



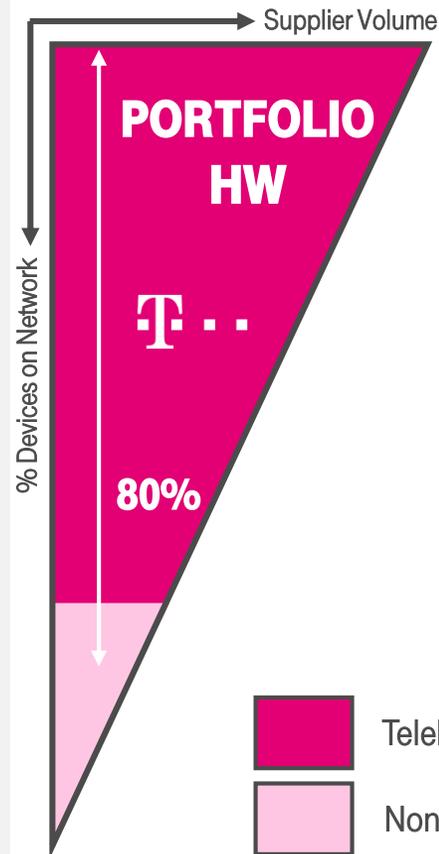
GNSS CERTIFICATION SERVICE

ENSURING HIGHLY-PERFORMANT LOCALIZATION



Why does DT deliver IoT certification services?

DEVICES ON CONSUMER NETWORK

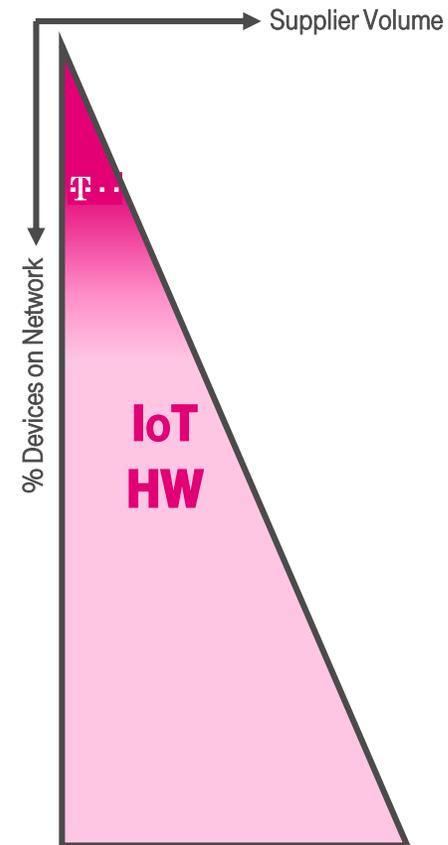


Most devices on **Consumer Network** are in-portfolio and validated by Telekom:

- Direct relationships with dominant vendors
- Technical compliance statements
- Standardized, mature services
- Dominant OS platforms

→ **LOW RISK TO NETWORK**

DEVICES ON IoT NETWORK



Few devices on **IoT Network** are in Telekom's portfolio and tested:

- Thousands of suppliers
- Little visibility / stake on 3rd party design
- Innovative, disruptive services
- No standardized APIs to protect network

