

Multicast Mobility in MIPv6: Problem Statement & Brief Survey Update

- draft-irtf-mobopts-mmcastv6-ps-01.txt -

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Outline

- 🕒 Scope & Focus of the Document
- 🕒 Status of the Draft
- 🕒 Changes in Version 1
 - 🕒 Hybrid Architectures
 - 🕒 Interface Issues: MLD
 - 🕒 Layer 2 Aspects: Wireless
- 🕒 Discussion: Roadmap & Open Issues ?



Aim of the Document

- o Provide a comprehensive exploration of
 - MMcast problem space
 - Existing conceptual ideas for solution
 - Perspectives on operational environments
- o Outline a conceptual roadmap for initial steps

For use of future mobile multicast protocol designers



The Key Problems

Provide Seamless Multicast Services to and from MNs

- o Approach native multicast forwarding in an infrastructure-compliant manner
- o At Listeners:
 - Ensure multicast reception in visited networks
 - Organize context transfer between mcast-enabled access networks
 - Expedite multicast forwarding on handovers
- o At Sources:
 - Sustain address transparency at end nodes (address duality problem)
 - Ensure persistence of receiver contact
 - Bridge tardy tree reconstruction/transformation procedures
- o At SSM Sources:
 - Manage address transparency at routers (source filtering)
 - Comply to source-specific security constraints
- o Focus on deployable solutions, minimize protocol extensions

Scope: Focal Scenario – MIPv6

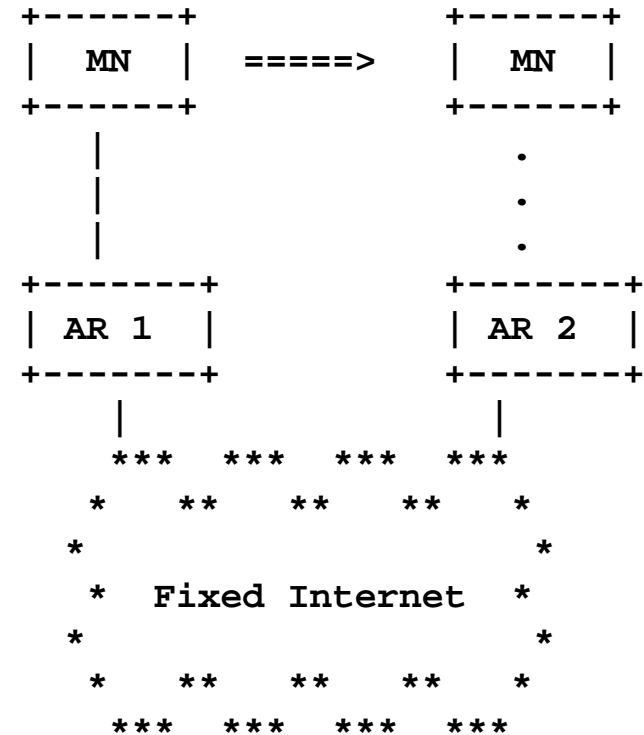
Covers key issues

- o Mobile Multicast Membership

 - as Listener

 - as Source (ASM/SSM)

