

The factory of the future



Industrial Ethernet

26 maart 2024 | De Basiliek, Veenendaal





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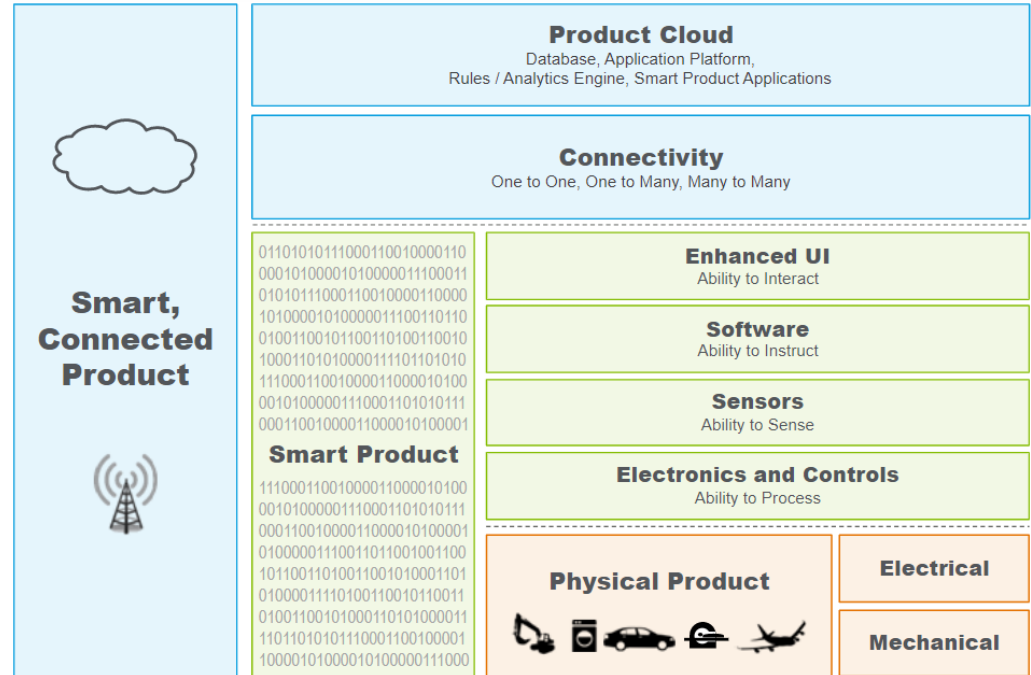
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• Wat is een Smart Connected Device?

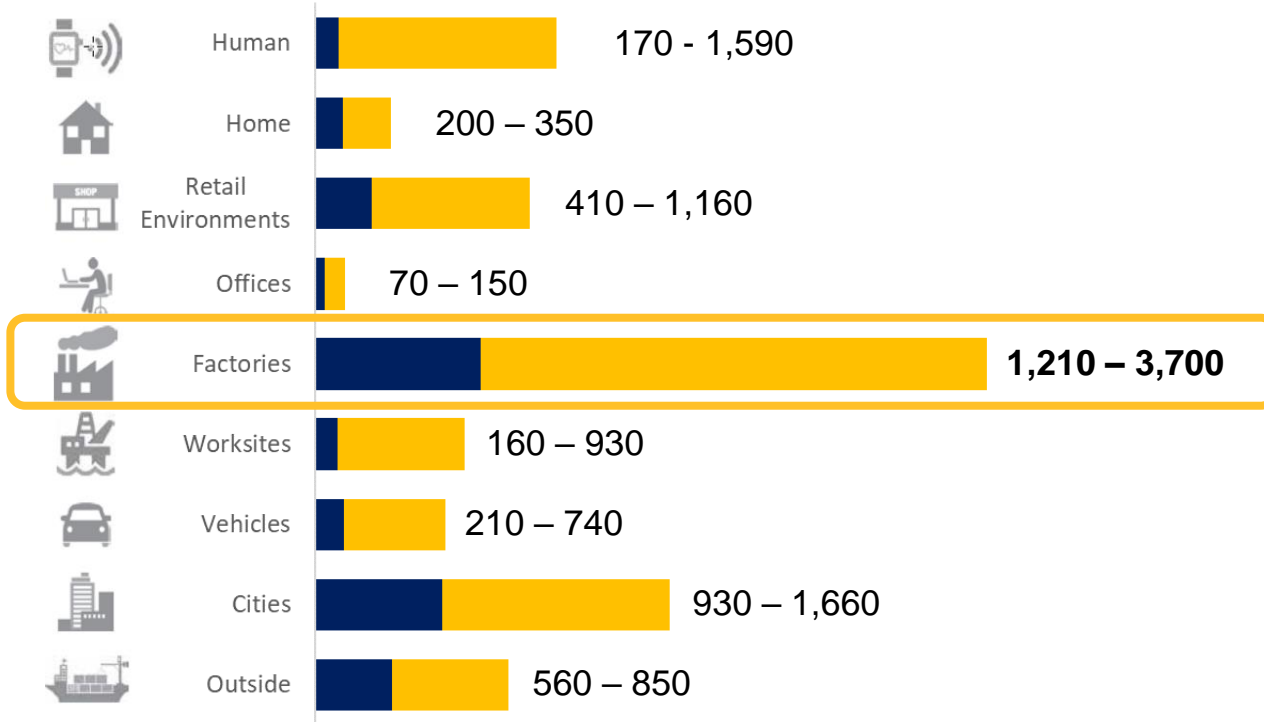
- 3 basis componenten:
 - Fysieke componenten
 - Smart componenten
 - Connectivity componenten
 - One to one
 - One to many
 - Many to many



Praktijk voorbeelden:

- Lift-technologie
 - 50% sneller door patroon herkenning.
- Energie sector
 - Blackouts voorspellen voordat ze optreden.
 - Dit wordt mogelijk door de analyse van grote hoeveelheden data.
- Klimaat beheersing gebouwen
 - Plafond ventilatoren gaan aan wanneer iemand binnenkomt en worden afgestemd op persoonlijke behoeften
- Kwaliteitssystemen en productiviteitsverbeteringen voor bedrijven en overheden
 - Dashboards met productie en bedrijfsinformatie.
 - Track and trace van producten
 - Wetgeving (kilometer registratie)
- Real-time Besturing logistieke systemen
 - Koppeling interne transport en voorraad systemen aan externe systemen (TNT/DHL/Amazon)





\$3.7T

Maximale potentiële waarde van IoT in de Setting van bedrijven

Belangrijkste toepassingen

Optimalisatie productie proces,
Preventief onderhoud,
Verbeteren voorraad beheer,
Gezondheid en veiligheid

