

# P4 Users Community Update, Japan

21<sup>st</sup> Dec, 2021

Kentaro Ebisawa <[ebisawa@toyota-tokyo.tech](mailto:ebisawa@toyota-tokyo.tech)>

Principal Researcher

InfoTech, Connected Company

Toyota Motor Corporation



Principal Researcher at Toyota Motor Corporation  
Kentaro Ebisawa



Independent Internet Professional

Terrasence

Apr 2010 – Present · 10 yrs 3 mos

Privately owned entity for consultancy work.

Technical consultancy / development and research in IP networking, Cloud and Data Center area.

[BizDev / Japan Entry and more...](#)

Market & Product Development,  
Consultation, Translation (Tech & Manga)



Research Professional

NTT Ltd. · Part-time

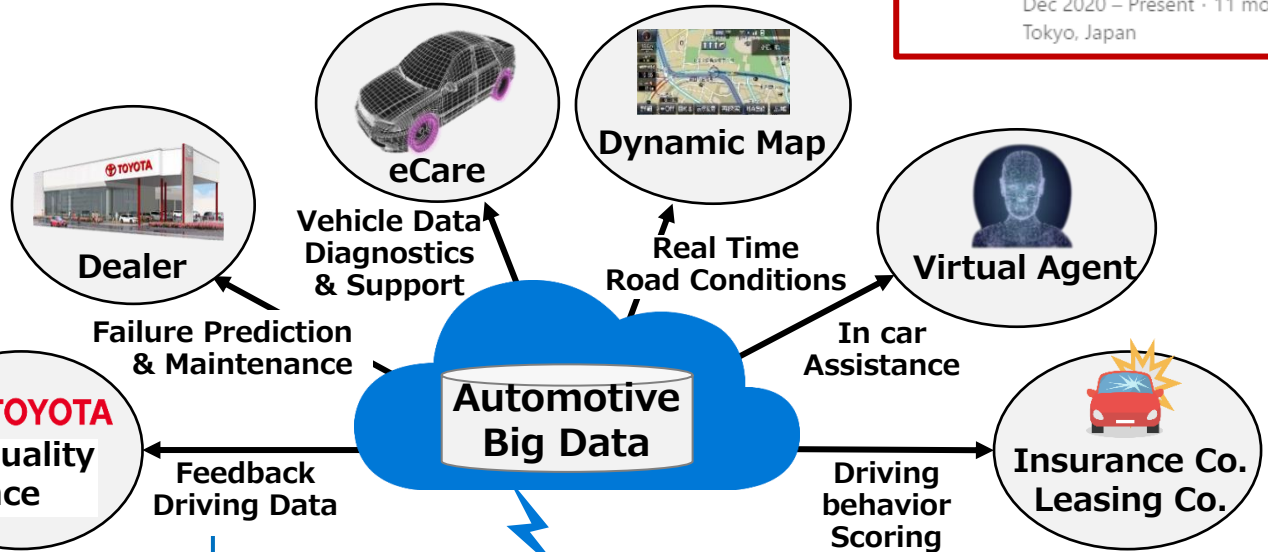
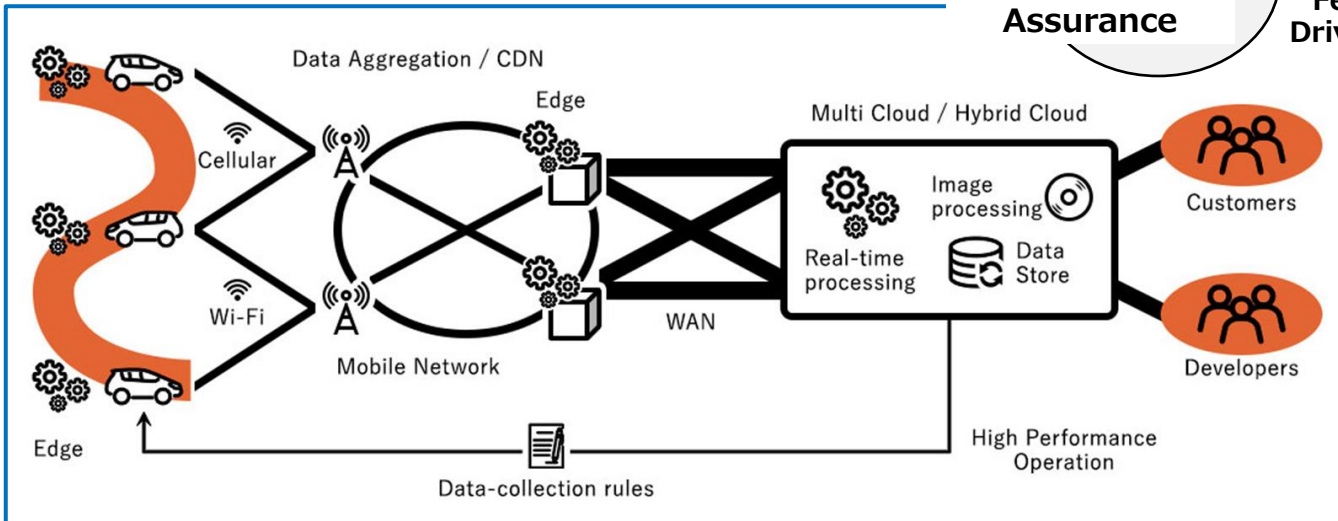
Dec 2020 – Present · 11 mos

Tokyo, Japan

### Research Area

Network Infra for Connected Cars  
in Data Center & Mobile network

P4, SRv6, GTP, Switch&Network OS, SDN ...




Connected Service Utilizing  
Automotive Big Data  
for better Mobility Experience

# P4 Community and Activity in Japan


# My “P4” Journey

A journey to find the best platform to implement “something new” on scalable dataplane.



