

Adaptive Unicast to Multicast Forwarding

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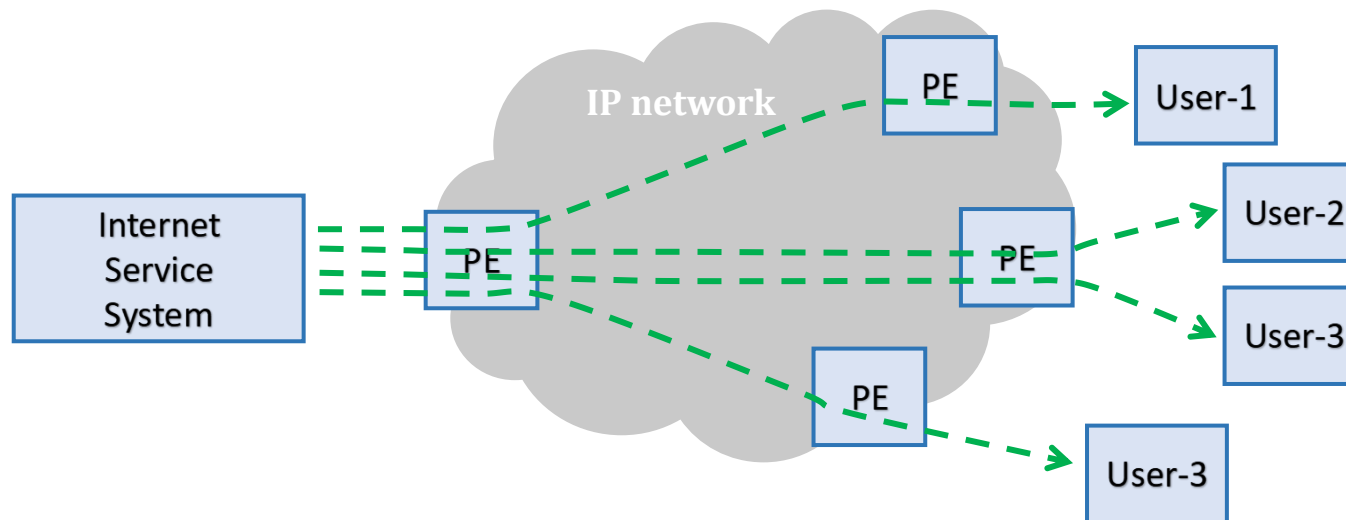
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Background

Current status of **point to multipoint** Internet service:

- Internet service systems don't support multicast.
 - Need large scale renovation for multicast transformation, but lack the power.
- Through unicast forwarding, the bandwidth pressure on the carrier network is enormous.
 - Redundant traffic for the same business, there are thousands of identical unicast traffic between edge service nodes and end users.
 - Occupy the bandwidth of other service traffic.



