



# Testing the Scalability of a Robust IoT System with Confidence

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# Speakers

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# AGENDA

- ❑ **Why IoT Testing is Important**
- ❑ **Challenges for IoT Testing**
- ❑ **Introducing HiveMQ Swarm**
- ❑ **Use Cases**
- ❑ **Distributed IoT Testing and Simulation**
- ❑ **Swarm Lifecycle**
- ❑ **Demo**
- ❑ **Q&A**



# Why IoT Testing is Important

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# Why IoT Testing is Important



Fixing IoT Production Errors are Costly to Fix in the Field



# Why IoT Testing is Important



Load & Stress Testing of Complete End-to-end IoT System is Required to Determine System Resilience



# Why IoT Testing is Important?



Capacity planning required to:

- Budget network and infrastructure costs
- Budget financial costing for cloud hosting



# Challenges for IoT Testing



IoT systems are massive distributed systems that can be difficult to test



Test environment is often different from production behaviour



Individual IoT devices can have multiple complex behaviour patterns



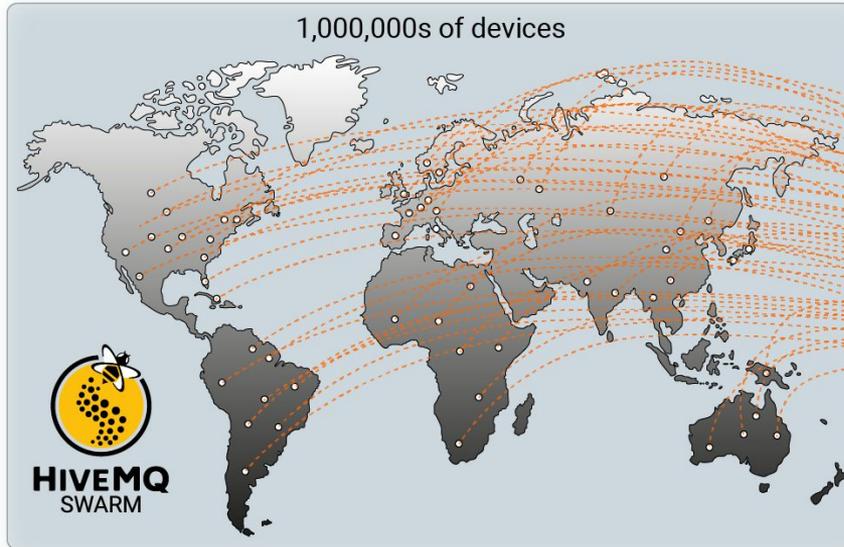
IoT production data can have a high degree of variability



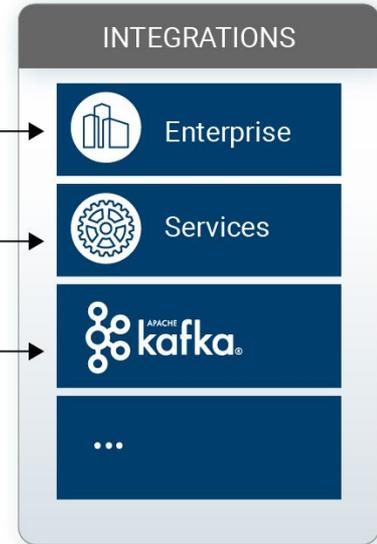
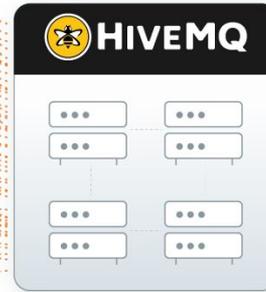
Testing at massive scale



