

Webinar series: 5G Device Testing Journey

PRODUCT TEST STRATEGIES AND SMART SOLUTIONS

Paul Newman
Market segment Manager
Cellular Wireless Production

ROHDE & SCHWARZ

Make ideas real



COMPANY RESTRICTED



4th May

Validation of digital design of next gen devices



11th May

Challenges to 5G mmWave component characterization



25th May

Simplifying 5G mobile device testing



1st June

ONE tool for automated device testing



8th June

Making lab testing more realistic



15th June

Production test strategies and smart solutions

5G DEVICE TESTING JOURNEY

Webinar Series



ABSTRACT

- ▶ Digitization of the factory
- ▶ Production & Technology relationship
- ▶ Total Cost of Ownership aspects

- Test. Equip yourself with in-depth technical material and interactive demonstrations.
- Think. Learn from industry leaders and technical experts about the latest industry insights, directions and technologies.
- Scale. Scale your design with applied knowledge to deployment.

Abstract:

Today industry has an expectation that improvements in quality, lead time and cost are and evolutionary continuous improvement process, even with the steps in technology advancement.

It is not always so easy to keep the trend line in any of these continue in the desired direction. But we can minimize exceptions by focusing on methods and techniques that are becoming more available through the technology evolution

In this webinar we will review the trends evolving in manufacturing, such as Digitization, I4.0, Smart factory and the necessity to improve Time to Market, Speed and flexibility in a global market. We will take a look at some of the challenges, where to start, basic techniques to apply on how to start the transformation

