

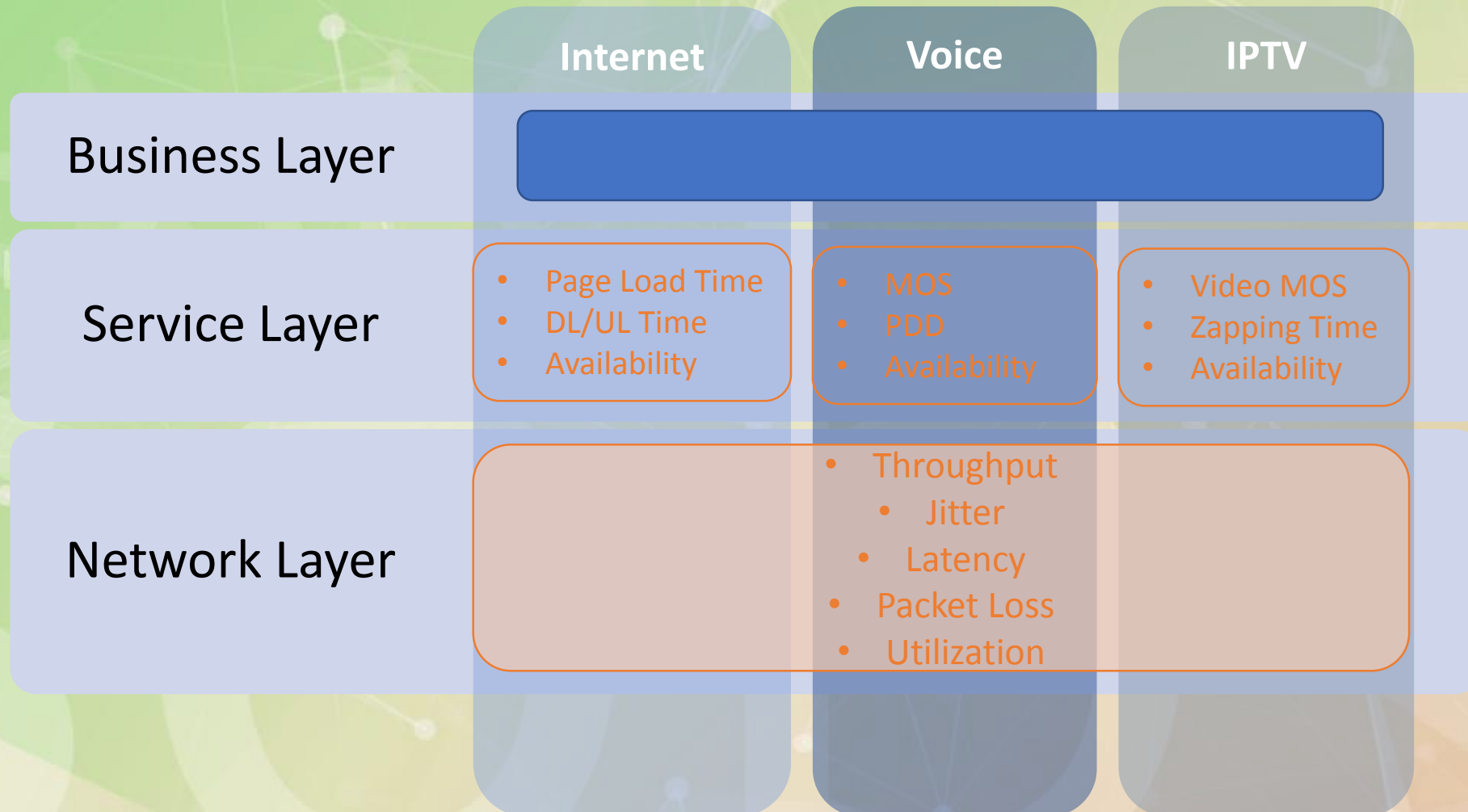


# Network Performance Monitoring Tools Assessment for IP & Core