

# Snow Plow Tracking and GIS

A tale of Two Cities

2016 ESRI User Conference

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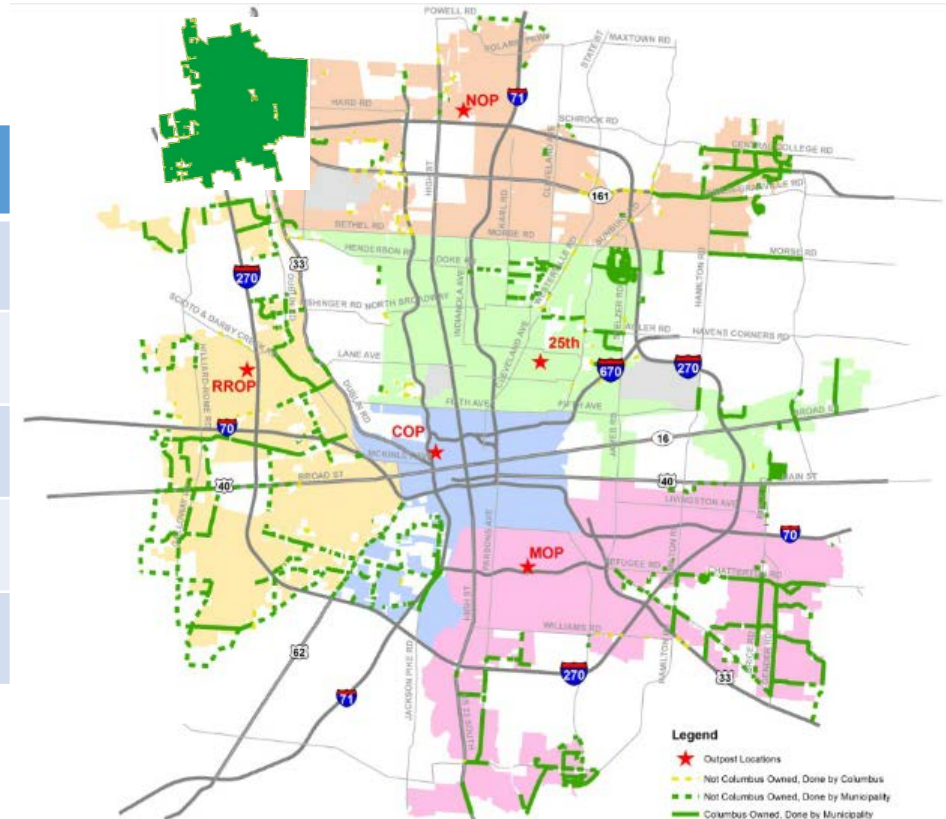
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GIS Administrator  
City of Dublin Ohio



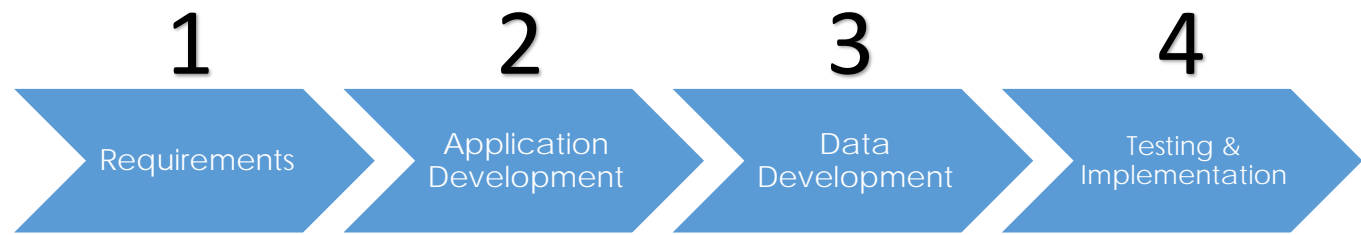
# A Tale of Two Cities

Resources	Columbus	Dublin
Vehicles	87	25
Staff	140	50
Square Miles	229	25
Centerline Miles	8,976	~300
Centerline Segments	86,897	1,124*

\*Simplified Centerlines



# Challenge



## 1) Gather User Requirements

- What is this thing supposed to do?
- How should it work?

## 2) Application Design

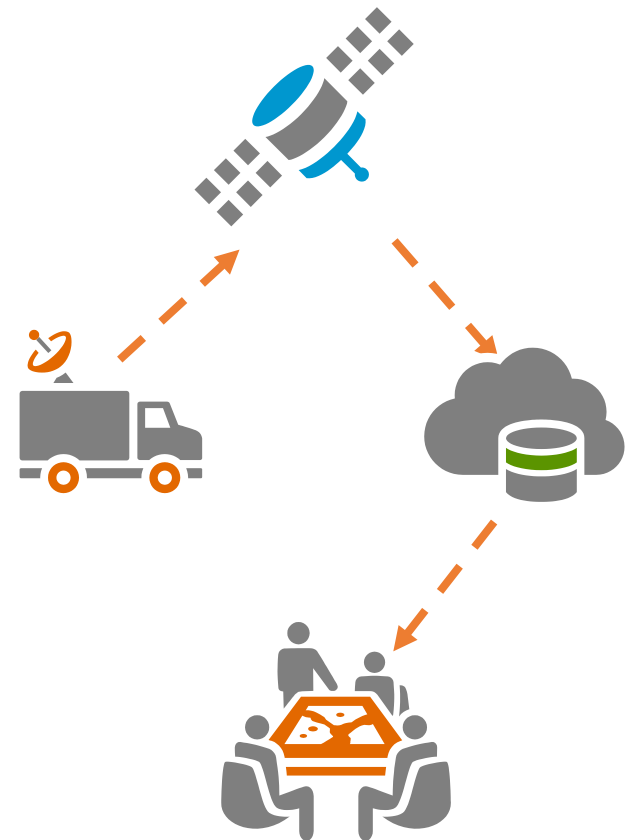
- Web-Application
- User Interface

## 3) Data Development

- ESRI GeoEvent Extension for ArcGIS
- System Architecture
- Geoprocessing

## 4) Implementation, Testing, Deployment

- Happy Users!!
- Happy Servers!!