→ **HIGH RISK TO NETWORK**

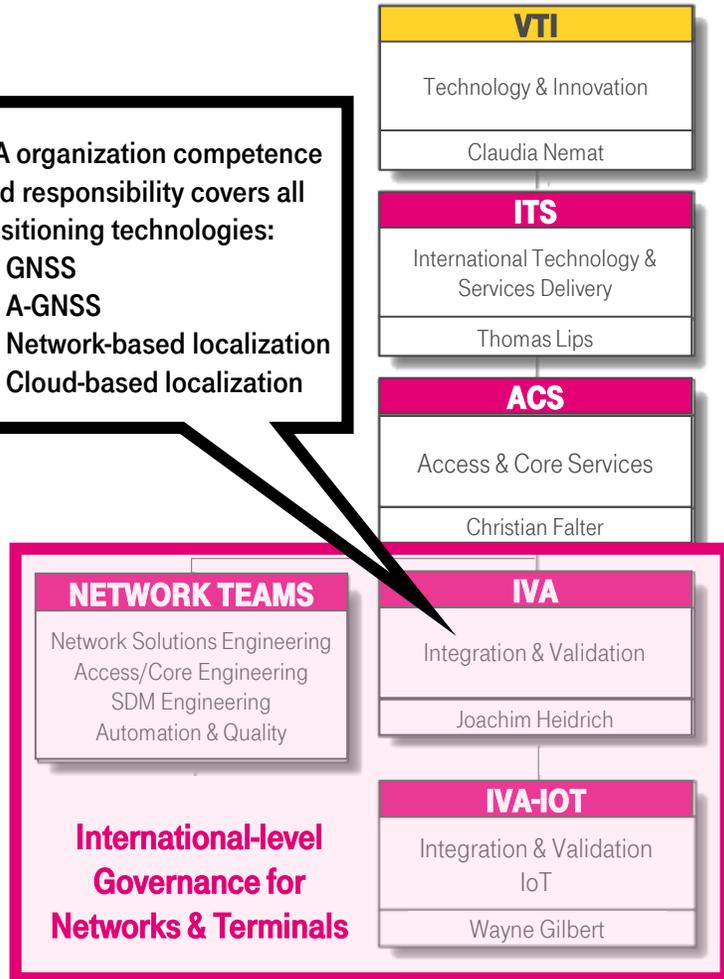
→ **HIGH RISK FEATURES FAIL**



International delivery of GNSS certification

IVA organization competence and responsibility covers all positioning technologies:

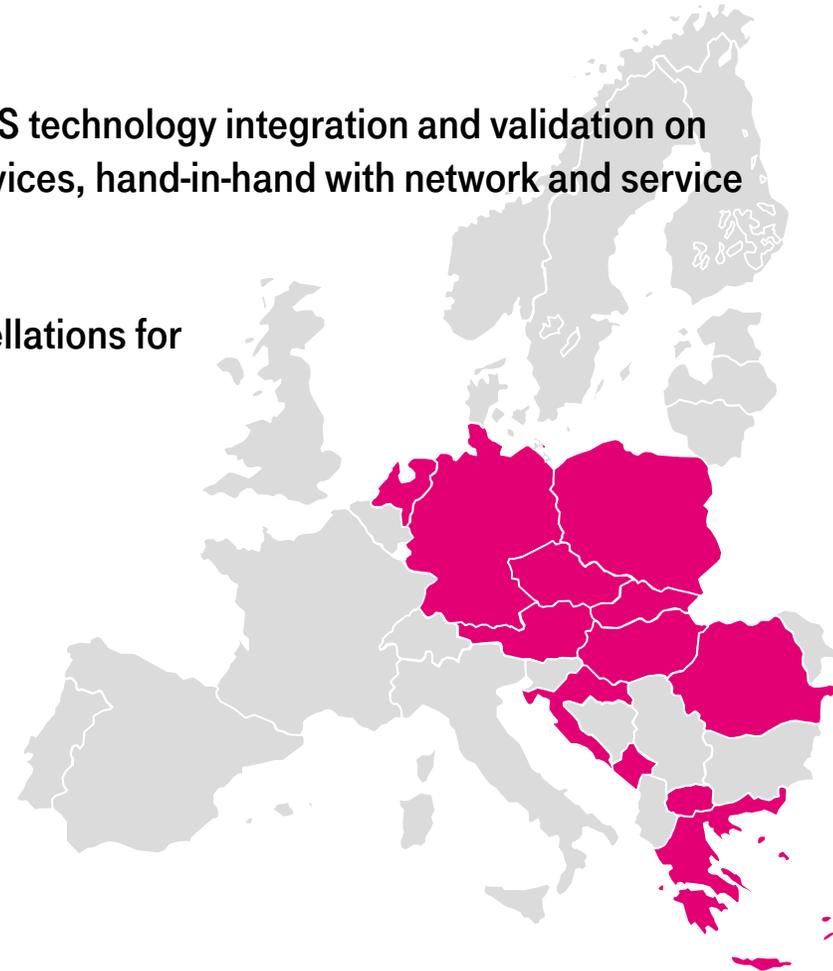
- GNSS
- A-GNSS
- Network-based localization
- Cloud-based localization



