Transit Networks

GRAPHED

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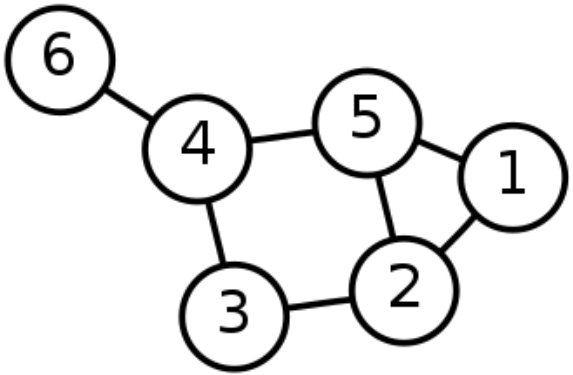
Washington, DC

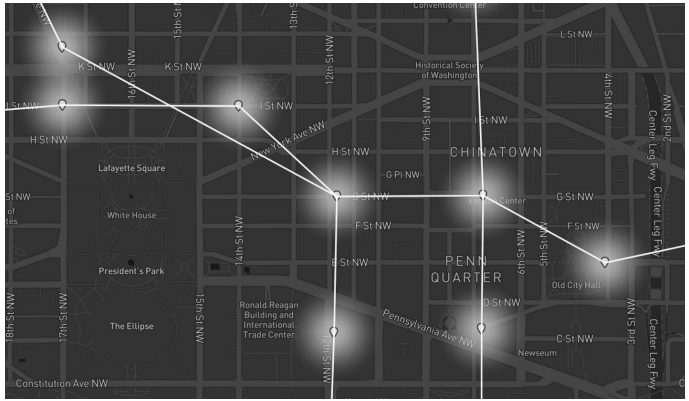

KENTUCKY


Outdoor Products



What is a graph?

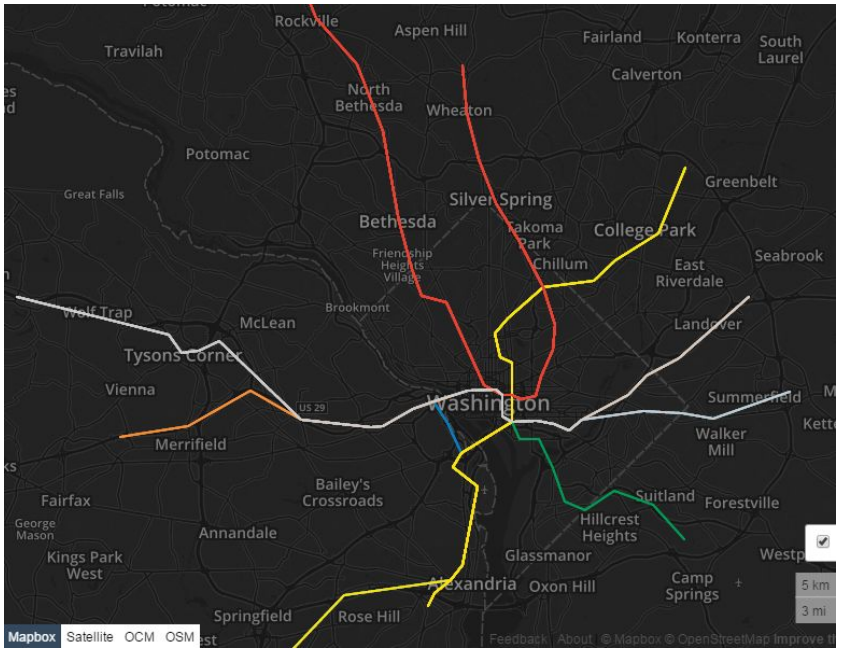
A collection of nodes and edges between them.



What does this have to do with transit?

We can calculate directions through a network!

Transit + Graphs =



How do we build a transit graph?

