

Wireless System Integration

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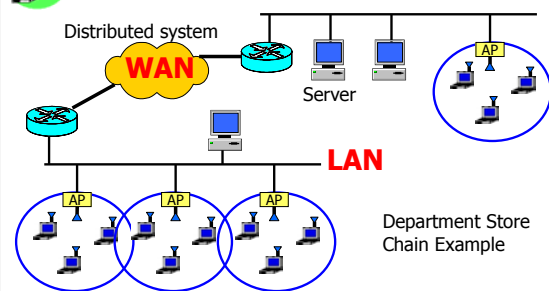
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Outline

- **Wireless System Architecture**
- Protocols
 - Roaming Protocol
 - Communications Protocol
 - Connectivity Software

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Wireless System Architecture



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WLAN

- Wireless Access Point
- Wireless NIC
- Adapter (PCMCIA/PCI adapter)

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LAN

- LAN Technologies
 - Ethernet
 - Token Ring
 - FDDI
- Speed – 10 / 100 / 1000 Mbps
- Media – UTP / Coax / Fiber
- Network devices
 - Hub / Switch / Bridge / Repeater

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WAN Technologies

- Frame Relay
 - Packet SW, less overhead X.25
 - 56 Kbps – 2 Mbps
- Switched Multimegabit Data Service (SMDS)
 - Packet Sw, connectionless datagram
 - 1.5 – 45 Mbps
- ATM
 - Circuit Sw
 - 155 Mbps

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WAN Technologies

- Private WAN
 - High cost /Dedicate links / Fixed BW
 - Leased T1 and 56 Kbps
- Public WAN
 - Low cost / variable BW / reliability
 - Leased connections shared among companies

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Roaming Protocols

- Multiple-Cell WLAN
- Wireless station moves from cell to cell
- Seamlessly connectivity maintain
- No roaming specified in IEEE 802.11

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Roaming Concept

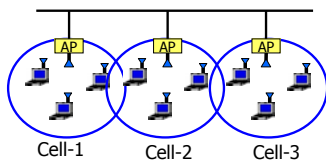
- 802.11 station checks its signal strength (Communication Quality:CQ) from Access Point
- CQ decreases when station move away from an Access Point
- If too low, looking for a new Access Point
- Reassociate to the new strong signal strength Access Point

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Proprietary Roaming Protocol

- Lucent's WaveAROUND
- All linked cells are called "Domain"
- Each wireless station can move among cells
- Cells need not to be overlapped



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Proprietary Roaming Protocol

- AP regularly broadcast beacon
- Beacon contain
 - DomainID
 - NetworkID of AP
 - Communications-quality info
 - Cell-Search threshold value
- Wireless Station uses beacon for monitoring and switch AP

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Responsiveness

- 3 Modes
 - Relaxed mode: low beacon rate
 - Normal mode: moderate beacon rate
 - Fast mode: High beacon rate
- Quality VS. overhead

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Cell Search Thresholds

- Sensitivity
 - Time used to search and switch AP
 - Level of Communication Quality
- 3 thresholds
 - **Regular cell search:** Start searching, switch only quality > *Stop cell search* Threshold
 - **Stop cell search:** Stop searching quality level [Low, Normal, High]
 - **Fast cell search:** start searching, switch if quality is better

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Inter-Access Point Protocol (IAPP)

- Roaming through multiple-vendor APs
- Use Distribution system interface of IEEE 802.11
- Operate between AP by using UDP & IP
- 2 basic protocols:
 - Announce Protocol
 - Handover Protocol

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Roaming note

- Depend on the product
- Choose the one that support IAPP
- Choose common vendor/product

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Communication Protocols

- TCP/IP
 - Static / Dynamic IP address (DHCP)
- TCP/IP issues for WLAN
 - High overhead (TCP)
 - Marginal condition
 - Mobile node address → Mobile IP

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Mobile IP

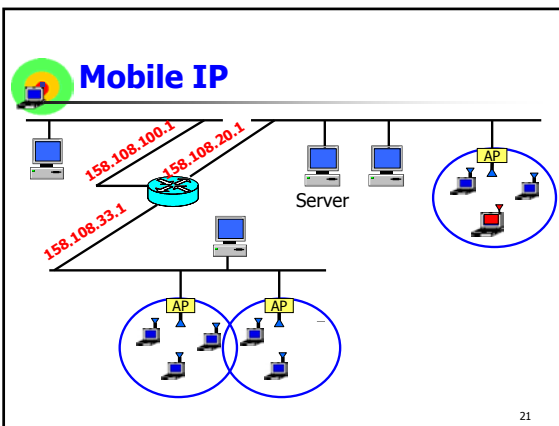
- Enhancement of standard IP protocol
- Enable station to roam among different IP network (subnetwork)
- Use Address forwarding mechanism (post mail delivery)
 - No change in the DNS or router

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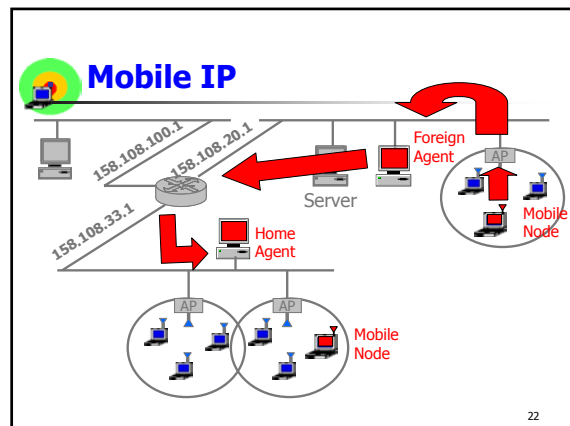
Mobile IP Entities

