Multicast Address Set Claim (MASC) Update

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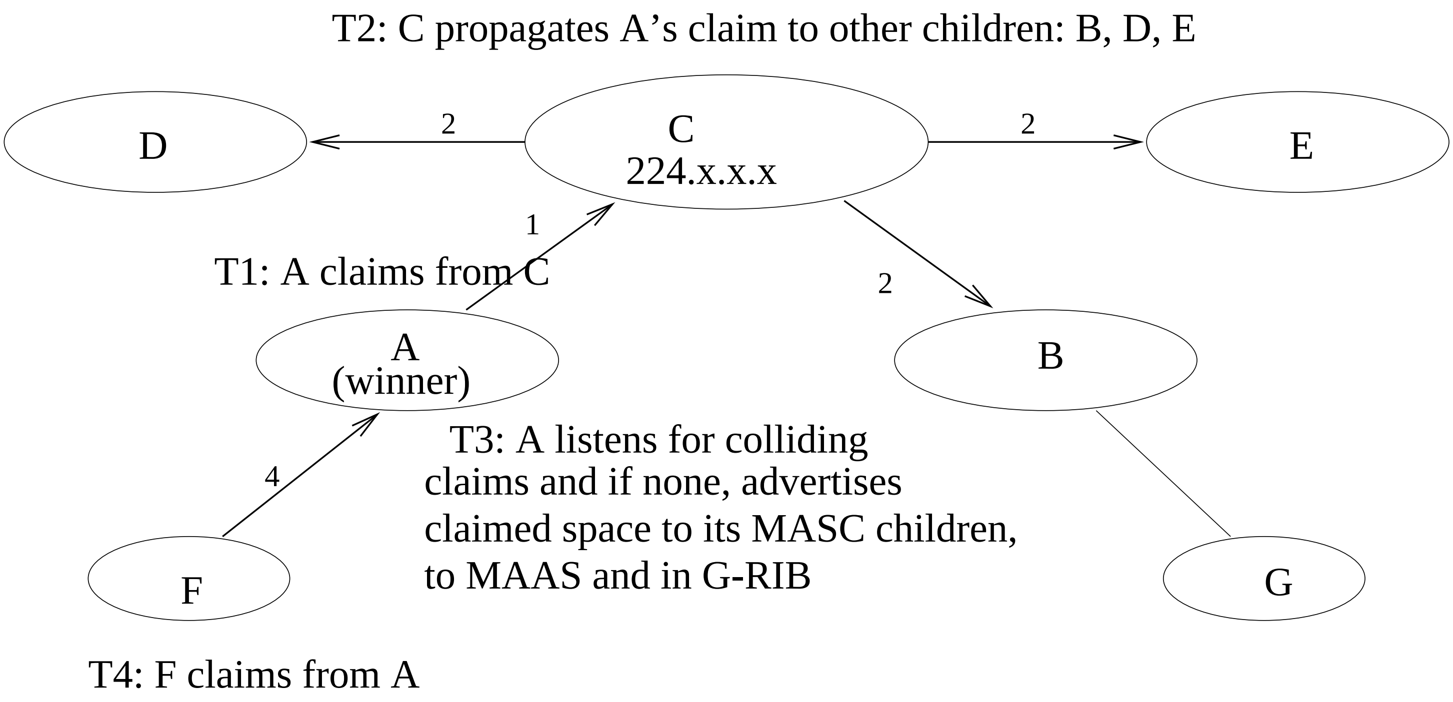
MASC Overview

- "Multicast-Address-Set Claim" (MASC):
  - Associates group ranges (prefixes) with AS's
  - Injects local associations into G-RIB (to be used by BGMP)
- Goals:
  - state aggregation (few prefixes per domain)
  - efficient use of address space
  - minimize flux in G-RIB
  - avoid third-party dependency (e.g. no registry)

Claim-Collide Mechanism

1. Choose a prefix
2. Claim and wait for collision
3. If no one opposes (i.e. no collisions), the claimed prefix could be used
4. If collision (lost), back-off and claim a new prefix

