5G AND SMART INDUSTRY

5G & IOT | IR. P.M.A.M. HEIJNEN

CONTENT

5G AND SMART INDUSTRY

WHAT IS A SMART FACTORY?

A smart factory is a highly digitalized and networked manufacturing plant, with the goal to have them completely self-organizing and self-optimizing.

Benefits

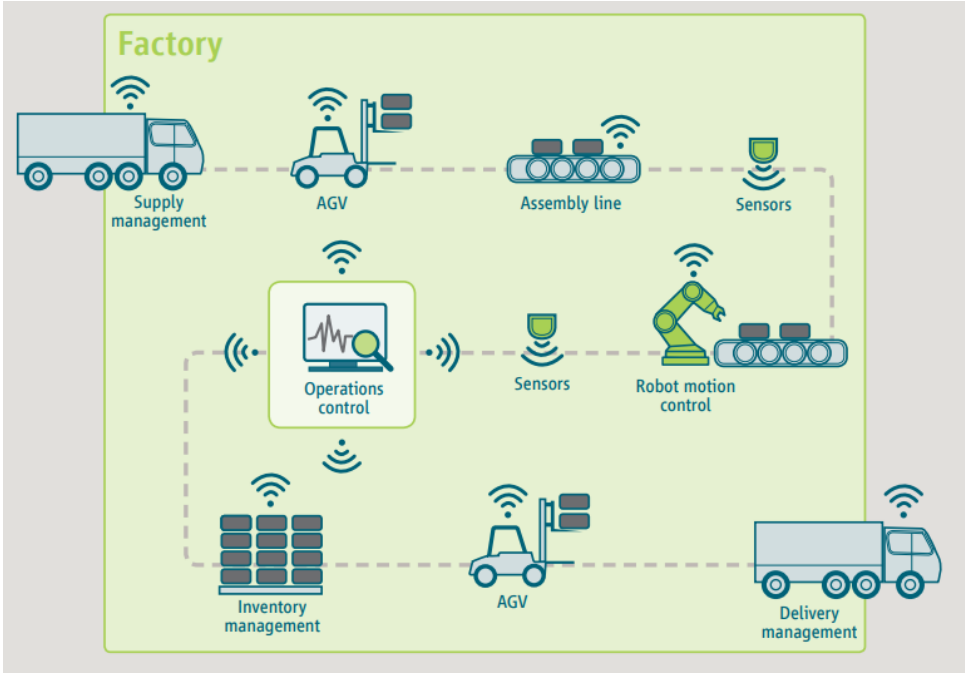
- Improved productivity
- Better product quality
- Energy efficiency
- Intelligent monitoring & maintenance
- Safe and efficient transport (Automated Guided Vehicles)

Challenges

- Data integration
- Costs
- Cybersecurity

Drivers for smart factory

- Global competition
- Changing consumer demand.
- Labour skills shortages.



Factory of the future (source: ZVEI)

WHAT IS A SMART FACTORY?

- "Highly digitalized and networked" means: The processes take place with minimal human interaction, using technologies such as
  - Artificial intelligence (AI),
  - Robotics,
  - Big Data,
  - Internet of Things (IoT).

