

*TOMORROW starts here.*



Cisco *live!*



## *Delivering a Network Virtualization Platform*



# What is VIRL ?



**A multi-purpose network virtualization platform that provides an easy way to build, configure and test new or existing network topologies**

Virtualized network devices run Cisco's network operating systems

VIRL's Virtual Machine orchestration can:

- Create highly-accurate models of real-world/future networks
- Scale from 10's to 1000's of virtual network devices
- Integrate virtual network appliances into physical networks
- 'Wire' VMs on-demand into the physical network for Elastic Services

# Business & Technical Advantages

## Technical Opportunities



- Build, test & deploy networks - virtually
- Validate and verify designs and configurations
- Rapid prototyping of new service offerings
- Reduce Risk & Errors by improved training
- Easy to use, yet powerful

## Benefits



- Lower spend on lab equipment
- Improved access to resources
- Flexibility to scale resources on demand
- Improve time to market for new services
- Accessible: On or Off-Prem usage





# DEMO

# VIRL: Architecture Overview



VIRL GUI



Services Topology  
Director



Cisco OpenStack Edition



Cisco Virtual Platforms



- Design and visualization workbench
- CLI/API-based Virtual Machine orchestration layer
- Virtual Machine control, management and networking
- Virtual Machines running Cisco Operating Systems

# VIRL: Easier, Faster, Smarter Solutions

SP / Enterprise

Production  
network modeling

"What-if" Analysis

Test Lab  
virtualization

Partner  
Community

Training &  
Education

Cisco OnePK  
virtual testbed

Test Lab  
virtualization

University &  
Education

Networking  
Research

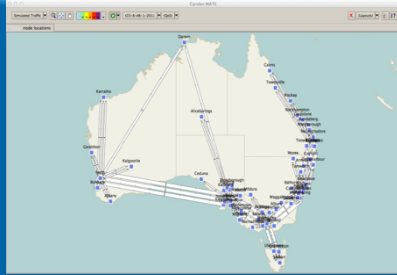
Rapid  
Prototyping

Network  
Education



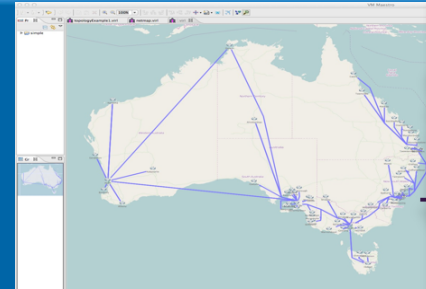
# VIRL: Customer Example: Network Import