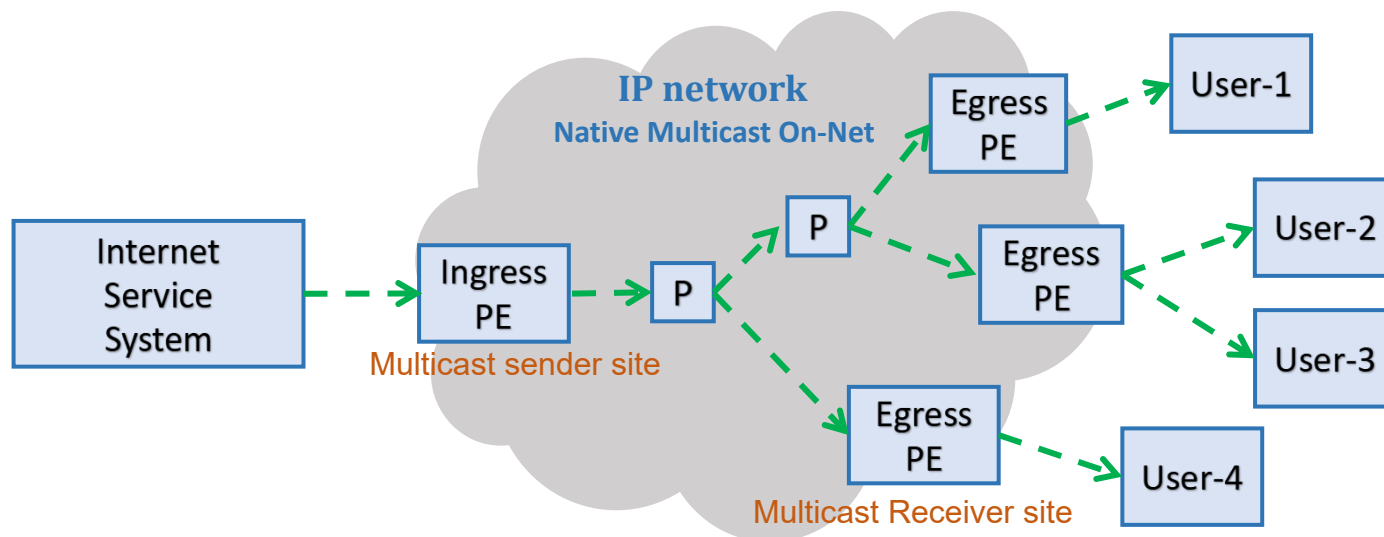
Device Role Definition

- Ingress PE of multicast domain

- Edge device located on the Internet service server side of the IP carrier network
- Act as device of multicast sender site
- Identify the characteristics of the service traffic
- Convert unicast packets into multicast based on their characteristics and forward them along the multicast forwarding path

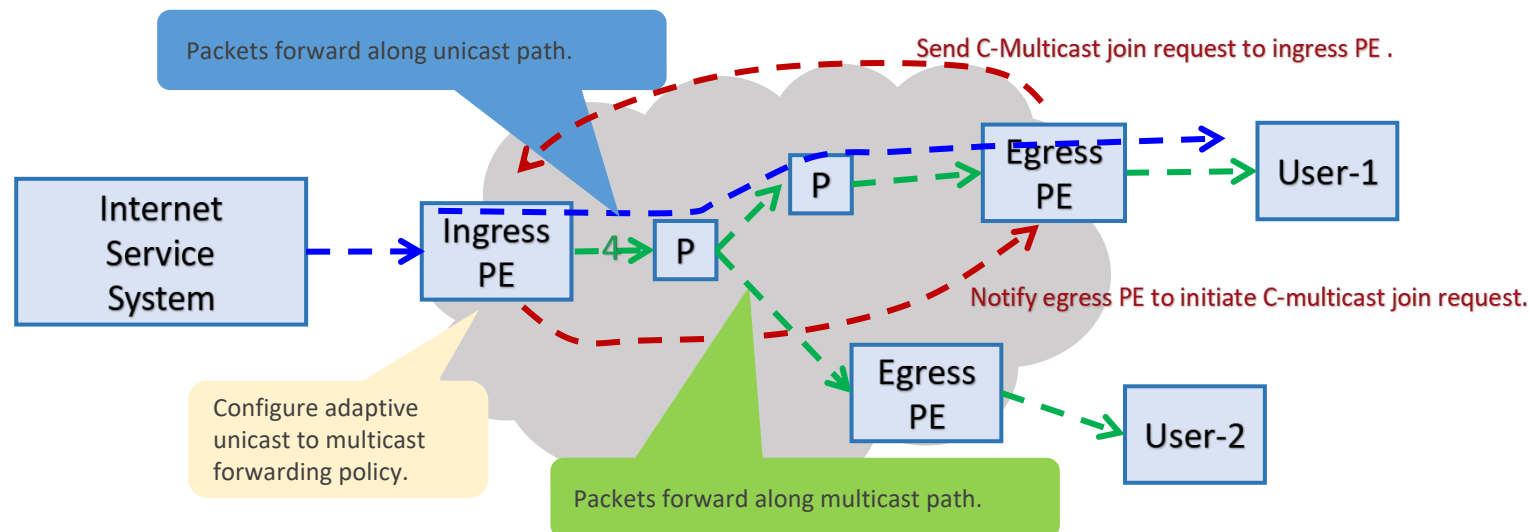
- Egress PE of multicast domain

- Edge device located on the terminal user side of the carrier network
- Act as device of multicast receiver site
- Convert multicast packets back to unicast and send them to end users on the unicast forwarding path



