Path Transparency Observatory (PTO) Version 3: *Once More, With Feeling*

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measurement and architecture for a middleboxed internet

measurement | architecture | experimentation

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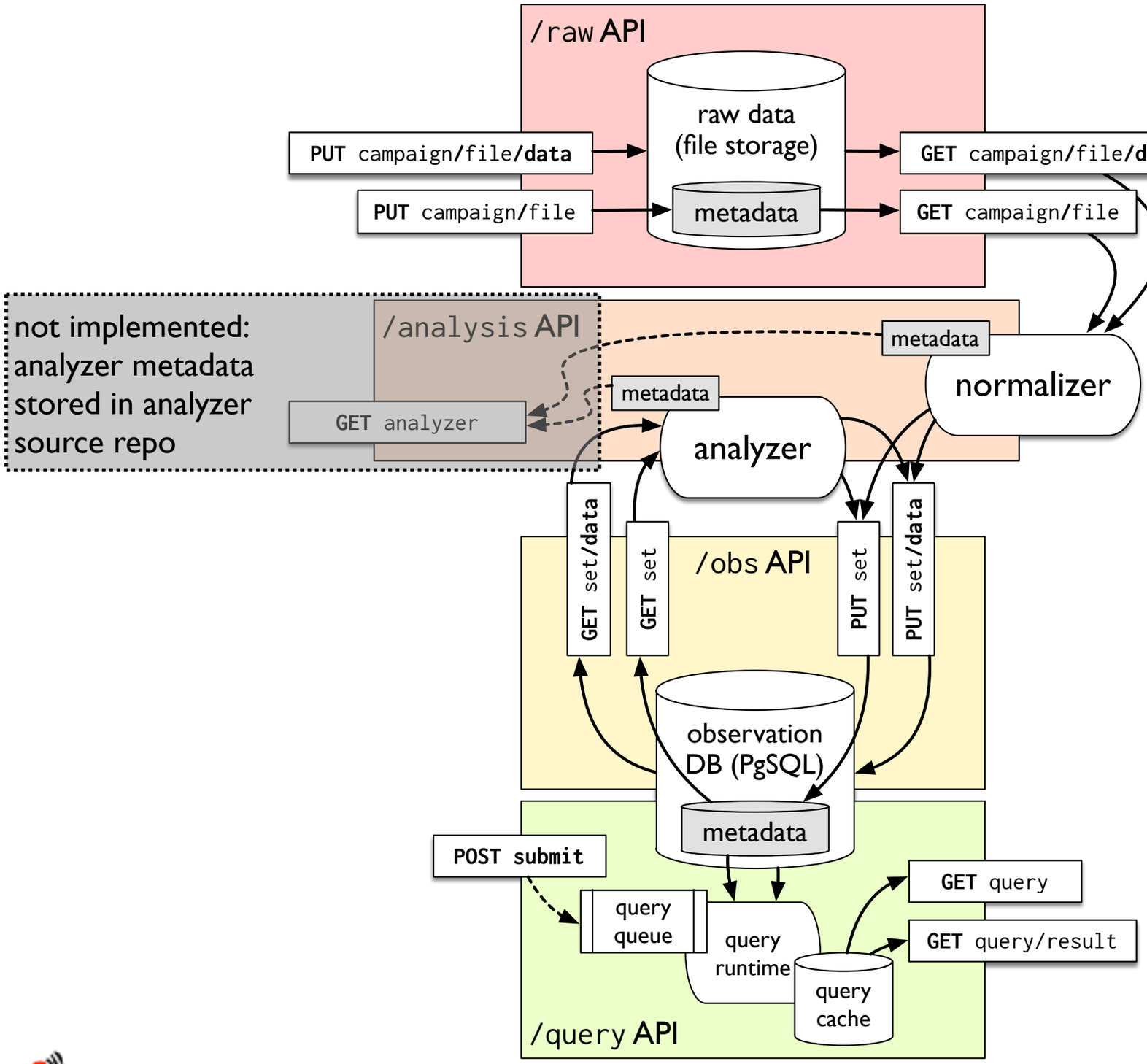
Current Status