MCKINSEY GLOBAL INSTITUTE: THE INTERNET OF THINGS: MAPPING THE VALUE BEYOND THE HYPE

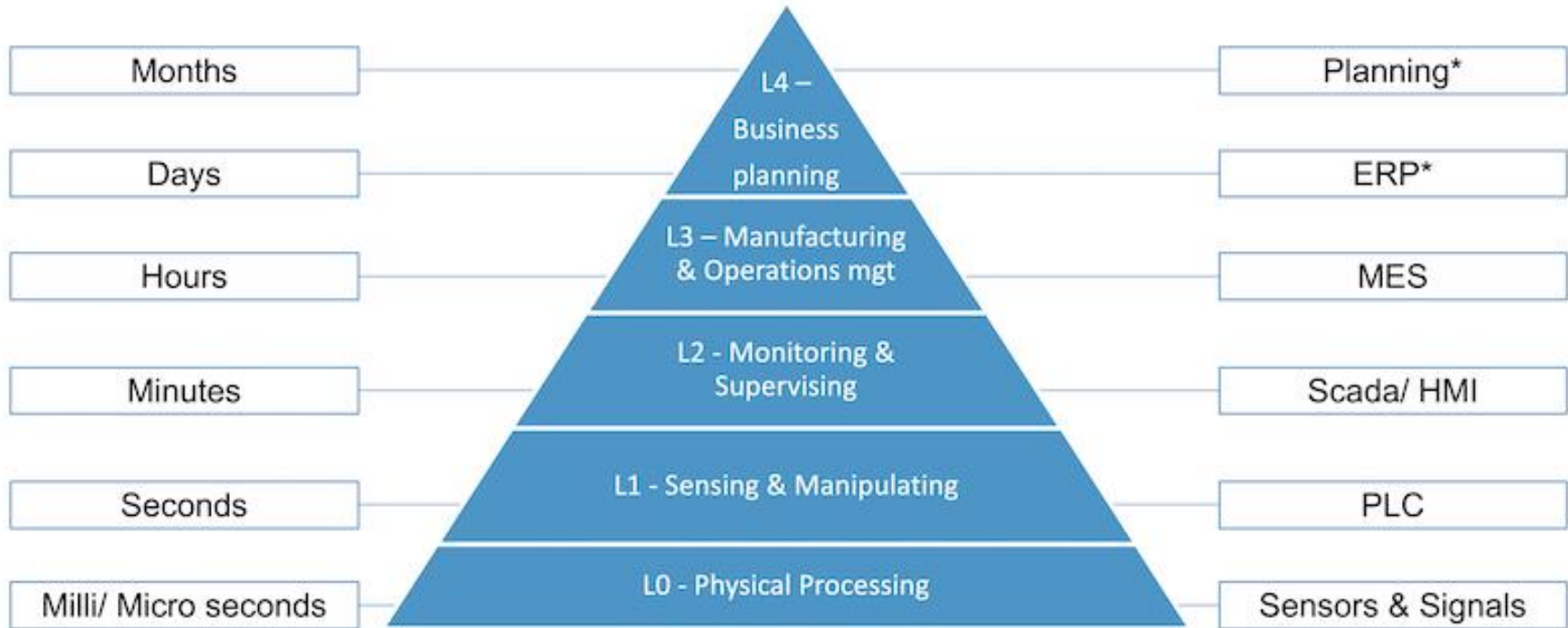


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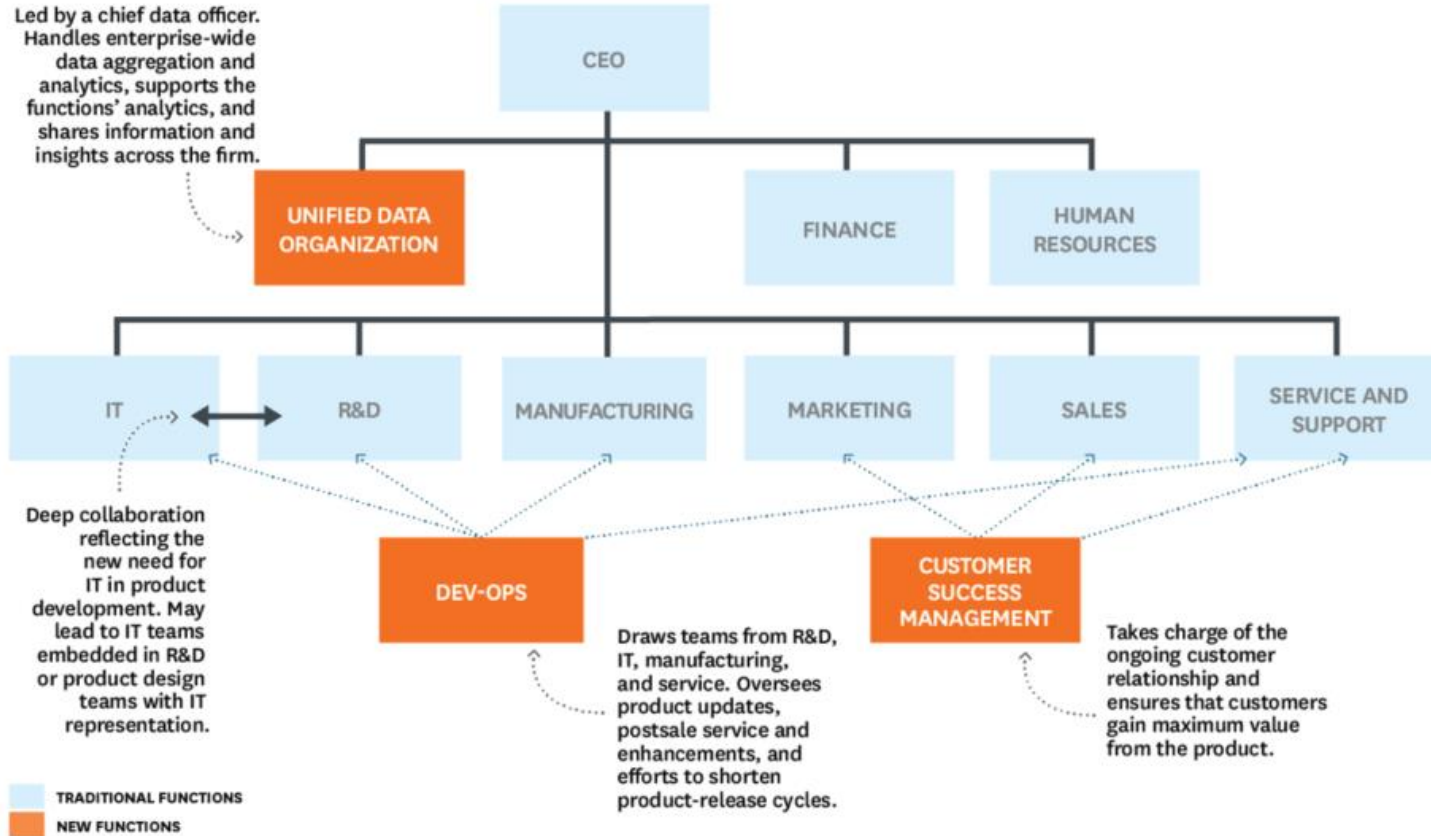
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ISA 95 – AUTOMATION PYRAMID



