WAN & Carrier Networks

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Vello Systems ,Vice President, Marketing

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Wiretap Ventures – Partner

We should leave this session with a common understanding of…

- . . . the ONF's definition of WAN and Carrier Networks
- . . . what people would like to do on WAN and Carrier Networks
- . . . some things we can't do on WAN and Carrier Networks today
- . . . some things you may be able to do on WAN and Carrier Networks with OpenFlow

Speakers Introduction

Harry Petty
Vello Systems, VP Marketing

- 20+ years in servers, networking, storage, and virtualization
- Brocade, Silverback, NEC
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- Brocade, Silverback, NEC
- Vello Systems
  - Marketing & Business Development
  - Open Systems, WAN, Data Protection, Ecosystem partnership
  - www.VelloSystems.com

Matthew Palmer
Wiretap Ventures, Partner

- 20+ years in networking and security, SaaS, and virtualization
- Pareto, Juniper, Netscreen, 7 patents issued; 4 pending in networking and network virtualization
- Wiretap Ventures
  - Strategy and Management Consulting
  - Network, Cloud, Virtualization,
  - www.SDNCentral.com

The networks we are going to discuss…

WAN Networks

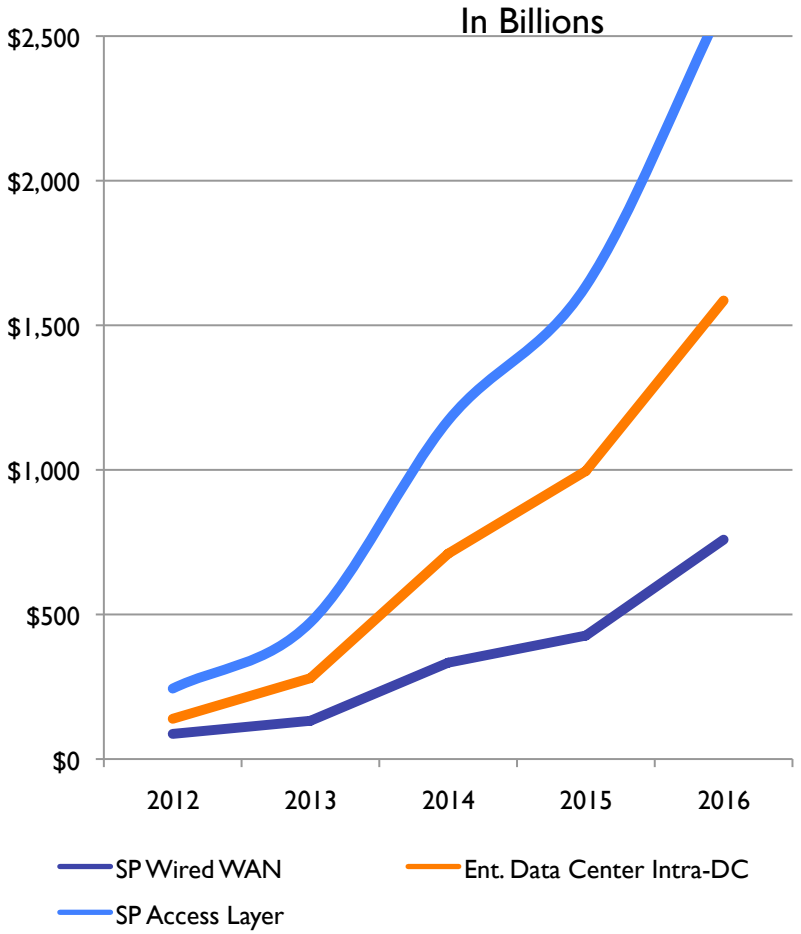
- Content Delivery DC Internetworks
  - Who: Enterprises trading on market data
  - What: Deterministic Low Latency MANs
  - Technology: Ethernet, Optical, App APIs
- Disaster Recovery Networks
  - Who: Enterprises require < 4 hrs downtime
  - What: Simple, Reliable, Economical replication nets
  - Technology: Ethernet, FC, Optical, storage APIs
- Agile Enterprise Networks
  - Who: Enterprises optimizing virtual resource pools
  - What: Multiple data centers connected via Flows
  - Technology: Virtualized compute, network, and storage orchestration across multiple DC

