Toward Transitional SDN Deployment in Enterprise Networks

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Motivation

I ❤ SDN
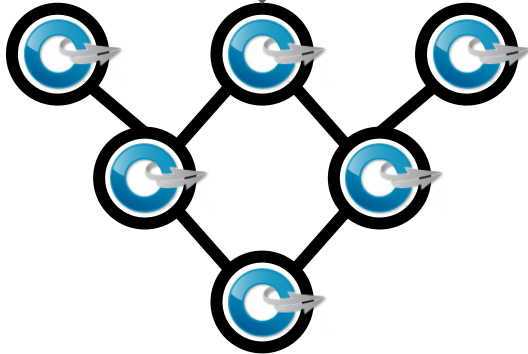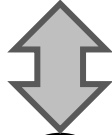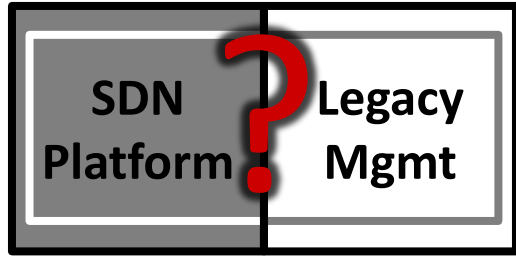
GOAL: Help SDN succeed!

The SDN Deployment Problem

UPGRADE

Full SDN

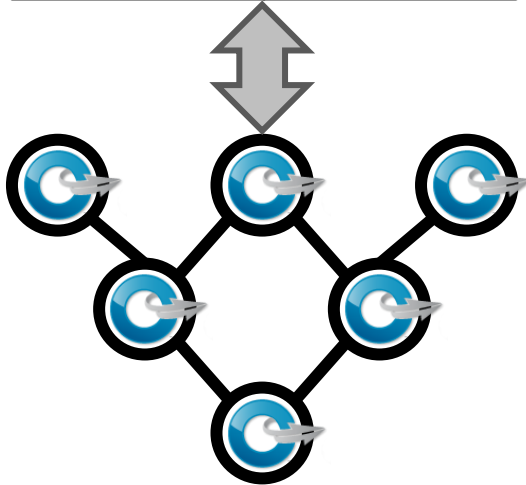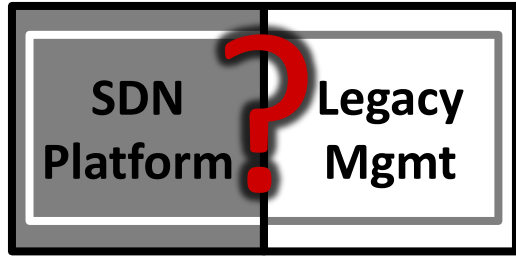Must upgrade to SDN incrementally

Key Questions

- How can we **incrementally deploy SDN** into enterprise campus networks?

- Can we reap the **benefits of SDN** with partial deployment?
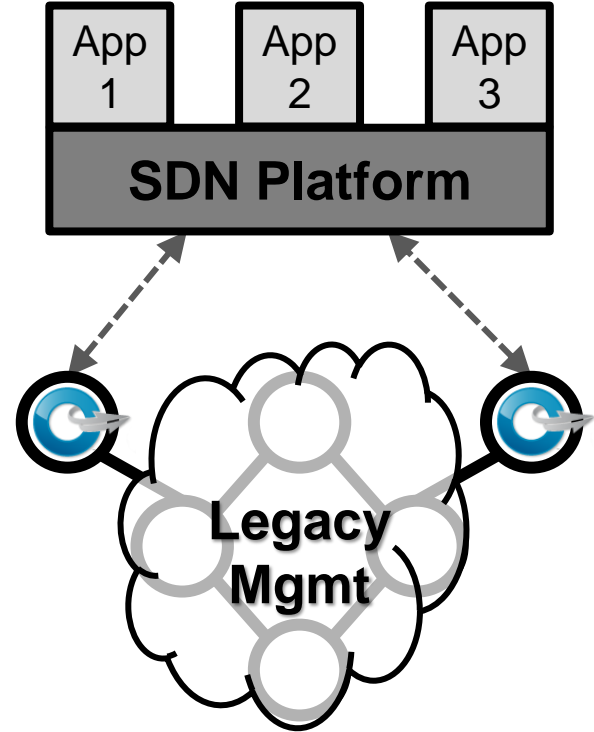
Current Transitional Networks

