Hybrid Transition Mechanism for MILSA Architecture for the Next Generation Internet

Jianli Pan, Subharthi Paul, **Raj Jain**
Washington University in Saint Louis
jain@cse.wustl.edu

Xiaohu Xu
Huawei Technologies, Co. Ltd.

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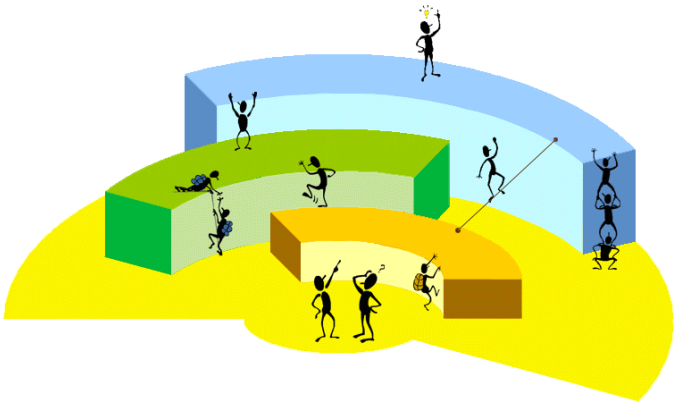
These slides and Audio/Video recordings of this talk are at:
http://www.cse.wustl.edu/~jain/papers/milsatp.htm

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



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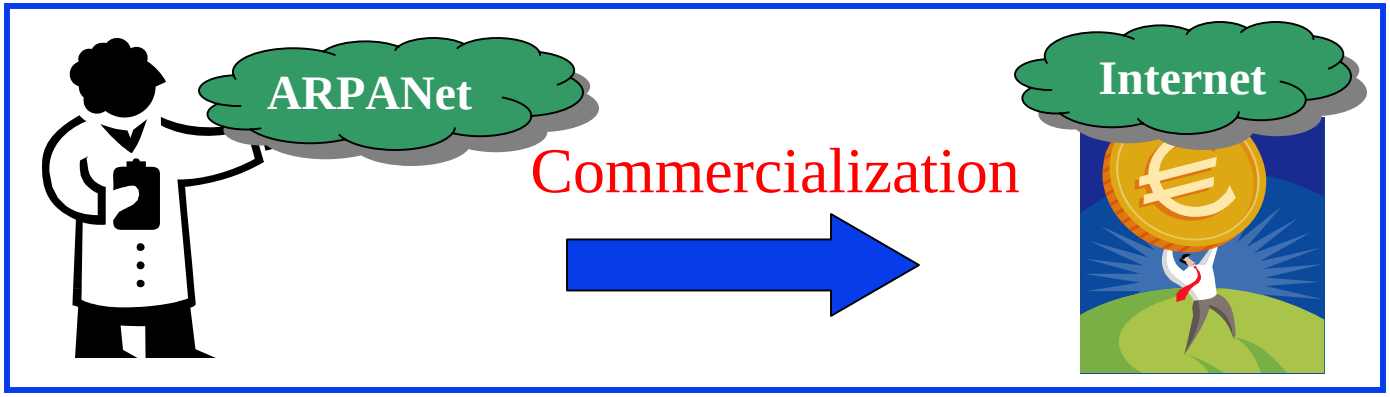
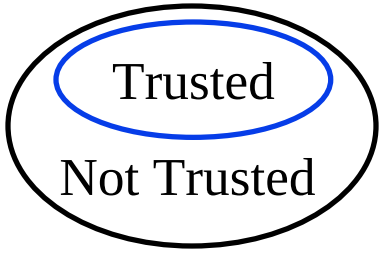
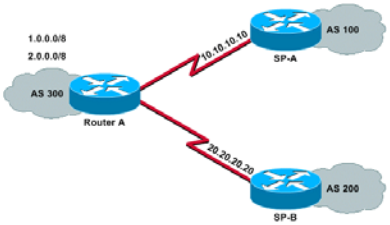
Problems of Current Internet



