AP Management
and Handover support
(802.11f)

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http://disi.unitn.it/locigno/index.php/teaching-duties/nomadic-communications

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ESS and Micro-mobility

- A collection of coordinated IBSS forms an ESS
- The APs in the same ISS can broadcast the same SSID
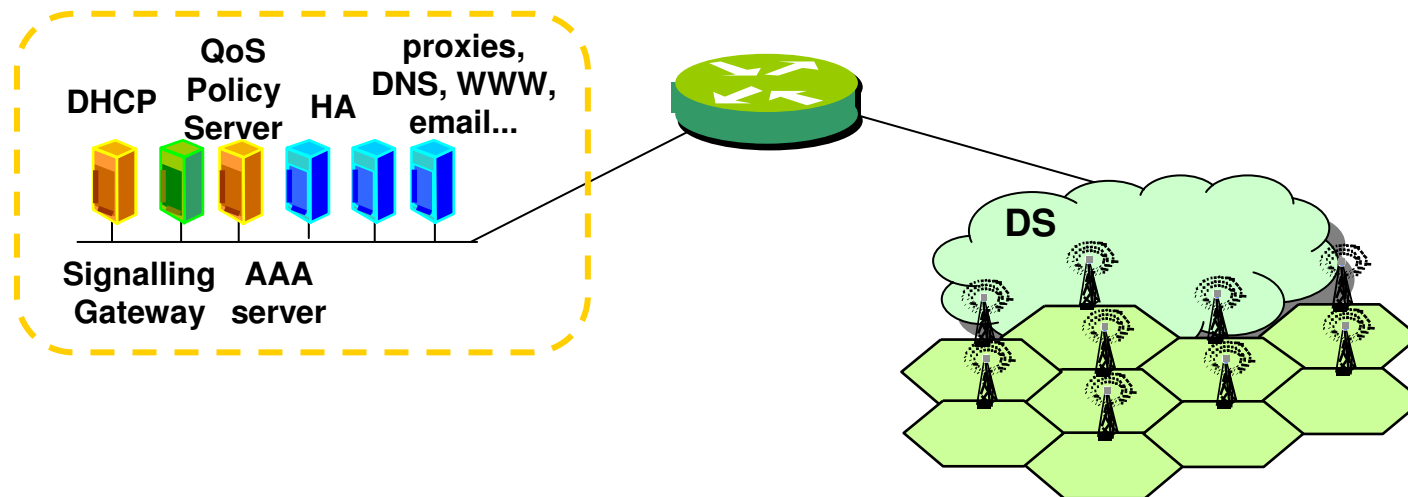
- As far as they are on the same LAN mobility between APs is allowed seamlessly (nearly)

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AP Coordination (1)

- How to position APs?

- How to assign them channels and power level?

- What happens if I add/remove and AP

- How fast is the re-association to an new AP if I'm roaming the area?

0.1s, 1s, 10s
???

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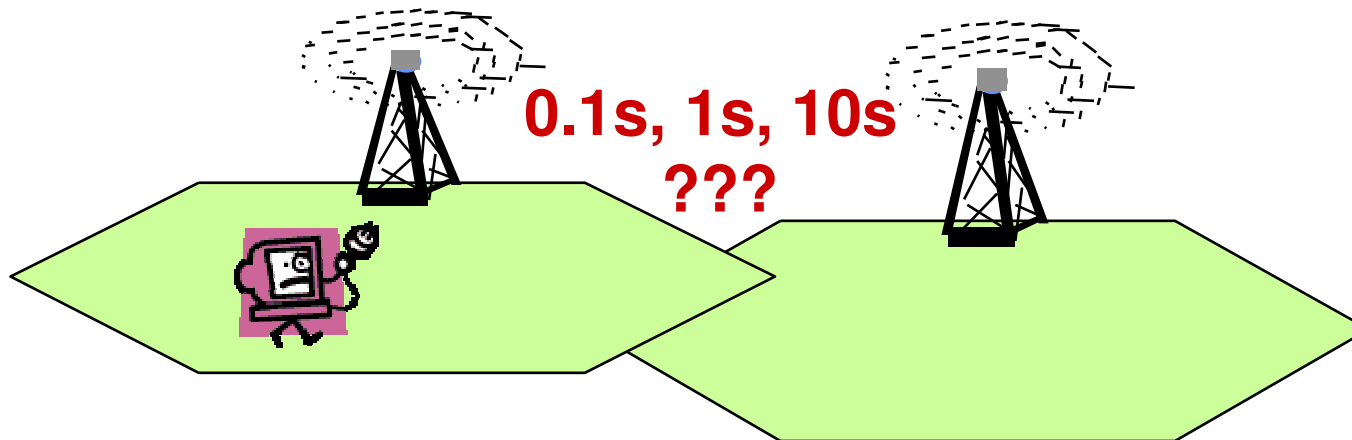
AP Coordination (2)

