

Connectivity Graph of the Metrorail System

Metro Hack Night VI

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Summary

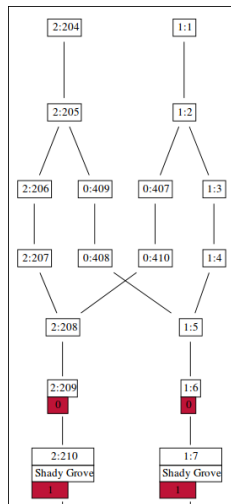
Goal

- ▶ Map the connectivity between the track circuits in the WMATA rail network into a human understandable form.

Motivation

- ▶ Where does a train go after it reaches its destination?
- ▶ Which tracks are being used because of Safetrack?
- ▶ Are there any interesting connections?

Logical vs. Physical Views



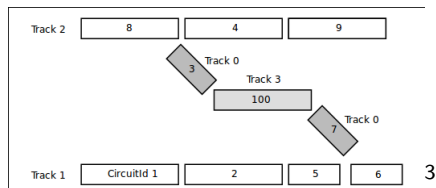
Logical View.



Physical View.

Connectivity Graph

Each track circuit may be connected to between 1 and 3 other circuits.

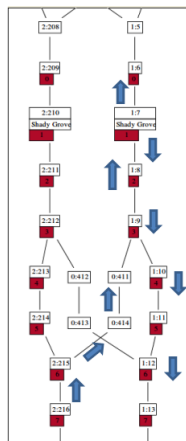


The rail network may be viewed as an undirected graph $G = (V, E)$, where the vertices are the track circuits and the edges are the connections to the neighboring circuits.

With this view we can then leverage graph drawing tools, (e.g., graphviz), to visualize the network.

Results: Where Does The Train Go?

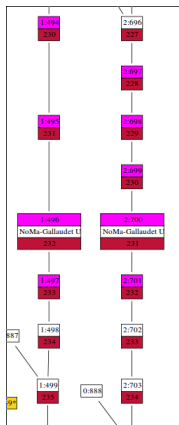
Recorded CID sequence:⁴ { ..., 217, 216, 411, 7, 6, 8, 10, 13, ... }:



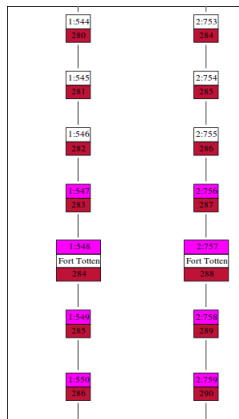
⁴Note how a train skips CIDs when crossing a switch

Results: Safetrack 11/16/2016

Visited CIDs in magenta. No traffic seen between NoMa-Gallaudet and Fort Totten.



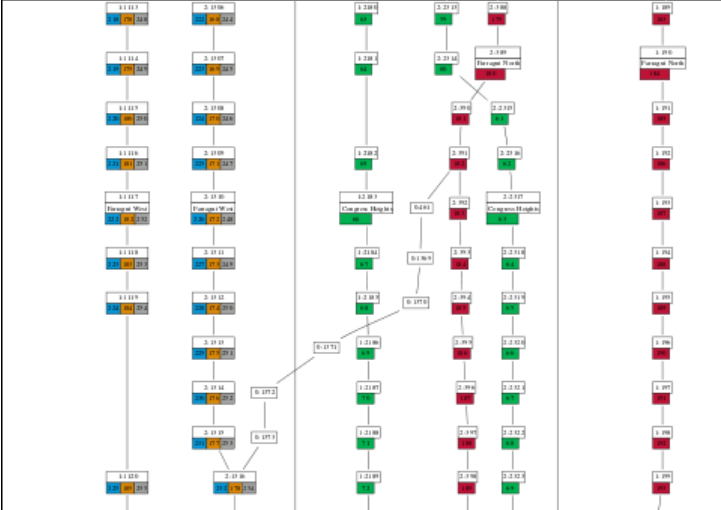
NoMa-Gallaudet.



Ft. Totten.

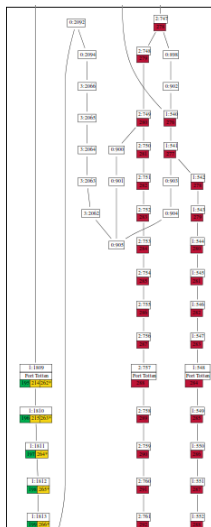
Results: Surprise Connections

There is a rail link between between the Red and Blue/Orange/Gray lines.



Results: Surprise Connections (cont.)

There is a rail link between between the Red and Green lines. As a result of these connections, a train can travel to any part of the network (graph is *connected*)



References

Connectivity Graph of Entire System

- ▶ PNG format
- ▶ SVG format

Code Used to Generate Graph

- ▶ draw graph
- ▶ library

Backup Slides

Analysis

- ▶ Info on CIDs
- ▶ CIDs on each line
- ▶ Continuous sections of track
- ▶ Switch CIDs
- ▶ Terminal CIDs