



F-INTEROP

Live Demos and Open Call

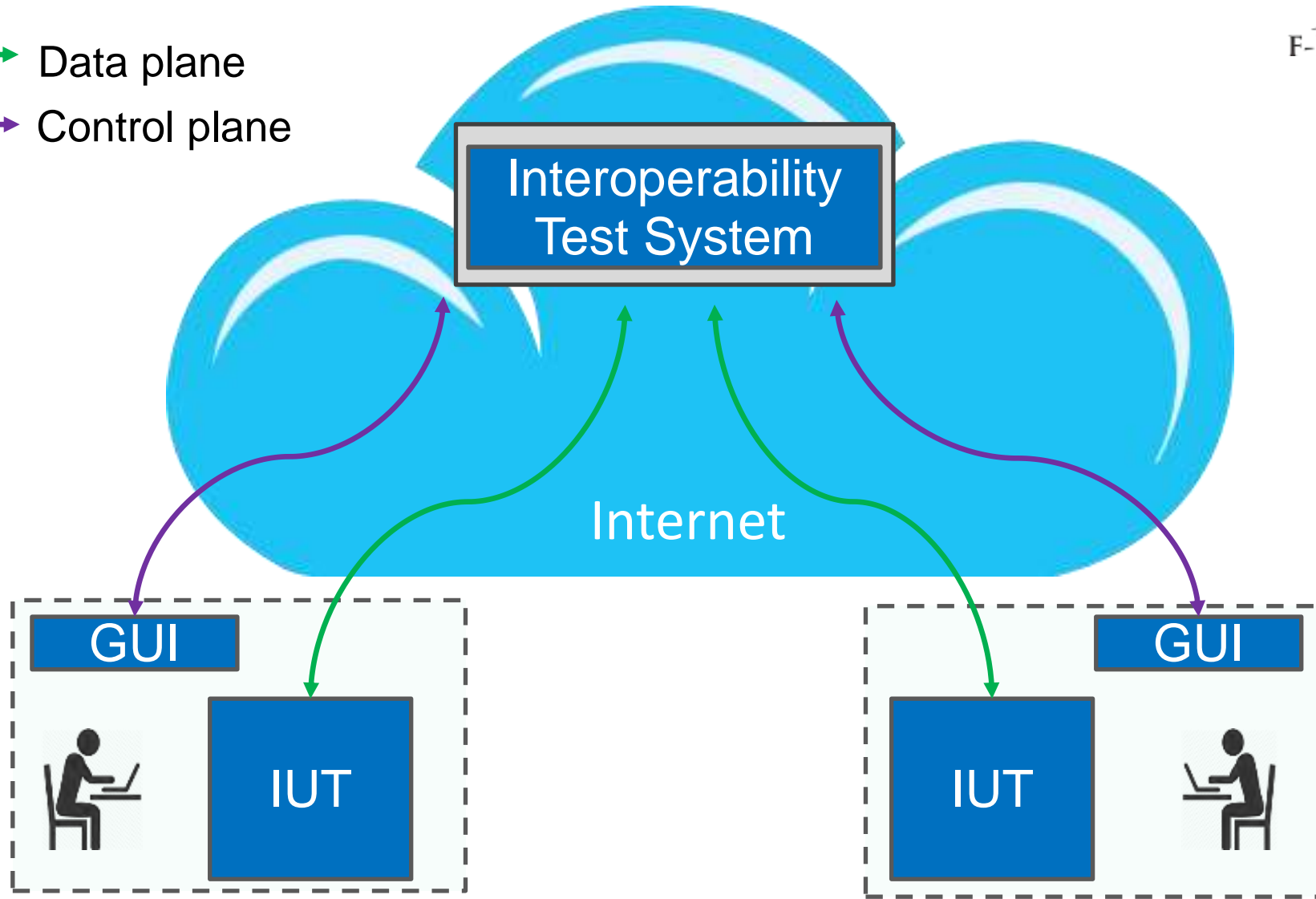
EUCNC, Athens, June 27-30



Remote interoperability testing – Overview



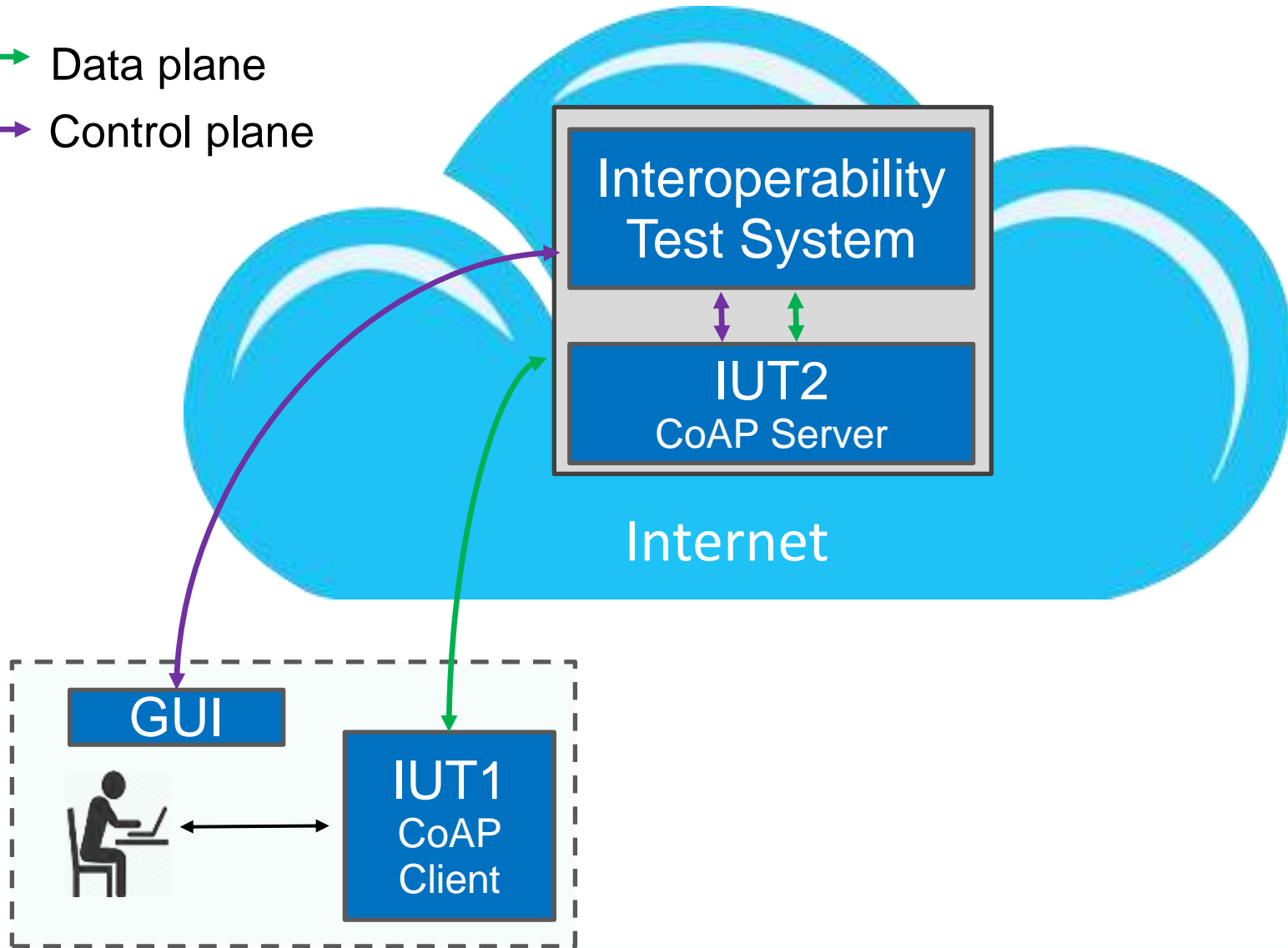
- ↔ Data plane
- ↔ Control plane



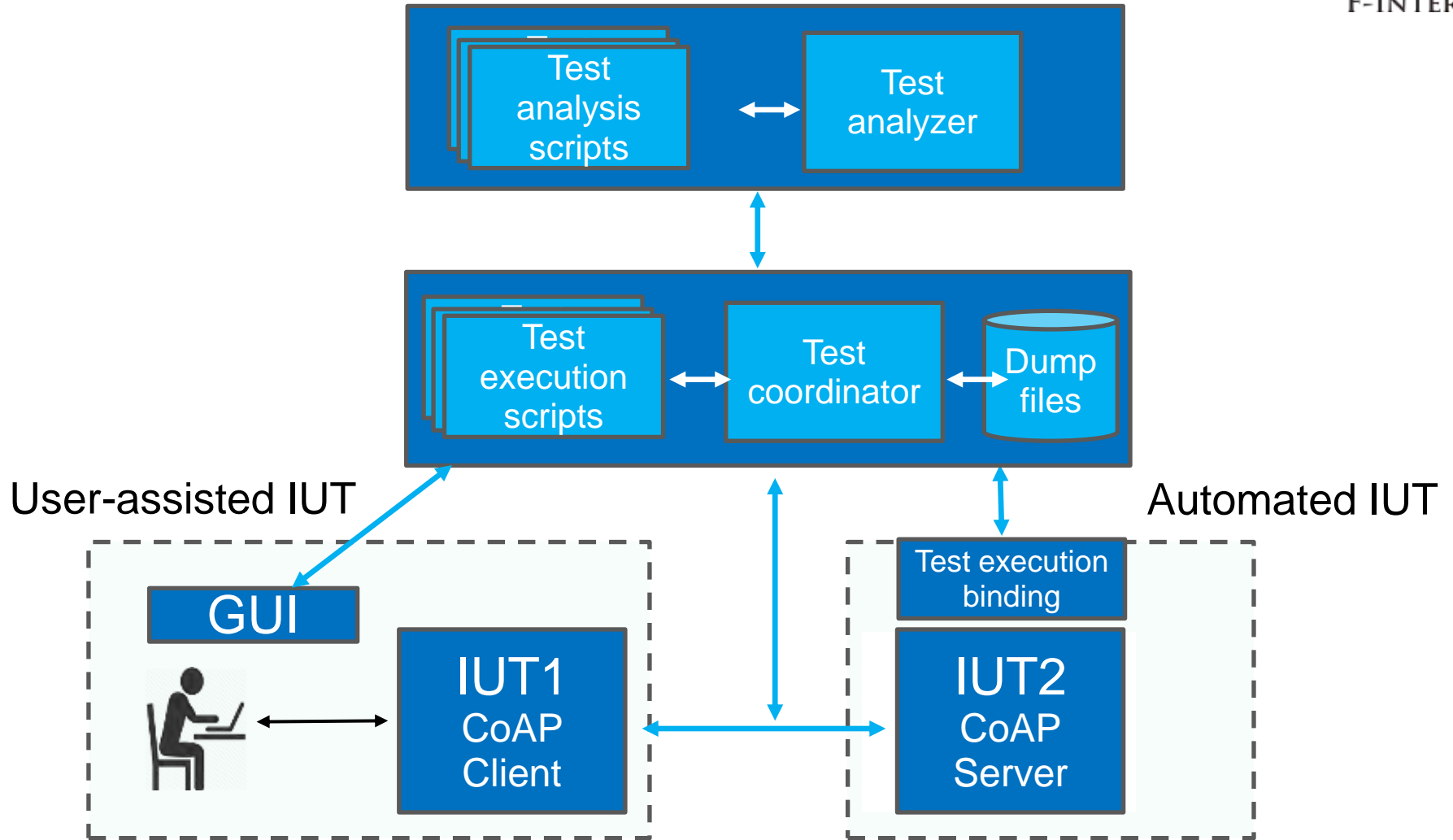
Remote interoperability testing – Demo Use Case



↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Main Components



CoAP remote interoperability testing – Session Execution



The screenshot displays the F-INTEROP CoAP testing interface. On the left, a list of test cases is shown, with TD_COAP_CORE_07 selected. The console on the right shows the execution of TD_COAP_CORE_06, with a blue arrow pointing to the 'Start Test Case' button. The interface also includes a 'Frame list' section and a 'No Frame Selected' status.