## Laptop to Cloud



Real-world network

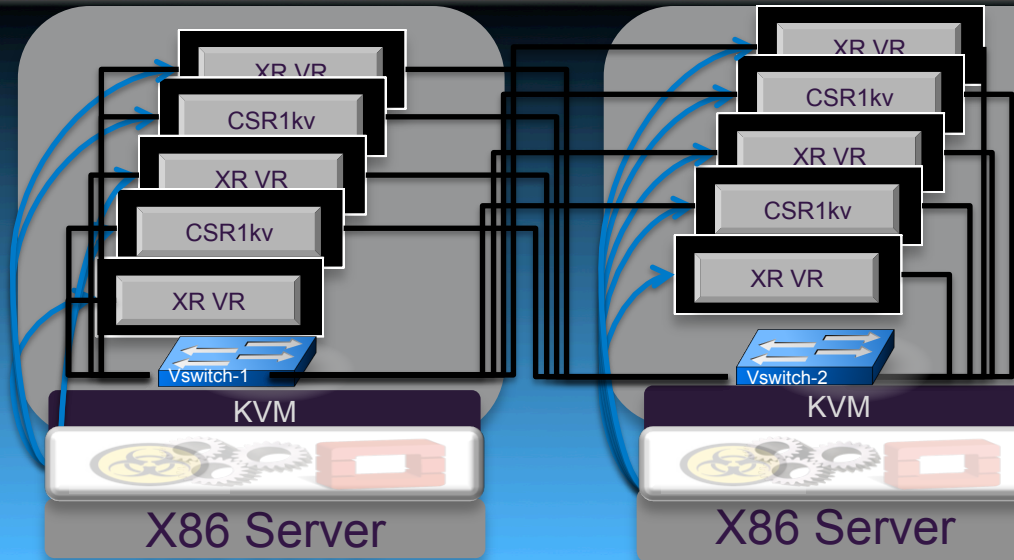
Topology Import



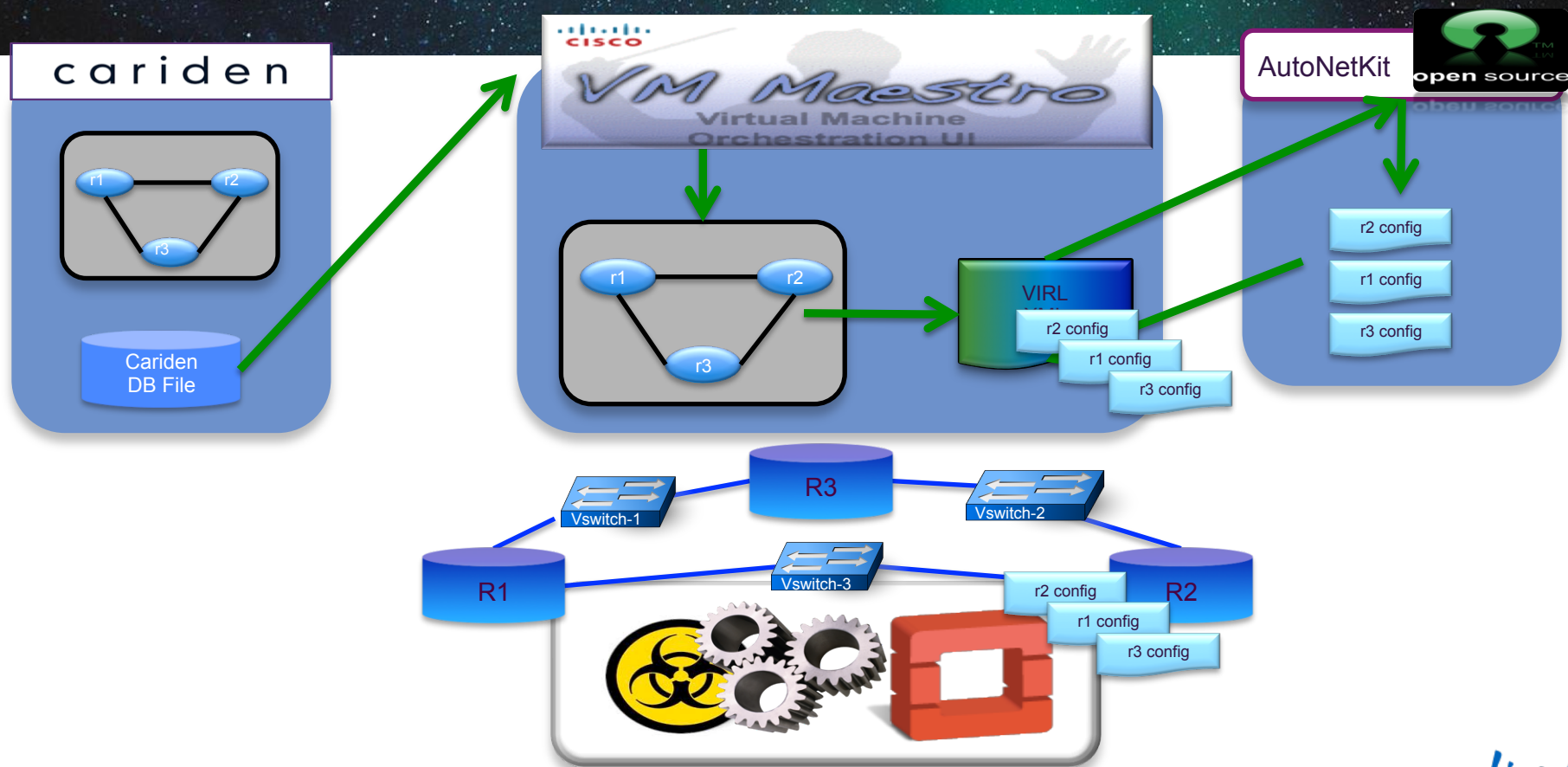
VIRL GUI

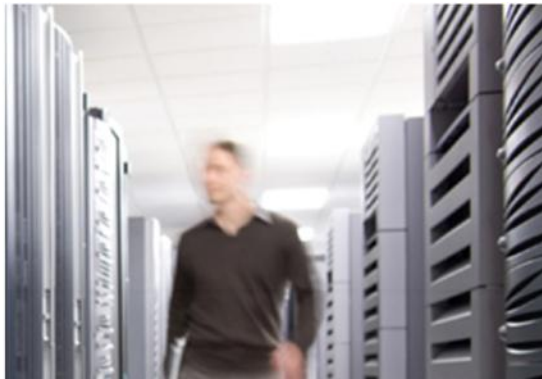
Laptop/  
Desktop

Cisco Virtual  
Machines  
deployed on x86  
OpenStack  
server cluster  
modeling real-  
world network



# VIRL workflow of tool integration



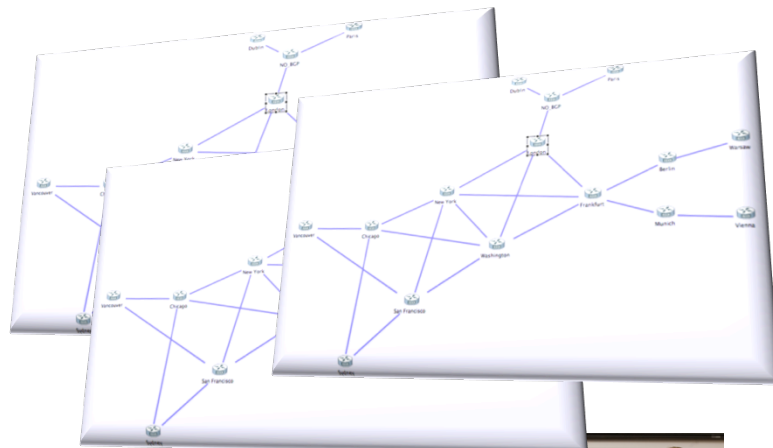


# Use Cases



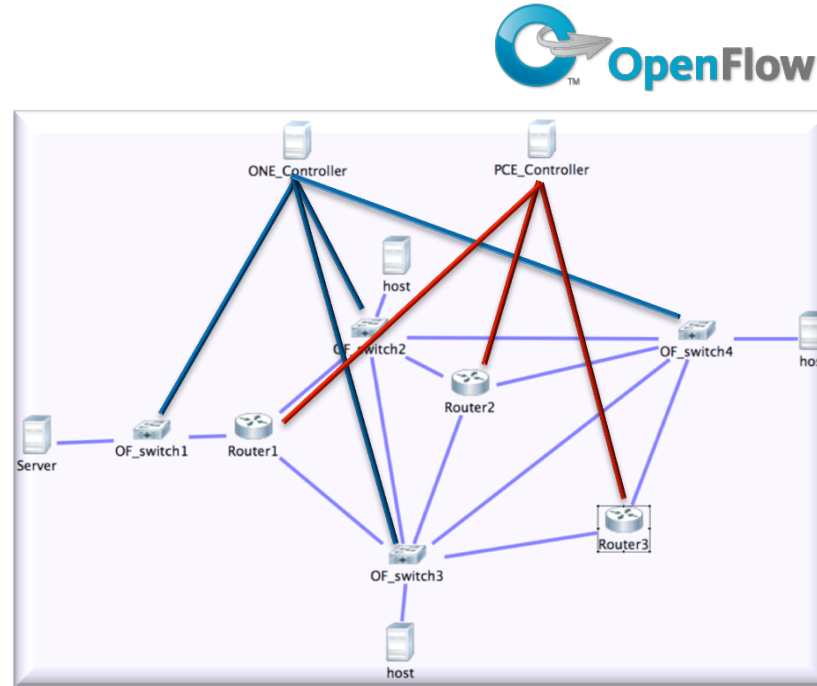
# Training & Education

- Teach and train the next generation
  - Network engineers
  - Operators
  - Designers
- Students need 'hands-on' experience, but Challenge is access to hardware
  - Learn by doing!
  - 10 students to 1 router or 1 student to 10 routers?
- Virtualized solution offers
  - Flexibility
  - Scalability
  - Repeatability
  - Reduced Capex and Opex



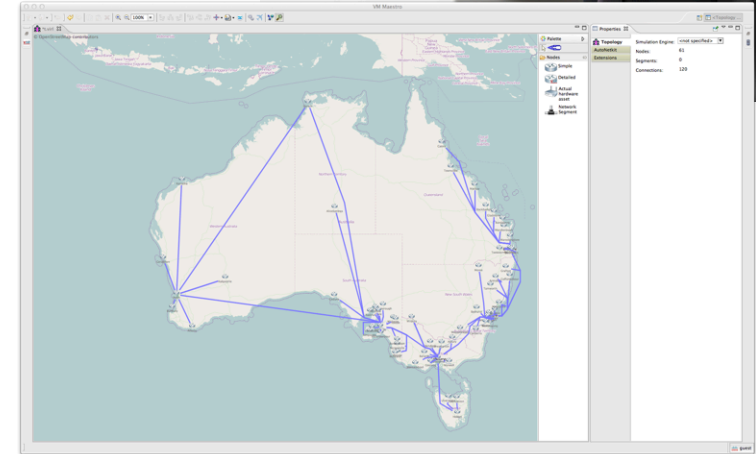
# SDN and OnePK

- Enable building, testing, learning and experimenting with Cisco SDN technologies
- E.g. OnePK-enabled virtual Openflow switches and routers in a mixed Openflow and MPLS-TE topology
- Virtual-machine based Cisco ONE and PCE controllers drive traffic through the network
- OnePK developers are able to test and validate applications against virtual devices before deploying to the real network



# Test Labs

- Model and troubleshoot live networks, validate new network designs, test new features and configuration before deployment, reduce time to market
- Reduce lengthy times typically required for NMS and OSS integration by testing against a scaled virtual network
- Create 'hybrid' lab: mix physical devices with virtual machines to create real-world scale without real-world cost
- Reduce risk of change by verifying network operations in virtual world before applying to the live network







