



BERLIN EXPERT DAYS

{join the talk}

2014



M2M for Java Developers

MQTT with Eclipse Paho

Dominik Obermaier

@dobermai



CTO @ dc-square

**passionate
Architect and
Maker**

**Member of the OASIS
MQTT TC**

**Regular speaker and
author**

HiveMQ Architect

The background is a dense, light gray collage of various digital and communication-related icons. These include a globe, a Wi-Fi signal, a smartphone, a speech bubble with 'SMS', a mail envelope, a house, a shopping cart, a Twitter bird, a gear, a padlock, a heart, a person silhouette, and several arrows pointing in different directions. The icons are scattered across the entire frame, creating a complex, interconnected visual field.

M2M?



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

IoT?



Things?



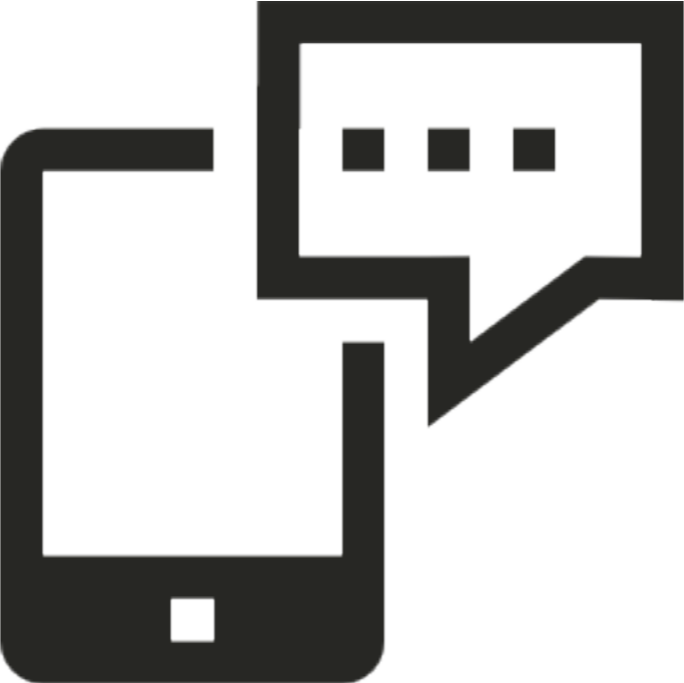


















**Why
should
we
care?**

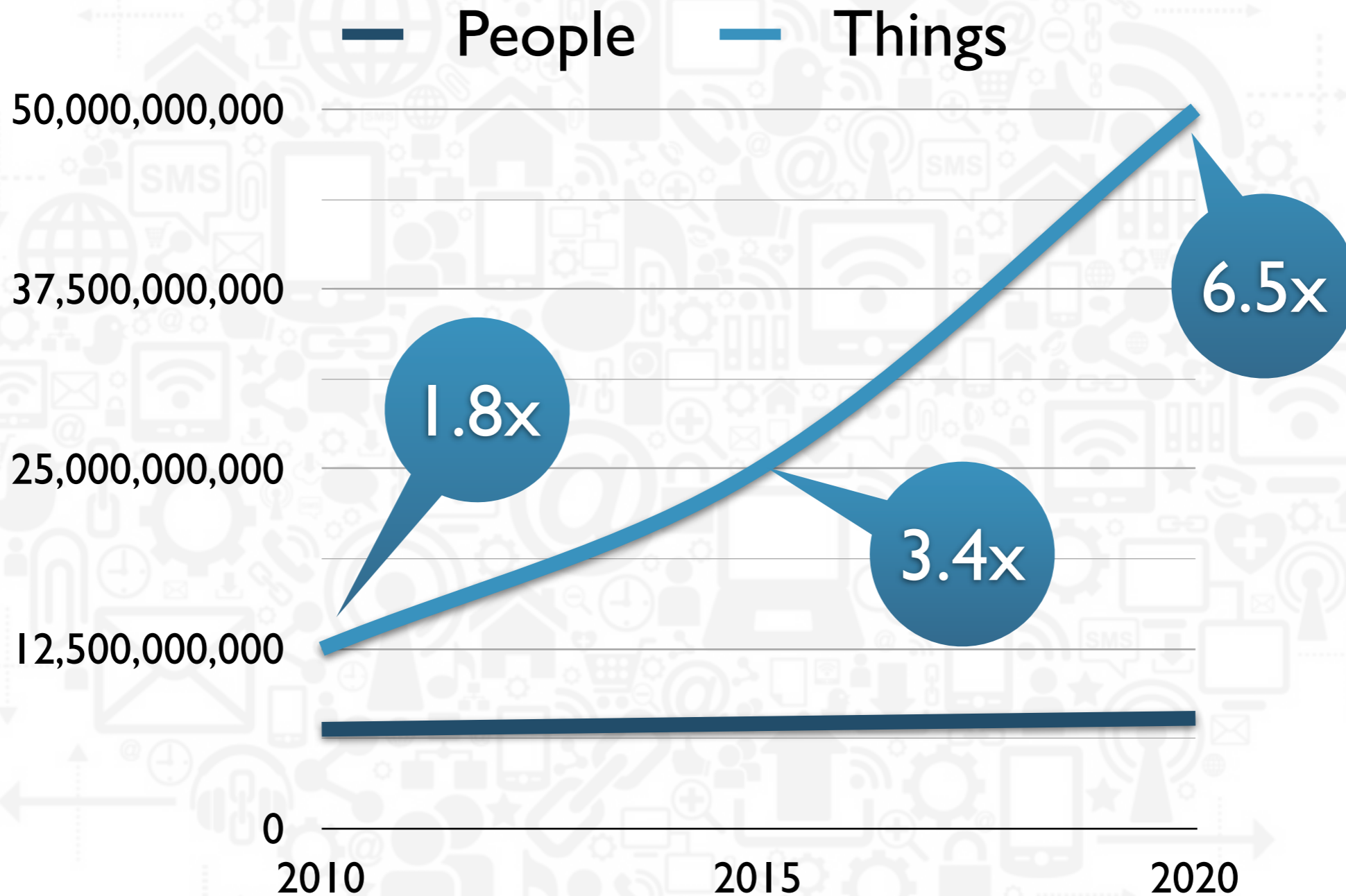
“Things” in the Internet

	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>

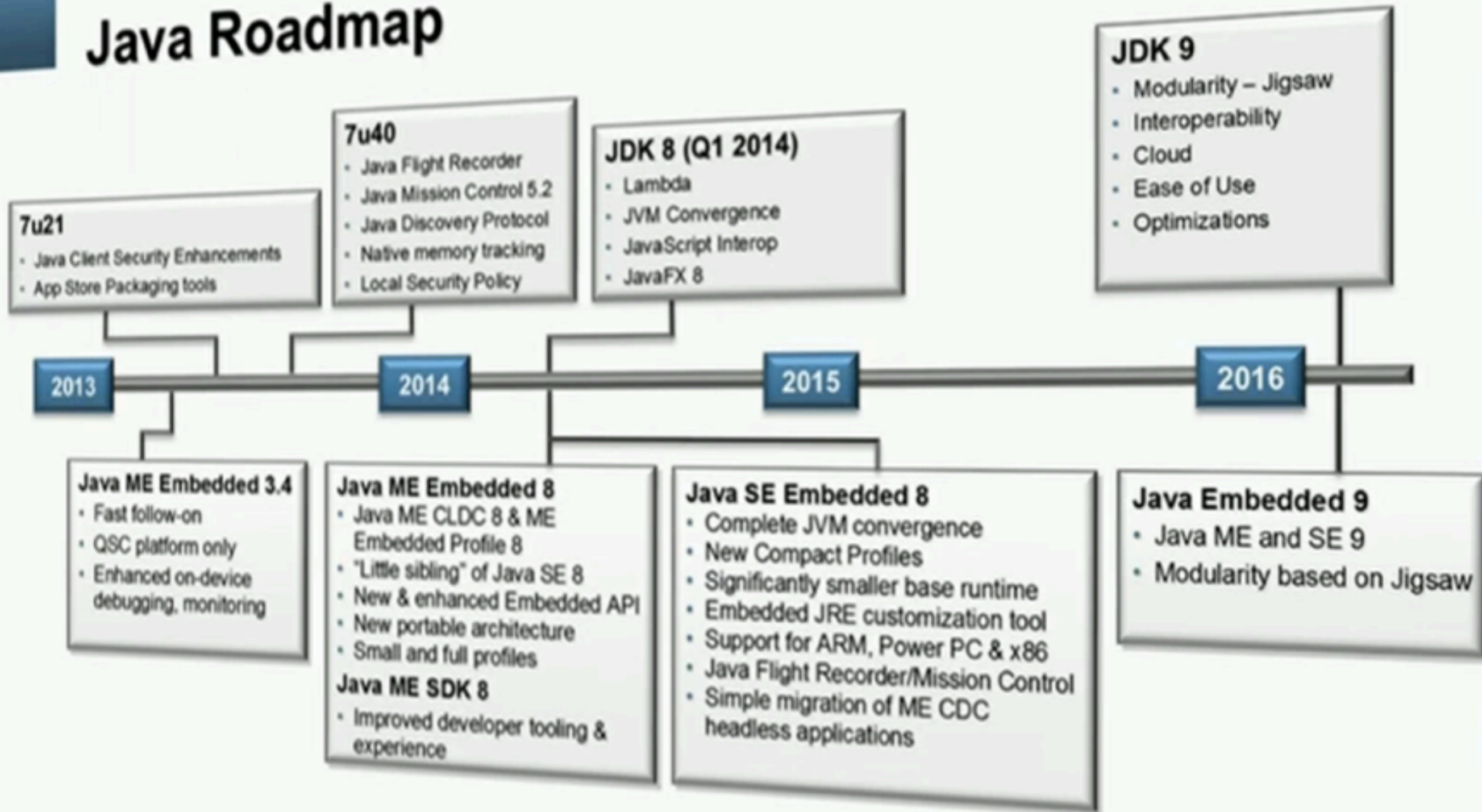
“Things” in the Internet





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

mqtt
Suchbegriff

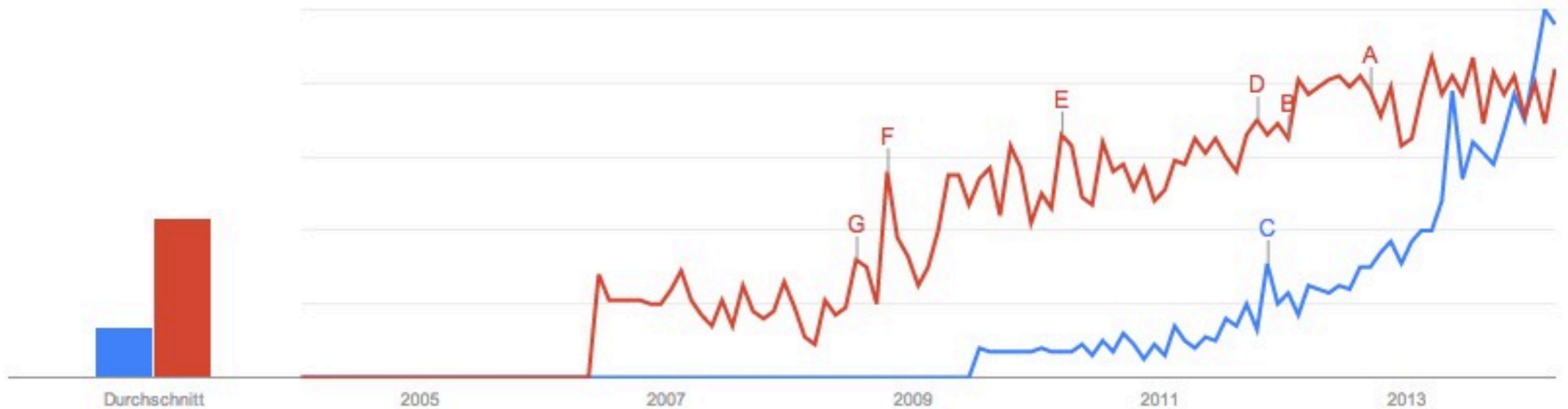
amqp
Suchbegriff

+ Suchbegriff hinzufügen

Teilen ▾

Interesse im zeitlichen Verlauf ?

Nachrichtenschlagzeilen Prognose ?



