LISP-Multicast

draft-farinacci-lisp-multicast-00.txt

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Agenda

- Overview of LISP for Unicast Routing
- LISP-Multicast Design Goals
- LISP-Multicast Definitions
- Describe LISP-Multicast
- LISP-Multicast Interworking
- AF Case Studies
- Summary

LISP Internet Drafts

draft-farinacci-lisp-08.txt
draft-fuller-lisp-alt-02.txt
draft-lewis-lisp-interworking-01.txt
draft-farinacci-lisp-multicast-00.txt
draft-meyer-lisp-eid-block-01.txt

draft-mathy-lisp-dht-00.txt
draft-iannone-openlisp-implementation-01.txt
draft-brim-lisp-analysis-00.txt

draft-meyer-lisp-cons-04.txt
draft-lear-lisp-nerd-04.txt
draft-curran-lisp-emacs-00.txt

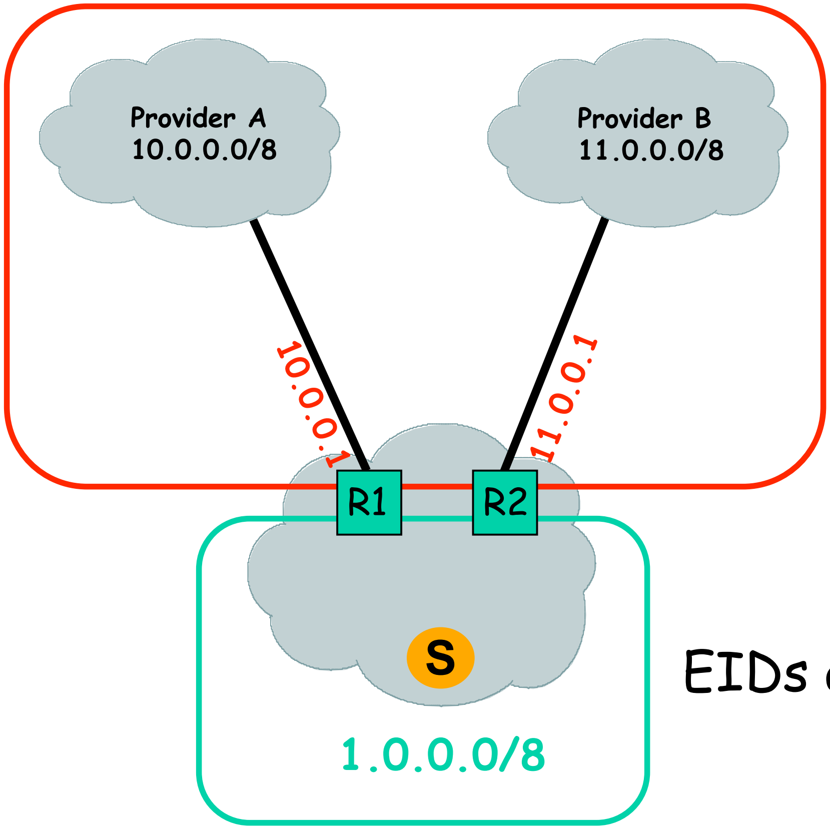
LISP Architecture

- Locator/ID Separation Protocol
  - Network-based solution
  - No changes to hosts whatsoever
  - No new addressing changes to site devices
  - Very few configuration file changes
  - Imperative to be incrementally deployable
  - Address family agnostic

LISP Architecture

- Locator/ID Separation Protocol
  - Defines architecture for 2 address spaces:
    - Endpoint IDs (EIDs)
    - Routing Locators (RLOCs)
  - Defines how Map-n-Encap routers operate and where they reside
  - Defines Variants for “EID routing”
  - Can use other designs for mapping EIDs to RLOCs
  - Defines encapsulation format for IPv4 and IPv6
  - Defines how RLOC reachability is performed
  - Defines how database mapping entries can be updated
  - Defines the Map-Request and Map-Reply format

Multi-Level Addressing



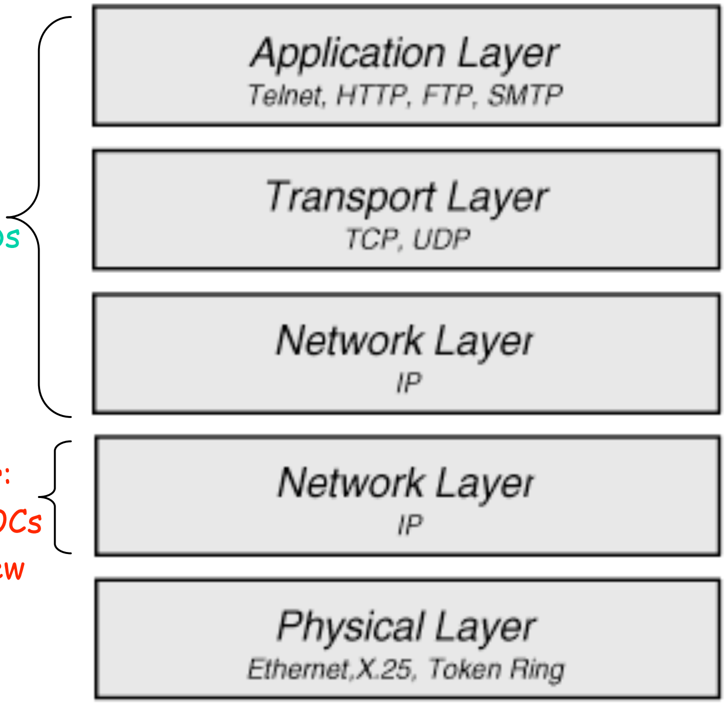
RLOCs used in the core

Mapping Database Entry:

1.0.0.0/8 -> (10.0.0.1, 11.0.0.1)

EIDs are inside of sites

Map-n-Encap



Application Layer
Telnet, HTTP, FTP, SMTP

Transport Layer
TCP, UDP

Network Layer
IP

Network Layer
IP

Physical Layer
Ethernet,X.25, Token Ring

Host Stack:
supplies EIDs

LISP Router:
supplies RLOCs
by adding new
header

Mapping Entry:

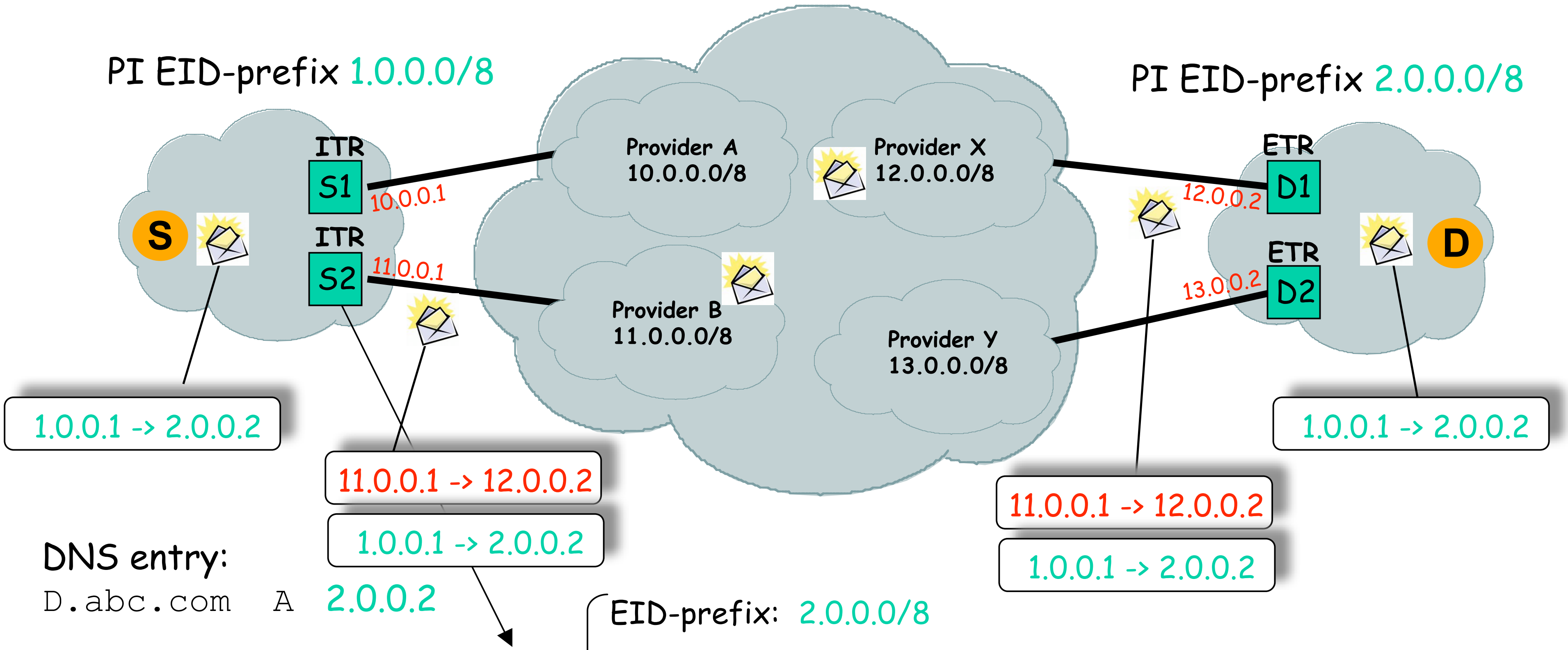
EID-prefix: 2.0.0.0/8

Locator-set (RLOCs):

12.0.0.2, priority: 1, weight: 50

13.0.0.2, priority: 1, weight: 50

Packet Forwarding



DNS entry:

`D.abc.com   A` 2.0.0.2

Mapping Entry

EID-prefix: 2.0.0.0/8

Locator-set:

12.0.0.2, priority: 1, weight: 50 (D1)

13.0.0.2, priority: 1, weight: 50 (D2)

Policy controlled by destination site

Legend:

EIDs -> Green

Locators -> Red

LISP Multicast Design Goals

- Keep EID state out of core network
- No head-end replication at source site
- Packets only go to receiver sites
- No changes to hosts, site routers, core routers
- Use existing protocols
- Support PIM SSM, don't preclude ASM & Bidir
- Have separate unicast and multicast policies

LISP Multicast Defs

- (S-EID, G)
  - S-EID is source host
  - G is group address receivers join to
  - State resides in source and receiver sites
- (S-RLOC, G)
  - S-RLOC is ITR on multicast tree
  - G is group address receivers join to
  - State resides in core
- Group addresses have neither ID or Location semantics
  - G is topologically opaque - can be used everywhere

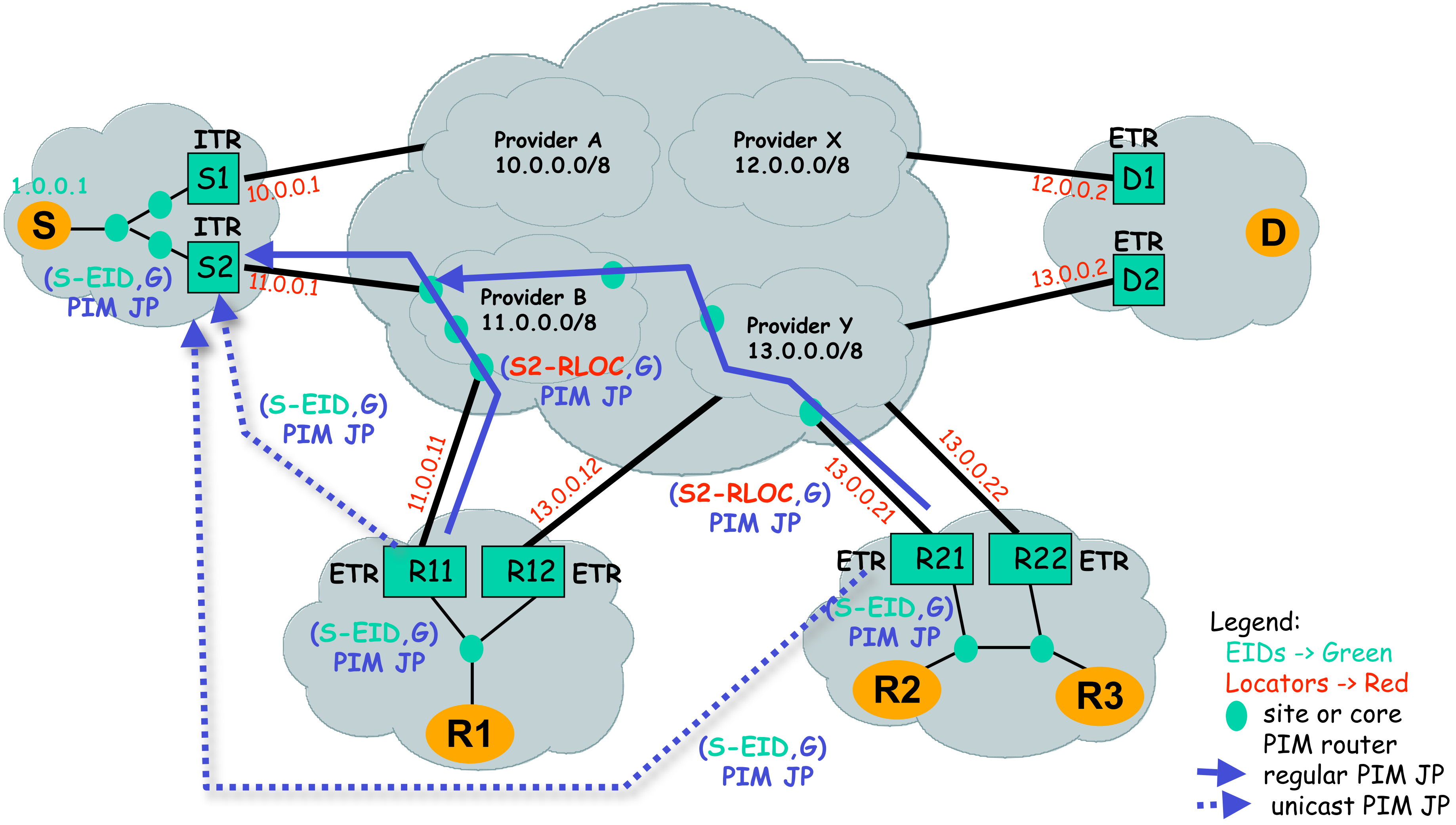
LISP Multicast Defs

- Non-LISP Site
  - Does not support LISP at all
- uLISP Site
  - Support LISP-Unicast only
- LISP-Multicast Site
  - Supports unicast and multicast LISP

