

Roaming in the wireless campus network

Agenda

- **Roaming defined**
- **Elements of roaming**
- **Principal implementations**
- **Examples**

Roaming - Definition

- **The ability to move from place to place and stay on the network**
- Two kinds of roaming:
 - **Seamless** roaming: uninterrupted, always on
 - **Nomadic** roaming: interrupted, yet always able to pick up again

Roaming - Definition

- **The ability to move from place to place and stay on the network**
- In our case, moving within the campus
 - Roaming in mobile networks often means: roaming between operators, countries, cities – that is not what we are talking about here
- “To stay on the network” means:
 - Avoid interruption
 - Avoid re-authentication
 - Keep state and session
- So we would like **Seamless Roaming** (?)

Roaming - Wireless

- Roaming is part of the wireless set of standards 802.11
 - specifically 802.11r
- The task of roaming in 802.11r lies completely with the *client*
- *"To stay on the network" means "Avoid interruption" ... however:*
 - A managed radio card can only be associated with one AP
 - Changing AP will always lead to interruption! The question is just:
 - How long?
 - What is being interrupted?

Roaming - Wireless

- The process of disassociation and re-association typically takes some 100 milliseconds ... up to seconds
- Details depend on security (e.g. 802.11x) , management, etc
- A one second break in web browsing is probably acceptable – and we typically do not browse as we walk
- The most vulnerable IP communication is voice – we often speak as we go, and everything over 500 ms is felt as delay

Roaming - Wireless

- As a client can only be associated with one AP at a time, managed roaming would mean to either
 - Have the AP talk to other APs (e.g. WDS, Fat AP approach)
 - or
 - Have a managing system behind the APs talk to all APs

Roaming – State & Session

- By all means, we would like to
 - Stay authenticated (e.g. through captive portal), website login
 - Keep session (e.g. shop transaction)
- Can we reach these goals? This does not only depend on the wireless side – mostly, it depends on
 - Layer 3 / 4 – connection or connectionless?
 - Applications
 - Network design (am I roaming in one subnet or across subnets? Does the core network still know me as I re-appear?)

Wireless Roaming

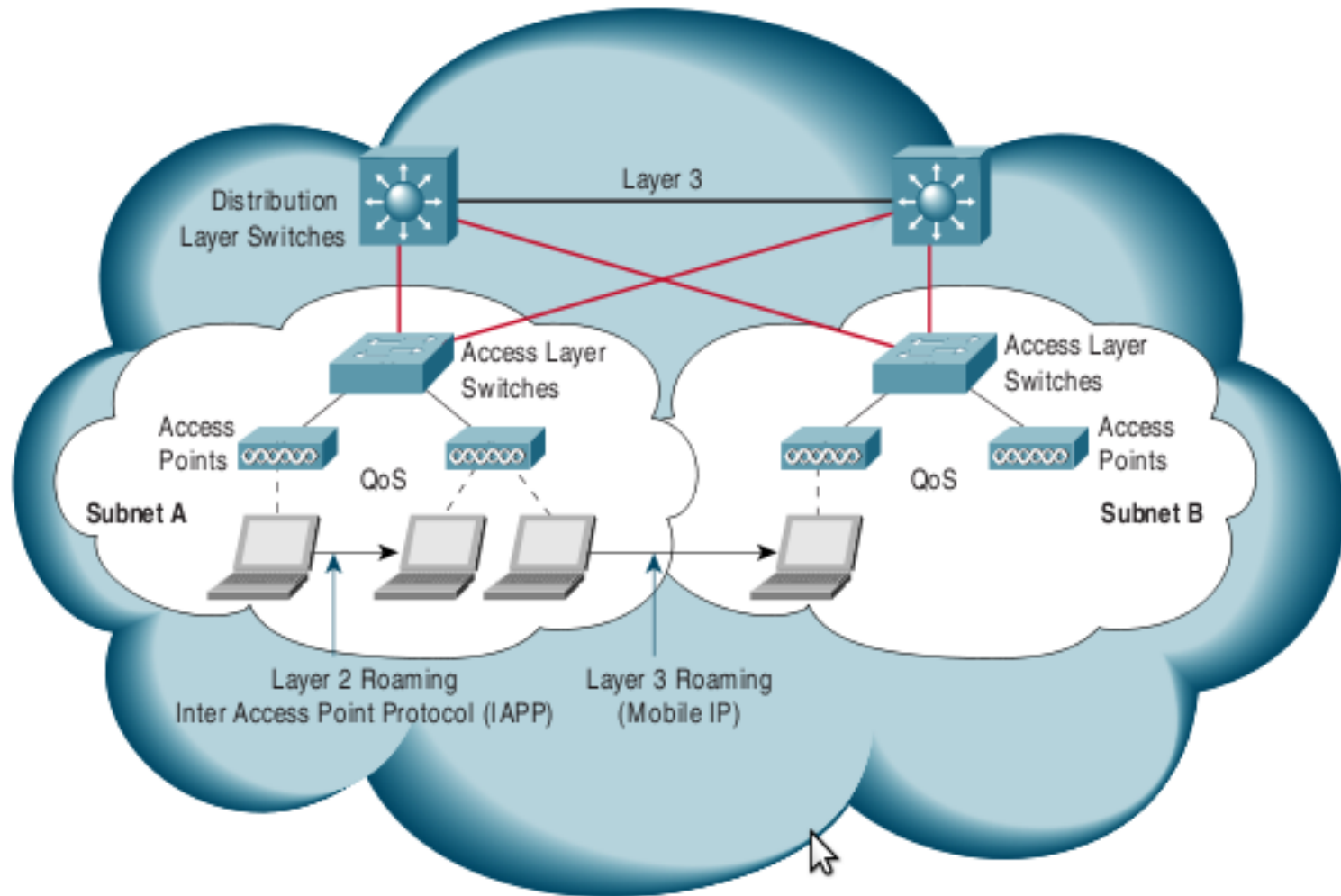
- Remember that 802.11 lives on Layer 1 / 2 – it does not know about TCP/IP, UDP, etc
- The *roaming domain* of 802.11 wireless is the (E)SSID – as long as clients are in the same SSID, they can broadcast and roam

