ONAP Evolution to support High Volume Data in DCAE to support Real Time PM

Nokia June xx, 2018

Real Time Performance Management Data Delivery to ONAP

- Topics
  - Problem Statement and Factors to Consider to solve the problem
  - High Volume/Near Real Time Performance Management Event Proposal
  - ONAP Project Impacts to support Real Time Performance Management Proposal

PBM Statement for Real Time PM

- Transmission of specific configured PM data which is time sensitive, delivered at frequent intervals, (less than one minute) from many producers to a single entity (DCAE)

Factors to consider to address the Problem Statement

- DCAE is the entity that collects, distributes and analyzes data.
- DCAE provides pub/sub capabilities within ONAP and scales to support event traffic.
- Specific NF instances will be supported by specific ONAP instances.
- DCAE architecture evolution to support high volume events is documented in the VES Event Listener Document.
- Efficient data delivery is critical with low latency since data loses relevance quickly.
- NF produces only the PM data requested by the operator at the configured intervals.

Nokia Proposed Solution: GPB over TLS/TCP

- TCP and TLS are broadly accepted and widely used
- GPB and TCP/TLS are lightweight
- GPB is an effective way to encode the data
- TCP is an efficient way to transmit the data
- TLS adds security, when needed, at modest overhead.
- TCP/TLS provides reliable transport with security
  - Level of reliability in the stack is sufficient for our use case
    - Built in error correction, flow control, congestion control, scaling…
- Caching/Persistency is not critical as data loses relevance quickly.
- Evolution of the existing architecture.
  - No new middleware integration for NF providers
  - Minimize impact on NF providers and consistent delivery of data to ONAP

Real Time PM Event must Support Variable Content

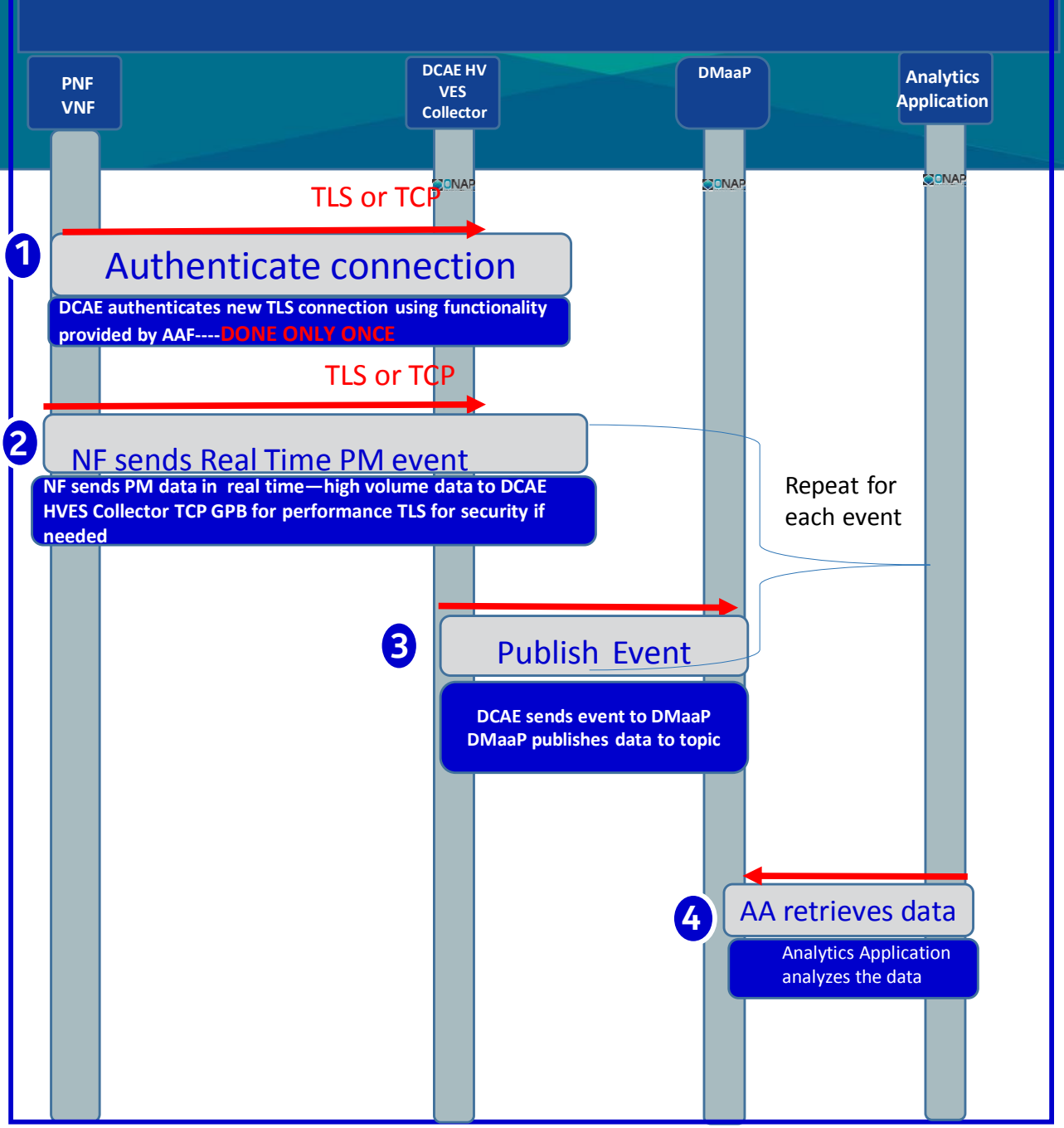
- 5G RAN NFs produce a large number of measurements (LTE has over 3000) which can be collected by a service provider on a periodic basis.
  - 3GPP Measurements
  - Vendor proprietary measurements (specific to custom features and equipment/configurations).
- The set of performance measurements a NF is capable of providing changes frequently (counters added, removed, changed) as a result of new features, standards changes, customer requests, software releases etc.
- The content of the Real Time Performance Measurements reports are variable based on service provider needs and can be reconfigured as desired.
- The definition of the Events to deliver measurements to ONAP needs to be simple and flexible to support the known variability in the event content.

