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Mobile Group Communication A Hybrid Perspective

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Introduction & Problem Statement

Rapidly emerging multimedia group applications such as IPTV, MMORPGs and video conferencing increase the demand for mobile group communication, but a standard design of mobile multicast is still awaited. The open problem poses significant operational and security challenges to protocols and the Internet infrastructure [1]:

Mobile Listener Perspective

- Ensure multicast reception, even in visited networks, without appropriate multicast support.
- Minimize multicast forwarding delay to provide seamless and fast handovers for real-time services.
- Minimize packet loss and reordering that result from multicast handover management.

Mobile Sender Perspective

- Sustain continuous multicast service without losing receiver contact.
- Assure address transparency for locators (RPF-check) and identifiers (applications).
- Comply with source-specific constraints in SSM scenarios, in particular secure source address binding updates.

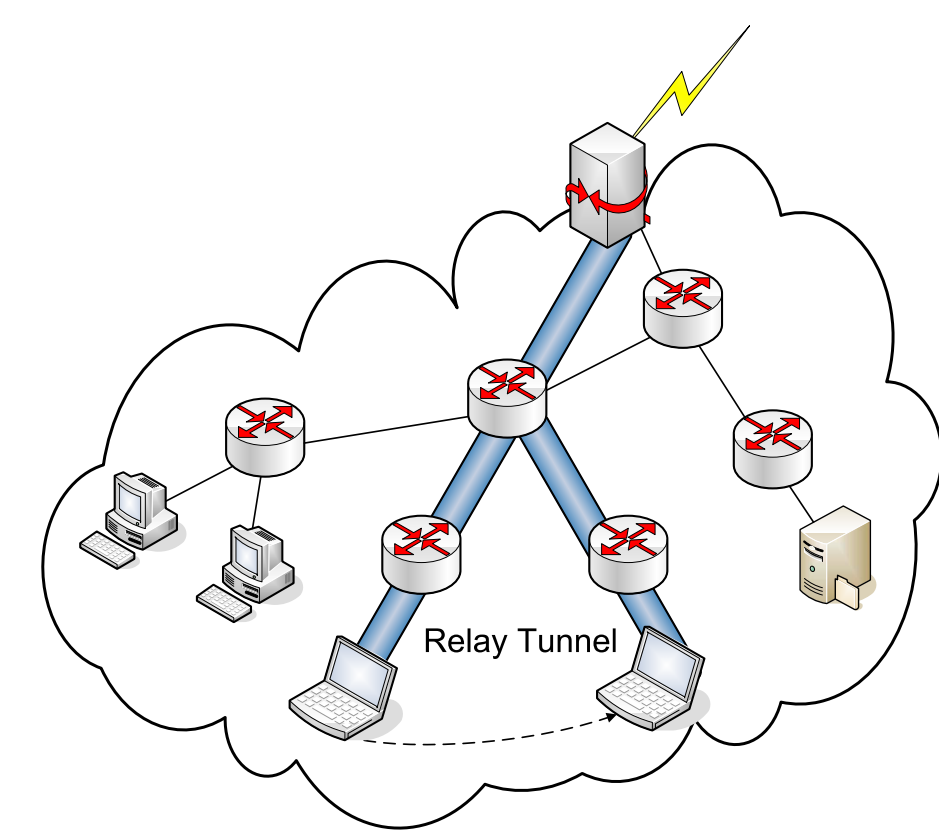
Network Perspective

- Realize native multicast forwarding, and where applicable utilize link layer multipoint distribution to avoid data redundancy.
- Activate link multipoint services, even if the MN performs only a layer 2 / vertical handover.
- Ensure routing convergence, even when the MN moves rapidly and performs handovers at a high frequency.
- Avoid avalanche problems and n-casting, which potentially result from replicated tunnels.