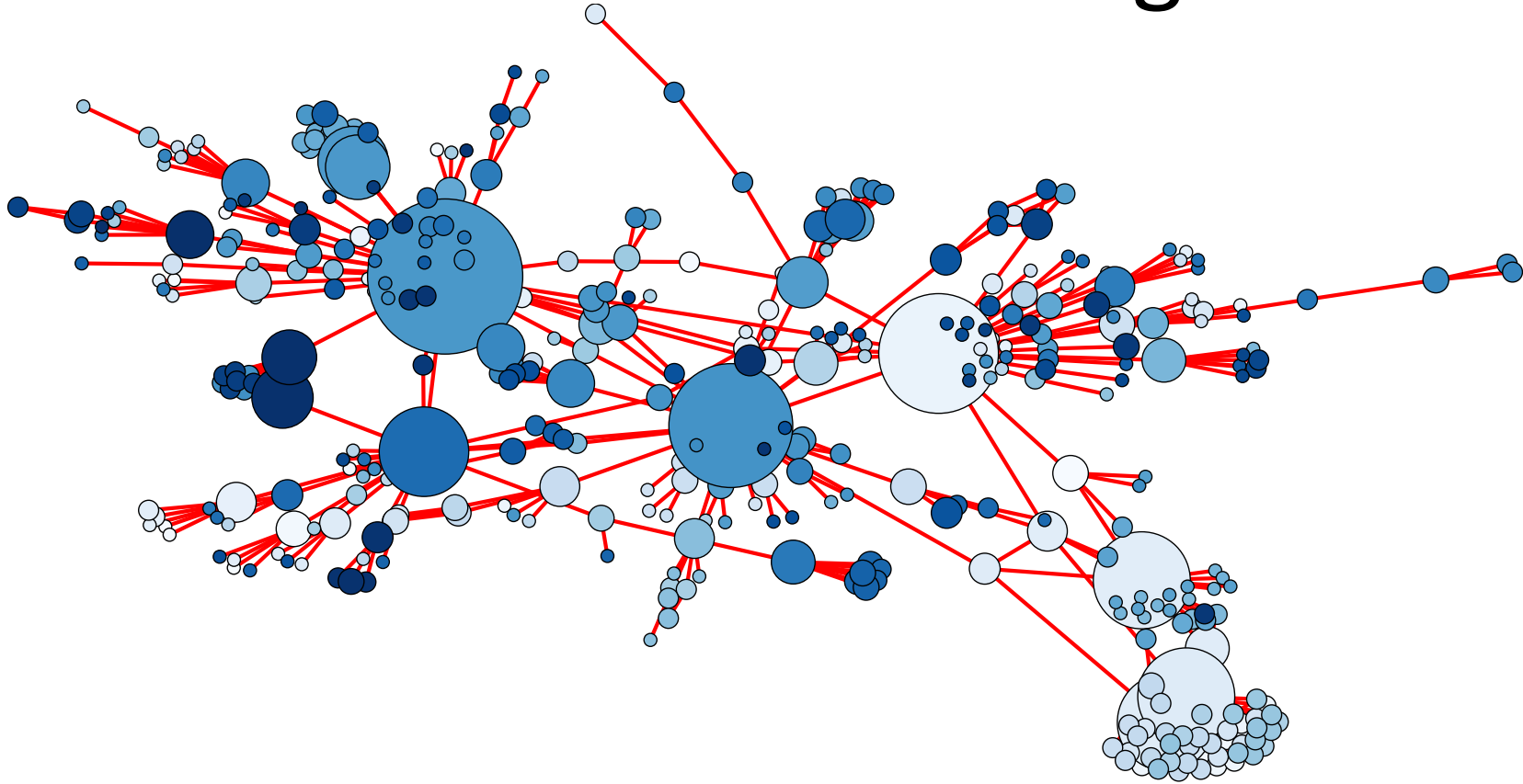
Dual-stack approach

Current Transitional Networks

Dual-stack approach

Edge-only approach

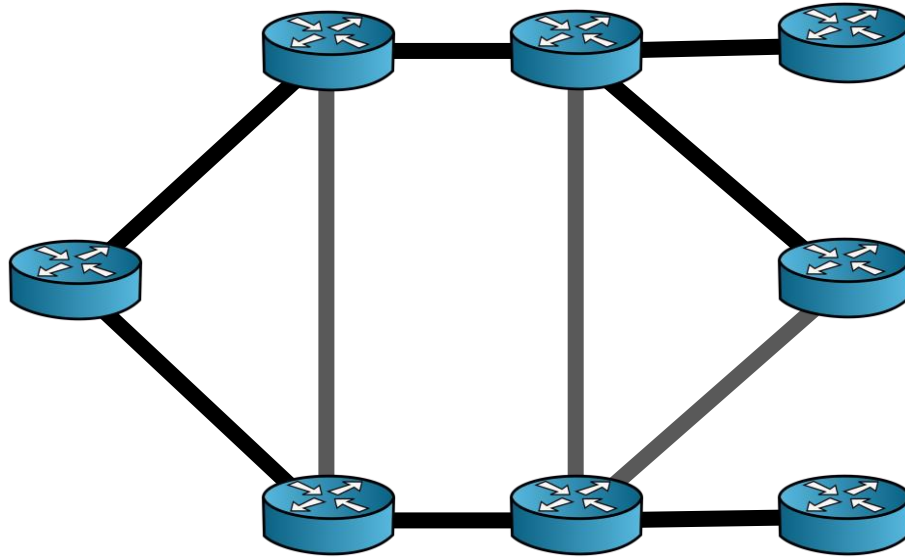# Where the heck is the edge?

