



Plug and Plot with Internet data

Reusable visualizations for Internet open datasets

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The Project

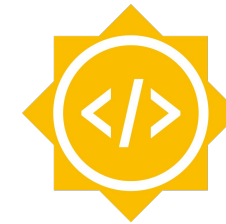
Project Goals:

- Provide reusable code blocks for visualizations related to the AS-hegemony data
- Extend Internet Health Report visualizations using their open data API
- Users are able to fork or copy these templates and customize them according to their requirements by adding their own data or making modifications

Features

- Built on ObservableHQ platform
- Reusable by any JavaScript component, not just within the ObservableHQ platform

Part of:



Google

Summer of Code

<https://summerofcode.withgoogle.com>

Built on:

 **Observable**

<https://observablehq.com>



What is AS Hegemony ?

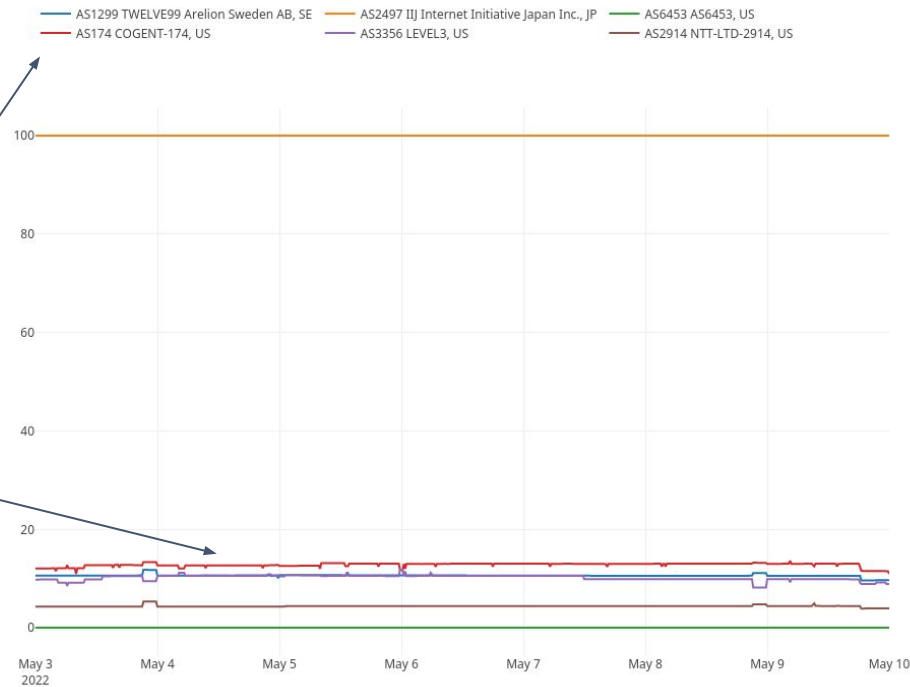
AS Hegemony is the metric that evaluates the extent to which an Autonomous System (AS) depends on other ASes, and is calculated using BGP data.

The metric is expressed as a value ranging from 0 to 1, representing the proportion of paths that incorporate a particular ASN.

[Original paper](#) by:

- Romain Fontugne
- Anant Shah
- Emile Aben

AS2497 depends by ~12%
from AS174



Plot depicting AS hegemony for AS2497 (IJ Internet Initiative Japan Inc.)



