Detecting and Characterizing Internet Traffic Interception based on BGP Hijacking

Alberto Dainotti, Phillipa Gill, Chiara Orsini,
Alistair King, Vasco Asturiano, Matthew Luckie

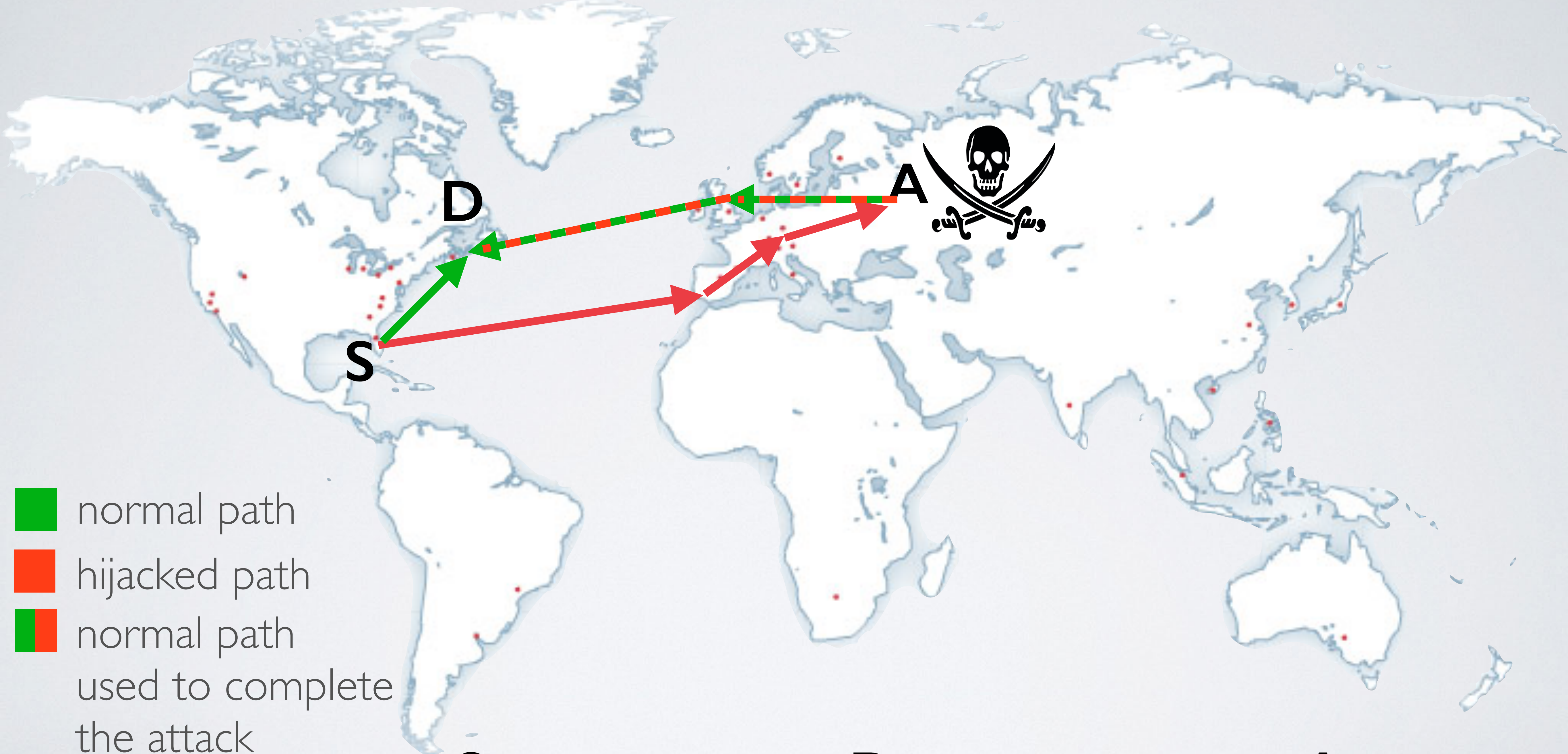
alberto@caida.org

caida

Center for Applied Internet Data Analysis

BGP MITM

BGP-based traffic interception



🟩 normal path

🟥 hijacked path

🟩🟥 normal path used to complete the attack

S source (poisoned) **D** dest (hijacked prefix) **A** attacker

http://research.dyn.com/2013/11/mitm-internet-hijacking/

“HIJACKS” PROJECT

identify BGP-based MiTM

- NSF SaTC, TTP option, started Aug 2014, 3 years
- Collaborative project with Phillipa Gill at Stony Brook University

