



# Identifier and Locator separation in IP network

July 10, 2007

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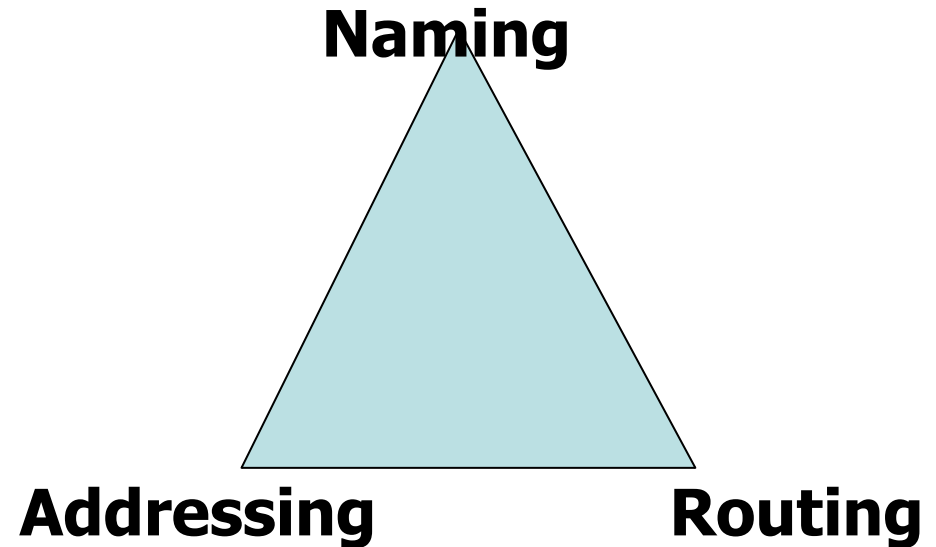
# Contents

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- IP Addresses in Internet Architecture
  - Overloaded semantic
- Issues of ID/Loc separation
- Standardization Trends
  - Activities of IETF
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- Conclusion

# Addresses and the IP Architecture

- What is Networking
  - How to refer to an entity?
  - How to refer to a route to an entity?
  - How to deliver packets to the entity?



- Within the IP architecture,
  - IP addresses are
    - Endpoint identifier
    - Routing objects
    - Key value for Forwarding Lookup

**Overloaded semantic**

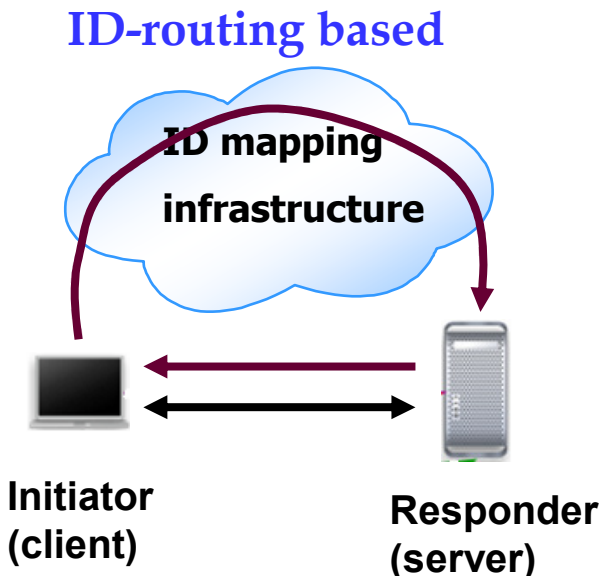
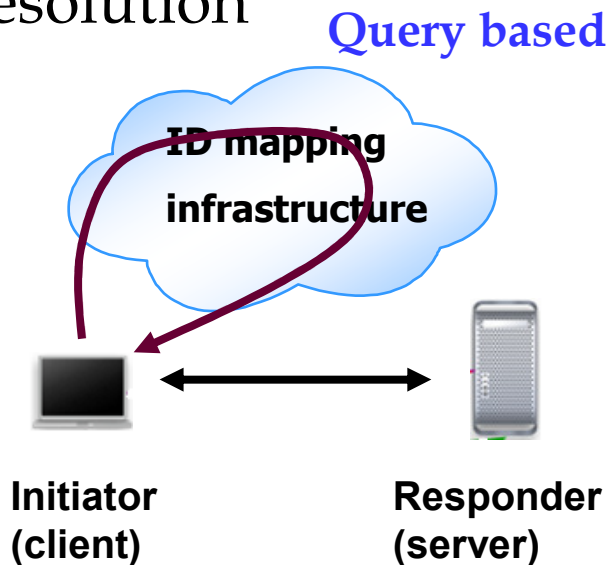
**separation**

# Some considerations for ID/Loc separation

- Deployment
  - S1: identifier fully conventionally routable
  - S1.5: identifiers routable over another infra
  - S2: identifier - locator mapping from the DNS
  - S3: advanced new id-based routing / query infra
- Implementation ID/LOC separation
  - Architectural
  - Vertical locus
    - Within app / library
    - In IP stack proper
    - Below IP
  - Implementational
  - Horizontal locus
    - Within host
    - First hop router
    - Site border router
    - ISP

# Some considerations (Cont'd)

- Mapping identifier to locator
  - If name == identifier, this is a no-op
  - Otherwise
    - Need to work with existing name resolution mechanisms
    - Need to deal with security
  - Mapping entry manage: Push/Pull
- Resolution



# Explicit in data packet or not?

- Is id->locator mapping explicit in every data packet, or implicit (only communicated in signaling plane)?
- Do we provide the ability for intermediate systems to see the identifier or not?
  
