

Toward Transitional SDN Deployment in Enterprise Networks

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with

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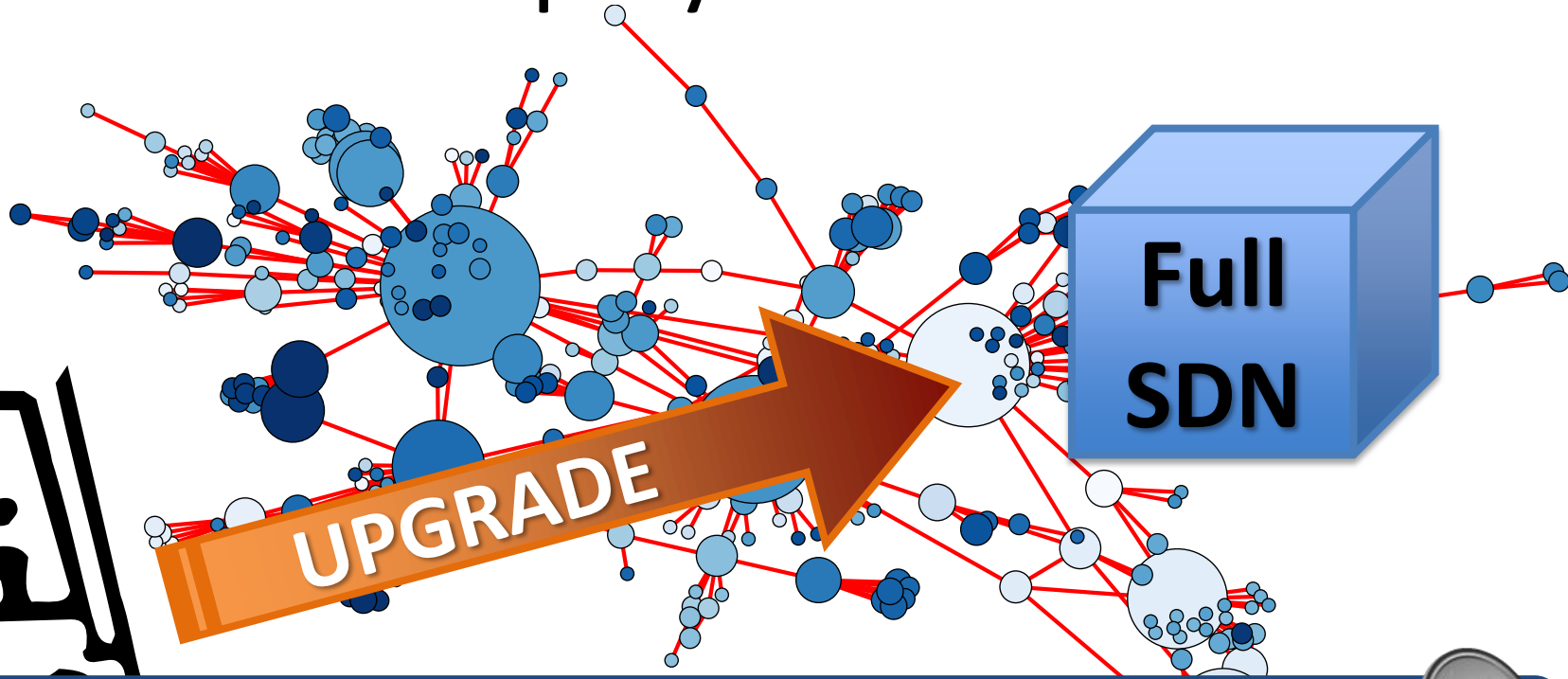
Motivation

I ♥ SDN

GOAL: Help SDN succeed!



The SDN Deployment Problem



Must upgrade to SDN incrementally

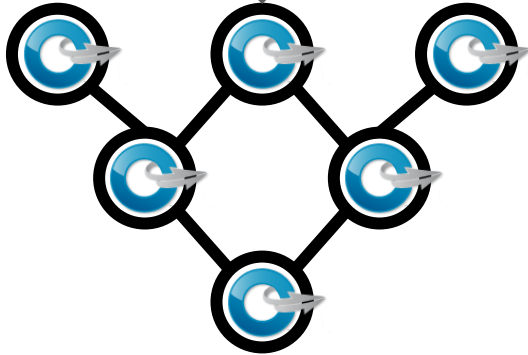
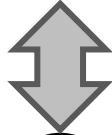
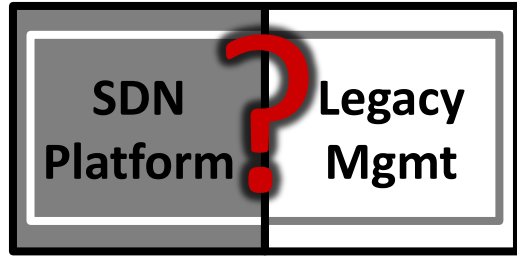


Key Questions

- How can we **incrementally deploy SDN** into enterprise campus networks?
- Can we reap the **benefits of SDN** with partial deployment?