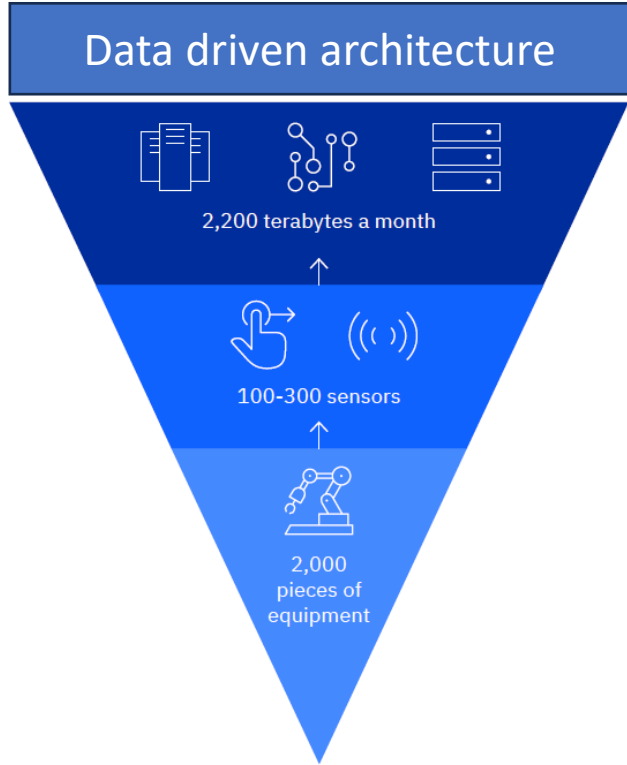
Organizations Change !



Organisaties processen meer DATA!

- DATA (beschikbaarheid van data en data analyse tools)
- Diagnose, Voorspelling, Normering van processen en acties
- Product ontwikkeling (user-experience , kwaliteit, support etc)
- Productiesystemen automatiseren / koppelingen (Smart Factory)
- Logistieke keten integratie (RFID, T&T, Vision, Planning, AI, etc.)
- Sales (Systemen “as a service”)
- Service (preventief onderhoud, storingen oplossing, instructies)
- Veiligheidsaspecten netwerk en data (IT-security, autorisatie, hacking)
- HRM (skill set en opleiding personeel)





Source: IBM Institute for Business Value

Data intensity

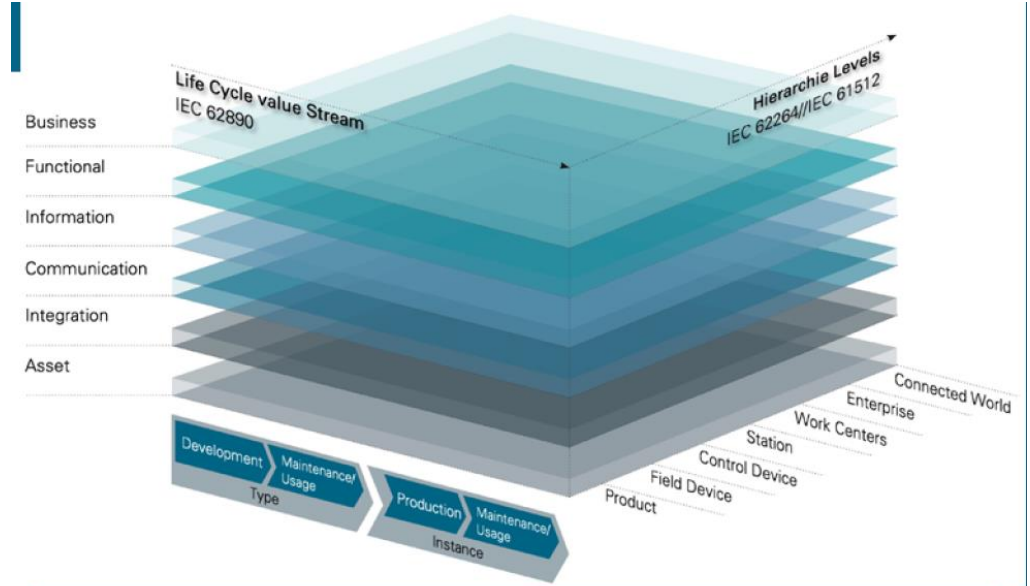


Figure 2 Representation of Reference Architecture Industry 4.0 as a "RAMI cube" (source: Industry 4.0 platform)

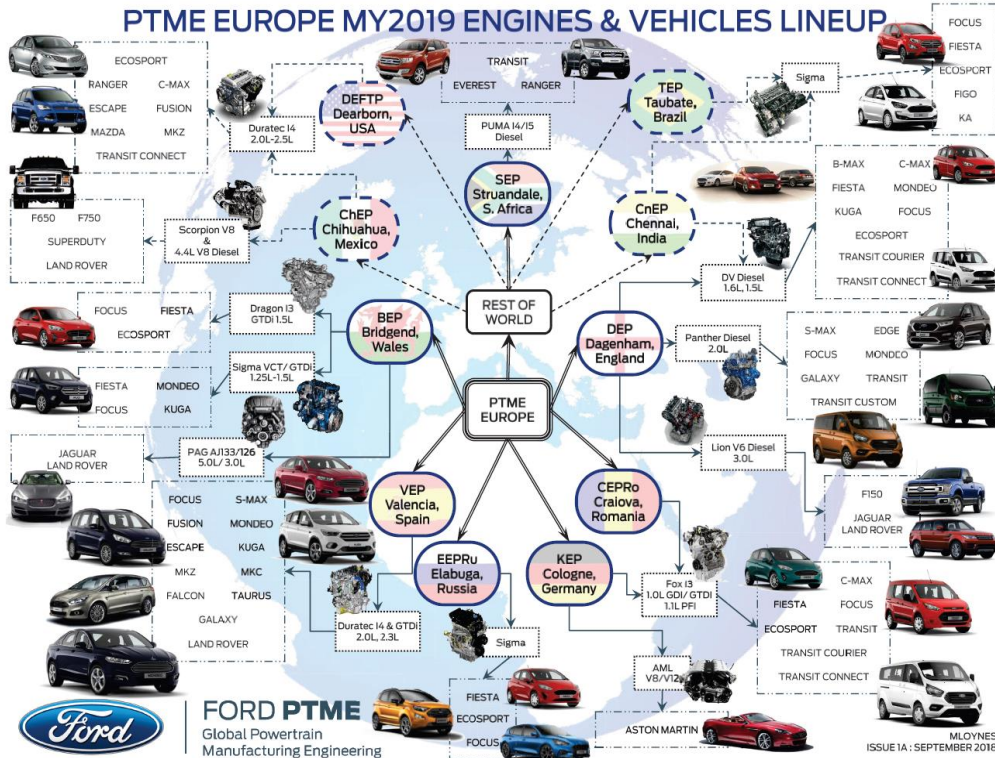


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Ford Pilot project 2019



UITDAGING : Ford Europe- Powertrain Footprint

Voorbeeld aanpassingen voor Panther Motor productie – Dagenham (nieuw in Nov 2015)

Benodigde machines (225) :

Assemblage - 125

Koppen draaien/frezen - 53

Crank bewerkingen - 52

Cylinder block - 55

+ machine capaciteit, upgrades, infrastructuur, logistiek

Totaal benodigde machines:

Europa 5000 +

Wereldwijd 1 miljoen +

Electrificering van powertrains vergt significante veranderingen

Er is een challenge en een business case om de manier van veranderen anders aan te pakken.....

