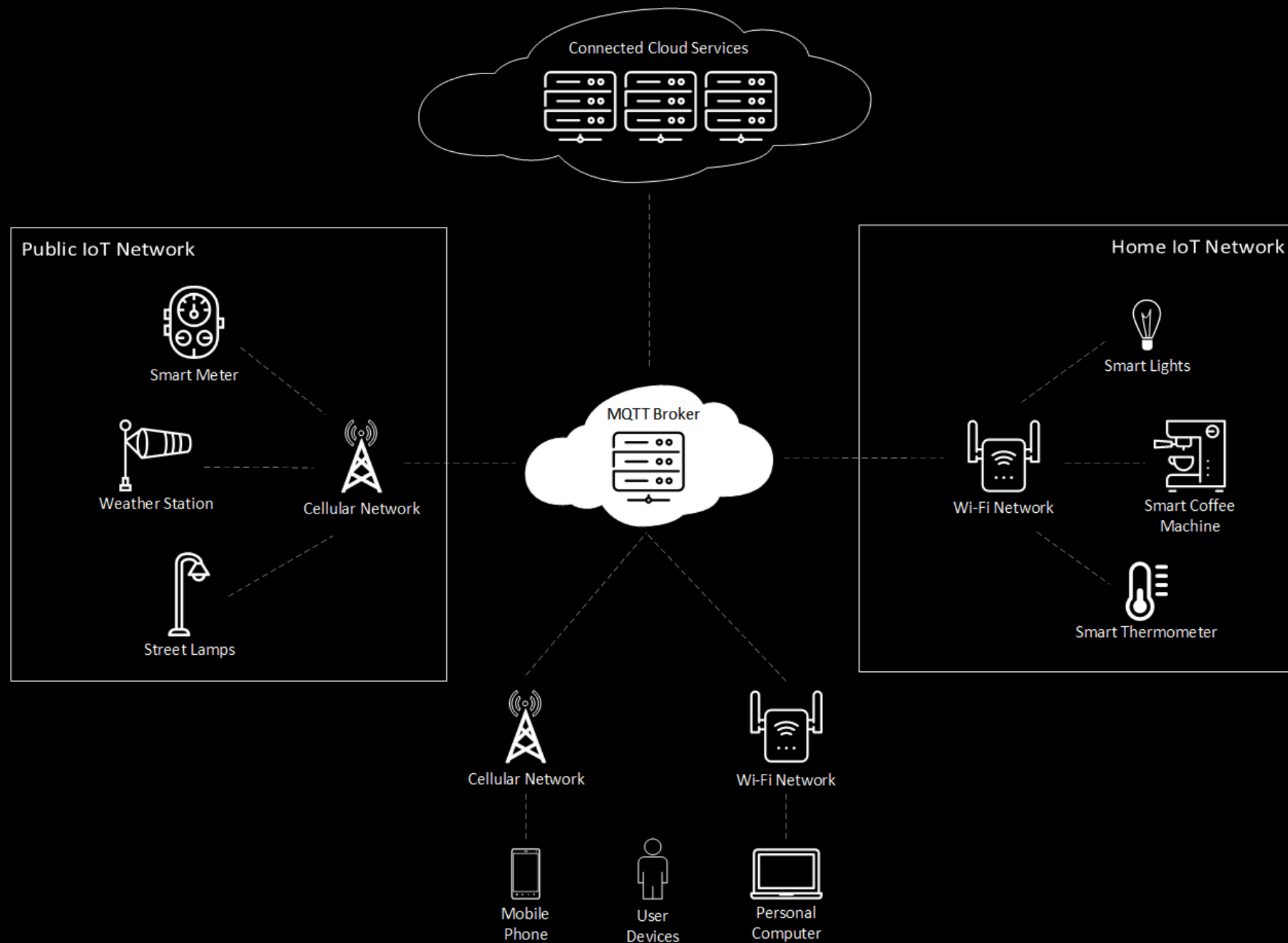


Quick MQTT Introduction

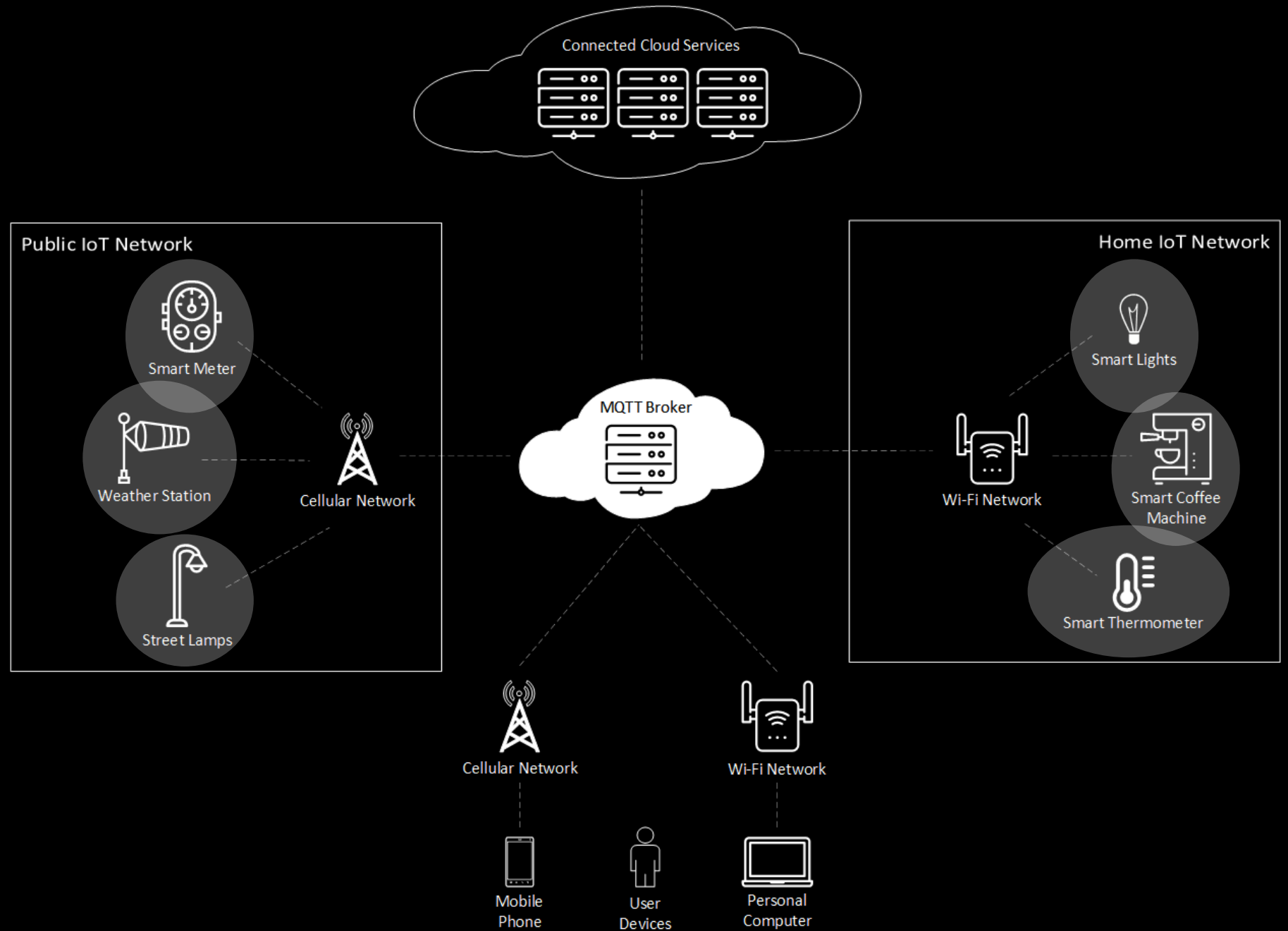
Chia Lih Wei (clw@nus.edu.sg)