History

MQTT invented
by IBM and
Arcom (Eurotech)

royalty free

OASIS TC
formed

MQTT is
OASIS
standard

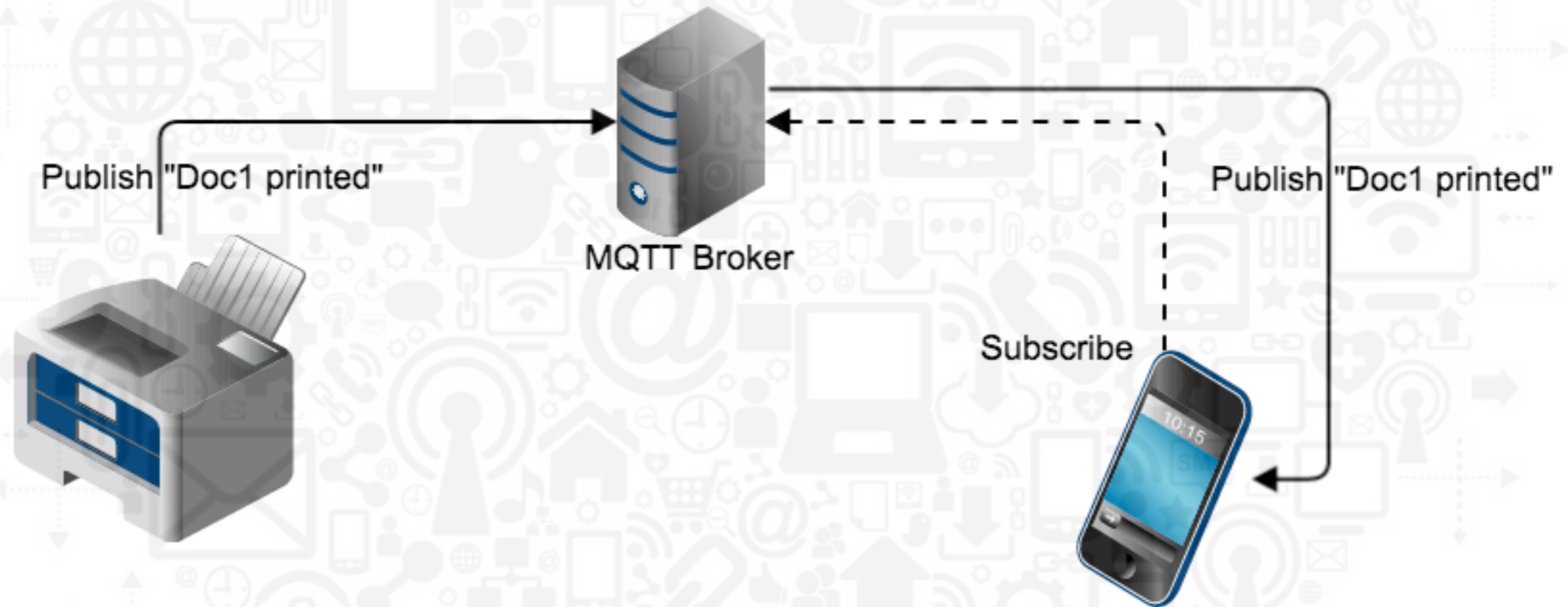
1999

2010

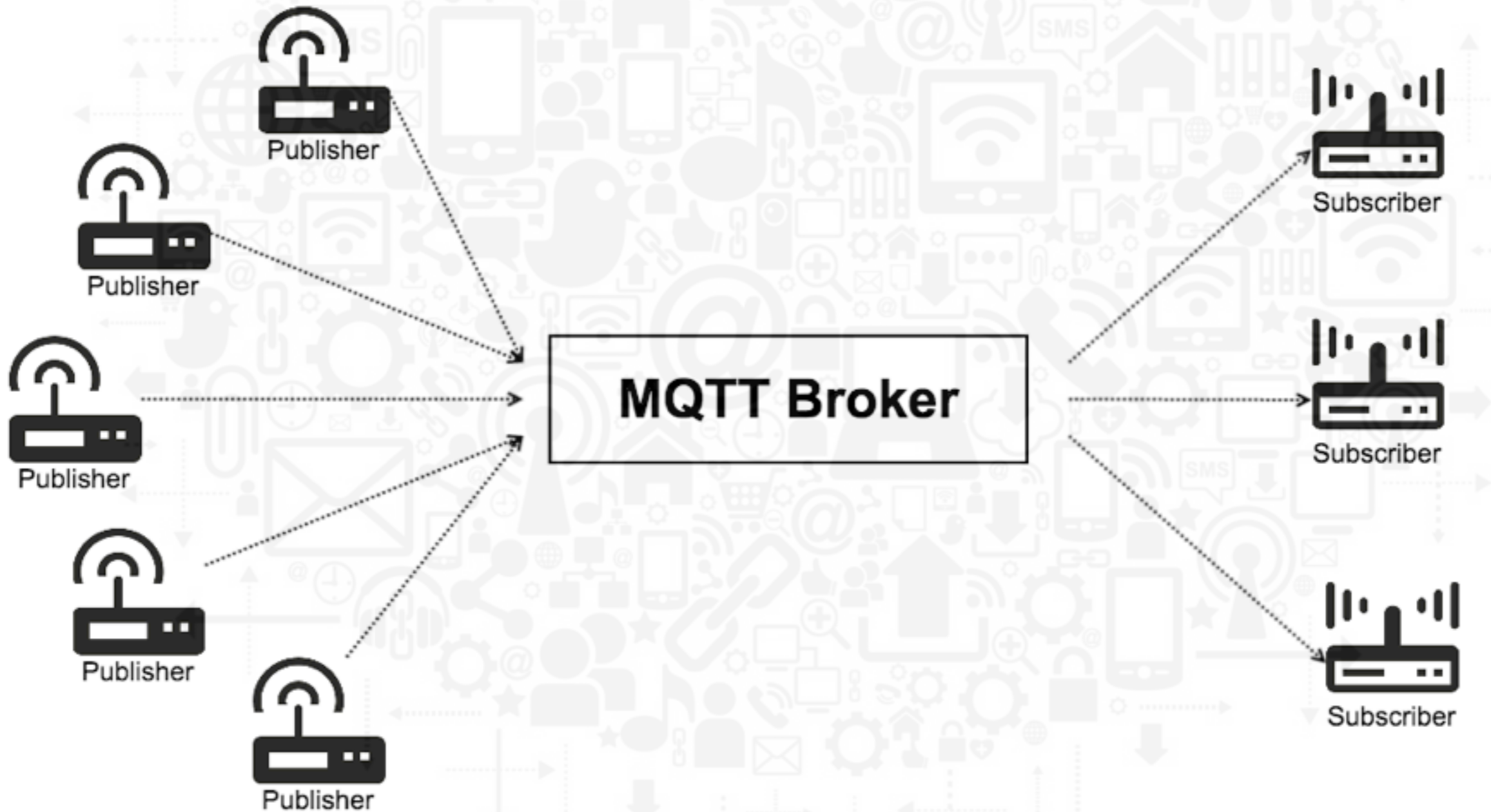
