

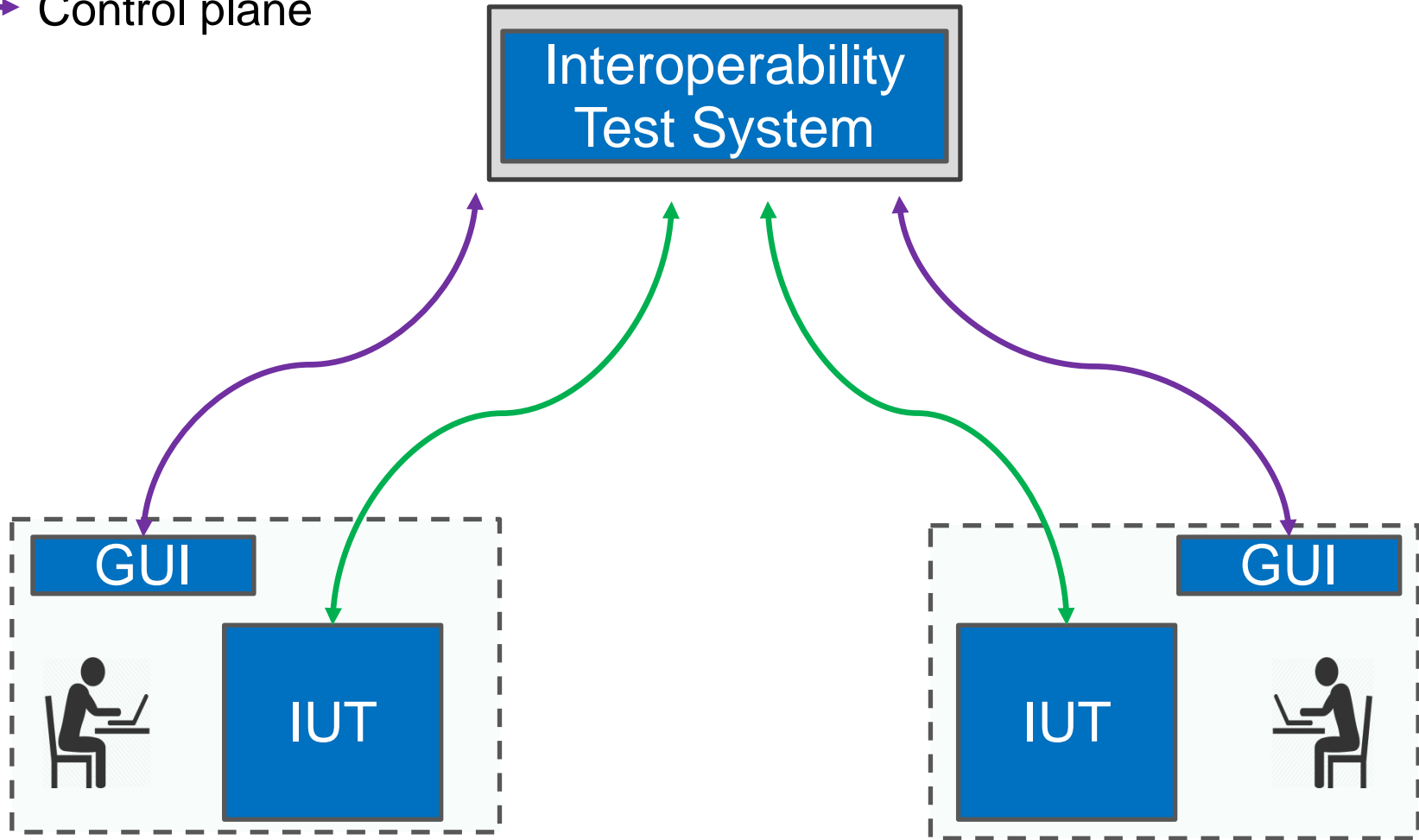


Live Demos and Open Call
EUCNC, Athens, June 27-30



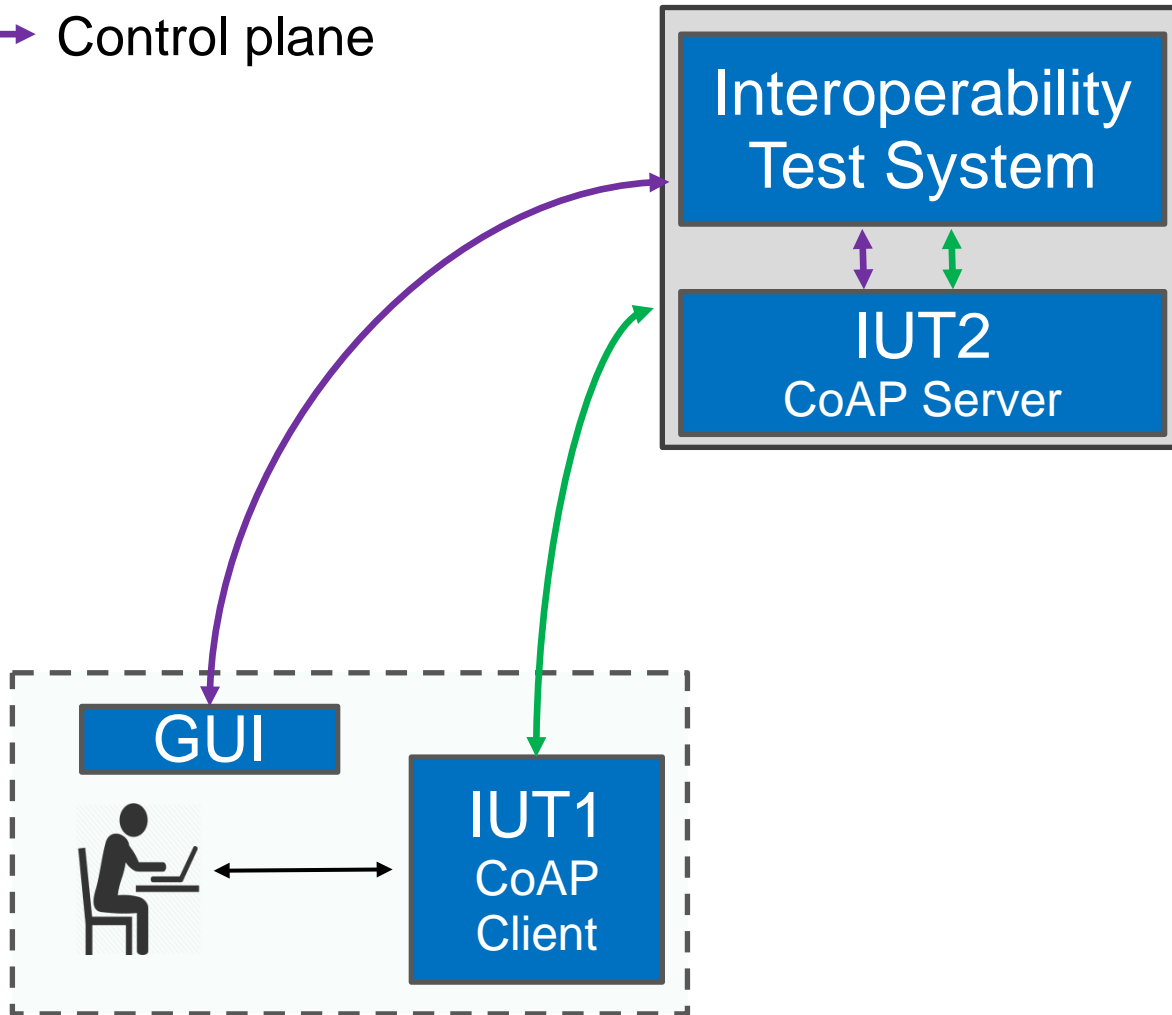
Remote interoperability testing – Overview

↔ Data plane
↔ Control plane

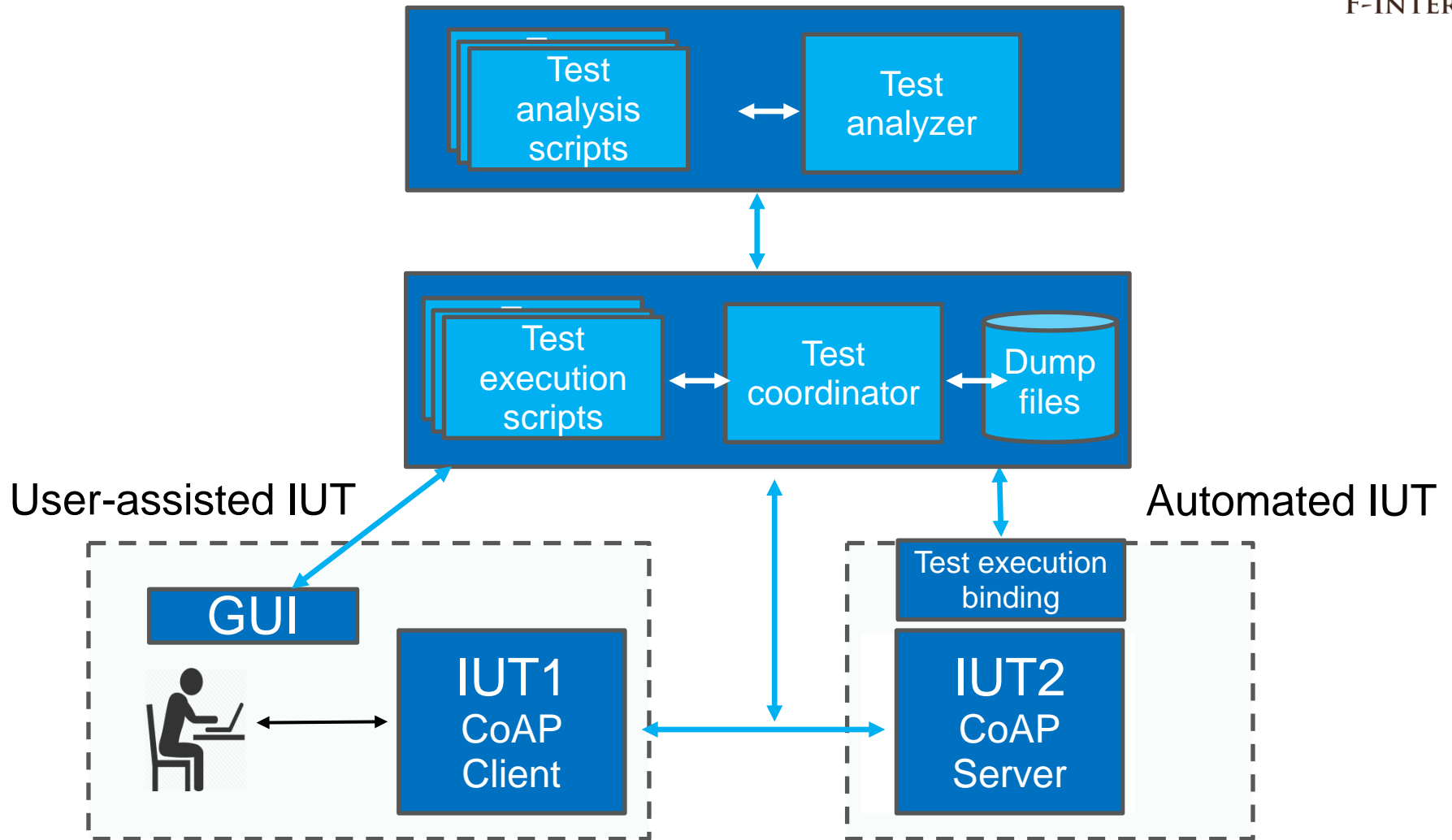


Remote interoperability testing – Demo Use Case



↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Main Components



CoAP remote interoperability testing – Session Execution



Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
TD_COAP_CORE_02	pass
Perform DELETE transaction (CON mode)	
TD_COAP_CORE_03	pass
Perform PUT transaction (CON mode)	
TD_COAP_CORE_04	pass
Perform POST transaction (CON mode)	
TD_COAP_CORE_05	inconc
Perform GET transaction (NON mode)	
TD_COAP_CORE_06	pass
Perform DELETE transaction (NON mode)	
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, 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 Test Case

