

# Internet Health Report

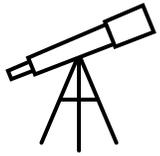
## - Thailand -



Romain Fontugne  
IIJ Research Lab



# IHR vision



An observatory for the Internet

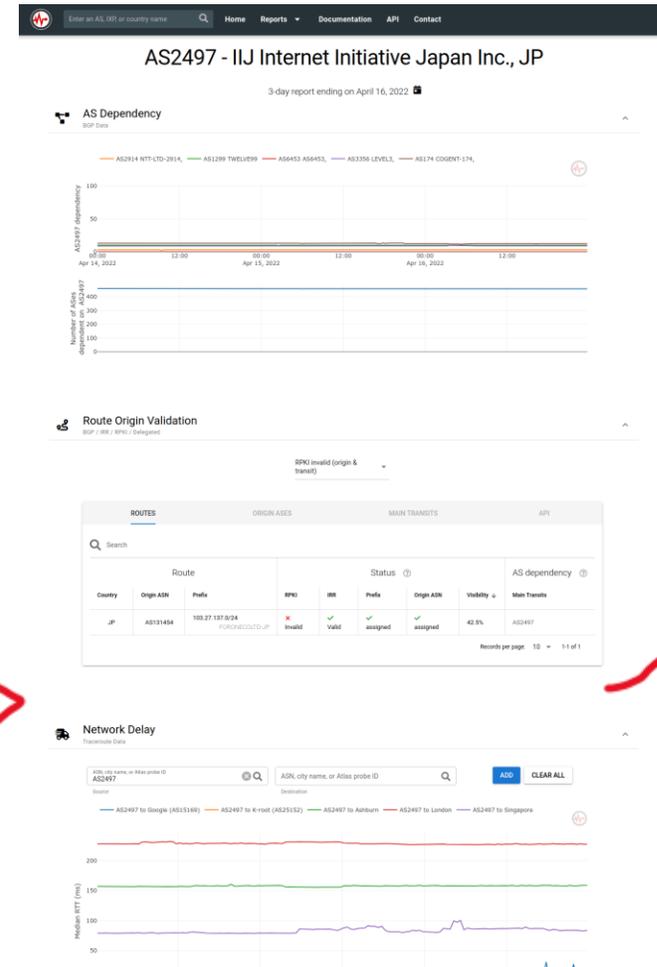
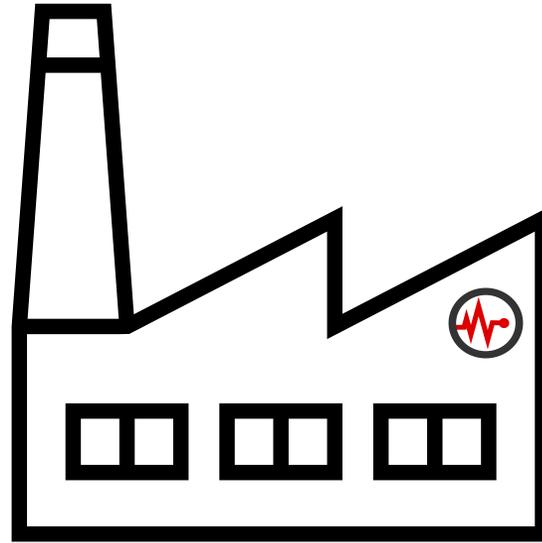


Monitor & document Internet topology, evolution, and sudden changes



Open data / open source

# Monitoring the Internet



## Open data

- BGP
- traceroute
- RPKI
- etc...

