Fratel

Panorama des innovations technologiques dans les réseaux : les nouveaux enjeux

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La 5G, la technologie pour la convergence des secteurs ?

SDN / NFV comme nouvel axe de transformation des télécoms ?

Et au final l'IoT comme cible d'usage ?

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La 5G, la technologie pour la convergence des secteurs ?

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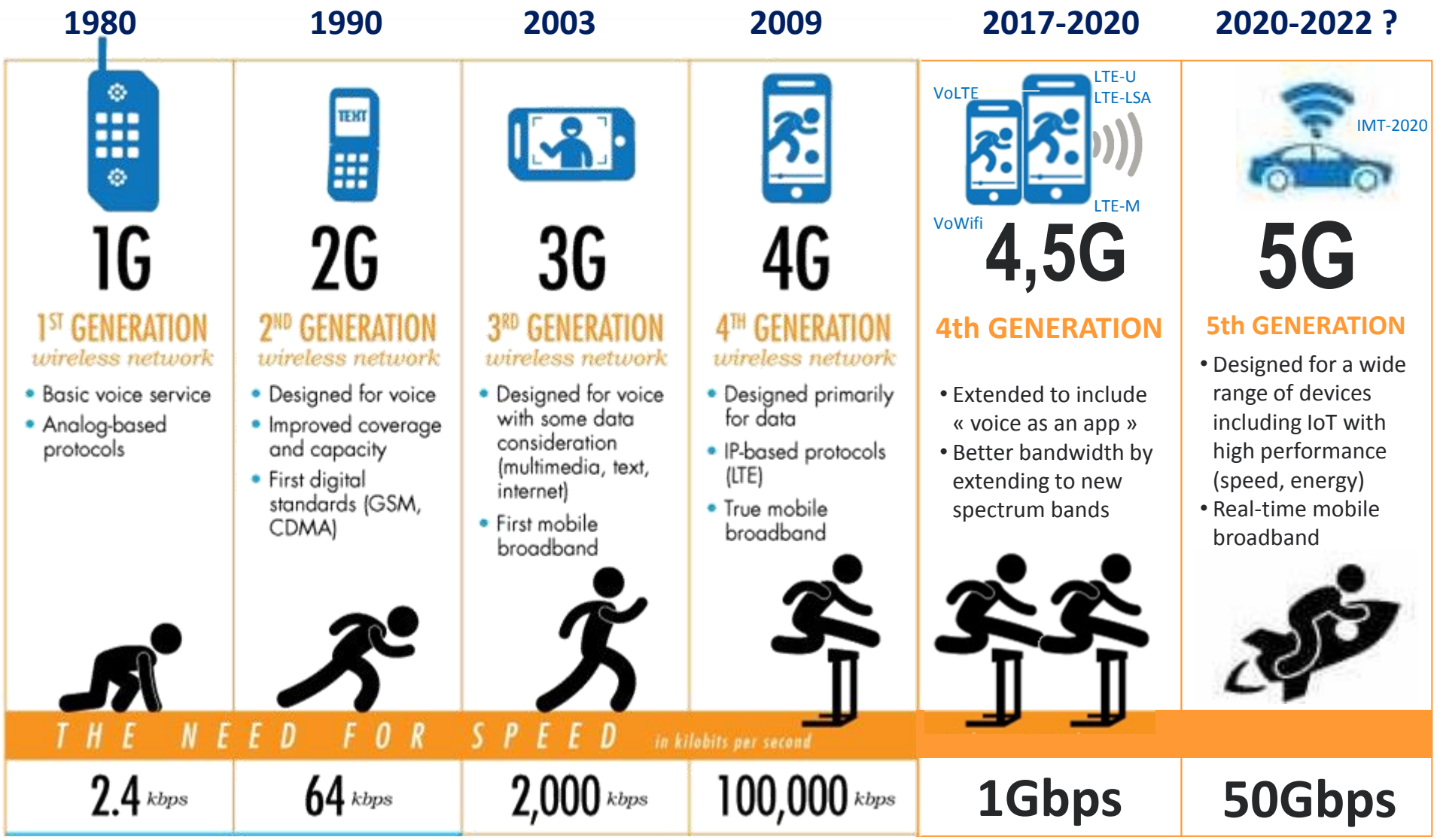
Le 5G s'inscrit dans 40 ans d'histoire des réseaux mobiles