Internet Health Report

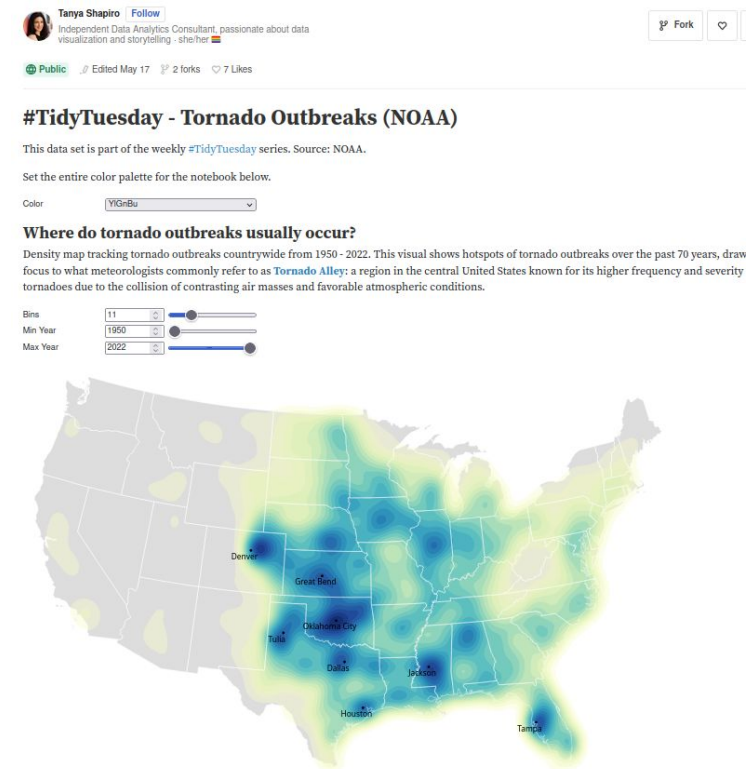
- The Internet Health Report is an organization that monitors the networks that make up the Internet to help network operators and policymakers understand its infrastructure and development.
- Public measurement platforms, such as RIPE Atlas, RIS, and Route Views, provide IHR with network data.
- The network data is then analyzed with specialized tools that identify delay changes, network disconnections, and other potential issues.
- The Internet Health Report promotes transparency and reusability by sharing its data and analysis tools publicly.
- The report encourages collaboration and innovation by making its data and analysis tools available to the public.



<https://ihr.iijlab.net>

ObservabeHQ

- Platform for developing, sharing and collaborating on data visualizations.
- Perfect for blogging and sharing data research.
- Similar to Jupyter notebook but for Javascript.
- Supports live updates.
- All notebooks can be exported and used outside of the platform.
- Ideal for re-usable data visualization templates.

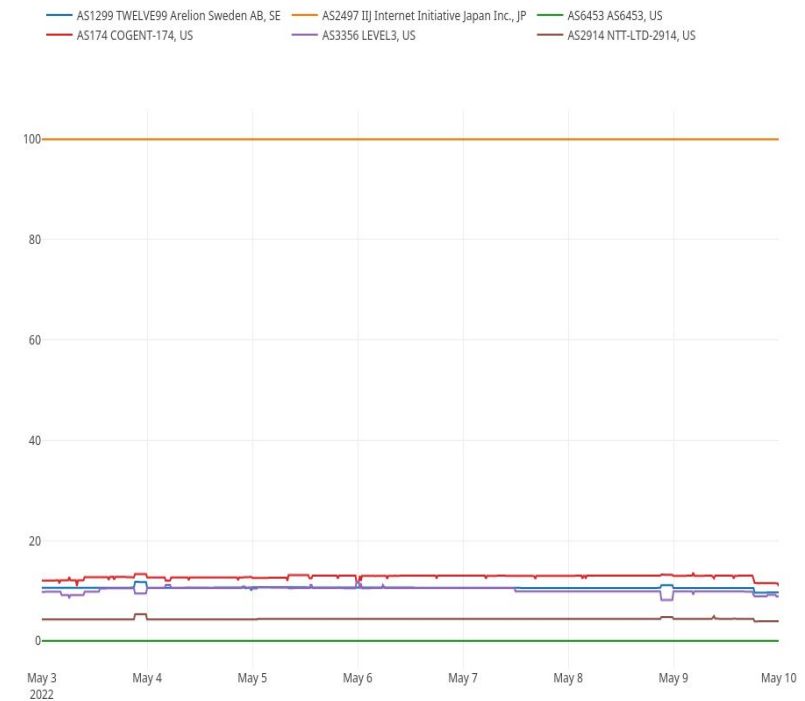


Example of an Observable notebook.



Reusable IHR plots

- Visualizations are open-source and implemented on the Observable HQ platform (feel free to fork and customize).
- Visualizations are provided as a series of public notebooks.
- Notebooks contain code blocks for visualizations related to AS-hegemony data.
- The code blocks retrieve data from the IHR AS-hegemony API and extend the visualizations of the IHR website.
- The project's goal is to allow users to interact with and embed IHR data on their own tools, sites or posts.
- Users can directly use the notebooks to visualize data with custom parameters.
- Users can also copy the code and use it in their own page/notebook, including embedding the visualizations as iframes.



Example of plot depicting AS hegemony and dependent networks for AS2497 (IIJ Internet Initiative Japan Inc.).



