Software Defined Internet Exchange Points

Arpit Gupta
agupta80@gatech.edu

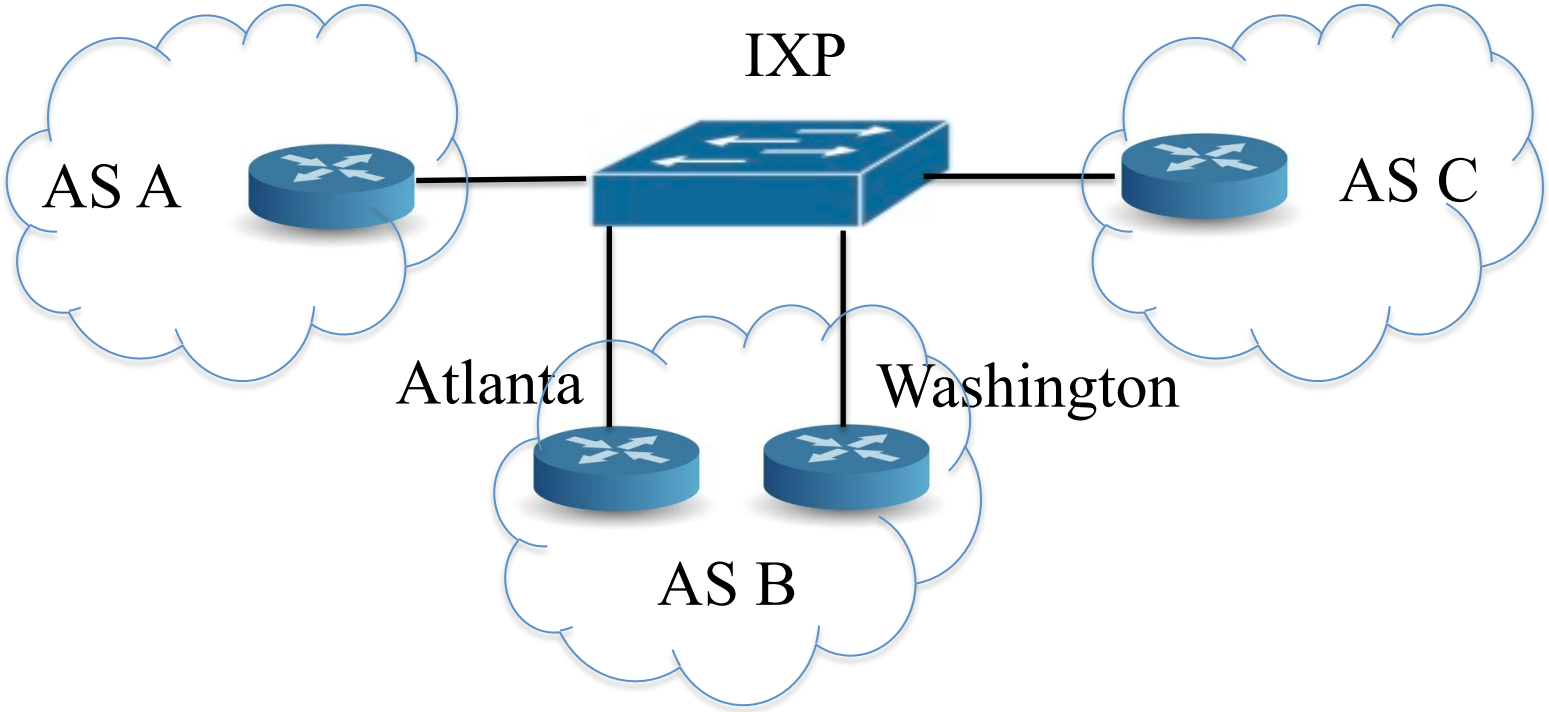
Partners in Crime:

Muhammad Shahbaz, Laurent Vanbever, Hyojoon Kim
Nick Feamster, Jennifer Rexford, Russ Clark, Scott Shenker

“Can Software Defined Networks simplify network operations for inter-domain routing?”