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List some commonalities

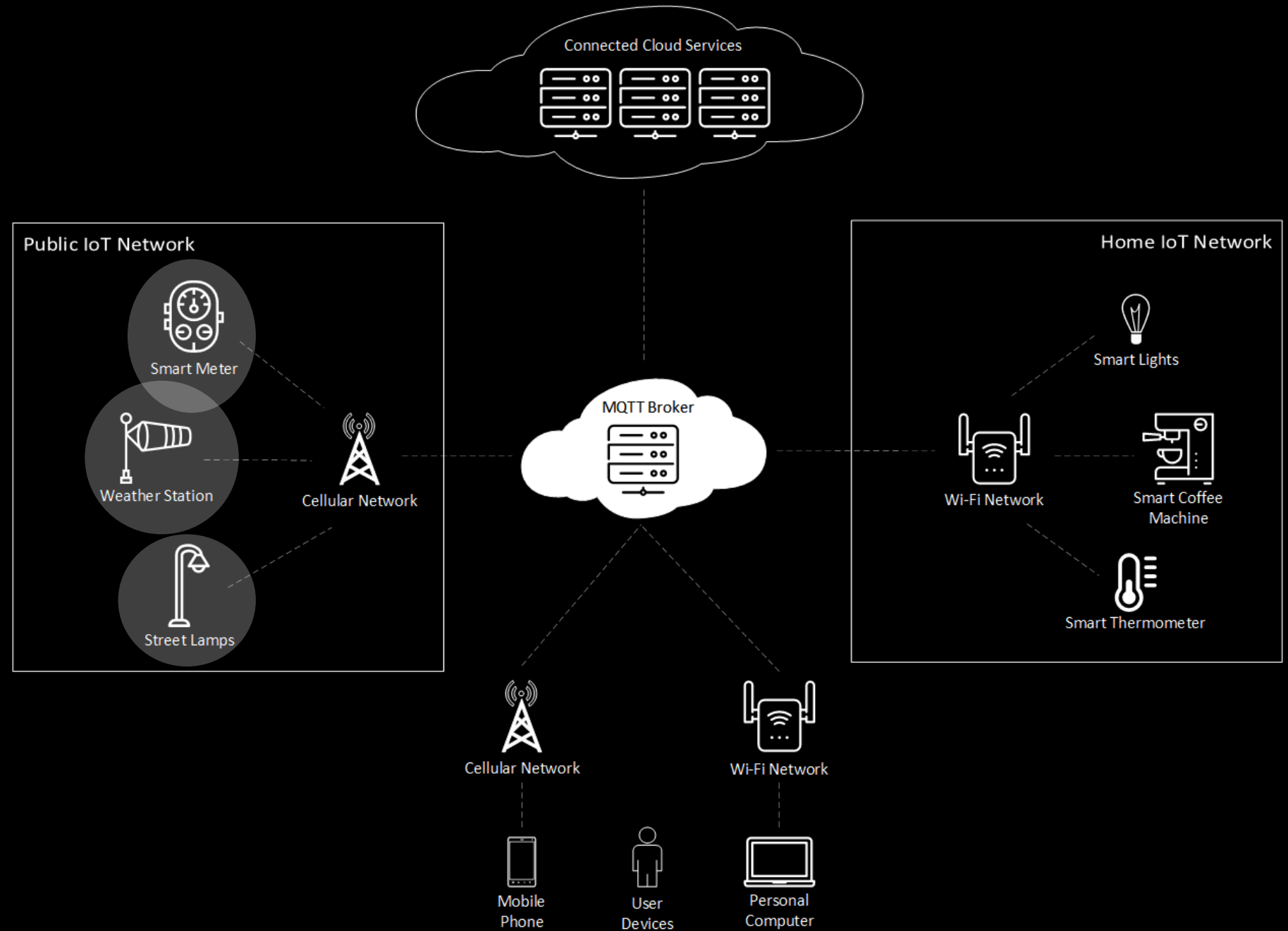
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Lack of Processing Capability



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Limited Data Rate + Limited Data Cap

IoTConnect Offerings

Singtel IoTConnect cellular technologies, comprising of 3G, 4G, CAT-M1 and NB-IoT networks, come with both standard SIM and durable ruggedised SIM options, provided with management capabilities from our IoT Control Centre.

Singtel IoTConnect	Standard	Frequency	Max. Throughput
4G	LTE-A, LTE-A Pro	1800MHz, 2600MHz	DL: 300Mbps UL: 150Mbps
3G	UMTS, HSPA (HSPDA), HSPA+	900MHz, 1800MHz	DL: 42Mbps UL: 8Mbps
CAT-M1	3GPP Rel-13	1.4 MHz	DL: 1Mbps/375Kbps UL: 1Mbps/300Kbps
NB-IoT	3GPP Rel-13	200KHz	DL: ~20Kbps UL: ~20Kbps

Low-Power Wide Area Networks

Low-Power Wide Area Networks (LPWANs) include CAT-M1 and NB-IoT which are 3GPP-standardised cellular solutions supported by an established ecosystem, ensuring interoperability across different network providers and prevents vendor lock-in. This means you will be able to scale up fast and enjoy rapid deployment.