How to use

There are 4 ways:

- **Easy way:** Users can visit Observable HQ notebooks in their web browser, select parameters, and visualize results.
- **Observable way:** Users can import code into a new Observable HQ notebook, create visualizations, customize parameters and data, and write their own text.
- **Iframe way:** Users can export visualizations as iframes and embed them in web pages by selecting the "export" -> "embed" option.
- **Developer way:** Users can export visualizations as a code bundle and embed them in web pages natively without iframes by selecting the "export" -> "download code" option and then using the observable runtime library to run it.



The easy way

This way is ideal if you want to play around with the visualizations and understand what they depict.

- Navigate to the project link
<https://observablehq.com/@tasos/hegemony?collection=@tasos/reusable-ihr-plots>
- Select the plot you want to examine and go to its notebook.
- Fill in the appropriate inputs and view your results.

AS Dependencies (Timeseries)

This visualization shows all the networks/ASes that the given network depends on (i.e., its "dependencies") and the AS hegemony value for each dependency, during the given time range.

This is the same visualization that can be found in the [IHR website](#)

Start Date

End Date

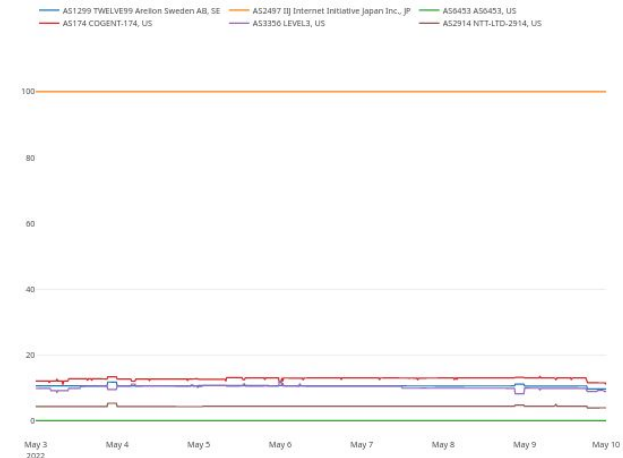
There is a 7 day range limit on the IHR API

AS Number

Use in your own notebook

```
import {dependencyTimeseries} from "@tasos/hegemony";  
dependencyTimeseries("2022-05-03", "2022-05-10", "2497");
```

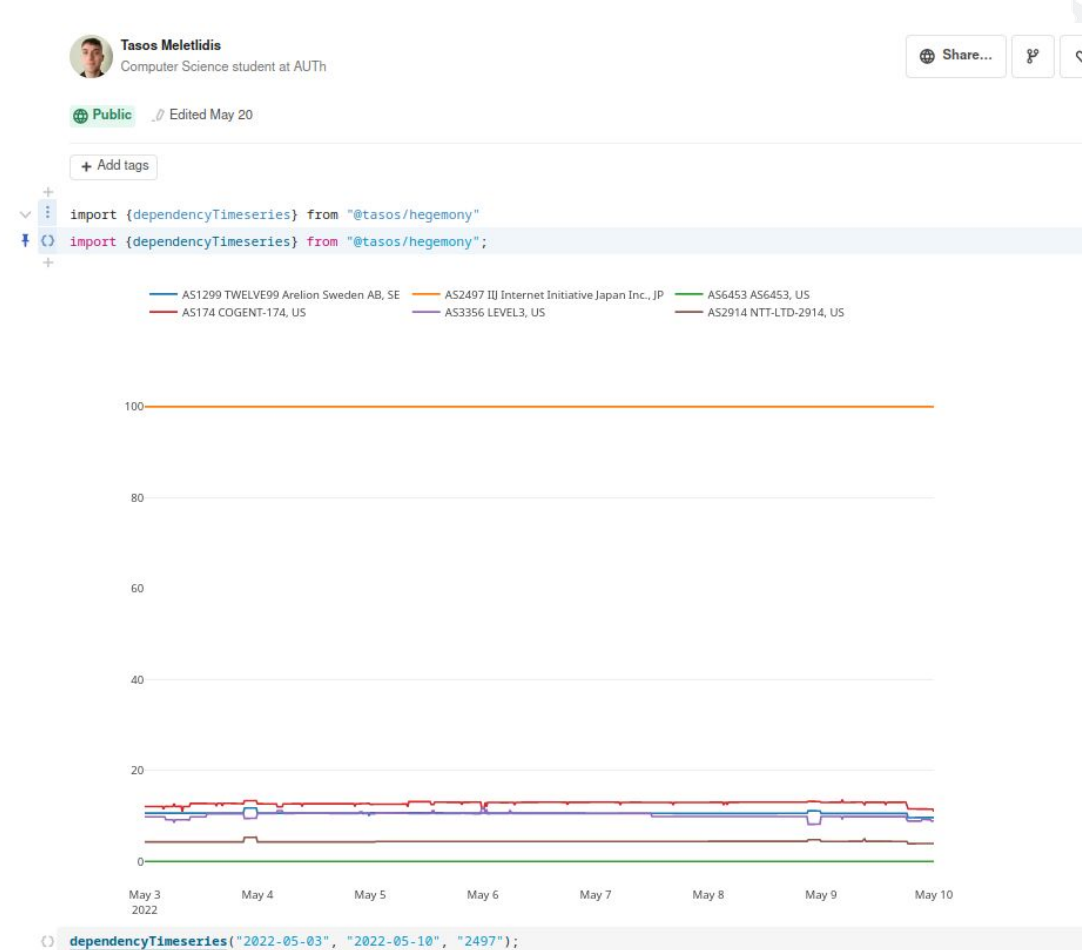
[Copy to clipboard](#)



