

ALTO and Software Defined Networking (SDN)

draft-xie-alto-sdn-extension-use-cases

Haiyong Xie
Tina Tsou
Diego Lopez
Hongtao Yin
Vijay Gurbani

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Background

- SDN is based on
 - A radical separation of control and data planes
 - Open interfaces between the elements implementing them
- SDN allows higher flexibility in managing the network
 - Override L2/L3 protocols if necessary
 - Additional input to the control plane
- SDN has started to be deployed in many networks
 - Production datacenters (including WAN interconnection)
 - Mature trials in carriers
- SDN deployment could include
 - Infrastructure comprised of SDN domains
 - End-to-end applications aware/unaware of SDN
 - Application modules residing inside SDN controllers

SDN Partitioning

- SDN partitioning is inevitable
 - A large network is likely to be divided into multiple SDN domains
 - Each SDN domain has its own controller, managing the SDN-compatible devices in the domain
- Reasons for SDN partitioning
 - Scalability
 - The number of devices a controller can manage is limited
 - Manageability
 - Privacy
 - Some sub-networks (e.g., data center networks) are dedicated to certain customers, special privacy policies may be necessary for such sub-networks
 - Deployment
 - Incremental deployment (i.e., only a part of a large network is SDN compatible) is desirable and sometimes necessary
- Partitioning is already a common practice
 - FlowVisor-enabled slices

Benefits & Challenges

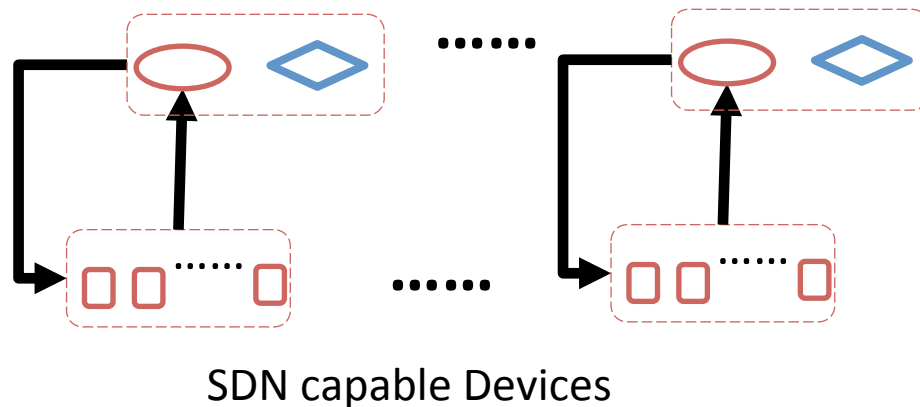
- Benefits
 - SDN controllers could become the main source of network information for ALTO
- Challenges
 - Architecture for co-existing ALTO & SDN should be carefully designed
 - Interactions between ALTO & SDN are complex
 - SDN domain-specific privacy policies should be accommodated by ALTO

