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The MQTT protocol family: where did it start, where is it now, and what's next?

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Messaging: how hard is it?



Over an unreliable network?

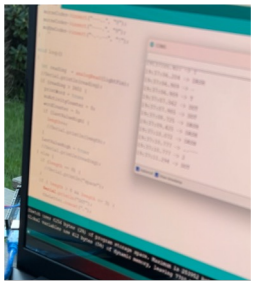


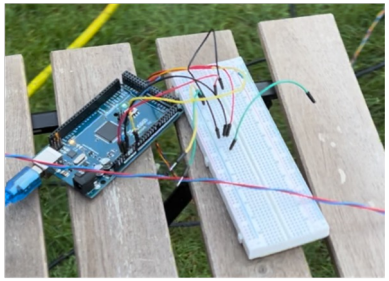
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T _
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4 bits/sec - pretty hard then!

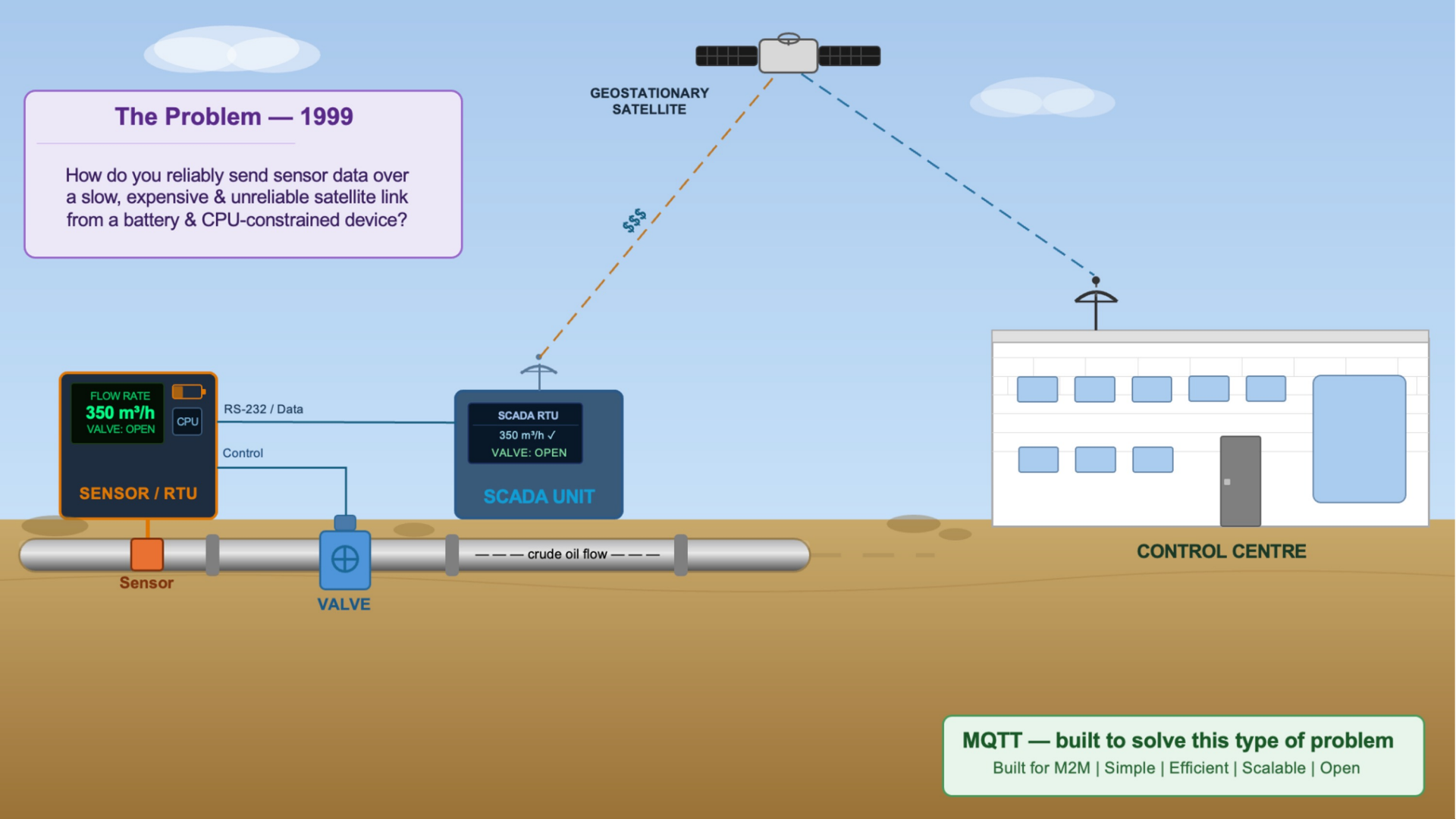




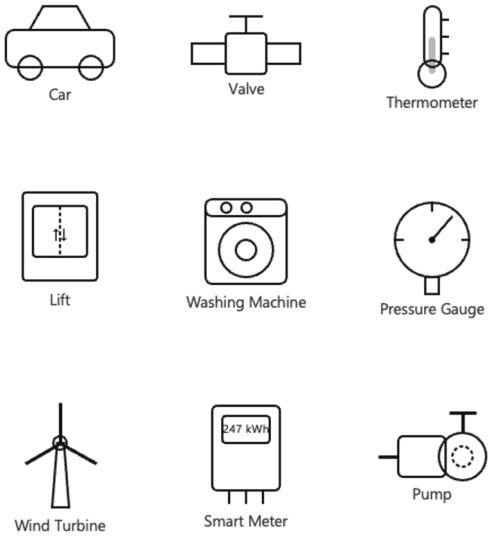