## Deployment Models

# The Product: 'Cisco Modeling Labs'

Cloud



- Cisco Hosted platform
- On-demand Service
- Single User to Enterprise Scale

On-Premise Clusters



- Linux & OpenStack Solution
- Scale Servers to suit user's needs
- Dedicated resource

Laptop



- Linux and OpenStack Solution
- Scale limited by CPU & Memory
- Virtualized network on the move

Scale

Deployment Flexibility

User Experience

# Pricing Models



## Cloud

- Multi-tenant instances in the cloud
- Auto upgrade
- Subscription model: Tiered - per resource & scale
- Instant access to design tools

\$100-\$500/VM/Month

Training,  
Education



## On-Premise Servers

- Scales to 1000's of nodes
- VIRL License
- Right To Use per network scale

VIRL Perpetual License: \$20K-\$30K/Server

VM Right To Use: \$1.2K-\$6K/VM

Virtual Test Labs,  
'What if',  
Modeling



## Laptop

- Limited in Scale
- VIRL License

VIRL Perpetual License: \$2K - \$3K/PC

VM Right To Use: \$1.2K-\$6K/VM

OnePK Dev,  
Students, SEs

Cisco Support Contract:

For License & RTU

SmartNet & SAS/U



# Cisco Virtual Machines

- Provide virtualized products across all major Cisco network operating systems, specifically:
  - IOS - vIOS
  - IOS-XE – CSR1000v
  - NXOS – vNXOS
  - IOS-XR – XR-VR
- Provide reference platform target as part of regular build cycle
- Enable production use cases such as controllers, route reflectors, etc
- Support major Hypervisors (KVM-QEMU, VMware ESXi)

## Virtualization Of Cisco NOSs

- Ethernet-only focus given virtualization environment
- Package Systems using standard OVA VM packaging model

## Key differences vs physical platforms

- Will not provide 100% Feature Parity
- Reduced Data Plane Performance
- Will not provide Full Media support
- Multi-tenant models, i.e. SDR support, must run separate VM instances

# EFT Status

In EFT with External Customers

In EFT with Internal Customers (eating our own dog food)