LISP Multicast Defs

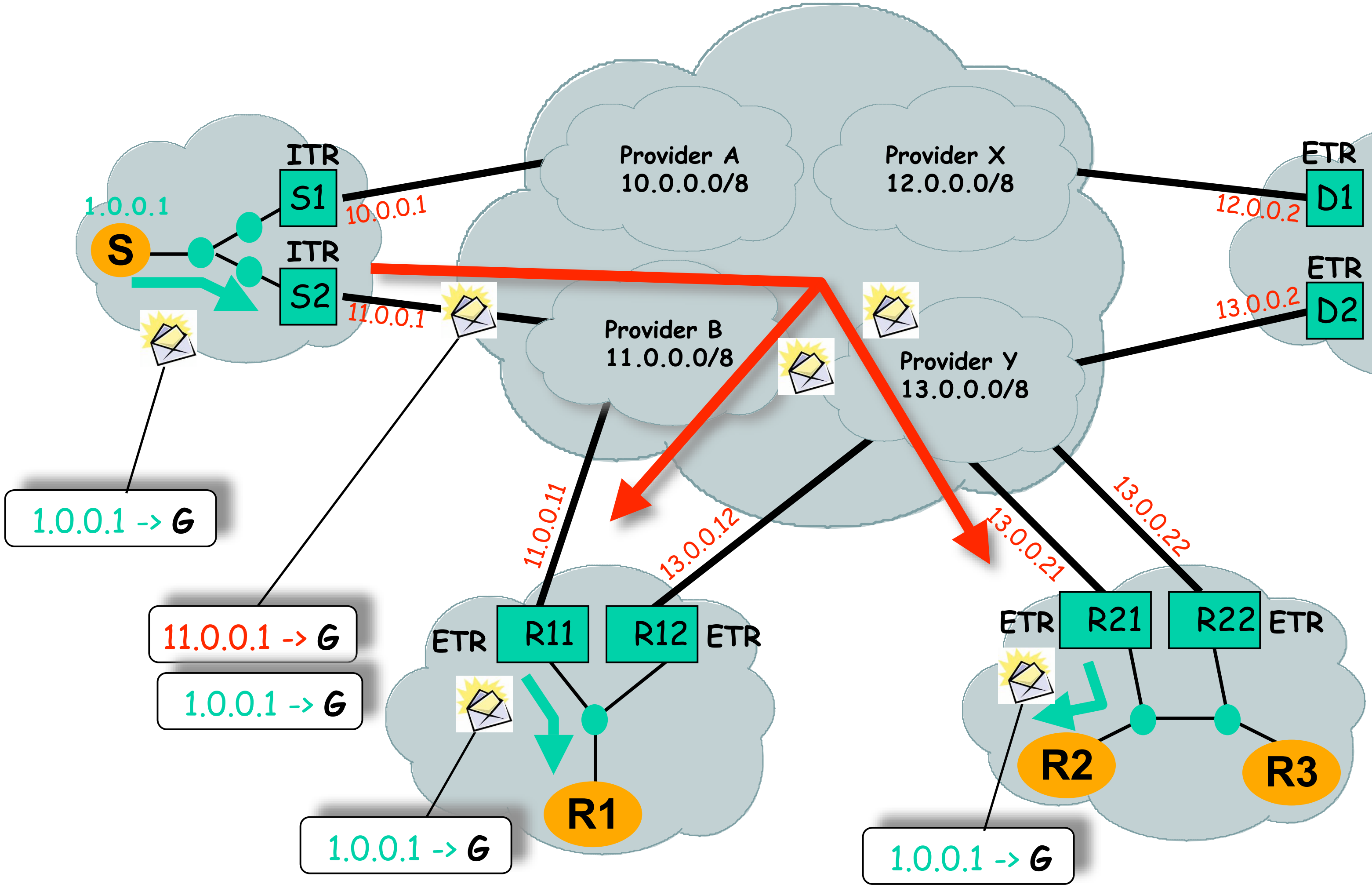
- Multicast ETRs at receiver sites
  - Receives PIM JP (S-EID, G) messages from site routers
  - Obtains S-RLOC from mapping for S-EID
  - Sends unicast PIM JP (S-EID, G) to ITR S-RLOC address
  - Sends regular PIM JP (S-RLOC, G) through core
  - Decapsulates multicast (S-RLOC, G) into (S-EID, G)
- Multicast ITRs at source sites
  - Receive unicast PIM JP (S-EID, G) messages and forward into source site
  - Acts as root of (S-RLOC, G) tree for site
  - Encapsulates (S-EID, G) packets into (S-RLOC, G)
- mPTRs
  - Multicast Proxy Tunnel Routers (PTRs)

Multicast Packet Forwarding



Legend:
EIDs -> Green
Locators -> Red
● site or core PIM router
➔ regular PIM JP
⇢ unicast PIM JP

