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THE NEXT BIG...

DEAL
CONNECTION
INNOVATION
TECHNOLOGY
LEADER
NETWORK

SCTE·ISBE CABLE-TEC EXPO 2017

DENVER, CO
OCTOBER 17-20

2017 Fall Technical Forum
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Overview

- "The Cloud"
    - So many things, to so many people and companies
    - So many choices…
- Adoption and use of the cloud seeing hockey stick rates of growth
- "The Cloud" is no longer you just using someone else's servers
    - Fueling diverse, aggressive levels of innovation
    - Adopter demand is driving cloud innovation
- Cloud platforms (public, private, or hybrid) are unique
    - Different features, functionality, properties, performance, and costs
- Ballooning of cloud adoption is stretching the limits of traditional networking infrastructure, technologies, and business models

Current State of the Art

- No two approaches for leveraging cloud platforms are identical today
- Most approaches loosely fall into one of a couple categories or styles
- Full Service
    - Generally implies migration of adopter application, services, or data (in part or entirely) to a cloud platform or provider
- Dedicated
    - Adopter leverages cloud platforms but infrastructure is treated (and may look) like their own
- Network connectivity is critical in both scenarios, the absence of any or all result in customer impact
    - Lack of network capacity yields poor performance
   - Lack of diversity decreases redundancy and localization
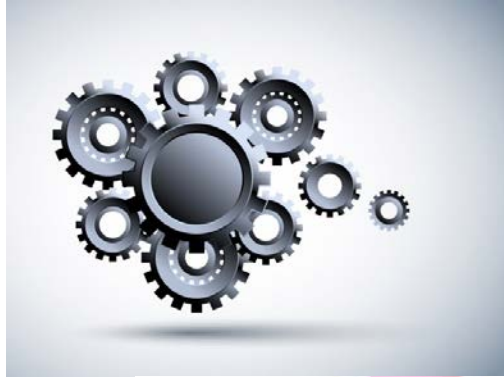
Motivations and Drivers

- Performance
    - Continue to leverage techniques and technologies to improve performance and localization
- Costs
    - Explore opportunities to reduce overall cloud costs
- Interoperability
    - Encourage greater interoperability amongst diverse cloud platforms
- Flexibility
    - Increase deployment options to improve flexibility and elasticity

Introducing CLOVER – Cloud Overlay

- Next generation approach to connecting to and leveraging cloud platforms
  - Applies to public, private, and hybrid clouds
  - Leverages existing protocols, no new protocol development required
- Virtually and securely connecting to cloud segments and platforms
  - Using a network "extension cord"
- Support across multiple cloud platforms
- Automated
 - Distributed control where desirable or required
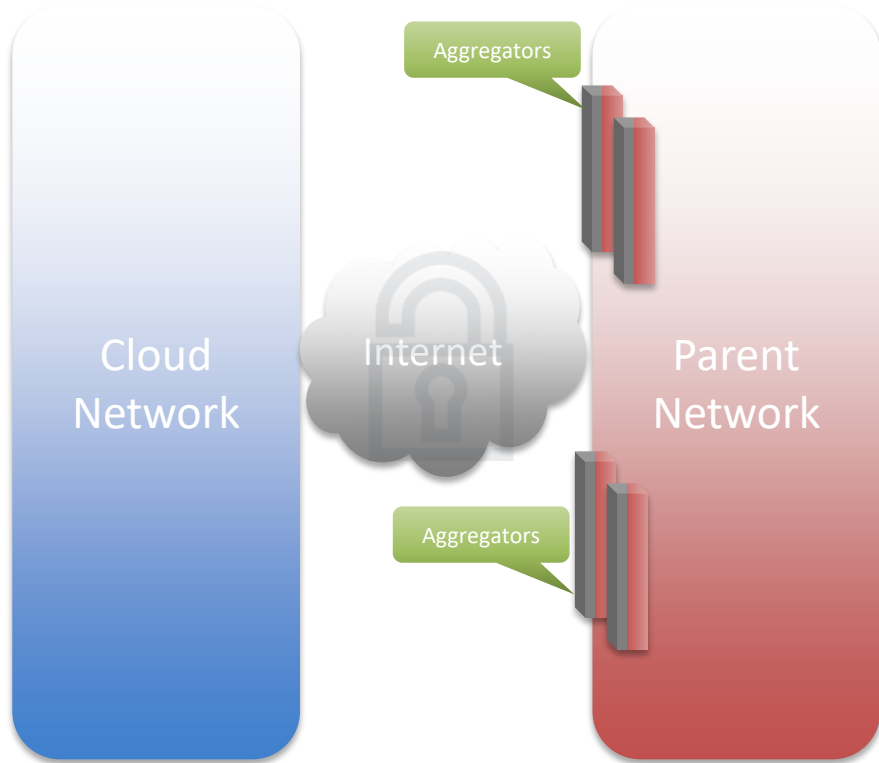
Aggregator

