

Webinar

How to Monitor and Observe IoT and MQTT Applications with HiveMQ

Hosted by  **HIVEMQ**





IoT Observability

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Speaker



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- David is Sales Engineer at HiveMQ and serves customers by identifying their needs and providing them with technical support.
- He has provided project and sales consulting services for many years in the areas of data and application integration, data management and messaging. Using this experience, he is helping HiveMQ customers to achieve best possible outcomes with their IoT solutions.
- His main focus is maintaining a high level of customer satisfaction at HiveMQ.

Agenda

- Differences of observability in classic IT and IoT
- Challenges that come with IoT
- Example production issue
- HiveMQ's capabilities that help customers reduce time to solution
- Live Demo



IT Vs. IoT Observability

IT Applications are:

- Distributed applications at large scale
- Network of well known actors
- Operate over reliable networks
- Mostly persistent access
- Mostly visibility into data flows
- Mostly single node applications

VS

IoT Applications are:

- Distributed applications at massive scale
- Network of black boxes
- Operate over unreliable networks
- No persistent access
- No visibility into data flows
- Crucial components are distributed



IoT Challenges: Identifying Errors in Noise



Many IoT applications are based on messaging

- Lost messages can create problems for an application
- Messages that are late to arrive can also create problems

IoT devices can lose messages

- Programming errors
- Networking error
- Hardware errors



IoT Challenges: Too much data



IoT applications can generate too much data for traditional analysis

- Network Monitoring tools such as Wireshark can be overwhelmed with the amount of IoT Data
- Analysis of live data has impact on performance
- Filters are needed to limit performance impact and reduce time to identify issues in clients or topics

IoT Challenges: System of Systems



IoT applications are made up of many systems

- Need to understand health of each service
- Services should generate metrics that can be used for a single application specific monitoring view
- Expose system related data e.g. memory, CPU, disk usage
- Expose MQTT related data e.g. connections, inbound publish rate, outbound publish rate



Production Issue in Car Sharing Service



- One day 8,000 cars in Frankfurt did not work
- Call center overwhelmed with support calls
- Overall system appears as a black box for the Call center
- They only see that the system is not working and is slow



Production Issue in Car Sharing Service



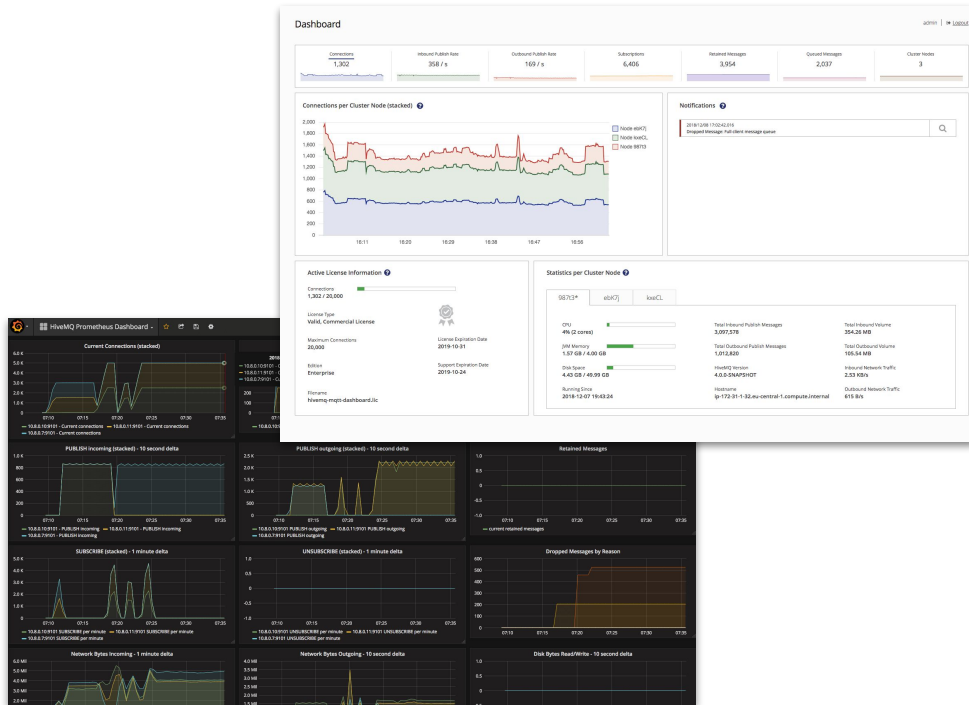
- HiveMQ, the MQTT broker, a central part of the system was able to provide visibility
- Used HiveMQ Control Center to discover the issue was with the cellular network provider not in the application layer