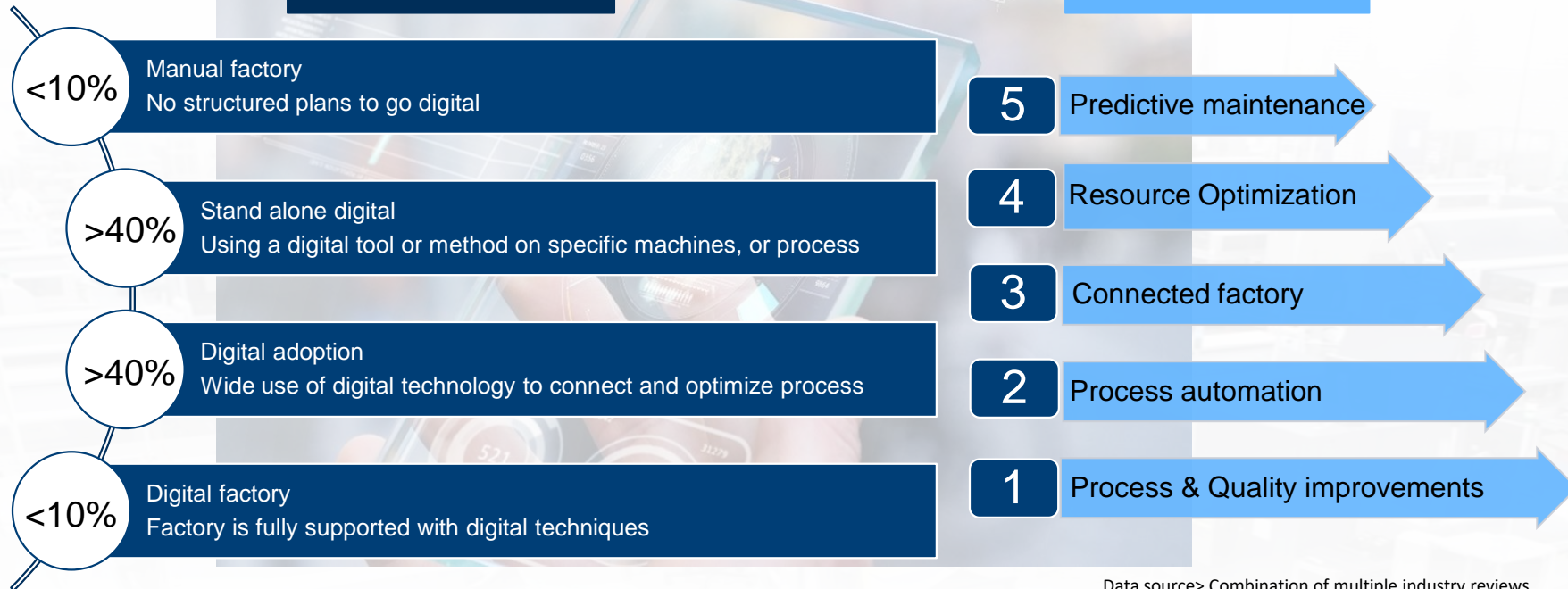


INDUSTRY DIGITAL IMPLEMENTATION

CONSOLIDATED MARKET INFORMATION

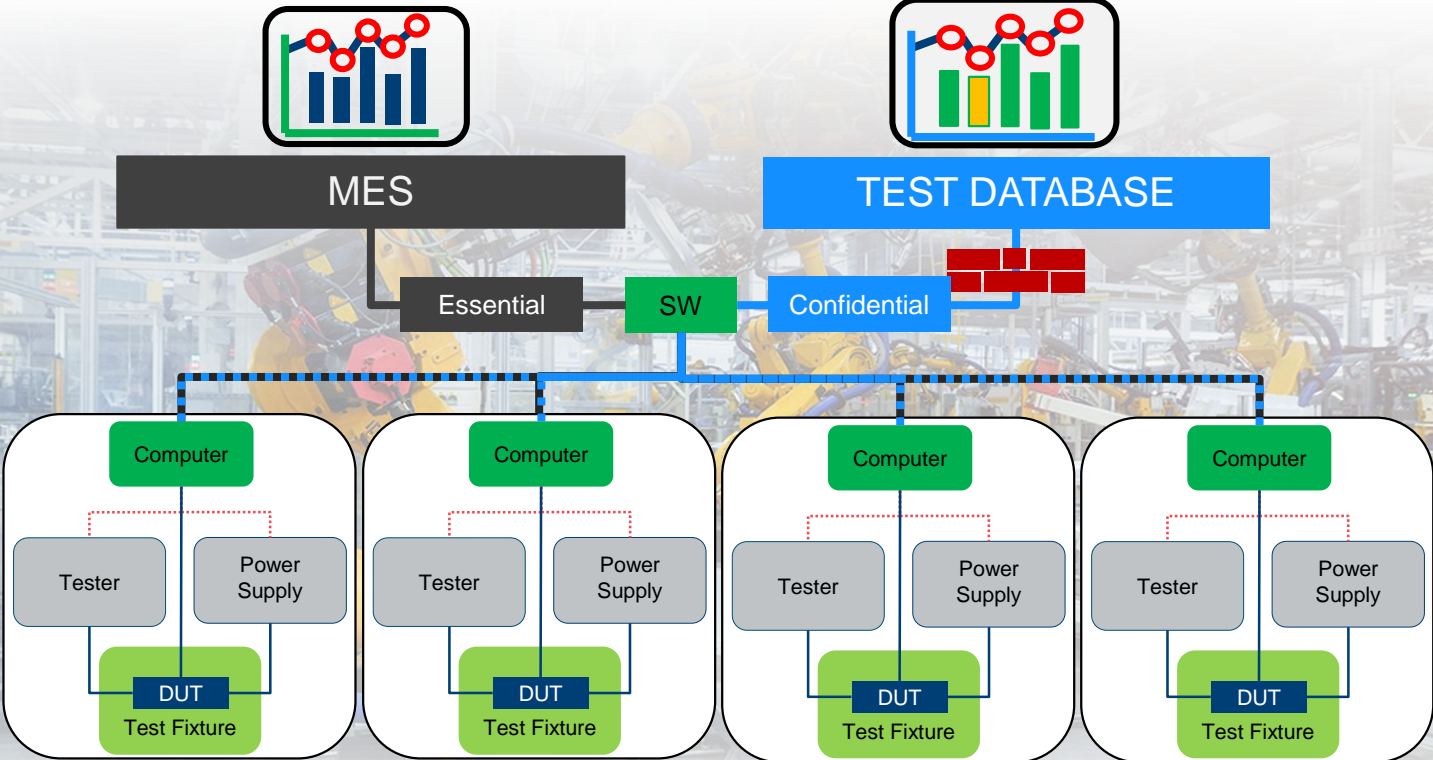
STATUS

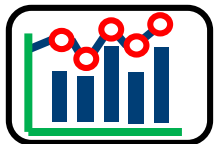
FOCUS



Data source> Combination of multiple industry reviews

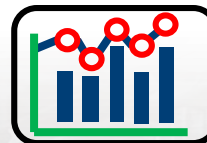
SIMPLIFIED FACTORY TEST DATA SOURCES





FACTORY MES BASIC FLOW

MANUFACTURING EXECUTION SYSTEM



Manual or no controls

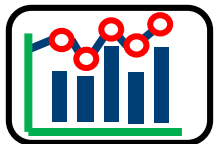
- WO #
- Station #
- Operator

- Start
- Pass
- Fail
- Stop

- Defect code
- Retest
- Analysis & fix
- Report

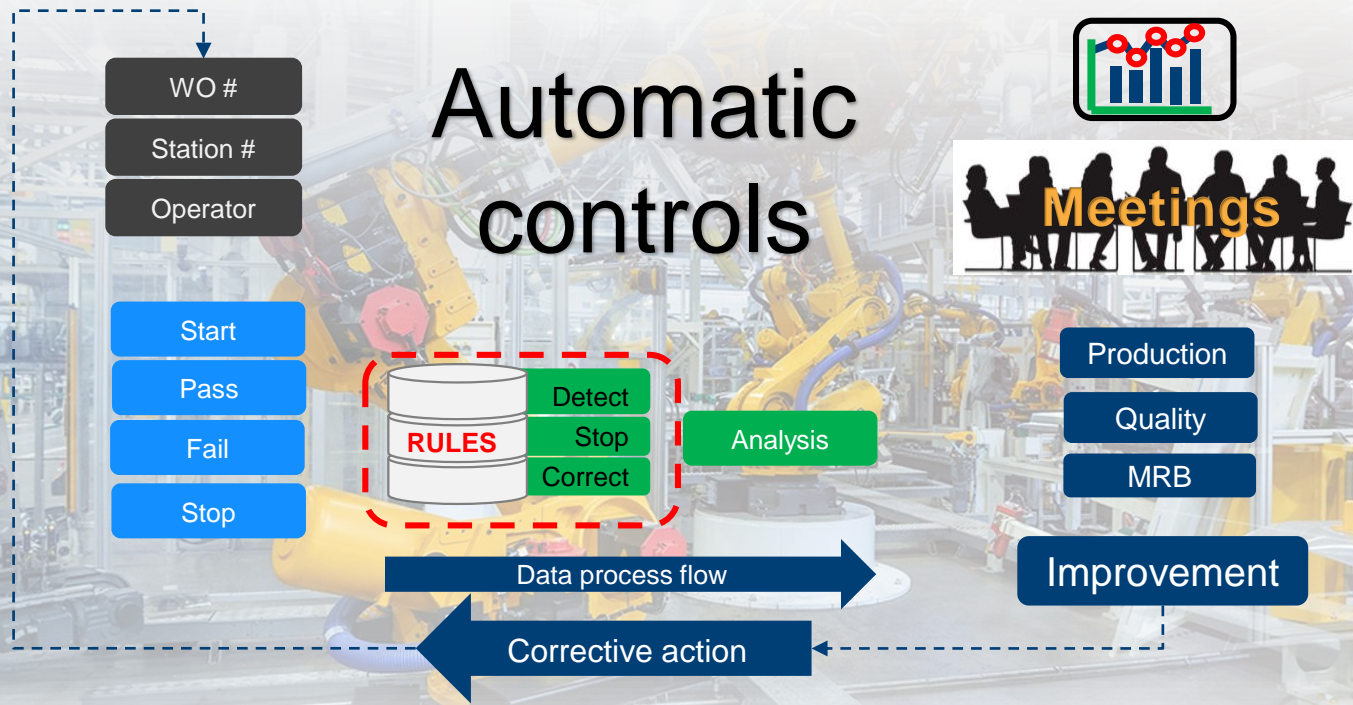
- Production
- Quality
- MRB
- Improvement