La 5G a plein de promesses mais encore lointaines



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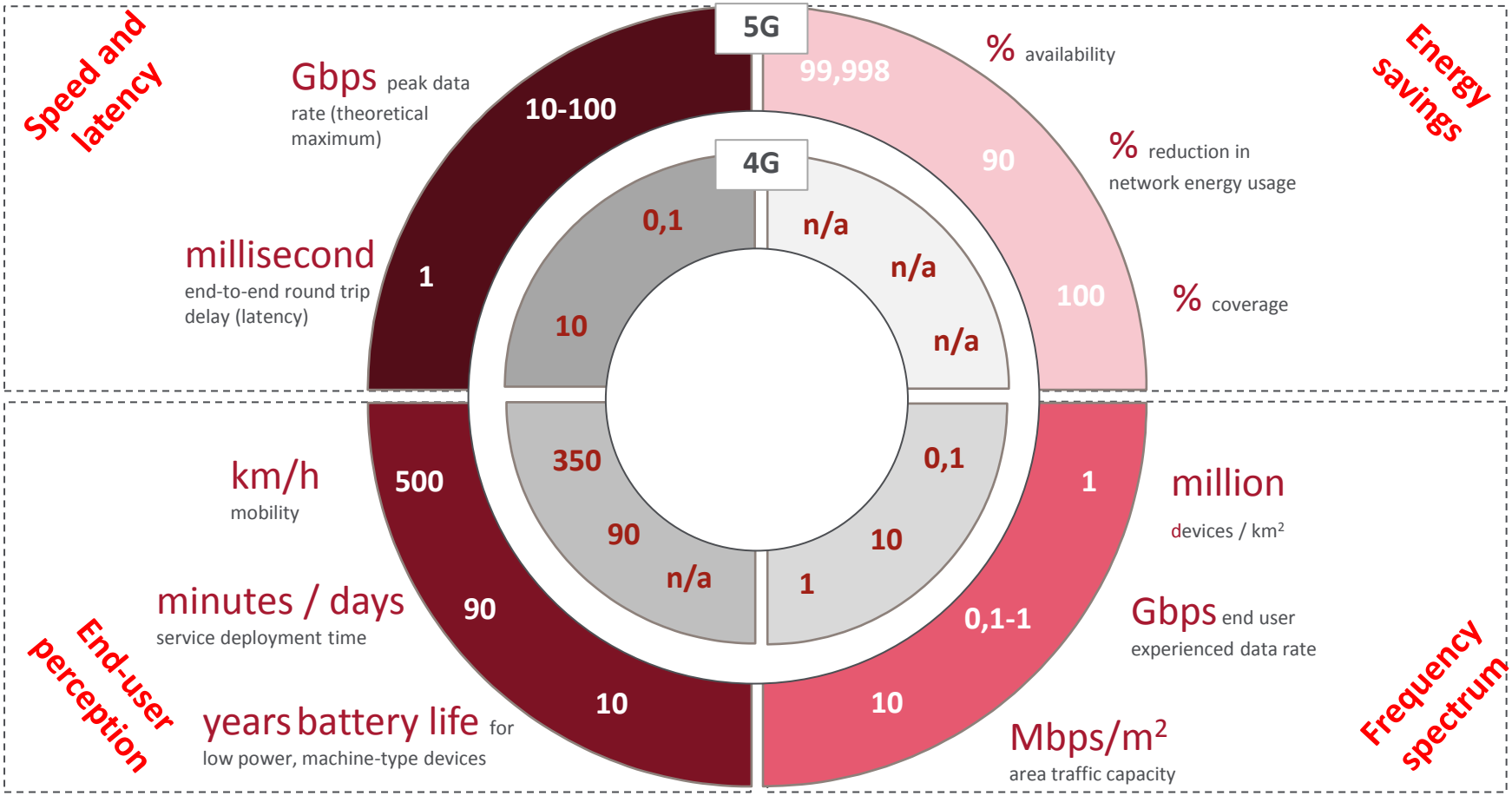
La 5G va vraiment bouleversé le monde du mobile

Les éléments techniques sous-tendent un changement à de multiples points de vue



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Le 5G va impacter de nombreux secteurs | exemple de l'automobile

La 5G va permettre une vraie convergence inter-sectorielle et ainsi contribuer au développement de l'Internet des Objets

Feature	Benefits for automobile industry
Very high bandwidth – up to 10 Gbps	• Suitable for high volume car-to-car communication • Frequent, high volume OtA (over the air) updates for new apps and content • Additional possibilities for new application
Low costs per Gbyte	• Frequent, high volume OtA (over the air) updates for new apps and content
Low latency	• Enabler for real-time car-to-car communication (e. g. emergency alerts, rapidly changing traffic conditions - frog, black ice danger, unexpected panic braking)
Low power consumption	• Can make future planed, additional on-board 42V power supply obsolete • Always on (Current vehicles need some time to wake up electronics) • A number of communication modules can be built in into vehicle (i. e. engine, caravan, multiply alarm device to reduce risk of vehicle theft) • Spontaneous communication between fuel tank and petrol pump
Multicast	• Connection between vehicles (platooning), traffic control
High availability	• Suitable for critical application
Ability to serve very high number of devices	• Suitable for critical application
International standard	• Build once – deploy everywhere

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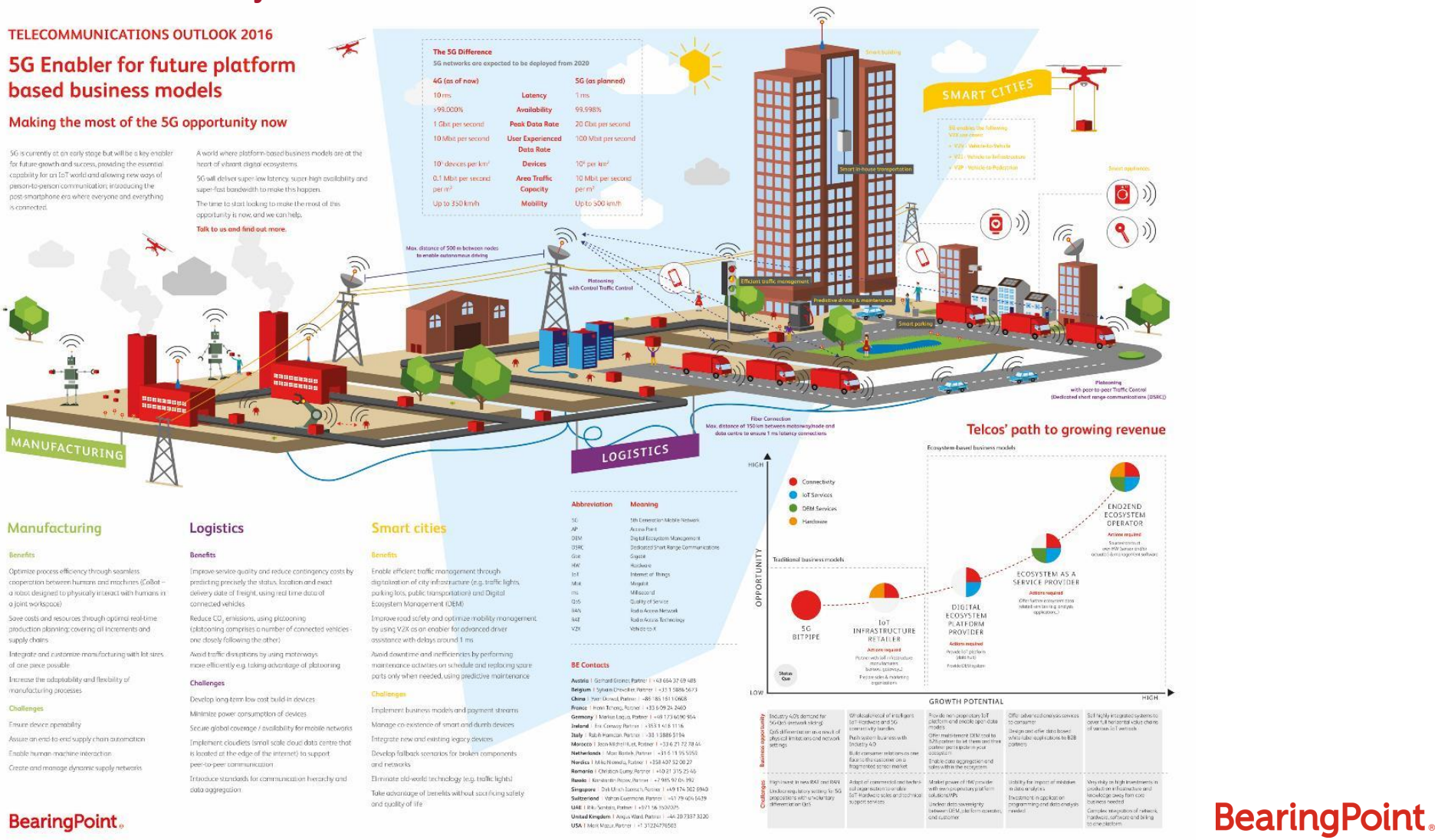
Le 5G va impacter de nombreux secteurs | exemple des smart cities

