Revisiting Multicast on ID/Locator Separation Network

Joo-Chul Lee*, Hee-Young Jung*

* ID Comm. Research Lab, ETRI, Daejeon, Republic of Korea
rune@etri.re.kr, hyjung@etri.re.kr

Abstract— **Multicasting is a way to deliver copies of single message to multiple recipients at different locations. On the traditional internet, group members join specific multicast address through membership management protocol and packets are delivered along the path tree built by multicast routing protocol. Now we consider how multicast communication can be designed in id/locator separation environment. In this environment a common id as a group name can be used and it is shared by all group members, or a specific id can be assigned to an anchor point and packets are distributed to the group members by the anchor point. In this paper we redefine groupcasting, and show how multicasting can be designed and implemented in id/locator separation network environment.**

Keywords— **Multicasting, Future Internet, id/locator separation**

I. INTRODUCTION

On the current internet, the role of IP address is "locator". An IP address assigned to an interface would be changed if a host moves to a new location. From this point of view, IP multicast address is not a locator, but rather it is more like "identifier". Hosts "join" any multicast addresses instead of assigning them to the interfaces. Delivering packets to the hosts which join any multicast addresses is done by the help of routers running multicast routing protocol and membership management protocol.

Thus multicasting can be implemented more easily on id/locator separation network. There are two ways to implement multicasting on id/locator separation network. The easiest way is to assign common id to all group members. On id/locator separation network each communication entities can have more than one id. We call this id "group id". Packets sent to this group id can be delivered to all hosts which has same group id. The other way is to assign group id to only one entity and let it care managing members and delivering packets to group members. Surely both ways can be used at the same time. Hybrid usage of both ways could lessen scalability problem which traditional multicasting has.

The rest of this paper is organized as follows. We explain details of multicasting on id/locator separation network in section 2 and show basic operations needed for multicasting in section 3. Finally the paper is concluded in section 4.

II. GROUPCAST IN ID.NET ARCHITECTURE

In this section we introduce id.net which is an id/locator separation network architecture based on recursive domain structure [4].

A. Id.net architecture

Id.net is an id/locator separation network architecture based on recursive domain concept. On id.net architecture whole network is composed of domains. A domain is a logical/physical group of nodes which have similar characteristics (e.g. network protocol, geographical region…). Each domain has at least one id domain gateway which forwards inbound/outbound packets. Locator is represented as a concatenation of domain ids; e.g. locator for domain "D2" is D1:D2 (Figure 1.). Routing table that any domain gateways have is represented by the locators. Mapping of id and locators is maintained by ILMS (Id Locator Mapping System) [3].
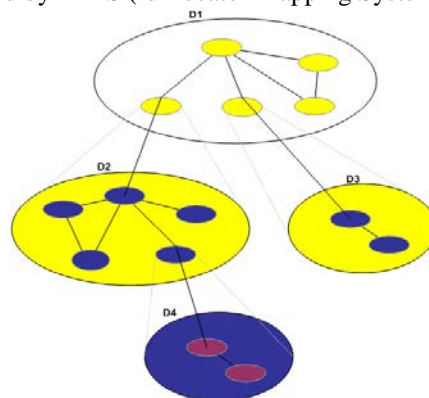

Figure 1. Recursive domain structure

Delivering id packets is done by id gateways of each domain. Each id gateway on path to the destination domain builds forwarding cache table for the destination id through path setup procedure (Figure 3.).

Existing socket API can't support id/locator separation, thus we introduce new type of socket API. We call this iPlug/dSocket (Figure 2.). iPlug is a structure which handles id entity and dSocket is a structure which handles domain socket. Each domain socket provides different type of communication service; e.g. connection-oriented, best effort etc. An iPlug should be plugged-in any domain socket to communicate with other id entity. Plugging an iPlug into any domain socket triggers updating location of id entity, that is to say this action lets host send "presence" message including

current locator to the ILMS. When the ILMS receives "presence" message it updates (or add in case of group id) locator.
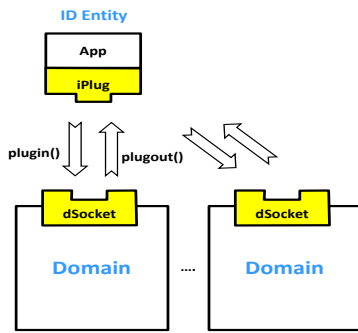

