

# **Airport Networks in the “Cloud”:** **NFV, SDN, and what they mean to Airport IT**

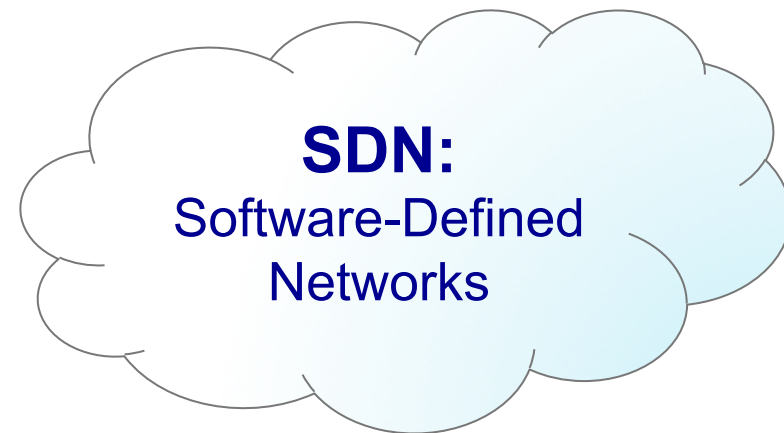
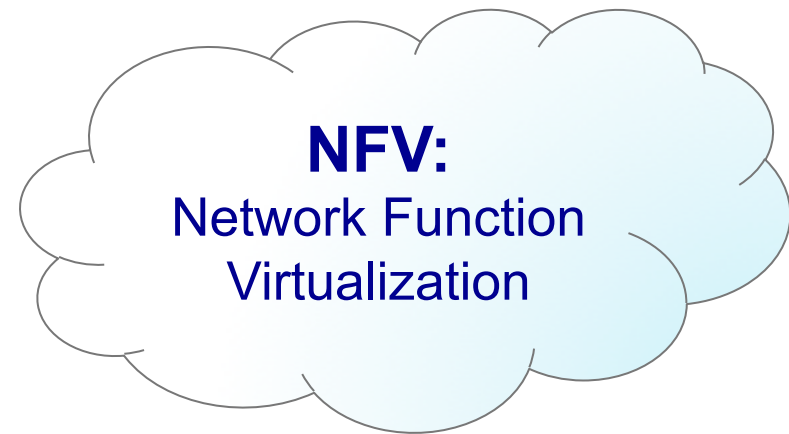
Scott Phillips, VP of Business Development, Boingo Wireless

March 25, 2015

# Why Are We Here?

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- Understand NFV & SDN
- The “Mobile Mind Shift”
  - More devices
  - More apps & services
  - More inter-connectivity
  - More challenges & threats
- Airport response & adaptation
  - IT tied to nearly every project
  - Multi-service networks require flexibility & scalability
  - Information security & consistency





# The “Mobile Mind Shift”

Mobile data traffic to **increase by 11x** between 2013-2018

**9.2GB**

Average monthly  
data usage

**80%**

consumed via Wi-Fi

**93%**

say Internet most  
important in daily life

**91%**

mobile devices most  
important in daily life

**200%**

increase in “Digital Elites”  
in last two years



# The Value of Virtualization

**New  
Services**

**QoE  
&  
Agility**

**Analytics  
&  
Visibility**

**Cost  
Efficiency**



# Today's Panelists

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**Marc Patterson**

Vice President, Product Management  
Boingo Wireless

*"Re-Imagining the Airport Network"*



**Cam Cullen**

Vice President, Global Marketing  
Procera Networks

*"Managing the Wi-Fi Quality of Experience (QoE)"*



**Houman Modarres**

Marketing  
Nuage Networks

*"Is SDN Cleared to Land in your Network?"*

# The Value of Virtualization: Re-Imagining the Airport Network

Marc Patterson, Vice President of Products, Boingo Wireless

March 25, 2015



# Solutions for Today's Wireless World

A global wireless leader, Boingo provides comprehensive solutions for consumers, large venues, network operators/wireless carriers, and advertisers.

Simply put, we help the world stay connected.

## Retail Solutions

Boingo Wi-Fi  
Boingo Broadband



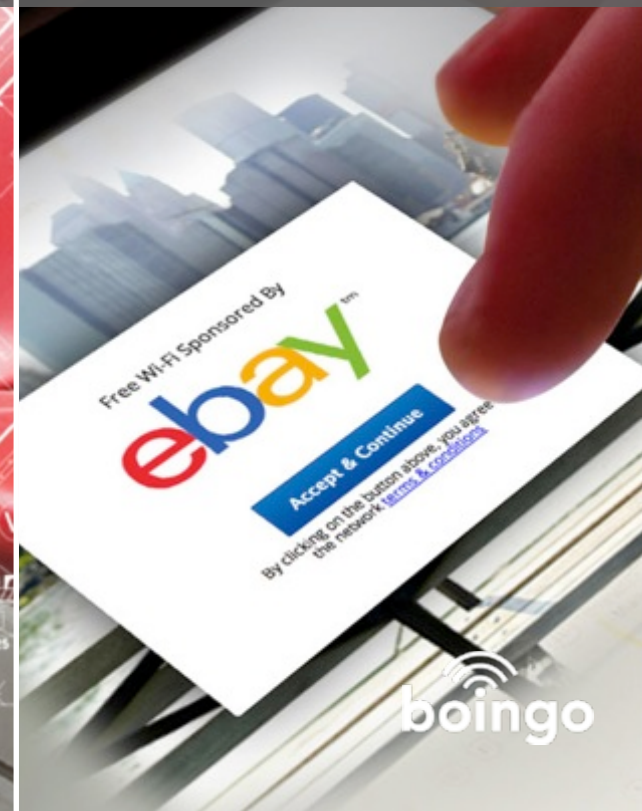
## Wholesale Solutions

DAS, Wi-Fi, Roaming, Private-Label,  
Bundling, Location-Based Services,  
Broadband & Digital TV



## Media Solutions

Advertising & Sponsorships  
Boingo Media Platform



# Basic NFV Architecture

Application Programming Interface

Network Application Layer

Multi-OS Layer

Hypervisor (VM Manager) Layer

Hardware / Server Layer

Virtual Private Cloud  
(VPC)

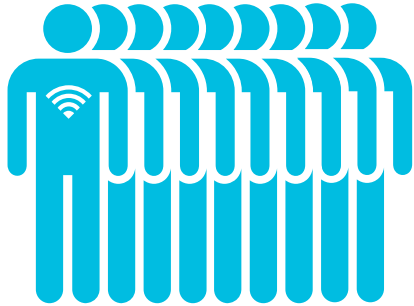
Venue Data Center  
(VDC)

