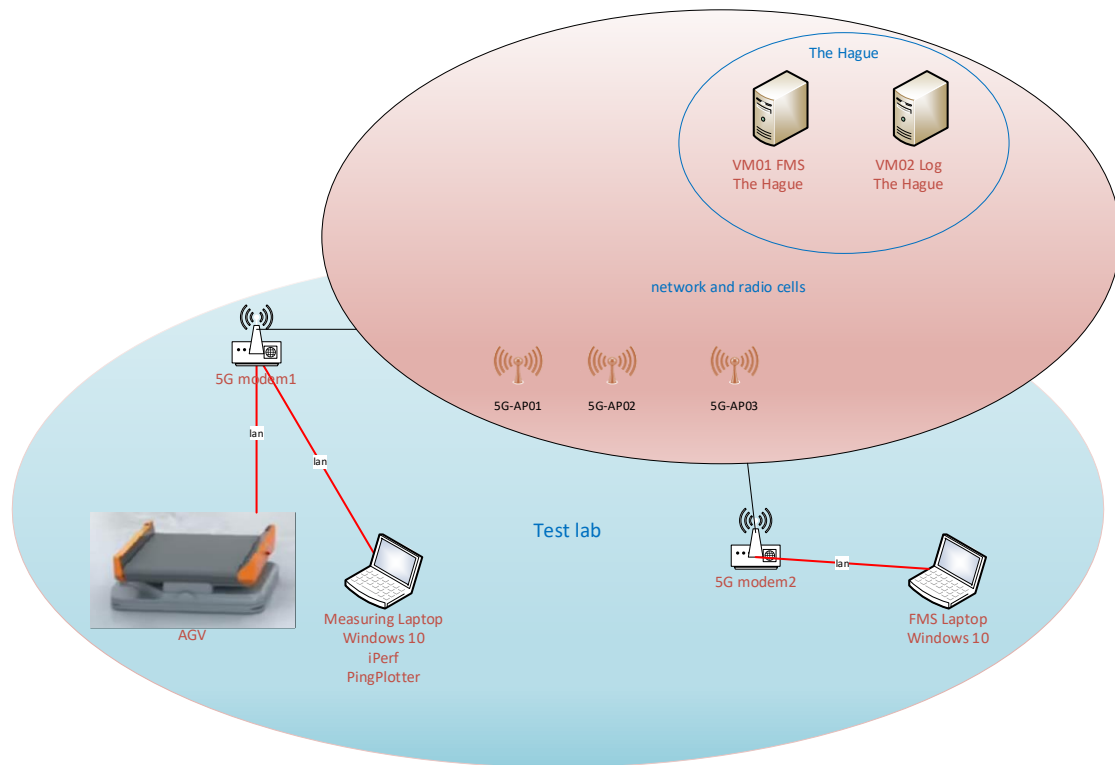VANDERLANDE

MOVING YOUR BUSINESS FORWARD

Vanderlande

› **Wilko van de Langenberg**

› **Project leader Innovate** working at the Innovate department with more than 20 years of ICT experience

› Within Innovate **broadened the scope to other domains** like mechatronics, AGV's, robotics
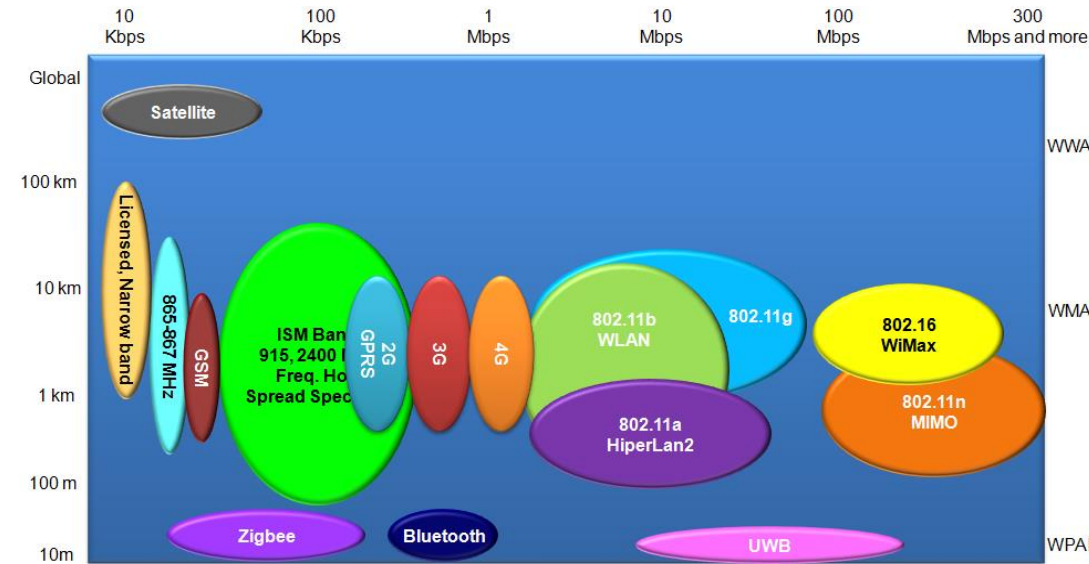
› 2 Minute shopped movie to indicate our work area

