



BERLIN EXPERT DAYS

{join the talk}

2014

M2M for Java Developers

MQTT with Eclipse Paho

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passionate
Architect and
Maker

Member of the OASIS
MQTT TC

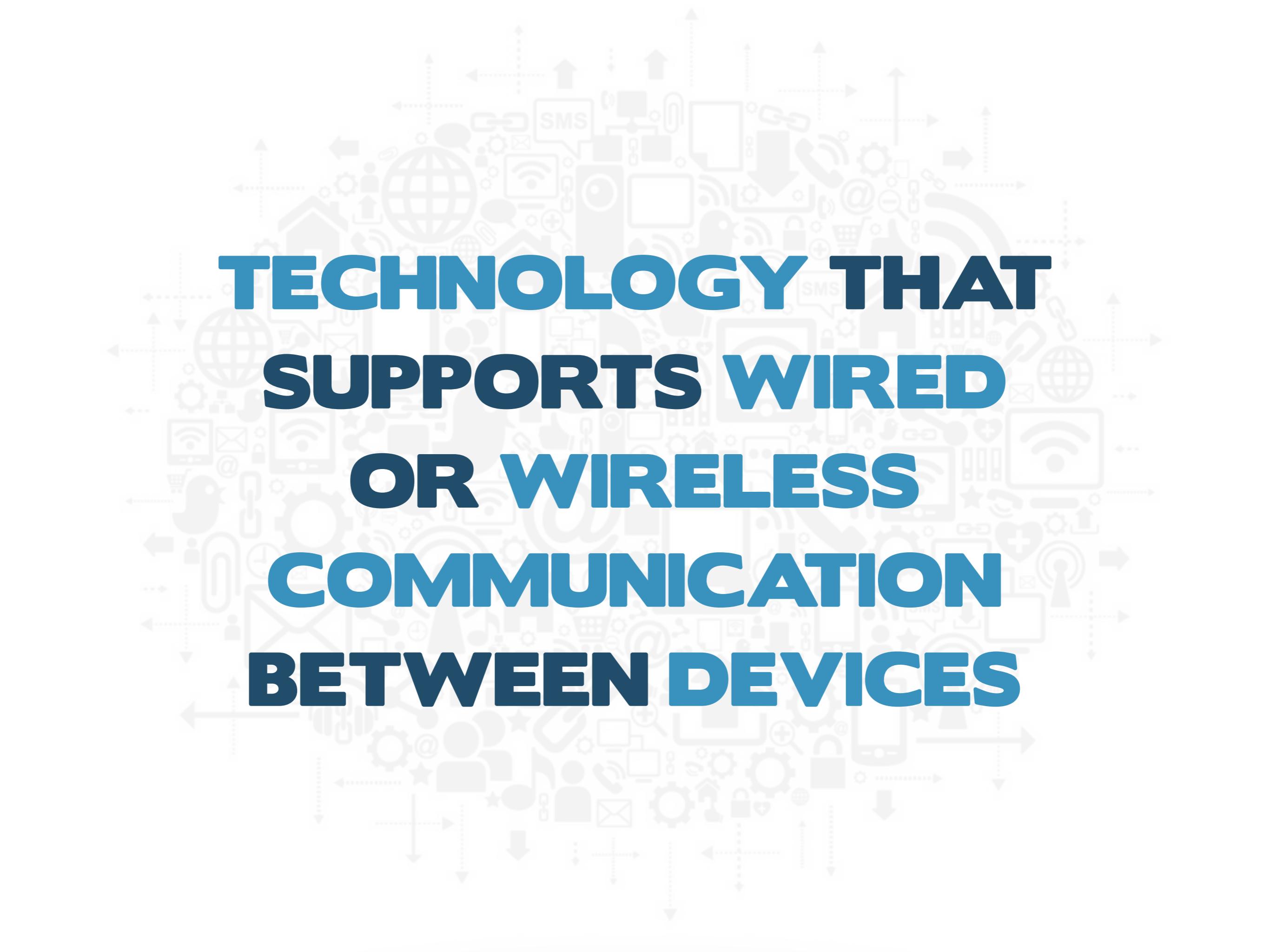
Regular speaker and
author

HiveMQ Architect



M2M?





**TECHNOLOGY THAT
SUPPORTS WIRED
OR WIRELESS
COMMUNICATION
BETWEEN DEVICES**

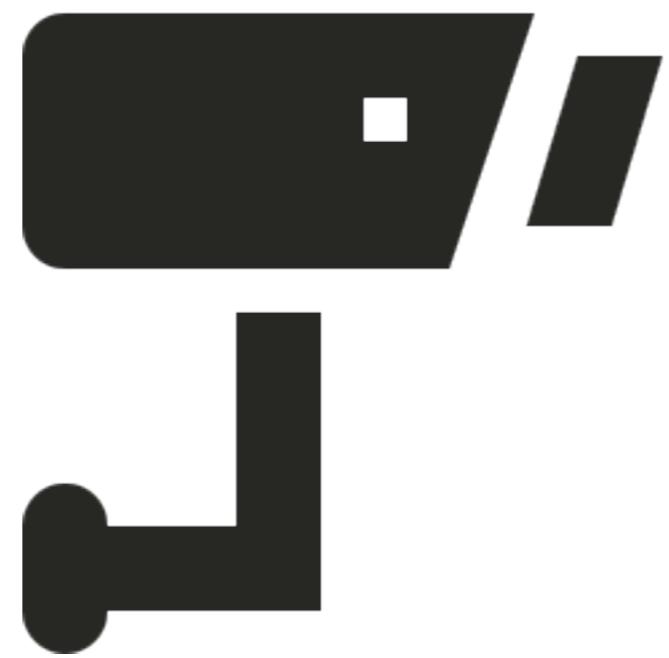
IoT?

Things?



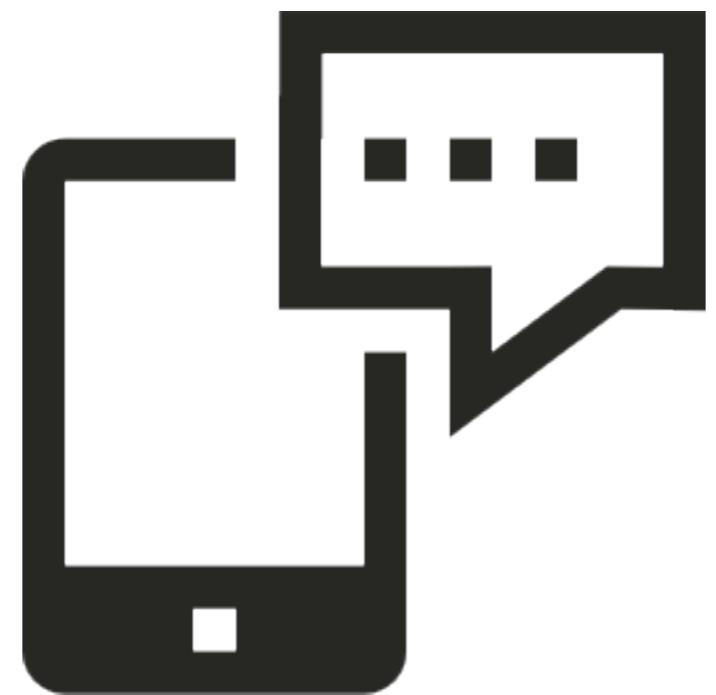
















Why
should
we
care?

