WLAN Network Planning and Site Survey

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Agenda

- WLAN Project Planning
- Tools
- How to carry out a site survey properly
- Installation Tips
- Ekahau example
- Case study Stadium deployment in Germany
- Q & A
- LinkPlanner – Some tips and tricks
WLAN Projekt Planning – Asking the right questions

Questions to clarify:
• Existing WLAN infrastructure – what do they currently have, how is it deployed, where do they have issues?
• Future WLAN Requirements
  – Users - Number and type
  – Clients/Devices – number and type – chip set is also important
  – Coverage
  – Can they provide building plans with dimensions?
• Applications
  – VoWLAN
  – Video
  – Alarm Server Integration
  – Location Tracking
  – Telemetry
  – Guest Access Requirements
  – Security
• Challenges
  – Known Interference (X-ray machine, microwave, etc...)
  – Service Options - Mission Critical or not
  – Network Infrastructure/Cabling
  – IT Resources
Different Site Survey Options

- Simulated Plan - Advantages
  - Can be carried out during constructions
  - Can estimate quickly the number of Aps required in order to generate a quote
  - With experience one can estimate the required number of Aps with +10-15% accuracy

- Simulated Plan - Disadvantages
  - You need software
  - It is not as accurate as a site survey carried out onsite
  - If you input the attenuation values of every wall and door it can be a very time consuming process
Different Site Survey Options

• Onsite Site Survey - Advantages
  – You see and measure actual signal strength values as well as noise
  – Onsite it is often possible to see or observe things that you cannot see on a plan
  – In many cases you can get away with using free of charge site survey software

• Onsite Site Survey - Disadvantages
  – Getting access to the building
  – Takes time – 2-3 days depending upon the size
  – Rule of Thumb: 3-4 AP’s per hour
Tools for Site Survey

• Software that must be purchased
  – Ekahau
  – Airmagnet / Netscout

• FOC Software
  – Wi-Fi Analyzer Matt Hafner (Windows Store)
  – inSSIDer (Windows)
    not free of Charge any more (2014)
    $149 cheapest version
  – Netspot Free Edition(Windows/Mac)
  – LinSSID (Linux)
  – Wi-Fi Analyzer (Android)
General Design Guidelines

• Coverage versus Capacity
  – Coverage
    ▪ -65dBm for Voice und Smart Devices, SNR > 25
    ▪ -70dBm for Laptops, SNR > 20
    ▪ When you have a lot of “Noise” you need a better signal
  – Clients/Devices
    ▪ Total number of expected Wi-Fi devices needs to be estimated
    ▪ Understand the applications that will need to be supported (data, voice, video, mission critical)
    ▪ With more that 30-35 Clients per Radio, you will need to add more APs (depending upon the application)
Regional Limitations (Country Specific)

- Transmission Power
  - Depends upon the country
  - Indoor and Outdoor are different

- Channel Usage
Channel Selection

• Typically three or four 2.4 GHz channels are available
  – Usually 1, 6, 11, plus 13 and/or 14 in some geographies

• Nineteen 5GHz channels available (Europe- ETSI regulation)
  – Can have seven bonded (40 MHz) channels or three (80 MHz) channels

• Avoid channel 120,124,128 (weather radar)
Antenna Types

- **Omnidirectional**
  - Provides a 360º coverage

- **Directional Antennas**
  - In order to focus the signal at a specific angle
  - 90º, 120º, 180º Degree options

- **Cambium AP’s have all internal antennas today**
Antenna Types

- Omni Directional – E500 E700

- Directional – E501S or E502S
  - 90° ~ 120° Sector E501S
  - 30° Sector E502S
RF Calculation

• Decibel (dB) is a logarithmic
  – +3dB means x 2 output power (20dbm = 100mW, 23dbm = 200mW)
  – -3dB means x 0.5 (17dbm = 50mw)

• Free-space path loss
  – Also an indoor topic for wide and open areas with low client density
  – 100 Meter distance ≈ 87db loss
  – 18dbm Radio Output Power + 5dbi antenna gain – (-60dbm) receiving signal level for high data rates = 83db path loss / ≈ 65 Meter max distance for the client
Design Considerations

• Coverage will depend upon the type of AP
• Frequency 2.4 GHz or 5 GHz

• Installation
  — Wall
  — Ceiling
  — Suspended Ceiling / Measure signal loss
Ekahau Site Survey Features

- Ekahau = A graphic tool to assist with the planing and installation of a WLAN network
- Features include:
  - Planing
  - Measurement
  - Analysis
  - Reporting
Ekahau Operator Interface

Planning tools: Scale, Simulation, AP, Floor, Wall

Menu und Toolbars
Access Point View
Plan View
Details View
Simulation: Using building plans

- Building plans
Simulation: Without Walls

- Building plans
- Insert APs in order to provide coverage

Signal Strength (in dBm)

