

Ασύρματη Καλωδίωση, Πιστοποίηση Υποδομών και Σχεδίαση WiFi

Του Λάμπρου Κωστάρα,
ESB AGENTS – Managing Director
lkostaras@esbagents.com





Η σύγχρονη και ρεαλιστική προσέγγιση στη μελέτη και το σχεδιασμό συστημάτων

Πόσο WiFi ?

Πόσο Fiber ?

Πόσο χαλκός ?

Πόσοι και τι είδους χρήστες ?

Που, πως και πόσο ?

Η διαφορά μεταξύ προτύπων καλωδίωσης και WiFi

Smart Choices

Ή αλλιώς : Ακούγοντας το χρήστη

Η αλήθεια εντός του κτιρίου

- 2015 - More mobile traffic offloaded to WiFi than remained on cellular network
- Within 5 years the average smart phone consumption will increase 5x to 4.4GB/month
- 2016 51% (3.9 exabytes/month) was offloaded
- 2020 55% (38.1 exabytes/month) will be offloaded



The 802.11 Standard,
the Ethernet Alliance and the ITU inside the
building



IEEE

The Wi-Fi Alliance (WiFi 6 πότε ?)

- Provides a highly-effective collaboration forum
- Promotes growth within the Wi-Fi industry
- Leads industry growth with new technology specifications and programs
- Support industry-agreed standards
- Delivers great product connectivity through testing and certification
- Helps to ensure interoperability across wireless vendors



Vendors

Δεν είναι
όλοι ίδιοι .



Πρότυπα ... CAT6A ? CAT7A ?

Controllers ?

GPON ?

Band Steering ?

PoE ?

Private WiFi ?

2,5 – 5 Gbps ?

MPTL ?

ISO 14763 – TIA testing ?

Το ασύρματο περιβάλλον



Wi-Fi traffic/noise



Non-Wi-Fi traffic/noise

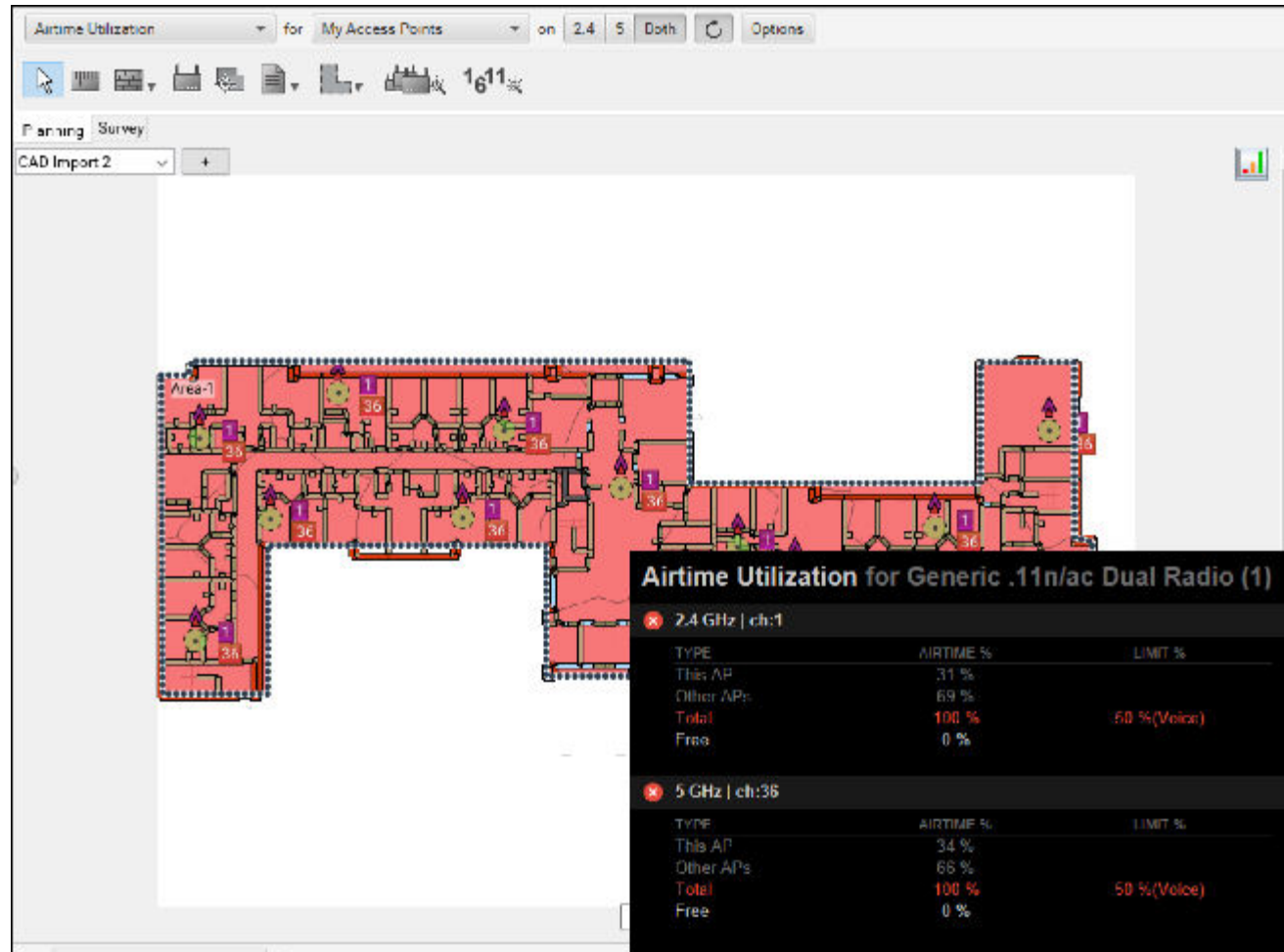
Η αμίλητη πλευρά του χρήστη ... το MAC Book και ο ... ξενοδόχος



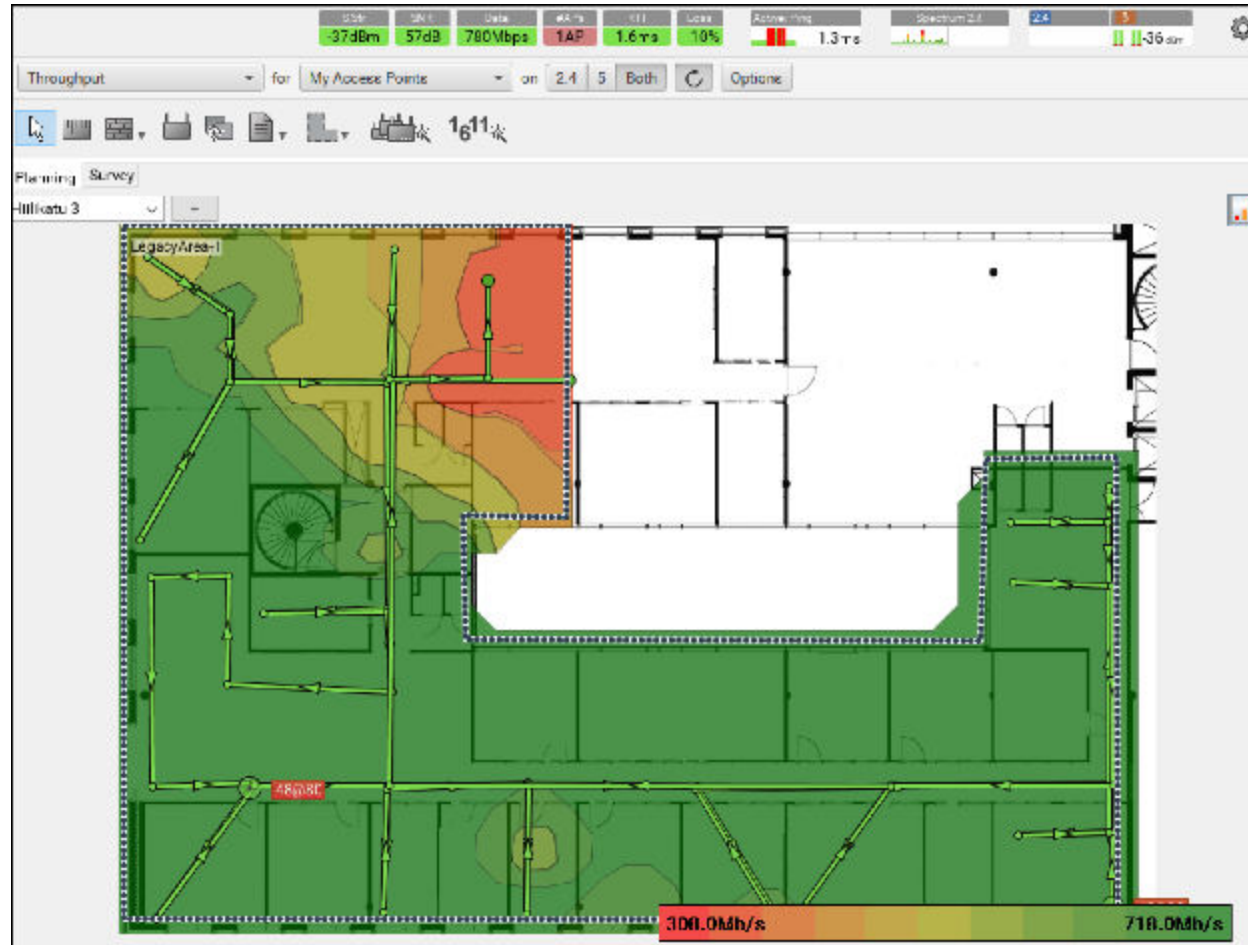
Βάζω ή σχεδιάζω WiFi ?



