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DEAL
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INNOVATION
TECHNOLOGY
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NETWORK

SCTE·ISBE CABLE-TEC
EXPO
2017

DENVER, CO
OCTOBER 17-20

2017 Fall
Technical Forum
SCTE·ISBE · NCTA · CABLELABS
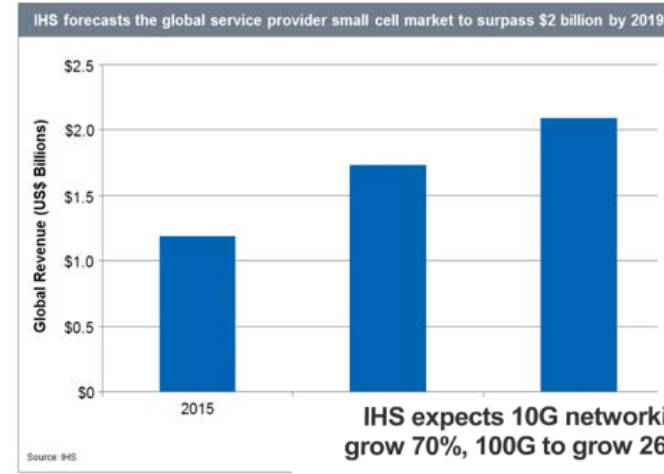
Topics to Discuss

- New market and trends for Metro Ethernet Services

- Service Provider Challenges to Service Activation and SLA Management
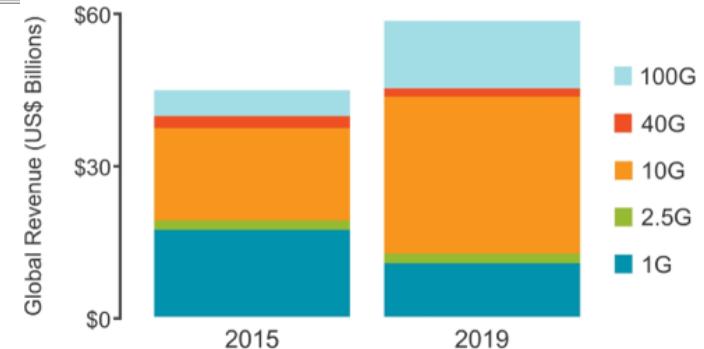
- Best practices for zero-touch automation

- Summary

- Small Cell growth drives increased demand for Ethernet backhaul services

- Expected delivery of voice, video, and data services require SLAs around packet delay, jitter, etc.

- IHS forecasts worldwide 100G port revenue to **grow at a 137 percent compound annual growth rate** (CAGR) from 2014 to 2019

- 100G price/port reduction is driving demand

Rapid growth requires Automated & Intelligent Service Assurance

IHS forecasts the global service provider small cell market to surpass $2 billion by 2019

Global Revenue (US$ Billions)

2015

Source: IHS

IHS expects 10G networking port spending to grow 70%, 100G to grow 262% from 2015 to 2019

Global Revenue (US$ Billions)

2015   2019

- 100G
- 40G
- 10G
- 2.5G
- 1G

© IHS, *IHS Infonetics Networking Ports: 1G, 2.5G, 10G, 40G, 100G: Biannual Market Size and Forecasts; September 2015*

Table C.2: Example cloud transport connectivity service attributes and SLA ([i.17])

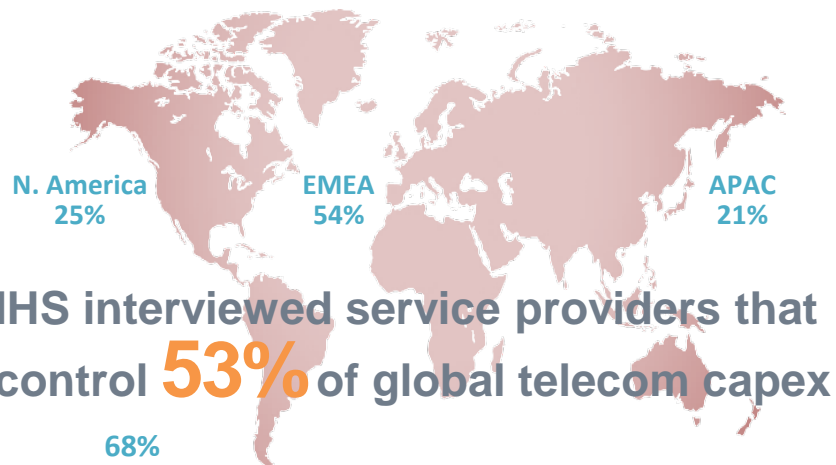| Service	Priority	CIR	EIR	Frame Delay	Delay Variation	Loss	Availability
VoIP calls	0	10 mbit/s	0	5 ms	< 1ms	0,1 %	≥ 99,99 %
Telepresence	1	50 mbit/s	0	25 ms	< 10 ms	0,1 %	N/A
Mission critical data	2	25 mbit/s	0	5 ms	< 1 ms	0,01 %	≥ 99,995 %
Streamed live content	3	40 mbit/s	0	5 ms	< 1 ms	0,01 %	≥ 99,99 %
Non real-time content	4	15 mbit/s	500 mbit/s	25 ms	10 ms	1 %	≥ 99 %

