

A Future Internet Architecture Based on De-Conflated Identities

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Audio/Video recordings of this talk are available on-line at:

<http://www.cse.wustl.edu/~jain/papers/deconf.htm>



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3. ADI Object Identifiers: Host ID, Infrastructure ID
4. ADI Operations:
 - A. Mapping and Negotiations
 - B. Site Multihoming, Traffic Engineering

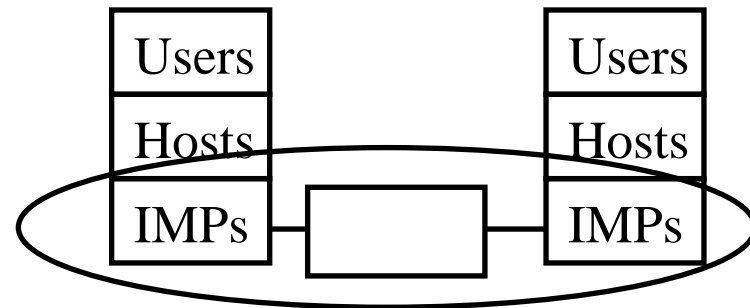
Conflated IDs

- ❑ Conflated ID = ID/Locator confusion
- ❑ IP Address = TCP End point ID, IP Address
- ❑ Communication Paradigm = Ownership, Policies
- ❑ ADI = Architecture based on De-conflated Identities
- ❑ Specific proposal for ID structure

Internet Generations

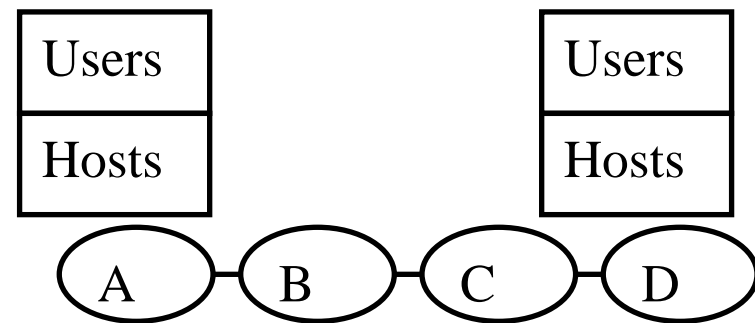
Internet 1.0 (1969 – 1989)

- Single ownership \Rightarrow Trust
- complete knowledge
- Algorithmic optimality \Rightarrow RIP



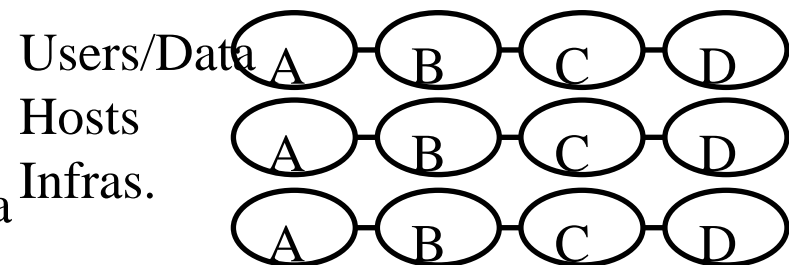
Internet 2.0 (1989–2009) Commerce

- Multiple ownership of infrastructure \Rightarrow Distrust, **Security**
- No knowledge of internal topology and resources
- Policy based** routing \Rightarrow BGP

