802.11 Protocol Chaos

Andrés Blanco
@6e726d

Is there something new?

IEEE 802.11 frames

Management

- Association Request
- Association Response
- Reassociation Request
- Reassociation Response
- Probe Request
- Probe Response
- Beacon
- ATIM
- Disassociation
- Authentication
- Deauthentication
- Action

Control

- Block ACK Request
- Block ACK
- PS-Poll
- RTS
- CTS
- ACK
- CF-End
- CF-End+CF-ACK

Data

- Data
- Data+CF-ACK
- Data+CF-Poll
- Data+CF-ACK+CF-Poll
- Null
- CF-ACK
- CF-Poll
- CF-ACK+CF-Poll
- QoS data
- QoS data+CF-ACK
- QoS data+CF-Poll
- QoS data+CF-ACK+CF-Poll
- QoS Null
- QoS+CF-Poll
- QoS+CF-ACK

Management frames

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- Association Response
- Reassociation Request
- Reassociation Response
- Probe Request
- Probe Response
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- Deauthentication
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- CF-ACK+CF-Poll
- QoS data
- QoS data+CF-ACK
- QoS data+CF-Poll
- QoS data+CF-ACK+CF-Poll
- QoS Null
- QoS+CF-Poll
- QoS+CF-ACK

Type	Length	Value
1 byte	**1 byte**	**1-255 byte**

Information Elements

Free Information

Cisco Client Extensions

If Aironet IE support is enabled, the access point sends an Aironet IE 0x85 (which contains the access point name, load, number of associated clients, and so on) in the beacon and probe responses of this WLAN, and the controller sends Aironet IEs 0x85 and 0x95 (which contains the management IP address of the controller and the IP address of the access point) in the reassociation response if it receives Aironet IE 0x85 in the reassociation request.

```
▶ Frame 6440: 253 bytes on wire (2024 bits), 253 bytes captured (2024 bits)
▶ IEEE 802.11 Beacon frame, Flags: ........
▼ IEEE 802.11 wireless LAN management frame
  ▶ Fixed parameters (12 bytes)
  ▼ Tagged parameters (217 bytes)
    ▶ Tag: SSID parameter set: \000
    ▶ Tag: Supported Rates 36(B), 48, 54, [Mbit/sec]
    ▶ Tag: DS Parameter set: Current Channel: 11
    ▶ Tag: Traffic Indication Map (TIM): DTIM 0 of 4 bitmap
    ▶ Tag: Country Information: Country Code US, Environment Any
    ▶ Tag: QBSS Load Element 802.11e CCA Version
    ▶ Tag: ERP Information
    ▶ Tag: HT Capabilities (802.11n D1.10)
    ▶ Tag: RSN Information
    ▶ Tag: HT Information (802.11n D1.10)
    ▼ Tag: Cisco CCX1 CKIP + Device Name
        Tag Number: Cisco CCX1 CKIP + Device Name (133)
        Tag length: 30
        Unknown: 07008f000f00ff035900
        Name: B67-DISASTER-AP
        Clients: 17
        Unknown2: 00003c
    ▶ Tag: Vendor Specific: Aironet: Aironet DTPC Powerlevel 0x0B
    ▶ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
    ▶ Tag: Vendor Specific: Aironet: Aironet Unknown (1) (1)
    ▶ Tag: Vendor Specific: Aironet: Aironet CCX version = 5
    ▶ Tag: Vendor Specific: Aironet: Aironet Unknown (11) (11)
    ▶ Tag: Vendor Specific: Aironet: Aironet Unknown (19)
```

CCX Information Elements

```
▶ Frame 10458: 173 bytes on wire (1384 bits), 173 bytes captured (1384 bits)
▶ IEEE 802.11 Reassociation Response, Flags: ........
▼ IEEE 802.11 wireless LAN management frame
  ▶ Fixed parameters (6 bytes)
  ▼ Tagged parameters (143 bytes)
    ▶ Tag: Supported Rates 36(B), 48, 54, [Mbit/sec]
    ▶ Tag: Extended Supported Rates 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
    ▶ Tag: HT Capabilities (802.11n D1.10)
    ▶ Tag: HT Information (802.11n D1.10)
    ▼ Tag: Cisco CCX1 CKIP + Device Name
        Tag Number: Cisco CCX1 CKIP + Device Name (133)
        Tag length: 30
        Unknown: 00008f0a0f00ff034000
        Name: B67-DISASTER-AP
        Clients: 0
        Unknown2: 00003c
    ▼ Tag: Cisco Unknown 95: Undecoded
      ▶ Tag Number: Cisco Unknown 95 (149)
        Tag length: 10
        Tag Data: 004096000a0f03010000
    ▶ Tag: Vendor Specific: Aironet: Aironet CCX version = 5
    ▶ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
```

Wireless LAN Controller

```
▶ Frame 166846: 256 bytes on wire (2048 bits), 256 bytes captured (2048 bits)
▼ IEEE 802.11 Reassociation Request, Flags: ........
    Type/Subtype: Reassociation Request (0x0002)
  ▶ Frame Control Field: 0x2000
    .000 0000 0010 1000 = Duration: 40 microseconds
    Receiver address:
    Destination address:
    Transmitter address: 00:de:ad:be:ef:00 (00:de:ad:be:ef:00)
    Source address: 00:de:ad:be:ef:00 (00:de:ad:be:ef:00)
    BSS Id: CiscoInc_53:85:f7 (68:86:a7:53:85:f7)
    .... .... .... 0000 = Fragment number: 0
    0011 1001 0000 .... = Sequence number: 912
▼ IEEE 802.11 wireless LAN management frame
  ▶ Fixed parameters (10 bytes)
  ▼ Tagged parameters (222 bytes)
```

```
  ▶ Tag: SSID parameter set: Usuarios
  ▶ Tag: Supported Rates 1(B), 2(B), 5.5(B), 6, 9, 11(B), 12, 18, [Mbit/sec]
  ▶ Tag: DS Parameter set: Current Channel: 6
  ▶ Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
  ▶ Tag: Country Information: Country Code AR, Environment Any
  ▶ Tag: QBSS Load Element 802.11e CCA Version
  ▶ Tag: ERP Information
  ▶ Tag: HT Capabilities (802.11n D1.10)
  ▶ Tag: RSN Information
  ▶ Tag: Extended Supported Rates 24, 36, 48, 54, [Mbit/sec]
  ▶ Tag: HT Information (802.11n D1.10)
  ▶ Tag: Cisco CCX1 CKIP + Device Name
  ▶ Tag: Vendor Specific: Aironet: Aironet DTPC Powerlevel 0x11
  ▶ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
  ▶ Tag: Vendor Specific: Aironet: Aironet Unknown (1) (1)
```

Fake reassociation request frame

```
▶ Frame 166851: 111 bytes on wire (888 bits), 111 bytes captured (888 bits)
▼ IEEE 802.11 Reassociation Response, Flags: ....R...
    Type/Subtype: Reassociation Response (0x0003)
  ▶ Frame Control Field: 0x3008
    .000 0001 0011 1010 = Duration: 314 microseconds
    Receiver address: 00:de:ad:be:ef:00 (00:de:ad:be:ef:00)
    Destination address: 00:de:ad:be:ef:00 (00:de:ad:be:ef:00)
    Transmitter address:
    Source address:
    BSS Id:
    .... .... .... 0000 = Fragment number: 0
    1000 0011 1111 .... = Sequence number: 2111
▼ IEEE 802.11 wireless LAN management frame
  ▼ Fixed parameters (6 bytes)
```

Reassociation response

```
    ▶ Capabilities Information: 0x0431
      Status code: Successful (0x0000)
      ..00 0000 1001 1101 = Association ID: 0x009d
  ▼ Tagged parameters (81 bytes)
    ▶ Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 6, 9, 12, 18, [Mbit/sec]
    ▶ Tag: Extended Supported Rates 24, 36, 48, 54, [Mbit/sec]
    ▶ Tag: Cisco CCX1 CKIP + Device Name
    ▼ Tag: Cisco Unknown 95: Undecoded
      ▶ Tag Number: Cisco Unknown 95 (149)
        Tag length: 10
        Tag Data: 00409600ac1c11990000
    ▶ Tag: Vendor Specific: Aironet: Aironet CCX version = 5
    ▶ Tag: Vendor Specific: Aironet: Aironet Unknown (11) (11)
    ▶ Tag: Vendor Specific: Aironet: Aironet Client MFP Enabled
```

