Distributed Aggregation Protocol
Draft and implementation updates

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PPM - IETF 116 - Yokohama

Draft updates: draft-irtf-cfrg-vdaf-04, -05

- Security analysis of Verifiable Distributed Aggregation Functions, by Davis et al.: ia.cr/2023/130
- Summary of protocol implications on the CFRG list
- SHA-3 based PRNG to replace AES

draft-ietf-ppm-dap-04: catching up with VDAF-05

- Report ID is used as nonce during input sharding
  - Restricts DAP to VDAFs with 16 byte nonces
- VDAF verification key requirements
  - MUST NOT be revealed to Clients
  - Aggregators MUST commit to a key before processing reports for a task
  - Suffices for Leader to choose the key and distribute it to Helper(s)
  - Verification key cannot rotate independently of a DAP task!
  - Task negotiation remains out of scope for DAP
- VDAF aggregation parameter validation
  - VDAF requirements vary, so DAP needs a generic mechanism
  - `Vdaf.is_valid(curr_agg_param, previous_agg_params) -> Bool`

draft-ietf-ppm-dap-04

- Collection resource representation now includes interval of time spanned by constituent reports
  - Particularly valuable for fixed-size tasks
  - May be smaller than the interval in the request for time-interval tasks

```
struct {
  PartialBatchSelector part_batch_selector;
  uint64 report_count;
  Interval interval;
  HpkeCiphertext
encrypted_agg_shares<1..2^32-1>;
} Collection;
```

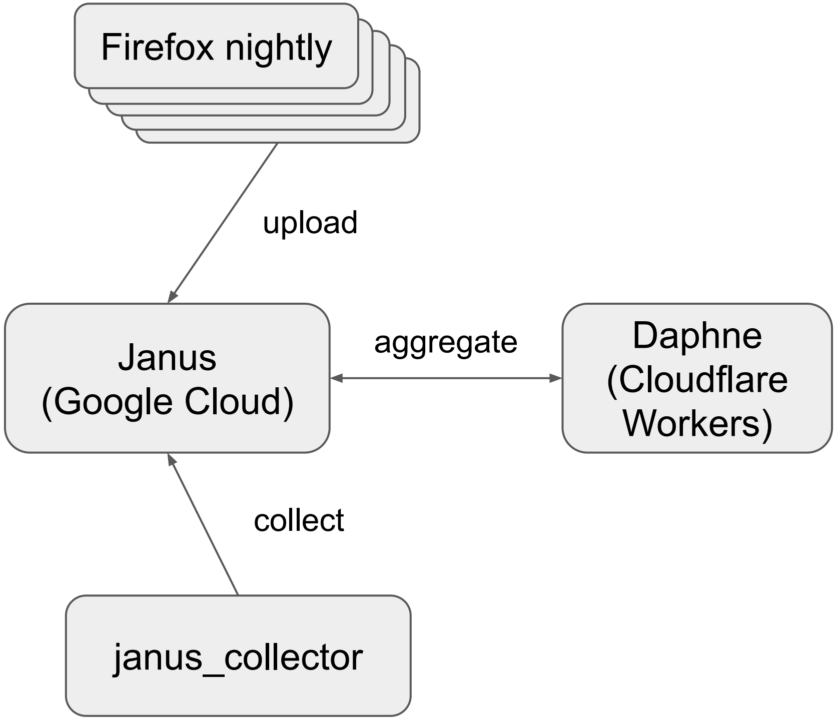
- New HTTP API
  - Removes need for message parsing hacks
  - Request idempotence for robust error recovery
  - Discussed at IETF 115
  - And on GitHub

Implementations

- libprio-rs
  - Implements Prio3 and Poplar1 VDAF families and VDAF abstraction
  - VDAF-04 in prio-0.11.x, VDAF-05 in prio-0.12.y
  - We'd love to see more implementations – Go would be great
- Daphne
  - Helper implementation targeting Cloudflare Workers
  - DAP-04 implementation is underway
  - Docker images available!
- Janus
  - Client, Leader, Helper, Collector implementations
  - DAP-04 implementation is complete (Prio3 only)
- divviup-ts
  - Typescript Client implementation
  - DAP-04 implementation mostly complete (Prio3 only)
- Firefox
  - DAP-04 client implementation underway

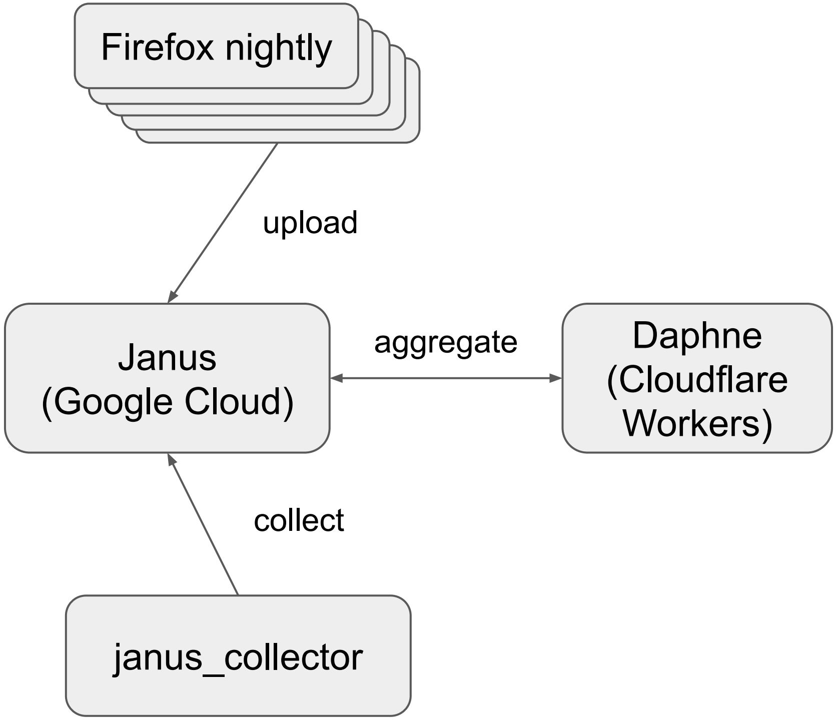
Daphne/Firefox/Janus interoperability test

- December 2022
- DAP-02, VDAF-03
- Prio3Sum
- 1% of Firefox nightly installs (~400 clients) all uploading the value 3



Daphne/Firefox/Janus interoperability test

- It worked!
- Scale too small to learn much about performance
- Automated task provisioning is vital
  - draft-wang-ppm-taskprov is one way forward



Future goals

- Poplar1
- Simplicity
  - Cut non-essential features and error codes
- Clarification
  - Sequence and block diagrams
  - Consistency and concision in text
- Central/server differential privacy
  - Generic mechanisms in conjunction with VDAF for applying noise to aggregate shares
- Security considerations
- Decoupling the aggregation parameter from aggregation jobs (#405)
- Specialize to one aggregator?

Backup: New HTTP API

Resource	**Supported by…**	**Required methods**	**Relative path**
HPKE configuration	Leader, helper	GET	/hpke_config[?task_id={task-id}]
Report	Leader	PUT	/tasks/{task-id}/reports
Aggregation job	Helper	PUT, POST, DELETE	/tasks/{task-id}/aggregation_jobs/{aggregation-job-id}
Aggregate shares	Helper	POST, DELETE	/tasks/{task-id}/aggregate_shares
Collections	Leader	PUT, POST, DELETE	/tasks/{task-id}/collections/{collection-job-id}