ALTO-SDN Architectures

The Horizontal Architecture

○ SDN Controller

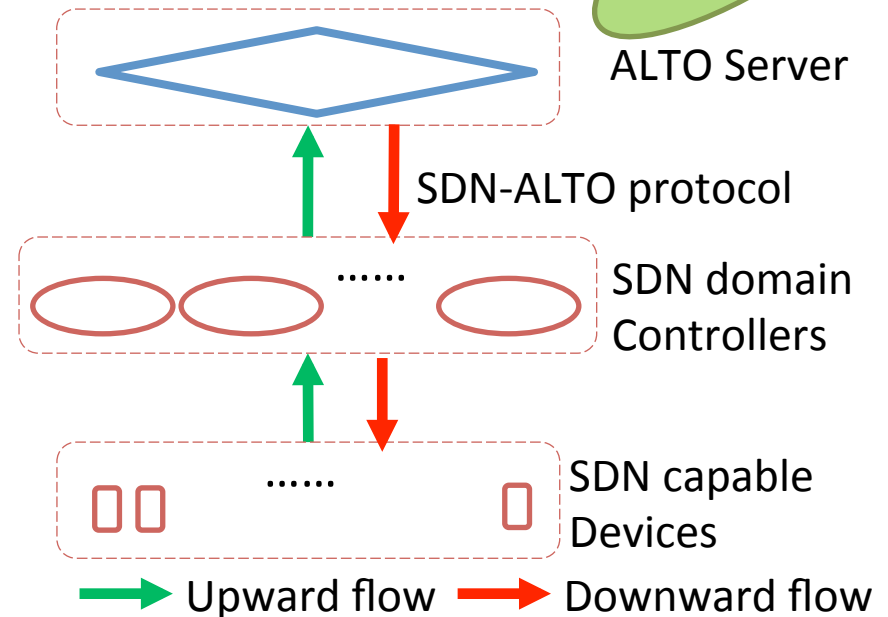
◇ ALTO Server



- Not well suited for partitioned environments
 - ALTO lacks support for communications among ALTO servers
 - Redundant & Inefficient
 - Possible violation of Privacy
 - Information obtained by ALTO directly is likely outdated due to its scale and granularity
 - ALTO decisions are local, while applications and network management typically require global ALTO decisions

The Vertical Architecture

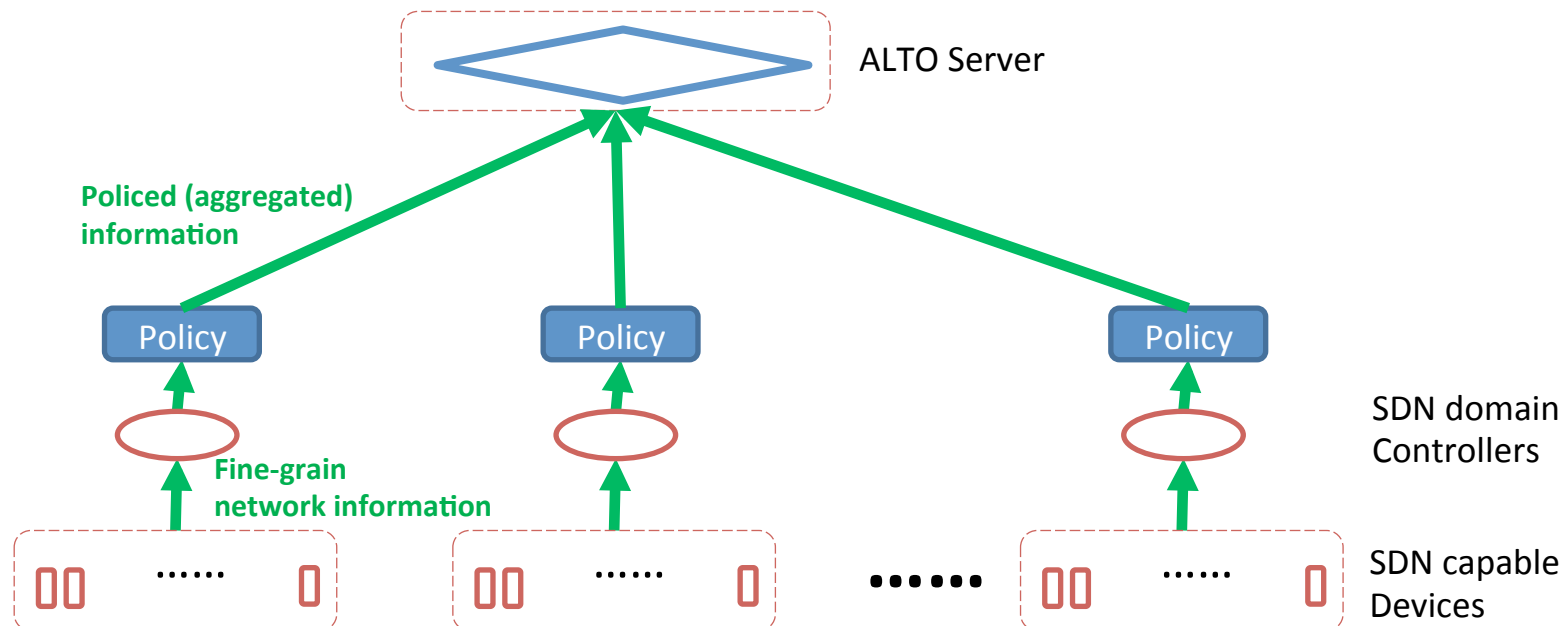
Preferred



- Better suited for partitioned environments
 - Efficient & scalable
 - Preserve domain-specific privacy
 - Allow incremental deployment
 - Allow independent evolution
 - Success of ALTO (SDN) does not depend on SDN (ALTO)
 - ALTO: coarse-grain information, SDN controller: fine-grain information

