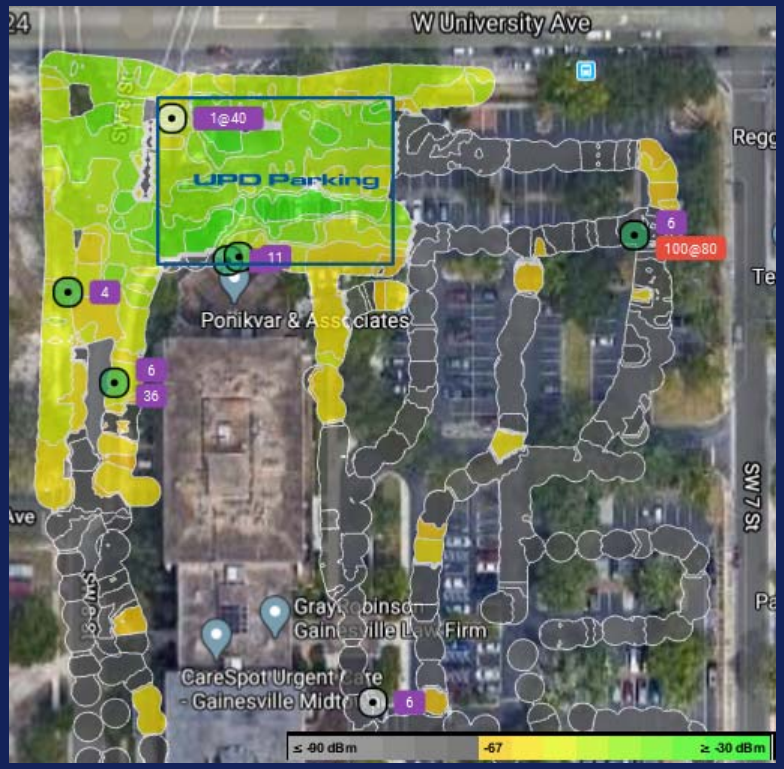
University Police Department

- Outdoor Wireless Access Points
- External panel antennas
- Additional space for cameras