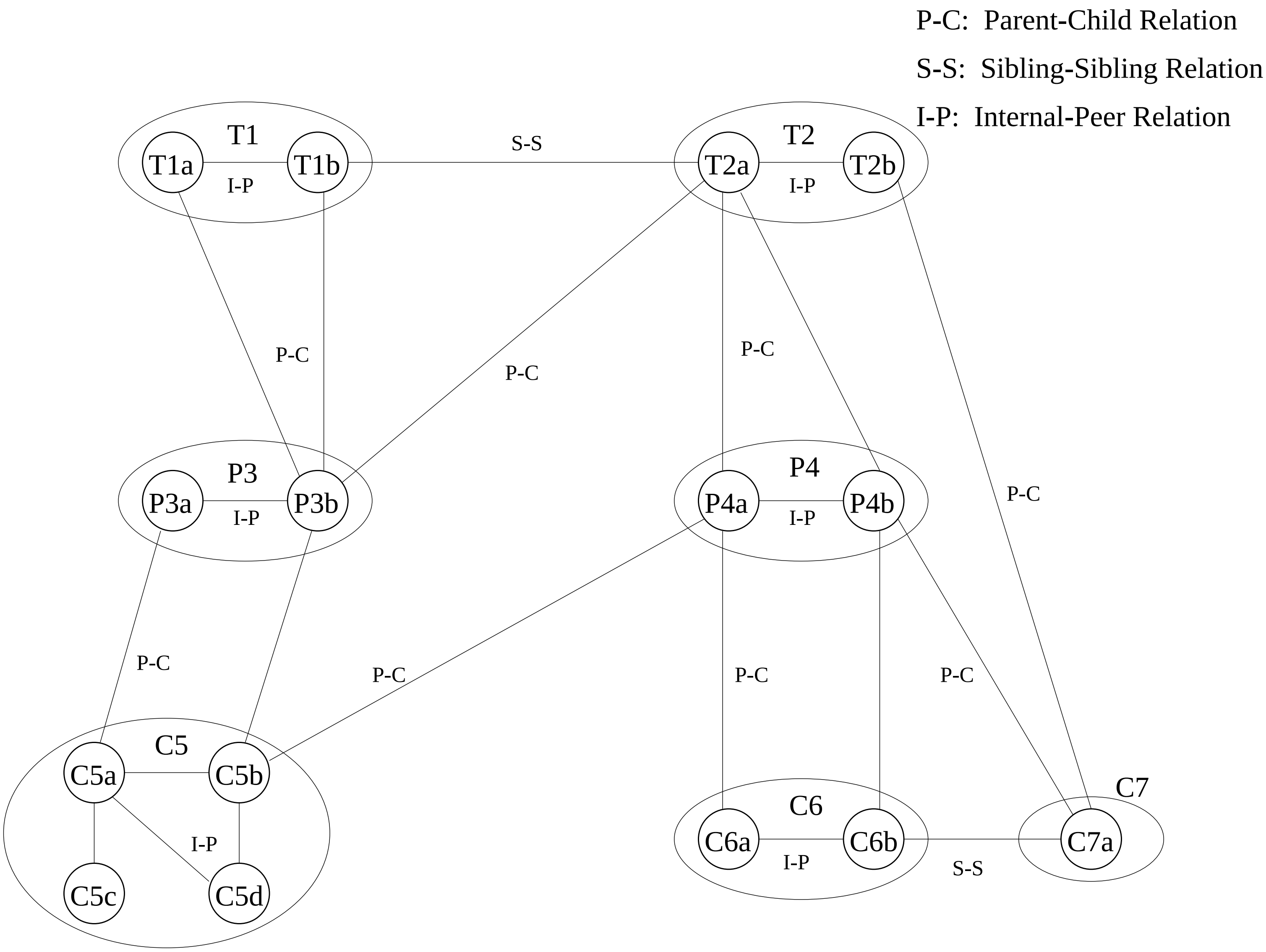
MASC Overview (cont.)



MASC Topology

- MASC will be usually run by BG(M)P routers
- A hierarchy of MASC domains; will follow the inter-domain topology
- A number of Top-Level Domains (TLDs), i.e. no single root
- Within a MASC domain, a number of MASC nodes connected by a TCP mesh (i.e. no need for any-to-any connectivity)
- A number of TCP connections between a parent and a child domain
- Could have TCP connections between siblings

MASC Topology Example



MASC Allocated Prefix

Each allocated (i.e. associated with a MASC domain) prefix has lifetime and can be used for:

- injection into G-RIB
- advertisement to the MASC children domain
- allocation of subranges by the local Multicast Address Allocation Servers

MASC UPDATEs Type

- NEW-CLAIM: “Claim new space”
- CLAIM-TO-EXPAND: “I already have allocated a subset of this claimed range”
- PREFIX-IN-USE: “I have allocated that space”
- CLAIM-DENIED: “The claim is denied”
- PREFIX-MANAGED: “Children, you can claim from that range”
- WITHDRAW: “The specified range is **temporary** obsoleted”