ETSI GS NFV-REL 004 V1.1.1 (2016-04)

"Latency is a very critical SLA metric, rated very important by 100% of respondents, followed by uptime/reliability, downstream bandwidth, jitter, and upstream bandwidth"

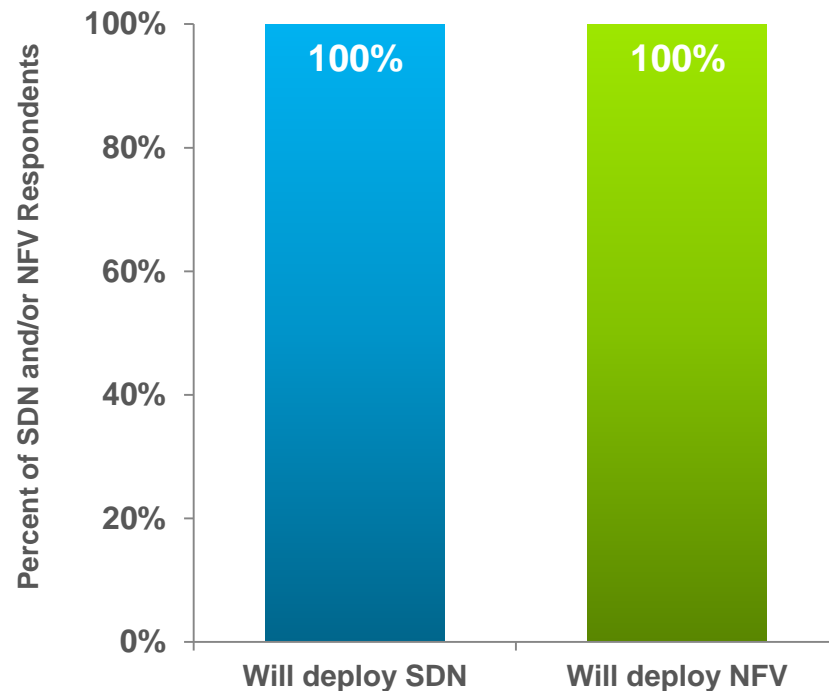Infonectics Macrocell Backhaul Strategies and Vendor Leadership: Global Service Provider Study
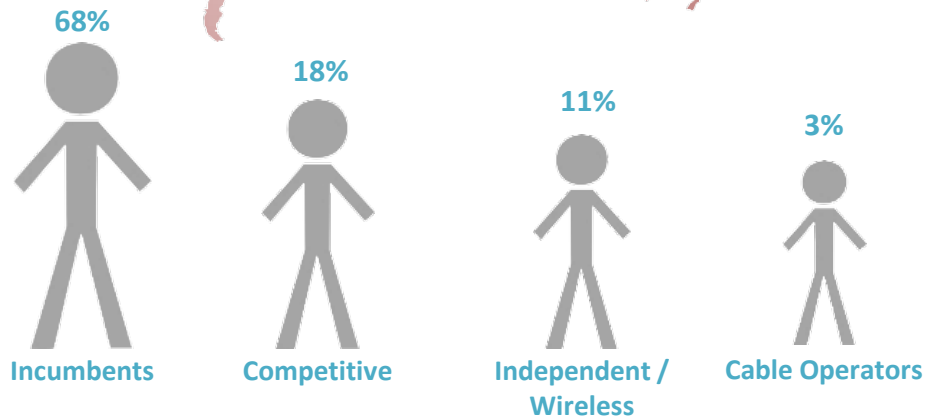
Requires increased focused on both delivery and performance

N. America
25%

EMEA
54%

APAC
21%

IHS interviewed service providers that control 53% of global telecom capex

68%

18%

11%

3%

Incumbents

Competitive

Independent / Wireless

Cable Operators

Percent of SDN and/or NFV Respondents

100%

100%

Will deploy SDN

Will deploy NFV

Source: IHS Markit Carrier SDN Strategies, 2016 and Carrier NFV Strategies, 2016; Respondents control 53% of global telecom capex