WPS & WiFi-Direct

```
▸ Radiotap Header v0, Length 36
▸ 802.11 radio information
▸ IEEE 802.11 Probe Response, Flags: ....R...C
▾ IEEE 802.11 wireless LAN management frame
  ▸ Fixed parameters (12 bytes)
  ▾ Tagged parameters (319 bytes)
    ▸ Tag: SSID parameter set: (T_T)
    ▸ Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54, [Mbit/sec]
    ▸ Tag: DS Parameter set: Current Channel: 10
    ▸ Tag: ERP Information
    ▸ Tag: ERP Information
    ▸ Tag: RSN Information
    ▸ Tag: Extended Supported Rates 6, 9, 12, 48, [Mbit/sec]
    ▸ Tag: QBSS Load Element 802.11e CCA Version
    ▸ Tag: HT Capabilities (802.11n D1.10)
    ▸ Tag: HT Information (802.11n D1.10)
    ▸ Tag: Overlapping BSS Scan Parameters: Undecoded
    ▸ Tag: Extended Capabilities (8 octets)
```

WPS Information Element

```
    ▾ Tag: Vendor Specific: Microsof: WPS
        Tag Number: Vendor Specific (221)
        Tag length: 134
        OUI: 00-50-f2
        Vendor Specific OUI Type: 4
        Type: WPS (0x04)
      ▸ Version: 0x10
      ▸ Wifi Protected Setup State: Configured (0x02)
      ▸ Ap Setup Locked: 0x01
      ▸ Response Type: AP (0x03)
      ▸ UUID E
      ▸ Manufacturer: NETGEAR, Inc.
      ▸ Model Name: R6300v2
      ▸ Model Number: R6300v2
      ▸ Serial Number: 679
      ▸ Primary Device Type
      ▸ Device Name: R6300v2
      ▸ Config Methods: 0x2008
```

Frame 4031: 334 bytes on wire (2672 bits), 334 bytes captured (2672 bits) on interface 0
Radiotap Header v0, Length 36
802.11 radio information
IEEE 802.11 Probe Response, Flags: C
IEEE 802.11 wireless LAN management frame
Fixed parameters (12 bytes)
Tagged parameters (258 bytes)
Tag: SSID parameter set: ciscosb
Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54, [Mbit/sec]
Tag: DS Parameter set: Current Channel: 1
Tag: Country Information: Country Code US, Environment Any
Tag: ERP Information
Tag: ERP Information
Tag: RSN Information
Tag: Extended Supported Rates 6, 9, 12, 48, [Mbit/sec]
Tag: Vendor Specific: Microsof: WPS
Tag Number: Vendor Specific (221)
Tag length: 155
OUI: 00-50-f2
Vendor Specific OUI Type: 4
Type: WPS (0x04)
Version: 0x10
Wifi Protected Setup State: Not configured (0x01)
Response Type: AP (0x03)
UUID E
Manufacturer: Cisco Small Business
Model Name: WAP121
Model Number: SER192401TV
Serial Number: SER192401TV
Primary Device Type
Dev
Cor
RF
Ver
Tag: \
Tag: \

WPS serial numbers

- Frame 154: 395 bytes on wire (3160 bits), 395 bytes captured (3160 bits) on interf
- Radiotap Header v0, Length 36
- 802.11 radio information
- IEEE 802.11 Probe Response, Flags: C
- IEEE 802.11 wireless LAN management frame
  - Fixed parameters (12 bytes)
  - Tagged parameters (319 bytes)
    - Tag: SSID parameter set: (T_T)
    - Tag: Supported Rates 1(B), 2(B), 5.5, 11, 18, 24, 36, 54, [Mbit/sec]
    - Tag: DS Parameter set: Current Channel: 10
    - Tag: ERP Information
    - Tag: ERP Information
    - Tag: RSN Information
    - Tag: Extended Supported Rates 6, 9, 12, 48, [Mbit/sec]
    - Tag: QBSS Load Element 802.11e CCA Version
    - Tag: HT Capabilities (802.11n D1.10)
    - Tag: HT Information (802.11n D1.10)
    - Tag: Overlapping BSS Scan Parameters: Undecoded
    - Tag: Extended Capabilities (8 octets)
    - Tag: Vendor Specific: Microsof: WPS
      - Tag Number: Vendor Specific (221)
      - Tag length: 134
      - OUI: 00-50-f2
      - Vendor Specific OUI Type: 4
      - Type: WPS (0x04)
      - Version: 0x10
      - Wifi Protected Setup State: Configured (0x02)
      - Ap Setup Locked: 0x01
      - Response Type: AP (0x03)
      - UUID E
      - Manufacturer: NETGEAR, Inc.
      - Model Name: R6300v2
      - Model Number: R6300v2

Disable WPS?

```
▸ Fixed parameters (12 bytes)
▾ Tagged parameters (319 bytes)
  ▸ Tag: SSID parameter set: (T_T)
  ▸ Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54, [Mbit/sec]
  ▸ Tag: DS Parameter set: Current Channel: 10
  ▸ Tag: ERP Information
  ▸ Tag: ERP Information
  ▸ Tag: RSN Information
  ▸ Tag: Extended Supported Rates 6, 9, 12, 48, [Mbit/sec]
  ▸ Tag: QBSS Load Element 802.11e CCA Version
  ▸ Tag: HT Capabilities (802.11n D1.10)
  ▸ Tag: HT Information (802.11n D1.10)
  ▸ Tag: Overlapping BSS Scan Parameters: Undecoded
  ▸ Tag: Extended Capabilities (8 octets)
  ▾ Tag: Vendor Specific: Microsof: WPS
      Tag Number: Vendor Specific (221)
      Tag length: 134
      OUI: 00-50-f2
      Vendor Specific OUI Type: 4
      Type: WPS (0x04)
    ▸ Version: 0x10
    ▸ Wifi Protected Setup State: Not configured (0x01)
    ▸ Ap Setup Locked: 0x01
    ▸ Response Type: AP (0x03)
    ▸ UUID E
    ▸ Manufacturer: NETGEAR, Inc.
    ▸ Model Name: R6300v2
    ▸ Model Number: R6300v2
    ▸ Serial Number: 679
    ▸ Primary Device Type
    ▸ Device Name: R6300v2
    ▸ Config Methods: 0x2008
    ▸ RF Bands: 2.4 and 5 GHz (0x03)
    ▸ Vendor Extension
  ▸ Tag: Vendor Specific: Broadcom
  ▸ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
  ▸ Tag: RM Enabled Capabilities (5 octets)
```

Disable WPS?

```
▶ Fixed parameters (12 bytes)
▼ Tagged parameters (264 bytes)
   ▶ Tag: SSID parameter set: DIRECT-
   ▶ Tag: Supported Rates 6(B), 9(B),                    48, 54, [Mbit/sec]
   ▶ Tag: DS Parameter set: Current Channel: 10
   ▼ Tag: Vendor Specific: Microsof: WPS
        Tag Number: Vendor Specific (221)
        Tag length: 163
        OUI: 00-50-f2
        Vendor Specific OUI Type: 4
        Type: WPS (0x04)
      ▶ Version: 0x10
      ▶ Wifi Protected Setup State: Not configured (0x01)
      ▶ Device Password ID: PIN (default) (0x0000)
      ▶ Response Type: Enrollee, Info only (0x00)
      ▶ UUID E
      ▶ Manufacturer: Western Digital Corporation
      ▶ Model Name: WD TV Live
      ▶ Model Number: WDBHG70000NBK
      ▶ Serial Number: WNC441203527
      ▶ Primary Device Type
      ▶ Device Name: WDTVLive
      ▶ Config Methods: 0x2388
      ▶ Vendor Extension
   ▼ Tag: Vendor Specific: Wi-FiAll: P2P
        Tag Number: Vendor Specific (221)
        Tag length: 41
        OUI: 50-6f-9a
        Vendor Specific OUI Type: 9
      ▶ P2P Capability: Device 0x23  Group 0x0
      ▶ P2P Device Info
   ▶ Tag: Vendor Specific: Wi-FiAll: Wi-Fi Display
```

WiFi-Direct

```
▶ Frame 244847: 417 bytes on wire (3336 bits), 417 bytes captured (3336 bits)
▶ IEEE 802.11 Beacon frame, Flags: ........
▼ IEEE 802.11 wireless LAN management frame
  ▶ Fixed parameters (12 bytes)
  ▼ Tagged parameters (381 bytes)
    ▶ Tag: SSID parameter set: DIRECT-24-HP DeskJet 3630 series
    ▶ Tag: Supported Rates 6(B), 9, 12(B), 18, 24(B), 36, 48, 54, [Mbit/sec]
    ▶ Tag: DS Parameter set: Current Channel: 1
    ▶ Tag: Traffic Indication Map (TIM): DTIM 0 of 0 bitmap
    ▶ Tag: Power Constraint: 0
    ▶ Tag: TPC Report Transmit Power: 17, Link Margin: 0
    ▶ Tag: ERP Information
    ▶ Tag: ERP Information
    ▶ Tag: RSN Information
    ▶ Tag: HT Capabilities (802.11n D1.10)
    ▶ Tag: HT Information (802.11n D1.10)
    ▶ Tag: Vendor Specific: Broadcom
    ▶ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
    ▶ Tag: Vendor Specific: Microsof: WPS
    ▼ Tag: Vendor Specific: HP
        Tag Number: Vendor Specific (221)
        Tag length: 98
        OUI: 08-00-09
        Vendor Specific OUI Type: 0
        Vendor Specific Data: 000400000017010201000314446573 6b4a65742033363330...
```

