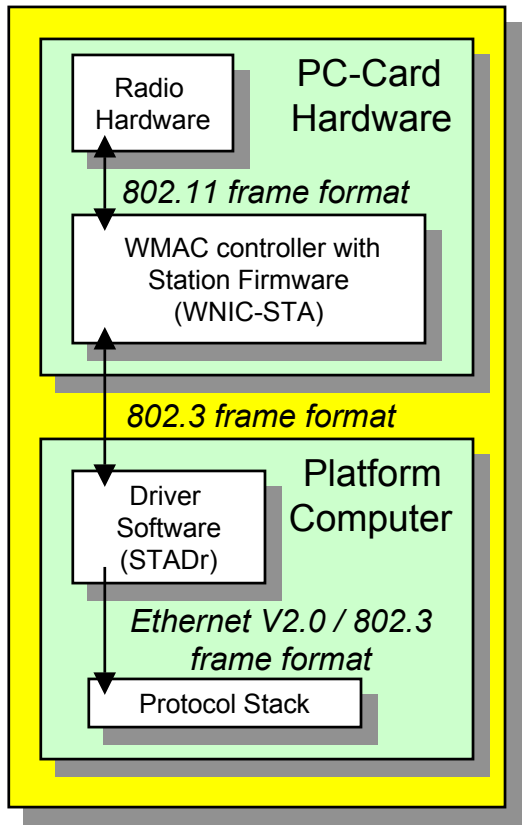
Module contents

- ★ **IEEE 802.11 Terminology**
- ★ IEEE 802.11 MAC Frames
- ★ Basic processes in IEEE802.11 networks
- ★ Configuration parameters

IEEE 802 .11 Terminology

Station (STA) Architecture:

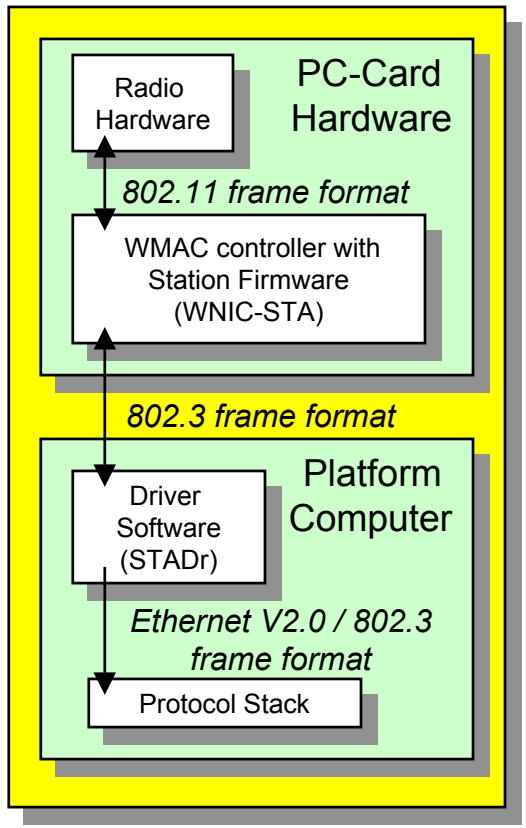
- ★ Device that contains IEEE 802.11 conformant MAC and PHY interface to the wireless medium, but does not provide access to a distribution system
- ★ Most often end-stations available in terminals (work-stations, laptops etc.)
- ★ Implemented in Avaya Wireless IEEE 802.11 PC-Card



IEEE 802 .11 Terminology

Station (STA) Architecture (cont'd):

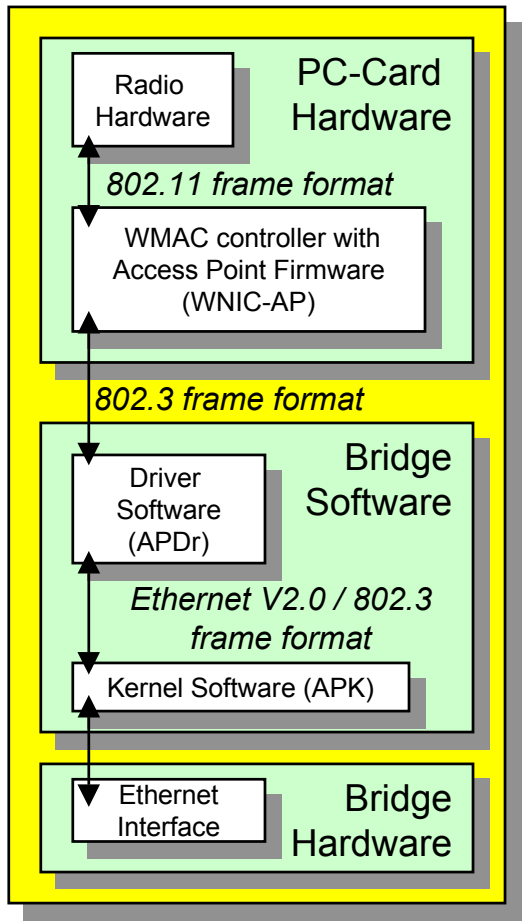
- ★ Ethernet-like driver interface
  - ★ supports virtually all protocol stacks
- ★ Frame translation according to IEEE Std 802.1H
  - ★ IEEE 802.3 frames: translated to 802.11
  - ★ Ethernet Types 8137 (Novell IPX) and 80F3 (AARP) encapsulated via the Bridge Tunnel encapsulation scheme
  - ★ All other Ethernet Types: encapsulated via the RFC 1042 (Standard for the Transmission of IP Datagrams over IEEE 802 Networks) encapsulation scheme
  - ★ Maximum Data limited to 1500 octets
- ★ Transparent bridging to Ethernet



IEEE 802 .11 Terminology

Access-Point (AP) Architecture:

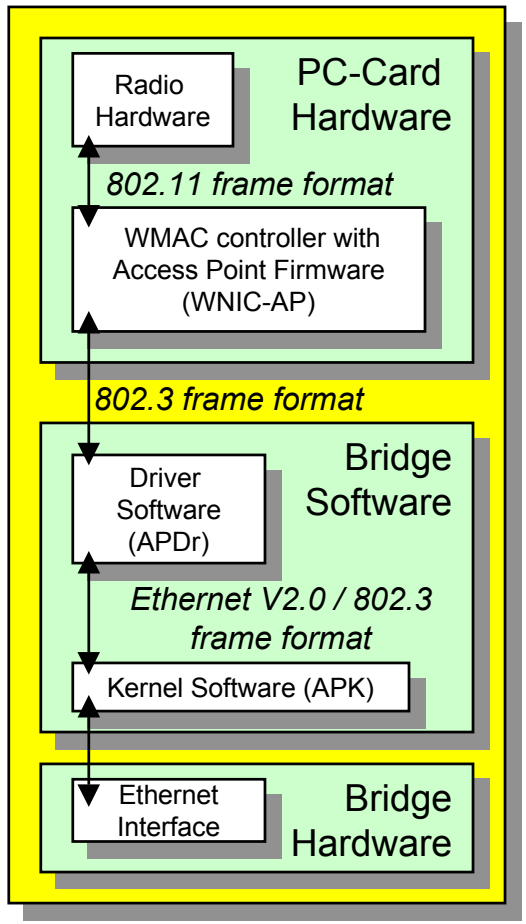
- ★ Device that contains IEEE 802.11 conformant MAC and PHY interface to the wireless medium, and provide access to a distribution system for associated stations
- ★ Most often infra-structure products that connect to wired backbones
- ★ Implemented in Avaya Wireless IEEE 802.11 PC-Card when it is inserted in an AP-500 or AP-1000