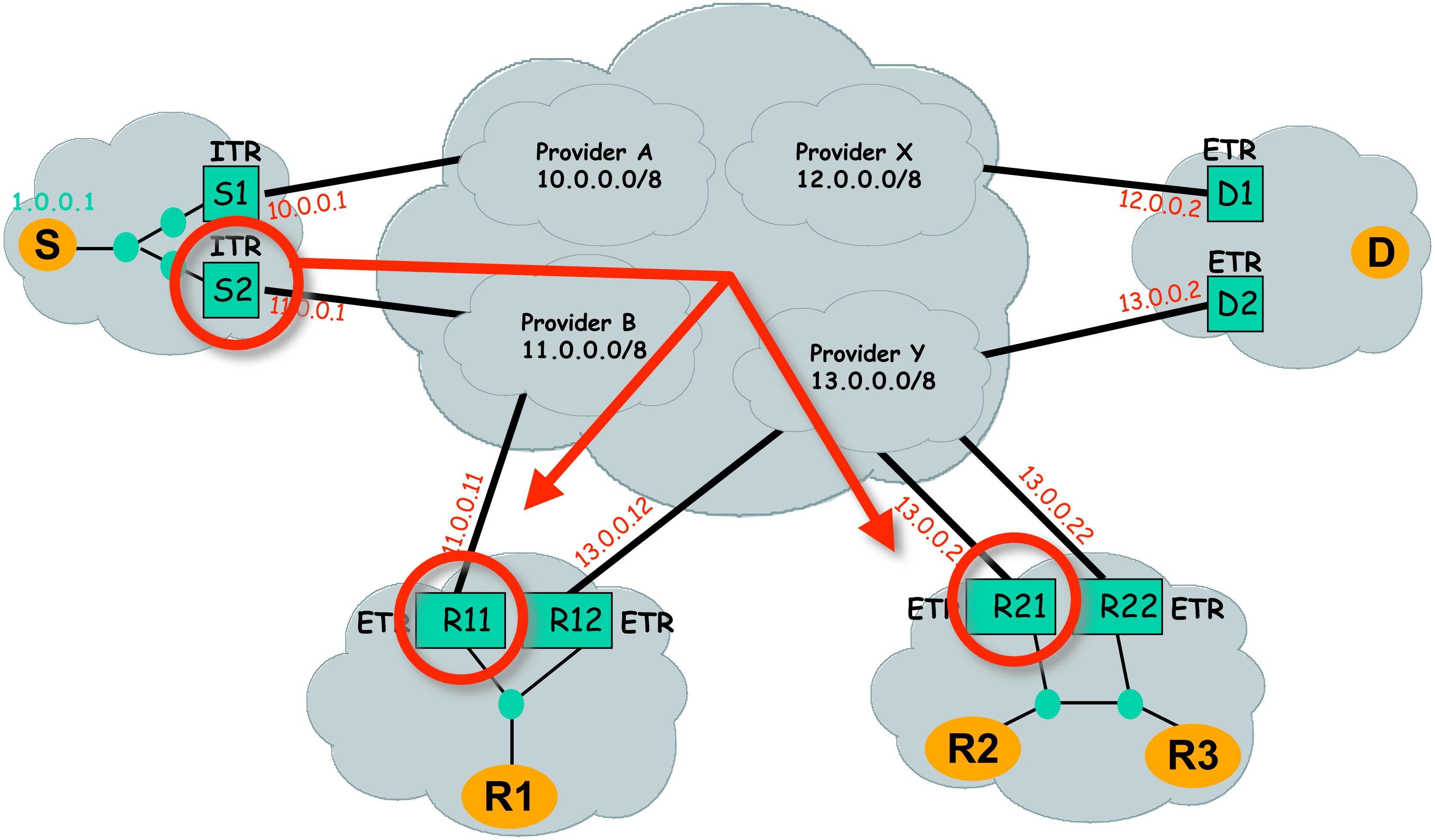
Multicast Packet Forwarding



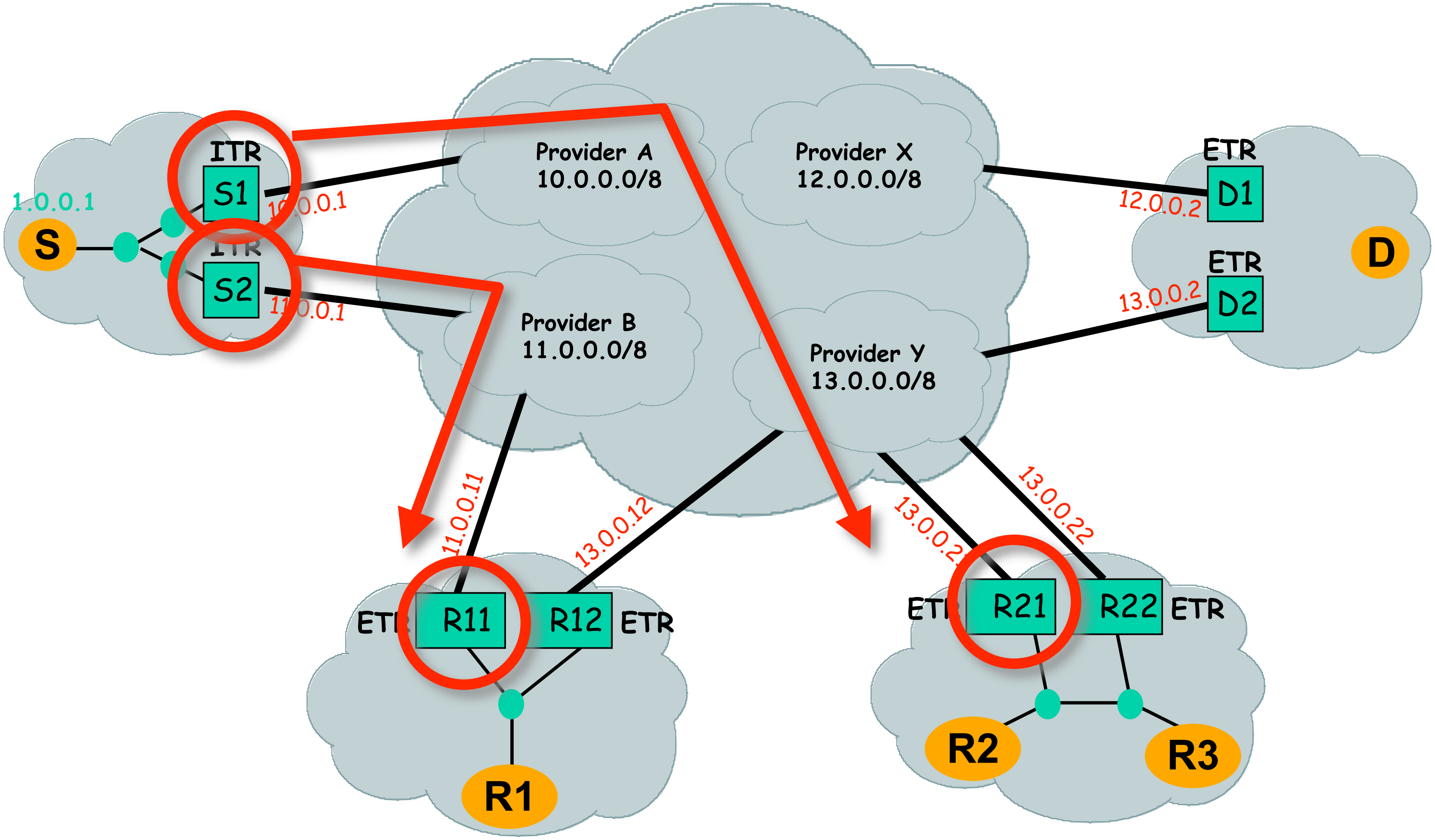
Aggregated-Trees
(S-EID, G):
(1.0.0.1, G)
(1.0.0.2, G)
map to:
(S-RLOC, G):
(11.0.0.1, G)

Use SSM!