WMATA GTFS

agency.txt
routes.txt
too_fast.txt
calendar_dates.txt
shapes.txt
trips.txt
stop_times.txt
route_xref.txt
stops.txt

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How do we build a transit graph?

stops.txt

```
stop_id,stop_code,stop_name,stop_desc,stop_lat,stop_lon,zone_id
5017,,"L'ENFANT PLAZA METRO STATION",,38.884886,-77.021600,10
12928,,"PENTAGON METRO STATION",,38.869474,-77.053777,42
```

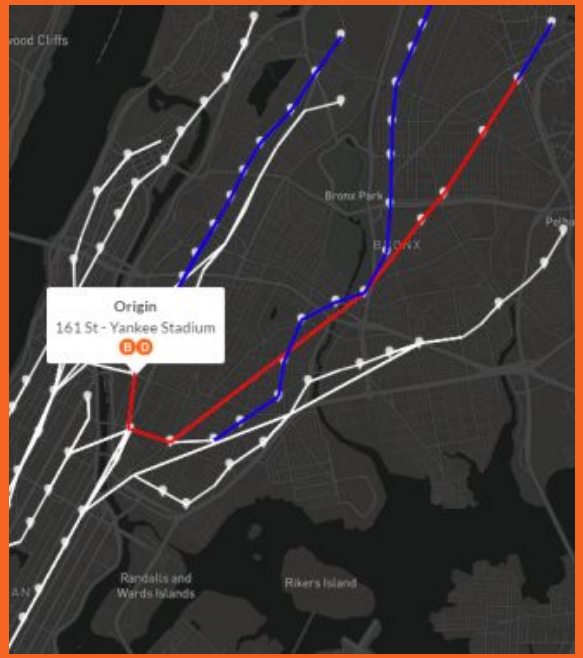
stop_times.txt

```
trip_id,arrival_time,departure_time,stop_id,stop_sequence,pickup_type,drop_off_type,shape_dist_traveled
75182,05:24:00,05:24:00,5017,1,0,0,0.0000
75182,05:29:00,05:29:00,12928,2,0,0,2.0231
```

What stations can I reach from my station?

Search algorithms

Depth-First Search



What is the fastest way to get to a given station?

Shortest-path algorithm

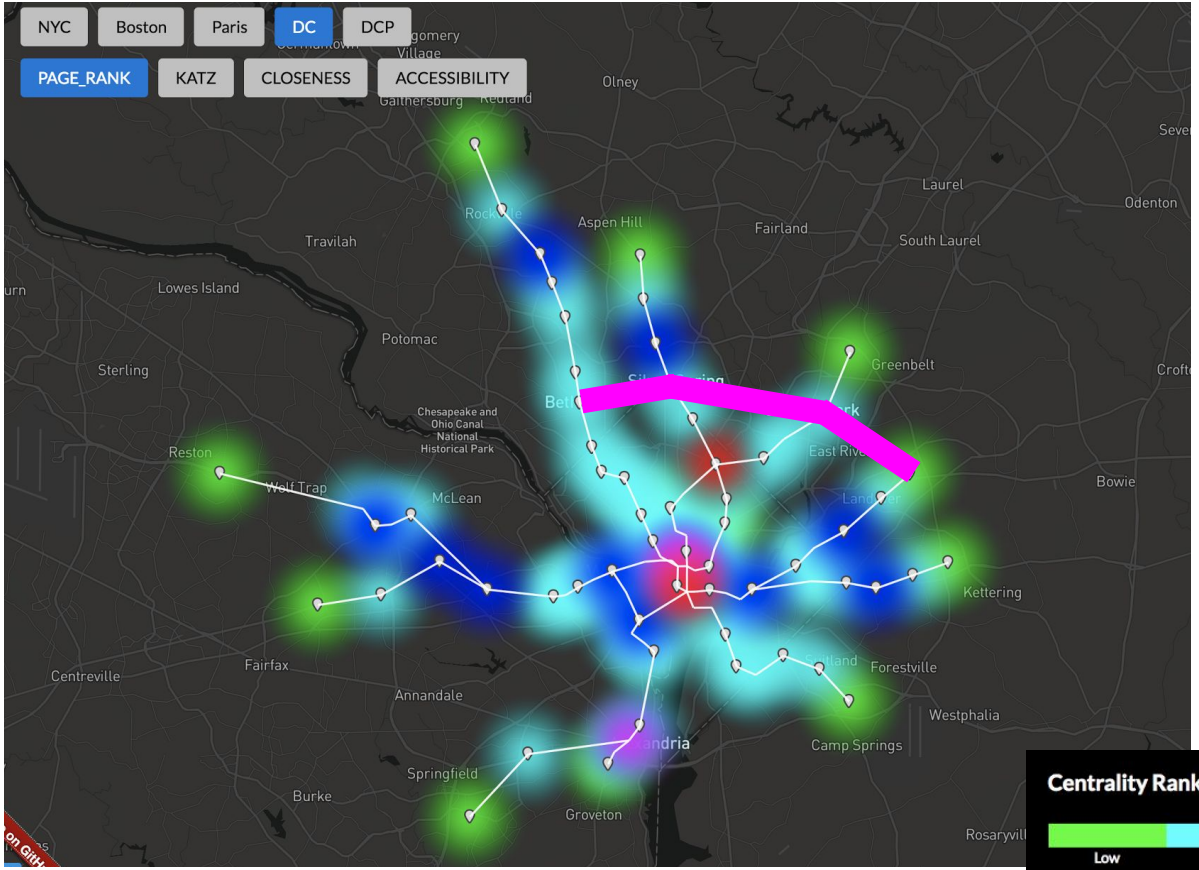
Dijkstra's Algorithm

What are the most important stations in a network?

