## Project Description

### What is Ciao?

Ciao (Cloud Integrated Advanced Orchestrator) is a cloud orchestration system developed by Intel. A cloud orchestration system manages the allocation and use of resources in a cloud environment, such as compute cycles, networks, and storage. Ciao provides an easy to deploy, secure, scalable system which handles virtual machines (VMs), containers, and bare metals apps as generic workloads.

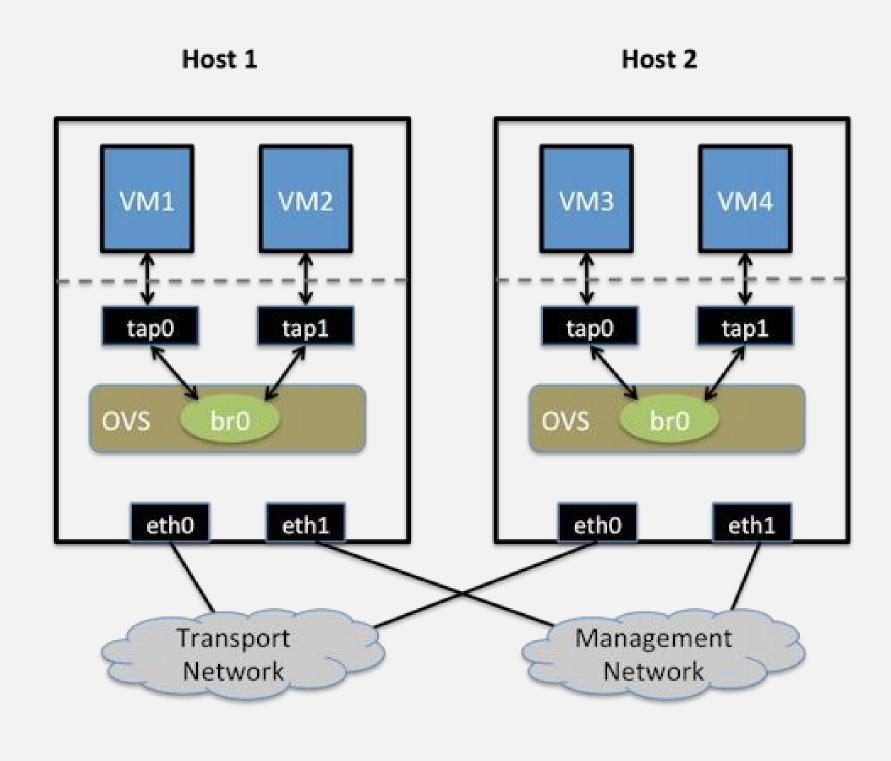
### The Problem

Ciao uses standard Linux networking tools and network objects managed by the Linux kernel to create and manage software defined networks for VMs. The current implementation is not compatible with new areas of innovation in networking technologies.

### **Proposed Solution**

Our proposed solution is to explore implementing network creation and management in Ciao using Open vSwitch (OVS). OVS is a software implementation of a multilayer network switch that supports many standard network interfaces and protocols, with Virtual Extensible LAN (VxLAN) and Network Virtualization using Generic Routing Encapsulation (NVGRE) being the technologies of primary interest. With these technologies, OVS is used to dynamically create bridges and tunnel endpoints between nodes in the cluster being managed by Ciao.