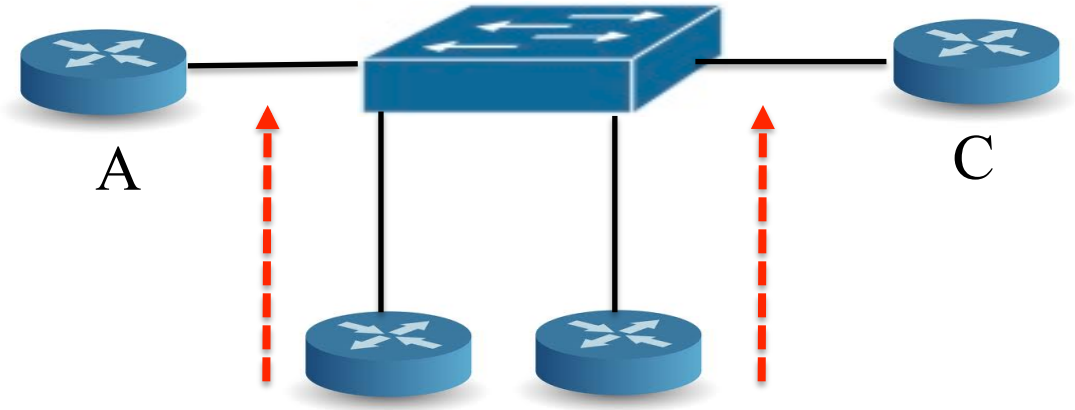
Inbound Traffic Engineering

Operator for AS B wants to control the inbound traffic for its two edge routers



Selective Announcements for Inbound TE

Add preferred destination IP prefixes for each router



[BGP Traffic Engg, APRICOT'13]

Other Approaches for Inbound TE

- AS_Path Prepending
- MEDs
- Community tagging

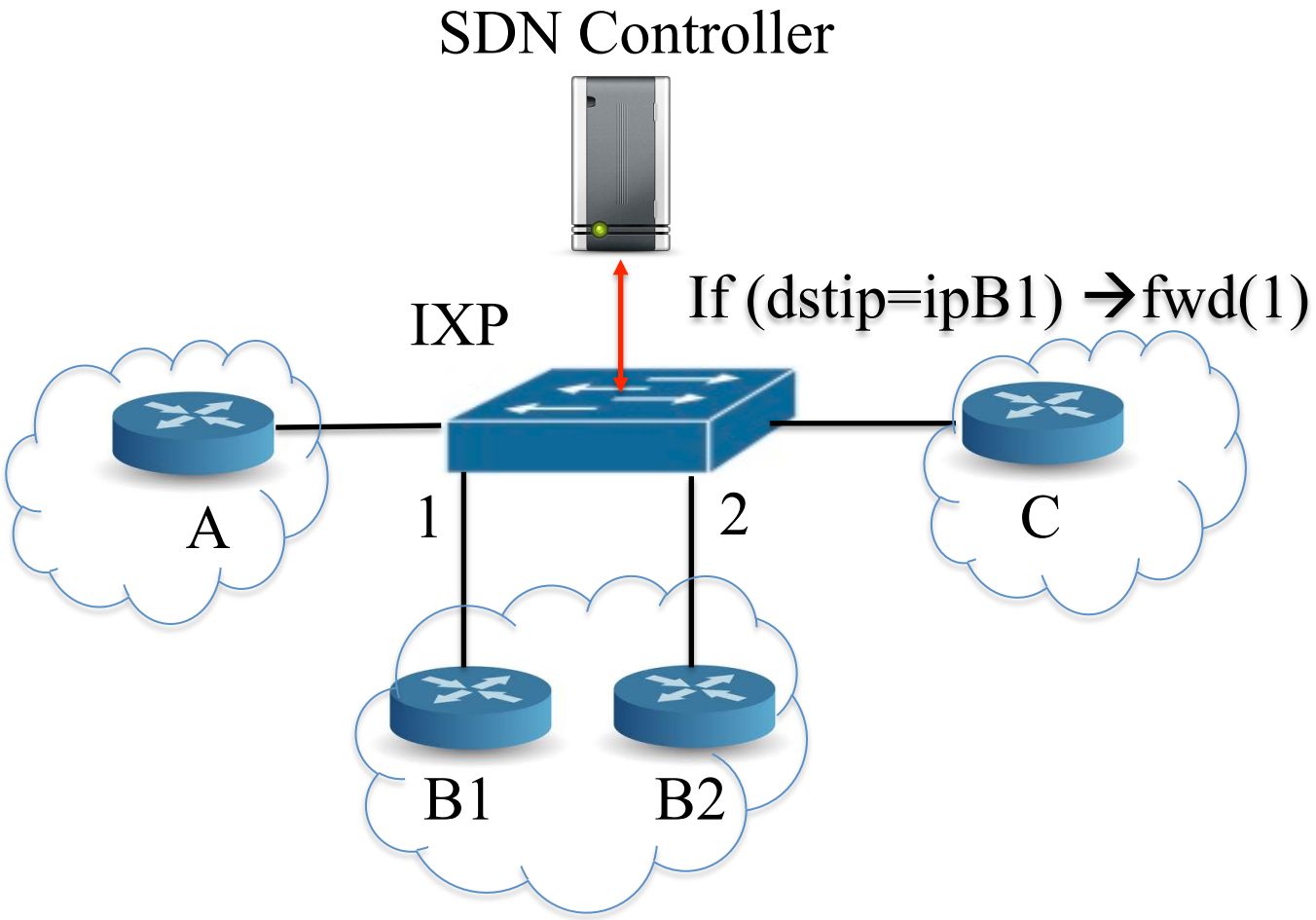
…

Problems with Current Approaches

- Inflexible
  - Limited to destination IP prefixes only
- Complex
  - Configuration intensive
- Unpredictable
  - No guarantee that the remote party will comply
  - Networks constantly change