Information Elements for everyone

```
BSSID: FC:3F:DB:98:9D:42
0000  00 04 00 00 00 17 01 02 01 00 03 14 44 65 73 6b   ............Desk
0010  4a 65 74 20 33 36 33 30 20 73 65 72 69 65 73 00   Jet 3630 series.
0020  04 05 33 36 33 30 00 05 10 43 4e 36 33 37 33 4e   ..3630...CN6373N
0030  32 35 51 30 36 37 50 00 00 06 10 1c 85 2a 4d b8   25Q067P......*M.
0040  00 1f 08 ab cd fc 3f db 98 5f 24 07 04 c0 a8 00   ......?.._$.....
0050  99 08 02 00 c4 09 02 00 08 0a 04                  ...........

Status Bitfield: '\x00\x00\x00\x17' - 23
 - Station is on.
 - Station is configured.
 - Station is connected.
 - Station doesn't support 5GHz.
 - USB connected to host.
AWC version: 1.0
Model Name: DeskJet 3630 series
Product SKU: 3630
Serial Number: CN6373N25Q067P
UUID: 1C852A4DB8001F08ABCDFC3FDB985F24
IPv4 Address: 192.168.0.153
--------------------------------------------------------------------------------
```

Information Elements for everyone

```
▶ Frame 342226: 444 bytes on wire (3552 bits), 444 bytes captured (3552 bits)
▶ IEEE 802.11 Probe Response, Flags: ........
▼ IEEE 802.11 wireless LAN management frame
  ▶ Fixed parameters (12 bytes)
  ▼ Tagged parameters (408 bytes)
    ▶ Tag: SSID parameter set: DIRECT-R3Samsung Wireless Audio
    ▶ Tag: Supported Rates 6, 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
    ▶ Tag: DS Parameter set: Current Channel: 11
    ▶ Tag: ERP Information
    ▶ Tag: HT Capabilities (802.11n D1.10)
    ▶ Tag: HT Information (802.11n D1.10)
    ▶ Tag: RSN Information
    ▶ Tag: Vendor Specific: Microsof: WMM/WME: Parameter Element
    ▶ Tag: Vendor Specific: Microsof: WPS
    ▼ Tag: Vendor Specific: 00:2d:25
        Tag Number: Vendor Specific (221)
        Tag length: 56
        OUI: 00-2d-25 ()
        Vendor Specific OUI Type: 32
        Vendor Specific Data: 2000310010c0a80103244b0378f417264b0378f417c0ffd4...
▶ Tag: Vendor Specific: Wi-FiAll: P2P
```

Information Elements for everyone

```
▶ Frame 600: 815 bytes on wire (6520 bits), 815 bytes captured (6520 bits)
▶ Radiotap Header v0, Length 36
▶ 802.11 radio information
▼ IEEE 802.11 Action, Flags: ........C
    Type/Subtype: Action (0x000d)
  ▶ Frame Control Field: 0xd000
    .000 0000 0000 0000 = Duration: 0 microseconds
    Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)
    Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
    Transmitter address: 9e:ae:17:fd:e4:3b (9e:ae:17:fd:e4:3b)
    Source address: 9e:ae:17:fd:e4:3b (9e:ae:17:fd:e4:3b)
    BSS Id: Apple_ff:94:73 (00:25:00:ff:94:73)
    .... .... .... 0000 = Fragment number: 0
    1100 1001 1001 .... = Sequence number: 3225
  ▶ Frame check sequence: 0xf3580425 [correct]
▶ IEEE 802.11 wireless LAN management frame
▶ [Malformed Packet: IEEE 802.11]
```

```
01c0  46 46 37 2c 30 78 45 08  6d 64 3d 30 2c 31 2c 32   FF7,0xE. md=0,1,2
01d0  0d 61 6d 3d 41 70 70 6c  65 54 56 33 2c 31 43 70   .am=Appl eTV3,1Cp
01e0  6b 3d 37 62 36 33 33 37  61 38 37 64 62 62 36 30   k=7b6337 a87dbb60
01f0  30 36 66 65 63 66 30 30  37 30 30 34 66 33 62 30   06fecf00 7004f3b0
0200  62 31 34 65 32 38 65 31  66 64 39 31 30 64 36 62   b14e28e1 fd910d6b
0210  63 33 33 39 64 39 31 34  39 30 39 34 65 63 62 61   c339d914 9094ecba
0220  65 64 06 73 66 3d 30 78  34 06 74 70 3d 55 44 50   ed.sf=0x 4.tp=UDP
0230  08 76 6e 3d 36 35 35 33  37 09 76 73 3d 32 32 30   .vn=6553 7.vs=220
0240  2e 36 38 04 76 76 3d 32  02 e0 00 0c 00 08 61 70   .68.vv=2 ......ap
0250  70 6c 65 20 74 76 c0 01  10 ce 00 00 00 1a 64 65   ple tv.. ......de
0260  76 69 63 65 69 64 3d 37  43 3a 44 31 3a 43 33 3a   viceid=7 C:D1:C3:
0270  32 36 3a 35 34 3a 44 31  17 66 65 61 74 75 72 65   [redacted] .feature
0280  73 3d 30 78 35 41 37 46  46 46 46 37 2c 30 78 45   s=0x5A7F FFF7,0xE
0290  09 66 6c 61 67 73 3d 30  78 34 10 6d 6f 64 65 6c   .flags=0 x4.model
02a0  3d 41 70 70 6c 65 54 56  33 2c 31 43 70 6b 3d 37   =AppleTV 3,1Cpk=7
02b0  62 36 33 33 37 61 38 37  64 62 62 36 30 30 36 66   b6337a87 dbb6006f
02c0  65 63 66 30 30 37 30 30  34 66 33 62 30 62 31 34   ecf00700 4f3b0b14
```