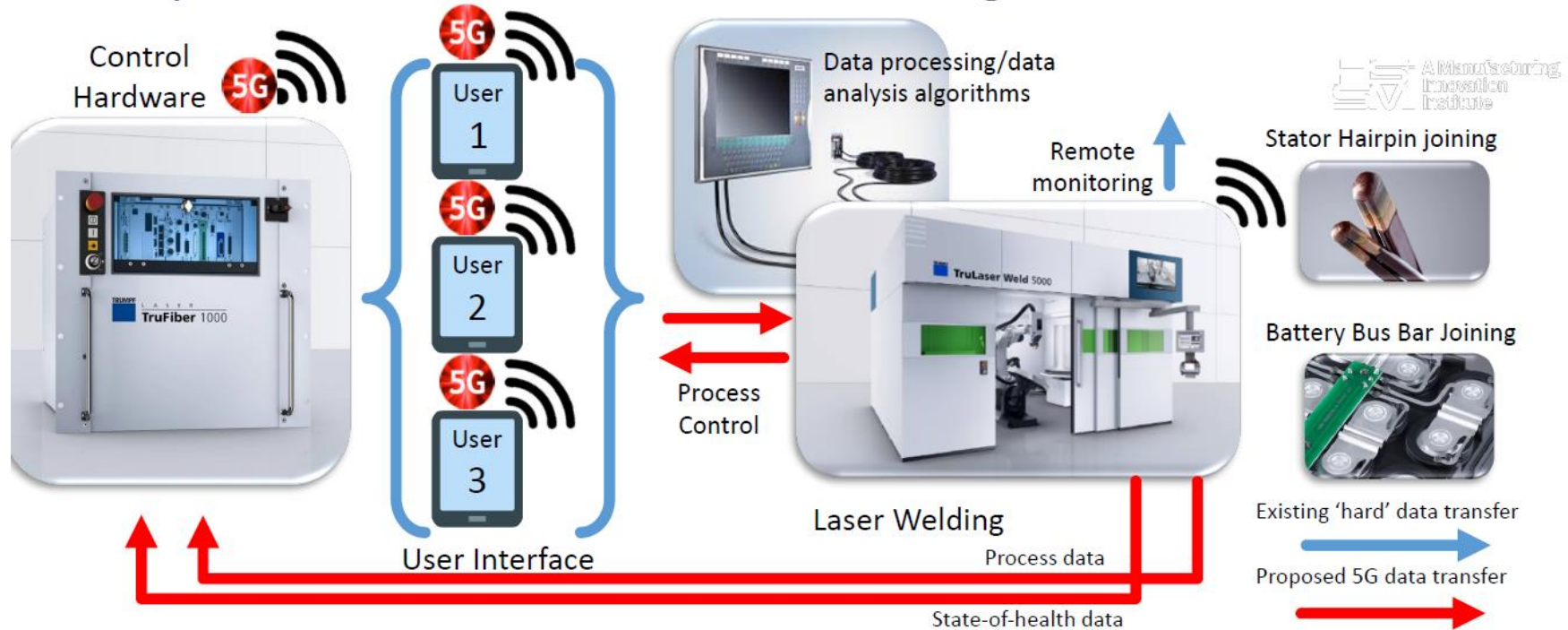


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Ford Pilot project



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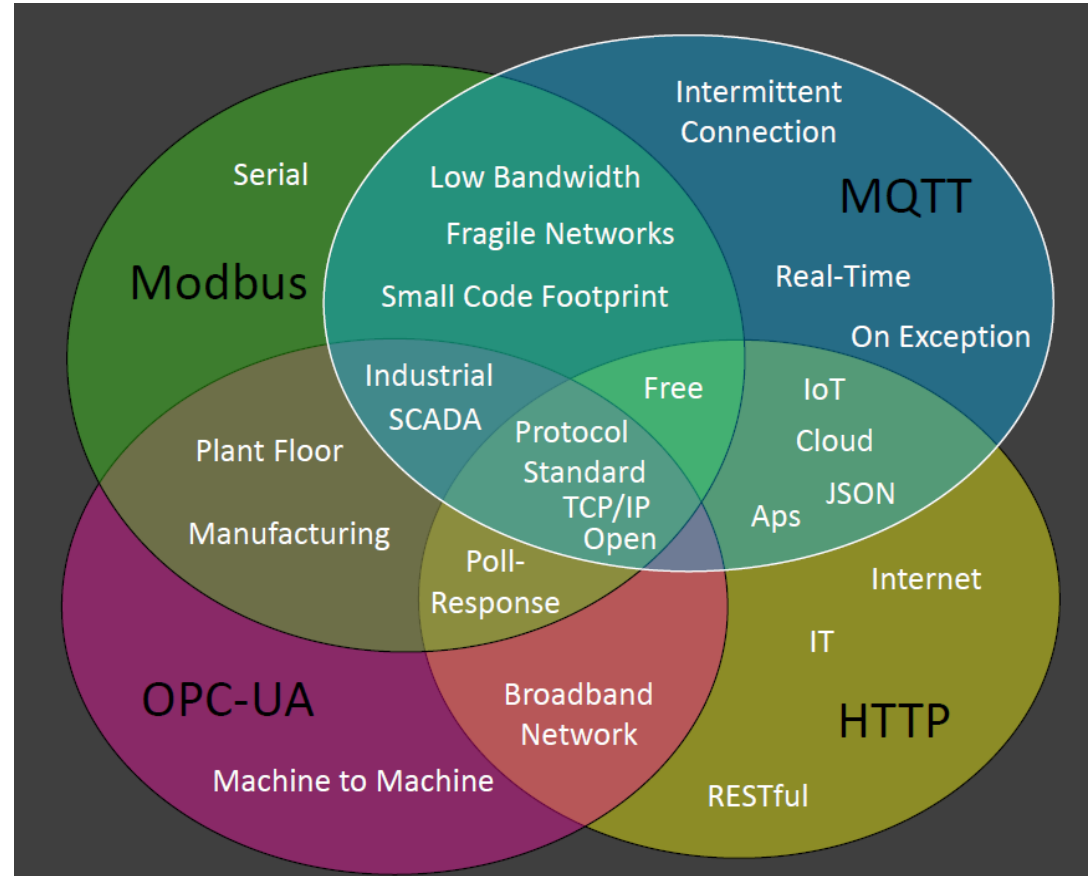
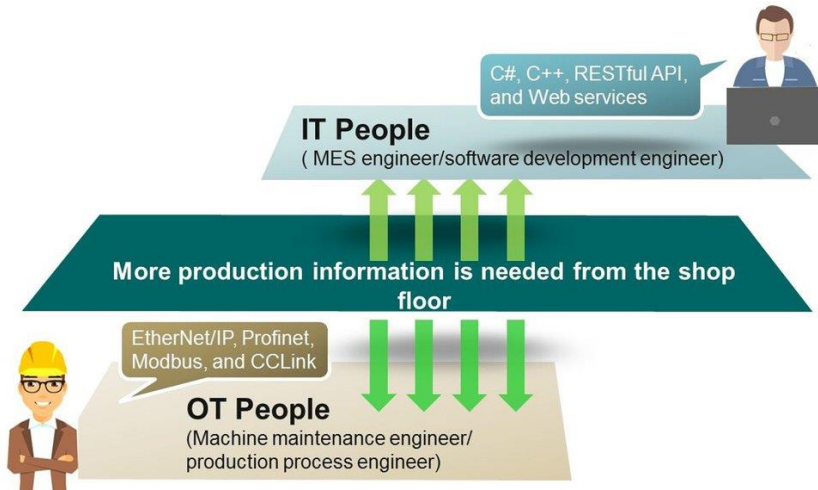
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OT – Protocollen