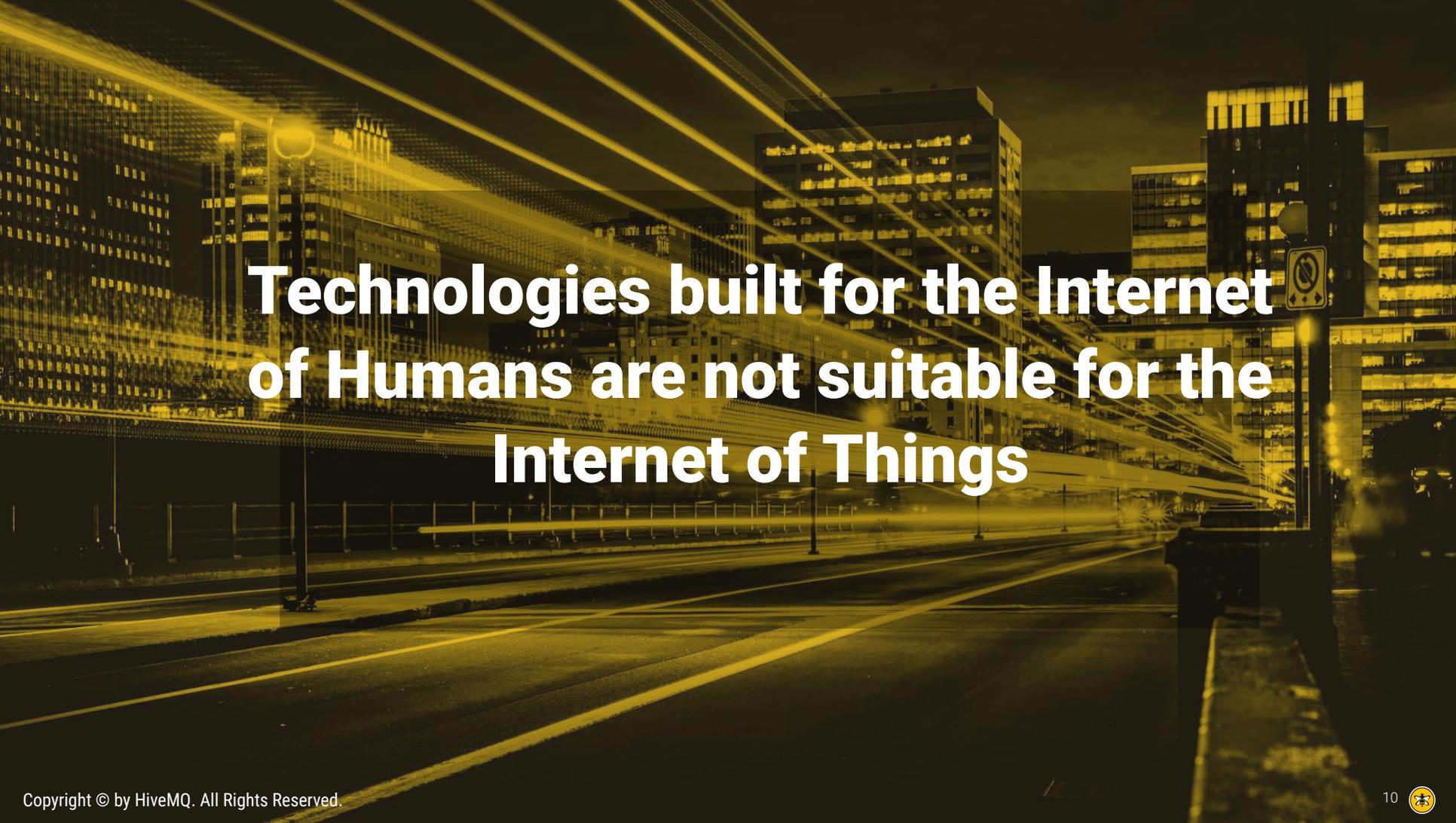
# Challenges for IoT Testing



- ➔ Massive distribution
- ➔ Very hard to set up in testing / staging



- ➔ Single Systems (10s-100s)
- ➔ Easy to setup in testing /staging



**Technologies built for the Internet  
of Humans are not suitable for the  
Internet of Things**



# Introducing HiveMQ Swarm

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- Distributed platform able to create millions of unique network connections
- Simulating millions of devices, messages and MQTT topics
- Develop reusable scenarios that simulate device behaviours
- Custom data generator that simulate complex use cases
- Resource friendly and easy deployment to public clouds (AWS, Azure, etc.) and Kubernetes