Security



Mobility



Multi-homing

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

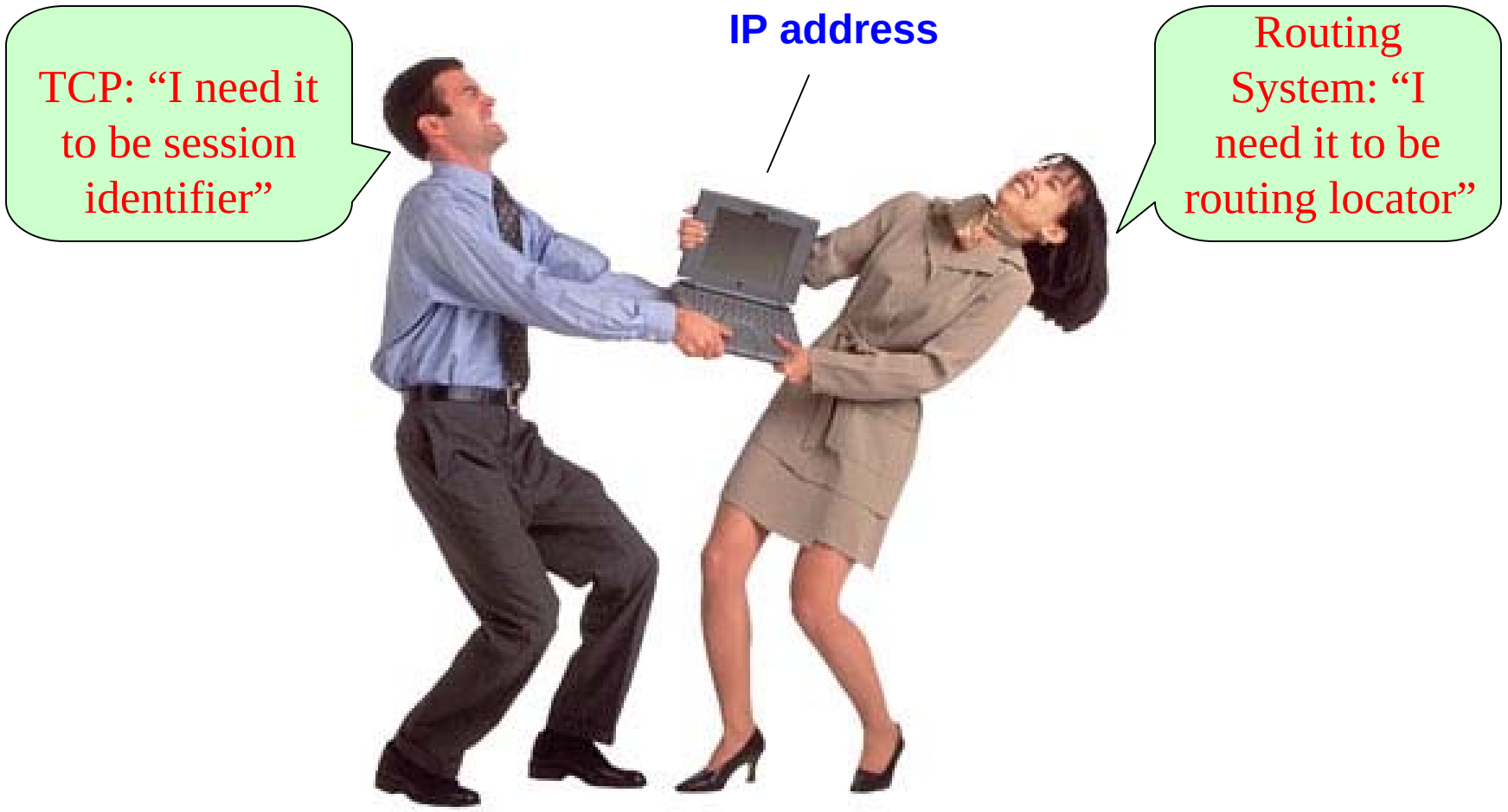
Multi-homing is PI based
⇒ Easy for end-site,
but high burden on routing

Problems for the Current Internet

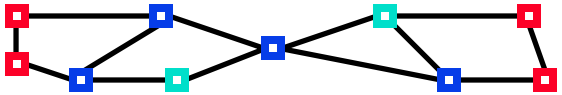
- Routing scalability
- Traffic engineering
- Mobility
- Multi-homing
- Renumbering
- Security
- Incremental deployment

Ref: [RFC4984] "Report from the IAB Workshop on Routing and Addressing," September 2007