Delivering GNSS technology integration and validation on capable IoT devices, hand-in-hand with network and service deployments

Satellite constellations for positioning:

- GPS
- GLONASS
- Galileo
- Beidou

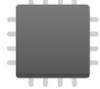


IoT device components

GNSS Application =
Connected Coffee Machine



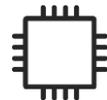
Microcontroller (MCU) (IoT Device Application)



Sensor(s), Actuator(s)



LDO or DC/DC Converter



Batteries (Saft S.A., etc.)

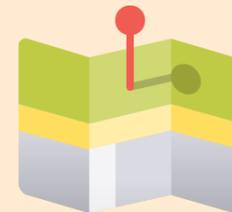
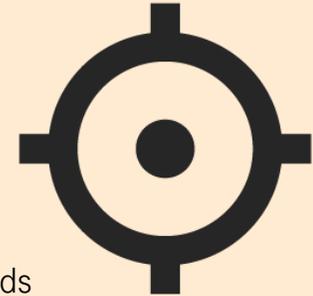


External Interfaces
(e.g. USB)

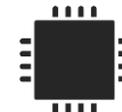


GNSS Chips & Modules

- Common RFFE (Radio Frequency Front End)
- Oscillators, filters, amplifiers, memory
- Satellite constellation support
- GNSS Antenna connection
- NMEA commands
- Functionality steered via dedicated AT commands
- Assisted GNSS with internet usage
- UICC software support
- **Vendors:** Fibocom, Murata, Nordic Sem., Sierra Wireless, SIMCom, Sony, u-blox, Quectel, Telit, Thales, etc.



Communication Chipset / Module
(e.g. NB-IoT)



GNSS Antenna



IoT value chain: GNSS certification benefits

Deutsche Telekom GNSS Certification Targets:



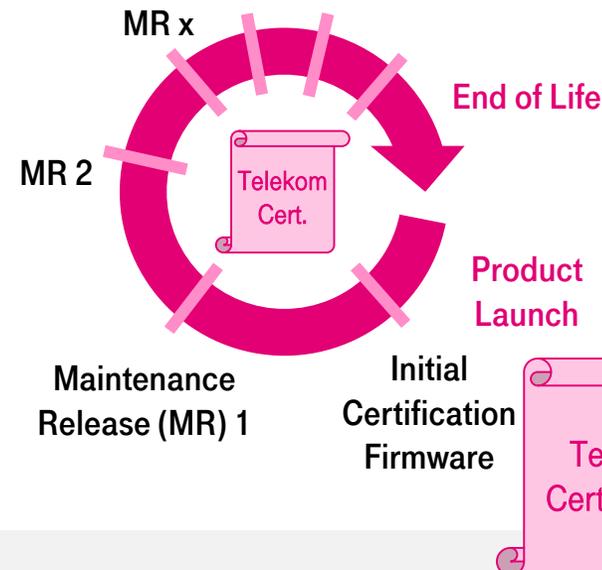
Certification secures **Best Quality & Interop.** on hundreds of IoT Devices



Technical validations rerun for:

- Corrected Issues
- New Features

DT Certification follows GNSS Chip Lifecycle:



