cisco The bridge to possible

Approach to Cloud Networking

Traditional Solutions to SDN

Iñigo Alonso
Principal Architect – Cisco Customer Experience

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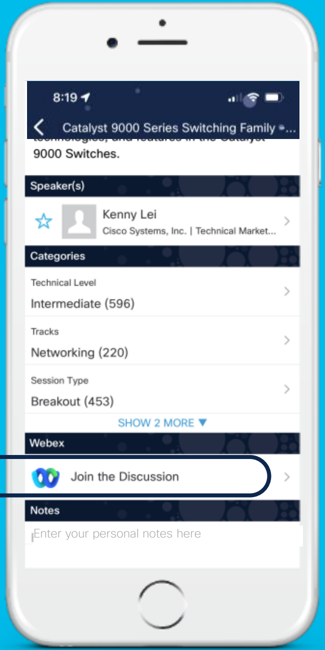

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Catalyst 9000 Series Switching Family ...

9000 Switches.

Speaker(s)

Kenny Lei
Cisco Systems, Inc. | Technical Market...

Categories

Technical Level
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Tracks
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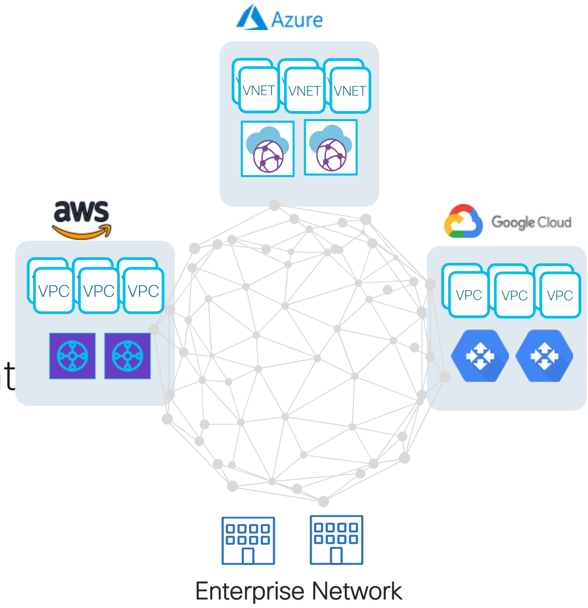
Agenda

- Introduction
- Generic Cloud Networking
- Connecting to the Public Cloud
- Multi-Cloud Network Topologies

Multi-Cloud Networking

- **Traditional**: native cloud networking constructs
- **Software-Defined Network**: controller-based multi-cloud overlay
- Context:
  - Multi-Cloud = consumption of two or more clouds, including hybrid cloud (private + public)
  - Public cloud as an extension of the private IT environment
  - Cloud benefits without compromising security and compliance
  - Multi-cloud private app-to-app communication



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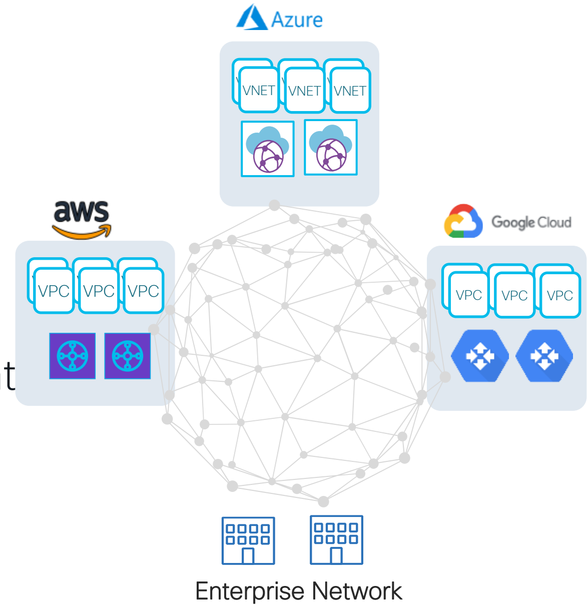
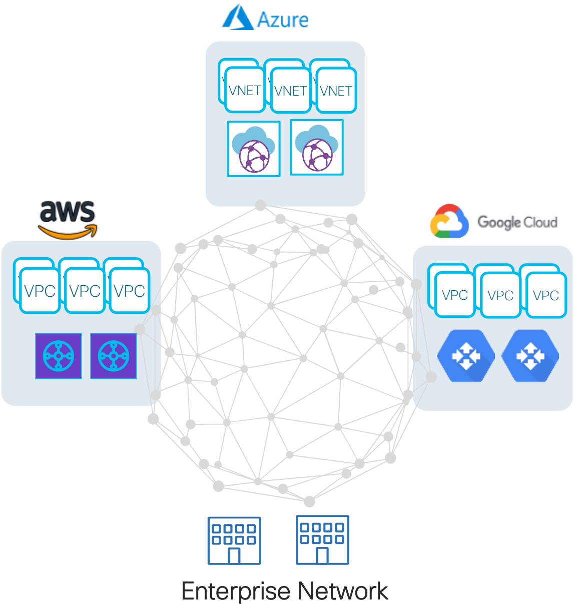


Is there a case for SDN in Multi-Cloud?

Multi-Cloud Networking

- Common requirements and design criteria
  - Performance, Scalability, Cost effective
  - High Availability, Resilience
  - Security, Compliance, Segmentation
  - Management, Operations, Visibility, Assurance
  - Consistency, Automation, Agility
  - Modularity, Flexibility, Simplicity
  - Cloud native support: programmability, integrations, devops user experience
  - Broader context



Hybrid/Multi Cloud Networking

Core Challenges

Connectivity

How do I connect distributed components across multiple cloud and edge providers?

Zero Trust and Security

How do I maintain a consistent security posture that is agnostic to where my app and clients are located?

Visibility

How do I observe and analyze traces, logs, and metrics across distributed threads of execution and time?

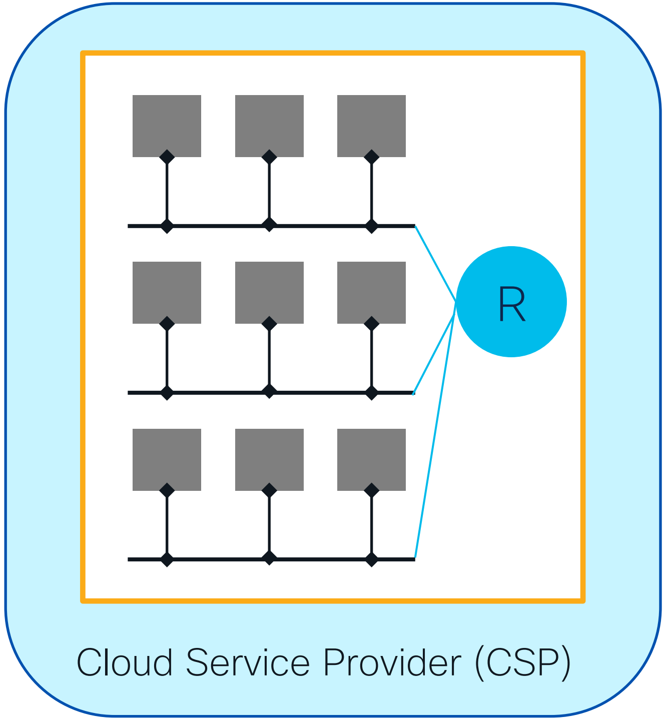
Application Networking

Developers need a declarative way to signal application connectivity requirements.

Need For Homogenous Experience Across Heterogenous Cloud Environments

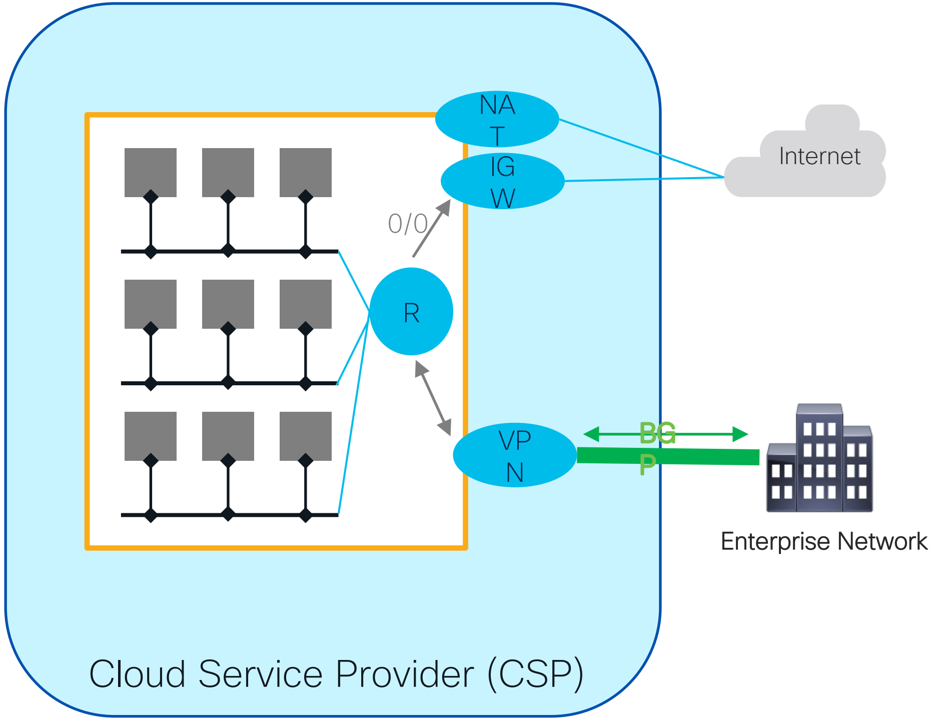
Generic Cloud Networking

- Virtual Data Center
  - AWS VPC, Azure VNET, GCP VPC
  - Regional or Global (GCP)
  - Connectivity for instances and endpoints
  - Subnets: zonal or regional
  - Private & public IP addressing
  - Static routing
  - L4 traffic filtering rules: Security groups, ACLs



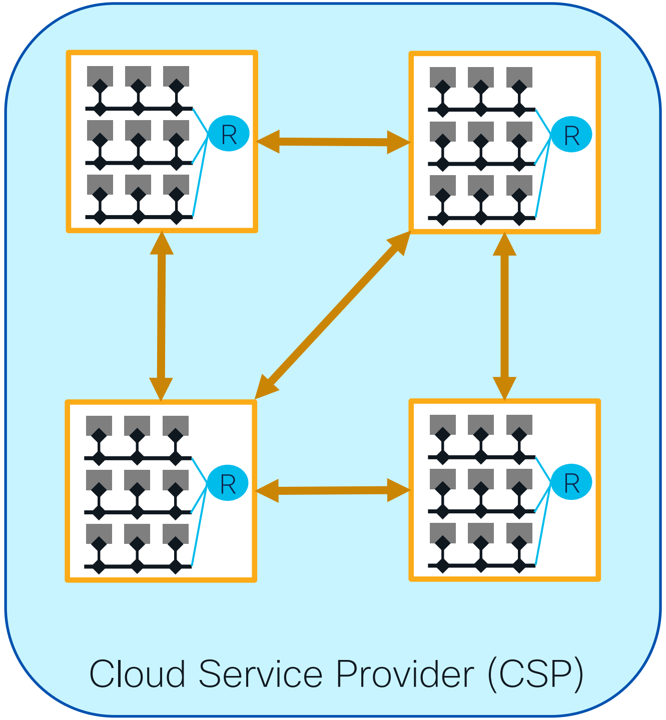
Generic Cloud Networking

- Virtual Data Center
  - Internet access
  - NAT: 1:1 (instance with public IP address), or address pool
  - VPN to remote public or private endpoints
    - Static or BGP routing
    - Propagate learned routes into routing table
    - Advertise VPC/VNET CIDR or subnets