## Benefits:

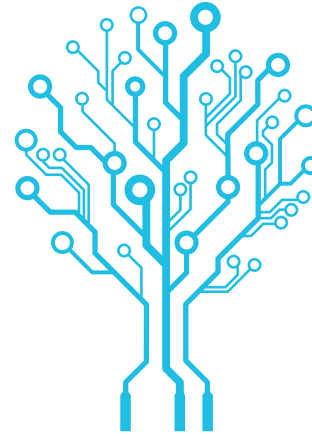
- Decouples network functions from proprietary hardware
- Network functions run as software, improving scalability
- Increased data visibility
- Distributed data centers
- Faster rollout of services and applications
- Information integrity & protection
- Airport impacts:
  - Network expansion/control
  - Segmentation
  - Analytics/policy control
  - Data center design
  - Flexibility to test apps/systems



# Re-imagined Network: Characteristics



High density, high capacity  
Flexible and scalable



Heterogeneous networks



Analytics and Location  
Based Service Support



Network & System  
Virtualization

# Re-imagined Network: Objectives

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- Provide a scalable, converged infrastructure
- Prepare for large scale mobile offloading
- Improve design flexibility to address increased AP counts
- Support higher bandwidth networks
- Increase the agility of policy control in venues
- Increase depth and breadth of analytical data/reporting
- Address increasing variability of venue size & demand
- Increase reliability and resiliency of network and systems
- Support new services & capabilities
  - Bandwidth on-demand
  - Dynamic content delivery



# Re-imagined Network: Service Definition

## S.M.A.R.T. Networks™



### Secure

All S.M.A.R.T. Networks will be Passpoint-enabled, supporting WPA2 encrypted connections for some classes of service, in addition to employing security configurations that protect the core network.



### Multi-Platform

S.M.A.R.T. Networks are designed to optimize the Wi-Fi experience, platform-by-platform. Boingo's classes of service help users and service providers pick the experience they desire, while the network intelligently optimizes that experience for the platform itself.



### Analytics-Driven

S.M.A.R.T. Networks are location-aware, enabling venues to better serve customers with actionable business intelligence derived from historic and predictive analytics.



### Responsive

S.M.A.R.T. Networks balance flexibility, capacity and connection performance with an adaptable network infrastructure. S.M.A.R.T. Networks continually evaluate the service being provided, ensuring that it's delivering the defined user experience for each class of service.



### Tiered

S.M.A.R.T. Networks support multiple classes of service that can be tuned for a defined user experience. The tiers of service classes create user experiences that meet the needs of casual and power users alike.



# Thank you!

Marc Patterson, Vice President of Products, Boingo Wireless  
[mpatterson@boingo.com](mailto:mpatterson@boingo.com)



**PROCERA**  
EMPOWERING INTELLIGENCE

## Managing the WiFi Quality of Experience Airport WiFi Challenges

**Cam Cullen**  
VP of Global Marketing

# Modified Maslow's Hierarchy of Needs



# What is Unique about Airport WiFi?



**Captive  
Audience**

**"Subsidized  
Audience"**

**Heavy BW  
Audience**



# Managing the Wi-Fi Subscriber Experience

The background of the slide is a photograph of a busy airport terminal. Large windows on the right side show a bright sky with a commercial airplane in flight. Inside the terminal, several people are walking, some with luggage, creating a sense of movement. The lighting is warm, suggesting late afternoon or early morning.

**Network &  
Subscriber  
Visibility**

**Network &  
Service  
Quality**

**Enhanced  
Service  
Flexibility**

# Real-Time Visibility



Name	Incoming	Outgoing	Incoming CPS	Outgoing CPS	Est. Connections	Un
▼ PSM	222.1 kbps	17.9 kbps	0	0	406.0	
▶ All Subscribers	222.1 kbps	17.9 kbps	0	0	406.0	
▼ By AP	222.1 kbps	17.9 kbps	0	0	396.0	
▶ 1.1.1.3	189.9 kbps	5,264.0 bps	0	0	38.0	
▶ 1.1.1.5	17.2 kbps	5,712.0 bps	0	0	17.0	
▶ 1.1.2.1	12.3 kbps	5,792.0 bps	0	0	47.0	
▶ 1.1.3.1	1,984.0 bps	592.0 bps	0	0	24.0	
▶ 1.1.1.4	576.0 bps	0 bps	0	0	97.0	
▼ 1.1.1.1	144.0 bps	88.0 bps	0	0	40.0	
▶ cc:3a:61:21:0c:09	104.0 bps	0 bps	0	0	12.0	
▶ 1c:a8:a7:b2:b0:b3	40.0 bps	88.0 bps	0	0	1.0	
▶ b0:ec:71:b0:bd:d3	0 bps	0 bps	0	0	3.0	
▶ ac:fd:ec:87:e4:70	0 bps	0 bps	0	0	1.0	
▶ 90:72:40:c6:93:a9	0 bps	0 bps	0	0	0	
▶ 7c:11:be:1f:81:9b	0 bps	0 bps	0	0	1.0	
▶ 34:e2:fd:c1:8e:4d	0 bps	0 bps	0	0	7.0	
▶ 20:c9:d0:81:42:2f	0 bps	0 bps	0	0	4.0	
▶ 20:64:32:c6:04:4d	0 bps	0 bps	0	0	0	
▶ 1c:b0:94:b7:a9:7d	0 bps	0 bps	0	0	2.0	
▶ 10:40:f3:96:8a:d4	0 bps	0 bps	0	0	9.0	
▶ 1.1.1.2	0 bps	0 bps	0	0	11.0	
▶ 1.1.2.2	0 bps	0 bps	0	0	10.0	
▶ 1.1.1.6	0 bps	0 bps	0	0	18.0	
▶ 1.1.3.2	0 bps	408.0 bps	0	0	94.0	
▶ By AP Channel	222.1 kbps	17.9 kbps	0	0	396.0	
▶ By AP Mode	222.1 kbps	17.9 kbps	0	0	396.0	
▶ By AP Mode Channel	222.1 kbps	17.9 kbps	0	0	396.0	
▶ By Channel	222.1 kbps	17.9 kbps	0	0	406.0	
▶ By Location AP	222.1 kbps	17.9 kbps	0	0	396.0	
▶ By Mode	222.1 kbps	17.9 kbps	0	0	406.0	

*How is the network performing in these sections right now compared to historical averages?*

