

# Multicast Routing in a home network

draft-pfister-homenet-multicast-00

draft-pfister-pim-ssbidir-00

draft-pfister-pim-border-proxy-00

Pierre Pfister

# Reminder: What is a 'Home Network'

- Homenet is an IETF Working Group
- Focuses on tomorrow's IPv6 home networks
  - Multiple routers and links
  - Multiple service providers / uplinks
  - End-to-end IPv6 connectivity
  - Zeroconf !
- What does it mean so far ?
  - Unicast routing protocol
  - Configuration protocol (HNCP)
  - Automatic prefix assignment
  - mDNS/DNS-SD proxying
  - What about multicast ?

Check out hnetd implementation:  
[www.homewrt.org](http://www.homewrt.org)

# Presentation Outline

1. Problem statement
2. Solution space
3. A proposal

# Why do we want multicast routing ?

- Architecture RFC says so:

It is desirable that, subject to the capacities of devices on certain media types, multicast routing is supported across the homenet, including source-specific multicast (SSM).

- Service Discovery

- UPnP uses site-local multicast
- mDNS/DNS-SD ? -> Not really. Current approach is based on proxying
- Others (SAP announces, vendor specific, etc...)

- Media streaming

- TV over IP
- CCTV
- In-home streaming

- Data sharing (IoT, sensors, etc...)

- Who knows ?

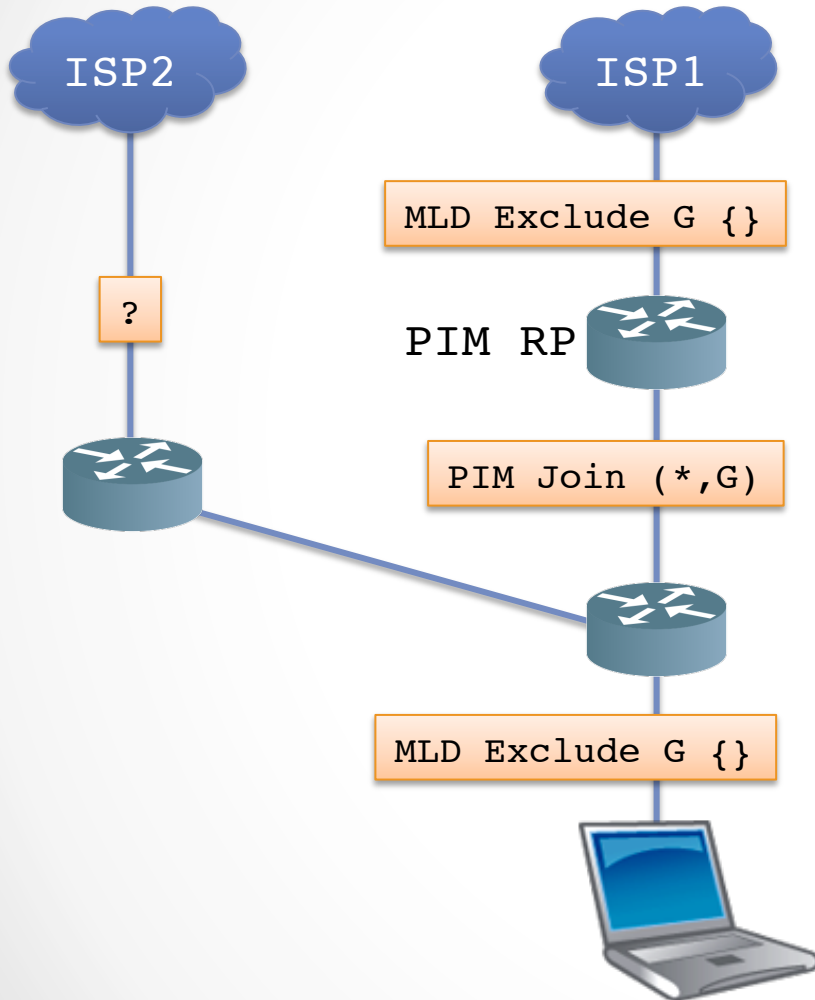
# What do we want ?

- Receive ASM or SSM traffic from sources located:
  - On the same link (easy)
  - In the home (We know how to do that)
  - Outside the home (tricky)
  - On different uplinks (even trickier)
- Tricky parts:
  - Multi-homing (multiple default routes)
  - Interfacing with ISP (MLD/IGMP)
  - Zeroconf
  - Keep it Simple

# What is the matter ? We have PIM !

- It's not so simple...
- Problem #1: Subscribe to ISP provided traffic.
- Problem #2: Source localization for SSM traffic.