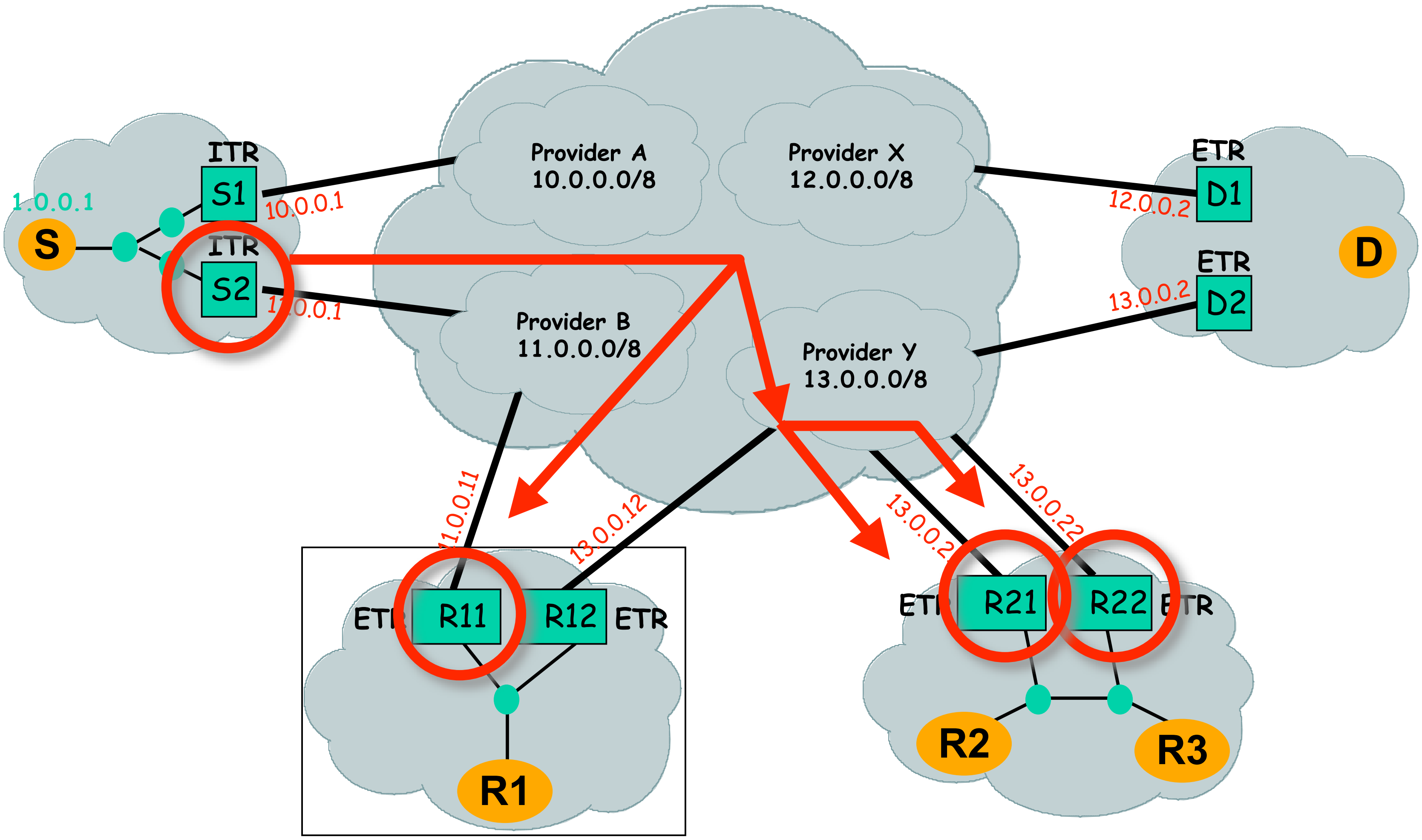
Join Policy - 1 Exit, 1 Entrance



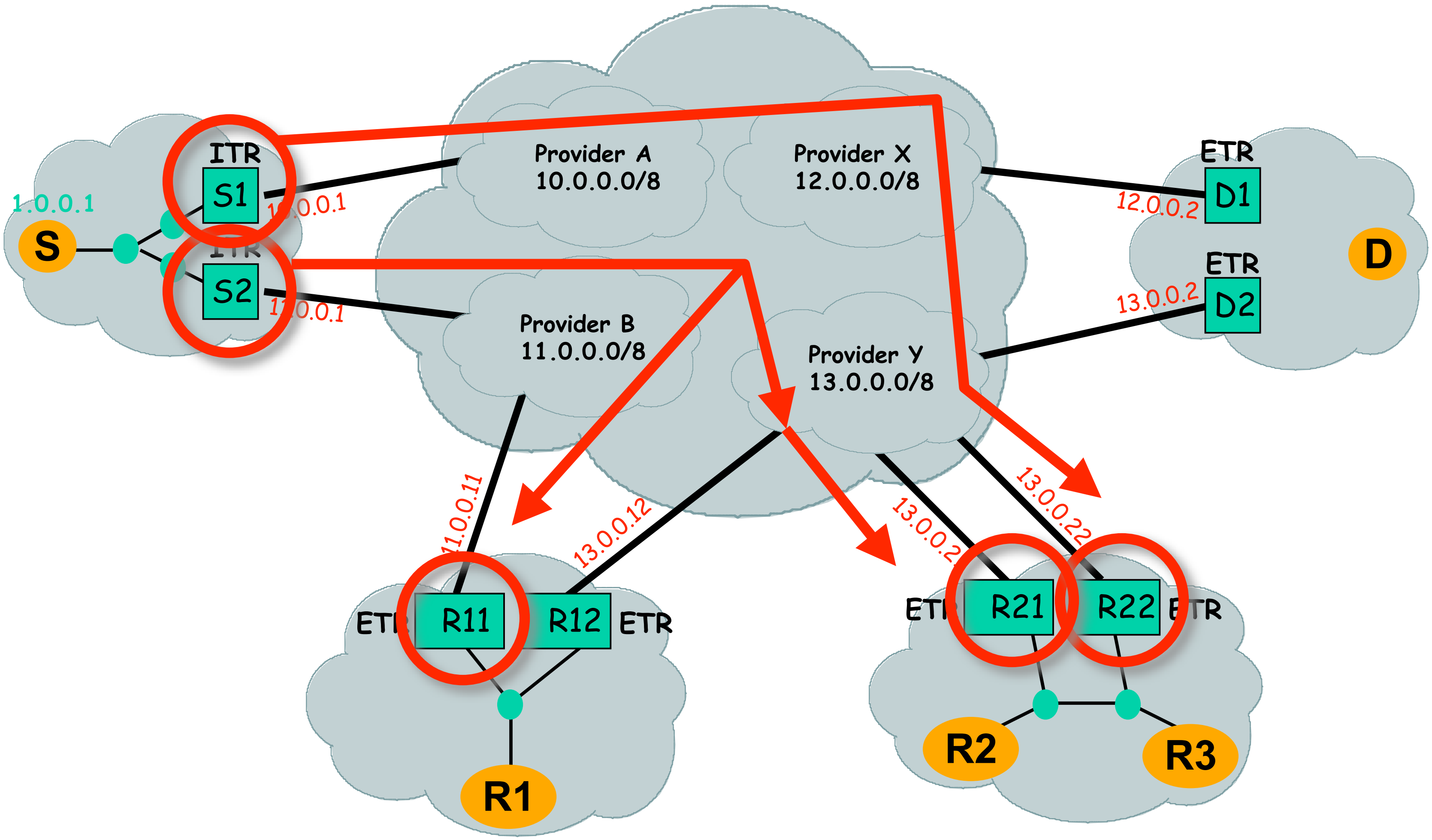
Join Policy - 2 Exits, 1 Entrance



Join Policy - 1 Exit, 2 Entrances



Join Policy - 2 Exits, 2 Entrances



6.1.4. Map-Reply Message Format

```
       +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
       |x|M|                 Locator Reach Bits                        |
       +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
       |                             Nonce                             |
       +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
       |Type=2 |              Reserved                 | Record Count  |
+----> +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      |                          Record  TTL                          |
|      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      | Locator Count | EID mask-len  |A|        Reserved             |
|      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
R      |            ITR-AFI            |            EID-AFI            |
e      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
c      |                  Originating ITR RLOC Address                 |
o      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
r      |                          EID-prefix                           |
d      +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     /|    Priority   |    Weight     |  M Priority   |   M Weight    |