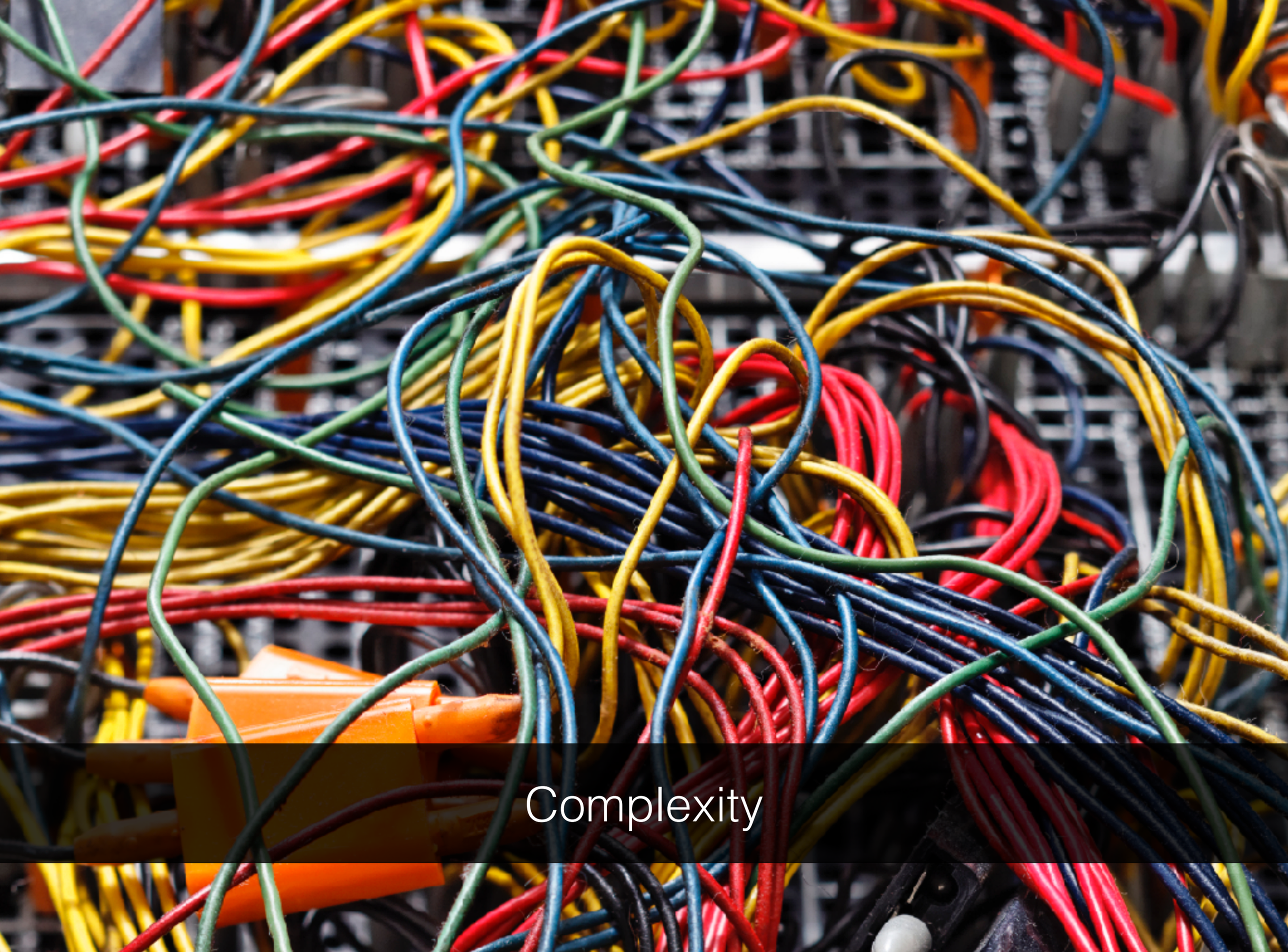
MAC randomization - AirPlay

MAC randomization - AirDrop

```
802.11 radio information
IEEE 802.11 Action, Flags: ........C
    Type/Subtype: Action (0x000d)
  ▸ Frame Control Field: 0xd000
    .000 0000 0000 0000 = Duration: 0 microseconds
    Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)
    Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
    Transmitter address: 1a:ea:15:4d:c3:14 (1a:ea:15:4d:c3:14)
    Source address: 1a:ea:15:4d:c3:14 (1a:ea:15:4d:c3:14)
    BSS Id: Apple_ff:94:73 (00:25:00:ff:94:73)
    .... .... .... 0000 = Fragment number: 0
    1000 1101 0011 .... = Sequence number: 2259
  ▸ Frame check sequence: 0xf1eba79d [correct]
```

```
0000  00 00 24 00 2f 40 00 a0  20 08 00 00 00 00 00 00   ..$./@..  .......
0010  c6 e1 72 09 00 00 00 00  10 18 85 09 c0 00 0c 00   ..r..... ........
0020  00 00 0c 00 d0 00 00 00  ff ff ff ff ff ff 1a ea   ........ ........
0030  15 4d c3 14 00 25 00 ff  94 73 30 8d 7f 00 17 f2   .M...%.. .s0.....
0040  08 10 03 00 5f 42 4f 01  43 42 4f 01 04 49 00 06   ...._BO. CBO..I..
0050  36 00 95 00 10 00 b8 01  00 18 10 00 10 00 06 00   6....... ........
0060  03 03 03 03 1a ea 15 4d  c3 14 04 00 b8 00 00 00   .......M ........
0070  0f 01 00 03 ff ff 1d 97  1d 97 1d 97 1d 97 1d 97   ........ ........
0080  1d 97 2b 06 2b 06 1d 97  1d 97 1d 97 1d 97 1d 97   ..+.+... ........
0090  1d 97 2b 06 2b 06 00 00  05 25 00 01 00 00 00 00   ..+.+... .%......
00a0  1a ea 15 4d c3 14 06 01  00 00 06 01 00 00 00 00   ...M.... ........
00b0  6a b5 ee 92 bf a4 00 00  00 00 6f 51 00 00 00 00   j....... ..oQ....
00c0  12 29 00 0f 03 00 03 ff  ff 95 80 95 80 95 80 95   .)...... ........
00d0  80 95 80 95 80 06 51 06  51 95 80 95 80 95 80 95   ......Q. Q.......
00e0  80 95 80 95 80 06 51 06  51 00 00 00 0c 1b 00 27   ......Q. Q......'
00f0  0f 41 52 00 95 00 78 45  61 e0 6f 70 06 00 e8 b2   .AR...xE a.op....
0100  ac 08 b4 88 1a ea 15 4d  c3 14 06 0d 00 00 00 00   .......M ........
0110  65 00 04 00 0c 40 01 80  40 02 07 09 00 00 00 6f   e....@.. @......o
0120                                                     ........ ....M...
0130                                                     ....2... ........
0140                                                     .....Jea n-Charle
0150                                                     s-iPad.. ........
0160  03 00 c0 07 0c 0f 00 00  00 0c 33 34 35 39 65 36   ........ ..3459e6
0170  39 30 64 66 32 31 c0 00  02 30 00 10 00 0c 33 34   90df21.. .0....34
0180  35 39 65 36 39 30 64 66  32 31 c0 07 21 1a 00 00   59e690df 21..!...
0190  00 00 00 00 00 22 42 11  4a 65 61 6e 2d 43 68 61   ....."B. Jean-Cha
```