Figure 2. iPlug and dSocket

B. Groupcast on Id.net

We would like to extend concept of multicast group on id.net. Group can be not only entities which have same group id but also followers of a SNS account (e.g. twitter..) or even all nodes attached to the same AP. All of these groups are represented as "domains". Thus, we use new term, groupcast, instead of multicast on this paper.
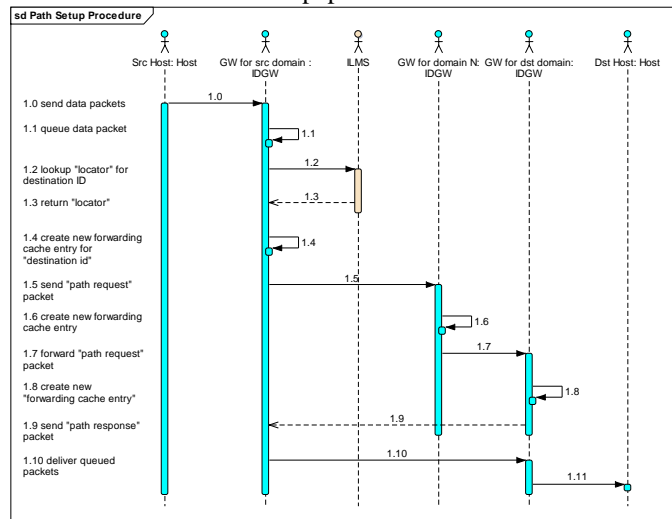

Figure 3. Reactive path setup on Id.net

There are two ways for groupcast on id.net. The first way is to use an id with multiple locator bindings. In this case all members of the group have same id. We call this id "group name". Group name denotes a group of entities collectively. Under this choice, all members updates their locations with the group name. ILMS maintains a list of locators for the group name; e.g. {group name, {loc1, loc2 …}}. Packets sent to this group are distributed to all locators through path setup procedure.

The second way is to use an id for anchor point. In this case sender only needs to know the id of anchor point. All members join this anchor point and anchor point manages group members. We call this "group address" because this id denotes the place where a group of entities are associated. Group address can denote the place, which could be anchor

point, wireless signal range, shared channel, etc. All these places can be abstracted as a "logical domain". Each logical domain could have its specific mechanism for groupcasting: join/leave, packet distribution, membership control, etc.

The combination of these two mechanisms could lessen forwarding scalability issue of traditional multicasting [2]. In Figure 4. shows combination use of two mechanisms. In this figure every member shares group name (filled circles and boxes) and updates their locations. Every anchor point updates their locations and sets up their own distribution mechanism. All members which belong to logical domain join anchor point explicitly, however members in case of wireless domain can join implicitly.
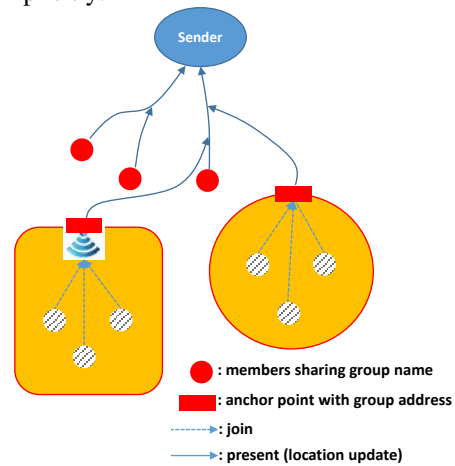

Figure 4. Combination of group name and group address

III. OPERATION

In this section we introduce how group by name mechanism operates. Figure 5. is illustrating an example topology. Blue entity is a sender and red entities are group members; one with a tag is a new member. Each circle means a domain. The number over each domain is its domain id. Green arrows on each connection mean next-hop information of forwarding cache for group name.
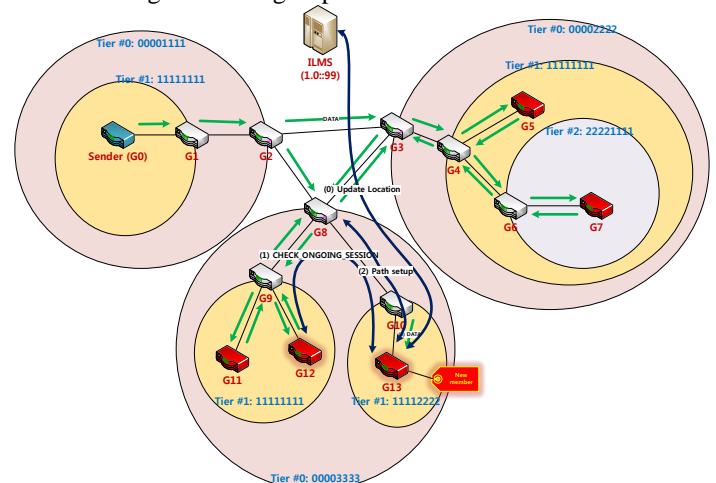