Carrier Networks

- Service Provider Wireline Networks
  - Who: Traditional Wireline Telcos
  - What: SP Backhaul Networks
  - Technology: Metro E, MPLS, Optical, etc
- Service Provider Mobile Access Networks
  - Who: Wireless Telco
  - What: Mobile Access Network
  - Technology: 3G / 4G , Pico, LTE, WIFI

Potential Market Opportunity

* Est. portion of spend these places in the network that goes SDN
** Use slide to think of relative size of SDN Uses Cases vs. Carrier & Ent Access Routers, Switches, WOC, ADC, Switching, Optical, SAN extension



- Comprised by a portion of spend of:
  - Carrier & Ethernet Routers, Switches, and APs
  - WOC's, ADC's, Optical, and SAN Extension
- Estimated use cases that could leverage SDN
- With a relatively small shift in spend – brings a relatively large SDN spend
- Not definitive – you can estimate yourself ☺
  - Compiled feedback from 4 former Juniper, Brocade, & Cisco exec's for estimates by use case
  - Ask two questions:
    - What % of spend by categories shifts to SDN?
    - What % of SDN spend applies per use case?

WAN Networks

Harry Petty
Vello Systems, Vice President, Marketing

Wide Area Network Discussion

Relevance to Product Managers

Why?

1. Data Center Interconnection is a new ONF topic
2. Disaster Recovery is mission critical for all clouds, large enterprises, SP data centers
3. Server and Storage connections required for business agility and business continuity
4. Huge big data opportunities in distributed data, eg. Healthcare

Challenges

1. Enterprises lacking WAN experience. SP inexperience with Enterprise use cases
2. Solutions need switches, controllers, transport, and management apps - the whole integrated platform
3. Simple solutions with large benefits will be available in 2012 for pioneers

