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

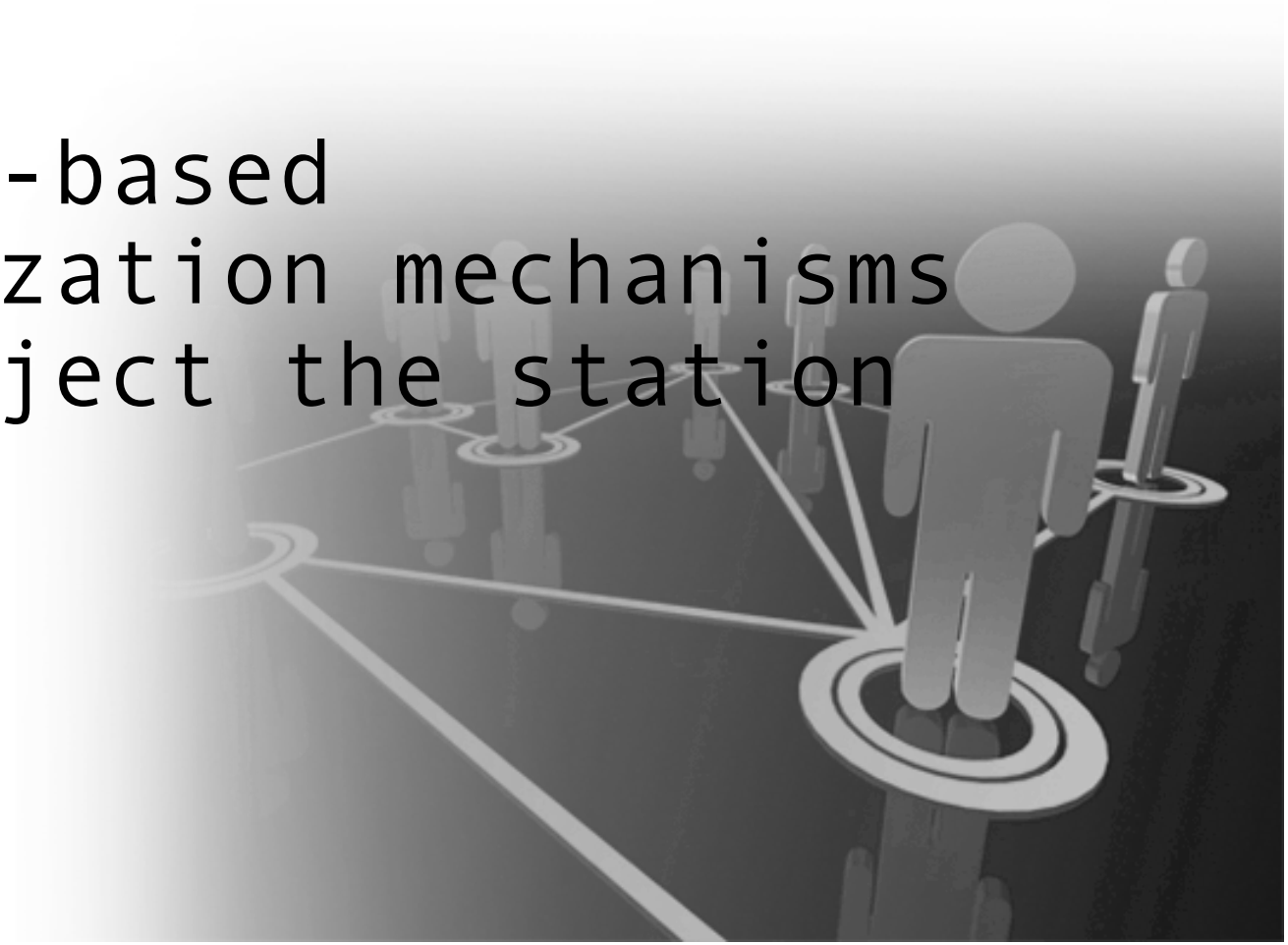
→ Logical IP subnet (LIS) corresponds to physical network

