Reusable IP Addresses in a Dynamic Network

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ABSTRACT

The topology of amateur packet radio networks changes rapidly due to the frequent addition of new stations, shutting down of old stations, and changing location of others. This paper presents a method for managing IP address assignments within such a network.

1. Background

TCP/IP networks require that each host have a unique S-bit address. These addresses are typically assigned by the network manager who must make sure that no duplicate addresses exist. In the amateur packet radio TCP/IP network, the assignments are done in a hierarchal fashion. The global coordinator (GC) assigns blocks of addresses to Local Area Network (LAN) coordinators who, in turn, assign individual station addresses.

The amateur packet radio community is constantly changing due to the adding of new stations, shutting down old stations, changing locations, and the like. In the AX.25 digipeater network, it becomes difficult to maintain an accurate map of reliable connection paths. In the TCP/IP network, the job of the LAN coordinator becomes similarly difficult

When a new station comes on the air in the TCP/IP network, its operator must first contact the LAN coordinator to get an address assignment If the coordinator is unavailable, the new user may get frustrated and choose a random address which may confl ict with previously assigned addresses, causing havoc on the network. In order to ease the adding of new stations to the TCP/IP network, the process of address assignment must be automated.

2. Automatic Address Assignment

It can be assumed that the LAN coordinator operates the router for his LAN and that it has knowledge of all LAN address assignments. It therefore has enough information to be able to assign addresses within the block assigned to it by the CC. When a new station comes on the air, it sends a broadcast packet that contains its callsign and a request for a "permanent" IP address. The LAN router searches its tables for the station's callsign, and if it is found, it responds with the previously assigned address. If a table entry is not found, the router allocates a new address from its block and assigns it to the requesting station. It also makes an entry in its tables linking the station's callsign with that address. This is similar to the Reverse Address Resolution Protocol [1] that is used in booting diskless workstations. The router then sends a packet to the requesting station informing it of its assignment The requesting station then records the assignment in its configuration fi le for subsequent use.

When the current block of addresses is exhausted, a new block would have to be requested from the CC. Currently, the LAN coordinator must make a request to the GC for another block of addresses. As the network develops better connectivity, we may be able to have the LAN router send a special packet to the CC's system to request another block of addresses. The CC would take the next available block and mark it as being assigned to that LAN, and send the information back to the originating LAN router. At the same time, the new block-to-LAN assignment is distributed to all other routers so that they may update their tables. The LAN router may elect to send its request when a few addresses are still unassigned in the old block, to allow for delays in response from the CC.

The LAN will also have a name server which will probably operate on the same system as the router. Its function is to accept packets contain-

ing callsigns and return the associated IP addresses.

3. Address Expiration

The local IP assignments may have an expiration date associated with them so that seldom-seen stations don't tie up IP addresses needlessly. This can be an arbitrarily long time, such as a couple of months. As long as a station remains active at least once during that time period, it retains its assignment and stays in the name servers. If an address expires, it is marked as being available for the next new station. This will lengthen the time before a new address block is needed.

4. Moving between LANs

When a station moves from one LAN to another, its IP address would be marked as invalid in the local router, and made to point into a forwarding table that indicates the station's new IP address. This would be maintained for some time to insure that the new IP address has had time to show up on the network's name servers, and so that the old address does not get reassigned locally until a reasonable time has passed. The rules that govern routing decisions that are made based on a partial IP (subnet) address cannot allow IP addresses to move between LANs. This is necessary because one cannot unplug a computer from one organization's network and relocate it to another organization's network and expect to keep the same IP address. With domain style addressing, it wouldn't even have the same hostname.

5. Mobile Stations

For mobile packet stations operating away from their home territory, a temporary address would be requested from the router in the station's current LAN. The local router then sends a forwarding order to his "home" router, cancelling any previous forwarding order. The home router then sends a cancellation order to the previous router so that the previous temporary address may be purged. The temporary address would have a much shorter expiration time than a regular address. This scheme assumes connectivity between all of the LANs on the mobile station's route.

6. Conclusion

As the number of stations using TCP/IP grows, it will become increasingly important to respond quickly to changes in the network. For this reason, some sort of automated network manangement is necessary. The ideas presented here represent a method for managing IP address assignments in such a network.

References

a. Finlayson, R., Mann, T., Mogul, J., and Theimer, M., "Reverse Address Resolution Protocol," ARPA RFC 903, June 1984.

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