

FACULTAD DE INGENIERÍA DEPARTAMENTO DE TECNOLOGÍAS DE INFORMACIÓN Y COMUNICACIONES

CÓDIGO – MATERIA : xxxxx – Redes Definidas por Software.

REQUISITO : Redes de Computadores II.
PROGRAMA - SEMESTRE : Ingeniería Telemática - 8

PERIODO ACADÉMICO : 2018-1 INTENSIDAD SEMANAL : 3 HORAS

CRÉDITOS : 3

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Laboratorio - Controlador ONOS

Objetivo Práctica Laboratorio

INTEGRAR el controlador SDN ONOS con una red desplegada en la herramienta mininet.

CONTRASTAR el controlador SDN ONOS con algunos controladores SDN presentes en el mercado actual.

Requisitos Laboratorio

Para el correcto desarrollo de este laboratorio es necesario contar con lo siguiente:

- Máquina virtual del Laboratorio Preparación Ambiente.
- Mininet.
- Acceso a Internet.
- Máquina virtual controlador.

Actividades Laboratorio

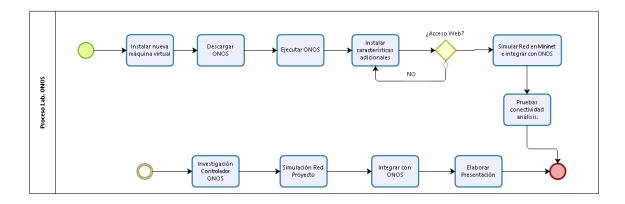


Diagrama 1. Proceso Laboratorio

Instalación Controlador ONOS

ONOS, es un controlador SDN, que admite tanto la configuración como el control en tiempo real de la red, lo que elimina la necesidad de ejecutar enrutamiento y conmutar los protocolos de control, dentro de cada equipo de la red. Al trasladar la inteligencia al controlador ONOS (que puede ser ejecutado en la nube), se habilita la innovación y los usuarios finales pueden crear fácilmente nuevas aplicaciones de red, sin la necesidad de alterar los sistemas actuales (Open Network Foundation, 2017).

Es importante tener en cuenta, que esté controlador debe instalarse en una máquina virtual diferente, considerando los siguientes recursos:

• CPU: 1 Núcleo.

Memoria RAM: 2 GB.Almacenamiento: 20 GB.

Red: Modo NAT/Conexión Puente.

Para evitar problemas a la hora de ejecutar este controlador SDN, deberemos detener el servicio del ovs-testcontroller instalado en prácticas anteriores:

```
sudo systemctl stop openvswitch-testcontroller
```

Primero, debemos descargar el controlador ONOS de la siguiente manera:

```
wget -nd -c "http://downloads.onosproject.org/release/onos-
1.5.1.tar.gz"
tar -xf onos-1.5.1.tar.gz
cd onos-1.5.1
```

Para ejecutar el controlador SDN ONOS, ejecutamos el siguiente script:

```
sudo ./bin/onos-service
```

Ahora bien, ya que la arquitectura de ONOS se basa en los microservicios, debemos instalar una serie de características adicionales para lograr tener una operación optima del controlador:

```
feature:install -v onos-app-fwd onos-host-provider onos-openflow onos-
openflow-base
```

Acceso Web

Una de las características que instalamos, nos permite acceder via web al controlador ONOS, para poder gestionarlo. Para acceder utilizamos la siguiente dirección:

```
http://Dir IP ONOS:8181/onos/ui
```

La siguiente es una captura de pantalla del acceso web a ONOS:

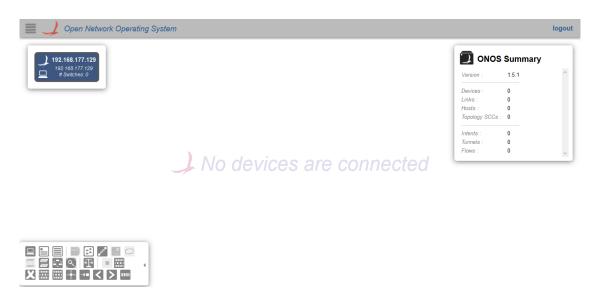


Imagen 1. Vista Web ONOS

Las credenciales para el acceso son:

Usuario: karafContraseña: karaf

Simulación con Mininet y ONOS

Iniciamos una nueva instancia de ONOS, y configuramos la siguiente topología de red en Mininet, está topología debemos conectarla con el controlador ONOS:

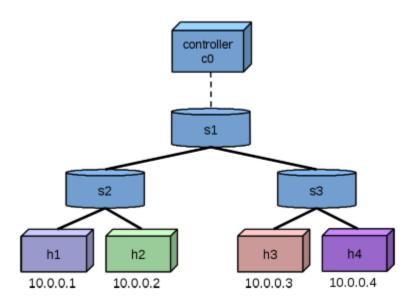


Diagrama 2 Topología de Red

Recuerden utilizar los comandos aprendidos en la práctica de laboratorio de Mininet.

