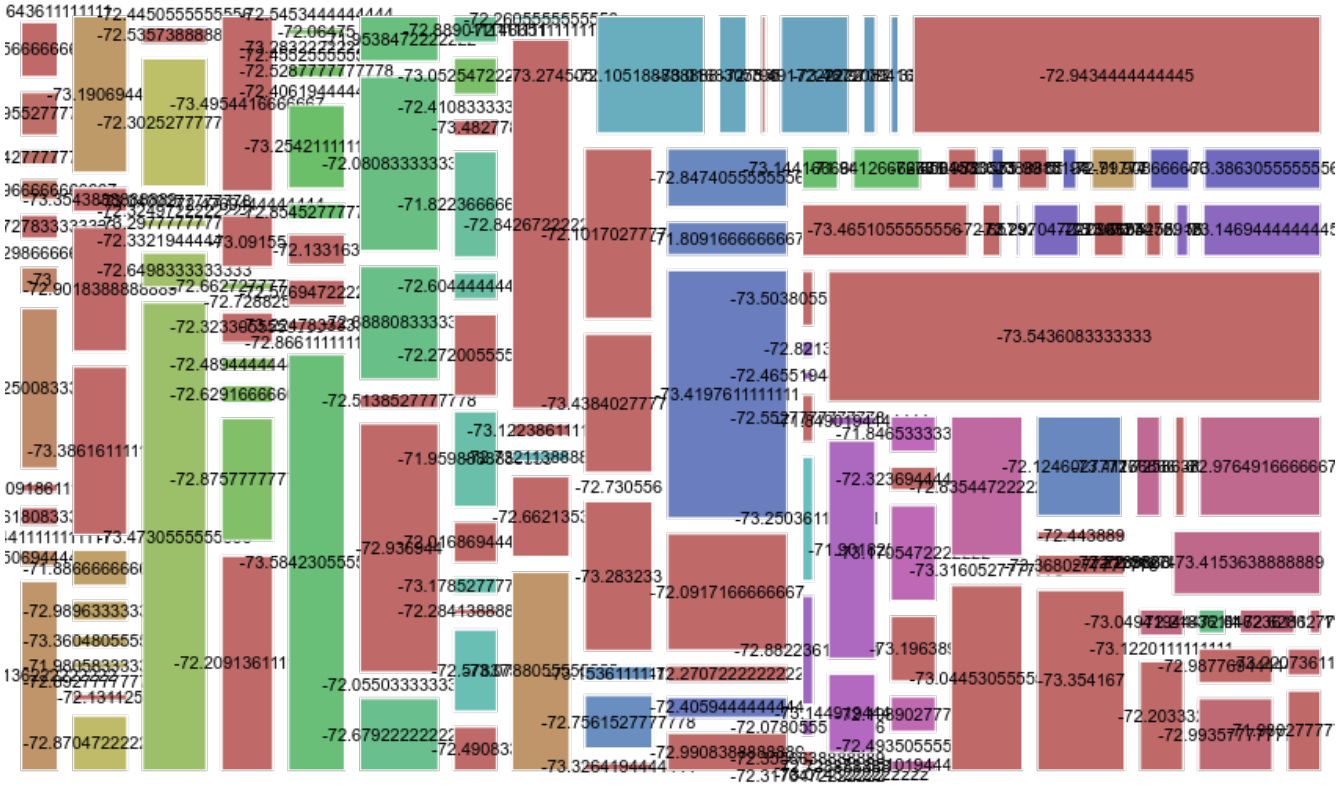
Data Visualization Case Study: Telecom Towers State-wide Samples: Connecticut and Vermont

Abstract: Telecom Towers take up a lot of space in order to allow us to communicate through GSM networks and the internet. Utilizing RAWGraphs, we look at various data visualizations of telecom towers in state level deployment. These visualizations are meant to fulfill the purpose of informing readers about how much infrastructure is required in order to get this off the ground. With technologies such as the decentralized-internet and its SDK, one is able to make a new type of wireless communications protocol that doesn't need all this infrastructure to fulfill such purpose, just devices.

Example of Telecom Tower, source: Needpix

Purpose of visuals: Convince people that telecom infrastructure is too much and needs to be replaced by a more simplistic software centric solution for the 21st century.

