

IoT: Conceitos e Plataformas

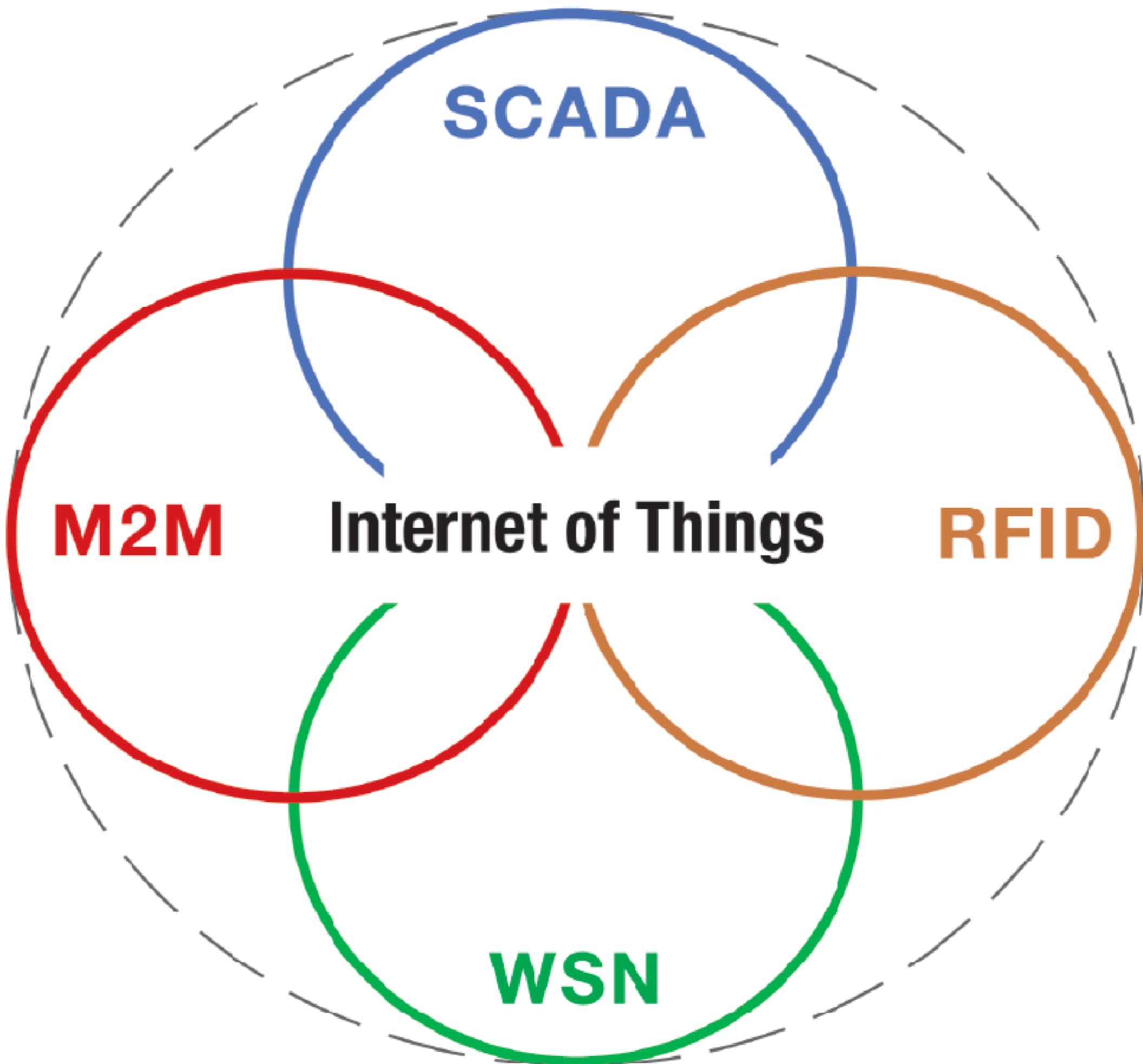
Kiev Gama

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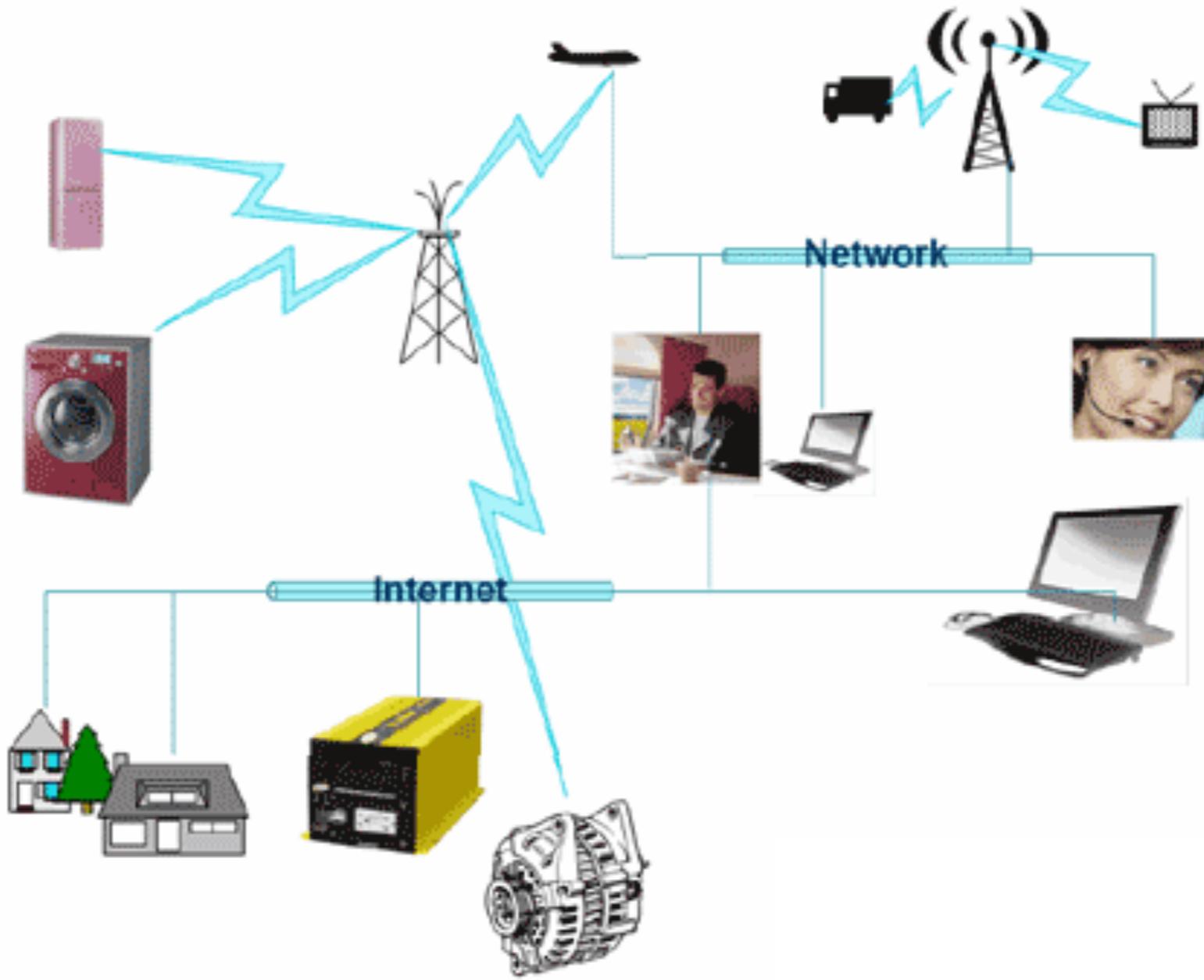
@kievgama

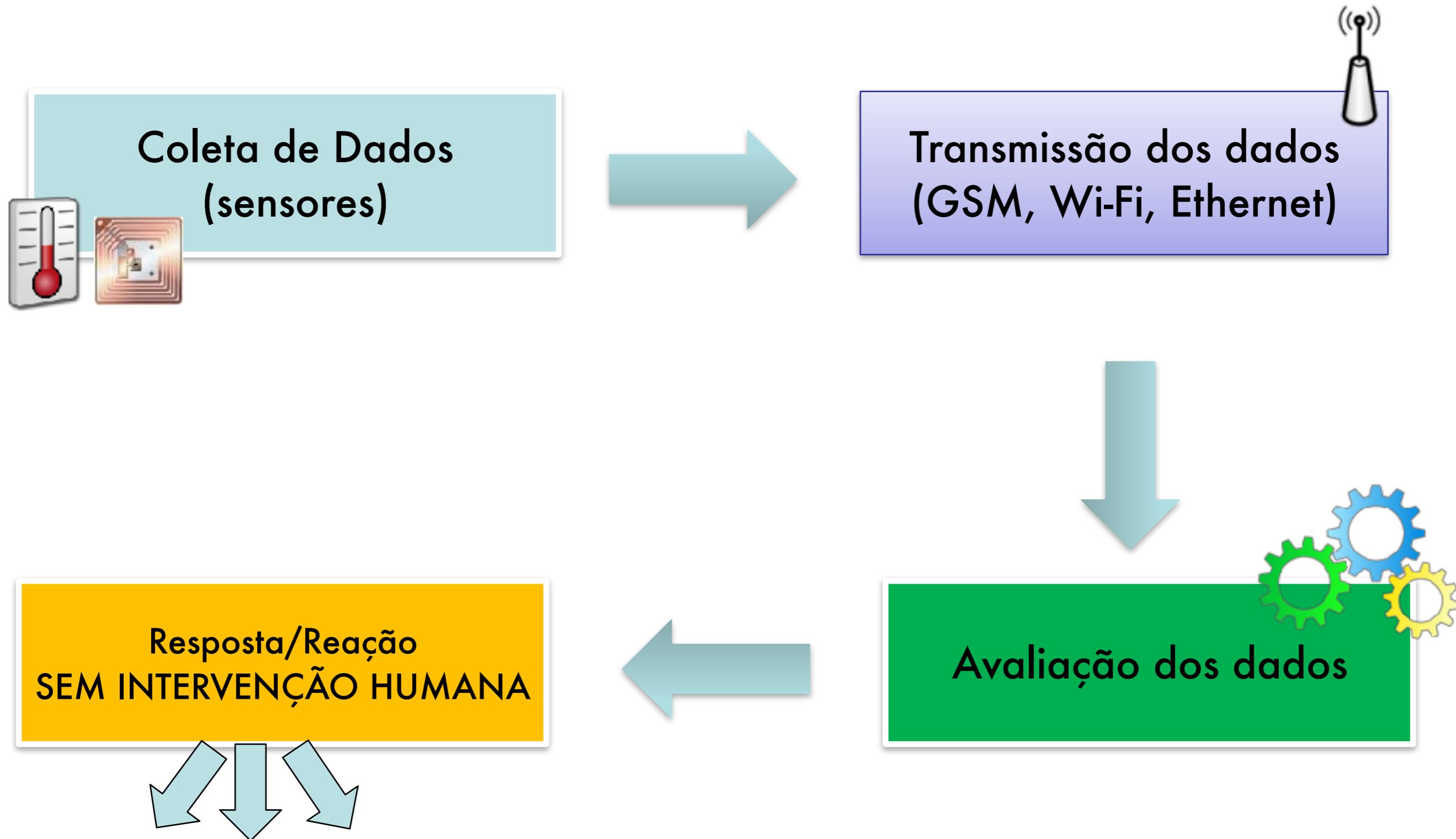
slideshare.net/kievgama



M2M

(machine to machine)





