



The Internet of Things – all connected!

And the role of Cloud and Fog Computing

Claus Schaale

WW Cloud business development

JULY, 2015

Role of Cloud and Fog Computing in IoT

Purpose

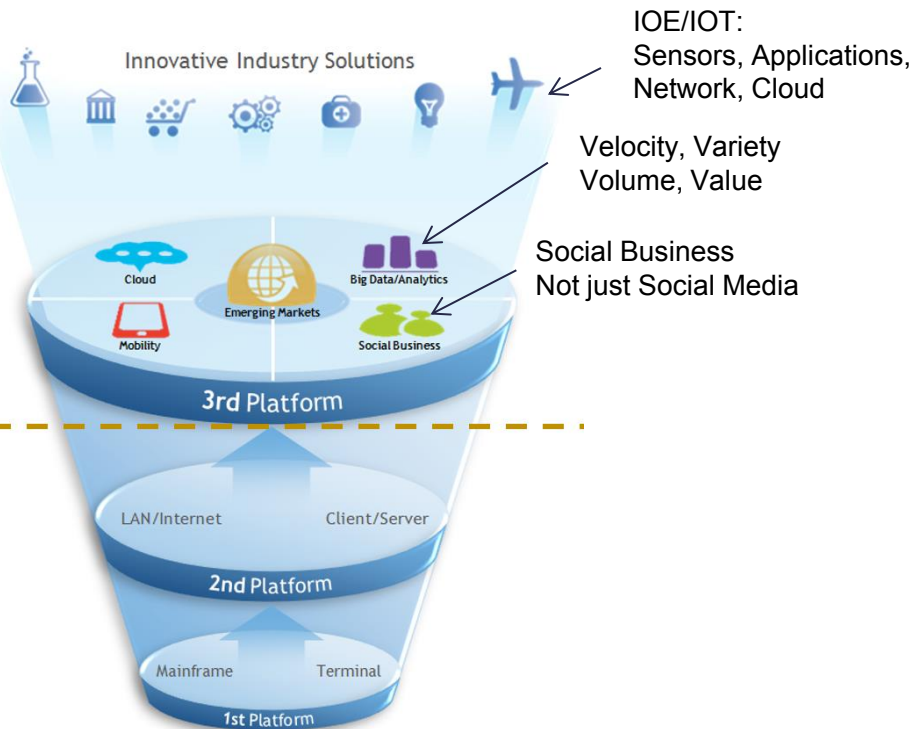


- To establish a common taxonomy and definition for M2M, IoT and IoE
- To review the current market trends and opportunities in IoT
- To present high level overview of architectures
- To present the Cloud and Fog computing role in IoT solutions
- To understand security and compliance components



What's going on with Cloud according to the analysts

IDC – The Third Platform



Battle of the buzzwords: M2M v IoT v IoE

Machine to Machine

M2M



A *device*...
that captures an *event*...
transmits it over a *network*...
to an *application*....
that translates it into
meaningful information.

Internet of Things IoT



A network of uniquely identifiable *“things”* that communicate *without human interaction* using IP connectivity

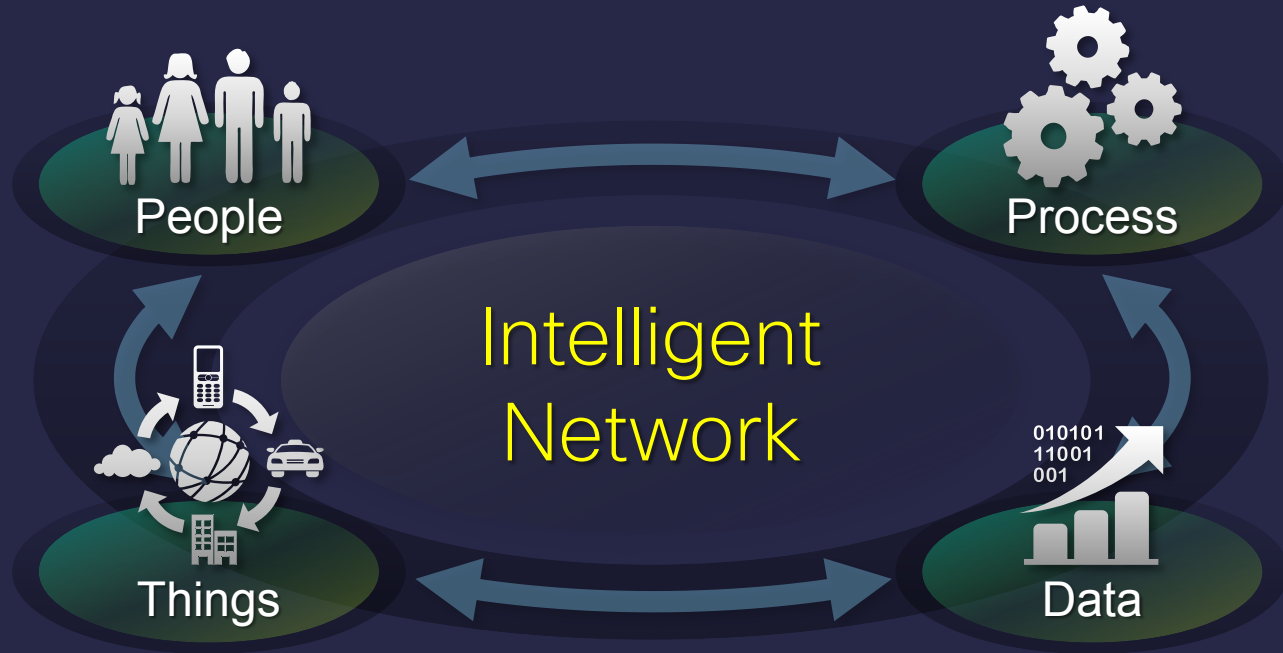
Internet of Everything

IoE



Bringing together the
people, process, data & things
to make networked
connections more relevant by
*turning information
into actions.*