TD_COAP_CORE_06

Gave the verdict **pass**

Review frames:
2

More informations

TD_COAP_CORE_05

Gave the verdict **inconc**

Review frames:
1, 2

More informations

TD_COAP_CORE_04

Gave the verdict **pass**

Review frames:
2

More informations

TD_COAP_CORE_03

Gave the verdict **pass**

Review frames:
2

More informations

TD_COAP_CORE_02

Gave the verdict **pass**

Review frames:
2

More informations

TD_COAP_CORE_01

Gave the verdict **pass**

More informations

No Frame Selected

No Frame

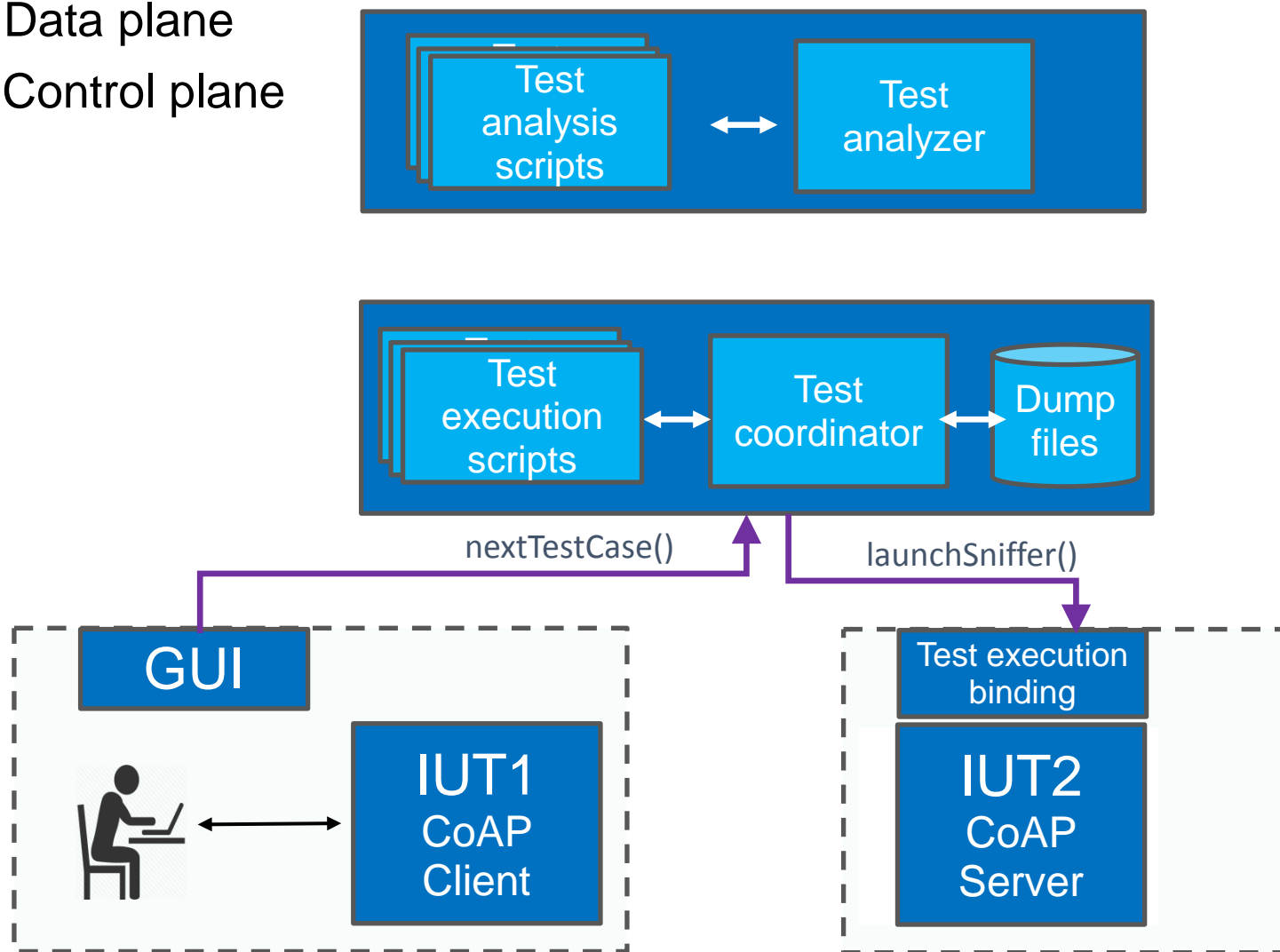
No frame selected for the moment

Frame list

No test case selected for the moment

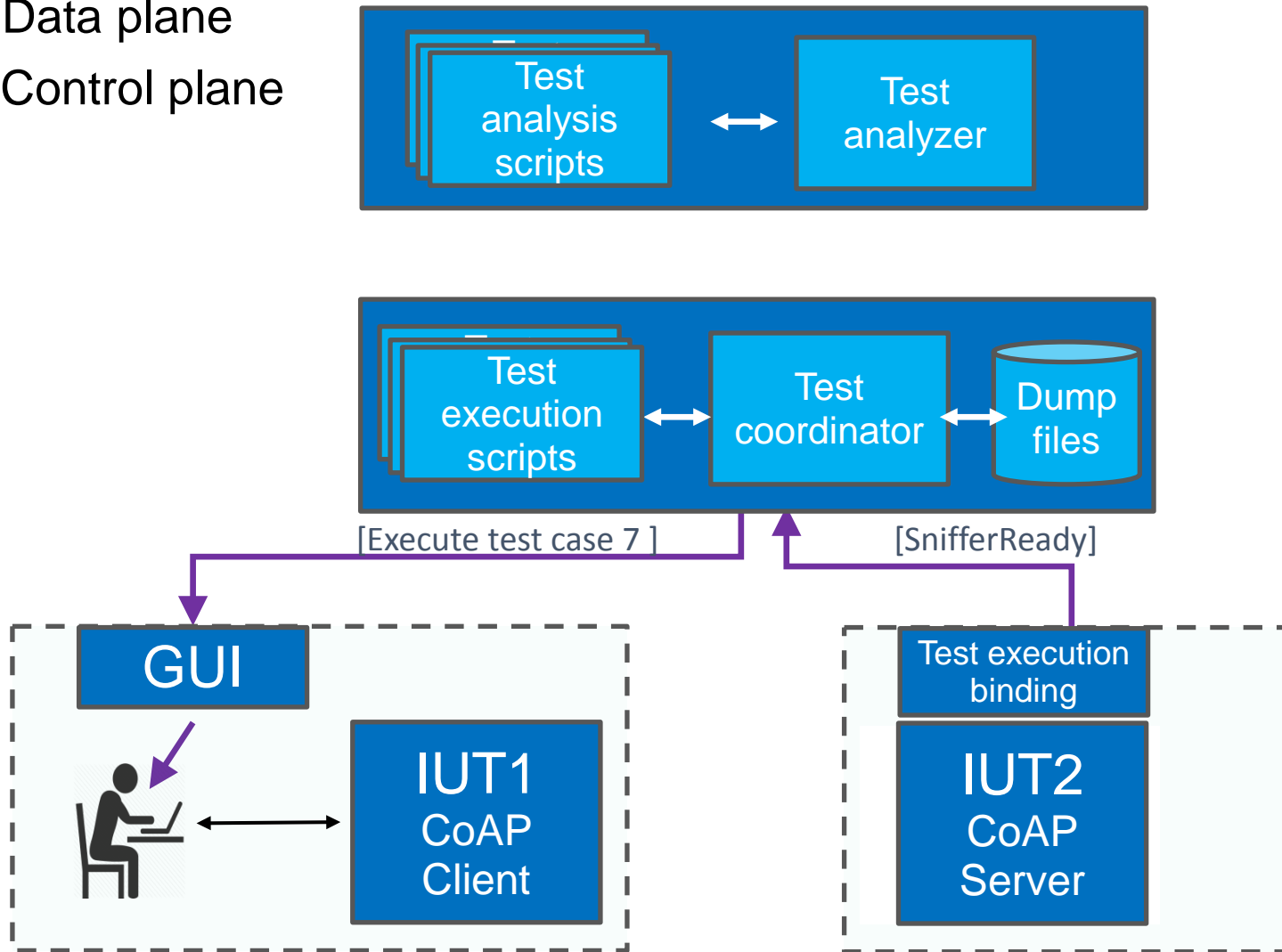
CoAP remote interoperability testing – Session Execution

↔ Data plane
↔ Control plane



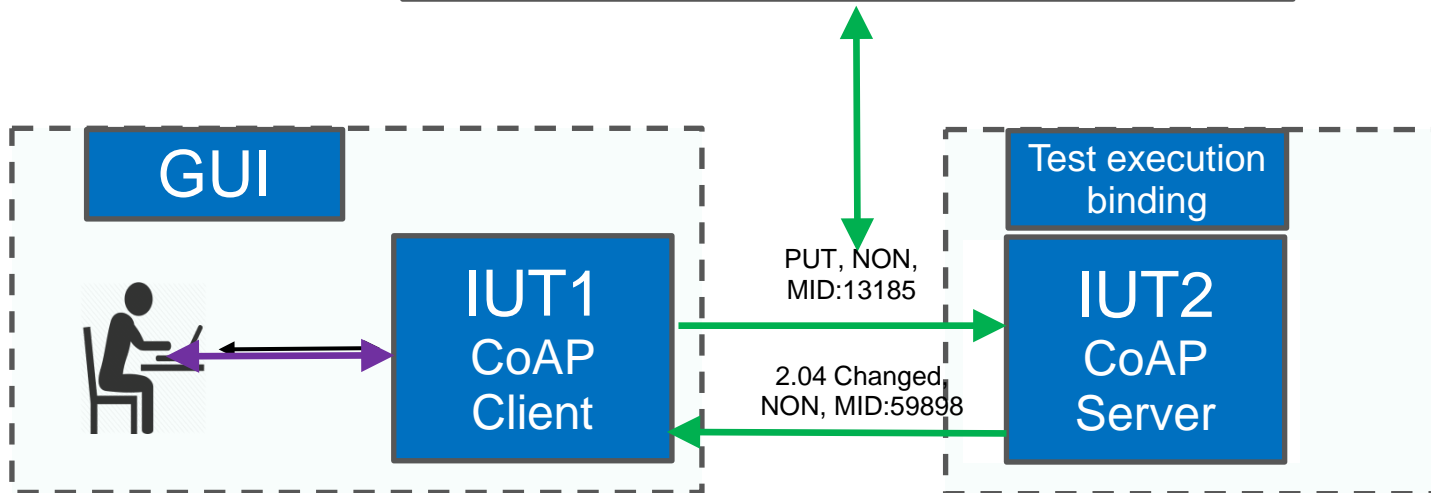
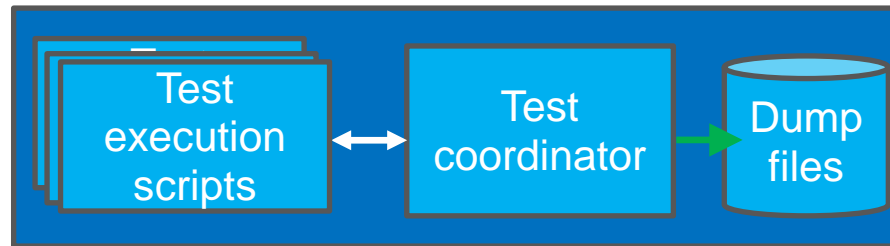
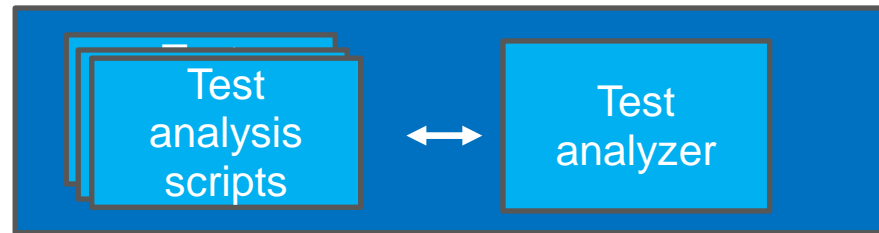
CoAP remote interoperability testing – Session Execution

