DNS aware multicast session directory service
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RESEARCH PROBLEM

There is an urgent need for a globally scalable and distributed multicast session directory service which would allow end users to discover relevant multicast sessions in real time. Lack of such service has prevented IP multicast from universal deployment.

Our proposal addresses this very issue. We believe our scheme could usher IP-multicast to new levels of deployment. It would be beneficial to Cisco as increased demand from end-users would convince ISPs all over the world to upgrade their network to support native IP-multicast hence creating demand for multicast enabled routers and other network hardware.

INTRODUCTION

Although IP-multicast has existed in some form since the inception of IPv4, it has not enjoyed widespread use. Much of this can be explained by lack of the necessary protocols for use of multicast addresses. While IGMP has matured over the years, it still lacks elements necessary to popularize IP-multicast, due to the layer at which it operates. We believe that increased usability at the application layer is needed for IP-multicast to have wide appeal and to fulfill the promise it has for improved efficiency of content delivery.

We have proposed a new multicast session directory architecture, mDNS [1, 2, 3, 4], that is scalable, distributed and hierarchical in design. We have tried to overcome many limitations in competing schemes such as sdr [5], Harvest [6], IDG [7] to name a few [8, 9, 10, 11]. mDNS allows sessions to be searched in domain-restricted as well as global scale. Close coupling of mDNS with existing DNS architecture allows us to assign mDNS URLs, which are similar to URLs used to bookmark popular webpages. These mDNS-URLs allow an end user to bookmark popular multicast sessions and later access the bookmarked session from within an mDNS-aware content browser. mDNS also provides a mechanism for the content provider to register mDNS-URLs. These URLs automatically point to the most recent session parameters including session address details. Any update to session parameters under mDNS scheme is made available in real time for discovery by end users.

mDNS further has the capability to geo-tag sessions [3]. This allows for geo-contexts such as location and radius parameters to be used as search criteria. Geo-tagging of sessions could allow some interesting usage pattern for IP-multicast that were not previously envisioned, in an efficient way.

mDNS fills an important gap between IGMPv3, IP-multicast and end users. It increases usability and appeal of IP-multicast to end users through an easy session discovery mechanism. This is missing in current networks. By providing this and other ease-of-use features, mDNS could push IP-multicast to the next level of deployment.

mDNS - DETAILS

A typical set of mDNS domain components are shown in Figure 1. MSD server is the “Multicast Session Directory” server, which stores session details of registered sessions that originate from within its own domain. We assume that at least one MSD server is co-located with the DNS server in any administrative domain in the Internet where mDNS has been deployed. If multiple MSD servers exist, then, one is chosen as the designated server among them. The rest listen to communications on the MSD-LOCAL-MCAST multicast channel, which is an administratively scoped channel address. URS server is the “URL Registration Server,” whose purpose is to enforce uniqueness among the registered session names for sessions originating in its domain. This is what enables unique mDNS-URL construction that in turn enables multicast sessions to be bookmarked by end users (see [2] for more details). In order for mDNS-URLs to be successfully resolved, a new record MCAST is added to the DNS server co-located with the MSD server.

@MCAST
{
  ANYCAST=a.b.c.d //anycast address for MSD servers in a domain
  CMCAST=233.[ASN Byte1].[ASN Byte2].XXX //GLOP Address
}
If multiple MSD servers are maintained in a domain, they all are assigned a common anycast [12] address, which allows the mDNS URLs to be translated properly. PMCAST and CMCAST are the multicast channel addresses. They are assumed to be taken from the GLOP [13] range and therefore are ISP assigned. Port numbers are assumed to be fixed and well known, and may eventually be IANA assigned. The MSD-designated server joins both PMCAST and CMCAST channels, which allows it to form a hierarchy with MSD-designated servers in its children sub-domains and MSD-designated servers in its parent domain and sibling domains under its parent domain. Figure 2 shows a typical mDNS hierarchical structure. It is this structure that allows searches to be routed to appropriate MSD servers and enables session discovery by end users. Bootstrap, search and session registration algorithms are described in detail in [2, 3, and 4]. mDNS uses hashes to distribute the keyword space in a fair manner to participating MSD servers [4]. mDNS searches are also scope sensitive. Session scoping information is stored as part of other session details during the registration process. mDNS does not impose any restriction in keywords selection by the session creators and hence prevents any compartmentalization among the registered sessions as is done by some other proposals.

PROGRESS TO DATE

mDNS architecture has been completed, subject to refinement. mDNS components have been identified and pseudocodes governing their behavior have been proposed. These concepts have been presented and some documents are under active review of some of the leading peer-reviewed conferences in computer networks. High level analysis of pseudocodes have been done that prove fairness in workload distribution (neglecting the unavoidable disparity due to higher popularity of some keywords compared to others). We have also developed an efficient routing mechanism among participating MSD servers for faster routing based on search keywords. Automatic geo-coding using Google Maps API has already been incorporated in our design.

PROPOSED WORK

Implementation of several module in order to demonstrate a proof of concept implementation remains a top priority.
patterns has to be finished. We intend to collect real data on average search latency and study the database stability in the face of topographical changes in the network hierarchy (such as inclusion and deletion of domains and sub-domains). We also propose to develop a multicast-aware browser that enables end users to load a session using previously stored mDNS-URLs. Ultimately we plan to float an IETF RFC towards mDNS protocol standardization.

**BENEFITS OF mDNS**

mDNS will enable end users to discover relevant sessions in a quick and simple manner. It promises real-time session discovery. It is space-, communication-, and computation-efficient, and is scalable, unlike most competing schemes. Furthermore, it is incrementally deployable, allowing ISPs, administrative domains, content providers, and end users to employ it when and as they see fit.

Geo-tagging of sessions enables some interesting use of multicast delivery mechanism; some scenarios have been envisioned in [3]. Hash-based keyword routing aims to reduce global search latency considerably. Being a partly push- and partly pull-based architecture, it incorporates the best features of both approaches. Lease-based session registration and soft state approach to hierarchy construction and maintenance ensures resilience and stability in our proposal. Keyword hashing also attempts to fairly distribute the workload among participating MSD servers.

Even though researchers have long agreed that IP-multicast is much more efficient mechanism to transmit live broadcasts to a large subscriber base, it has failed to gain common use. We hope to allow users to leverage the existing multicast infrastructure by improving usability and capabilities, therefore creating user demand for IP multicast services and in turn increased deployment by ISPs around the world.

**REFERENCES**


[02] Piyush Harsh and Richard Newman. “mdns - a proposal for hierarchical multicast session directory architec-


[04] Piyush Harsh and Richard Newman. “Efficient Distributed Search for Multicast Session Keywords”; under review IEEE Infocom 2009.