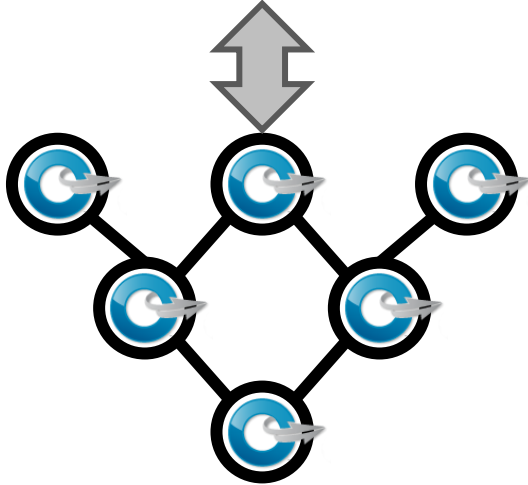
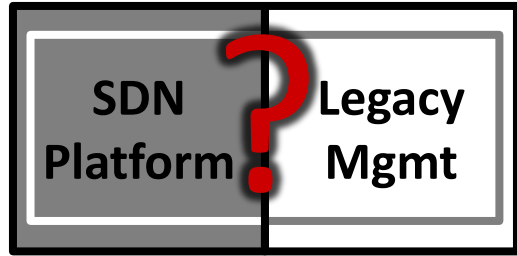
Current Transitional Networks



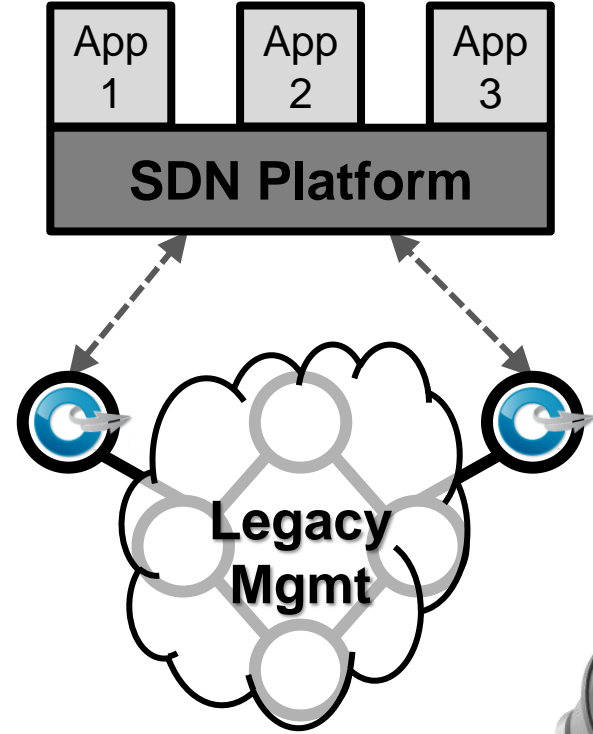
Dual-stack approach



Current Transitional Networks

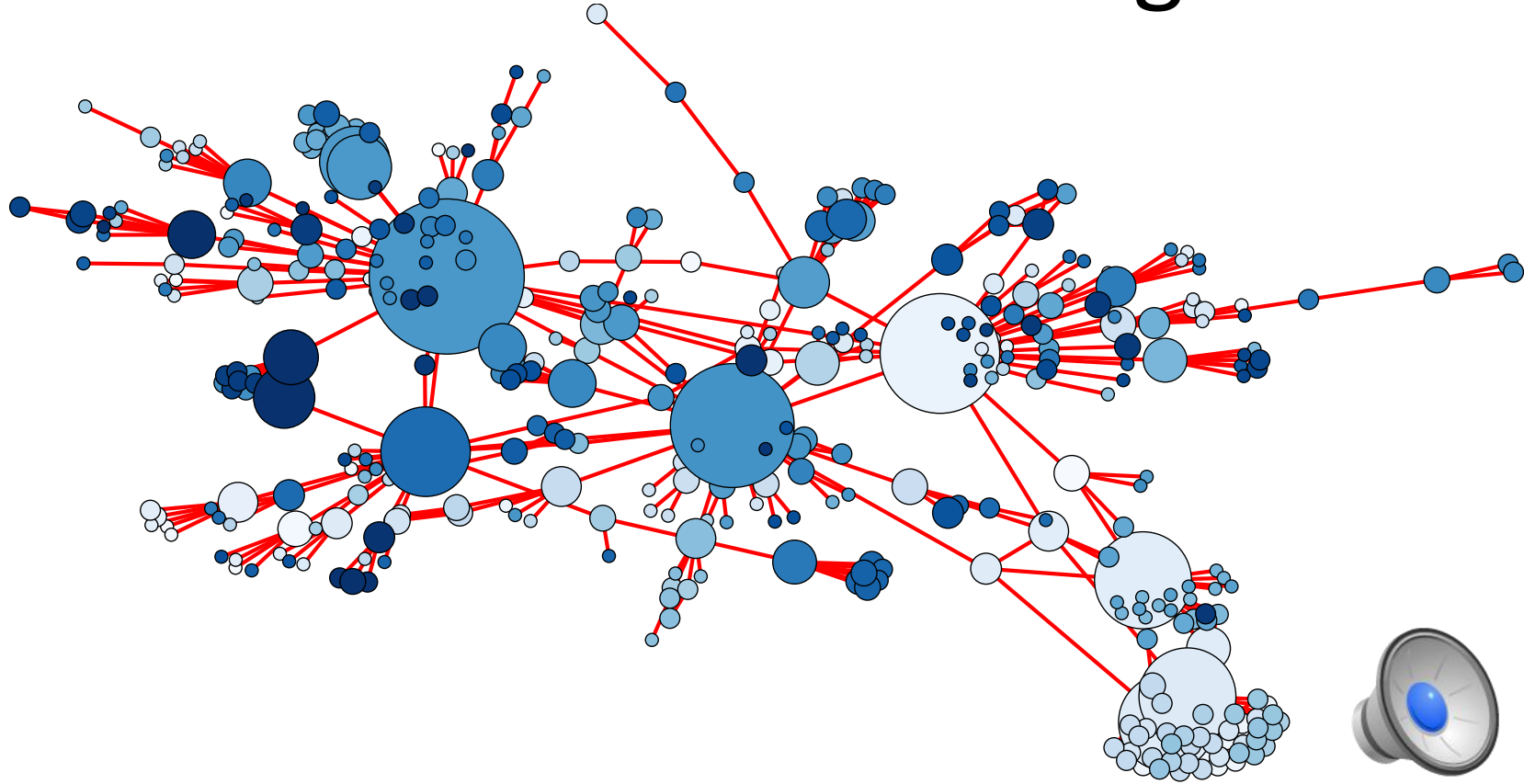


Dual-stack approach



Edge-only approach

Where the heck is the edge?