Internet of Everything

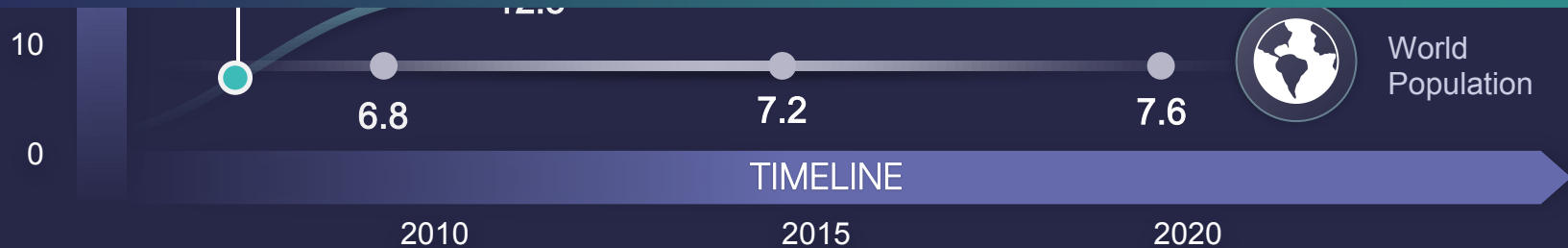


People-to-People + People-to-Machine + Machine-to-Machine

IoT Is Here Now – and Growing!



The New Essential Infrastructure



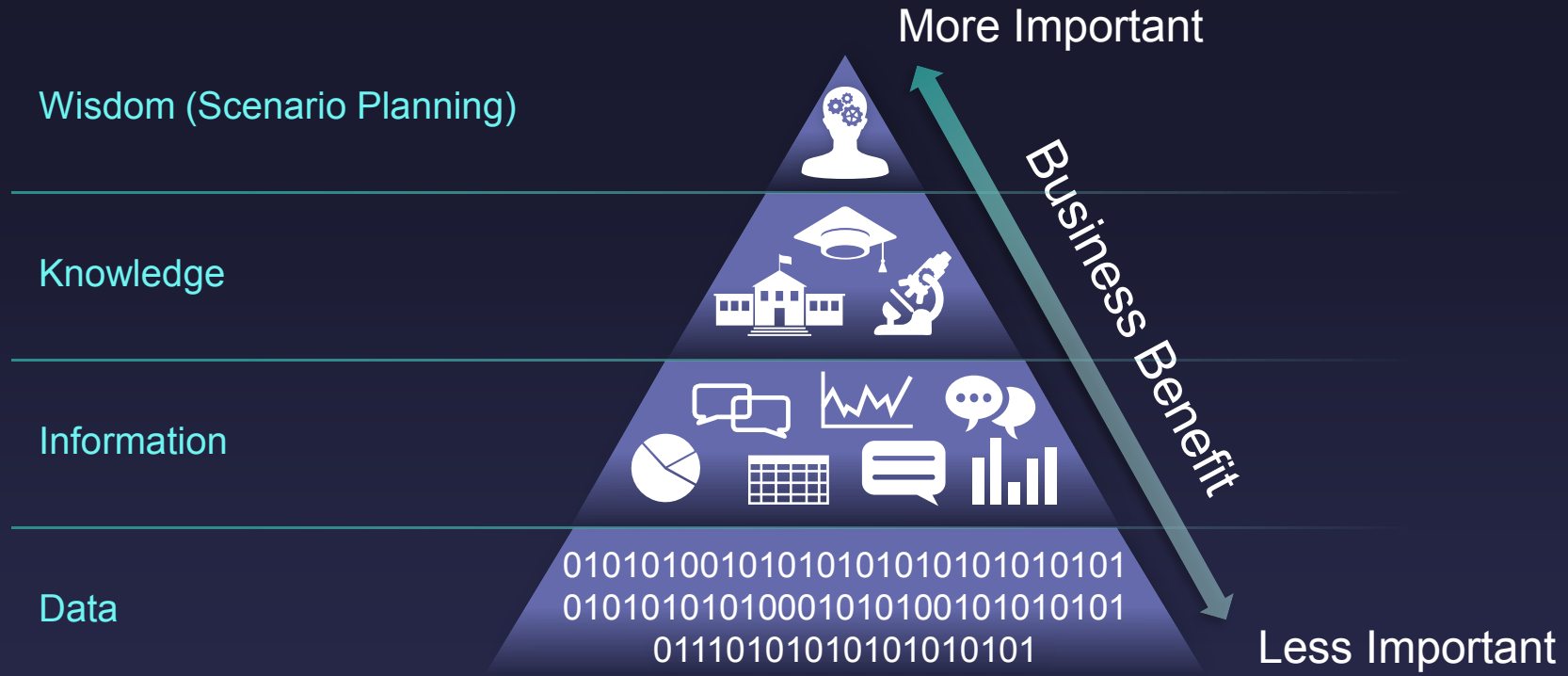
Source: Cisco IBSG, 2011

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IoT Transforms Data into Wisdom