The Observable way

This way is ideal if you want to make a post on observable related to AS-hegemony.

- Navigate to the project link
<https://observablehq.com/@tasos/hegemony?collection=@tasos/reusable-ihr-plots>
- Select the plot you want to examine and go to its notebook.
- Fill in the appropriate inputs and view your results.
- Click on “copy to clipboard”.
- Go to the notebook where you want to import the plot.
- Create 2 new code cells, one for importing my notebook and one for running the visualization function with your parameters.
- Paste the copied code and split it on the 2 cells.



The iframe way

This way is ideal if you want to make a post on an external website related to AS-hegemony.

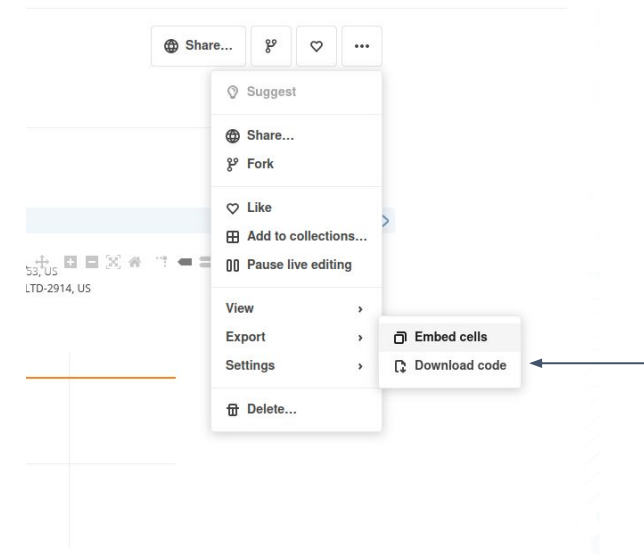
- Navigate to the project link <https://observablehq.com/@tasos/hegemony?collection=@tasos/reusable-ihr-plots>
- Select the plot you want to examine and go to its notebook.
- Fill in the appropriate inputs and view your results.
- Click on “copy to clipboard”.
- Create a new notebook where you want to import the plot.
- Create 2 new code cells, one for importing my notebook and one for running the visualization function with your parameters.
- Paste the copied code and split it on the 2 cells.
- On the top right click on the three dots, then click on “export” then on “embed cells”
- Then you can click on “copy” to get the iframe to use on your site.

The screenshot shows the ObservableHQ interface with a context menu open over a plot. The menu includes options like 'Share...', 'Fork', 'Like', 'Add to collections...', 'Pause live editing', 'View', 'Export', 'Settings', and 'Delete...'. The 'Export' option is expanded, showing 'Embed cells' and 'Download code'. An arrow points from the 'Embed cells' option to the 'Embed' dialog box. The dialog box has a title 'Embed' and a close button. It contains the text 'Select cells to embed in any web page. Learn more.' and two checked options: 'Entire notebook' and '2 unnamed cells'. Below these is a dropdown menu set to 'iframe'. There is a checkbox for 'Remove attribution banner' and a purple 'Enterprise' button. A paragraph of text explains that the HTML tag works almost anywhere and preserves styles. Below this is a code block containing an iframe tag with width='100%', height='500', frameborder='0', and a src attribute with a long URL. At the bottom of the dialog are two buttons: 'Copy URL only' and 'Copy'.