PANOPTICON

SDN ARCHITECTURE

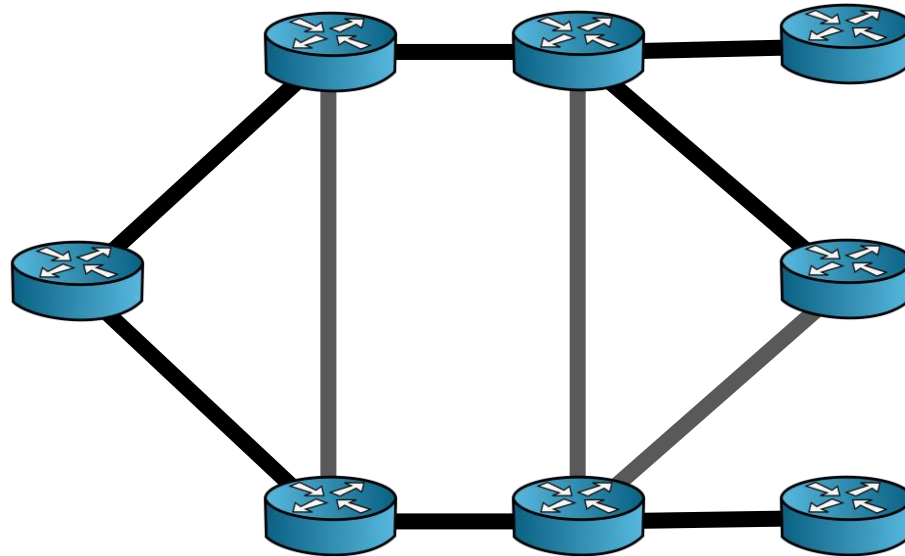
Operate the network as
a (nearly) full SDN

TOOL

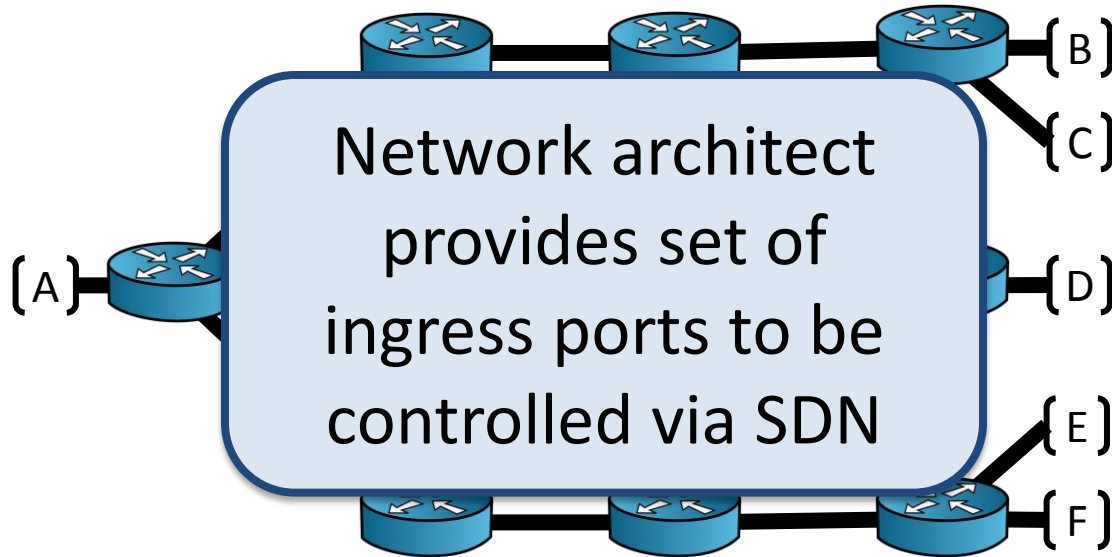
Determine the partial
SDN deployment



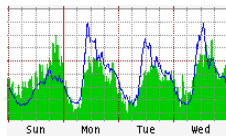
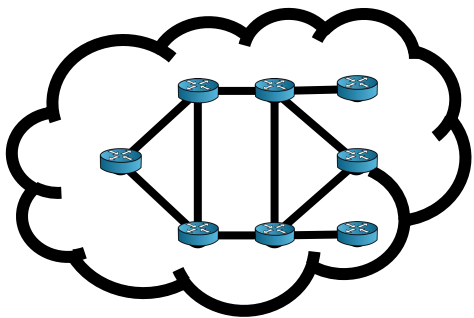
The Existing Network