Let's talk about where to spend your time…

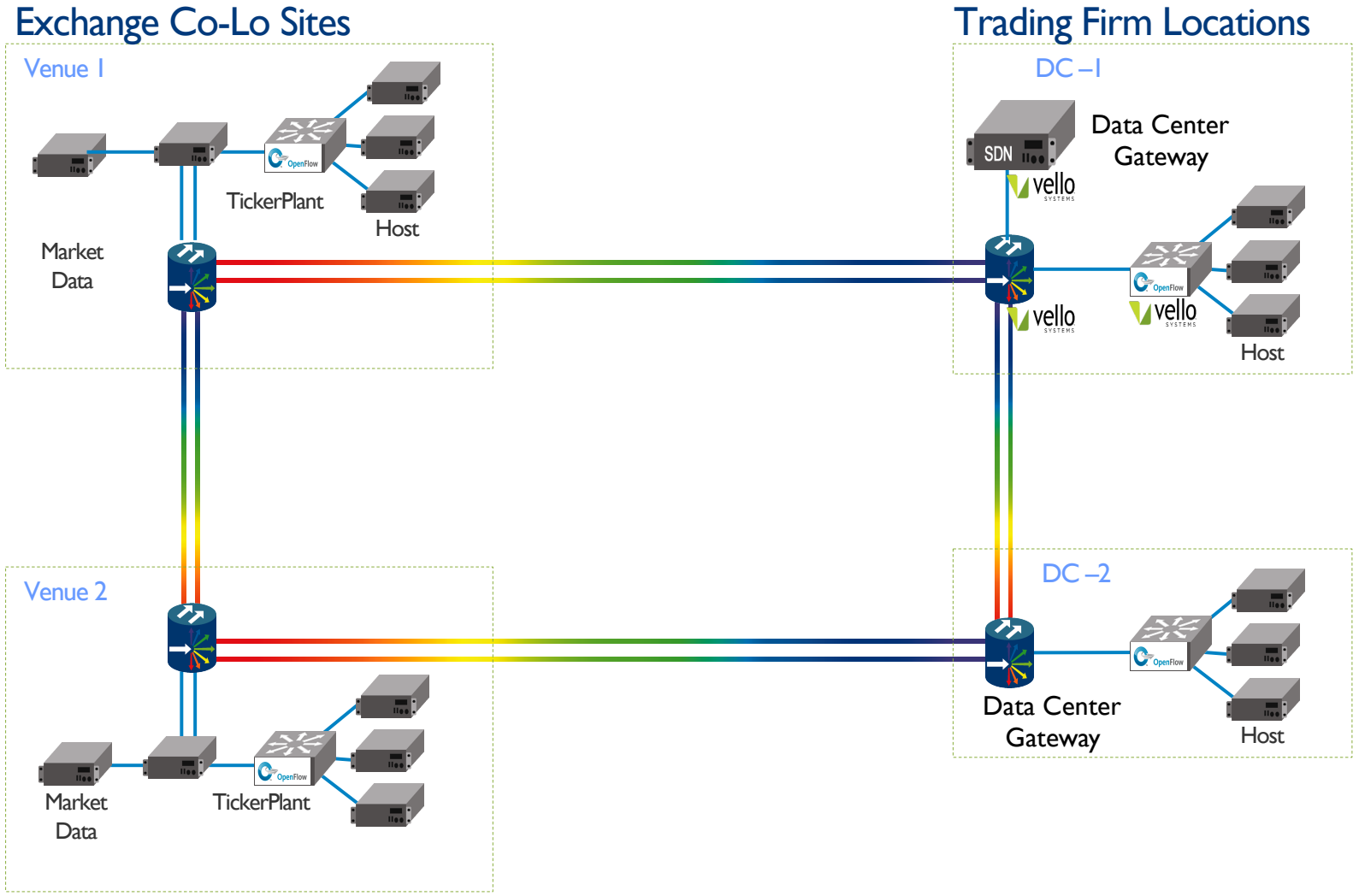
Sample SDN Use Case

Speed

Use Case	Ultra Low Latency Content Delivery
Business Problem	• Mission critical applications with stringent latency and reliability SLAs • Corporate profits highly leveraged on IT advantage • Highly competitive industry peers • Rapid innovation across architectures and technologies
Solution	• Best in class optical delivery, hybrid switched/optical network architectures, SDN control and network services
Network Problem	• Delay, jitter, head of line blocking, buffering, reliability, continuous monitoring
Scenario	• Distributed trade servers, algorithmic trading
SDN Solution	• Use SDN to dynamically allocate optical bandwidth and ensure strict SLAs are met