La 5G va permettre une vraie convergence inter-sectorielle et ainsi contribuer au développement de l'Internet des Objets



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Quelques exemples d'application de la 5G

5G use cases

User advantage :

- *Virtual Reality/Augmented Reality/Immersive or Tactile Internet*
- *Autonomous driving/Connected cars*
- *Wireless cloud-based office/Multi-person videoconferencing*
- *Machine-to-machine connectivity (M2M)*

Operators advantage :

Last Mile implementation for networks deployment : lay fiber then use mobile to cover remote or complex areas

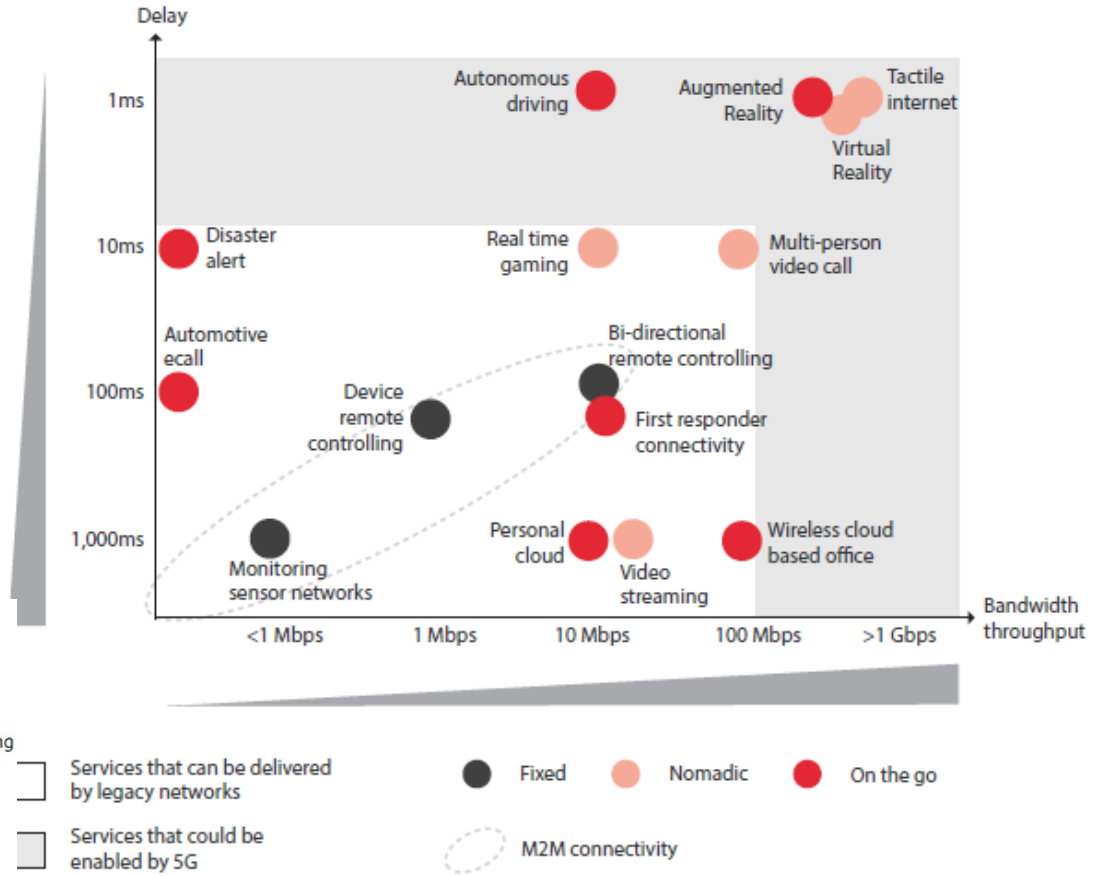

Figure 1: Bandwidth and latency requirements of potential 5G use cases

Source: GSMA Intelligence

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D’ici 2020, des changements notables vont concerner la voix et la data

Evolution d’ici 2020

	voice	data
	ready	coming soon
how ?	With **VoLTE and VoWifi**, voice becomes just another application enabled by mobile data	**LTE-U, LTE-LAA, LTE-LSA, and LTE-M** allow extending LTE to new spectrum bands to extend capacity and types of devices (IoT)
roadmap & maturity	**Commercially available** ▪ By 2018, most operators will provide VoLTE & VoWifi. ▪ Currently : ✓ **VoLTE & VoWifi** are available in US + APAC, rolling-out in Europe ✓ **VoLTE :** launched by 60+ operators in 39 countries ✓ **VoWifi :** launched by 100 operators	**Commercially available in 2-4 years** ▪ LTE-x technologies are still in a trial phase and will be available in 2018-2019. ✓ **LTE-U :** Ericsson & Qualcomm started trials since 2014. MTN & US operators joined them in 2016 ✓ **LTE –M :** after a standardization phase, Sierra Wireless plans to launch a 1st field prototype in 2017.