FCS: Target Dec'13

# Take-aways





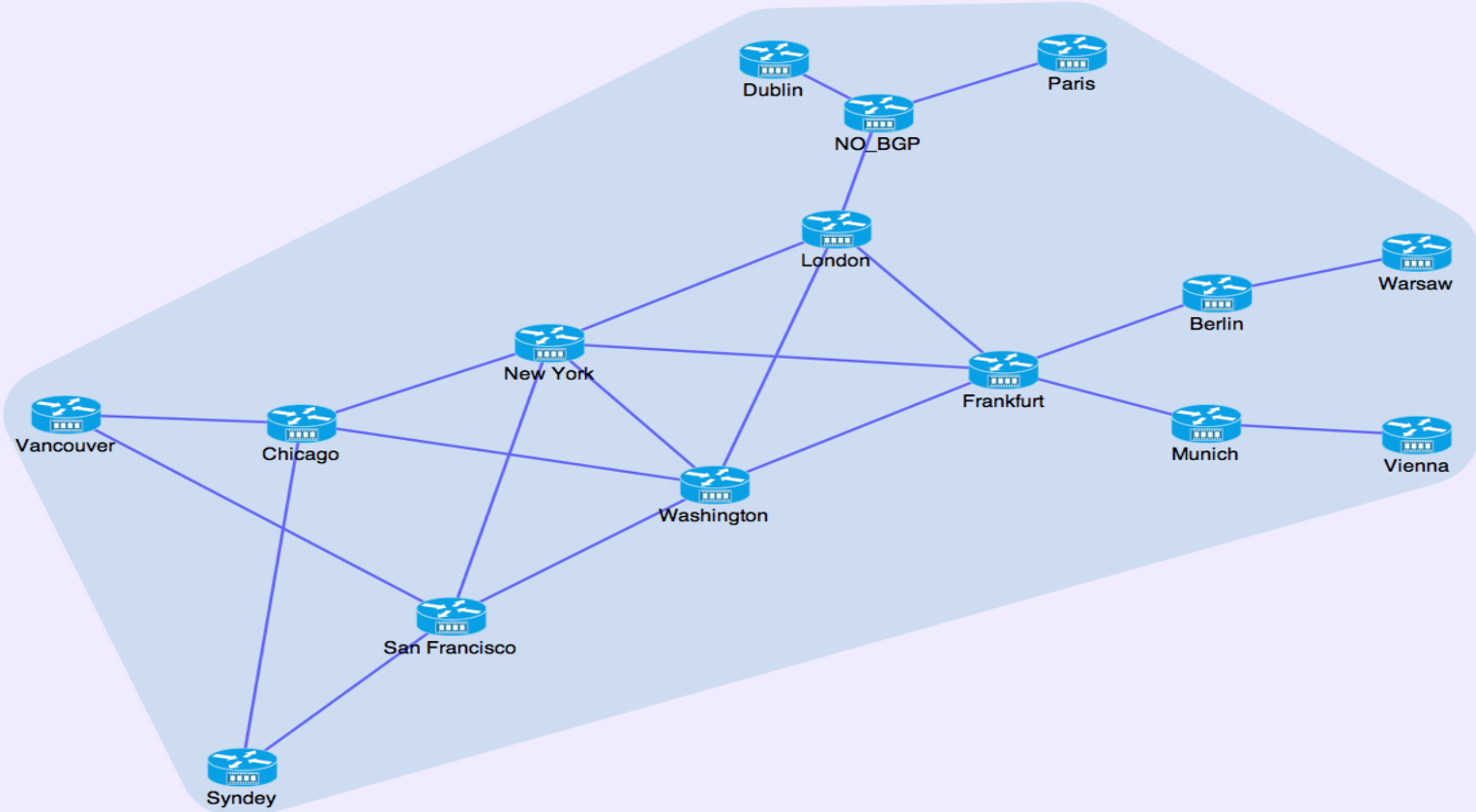


**CISCO** <sup>TM</sup>



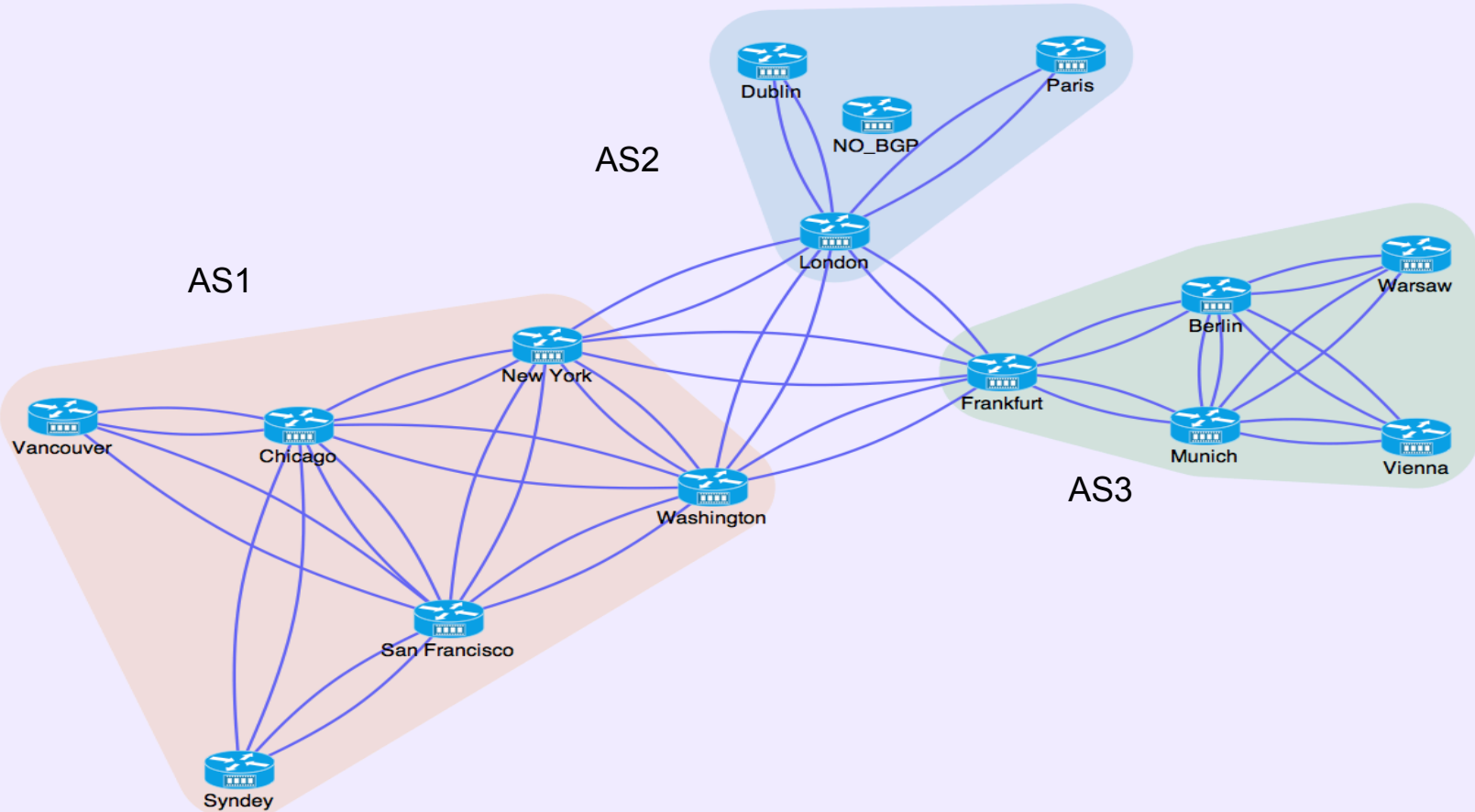
## Backup Slides

# A network of layers – Physical Connectivity





# BGP Layer Connectivity



# Deployment scenario





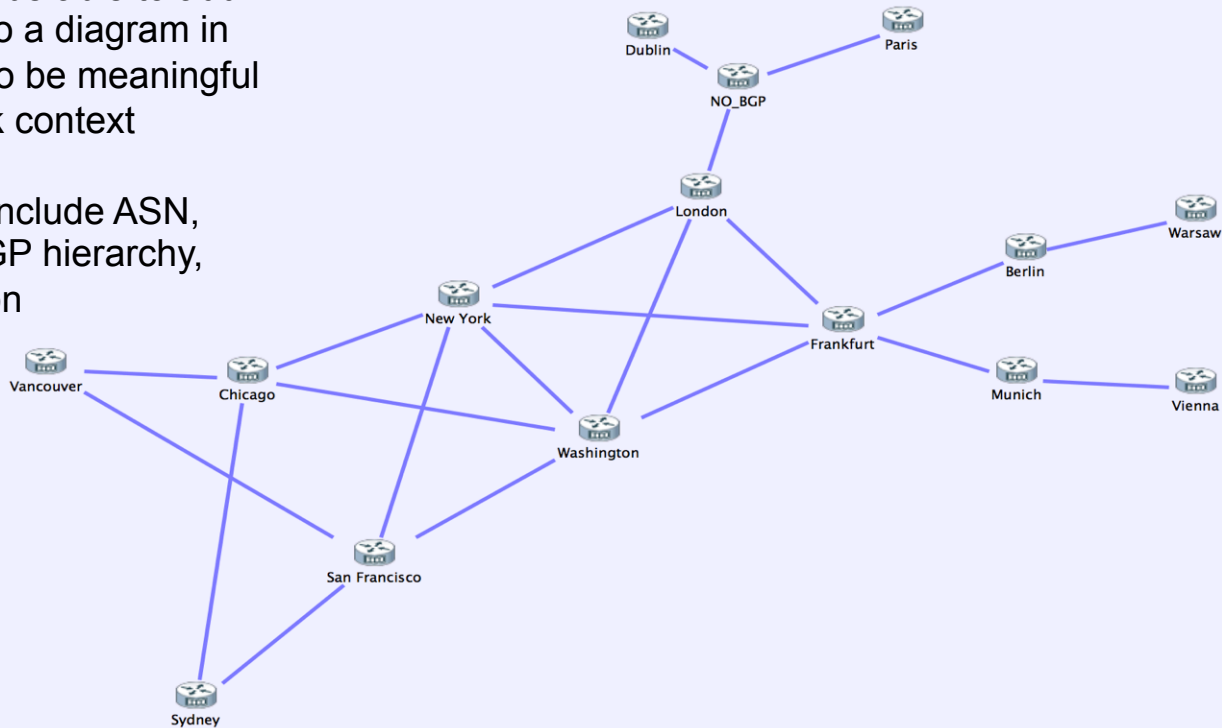
**CISCO** <sup>TM</sup>



# Building configurations from the network

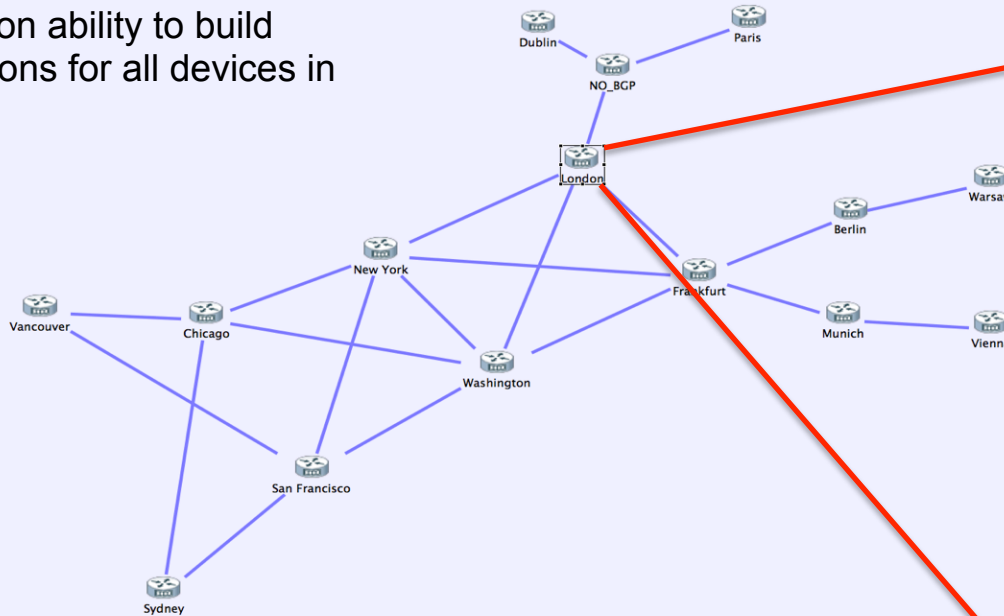
We need to be able to add  
'attributes' to a diagram in  
order for it to be meaningful  
in a network context