# Dublin

Requirements

Application Development

Data Development

Testing & Implementation



## Megan's Dream

3/6/14

- Other AVL data (Steps, idle)*

**H** ~~Plan~~ All vehicles that are used for snow and ice events have GPS. *idle time*
- H** All trucks with a plow have a "plow up/plow down" sensor. *Big Trucks Parks Gators etc*
- H** All trucks with a spreader have "spreader on/spreader off and rate" sensor. *Detail kills*
- S** The snow and ice manager has the ability to view progress graphically or in report format. *Easy software/UI*
- C** The system has the ability to produce reports outlining service history by street. *Easy work*
- S** Specific vehicle history can be searched. *software easy*
- S** The system is user friendly and real time. *software/UI*
- IT Facilitates** There is a work station with a computer and multiple screens for the snow and ice manager to monitor during an event. *software/UI*
- S** Service progress information will be posted on the internet for residents. *Tie GPS to call times status*
- S** The system can be expanded in the future to other city services. *software/UI*



**All in time for the next snow season!**

Eric, you've been plowed

Status & communication




# Dublin



- Megan's Dream (Public Works Director)
- All Snow Vehicles – AVL, plow & salt sensors
- Easy way for staff to see:
  - Which roads have we not treated?
  - Vehicle history
  - Snow event status updates
- Public view of our progress

# Dublin



- Requirements  Reality
- Agile(ish) project management style
- Technical Jibberish

# Columbus



## Internal Application - 2013

(Support Dispatchers, Supervisors & Decision Makers)

- Replaced an existing system (C.O.M.B.A.T)
- Display “Real-Time” Truck Information
- Search Truck Activity
- Generate Standard Reports

## External Application - 2014

(Answer common questions from the public)

1. What has been treated?
2. What priority is my street?

**C.O.M.B.A.T.**



# Columbus



## Internal & External Applications – 2015/2016

*(Warrior Watch 2.0)*

- **Enhanced Back-End Processes**
- **New Dashboard**
  - Performance Metrics
  - Vehicle Management
  - User Management
  - News Ticker Management
  - Manual Route Complete



# Dublin

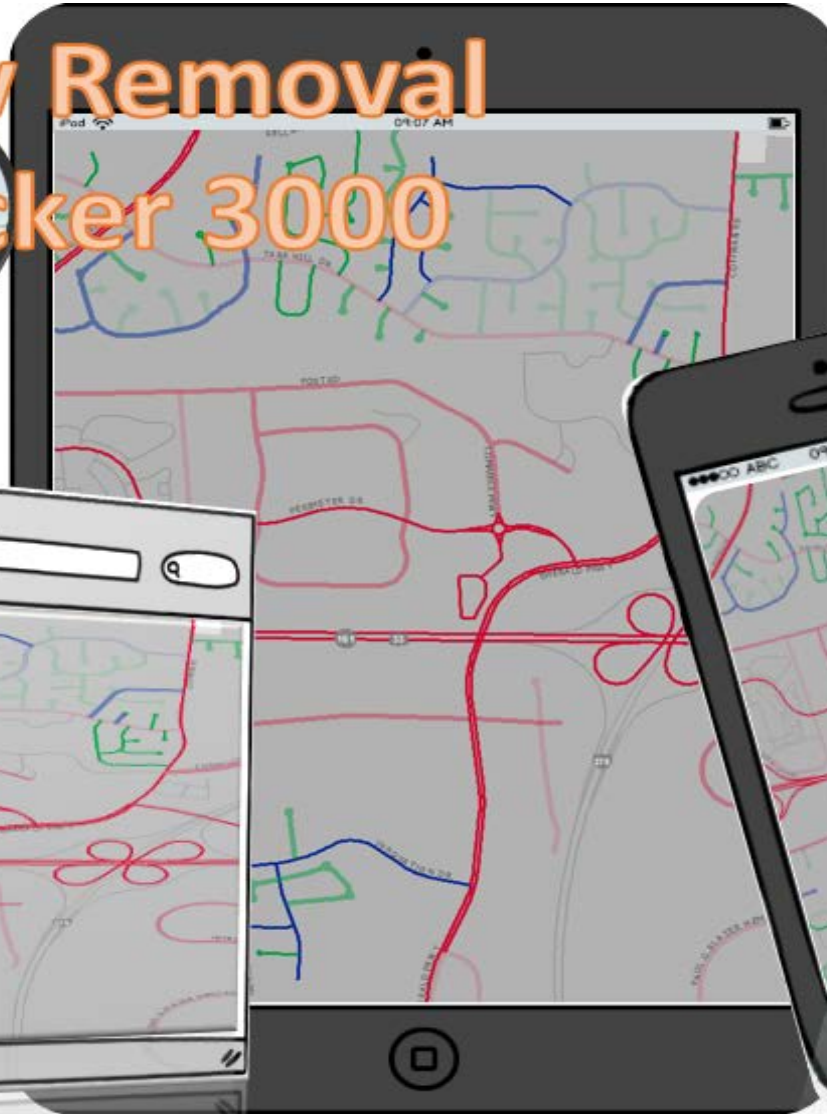
Requirements

Application  
Development

Data  
Development

Testing &  
Implementation

## Snow Removal Tracker 3000



# Dublin

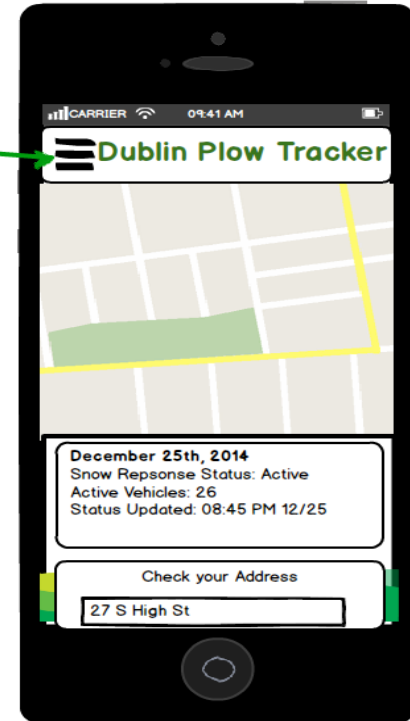
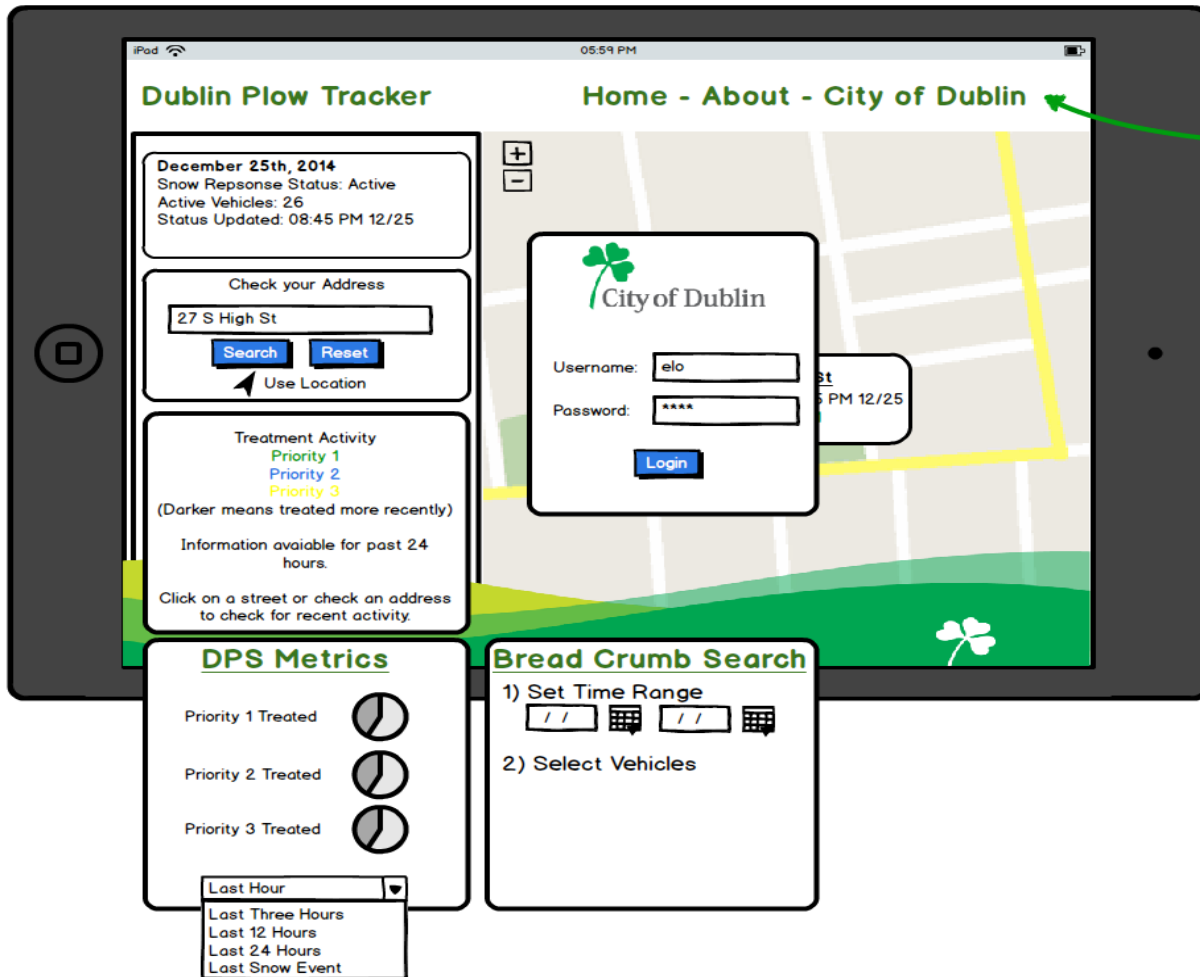


