Measuring the customer experience of indoor networks

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ROHDE&SCHWARZ

Rohde & Schwarz at a glance

- **History**
  Established 1933 in Munich, Germany
- **Type of enterprise**
  Independent family-owned company
- **Global presence**
  In over 70 countries, approx. 60 subsidiaries
- **Net revenue**
  Approx. EUR 1.75 billion (FY 13/14, July through June)
- **Export share**
  More than 90 percent
- **Employees**
  9900 worldwide, with approx. 5900 in Germany
- **Success**
  A leading international supplier in all of its fields of business

SwissQual

- Founded in April 2000, acquired by Rohde & Schwarz in July 2012
- Headquartered in Zuchwil, Switzerland
- 100 staff worldwide
- Recognized market leader
  - Mobile Network Quality Benchmarking
  - Mobile Network Quality Optimization
  - Mobile Network Qualtity Monitoring
- More than 200 customers
- In more than 100 countries

SwissQual
A Rohde & Schwarz Company

Trend: QoS Evolution

2G
- Voice (MOS)

2.5G
- Voice (MOS)
- Data Services
- WAP

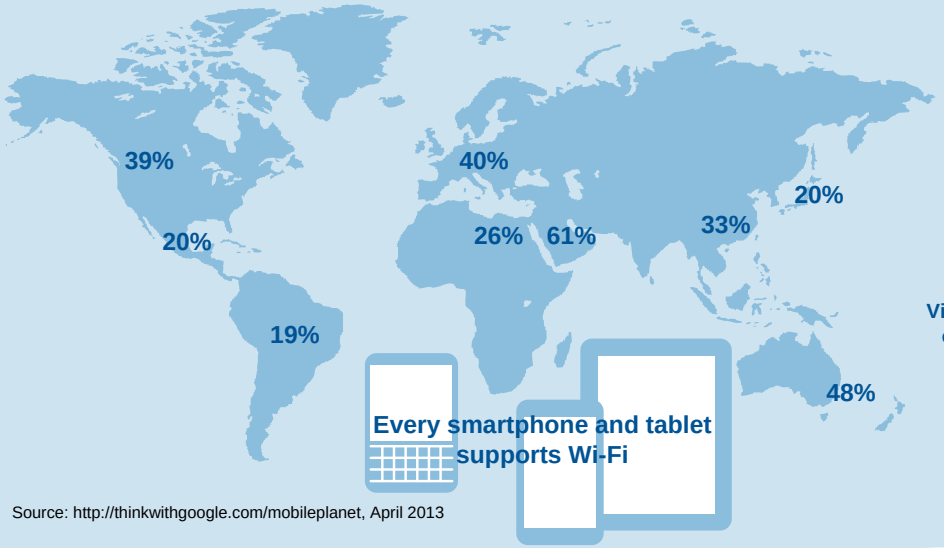
3G
- Voice (MOS)
- Data Services
- Multi-RAB
- Video Call (MOS)

3.5G
- Voice (MOS)
- Data Services
- Multi-RAB
- Video Streaming
- Email
- VoIP

4G
- CS Fallback
- VoLTE
- Skype
- Voice
- Multi-RAB
- You Tube
- VoIP
- Email
- Latency
- Gaming
- Social...

