



Web of Things, Internet of Things and MEMS

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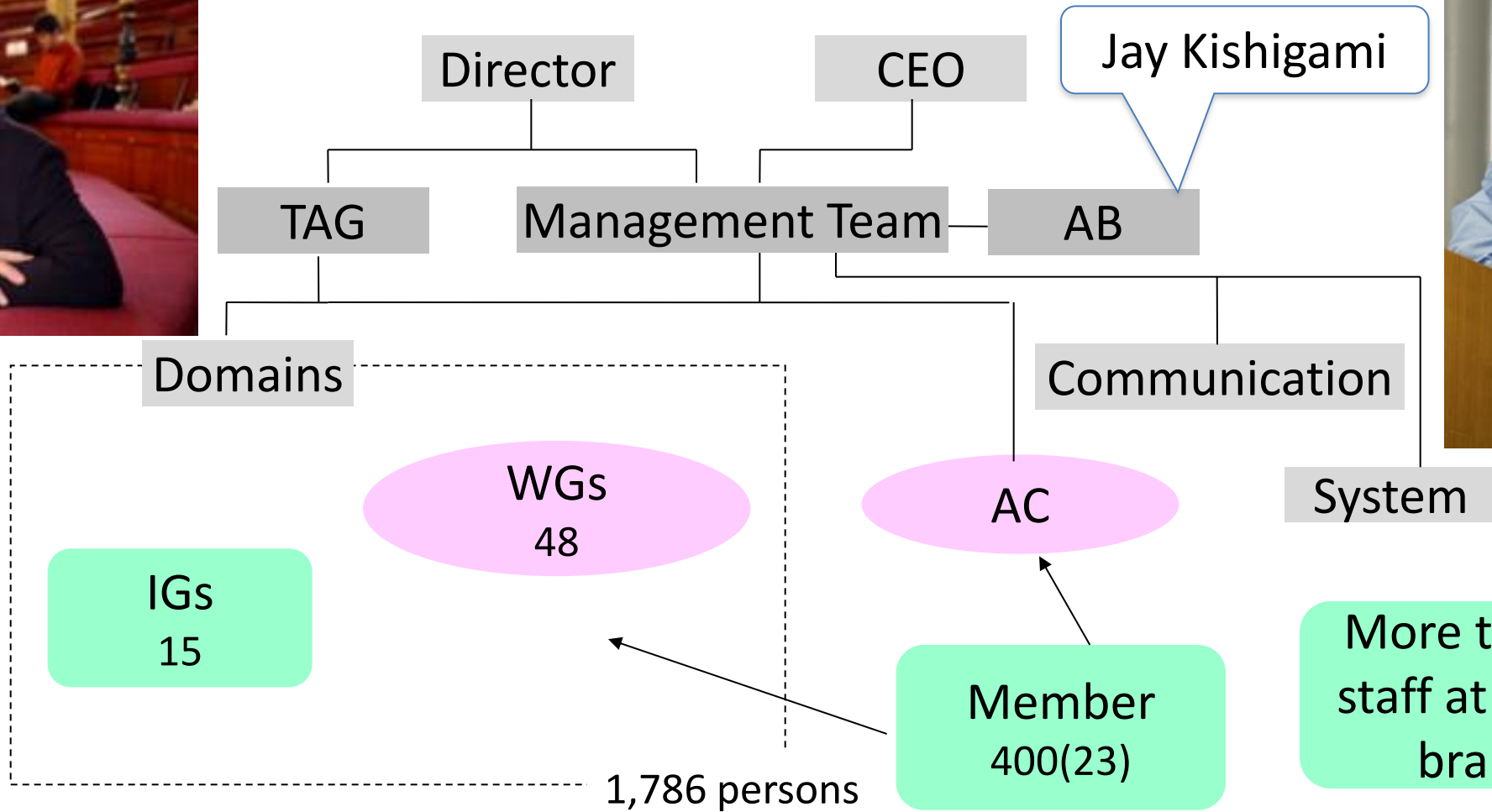


Tim Berners-Lee with NeXT at London Olympic



<http://www.zdnet.com/uk/web-inventor-tim-berners-lee-stars-in-olympics-opening-ceremony-7000001744/>