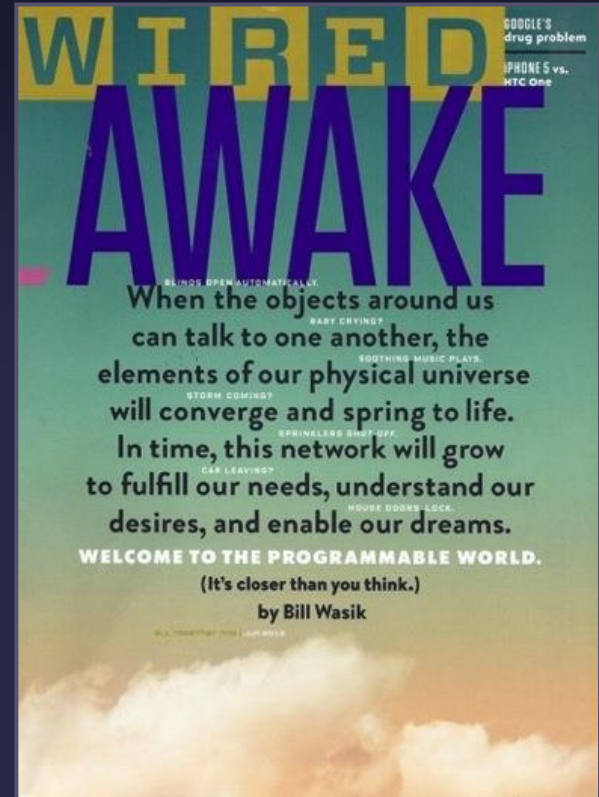


Big Data becomes Open Data for Customers, Consumers to Use

How Big Is the Potential Market?

“Trying to determine the market size for the Internet of Things is like trying to calculate the market for plastics, circa 1940. At that time, it was difficult to imagine that plastics could be in everything.”

Prof. Michael Nelson
Georgetown University



Sizing the Opportunity

\$19.0* Trillion

VALUE AT STAKE

14.4 Trillion PRIVATE SECTOR

Includes Both Industry-specific and Horizontal Use Cases:

- Customer experience
- Innovation
- Employee productivity
- Supply chain
- Asset utilization

4.6 Trillion PUBLIC SECTOR

Includes Cities, Agencies, and Verticals Such as Healthcare, Education, Defense:

- Increased revenue
- Reduced cost
- Employee productivity
- Connected militarized defense
- Citizen experience

Estimate Is Based on Bottom-up Analysis of **61 Use Cases**, Including
21 for Private Sector and 40 in Public Sector (*2013-2022)

IoE Consists of M2M, M2P, and P2P Connections

CONNECTION TYPE

IoE VALUE (2013-2022)



MACHINE-TO-MACHINE (M2M)

- Data sent / received from one machine (thing) to another
- Often called the “**Internet of Things**”

\$7.4 TRILLION



MACHINE-TO-PERSON (M2P)

- Data sent / received from a machine (thing) to a person
- Often called “**data and analytics**”

\$4.6 TRILLION



PERSON-TO-PERSON (P2P)

- Data sent / received from one person to another
- Often called “**collaboration**”

\$7.0 TRILLION

The Business Quickly Becomes A "With One Efficiency" ...

MANUFACTURING



Operational Efficiency



SMART CITIES



New Revenue



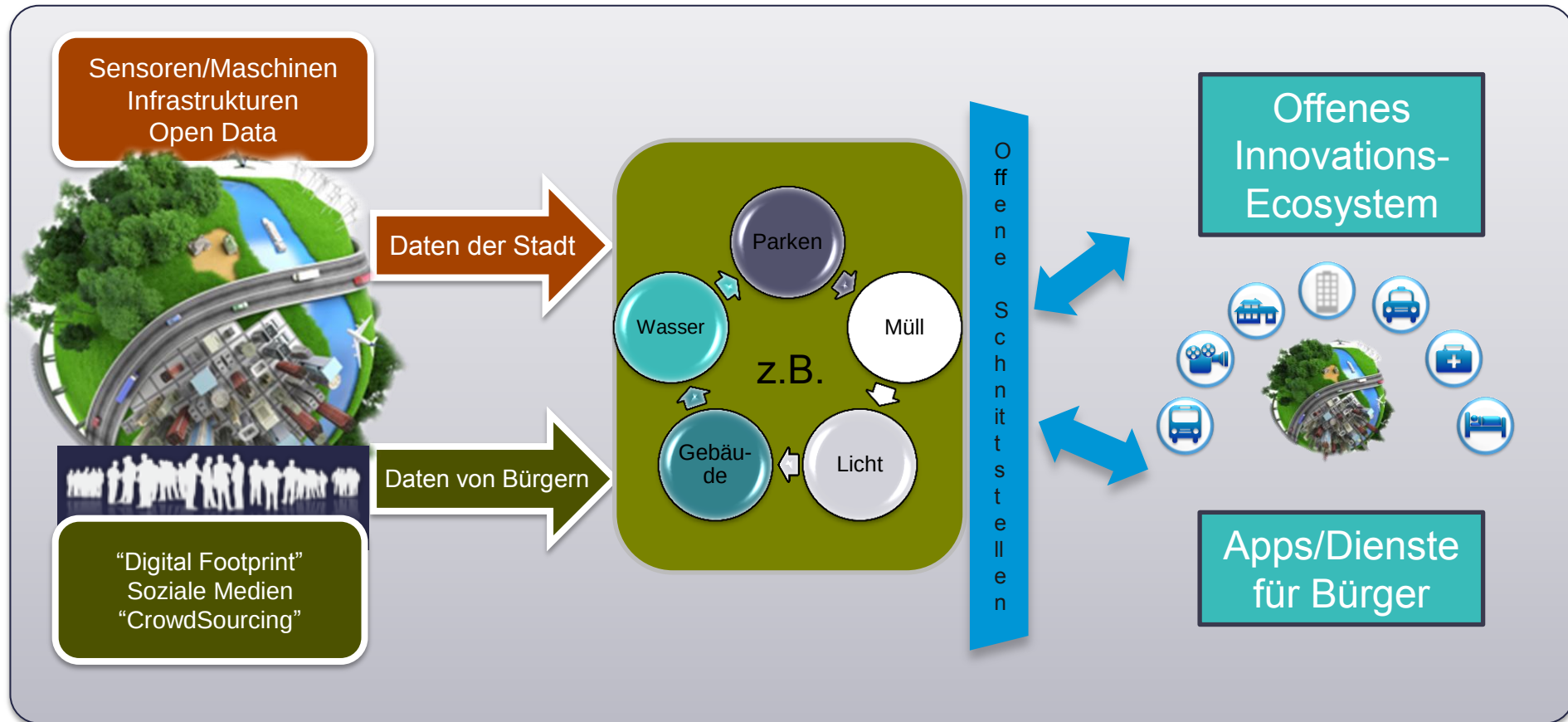
TRANSPORTATION



Regulatory Compliance



IoE für Städte: “High Level” Architektur



[Click here for the official list of NYC datasets](#)



