Towards an Mobility Management Architecture

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What is an IP Address?

- An endpoint identifier
  - Uniquely identifying a communication endpoint
- A topological locator
  - Indicating where in the network topology a device interface is located
- A forwarding identifier
  - Allowing routing intermediaries to forward packets to a device interface
Why is Mobility an Architectural Problem?

• Mobile host movement splits the functions of an address
  – Forwarding identifier changes since the attachment point changes
  – Endpoint identifier remains the same since the mobile host is the same

• Up until now, most applications …
  – Nomadic application
  – Haven’t needed session continuity
  – User sits down, opens a laptop, works for a while, closes the laptop moves to a new location…
Why is Mobility an Architectural Problem?

• New services now require session continuity when the user moves between different locations
  – VoIP, streaming video, WiMAX

• Need Mobility Management Protocol
  – Support mobile usage
  – Maintain session continuity of mobile node by mapping
  – Alleviate the difficulties caused by the two functions of the IP address
    • One as an endpoint identifier and the other as a location marker
Global vs. Localized Mobility

- Based on topological distance in the routing infrastructure
  - by the number of routing hops, network provider
- Global mobility management
  - handles changes between different serving network providers' subnets
- Localized mobility management
  - handles mobility within the serving operator's network
Host-based vs. Network-based Protocol

- Host-based mobility management protocol
  - Host itself detects the movement at the IP layer
  - Perform the signaling that updates the mapping (between the forwarding identifier and the endpoint identifier)

- Network-based mobility management protocol
  - Mobility anchor rearranges the overlay routing so that the old address can still be used as a forwarding identifier
  - Host is not required to update the forwarding identifier to endpoint identifier mapping
Existing Mobility Management Solutions

- Split the identity and location function of the IP address
  - Use one IP address for identity, another for location
    - Mobile IP - global network mobility management protocol

- Change routing so that identity and location function remain equal on move
  - Overlay rerouting in the local topology
  - Proprietary solutions
    - GPRS – localized management protocol (operating within some part of a service provider’s network)
Mobile IP Basics

- Host-based mobility protocol
- Basic Architectural Idea: split address functions
  - Forwarding identifier
    - Changes as the mobile host moves from subnet to subnet
    - Care of address - address on the local subnet
  - End node identifier
    - Home address - address on a server (the home agent) in the home network
    - Identifier
Mobile IP Basics (cont’d)

• Global Rerouting Overlay
  – Correspondent hosts send packets to the home address
  – Home agent reroutes the packets to the care of address using a tunneling overlay
  – Mobile host sends routing updates to the home agent when the care of address changes
Problem: Two Koreans in America

- Long dogleg routes back to home agent in Korea
  - Could introduce substantial latency into VoIP
- Optimize routes by getting rid of overlay
  - Route optimization introduced into Mobile IPv6
- Mobile host signals directly to correspondent on movement
  - Sends new care-of address
  - Security complex: how can correspondent know that sender is authorized to change the IP address?
GPRS Basics

- General Packet Radio Service (GPRS)
- Proprietary protocol for cellular systems utilizing GSM signaling
- Provide a kind of IP localized mobility management
- Basic architectural idea: keep the IP address the same when the host moves \(\rightarrow\) change routing
  - Locator and endpoint identifier functions are not split
  - Locator function is updated by the network on movement to match current location
- Mobile host’s point of view
  - Nothing has happened at the IP layer
GPRS Basics (cont’d)

• Local Rerouting Overlay
  – A mobility anchor (GGSN) maintains host-routes to/from mobile host's current subnet
  – GGSN tunnels data traffic to/from SGSN on local subnet
  – Mobile host signals SGSN to detect movement but no change in IP address
  – SGSN signals host-route updates to GGSN
  – GGSN updates tunnel endpoint

• GPRS only handles localized mobility within some part of a service provider's network
GPRS Architecture

Movement Detection

Route Update

Corresponding Host
Proposal For a Network-based Localized Mobility Protocol

- NETLMM (NETwork based, Localized Mobility Management)
  - IETF Working Group developing a network based mobility management protocol for IPv6
  - Intend to provide an Internet standard with similar functionality to GPRS
  - The protocol will be an Internet standard that could be used in any IP based network
Conclusion

- Node mobility is a fundamental problem in the Internet architecture
  - Endpoint identity and forwarding identity
- Mobility management protocols
  - Such as Mobile IP and GPRS provide session continuity
- Network-based, localized mobility management
  - Local IP address doesn't change
  - Host is not required to update the forwarding identifier to endpoint identifier mapping
- Host-based, global mobility management
  - Change in local IP address
  - Host required to sense wireless on a new interface and move sessions to the interface
Thank you!