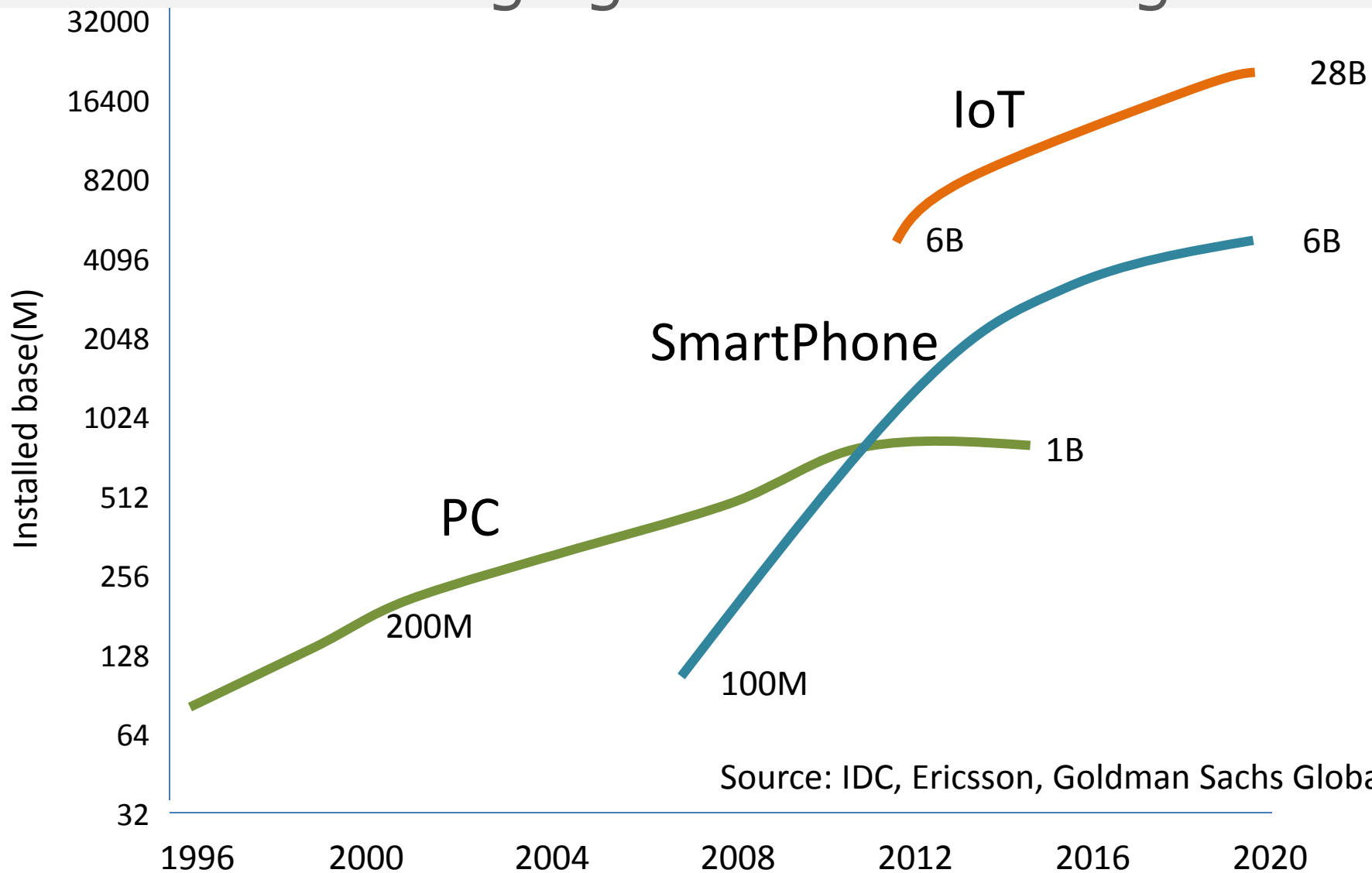
W3C



Open Web platform moving from PC to Devices

- Digital Publishing
- Social Web
- Web Payments
- Digital Marketing
- Telecommunications
- Entertainment
- and Things

IoT emerging as the next mega-trend



Source: IDC, Ericsson, Goldman Sachs Global Investment Research.