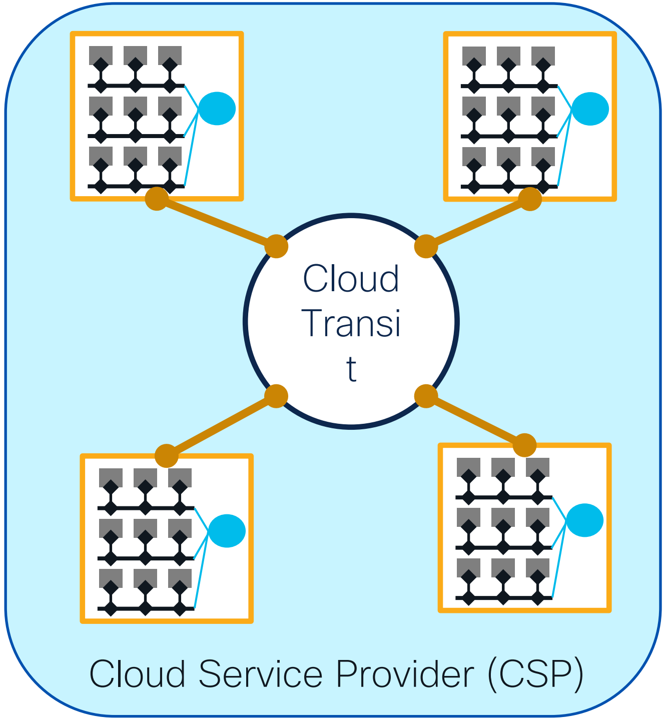
Generic Cloud Networking

- Virtual Data Center Peering
  - Intra-region or inter-region
  - Non-transitive
  - Full mesh required for any-to-any communication
  - Scale challenges



Generic Cloud Networking

- Cloud Transit
  - AWS Transit Gateway, Azure vWAN Hub, GCP Transit VPC
  - Interconnect VPCs/VNETs
  - Hub & Spoke connectivity model
  - Regional scope; 1 or more per region
  - Static routing; multiple routing tables



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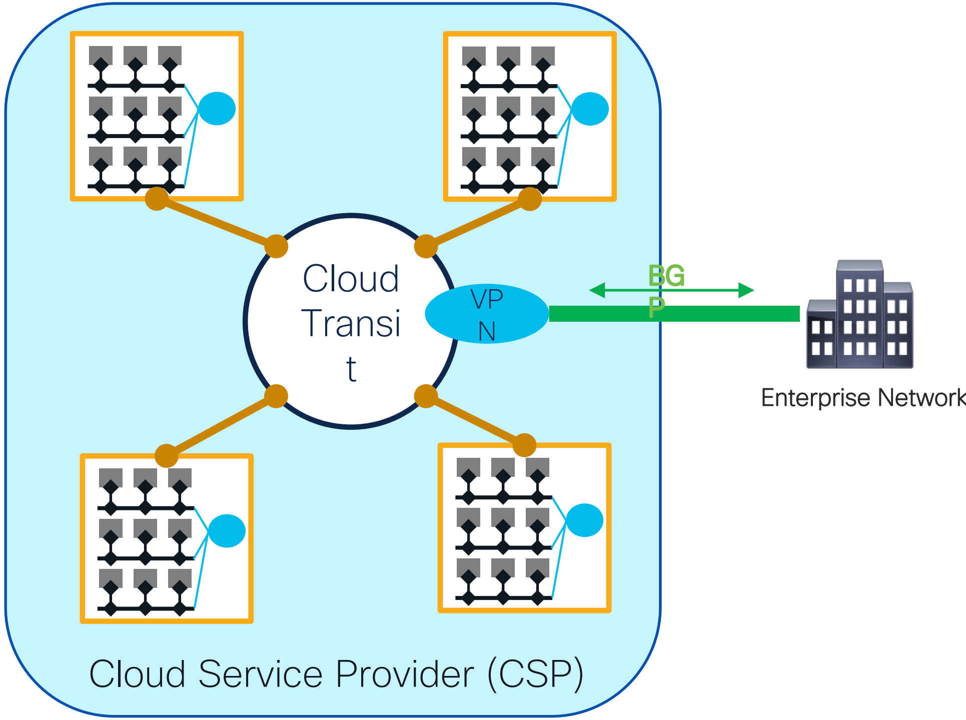
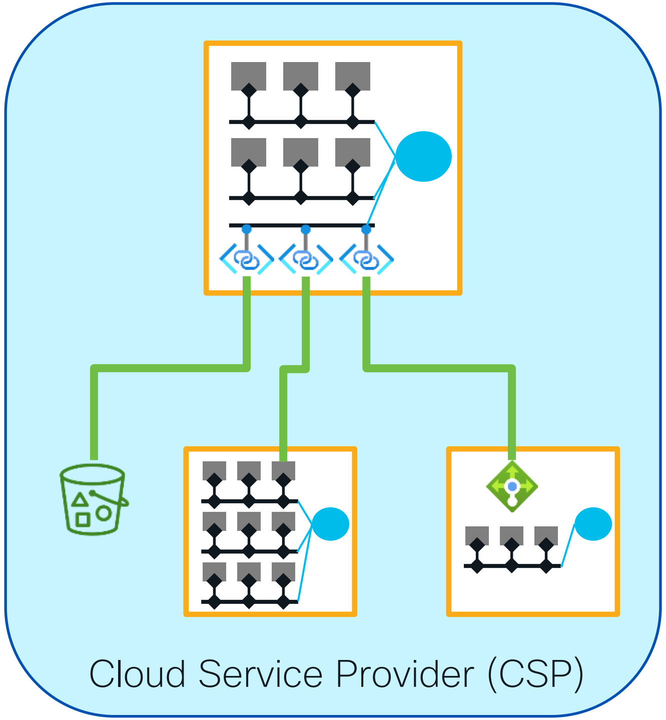


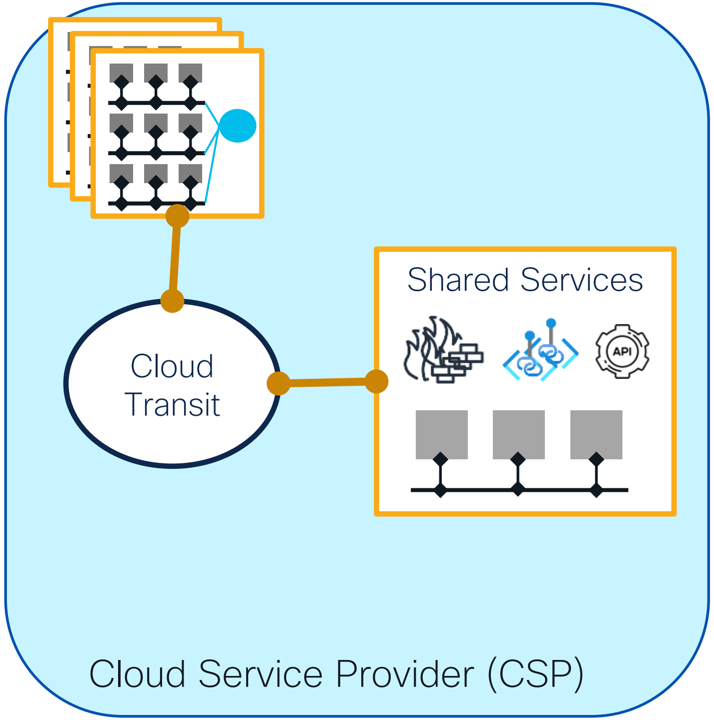
Generic Cloud Networking

- Private Access to Services
  - Access to CSP's PaaS services (Storage, DB, etc) via private endpoints
  - Access to services in other virtual environments via private endpoints – within and across organizations
  - Access to Load Balancers via private endpoints
  - Ex: AWS interface endpoints and gateway endpoints; Azure Private Link; GCP Private Service Connect



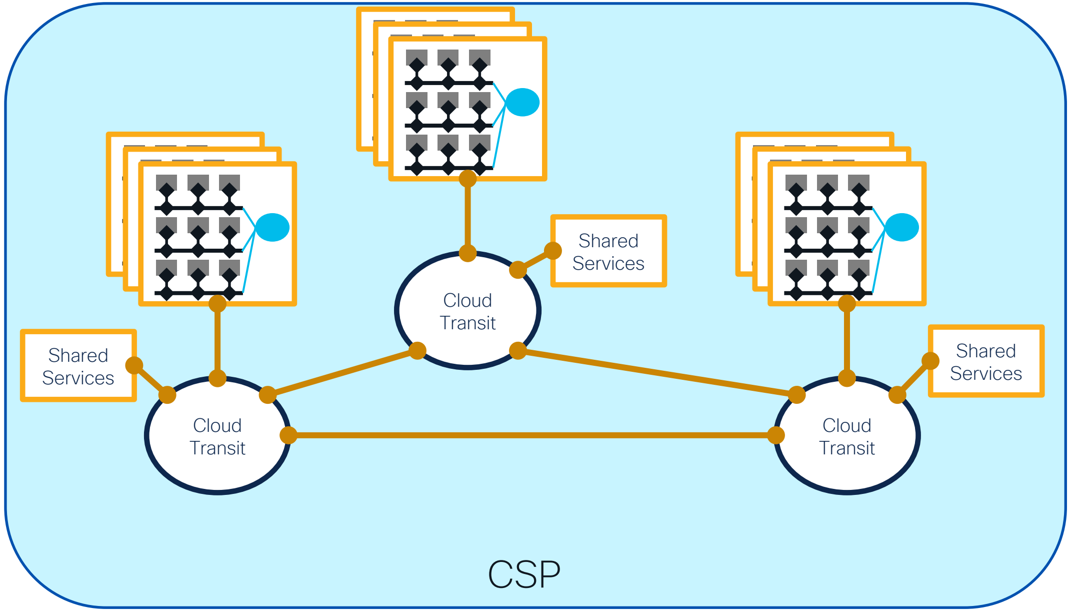
Generic Cloud Networking

- Shared Services
  - Common infrastructure services shared by multiple groups
  - Network services: DNS, proxy
  - Security: firewall, inspection
  - App middleware: API gateway, data broker
  - Private access to services
  - Monitoring, logging



Generic Cloud Networking

- Multi-Region Cloud Transit
  - Modular design, repeatable
  - Native CSP network constructs