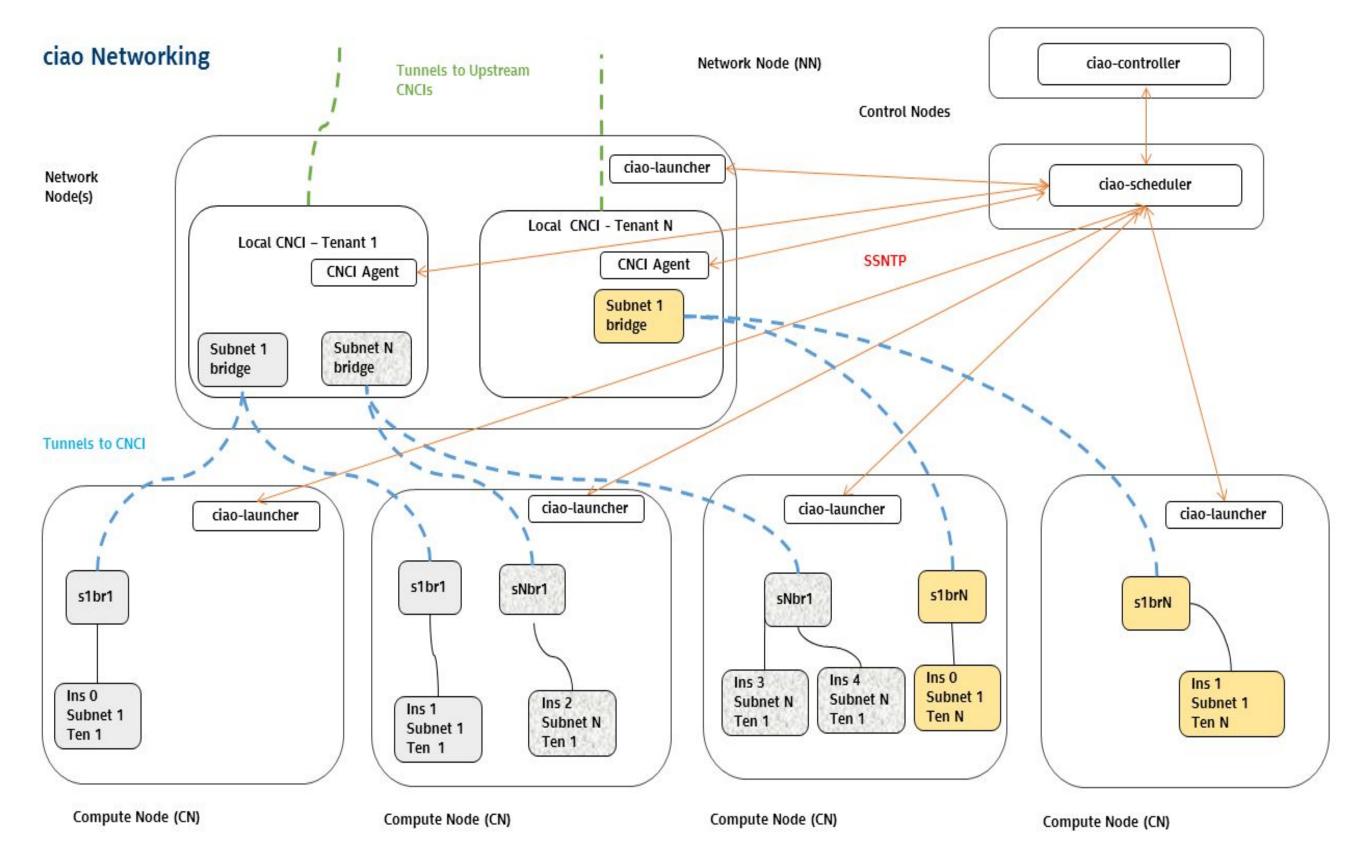
### Open vSwitch Tunneling Diagram



Source: http://docs.openvswitch.org/en/latest/\_images/tunneling.png

# Cloud Orchestration Networking

Increasing server-to-server speed, and increased scalability



Source: https://github.com/01org/ciao/blob/master/networking/documentation/ciao-networking.png

# Findings and Results

The objective of the project was to explore full integration of the Open vSwitch (OVS) virtual switch platform into Ciao. These were our findings:

- Proof of concept of communication between two virtual machines using an OVS bridge on the host is successful.
- Open vSwitch does not recognize networking interfaces, bridges, or tunnel endpoints managed by the Linux kernel. Each of these must be created individually by OVS.
- A full replacement of tunnel endpoints and Linux bridges with Open vSwitch bridges and endpoints was required for Ciao integration.
- When the OVS network mode is selected via user configuration, the Ciao SDN will use OVS bridges and tunnel endpoints for controller and compute node network connections.
- Switching to innovative tunneling protocols such as VxLAN and NVGRE is as simple as a single parameter change with Open vSwitch tunnel creation.