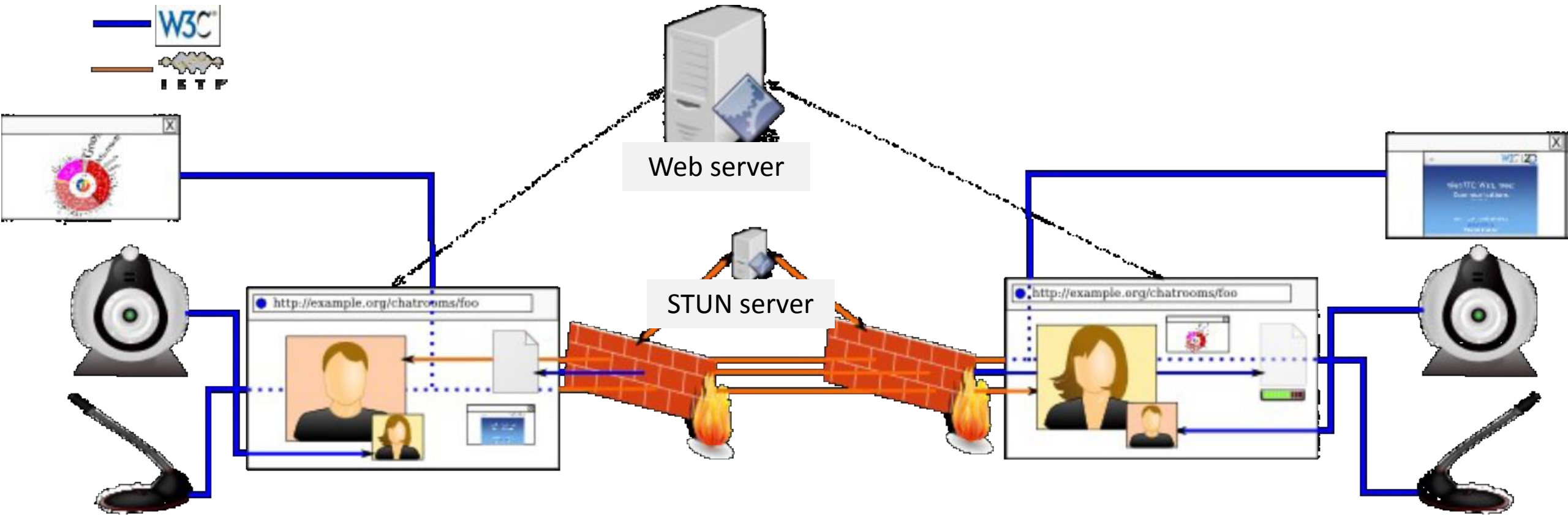


webRTC

Real-time Communication Between Browsers

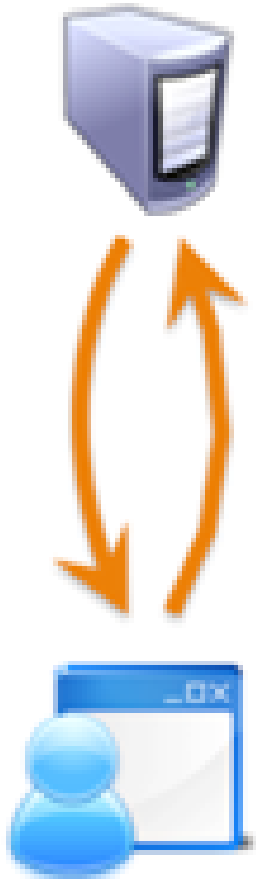


W3C and IETF collaborative standard

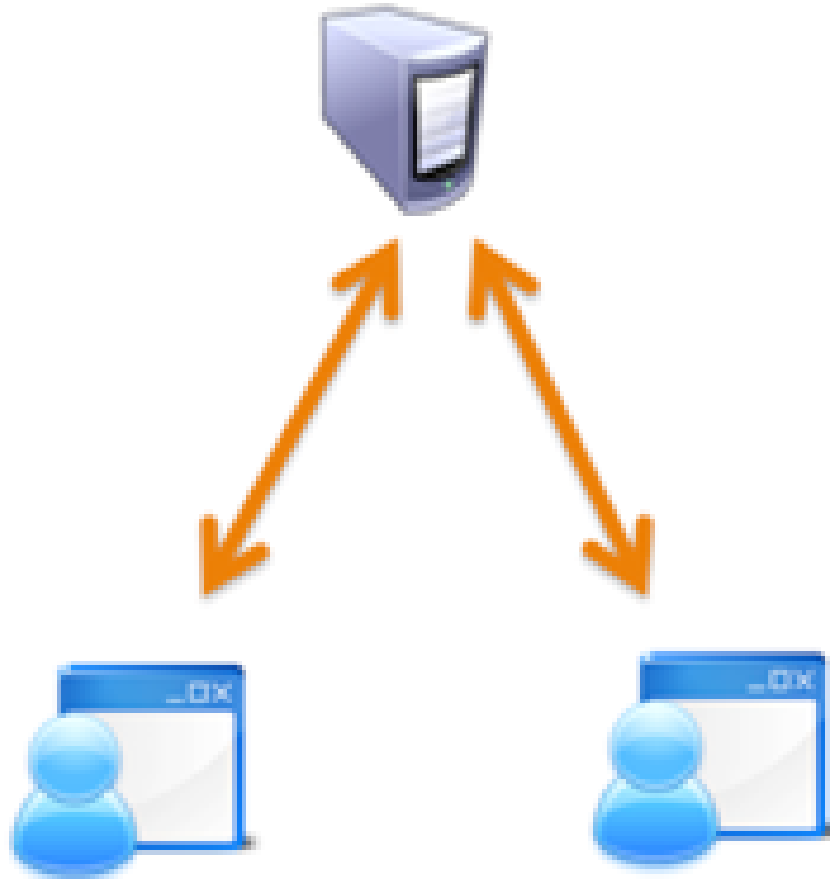


WebSocket and webRTC

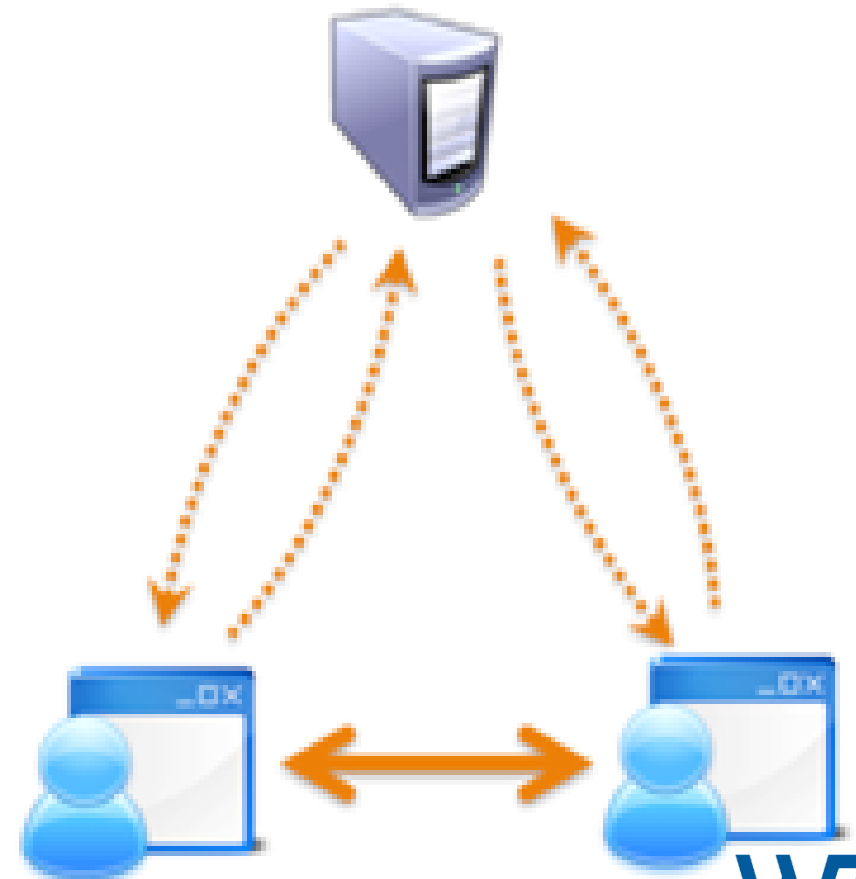
HTTP



WebSocket











WebRTC



members

- Alcatel-Lucent
- Apple
- Samsung
- Opera
- Google
- Microsoft
- Avaya
- Baidu
- Bistri
- Cable Labs
- Cisco
- ETRI
- Ericsson
- Huawei
- Mitsubishi h
- Mozilla
- Nokia
- Chinese Acad.Of Sciences
- AT&T
- China Unicom
- Orange
- Telecom Italia
- Verisign
- Voxeo
- Unify
- Tencent
- Temasys
- Qihoo 360
- Plantronics
- Qihoo 360
- Nuance
- NICTA
- Mstar
- Mirae Web
- Hookflash
- Genesys