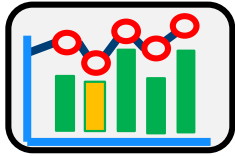




FACTORY MES IMPROVED

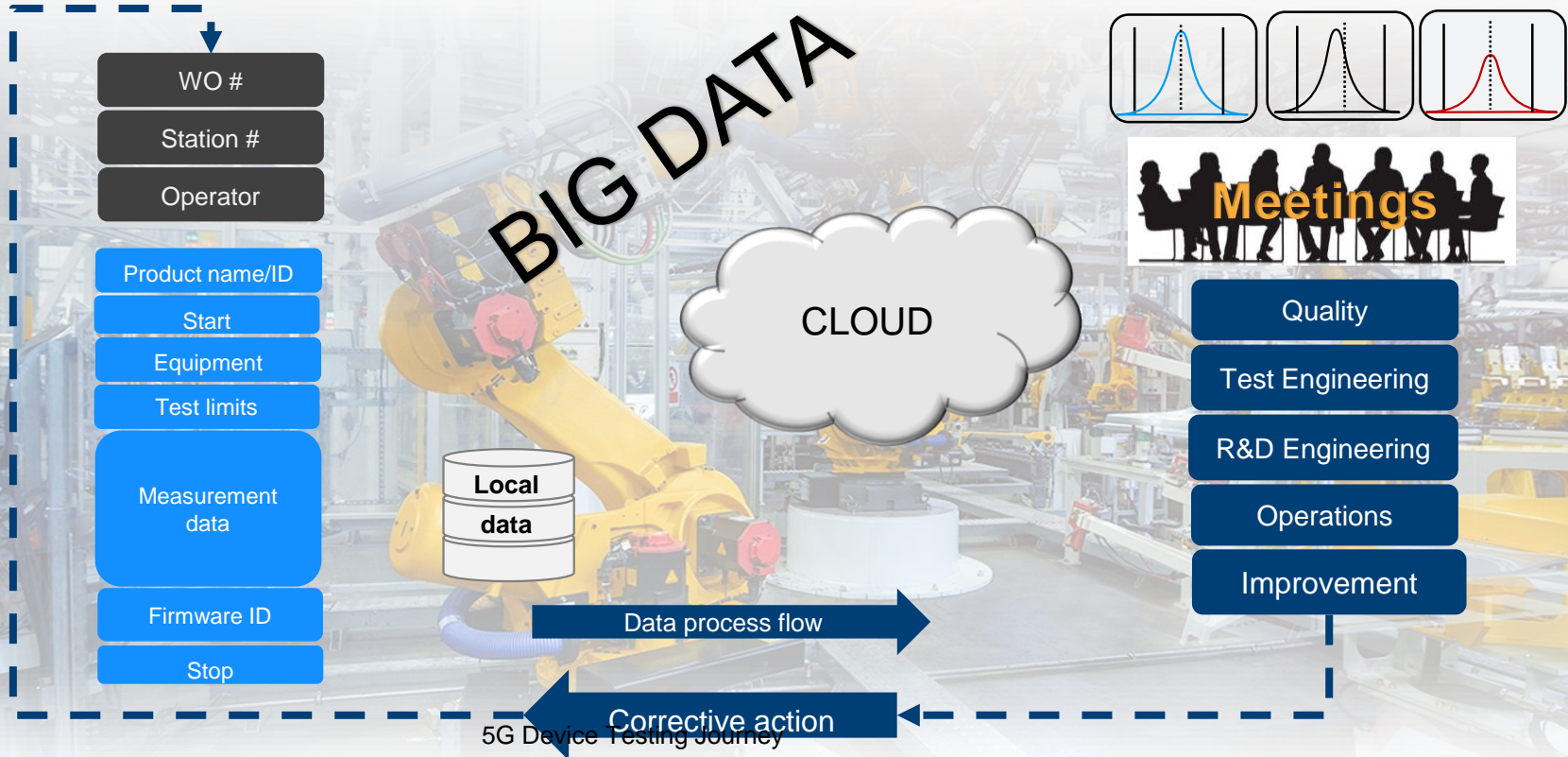
MANUFACTURING EXECUTION SYSTEM

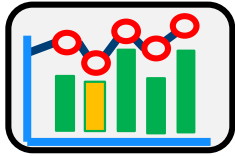




TEST DATA BASIC FLOW

PRODUCT TEST RECORDS





TEST DATA IMPROVED

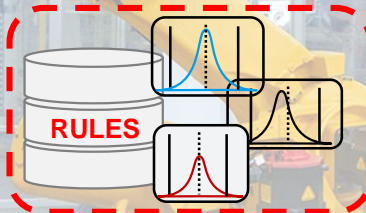
PRODUCT TEST RECORDS

Managed data



- WO #
- Station #
- Operator

- Product name/ID
- Start
- Equipment
- Test limits
- Measurement data
- Firmware ID
- Stop