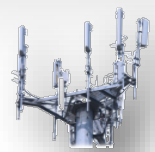## Service Delivery

Failure To Meet Installation Critical Dates
(Turn-Up / Activation Issues)

High Percentage of Turned Up Broke
(Dead on Arrival)

Is the Service Delivering What Was Ordered?
(Customer Dissatisfaction)

Trouble Management

Large number of man hours to isolate troubles
(Large Mean Time To Repair)

Multiple Dispatches to Find then Fix
(Many Truck Rolls)

Sectionalizing between Service Providers
(Finger Pointing)

SLA Management

No Visibility into Service Performance
(Reactive approach to problems)

SLAs not being met
(Customer Credits)

Service Turn Up with Handhelds

- Requires multiple personnel (field, NOC, etc.) to be "dispatched"
- Difficult to scale handhelds and personnel as the service grows
- Single NOC/Data Center tech can only test one circuit at a time
- Costly and doesn't scale well

Monitoring SLAs with NIDs

- Every NID is managed by separate by vendor-specific EMS. (requires "swivel chair" in heterogeneous networks)
- End-to-End testing typically treats the network as a "black box", with no ability to sectionalize, when SLAs **are not** being met.
- Difficult to troubleshoot problems >leads to finger pointing
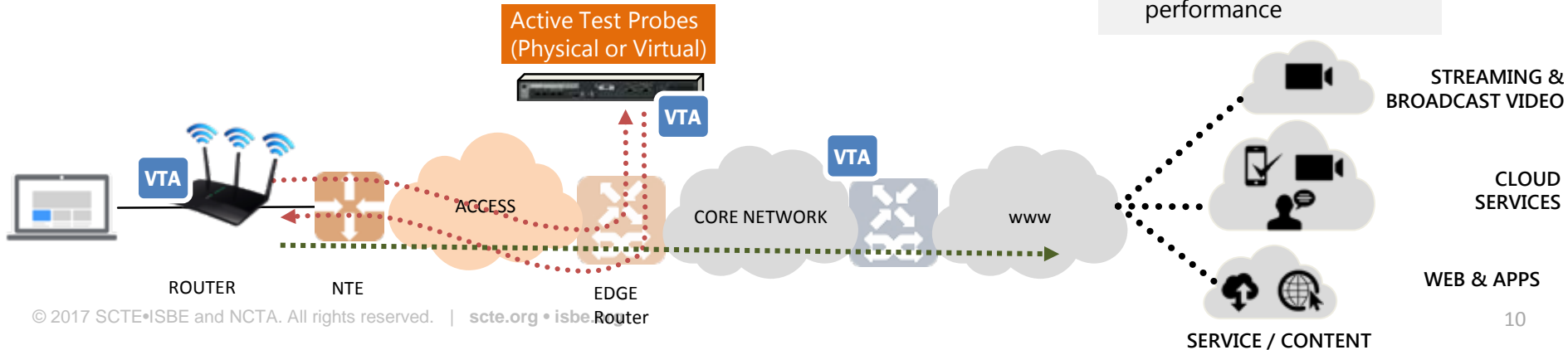
Monitoring SLAs with Passive Probes

- Passive monitoring involves analyzing real-time user traffic
- Limited to data collection only on the ingress UNI
- Doesn't provide an end-to-end view of service performance
- Only provides analysis when user traffic is available.
- Doesn't adequately support virtual & hybrid networks

Best Practices for "Zero-Touch" Ethernet Service Assurance

1. Centralized, automated and intelligent Lifecycle Service Assurance

2. Use of global, industry-wide test standards (e.g., leverage CPE embedded features)

3. End-to-end visibility, troubleshooting & segmentation (e.g., "Dispatch to fix, not to find")

4. Integration of all dependent systems within a single Service Assurance Test Controller

5. Scalability to handle drastic service growth w/o large increases in OPEX

1. Complete Lifecycle Service Assurance
Supports for hybrid networks from activation, monitoring & troubleshooting

Active Service Activation

- Enables consistent and repeatable activation
- Centralized storage of Service Birth Certificate
- Automated network element control
- Multiple test methodologies

Active Performance Monitoring

- Scalable, 24x7 analysis, monitoring & reporting
- SLA and Availability Monitoring enables SLA management
- Native web GUI and NB interface to existing OSS

Passive Monitoring (On Demand Troubleshooting)

- Traffic Visibility – VLAN statistics, Class of Service & more
- Data Analysis – top talkers, top apps, etc.
- Capture/Decode – deep dive analysis

