



UNIVERSITY OF
STIRLING



Application Layer Multicast Extensions to RELOAD

draft-kolberg-sam-baseline-protocol-00

Mario Kolberg, University of Stirling, UK (Editor)

John Buford, Avaya Labs Research, USA

Thomas C. Schmidt, HAW Hamburg

Matthias Waehlich, link-lab & FU Berlin



UNIVERSITY OF
STIRLING



Overview

- New baseline document
 - Extension to RELOAD, uses P2PSIP RELOAD as the overlay layer
 - Uses AMT (Automatic IP Multicasting Tunneling) for tunneling between ALM and Native Multicast regions
- Based on previous framework and protocol IDs
 - draft-irtf-sam-hybrid-overlay-framework-02
 - draft-irtf-sam-overlay-protocol-00.txt
 - draft-waehlich-sam-common-api-01
 - draft-irtf-sam-problem-statement-02.txt
- Request that the RG adopt this as an RG deliverable for future RFC submission



UNIVERSITY OF
STIRLING



RELOAD Extensions

- Experimental
- New overlay protocol messages to support ALM tree lifecycle
- New overlay protocol messages to support formation of ALM-NM trees
- New RELOAD usages to support storing tree root, tree attribute, statistics, and diagnostics in the DHT
- API for group management



Contents

draft-kolberg-sam-baseline-protocol-00

| | | |
|------|-------------------------------------|---|
| 1. | Introduction | 4 |
| 1.1. | Requirements Language | 4 |
| 2. | Definitions | 4 |
| 2.1. | Overlay Network | 5 |
| 2.2. | Overlay Multicast | 5 |
| 2.3. | Peer | 5 |
| 2.4. | Multi-Destination Routing | 5 |
| 3. | Assumptions | 6 |
| 3.1. | Overlay | 6 |
| 3.2. | Overlay Multicast | 6 |
| 3.3. | F2PSIP | 7 |
| 3.4. | NAT | 7 |
| 3.5. | Regions | 7 |
| 3.6. | AMT | 7 |

Sec. 2 and 3 were adopted from draft-irtf-sam-hybrid-overlay-framework-02



Contents

draft-kolberg-sam-baseline-protocol-00

- 4. Hybrid ALM Tree Operations 8
 - 4.1. ALM-Only Tree - Algorithm 1 10
 - 4.2. ALM tree with peer at AMT site (AMT-GW) 11
 - 4.3. ALM tree with NM peer using AMT-R 11
 - 4.4. ALM tree with NM peer with P-AMT-R 12
 - 4.5. Mixed Region Scenarios 12
- 5. Group Management API 13
 - 5.1. Data Types 14
 - 5.2. Send and Receive Calls 14
- 6. Protocol 14
 - 6.1. Introduction 14
 - 6.2. Tree Lifecycle Messages 15
 - 6.2.1. Create Tree 15
 - 6.2.2. Join 16
 - 6.2.3. Join Accept 16
 - 6.2.4. Join Confirm 17
 - 6.2.5. Join Decline 17
 - 6.2.6. Join Via AMT Gateway 18

Sec 4. was adopted from draft-irtf-sam-hybrid-overlay-framework-02
 Sec 5. was adopted from draft-waehlich-sam-common-api-01
 Sec 6. was adopted from draft-irtf-sam-hybrid-overlay-protocol-00 and modified to be consistent with RELOAD baseline v07



Contents

draft-kolberg-sam-baseline-protocol-00

- 6.2.7. Join Via Native Link 18
- 6.2.8. Leave 19
- 6.2.9. Leave via AMT Gateway 20
- 6.2.10. Re-Form or Optimize Tree 21
- 6.2.11. Heartbeat 21
- 6.3. AMT Gateway Advertisement and Discovery 21
- 6.4. Peer Region and Multicast Properties Messages 22
- 7. RELOAD Usages 23
 - 7.1. ALM Usage for RELOAD 24
 - 7.2. Hybrid ALM Usage for RELOAD 24
- 8. Examples 24
- 9. IANA Considerations 24
- 10. Security Considerations 24
- 11. References 25
 - 11.1. Normative References 25
 - 11.2. Informative References 25
- Appendix A. Additional Stuff 27
- Authors' Addresses 27

