

# 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

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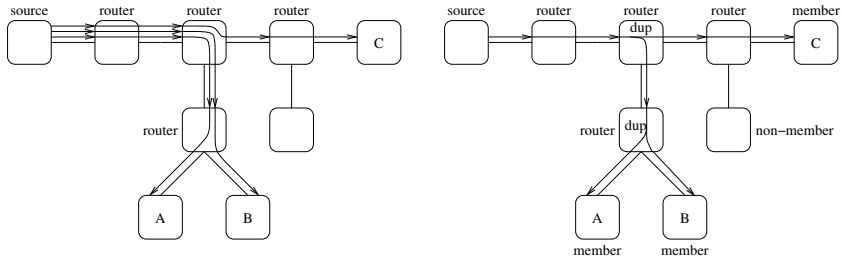
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The server itself is not interested or involved in the IGMP message

# Multicast



Unicast vs. Multicast

## Multicast Addresses: v4

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So there is more protocol to monitor and maintain groups using timeouts and maintenance messages

**Exercise** Read about this

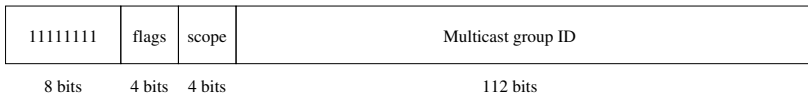
## Multicast Addresses: v6

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

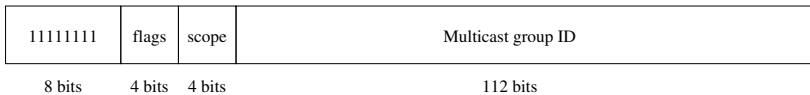
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IPv6 multicast is much as v4, but simplified

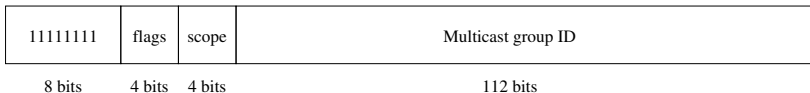


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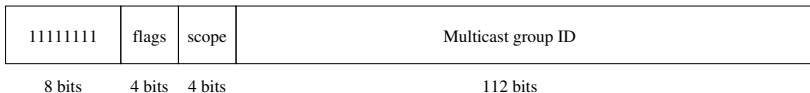
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## IPv6 multicast addresses

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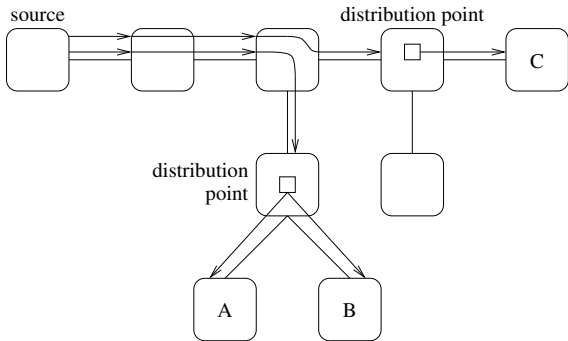
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Most big streaming providers rely on having many local distribution points containing identical data, even for live streams

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Not Multicast

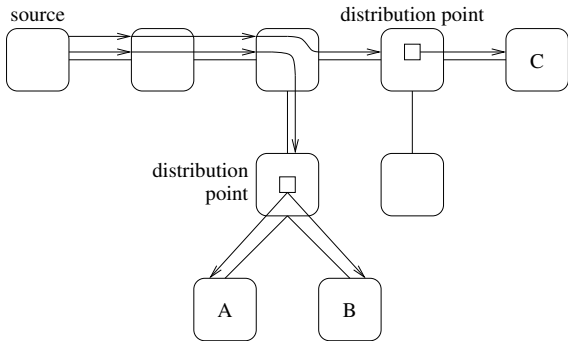


Content distribution points

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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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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**Exercise** 1.1.1.1 is an anycast address. Investigate

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But it is not always feasible to do this

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- Some installations have machines that come and go all the time, e.g., laptops in the library