1. Planning the SDN Deployment



Network topology



Traffic estimates



Objectives

- Upgrade budget
- Path delay

Cost-aware optimizer

TOOL

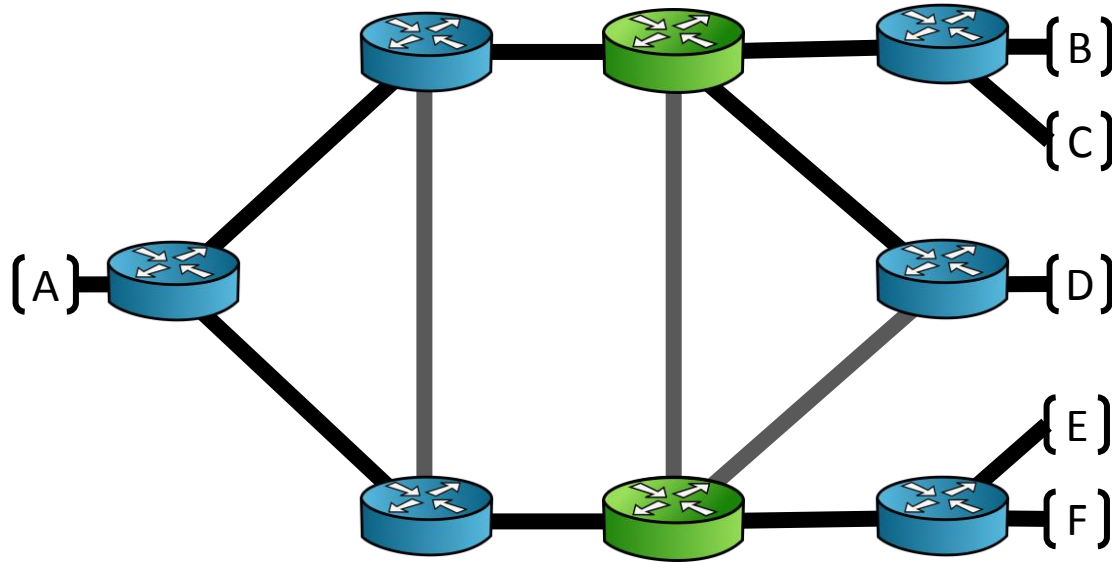
Optimized partial SDN deployment

Tunable parameters

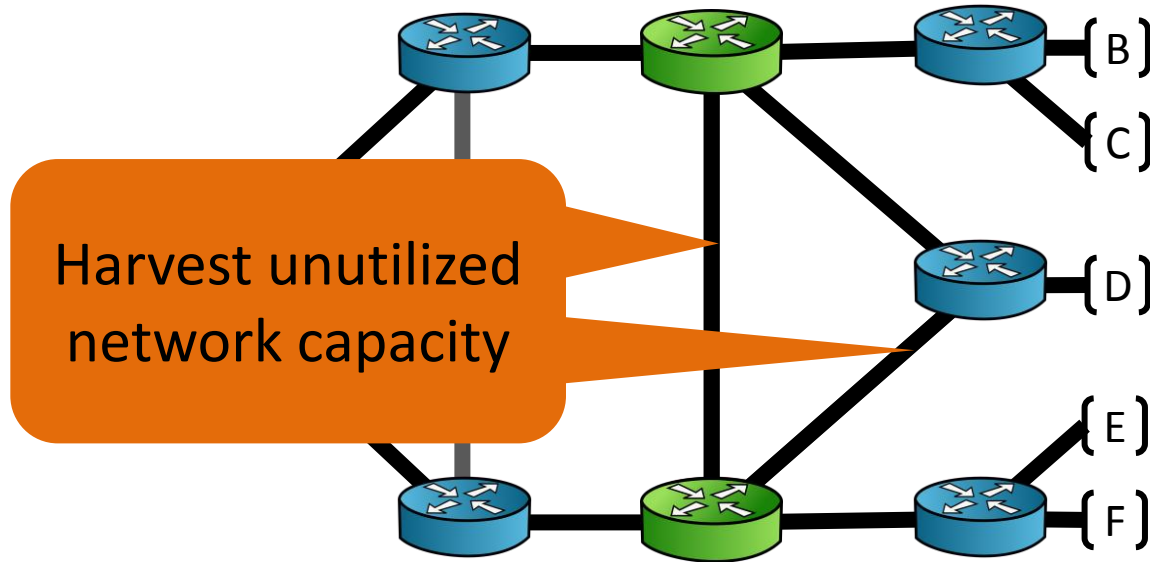
- Port priorities
- Price model
- Utilization thresholds
(link utilization, VLANs, etc.)



The Partial SDN Deployment ()



Benefits of Partial SDN Deployment?