Active (On-Demand Troubleshooting)

- Integration with trouble ticketing and inventory systems enables automated fault isolation
- Simplified web UI enables customers to self test their services
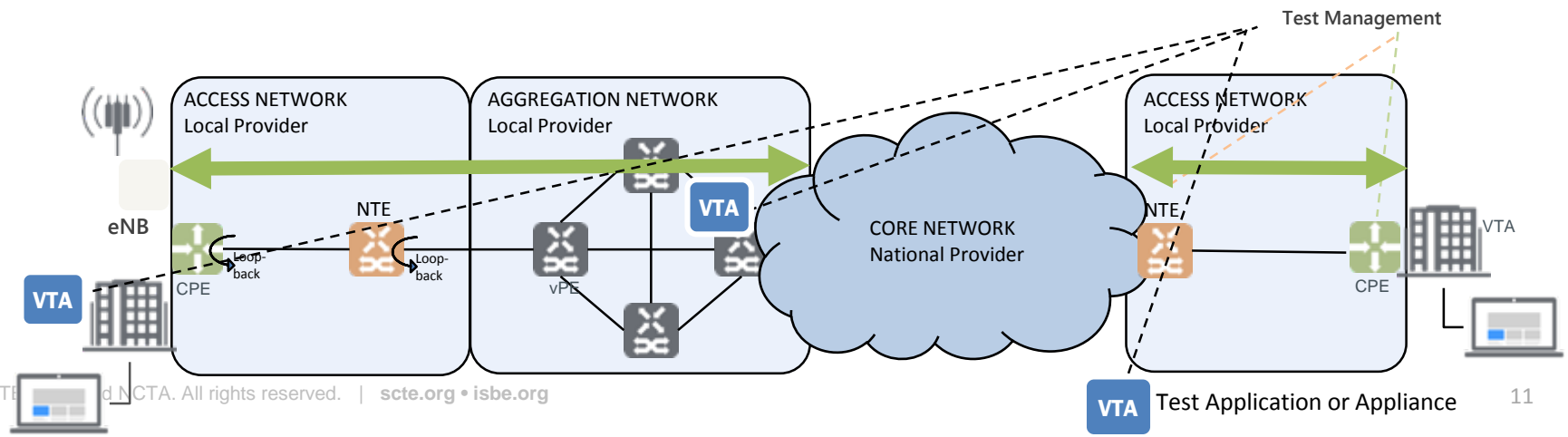- Active Test Suite at Layer 2/3/4 emulates customer traffic, verifies service performance

Active Test Probes (Physical or Virtual)

VTA · VTA · VTA

STREAMING & BROADCAST VIDEO

CLOUD SERVICES

WEB & APPS

SERVICE / CONTENT

ROUTER · NTE · ACCESS · EDGE Router · CORE NETWORK · www

Active Testing at Layer 2/3/4 enables rapid & thorough provisioning validation:

- 802.1ag / Y.1731
  - Loopback Message
  - Delay Message
  - Multicast Loopback

- RFC 2544 – Benchmarking Test

- RFC 5357- TWAMP
  - Session Sender
  - Session Reflector

- RFC 6349 TCP Throughput Testing

- Y.1564 – Service Activation Test
  - EMIX
  - Burst

- PING
  - UDP / TCP

- Trace Route

Test Management

ACCESS NETWORK
Local Provider

AGGREGATION NETWORK
Local Provider

CORE NETWORK
National Provider

ACCESS NETWORK
Local Provider

eNB

NTE

VTA

NTE

VTA

VTA

CPE

Loop-back

Loop-back

vPE

CPE

VTA   Test Application or Appliance

24x7 Active Performance Monitoring enables proactive management of SLAs:

- Thousands of endpoints supported from each physical / virtual test head

- 802.1ag / Y.1731 EOAM PM
  - Loopback
  - Delay Message

- L2/L3 Network Quality PM
  - Multi-Stream
  - Loss/Latency/Jitter
  - Availability