Elements of roaming

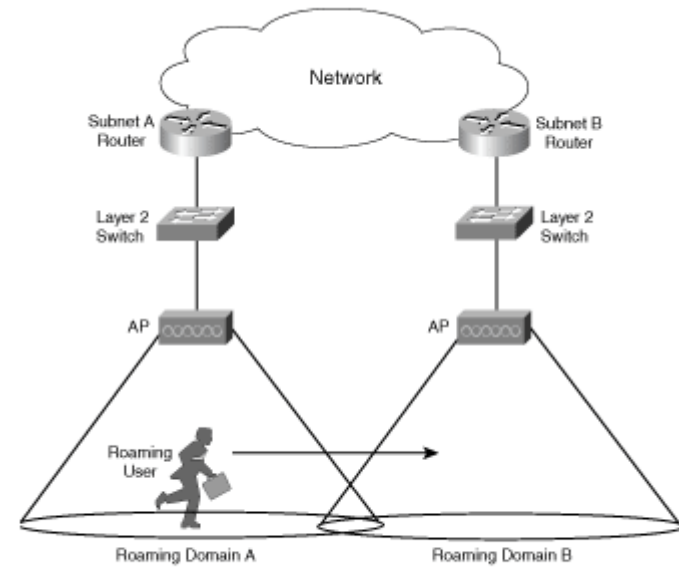
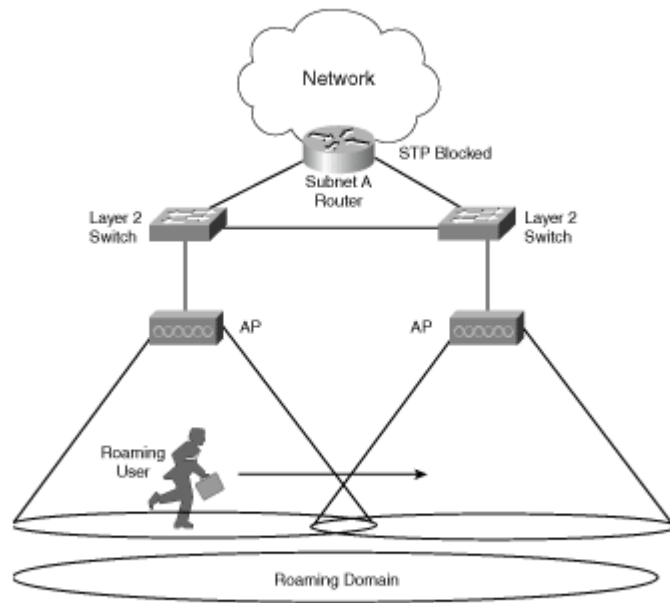
- Scan
- Decide
- Leave one AP
- Handshake with other AP