## Analysis modules

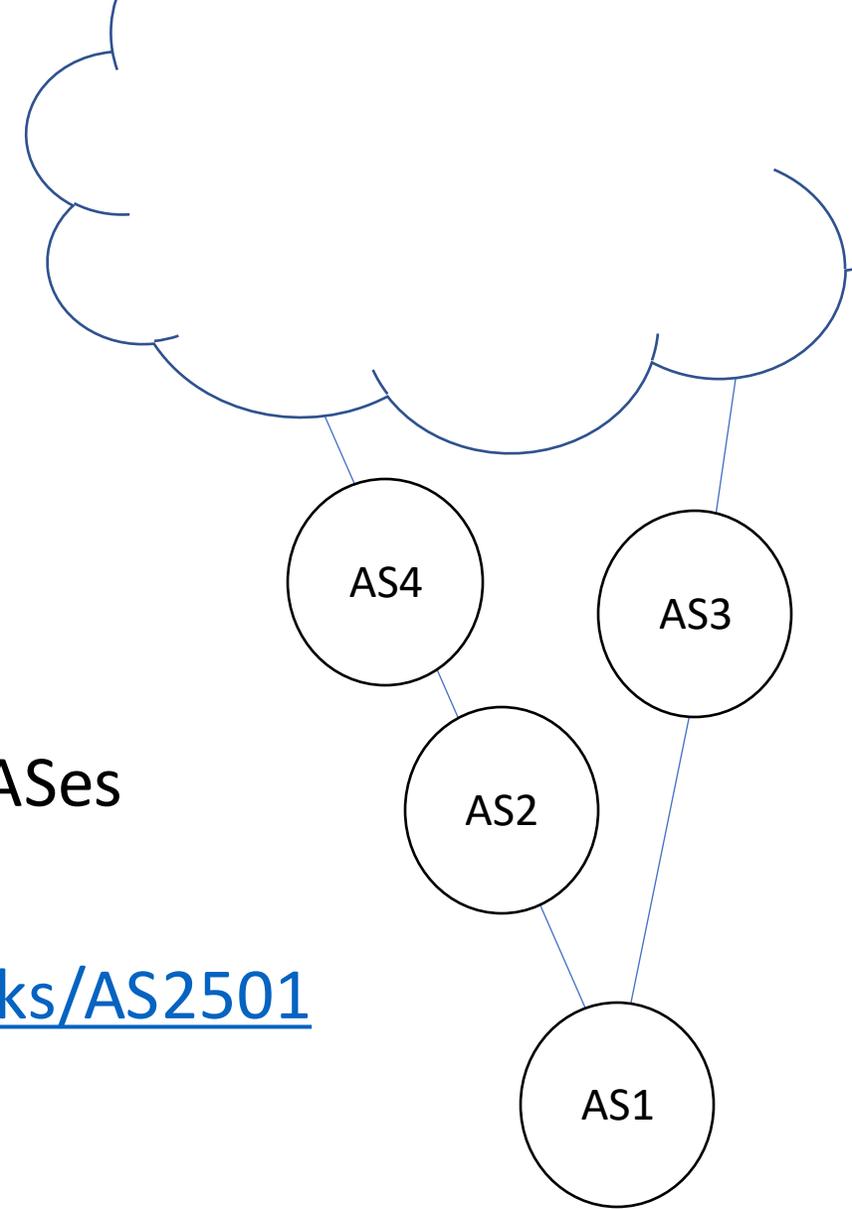
- Network dependency
- Network latency
- Disconnections
- Anomaly detection

## Outcomes

- <https://www.ihr.live>
- Visualization
- API
- Daily dumps
- External collaborations / tools