- TWAMP PM
  - Round trip & one-way metrics
  - Multi-Stream
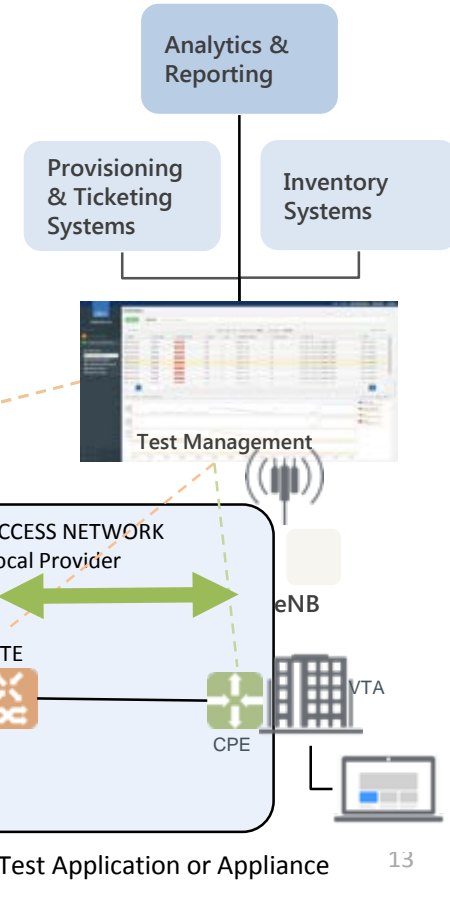 - Loss/Latency/Jitter
  - Availability
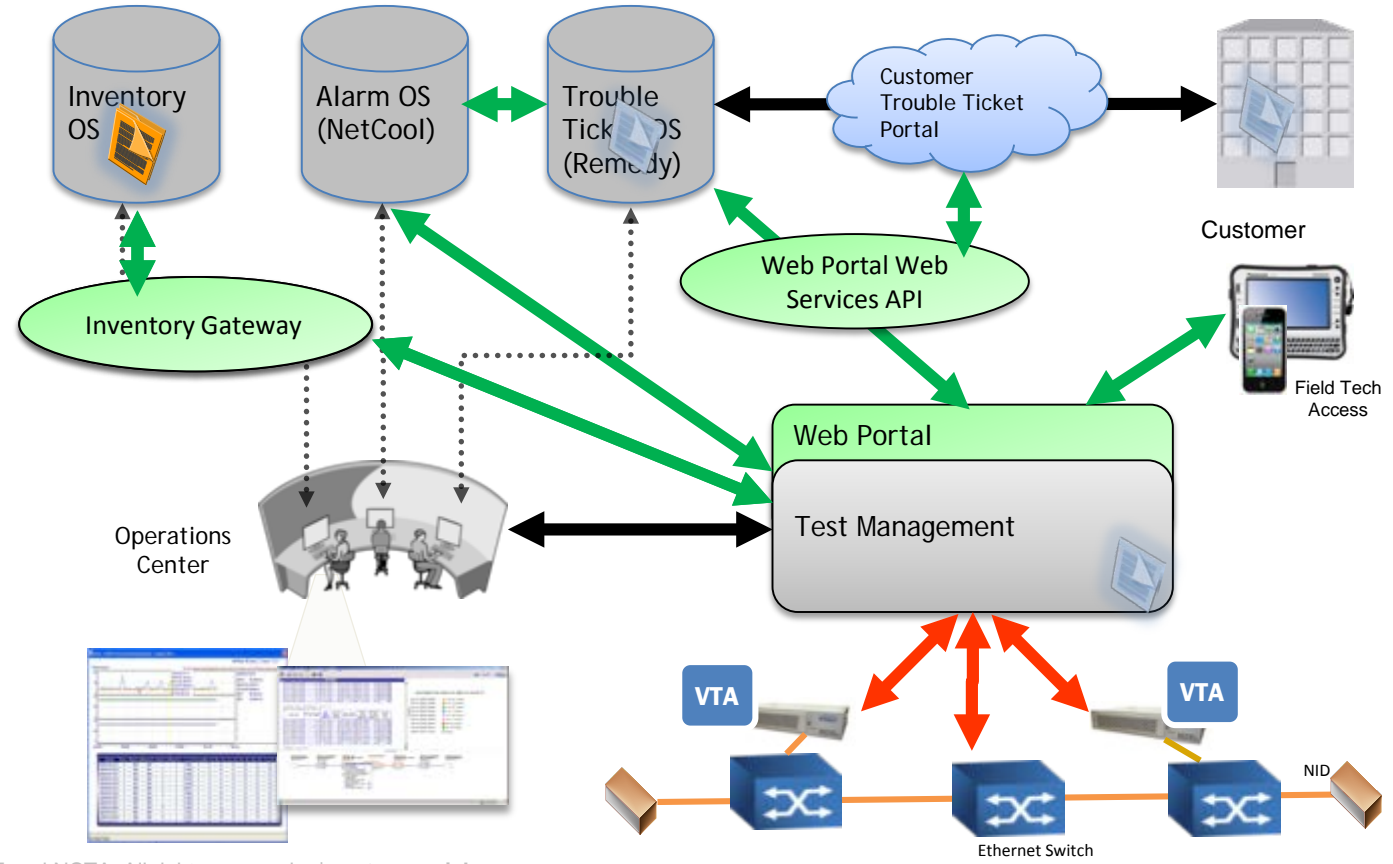
- PING PM
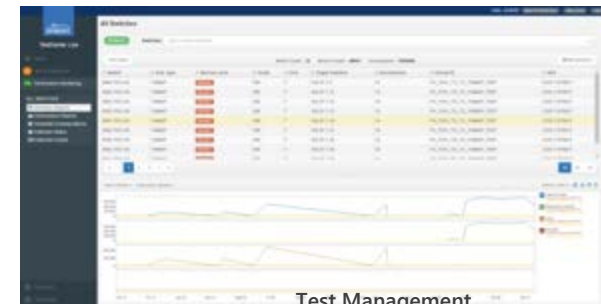
Test Management