MASC UPDATEs Format

<table>
<tr><th>0</th><th>1 2</th><th>10</th><th>11 15</th><th>16 31</th></tr>
<tr><td>A</td><td>Rol</td><td>Reserved</td><td>AddrFam</td><td>Origin Domain Identifier</td></tr>
<tr><td colspan="5">Origin Node Identifier</td></tr>
<tr><td colspan="5">Claim Timestamp</td></tr>
<tr><td colspan="5">Claim Lifetime</td></tr>
<tr><td colspan="5">Claim Holdtime</td></tr>
<tr><td colspan="5">Address (variable length)</td></tr>
<tr><td colspan="5">Mask (variable length)</td></tr>
</table>

Rol = {INTERNAL, CHILD, SIBLING, PARENT}, updated hop-by-hop

MASC UPDATEs Processing

- Accept/reject
  - Timestamp + Holdtime > CurrTime?
  - Do I have same message in local cache?
- Compare with local domain's initiated messages/states and take appropriate actions: cancel a claim, withdraw an entry from G-RIB, etc.
- Save in the local cache (up to Timestamp + Holdtime)
- Propagate, based on UPDATE Type and relation to UPDATE Origin

UPDATEs Propagation and Failure Recovery

MASC-level (i.e. application level) “selected broadcast” to the MASC parent domain and/or all children and/or siblings:

- Simple
- “One-time” propagation
- Robust:
  - after connection (re)establishment, both sides exchange their UPDATEs
  - After a reboot, a child can obtain its own “claim-in-progress” state from its parent and/or siblings

Claims Comparison Function

1. PREFIX-IN-USE > CLAIM-DENIED > CLAIM-TO-EXPAND > NEW-CLAIM
2. Earliest claim (smallest timestamp) wins
3. Smallest Origin Node ID wins

Expanding a Prefix

Reclaim in advance the desired larger prefix

Renewing a Prefix

Reclaim in advance with the desired longer lifetime

Releasing a Prefix

- Implicit releasing (default): prefix left to timeout everywhere
- Explicit releasing (optimization): could send an explicit withdraw message; used for end-to-end interpretation

MASC Domain "Internal" Synchronization

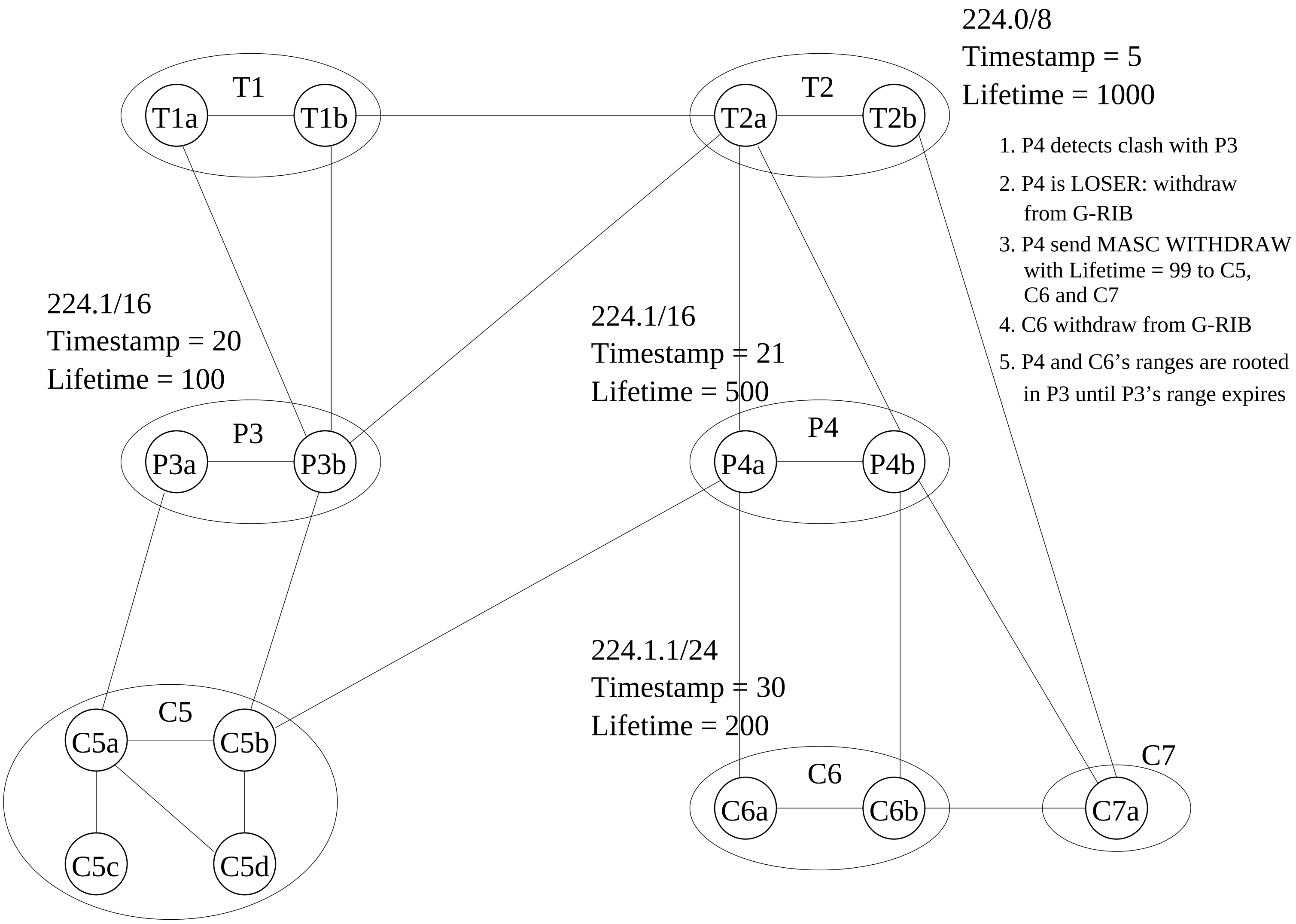
- Wait randomly between 0 and 10 minutes before initiating a new claim
- Use the same claim-collide mechanism
- Do not claim a new range, if collision winner is a node from the same domain