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Les consommateurs et les opérateurs vont y trouver leur compte

Impacts forts pour la data

voice

minor benefits

- **VoLTE :** a better voice quality for customers, and an enabler for unified communication services
- **VoWifi :** roaming savings with better indoor coverage, and a way to off-load mobile networks

data

major benefits

- **LTE-U & LSA will improve the bandwidth for existing apps without heavy network spendings**
- **LTE-M will enable new IoT applications**

customers

better voice experience due to :
- [VoLTE] lower latency for connection
- [VoX] more stability in data rate (QoS)
- [VoX] ability to use a data connection meanwhile
- [VoWiFi] better indoor coverage

reduced call charges, mainly in roaming situations

improved bandwidth & latency useful for gluttonous services :
- video : high quality (4K), live streaming, videoconferencing…
- live gaming
- telemedicine

operators

- enabling **unified communication services**
- increased network capacity with **limited investment**
- **off-loading mobile networks** on local networks like WiFi

- **get more revenues** from data OTT services like streaming & gaming **without buying spectrum**
- **improve market share** on the IoT market **without spending** on expensive LPWA networks

use case

Telemedicine, with VoWiFi

patients and doctors can communicate visually and verbally as they review a patient's vitals dashboard in real time

Smart Buildings, with LTE-M

energy savings can be made in smart buildings in which water & electricity consumption are monitored and adapted to weather conditions

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Network Function Virtualization (NFV) et Software Defined Networking (SDN) are sont des approches complémentaires pour rendre les réseaux plus dynamiques

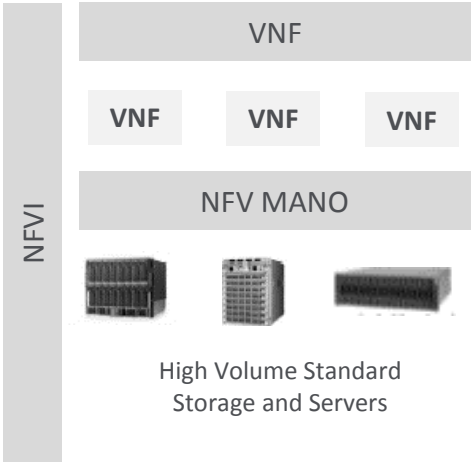
Description technique NFV et SDN

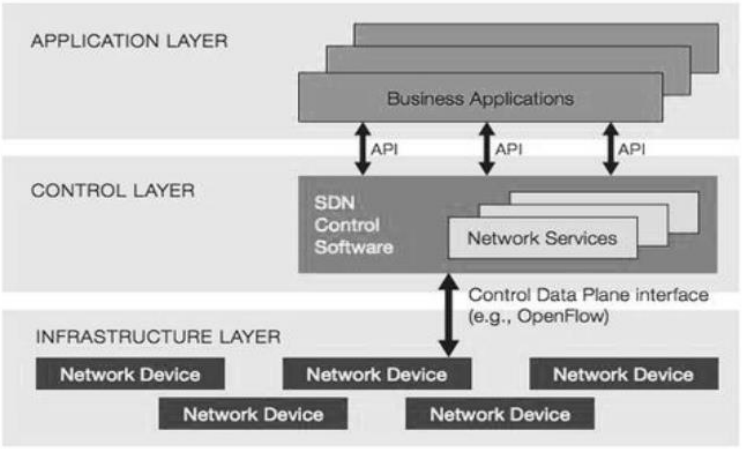
Network Function Virtualization

- Approach: Implement network functions on standard equipment
- Purpose: Decouple network functions from proprietary hardware
- Target Location: Service provider network
- Target Devices: Commodity servers and switches
- Initial Applications: Routers, firewalls, gateways, CDN, etc.

Software Defined Networking

- Approach: Separate the network's control and forwarding planes
- Purpose: Provide more efficient orchestration and automation
- Target Location: Campus, data center / cloud
- Target Devices: Commodity servers and switches
- Initial Applications: Cloud orchestration and networking





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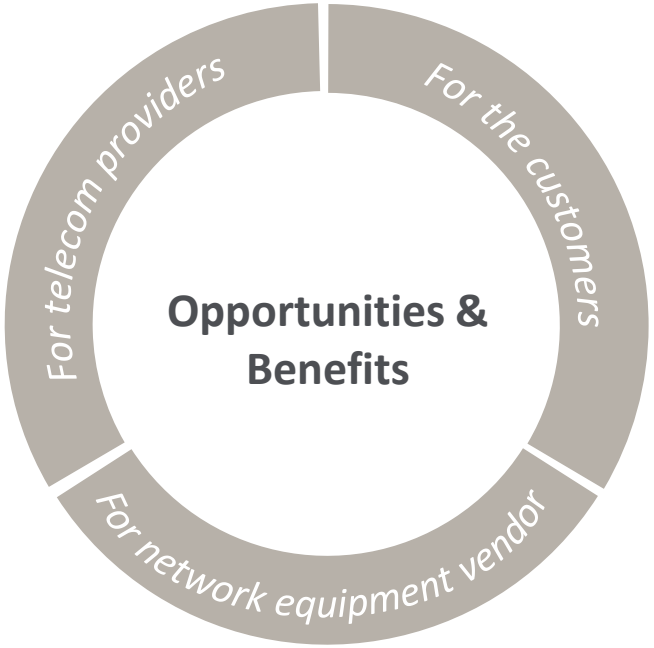
Bénéfices et opportunités liés à ces transformations

- **Cost reduction**
- **New revenues**
- **Operational excellence**

- **New revenues** by enabling agile creation of innovative new services that will revolve their traditional business
- **Cost reduction** by reducing costs of hardware and maintenance costs
- **Support innovation and reduce lifecycle** by enabling easier/faster deployment of updates that can be monetized



- **Greater agility & performance** with possibility to scale up or down services quickly on a self-service mode
- **Simplify IT management** with end-to-end visibility and control over security anywhere in the world
- **Strengthen network security** with easier and quicker security rule implementation
- **Better support & faster deployment** with quick self-service activation and reduced time-to-resolution

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SDN et NFV vont créer de nouvelles opportunités pour le secteur des télécoms

Opportunités pour les opérateurs télécoms

Cost reduction

Impact on CapEx

- Reduce costs of hardware
  - Less CPE required
- Reduce network equipment

Impact on OpEx -40-50%

- Lower maintenance costs
  - Automating traditional manual configuration operations
  - Less manual work decreases error proneness
- Reduce costs for space
  - Less physical infrastructure items required
- Reduce cost for power
  - Replace older servers sooner consuming much more energy
- Reduce costs for cooling
  - Decrease in same proportion as power

New revenues

70% faster

- Enable agile creation of new services
- Accelerate time-to-market of new networking services
- Lower risks of rolling out new services due to easy trial
- Real-time, end-user customizable service options

