Lec16 - IOT平台关键技术

通信协议

IOT协议

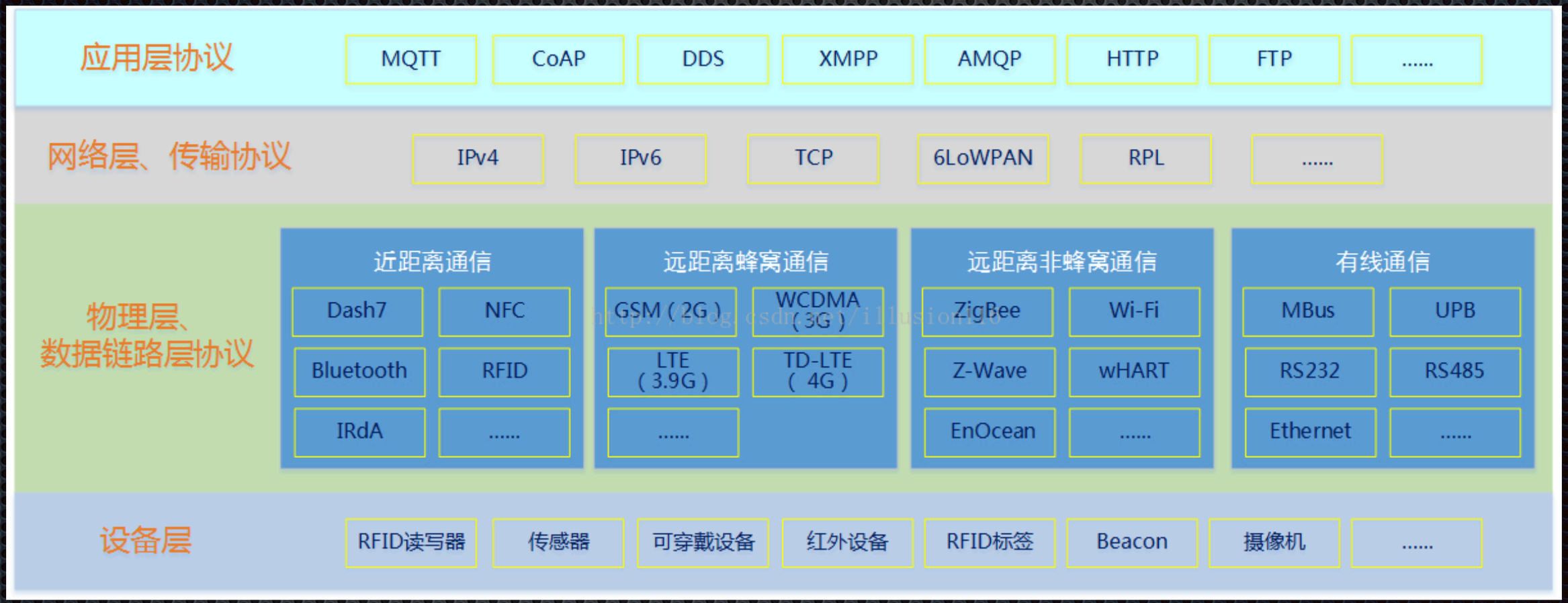

应用层协议
MQTT
CoAP
DDS
XMPP
AMQP
HTTP
FTP
.....
网络层、传输协议
IPv4
IPv6
TCP
6LoWPAN
RPL
.....
物理层、
数据链路层协议
近距离通信
Dash7
NFC
Bluetooth
RFID
IRdA
.....
远距离蜂窝通信
GSM (2G)
WCDMA (3G)
LTE (3.9G)
TD-LTE (4G)
.....
远距离非蜂窝通信
ZigBee
Wi-Fi
Z-Wave
wHART
EnOcean
.....
有线通信
MBus
UPB
RS232
RS485
Ethernet
.....
设备层
RFID读写器
传感器
可穿戴设备
红外设备
RFID标签
Beacon
摄像机
.....

TABLE 1. Some of the data link layer protocols comparison.

