THE POLICY SPACE FOR SOFTWARE DEFINED EXCHANGES
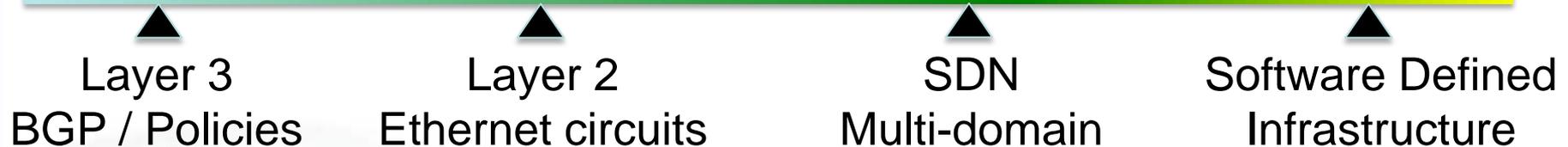
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Introduction and Motivation

- In traditional Research and Education (R&E) networks, exchange points are used to share computing, storage and networking resources.

- In the commercial space, Internet Exchange Points (IXP) and Hybrid Clouds are used for similar purposes.

- A Software Defined eXchange (SDX) seeks to introduce Software Defined Networking (SDN) and Cloud Orchestration technologies into the Exchange Point to optimize resource sharing and allocation

What does "SDX" mean ?

A range of SDX ideas and use cases

Layer 3	Layer 2	SDN	Software Defined
BGP / Policies	Ethernet circuits	Multi-domain	Infrastructure

- "Networking" SDX – connectivity / routing
  - Layer 3 (IP) – e.g., connect AS's
  - Layer 2 (Ethernet) – e.g., multi-domain circuits
  - SDN – connect SDN islands

- "Cloud service" SDX – with compute/storage
  - Connect SDI islands
  - Compute / storage / network / instruments
  - GENI as an early instance

An SDX Taxonomy
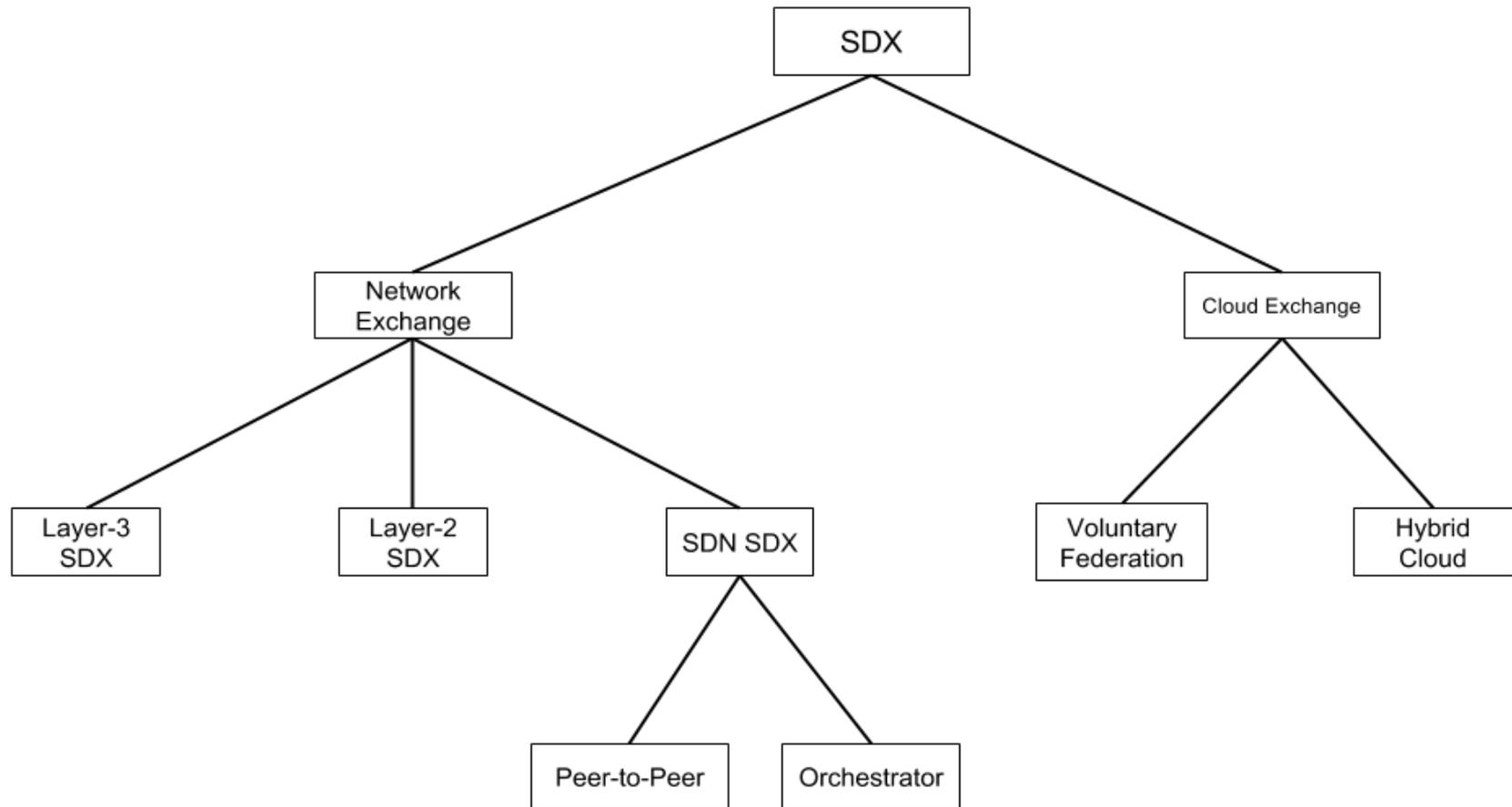
SDX Applications

- To augment BGP policies in an IXP:
  - Application-specific peering
  - Inbound traffic engineering
  - Wide-area load balancing
  - Redirection through middle boxes