Senior Product Manager, Engineering  
Sable Networks  
Apr 2008 – Nov 2010 · 2 yrs 8 mos

nat64, CGN on Flow Router ASIC (ex-Caspian)




VP of Technology  
Riava Inc.  
Jul 2014 – Sep 2015 · 1 yr 3 mos  
Tokyo, Japan

More Flexibility

Full featured OpenFlow Switch on FPGA

(Funded by Investor in Taiwan. Platform developed by HW dev team in Taiwan)

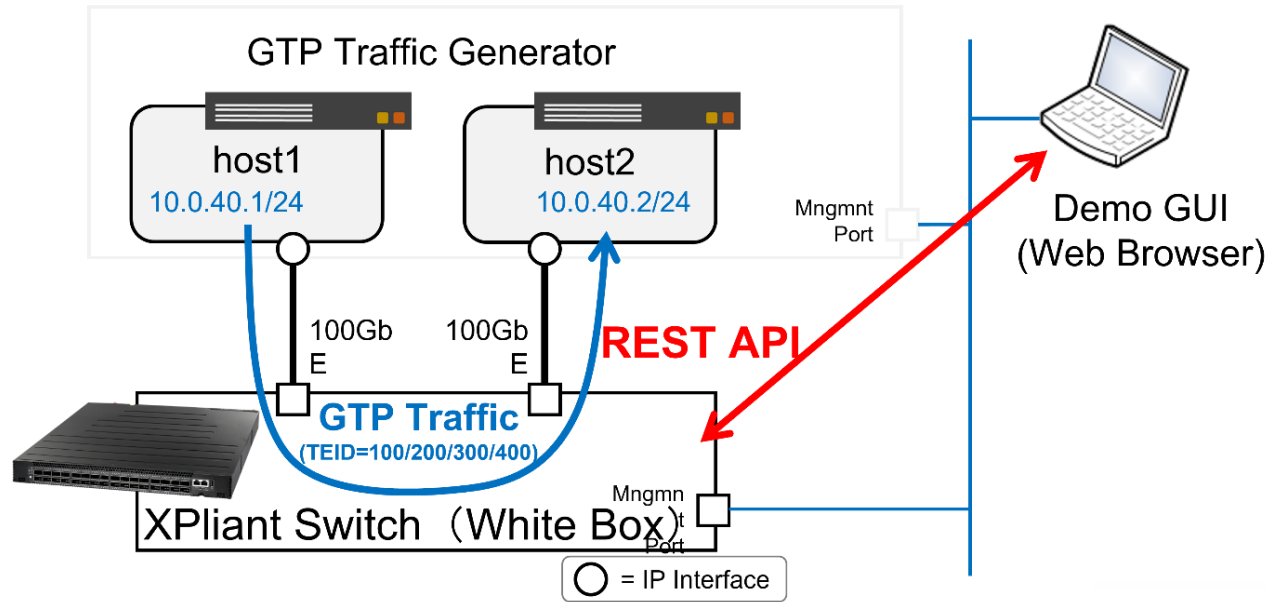


Co-Founder, CTO  
Ponto Networks, Inc.  
Dec 2015 – Jun 2018 · 2 yrs 7 mos

More Flexibility + Performance  
(And low cost ... WhiteBox Switch)

GTP + SRv6 on XPliant ASIC

# GTP TEID match/action & stats using XPliant ASIC



- Parse GTP Header
- Match/Action based on GTP TEID
- Set config & Get stats via REST API

Check Flow Entry

```

Action
{"cookie":300,"table":0,"match":{"priority=50000,udp,in_port=1,tp_dst=2152,gtpu_teid=300},"actions":{"drop"}}
{"cookie":4,"table":0,"match":{"priority=40000,udp,in_port=1,tp_dst=2152,gtpu_teid=400},"actions":{"output:5"}}
{"cookie":2,"table":0,"match":{"priority=40000,udp,in_port=1,tp_dst=2152,gtpu_teid=200},"actions":{"output:5"}}

```

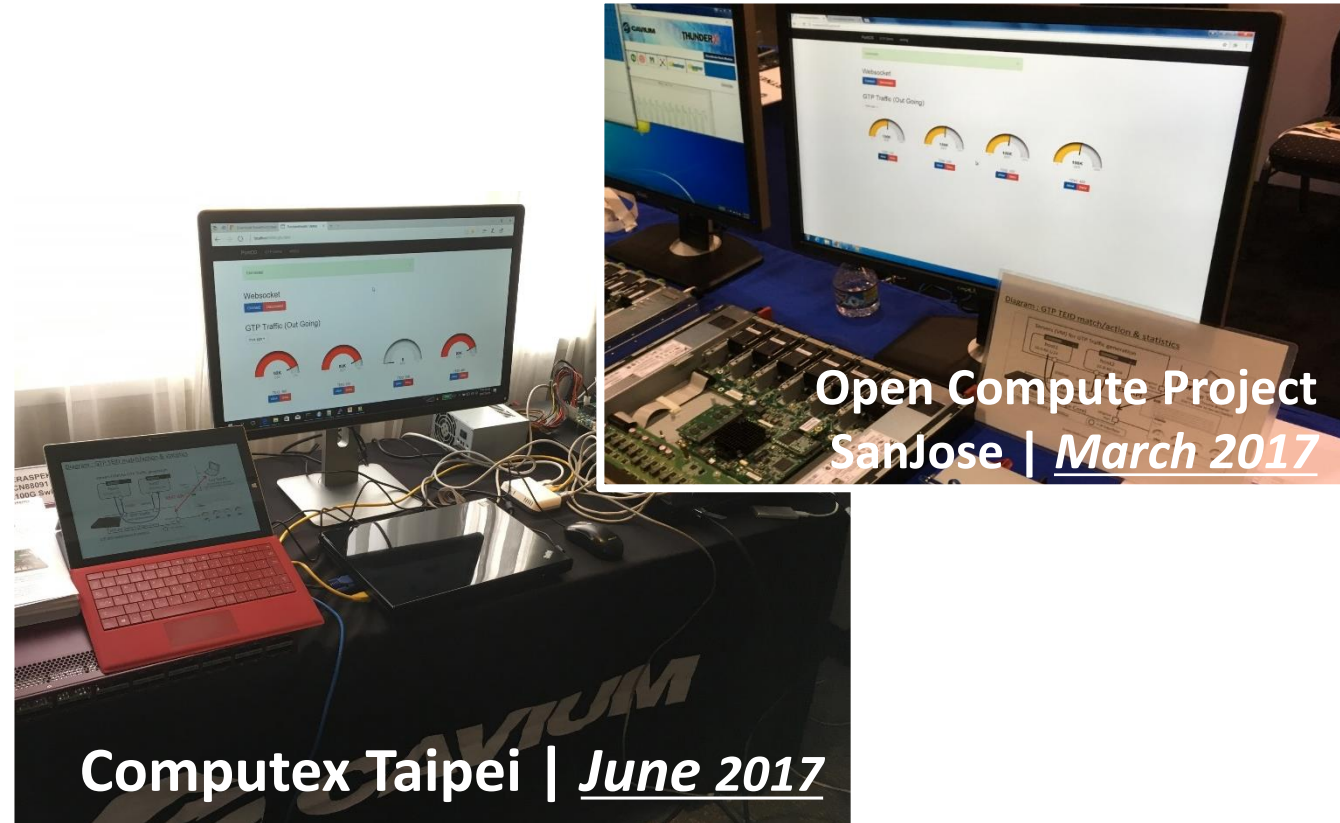
Websocket

Connect Disconnect

Gtp Traffic

Total: 6

max pps



Computex Taipei | June 2017

MEDIA AND TELECOMS NOVEMBER 20, 2017 / 9:57 AM / UPDATED 4 YEARS AGO

## Marvell Technology to buy rival chipmaker Cavium for \$6 billion

By Sonam Rai, Laharee Chatterjee

3 MIN READ



(Reuters) - Chipmaker Marvell Technology Group Ltd [MRVL.O](#) said on Monday it would buy smaller rival Cavium Inc [CAVM.O](#) for about \$6 billion, as it seeks to expand its wireless connectivity business in a rapidly consolidating semiconductor industry.