Implementation status now

								
	Canary	Chrome	Opera	Nightly	Firefox	Bowser	IE	Safari
PeerConnection API	Green	Green	Green	Green	Green	Green	Red	Red
getUserMedia	Green	Green	Green	Green	Green	Green	Yellow	Red
WebAudio Integration	Yellow	Yellow	Yellow	Green	Green	Red	Red	Red
dataChannels	Green	Green	Green	Green	Green	Red	Red	Red
TURN support	Green	Green	Green	Green	Green	Green	Red	Red
Echo cancellation	Green	Green	Green	Green	Green	Green	Red	Red
MediaStream API	Green	Green	Green	Yellow	Yellow	Green	Red	Red
Multiple Streams	Yellow	Yellow	Yellow	Green	Red	Green	Red	Red
Simulcast	Yellow	Yellow	Red	Red	Red	Red	Red	Red
Screen Sharing	Yellow	Yellow	Red	Yellow	Yellow	Red	Red	Red
mediaConstraints	Yellow	Yellow	Yellow	Yellow	Red	Yellow	Red	Red
Stream re-broadcasting	Yellow	Yellow	Yellow	Green	Red	Red	Red	Red
getStats API	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red	Red
ORTC API	Red	Red	Red	Red	Red	Red	Yellow	Red
H.264 video	Red	Red	Red	Green	Green	Green	Red	Red
VP8 video	Green	Green	Green	Green	Green	Green	Red	Red
Solid interoperability	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red	Red
srcObject in media element	Red	Red	Red	Green	Green	Red	Red	Red



More friendly on Audio and Video

- Challenge to the Telco
- Competition between OTT players
- More conversation besides communication, customer care, e-health, and e-learning
- The conversation as one of the features
- P2P + Web

Future

- HTTP, HTML added the infinite value for the Internet
- WebRTC is a magic
- Next target would be SDN and IoT

Web of Things IG

*Enabling Open Markets for
the Web of Things*



Wearables



Healthcare



Smart Meters

Electricity meter – Southern Electric (UK)



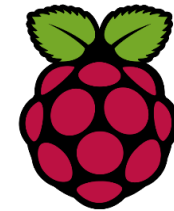
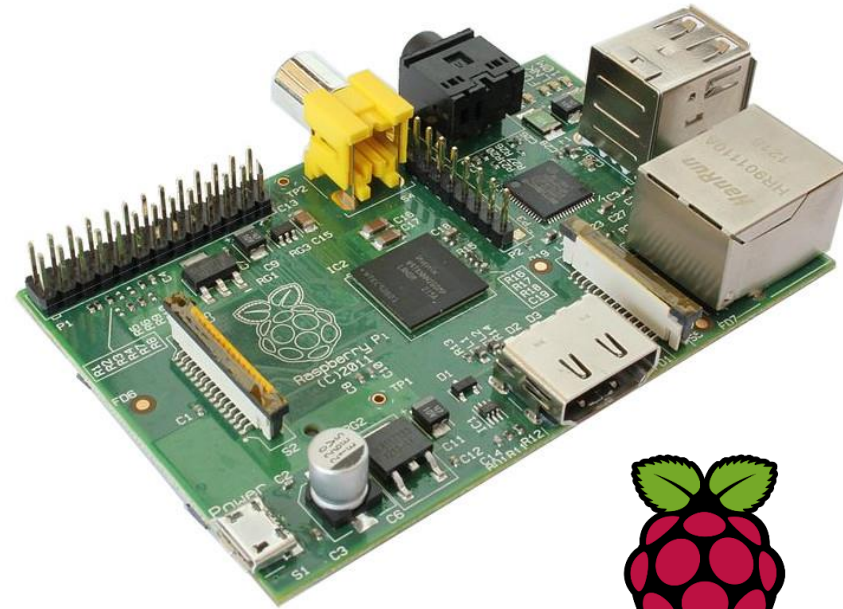
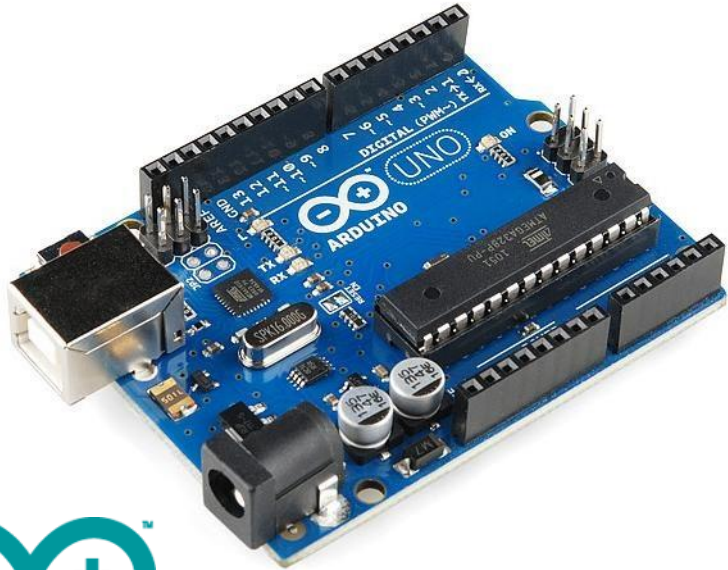
Gas meter – British Gas

Enable people to learn to reduce their consumption, and lower the cost of their bills. If lots of people do this, we can reduce risk of power cuts from overloaded power grids, and help the environment!

