Stream Address Allocation in Ethernet AVB

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Issues

- Stream Addresses need to be unique
- Stream Addresses need to be available for both Layer 2 (61883) and higher level protocols (IP, RTP, TCP)
- Stream Address management is more efficient if addresses are grouped. (MMRP concern)
- All sizes of networks need to be supported

Stream Types

- Layer 3 and above
  - IP, RTP, TCP
- Layer 2
  - 61882 over AVB

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IP based Streams

- Need to use IPv4/IPv6 multicast addresses
- Established Multicast infrastructure
- Unique layer 2 multicast not guaranteed
- Mapping from IP to layer 2 is not reversible

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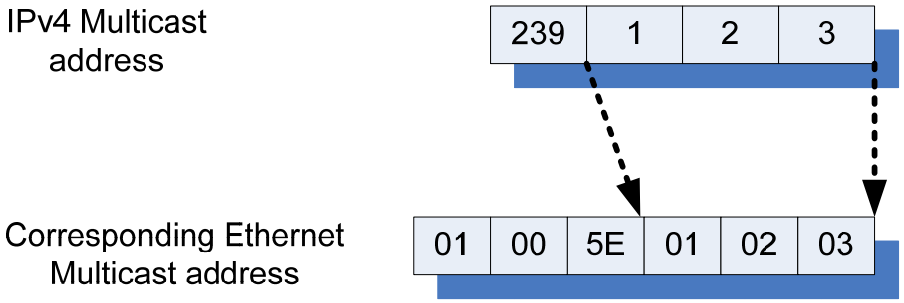
IP Multicast Address Allocation

- MADCAP – Multicast Address Dynamic Client Allocation Protocol (RFC 2730)
- MALLOC – Multicast Address Allocation Architecture (RFC 2908)
- MASC – Multicast Address Set Claim Protocol (RFC 2909)
- SSM – Source Specific Multicast (RFC 3569)
- AAP – Multicast Address Allocation Protocol
- ZMAAP – Zeroconf Multicast Address Allocation Protocol

IPv4 Multicast

- 224.0.0.0 – 239.255.255.255 reserved for multicast
- An IP host group address is mapped to an Ethernet multicast address by placing the low-order 23-bits of the IP address into the low-order 23 bits of the Ethernet multicast address 01-00-5E-00-00-00 (hex).
- Because there are 28 significant bits in an IP host group address, more than one host group address may map to the same Ethernet multicast address. (RFC 1112)
- 32 to 1 possible address overlap

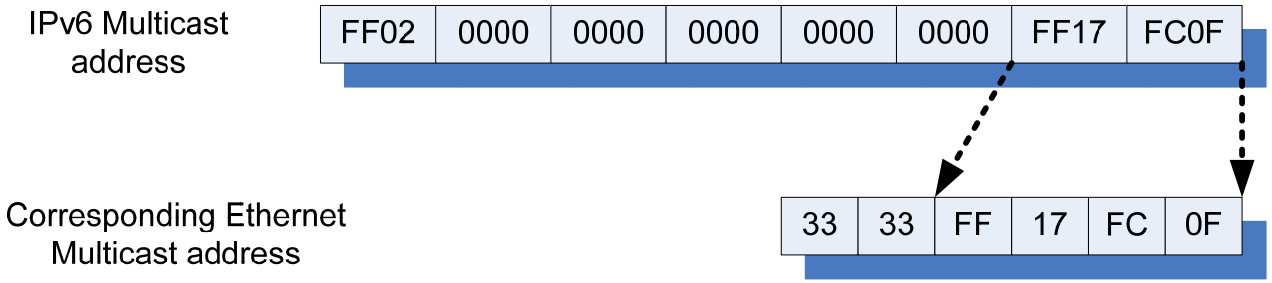
IPv4 Multicast



IPv6 Multicast

- IPv6 multicast addresses are distinguished from unicast addresses by the value of the high-order octet of the addresses
- A value of 0xFF (binary 11111111) identifies an address as a multicast address
- FFxx::/8

IPv6 Multicast



IP Solutions

- No solution needed
  - Likelihood of non unique multicast addresses is low
  - Require MMRP/SRP to fail gracefully with non unique multicast addresses.