Comparing Singtel CAT-M1 and NB-IoT

Network	Bandwidth	Coverage	Capacity	Mobility	Voice	Possible Usage
CAT-M1	1.4Mhz	160dB (+15dB)	To be verified	Connected & idle	Supported	Mobile applications with higher service requirements
NB-IoT	200kHz	164dB (+20dB)	200K devices/cell	Limited	Not supported	Ultra-low end applications such as sensors, meters, smoke alarms, and more

From (PDF):
<https://www.singtel.com/content/dam/singtel/business/globalservices/Featured%20Articles/brochure-iotconnect.pdf>

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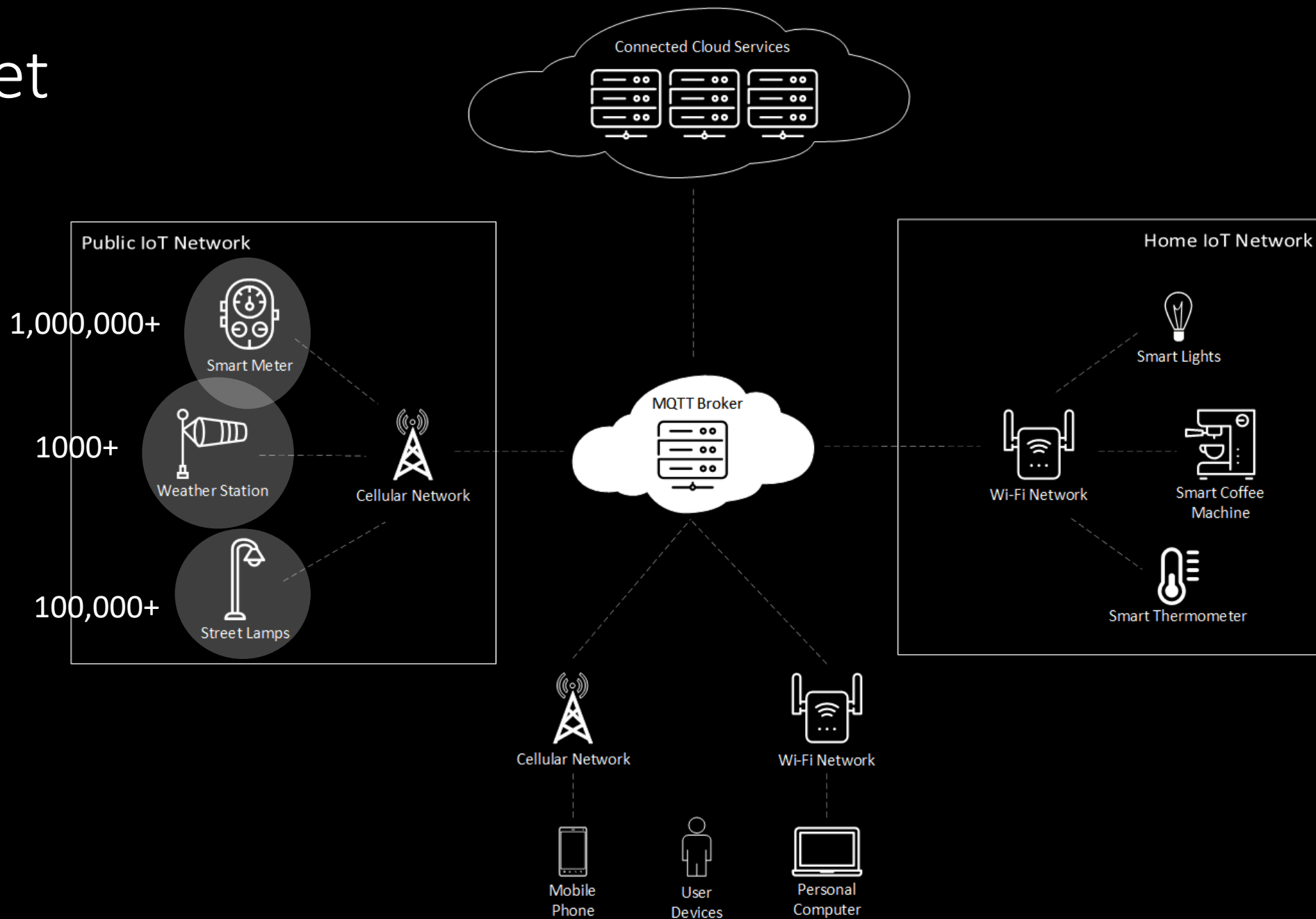
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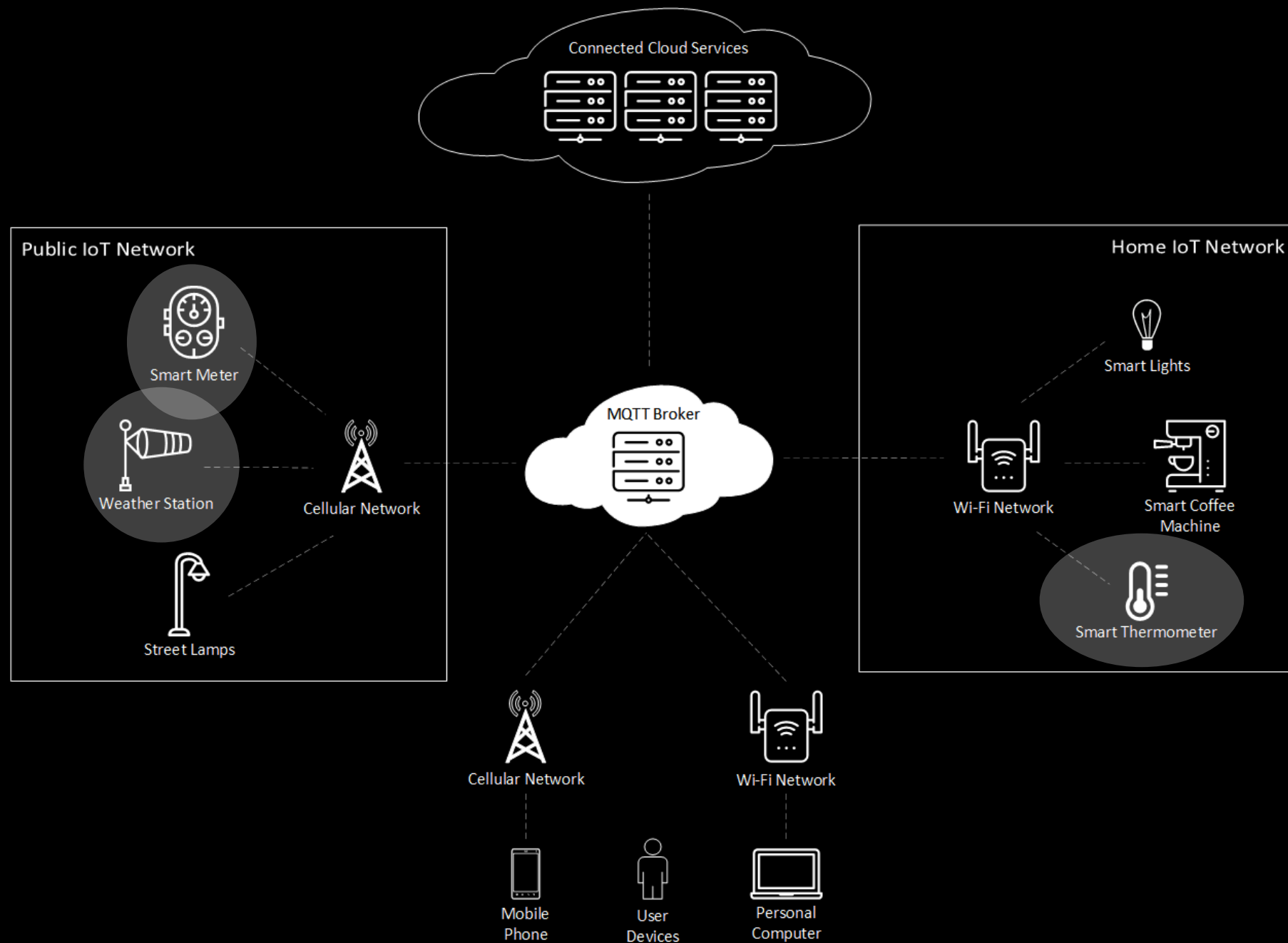
From (PDF):