*What is the real-time usage for each AP?*

# Real-Time Visibility

PacketLogic - 192.168.0.200

LiveView: Local Hosts

Name	Incoming	Outgoing	Total	Incoming CPS	Outgoing CPS	Total CPS	Est. Connections	Unest. Connections	Total Connections	In Int Quality	In Ext Quality	Out Int Quality	Out Ext Quality
PSM	16.7 Mbps	3,310.8 kbps	20.1 Mbps	3.0	182.0	185.0	3,490.0	4,378.0	7,868.0	99.0 %	100.0 %	100.0 %	96.0 %
ISP	16.7 Mbps	3,310.3 kbps	20.1 Mbps	3.0	181.0	184.0	3,466.0	4,360.0	7,826.0	99.0 %	100.0 %	100.0 %	96.0 %
Cable	16.7 Mbps	3,310.3 kbps	20.1 Mbps	3.0	181.0	184.0	3,466.0	4,360.0	7,826.0	99.0 %	100.0 %	100.0 %	96.0 %
DSL	15.8 Mbps	3,228.7 kbps	19.0 Mbps	3.0	181.0	184.0	3,407.0	4,348.0	7,755.0	99.0 %	99.0 %	100.0 %	96.0 %
Fixed Wireless	15.8 Mbps	3,228.7 kbps	19.0 Mbps	3.0	181.0	184.0	3,407.0	4,348.0	7,755.0	99.0 %	99.0 %	100.0 %	96.0 %
By Tower	15.8 Mbps	3,228.7 kbps	19.0 Mbps	3.0	181.0	184.0	3,407.0	4,348.0	7,755.0	99.0 %	99.0 %	100.0 %	96.0 %
By Frequency	15.8 Mbps	3,228.7 kbps	19.0 Mbps	3.0	181.0	184.0	3,407.0	4,348.0	7,755.0	99.0 %	99.0 %	100.0 %	96.0 %
By Channel	15.8 Mbps	3,228.7 kbps	19.0 Mbps	3.0	181.0	184.0	3,407.0	4,348.0	7,755.0	99.0 %	99.0 %	100.0 %	96.0 %
6	4,086.6 kbps	756.0 kbps	4,842.6 kbps	0	23.0	23.0	754.0	634.0	1,388.0	99.0 %	100.0 %	100.0 %	88.0 %
161	2,681.4 kbps	593.9 kbps	3,275.3 kbps	2.0	105.0	107.0	755.0	1,849.0	2,604.0	99.0 %	100.0 %	100.0 %	97.0 %
11	2,650.2 kbps	703.1 kbps	3,353.3 kbps	0	16.0	16.0	378.0	549.0	927.0	100.0 %	100.0 %	100.0 %	98.0 %
Arron.Norwood	804.8 kbps	16.2 kbps	821.0 kbps	0	0	0	8.0	2.0	10.0				
Camille.Greenlee	759.8 kbps	93.2 kbps	853.0 kbps	0	0	0	7.0	0	7.0	100.0 %	100.0 %	100.0 %	100.0 %
Eric.Keenan	613.2 kbps	25.7 kbps	638.9 kbps	0	0	0	15.0	0	15.0	100.0 %	100.0 %	100.0 %	100.0 %
Andy.Warren	225.9 kbps	199.9 kbps	425.8 kbps	0	1.0	1.0	56.0	87.0	143.0	100.0 %	97.0 %	100.0 %	100.0 %
Darryl.Gordon	95.8 kbps	24.8 kbps	120.6 kbps	0	0	0	7.0	2.0	9.0	100.0 %	100.0 %	100.0 %	100.0 %
Charles.Wagner	94.8 kbps	5,528.0 bps	100.4 kbps	0	7.0	7.0	2.0	84.0	86.0				
Bernard.McSweeney	18.0 kbps	36.9 kbps	54.9 kbps	0	0	0	1.0	7.0	8.0				
Candy.Merrill	9,376.0 bps	2,256.0 bps	11.6 kbps	0	0	0	14.0	0	14.0				
Carlton.Haston	6,376.0 bps	4,624.0 bps	11.0 kbps	0	0	0	9.0	1.0	10.0	100.0 %	100.0 %	100.0 %	100.0 %
Benjamin.Freeman	4,960.0 bps	1,920.0 bps	6,880.0 bps	0	0	0	2.0	0	2.0				
Darrel.Simmons	3,176.0 bps	2,808.0 bps	5,984.0 bps	0	0	0	2.0	0	2.0				
Danuta.Hall	3,000.0 bps	85.2 kbps	88.2 kbps	0	0	0	41.0	29.0	70.0	100.0 %	100.0 %	100.0 %	84.0 %
Edward.Burch	2,904.0 bps	100.6 kbps	103.6 kbps	0	1.0	1.0	57.0	96.0	153.0	100.0 %	100.0 %	100.0 %	78.0 %
Cody.Ortega	2,656.0 bps	49.2 kbps	51.8 kbps	0	1.0	1.0	48.0	86.0	134.0	100.0 %	100.0 %	100.0 %	84.0 %
Anthony.Hill	2,520.0 bps	41.1 kbps	43.6 kbps	0	1.0	1.0	13.0	36.0	49.0	100.0 %	100.0 %	100.0 %	87.0 %
Evelyn.Burges	1,712.0 bps	6,712.0 bps	8,424.0 bps	0	0	0	2.0	3.0	5.0	100.0 %	100.0 %	100.0 %	100.0 %
Dwight.Schramm	840.0 bps	3,992.0 bps	4,832.0 bps	0	2.0	2.0	10.0	70.0	80.0	100.0 %	100.0 %	100.0 %	87.0 %
Donald.Tarnowski	224.0 bps	224.0 bps	448.0 bps	0	0	0	2.0	0	2.0				
Donald.Nordstrom	96.0 bps	2,096.0 bps	2,192.0 bps	0	0	0	3.0	2.0	5.0	100.0 %	100.0 %	100.0 %	100.0 %
Donna.Kim	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Alan.Shelly	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Emily.Davis	0 bps	0 bps	0 bps	0	0	0	7.0	0	7.0				
Eric.Byrd	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Bert.Costas	0 bps	0 bps	0 bps	0	0	0	7.0	0	7.0				
Donald.Banks	0 bps	0 bps	0 bps	0	0	0	2.0	0	2.0				
Flora.Carter	0 bps	0 bps	0 bps	0	0	0	2.0	0	2.0				
Beth.Roth	0 bps	0 bps	0 bps	0	0	0	3.0	0	3.0				
Enrique.Aguilar	0 bps	0 bps	0 bps	0	0	0	4.0	0	4.0				
Adriana.Zimmer	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Brandy.Dalton	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Amy.Himes	0 bps	0 bps	0 bps	0	0	0	10.0	2.0	12.0				
Donald.Johnson	0 bps	0 bps	0 bps	0	0	0	6.0	4.0	10.0				
Dawn.Higgins	0 bps	0 bps	0 bps	0	0	0	1.0	0	1.0				
Arthur.Knapp	0 bps	0 bps	0 bps	0	0	0	6.0	1.0	7.0				
Brian.Crisman	0 bps	0 bps	0 bps	0	0	0	5.0	28.0	34.0				

System Overview LiveView System Diagnostics Statistics

Version: 15.0.3.7 System ID: 009008259808 System: 192.168.0.200 Username: admin 2014-04-16 16:29:36

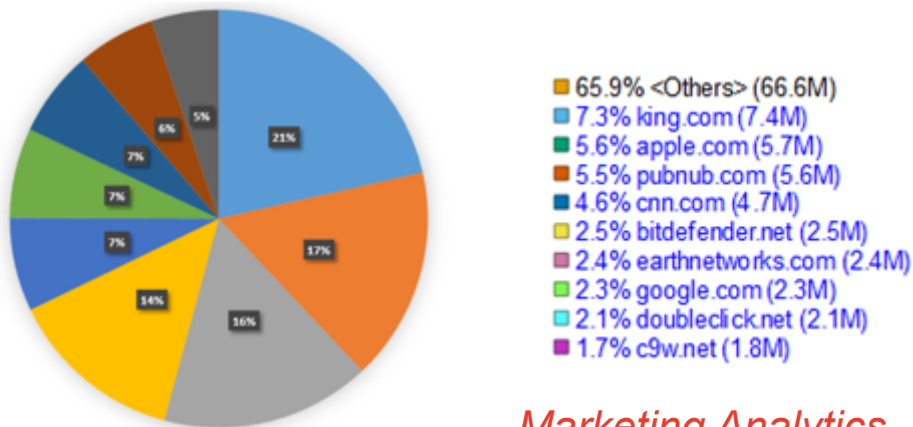
*How are individual subscriber connections performing?*