M2M

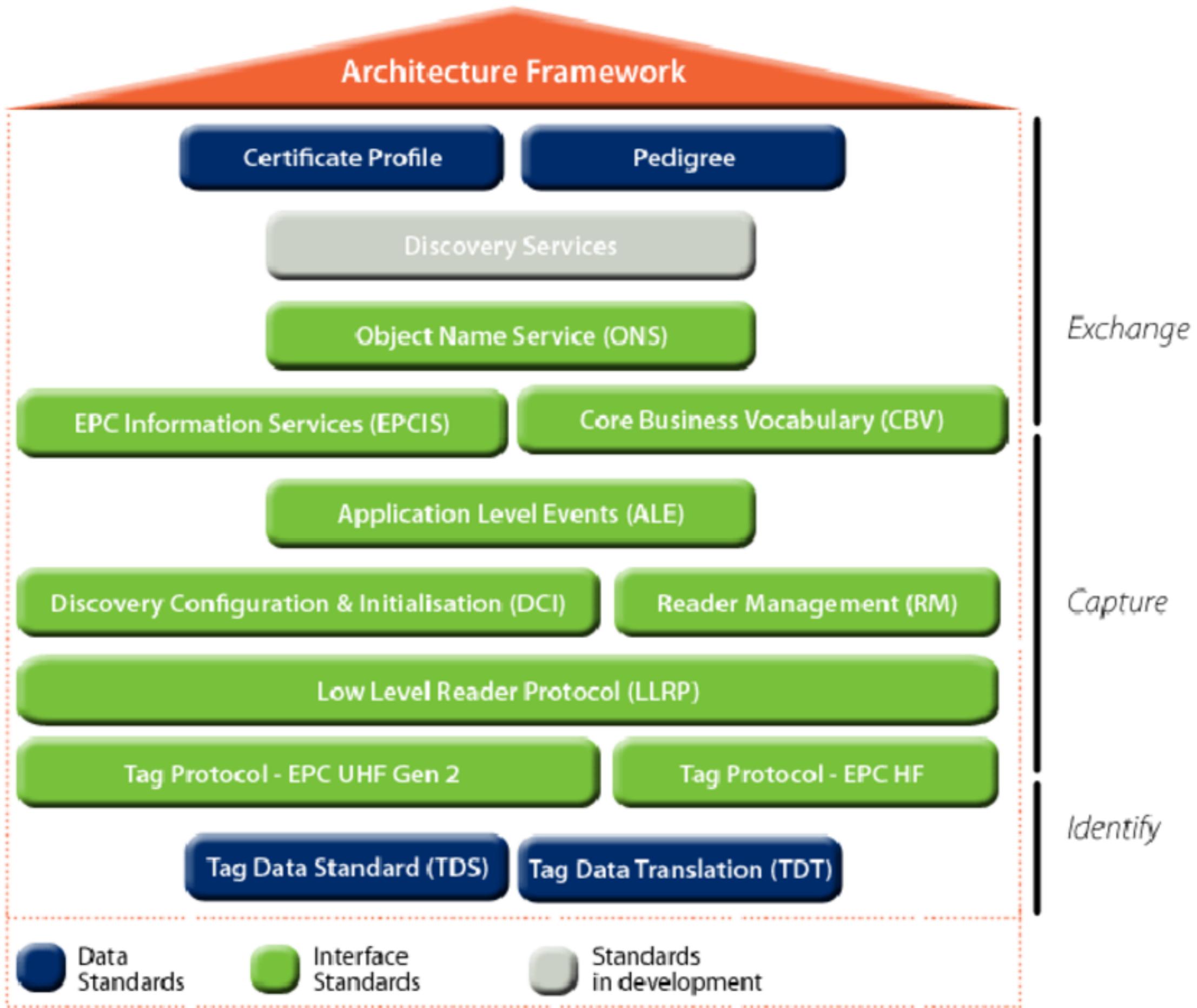
**Envolve dispositivos e sistemas que
comunicam-se entre si em diversos
contextos**

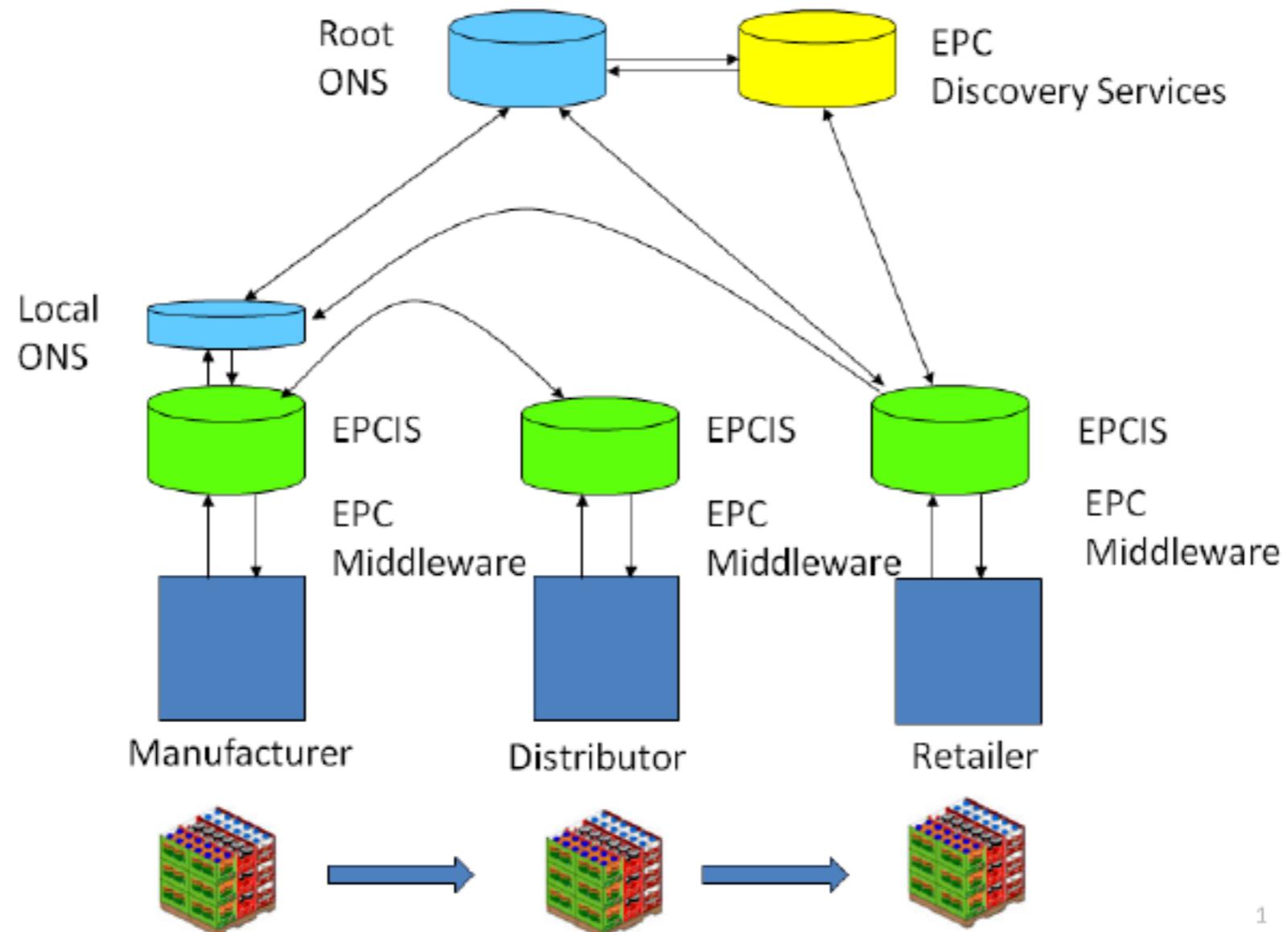
**Contempla middleware, protocolos de
comunicação, armazenamento de dados**

É um habilitador para a Internet das Coisas

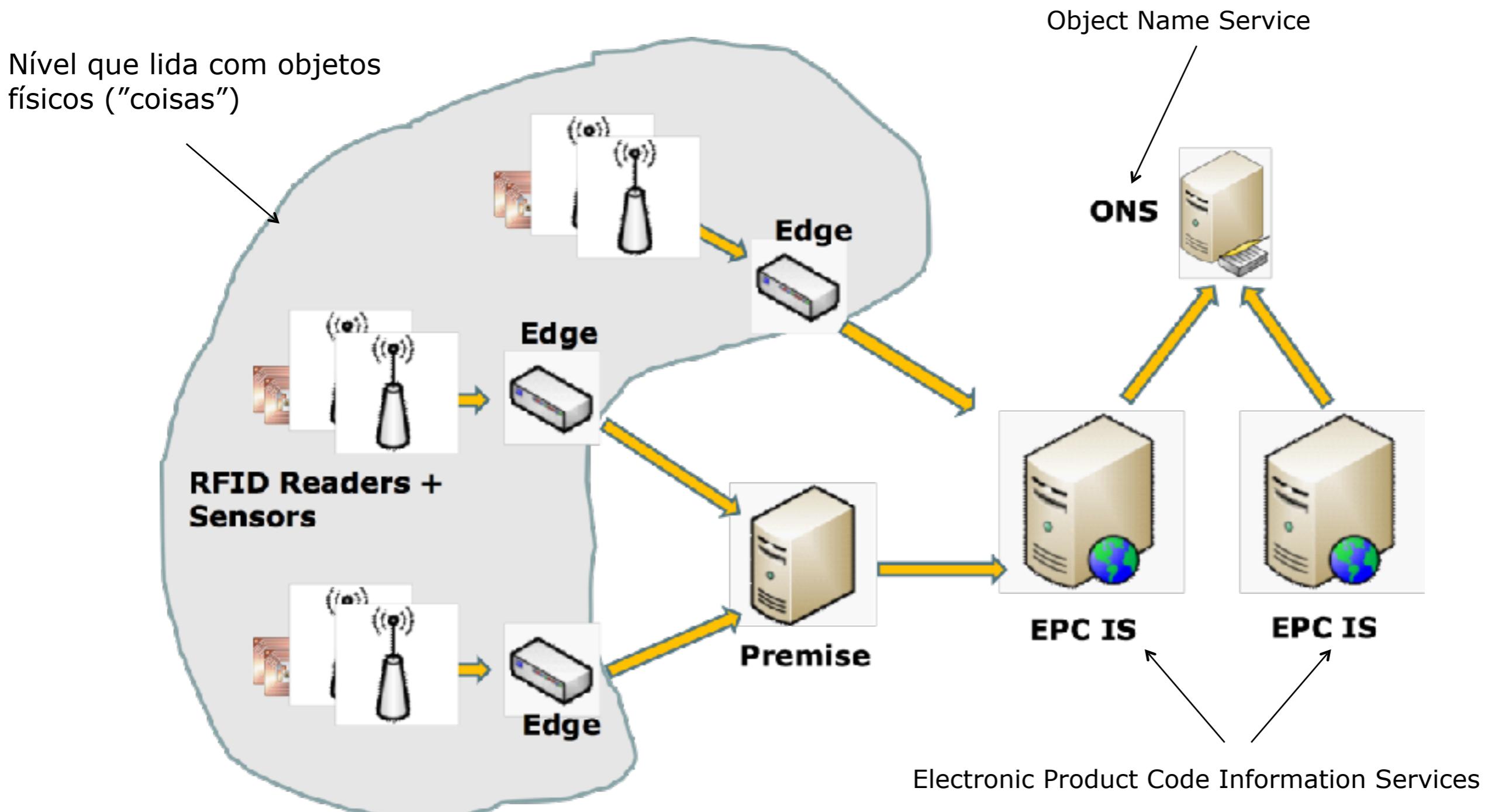
RFID
**(radio frequency
identification)**

Architecture Framework





Arquitetura EPCCGlobal



WSN
(wireless sensors
networks)

