NANOG 76

HACKATHON RECAP

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ORACLE

Hackathon Recap

- 8th hackathon organized by NANOG
- Roughly had 50 participants
- Working in 10 different teams
- A lot of college students
- Bunch of first timers

Hackathon Goals

- Theme of hackathon was deploying active monitoring solution
- Extract topology info using some kind of automation
- Build network map using topology info
- Calculate all possible best path between end points
- Probe all possible best paths and account for failure as it happens

Experience

- Day started with explaining hack, lab topology
- We gave a quick of overview of tools and protocols that might help to come up with solution
- It was interesting to notice a lot of participants have heard about exabgp but never got chance to use it.
- Some of the participants have not heard about BGP – LS and SCAPY.
- Teams worked on hack from 10:30 to 6pm
- At 6pm each team presented their work
- Winner was decided based on voting

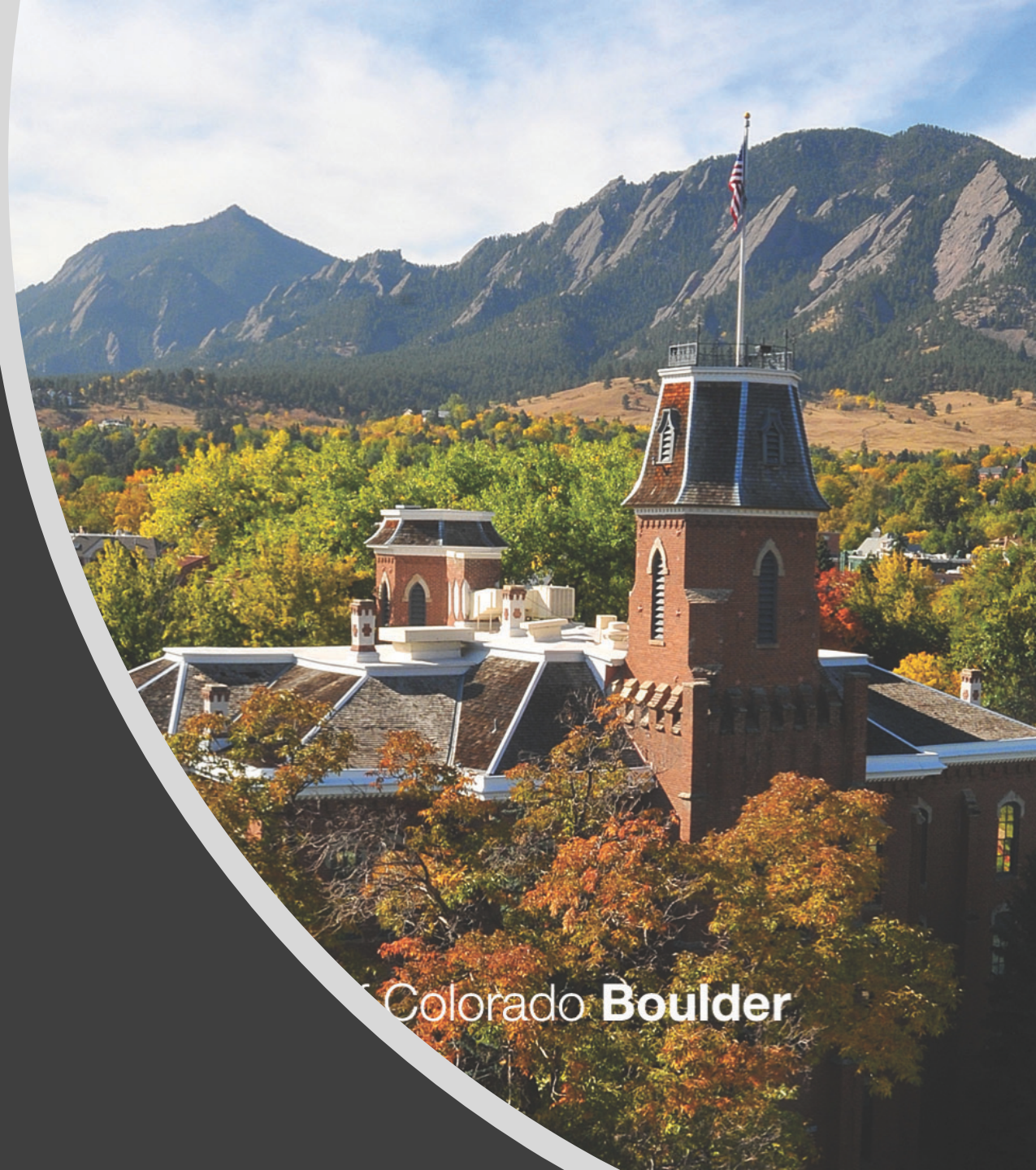
Experience (contd.)