Key Problem: Overloaded Semantics of IP Addresses



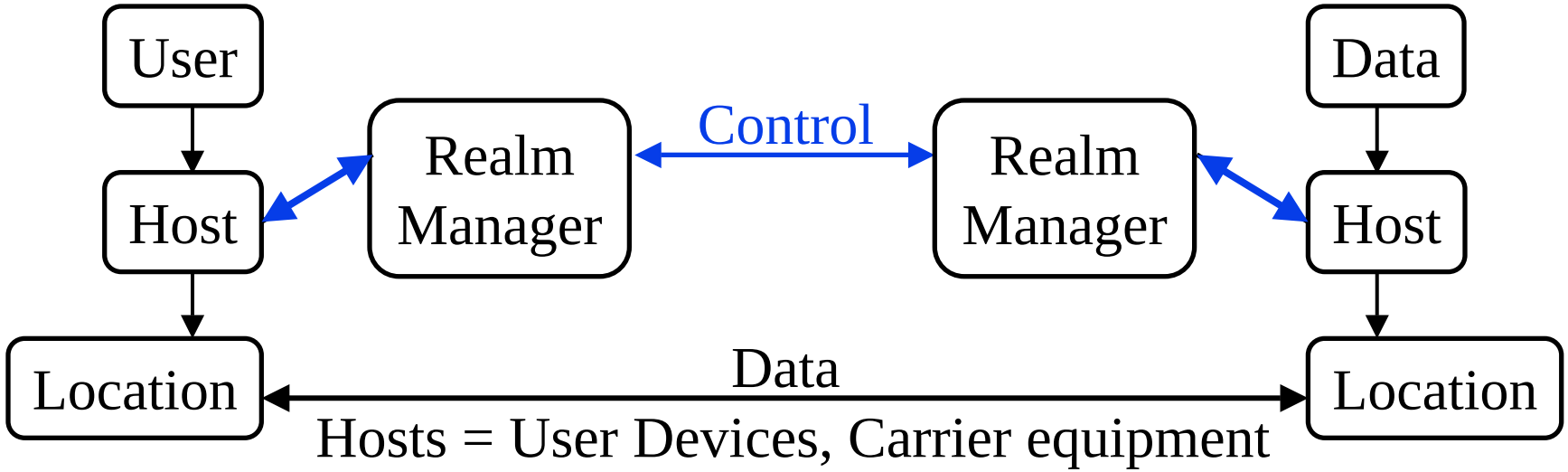
Realms



- 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

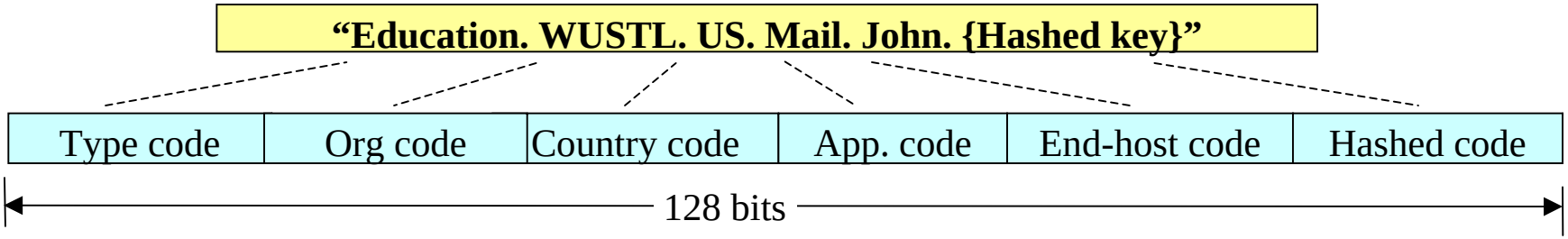


Realm managers:

- 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]

MILSA: Key Features

- Hierarchical URI-like Identifiers (HUI): Example



- 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, Multi-homing support

⇒ Trust, policy enforcements

Cons:

⇒ Need host modifications

"*Core-edge separation*"

Pros:

⇒ No host Modification

Cons:

⇒ Mobility, Multi-homing

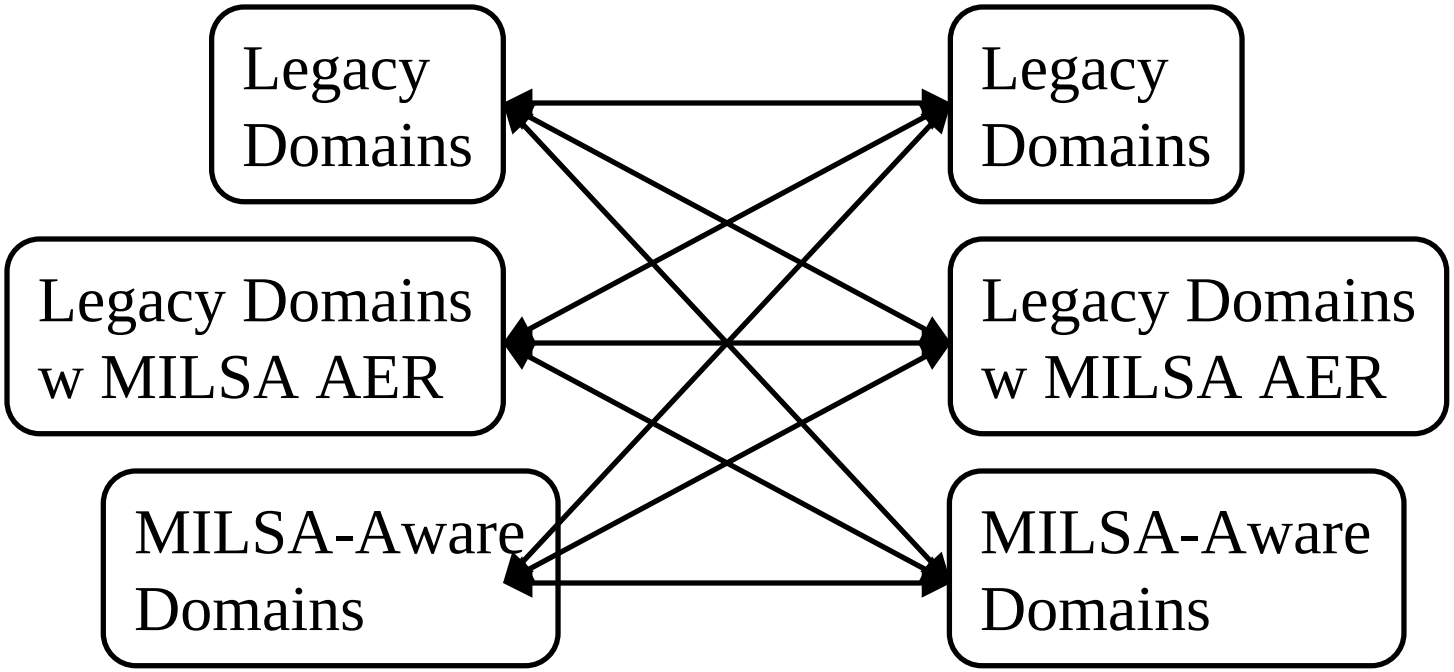
⇒ Trust, policy enforcements

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

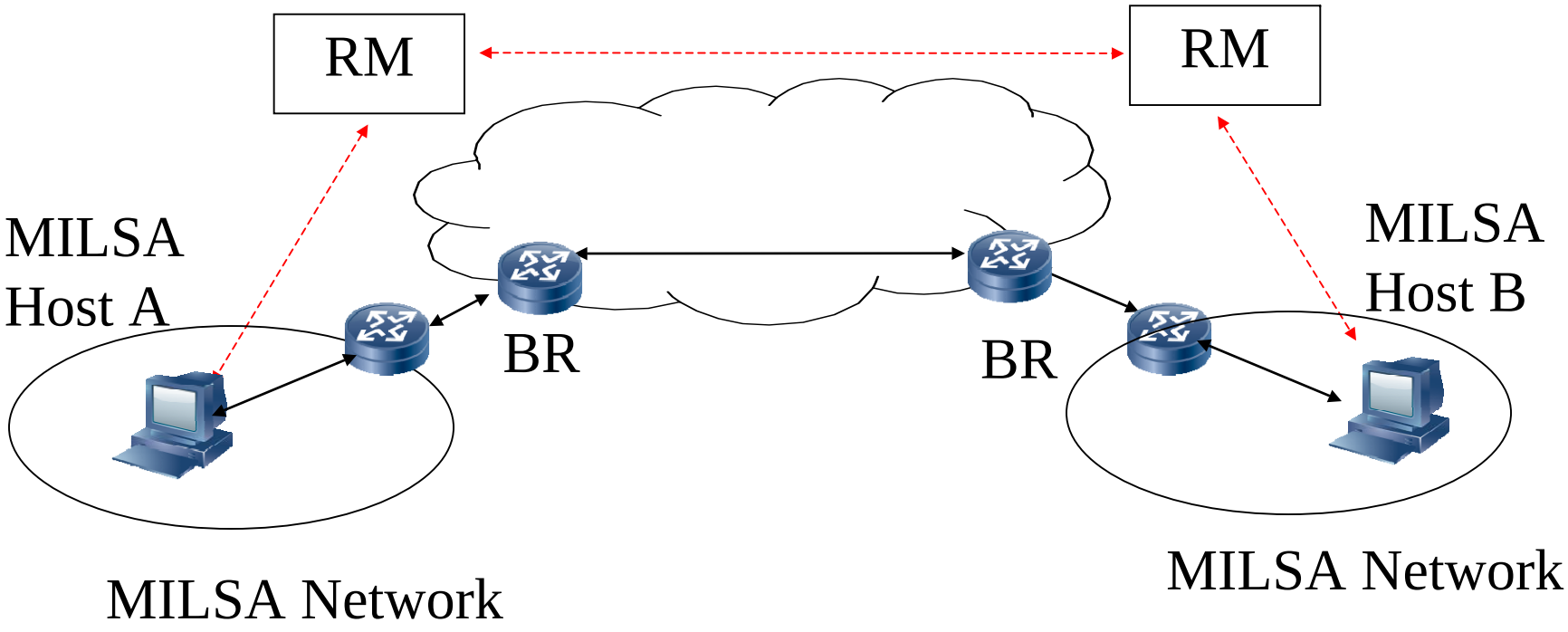
Transition Scenarios