2013

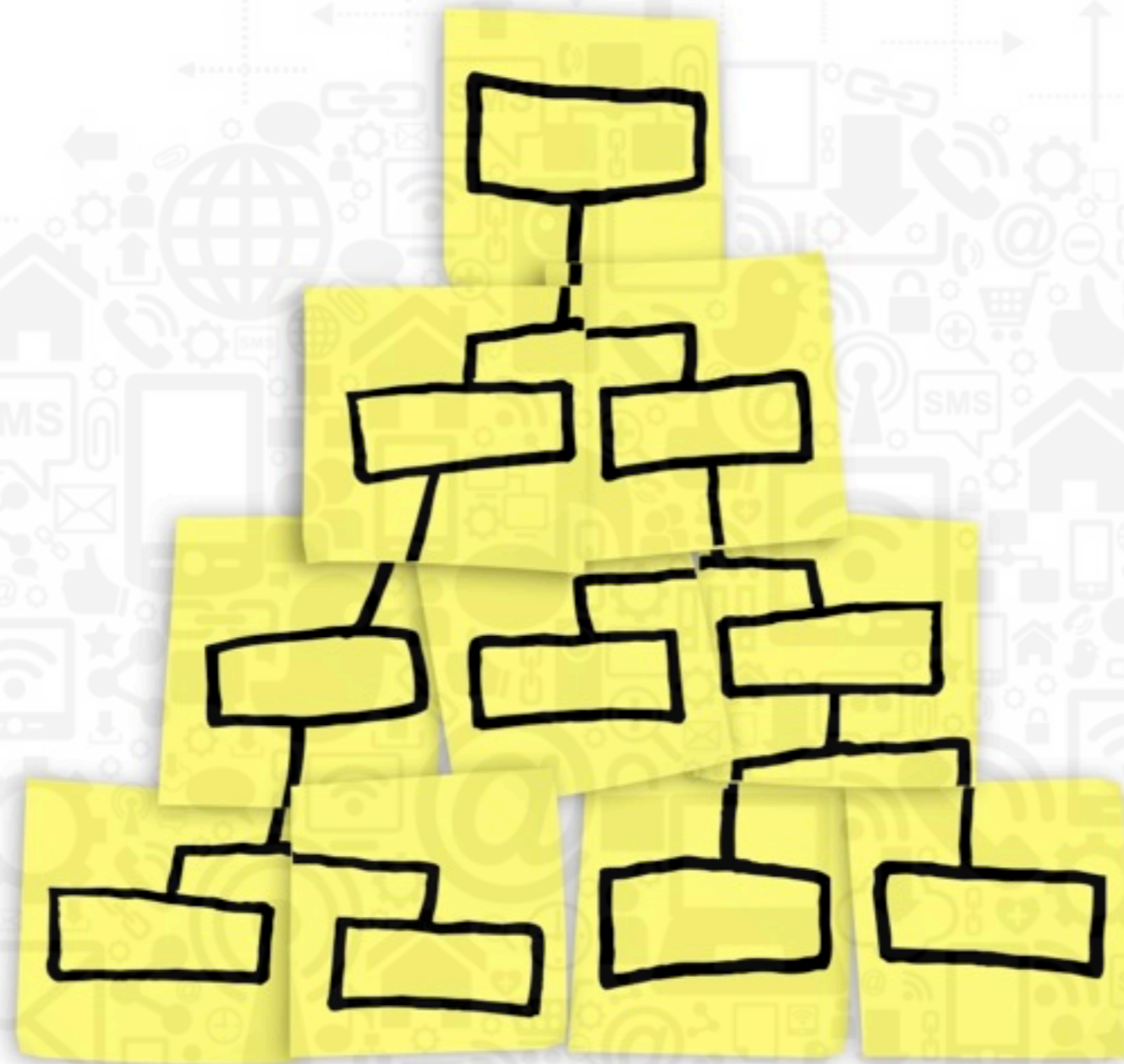
2014

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

Bacon

looks

is

fantastic

awesome



MQTT Topics

Bacon/is/awesome

MQTT

Bacon