PANOPTICON

SDN ARCHITECTURE
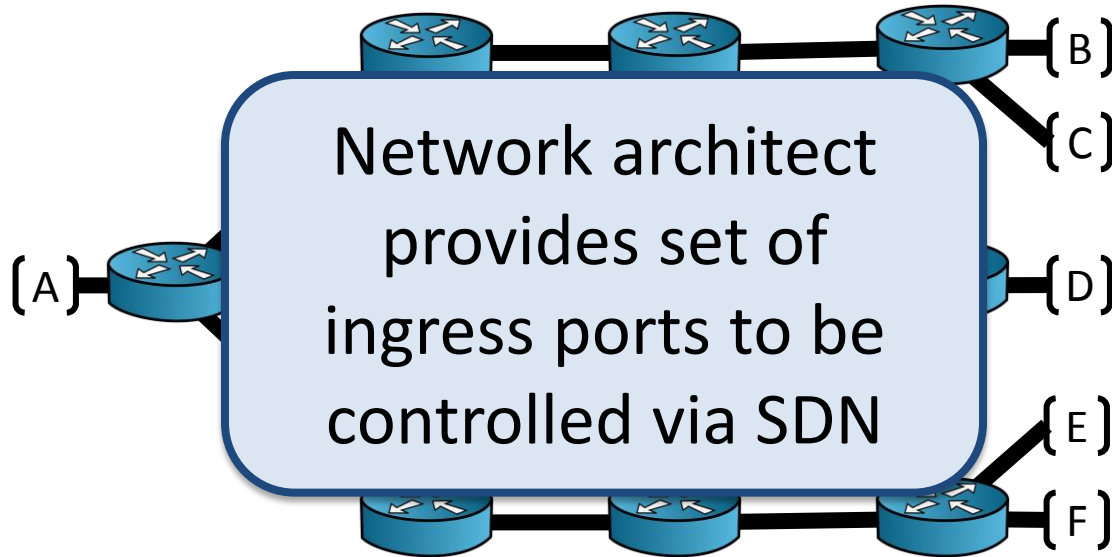Operate the network as a (nearly) full SDN
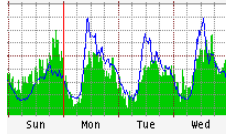
TOOL
Determine the partial SDN deployment

The Existing Network

1. Planning the SDN Deployment

Network architect provides set of ingress ports to be controlled via SDN

Network topology
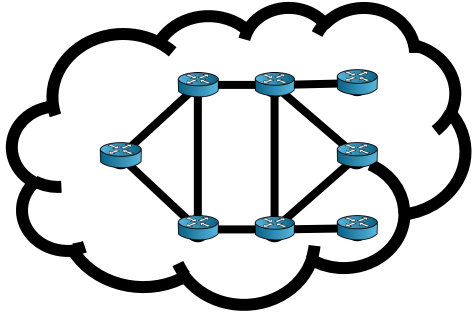
Traffic estimates

Objectives
- Upgrade budget
- Path delay

TOOL

Cost-aware optimizer

Optimized partial SDN deployment

Tunable parameters
- Port priorities
- Price model
- Utilization thresholds
(link utilization, VLANs, etc.)

The Partial SDN Deployment ()
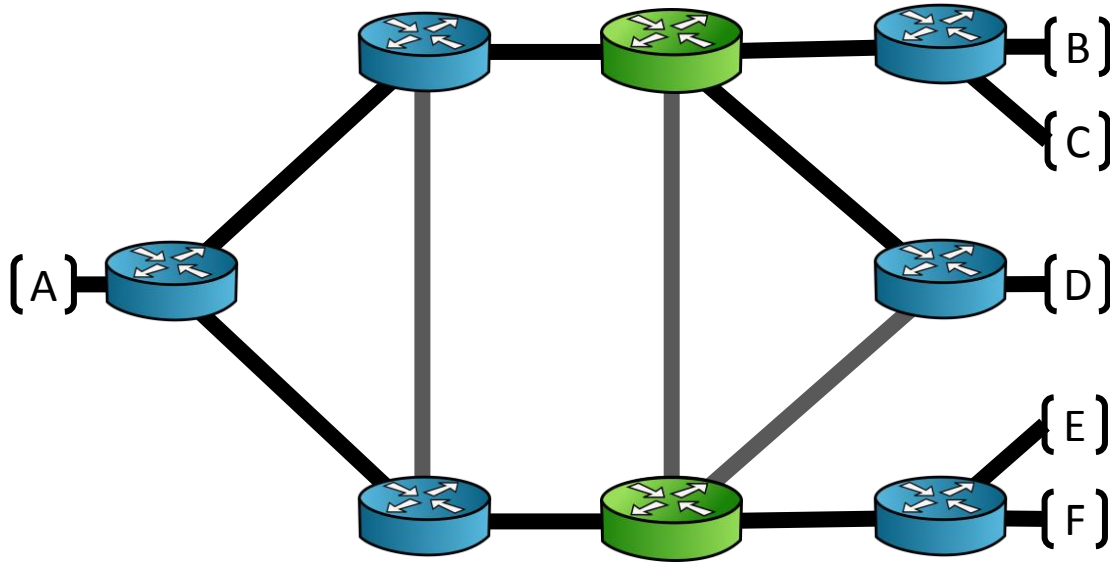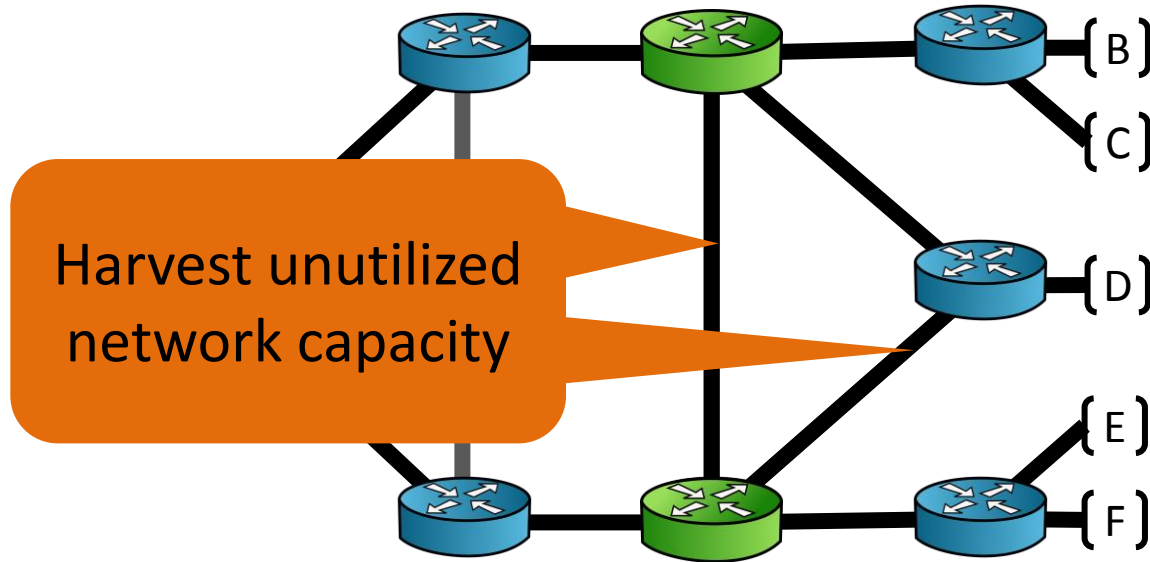
Benefits of Partial SDN Deployment?