Trend: Extreme Mobile Data Traffic Growth -> Indoor

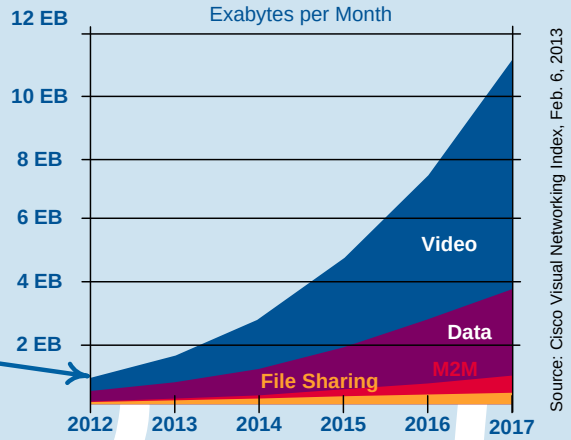
Smartphone and Tablet Penetration



Source: http://thinkwithgoogle.com/mobileplanet, April 2013

Global Mobile Data Traffic

Exabytes per Month

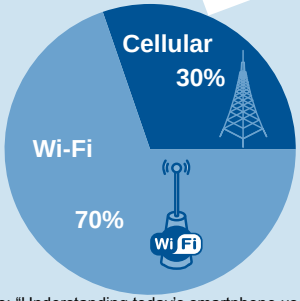


Wi-Fi usage increasing and mainly user driven

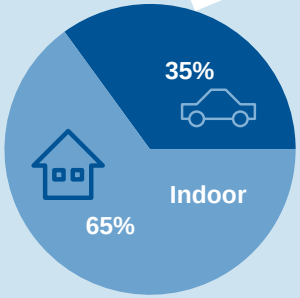
More data generated indoors or stationary.

30% of the world's population will live in urban areas and generate 60% of the mobile traffic.
50% will have access to LTE.

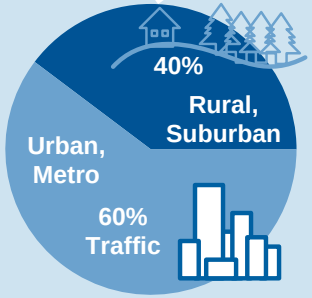
Wi-Fi is considered as an attractive complement to the small cell and heterogeneous networks strategy.



Source: "Understanding today's smartphone user: Demystifying data usage trends on cellular & Wi-Fi networks," Mobidia, Feb. 27, 2012

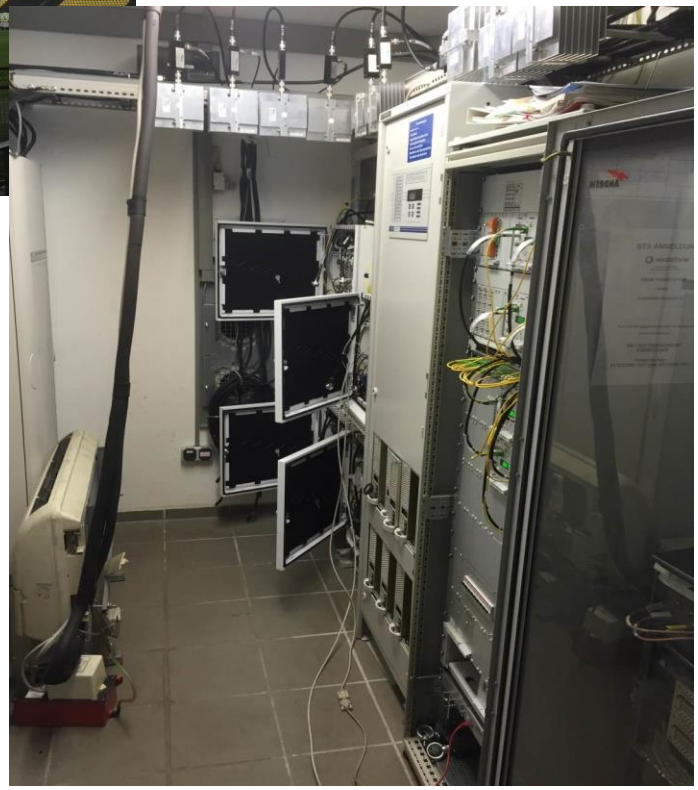


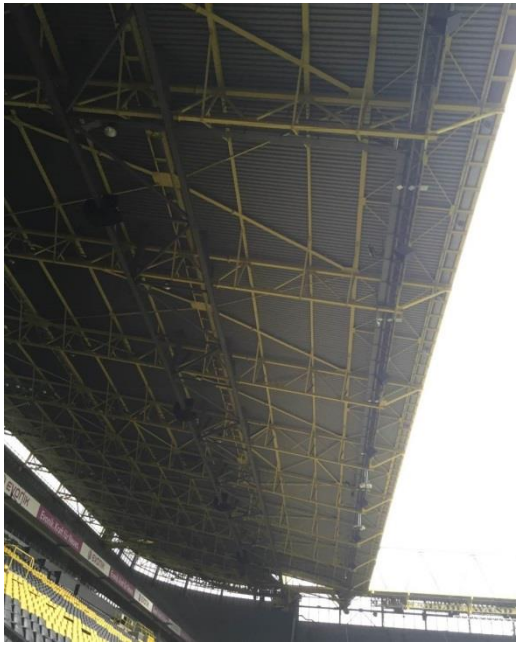
Source: Nokia Siemens Networks/ ABI Research



