University of Pittsburgh

Telecommuncation Program

Course : TelCom 2310 - Computer Networks
Term : Fall Term 01-1

Project

1. Purpose

The purpose of the project is to design and implement the exchange information component of a *Simple Routing Information Protocol* (SRIP) between *neighbor* routers. SRIP is used to advertize reachability information between adjacent routers in a network environment. This information is exchanged through Sockets in an Internet domain. The protocol has three main features:

- Support for neighbor acquisition,
- Support for ‘‘alive’’ messages, and
- Support for periodic exchange of routing information.

2. SRIP Messages

In order to accommodate these functionalities, the protocol defines three types of messages, namely neighbor acquisition messages, ‘‘alive’’ messages and routing update messages.

2.1 Neighbor Acquisition Messages

The neighbor acquisition messages are used by two adjacent routers to establish ‘‘neighborhood’’ for routing information exchange. This class of messages include *be_neighbors_request*, *be_neighbors_confirm*, *be_neighbors_refuse*, *cease_neighbors_request*, and *cease_neighbors_confirm*. The be_neighbors_request message is used by one router to invite another router to become neighbors.

In addition to the standard fields, the message contains initial values for the *hello interval*, the *update interval*, *router ID*, and any other parameter you see fit in the initialization process. The hello interval determines the amount of time a router waits before it tests if the neighbor is alive. The update interval determines the maximum frequency of routing updates. Additional parameters may include maximum packet length, if required, cost metrics, encryption keys, etc.

Upon receiving a be_neighbors_request message, the invited router can either accept the invitation, in which case it replies by sending a be_neighbors_confirm message, or reject the invitation by issuing a be_neighbors_refuse message. The choice of accepting or rejecting a neighborhood request is made by the system administrator. The neighborhood decision is initially made during the router configuration phase, but can be modified any time thereafter. A router may also refuse an invitation to become a neighbor if it does not run the same version of the SRIP protocol as the requesting router. In case of acceptance, the values of the initial parameters are negotiated during this phase to accommodate the profile of each router.

2.2 Alive Messages

The ‘‘alive’’ messages are sent periodically by one router to test whether the neighbor is still alive. The period is determined by the length of the *hello interval*.

2.3 Routing Update Messages

The routing update messages are sent periodically by a router to convey information about reachable networks to its neighbors. The routing information is used by the router to update its routing table. We will assume that the router uses a distance vector based implementation of the shortest path routing algorithm. Loops are dealt with using either the simple form of ‘‘Split Horizon’’, or the more aggressive ‘‘Split Horizon with Poison Reverse’’.

Each entry of the routing table contains the following information:

- The network identity,
- The number of hops to reach the network
- The address of the first gateway along the path to the specified network.

The basic update messages include :

- Tbl_Hdr Packet : This Packet carries the table header which contains the table sequence number. This number is updated by a router every time a new information is stored in the table.
- Tbl_Entry Packet = This Packet contains information stored in a table entry.
- Tbl_Ovr Packet = This Packet signals the end of transmission of a routing table.
- Tbl_Ack = This packet carries a positive acknowledgement of a previously transmitted packet.
- Tbl_Nck = This packet carries an negative acknowledgement of a previously transmitted packet.
- Tbl_Ftl = This packet signals a fatal error.

The protocol used by a router to transfer the routing table information is driven by the sender; the receiver simply acknowledges each packet it gets. If an error is detected, the receiver sends back a negative acknowledgement which causes the retransmission of the last packet.

The transaction begins when the sender transmits a Tbl_Hdr packet to indicate that a new routing table is to be transmitted. The sender indicates to the receiver the sequence number of the table to be transmitted. Upon receiving an acknowledgement of the Tbl_Entry packet, the sender proceeds to transmit as many Tbl_Entry packets as required, and waits either for a Tbl_Ack or a Tbl_Nck packet. Tbl_Ack and Tbl_Ncks are sent according to the window strategy used (i.e., stop-and-wait, sliding window, etc). A packet, Tbl_Ovr, signals the end of the transmission of the routing table. Finally, a Tbl_Ftl packet reports a fatal error and signals the end of the transaction.

2.3.1 SRIP Packet Format

Ver	Len	Seq	Type	Data	FCS	End

Ver : SRIP Version Number.

Len : Total length of the packet.

Seq : The sequence number of the packet (0<=Seq<64).

Type : The type of the packet, as defined above.

Data : The type of the packet, as defined above.