## Internal App

Landscape (Large Format)

[Home](#) > [Products](#) > [Xyz](#) > Features

Portrait (Small Format)



Scrolls to reveal all content on desktop side panel

# Dublin

Requirements

Application Development

Data Development

Testing & Implementation

SNOW 60



Switch to Activity View

*Mon Nov 03 2014*

The City has a curb to curb snow removal policy. All public streets within Dublin receive snow removal service according to the following priorities:

### Priority 1

major arteries, streets with dangerous hills or curves are plowed first. These streets will continue to receive treatment as long as weather conditions continue. Blowing snow and freezing roads once snow has thawed can require continued treatment.

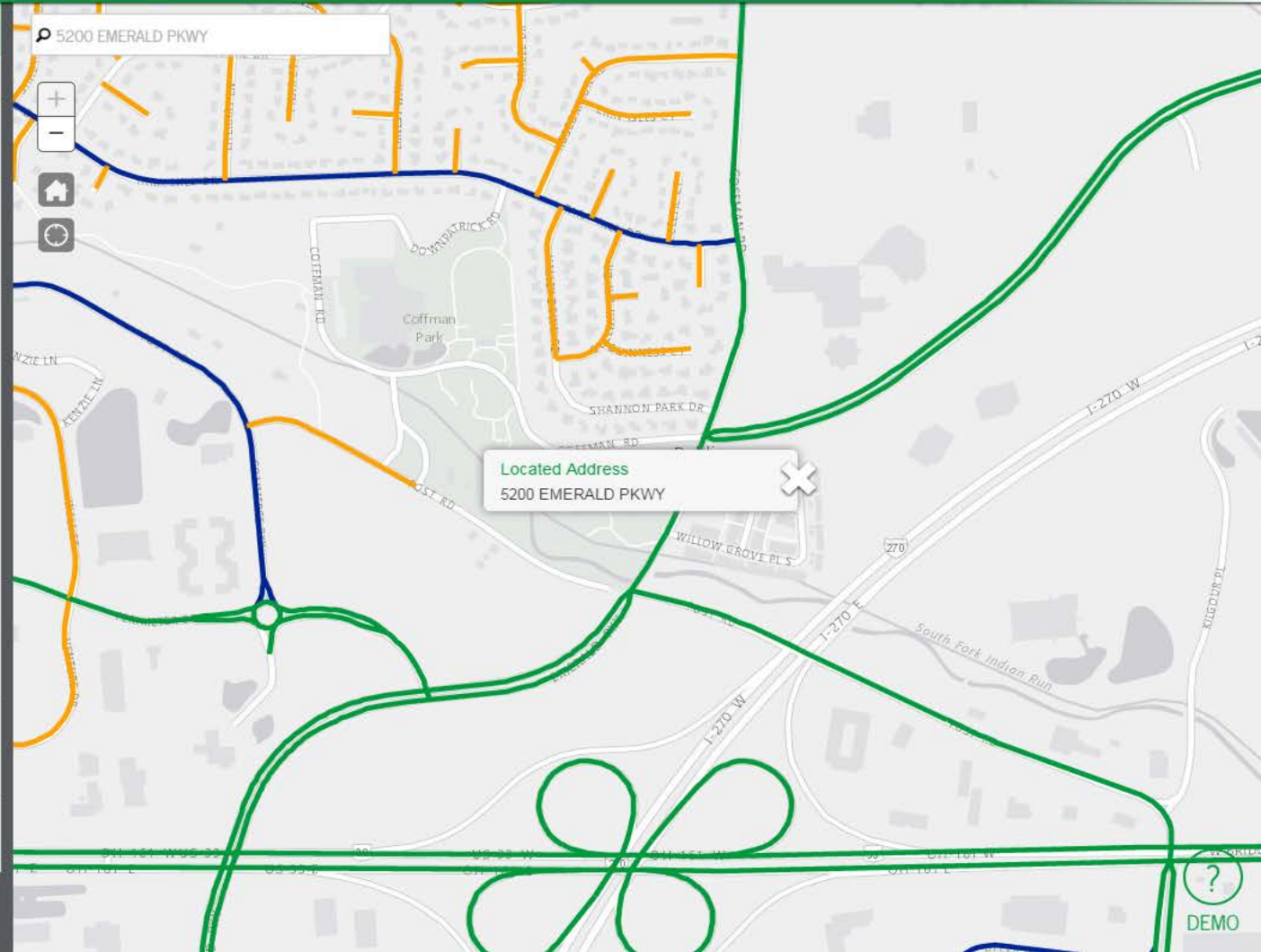
### Priority 2

main roads through subdivisions, streets connecting two or more priority 1 streets. These streets will be plowed and salted once priority 1 streets have received treatment.

### Priority 3

courts, cul-de-sacs and alleys will be serviced once priority 1 and priority 2 streets are cleared.

CLICK ON A STREET OR CHECK AN ADDRESS FOR MOST RECENT ACTIVITY



# Dublin

Requirements

Application Development

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**SNOW GO**

Sun Jun 26 89° scattered clouds

Activity Priority

The City has a curb to curb snow removal policy. Dangerous hills, curves, and bridges are monitored and treated as necessary throughout an event. All public streets within Dublin receive snow removal service according to the following priorities that have been established based on traffic volumes and speeds:

- Priority 1**  
Major arteries are plowed first. These streets will continue to receive treatment as long as weather conditions continue. Blowing snow and freezing roads once snow has thawed can require continued treatment.
- Priority 2**  
Main roads through subdivisions, streets connecting two or more priority 1 streets. These streets will be plowed and salted once priority 1 streets have received treatment.
- Priority 3**  
Residential streets, courts, cul-de-sacs and alleys will be serviced once priority 1 and priority 2 streets are cleared.
- Not treated by City of Dublin**  
Private residential and commercial streets as well as streets in other jurisdictions.