Airtime Utilization



Throughput



The Ekahau Solution

3D Wi-Fi Planning

Automatic Wall Detection

Capacity Planning & Analysis

Site Surveys

Passive, Active

Throughput, Spectrum

Fully customizable Reporting

On-The-Spot Troubleshooting



Ο τρόπος να ελέγξουμε τι βλέπει ο χρήστης

The Ekahau Sidekick™

A wearable Survey and Troubleshooting tool

Works with Ekahau Site Survey

Integrated Enterprise quality Wi-Fi radios

Spectrum Analyzer

USB connectivity

Self contained battery



The Ekahau Solution

Some Customers & Partners

- 15,000 businesses worldwide, including over 100 of the Fortune 500, use Ekahau site survey and planning solutions
- Our customers include thousands of enterprise network administrators and systems integrators
- Today, there are 1M+ Ekahau users worldwide



“Always my planning tools of choice.”
– Jim Florwick



“Aruba chooses to use Ekahau”
– Michael Tennefoss



“It’s AWESOME!”
– Greg Kamer



“This tool rocks!”
– Will Aguilar



“Our team and customers love Ekahau tools”
– Abby Strong



“The best site survey / planning tool”
– Tom Berry



Technology Overview



WIRELESS

>10G



2009
IEEE 802.11n



2013
IEEE 802.11ac



≈ 2020
IEEE 802.11ax

Antennas	Access Points Datarate (theoretical maximum)		
1x1	150 Mbit/s	866 Mbit/s	≈ 3.4 Gbit/s
2x2	300 Mbit/s	1.7 Gbit/s	≈ 6.8 Gbit/s
4x4	450 Mbit/s	3.4 Gbit/s	≈ 13.6 Gbit/s
8x8	600 Mbit/s	6.9 Gbit/s	≈ 27.6 Gbit/s
Distance	~ 70 m	~ 35 m	~ 10 - 20 m