The developer way

This way is ideal if you want to make a post on an external website related to AS-hegemony without relying on observable for hosting the iframe.

- Navigate to the project link
<https://observablehq.com/@tasos/hegemony?collection=@tasos/reusable-ihr-plots>
- Select the plot you want to examine and go to its notebook.
- Fill in the appropriate inputs and view your results.
- Click on “copy to clipboard”.
- Create a new notebook where you want to import the plot.
- Create 2 new code cells, one for importing my notebook and one for running the visualization function with your parameters.
- Paste the copied code and split it on the 2 cells.
- On the top right click on the three dots, then click on “export” then on “Download code”, this will download an archive with your notebook files and the observable runtime.
- If you extract the archive and open **index.html** you can see where your files are imported and rendered.
- You can now host and use at your own site.



```
<!DOCTYPE html>
<meta charset="utf-8">
<title>Untitled</title>
<link rel="stylesheet" type="text/css" href="./inspector.css">
<body>
<script type="module">

import define from "./index.js";
import {Runtime, Library, Inspector} from "./runtime.js";

const runtime = new Runtime();
const main = runtime.module(define, Inspector.into(document.body));

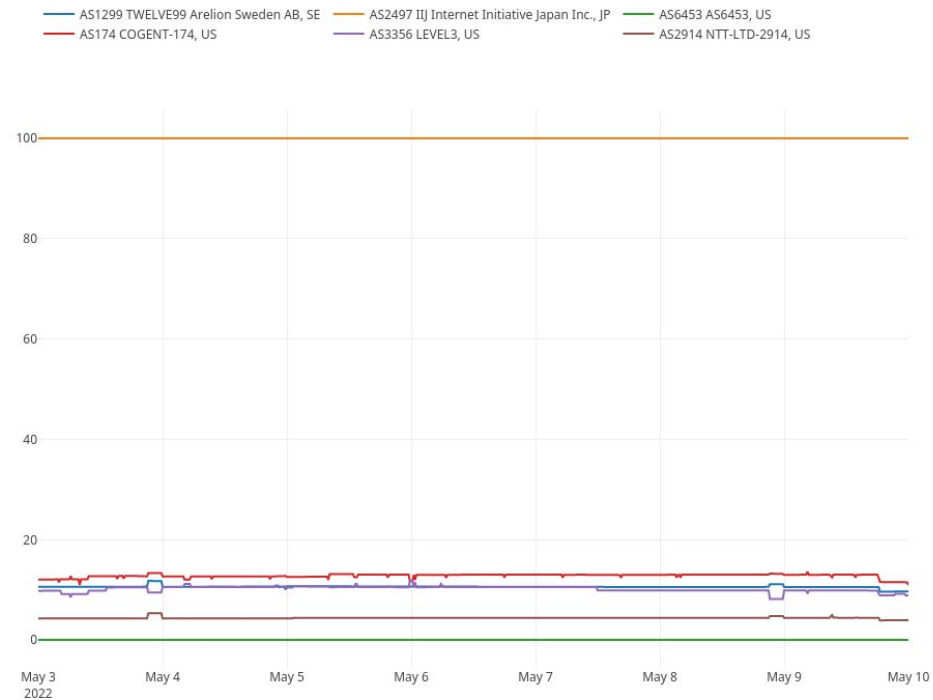
</script>
```



Examples of plots

AS Dependencies (Timeseries)

This visualisation shows all the ASes that the given network depends on - i.e., upstream networks - and the AS hegemony value for each dependency, during the given time range. It is the same visualisation that can be found in the IHR website.