The Upward Flow

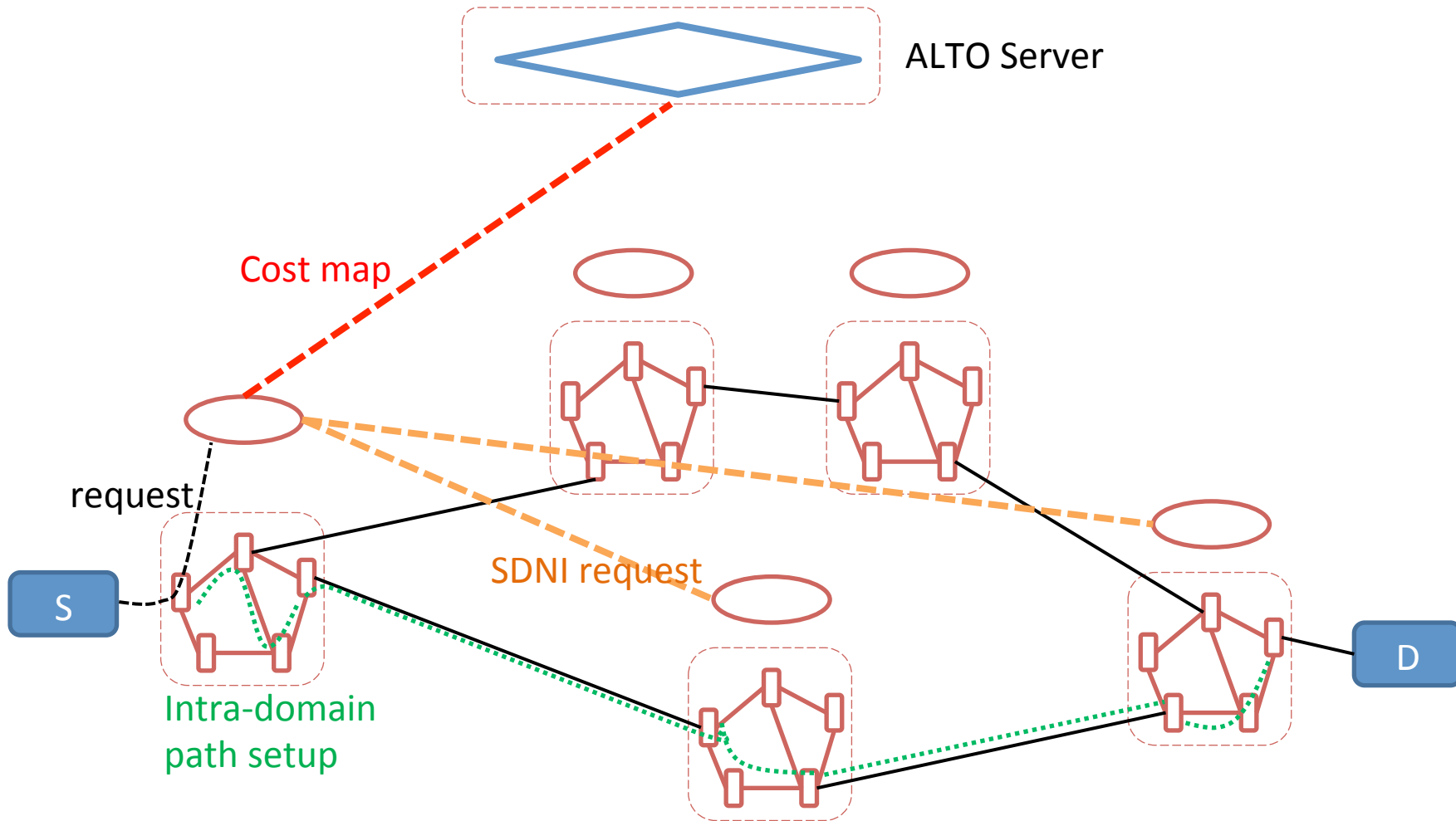
- SDN controllers export network information to ALTO server
 - Information exporting is subject to domain-specific policies, e.g., privacy policy, aggregation/filtering policy
- ALTO server build cost maps based on such information
 - Inter-domain & intra-domain cost maps
- Outside current specifications
 - But we believe it should be considered in extensions