Technology Overview



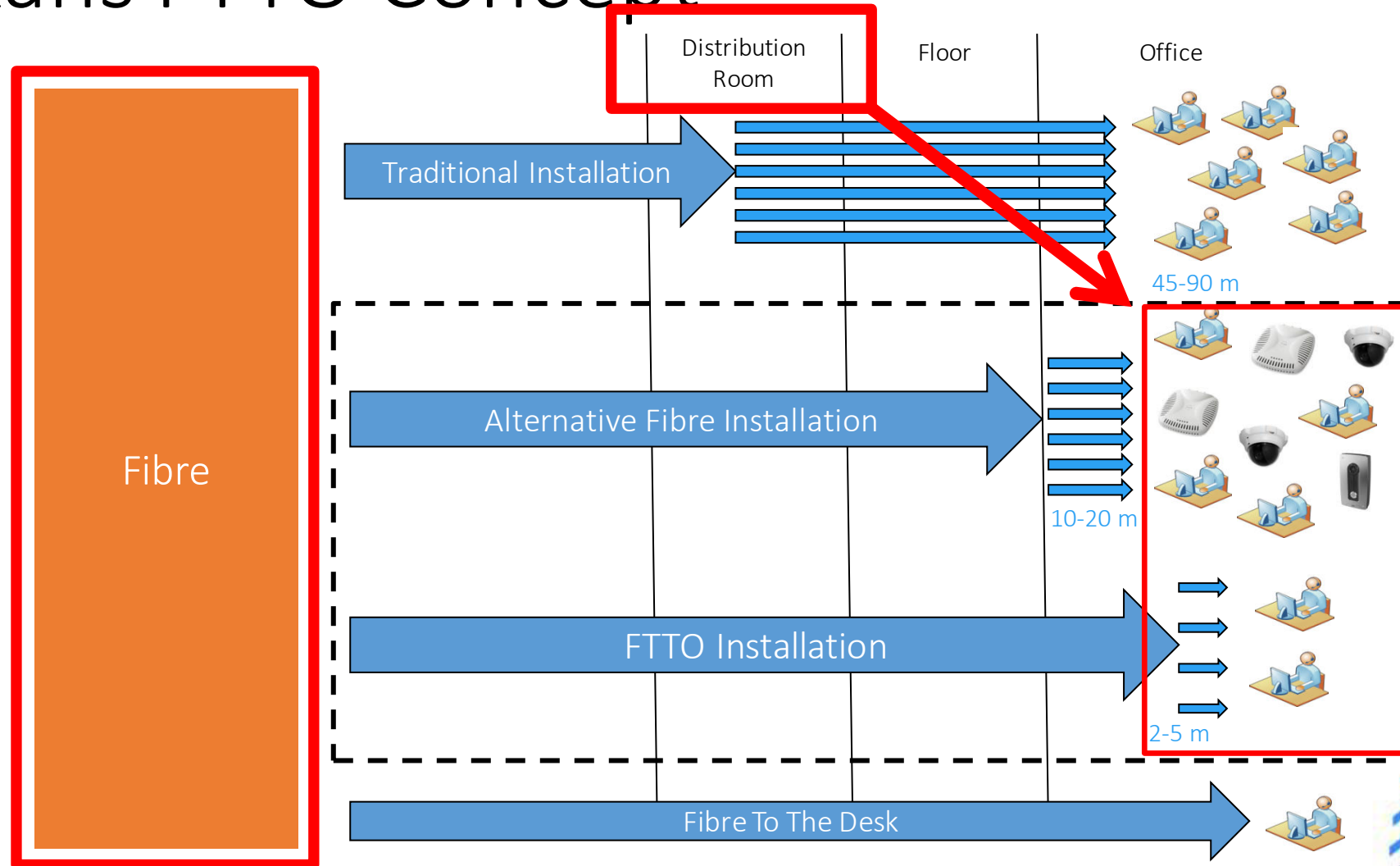
ENERGIE

x3
Power

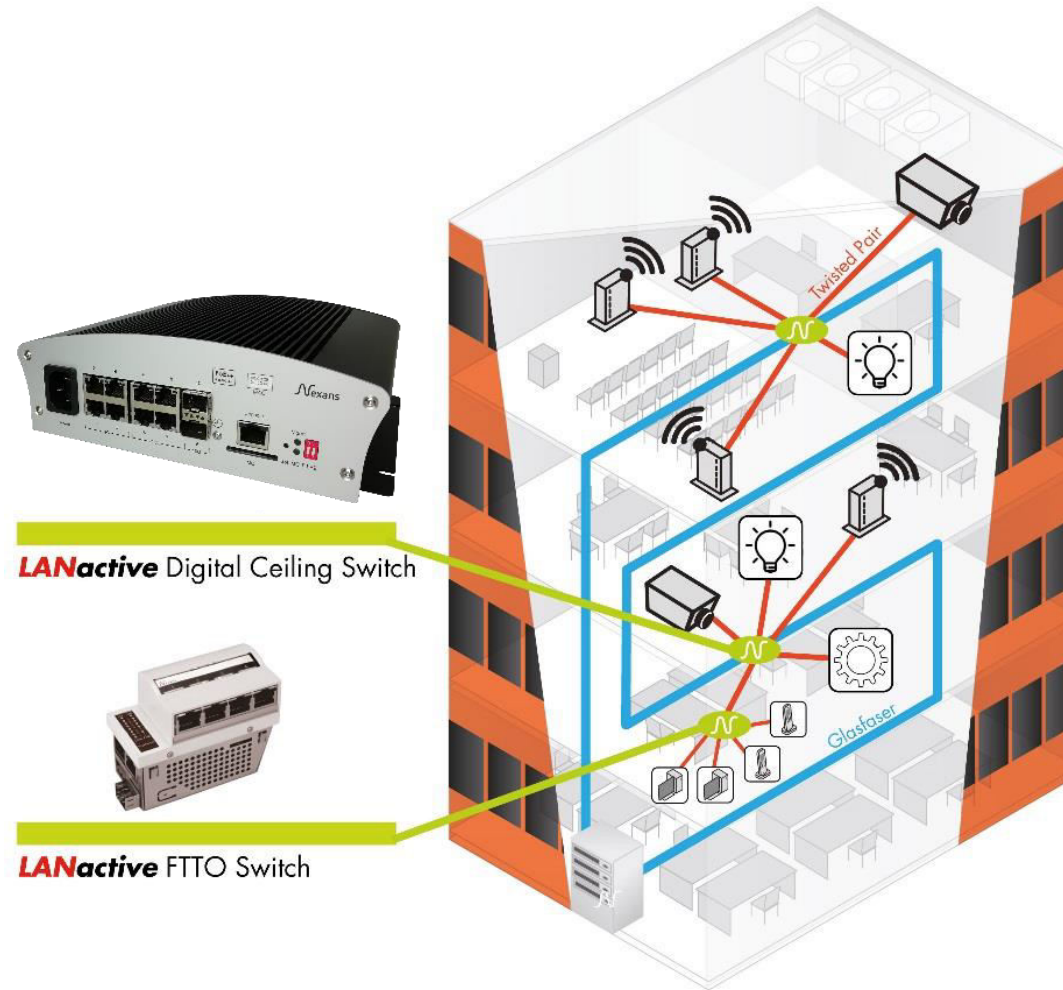
	2003	2009	2018	2018
	PoE Typ 1 IEEE 802.3af	PoE+ Typ 2 IEEE 802.3at	PoE++ Typ 3 IEEE 802.3bt	PoE++ Typ 4 IEEE 802.3bt
Output power	15.4W	30W	60W	90W
Used by PD	12.95W	25.50W	51W	71W
Used pairs	2	2	4	4



Nexans FTTO Concept

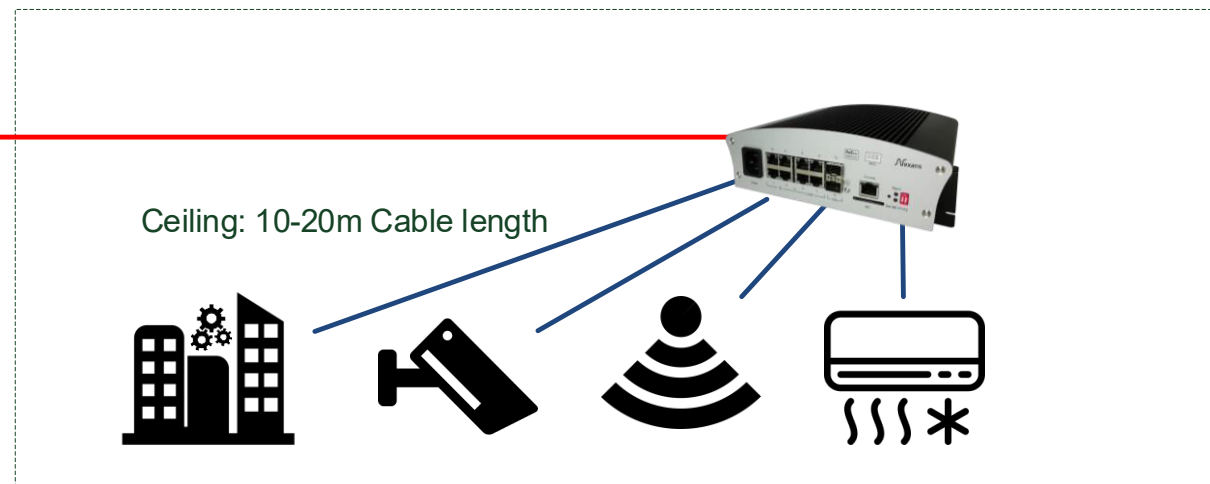
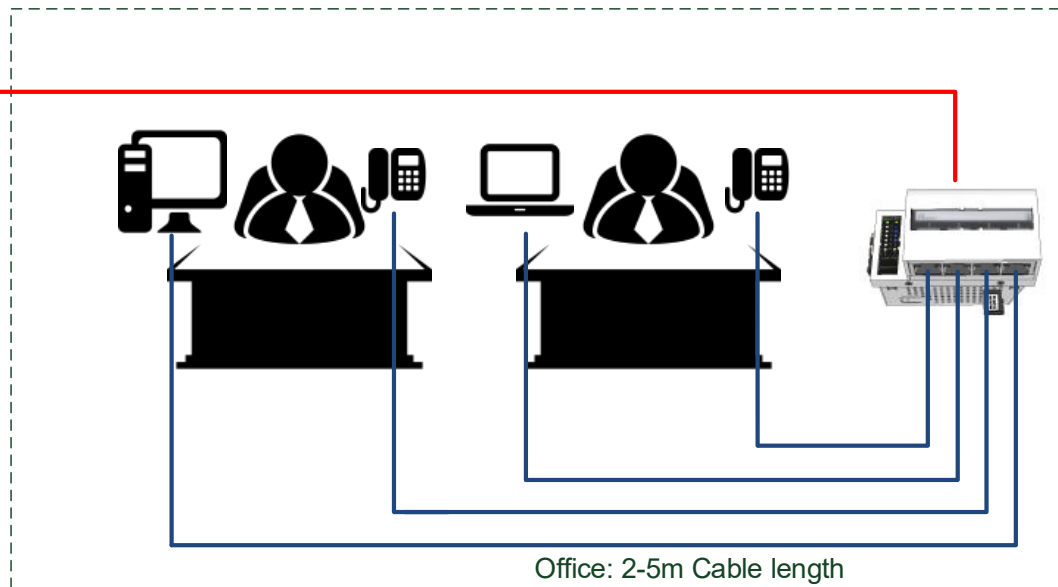


Nexans FTTO Concept – Digital Ceiling



Nexans FTTO Concept

- Traditional Fibre To The Office Installation
- Gigabit bandwidth to the desk
- Power over Ethernet (PoE+) to the IP Phones
- 2-5m copper cable length
- Link Aggregation and redundancy protocols
- Access Network Layer
- Zero-Touch Configuration



- Fibre in the Digital Ceiling
- More IP equipment in the ceiling (e.g. WLAN APs, IP Cameras, Connected Lighting, Smart Building Systems, etc.)
- More than 4 access ports required
- MultiGigabit ports to the WLAN APs
- Higher density of WLAN APs, cells with a radius of 10...20m
- Power over Ethernet with more than 30W (PoE++)
- Link Aggregation and redundancy protocols
- Smart Ceiling Installation
- Access/Distribution Network Layer