Proximity Trading

High Frequency Trading Firm



Sample SDN Use Case
BC/DR

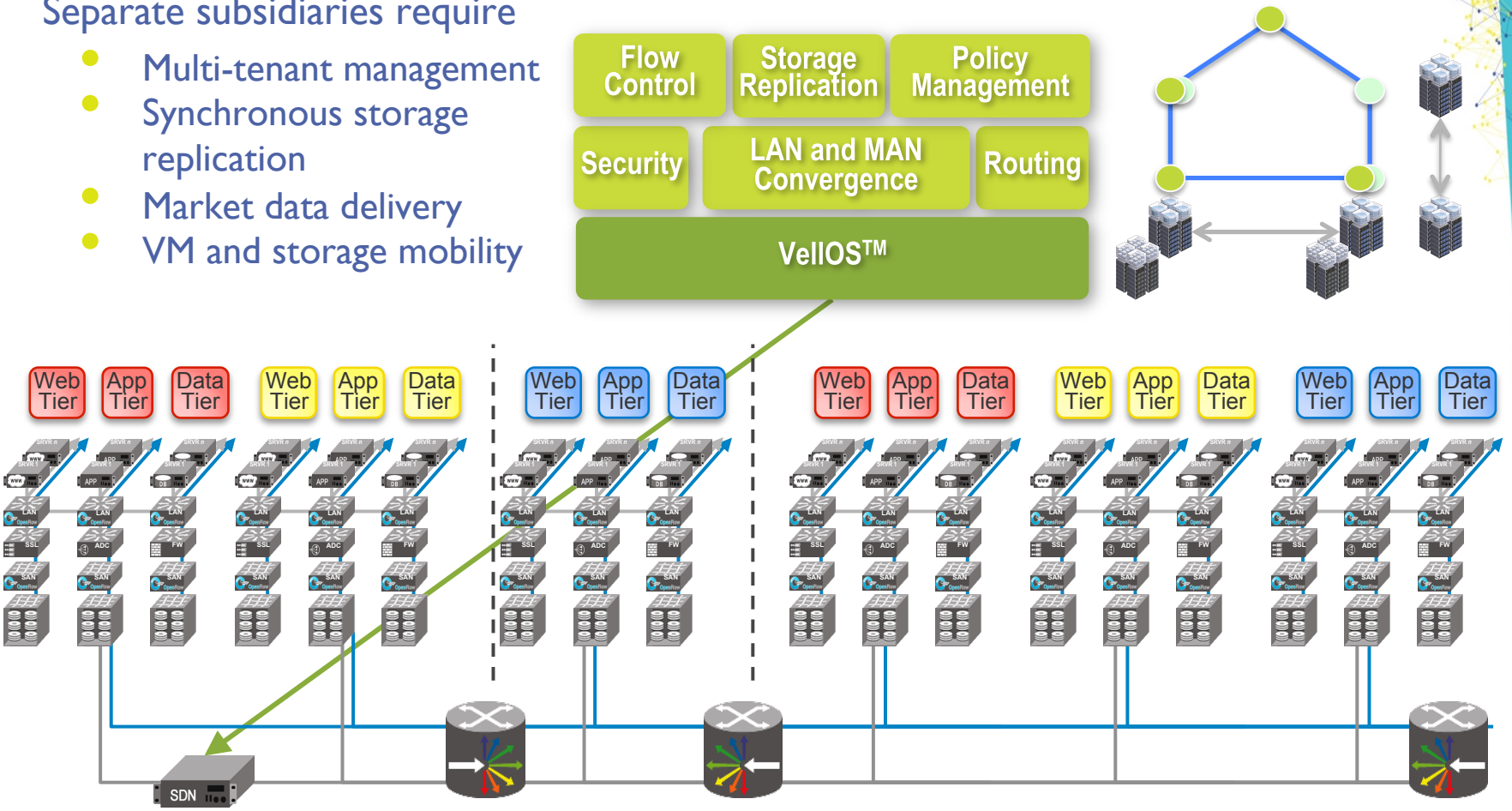
Use Case	Active/ Active Data Centers for Disaster Recovery
Business Problem	• Storage administrators find SAN Extension complicated, unreliable, expensive • Enterprise loses too much profit if operations are interrupted
Solution	• Simple, reliable, economical, programmable networks for DR
Network Problem	• Blackhole for customers to monitor, diagnose problems. Router complexity and latency
Scenario	• Business protection from disastrous DC failure with <4hr RTO
SDN Solution	• Use SDN to give storage application visibility on flows and continuously monitor and route the flows. Globally optimize for latency with a hybrid switched and circuit network for shared bandwidth with QoS control

Multi-Tenant, Multi-Site

Fortune 500 Bank

Separate subsidiaries require

- Multi-tenant management
- Synchronous storage replication
- Market data delivery
- VM and storage mobility