Network

KJN M-038-2017

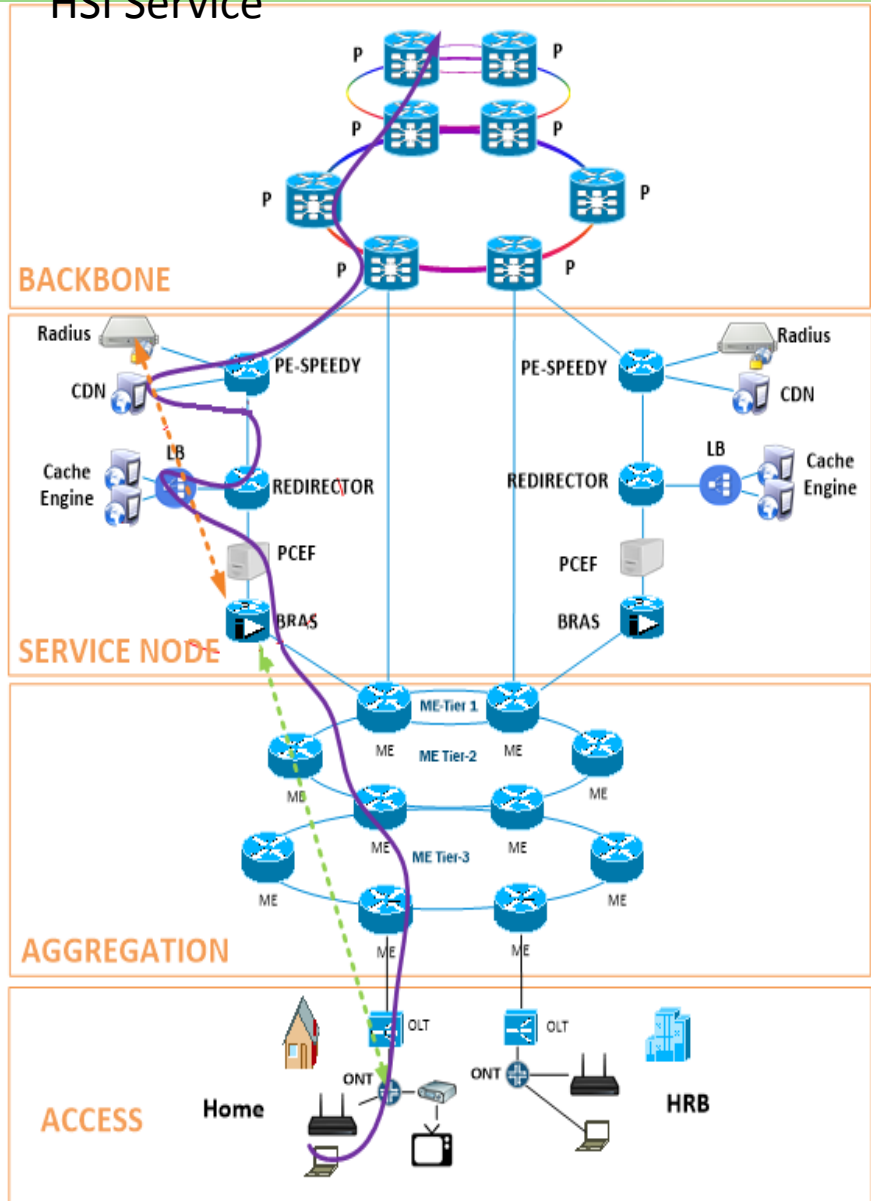
Digital Infrastructure Research – Telkom DDS

