Distributed Search for Multicast Sessions

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Brief Introduction to mDNS

mDNS is a multicast session directory architecture. It is
- DNS aware,
- hierarchial and
- scalable.

It allows for multicast session registration and makes them discoverable in real time.
A typical mDNS domain components

Figure: a typical mDNS domain setup
A typical mDNS domain hierarchy

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@MCAST { PMCAST CMCAST MSD-LOCAL-MCAST }
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@MCAST { PMCAST CMCAST MSD-LOCAL-MCAST URS }
In a major design improvement from earlier proposal, we have optimized the session search algorithm in current version.

New algorithm is based on appropriate keyword routing that allows activation of a few MSD servers along the route compared to a broadcast storm approach deployed in earlier implementation.
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- A session keyword is hashed using MD5.
- Keyword hash is used to route the session registration and search requests to appropriate server.
- Each MSD server maintains a keyword routing table that facilitates correct request routing.
Hash Space Distribution

- Each MSD server reports total count of domains below it including itself to its parent.

**Figure**: a sample hierarchy
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![A sample hierarchy diagram](image)

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- In time, the root node knows the total count of mDNS domains in the hierarchy.
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- The space allotment then propagates top-down from root to leaves.
- Each node uses this space division to construct the forwarding table for correct routing of service requests.

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Routing Table Construction

Any request can be acted upon three possible ways.

- if associated keyword’s hash falls in self managed hash range, then process locally.
- if keyword’s hash lies in the range assigned to child domain, then propagate on CMCAST.
- else forward on the PMCAST channel
  of course, care is taken to avoid request propagation looping!

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Routing table contains significant bits, start - end of range and next channel.

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Routing Table Construction

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Routing table maintained at node B.

Here the root node is not participating as a MSD server. If it were, the distribution would have been slightly different.
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  - frequent routing updates may degrade the service quality offered by mDNS.
In order to improve routing stability, domain count reporting to parent nodes is governed by change variables $\alpha$ and $\beta$. Typical values used are: $\alpha = 0.4$ and $\beta = 0.8$. If fractional change in node count is less than $\alpha$, then no action is taken. If change lies between $\alpha$ and $\beta$, then hash reassignment is done for all child nodes. This may lead to routing table updates from that particular node to the leaves along that branch. If fractional change is more than $\beta$, then the updated count is reported to the parent node. This may lead to global route updates. A higher value of $\beta$ is suggested to minimize this effect.
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Search Redundancy Implementation

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In case one of these two servers is down, the session details can be retrieved from the backup server by sending the search request by inverting all the keyword hash bits along the alternate route.
Search Algorithm - By Example
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Software Link
http://www.cons.cise.ufl.edu/mdns/