Technology	Throughput *(Approximate)* *(Kbps)*	Range *(Approximate)* *(m)*	Mobility Support
NFC	424	0.1	Yes
ANT+	1,000	50	Yes
ZigBee	250	100	Yes
Z-Wave[1]	40	100	Yes
Bluetooth[3]	1,000	100	Yes
WiFi	54,000	150	Yes
WirelessHART	250	150	Yes
Weightless-W	10,000	5,000	Yes
LTE-M	1,000	11,000	Yes
LoRaWAN	0.3[4]	14,000	Yes
Sigfox[2]	0.1	17,000	Yes
NB-IoT	200	20,000	No[5]

[1] outdoor or open air; indoor is approximately 50m

[2] data rate may vary depending on the deployed region (up to 600 bps)

[3] Bluetooth 5 can support a range of approximately 150m (outdoor) with up to 8x broadcasting capacity

[4] range up to 50kbps if using Frequency-Shift Keying (FSK) instead of LoRa

[5] minimal, no full support for mobility as in LTE (possibly during cell reselection - idle state)

APPLICATION LAYER PROTOCOL

- HTTP/REST
  - REST即表述性状态传递，是基于HTTP协议开发的一种通信风格
- 受限应用协议(CONSTRAINED APPLICATION PROTOCOL，CoAP)
  - 是一种web传输协议，用于运行在受限(例如低功耗、有损)的网络
- 消息队列遥测传输（Message Queue Telemetry Transport， MQTT ）
  - 是一种轻量级、基于发布-订阅模式的消息传输协议，适用于资源受限的设备和低带宽、高延迟或不稳定的网络环境
- 高级消息队列协议（ADVANCED MESSAGE QUEUING PROTOCOL，AMQP）
  - OASIS和ISO标准，通常用于企业环境，并侧重于互操作性
  - 轻量级但可扩展的消息传递协议，专为M2M消息传递而设计
- 数据分发服务DDS（DataDistributionService，DDS）
  - 采用发布/订阅体系架构，强调以数据为中心，提供丰富的QoS服务质量策略，能保障数据进行实时、高效、灵活地分发，可满足各种分布式实时通信应用需求
- 可扩展通讯和表示协议（Extensible Messaging and Presence Protocol，XMPP）
  - 网络元素之间的实时通信和xml数据流
- WebSocket

IoT APPLICATION RANGE REQUIREMENTS

TABLE 2. IoT application range requirements [120]–[123], [130]–[140].

