

Distributed Search for Multicast Sessions

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Organization of this talk

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Search for
Multicast
Sessions

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& Richard
Newman

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Hash Scheme
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- 5 Questions

Brief Introduction to mDNS

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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

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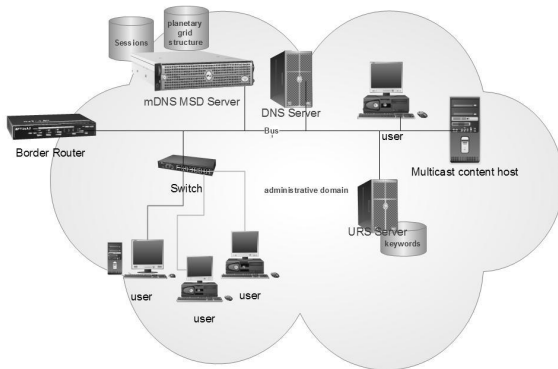


Figure: a typical mDNS domain setup

A typical mDNS domain hierarchy

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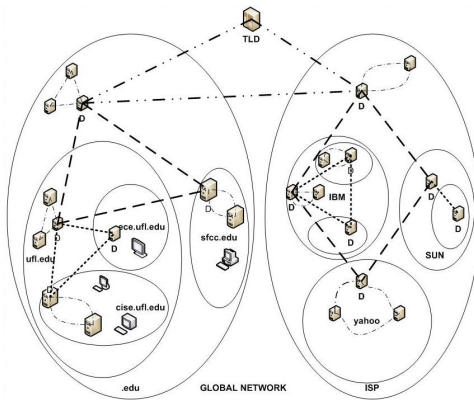
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Hierarchy buildup is due to inclusion of these parameters in MSD servers.

@MCAST {

}

A typical mDNS domain hierarchy

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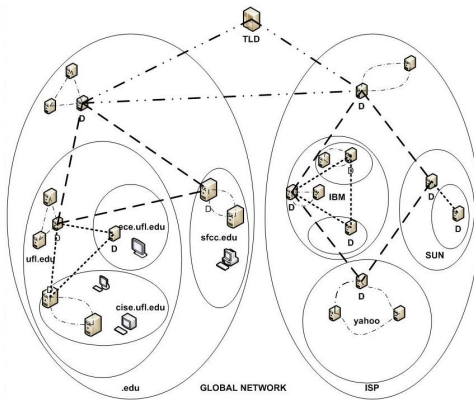
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@MCAST { **PMCAST**

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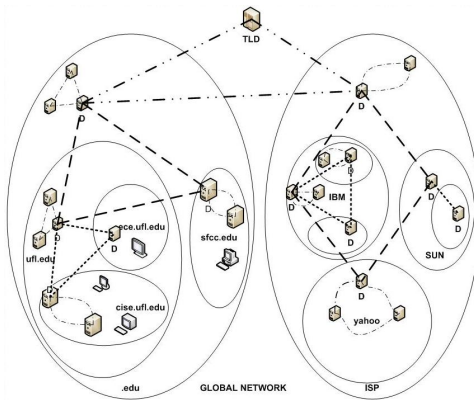
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@MCAST { PMCAST CMCAST

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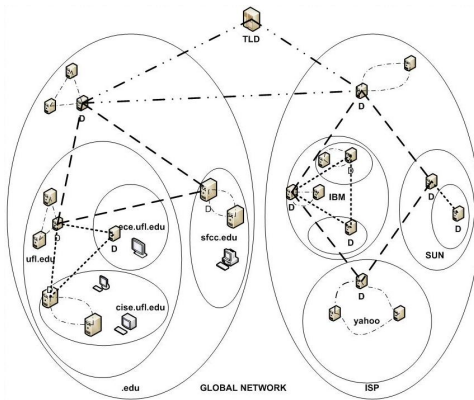
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Hierarchy buildup is due to inclusion of these parameters in MSD servers.

```
@MCAST { PMCAST CMCAST MSD-LOCAL-MCAST }
```