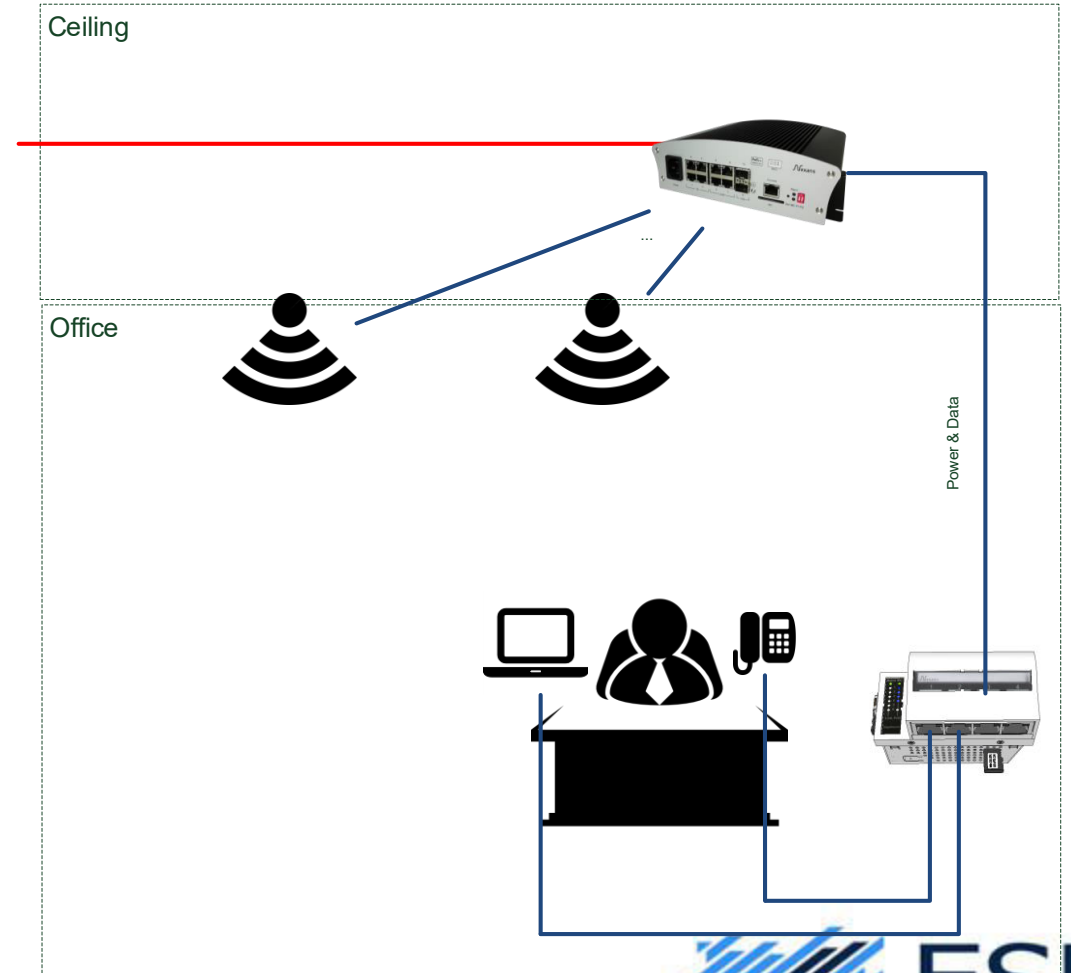
XGigaSwitch 8TP 2SFP+ AC/DC

- Layer3 Ethernet Switch with Zero-Touch Configuration
- Fan less design
- 2x 10Gbps Uplink (SFP+)
- 4x 2.5Gbps + 4x 1Gbps Access Ports
- 8x PoE++ with 90W (max. 480W)
- Internal/External Power Supply
- Smart Ceiling Installation (tool-less)
- Adaptor for 19" and DIN-Rail available



Furthermore...

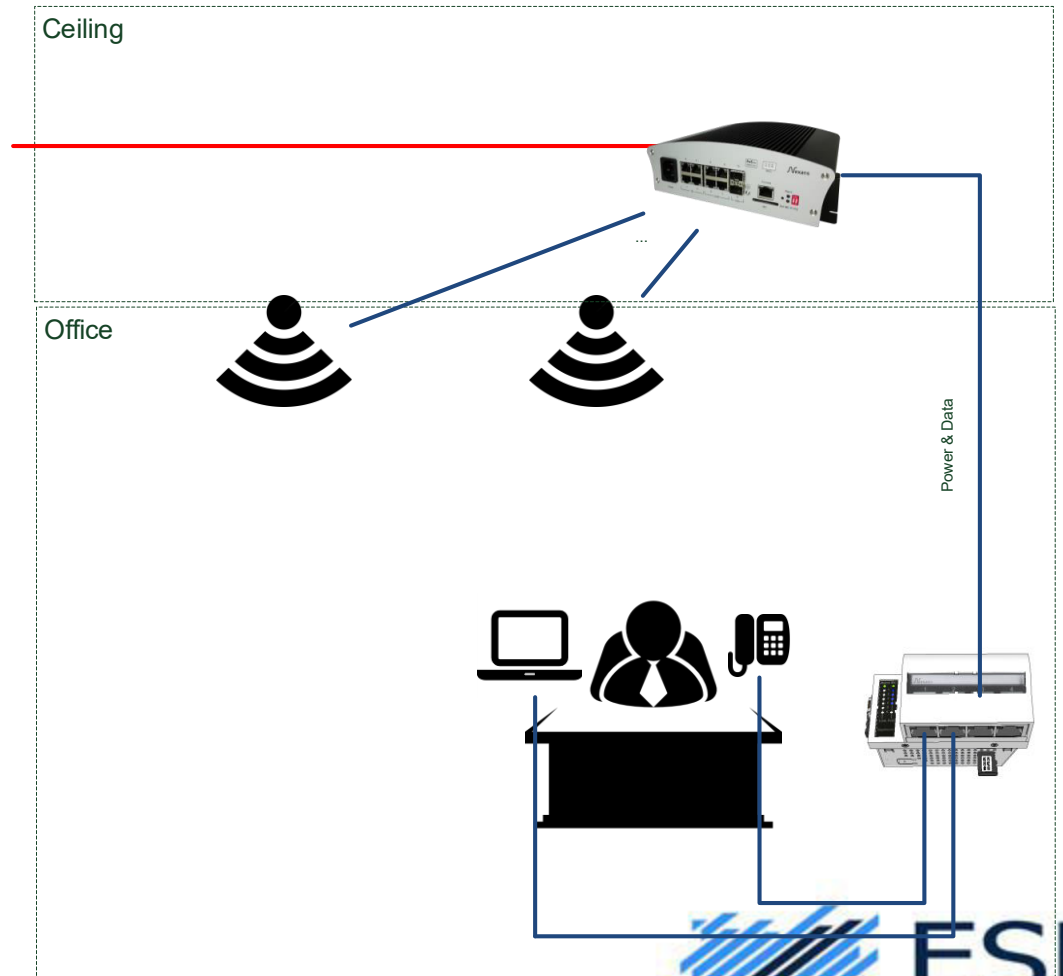
- More than coexisting concepts
- Connection of separated working places
- The XGigaSwitch provides data and power to the FTTO Switch
- FTTO Switch forwards the power to the IP Phone
- And ... **CABLE STATISTICS**



Στα ενδότερα της φυσικής υποδομής ...

Τι πραγματικές δυνατότητες δίνει η φυσική υποδομή στον τελικό χρήστη ...

Τι νόημα έχουν τα 35dB NEXT στα 500 MHz στα υψηλά επίπεδα του OSI ?