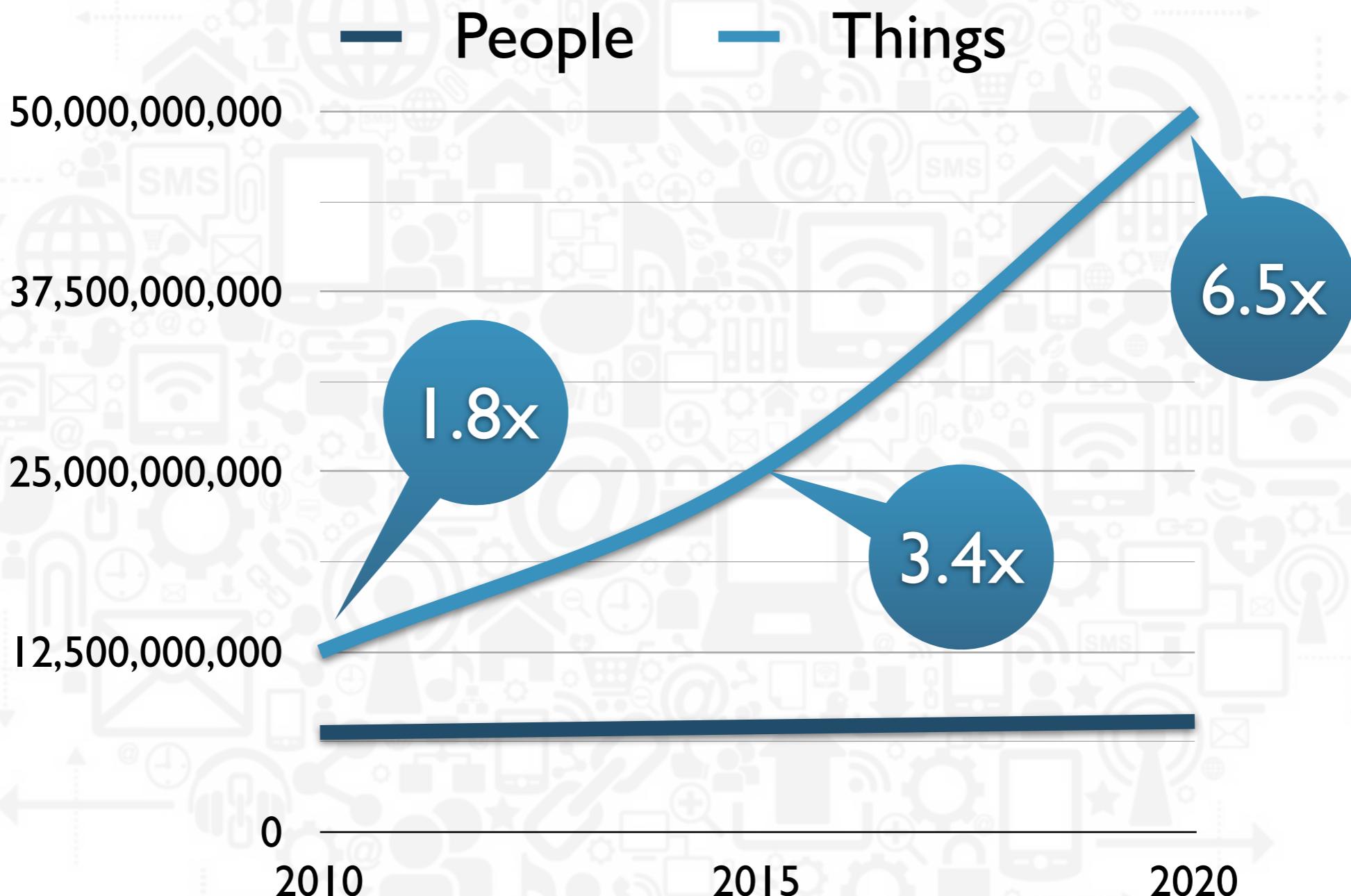
“Things” in the Internet

	2010	2015	2020
[1] 	~6.909.000.000	~7.302.000.000	~7.675.000.000
[2] 	~12.500.000.000	~25.000.000.000	~50.000.000.000

[1]Source: http://www.un.org/esa/population/publications/wpp2008/wpp2008_highlights.pdf

[2]Source: <http://share.cisco.com/internet-of-things.html>

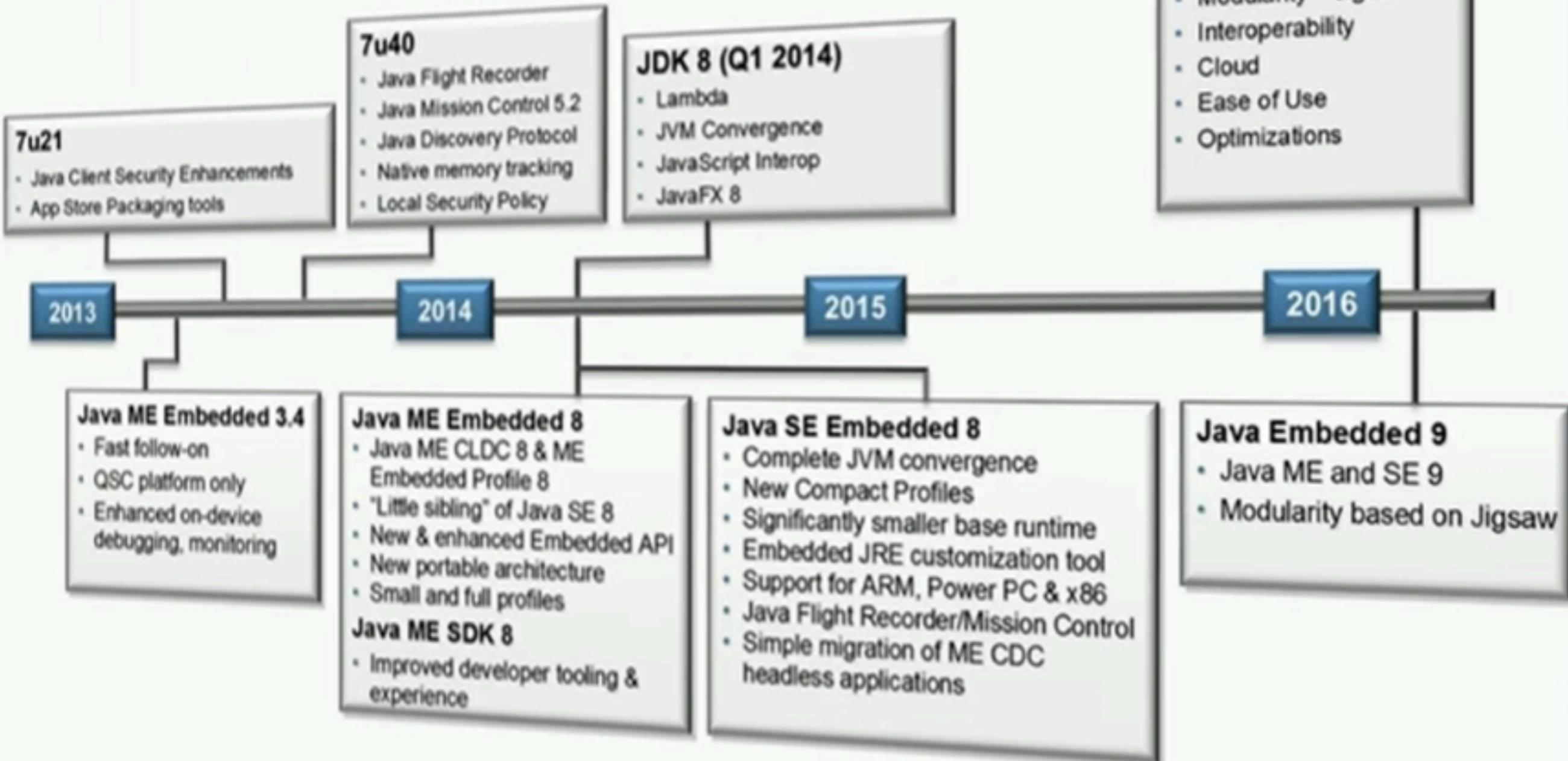
“Things” in the Internet





Another revolution?

Java Roadmap



Protocols?



Requirements for a IoT protocol

- ✓ **efficient in bandwidth**
- ✓ **scalable**
- ✓ **standardized**
- ✓ **open**
- ✓ **data agnostic**
- ✓ **must be suited for constrained devices AND server infrastructure**

HTTP?

- ✗ Request / Response
- ✗ Verbose
- ✗ Polling instead of Push
- ✗ No quality of service
- ✗ How to get notified if clients die?
- ✗ Stateless



MQTT

Why MQTT?

- ✓ **Simple**
- ✓ **Efficient**
- ✓ **Publish / Subscribe**
- ✓ **Quality of Service Levels**
- ✓ **Last Will and Testament**
- ✓ **Designed for unreliable networks**
 - Wireless? Yep, then it probably is unreliable

MQTT vs HTTPS

- ✓ **93x faster (throughput)**
- ✓ **11x less battery when publishing**
- ✓ **170x less battery when receiving messages**
- ✓ **8x less network overhead**

Oil pipeline



Sprint Velocity



#SprintVelocity

Logistics



Facebook Messenger



<https://www.facebook.com/notes/facebook-engineering/building-facebook-messenger/10150259350998920>

Sports



Google Trends



History

MQTT invented
by IBM and
Arcom (Eurotech)