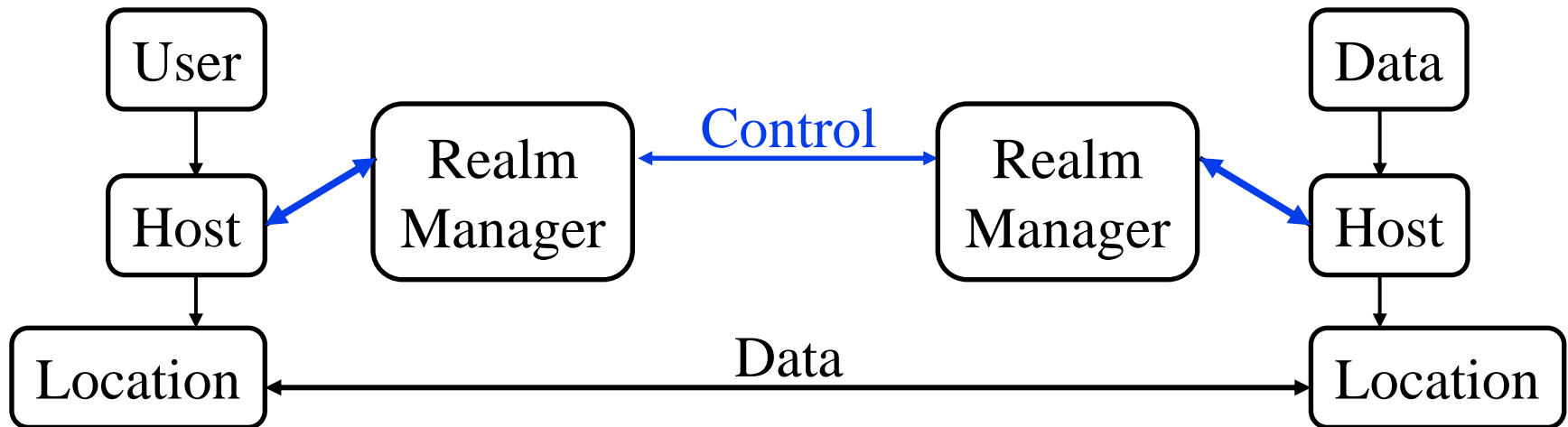


Internet 3.0 (2009–2029) Commerce

- Users, Content, Host ownership
- Requirements, Service Negotiation
- Mobility of users and distributed data