<https://www.reuters.com/article/us-cavium-m-a-marvell-technlgy-idUSKBN1DK02S>

Project terminated due to acquisition.  
(and XPliant discontinuation)

Nov 2017

**A Technology being good is not good enough.  
... It MUST have community large enough to survive.  
(to support the ecosystem)**

# Started giving talk about “Dataplane Programmability”

- 2017/10/20 | ONIC Japan 2017  
“The era of **Programmable Dataplane** and Network Operation Stack”
- 2017/11/29 | Software Router BoF @ Internet Week 2017
- 2017/12/07 | Okinawa Open Days 2017  
“p4alu ... Arithmetic Logic Unit in **P4**”  
<https://www.slideshare.net/kentaroebisawa/p4alu-arithmetic-logic-unit-in-p4>  
<https://github.com/ebiken/p4sandbox/tree/master/p4alu>
- 2018/02/23 | ENOG#49@NIGATA Rankei-So  
“Zebra 2.0 **SRv6 CLI** on Linux dataplane”
- 2018/04/20 | ONOS/CORD meetup in Tokyo  
“proto-typing new protocol with **P4 SRv6** for Mobile User Plane”

... and more ...



# p4srv6 ... proto-typing SRv6 functions with P4 lang.

The objective of this project is to implement SRv6 functions still under discussion using P4 Lang to make running code available for testing and demo. Since there is no Open Source P4 switch implementation supporting SRv6, this should include basic switch features required to test SRv6.

## List of SRv6 functions of interest and status:

- [draft-filsfils-spring-srv6-network-programming-04](#)
  - T.Insert
  - T.Encaps, T.Encaps.Red
  - End, End.DT6
- [draft-ietf-dmm-srv6-mobile-uplane-01](#)
  - End.MAP (future)
  - End.M.GTP6.D
  - End.M.GTP6.E
  - End.M.GTP4.E (future)
  - T.M.Tmap (future)
  - End.Limit (not planned)

## List of helper actions:

- GTP
  - Encap/Decap GTP-U

# Open Sourced SRv6 / GTP on P4-14

<https://github.com/ebiken/p4srv6>

The screenshot shows the GitHub repository page for 'ebiken / p4srv6'. The repository description is 'Proto-typing SRv6 functions with P4 lang.' It features 16 commits, 1 branch, 0 releases, 1 contributor, and is licensed under Apache-2.0. The file list includes 'demo', 'examples', 'p4src', 'tools', '.gitignore', 'LICENSE', 'README.md', and 'TODO.txt'. The most recent commit by 'ebiken' is titled 'Update list of SRv6 functions supported' and was made 22 seconds ago.



The First

# P4 Workshop 2018 in Tokyo

## P4 Language Community Gathering in Japan

By P4.org, Barefoot Networks, NetOne Systems (Japan Local Sler)

### Sessions

Barefoot Networks

NetOne Systems

P4.org

Arista

Cisco

APRESIA Systems & Edgecore

Kaloom Software



22 Oct, 2018

In the news: <https://www.globenewswire.com/en/news-release/2018/10/22/1625097/0/en/Barefoot-Networks-to-Present-at-P4-Workshop-2018-Tokyo.html>

# Japan P4 Users Group

## 28<sup>th</sup> June, 2019

### Founding Members

Net One Systems Co., Ltd

Toyota Mortor Corporation

APRESIA Systems, Ltd.

Intel K. K.

MACNICA, Inc. ALTIMA Company

After 6 month of seeking for & talking with “P4 enthusiasts”,  
we finally founded Users Group focused in “P4”

### 日本 P4 ユーザ会 運営委員 (Committee Members of P4 Users Japan)

氏名	役職	所属
ハディ ザケル Zaker Hadi	会長	ネットワンシステムズ株式会社 Net One Systems Co., Ltd.
海老澤 健太郎 Kentarō Ebisawa	役員	トヨタ自動車株式会社 Toyota Motor Corporation
岸本 貴之 Takayuki Kishimoto	役員	APRESIA Systems株式会社 APRESIA Systems, Ltd.
桑田 斉 Hitoshi Kuwata	役員	APRESIA Systems株式会社 APRESIA Systems, Ltd.
小柳 敏則 Toshinori Koyanagi	役員	インテル株式会社 Intel K. K.
清水 裕晶 Hiroaki Shimizu	役員	株式会社マクニカ アルティマカンパニー MACNICA, Inc. ALTIMA Company
新林 辰則 Tatsunori Shimbayashi	役員	ネットワンシステムズ株式会社 Net One Systems Co., Ltd.
鈴木 秀臣 Hideomi Suzuki	役員	株式会社マクニカ アルティマカンパニー MACNICA, Inc. ALTIMA Company
曾我 亨弘 Yukihiko Soga	役員	ネットワンシステムズ株式会社 Net One Systems Co., Ltd.
野津 雅洋 Masahiro Notsu	役員	ネットワンシステムズ株式会社 Net One Systems Co., Ltd.
久田 勇気 Yuki Hisata	役員	ネットワンシステムズ株式会社 Net One Systems Co., Ltd.
平部 真彬 Masaaki Hirabe	役員	株式会社マクニカ アルティマカンパニー MACNICA, Inc. ALTIMA Company
山崎 大輔 Daisuke Yamasaki	役員	インテル株式会社 Intel K. K.