- We also encourage participants to bring their own project
- Project that got resurrected from NANOG67. PiCon: Console servers from RPi’s
- Winner of this hackathon are
  - NetBuffs
  - picon: Console servers from RPis

NANOG 76 HACKATHON

Team: **NETBUFFS**

University of Colorado Boulder



Thank you!

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Cloud Infrastructure

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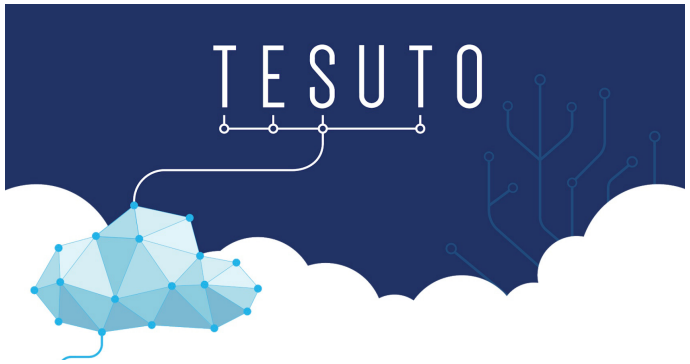


Problem Statement

- Build a system to automate network monitoring and failure detection
- Reduce time to identify network and application problems
- Automate reporting of the issue based on the detected failure
- Make use of open source tools

Hackathon Goals

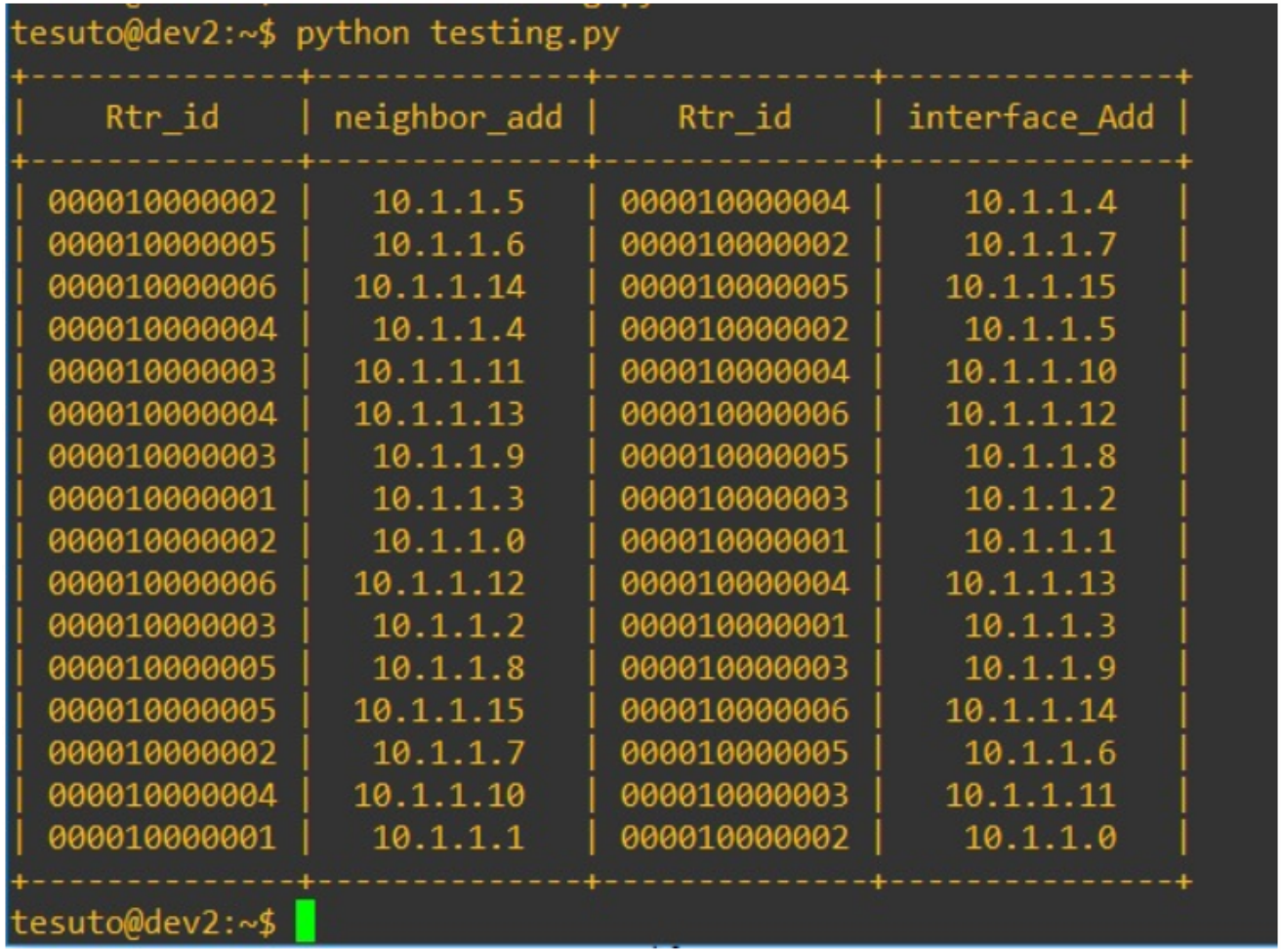
- Extract topology information (number of all possible paths and hops)
- Active monitoring of network paths for failures
- Automatically report failures