Una vez tengan simulada la red y conectada con ONOS, realiza una prueba de conectividad con todos los nodos y revisa:

¿Qué cambios se pueden presenciar en el controlador ONOS? Revise la topología y los nodos, en el menú lateral de la herramienta web.

Una de las ventajas a la hora de utilizar el controlador ONOS, es que permite analizar los flujos de tráfico generados en nuestra red con mayor facilidad. Así pues, realicé lo siguiente:

Realicé pruebas de flujos de tráfico con iperf y HTTP. Utilicé los siguientes enlaces como guía: http://mininet.org/walkthrough/ http://mininet.org/sampleworkflow/. Evalué los flujos de tráfico desde la herramienta web de ONOS. ¿Cómo un controlador SDN y esté tipo de soluciones, apoya en la gestión de una red de comunicaciones? Investigué los problemas comunes a los que se enfrentan los administradores de red en su labor, para realizar un mejor análisis.

Ahora bien, iniciamos una captura de tráfico en Wireshark y pasamos a analizar el tráfico del protocolo OpenFlow, las pruebas de iperf y HTTP en nuestra topología de red. Debemos obtener una captura como la siguiente:

208 5.343966773		202120012001200	201012120		2200 100 22101 821 00000 201 0
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211 5.499561799 192.168.206.130 19.0.2.15 0penFlow 62 Type: OFFT BARRIER REQUEST 192.168.206.130 0penFlow 62 Type: OFFT BARRIER REPLY 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1095 Ack=16039 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=21879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=2151 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=2151 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1287 Ack=23879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1287 Ack=23879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1287 Ack=23879 Win=65535 Len=0 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1287 Ack=23839 Win=65535 Len=0	209 5.348316710	10.0.2.15	192.168.206.130	OpenFlow	194 Type: OFPT_PACKET_IN
211 5.499561799 19.2.168.206.130 19.2.15 OpenFlow 62 Typt: OFPT_BARRIER_REQUEST 19.2.168.206.130 19.2.15 OpenFlow 62 Typt: OFPT_BARRIER_REQUEST 19.2.168.206.130 19.2.15 TCP 60 6653 - 36710 [ACK] Seq=1095 Ack=16039 Win=65535 Len=0 214 6.487919389 192.168.206.130 19.0.2.15 OpenFlow 6166 Type: OFPT_MULTIPART_REQUEST, OFPMP_TABLE 215 6.488951438 10.0.2.15 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=24914 Win=65535 Len=0 217 6.488971436 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=24919 Win=65535 Len=0 218 6.488972395 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=24919 Win=65535 Len=0 219 6.488973456 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 219 6.498074424 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 220 6.494064124 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 223 6.5172612354 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 223 6.5172612354 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 223 6.517361539 19.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_FLOW 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_FLOW 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_FLOW 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 225 6.518582485 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 226 6.519369186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 226 6.519365186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 226 6.519365186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 226 6.519365186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP DESC 126.520823288 192.168.206.130 19.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_OPENT_STATS 236 6.52186256 192.168.206.130 19.0.2.15 Ope	210 5.348931883	192.168.206.130	10.0.2.15	TCP	60 6653 - 38712 [ACK] Seq-1193 Ack=16047 Win=65535 Len=0
212 5.499719429 10.0.2.15 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1095 Ack=16039 Win=65535 Len=0 214 6.487919389 192.168.206.130 10.0.2.15 OpenFlow 6166 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_TABLE 215 6.488198138 10.0.2.15 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1095 Ack=16039 Win=65535 Len=0 216 6.488959289 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=29899 Win=65535 Len=0 217 6.488971486 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=29819 Win=65535 Len=0 218 6.48897345 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=29419 Win=65535 Len=0 219 6.48897345 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=29419 Win=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22515 Win=65535 Len=0 221 6.495158608 10.0.2.15 Upon=10 Vin=20	211 5.499501799	192.168.206.130	10.0.2.15	OpenFlow	62 Type: OFPT BARRIER REQUEST
214 6.48791389 192.168.206.130 19.0.2.15 OpenFlow 6166 Type: OFPT_MULTIPART_REQUEST, OFPME_TABLE 1216 6.488959289 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=18959 Win=65535 Len=0 217 6.488971486 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=20419 Win=65535 Len=0 218 6.488972395 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=20419 Win=65535 Len=0 219 6.488973405 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 219 6.4894064124 192.168.206.130 19.0.2.15 OpenFlow 110 Type 0FPT_MULTIPART_REQUEST, OFPMP_FLOW 216.495158608 10.0.2.15 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 216.495158608 10.0.2.15 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1117 Ack=2247 Win=65535 Len=0 226 6.49549431 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1117 Ack=2247 Win=65535 Len=0 226 6.517221354 192.168.206.130 19.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, OFPMP_FLOW 0FPT_MULTIPART_REQUEST, OFPMP_GROUP_DESC 225 6.5188582485 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 225 6.5188582485 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 226 6.519365196 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 226 6.519451961 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, OFPMP_GROUP 228 6.519651186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, OFPMP_GROUP 228 6.519651186 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1108 Ack=22879 Win=65535 Len=0 232 6.523849444 10.0.2.15 192.168.206.130 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_PORT_STATS 230 6.52186256 192.168.206.130 19.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_PORT_STATS 236 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1205 Ack=23899 Win=65535 Len=0 232 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23399 Win=	212 5.499719429	10.0.2.15	192.168.206.130	OpenFlow	62 Type: OFPT BARRIER REPLY
