MOBILITY IN IP NETWORKS
Outline

→ Mobility challenges
→ Mobile IP
→ Proxy Mobile IPv6
→ Locator/Identifier Separation Protocol
→ Host Identity Protocol
MOBILITY
CHALLENGES
Does Mobility Imply Wireless?

Not necessarily, although common

→ A laptop being deployed in different offices
→ Temporary guest
Macromobility

→ Nomadic computing
→ Infrequent movements
→ Not necessarily wireless
→ No seamless operation
Micromobility

→ Frequent or continuous movement

→ E.g. handheld device moving on a cellular network

→ Applications must be able to operate seamlessly
Transparent (to IP) Movements

→ Within same physical network
  → Within a cell of a cellular network
  → Among cells
  → Between switch ports
→ Handled by layer 2
Changing Physical Network

IP address prefix depends on the “position” of the station

→ Logical IP subnet (LIS) corresponds to physical network
→ If a station changes physical network
  → It must change LIS (prefix)
    → Address change
  → Host specific route
New address? No thanks

Existing TCP connections and UDP sessions are interrupted
Connection/session identifier includes IP address

Address-based authorization mechanisms will reject the station
Host specific route? Rather not

Routing table explosion

→ Give up hierarchy

→ Size on the order of the number of stations
Unreachability of hosts if information is not updated promptly
MOBILE IP
Features

→ RFC 3344 (2002)
→ Transparent for transport layer and applications
→ Interoperability with station that do not have mobile IP support
→ Scalability
Security

→ Authentication to avoid mobile station spoofing

Limited mobility

→ At most one “movement” per second
Addressing

→ Mobile station has its own permanent address
→ Corresponding to its main location
→ Home address
→ When a station moves to a Foreign network
→ It acquires a local address
→ Care-of address
Packet Forwarding

Home address is used for packet transmission (as source and destination address)
Packets to mobile station are sent to the home address but delivered to the care-of address.

\[ \text{Da H2 a F3} \] \[ \text{Da Z3 a H1} \] \[ \text{IP data} \]

Tunnelling
Who is at the ends of the tunnel?

Home agent

Da Z3 a H1

Da H2 a F3

Home agent

Da Z3 a H1
Co-located care-of address

→ Permanent or dynamic
  → E.g. DHCP
→ More IP addresses needed
→ Host terminates tunnel
  → Higher processing load
→ No need for foreign agent
Foreign Agent

- Da Z3 a H1
- Da H2 a F3
- Da H2 a F3
- Da Z3 a H1
Foreign Agent Care-of Address

→ Foreign agent address
→ Address sharing
→ No processing load on mobile station
→ FA terminates tunnel
Registration

A station becoming active on a foreign network must register with its home agent.

→ Communicate care-of address

Registration can take place through the foreign agent.
Registration messages

→ Mobile IP protocol

Authentication functionality

→ To avoid that a malicious station pretends to be part of the home network to gain access to it
Agent Advertisement

→ Mobile IP agents need to advertise
→ ICMP router advertisement extension
→ Mobile station can understand “where” it is
→ Home network or foreign network
A mobile station can solicit a mobile IP agent advertisement

ICMP router solicitation
PROXY MOBILE IPV6
(PMIPv6 OR PMIP)
Features

→ No support required in hosts

→ Network element tracks movements of hosts

→ Based on standard, commonly deployed protocols
→ Network element takes care of mobility related actions

→ Signaling

→ Tunneling

→ Solution specific protocols
Architecture

Mobile node (MN)

Mobile Access Gateway (MAG)

Local Mobility Anchor (LMA)
Not Necessarily IPv6

→ Mobile node: IPv4 or IPv6 (or dual stack)

→ Network between MAG and LMA: IPv4 or IPv6
Signaling is based on IPv6, but can be IPv4

LMA is a Mobile IPv6 Home Agent
Key Steps

- MN detection
- DHCP, ARP, neighbor discovery
- MN authentication
  - Might be done by MAG or nearby node
- MN policy retrieval
  - E.g. RADIUS or local
  - Includes LMA address
- Signaling to LMA
- Address assignment
  - Possibly from LMA
  - DHCP to MN
LOCATOR/IDENTIFIER SEPARATION PROTOCOL (LISP)
IP Addresses Have Two Functions

→ Identify stations
→ Locate stations
  → Support routers in finding a path to hosts

LISP separates them
Identifiers and Route Locators

→ IP address
→ Something else
   → E.g. GPS coordinates, MAC address
Applications Fields

→ Mobility
→ Routing scalability
→ IPv4/IPv6 address space traversal
→ Network virtualization
→ Multihoming
Working Principles

→ Mapping system:
   identifier ↔ locator
→ Initially BGP-based
→ Then DNS-inspired
→ Any can be used
→ Used by routers
→ Hosts are unaware
LISP and Mobility

→ Hosts keep identifier as they move
→ Locator acquired as they move
→ LISP used for mapping and ensuring packet delivery
HOST IDENTITY PROTOCOL (HIP)
What

→ Decouples identity from location

→ Creates Host Identity name space

→ Based on asymmetric (public key) cryptography
How

- Applications use cryptographic identifiers
- Host Identity Tag from public key
Protocols to ensure correspondent owns corresponding private key is owned
Why

→ Created to address security issues

→ Used for mobility since identifier is location independent

→ Address change does not impact connections