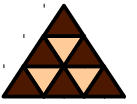


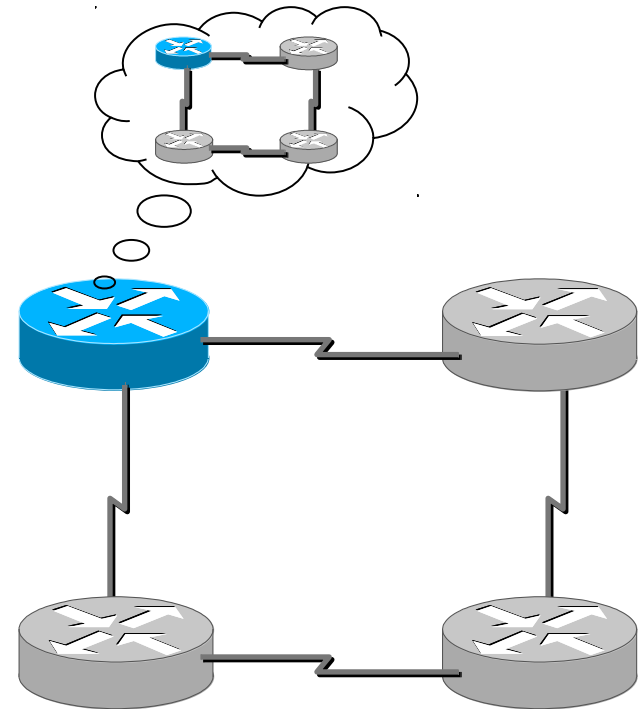
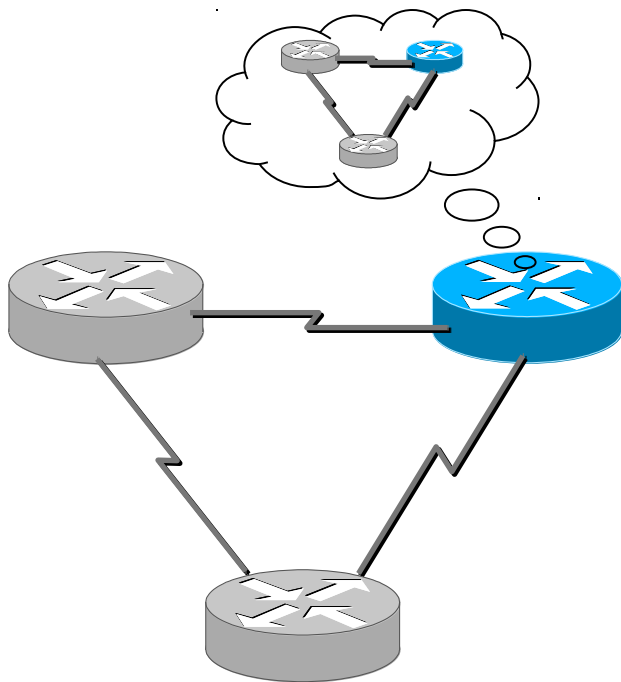
OSPF – Link State Establishment

The IETF Routing Master
Part 2

Basic Principle (1)



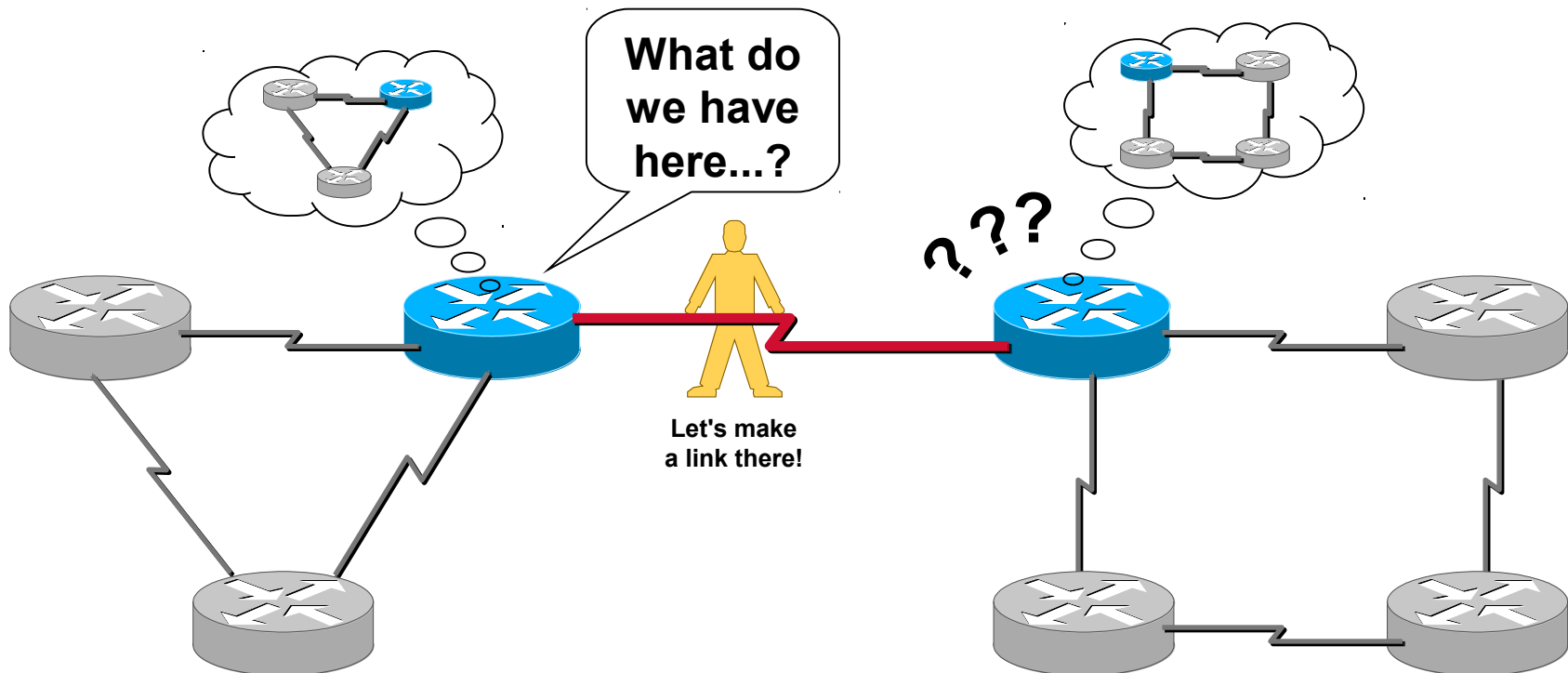
- Consider two routers, lucky integrated in their own networks...



