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Q1 Response:

When Routing Information Protocol (RIP) is employed in a ring topology with eight routers, the convergence of all of the routing tables in the network following the failure of a specific router (in this case, R1, as per the provided hint) takes time to update based on the protocol's inherent methodology, which is known as split horizon with poisoned reverse (SHPR). If a router does not hear from its neighbors after 180 seconds, the neighbor that has not advertised will be considered unreachable. This process averts routing loops, and relies on a routing update timer to periodically exchange routing information with neighbors—When R1 fails, it informs its neighbors (R2 and R8) that it is no longer reachable by setting its RIP cost to unreachable (7 denotes unreachable in this case, which is n-1. Note: RIP has a max of 15). Consequently, the routing tables of R2 and R8 are then updated after receiving this information, and subsequently share the updates with their neighbors (R3 and R7). This process continues to cascade through the network until all routers have updated their routing tables to reflect that R1 is unreachable. Accordingly, the time it takes for this information to propagate through the network and update all of the routing tables in the ring topology depends on the update timer interval, which typically sends a RIP response messages or advertisements every 30 seconds and contains up to 25 destination subnets (Kurose & Ross, 2013). Therefore, in the scenario outlined, the routing tables are anticipated to fully converge again after an approximate duration of **210 seconds** since the timer is not dependent on the number of hops, but the 180-second hold-down period + the 30 second update interval would need to be combined. Although the exact duration may fluctuate slightly based on the particular configuration parameters.

After watching the ‘RIP_EXAMPLE’ video in the week 8 & 9 section of course content, it became apparent in the third iteration from the base case, that the most efficient solution for this RIP network will N1 reaching R3 in **6 hops (N-2)**, which is the maximum possibility before being denoted as unreachable.

	R1	R2	R3	R4	R5	R6	R7	R8
Base case	*N2, 1, –*	N1, 3 infinity, R1	N1, 3, R2	N1, 4, R3	N1, 4, R6	N1, 3, R7	N1, 2, R8	*N1, 1, –*
Iteration 1		N1, infinity, –	N1, infinity, –	N1, 4, R3	N1, 4, R6	N1, 3, R7	N1, 2, R8	*N1, 1, –*
Iteration 2		N1, infinity, –	N1, infinity, –	N1, 5, R5	N1, 4, R6	N1, 3, R7	N1, 2, R8	*N1, 1, –*
Iteration 3		N1, infinity, –	N1, 6, R4	N1, 5, R5	N1, 4, R6	N1, 3, R7	N1, 2, R8	*N1, 1, –*
Iteration 4		N1, infinity, –	N1, 6, R4	N1, 5, R5	N1, 4, R6	N1, 3, R7	N1, 2, R8	*N1, 1, –*

In RIP networks, several timers come into play, including the following:

- **Update Timer:** This timer determines how often routers send periodic updates to their neighbors. This interval can affect the convergence time.
- **Invalid Timer**: The Invalid Timer specifies the time a router waits for a route to become invalid. If the router doesn't receive an update for this route within the Invalid Timer, it marks the route as invalid.
- **Hold-Down Timer**: The Hold-Down Timer is triggered when a router receives an update indicating that a route is unreachable or has a higher cost (poisoned route). During the Hold-Down Timer, the router suppresses updates regarding that route to prevent route instability and loops.
- **Route Timeout**: After a route is marked as invalid, it may be retained in the routing table for a certain period (Route Timeout) before it is removed. This allows the router to continue using the route temporarily while looking for alternatives.

The convergence time depends on the interaction between these timers and the specific events in the network, such as the detection of a router failure and the propagation of poisoned routes due to SHPR. The number of hops also plays a role but isn't the sole determinant.

References

Kurose, J. F., & Ross, K. W. (2013). *Computer networking: A top-down approach* (6th ed.). Pearson.