<https://p4users.org/committee-members/>



# The First P4 Users Japan Meet Up on 11<sup>th</sup> Oct, 2019



145 + ~20 staffs

# The First P4 Users Japan Meet Up on 11<sup>th</sup> Oct, 2019



時間	講演タイトル / 登壇者
09:30~14:30	受付
10:00~10:10	● 冒頭挨拶・会場説明 ネットワンシステムズ株式会社 藤田 雄介
10:10~10:55	● P4の現状と展望・そして我々にできること トヨタ自動車株式会社 海老澤 健太郎
10:55~11:40	● キャリアにおける P4 ユースケースの紹介 NTTネットワークサービスシステム研究所 武井 勇樹
11:40~12:25	● P4 テストベッドについて 国立研究開発法人情報通信研究機構 (NICT) 石井 秀治
12:25~14:00	休憩
14:00~14:30	● Programmable スイッチによる GTP/SRv6 の Stateless 変換の性能評価 ● トヨタ自動車株式会社 李 忠翰
14:30~15:00	● インテル® FPGA PAC N3000 を P4 でプログラミングする NETCOPE P4 コンパイラの使用事例 ● インテル株式会社 小柳 敏則 ● 株式会社マクニカ アルティマカンパニー 清水 裕晶
15:00~15:30	● CiscoにおけるP4の活用と展望 シスコシステムズ合同会社 佐藤 哲大
15:30~16:00	● Arista 7170紹介とデモンストレーション アリスタネットワークスジャパン合同会社 土屋 師子生
16:30~17:00	● Cloud-Grade Routing Stack for P4/Stratum ジュニパーネットワークス株式会社 有村 淳矢
17:00~17:30	● 進化するデータプレンプログラマビリティ対応ハードウェアと実現されるユースケース ● APRESIA Systems株式会社 桑田 斉
17:30~18:00	● In-band Network Telemetry とその可能性 ネットワンシステムズ株式会社 新林 辰則

- Community
- Users (Service Providers, Enterprise)
- Academia / Research
- Technology Provider (Vendor)
- System Integrator (VAR)



# Hands-on Workshop in Japanese (online)

イベント

## P4 勉強会+ハンズオン – イベント・フィードバック

2021年5月27日

2021年4月16日に開催されたイベント（P4ハンズオン）の様子、参加者からのコメントを公開致

### 【実施概要】

- イベント名 : 【オンライン開催】 P4 勉強会+ハンズオン
- 開催日時 : 2021年4月16日（金） 13:10～17:30
- 開催方法 : Connpass 経由の開催 (<https://connpass.com/event/206153/>)
- 主催 : 日本 P4 ユーザ会
- 資料 : [P4.org](https://p4.org) Education Working Group から頂いた資料をベースにした日本語資料

### 【参加状況】

- 申し込み : 10名（勉強会3名、ハンズオン7名）
- 出席者 : 9名（勉強会1名、ハンズオン8名）

<https://p4users.org/2021/05/27/p4-handson-202104-feedback/>

**P4<sub>16</sub> Hello World (V1Model)**

※MyIngressのみ変更  
 ※Forwardテーブルは外部に定義  
 ※機能は前スライドと同様

```
#include <core.p4>
#include <v1model.p4>
struct metadata {}
struct headers {}

parser MyParser(packet_in packet, out headers hdr,
  inout metadata meta,
  inout standard_metadata_t standard_metadata) {
  state start { transition accept; }
}

control MyIngress(inout headers hdr, inout metadata meta,
  inout standard_metadata_t standard_metadata) {
  3 action set_egress_spec(bit<9> port) {
    standard_metadata.egress_spec = port;
  }
  2 table forward {
    key = { standard_metadata.ingress_port: exact; }
    actions = {
      set_egress_spec;
      NoAction;
    }
    size = 1024;
    default_action = NoAction();
  }
  1 apply { forward.apply(); }
}
```

```
control MyEgress(inout headers hdr,
  inout metadata meta,
  inout standard_metadata_t standard_metadata) {
  apply { }
}

control MyVerifyChecksum(inout headers hdr, inout metadata
  meta) { apply { } }

control MyComputeChecksum(inout headers hdr, inout metadata
  meta) { apply { } }

control MyDeparser(packet_out packet, in headers hdr) {
  apply { }
}

V1Switch( MyParser(), MyVerifyChecksum(), MyIngress(),
  MyEgress(), MyComputeChecksum(), MyDeparser() ) main;
```

Key	Action ID	port
1	set_egress_spec	2
2	set_egress_spec	1

# The 2nd P4 Users Japan Meet Up on 22<sup>nd</sup> Oct, 2020

<https://p4users.org/events/event-en/>



ONLINE event with only the speakers onsite.

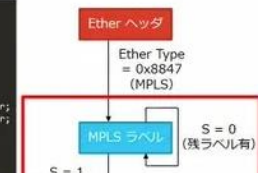
- x7 Live talk Session + x2 Panel Discussions
- x7 Recorded Sessions.



## ハードウェア処理部 | Parser (2/2) NTT

- P4には“Header Stack”というデータ構造が存在し、ヘッダスタックを扱うために有用な各種メソッド・パラメータが規定されている。
- next: その時点までのスタックの次の要素を validate して、その要素を参照する。
- last: その時点までにパースした末尾の要素を参照する。

```
struct header_t {  
    ethernet_h ethernet;  
    vlan_tag_h vlan_tag;  
    mpls_h mpls;  
    ipv4_h ipv4;  
    ipv6_h ipv6;  
    tcp_h tcp;  
    udp_h udp;  
    probe_marker_forw_h probe_marker_forw;  
    probe_marker_latter_h probe_marker_latter;  
    int_shm_h shm_hdr;  
    int_hbh_md_h hbh_md_hdr;  
    int_data_h data;  
};  
  
header_mpls_h {  
    bit<20> label;  
    bit<4> exp;  
    bit<1> bms;  
    bit<8> ttl;  
};
```



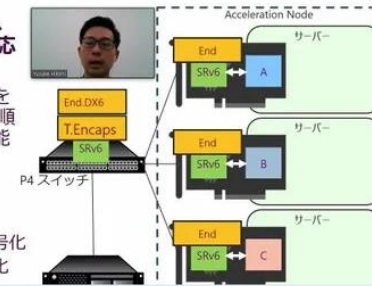
## パネリディスカッション 議題

- ◆ 初めに
- ◆ P4関連の動向において注目していること
- ◆ Programmable Switch,
- ◆ ポストコロナ/生活環境
- ◆ 会場の皆様からパネリス



## SRv6 を活用することによるメリット

- 複数ファンクションを任意の順番、段数で接続することにより要望に応じた処理の実行が可能となる
- アプリケーション毎に SR ヘッダを変更することで FPGA で行う処理順序、処理内容を制御することが可能
- 例
  - App1: 復号化→データ処理→暗号化
  - App2: データ処理→圧縮→暗号化



<https://p4users.org/2020/12/28/event2020-feedback/>

p4users-jp

# general

チャンネル

- 20200413\_p4online...
- 20210416\_p4online...
- admins-workspace
- live-session-presente...
- p4-hands-on
- # p4-japan-2019
- # p4-japan-2020
- # random
- staff-20191011
- チャンネルを追加する

App

- Google Calendar
- アプリを追加する

# general 全社的なアナウンスと業務関連の事項

220

8月24日(火)

<https://p4users-jp.slack.com>

全の観点から、今年もP4イベントを完全オンラインと録画セッションの開催予定です。詳細はこちらから確認することができます。

<https://p4users.org/events/p4usersjp2021/> Slackへの参加はこちらから [https://p4users-jp.slack.com/# イベント情報](https://p4users-jp.slack.com/#イベント情報) ■

開催日時 2021年10月21日(木曜日) 午後13時00分 LIVEセッション...