Parsing network configuration

- Below information of each link was parsed from routes.txt:
- Neighbor ID
- Neighbor address
- Interface ID
- Interface Address

Tools Used:

- Python
- Json
- ExaBGP

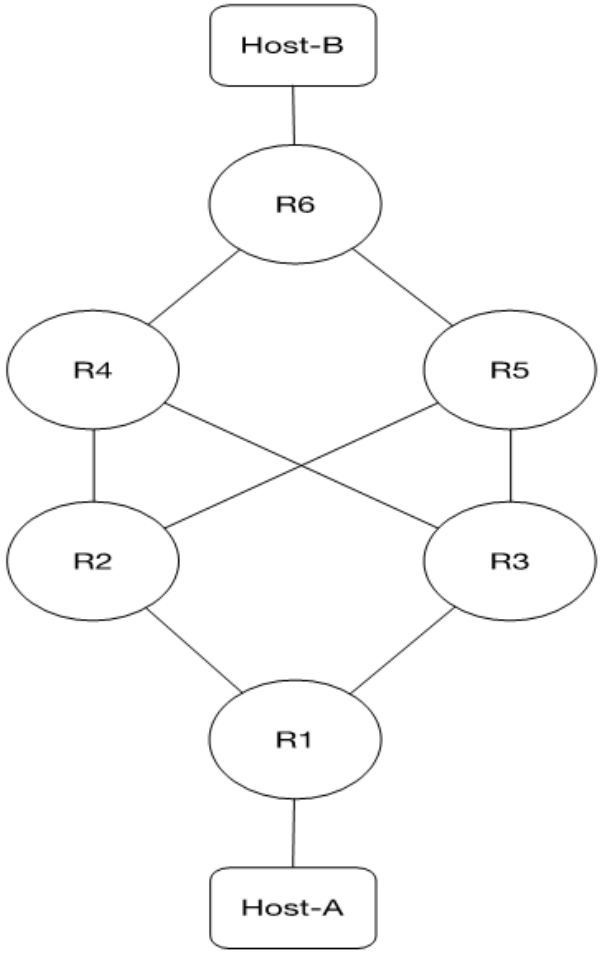


```
tesuto@dev2:~$ python testing.py
+--------------+--------------+--------------+--------------+
|    Rtr_id    | neighbor_add |    Rtr_id    | interface_Add |
+--------------+--------------+--------------+--------------+
| 000010000002 |   10.1.1.5   | 000010000004 |    10.1.1.4   |
| 000010000005 |   10.1.1.6   | 000010000002 |    10.1.1.7   |
| 000010000006 |  10.1.1.14   | 000010000005 |   10.1.1.15   |
| 000010000004 |   10.1.1.4   | 000010000002 |    10.1.1.5   |
| 000010000003 |  10.1.1.11   | 000010000004 |   10.1.1.10   |
| 000010000004 |  10.1.1.13   | 000010000006 |   10.1.1.12   |
| 000010000003 |   10.1.1.9   | 000010000005 |    10.1.1.8   |
| 000010000001 |   10.1.1.3   | 000010000003 |    10.1.1.2   |
| 000010000002 |   10.1.1.0   | 000010000001 |    10.1.1.1   |
| 000010000006 |  10.1.1.12   | 000010000004 |   10.1.1.13   |
| 000010000003 |   10.1.1.2   | 000010000001 |    10.1.1.3   |
| 000010000005 |   10.1.1.8   | 000010000003 |    10.1.1.9   |
| 000010000005 |  10.1.1.15   | 000010000006 |   10.1.1.14   |
| 000010000002 |   10.1.1.7   | 000010000005 |    10.1.1.6   |
| 000010000004 |  10.1.1.10   | 000010000003 |   10.1.1.11   |
| 000010000001 |   10.1.1.1   | 000010000002 |    10.1.1.0   |
+--------------+--------------+--------------+--------------+
tesuto@dev2:~$
```