FCS : Frame Check Sequence

3. Requirements

As a minimum requirement, SRIP must:

- Provide a user interface that can be used to properly configure the protocol version number, update and alive intervals, the neighbor acquisition authorization, and any other parameters as requested by your design. This is only done once at the beginning of the session. The user interface should allow viewing of the information contained in the transmitted and received routing table.
- Handle exchange of routing and control information in typical configurations such as the one depicted in Figure 1. In this figure, a Virtual Router and a Router reside within the same host. The role of the Virtual Router is to randomly generates new routes to a set of destinations and advertize these routes to the local Router. The local Router in turn updates its Routing Table and advertizes new routes to the adjacent routers. Notice that Routers do not advertize routes to Virtual Routers. Furthermore, the same destination can be advertized by different Virtual Routers with potentially different path length.
- Implement at least a stop-and-wait based scheme to handle errors and flow control (a window-based protocol is a bonus).
- The implementation must be able to simulate link failures between routers and handle potential looping due to these failures, using a split horizon based approach.

4. Design Phases

The first phase of the project deals with the design of the protocol architecture. Prior to implementing the system, you must submit an initial design report. The report should include the following:

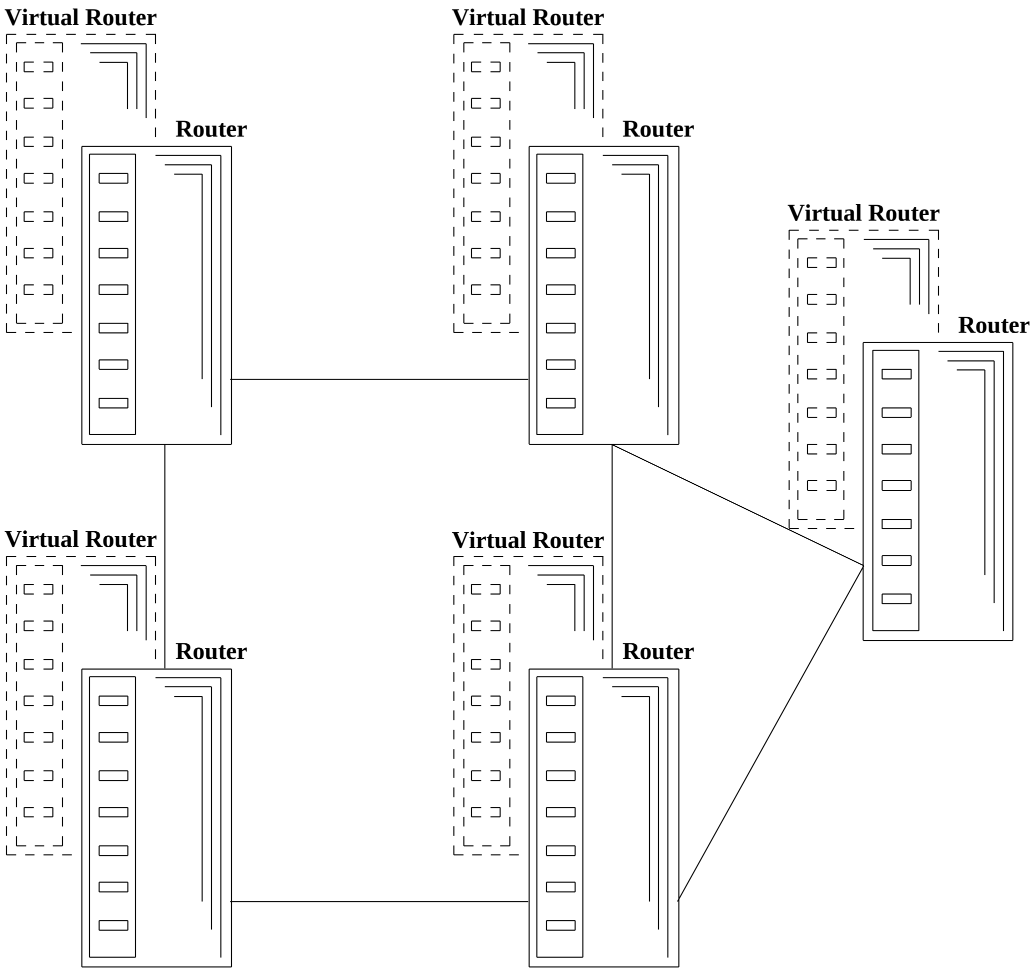

Figure 1. Basic Configuration

- A detailed description of the structure of the user interface. The design of the interface should allow the user to ask and obtain at least one level of help for each command provided at the interface.
- A modular decomposition of each component of the system, a description of the interface between each pair of components, and a justification of your design choices. Careful thought must be given to the design to allow for new functionalities to be added to the system.

The proposed architecture will be evaluated and either **approved** or recommended for modifications.

The second phase of the project is concerned with the implementation of the approved design. As part of the final report, you are expected to discuss the program design and implementation in detail, and justify whatever design decisions you have made. Enclose a well documented **user manual** and a listing of the source code.

5. Due Dates

- **The project Design is Due October 4, 1999**.
- **The project code and final report is due no later than December 8, 1999**.

Each group will be asked to perform a demonstration of the program.