- Aggregation or concentrator network element that terminates secure CLOVER underlay connectivity
- Typically hardware based, but not strictly required
  - Candidate for commodity, high performance computing
- Must be redundant and secure
- Placement in the parent network determines scope of reachability via CLOVER
- Typically reachable over the Internet to maximize usability with third party cloud platforms
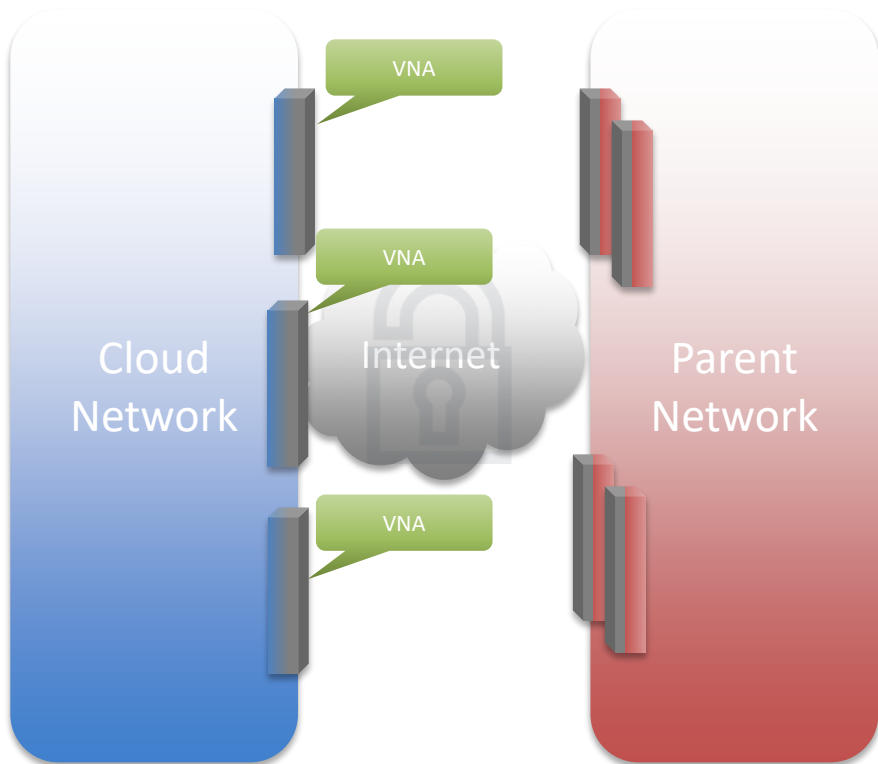
Virtual Network Appliance (VNA)

