

SD

The word cloud illustrates the key concepts and applications of SDN:

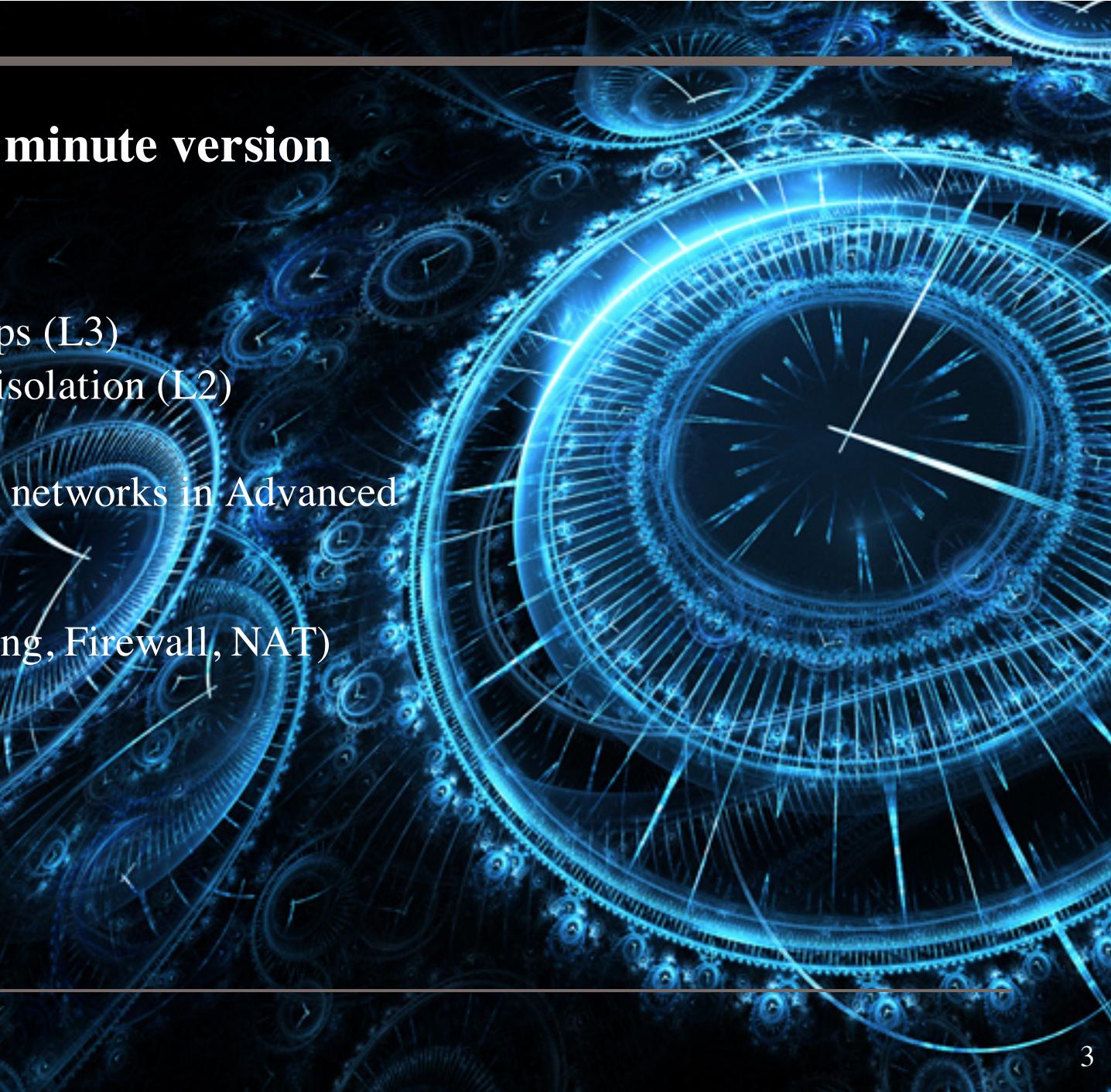
- SDN**: The central focus, appearing in large, bold letters.
- network**: A large word associated with the core concept of networking.
- control plane**: A large word indicating the separation of control from data.
- data center**: A significant application area for SDN.
- virtualization**: A key technology used in SDN.
- switches**: Network hardware components.
- routing**: A fundamental function managed by SDN.
- forwarding**: Another basic function.
- switch fabric**: The internal structure of switches.
- host**: Refers to end-user devices.
- VMs**: Virtual machines running on hosts.
- compute**: Refers to processing power.
- storage**: Refers to storage resources.
- application**: The software layer.
- management**: The control layer.
- programming**: The interface between management and the network.
- abstraction**: Separating the physical from the logical.
- decoupling**: The separation of control and data planes.
- reliability**: A desired characteristic of SDN infrastructure.
- scalability**: The ability to handle increasing traffic volumes.
- flexibility**: A key benefit of SDN.
- automation**: The use of scripts and APIs for configuration.
- policy-based**: A way to manage network behavior.
- policy**: The rules and configurations applied to the network.
- quality of service**: Ensuring priority for certain traffic types.
- traffic engineering**: Optimizing network paths.
- content delivery networks**: A specific application of SDN.
- mobile networks**: Another application area.
- internet of things**: Emerging technologies.
- big data**: The analysis of large amounts of network data.
- cloud computing**: Another application area.
- mobile devices**: End-user devices.
- user experience**: The overall quality of service for users.