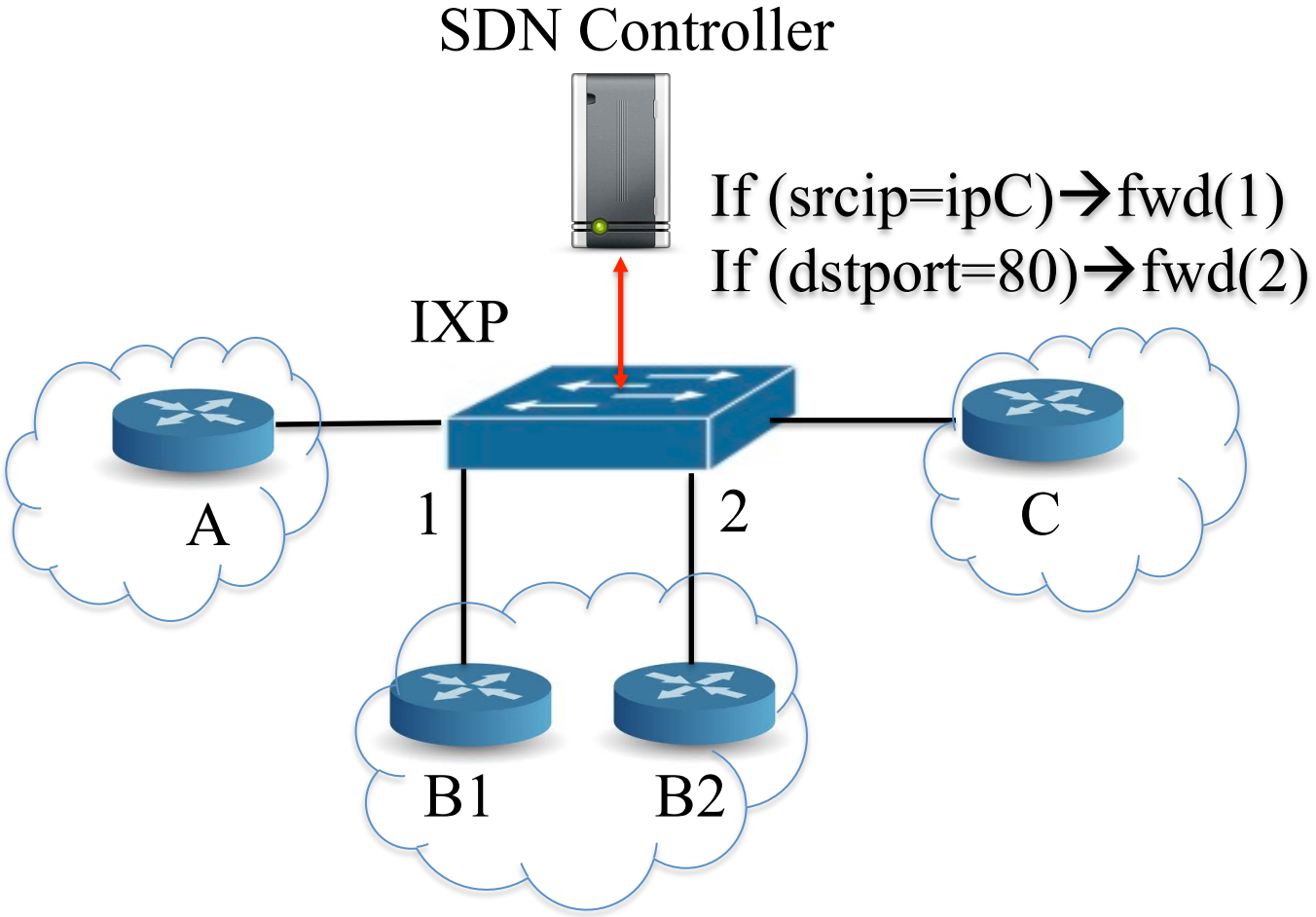
Inbound TE using Software Defined Networks