Elements of roaming

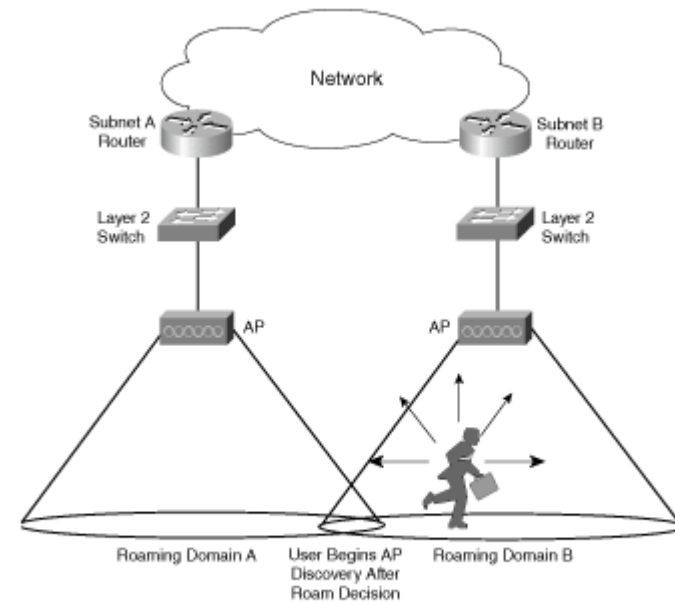
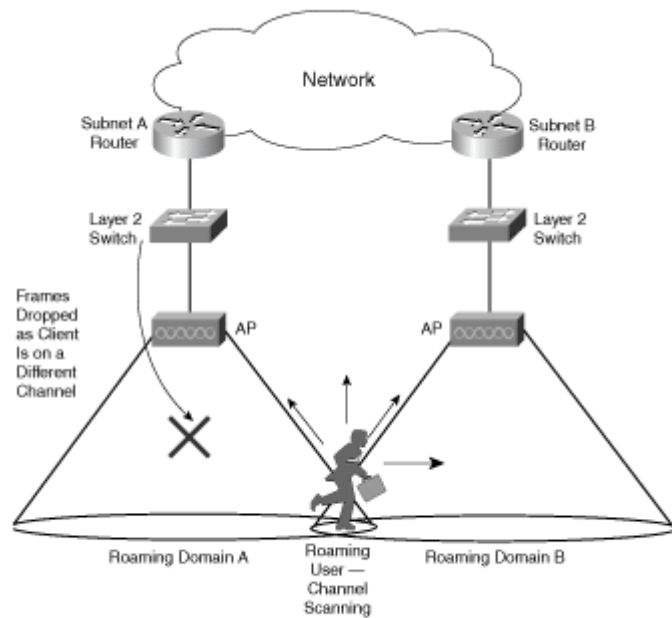
Figure 2 Layer 2 and Layer 3 Roaming



Elements of roaming



Elements of roaming



A simple effective way

- Roaming on Layer 2: taken care of by 802.11r, broadcast domain (one SSID!)
- Roaming on Layer 3: taken care of by IP network design
 - Need to be on same subnet, keep IP
 - DHCP needs to remember MAC

Roaming Modes in a Controller based system.

- **Intra-controller roaming** The wireless user moves from one AP to another AP connected to the same controller. In this case, the controller's only action is to change the associated AP in the client database entry. The process is transparent to the client and takes less than 10 ms.

Roaming Modes in a Controller based system

- **Layer 2 intercontroller roaming:** The wireless user moves from one AP to another AP connected to another controller in the same subnet (as the first controller). When the client tries to join the new AP, both controllers exchange the client details (database entry and credentials). The process takes less than 20 ms and is usually seamless for the client.

