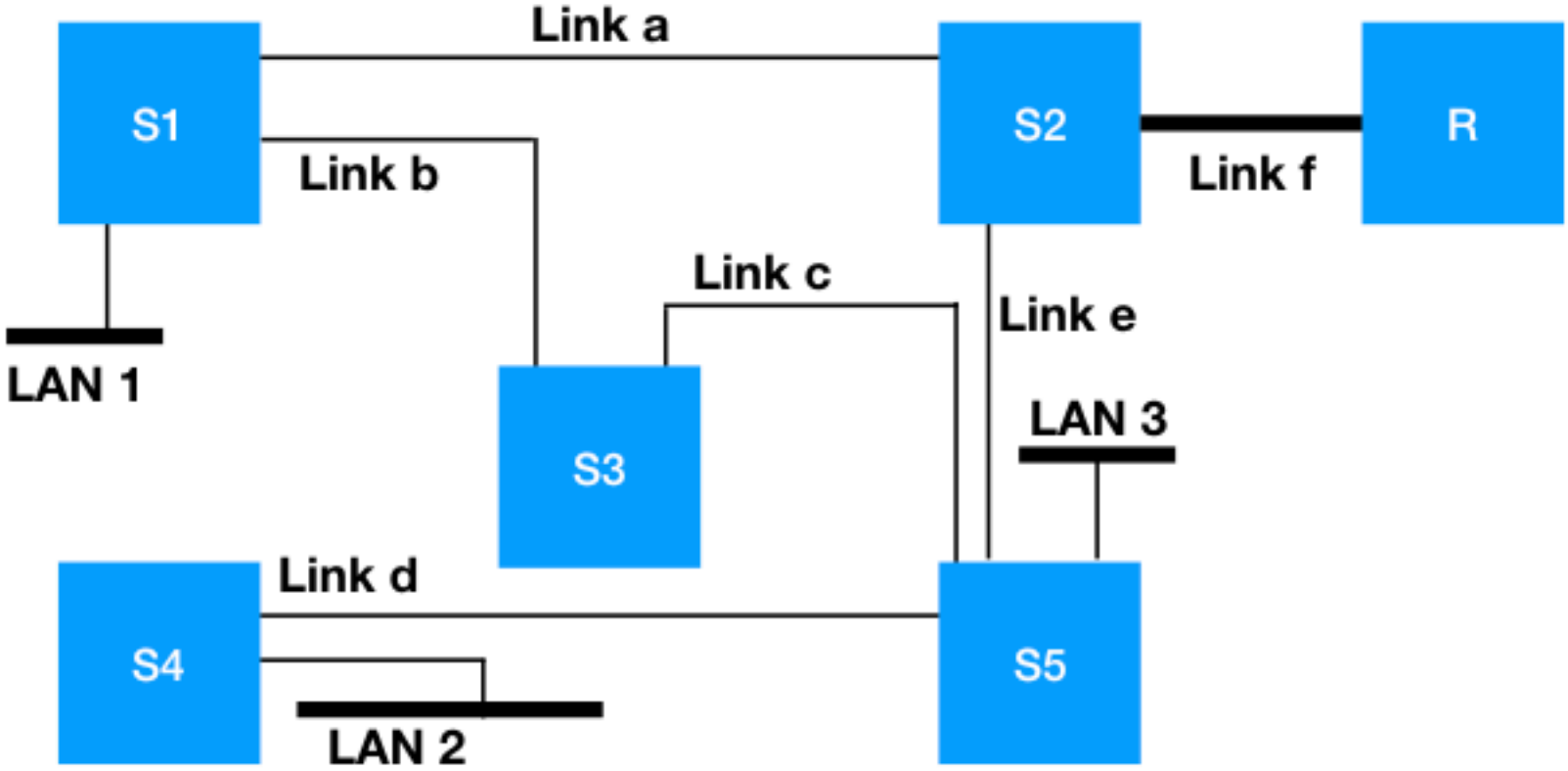
Spanning Tree Tutorial

A company has enabled the Spanning Tree Algorithm (STA) and configured switch S2 so that it becomes the root node.