Centrality algorithms

- PageRank
- Closeness Centrality

PageRank

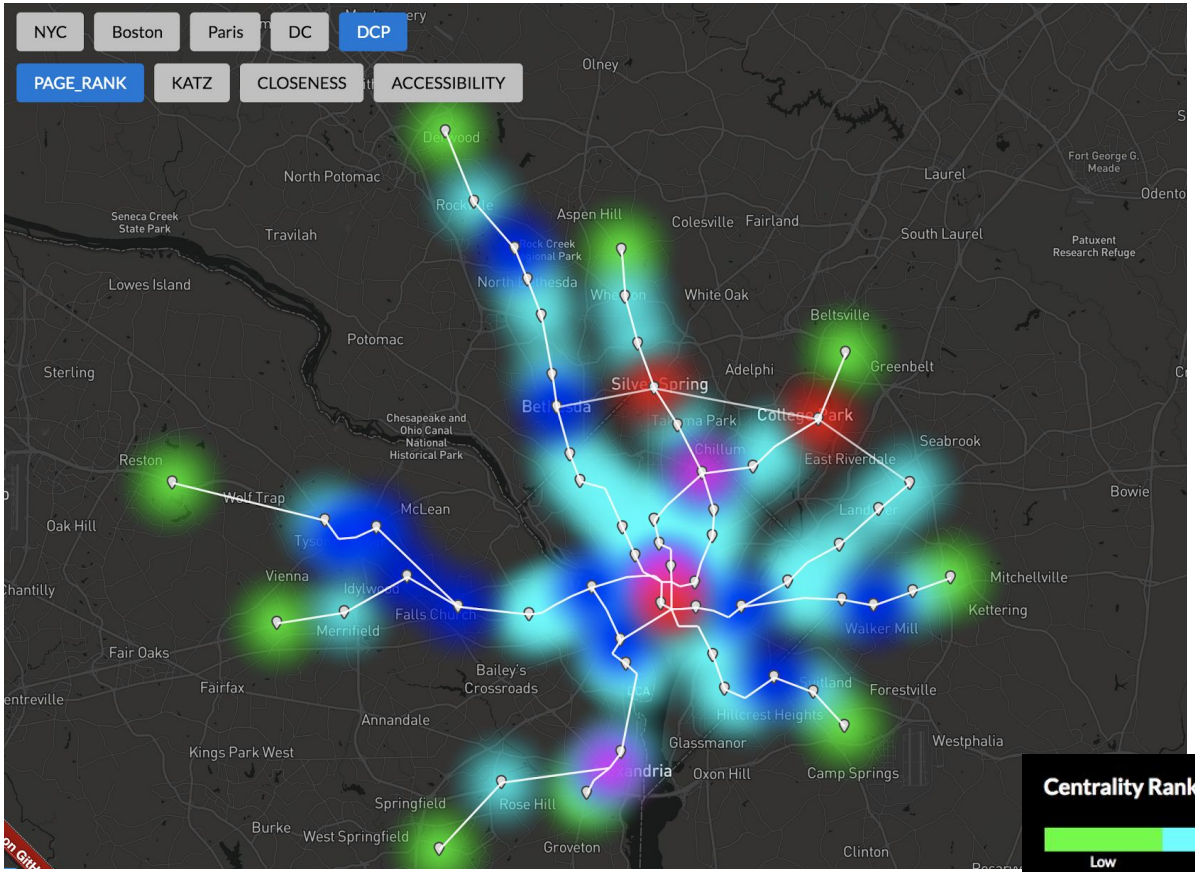


1.	2.10437	L'Enfant Plaza
2.	1.81865	Fort Totten
3.	1.74702	Metro Center
4.	1.71635	King Street
5.	1.65715	Gallery Place Chinatown
6.	1.36668	Stadium Armory
7.	1.35918	East Falls Church
8.	1.32541	Pentagon
9.	1.28757	Rosslyn
10.	1.22946	Greensboro