Generic Cloud Networking

- Multi-Region Cloud Transit
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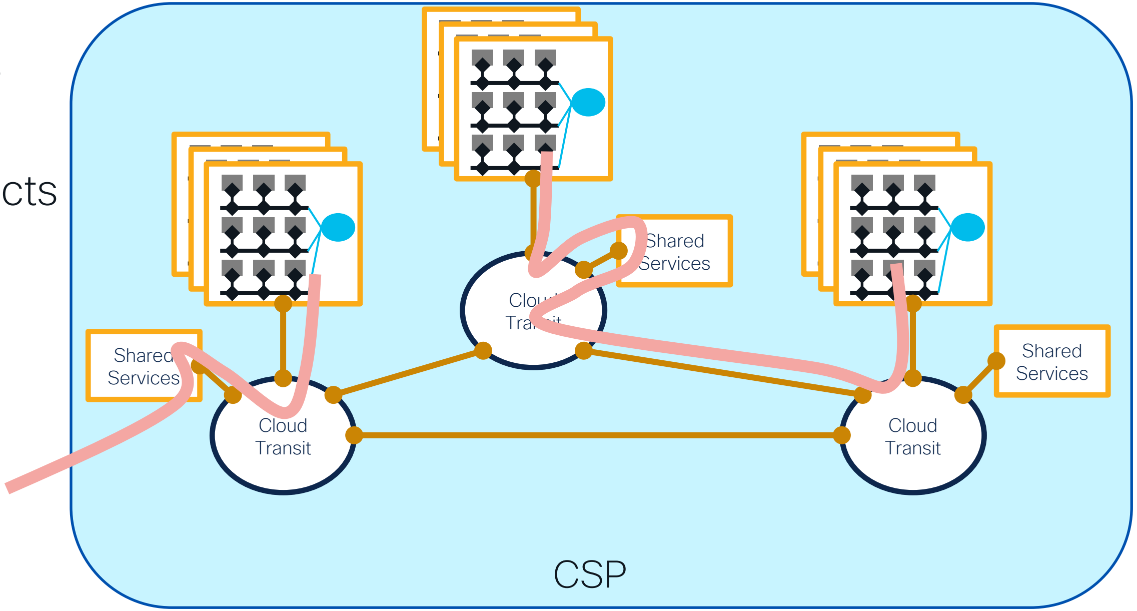
  - Common traffic patterns



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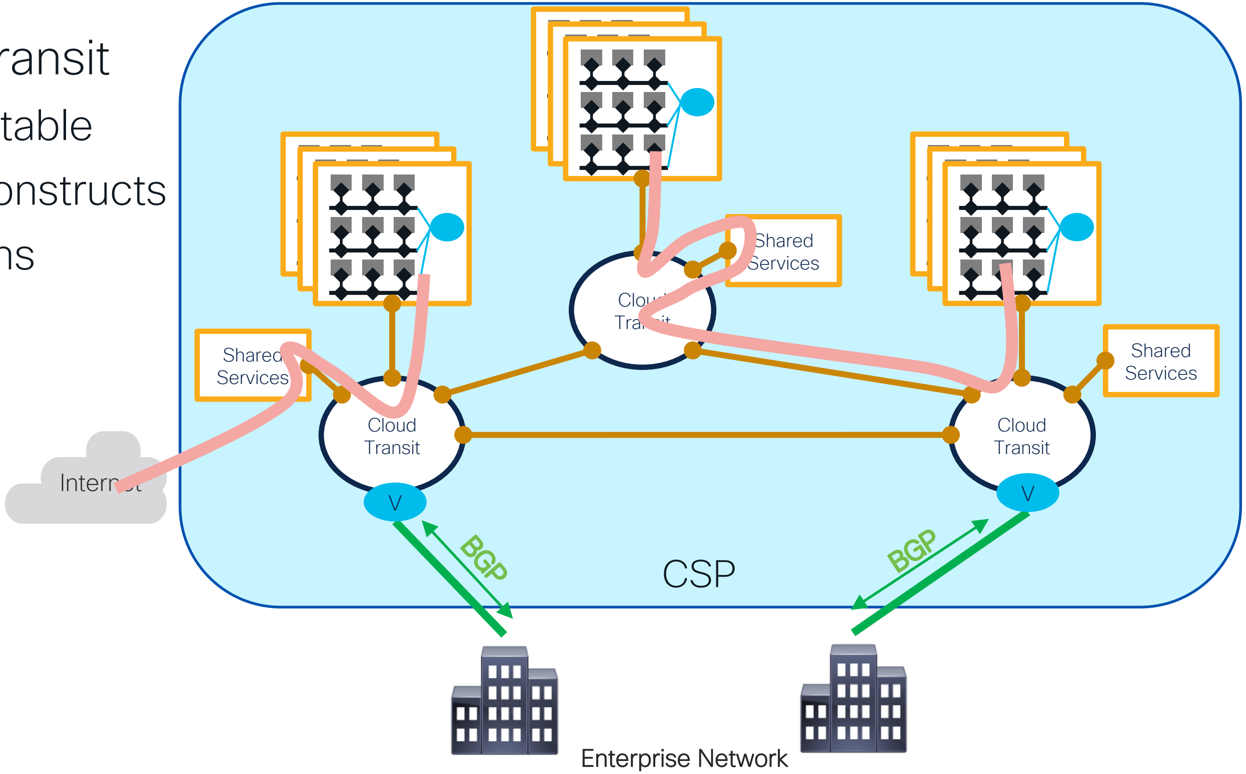
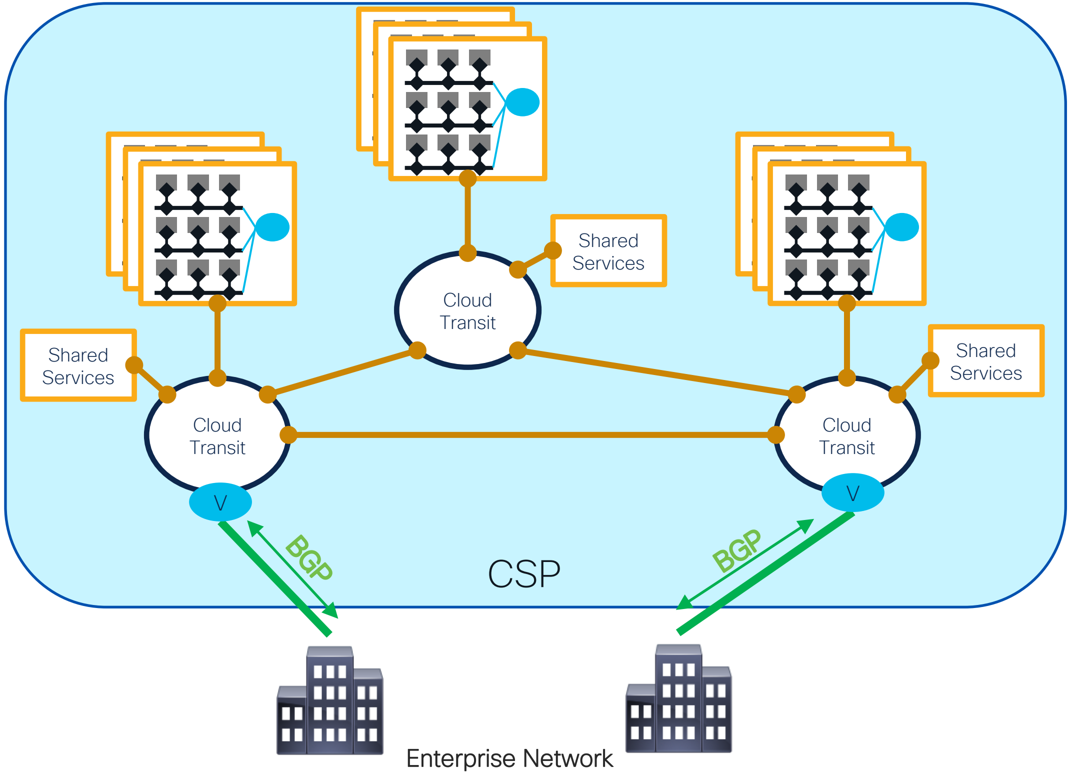


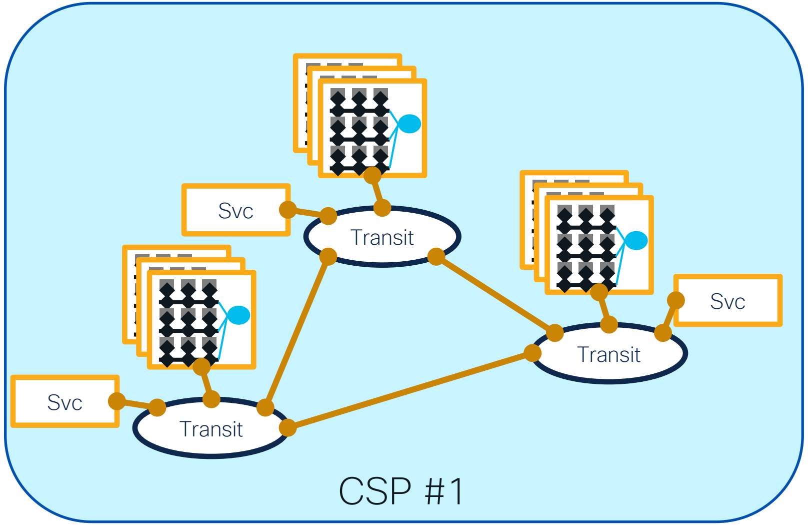
Generic Cloud Networking

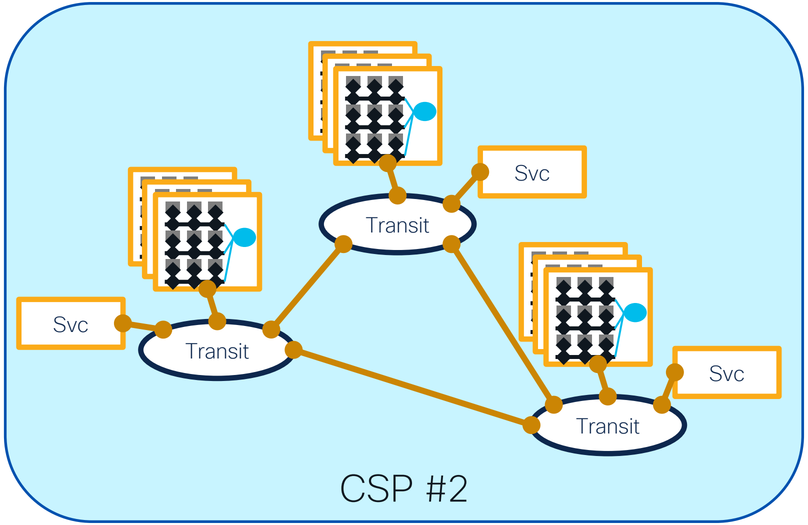
- Multi-Region Cloud Transit
  - Modular design, repeatable
  - Native CSP network constructs
  - Common traffic patterns
  - External connections
  - Limitations*
    - Limited control & visibility
    - Networking features and scaling
    - Different implementation in CSPs
    - Multiple cost factors
    - Not designed for multi-cloud



