Advanced Connectivity for Industry 4.0

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Nokia Innovation Steering

November 2016

NOKIA

Nokia is no longer....

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Our vision

Expanding the human possibilities of the connected world

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Physical – Digital Becoming One

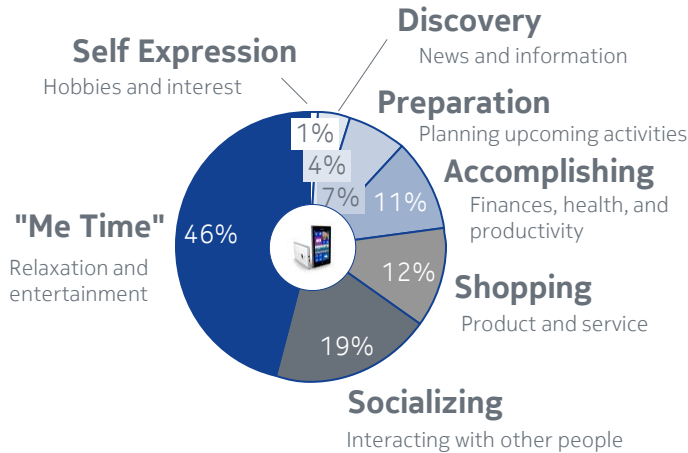Increasingly pervasive use of technology with plenty of disruption potential

Mobile

Wireless Voice 100%

Mobira Senator NMT450 (1982)

Smart Applications

Self Expression
Hobbies and interest

Discovery
News and information

Preparation
Planning upcoming activities

Accomplishing
Finances, health, and productivity

Shopping
Product and service

"Me Time"
Relaxation and entertainment

1%
4%
7%
11%
46%
12%
19%

Socializing
Interacting with other people

Source: Harvard Business Review: How People Really Use Mobile

Internet of People & Things

New Sensors & Actuators

New User Interfaces

Artificial Intelligence

Cloud Everywhere

Augmented World

Advanced Connectivity

On-Demand Economy

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New Opportunities and Requirements for Advanced Connectivity
New ways how people and things interact