Κατανοώντας την πιστοποίηση



Certifiers



Qualifiers



Verifiers

T568B PASS

1 2 3 6 4 5 7 8 S

1 2 3 6 4 5 7 8 S VoP 79,0%

Paar 1-2 Laenge = 35,9 m

Paar 3-6 Laenge = 36,3 m

Paar 4-5 Laenge = 36,2 m

Paar 7-8 Laenge = 36,5 m

Duplex Duplex Duplex Duplex

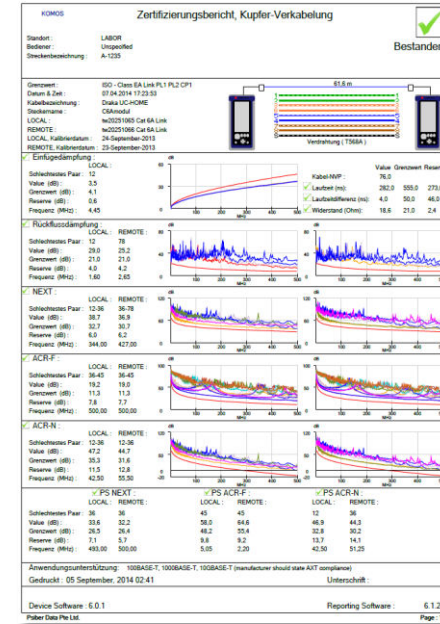
100 Base-TX MDI FDX 0,0 V Min Load

PoE 0,0 V Max Load

Cable Test Detail Report

Report	File Location	Site	Tester	Tester Company
Date	Monday, 04/11/2014	Company	Harlan	Harlan
Time	10:00:00	Phone	9001-100000	
Technician	John Smith	Brand	panf@bluewin.ch	

Cable	Pair	Length	Building	Floor	Room	Room	Room	Pair
Cable 1	1,2	36,0	University Center 1021	1	202	000076	100000	100000
	3,6	36,0	Typ	200	000076	100000	100000	
	4,5	36,0	CAT5E	21,1	0	164119	100000	
	7,8	36,0	Standard Pair	39,2	Result	0/100		
Cable 2	1,2	36,0	University Center 1021	1	202	000076	100000	
	3,6	36,0	Typ	200	000076	100000	100000	
	4,5	36,0	CAT5E	21,1	0	164119	100000	
	7,8	36,0	Standard Pair	39,2	Result	0/100		
Cable 3	1,2	36,0	University Center 1021	1	202	000076	100000	
	3,6	36,0	Typ	200	000076	100000	100000	
	4,5	36,0	CAT5E	21,1	0	164119	100000	
	7,8	36,0	Standard Pair	39,2	Result	0/100		
Cable 4	1,2	36,0	University Center 1021	1	202	000076	100000	
	3,6	36,0	Typ	200	000076	100000	100000	
	4,5	36,0	CAT5E	21,1	0	164119	100000	
	7,8	36,0	Standard Pair	39,2	Result	0/100		
Cable 5	1,2	36,0	University Center 1021	1	202	000076	100000	
	3,6	36,0	Typ	200	000076	100000	100000	
	4,5	36,0	CAT5E	21,1	0	164119	100000	
	7,8	36,0	Standard Pair	39,2	Result	0/100		



Testing on passive cables

Verification

- Basic test of Structured Cabling
- Wiremap test
- Continuity



Should it work for my applications?

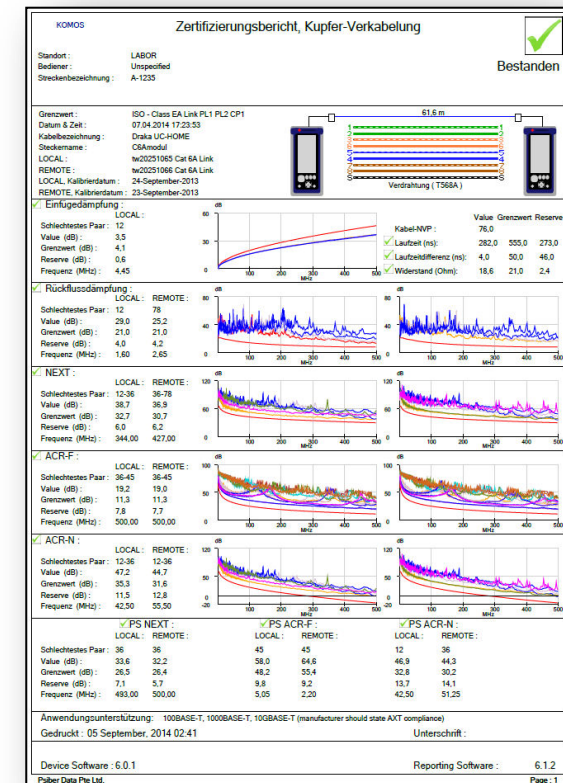
Qualification

- This is not certification
- Determining of Ethernet Performance
- Is it in context with the application (IEEE specs)



Certification

- This is not qualification
- Standard acceptance test for networks (TIA, ISO global standards)
- Link definitions
- LF and RF measurements and calculated parameters