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The Problem — 1999
How do you reliably send sensor data over a slow, expensive & unreliable satellite link from a battery & CPU-constrained device?
GEOSTATIONARY SATELLITE
$$$
FLOW RATE
350 m³/h
VALVE: OPEN
CPU
SENSOR / RTU
RS-232 / Data
Control
SCADA RTU
350 m³/h ✓
VALVE: OPEN
SCADA UNIT
CONTROL CENTRE
Sensor
VALVE
— — — crude oil flow — — —
MQTT — built to solve this type of problem
Built for M2M | Simple | Efficient | Scalable | Open

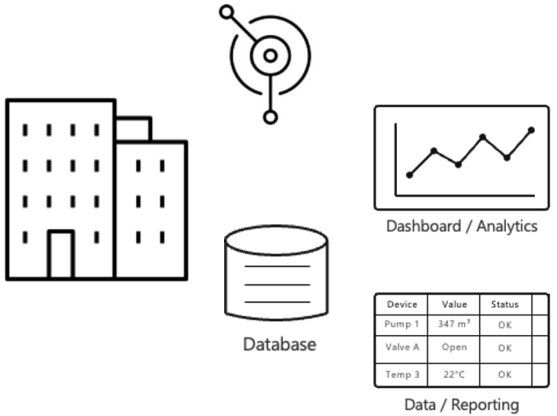
OT/IT Convergence



Operational Technology

Convergence zone (1999)