- Centralized management?

- Distributed coordination?

- What layer (Ethernet or IP)?

- What functionalities

- Integration with user management?

- What about resources?

- Can we balance their use?

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IEEE vs. IETF

- Two main proposal for standardization of an Inter Access Points Protocol – IAPP

- One in IEEE: 802.11f (already standard … not much implemented ☹) mainly supports coordinated handovers, 802.11r (resource management), 802.11k (fast handover for vehicular applications)

- One in IETF: capwap (Control And Provisioning of Wireless Access Points), not yet definitive (RFCs 4118, 4565, 4564, 3990, plus drafts), omni-comprehensive, not much focused on handovers
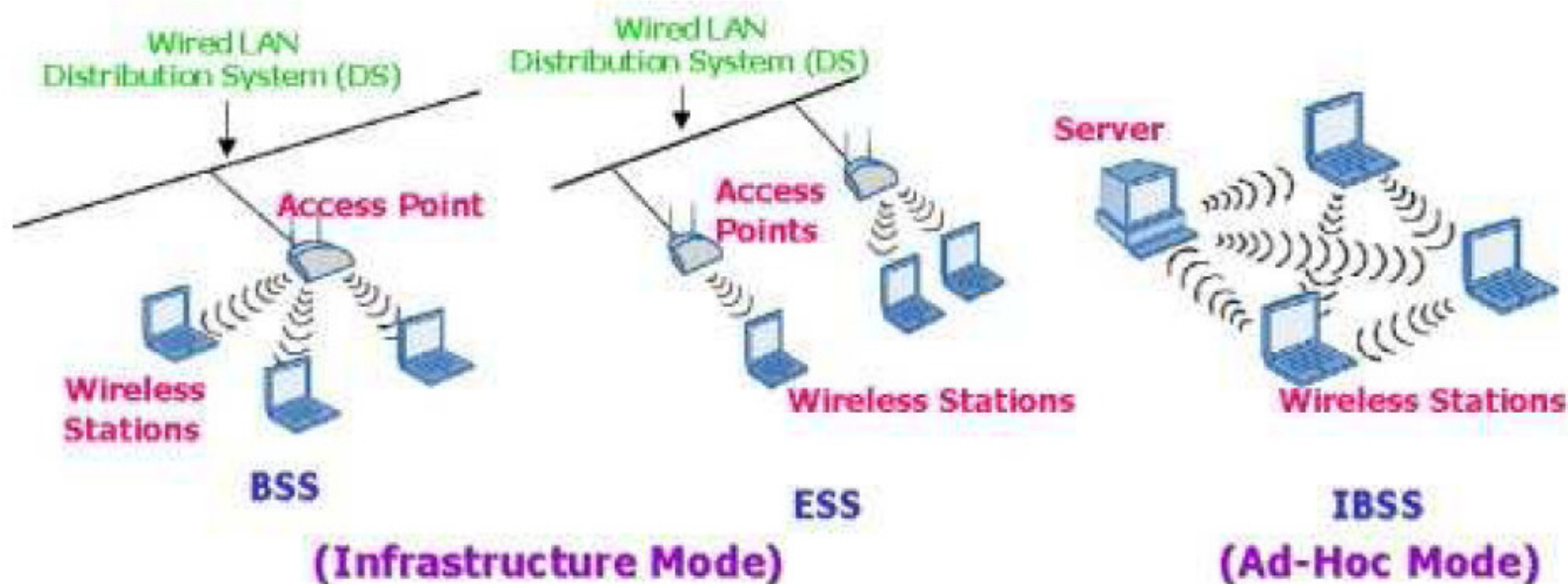
- Proprietary solutions (Cisco, Avaya, …)