Source: Ericsson, Traffic and Market Data Report, Nov. 2012

Example: Football Stadium





Multiple Antenna Installation

Example: Tunnel/Subway

Solution: QualiPoc Freerider for Indoor QoS Benchmarking

All supported technologies

Speech & Data application testing

Logging of all RF, L3, IP results

- The lightweight, smartphone based tool for indoor and ad hoc benchmarking in smaller areas
- Freerider Tablet controls Up to 6 of the latest Android smartphones 1 multi-technology
- Extensive functionalities to test voice, data, video, and messaging to assess QoS and QoE from a real end-user perspective

QualiPoc for Indoor Optimization

Floor plan navigation

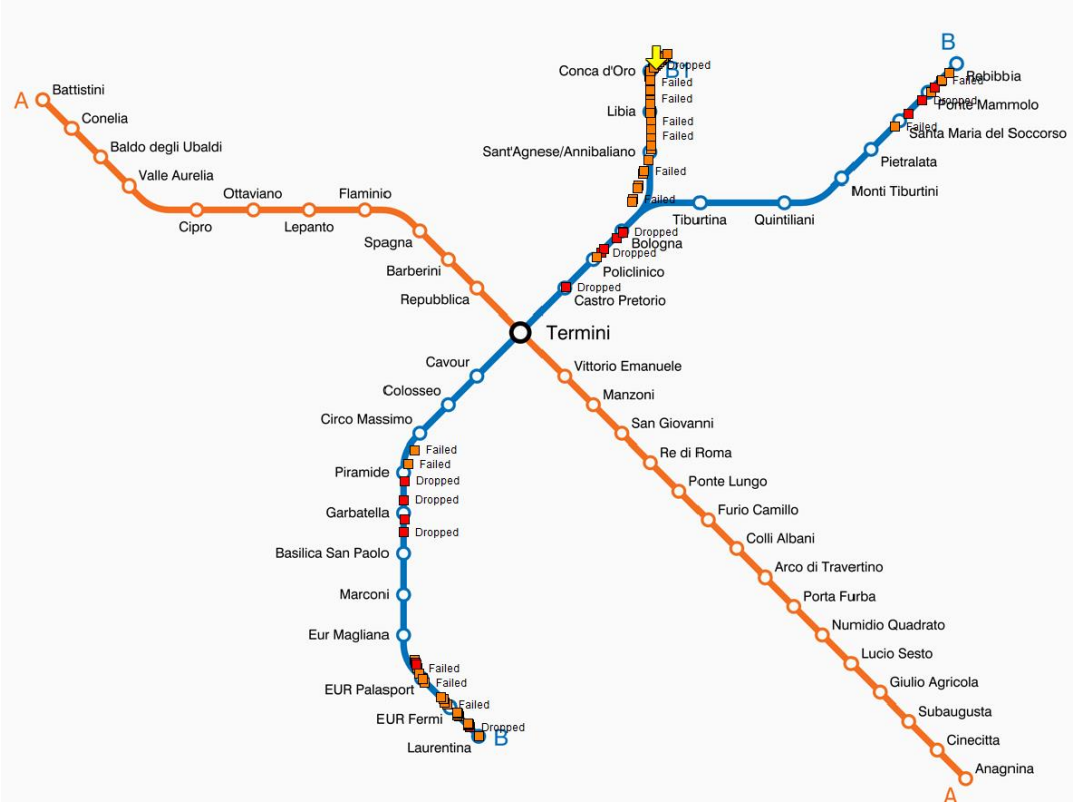
- Multi floor picture collection, *.zip or iBwave *.ibwc files
- Change of floors on the fly
- Simple and easy using touch and pan
- Interpolation of positions between each watchpoint
- Undo function for last position