IT – Protocollen



Source: Johnathan Hottell : Protocol benchmark



Table 3. Comparison Among the Existing IoT Platforms

“ \mathcal{K}_1 ” signifies that the feature is *Security*. “ \mathcal{K}_2 ” signifies that the feature is *Real-time Analysis*. “ \mathcal{K}_3 ” signifies that the feature is *Visualization*. “ \mathcal{K}_4 ” signifies that the feature is *Technology Support*. “ \mathcal{K}_5 ” signifies that the feature is *User Connectivity*. “ \mathcal{K}_6 ” signifies that the feature is *Customer Demand*.

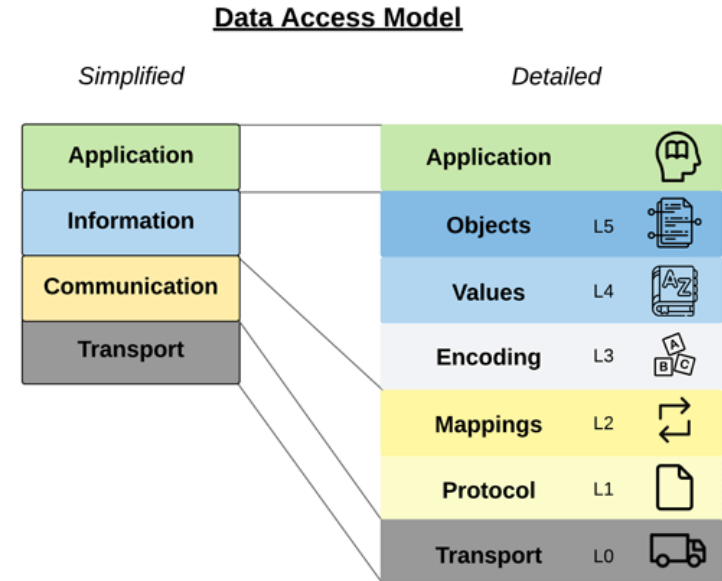
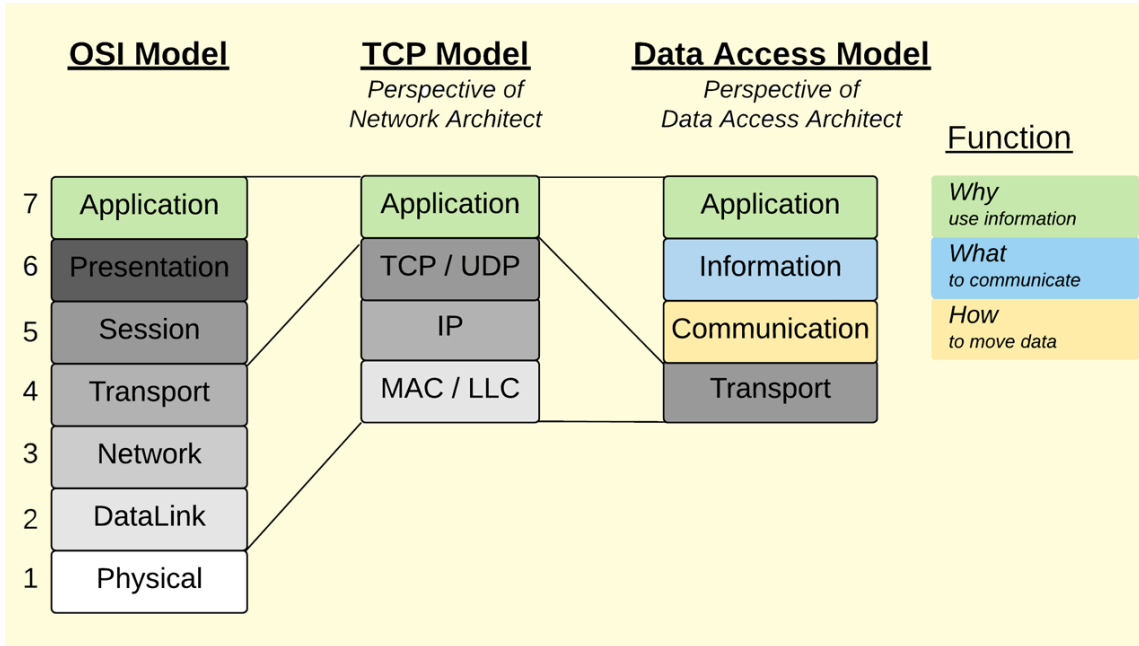
IoT Platform	Device Management	REST API	Protocol	\mathcal{K}_1	\mathcal{K}_2	\mathcal{K}_3	\mathcal{K}_4	\mathcal{K}_5	\mathcal{K}_6	Open Source	Interoperability	Industrial Application
Amazon AWS	✓	✓	HTTPs, SMS	✓	✓	✓	High	High	High	✗	✓	✓
Microsoft Azure	✓	✓	MQTT, AMQP	✓	✓	✓	High	High	High	✗	✓	✓
Oracle IoT	✓	✓	MQTT, COAP	✓	✓	✓	High	High	High	✗	✓	✓
Google Cloud	✓	✓	HTTP, MQTT	✓	✓	✓	High	High	High	✗	✓	✓
Cisco Kinetic	✓	✓	HTTPs	✓	✓	✓	High	High	High	✗	✓	✓
IBM Watson	✓	✓	MQTT, HTTP	✓	✓	✓	High	High	High	✗	✓	✓
AT&T M2X	✓	✓	MQTT	✓	✓	✓	Medium	Medium	Medium	✗	✓	✓
GE Predix	✓	✓	MQTT	✓	✓	✓	Medium	Medium	Medium	✗	✗	✓
SAP Leonardo	✓	✓	CoAP, SNMP	✓	✓	✓	Medium	Medium	Medium	✗	✗	✓
Huawei Oceanconnect	✓	✓	LWM2M, CoAP	✓	✓	✓	Medium	Medium	Medium	✗	✓	✓
Alibaba Cloud	✓	✓	MQTT	✓	✓	✓	Medium	Medium	Medium	✗	✓	✓
IoT Toolkit	✓	✓	HTTP, MQTT	✗			Medium	Medium	Medium	✓	✗	✓
ThingSpeak	✓	✓	HTTP, MQTT	✗	✓	✓	Medium	Medium	Medium	✓	✗	✓
C3 IoT Platform	✓	✓	MQTT, COAP	✓	✓	✓	Medium	Medium	Medium	✗	✗	✓
Siemens MindSphere	✓	✓	MQTT	✓	✓	✓	Medium	Medium	Medium	✗	✗	✓
Ericsson DC Platform	✓	✓	HTTP	✓	✓	✓	Low	Low	Low	✗	✓	✓
Hitachi Lumada	✓	✓	HTTP	✓	✓	✓	Low	Low	Low	✗	✗	✓
Orange IoT Suite	✓	✓	MQTT, CoAP	✗	✓	✓	Low	Low	Low	✗	✗	✓
Kinoma	✓	✓	HTTP	✗	✓	✓	Low	Low	Low	✗	✗	✗
Arduino	✓	✓	MQTT	✗	✓	✓	Low	Low	Low	✓	✗	✗
OpenWSN	✓	✓	HTTP, CoAP	✗	✓	✓	Low	Low	Low	✓	✗	✗