IP Solutions

- Force IP solutions to adopt a new method of mapping IP addresses to Ethernet addresses to work with AVB
  - IP is already a one way mapping
  - Devices will have to be modified to work with AVB anyway
  - Enforced with SRP

Layer 2 streams

- No current method for dynamic Multicast Allocation
- Vendors could assign additional MAC addresses to devices

Layer 2 Solutions

- Vendor specific Stream addresses
- Server based allocation
- MRP based allocation
- Peer to Peer link local allocation (broadcast and defend)

Vendor specific Addresses

- A single stream device could use the multicast version of it's own MAC address
- Multiple stream devices would require MAC addresses assigned by the manufacturer

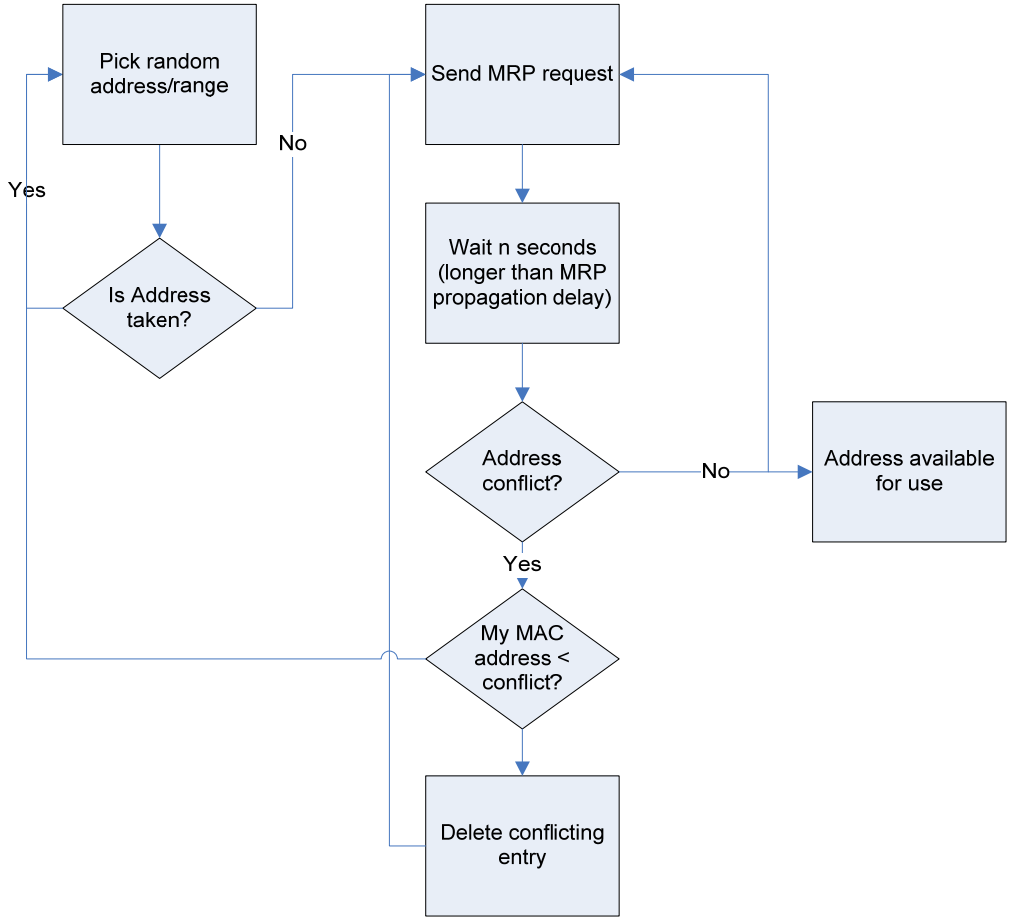
Server

- Where does the server live?
- Distributed data base on the bridges?
- Many small networks will have no infrastructure other than a bridge. Some won't even have bridge
- If we define a server then there still has to be a fallback for small networks.