Business



City Government



Education



Environment



Health



Housing & Development



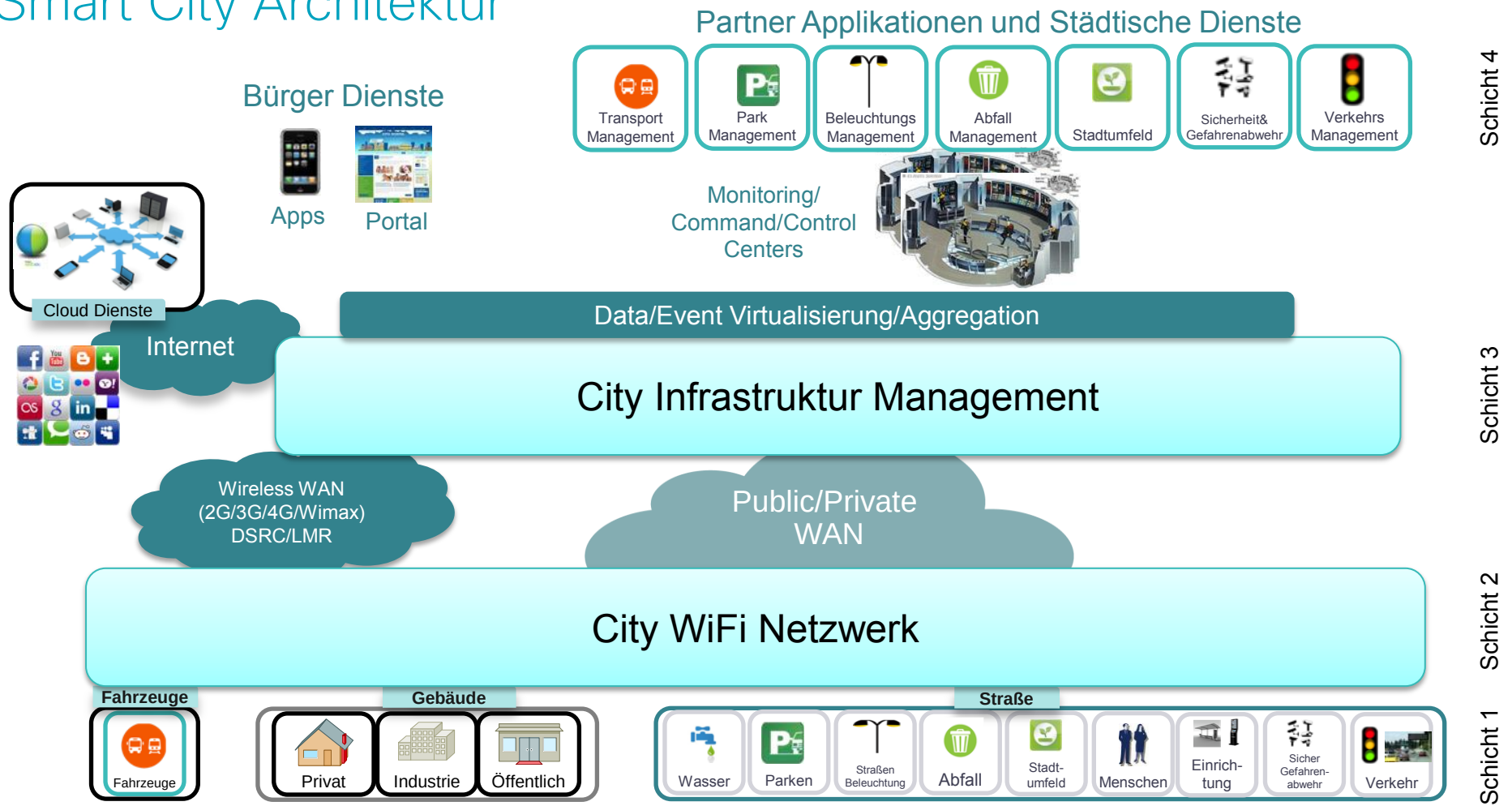
Public Safety



Recreation



Smart City Architektur



Smart+Connected City – Anwendungsfälle



Intelligentes Parkraum- Managemnet



Bürger bekommen
Echtzeit-Informationen
ber Verfügbarkeit von
Parkplätzen

Reduzierung von
kreisendem Verkehr,
Umweltbelastung und
Verkehrsstörungen

Intelligente Verkehrssteuerung



Beobachtung und
Management von
Verkehrseignissen

Reduzierung von Staus
und Erhöhung der
Lebensqualität in der
Stadt

Sicherheit in der Stadt



Automatische Erkennung
von Sicherheits-
Ereignissen

Verkürzung von
Reaktionszeiten

Datenanalyse zur
Reduzierung der
Kriminalität

Intelligente Lokalisierungsdienste



Sichtbarkeit von
Menschenströmen zur
Unterstützung der Planung
und Beeinflussung von
Kontext-bezogenen
Inhalten und Werbung