↔ Data plane
↔ Control plane



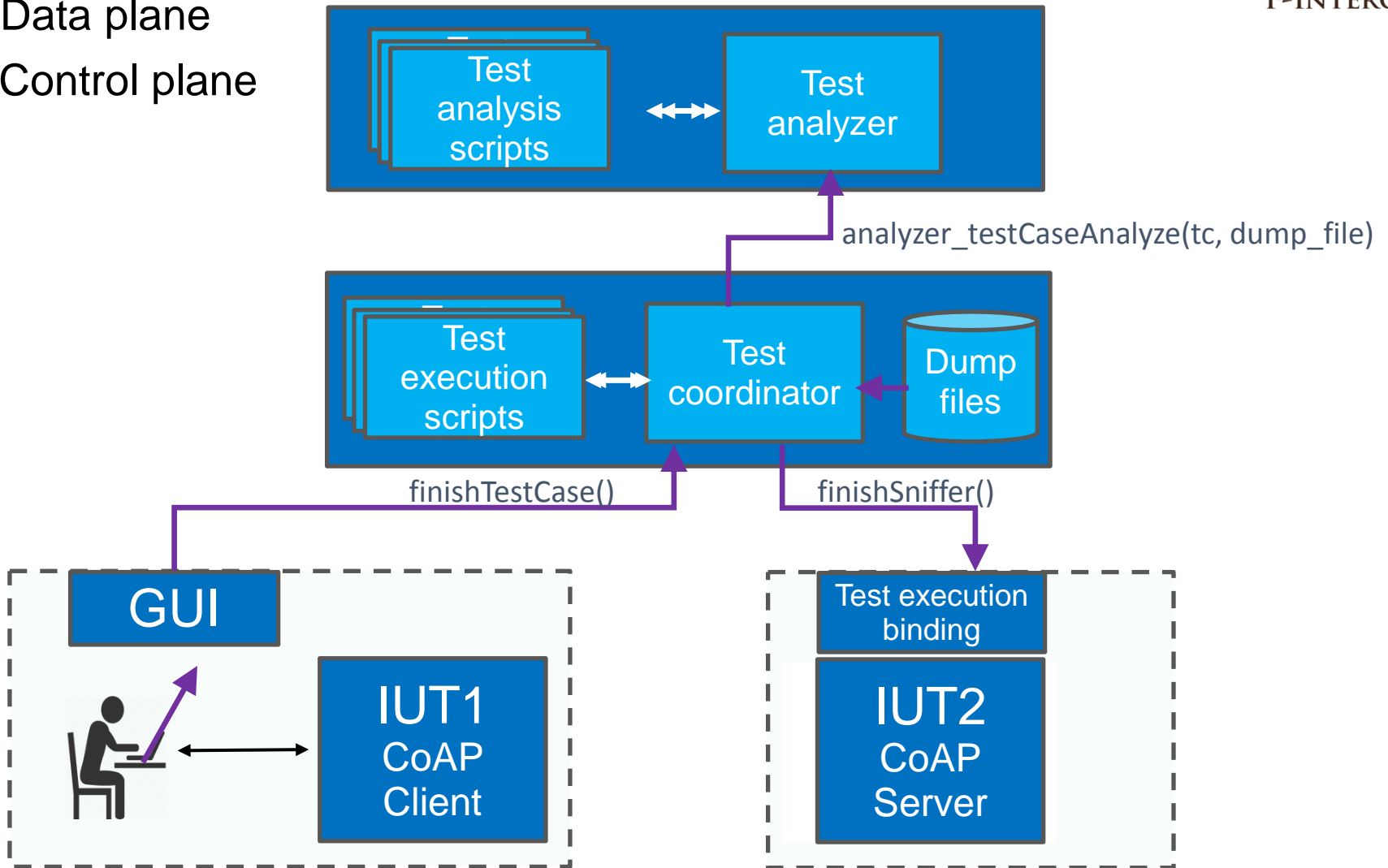
CoAP remote interoperability testing – Session Execution

↔ Data plane
↔ Control plane



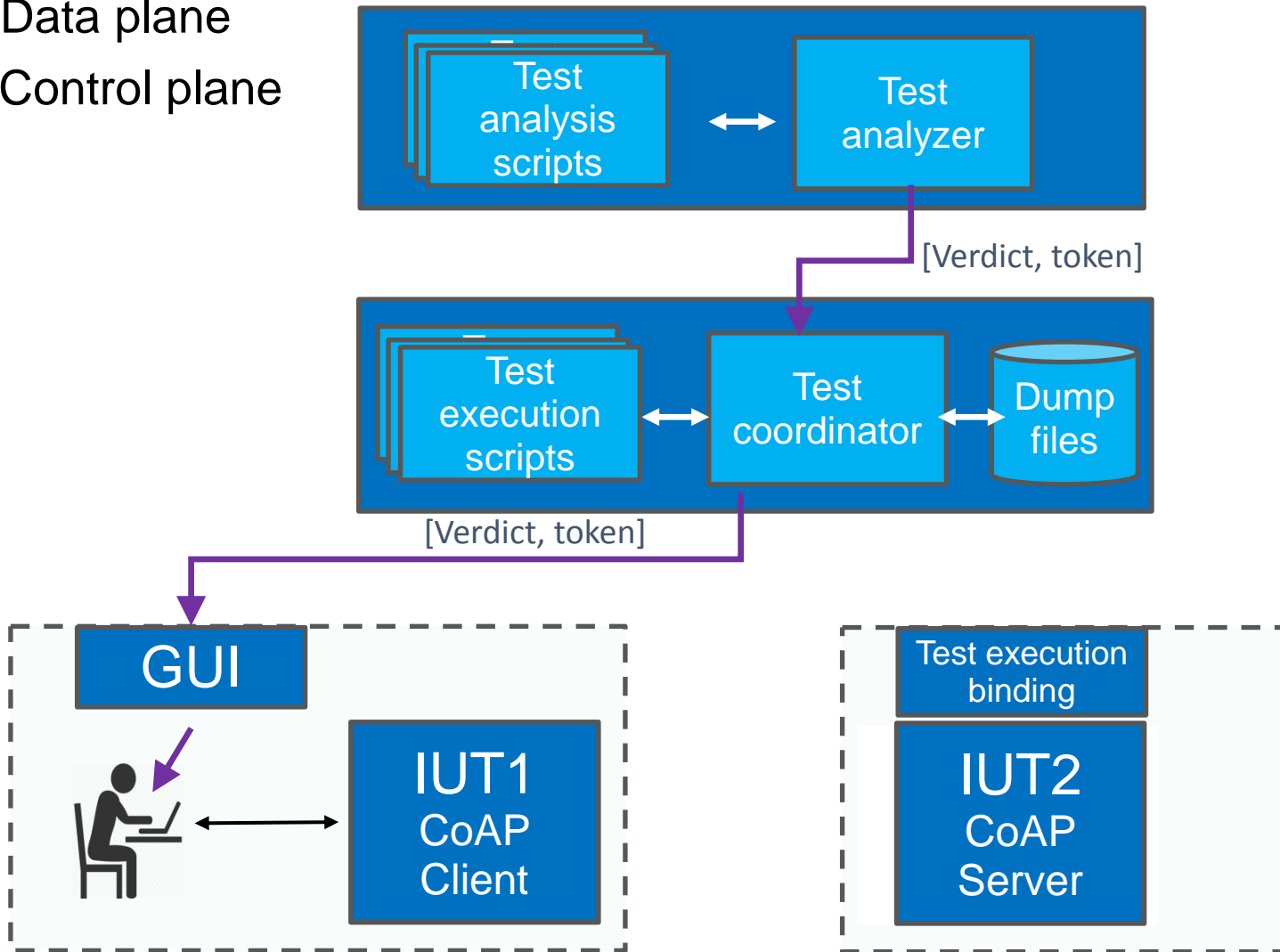
CoAP remote interoperability testing – Session Execution

↔ Data plane
↔ Control plane





CoAP remote interoperability testing – Session Execution

↔ Data plane
↔ Control plane



CoAP remote interoperability testing – Verdicts





Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
TD_COAP_CORE_02	pass
Perform DELETE transaction (CON mode)	
TD_COAP_CORE_03	pass
Perform PUT transaction (CON mode)	
TD_COAP_CORE_04	pass
Perform POST transaction (CON mode)	
TD_COAP_CORE_05	inconc
Perform GET transaction (NON mode)	
TD_COAP_CORE_06	pass
Perform DELETE transaction (NON mode)	
TD_COAP_CORE_07	fail
Perform PUT transaction (NON mode)	
TD_COAP_CORE_08	
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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 Test Case

TD_COAP_CORE_07
Gave 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
Gave the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_05
Gave the verdict inconc
Review frames:
1, 2
More informations

TD_COAP_CORE_04
Gave the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_03
Gave the verdict pass
Review frames:
2
More informations

TD_COAP_CORE_02

No Frame Selected

No Frame

No frame selected for the moment

Frame list



No test case selected for the moment

TEST CASE VERDICT



CoAP remote interoperability testing – Verdict Diagnostics





Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
TD_COAP_CORE_02	pass
Perform DELETE transaction (CON mode)	
TD_COAP_CORE_03	pass
Perform PUT transaction (CON mode)	
TD_COAP_CORE_04	pass
Perform POST transaction (CON mode)	
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Perform GET transaction containing several URI-Path options (CON mode)	
TD_COAP_CORE_14	

Console

Start Test Case

TD_COAP_CORE_07

Gave 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

Gave the verdict pass

Review frames:

2

More informations

TD_COAP_CORE_05

Gave the verdict inconc

Review frames:

1, 2

More informations

TD_COAP_CORE_04

Gave the verdict pass

Review frames:

2

More informations

TD_COAP_CORE_03

Gave the verdict pass

Review frames:

2

More informations

TD_COAP_CORE_02

No Frame Selected

No Frame

No frame selected for the moment



Frame list

No test case selected for the moment



CoAP remote interoperability testing – Verdict Diagnostics





Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
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Console

Start Test Case

TD_COAP_CORE_07
Gave the verdict **fail**
Review frames:
4, 5
More informations
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.opt: CoAPOptMismatch got: expected: CoAPOptionContentFormat() 127.0.0.1] CoAP [NON 59898] 2.04 Changed > [pass] match: CoAP(type=1, code=Any(65,68), tok=b'bxda')

Test case TD_COAP_CORE_07 started, press the Finish button when completed

TD_COAP_CORE_06
Gave the verdict **pass**
Review frames:
2
More informations

TD_COAP_CORE_05
Gave the verdict **inconc**
Review frames:
1, 2
More informations

TD_COAP_CORE_04
Gave the verdict **pass**
Review frames:
2
More informations

No Frame Selected

No Frame

No frame selected for the moment

Frame list



No test case selected for the moment

VERDICT EVALUATION INFORMATION



CoAP remote interoperability testing – Verdict Diagnostics





Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
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Perform PUT transaction (CON mode)	
TD_COAP_CORE_04	pass
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Console

Start Test Case

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Gave the verdict fail

Review frames:

4, 5

More informations

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Test case TD_COAP_CORE_07

started, press the Finish button when completed

TD_COAP_CORE_06

Gave the verdict pass

Review frames:

2

More informations

TD_COAP_CORE_05

Gave the verdict inconc

Review frames:

1, 2

More informations

TD_COAP_CORE_04

Gave the verdict pass

Review frames:

2

More informations

No Frame Selected

No Frame

No frame selected for the moment



Frame list

No test case selected for the moment



CoAP remote interoperability testing – Verdict Diagnostics





Test cases

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Perform GET transaction (CON mode)	
TD_COAP_CORE_02	pass
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TD_COAP_CORE_06
Gave the verdict **pass**
Review frames:
2
More informations

TD_COAP_CORE_05
Gave the verdict **inconc**
Review frames:
1, 2
More informations

TD_COAP_CORE_04
Gave the verdict **pass**
Review frames:
2
More informations

Analyse TC - TD_COAP_CORE_07

Frame n°4

CoAP
UDP
IPv4
NullLoopback

Frame list



1. [127.0.0.1 -> 127.0.0.1] UDP 50845 -> 50845
2. [127.0.0.1 -> 127.0.0.1] UDP 49374 -> 5684
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 59898] 2.04 Changed**

EXCHANGED
MESSAGES



CoAP remote interoperability testing – Verdict Diagnostics





Test cases

TD_COAP_CORE_01	pass
Perform GET transaction (CON mode)	
TD_COAP_CORE_02	pass
Perform DELETE transaction (CON mode)	
TD_COAP_CORE_03	pass
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TD_COAP_CORE_14	