AS **B** writes simple Open Flow (OF) rules for its inbound traffic at IXP



Inbound TE using Software Defined Networks

Not limited to destination IP prefixes



Outline

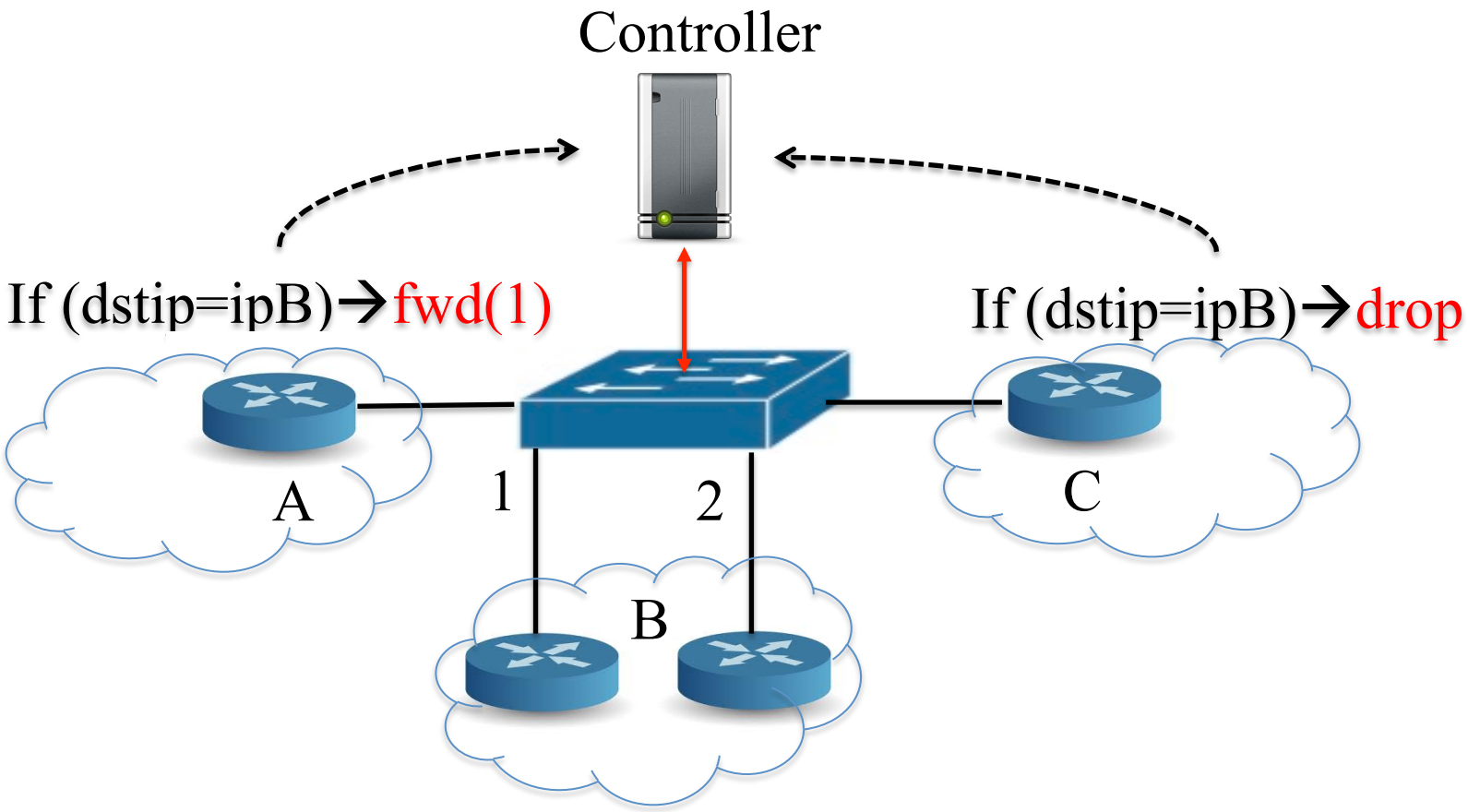
- Motivation
- SDX: Software Defined Exchange Points
- SDX's Features
- Current Status

Why Software Defined Internet Exchange Points?

- SDN widely used in various campus networks, datacenters
- Why we don't have SDN for inter-domain routing?
  - Deployment Cost
- Start with Software Defined IXPs (**SDX**)
  - Structural Advantage

SDX: Challenges

What happens when all participants write policies at SDX?