- → 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

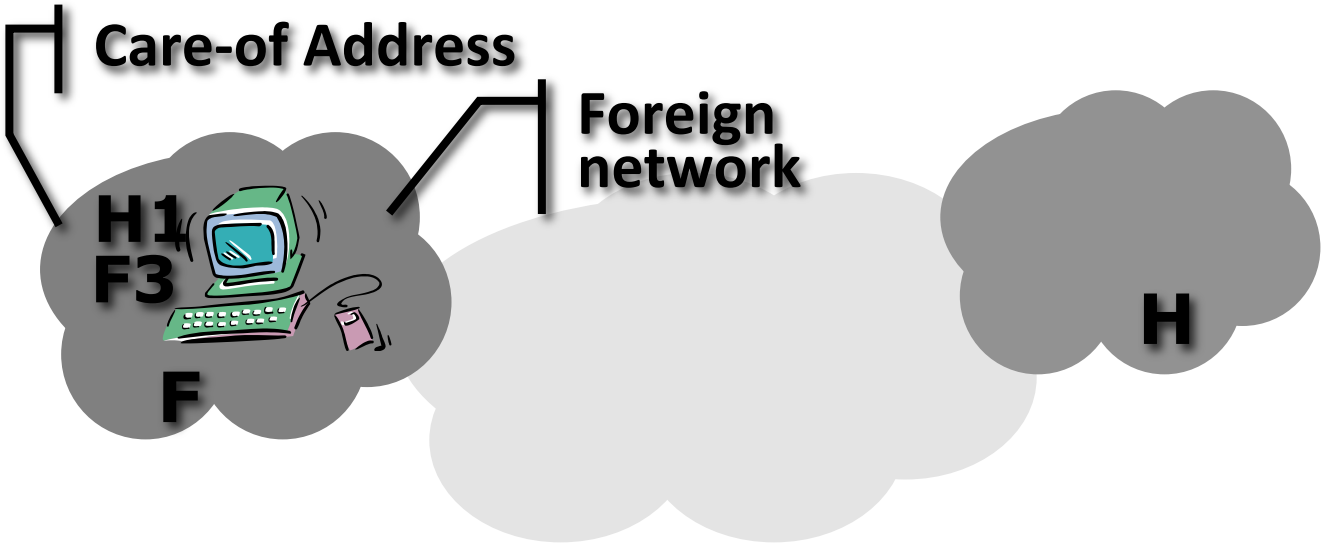
Limited mobility

→ At most one “movement” per second

Addressing

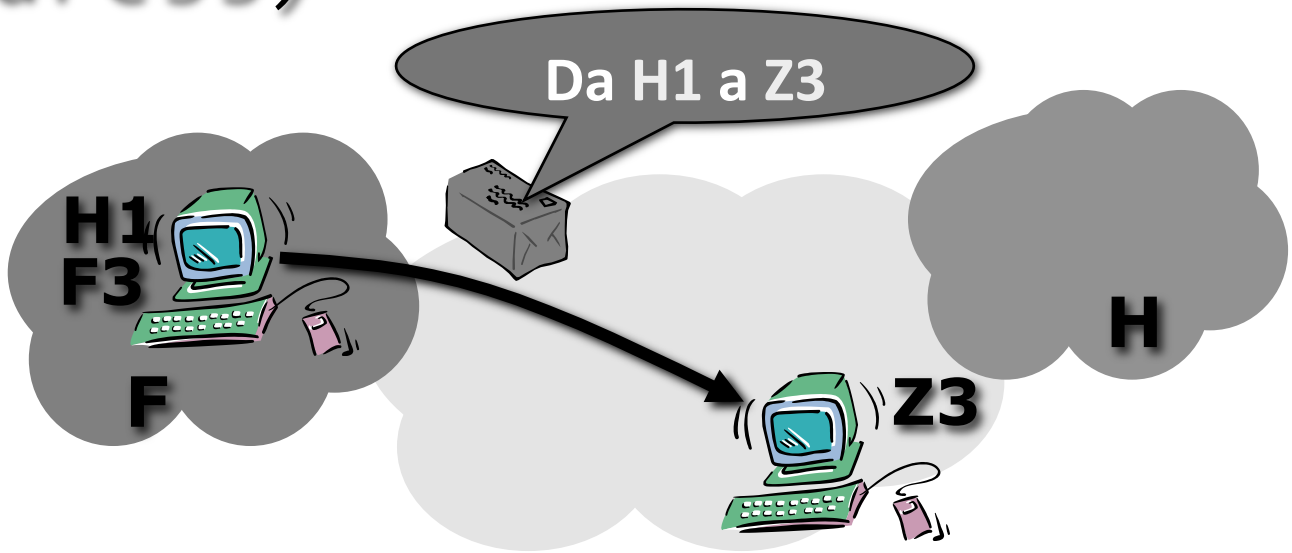
- → Mobile station has its own permanent address
- → Corresponding to its main location
- → Home address