GPB encoding and schema with TCP or TLS for Real Time PM

- Real Time PM data (delivered at configurable intervals—1 Minute or less)
  - Reduced number of measurements, configured for delivery by the service provider, to study behavior of the NF.
  - Operator can re-configure which measurements are collected as needed.
  - Report sizes are small to medium but the periodicity is frequent (5, 10, …60 seconds) which can result in a high volume of data.
- Event streaming suitable for real-time PM use cases
  - Performance studies have shown 2-3 times improved runtime performance using GPB compared with using JSON.
  - Message sizes using GPB are approximately half of those produced using JSON
  - Persistent connection (proposing socket) due to the frequency of the events and overhead of setting up each connection.
- Proposal: Real Time PM data sent using a new VES Event encoded as GPB binary and streamed via TCP Sockets for efficiency and TLS for security when needed.

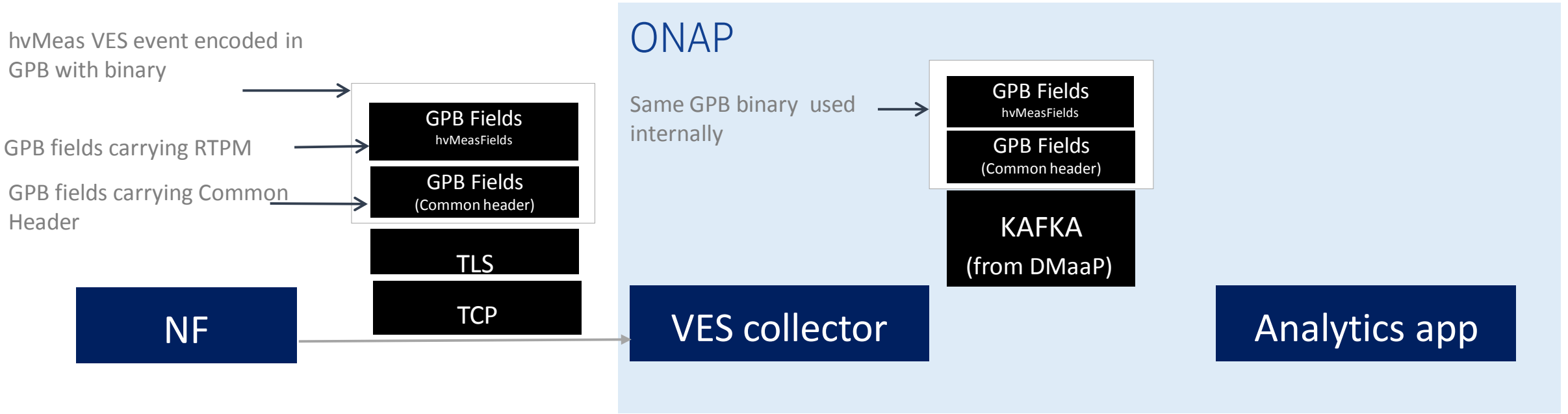
Real Time PM Flow

1. NF initiates initial VES event and establishes connection. DCAE authenticates connection—connection is persistent so this is only done once.
2. NF sends hvMeas Event to VES collector. Real Time PM sent with GPB schema. No retries if Real Time data delivery fails. DCAE requires a VES Collector to receive and validate GPB events.
3. DCAE validates the VES event using the VES_Event.proto file and sends the event to DMaaP for publication. DMaaP publishes the data to a topic. DMaaP enhancements needed to support high volume events in GPB format.
4. Analytics Application retrieves data. AA uses the VES_Event.proto file, the HvMeasFields.proto file and the PM Content Metadata to process the data.



hvMeas for RTPM

Artifacts (slides 10 and 11)	Function
VES_Event.proto	Used by VES to validate the event and by the Analytics app to decode the event.
HvMeasFields.proto	Used by Analytics Application to process the hvMeas events
PM Content metadata	Used by Analytics Application to process the hvMeas events



Proto files for hvMeas (RTPM) Artifacts

VES_Event.proto

- Common for all high-volume domains
- Identifies fields in the Common Event Header that will be provided.
- Provides capability for VES to validate the event.
- Provides capability for Analytics Application to decode the event header.

HvMeasFields.proto

- Identifies required fields in the event and their schema.
- Identifies optional fields the vendor will provide.
- Defines format of measurement payload delivery.
- Measurements are provided by MO Class.
- Describes Measurements structure within each instance of the class and the hierarchy of the MO Class.
- Provides capability for Analytics Application to decode the RTPM payload

PM Content Metadata Artifact

- File must be provided whenever PM are added deleted or modified.
- Must contain all Measurements that could be provided by a NF.
- Contains detailed information about each Measurement including Managed Object Class, Measurement ID, Measurement Name, Counter ID, Counter Name, Counter Definition, Value Ranges, Unit of Measure, Aggregation Formula, etc.
- Used by Analytics Applications to process the hvMeas events.

New hvMeas VES Event

- NF sends Real Time PM data to DCAE via a new hvMeas event encoded as message length + GPB binary and streamed via TCP Sockets for efficiency with TLS for security when needed.
- GPB Binary contains two sets of fields: Common Header with the same fields as defined for JSON events for consistency(slide 10) and payload—in this case RTPM(slide 11).
- Each high-volume domain will have it's own GPB schema for the payload.