Centrality Ranking

Low — Medium — High

PageRank

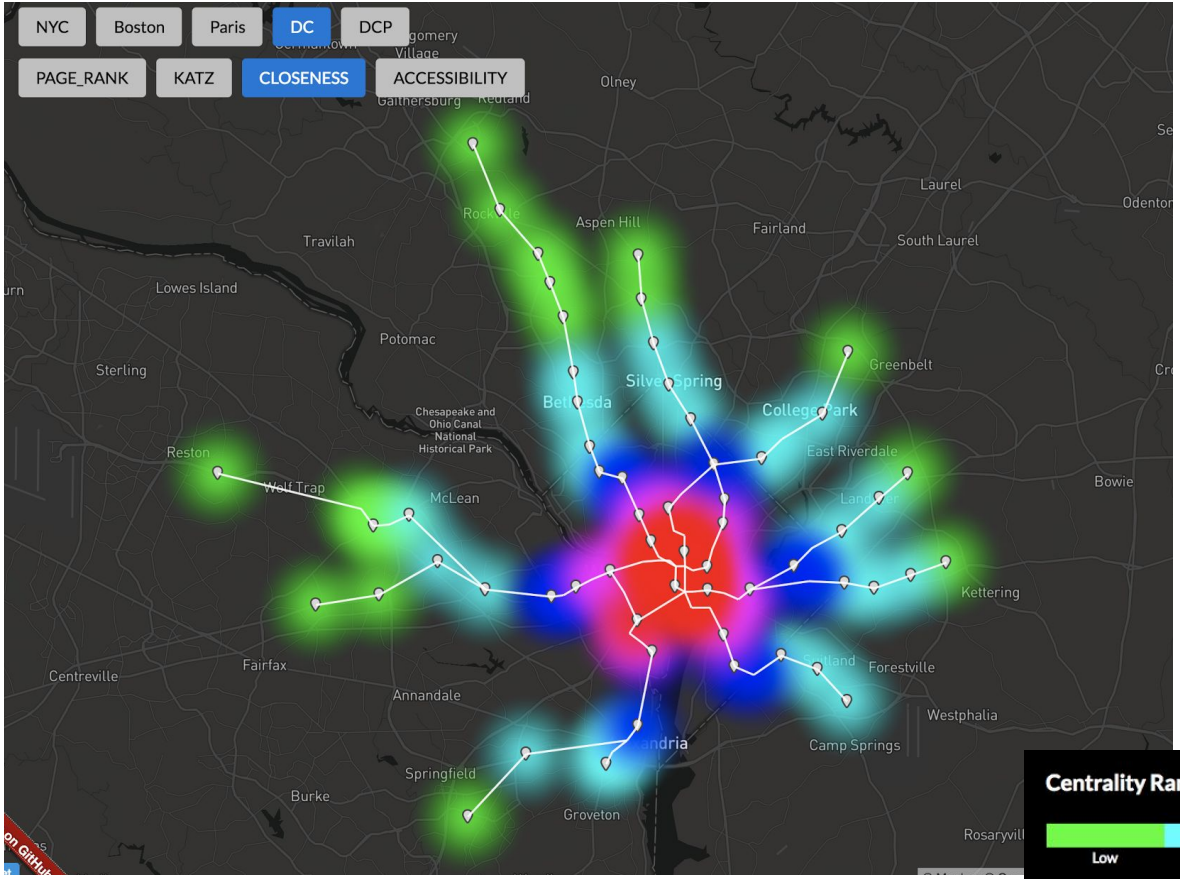


1.	2.10348	L'Enfant Plaza
2.	1.7797	Silver Spring
3.	1.77601	College Park/U Of MD
4.	1.74334	Metro Center
5.	1.71635	King Street
6.	1.68506	Fort Totten
7.	1.65219	Gallery Place Chinatown
8.	1.42914	Bethesda
9.	1.35918	East Falls Church
10.	1.34346	Stadium Armory