royalty free

OASIS TC
formed

MQTT is
OASIS
standard

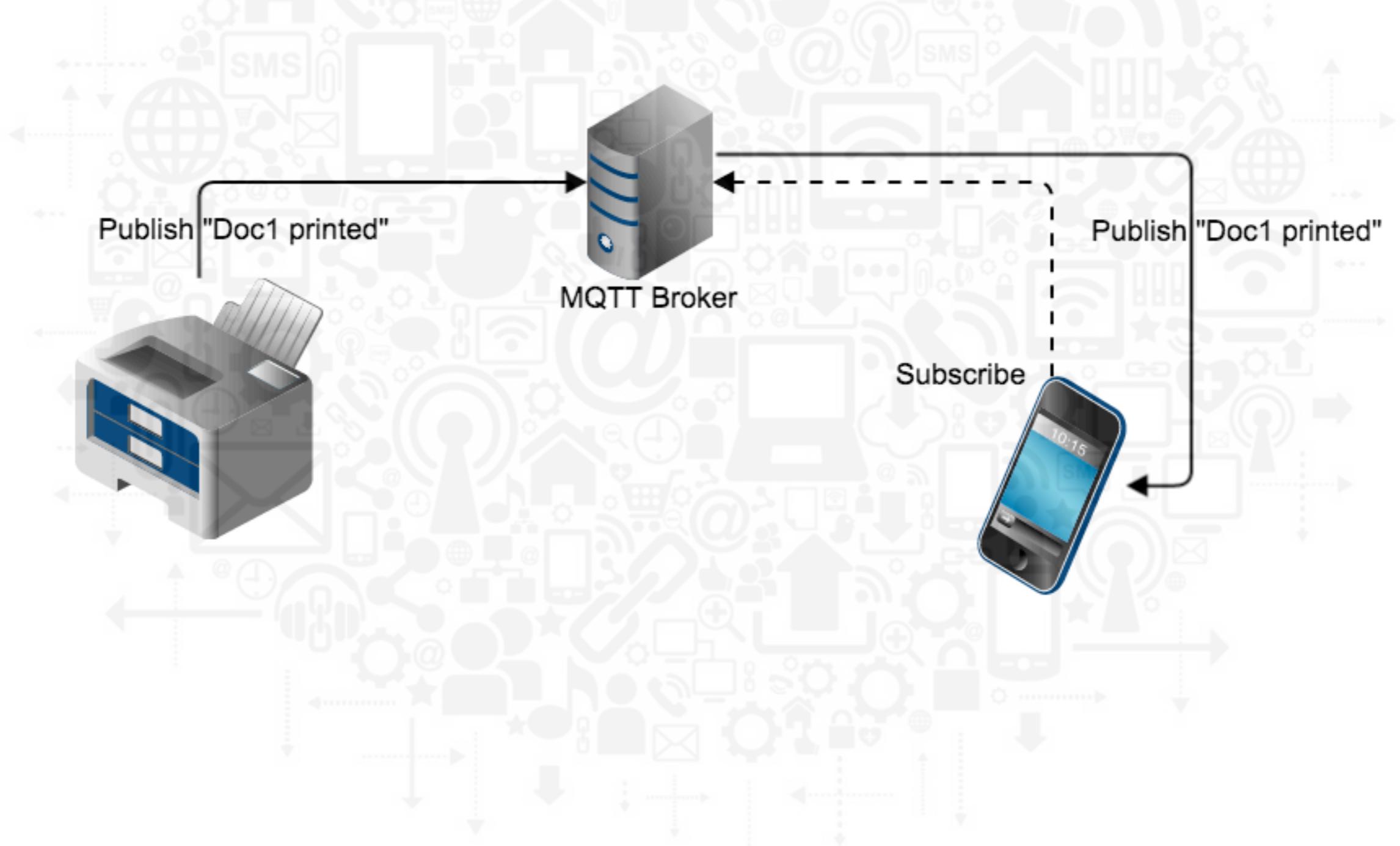
1999

2010

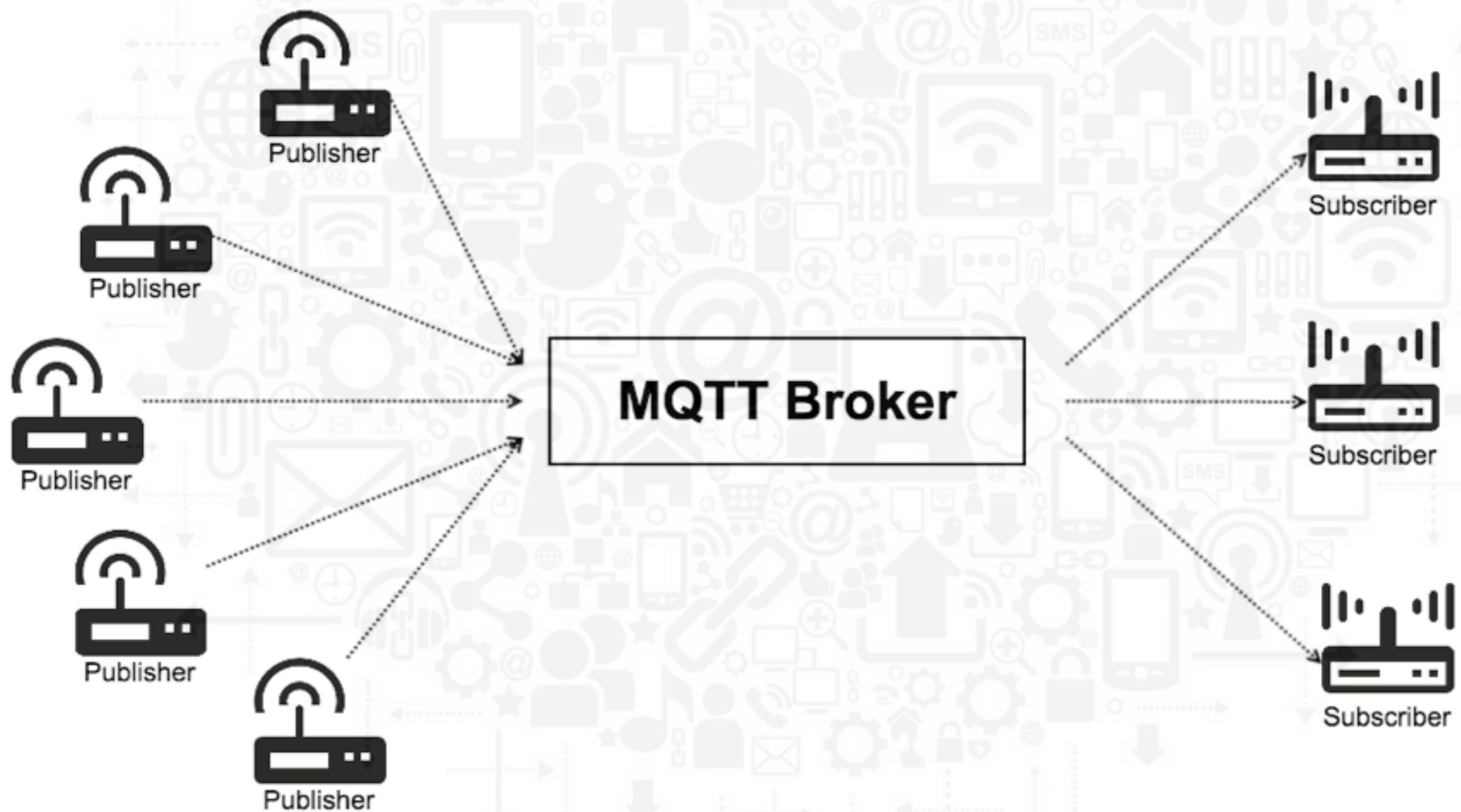
2013

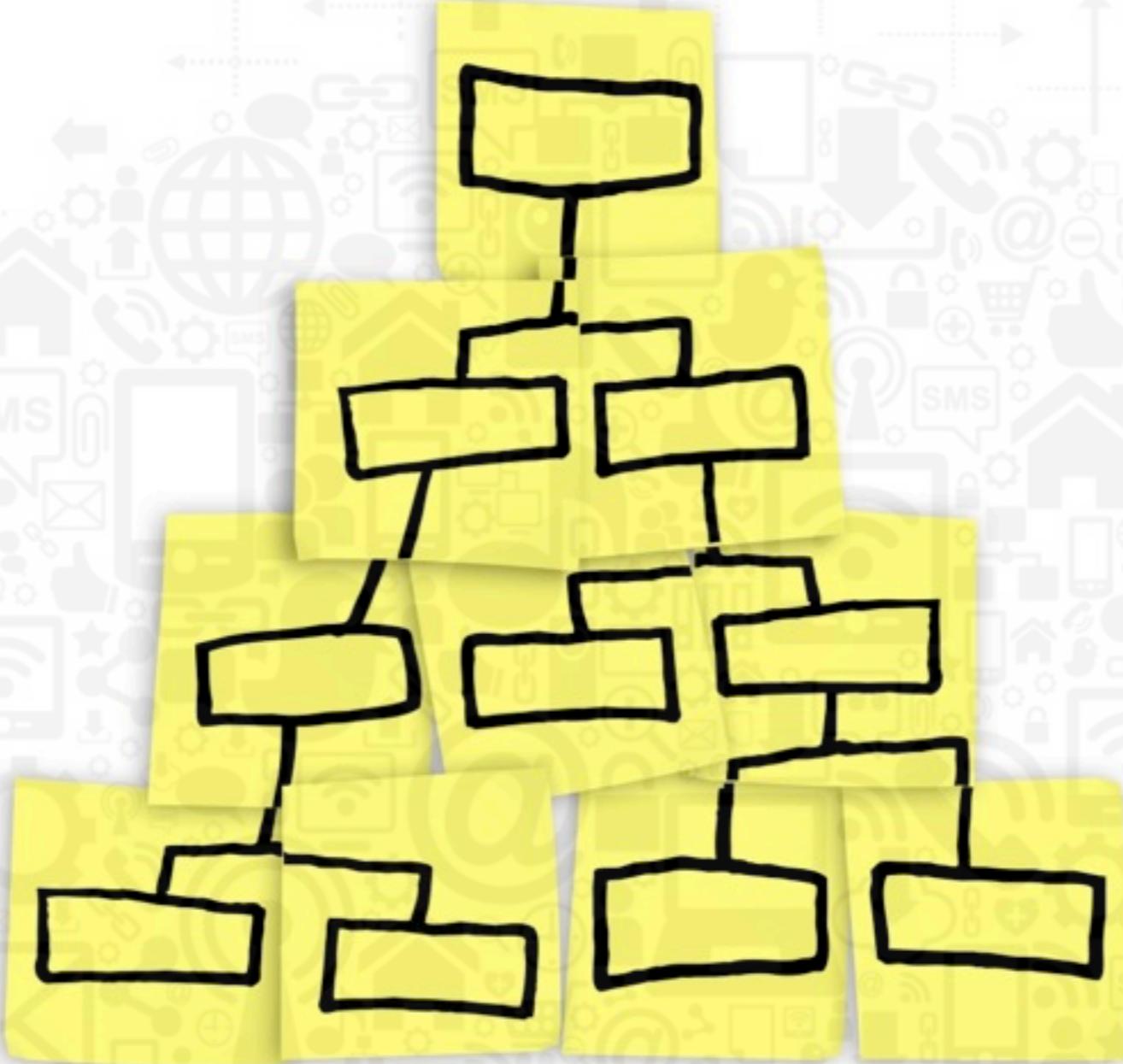
2014

Publish / Subscribe