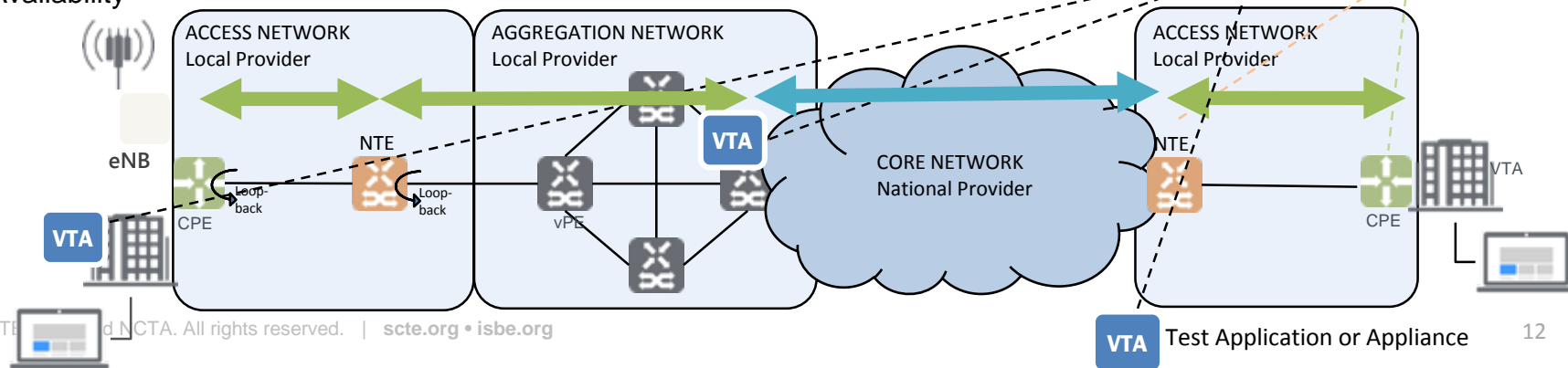
- Centralized Test Management provides a single pane of glass for testing end-to-end as well as segmenting the network; interfaces to multiple vendor's equipment: Accedian, Ciena, Cisco, ALU, Juniper, Arista , Rad