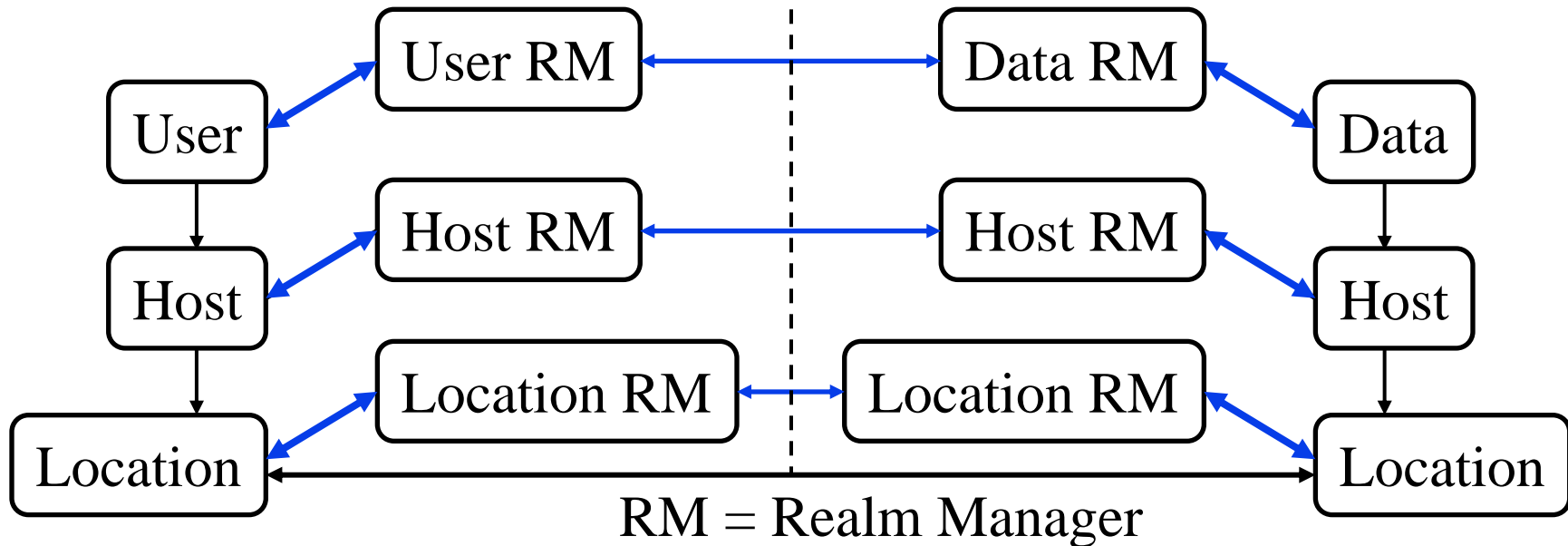
Policy Based Networking Architecture



Realm managers (RM): Many organizational functions

- ❑ Allow **mobility**, multi-homing, location privacy
- ❑ **ID-Locator**: Resolve current location for a given host-ID
- ❑ Policy Monitoring. Conformance to Contracts. Troubleshooting.
- ❑ Enforce policies related to authentication, authorization, privacy
- ❑ Proxy services enabling hosts to sleep
⇒ Energy-aware networking

3-Tier Model of Internet 3.0

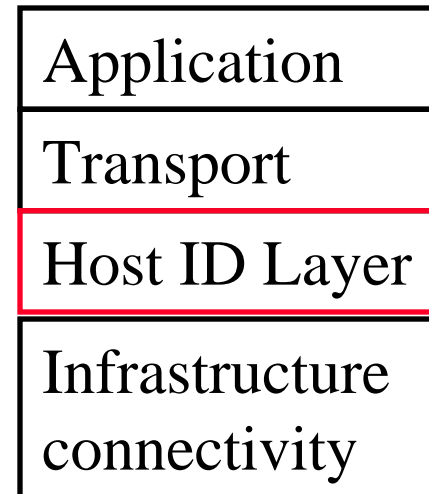


- ❑ Both Users and data need hosts for communication
- ❑ Data is easily replicable. All copies are equally good.
- ❑ Users, Hosts, Infrastructure, Data belong to different realms (organizations).
