

Measurements: Mapping Manipulation in the Internet

Brian Trammell, ETH Zürich, WP1 Lead

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measurement and architecture for a middleboxed internet

measurement

architecture

experimentation



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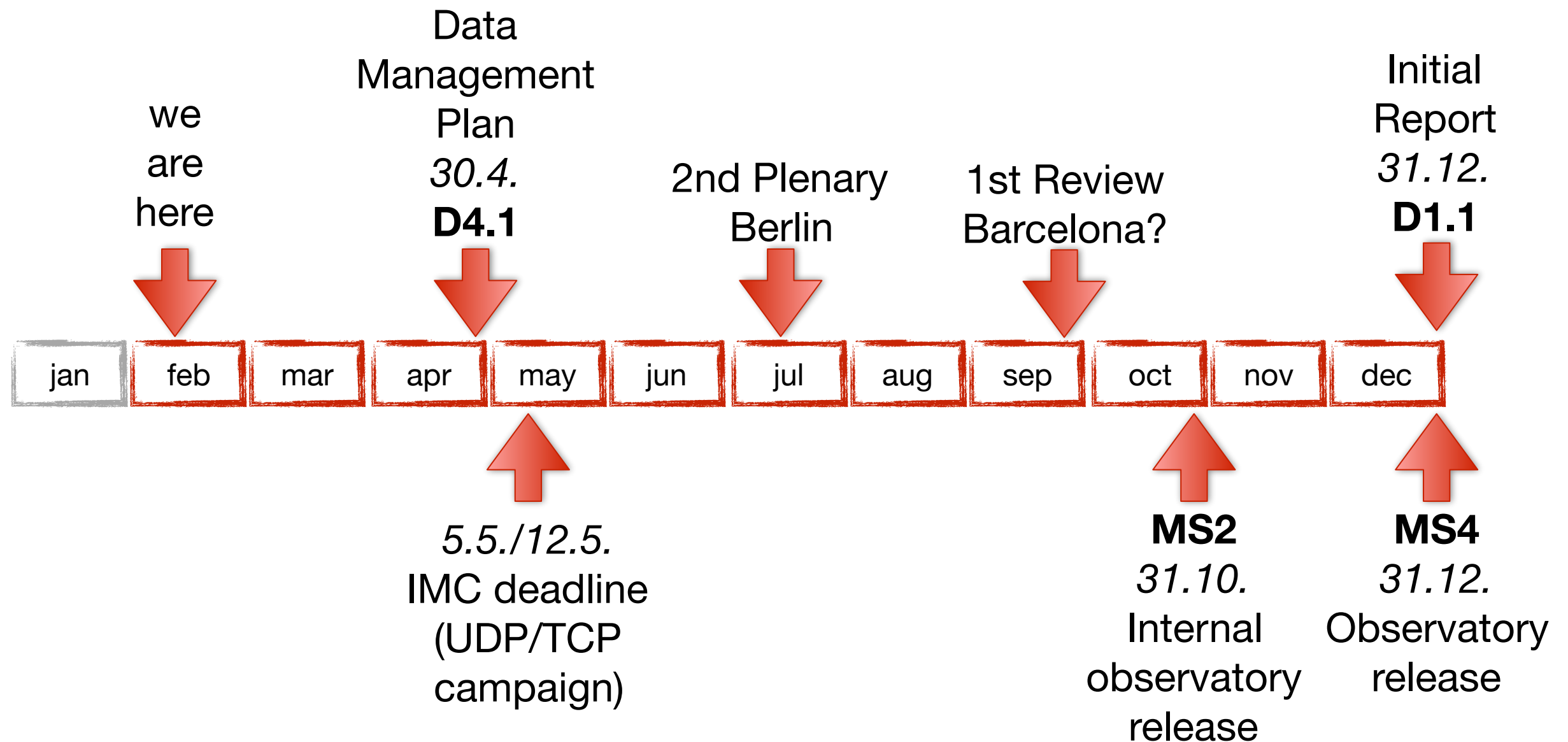


What We're Doing

- Methodology and Measurement Tool Design [1.1, from now]
 - Tracebox, Copycat2, Pathspider, Atlas for UDP, CGN detection
- Initial Measurements and Middlebox Detection [1.2, from April]
 - Atlas, Copycat/Tracebox on Ark etc. for IMC underway
- Data Model and Middlebox Observatory [1.4, from June in progress]
 - details on following slides