Basic Principle (2)



- Suddenly, some brave administrator connects them via a serial cable...
- Both interfaces are still in the "Down state"

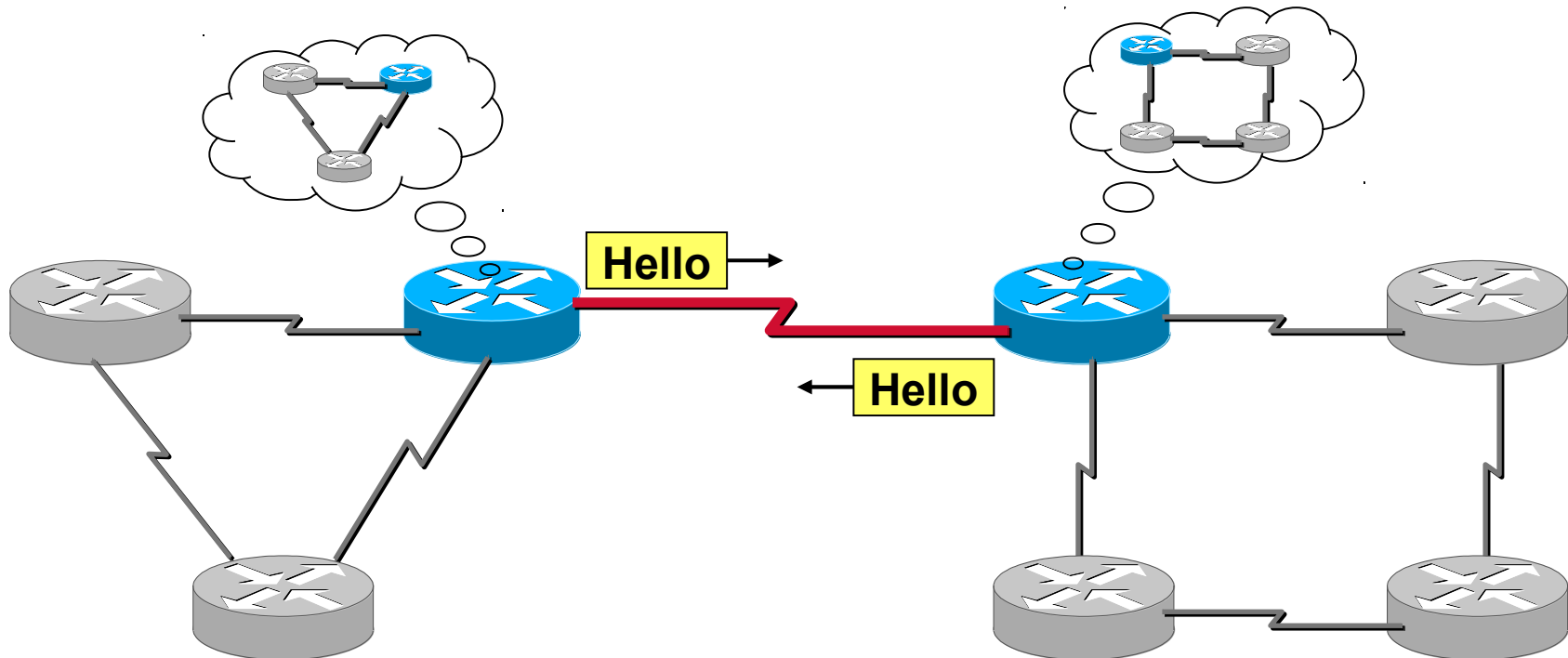


Basic Principle (3)



- **Init state:**

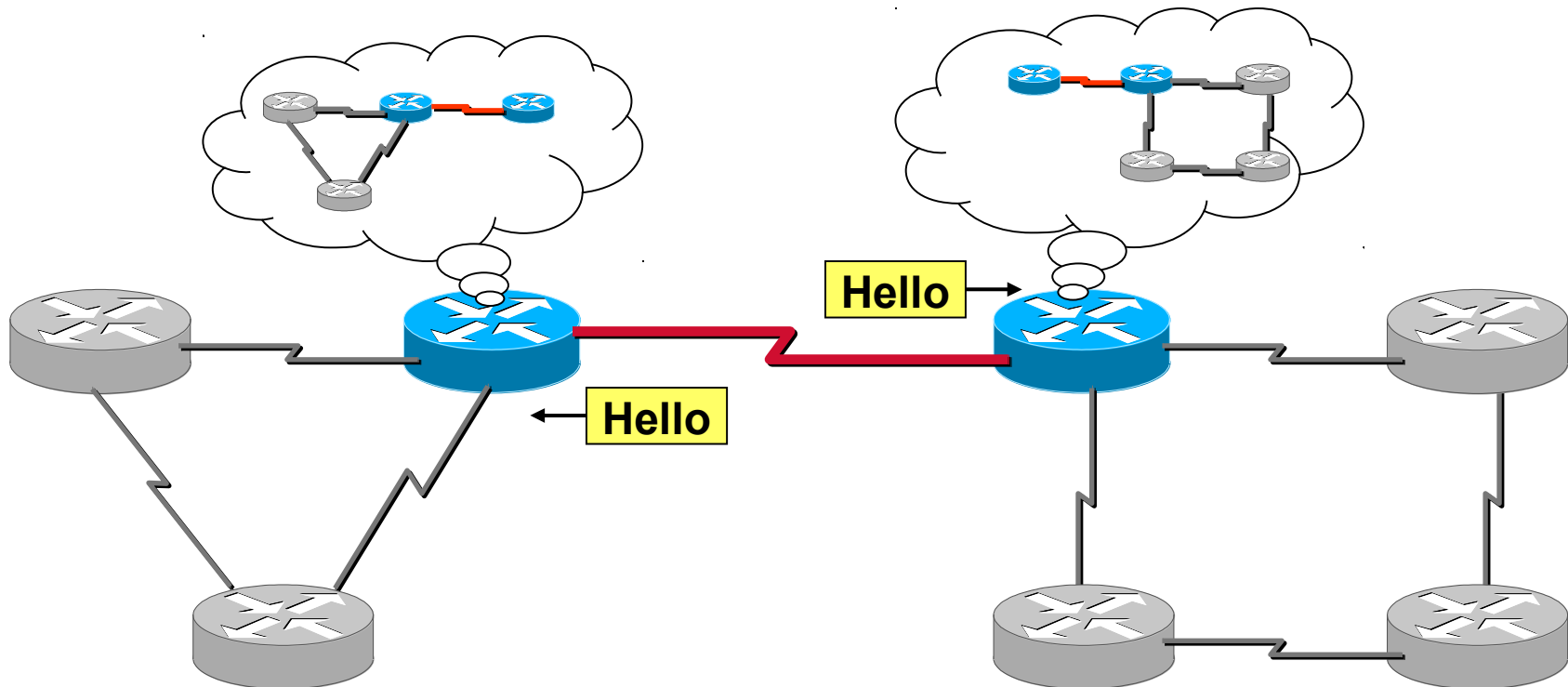
- ◆ **Friendly as routers are, they welcome each other using the "Hello protocol"...**