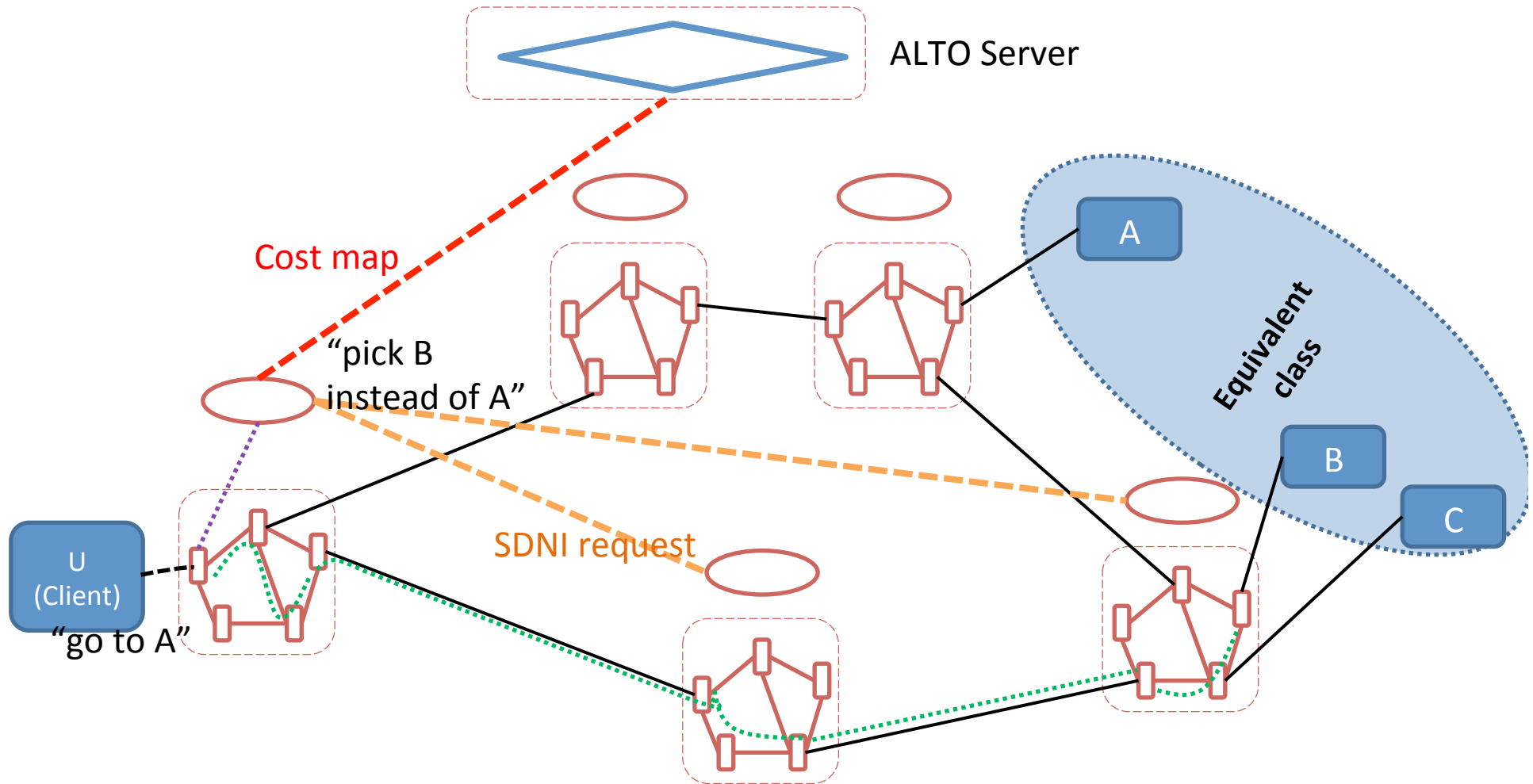
The Downward Flow

- SDN controllers use ALTO maps as a key source to take their decisions
 - Under application requests
 - Coordinated with controllers in other domains
- Require extensions to the current protocol
 - Data
 - Session control
 - Security
- Use cases
 - On-demand bandwidth
 - CDN
 - Classical CDN
 - Information-Centric CDN (*refer to the draft*)

Use Case: On-Demand Bandwidth



Use Case: CDN



Summary

- SDN introduces new benefits as well as challenges to ALTO
 - Domain-specific policy
 - Granularity and scale of information collection and share
 - Delegation of domain-specific decision making and execution
- ALTO must co-exist with multiple SDN domains
 - Coordination and joint optimization become more challenging
- ALTO-SDN architecture should be carefully designed in order to avoid overhauling at later times
 - Vertical architecture is better suited to multi-domain than the horizontal one
 - ALTO-SDN interactions must include upward and downward information flow
- Several interesting use cases in sight
 - Connected with already proposed challenges

PoC demonstration during the Bits-and-Bites on Thursday