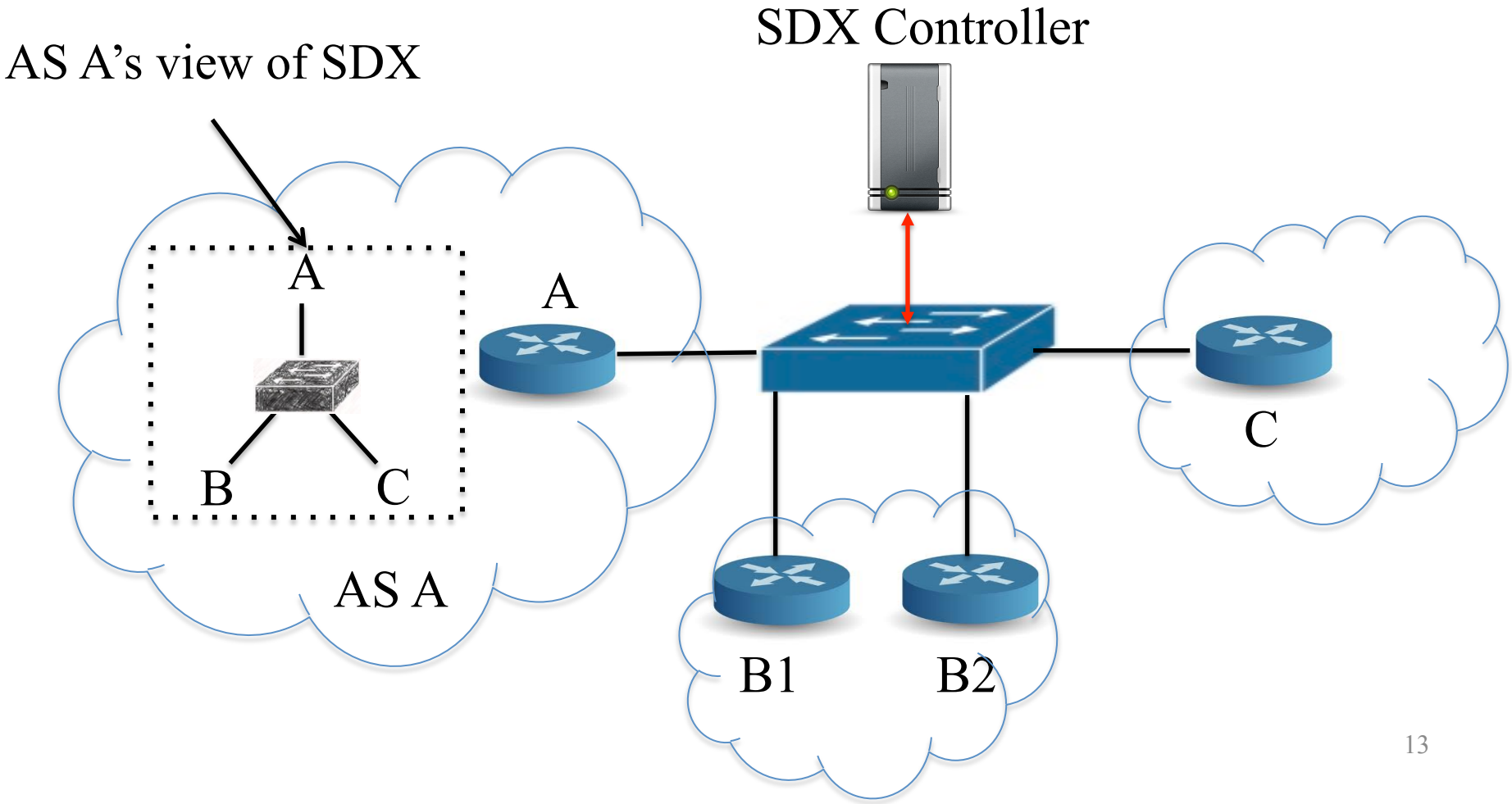


Managing Multiple Participants

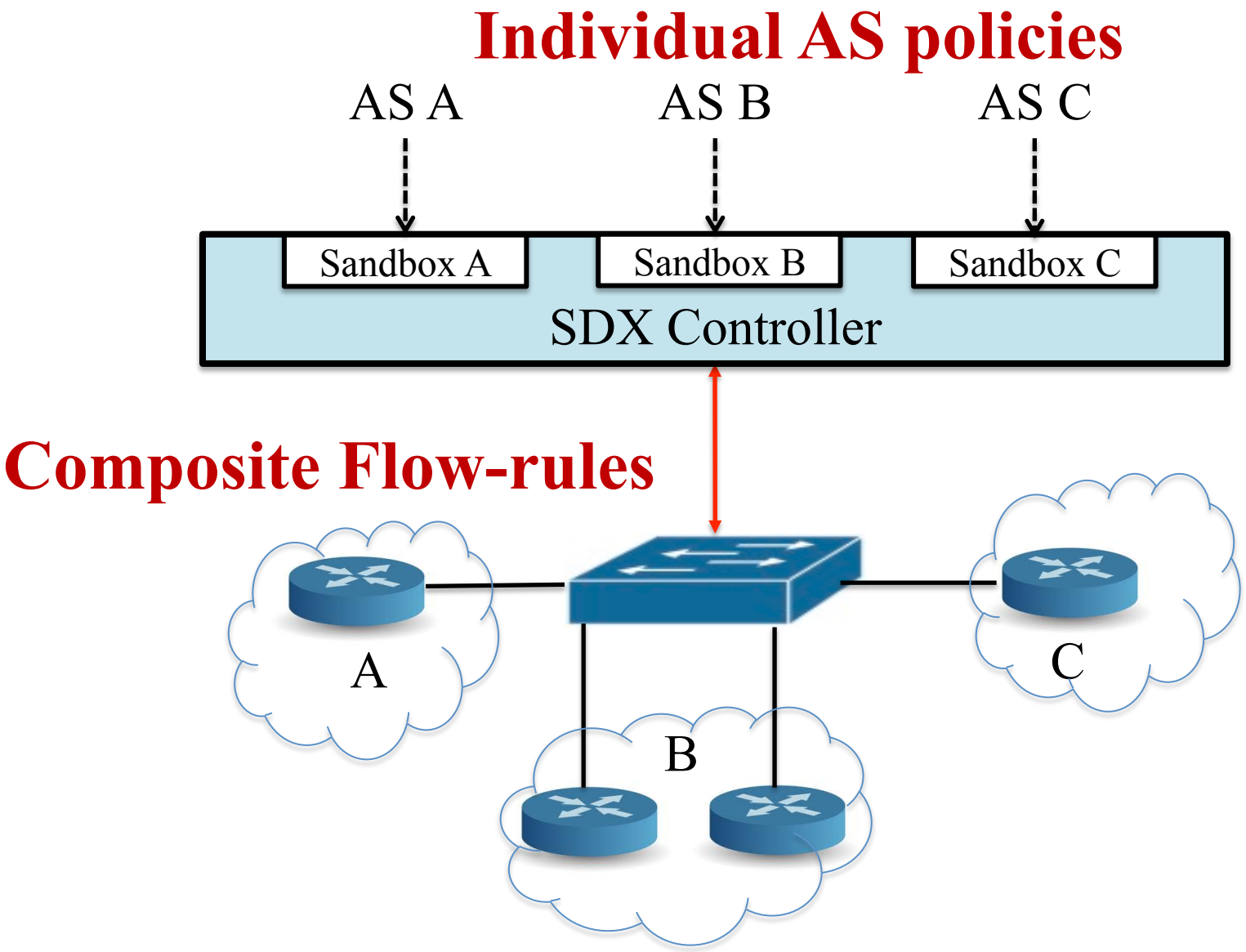
- Challenges
  - Minimize complexity
  - Avoid potential conflicts
  - Ensure security
- Solutions
  - Virtual SDX Abstraction
  - Sandbox

Virtual SDX Abstraction

Each AS has its own view of the SDX



Sandbox


Individual AS policies
AS A
AS B
AS C
Sandbox A
Sandbox B