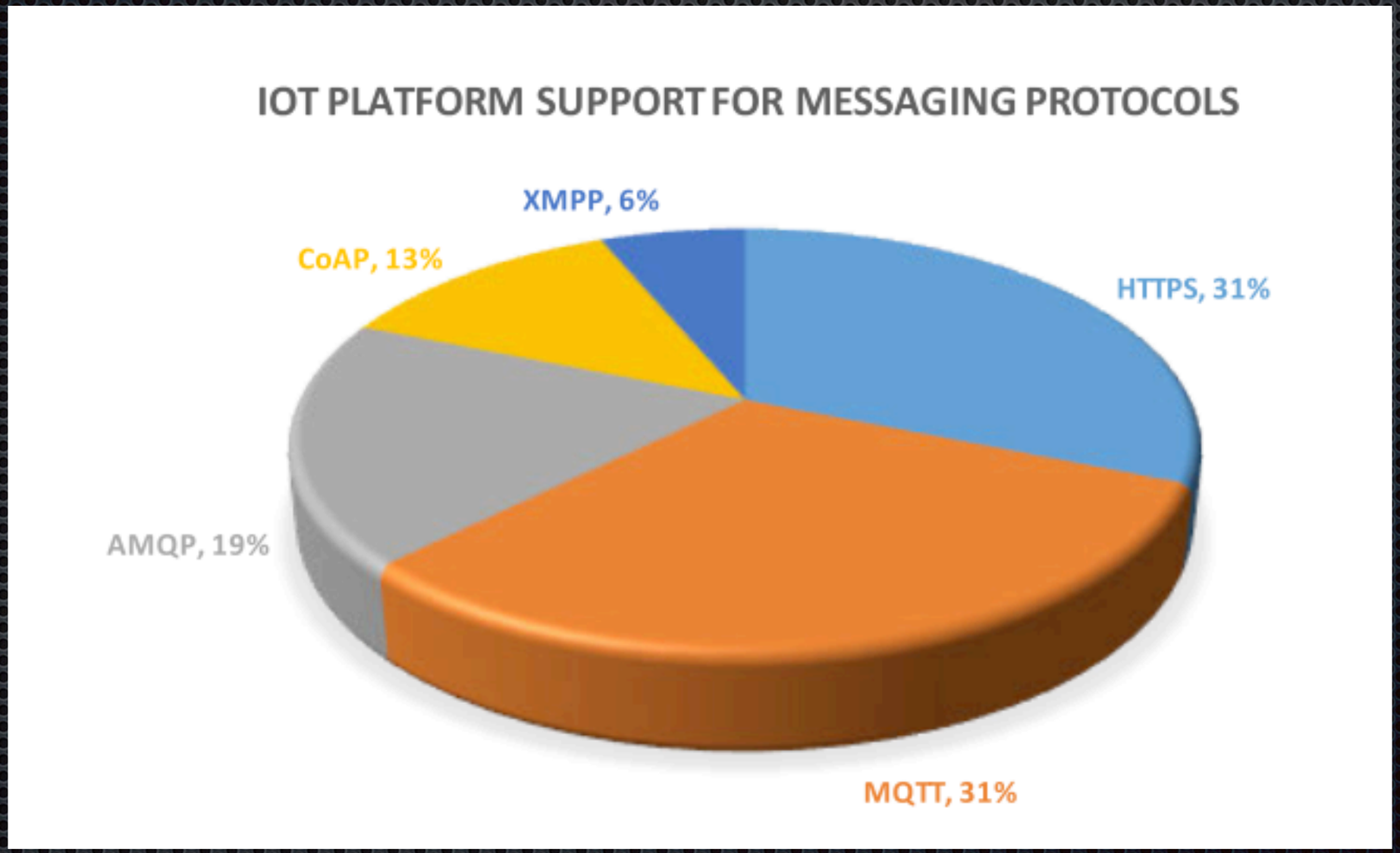
Application	~ Range	Technology
Industry Automation	10m - 50m	LoRa, ZigBee, WirelessHART
Smart Metering	15km - 40km	LoRa, Weightless-N
Smart Buildings	10m - 250m	LoRa, Sigfox
Asset Tracking	50m - 500m	LoRa, Sigfox, Weightless
Smart Energy	100m - 15km	LoRa
Environmental Monitoring	100m - 1.5km	LoRa, Sigfox
Health Monitoring	10m - 25m	BLE, LoRa, ZigBee, ANT+
Wearable & Fitness	30m-50m	ANT+, BLE
Consumer Electronics	10m-25m	ZigBee, Z-Wave, BLE