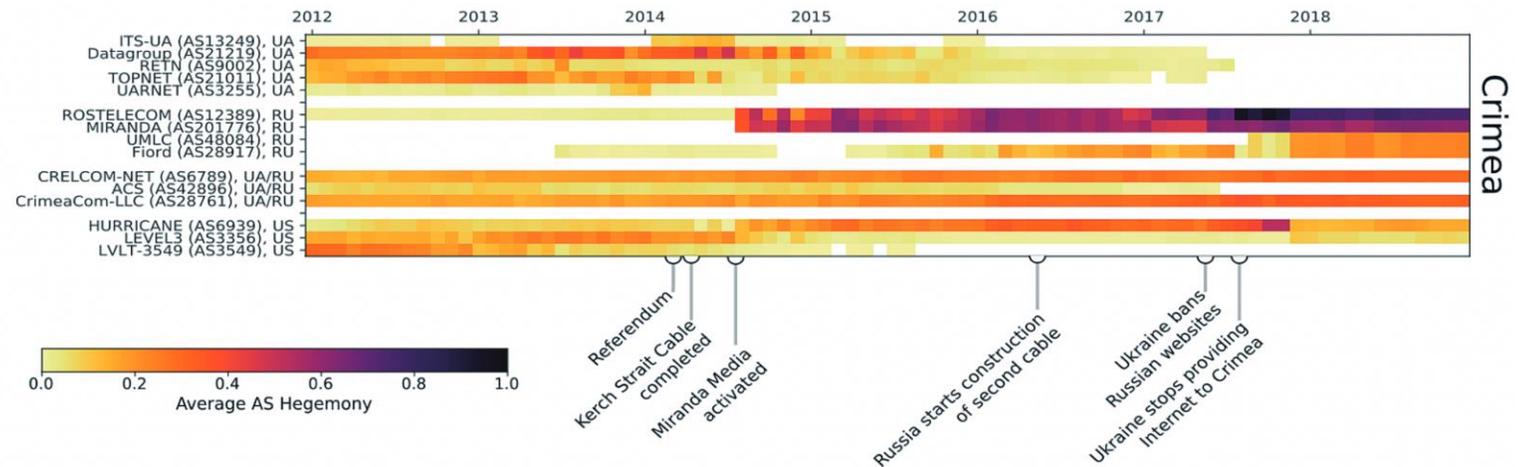
# Network dependency (AS Hegemony)

- Measure AS inter-dependencies
- Using BGP data
- Give a good idea of the 'topological location' of ASes
- Customers of an AS
- Example: <https://www.ihr.live/ihr/en-us/networks/AS2501>



# Network dependency variants

- Regional bottleneck (e.g. Crimea)



- Countries' AS dependency:

- <https://www.ihr.live/ihr/en-us/countries/JP>

- BGP leak/hijacks, routing anomalies, AS ranking, consolidation, bottlenecks, peering

- Rogers outage: [https://twitter.com/ihr\\_alerts/status/1545789981603823616](https://twitter.com/ihr_alerts/status/1545789981603823616)

# RPKI

- Convey operators' intent
- Trust (Public Key Infra.)
- Route Origin Authorization (ROA)
  - AS15169 is authorized to announce 8.8.8.0/24

Route Origin Validation

3-day report ending on July 12, 2021

RPKI invalid

ROUTES				ORIGIN ASES		MAIN TRANSITS		API	
Country	Origin ASN	Prefix	Route	RPKI	IRR	Prefix	Origin ASN	Visibility ↓	Main Transits
IN	AS36040	43.229.88.0/22	Route object	Invalid	Invalid	assigned	assigned	80.3%	AS58969, AS9498,
US	AS26695	23.140.96.0/24	PNAP-SEF Wow Technologies	Invalid	Invalid	assigned	assigned	78.3%	AS16584, AS31857
IN	AS138785	121.243.86.0/23	VSNL Route Object	Invalid	Invalid	assigned	assigned	76.3%	AS4755, AS6453, A
IN	AS133902	115.111.150.0/24	TCL Route Object - HYD-LEGACY-STDILL	Invalid	Invalid	assigned	assigned	75.7%	AS4755, AS6453, A
MA	AS26040	107.220.70.0/24	GOP Online Marketing	Invalid	Invalid	assigned	assigned	75%	AS36095, AS5511

**Routes seen in RIS/Routeviews**

**Status in RPKI & IRR**

**Upstream networks**

- IHR monitors operators' intentions (RPKI/IRR) and actions (BGP)
  - Global view: <https://www.ihr.live/en/rov>
  - Country-wide view: <https://www.ihr.live/en/countries/TH>
  - Per AS: <https://www.ihr.live/en/networks/AS22822>