Basic Principle (4)



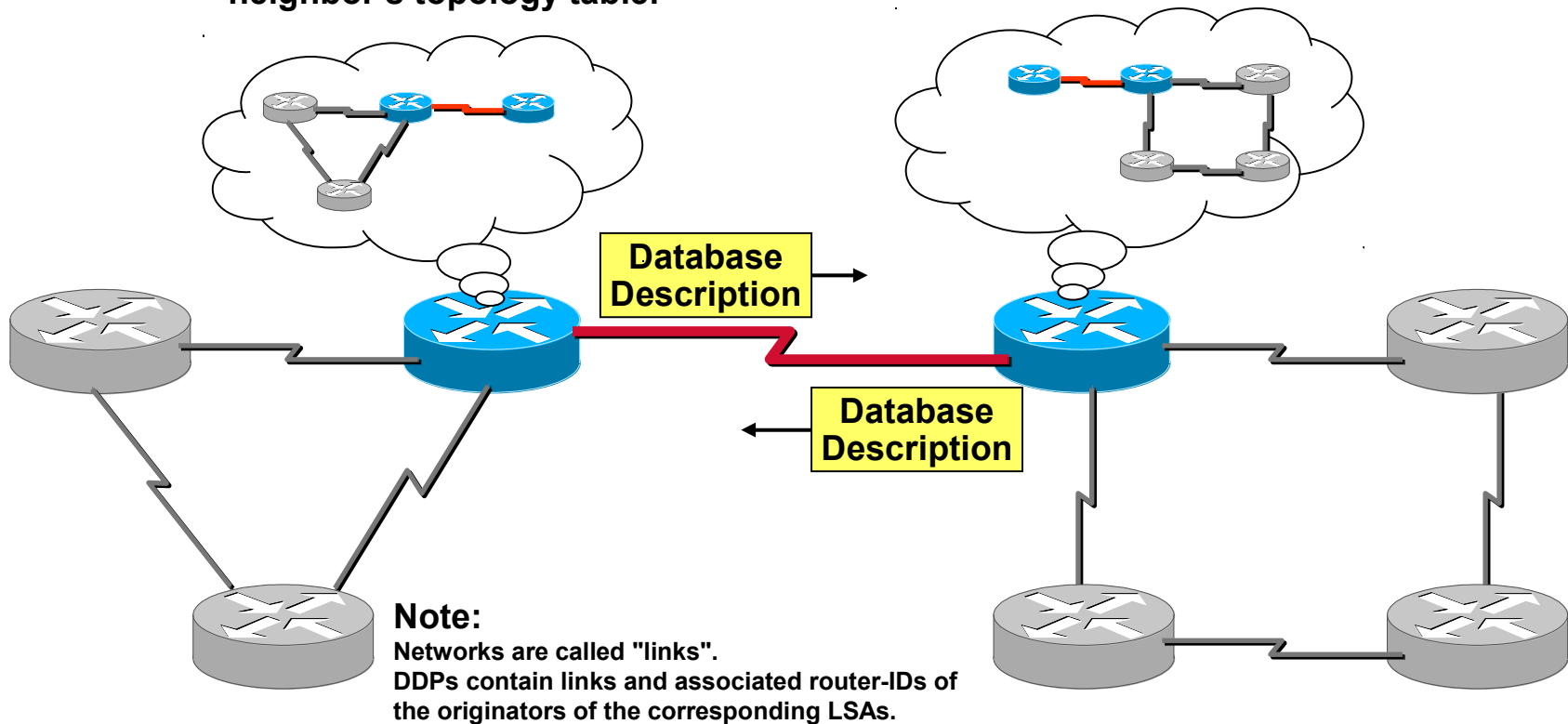
- **Two-way state:**
 - ◆ Each Hello packet contains a list of all neighbors (IDs)
 - ◆ Even the two routers themselves are now listed (=> 2-way state condition)
 - ◆ Both routers are going to establish the new link in their database...



Basic Principle (5)



- **Exstart state:**
 - ◆ Determination of master (highest IP address) and slave
 - ◆ Needed for loading state later
- **Exchange state:**
 - ◆ Both router start to offer a short version of their own roadmap, using "Database Description Packets" (DDPs)
 - ◆ DDPs contain partial LSAs, which summarize the links of every router in the neighbor's topology table.