Handle cartons, trays and totes

History of prior communication explorations

› In **Q1 2020** the '**Wireless communication**' exploration was executed to find the **best wireless communication technology** for Vanderlande

› In **Q2 2020** a Vanderlande **AGV was** driving in a lab environment while communicating over a **5G 3,5GHz** connection. **Got first insight** into **the 5G architecture**
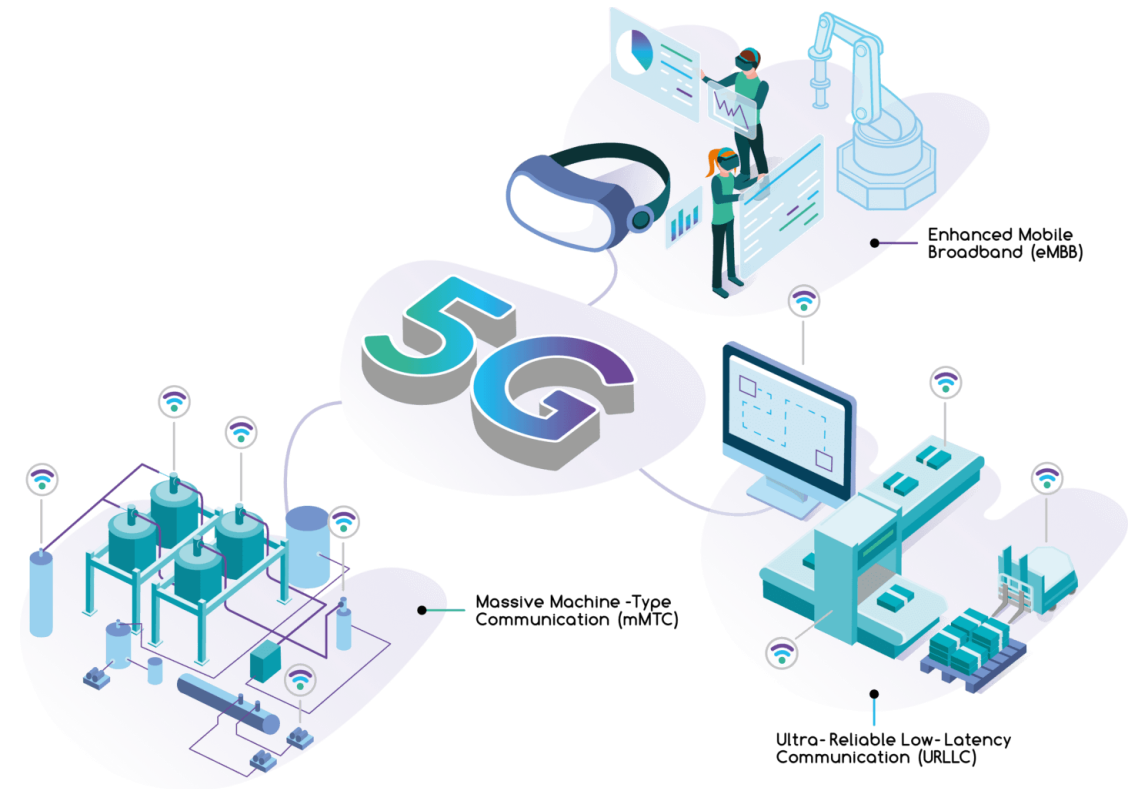

The Hague

VM01 FMS
The Hague

VM02 Log
The Hague

network and radio cells

5G modem1

lan

lan

5G-AP01   5G-AP02   5G-AP03

Test lab

5G modem2

lan

AGV

Measuring Laptop
Windows 10
iPerf
PingPlotter

FMS Laptop
Windows 10

| 10 Kbps | 100 Kbps | 1 Mbps | 10 Mbps | 100 Mbps | 300 Mbps and more |

Global

Satellite

WWA

100 km

Licensed, Narrow band

865-867 MHz

GSM

10 km

ISM Band
915, 2400
Freq. Ho
Spread Spec

2G GPRS

3G

4G

802.11b WLAN

802.11g

802.16 WiMax

WMA

1 km

802.11a HiperLan2

802.11n MIMO

100 m

10 m

Zigbee

Bluetooth

UWB

WPA

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Motivation to continue exploring 5G