云上支持的物联网消息协议

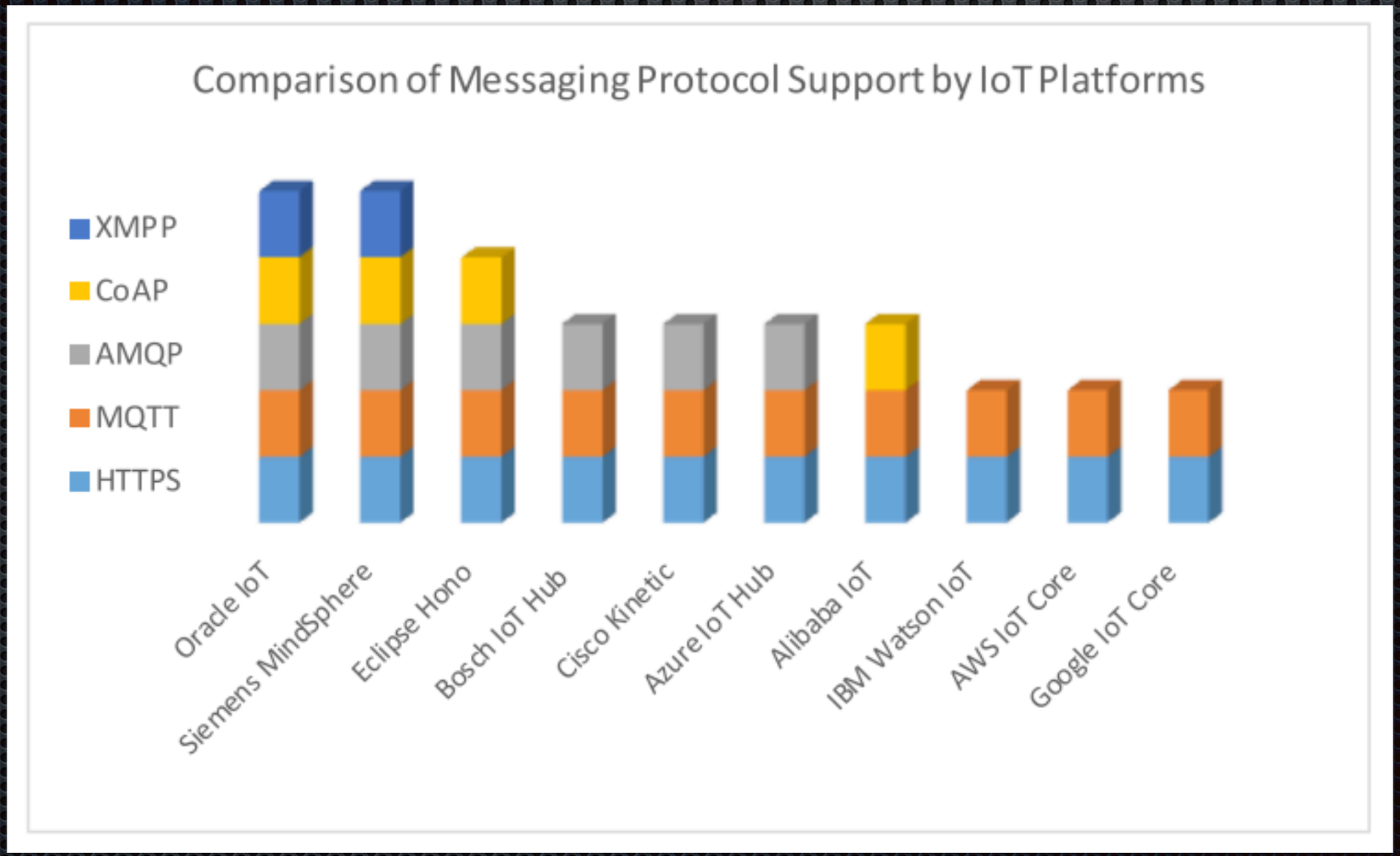
IoT Platform, *Year of First General Availability (GA)*	Protocol
Azure IoT Hub [166], *2014*	HTTP(S), MQTT, MQTT over WebSocket, AMQP, AMQP over WebSocket *custom protocols transmit via a gateway*
Google IoT Core [167], *2018*	HTTP(S), MQTT *custom protocols transmit via a gateway*
IBM Watson IoT [168] *2014*	HTTP(S), MQTT
AWS IoT Core [169] *2015*	HTTP(S), MQTT, MQTT over WebSocket, WebSocket
Alibaba IoT [170] 2015	HTTP(S), CoAP, MQTT, MQTT over WebSocket, WebSocket, *support network types: 3G, 4G, NB-IoT & LoRa*
Oracle IoT [171] *2016*	HTTP(S), CoAP, MQTT, AMQP, XMPP, WebSocket
Siemens MindSphere [172] *2016*	HTTP(S), CoAP, MQTT, AMQP, XMPP, *supports wide range of device protocols via field gateways (e.g. MindConnect) such as OPC UA, LoRaWAN, Modbus, 6LoWPAN, LwM2M*
Bosch IoT Hub [173] *2017*	HTTP(S), MQTT, AMQP, LoRaWAN
Cisco Kinetic [174] *2017*	HTTP(S), MQTT, AMQP, WebSocket *custom protocols transmit via a gateway (e.g. Cisco IoT Gateway)*
Eclipse Hono [175] *2018*	HTTP(S), CoAP, MQTT, AMQP *uses AMQP 1.0 as primary messaging protocol custom protocols transmit via a gateway*