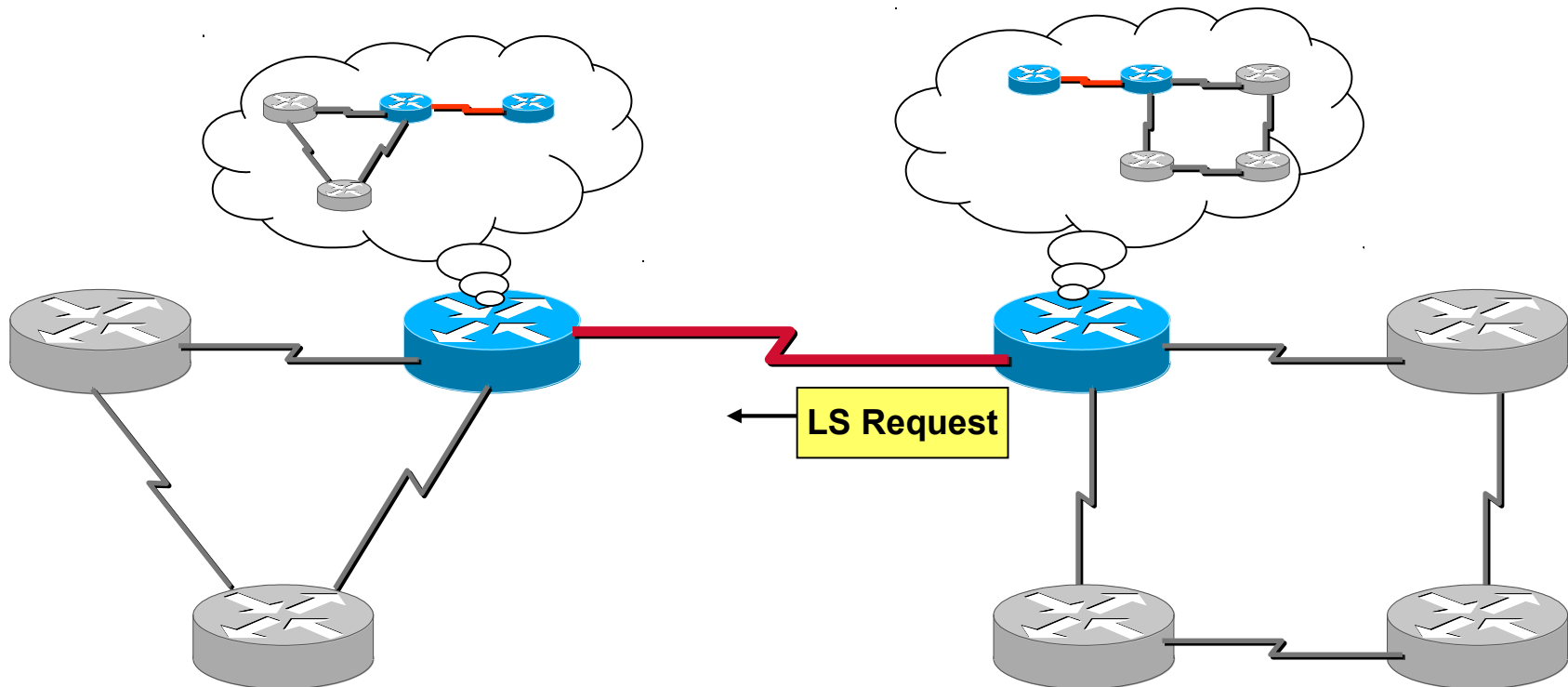


Basic Principle (6)



- **Loading State:**

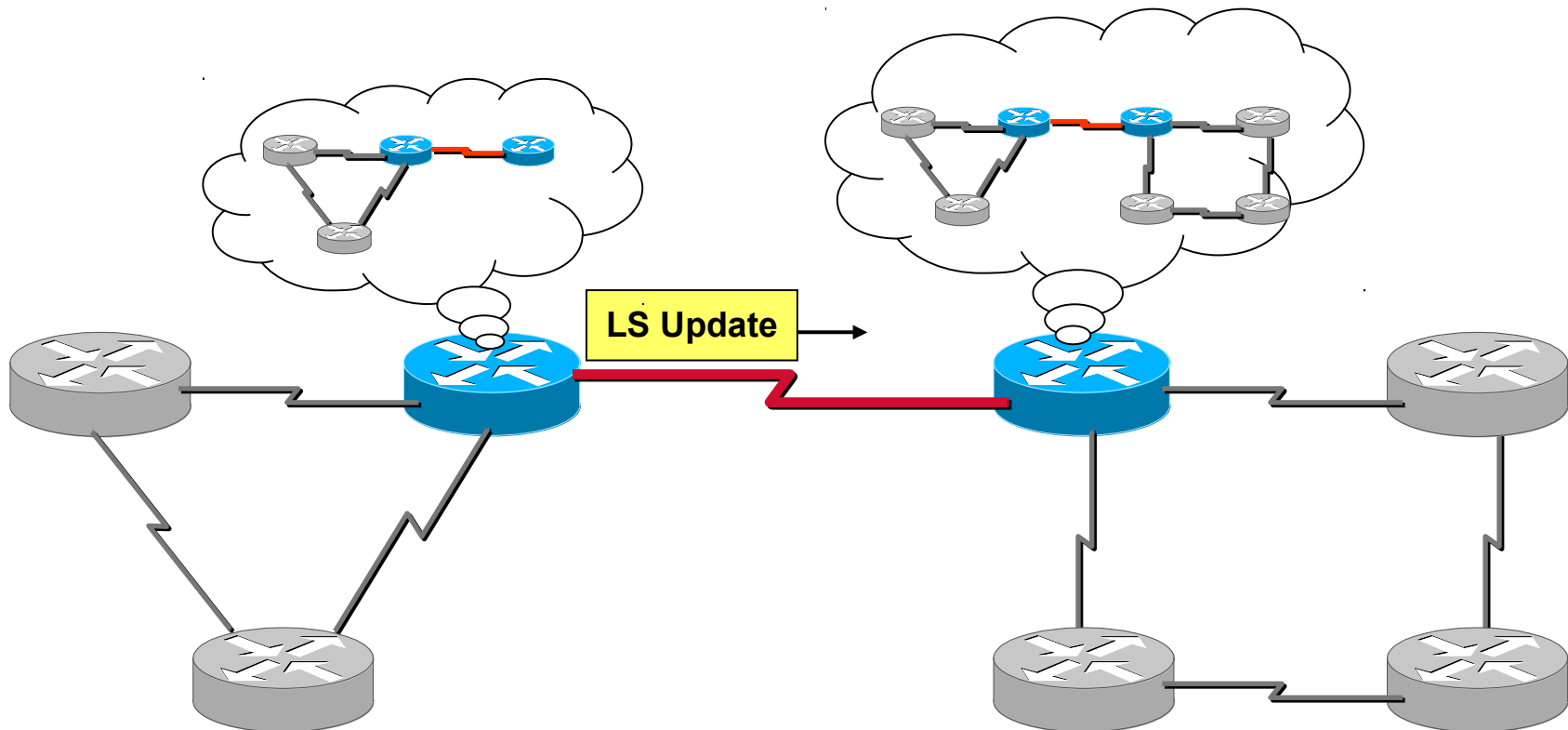
- ◆ One router (here the right one) recognizes some missing links and asks for detailed information using a "Link State Request" (LSR) packet...