- o Interplay of Multicast Routing and Mobility

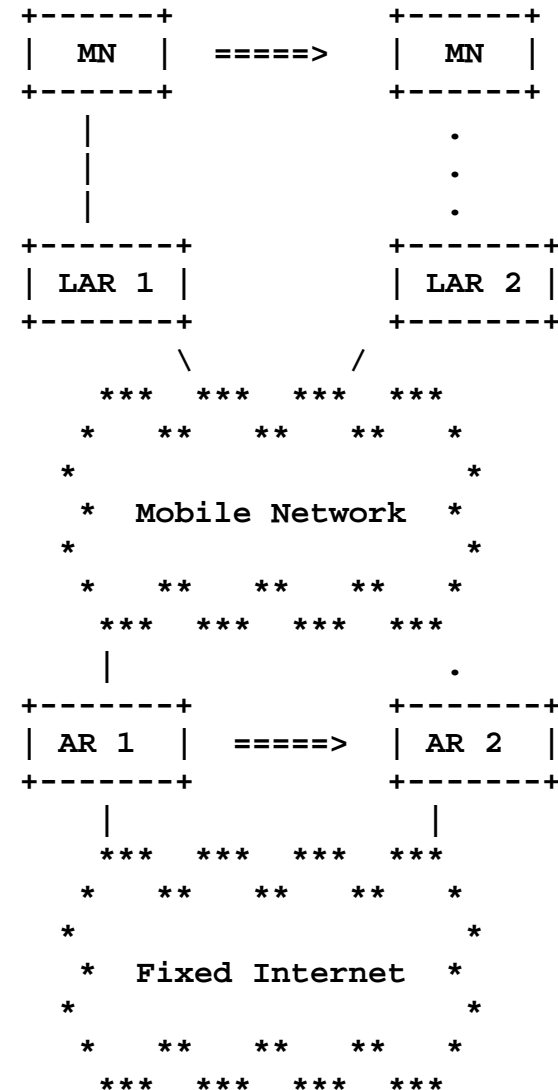


Scope: Side Focus – Nemo

Key issues inherited

Additional complexity basically covered by:

- o Encapsulation for clamping to fixed Internet positions
- o Flooding within mobile network (depending on the MANET routing)



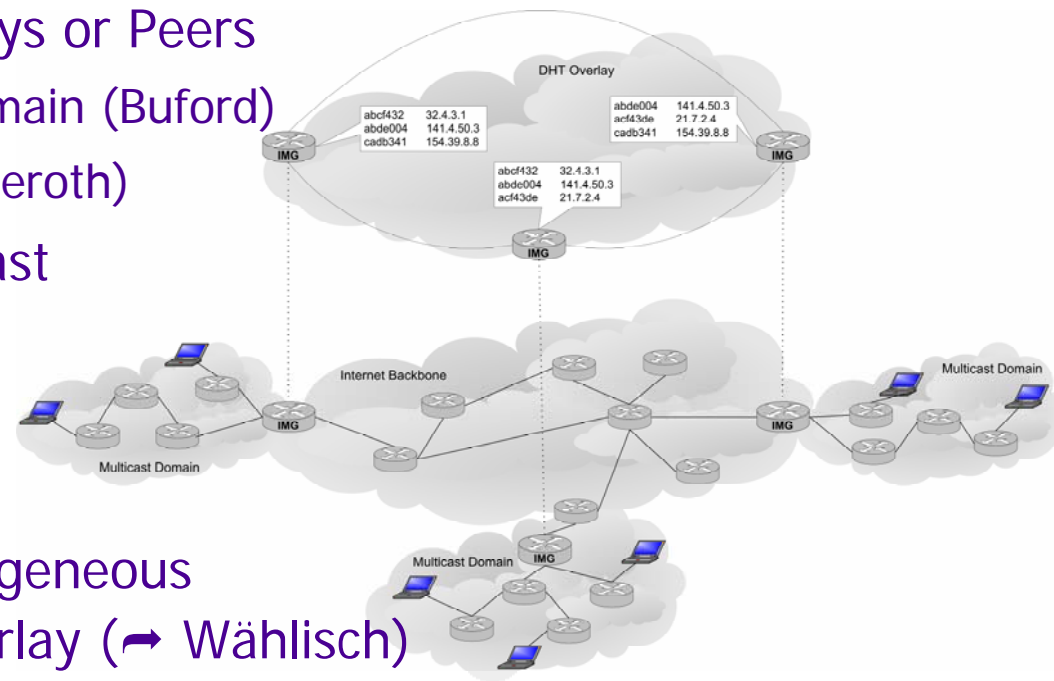
Status of the Draft

- o State at IETF68: `draft-schmidt-mobopts-mmcastv6-ps-02.txt`
- o Now RG Document: `draft-irtf-mobopts-mmcastv6-ps`
- o Version 00 - Minor update including
 - Interdomain protocols and deployment issues
 - Security aspects: CGA-support in listener & source updates
- o Version 01 – Major update including
 - Hybrid approaches ➔ SAM RG
 - Layer 2 aspects,
examples 802.11, 802.16, 3GPP, DVB-H/IPDC, 802.21
 - First conceptual review by Kevin C. Almeroth
- o Version 02 – in preparation – following your input 😊



Hybrid Approaches

- o Motivation: Bridge Interdomain Deployment Gap
- o Establish Multicast Gateways or Peers
 - Within End System Domain (Buford)
 - At Access Routers (Almeroth)
- o Transfer to Overlay Multicast
 - Tunneling: AMT
 - Explicit: XCAST
 - DHT-based Overlays
- o Mobility: Establish a Homogeneous Mobility-agnostic DHT Overlay (→ Wählisch)
- o Work of SAM RG