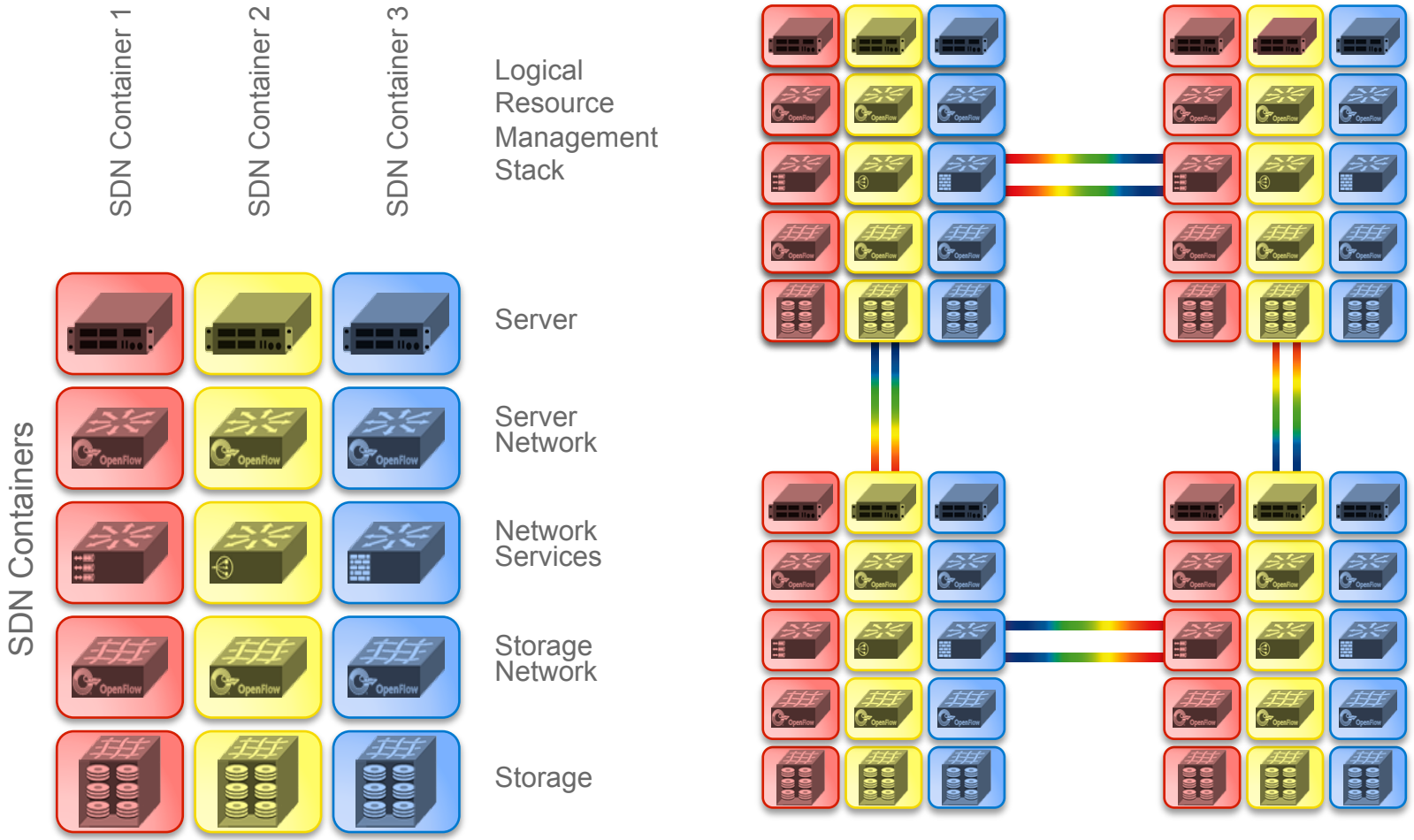
Sample SDN Use Case

Agility

Use Case	Pooled compute and storage across multi-DC
Business Problem	• Workload placement and mobility across multiple DC • Storage access for workloads across DC • Provision and manage the logical "wire" across the global cloud • Simplify global resource allocation between DC using virtualization
Solution	• SDN unifying LAN, SAN and WAN internetworking between DC sites
Network Problem	• Layer 3 tunnels for Layer 2 connection management. Coordinated changes between routing and circuit networks
Scenario	• SAN, Network, Server admins and apps have automated shared stats and policies for managing DC interconnects-as-a-service.
SDN Solution	• Use SDN to carve out bandwidth across switched and transport networks using latency optimized forwarding planes. Use SDN API to integrate into applications and orchestration frameworks to deliver DC interconnect-as-a-service

Workload and Application Data Mobility

Orchestration via SDN Containers



Potential Waves of WAN Adoption

Phase 1

- Financial Services DC Internetworks
  - Where: F500 banks, hedge funds
  - Driver: Latency sensitive apps, DR, Network simplification and custom control

Phase 2

- Global Cloud Workload and Data Mobility
  - Where: Multi-Data Center Private Cloud, Cloud Storage-as-a-Service Providers,
  - Driver: Medium Enterprise need for DR, Cloudbursting, Shared Virtual Bandwidth Economics

Phase 3

- SP Metro Access Networks for BC-as-a-Service
  - Where: CoLo Providers, Cloud Storage-as-a-Service Providers, Cloud Infrastructure SP
  - Driver: Medium Enterprise need for DR, Cloudbursting, Shared Virtual Bandwidth Economics

Benefits

- For Enterprises, look at Software Defined Networks for:
  - a new network architecture
  - to simplify DCI operations through automation and
  - closely couple storage and application needs programmatically to the network
- For SP, use Software Defined Wide-Area Networks for new service opportunities for Enterprise customers via DCI use cases

Carrier Networks

Matthew Palmer
Wiretap Ventures, Partner

Carrier Network Discussion

Relevance to Product Managers

Why?

