1. Motivation

- Flexible traffic control on IXs with SDN technologies
- Limitations of current IXs and Inter-domain networking
  → traffic engineering based on IP Prefix with BGP
  → there are no intelligences on IX
  → require security functions against large scale cyber attacks

2. PIX-IE

PIX-IE provides following functions on the IX network;

- **Security**
  - Filtering DoS/DDoS traffic on ingress ports of attacks, before the traffic is forwarded to a victim network
  - use case: DoS/DDoS filtering

- **Multilayer Path Exchange**
  - connecting multilayer paths among ASs such as MPLS or VLAN
  - use case: inter-cloud, inter-VPN

- **Flexible Traffic Control**
  - control traffic based on a type of application
  - use case: application based load balancing

Figure 1. shows a design of the PIX-IE. The IX is comprised with the controller and SDN switches. OpenFlow is a candidate of the SDN technology. The PIX-IE has to coordinate to avoid any conflicts in rules. In addition the controller should fairly assign the SDN resources to ASs (e.g. Flow Table, Bandwidth).

3. Demonstration in INTEROP Tokyo

We demonstrated the PIX-IE in INTEROP Tokyo 2014 (Jun. 2014) . That is one of the biggest business shows in computer networking. Figure 2. shows the overview of the demonstration. In the demos, we deployed a prototype of PIX-IE on the network and provided flexible path exchange functions on the network. Totally, we have successfully exchanged 70 paths on the PIX-IE.

4. Future Work

- Implement security functions
- Demonstrate the PIX-IE with security functions on INTEROP Tokyo2015
- Deploy and evaluate the PIX-IE on NSPIXP and improve the features
- Publish papers and journals on this research