HiveMQ Observability Capabilities

System Monitoring

- HiveMQ Control Center allows for monitoring of system health of the HiveMQ broker
- JMX endpoint and extensions enable integration into any existing application performance monitoring tool



HiveMQ Observability Capabilities

Logging

- HiveMQ uses Logback and therefore supports multiple logging appenders
- Easy to integrate logging consolidation like Syslog
- Multiple log files
- Easy to create separate files for custom extensions

```
1 <configuration>
2 ...
3
4 <appender name="SYSLOG" class="ch.qos.logback.classic.net.SyslogAppender">
5
6     // IP-Address of your syslog server
7     <syslogHost>$IP-Address</syslogHost>
8
9     <facility>user</facility>
10    // replace X with the actual node
11    <suffixPattern>[nodeX] %-30(%d %level)- %msg%n%ex</suffixPattern>
12 </appender>
13
14 <root level="DEBUG">
15     <appender-ref ref="SYSLOG" />
16 </root>
17
18 ...
19
20 </configuration>
```



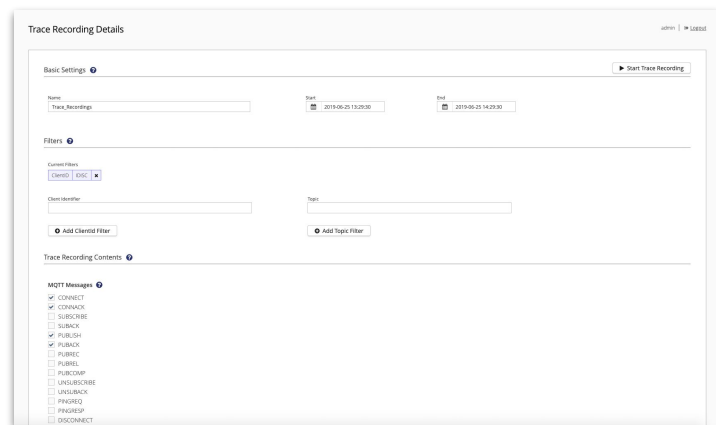
HiveMQ Observability Capabilities

Client & Topic Tracing

HiveMQ Trace Recording allows to:

- Specify time frame to record
- Specify range of devices to record
- Set filters for MQTT topics to trace
- Set MQTT Messages to trace

→ Enables fine grained diagnostics and debugging of irregular behaviour while dealing with millions of actors and events per second



HiveMQ Observability Capabilities

Device Health

- HiveMQ Control Center allows to query and list all present devices
- Drill down into each to show the health and connection information of a specific device
- Client Event history

Showing a snapshot of all available MQTT sessions. This snapshot was created 1s ago. Refresh Snapshot

Client ID	Clean Session	Connection Status	Username	IP Address
client-0-32K13Qchd8mhwjw68K	✓	✓	user0	10.2.1.49
client-1-6d8717m6w6m6g6g68	✓	✓	user1	10.2.1.49
client-10-4W5Z0E-u6C3p6k6v	✓	✓	user10	10.2.1.49
client-11-y6T7F0Z6p6w6R6E7	✓	✓	user11	10.2.1.49
client-12-w6M7B6u6c6u6r6m6	✓	✓	user12	10.2.1.49
client-13-0P6jAM6G6R6P6D6H4	✓	✓	user13	10.2.1.49
client-14-m6m6u6d6R6D6D6D6D6D6D6	✓	✓	user14	10.2.1.49
client-15-6m6p6D6G6m6c6D6P6m6	✓	✓	user15	10.2.1.49
client-16-16m6v6C6Z6m6Q6G6C6h6	✓	✓	user16	10.2.1.49
client-17-76R6T6N6S6A6Q6u6Q6	✓	✓	user17	10.2.1.49
client-18-6m6p6m6D6D6D6D6D6D6D6D6D6	✓	✓	user18	10.2.1.49
client-19-6m6D6G6S6R66p6k6G6g6c6	✓	✓	user19	10.2.1.49
client-2-8P6R6W6E6j6g6C6H626	✓	✓	user2	10.2.1.49
client-20-6m6C6D6D6D6D6D6D6D6D6D6D6D6	✓	✓	user20	10.2.1.49
client-21-76C6u6m6p6g6p6h6m6D6x6	✓	✓	user21	10.2.1.49
client-22-2L6J6S6U6-6A6T6R636u6	✓	✓	user22	10.2.1.49
client-23-6m6C6D6D6D6D6D6D6D6D6D6D6D6	✓	✓	user23	10.2.1.49
client-24-6Q6J6S6A6D66p6m6Y6	✓	✓	user24	10.2.1.49
client-25-2L6J6S6U6-6A6T6R636u6	✓	✓	user25	10.2.1.49
client-26-2P6S6Q66p6k6G6g6c6	✓	✓	user26	10.2.1.49
client-27-27m6E6D6C6W66h6q6T6S6D6	✓	✓	user27	10.2.1.49
client-28-20m6v6C6Z6m6Q6G6C6h6	✓	✓	user28	10.2.1.49