looks

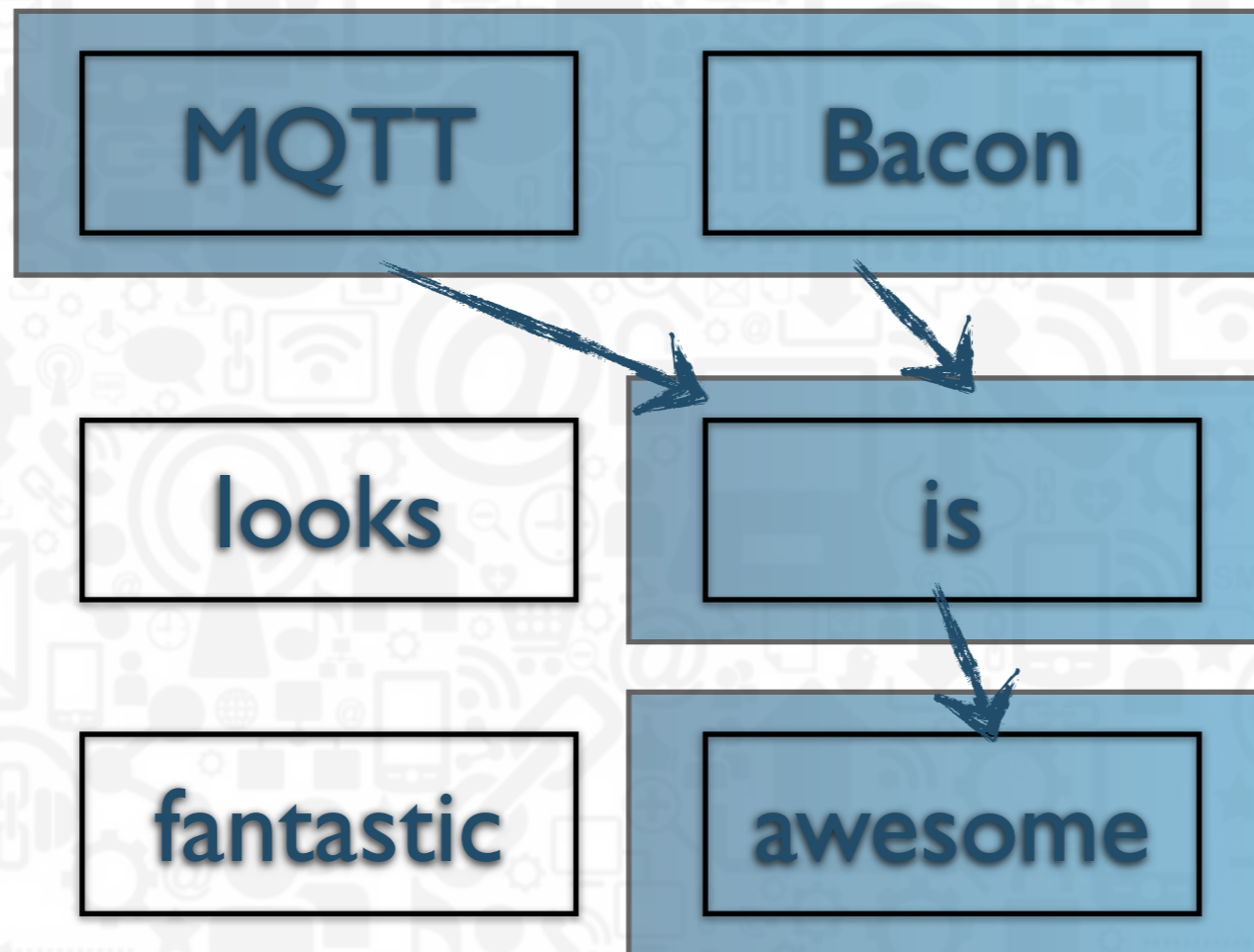
is

fantastic

awesome

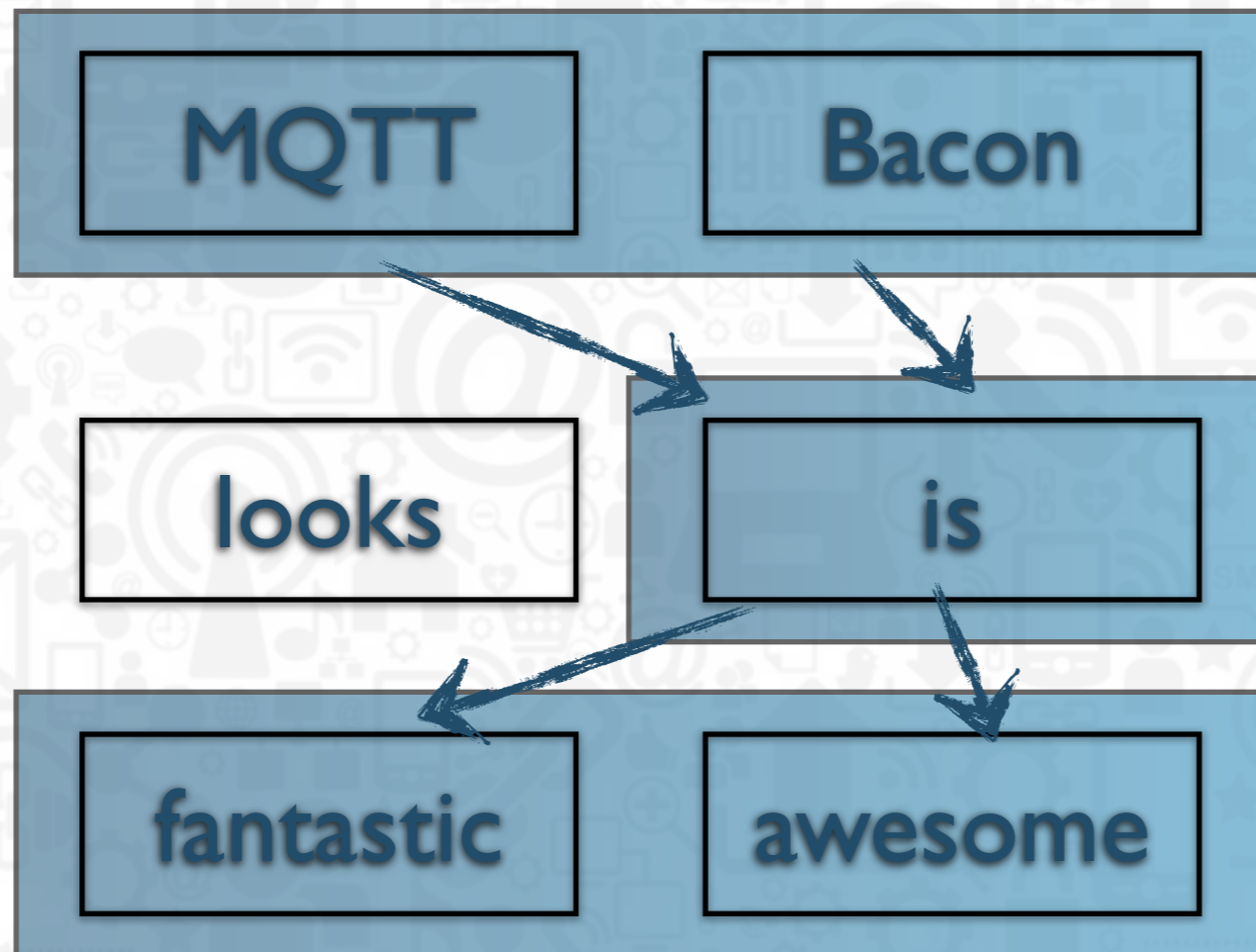
MQTT Topic Level Wildcard

+/is/awesome



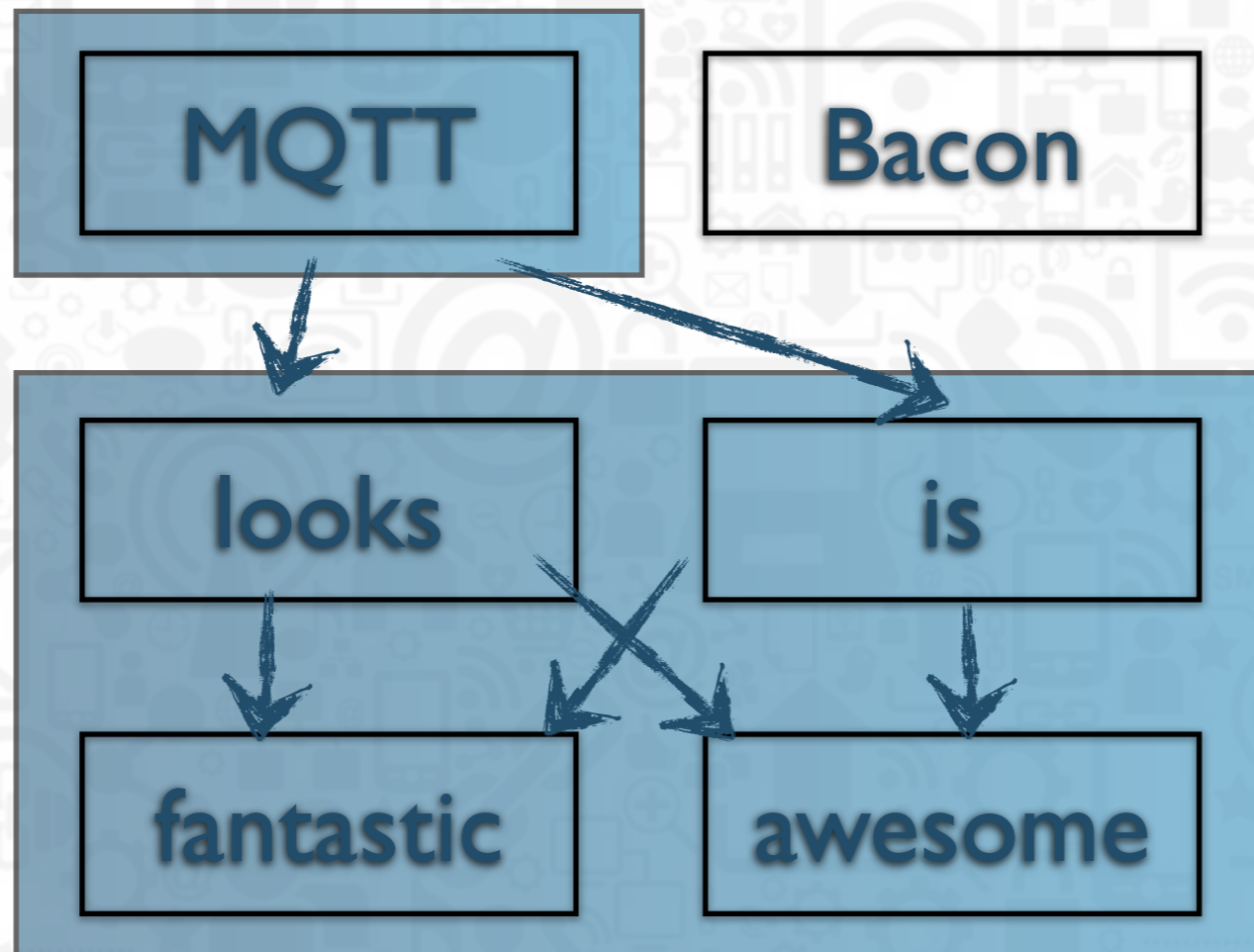