'Attributes' include ASN,  
IGP type, IGP hierarchy,  
BGP function



# Auto-generate router configuration

Press-button ability to build configurations for all devices in seconds



Properties

Node: **AutoNetki**

Extensions: **ibgp\_role**

Parameters: **RR\_cluster: one**

Router Configuration

Auto-generate

IOS-XR Config generated by autonetkit\_0.2.21 on 2013-01-23 13:36

```
hostname London
service timestamps log datetime msec
service timestamps debug datetime msec
telnet vrf default ipw server max-servers 10
domain lookup disable
line template vty
  timestamp
  exec-timeout 720 0
line console
  exec-timeout 0 0
line default
  exec-timeout 720 0
vty-pool default 0 50
control-plane
  management-plane
inband
  interface all
  allow all
!
interface GigabitEthernet0/0/0/0
  description London to New York
  ipw4 address 192.168.1.77 255.255.255.252
  ipw6 address ::b:1:1:0:2a/126
  no shutdown
!
interface GigabitEthernet0/0/0/1
  description London to Washington
  ipw4 address 192.168.1.18 255.255.255.252
  ipw6 address ::b:1:1:0:51/126
  no shutdown
!
interface GigabitEthernet0/0/0/2
  description London to Washington
  ipw4 address 192.168.1.69 255.255.255.252
  ipw6 address ::b:1:1:0:42/126
  no shutdown
!
interface GigabitEthernet0/0/0/3
  description London to NO_BGP
  ipw4 address 192.168.1.29 255.255.255.252
  ipw6 address ::b:1:1:0:1d/126
  no shutdown
!
interface Loopback0
  description Loopback
  ipw4 address 10.0.0.14 255.255.255.255
  ipw6 address ::a:1:0:0:8/126
  no shutdown
!
!
router isis 1
  net 49.0100.0000.0014.00
  address-family ipw4 unicast
  metric-style wide
  mpls traffic-eng level-2-only
  mpls traffic-eng router-id 10.0.0.14
!
interface Loopback0
  passive
  circuit-type level-2-only
  address-family ipw4 unicast
!
interface GigabitEthernet0/0/0/0
  circuit-type level-2-only
  point-to-point
  address-family ipw4 unicast
  metric 1
!
interface GigabitEthernet0/0/0/1
  circuit-type level-2-only
  point-to-point
  address-family ipw4 unicast
  metric 1
!
interface GigabitEthernet0/0/0/2
  circuit-type level-2-only
  point-to-point
```



## Delivering a Network Virtualization Platform

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Director,  
CAO Team

Vittal Krishnamurthy  
Product Manager,  
NOSTG

# Design Workbench

VM Maestro

<Topology ...