hvMeas Event Proposed Common Header Content

hvMeas event input in red

Field	Type	Required?	Description
version	string	Yes	Version of the event header (currently: 3.0) 3.0
eventName	string	Yes	hvMeas_nfTYPE where nfTYPE is defined by the NF provider e.g. NOKIA5Gcu, NOKIA5GBTS etc
domain	number (enum)	Yes	Event domain enumeration: '0' is fault, '1' is heartbeat, '2' is measurement, '3' is mobileFlow, '4' is other, '5' is pnfRegistration, '6' is sipSignaling, '7' is stateChange, '8' is syslog', '9' is thresholdCrossingAlert', '10' is voiceQuality, '11' is hvMeas
eventId	string	Yes	Event key that is unique to the event source hvMeasyyyy
eventType	string	No	hvMeas
nfcNamingCode	string	No	Network function component type: 3 characters (aligned with vfc naming standards) Not used
nfNamingCode	string	No	Network function type: 4 characters (aligned with vnf naming standards) Not used
sourceId	bytes	No	UUID identifying the entity experiencing the event issue (note: the AT&T internal enrichment process shall ensure that this field is populated) Not used
sourceName	string	Yes	Name of the entity experiencing the event issue NFid (PNFid or VNF name) as entered in A&AI uniquely identifying this instance of the NF
reportingEntityId	bytes	No	UUID identifying the entity reporting the event, for example an OAM VM (note: the AT&T internal enrichment process shall ensure that this field is populated) Not Used
reportingEntityName	string	Yes	Name of the entity reporting the event, for example, an EMS name. May be the same as the sourceName. For synthetic events generated by DCAE, it is the name of the app generating the event. NFid (PNFid or VNF name)
priority	number (enum)	Yes	Processing priority enumeration:'0' is High, '1' is Medium, '2' is Normal, '3' is Low' NOTE in GPB default must be 0. 0
startEpochMicrosec	number (uint64)	Yes	the earliest unix time aka epoch time associated with the event from any component--as microseconds elapsed since 1 Jan 1970 not including leap seconds Measurement Report granularity period start time
lastEpochMicrosec	number (uint64)	Yes	the latest unix time aka epoch time associated with the event from any component--as microseconds elapsed since 1 Jan 1970 not including leap seconds Measurement Report granularity period end time
sequence	number (uint32)	Yes	Ordering of events communicated by an event source instance (or 0 if not needed) 0 or null
internalHeader Fields	internalHeader Fields	No	Fields (not supplied by event sources) that the VES Event Listener service can use to enrich the event if needed for efficient internal processing. This is an empty object which is intended to be defined separately by each provider implementing the VES Event Listener. Empty Not Used

hvMeas Event Proposed hvMeasFields

Field Name	Req/Opt	Enriched @ Broker	Source	Format	Format Example	Field Description	Comments
hvMeasFieldsVersion	M	VNF or PNF	VNF or PNF	string	1.1	Version of the hvMeas event	This version is updated whenever the hvMeas event format is changed.
additionalFields	O	VNF or PNF	VNF or PNF	hashMap			Allows vendors to provide additional information if needed.
measurementInterval	O	VNF or PNF	VNF or PNF	number (uint32)	15000	Granularity period for the PM report in milliseconds	Period can be derived from startEpochMicrosec and lastEpochMicrosec.
timezone	M	VNF or PNF	VNF or PNF	string	EDT	Time zone of PM reporting VNF or PNF	Local time zone where the report is generated.
pmContentVsn	M	VNF or PNF	VNF or PNF	string	NOKIA_LN7.0	Version of PM Content Metadata that correlates to this measurement data. Vendor name and schema version uniquely identify the relevant PM Content information	Version updated whenever PM counts are added, deleted or modified in the VNF or PNF software. Must correlate the PM counts in the report with the PM Content Metadata.
zeroCountersSuppressed	M	VNF or PNF	VNF or PNF	Boolean	0	Determines if counters with zero value for measurement interval are suppressed	Default is 0 meaning zeroCountersSuppressed is false, therefore, all counters are sent.
hvMeasPayload	M	VNF or PNF	VNF or PNF	bytes	Binary object ids, measurement ids, counter ids, and counter values, missing counter ids, suspect flag	PM Measurements	Format described by GPB schema. Content described in schema and PM Content Metadata.

ONAP Project impacts to support hvMeas Event

- DCAE: Ensure that authentication of TLS connection is available (provided by AAF project)
- DCAE: Implement High Volume VES Collector and support for new *hvMeas* VES Event.
- DCAE: Add support for high volume events in GPB format.
- DMaaP: Add support for high volume events in GPB format.
- Analytics Applications: to access data.
- AAF: Provide projects with authentication capability

BACKUP

REAL TIME PM-HV EVENT PROPOSAL TO ENHANCE DCAE (in 5G Use Case Committee)

Real Time PM--HV Event proposal to DCAE 5G Use Case Presentation.pdf

Real Time PM-HV event proposal to enhance DCAE

Use case proposal: 5G- RAN deployment, Slicing, SON

https://wiki.onap.org/display/DW/Use+case+proposal%3A+5G-+RAN+deployment%2C+Slicing%2C+SON