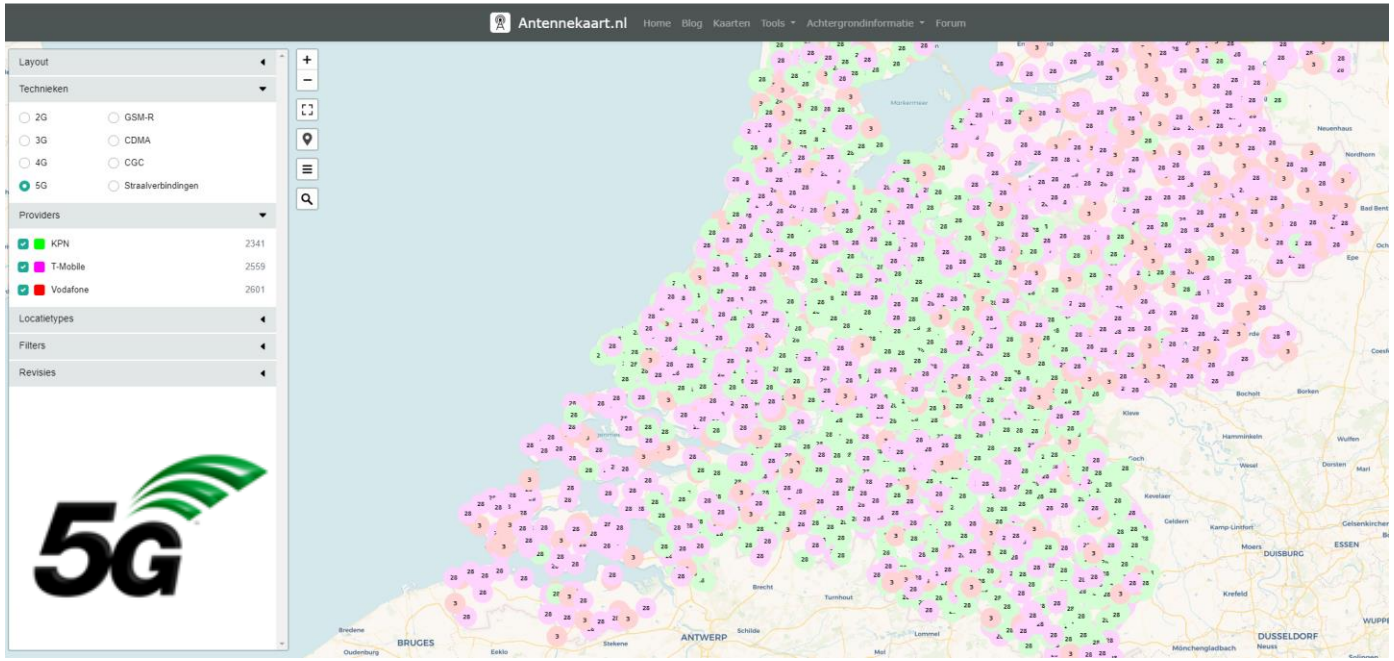
- For these technologies, smart factories depend on:

> Connectivity.
>
> Information needs to be transferred reliably, securely, and in real-time, between processes and equipment [within the plant and between plant and supply chain partners, maintenance providers, etc.].

5G IS A REALITY!

- At the end of October 2021, 5G commercial services were available in twenty-five of the EU-27 countries.[ref. 5G Observatory Quarterly Report 13 Up to October 2021]

- Commercial and test 5G networks available in the Netherlands



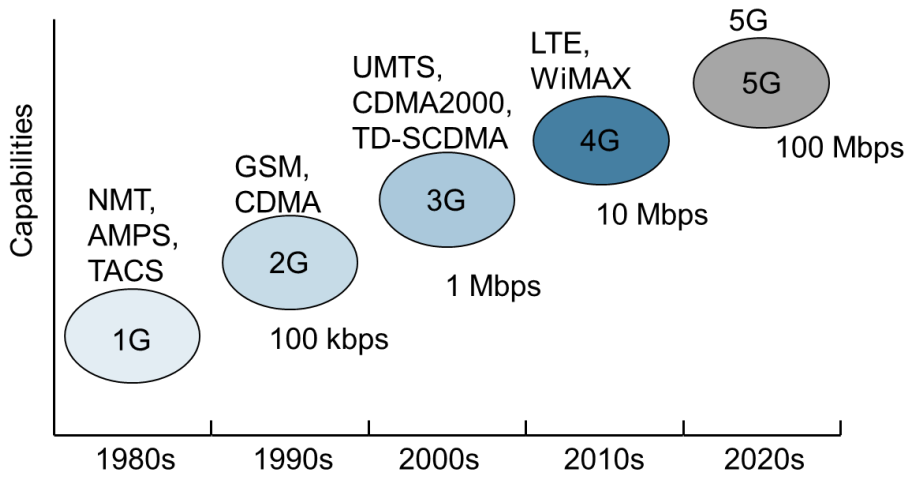
5GRONINGEN

Do IoT
innovation in internet of Things
Fieldlab

Hi5 5G

HOW 5G DIFFERS?