Main benefits of **SDN**

=

Principled orchestration of
the network policy

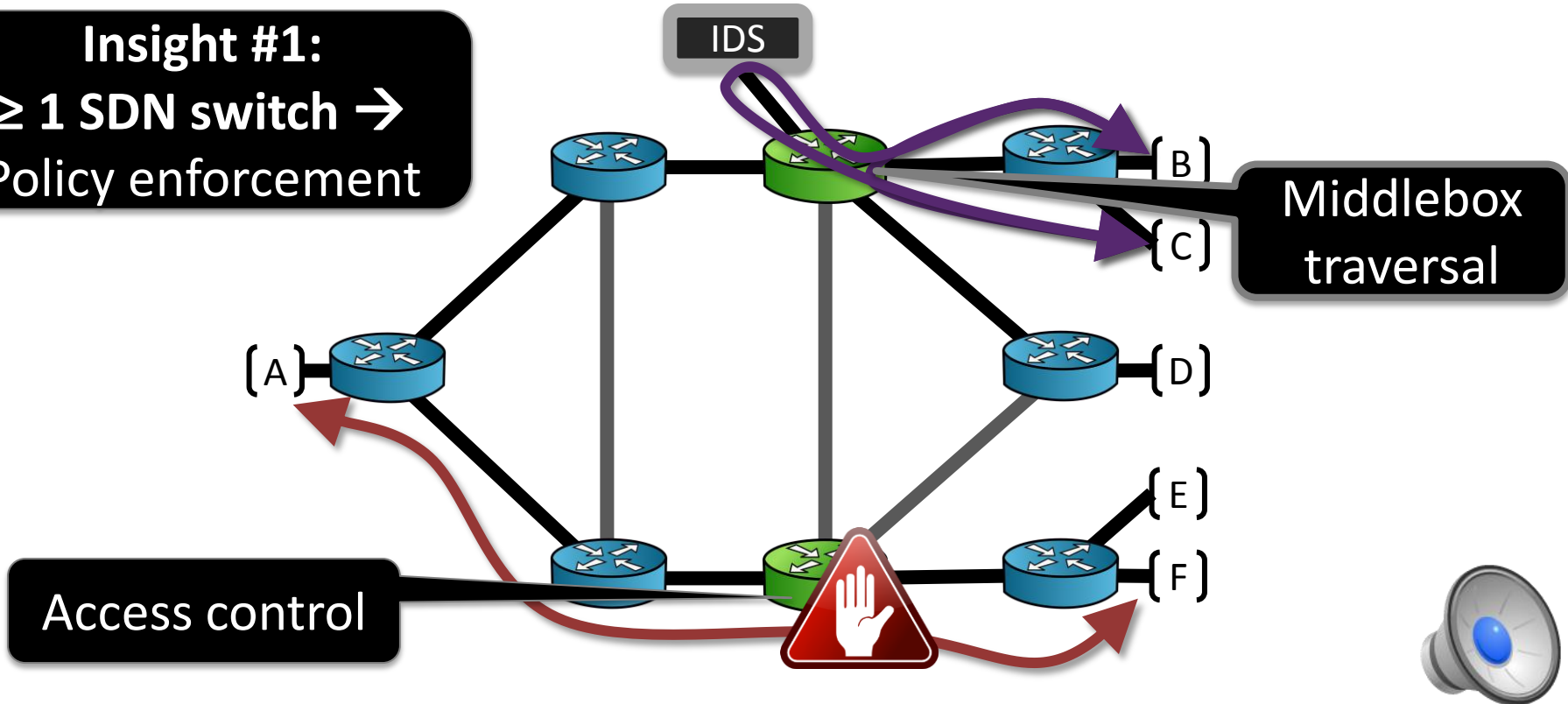


Can partial SDN deployment
still take advantage of
the principled orchestration of
the network policy



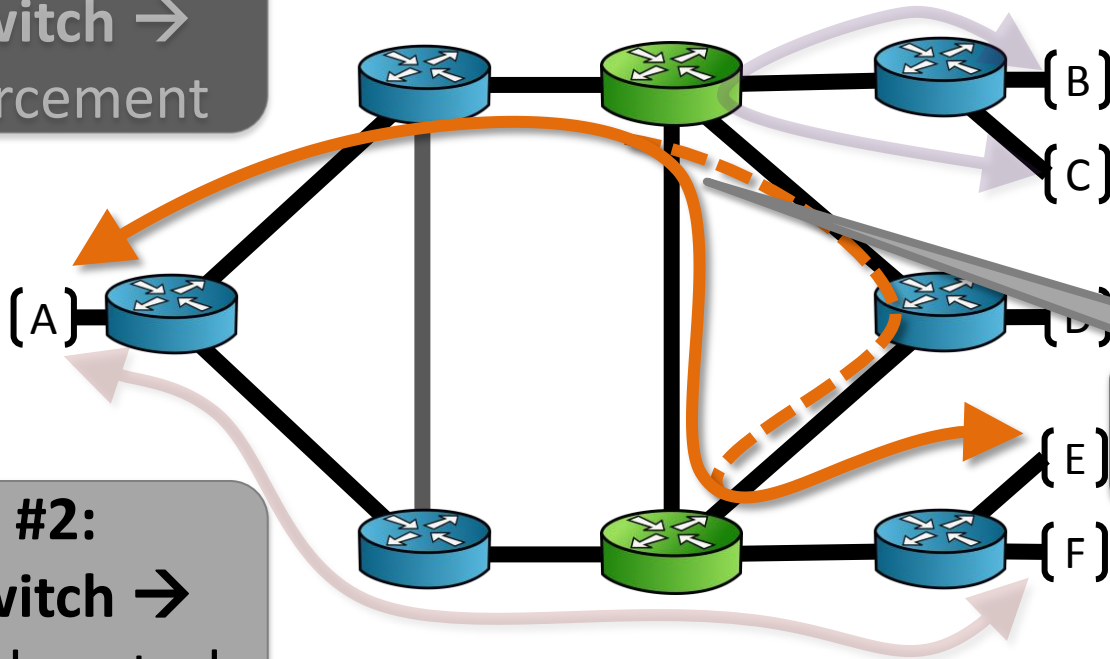
2. Realizing the Benefits of SDN

Insight #1:
 ≥ 1 SDN switch \rightarrow
Policy enforcement



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Insight #2:
 ≥ 2 SDN switch \rightarrow
Fine-grained control