- → When a station moves to a Foreign network
- → It acquires a local address
  - → Care-of address



Packet Forwarding

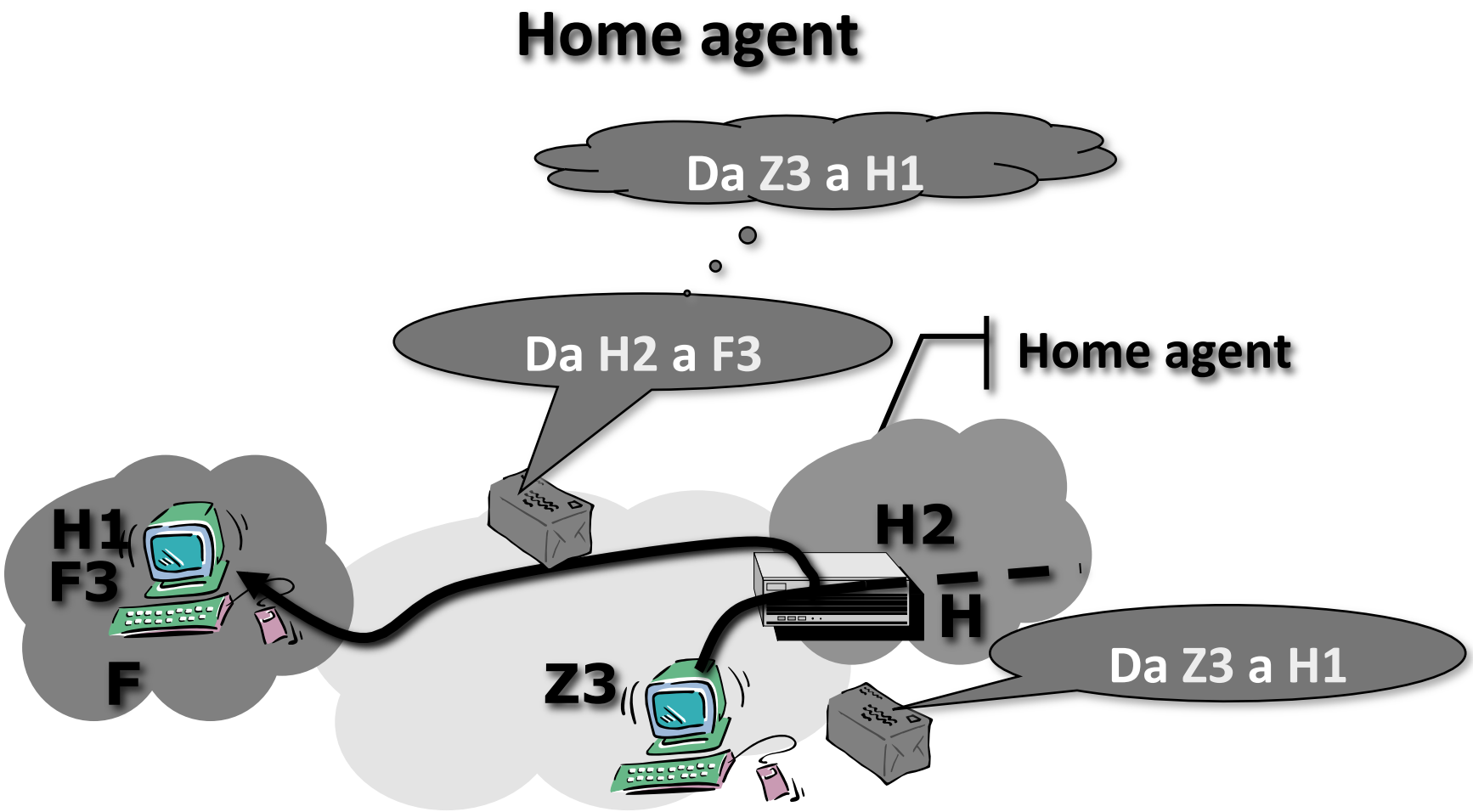
Home address is used for packet transmission (as source and destination address)