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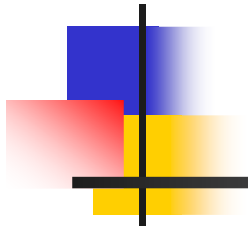
802.11f

Scope & Goals

- Main (unique??) goal is enabling and simplifying the mobility between APs within the same ESS

Wired LAN Distribution System (DS)
Access Point
Wireless Stations
BSS
(Infrastructure Mode)

Wired LAN Distribution System (DS)
Access Points
Wireless Stations
ESS

Server
Wireless Stations
IBSS
(Ad-Hoc Mode)

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Realization & Implementation

- IAPP is an application level protocol

- Runs directly on ethernet multicast or on IP multicast, obviously enclosed within the DS

- The standard provides primitives for handover only

- Requires the presence of a Radius server for management purposes

- APs should be registered on the Radius server

- Uses standard MIBs for accessing managing the AP data

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Some more stuff ...

- IAPP is not a routing protocol, and assumes a 802-based DS

- IAPP is not concerned with user data delivery

- No address management is considered, STA must have/obtain valid addresses

- May keep a table of physically adjacent APs to support handovers and to do load balancing

- If IAPP is used all APs with the same SSID on the same DS are part of the same ES

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IEEE 802.11f: primitives (examples)

- **IAPP-INITIATE/ADD/TERMINATE:** create an ESS, add a node (1 AP) to it, terminate one node

- **IAPP-MOVE.request/indication(STA,AP1):** indicates on the multicast group that STA re-associated with AP1

- **APP-MOVE.response/confirm(STA,AP1,AP2):** transmit all information relevant to STA from the old association AP2 to the new association AP1

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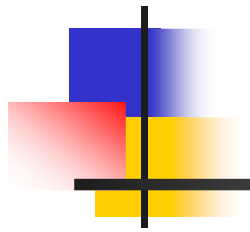
CapWap

capwap basics

- Not alternative to any 802.11 standard/proposal

- Takes a "wide-network (or network-wide?)" perspective w.r.t. the "local-network" perspective of 802

- Indeed, in the end, it is alternative to 802.11f

- Starts providing an interesting classification of different WLAN solutions all supported by 802.11

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capwap taxonomy

- AP used as a generic, legacy term
- WTP - Wireless Termination Point: A point of wireless access to the network
  - may or may not implement all APs functionalities
  - if not is also known as "thin-AP"
- AC – Access Controller: centralized point of control if many WTPs are jointly controlled by a back-end unit

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capwap functions

- RF monitoring
  - radar detection
  - noise and interference detection
  - measurement.
- RF configuration
  - for retransmission
  - channel selection/assignment
  - transmission power adjustment
- WTP configuration
- WTP firmware loading (e.g. granting network wide consistency)
- Network-wide STA state information
  - information for value-added services
  - mobility and load balancing.
  - ...
- Mutual authentication between network entities

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WLAN arch: autonomous

- Traditional WLAN architecture (a WTP is an AP as we know and use every day)

- Each WTP is a single physical device

- Implements all the 802.11 services,

- Configured and controlled individually

- Can be monitored and managed via typical network management protocols like SNMP