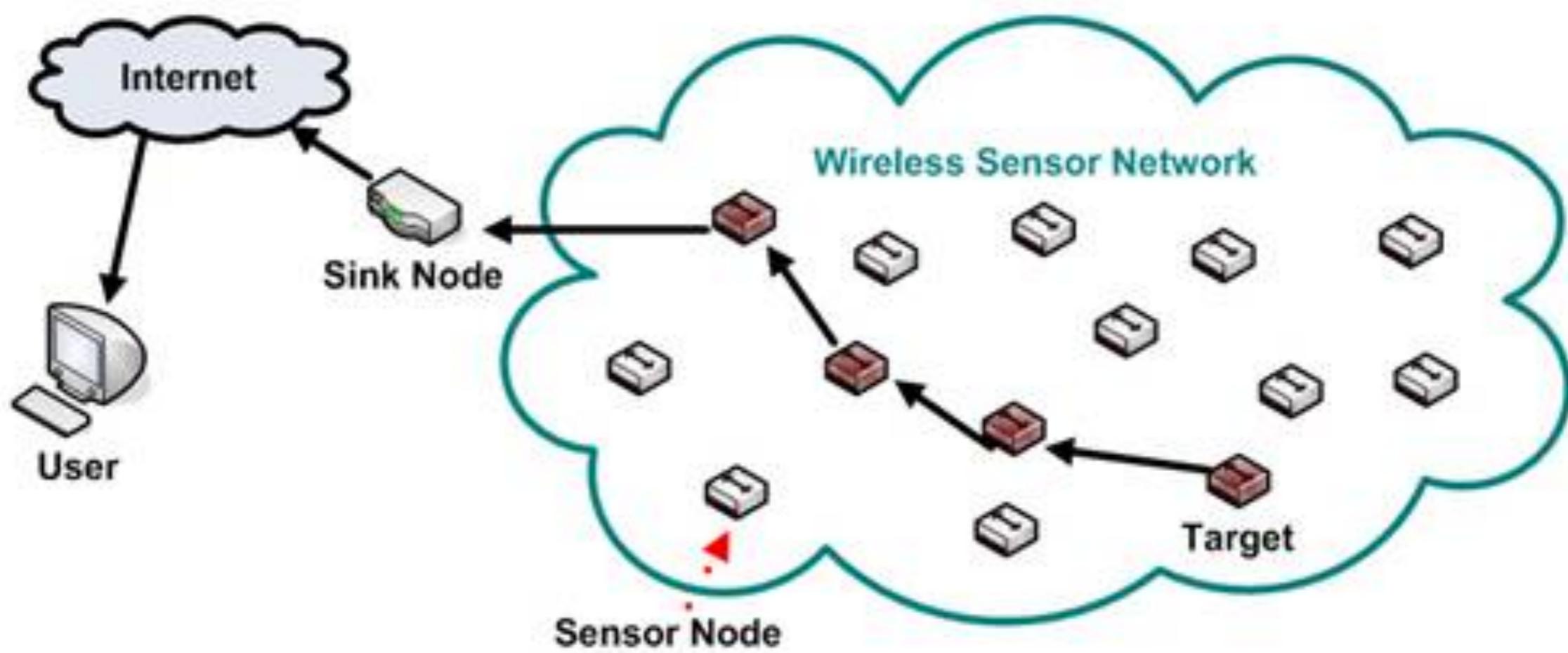
Sensores autônomos distribuídos espacialmente para monitorar condições físicas ou ambientais(temperatura, pressão, movimento ou poluentes)

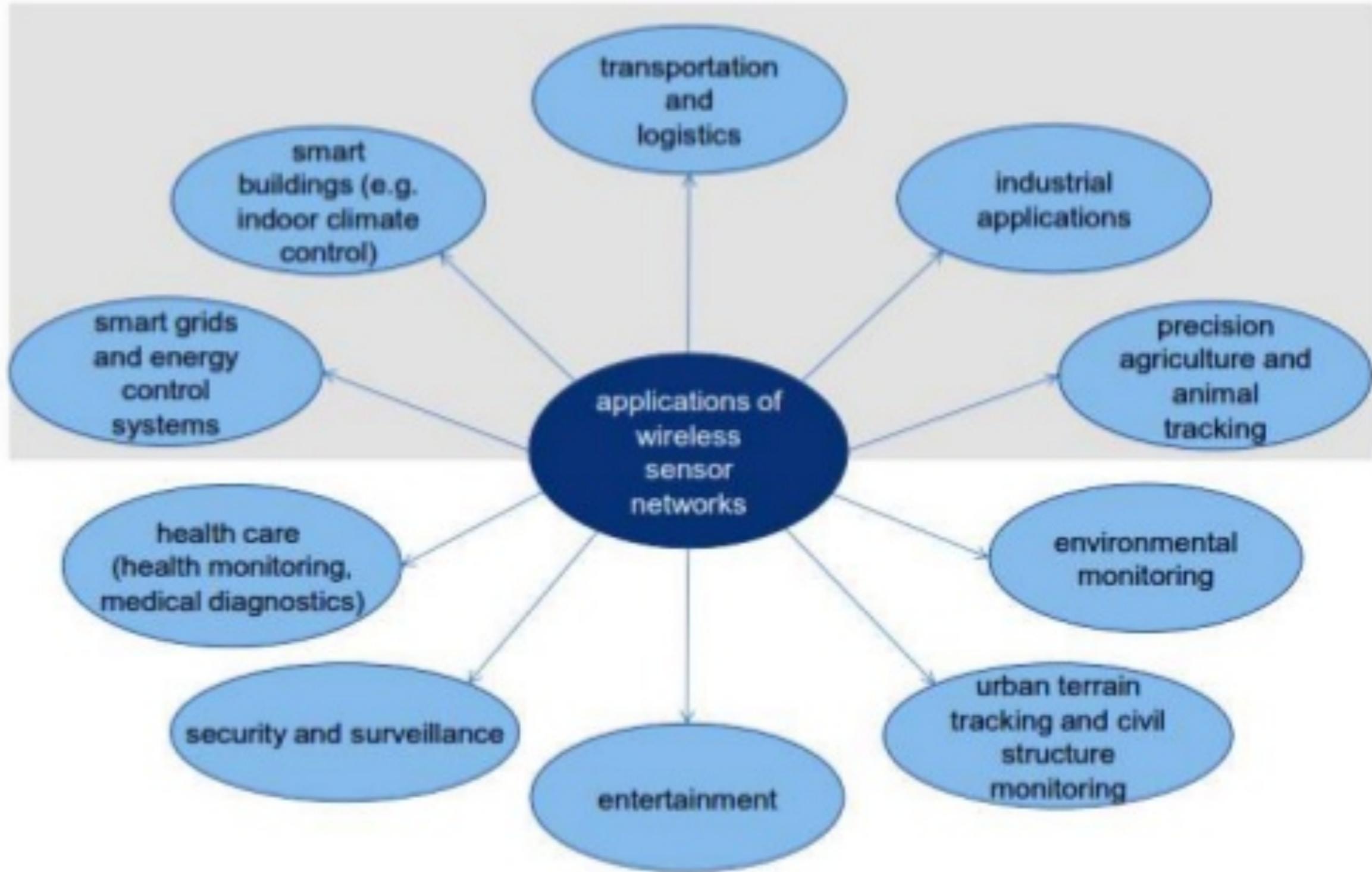
Transmitem dados de forma cooperativa através da rede

Trabalham com curto alcance

Redes mesh tipicamente sem fio

Dados são canalizados para um local principal





SCADA
**(supervisory control
and data acquisition)**

SCADA

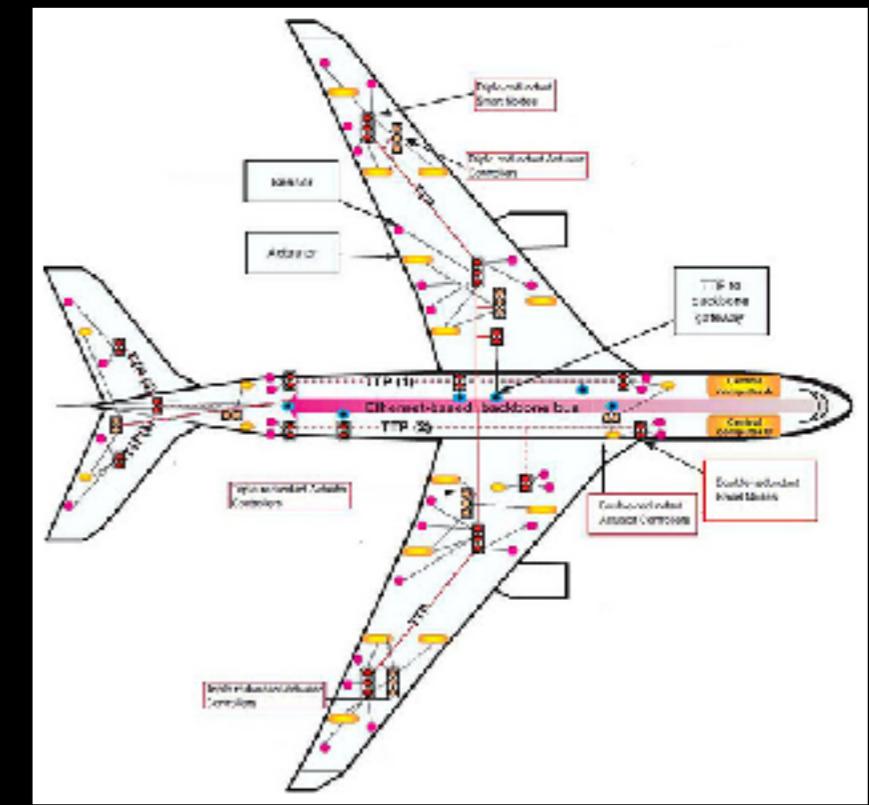
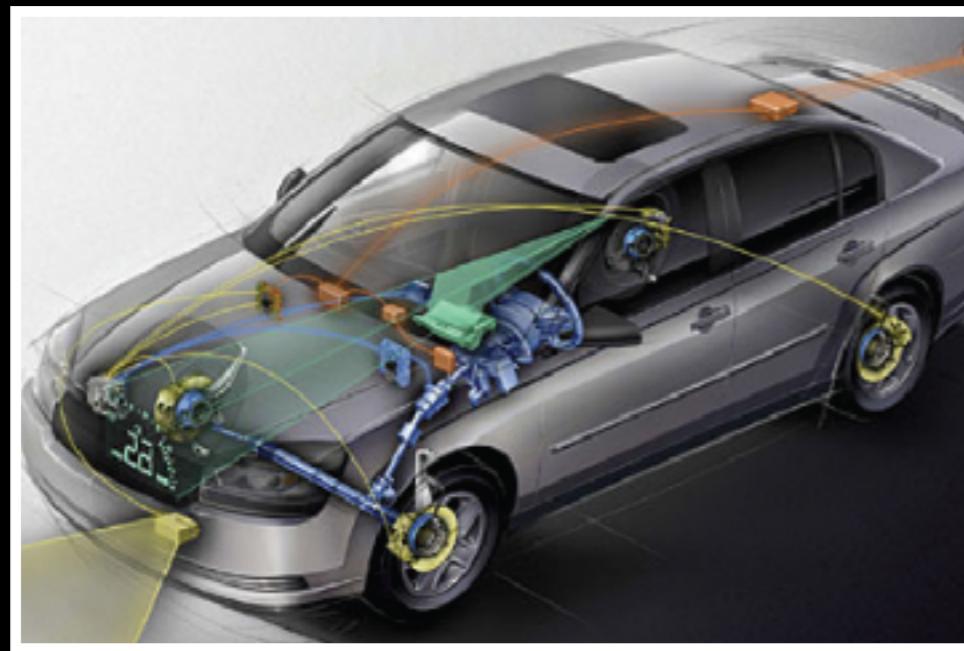
sistemas autônomos