日本 P4 ユーザ会

イベント情報-日本P4ユーザ会2021

日本P4ユーザ会2021 English Page Available here 日本P4ユーザ会で健...

7月19日

13

8月27日(金)

Hitoshi Kuwata 11:27

気づくのが遅れたのですが、機械学習のパフォーマンスを向上させるスコードが公開されていました。

<https://github.com/p4lang/p4app-switchML>

この研究自体は2019年ごろから実施されていたようですが、NSDI21(うです。

<https://www.usenix.org/conference/nsdi21/presentation/sapio>

ドキュメントは以下です。

<https://switchml.readthedocs.io/en/latest/>

まだ触れておりませんが、まずは情報共有までです。

GitHub

GitHub - p4lang/p4app-switchML: Switch ML Application

Switch ML Application. Contribute to p4lang/p4app-switchML development on GitHub. (50 kB)

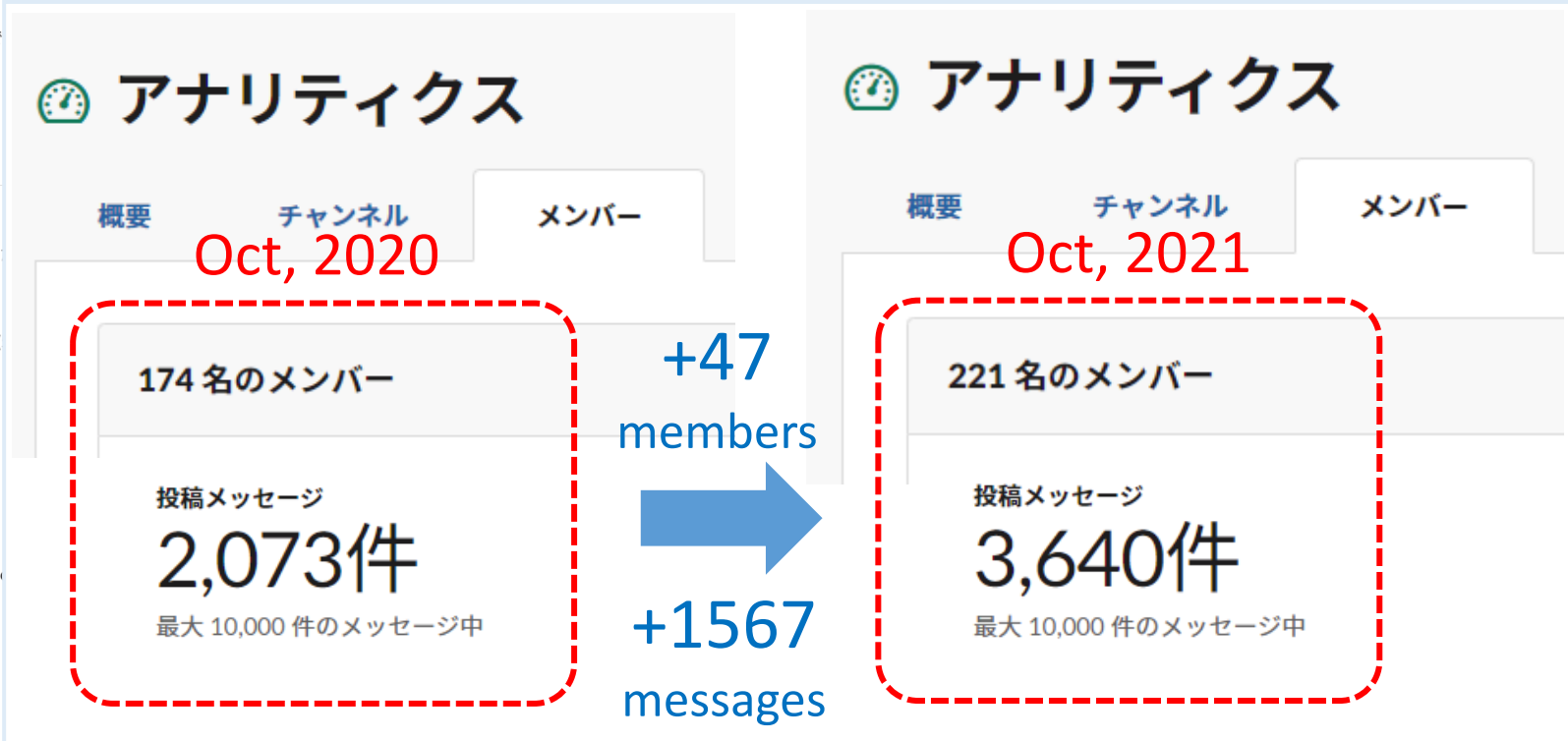
p4lang/p4app-switchML

Switch ML Application

3 Contributors 0 Issues 34 Stars 7 Forks



p4users-jp Slack Workspace is still growing.





# The 3rd P4 Users Japan Meet Up on 21<sup>st</sup> Oct, 2021

<https://p4users.org/events/p4usersjp2021-en/>

## Live session timetable



### P4 Users Japan 2021

#### P4 Users Japan 2021

Thursday, October 21, 2021 - 1.00 p.m. Japan Time - Virtual  
October 20, 9.00 p.m. PDT

[日本語のページはこちら](#)

The growing global health concerns about the spread of COVID-19, the Japan P4 Users Group is pleased to announce that this year's event will be held online. There have been many P4 related updates since last year's event. This latest information will be held in this event in two configurations, the LIVE session, and the on-demand sessions.

The P4 Users Japan would like to inform you about a Call for Presenters (both live and on-demand sessions) for the P4 Users Japan 2021 Event.

We're looking forward to welcoming you and mark your calendar on October 21, 2021 (October 20 in PDT).