Wi-Fi Address E8:B2:AC:08:B4:88



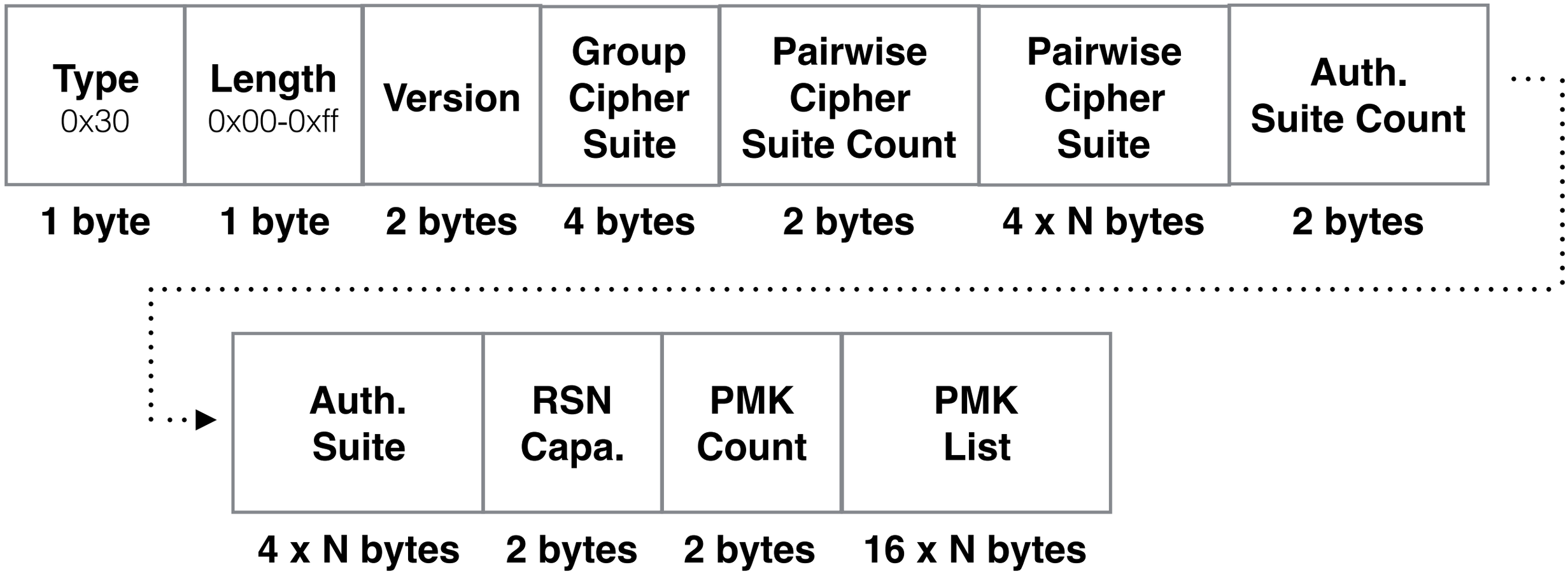
Complexity

SoftMAC Wireless NIC

FullMAC Wireless NIC

Type 0x00	**Length** 0x00-0x20	**Value**
1 byte	**1 byte**	**0-32 byte/s**

SSID Information Element

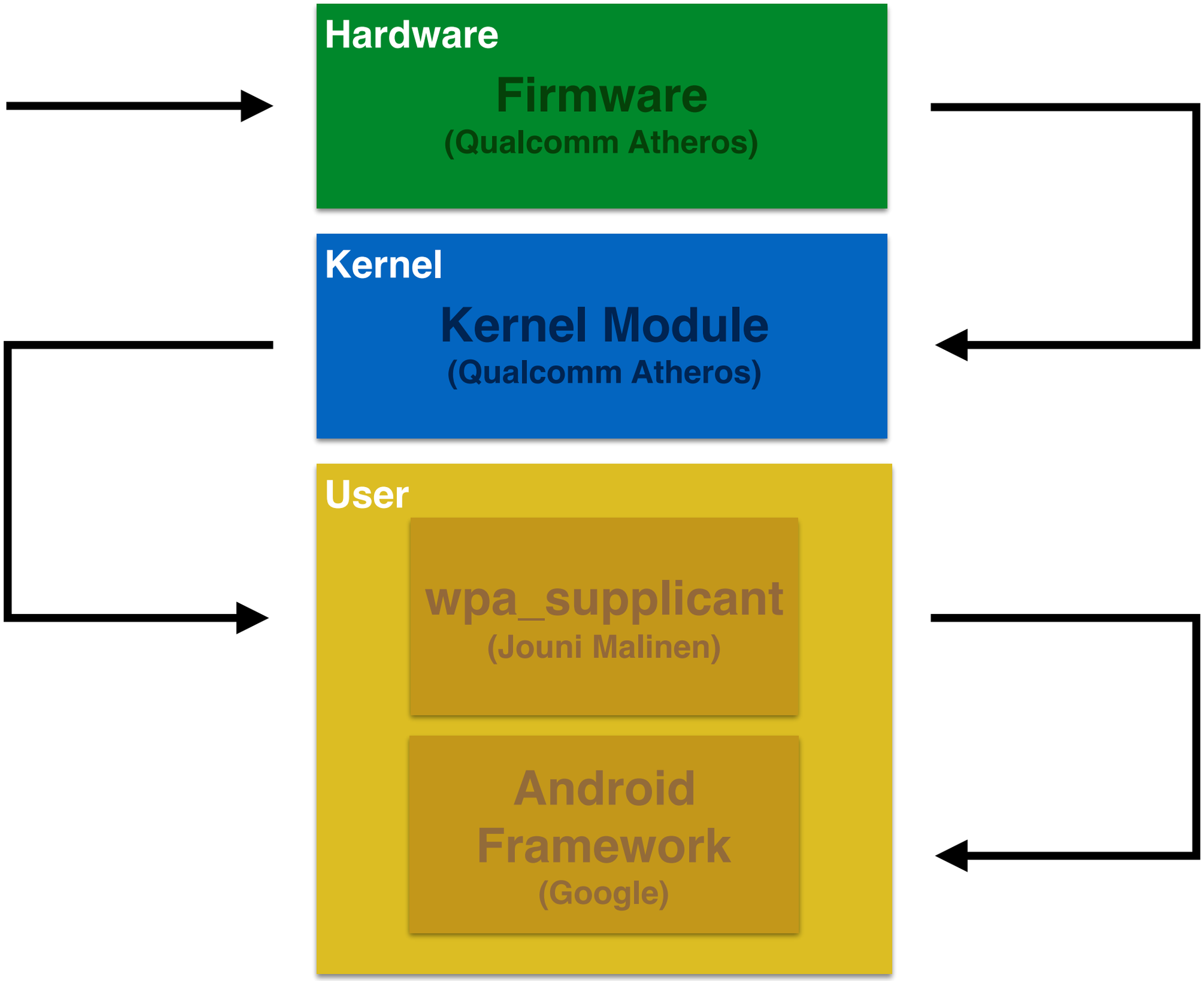


RSN Information Element

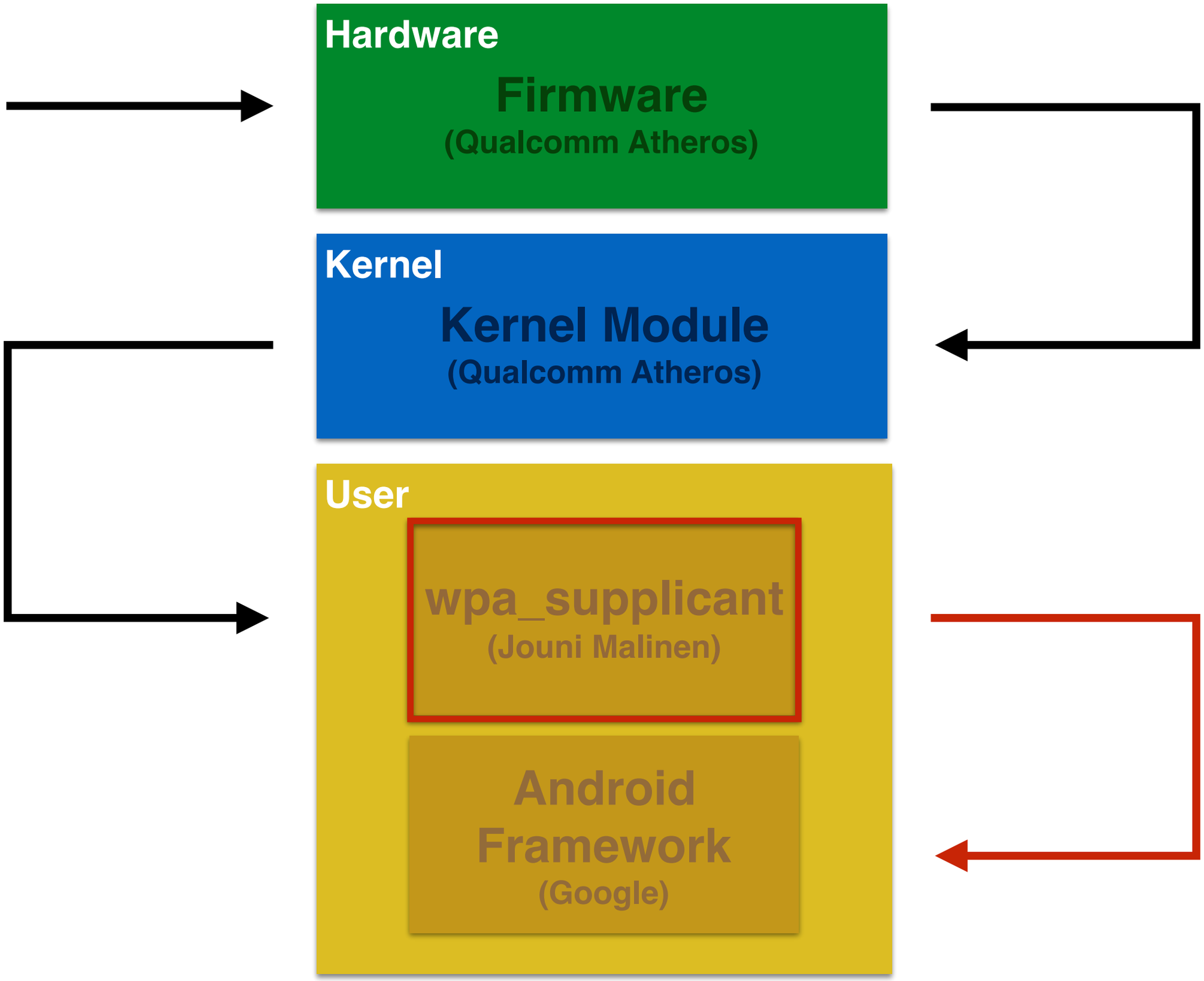
```
▸ Frame 1165: 119 bytes on wire (952 bits), 119 bytes captured (952 bits) on interface 0
▸ Radiotap Header v0, Length 36
▸ 802.11 radio information
▾ IEEE 802.11 Beacon frame, Flags: ........C
    Type/Subtype: Beacon frame (0x0008)
  ▸ Frame Control Field: 0x8000
    .000 0000 0000 0000 = Duration: 0 microseconds
    Receiver address: Broadcast (ff:ff:ff:ff:ff:ff)
    Destination address: Broadcast (ff:ff:ff:ff:ff:ff)
    Transmitter address: fa:fa:fa:fa:fa:fa (fa:fa:fa:fa:fa:fa)
    Source address: fa:fa:fa:fa:fa:fa (fa:fa:fa:fa:fa:fa)
    BSS Id: fa:fa:fa:fa:fa:fa (fa:fa:fa:fa:fa:fa)
    .... .... .... 0000 = Fragment number: 0
    0111 0011 1100 .... = Sequence number: 1852
  ▸ Frame check sequence: 0xc201c58e [correct]
▾ IEEE 802.11 wireless LAN management frame
  ▸ Fixed parameters (12 bytes)
```

CVE-2012-2619

```
  ▾ Tagged parameters (43 bytes)
    ▸ Tag: SSID parameter set: fafafa
    ▸ Tag: Supported Rates 1(B), 2(B), 5.5(B), 11(B), 18, 24, 36, 54, [Mbit/sec]
    ▸ Tag: DS Parameter set: Current Channel: 6
    ▾ Tag: RSN Information
        Tag Number: RSN Information (48)
        Tag length: 20
        RSN Version: 1
      ▸ Group Cipher Suite: 00-0f-ac AES (CCM)
        Pairwise Cipher Suite Count: 1
      ▸ Pairwise Cipher Suite List 00-0f-ac AES (CCM)
      ▸ Auth Key Management (AKM) Suite Count: 65535
      ▸ Auth Key Management (AKM) List 00-0f-ac PSK
      ▸ RSN Capabilities: 0x0000
```



