

Monitor Traffic Flow through In-band Network Telemetry (INT)

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Outline

- ▶ Goal
- ▶ The Header Structure
- ▶ Testing

Goal

- ▶ Understand how the packet is forwarded in the network.
- ▶ What to monitor?
 - ▶ The forwarding path
 - ▶ The length of queue in each switch
 - ▶ Time stayed in queue
 - ▶ Ingress Timestamp
 - ▶ Timestamp when the packet is first enqueued
- ▶ Users can select the information that they want to know.

Header Structure

- ▶ INT Identifier <4 bytes>
 - ▶ 0 off / 1 on
- ▶ INT Type <1 byte>
 - ▶ destination based 0
 - ▶ hop by hop 1
- ▶ INT length <1 byte>
 - ▶ Size of INT data

Byte 0	Byte 1	Byte 2	Byte3
Ethernet			
IPv4			
TCP			
INT Identifier			
INT Type	Rsvd	INT length	Rsvd
ins_cnt	max_hop_cnt	total_hop_cnt	Instruction map
INT INFO			
Payload			

Header Structure

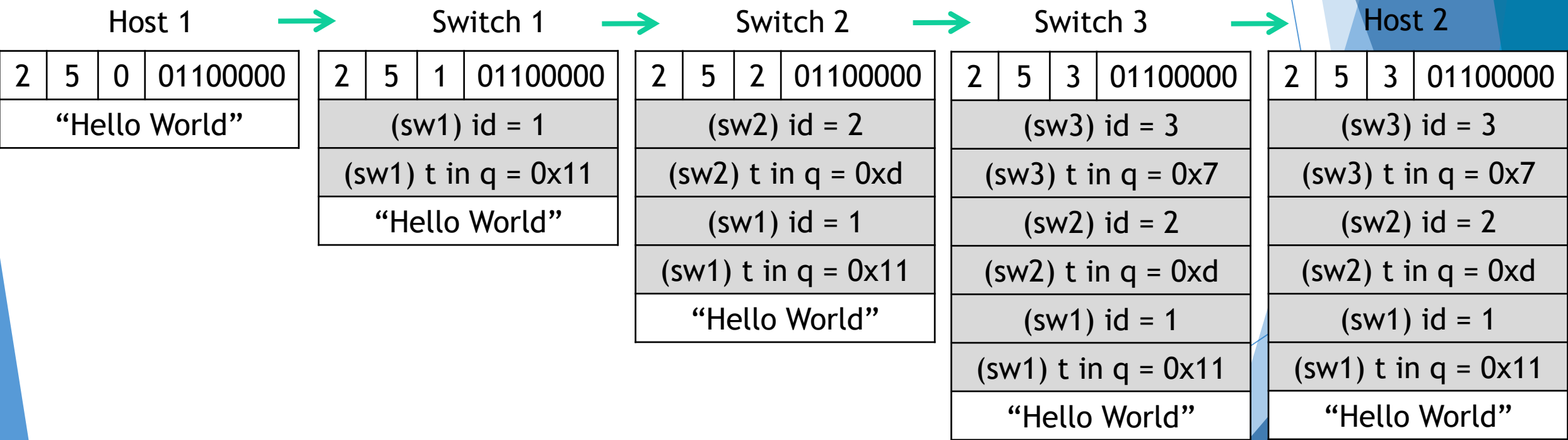
- ▶ ins_cnt <1 byte>
 - ▶ number of instruction
- ▶ instruction map < 1 byte>
 - ▶ e <1 bit>
 - ▶ inst0 <1 bit>
 - ▶ switch id
 - ▶ inst1 <1 bit>
 - ▶ time stayed in queue
 - ▶ inst2 <1 bit>
 - ▶ enqueued timestamp
 - ▶ Length of queue
 - ▶ inst3 <1 bit>
 - ▶ Ingress timestamp
 - ▶ rsvd <3 bits>

Byte 0	Byte 1	Byte 2	Byte3
Ethernet			
IPv4			
TCP			
INT Identifier			
INT Type	Rsvd	INT length	Rsvd
ins_cnt	max_hop_cnt	total_hop_cnt	instruction map
INT INFO			
Payload			

Example

ins_cnt	max_hop_cnt	total_hop_cnt	Instruction map
INT INFO			
Payload			

- ▶ The information that the user want to know will be stored in the ‘INT INFO’ field.



turtlechen@turtlechen-VirtualBox: ~/桌面

```
tos      = 0x0
len      = 62
id       = 1
flags    =
frag     = 0L
ttl      = 64
proto    = tcp
chksum   = 0x62f0
src      = 10.0.1.101
dst      = 10.0.2.101
\options \
###[ TCP ]###
sport    = 53552
dport    = 1234
seq      = 0
ack      = 0
dataofs  = 5L
reserved = 0L
flags    = S
window   = 8192
chksum   = 0x9a82
urgptr   = 0
options  = []
###[ INT_On ]###
INT_set  = 1
###[ INT_shim_header ]###
INT_header_type= 1
rsvd     = 0
INT_data_length= 2
rsvd     = 0
###[ INT_header ]###
ins_cnt  = 4
max_hop_cnt= 5
total_hop_cnt= 0
e        = 0L
inst_0   = 1L
inst_1   = 1L
inst_2   = 1L
inst_3   = 1L
rsvd     = 0L
###[ Raw ]###
load     = 'HelloWorld'
len(pkt) = 76
turtlechen@turtlechen-VirtualBox:~/桌面$
```

```
inst_1   = 1L
inst_2   = 1L
inst_3   = 1L
rsvd     = 0L
```

###[Raw]###

```
load     = '\x00\x00\x00\x03\x00\x00\x00\x0f\x9c\x83\xa5\x0
0\x01\x9c\x82\xf6\x00\x00\x00\x02\x00\x00\x00\x11\x9d+\xc8\x00\x01\x9d+(\x00\x00
\x00\x01\x00\x00\x00\x18\x9d\xd5\xf7\x00\x01\x9d\xd4\xc4HelloWorld'
len(pkt) = 124
```

###[INT info]###

Switch id = 00000003

Time in queue = 0000000f

Enqueue Timestamp = 9c83a5

Queue Length = 00

Ingress Timestamp = 019c82f6

#####

Switch id = 00000002

Time in queue = 00000011

Enqueue Timestamp = 9d2bc8

Queue Length = 00

Ingress Timestamp = 019d2b28

#####

Switch id = 00000001

Time in queue = 00000018

Enqueue Timestamp = 9dd5f7

Queue Length = 00

Ingress Timestamp = 019dd4c4

#####

Payload = HelloWorld

#####