Date	LIVE Session / October 21st, 2021 1:00 PM Japan Standard Time(JST) On-demand session will be opened 9:00 AM Japan Standard Time(JST)
Venue	Online / access information will be provided later
Fee	Free (Registration requested)
Hosted by	P4 Users Japan
Language	Japanese
Sponsors	APRESIA Systems, Ltd. Intel K. K. Macnica, Inc. Altima Company Net One Systems Co., Ltd. Toyota Motor Corporation

Details will be updated as available  
Starts from 1:00 PM Japan Standard Time(JST), October 21st, 2021

No.	Time	Title & Presenter
		<b>Welcome Address</b>
1	01:00-01:10	Yuki Hisata P4 Users Japan Chairman
		<b>P4 Updates</b>
2	01:10-01:30	Kentaro Ebisawa Toyota Motor Corporation
		<b>Performance Made Flexible ~Tofino X and Load-Balancer use cases ~</b>
3	01:30-02:00	Ryosuke Kobuna Intel Corporation
		<b>Implementation of end-to-end network monitoring system</b>
4	02:00-02:30	Kazuma Kamienuo NTT Network Innovation Center
		<b>P4 usecase for mobile platform in ONF</b>
5	02:30-03:00	Shinji Yonesaka NIPPON TELEGRAPH AND TELEPHONE WEST CORPORATION
6	03:00-03:10	Break
		<b>Introducing on-demand sessions</b>
7	03:10-03:20	Yuki Hisata
		<b>Testbed for NICT P4</b>
8	03:20-03:30	Yoshihiko Kanamui NEC/NICT ICT Testbed Research, and Development Promotion Center
		<b>NOS and use case for P4 switch</b>
9	03:30-04:00	Hitoshi Kuwata APRESIA Systems, Ltd.

		<b>NOS and use case for P4 switch</b>
9	03:30-04:00	Hitoshi Kuwata APRESIA Systems, Ltd.
		<b>P4 Use Cases in Programmable NICs -Pensando</b>
10	04:00-04:20	Ryosunata Suhartono Net One Systems Co., Ltd.
		<b>GTP Packet Broker Development by P4</b>
11	04:20-04:50	Wataru Kumagai SoftBank Corp.
		<b>Inovative Development Flow for C/D plane with P4</b>
12	04:50-05:20	Yusuke Hikichi MACNICA, Inc. ALTIMA Company
		<b>Panel Discussion</b> How to be more "OPEN" <b>Moderator:</b> Kishimoto Takayuki <b>Panelist:</b>
13	05:20-05:50	Kentaro Ebisawa Kuwata Hitoshi Wataru Kumagai Kazuma Kamienuo YOU (questions from online participants)

# The 3rd P4 Users Japan Meet Up on 21<sup>st</sup> Oct, 2021

<https://p4users.org/events/p4usersjp2021-en/>



## On-demand sessions

Starts from 9:00 AM Japan Standard Time(JST), October 21st, 2021

No.	Category	Title & Presenter	Resources (VoD, Documents, URL)
<b>In-band Telemetry</b>			
1	Network	Shishio Tsuchiya Arista Networks Japan Limited.	
<b>A Journey from OpenFlow to P4 - Improved Performance and Reduced Development Time</b>			
2	Case Study	Jeff Elpern NoviFlow Inc.	
<b>Smart NIC を活用した短期間でのデータプレーン開発 : NAT 編</b>			
3	Case Study	Yusuke Hikichi MACNICA, Inc. ALTIMA Company	
<b>Post Card Based Telemetry</b>			
4	Case Study	Masashi Takano NTT COMWARE Corporation	

## Sponsors

**APRESIA**

APRESIA Systems, Ltd.

**intel**

Intel K. K.

**TOYOTA**

Toyota Motor Corporation

**net one**

Net One Systems Co., Ltd.

**MACNICA**

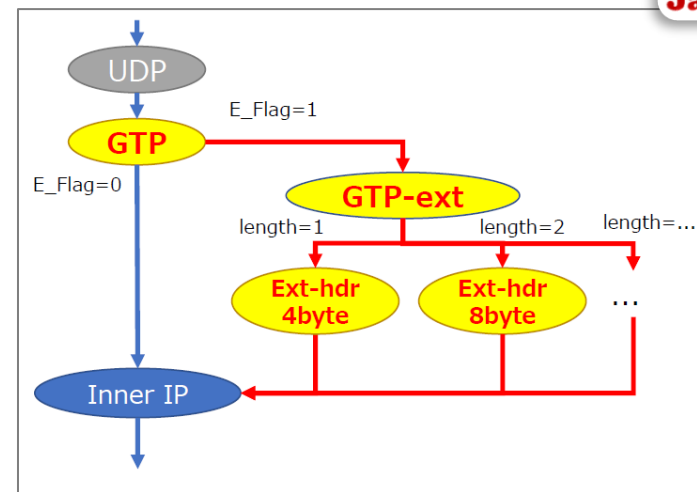
Macnica, Inc. Altima Company

# How P4 is used in Japan?

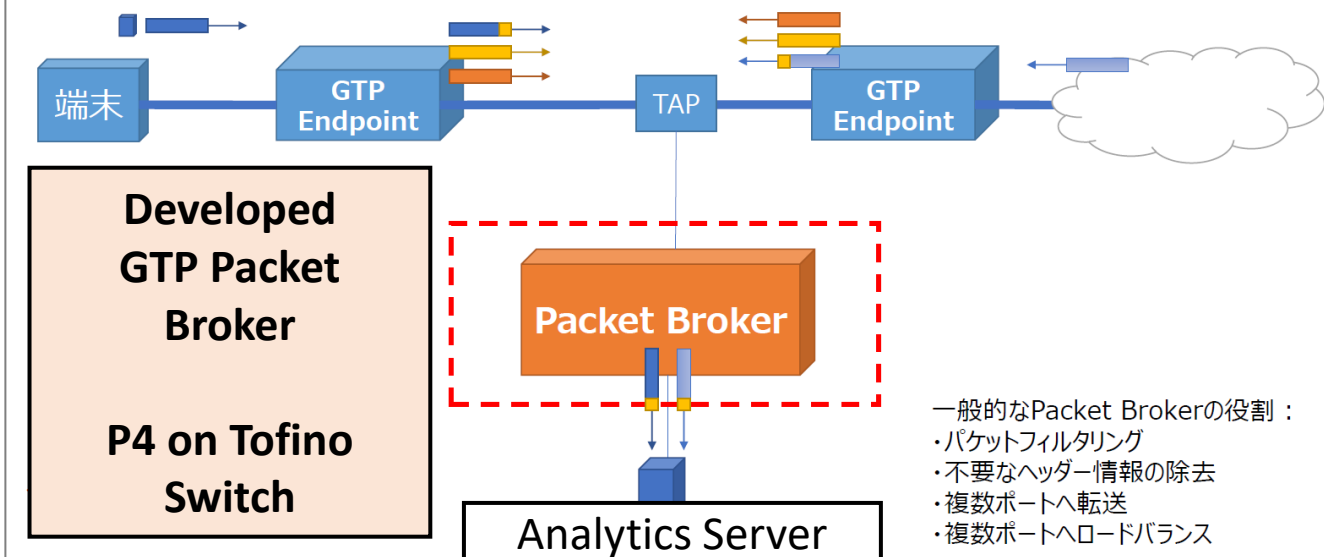
Use cases presented in The 3rd P4 Users Japan Meet Up (21<sup>st</sup> Oct, 2021)