# Historical & Trends

Band	Num. Sub.	↓ Vol.	↓ Peak Thr.	↑ Peak Thr.
802.11n 2.4GHz	913	8.26 GiB	14.5 Mbps	9.20 Mbps
802.11n 5GHz	428	6.03 GiB	10.9 Mbps	21.1 Mbps

## Usage Analytics



## Marketing Analytics

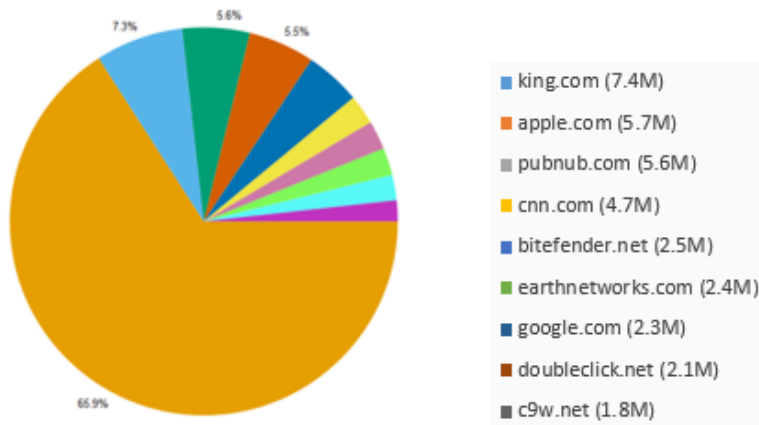


Table 6. The most used devices on 802.11n 2.4GHz. Total number of subscribers is 913. Downstream volume is 8.26 GiB.

Device	↓ Vol.	Num. Sub.	Int.RTT
Android (Phone)	11 %	214 (23 %)	180 ms
iPhone (Phone)	24 %	158 (17 %)	250 ms
iPad (Tablet)	2.7 %	9 (0.99 %)	65 ms
Mac (Computer)	6.0 %	7 (0.77 %)	44 ms

## Device & QoE Analytics

Table 7. The most used devices on 802.11n 5GHz. Total number of subscribers is 428. Downstream volume is 6.03 GiB.

Device	↓ Vol.	Num. Sub.	Int.RTT
Android (Phone)	17 %	105 (25 %)	78 ms
iPhone (Phone)	32 %	84 (20 %)	160 ms
iPad (Tablet)	2.9 %	13 (3.0 %)	20 ms
Mac (Computer)	0.51 %	4 (0.93 %)	1.9 ms

Table 8. The most used devices on 802.11g. Total number of subscribers is 11. Downstream volume is 237 MiB.

Device	↓ Vol.	Num. Sub.	Int.RTT
iPhone (Phone)	96 %	5 (45 %)	8.3 ms

# Wi-Fi Quality Management

**Congestion Management**

**Fairness**

**Premium Services**

**Managing High Volume Applications**

**Wholesale Traffic**

**Prioritizing Sign-on Traffic**



# Service Flexibility



- “Free”/Ad-Supported Services
- Premium Services
- Video-Friendly Services
- Turbo Services
- Usage Management & Tiers
- Application-Controlled Services

# Virtualization is Natural for Airport Wi-Fi



**Off-the-Shelf  
Hardware**

**Multiple  
Services  
Per Platform**

**Dynamically  
Scalable**

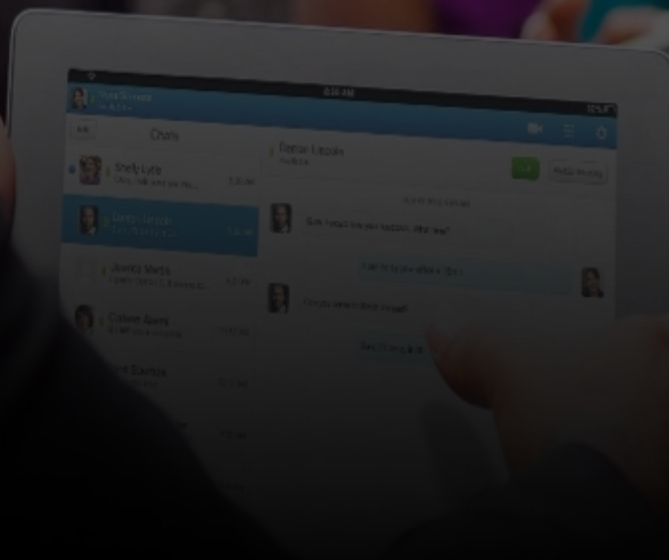
**Cost  
Flexibility**



A blurred background image of three people in an office setting. A man on the left, a woman in the center, and a man on the right are gathered around a tablet. The woman is pointing at the screen. The man on the right is holding the tablet. The background is out of focus, showing office plants and a white cup.