Palette

Nodes

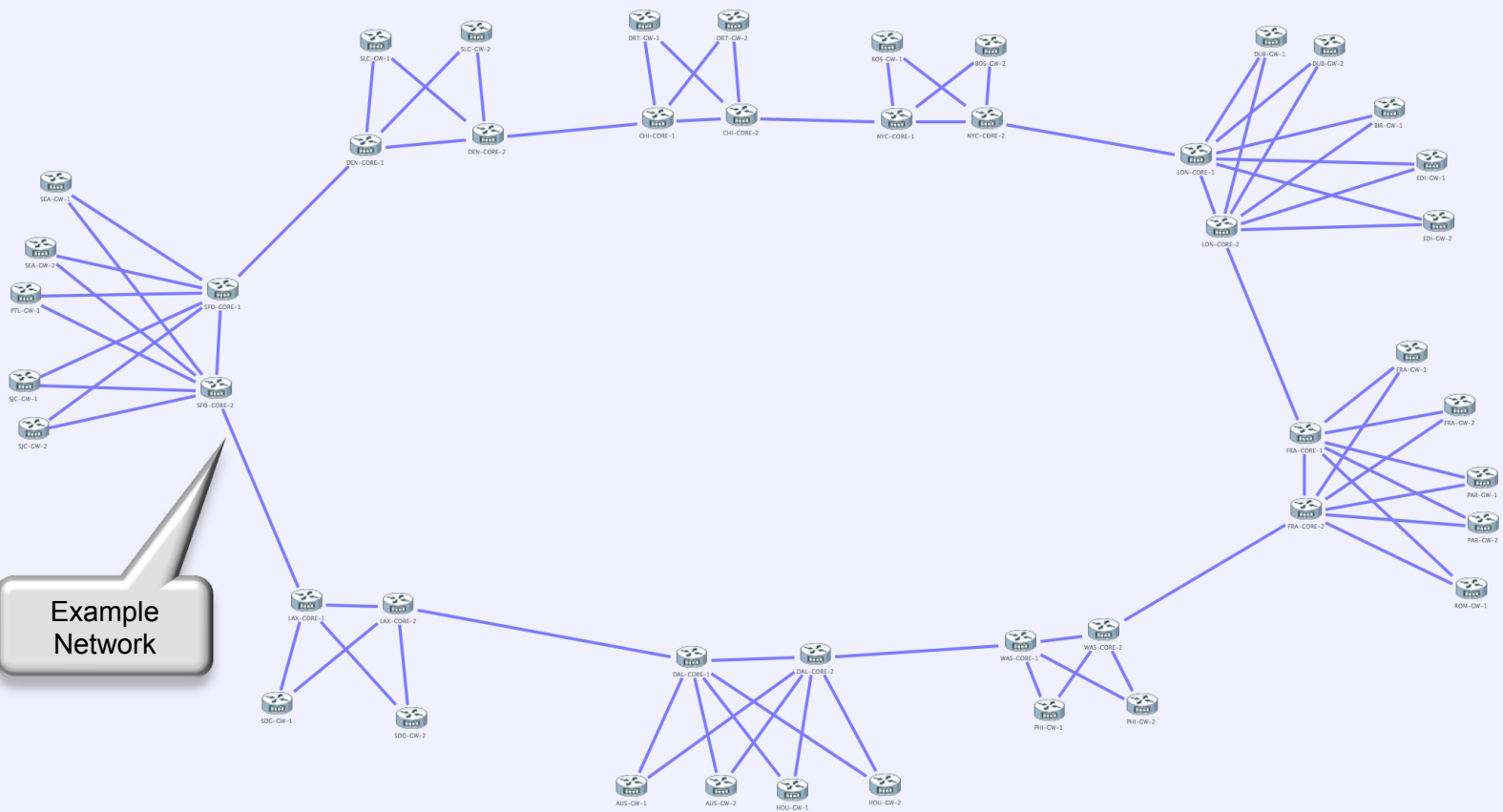
Simple

Detailed

Actual hardware asset

Network Segment

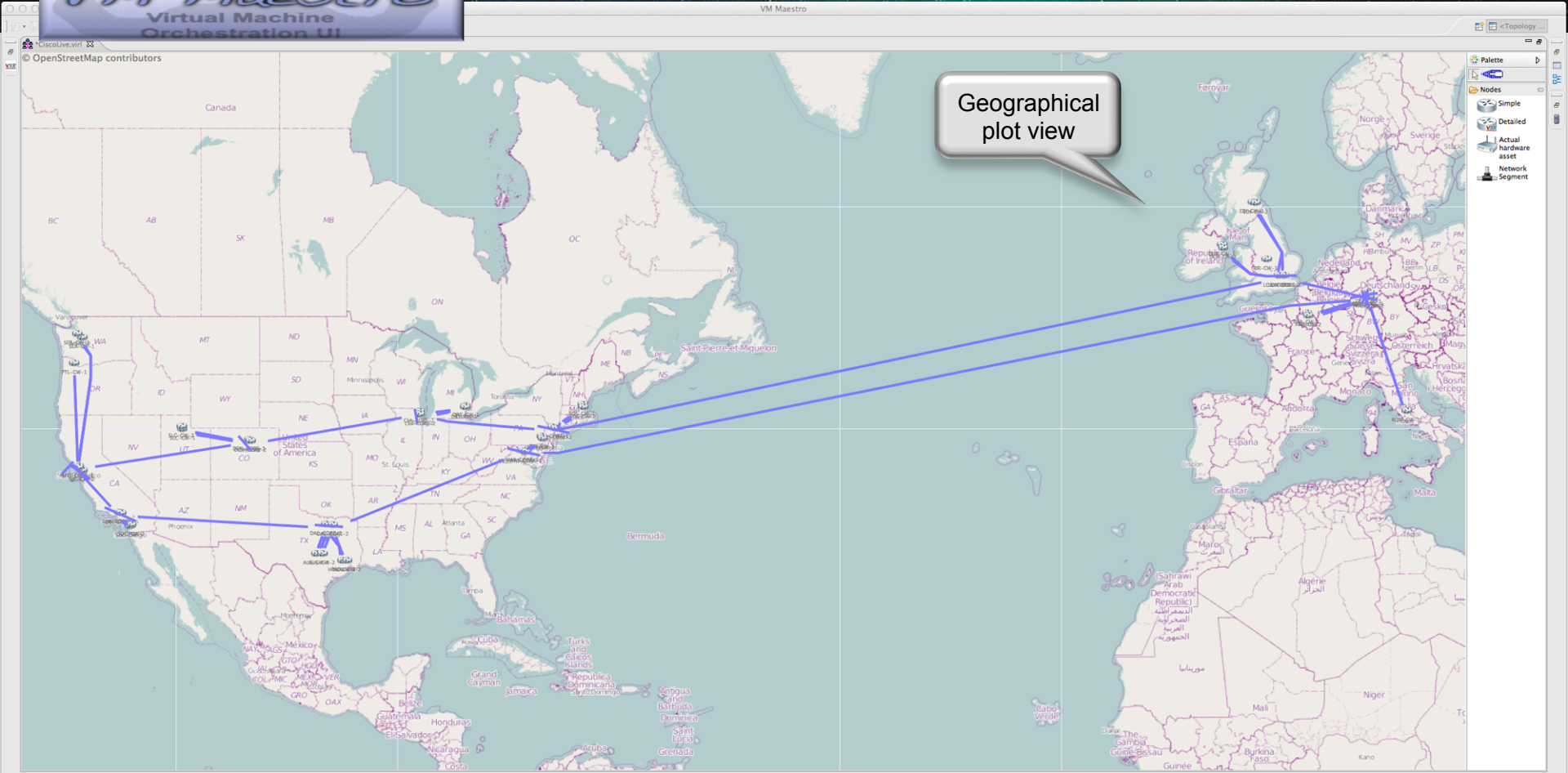
Example Network







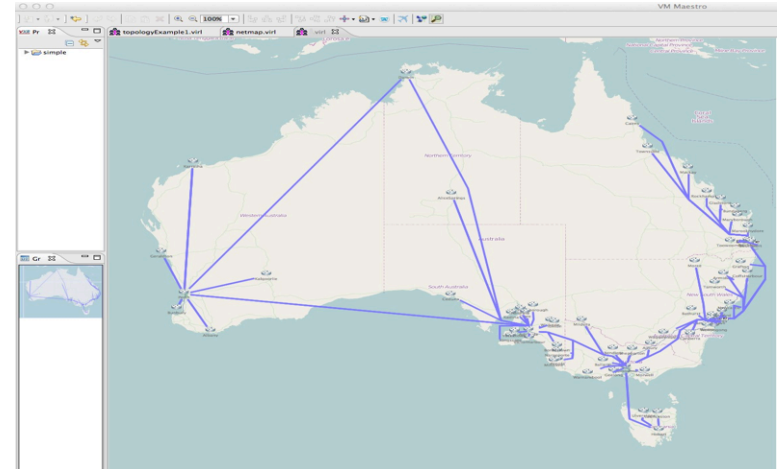
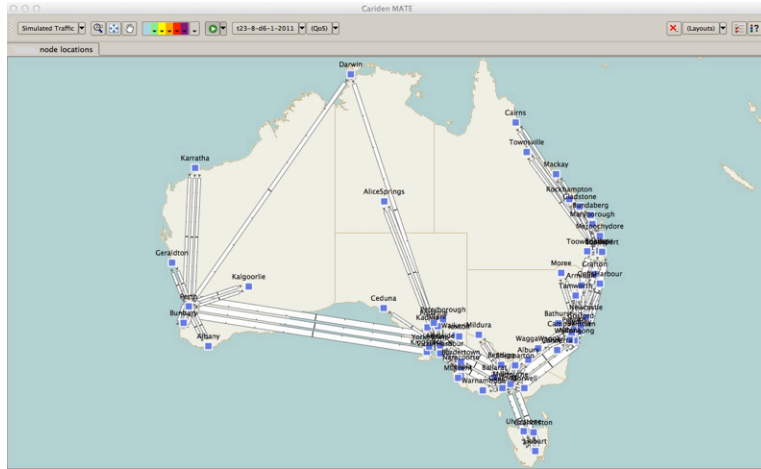
# Design Workbench



# Real-World Network import



Topology Import



Cariden MATE Design builds view based on customer's network data  
MATE PLAN files imported to Maestro and prepared for topology launch