› **5G is buzzing** everywhere by vendors at seminars and customers

› **Wifi is** used for several Vanderlande use cases

- To be able to **judge if 5G is complementary or can replace Wifi** you need to understand

› It **takes time** to **understand** what 5G means

› It **takes time** to implement, **so start early**

Enhanced Mobile Broadband (eMBB)

Massive Machine -Type Communication (mMTC)

Ultra- Reliable Low- Latency Communication (URLLC)

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Use cases and technical motivation

› Wireless

- Controlling the **AGV's**

- Controlling the **shuttles**

- **Service** engineers

- **Operators** with handhelds

- Driving outside

- Augmented Reality for operators

- LoRa Sensors for **predictive maintenance**

- …

› Wired

- Many **sensors** and **actuators**

- **Controlling** the motors of the conveyor bells

› **Motivation to look into 5G**

- Wifi has some flaws:

  › *Engineers think they can install and configure, but lack knowledge*

  › *Without alignment the frequency spectrum can be messy*

- Possibly another communication technology can solve these issues

  › *Will bring new challenges*

- **Need to understand** what it means to have an **answer to customer** questions
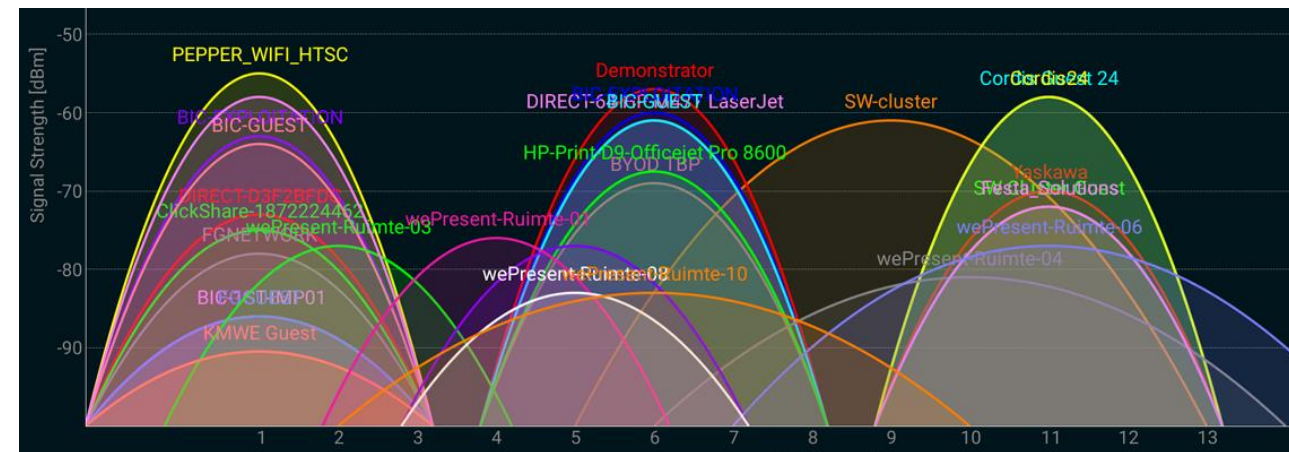
Q4 2021 Started the 5G investigation

› **Goal: Implement a stand-alone private 5G environment with a local breakout to the Vanderlande data center**

- We want to **learn by doing** where we **don't know all the use cases yet**. The use cases are strongly dependent on the **5G ECO system and 5G possibilities**.

- **CAPEX** and **OPEX** needs to be made clear to build the business case

- **Test facility** is the Advanced Design Center of Vanderlande. Dimensions ~ 42m x 140m x 8m high.

| requirements / use cases / learnings	Rationale
Implementation of a local UPF (breakout)	When deploying at our customers the data processing is done in a local data center and not in the cloud
Understand what it means when the 5G connection is disrupted by means of: •Local interference •Missing connection between the local UPF and remote 5G backbone	Being able to identify dependencies and risks
The solution must be able to be extended and enriched with the new 5G releases like localization	5G is constant in development and new releases are coming fast. To make the 5G environment future proof the 5G environment needs to grow as well
Learn what it means when moving from indoor to outdoor	There are use cases where there will be movement from indoor to outdoor and vise versa
Test roaming between cells	Test and understand the impact on the Vanderlande application in practice when roaming
Measure and test the coverage	Need to know the qaulity, hence the coverage needs to be measured
Learn the administrative processes of for example the SIM's	How does the administrative process look like