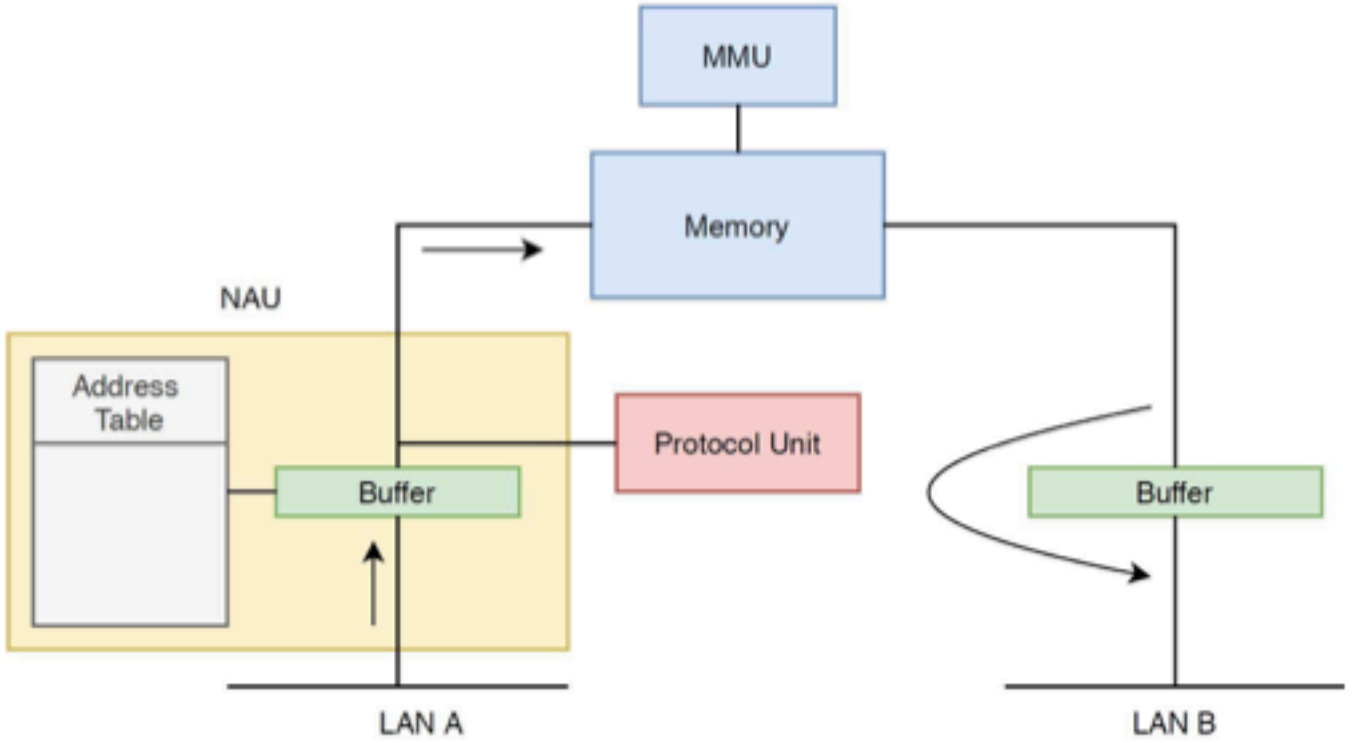
Comment on this choice of a root node, and explain how the algorithm can achieve stable operation.

What happens to the forwarding of frames after link e has failed?

What happens if links b and e both fail?