“✓” signifies that the features are fully/partially available for the IoT Platform.

“✗” signifies that the features are not available for the IoT Platform.

<https://www.researchgate.net/publication/356474280>





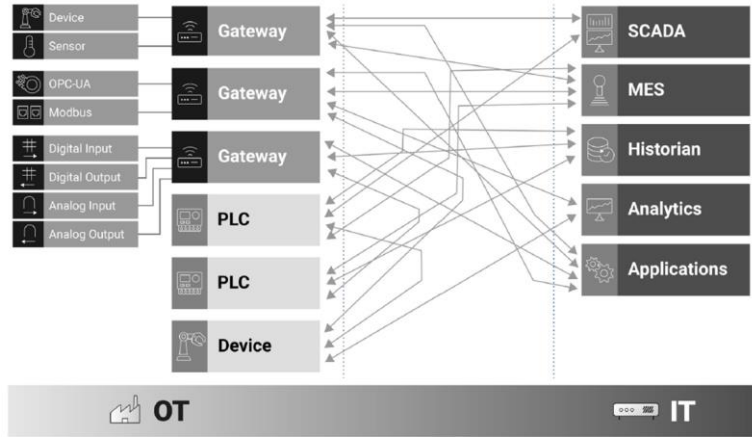
<https://iebmedia.com/technology/iiot/how-all-protocols-fail-at-data-access-interoperability/>



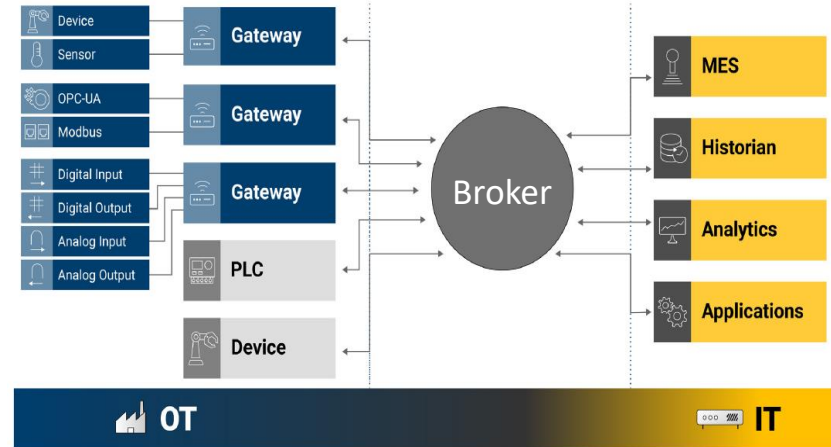
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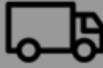
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Sparkplug

OPC UA over MQTT

Objects	L5		CUSTOM	CUSTOM	AutoID	Robot	Others
Values	L4		19 base types	Custom types	60 base data types	Custom types	
Encoding	L3		Protobuf	UA-JSON	UADP		
Mappings	L2		Sparkplug B	Pub / Sub			
Protocol	L1		MQTT	MQTT			
Transport	L0		TCP	WS	TCP	WS	

<https://iebmedia.com/technology/iiot/how-all-protocols-fail-at-data-access-interoperability/>



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ISO/IEC 20237:2023

Information technology
Sparkplug® version 3.0

Status : **Published**



Sparkplug

MQTT Topic &
Payload Definition

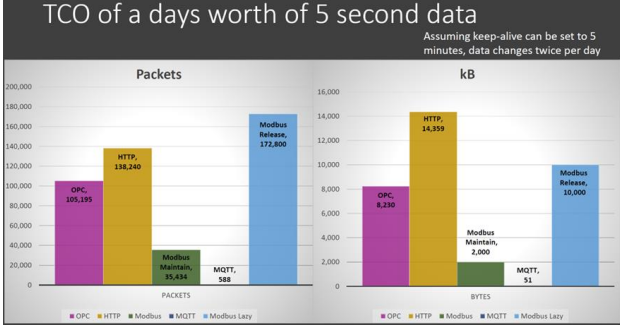
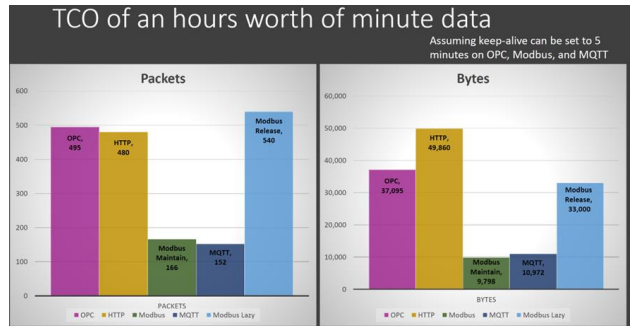
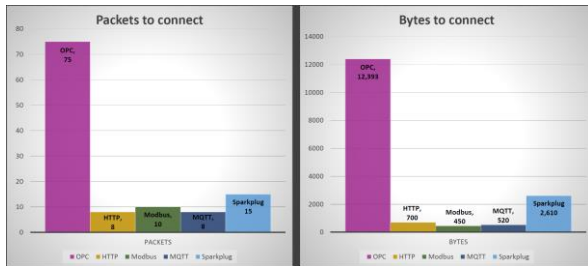
Revision Number	Date	Author	Description
1.0	5/26/16	Cirrus Link	Initial Release
2.1	12/10/16	Cirrus Link	Payload B Addition
2.2	10/11/19	Cirrus Link	Re-branding for Eclipse foundation added TM to Sparkplug
3.0.0	11/16/22	Eclipse Sparkplug Specification Project Team	Reorganized to be in AsciiDoc format and to include normative and non-normative statements

Sparkplug®, Sparkplug Compatible, and the Sparkplug Logo are trademarks of the Eclipse Foundation.



MQTT Sparkplug enables:

Real-time Data Sharing - monitoring and controlling processes, equipment, and products efficiently, as the data exchange between devices and systems happens in real time.



