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Source Specific Multicast (SSM)

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Enable Your Network
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Barriers to Multicast Deployment

- Global Multicast Address Allocation
  - Dynamic Address Allocation
    - No adequate dynamic address allocation methods exist
    - SDR – Doesn’t scale
    - MASC – Long ways off!
  - Static Address Allocation (GLOP)
    - Based on AS number.
    - Insufficient address space for large Content Providers.
- Multicast Content “Jammers”
  - Undesirable sources on a multicast group.
    - “Capt. Midnight” sources bogus data/noise to group.
    - Can cause DoS attack by congesting low speed links.

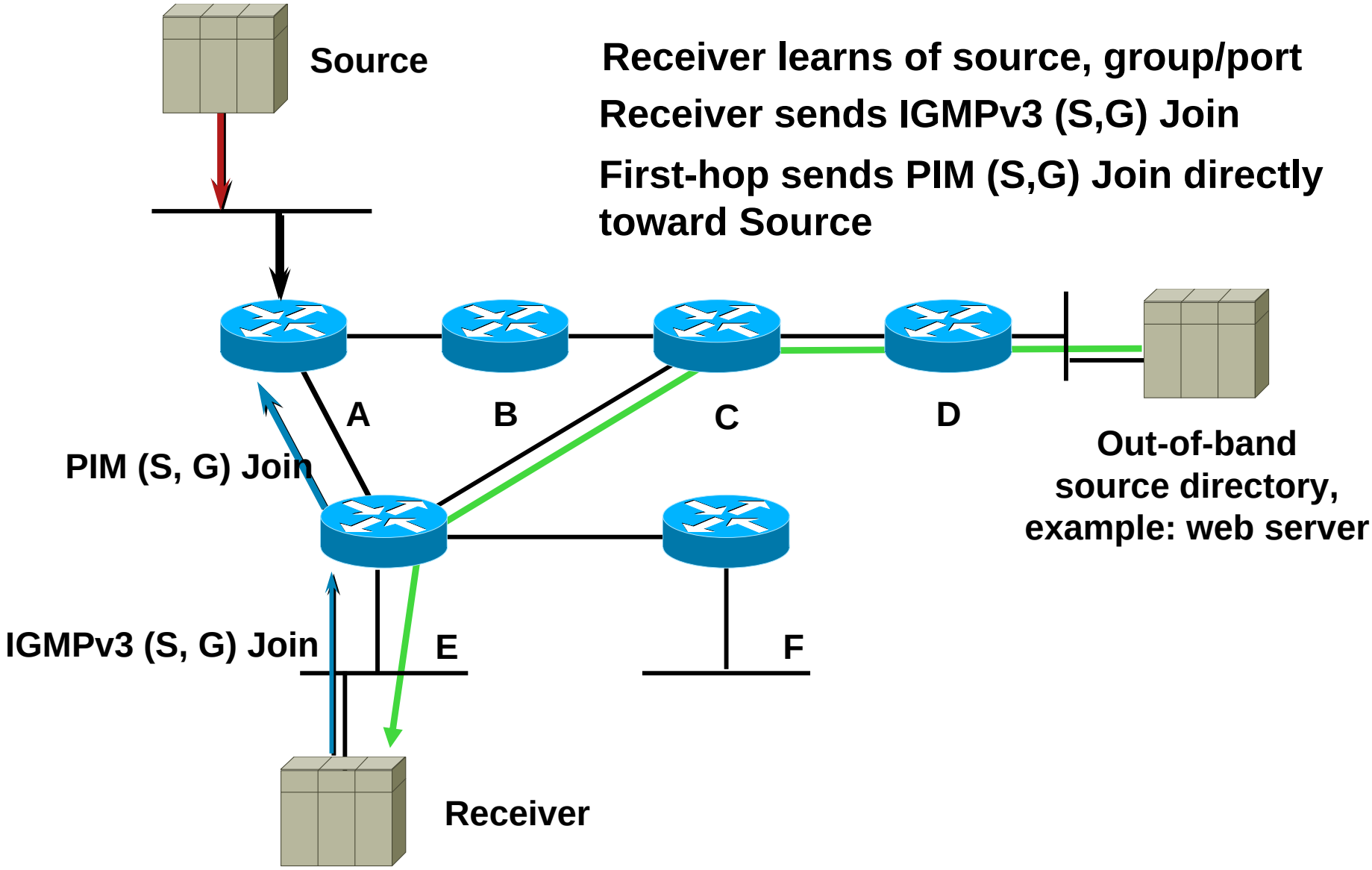
Source Specific Multicast (SSM)

- Uses Source Trees only.
- Assumes One-to-Many model.
  - Most Internet multicast fits this model.
  - IP/TV also fits this model.
- Hosts responsible for source discovery.
  - Typically via some out-of-band mechanism.
    - Web page, Content Server, etc.
  - Eliminates need for RP and Shared Trees.
  - Eliminates need for MSDP.