4 main components of a bridge/switch:



- Network interface for each port which forwards using the address table
- Protocol unit: responsible for Spanning Tree Protocol, and network management.
- Memory: frames are forwarded and buffered using the memory
- MMU: memory management unit implements the queue, sending frames priority order

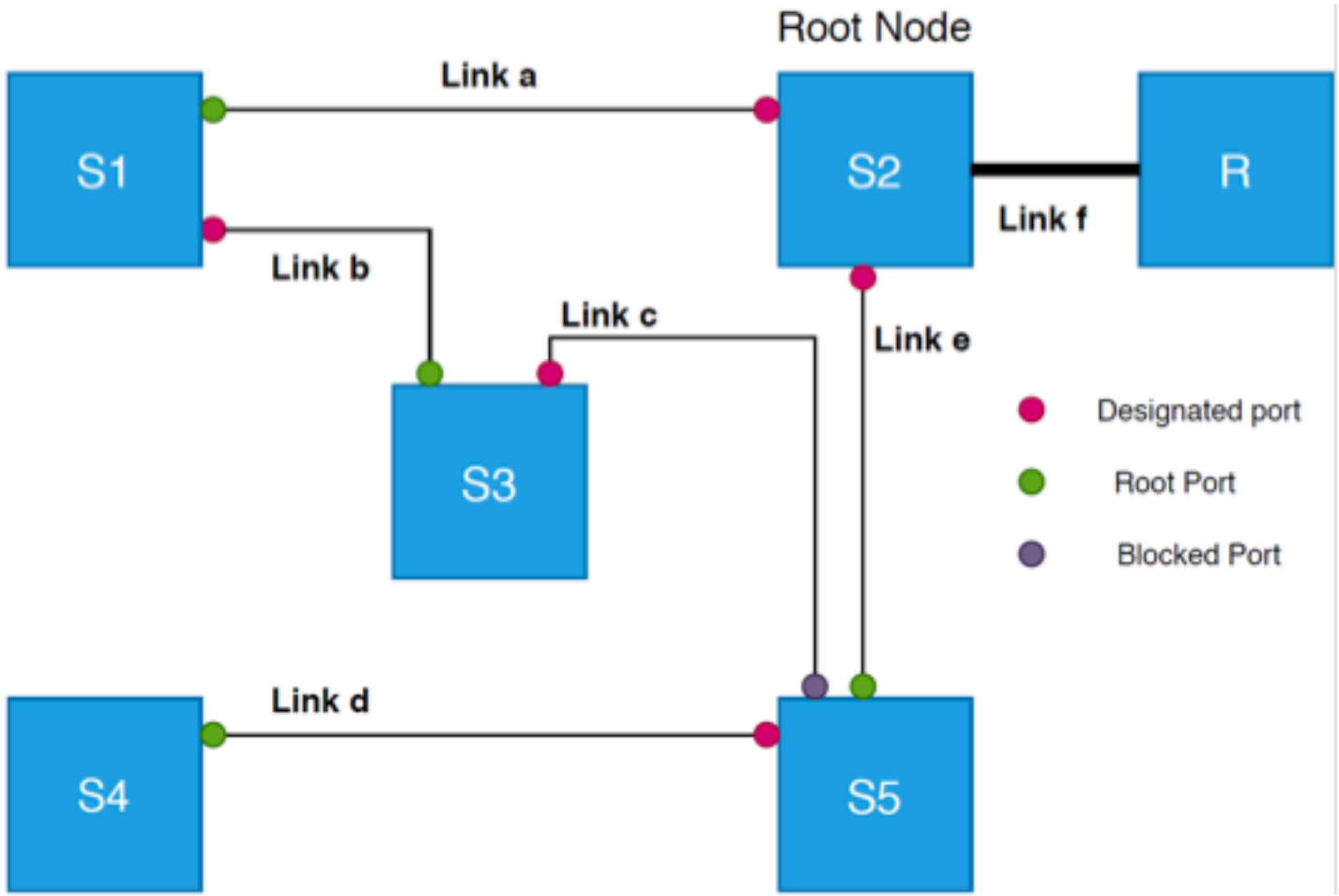
STP is configured by switches, which exchange special frames, called STP frames, or Bridge Protocol Data Units (BDPUs). The spanning tree algorithm for the network is given by the following steps.

1. **Elect a root node** - First, a root node is selected. Usually, this is the switch with the lowest address, which would be S1. However, it has been stated that the root is S2, and for good reason. Presumably, large amounts of traffic will flow through S2 to connect to the router R, which provides a connection to the internet. Therefore, every switch knowing the shortest path to the router would be the most efficient configuration.