<https://www.singtel.com/content/dam/singtel/business/globalservices/Featured%20Articles/brochure-iotconnect.pdf>

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The Internet of Things



(Extremely) Limited Power Source



Image source: Getty Images/iStockphoto



Image source: Flonidan A/S



2.5cm

Image source: Saft Groupe SAS



Image source: UniBot

Issues Facing IoT Devices

- Limited processing capability
- Limited data rate
- Limited data cap
- (Extremely) Limited power source

Issues Facing IoT Devices

- Limited processing capability¹
- Limited data rate²
- Limited data cap³
- (Extremely) Limited power source⁴

Thus, data transfers must be

- Simple^{1, 4}
- Lightweight^{2, 3, 4}

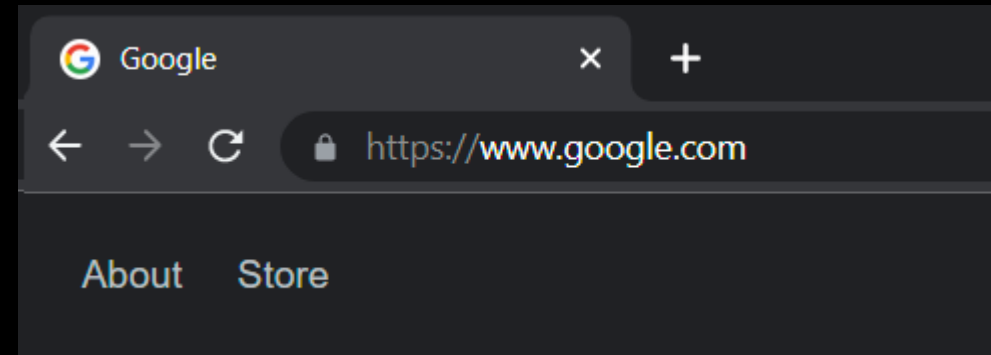
Message Queue Telemetry Transport

MQTT

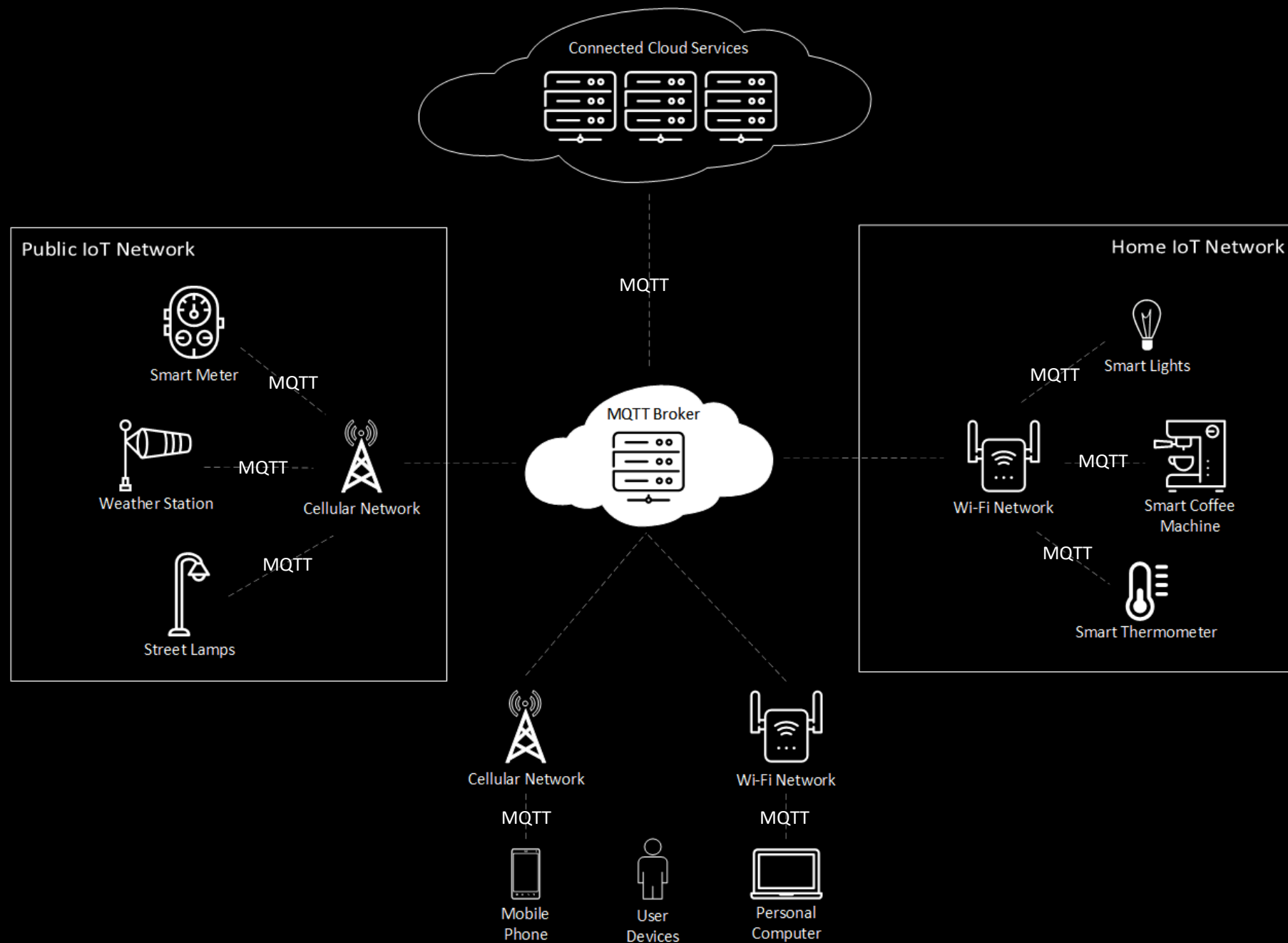
MQTT is the
Communication Protocol

Communication Protocol?

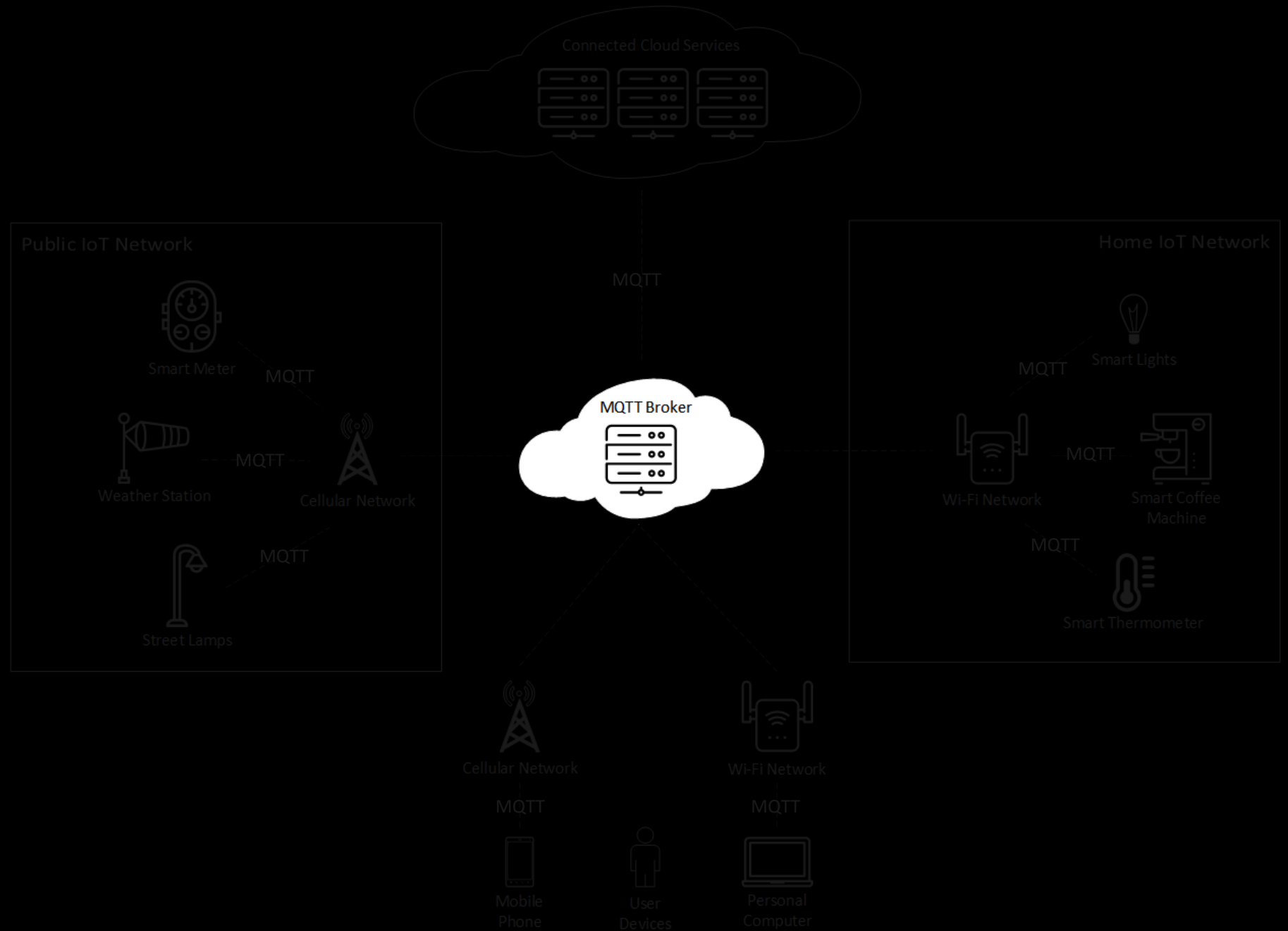
- Communication protocols you use daily:
 - HTTP/HTTPS – Web browsing
 - RTSP/RTP – Video streaming
 - SMTP/POP/IMAP - Emails
 - FTP – File downloads (legacy)
- Standards for machines to talk to each other to exchange information efficiently