Basic Principle (7)



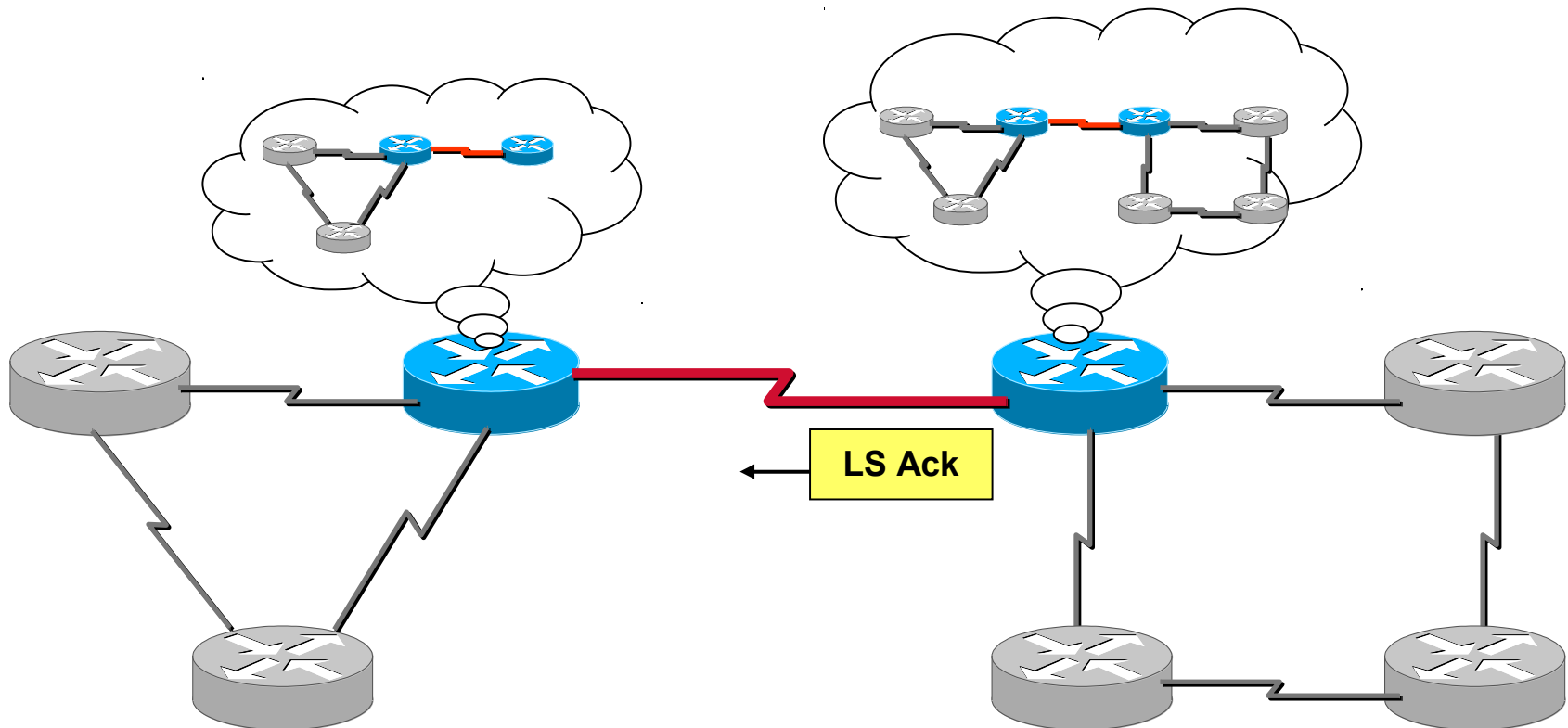
- The left router replies immediately with the requested link information, using a "Link State Update" (LSU) packet ...



Basic Principle (8)