Wi-fi Survey – Before

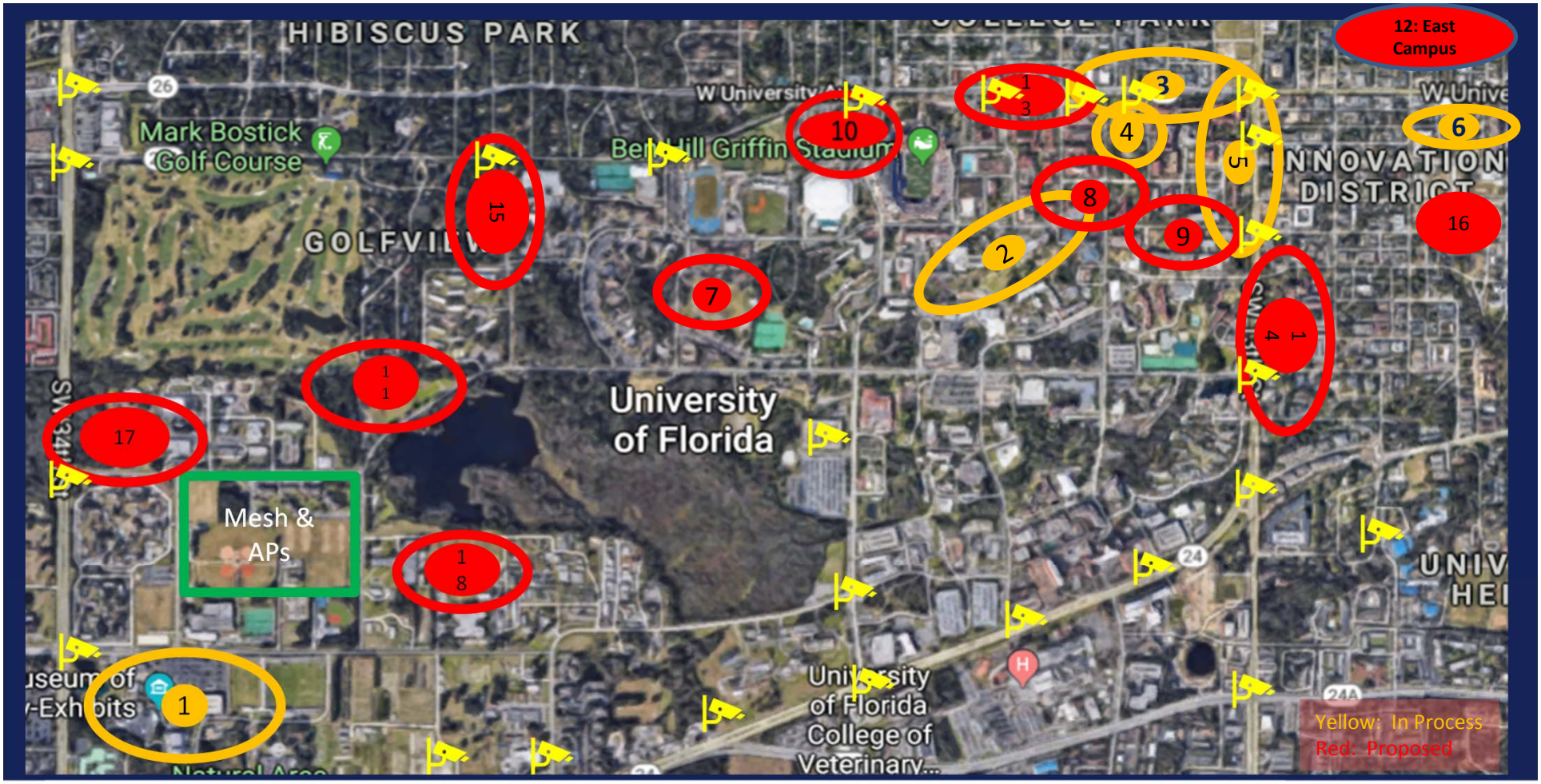


Wi-fi Coverage – After



Connected City Projects -- Ongoing

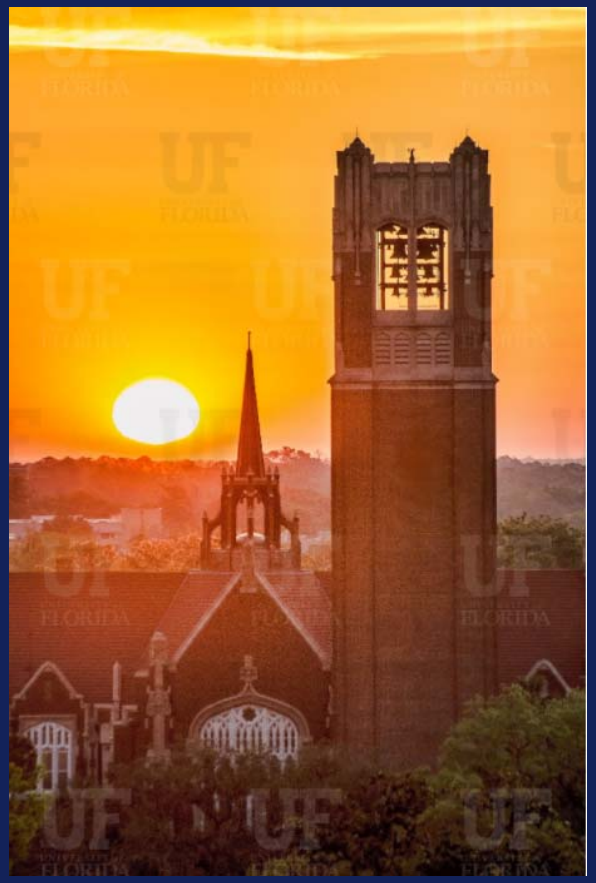
- License Plate Readers
- Smart Lighting
- Connected Vehicle
- WIFI on City Buses


12: East Campus
HIBISCUS PARK
Mark Bostick Golf Course
GOLFVIEW
University of Florida
Mesh & APs
University of Florida College of Veterinary...
INNOVATION DISTRICT
Yellow: In Process
Red: Proposed

Connected City Projects -- Ongoing

- License Plate Readers
- Smart Lighting
- Connected Vehicle
- WIFI on City Buses

Thank You

UF | UNIVERSITY of FLORIDA
Information Technology

Contact:
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UF Information Technology
Email: jmadey@ufl.edu