- Mobile Node
- Home Agent (a host / a router)
- Foreign Agent (a host / a router)
- Care-of-Address (Foreign Agent IP)
- Correspondent Node (a server)

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Mobile IP Protocol

- Agent Discovery
- Assignment of Care-of-Address
- Registration
- Tunneling & Encapsulation

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Agent Discovery

- Goal
 - Bind mobile host to foreign/home agent
- Foreign Agent & Home agent periodically broadcast beacon
- Mobile listens and initiate registration request
- Determine its location
 - If it is located on home network
 - not use mobility function
 - If it is located on foreign network
 - obtain a Care-of-Address

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Assignment of Care-of-Add

- Home network uses Care-of-Address to forward packet to the mobile node
- To assign a Care-of-Address
 - Foreign agent maintain a single care-of-add for all mobiles (IP of FA)
 - Mobile node acquires the care-of-address through a protocol (DHCP)

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Care-of-Address

Home Address	Care-of-Address	LifeTime (ms)
158.108.33.2	171.12.1.2	300

Home Agent Table (mobility binding table)

Home Address	Home Agent Address	Mobile Address	LifeTime (ms)
158.108.33.2	158.108.33.1	01-1F-12-56-44-3F	300

Foreign Agent Table (visitor list)

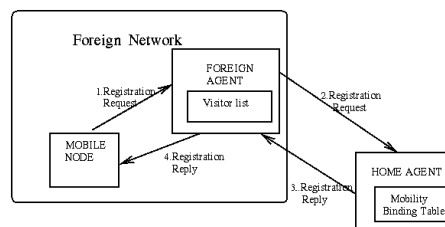
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Registration

- After receiving a care-of-add,
 - Mobile node (Foreign agent) registers to Home agent
- Establish a link between the foreign and Home network
- Mobile node & Home Agent communicate with encryption (like a tunnel)

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Registration



Source: CS640 - WISC

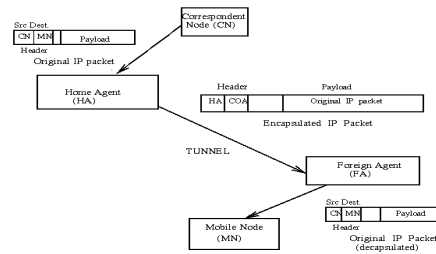
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Tunneling & Encapsulation

- The tunnel end point
 - Home agent IP
 - Care-of-Address
- Home agent intercepts datagram of mobile node
 - Then encapsulate and send to the care-of-address destination
- Foreign agent decapsulates
 - Then passes the datagram to mobile node
- Mobile node can send data using regular IP packet to the destination

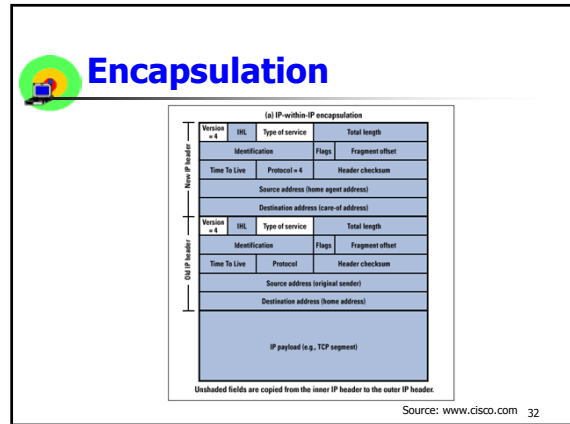
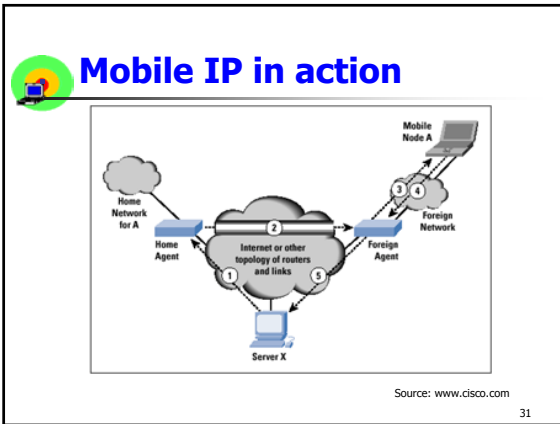
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Tunneling & Encapsulation



Source: CS640 - WISC

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- ## Mobile IP... Problems?
- Sub-Optimal Triangle Routing
 - Reliability problem
 - Home agent down?
 - Security
 - Fake connection
 - Etc.
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- ## Connectivity Software
- Deal with the application software (presentation layer)
 - Terminal Emulation
 - Direct Database Connectivity
 - Internet-Based Connectivity Software
 - Middleware
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- ## Terminal Emulation
- Make the appliance appear as a terminal on host-based OS
 - Advantages
 - No programming needed
 - Centralize
 - Low cost
 - Disadvantages
 - Inflexible
 - Limited application support
 - Significantly effect on wireless network (TCP)
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Direct DB Connectivity

- Interface directly to database on the server
- Communicate via API or ODBC (Open Database Connectivity)
- Advantages
 - Flexible / Low cost
 - Good support for client/server
 - Good data transfer
- Disadvantages
 - Distributed software control
 - TCP overhead

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Internet-Based

- Web client / server
- Using HTTP
- Advantages
 - No programming needed
 - Centralize
 - Low cost
 - Strong support of client/server
- Disadvantages
 - TCP overhead

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Middleware

- Increase performance of application running across wireless network
 - BW & disruption connection
- Advantages
 - Data compression
 - Intelligent restart (from disruption)
 - Picky-back ACK
 - Store-and-forward packet
 - Support Mobile IP
- Disadvantages
 - High cost (long term cost saving)

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