

Protocol Analysis for Extensions to RIP to Support Demand Circuits

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Abstract

As required by Routing Protocol Criteria [1], this report documents the key features of Routing over Demand Circuits on Wide Area Networks - RIP [2] and the current implementation experience.

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I would like to thank colleagues at Spider, in particular Richard Edmonstone and Alan Turland who developed Spider's IP RIP and IPX RIP and SAP implementations.

1. Protocol Documents

"Extensions to RIP to Support Demand Circuits" [2] suggests an enhancement to the "Routing Internet Protocol" (RIP) [3] and "RIP-2" [4] to allow them to run more cost-effectively on Wide Area Networks (WANs). Network management extensions for Demand RIP are described in RIP Version 2 MIB Extensions [5].

2. Applicability

Demand RIP requires that there is an underlying mechanism for determining unreachability in a finite predictable period.

The demand extensions to RIP are particularly appropriate for WANs where the cost - either financial or packet overhead - would make periodic transmission of routing (or service advertising) updates unacceptable:

- o Connection oriented Public Data Networks - for example X.25 packet switched networks or ISDN.
- o Point-to-point links supporting PPP link quality monitoring or echo request to determine link failure.

A demand RIP implementation runs standard RIP on Local Area Networks (LANs) allowing them to interoperate transparently with implementations adhering to the original specifications.

3. Key Features

The proposal shares the same basic algorithms as RIP or RIP-2 when running on LANs or fixed point-to-point links; Packet formats, broadcast frequency, triggered update operation and database timeouts are all unmodified.

The new features operate on WANs which use switched circuits on demand to achieve intermittent connectivity. Instead of using periodic 'broadcasts', information is only sent as triggered updates. The proposal makes use of features of the underlying connection oriented service to provide feedback on connectivity.

3.1 Triggered Updates

Updates are only sent on the WAN when an event changes the routing database. Each update is retransmitted until acknowledged. Information received in an update is not timed out.

The packet format of a RIP response is modified (with a different unique command field) to include sequence and fragment number information. An acknowledgement packet is also defined.

3.2 Circuit Manager

The circuit manager running below the IP network layer is responsible for establishing a circuit to the next hop router whenever there is data (or a routing update) to transfer. After a period of inactivity the circuit will be closed by the circuit manager.

If the circuit manager fails to make a connection a circuit down indication is sent to the routing application. The circuit manager will then attempt at (increasing) intervals to establish a connection. When successful a circuit up indication is sent to the routing application.

3.3 Presumption of Reachability

In a stable network there is no requirement to propagate routing information on a circuit, so if no routing information is (being) received on a circuit it is assumed that:

- o The most recently received information is accurate.
- o The intervening path is operational (although there may be no current connection).

If the circuit manager determines that the intervening path is NOT operational routing information previously received on that circuit is timed out. It is worth stressing that it can be ANY routed datagram which triggers the event.

When the circuit manager re-establishes a connection, the application exchanges full routing information with its peer.

3.4 Routing Information Flow Control

If the circuit manager reports a circuit as down, the routing application is flow controlled from sending further information on the circuit.

To prevent transmit queue overflow and also to avoid 'predictable' circuit down messages, the routing application can also optionally limit the rate of sending routing messages to an interface.

4. Implementations

At this stage there is only believed to be one completed implementation.

The Spider Systems' implementation supports all the features outlined for IP RIP-1, IPX RIP and IPX SAP. RIP-2 is not currently supported. It has been tested against itself on X.25 and ISDN WANs. It has also been tested in operation with various router and host RIP-1, IPX RIP and IPX SAP implementations on Ethernet LANs.

Two other Novell-only implementations are known to be under development.

5. Restrictions

Demand RIP relies on the ability to place a call in either direction. Some dialup services - for example DTR dialing - allow calls to be made in one direction only.

Demand RIP can not operate with third-party advertisement of routes on the WAN. The next hop IP address in RIP-2 should always be 0.0.0.0 for any routes advertised on the WAN.

6. Security Considerations

Security is provided through authentication of the logical and physical address of the sender of the routing update. Incoming call requests are matched by the circuit manager against a list of physical addresses (used to make outgoing calls). The routing application makes a further check against the logical address of an incoming update.

Additional security can be provided by RIP-2 authentication [2] where appropriate.

7. References

- [1] Hinden, R., "Internet Engineering Task Force Internet Routing Protocol Standardization Criteria", RFC 1264, Bolt Beranek and Newman, Inc, October 1991.
- [2] Meyer. G., "Extensions to RIP to Support Demand Circuits", RFC 1582, Spider Systems, February 1994.
- [3] Hedrick. C., "Routing Information Protocol", STD 34, RFC 1058, Rutgers University, June 1988.
- [4] Malkin. G., "RIP Version 2 - Carrying Additional Information", RFC 1388, Xylogics, January 1993.
- [5] Malkin. G., and F. Baker, "RIP Version 2 MIB Extensions", RFC 1389, Xylogics, ACC, January 1993.

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