# Problem #1: Subscribe to ISP traffic



- PIM reacts to:
  - MLD/IGMP messages.
  - Multicast traffic reception.
- Border router needs to subscribe *\*first\**
  - Needs to know to which group/source.
  - PIM RP at the border will know:
    - ASM subscriptions
    - SSM in singled home network
  - Multi-homing complicates things:
    - No single border (as PIM RP)
- No assumption on ISP interface protocol
  - MLD/IGMP is default.
  - Custom (PIM, ...) is possible.

# Solution space: Subscribe to ISP

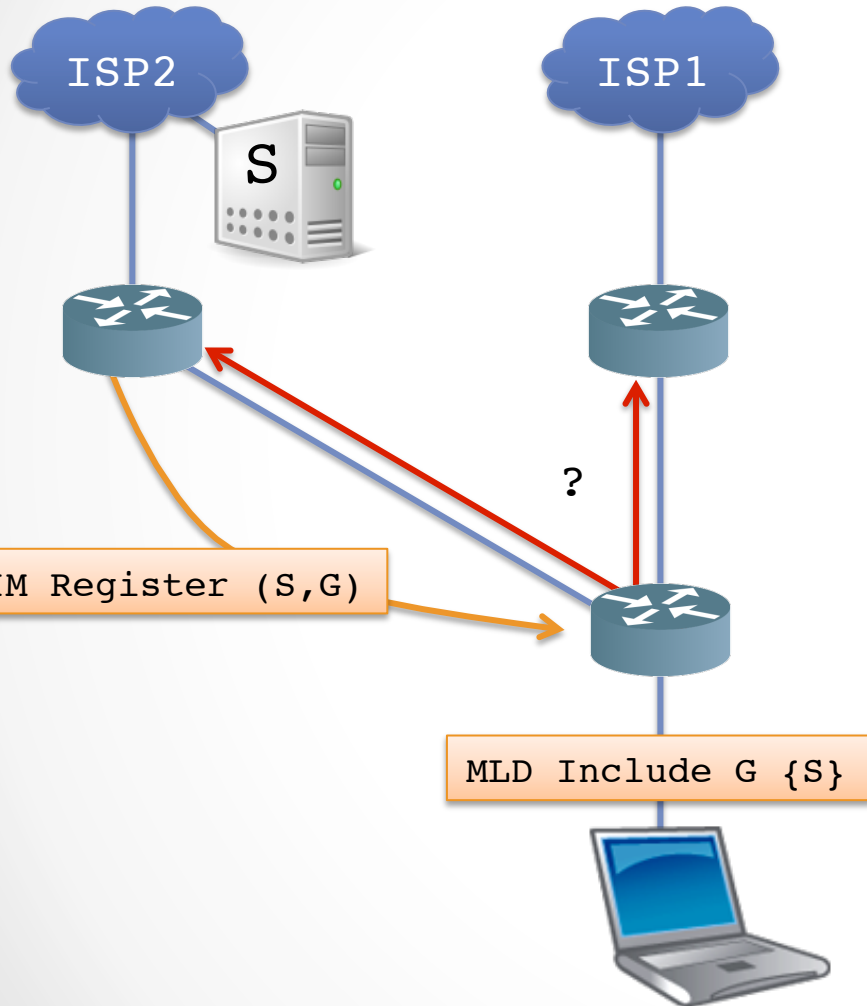
Border routers need knowledge !

- Home-wide ASM and SSM subscription state
- PIM-SM RP does not know SSM state
- For global or multicast groups only

1. Send 'informational' J/Ps to Border Routers
  - Creates lots of state on intermediate routers
2. Single router gathers information and sends it to border routers.
  - 1 peering per border router
3. All routers send local subscriptions to border routers.
  - 1 peering per border router AND per link



# Problem #2: Source Localization



- PIM uses the RIB for reverse path forwarding.
  - To the PIM RP (RP tree)
  - To the source (SSM)
- If multiple default routes
  - SSM will not work
  - ASM will be tunneled (PIM-SM)
- Send Join(S,G) to both ?
  - Routing not defined in PIM-SM
  - Possible routing loops