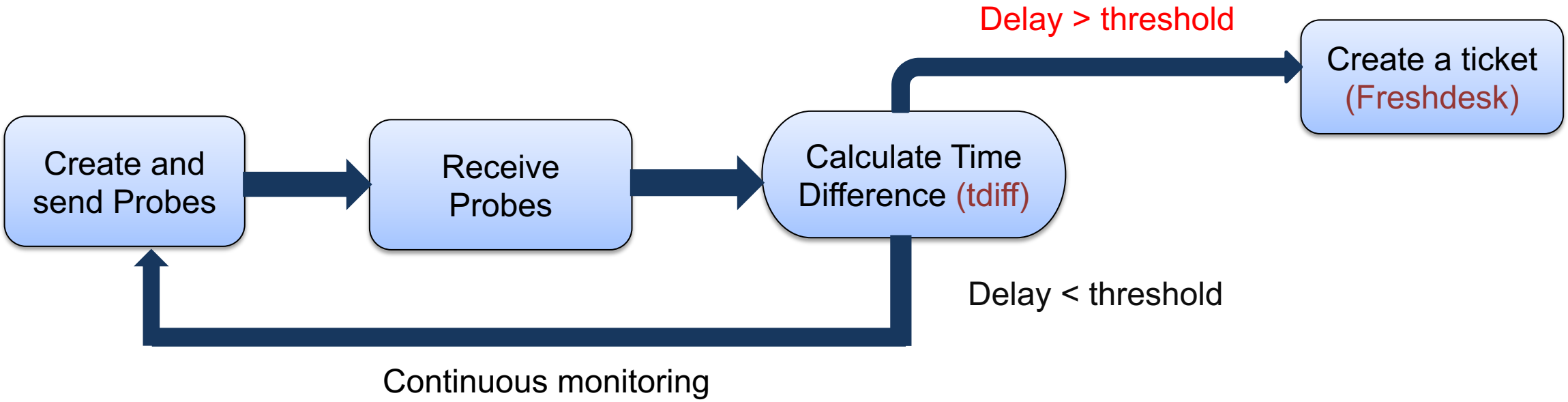
Topology

- Fetched all possible paths from end points
- Tool used: NetworkX

```
tesuto@agent:~$ python3 test.py
['dev1', 'R1', 'R3', 'R5', 'R2', 'R4', 'R6', 'dev2']
['dev1', 'R1', 'R3', 'R5', 'R6', 'dev2']
['dev1', 'R1', 'R3', 'R4', 'R2', 'R5', 'R6', 'dev2']
['dev1', 'R1', 'R3', 'R4', 'R6', 'dev2']
['dev1', 'R1', 'R2', 'R5', 'R3', 'R4', 'R6', 'dev2']
['dev1', 'R1', 'R2', 'R5', 'R6', 'dev2']
['dev1', 'R1', 'R2', 'R4', 'R3', 'R5', 'R6', 'dev2']
['dev1', 'R1', 'R2', 'R4', 'R6', 'dev2']
```



Workflow


Delay > threshold
Create a ticket
(Freshdesk)
Create and
send Probes
Receive
Probes
Calculate Time
Difference (tdiff)
Delay < threshold
Continuous monitoring

