



# DYNAMIC VPN OPTIMIZATION BY ALTO GUIDANCE

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Oct. 10, 2013 - Second European Workshop on Software Defined Networks (EWSDN)

..... Alcatel-Lucent



# AGENDA

## VIRTUAL PRIVATE NETWORKS

### ALTO VPN SERVICE

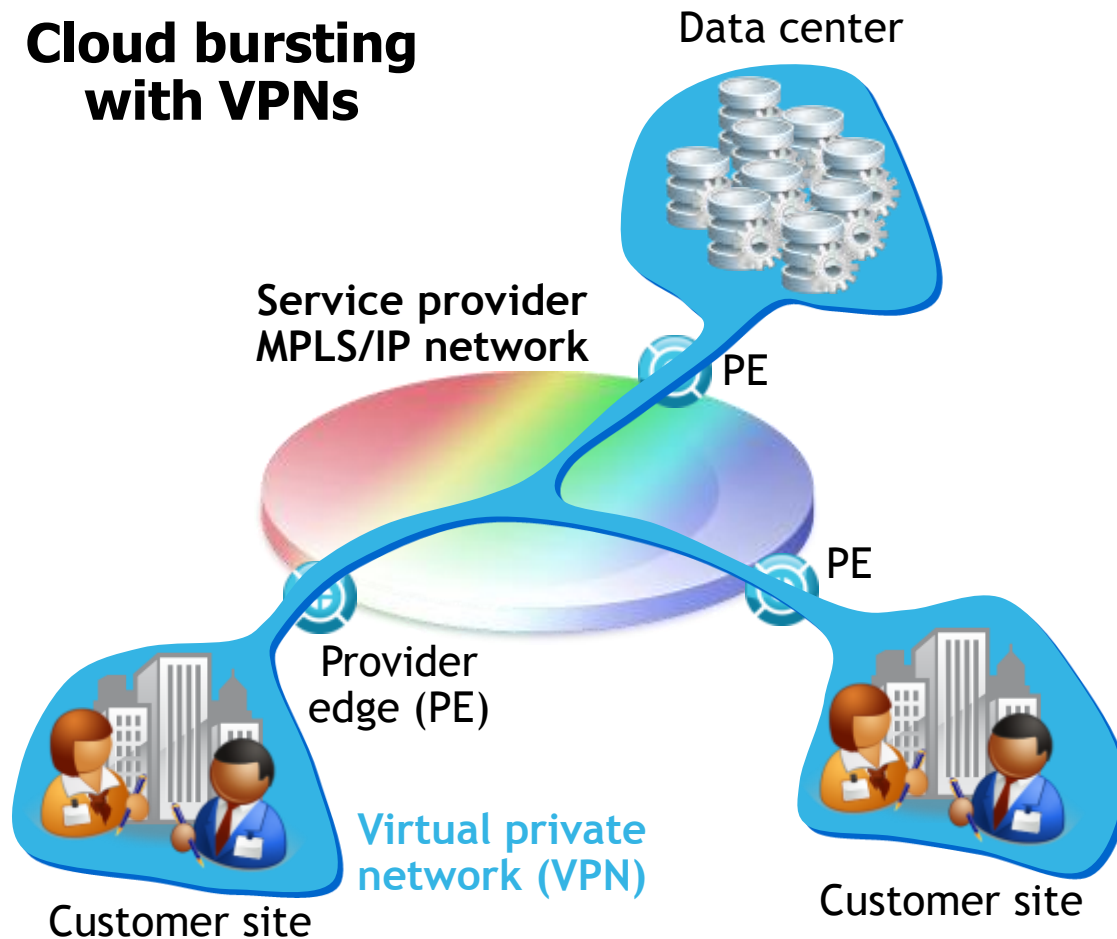
### PROTOTYPE

### CONCLUSIONS AND OUTLOOK

# VIRTUAL PRIVATE NETWORKS

## PROVIDER