IEEE 802 .11 Terminology

Access-Point (AP) Architecture (cont'd):

- ★ Stations select an Access-Point and "associate with it
- ★ Access-Points :
  - ★ Support roaming
  - ★ Provide time synchronization functions (beaconing)
  - ★ Provide Power Management support
- ★ Traffic typically flows through Access-Point
  - ★ in IBSS direct Station-to-Station communication takes place

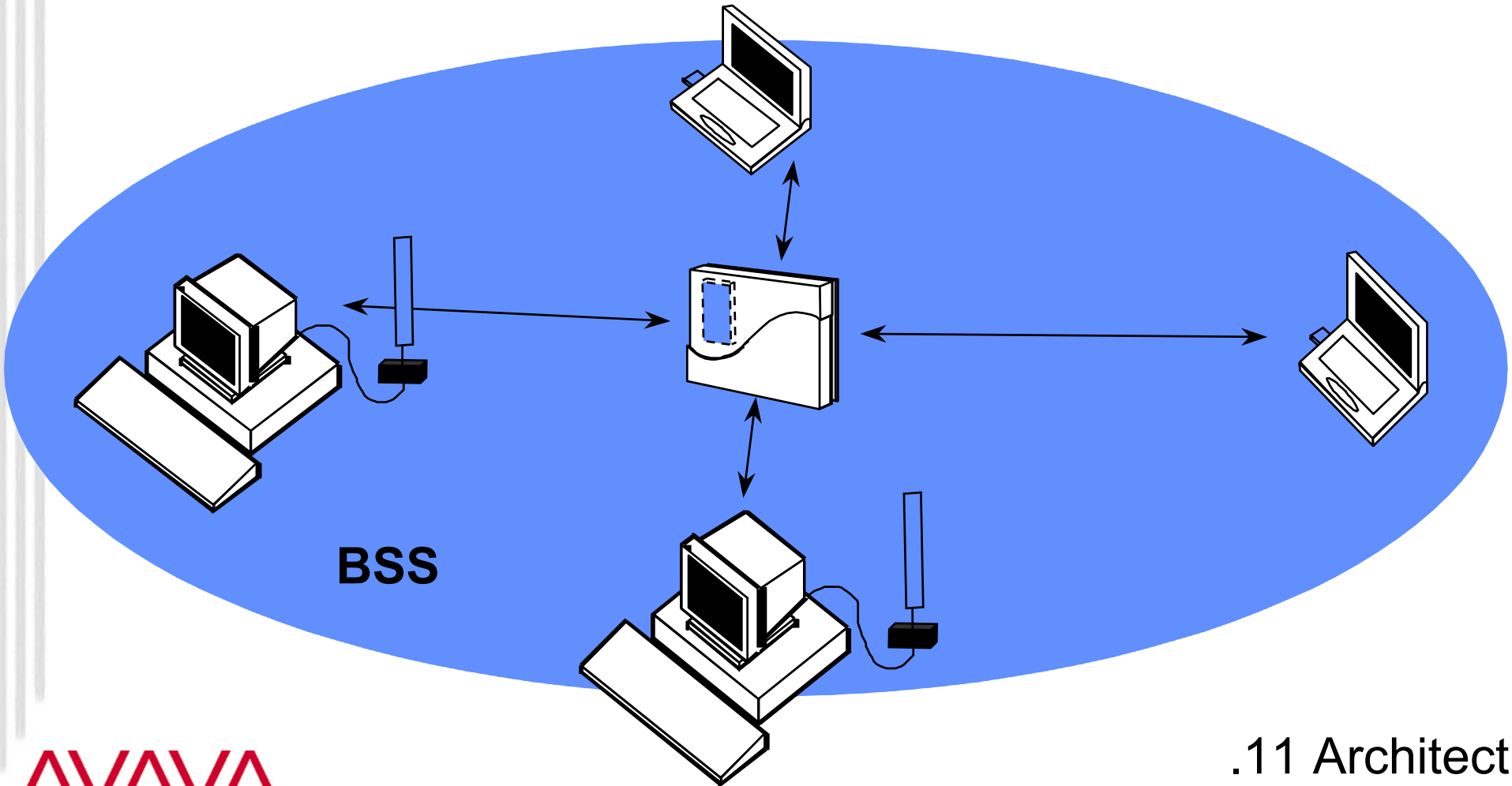


IEEE 802 .11 Terminology

Basic Service Set (BSS):

- ★ A set of stations controlled by a single “Coordination Function” (=the logical function that determines when a station can transmit or receive)
- ★ Similar to a “cell” in pre IEEE terminology
- ★ A BSS can have an Access-Point (both in standalone networks and in building-wide configurations), or can run without and Access-Point (in standalone networks only)
- ★ Diameter of the cell is app. twice the coverage-distance between two wireless stations

Basic Service Set (BSS)



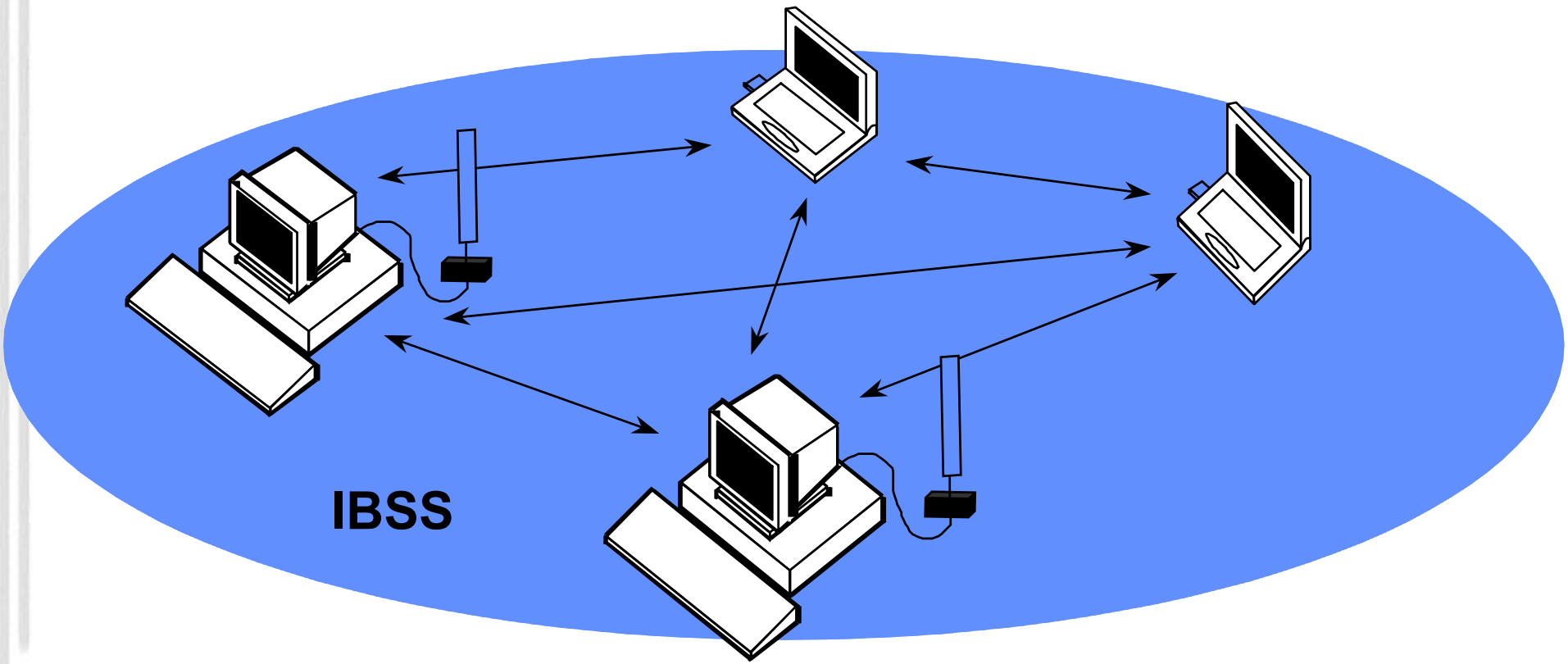
IEEE 802 .11 Terminology

Independent Basic Service Set (IBSS):