|    / +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Loc |          Unused Flags       |R|         Loc-AFI               |
|    \ +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     \|                           Locator                             |
+--->  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
       |                     Mapping Protocol Data                     |
       +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Locator Reachability

- Loc-reach-bits
  - Used for both unicast and multicast
  - Mapping entries contain all locators
  - You can turn locators on for unicast and off for multicast by setting priority to 255
  - Multicast and Unicast fate-share each other
    - A mapping obtained for a unicast packet can be used for a multicast join and vice-versa

LISP-Multicast Interworking

- Non-LISP sites
  - Unicast only
  - Unicast and multicast
- uLISP sites
  - Unicast-LISP
  - Multicast-Traditional
  - No Multicast at all
- Multicast-LISP sites
  - Both Unicast-LISP and Multicast-LISP
- Simplification
  - Treat Non-LISP-multicast and uLISP-multicast-traditional the same

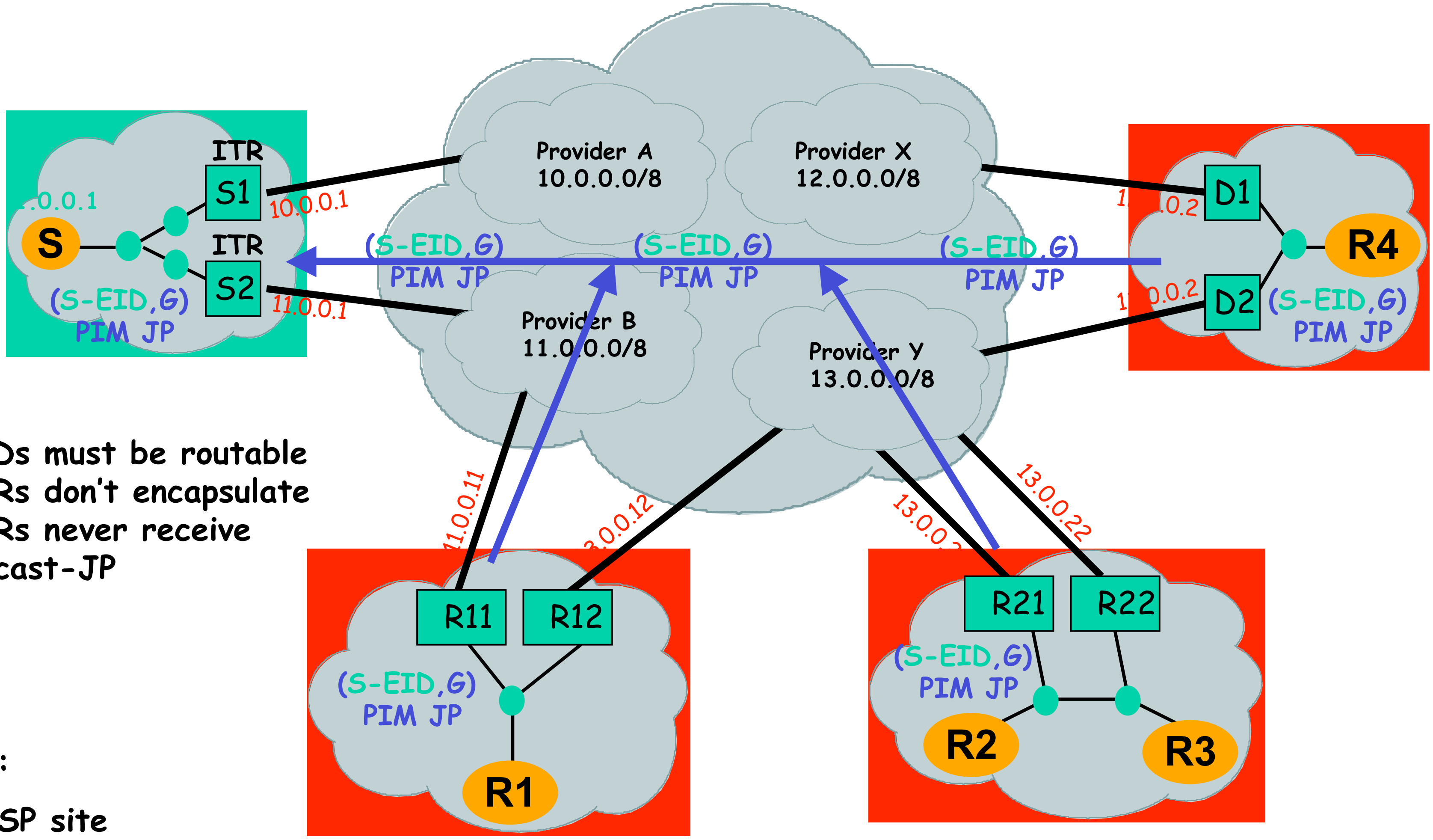
Interworking Solutions

- Unicast Interworking
  - Translation at source site
  - Proxy Tunnel Routers (PTR)
- Multicast Interworking
  - Translation at receiver site
    - Would require another mapping table
    - Receiver sites must translate to same routable (S-EID)
    - Operationally a non-starter
  - Multicast Proxy Tunnel Routers (mPTRs)