-70.0dBm ➞ -20.0dBm
Simulation: Adding Outer Walls

- Building plans
- Insert APs in order to provide coverage
- Here you can see the effect of adding outer walls
Simulation: Adding All Walls

- ... and now the impact of adding all of the walls
- The AP positioning is important

Signalstärke (in dBm)

-70.0dBm ≥ -20.0dBm
Visualisation

- Signal Strength
  - Seen in different colours
  - Simulate with a bad clients
- Transmission Rate
- AP Count
- SNR
- Network Health Check
- Interference levels and Sources
Reporting

• You can create reports for 2.4GHz and 5GHz coverage
• Detailed, non detailed reporting functions
• You can also export heatmaps only
• Floors, areas are selectable
• Docx and PDF format
Creating a Simulated Network Plan

- Import map
- Add walls
- Set Network Health parameters
- Place APs
- Run visualization (5 GHz)
- Run report
Planning your High Capacity WiFi Network
“80% of a WLAN Network’s Performance is related to the correct planning and installation of the network”

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Where do we find High Density?

- Stadiums
- Tradeshow Locations
- Smart Cities
- Concerts
- Events
- Conference Hotels
- Schools/Universities
Planning for High Density?

Factors to take into consideration

- Capacity Requirements
- Availability of the solution - Redundancy
- Number and type of Users / Devices
- Applications
- Installation options – think about the cabling and the physical installation points -> power!
- Temperature – for outdoor installs
- Monitoring/Management – Internet bandwidth, DHCP, DNS for high density
- Authentication Requirements – Guest Portal options

- Project – In Phases:
  - Planning
  - Testing
  - Go Live
Planning for High Density?

- Detailed plans of the Venue are essential
- Onsite visits are required
Sector Planning

- Roll-out in Phases
- Stadium divided into sectors and layers
  - Total Seats 50,000
  - Phase 1 – Osttribune and Familienblock – 150 APs 1 season testing and calibration
  - Build up of a Network Operations Centre for monitoring and troubleshooting
  - Phase 2 – Rollout – 450 APs
- Sectors with directional antennas
  - 2.4 GHz very challenging
  - 5 GHz channel width 20 MHz
  - Reduced output power to 30%
Planning for High Density?

- Physical Installation – Height, Sectors, Static of the building, fire zones
- Channel Planning – Interference 2.4GHz, 5 GHz DFS
- Capacity Planning – Rule of Thumb – 50-100 Clients per AP – depending upon the applications
Q & A?

Cambium Networks™
LinkPlanner
Some tips and tricks
LinkPlanner – Some tips and tricks

- Export of location information from Google maps
- Using Google Earth pro for easily exporting data to LinkPlanner
- Move Network sites inside LinkPlanner
- Adding in obstruction points (buildings, trees) manually
- Spatial Diversity Reflection points
LinkPlanner – Some tips and tricks / Export Google maps

- How export Network Sites with Google – Need a Google account
- Use https://www.google.com/mymaps
- Create different folders for each Project
- Mark your network sites
- And add them to the folder
LinkPlanner – Some tips and tricks / Export Google maps

• Now you can export the locations as .kml file and import it afterwards to LinkPlanner
LinkPlanner – Some tips and tricks / Export with Google Earth

- Much easier to do it directly with Google Earth Pro / Export to an e-mail – or copy paste to LinkPlanner
• Moving Network sites within LinkPlanner using the integrated Google maps option
  - this only works without links, need to switch on “Show the items without links” button
LinkPlanner – Some tips and tricks / Obstruction points

- Adding obstruction points manually, e.g. trees, buildings .....
LinkPlanner – Some tips and tricks / Spatial Diversity - Reflection

- Does the path have a large smooth area?

- Edit Reflection Parameters and Enable Reflection Mitigation – is the reflection point on the smooth area?
• Reflected path is longer than the direct path, which means it can be at a different phase.

• In worst case this can add an anti-phase signal to direct wave causing complete cancellation.

• With the right spacing the two diverse antennas will not be in a null simultaneously.

Required separation is a geometrical calculation.
The reflection editor shows the amount of antenna separation required.

**Licensed Band**

- **Reflection Editor**
  - Enable Reflection Mitigation: ✔
  - Reflection Surface Height (ASL): 1171 meters
  - Multiplier: 1
  - Required Spacing at Lake Hasty: 2.86 meters
  - Required Spacing at Caddo: 5.55 meters

Spacing required at both ends

**Unlicensed Band**

- **Reflection Editor**
  - Enable Reflection Mitigation: ✔
  - Reflection Surface Height (ASL): 1171 meters
  - Multiplier: 1
  - Optimum Spacing at Lake Hasty: 3.70 meters
  - Optimum Spacing at Caddo: 7.19 meters
  - End with Diversity: Caddo
  - Selected Spacing at Caddo: 7.18 meters

Spacing required at one end, choose end
Thank You!!

Cambium Networks™

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