About me

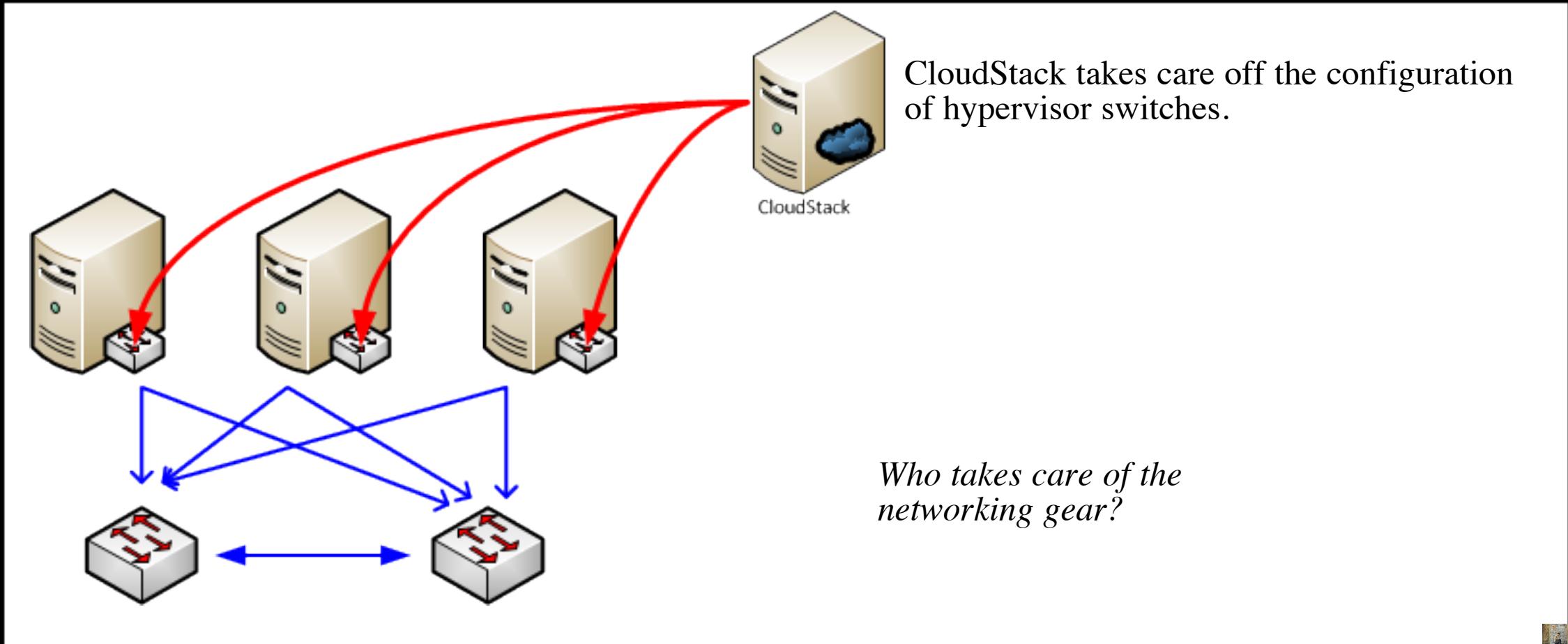
- » Hugo Trippaers
 - Email: htrippaers@schubergphilis.com
 - Twitter: [@Spark404](https://twitter.com/Spark404)
 - Freenode: [Spark404](#)
- » I've been working in IT for over two decades, mainly at ISP and hosting companies
- » Mission Critical Engineer at Schuberg Philis for almost 6 years.
 - Responsible for the 100% availability of our customers application landscapes
 - Currently part of the internal development team
- » PMC member for Apache Cloudstack

CloudStack networking - the five minute version

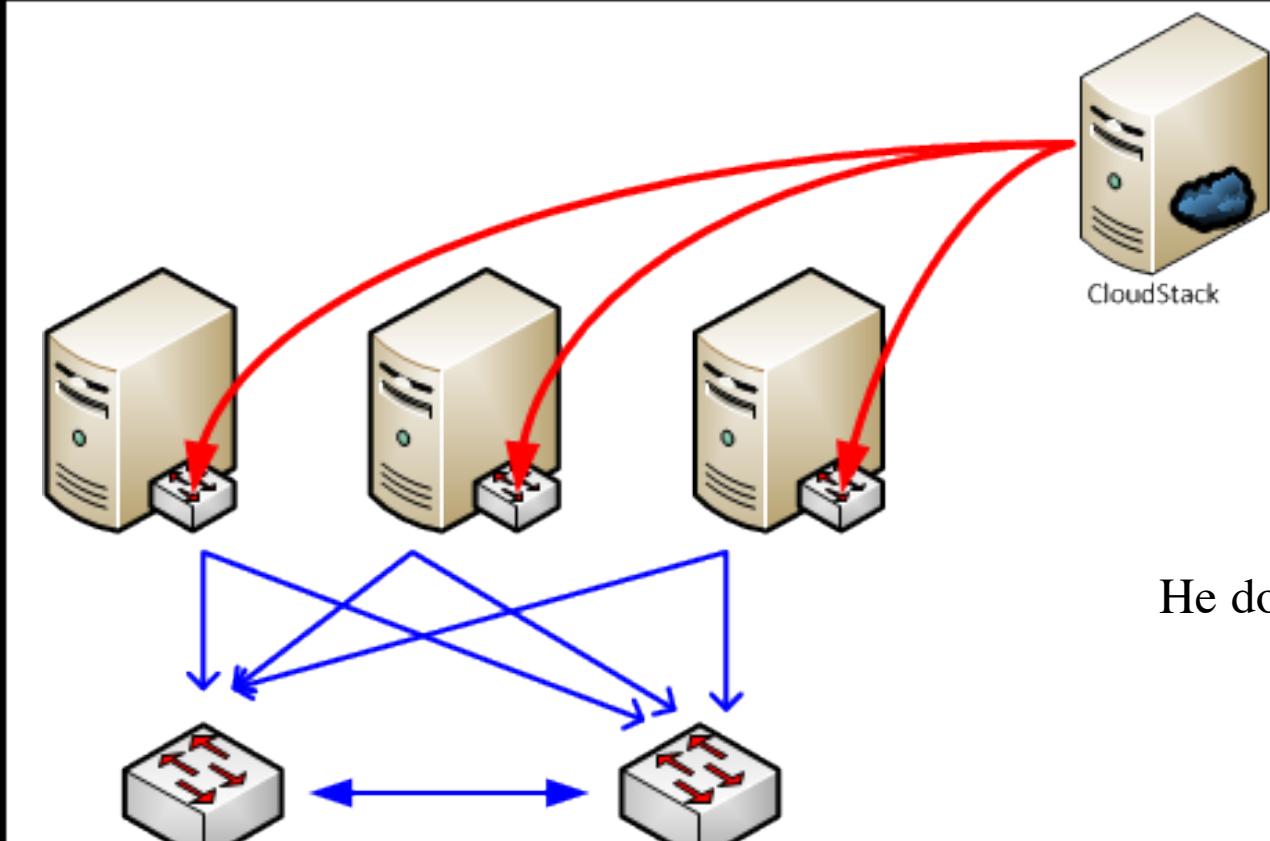
- » CloudStack networking
 - Basic, isolation using security groups (L3)
 - Advanced, isolation using network isolation (L2)
- » SDN was introduced to create isolated networks in Advanced zones
- » By now it can do much more... (Routing, Firewall, NAT)