- Designed to be fully virtualized
  - For flexibility, ease of deployment, and maintainability
- High performance
  - Maximizes the performance of the underlying cloud platform computer and network
- Support for secure underlay communications
  - IPSec over IPv6 or IPv4
- Commercial or open source
  - Third party images available natively in many third party clouds
 - High performance open source platforms including VPP via fd.io
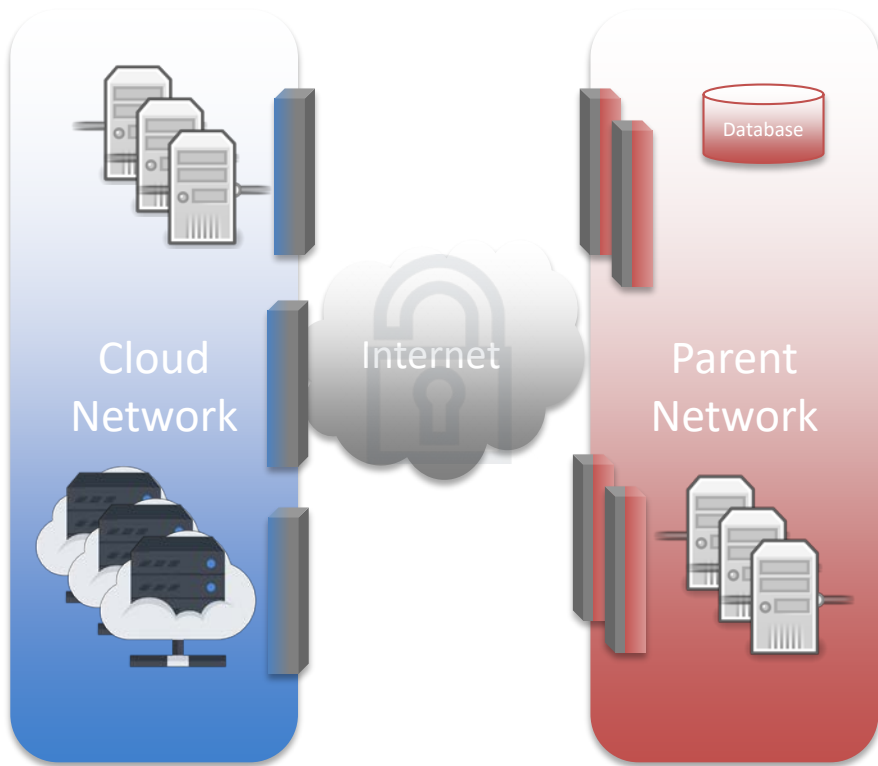
Hosts

- Bare metal or virtual machines
    - Resident on the cloud and parent network
    - Must be able to communicate, securely to one another
- End user specific applications, services, and data may be on hosts in a CLOVER deployment
- Hosts with CLOVER are just like any other hosts
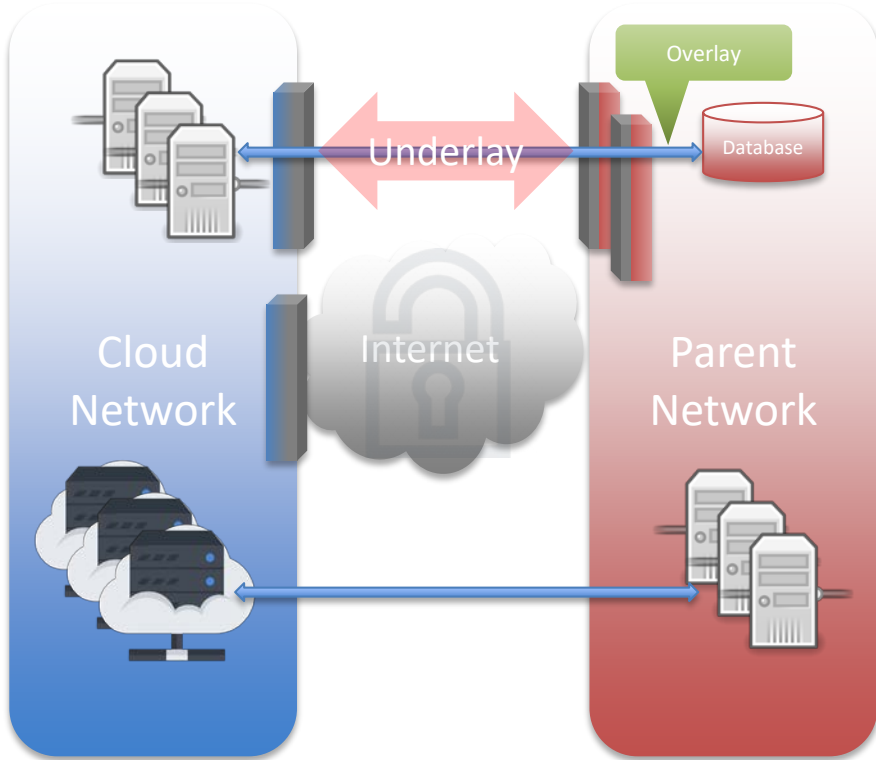
Connectivity Models