214 6.48791389 192.168.206.130 10.0.2.15 OpenFlow 6166 Type: OFPT_MULTIPART_REQUEST, OFPME_TABLE 1216 6.488959289 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 ACk=18959 Win=65535 Len=0 217 6.488971486 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 ACk=20419 Win=65535 Len=0 218 6.488972395 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 ACk=20419 Win=65535 Len=0 219 6.488973405 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 ACk=221879 Win=65535 Len=0 210 6.4894064124 192.168.206.130 10.0.2.15 OpenFlow 70 Type 0 OFPT_MULTIPART_REQUEST, OFPME_FLOW 216.495158608 10.0.2.15 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 ACk=22187 Win=65535 Len=0 216.495158608 10.0.2.15 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1117 ACk=22187 Win=65535 Len=0 222 6.495494431 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1107 ACk=2247 Win=65535 Len=0 223 6.577221534 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPME_GROUP_DESC 225 6.5188582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACk=22863 Win=65535 Len=0 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPME_GROUP_DESC 225 6.5188582485 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPME_GROUP_DESC 226 6.519365196 10.0.2.15 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPME_GROUP 228 6.519065196 10.0.2.15 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPME_GROUP 228 6.520823288 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10.0.2.15 192.168.206.130 10	213 5.499851636	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seq=1095 Ack=16039 Win=65535 Len=0
216 6.48897289 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=2859 Win=65535 Len=0 217 6.488971486 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=28419 Win=65535 Len=0 218 6.48897295 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=2819 Win=65535 Len=0 219 6.488973465 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1111 Ack=22151 Win=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 OpenFlow 710 Type 0FPT_MULTIPART_REPLY, 0FPMP_FLOW 221 6.495158608 10.0.2.15 192.168.206.130 OpenFlow 750 Type 0FPT_MULTIPART_REPLY, 0FPMP_FLOW 222 6.495494431 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1117 Ack=2247 Win=65535 Len=0 223 6.517221534 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_FLOW 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 224 6.517365639 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 225 6.5194694661 10.0.2.15 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.519469466 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.5194694666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.5194694666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.51966946 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DERCOUP_DESC 326 6.520823288 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DESC 70 TMP_DESC 70 T	214 6.487919389	192.168.206.130	10.0.2.15	OpenFlow	70 Type: OFPT MULTIPART REQUEST, OFPMP TABLE
217 6.488971486 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 ACK] Seq=1111 Ack=29419 Win=65535 Len=0 219 6.48897345 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 ACK] Seq=1111 Ack=21879 Win=65535 Len=0 220 6.494064124 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 ACK] Seq=1111 Ack=22151 Win=65535 Len=0 220 6.494064124 192.168.206.130 19.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 221 6.495158608 10.0.2.15 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 ACK] Seq=1111 Ack=22151 Win=65535 Len=0 220 6.49516804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 ACK] Seq=1101 Ack=2247 Win=65535 Len=0 223 6.517221354 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_GROUP_DESC 225 6.518582485 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_GROUP_DESC 226 6.519329947 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.519329947 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 226 6.519382945 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 227 6.519481666 10.0.2.15 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 228 6.519651186 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 229 6.520823288 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_GROUP_DESC 229 6.520823288 192.168.206.130 19.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DROT_STATS 230 6.52186256 192.168.206.130 19.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DROT_STATS 230 6.52186256 192.168.206.130 19.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DROT_STATS 230 6.523401804 192.168.206.130 19.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DROT_STATS 230 6.523401804 192.168.206.130 19.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMP_DROT_STATS 230 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 233 6.523401804 192.168.206.130	215 6.488198138	10.0.2.15	192.168.206.130	OpenFlow	6166 Type: OFPT MULTIPART REPLY, OFPMP TABLE