Reporting: Radio Technology Coverage

Reporting: Data Technology Coverage

Reporting: Voice Call Statistics

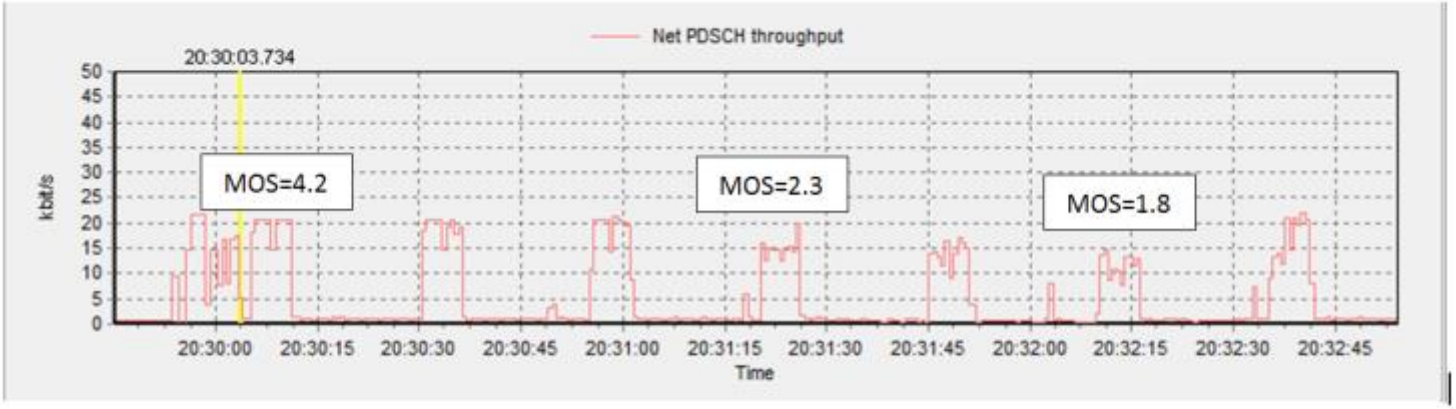
- Voice Call Statistics with Automatic Failure Analysis
  - i.e. Dropped, Failed Handover (Abnormal release, timer expired), Radio Link Timeout, High RxQual, Low RxLev, Call Re-Establishment attempt



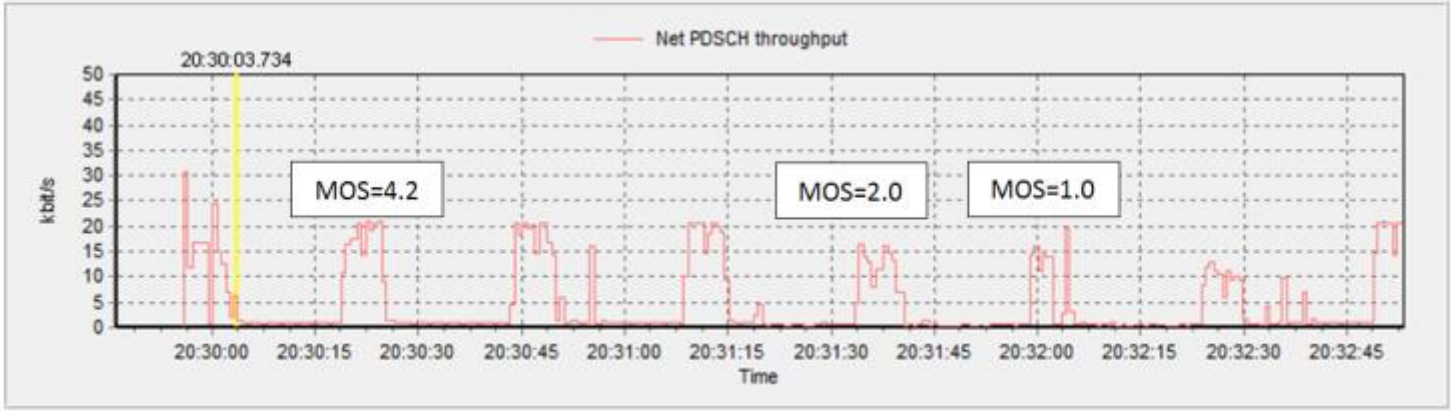
Technology Trend: HD Voice

Measurement: VOLTE HD Voice call

A-Side: Samsung Galaxy S4 Mini (SGH-I257)