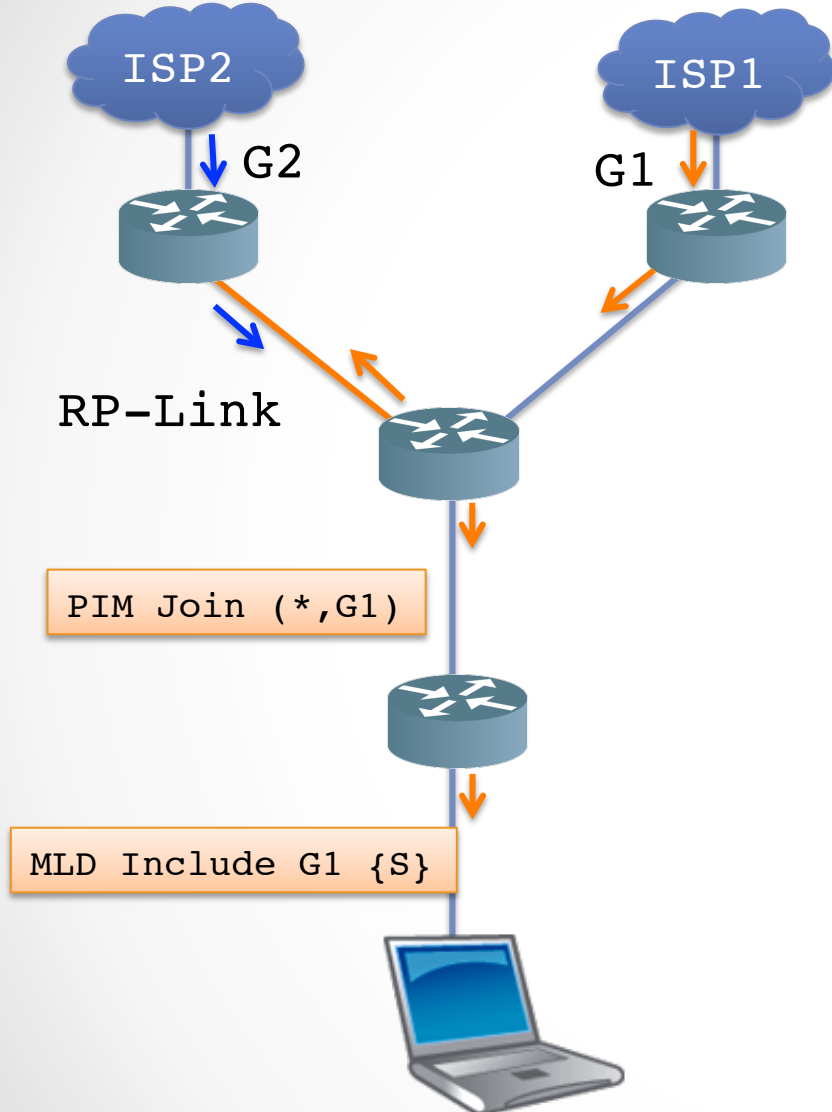
# Solution space: Source localization

- RP can locate the source (Register source address)
  - Use RPF Vector to forward SSM to the first-hop-router  
draft-ietf-pim-explicit-rpf-vector
  - Other routers could discover source location but first packets would be lost!  
draft-ietf-pim-source-discovery-bsr
  - Send Join(S,G) to the RP, but conflicting RPF Vectors have unspecified behavior.
- Use PIM-BIDIR
  - Problem solved 😊 (Always forward traffic to the RPA)
  - This proposal uses PIM-SSBIDIR (draft-pfister-pim-ssbidir-00)
- Use MLD/IGMP proxying
  - Works in a tree. Needs upstream election, or asserts in arbitrary topology.
  - Similar to PIM-SSBIDIR with other messaging.

# One way to skin this cat...

1. PIM-SSBIDIR draft-pfister-pim-ssbidir
  - No Source-localization problem
  - Similar to PIM-BIDIR but with Source-Specific state.
2. One single Proxy-Controller, on the RP-Link controls all border proxies draft-pfister-pim-border-proxy
  - Proxy-Controller knows the home-wide subscription state
3. Homenet glue draft-pfister-homenet-multicast
  - Use HNCP for RPA and controller election
  - Use HNCP for border-proxy discovery
  - Send Join/Prunes on the RP-Link

# Reminder: PIM-BIDIR



- One single routing tree
  - Routed at the RP-Link
- Always forward toward the RP-Link
  - No need to know where the source is !
- All Source Multicast Only
- Designated-Forwarder Election