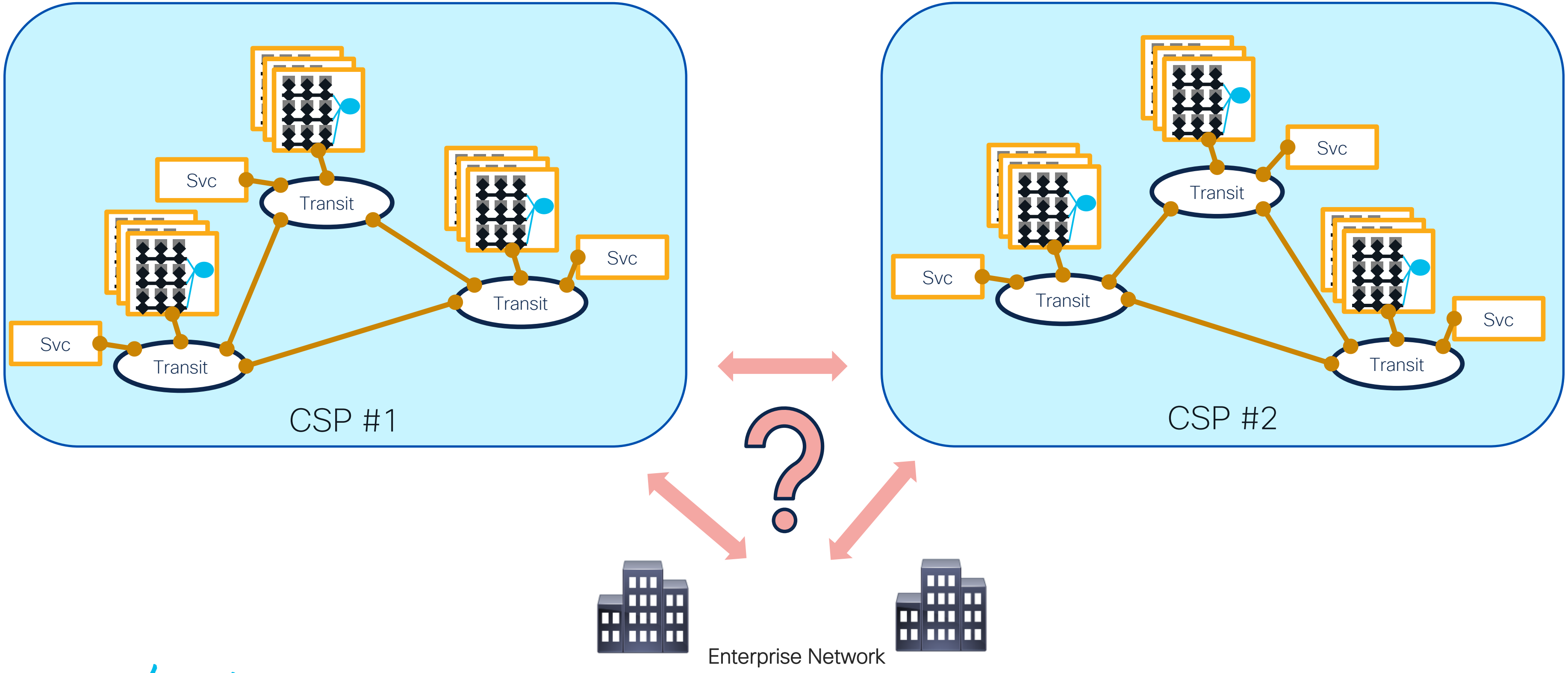
(*) CSP Networking Features are continuously evolving

Generic Cloud Networking

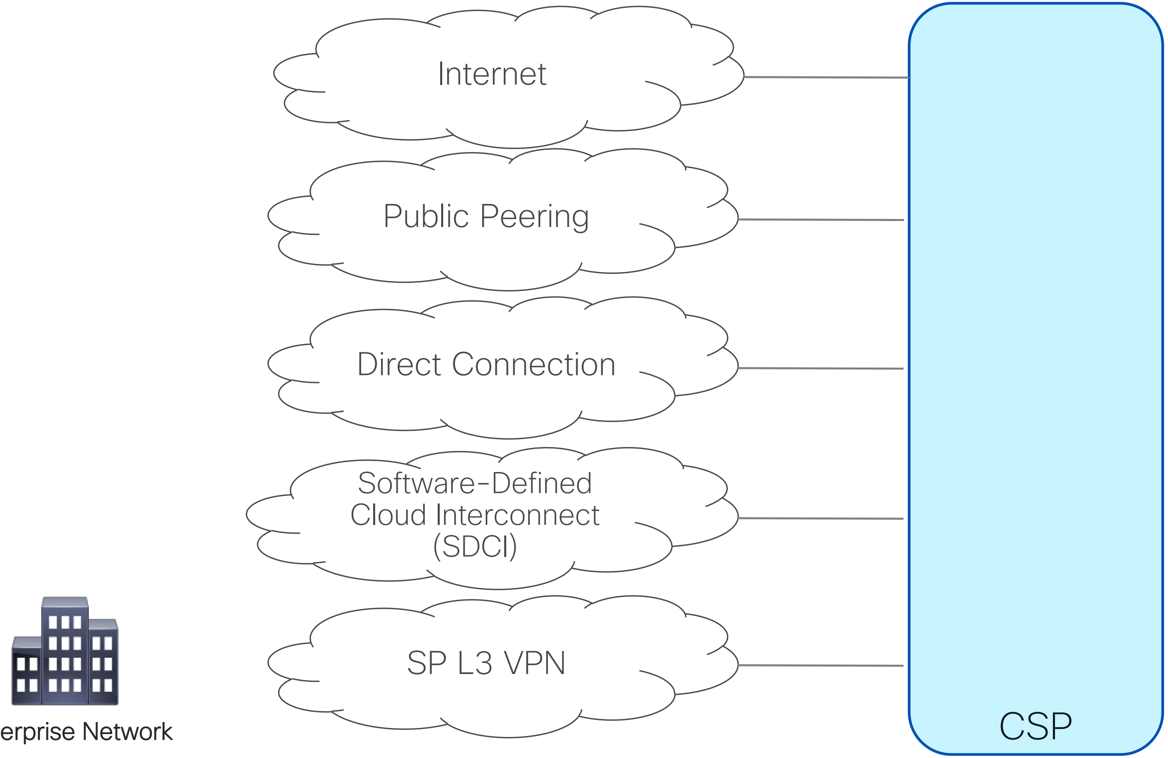




Generic Cloud Networking



Connecting to the Public Cloud


Internet

Public Peering

Direct Connection

Software-Defined Cloud Interconnect (SDCI)

SP L3 VPN

Enterprise Network

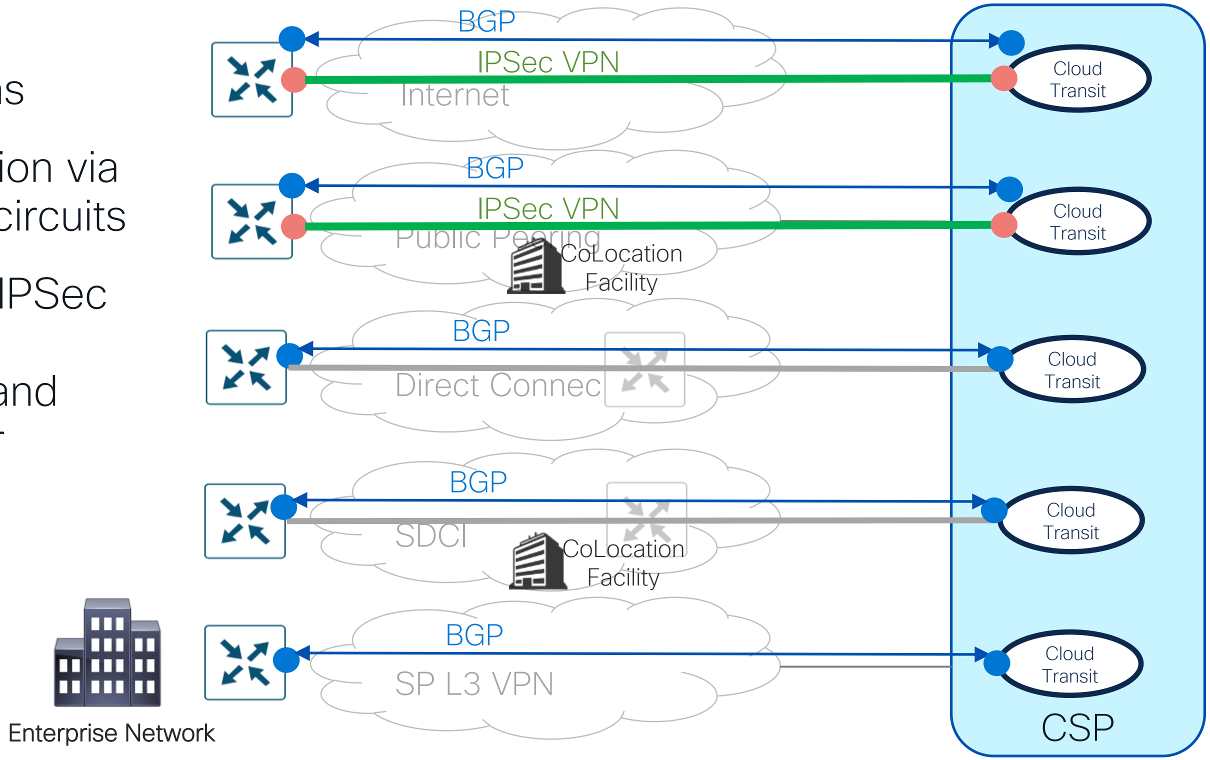
CSP

Connecting to the Public Cloud

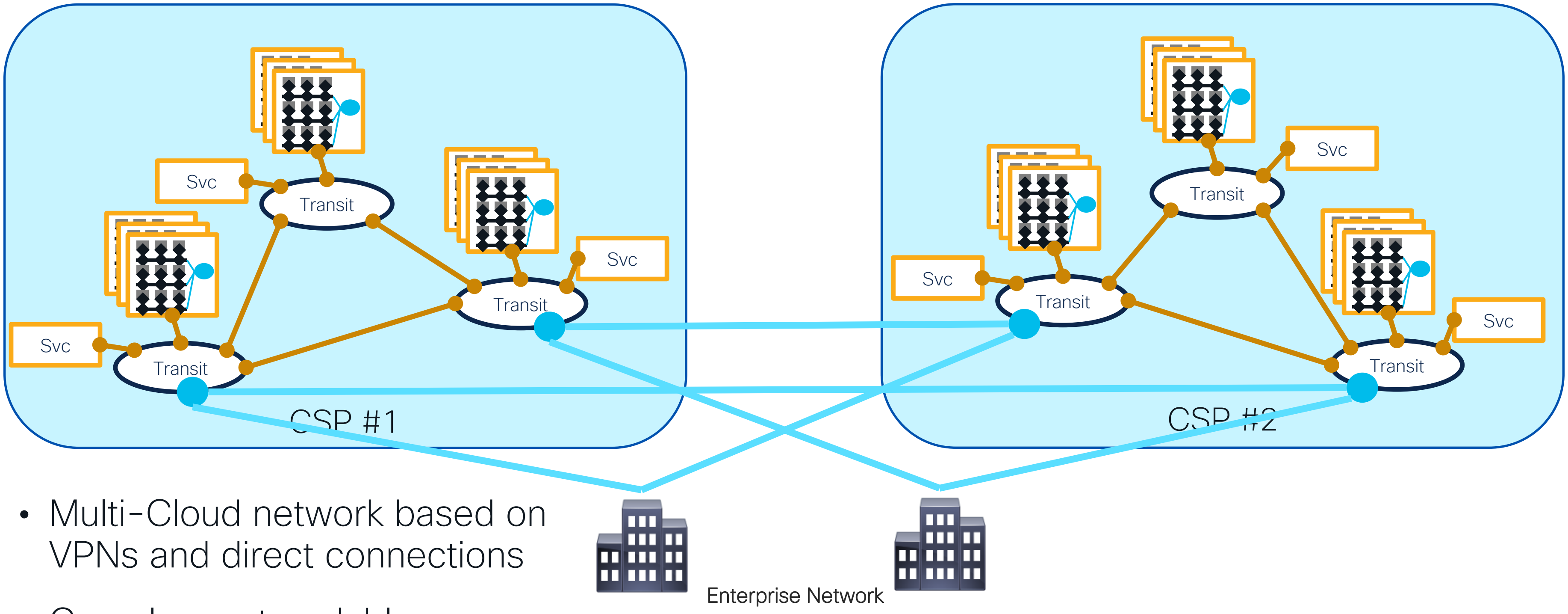
- Public & Private connection options
- Macro segmentation via multiple VPNs or circuits
- All CSPs support IPSec VPN and BGP – implementations and options may differ