2. **Find root ports** - Each port must then find the shortest path to the root node, which is done by exchanging BDPUs. In the case of S3 which has two paths to the root port, it will pick the port that leads to the switch with the lowest address, S1. The port with the shortest path to the root is called a “designated port”, shown by green dots in Figure 1.

3. **Designated ports are chosen** – all ports that face root ports at the other end of a connection are designated ports, shown by the red dots. Following that, if two connected ports are unlabelled, the port at the switch which has the lowest ID is also a designated port. Link C at S3 is an example of this.

4. **Establish blocked ports** – ports which are neither root ports nor designated ports are established as “blocked” ports. No frames will flow from these ports, but they are there as a backup in case one connection is lost. The only blocked port is link link e.



The switch with the lowest ID number will ultimately be elected as the root node

Spanning Tree States

Disabled

Ports in this state have been shut down or are broken. This sate can be entered at any tim

Blocking

This is an enabled port which may cause a switch loop and thus is blocked.

Listening

Acts on information in BPDU's and may go to blocked state or learning state.

Learning

Ports does not forward frames but learns source addresses to be added to filtering table.

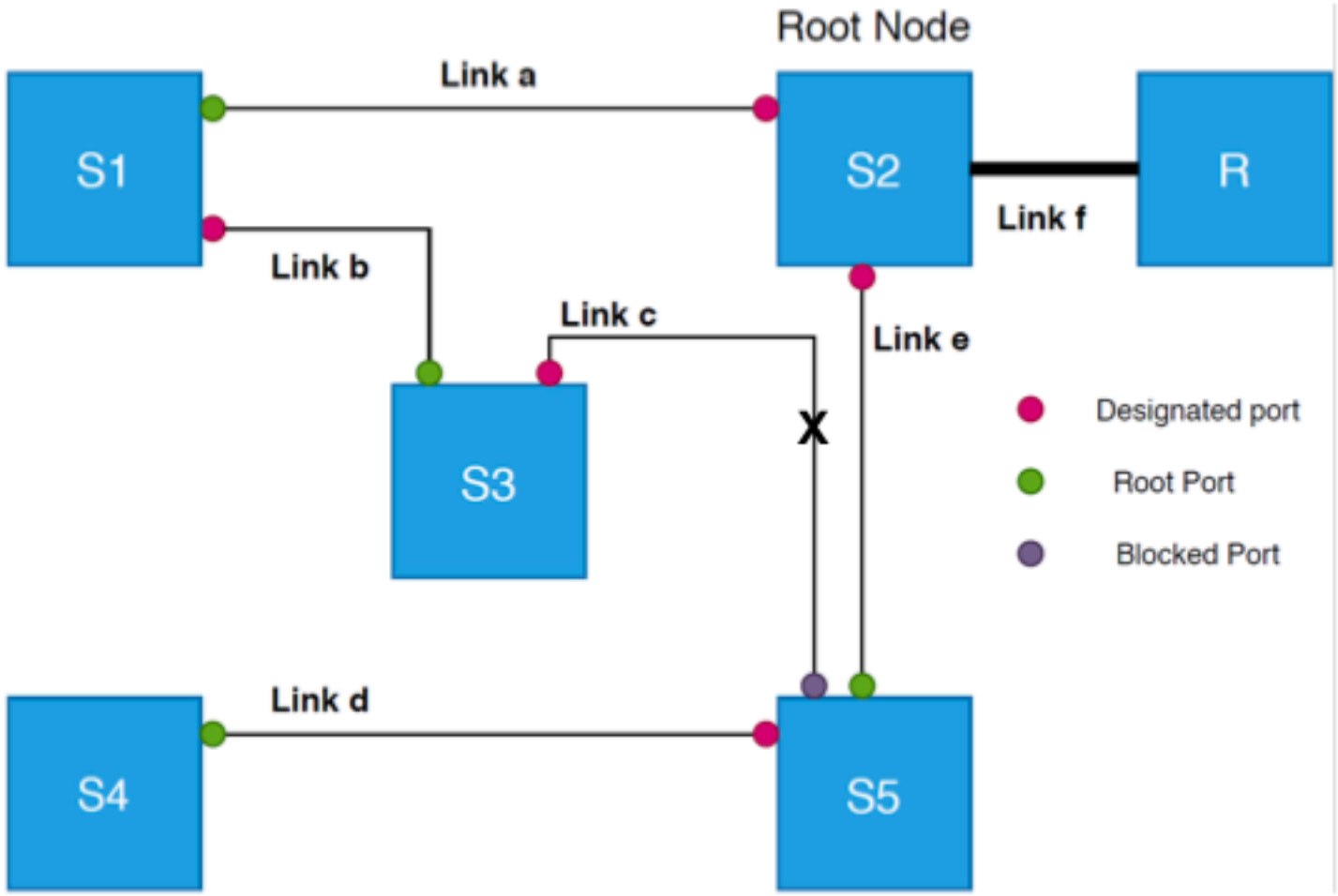
Forwarding

In this state the port sends and receives data.

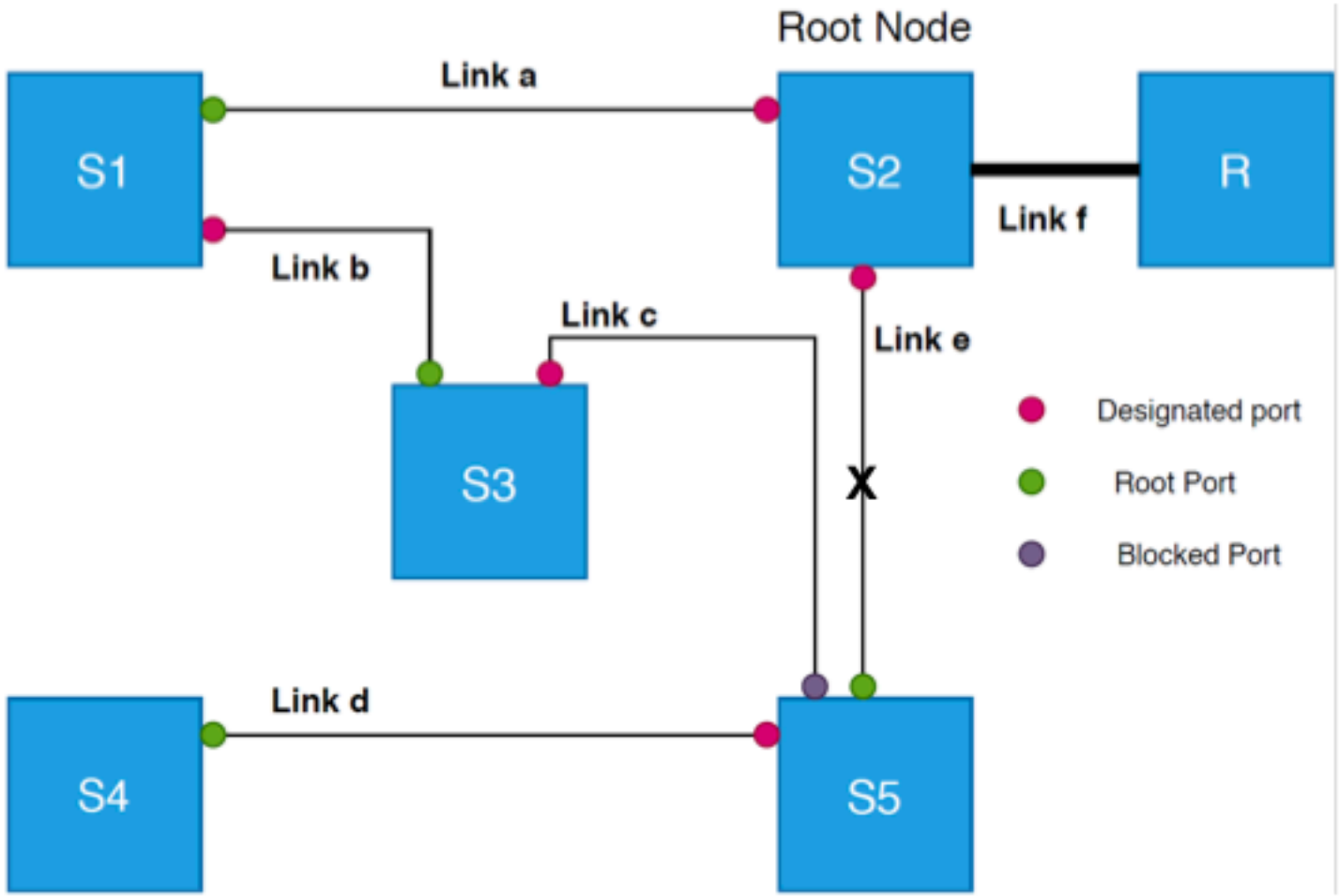
Switches select the best connection towards the root node for forwarding. Redundant links are then blocked.