Isolation with VLAN



Isolation with VLAN

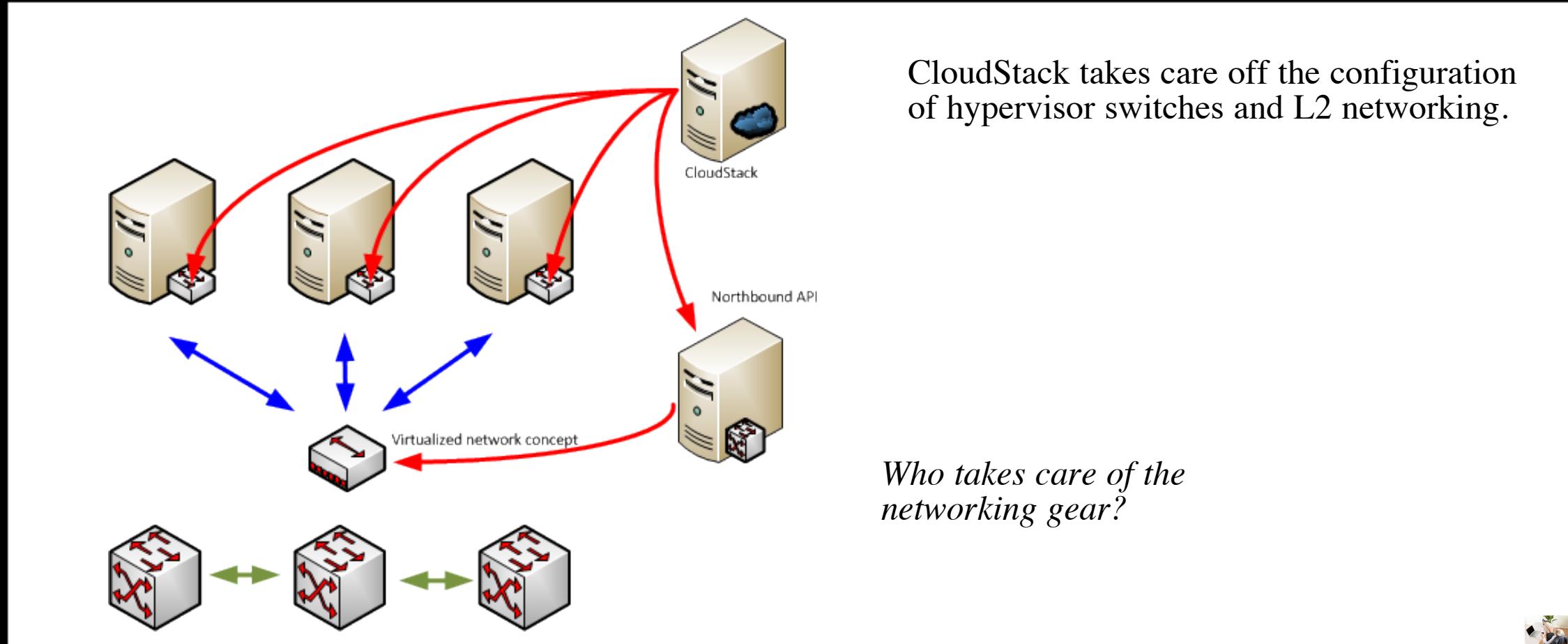


CloudStack takes care off the configuration of hypervisor switches.

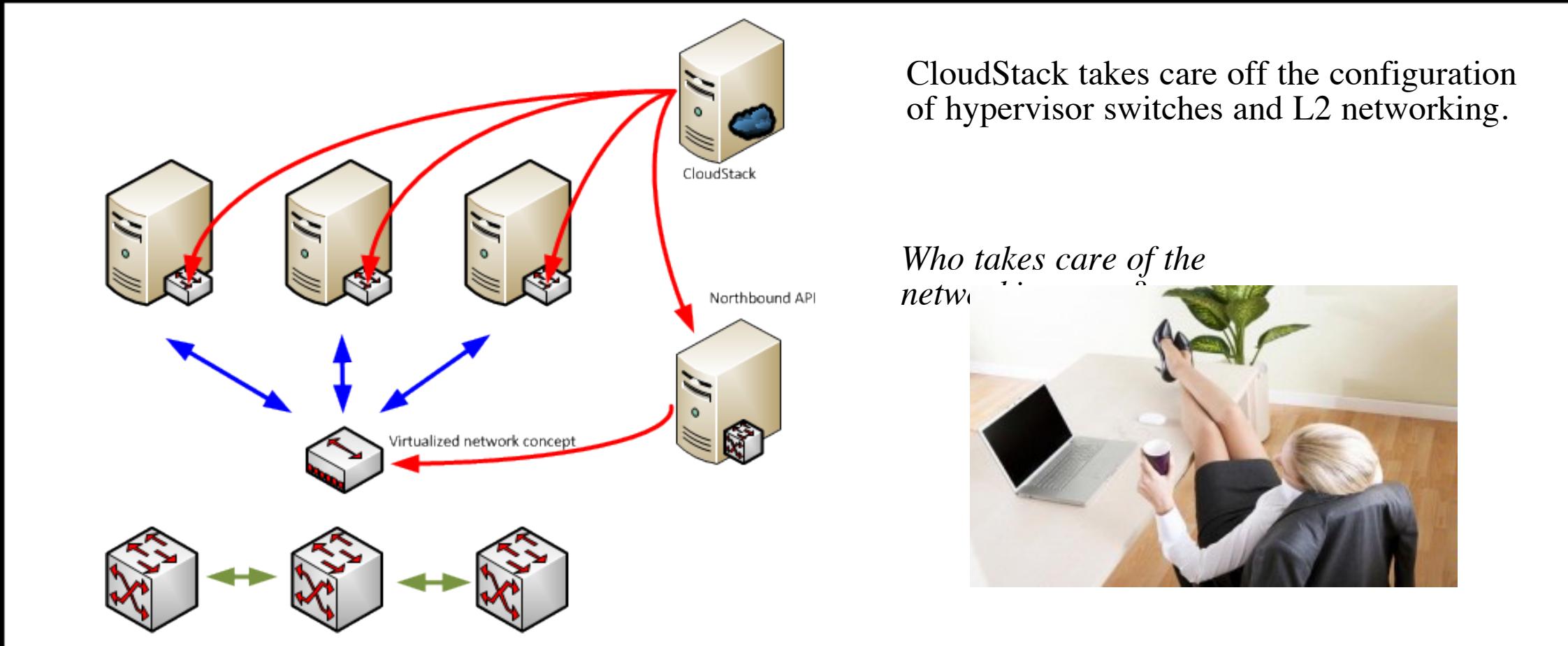
He does...