Test cases

- TD_COAP_CORE_01 Perform GET transaction (CON mode) **pass**
- TD_COAP_CORE_02 Perform DELETE transaction (CON mode) **pass**
- TD_COAP_CORE_03 Perform PUT transaction (CON mode) **pass**
- TD_COAP_CORE_04 Perform POST transaction (CON mode) **pass**
- TD_COAP_CORE_05 Perform GET transaction (NON mode) **more**
- TD_COAP_CORE_06 Perform DELETE transaction (NON mode) **pass**
- TD_COAP_CORE_07 Perform PUT transaction (NON mode)**
- TD_COAP_CORE_08 Perform POST transaction (NON mode)
- TD_COAP_CORE_09 Perform GET transaction with separate response (CON mode, or piggyback)
- TD_COAP_CORE_10 Perform GET transaction containing non-empty Token (CON mode)
- TD_COAP_CORE_11 Perform GET transaction containing non-empty Token with a separate response (CON mode)
- TD_COAP_CORE_12 Perform GET transaction using empty Token (CON mode)
- TD_COAP_CORE_13 Perform GET transaction containing several URI-Path options (CON mode)
- TD_COAP_CORE_14

Console

No Frame Selected

No Frame

No frame selected for the moment

Start Test Case

TD_COAP_CORE_06
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_05
Give the verdict indone
Review frames:
1, 2
More informations

TD_COAP_CORE_04
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_03
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_02
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_01
Give the verdict pass
More informations

Frame list

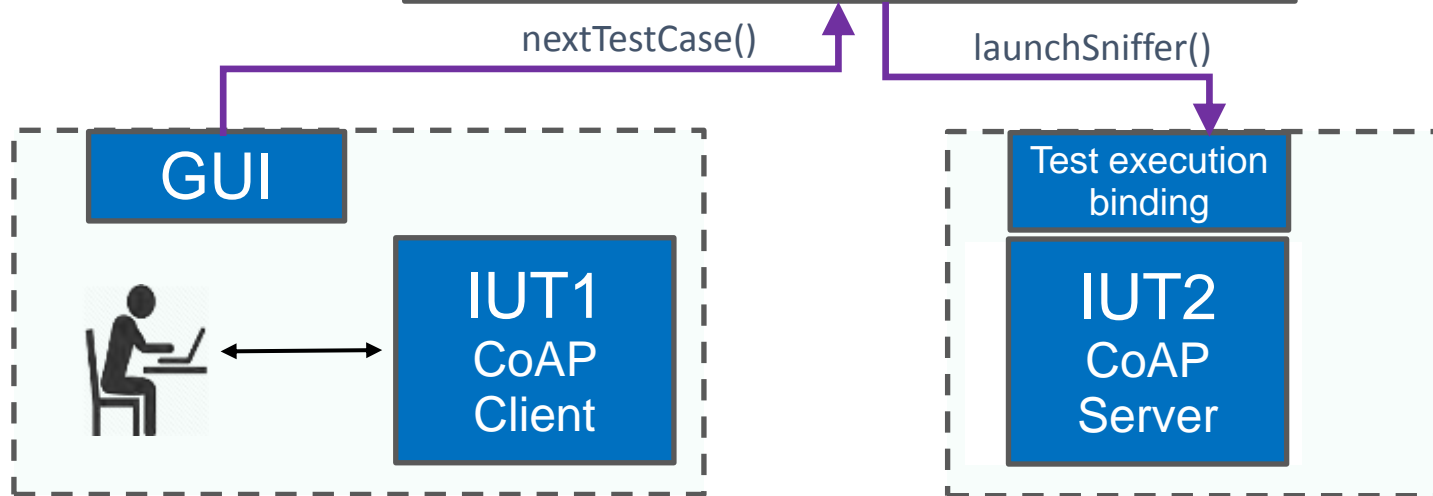
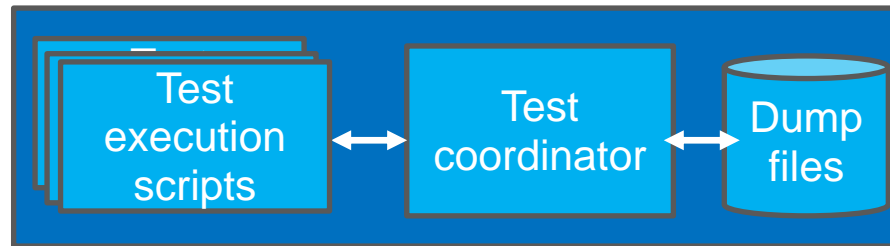
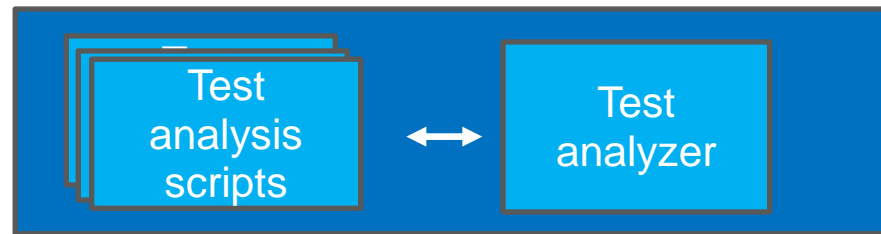
No test case selected for the moment



CoAP remote interoperability testing – Session Execution



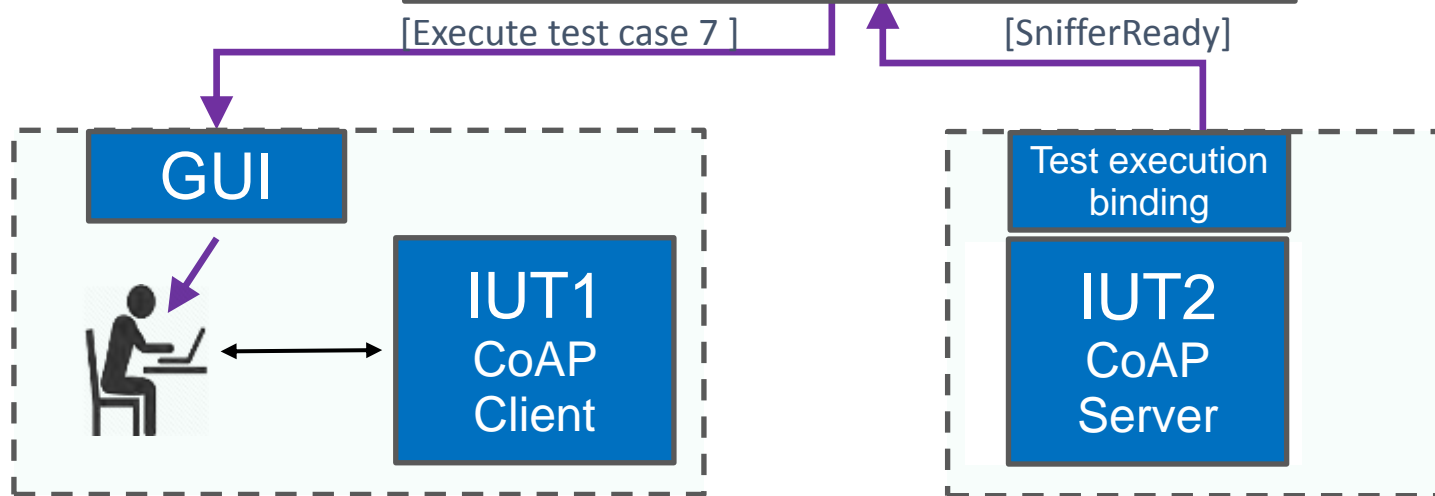
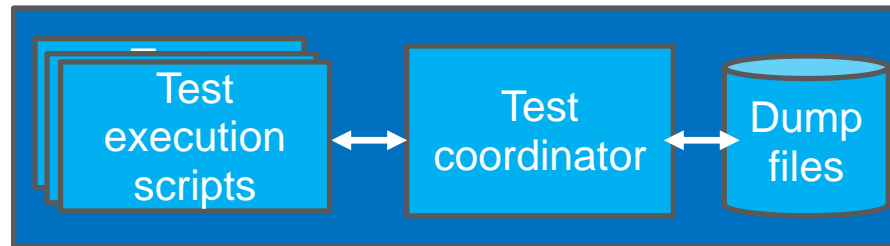
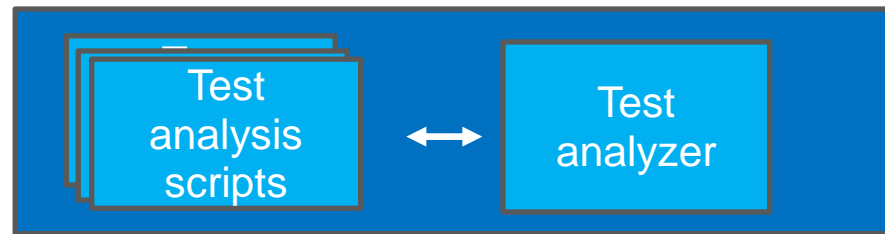
↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Session Execution



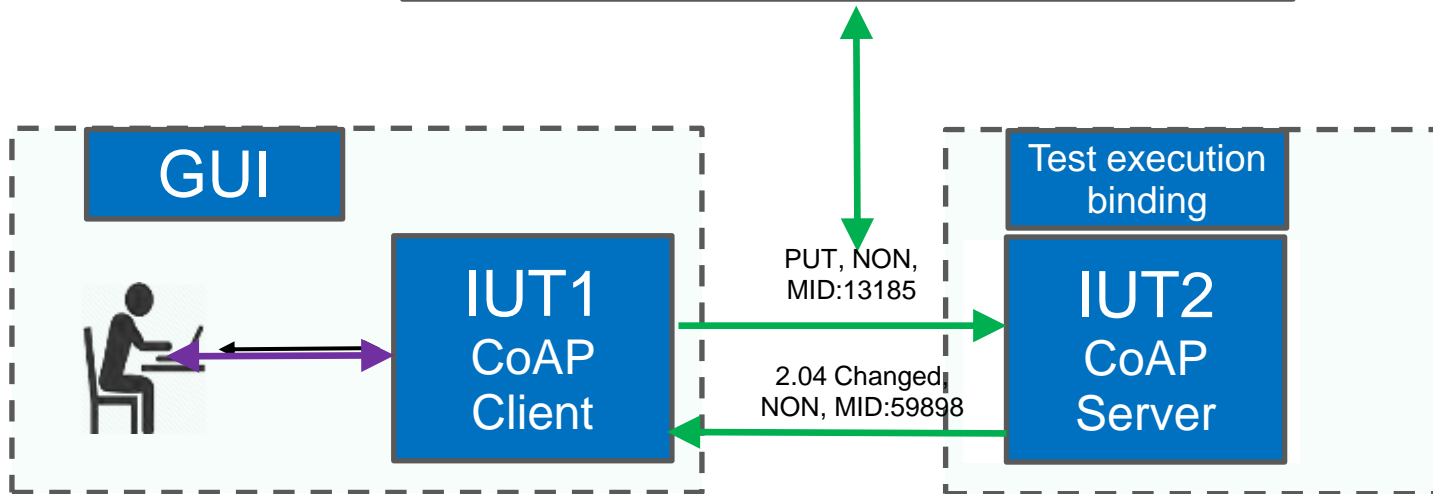
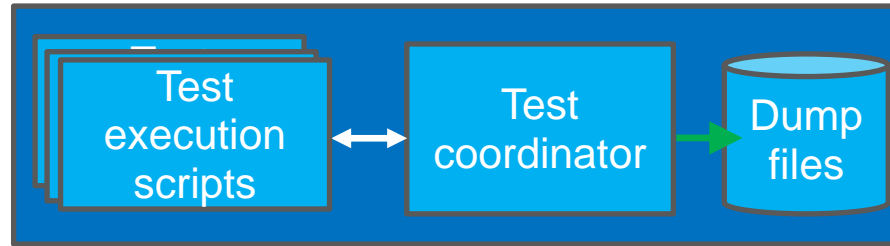
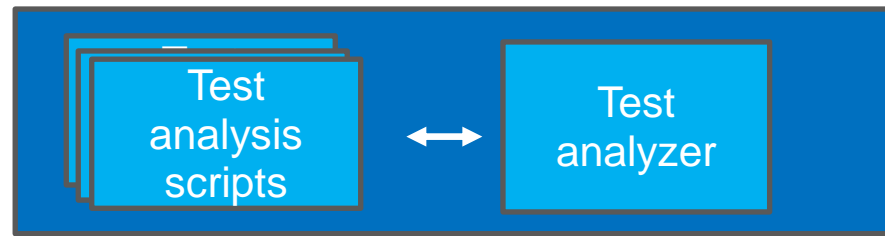
↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Session Execution