Console

Start Test Case

TD_COAP_CORE_07
Gave the verdict **fail**
Review frames:
4, 5
More informations
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CoAP(opt=Opt(CoAPOptionContentFormat()), pl=Not(b"")) CoAP.opt: CoAPOptMismatch got: expected: CoAPOptionContentFormat() 127.0.0.1] CoAP [NON 59898] 2.04 Changed > [pass] match: CoAP(type=1, code=Any(65,68), tok=b'bxda')

Test case TD_COAP_CORE_07 started, press the Finish button when completed

TD_COAP_CORE_06
Gave the verdict **pass**
Review frames:
2
More informations

TD_COAP_CORE_05
Gave the verdict **inconc**
Review frames:
1, 2
More informations

TD_COAP_CORE_04
Gave the verdict **pass**
Review frames:
2
More informations

Analyse TC - TD_COAP_CORE_07

Frame n°4

CoAP
Version: 1
Type: 1
TokenLength: 2
Code: 3
MessageID: 0x3381
Token: b'bxda'
Options:
CoAPOptionUriPath:
Delta: 11
Length: 4
Value: test
Payload: b'98'
UDP
IPv4
NullLoopback

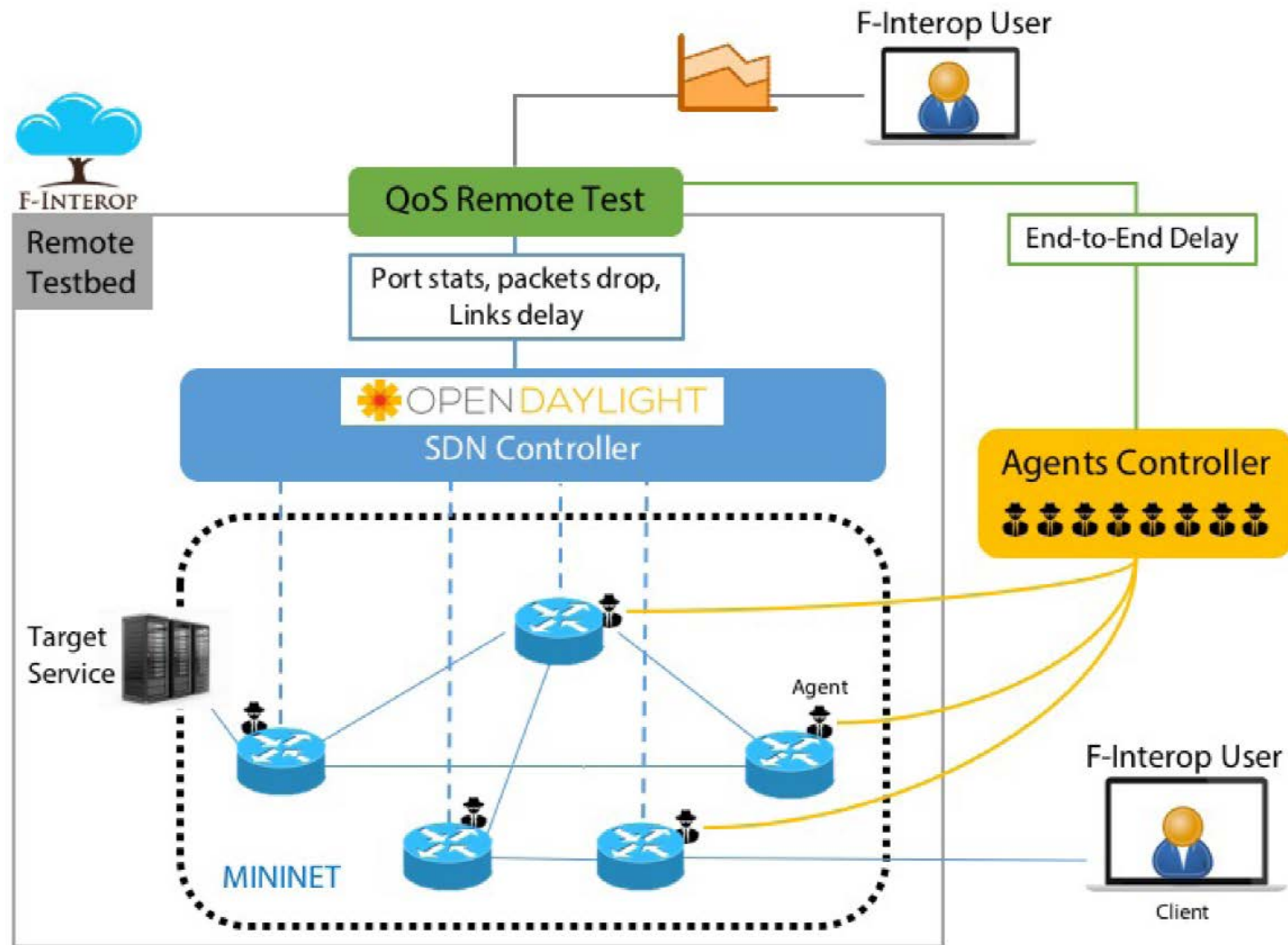
Frame list

1. [127.0.0.1 -> 127.0.0.1] UDP 50845 -> 50845
2. [127.0.0.1 -> 127.0.0.1] UDP 49374 -> 5684
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 59898] 2.04 Changed

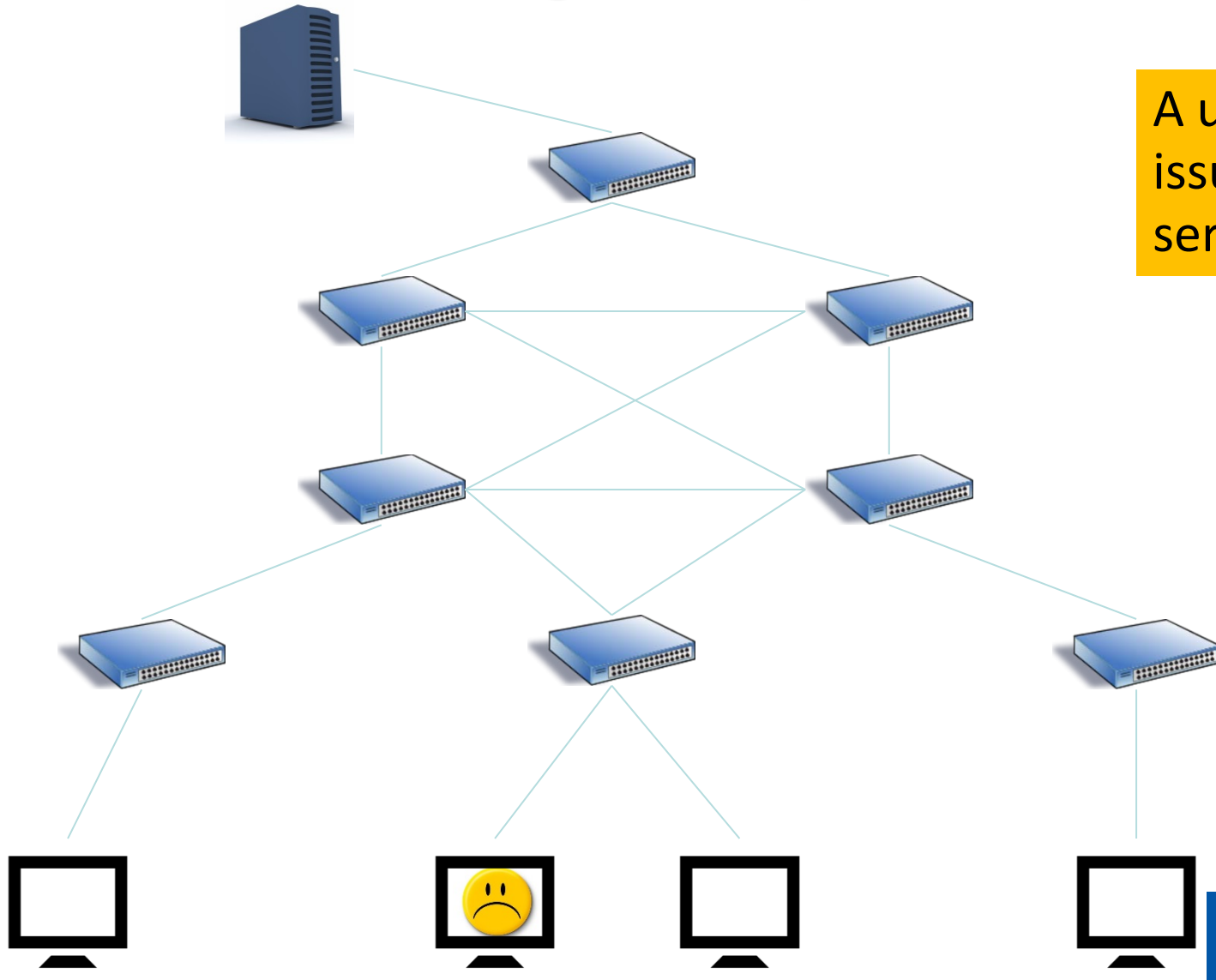
PROTOCOL FIELD INFORMATION



QoS Monitoring Tool - Architecture

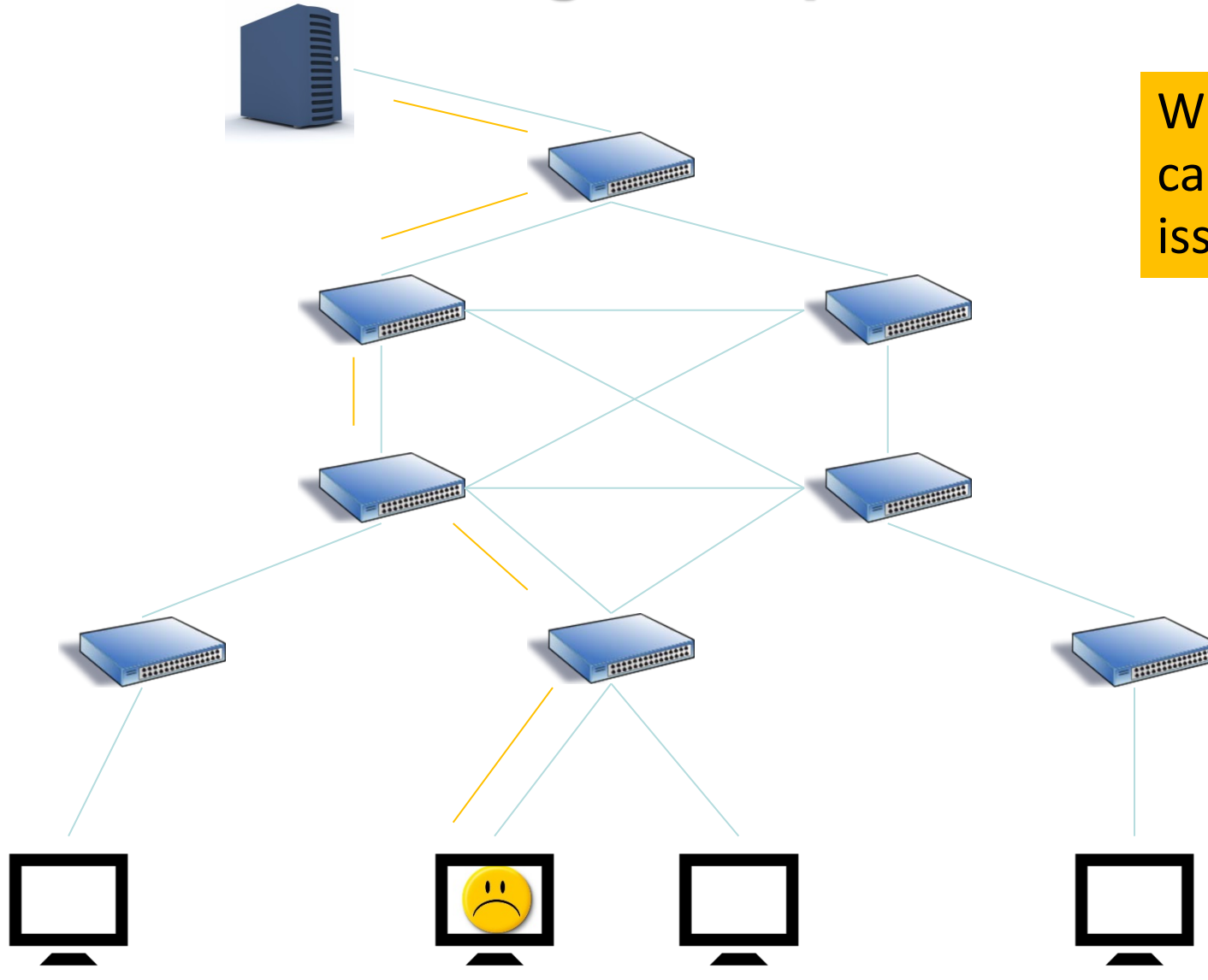


QoS Monitoring Tool Troubleshooting Example



A user has an issue with the service...