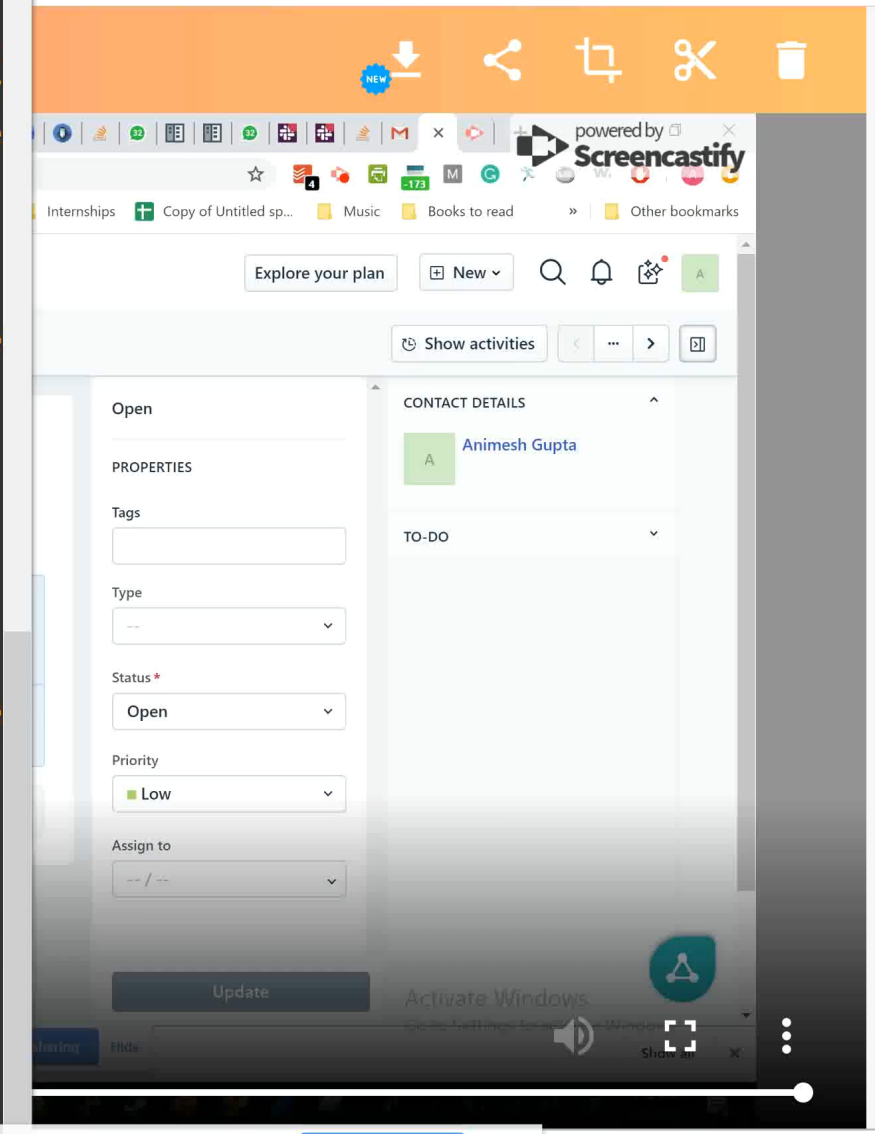
Probe creation

- Create IP GRE headers to trace all the paths.
- Used SCAPY to create the packets.
- Send the packet from source to destination.

```
from struct import pack,unpack
from scapy.all import *
#from time import *
import time
s = conf.L3socket(iface="eth1")
packetSentCount=1

for i in range (packetSentCount):
    p1 = IP(src='20.0.0.2', proto=47,tos=0, dst='20.0.0.1',version=4,ttl=64)
    p2=GRE()
    p3=IP(src='20.0.0.2', proto=47, dst='10.1.1.1')
    p4=GRE()
    p5=IP(src='20.0.0.2', proto=47, dst='10.1.1.5')
    p6=GRE()
    p7=IP(src='20.0.0.2', proto=47, dst='10.1.1.13')
    p8=GRE()
    p9=IP(src='20.0.0.2', proto=47, dst='20.0.0.6')
    p10=GRE()
    p11=IP(src='20.0.0.2', proto=17, dst='20.0.0.2')

    p12=UDP(dport=3000, sport=3000)
    #payload=pack('dlll',time.time(), i, 0 ,packetSentCount)
    #payload=pack('l',0)
    value = time.time()

    payload= str(value)
    packet=p1/p2/p3/p4/p5/p6/p7/p8/p9/p10/p11/p12/payload
    #packet=p1/p2/p11/p12/payload
    s.send(packet)
```

```
import smtplib

def print_return_packet_details(x):
    #sendTime,seq,probe,total=unpack('dlll',x.load)
    #print (x.Time, sendTime, seq, probe, total)

    print(x.load)
    print(x.time)
    threshold = 1
    difference = float(x.time)-float(x.load)
    if (float(x.time)-float(x.load)) < threshold:
        print("Delay in this route is higher than threshold. Creating a new ticket for debugging!")


        fromaddr = 'animeshgupta720@gmail.com'
        toaddrs  = 'support@animeshgupta720help.freshdesk.com'
        msg = 'There is a high latency on the R1-R2-R4-R6 route. Please take necessary action.'


        server = smtplib.SMTP("smtp.gmail.com:587")

        server.starttls()
        username='animeshgupta720@gmail.com'
        password=[redacted]

        server.login(username,password)

        server.sendmail(fromaddr, toaddrs, msg)
        #server.quit()
```

```
    server.login(username,password)
  File "/usr/lib/python2.7/smtplib.py", line 623, in login
    raise SMTPAuthenticationError(code, resp)
smtplib.SMTPAuthenticationError: (534, '5.7.14 <https://acc
vGuqSrJrRnsJuY0I_JUsAHRhVQPF6D4FF7628Alc6n9Huzg6oSjj53wHGS7
87-yQVh> Please\n5.7.14 log in via your web browser and the
/mail/answer/78754 g41sm2326496uah.12 - gsmtp')
tesuto@dev1:~$ sudo python test4.py
1560115679.91
1560115679.98
Delay in this route is higher than threshold. Creating a ne
tesuto@dev1:~$ cat testing.py ^C
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$ sudo vi test4.py
tesuto@dev1:~$ sudo python test4.py
1560115968.87
1560115968.93
Delay in this route is higher than threshold. Creating a ne
w ticket for debugging!
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$ sudo python test4.py
```



