

# Addresses

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In particular there are several types of address that can refer to more than one host at a time

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- Broadcast: as in the link layer, a single packet goes to every host in the local network. But, now, the “network” is at the IP layer, so may comprise more than one link layer network
- Multicast: in between uni- and broadcast. A single packet goes to one or more hosts

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So we need to look at four types of address

# Unicast Addresses: v4 & v6

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- Most current IP traffic is unicast

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- Don't have to know how many destination hosts there are

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E.g., 172.16.1.255 on the subnet 172.16.1/24

We can also use 255.255.255.255 as a broadcast to the local network for when we don't yet know our network address

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IPv6 uses multicast to achieve the same effect



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E.g., for streaming radio we could send individual unicast packets to all listening hosts, but it would be much more efficient to send a single packet that the listening hosts receive and the non-listening hosts don't

Also, we can't use broadcast as broadcast is network-limited: listeners can be spread far and wide over multiple networks

## Multicast Addresses: v4

One class of IPv4 addresses is reserved for multicast



28 bits

Multicast addresses

In IPv4, class D (224.0.0.0 to 239.255.255.255) addresses are used for multicast

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Host groups can cross multiple networks and there is no limit on the size of a group; and generally you can't know how big the group is

## Multicast Addresses: v4

Some group addresses are preallocated by IANA: the *permanent host groups*

- 224.0.0.1: all multicast aware hosts on this subnet (not all IPv4 hosts support multicast)
- 224.0.0.2: all multicast routers on this subnet

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The routers on the path to the server take note and so know to route multicast packets for this group towards the joining host

## Multicast Addresses: v4

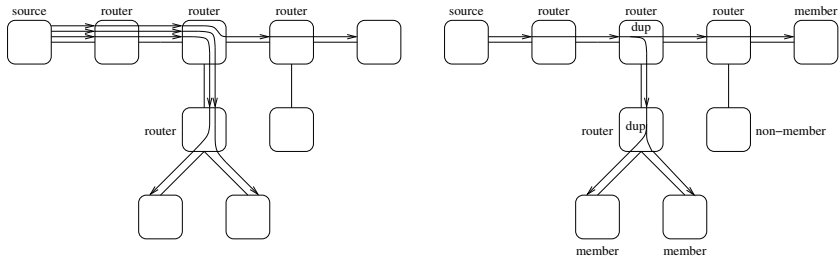
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The server itself is not interested or involved in the IGMP message

# Multicast



Unicast vs. Multicast

## Multicast Addresses: v4

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**Exercise** Read about this

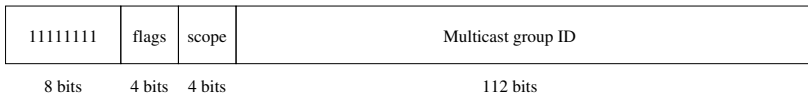
## Multicast Addresses: v6

While multicast was optional in IPv4, it is required in IPv6 (otherwise it would not have broadcast!)

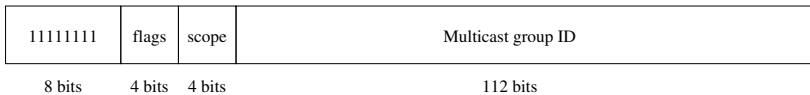
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IPv6 multicast is much as v4, but simplified

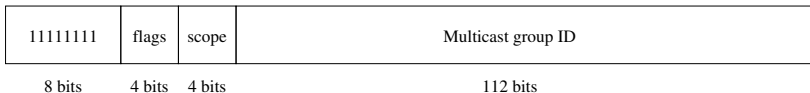


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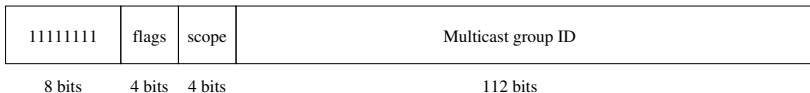
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## IPv6 multicast addresses

- Addresses start with hex FF
- Four bits of flags, including the T bit which means transient group (as opposed to a permanent IANA allocated group)
- Four bits of scope. Limit the range of this multicast to, e.g., the local network; the organisation; the country; worldwide

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**Exercise** Read about how IPv4 uses the TTL to limit scope

**Exercise** Find out what IPv6 needs to do to broadcast to the local network

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**Exercise** Read about the *Simple Service Discovery Protocol* (SSDP)

**Exercise** And the *Multicast Domain Name System* (mDNS)

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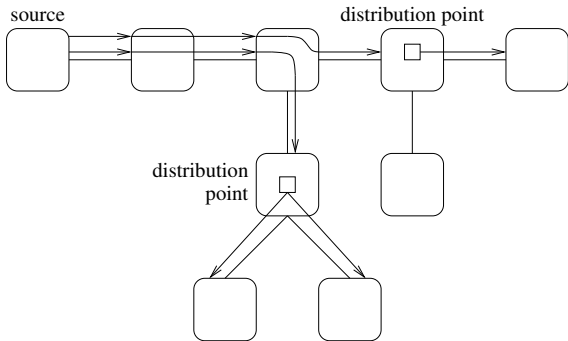
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While ideal for a live transmission, multicast does not work when everyone wants to watch things at different times

Most big streaming providers rely on having many local distribution points containing identical data, even for live streams

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Not Multicast

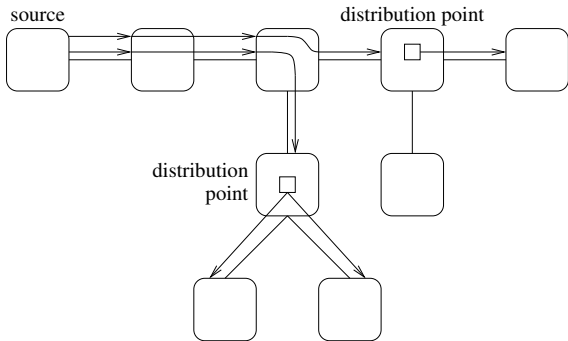


Content distribution points

The source supplies (relatively few) distribution points using unicast, which serve content directly using unicast

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**Exercise** Read about *content delivery networks*

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A router must keep a record of all multicast paths passing through it, so routers on popular paths (e.g., in internet exchanges) might need to keep a large amount of data

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**Exercise** Read about BT TV

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For example, replicated Web servers: have many servers around the world with identical content and the same anycast address. A browser would get pages from the closest server, thus sharing load

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The reply would be unicast

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Address format?

Any unicast address that happens to be assigned to more than one server. It is up to the routers to figure this out



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Anycast has plenty of potential, but we need to be using IPv6 to get it properly, though some people do support it in IPv4

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But it is not always feasible to do this

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- Some installations have too many machines to get around and configure them all, e.g., in the library
- Some installations have machines that come and go all the time, e.g., laptops in the library