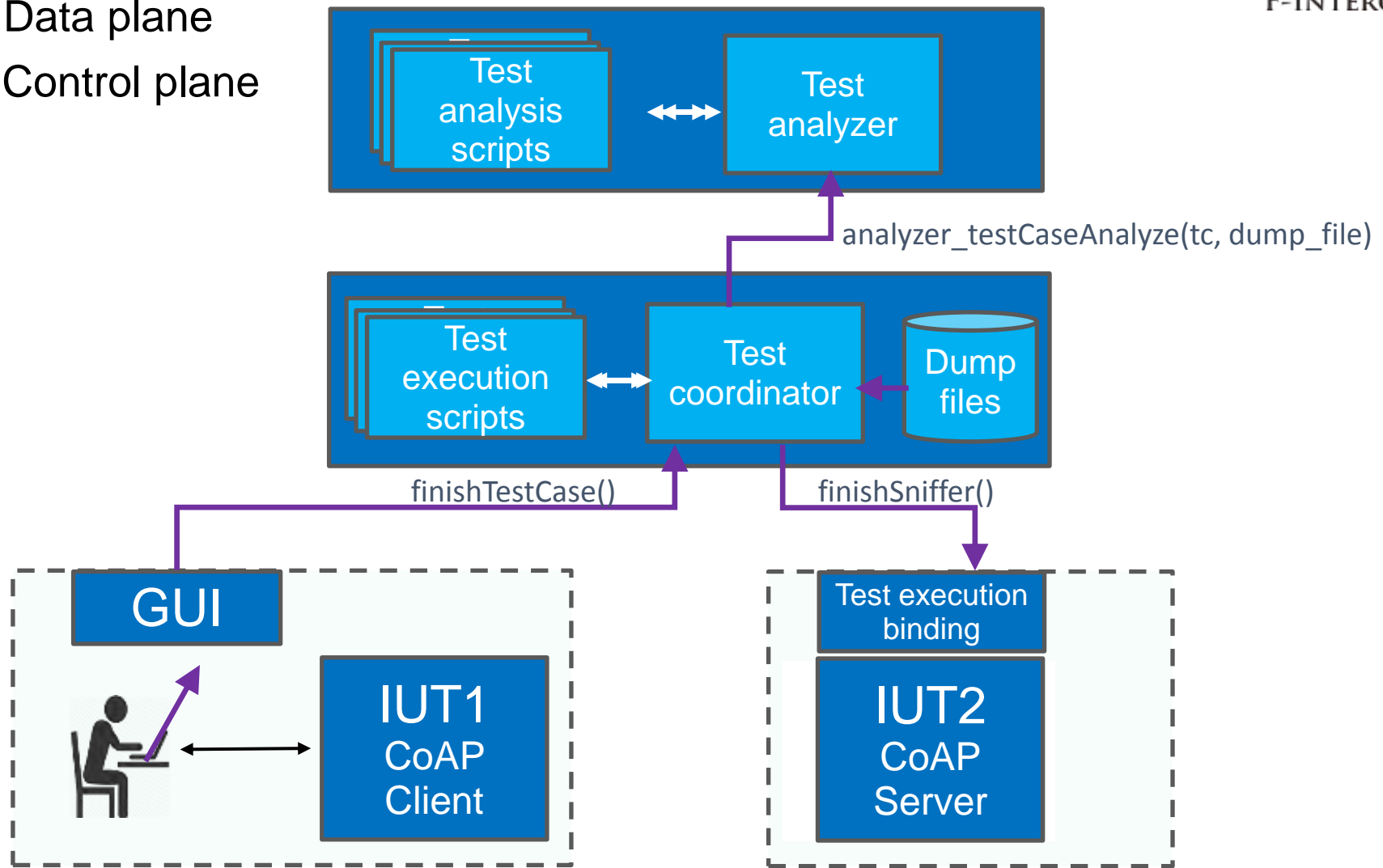
↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Session Execution



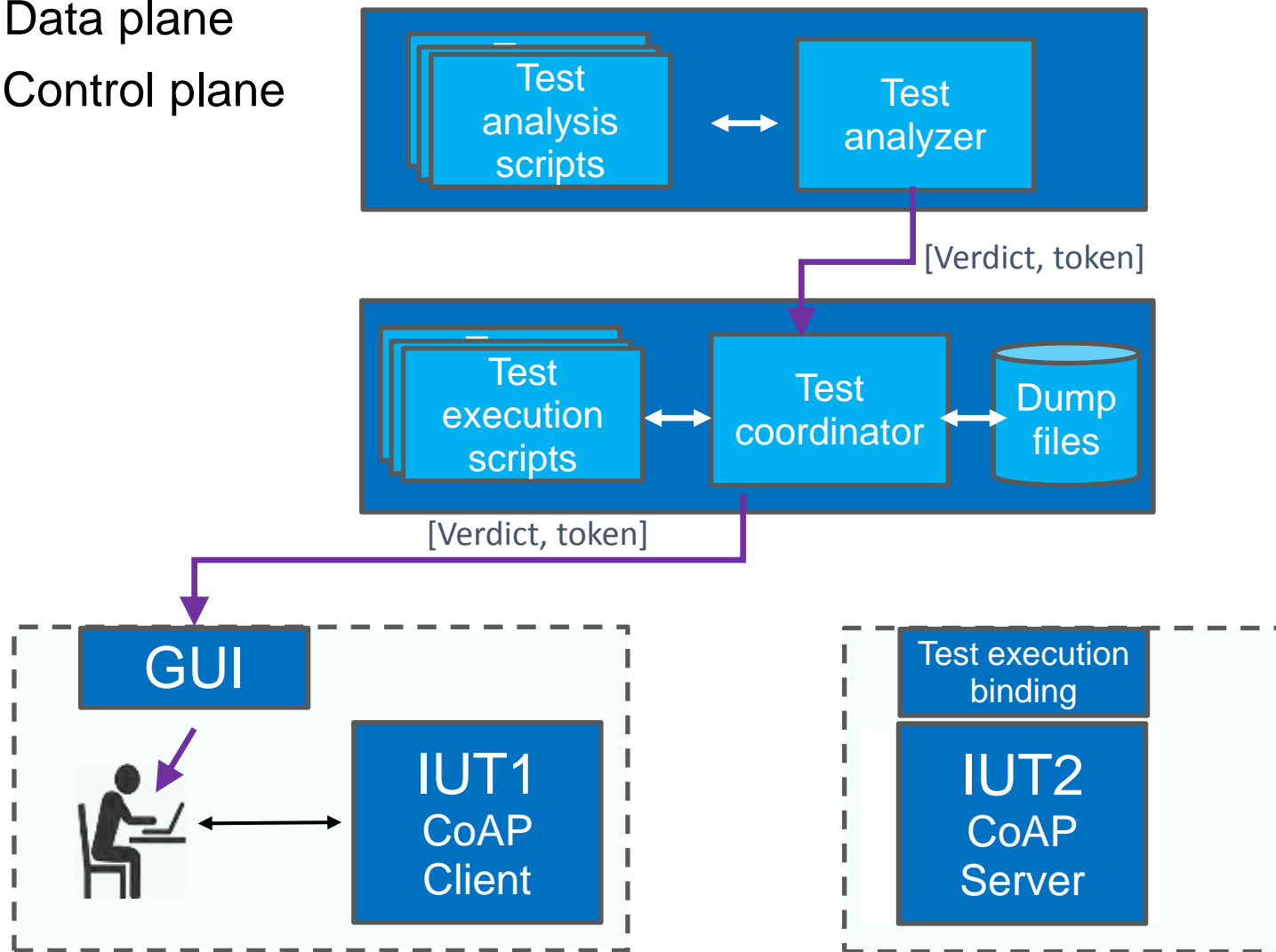
↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Session Execution



↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Verdicts



The screenshot displays the F-INTEROP testing interface. On the left, a list of test cases is shown, with TD_COAP_CORE_07 highlighted in blue. The console in the center shows the execution of TD_COAP_CORE_07, which failed. A red box highlights the test case name and description in the console. A large blue text overlay reads 'TEST CASE VERDICT'. The right side of the interface shows 'No Frame Selected' and 'No frame selected for the moment!'.

Test cases

- TD_COAP_CORE_01 Perform GET transaction (CON mode) **pass**
- TD_COAP_CORE_02 Perform DELETE transaction (CON mode) **pass**
- TD_COAP_CORE_03 Perform PUT transaction (CON mode) **pass**
- TD_COAP_CORE_04 Perform POST transaction (CON mode) **pass**
- TD_COAP_CORE_05 Perform GET transaction (NON mode) **more**
- TD_COAP_CORE_06 Perform DELETE transaction (NON mode) **pass**
- TD_COAP_CORE_07 Perform PUT transaction (NON mode) **fail**
- TD_COAP_CORE_08** Perform POST transaction (NON mode)
- TD_COAP_CORE_09 Perform GET transaction with separate response (CON mode, no piggyback)
- TD_COAP_CORE_10 Perform GET transaction containing non-empty Token (CON mode)
- TD_COAP_CORE_11 Perform GET transaction containing non-empty Token with a separate response (CON mode)
- TD_COAP_CORE_12 Perform GET transaction using empty Token (CON mode)
- TD_COAP_CORE_13 Perform GET transaction containing several Uri-Path options (CON mode)
- TD_COAP_CORE_14

Console

Start First Case

TD_COAP_CORE_07
Give the verdict fail
Review frames:
4-5
More informations

Test Case TD_COAP_CORE_07 started, press the Finish button when completed

TD_COAP_CORE_06
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_09
Give the verdict success
Review frames:
1-2
More informations

TD_COAP_CORE_04
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_03
Give the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_02

Frame list

No test case selected for the moment!



CoAP remote interoperability testing – Verdict Diagnostics



The screenshot displays the Verdict Diagnostics interface, which is divided into three main sections: Test cases, Console, and Frame list.

- Test cases:** A list of 14 test cases (TD_COAP_CORE_01 to TD_COAP_CORE_14) is shown. TD_COAP_CORE_08 is currently selected and highlighted in blue. Each case includes a brief description of the transaction to be performed (e.g., 'Perform GET transaction (CON mode)').
- Console:** This section shows the execution progress. A green 'Start First Case' button is at the top. The console output for TD_COAP_CORE_07 is visible, indicating a 'Give the verdict fail' and 'Review frames: 4, 5'. A blue arrow points to a 'More informations' link for this case. Below it, the console shows TD_COAP_CORE_06 with a 'Give the verdict pass' and 'Review frames: 2'. Further down, TD_COAP_CORE_05 and TD_COAP_CORE_04 are also listed with their respective verdicts and frame counts.
- Frame list:** This section is currently empty, displaying 'No Frame Selected' and 'No frame selected for the moment'.



CoAP remote interoperability testing – Verdict Diagnostics



The screenshot displays the Verdict Diagnostics interface with three main sections: Test cases, Console, and No Frame Selected.

- Test cases:** A list of 14 test cases (TD_COAP_CORE_01 to TD_COAP_CORE_14) with status indicators (pass, more, stop).
- Console:** A log of test results. TD_COAP_CORE_07 is highlighted with a red background and a blue box around its 'More Information' section. TD_COAP_CORE_06 is highlighted with a green background. TD_COAP_CORE_05 is highlighted with a blue background. TD_COAP_CORE_04 is highlighted with a light green background.
- No Frame Selected:** A section showing 'No Frame Selected' and 'No frame selected for the moment!'.

More Information for TD_COAP_CORE_07:

```
127.0.0.1 | CoAP (NON 131.05) PUT /test/ |  
pass | match: CoAP(type=1, code=3) | [ok] |  
mismatch:  
CoAP(opt=Opt(CoAPOptionContentFormat()),  
pl=Not(b*)) CoAP.cdc: CoAPOptMismatch  
[ok: expected: CoAPOptionContentFormat()]  
127.0.0.1 | CoAP (NON 131.05) 2.04  
Changed -> | pass | match: CoAP(type=1,  
code=Any(05.08)) | tok=b7b0da }
```

**VERDICT EVALUATION
INFORMATION**



CoAP remote interoperability testing – Verdict Diagnostics



The screenshot displays the Verdict Diagnostics interface with three main sections: Test cases, Console, and Frame list.

- Test cases:** A list of 14 test cases (TD_COAP_CORE_01 to TD_COAP_CORE_14) with status indicators (pass, more, stop).
- Console:** Shows the execution of test case TD_COAP_CORE_07. A red box highlights the error code '4.5' with a blue arrow pointing to it. The console text includes:

```
TD_COAP_CORE_07
Give the verdict fail
Review frames:
4.5
More information:
127.0.0.1 | CoAP (NON 13185) PUT /test |
pass | match: CoAP(type=1, code=3) | fail |
mismatch:
CoAP(opt=Opt(CoAPOptionContentFormat()),
pl=Not(b*)) CoAP.cdc: CoAPOptionMismatch
got: expected: CoAPOptionContentFormat()
127.0.0.1 | CoAP (NON 13188) 2.04
Changed -> | pass | match: CoAP(type=1,
code=Any(05.08), tok=b'tokda')
```
- Frame list:** Shows 'No Frame Selected' and 'No test case selected for the moment'.