Operational excellence

- Deliver agility and flexibility
- Optimized network: scale up or down services quickly to address changing demands
- Support innovation by enabling service delivery via any software on standard server hardware
- Create cross-functional tasks and optimized task structures
- Create room for new capabilities as resources can be saved

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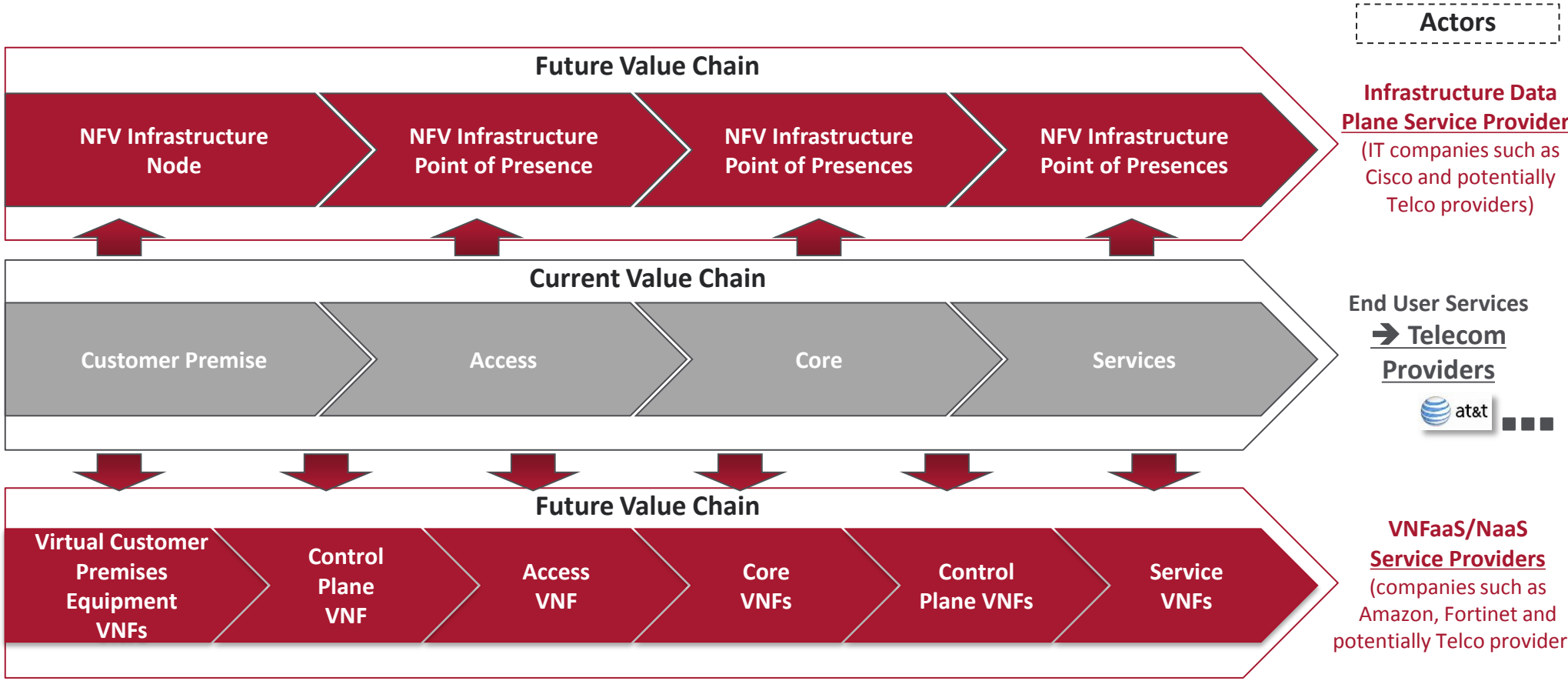
SDN / NFV : un nouvel écosystème

De nouveaux acteurs pour une chaine de valeur revue



This value chain will be **more dynamic** with **more programmation**

Each bloc will allow **more actors**, **more layers**, **more combinations** and **more links**

FORTINET zscaler riverbed CISCO InfoVista aruba NETWORKS

Source : - Impact of network softwerization, NFV and SDN, on network operators and regulation - HPE presentation to BEREC (Bureau European Regulation)
- WEBINAR Connectivity International Marketing

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Mais une transformation qui sous tend des défis

Pour les acteurs télécoms ces changements ne sont pas si évidents

Non-telecom providers are well positioned on the SND/NFV market

➔ To reduce the gap with these actors, and take full advantage of the new perspectives, telecom providers need to face these 3 main challenges

1

Technical challenges to implement the technology in a large scale

Examples of technical challenges

- Implement a **new network management model** to integrate legacy and virtual tools
- **Find tools that let them equally manage virtual and physical through a common interface**
- **Integrate OSS/BSS** into this new orchestration infrastructure

2

Integrate new companies in order to develop various functions (VNF) for the end-user

Classical Telco providers have already formed partnerships with start up or more established companies as :

- **NTT & Vitrela** (technological partner acquired by NTT in 2014)
- **Orange & Juniper** (technological partner)
- **Verizon & Ericsson** (for support of virtualized global Managed Network Services platform)

3

Cyber Security challenges

SDN/NFV exposes Telco Providers because :

- Network technology moves **from proprietary single-purpose devices to computed elements with network functions provided as virtualized services** (VNFs)
- They use **open protocols** (ex : open source collaboration between Orange and AT&T)

Source : - http://www.zdnet.fr/actualites/le-nfv-et-le-sdn-tendances-majeures-de- 2016-avertit-le-gartner-39832960.htm
- Webinar Easy Go Network Follow up
- http://www.telco.com/blog/main-security-challenges-in-protecting-sdn-and-nfv-networks-from-security-vulnerabilities/
- http://searchsdn.techtarget.com/news/2240215704/SDN-and-NFV-will-come-to-life-in-the-operator-network-eventually