Approach and learnings

› Contacted a **telecom provider and a company which delivers 4G, 5G** hardware with consultancy

› **Offering hardware and consultancy company**

- Offering 1

  › *A stand alone **4G Private LTE** offer with a **download speed of 20Mbps** and an **upload speed of 5Mbps** with a **guaranteed latency below 50ms**.*

  › *Costs excluding cabling in the building based on CommScope hardware **~ 5 times Wifi***

  › ***Technically not meeting our requirements***

- Offering 2

  › *CommScope will **not deliver 5G radios (3,5GHz) before Q3 2022***

  › ***Nokia can deliver 3,5GHz** to a much higher costs (rough estimate **times 15 times Wifi**). Nokia is focusing on telecom providers. And uses the hardware used for telecom providers for enterprise use cases.*

  › *Technically meeting our requirements*

  › ***Financially not (yet) possible to make the business case***

› **Offering telecom provider**

- Offering **as a service**. Data usage will be separately charged

- Delivering **5G based on 3,5GHz without a local breakout**

- Local breakout is key. **Investigate** with the hardware supplier of the telecom provider define **what is possible as stand-alone environment**

- **Financially and technically not (yet) meeting our requirements**

Learned so far

› **The devil is in the details.** The suppliers say that they can deliver 5G, but initially didn't mention the details of which 5G release with which features they can deliver

› Suppliers are eager to work together

› Both **suppliers are not (yet)** able to deliver a **stand alone (private) 5G infrastructure based on 3,5GHz** which meets are requirements. For at least not till the end of 2022.

› The **costs for 5G are relatively high** compared to the wireless communication technology that is currently in use at Vanderlande

› The **industrial 5G client ECO system is not mature yet**. 5G clients are hardly or not available for example to place in an AGV

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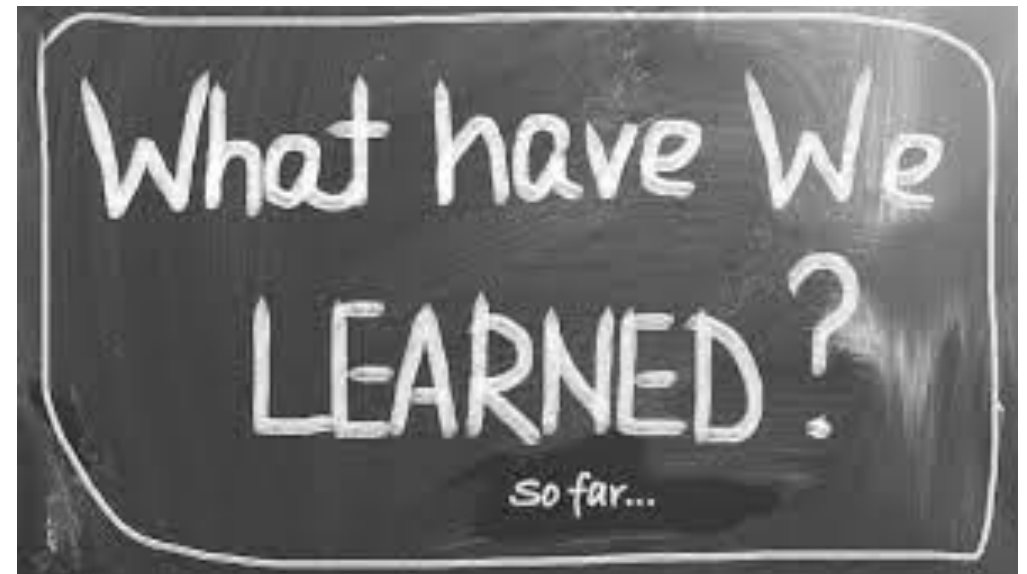
Motivation to pause the 5G exploration

› The current **technology readiness level of 5G** infrastructure and clients is **too low for our use cases**

› The **added value is too low** as well for our use cases

› **Costs are relatively high**, so need to **expand** the business case **to get more use cases**.

› The first step is to **inventory at the Vanderlande roadmap** where 5G could bring **added value** and quantify it into the business case. Meanwhile the 5G developments will be **monitored to stay up to date** with the developments

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What should you do?

› **Understand** what it can bring when

› **Investigate** what it means for **your business**

› Decide when to **follow up**

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