Virtual Twin Modeling



HARDWARE Catalog



✓ **Compliant IoT Devices**



IoT Digital Shelf: Our ecosystem platform

The IoT Ecosystem for Telekom Affiliates & Partners

1-Stop Shop for **Hardware, Services, IoT-Knowledge**

- Fully white-labelable to become IoT offering of any M(V)NO
- International, available in up to 20 languages
- Scalable & optimized for immediate integration & deployment
- Delight customers: Product recommendations & performance modeling

IoT Hub



Digital Shelf provides:

- Pre-integrated HW in DT-IoT Offering
- Partner ecosystem enabled in IoT Hub

Integrated Catalog of Partner Solutions & Technologies



IoT Digital Shelf

CONNECTIVITY

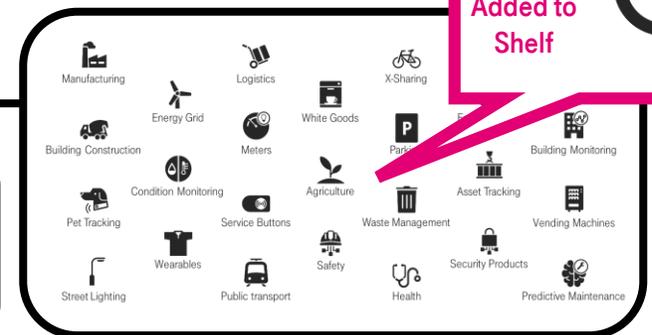
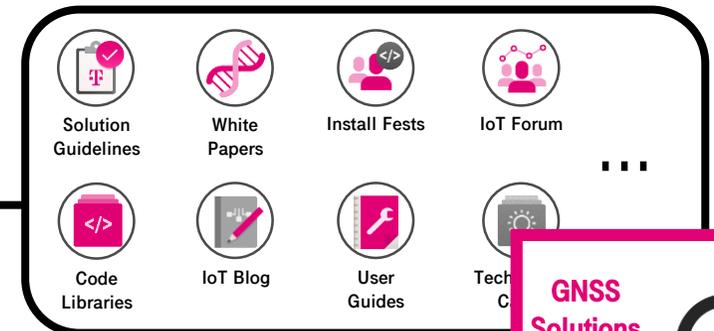
PRODUCTS