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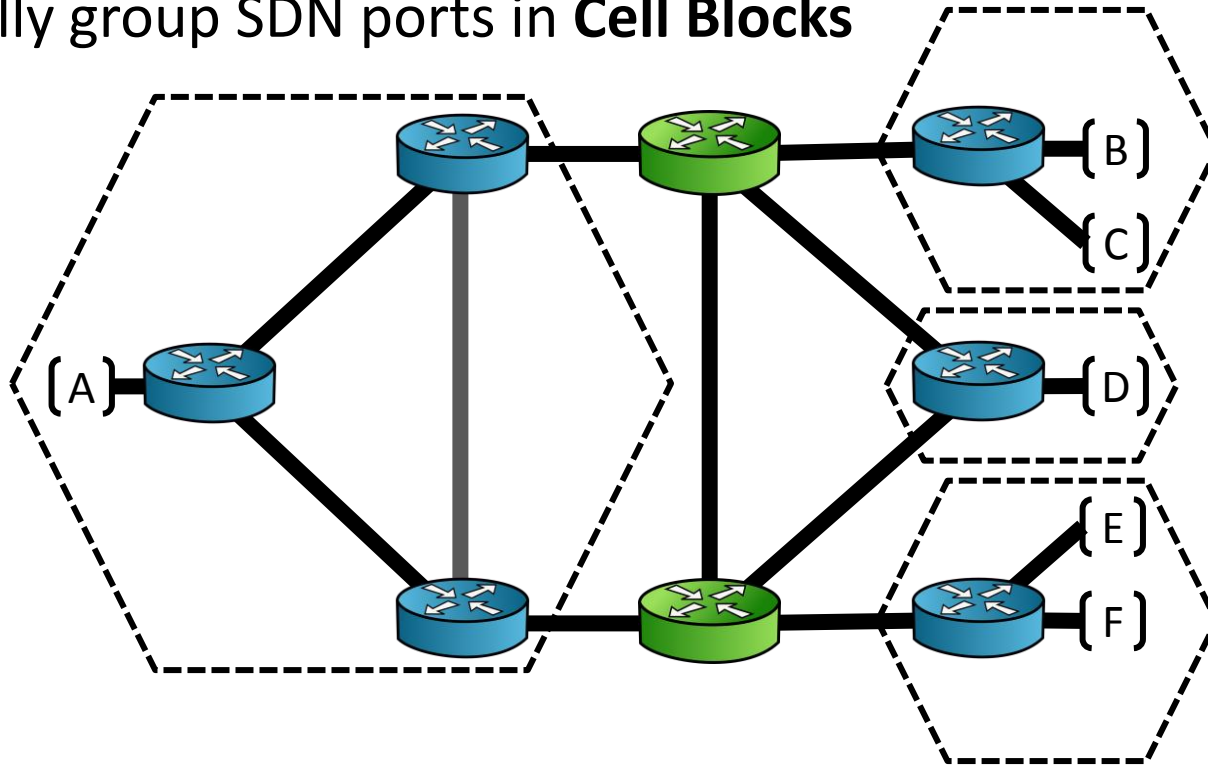
Ensure that all traffic to/from
an SDN-controlled port always
traverses at least one SDN switch
SDN Waypoint Enforcement