# Parameter Service Quality Management

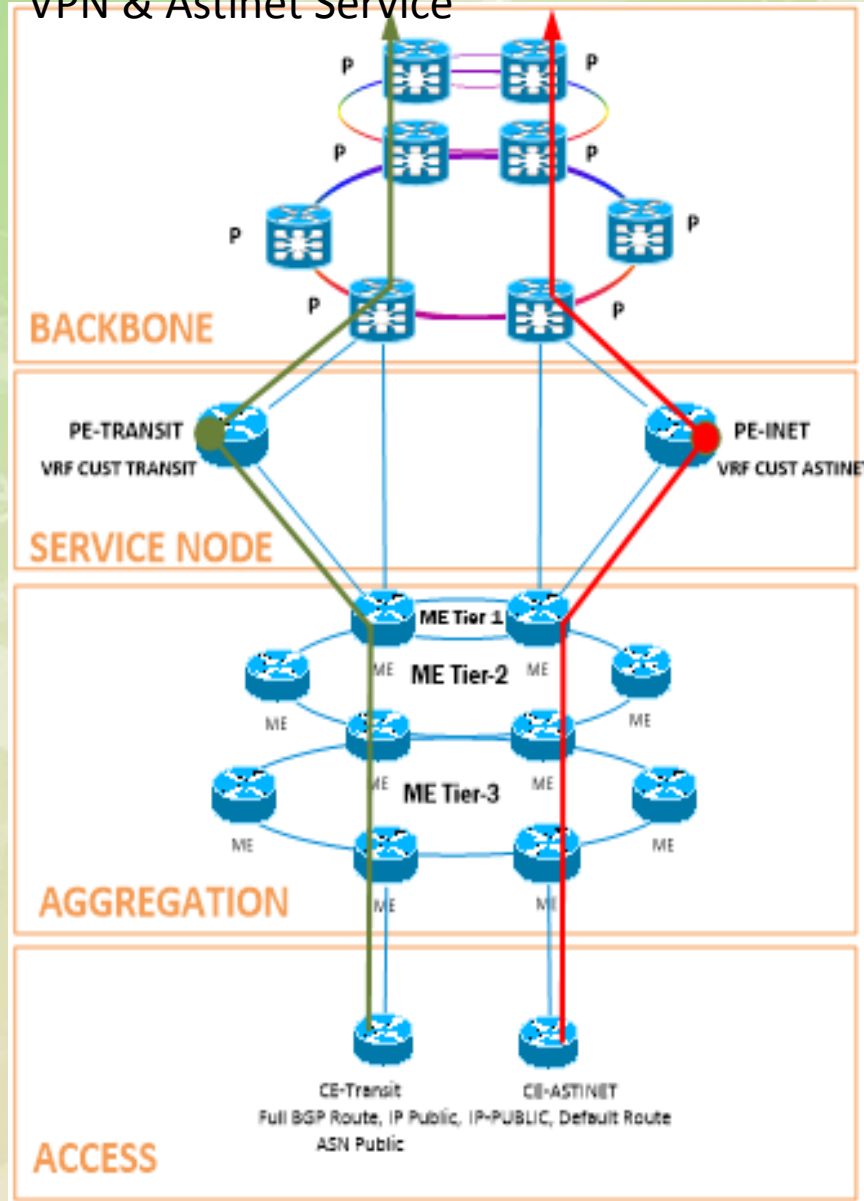


# Network Topology per Service (Internet)

## HSI Service



## VPN & Astinet Service



### Parameter Service :

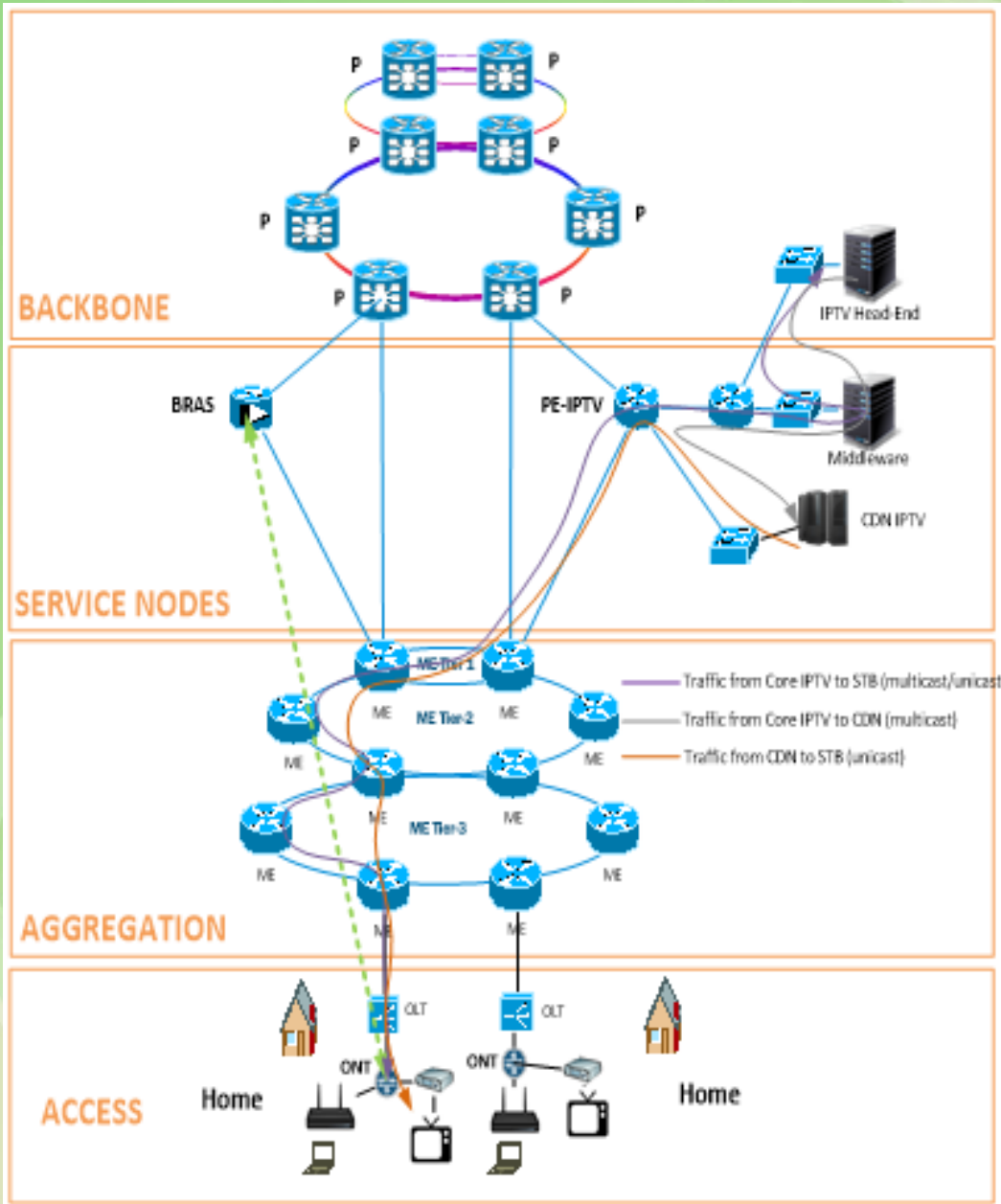
- Page Load Time : Access - Internet
- DL/UL Time : Access - Internet
- Availability : Access; Aggregation; SN; BB

### Parameter Network

- Throughput : Access-SN; SN – Internet; Aggregation; BB
- Jitter : Access; Aggregation; SN; BB
- Latency : Access; Aggregation; SN; BB
- Packet Loss : Access; Aggregation; SN; BB
- Utilization : Access; Aggregation; SN; BB