Home automation



Build your own IoT solution

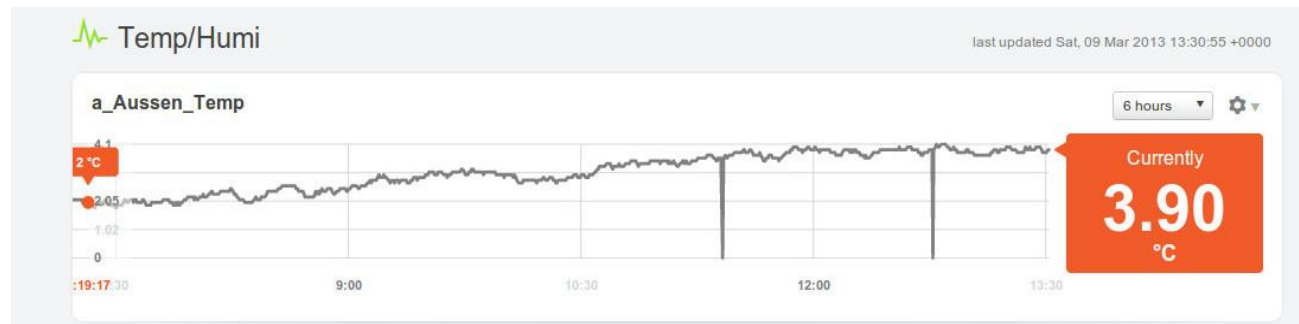
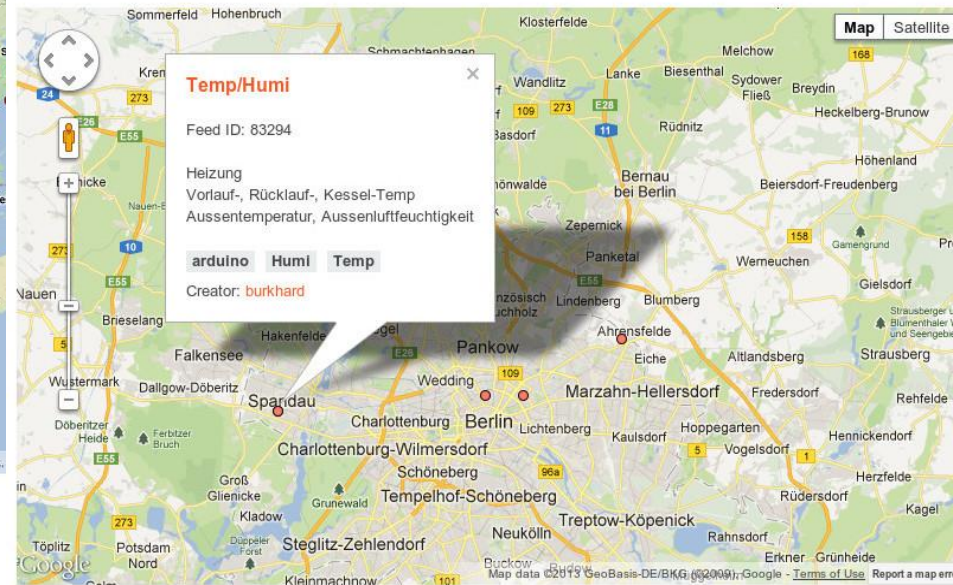


Publish your own data

Devices/Feeds talking to Cosm (most recent 1,000)



Devices/Feeds talking to Cosm (most recent 1,000)



Smart Manufacturing



Courtesy of Cyceera.com

Application Domains

- Smart homes and living
 - Home heating & lighting, home entertainment, home healthcare, home security, sports ...
- Building automation for hotels, offices, retail
- Construction
- Smart Transport
- Smart Utilities & Smart Grid
- Next Generation Hospitals
- Next Generation Manufacturing
 - Germany's Industrie 4.0

Huge potential, but lots to do...

- Most work to date has been about the Internet of Things from the perspective of sensors and transport protocols
- But most of the money will come from services
 - Services, Not Sensors: Gartner expects Internet of Things vendors to top \$309 billion in direct revenue by 2020, with most of that money deriving from services.
- Today, we see problems with product silos
 - No provision for 3rd parties to add value
 - This is holding back the huge potential

What's needed for open markets of WoT services?

- Removing barriers to free competition
- Data modelling standards
- Service descriptions and dependencies
- Discovery and trust management
- End to end security and privacy
- Bridging the gap between WoT and IoT
- Relationship between apps/service layer and the network layer
- Monetization – see W3C work on payments
- Provisioning and lifecycle management

W3C Web of Things Workshop Berlin, June 2014



Web of Things Interest Group

- Follows precedent of W3C Web & Mobile, Web & TV, and Web Payments Interest Groups
- Collaboration on gathering use cases, requirements, identifying gaps, best practices, and proposing work items for standardization in W3C Working Groups
- See <http://www.w3.org/WoT/IG/>
- Chairs: Joerg Heuer (Siemens) and Ricardo Morin (Intel)

Proposed Deliverables

- Use Cases and Requirements for the Web of Things
- Survey of Existing Practices and Standards Relevant to the Web of Things
- Guidelines on Best Practices
- Requirements for Open Markets of Products and Services for the Web of Things
- End to End Security for the Web of Things
- Resilience for the Web of Things