# Use Cases



**Load and stress testing**



**IoT Scenario Testing**



**Capacity planning**



**Device rollout simulations**



**Quality assurance testing**

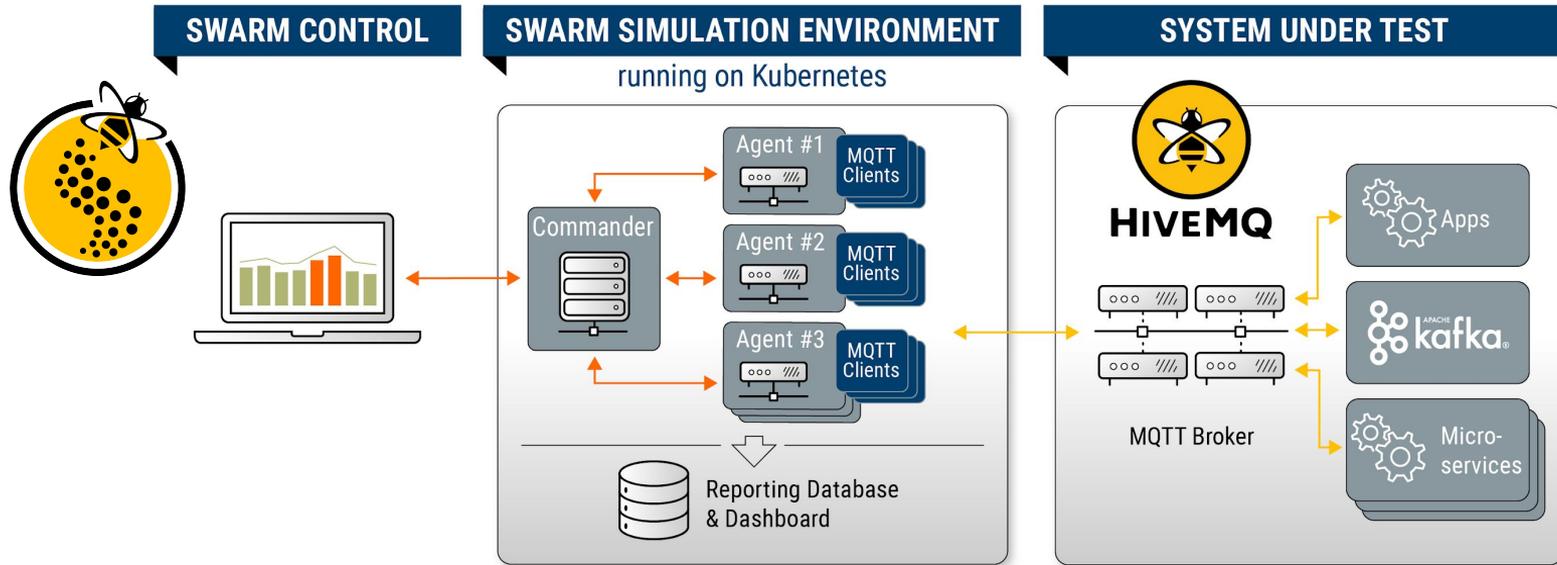


**Troubleshooting**



**Test HiveMQ custom extensions**

# Distributed IoT Testing and Simulation

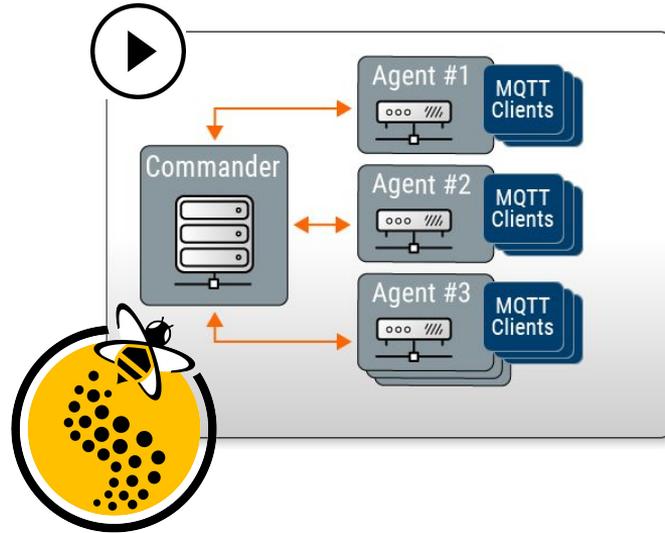


# Swarm Lifecycle

## 1. CREATE SCENARIO

```
<xml>  
<brokers>  
<address></address>  
...  
...  
</xml>
```

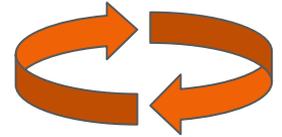
## 2. EXECUTE IN SIMULATION ENVIRONMENT



## 3. REPORT



## REPEAT



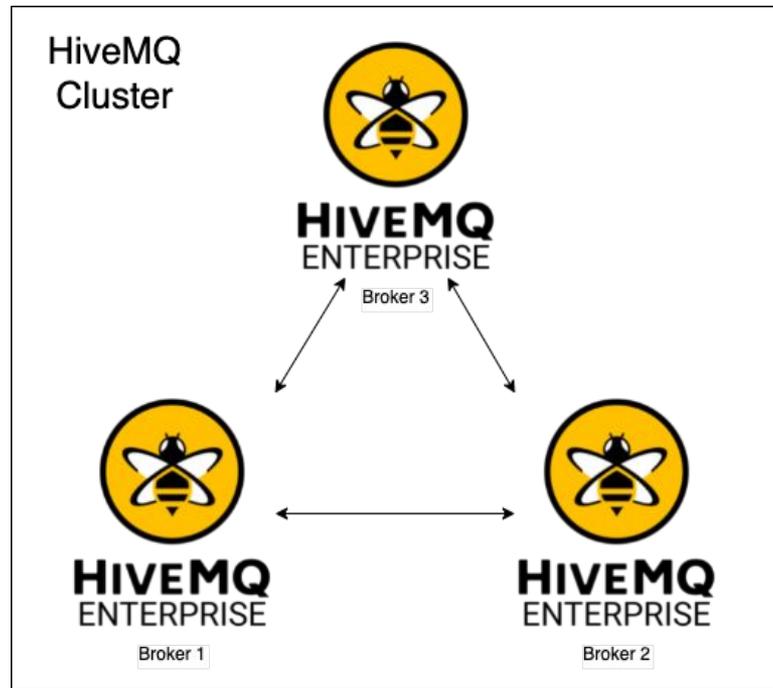
# Demo

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# HiveMQ Setup

- 3 HiveMQ Nodes
- Running on Kubernetes



# The Load



- 20k **Current Connections**
- 10k/min incoming **CONNECT**
- 10k/min incoming **PUBLISH**
- 10k/min outgoing **PUBLISH**



# Scaling?



Is the Setup able to handle 2x / 4x the amount of connections, and messages without adding additional HiveMQ Nodes?

## 1x

- 20k **Current Connections**
- 10k/min incoming **CONNECT**
- 10k/min incoming **PUBLISH**
- 10k/min outgoing **PUBLISH**