● Private IP endpoint

● Public IP endpoint

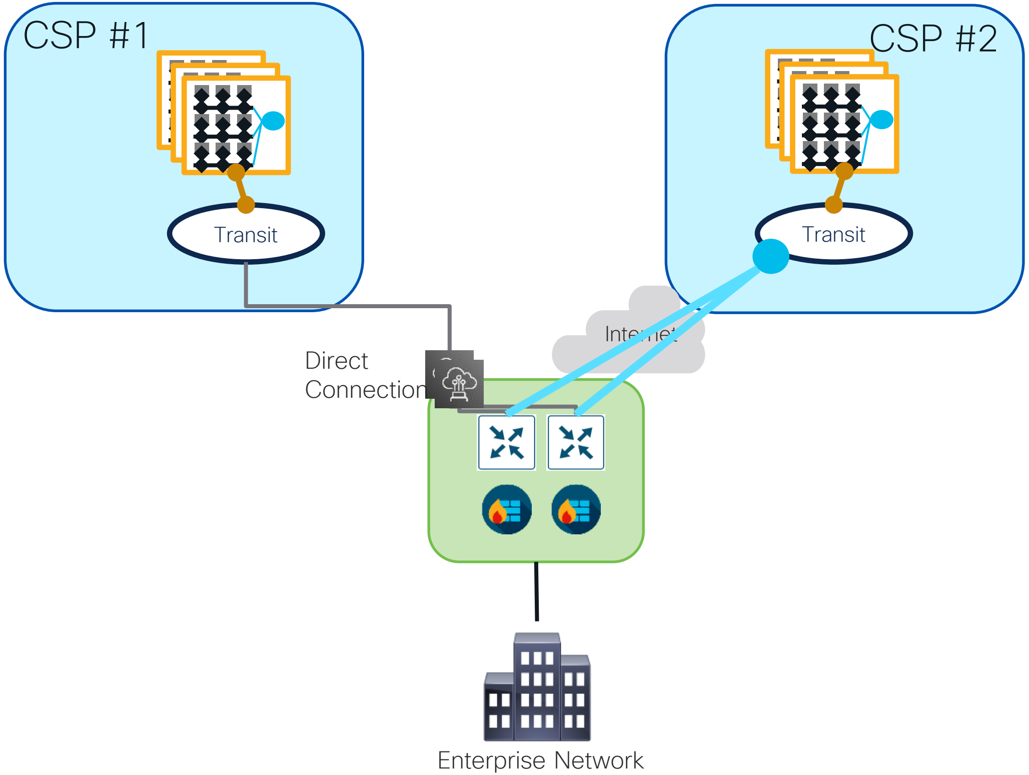


Multi-Cloud Network Topologies



- Multi-Cloud network based on VPNs and direct connections
- Complex, not scalable

Multi-Cloud Network Topologies



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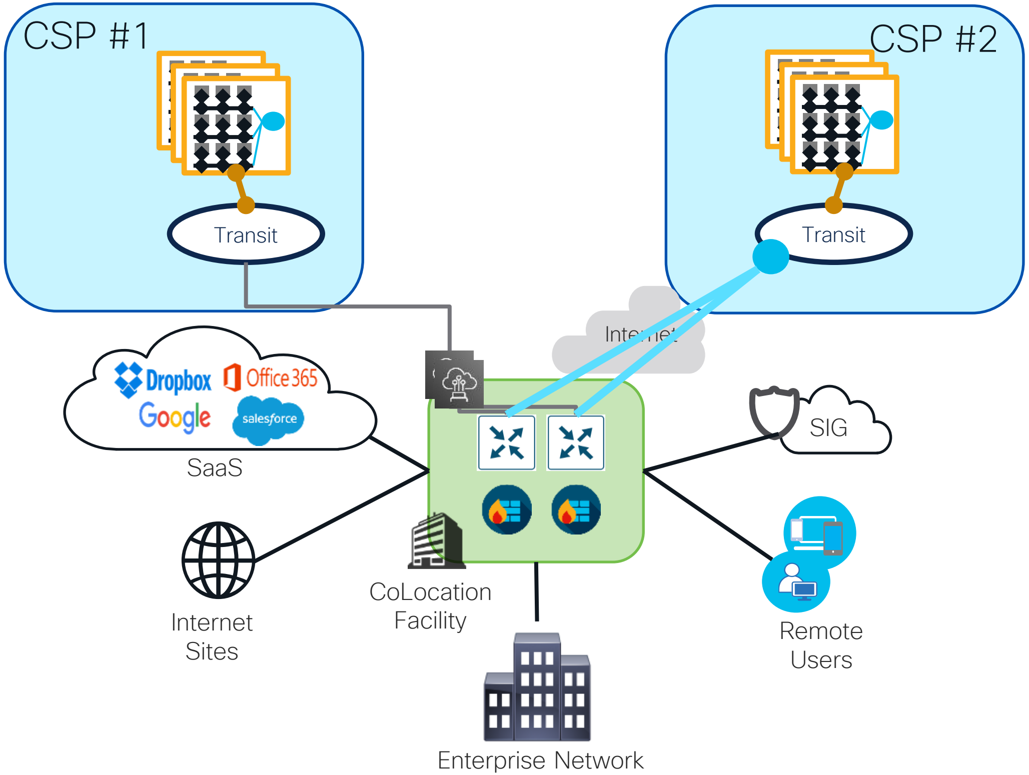

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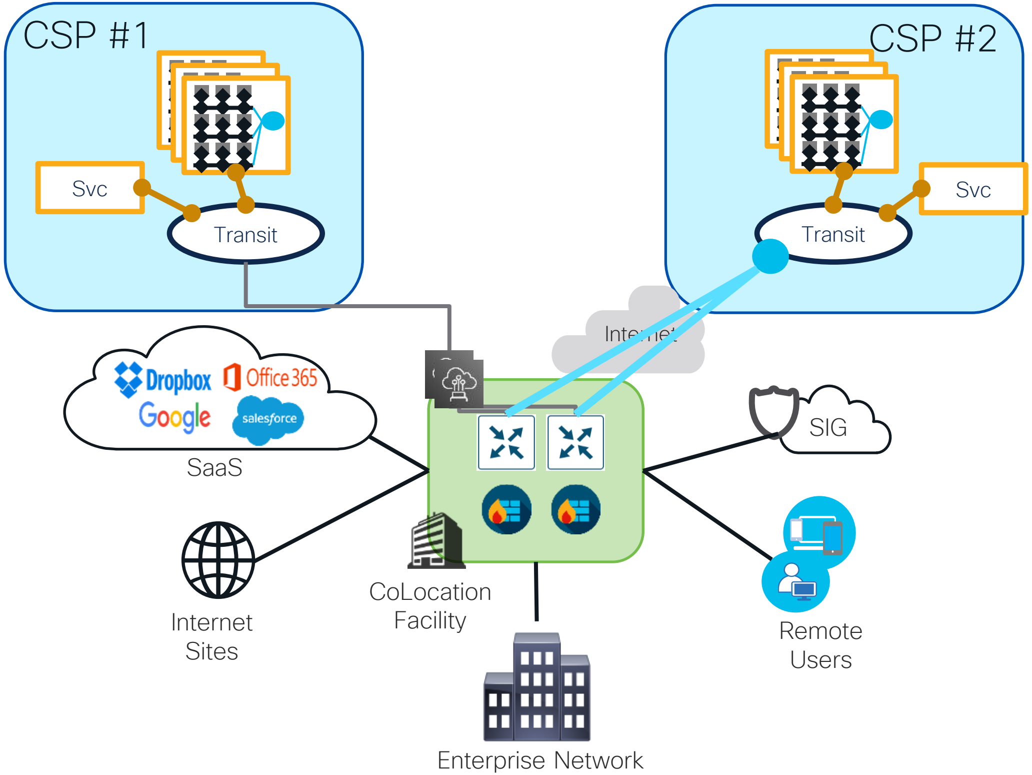