Isolation with Software Defined Networking



Isolation with Software Defined Networking



Software defined networking - core concepts

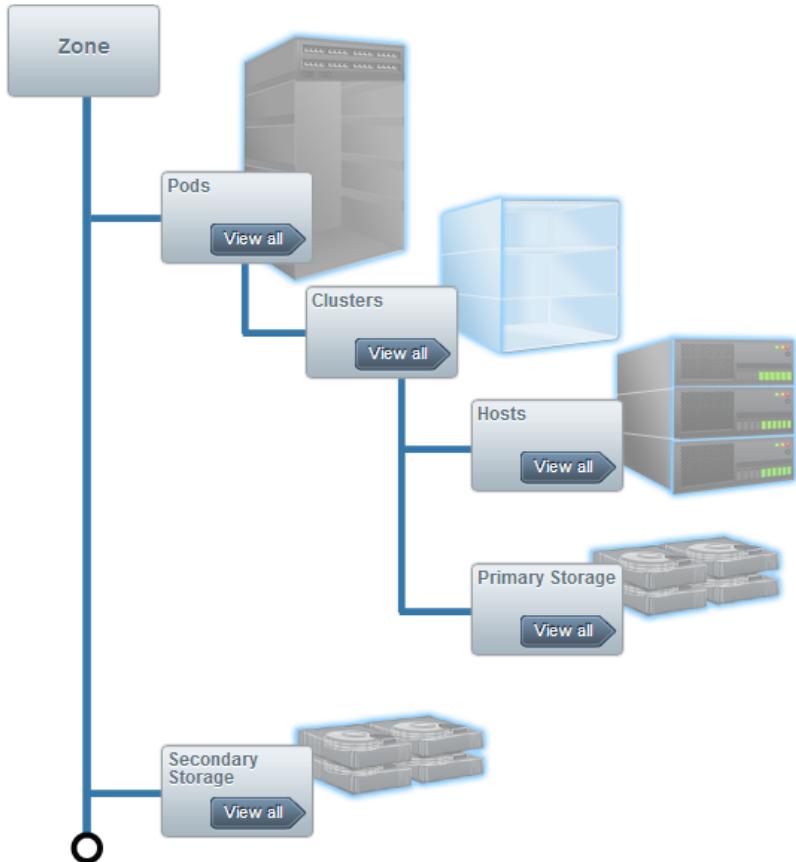
- » Decouples the control plane (what data is going where) from the data plane (how to get data there)
- » Makes network management easier by abstracting low-level functionality into virtual services.
 - Independent of hardware and/or vendor
- » Provides a Northbound API
 - Allows administrators to use automated tooling to provision services
- » Scale?

Software Defined Networking - advanced

- » Where can we go if we have a software based network infrastructure.
 - Distributed routing?
 - Integrated security framework?
 - Application controlled networking?
- » Endless possibilities, it's all software anyway

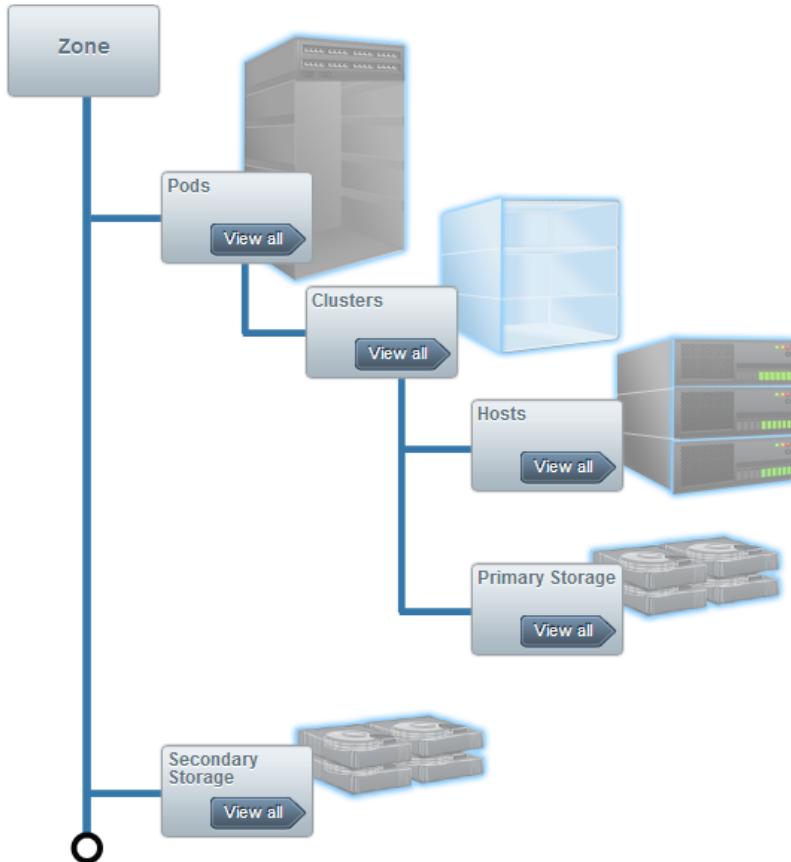
SDN in CloudStack

Where is it?



SDN in CloudStack

Where is it?



Implemented in the core of CloudStack.

“Movable parts” configured per plugin.

Controlled by existing offering model.

SDN implementations

	Isolation	DHCP	Firewall	NAT	Security Groups	VPC
GRE isolation	Pre ACS	-	-	-	-	-

SDN implementations - GRE isolation

- » Uses the existing implementation of OpenVSwitch in XenServer and XCP
 - Uses the OpenVSwitch GRE tunnels to “link” OpenVSwitch bridges between hypervisors
 - Entirely controlled by CloudStack
- » Pros
 - Doesn’t require external components
- » Cons
 - Bandwidth is limited due to lack of offloading
 - Large deployments require a lot of tunnels
 - Limited set of hypervisors supported (XenServer)

