Scalable Mobility Support for Overlay Networks

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Objectives

- Scalable mobility support over a wide area
- Support for fast handoffs within a local environment
  - real-time audio/video across handoffs
- Support for overlay networks
  - using multiple NIs simultaneously
  - vertical handoffs

Mobile IP

- Entities
  - Mobile host
  - Home agent
  - Foreign agent
  - Correspondent host

- MH registers its care-of-address with its HA after each handoff

- Normal data flow: tunneled from HA to FA or MH

- Route optimization: tunneled from CH to FA or MH

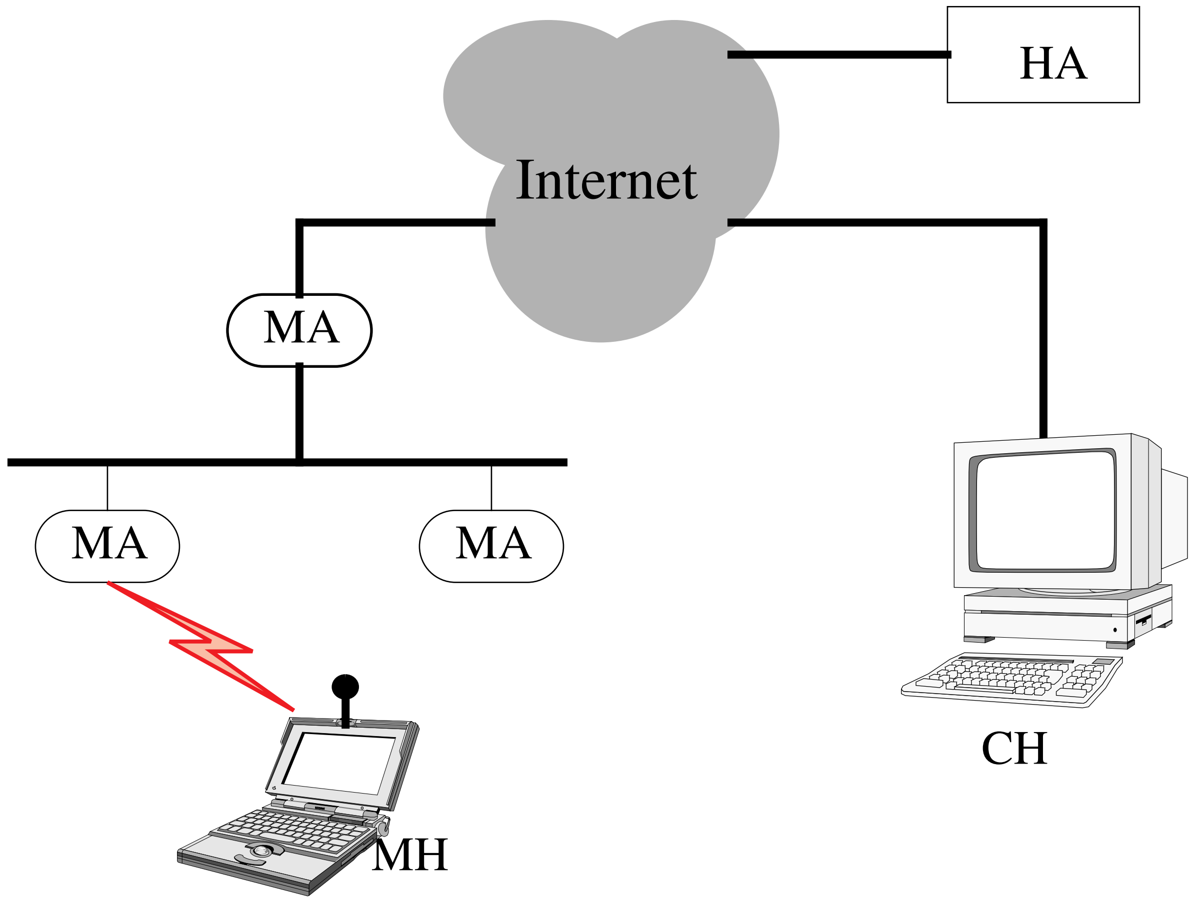
Why Mobile IP is inadequate?

- Excessive communication with the home agent
    - latency of communication
    - load on home agent and backbone network
- Local handoff protocol is coupled with the global mobile routing protocol
- No support for multiple care-of-addresses for a mobile host
    - simultaneous registrations is not quite the same thing

Hierarchical Mobility Agents

- Hierarchy of mobility agents (MA) in a domain (like UCB)
    - incorporate some functionality of both home agents and foreign agents
- MH uses address of top-level MA as care-of-address
- Common case: local mobility
    - changes confined to subtree rooted at common ancestor MA
    - protocol between lower-level and higher-level MAs

Hierarchical Mobility Agents



Issues

- Security
  - MA hierarchy should coincide with security domain
  - authentication protocol between MAs in a domain
- Routing
  - host routes maintained by MAs to avoid repeated encapsulation/decapsulation
  - can optimize with support from CH and MH
- MA as a multi-protocol agent
  - can use optimized protocol for local handoffs
  - Example: multicast in a local environment for efficient low-latency handoff

Overlay Network Issues

- Vertical handoffs may violate locality
  - routes to WaveLAN and Metricom base stations diverge far from the mobile host
  - WaveLAN and IR base stations might be close to each other
- Simultaneous use of multiple overlays
  - Example: CDPD for short, bursty data; cellular modem for bulk data
  - route data to MH via appropriate network based on constraints/preferences
  - demultiplexing at HA, FA, or CH
  - tolerate loss of connectivity on a subset of NIs