表：现有物联网支持的协议/技术列表

物联网平台支持的消息协议分布



物联网平台支持的消息协议比较



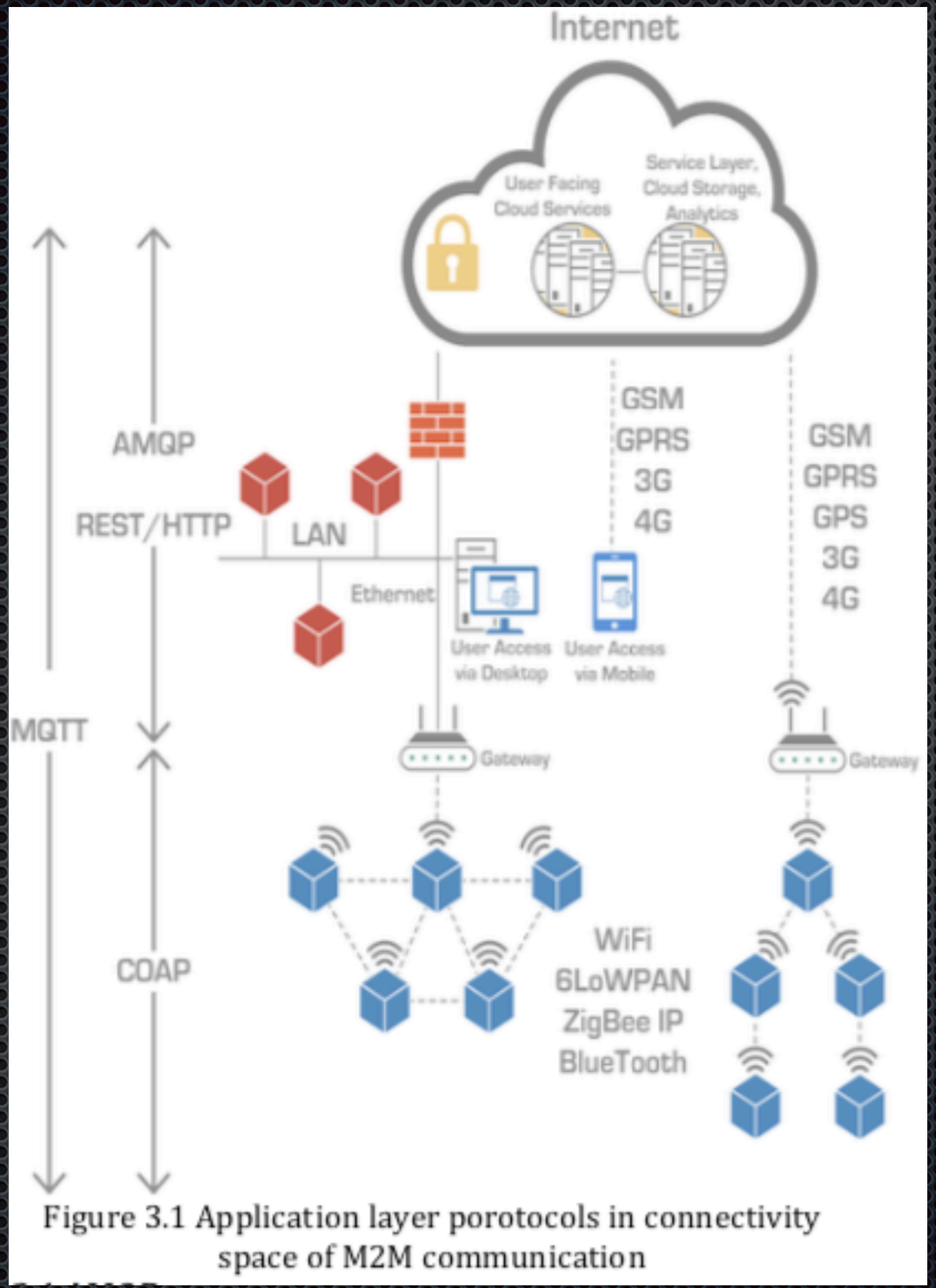
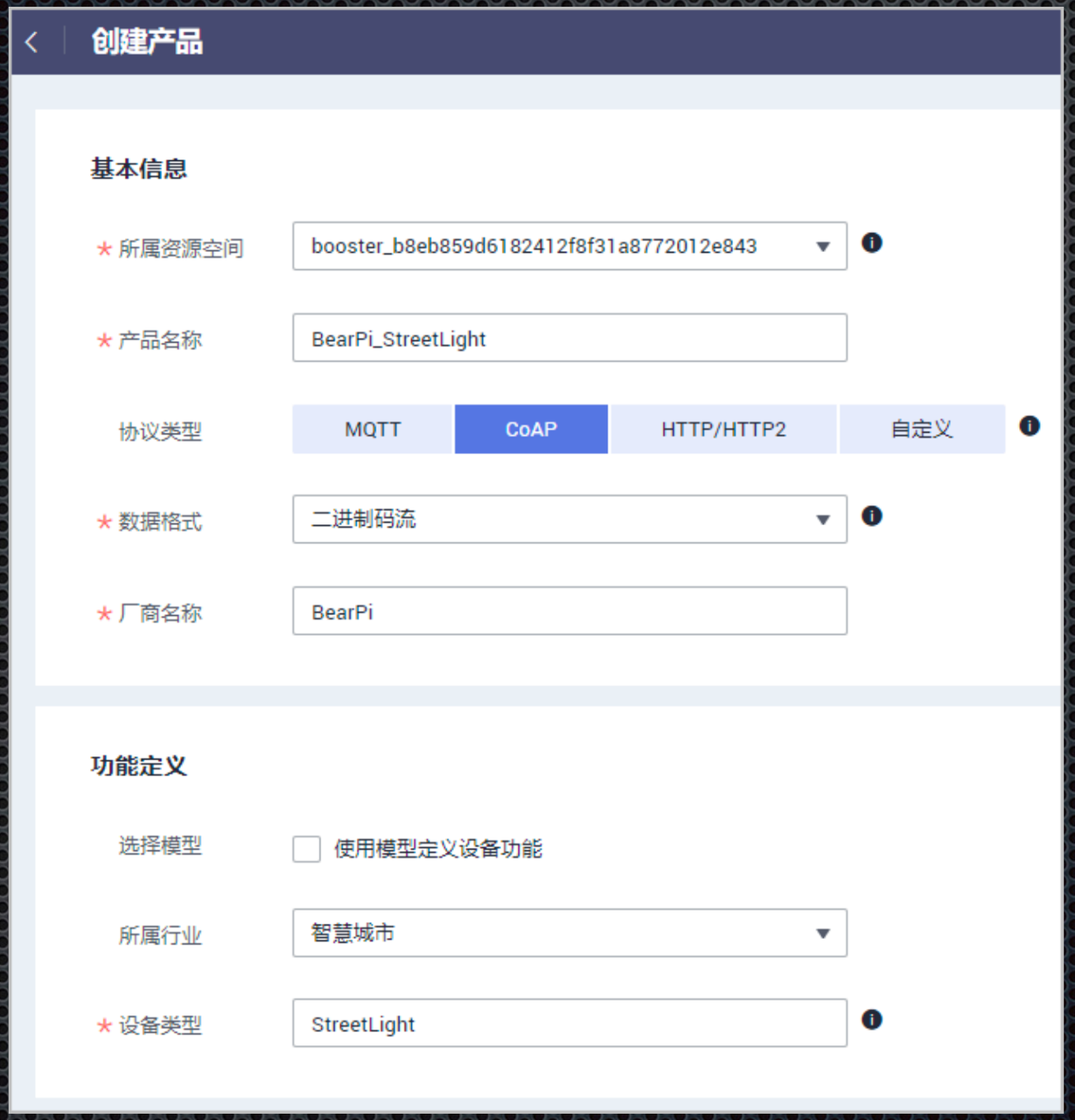