# Network Topology per Service (IPTV)



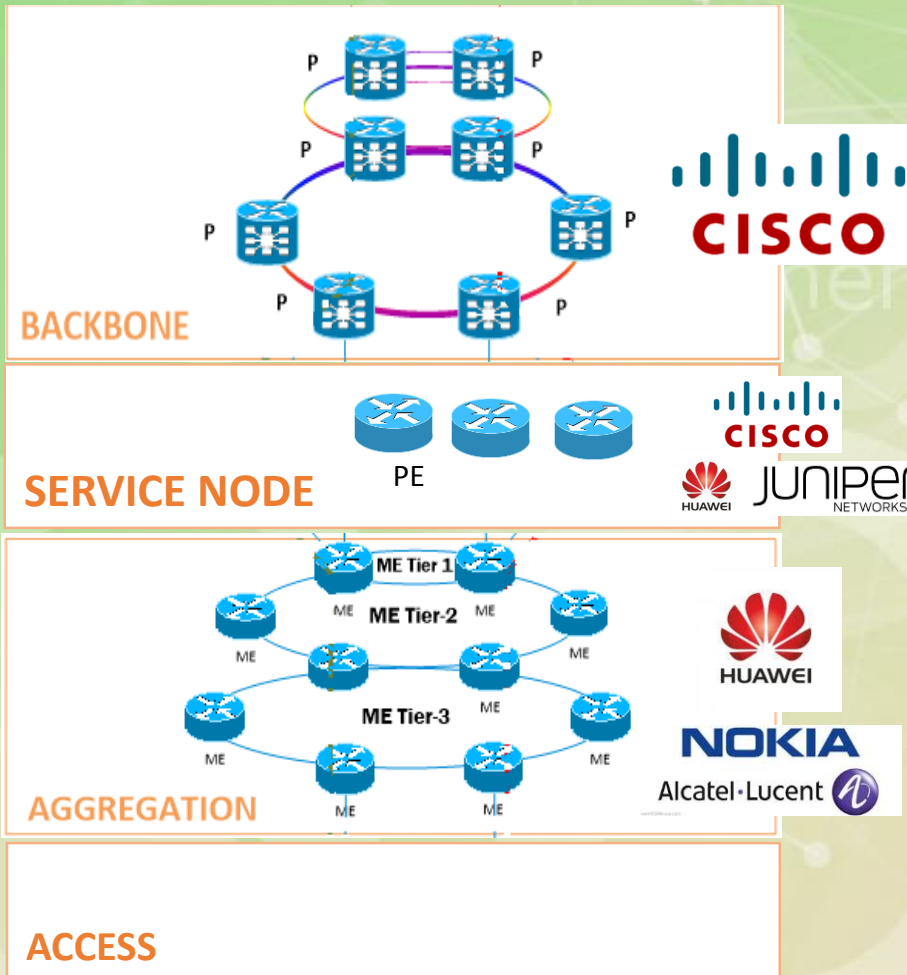
## Parameter Service :

- Video MOS : Access – SN;
- Zapping Time : Access - Internet
- Availability : Access; Aggregation; SN; BB

## Parameter Network

- Throughput : Access- SN; SN – Internet; Aggregation; BB
- Jitter : Access; Aggregation; SN; BB
- Latency : Access; Aggregation; SN; BB
- Packet Loss : Access; Aggregation; SN; BB
- Utilization : Access; Aggregation; SN; BB

# Inventories



Network Elements  
Parameter Monitored by  
Tools:

- Active
  - Delay,
  - Jitter,
  - Packet Loss
  - Throughput
- Passive
  - Utilization Node,
  - Utilization Link,
  - Availability Node,
  - Availability Link