Mobility-aware End Hosts

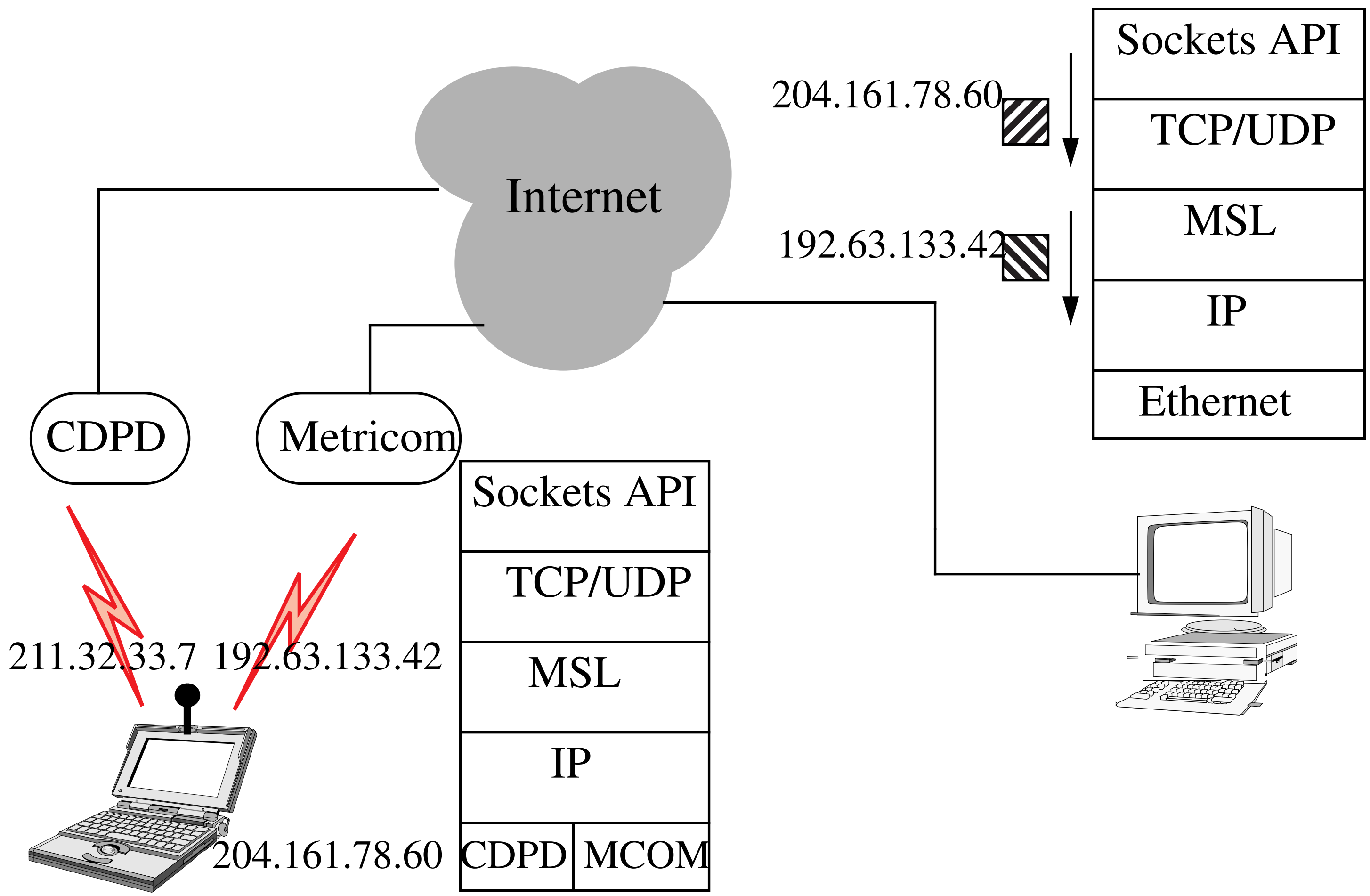
- Desire direct communication between CH and MH
  - efficiency, fault tolerance
- Mobile IP route optimization
  - out-of-band caching scheme
- IPv6 mobility support
  - MH acquires care-of address (auto-configuration)
  - MH sends binding update to CH using destination option
  - CH uses routing header to specify care-of address in source route
  - HA uses encapsulation to route via care-of address
  - overlays not considered

Mobility-aware End Hosts (contd.)

Our approach:

- Decouple transport address from network address
    - Mobility Support Layer (MSL) between TCP/UDP and IP
    - MSL translates between transport and network addresses, perhaps based on port number or flow ID
        - at MH: use appropriate IP source address
        - at CH: use appropriate IP destination address
    - extensions to user API to configure MSL at MH
    - both TCP/UDP and IP are unaware of MSL
- MSL header added to packets when needed to inform peer of change in care-of address or routing constraints

Mobility-aware End Hosts (contd.)



Open Issues

- Hierarchical mobility agents
  - security for local handoffs
  - MA as a multi-protocol agent
    - translation between Mobile IP and proprietary protocol (Metricom, CDPD, etc.)
- End-host support for mobility
  - clean separation of transport and network layer addressing
  - authentication of routing updates
    - does IP spoofing protection help?