Figure 3.1 Application layer porotocols in connectivity space of M2M communication

A Survey of MAC Layer Issues and Application layer Protocols for Machine-to-Machine Communications

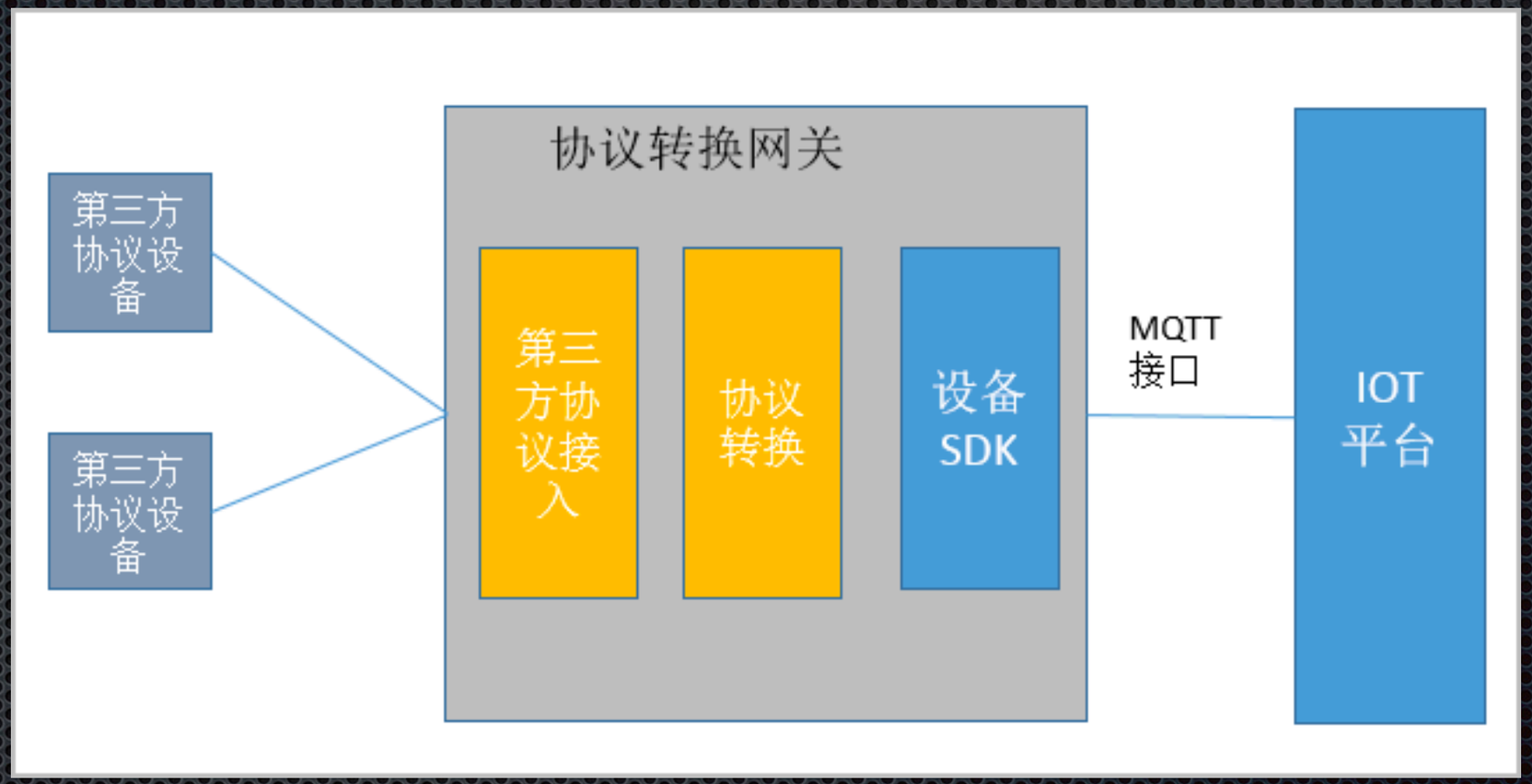
连接管理

- MQTT，COAP，HTTP/HTTP2
- 其他的协议?