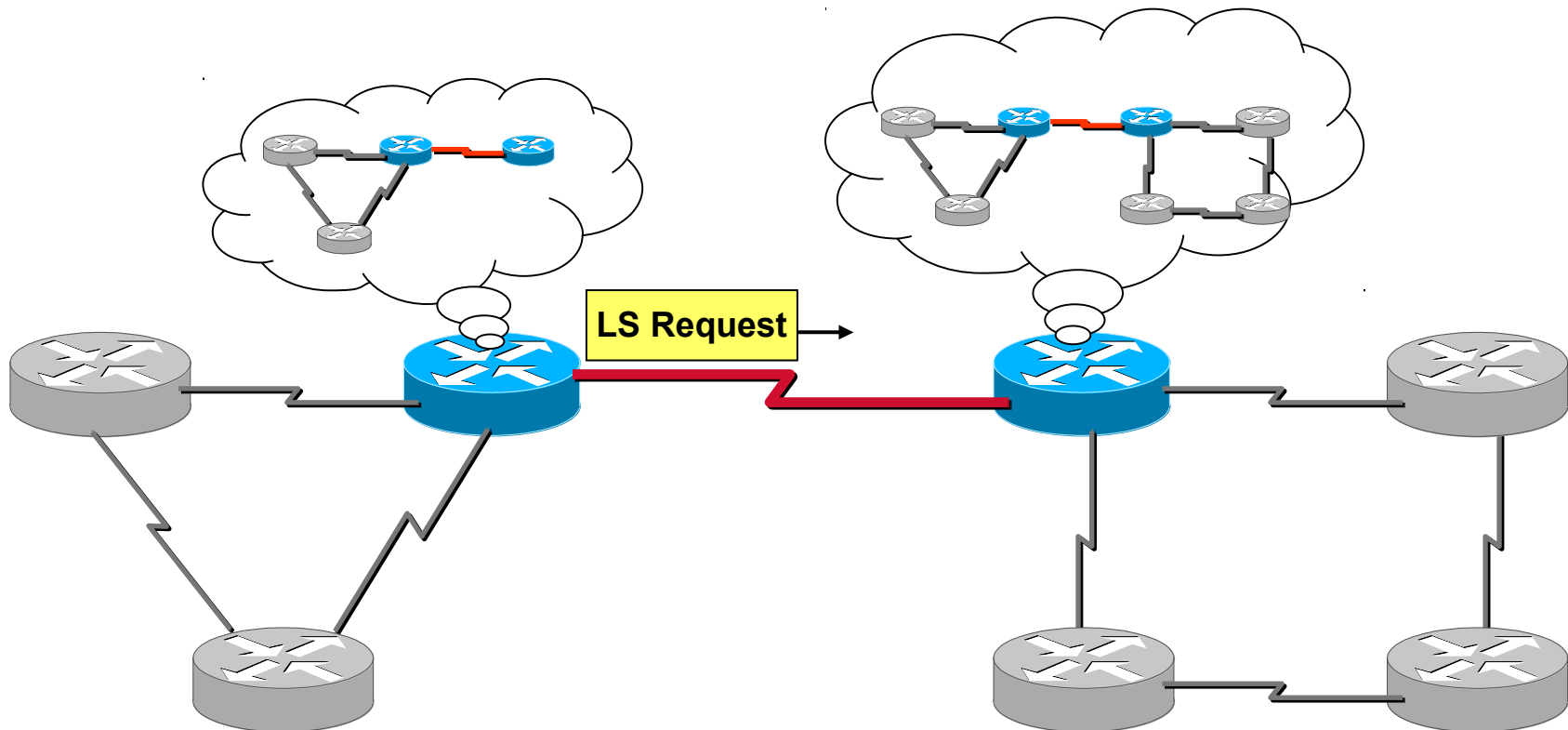
- The right router is very thankful, and returns a "Link State Acknowledgement"...



Basic Principle (9)



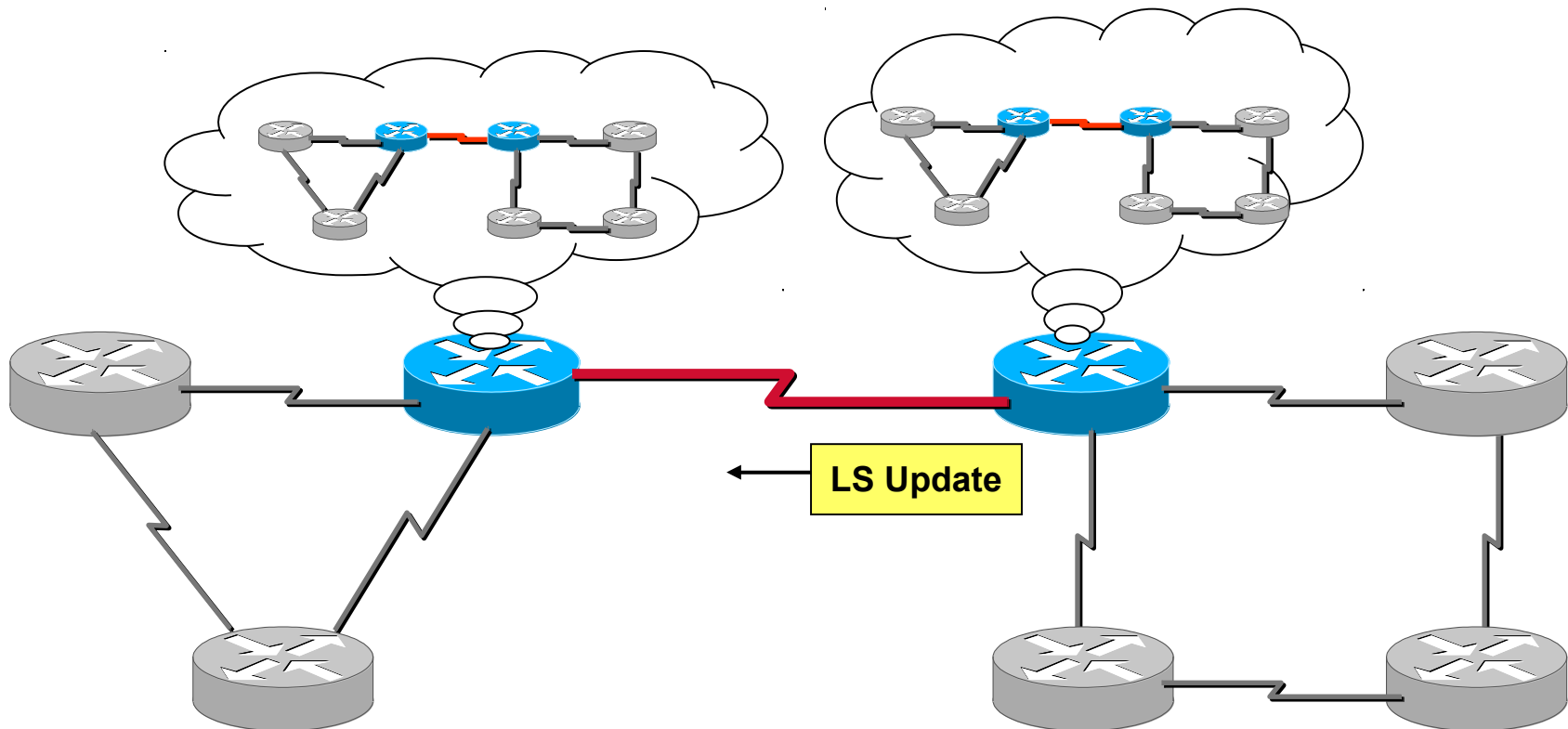
- Then the left router recognizes some unknown links and asks for further details...