## 2x

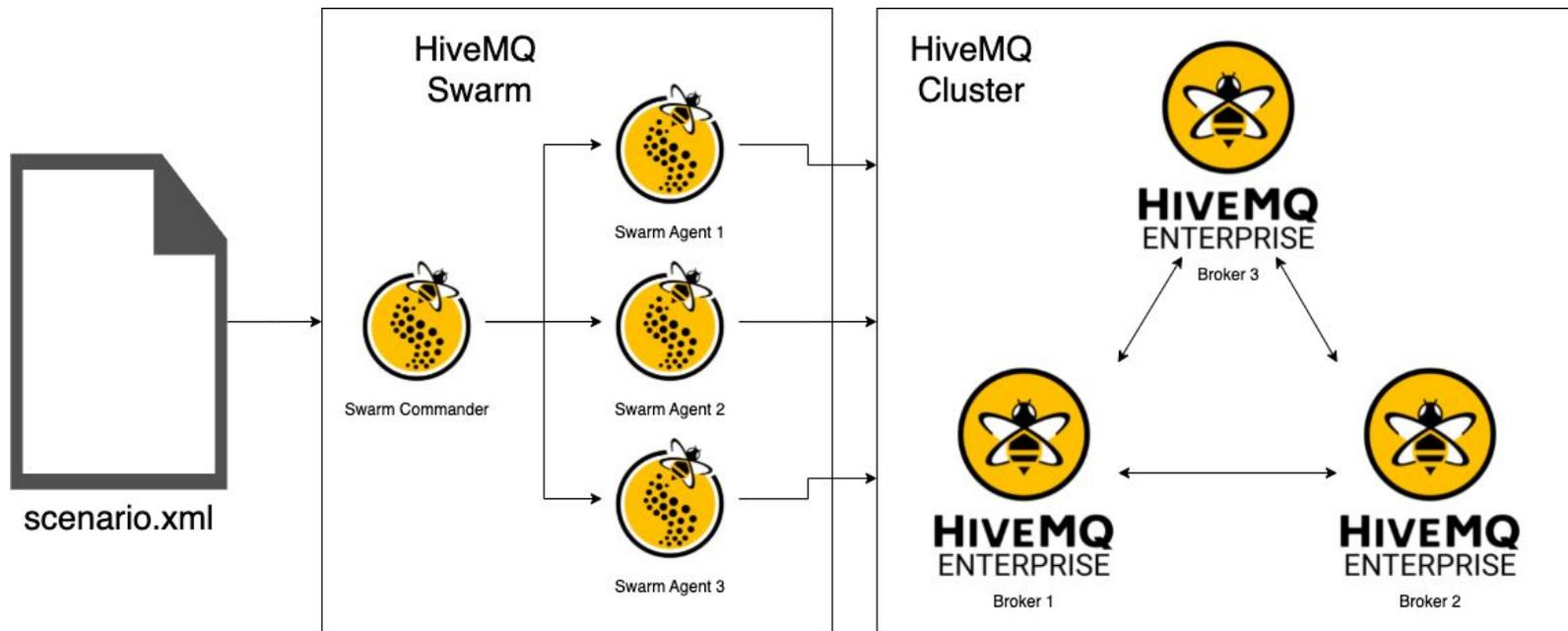
- 40k **Current Connections**
- 20k/min incoming **CONNECT**
- 20k/min incoming **PUBLISH**
- 20k/min outgoing **PUBLISH**

## 4x

- 80k **Current Connections**
- 40k/min incoming **CONNECT**
- 40k/min incoming **PUBLISH**
- 40k/min outgoing **PUBLISH**



# HiveMQ Swarm Setup



# HiveMQ Swarm Clients

- 20k **Current Connections**
- 10k/min incoming **CONNECT**
- 10k/min incoming **PUBLISH**
- 10k/min outgoing **PUBLISH**

## 10k **Connectors**

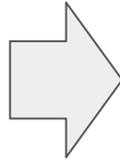
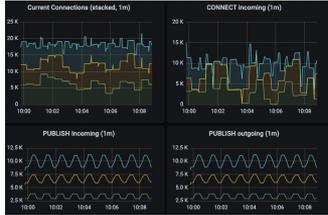
- Connect / Disconnect every minute

## 10k **Publishers**

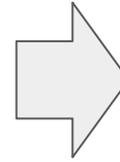
- Connect
- Publish 1 Message every minute
- Disconnect

# Conclusion

- Analyzed monitoring to create a HiveMQ Swarm Scenario



- 20k **Current Connections**
- 10k/min incoming **CONNECT**
- 10k/min incoming **PUBLISH**
- 10k/min outgoing **PUBLISH**



scenario.xml

- Scaled up and executed the HiveMQ Swarm scenario to verify that the deployment is able to operate under higher load

# ANY QUESTIONS?

Reach out to [community.hivemq.com](https://community.hivemq.com)



# Resources



[Evaluate HiveMQ Broker, with Swarm Built-in](#)



[Get Started with MQTT](#)



# THANK YOU

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