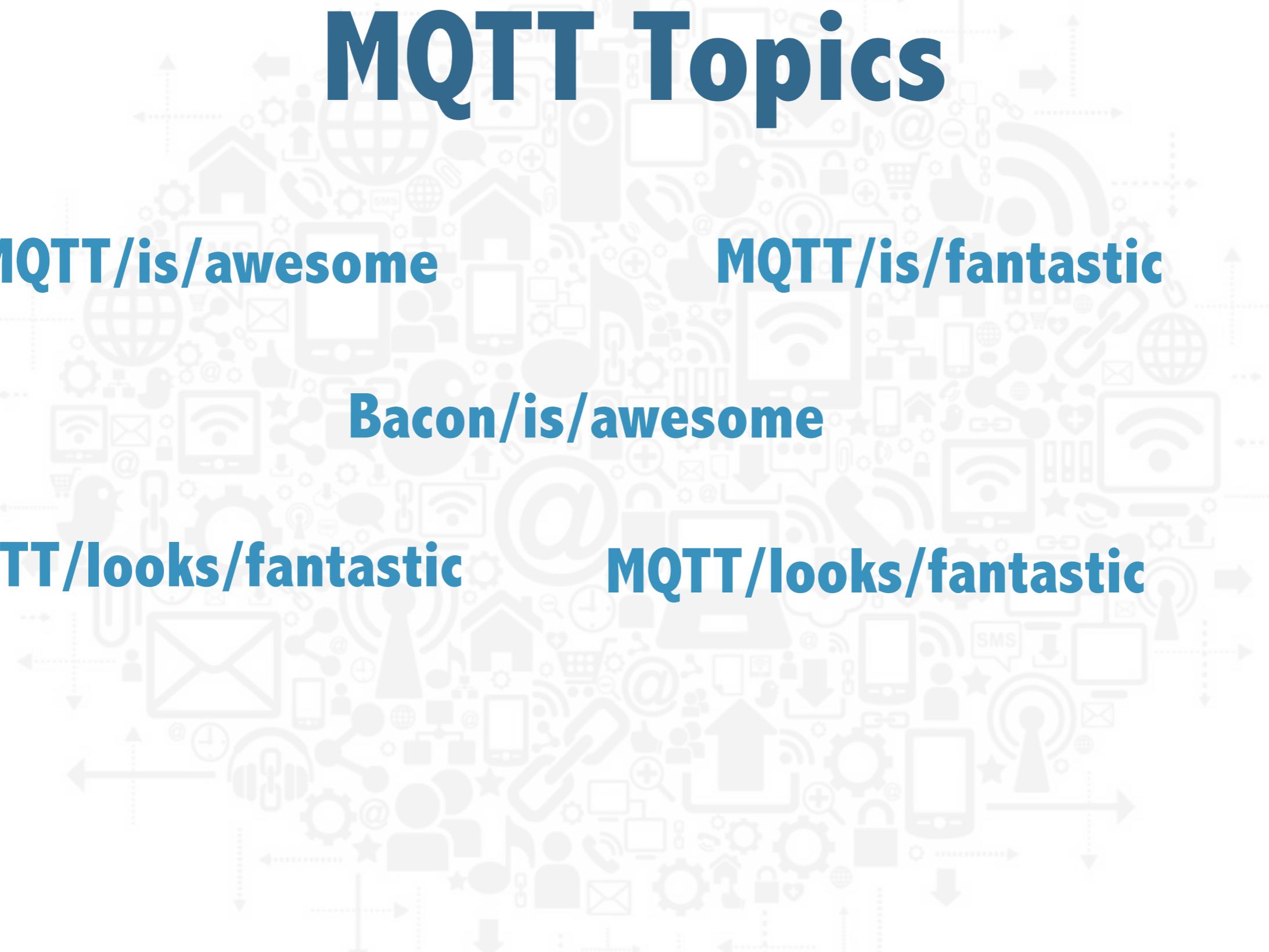
Publish / Subscribe





MQTT Topics

MQTT Topics



MQTT/is/awesome

MQTT/is/fantastic

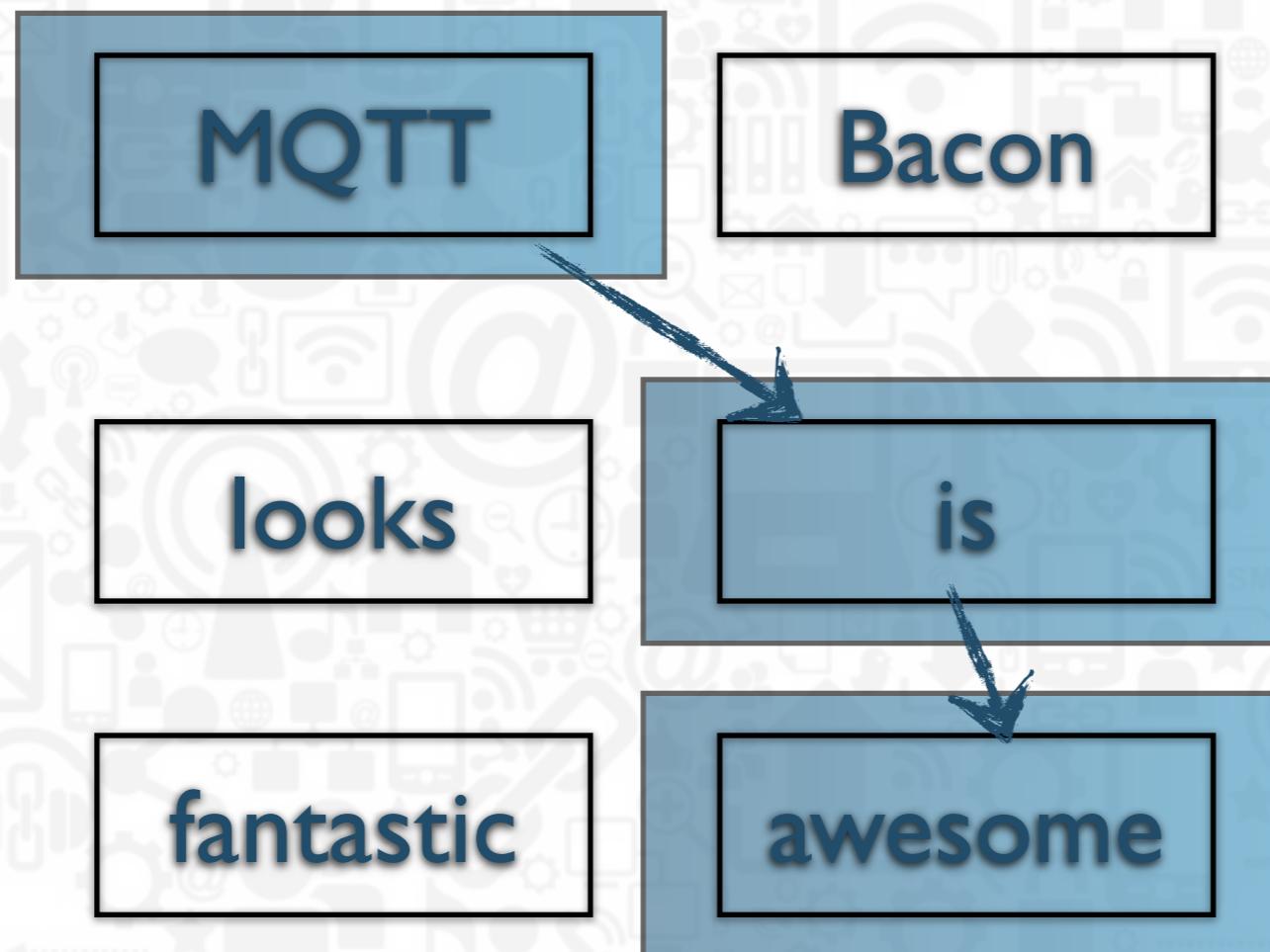
Bacon/is/awesome

MQTT/looks/fantastic

MQTT/looks/fantastic

MQTT Topics