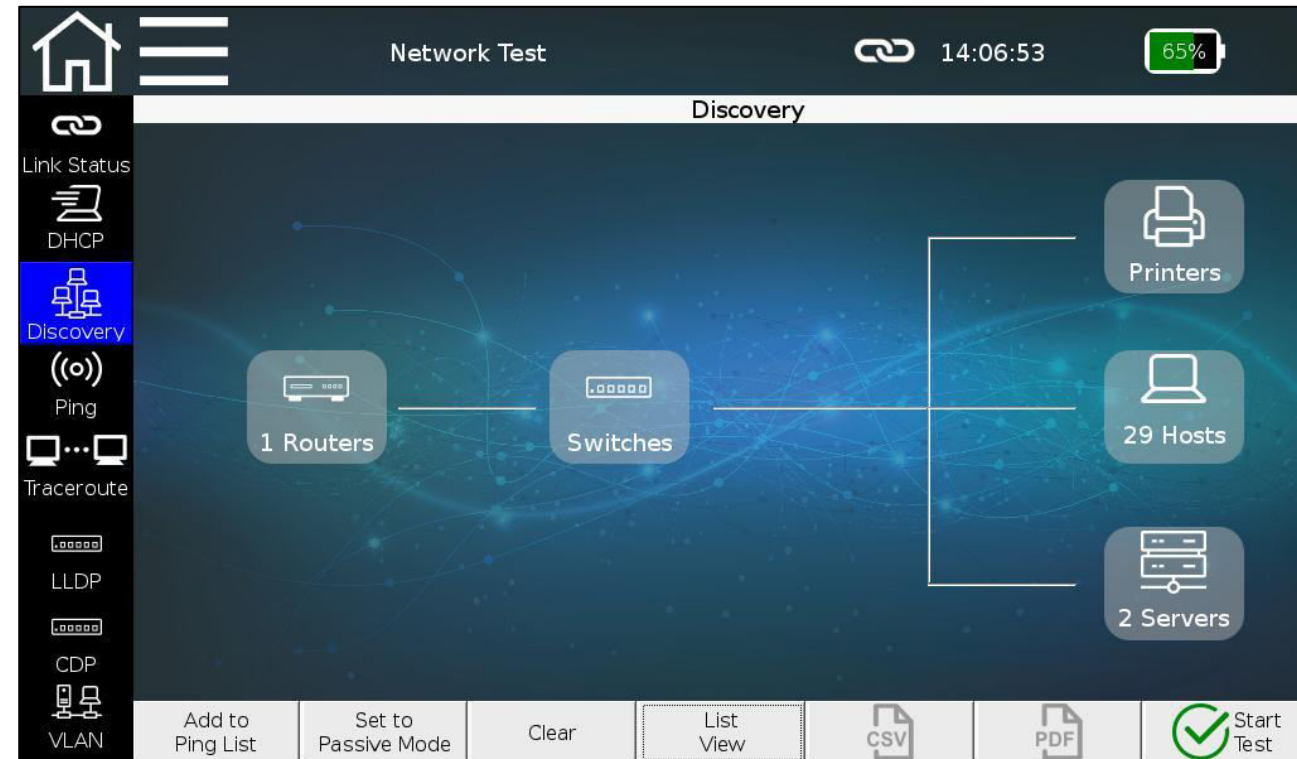


Testing on active networks

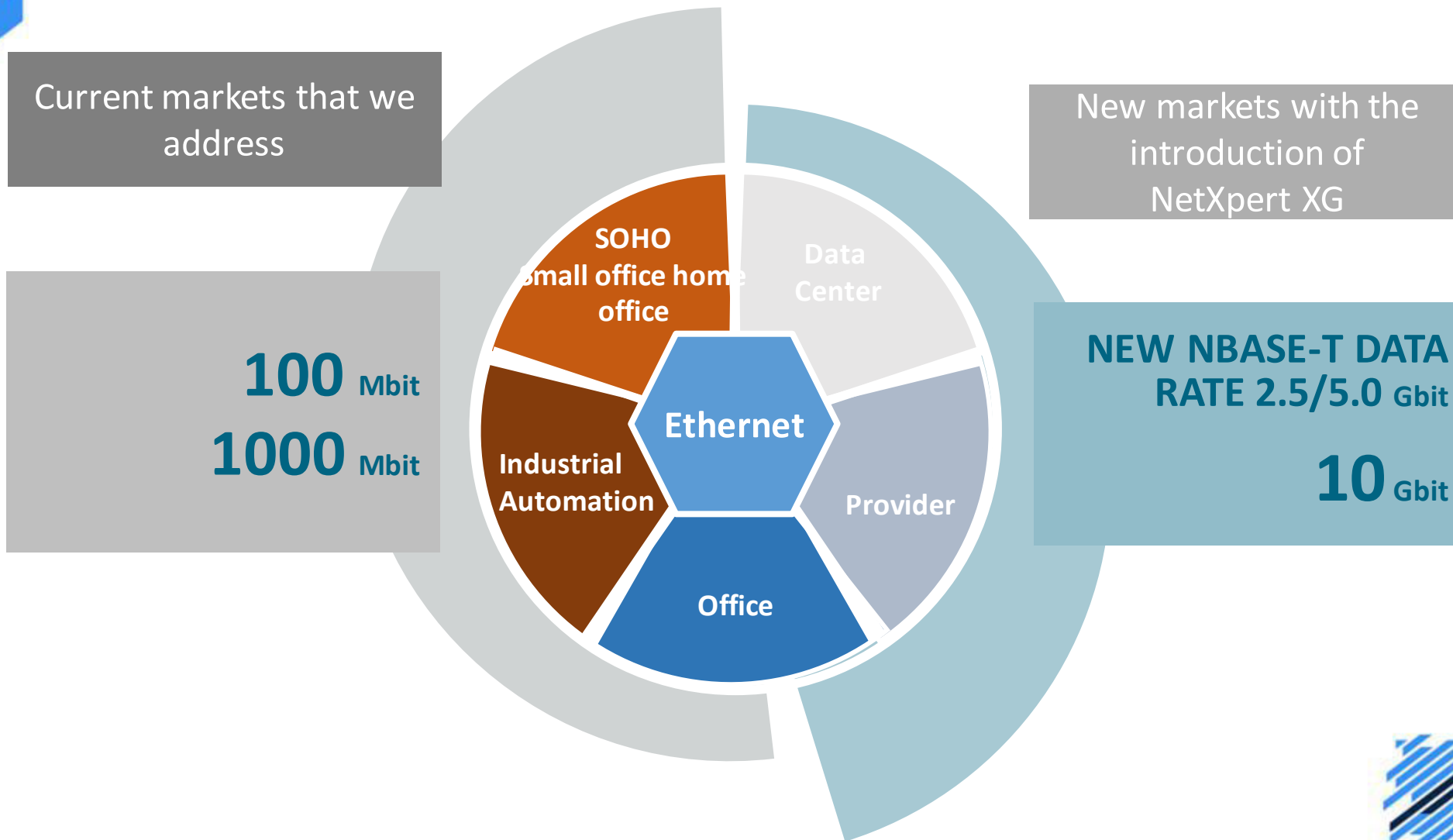
What about the things my cables are connected to?

Active/Troubleshooting

- Does not include verification, qualification, certification
- Typical Ethernet problems
- Special testers for troubleshooting (intermittent problems, long term traffic tests, frame test)



Applications Served



Only selected links will need higher datarates

- Most of the connected clients will continue with 1Gbit/s for the next years
- In real life, only selected devices in existing installations will be upgraded and will require higher link speeds



Next generation NetXpert

- Qualifies data cablings up to 10Gbit/s
- Combines 3 different tests for reliable test results
- Troubleshoots passive and active networks
- SFP/SFP+ for fiber support
- PoE/PoE+/PoE++ load tests
- Multilingual software support



NetXpert XG is the only qualifier running 3 tests to 10G speeds

SNR

Signal to Noise Ratio

1

- The ratio of signal power to the noise power
- When signal power gets too low and noise power too high, data can not be detected by receiver

BERT

Bit Error Rate Test

2

- Selectable cable types and BERT speeds (1, 2.5, 5, 10 Gigabit Ethernet)
 - A BERT passes, if bits that are sent in a defined time, return without any loss.
- Load generation up to 10Gbit/s and testing if transmission errors occur

Delay Skew

3

- Delay difference between pairs caused by different twisting.
- From 1 GbE, all 4 pairs are used. The data is split between the pairs and then re-assembled on the other side.
- If the delay difference is too high, then data can not be recovered by the receiver, resulting in repetition or speed reduction



NetXpert XG – Cable testing

- Graphical **wire map** display
- Measures and displays **length** for each pair in feet or meters
- Improperly terminated cables are clearly displayed
- Detects **Length to Opens and Shorts**
- Displays **crossings, swaps** and **split pairs**
- Tone generation
- Testing and ID Remotes
 - up to 8 Full Wiremap Remote
 - up to 24 Mapper IDs available for identifying ports

The screenshot displays the NetXpert XG software interface. At the top, there is a list of tools with their respective status and battery levels:

Tools	Status	Battery
Tools	15:46:53	22%
Cable Test	15:53:50	21%
Tools	15:44:16	24%
Tools	15:53:17	20%
Tools	15:38:16	26%

The main interface is divided into two sections. The left section, titled 'Wiremap & Margin', shows a large graphic of a port labeled '19' with a yellow bar at the bottom. The right section, also titled 'Wiremap & Margin', displays the following settings and results:

- Cable Speed: 100Mb, 1Gb/s, 2.5Gb/s, 5Gb/s, 10Gb/s (selected)
- pF/m: 49.2, NVP: 66.0
- Shielded: Two-pair: X-over:
- Continuous Testing: Test:

NetXpert XG– Qualification

- Configure Project (Customer name, Report type)
- Choose cable type
- Define cable labelling
- Start test and get result (test cables in sequence or in disorder, easy to retest)

The screenshot displays the NetXpert XG software interface. On the left, a vertical navigation menu includes icons for Home, Projects + Reports, Cable Type, Cable Labeling, Cable Test (highlighted in blue), and Set Reference. The main area is divided into two sections. The top section shows a list of four 'Cable Test' entries with timestamps and 86% completion indicators. The bottom section provides a detailed view for 'Cable002' (2.3 m). It includes a table of wiremap data and a large green '10Gb' status icon.

Name	Type	Length
Cable001	CAT6A ...b-STP	1.7
Cable002	CAT6A ...b-STP	2.3
Cable003	CAT6A ...b-STP	---
Cable004	CAT6A ...b-STP	---
Cable005	CAT6A ...b-STP	---
Cable006	CAT6A ...b-STP	---
Cable007	CAT6A ...b-STP	---
Cable008	CAT6A ...b-STP	---
Cable009	CAT6A ...b-STP	---

Wiremap	Length	Status	Skew	SNR Margin
1	2.4 m	Ok	15.0 ns	7.4 dB
2				
3	2.6 m	Ok	0.0 ns	3.1 dB
6				
4	2.3 m	Ok	0.0 ns	3.7 dB
5				
7	2.3 m	Ok	5.0 ns	6.9 dB
8				
S				

Cable002
2.3 m

CAT6A 10Gb-STP 49.2pF/m
BERT:0 errors
AR ID: 1

Retest Test

NetXpert XG– Qualification

Or simply select desired cable speed and start testing without the need of setting up a project

The screenshot shows the NetXpert XG application interface. The top bar includes a home icon, the word 'Tools', the time '14:16:29', and a battery level of '61%'. The main screen is titled 'singleTest' with a distance of '2.3 m'. It features a table with columns for 'Wiremap', 'Length', 'Skew', and 'SNR Margin'. A large green checkmark icon with '10Gb' is prominently displayed. To the right, the 'Wiremap & Margin' panel shows 'Cable Speed' options (100Mb, 1Gb/s, 2.5Gb/s, 5Gb/s, 10Gb/s) and test parameters like 'pF/m' (49.2) and 'NVP' (66.0). A 'Test' button is visible at the bottom right.