### Technical Details

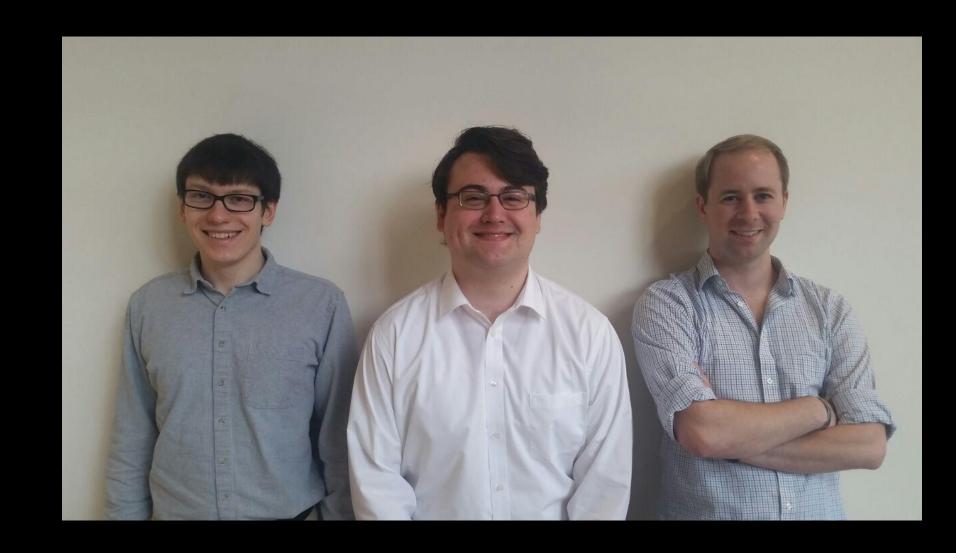
#### Ciao Software Defined Network

- Simpler Software Defined Network (SDN) implementation. An SDN is a network layer defined in software rather than on physical switches and routers.
- Targets small or medium enterprise datacenters with several hundred servers
- Creates self-configuring, stateless, software defined overlay networks for tenants on top of existing networking hardware
- Uses Linux bridges and GRE tunnels to create overlays

#### • Problems:

- Current SDN innovation is being done with Open vSwitch
- Linux bridges and GRE tunnels used by Ciao are not compatible with Open vSwitch

### The Team



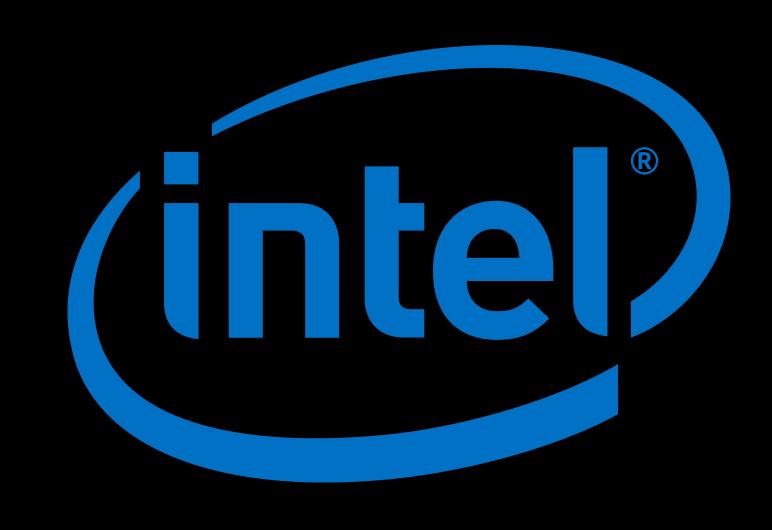
# Project Members and Sponsor

### Team Members

Garrett Smith, Computer Science smithgar@oregonstate.edu

Cody Malick, Computer Science malickc@oregonstate.edu

Matthew Johnson, Computer Science johnsma8@oregonstate.edu



### **Project Sponsor**

Robert Nesius, Engineering Manager, OTC Advanced Systems Engineering, Intel Corporation

Special thanks to Intel Principal Engineer Manohar Castelino

Oregon State
UNIVERSITY