MQTT/is/awesome



MQTT Topics

Bacon/is/awesome

MQTT

Bacon

looks

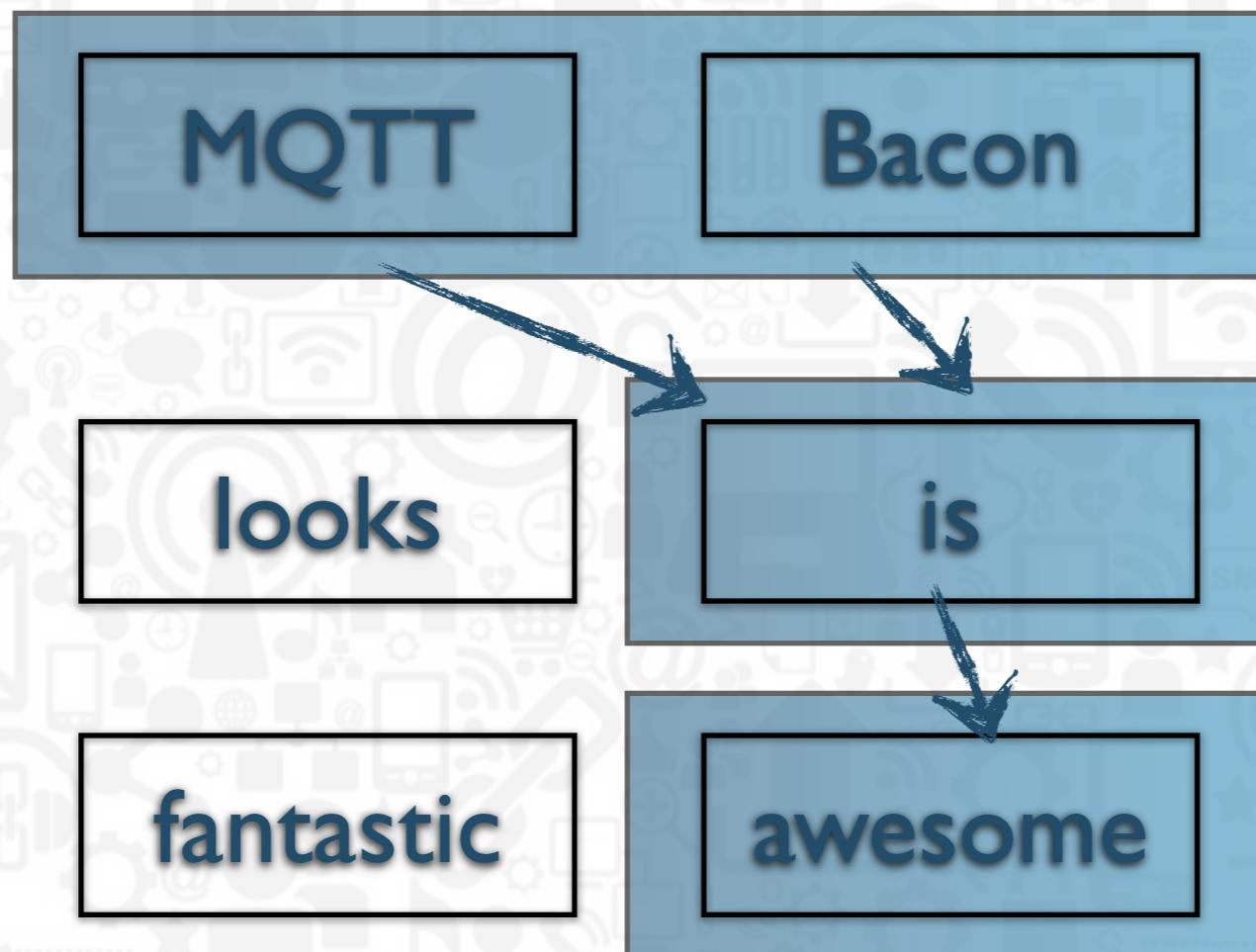
fantastic

is

awesome

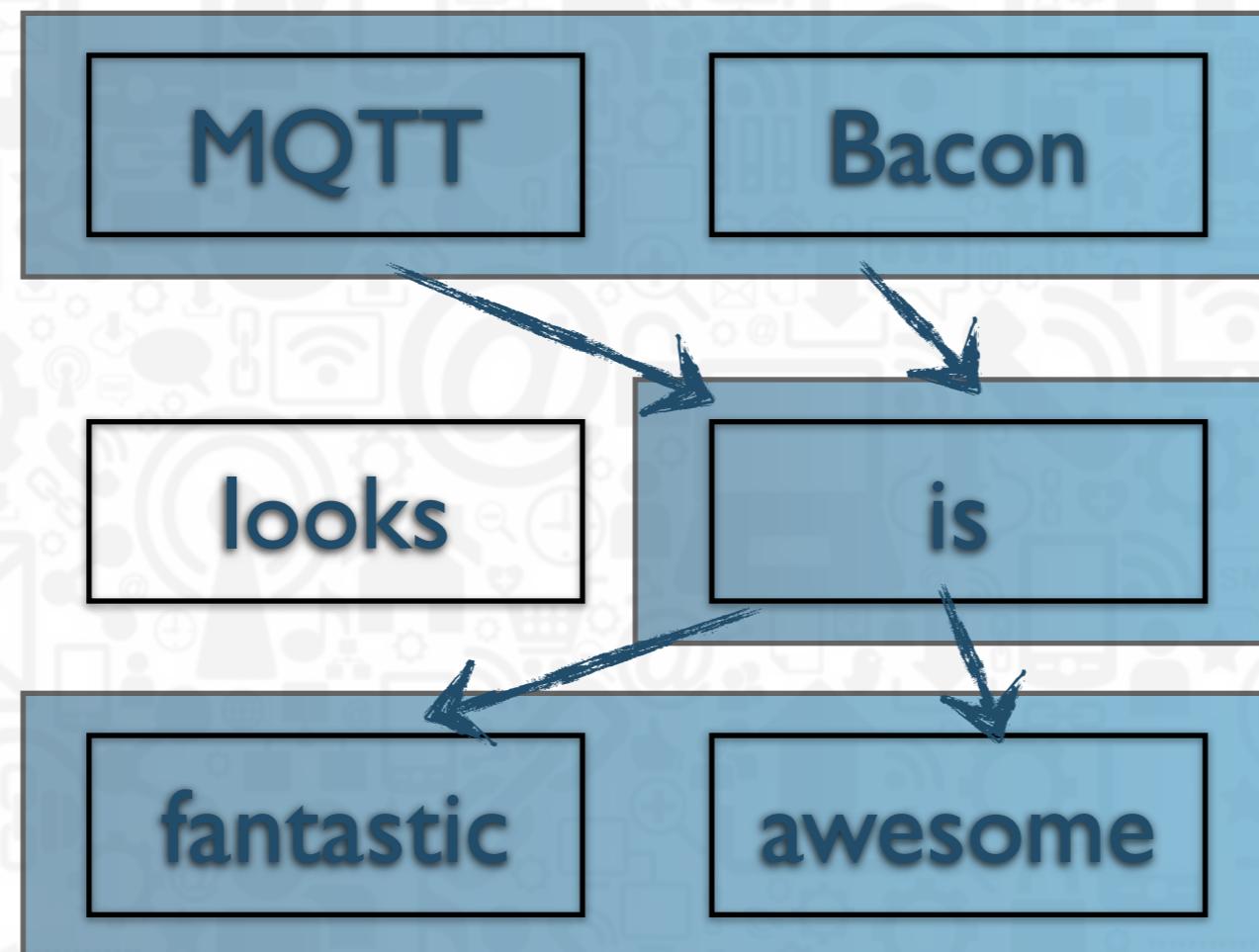
MQTT Topic Level Wildcard

+/is/awesome