- ★ A Basic Service Set (BSS) which forms a self-contained network in which no access to a Distribution System is available
- ★ A BSS without an Access-Point
- ★ One of the stations in the IBSS can be configured to “initiate” the network and assume the Coordination Function
- ★ Diameter of the cell determined by coverage distance between two wireless stations

Independent Basic Service Set

(IBSS)



IEEE 802 .11 Terminology

Extended Service Set (ESS):

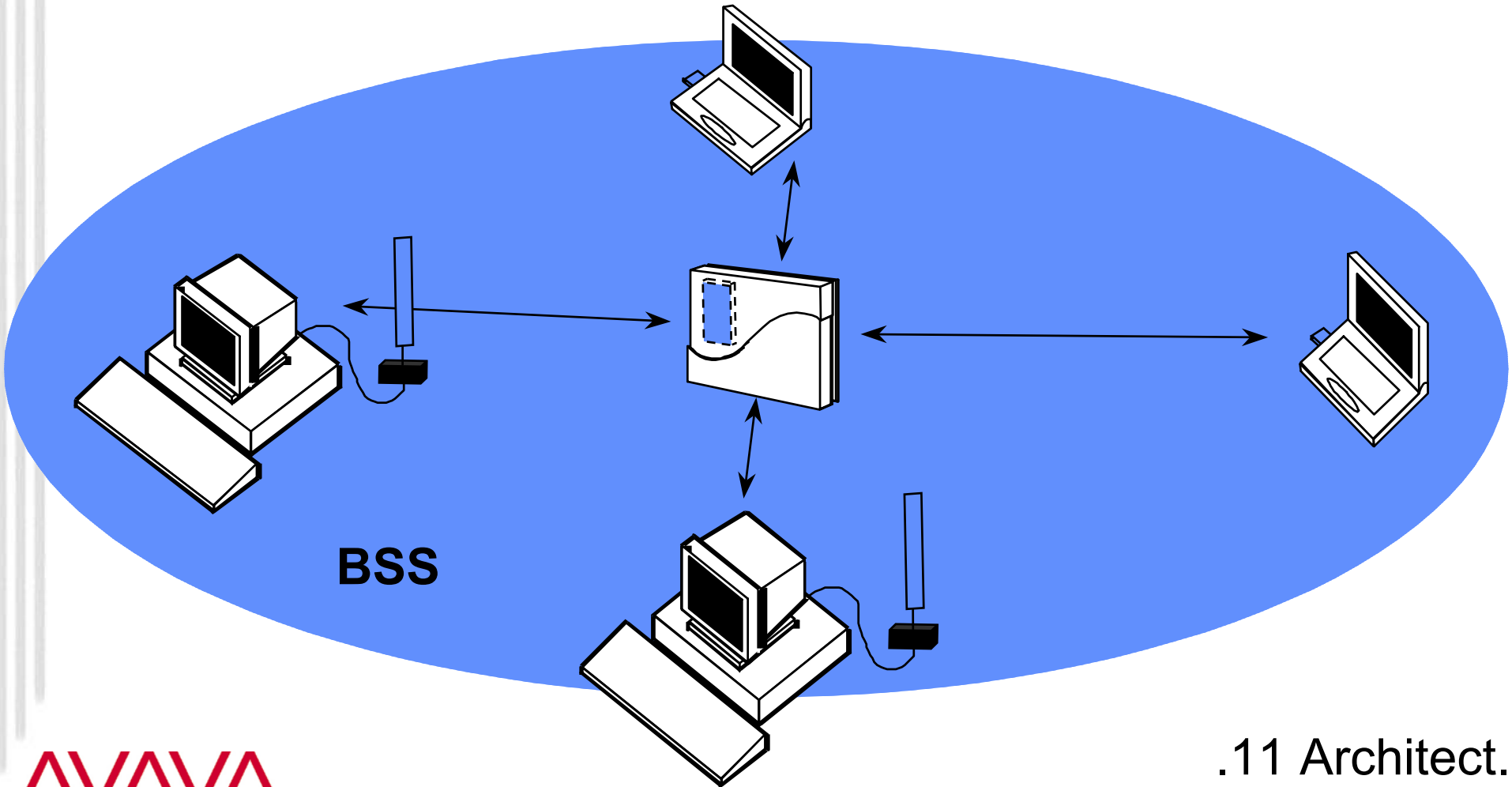
- ★ A set of one or more Basic Service Sets interconnected by a Distribution System (DS)
- ★ Traffic always flows via Access-Point
- ★ Diameter of the cell is double the coverage distance between two wireless stations

Distribution System (DS):

- ★ A system to interconnect a set of Basic Service Sets
  - ★ Integrated; A single Access-Point in a standalone network
  - ★ Wired; Using cable to interconnect the Access-Points
  - ★ Wireless; Using wireless to interconnect the Access-Points