City of Dublin Snow Removal

5200 Emerald Pkwy

ERICK

DEMO

# Dublin



Switch to Priority View

Mon Nov 03 2014

- Treated less than an hour ago
- Treated one to 3 hours ago
- Treated more than 6 hours ago

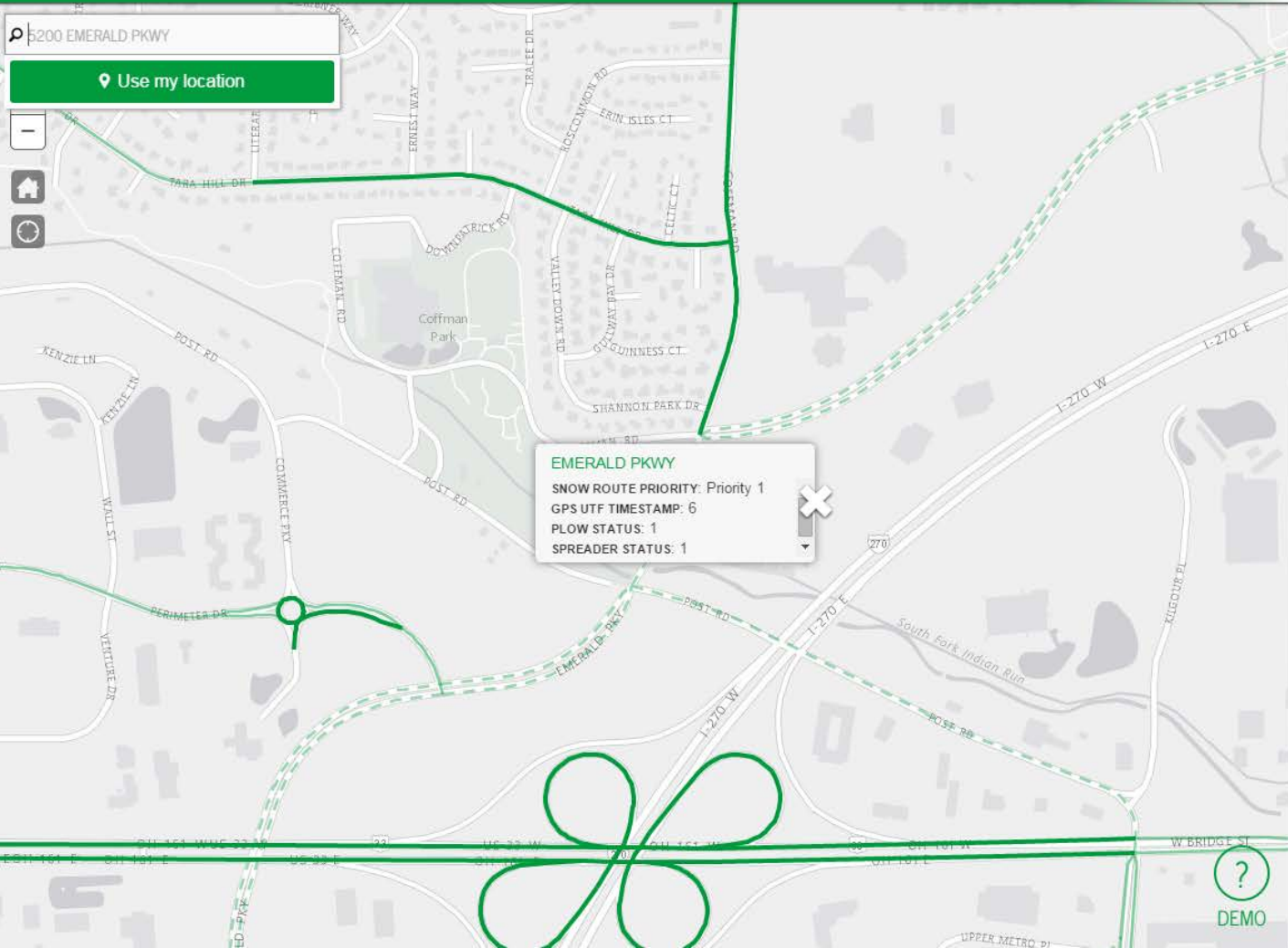
- Light snow falling. Roads may be slippery. Use caution today.
- Morning Classes for the Dublin Community Recreation Center have been canceled. Evening classes will take place as scheduled.
- Residents are required to keep their sidewalks, curbs and gutters in repair and free of snow, ice, debris and obstructions.

CLICK ON A STREET OR CHECK AN ADDRESS FOR MOST RECENT ACTIVITY



5200 EMERALD PKWY

Use my location



EMERALD PKWY

SNOW ROUTE PRIORITY: Priority 1

GPS UTF TIMESTAMP: 6

PLOW STATUS: 1

SPREADER STATUS: 1



# Dublin



Public View »

Switch to Priority View

Mon Nov 03 2014

- Treated less than an hour ago
- Treated one to 3 hours ago
- Treated more than 6 hours ago

CLICK ON A STREET OR CHECK AN ADDRESS FOR MOST RECENT ACTIVITY

Facebook, Twitter, LinkedIn, Email, RSS icons

5200 Emerald Pkwy

## Event Manager

To create a new event close the current one.

Snow Event # 25 [Edit](#)

Phase: Start Event  
Event Manager: John Babyak  
Start: Wednesday, March 12, 2014 6:00 PM  
End: In progress

Updates [Add Update](#)

- Shift Change - 3/12/2014 9:50 PM
- Pre-Event - 3/12/2014 6:00 PM

**Shift Change - Wednesday, March 12, 2014 9:50 PM** [Edit](#)

Author:	John Babyak	Trucks:	Out 19	Available:	4
Crew Supervisor:	Gary Browning 614-374-5068	Down:	1	Max:	1
Current Conditions:	Snowing lightly, 29 degrees	Salt:	650 tons - Snowing lightly, 29 degrees		
Forecast:	Snow: Tonight..Mostly cloudy with a 50 percent chance of snow in the evening..then clear after midnight. Snow accumulations of <1/4 inch. Thursday..Sunny. Thursday Night..Partly cloudy. Wednesday..High: 51,				

Map background showing streets like Powell, Worthington, Riverlea, and Ohio State University Airport.