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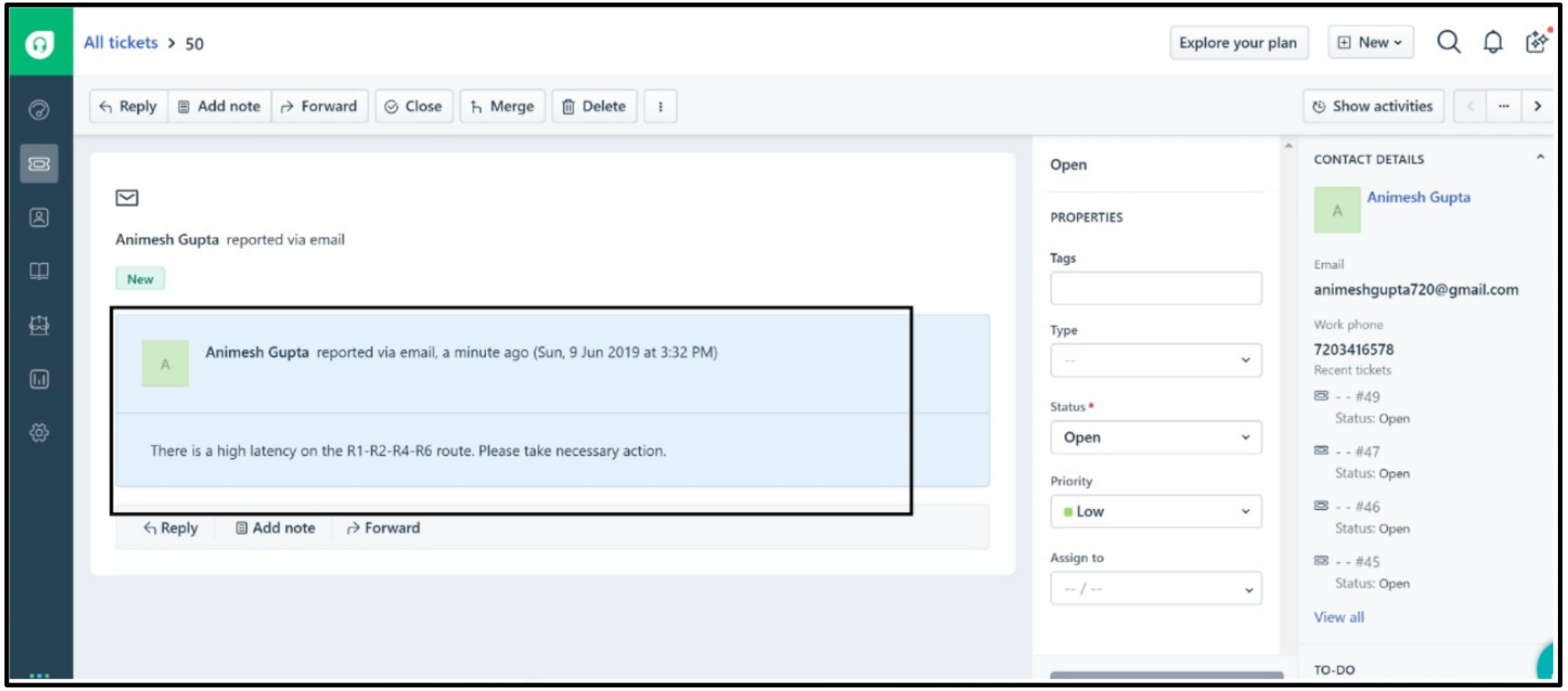
5:35 PM 6/9/2019

```
tesuto@dev1: ~
87-yQVh> Please\n5.7.14 log in via your web browser and the
/mail/answer/78754 g41sm2326496uah.12 - gsmtp')
tesuto@dev1:~$ sudo python test4.py
1560115679.91
1560115679.98
Delay in this route is higher than threshold. Creating a ne
tesuto@dev1:~$ cat testing.py ^C
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$ sudo vi test4.py
tesuto@dev1:~$ sudo python test4.py
1560115968.87
1560115968.93
Delay in this route is higher than threshold. Creating a ne
w ticket for debugging!
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$ sudo python test4.py
1560116123.1
1560116123.15
Delay in this route is higher than threshold. Creating a ne
w ticket for debugging!
tesuto@dev1:~$
```

```
tesuto@dev1: ~
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$
tesuto@dev1:~$ sudo python test3.py
tesuto@dev1:~$
tesuto@dev1:~$ sudo python test3.py
tesuto@dev1:~$
```

Report Failure

- Raised ticket and reported issue by integrating our script with a ticketing tool (Freshdesk)



Future Scope

- **Scalability**

  Scale this to a higher number of nodes

- **Traffic Engineering**

  Reroute traffic to different paths as per issue reported

- **Visualization**

  Use data visualization tools such as Grafana to create dashboards

Takeaway

- Tools – Scapy, NetworkX, Python, ExaBGP
- Power of Network Programmability
- Planning
- Team work
- Don’t give up!

Team Members

- Animesh Gupta (animesh.gupta@colorado.edu)
- Vibhum Chandorkar (vibhum.chandorkar@colorado.edu)
- Ameya Korgaonkar (ameya.korgaonkar@colorado.edu)
- Jose Dahlson Irenish Kumar (joir9977@colorado.edu)
- Apurva Bhiwapurkar (Apurva.bhiwapurkar@colorado.edu)

THANK YOU ☺

>_

PICON

Anand Oliver Ryan Taylor

NANOG76 Active Monitoring - Picon

Common issues:

- Islands of console capability
- Poor documentation
- Little or no proactive testing
- Pain when needed but not present

Open Hyperterm..... It's in the start menu.....
the button in the lower corner of your screen

The Solution

Open-source self-discovery framework

- Commodity hardware
- Operate over untrusted network
- Single view of all capabilities
- Pick and implement advanced features over time
    - Concurrency, logging of console output, point-and-click access

All you need

Less than $50 USD!