PROVISIONED VPNS

### Cloud bursting with VPNs

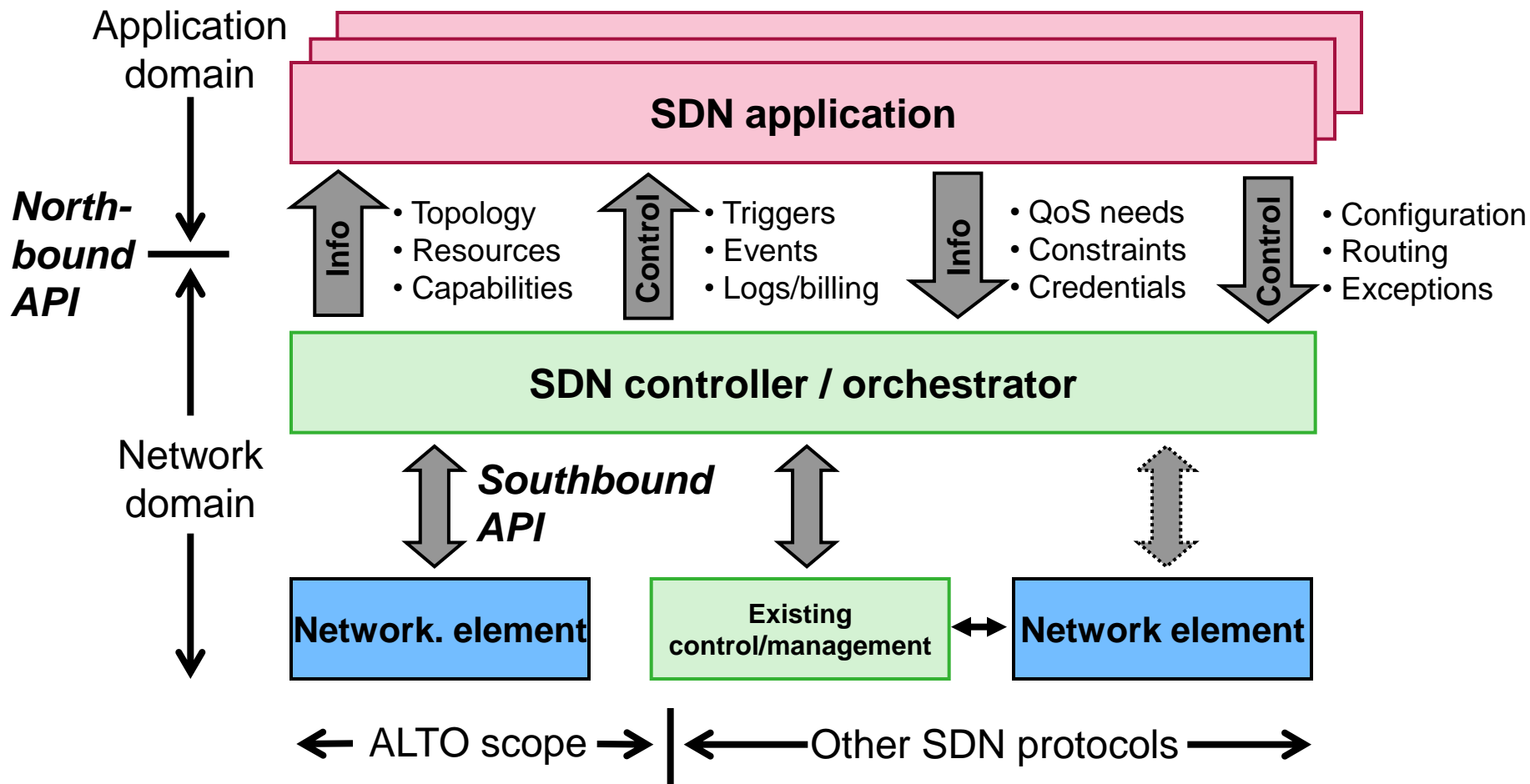


- **State-of-the-art VPN technologies [RFC 4026]**
  - Layer 2 VPN, e. g., VPLS [RFC 4762]
  - Layer 3 VPN, e. g., BGP/MPLS IP VPNs [RFC 4364]
  - Possibly with QoS guarantees
- **“Cloud bursting” use case**
  - Interconnecting customer sites and data centers
  - More dynamic than traditional VPN provisioning