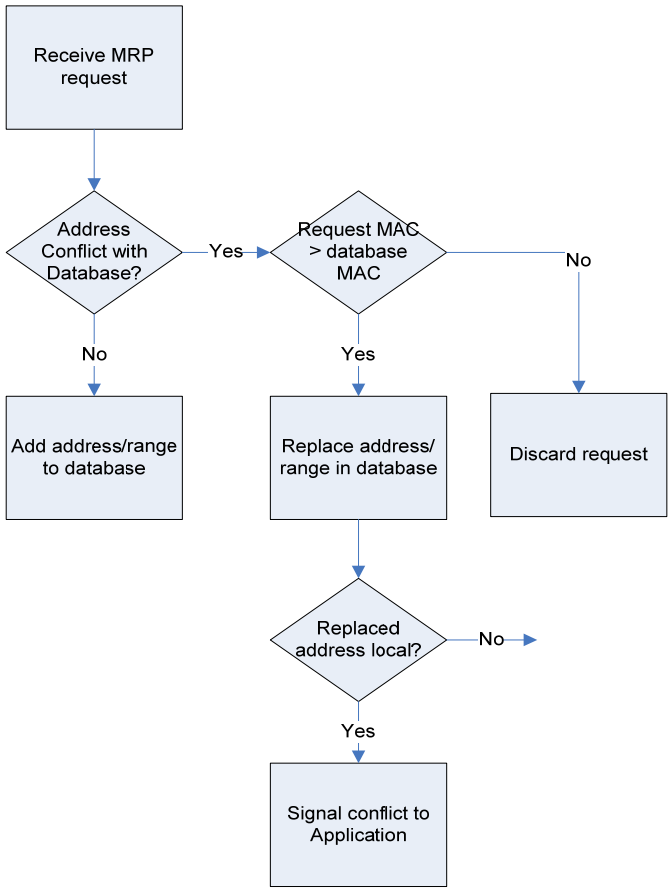
MRP Application

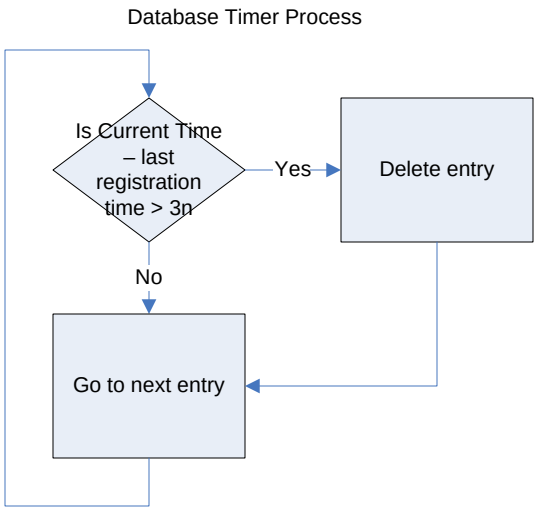
- Works without a dedicated server
- Bridges not required to implement
- Requires each talker to maintain entire database of assigned addresses
- MRP lacks positive ACK/NAK mechanism
- Nonconforming talker could cause late collisions, forcing stream reinitialization

MRP Address Acquisition Algorithm



MRP Database Algorithms





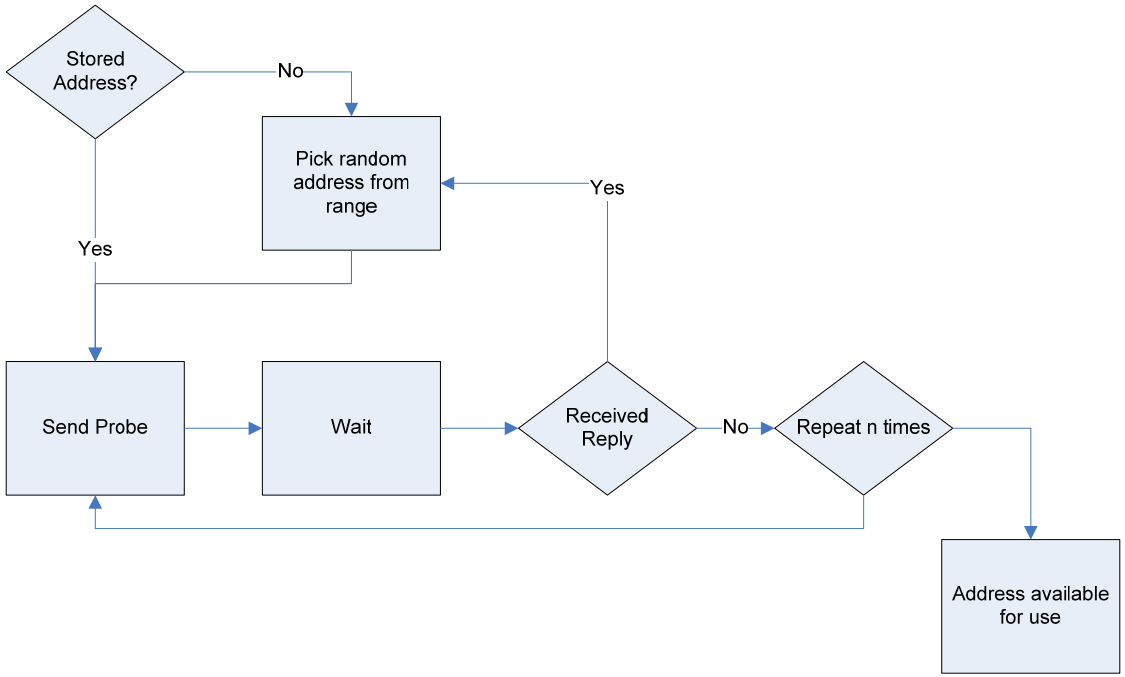
Database Entries
- Start Stream Address
- End Stream Address
- MAC Address
- Last registration time