Packets to mobile station are sent to the home address but delivered to the care-of address

Tunnelling

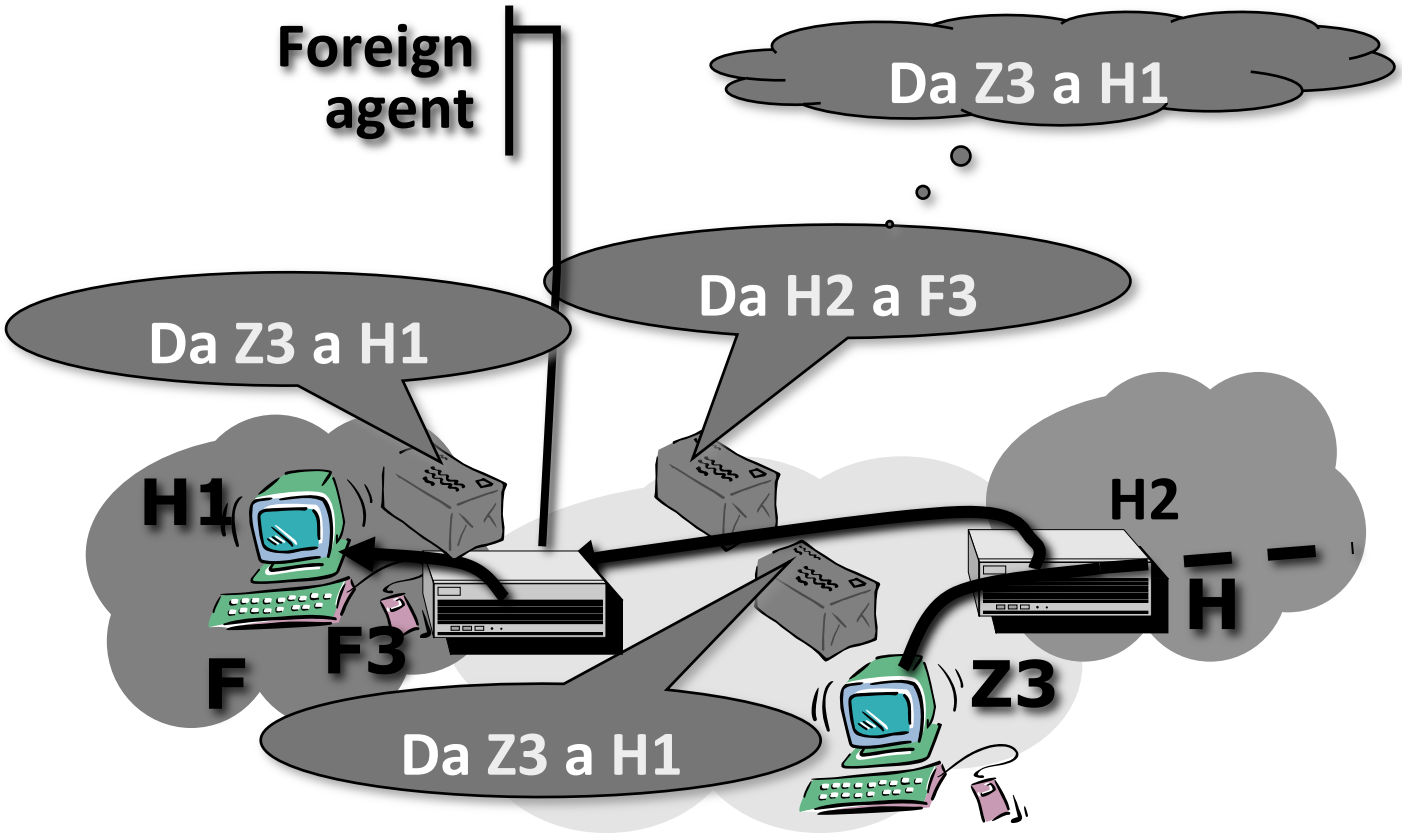
Who is at the ends of the tunnel?