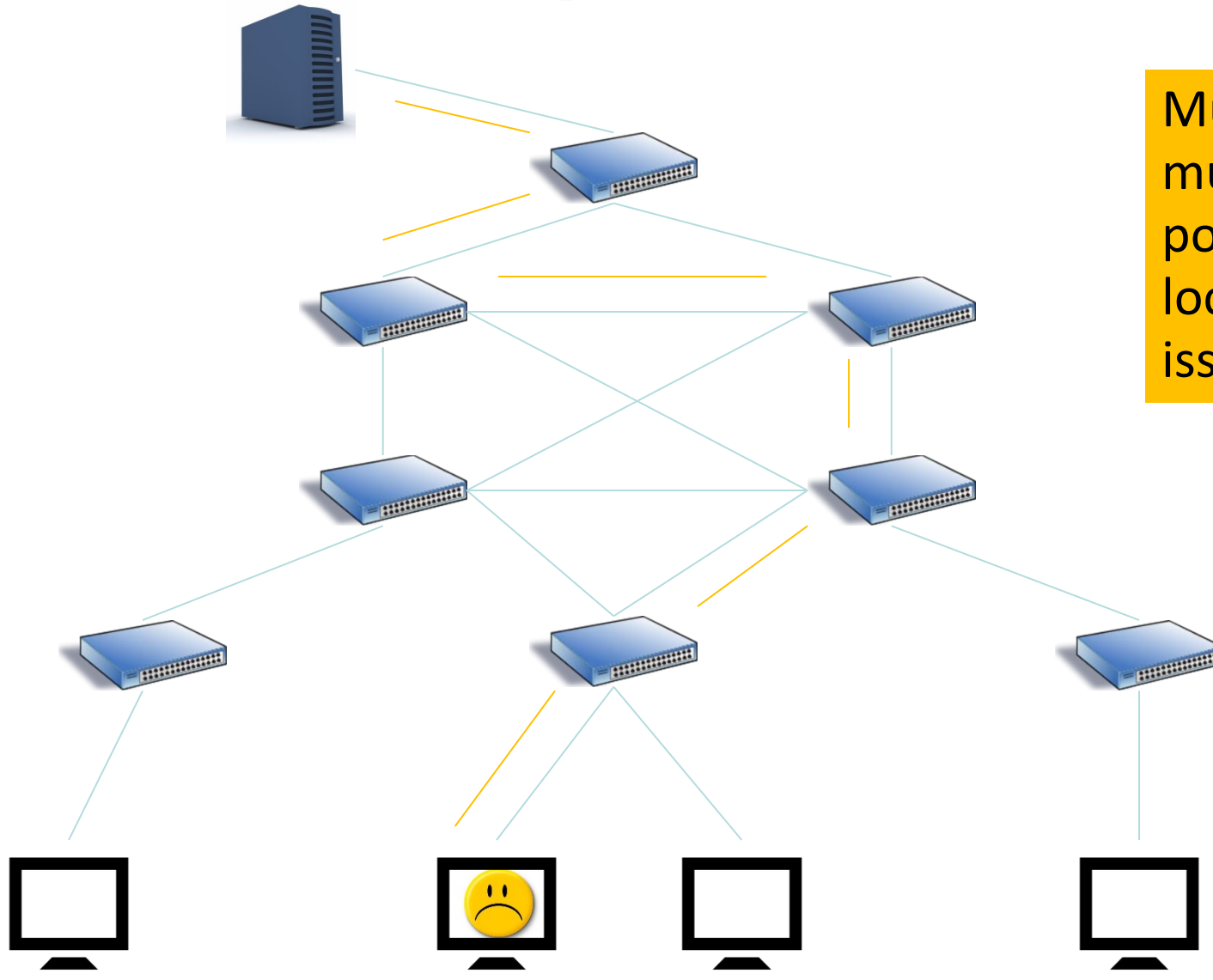
QoS Monitoring Tool Troubleshooting Example



What is the root cause of the issue?



QoS Monitoring Tool Troubleshooting Example



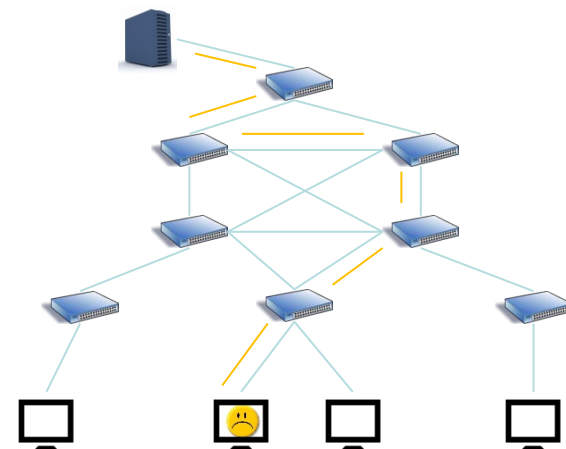
Multiple paths:
multiple
potential
locations for the
issue...

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.

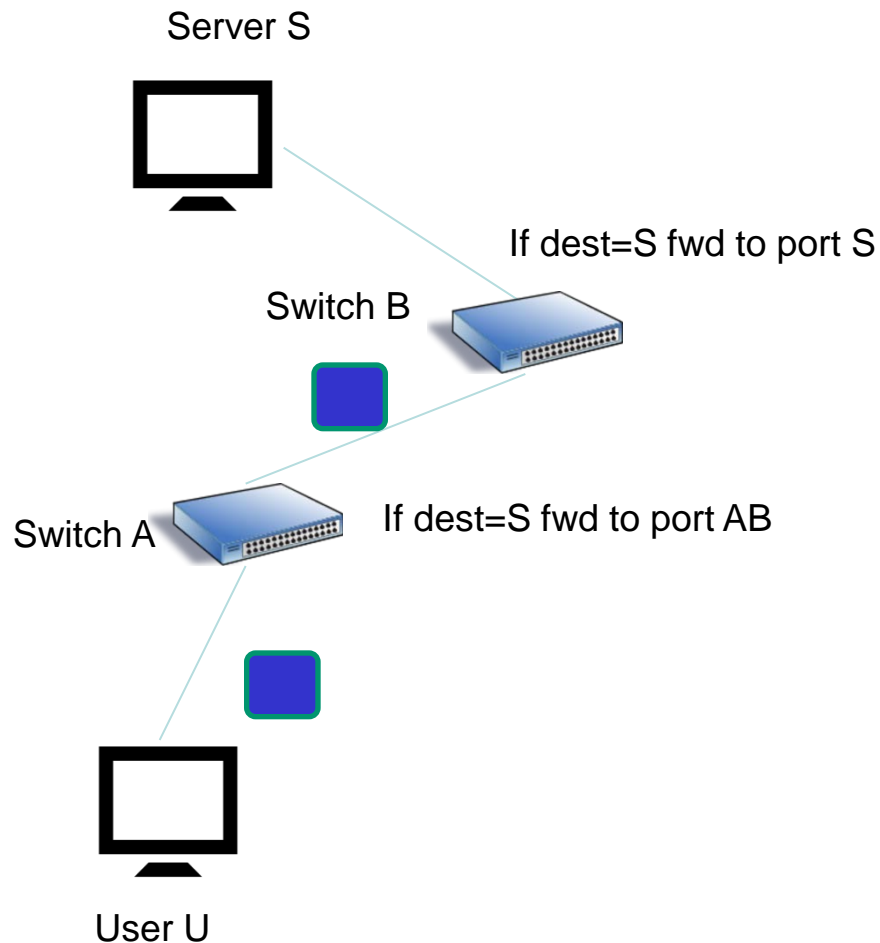
Tracking **packets** in SDN is not specifically addressed by OpenFlow and OpenDayLight based networks.