Harvest unutilized network capacity
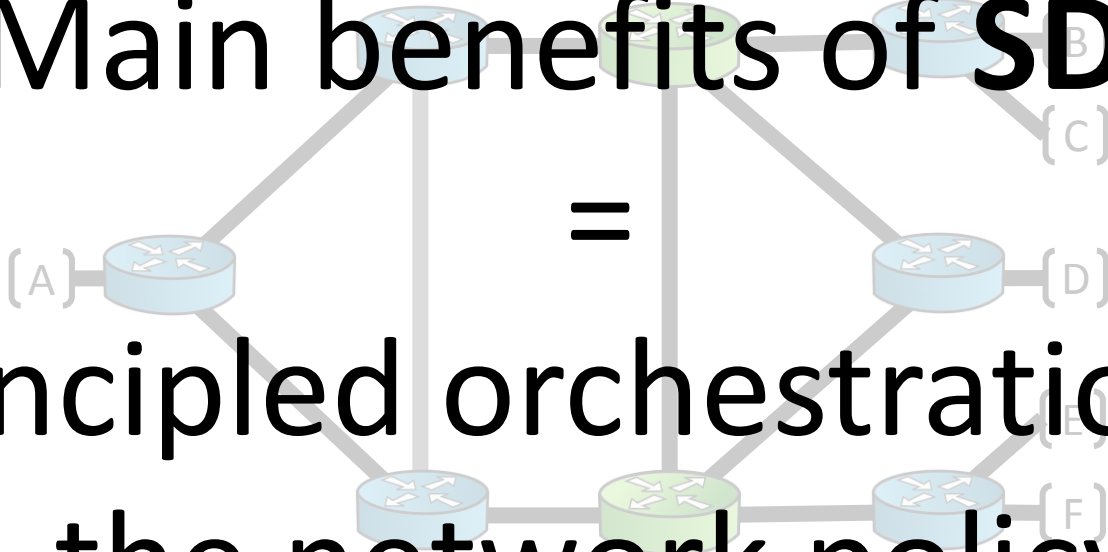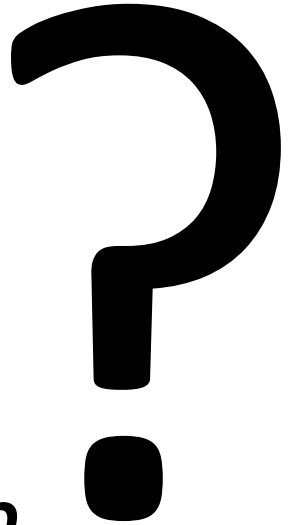
Main benefits of **SDN**
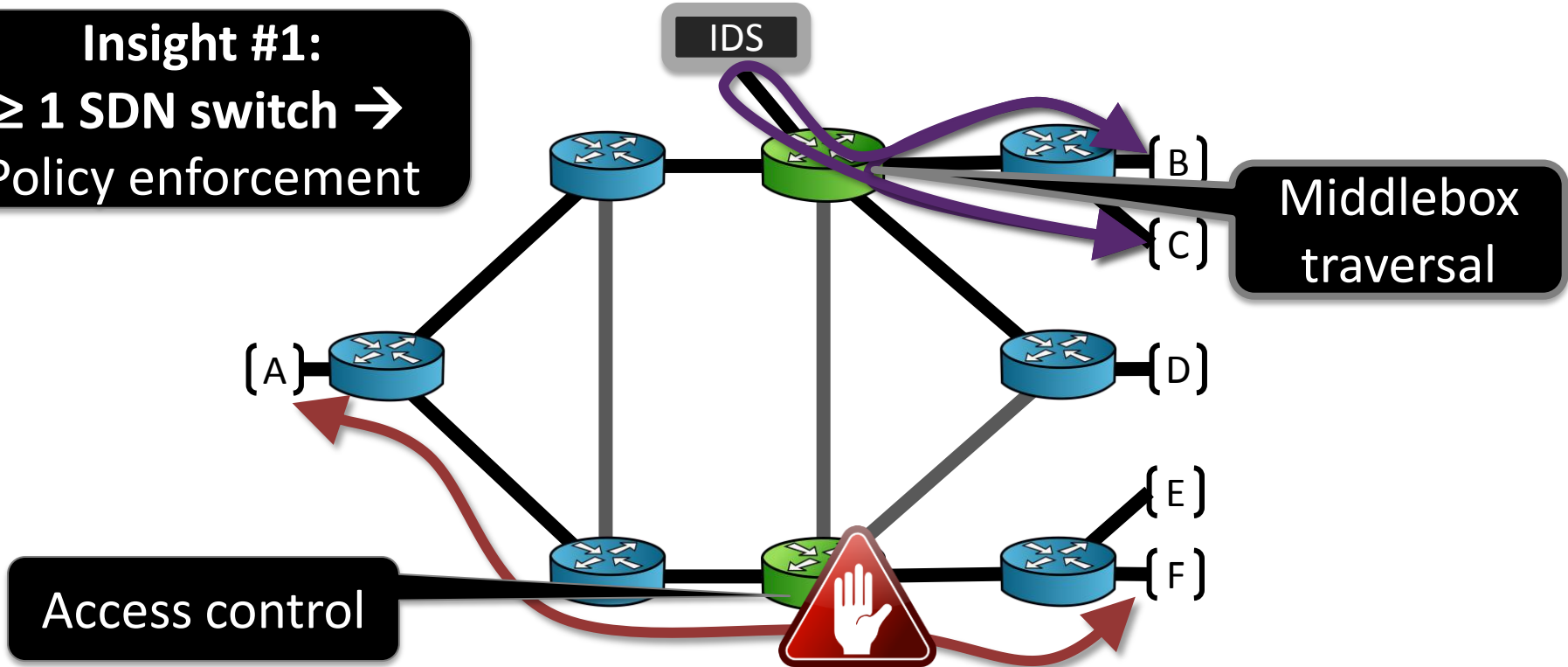
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Principled orchestration of the network policy