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



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

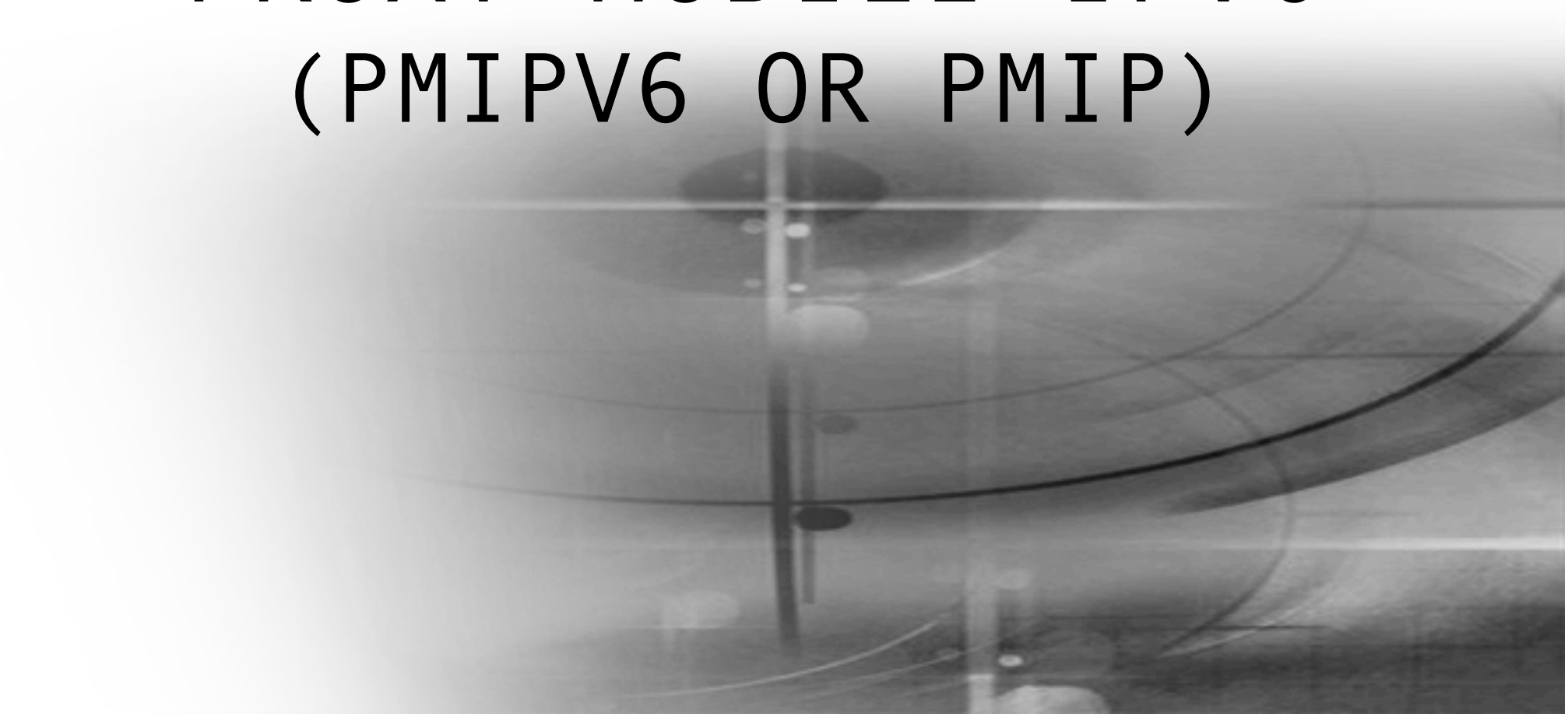
→ To avoid that a malicious station pretends to be part of the home network to gain access to it