# Columbus



- Beta Software
- IT Infrastructure
- Internal Application
- Public Application

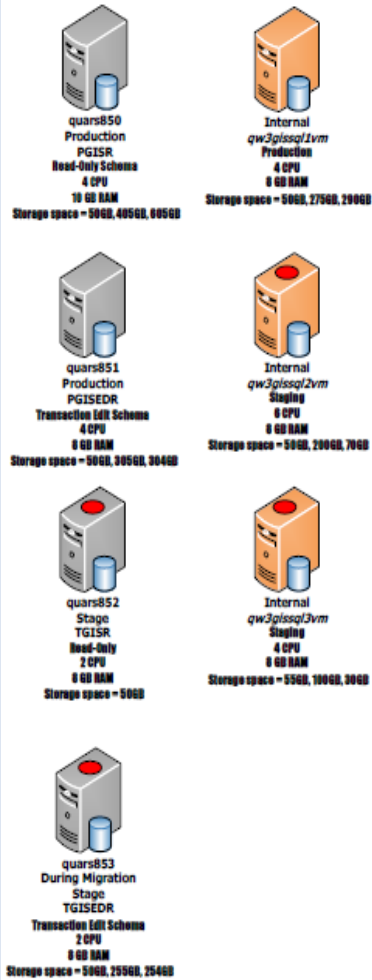


esri

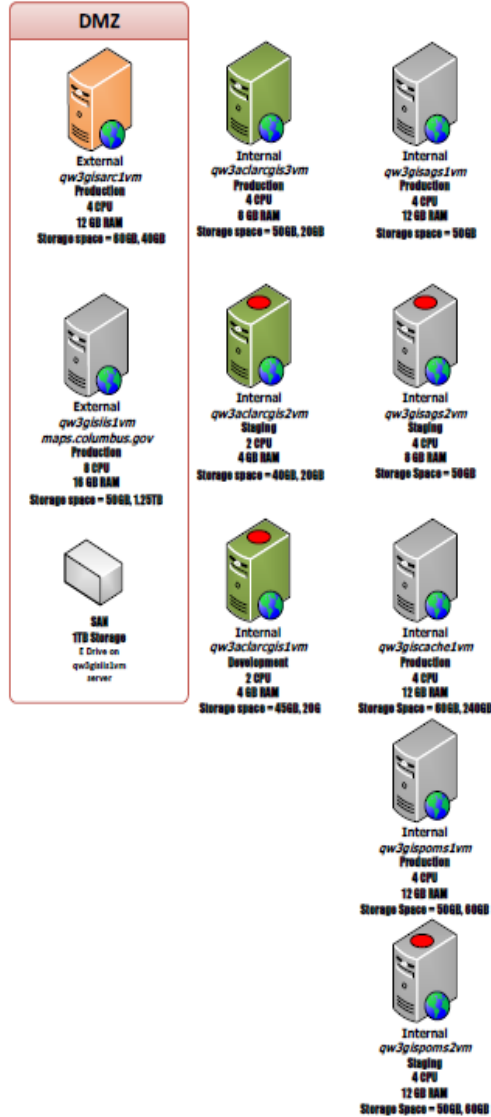


# City of Columbus GIS Enterprise Server Diagram October 2015

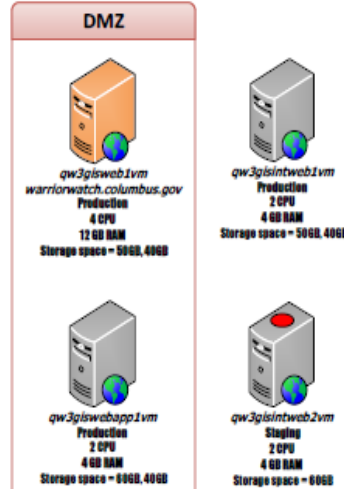
## Database Servers



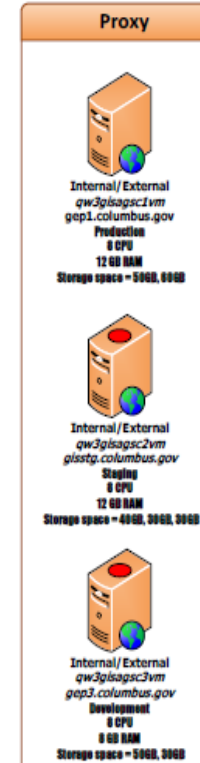
## Map Servers



## Web Servers



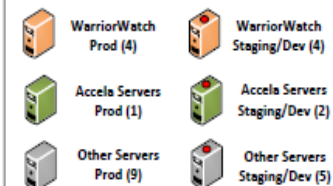
## Web and Map Servers



## File/Autoprc/License



### Legend



### Server Numbers

Database Servers = 7  
Map Servers = 10  
Web Servers = 4  
Web & Map Servers = 3  
Misc Servers = 1  
Total = 25