Can partial SDN deployment still take advantage of *principled network orchestration*?
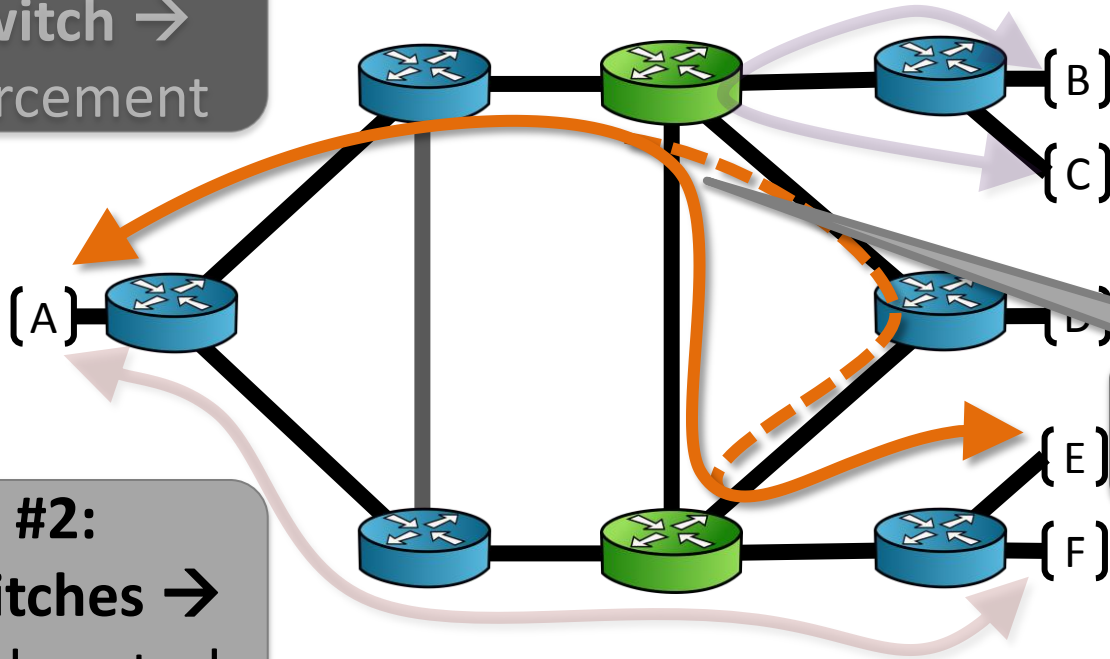
2. Realizing the Benefits of SDN

