

# Enhancing Monitoring with Spatial Data and Maps

Derek Arnold

d.arnold7@gmail.com

usenix

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# About me

- Twitter handle: @darnold0714
- LinkedIn URL: <https://www.linkedin.net/in/derek-a-arnold>
- Github: <https://www.github.com/darnold76>
- Last position: Sr. Systems Engineer at a fiber/wireless ISP in Northeastern Ohio
- Interests: Linux, Python, maps (of course), cities (big and small), mathematics, systems of various kinds
- Number of wives: 1, also named Lisa
- Number of kids: 1
- Number of four legged stepchildren: 1
- Number of days on Jeopardy!: 1

# Roadmap\*

- Why this talk?
- What Is Spatial Data?
- Storage Considerations for Spatial Data
- Collecting / Acquiring Spatial Data
- Integration with Current Data
- Visualization of Spatial Data (Maps!)
- Conclusion

\* Slight pun intended

# Why am I Here?

- Convergence of multiple personal interests:
  - Math / Problem Solving
  - Maps
  - Data / Computers
- Professionally: learned about spatial data during web internship at the Greater Cleveland Regional Transit Authority (GCRTA) (1999-2000)

# Why This Subject?

- Metrics are our friends
- Measures come from stationary objects...but that isn't a limitation
- The use cases where location needs to be known, tracked and integrated are growing (more on that later)
- Enter spatial data

# Why Does Spatial Data Matter?

- Storage is cheap and plentiful
- Bandwidth is (nearly) ubiquitous\*
- Lots of free (gratis and/or libre) and non-free (paid and/or proprietary) software to manipulate data
- The world is a lot smaller and the population is more mobile
  - Examples
    - Smart Phones
    - Intelligent Transportation
    - Internet of Things

\* There are lots of exceptions...it is an issue that needs to be addressed but it's beyond the scope of this tutorial.

# What is Spatial Data?

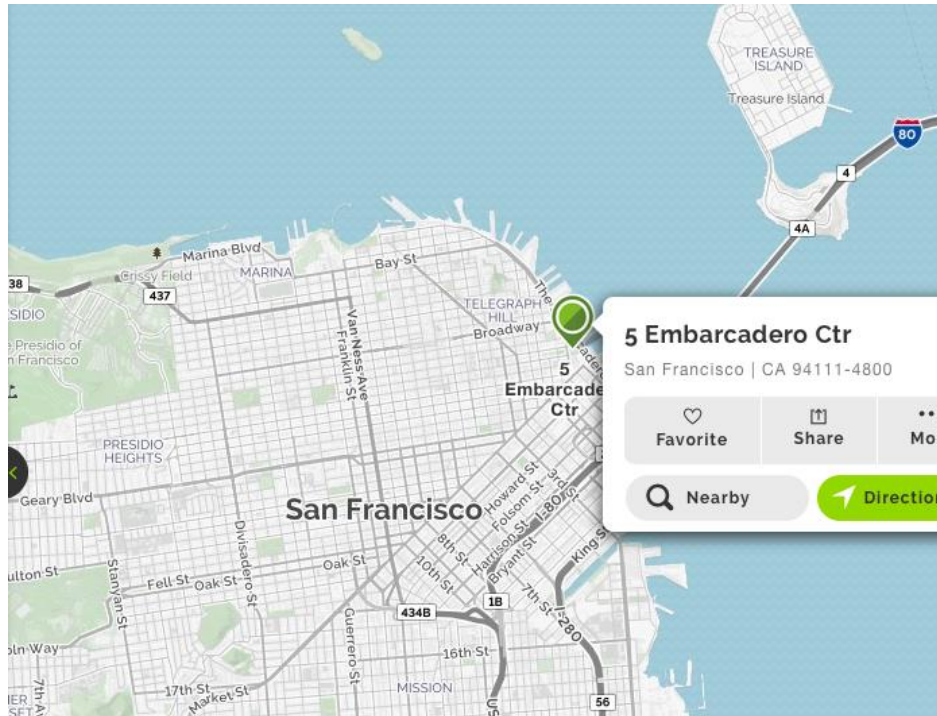
- GIS – Geographic Information System
  - Coined by Dr. Roger Tomlinson (Geographer – UK) – 1968
  - System for capturing, storing, manipulating, analyzing, managing and presenting spatial data
  - Current day examples of spatial data include:
    - Borders of political divisions (city, state, country, etc.)
    - A jogger's path taken by a phone app
    - A route used by a delivery service
    - Real-time data from buses in a transit system