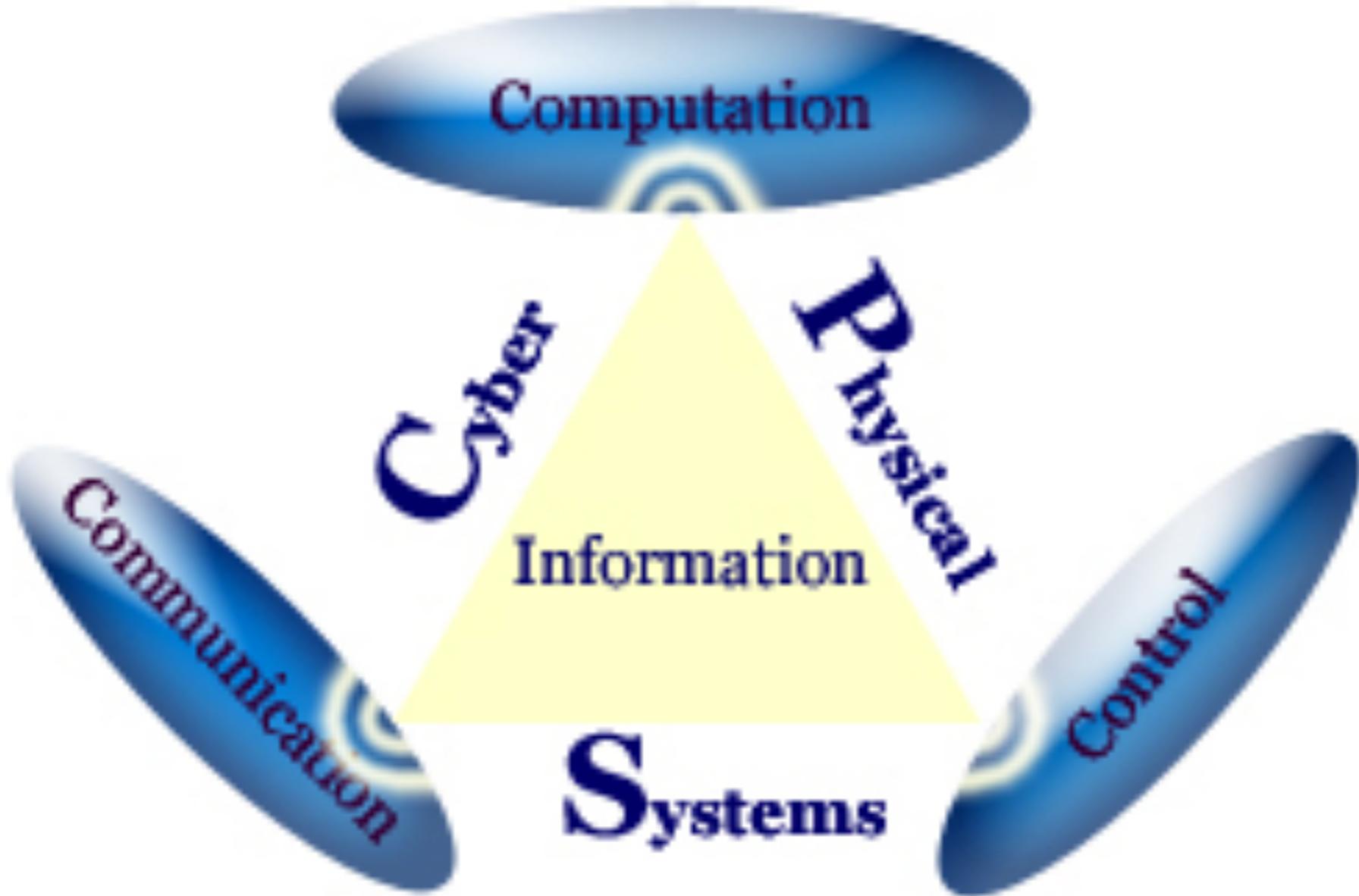
baseados em control loops

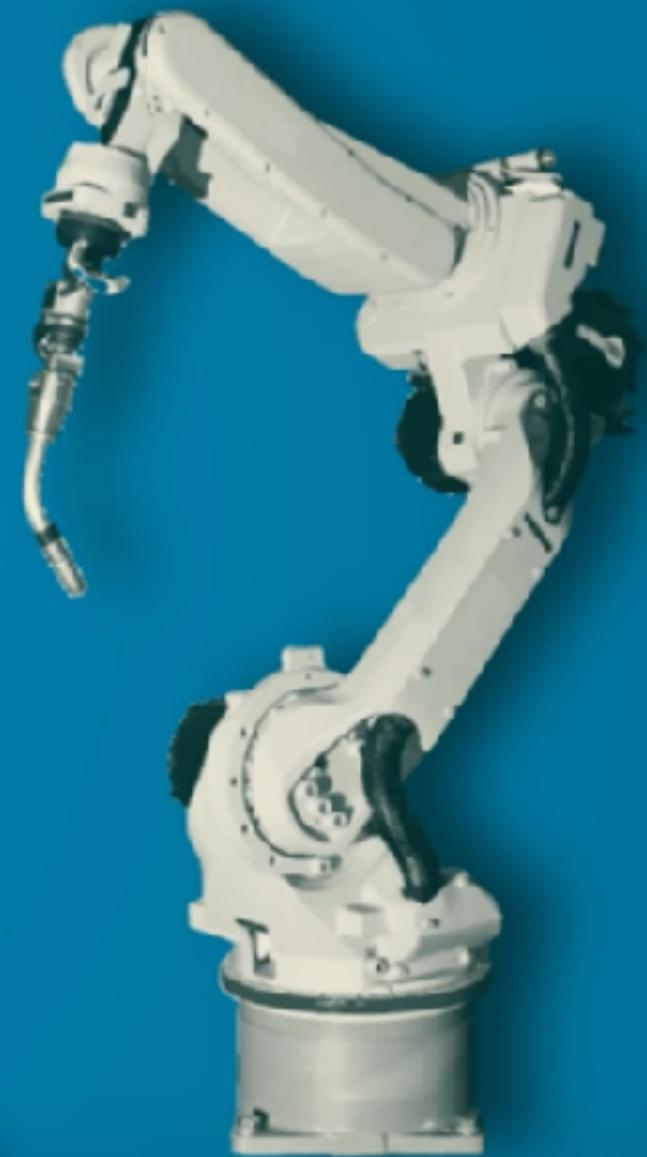
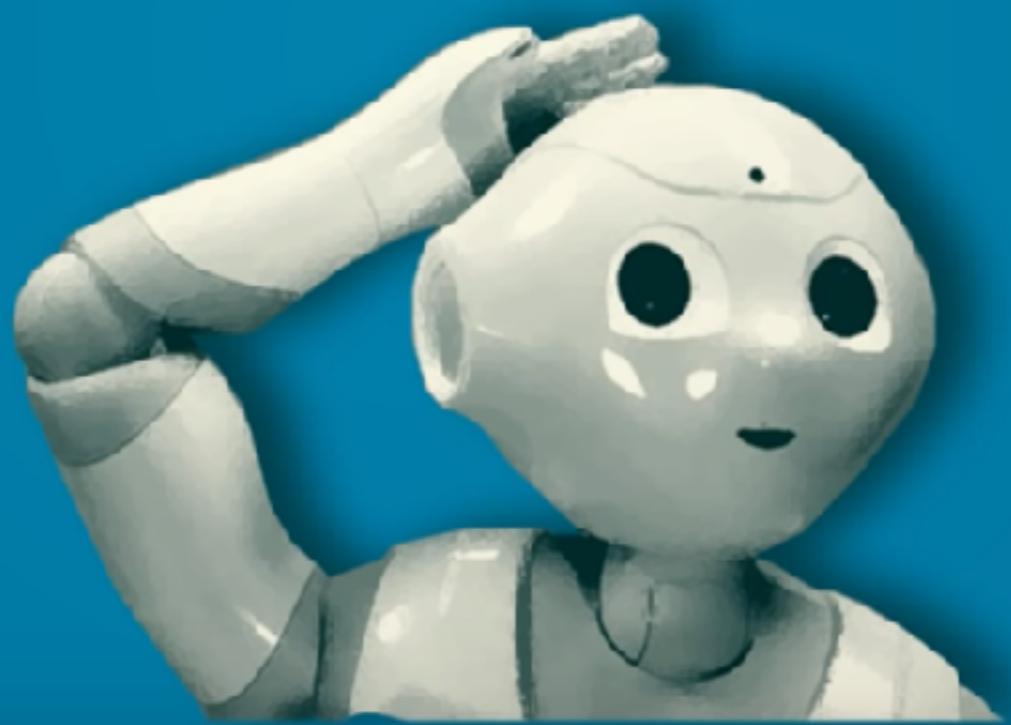
usado em ambientes de controle e
automação



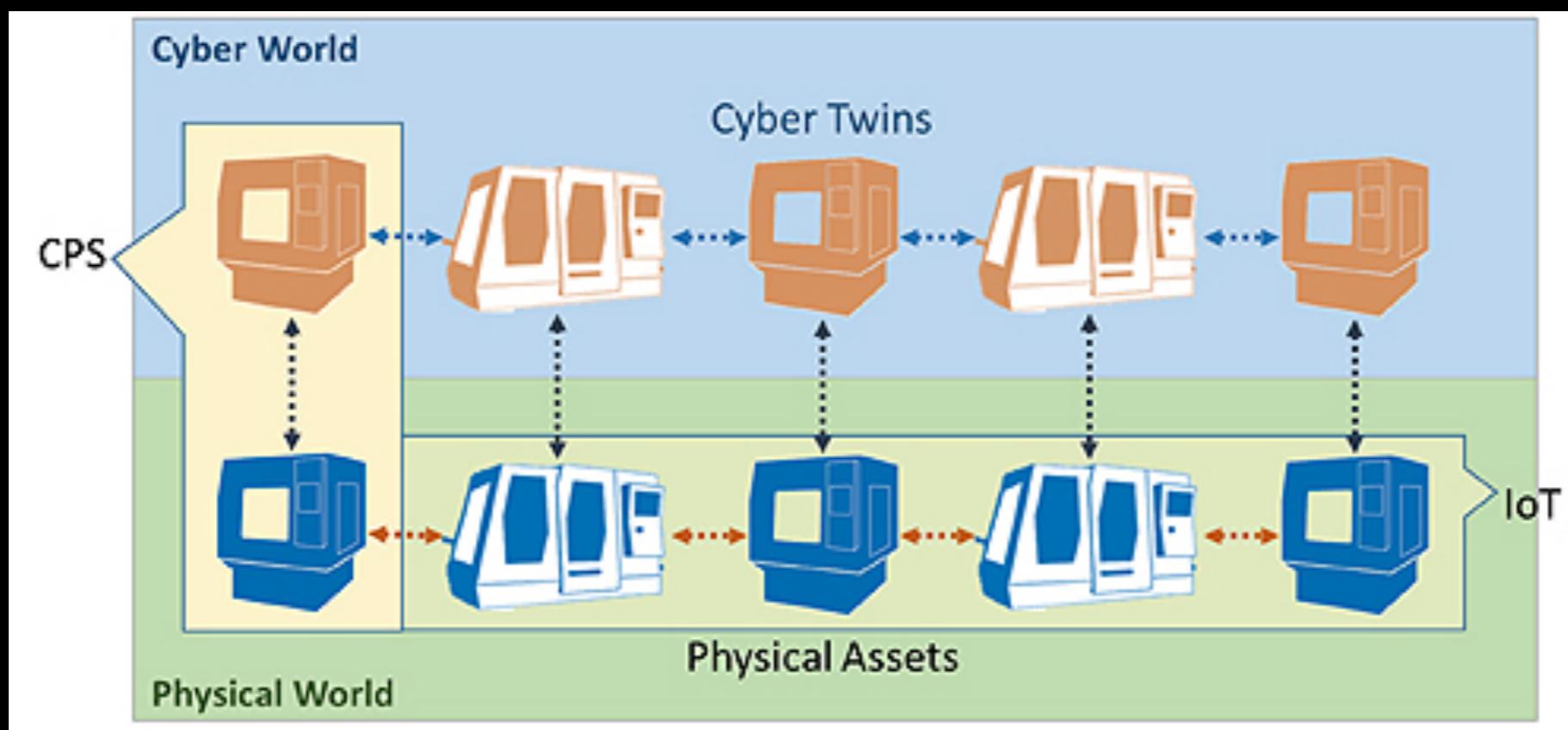
SCADA é fortemente ligado
ao conceito de
sistemas ciberfísicos