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

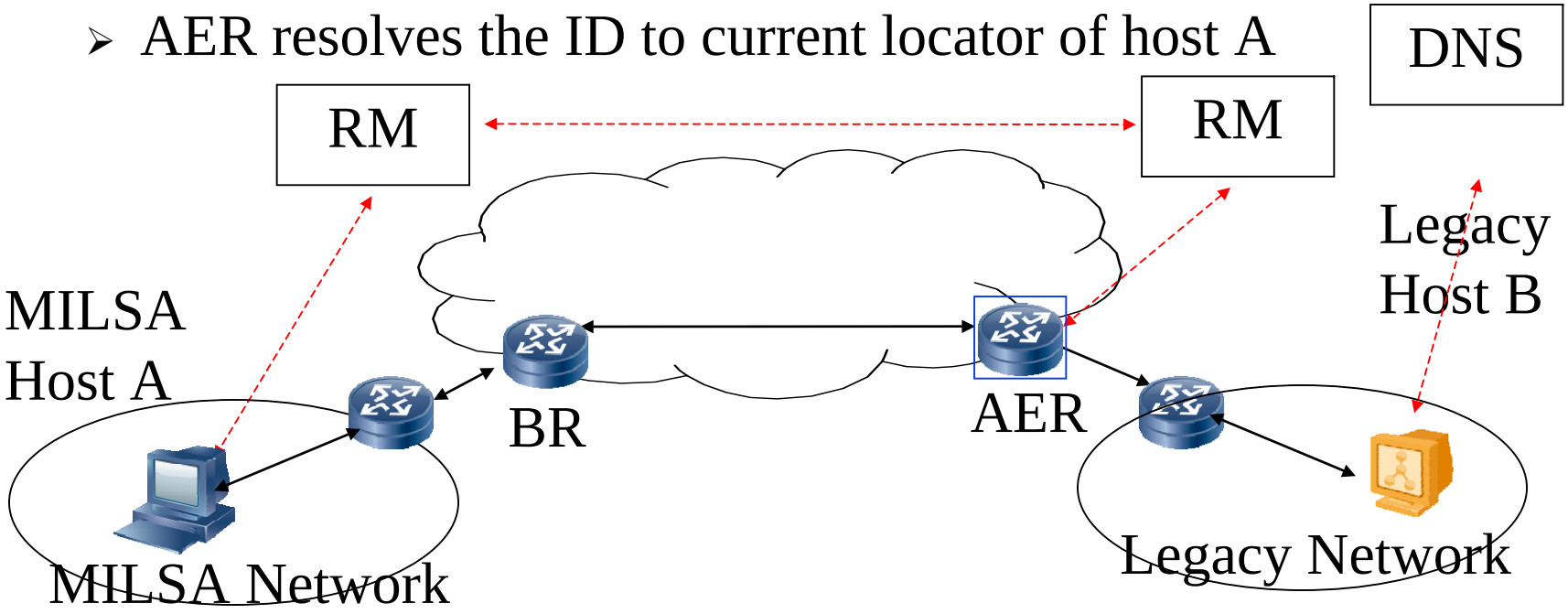
1. MILSA Hosts ⇔ MILSA Hosts

- MILSA host gets the latest locator (PA) of the correspondent from RM
- No PI addresses in the core ⇒No scalability issue