- Interfaces with Northbound Systems to enable automated ticketing and reporting; complete no-touch provisioning and segmentation

- A single, intuitive point/click UI to reduce swivel chair operations, eliminate dispatch & reduce time-to-repair

Analytics & Reporting

Provisioning & Ticketing Systems

Inventory Systems

Test Management

ACCESS NETWORK
Local Provider

AGGREGATION NETWORK
Local Provider

ACCESS NETWORK
Local Provider

eNB

NTE

VTA

CORE NETWORK
National Provider

NTE

eNB

CPE

Loop-back

Loop-back

vPE

CPE

VTA

VTA

VTA   Test Application or Appliance

13

Integration & automation - with other systems

CSR

Configuration Validation
Port & EVC Throughput
Loopback Setup

NTE/CPE

Configuration Validation
Port & EVC Throughput
Show MAC Table
Show MEP Config
Show Port Counts
Show Device Status
Loopback Setup
RFC-2544 Tests
EOAM Tests
IP Tests

EMUX

Port Throughput
Find MAC
Chassis Information
MEP Information
Port Information
System Configuration
Transceiver Information
VLAN Information
EOAM Tests
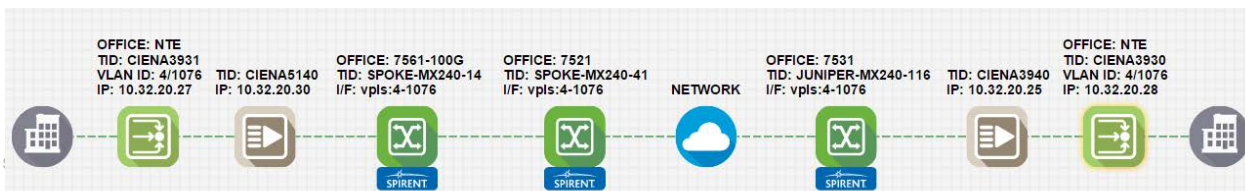IP Tests

SWITCH/ROUTER

Service reconfiguration to
add test head to service
under test
      ELINE, EPIPE, VPLS,
      VPWS, MPLS, and
      other Service types
Port & EVC Throughput
CRC Errors
Show MAC Table
Show QoS Policy
Show Transit Stat
Show VLAN Tag
Show VPLS Stats
RFC-2544 Tests
EOAM Tests

NID/SmartSFP

Configuration Validation
Port & EVC Throughput
Loopback Setup
RFC-2544 Tests
EOAM Tests
IP Tests

OFFICE: NTE		OFFICE: 7561-100G	OFFICE: 7521		OFFICE: 7531		OFFICE: NTE
TID: CIENA3931	TID: CIENA5140	TID: SPOKE-MX240-14	TID: SPOKE-MX240-41	NETWORK	TID: JUNIPER-MX240-116	TID: CIENA3940	TID: CIENA3930
VLAN ID: 4/1076	IP: 10.32.20.30	I/F: vpls:4-1076	I/F: vpls:4-1076		I/F: vpls:4-1076	IP: 10.32.20.25	VLAN ID: 4/1076
IP: 10.32.20.27							IP: 10.32.20.28

	Manual	Automated
Inventory Query (e.g. Granite)	1 min	10 sec
Validate Configuration (e.g., Granite, various EMSs, etc.)	20 min	20 sec
Enable Loopback on NTE (e.g., NID, CSR, etc.)	1 min	10 sec
Add test agent/appliance to service (via. test controller)	5 min	30 sec
Execute Service Tests (via. test controller)	4 min	4 min
Return service to original configuration & validate (via. test controller, various EMSs etc.)	10 min	40 sec
Totals:	41 min	5 min 50 sec