Production Total = 14  
Staging/Dev Total = 11

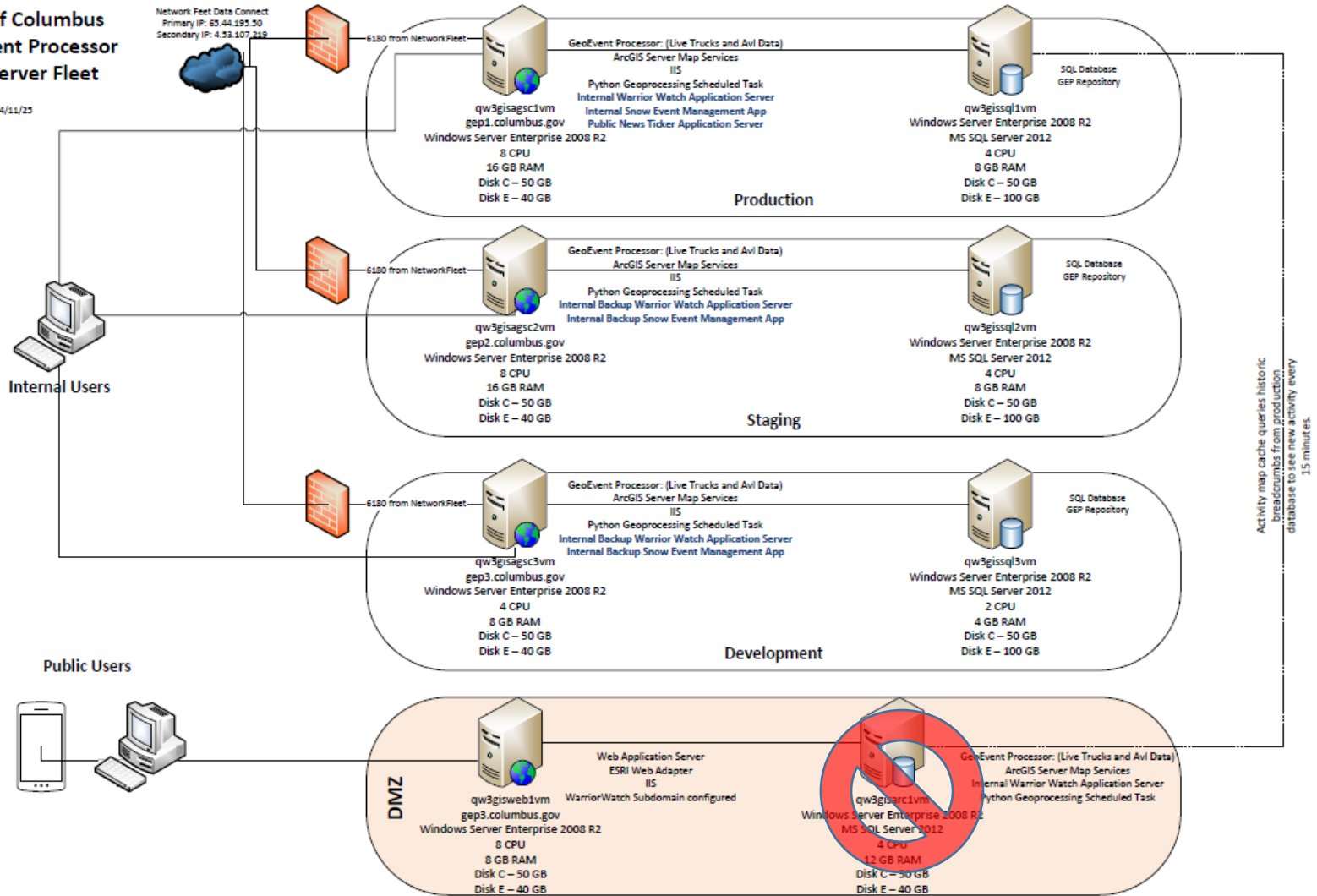


# Columbus



## City of Columbus GeoEvent Processor GIS Server Fleet

2014/11/25



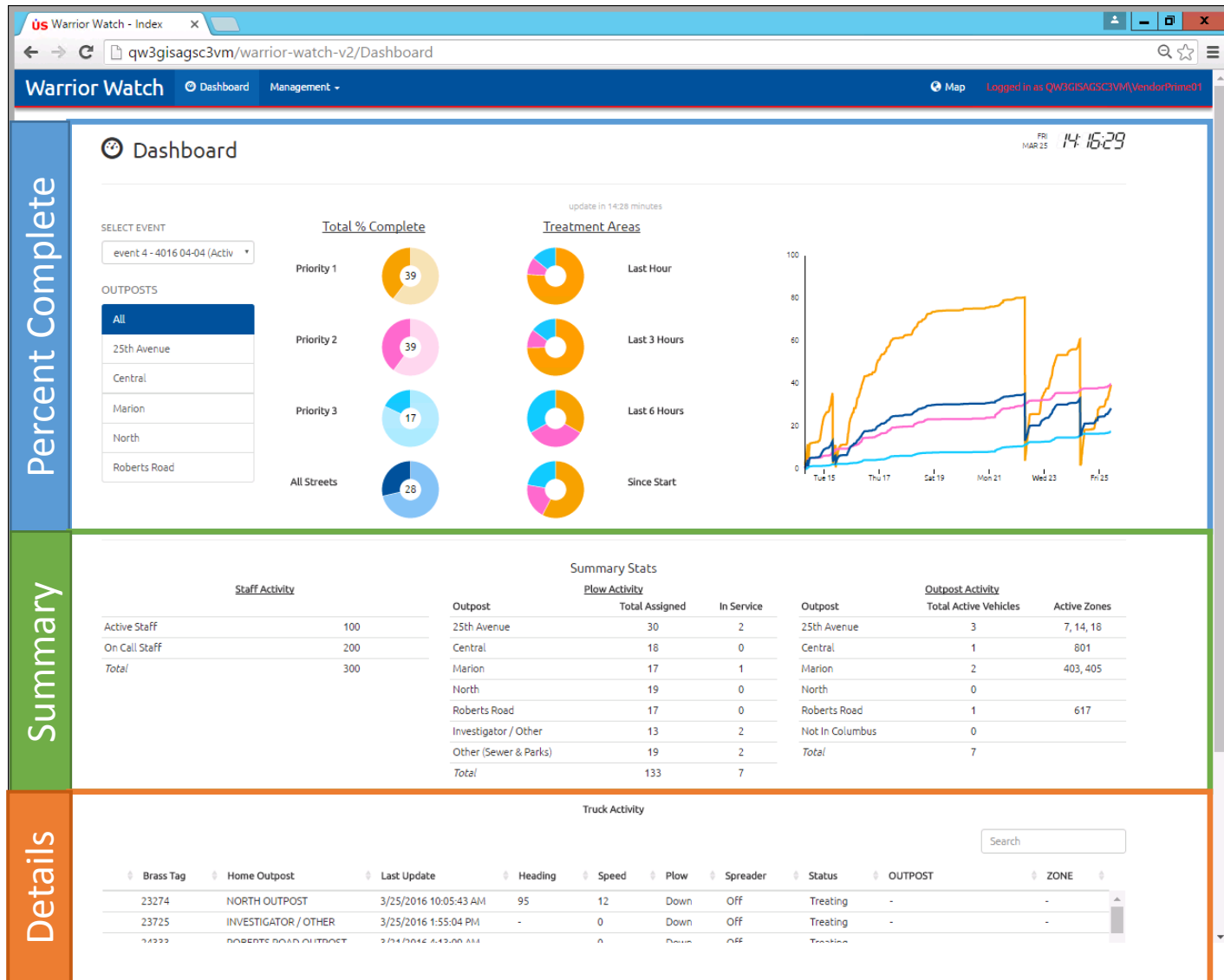
# Columbus

Requirements

Application Development

Data Development

Testing & Implementation



# Columbus



Warrior Watch - Index | Warrior Watch - Mapping | Warrior Watch - Index

qw3gisagsc3vm/warrior-watch-v2/Dashboard

Warrior Watch | Dashboard | Management | Map | Logged in as QW3GISAGSC3VMVendorPrimeB1

## Dashboard

FRI APR 8 14:49:09

update in 13:14 minutes

SELECT EVENT: event 8 - 2016-04-06 (Activ)

OUTPOSTS: All, 25th Avenue, Central, Marion, North, Roberts Road

### Total % Complete

Priority 1: 58

Priority 2: 12

Priority 3: 4

All Streets: 22

### Treatment Areas

Last Hour

Last 3 Hours

Last 6 Hours

Since Start

### Staff Activity

Active Staff	0
Inactive Staff	0
Total	0

### Plow Activity

Outpost	Total Assigned	In Service
25th Avenue	29	19
Central	22	3
Marion	18	3
North	21	5
Roberts Road	17	2
Investigator / Other	13	8
Other (Sewer & Parks)	19	9
Total	139	49

### Outpost Activity

Outpost	Total Active Vehicles	Active Zones
25th Avenue	28	2(2), 5, 6, 12, 18, 22, 28, 29(17), 30, 35(2)
Central	7	801, 811(2), 814(2), 819(2)
Marion	4	403, 408(2), 427
North	7	221, 222(2), 229, 233(2), 234
Roberts Road	3	603, 606, 617
Not In Columbus	0	
Total	49	

### Truck Activity

Brass Tag	Home Outpost	Last Update	Heading	Speed	Plow	Spreader	Status	OUTPOST	ZONE
24634	ROBERTS ROAD OUTPOST	4/8/2016 12:51:41 PM	-	0	Down	Off	Treating	ROBERTS ROAD OUTPOST	603
26271	25TH AVE	4/8/2016 11:03:15 AM	-	0	Down	Off	Not Treating	ROBERTS ROAD OUTPOST	606

# Columbus

Requirements

Application Development

Data Development

Testing & Implementation

The screenshot displays the Warrior Watch web application interface. At the top, there are browser tabs for "us Warrior Watch - Index" and "us Warrior Watch - Mapping". The address bar shows the URL "qw3gisagsc3vm/warrior-watch-v2/". The application header includes the "Warrior Watch" logo and a navigation menu with options: Trucks, Sweepers, Mowers, Tools, and Layers. A "Dashboard" link and a user login status "Logged in as QW3GISAGSC3VMVendorPrime01" are also visible. The main content area is a map of Columbus, Ohio, with a "Quick Address Search" bar. The map shows various landmarks, including Ohio State University, Westerville, and Columbus International Airport. A satellite view inset is located on the right side of the map. The bottom of the screen shows the Windows taskbar with the time "2:37 PM" and date "4/8/2016". The "WARRIORWATCH" logo is prominently displayed in the bottom right corner of the application area.