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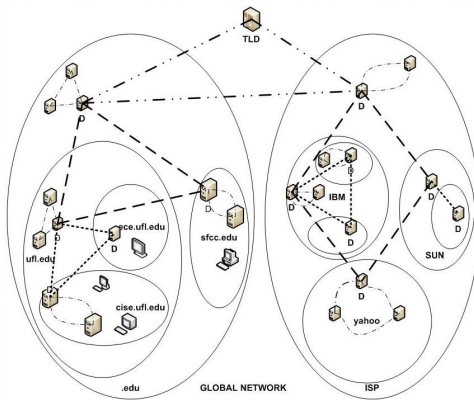
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Hierarchy buildup is due to inclusion of these parameters in MSD servers.

@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.

Uniform Distribution using Hash Schemes

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- Each MSD server maintains global session information for the keyword set assigned to it.

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- Each MSD server maintains global session information for the keyword set assigned to it.
- A session keyword is hashed using MD5.

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- Each MSD server maintains global session information for the keyword set assigned to it.
- 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.

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

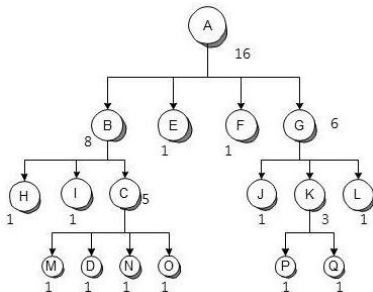


Figure: a sample hierarchy

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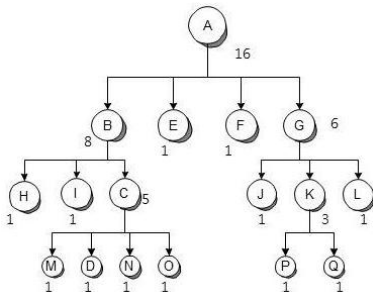


Figure: a sample hierarchy

- Each MSD server reports total count of domains below it including itself to its parent.
- In time, the root node knows the total count of mDNS domains in the hierarchy.

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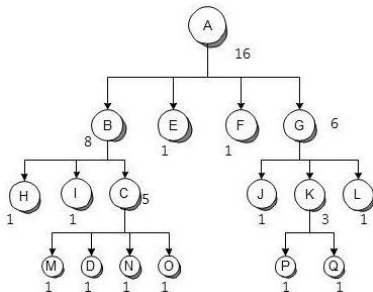


Figure: a sample hierarchy

- Each MSD server reports total count of domains below it including itself to its parent.
- In time, the root node knows the total count of mDNS domains in the hierarchy.
- The root node does hash space division using this knowledge.

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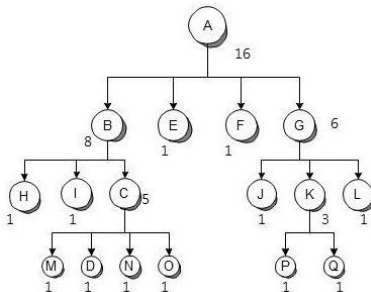


Figure: a sample hierarchy

- Each MSD server reports total count of domains below it including itself to its parent.
- In time, the root node knows the total count of mDNS domains in the hierarchy.
- The root node does hash space division using this knowledge.
- The space allotment then propagates top-down from root to leaves.

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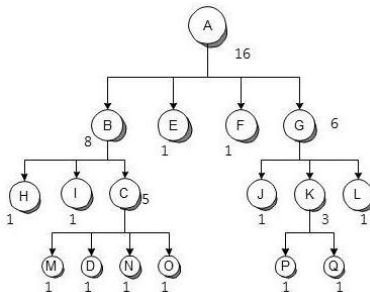


Figure: a sample hierarchy

- Each MSD server reports total count of domains below it including itself to its parent.
- In time, the root node knows the total count of mDNS domains in the hierarchy.
- The root node does hash space division using this knowledge.
- 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.