CoAP remote interoperability testing – Verdict Diagnostics



The screenshot displays the Verdict Diagnostics interface with three main sections:

- Test cases:** A list of 14 test cases (TD_COAP_CORE_01 to TD_COAP_CORE_14) with status indicators (pass, more, fail).
- Console:** A log of test results. TD_COAP_CORE_07 is highlighted in red, indicating a failure. The console shows a 'Give the verdict fail' message and a 'More informations' block detailing a CoAP mismatch: 'CoAP (NON 13185) PUT /test/ | pass | match: CoAP(type=1, code=3) | fail | mismatch: CoAP(opt=Opt(CoAPOptionContentFormat()), pl=Not(b*)) CoAP(opcode=CoAPOptMismatch get: expected: CoAPOptionContentFormat() 127.0.0.1 | CoAP (NON 13185) 2.04 Changed -> | pass | match: CoAP(type=1, code=Any(05.08), tok=b'txwda')'.
- Analyse TC -> TD_COAP_CORE_07:** A detailed view of the failed test case, showing 'Frame n°4' with CoAP, UDP, IPV4, and MTLCoopback details. Below this is a 'Frame list' table:

Frame list
1. [127.0.0.1 -> 127.0.0.1] UDP 50845 -> 50845
2. [127.0.0.1 -> 127.0.0.1] UDP 45374 -> 50845
3. [127.0.0.1 -> 127.0.0.1] Internet Control Message
4. [127.0.0.1 -> 127.0.0.1] CoAP (NON 13185) PUT /test/
5. [127.0.0.1 -> 127.0.0.1] CoAP (NON 13185) 2.04 Changed

EXCHANGED MESSAGES



CoAP remote interoperability testing – Verdict Diagnostics



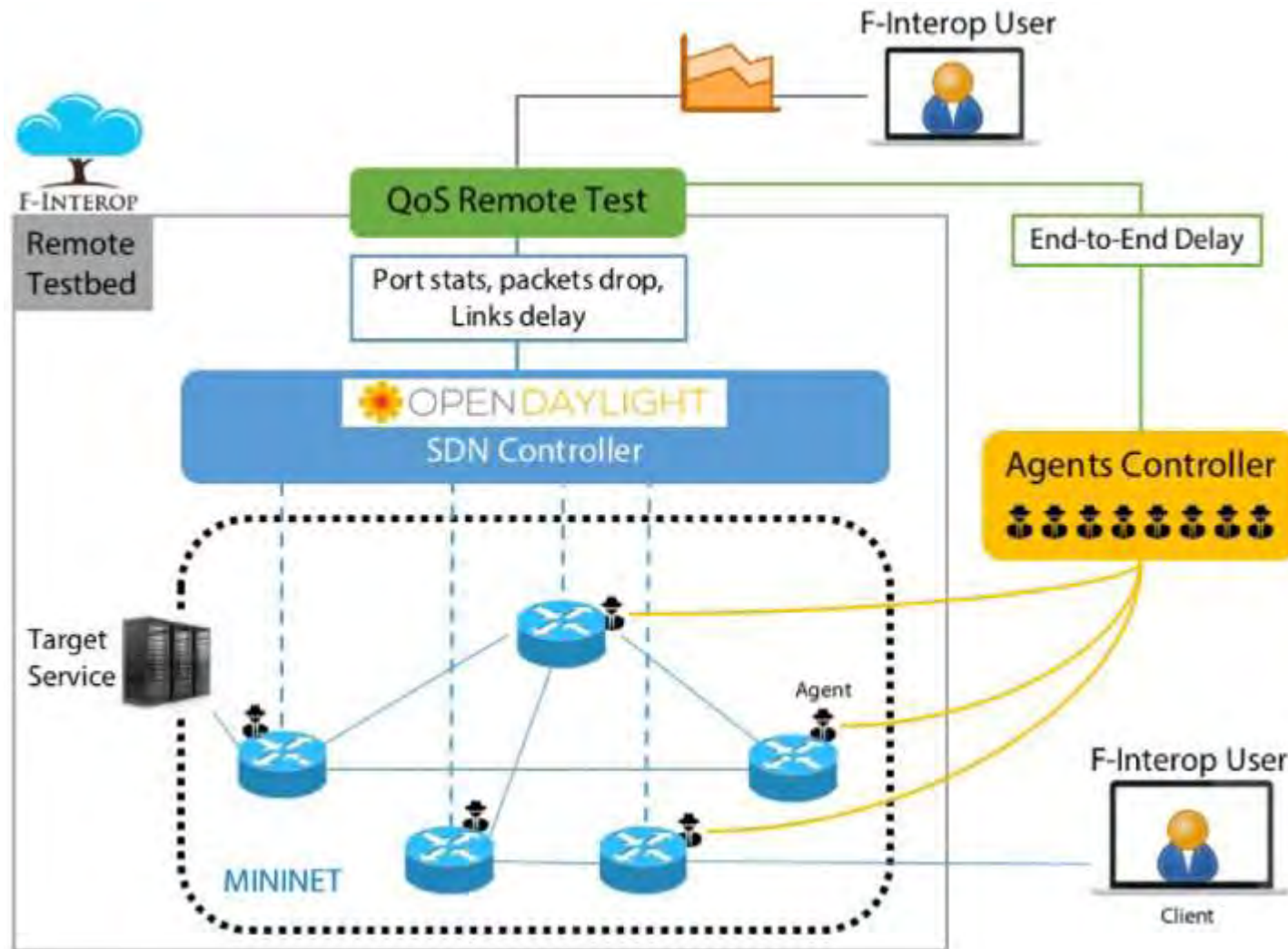
The screenshot displays the Verdict Diagnostics interface for CoAP testing. It is divided into three main sections:

- Test cases:** A list of 14 test cases (TD_COAP_CORE_01 to TD_COAP_CORE_14) with status indicators (pass, more, fail).
- Console:** A central area showing the execution of test case TD_COAP_CORE_07. It includes a 'Start Test Case' button and detailed error messages such as 'Give the verdict fail' and 'Mismatch: CoAP(type=1, code=3) [fail] mismatch: CoAP(opt=Opt(CoAPOptionContentFormat()), pl=Not(b*)) CoAP(opcode=CoAPOptMematch get: expected: CoAPOptionContentFormat() 127.0.0.1 | CoAP (NON 13185) 2.04 Changed => [pass] match: CoAP(type=1, code=Any(65,68), tok=b'bwda')'.
- Analyse TC - TD_COAP_CORE_07:** A detailed view of a protocol frame (Frame n°4) showing CoAP message details: Version: 1, Type: 1, TokenLength: 2, Code: 3, MessageID: 0x1381, Token: b'bwda', Options: CoAPOptionUriPath (Delta: 11, Length: 4, Value: test), Payload: b'98'. Below this is a 'Frame list' showing a sequence of frames from 1 to 5.

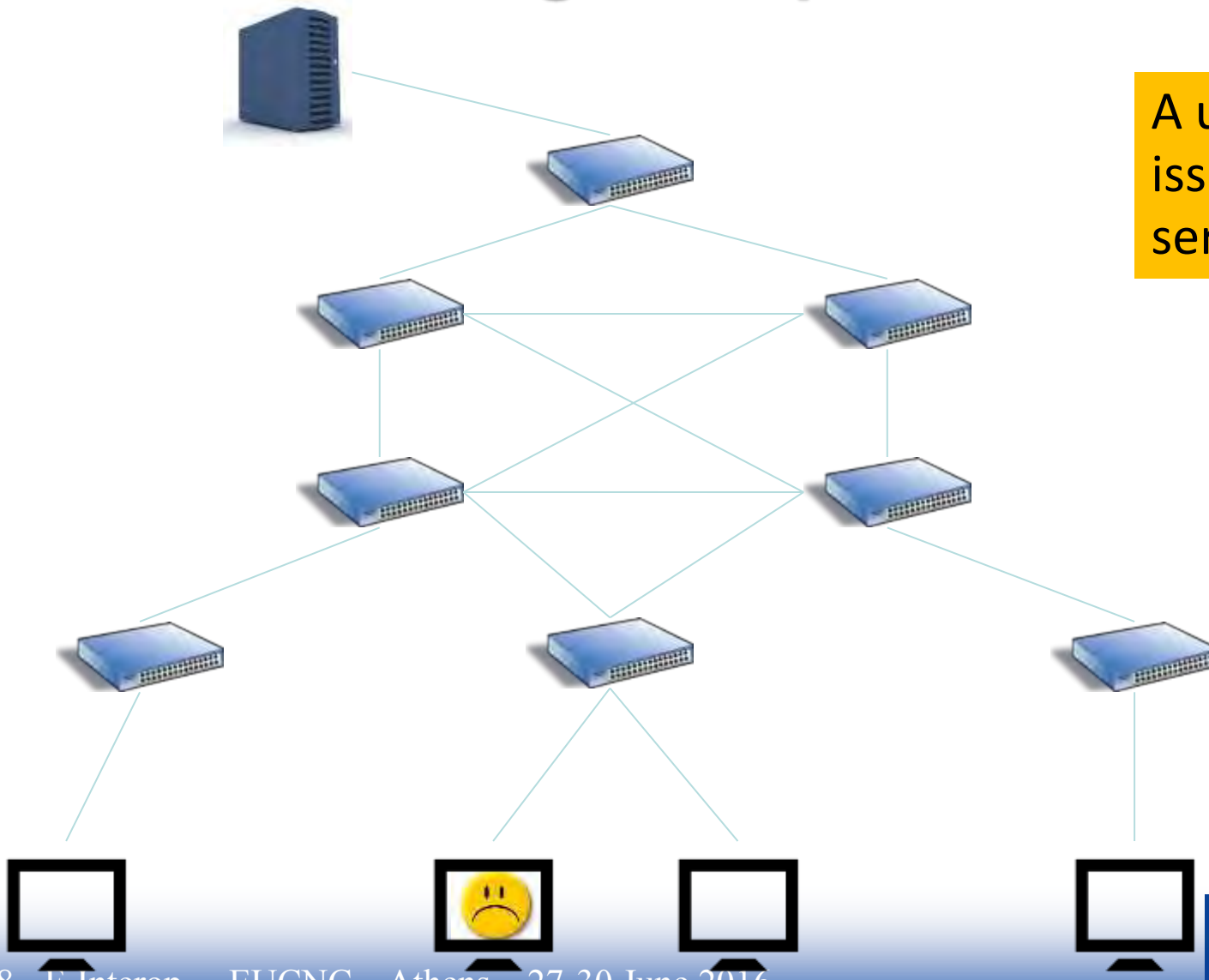
**PROTOCOL
FIELD
INFORMATION**



QoS Monitoring Tool - Architecture



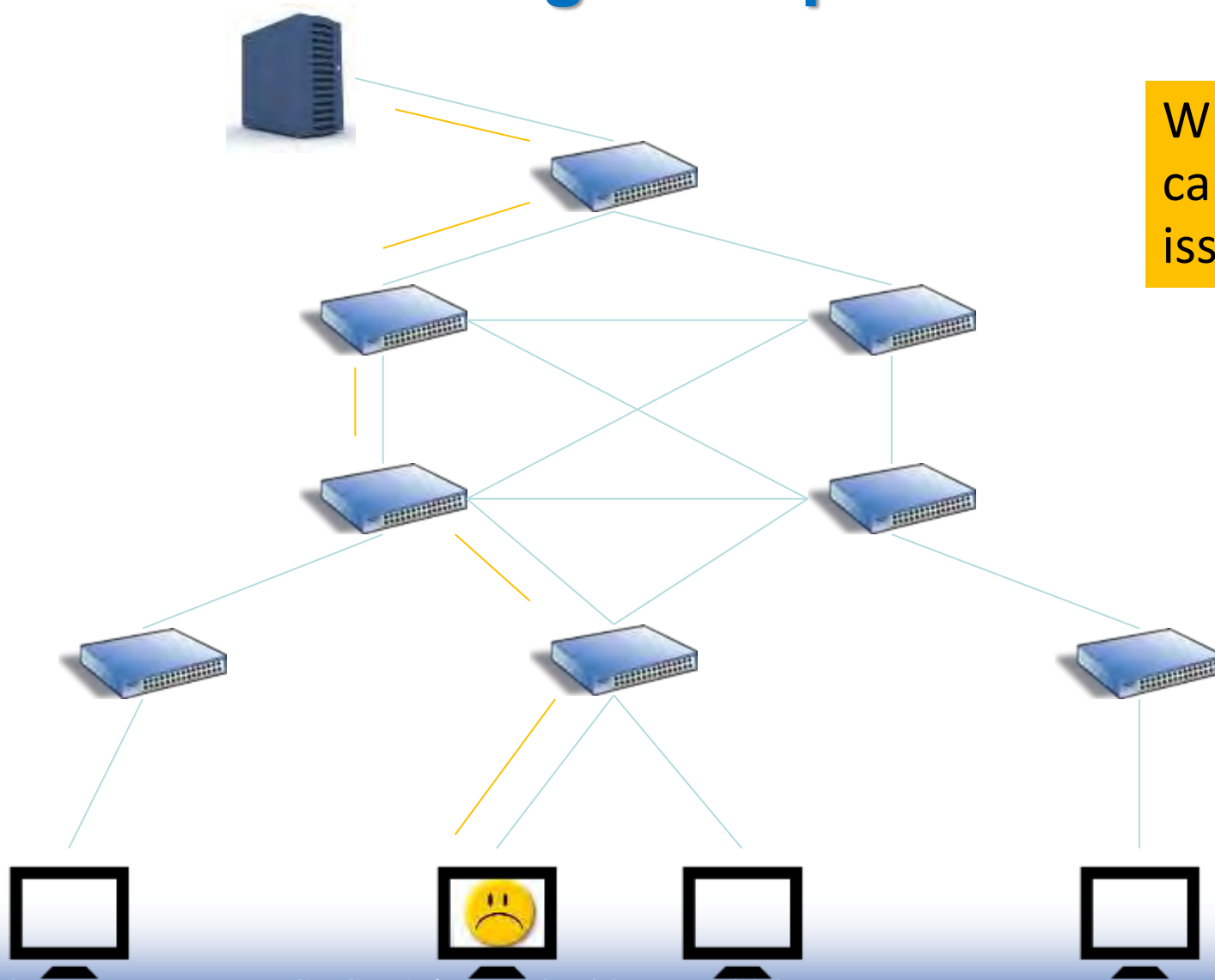
QoS Monitoring Tool Troubleshooting Example



A user has an issue with the service...