# Generate router configurations (REMOVE)

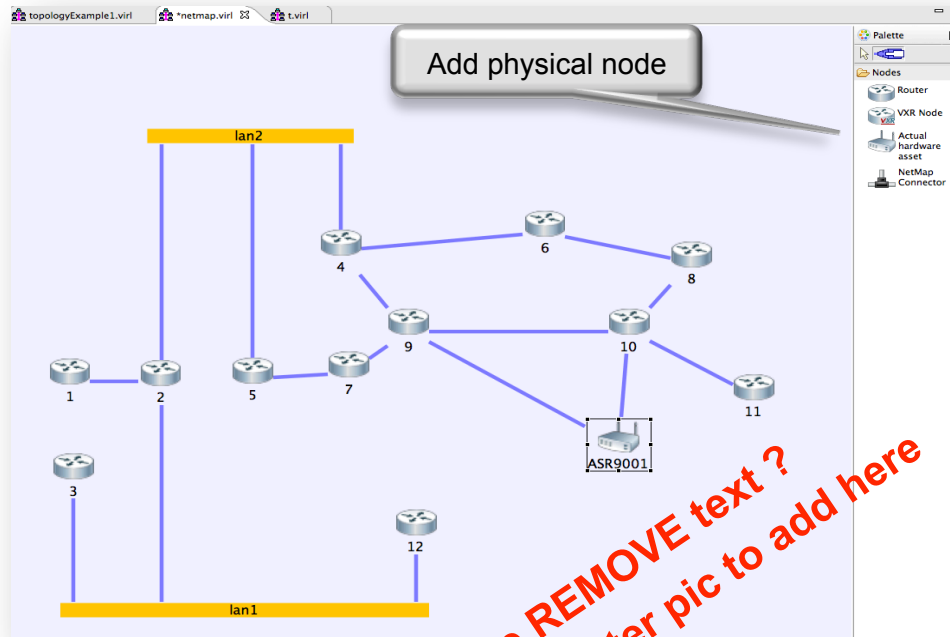
- Building a virtual network needs to be quick and efficient
- Manually creating configuration takes many hours – the larger the network, the more time required
- Solutions:

1. Take configurations from real-world devices and load onto Virtual devices, where possible

2. Create configurations automatically based on the network topology

Support IOS, IOS-XR, NX-OS syntaxes – must be extensible for other applications

# Hybrid Topologies: Mixing virtual & physical



Enables physical nodes to be added to a virtual topology

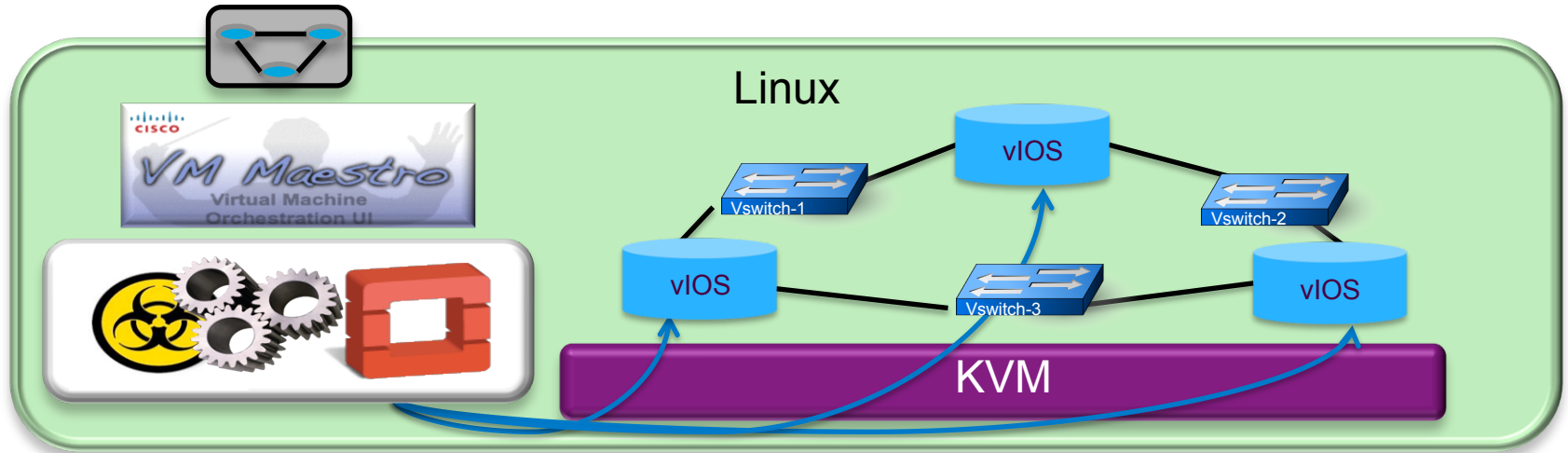
Provide node property information (OS type, mgmt IP address etc.)

Draw a connection from the physical to the virtual topology

Click on “Launch” and the VMs will be created and a Network connection between the 9001 and the Virtual Network will be constructed



# Small Topology on a laptop



# Cisco Modeling Labs

Powered by VIRL

## Basic Product Structure

PROPOSED

Virtual Network OS sold separately for standalone PC/Mac and Server editions



### CML standalone PC/Mac

- VIRL SW
- Limited Scale
- VIRL License
- NE RTU per laptop scale

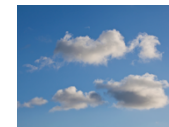
Lic: \$2K - \$3K/PC  
RTU: \$1.2K-\$6K/NE



### CML on-premise Server

- VIRL SW
- Server Scale
- VIRL License
- RTU per network scale

Lic: \$20K-\$30K/Server  
RTU: \$1.2K-\$6K/NE



### CML in the Cloud

- Multi-tenant
- Auto upgrade
- Subscription per scale & usage

\$100-\$500/NE / Month

### Cisco Technical Support Options

Annual SW Support for Lic and RTU ~ SmartNet/SAS

# Cisco Virtual Platforms



CISCO

IOS-XR

VM-based tool: XR VR



CISCO

NX-OS

VM-based tool: vNXOS



CISCO

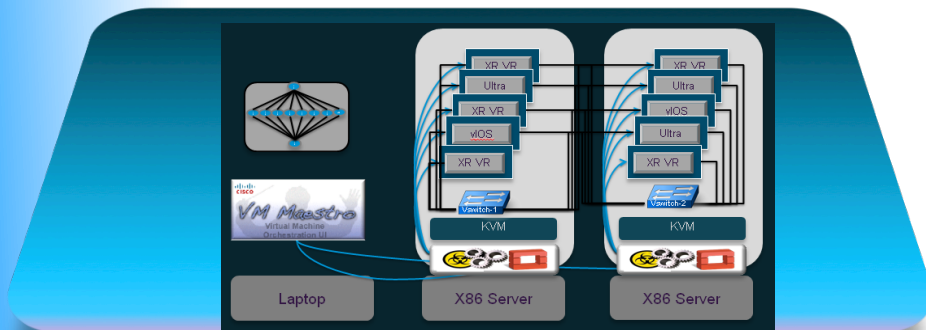
IOS-XE

VM-based tool: CSR1000v

CISCO

IOS

VM-based tool: vIOS





# 2 Products

Powered by VIRL

A photograph of a classroom setting where a man in a red shirt is presenting to a group of students seated at desks with laptops. The text "Cisco Learning Labs (CLL)" is overlaid in white.

Cisco Learning Labs (CLL)

A photograph of a control room with multiple computer monitors displaying network maps and data. Two men are working at the consoles. The text "Cisco Modeling Labs (CML)" is overlaid in white.