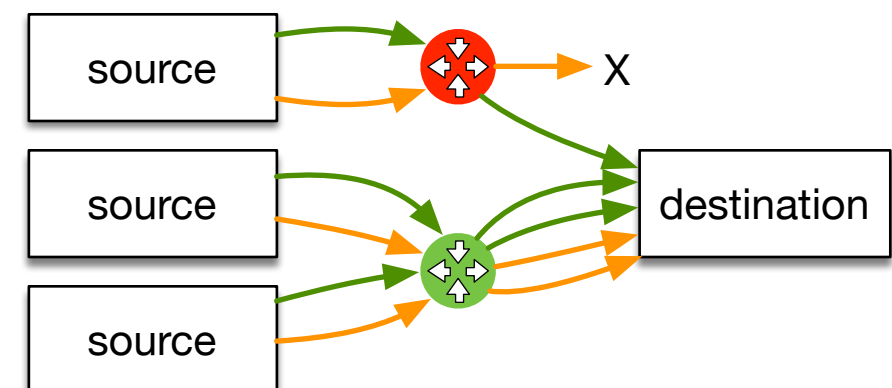
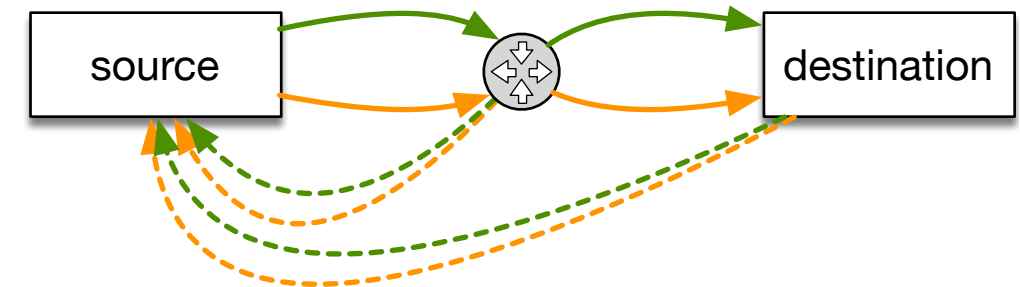
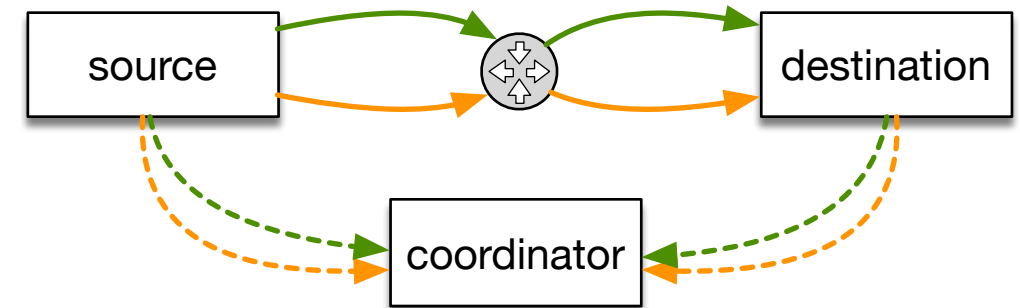
What Gets Done When (Y1)?





Active Measurement of Path Transparency

- Basic methodology: throw a bunch of packets with certain properties at the Internet, and see what happens.
 - Ideal: two-ended A/B testing
 - More scalable: one-ended A/B testing
 - Comparison with topology to isolate on-path vs near-endpoint impairments
- Observations from platform- and application-level logs of failed attempts to use protocol features also useful.
- Integrate heterogeneous observations from many campaigns for better insight.
 - Build an observatory for this integration





Observatory Requirements

- Accept data from a wide variety of sources, e.g.:
 - Raw output from tools we maintain.
 - Raw packet traces of active measurements.
 - “Here’s data from a measurement study, and references to commits in GitHub for the tools and configuration used to generate it.”
 - “Option foo breaks on these paths but not these paths; we’re not going to tell you where they are, but this set of them belong to a major mobile carrier.”
- Support path pseudonymization and aggregation for privacy.
- Support condition definition with enough precision to allow active measurements to reproduce observations on other paths.
- Integrate with existing tools, without restrictions on implementation.



Observation Data Model Proposal

- An observatory is a collection of single **observations** $\{t, P, c\}$ where
 - **t** : time at which the observation was taken (and assumed valid)
 - **P** : designator of the path on which the observation was taken
 - sequence of node/network/multi-network identifiers or pseudonyms
 - **c** : variable-definition expression of the condition observed on that path
 - including **v** : vector of condition-specific variables
 - Initial plan: reference to external condition identifier linked to how it was generated (stable code, configuration, raw-data reference)
- “Raw” data within the observatory used to back these observations.
- Queries always operate on this intermediate observation representation.