Client Detail

admin | Logout

publisher
connected, clean session = true Disconnect Client Refresh Page

Session Information

Session	Connection	TLS	Restrictions
Client ID publisher	Client ID 10.2.1.49	TLS Version TLSv1.2	Maximum Bytes per Second Inbound Unlimited
Clean Session True	Username username	Digital Suite TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 (show more)	Maximum Bytes per Second Outbound Unlimited
Connected Since 2018-05-08 11:21:30	Password ***** (show password)	X.509 client certificate Present (show certificate)	Maximum Message Size 256.00 MB
Offline Session TTL 0 Seconds	MQTT Version MQTT3.1.1	Last Will	Maximum Message Queue Size 1,000 Messages
Offline Message Queue Size 0 Messages	Keep-Alive 600 Seconds	Will Topic my/personal/last/will/... (show more)	Drop Strategy for Queued Messages Discard
	Listeners TCP listener with TLS at 0.0.0.0:1884	Will QoS 2 - Exactly Once	Maximum Inflight Queue Size 1,000 Messages
	Connected Node 90CA1	Will Retained True	Proxy Protocol No Proxy Information Available

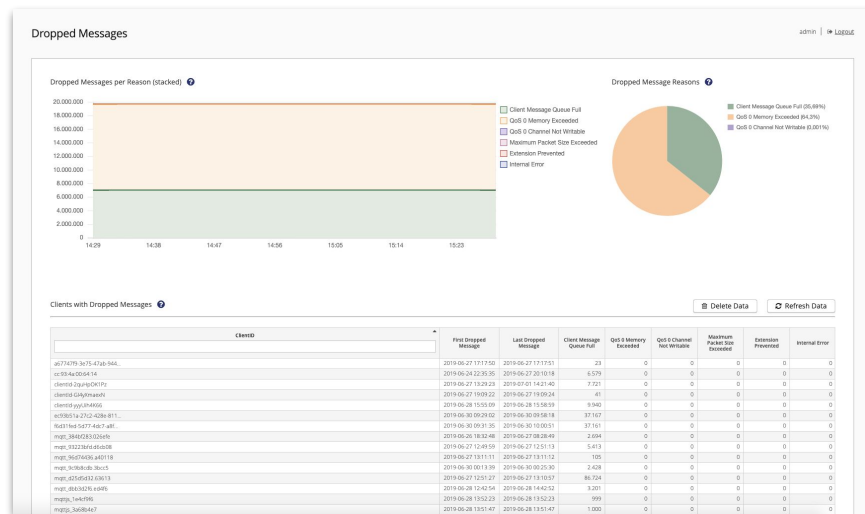


HiveMQ Observability Capabilities

Dropped Message

HiveMQ Control Center offers analytics functionality of messages not published by a broker, called dropped messages. It can provide information about:

- Reason of dropped message
- Affected clients or shared subscriptions
- Relevant timestamps