Sandbox C
SDX Controller
Composite Flow-rules
A
B
C

Outline

- Motivation
- SDX: Software Defined Exchange Points
- SDX's Features
- Current Status

Uses Auxiliary Information

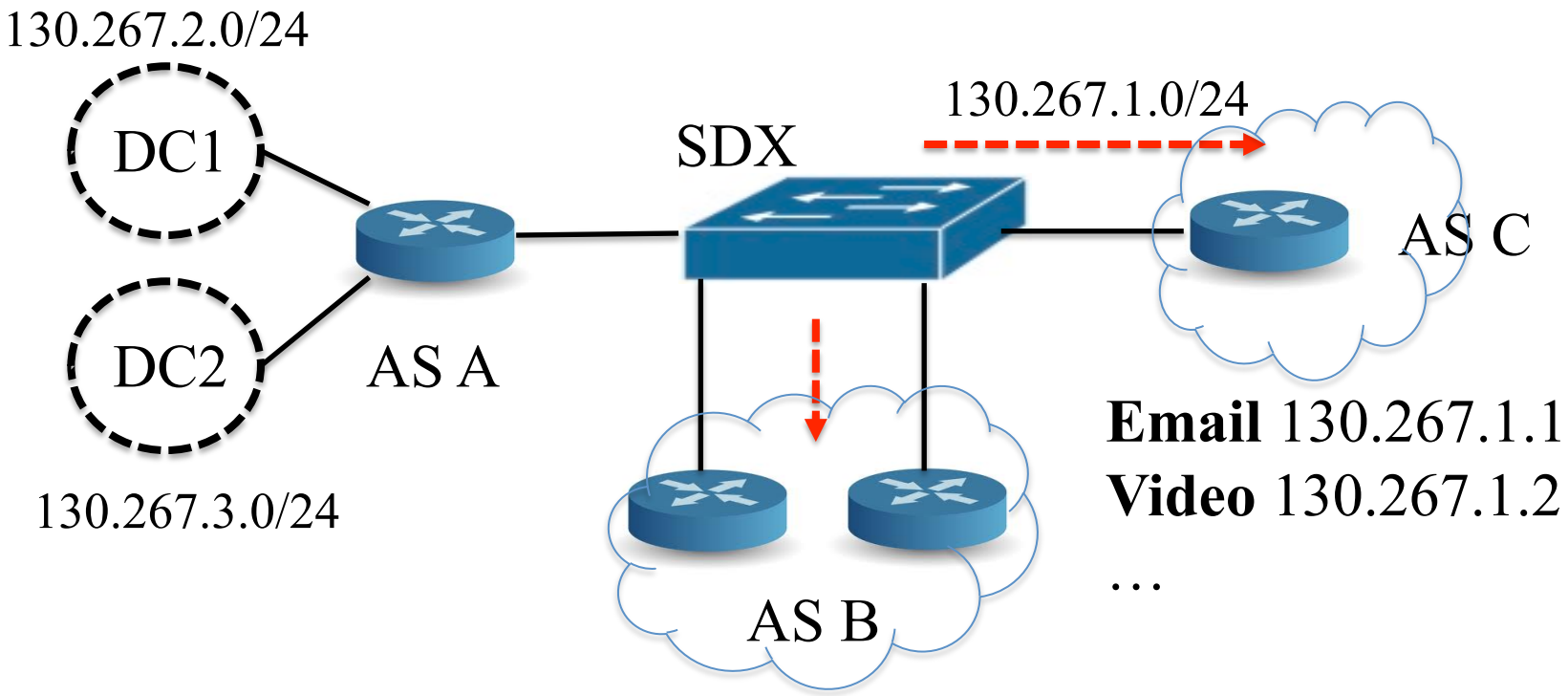
- SDX uses auxiliary information sources
  - Resource Public Key Infrastructure (RPKI)
  - Route Servers
  - …
- Example
  - Application Specific Peering
  - Prevent Free-riding