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)

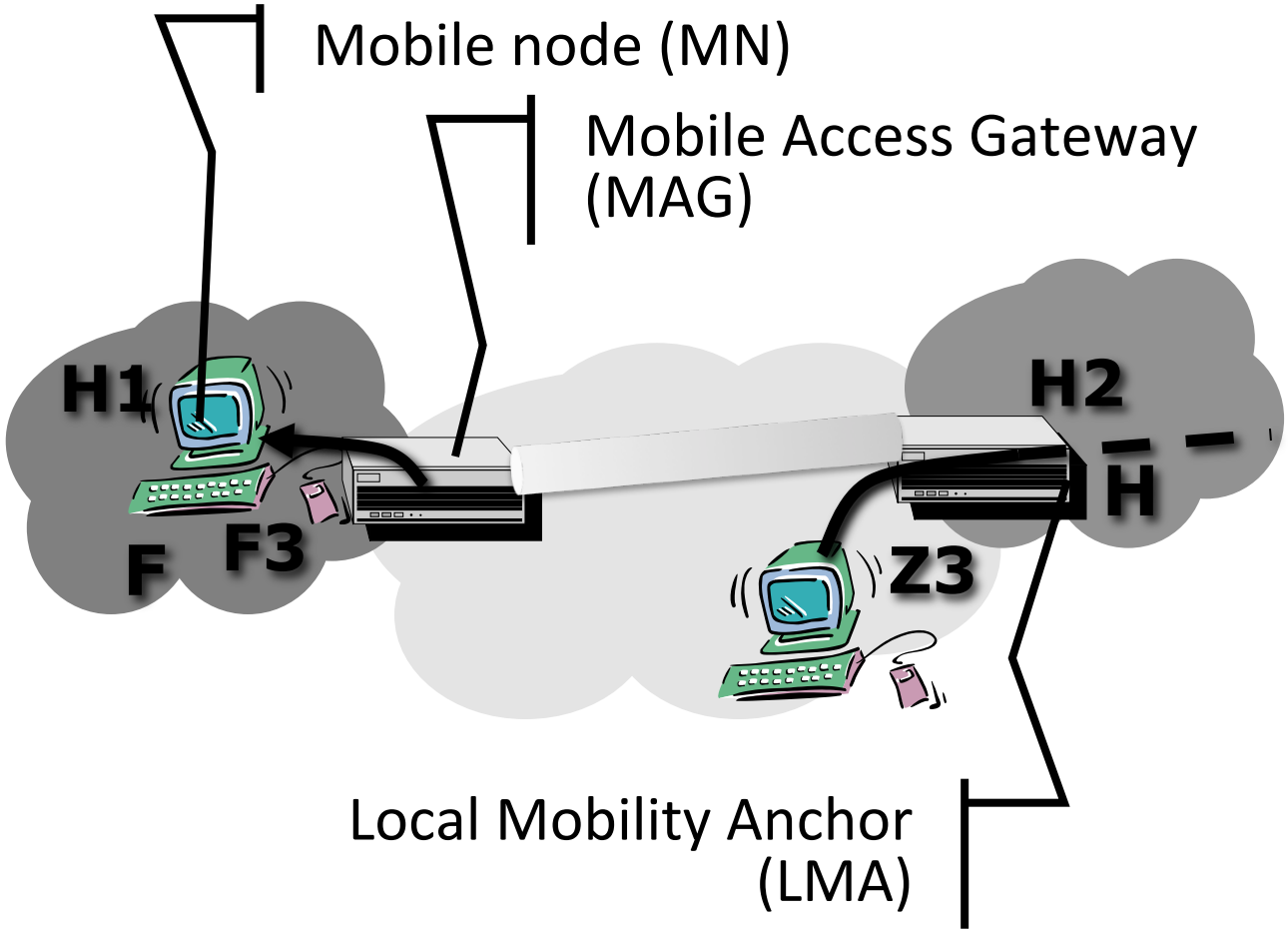


Features

- → 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