- ❑ Each object has to follow its organizational policies.

Note: This presentation is limited to the bottom two tiers.

ADI Host ID Layer

- ❑ Implements logical end-to-end functions between host realms (like IPSec)
- ❑ Separates physical end-to-end path
- ❑ Logical connections are shielded from infrastructure changes, host mobility
- ❑ Logical layer provides security and other policy negotiations
- ❑ New HID-aware transport protocols

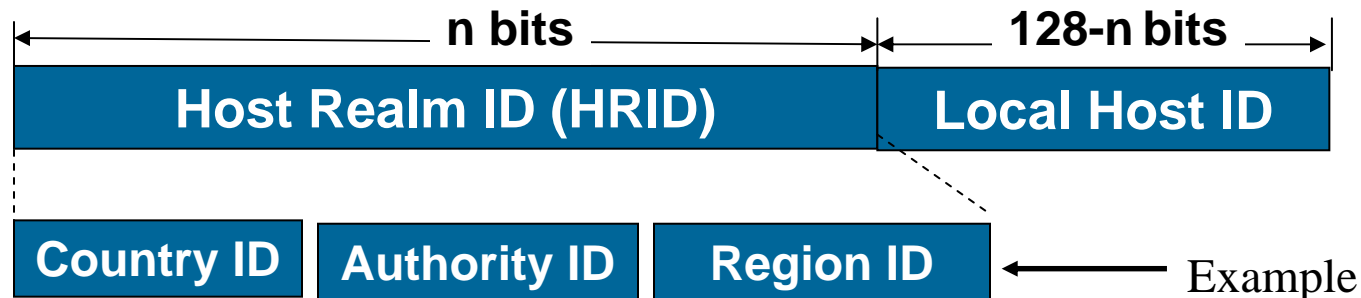


ADI Object Identifiers

- ❑ Host ID = $\langle \text{Realm ID}, \text{Object ID} \rangle$
- ❑ Infrastructure ID = $\langle \text{Realm ID}, \text{Object ID} \rangle$