All switches communicate with each other using bridge protocol data units or BPDU's sent by the Protocol Unit - A general purpose processor responsible for management.

What happens to the forwarding of frames after link e has failed?

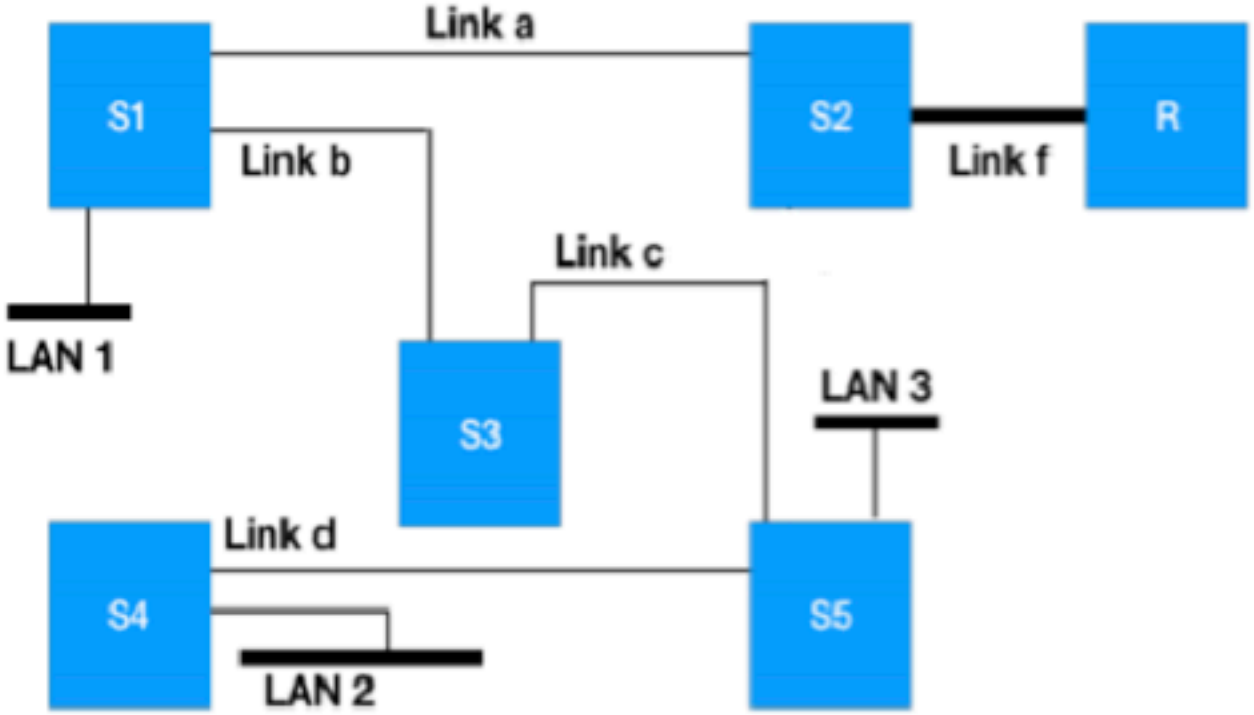


If link E were to fail, frames will no longer be able to pass from S2 to S5.