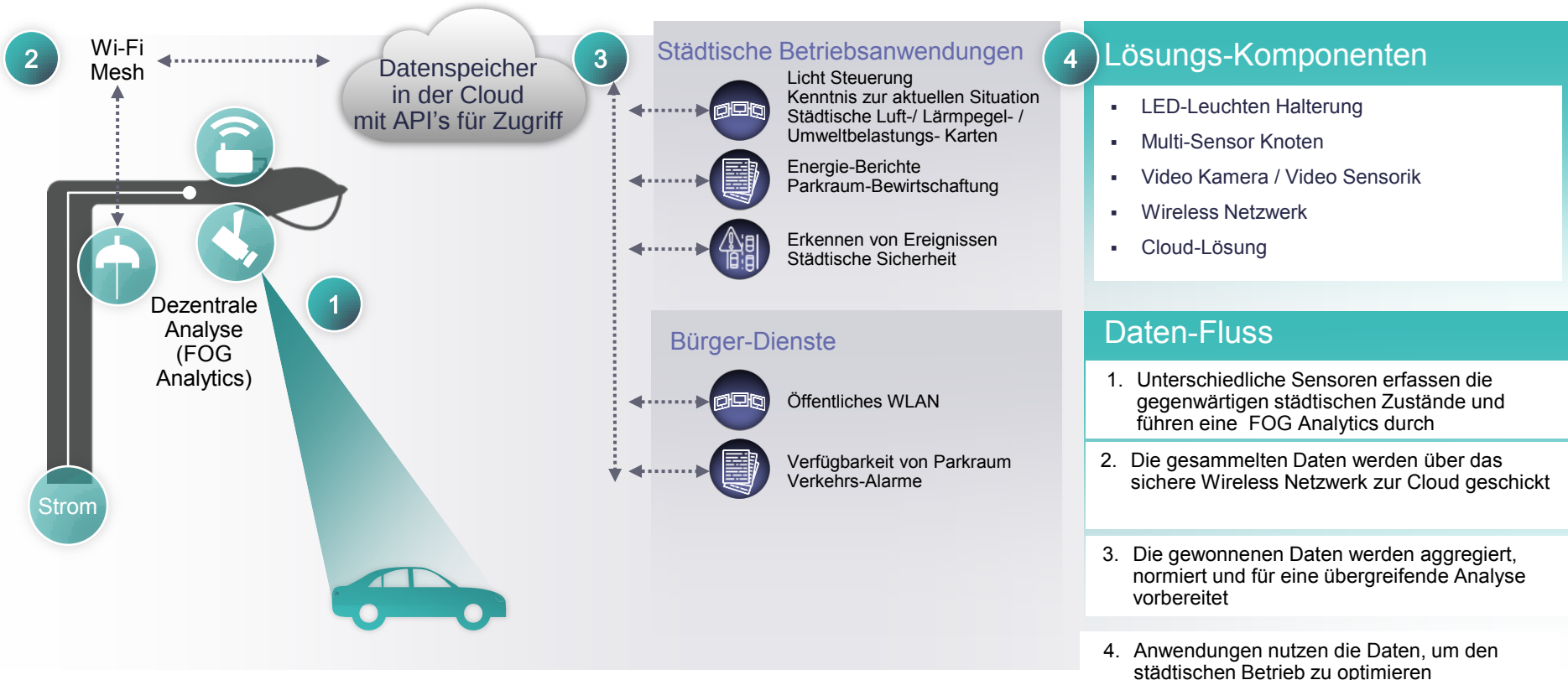
Intelligente Stadtbeleuchtung



Management der
Straßenbeleuchtung zur
Einsparung von Energie
und Wartungs-Kosten

Verfügbarkeit von
zusätzlichen Diensten
(Hotspot, Analytics,
Überwachung,
Parkraummanagemnt
usw.)

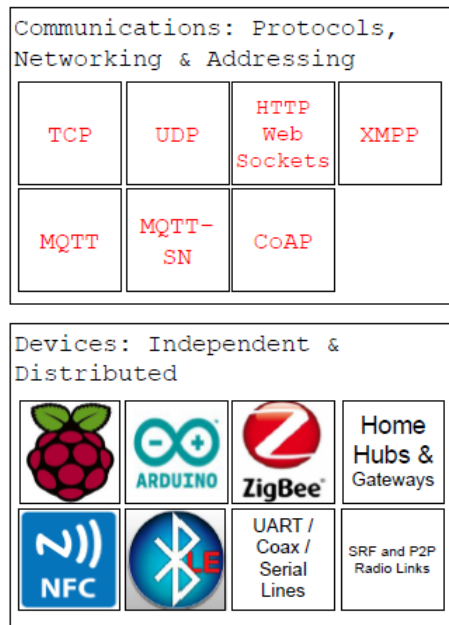
Beispiel: Die Straßenbeleuchtung als Multi-Sensor-Knoten