MQTT Topic Level Wildcard

+ /is/ +



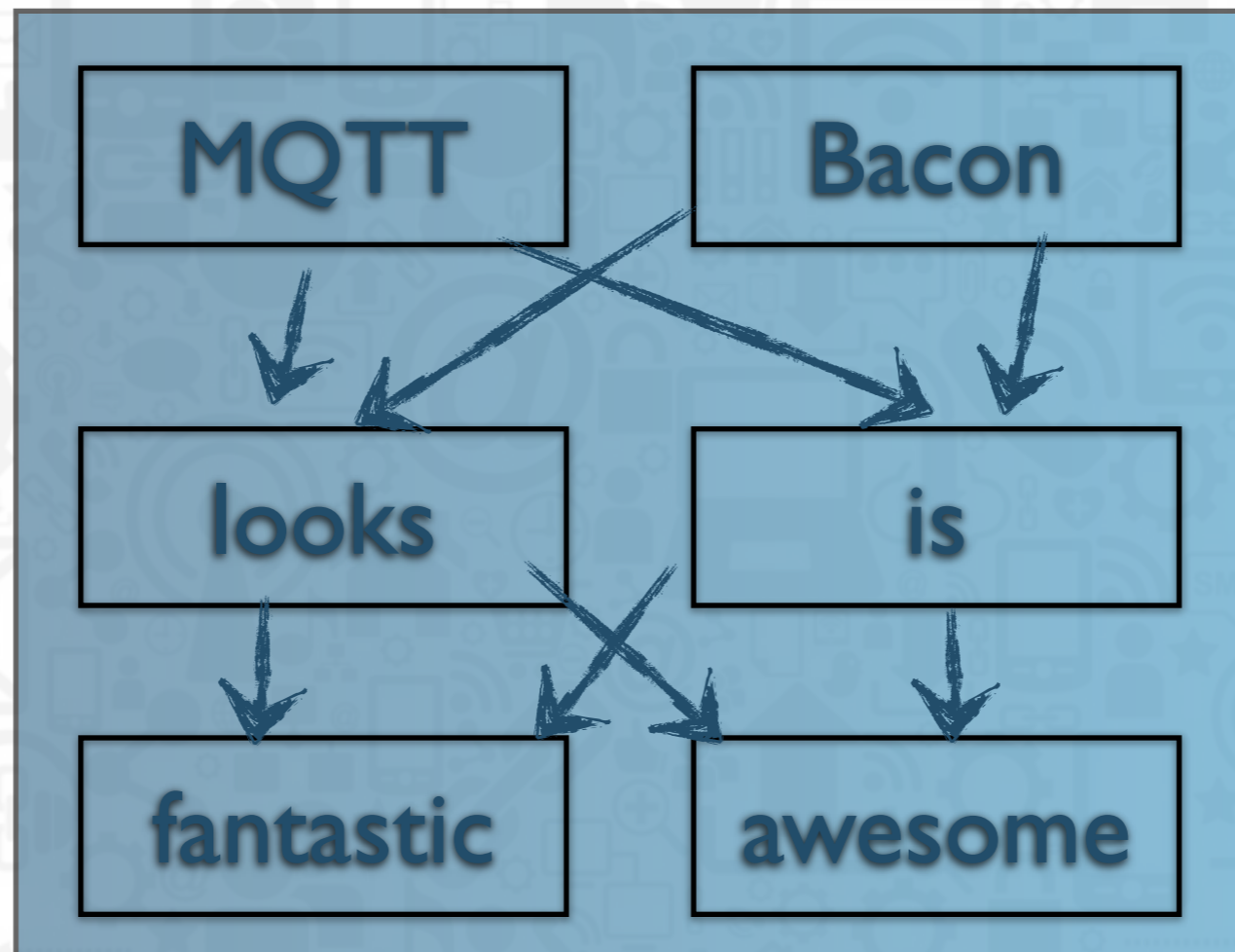
MQTT Wildcard

MQTT/#

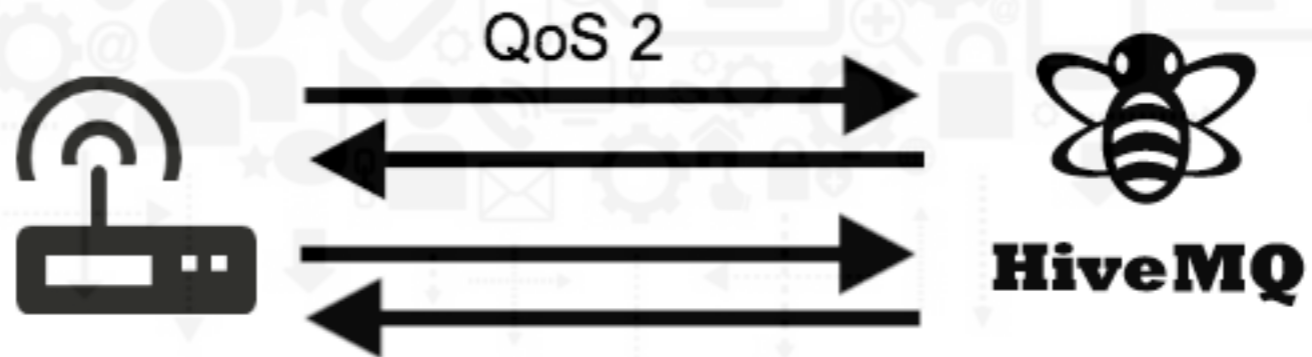
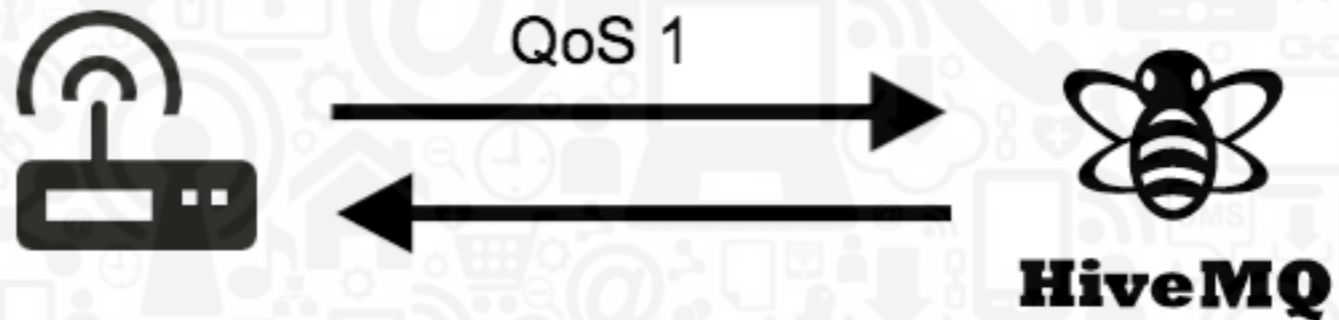