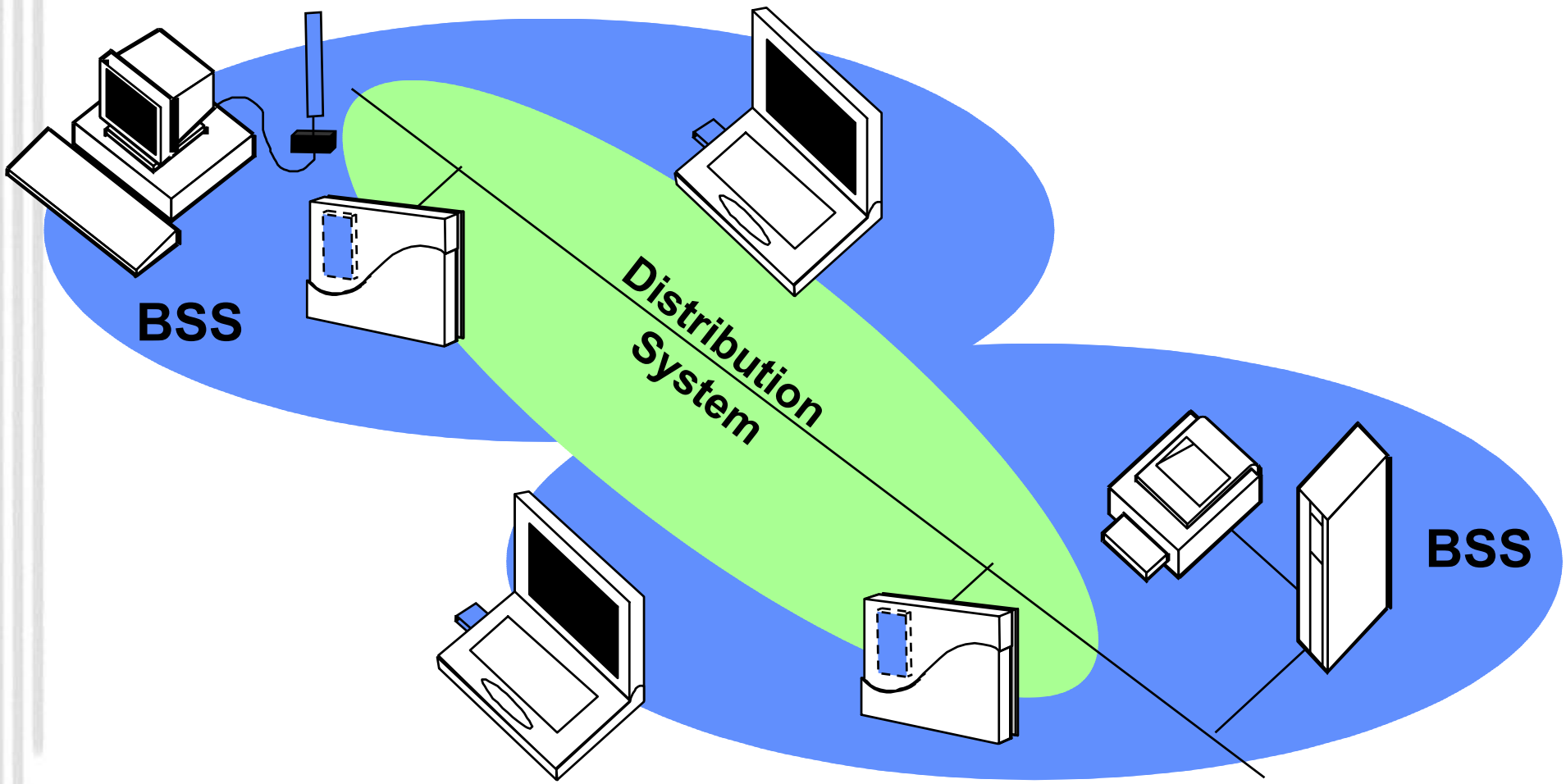
Extended Service Set (ESS)

single BSS (with integrated DS)



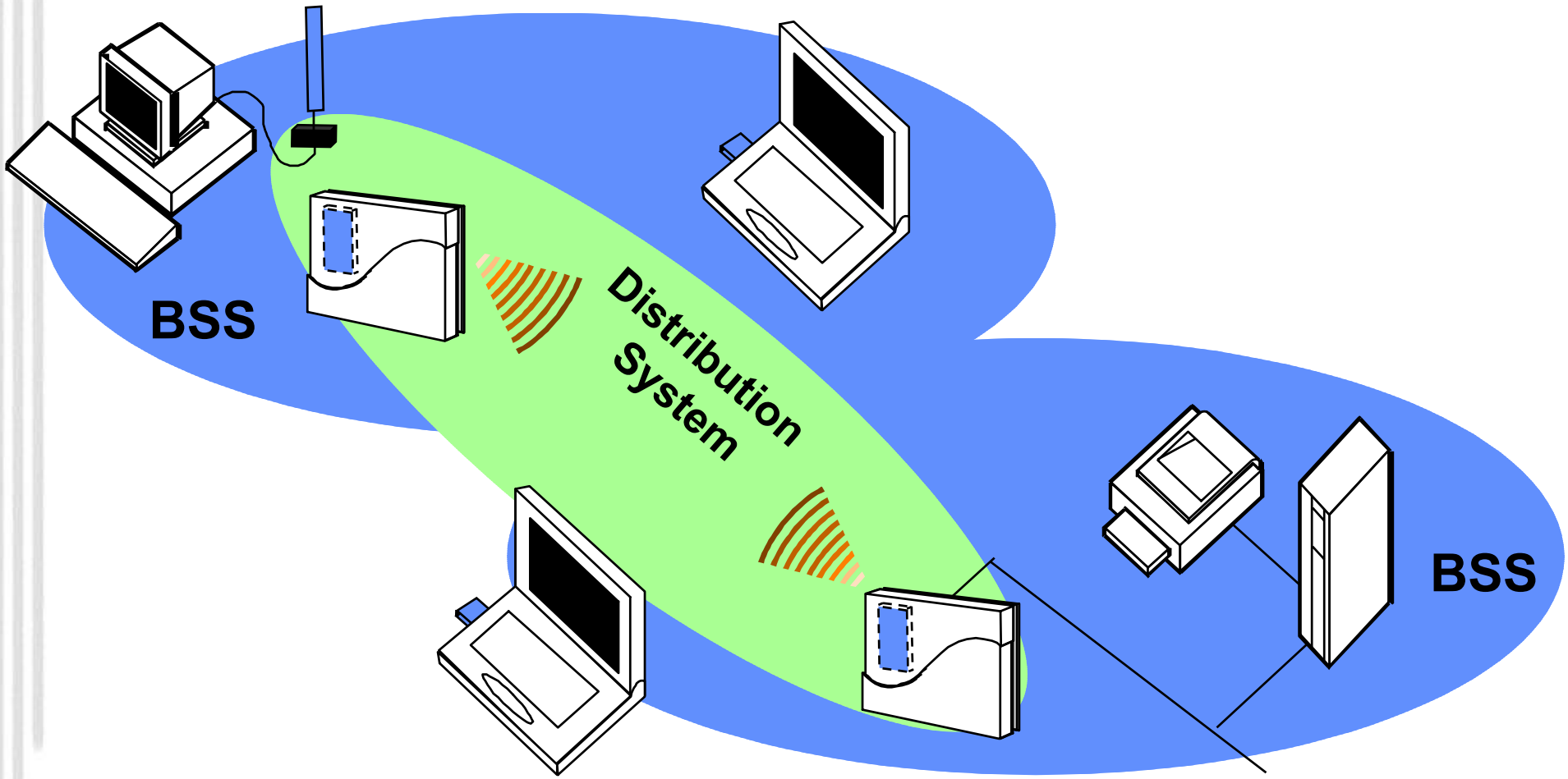
Extended Service Set (ESS)

BSS's with wired Distribution System (DS)



Extended Service Set (ESS)

BSS's and wireless Distribution System (DS)



AVAYA communication

IEEE 802 .11 Terminology

Service Set Identifier (SSID):

★ “Network name”