Convergence of networks

IoT Communications & Devices

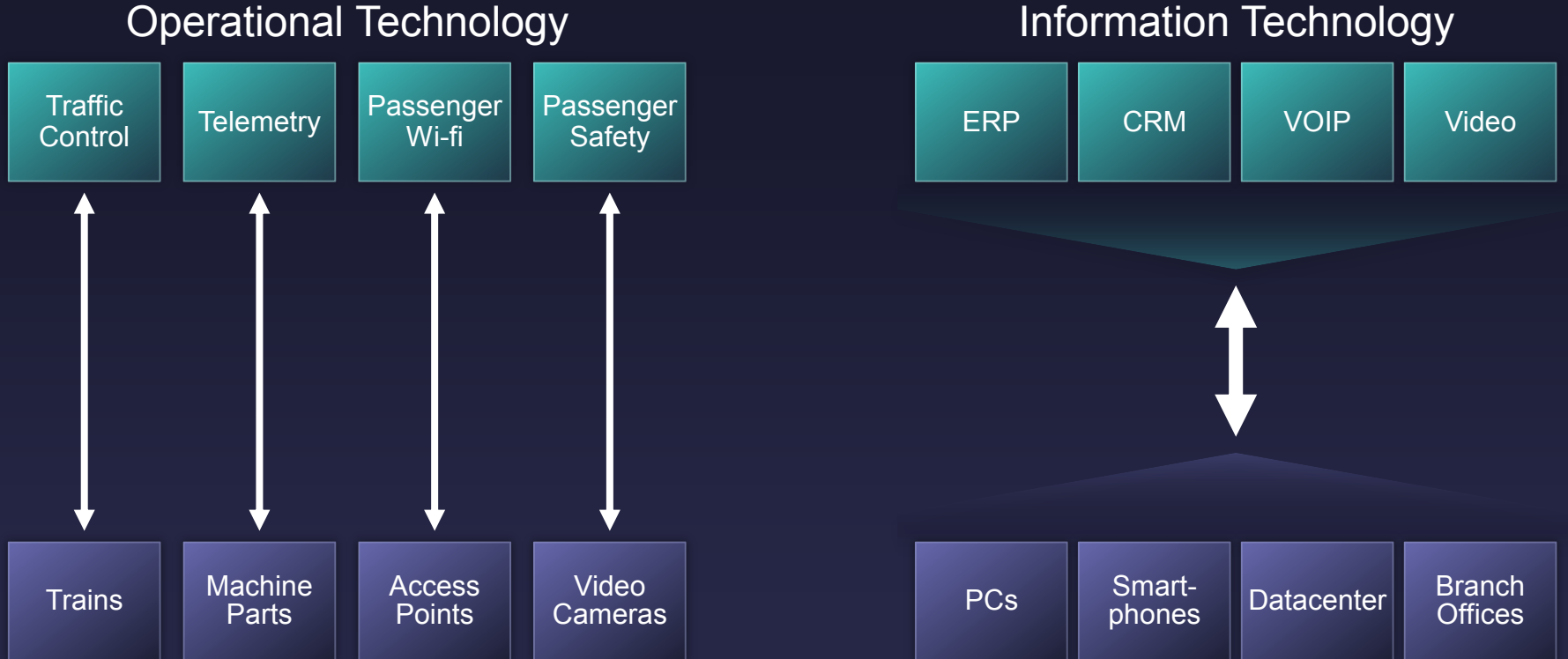
- Devices are independent & distributed
- Multiple protocols
- Device network handoff involve multiple protocols
- Communications involve complex Networking and Addressing
- One size does not fit all



Wireless Protocols for IoT

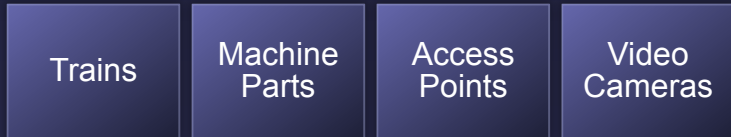
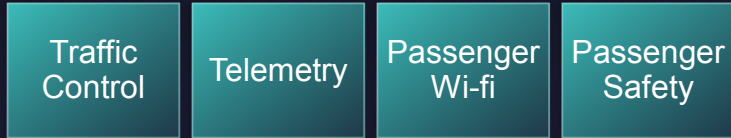
- IEEE 802.11
- Bluetooth/Bluetooth Smart
- ZigBee/ZigBee Smart Energy 2.0
- IEEE 802.15.6-2012: Body Area Networking
- Wireless HART (Highway Addressable Remote Transducer Protocol)
- International Society of Automation (ISA) 100.11a
- Z-Wave
- MiWi (Microchip Technology Wireless)
- ANT+
- Wireless M-BUS

Converged Operational and IT processes

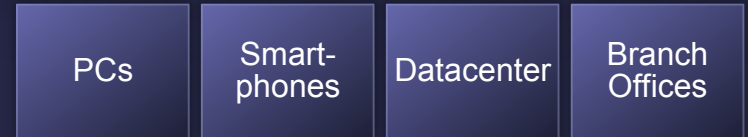
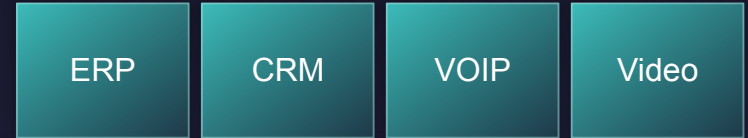