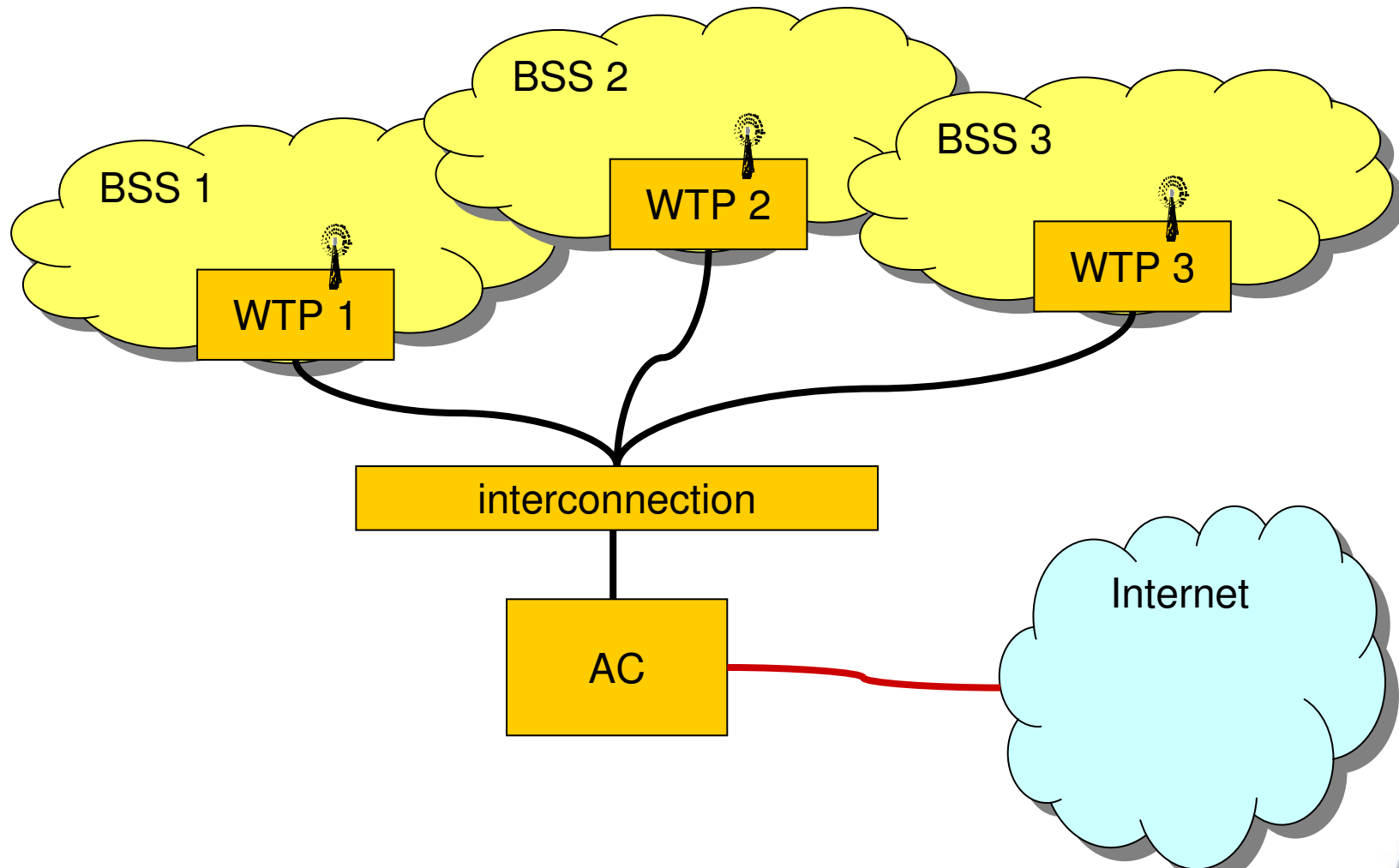- Such WTPs are sometimes referred to as "Fat APs" or "Standalone APs"

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capwap WLAN arch: centralized

- Hierarchical architecture

- One or more Access Controllers (ACs) manage a large number of WTPs

- AC can be the aggregation point for the data plane

- AC is often co- located with an L2 bridge (Access Bridge), a switch, or an L3 router (Access Router)