A. Gupta, E. Katz-Bassett, L. Vanbever, M. Shahbaz, S. P. Donovan, B. Schlinker, N. Feamster, J. Rexford, S. Shenker, and R. Clark, "SDX," ACM SIGCOMM Comput. Commun. Rev., vol. 44, no. 4, pp. 551–562, Aug. 2014.

SDX Applications

- Data Domain:
  - Data-on-demand
  - Data preprocessing
  - High-quality media transmission over long-distance networks.

- Infrastructure Domain:
  - Data mobility for Inter-cloud use
  - Follow the sun (or moon) principles for Datacenter
  - Disaster recovery by IaaS migration.

G. Carrozzo, R. Monno, B. Belter, R. Krzywania, K. Pentikousis, M. Broadbent, T. Kudoh, A. Takefusa, A. Vieo-Oton, C. Fernandez, B. Puvpe, and J. Tanaka, "Large-scale SDN experiments in federated environments," in 2014 International Conference on Smart Communications in Network Technologies (SaCoNeT), 2014, pp. 1–6.

SDX Policies

- Policies based on packet header field
  - Match TCP or UDP source and destination ports,
  - Match source and destination IP address or
  - Match source and destination MAC addresses
  - Apply actions accordingly.
- Policies based on external data
  - Collect information from other systems such as: network monitoring systems, user databases, DNS or NTP server
  - Match parameters such as network latency, bandwidth, user name, domain name, date and time
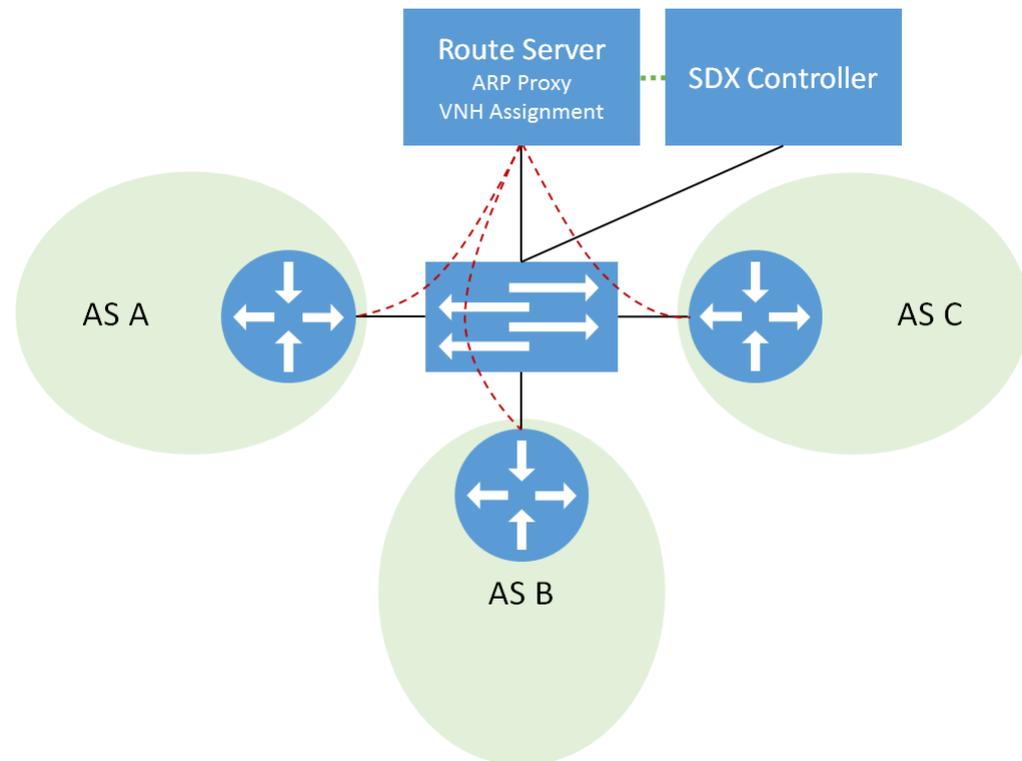 - Apply actions accordingly.

Application Specific Peering

```
if (dstport == 80)
    forward to B
else if (dstport == 4321 || dstport == 4322)
    forward to C
```

More Policy examples

- On-demand Virtual Circuit provisioning

```
if (current_latency > SLA_latency)
        secondary = findSecondaryPath()
while (current_latency > SLA_latency)
        LoadBalance(primary, secondary)
```

- Bandwidth Calendaring

```
scheduled_time = 21:00:00 GMT -5
if (current_time == scheduled_time) {
        BW = 90 // Bandwidth in Mbps
        t = 60 // Reservation time
        OnDemandVC(BW, t)
}
```

Ongoing Research

- Exploration of extended Pyretic policies
- Representation of policies as RESTful or JSON APIs
- Evaluation of new intent-based networking interfaces for SDN controllers

THANK YOU

QUESTIONS?

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