218 6.48897395 192.168.206.130 10.0.2.15 TCP 60 6653 — 36710 ACK] Seq=1111 Ack=22157 Min=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 TCP 60 6653 — 36710 ACK] Seq=1111 Ack=22151 Min=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_GROUP_DESC 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_QUEUE_DESC 750 TYPE: 0FPT_MULTIPART_REQUEST, 0FPMP_QUEUE_DESC 750 TYPE: 0FPT_MULTIPART_REPLY, 0FPMP_QUEUE_DESC	216 6.488959289	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seg=1111 Ack=18959 Win=65535 Len=0
218 6.48897395 192.168.206.130 10.0.2.15 TCP 60 6653 — 36710 ACK] Seq=1111 Ack=22157 Min=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 TCP 60 6653 — 36710 ACK] Seq=1111 Ack=22151 Min=65535 Len=0 220 6.494064124 192.168.206.130 10.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_FLOW 750 Type 0FPT_MULTIPART_REQUEST, 0FPMP_GROUP_DESC 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_DEST_STATS 750 Type: 0FPT_MULTIPART_REQUEST, 0FPMP_QUEUE_DESC 750 TYPE: 0FPT_MULTIPART_REQUEST, 0FPMP_QUEUE_DESC 750 TYPE: 0FPT_MULTIPART_REPLY, 0FPMP_QUEUE_DESC	217 6.488971486	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seq=1111 Ack=20419 Win=65535 Len=0
229 6.494064124 192.168.206.130 10.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMF_FLOW 221 6.49518808 10.0.2.15 192.168.206.130 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMF_FLOW 222 6.495494431 192.168.206.130 10.0.2.15 TCP 60 6653 - 36716 [ACK] Seq=1107 ACK=22847 WIN-65535 Len=0 223 6.517261539 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 225 6.518582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACK=22863 WIN-65535 Len=0 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMF_GROUP 228 6.5206823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMF_PORT_STATS 230 6.5210602597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: 0FPT_MULTIPART_REPLY, 0FPMF_PORT_STATS 230 6.52180256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 ACK=23343 WIN-65535 Len=0 232 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMF_QUEUE 233 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMF_QUEUE 233 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12355 ACK=23359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653	218 6.488972395	192.168.206.130	10.0.2.15	TCP	
229 6.494064124 192.168.206.130 10.0.2.15 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMF_FLOW 221 6.49518808 10.0.2.15 192.168.206.130 OpenFlow 750 Type 0FPT_MULTIPART_REQUEST, 0FPMF_FLOW 222 6.495494431 192.168.206.130 10.0.2.15 TCP 60 6653 - 36716 [ACK] Seq=1107 ACK=22847 WIN-65535 Len=0 223 6.517261539 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 225 6.518582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACK=22863 WIN-65535 Len=0 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP_DESC 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: 0FPT_MULTIPART_REQUEST, 0FPMF_GROUP 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMF_GROUP 228 6.5206823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMF_PORT_STATS 230 6.5210602597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: 0FPT_MULTIPART_REPLY, 0FPMF_PORT_STATS 230 6.52180256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 ACK=23343 WIN-65535 Len=0 232 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 78 Type: 0FPT_MULTIPART_REPLY, 0FPMF_QUEUE 233 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: 0FPT_MULTIPART_REPLY, 0FPMF_QUEUE 233 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12355 ACK=23359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK=2359 Win-65535 Len=0 2346.523401804 192.168.206.130 10.0.2.15 TCP 60 6653	219 6.488973465	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seq=1111 Ack=22151 Win: 65535 Len=0
222 6.495494431 192.168.206.139 10.0.2.15 TCP 60 6653 - 30710 ACK, Seq-1107 ACK-22647 WINE 65535 Len=0 223 6.517221354 192.168.206.139 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP_DESC 224 6.517366539 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 225 6.518582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACK-22863 Win-65535 Len=0 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 228 6.519651186 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 ACK-22879 Win-65535 Len=0 229 6.520823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 230 6.5210602597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 231 6.521186256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 ACK-22879 Win-65535 Len=0 232 6.523133240 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 ACK-22343 Win-65535 Len=0 233 6.523491840 10.0.2.15 192.168.206.130 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_QUEUE 234 6.523491804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK-23359 Win-65535 Len=0 234 6.523491804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK-23359 Win-65535 Len=0 234 6.523491804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK-23359 Win-65535 Len=0 235 6.523491804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK-23359 Win-65535 Len=0 234 6.523491804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACK-23359 Win-65535 Len=0	220 6.494064124	192.168.206.130	10.0.2.15	OpenFlow	
223 6.51721354 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP_DESC 224 6.517366539 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP_DESC 225 6.518582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACk=22863 Win=65535 Len=0 226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP 228 6.519651136 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 ACk=22879 Win=65535 Len=0 229 6.520823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REQUEST, OFPMP_PORT_STATS 230 6.521062597 10.0.2.15 192.168.206.130 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 231 6.521186256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 Ack=23343 Win=65535 Len=0 232 6.52333240 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 233 6.523183240 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 Ack=23343 Win=65535 Len=0 233 6.523284944 10.0.2.15 192.168.206.130 OpenFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_QUEUE 234 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1225 Ack=23359 Win=65535 Len=0 234 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0	221 6.495158608	10.0.2.15	192.168.206.130	OpenFlow	750 Type OFPT_MULTIPART_REPLY, OFPMP_FLOW