# PROCERA

EMPOWERING INTELLIGENCE



# Is SDN Cleared to Land in your Network?



Houman Modarres  
Marketing, Nuage Networks

**Airports Council International**

Spring Business Information Technology

March 2015



**nuagenetworks**



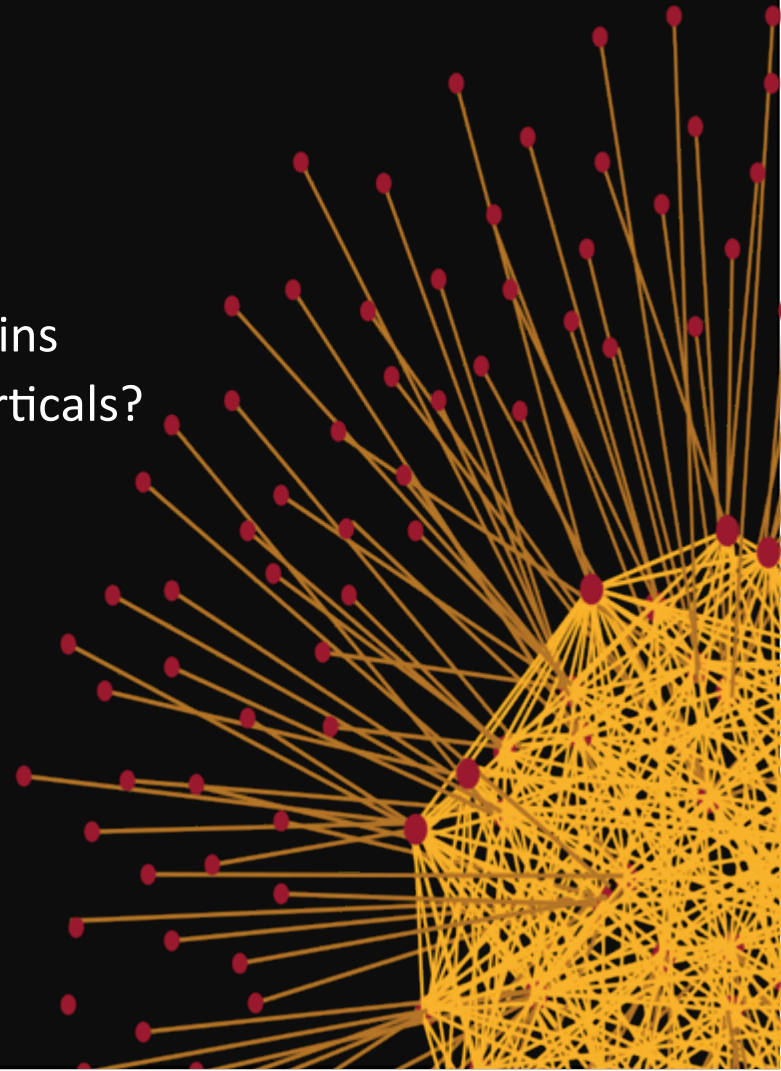
@nuagenetworks

@modarres



# The Cloud & Your Business

- What has changed?
- What needs to be re-thought as a result?  
(as far as networking is concerned)
- What does this mean to CIOs & network admins  
in the transportation industry & other key verticals?
- What's possible?



# The Big Change

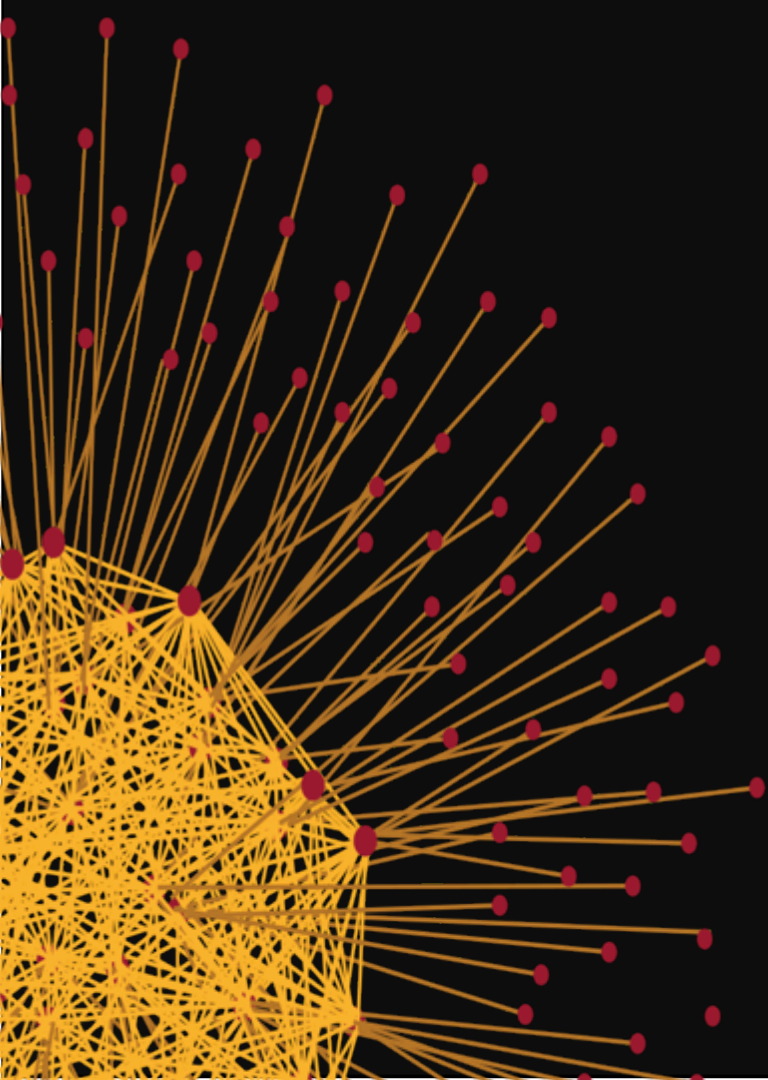
- The **Marriage of “IP” & “IT”**
- Shift in Operational Mindset
- Network Services on demand, in support of cloud applications
- Any application, any cloud, every time



# The Big Idea

Networking every bit as instantaneous  
and readily consumable as compute

- **Open:** Preserve choice
- **Boundary-less:** Networks, not islands
- **Policy-Driven:** Security & visibility