Insight #1:
≥ 1 SDN switch →
Policy enforcement

IDS

{B}

{C}

Middlebox traversal

{A}

{D}

{E}

{F}

Access control

2. Realizing the Benefits of SDN

Insight #1:
≥ 1 SDN switch →
Policy enforcement

Insight #2:
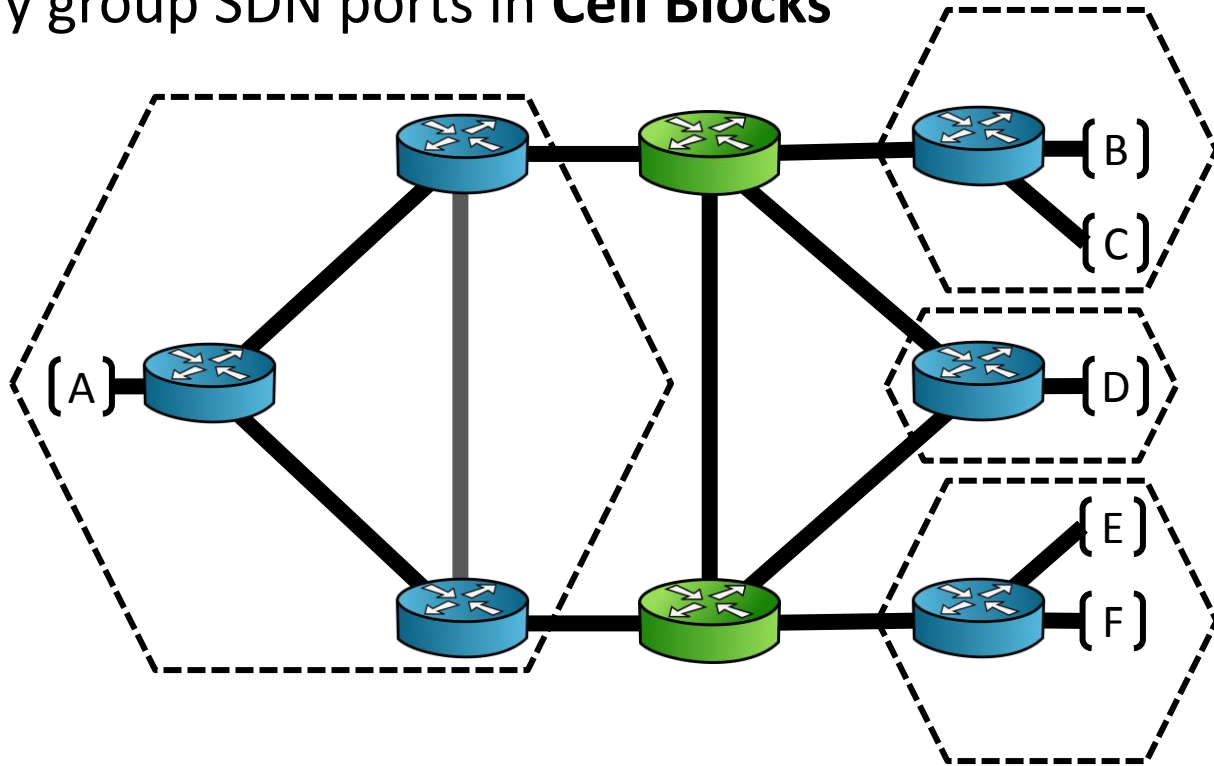≥ 2 SDN switches →
Fine-grained control

Traffic
load-balancing

Ensure that all traffic to/from
an SDN-controlled port always
traverses at least one SDN switch

SDN Waypoint Enforcement
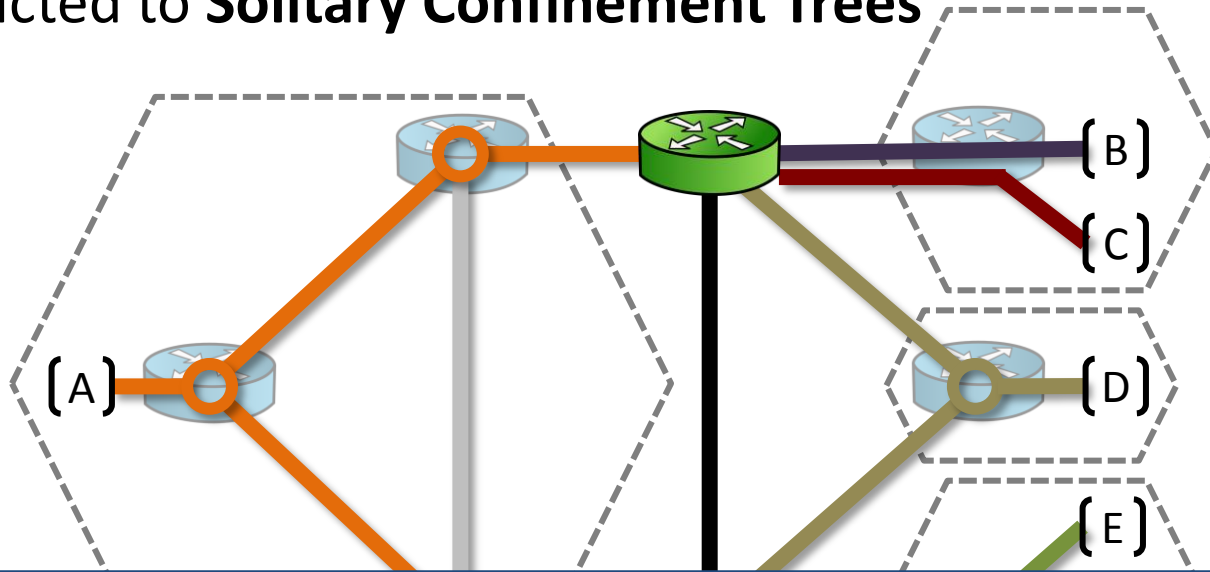
Legacy devices must direct traffic to SDN switches