1. Huge spend and large market
2. Mission critical area in the network
3. Costs are out of control – things have to change
4. Lots of potential use cases

Challenges

1. Arguably the most important networks – from Carrier revenue perspective
2. Which makes change hard (i.e. time consuming)
3. SDN for Carrier Networks is especially 'complex'
4. There are arguably easier use cases with faster ROI

Let's talk about where to spend your time…

Where SDN is Most Useful in Carrier Networks

- Key attributes conducive to SDN
  - Agility and dynamism required
  - Traffic growth is rapid
  - Management of individual flows is necessary and adds value
    - Static configuration no longer meets customer need
- Candidate areas
  - Hotspot 2.0/LTE/Wi-Fi/3G converged access
    - Mobile device explosion, data rate explosion
    - Unique QoE per subscriber class
  - Cross-DC, hyperscale-related Carrier Ethernet services
    - Where tracking of individual flows or optimizing over multiple DC is necessary and of value

Market Opportunities

Market Opportunity

- Mobile Access Networks have hyperscale growth problem
- Traditional Wire is optimization play

Phases

- Mobile Access 3 -5 years behind datacenter in terms of use cases
- Traditional Wire will be last to transition

Open Questions

- Will Carriers build their own network HW / SW for mobile access networks? – like hyperscale DC
- Timing – for both use cases one due to complexity; other to do lack of compelling reason to move

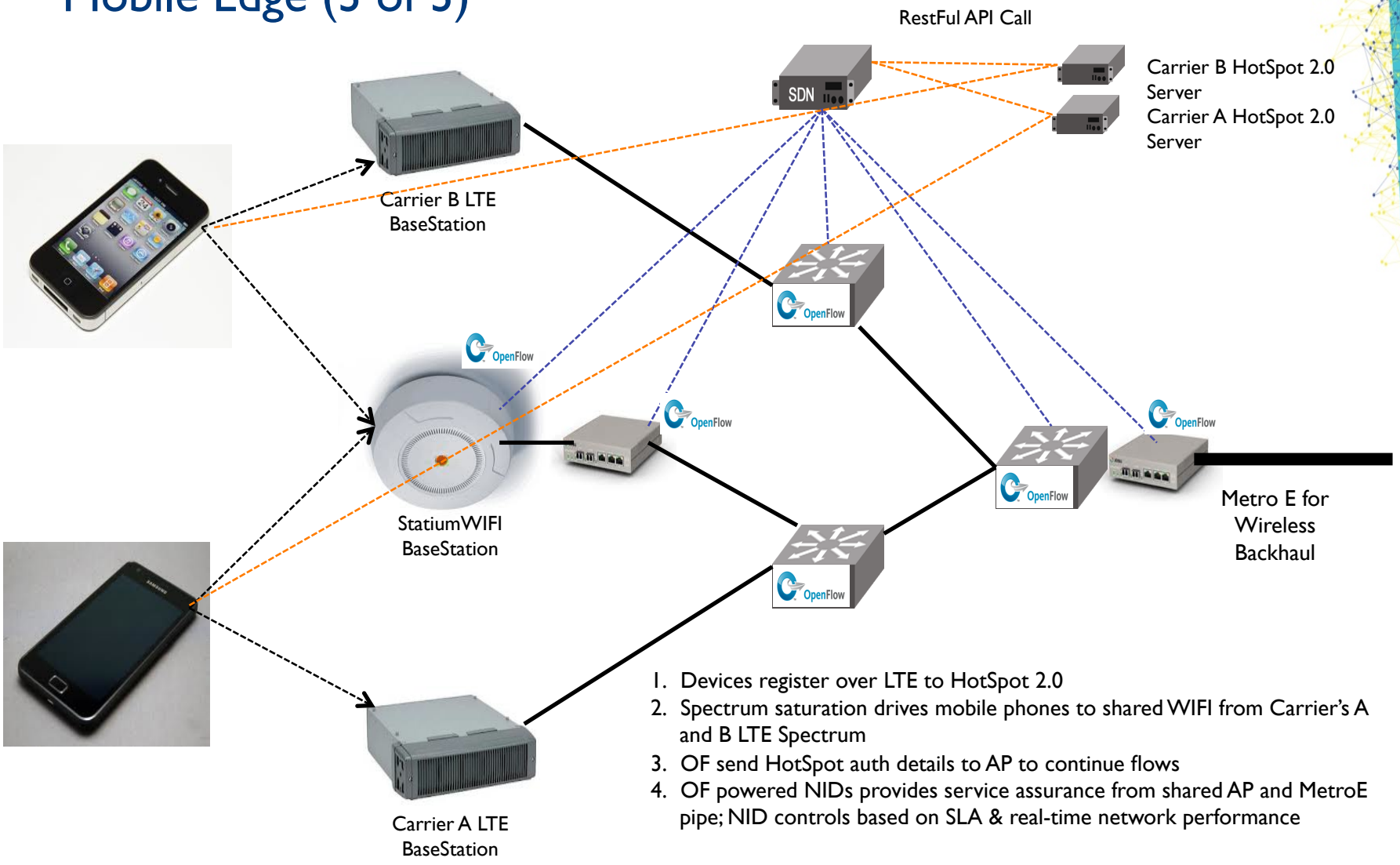
Sample SDN Use Case
Mobile Edge (1 of 3)