223 6.517326539 10.0.2.15 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP_DESC 225 6.518582485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0 225 6.5185829947 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP 228 6.519481666 10.0.2.15 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=2187 Ack=22879 Win=65535 Len=0 229 6.520823288 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.5210862597 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_ORD TSTATS 230 6.5210862597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 230 6.523133240 192.168.206.130 10.0.2.15 OpenFlow 518 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REQUEST, OFPMP_ORD TSTATS 230 6.523401804 100.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_ORD TSTATS 230 6.523401804 100.0.2.15 100	222 6.495494431	192.168.206.130	10.0.2.15	TCP	60 6653 → 30710 [ACK] Seq=1107 Ack=22847 Win=65535 Len=0
225 6.51882485 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1183 ACk=22868 Win=65535 Len=0 226 6.5193294917 192.168.206.130 10.0.2.15 OpenFlow 70 Type: OFPT_MULTIPART_REDUEST, OFPMP_GROUP 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REDUEST, OFPMP_GROUP 228 6.5195651186 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 ACk=22879 Win=65535 Len=0 229 6.520823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REDUEST, OFPMP_PORT_STATS 230 6.521062597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: OFPT_MULTIPART_REDUEST, OFPMP_PORT_STATS 231 6.521186256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 ACk=23343 Win=65535 Len=0 232 6.523133240 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REDUEST, OFPMP_QUEUE 233 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1235 ACk=23349 Win=65535 Len=0 228 ACS23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1235 ACk=234959 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1235 ACk=234959 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229 ACK 23401804 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 ACk=23595 Win=65535 Len=0 229	223 6.517221354	192.168.206.130	10.0.2.15	OpenFlow	
226 6.519329947 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFFT_MULTIPART_REQUEST, OFPMP_GROUP 227 6.519481666 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFFT_MULTIPART_REPLY, OFFMP_GROUP 228 6.5296323288 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 Ack=22879 Win=65535 Len=0 229 6.529823288 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFFT_MULTIPART_REQUEST, OFPMP_PORT_STATS 230 6.521062597 10.0.2.15 192.168.206.130 OpenFlow 518 Type: OFFT_MULTIPART_REPLY, OFFMP_PORT_STATS 231 6.521186256 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 Ack=23343 Win=65535 Len=0 232 6.523133240 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFFT_MULTIPART_REQUEST, OFPMP_QUEUE 233 6.523184944 10.0.2.15 192.168.206.130 OpenFlow 78 Type: OFFT_MULTIPART_REPLY, OFFMP_QUEUE 234 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1255 Ack=23359 Win=65535 Len=0	224 6.517366539	10.0.2.15	192.168.206.130	OpenFlow	70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP_DESC
227 6.519481666 10.0.2.15 192.168.206.130 0penFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_GROUP 228 6.519651186 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 Ack=22879 Win=65535 Len=0 229 6.5210625287 10.0.2.15 192.168.206.130 0penFlow 78 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 230 6.521062597 10.0.2.15 192.168.206.130 0penFlow 518 Type: OFPT_MULTIPART_REPLY, OFPMP_PORT_STATS 231 6.521386256 192.168.206.130 10.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REPLY_OFPMP_PORT_STATS 232 6.523133240 192.168.206.130 19.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REQUEST, OFPMP_QUEUE 233 6.523491804 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY_OFPMP_QUEUE 234 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1255 Ack=23359 Win=65535 Len=0	225 6.518582485	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seq=1183 Ack=22863 Win=65535 Len=0
228 6.519651186 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1207 Ack=22879 Win=65535 Len=0 229 6.520823288 192.168.206.130 19.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REQUEST, OFPMP_PORT_STATS 231 6.521186256 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 Ack=23343 Win=65535 Len=0 232 6.523133240 192.168.206.130 19.0.2.15 OpenFlow 78 Type: OFPT_MULTIPART_REQUEST, OFPMP_QUEUE 233 6.523134944 10.0.2.15 192.168.206.130 OpenFlow 70 Type: OFPT_MULTIPART_REPLY, OFPMP_QUEUE 234 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1231 Ack=23343 Win=65535 Len=0 78 Type: OFPT_MULTIPART_REPLY, OFPMP_QUEUE 234 6.523401804 192.168.206.130 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=12255 Ack=23359 Win=65535 Len=0 19.	226 6.519329947	192.168.206.130	10.0.2.15	OpenFlow	78 Type: OFPT_MULTIPART_REQUEST, OFPMP_GROUP
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234 6.523401804 192.168.206.130 10.0.2.15 TCP 60 6653 - 36710 [ACK] Seq=1255 Ack=23359 Win=65535 Len=0	232 6.523133240	192.168.206.130	10.0.2.15	OpenFlow	78 Type: OFPT_MULTIPART_REQUEST, OFPMP_QUEUE
		10.0.2.15	192.168.206.130	OpenFlow	70 Type: OFPT_MULTIPART_REPLY, OFPMP_QUEUE
20E 6 000EE36E4 403 460 306 430 40 0 3 4E 000E516: 63 Tuno, OFDT DADDTED DEGLECT	234 6.523401804	192.168.206.130	10.0.2.15	TCP	60 6653 → 36710 [ACK] Seq=1255 Ack=23359 Win=65535 Len=0
250 0.300002004 132.100.200.130 10.0.2.15 OpenH1OW 02 Type: UHPT_BARKIEK_KEQUEST	235 6.988552654	192.168.206.130	10.0.2.15	OpenFlow	62 Type: OFPT_BARRIER_REQUEST