The PANOPTICON SDN Architecture

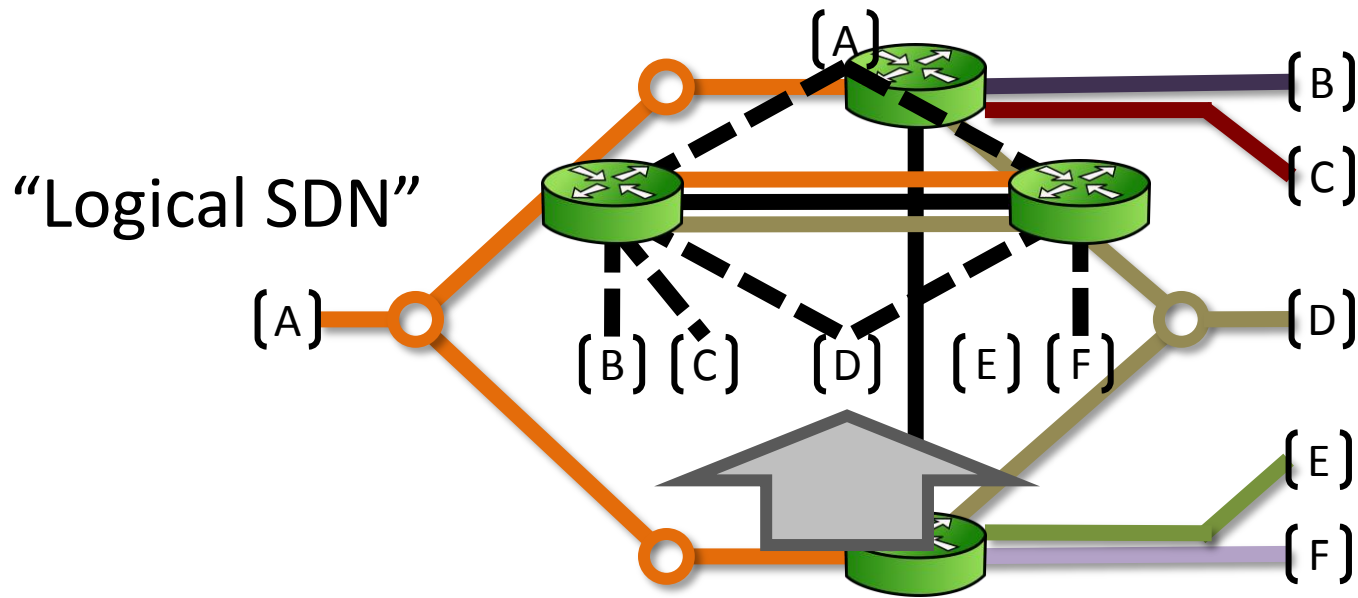Conceptually group SDN ports in **Cell Blocks**
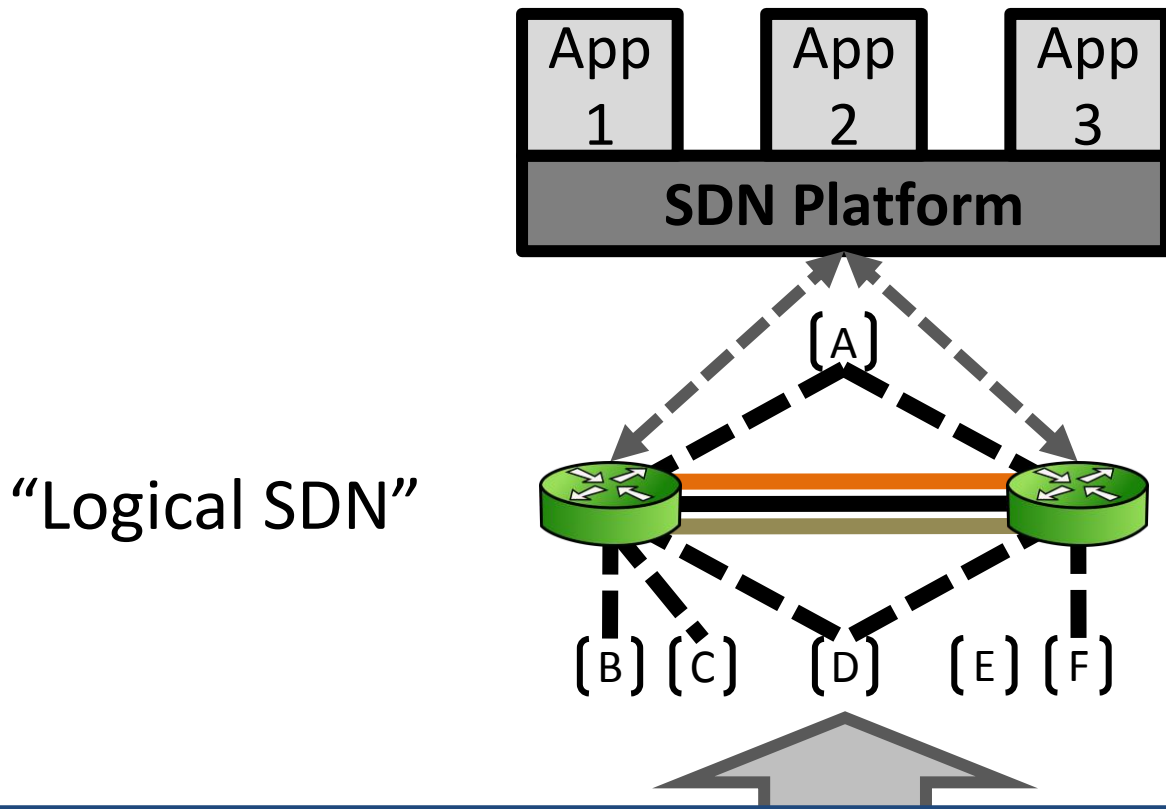
The **PANOPTICON** SDN Architecture

Traffic restricted to **Solitary Confinement Trees**

Per-port spanning trees that ensure waypoint enforcement

PANOPTICON

"Logical SDN"

App 1 · App 2 · App 3

SDN Platform

(A)

"Logical SDN"

(B) (C) (D) (E) (F)