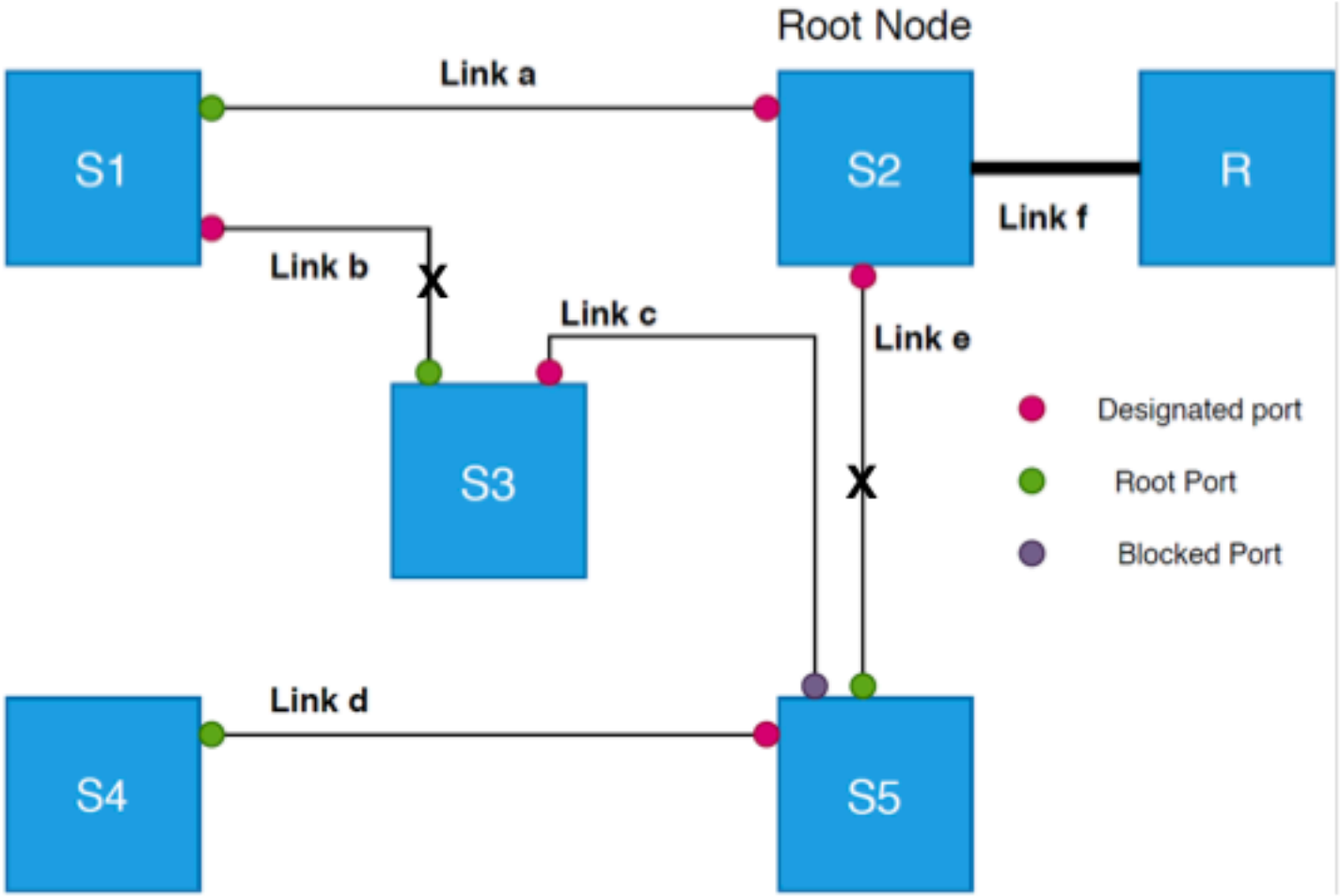
The spanning tree algorithm will reconfigure, unblocking link C at S5
Frames can then travel from S2 via S1 and S3.

Reconfigured LAN forwarding:



It will take packets longer to reach the company servers, an important part of the network, but it is still functioning.

What happens if links b and e both fail?



Significant problems will occur if both B and E fail. Switches S3, S4 and S5 will no longer be connected to the network, which is said to be “partitioned”.

What happens if links b and e both fail?