➔ **New, IT-friendly APIs**

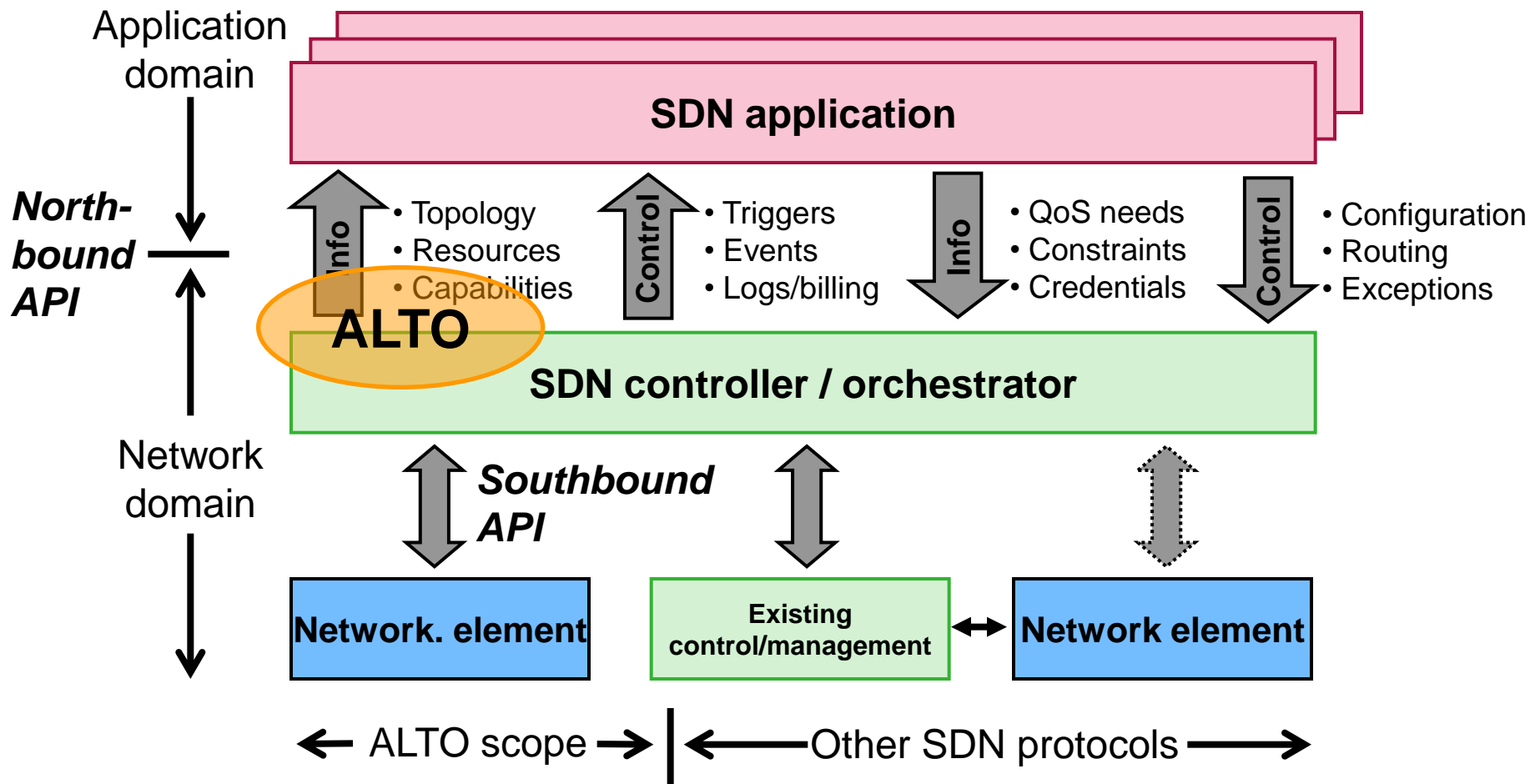
# VIRTUAL PRIVATE NETWORKS

## SDN FRAMEWORK



# VIRTUAL PRIVATE NETWORKS

## SDN FRAMEWORK WITH ALTO



# AGENDA

VIRTUAL PRIVATE NETWORKS

**ALTO VPN SERVICE**

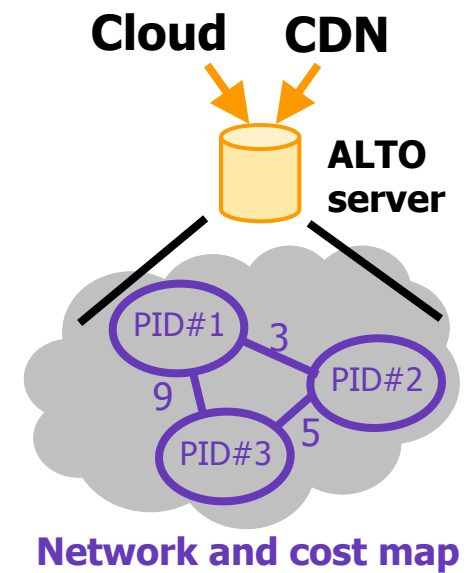
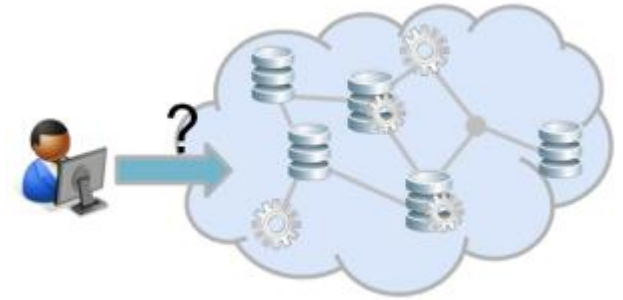
PROTOTYPE