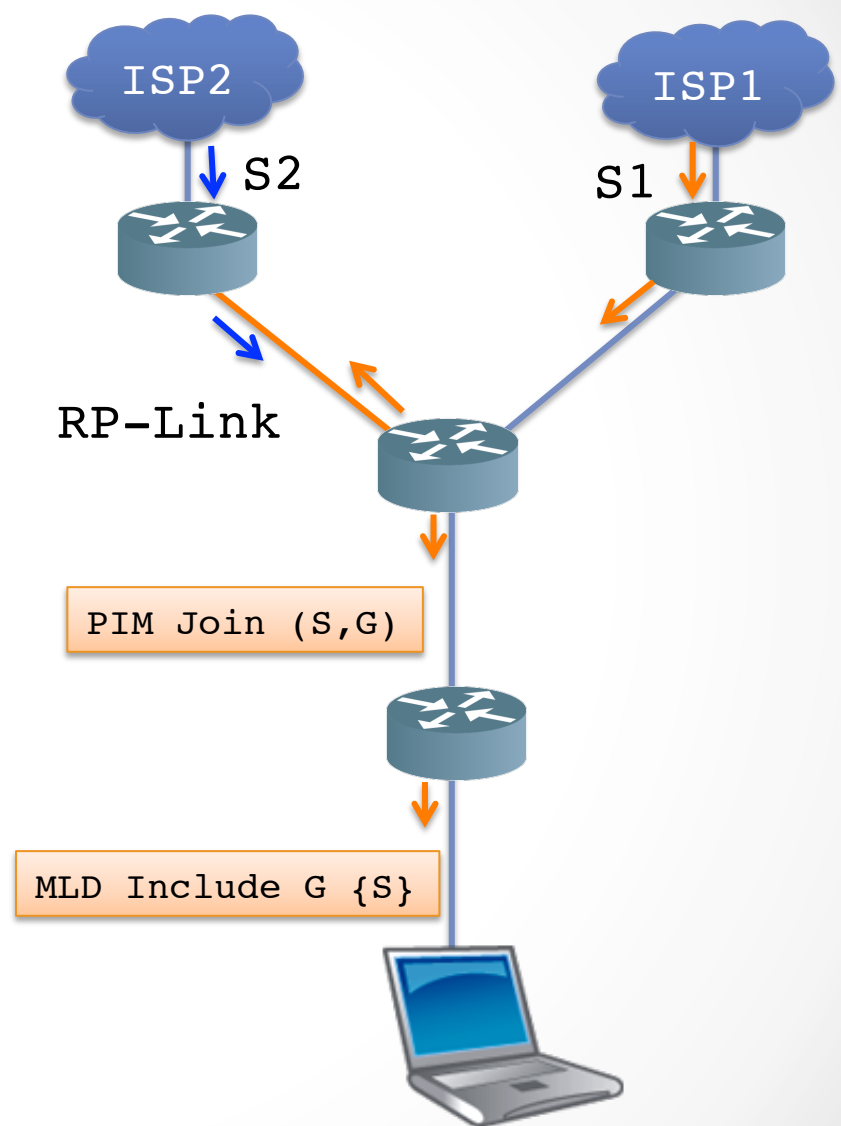
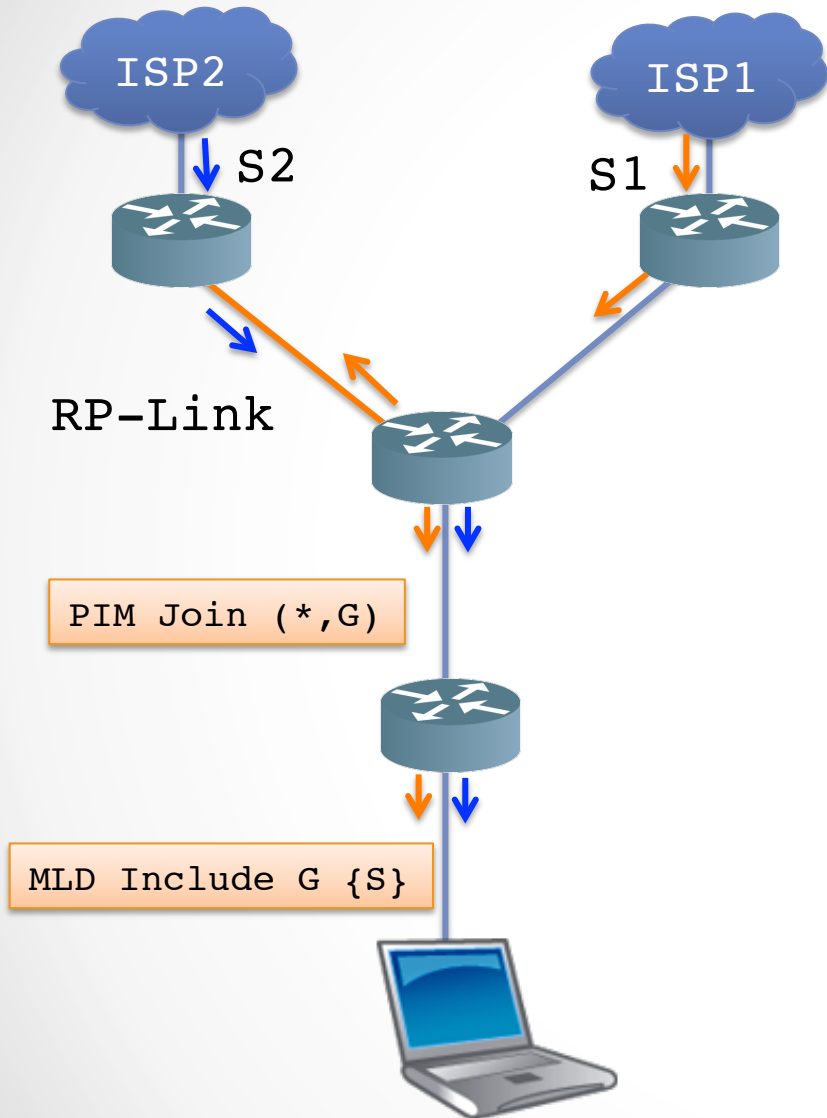
# 1. PIM-SSBIDIR