Some Related SDO's

- CEA – US Consumer Electronics Association
- GS1 – standards for supply and demand chains
- Industrial Internet Consortium – interconnected machines, intelligent analytics and people at work
- Industrie 4.0 – German project on smart manufacturing
- Bluetooth SIG – standards for Bluetooth based communications
- OASIS – e.g. for work on MQTT pub-sub protocol
- OMG – e.g. Data Distribution Service
- ETSI – globally-applicable standards for Information and Communications Technologies
- OneM2M – machine to machine standards based upon work by ETSI
- ISO/EIC JTC 1/WG 7 – standards for sensor networks
- GSMA – industry body representing mobile network operators
- IETF – protocol standards for the Internet, e.g. HTTP, CoAP

Internet of Things as the Foundations

- Sensors, Actuators and IoT protocols



Dubai Tower

Web of Things as the Skyscraper

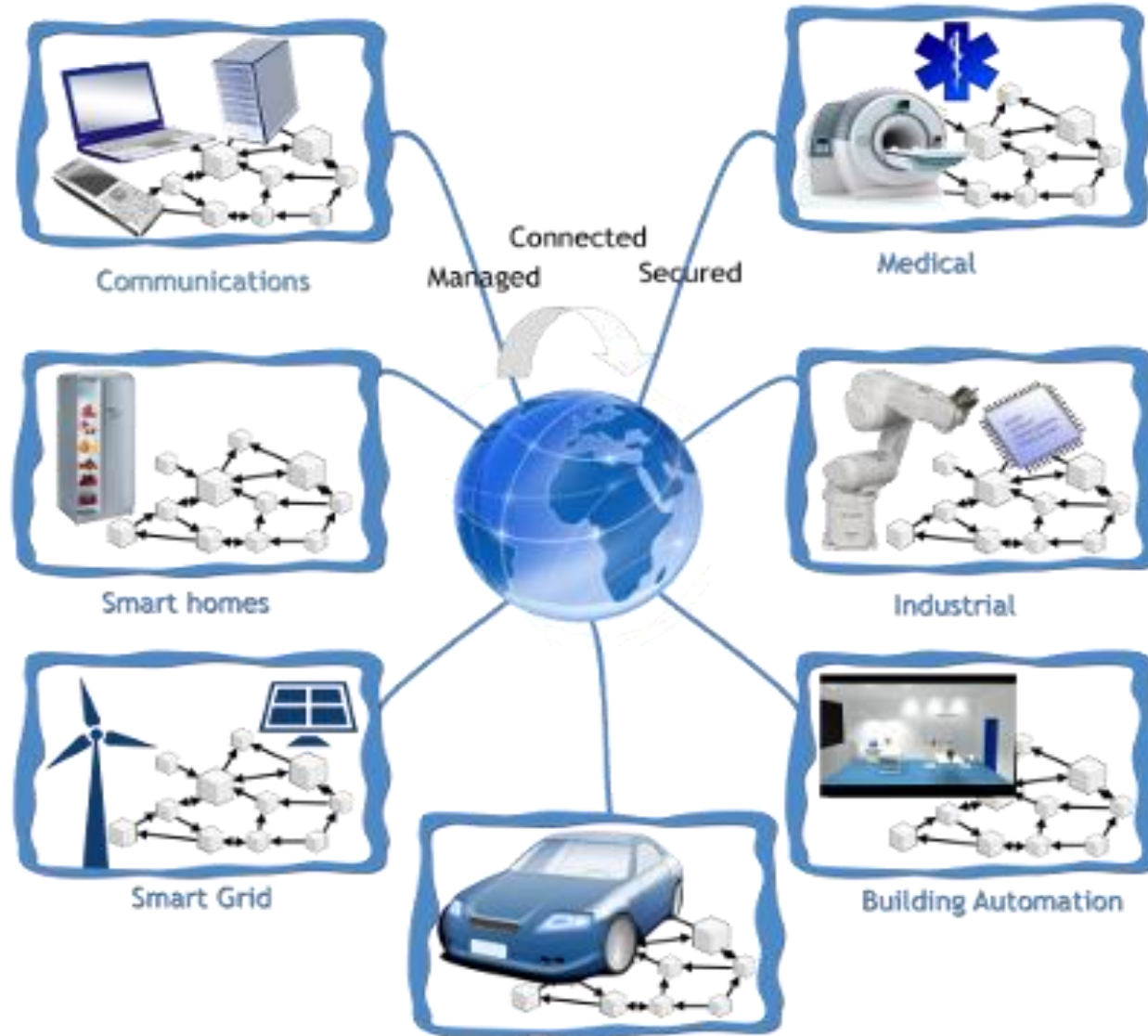
- Focus on application and service layer
 - Where the big money is!
 - Breaking out of the silos
 - Web scale
- Open markets & ecosystems
 - Discovery & provisioning
 - Rich descriptions & data models
 - Interoperability
- Security & Resilience



Opportunities for Scripting

- Scripting languages have a bright future
 - Browsers for direct access
 - e.g. via Bluetooth Low Energy from smart phone
 - Service platforms in the cloud or network edge, e.g. home hubs and servers in your phone/tablet
 - Device gateways bridging IoT protocols and the Web, and simplifying service development
- Where practical use same APIs across all 3
- Decoupling scripts from transport protocols