- Much better manageability for large scale networks

- IEEE 802.11 functions and CAPWAP control functions are provided by the WTP devices and the AC together

- The WTPs may no longer fully implement 802.11 functions

- WTPs are sometimes called "light weight" or "thin APs"

capwap WLAN arch: centralized

BSS 2

BSS 3

BSS 1

WTP 2

WTP 3

WTP 1

interconnection

Internet

AC

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capwap centralized: protocol view

- Interconnection can be L3, L2 or even direct physical connection
- AC can be distributed over several physical devices
- Can support 3 different protocol architectures

"local MAC"   **"split MAC"**   **"remote MAC"**

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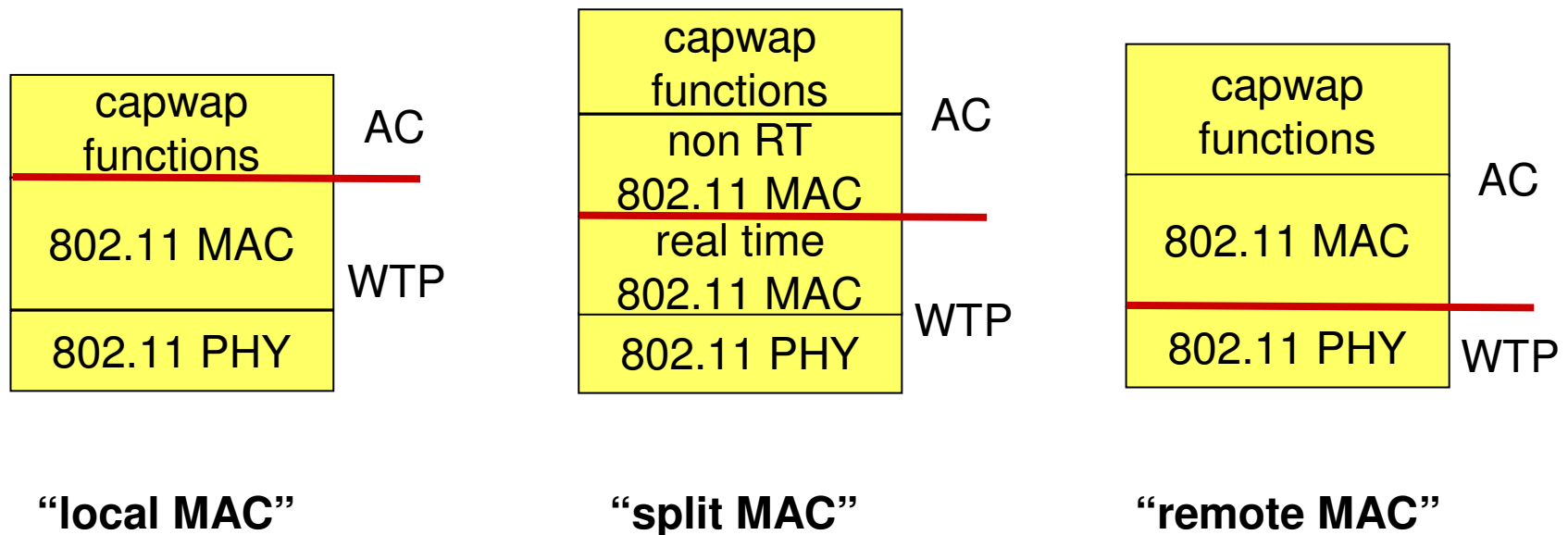
capwap centralized: AC-WTP Interface

- Discovery: The WTPs discover the AC with which they will be bound to and controlled by
- Authentication: WTPs must authenticate with AC (and possibly vice-versa)
- WTP Association: WTP registers with the AC
- Firmware Download: WTP pull or AC push the WTPs firmware
- Control Channel Establishment: The WTP establishes an IP-tunnel with the AC
- Configuration Download: AC push configuration parameters to the WTP

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