Cisco Modeling Labs (CML)





For any VIRL  
instance used in  
Educational  
Settings

## Individual Edition

For individual self-study and practice  
Cloud

## Teaching Edition

Classroom use by Learning and Academic Partners  
Cloud • On-Premise

## Resale Edition

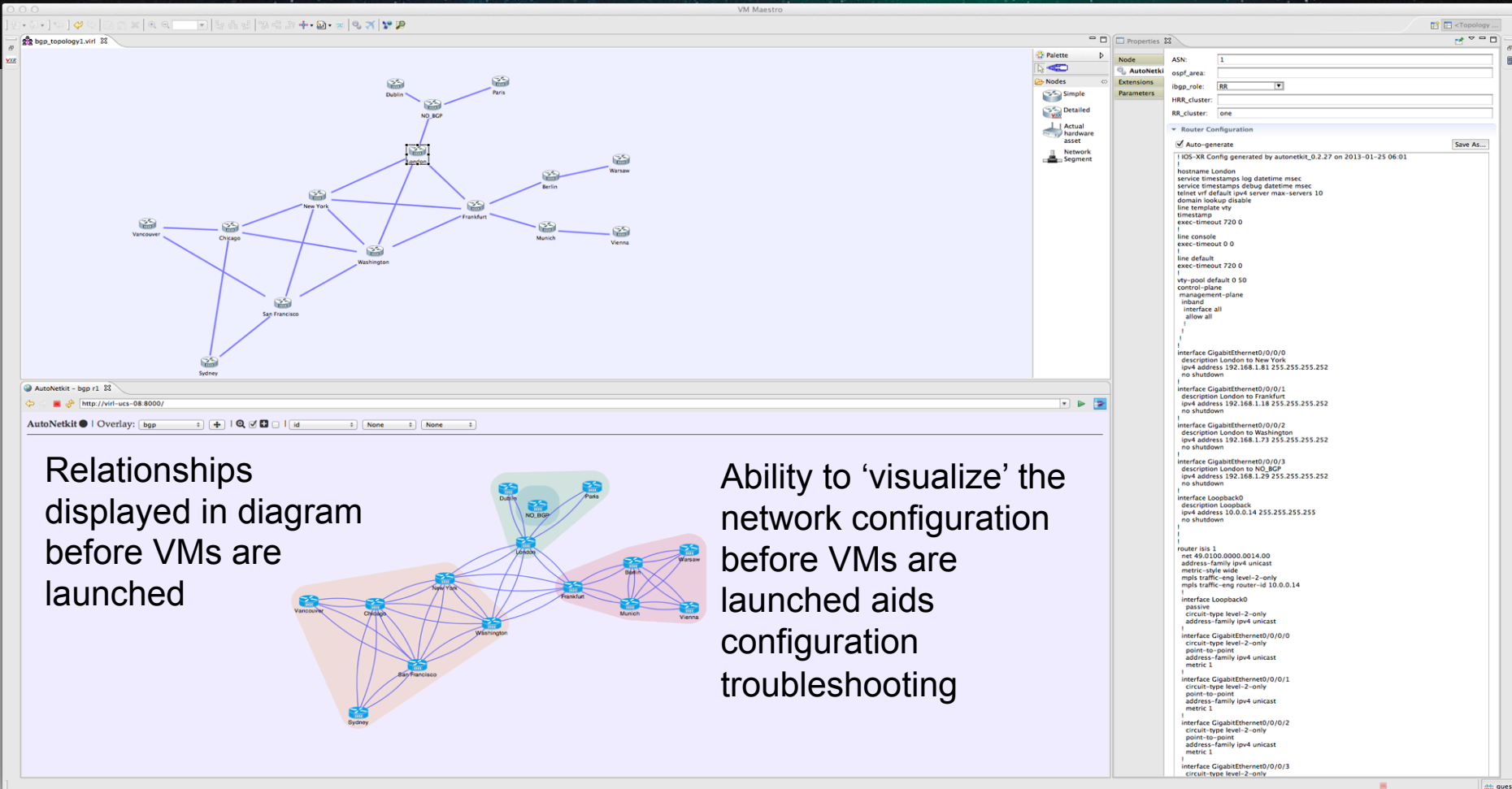
Resale by Learning and Academic Partners  
Cloud

## Embedded Editions

Sales Acceleration for Cisco direct-delivery training to corporate accounts  
Cloud • Part of \$3500/student/class • Part of \$3300/person/CTE subscription

**Cisco** *live!*

# Visualization before deployment



The screenshot displays the VM Maestro interface, which is used for visualizing and configuring network topologies before deployment. The main window shows a network diagram with nodes representing routers and their interconnections. The nodes are color-coded: blue for core routers, green for edge routers, and red for customer routers. The diagram is titled 'bgp\_topology1.vml' and shows a complex network structure with multiple interconnected nodes.

Below the main diagram, there is a smaller, more detailed view of the network topology, showing the relationships between the nodes. This view is titled 'AutoNetkit - bgp r1.32' and shows the network configuration details, including the IP addresses of the nodes and the connections between them.

On the right side of the interface, there is a 'Properties' panel that displays the configuration details for the selected node. The configuration includes the node name, the network role, and the network segment. The configuration is titled 'Router Configuration' and shows the details for the 'Auto-generate' option.

The configuration details for the 'Auto-generate' option are as follows:

```
IOS-XR Config generated by autonetkit.0.2.27 on 2013-01-25 06:01

hostname London
service timestamps log datetime msec
service timestamps debug datetime msec
telnet vrf default ipv4 server max-servers 10
domain lookup disable
line template vty
timestamp
exec-timeout 720 0
!
line console
exec-timeout 0 0
!
line default
exec-timeout 720 0
!
vty-pool default 0 50
control-plane
management-plane
inband
interface all
allow all
!
!
interface GigabitEthernet0/0/0/0
description London to New York
ip address 192.168.1.81 255.255.255.252
no shutdown
!
interface GigabitEthernet0/0/0/1
description London to Frankfurt
ip address 192.168.1.18 255.255.255.252
no shutdown
!
interface GigabitEthernet0/0/0/2
description London to Washington
ip address 192.168.1.73 255.255.255.252
no shutdown
!
interface GigabitEthernet0/0/0/3
description London to NO_BGP
ip address 192.168.1.29 255.255.255.252
no shutdown
!
interface Loopback0
description Loopback
ip address 10.0.0.14 255.255.255.255
no shutdown
!
router isis 1
net 49.0100.0000.0014.00
address-family ipv4 unicast
metric-style wide
mpls traffic-eng level-2-only
mpls traffic-eng router-id 10.0.0.14
!
interface Loopback0
passive
circuit-type level-2-only
address-family ipv4 unicast
!
interface GigabitEthernet0/0/0/0
circuit-type level-2-only
point-to-point
address-family ipv4 unicast
metric 1
!
interface GigabitEthernet0/0/0/1
circuit-type level-2-only
point-to-point
address-family ipv4 unicast
metric 1
!
interface GigabitEthernet0/0/0/2
circuit-type level-2-only
point-to-point
address-family ipv4 unicast
metric 1
!
interface GigabitEthernet0/0/0/3
circuit-type level-2-only
```

Relationships displayed in diagram before VMs are launched

Ability to 'visualize' the network configuration before VMs are launched aids configuration troubleshooting

# VIRL Timeline

Solution	Date	Detail
Laptop	EFT February'13	VIRL 'laptop' solution in EFT with major SP customers
Server	EFT February'13	VIRL 'on-premise' solution in EFT with major SP customers
Cloud		Internal Trials



**IOS-XE**

VM-based tool: CSR1000v  
Shipping



**IOS**

VM-based tool: vIOS  
FCS Target: H2CY13



**IOS-XR**

VM-based tool: XR VR  
FCS Target: H2CY13



**NX-OS**

VM-based tool: vNXOS  
FCS Target: H1CY14