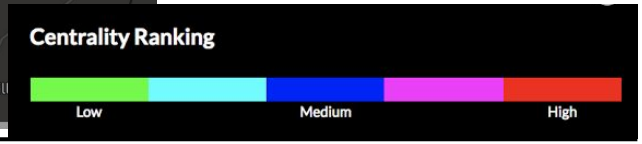
Centrality Ranking

Low — Medium — High

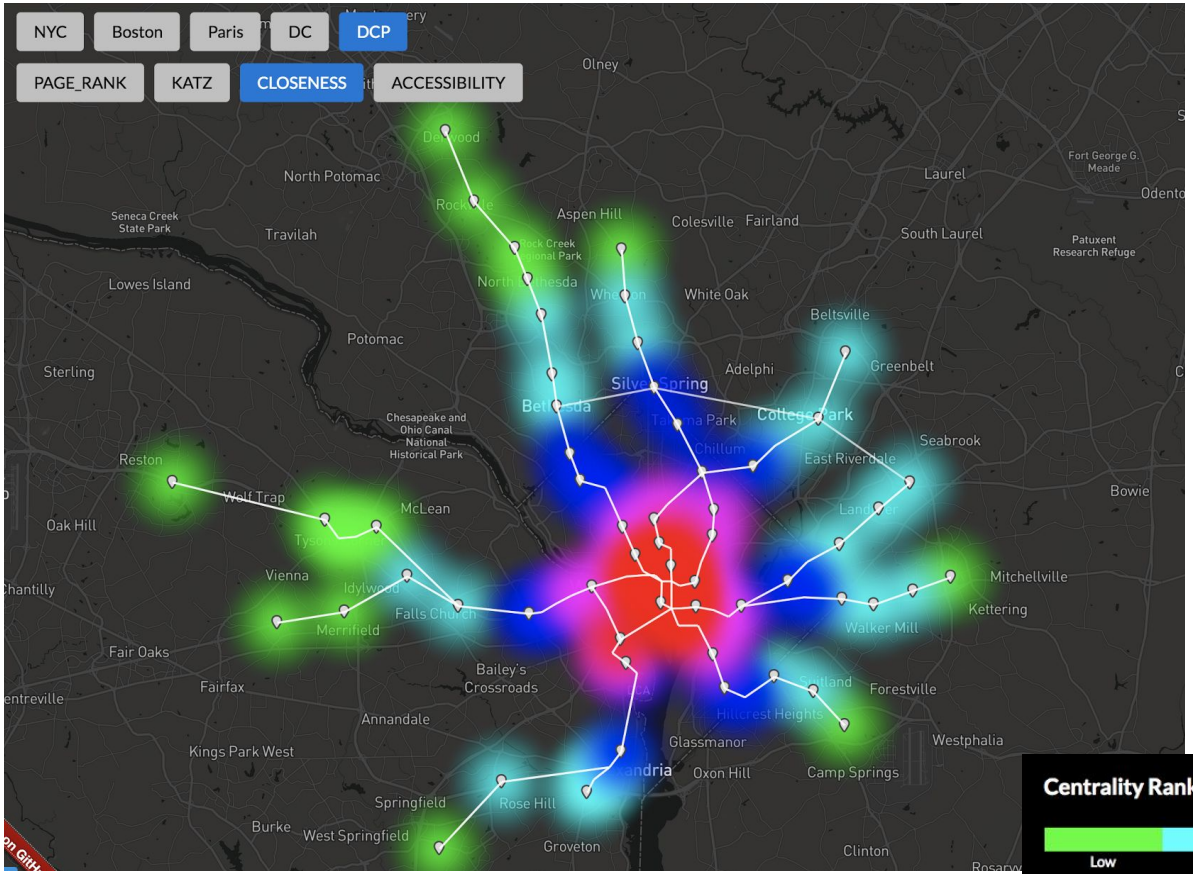
Closeness



1.	0.00097	L'Enfant Plaza
2.	0.00096	Gallery Place Chinatown
3.	0.00095	Archives
4.	0.00095	Metro Center
5.	0.00094	Federal Triangle
6.	0.00092	Smithsonian
7.	0.0009	Federal Center
8.	0.00089	Waterfront
9.	0.00089	McPherson Sq
10.	0.00089	Mt Vernon Sq/7th St-Convention Center



Closeness



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Centrality Ranking

Low — Medium — High

Pros & Cons

- Macro-scale
- GTFS-based
- Theoretical

- Macro-scale
- GTFS-based
- Theoretical

Continuing Education

- App
  - https://gtfs-graph.herokuapp.com/
  - https://gtfs-graph.herokuapp.com/demo/
- Code
  - gtfs-graph (https://github.com/tyleragreen/gtfs-graph)
  - transit-tools (https://github.com/tyleragreen/transit-tools)
- Blog
  - http://www.tyleragreen.com/blog/tag/graph/
- The most fun I've ever had reading an academic paper
  - "Network Centrality of Metro Systems," Sybil Derrible, 2012.
- Tools
  - enmodal (http://enmodal.co/)