IP Layer Support of Multicast Mobility

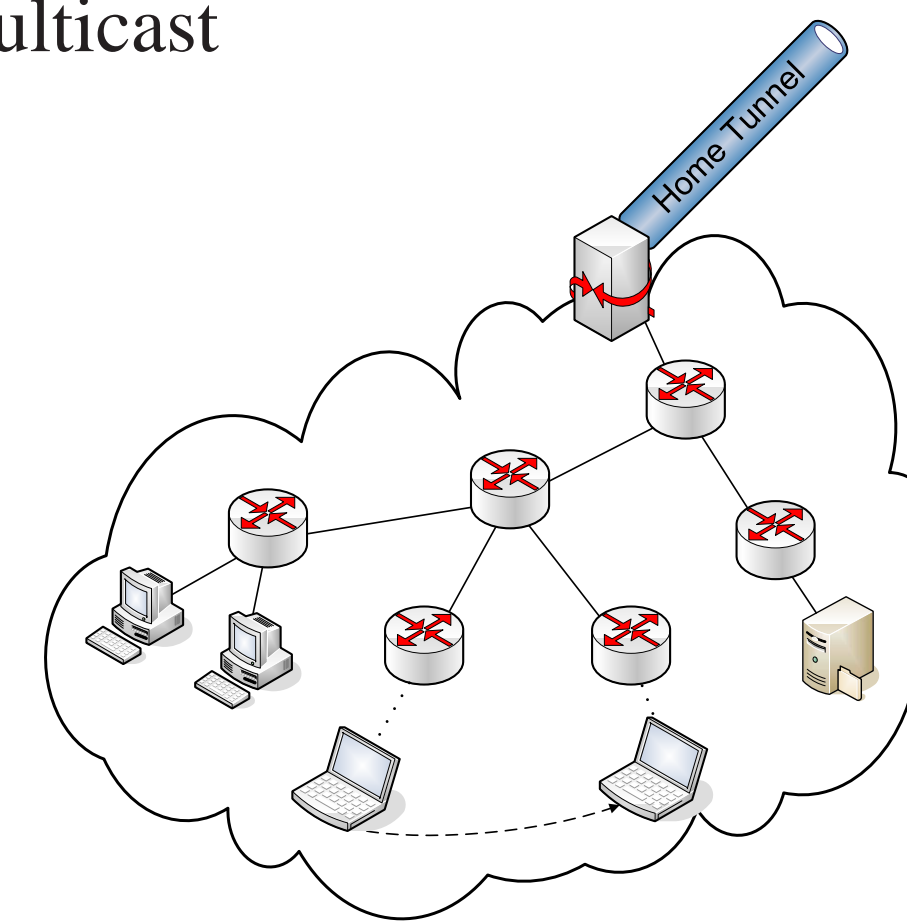
Mobility Relay

- Regional tunnels to shield micro-mobility
- Relays to distribute & buffer multicast