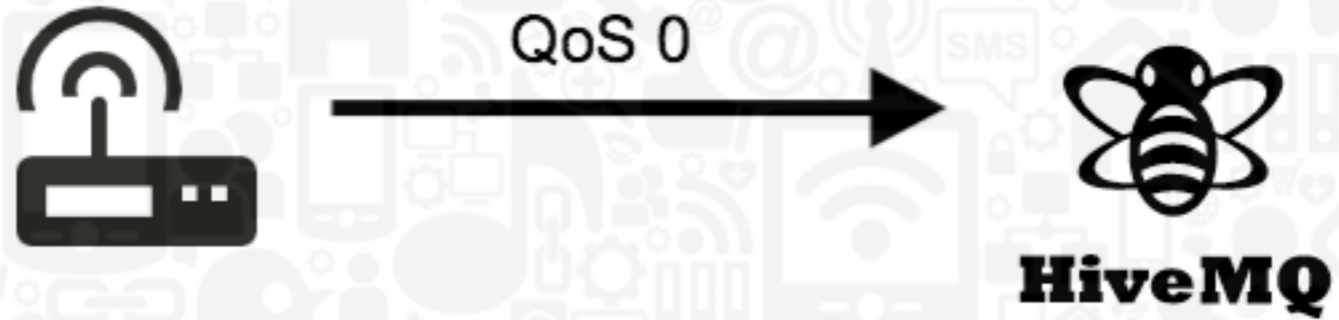


MQTT Wildcard

#



Quality of Service Levels



Last Will and Testament



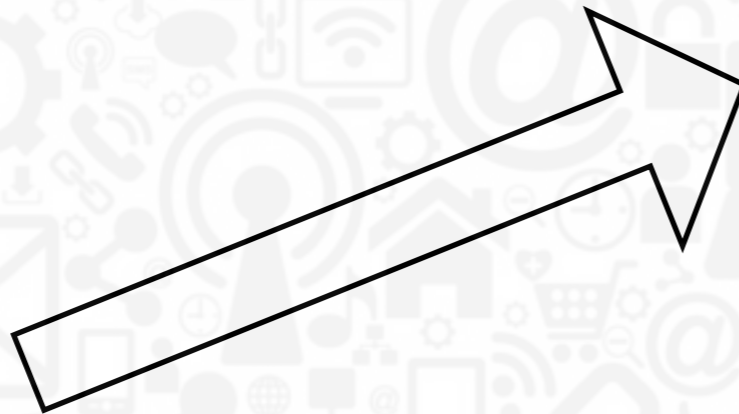
MQTT Broker

Connect with LWT topic “clientA/lwt”