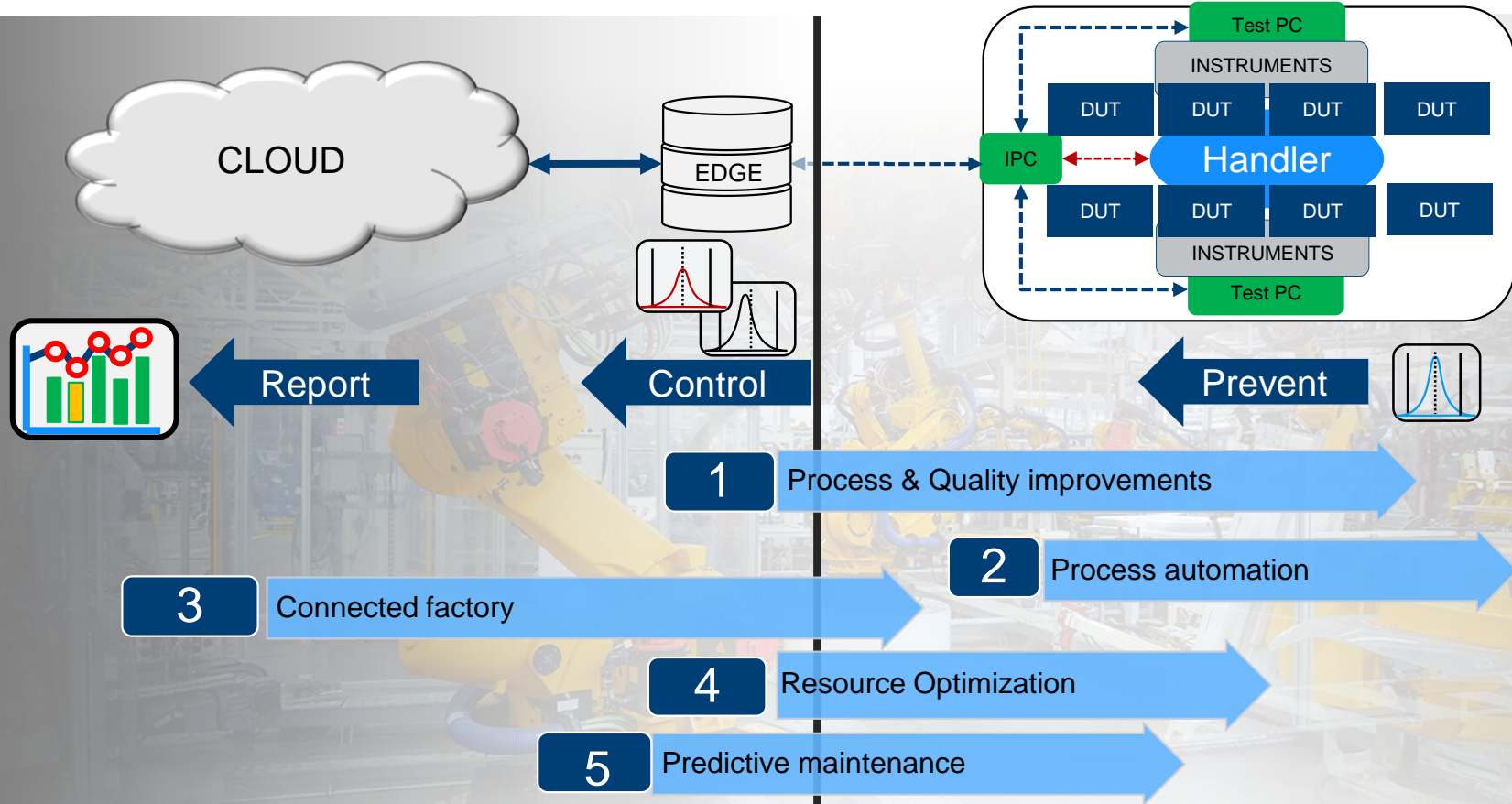


- Test Engineering
- R&D Engineering
- Quality
- Operations
- Improvement

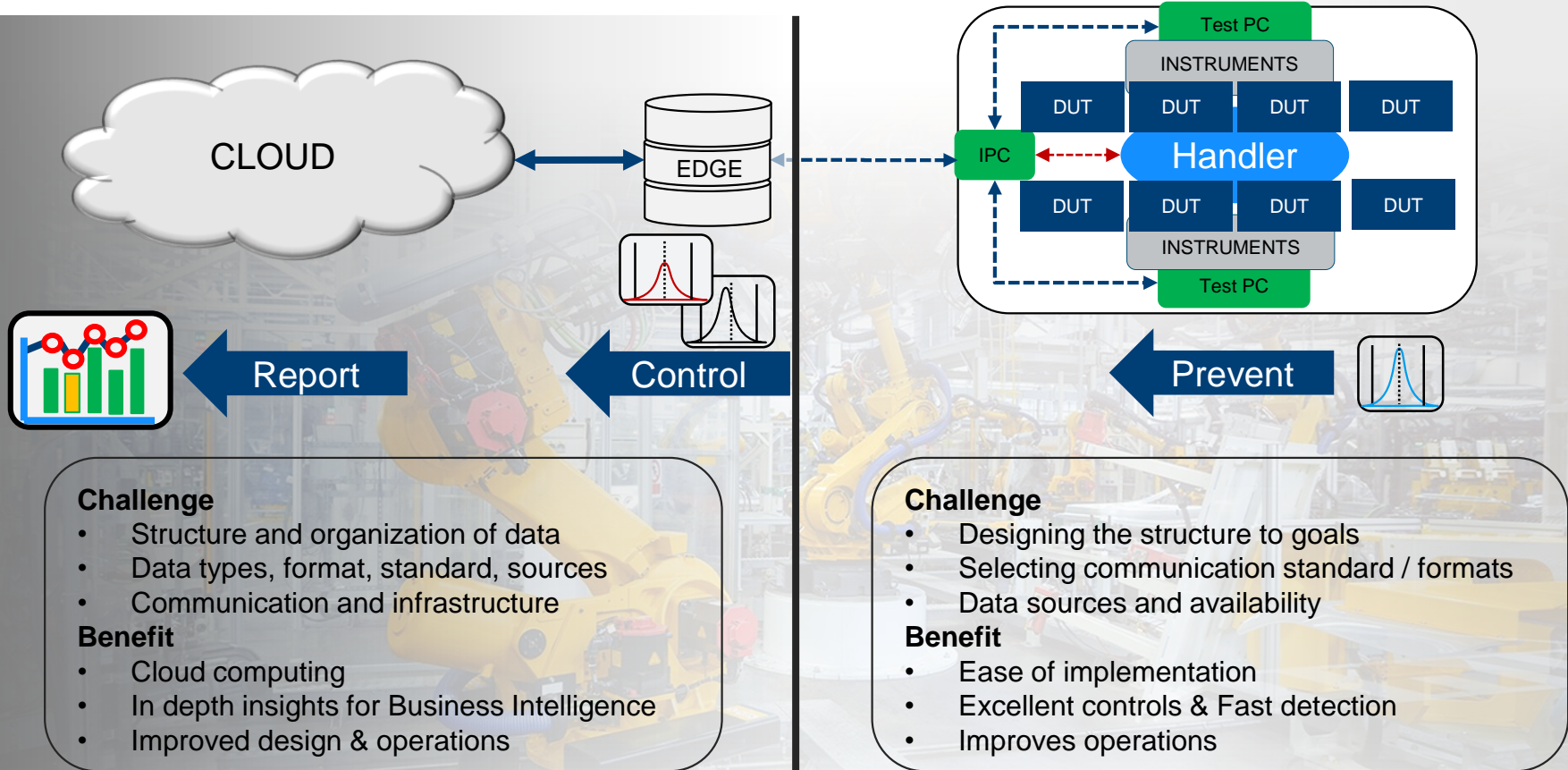


5G Device Testing Journey

FOCUS AREAS

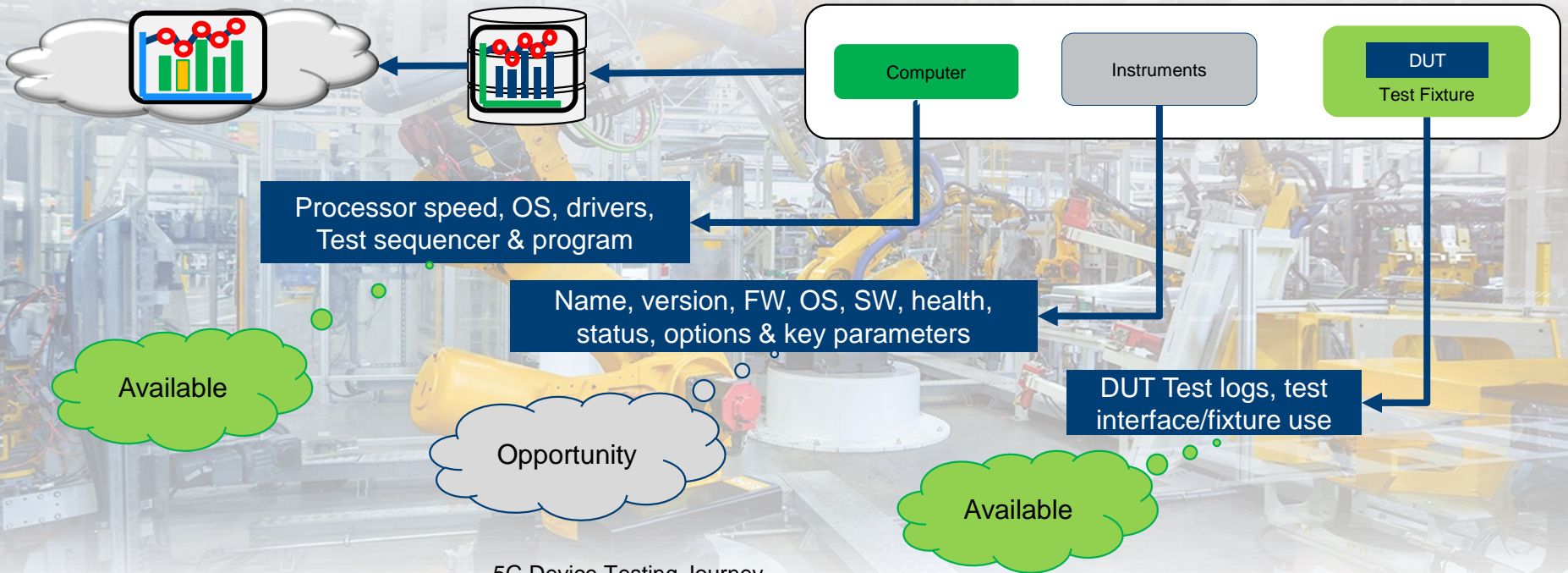


CHALLENGES Vs BENEFITS



KEY DATA AVAILABILITY

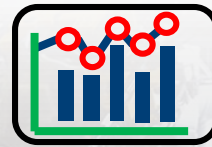
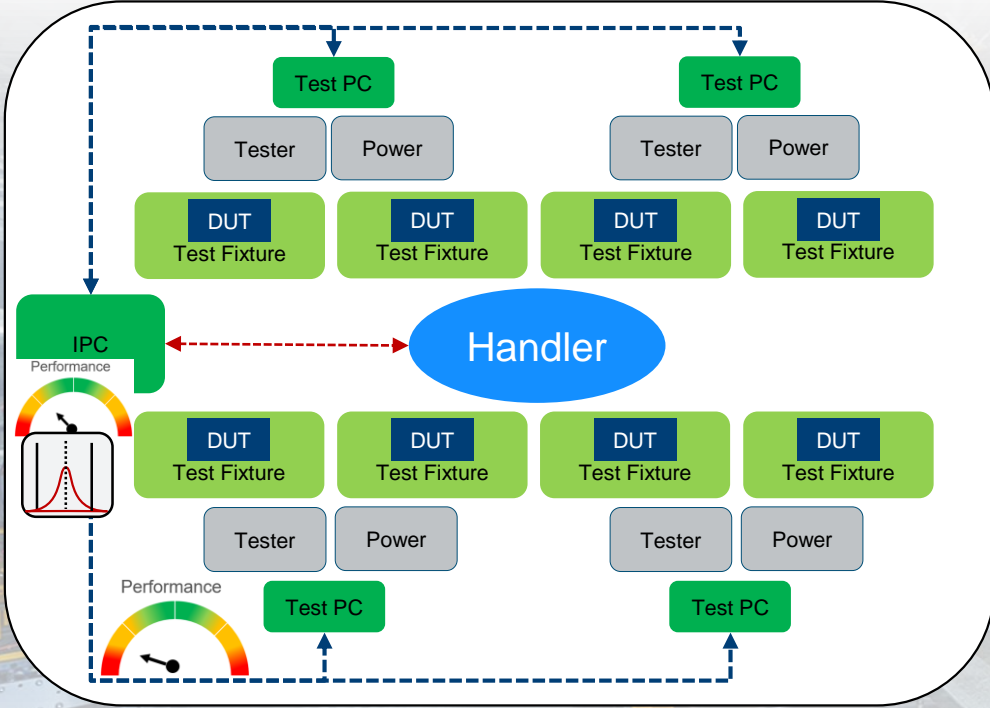
Test station



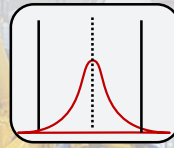
BENEFITS TO REAL TIME MONITORING PRODUCTIVITY



Test cell UPH is lower than planned



No recorded DUT failures
One station has lower throughput



Variable test times
Logs show repeated "re-test" on one test

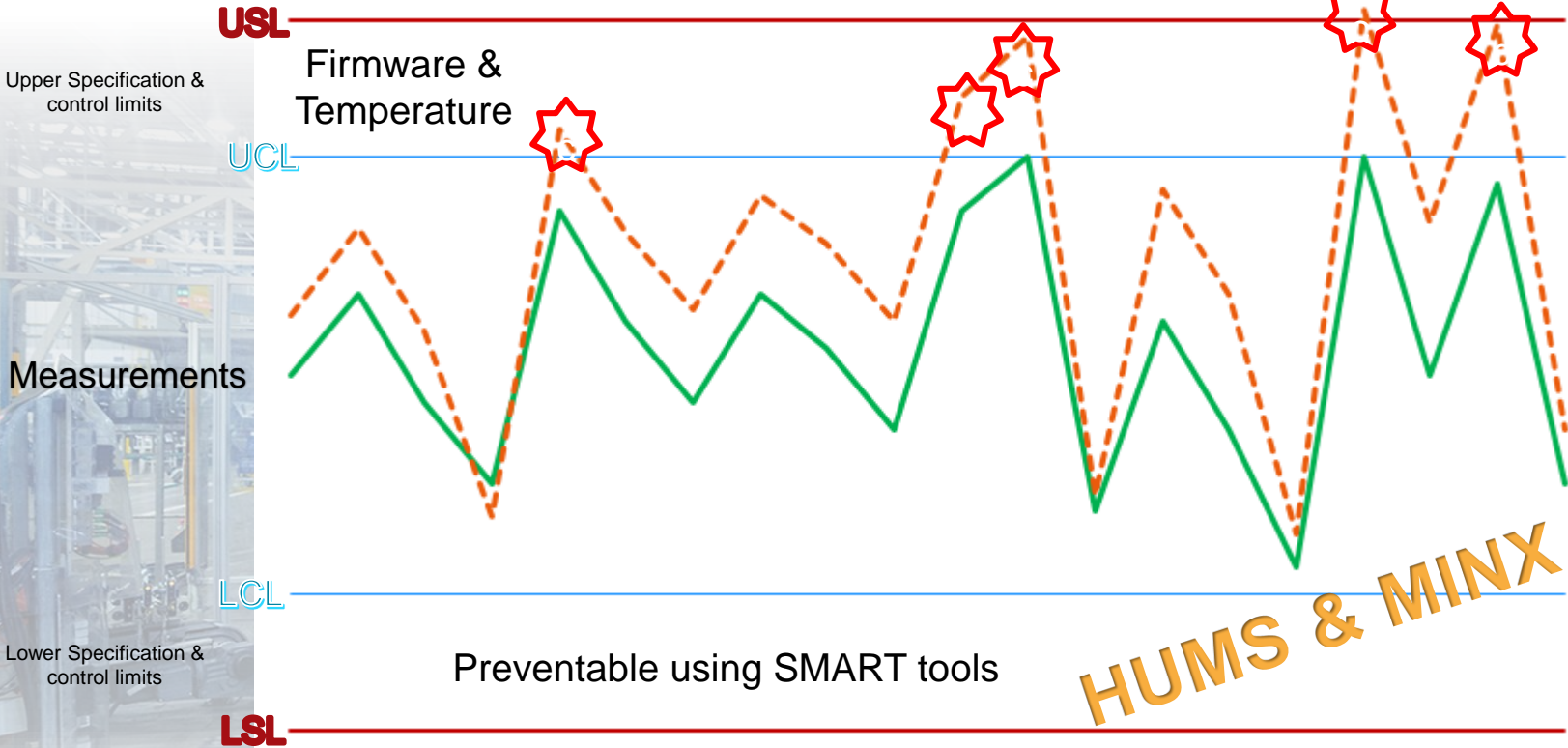


Fixture wear and tear?
Instrument condition?
Something else?

Analytics & Machine learning

LINE STABILITY AVOIDING MARGINAL DEFECTS

 Potential defect



TEST CELL STANDARDIZATION INSTRUMENT LEVEL TOOLS

The screenshot displays a software interface for instrument discovery and configuration. The window title is "Discovery: *5GNR Test Xfr - MINX" and it shows "3 items" in the group. The interface is divided into four panels, each representing a different instrument:

- Top Left Panel:** Discovery ID: **FSW-26-123456**, IP: 127.0.0.1 : 60744. Instrument type: **Spectrum Analyser**. Includes a "Click to show Options" button and an Applications section.
- Top Right Panel:** Discovery ID: **NGL202-101622**, IP: 192.168.58.100 : 857. Instrument type: **Power Supply**. Includes an Applications section.
- Bottom Left Panel:** Discovery ID: **Team FSW26-101111**, IP: :. Status: **Missing** (highlighted in red). Instrument type: **Spectrum Analyser**. Includes a "Click to show Options" button and an Applications section.
- Bottom Right Panel:** Discovery ID: **Team SMBV100B**, IP: 172.23.172.59 : 61537. Instrument type: **Signal Generator**. Includes an Applications section.