802.11 Android architecture



802.11 Android architecture

```
D/TCMD    (  519): Listening for incoming client connection request
I/wpa_supplicant( 3482): P2P-DEVICE-FOUND 70:5a:0f:16:ed:54 p2p_dev_addr=72:5a:0f:16:b4:66 pri_de
 name='DIRECT-66-HP OfficeJet Pro 8710' config_methods=0x5a88 dev_capab=0x4 group_capab=0x1 level
I/wpa_supplicant( 3482): P2P-DEVICE-FOUND 00:de:ad:fa:fa:fa p2p_dev_addr=00:de:ad:fa:fa:fa pri_de
5 name='fafa<FA><FA>' config_methods=0x188 dev_capab=0x21 group_capab=0x0 level=-27
D/MDMCTBK (  267): reply_len: 40 reply is = <3>P2P-DEVICE-FOUND 70:5a:0f:16:ed:54 p2
D/MDMCTBK (  267): Event received = P2P-DEVICE-FOUND 70:5a:0f:16:ed:54 p2
D/MDMCTBK (  267): reply_len: 40 reply is = <3>P2P-DEVICE-FOUND 00:de:ad:fa:fa:fa p2
D/MDMCTBK (  267): Event received = P2P-DEVICE-FOUND 00:de:ad:fa:fa:fa p2
D/WifiP2pService( 1024): InactiveState{ when=-1ms what=147477 obj=Device: DIRECT-66-HP OfficeJet
D/WifiP2pService( 1024):  deviceAddress: 72:5a:0f:16:b4:66
D/WifiP2pService( 1024):  primary type: 3-0050F204-1
D/WifiP2pService( 1024):  secondary type: null
D/WifiP2pService( 1024):  wps: 23176
D/WifiP2pService( 1024):  grpcapab: 1
D/WifiP2pService( 1024):  devcapab: 4
D/WifiP2pService( 1024):  status: 3
D/WifiP2pService( 1024):  wfdInfo: null
D/WifiP2pService( 1024):  level: -49 target=com.android.internal.util.StateMachine$SmHandler }
```

```
D/WifiP2pService( 1024): P2pEnabledState{ when=-1ms what=147477 obj=Device: DIRECT-66-HP OfficeJe
D/WifiP2pService( 1024):  deviceAddress: 72:5a:0f:16:b4:66
D/WifiP2pService( 1024):  primary type: 3-0050F204-1
D/WifiP2pService( 1024):  secondary type: null
D/WifiP2pService( 1024):  wps: 23176
D/WifiP2pService( 1024):  grpcapab: 1
D/WifiP2pService( 1024):  devcapab: 4
D/WifiP2pService( 1024):  status: 3
D/WifiP2pService( 1024):  wfdInfo: null
```

CVE-2014-0997

```
D/WifiP2pService( 1024):  level: -49 target=com.android.internal.util.StateMachine$SmHandler }
W/dalvikvm( 1024): threadid=71: thread exiting with uncaught exception (group=0x4171bd40)
E/AndroidRuntime( 1024): *** FATAL EXCEPTION IN SYSTEM PROCESS: WifiMonitor
E/AndroidRuntime( 1024): java.lang.IllegalArgumentException: Malformed supplicant event
E/AndroidRuntime( 1024):        at android.net.wifi.p2p.WifiP2pDevice.<init>(WifiP2pDevice.java:2
E/AndroidRuntime( 1024):        at android.net.wifi.WifiMonitor$MonitorThread.handleP2pEvents(Wif
E/AndroidRuntime( 1024):        at android.net.wifi.WifiMonitor$MonitorThread.dispatchEvent(WifiM
E/AndroidRuntime( 1024):        at android.net.wifi.WifiMonitor$MonitorThread.run(WifiMonitor.jav
I/Process ( 1024): Sending signal. PID: 1024 SIG: 9
I/ServiceManager(  255): service 'package' died
I/ServiceManager(  255): service 'sensorservice' died
```

There's more than one way

IOT

Air Conditioner Botnet

WD TV Live

ork Settings

tup

Authentication?

Network Setup

Check Connection

Auto Detect Wi-Fi Direct Setup On

Wireless Display (Miracast™)

Device Name WDTVLive

```
Completed SYN Stealth Scan at 22:04, 4.61s elapsed (1000 total ports)
Initiating Service scan at 22:04
Scanning 5 services on 192.168.69.61
Completed Service scan at 22:04, 26.03s elapsed (5 services on 1 host)
Initiating OS detection (try #1) against 192.168.69.61
Retrying OS detection (try #2) against 192.168.69.61
NSE: Script scanning 192.168.69.61.
Initiating NSE at 22:04
Completed NSE at 22:05, 66.34s elapsed
Initiating NSE at 22:05
Completed NSE at 22:05, 0.00s elapsed
Nmap scan report for 192.168.69.61
Host is up (0.0033s latency).
Not shown: 995 closed ports
PORT      STATE SERVICE     VERSION
80/tcp    open  http        Apache httpd (PHP 5.2.17)
139/tcp   open  netbios-ssn Samba smbd 3.X (workgroup: WORKGROUP)
443/tcp   open  ssl/http    Apache httpd (PHP 5.2.17)
445/tcp   open  netbios-ssn Samba smbd 3.X (workgroup: WORKGROUP)
30000/tcp open  unknown
MAC Address: 02:90:A9:67:7B:7E (Unknown)
OS fingerprint not ideal because: Didn't receive UDP response. Please try again with -
No OS matches for host
Network Distance: 1 hop

TRACEROUTE
HOP RTT     ADDRESS
1   3.34 ms 192.168.69.61

NSE: Script Post-scanning.
Initiating NSE at 22:05
Completed NSE at 22:05, 0.00s elapsed
Initiating NSE at 22:05
Completed NSE at 22:05, 0.00s elapsed
```

Services

HP WiFi Printers

HP OfficeJet Pro 8710

Embedded Web Server

Search

Home | Scan | Fax | Web Services | Network | Tools | Settings

NETWORK

+ General

+ Wired (802.3)

+ Wireless (802.11)

– Wi-Fi Direct

Status

+ AirPrint™

+ Google Cloud Print

+ Internet Printing Protocol

+ Advanced Settings

Wi-Fi Direct

Status

Wi-Fi Direct Settings

Change the Wi-Fi Direct settings, and then click Apply.

Status: On

Wi-Fi Direct Name: DIRECT-66-HP OfficeJet Pro 8710

Connection Method: Automatic

Wi-Fi Direct Password: 12345678 Generate

Default credentials

Apply Cancel

English

HP Connected | Product Support | Software | HP SureSupply | About HP

HP OfficeJet Pro 8710

Embedded Web Server

Search

Home | Scan | Fax | Web Services | Network | Tools | Settings

NETWORK

- General
  - Network Summary
  - Network Identification
  - Network Protocols
  - Proxy Settings
- + Wired (802.3)
- + Wireless (802.11)
- + Wi-Fi Direct
- + AirPrint™
- + Google Cloud Print
- + Internet Printing Protocol
- + Advanced Settings

General

Network Summary

Wired (802.3)

Status: Not connected

Host Name: HP16B465

IP Address:

Hardware (MAC) Address: 705A0F16B465

Wireless (802.11)

Status: Connected

Host Name: HP16B465

IP Address: 192.168.0.104

Hardware (MAC) Address: 705A0F16B466

SSID: [redacted]

Wi-Fi Direct

Status: On

Wi-Fi Direct Name: DIRECT-66-HP OfficeJet Pro 8710

Security by default

```
Initiating SYN Stealth Scan at 22:31
Scanning 192.168.223.1 [1000 ports]
Discovered open port 443/tcp on 192.168.223.1
Discovered open port 8080/tcp on 192.168.223.1
Discovered open port 80/tcp on 192.168.223.1
Discovered open port 9220/tcp on 192.168.223.1
Increasing send delay for 192.168.223.1 from 0 to 5 due to 34 out of 113 dropped probe
 increase.
Increasing send delay for 192.168.223.1 from 5 to 10 due to 34 out of 111 dropped prob
t increase.
Discovered open port 515/tcp on 192.168.223.1
Increasing send delay for 192.168.223.1 from 10 to 20 due to 19 out of 61 dropped prob
t increase.
Increasing send delay for 192.168.223.1 from 20 to 40 due to 11 out of 26 dropped prob
t increase.
Increasing send delay for 192.168.223.1 from 40 to 80 due to 11 out of 33 dropped prob
t increase.
```