overlap de CPS e IoT



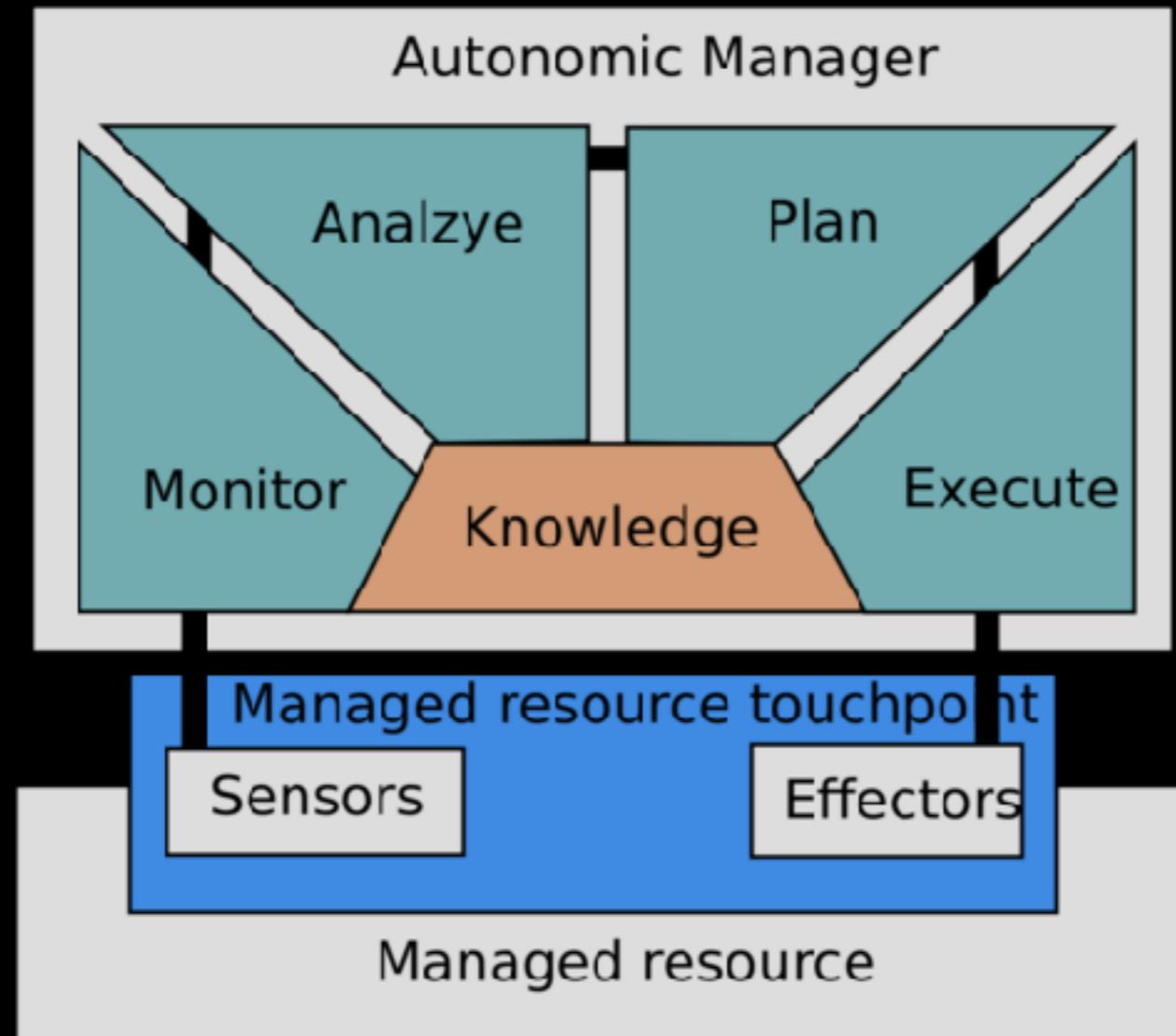
Ciber
(Software)

Atuadores

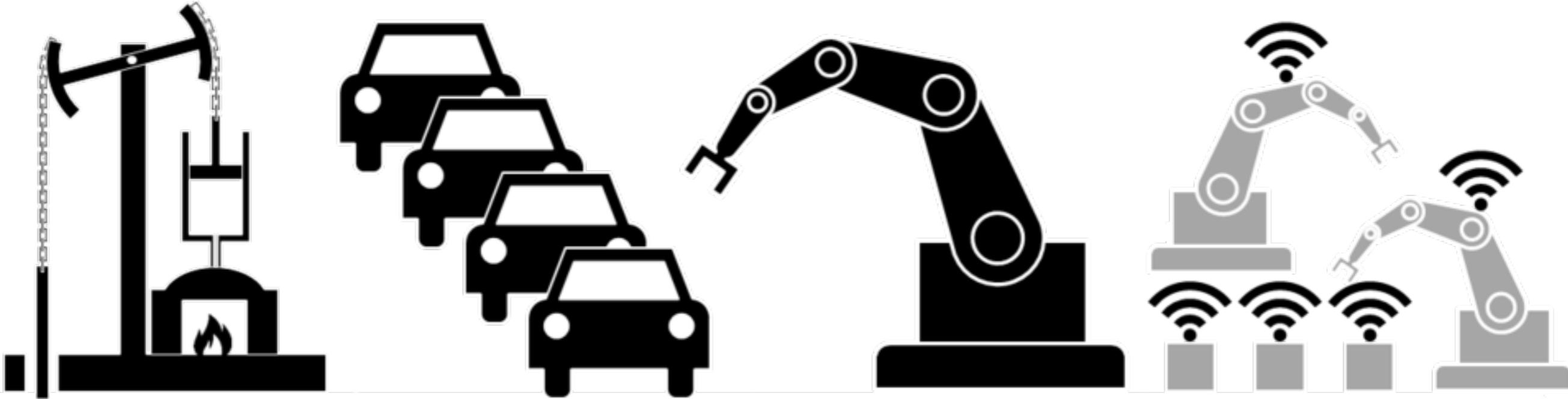
Sensores

Físico
(Equipamentos)





**a indústria 4.0 é
baseada em CPS**



1st

2nd

3rd

4th

Mechanization,
water power, steam
power

Mass production,
assembly line,
electricity

Computer and
automation

Cyber Physical
Systems

industry 4.0 design principles

Interoperability

Information Transparency

Decentralized Decisions

Technical Assistance

IoT

Interoperability

CPS

Information Transparency

Decentralized Decisions

industry 4.0 design principles

Technical Assistance

Interoperability

Internet of Things + Internet of People

$$\text{IoT} + \text{IoP} = \text{IoE}$$

Information Transparency

Modelos + dados de sensores =
“Cópia virtual” do mundo físico
("Digital Twin")

(Realtime) Analytics

Decentralized Decisions

Máquinas autônomos
conversando entre si

Problemas e decisões críticas são
delegados para pessoas

Technical Assistance

Aparatos para humanos visualizarem e interagirem com os sistemas ciberfísicos

Tablets, smartphones, wearables, robôs

Industry 4.0 Challenges

Technical challenges

ICT Infrastructure

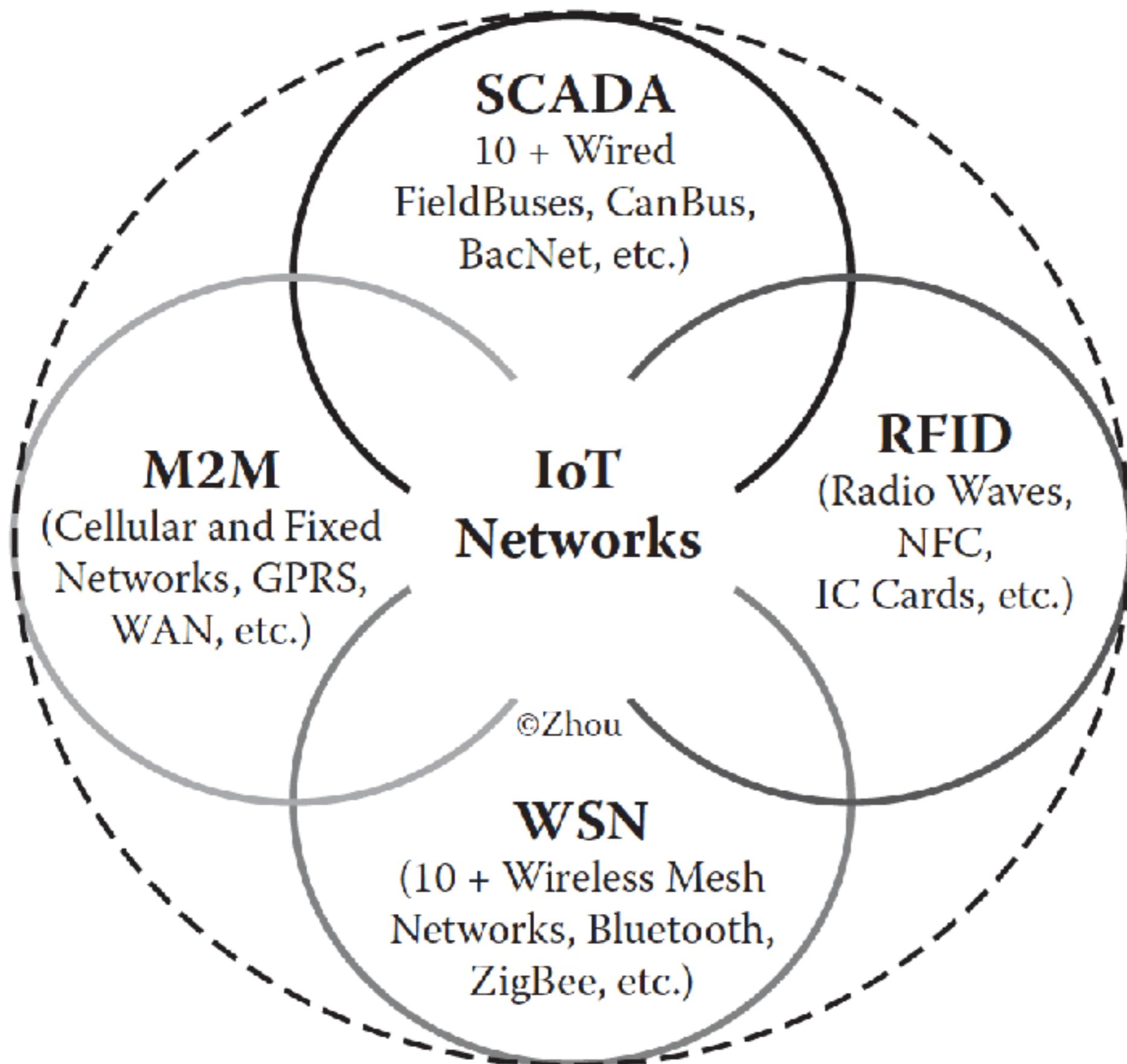
Scalability

Data Science/Analytics

IoT technical challenges

Standardization

Information Security and Privacy



**como organizar estos
sistemas?**

IoT World Forum IoT Reference Model

- 7 **Collaboration and Processes**
(Involving People and Business Processes)
- 6 **Application**
(Reporting, Analytics, Control)
- 5 **Data Abstraction**
(Aggregation and Access)
- 4 **Data Accumulation**
(Storage)
- 3 **Edge Computing**
(Data Element Analysis and Transformation)
- 2 **Connectivity**
(Communication and Processing Units)
- 1 **Physical Devices and Controllers**
(The "Things" In IoT)



Key Points

- IT-OT
- Decoupling Scalability Agility
- Interoperability
- Legacy Compatibility
- Analytics
- Integrated with the Enterprise

fog/edge computing

Fog Computing - Another Layer

Hundreds
Data Centre/ Cloud
Hosting IoT Analytics

Thousands
Backhaul
IP/ MPLS, Security, QoS, Multicast

Tens of Thousands
Multi-Service Edge
3G/ 4G/ LTE/ Wi-Fi/ RF Mesh/ PLC

Millions
Embedded Systems & Sensors
Low power, low bandwidth

Data Centre/Cloud

Backbone network links

Up to 1000s of Km
10/40/100GE, Fiber, WDM
Transactional response times

Core Network

Backhaul and access links

Up to 100s of Km
1/10/40GE, ePON, DSL, DOCSIS
QoE driven response times

Fog Network

Local IoE facilities

A few Km
100M/1G/10GE, PoE, Wireless
Millisecond Response times

Smart Objects

fog/edge computing

Maior processamento na borda (edge) da rede
Baixa latência

Pré-processamento de dados

Agregação de resultados e economia no uso de banda

Forte presença de streaming e realtime

Heterogeneidade de tecnologias

**vários protocolos e padrões
precisam conversar entre si...**

XMP
DPWS
QRCode
Bluetooth
MQTT
ONSM
COAP
IPv6
ZigBee
REST
SOAP
COAP
TLS
DTLS
WiFi
SensorML
3G
WebSocket
uIP
6LoWPAN
NFC
BTLE
4G