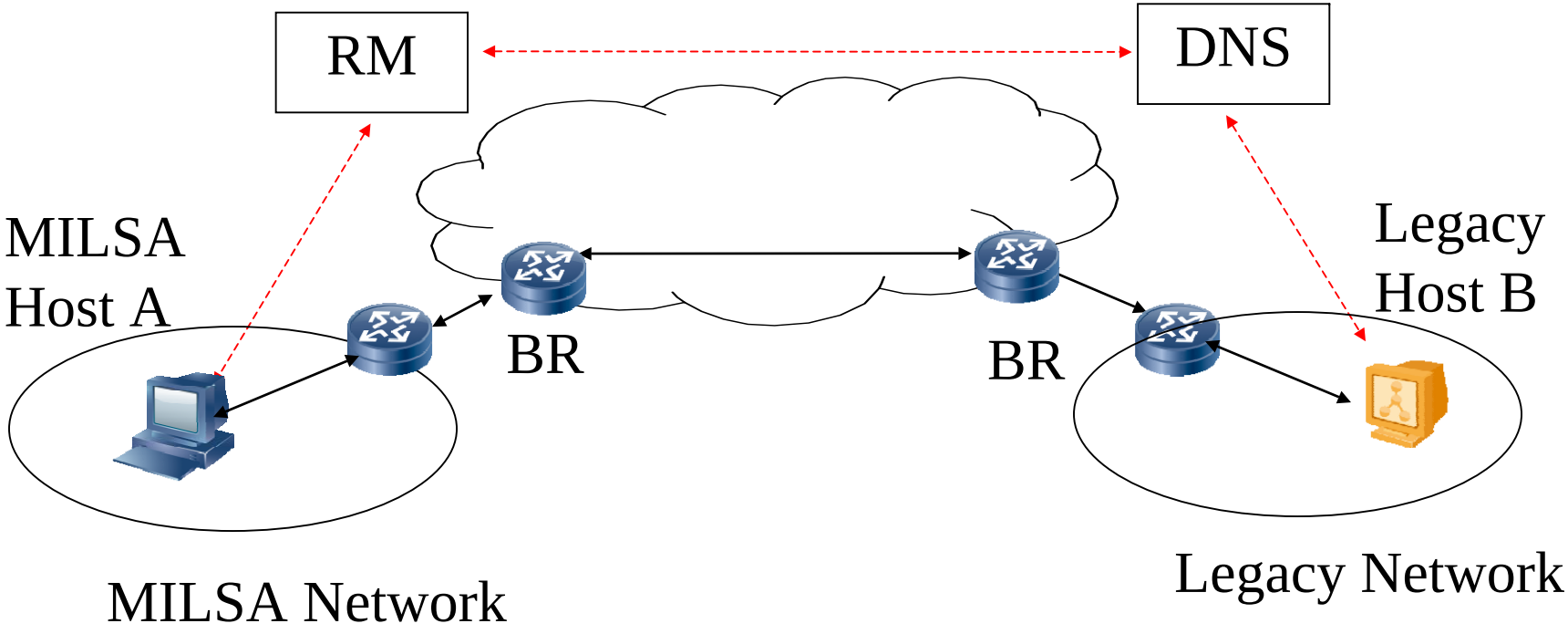
2. MILSA Hosts ⇔ Legacy Domains with AER