Source: Johnathan Hottell : Protocol benchmark



MQTT Sparkplug enables:

Improved Collaboration - MQTT Sparkplug establishes a **single source of truth** for data from all siloed OT legacy equipment, enabling and defining it for IT.

Single Source of Truth Principles



All data must be reliable and consistent

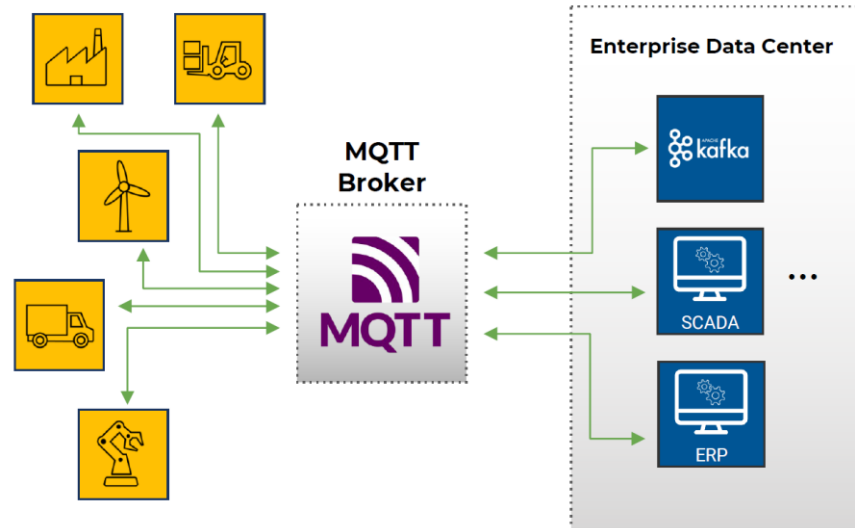


The data must be accessible to all who need it



The data must be updated in a timely manner

www.erp-information.com

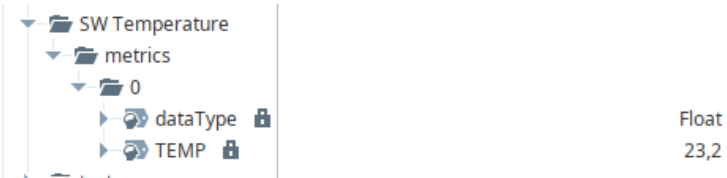


kai.waehner@confluent.io



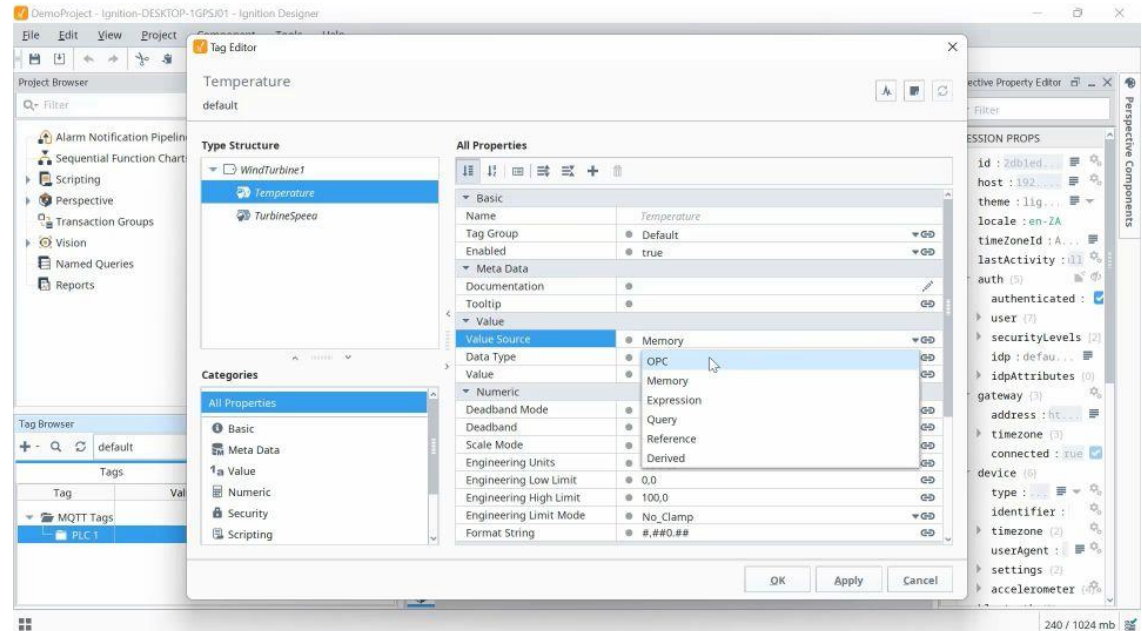
MQTT Sparkplug:

Eliminates Custom Programming – No need to program scripts to integrate data. Use of tools on platforms to configure systems and devices through a graphical interface. Reducing the risk and life-cycle costs of adding custom software in smart manufacturing ecosystem.



```

▼ 192.168.78.153
  ▼ spBv1.0
    ▼ group_1
      ▼ DDATA
        ▼ plc
          DB_CONVEYOR_1 = {"name": Temp,"datatype": real,"value":12}
          ► NCMD (1 topic, 1 message)
    
```

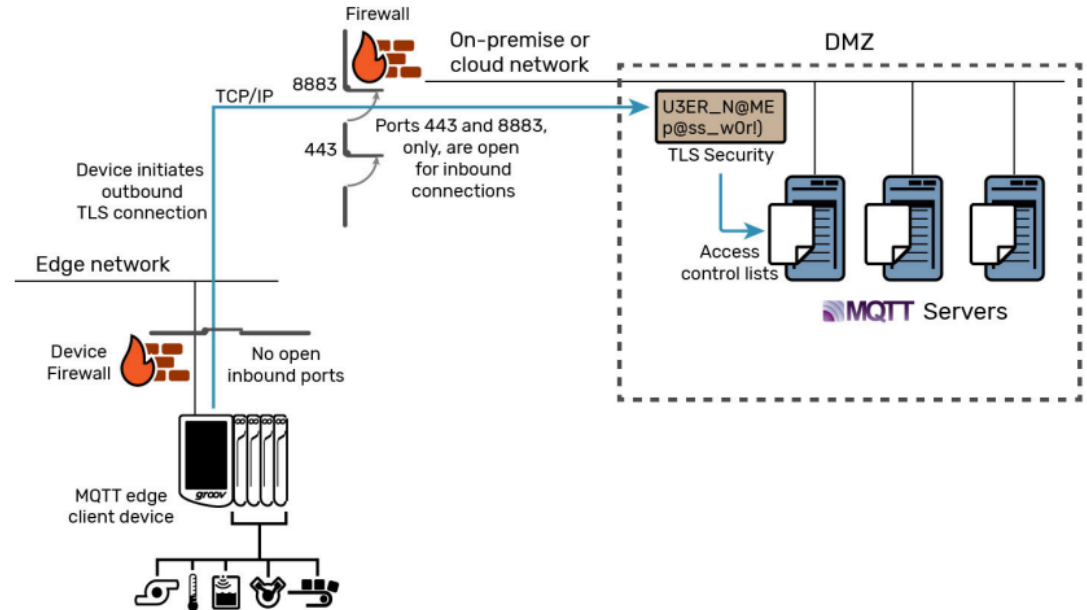


MQTT Sparkplug:

Security - Supports robust security measures, including encryption, access controls, and user authentication, to protect sensitive data and prevent unauthorized access.