# The Fundamental Shift

A shift in  
**ABSTRACTION**  
How applications meet with the network



Lost in Translation



IT-Friendly Definition



## A Fundamental Shift

A shift in  
**AUTOMATION**  
How network services are installed

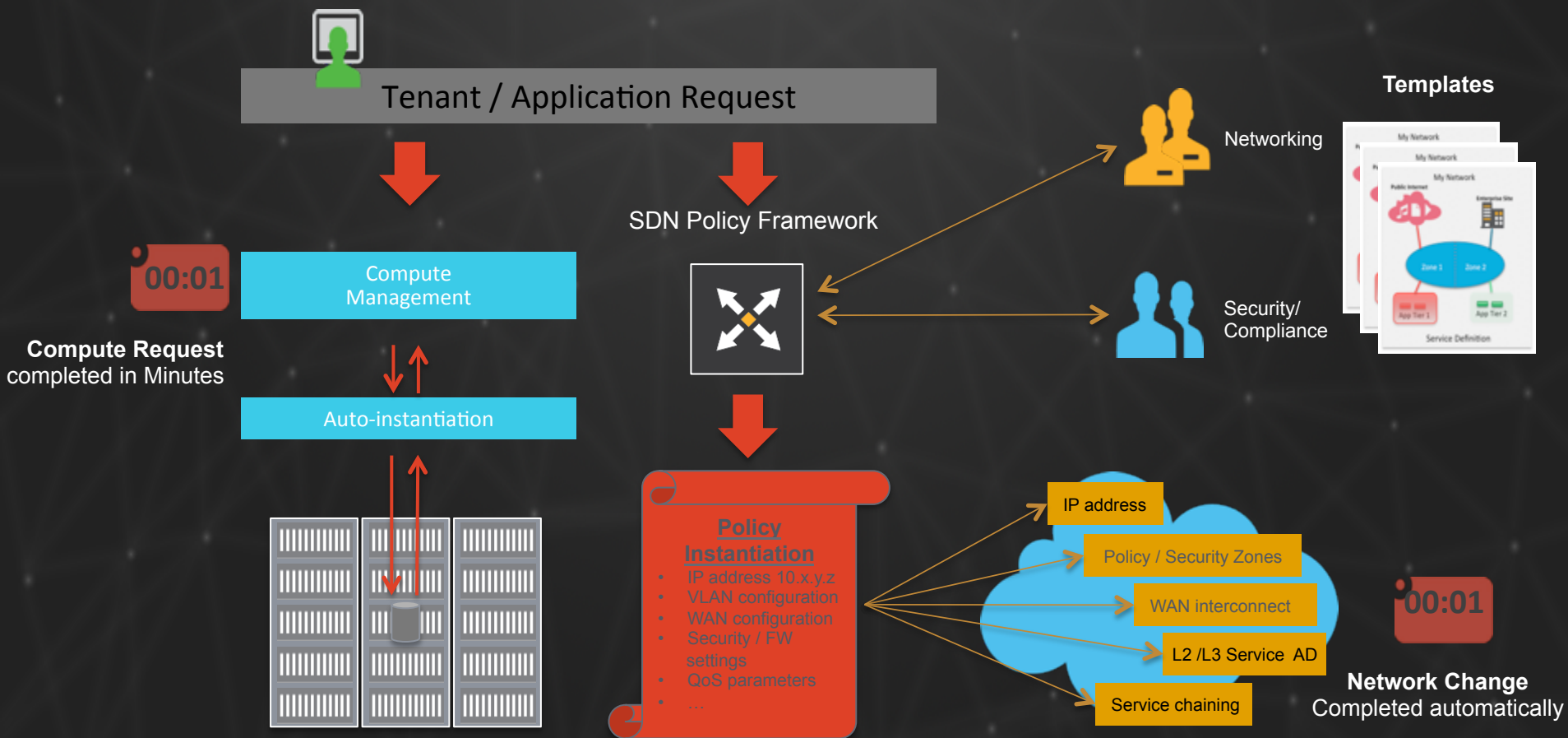


Configuration-driven



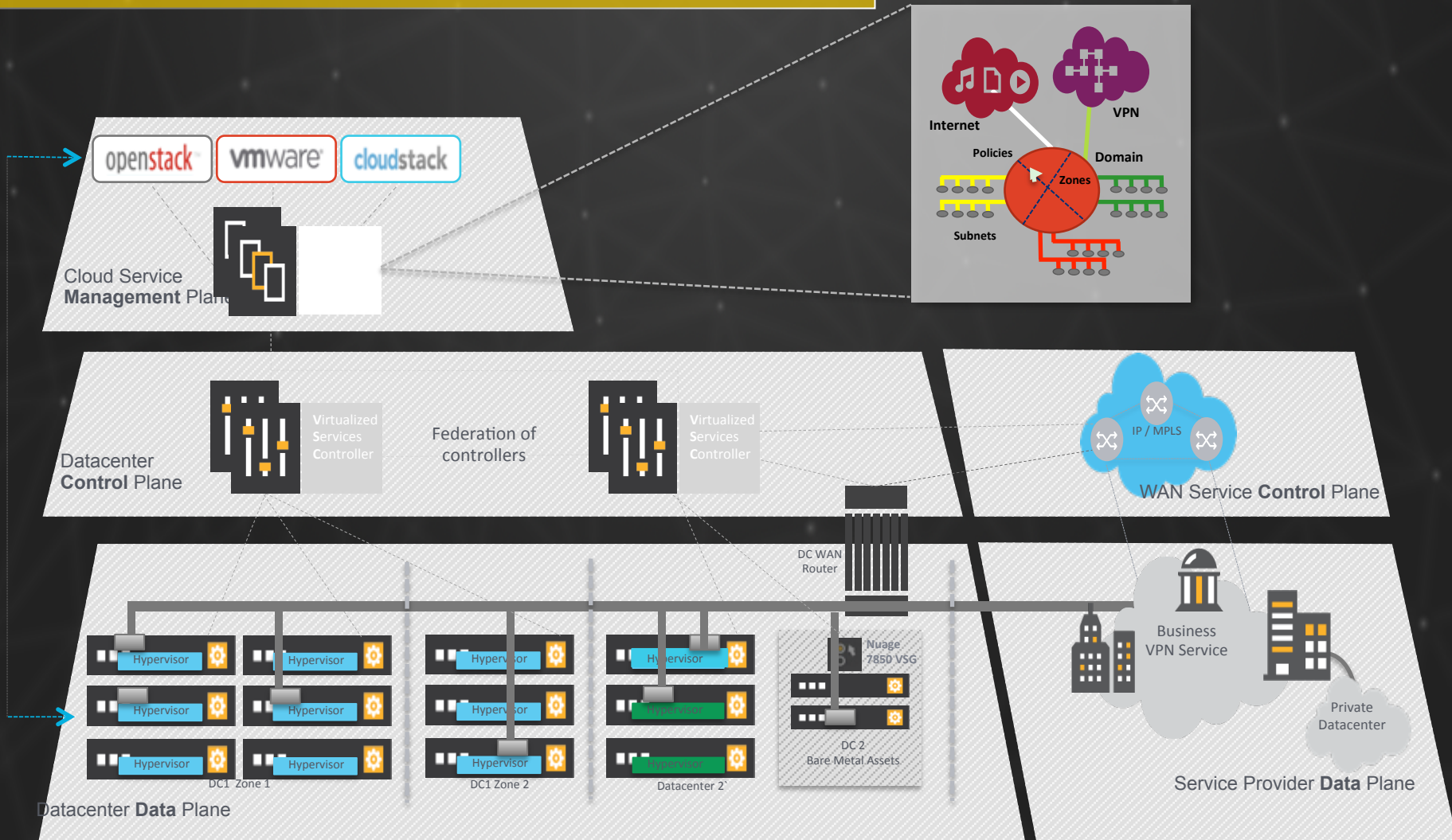
Auto-instantiation

# Policy-Driven Network Automation



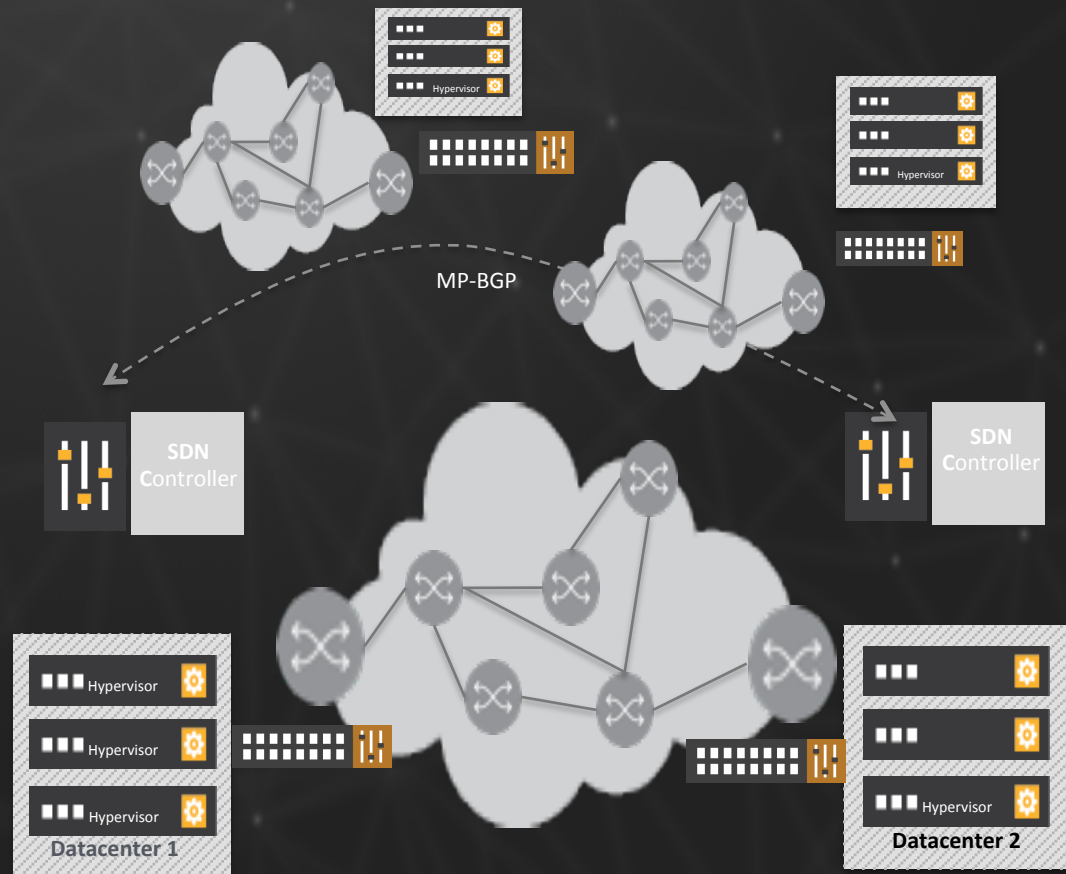


# SDN Automation across all Assets



# Use Case: Datacenter Interconnection

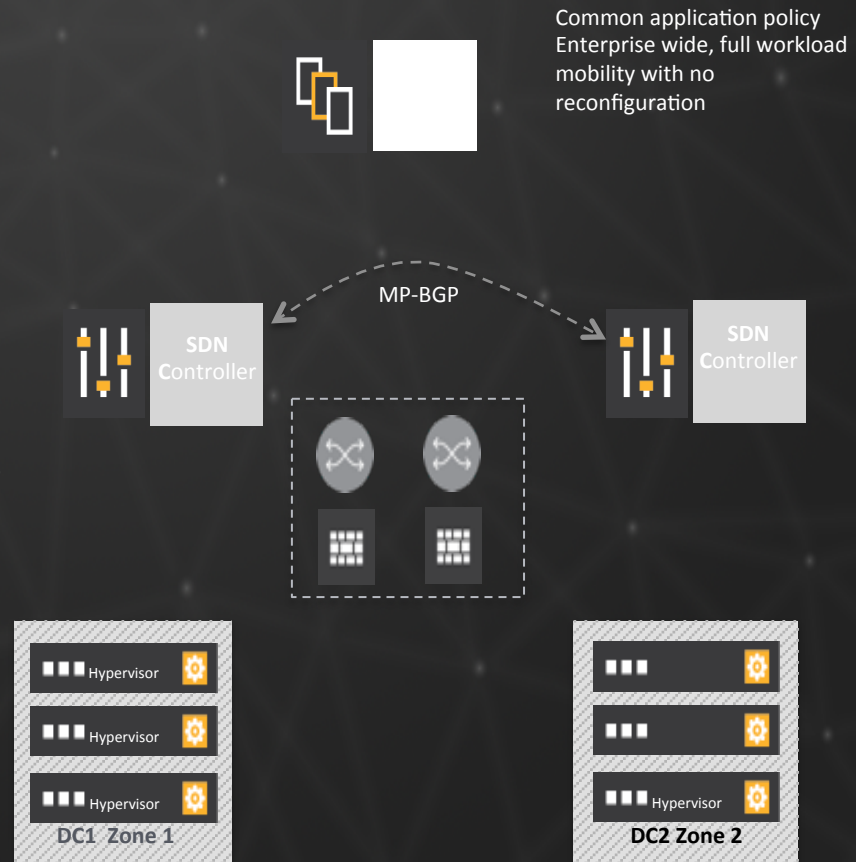
- Move workloads over existing network infrastructure