Necessidade de integração

IoT “as a Service”



SensorCloud®
Powered by LORD MicroStrain®

sen.se



libelium
wireless distributed communications

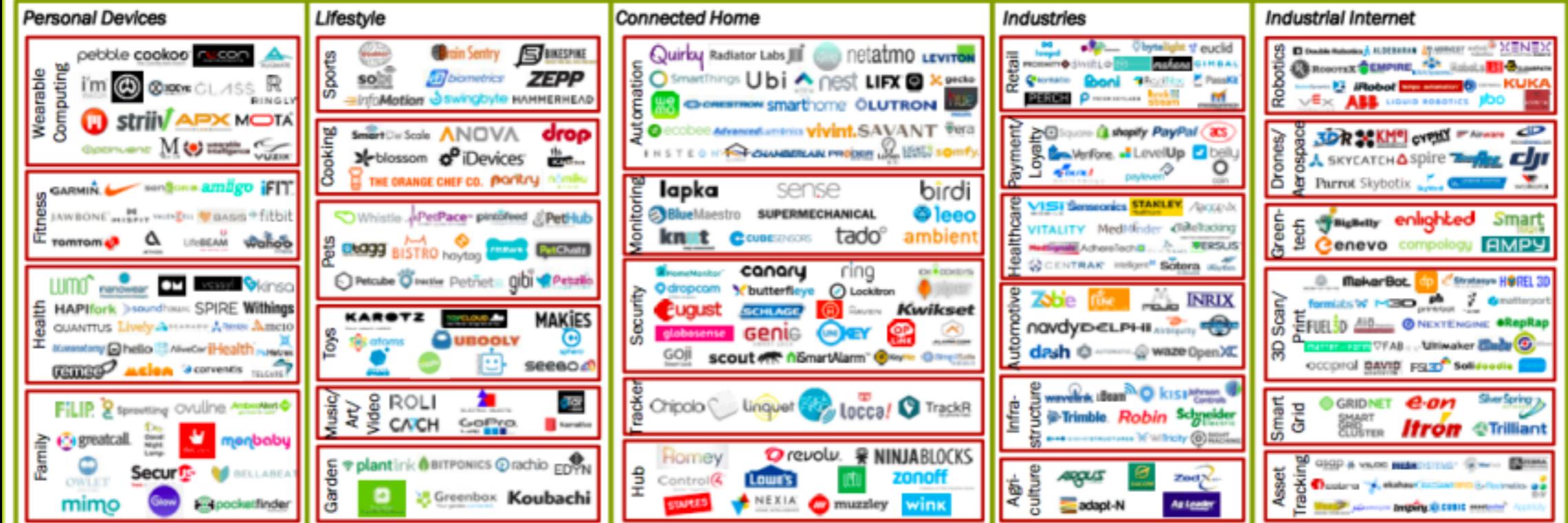
A red dragonfly icon is positioned above the word "libelium". Red signal wave icons are placed above the letters "i", "l", "e", and "l" in the company name.

Plataformas mapeadas e Critérios gerais de avaliação

Código	Plataforma	URL	Ano	Licença	Documentação	Arquitetura
[P01]	2lemetry	http://2lemetry.com/iot-platform/	2012	Comercial	adhoc	Cloud
[P02]	Amee	http://blog.amee.com/products/ameerealtime/	2012	Comercial	Informal	-
[P03]	Arrayent	http://www.arrayent.com/platform/iot-platform-overview	2014	Comercial	Inexistente	Cloud
[P04]	Axeda	http://www.axeda.com	2010	Comercial	Adhoc	Cloud
[P05]	Aylanetworks	https://www/aylanetworks.com	2013	Comercial	Inexistente	Cloud
[P06]	Bosch IoT Suite	https://www.bosch-si.com/products/bosch-iot-suite/benefits.html	2015	Comercial	Inexistente	Cloud
[P07]	Carriots	https://www.carriots.com	2012	Comercial	Adhoc	Cloud
[P08]	DeviceHive	http://devicehive.com/	2014	Open Source	Adhoc	Cloud
[P09]	Digi	http://www.digi.com/cloud-overvie	2013	Comercial	Adhoc	Cloud
[P10]	Evrythng	https://evrythng.com	2012	Comercial	Adhoc	Cloud
[P11]	Exosite	http://exosite.com/products/onep	2009	Comercial	Adhoc	Cloud
[P12]	Fi-ware	http://www.fi-ware.org	2011	Open Source	Adhoc	Cloud
[P13]	Glassbeam	http://www.glassbeam.com/spl-technology	2013	Comercial	Inexistente	Cloud
[P14]	Greenwave Systems	http://www.greenwavesystems.com	2014	Comercial	Inexistente	Cloud
[P15]	IBM Bluemix	https://internetofthings.ibmcloud.com	2014	Comercial	Adhoc	Cloud
[P16]	Intel IoT	http://www.intel.com/content/www/us/en/internet-of-things	2014	Comercial	Adhoc	Cloud
[P17]	IoBridge Connect	http://connect.iobridge.com	2014	Comercial	Adhoc	Cloud
[P18]	Jasper	https://www.jasper.com	2014	Comercial	Inexistente	-
[P19]	KaaProject	http://www.kaaproject.org	2014	Open Source	Completa	Híbrida
[P20]	Kii	http://en.kii.com/platform/internet-of-things	2014	Comercial	Informal	Cloud
[P21]	Nimbits	http://www.nimbits.com	2013	Open Source	Informal	Cloud
[P22]	Octoblu	http://www.octoblu.com	2014	Open Source	Informal	Cloud
[P23]	Parstream	https://www.parstream.com	2014	Comercial	Inexistente	Cloud
[P24]	Prismtech	http://www.prismtech.com/vortex	2014	Comercial	Informal	Cloud
[P25]	Samsung IoT	http://developer.samsung.com/iot	2014	Comercial	Inexistente	Cloud
[P26]	m2mAIR Cloud	http://www.telit.com/trym2maircloud/	2014	Comercial	Inexistente	Cloud
[P27]	Seecontrol	http://www.seecontrol.com	2010	Comercial	Inexistente	Cloud
[P28]	Smarthings	http://www.smarthings.com/developers	2013	Comercial	Completa	-
[P29]	Sofia2	http://sofia2.com/sofia2incloud_en.html	2014	Comercial	Completa	Cloud
[P30]	TempoIQ	https://tempoiq.com	2011	Comercial	Adhoc	Cloud
[P31]	Thingspeak	https://thingspeak.com	2010	Open Source	Inexistente	Cloud
[P32]	Thingworx	http://www.thingworx.com	2010	Comercial	Inexistente	Cloud
[P33]	Xively	https://xively.com	2013	Comercial	Adhoc	Cloud
[P34]	Zatar	http://www.zatar.com/features	2013	Comercial	Adhoc	Cloud
[P35]	ZettaJS	http://www.zettajs.org	2014	Open Source	Adhoc	Cloud

Sendo: - não informado

Applications (Verticals)

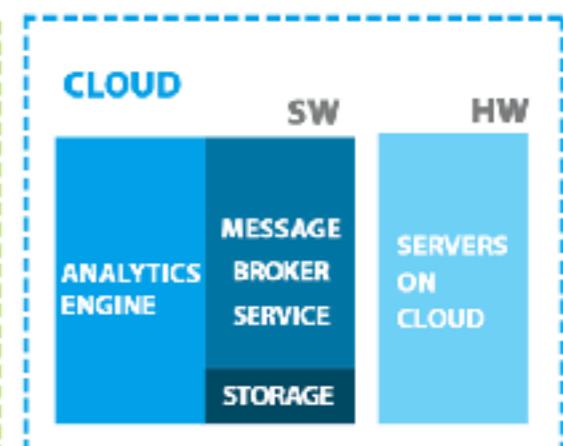
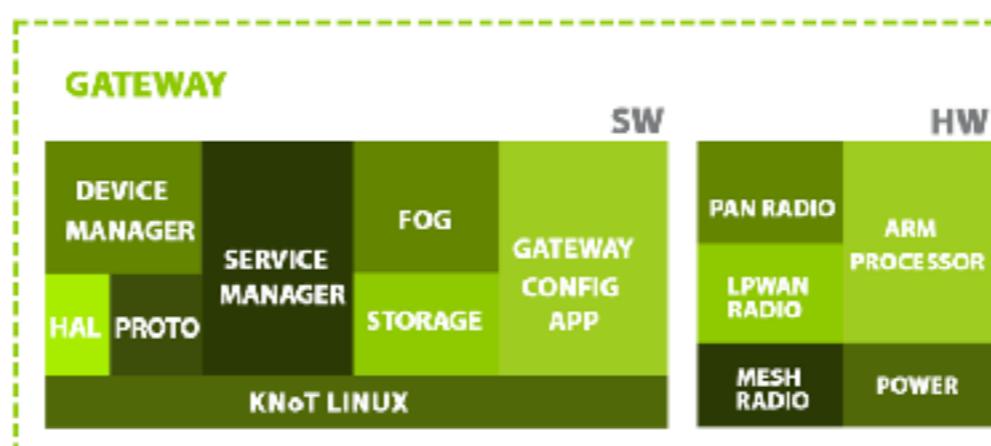
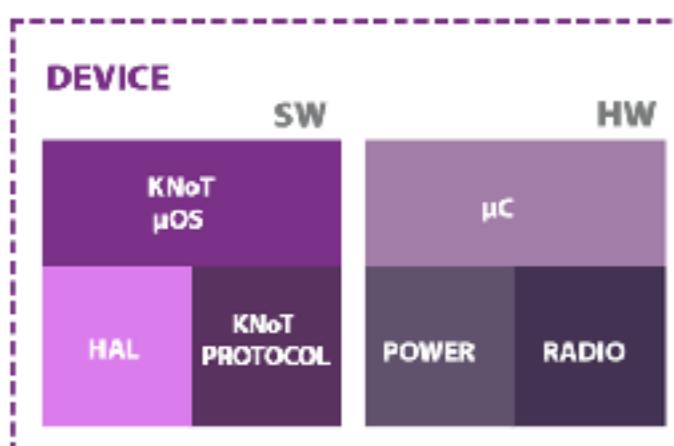
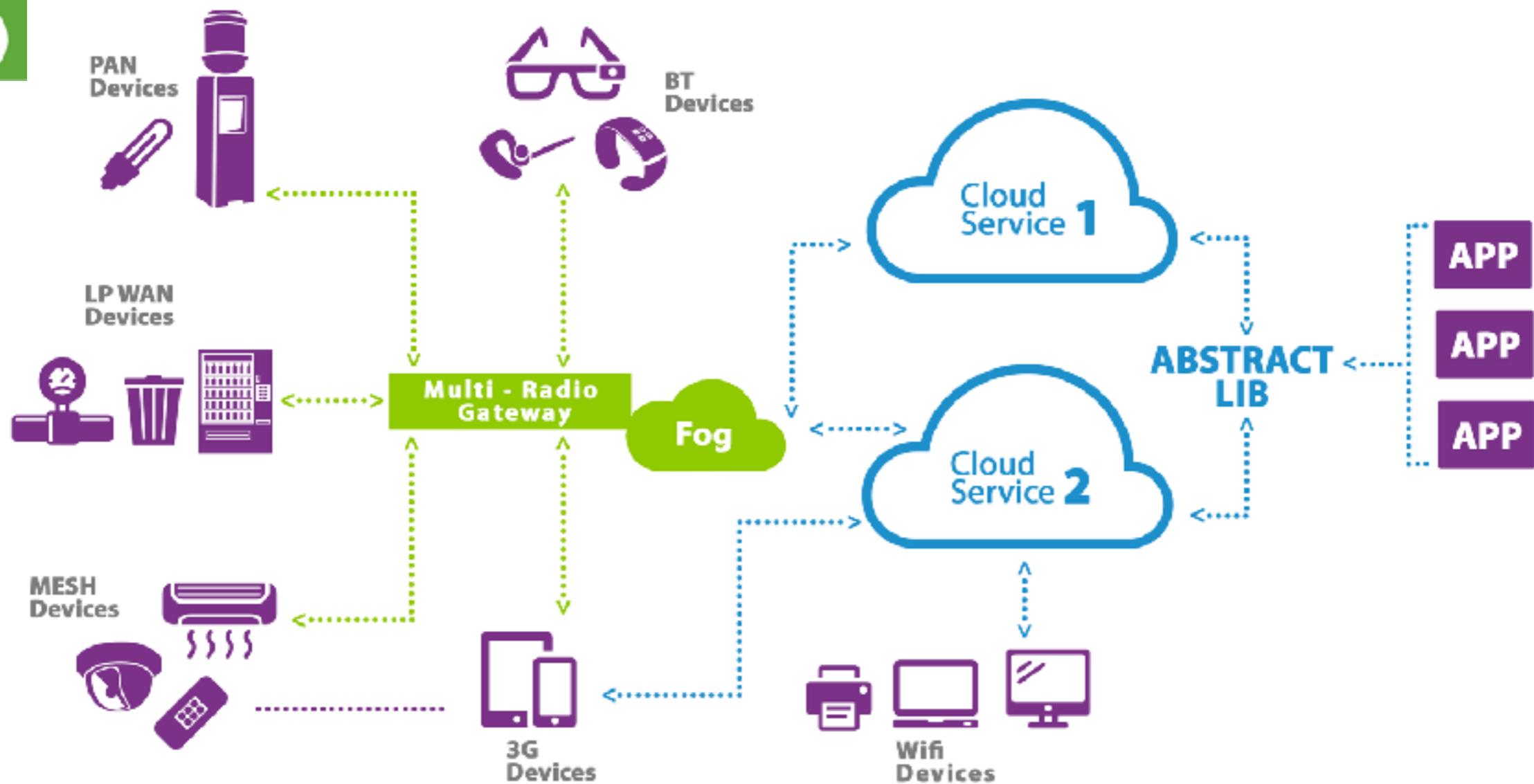
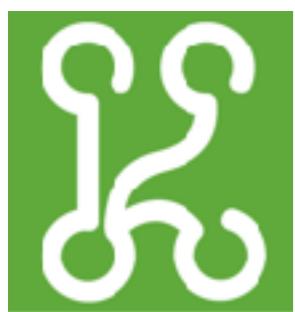