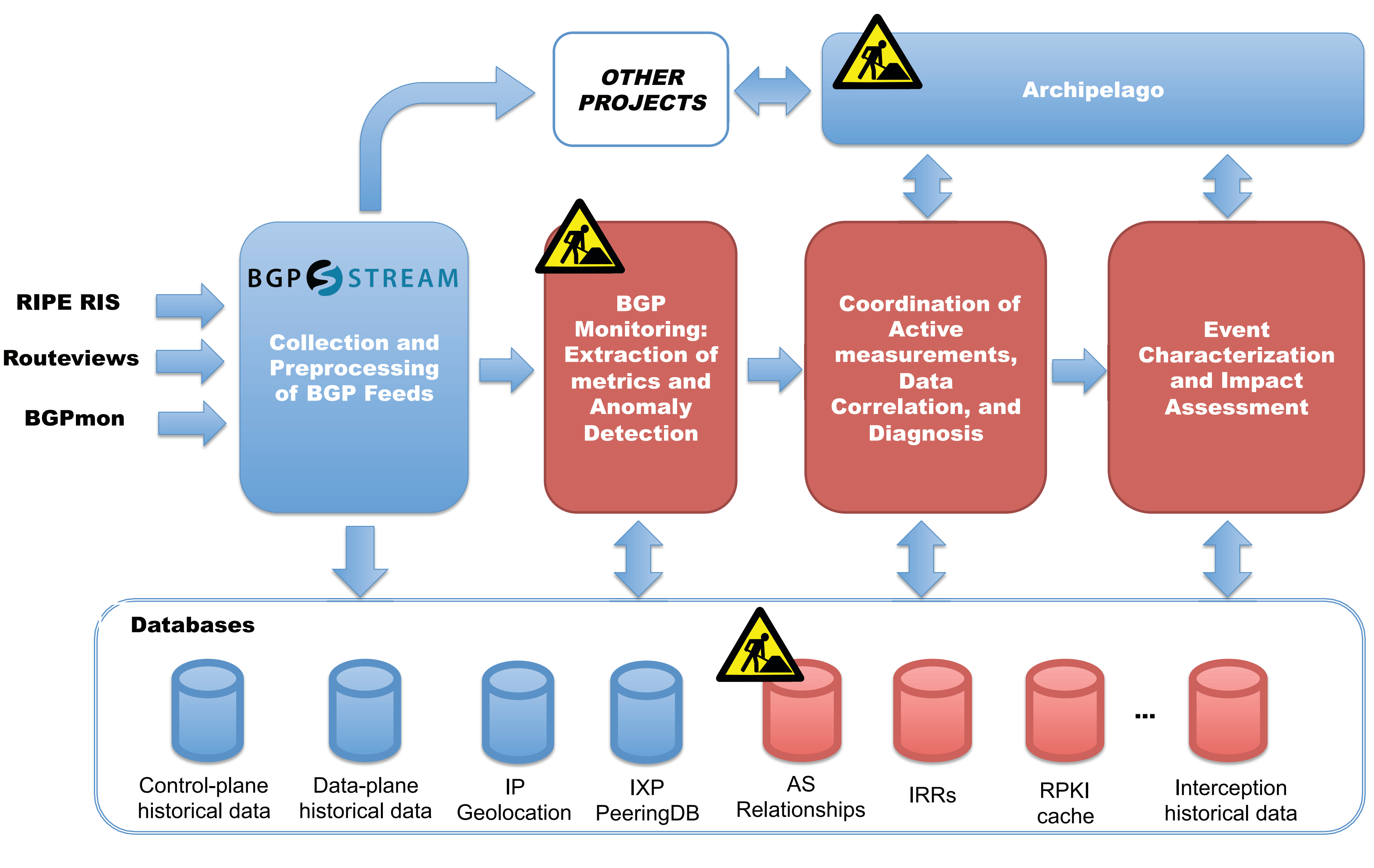
- Goals:
  - develop methodologies to detect interception
  - live monitoring
  - test/evaluate the system with real hijacks (thanks to the PEERING testbed - *http://peering.usc.edu*)
  - understand/quantify impact of events
  - log events, share data (e.g., through DHS PREDICT)

- *Happy to identify BGP hijacks in general*

http://www.caida.org/funding/hijacks/

HIJACKS

main components



OTHER PROJECTS

Archipelago

RIPE RIS

Routeviews

BGPmon

BGPSTREAM

Collection and Preprocessing of BGP Feeds

BGP Monitoring: Extraction of metrics and Anomaly Detection

Coordination of Active measurements, Data Correlation, and Diagnosis

Event Characterization and Impact Assessment

Databases

Control-plane historical data

Data-plane historical data

IP Geolocation

IXP PeeringDB

AS Relationships

IRRs

RPKI cache

...

Interception historical data

TWO MONITORING PHASES

BGP events are further analyzed through traceroutes

- Detect suspicious events using criteria based on **BGP data**
  - MOAS
  - valley free violations
  - new edges
  - inconsistent prepending
  - …

- We analyze these cases with on-demand **traceroutes** from **Archipelago** probes

ARK

two probing schemes

- Ark's Topo **on Demand** to do traceroutes from *all* Ark probes towards prefixes associated with suspicious events

- **Daily continuous** traceroutes towards all prefixes
  -target prefix list: updated every day. 1 week sliding window
  -Purpose:
    - comparison against ad hoc traceroutes
    - infer additional AS relationships
    - historical data analysis