Adaptive Unicast to Multicast Forwarding Mechanism

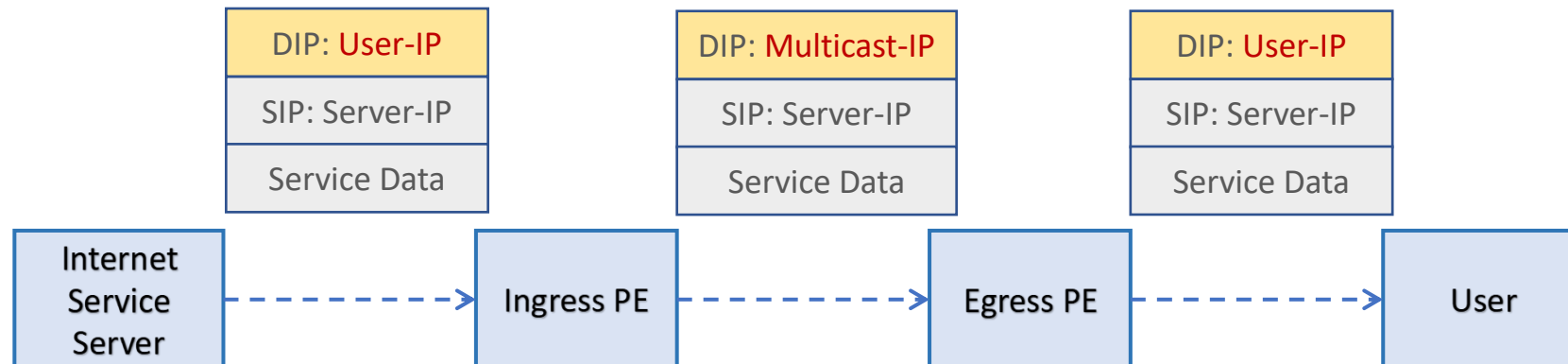
1. Configure adaptive optimization policy on ingress PE, and specify the mapping relationship for unicast flow characteristics and multicast IP addresses via controller, ingress PE forwards the service traffic along the unicast forwarding path.
2. After receiving the stable service traffic with specified characteristics, the ingress PE sends a notification to the egress PE of the user to trigger the egress PE to send a C-Multicast join request.
3. The egress PE adds a mapping relationship entry and sends a C-Multicast join request to the ingress PE to join the corresponding multicast group.
4. When the ingress PE receives the unicast packet, it converts the packet's DIP based on the mapping relationship, and send it to the egress PE along the multicast forwarding path.
5. The egress PE restores unicast DIP of packet based on the mapping relationship, and continues to unicast forwarding to the user.



Packet Forwarding Process

The packet forwarding process of adaptive unicast to multicast is as follows:

1. After receiving a packet from the server, ingress PE identifies the unicast packet that needs adaptive forwarding optimization based on the flow characteristics.
2. Ingress PE searches the mapping relationship table, replaces DIP with a multicast group address, and converts the identified unicast traffic into the corresponding multicast traffic.
3. According to the updated DIP, ingress PE forwards the message on the multicast forwarding path.
4. After receiving the multicast traffic, egress PE replaces DIP with the user' IP, and restores the multicast traffic to a unicast traffic based on the mapping relationship.
5. According to the DIP, egress PE sends the unicast traffic to the user.



Characteristics of Unicast Traffic

The characteristics of unicast traffic include but are not limited to one or a combination of more packet information as follows:

- Source IP address
- Destination IP address
- TCP/UDP source port
- TCP/UDP destination port
- Protocol number
- DSCP
- Service ID

For example, identifying an unicast service traffic based on the five-tuple (SIP, DIP, SPort, DPort, Protocol number) of the packet.

Mapping Relationship Table

The mapping relationship table for adaptive unicast to multicast forwarding records the mapping relationship between unicast flow characteristics, end user IP addresses, and multicast group addresses.

The mapping relationship table is recorded on ingress PEs and egress PEs.

Multicast IP	User IP	service flow characteristics Using five-tuple as an example (DIP, SIP, DPort, Sport, Protocol)
FF0E::1	2001::1	2001::1, 3001::1, 4545, 8000, IP
FF0E::1	2001::2	2001::2, 3001::1, 3400, 8000, IP
FF0E::2	2001::3	2001::3, 3001::2, 6000, 5000, IP
FF0E::3	2001::4	2001::4, 3001::2, 7000, 5000, IP
FF0E::3	2001::1	2001::1, 3001::2, 8000, 5000, IP

Next Steps

- Invite interested partners to join us
- Welcome questions and comments
- Seeking feedback from WG