# Mobile Packet Broker

- Softbank developed Mobile Packet Broker on Tofino Switch.
  - Parser for GTP and extension headers
  - Load Balance based on Inner IP address and L4 port
  - Rewrite outer header to support RSS on analytic server



## GTP Packet Broker 概要



```
@symmetric("hdr.inner_ipv4_src", "hdr.inner_ipv4_dst")
@symmetric("hdr.inner_l4_src", "hdr.inner_l4_dst")
Hash<bit<32>>(HashAlgorithm_t.CRC32) loadbalance_hash;
...
table load_balance {
    key = {
        ingress_port      : exact;
        loadbalance_hash  : selector;
    }
    actions = {
        set_egress_port;
    }
    implementation = loadbalance_selector;
}
apply {
    ...
    hash = loadbalance_hash.get({hdr.inner_ipv4_src,
    hdr.inner_ipv4_dst, hdr.inner_l4_src, hdr.inner_l4_dst});
    load_balance.apply(hash);
    ...
}
```

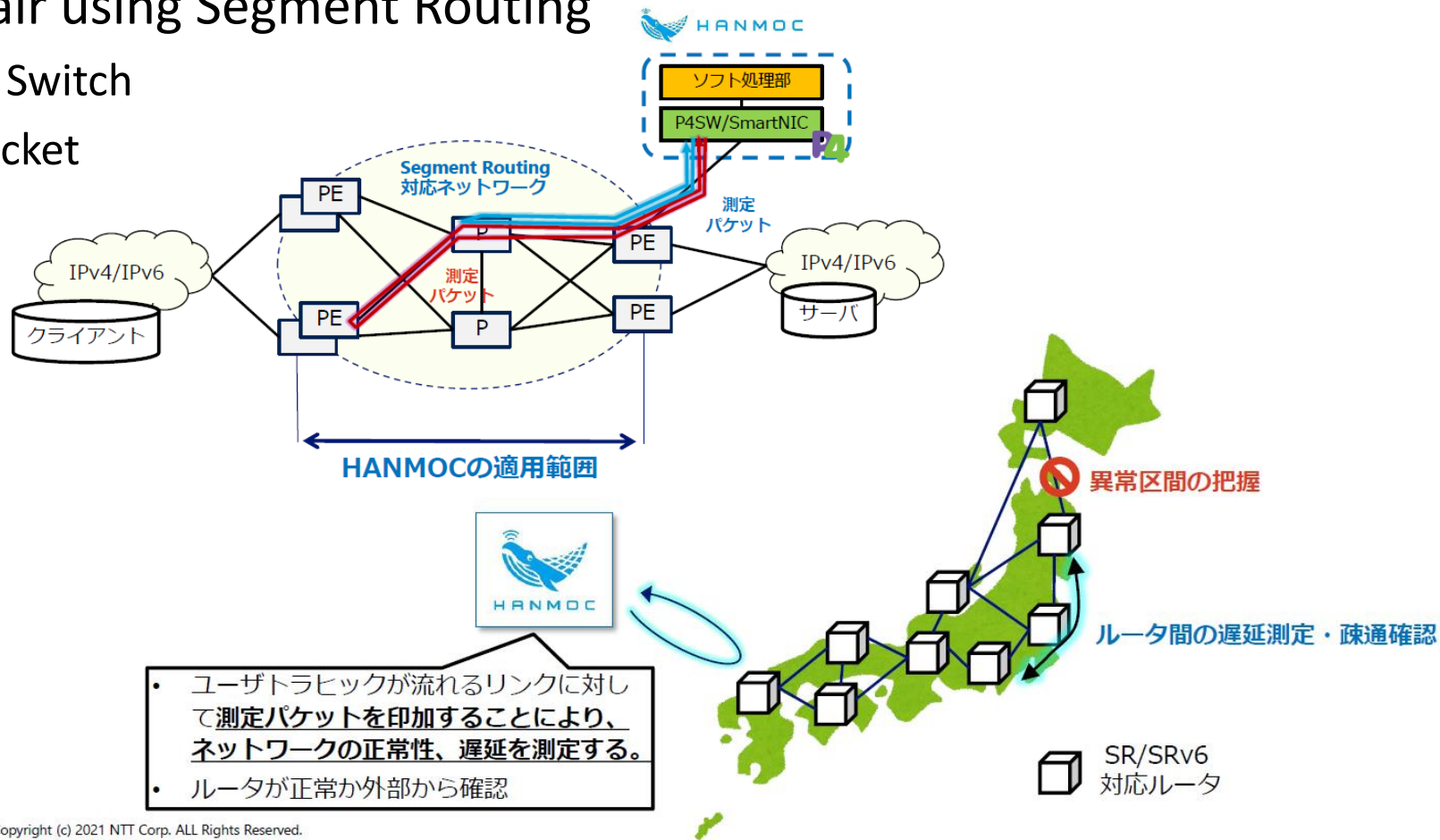
symmetric hashの定義

生成したHash値により、Load balanceの送信先ポートを選定

Inner情報よりHash値を生成

# Network Latency Monitoring System (NTT)

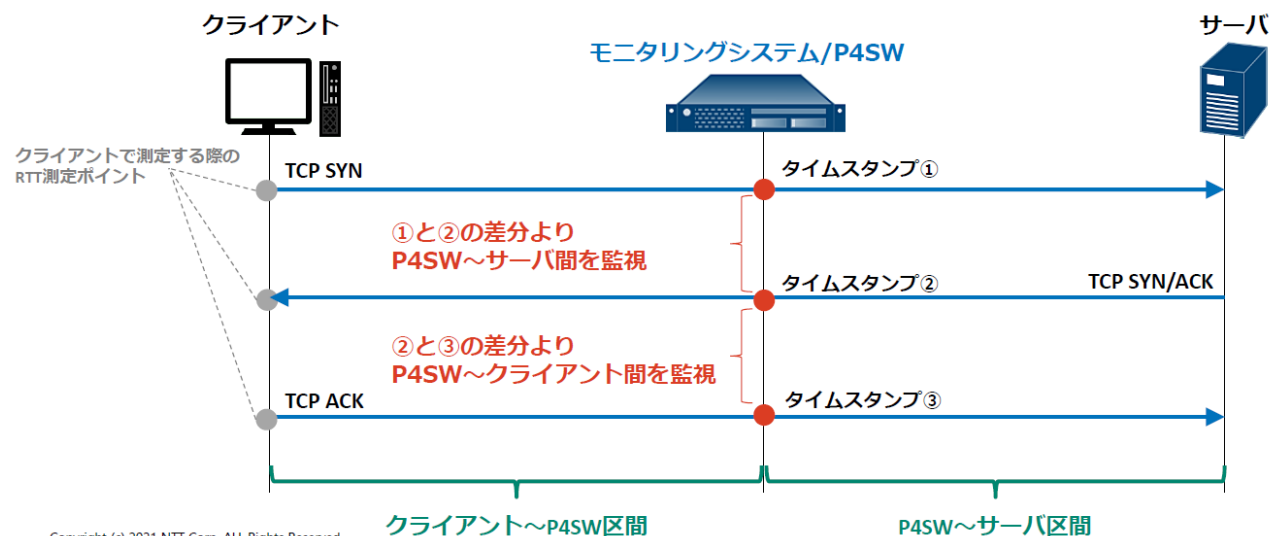
- HANMOC ... High-Accuracy Network MOnitoring and Control
- Measure Latency of any node pair using Segment Routing
  - Inject timestamp to packet on P4 Switch
  - Calculate delay when receiving packet