LEARN

PARTNERS

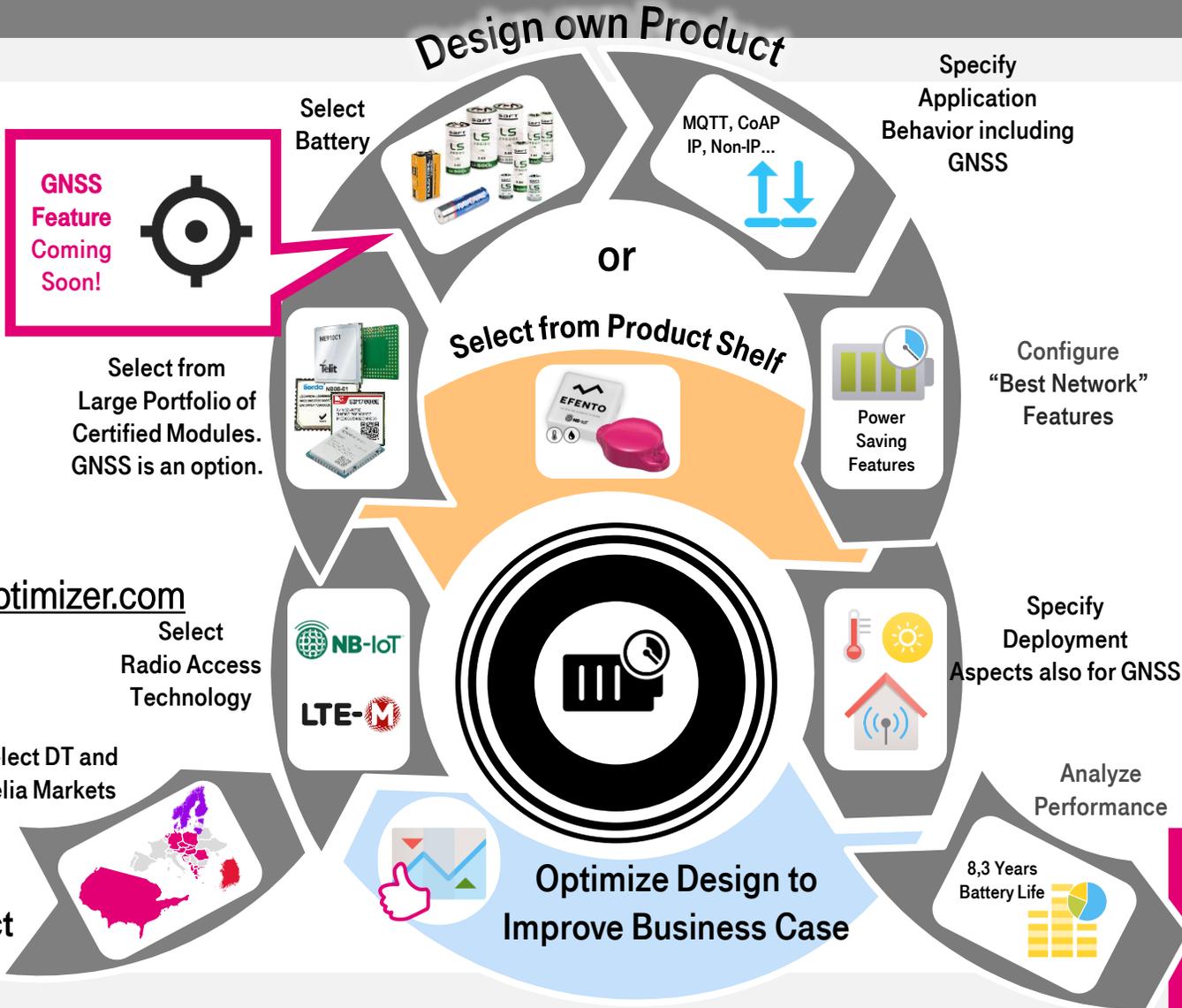
SERVICES

HARDWARE



GNSS in the IoT Solution Optimizer

Enterprises gain TTM and reduce costs with cloud-based service that models virtual twin prototypes of NB-IoT / LTE-M / GNSS services, optimizing them for longer battery life and superior coverage performance!



<https://iotsolutionoptimizer.com>



IoT Devices - IoT Solution Optimizer - My Projects - Tony's Condition Monitor Miguel Rodriguez@telekom.de

Tony's Condition Monitor

Table of Contents

- Chapter 1: Project Configuration Summary
- Chapter 2: Project Analysis
- Chapter 3: Project Optimization Recommendations

Buttons: Roll Project, Finish Project, Share Report

Chapter 1: Project Configuration Summary

Mobile Operator Network: SK Telecom

Access Technology: NarrowBand IoT (LTE Category NB1)

IoT Vertical: Condition Monitoring

Application: Eferio NB-IoT Generator

Communication Activity: Number of Transactions per Day: 12.00

Coverage & Mobility

Outdoor	50.00 %
Indoor	30.00 %
Deep Indoor	20.00 %
Mobility Model	Static

Chapter 2: Project Analysis

IoT Device Battery Lifetime Estimates

Coverage Quality	Lifetime (Years)
Composite (100%)	~7.5
Outdoor (20% CPLevel0)	~11.0
Indoor (30% CPLevel1)	~7.0
Deep Indoor (20% CPLevel2)	~1.5

Chapter 3: Project Optimization Recommendations

Application Reporting Period

Impact of the application reporting interval on battery lifetime

Please note: The diagram was limited to 15 years. For longer operational lifetimes, please contact your battery supplier for

- MNO Onboarding Link
- Project Summary Report
- AT Command Checklist
- Supplier Contact Links

Process inputs (Supplier deliverables)

HARDWARE

- 1-2 modules or GNSS chips with latest firmware
- 1-2 evaluation kits (EVK) to mount and connect the modules/chipsets
- Antenna connectors (if not standard SMA)
- Accessories if required (e.g. special trace cables, audio connectors, switches etc.)
- Power supply if not standard USB (mini/micro/...)