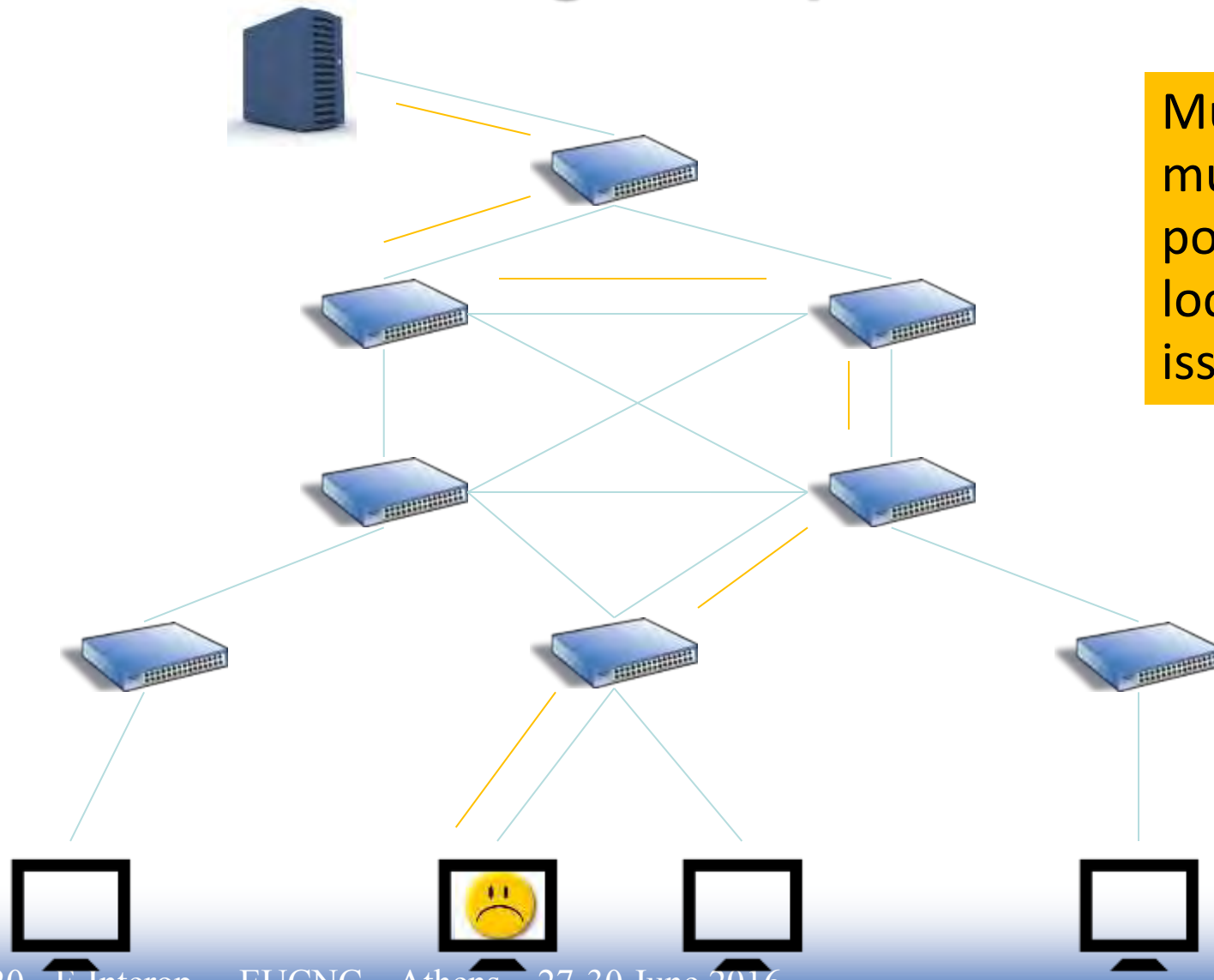
QoS Monitoring Tool Troubleshooting Example



What is the root cause of the issue?



QoS Monitoring Tool Troubleshooting Example



Multiple paths:
multiple
potential
locations for the
issue...



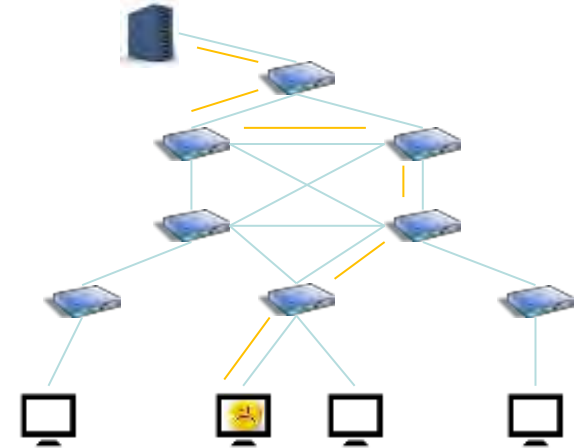
QoS Monitoring Tool

Path Extraction



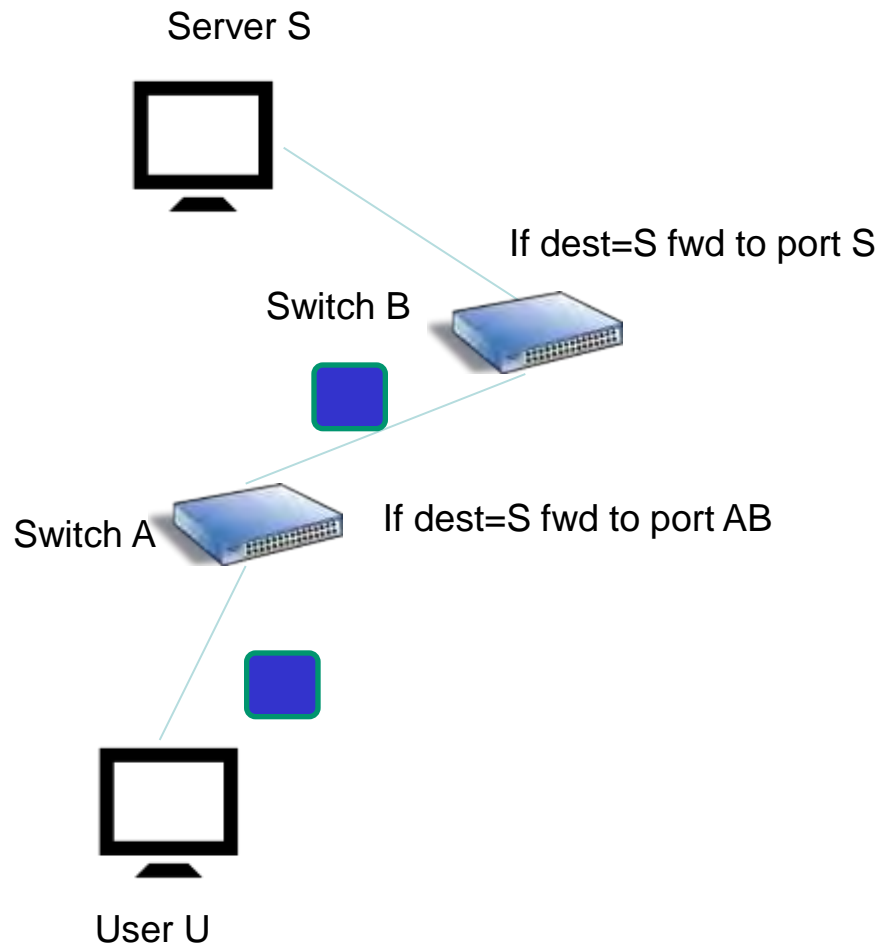
Need to identify the specific **end to end path** followed by the packet from the end user to the target server.

Tracking **packets** in SDN is not specifically addressed by OpenFlow and OpenDayLight based networks.



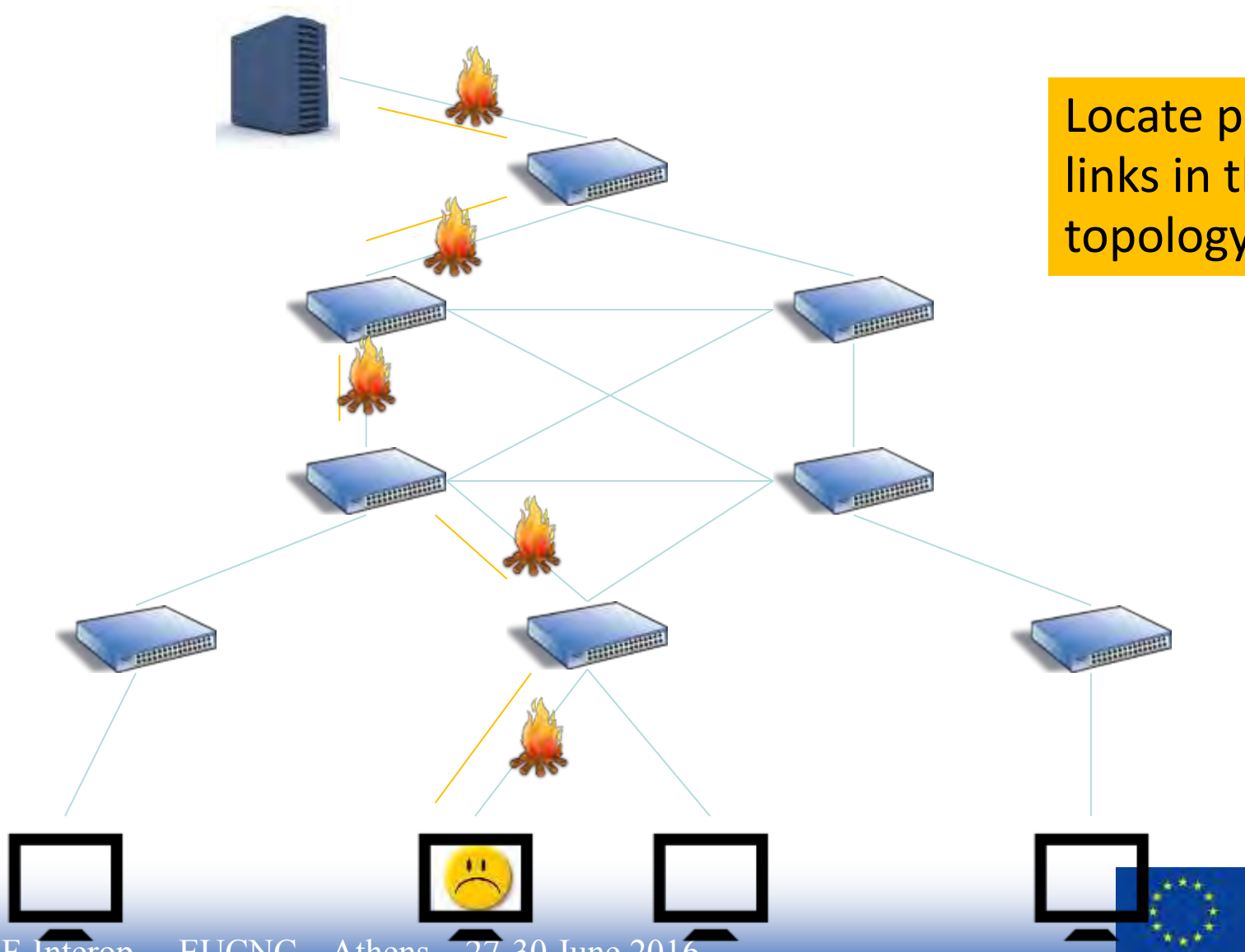
QoS Monitoring Tool Path Extraction

- ❑ Based on the SimpleForwarding application (by default in OpenDaylight, Hydrogen)
- ❑ Dumping switch rules
- ❑ Looking in the rules in search for `dest=B`
- ❑ No need of modifications in the switches



