HTTPS-Notif-Draft implementation, Kafka integration and Bandwidth Analysis

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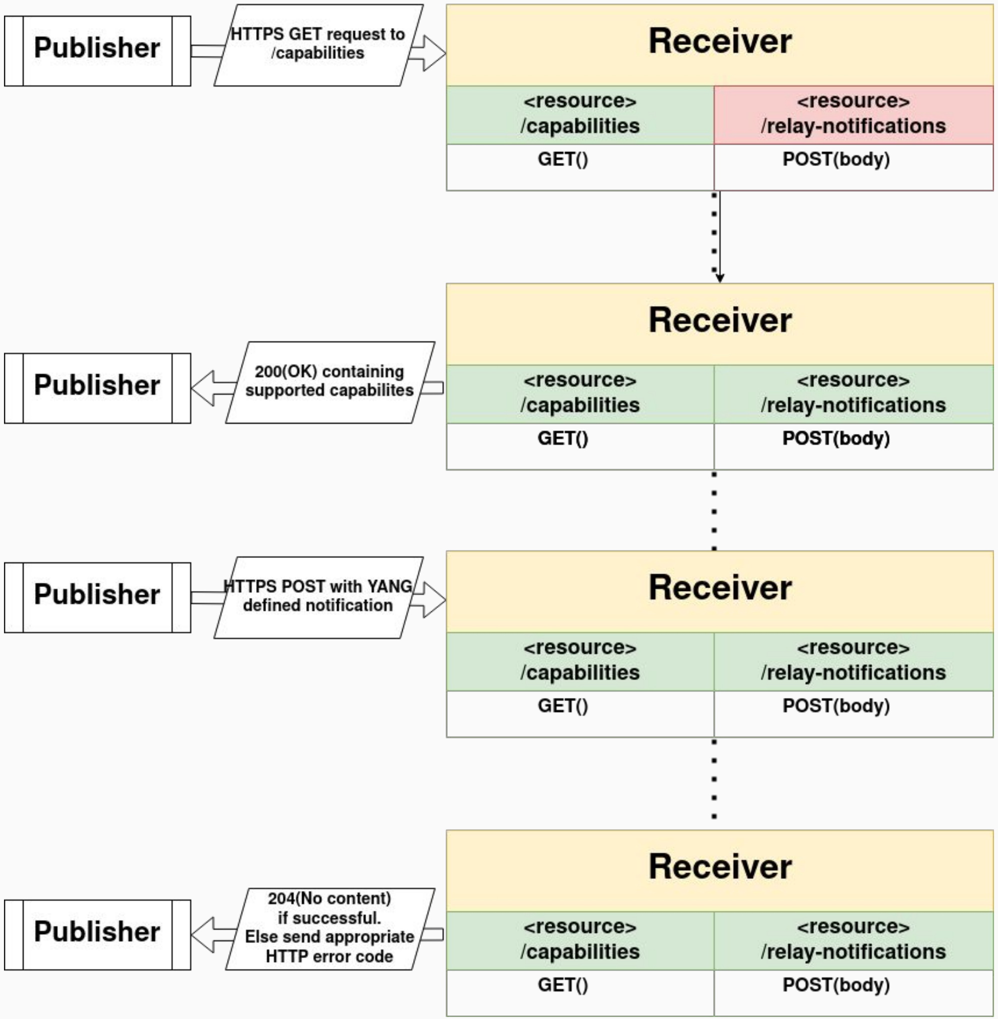
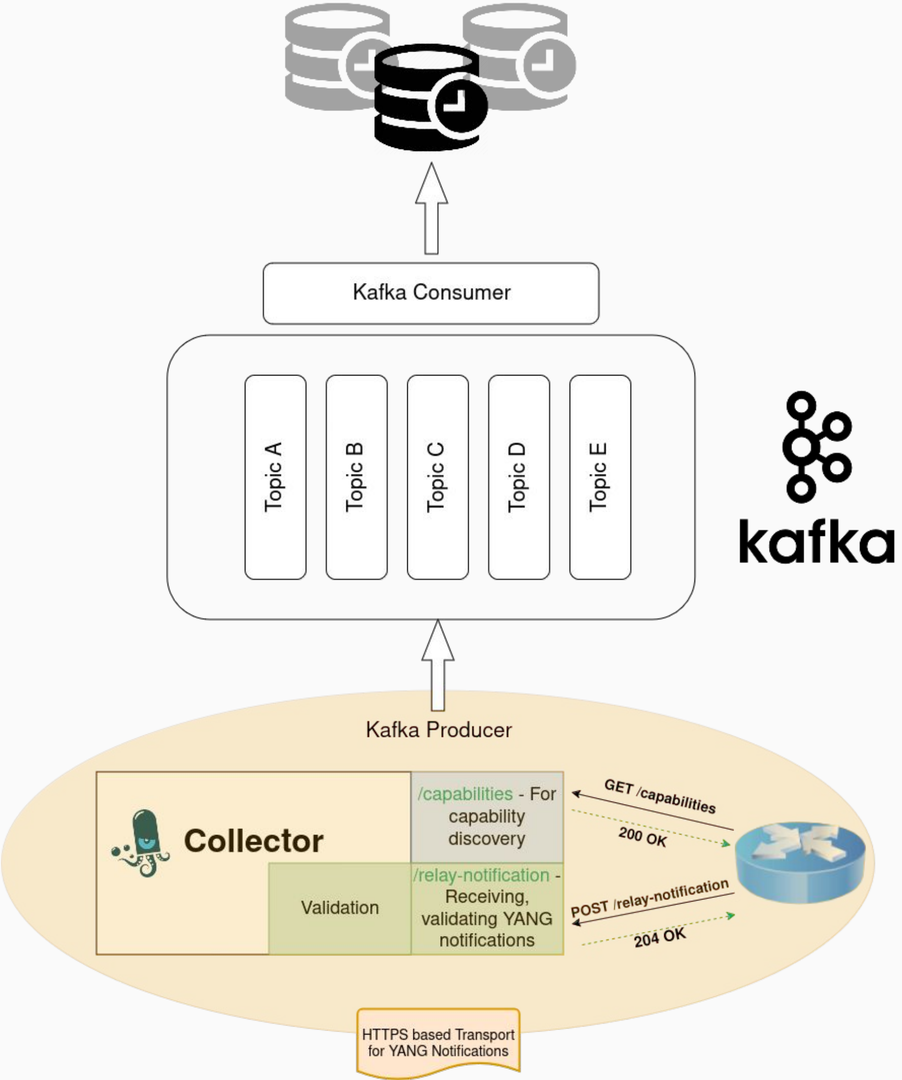
Draft Overview