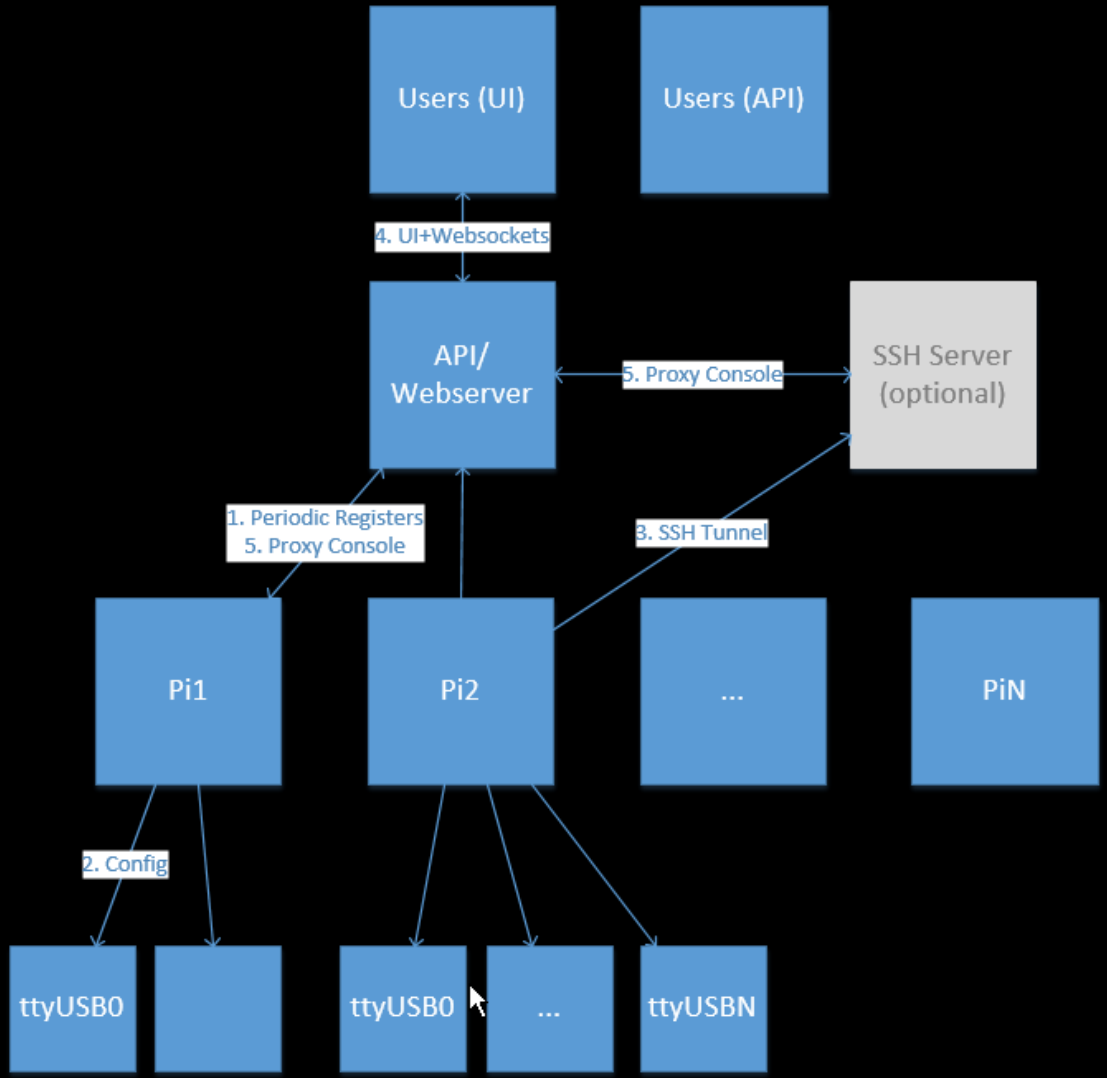
USB Serial Adapter

Raspberry Pi 3

```
{
    'addrs': ['2001:DB8'],
    'ports': ['ttyUSB0',
              'ttyUSB1']
}
```

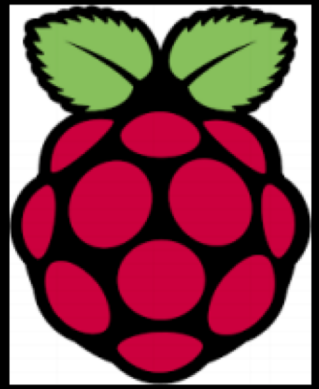
3G/4G, Wifi, Ethernet

PICON


Users (UI)
Users (API)
4. UI+Websockets
API/
Webserver
5. Proxy Console
SSH Server
(optional)
1. Periodic Registers
5. Proxy Console
3. SSH Tunnel
Pi1
Pi2
...
PiN
2. Config
ttyUSB0
ttyUSB0
...
ttyUSBN

Why Pi?