Enables Task Offloading for Participants

- Enables participants to offload SDN related tasks to SDX
- Simplifies implementation of various new SDN based network operations
- Example
  - Middlebox
  - WAN Load Balancing

Offloading WAN Load Balancing Task

Network **A** offloads WAN load balancing task to SDX

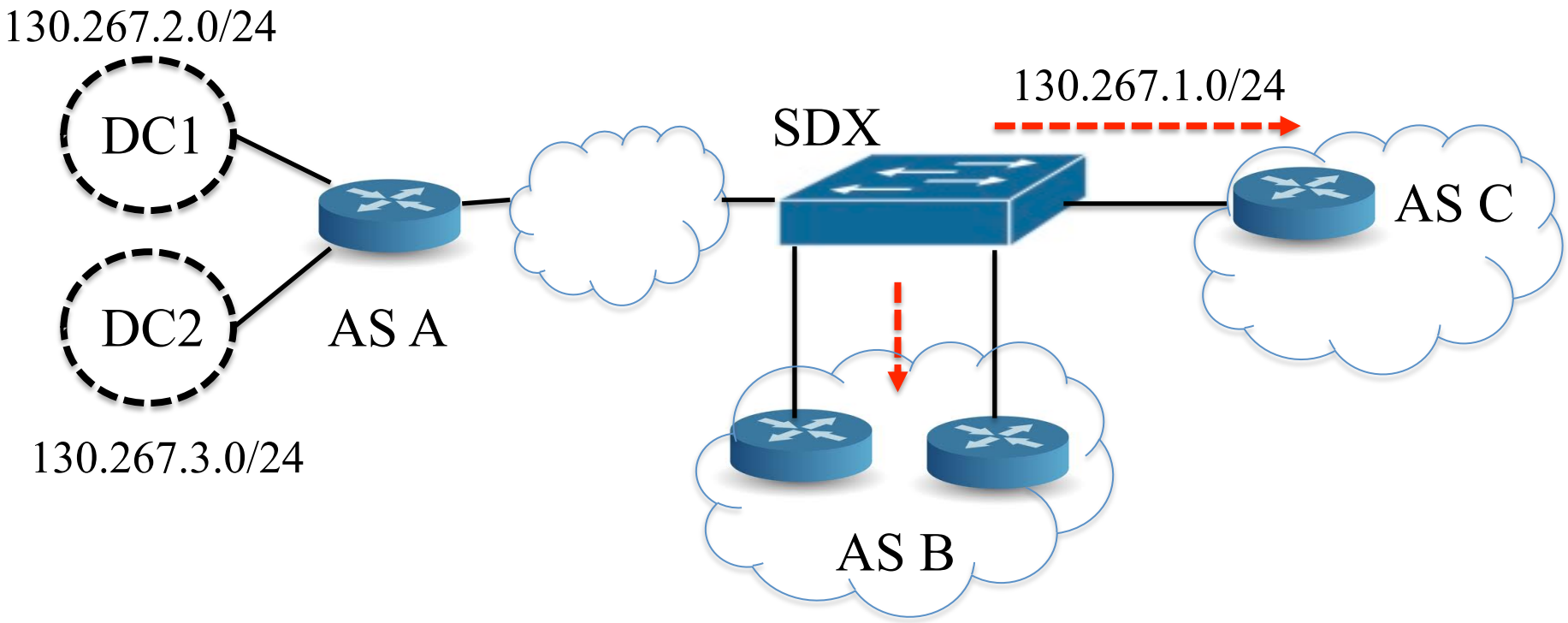


Supports Remote Control

- ASes can control exchange traffic remotely
- Opportunity to process packets and control routing decisions remotely
- Example
  - Prevent selection of paths via problematic ASes
  - DDoS Squelching