Peer to Peer

- Claim and defend algorithm similar to link layer IP addresses
- Ranges or individual multicasts can be supported
- Requires only talkers to participate
- Requires a large range to avoid thrashing
- Same rules apply for all networks

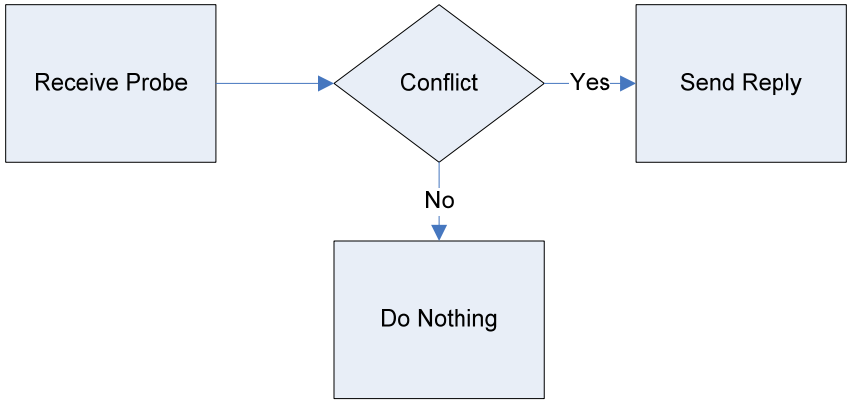
Address Acquisition Algorithm

- Pick random Stream Address(es)
- Probe
- Watch for Reply



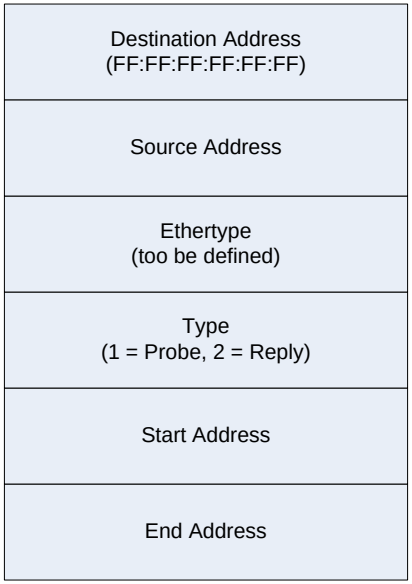
Address Defense Algorithm

- Watch for Probe packets
- If a conflict, send a Reply



Address Acquisition Packet

- Protocol allows for a single address or a range to be requested
- Reply packets should contain only the conflicting addresses



Stream Address Range

- Stream address range needs to be sufficiently large to allow a minimum number or retries.
- Allocating ranges may allow the address space to become more fragmented.