CONCLUSIONS AND OUTLOOK

# ALTO VPN SERVICE

## IETF ALTO STANDARD

- **IETF Application-Layer Traffic Optimization (ALTO)** for network awareness
  - Standardized API between network and apps
  - Exchange topology and status information
- Objective: **Optimized resource selection**
  - Network map: Abstract the network topology
  - Cost map: Optimized costs based on service provider preferences
- Benefit: **Win-win situations** for network and applications
  - Application: Better performance with minimal overhead
  - Network: Optimized traffic and policy compliance
- Bell Labs is a core contributor to **standardization**
  - Co-chair of IETF ALTO WG and IRTF P2P RG
  - Authoring key protocol extensions for clouds and CDNs
- **Full standard-compliant ALTO server** by Bell Labs (<http://alto.alcatel-lucent.com:8000/directory>)



# ALTO VPN SERVICE EXAMPLE FOR ALTO MAPS

HTTP/1.1 200 OK

**Network map**

...  
Content-Type: application/alto-networkmap+json

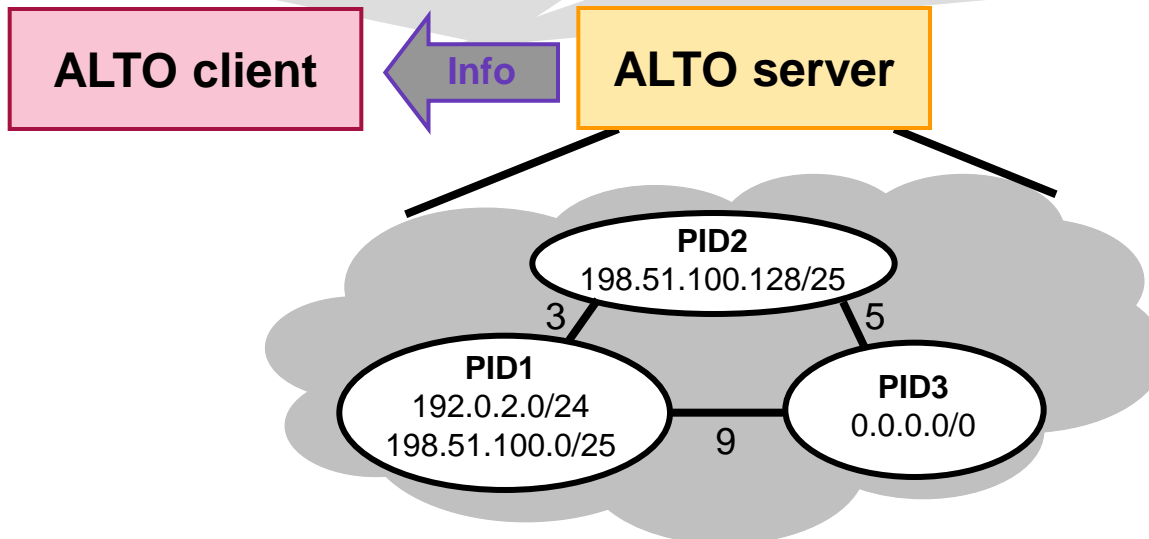
```
{ "data" : { "map-vtag" : "1266506139",  
  "map" : {  
    "PID1" : { "ipv4" : [ "192.0.2.0/24", "198.51.100.0/25" ] },  
    "PID2" : { "ipv4" : [ "198.51.100.128/25" ] },  
    "PID3" : { "ipv4" : [ "0.0.0.0/0" ] }  
  }  
}}
```