Convergence Delivers Control Over IP

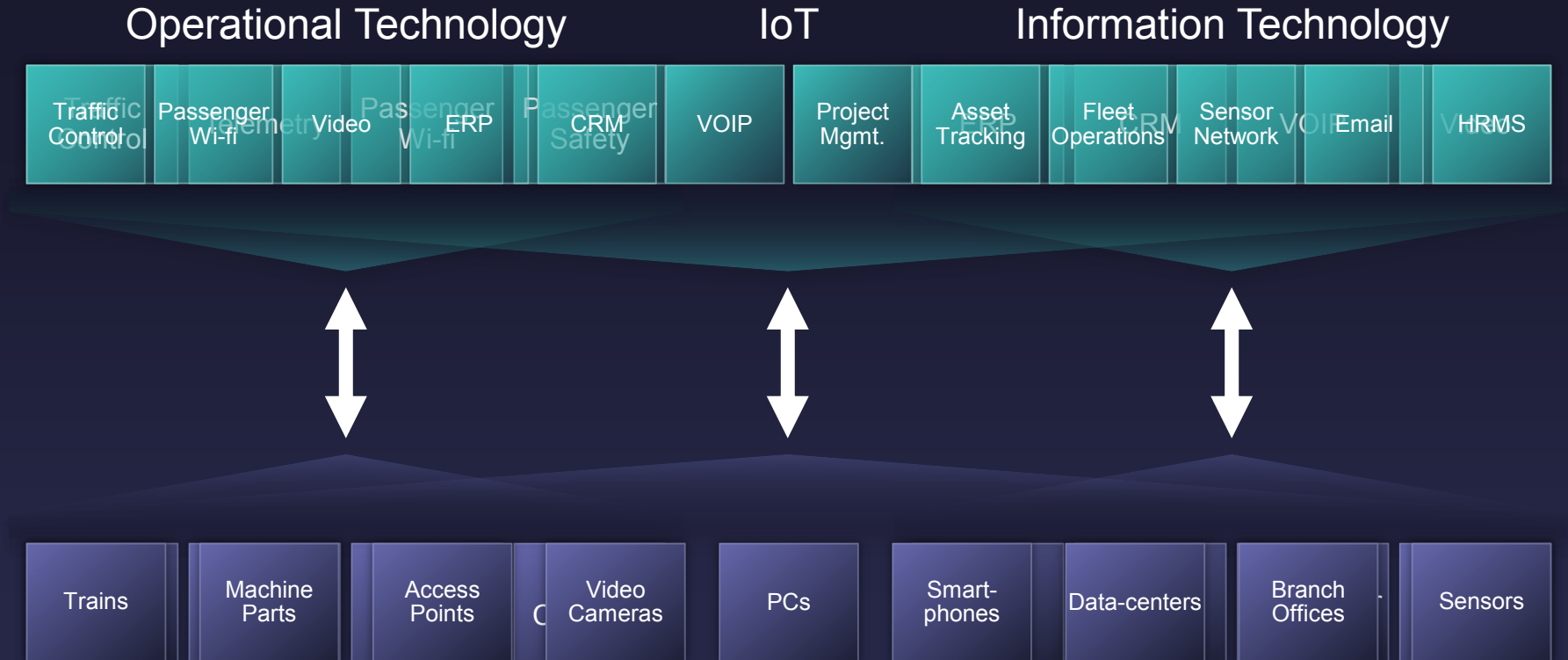
Operational Technology



Information Technology

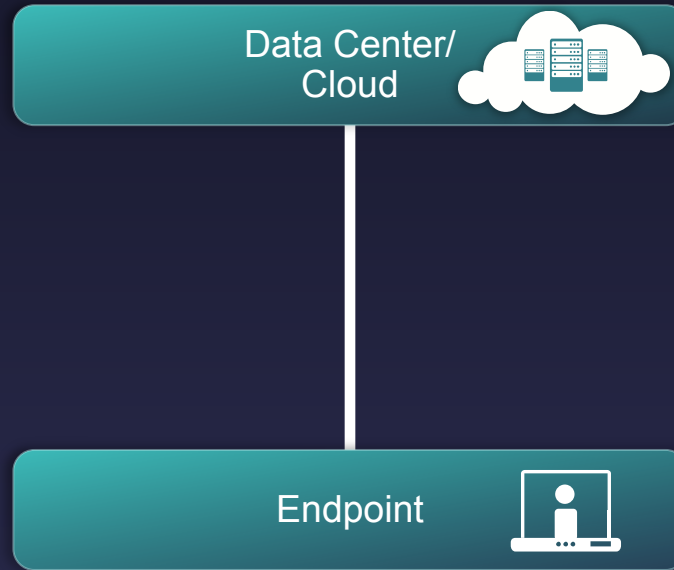


Convergence Delivers Control Over IP



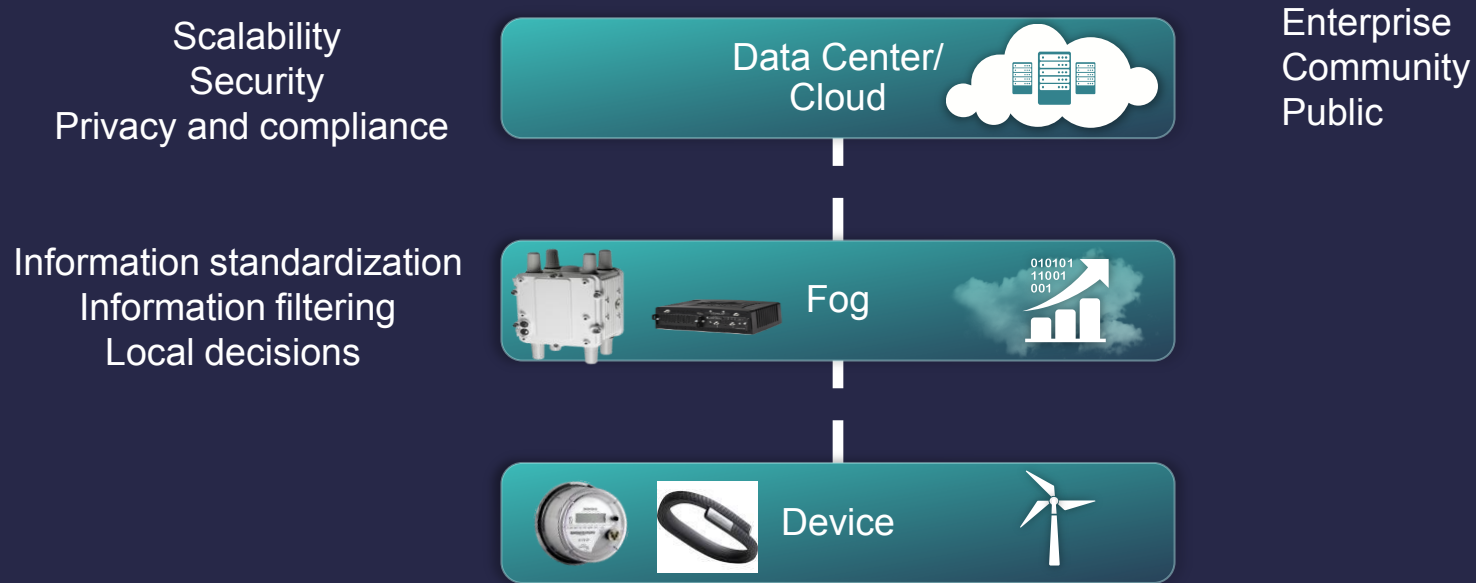
IoT Requires Distributed Computing

Traditional Computing Model (Terminal/Mainframe, Client-Server, Web)