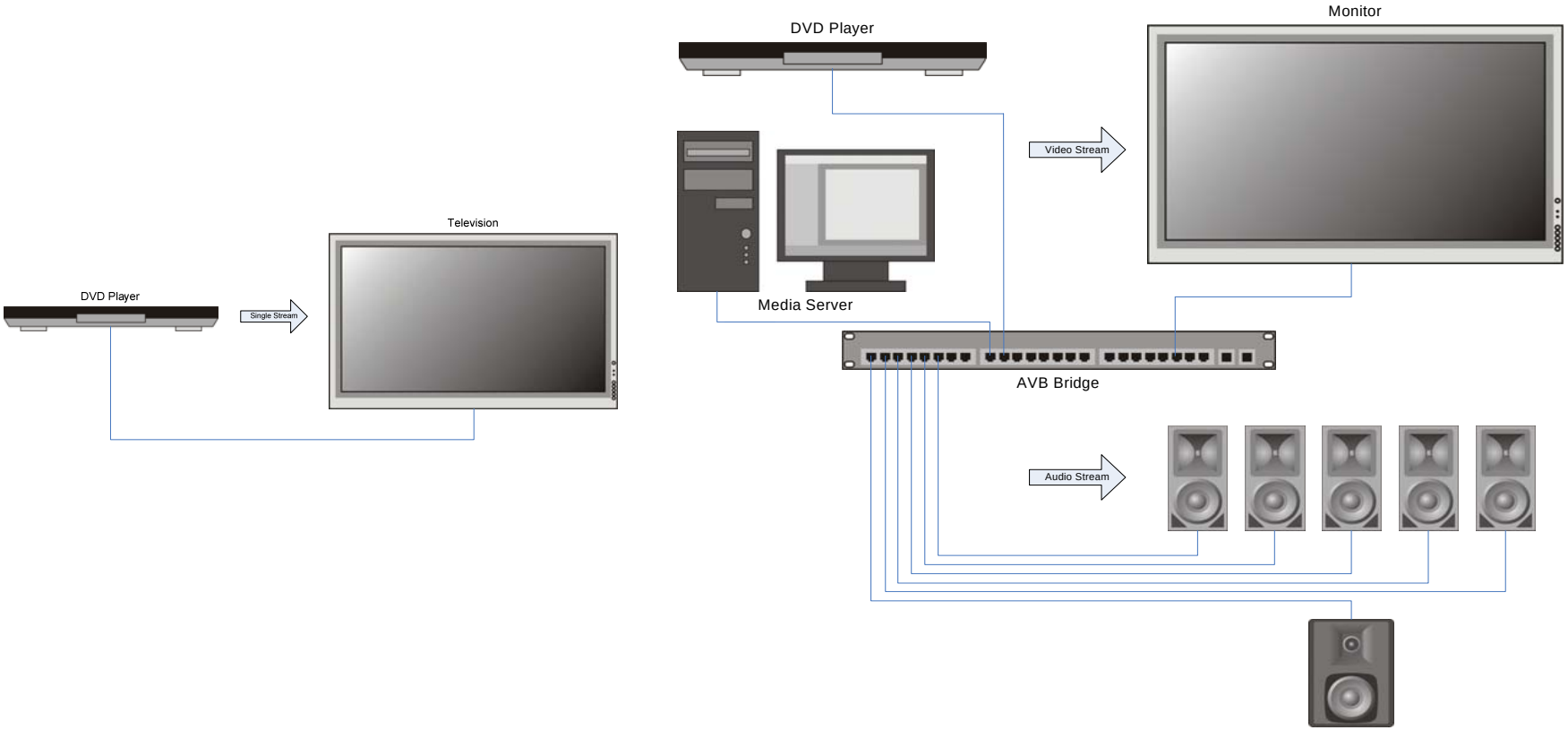
IPv4 Address Range Example

- IPv4 Link Local Addressing has 65,024 available addresses and has a recommended maximum network size of around 1300
- A host connecting to a link that already has 1300 hosts, selecting an IPv4 Link-Local address at random, has a 98% chance of selecting an unused IPv4 Link-Local address on the first try.

IPv4 Address Range Example

- A host has a 99.96% chance of selecting an unused IPv4 Link-Local address within two tries.
- The probability that it will have to try more than ten times is about 1 in 10^17.
- (RFC 3927)

Network size independent



Where do we go from here?

- Should this be defined as part of 802.1?
- Should this be defined as part of the 61883 under MSC?
- Do we need a PAR?
- Is this just part of a recommended practices document?
- Where do we get the multicast range and ethertype?