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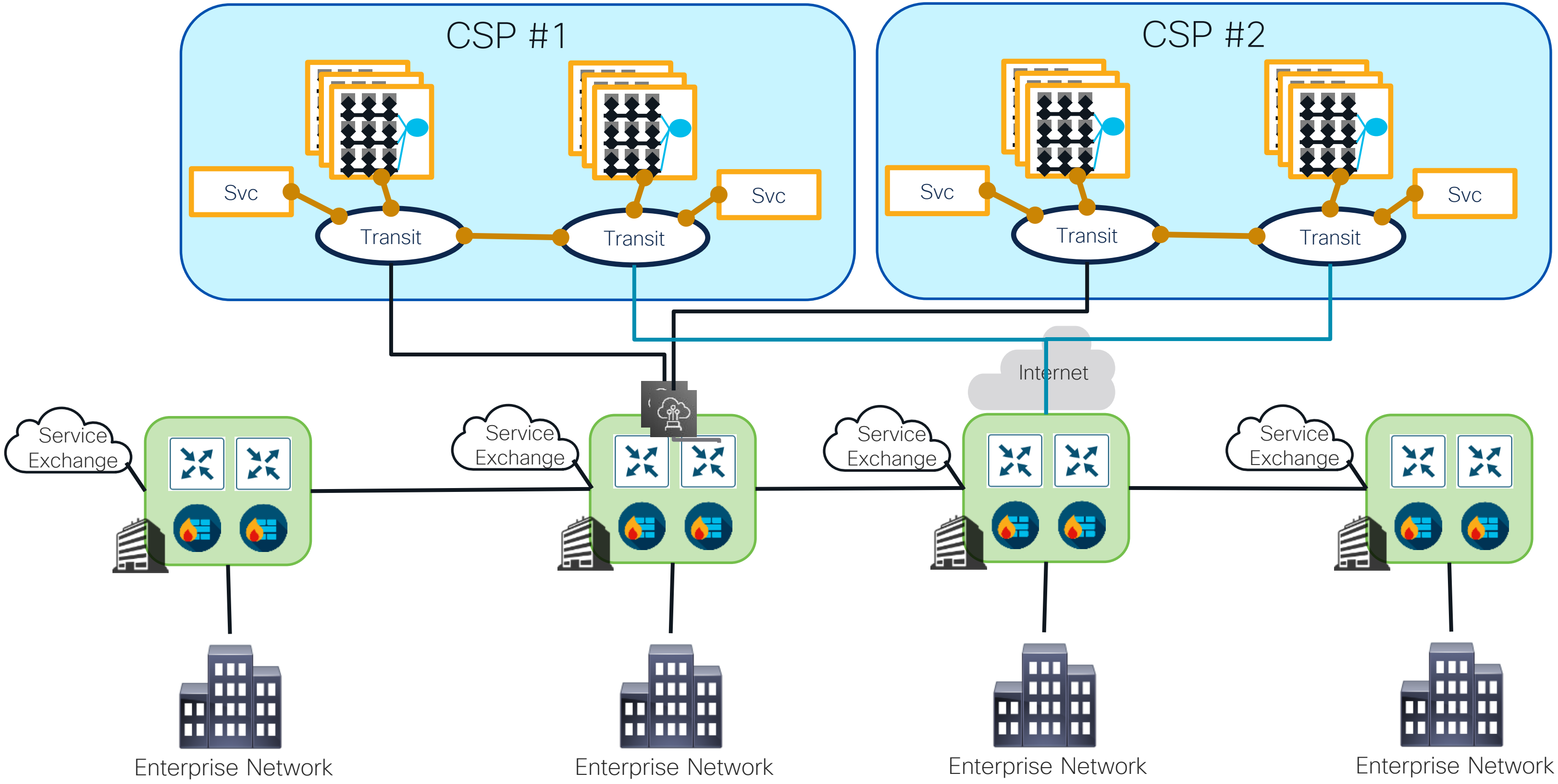
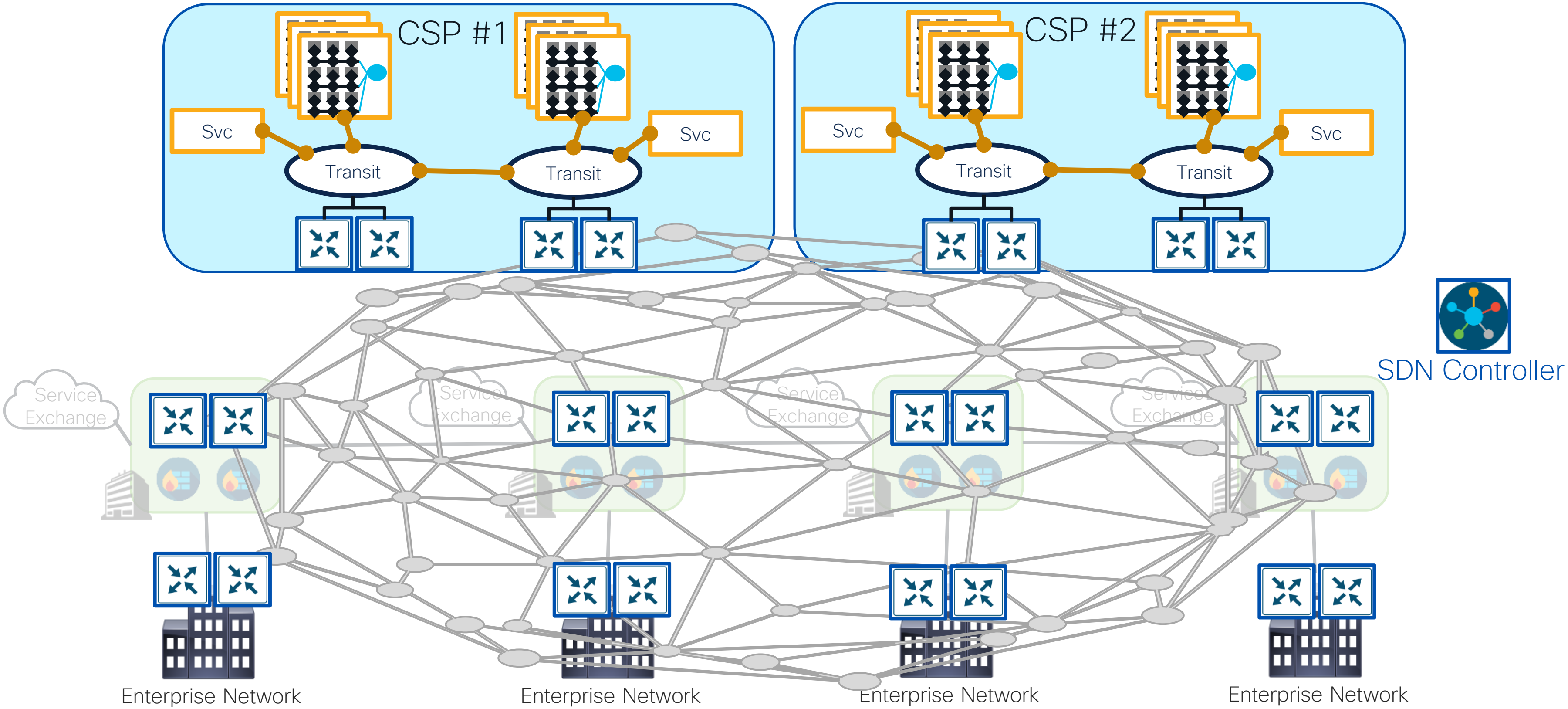
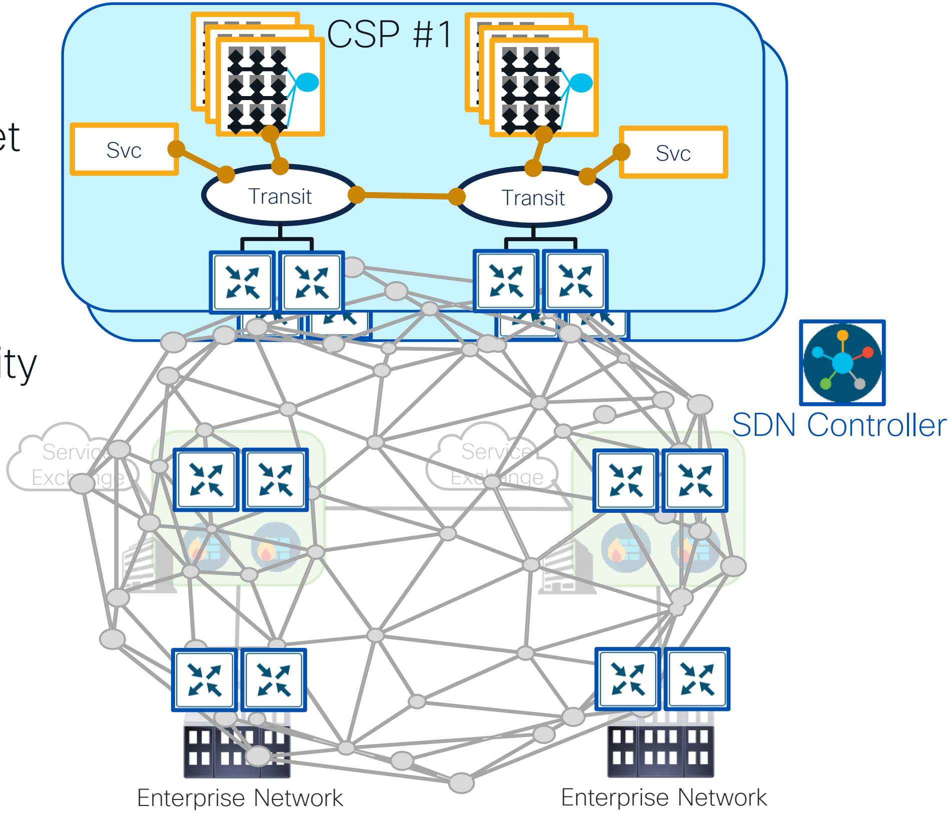


Multi-Cloud Network Topologies – SDN



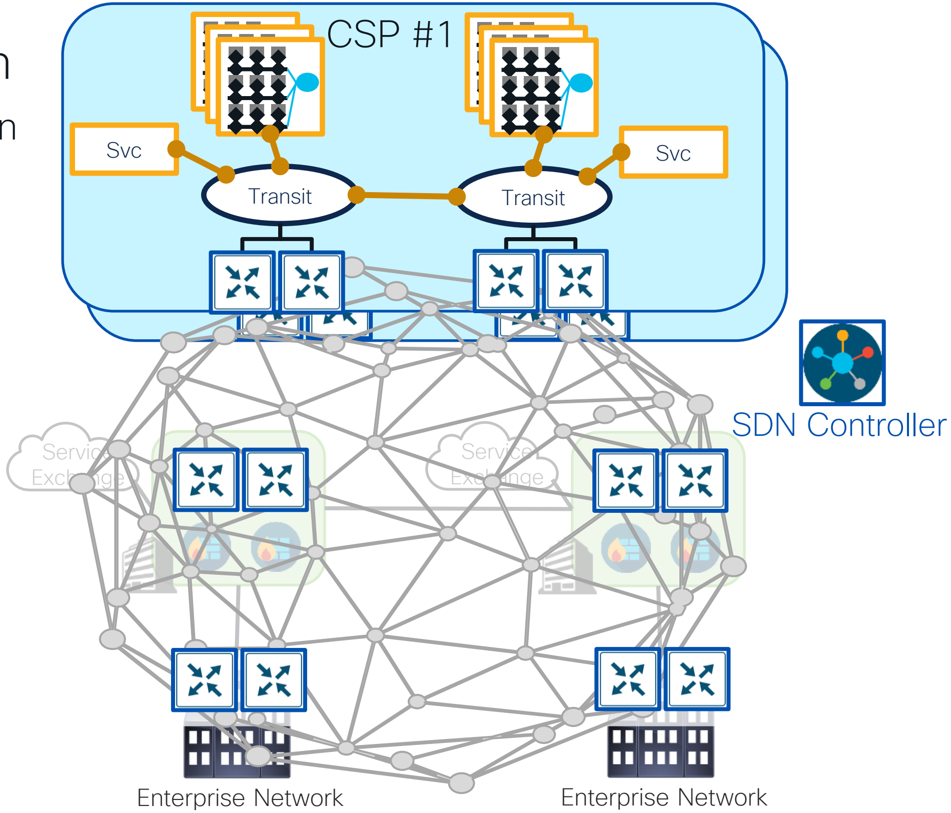
Multi-Cloud Network Topologies – SDN

- SDN Approach
  - + Match the capabilities and feature set of non-SDN solutions
  - + Support any transport, private or public
  - + Normalize the multi-cloud connectivity
  - — An additional solution
  - — Overhead and performance
  - — Programmability and integrations



Multi-Cloud Network Topologies – SDN

- Path Monitoring and Path Selection
  - Advanced application-based path selection policies
  - Any transport: private, public, or CSP backbone
  - Underlay and overlay path measurements; detect path degradation
  - Can include app telemetry and synthetic probing data (ex: Cisco ThousandEyes)
  - Can be combined with data analytics