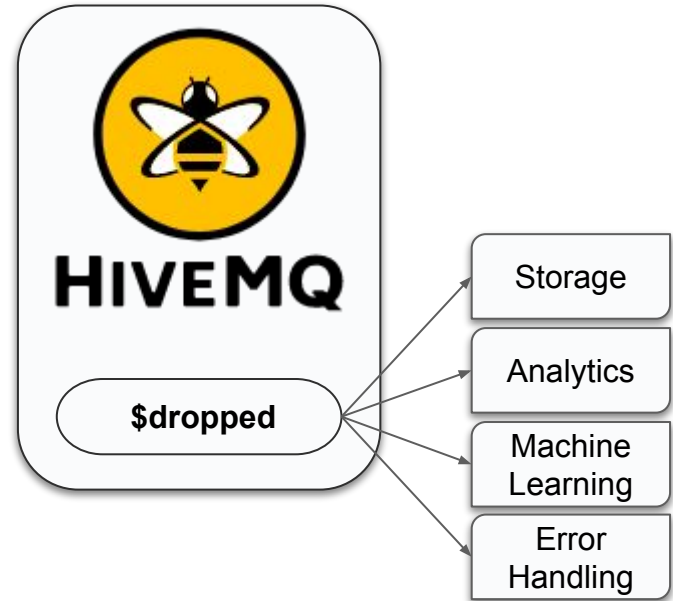


HiveMQ MQTT-Addons

\$dropped Topic

Captures all dropped messages on the system

- Client's message queue full
- QoS 0 message not delivered due to inability to write to client socket or memory being exceeded
- Message size bigger than max size of the receiving client
- Dropped messages due to internal errors or prevented by a Publish Inbound Interceptor

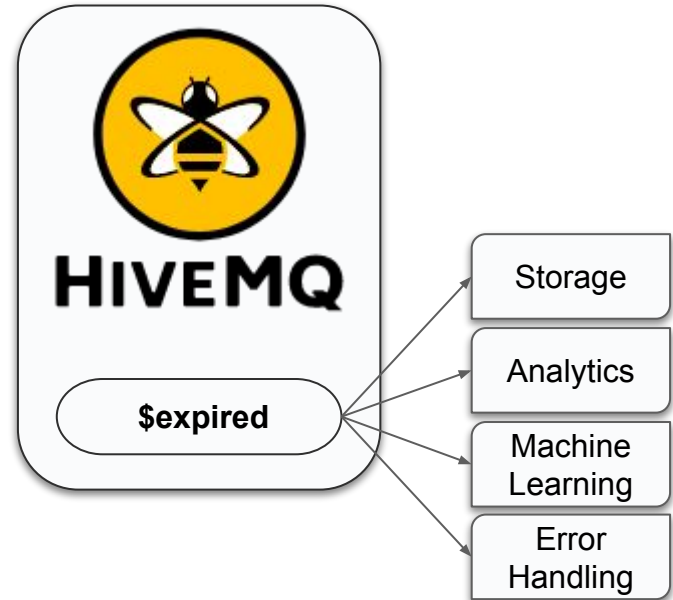


HiveMQ MQTT-Addons

\$expired Topic

Captures all expired messages on the HiveMQ system

- A client takes too long to consume the message
- A message expires before an offline client can consume it
- A retained message that is stored on the broker expires

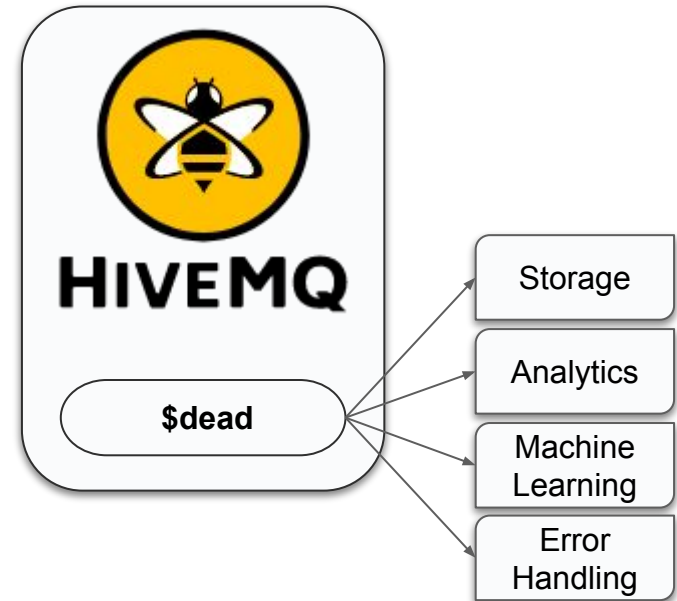


HiveMQ MQTT-Addons

\$dead Topic

Captures all dead messages on the HiveMQ system

- A published message without subscribers is considered a dead message



Live Demo



Resources

Try HiveMQ!

<https://www.hivemq.com/downloads/>

Visit HiveMQ Control Center

<https://www.hivemq.com/docs/hivemq/4.6/control-center/introduction.html>

Try HiveMQ Cloud!

<https://www.hivemq.com/cloud/>



Poll and Q&A



THANK YOU

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