The bottom status bar shows "Group:" followed by icons for file, folder, and printer, and a summary: "3 in group 1 missing".

Step 1

Load known instrument file. Discover and confirm set-up of the group NGL monitoring

Step 2

After a service we ID a replacement SA. We ID the difference and change the group, pending Option update

Step 3

Confirming the instrument is version compliant, just options to update

Step 4

Options updated, instrument confirmed as a match. Reset the group

HUMS: INCREASING UTILIZATION AND OPTIMIZING COST OF T&M INSTRUMENTS

Iratxe Fernández Antón
R&S Product Manager Spectrum and Signal Analyzers

ROHDE & SCHWARZ

June 2021

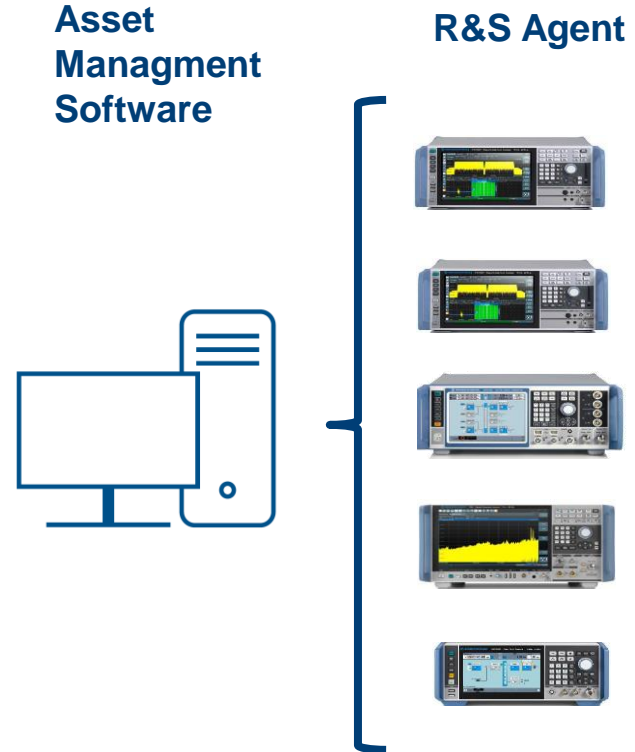
Make ideas real



COMPANY RESTRICTED

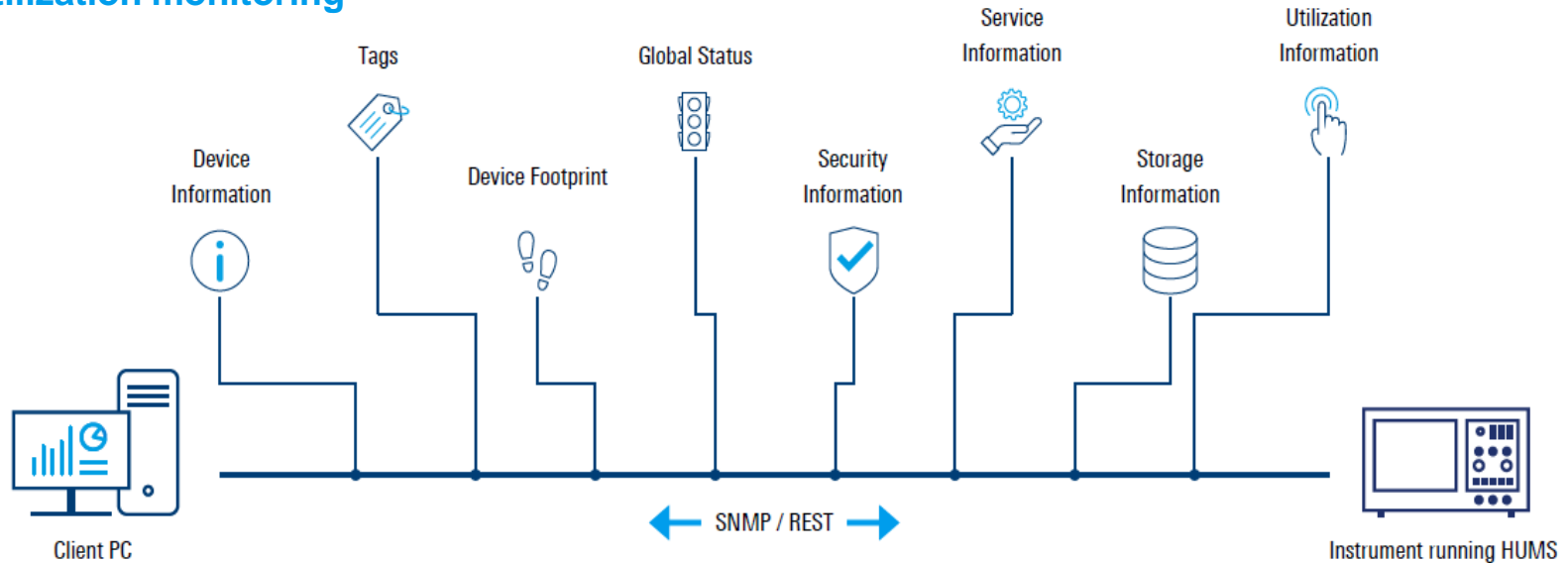
INCREASE UTILIZATION, AVOID DOWNTIME, REDUCE COSTS

- ▶ Goal: increase the overall instrument utilization, avoid downtime, reduce costs optimize resources
- ▶ Be able to monitor the use, status and health of the instrument
- ▶ **Health and Utilization Monitoring Service (HUMS)** has been designed to retrieve information on device health and utilization
- ▶ HUMS is a software option (K980) for high end signal generators and spectrum analyzers
- ▶ **Target customers:** customer running hundreds of instruments and want to keep track of the utilization
Example: manufacturing plants



INSTRUMENT DATA

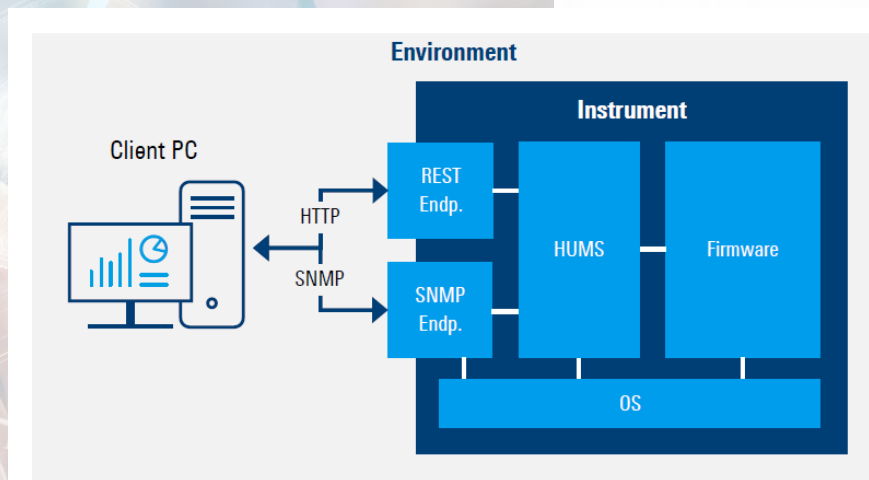
- ▶ **IT network monitoring:** patch levels of windows and Linux
- ▶ **Health monitoring:** HW resources (CPU, RAM, Temperature, HDD/SSD)
- ▶ **Asset management:** Device Footprint
- ▶ **Utilization monitoring**