PANOPTICON provides the abstraction of a (nearly) fully-deployed SDN in a partially upgraded network

Results Highlights

- Evaluated a large campus network (1713 switches)
- Upgrade **6%** of distribution switches →
  - 100% SDN-controlled ingress ports
  - avg. path stretch < 50%
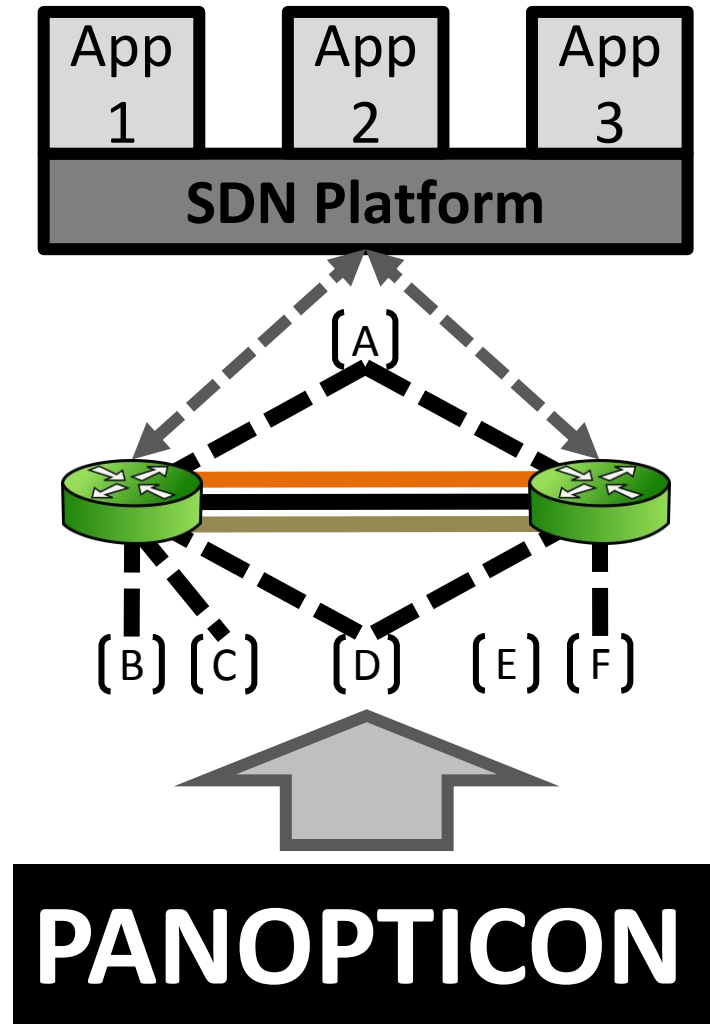 - max. link util. < 70%

Summary

SDN ARCHITECTURE
Operate the network as a (nearly) full SDN

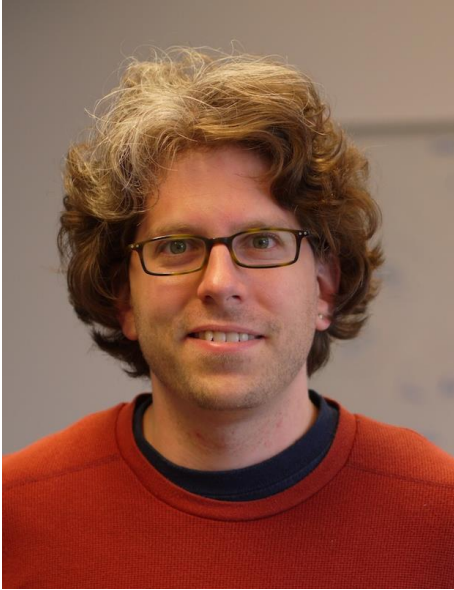**TOOL**
Determine the partial SDN deployment
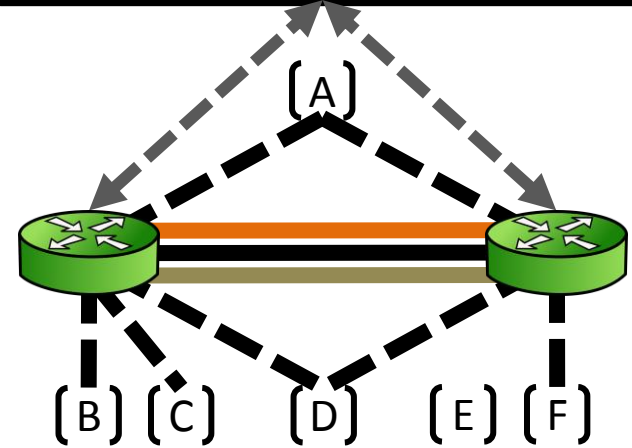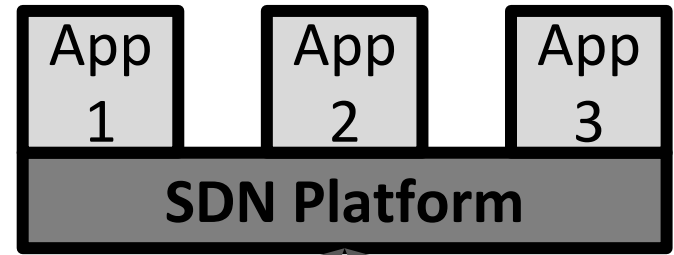
The Collaborators

Dan Levin

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Thank you! Questions?

Come and see us!