Wiremap	Length	Skew	SNR Margin
1	2.5 m	5.0 ns	6.2 dB
2			
3	2.7 m	10.0 ns	2.4 dB
6			
4	2.3 m	0.0 ns	3.0 dB
5			
7	2.3 m	5.0 ns	6.0 dB
8			
S			

NetXpert XG

Active Testing and Troubleshooting

Network Tests and Diagnosis

- Link Status
- DHCP test
- Network Discovery
- Ping list
- Traceroute
- VLAN detection
- PoE/PoE+/PoE++ load test
- IPV4/IPV6 Support
- Discovers CDP and LLDP Protocols
- VLAN detection
- Link Light



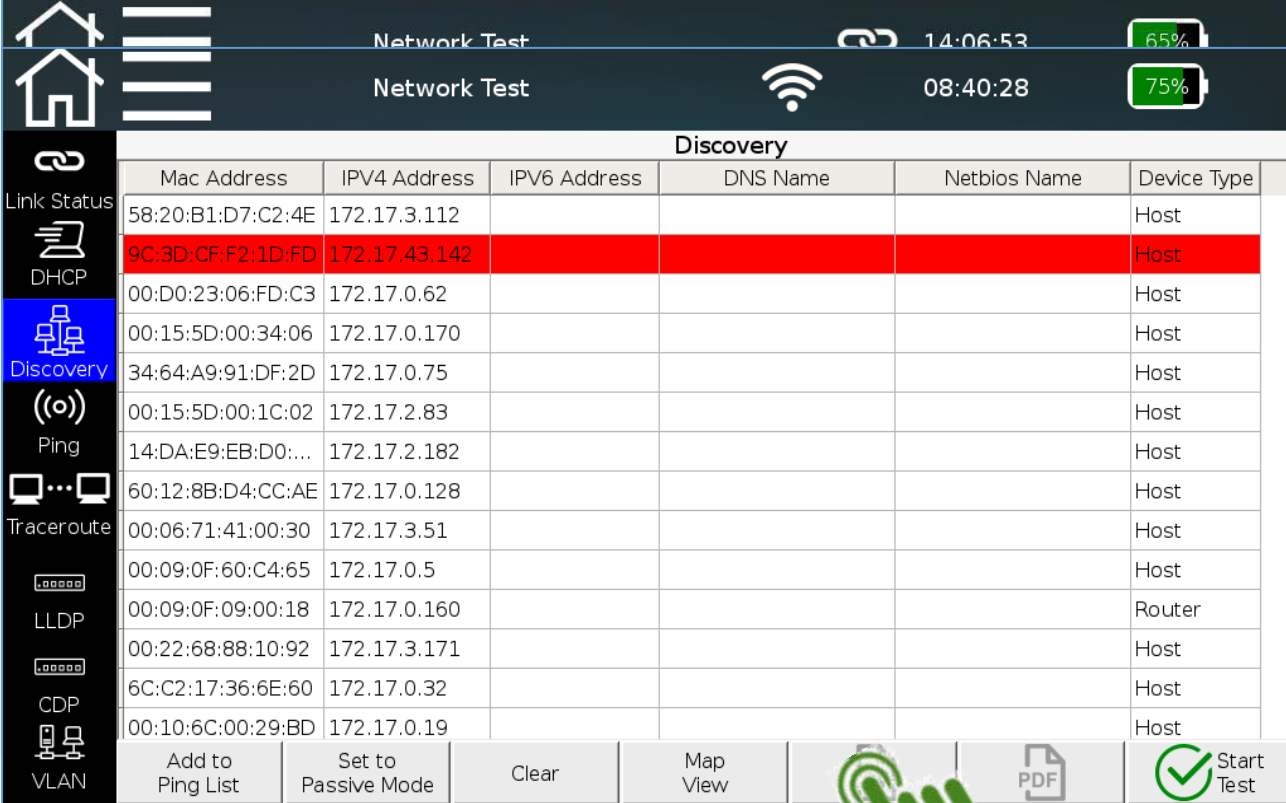
NetXpert XG– Network Test

- Get information about the connected Link
- Trigger DHCP and show given information
- Show VLAN information when available
- Show LLDP and CDP information when available



NetXpert XG– Network Discovery

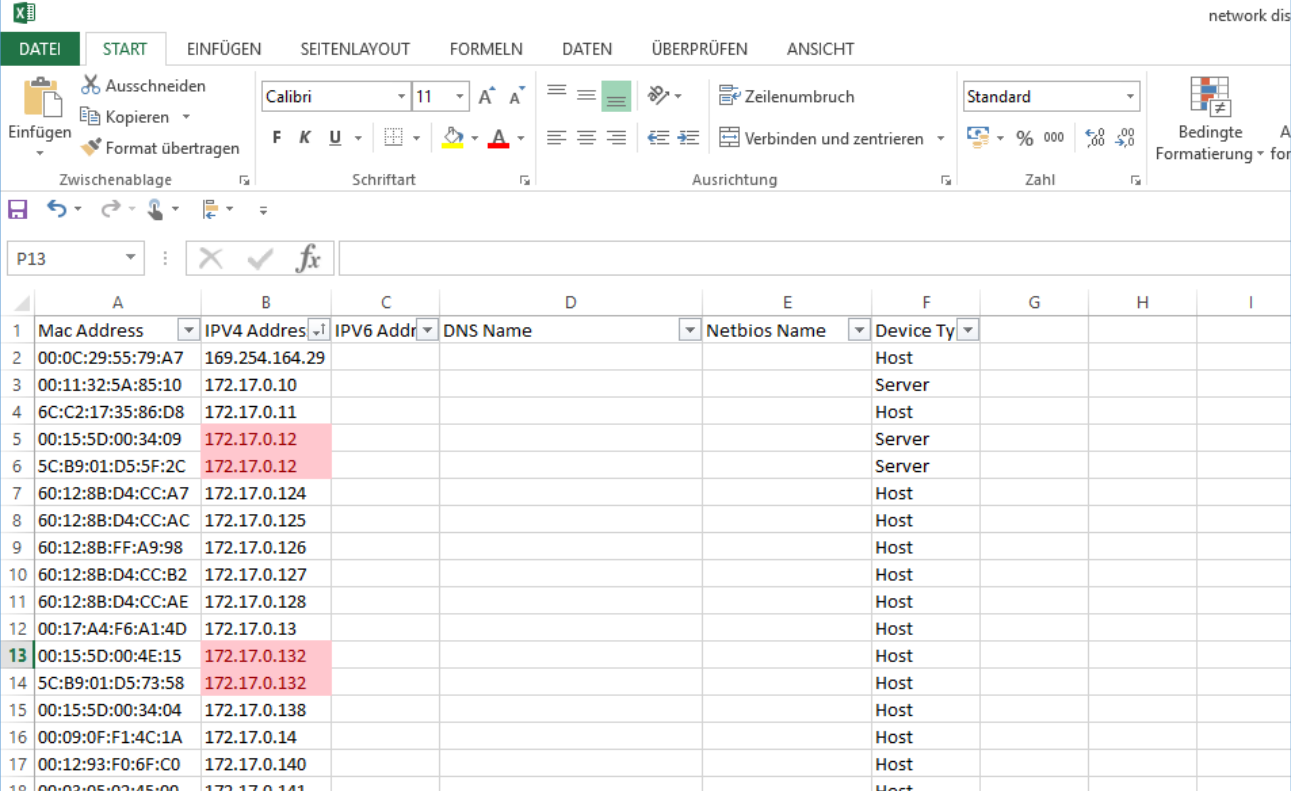
- Graphical network discovery gives an overview on reachable devices within same subnet
- Network discovery list-view shows all devices and lets you directly transfer them into the ping list
- Duplicate IP addresses are marked in red for you to detect them easily



Discovery					
Mac Address	IPv4 Address	IPv6 Address	DNS Name	Netbios Name	Device Type
58:20:B1:D7:C2:4E	172.17.3.112				Host
9C:3D:CF:F2:1D:FD	172.17.43.142				Host
00:D0:23:06:FD:C3	172.17.0.62				Host
00:15:5D:00:34:06	172.17.0.170				Host
34:64:A9:91:DF:2D	172.17.0.75				Host
00:15:5D:00:1C:02	172.17.2.83				Host
14:DA:E9:EB:D0:...	172.17.2.182				Host
60:12:8B:D4:CC:AE	172.17.0.128				Host
00:06:71:41:00:30	172.17.3.51				Host
00:09:0F:60:C4:65	172.17.0.5				Host
00:09:0F:09:00:18	172.17.0.160				Router
00:22:68:88:10:92	172.17.3.171				Host
6C:C2:17:36:6E:60	172.17.0.32				Host
00:10:6C:00:29:BD	172.17.0.19				Host