- Inexpensive
- Linux based
- Puppet, Chef, Anisible
- Wide range of hardware/hack support
- Linux Authentication (kerberos, ssh keys, etc)
- 1G Ram, SD Card Storage, decent CPU



Initial Work

- Python3, Flask, Bootstrap
- Webserver+API
    - API for registration, UI for device list
- Self-registering agent
    - Reported available TTY, interfaces, addresses
    - SSH to central server

Next Steps

- Additional Web and UI Capabilities (configurability)
- Programmatic console access
- In-browser console access
- Proxy agent for joining other consoles (Cisco, Digi, Avocent, etc)
- Physical configurations for deployment such as cases, custom FTDI daughterboards, etc

```
(picon-venv) picon@picon:~/picon/agent $ python3 agent-bootstrap.py -vvv http://172.28.10.2:5000/api
2019-06-09 22:56:11,855 INFO: Starting PiCon Agent...
2019-06-09 22:56:11,856 INFO: Using endpoint http://172.28.10.2:5000/api/s, holdtime 300s, reporting interval 60
2019-06-09 22:56:11,925 DEBUG: Starting new HTTP connection (1): 172.28.10.2:5000
2019-06-09 22:56:12,010 DEBUG: http://172.28.10.2:5000 "POST /api/register HTTP/1.1" 200 88
2019-06-09 22:56:12,013 INFO: Successfully registered with endpoint http://172.28.10.2:5000/api/register
2019-06-09 22:56:12,013 DEBUG: Sent JSON in POST body:
{
  "holdtime": 300,
  "hostname": "picon",
  "interfaces": {
    "eth0": {
      "addrs": [
        "172.28.10.5"
      ],
      "state": true
    },
    "lo": {
      "addrs": [],
      "state": false
    },
    "wlan0": {
      "addrs": [
        "199.187.221.226",
        "2620:0:ce0:101:ba27:ebff:fe43:b34c"
      ],
      "state": true
    }
  },
  "ports": [
    "ttyUSB0"
  ],
  "sn": "000000003316e619"
}
2019-06-09 22:56:12,014 DEBUG: Received JSON in POST response:
{
  "status": "ok",
  "tunnel": {
    "port": 2220,
    "server": "172.28.10.3"
  }
}

2019-06-09 22:56:12,015 INFO: Starting SSH tunnel connection to 172.28.10.3:2220
```

PICON Home Devices

Hostname	Serial	Addresses	Ports	First seen	Last seen	Status
picon	000000003316e619	**eth0** 172.28.10.5 **wlan0** 199.187.221.226 2620:0:ce0:101:ba27:ebff:fe43:b34c	ttyUSB0 *fw-1* ttyUSB1 *available/future use*	2019-06-09 19:52:42.452234	2019-06-09 21:46:44.543895	

picon

Serial Number
0000000003316e619
First Seen
2019-06-09 19:52:42.452234
Last Seen
2019-06-09 21:45:44.276528
Tunnel Details
Port: 2220

Network Interfaces

Interface Name	State	Addresses
eth0	1	172.28.10.5
wlan0	1	199.187.221.226 2620:0:ce0:101:ba27:ebff:fe43:b34c

Serial Ports

Port name	
ttyUSB0	fw-1 ✔ ✖
ttyUSB1	available/future use

PICON Home Devices

Hostname	Serial	Addr	Last seen	Status
picon	000000003316e619	eth0 172.2 wlan 199.1 2620	2019-06-09 21:47:44.775380	

Console for port ttyUSB0 on host picon

Refresh | Request Exclusive

User <websockets.server.WebSocketServerProtocol object at 0x7fa7a30f5710> requested Exclusivity

3 users connected

Close | Save changes

Accomplishments

- Team gained valuable experience with:
  - Websockets package and async workflows
  - Interacting with tty via python serial module
  - More features of Bootstrap and rusty jquery skills
- Various UI tweaks and progress
- Websockets POC is embedded in codebase

Take-aways

Flask and Bootstrap simplify non-developer progress

Websockets and asynchronous IO do not

Trying to implement the UI workflow will take much more planning

Less-technical takeaways from the challenge

Future Work/Next Steps

- Integrate Websockets with console access
- Basic authentication and privilege system
- Identify hardware for POC deployment
- Extend/abstract configuration
- Proxy agent

Thanks

https://github.com/piconsole/picon

Thanks Tesuto, Oracle and NANOG for this event