Host ID

- ❑ 128 bit like IPv6
⇒ Compatibility with IPv6 applications
- ❑ HRID
⇒ Locate service access points, mapping, security, ...
- ❑ Hierarchical structure ⇒ Easy global management



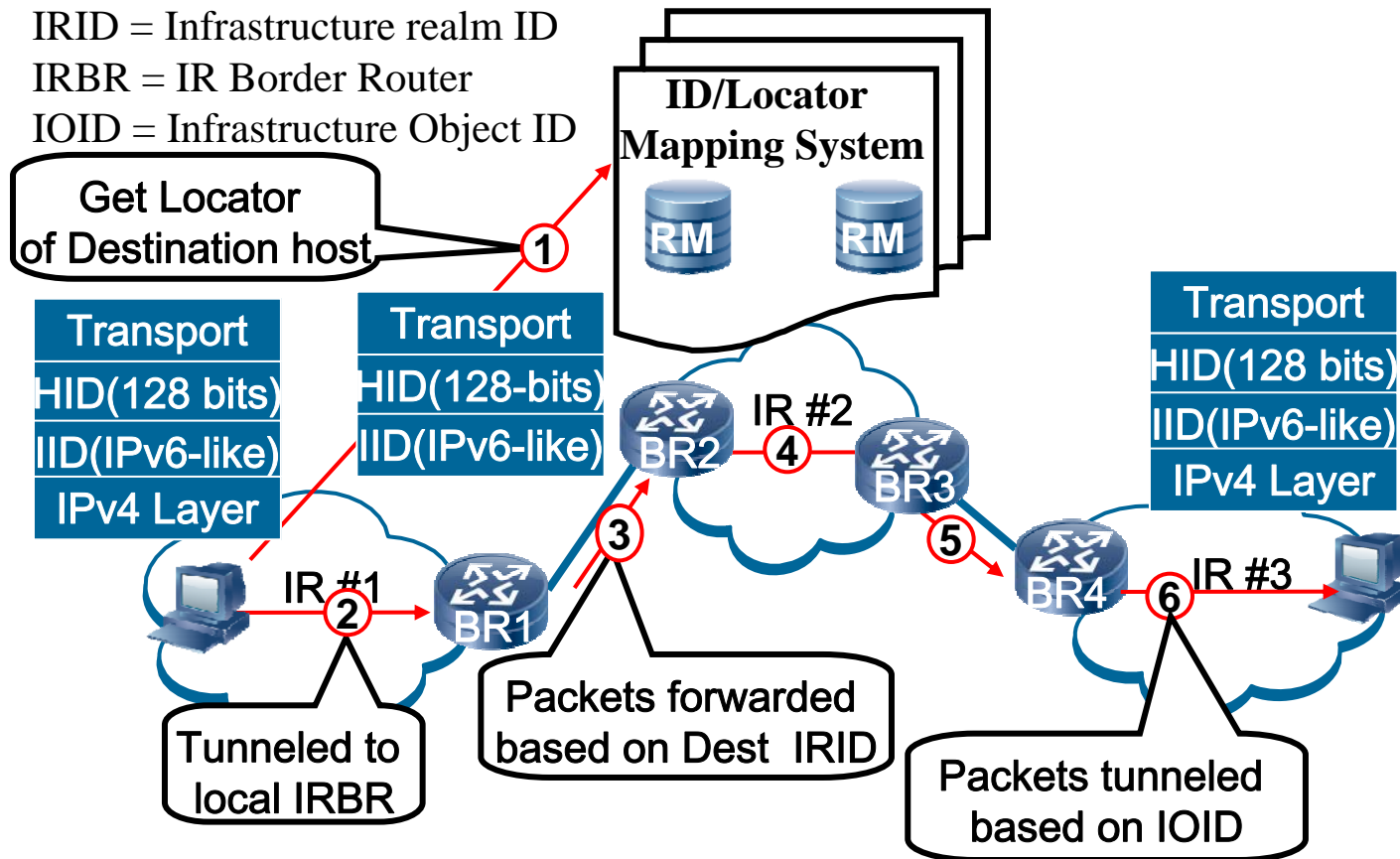
Infrastructure ID

- ❑ Infrastructure Realms: Similar to Autonomous Systems
- ❑ Explicit policy negotiations between realms
- ❑ Each realm has independent local IPv4 address space
- ❑ Helps in renumbering



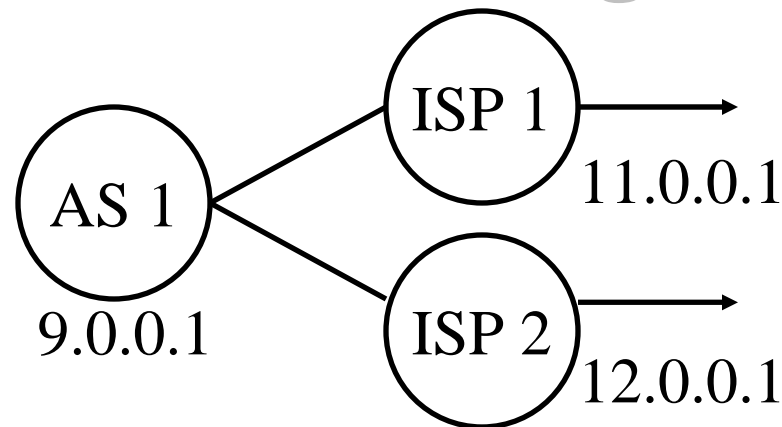
ADI Operations

IR= Infrastructure Realm
 IRID = Infrastructure realm ID
 IRBR = IR Border Router
 IOID = Infrastructure Object ID