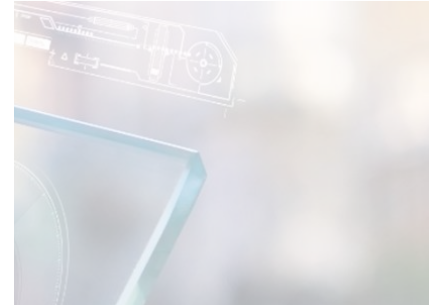
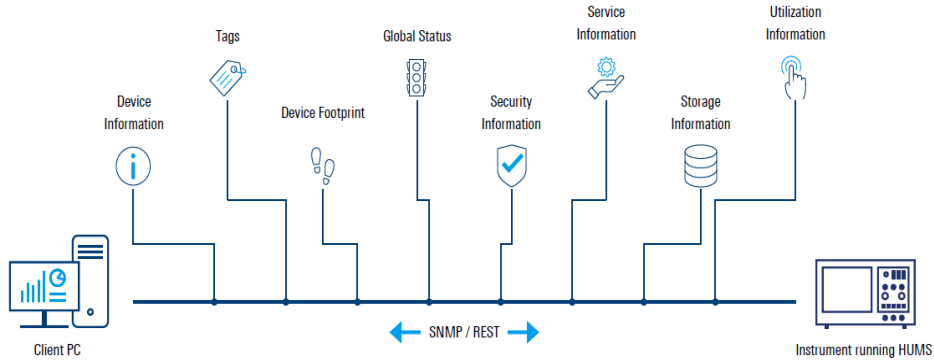
INTERFACES

- ▶ HUMS is a SW option which runs as a service in the background on the device operating system and communicates with the operating system (OS) and the device firmware.
- ▶ Interfaces to read the monitoring and utilization data:
 - ▶ **SNMP**
 - SNMPv1, SNMPv2c
 - SNMPv3 (encryption and authentication)
 - ▶ **REST**
 - ▶ **SCPI commands**
 - ▶ **History download**

SNMP and REST do not interfere with standard SCPI remote control



DIAGNOSTICS WEBPAGE



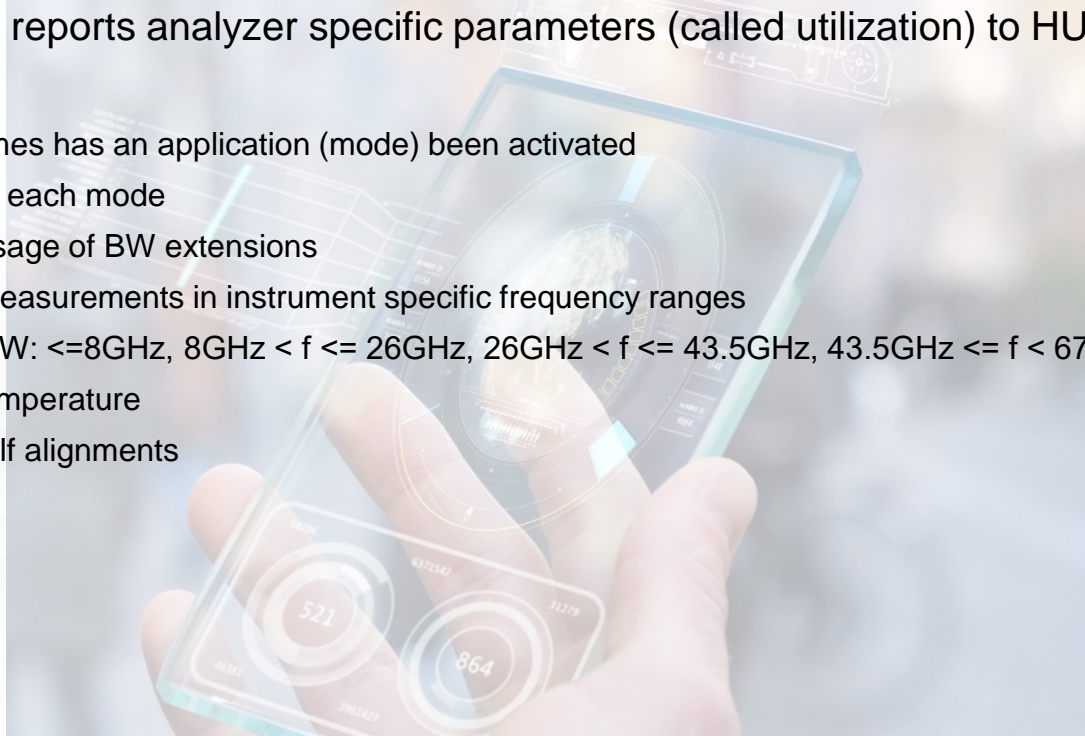
Device Info	Disks	S.M.A.R.T.	Installed packages
Device Tags	Disk information /dev/sda ▼		
Equipment	Temperature		
Status			
Service	Partition: C: File system: NTFS Total: 116 GB		
Security	Free space: 76 GB		
Storage			
Utilization	Used space: 40 GB		

UTILIZATION DATA EXAMPLES

► The firmware reports analyzer specific parameters (called utilization) to HUMS

► Examples:

- How many times has an application (mode) been activated
- Time spent in each mode
- Duration of usage of BW extensions
- Duration of measurements in instrument specific frequency ranges
 - E.g. for FSW: $\leq 8\text{GHz}$, $8\text{GHz} < f \leq 26\text{GHz}$, $26\text{GHz} < f \leq 43.5\text{GHz}$, $43.5\text{GHz} \leq f < 67\text{GHz}$, ...
- Instrument temperature
- Number of self alignments



SUMMARY

- ▶ The HUMS agent enables the collection of key asset status, health and utilization data
- ▶ HUMS is a software option (K980)
- ▶ Data analytics can increase the overall instrument utilization, avoid downtime, reduce costs and optimize resources



PROBLEMS TO SOLVE

Productivity

- Avoid unplanned down times
- Improved maintenance schedules and processes
- Missed UPH or Quality targets
- Reduce False Failures