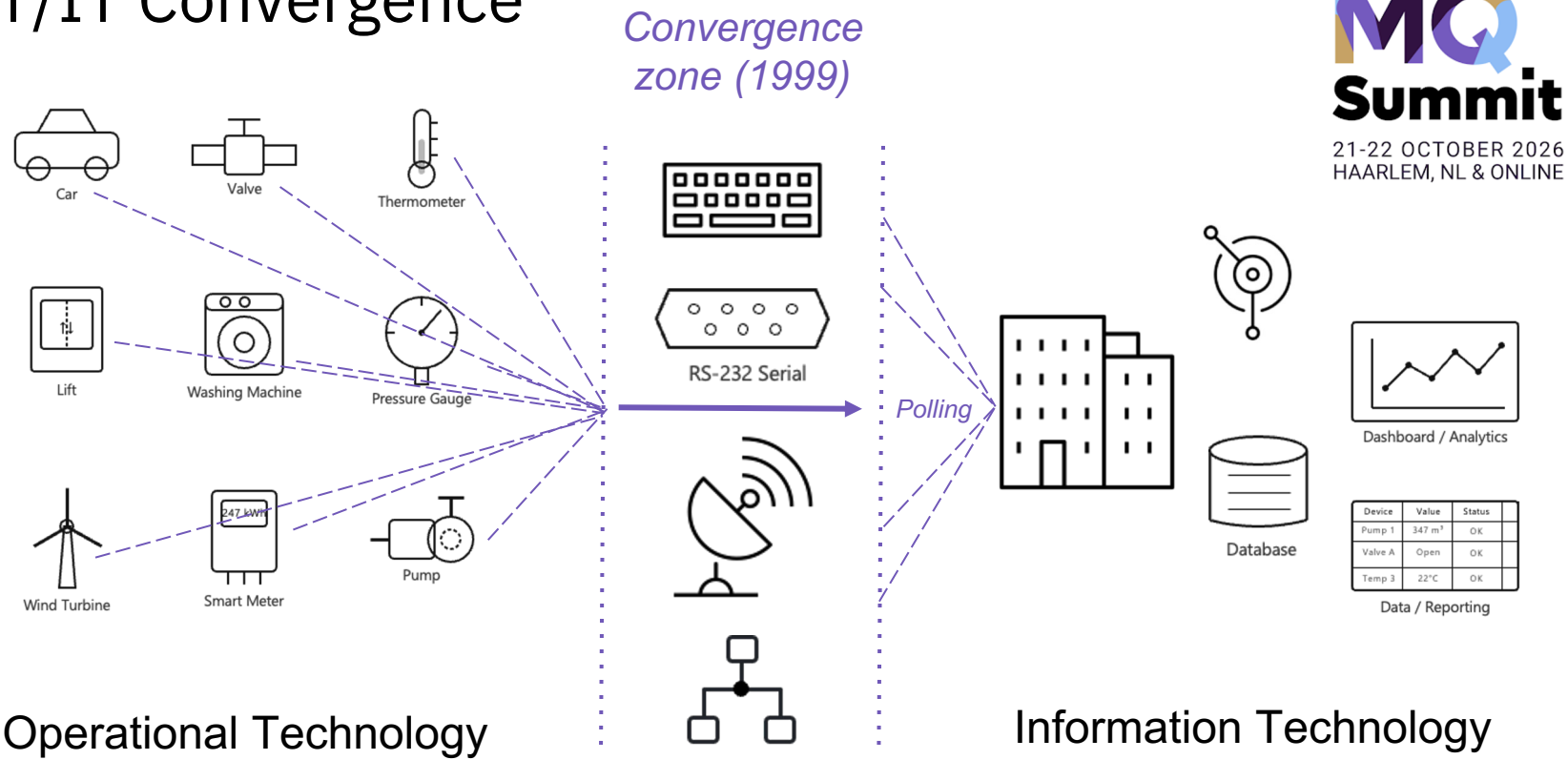




Information Technology

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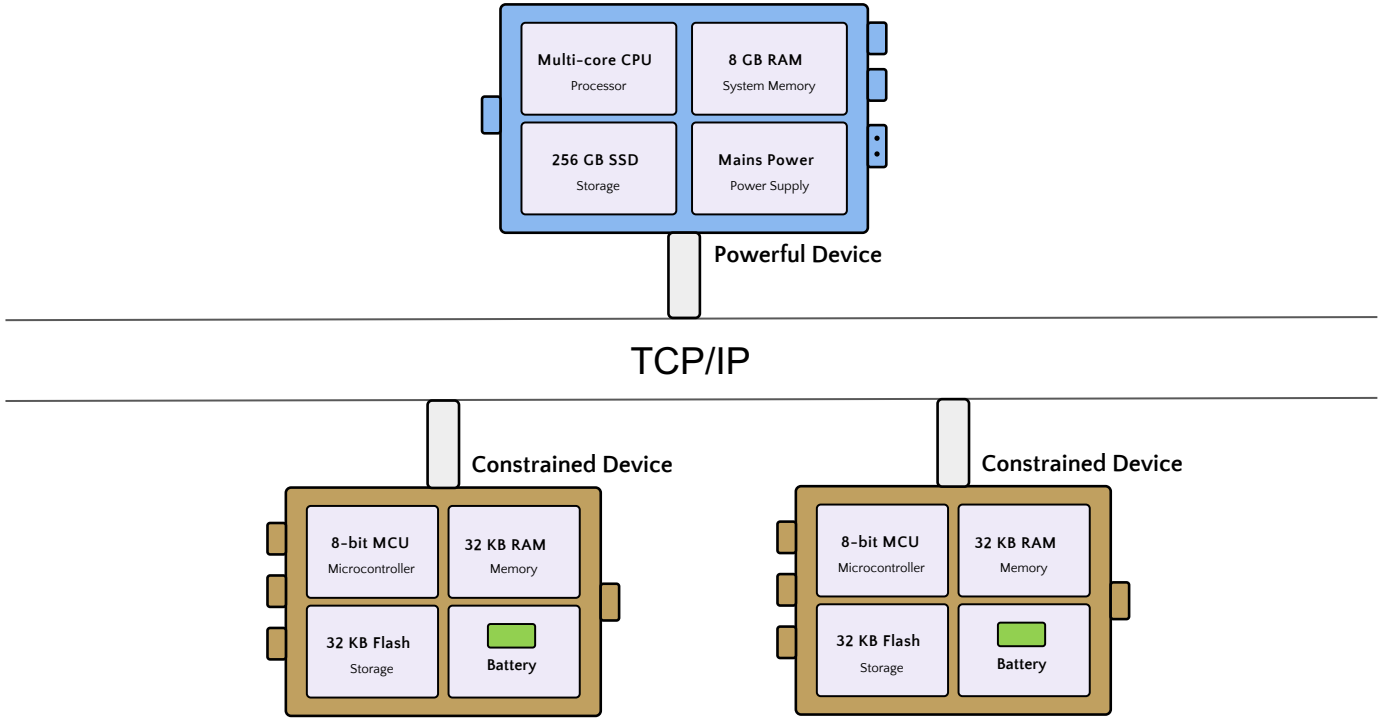
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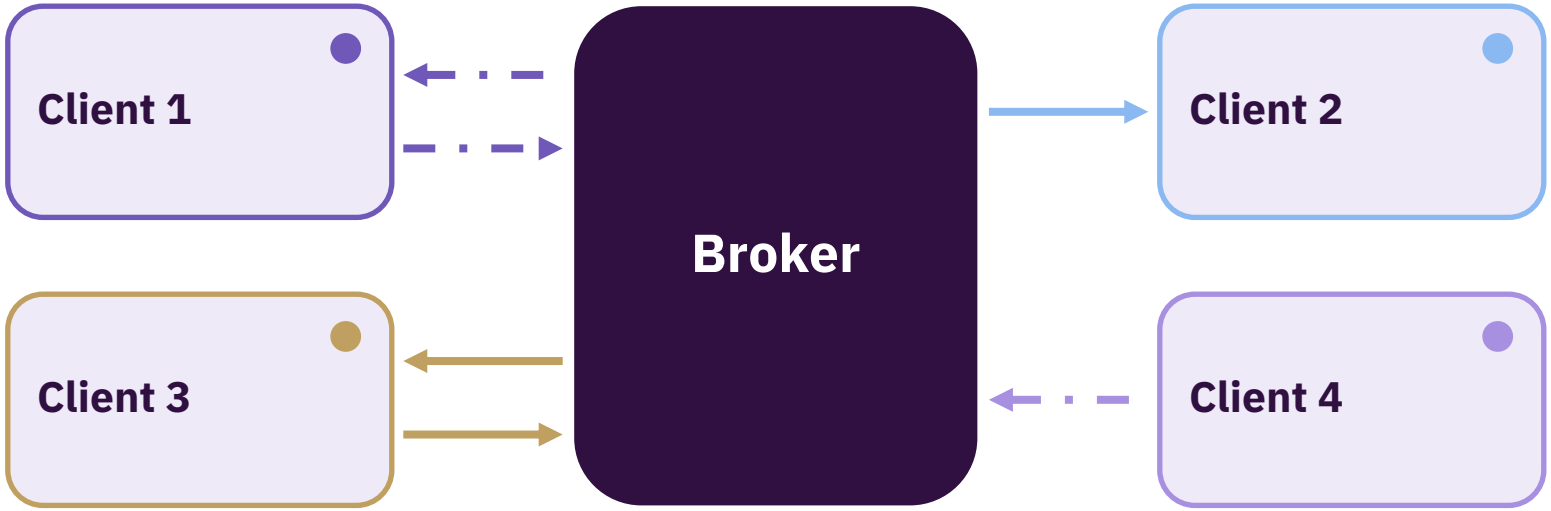
A foundation for connected things...

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Vision: Simple Client, Sophisticated Broker

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MQTT

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MQTT is a Client Server publish/subscribe messaging transport protocol. It is **lightweight**, **open**, **simple**, and designed so as to be **easy to implement**. …ideal …where a small code footprint is required and/or network bandwidth is at a premium.