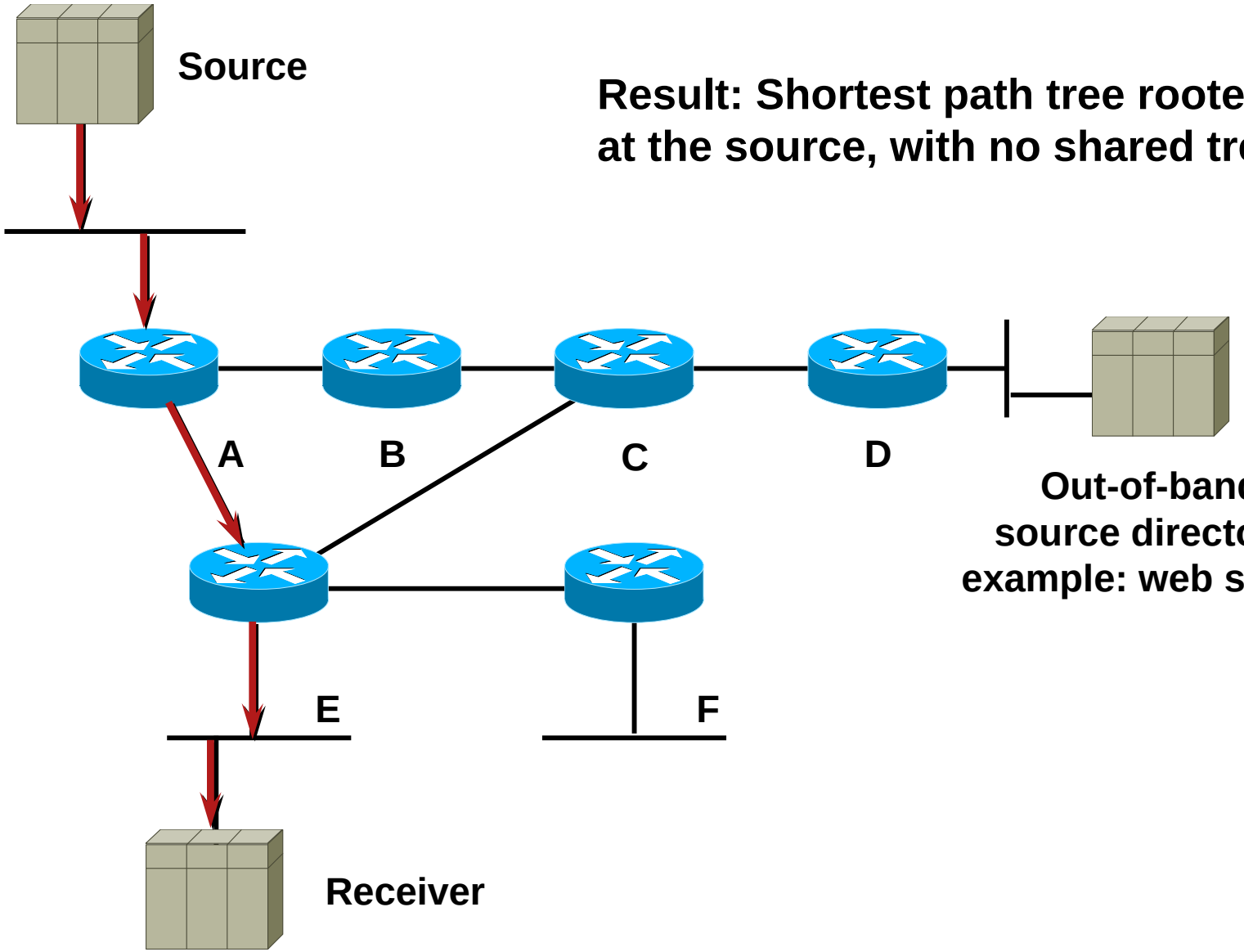
SSM Overview

- Hosts join a specific source within a group.
  - Content identified by specific (S,G) instead of (*,G).
  - Hosts responsible for learning (S,G) information.
- Last-hop router sends (S,G) join toward source
  - Shared Tree is never Joined or used.
  - Eliminates possibility of content Jammers.
  - Only specified (S,G) flow is delivered to host.
- Simplifies address allocation.
  - Dissimilar content sources can use same group without fear of interfering with each other.