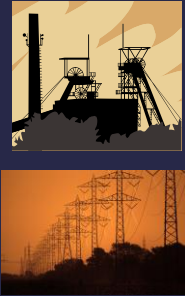


IoT Requires Distributed Computing

IoT Computing Model



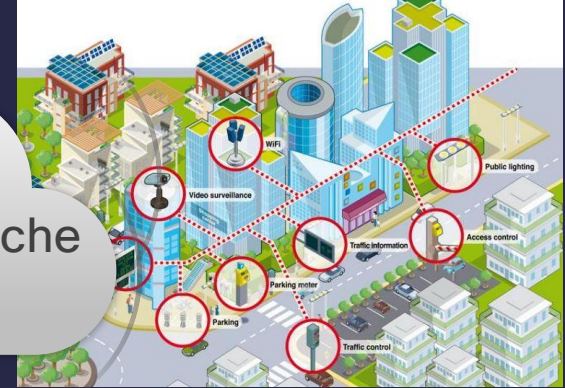
What are the different Cloud scenarios?



DC/Private
Clouds

FlexPod® **VBLOCK**
READY

Regional/Niche
Clouds



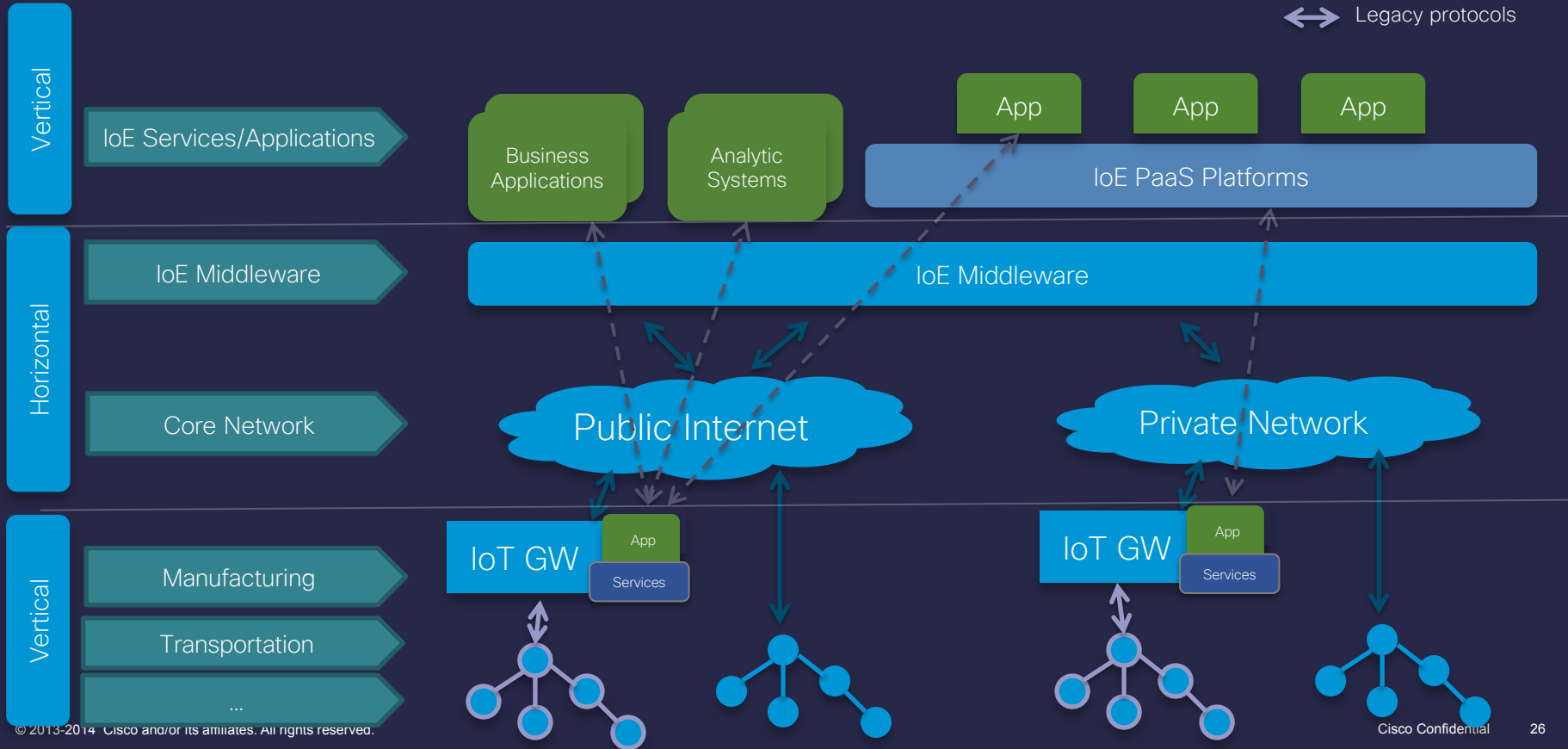
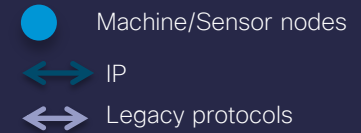
Public
Clouds



SOFTLAYER®



Executing on IoE Architecture



5 Requirements for Successful IoT Implementations

Converged,
Managed
Network



Resilience at
Scale



Security &
Privacy



Distributed
Intelligence



Application
Enablement



Last but not least...Privacy and compliance



IoT will reach and produce information that is or will be subject to privacy or compliance regulation

Privacy by design allows us to keep getting the value of IoT and Cloud while taking into consideration these factors

In summary

- Internet of Things as the next big digital revolution, Convergence of operational technologies and information technologies
- Cloud as IoT enabler/IoT foundation
- Fog is needed for scale and real-time apps
- Privacy by design as emerging need

**IoT is a US\$19 trillion
Opportunity!**

Vielen Dank!

Additional information

<http://internetofeverything.cisco.com/>

<http://clausoncloud.blogspot.com/>

[@IoTBerlin](#)