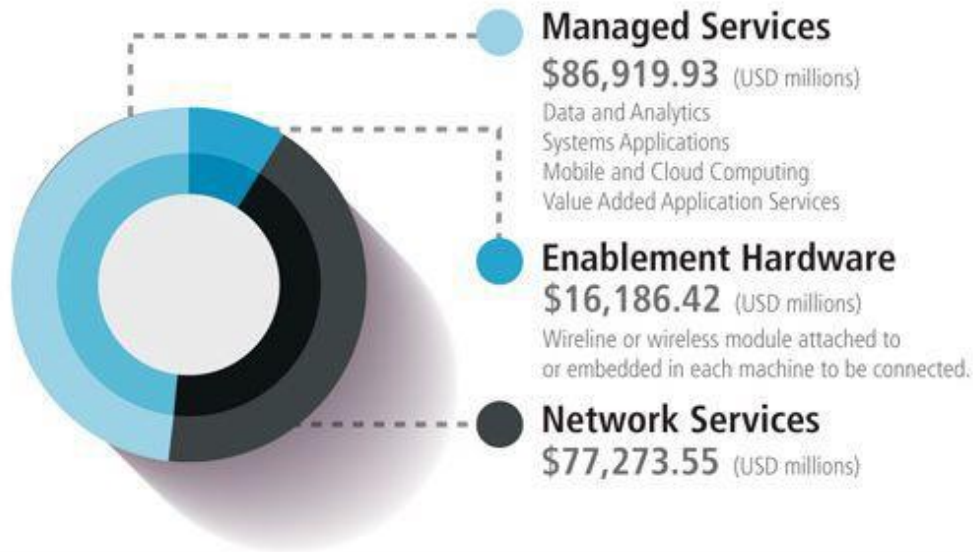
The Web is about to become a whole lot bigger!



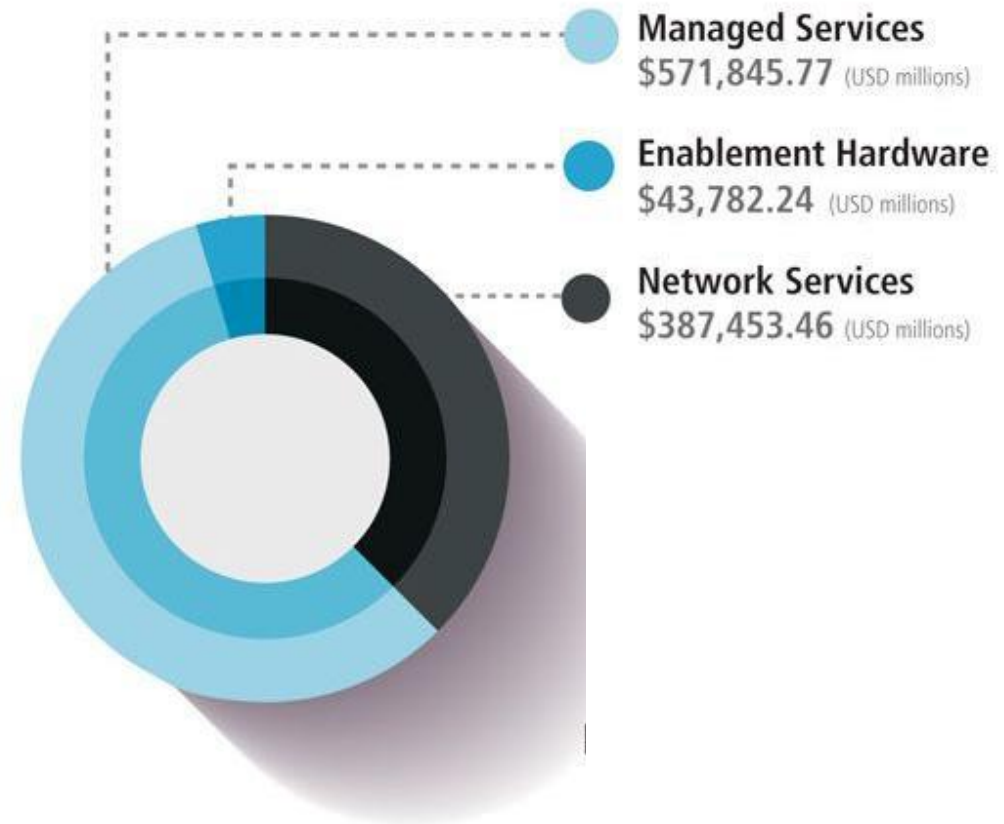
IoT market is increasing, but...

2014

180+ Billion in Revenue in 2014



2020



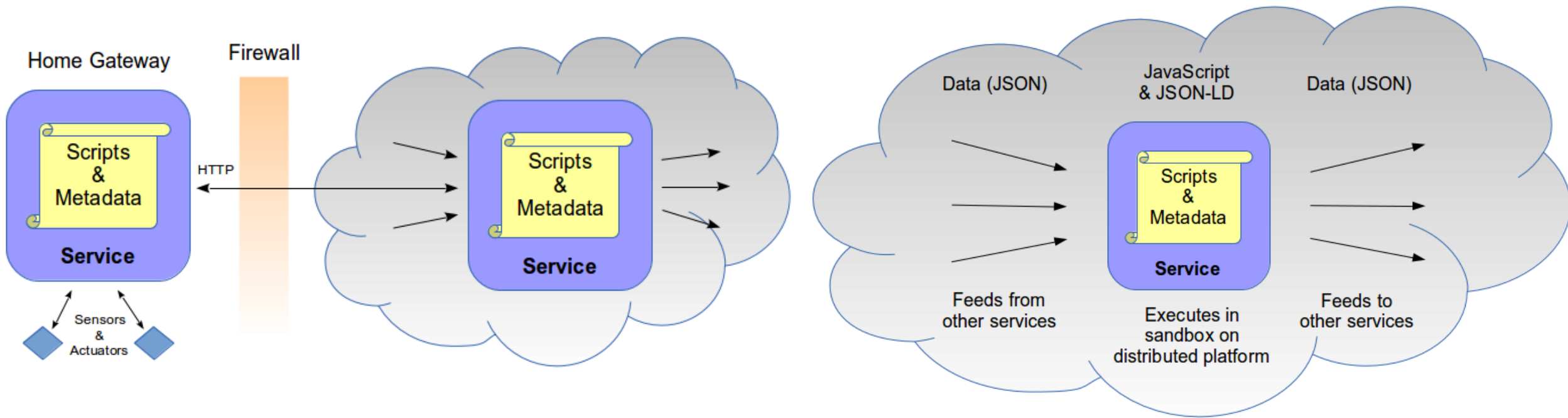
So many complex system!