PIM Source Specific Mode



PIM Source Specific Mode



SSM Configuration

- Global command

```
ip pim ssm {default | <acl>}
```

Defines SSM address range

Default range = 232.0.0.0/8

Prevents Shared Tree Creation

(*, G) Joins never sent or processed

PIM Registers never sent or processed

Available starting in IOS versions

12.1(5)T, 12.2, 12.0(15)S, 12.1(8)E

IGMPv3 Status

- IGMPv3—RFC 3376
- IGMPv3 implementations needed in:
  - Multicast receivers—hosts
  - Last hop routers with directly attached receivers
  - LAN switches doing IGMP snooping
  - Proxy devices that pass on IGMP reports
- Full IGMPv3 host stacks still not to be ubiquitous for some time

IGMPv3 Stack Support

- Windows XP and later for IPv4
- Windows Vista and later for IPv6 (MLDv2)
- Windows Media 9.0 and later for example support windows media server and player via SSM.
- Linux 2.6 kernels for IPv4 and IPv6
- Solaris 10 for IPv4 and IPv6
- MacOS: (OSX 10.5 ?)
- APIs are in RFC3678

SSM Mapping

- Network operator want to deploy SSM
  - Host/App may not support IGMPv3/SSM – only joins group
  - Outside of network operators control
- Mapping: Have router map group join to (S,G) join
  - Static mapping configured on router
- Network operators may not want to administer mapping
  - Application operator / content provider knows mapping
  - Mapping in router-external database allows them to administer
  - DNS used as database for mapping
    - Also allows subdivision of address space (multiple content provider)
- Limitation: One “content” per group
  - Group may map to multiple sources (redundancy) – all joined

SSM Mapping - Configuration

Enabling SSM mapping on the router

```
ip igmp ssm-map enable
```

For static mapping:

```
ip igmp ssm-map static <acl-1> <source-1 IP address>
ip igmp ssm-map static <acl-2> <source-2 IP address>
```

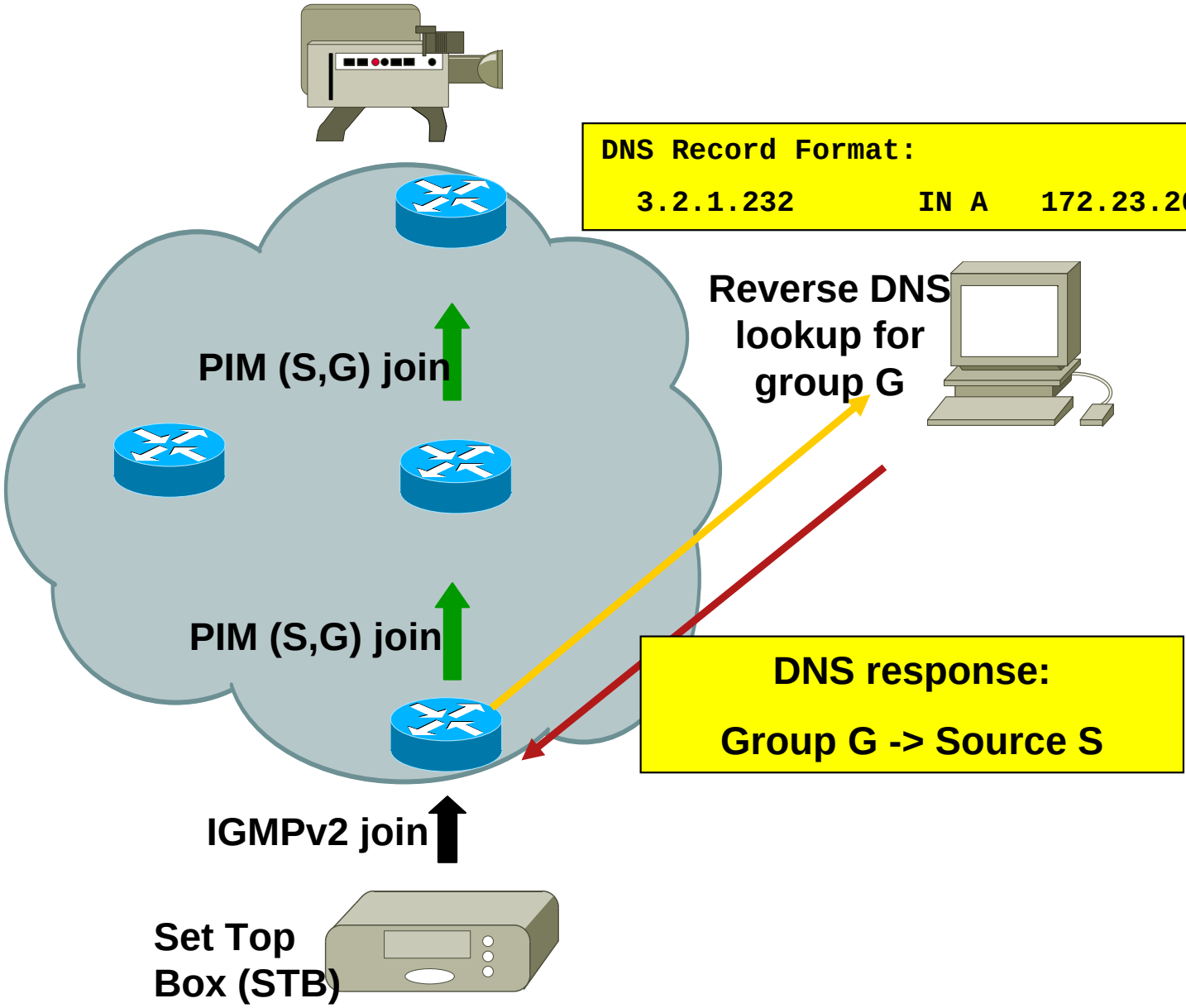
For DNS mapping (existing commands):

```
ip domain-server <ip address>
ip domain-name <domain.com>
```

