Alternative to Traditional Routing

An Implementation of OpenFlow

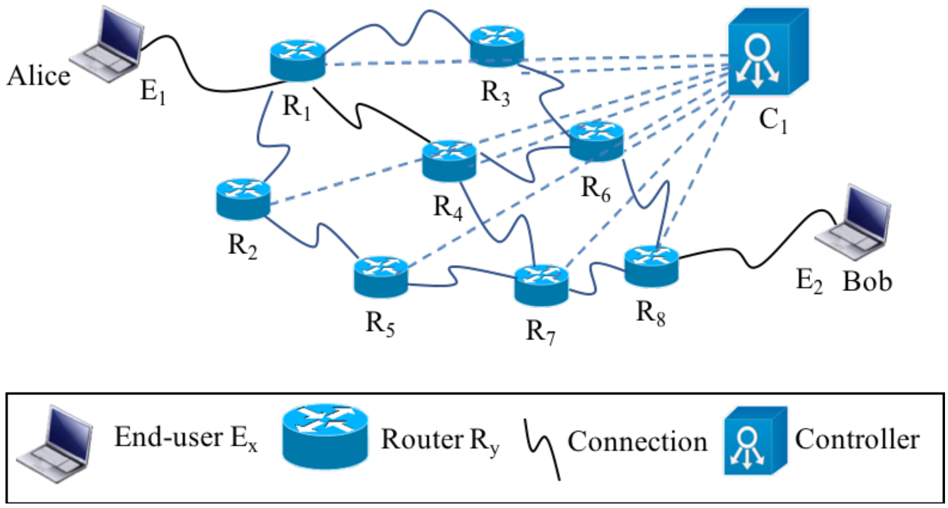

Figure 1: An example scenario that shows a number of routers R1 to R8 and a controller C1. When routers start, they connect to the controller and receive a configuration for flows from the controller.

Assume that you are working for a manufacturer of network equipment and have been asked to implement a version of OpenFlow for the communication between controllers and number of routers of the company. Your task is to implement the controller- and router-side of the protocol, as well as design your version of the protocol. Every router should have a flow table and the messages from the controller will be used to change the content of the flow table. You can assume that a controller will be start first and is present when routers are starting.

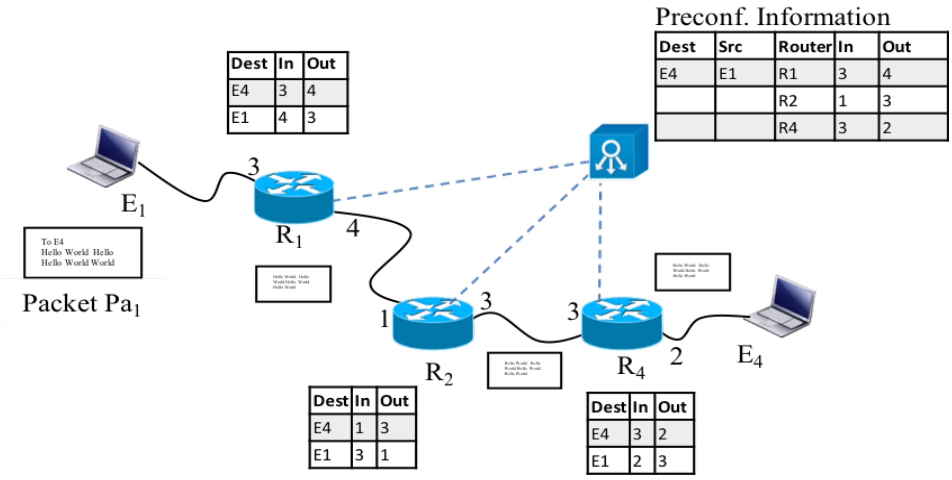

Figure 2: Scenario of a delivery of packet Pa_1 from E_1 to E_4. The message flows along the path on the data plane while the routers receive information about flows from the controller on the control plane.

The focus of this assignment is the implementation of the OpenFlow protocol, the implementation of flow tables in the routers and the message types that support the configuration of switches through a controller.

At the start of an execution, the controller will be started and wait for connections from routers. Once routers are started, they will contact the controller with a *Hello* message. The controller should respond to this message with its own *Hello* message, followed by a *FeatureRequest* message, etc. When a router receives a packet from an endpoint, it should try to route the packet depending on its flow table. If an incoming packet from an endpoint does not match an entry in the flow table, a router should contact the controller and ask how to proceed. The controller should have preconfigured (hardcoded) routing information and should inform all routers along a path, when it is contacted about a packet entering its network. For example if E_1 would send a packet Pa_1 addressed to E_4 to R_1, R_1 would contact the controller, which then would look up how to get from R_1 to E_4 and send configurations to R_2, R_4 and R_1 about a new flow. Subsequent packets from E_1 to E_4 should not require any messages between the routers and the controller.

As an extension, you could provide the controller with an implementation of a Link State or Distance Vector Routing approach instead of the preconfigured routing information. In this case, the individual routers should have preconfigured/hardcoded information about their connections to other routers and end-devices. At the start of the execution, the routers would inform the controller about their connections and the controller would build a routing table that would then be used to guide incoming packets through the network.

The implementation should be accompanied by a report that explains the design and implementation of the protocols, the choices that you have made and the advantages and disadvantages that these decisions introduced. The description of the design should be accompanied by snapshots of some of the packets that were transmitted by your implementation. The explanations of the packets should highlight the management information in these packets and illustrate how this information is used by your implementation. The report should conclude with a reflection on the assignment as a whole, what went well for you and what you could have done better, and an estimation of the time that you spent on the assignment.

Submission Details

The files that contain the implementation and the report should be submitted through Blackboard. Every file should contain the name of the author and the student number. The source files of the implementation should be submitted as an archived file e.g. ".zip" or ".tar.gz". The report should be submitted as either word- or pdf-document.

The name of the archive file and the report should be include the name and the student number of the author; for example, "123456-John-Doe-FlowC-Implement.zip" and "123456-John-Doe-FlowC-Report.pdf" where the name of the student is John Doe and the student # is 123456. The deadline for the submission is given in Blackboard.

Marking Scheme

The marks for the implementations will be split 50% for the implementation and 50% for the documentation through the report.