Treemap Visualization:

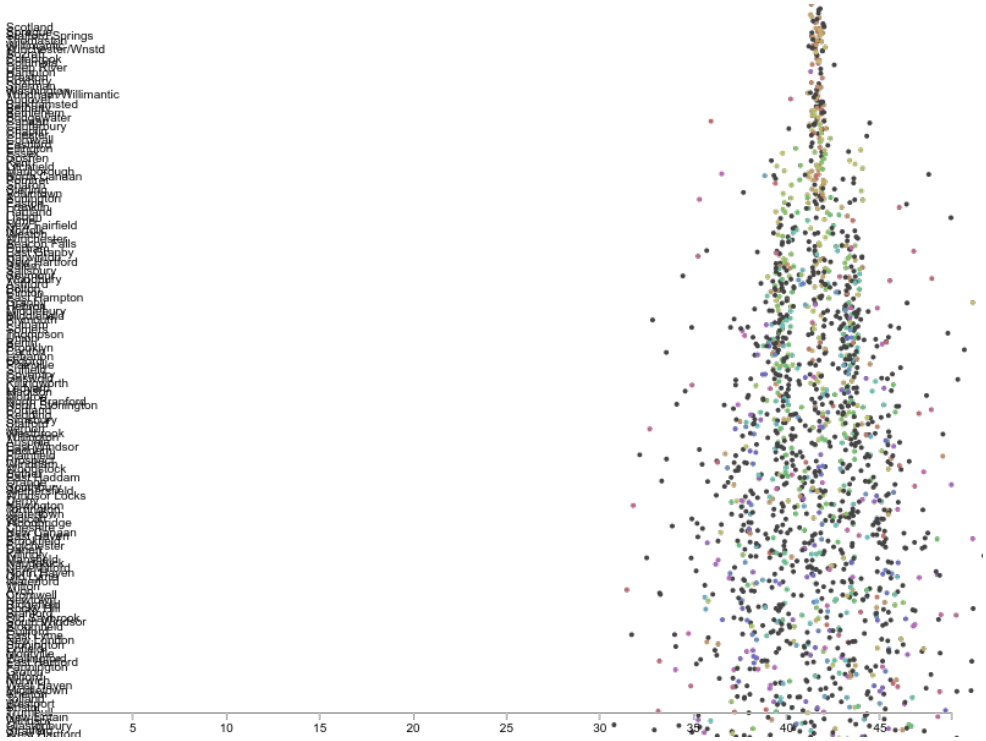


Graphed: Town, Georeferences, Carrier 2 Category, and Longitude

This treemap was mainly for georeferences and it showed the different carriers by color. There are also different sizes likely representing different sized telecom towers. As one can see, the amount of telecom towers needed to cover an entire city are numerous in numbers.

Beeswarm Plot:

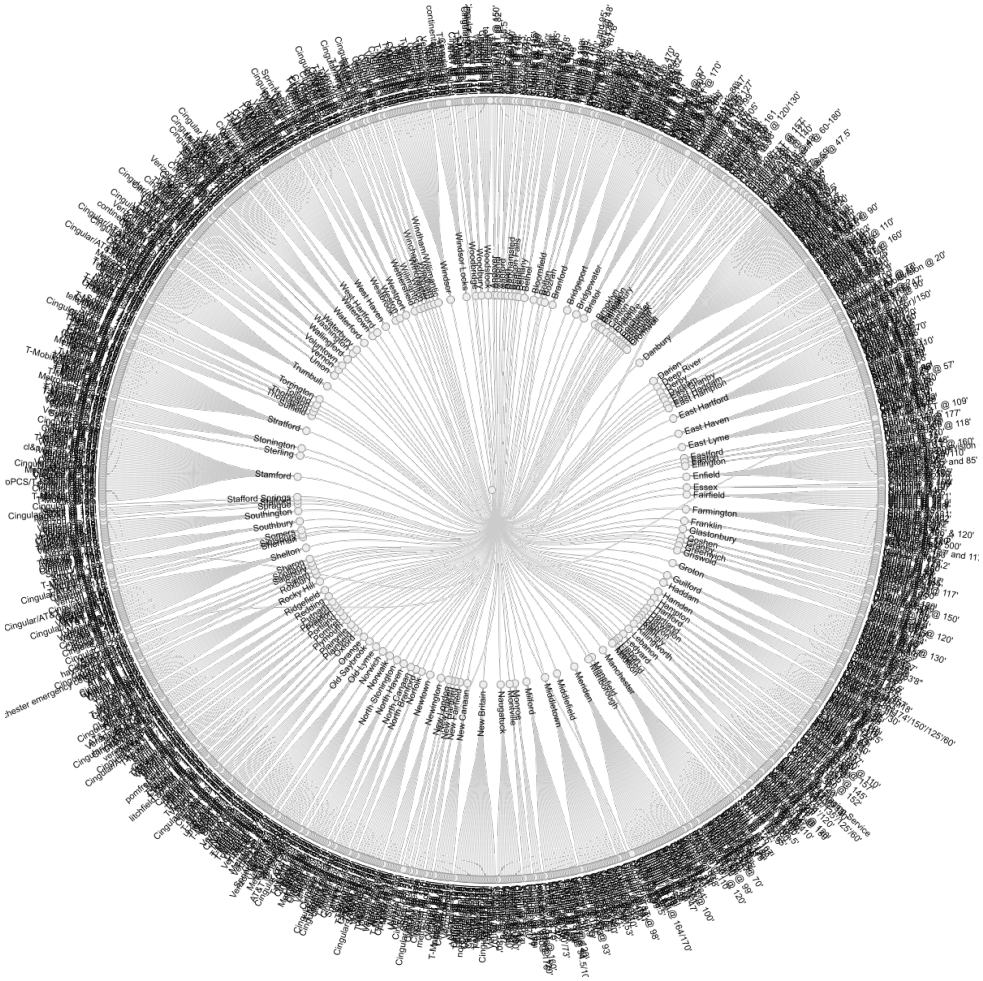
Graphed: Town, Latitude, Tower Type, and Carrier 2 Category; sorted by total ascending



