How difficult can it be to install a Wi-Fi network for a large enterprise?

18th of April 2017
1.30pm – 5.00pm
Dubai, United Arab Emirates (UAE)

Ronald van Kleunen
CEO, Globeron Pte Ltd
ronald@globeron.com

2017 BICSI Middle East & Africa Conference & Exhibition
Internet of Things - Data Centre, Wireless, Infrastructure
April 18, 33rd Floor,
Sheikh Rashid Tower, Dubai World Trade Centre, Dubai
Synopsis
Many people install their own access point at home and perceive it is that easy to do the same at a large facility.

However in both environments Wi-Fi issues exist. In this workshop attendees will learn how to troubleshoot Wi-Fi networks, which advance tools exist and to get a better Wi-Fi experience!
Agenda

• Home/residential networks
• Enterprise Level networks
• Troubleshooting Wi-Fi networks
Home/residential networks growing to cities
Example of Radio Frequency (RF) distribution in a home

https://twitter.com/ThingsWork/status/834188228420857856/video/1
Example of 2.4 GHz at DWTC Apartments

<table>
<thead>
<tr>
<th>SSID</th>
<th>MAC Address</th>
<th>RSSI</th>
<th>Chan</th>
<th>802.11</th>
<th>Max Speed</th>
<th>WEP</th>
<th>WPA</th>
<th>WPA2</th>
<th>WPS</th>
<th>Vendor</th>
<th>First</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-50</td>
<td>1</td>
<td>b, g, n</td>
<td>144.4 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:02</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-61</td>
<td>6</td>
<td>b, g, n</td>
<td>144.4 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:02</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-76</td>
<td>6</td>
<td>b, g, n</td>
<td>144.4 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:07</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-73</td>
<td>11</td>
<td>b, g, n</td>
<td>144.4 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:02</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-71</td>
<td>11</td>
<td>b, g, n</td>
<td>144.4 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:02</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>60:7e:02:a2:ff:47</td>
<td>-67</td>
<td>36</td>
<td>a, n</td>
<td>216.7 Mbps Open</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:01</td>
</tr>
<tr>
<td>@DWTC Free Wifi</td>
<td>84:da:7f:05:94:96</td>
<td>-63</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aruba Networks</td>
</tr>
<tr>
<td>DWTC_Exhibitor_Internet</td>
<td>84:da:7f:05:94:90</td>
<td>-83</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aruba Networks</td>
</tr>
</tbody>
</table>

![Network Diagram](image-url)
Example of 5GHz at DWTC Apartments

<table>
<thead>
<tr>
<th>SSID</th>
<th>MAC Address</th>
<th>RSSI</th>
<th>Chan</th>
<th>802.11</th>
<th>Max Speed</th>
<th>WEP</th>
<th>WPA</th>
<th>WPA2</th>
<th>WPS</th>
<th>Vendor</th>
<th>First</th>
<th>First</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>64:70:02:7A:00:27</td>
<td>-67</td>
<td>11</td>
<td>b, g, n</td>
<td>144.4 Mbps</td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:02</td>
<td>00:00</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>64:70:02:7A:7A:02</td>
<td>-71</td>
<td>36</td>
<td>a, n</td>
<td>216.7 Mbps</td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:01</td>
<td>00:00</td>
</tr>
<tr>
<td>[Hidden]</td>
<td>64:70:02:7A:00:27</td>
<td>-84</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:18</td>
<td>00:00</td>
</tr>
<tr>
<td>DWTC-Micros</td>
<td>64:70:02:7A:00:27</td>
<td>-84</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>©DWTC Free Wifi</td>
<td>64:70:02:7A:00:27</td>
<td>-83</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>DWTC_Exhibitor_3G</td>
<td>64:70:02:7A:00:27</td>
<td>-88</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>[Hidden]</td>
<td>64:70:02:7A:00:27</td>
<td>-82</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>5GHz Exhibitor Internet</td>
<td>64:70:02:7A:00:27</td>
<td>-82</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>[Hidden]</td>
<td>64:70:02:7A:00:27</td>
<td>-82</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>DWTC_Exhibitor_3G</td>
<td>64:70:02:7A:00:27</td>
<td>-81</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>5GHz Exhibitor Internet</td>
<td>64:70:02:7A:00:27</td>
<td>-81</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>DWTC-Corp</td>
<td>64:70:02:7A:00:27</td>
<td>-80</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>DWTC-Micros</td>
<td>64:70:02:7A:00:27</td>
<td>-80</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:20:23</td>
<td>00:00</td>
</tr>
<tr>
<td>DTCHA - EmiratesWifi</td>
<td>64:70:02:7A:00:27</td>
<td>-76</td>
<td>11</td>
<td>b, g, n</td>
<td>144.4 Mbps</td>
<td>Open</td>
<td></td>
<td></td>
<td></td>
<td>TP-LINK TECHNOLOGIE</td>
<td>12:20:05</td>
<td>00:00</td>
</tr>
<tr>
<td>[Hidden]</td>
<td>64:70:02:7A:00:27</td>
<td>-80</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:21:11</td>
<td>00:00</td>
</tr>
<tr>
<td>©DWTC Free Wifi</td>
<td>64:70:02:7A:00:27</td>
<td>-81</td>
<td>132+128</td>
<td>n, ac</td>
<td>1170.45 Mbps</td>
<td></td>
<td>PSK-CCMP</td>
<td></td>
<td></td>
<td>Aruba Networks</td>
<td>12:21:11</td>
<td>00:00</td>
</tr>
</tbody>
</table>