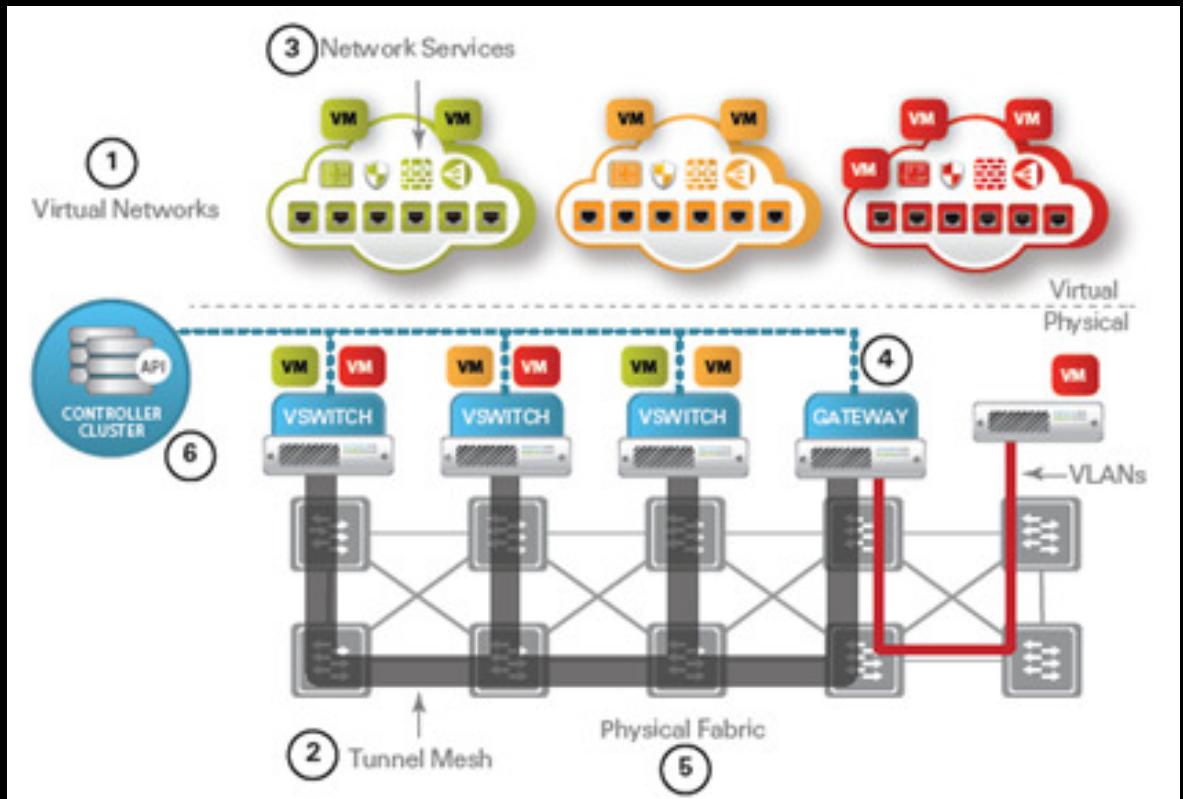


SDN implementations

	Isolation	DHCP	Firewall	NAT	Security Groups	VPC
GRE isolation	Pre ACS	-	-	-	-	-
Nicira NVP	≥ 4.0	-	-	-	-	-

SDN implementations - Nicira NVP

- » A commercial SDN solution developed by Nicira. Uses both OpenVSwitch and OpenFlow to build overlay tunnels on an existing network.
- » Pros
 - STT tunnel protocol is optimized for high-bandwidth
 - Includes a gateway to link existing L3 or L2 networks to the virtual switch
- » Cons
 - Requires custom OpenVSwitch on hypervisors.

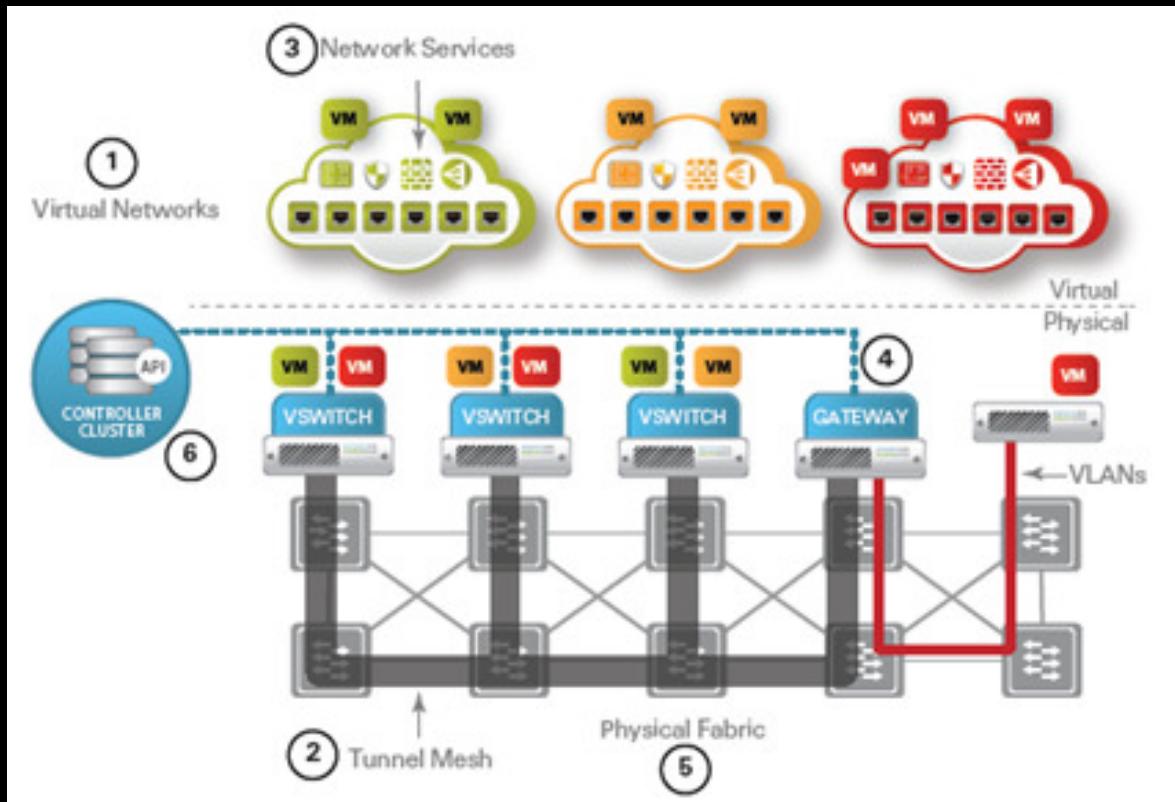


SDN Implementations

	Isolation	DHCP	Firewall	NAT	Security Groups	VPC
GRE isolation	Pre ACS	-	-	-	-	-
Nicira NVP	≥ 4.0	-	≥ 4.1	≥ 4.1	-	≥ 4.1
Big Switch VNS	≥ 4.1	-	-	-	-	-

