IoT WebTalk

5G Private & Dedicated Networks FOR INDUSTRY 4.0

Tuesday, 13 October 2020 | 09:00 EDT | 14:00 BST | 15:00 CEST
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>5G Private and Dedicated Networks for Industry 4.0</td>
<td>Aruna Srinivasan, Executive Director, IoT Capabilities, GSMA</td>
</tr>
<tr>
<td>15 min</td>
<td>Creating the 5G Factory of the Future</td>
<td>Chris White, 5GEM UK Project Lead, Ford UK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marc Sauter, Head of Mobile Private Networks, Vodafone</td>
</tr>
<tr>
<td>15 min</td>
<td>5G IoT for Connected Factories 4.0</td>
<td>Stephane Gervais, Executive VP Strategic Innovation, LACROIX Group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ronan Le Bras, Head of Technical Strategy – IoT &amp; Wireless Networks, Orange</td>
</tr>
<tr>
<td>25 min</td>
<td>Panel Discussion: 5G Private and Dedicated Networks Deployment</td>
<td>Moderator: Steve Doyle, Principal Technical Architect, GSMA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Alexander Deo, Innovation Manager: SmartSensor &amp; IoT, DHL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Jacob Groote, EVP 5G, KPN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lov Kher, Managing Principal &amp; Master Architect, Verizon</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Marijn Bezuijen, Business Opportunity Manager, Shell</td>
</tr>
</tbody>
</table>
5G IoT for Manufacturing offers new revenue opportunities

<table>
<thead>
<tr>
<th>Icon</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Wi-Fi" /></td>
<td>Industry 4.0 IoT connections in 2025. 2bn</td>
</tr>
<tr>
<td><img src="image" alt="Cellular" /></td>
<td>Licensed cellular will account for 18% of connections. 18%</td>
</tr>
<tr>
<td><img src="image" alt="Currency" /></td>
<td>Operators’ expected revenue is 14% of total market. $1.8bn</td>
</tr>
<tr>
<td><img src="image" alt="Chart" /></td>
<td>Connectivity will be 10% of $13 billion Industry 4.0 revenues. 10%</td>
</tr>
</tbody>
</table>

**Notes:**
1. Includes manufacturing and supply chain. 2. Source: GSMA Intelligence, July 2020.
5G Private and Dedicated Networks

- **Public Network**
  - Efficient use of infrastructure & spectrum
  - Mobile Edge Computing within public network

- **Public Network with SLAs**
  - Operator expertise & spectrum portfolio
  - Superior customer support and SLAs

- **Public Network with Network Slicing**
  - Network resources dedicated and customised
  - Higher data isolation, security and privacy

- **Public Network with Local Infrastructure**
  - Dedicated network equipment
  - Choices regarding localisation of data and control
  - On-site Mobile Edge Computing

- **Private Network (Operator Spectrum)**
  - Isolated network
  - Managed service or leasing of spectrum
  - Customised design, deployment & operation

- **Private Network (Unlicensed or Private Spectrum)**
  - Direct responsibility for spectrum access & usage
  - Independent design, procurement, operation & radio plan

Operators’ revenue uplift from customised network services.

$1.4bn
A guide to private and dedicated 5G networks for manufacturing, production and supply chains

This report covers:

- The application of private and dedicated 5G networks to the Internet of Things in manufacturing/production and supply chain
- The benefits of private and dedicated networks
- A selection of use cases that benefit from these networks
- The range of public, dedicated and private network options available to enterprises
- Key new features within 5G that make these networks work better for industrial applications

Download now: https://www.gsma.com/iot/resources/5g-private-npn-industry40/
IoT WebTalk

5G Private & Dedicated Networks FOR INDUSTRY 4.0

Tuesday, 13 October 2020 | 09:00 EDT | 14:00 BST | 15:00 CEST
Creating the 5G Factory of the Future

Marc Sauter – Vodafone
Chris White – Ford
Speakers

Marc Sauter
Head of Mobile Private Networks
Vodafone

Chris White
Electrification and Global Engineering Alignment Manager – Europe
Ford Motor Company
Session Overview

- What 5G Private and Dedicated Networks are and their benefits
- Enterprise drivers for 5G Private and Dedicated Networks
- The various deployment models possible and their features
- Case Study: Ford Motor Company
A wide range of industries are embracing digital transformation.

- **Manufacturing**
  - Industrial robots
  - Connected machines

- **Transport & Logistics**
  - Autonomous guided vehicles
  - Container location tracking

- **Energy & Utilities**
  - Surveillance drones
  - Sensor monitoring

Many of these capabilities require reliable, high-performance wireless networks.
Doing new things in new places

Imagine:
- Protecting your employees on site
- Automating, reconfiguring production
- Across large and complex sites
- Almost any remote location

Consider:
- 4G and 5G communication
- Mobile Private Network
- Mobile Edge Computing
- End-to-end applications

4G
5G

Super-low latency, enabling new possibilities
Guaranteed service levels and security, 5G, 4G, NB-IoT options

Private / reserved mobile coverage, assured SLAs
Choice of dedicated or distributed service partners AWS & Microsoft

Ability to connect to the public network – mobile and fixed
Computing at the edge. Mobile and fixed options
What is a Mobile Private Network (MPN)?