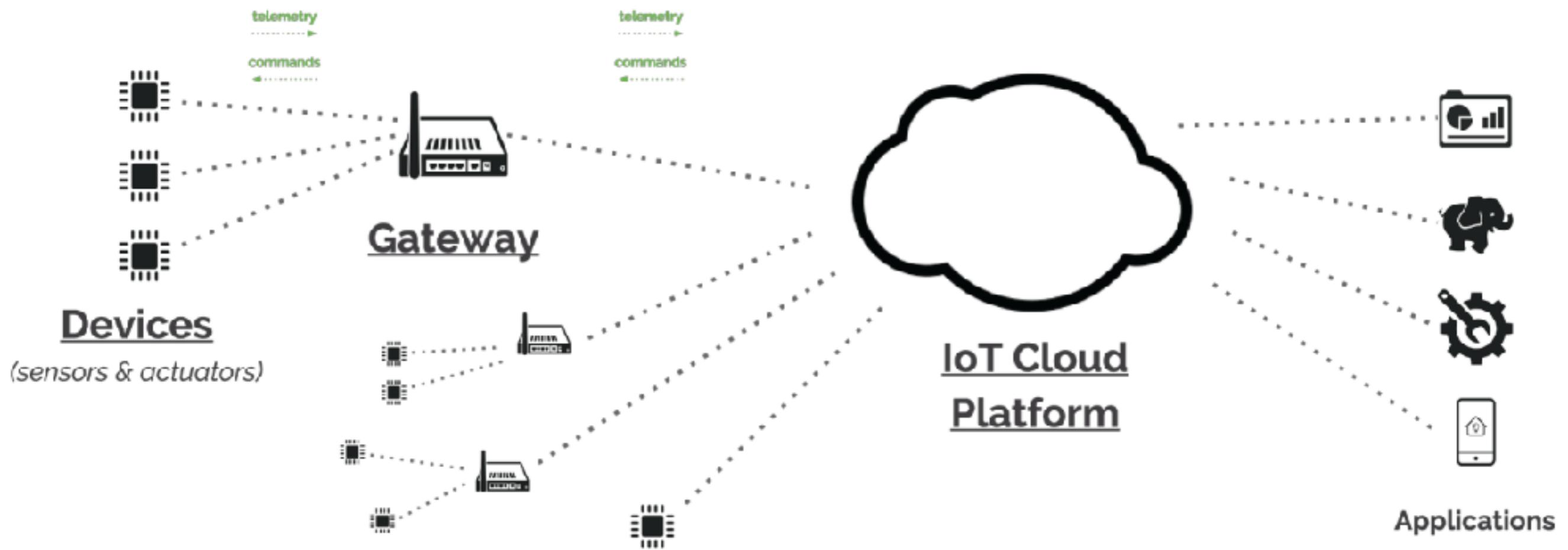
Platforms & Enablement (Horizontals)

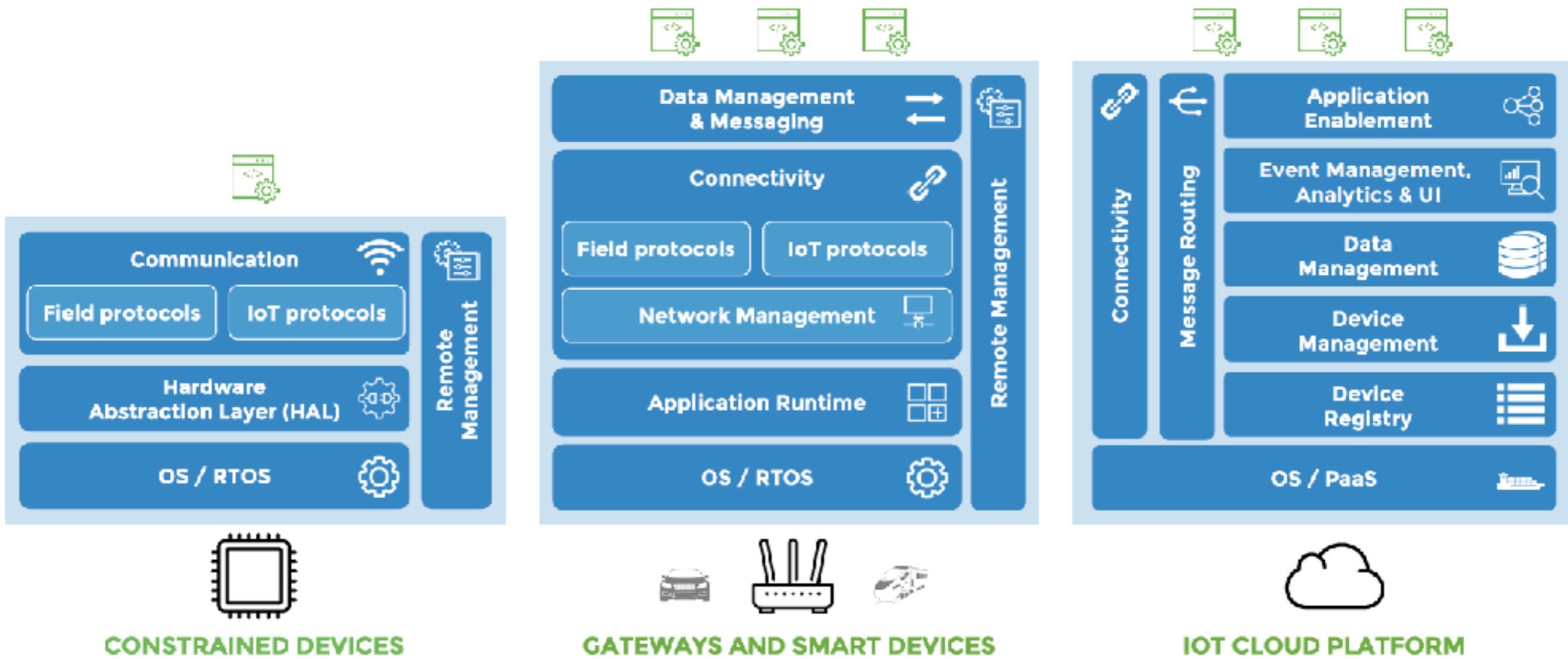


Building Blocks









IOT Platform

Gartner Hype Cycle for Emerging Technologies, 2016



gartner.com/SmarterWithGartner

Source: Gartner
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Gartner

6 MINUTE READ | APP ECONOMY

Why The Internet Of Things Might Never Speak A Common Language

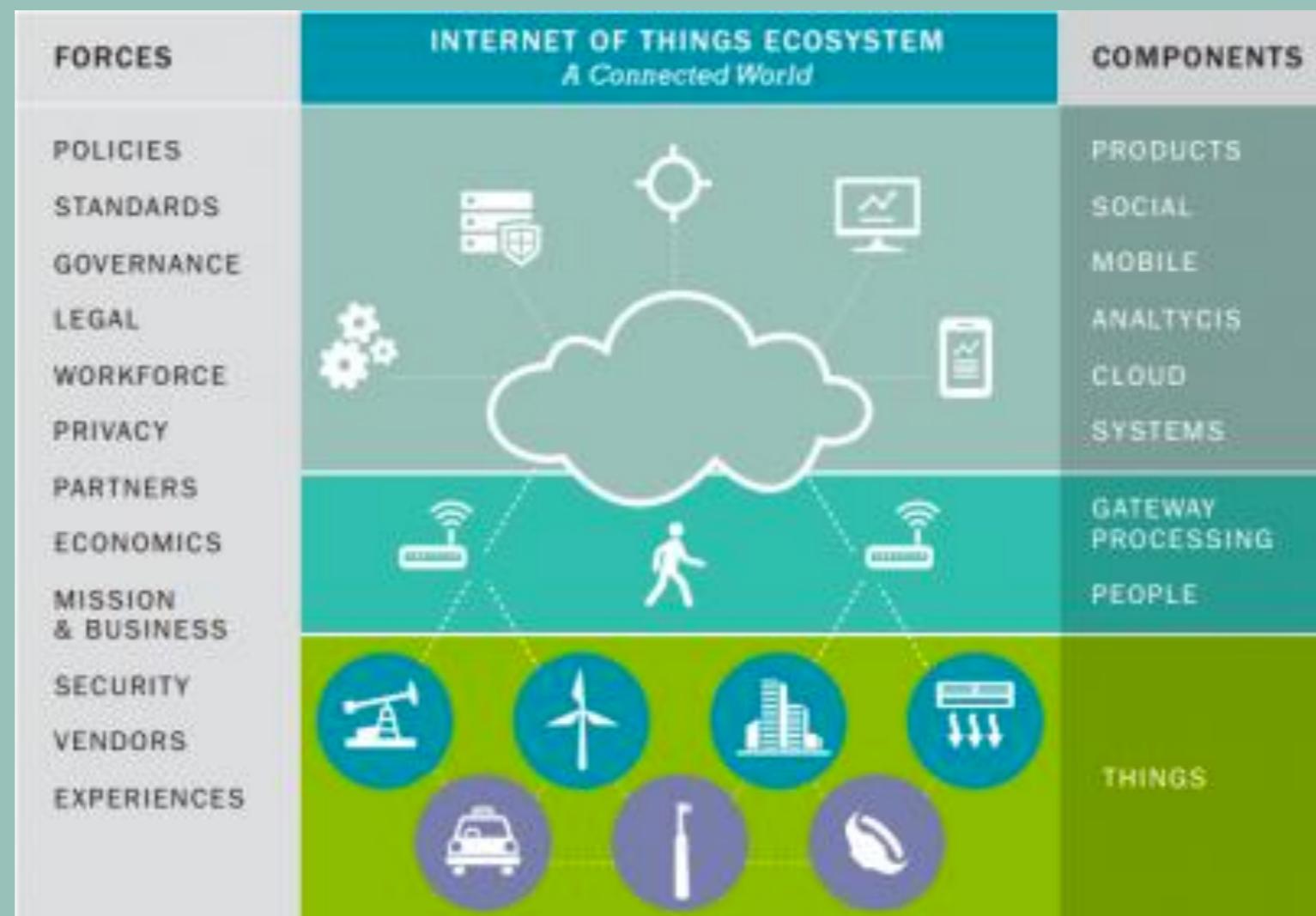
A single standard for smart homes and other connected devices sounds great, but some of the biggest tech firms don't seem interested.