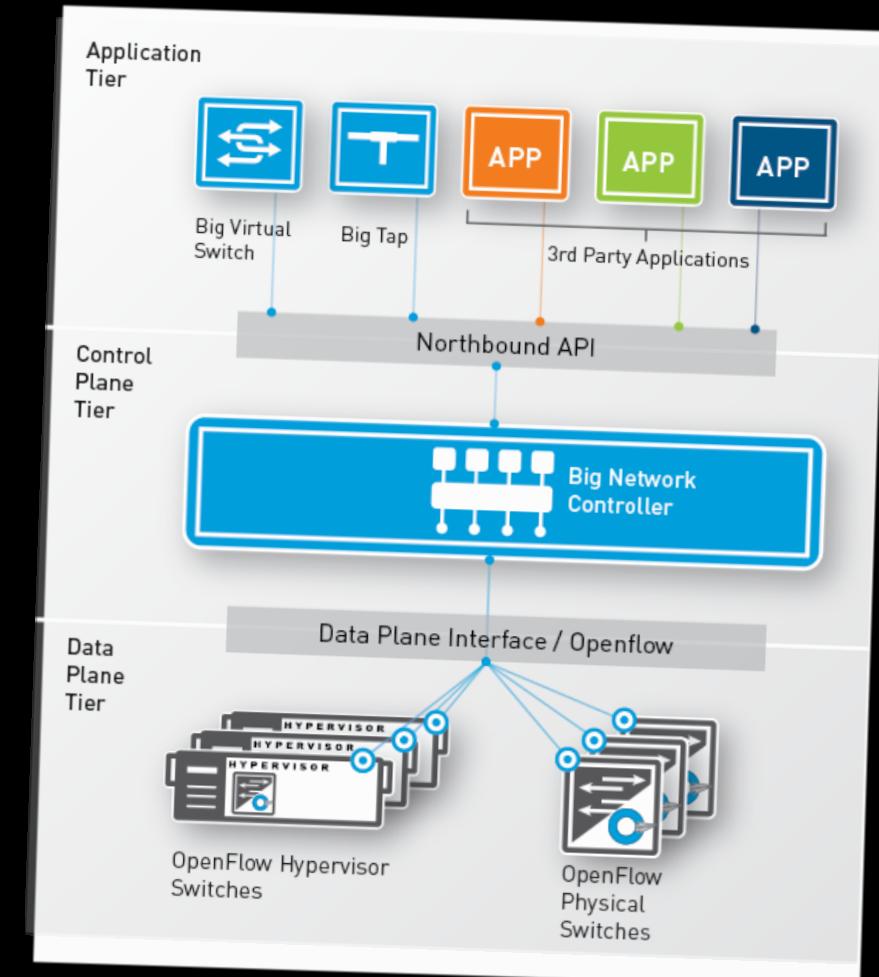
SDN implementations - Nicira NVP (>= ACS 4.1)

- » Nicira NVP plugin is updated to support L3 functionality. With this functionality the existing VRouter can be replaced with a SDN based construct.
- » Several changes have been made to the VPC setup to support SDN based networks in VPCs.



SDN implementations - BigSwitch VNS

- » The Big Switch Networks plugin is a CloudStack SDN plugin using the BigSwitch VNS platform. While BigSwitch VNS is a commercial solution, it is completely based on open standards like OpenFlow
- » Pros
 - Uses open standards
- » Cons
 - Requires hypervisors are switches to support OpenFlow

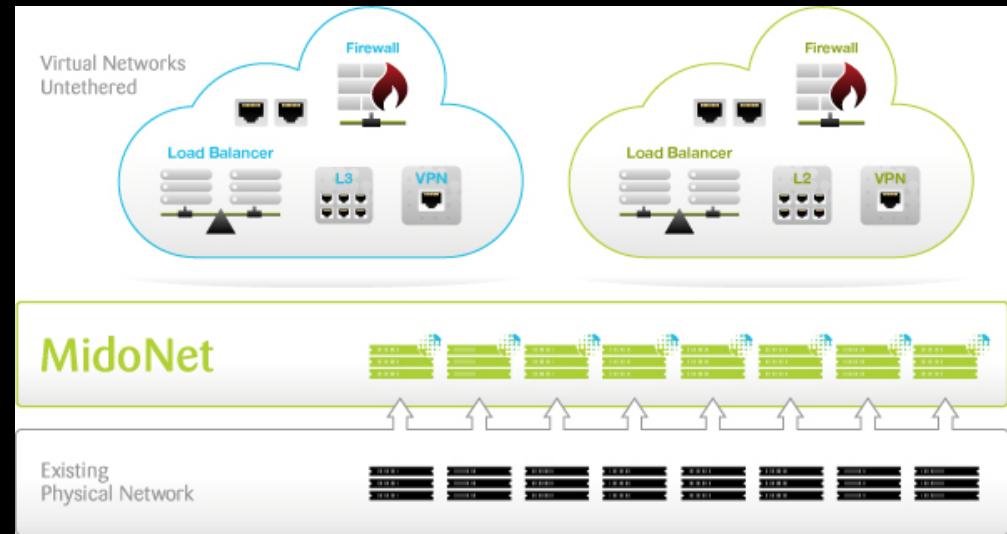


SDN Implementations

	Isolation	DHCP	Firewall	NAT	Security Groups	VPC
GRE isolation	Pre ACS	-	-	-	-	-
Nicira NVP	≥ 4.0	-	≥ 4.1	≥ 4.1	-	≥ 4.1
Big Switch VNS	≥ 4.1	-	-	-	-	-
Midokura Midonet	master	master	master	master	-	-
Stratosphere SSP	review	-	-	-	-	-