Simple



Simple to understand and easy implement spec

Efficient

0011

Just enough on top of TCP/IP to deliver the payload

Stateful



Broker can retain information for disconnected clients

Open



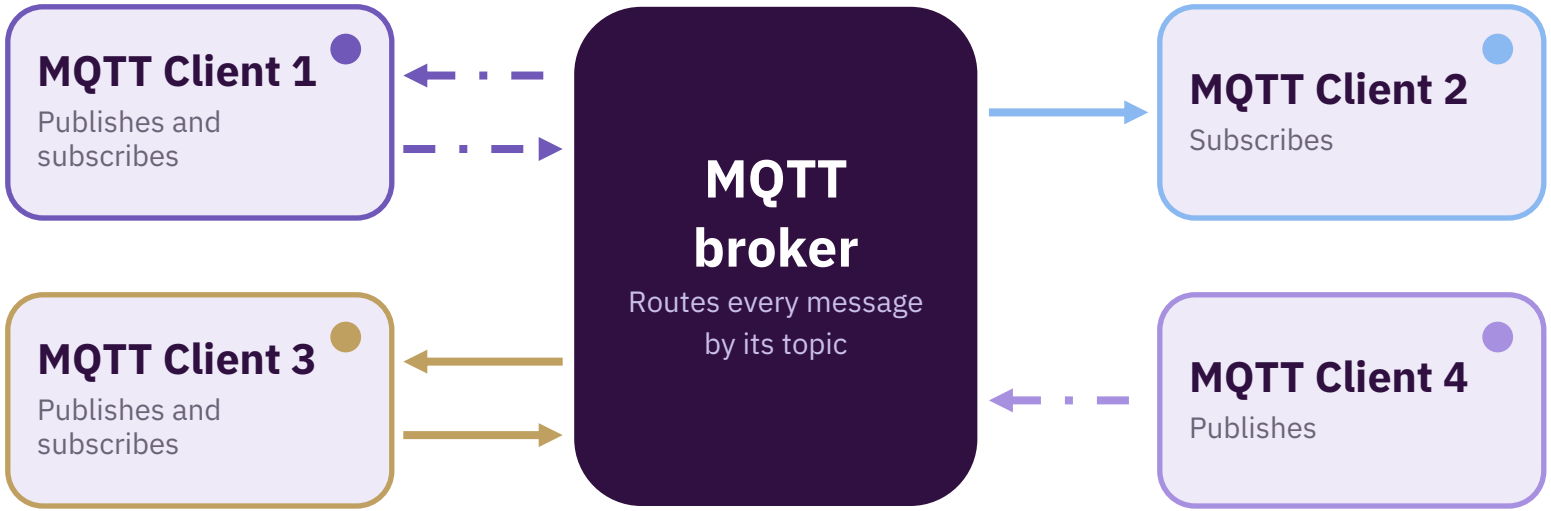
Public domain to encourage implementers



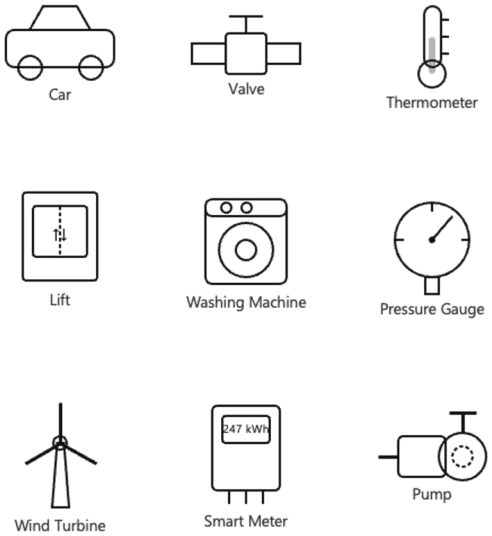
OTWP, MQIsdp, MQIPDP,
Message Queuing Telemetry Transport → MQTT

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Simple clients leverage a sophisticated broker…



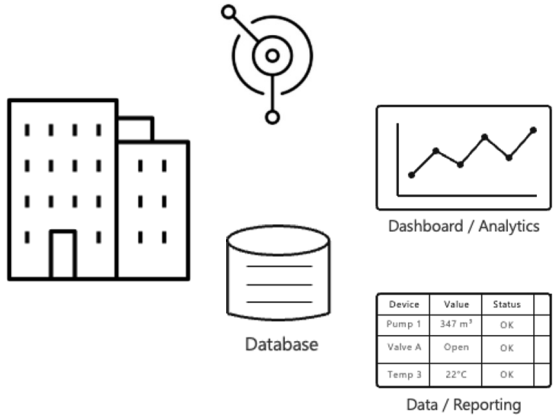
OT/IT Convergence



Convergence zone

MQTT broker

/vehicle/
/pipeline/valve/
/store/refrigerator/temp/
/windfarm/turbine/
/hursley/domestic/meter
…