Stability

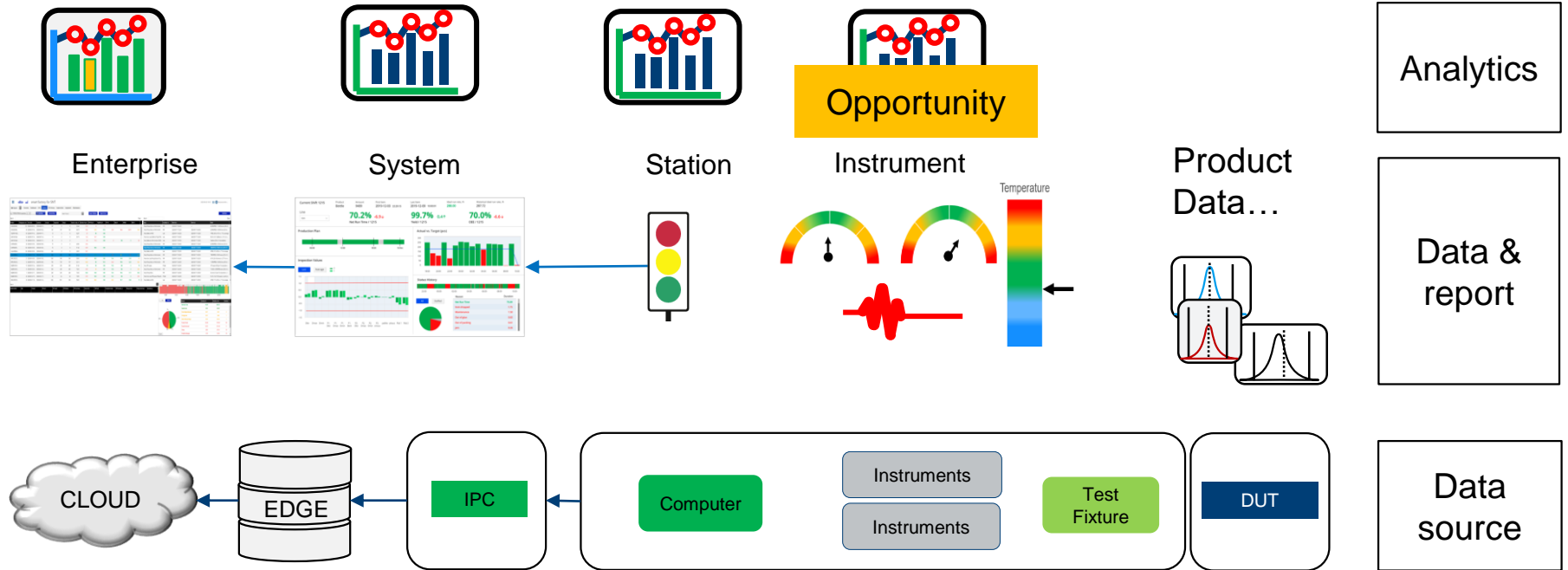
- Ensure the station and line set-up is as designed
- Adding capacity or a line changeover is faster
- Ensure rental or replacement equipment aligns to specifications

Benefits

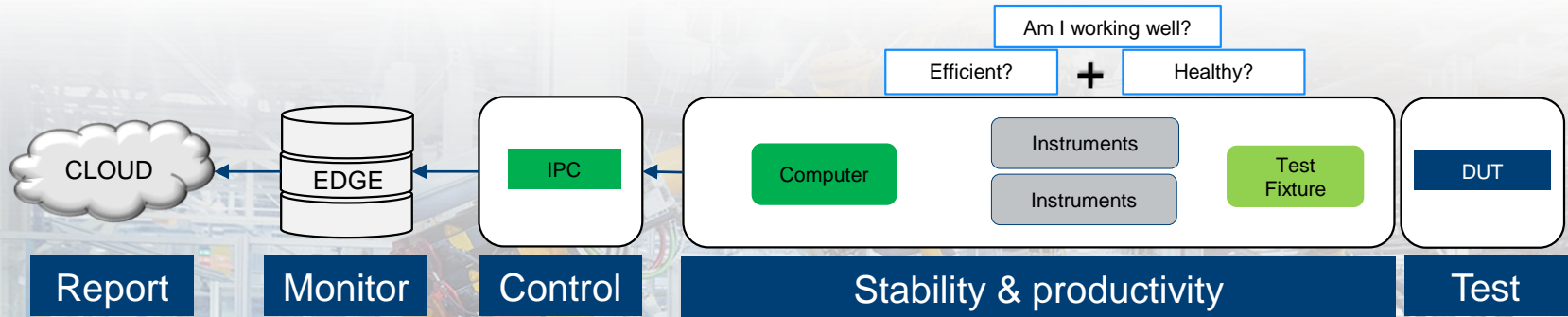
- Improved Operations & Supply chain
- Reduction in Capital spending
- Improved quality
- Reduced crisis to manage
- Team focus on improvements Vs fixing
- Reduce in meetings & reporting
- Reduction in manufacturing costs

SYSTEM STRUCTURE

Design the System in layers with modularity using the opportunity of each subsequent layer to provide data for key decisions



EXTENDING YOUR DIGITAL CHAIN DATA & INFORMATION



Factory Management

System health
Order – delivery ETA
MRP RT updates
Services – CAL & Maintenance
License and instrument management
Capacity & costs *forecast

Production Controls

Line & Asset Management
Station and line performance
Defect patterns & analytics
In depth diagnostics
Preventative maintenance

Computer

Processor speed, OS, drivers, Test sequencer & program details

Instrument

Name & type
IP/Serial number, HW/SW rev
Location & Pairing*
Options / age Environment - temp
Utilization
Calibration & health

MINX

Instrument *HUMS

Environment - temp
Time in use/on/off/idle
Optimization of SW & options
Performance improvements
Calibration & health

+ HUMS

Fixture (inc box) Status

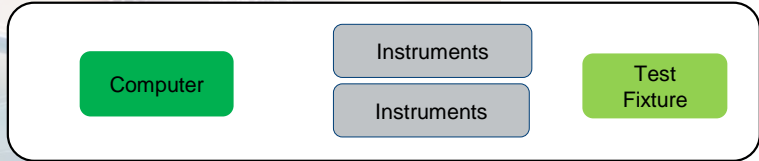
Cycles
Calibration, shielding
Connectivity

DUT

Test log
Limits & measurements
Unique ID

FOCUS AREA REALIZATION

- 5 Predictive maintenance
- 4 Resource Optimization
- 3 Connected factory
- 2 Process automation
- 1 Process & Quality improvements



Computer
Processor speed, OS, drivers, Test sequencer & program details

Instrument *HUMS
Environment - temp
Time in use/on/off/idle
Optimization of SW & options
Performance improvements
Calibration & health

Instrument
Name & type
IP/Serial number, HW/SW rev
Location & Pairing*
Options / age Environment - temp
Utilization
Calibration & health

MINX + **HUMS**

Fixture (inc box) Status
Cycles
Calibration, shielding
Connectivity

Instrument data & analytics completes the picture

THANK YOU

Think big

Too much data

Start with basic / essential data

Pick a project

Determine the limits & rules

Scope creep

Start small

Get a win

Keep it simple

Learn, apply and do another

Be realistic

Be disciplined

R&S Solutions:



Rohde & Schwarz

5G Device Testing Journey