Last Will and Testament



MQTT Broker



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**

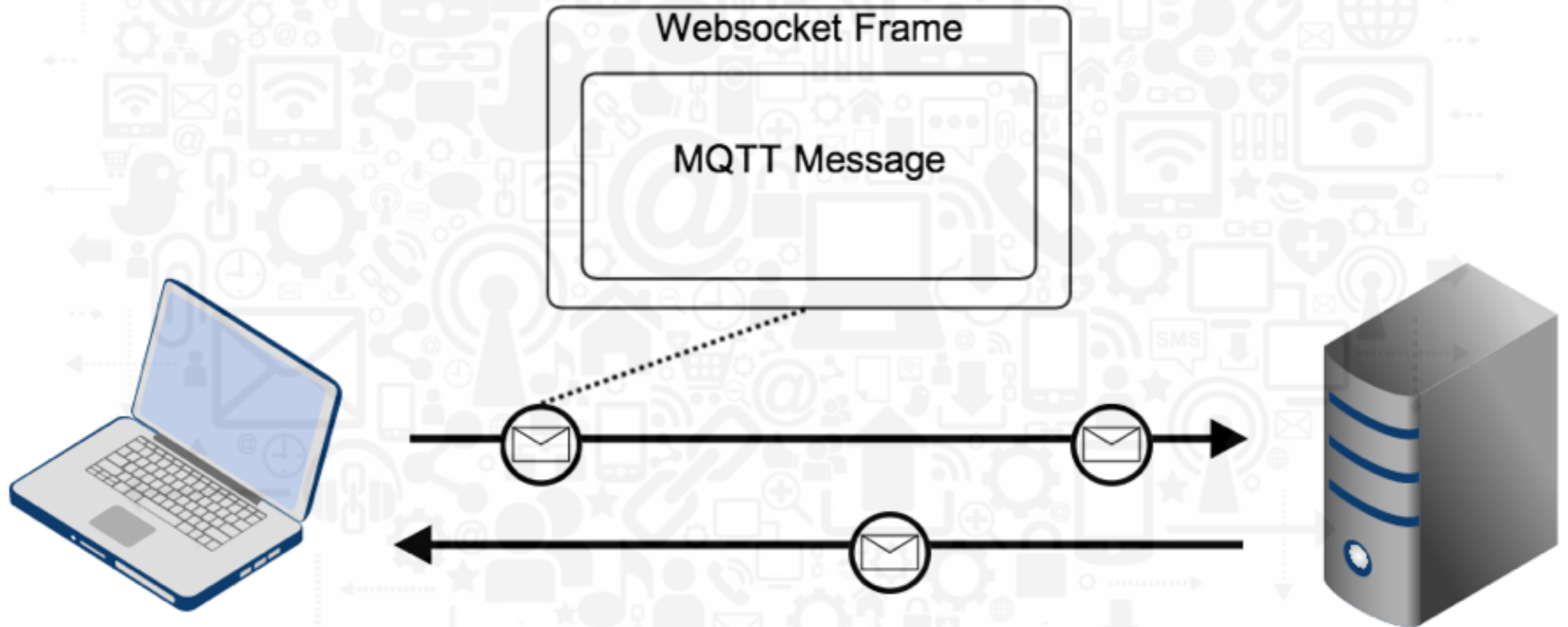
+ others

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 top-down view of a glass mug filled with coffee. The coffee has a thick layer of brown foam on top. In the center of the foam, there is a smiley face shape formed by the coffee's surface. Two small, dark, circular spots in the foam serve as eyes, and a larger, dark, curved shape below them serves as a mouth. The word "Java!" is overlaid in large, white, bold, sans-serif font across the center of the foam. The background is a blurred, warm-toned surface, possibly a wooden table or countertop.

Java!

paño



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

contribution of IBM
announced at
EclipseCon Europe

first version
in GIT

Release
v0.1

Release
v0.2

**Release
v0.4.0**

11/2011

03/2012

11/2012

04/2013

08/2013

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!



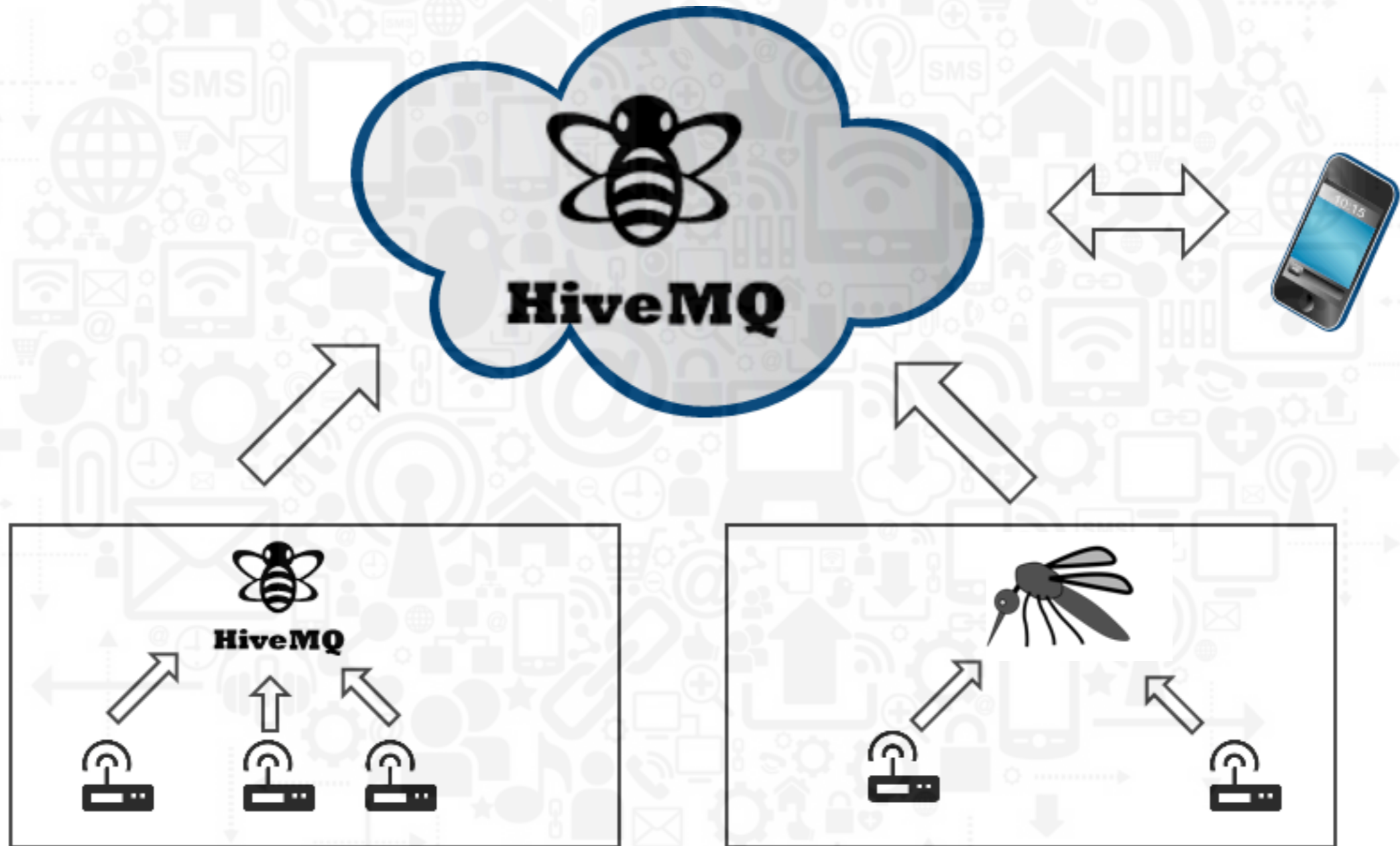
<https://github.com/dobermai/bedcon-mqtt-clients>



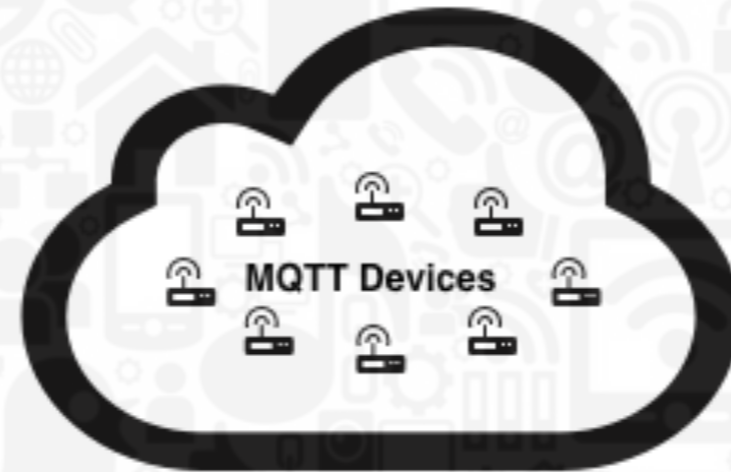
THANK

YOU!

Bridging



Clustering



Loadbalancer



HiveMQ



HiveMQ