- Publisher sends a GET request to /capabilities resource of the Receiver(i.e Collector)
- Publisher learns the Receiver’s capabilities from the response body.
- Publisher sends a POST request with YANG defined notification data.
- Receiver responds with a 204(No Content) is successful.



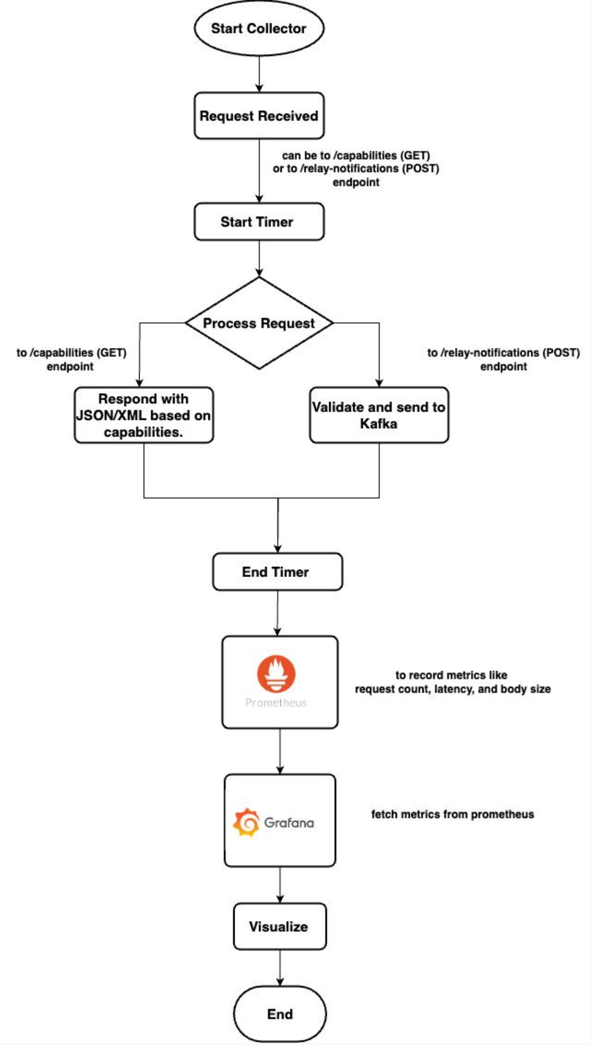
Implementation Architecture

- Collector(receiver) supports /capabilities and /relay-notifications
- Collector receives the relay notification and **publishes the notification data to a designated Kafka topic**.
- A parallel Kafka **consumer continuously reads messages from this topic and inserts the data into a Time Series Database** (InfluxDB in our implementation)



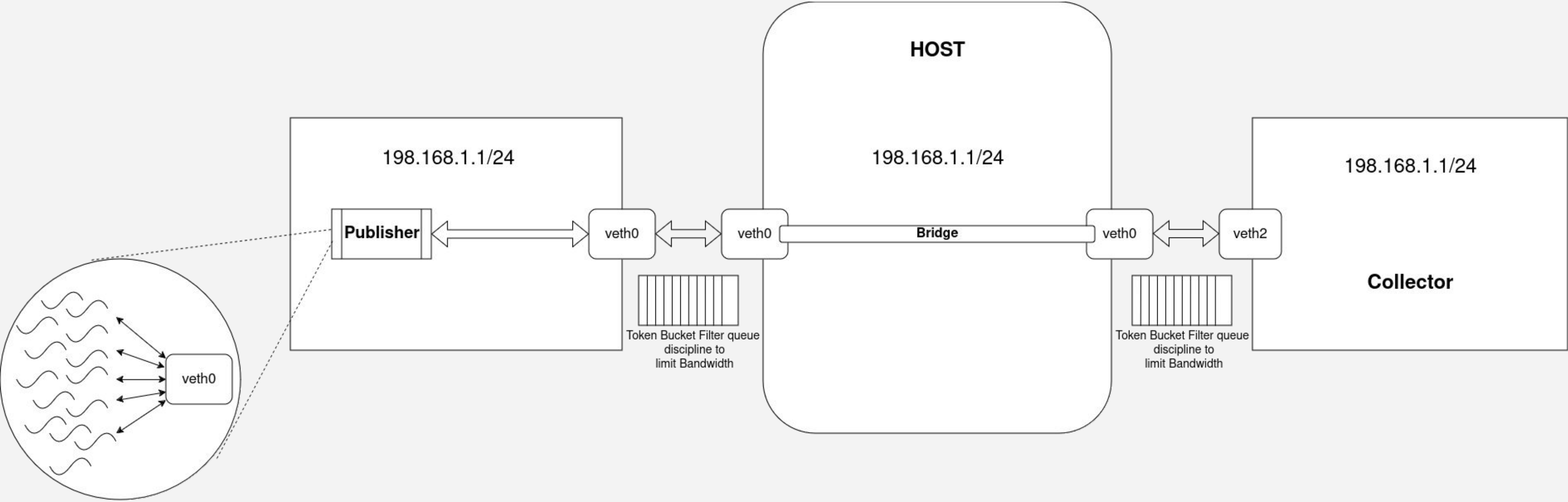
Monitoring metrics with Prometheus and Grafana