QoS Monitoring Tool: Cause Analysis

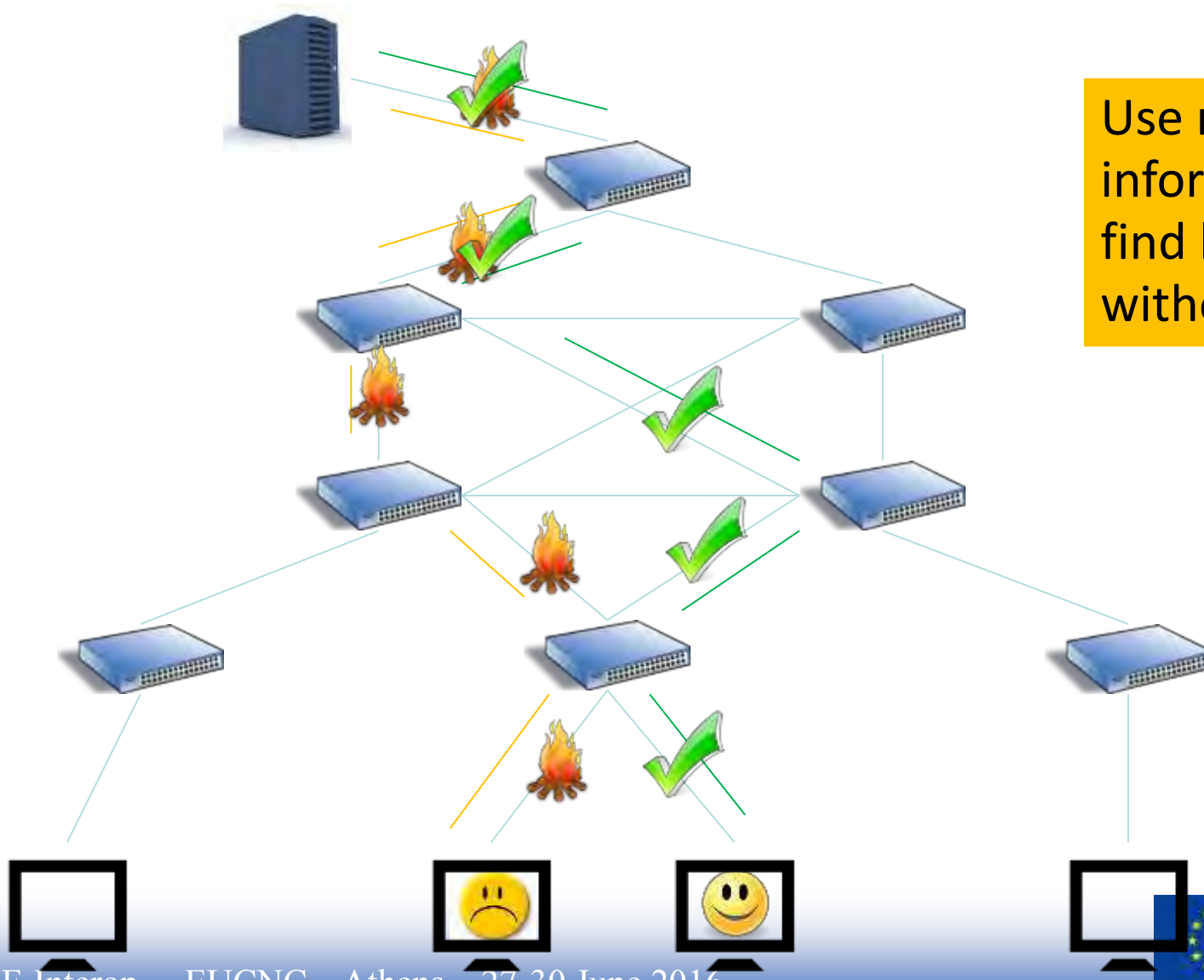
Locate possible links in the topology



QoS Monitoring Tool: Cause Analysis



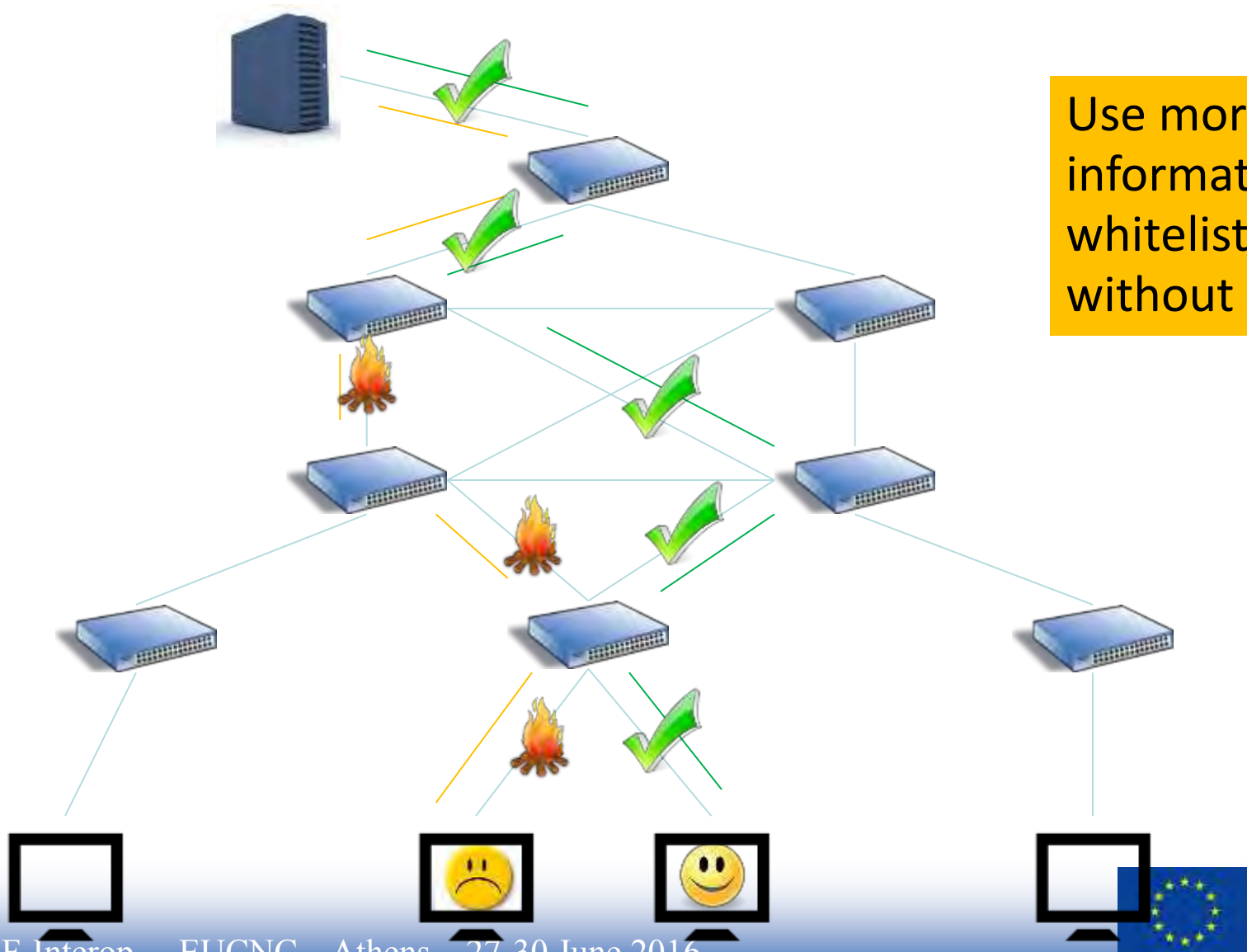
Use more information:
find links
without issues