Basic Principle (10)



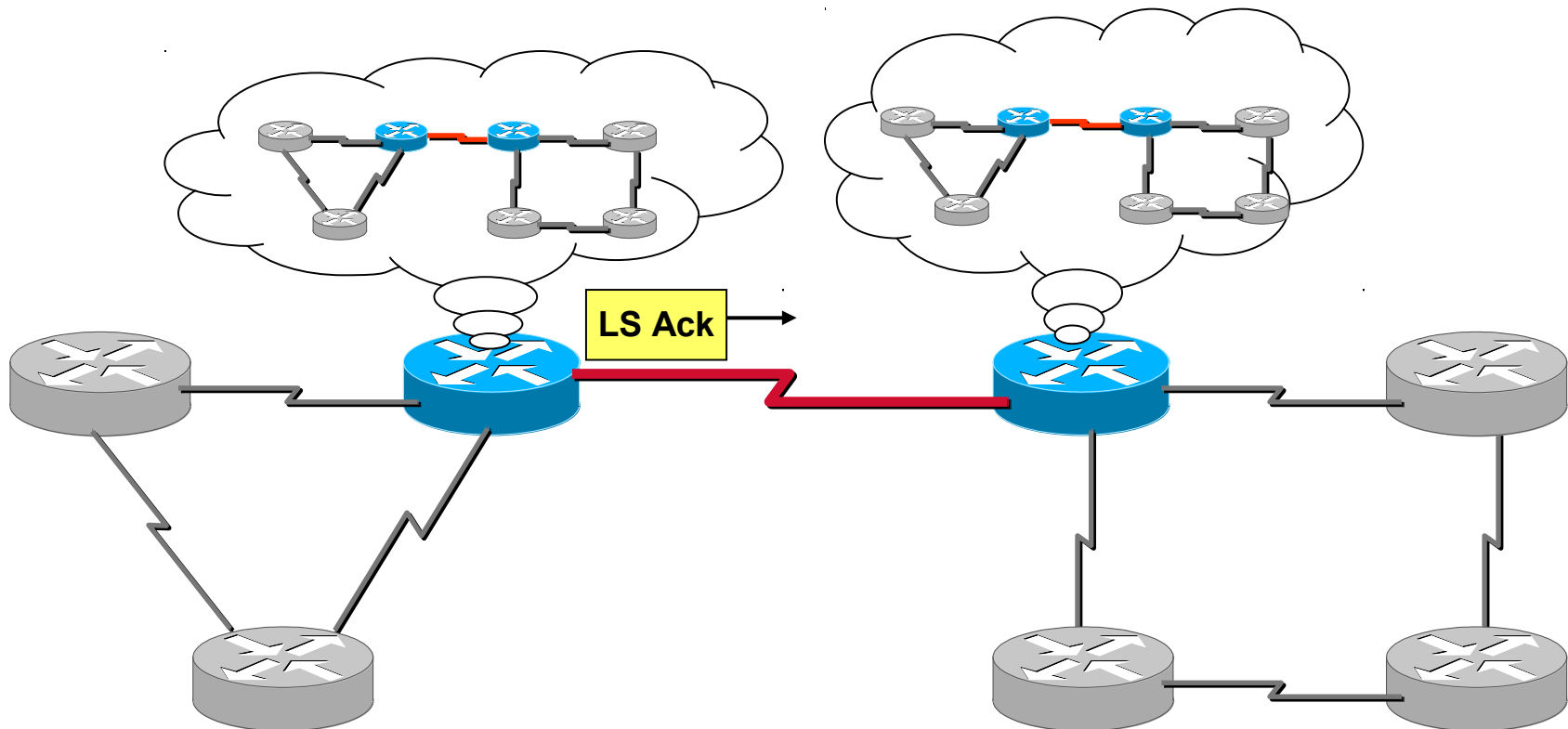
- The right router sends detailed information for the requested unknown links...



Basic Principle (11)



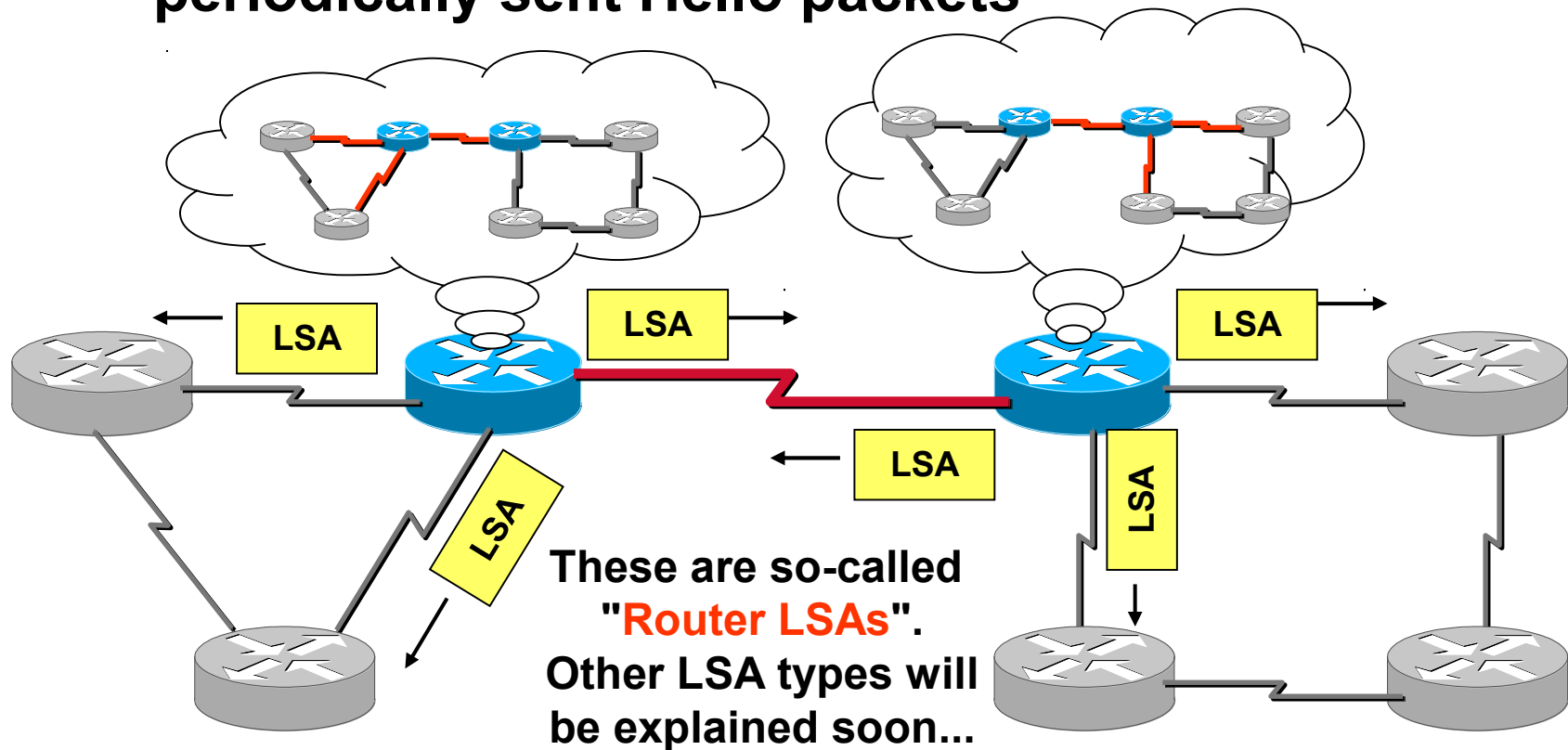
- The left router replies with a link state acknowledgement – **a new adjacency has been established...**
 - ◆ Neighbors are "fully adjacent" and reached the "full state"