★ 32 octets long

★ Similar to “Domain-ID” in the pre-IEEE WaveLAN systems

★ One network (ESS or IBSS) has one SSID

IEEE 802 .11 Terminology

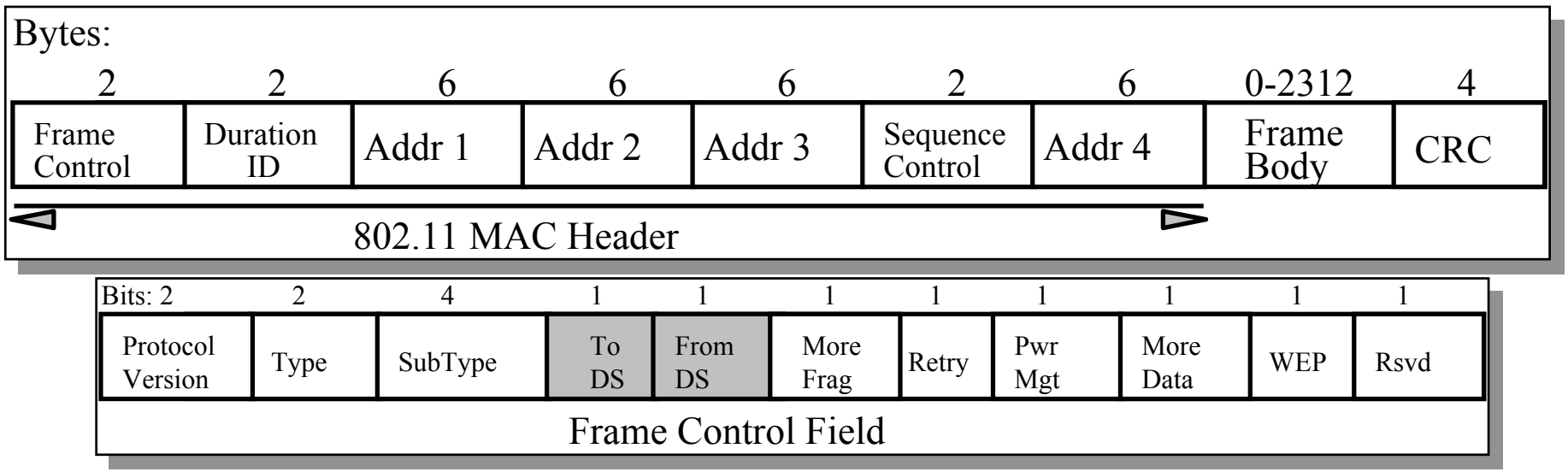
Basic Service Set Identifier (BSSID)

- ★ “cell identifier”
- ★ 6 octets long (MAC address format)
- ★ Similar to NWID in pre-IEEE WaveLAN systems
- ★ One BSS has one SSID
- ★ Value of BSSID is the same as the MAC address of the radio in the Access-Point

Module contents

- ★ IEEE 802.11 Terminology
- ★ **IEEE 802.11 MAC Frames**
- ★ Basic processes in IEEE802.11 networks
- ★ Configuration parameters

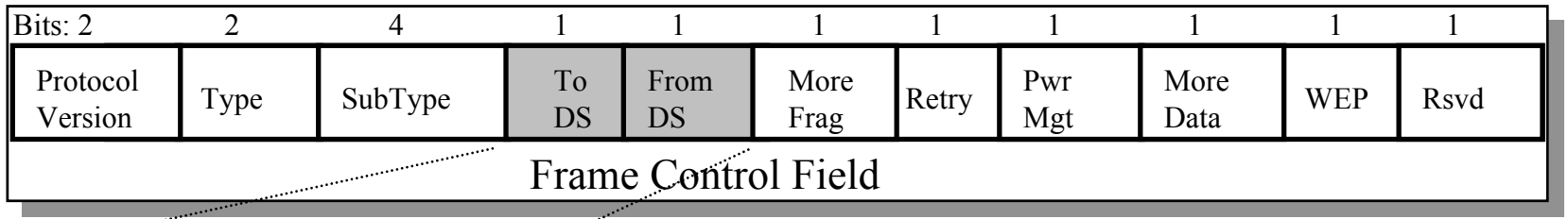
Frame Formats



MAC Header format differs per Type:

- ★ Control Frames (several fields are omitted)
- ★ Management Frames
- ★ Data Frames

Address Field Description



To DS	From DS	Address 1	Address 2	Address 3	Address 4
0	0	DA	SA	BSSID	N/A
0	1	DA	BSSID	SA	N/A
1	0	BSSID	SA	DA	N/A
1	1	RA	TA	DA	SA

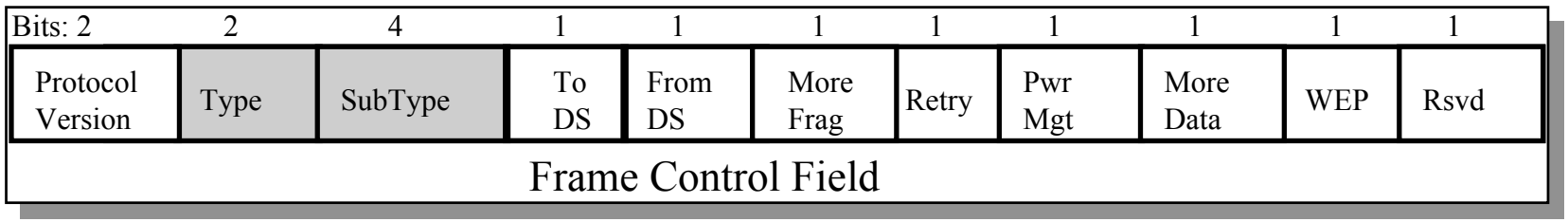
Addr. 1 = All stations filter on this address.

Addr. 2 = Transmitter Address (TA), Identifies transmitter to address the ACK frame to.

Addr. 3 = Dependent on *To* and *From DS* bits.

Addr. 4 = Only needed to identify the original source of WDS (*Wireless Distribution System)* frames

Type field descriptions



Type and subtype identify the function of the frame:

★ Type=00 Management Frame

Beacon	(Re)Association
Probe	(De)Authentication
Power Management	

★ Type=01 Control Frame

RTS/CTS	ACK

★ Type=10 Data Frame

MAC Management Frames

- Beacon
  - Timestamp, Beacon Interval, Capabilities, SSID, Supported Rates, parameters
  - Traffic Indication Map
- Probe
  - SSID, Capabilities, Supported Rates
- Probe Response
  - Timestamp, Beacon Interval, Capabilities, SSID, Supported Rates, parameters
  - same for Beacon except for TIM

MAC Management Frames (cont'd)

- Association Request
  - Capability, Listen Interval, SSID, Supported Rates
- Association Response
  - Capability, Status Code, Station ID, Supported Rates
- Re-association Request
  - Capability, Listen Interval, SSID, Supported Rates, Current AP Address
- Re-association Response
  - Capability, Status Code, Station ID, Supported Rates

MAC Management Frames (cont'd)

- ★ Dis-association
  - ★ Reason code
- ★ Authentication
  - ★ Algorithm, Sequence, Status, Challenge Text
- ★ De-authentication
  - ★ Reason

Module contents

- ★ IEEE 802.11 Terminology
- ★ IEEE 802.11 MAC Frames
- ★ **Basic processes in IEEE 802.11 networks**
- ★ Configuration parameters

Operational processes

Association

- ★ To establish relationship with Access-Point
- ★ Stations scan frequency band to and select Access-Point with best communications quality
  - ★ Active Scan (sending a “Probe request” on specific channels and assess response)
  - ★ Passive Scan (assessing communications quality from beacon message)
- ★ Access-Point maintains list of associate stations in MAC FW
  - ★ Record station capability (data-rate)
  - ★ To allow inter-BSS relay
- ★ Station’s MAC address is also maintained in bridge learn table associated with the port it is located on

Operational processes

Authentication

- ★ To control access to the infrastructure via an authentication
- ★ Stations identify themselves to other stations (or Access-Points) prior to data traffic or association
- ★ Open System Authentication
  - ★ Uses null authentication algorithm
  - ★ Default
- ★ Shared Key Authentication
  - ★ Uses WEP privacy algorithm
  - ★ Optional