- PTOv3: reimplement pilot PTO to a RESTful architecture
  - Less BigData™ overhead, web concepts for provenance
- Timeline in Oslo (Python 3 + flask + SQLalchemy impl)
  - raw data by August
  - analysis up in September
- Timeline in reality (almost bare-metal Golang impl)
  - alpha nowish, doing first real analysis
  - beta by IMC '18 deadline

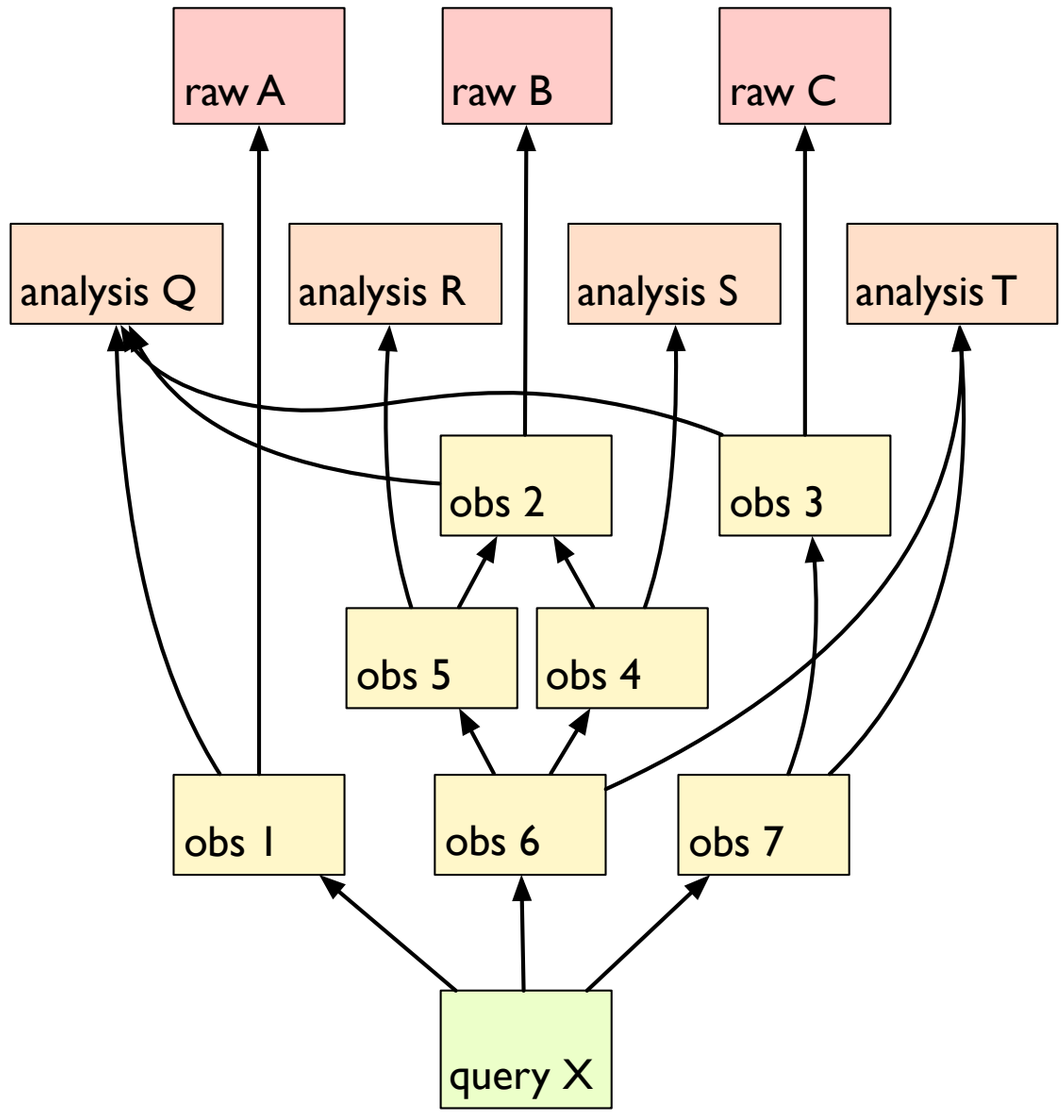
What changed?