# What is Spatial Data?

- How do we describe data?
- Latitude
  - From the Latin latus meaning breadth
  - Lines running east to west at varying angles from the center of the earth (parallels).
  - 0° Latitude = the Equator
  - Latitudes  $> 0$  = Northern Hemisphere, Latitudes  $< 0$  = Southern Hemisphere
- Longitude
  - Lines running north to south at varying angles from the center of the earth (meridians)
  - 0° Longitude = the Prime Meridian (runs through Greenwich, UK)
  - Longitudes  $> 0$  = Eastern Hemisphere, Longitudes  $< 0$  = Western Hemisphere



# You Are Here



Source: Mapquest

37.7942211,-122.397855

# What is Spatial Data?

- Addresses -> Coordinates?
- Geocoding...and reverse geocoding (Coordinates->Addresses)
- Tools exist:
  - Nominatum
  - Google Geocoding API

# Demo Time

- Nominatum

# Demo Time

- Google Geocoding API

# Storage of Spatial Data

- Where does it go?
- The same databases already in production can store and manipulate spatial data
- PostgreSQL (with PostGIS)
- MariaDB and MySQL
- Oracle Spatial
- Microsoft SQL Server 2008+

# Storage of Spatial Data

- Spatial data != just points
- Points
- Lines
  - Roads, network connections
- Polygons
  - Borders of political divisions, land
- Operations on all of these are included in spatial-aware DBs
- Will discuss in depth later

# Acquisition of Spatial Data

- You may already have data
  - Business data
  - In-house GIS staff
- Many different formats
  - CSV
  - XLS
  - JSON
  - ESRI SHP
    - “Shapefile” – format created by ESRI
  - KML
    - Keyhole Markup Language – default of Google Earth
  - SQL

# Monitoring and Spatial Data

- Add spatial data to your devices
- Nagios & Nagios XI – define host lat/long with custom object variables
- Custom code to update host definition files in the case of moving hosts
- Data doesn't have to live together to work together



# Visualization of Spatial Data

- Many spatial data tools for manipulation of spatial data
- Software
  - Quantum GIS (QGIS)
    - QGIS:ESRI ArcGIS::GIMP:Photoshop
    - Boundless Desktop (based on QGIS)
- Frameworks
  - GDAL – Geospatial Data Abstraction Library(command-line library)
  - OpenLayers (web-based JavaScript library)

# Visualization of Spatial Data

- Sharing With Teams
  - Google Earth (1 – 2 people)
  - ArcGIS Online (public and private sharing options)
  - Boundless Suite
  - Custom solutions using aforementioned frameworks

# Conclusion

- Spatial data == organized way to say where things are
- Unlimited usefulness when aligned with business need
- Provides insight into the spatial world around us through a wealth of usable data
- Spatial data has more applications than pretty maps

# More Information

- PostGIS: <https://www.postgis.org>
- MariaDB: <https://www.mariadb.com/kb/en/library/geographic-geometric-features/>
- What is a Spatial Database?: <http://workshops.boundlessgeo.com/postgis-intro/introduction.html>
- ArcGIS: <https://www.arcgis.com/features/index.html>
- MS SQL Server: <https://docs.microsoft.com/en-us/sql/relational-databases/spatial/spatial-data-sql-server>
- OpenLayers: <http://openlayers.org/en/latest/apidoc/>
- GDAL: <http://www.gdal.org>

# Questions?

# Q/A

# The End

Thank you all for your time and attention.  
Please do not forget to fill out an evaluation of this tutorial.