- Virtual networks span across physical locations
- Workloads inherit the same policy & attributes regardless of location
- Control and visibility across separate physical locations
- Ideal for traversing private, public or hybrid clouds





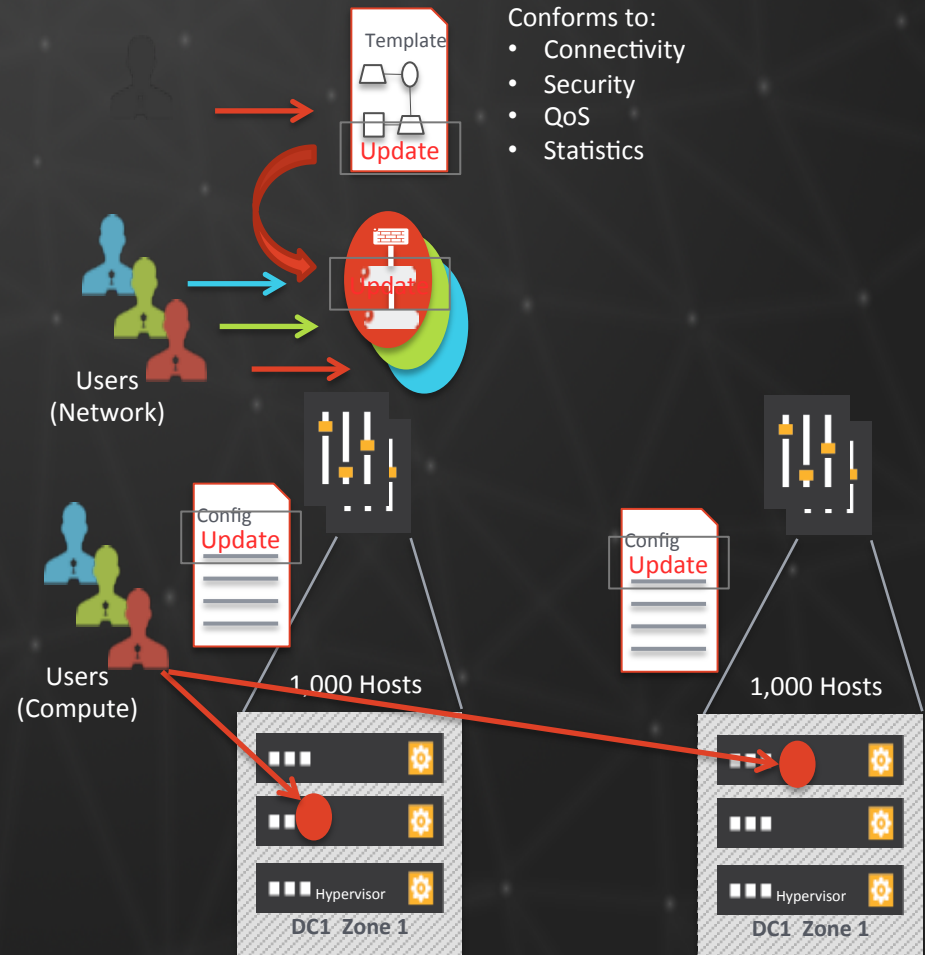
# Implicit Benefit: Disaster Recovery

- Move or mirror applications to backup sites in private or hybrid cloud
- Virtual networks scale between physical locations
- Application servers inherit configurations, are instantiated based on policy
- Control and visibility across disparate physical locations