Clash Problems

Collision of PREFIX-IN-USE is a "clash". Could happen if network partitioning lasts longer than 48 hours, and if happens:

- Different sessions/applications may have obtained the same multicast address
- Different domains are injecting ambiguous entries into G-RIB, and will result in partitioning (lack of connectivity) in the inter-domain multicast routing

Clash Example



Clash Resolving Mechanism

- MUST solve the routing problem:
  - Only one domain (the "winner" of the clash) must remain Root Domain
  - The loser(s) of the clash have to withdraw from G-RIB
  - The loser(s) must inform their children to withdraw from G-RIB
- OPTIONAL: (if possible) use API to inform asyncronously applications to change the address

If need a better clash protection, increase the Claim Holdtime.

Changing network provider

- Keep temporarily a TCP connection with the old provider to “defend” my allocations
- If the new provider is willing to carry the traffic for the “migrated” prefix, inject into G-RIB

Administratively-Scoped Address Allocation

- Learn zones by listening to MZAP messages
- A domain without a parent within the scope zone will become a Zone TLD
- MASC domains within the same zone assume the same hierarchy relation as for the globally allocated range

MASC Debugging

Local MASC servers have the **aggregated prefix-to-domain** and **domain-to-prefix** lookup information. If more detailed information needed:

- Prefix-to-domain lookup: use mtrace
- Domain-to-prefix(es) lookup: open issue
  - Query a MASC/BGMP mode in that domain
  - How to find the address of a BGMP router in a particular domain?

MASC Storage

- Keep only local domain allocations in local storage (if such), otherwise use AAP to save into/query from the MAASs
- Do NOT need to save claims in progress

Default/Suggested Values

- CLAIM-WAITING-PERIOD: 48 hours
- INITIATE-CLAIM-DELAY: (0-10 minutes)
- Default initial claim size: 256 addresses
- Default initial claim lifetime: 30 days

Open Issues

- MASC TCP port
- Domain-to-prefix(ex) lookup mechanism
- Need to use relative time instead of absolute time?
- Change the 16 bits MASC Domain ID to 32 bits?
  - 16 bits AS Number
  - 16 bits locally assigned (to divide a large AS into several MASC domains)

Open Issues (cont)

- Allow indirect parent-child relationship (through child's sibling)?
- Get from IANA the Globally Allocatable Multicast Address Range:
  - (225.0.0.0 - 231.255.255.255) AND (233.0.0.0 - 238.255.255.255)?

Conclusions

- Simple and robust claim-collide mechanism
- MASC topology congruent to the unicast topology
- Low bandwidth and low memory usage
- Robust information recovery after reboot
- Simple messages propagation and processing
- Automatic clash resolving mechanism
- MASC protocol/mechanism is separated from the address allocation algorithm