Numbers are according to Nokia Bell Labs and analyst researches

Connected devices by 2020

Up to 46 B

Cellular IoT global daily connection requests by 2020

Up to 135x

New, diverse and extreme requirements to existing networks

Max potential value of sized applications in 2025

$11Tn

Forecast M2M CAGR (2014-2019) revenue

27%

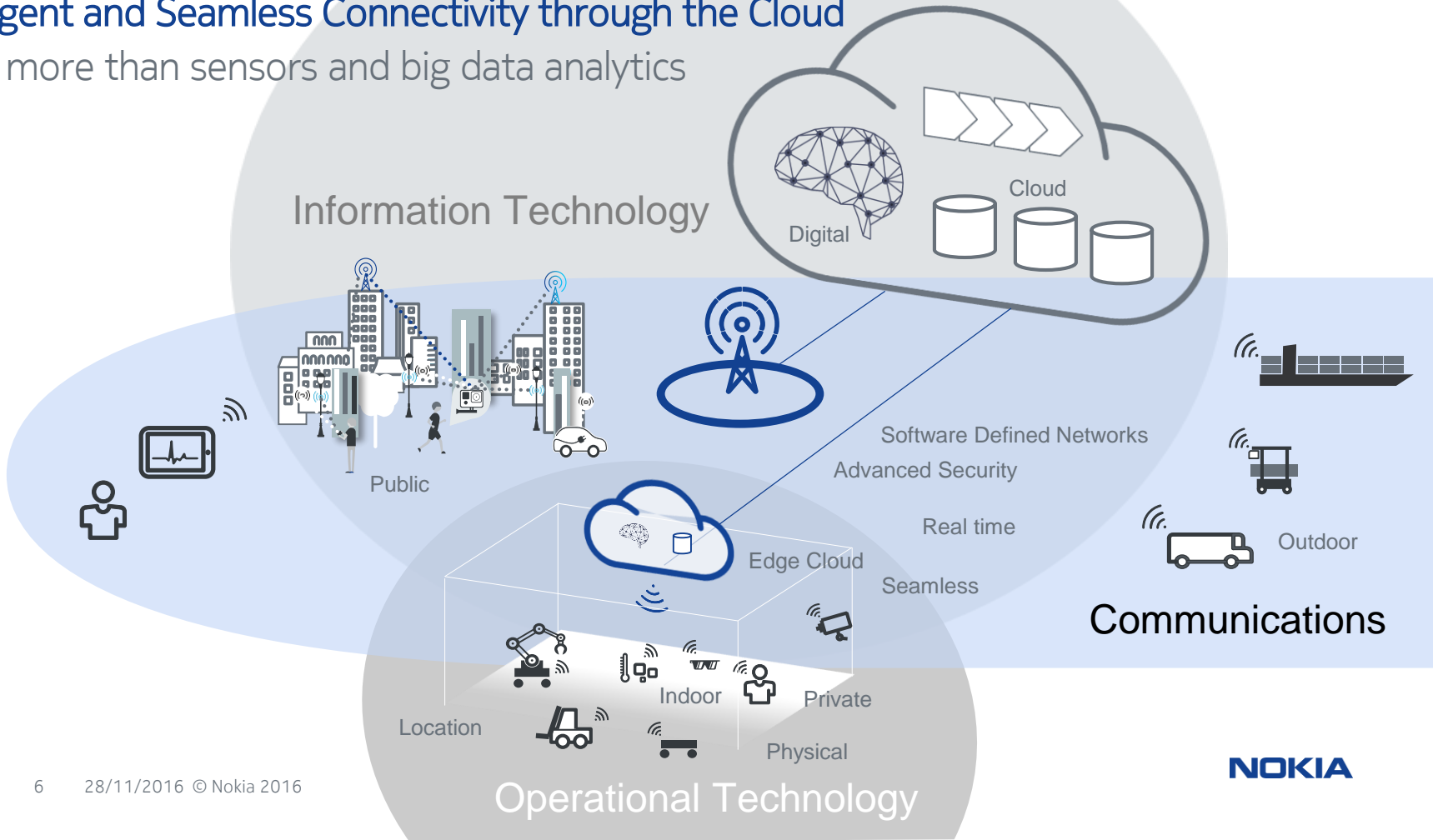Today most IoT data goes unused

~90%

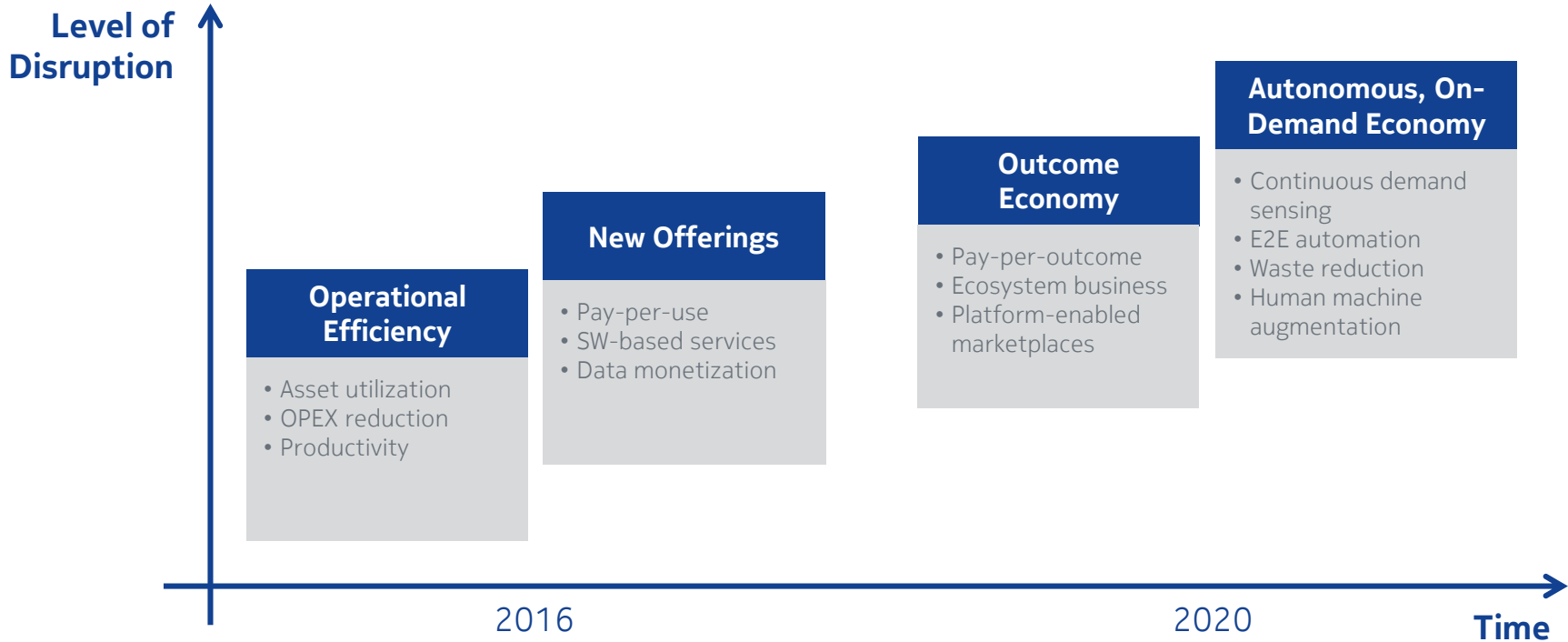Massive IoT applications

1,000s

New sensing and actuation

New

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Intelligent and Seamless Connectivity through the Cloud
IoT is more than sensors and big data analytics

Information Technology

Cloud

Digital

Public

Software Defined Networks

Advanced Security

Real time

Edge Cloud

Seamless

Communications

Outdoor

Location

Indoor

Private

Physical

Operational Technology

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New Value Drivers Emerging over Time
Business Model Evolution of the Industrial Internet of Things

Level of Disruption

Operational Efficiency

- Asset utilization
- OPEX reduction
- Productivity

New Offerings

- Pay-per-use
- SW-based services
- Data monetization

Outcome Economy

- Pay-per-outcome
- Ecosystem business
- Platform-enabled marketplaces

Autonomous, On-Demand Economy

- Continuous demand sensing
- E2E automation
- Waste reduction
- Human machine augmentation

2016

2020

Time

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In synch
Industrial grade unified ICT infrastructure

Core

Embedded Intelligence

Edge Intelligence

Centralized Intelligence

"Artificially intelligent" production system

Logic control/ Motion control

4G/5G factory cloud

Mobility mgmt.