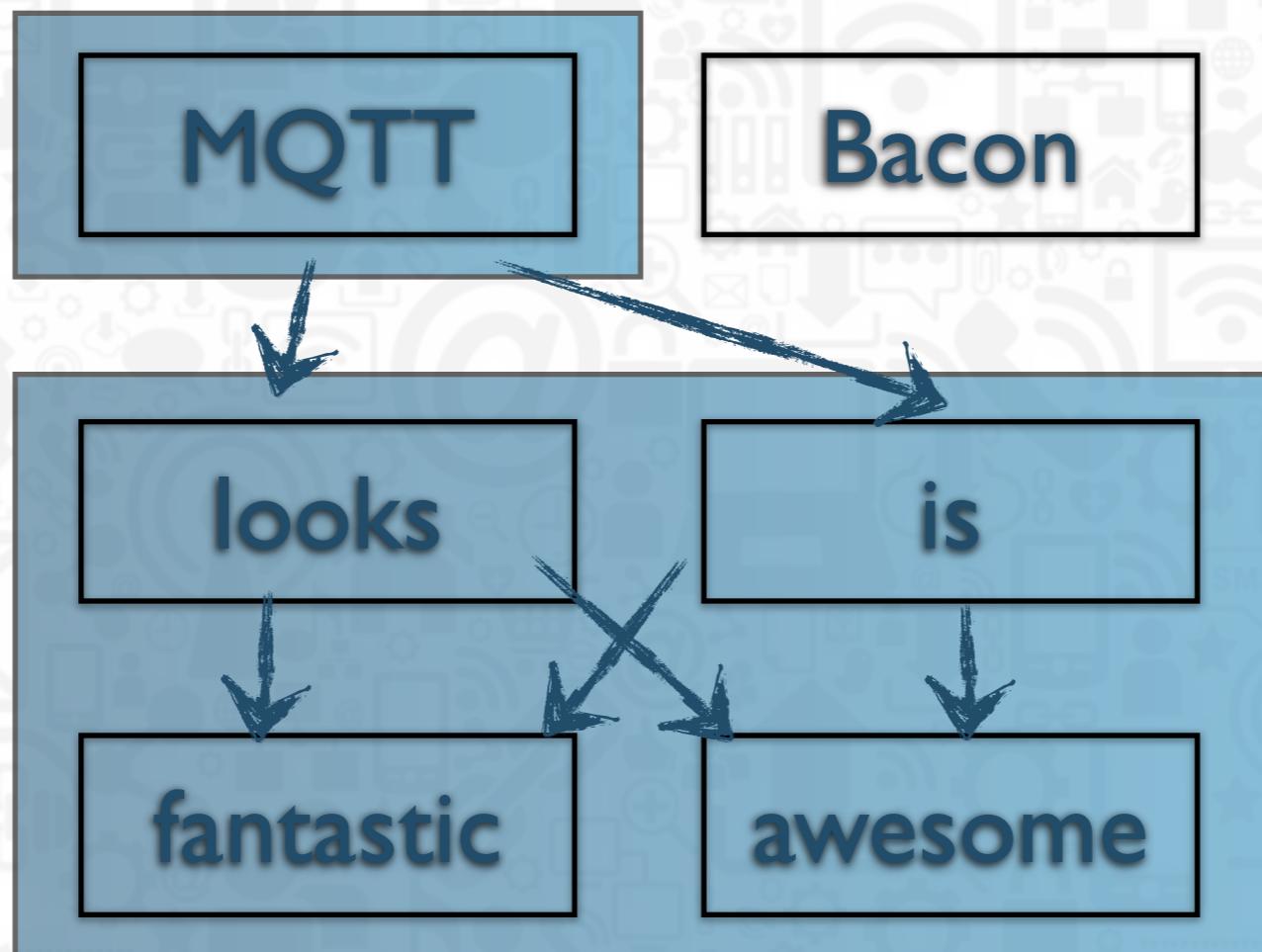
MQTT Topic Level Wildcard

+/is/+



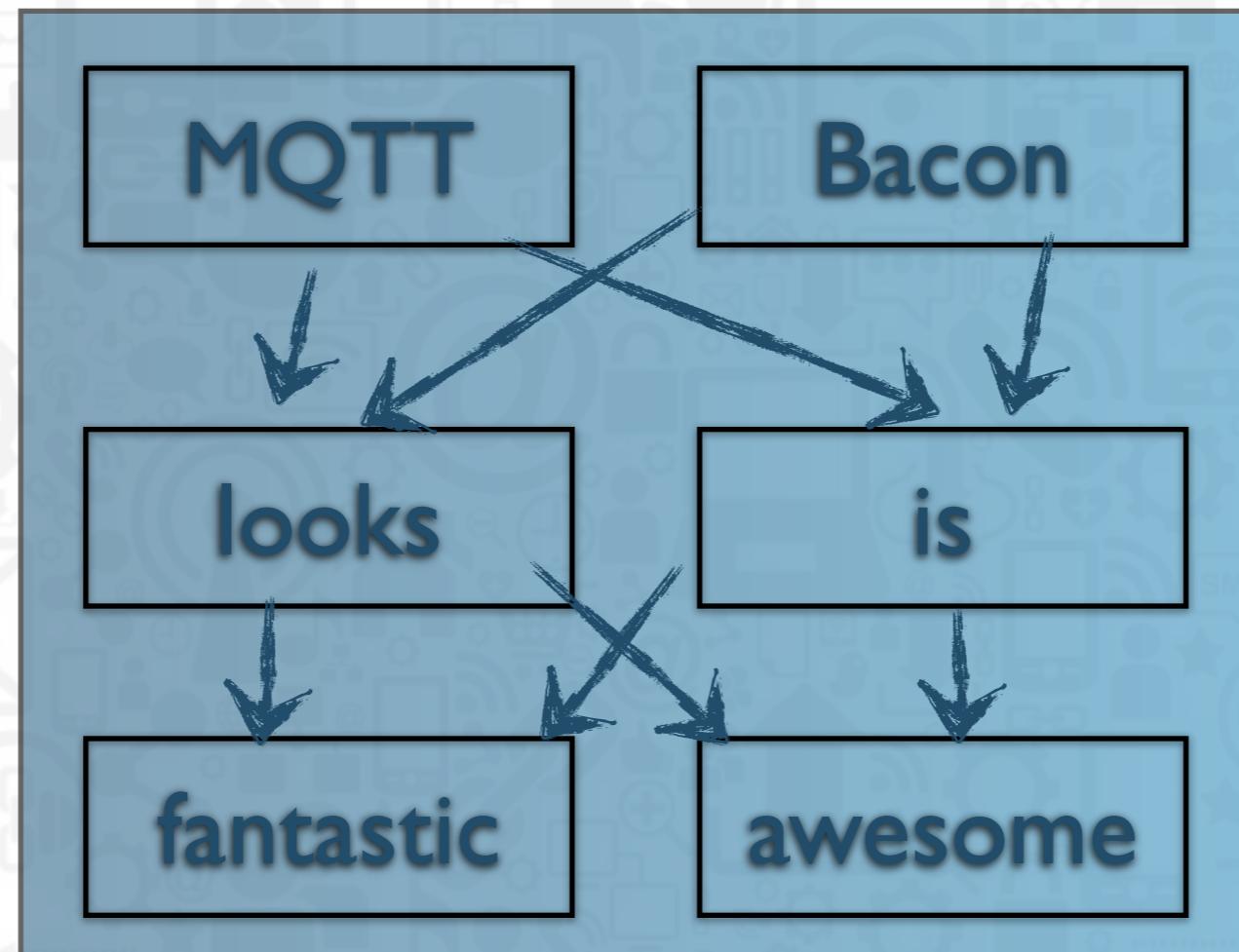
MQTT Wildcard

MQTT/#

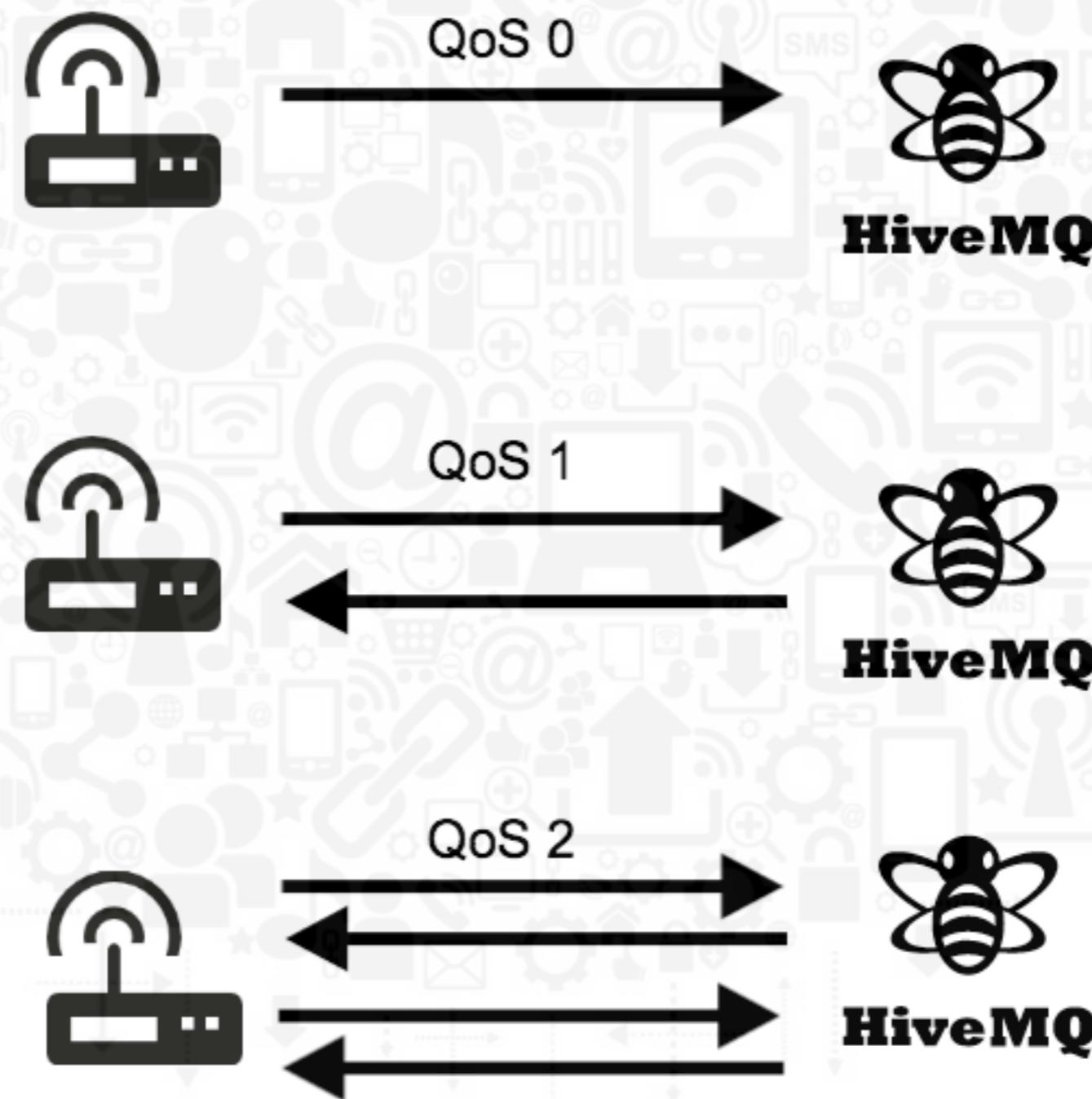


MQTT Wildcard

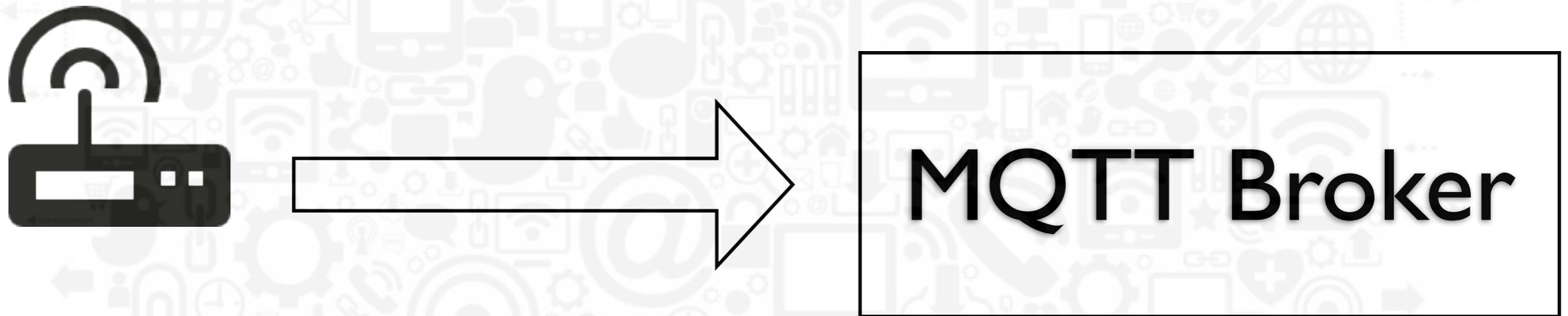