For most manufacturers, security and privacy risk is the most significant barrier to adopting smart manufacturing.

MQTT's device-originating connections simplify cybersecurity.

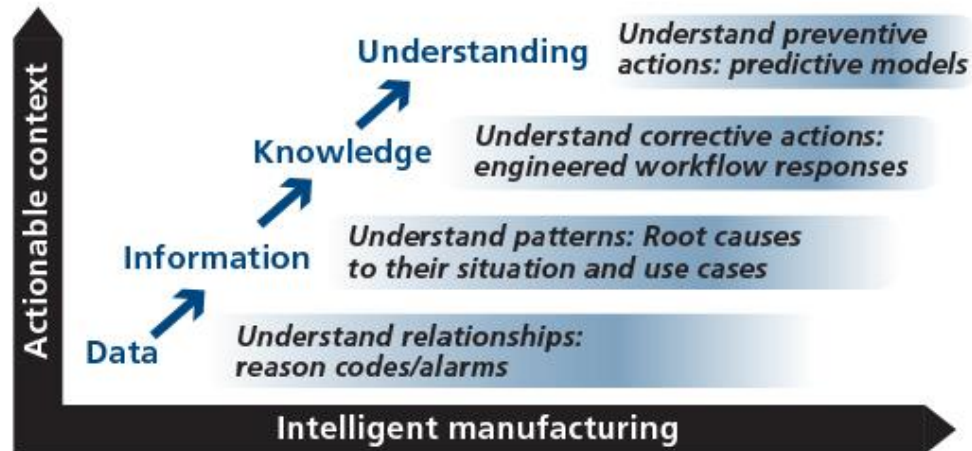


https://documents.opto22.com/2357_Industrial_Strength_MQTT_Sparkplug_B.pdf



MQTT Sparkplug:

Contextualized Data - By allowing you to add metadata to MQTT messages. This includes characteristics like the data's source and destination and the data's type and format. With this, applications can access the information correctly and use it in the appropriate context.



<https://www.isa.org/>

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MQTT Sparkplug:

Pros

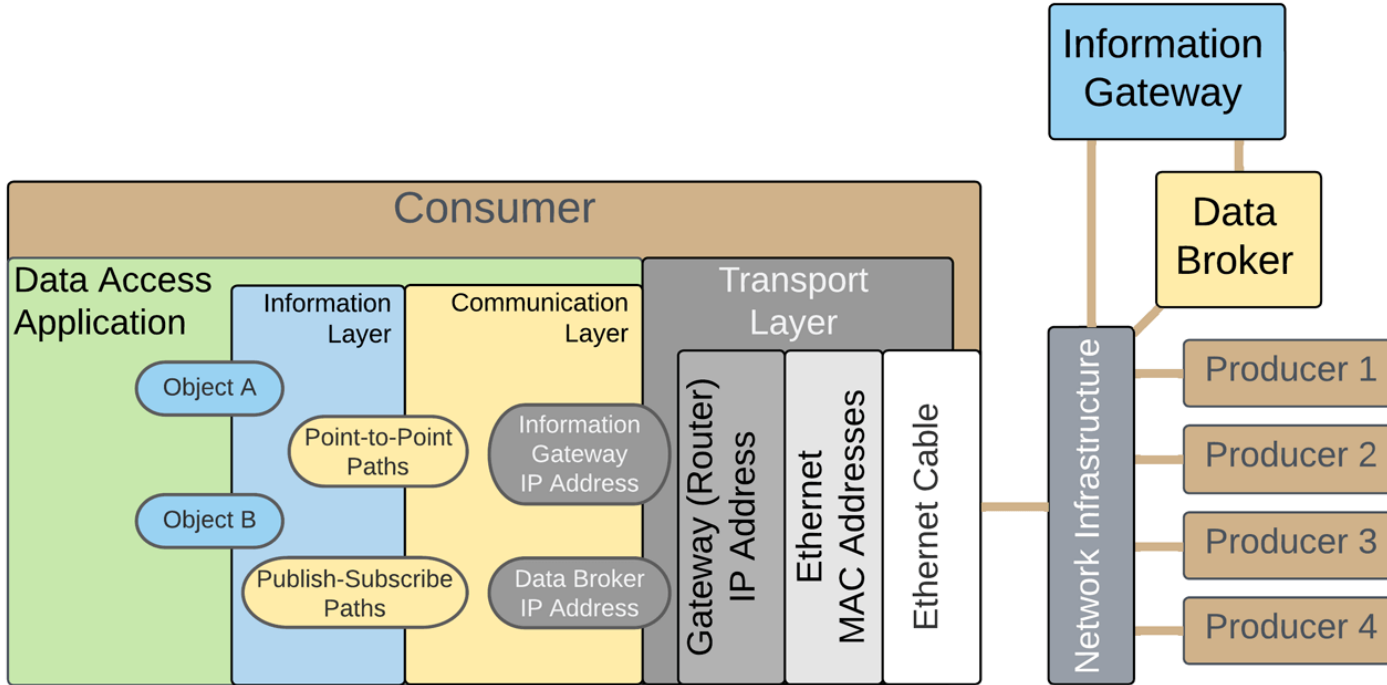
- Lightweight
- Built for thousands of connections
- All programming languages supported
- Built for poor connectivity / high latency scenarios
- High scalability and availability (depending on broker implementation)
- ISO Standard ISO/IEC 20237:2023
- Most popular IoT protocol (competing with OPC UA)

Cons

- Adoption mainly in IoT use cases
- Only pub/sub, not stream processing
- No reprocessing of events

Source: kai.waehner@confluent.io





<https://iebmedia.com/technology/iiot/how-all-protocols-fail-at-data-access-interoperability/>



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	<u>TCP Model</u>	<u>Data Access Model</u>
	Device	Information
Access any ____	Ethernet Switch	Data Broker
One endpoint to access any ____	IP Router	Information Gateway

TRL	Entrance Criteria
9	Multiple applications from multiple vendors that integrate out-of-the-box at most levels of the enterprise
8	Multiple consumer applications that integrate out-of-the-box
7	Multiple consumers from multiple vendors requiring custom integrations
6	A single consumer application requiring custom integrations
5	Interoperability Workout between multiple OEMs
4	Internal product validation from OEM
3	Characteristic proof-of-concept
2	Market research and white papers
1	Observations & reports

<https://iebmedia.com/technology/iiot/how-all-protocols-fail-at-data-access-interoperability/>



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Demonstratie “de soepfabriek” communicatie met MQTT SPARKPLUG



● ● ● Industrial Ethernet

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Bedankt voor uw aandacht

Johan Visser

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