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The Internet of Things



Issues Facing IoT Devices

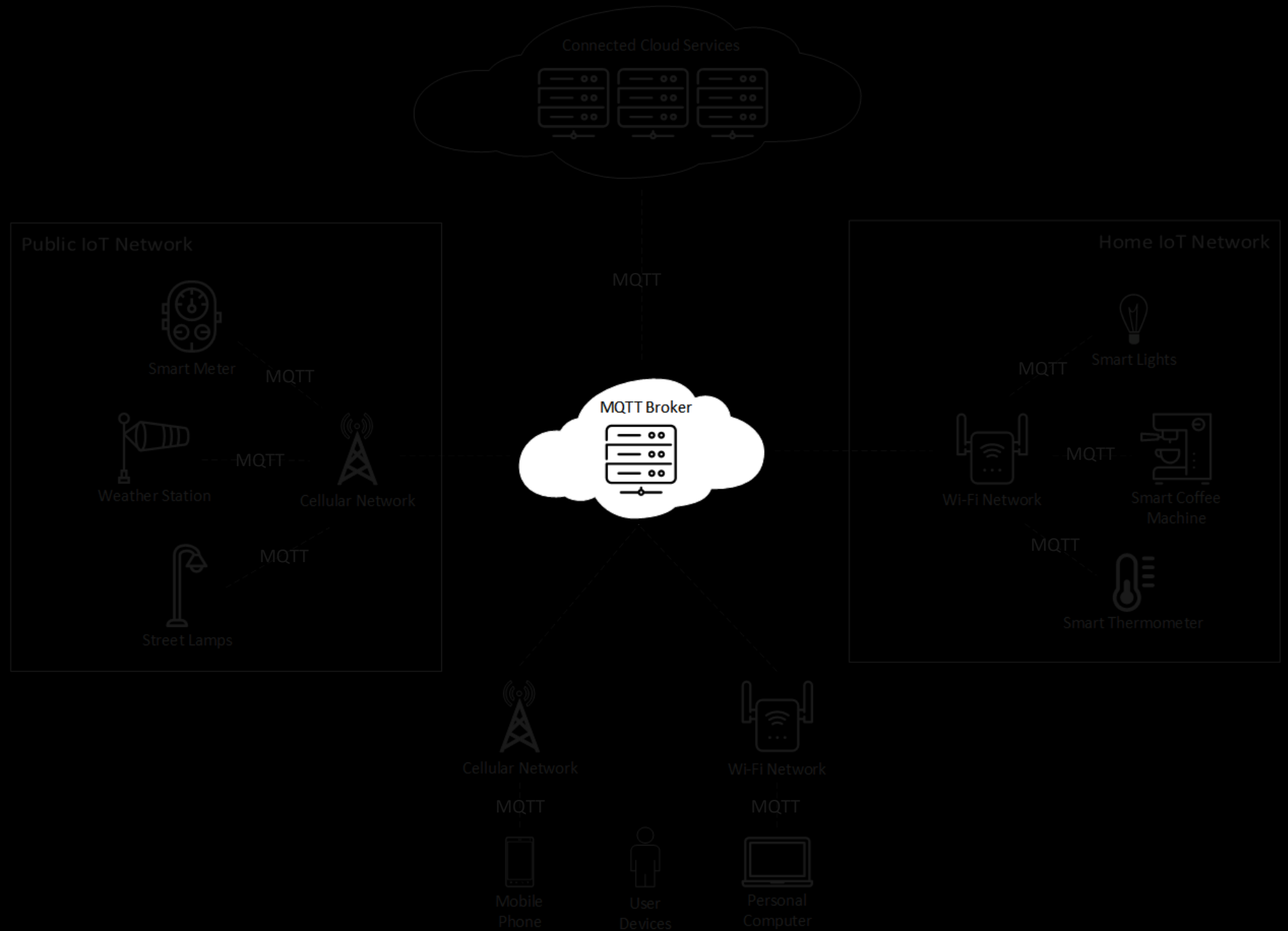
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Issues Facing IoT Devices

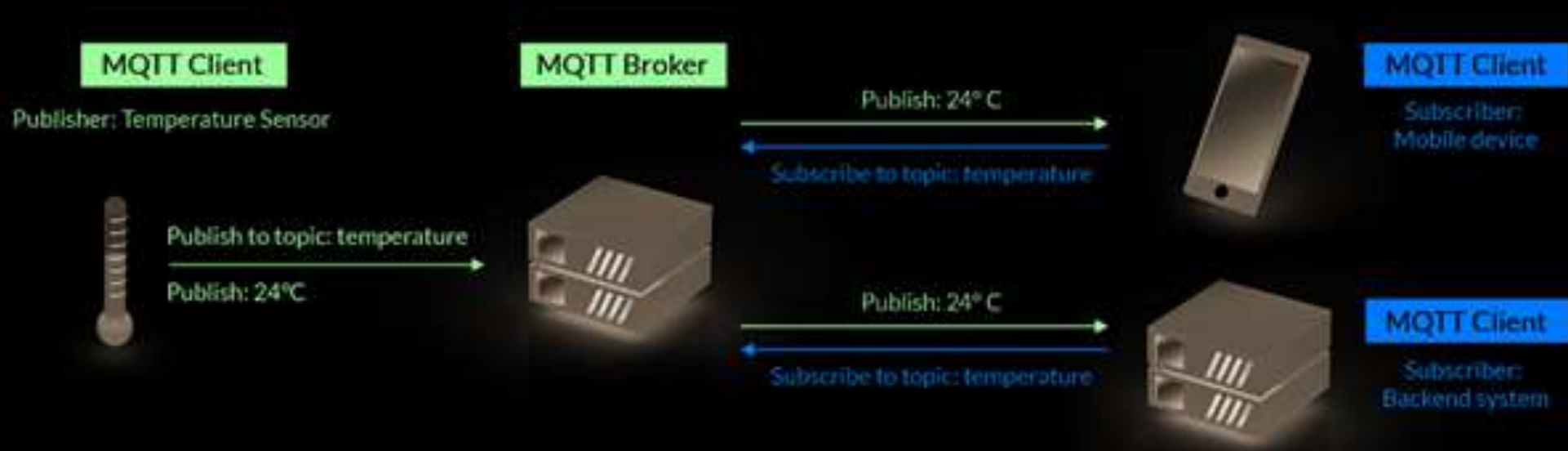
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- ~~(Extremely) Limited power source~~