To disable DNS mapping

```
no ip igmp ssm-map query dns
```

SSM Mapping – DNS Example



SSM and IGMPv3: Interim Solutions

- IGMPv3-lite
  - Based on IGMPv3 API
  - Provides basic IGMPv3 support on router for source specific inclusion
  - Utilizes simple daemon for most platforms to provide partial IGMPv3 functionality
- URD - URL Rendezvous Directory
  - Requires no changes to host stack or apps
  - First-hop router intercepts info from http session

Effect of Shared Trees on SSM

- 232.0.0.0/8 has been allocated for groups where shared trees are prohibited.
- SSM coexists with normal PIM Sparse mode:

  Filter Register messages for sources sending to 232.0.0.0/8 groups

  Filter (*, G) Join messages for 232.0.0.0/8 groups

  Prevent origination or forwarding of SA-messages (in MSDP) for 232.0.0.0/8 groups.

SSM – Summary

- Uses Source Trees only.
  - Hosts are responsible for source & group discovery.
  - Hosts must signal router which (S,G) to join.
- Solves multicast address allocation problems.
  - Flows differentiated by both source and group.
  - Content providers can use same group ranges.
    - Since each (S,G) flow is unique.
- Helps prevent certain DoS attacks
  - “Bogus” source traffic:
    - Can’t consume network bandwidth.
    - Not received by host application.

SSM Benefits

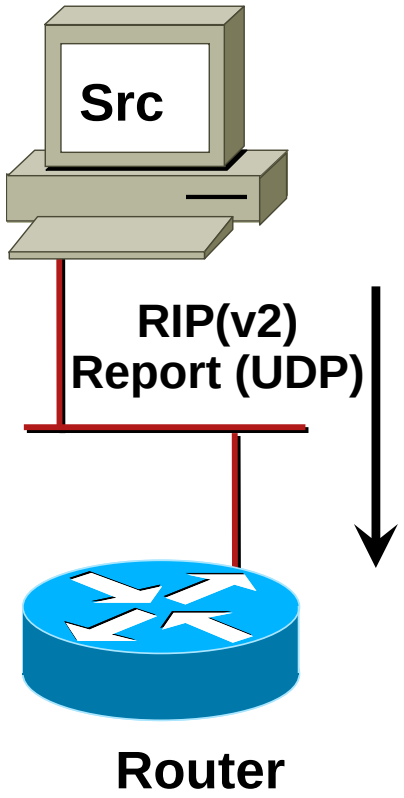
- Address management / overlap simplified
- More security in the data plane
- No shared tree control plane issues
  - (*,G) state
  - RP management
  - RPT switchover
  - MSDP
- Better / faster convergence times
- Explicit receiver tracking possible
- State reduction – 1 state per stream
- Admission control simplified
- MVPN delivery simplified – no RP needed in the core