- Ever increasing user date rate
  - 10 times increasing per generation
  - ~10 year per generation

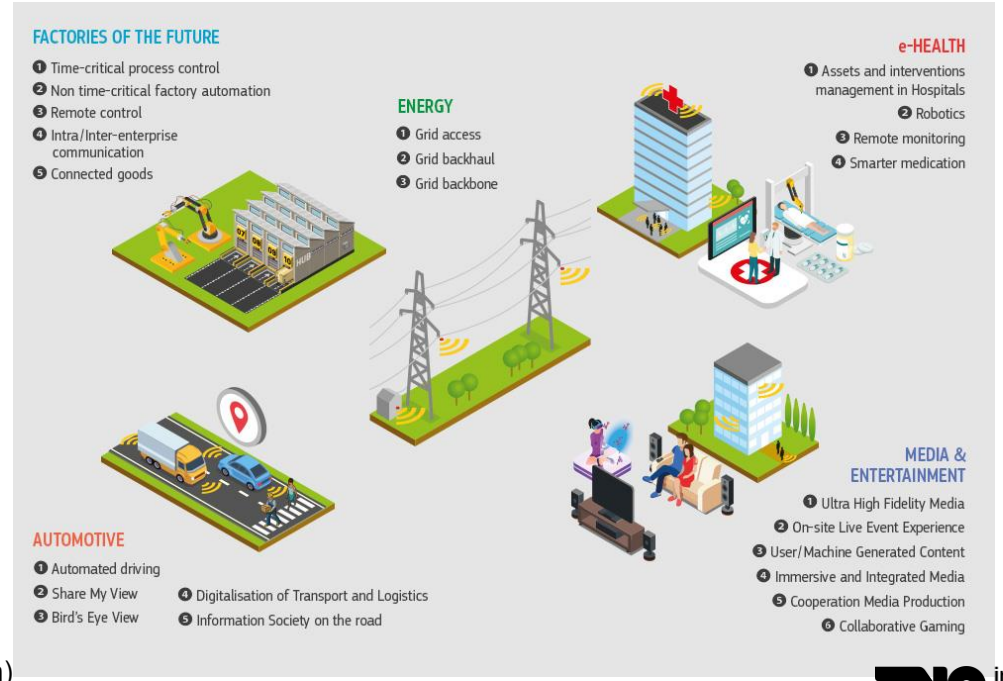


- However, 5G is more than just higher data rate

  Support of “vertical” sectors (machine-type communications, Internet of Things)