NetXpert XG– Network Discovery

Simply export your results to your PC and analyse them i.e. with Excel



	A	B	C	D	E	F	G	H	I
1	Mac Address	IPV4 Address	IPV6 Addr	DNS Name	Netbios Name	Device Ty			
2	00:0C:29:55:79:A7	169.254.164.29				Host			
3	00:11:32:5A:85:10	172.17.0.10				Server			
4	6C:C2:17:35:86:D8	172.17.0.11				Host			
5	00:15:5D:00:34:09	172.17.0.12				Server			
6	5C:B9:01:D5:5F:2C	172.17.0.12				Server			
7	60:12:8B:D4:CC:A7	172.17.0.124				Host			
8	60:12:8B:D4:CC:AC	172.17.0.125				Host			
9	60:12:8B:FF:A9:98	172.17.0.126				Host			
10	60:12:8B:D4:CC:B2	172.17.0.127				Host			
11	60:12:8B:D4:CC:AE	172.17.0.128				Host			
12	00:17:A4:F6:A1:4D	172.17.0.13				Host			
13	00:15:5D:00:4E:15	172.17.0.132				Host			
14	5C:B9:01:D5:73:58	172.17.0.132				Host			
15	00:15:5D:00:34:04	172.17.0.138				Host			
16	00:09:0F:F1:4C:1A	172.17.0.14				Host			
17	00:12:93:F0:6F:C0	172.17.0.140				Host			
18	00:02:05:03:45:00	172.17.0.141				Host			

NetXpert XG– Ping List

- Enter IPv4 or IPv6 addresses
- Enter Domain names
- Get addresses from the Network Discovery function
- Continuously ping all addresses in parallel

Ping				
Target	Tx/Rx	Min (ms)	Avg (ms)	Max (ms)
192.168.1.1	43/43	5	21.53	33
213.30.210.161	43/43	6	22.84	34
62.214.151.221	43/43	17	55.26	220
62.214.105.17	43/43	17	24.37	35
www.softing.de (172.17.5.253)	43/43	5	22.09	32

NetXpert XG– Traceroute

- Enter IPv4 or IPv6 addresses or Domain names
- See number and details of hops to target
- Detect location of trouble
 - Internal
 - External
- Document via CSV and/or PDF
 - E.g. evidence for provider

The screenshot shows the NetXpert XG Traceroute interface. The top bar includes a home icon, a menu icon, the text "Network Test", a refresh icon, the time "13:29:00", and a battery icon showing "69%". The main content area is titled "Traceroute www.google.de" and displays a table with the following data:

Hop	Delay #1	Delay #2	Delay #3	Destination
1	16 ms	13 ms	13 ms	192.168.1.1
2	21 ms	3 ms	20 ms	213.30.210.161
3	21 ms	22 ms	162 ms	62.214.151.221
4	22 ms	19 ms	20 ms	62.214.105.17
5	29 ms	31 ms	21 ms	62.214.37.130
6	***	***	***	
7	***	***	***	
8	26 ms	37 ms	31 ms	216.239.47.244
9	21 ms	22 ms	32 ms	108.170.251.145
10	21 ms	22 ms	39 ms	209.85.252.29
11	56 ms	49 ms	31 ms	72.14.234.10
12	42 ms	42 ms	45 ms	172.253.50.101
13	31 ms	42 ms	46 ms	216.239.63.48
14	31 ms	51 ms	39 ms	108.170.253.65

On the left side of the interface, there is a vertical menu with icons for: Link Status, DHCP, Discovery, Ping, Traceroute (highlighted), LLDP, CDP, and VLAN. At the bottom of the interface, there are buttons for "Edit Target", "CSV", "PDF", and "Start Test" (with a green checkmark icon).

NetXpert XG– Tools

- Show PoE class and perform a load test
- Perform a single BERT test, define how long the test runs and get detailed results
- Continuous wire map testing

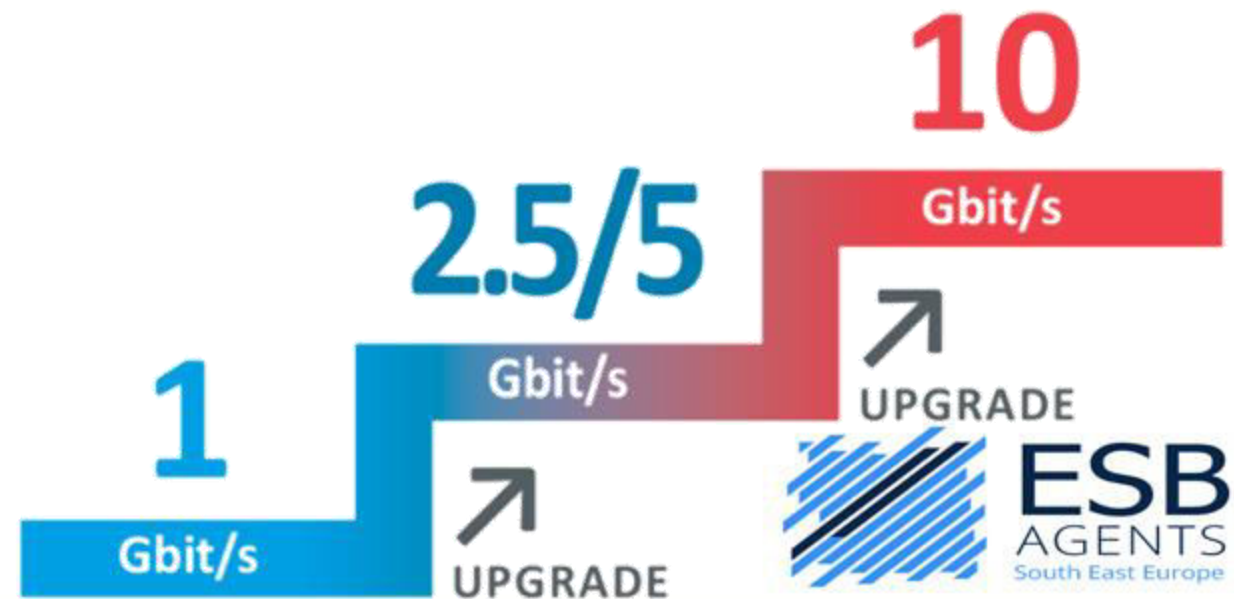
The screenshot displays the NetXpert XG Tools interface. The top navigation bar shows three instances of the 'Tools' menu with timestamps and battery levels (68%, 61%, and 61%). The main interface is divided into several sections:

- Wiremap & Margin:** A table showing test results for a 2.3m cable. The table has columns for Wiremap, Length, Skew, and SNR Margin.
- Wiremap & Margin Table:**

Wiremap	Length	Skew	SNR Margin
1	2.5 m	5.0 ns	6.2 dB
2			
3	2.7 m	10.0 ns	2.4 dB
6			
4	2.3 m	0.0 ns	3.0 dB
5			
7	2.3 m	5.0 ns	6.0 dB
8			
S			
- Custom:** 49.2pF/m
- AR ID:** 1
- 10Gb:** A green checkmark icon indicating a 10Gb test result.
- Wiremap & Margin (Right Panel):** A section for configuring cable speed and testing options. It includes radio buttons for Cable Speed (100Mb, 1Gb/s, 2.5Gb/s, 5Gb/s, 10Gb/s) and checkboxes for Shielded, Two-pair, and X-over. It also shows pF/m (49.2) and NVP (66.0) values.
- Continuous Testing:** A green checkmark icon and a red stop sign icon labeled 'Test'.

NetXpert XG - Upgradable

- Available for 1G, 2.5/5G or 10GBit/s
- Speed upgrade through licensing system
- Use report generation on main unit or eXport PC software
- Use standard SFP/SFP+ for fiber testing no special measurement hardware needed
- Use two main units or one main and one active remote depending on your needs





Smart Choices,
Smart Design, Smart Testing

Ακούγοντας καλύτερα τη
πλευρά του χρήστη

optimize!
softing

The logo for Ekahau, featuring the word "ekahau" in white lowercase letters on a black background, with a horizontal line below it that transitions from red to yellow to green. Below the line, the words "WIRELESS DESIGN" are written in white uppercase letters.

ekahau
WIRELESS DESIGN

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