QoS Monitoring Tool: Cause Analysis

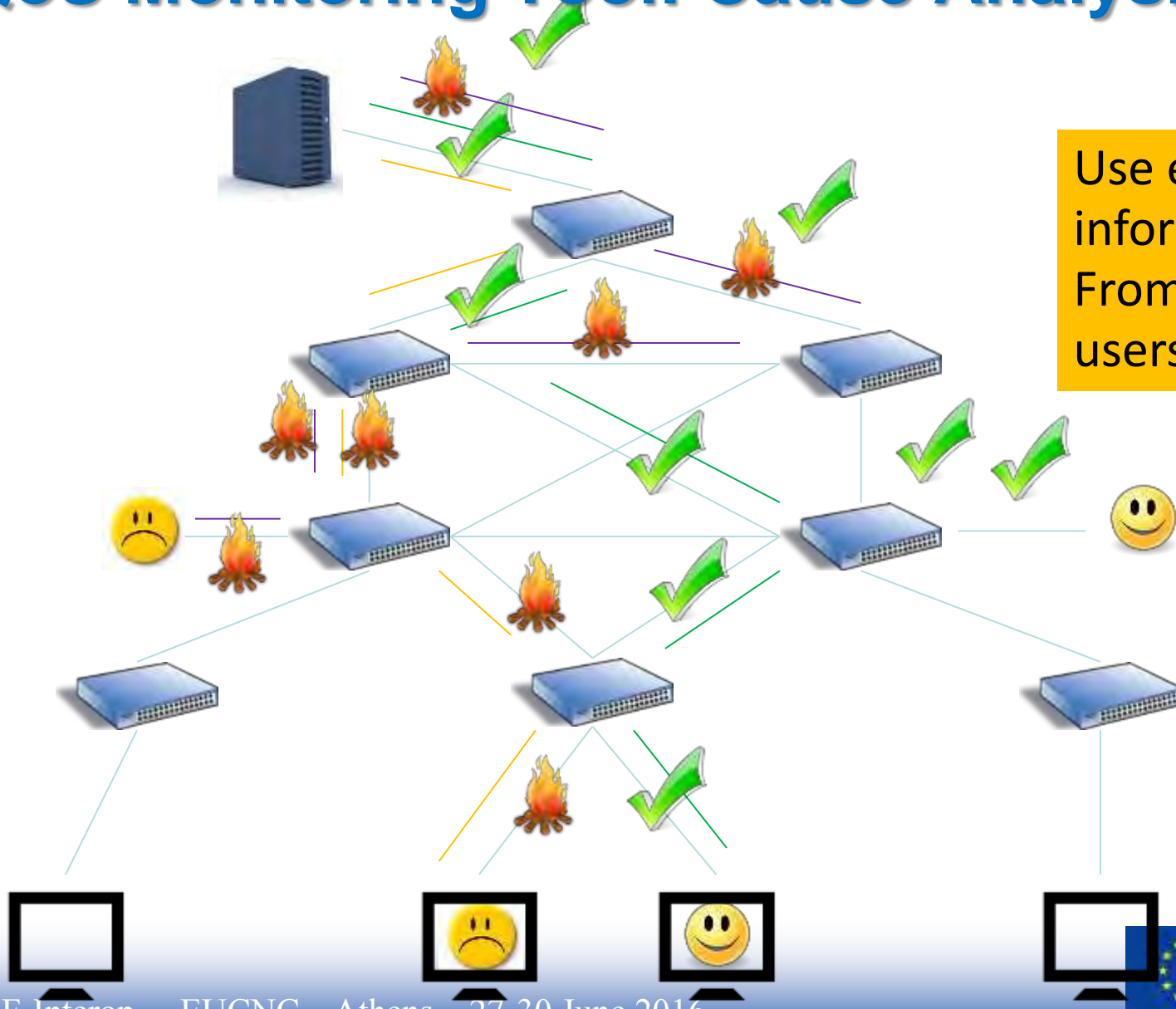


Use more information:
whitelist links
without issues



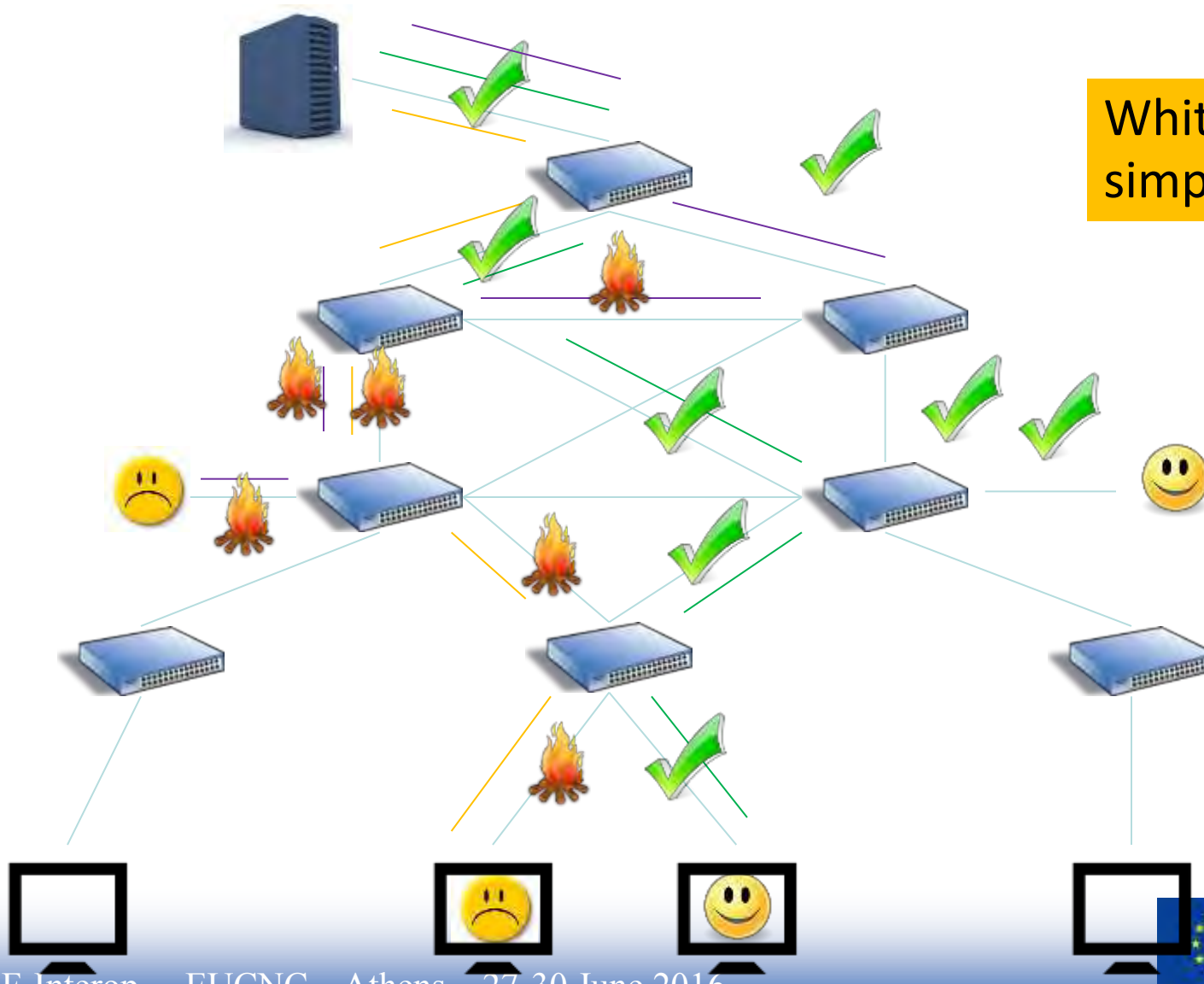
QoS Monitoring Tool: Cause Analysis

Use even more information...
From other users



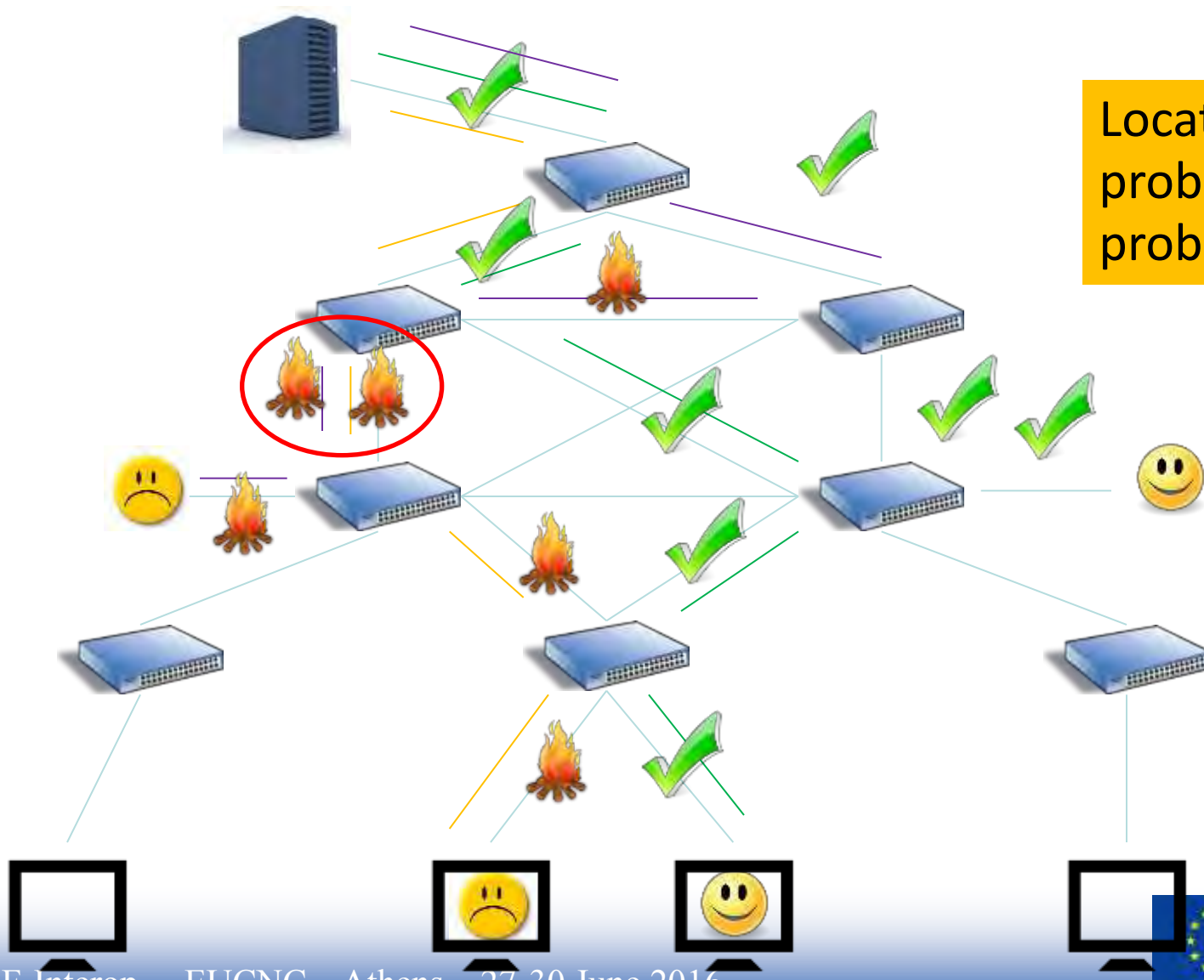
QoS Monitoring Tool: Cause Analysis

Whitelist,
simplify



QoS Monitoring Tool: Cause Analysis

Locate most probable problematic link



QoS Monitoring Tool: Testbed



The screenshot displays the 'jFed Experimenter Toolkit' interface. At the top, there are tabs for 'General', 'Topology Viewer', 'RSpec Viewer', and 'Timeline Viewer'. Below the tabs is a toolbar with icons for 'Update Status', 'Renew', 'Terminate', 'Reboot', 'Edit SSH-keys Advanced', 'Share', and 'Auto Layout Layout'. The main area shows a network topology diagram with a central 'link0' node connected to 'Controller', 'QoSAgent2', 'Topology', and 'QoSAgent1'. A 'qos' button is visible in the top left. At the bottom, there is a 'Progress' section with a list of tasks:

- Restore manifest from iMinds Virtual Wall 1
- Waiting for nodes from iMinds Virtual Wall 1 to become ready.
- Testing connectivity to nodes from iMinds Virtual Wall 1.

- 4 VMs in **Fed4Fire**
- Switches and hosts: **Mininet**
- SDN Controller: **OpenDaylight**
- Nephos6 Sonar Controller
- 2..N Nephos6 Sonar Agents
- Measurement type: ping-RTT

RSPEC to automatically configure a new experiment with all software configured.



QoS Monitoring Tool: Fed4Fire RSPEC



```
Fed Experimenter Toolkit
General | Topology Editor | RSpec Editor | Timeline Editor
Run | Reserve | Save | Format Code | Verify RSpec | (Un)Bind RSpec Code | Search | Search & Replace

3 <emulab:routable pool client id="qos" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm" count="1" type="any"
4 <node client_id="Topology" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
5 <sliver_type name="zaw-pc">
6 <disk_image name="urn:publicid:IDN+wall1.ilabt.iminds.be+image+emulab-ops:UBUNTU14-64-STD"/>
7 </sliver_type>
8 <services>
9 <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
10 <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
11 <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
12 <execute shell="sh" command="sudo route add -net 10.2.32.0 netmask 255.255.240.0 gw 10.2.15.254"/>
13 <execute shell="sh" command="sudo apt-get -y update"/>
14 <execute shell="sh" command="sudo apt-get -y install python-software-properties"/>
15 <execute shell="sh" command="sudo add-apt-repository ppa:openjdk-r/ppa --yes"/>
16 <execute shell="sh" command="sudo apt-get -y update"/>
17 <execute shell="sh" command="sudo apt-get -y install openjdk-8-jdk"/>
18 <execute shell="sh" command="sudo apt-get -y install mininet"/>
19 <execute shell="sh" command="sudo service openvswitch-controller stop"/>
20 <execute shell="sh" command="sudo update-rc.d openvswitch-controller disable"/>
21 <execute shell="sh" command="sudo git clone https://gitlab.uni.lu/llamorte/FINTEROP.git"/>
22 <execute shell="sh" command="sudo touch ~/Installation_Done.md"/>
23 </services>
24 <location xmlns="http://jfed.iminds.be/rspec/ext/jfed/1" x="410.0" y="385.0"/>
25 <interface client_id="Topology:IF0">
26 <ip address="192.168.3.2" netmask="255.255.255.0" type="ipv4"/>
27 </interface>
28 </node>
29 <node client_id="QoSAgent1" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
30 <sliver_type name="zaw-pc"/>
31 <services>
32 <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
33 <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
34 <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
35 <execute shell="sh" command="sudo route add -net 10.2.32.0 netmask 255.255.240.0 gw 10.2.15.254"/>
36 <execute shell="sh" command="sudo apt-get -y update"/>
37 <execute shell="sh" command="sudo apt-get -y install openjdk-7-jre git"/>
38 <execute shell="sh" command="sudo wget https://agents.v6sonar.com/builds/Aiz44dXztpNDTJgzHCro/sonar-install-2.5.0.zip -P /icoe"/>
39 <execute shell="sh" command="sudo git clone https://gitlab.uni.lu/llamorte/FINTEROP.git"/>
40 <execute shell="sh" command="sudo /FINTEROP/qosagent/install_qos_agent.sh"/>
41 <execute shell="sh" command="sudo /FINTEROP/qosagent/tunnel.sh"/>
42 <execute shell="sh" command="sudo touch ~/Installation_Done.md"/>
43 </services>
44 <location xmlns="http://jfed.iminds.be/rspec/ext/jfed/1" x="210.0" y="318.33333333333337"/>
45 <interface client_id="QoSAgent1:IF0">
46 <ip address="192.168.3.1" netmask="255.255.255.0" type="ipv4"/>
47 </interface>
48 </node>
49 <node client_id="QoSAgent2" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
50 <sliver_type name="zaw-pc">
51 <disk_image name="urn:publicid:IDN+wall1.ilabt.iminds.be+image+emulab-ops:UBUNTU14-64-STD"/>
52 </sliver_type>
53 <services>
54 <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
55 <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
56 <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
57 <execute shell="sh" command="sudo route add -net 10.2.12.0 netmask 255.255.240.0 gw 10.2.15.254"/>
58 </services>
59 </node>
60 </emulab:routable pool>
```



QoS Monitoring Tool: Prototype GUI



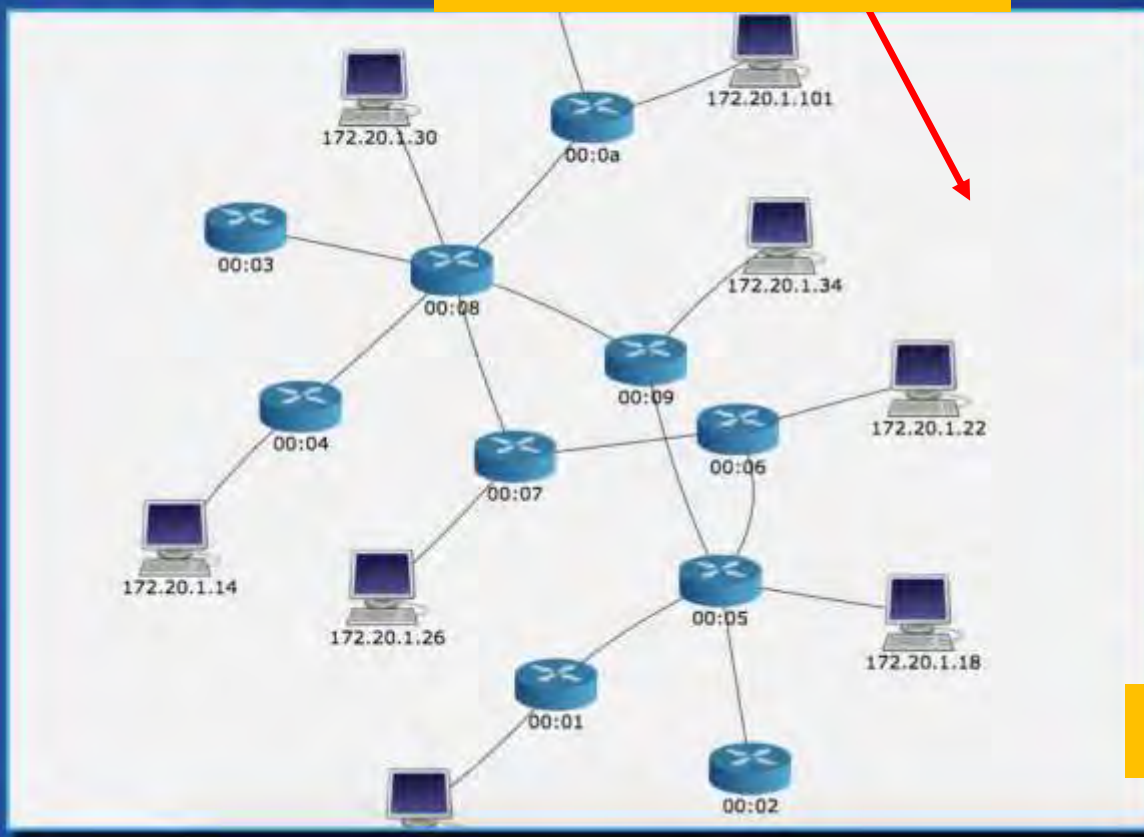
SDN Monitoring Tool (ver.1.0)