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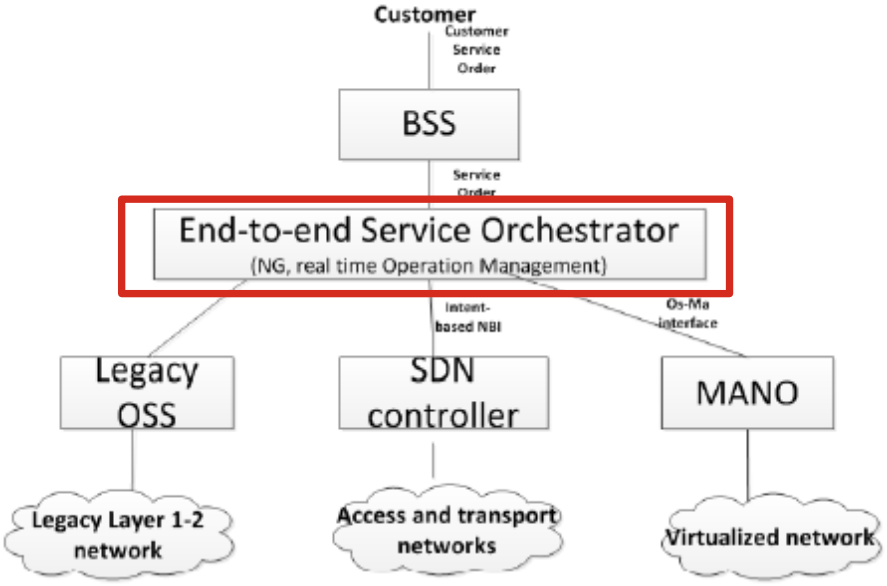
Pour réussir la transformation SDN/NFV les opérateurs vont devoir transformer leur organisation actuelle

L'orchestration de service comme élément clé

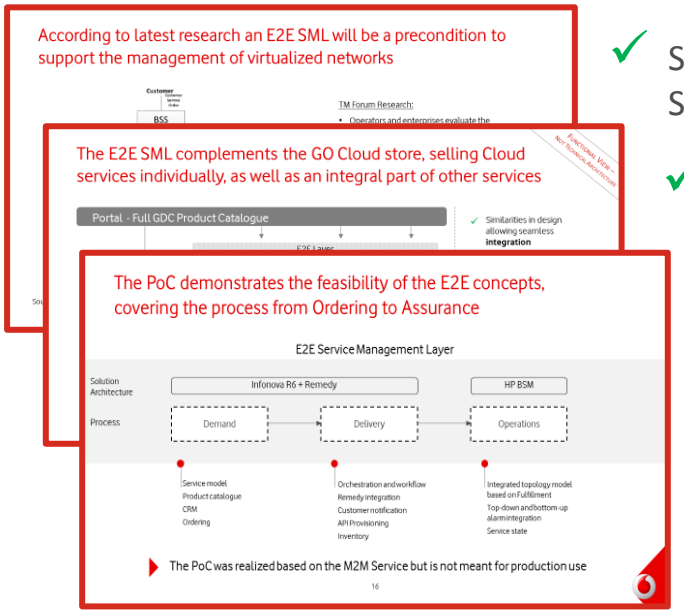
Scheme of the different organizations, processes and systems to integer



Source: TM Forum

In near future services will be provided that are build by subservices coming from legacy cloud and SDN/NFV. **Telcos urgently need an E2E picture of all their services, the service lifecycles and the performance of the services**. This will **change the entire OSS/BSS Infrastructure** and all main processes in ordering, fulfilment and assurance.

Orchestrating services E2E :
POC @ Vodafone with R6



✓ Supporting SDN/NFV

✓ Cloud ready

✓ Really E2E

BearingPoint delivered a **POC based on R6 as orchestration layer for Vodafone Group to orchestrate Group services through entire lifecycle across the entire organization**… the POC is still available

A Similar project already started @ Telecom Group Austria.

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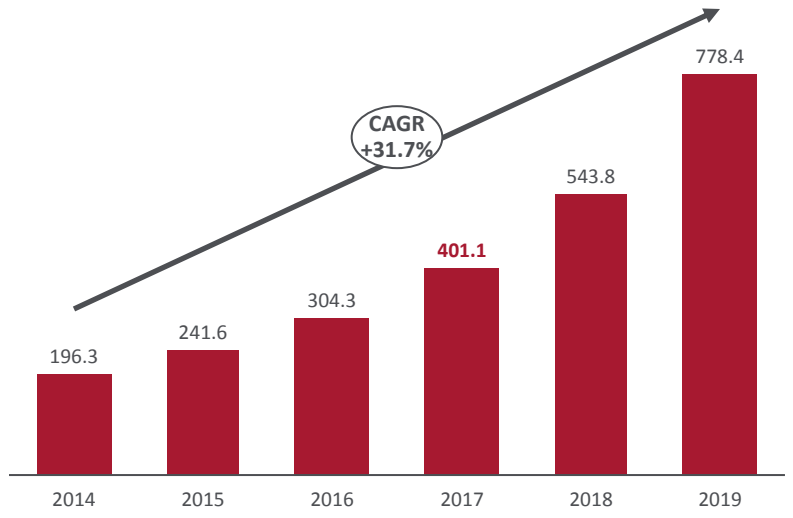
L'IoT : le marché en pleine explosion

Quelques éléments de marché

Global IoT market size and forecast

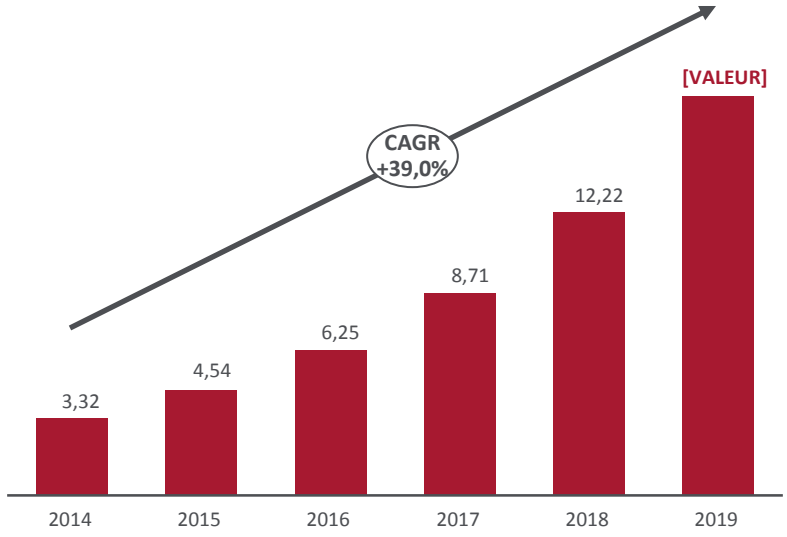
US$ billion



- Today's IoT market is at valued around US$ **400 billion**, more than doubled its original size in 2014
- With a CAGR of 31.72 % it is expected to reach **US$ 778,43 billion** in 2019
- Strong market growth is mainly driven by a high adoption rate from companies entering the IoT market