  Softwarization

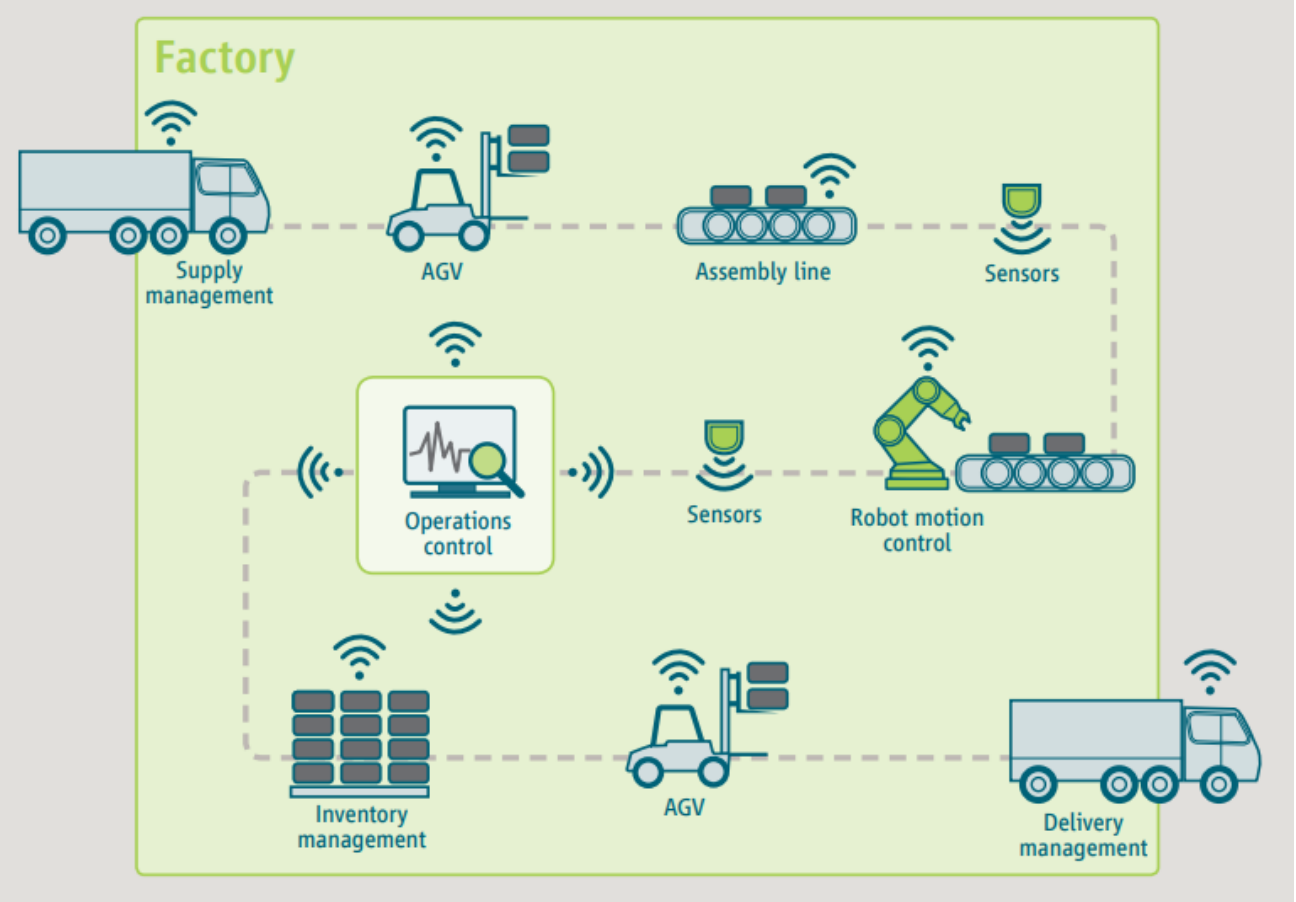
  Networking + edge computing + edge storage



(Source: European commission)

WHERE 5G MAY ADD VALUE

- Advantages of wireless connectivity
  - Mobility (e.g. AGVs)
  - Flexibility and re-configurability
- Integration potential with (existing) wired infrastructure
  - Compatibility with Industrial Ethernet
  - 5G support of Time-Sensitive Networking (TSN)
- KEY 5G technical ENABLERS
  - Network slicing
  - Compatibility with industrial ethernet
  - Ultra-reliable and low-latency communication
  - Massive machine-type communication
  - Security
  - 5G private network / public network / hybrid network



Example applications of 5G in a factory of the future (source: ZVEI)

CHALLENGES

- Existence of many technical options (e.g. private vs. public network, slicing configuration), to be determined per application scenario
  - There is no one-size-fits-all solution
  - Are the requirements sufficiently fulfilled?
- There is so far no (mature) macroeconomic guidelines
  - Who should invest? Business model?
- Concerns around safety and security: it is wireless!
- Development of 5G-connected Industrial components
  - It may still take some time before massive production is available

ACTIONS REQUIRED

- More effective involvement of manufacturing sector in 5G design!