Video Source Redundancy Approaches

Primary-Backup	Live-Live / Hot-Hot
Two sources, One is active and src'ing content, Second is in standby mode (not src'ing content) Heartbeat mechanism used to communicate with each other	Two sources, *both* are active and src'ing multicast into the network No Protocol between the two sources
Only one copy is on the network at any instant Single Multicast tree is built per the unicast routing table	Two copies of the multicast packets will be in the network at any instant Two Multicast tree on almost redundant Infrastructure
Uses required bandwidth	Uses 2x network bandwidth
Receiver's functionality simpler: Aware of only one src, fail-over logic handled between sources.	Receiver is smarter: Is aware/configured with two feeds (s1,g1), (s2,g2) / (*,g1), (*,g2) Joins both and receives both feeds
This approach requires the network to have fast IGP and PIM convergence	This approach does not require fast IGP and PIM convergence

Anycast / Prioritycast Signaling

- Redundant sources announce Source Address via RIPv2
- Routers redistribute (with policy) into actual IGP
  - Easily done from IPTV middleware (UDP)
  - No protocol machinery required – only periodic announce packets.
  - Small periodicity for fast failure detection
    - Better: Use BFD between Router/Host too.
  - All routers support RIPv2, but not often used as real IGP:
    - Allows secure constrained config on routers



Anycast / Prioritycast Policies

- Policies

  Anycast: clients connect to the closest instance of redundant IP address

  Prioritycast: clients connect to the highest-priority instance of the redundant IP address

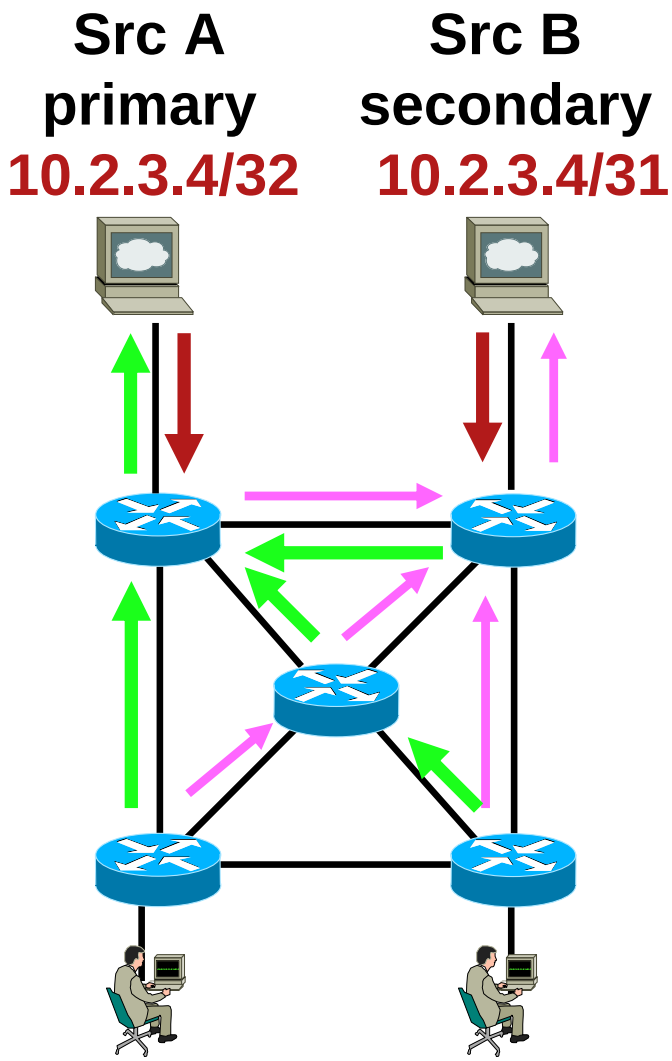
- Also used in other places

  e.g. PIM-SM and Bidir-PIM RP redundancy

- Policy simply determined by routing announcement and routing config

  Anycast well understood

  Prioritycast: engineer metrics of announcements or use different prefix length.



Example: Prioritycast with Prefixlength announcement

Anycast / Prioritycast Benefits

- Subsecond failover possible
- Represent program channel as single (S,G)
  - SSM: single tree, no signaling, ASM: no RPT/SPT
- Move instances “freely” around the network
  - Most simply within IGP area
  - Regional to national encoder failover (BGP..)
- No vendor proprietary source sync proto required
- Per program, not only per-source-device failover
  - Use different source address per program

Q & A