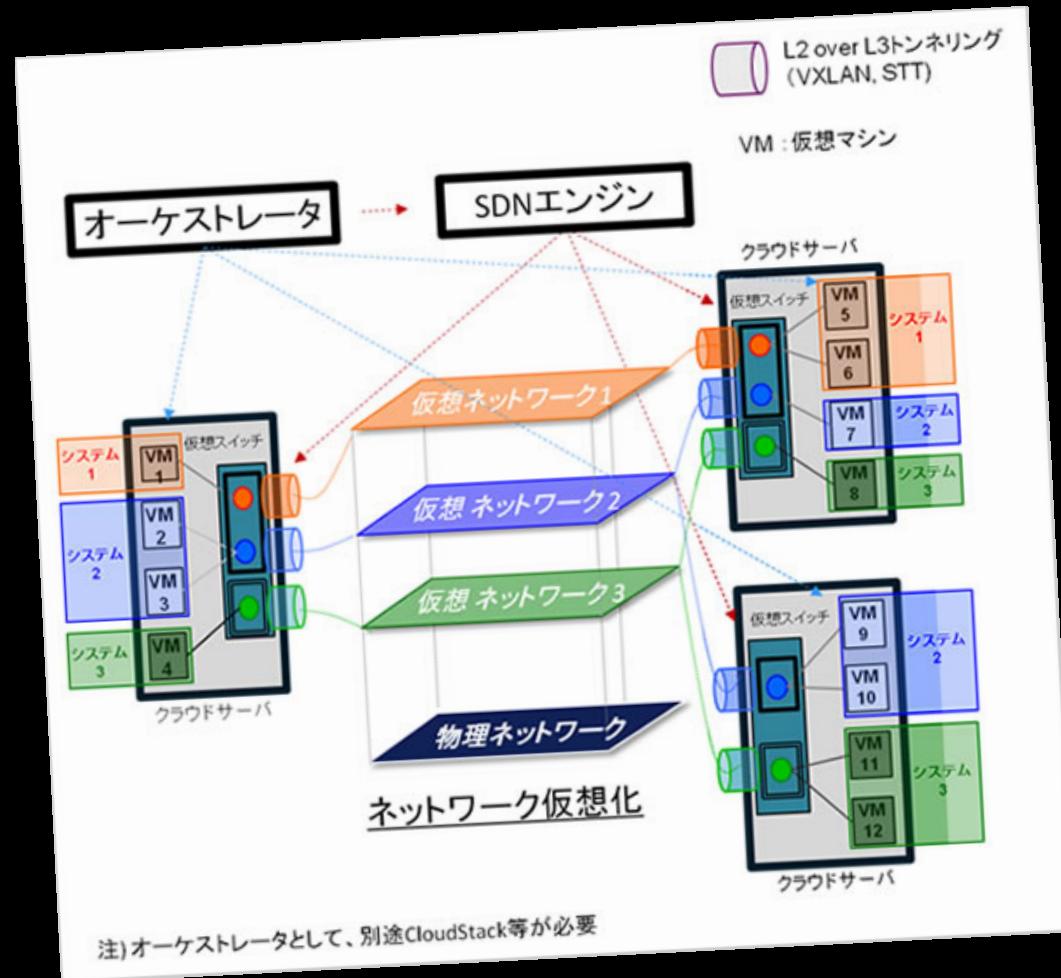
SDN implementations - Midokura Midonet

- » Midokura Midonet is implemented as a CloudStack plugin. It offers a complete set of advanced features like DHCP, L3 Routing and various NAT options.
- » Pros
 - Complete solution for building standard networks including L3 functions.
- » Cons
 - Can only be used with the KVM hypervisor.



SDN implementations - Stratosphere

- » Stratosphere SSP is an SDN controller that controls or brokers physical and or virtual network devices. Stratosphere SSP will build a vxlan backed overlay network. The plugin makes L2 connectivity service provided by SSP.
- » Not much information available yet.



SDN implementations - next steps?

- » Support for VPC
 - Including private gateways
- » Common configuration and setup
- » Security Groups

SDN in CloudStack - how does it work

- » Preparing a SDN solution for use requires some configuration work up front



Preparation - Configure physical network

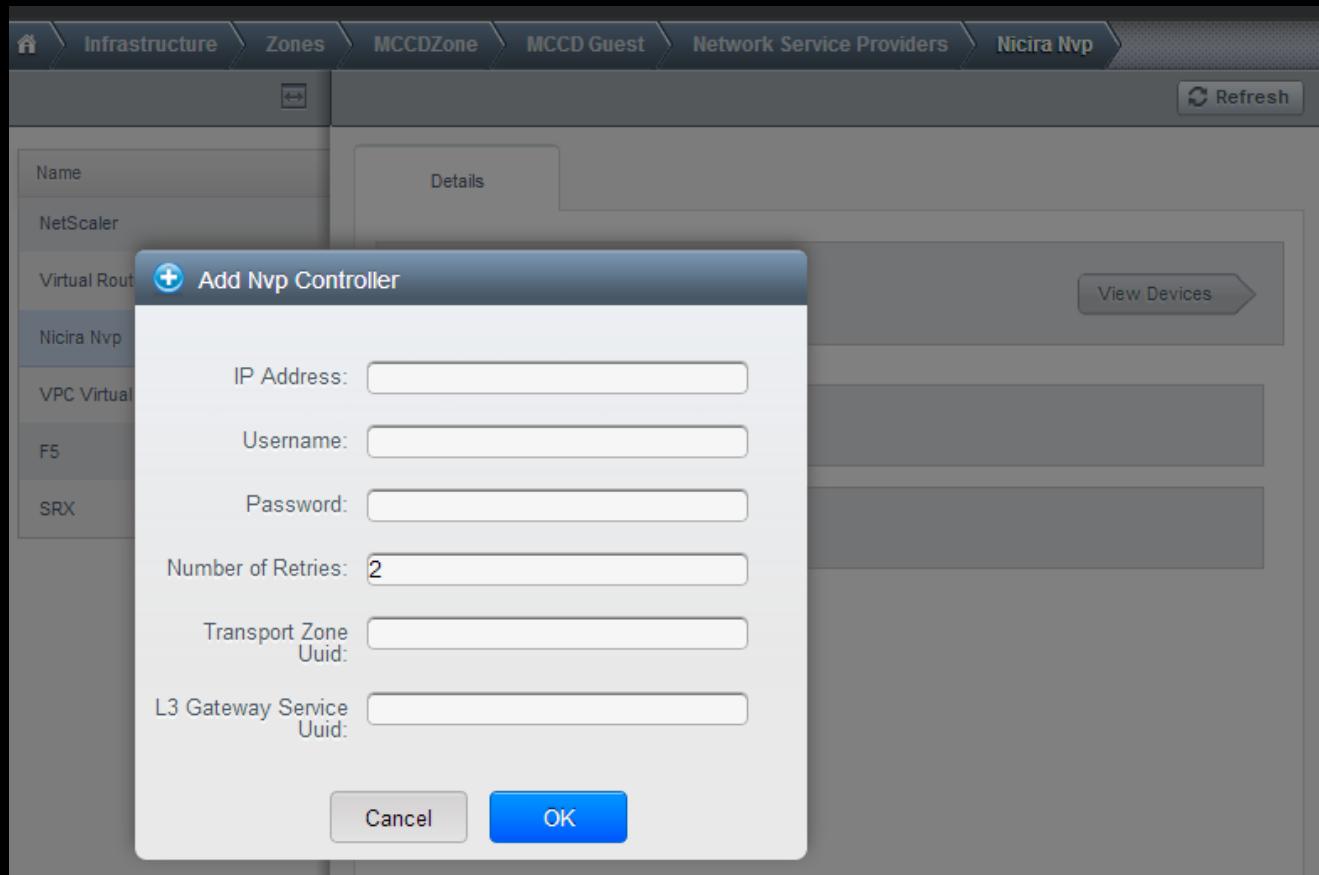
- » The physical network defines the type of L2 isolation used.