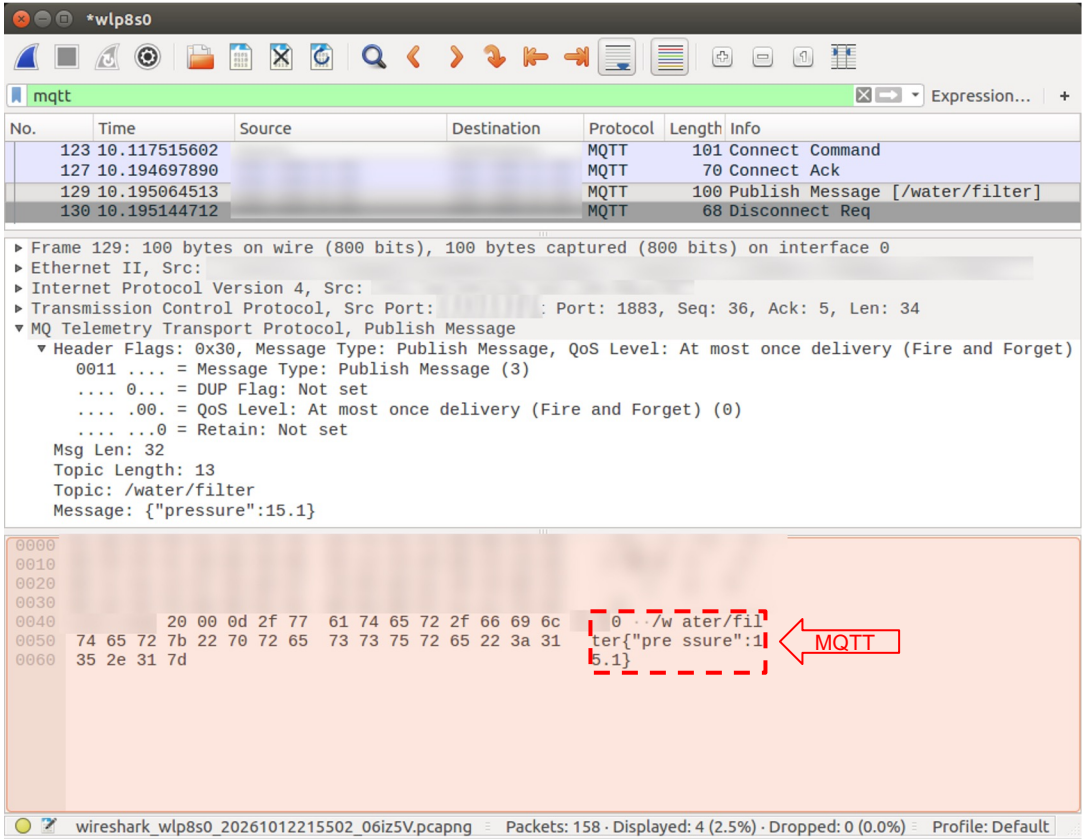


Operational Technology

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Simple & Efficient



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Mnemonic	Enumeration	Description
Reserved	0	Reserved
CONNECT	1	Client request to connect to Server
CONNACK	2	Connect Acknowledgment
PUBLISH	3	Publish message
PUBACK	4	Publish Acknowledgment
PUBREC	5	Publish Received (assured delivery part 1)
PUBREL	6	Publish Release (assured delivery part 2)
PUBCOMP	7	Publish Complete (assured delivery part 3)
SUBSCRIBE	8	Client Subscribe request
SUBACK	9	Subscribe Acknowledgment
UNSUBSCRIBE	10	Client Unsubscribe request
UNSUBACK	11	Unsubscribe Acknowledgment
PINGREQ	12	PING Request
PINGRESP	13	PING Response
DISCONNECT	14	Client is Disconnecting
Reserved	15	Reserved

MQTT’s origin story with Andy and Arlen

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Celebrating 20 years @ ICC 2018





ibm.biz/mqtt-story

Next stop, **World Domination!**
…all devices talk TCP/IP and MQTT

Why Standardise?

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Remove fear of vendor lock-in



MQTT was published royalty free, but still owned by IBM

Establish a community



Collaboration builds mindshare and confidence

Hard prereq for compliance



Some industries only adopt standardised protocols

Proven interoperability



Confidence to build devices and software in level playing field

Necessary to drive adoption of MQTT powered solutions

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OASIS OPEN

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Trusted body with global reach

Record in building high quality international standard

Governance model

Strong processes and frameworks to ensure fairness and rigor

Aligned with collaborators

Many messaging vendors already working within OASIS

Clear IPR policy

Clear licensing policy supports collaboration and implementation

OASIS is a trusted international standards body with feed-in to ISO/IEC

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A standard: so what?



So what? An open standard everyone could trust, and open source could build on it

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Clear scope, fair process

A charter sets the scope, and members vote on decisions

Normative language

MUST and SHOULD (RFC 2119) make every rule testable

Interoperable standard

Any conforming client works with any conforming broker

Kickstart development

Establish trust to invest in writing code

Open source did the rest: free clients and brokers everywhere, and adoption took off.