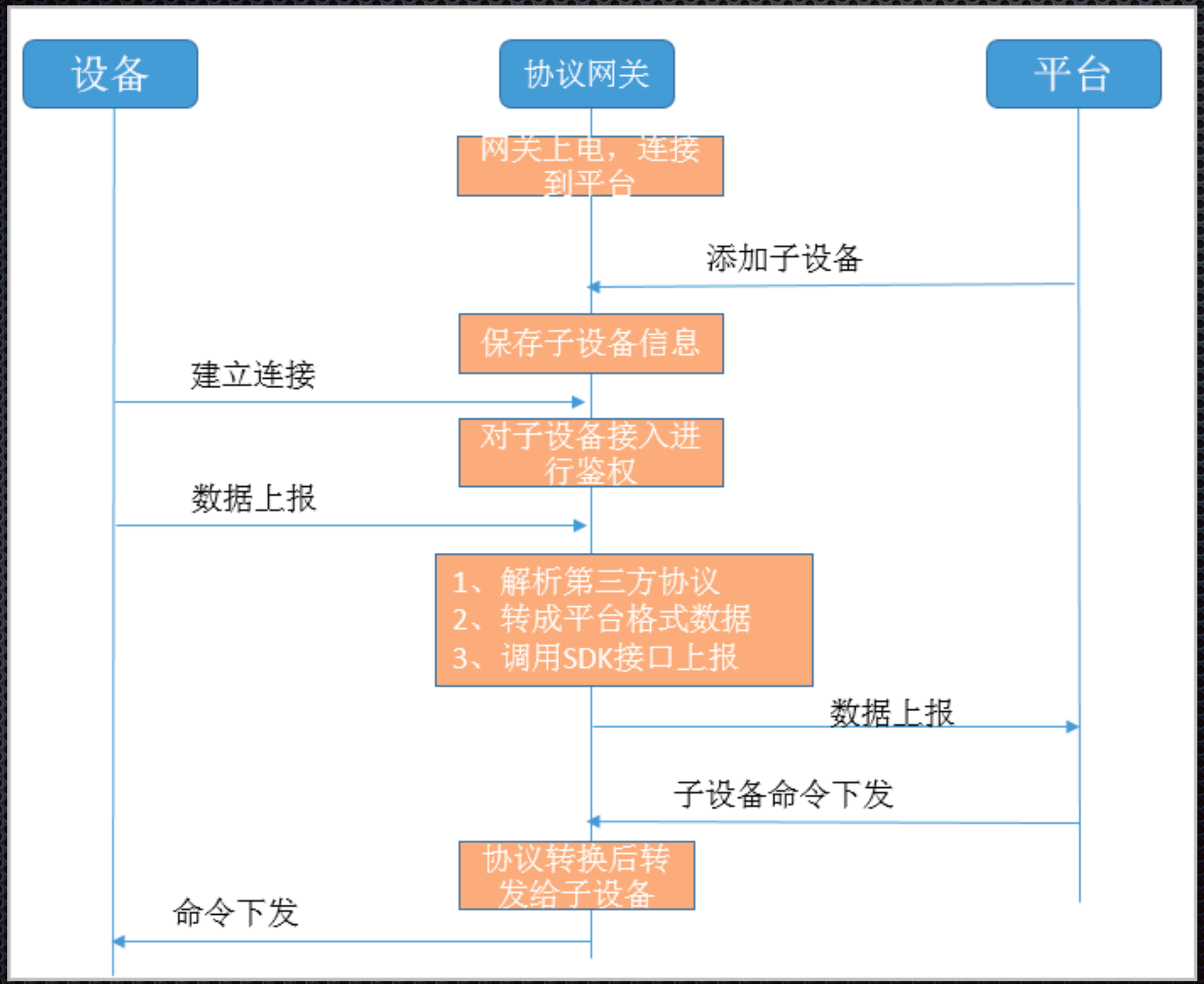


https://support.huaweicloud.com/bestpractice-iothub/iot_bp_0007.html

通过协议转换网关实现泛协议设备接入



https://support.huaweicloud.com/bestpractice-iothub/iot_bp_0009.html


设备
协议网关
平台
网关上电，连接到平台
添加子设备
保存子设备信息
建立连接
对子设备接入进行鉴权
数据上报
1、解析第三方协议
2、转成平台格式数据
3、调用SDK接口上报
数据上报
子设备命令下发
协议转换后转发给子设备
命令下发

参考文献

- Challenges and Opportunities in Edge Computing.pdf
- edge and fog computing for IoT A survey on current research activities future directions
- IDC：中国边缘基础设施市场概览报告发布——边缘云发展正当时
- https://zhuanlan.zhihu.com/p/55306124
- https://zhuanlan.zhihu.com/p/339727674