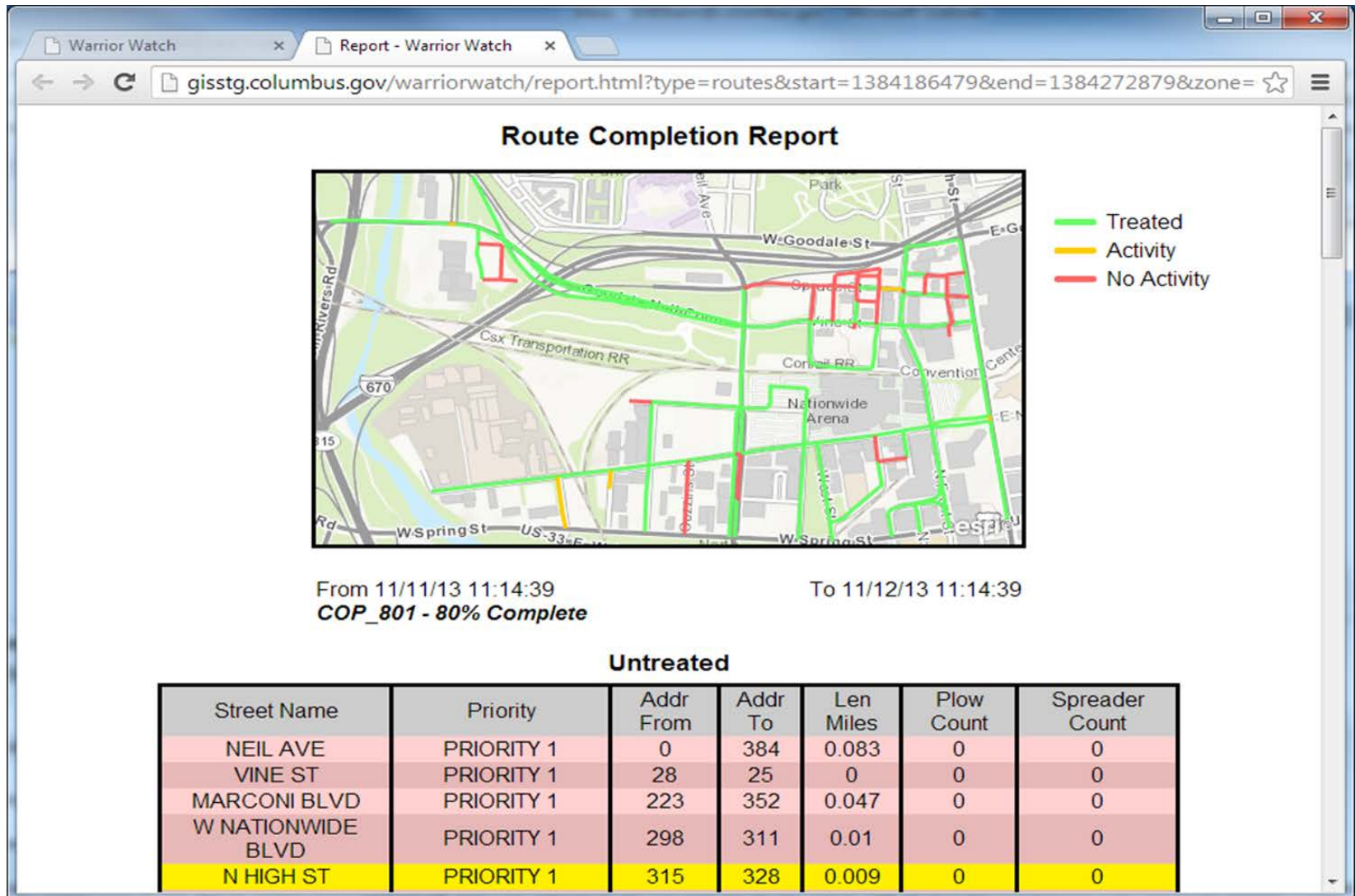
# Columbus

Requirements

Application Development

Data Development

Testing & Implementation



# Columbus

Requirements

Application Development

Data Development

Testing & Implementation

## Public WarriorWatch (Activity Cache)



THE CITY OF COLUMBUS  
ANDREW J. GINTHER, MAYOR

1 What has been treated?

2 What priority is my street?

Check out your street's priority. No storms are...

What has been treated?

200 W Broad Street

Use my location

Last 6 Hours  
Last 12 Hours  
Last 24 Hours  
Last 72 Hours  
City Boundary

Residents are encouraged to shovel sidewalks in residential neighborhoods.

For more information please visit <https://www.columbus.gov/snow/>

Visit us on Facebook

Last 24 Hours

Last Treated: 6/20 @ 3:43pm  
2849 - 2947 ATWOOD TER  
Maintained by Columbus

esri

# Columbus

Requirements

Application Development

Data Development

Testing & Implementation

## Public WarriorWatch (Priority Cache)



THE CITY OF COLUMBUS  
ANDREW J. GINTHER, MAYOR

1 What has been treated?

2 What priority is my street?

WARRIORWATCH

What priority is my street?

200 W Broad Street

Use my location

Priority 1 —

Priority 2 —

Priority 3 —

City Boundary

Residents are encouraged to shovel sidewalks in residential neighborhoods.