Signal Strength | Network Quality | 2.4GHz APs Channels | 5GHz APs Channels

- 5180
- 5240
- 5260
- 5320
- 5500
- 5720
- 5745
- 5805
- 5825

- UNII-1 (Lower)
- UNII-2 (Middle)
- UNII-2 (Extended)
- UNII-3 (ISM)

![Bicsi Middle East & Africa](image)
But Spectrum and Channel planning is not the only item that need to be covered…

- Channel utilization / non Wi-Fi activity
- Protocols / communication / technology
- Services running on top of the network
Wi-Fi Services and Security Impact

End-User experience using Wi-Fi Services

1. Service Availability
2. Service Performance
3. Service Security
Wireless Service overview of “Configuration Items”

- Good/Bad (Rogue) clients
- Roaming
- Low/High Density
- Smartphones/Tablets/Laptops
- Internet of Things (IoT)
- Wireless Access Points
- Rogue APs
- Tethering / IoT
- Cabling
- Infrastructure Devices
- Switches, Routers, Firewalls

Wireless Service: Availability, Performance, Security and Management

- Facility Management
- Racks, DataCenter
- Power, Temperature, etc.

- Content Servers
- Identity Management
- Mobile Device Management
- Logging
- Wireless Controllers
- Cooperative Controllers
- Wireless Network Management Systems
- Cloud based systems

- Wireless Skills
- Business Skills
- Alignment of Skills
Troubleshooting / analyzing Wi-Fi networks

• Connectivity / availability
• Performance
• Security
Workshop 1

Wireless Reconnaissance

Example of Tools:
Apple
- WiFi Scanner
Windows
- Metageek inSSIDer
- Acrylic WiFi
Android
- WiFi Analyser

Dongle requirements:
built-in
built-in adapter
built-in adapter
Wireless Spectrum Analysis

Example of Tools: Dongle
requirements:
Apple iPad/iPhone
  • WiPry (Oscium) 2.4GHz +5 GHz WiPry dongle
Windows
  • Metageek Chanalyser WiSpy dongle
  • Netscout/Spectrum XT SpectrumXT
  • Cisco Cognio SpectrumExpert (3500) Use a Cisco AP
  • Integrated in Site Survey Software
  • Ekahau, Tamosoft, Netscout
Android
  • WiPry
  • RF Explorer 6G Combo

Note: some Enterprise solutions can use the “Sensor-mode” on the AP to do Remote Spectrum Analysis
Workshop 3

Wireless Protocol Analysis

Example of Tools:
- Apple
  - MacOS X
- Windows
  - Wireshark
  - Savvius OmniPeek
  - Netscout AirMagnet WiFi Analyzer
  - TamoSoft CommView
- Android
  - ?