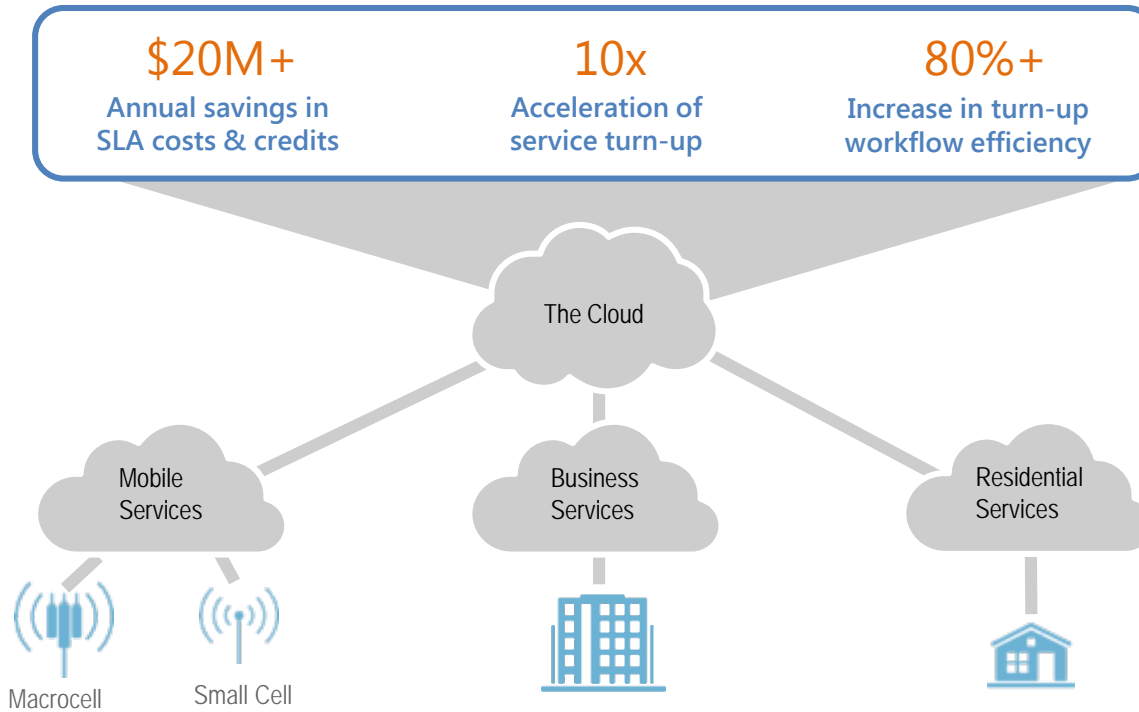87% reduction in total test time – Elimination of manual entry errors
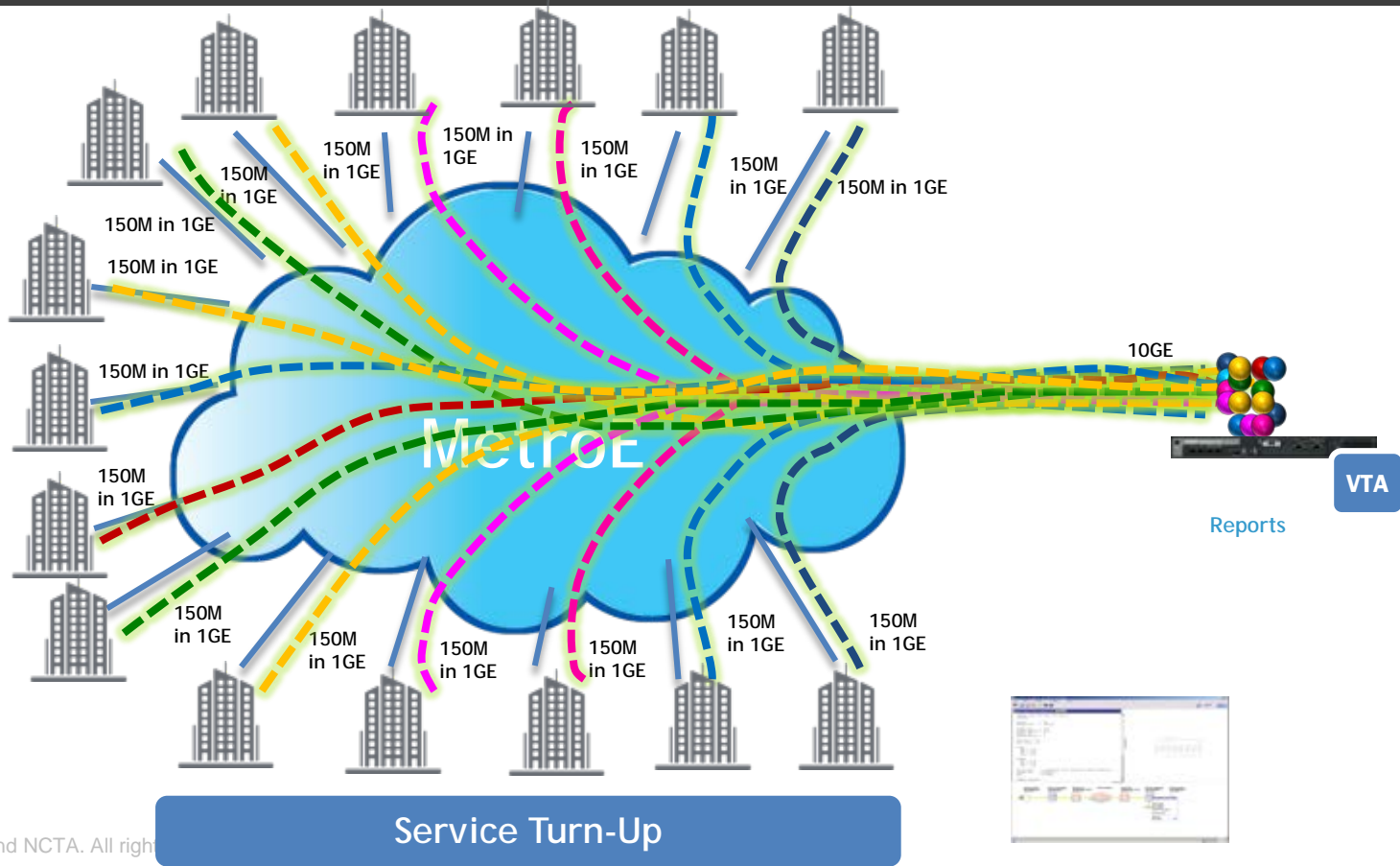
Automated Service Assurance Delivers Significant Benefits

$20M+
Annual savings in
SLA costs & credits

10x
Acceleration of
service turn-up

80%+
Increase in turn-up
workflow efficiency

The Cloud

Mobile
Services

Business
Services

Residential
Services

Macrocell

Small Cell