QoS Monitoring Tool

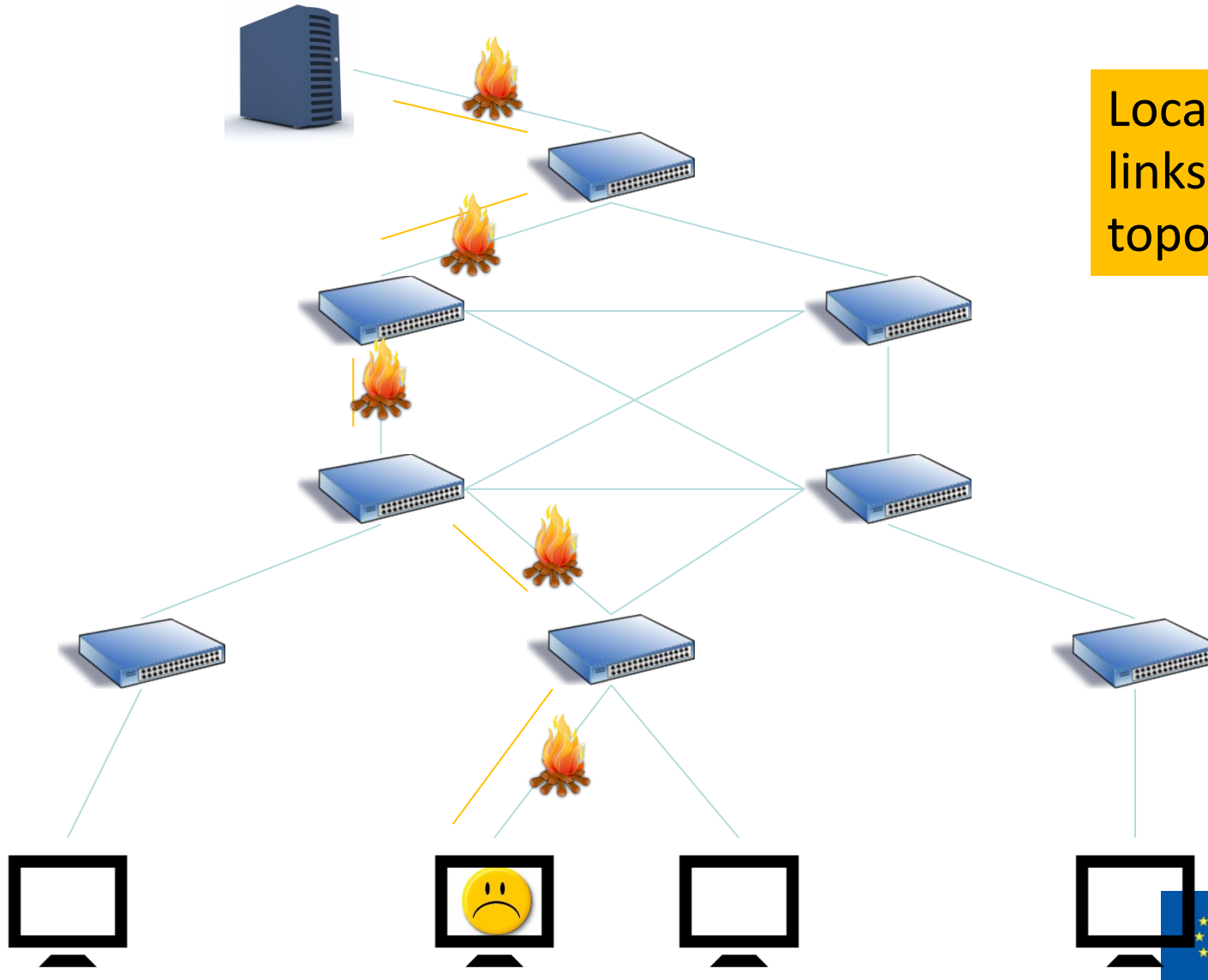
Path Extraction

- ❑ 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

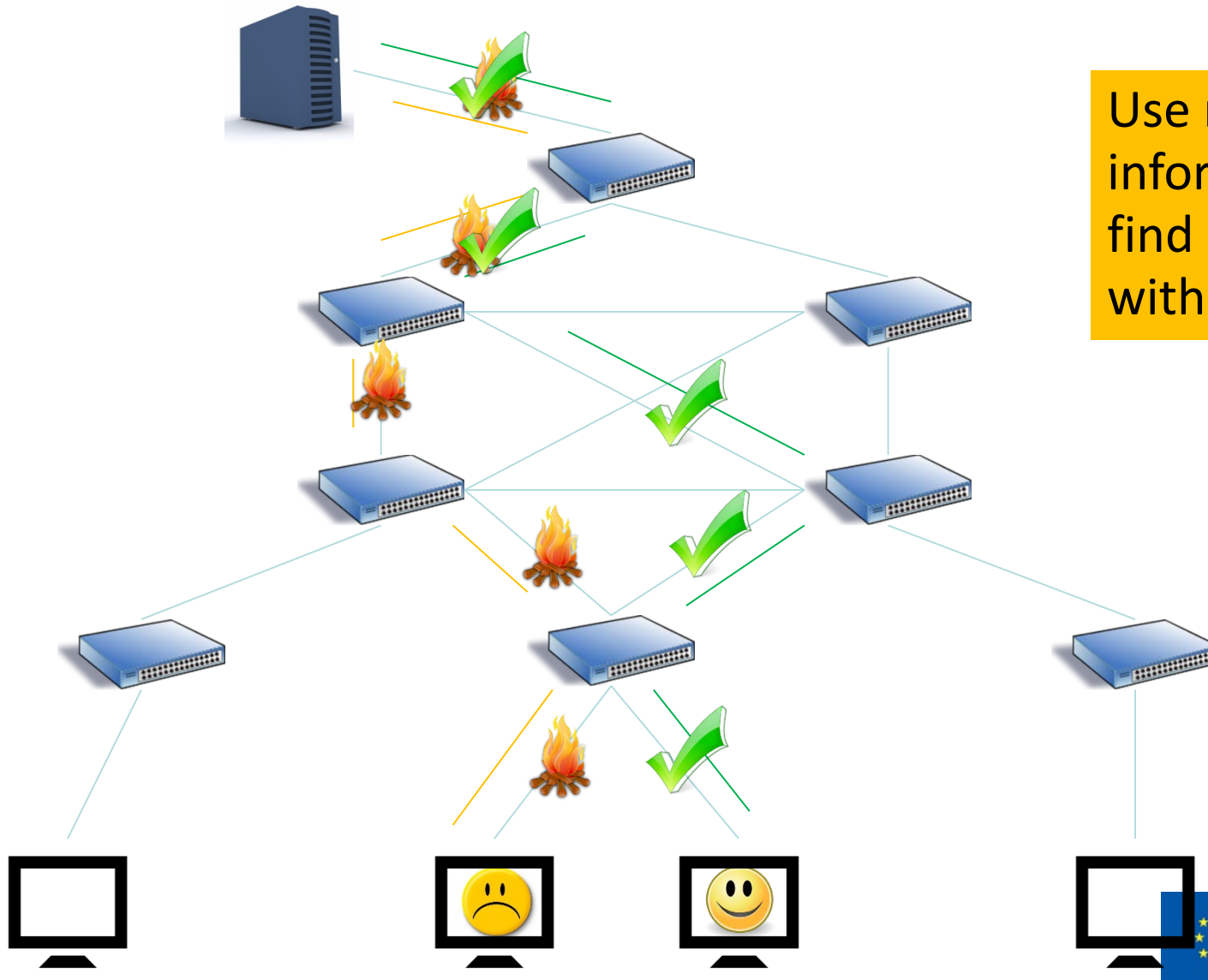


QoS Monitoring Tool: Cause Analysis

Locate possible
links in the
topology

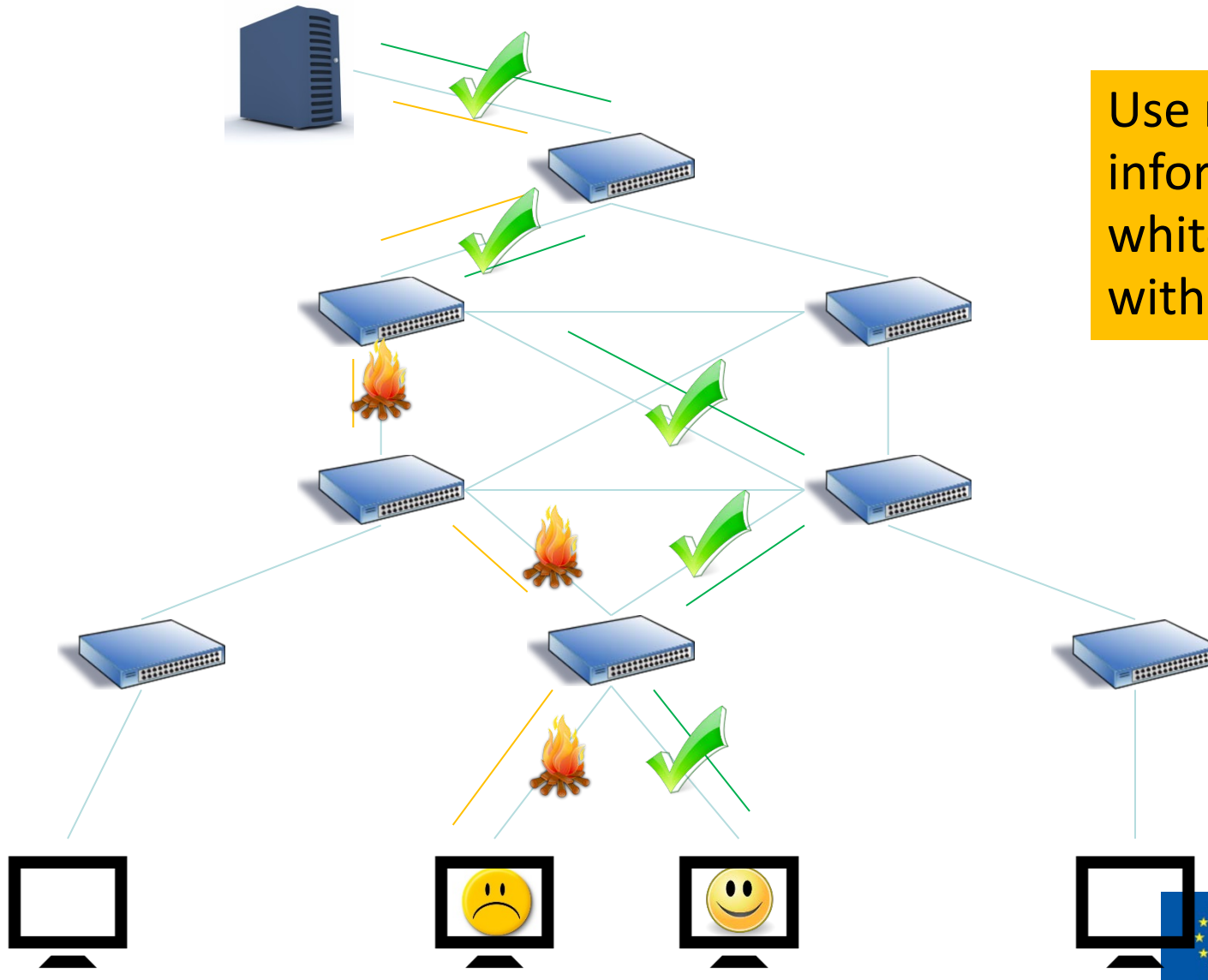


QoS Monitoring Tool: Cause Analysis



Use more
information:
find links
without issues

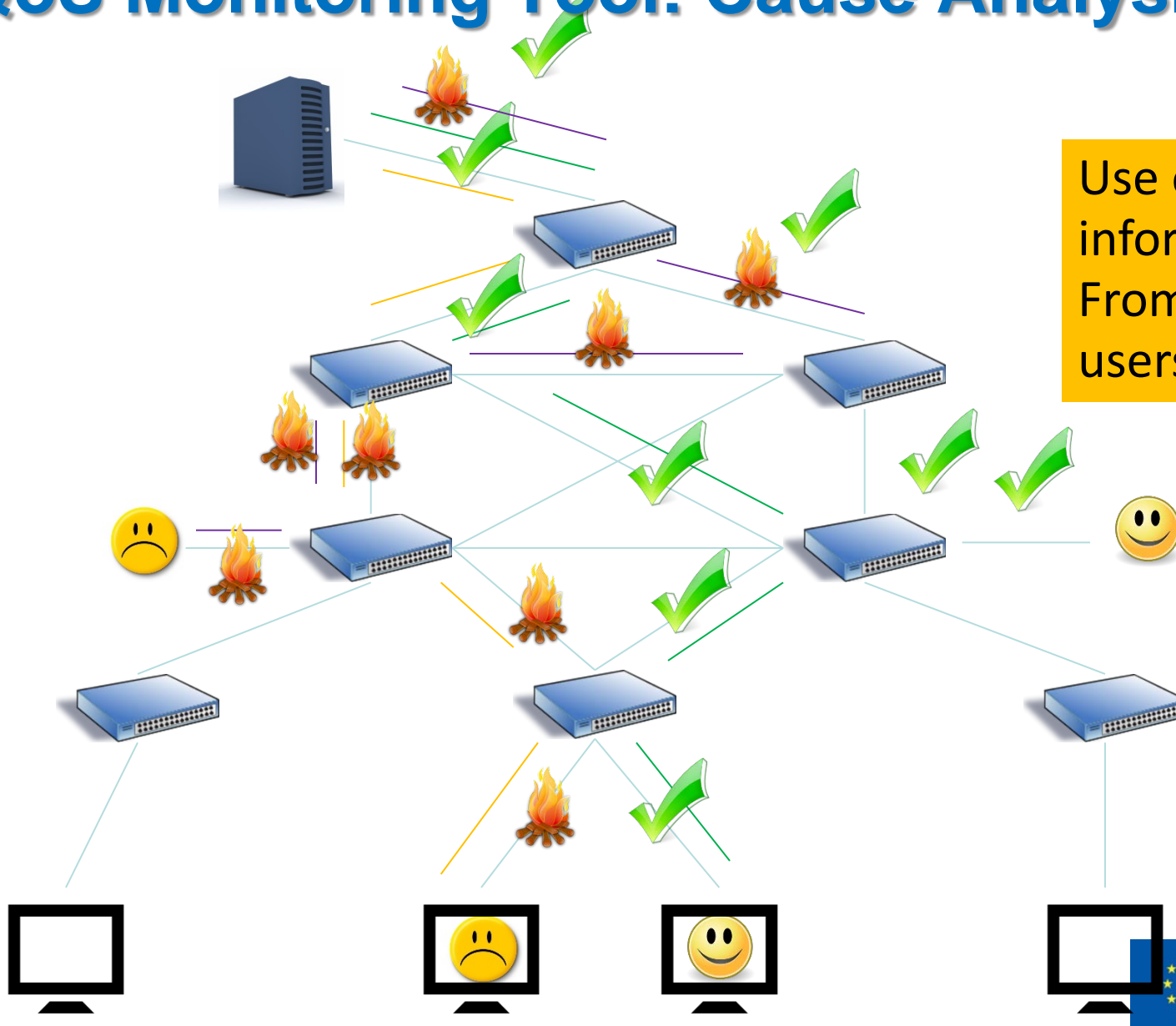
QoS Monitoring Tool: Cause Analysis



Use more
information:
whitelist links
without issues

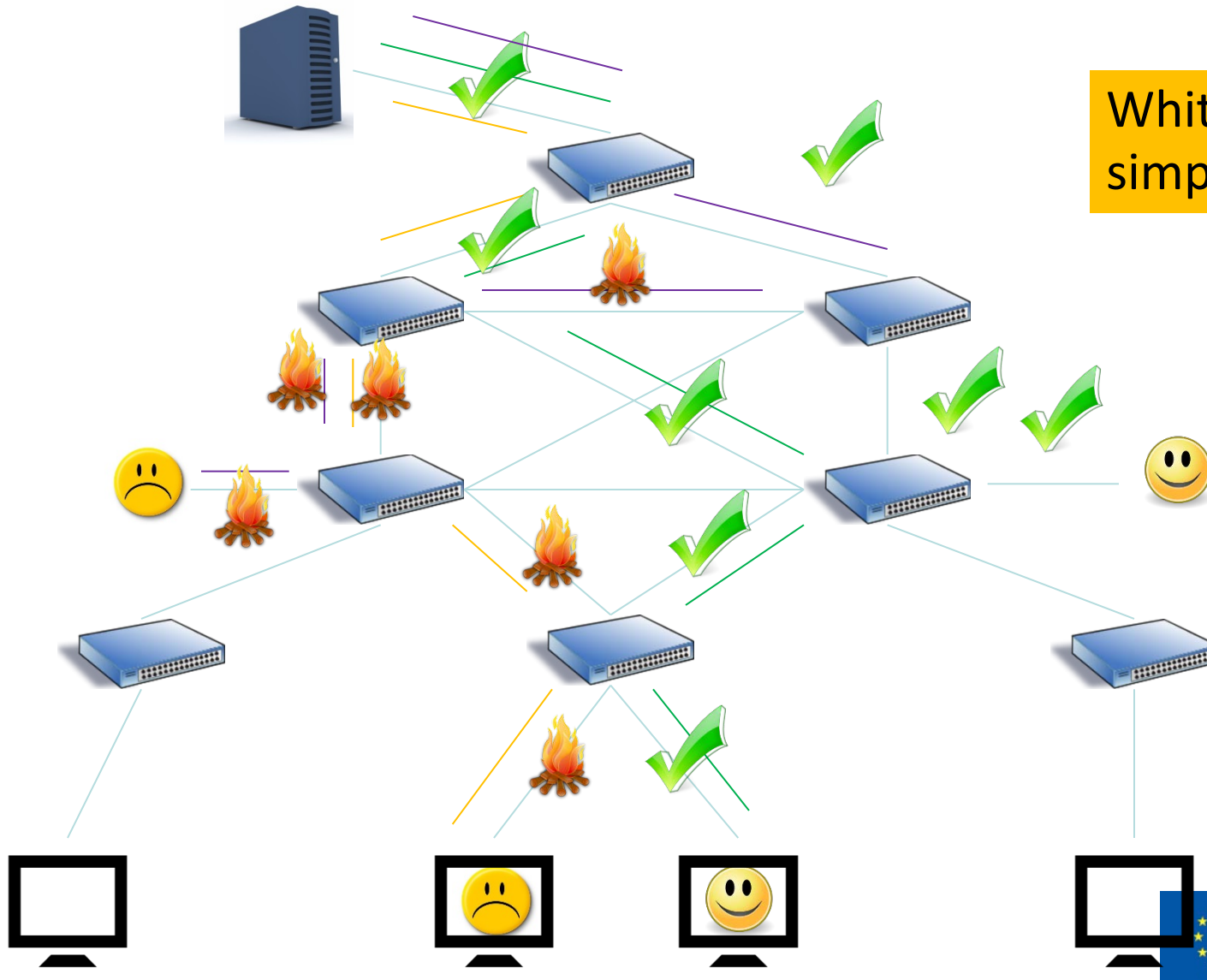
QoS Monitoring Tool: Cause Analysis

Use even more
information...
From other
users



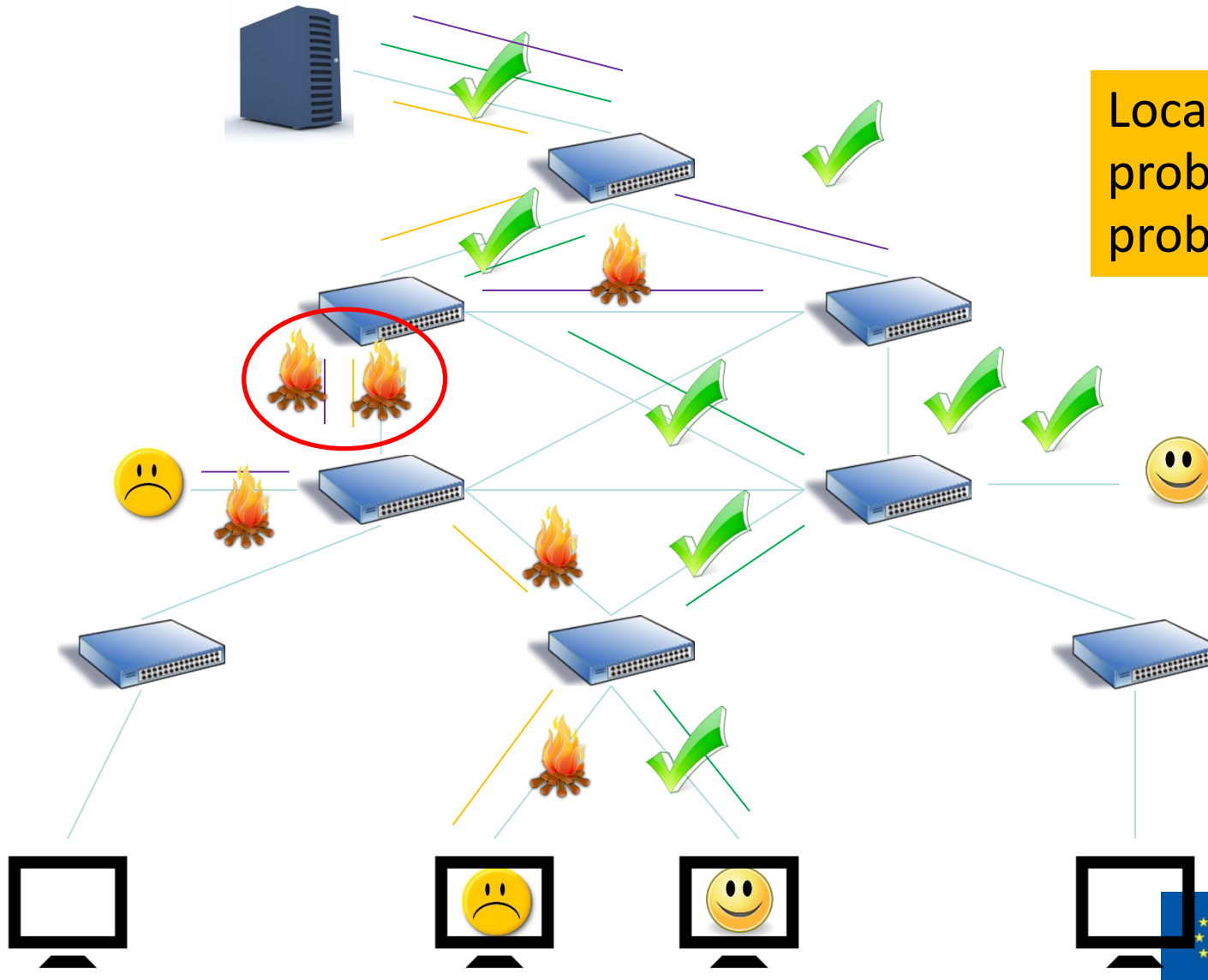
QoS Monitoring Tool: Cause Analysis

Whitelist,
simplify



QoS Monitoring Tool: Cause Analysis

Locate most
probable
problematic link



QoS Monitoring Tool: Testbed



The screenshot displays the jFed Experimenter Toolkit interface. The top menu bar includes 'General', 'Topology Viewer', 'RSpec Viewer', and 'Timeline Viewer'. Below the menu, there are several icons for 'Update Status', 'Renew', 'Terminate', 'Reboot', 'Edit SSH-keys', 'Share', and 'Auto Layout'. The main area shows a network topology diagram with a central 'link0' node connected to 'Controller', 'QoSAgent2', 'Topology', and 'QoSAgent1'. A 'qos' node is also visible in the top left. On the right, a list of configuration options is shown:

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

At the bottom, there are tabs for 'Progress', 'Errors', and 'Timeline log'. The 'Progress' tab is active, showing 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.