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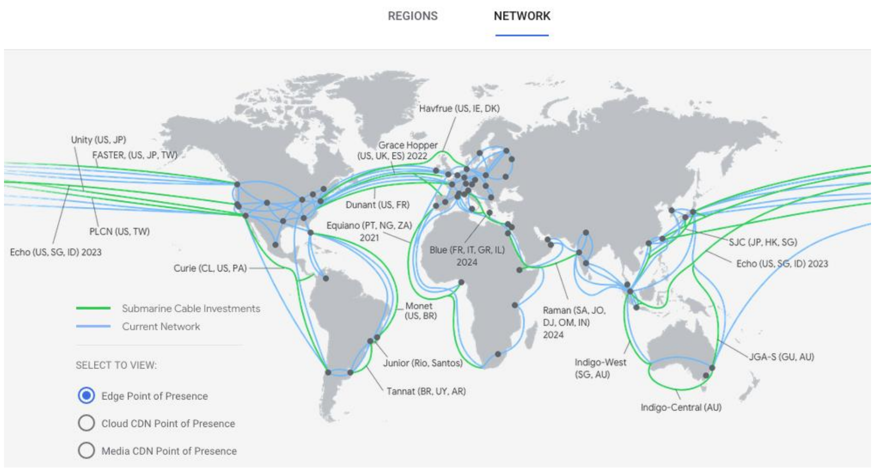
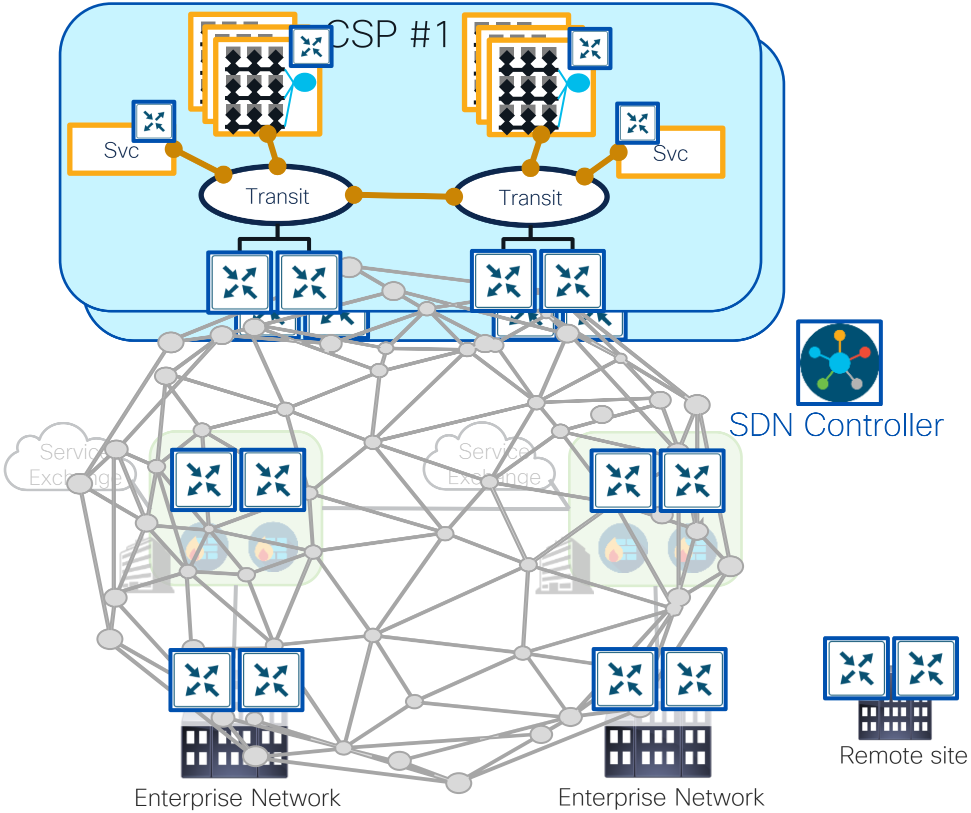


GCP Global Network

Multi-Cloud Network Topologies – SDN

- SDN Extensions
  - Extend to the CSP virtual data centers
  - Tighter end-to-end control and visibility
  - Possibility to extend/integrate at the micro-services layer
- SDN Flexibility
  - Policy-based hierarchical topology
  - Adapt to special situations, ex: large or critical remote sites
- End-to-end segmentation
  - Macro & micro segmentation



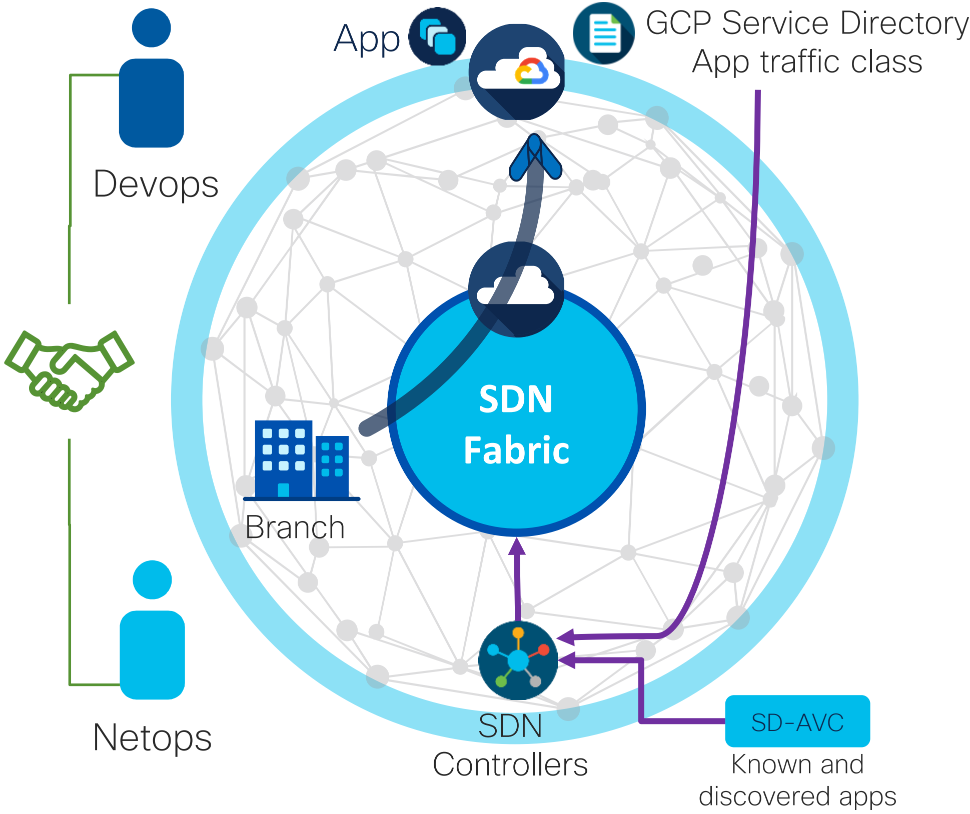
SDN Automatic Application Discovery

Use Case Summary

Devops: register cloud apps in GCP Service Directory.
App metadata includes traffic type or class.

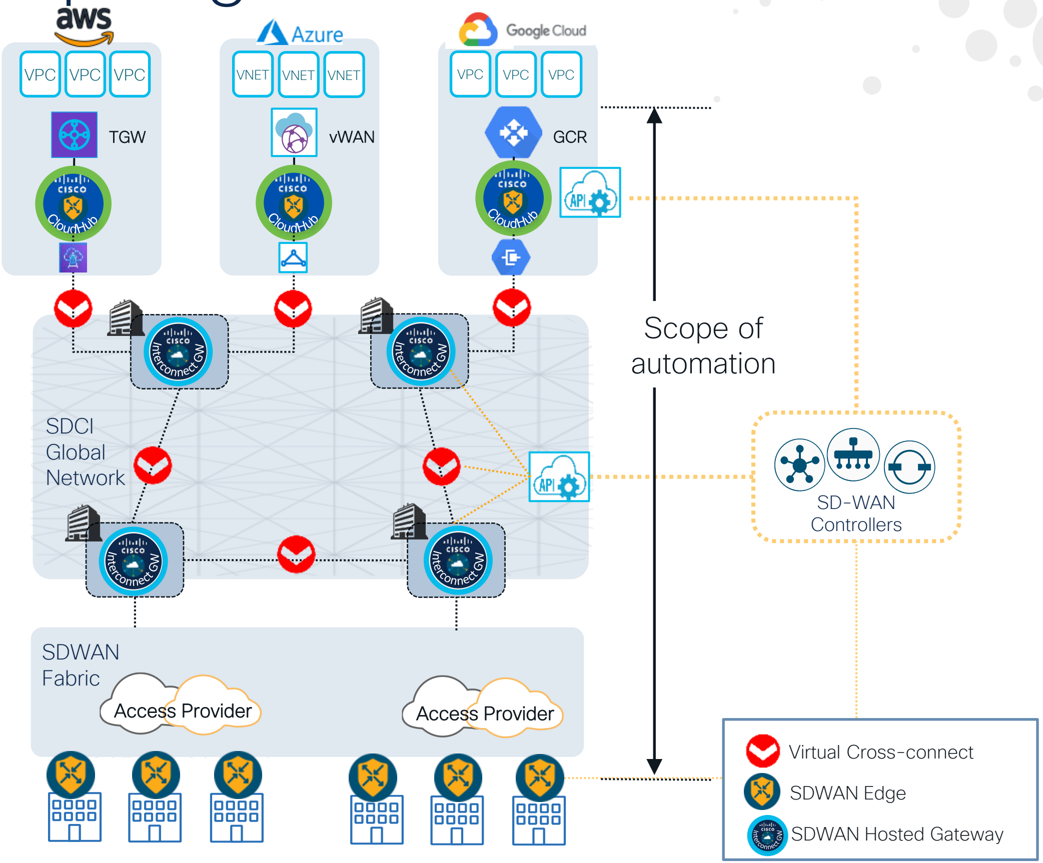
Netops: create and maintain SDN policies for the different traffic types/classes.

SDN controllers: read apps from Service Directory; distribute policies and app info to the network.



