MQTT as a Unified Message Bus for Infrastructure Services

Matthew Treinish
Open Source Developer Advocate - IBM
mtreinish@kortar.org
mtreinish on Freenode

Jeremy Stanley
fungi@yuggoth.org
fungi on Freenode

January 23, 2018

https://github.com/mtreinish/firehose/tree/lca2018

The problem

- The OpenStack community infrastructure operates >40 services on >250 servers
- All the community infrastructure runs on donated public cloud resources
- Some services depend on automation from others
- Several user facing services expose event buses
- A real mess when you try to consume infrastructure events for any purpose

OpenStack Community Infrastructure Firehose

- An MQTT broker for the OpenStack community infrastructure
- Has anonymous, read-only access via MQTT on 1883/tcp
- SSL/TLS MQTT also available on 8883/tcp
- Websockets supported (but temporarily disabled)

MQTT

- Pub/sub messaging protocol
- Formerly MQ Telemetry Transport
- ISO/IEC 20922
- Protocol dates back to 1999
- Standard Maintained by OASIS
- Lightweight design, low bandwidth, and designed to handle unreliable networking
- Popular in IoT and sensor network applications
- Large application ecosystem

MQTT Clients

- Bindings available for most languages
- https://github.com/mqtt/mqtt.github.io/wiki/libraries
- Eclipse Paho project provides similar interfaces across multiple languages

MQTT Brokers

- Relies on a central broker
- Many different options: https://github.com/mqtt/mqtt.github.io/wiki/servers

MQTT Topics and Subscriptions

- Topics are generated dynamically
- Topics are heirarchical
- Supports wildcarding

Examples:

sensors/*HOSTNAME*/temperature/*HDD_NAME*

- sensors/sinanju/temperature/nvme0n1p1
- sensors/+/temperature/+
- sensors/sinanju/temperature/+
- sensors/sinanju/#

QoS

- 3 QoS Levels:
  - **0**: The broker/client will deliver the message once, with no confirmation.
  - **1**: The broker/client will deliver the message at least once, with confirmation required.
  - **2**: The broker/client will deliver the message exactly once by using a four step handshake.
- QoS of a message sent with each PUBLISH
- Client sends QoS with SUBSCRIBE

The Firehose

- Runs Mosquitto MQTT broker
- Single broker instance
- **Hardware Specs:**

vCPUs	2
CPU Frequency	2.6 GHz
RAM	2 GB
swap	0 B
Disk	40 GB
Bandwidth	200 Mbps

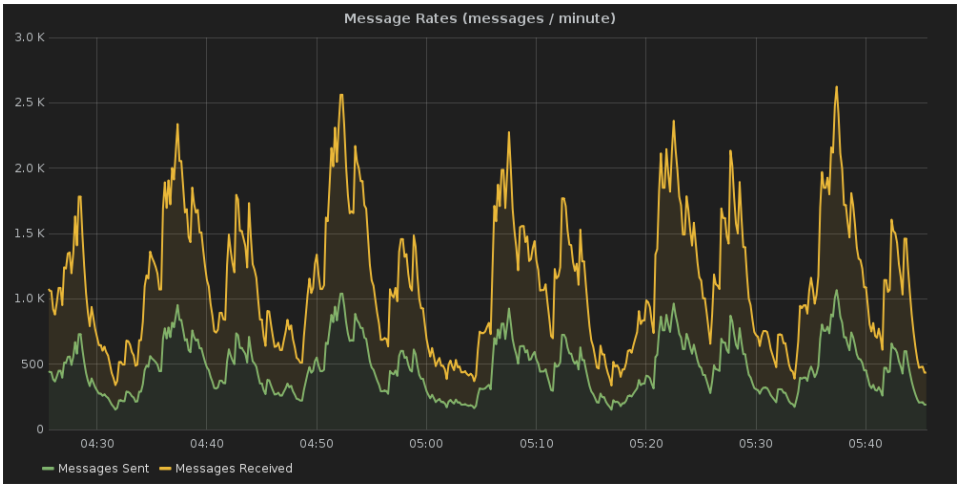
Mosquitto

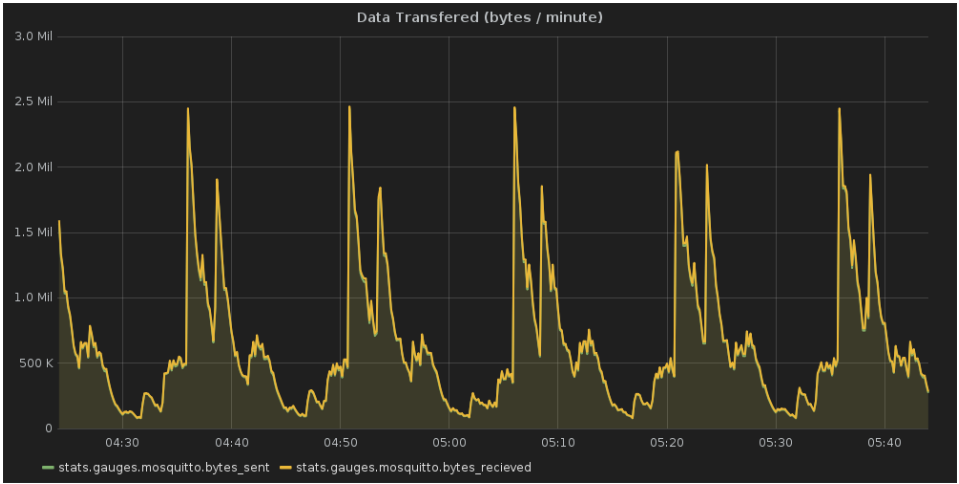
- MQTT broker implemented in C
- An Eclipse IoT project
- Support for MQTT v3.1 and v3.1.1