Use Case	Seamless roaming between 3G/4G + WIFI
Business Problem	• Hyperscale growth in devices & bandwidth consumption per device • Lack of spectrum; coverage or density of coverage in many areas • Even if solve spectrum + density issues – can't afford to roll it out • As lose subscribers and revenue; the less can afford to catch up
Solution	• Leverage unlicensed spectrum via WIFI to both off load spectrum and increase density
Network Problem	• Fast, seamless voice, data, video transition from separate 3G / 4G to WIFI networks and back
Scenario	• 100k people at a football stadium; fixed WIFI at stadium who want to stream video
SDN Solution	• Use SDN to dynamically partition access points and cell radios on-demand based on carrier, usage, identity, device type etc. to enable optimal usage of spectrum and WIFI and mobile backhaul links to enable maximum number of users to download video

Sample SDN Use Case
Mobile Edge (2 of 3)

Use Case	Seamless roaming between 3G/4G + WIFI
Why can't you do this today	• Common interfaces b/w networks is limited to identity (Hotspot 2.0) • Can't easily carve up an access point across carriers • Can't easily carve up backhaul bandwidth on-demand based on number of subscribers and bandwidth requirements
Prerequisites	• AP's and cell stations that can be dynamically controlled (OF?) • Service assurance technologies that can be dynamically collect, report and be reconfigured based on data (OF?) • Robust policy engine that can carved up based on business agreements and enforced on the network
Benefits	• 100k people can watch the replay on-demand • Shared (multi-tenant) infrastructure at location that makes sense – make delivering services cost effective • Ability to enforce business logic & policy on network enables new revenue stream and / or protects existing

Sample SDN Use Case
Mobile Edge (3 of 3)



1. Devices register over LTE to HotSpot 2.0
2. Spectrum saturation drives mobile phones to shared WIFI from Carrier's A and B LTE Spectrum
3. OF send HotSpot auth details to AP to continue flows
4. OF powered NIDs provides service assurance from shared AP and MetroE pipe; NID controls based on SLA & real-time network performance

Potential Waves of SDN Carrier Network Adoption

Phase 1

- Research and Education Networks
  - Where: GENIE, Internet 2, etc.
  - Driver: Experiment & Learn how adds unique value to Carrier Networks

Phase 2

- Mobile Access Layer
  - Where: Cellular, Wi-Fi, PicoCells, FemtoCells, etc and their wired backhaul networks
  - Driver: Hyperscale growth in mobile devices & bandwidth – much change

Phase 3

- Traditional Wired Networks
  - Where: Carrier WAN transport networks
  - Driver: Cost and Service Optimization

Take-Aways

Most important job is choose SDN markets and opportunities wisely

- Size
- Timing
- Drivers

Qualify why a use case takes time to evolve:

- Incremental improvement
- Wholesale change
- Economic Buyer
- Compelling reason to buy

Carrier Use case recommendations

- Experiment w/ REN's – learn how / what market evolves -
- Focus on how to become part of hyperscale mobile ecosystem
- Focus less on 'how' and more on 'what' and 'why'

THANK YOU

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