- Similar to PIM-BIDIR
  - One single tree is used
  - All traffic is always forwarded up to the RP-Link
  - No Source-Specific Path optimization
- With Source-Specific messaging
  - Join/Prune (S,G) used in 'include' mode
  - (\*,G) and (S,G,rpt) used in 'exclude' mode
  - Traffic filtered based on source-specific state
- Backward compatible with PIM-BIDIR
  - PIM-SSBIDIR capable hello option
  - If a neighbor is BIDIR-only -> Do not use (S,G,rpt)
  - If the Designated Forwarder is BIDIR-only -> Do not use (S,G)

# BIDIR

Vs

# SSBIDIR



# PIM-SSBIDIR Pros and Cons

With respect to PIM-SM

- Pros

- No need to locate the source
- Supports Source-Specific filtering
- Provides all subscription state to the RP-Link for free
- Simplicity

- Cons

- No Source-Specific path optimization
- Relies on DF-Election (Less robust than asserts ?)

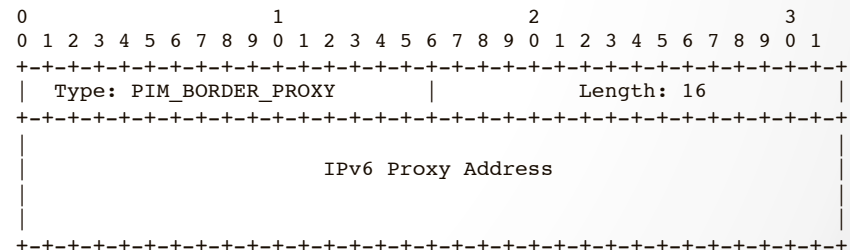
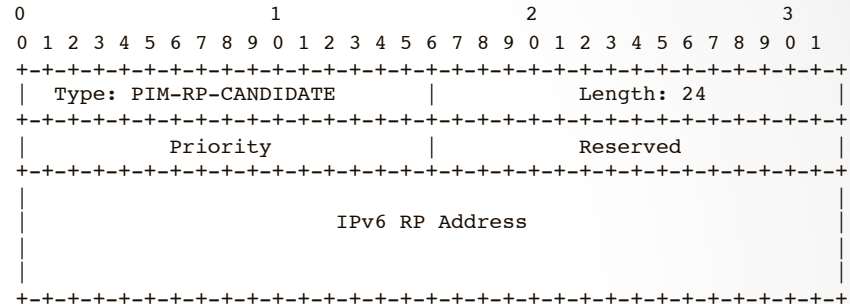
## 2. PIM Border Proxy - Controller

- PIM state replication
- Based on TCP
  - Reliability (Retries)
  - In order reception (Partial updates)
  - Session loss detection (State creation and destruction)
- Using PIM messaging (Can be used for any state)
- Uplink protocol agnostic (MLD/IGMP, PIM, logging, etc...)
- Multiple controllers and Multiple proxies



# 3. Homenet Glue

- HNCP is used for electing:
  - The RP Address
  - The Proxy-Controller
- Border routers are discovered using HCNP
- Join/Prune messages are sent on the RP-Link
- The Proxy-Controller sends subscription state to border routers



# Summary

- Two homenet specific problems
  - Subscribe to ISP
  - Source localization
- Several possible solutions have been proposed
- One fully-functional proposal (from me)
  - draft-pfister-homenet-multicast-00
  - draft-pfister-pim-ssbidir-00
  - draft-pfister-pim-border-proxy-00
- We are just getting started.
  - Comments or other solutions ?