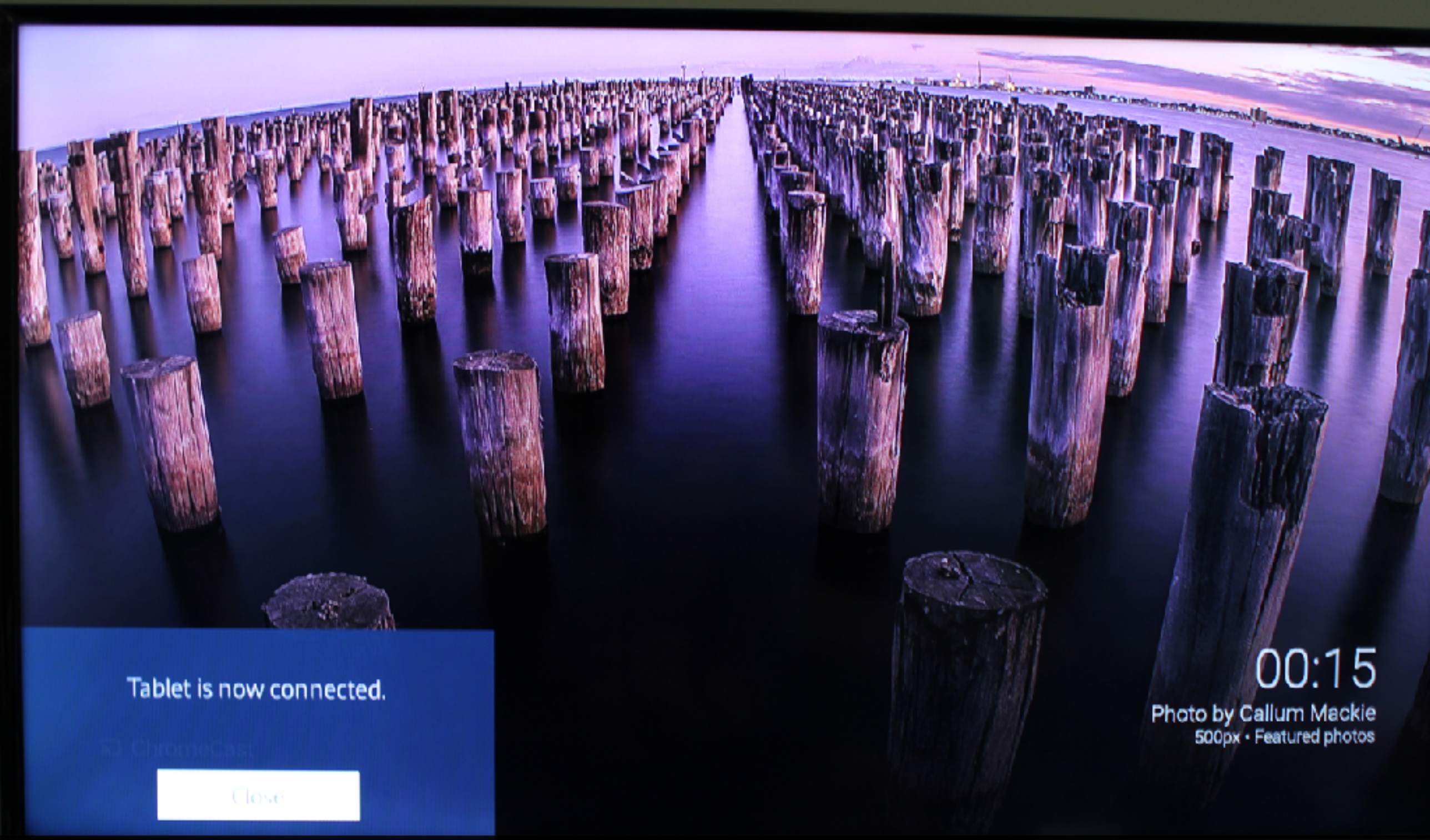
```
Discovered open port 9100/tcp on 192.168.223.1
Discovered open port 631/tcp on 192.168.223.1
Completed SYN Stealth Scan at 22:33, 84.01s elapsed (1000 total ports)
Nmap scan report for 192.168.223.1
Host is up (0.0020s latency).
Not shown: 993 closed ports
PORT     STATE SERVICE
80/tcp   open  http
443/tcp  open  https
515/tcp  open  printer
631/tcp  open  ipp
8080/tcp open  http-proxy
9100/tcp open  jetdirect
9220/tcp open  unknown
MAC Address: 70:5A:0F:16:ED:54 (Hewlett Packard)

Read data files from: /usr/bin/../share/nmap
```

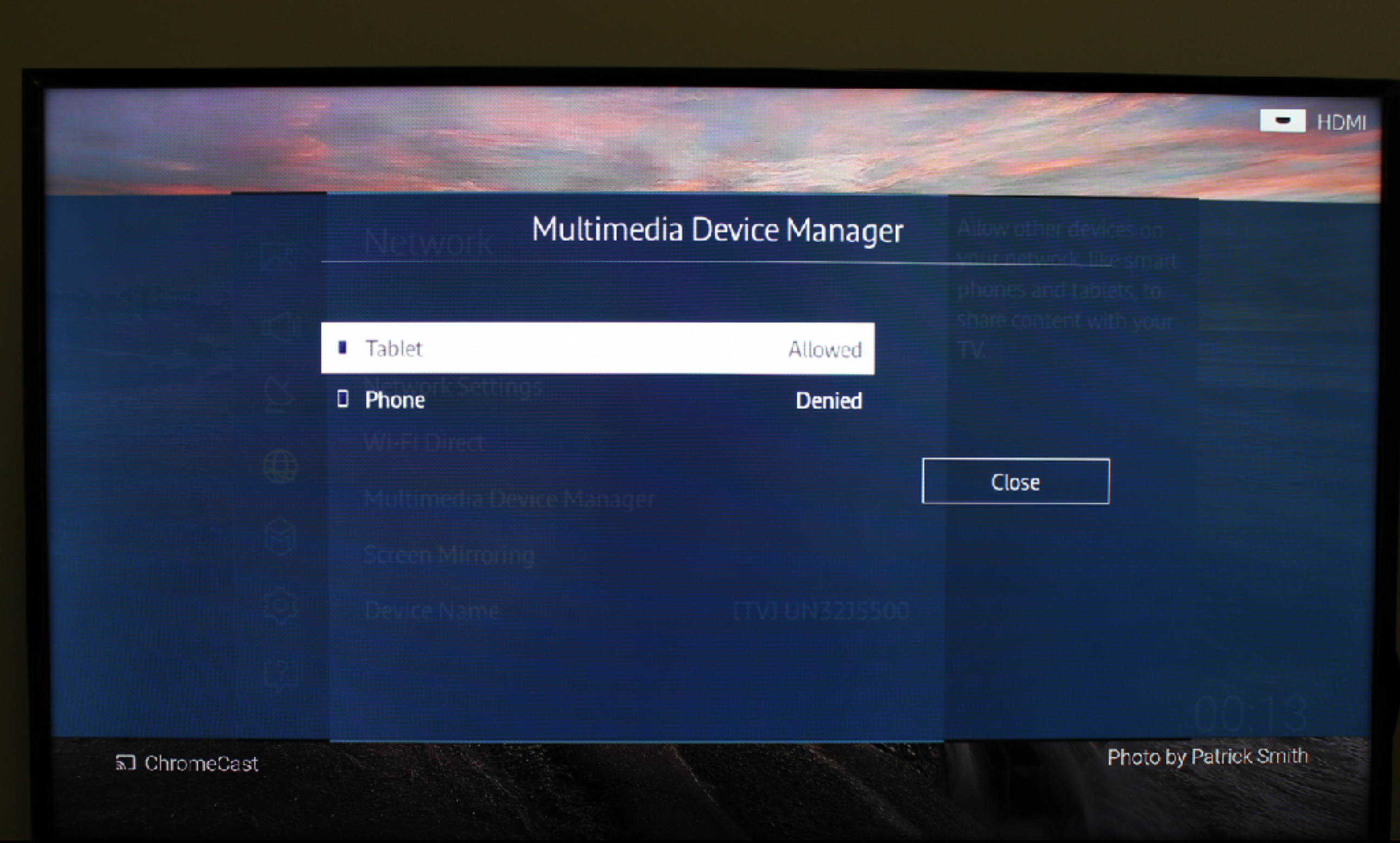
Services

Samsung Smart TVs

Authentication



Notification



Device Manager

```
Initiating SYN Stealth Scan at 22:42
Scanning 192.168.49.1 [1000 ports]
Discovered open port 8080/tcp on 192.168.49.1
Discovered open port 7676/tcp on 192.168.49.1
Discovered open port 8002/tcp on 192.168.49.1
Increasing send delay for 192.168.49.1 from 0 to 5 due to 113 out of 376 dropped probe
 increase.
Increasing send delay for 192.168.49.1 from 5 to 10 due to 145 out of 481 dropped prob
t increase.
Increasing send delay for 192.168.49.1 from 10 to 20 due to 12 out of 39 dropped probe
 increase.
Increasing send delay for 192.168.49.1 from 20 to 40 due to max_successful_tryno incre
Increasing send delay for 192.168.49.1 from 40 to 80 due to 11 out of 34 dropped probe
 increase.
Discovered open port 8001/tcp on 192.168.49.1
Increasing send delay for 192.168.49.1 from 80 to 160 due to 48 out of 159 dropped pro
st increase.
Discovered open port 8000/tcp on 192.168.49.1
Discovered open port 9999/tcp on 192.168.49.1
Completed SYN Stealth Scan at 22:43, 66.01s elapsed (1000 total ports)
Nmap scan report for 192.168.49.1
Host is up (0.062s latency).
Not shown: 994 closed ports
PORT     STATE SERVICE
7676/tcp open  imqbrokerd
8000/tcp open  http-alt
8001/tcp open  vcom-tunnel
8002/tcp open  teradataordbms
8080/tcp open  http-proxy
9999/tcp open  abyss
MAC Address: CE:B1:1A:F4:B7:F5 (Unknown)

Read data files from: /usr/bin/../share/nmap
Nmap done: 1 IP address (1 host up) scanned in 79.32 seconds
```

