



Information Sciences Institute

DataRouter: A Network Layer Service for Application Layer Forwarding

Problem

- Application layer networks are “bad”
 - Poor performance
 - Require additional E2E protocols
 - Recapitulate network layer
 - Hard to compose
 - Code sharing difficult
- Network level overlays are insufficient:
 - Lack application endpoint identifiers
 - Cannot forward based on application identifiers

Data Router

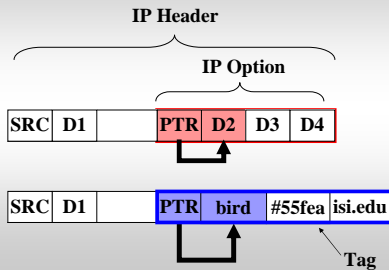
forwarding based on string rewriting

- Extends IP Loose Source Route
 - Network layer option
 - Works as an encapsulation header
- Data Source Route Entry: A Tag
 - Explicit application context
 - Forwarding via tag rewriting
 - Tag → (IP, Tag)

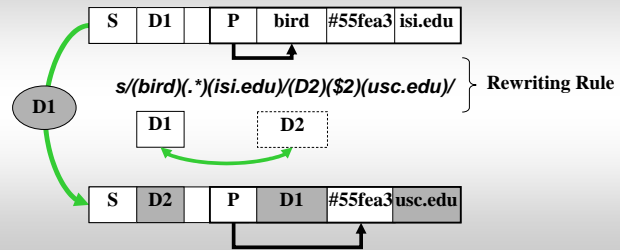
Advantages

- Supports application-directed forwarding
- Avoids reinventing the network layer
- Avoids reinventing the transport layer
- Enables composition/integration of application services
- Supports IPsec
- Forwards fast

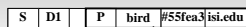
LSR and Data Route



Data Route Processing

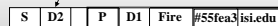


Incoming IP Packet



Data Routing Table

Tag	Class	Match	Next Hop	Replacement Tag
Bird	String	Exact	D2	Fire



Outgoing IP Packet

Tag Properties

Set by the application

- Classes:
 - Hash, String, RegEx
- Matching Policies:
 - Exact, Longest, First, Range
- Rewriting Rules:
 - String rewriting
- Tag value:
 - Any byte string (character string, integer)

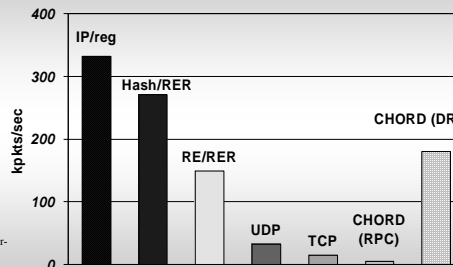
Current Status

- FreeBSD 5.0 patch
 - Rewriting rule table in kernel
 - “droute” command to manipulate rules
 - Sockopt to set packet tags
 - User libraries for convenience
- Performance tests
 - Raw tests completes
 - Integration with Chord

Publication: IWAN 2003

J. Touch, V. Pingali. “DataRouter: A Network-Layer Service for Application-Layer Forwarding.” Proc. International Workshop on Active Networks (IWAN), Osaka, Springer-Verlag, December 2003.

Performance



Related Work

- Application-directed forwarding
 - Using predicates[Sigcomm03]
 - Linda Tuples
 - Active Networks
- Application-level forwarding
 - DHTs, web proxies
- Alternate network-level forwarding
 - Catanet, TRIAD, I3, IPNL, Heaps, Network Pointers
- Others
 - Anycast
 - Late binding

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