For more information please visit <https://www.columbus.gov/snow/>

Visit us on Facebook

Priority 3

547 - 643 GIBBARD AVE  
Maintained by Columbus

esri

# Dublin





# Dublin

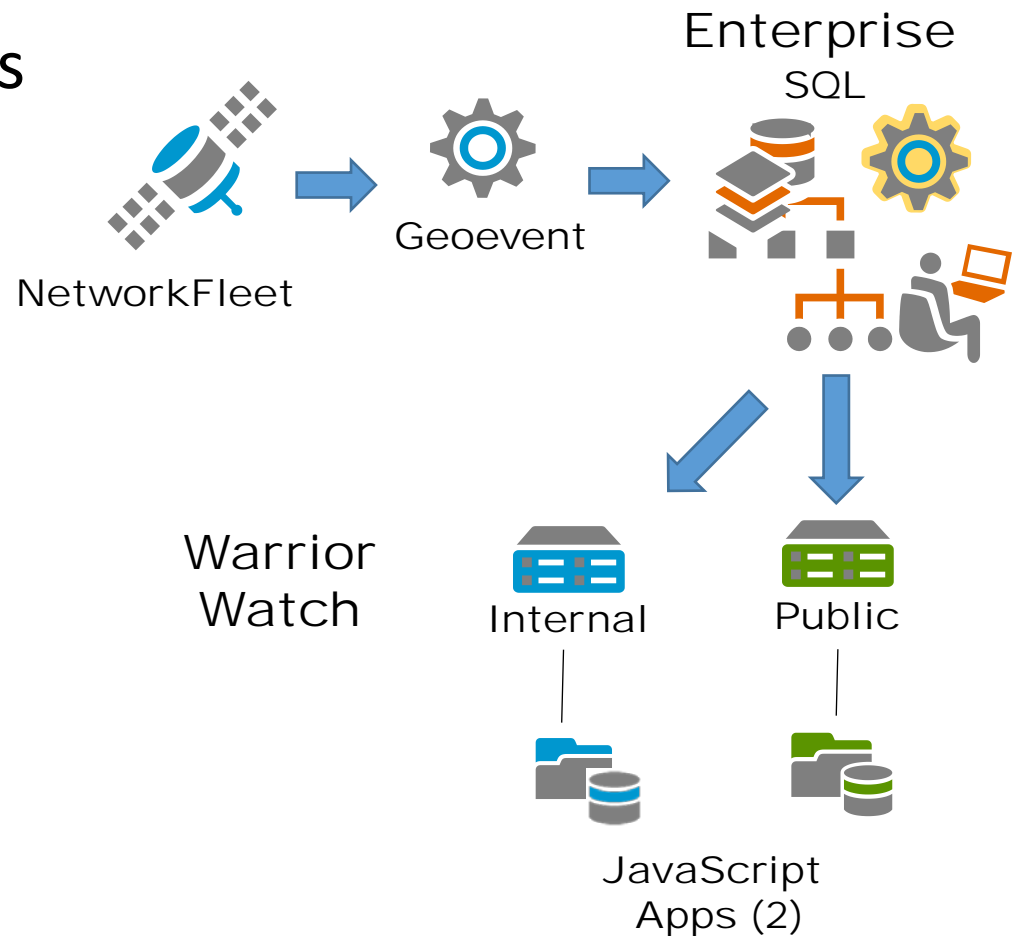


- Geoevent workflows
  - Filter trucks, detect sensor status, populate data table, update street table if activity
- Saving Data
  - Only save what we really need
  - Simplified Centerlines
- SQL Views
  - Let the database do some heavy lifting for stats
- Services
  - Stream services
  - JSON websockets
- Web Maps

# Columbus



- Goevent workflows
- Enterprise Data
- Performance



# Dublin



- Leaf Removal – trucks were out doing work
  - Showed areas for improvement in Geoevent Processes
    - Sequencing
    - Data storage vs pass through
    - Single large process or separate processes
- Backup environment to turn on if needed
- User feedback during an event

# Columbus

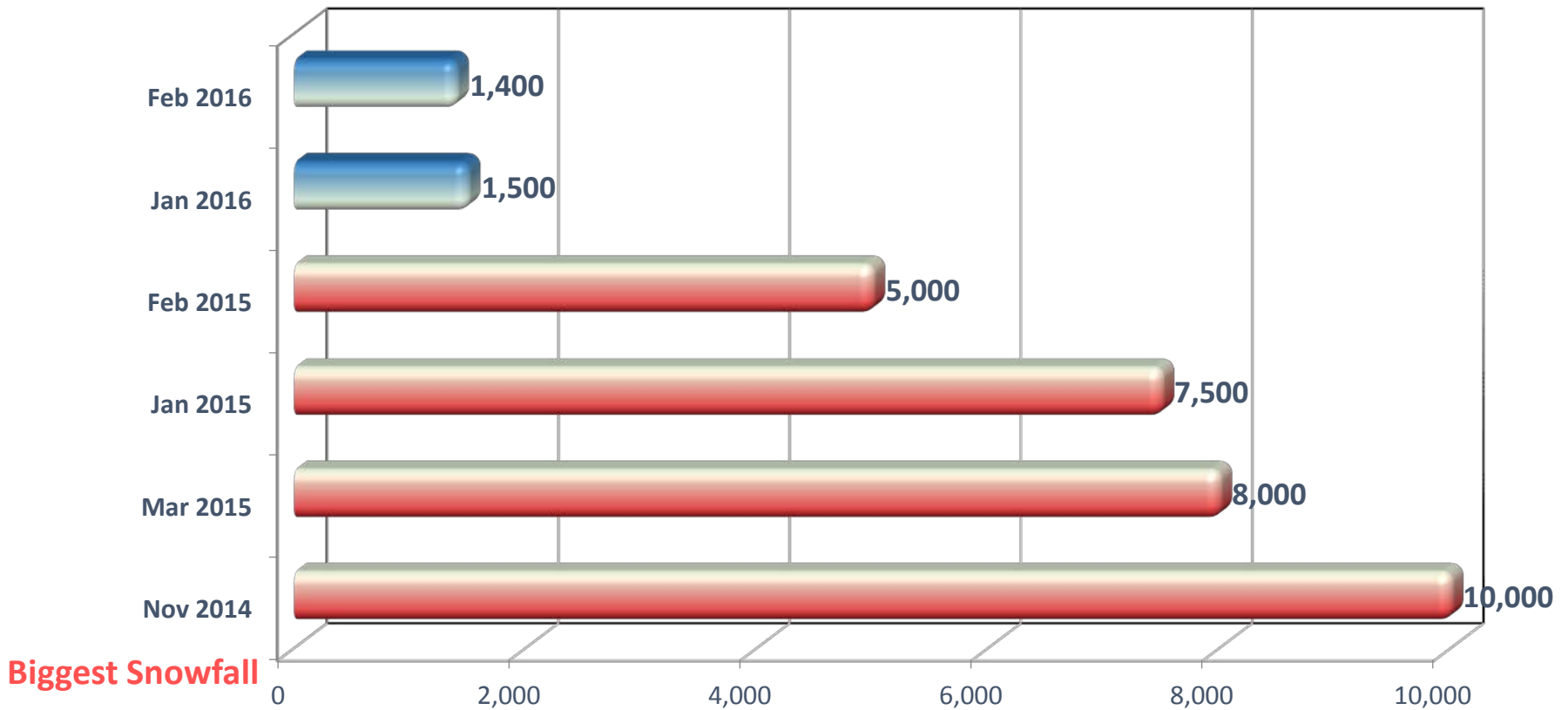


- Hired a company to perform load testing
    - Applied various tests from 500, 1000, to 2000 users (ramped up @ 0.07 seconds or on impulse).
- As a result, made several changes including:
- Additional Cores
  - Additional Memory
  - Modifying GeoProcessing Functions

# Columbus



## WarriorWatch - Number of User Sessions by Snow Event 2014-2016



**Biggest Snowfall**

# Conclusion and Steps Ahead

(Snow Plow AVL / GIS is AWESOME!!!!)



- Decouple Event start/stop control & status updates
- Show trucks (last reported position) on public map
- Test integration with Waze



- Testing & launching the new dashboard
- Expanding functionalities
- Integrating with optimized routing & work order asset management

**BRACE YOURSELF**



**WINTER IS COMING**

makeameme.org