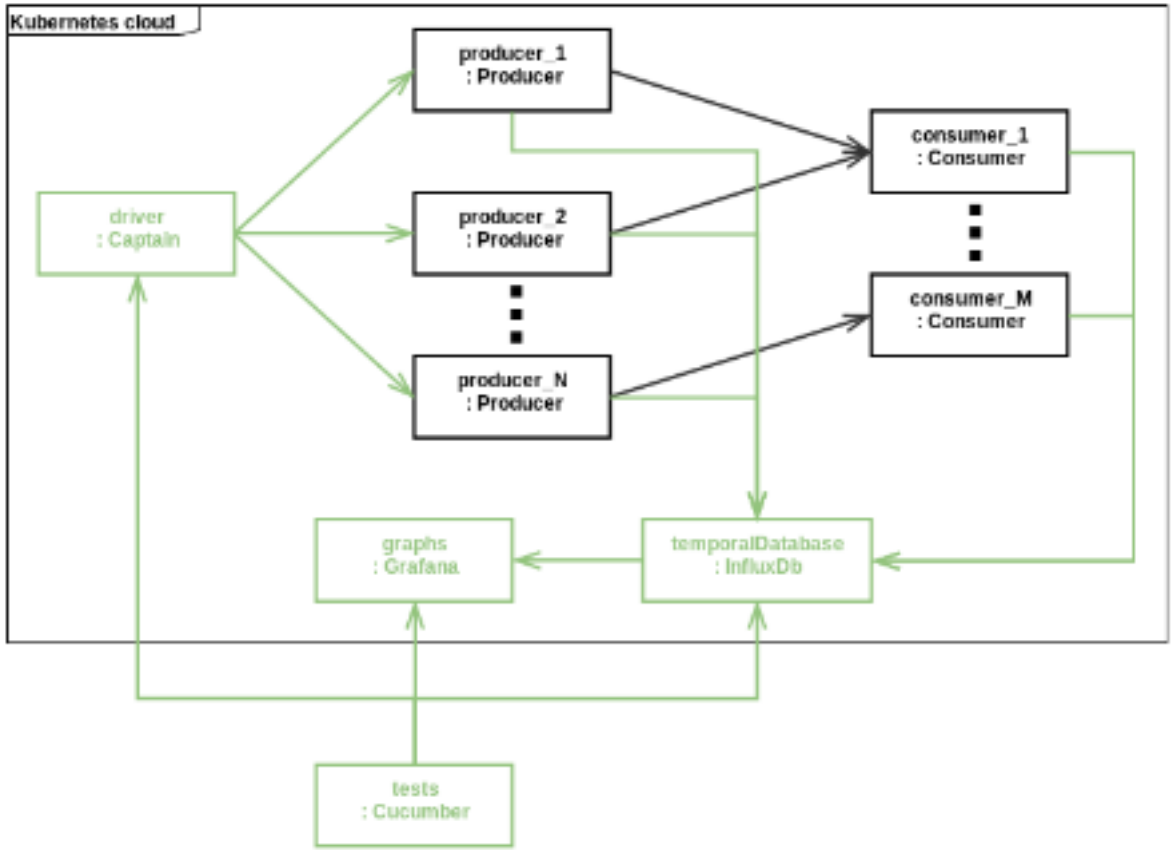
RTPM: GPB* versus JSON:: Test environment

Environment:

* Kubernetes on top of EECloud
* 3x hi1.4xlarge nodes, 1x cc1.4xlarge
* Total 76 vCPU and 320 GiB memory ready to be used

Scenario:

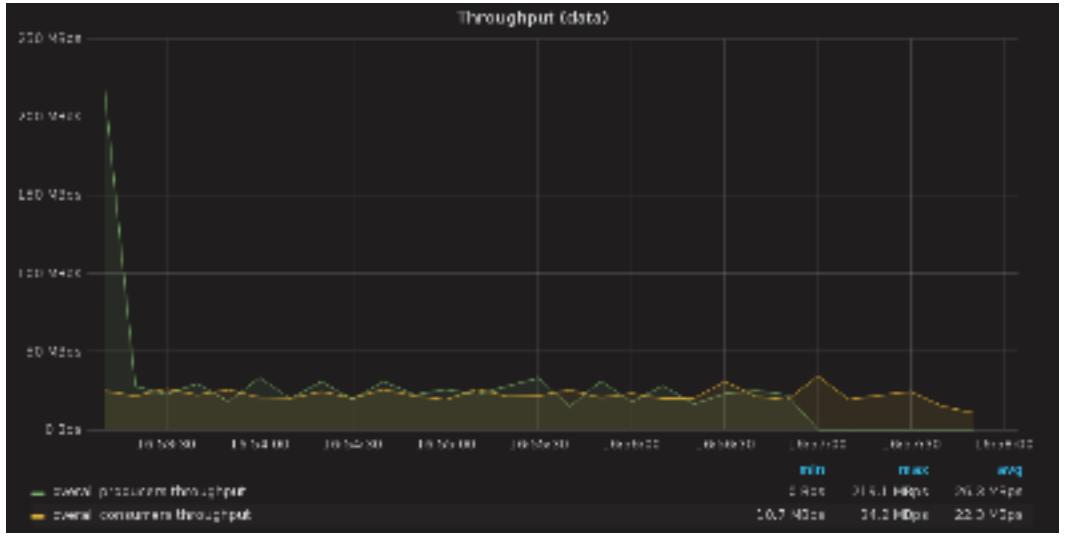
* 3 producers, 2 consumers
* single container limits:
  1 CPU, 3 GiB memory
* each producer produces 10 msgs/s each containing 30,000 counters
  → each producer simulates ~6000 BTSes