Eclipse Paho · Eclipse Mosquitto · MQTT.js · HiveMQ & EMQ MQTT Brokers · Node-RED · Eclipse IoT

Wow: MQTT *has* achieved world domination

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12 billion

MQTT enabled devices

Where HiveMQ customers run MQTT today

Connected car

~100,000 msg/s for a fleet of 10 million cars

Each car keeps a persistent session over patchy mobile networks. Telemetry goes up every few seconds; commands such as remote unlock and software updates come back down.

Manufacturing

10,000 to 50,000 msg/s per plant

Machines publish into a Unified Namespace every second. Plant brokers bridge to a central cluster for OEE, maintenance and analytics across sites.

Energy and utilities

~1,000 msg/s per million meters

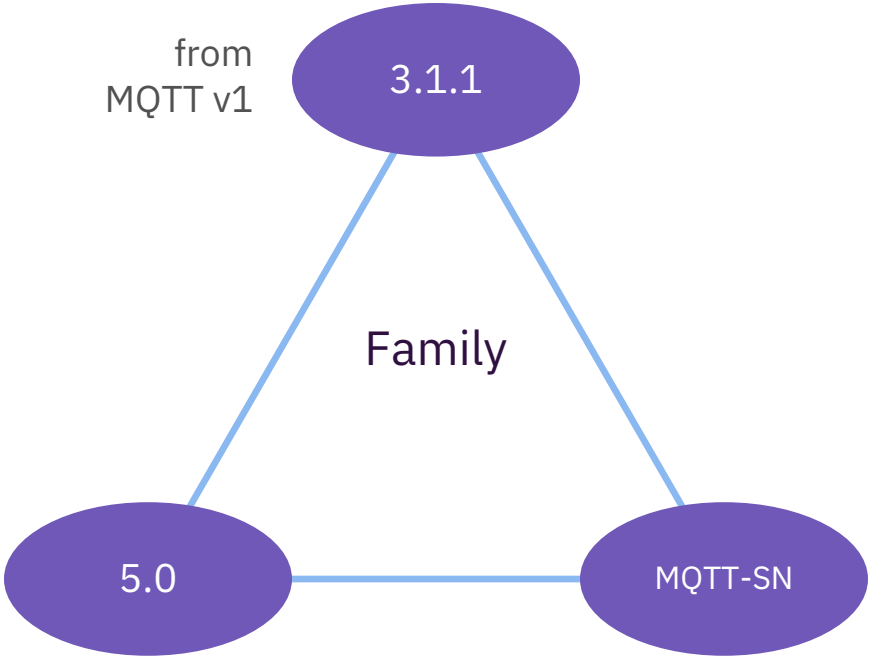
Smart meters, substations and wind and solar sites report every 15 minutes. Billing, grid balancing and outage alerts subscribe to the same data.

Most of this runs on a large open source ecosystem of clients.

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MQTT has evolved to be a family of three protocols, each with its own sweet spot

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3.1.1: the protocol for IoT

Low complexity, optimised for TCP/IP. Took IoT from HTTP to structured pub/sub and drove adoption.

5.0: the integrator's protocol

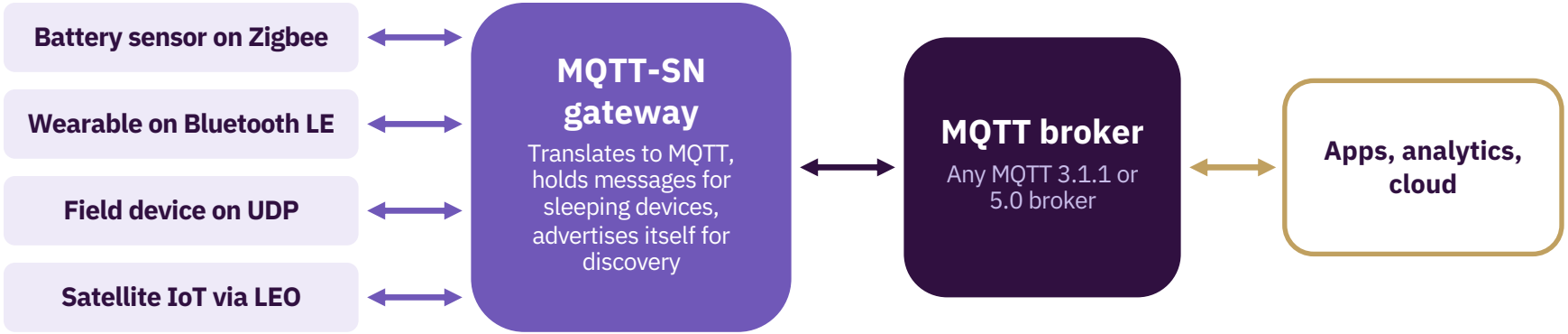
Enterprise ready and more versatile: error handling, scale, shared subscriptions, auth, user properties, request/response.