SOFTWARE/TOOLS

- USB drivers for Windows OS
- Flashing tool to upgrade firmware if necessary
- Trace tool to analyze at least layer 3 radio messages (RRC, NAS)

DOCUMENTATION

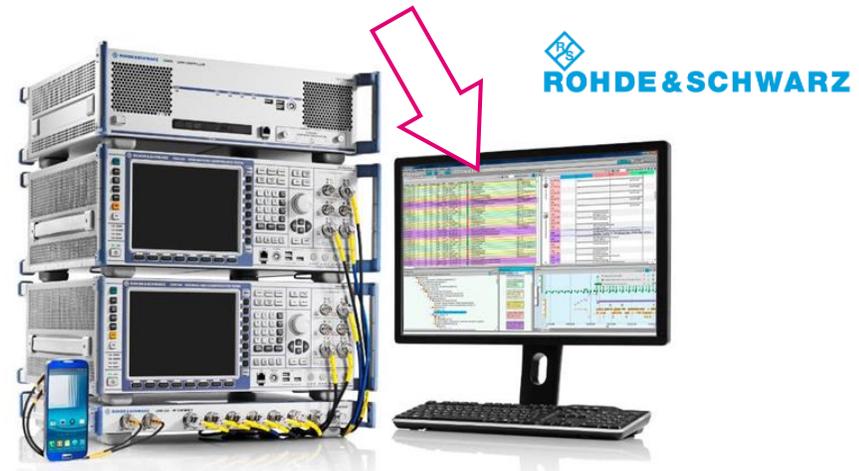
- Chipset/module product description (3GPP release, supported bands, UE categories, etc.)
- Firmware release notes / known issue lists
- AT command reference (3GPP and proprietary)
- Evaluation kit set-up guidelines
- Firmware flashing guidelines
- Logging/tracing guidelines

Where / how certification takes place

Telekom qualifies GNSS component performance in a live and simulated environment:



Manual testing of GNSS takes place at the **Group Test Facility** in Germany. Performance measurements are taken to assess and characterize the component properly.



Rohde & Schwarz CMW500 units are employed to simulate negative scenarios for GNSS to check sensitivity, accuracy and functionality, as well as to emulate complex scenarios involving continuous tracking, assisted mode, etc.

GNSS chip certification criteria

Below is a table of different validation conditions, and their GNSS certification outcomes:

CERTIFICATION TYPE (GNSS Certification Criteria has been met)	GNSS CERTIFICATION CRITERIA		
	PRIORITY 1 ISSUES PRESENT WITH NO WORKAROUNDS	PRIORITY 1 ISSUES PRESENT WITH WORKAROUNDS	NO PRIORITY 1 ISSUES PRESENT
FULLY CERTIFIED			◆
LIMITED CERTIFIED		◆	
NOT CERTIFIED	◆		

◆ = Confirmed criteria

Process outputs (DT deliverables)

What does a vendor receive once their GNSS chipset or module is Telekom-certified?

- **GNSS Certification Letter**
- **GNSS Technical Report** (issues, work-arounds, performance analysis)
- **Product Management / Sales informed** (European affiliates) about GNSS certification, specs distributed
- **Component presented to customers** as part of DT consultancy services (wherever positioning is required)
- Inclusion to Deutsche Telekom's online **Certified GNSS chip lists (IoT Digital Shelf)**
- Inclusion to Deutsche Telekom's online **virtual twin modeling service (IoT Solution Optimizer)**
- Pre-qualification for **indirect sales via DT Marketplace**



Thank you