Remote WAN Load Balanicng

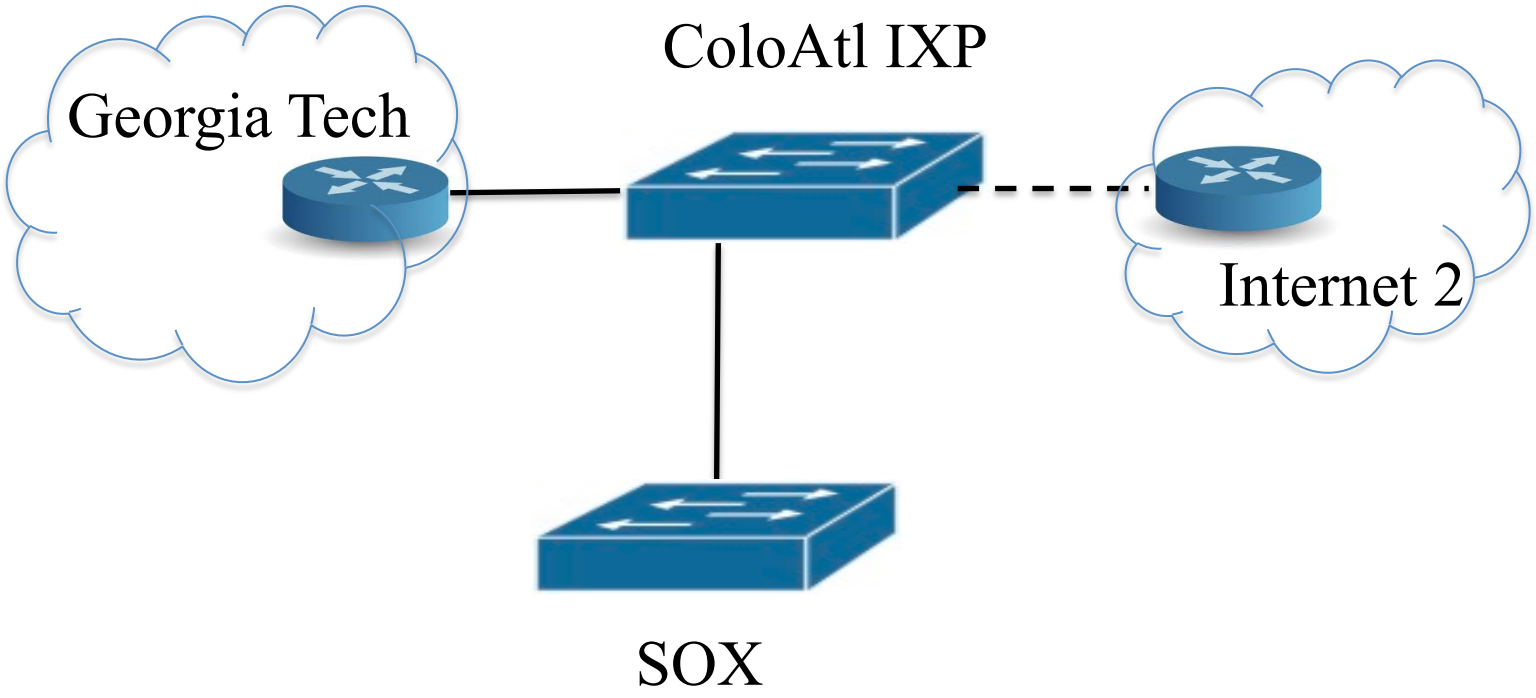
For WAN load balancing, AS A can remotely apply its load balancing policy at SDX



Outline

- Motivation
- Challenges & Solutions
- SDX's Features
- Current Status

Deployment Status



In talks with ESNet, few cloud providers and CDNs

SDN for inter-domain networking has tangible benefits!

SDX simplifies usage of SDN for inter-domain routing

Join the SDX project

noise-lab.net/projects/software-defined-networking/sdx/

- Peer with us, its simple
- Participate in SDX's survey
- Contribute to the SDX project

Arpit Gupta (agupta80@gatech.edu)

Work in Progress

- Creating interface for participants to write dynamic policies
- Integrating Route Server with SDX controller
- Adding more peers and deployment sites