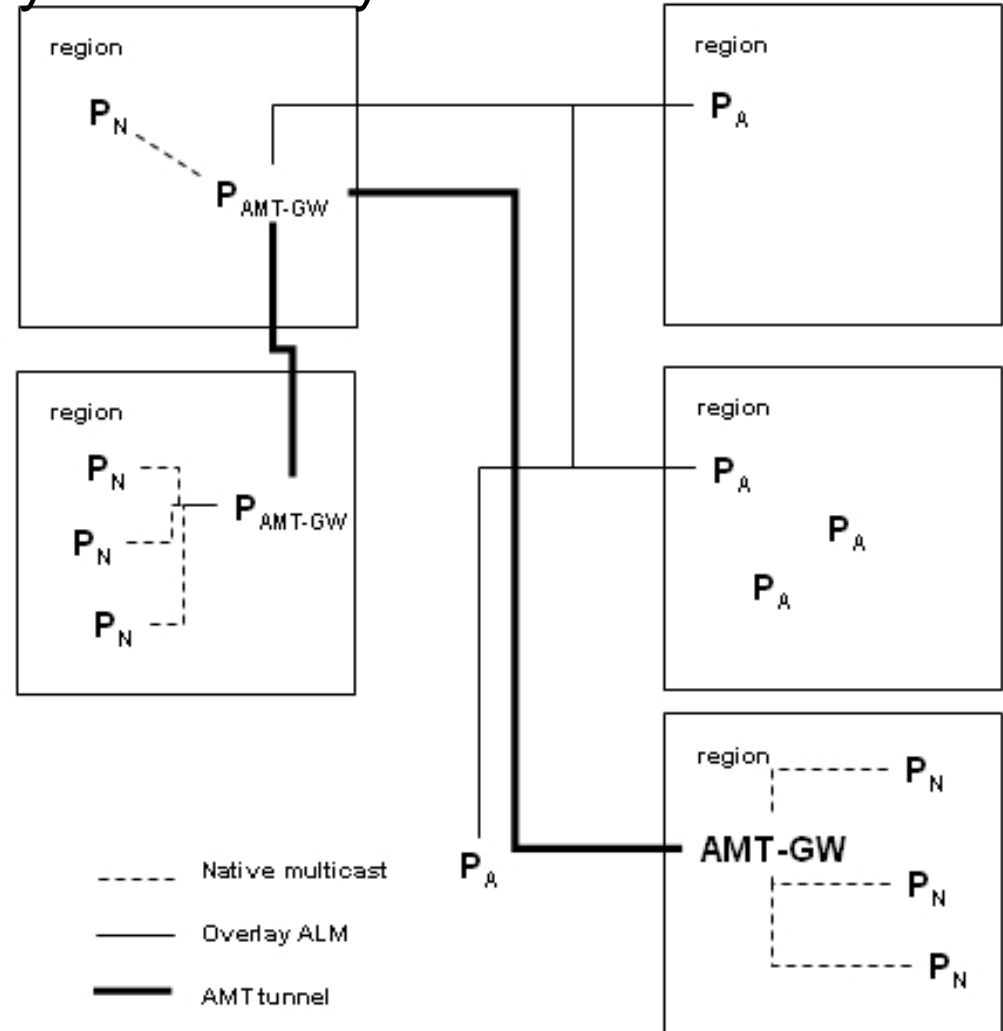
Sec 7 is new
 Sec 8 is a placeholder



Example ALM-NM Toplogy

from: draft-irtf-sam-hybrid-overlay-framework-02

- Select between OM subtree and NM subtree opportunisticly
- Expect improved network efficiency, increase throughput and reduce latency
- Design based on AMT tunnelling mechanism
- Protocol uses structured P2P overlay to connect peers in different types of multicast regions





Sec. 4.1 Algorithm: ALM only

- `groupID=create()`
 - Allocation of unique groupID
 - Out of band advertisement/publishing in DHT
- `joinTree(groupID)`
 - Out of band discovery of groupID (lookup in DHT)
 - Send join message to peer with the nearest NodeID to the groupID (tree root)
 - Peers on the path to the root join tree as forwarding nodes
- `leaveTree(groupID)`
 - Sends leave message to each child node and the parent node
 - If parent is a forwarding node and this is its last child, forward to its parent
 - Child node receiving a leave message from parent sends join message to tree root
- `multicastMsg(groupID)`
 - SSM tree: creator of tree is source; it sends data message to tree root from where it will be forwarded down the tree
 - ASM: peer sending message will send it to its parent and children; each node receiving message will forward it to remaining tree edges it is connected to