Topology re-created from SDN Info

Home Histogram Links Node



Thresholds



Configuration

IP: 172.20.1.101	Target/Server
ms: 100	Latency
W: 0	Bandwidth
H: 1	Packets Loss

- Measurements**
- Latency
 - Packet losses
 - Bandwidth

- More...**
- Show Agents
 - Refresh Topo
 - IDLE

QoS performance



QoS Monitoring Tool: Packet Loss Data



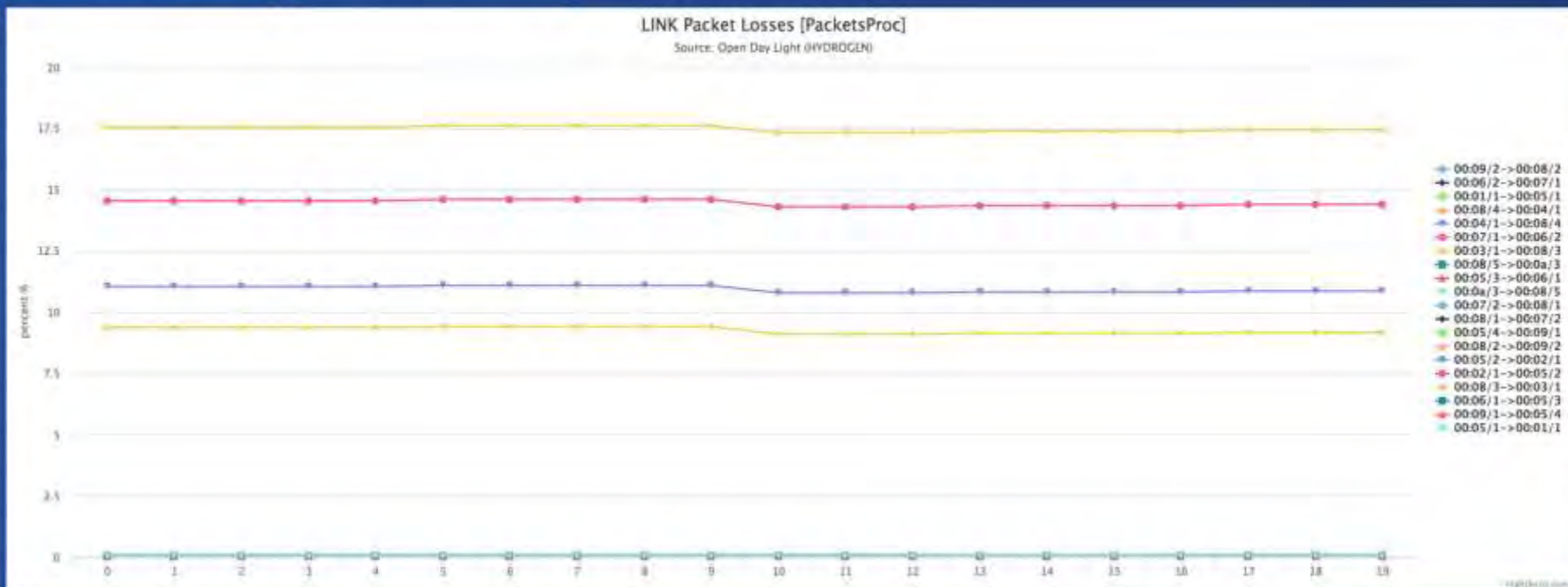
SDN Monitoring Tool (ver.1.0)



Home Histogram Links Node

Packet losses

Bandwidth



QoS Monitoring Tool: Link Bandwidth Data



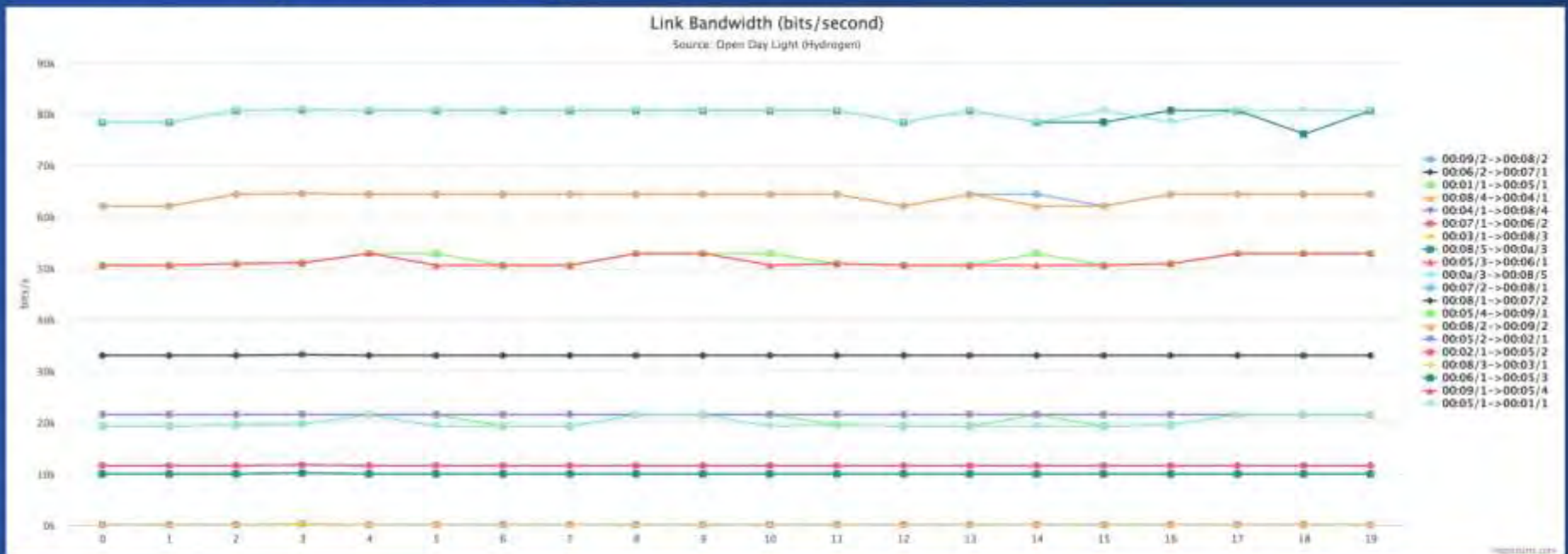
SDN Monitoring Tool (ver.1.0)



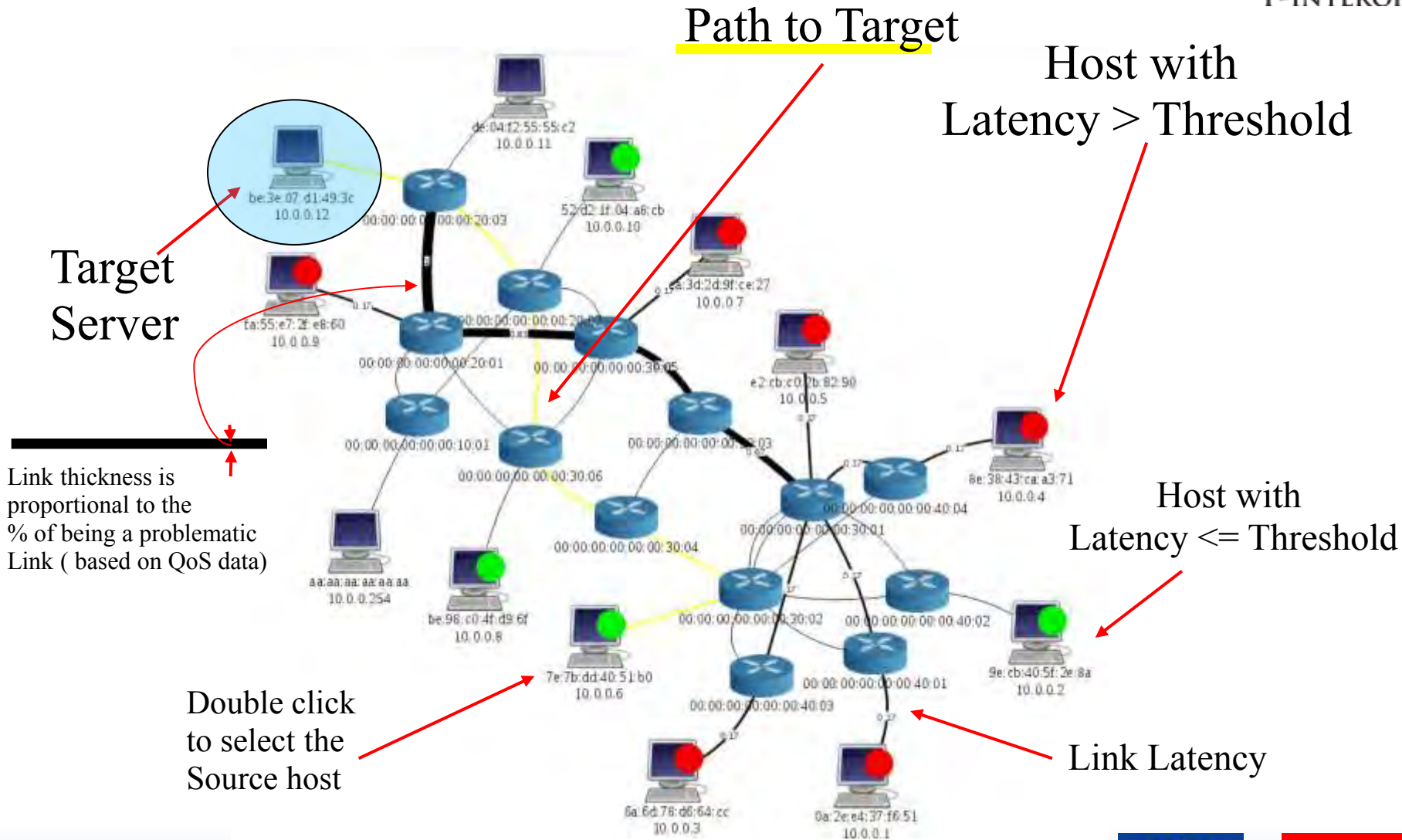
Home Histogram Links Node

Packet losses

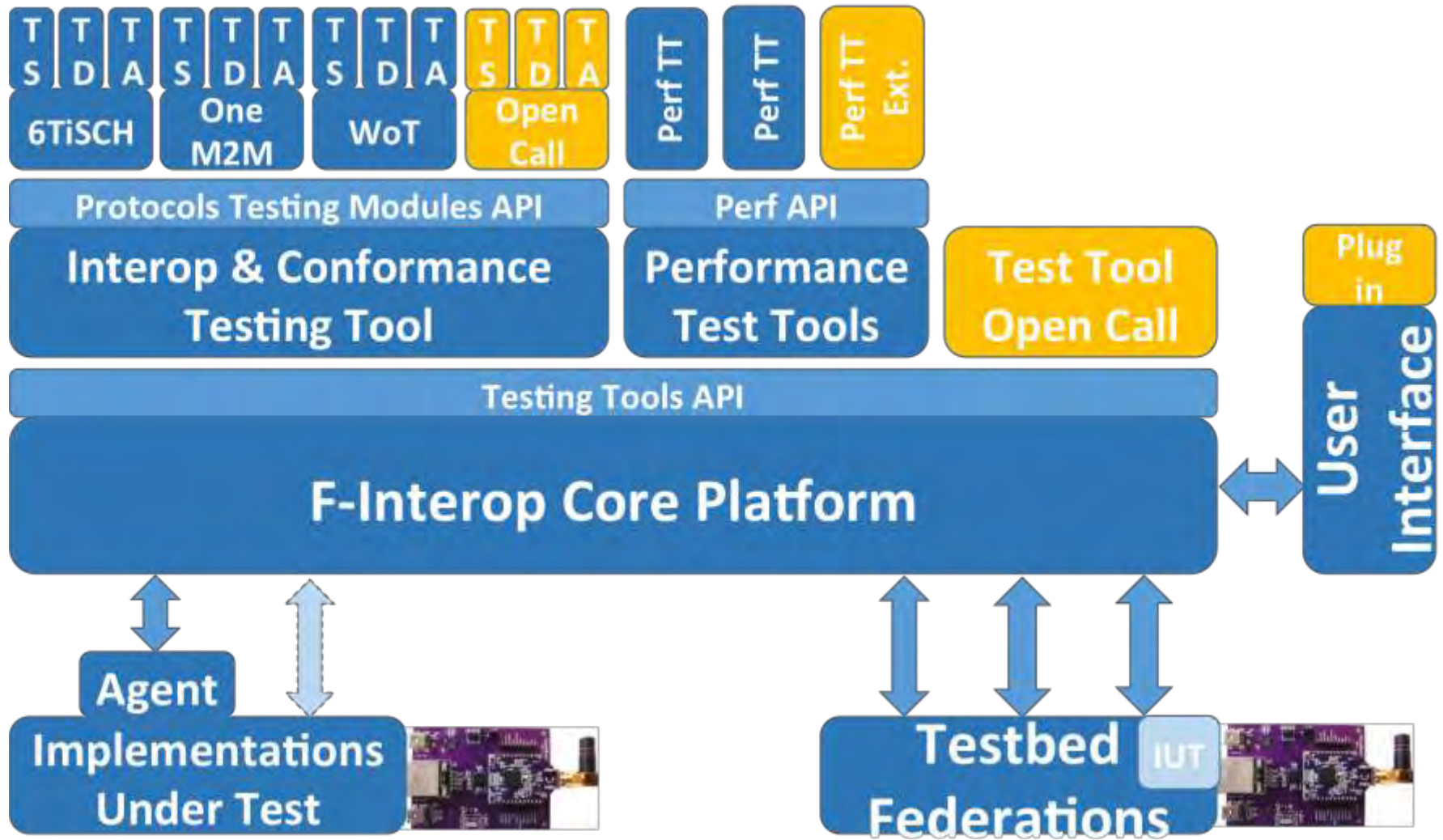
Bandwidth



QoS Data Visualization



Open Call: Current Base Platform



Open Call Categories



- **New testing tools** to extend capabilities of F-Interop
- **New tests designs** to test interoperability & other measures
- **SME device Interop tests** to test F-Interop platform
- **Plugtests** to conduct 3 remote online plugtest events



Open Call: Supported Activities & Budget



List of Categories	Grants	Award
New F-Interop tools extensions	3	100 000
New interop test design and implementation	3	60 000
Plugtests	3	10 000
SME devices F-Interop tests and report	10	10 000



Open Call: Community Support & Impact



- Follow-up selected proposals submitted to the open call
- Management of project startups throughout the life cycle of the experiments
- Support for tools development & test design projects
- Cascade funding payments



Open Call: Important Dates