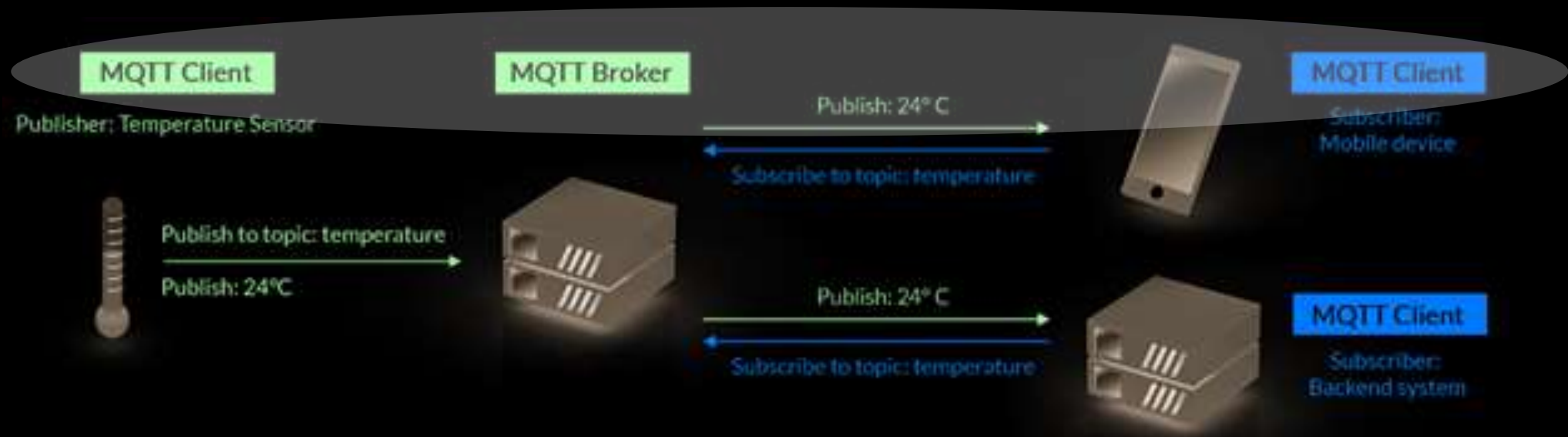
The Internet of Things



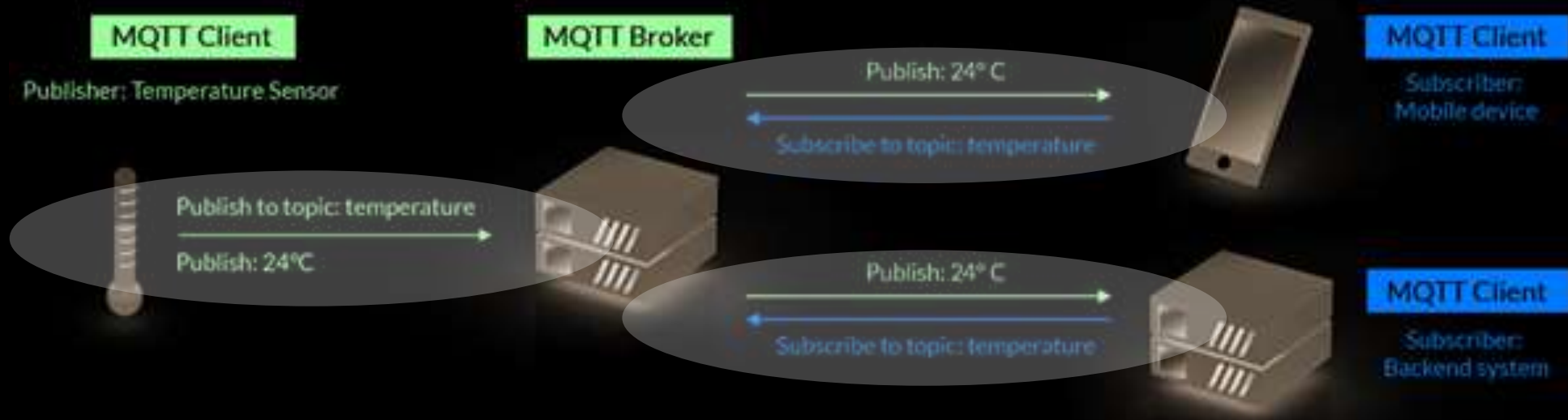
Achieving Simplicity: Publish-Subscribe Architecture