Interface Issues: MLD

- o MN has per interface aggregated states (groups + source filters)
- o AR has per network aggregated states
- o MLD frequently serves as L2 Mcast trigger
 - Lightweight MLDv2 (mboned): diminish exclude mode
- o MLD state transfer → Mcast context transfer
- o Issues: MLD is slow – adjust Query Interval timer?
 - On leave → state pruning (timeout)
 - Leave on Pt-to-Pt Links → membership query dispensable
 - Leave expedition otherwise → state table at AR
 - On prediction → early state acquisition & early leave
 - On proxy → state maintenance (without forwarding)



Layer 2 Aspects: Wireless Multicast

Shared, limited media largely profit from group distribution services

➔ widely supported

Technologies of significant difference:

- o Connectionless broadcast type: 802.11
 - Reduced reliability
 - Congestion threat
- o Connection-oriented point-to-multipoint type: 802.16, 3GPP/MBMS
 - Complex control
 - Reduced efficiency (no layer 2 source-to-destination transition)
- o Connection-oriented broadcast type: DVB-H/IPDC
 - Unidirectional (downstream only)

Layer 2 Aspects: Wireless Mcast (2)

o Address mapping: IPv6 Mcast → MAC/Channel ID

- 802.11: 112 → 32 (Ethernet)
- 802.16: To CID (16 bits, 8 reserved)
proposal 112 → 4 (with Scope)/ 8 (for Ethernet CS)
- DVB-H: To PID (13 bits),
based on dynamic tables

o Service mapping:

- MLD Snooping
- Multicast VLAN Registration (MVR – for Ethernet CS)

802.11: Multicast on Broadcast NW

- o A mobile Station sends multicast data to an AP in point-to-point channel (ToDS bit on)
 - Treated as acknowledged unicast
- o The AP repeats multicast frames to the BSS and propagates them to the ESS
 - Treated as unacknowledged broadcasts
- o Limited Reliability
 - increased probability of lost frames from interference, collisions, or time-varying channel properties
- o Delayed Distribution
 - AP buffers mcast packets and waits for DTIM, if stations in power saving mode
- o Congestion Threat
 - Distribution System experiences multicast as flooding
 - ✦ Most APs provide configurable mcast rate limiting
 - Replicate mcast packets over all APs in same IP subnet
 - ✦ MLD Snooping: at AP bridge (BSS : ESS) or connecting switches

802.16: Multicast on Point-to-Multipoint

- o SS sends multicast data to BS in point-to-point channel
- o Multicast traffic identification at AR
 - But CID-initiation only at BS
- o BS may initiate downlink multicast distribution
 - Assigns common CID to all group members (SSs)
 - Automatic Repeat Request (ARQ) not applicable
- o BS operates as L2 Switch and may support MLD snooping (even MLD proxying in 802.16e)
 - On reception SS cannot distinguish multicast from unicast stream
- o Two link models: Point-to-Point and Shared IPv6 Prefix
 - Point-to-point contradicts IP-layer mcast service mapping
- o Address mapping: High CID collision rate, little selectiveness

Vertical Handovers

- o Context transfer needed for L2-only HOs
- o Vertical transfer addressed in 802.21
 - But required beyond IEEE protocols (DVB, 3GPP)
- o Mobility service transport for Media Independent Handovers (MIH) assigned to L3
- o Issues
 - Service discovery
 - Service context transformation
 - Service context transfer
 - Service invocation



Proposed Roadmap for Initial Steps

1. Multicast Listener Support

- i. Extend Unicast Solutions FMIPv6, HMIPv6, ...
- ii. Contribute Mobility Aspects to Specs in AMT and Hybrid Multicast Solutions
- iii. Accelerate MLD
- iv. Contribute to Vertical L2 Context Transfer

2. Multicast Sender Support for ASM

3. Multicast Sender Support for SSM



Open Questions

o Deployment Aspects:

- Further prospects relevant for deployment?

o Layer 2 Aspects:

Gaps to fill?

- Performance data for 802.16, MBMS, DVB-H?

o Multihoming:

Are there Multicast-specific Issues?

- Interface/connectivity maintenance → unicast
- Of course: Multicast context transfer may use multiple bindings ... as unicast does



Open Issues

o Anything else missing?

Please send your feedback to mobopts@irtf.org
to advance the quality of this document



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