- CLOVER connectivity defines, determines, and dictates host reachability
  - Applies equally to hosts on the cloud and parent networks
- Connectivity models and properties impact behavior of a CLOVER deployment
  - Performance
  - Localization
  - Capacity requirements for the underlay and overlay
- Underlay are most similar to virtual private networks (VPNs)
  - Except on a much larger scale
  - Underlay for CLOVER is a secure, virtual network connection
- Overlay communications are the actual application or service traffic
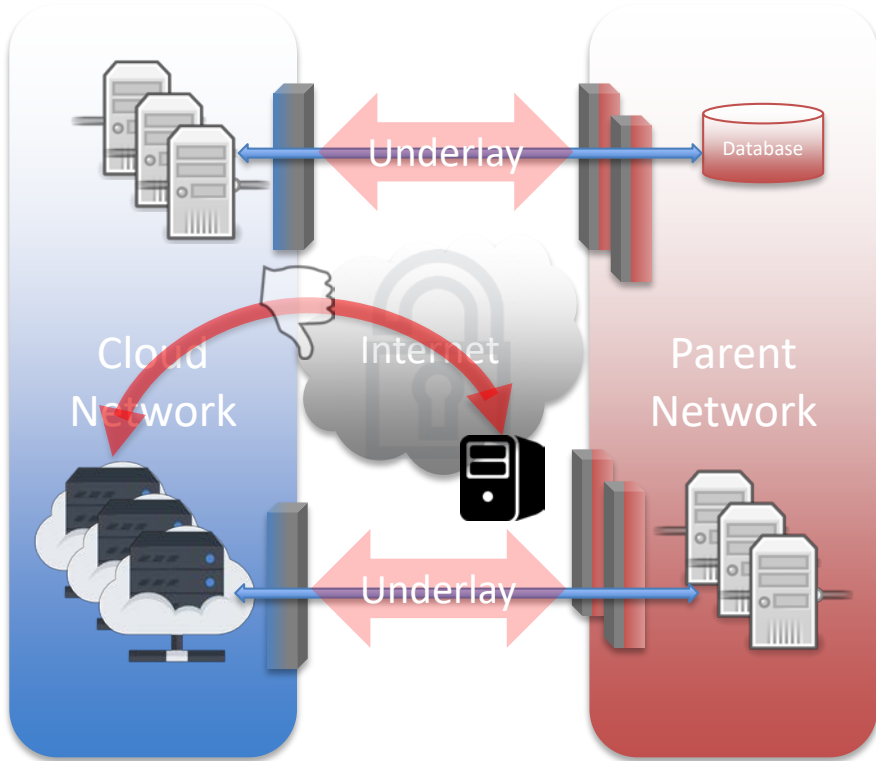
Converged Connectivity

- All communications to and from hosts in the cloud to hosts on the parent network traverse a CLOVER underlay