- Dedicated spectrum for local/private licensing
  - Spectrum license only valid for a limited area (e.g. in a factory), with relatively higher security and lower interference
  - Germany, 100 MHz @ 3.5 GHz band, >30 buyers including Bosch, BMW, BASF, Lufthansa, Siemens and Volkswagen
  - In the Netherlands: auction of the 3.5 GHz band in 2022

- TRIALS TRIALS TRIALS: More trials and pilots are needed

  To gain more insight in the values of 5G

  To learn technically what the challenges are

  To determine the most proper 5G options for selected use cases (e.g. private vs. public network, slicing configurations)

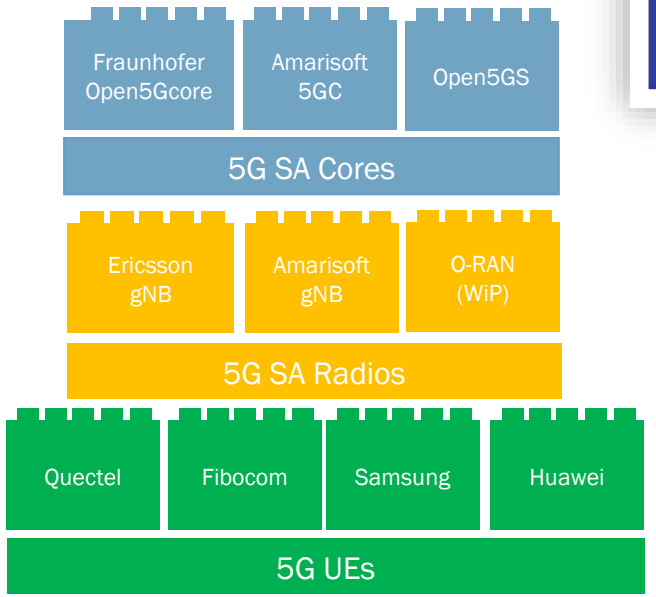
5G-RELATED ACTIVITIES @ TNO

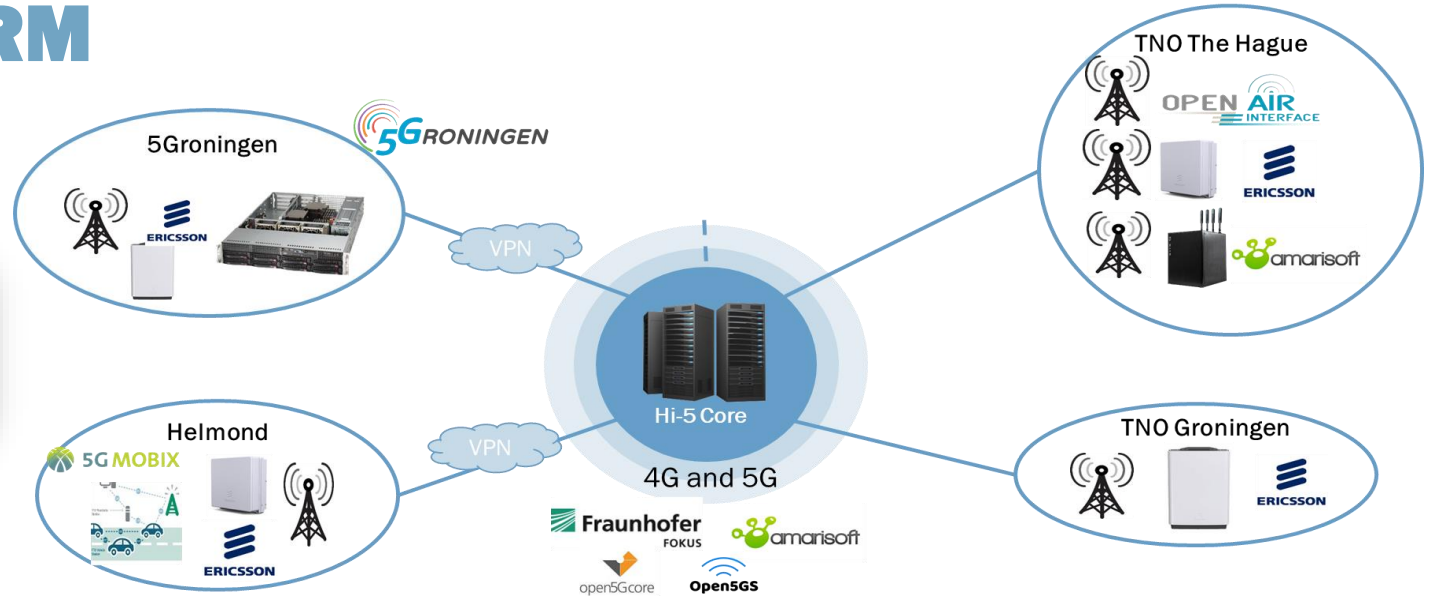
- Research in 5G for companies European research projects
- 3GPP standardization
- Tests & Trials: 5Groningen, Hi5, DoIoT
- Consultancy
- Topsector ICT –Future Network Services Key Technology
- 5G for verticals