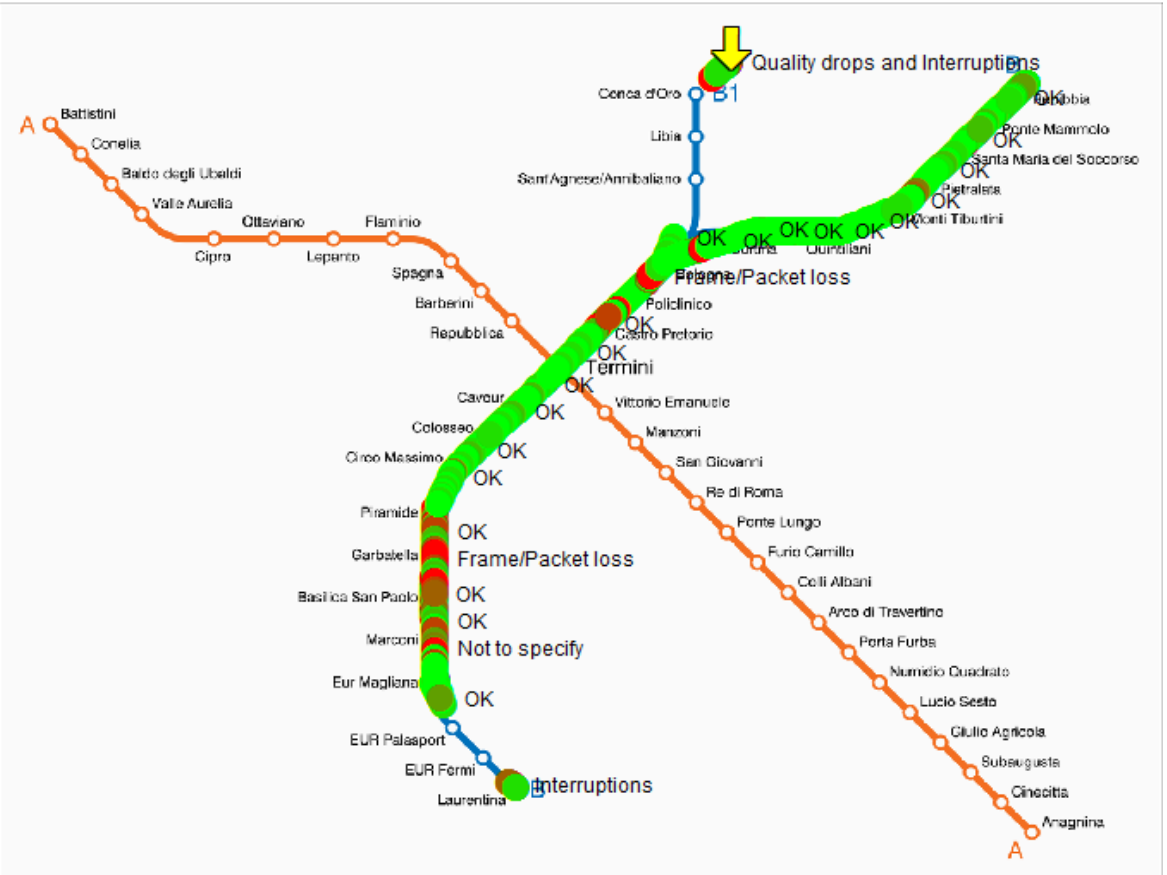


B-Side: Samsung Galaxy S4 Mini (SGH-I257)



Reporting: Voice Quality (POLQA)