Services Using the Firehose

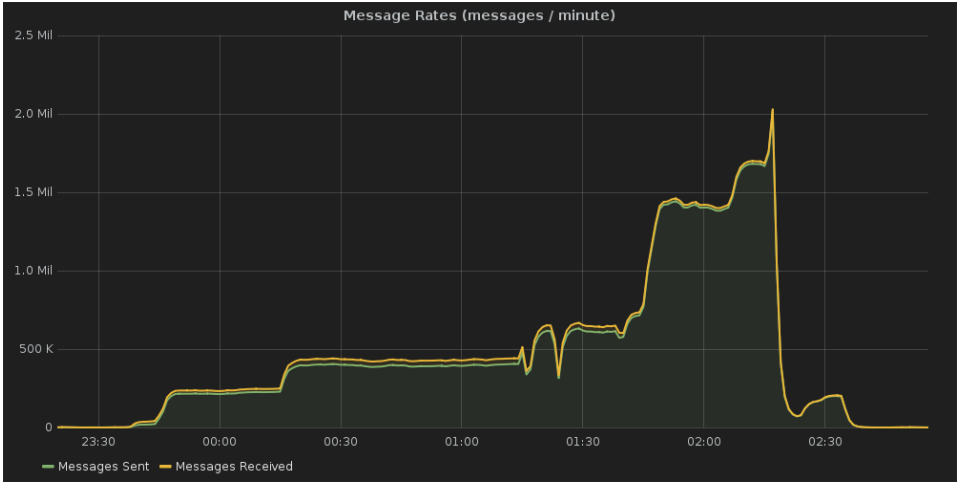
Service	Base Topic	Source of Messages
Ansible	ansible	Ansible MQTT Callback Plugin
Gerrit	gerrit	germqtt
Launchpad	launchpad	lpmqtt
Subunit Gearman Worker	gearman-subunit	subunit-gearman-worker
Logstash Workers	gearman-logstash	logstash-gearman-worker

Typical Firehose Load

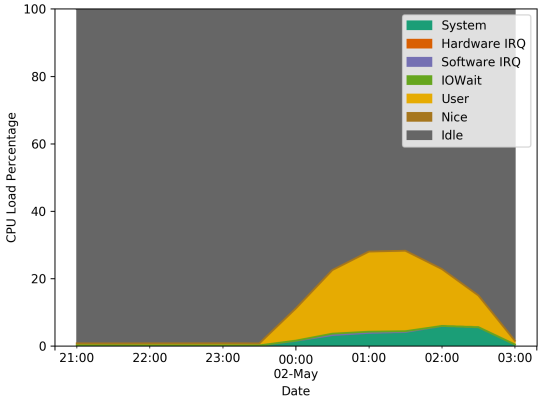



Data Transfered (bytes / minute)
3.0 Mil
2.5 Mil
2.0 Mil
1.5 Mil
1.0 Mil
500 K
0
04:30
04:40
04:50
05:00
05:10
05:20
05:30
05:40
stats.gauges.mosquitto.bytes_sent
stats.gauges.mosquitto.bytes_recieved

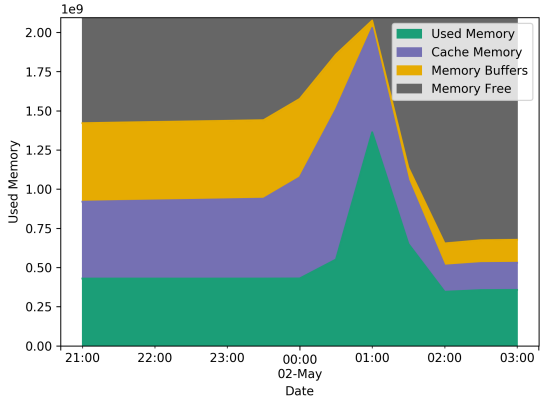
Manually Load Testing



CPU Usage:



Memory Usage:



Use cases for Firehose

- 3rd Party CI Operators
- Desktop Notifications:
  - mqttwarn: https://github.com/jpmens/mqttwarn
- Inter Service communication:
  - gerritbot: https://git.openstack.org/cgit/openstack-infra/gerritbot/
- Graphing metrics:
  - mqtt_statsd: https://git.openstack.org/cgit/openstack-infra/mqtt_statsd
  - grafana: http://grafana.openstack.org/dashboard/db/mosquitto-status

Where to get more information

MQTT:

- http://mqtt.org/
- http://docs.oasis-open.org/mqtt/mqtt/v3.1.1/os/mqtt-v3.1.1-os.html
- https://mosquitto.org/
- https://www.eclipse.org/paho/
- #mqtt on Freenode
- https://github.com/mtreinish/pymqttbench

Firehose:

- openstack-infra ML openstack-infra@lists.openstack.org
- #openstack-infra on Freenode
- http://docs.openstack.org/infra/system-config/firehose.html
- https://docs.openstack.org/infra/system-config/firehose_schema.html