As you can see many cities seem to have a similar # of towers setup and some have an extremely high amount of carrier towers. One can also tell that this is a lot of infrastructure for cities and towns. Utilizing the SDK I was talking about, one would be able to have an offline-centric network that doesn't require telecom towers in order to work.

Circular Dendrogram:

Graphed: Town, and Carrier 1 Category



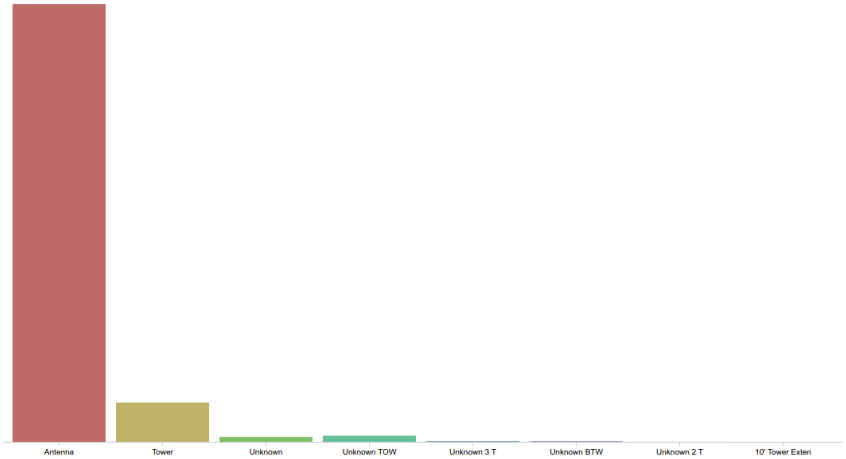
Connecticut Stats

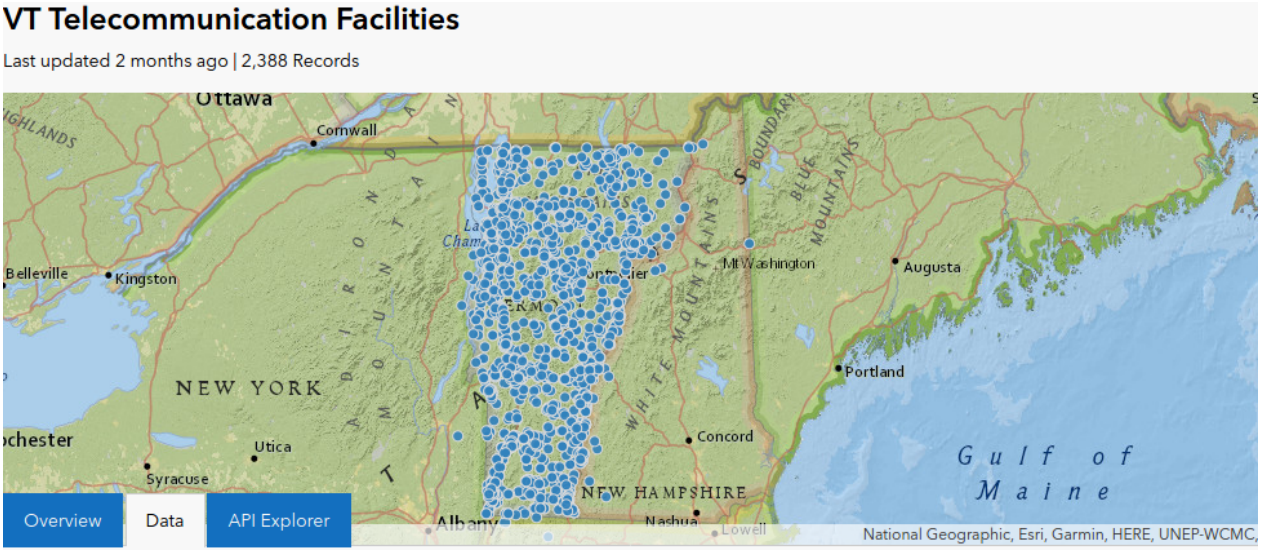
Mean ~ 125.4274056967ft in height

Median ~ 145ft in height

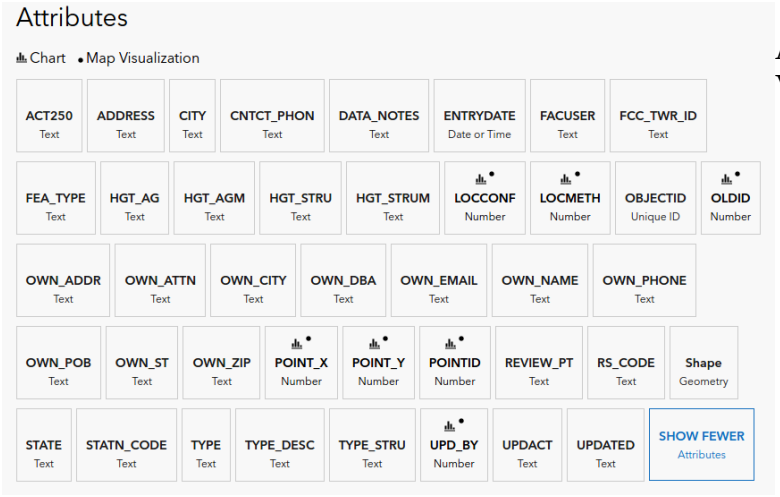
Standard Deviation ~ 94.2759307793ft in height

Graphed **Vermont sample** bar graph, Type, Point_Y, OldID #





Above seen is the Vermont Geodata Portal for this data



Attributes as seen in the Vermont Geodata portal

Data view via argis

Pros and Cons

Treemap:

Pros:

- Grid view
- Easy to differ colors
- Easy to differ size

Cons:

- Lacking enough data
- Limited assorting for legends

Beeswarm:

Pros:

- Easy assortment
- Full data set
- Color coded categorically

Cons:

Requires more space for full chart view

Circular Dendrogram:

Pros:

- Circular 360 view
- Categorically split

Cons:

- Hard to examine

-Not as much of a general sense of knowledge for the data

Geospacial:

Pros:

- Location based
- Easy to differ distances

Cons:

- Less categorical for data

For the datasets that I were using, I feel like beeswarm was the best given how easy the assorting was, and Geospacial was as useful given you should utilize geo mapping for visualizations. I found the tools quite easy to integrate and give me a general sense of knowledge on the data observed.

In regards to the data: While this dataset was quite small, I think it is important to keep in mind the geospatial area that it represents as a small statistical pool. We are looking at a seemingly and extensively large area of telecom towers and an outdated grid. This is representative of the rest of the world. If you look at the growth of the telecom towers market, it is already growing at an estimated compound annual rate for 2018 all the way up to 2025 at 24.3%. [*Source ~ Kenneth Research*]. This is problematic given that we are already expanding infrastructure that many people believe utilize an outdated means of wireless communications. This is something to keep in mind given we have the StarLink communications satellite batch, as well as the competing rise of web decentralization.

Also, America has an outdated power grid infrastructure. This will not only lead to a potential unprecedented energy crisis, but systems that rely heavily on a power grid such as telecom towers will lead to vastly disrupted wireless communications. Also, the fact that a majority of our wireless infrastructure mostly rely on a power grid, makes us more vulnerable to a devastating cyber attack. Many cybersecurity professionals have said for a while, that the current infrastructure that we have for

wireless communication and a way of doing things, need to be “greatly disrupted”. In my opinion, blockchain and decentralization do provide valuable alternatives.