Dongle requirements:
- built-in
- AirPCAP dongle
  - Several (Atheros, etc.)
- Several (Atheros, etc.)

Note: some Enterprise solutions can use the “Sensor-mode” on the AP to do Remote Protocol Analysis
Workshop 4

Wireless Site Survey

Example of Tools:
Apple
- ?
Windows
- Netscout AirMagnet Site SurveyPro
- Ekahau Site Survey (ESS)
- TamoGraph Site Survey
- iBwave WiFi
- VisiWave
- Extreme Networks LAN Planner/AirDefense
Android
- Netscout – AirMapper
- Ekahau
- iBwave Mobile

Dongle requirements:
- Several (Atheros, etc.)
- Several (Atheros, etc.)
- Several (Atheros, etc.)
- Several
- Built-in
- Several (Atheros, etc.)

Note: some Enterprise solutions can use the APs and “Sensors” to visualise the RF propagations on an map.
Wireless Security
(Auditing / PenTest)

Example of Tools:
Apple
• ?
Linux Tool-kits (LiveCDs)
• Kali Linux (aka BackTrack)
• PenToo
• OSWA
Embedded
• WiFi PineApple

Dongle requirements:
Several (Atheros, Ralink)
Several (Atheros, Ralink)
Several (Atheros, Ralink)
# Workshop 6

## Enterprise Level Wireless Management

**Service + Security + MDM (BYOD)**

### Example of Tools:

<table>
<thead>
<tr>
<th>WLAN Management (or Cloud)</th>
<th>WIPS solutions</th>
<th>MDM (Mobile Dev. Mgmt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cisco Prime / Cisco Meraki</td>
<td>• Cisco Meraki (AirMarshall)</td>
<td>• Mobile Iron</td>
</tr>
<tr>
<td>• HP IMC</td>
<td>• Netscout</td>
<td>• Maas 360 (Fiberlink / IBM)</td>
</tr>
<tr>
<td>• HPE/Aruba AirWave</td>
<td>• AirMagnet Enterprise</td>
<td>• AirWatch (Vmware)</td>
</tr>
<tr>
<td>• Extreme Networks AirDefense</td>
<td>• Mojo Networks</td>
<td></td>
</tr>
<tr>
<td>• Mojo Networks</td>
<td>• WIPS</td>
<td></td>
</tr>
<tr>
<td>• Ruckus</td>
<td>• AirDefense WIPS</td>
<td></td>
</tr>
<tr>
<td>• 7 Signals (Performance Mgmt)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
All the other configuration items part of a wireless service

Cabling
Power (PoE), UPS
Aircon
Switches, Routers, etc.
Firewalls
Applications
Databases
Approach

• Requirements (big list)
  • Coverage, Capacity, Devices, Security, Aesthetics, etc.

• Design
  • Many approaches, there is not 1 design fits all

• Installation
  • Who installs, which std they follow?

• Validation
  • Which thresholds to follow

• Operation / Management
BICSI Wireless Subcommittee


Wireless Systems Subcommittee

Leadership
Mike Patterson, Rcdd, Nts  
mike@physical-layer.com

Mission Statement
This subcommittee develops vendor-neutral standards and/or best practices standards and documents as needed for the design and installation of radio and other wireless systems. This subcommittee will also monitor existing codes and standards concerning radio and wireless systems and report on related activity.

Standards Published
ANSI/BICSI 006-2015, Distributed Antenna System (DAS) Design and Installation

Subcommittee Activity
Summary

- To design and implement Wi-Fi networks should not be underestimated
- Get (certified) Wi-Fi professionals involved who understand how Wi-Fi works and can help with design, coverage, performance and troubleshooting
- Educate/train installers how to mount Wi-Fi devices
- Get Security professionals involved to validate the security of these networks.
- 24x7 Wireless network management
How difficult can it be to install a Wi-Fi network for a large enterprise?

18th of April 2017
1.30pm – 5.00pm
Dubai, United Arab Emirates (UAE)

Ronald van Kleunen
CEO, Globeron Pte Ltd
ronald@globeron.com