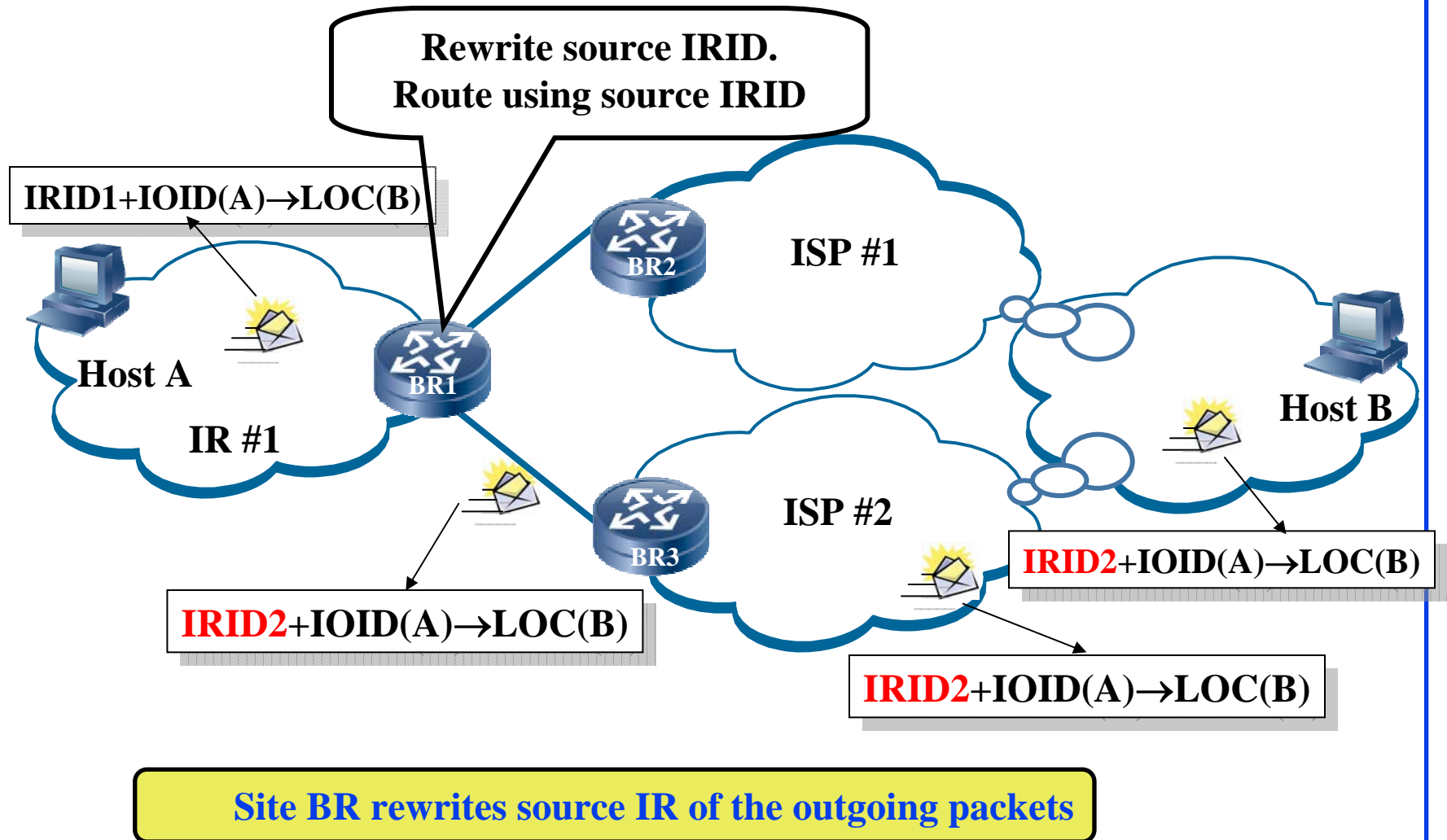
- ❑ DNS=Static, DHT=No concept of ownership
- ❑ Mapping based on ownership

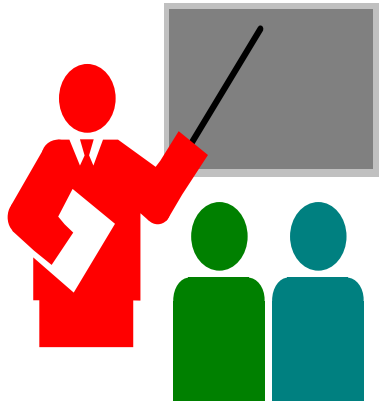
Site Multihoming



- ❑ Provider Independent (PI) Addresses \Rightarrow Scalability Issues
- ❑ Site multihoming used for local link redundancy
- ❑ Does not allow hosts' traffic engineering or fault tolerance
- ❑ In ADI, a host ID may be mapped to multiple Infrastructure IDs
- ❑ Host tier may inform infrastructure tier about path problems
- ❑ Infrastructure tier may inform host tier about multiple paths

Stub-Site Traffic Engineering





Summary

1. 3-Tiers of Ownership/Policy: Users/Data, Hosts, Infrastructure
ADI handles the bottom two tiers
2. All tiers are organized as Realms
3. 128 bit Host IDs and Infrastructure IDs
⇒ IPv6 Application compatibility
4. Host ID = $\langle n\text{-bit Host Realm ID, } 128\text{-}n \text{ bit Host object ID} \rangle$
Allows hierarchical aggregation of host IDs
5. Infrastructure ID
= $\langle 96\text{-bit Infrastructure Realm ID, } 32\text{-bit Infrastructure ID} \rangle$
⇒ Allows IPv4/IPv6 in the core