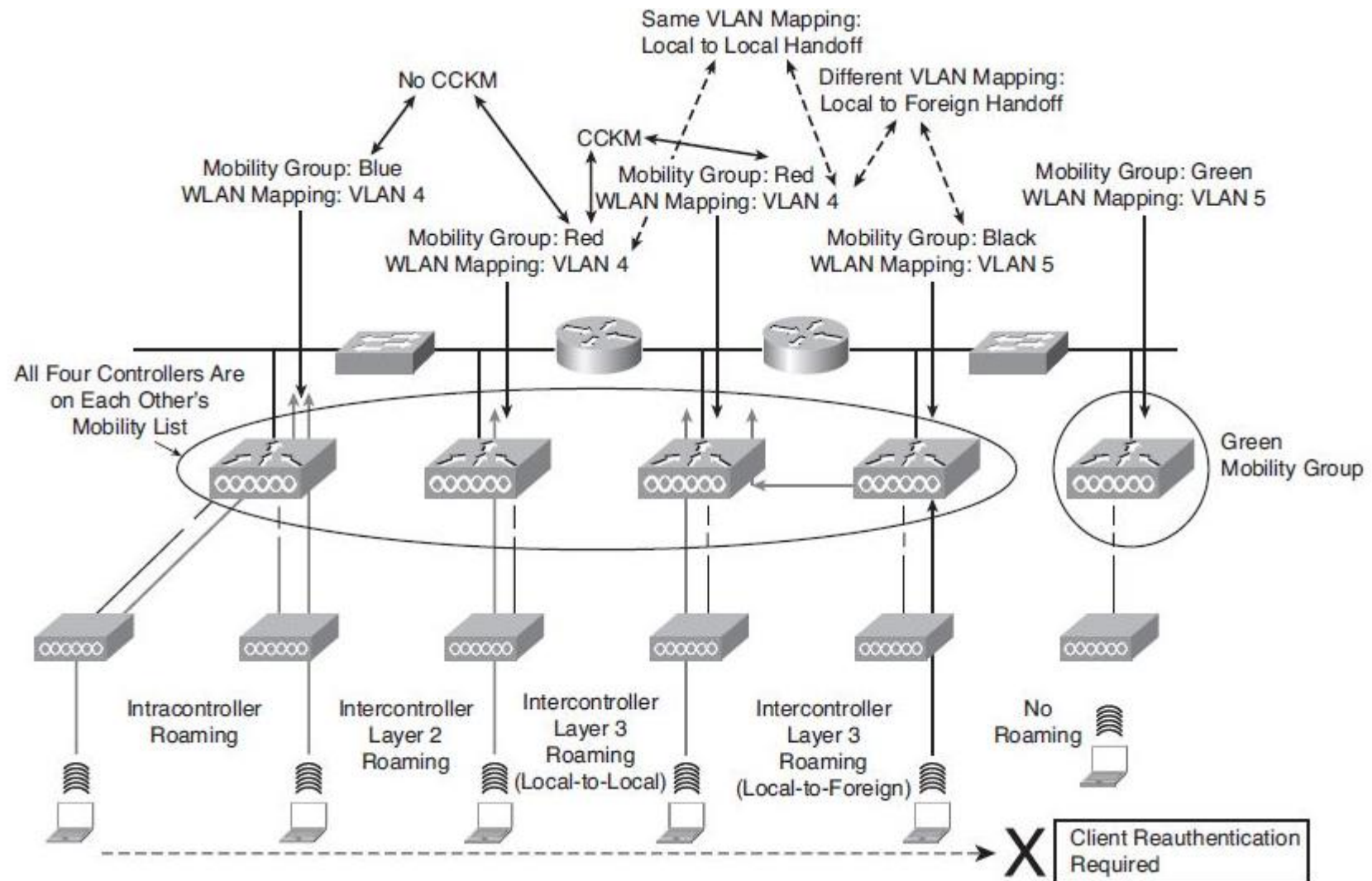
- **Layer 3 intercontroller roaming** Controllers are in Different Subnets. When the client tries to join the new AP, both controllers also exchange the client details (database entry and credentials). The process takes less than 30 ms and is usually seamless for the client. When VLAN to WLAN mapping client is moved. . In this case, the client entry is moved completely to the new controller..

Roaming Modes in a Controller based system

The roaming can also be local-to-foreign if both controllers' WLAN-to-VLAN mapping for the client WLAN is different. In that case, the new controller (called the foreign controller) encapsulates the client traffic into an Ethernet over IP (EoIP) packet and forwards it to the old controller, called the *anchor*

Return traffic is sent to the anchor controller, which forwards it via EoIP to the foreigncontroller and the client. For the wired infrastructure, the client traffic is still entirely handled by, and goes through, the anchorcontroller. When idle, the roamed client may renew its connection and then associate locally to the foreign controller.

Roaming Graphical



That was it ...

Thank you!