Operational processes

Starting an ESS

- ★ The infrastructure network is identified by its ESSID
- ★ All Access-Points will have been set according to this ESSID
- ★ Avaya Wireless stations will be configured to set their desired SSID to the value of ESSID
- ★ On power up stations will issue Probe Requests and will locate the Access-Point that they will associate with:
  - ★ “best” Access-Point with matching ESSID
  - ★ “best” Access-Point if the “desired SSID” has been set to “ANY”

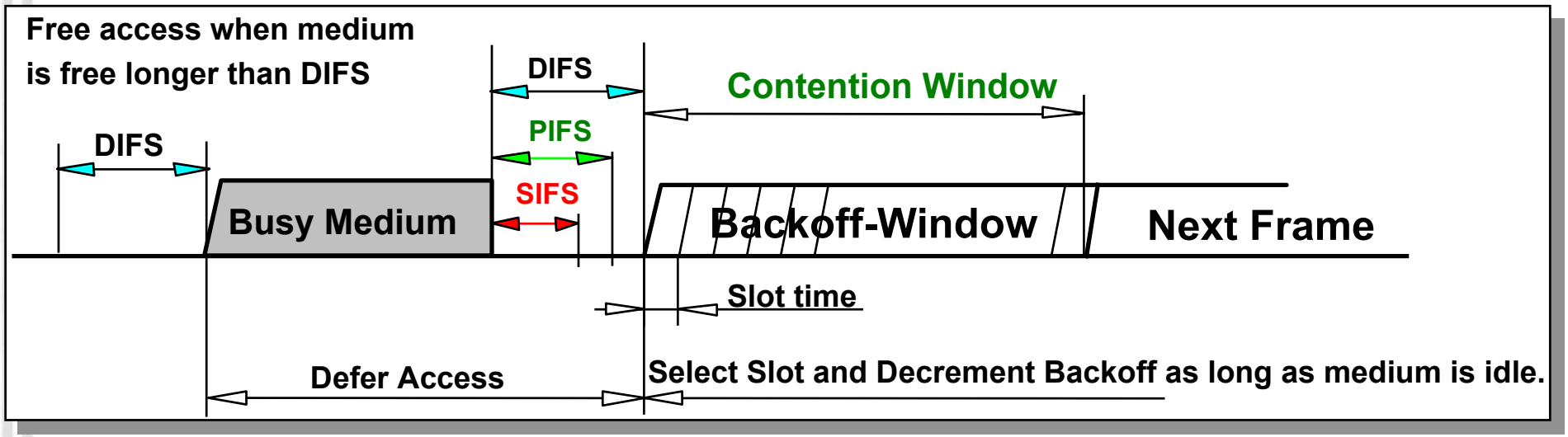
Operational processes

Starting an IBSS

- ★ Station configured for IBSS operation will:
  - ★ “look” for Beacons that contain a network name (SSID) that matches the one that is configured
  - ★ When Beacons with matching Network Name are received and are issued by an AP, Station will associate to the AP
  - ★ When Beacons with matching Network Name are received and are issued by another Station in IBSS mode, the station will join this IBSS
  - ★ When no beacons are received with matching Network Name, Station will issue beacons itself.
- ★ All Stations in an IBSS network will participate in sending beacons.
  - ★ All stations start a random timer prior to the point in time when next Beacon is to be sent.
  - ★ First station whose random timer expires will send the next beacon

Operational processes

Inter-Frame Spacing



★ Inter frame spacing required for MAC protocol traffic

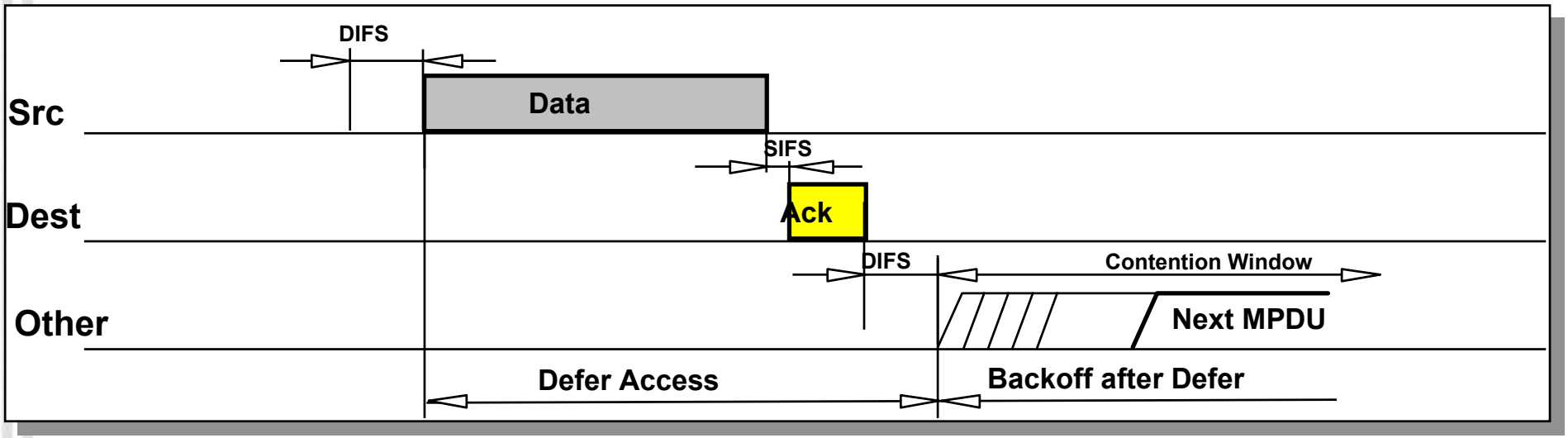
- ★ SIFS = Short interframe space
- ★ PIFS = PCF interframe space
- ★ DIFS = DCF interframe space

