Hybrid Transition Mechanism for MILSA Architecture for the Next Generation Internet

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These slides and Audio/Video recordings of this talk are at:
http://www.cse.wustl.edu/~jain/papers/milsatp.htm
MILSA=Mobility and Multi-homing Supporting Identifier-Locator Split Architecture

1. Internet 3.0 and our project
2. Problems with the current Internet
3. Our proposed solution: MILSA
4. Hybrid Transition for MILSA
Internet 3.0: Next Generation Internet

- Internet 3.0 is the name of the Washington University project on the Future Internet (inspired by NSF’s FIND and GENI)
- Project supported by Intel and Huawei
- Named along the lines of “Web 2.0”
- Goal 1: Develop a clean slate architecture to overcome limitations of the current Internet
- Goal 2: Develop an incremental approach to implement the architecture
Problems of Current Internet

ARPANet → Internet

Commercialization

Security

Two types of addresses
PI: Provider Independent
PA: Provider Aggregatable

Multi-homing is PI based
⇒ Easy for end-site,
but high burden on routing

Multi-homing

Mobility

PI: Provider Independent
PA: Provider Aggregatable

Trusted

Not Trusted
Problems for the Current Internet

- Routing scalability
- Traffic engineering
- Mobility
- Multi-homing
- Renumbering
- Security
- Incremental deployment

Key Problem: Overloaded Semantics of IP Addresses

TCP: “I need it to be session identifier”

IP address

Routing System: “I need it to be routing locator”
Realms

- Object names and Ids are defined within a realm
- A realm is a **logical** grouping of objects under an administrative domain
- The Administrative domain may be based on Trust Relationships
- A realm represents an organization
  - Realm managers set policies for communications
  - Realm members can share services.
  - Objects are generally members of multiple realms
- Realm Boundaries: Organizational, Governmental, ISP, P2P,…

**Realm = Administrative Group**
**Organizational Representation**

**Realm managers:**
- Resolve current location for a given host-ID
- Enforce policies related to authentication, authorization, privacy
- Allow mobility, multi-homing, location privacy
- Different from several other ID-locator splitting proposals. Our Emphasis on organizational control.
- Ref: [PAN08]
Hierarchical URI-like Identifiers (HUI): Example

```
“Education. WUSTL. US. Mail. John. {Hashed key}”
```

- HUI can have same length as IPv6 address for transition benefit
- A node can register multiple locators with a realm manager ⇒ Multihoming
- In MILSA-unaware legacy domains, the IPv4 address space are treated as the ID in the edge and mapped to locator by AER (Access Edge Router) through a triple binding of “legacy prefix – HUI – AER locator”.
- DNS registers HUIs but can optionally distinguish IDs from Locators and returns locators when a legacy host resolves a name whose HUI is found.
Current Proposals

Two possible approaches:

"ID/Locator Split"

Pros:
⇒ Clear
⇒ Mobility, Multihoming support
⇒ Trust, policy enforcements
Cons:
⇒ Need host modifications

"Core-edge separation"

Pros:
⇒ No host Modification
Cons:
⇒ Mobility, Multihoming
⇒ Trust, policy enforcements
Hybrid Transition

- Allows coexistence, puts the decision to future competence
  - reduces investment risk
- Allows evolution in either direction
- Deploy incrementally, and reduce the global routing table size gradually
Transition Scenarios

1. MILSA ⇔ MILSA
2. MILSA ⇔ AER
3. MILSA ⇔ Legacy
4. AER ⇔ AER
5. AER ⇔ Legacy
6. Legacy ⇔ Legacy
1. MILSA Hosts ⇔ MILSA Hosts

- MILSA host gets the latest locator (PA) of the correspondent from RM
- No PI addresses in the core ⇒ No scalability issue
2. MILSA Hosts ↔ Legacy Domains with AER

- A to B: AER registers legacy prefix of B-HUI-PA with RM
  - A gets the locator of the correspondent AER
  - AER redirects the packets to legacy host B
- B to A: Legacy host uses HUI of Host A obtained from DNS
  - AER resolves the ID to current locator of host A
3. MILSA Hosts ⇔ Legacy Hosts

- A to B: MILSA host A won’t get any mapping from RM; A constructs legacy packets using MILSA locator as source address and sends to B. B’s prefix is still in core network.

- B to A: Legacy host gets the PI=HUI of A from DNS
  - DNS may optionally resolve it to PA via RM
4. Legacy w AER ⇔ Legacy w AER

- AER registers site legacy prefix-HUI-PA mapping with RM
- Legacy hosts can use IPv4 PI or PA addresses
- AER change legacy prefixes to PA locators in the core network
5. Legacy w AER ⇔ Legacy Hosts

- A to B: AER registers group legacy prefixes-HUI-PA binding w RM
  - AER sets source prefix of its site to PA on the core network and sends out legacy packets
- B to A: B gets the HUI of A from DNS. DNS can optionally resolve that to PA of A. AER changes PA to legacy prefix
6. Legacy Hosts ⇔ Legacy Hosts

- No AER
- Legacy Hosts’ prefixes (if PI) still not aggregated in DFZ
  ⇒ Scalability Problem
Summary

1. Realm managers in Mobility and multi-homing supporting ID-locator split architecture (MILSA) enforce trust policies while allowing mobility, multi-homing, scalability, ...
2. MILSA can be implemented by host modification or by router modification
3. Hybrid transition mechanism allows both core-edge separation and id-locator split strategies to coexist and transit to either direction in the future
4. Incrementally deployable
   ⇒ Allows reducing the routing table size gradually
References


References (Cont)