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



QoS Monitoring Tool: Fed4Fire RSPEC

JFed Experimenter Toolkit

General | Topology Editor | RSpec Editor | Timeline Editor

Run | Reserve | Save | Format Code | Verify RSpec | (Un)Bind RSpec | 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 </emulab:routable_pool>
5 <node client_id="Topology" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
6   <sliver_type name="raw-pc">
7     <disk_image name="urn:publicid:IDN+wall1.ilabt.iminds.be+image+emulab-ops:UBUNTU14-64-STD"/>
8   </sliver_type>
9   <services>
10     <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
11     <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
12     <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
13     <execute shell="sh" command="sudo route add -net 10.2.32.0 netmask 255.255.240.0 gw 10.2.15.254"/>
14     <execute shell="sh" command="sudo apt-get -y update"/>
15     <execute shell="sh" command="sudo apt-get -y install python-software-properties"/>
16     <execute shell="sh" command="sudo add-apt-repository ppa:openjdk-r/ppa --yes"/>
17     <execute shell="sh" command="sudo apt-get -y update"/>
18     <execute shell="sh" command="sudo apt-get -y install openjdk-8-jdk"/>
19     <execute shell="sh" command="sudo apt-get -y install mininet"/>
20     <execute shell="sh" command="sudo service openvswitch-controller stop"/>
21     <execute shell="sh" command="sudo update-rc.d openvswitch-controller disable"/>
22     <execute shell="sh" command="sudo git clone https://gitlab.uni.lu/llamorte/FINTEROP.git"/>
23     <execute shell="sh" command="sudo touch ~/Installation_Done.md"/>
24   </services>
25   <location xmlns="http://jfed.iminds.be/rspec/ext/jfed/1" x="410.0" y="185.0"/>
26   <interface client_id="Topology:if0">
27     <ip address="192.168.3.2" netmask="255.255.255.0" type="ipv4"/>
28   </interface>
29 </node>
30 <node client_id="QoSAgent1" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
31   <sliver_type name="raw-pc"/>
32   <services>
33     <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
34     <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
35     <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
36     <execute shell="sh" command="sudo route add -net 10.2.32.0 netmask 255.255.240.0 gw 10.2.15.254"/>
37     <execute shell="sh" command="sudo apt-get -y update"/>
38     <execute shell="sh" command="sudo apt-get -y install openjdk-7-jre git"/>
39     <execute shell="sh" command="sudo wget https://agents.v6sonar.com/builds/Aiz44dXztpNDTJgzHCro/sonar-install-2.5.0.zip -P /local"/>
40     <execute shell="sh" command="sudo git clone https://gitlab.uni.lu/llamorte/FINTEROP.git"/>
41     <execute shell="sh" command="sudo /FINTEROP/qosagent/install_qos_agent.sh"/>
42     <execute shell="sh" command="sudo /FINTEROP/qosagent/tunnel.sh"/>
43     <execute shell="sh" command="sudo touch ~/Installation_Done.md"/>
44   </services>
45   <location xmlns="http://jfed.iminds.be/rspec/ext/jfed/1" x="210.0" y="318.33333333333337"/>
46   <interface client_id="QoSAgent1:if0">
47     <ip address="192.168.3.1" netmask="255.255.255.0" type="ipv4"/>
48   </interface>
49 </node>
50 <node client_id="QoSAgent2" exclusive="true" component_manager_id="urn:publicid:IDN+wall1.ilabt.iminds.be+authority+cm">
51   <sliver_type name="raw-pc">
52     <disk_image name="urn:publicid:IDN+wall1.ilabt.iminds.be+image+emulab-ops:UBUNTU14-64-STD"/>
53   </sliver_type>
54   <services>
55     <execute shell="sh" command="sudo route del default gw 10.2.15.254"/>
56     <execute shell="sh" command="sudo route add default gw 10.2.15.253"/>
57     <execute shell="sh" command="sudo route add -net 10.11.0.0 netmask 255.255.0.0 gw 10.2.15.254"/>
58     <execute shell="sh" command="sudo route add -net 10.2.32.0 netmask 255.255.240.0 gw 10.2.15.254"/>
59   </services>
60 </node>
```

QoSDemo3 | DEMO_VW1 x

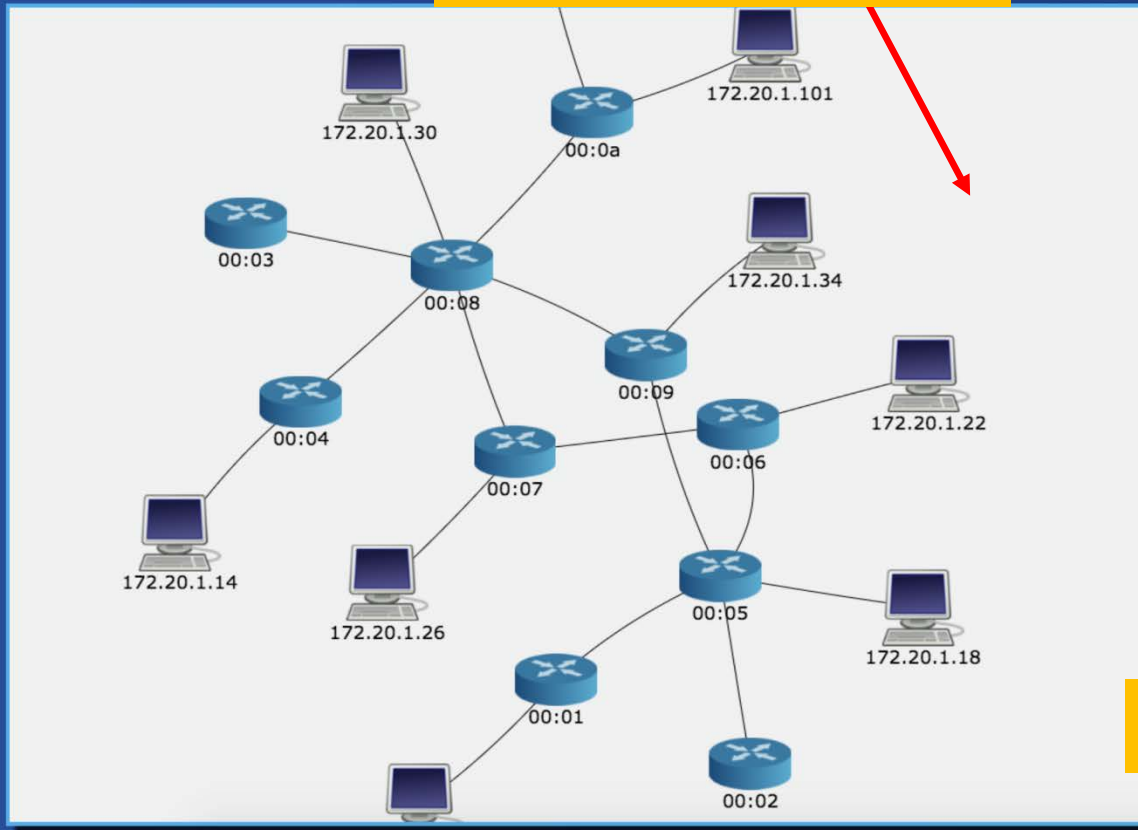


QoS Monitoring Tool: Prototype GUI

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
%	0	Bandwidth
%	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)



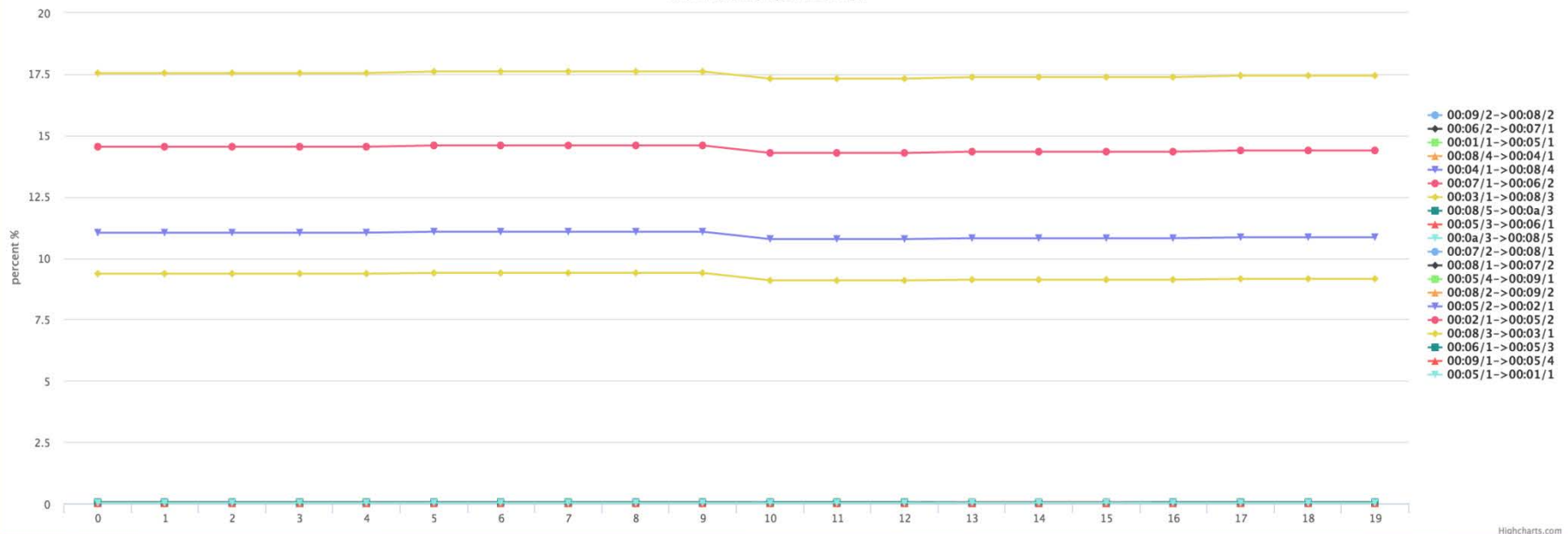
Home Histogram Links Node

Packet losses

Bandwidth

LINK Packet Losses [PacketsProc]

Source: Open Day Light (HYDROGEN)



QoS Monitoring Tool: Link Bandwidth Data



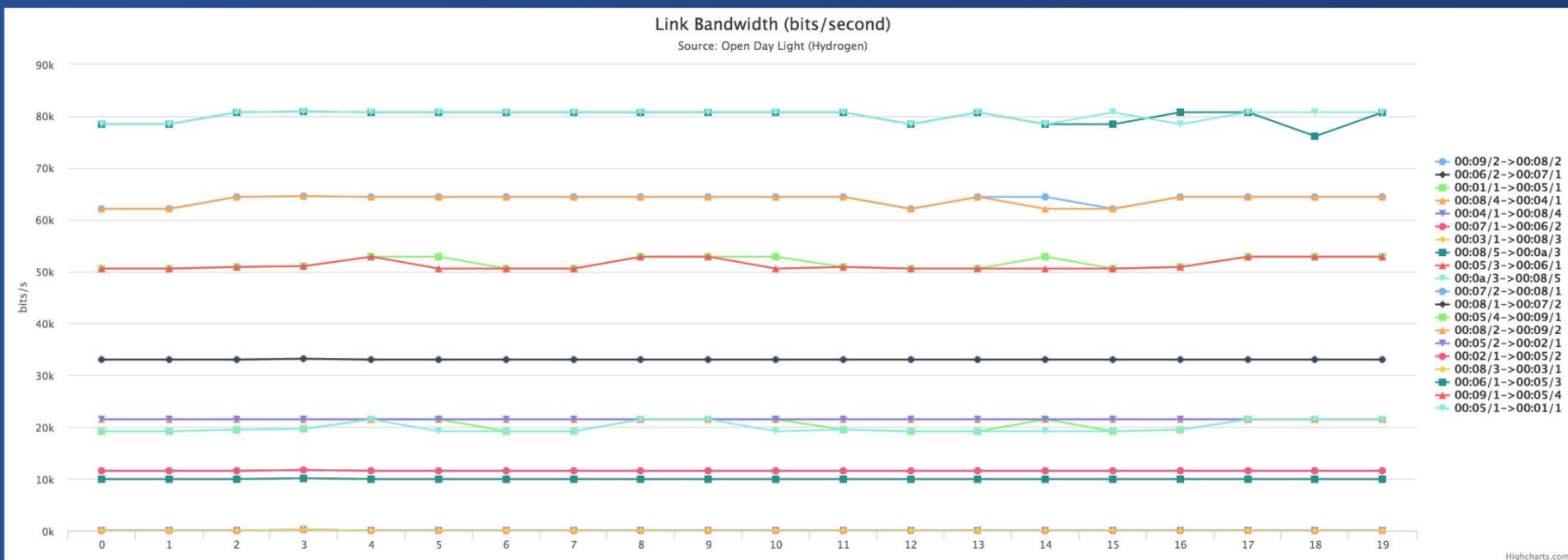
SDN Monitoring Tool (ver.1.0)



Home Histogram Links Node

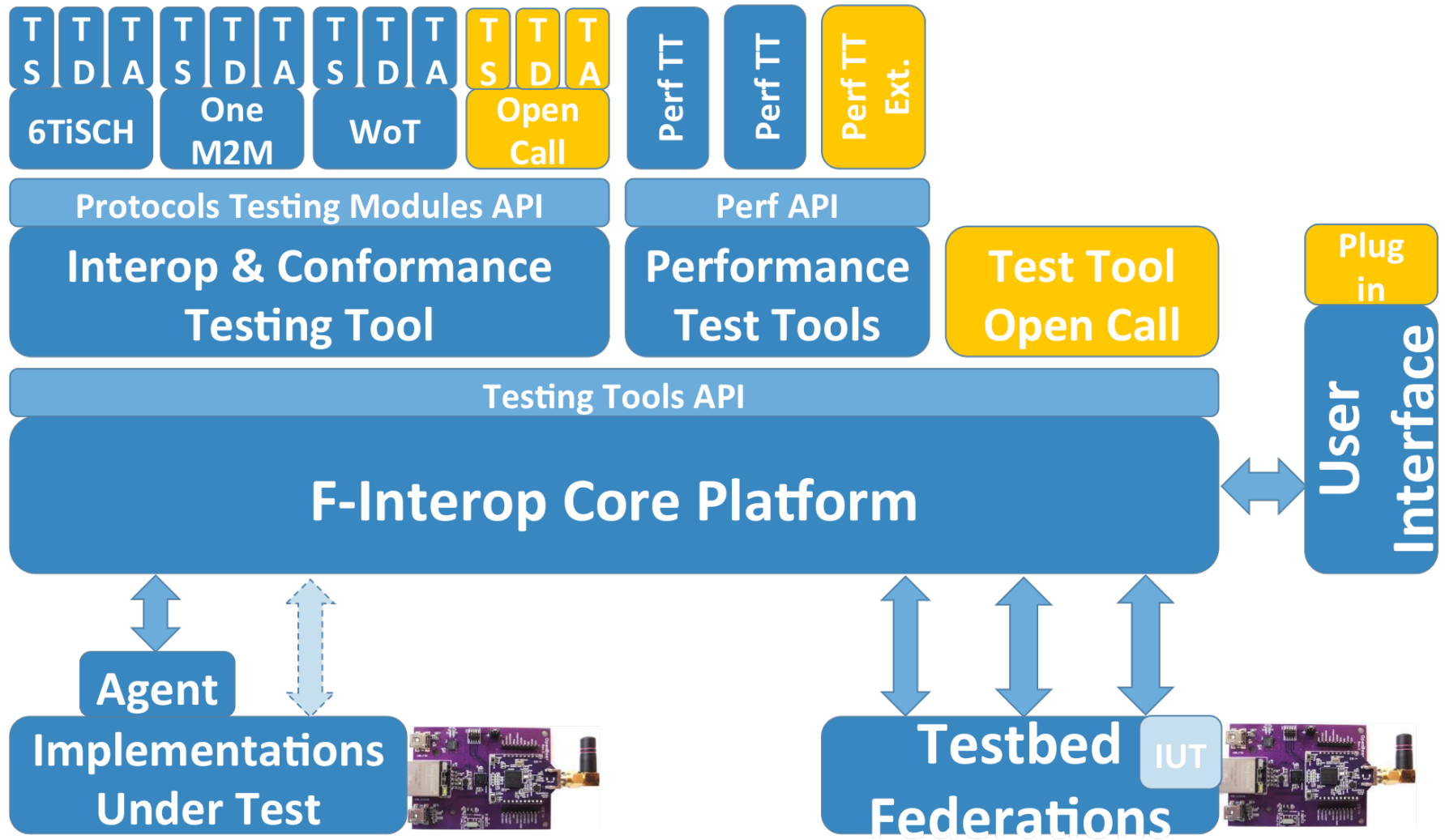
Packet losses

Bandwidth





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