Routing Table Construction

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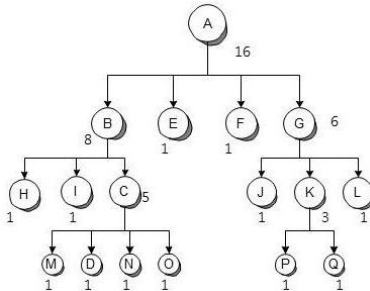


Figure: a sample hierarchy

① 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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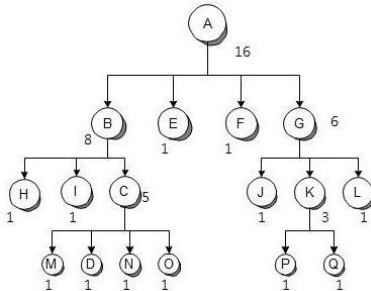


Figure: a sample hierarchy

- 1 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!
- 2 Routing table contains significant bits, start - end of range and next channel.

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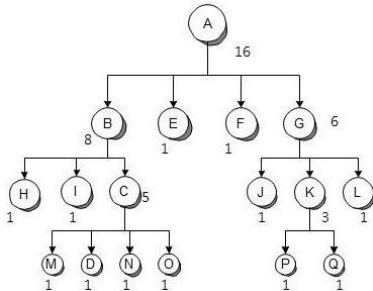


Figure: a sample hierarchy

start	end	node ID	channel
0000	0000	self	MSD-LOCAL-MCAST
0001	0001	H	CMCAST
0010	0010	I	CMCAST
0011	0111	C	CMCAST
*	*	-	PMCAST
Significant Bits: 4			

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.

Routing Stability Issue - I

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- Most state information is maintained using soft-state approach.

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- Most state information is maintained using soft-state approach.
 - this allows for dynamic adaptability to changing topology
 - if topology change is very frequent, this may lead to instability

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- Routing tables need to be updated when new domains are added or old domains go offline

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 - this allows for dynamic adaptability to changing topology
 - if topology change is very frequent, this may lead to instability
- Routing tables need to be updated when new domains are added or old domains go offline
 - routing stability is essential for smooth operations
 - frequent routing updates may degrade the service quality offered by mDNS.

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Routing Stability Issue - II

- In order to improve routing stability, domain count reporting to parent nodes is governed by change variables α and β

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- In order to improve routing stability, domain count reporting to parent nodes is governed by change variables α and β
 - typical values used are: $\alpha=0.4$ and $\beta=0.8$
 - if fractional change in node count is less than α then no action is taken

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 - if fractional change in node count is less than α then no action is taken
 - if change lies between α and β 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

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 - if fractional change in node count is less than α then no action is taken
 - if change lies between α and β 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 β then the updated count is reported to the parent node.
 - this may lead to global route updates
 - a higher value of β is suggested to minimize this effect

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Search Redundancy Implementation

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As a precaution against intermittent MSD server failures, the registration request is duplicated and sent along different route by inverting all keyword hash bits. Therefore two copies of session details are maintained by two separate MSD servers in two different domains.

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As a precaution against intermittent MSD server failures, the registration request is duplicated and sent along different route by inverting all keyword hash bits. Therefore two copies of session details are maintained by two separate MSD servers in two different domains.