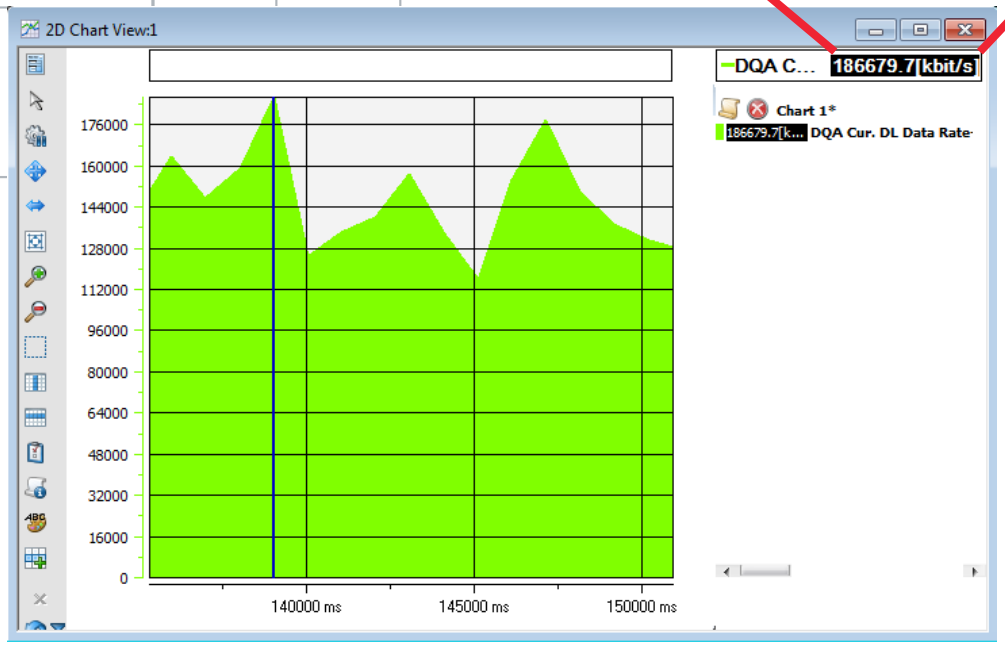
- Voice Quality (POLQA) (**POLQA** *Perceptual Objective Listening Quality Assessment*, also known as ITU-T Rec. P.863[1] is an ITU-T Standard that covers a model to predict speech quality by means of digital speech signal analysis)



Trend: higher Speed -> Carrier Aggregation

UE category		Max data rate in Mbps		Min. number of DL CCs	DL MIMO layer(s)	Highest Modulation Scheme	
		DL	UL			DL	UL
Rel8	1	~10	~5	1	1	64QAM	16QAM
	2	~50	~25		2		
	3	~100	~50				
	4	~150					
	5	~300	~75		4		64QAM
Rel10	6	~300	~50	1 or 2	2 or 4		16QAM
	7	~300	~100				
	8	~3000	~1500	5	8		64QAM
Rel11	9	~450	~50	2 or 3			
	10		~100				
	11	~600	~50	2, 3 or 4			
	12		~100				

186 Mbps



Measurement example
LTE Carrier Aggregation

- Device: Cat 6
  (300Mbps @ 20 + 20MHz)
- Network:
  20MHz band 7 (2.6GHz) +
  10MHz band 20 (800MHz)

Conclusion

- User experience becomes more and more important due to increase of applications
- Indoor networks have become critical optimization targets
- Trends: HD Voice, VoLTE & Carrier Aggregation
- KPI testing is a must and need to be chosen so that they reflect user experience

Emulating Customer Behaviour and Measure Customer Experience is the key

Portfolio overview
Benchmarking/Optimization

www.rohde-schwarz.com/mobile-network-testing

Diversity Benchmarker II

QualiPoc Freerider II

TSMW

Diversity Ranger

QualiPoc Android

TSME

Diversity Optimizer

QualiPoc Remote Control

ROMES

ROMES

Probe control
Value display
Event alert
File replay

NQView

NQDI

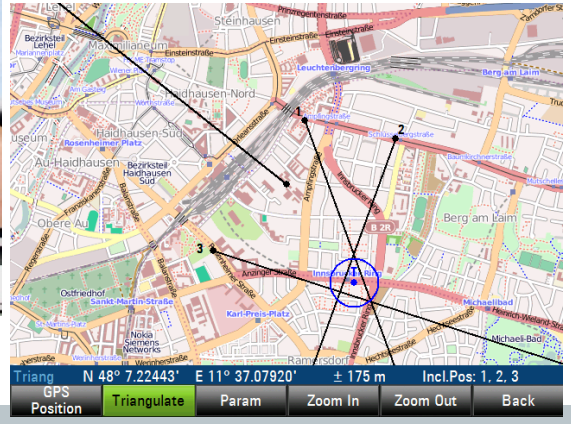
Data analysis
Drill down
Reporting
Map plotting