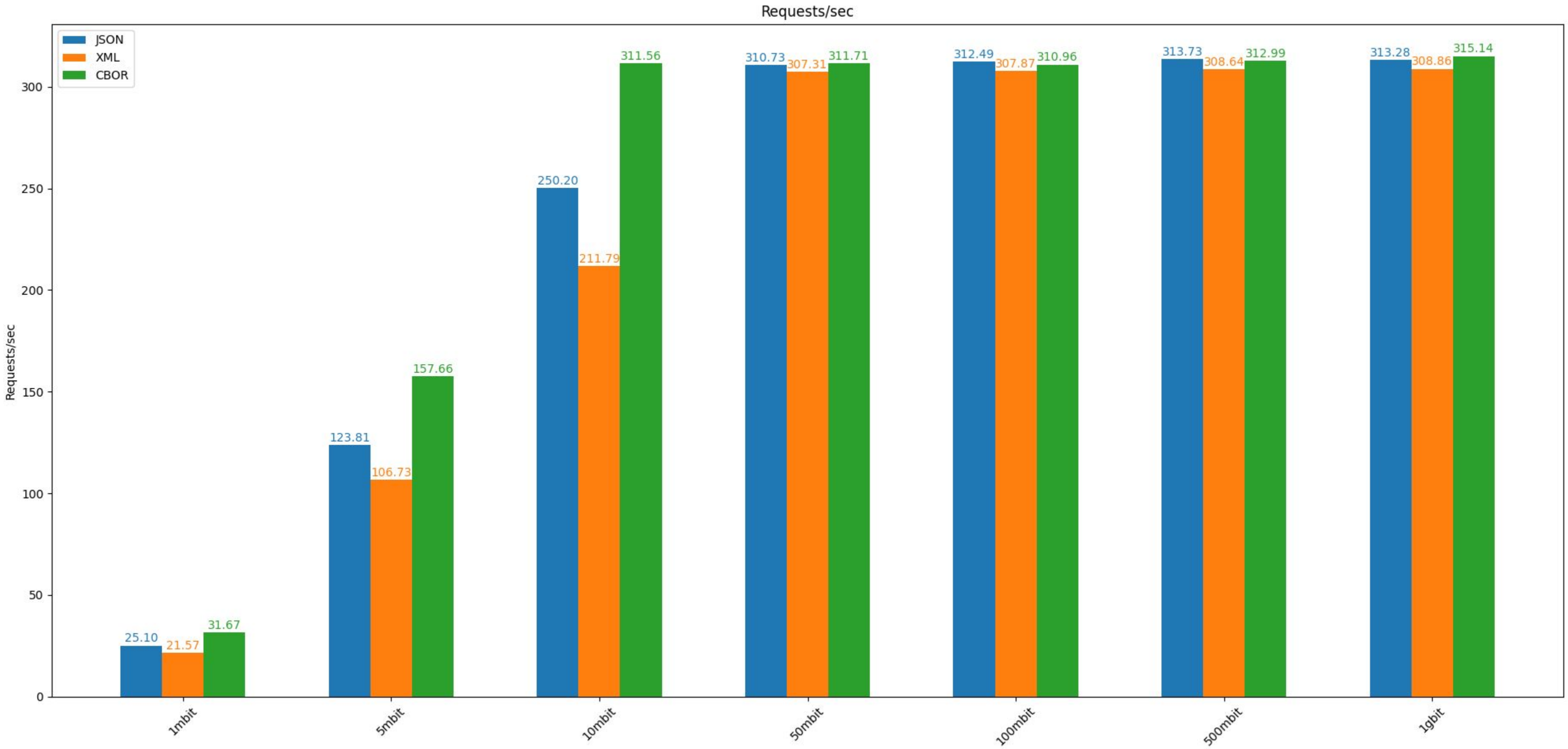
- The application uses Prometheus client libraries to define **metrics such as HTTP request counts, request latencies and POST request body sizes**.
- Prometheus collects the metrics exposed by the application. Grafana is used to visualize these metrics.