Must isolate traffic across legacy device



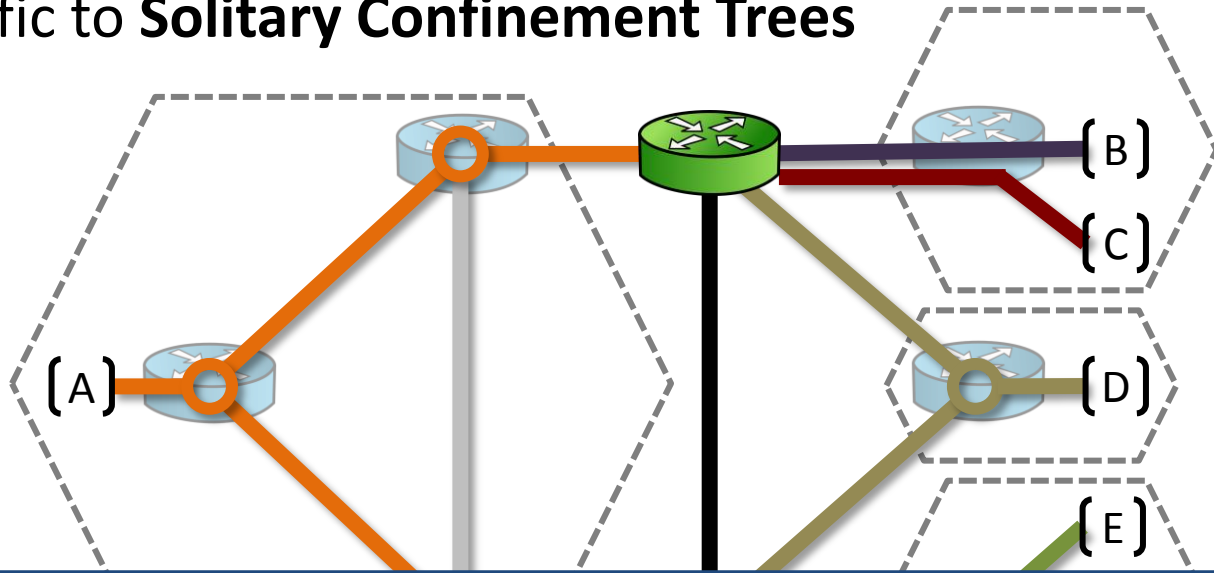
The **PANOPTICON** SDN Architecture

Conceptually group SDN ports in **Cell Blocks**



The **PANOPTICON** SDN Architecture

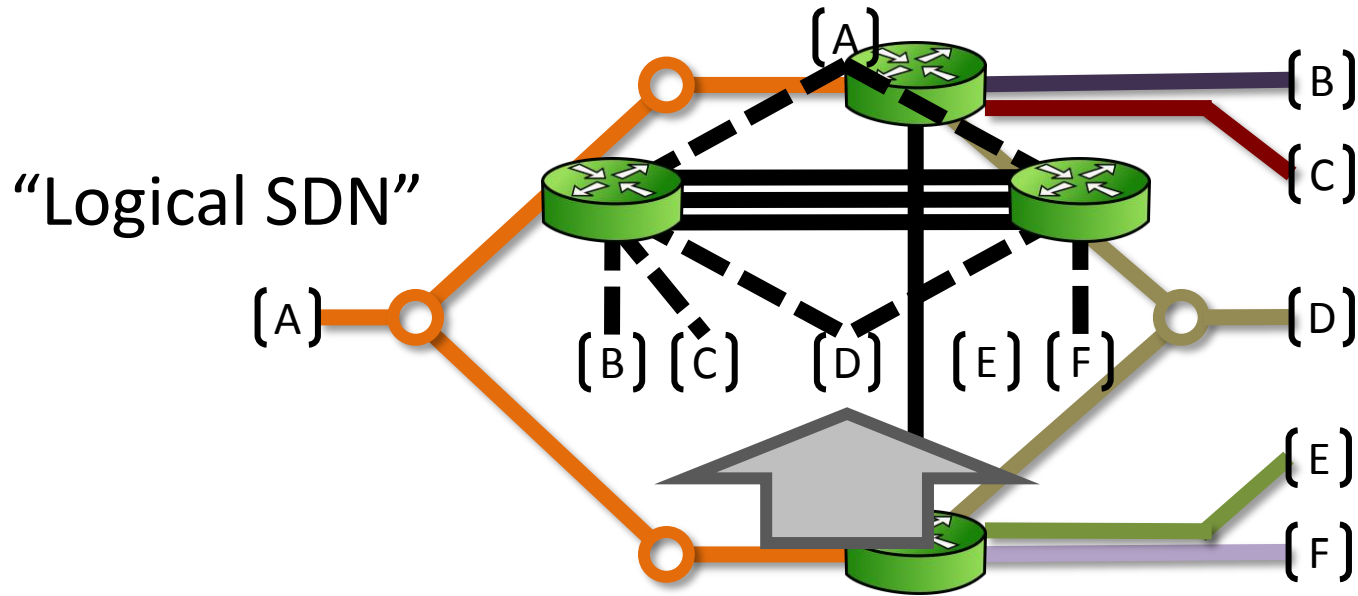
Isolate traffic to **Solitary Confinement Trees**

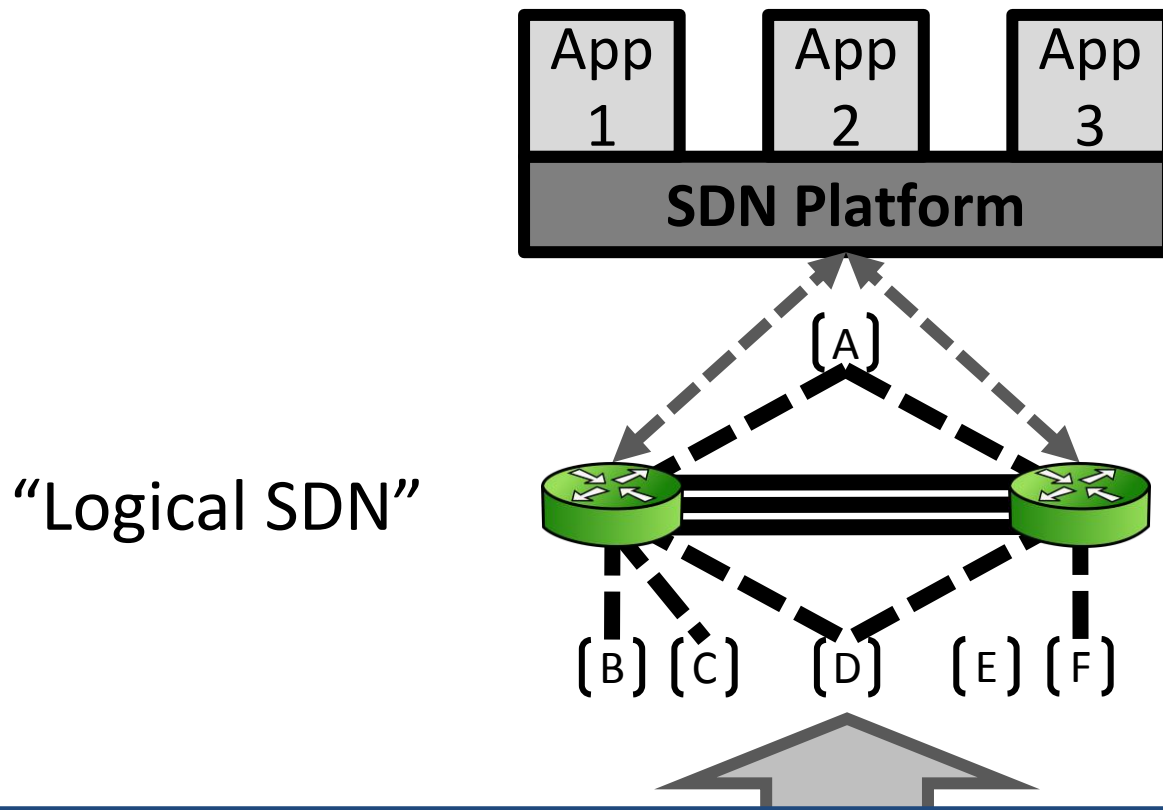


Per-port spanning trees ensure waypoint enforcement while providing traffic isolation.



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PANOPTICON provides the abstraction of a fully-deployed SDN in a partially upgraded network.