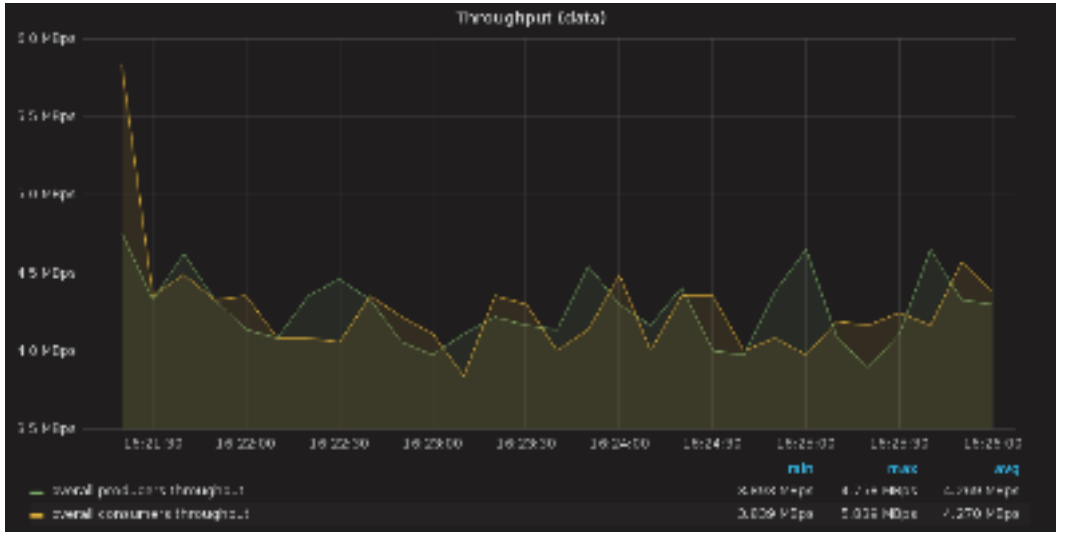
*) GPB → Google Protocol Buffers

RTPM: GPB versus JSON: Throughput

JSON



GPB



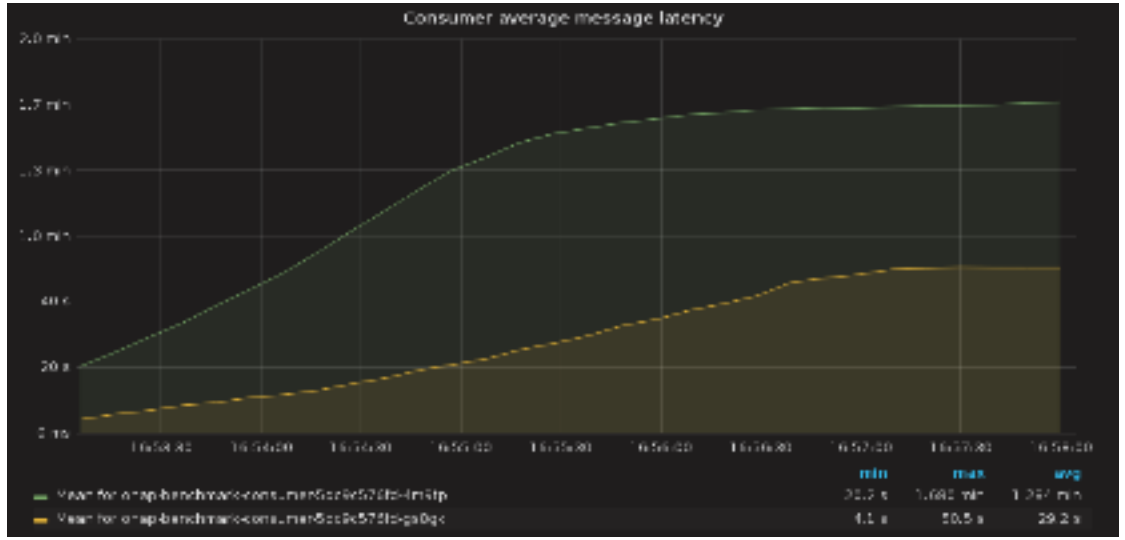
* Averages:
  * JSON over WebSocket: 22.3 MiB/s
  * GProtoBuf over WebSocket: 4.3 MiB/s