The screenshot shows a software interface for managing cloud infrastructure. The top navigation bar includes icons for Home, Infrastructure, Zones, and MCCDZone, with a Refresh button on the right. Below the navigation is a horizontal tab bar with five tabs: Details, Compute and Storage, Physical Network, Resources, and System VMs. The Physical Network tab is selected, indicated by a grey background. A table below the tabs lists two entries:

Name	State	Isolation method	Actions
MCCD Mgmt	<input checked="" type="radio"/> Enabled	VLAN	
MCCD Guest	<input checked="" type="radio"/> Enabled	STT	

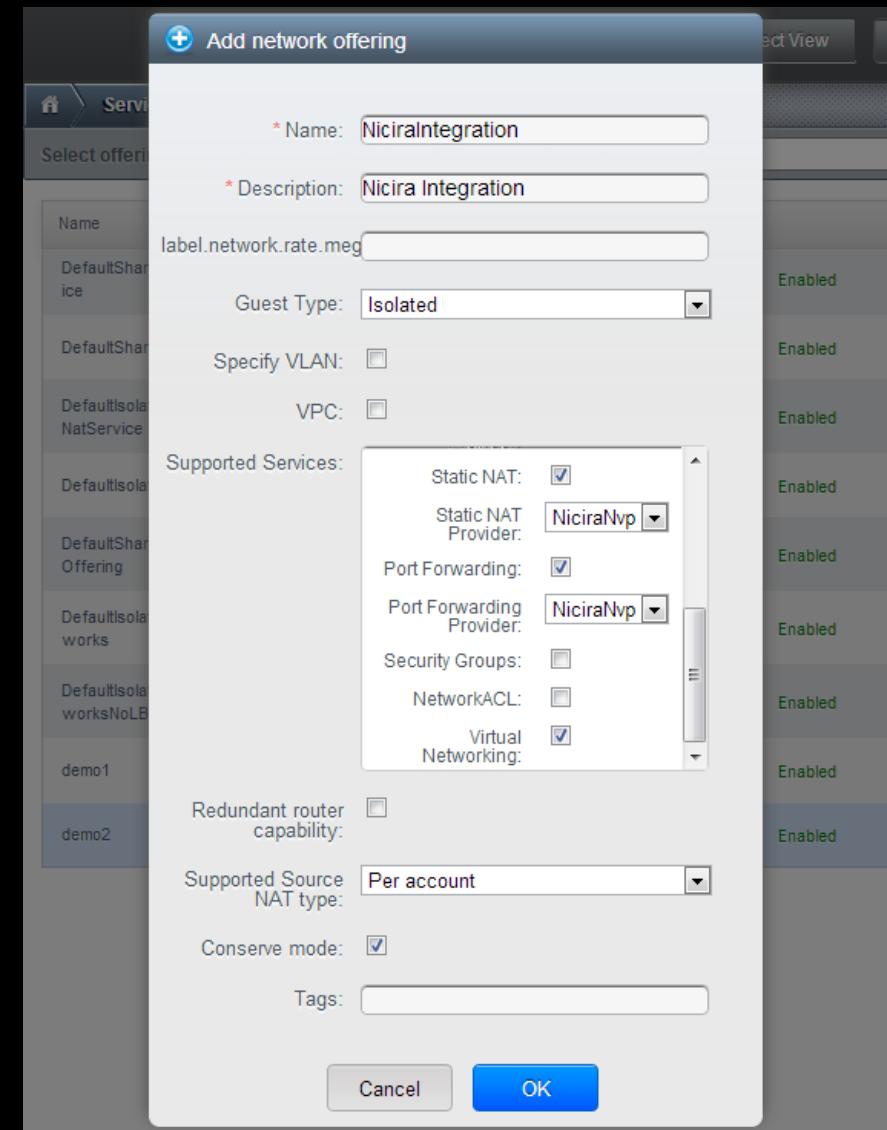
Preparation - Setup Providers

- » The provider is the place to configure the SDN controller
- » Not used by the GRE tunnels, that is configured using configuration parameters.



Preparation - Setup network offerings

- » Connectivity is key
- » Services define where and how SDN is used in the offering



SDN in CloudStack - how does it work

- » Preparing a SDN solution for use requires some configuration work up front
- » Using the SDN solution is as straight forward as any networking in CloudStack



Usage - Creating a new network

- » The role of Network Gurus
 - each guru supports a specific type of network
 - select based on a number of criteria, of which isolation type is only one
- » Selected guru is stored in the database for this particular network.



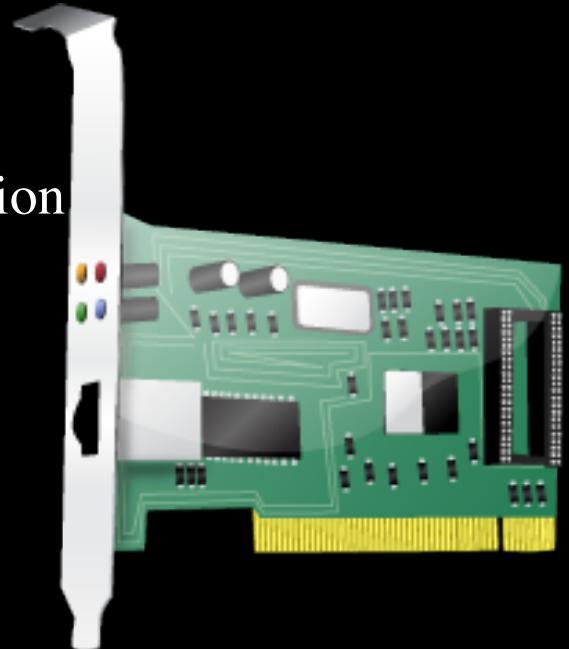
Usage - Creating a new network

- » The role of Network Elements
 - triggered when ever a new NIC is attached to a network
 - configure devices like firewall, routers, etc..
- » Elements are selected based on the network offering used to create the network.



Usage - My first VM

- » Multiple actions happen at the same time
 - network elements
 - hypervisor resources
- » The NIC is the linking pin between a VM and the SDN implementation
- » The hypervisor sets flags to allow the VIF to be found
- » The network element tells the SDN solution what to look for
- » Not a generic way of doing things, depends on the SDN in use.



Usage - Ready

The screenshot displays two overlapping web-based management interfaces. The top interface is the CloudStack 'Network - Guest networks' view, showing a single entry for 'htrippaers-default' with account 'htrippaers_admin', type 'Isolated', VLAN 'N/A', and CIDR '10.1.1.0/24'. The bottom interface is the Nicira NVP Manager 'Logical Switch "lswitch-htrippaers-default"' configuration page. This page shows the logical switch's UUID as '746cdf8f-9930-4ed8-a6e4-120bab7b9565', its status as 'Up', and its configuration, including 'Port Isolation' set to 'Disabled'. It also displays statistics such as 'Configured Ports: 11' and 'Attach Points Up: -'. The browser address bar indicates the URL is 192.168.12.50/1/resource/lswitch/746cdf8f-9930-4ed8-a6e4-120bab7b9565.

Thats all there is to it

- » <http://apache.cloudstack.org>
 - » <http://www.nicira.com>
 - » <http://www.bigswitch.com>
 - » <http://www.midokura.com>
 - » <http://www.ij.ad.jp/en/>
-
- Email: htrippaers@schubergphilis.com
 - Twitter: @Spark404
 - IRC Freenode: Spark404