HTTP/1.1 200 OK

**Cost map**

...  
Content-Type: application/alto-costmap+json

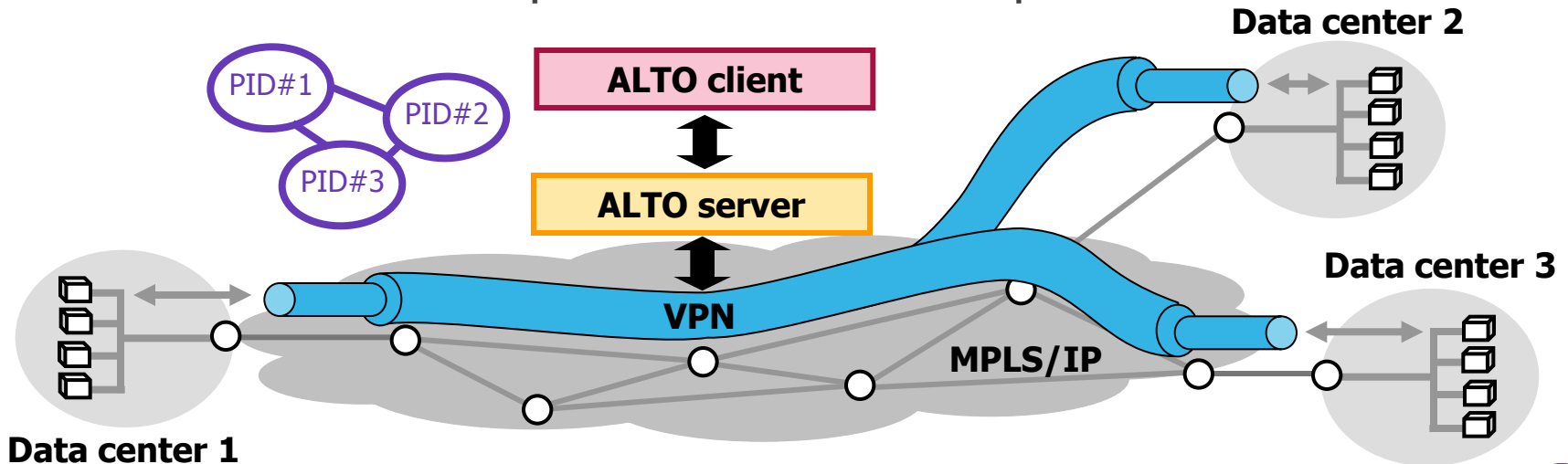
```
{ "data" : { "map-vtag" : "1266506139",  
  "cost-mode" : "numerical", "cost-type" : "routingcost",  
  "map" : {  
    "PID1" : { "PID1": 0, "PID2": 3, "PID3": 9 },  
    "PID2" : { "PID1": 3, "PID2": 0, "PID3": 5 },  
    "PID3" : { "PID1": 9, "PID2": 5, "PID3": 0 }  
  }  
}}
```





# ALTO VPN SERVICE MOTIVATION AND REQUIREMENTS

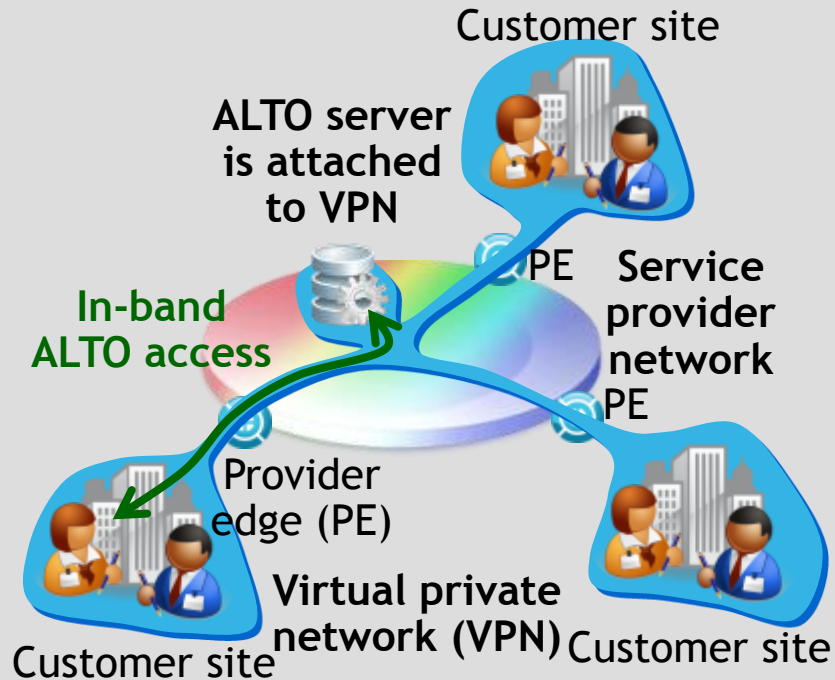
- **Differences between VPNs and public Internet**
  - Addressing – VPN sites may not have meaningful address
  - Overlay over the MPLS/IP core, not only using BGP/ISIS/OSPF/... routing
  - **No connectivity to sites not already attached to the VPN**
  - Topology is customer-specific and must only be exposed to authorized users
  - Better ALTO guidance possible due to controlled environment (typically single AS)
- **Benefits of ALTO guidance**
  - Avoid the overhead and issues of per-application measurements
  - Expose information not measurable (e. g., cost to unconnected VPN sites)
- **More details on use cases and requirements: draft-scharf-alto-vpn-service-01**



