Apple Internet Router: WAN Network Options (2/93)

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TOPIC ---

This article describes additional Wide Area Network WAN network options
found in the DialUp, and IP Tunnel Setup Port Info windows. These options
include Network Hiding, Network Number Remapping, Clustering, Hop Count
Reduction, Hop Count Weighting, and Backup Paths.

DISCUSSION --

Half-routing and tunneling ports both support a variety of options that are
not applicable to AppleTalk ports. These options are selected in the
Options… dialog box.

Network Hiding

It may be desirable, for security reasons, that certain networks in an
internet not be made visible to other internets connected to the tunnel.
This is accomplished simply by not providing information about these
"hidden" networks to other exterior routers during the routing information
exchange. You can choose to hide no networks, a specific list of networks,
or all networks except a specific list.

Network hiding has advantages and disadvantages.

Some advantages are:
  • Security
  • The amount of routing information passed into the tunnel (and hence
    into all the remotely-connected internets) can be greatly reduced.
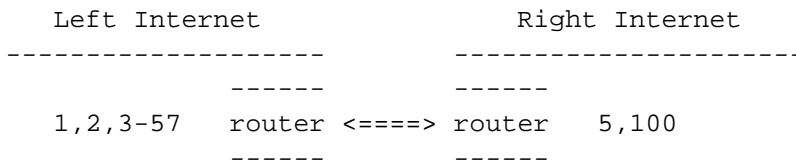
Some disadvantages are:
  • Lack of selectivity – there is no access through the tunnel to any
    nodes on hidden networks.
  • A node on a hidden net will see all of the AppleTalk zones exported by
    all of the exterior routers on the tunnel, but will not be able to see
    any devices in these zones since those devices cannot respond to the
    node's NBP lookups.

Network Number Remapping

With AppleTalk WANs becoming larger and larger, we cannot safely assume
that there will be no network number conflicts when connecting two or more
WANs together. In fact, the large size of many WANs makes it more likely that
there will be conflicts in such a case.

Network number remapping is a technique used to resolve network number
conflicts between two networks without requiring reconfiguration of either
one. Remapping is allowed on tunneling and half-routing ports only, not on
AppleTalk ports.

As an example of the use of network number remapping, assume that one
internet contains networks 1,2, and 3-57. If this internet is connected to
another internet that contains network numbers 5 and 100, then a conflict
would ordinarily result because network 5 exists in both internets.

```
        Left Internet                 Right Internet
     -------------------         ---------------------
                 ------          ------
        1,2,3-57   router <====> router   5,100
                 ------          ------
```

With network number remapping, the Left router can be configured to remap
network 5 into network 58 (or any other nonconflicting number). This
allows the Left internet to see the Right internet's network numbers as
58,100.

At the same time, the Right router can be configured to remap networks 3-57
into networks 103-157. This allows the Right internet to see the Left
internet's network numbers as 1,2,103-157.

Loop configurations are not allowed when remapping is active. Looking at
the previous example again, see what would happen if there were a loop
configuration here. Remapped network numbers would loop back to the router
that performed the remapping in the first place. This time, they would be
viewed as new networks, and could be remapped again, causing an infinite
loop of remapping, broken only by hop count limitation.

Apple Internet Router attempts to detect such loops at startup, and will
not activate a remapping port if it would create such a loop. If a loop is
detected later, the remapping port will be brought down.

Network number remapping is enabled through the Options dialog. Here, you
specify a network range to remap remote network numbers into.

In a WAN with more than one tunnel or half-routing link, network numbers
may be repeatedly remapped as they travel across the WAN. This does not
present a problem, since all the remapping information is handled locally,
and it is transparent to the user.

For network number remapping to work, all network number references in each
packet traveling between the two networks must be remapped before the
packet enters the new network. This includes source and destination

network numbers in the DDP header, network numbers carried in NBP and RTMP
packets, and network numbers in ZIP query and response packets.

Note that this also includes network numbers obtained by clients of these
protocols and carried as part of the DDP data field. It is impossible for
routers to be aware of all such instances of network numbers in data, so
remapping will not always work in these cases. For this reason, Apple
advises against doing network management across remapped links, because
network management data often contains network numbers. Instead, manage
each internet separately.