An MPN is a secure mobile communications network for a specific company site (e.g. Factory, Port, Campus). It provides dedicated RAN and/or Core mobile network resources (dedicated, hybrid, or slicing) to enable customer-specific use cases. The customer is able to control and authorize which devices connect to the relevant network infrastructure, which means it is useable exclusively by these devices.
MPN Connectivity options – 3 possible versions

**Dedicated MPN**
Physical standalone mobile private network

*Customer Campus* | *Public network*
---|---
Private Radio |  
Private Core

**Hybrid MPN**
Physical private network elements deployed in conjunction with the public network

*Customer Campus* | *Public network*
---|---
Private Radio | Data routing
Public Core |  

**Virtual MPN**
QoS in the Vodafone network with Network Slicing

*Customer Campus* | *Public network*
---|---
Private slice | Public Slice
Public Core |  

**Assured QoS**
Keep your data on your campus
100% control through customer
Interworking with public network

**Dedicated MPN**
- Assured QoS: ✓
- Keep your data on your campus: ✓ ✓
- 100% control through customer: ✓ ✓
- Interworking with public network: ✗

**Hybrid MPN**
- Assured QoS: ✓ ✓
- Keep your data on your campus: ✓ ✓
- 100% control through customer: ✗ ✗
- Interworking with public network: ✓ ✓

**Virtual MPN**
- Assured QoS: ✓ ✓
- Keep your data on your campus: ✓ ✓
- 100% control through customer: ✗ ✗
- Interworking with public network: ✓ ✓
Case Study: Laser Welding at Ford
Enabling Vehicle Electrification: Industry 4.0 & Wireless Connectivity

Current

- Fixed connections take too long to complete, maintain and validate
- Equipment cannot easily be reconfigured or move during production
- Remote expert access is only possible via Ford Networks - cyber security risk
- Data connections, decision making and analysis is dispersed across shop floor based computers
- Physical limitations on the amount of data that can be transferred and stored

Future

- Safer, faster connections that can be validated prior to equipment delivery
- Reconfigurations without network updates
- Constant data from moving equipment
- Equipment communicating with manufacturers, experts, service providers as well as Ford Network. Use technology such as AR, AI
- Provide more robust and manageable, centralised remote computing
- New and increased amounts of data traffic accommodated

5G as a potential Enabler
Why does Ford need Industry 4.0?

- Safer, faster connections that can be validated prior to equipment delivery
- Reconfigurations without network updates, constant data from moving equipment
- Equipment communicating with manufacturers, experts, service providers as well as Ford Network. Use technology such as AR, AI
- Provide more robust and manageable, centralised remote computing
- New and increased amounts of data traffic accommodated

Improved launch is a business imperative

Factory of the future and IoT Enablers

Tesla's in the third version of 'hell' with its Model 3 — and it launching an SUV could make even things worse

Business Ford Botches Explorer Launch, Putting CEO Back on the Hot Seat
Use Case: Laser Welding Processes in EV’s

**Laser Welding of Battery tabs**

- 2KW Fibre laser with depth monitoring of welds
- Weld diversity:
  - Copper/ Aluminium/ nickel battery electrodes/ busbars
  - Differing thicknesses and weld patterns
- 860 milli sec weld time
- 480 welds per vehicle
- Heavy Data Processing
  - Requirement with enabled Real Time Process Analysis and Control
- >250K pieces of data per battery

**Stator Motor Hairpins**

- ‘Hairpin’ stators for e-drive or hybrid drives
  - 150 connections per hairpin stator
  - Normally 2 stators per EV (300 welds)
  - 6KW laser, pure copper to copper weld
  - Highly dependent on prior processes
  - Incoming part variation
  - Removal of insulating enamel required
  - Risk of damaging stator insulation through overheating

Laser welding hairpins and arrays are a new, complex applications - large amounts of data to be processed quickly
# 5G Laser Welding Use Case Selection

### Real Time Machine Monitoring
- Machine state reporting
- Blocked
- Starved
- Faults
- Sub system state reporting:
  - Laser source
  - Chiller
  - Extraction

### Condition Monitoring
- Connect equipment suppliers
- Collect and process ‘raw’
- Integration of simple IOT devices into legacy equipment

### Remote Support
- Remote experts via AR
- Managed access to machine programs
- Fixed cameras for machine fault finding / learning
- Access to the digital twin

### Quality Monitoring
- Vision data (pre, post or in-process):
  - Centralised vision data processing
  - Enabling AI computing