Number of connected devices

billion units



- Current forecasts predict **17.22 billion devices** connected in use, starting from 3.32 billion devices back in 2014 and growing with a CAGR of 39%

Data source on this slide: TechNavio report "Global Internet of Things (IOT) Market 2015-2019"

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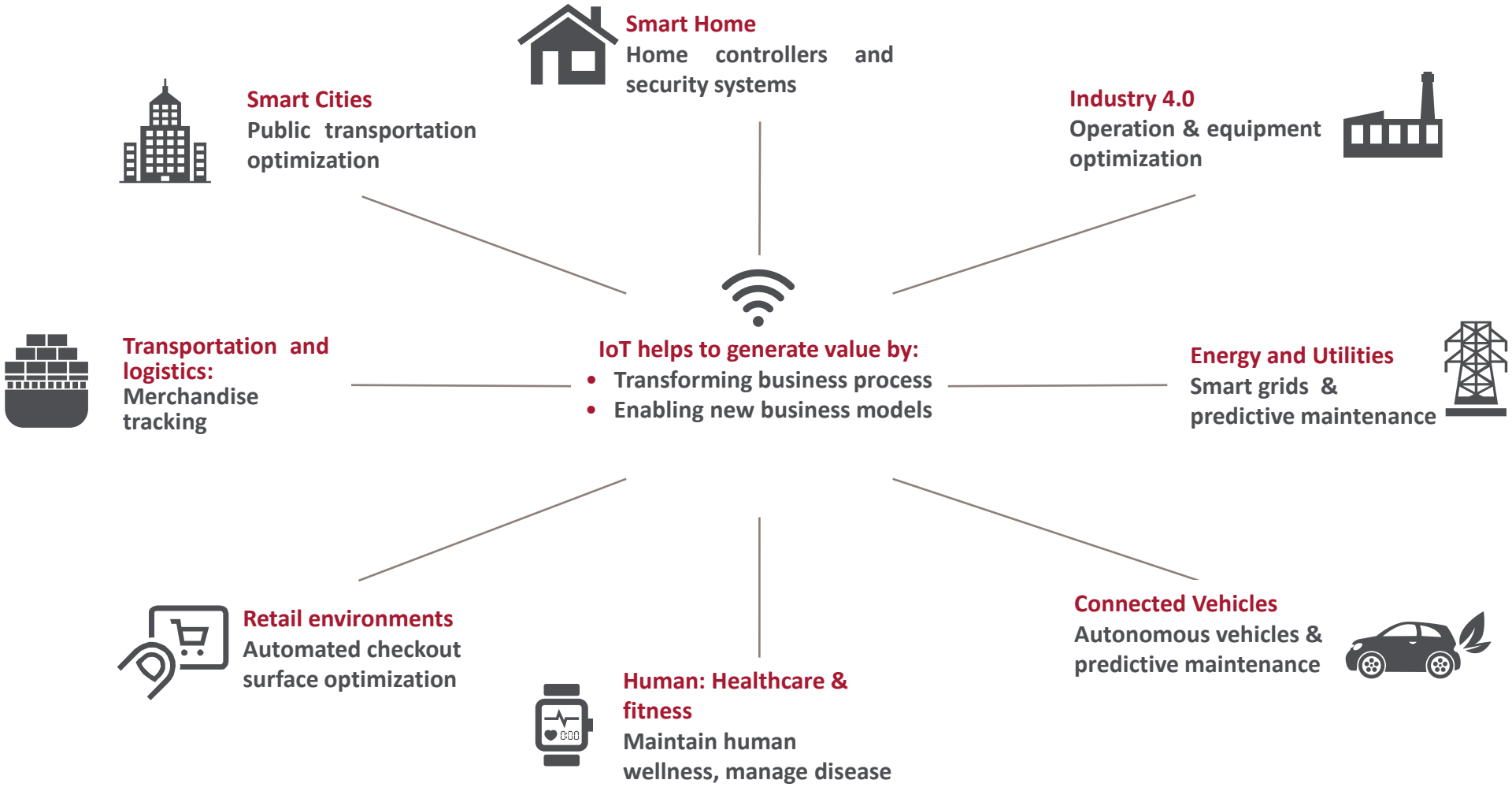
L’IoT au coeur de la transformation digital ?

Quelques exemples d’applications



Source: McKinsey Global Institute, “The Internet of Things, mapping the value beyond the hype, 2015

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L'IoT un marché en train de structurer

Exemples d'acteurs sur la chaine de valeur

	Device manufacturers	Connectivity layer	Platform layer	Solution layer
OEMs	ERICSSON, HUAWEI developed NB-IoT NOKIA developed **LTE-M**		SAMSUNG SAMI platform allows to connect devices from different OEMs	
Software companies /integrators			Microsoft Azure, CISCO Jasper, amazon web services Application mgmt. platforms including API services for B2B clients	amazon echo, CarPlay
Telecom Operators		at&t deploys **LTE-M** and **NB IoT** vodafone deploys **NB IoT**	at&t, verizon, Telefónica Application mgmt. platforms including API services for B2B clients	at&t, verizon, Telefónica Smart object services (m-health, smart home…)
Unlicensed LPWA operators	sigfox, LoRa	Telefónica deploys sigfox orange deploys LoRa	sigfox, LoRa Open protocols facilitate end-user integration	Private network solutions developed by corporate and public sector customers

Source: Orange, "Connectivité et Plateformes IoT dans le monde", July 2016

Et des technologies loin d'être stabilisées

Une bataille mondiale autour des réseaux Low Power Wide Area (LPWA)

Sigfox
A French startup created in 2009, developing low-cost LPWA devices.