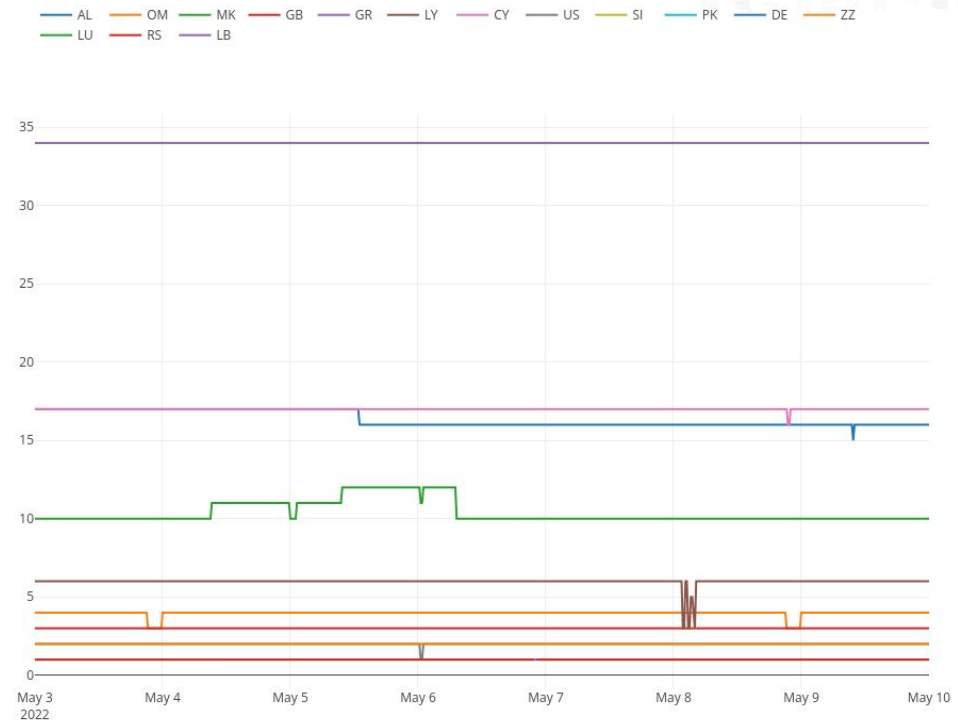


AS hegemony and dependent networks for AS2497 (IIJ Internet Initiative Japan Inc.)

Examples of plots

Dependent Networks Grouped By Country (Timeseries)

This is a visualisation similar to the number of dependent networks, but instead of presenting the total number of networks (i.e., one line), it presents the number of networks per country (i.e., one or more lines).



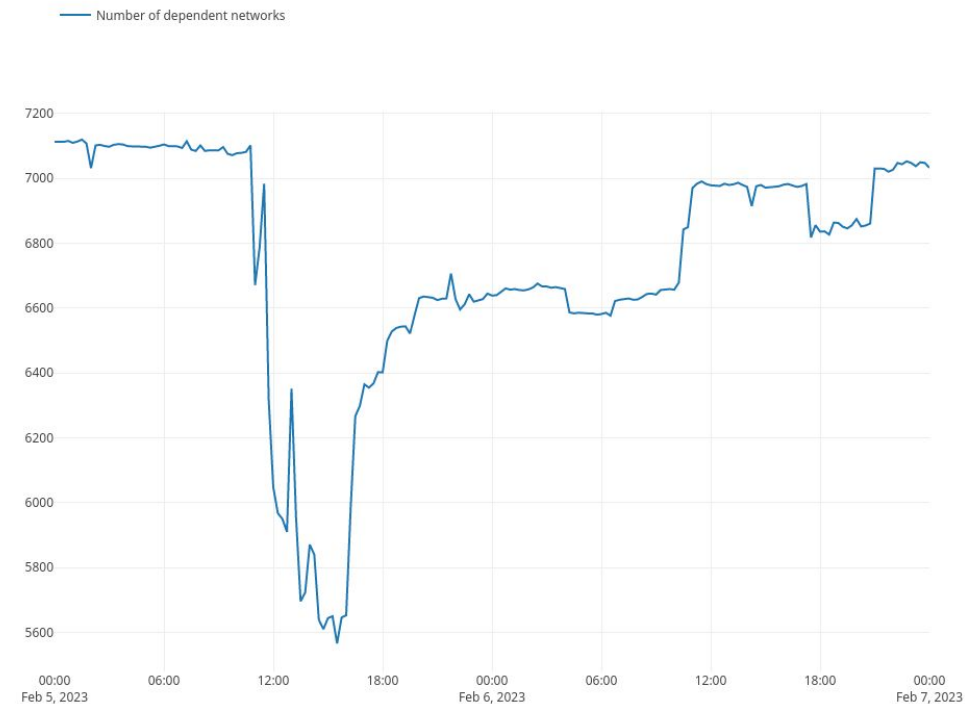
Number of dependent networks, grouped by country, for AS12713 (OTEGlobe Ote SA)