# ALTO VPN SERVICE

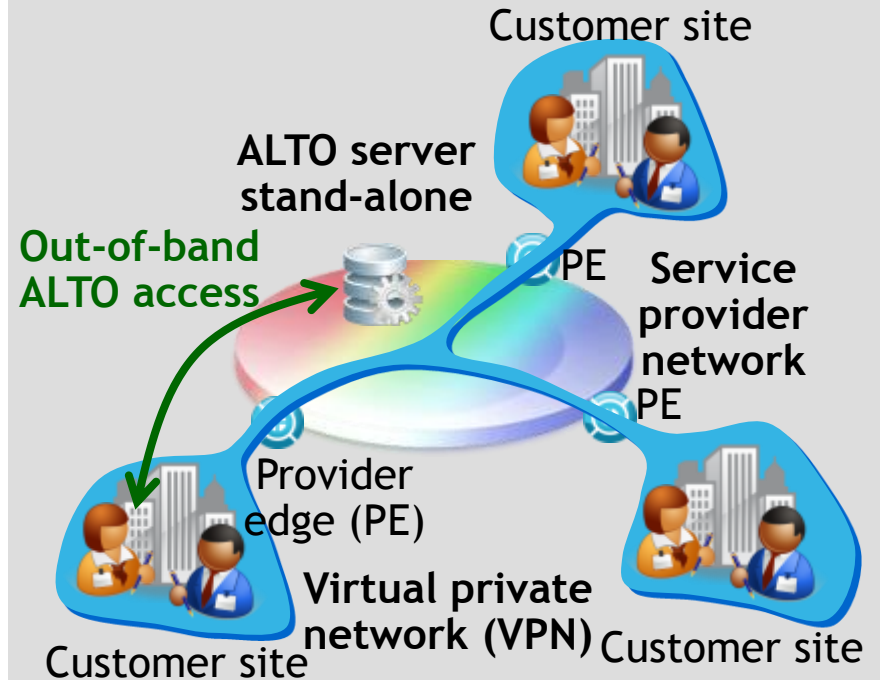
## TWO DIFFERENT USE CASES

### In-band



→ User applications

### Out-of-band



→ Management applications

# AGENDA

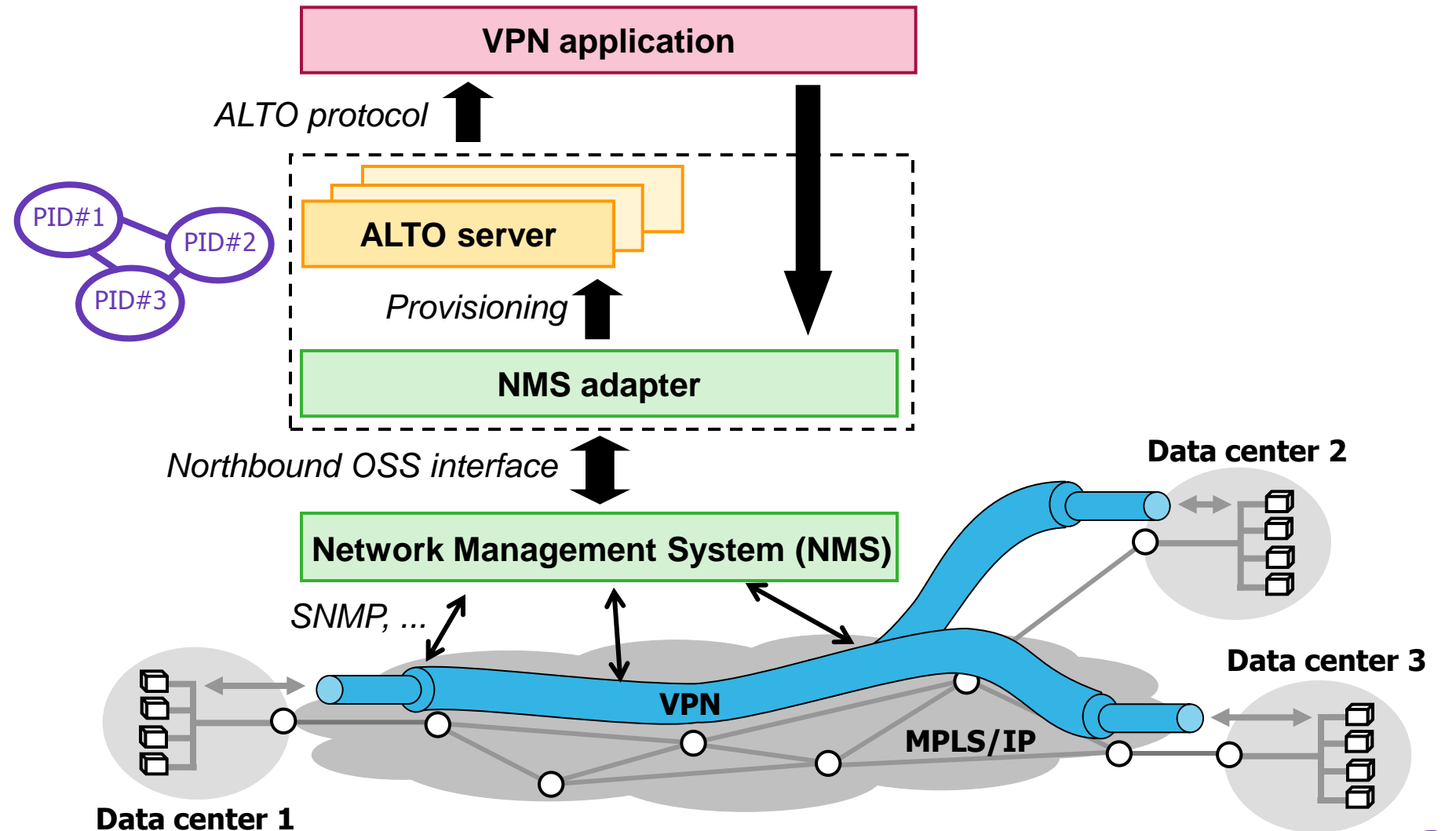
VIRTUAL PRIVATE NETWORKS

ALTO VPN SERVICE

**PROTOTYPE**

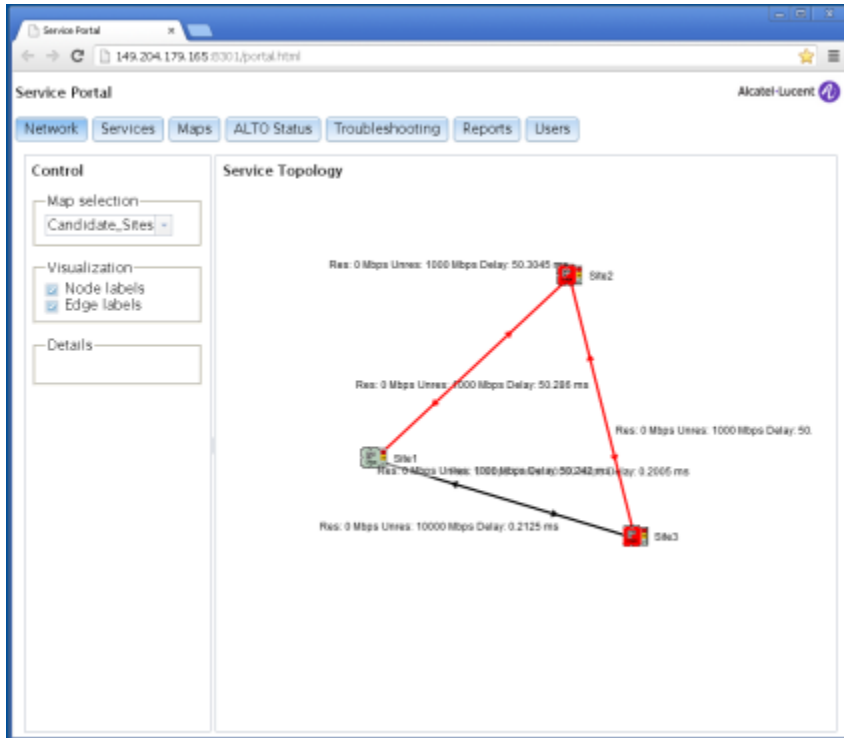
CONCLUSIONS AND OUTLOOK

# PROTOTYPE SYSTEM ARCHITECTURE

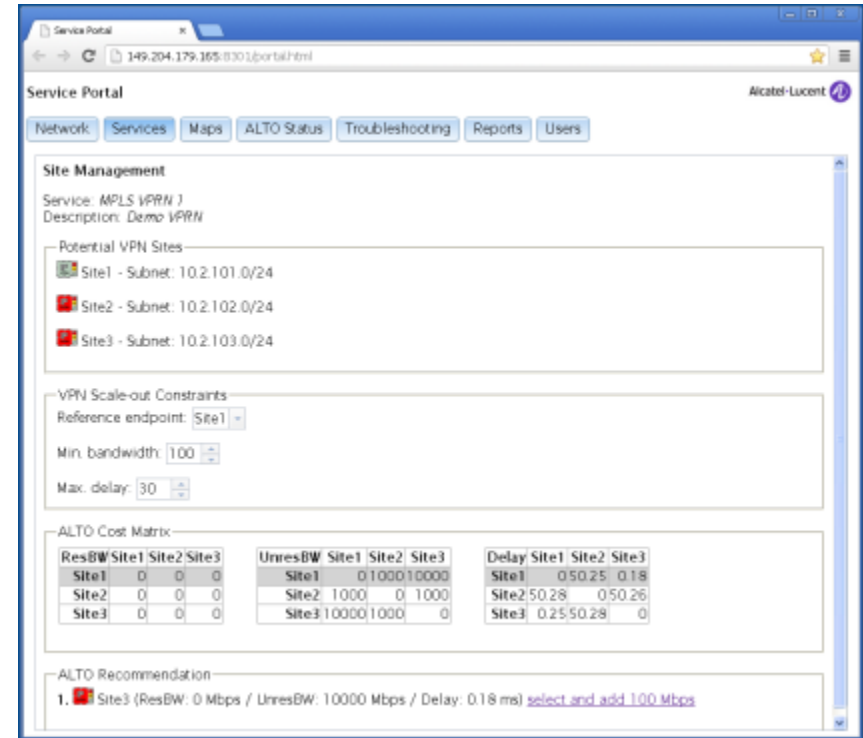


# PROTOTYPE WEB PORTAL SCREENSHOTS

## VPN topology view



## Constraint-based scale-out



- Topology scale-out of an MPLS-based L3VPN in a test-bed with three MPLS/IP routers