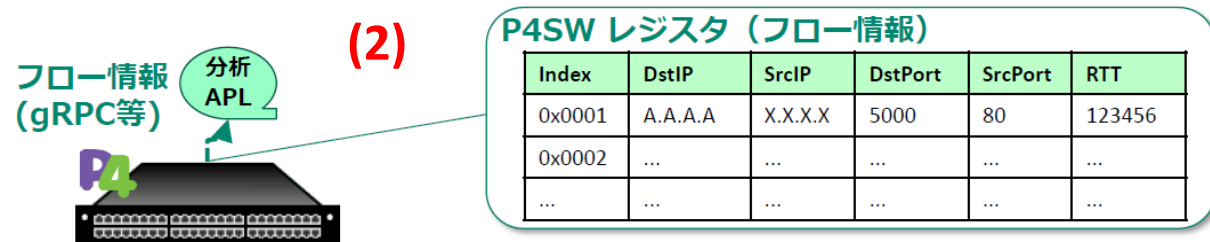
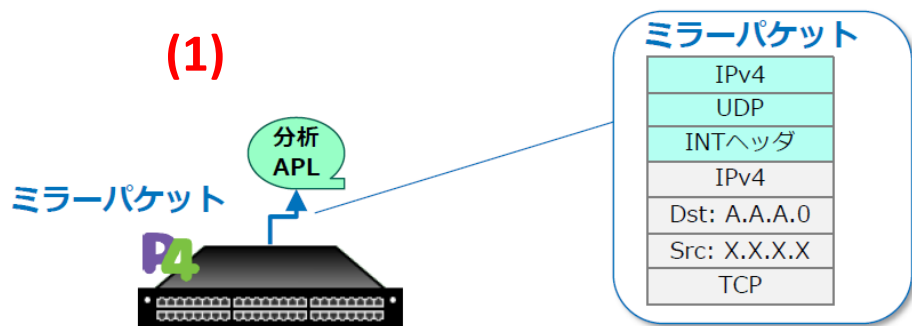
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# End-to-End Network Monitoring System (NTT)

- Monitor and record timestamp in the middle of network.
- Corelate and identify session and packet order using arbitrary field in packet header.
  - e.g. 5 Tuple + ACK for TCP
- 2 options
  - (1) mirror packet to analytics server
  - (2) store & calculate RTT using P4 SW register

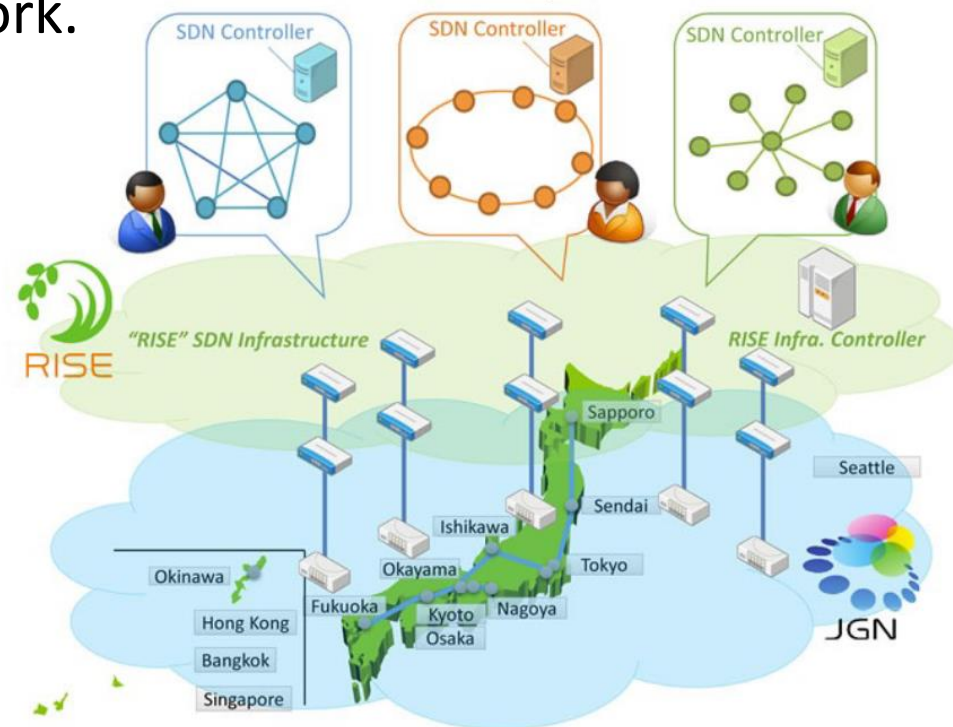


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# P4 Test bed by NICT (Under Construction)

- Adding “P4 Test bed” to nationwide SDN research network.
  - Currently used to test “OpenFlow”.
- Evolve SDN with dataplane programmability.
- Easy challenge, fail, and learn!!
- Provide “virtual” P4 environment to users.
  - BMv2 on VM
  - SmartNIC (FPGA - Intel PAC N3000)
  - Tofino Switch (Wedge 100BF-32X)
- Trying to figure out how to support multi-tenancy on P4 switch.



©NICT

=> If there is any (research) activity on “P4 + multi-tenancy”, please let us know!!



# How we see current P4 status in Japan?

- Platform is steadily increasing... 😊
  - BMv2 on CPU (Learning & POC)
  - Switch ASIC (Tofino)
  - SmartNIC (Intel IPU, NVIDIA DPU, Pensando DSC)
- “OPEN” is the key for even more active P4 community.
  - Difficult to prove “it’s worth spending my time & budget” to convince managers without trying.
  - Strong demand for Tofino Emulator & P4 Compiler for ASIC ... just like gcc for Intel CPU 😊
  - We also expect other vendors to follow Intel’s Open Strategy: Pensando, NVIDIA, Xilinx etc.
- Some use cases are made public ... but should have more.

**Looking forward to attending the sessions today,  
and bring ideas and use cases back to Japan P4 community !!**