ARK

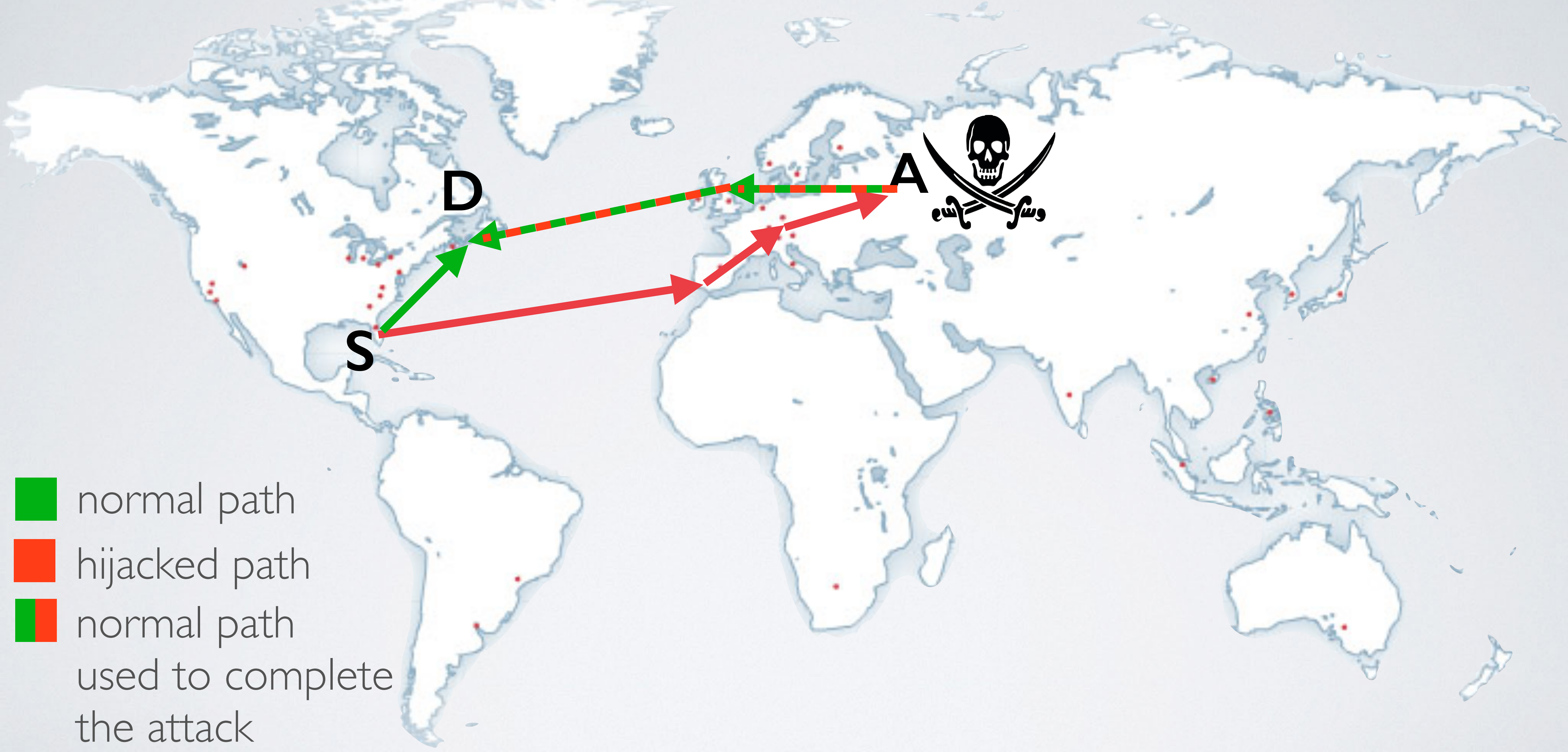
researchy topics

- Exploit co-location with BGP monitors from RouteViews and RIPE RIS
  - Out of 200 ASes providing a full IPv4 routing table, 20 host an ARK vantage point
    - we plan to increase this fraction
    - how would *you* use it?

- Automatically and accurately translate traceroutes to inferred AS paths
    - collaboration with Matthew Luckie

A TYPICAL SCENARIO

AS-A announces prefix-d, normally announced by AS-D



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A TYPICAL SCENARIO

AS-A announces prefix-d, normally announced by AS-D

- BGP will observe a MOAS

- Traceroutes (translated in AS paths.. let's call them "*IP AS-paths*") will show:
  1. all VPs: IP AS-path will **end at AS-D**
  2. VPs co-located with BGP monitor + following hijacked path: **BGP AS-path != IP AS-path**. The first portion of the IP-AS path will match the BGP AS-path
  3. VPs following hijacked path: **AS-A** is in the middle of the IP AS-path
  4. VPs following hijacked path: IP AS-path typically is **longer than the historical** ones

IP TO AS PATHS

Infer AS paths from traceroutes

In the scope of this project, there are some interesting variations to the classic problem:

- *constraint*: we can't use BGP's AS Paths as ground truth

- *pro*: we can tolerate uncertainty on some hops: looking for large mismatches *[cases 2 and 4]*

- *pro*: we may not care too much about consistent errors *[case 4]*