- Bandwidth information from ISIS-TE, RSVP-TE, and SNMP
- Delay information from active VPN OAM delay measurements

# PROTOTYPE

... NOT SOFTWARE ONLY ;)

## Networking components

Network management  
5620 SAM, 5650 CPAM

Routing monitor  
7701 CPAA

MPLS/IP Router 1  
7750 SR-c4

MPLS/IP Router 2  
7750 SR-c4

MPLS/IP Router 3  
7750 SR-7

## IT demo components

Bell Labs ALTO server

Servers

External/web gateways

Network/delay emulation



# AGENDA

**VIRUAL PRIVATE NETWORKS**

**ALTO VPN SERVICE**

**PROTOTYPE**

**CONCLUSION AND OUTLOOK**

# CONCLUSION AND OUTLOOK

## ALTO VPN SERVICE

- **Dynamic control and management of VPNs (L2VPN, L3VPN, ...)**
  - New use cases such as “cloud bursting”
  - New interfaces between NMS and IT applications
- **ALTO VPN service**
  - Support of scale-out of VPNs to new sites by topology awareness
  - Standardization of ALTO protocol extensions required
- **Proof-of-concept prototype for optimized VPN site selection**
  - Using a carrier-grade NMS with existing northbound interfaces
  - Demonstration in a test-bed with MPLS/IP routers
- **Open issues and next steps**
  - Tests in larger and more complex VPN scenarios
  - Quantification of the benefits of the ALTO VPN service