Clustering

Clustering is a way of representing a portion of the internet as a single,
multi-zone extended network. Clustering is available only on tunneling and
half-routing ports, and then only when remapping is active. Like
remapping, clustering is applied by an exterior router to network
information it receives from other exterior routers. The clustering
exterior router represents the remote internets to its own local internet
as single, multi-zone extended networks.

```
                 exterior |   Nets 1 (zone A),    | exterior
<================= router |      2 (zone B),      | router ================>
 Net 1-57 (zone A,        | 3-57 (zone A, zone C) |     Net 1-57 (zone A,
    zone B, zone C)                                        zone B, zone C)
```

For example, the internet shown in the center of the above diagram consists
of three separate networks: two that each have a single network number and
zone name (1, Zone A and 2, Zone B) and one that has a network number range
and a zone list (3-57, Zone A, Zone C). With clustering active, this
internet would be represented to other internets as a single extended
network with network numbers 1-57 and the zone list Zone A, Zone B, Zone C.

Clustering imposes some limitations on network design. All the networks in
a cluster must appear, from an RTMP point of view, to be the same number of
hops away.

A more serious limitation is that representing a portion of the internet
this way amounts to taking a snapshot of that portion and passing it to the
rest of the internet. If the picture changes, the snapshots are generally
not updated.

There are two possible cases where this can happen. First, if a new
network comes up in the clustered portion, and its network number range is
outside the cluster range, that network must be represented individually to
the rest of the internet because the cluster range cannot easily be grown
to include the new network.

Second, if a new network comes up within the cluster and its network number
range is within the cluster range, then it automatically becomes part of
the cluster. However, if its zone list contains a zone name not in the
cluster's original zone list, that zone name will not appear in the
cluster's zone list until the clustering routers are restarted.

Hop Count Reduction

When two internets are connected through a half-router or a tunnel, it is
easy to see that the maximum distance across the resulting internet could
easily exceed 15 hops. For this reason, Apple Internet Router tunneling
and half-router ports allow you to turn on the hop count reduction feature,
which appears in the Options dialog as "Allow more than 15 hops".

Hop count reduction is available only on tunneling and half-routing ports,
and only when remapping is active. Remapping is a requirement because, for
hop count reduction to be safe, there must be no loops across the hop count
reduced link, and Apple Internet Router prevents loops in a remapped
environment. If loops were allowed, a reduced hop count packet could
travel forever on the network.

When hop count reduction is active on a port, all networks that are
accessible out that port appear to be one hop away. This makes the remote
networks accessible by all the networks in the local internet, regardless
of their actual distance in hops.

Hop Count Weighting

When multiple paths are available between two networks, the network
administrator may wish to direct traffic to a preferred path. This is
especially important when one path includes a slow link or tunnel. Current
AppleTalk protocols will choose the path with the fewest hops, without
regard to the speed of the link. If two paths are equal hops, traffic will
alternate between them at ten-second intervals.

Hop count weighting allows you to artificially increase the hop count for a
half-routing port or tunnel by a number from 1 to 14. By weighting a link
as a large number of hops, you can cause traffic to take an alternate route
if one is available. This feature also allows you to implement a more
accurate modeling of the internet when slow links are involved, by
weighting links according to their speed (higher hop counts for slower
links).

Hop count weighting may be used whether or not network number remapping is
on. However, it may not be meaningful if remapping is on because there
will be no loops or redundant paths in that case.

Backup Paths

Tunneling and half-routing ports can be designated as "backup paths" only
when remapping is not on (since redundant paths are not allowed with
remapping). If a port is designated as a backup path, then it will not be
used for data forwarding if an alternate route between the half-routers or
tunneling routers is available.

The link will be used only for the exchange of routing information between
the two half-routers. This exchange is necessary to determine when the
backup path needs to be made active. Once a backup link becomes active,

that link may continue to be used for some amount of data forwarding, even
if the primary link comes back up. The link won't fully return to backup
status until the router is restarted.

If a half-routing or tunneling port is designated as a backup port, a hop
count weight may also be assigned for use if the port becomes active.
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