MQTT-SN: the edge protocol

Brings the same model to constrained and connectionless networks, where latency and power matter.

MQTT-SN: the same publish/subscribe model, for networks TCP can't reach

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Short topic IDs, sleeping clients and sessionless publish save battery, bandwidth and satellite airtime.

MQTT-SN 2.0 Highlights

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Aligned with MQTT 5

Reason codes, session expiry and clean start behave the way MQTT 5 users expect

Proper authentication

An authentication exchange, so devices can prove who they are, not just connect

Sleeping devices

Clearer rules for sessions and buffered messages while a device sleeps

Testable conformance

Normative statements throughout, so every rule can be tested

The draft is written. It now needs reviewers who build real devices.

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Where MQTT-SN fits: far from any network

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Connected cow

Livestock collars report location and health, waking only to publish

NB-IoT over satellite

3GPP Release 17 brings NB-IoT to satellite: small messages from anywhere

Emergency response

Alerts that get through on any available link and reach every subscriber

Remote assets

Pipelines, shipping and remote sites: the problem MQTT was first built to solve in 1999, even more constrained

Coming soon: white papers on MQTT-SN for satellite and remote IoT.



Call to action: help us review MQTT-SN 2.0

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1. Review the draft

MQTT-SN 2.0 is going out for public review. Read it, try it against your devices and gateways, and tell us what breaks.

2. Help us secure it

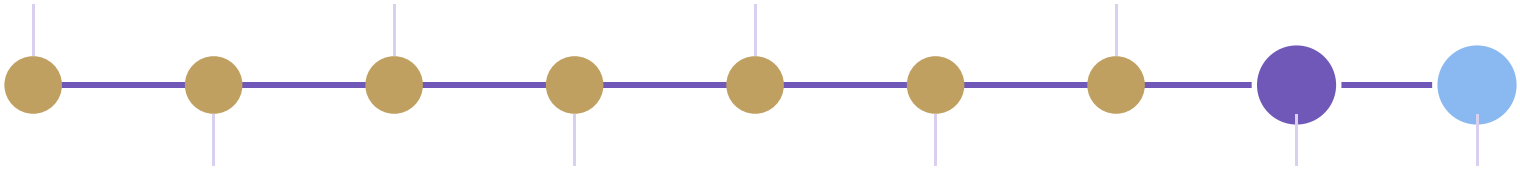
Constrained networks need security that fits: authentication for tiny devices, DTLS over UDP, and keys for devices that sleep. If you have built this, we want to hear from you.

Every comment from a real deployment makes the standard better.

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From one pipeline to a family of open standards: 27 years of MQTT

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1999
MQTT v1
Andy Stanford-Clark and Arlen Nipper build it to monitor an oil pipeline over satellite

2010
MQTT 3.1
IBM publishes the specification royalty free

2013
OASIS MQTT TC
Standardisation starts. MQTT-SN 1.2 published for non-TCP networks

2014
MQTT 3.1.1
First OASIS Standard

2016
ISO/IEC 20922
3.1.1 becomes an international standard

2019
MQTT 5.0
OASIS Standard for enterprise and cloud integration

2025
TC reconvened
New energy: MQTT-SN 2.0 drafted, AI and new transports on the agenda

2026
MQTT-SN 2.0
Public review

Next
What comes next
AI, QUIC, alignment with MCP and AMQP

What's next: MQTT for AI, a renewed community, and new transports

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AI working group

MQTT as a transport for AI agents, including alignment with MCP and AMQP, building on the previous session

Re-engaging the community

Hearing from users and implementers about what has worked, and where MQTT should evolve next

MQTT over QUIC

Faster connection set-up, connections that survive network changes, and streams without head-of-line blocking

The same publish/subscribe model, carrying new kinds of traffic.

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The MQTT TC is open for feedback

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Open contributions are welcome!

- Join the community
- Accept the **feedback licence**
- Feedback and contribute

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Feedback on this MQ Summit Session

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The future of MQTT - an update from the technical committee

End / Review / Backup