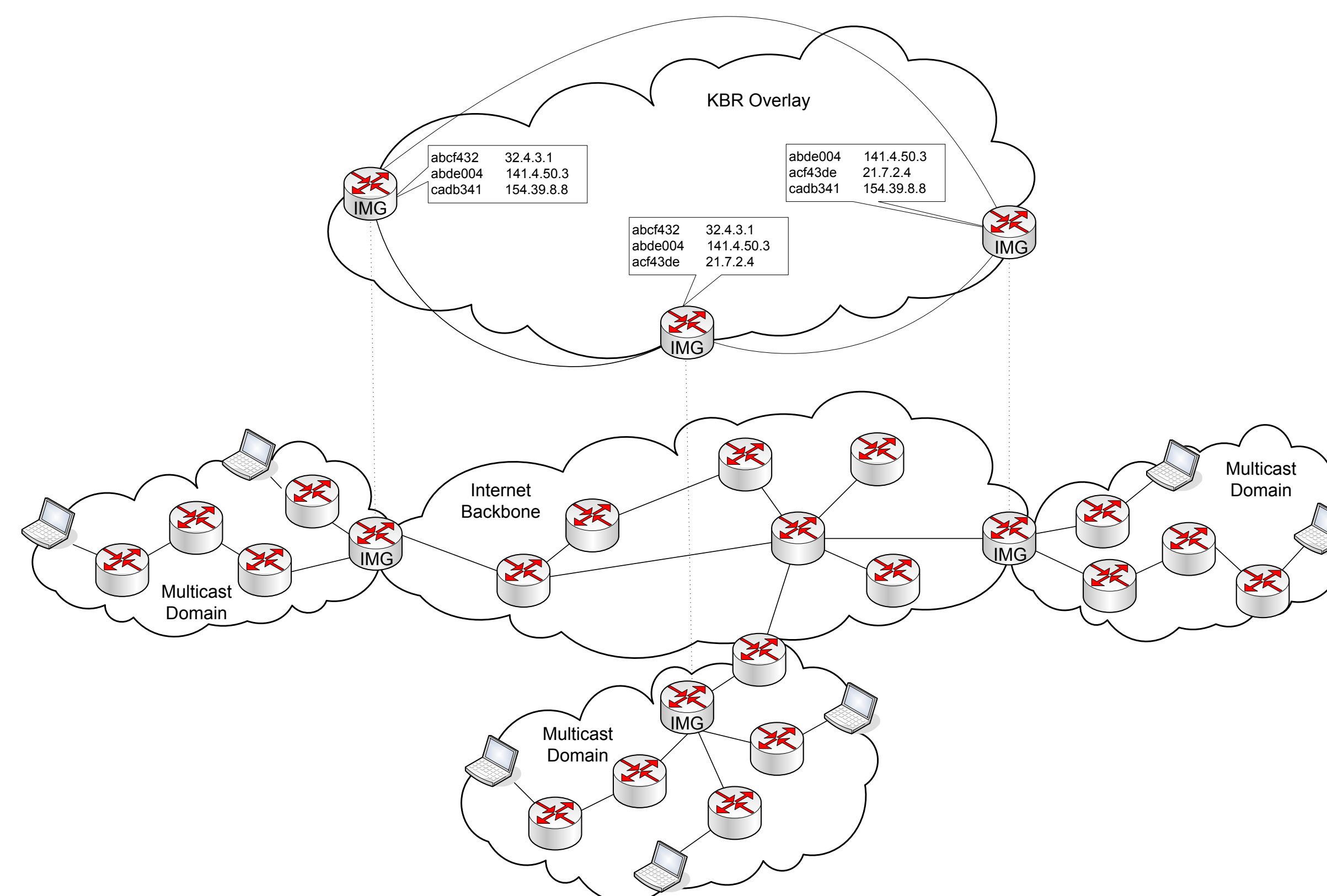
Mobility Gateway

- Remote tunnels to provide multicast service
- Gateways to avoid avalanches and facilitate native multicast



Hybrid Shared Tree Multicast

- Mobility-agnostic structured overlay in the Internet backbone
- Native multicast (L3 & L2) in edge domains – mobility-agnostic with BIDIR-PIM
- Transparent inter-domain multicast gateways to glue overlay with underlay



AuthoCast: Mobility-Compliant Sender Authentication

Seamless multicast extensions to MIPv6 binding update:

- Use cryptographically generated addresses
- Extend mobility binding update by Hop-by-Hop router alert option
- Jointly signal unicast & multicast binding update

IPv6 Header	Hop-by-Hop Options Header	Dest. Options Header	Mobility Header		Upper Layer Header + Data
Src: CoA Dst: G	Router Alert Option	Home Address Option	Binding Update Message	CGA Param. Option CGA Signature Option	Data

Future Work

- Implementation of the transparent group communication stack
- Integration of the Hybrid Shared Tree in current mobility optimization protocol standards
- Testbed infrastructure for hybrid multicast mobility solutions

References

- [1] T. C. Schmidt, M. Wählisch, and G. Fairhurst, "Multicast Mobility in MIPv6: Problem Statement and Brief Survey," MobOpts, IRTF Internet Draft – work in progress 04, July 2008.
- [2] M. Wählisch and T. C. Schmidt, "Between Underlay and Overlay: On Deployable, Efficient, Mobility-agnostic Group Communication Services," *Internet Research*, vol. 17, no. 5, pp. 519–534, 2007.