---

- Is the technology available in the timeframe of the project (or can it be simulated)?
- Is it affordable?
- Is it beneficial?
- Is it a good 5G demonstrator- or are other technologies more suitable /relevant?
- Does it highlight the skills/ offerings/ aspirations of all partners
# Project Status

## Device Availability
- Lack of 5G enabled machines/equipment
- Industrial device suppliers are considering IoT
- Strategies for wireless connectivity in IoT are diverging
- Pilots are using equipment that is not designed/integrated for shop-floor environments

## 5G vs. other Wireless Technologies
- WiFi6
- LoRa
- LiFi
- OE-Link
- CBRS

## 5G Concerns
- Workplace health and safety
- Use of 5G for safety critical communications
- Security

## Awareness and Understanding
- Limited telecoms/IT experience in the engineering community
- Interdependencies with plans for IoT/edge devices
- Standardisation limited across Automotive controls architecture and software
Further Information

<table>
<thead>
<tr>
<th>Ford</th>
<th>Vodafone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris White</td>
<td>Chris Allen</td>
</tr>
<tr>
<td>Manager – EU Electrification</td>
<td>Product Manager</td>
</tr>
<tr>
<td><a href="mailto:Chris.White@ford.com">Chris.White@ford.com</a></td>
<td><a href="mailto:Chris.Allen@vodafone.com">Chris.Allen@vodafone.com</a></td>
</tr>
</tbody>
</table>
Creating the 5G Factory of the Future
5G IoT at our Factory 4.0

Stephane GERVAIS
EVP Strategic Innovation
LACROIX Group
Providing our customers with equipment for a smarter and more sustainable world

LACROIX City
Own-brand equipment for smart road infrastructure management

LACROIX Environment
Own-brand equipment for water, smart grid and energy infrastructure management

LACROIX Electronics
Design and manufacturing of embedded systems and connected devices for its professional customers

SMART MOBILITY
LACROIX City
Street lighting
Signage
Traffic management
V2X

SMART ENVIRONMENT
LACROIX Sofrel
Energy
Wastewater treatment
Drinking water

SMART INDUSTRIES
LACROIX Elec.
Automotive
Home automation
Civil & Defense avionics
Healthcare
Industry

€482M
REVENUE

4000
EMPLOYEES
5G: Orange – LACROIX Group Partnership

Co-innovation: « Full-scale testing of 5G / IoT solutions for industrial production site »

Co-innovation 5G Kickoff
15/10/2019
5G - First Selected Use Cases

Operators supported by augmented reality

Energy monitoring and controlling of the whole factory

Wireless, secured and real-time factory (LAN to WAN)

Automatic Optical Inspection

Secured & real-time monitoring of the factory

Dynamically guiding AGV (Automated Guided Vehicle)
5G: What do We expect?

Industrial innovation
Creation of the first French electronics factory of the future

Sustainable and responsible innovation
A smart and environnemental building of high energy performance

- Enable **Flexibility / Adaptability** with **mobility** (wireless, )
- **Speed** (decision, increasing components and material flow…)
- Higher **reliability** (quality, security, redundancy…)
- Increased and flowless information for **optimum decision** (digital twin, decision based on data…)
- “Dynamic automatization” for **best efficiency**
- **Sustainable factory** (carbon emission, energy, water and consumption, maintenance…)
- More value added for our **colleagues/operators**
- Transform the **full value chain** (forecast, ordering, stock…)
- European electronic manufacturing **boosting reshoring / near shoring**
Industry 4.0
Learning through co-innovation

Orange – LACROIX Group

Ronan LE BRAS
Head of Technical Strategy
Technology & Global innovation
End-to-end capabilities and expertise accelerates transformation
5G to accelerate the “Collect” part
Co-innovation project with Lacroix

- **Use case analysis**
- **Solution design**

**Solution Installation**
- **Use cases in operation**

**Feedback and learnings**

- **October 2019**
- **Kick off Co-Innovation Project**
- **March 2021**
- **Conclusions of co-innovation**
Orange and its partners selected a solution based on scenario 3 of the 5G-ACIA.

- Dedicated Indoor Radio solution using temporary 3.5 GHz spectrum
- Signalling Traffic routed to/from Orange Core network in NSA
- Lacroix User Data and services kept local

Reference Scenarios from 5G-ACIA White Paper
Orange objectives in Co-innovation

- Get knowledge from the Industry sector through real experimentation and use cases
- Understand the real needs of the customers
- Identify the role of 5G with other connectivity solutions in the factory of the future
- Evaluate the operational aspects of 5G in the industry
5G co-innovation on different business verticals in France and Europe

5G opens up new perspectives in the B2B world, Orange works with its customers to implement use cases thanks 5G. Co-innovation projects aim to cover as many verticals of the economy as possible.
IoT WebTalk

5G Private & Dedicated Networks FOR INDUSTRY 4.0

Tuesday, 13 October 2020 | 09:00 EDT | 14:00 BST | 15:00 CEST