#



Quality of Service Levels

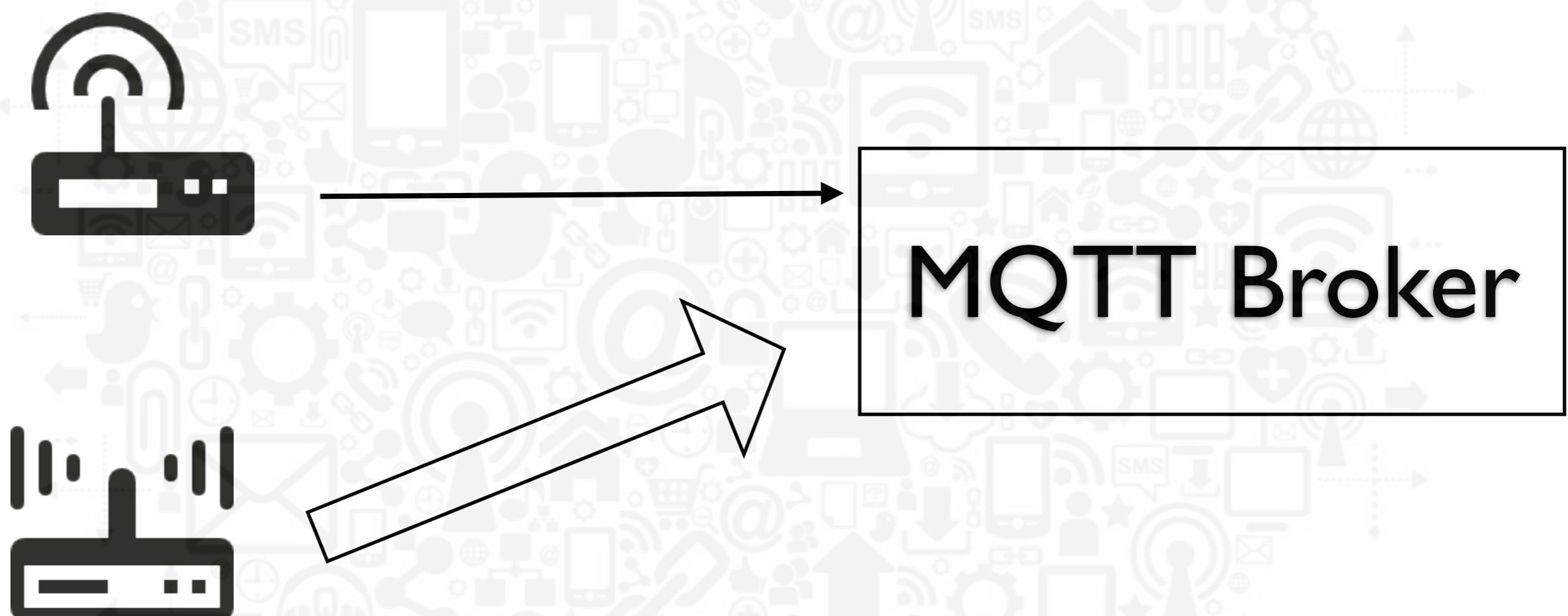


Last Will and Testament



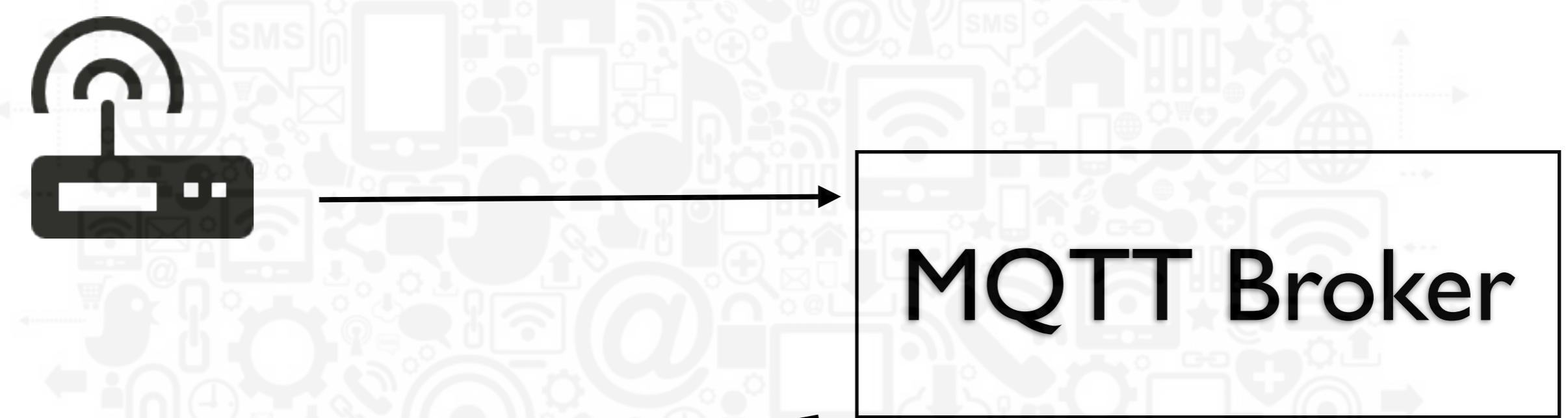
Connect with LWT topic “clientA/lwt”

Last Will and Testament



Subscribe to topic “clientA/lwt”