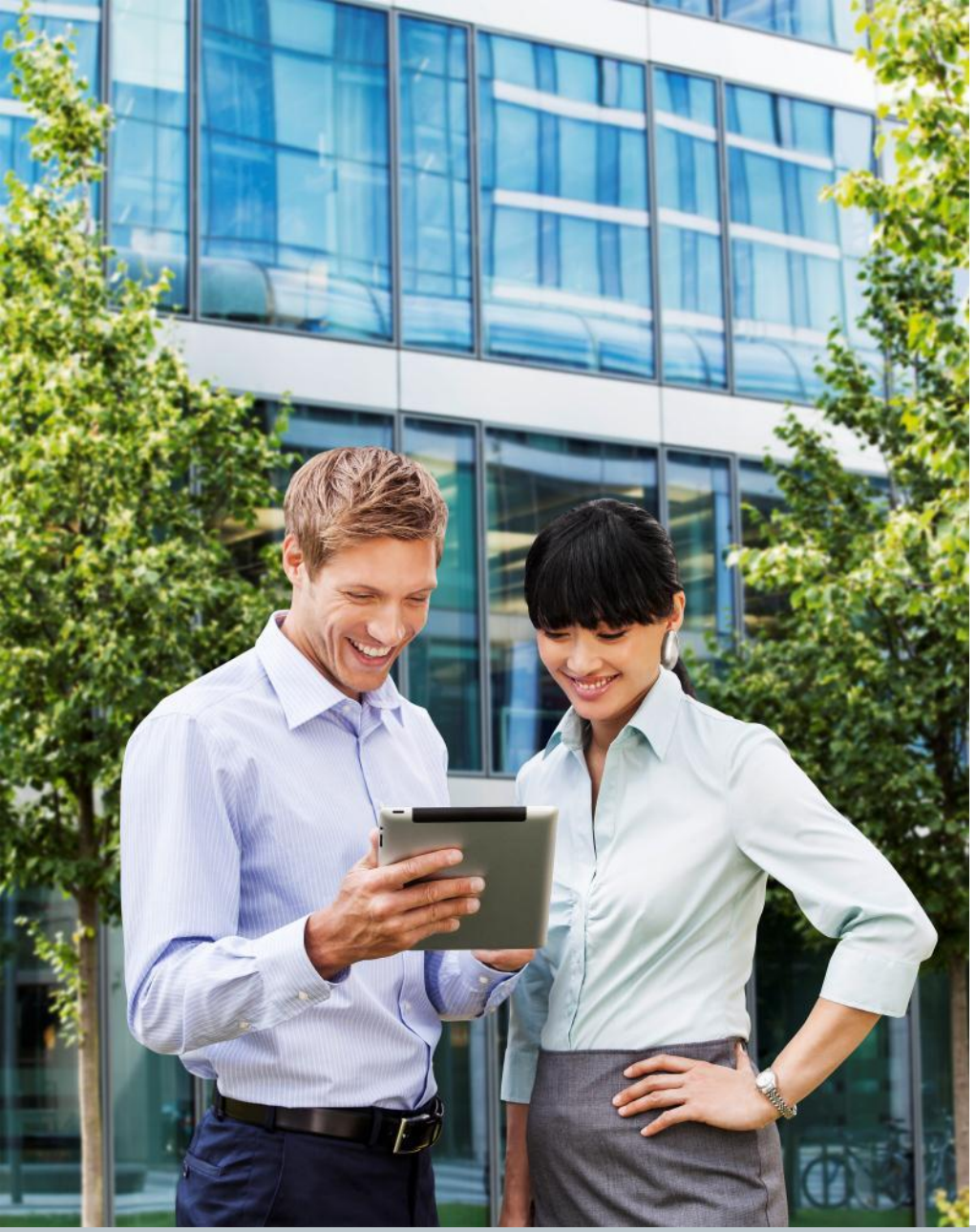
NQWeb

Web reporting
Fleet monitoring
Automation
Alarming

Portfolio overview

Installation/Interference Hunting/ PIM Testing





Thank you
for your attention!

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