# Network delays

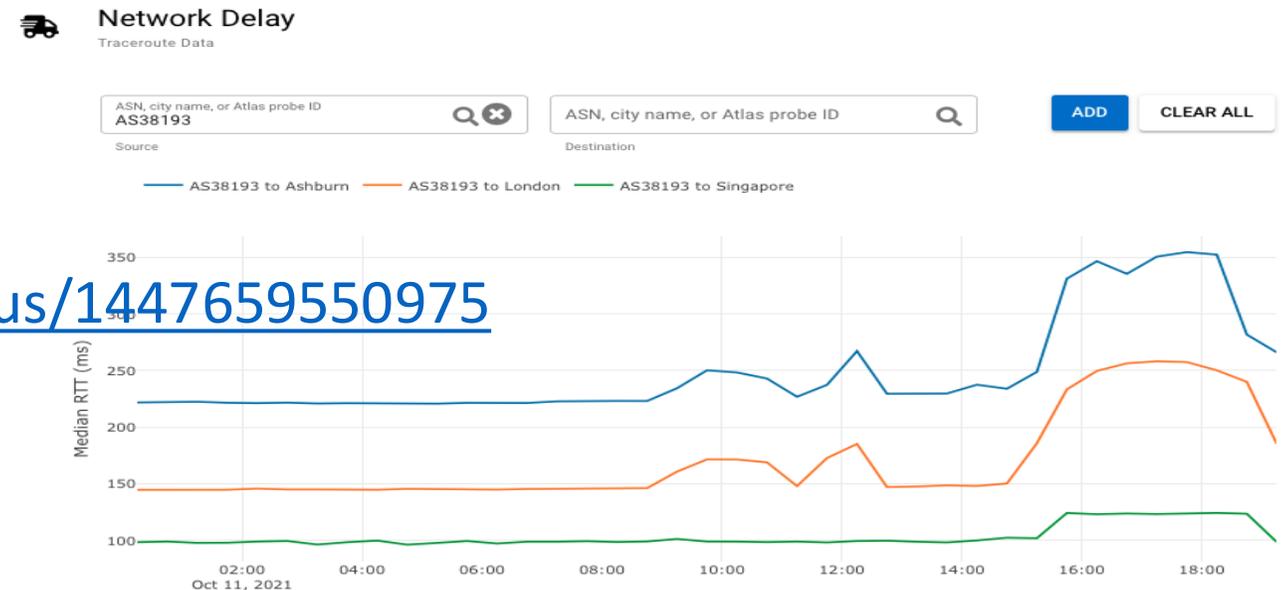
- RIPE Atlas (12k probes)  
Tons of traceroutes to several destinations
- IHR monitors latency between Atlas probes and ASes/IXPs/cities/countries found in traceroutes



- Examples:

- Impact of subsea cable cut:

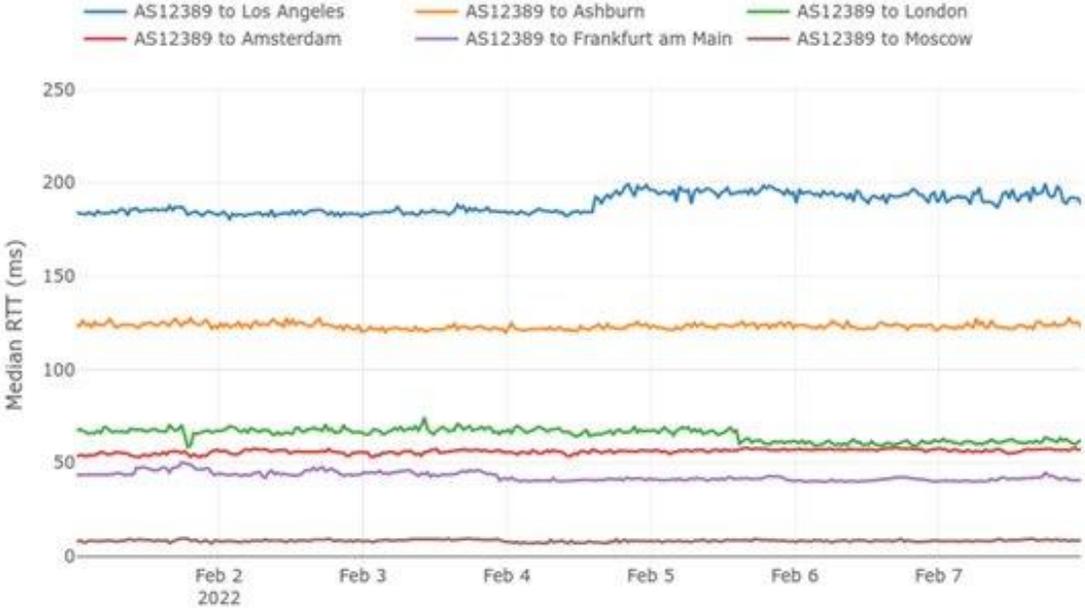
<https://twitter.com/DougMadory/status/1447659550975406094>