Performance Analysis of Encoding Formats Under Varying Bandwidth

Virtual Network Namespace Setup





Req/sec, average measurement of the above experiment

CBOR Encoding for HTTPS-based Transport for YANG Notifications

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Why CBOR Extension?

Using HTTPS, which is a secure form of HTTP Semantics [RFC9110], **maximizes transport-level interoperability**, while allowing for a **variety of encoding options**. Current draft supports JSON and XML encoding as options .

CBOR is another widely used encoding standard and it also provides greater throughput in bandwidth networks.

Our draft describes the **standard to conform to in order to include** the **CBOR** encoding format.

In accordance with Encoding of Data Modeled with YANG in the Concise Binary Object Representation (CBOR) [RFC9254], we propose support for usage of both **SIDs in keys** and **Names in keys**.

Overview of Draft

- YANG notifications can be encoded in CBOR using Names or SIDs in keys.
- Examples of the GET and POST request and reply encoded in CBOR along with their diagnostic notation and encoding examples

Diagnostic notation:

```
{
  "ietf-https-notif:notification":{

"eventTime":"2013-12-21T00:01:00Z",
          "example-mod:event":{
          "event-class":"fault",
          "reporting-entity":{
          "card":"Ethernet0"
          },
          "severity":"major"
          }
  }
}
```

Cbor Encoding:

```
A1                          # map(1)
  78 1D                       # text(29)

696574662D68747470732D6E6F7469663A6E6F746966
69636174696F6E # "ietf-https-notif:notification"
  A2                        # map(2)
    69                      # text(9)
      6576656E7454696D65          # "eventTime"
    74                      # text(20)

323031332D31322D32315430303A30313A30305A #
"2013-12-21T00:01:00Z"
    71                      # text(17)
      6578616D706C652D6D6F643A6576656E74 #
"example-mod:event"
    A3                      # map(3)
      68                    # text(8)
        7365766572697479          # "severity"
      65                    # text(5)
        6D616A6F72              # "major"
      6B                    # text(11)
        6576656E742D636C617373      # "event-class"
      65                    # text(5)
        6661756C74              # "fault"
      70                    # text(16)
        7265706F7274696E672D656E74697479 #
"reporting-entity"
      A1                    # map(1)
        64                  # text(4)
          63617264            # "card"
        69                  # text(9)
          45746865726E657430      # "Ethernet0"
```

Issues, areas of improvement

- Areas of improvement and future work:
  - Improved experimentation setup - shift from virtual namespaces on local devices to realistic multi device setup. Avoid unknown overheads which add to uncertainty.
  - Understand and minimize(or atleast account for) various factors which affect our performance analysis.
  - CBOR SIDs vs CBOR Named IDs - Hypothesis : Using CBOR SIDs should result in better throughput(because the notification data will be smaller). Validation would require using a mapping between SIDs and their true representation. This will increase the space complexity of the application, but does not significantly worsen performance(due to the O(1) nature of element lookup).
- Issues faced while implementing:
  - Lack of tooling and support for YANG in general. Eg : No support for YANG Data Structure Extensions Module (*structure*) in yangson(Python)
  - Lack of support for XML and CBOR YANG data validation in libraries and tooling like yangson and libyang. (We had to convert them to JSON! Which added some unnecessary overhead and affected our numbers :(
  -

Any questions?

Thank you!

Link to Github : https://github.com/MeherRushi/https-notif-draft-impl/
Link to Datatracker Draft :
https://datatracker.ietf.org/doc/draft-chittapragada-netconf-https-notif-cbor/