# Derived Benefit: Compliance & Audit

- Update security policy once, centrally.
- Deploys across all appropriate endpoints
- Adhere to changes across the infrastructure implicitly
  - Compliance with global security policy
  - Configuration consistency



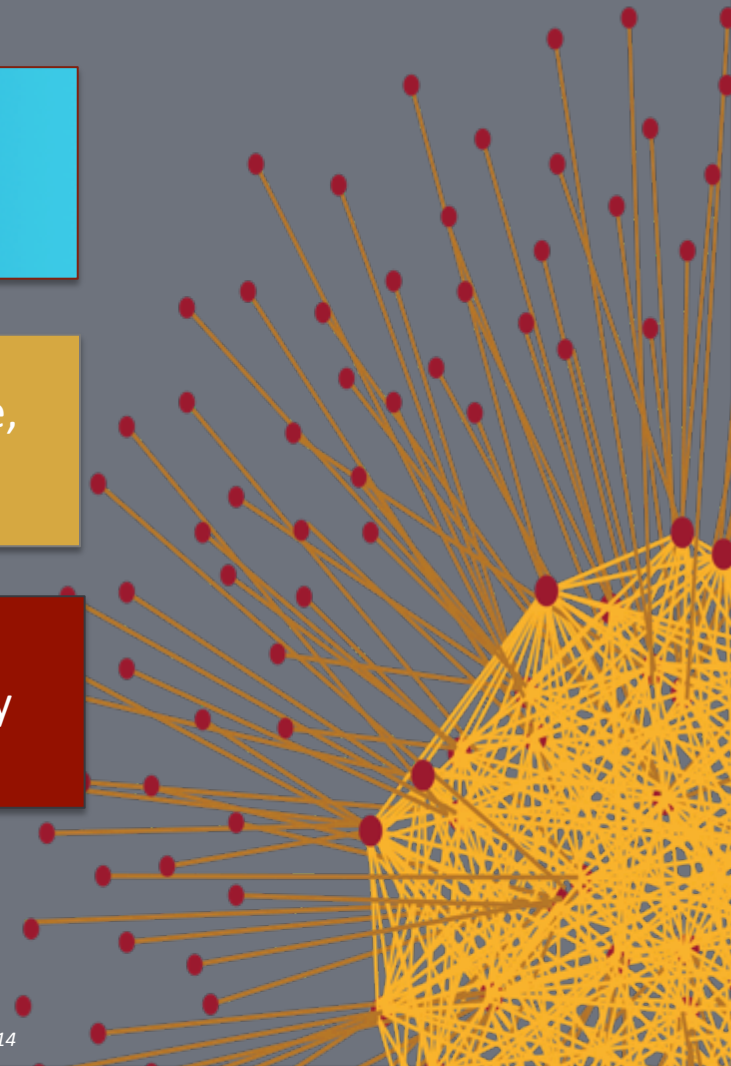


## Bottom Line for the CIO

**50%** Reduction in Operational Expense  
(Equipment, Power, Cooling, Space)

**10x** Improvement in turn-up response time,  
Reduction in configuration errors

**40%** Increase in asset utilization & flexibility



# What's Possible

- Taking the datacenter as it stands
- Policy-Based Network Auto-instantiation
- Agility without losing control & visibility
- Virtualizing Networks not islands
- Within & across datacenters & branches

**ANY APPLICATION,  
ANY CLOUD,  
EVERY TIME.**





# Key Points

- Networks should follow at speed of cloud apps
- SDN = Abstraction + Automation  
(& its principles really can drive more agility & less lock-in)
- Policy-driven auto-instantiation  
in lieu of device-by-device configuration  
(like mobile networks)
- Peering without boundaries, inclusive of branches  
(like the internet & VPNs)
- Benefits must extend across all assets  
(virtualized & bare metal, as many of your critical apps require)



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@nuagenetworks

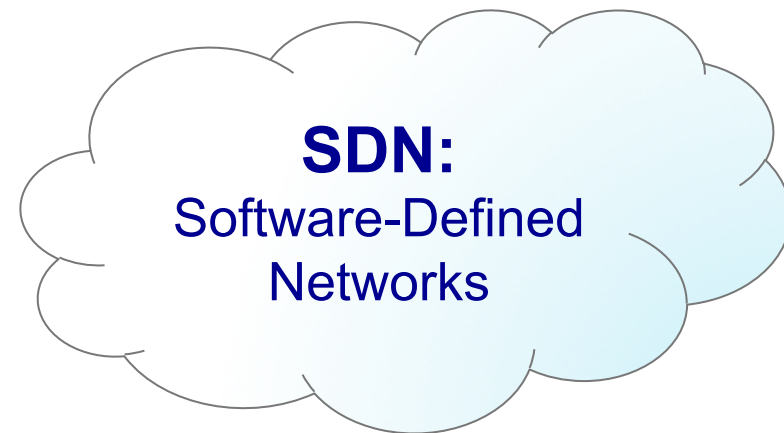
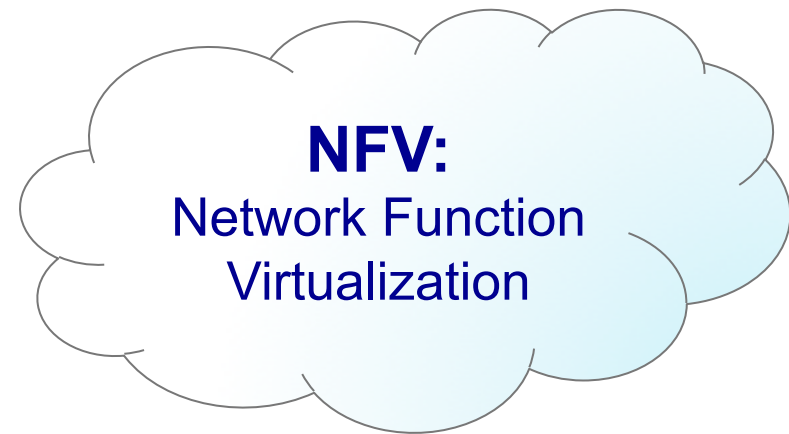


# Wrap-Up

# Why Are We Here?

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- Understand NFV & SDN
- The “Mobile Mind Shift”
  - More devices
  - More apps & services
  - More inter-connectivity
  - More challenges & threats
- Airport response & adaptation
  - IT tied to nearly every project
  - Multi-service networks require flexibility & scalability
  - Information security & consistency







**Thank you!**