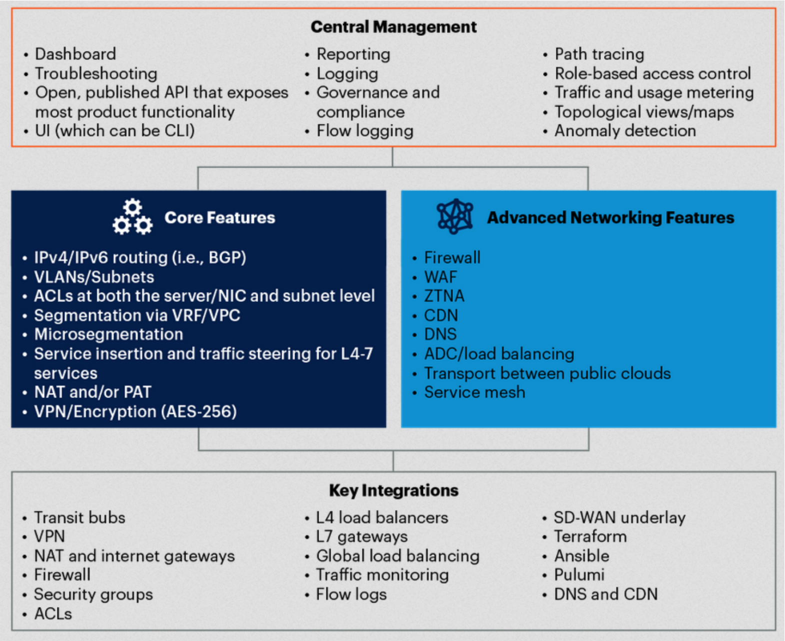
Multi-Cloud Network Topologies – SDN

- Programmability
  - Programmable, Automated, On-demand WAN Core network-as-a-service
  - Automation of SDCI service and CSP connectivity
  - Controller-based orchestration and overlay topology
  - Full segmentation, traffic engineering policy control



Multi-Cloud Network Topologies – SDN

- Feature Set for Multi-Cloud



Central Management

- Dashboard
- Troubleshooting
- Open, published API that exposes most product functionality
- UI (which can be CLI)
- Reporting
- Logging
- Governance and compliance
- Flow logging
- Path tracing
- Role-based access control
- Traffic and usage metering
- Topological views/maps
- Anomaly detection

Core Features

- IPv4/IPv6 routing (i.e., BGP)
- VLANs/Subnets
- ACLs at both the server/NIC and subnet level
- Segmentation via VRF/VPC
- Microsegmentation
- Service insertion and traffic steering for L4-7 services
- NAT and/or PAT
- VPN/Encryption (AES-256)

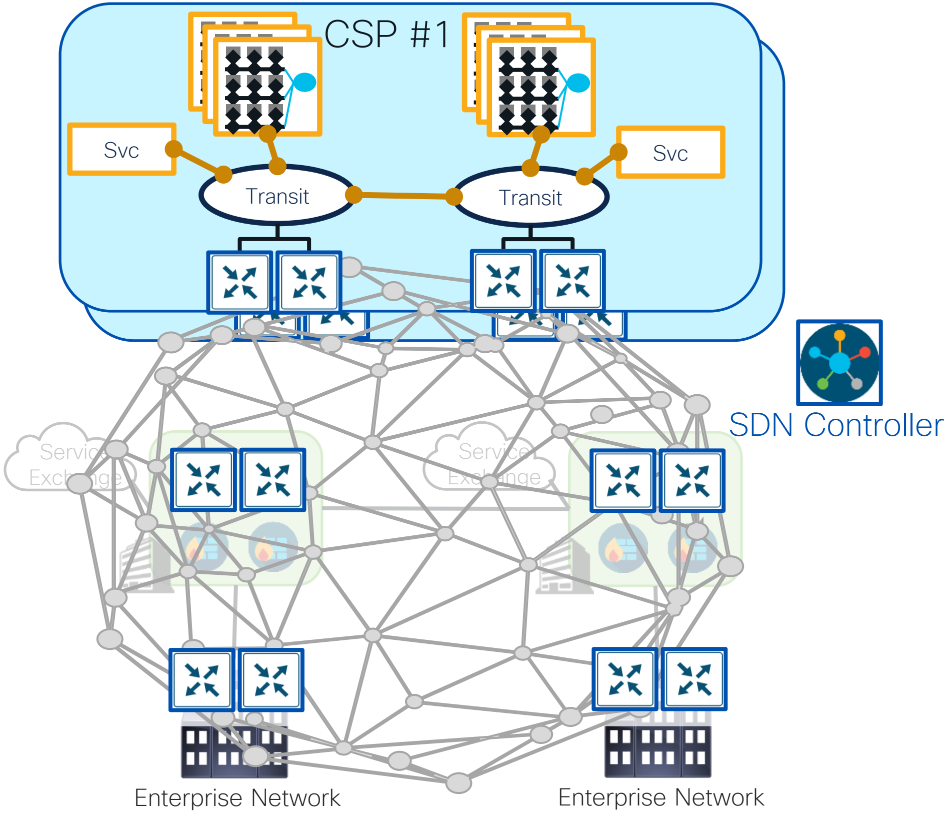
Advanced Networking Features

- Firewall
- WAF
- ZTNA
- CDN
- DNS
- ADC/load balancing
- Transport between public clouds
- Service mesh

Key Integrations

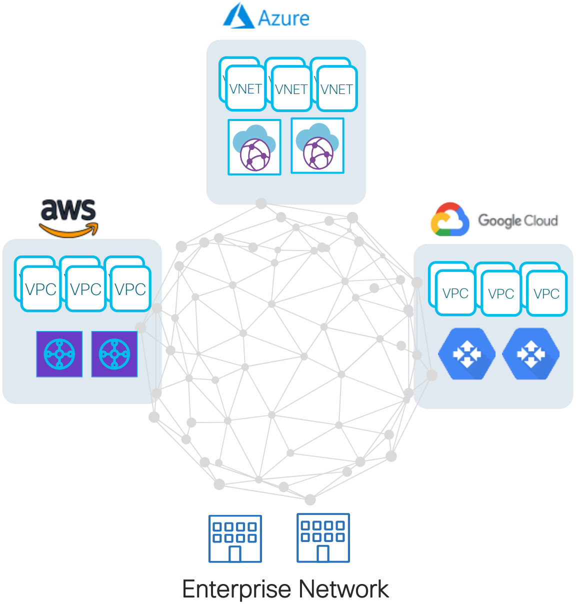
- Transit bubs
- VPN
- NAT and internet gateways
- Firewall
- Security groups
- ACLs
- L4 load balancers
- L7 gateways
- Global load balancing
- Traffic monitoring
- Flow logs
- SD-WAN underlay
- Terraform
- Ansible
- Pulumi
- DNS and CDN

Source: Gartner



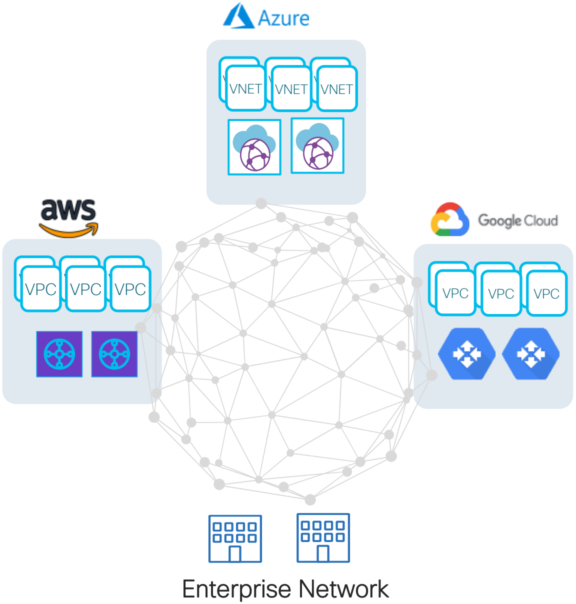
Multi-Cloud Networking

- Is there a case for SDN in Multi-Cloud?
  - + Global network, any location any service any transport
  - + Advanced features & policy engine
  - + Programmable, easy to consume
  - – Suitable non-SDN solution for the requirements
  - – Evolution of native Cloud services and networking
  - – Additional complexity, scalability



Multi-Cloud Networking

- What does the Artificial Intelligence say?

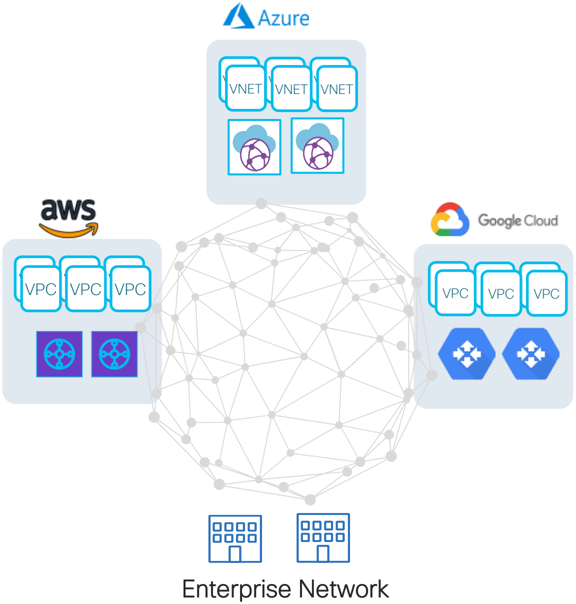


Multi-Cloud Networking

- What does the Artificial Intelligence say?

ChatGPT AI (Feb'2023):

Q) *Best approach for multi-cloud networking?*



Multi-Cloud Networking

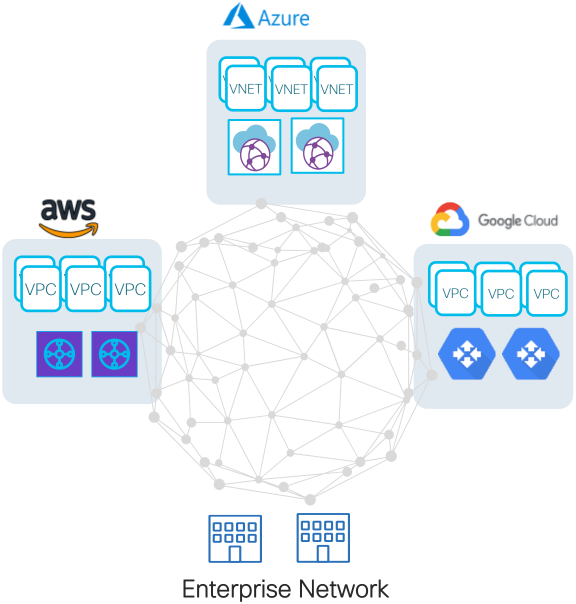
- What does the Artificial Intelligence say?

ChatGPT AI (Feb'2023):

Q) *Best approach for multi-cloud networking?*

"A commonly recommended approach for multi-cloud networking is to implement a software-defined network (SDN) solution, such as an overlay network, that abstracts and centralizes network management and allows for consistent policy enforcement across different clouds. (…)".

"Software-defined networking (SDN) solutions for multi-cloud networking have some potential drawbacks that need to be considered: complexity, interoperability, latency, scalability, security, cost."



Reference CiscoLive Sessions

- CL2023
  - BRKENT-2060: Cisco SD-WAN Cloud onramp for Multicloud
  - BRKENT-3297: Multi-Cloud SD-WAN Design
  - BRKDCN-2653: Cisco Cloud Network Controller – Hybrid Multi-Cloud Infrastructure and Policy Automation enabler
  - BRKENT-2809: Enterprise Direct Cloud Connectivity with Catalyst 8500 Series
- CL2022
  - BRKENT-2157: Securing Private Links to Public Cloud Providers
  - BRKAPP-1002: Cloud Bound, Key differences in Public Cloud Connectivity Architectures
  - BRKENT-2001: Secure SD-WAN and Cloud Edge Transformation
  - BRKDCN-2221: Architecting Hybrid / Multi-Cloud Infrastructures

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