Services

12175 Access Points

98

120

208

120

12175 Access Points

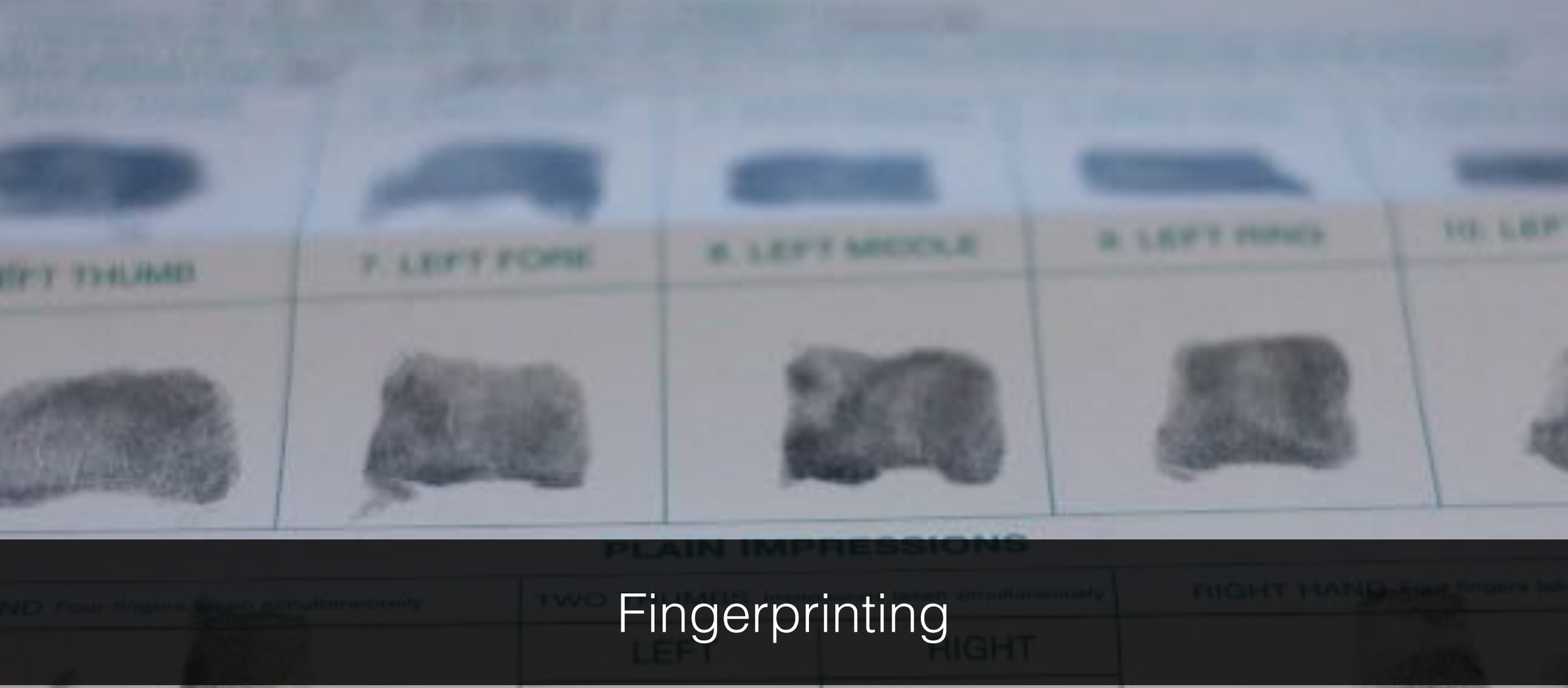
NORMANDY, 1944

THE INVASION AND OPERATIONS, 6-12 JUNE 1944

55

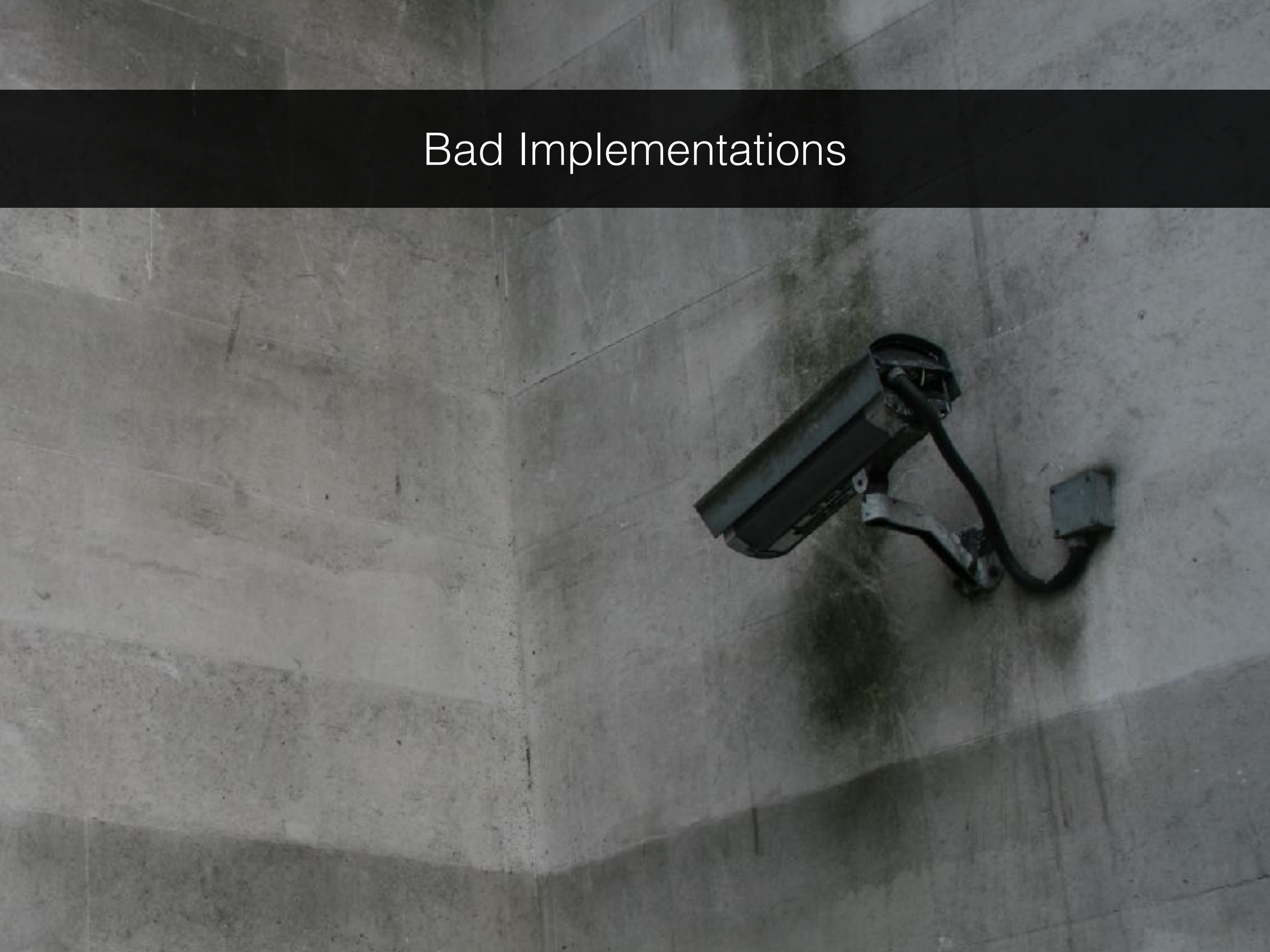
Attack Surface

Fingerprinting



Too Many Hands in the Pot

Bad Implementations



Network Access


Airplane Mode
Wi-Fi
Not Connected
Bluetooth
Off
Notifications
Control Centre
Do Not Disturb
General
1
Display & Brightness
Wallpaper
Wi-Fi
Wi-Fi
CHOOSE A NETWORK...
https://github.com/6e726d/WIG
6e726d@gmail.com
@6e726d