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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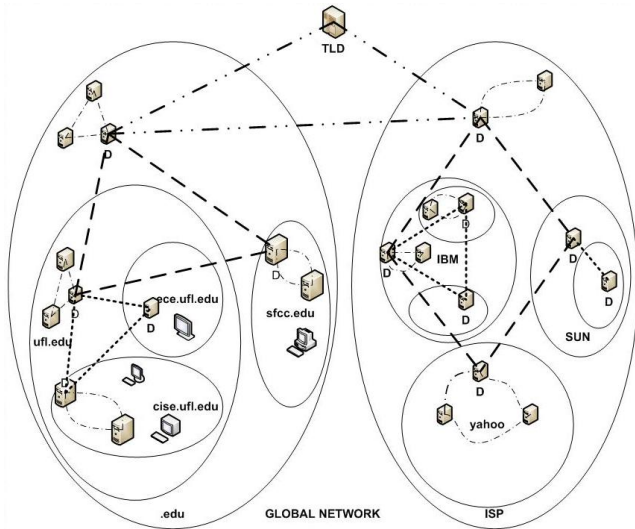
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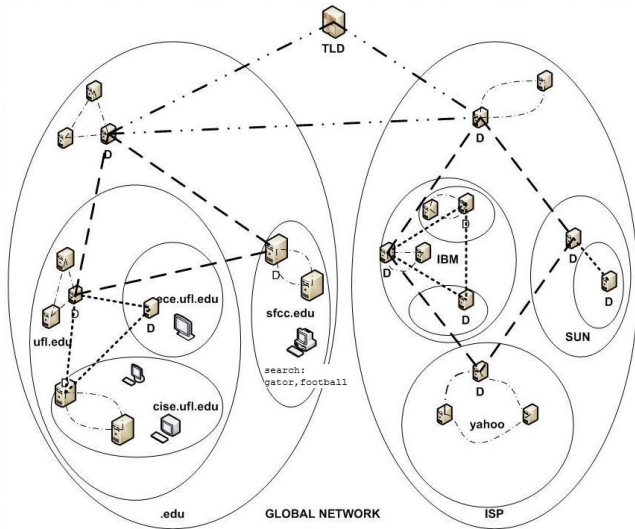
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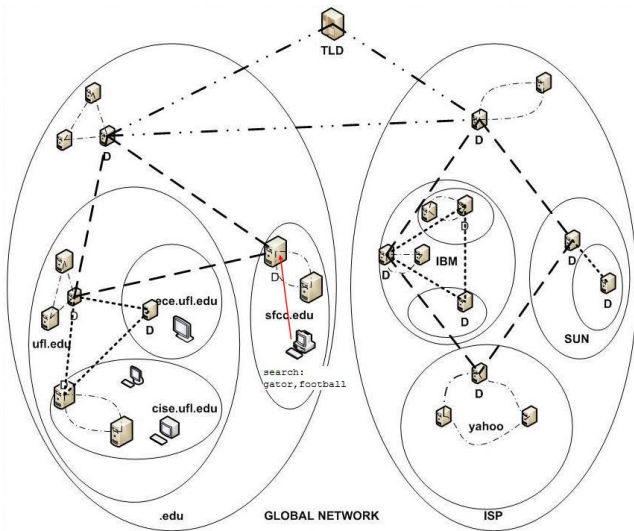
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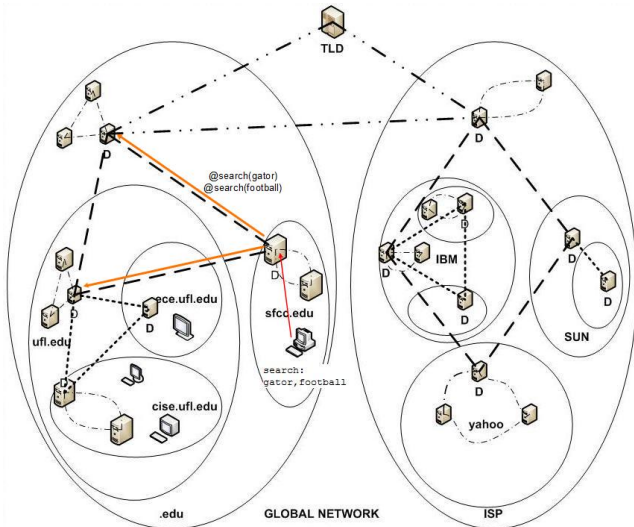
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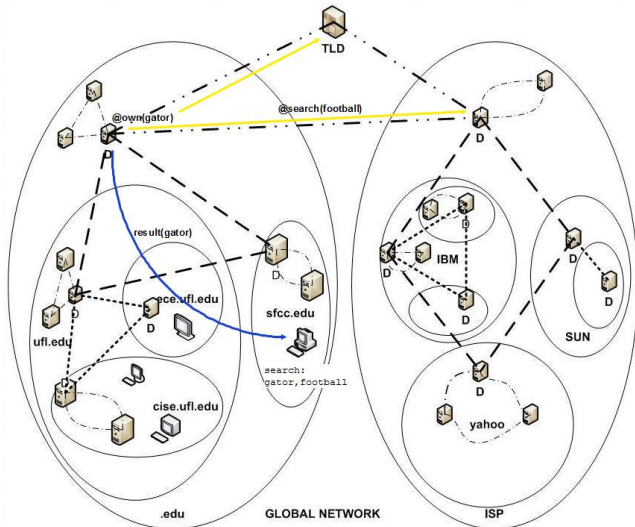
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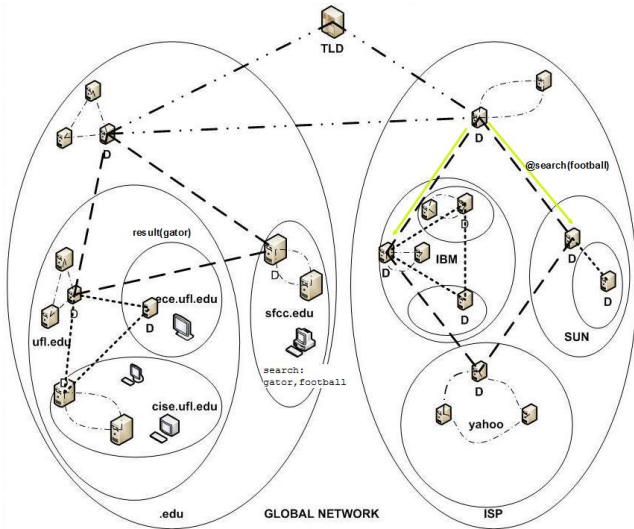