    - Reduce where (S-EID) state resides in network
    - (S-EID) state exists between non-LISP site and mPTR

Interworking Case Studies

- Non-LISP multicast source site
  - All receiver sites are LISP
  - Mix of LISP and non-LISP receiver sites
- uLISP source site -- same as above
- LISP multicast source site
  - All receiver sites are non-LISP
  - All receiver sites are LISP
  - Mix of LISP and non-LISP

LISP-Multicast Interworking



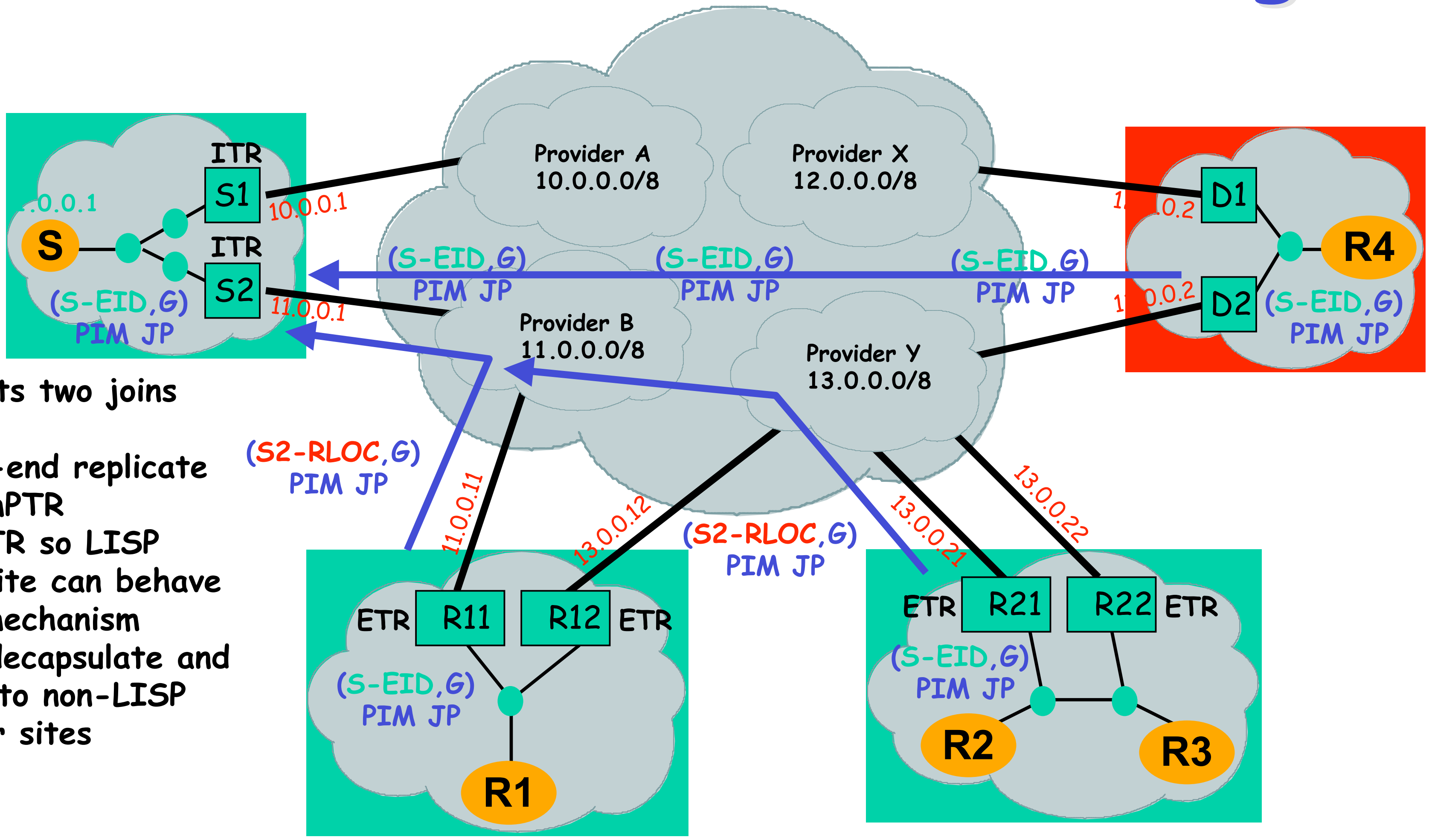
1) EIDs must be routable
2) ITRs don't encapsulate
3) ITRs never receive
   unicast-JP

Legend:

🟩 LISP site

🟥 non-LISP site

LISP-Multicast Interworking



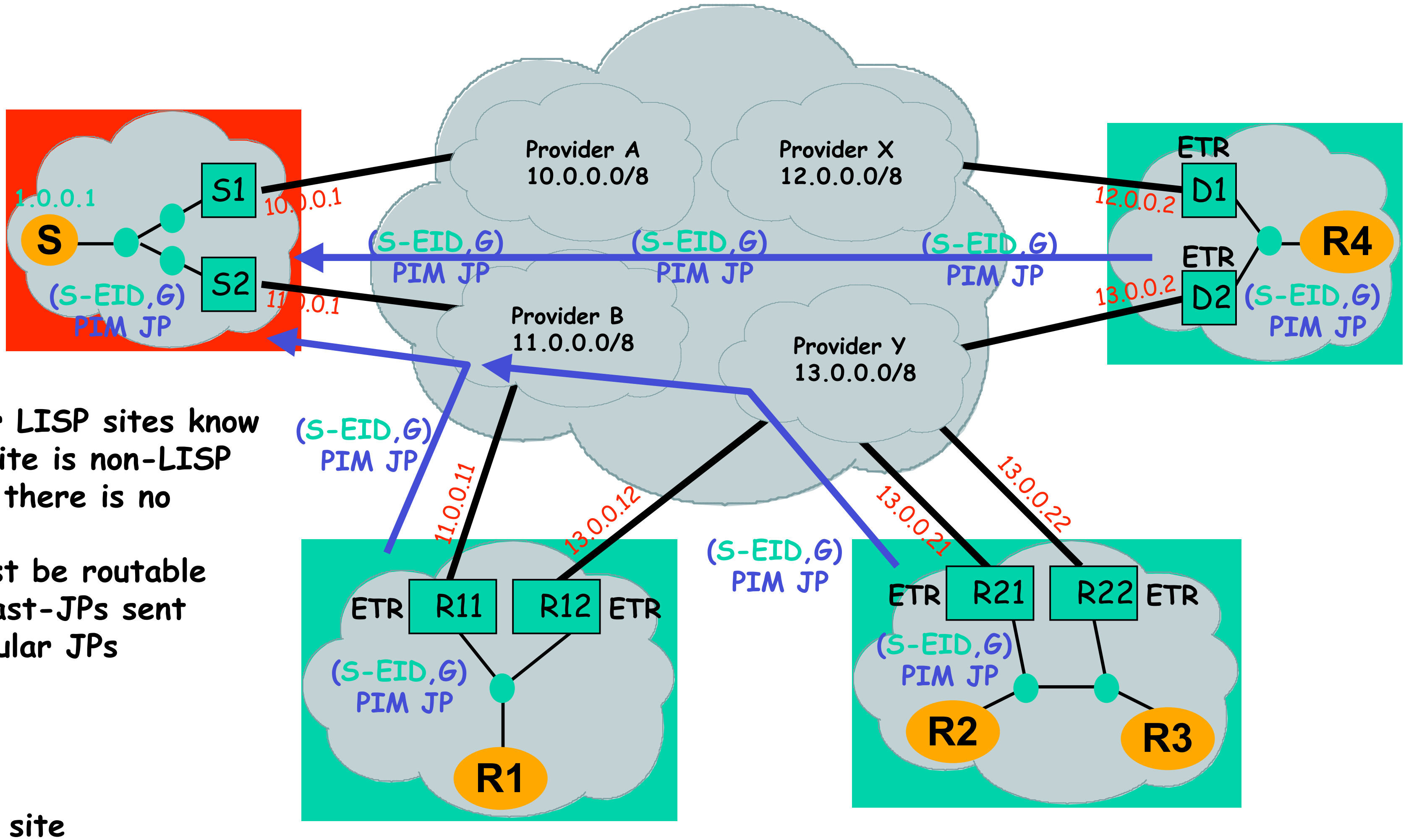
1) ITRs gets two joins
   Options:
      Head-end replicate
      Use mPTR
2) Use mPTR so LISP source site can behave with 1 mechanism
3) mPTRs decapsulate and deliver to non-LISP receiver sites

Legend:

🟩 LISP site

🟥 non-LISP site

LISP-Multicast Interworking



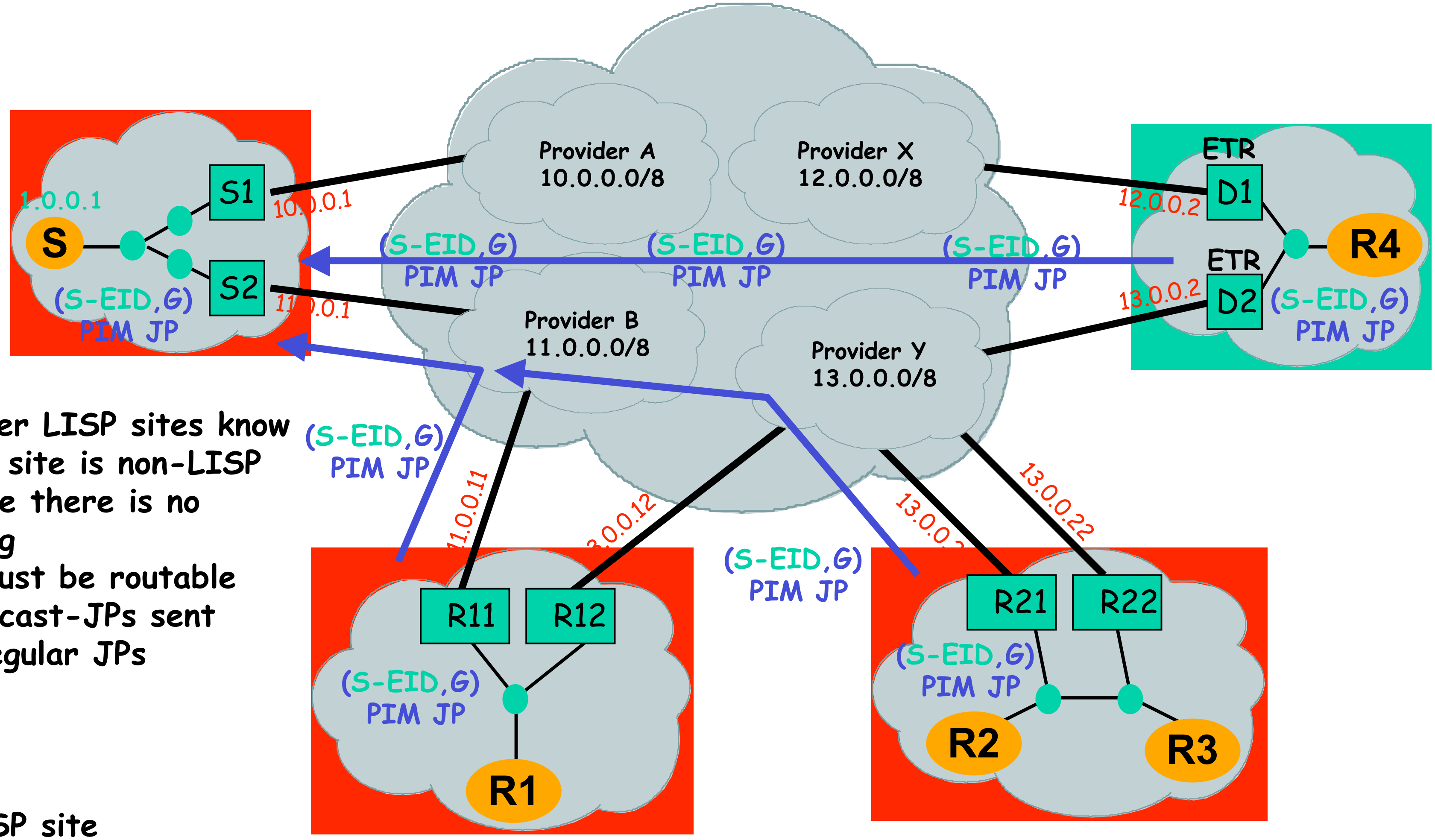
1) Receiver LISP sites know source site is non-LISP because there is no mapping
2) EID must be routable
3) No unicast-JPs sent just regular JPs

Legend:

🟩 LISP site

🟥 non-LISP site

LISP-Multicast Interworking



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2) EID must be routable
3) No unicast-JPs sent just regular JPs

Legend:

🟩 LISP site

🟥 non-LISP site

Multicast PTRs

- Unicast PTRs
  - They proxy for ITR functionality
  - They advertise coarse prefixes to attract and encapsulate packets