Results Highlights

- Evaluated a large campus network (1713 switches)
- **5 SDN distribution switches (1.2%) →**
 - **SDN-controlled > 80%** of network end-points



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- Evaluated a large campus network (1713 switches)
- **5 SDN distribution switches (1.2%) →**
 - **SDN-controlled > 80%** of network end-points
- 6% of upgraded distribution switches →
 - 100% SDN-controlled
 - avg. path stretch < 50%
 - max. link util. < 70%



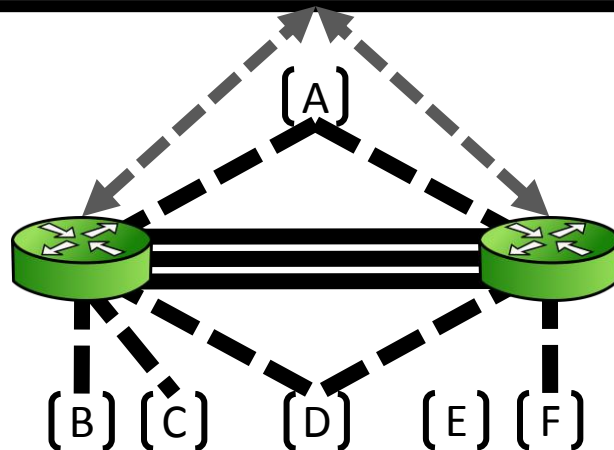
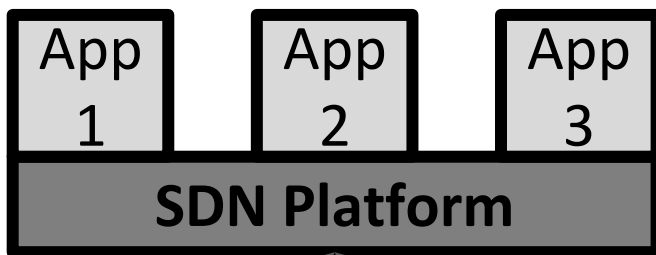
Summary

SDN ARCHITECTURE

Operate the network as
a (nearly) full SDN

TOOL

Determine the partial
SDN deployment



PANOPTICO



The Collaborators



Dan Levin



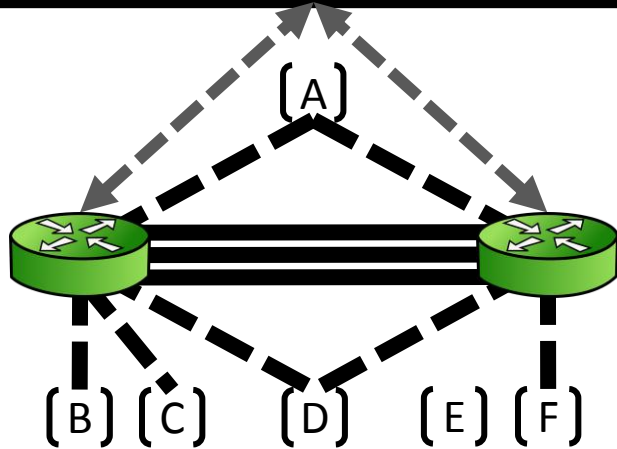
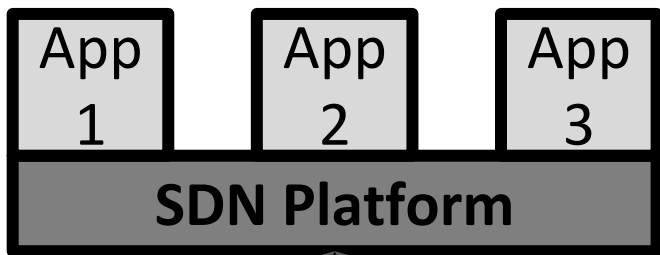
Stefan Schmid



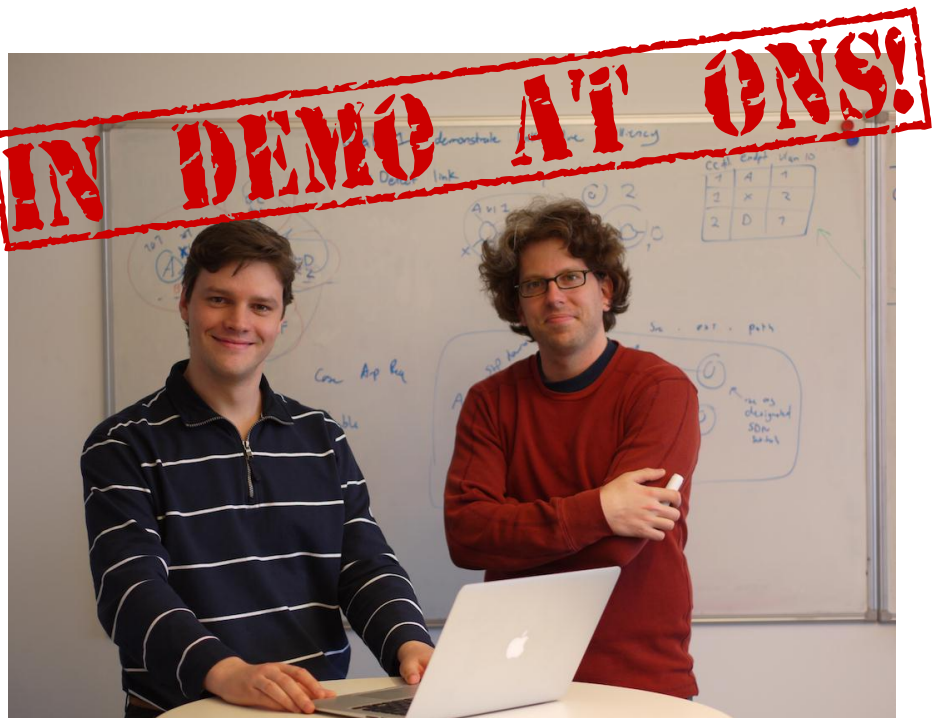
Anja Feldman



Thank you! Questions?



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PANOPTICON

Demo at ONS. Come and see us!

- Rigorously planned partial SDN deployment
 - Cost-aware optimization framework that plans for operational objectives
- [IN DEMO AT ONS!]**
- SDN architecture for operating transitional networks
 - Exposes the abstraction (and the benefits) of a nearly fully-deployed SDN