The good example of WoT (CCS, ISO/IEC 15118)



JavaScript, JSON and JSON-LD



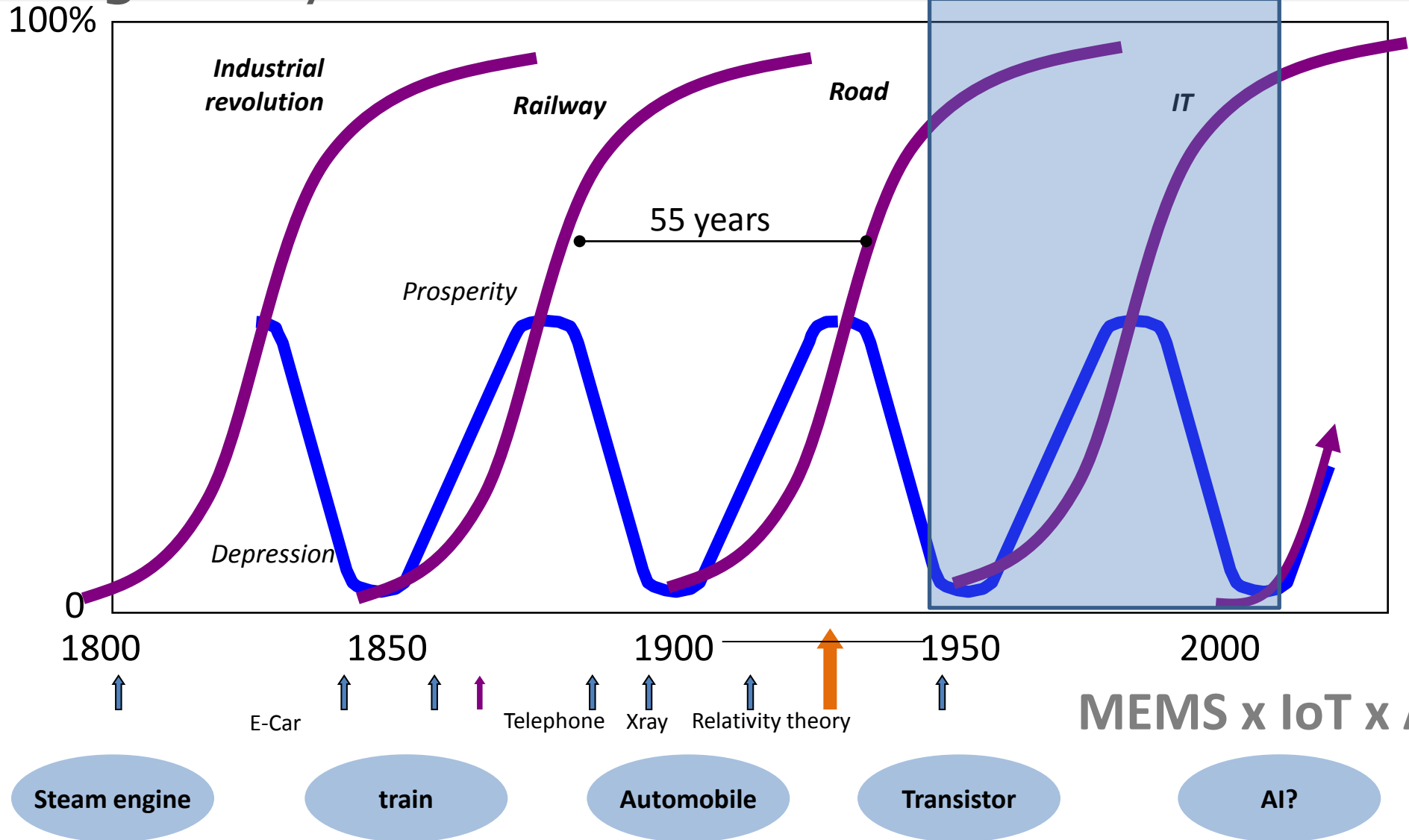
Status now

- Still use case show
- First runner is automobile in Germany pushed by EU
- JSON and JSON-LD are the most common for the data exchange

WoT IG events at W3C

- This work is supported by the European Union's 7th Research Framework Programme (FP7/ 2013-2015) under grant agreement n°317862 - Compose
- Upcoming events
 - Weekly teleconferences every Tuesday alternating between 9am GMT and 6pm GMT.
- Initial face to face, Munich, 20-22 April 2014, hosted by Siemens
- Past events
 - Web of Things Workshop (Berlin, June 2014)

Singularity and Kondratieff's Economic Wave



MEMS x IoT x AI is ?

Steam engine

train

Automobile

Transistor

AI?



New technology meets another

- IoT(WoT) meets webRTC
 - Still at their early development stage, but some stakeholders already start. iWatch?
 - Real-time collaboration with Things
- IoT(WoT) meets AI
 - Still at their very early stage, but rapidly improved.
- WoT + webRTC meet Robot, MEMS
 - Real-time operation and data gathering