GPB ~ 5x more effective, than JSON*

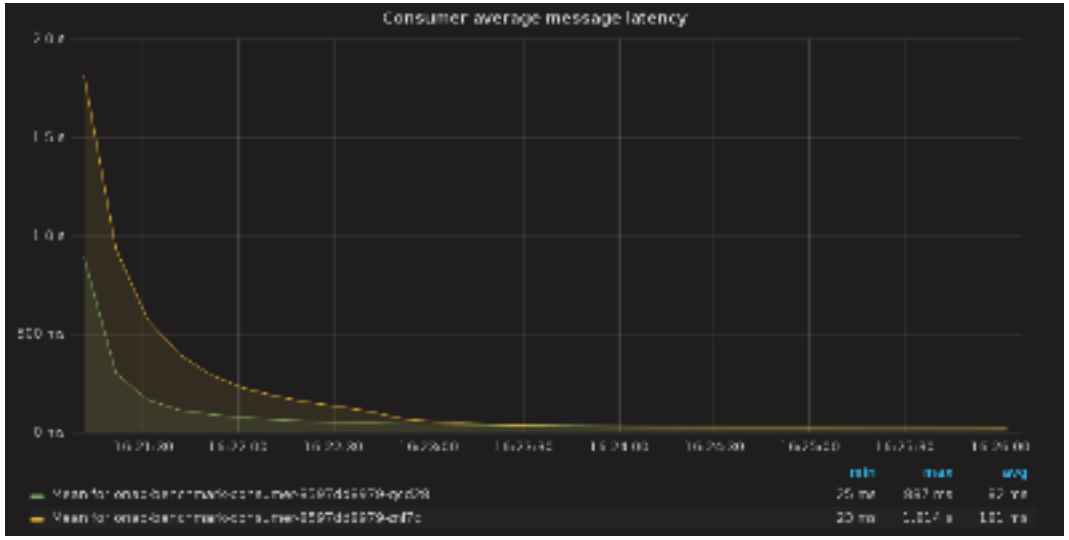
*) Based on real Nokia RTPM interface data

RTPM: GPB versus JSON: Latency*

JSON



GPB



* Normalized max value after 5 minutes:

* JSON over WebSocket: 100,800 ms **(1min, 40 sec)**

* ProtoBuf over WebSocket: 25 ms

Size of JSON encoded data determines much longer processing latency

*) Latency understood as a complete stream of data generation, serialization, transfer over the network, and deserialization at receiving end

RTPM Improved Efficiency in organizing the measurement payload by Managed Object.

- The total size of the hvMeas message is proportional to the number of relevant Managed Objects - typically cells - in BTS.
- In 5G, the number of cells under one BTS can exceed 1000.
- The size of the transmitted data per Managed Object is therefore an interesting efficiency indicator.
- With the proposed schema, the size per object is measured to be about 250B after GPB encoding, when using the following assumptions:
  - A total of 50 RTPM counters are reported, they are distributed in 10 measurements.
  - The URI string is 32 bytes long.
  - The measurement IDs, counter IDs and counter values are as per the sample file.

    (this example has only 2 measurements and 2 objects)

- The size per object is doubled if the schema is modified so that the data is organized at the top level by measurement, rather than by Managed Object.
  This is because the string encoding is not efficient for the object URI field, and this information is repeated multiple time if the modified schema is used.