Last Will and Testament



MQTT Broker

Last Will and Testament



MQTT Broker



Broker detects 'death' of ClientA

Last Will and Testament



MQTT Broker



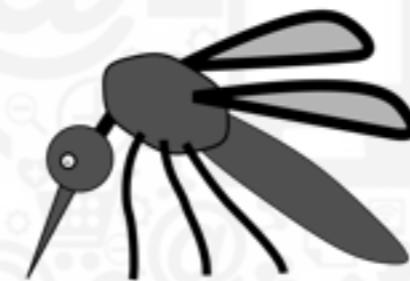
Broker publishes LWT of ClientA

Broker Implementations



HiveMQ

 **RabbitMQ**
Open Source Enterprise Messaging



ActiveMQ

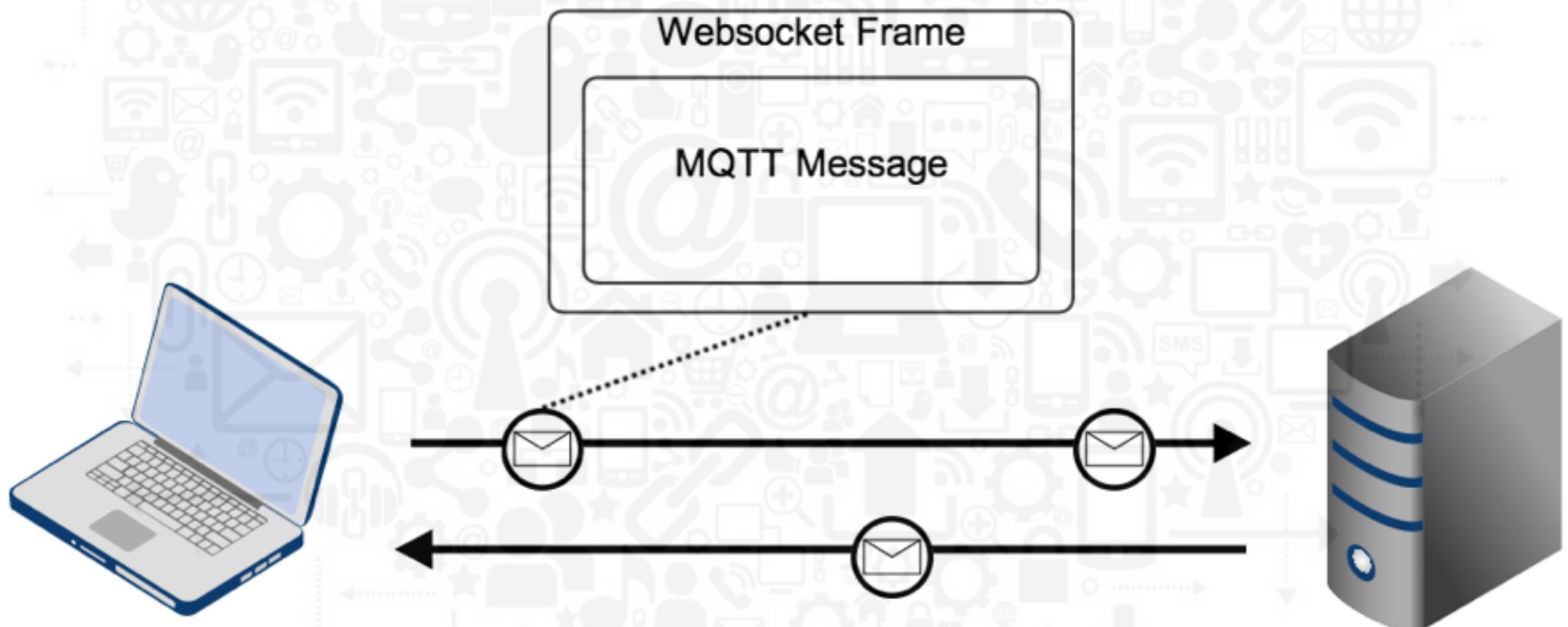
+ others

Extensive list of brokers available at <http://mqtt.org/wiki/doku.php/brokers>

Broker Implementations

	QoS 0	QoS 1	QoS 2	Auth	Bridge	\$SYS	SSL	dynamic topics	cluster	websockets	plugins
HiveMQ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
mosquitto	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓
RSMB	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗
RabbitMQ	✓	✓	✗	✓	✗	✗	✓	✓	?	?	?
ActiveMQ	✓	✓	✓	?	✗	✗	?	?	?	✓	?

MQTT over Websockets



Why MQTT over websockets?

- ✓ Every Browser is a ‘device’
- ✓ Device-to-Browser Push
- ✓ Broadcasting to all online users
- ✓ Detect if a user is offline
- ✓ Direct Browser-to-device push
- ✓ Minimum payload
- ✓ No application-specific protocol

MQTT Libraries

- Paho (Java, Javascript, Python, C, C++, ObjectiveC, Lua, Go)
- .Net
- Ruby
- Erlang
- Node.js
- and **many** more



OK, got it.

How to
start
hacking?

A close-up photograph of a cup of coffee. The coffee has a thick, light brown foam layer on top, which is shaped into a smiling face with two small, dark circular indentations for eyes. The word "Java!" is overlaid in large, white, sans-serif capital letters across the center of the foam. The cup is made of clear glass and is set against a warm, blurred background.

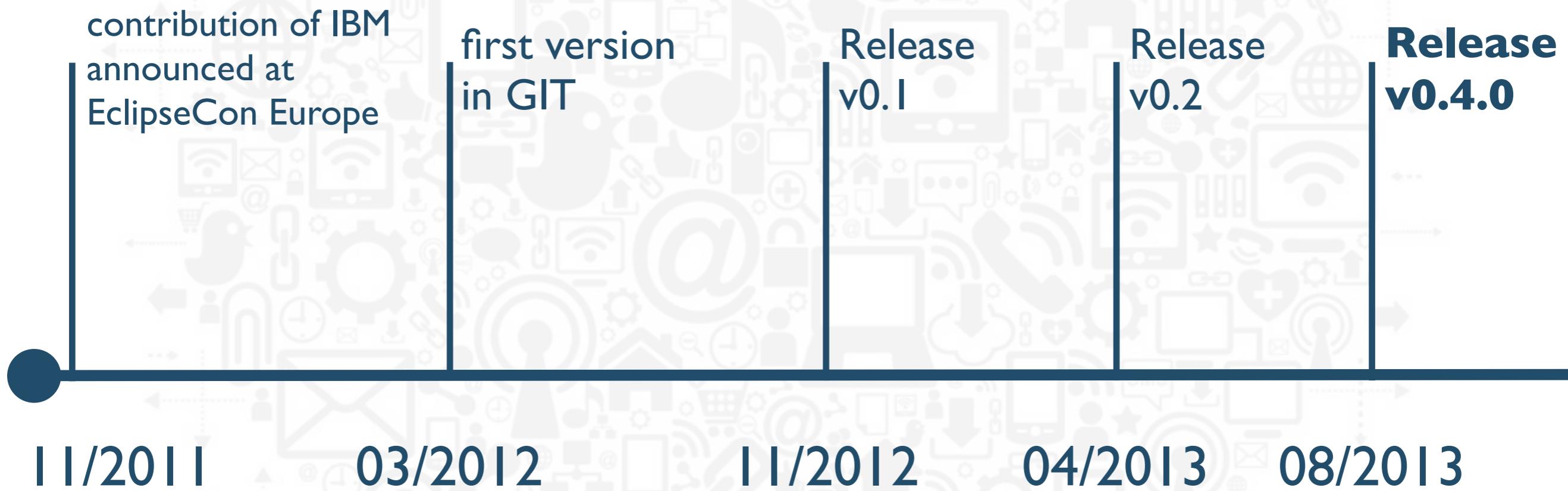
Java!



What is Paho?

- ✓ Scalable Open Source Implementations of M2M standard protocols
- ✓ Focus on MQTT
- ✓ Implementations in Java, Javascript, Lua, C, C++, Go and Python
- ✓ Eclipse Incubator

Paho - Java



Eclipse Paho



- ✓ “Reference Implementation”
- ✓ Active Community
- ✓ Blocking and Async API
- Not in Maven Central :-(

DEMO!





MQTT-Client

Fusesource MQTT Client

- ✓ 3 API Styles
- ✓ Very easy to intercept
- ✓ Based on HawtIO
- ✓ Very performant
- ✓ In Maven Central

DEMO!

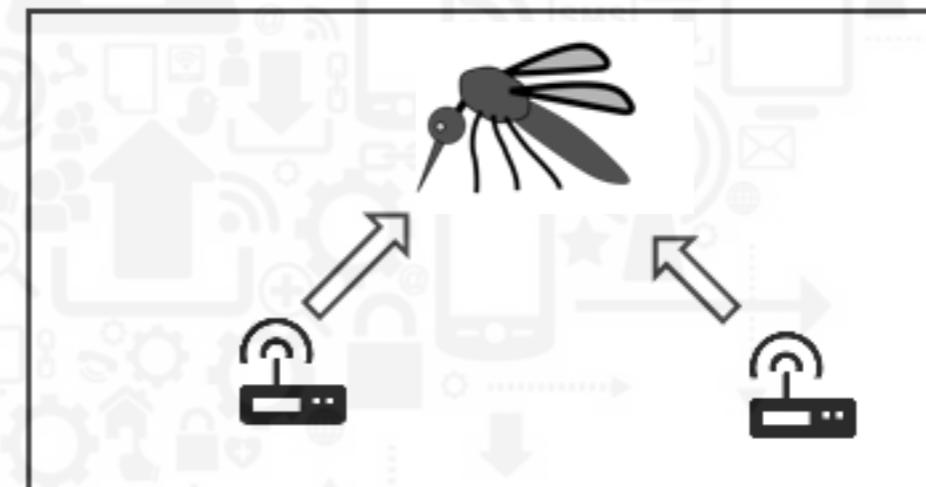
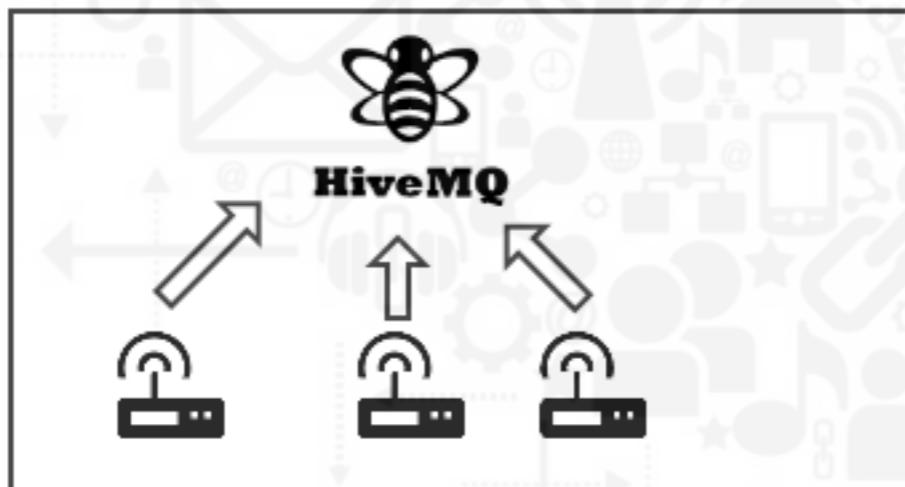




<https://github.com/dobermai/bedcon-mqtt-clients>

THANK YOU!

Bridging



Clustering