Imagen 2. Captura Tráfico

② Describa el intercambio de paquetes que ocurre entre el controlador ONOS y el resto de la red. ¿Puede observar está interacción dentro del controlador ONOS?

Contraste con otras soluciones.

Parte importante del desarrollo de un Ingeniero profesional, es la capacidad de comparar las diferentes opciones que existen para dar solución a un problema específico. Así, existen una gran cantidad de controladores SDN en el mercado, pero en esta clase se analizarán 4: OpenDayLight, ONOS, Floodlight y SDN CTL (HP). De esta manera, deberán:

Realizar una presentación para la siguiente clase, a través de la cual, poder discutir: la historia, las características principales, la arquitectura, las ventajas, las desventajas, casos de uso éxitos y los desafíos que busca resolver el controlador ONOS. Cabe resaltar, que es importante realizar la presentación con capturas de pantalla o videos que sustenten lo mencionado durante la presentación.

Entregable Proyecto.

Tal como se mencionó en clase, la tercera entrega del proyecto será calificada con el desarrollo de estos laboratorios. De esta manera, simule la red diseñada en la segunda entrega del proyecto del curso a través de Mininet e intégrela con el controlador ONOS. Durante la presentación exponga los procedimientos que llevaron a cabo para simular la red y las pruebas que realizaron para validar su funcionamiento. Debe mostrar el procedimiento para realizar la configuración de un flujo adicional, una vez se encuentre en operación el controlador ONOS. Tener en cuenta los análisis de flujos de tráfico.

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