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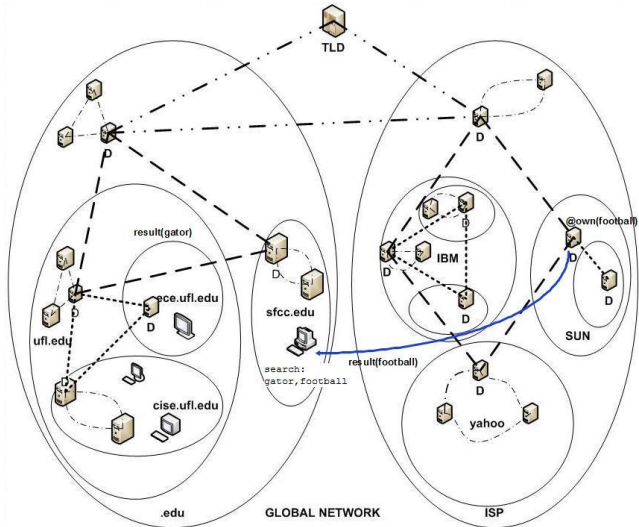
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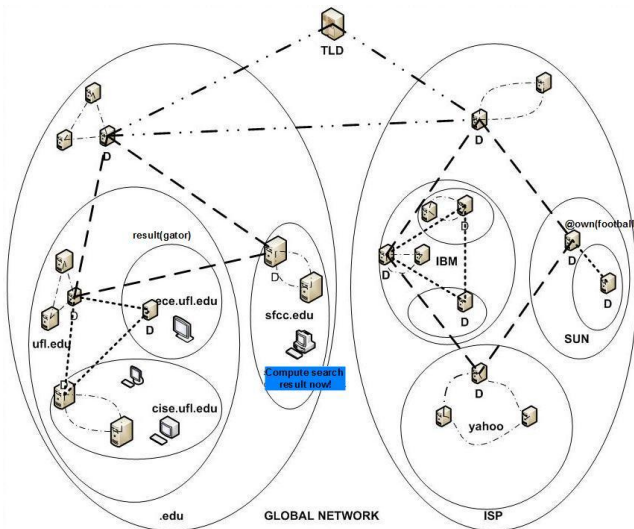
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Questions



Distributed
Search for
Multicast
Sessions

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Hierarchy

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Space Division
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Questions

Any Questions?

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Software Link

<http://www.cons.cise.ufl.edu/mdns/>