LoRa
A 330 member alliance that specified the "LoRaWAN" protocol. This standard ensures inter-operability LoRa devices

EC – GPRS:
Based on 2G networks, this LPWA technology is especially suitable for deploying IoT services in the absence 3G/ 4G net-works, e.g. emerging countries

NB-IoT: *(LTE Derivative)*
Direct competitor of LoRa. Co-developed by both equipment manu-facturers (Ericsson, Huawei, Intel) and operators (Vodafone, AT&T, DT). Collaborating within the 3GPP standardization body

LTE-M: *(LTE derivative)*
Its larger bandwidth targets IoT applications with a demand for large data volumes, e.g. managing industrial processes, machinery or infrastructure

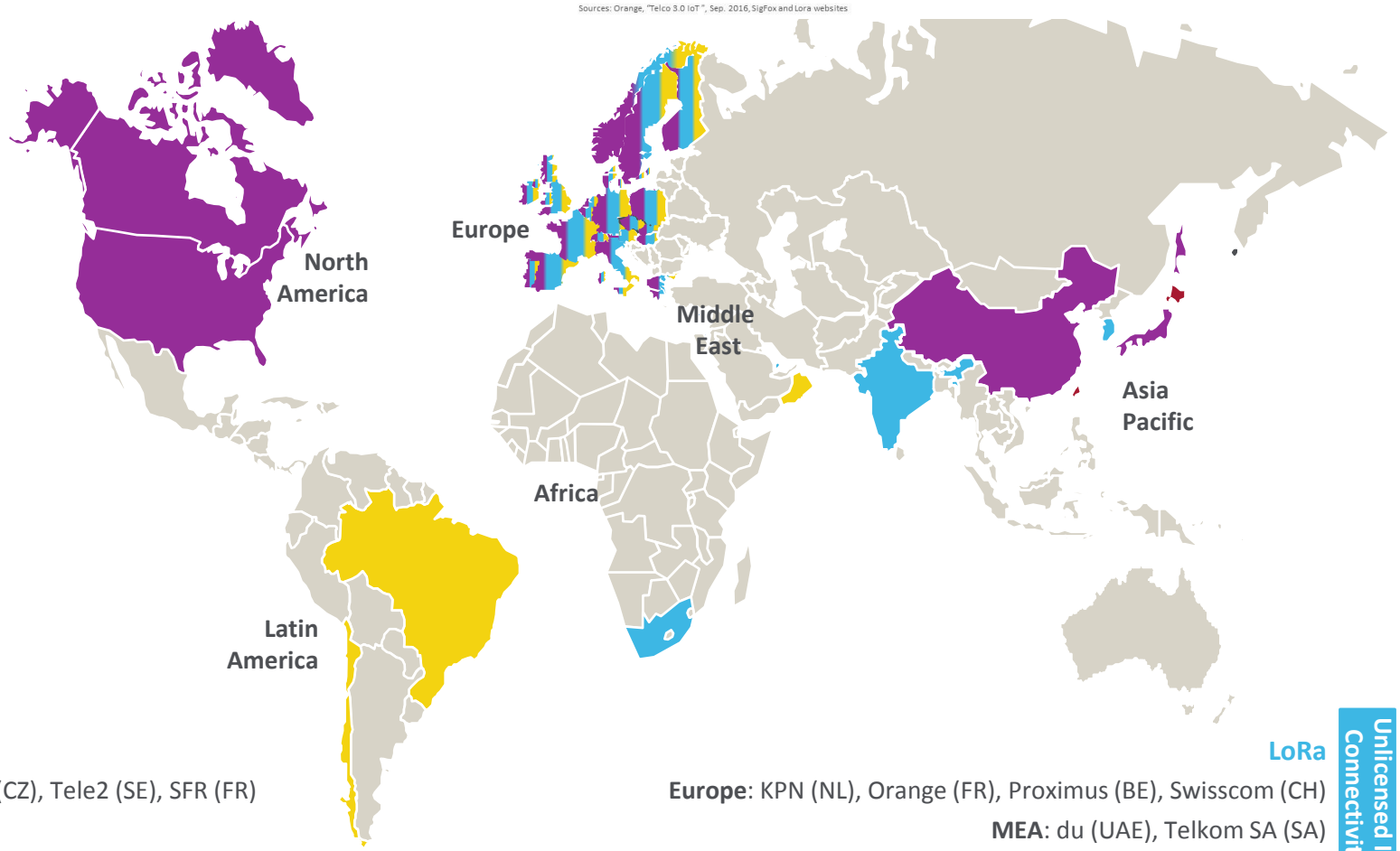
Licensed IoT Connectivity

Mobile IoT (LTE-M, NB-IoT)

North America (LTE-M):
AT&T (US), Verizon (US)

Europe (NB-IoT):
British Telecom/ Everything Everywhere (UK), Deutsche Telekom (D), TDC (DK), Telefónica (ES) and Vodafone (UK)

Asia (NB-IoT):
China Mobile (CN), China Unicom (CN), M1 (SG), NTT Docomo (JP)



Unlicensed IoT Connectivity

Sigfox

Europe: T-Mobile Czech (CZ), Tele2 (SE), SFR (FR)

MEA: Omantel (OM)

LATAM: Telefónica (BR & CL)

Unlicensed IoT Connectivity

LoRa

Europe: KPN (NL), Orange (FR), Proximus (BE), Swisscom (CH)

MEA: du (UAE), Telkom SA (SA)

Asia: Tata Communications (IND), SK Telecom (SK), Softbank (JP)

Source: Orange, "BADIM Internet des Objets, du Hype à la réalité", Q3 2016

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Pour un choix pas si évident

Chaque réseau à ses avantages

	SigFox	LoRa Alliance	EC-GPRS	LTE-derivatives
Low operating costs	✓	✓		
High QoS			✓	✓
Secured private networks (industrial applications)		✓		
Latency / performance			✓	✓
Reaching rural or suburban areas	✓	✓	✓	

Sources : ICT Express “A Survey on LPWA Technology”, March 2017, publisher :Elsevier.

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Et donc des questions pour les régulateurs

Pour tout nouveau marché qui se construit des questions pour les régulateurs

Des questions classiques
- autour des réseaux, passage 4G, 4,5G, 5G ?
- des services universels associés ?
- des spécificités des réseaux nouveaux ?
- le suivi géographique des déploiements

Des questions qui se renforcent
- l'intersectoriel (cf. mobile payment)
- la cybersécurité
- la neutralité du net à la protection des données avec l'IoT
- le juste partage de la valeur y compris au borne du secteur (ex : les ICC)

Des questions nouvelles
- de nouveaux acteurs
- quels marchés pertinents ?
- des télécoms à l'IT
- de l'informatique au numérique