Basic Principle (12)



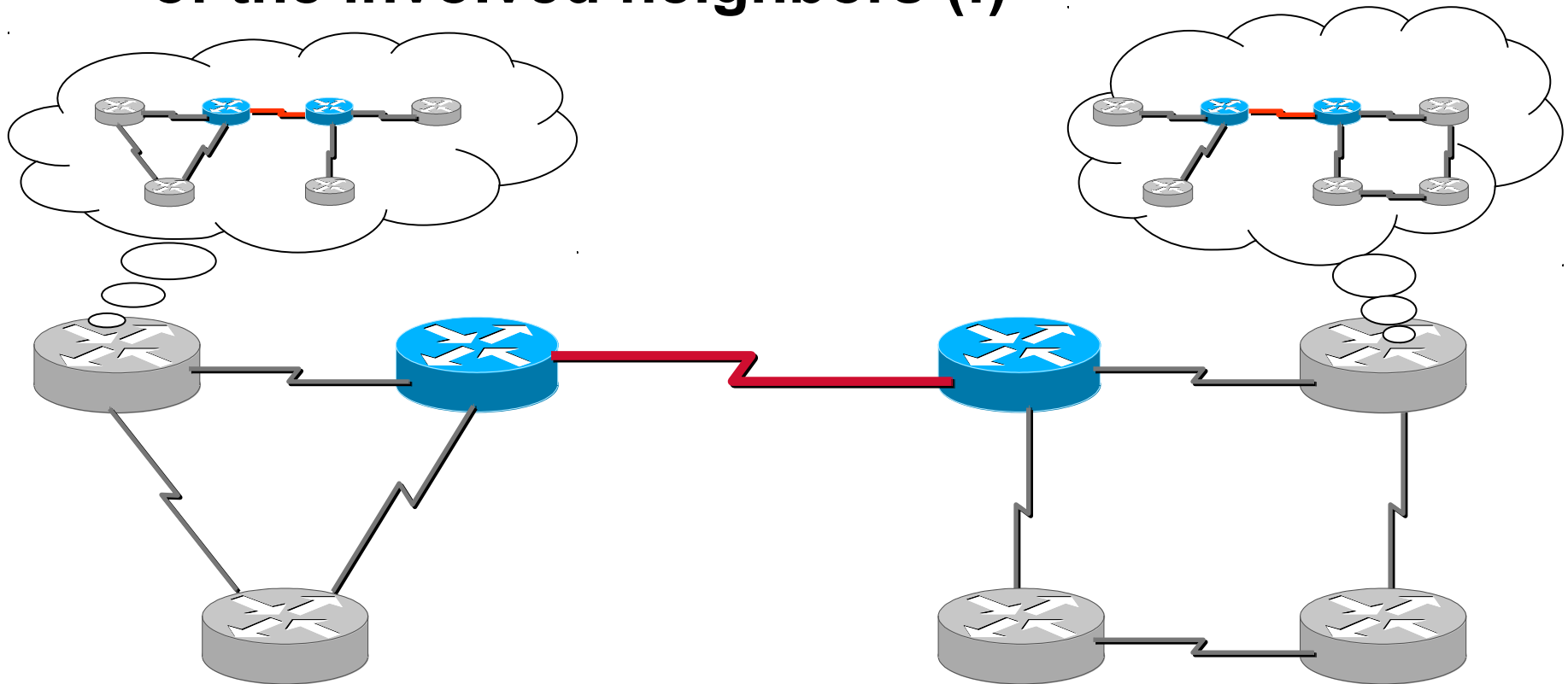
- Both routers tell all other routers about all local adjacencies by flooding link state advertisements (LSAs)
- Both routers now see their own IDs listed in the periodically sent Hello packets

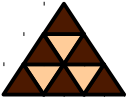


Database Inconsistency



- When connecting two networks, LSA flooding only distributes information of the **local** links of the involved neighbors (!)





- Every router sends its LSAs every **30 minutes (!)**
 - ◆ Long inconsistency times
- Optionally **flash updates** configured
 - ◆ Upon receiving an LSA a router not only forwards this LSA but also immediately sends its own LSAs
 - ◆ Cisco default (can be turned off)

Finally: Convergence!



- When LSAs are flooded, OSPF is quiet (at least for 30 minutes)
- Only Hello's are sent out on every interface to check adjacencies
 - ◆ Topology changes are quickly detected
 - ◆ Default Hello interval: **10 seconds (LAN, 60 sec WAN)**
 - ◆ Hellos are terminated by neighbors