- 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



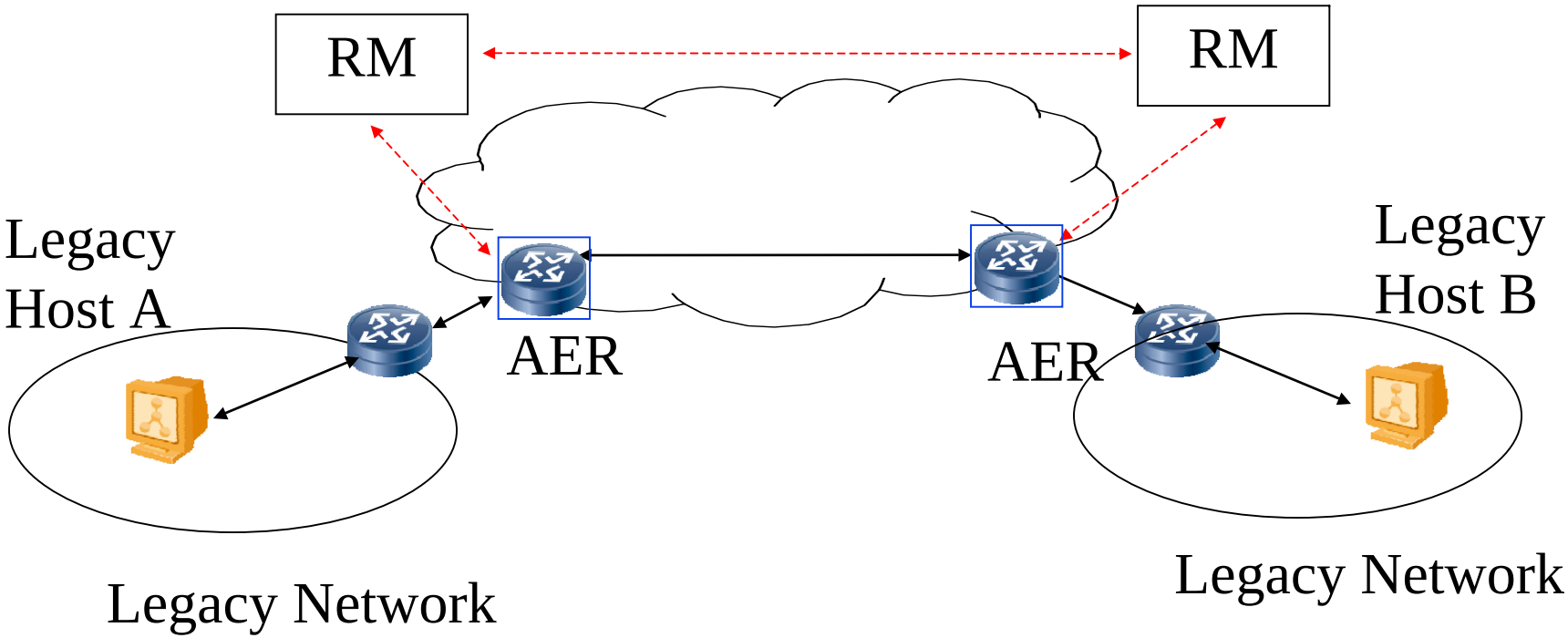
3. MILSA Hosts ⇔ Legacy Hosts

- 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



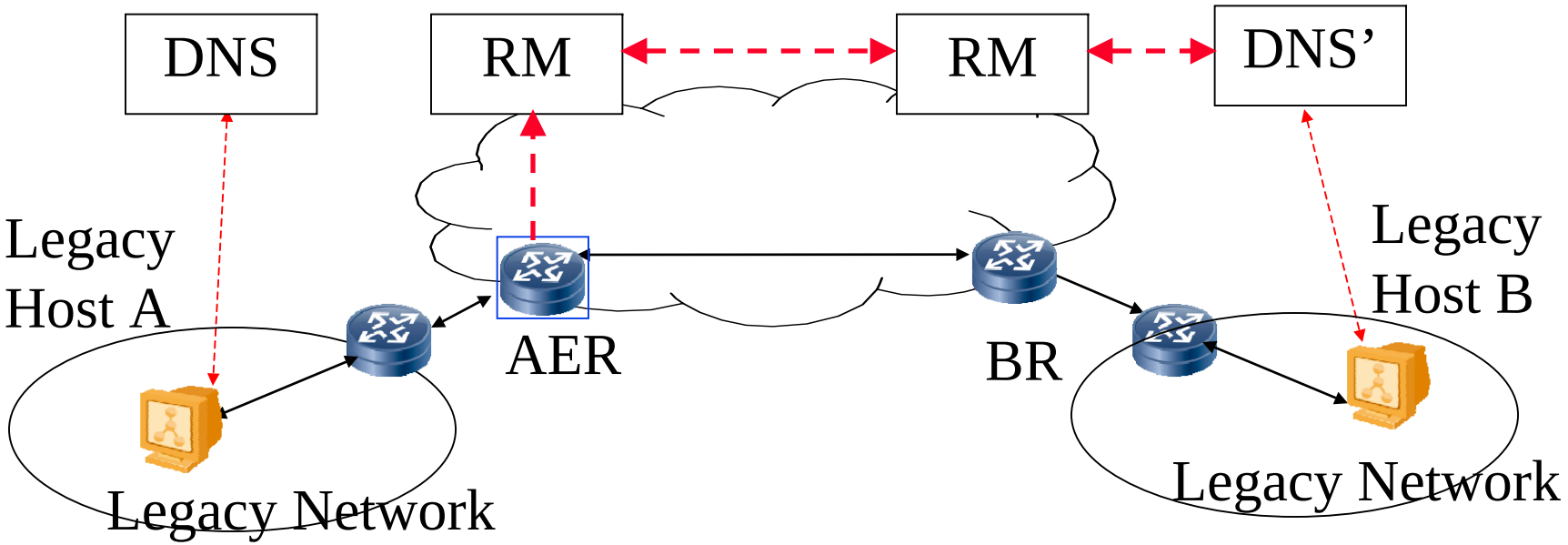
4. Legacy w AER ⇔ Legacy w AER

- 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



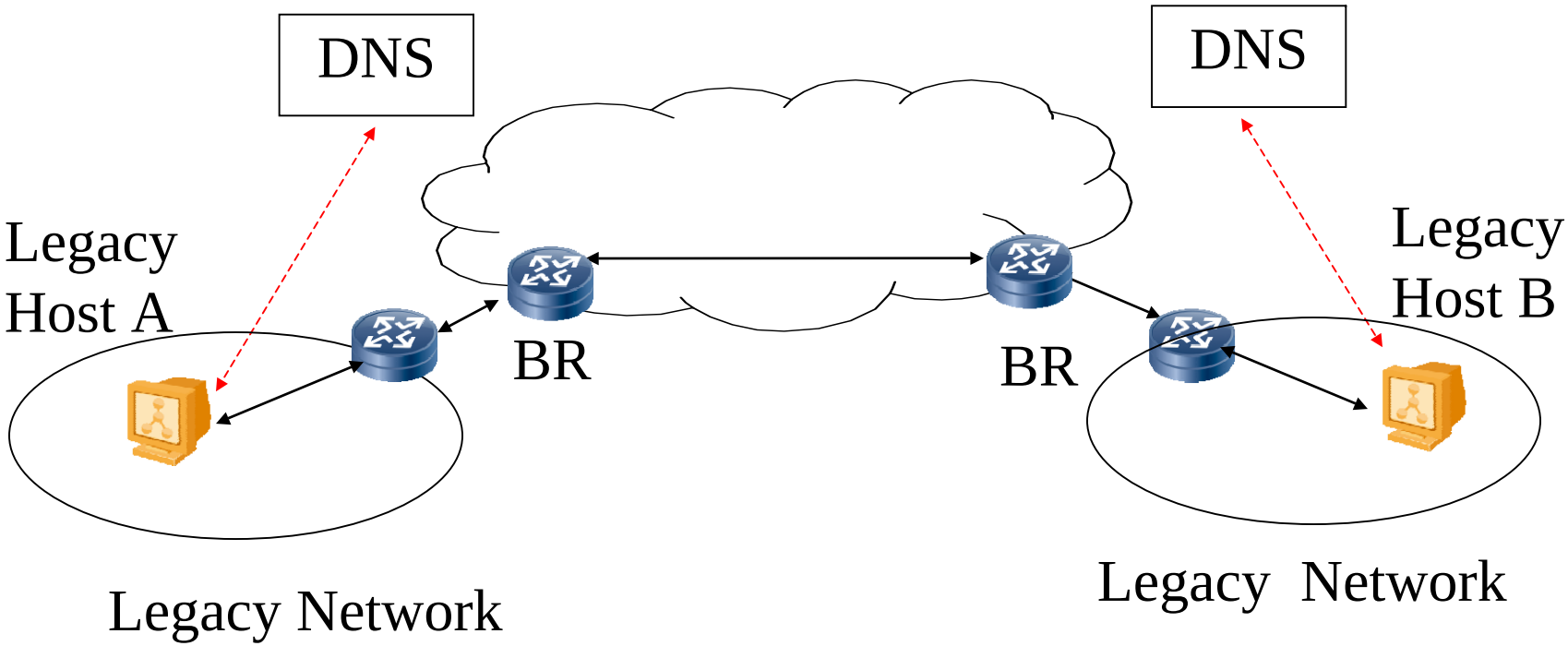
5. Legacy w AER ⇔ Legacy Hosts

- 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

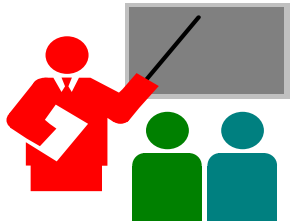


6. Legacy Hosts ⇔ Legacy Hosts

- 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
   $\Rightarrow$ Allows reducing the routing table size gradually

References

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2. Subharthi Paul, Raj Jain, Jianli Pan, and Mic Bowman, "**A Vision of the Next Generation Internet: A Policy Oriented View**," British Computer Society Conference on Visions of Computer Science, Sep 2008, http://www.cse.wustl.edu/~jain/papers/pona.htm
3. Jianli Pan, Subharthi Paul, Raj Jain, and Mic Bowman, "**MILSA: A Mobility and Multihoming Supporting Identifier-Locator Split Architecture for Naming in the Next Generation Internet**," Globecom 2008, Nov 2008, http://www.cse.wustl.edu/~jain/papers/milsa.htm

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4. Jianli Pan, Raj Jain, Subharthi Paul, Mic Bowman, Xiaohu Xu, Shanzhi Chen, "**Enhanced MILSA Architecture for Naming, Addressing, Routing and Security Issues in the Next Generation Internet**," Proceedings of IEEE International Conference in Communications (ICC) 2009, Dresden, Germany, June 14-18, 2009, (sponsored by Huawei) http://www.cse.wustl.edu/~jain/papers/emilsa.htm
5. Subharthi Paul, Jianli Pan, and Raj Jain, "**Architectures for the Future Networks and the Next Generation Internet: A Survey**," WUSTL Technical Report, WUCSE-2009-69, October 2, 2009, 59 pp., http://www.cse.wustl.edu/~jain/papers/i3survey.htm