- Explicit (e.g., tunneling):
  - Identifier can be seen in packet by intermediate systems that change to look for it
  - Causes increase in packet size, more fragmentation
- Implicit (e.g., index or translation):
  - Identifier not findable in data packets
  - Asymmetric paths mean intermediate systems may not have mapping state



# Standardization Trends: IETF & ITU-T

# Recent Activities - IETF, IRTF, IAB

- Historical timeline
  - Packet switching invented (1962)
  - Internet concept invented (1974)
  - IP designed (~1978)
  - BGP designed (~1988)
  - CIDR designed (1992)
  - IPv6 designed (1995)
- Growing concern about scaling, transparency, multihoming, renumbering, provider independence, traffic engineering, IPv6 impact (1995-2006)
- IAB Routing & Addressing workshop (2006)



# Recent Activities (Cont'd)

- What should be the 5 year goal?
  - Deploy & define fundamental Architecture
- R&A Directorate established
  - IRTF - Routing Research Group recharter
  - R&A discussion list active (ram@iab.org)
- Internet and Routing ADs prepared for ROAP BoF
  - Operational Plenary, Internet Area, Routing Area, RRG, etc.
  - ID/Locator Split and Multi-level Locator
  - BGP table growth and dynamics

# Solution directions for IETF

- RIB/FIB scaling - engineering by microelectronics and router designers
- Update dynamics - BGP adjustments, better operational practices
- Traffic engineering, Multihoming, e2e transparency, and mobility would benefit from architectural changes
  - Fundamentally change Architecture
  - Identifier/locator separation and/or multilevel locators form a hopeful approach

**For solving the scalability problem, the research and exploration phase needed before standardization work**

# Solution directions (Cont'd)

- Internet Area
  - ID/Locator Split and Multi-level Locator
  - Candidates
    - HIP (Host Identity Protocol)
    - SHIM6 (Site Multihoming by IPv6 Intermediation)
    - LISP (Locator/ID Separation Protocol)
    - PASH (Proxying Approach to SHIM6 and HIP)
- Routing Area
  - BGP table growth and dynamics
- Routing RG
  - Clean slate approaches

# Taxonomy for solutions

- Host vs. Network based approach
  - Host based approaches
    - HIP, SHIM6
  - Network based approaches
    - GSE, LISP, PASH
- Direction vs. Indirection for data packet
  - Direction
    - Directly re-write address as locator
    - HIP, SHIM6, GSE, PASH
  - Indirection
    - Such as Map-and-Encapsulation, which use tunneling
    - LISP

# Analysis

	<b>LISP</b>	<b>PASH</b>	<b>HIP</b>	<b>SHIM6</b>
<b>Reduce RT</b>	Loose spec. exists	Possible No design	Possible or incompatible	
<b>Traffic Engineering</b>	Loose spec. exists	Possible No design	incompatible	Possible No design
<b>Mobility &amp; Multihoming</b>	Loose spec. exists	Rough design exists	implement	Rough design exists & implement
<b>Delegative names</b>			implement	
<b>IPv4 &amp; 6 Interoperability</b>	Rough design exists	Rough design exists	implement	Possible No design

# ITU-T

## ■ ITU-T Study Group 13

- Next Generation Network Group (2005 ~ 2008)
  - Dealing with evolution and convergence of next generation networks including frameworks and functional architectures

WP	Goal	Questions	Chair
1	Project management and coordination	1/13, 11/13, 13/13	Mr. Helmut Schink (Siemens, Germany)
2	Functional architecture and mobility	3/13, 6/13, 9/13, 10/13, 15/13	Mr. Chae-Sub Lee (Korea)
3	Service requirements and scenarios	2/13, 7/13, 8/13, 12/13, 14/13	Mr. Naotaka Morita (NTT, Japan)
4	QoS and OAM	4/13, 5/13	Mr. Neal Seitz (USA)

# Current Activities - ITU-T

- NGN Architecture (SG13, Q3)
  - Current related work
    - Progressed the Draft Recommendation
      - Requirements for ID/LOC separation (Y.ipsplit)
        - » ETRI have developing the document
  - Further work
    - Request NGN R2 to adopt ID/LOC separation design
  - Liaison work
    - IETF & ITU-T work

# Conclusion

- Within the IP architecture,
  - There is overloaded semantic
  - Cause to the semantic, it is hard to support Scalability, Traffic engineering, Multihoming, e2e transparency, and mobility
- IETF Solution directions
  - Fundamentally **change Architecture**
  - **Identifier/locator separation** and/or **multilevel locators** form a hopeful approach
  - Possible Solution
    - GSE, HIP, SHIM6, LISP, and PASH
- ITU-T
  - Progressed the Draft Recommendation
    - **Requirements for ID/LOC separation (Y.ipsplit)**
- Liaison work
  - IETF & ITU-T work



# References

- This is not original work and credit is due:
  - 68<sup>th</sup> IETF Meeting materials
    - [https://datatracker.ietf.org/public/meeting\\_materials.cgi?meeting\\_num=68](https://datatracker.ietf.org/public/meeting_materials.cgi?meeting_num=68)
  - 68<sup>th</sup> IRTF RRG meeting materials
    - <http://www1.tools.ietf.org/group/irtf/trac/wiki/RoutingResearchGroup>.
  - ITU-T Study Group 13
    - <http://www.itu.int/ITU-T/studygroups/com13/index.asp>



# Thank you !!!

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