- Internet facing reachability for hosts in the cloud is restricted/unsupported

- Increase capacity and performance requirements for the CLOVER VNA and Aggregators
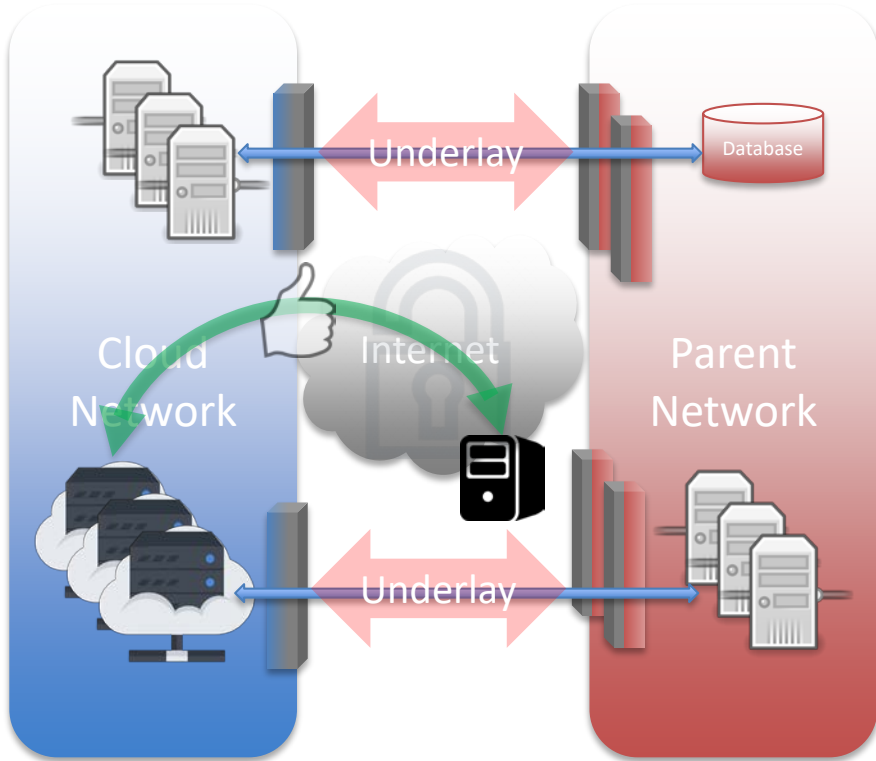
Split Connectivity

- A subset of host to host communications traverses the secure CLOVER underlay

- Communications to and from hosts in the cloud are permitted directly from the Internet

- Bifurcating communications to and from hosts in the cloud decreases capacity and performance requirements on the CLOVER VNAs

  - Potentially improves overall performance of a deployment that leverages CLOVER

Deploying CLOVER

- Virtualization and automation are cornerstone concepts for CLOVER

- Leverage programmatic interfaces or APIs for CLOVER Aggregators

    - Automated CLOVER underlay provisioning and decommissioning

    - Ease of migration

- Leverage rich, existing interfaces to public, private, and hybrid cloud platforms

    - Automate the creation, deployment, and provisioning of CLOVER VNAs (virtual machines)

    - Secure underlay can be established from the CLOVER VNA to the CLOVER Aggregator over the Internet, no dedicated connections required

    - Tunable levels of security based on deployment requirements

- Utilize private, public, and hybrid cloud interfaces to build and deploy hosts

    - Automate the provisioning and association of host to CLOVER VNAs

- Deployments can leverage customized network properties

    - IP address families for underlay and overlay communications

    - Use of "bring your own" IP address space (IPv6 and/or IPv4)

CLOVER Enhancements

- Enhancements to VNA technology to increase performance and reduce costs and capacity requirements
    - Includes the evolution of open source implementation coupled with advancements in commodity hardware performance
- Explore opportunities that are only possible using IPv6
    - Implement support for IPv6 Segment Routing to optimize VNA to Aggregator communications
- VNA bypass
    - Allow hosts that are CLOVER capable to communicate directly to CLOVER Aggregators, or other CLOVER capable hosts (mesh)
    - The use of IPv6 Segment Routing by CLOVER capable hosts for host-to-host communications

Summary

- Cloud adoption and use will only continue to grow
    - As will the challenges and opportunities
- Cloud providers and platforms will continue to innovate and develop new technologies
    - That end user want and need, or
    - To simply attract new customers
- Cloud adopter realizations include:
    - The need for tools and technology that enable flexibility and increase performance
    - Mechanisms to manage costs
    - Leverage the benefits of diverse cloud platforms, securely
- CLOVER-oriented solutions represent an opportunity and the means to shift the cloud adoption paradigm