- Funded by the EC, national funding or our customers
- Type of work
  - Use cases and requirements definition
  - Research on 5G solutions
  - Pilots and trials
  - Strategic advices
  - Joint promotion e.g. via white papers, (3GPP) standardisation impacts

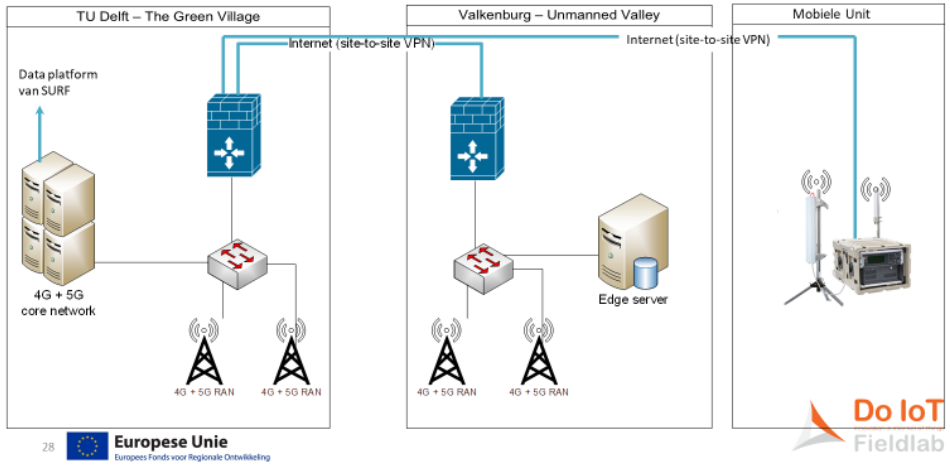
TNO'S HI5 5G SA PLATFORM

- One of the most advanced 5G test networks in EU
- Flexible to be used/deployed/integrated for specific use case





DoIoT Fieldlab 5G SA network



COLLABORATION OPPORTUNITY

- You and TNO jointly identify or create **concrete industrial use cases** where 5G is meaningful for innovation
  - 5G/wireless connectivity brings added-value
  - Challenging enough - 4G or Wi-Fi is not sufficient
- You and TNO collaborate in 5G **trials/pilots in an industrial environments** for selected use cases
  - To exploit use cases benefit
  - To learn technically what the challenges are
  - To determine the most proper 5G options for the selected use cases (e.g. private vs. public network, slicing configurations)
- You and TNO jointly initiate **research and innovation project** (proposals)
  - EU, national and regional funding programs
- You and TNO jointly **promote** your 5G-enabled use cases (e.g. white papers, 3GPP standardisation impact)

- Benefits of working with TNO
  - TNO's updated and comprehensive **knowledge** of 5G, built via TNO's continuous involvement of research projects and 5G standardization
  - TNO's **experience** in and around "5G for smart industry", built via previous and ongoing relevant projects
  - Chance to use TNO's advanced **Hi5 5G test network**, without the needs to wait for commercial availability
  - TNO's **neutrality**: always objective opinions!

THANK YOU FOR YOUR ATTENTION!

Q & A

TNO innovation for life

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