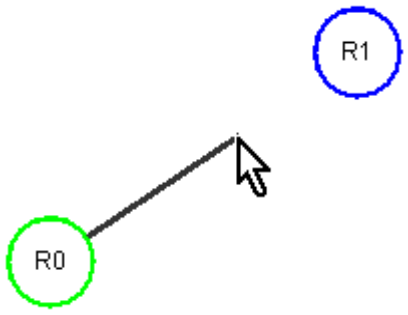
Intra-AS Routing Protocol and Algorithm Simulation

by Andrew Walker

This was a final year project centred on the production of a program capable of demonstrating the behaviour and performance of two fundamentally different Intra-Autonomous System routing protocols in the face of network occurrences such as traffic congestion, link failure and routing loops. The two protocols incorporated into this interactive simulation were the Routing Information Protocol (RIP) and a Link-State protocol based on the main routing protocol in use today, the Open Shortest Path First (OSPF) protocol.

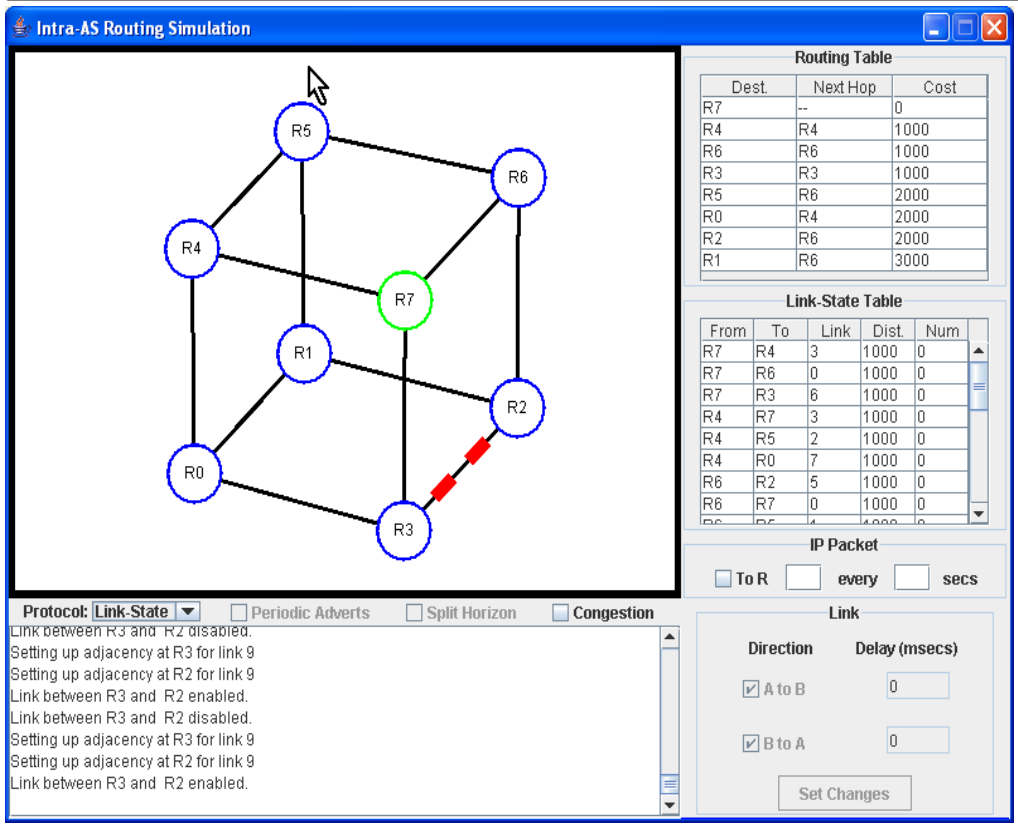


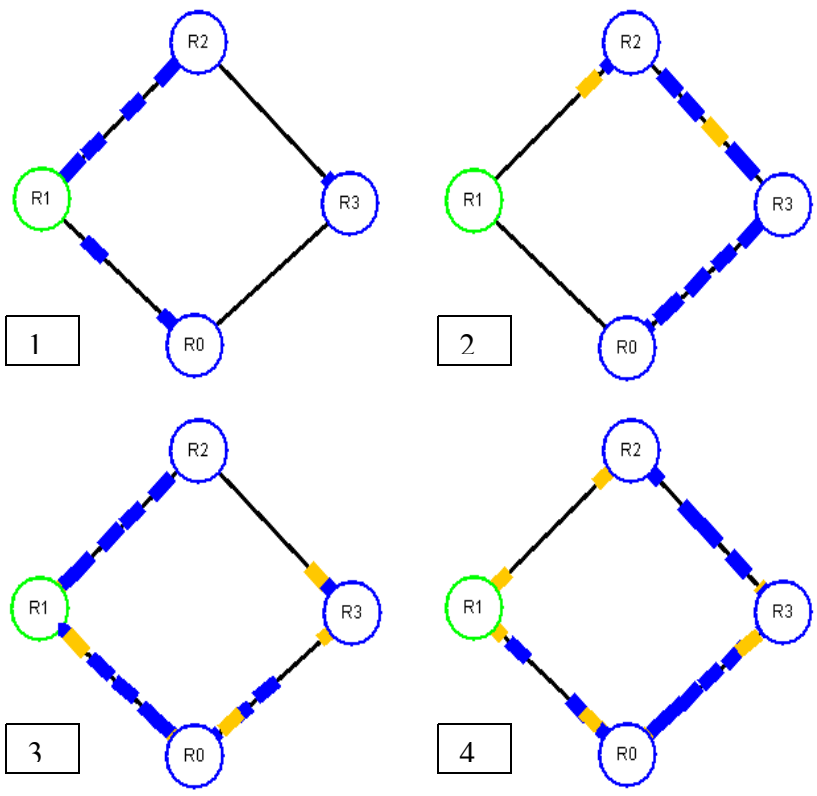
Creating the network

In the program, a user may create new routers simply by double clicking and link them up by dragging the mouse across from one router to the other. The ability now exists to design an abstract graphical representation of the router network that we want to observe…

Observing and Interacting

Once the topology of the network has been completed, the contents of selected routers' routing and link-state tables can be observed on the right hand side of the window. Options exist allowing you to set the state of the network with regards to *the routing protocol in use, routing periodic adverts, anti-routing loop protocol methods, congestion, specific network traffic direction as well as links' propagation delays and directional functionality*. The user may also choose to disable/enable any link at any moment, as well as have a router send specific messages instantly. Communication between routers is presented in the form of animation displaying small colour coded blocks, representing packets, travelling across the links.





Route Oscillation

The four network diagrams on the left display a sequence belonging to a scenario known as *route oscillation* which is to be found in routing protocols using metrics based on dynamic values such as congestion. The diagrams portray a network where all the lower routers are forwarding data traffic (blue packets) to the top router. As we can see, whichever route (clockwise/counter-clockwise) is chosen by the lowest router will suffer the most congestion and as such the alternative direction will soon be chosen as the optimal route, however that will simply make the alternative route the most congested mirroring the previous state and as can be foreseen the routers will have the network traffic oscillating between the two routes, always suffering maximum congestion, as is shown to the left.

Routing Loops

The picture to the right displays a routing loop that has formed as a result of the *count to infinity* problem belonging to RIP. The blue packets represent general data traffic destined for router R6, which has become isolated after the failure of link R5 – R6. Congestion here has caused all routing update packets to have been lost, meaning recovery now lies in the hands of the periodic routing advertisements still to come.