Examples of plots

Number of Dependent Networks (Timeseries)

It shows the number of networks/ASes that depend on a given network (i.e. downstream networks), during a given time range. This visualisation can be used, for example, for detecting significant routing changes that affect many networks. An example is shown that specifically depicts the drop in dependent networks TELECOM ITALIA had due to a [recent outage](#) between 2023-02-05 and 2023-02-07



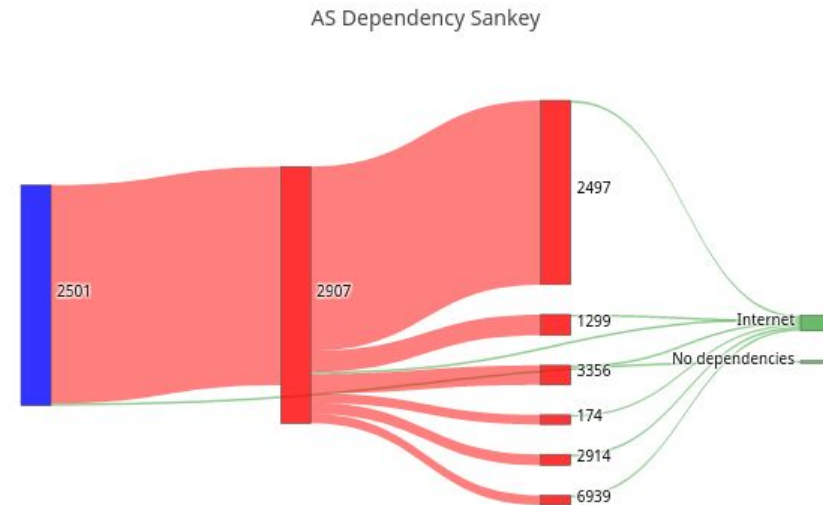
Number of dependent networks for AS6762 (SEABONE-NET TELECOM ITALIA SPARKLE S.p.A)



Examples of plots

Two Hop AS Dependencies (Sankey Plot)

This visualisation shows in a sankey plot the direct and indirect dependencies of the given network.



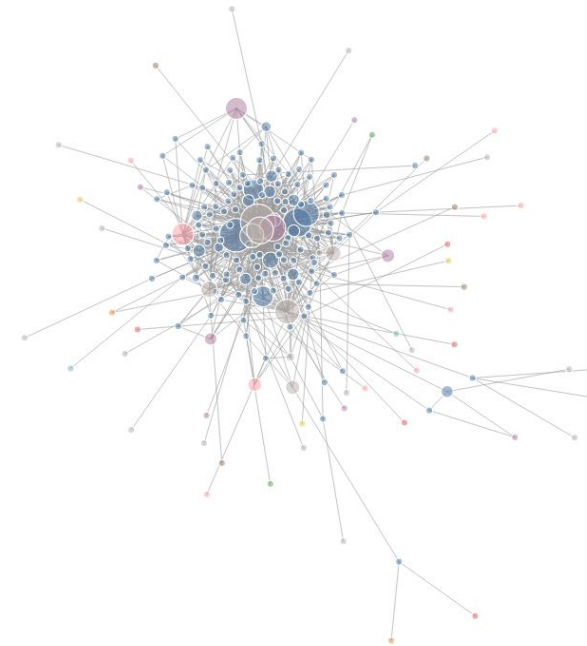
Sankey plot with two-hop AS dependencies for AS2501 (UTNET The University of Tokyo)



Examples of plots

Country Hegemony Graph (Graph Plot)

This visualisation shows a graph with all the networks that are dependencies of the given country for the given date (find more information at the [IHR website](#)).



AS dependency graph for Japan



Summary

Thanks for listening!

We hope this tool will encourage and help researchers on their internet data endeavors

Big thanks to:

- [Romain Fontugne](#), IIJ Research Lab
- [Emile Aben](#), RIPE NCC
- [Pavlos Sermpezis](#), Datalab, AUTH

[Project Link](#)

<https://bit.ly/3W0zSGd>

[RIPE labs article](#)

<https://bit.ly/3KvImC2>