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)

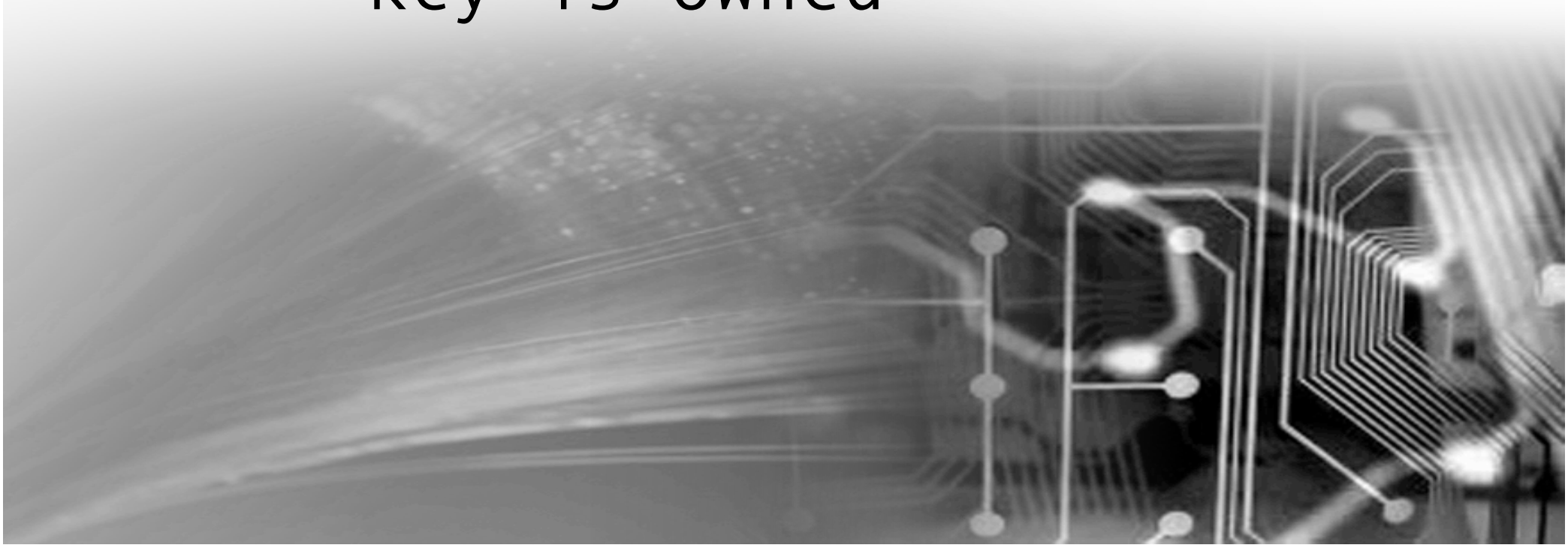
What

- → 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