Figure 5. Example topology

When a new member want to join a group (Figure 6.), it only have to create iPlug for group name and plugin any domain socket, then host checks if there is on-going group communication session. This is done by sending "check on-going session message" to the group name in anycast way. If it receives positive response it starts path setup procedure to the sender. This procedure is usually finished in the middle of path to the sender because there exist forwarding caches for the group name. The path setup procedure stops as soon as it encounters existing forwarding cache entry.
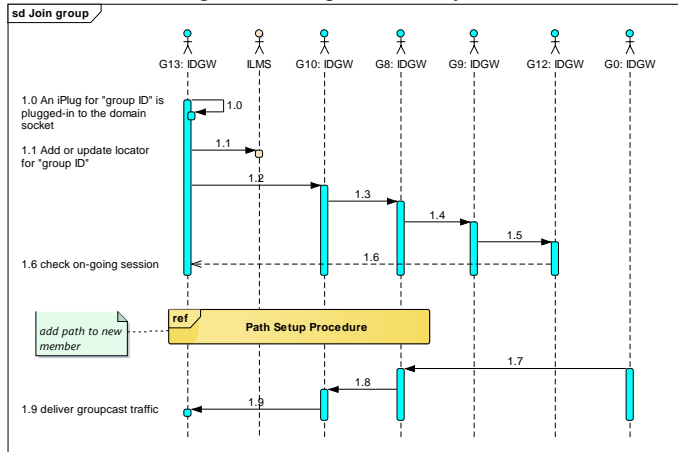

Figure 6. New member joins existing group

When an existing member decide to leave the group, it simply unplug from domain socket (Figure 7.). If an iPlug is unplugged from the domain socket, "de-presence" message is sent to the ILMS. The ILMS removes existing locator as soon as it receives "de-presence" message. After this, path setup procedure begins to clean existing forwarding cache entries for this member.
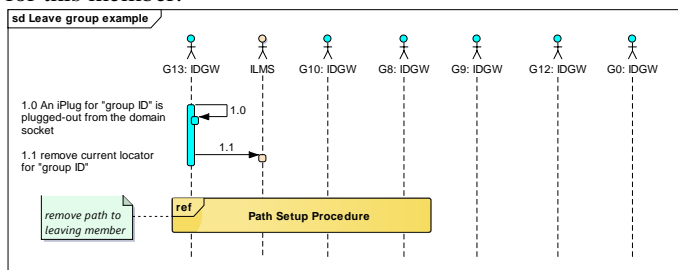

Figure 7. Existing member leaves group

IV. CONCLUSION

Multicasting in current internet operates with the help of membership management protocol and multicast routing protocol. The former tracks members who want to receive multicast traffic, and the latter maintains path to the all group members. Not like other ipp address, multicast ip address is not "locator"; it cannot be assigned to any interfaces, but it is more like "identifier". Therefore multicast can be easily implemented on id/locator separation network environment.

Id.net is an id/locator separation network architecture that we designed. Every entities on id.net communicates through their ids. ILMS maintains id/locator mapping and path setup procedure performed by each domain gateway keeps forwarding cache table to the destination ids.

We extend concept of multicasting to include various type of group; we call it groupcast, and two ways are proposed for groupcasting. The first approach, group by name, uses common id named as "group name". Group name can be assigned to all group members, thus packets sent to the group name can be delivered to all members which shares group name. The second approach assign group id to an anchor point. The anchor point manages group members and distribute packets to all members who join the anchor point. In this case the anchor point plays the role of a holder (or a place) where all group members stay, thus we call the group id "group address". That is why we call it "group by address". Combination of both ways can lessen scalability issue of multicasting thanks to its "divide and conquer" approach.

Implementation of groupcasting is still under way. We uses click modular router as platform [5]. iPlug/dSocket is implemented as user library and click element and id stack is being implemented as click elements. Routing module is implemented as a user daemon.

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