- Migrate (again) from Python to Go
  - Python web frameworks get annoying quickly unless all you want to implement is the example social network app.
  - Go support for web API development in standard library is easier to deal with, higher performance, less prone to concurrency errors.
- Raw access to observation data through /obs paths
  - Allows easy creation of remote analyzers.
- Replace IQL with a (less capable) HTTP parameter representation
  - Easier analysis of queries to generate provenance information
  - Restriction of queries to reduce database running time

PTO v3 Architecture



PTO v3 Provenance



/raw

- Each campaign is an resource, representing its metadata
  - e.g. `/raw/my_campaign`
- Each file is a resource representing its metadata
  - e.g. `/raw/my_campaign/my_file.ext`
  - Files inherit, override metadata from their campaigns
- File contents are a separate resource under the file
  - e.g. `/raw/my_campaign/my_file.ext/data`
- All content is immutable once uploaded
  - Deletion requires manual intervention (and isn't implemented yet)

/obs

- Each observation set is an resource, representing its metadata, identified by its serial number
  - e.g. `/obs/0000000000003a`
- Observation contents are a separate resource under the observation set, represented as NDJSON
  - e.g. `/obs/0000000000003a/data`
- Observation content is immutable once uploaded

Obervation file format

- each observation is a JSON string array:
- [set_id, time_start, time_end, path, condition, value]
  - set_id in hex (just like IDs in links)
  - time_start, time_end in RFC 3339 format UTC
  - path is a space-separated element list
  - condition is a condition name
  - value is ~~an integer~~ a string ***(todo)***

Local analyzer interface

- Analyzers are simply UNIX executables
  - Normalizer: raw to obs
    - raw data on stdin
    - raw metadata on filehandle 3
    - observations and metadata on stdout
  - Analyzer: obs to obs
    - observations and metadata on stdin
    - observations and metadata on stdout

ptocat, ptoload, ptonorm

- `ptocat`: dump observation set +metadata on stdout
- `ptoload`: load observation set + metadata from stdin
- running an analyzer: `$ ptocat` *set-ids* | *analyzer* | `ptoload`

- `ptonorm`: read raw data and metadata, set up on stdin + fh3, read observation data into db.
- running a normalizer: `$ ptonorm` *analyzer campaign/file*

- `ptopass`: simple normalizer to pass raw observation files into the database

/query

- Each query is identified by a hash of its normalized parameters
- `/query`: list queries in the cache
  - `pending`: queries still waiting for execution, or executing
  - `completed`: queries that are done, not yet purged
  - `permanent`: queries that are externally referenced and will not be purged
- `/query/submit`: submit a query given params
  - idempotent: a given set of params will only run once
- `/query/`*query-id*: read, update query metadata
- `/query/`*query-id*`/results`: read/paginate results

/query/submit parameters

- Select parameters use and-of-or semantics
  - `time_start, time_end`: temporal scope, required
  - `set`: observation set scope
  - `conditions`: select by condition, with wildcards
  - `source, on_path, target`: select by path element
    - ***missing***: query by observation set metadata
- `group` parameters change query to count from selected observations by group
  - `year, month, week, day, hour, week_day, day_hour:` time series grouping
  - `condition`
  - `source, target`
- `options` change how queries are interpreted
  - `sets_only`: only return links to sets having observations matching query; used for finding sets to feed into an analysis
  - ***missing***: option to count targets, not observations

Status

- Everything in this presentation *should* work,
  in `master` branch of https://github.com/mami-project/pto3-go
  - (caveat: test coverage less than 60%)

- New observatory API running at https://v3.pto.mami-project.eu by 8 Feb

- Now: loading 2017 ANRW and various ETH Pathspider measurements.
  - pto is metadata agnostic, but we need conventions for MAMI data
- Next: migration of the rest of the raw data, analysis into obsets
- Later: update the front-end, beta release.
  - Issues list: https://github.com/mami-project/pto3-go/milestone/3