★ Back-off timer expressed in terms of number of time slots

AVAYA communication

Operational processes

Data Frames and their ACK

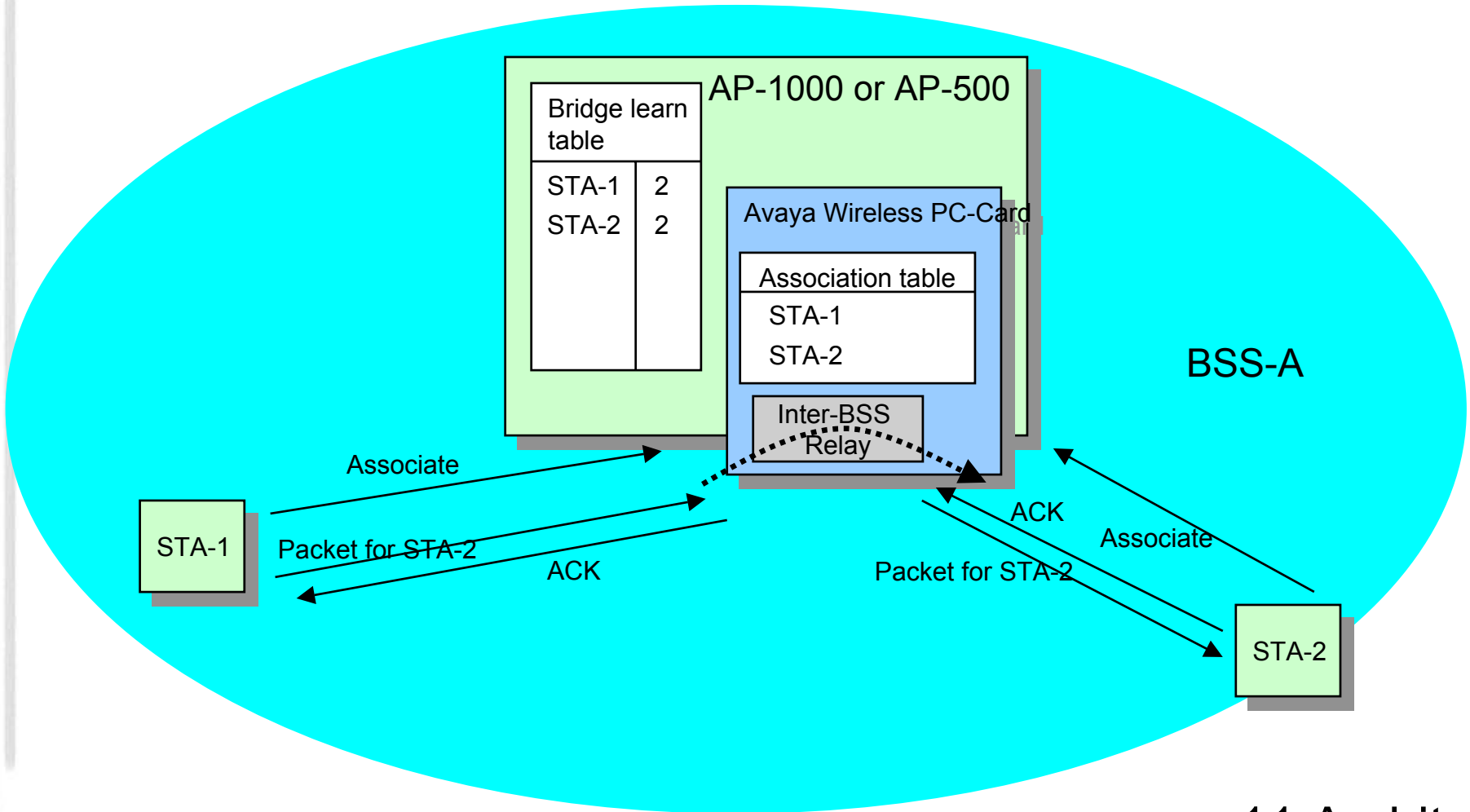


★ Acknowledgment are to arrive at within the SIFS

★ The DCF interframe space is observed before medium is considered free for use

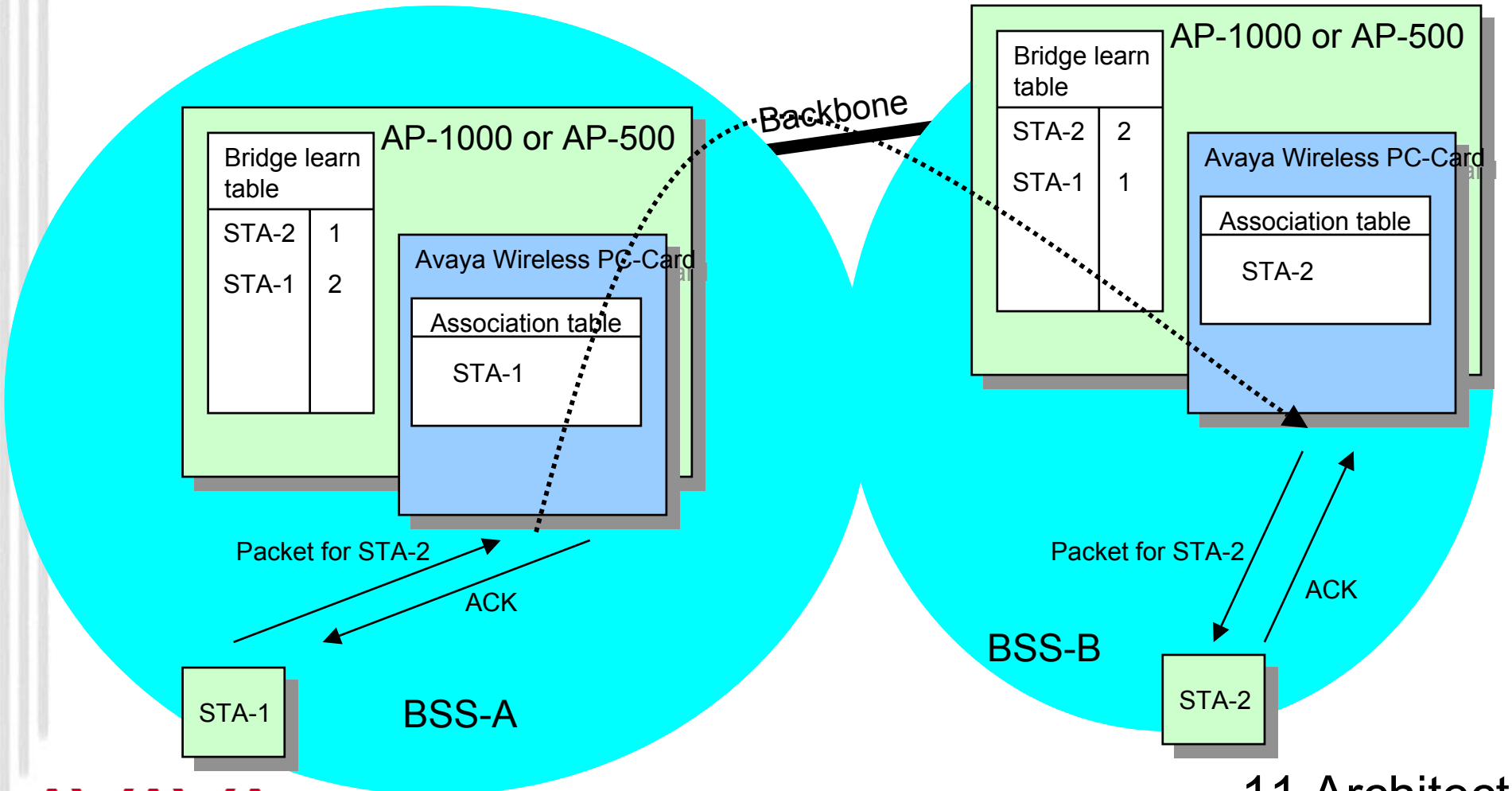
Operational processes

Traffic flow - Inter-BSS



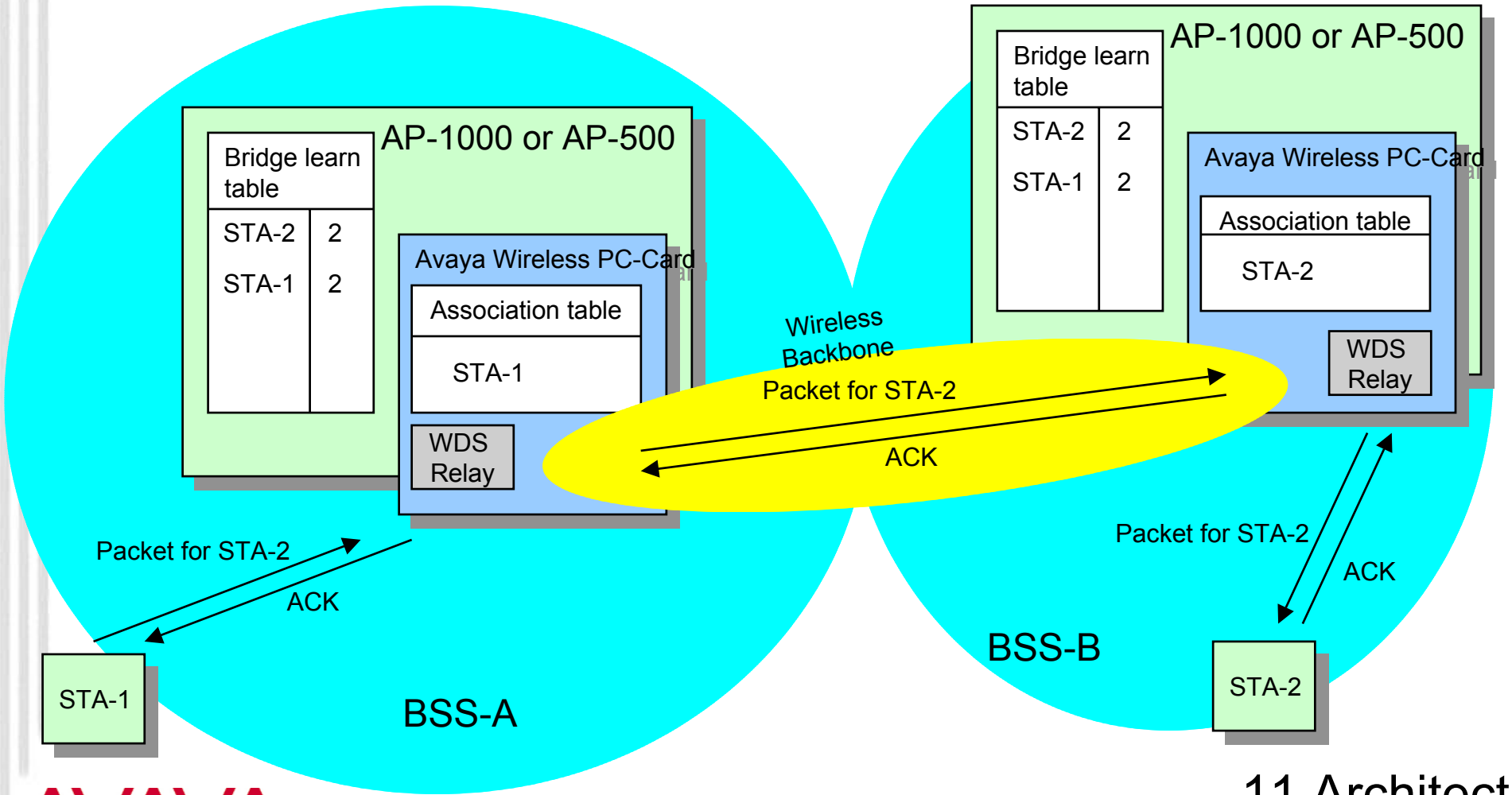
Operational processes

Traffic flow - ESS operation



Operational processes

Traffic flow - WDS operation



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- ★ **Configuration parameters**

Configuration Parameters

Avaya Wireless PC-Card used in client station and AP-1000 or AP-500

- "Behaves" differently based on the parent unit
  - When inserted in AP-1000 or AP-500, AP firmware is downloaded into the PC-Card (Note: this is Avaya Wireless/MAC FW, not "Bridge FW")
  - When inserted in client station, STA firmware is active (default FW)
- Requires different configuration parameter sets to support the different behavior
- Configuration can be performed by:
  - Setting parameters at installation
  - Changing parameters in property settings
  - Using Avaya Wireless AP Manager (for APs)

Configuration Parameters

Basic parameters (Station)

Network Name (SSID)

★ ASCII string to identify the network that the station wants to connect to (similar to Domain-ID in WLAN pre-IEEE)

Station Name (SSID)

★ ASCII string to provide a user friendly station identification, when used in diagnostic purposes (in Windows systems: equal to "computer name")

Type of Operation

★ To identify the kind of network that the station will be part of
  - ★ Network centered around APs (or RG-1000)
  - ★ IBSS (peer-to-peer network)

Configuration Parameters

Advanced parameters (Station)

MAC Address

- Physical address of the card:
  - Universal; factory installed (default)
  - Local; user-defined (6 Hexadecimal characters)

Distance between APs

- To specify the coverage of a “cell” in terms of the distance between the Access-Points
  - Large
  - Medium
  - Small

Configuration Parameters

Advanced parameters (Station)

Microwave Oven Robustness

★ Check box to enable/disable data-rate fallback delay-mechanism to allow improved performance in presence of microwave ovens

RTS/CTS Medium Reservation

★ Check box to enable/disable the RTS/CTS handshake.

Card Power Management

★ Check box to enable/disable Power Management

Configuration Parameters

Encryption parameters (Station)

Enable Encryption