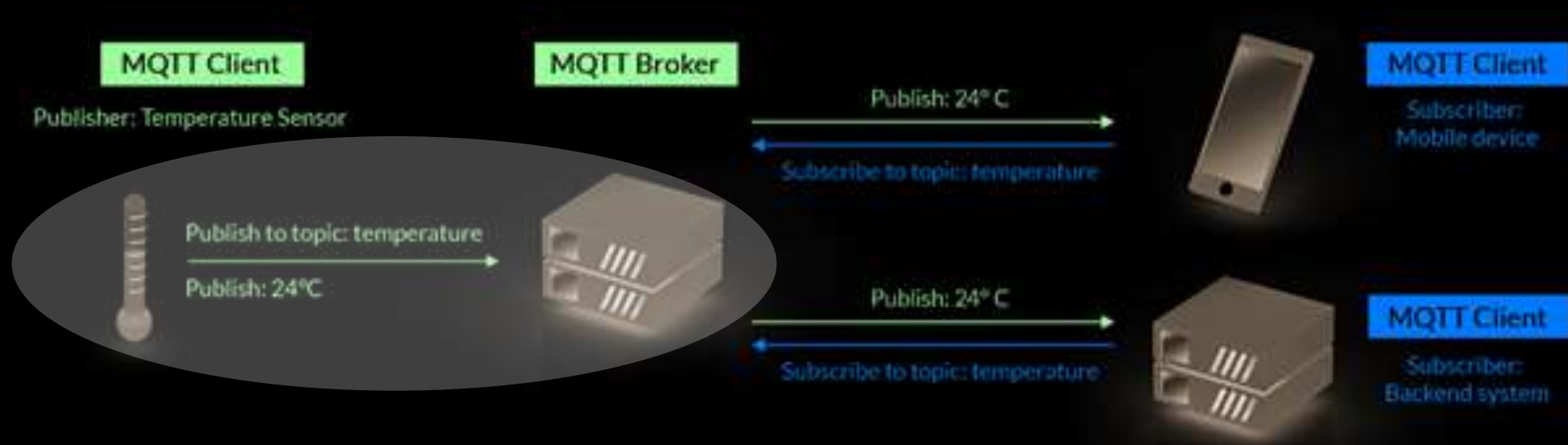
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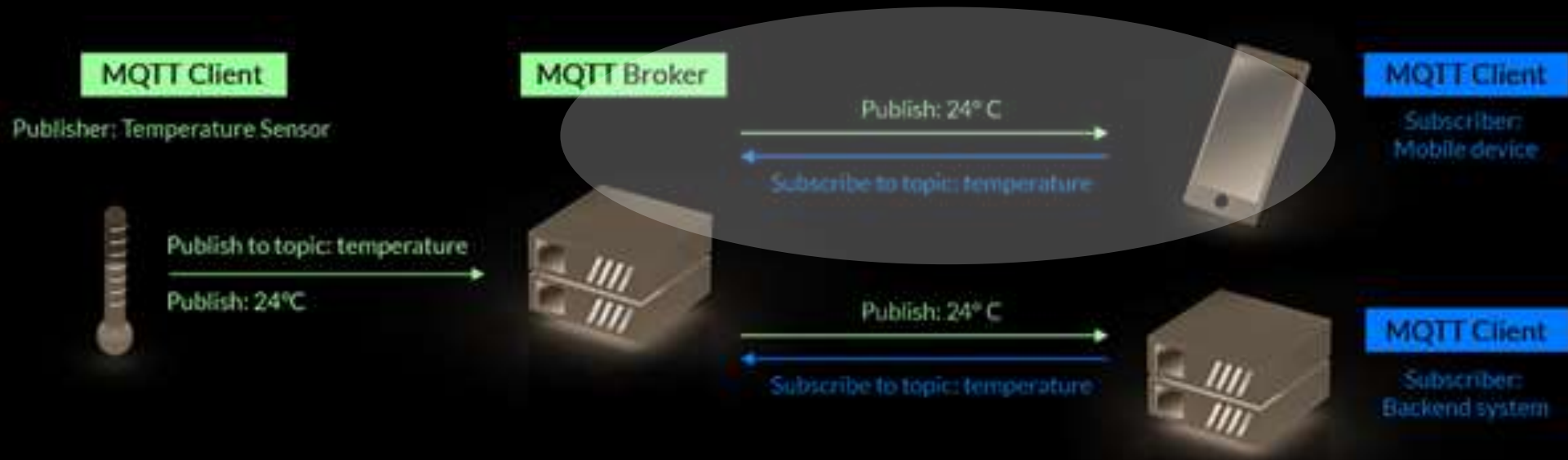
Achieving Simplicity: Publish-Subscribe Architecture



Achieving Simplicity: Publish-Subscribe Architecture



Achieving Simplicity: Publish-Subscribe Architecture



For further information

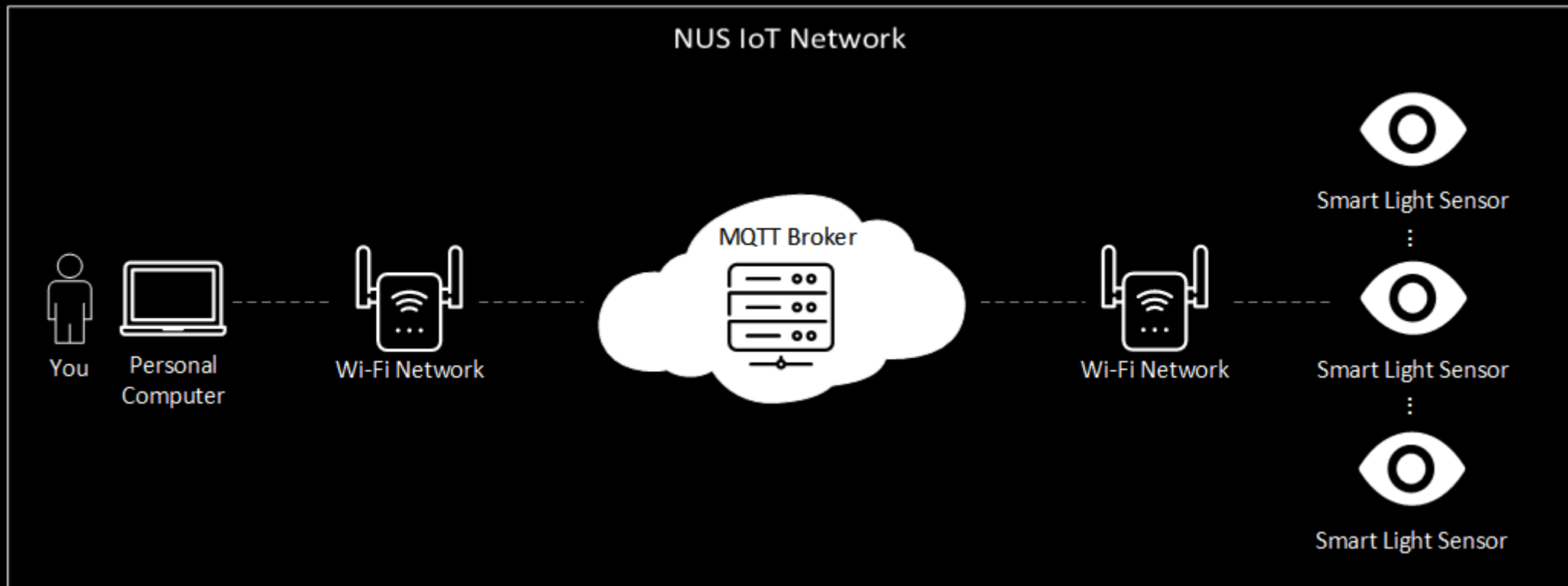
Read the lab manual for a brief on the features of MQTT

Or check out the excellent 10-part series by HiveMQ:

<https://www.hivemq.com/blog/mqtt-essentials-part-1-introducing-mqtt/>

Demonstration

Setup – Collecting Data from a MQTT Sensor



Setup – Collecting Data from A MQTT Sensor