SDN

Product data

Service data
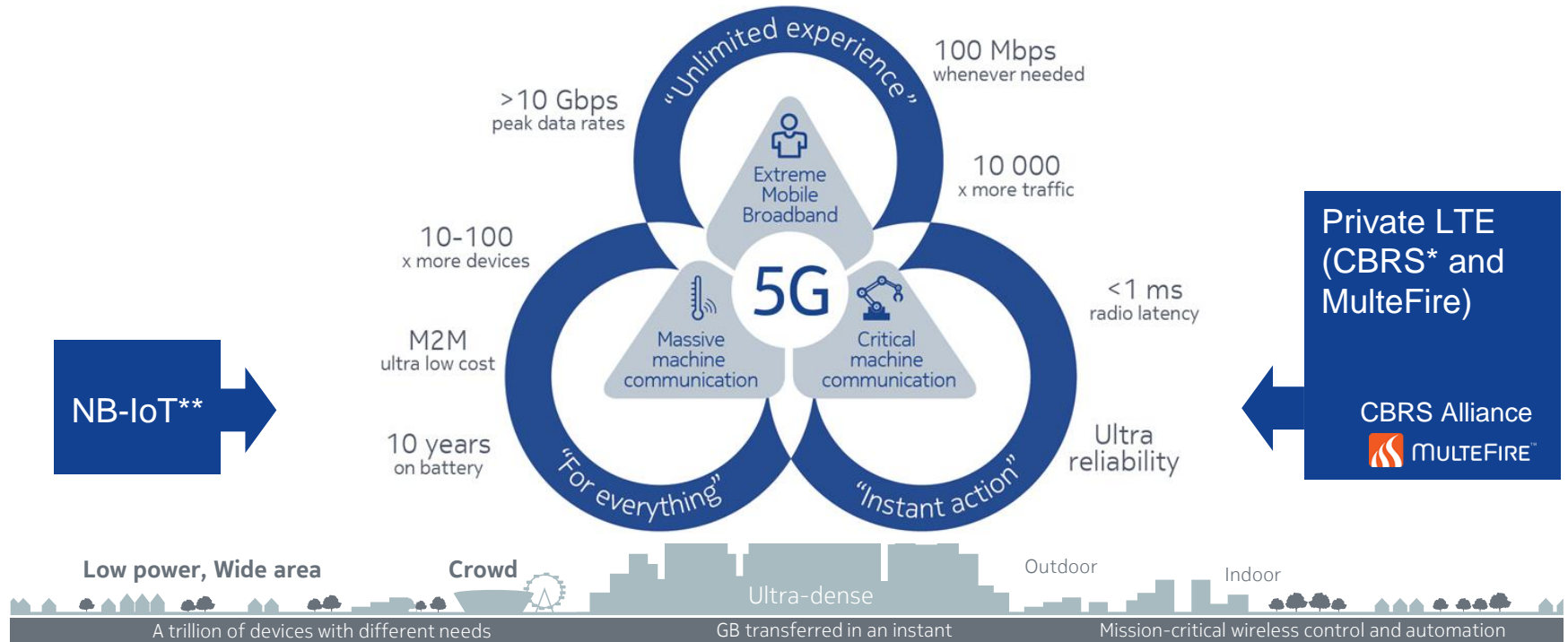
Engineering data

Order data

Supply chain data

Operational data

Usage data
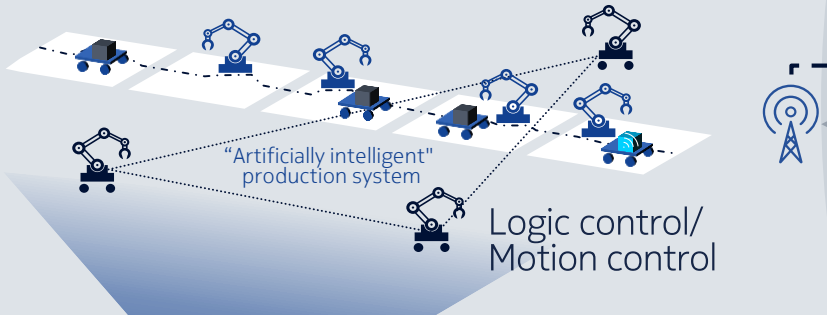
- Secure
- Deterministic Quality of Service (QoS)
- Seamless (public/private, indoor/outdoor)
- Robust and widely adopted technology
- Software Definable / Programmable

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5G Covering Different Requirements – starting with LTE today

Different Deployment Options

>10 Gbps
peak data rates

"Unlimited experience"

100 Mbps
whenever needed

Extreme
Mobile
Broadband

10 000
x more traffic

10-100
x more devices

5G

<1 ms
radio latency

M2M
ultra low cost

Massive
machine
communication

Critical
machine
communication

NB-IoT**

Private LTE
(CBRS* and
MulteFire)

CBRS Alliance

MULTEFIRE™

10 years
on battery

"For everything"

"Instant action"

Ultra
reliability

Low power, Wide area

Crowd

Outdoor

Indoor

Ultra-dense

A trillion of devices with different needs

GB transferred in an instant

Mission-critical wireless control and automation

* Citizens Broadband Radio Services (USA)   ** LTE Narrow Band IoT

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Which applications to start with?

| Real time	Interactive	Private	IoT	Data and compute heavy
Lowest application latency end-to-end, for a real time user experience or critical communications	Maximum transaction rate between device and cloud for an interactive user experience	Local communications for robust performance, privacy, and security	Real time insights from data exploited at the point of capture, minimum cloud ingress bandwidth	Local compute and storage for most demanding workloads to go mobile

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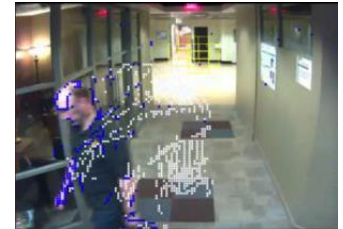
In November 2015 Car2X was publicly showcased on A9 highway, based on Zone Computing installed in Deutsche Telekom's live LTE network

Cooperative overtaking assistant (left)
Electronic brake light (right)
Robust 10…15ms application latency end-to-end

Demanding use cases

Deutsche Telekom LTE
Nokia Zone Computing
Fraunhofer onboard units
Continental in-car applications
Highest level political support

Teamwork

Strong partners

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Private LTE Trial in a Nokia Factory

Real-time
Reliable wireless

Live AGV tracking

Private LTE trial in a factory setup
Improved wireless coverage
Existing and proven technology
Enterprise Core

Network in a Box (NIB)

Push-to-Talk
Real-time video broadcasting
Flexibility

**Wireless-connected
workers and assets**

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Building It Together With You