- Multicast PTRs
  - They proxy for ETR functionality
  - They advertise coarse prefixes to attract Joins and therefore attract and decapsulate packets
- No unicast EID state in core from PTRs to ETRs
- No multicast (S-EID, G) state in core from ITRs to mPTRs

AF Case Studies

1. LISP-Multicast IPv4 Site
2. LISP-Multicast IPv6 Site
3. LISP-Multicast Dual-Stack Site
4. uLISP IPv4 Site
5. uLISP IPv6 Site
6. uLISP Dual-Stack Site
7. non-LISP IPv4 Site
8. non-LISP IPv6 Site
9. non-LISP Dual-Stack Site

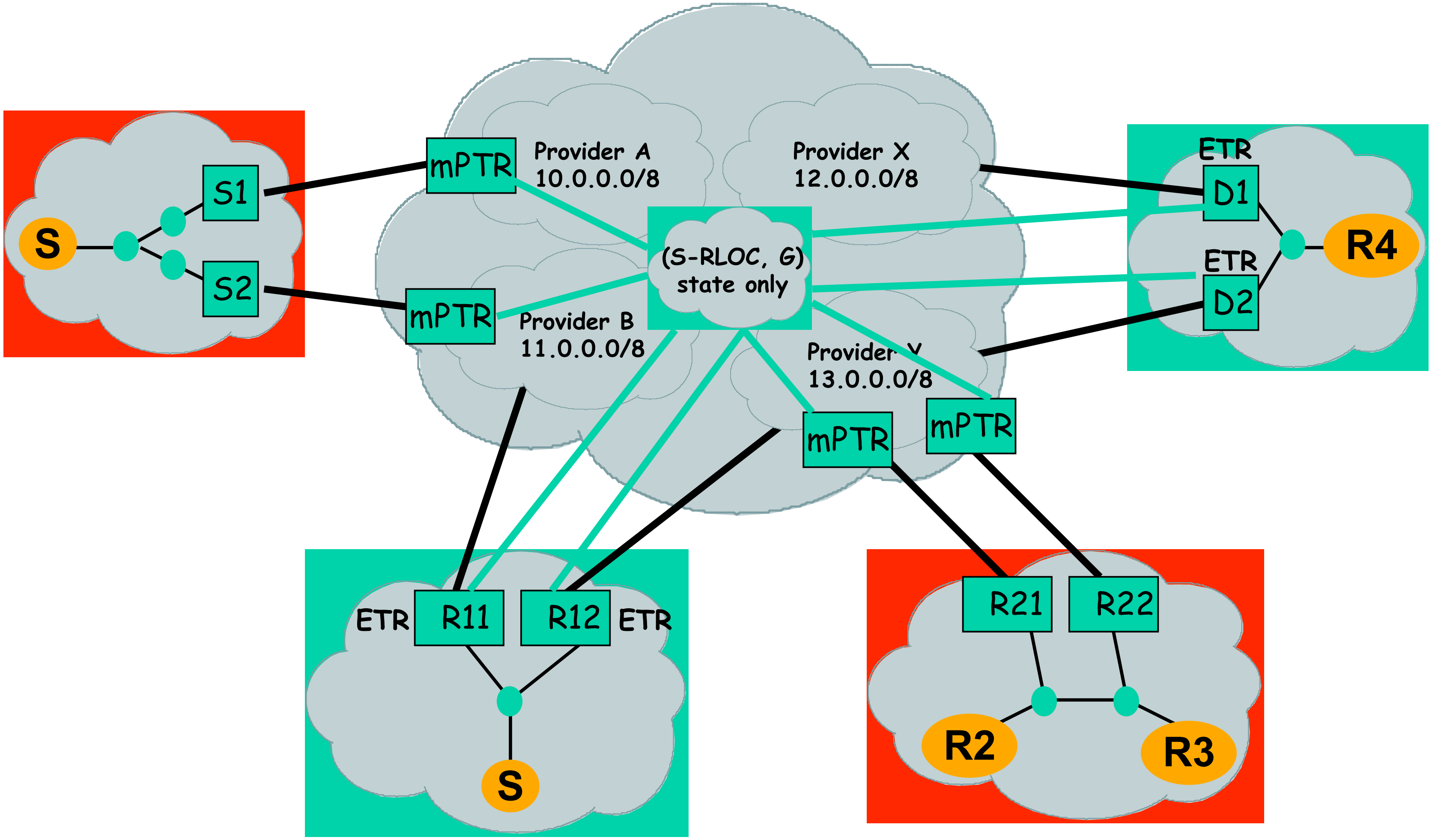
Case Studies

- A Combinatorial Explosion
  - (9 1) + (9 2) + . . . + (9 9)
  - 502 combinations!
- Rationalize by forcing multicast tree be AF homogenous
  - Avoid head-end replication and translation
  - Source site mapping entry priority decides which AF
  - When source site is non-LISP, use application-level directory to determine AF
- Further simplification
  - Make all sites that deploy LISP be unicast & multicast capable from the day-one

LISP Protocol Mechanisms

- Changes only to ITRs, ETRs, & PTRs
- Simple change to PIM
  - Sending/receiving unicast JPs
  - Translation of JP from EID to RLOC
- Simple change to MSDP
  - Translation for RPF-peering for RP
- Simplification
  - Only support SSM for inter-domain
- Use mPTRs to reduce (S-EID, G) state
  - Using (S-RLOC, G) reduces multicast routing table size we have today!

Best Possible Outcome



mLISP

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RULES