Sec. 4.2 Algorithm: ALM with peer at AMT site

- Joining peer
 - use ALM algorithm
 - If tree includes peer in NM, joining peer can use AMT-GW to connect to NM
 - Joining peer can chose delivery path based on latency etc
- If peer is not a joining peer, but on the overlay path of a join request
 - If next hop is peer in NM with AMT-R, peer can select overlay routed multicast or AMT delivered multicast
 - If next peer is a peer outside of NM, then peer can use ALM only or use AMT delivery as an alternative



Sec. 4.4 ALM with NM peer using AMT-R

- There is no peer in the tree which has AMT-GW. NM peer uses ALM.
- There is one peer which can operate as P-AMT-GW. NM peer can use ALM or P-AMT-GW.
- There is one peer in the tree which is in AMT-GW region. The NM peer can use ALM or connect to the AMT-GW
- If we have an ALM tree with NM peer with P-AMT-R functionality, then the 3 rules above apply similarly



Sec 5. Group Management API

- API between Application and Group stack
- `init(out Handle s)`
 - This call creates a multicast socket that is bound to some virtual multicast interface and provides a corresponding handle to the application programmer, which will be used for subsequent communication.
- `join(in Handle s, in URL g)`
 - This operation initiates a group subscription for the name `g`, including the corresponding tree access.
- `leave(in Handle s, in URI g)`
 - This operation results in an unsubscription for the given name `g`, including the corresponding disconnect of the tree.
- `send(in Handle s, in URI g, in Message m)`
 - This call sends data `m` to the multicast group name `g`. It simultaneously initiates creation of the group state, if not already present.
- `receive(in Handle s, out URI g, out Message m)`
 - This call delivers data `m` to the application along with an indicator of the group membership.



Sec. 6 Protocol definition

- Messages between RELOAD nodes
- Supports different tree formation algorithms described earlier
- Control messages are propagated using overlay routing
- Message categories
 - ALM Usage:
 - Tree life-cycle (create, join, leave, re-form, heartbeat)
 - Hybrid ALM Usage:
 - Tree life-cycle
 - AMT gateway advertisement and discovery
 - Peer region and multicast properties



UNIVERSITY OF
STIRLING



New RELOAD Usages

- Applications of RELOAD are restricted in terms of the data types they can store in the overlay → usage
- RELOAD is extendible in that new usages can be defined
- ALM applications need additional data types to the base RELOAD types → define new usage
- Define 2 new usages
 - ALM Usage
 - Hybrid ALM Usage



ALM Usage

- ALM applications use the RELOAD data storage functionality to store a groupID when a new ALM tree is created, and to retrieve groupIDs for existing ALM trees.
- ALM applications use the RELOAD data storage functionality to store a set of attributes for an ALM tree,
 - E.g. owner, tree size, tree height, tree formation algorithm, and join criteria.
- ALM applications and management tools use the RELOAD data storage functionality to store diagnostic information about the operation of tree,
 - average number of trees, delay from source to leaf nodes, bandwidth use, lost packet rate.
 - In addition, diagnostic information may include statistics specific to the tree root, or to any node in the tree.



UNIVERSITY OF
STIRLING



Hybrid ALM Usage

- HALM applications use the RELOAD data storage functionality to store a set of attributes for a AMT Gateway that can connect to at least one node in the overlay.
- HALM applications use the RELOAD data storage functionality to store a set of attributes about a native multicast region associated with an AMT Gateway.
- HALM applications and management tools use the RELOAD data storage functionality to store diagnostic information about the operation of AMT and ALM interconnections.



UNIVERSITY OF
STIRLING



V01 Changes Being Discussed

- Provide a more detailed, illustrative sample use case in section 4 that explains what actually can be achieved and how.
- Move section 7 up just behind section 4 and reflect the achievable operations directly in reload usages.



UNIVERSITY OF
STIRLING



Experimental Plan

- We are looking for a RELOAD implementation that is consistent with the current RELOAD spec
 - `draft-ietf-p2psip-base-07`



UNIVERSITY OF
STIRLING



RG Action Requested

- Request that the RG adopt this as an RG deliverable for future RFC submission