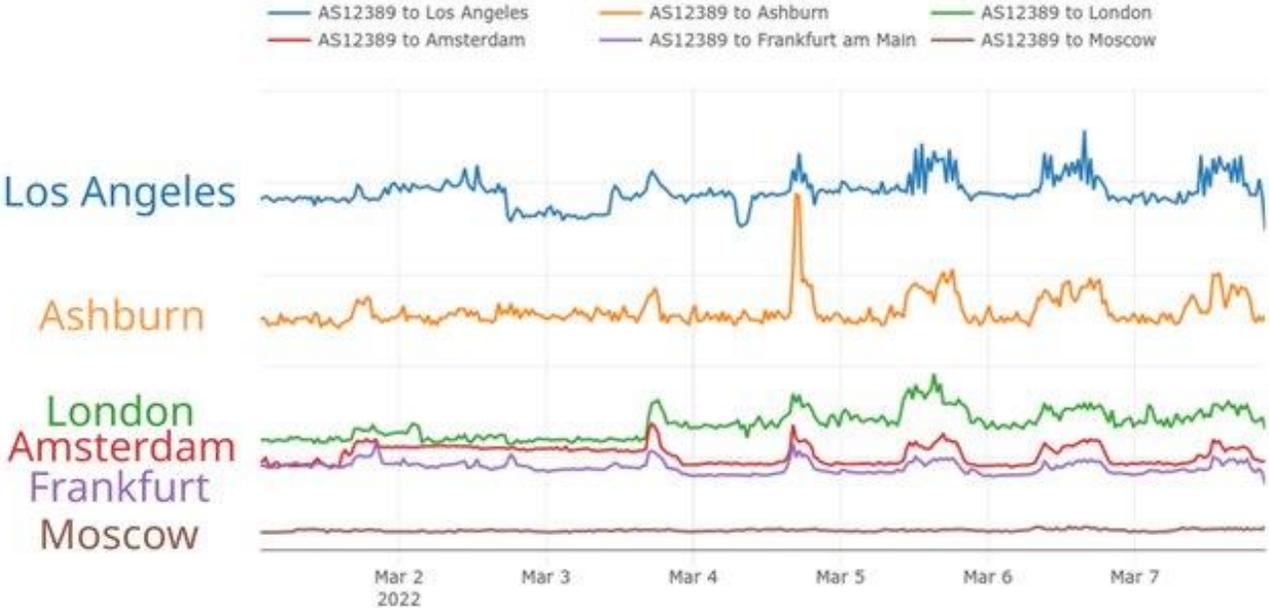
# Network congestion

## Round Trip Time from Rostelecom (AS12389)

### February 2022

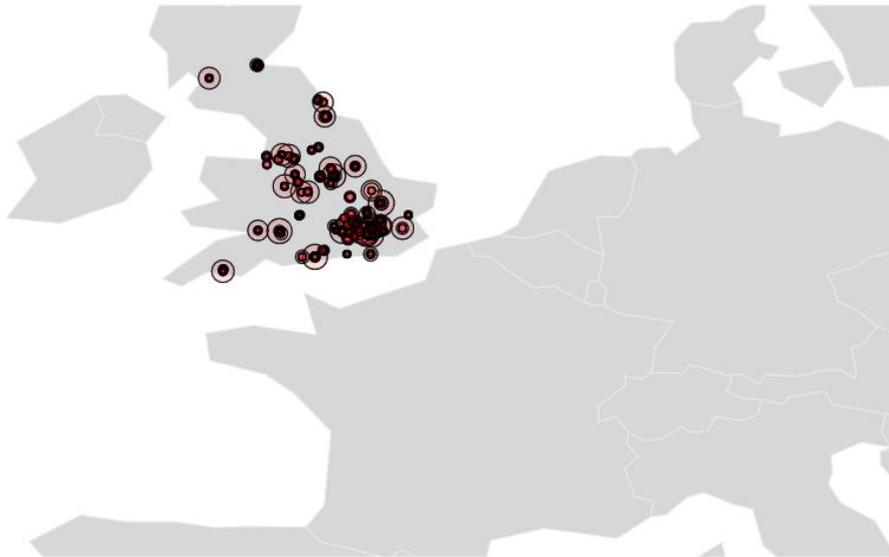


### March 2022



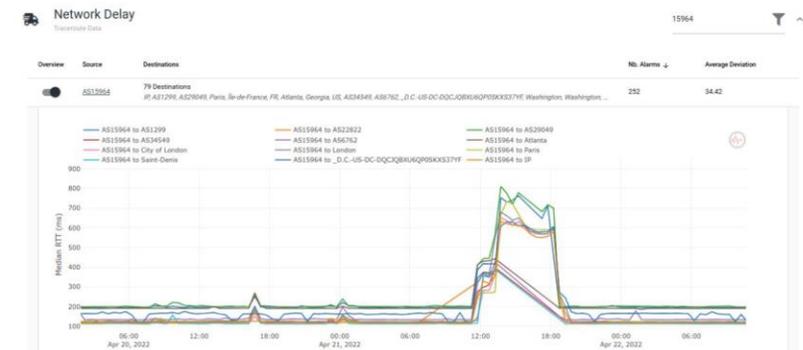
# IHR Anomaly detectors

- Disco
  - Outage detection
  - Based on RIPE Atlas
  - [Virgin Media outage](#)



- Route, delay changes

- [Global report](#)



# Internet Yellow Pages

- Knowledge graph for networking data
- 25 data sources:
  - APNIC, BGPKIT, Bgp.tools, CAIDA, Cloudflare, IHR, OpenINTEL, PeeringDB, RIPE NCC, NRO, Tranco, etc..
- About 26M nodes, 161M links
- <https://iyp.ihr.live>

The image shows a screenshot of the Neo4j web interface. On the left, the 'Database Information' panel is visible, showing the database name 'neo4j' and a list of node labels and relationship types. The main area displays two graph visualizations. The top graph shows a query result for a specific AS (12389) and its relationships, with nodes like '12389', '213.59.2...', and '87.226.1...'. The bottom graph shows a query result for nodes containing 'crimea', with a dense network of nodes and relationships. The interface includes a command prompt at the top and an overview panel on the right for each graph.

# Demo!

## Examples:

- Thailand: <https://www.ihr.live/en/country/TH>
- Chulalongkorn University: <https://www.ihr.live/en/network/AS3839>

♥ Special thanks to



# References

- IHR website: <https://www.ihr.live>
- Github: <https://github.com/InternetHealthReport>
- IHR daily dumps: <https://archive.ihr.live>
- Internet Yellow Pages: <https://iyp.ihr.live>

[romain@iij.ad.jp](mailto:romain@iij.ad.jp) @ihr\_alerts