In fact, in the past hackers have already tried targeting “blind spots” and simple vulnerabilities that led grid operators vulnerable to a cyber attack that wasn’t very detrimental. Luckily, this was a simple case. If someone was to find a way to release a massively distributed botnot-like system, or worser attack, the story may have been quite different. It is safe to conclude that the fact is, we have outdated technology and infrastructure that is seemingly expanding. The grid system as the way it stands needs to be drastically updated.

Another important detail to keep in mind, is that most humans have a herd mentality. If a massive blackout was to happen as a result of us relying on heavily outdated grids, it would lead to one of the worst herd mentalities ever. This whole “order out of chaos” or “phoenix rising out of the asses” mentality would take place politically, people would be massively rioting, and the natural tendency to over panic in order to worsen a disaster would take place. Undoubtedly, in an interconnected world such as ours, people wouldn’t have the intellectual capability to universally act civil. Many want to pretend to be deuntologist, but become utilitarian or even nihilist when time allows. This is why mitigating such a risk is important before it happens.

Sources:

[1] Hodan, G. (n.d.). Telecom,tower,wireless,network,signal - free image from needpix.com. Retrieved from https://www.needpix.com/photo/1455707/telecom-tower-wireless-network-signal-cellular-gsm-mast-wave

[2] Kleykamp, T. (2019, July 24). Telecommunications Towers and Antennas. Retrieved January 24, 2020, from https://catalog.data.gov/dataset/telecommunications-towers-and-antennas

[3] VT Telecommunication Facilities. (2018, August 4). Retrieved January 24, 2020, from https://catalog.data.gov/dataset/vt-telecommunication-facilities

[4] DensityDesign Research Lab. (n.d.). RAWGraphs. Retrieved from https://app.rawgraphs.io/
[5] VT Telecommunication Facilities. (n.d.). Retrieved from http://geodata.vermont.gov/datasets/9559bacdc938428ea4407f3c48cddded_59

[6] (n.d.). Retrieved from https://www.arcgis.com/home/webmap/viewer.html?panel=gallery&suggestField=true&url=https://maps.vcgi.vermont.gov/arcgis/rest/services/EGC_services/OPENDATA_VCGI_UTILITIES_SP_NOCACHE_v1/MapServer/59

[7] Knapp, T. R. (2013). To pool or not to pool: That is the confusion. Retrieved March 21, 2020, from http://www.statlit.org/pdf/2013-Knapp-To-pool-or-not-to-pool.pdf

[8] By. (2019, October 7). Global Telecom Towers Market- What Are The Main Factors That Contributing Towards Industry Growth? Retrieved March 21, 2020, from https://www.marketwatch.com/press-release/global-telecom-towers-market--what-are-the-main-factors-that-contributing-towards-industry-growth-2019-10-07

[9] Mann, A. (2020, January 17). Starlink: SpaceX's satellite internet project. Retrieved March 21, 2020, from https://www.space.com/spacex-starlink-satellites.html

[10] Meigs, J. B., & Barron, S. (2019, August 14). America's Outdated Power Grid. Retrieved March 21, 2020, from https://www.city-journal.org/americas-outdated-power-grid

[11] Sussman, B. (2019, October 8). Revealed: Details of 'First of Its Kind' Disruptive Power Grid Attack. Retrieved March 21, 2020, from https://www.secureworldexpo.com/industry-news/first-u.s.-power-grid-attack-details

[12] Kamal, A. M. decentralized-internet. npm (2020). Available at: https://www.npmjs.com/package/decentralized-internet. (Accessed: 18th March 2020)

[13] Barrett, B. (2019, September 7). An Unprecedented Cyberattack Hit US Power Utilities. Retrieved March 21, 2020, from https://www.wired.com/story/power-grid-cyberattack-facebook-phone-numbers-security-news/

[14] Knake, R. K. (2017, April). CONTINGENCY PLANNING MEMORANDUM NO. 31. Retrieved March 21, 2020, from https://www.cfr.org/sites/default/files/pdf/2017/03/ContingencyPlanningMemo31_Knake.pdf

[15] What is the meaning of Nietzsche's "From chaos, comes order"? (n.d.). Retrieved March 21, 2020, from https://www.quora.com/What-is-the-meaning-of-Nietzsches-From-chaos-comes-order