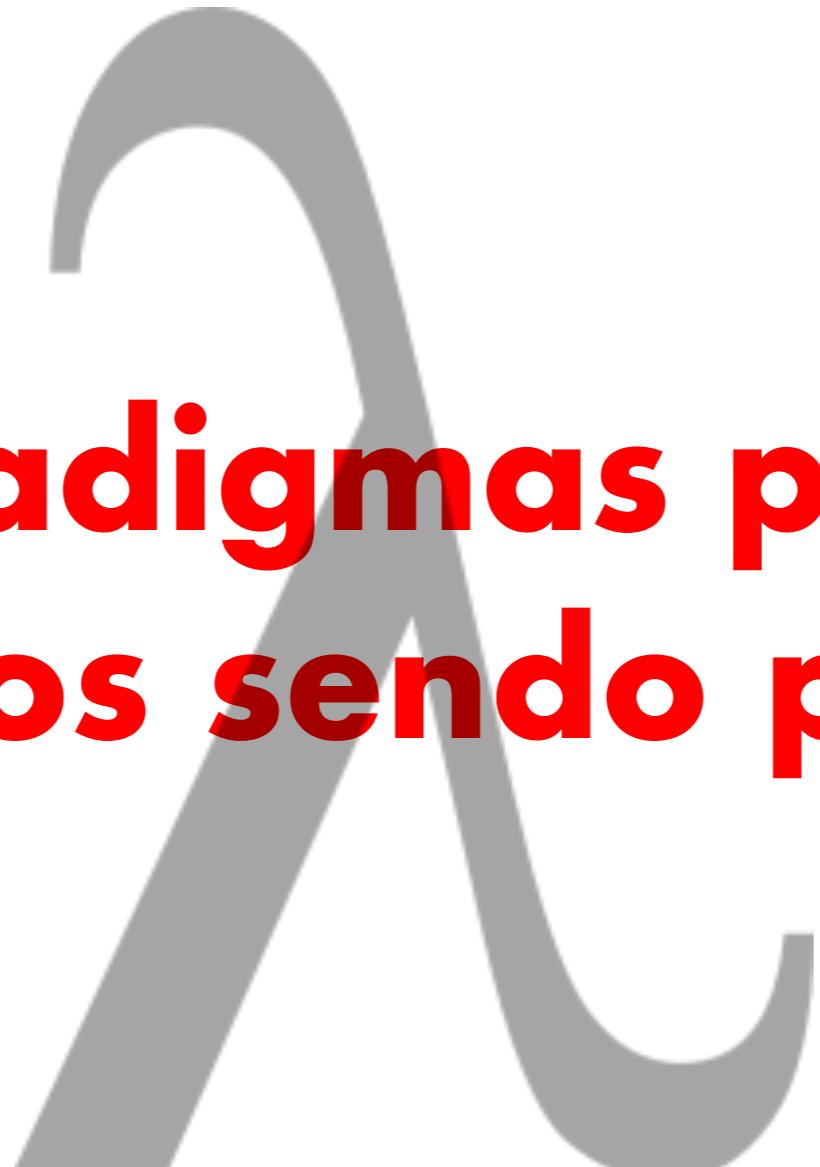
The Tower of Babel by Pieter Bruegel the Elder (1563) [Artwork: Wikimedia Commons]

Ecossistemas de software são frequentemente sustentados por um *mercado ou uma plataforma tecnológica em comum* e operam através da troca de informações, recursos e artefatos [digitais]

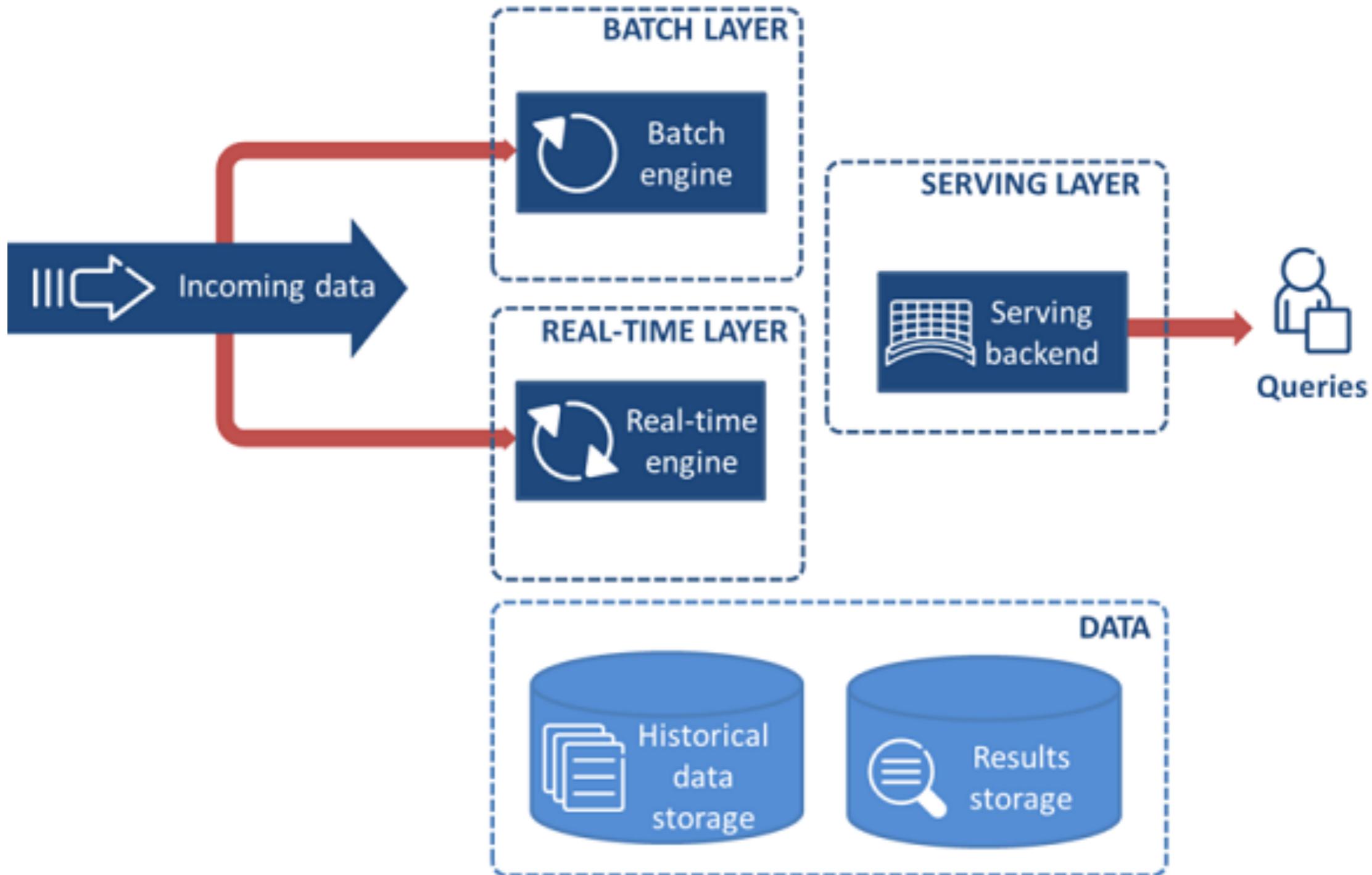
ecossistemas



já tínhamos falado que o valor
da IoT não está nas coisas



**novos paradigmas para tratar
tantos dados sendo produzidos**



BIG data



Volume
Velocidade
Variedade
Veracidade
Valor

realtime big data



**exemplo:
manutenção preditiva**



**eventos baseados em
padrões conhecidos**

x

descobrir padrões nos dados

Simple Event Processing (SEP)

Event Stream Processing (ESP)

Processos individuais não fazem muito sentido

Grupos de eventos são considerados
(ex: etiquetas RFID)

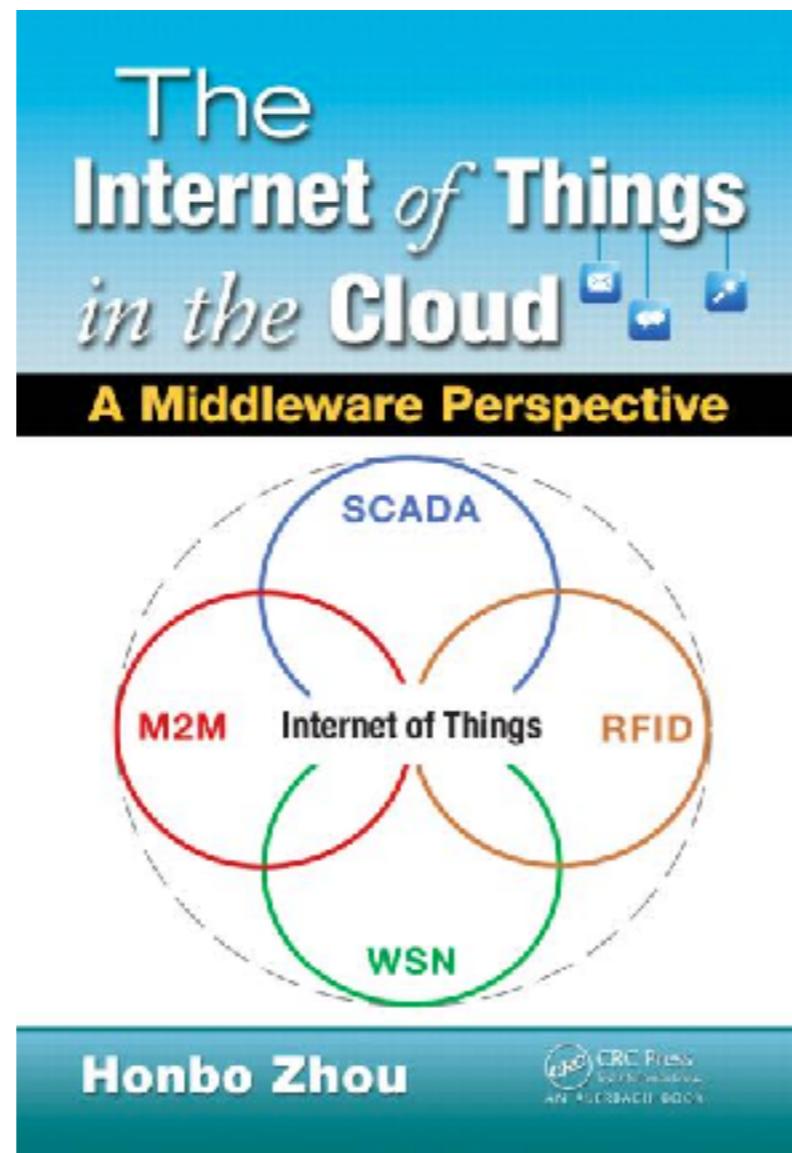
Complex Event Processing (CEP)

Conjunto maior de eventos é considerado

Inclui filtragem, correlações, agregações de eventos
(ex: inferir fluxo de mercadorias etiquetadas com RFID)

Regras mais complexas
(correlação causal, temporal, espacial)

Leitura



Outras referências

Kephart, J. O., & Chess, D. M. (2003). The vision of autonomic computing. *Computer*, 36(1), 41-50.

Hermann, M., Pentek, T. and Otto, B., 2016, January. Design principles for industrie 4.0 scenarios. In *System Sciences (HICSS), 2016 49th Hawaii International Conference on* (pp. 3928-3937). IEEE.

Silva, E. C. G., Oliveira, M. I. S., Oliveira, E., da Gama, K. S., & Lóscio, B. F. (2015). Um Survey sobre Plataformas de Mediação de Dados para Internet das Coisas. In *XLII Seminário Integrado de Software e Hardware (SEMISH)*

Jansen, S., Finkelstein, A., & Brinkkemper, S., 2009, May). A sense of community: A research agenda for software ecosystems. In *Software Engineering- Companion Volume, 2009. ICSE- Companion 2009. 31st International Conference on* (pp. 187-190). IEEE.