★ To enable/disable Encryption

Encryption keys

★ Four fields to store up to four different encryption keys

★ Entries take up to 5 ASCII or 10 hexa-decimal values (when using 64 WEP)

Encryption key index

★ Index identifying which of the four keys is the active one

Configuration Parameters

Basic parameters (AP-500/1000)

Network Name (SSID)

★ ASCII string to identify the network that the Access-Point is part of (similar to Domain-ID in WaveLAN pre-IEEE). Only available in "Access Point" mode.

Frequency (channel)

★ To indicate the frequency channel that the AP-500/1000 will use for its "cell". The channel is selected from the set that is allowed in the regulatory domain.

Configuration Parameters

Advanced parameters (AP-500/1000)

Medium Reservation

- To enable/disable the RTS/CTS handshake.
  - Threshold value 0-2346 (value=2347 disables Medium Reservation)

Distance between APs

- To specify the coverage of a “cell” in terms of the distance between the Access-Points
  - Large
  - Medium
  - Small

Multicast Rate

- To specify data-rate used for transmitting Multicast frames

Configuration Parameters

Advanced parameters (AP-500/1000)

Microwave Oven Robustness

★ Check box to enable/disable data-rate fallback delay-mechanism to allow improved performance in presence of microwave ovens

DTIM

★ Power Management related parameter to specify the timing of the delivery of multicast traffic to stations that have indicated to receive multicast messages while under power management.

Example:

- ★ DTIM=1 means multicast traffic when it arrives at the AP is passed through after every beacon
- ★ DTIM=3 means multicast traffic is passed through after every 3rd beacon message

Configuration Parameters

Security parameters (AP-500/1000)

Closed System (AP)

★ To enable rejection of association requests from stations with *Network Name* set to “ANY”

Enable Encryption

★ To enable/disable Encryption

Encryption keys

★ Four fields to store up to four different encryption keys

Encryption key index

★ Index identifying which of the four keys is the active one

Configuration Parameters

For future implementation

Message Fragmentation (STA and AP)

★ To enable/disable fragmentation of messages. When enabled user is prompted to set the fragment-size (256-2346). Default: fragmentation disabled

- Microwave Oven (threshold = 500)
- Medium Velocity (15 km/h) (threshold = 800)
- High Velocity (30 km/h) (threshold = 300)

WDS Address (AP)

★ MAC address of the corresponding AP in a WDS link

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