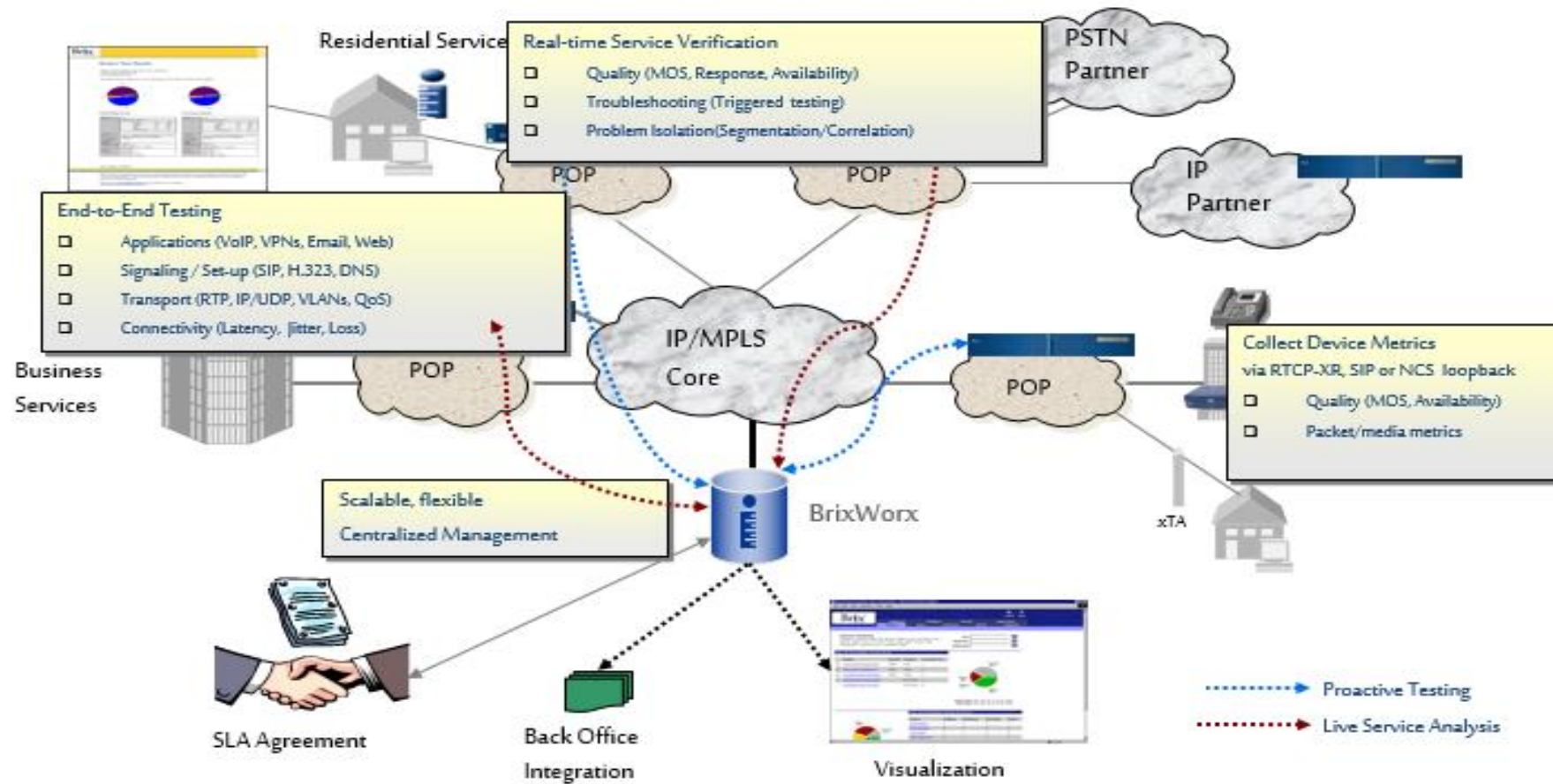
DIGITAL SERVICE

Security Assessment Report

# BRIX - EXFO

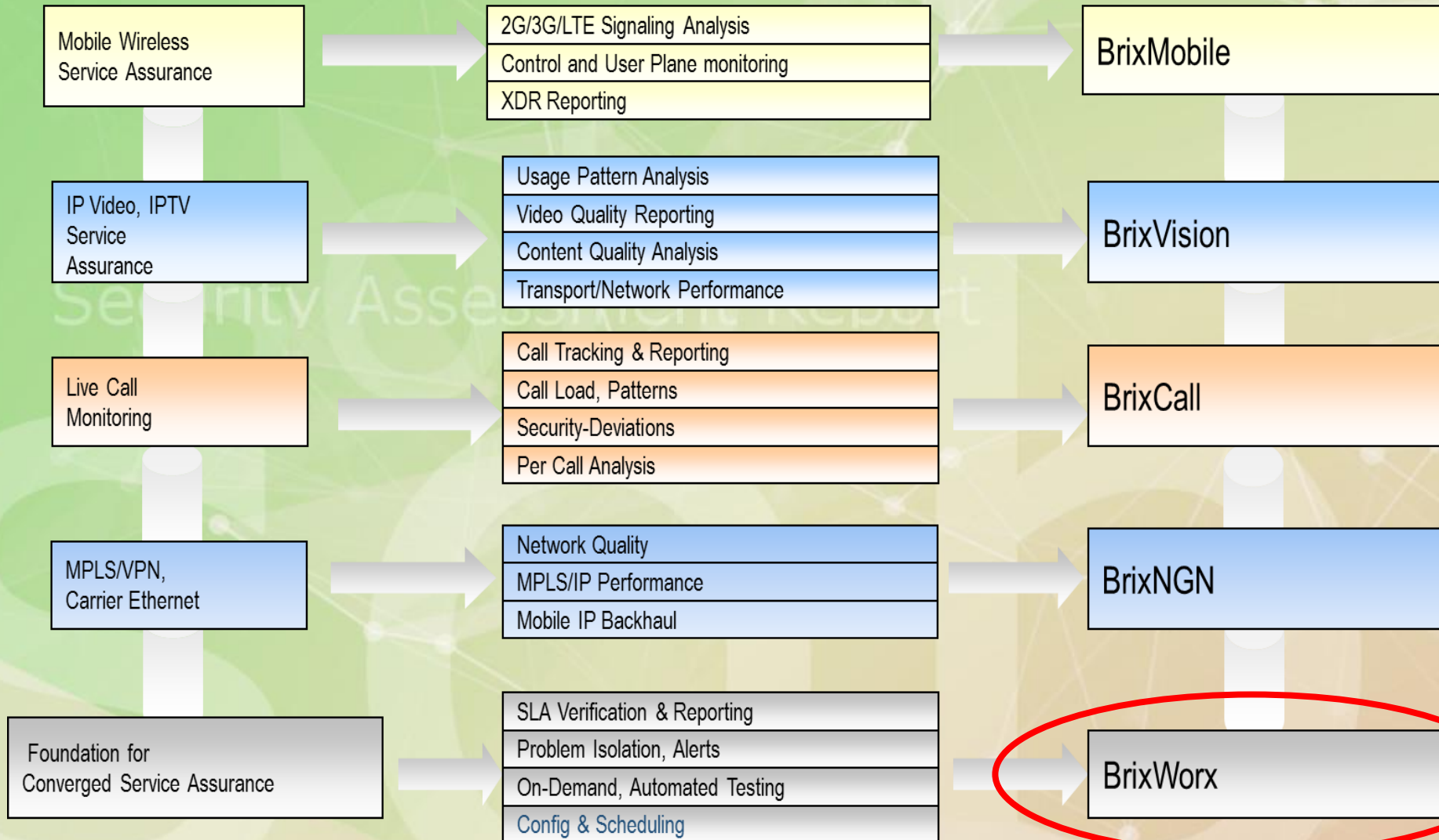


# BRIX - EXFO



There is next gen probe placed at key points in the network. Brix provides automated active testing, passive monitoring for live service analysis and reporting.

# BRIX - EXFO



Yang saat ini dimiliki Telkom Digunakan untuk memonitor perangkat Metro, PE dan Tera Router (active tools)



BrixWorx: Run On-Demand x

118.98.91.6:8080/diag/index.html

## Run On-Demand Test

print log out help

BrixWorx

- HOME
- ALERTS
- BRIXVISION
  - ACTIVE TESTING
  - ON-DEMAND TESTING
  - TEMPLATES
  - RUN ON-DEMAND TEST
- REPORTS
- SLAS
- SERVICES
- SYSTEM
- USERS
- VERIFIERS

Tests

IPTV Multicast Active Test

Advanced Video - OTT Service Active Test

Advanced Video - RTSP Active Test

Advanced VoIP - SIP Proxy Server Availability Active Test

Advanced VoIP - SIP Service Active Test

DHCP Active Test

DNS Active Test

Ethernet Frame Delay Test (Brix Verifier)

Ethernet Linktrace Test (Brix Verifier)

Ethernet Loopback Test (Brix Verifier)

Ethernet Throughput Availability Test (Brix Verifier)

EtherSAM Performance Turn-Up Test

FTP Availability Active Test

FTP Multi-Connection Active Test

FTP Multi-file Performance Active Test

FTP Performance Active Test

HTTP Active Test

Service Message

Upgraded 9/2014 to BW8.4 SP6

EXFO

BrixWorx: Run On-Demand x

118.98.91.6:8080/diag/index.html

## Run On-Demand Test

print log out

BrixWorx

- HOME
- ALERTS
- BRIXVISION
  - ACTIVE TESTING
  - ON-DEMAND TESTING
  - TEMPLATES
  - RUN ON-DEMAND TEST
- REPORTS
- SLAS
- SERVICES
- SYSTEM
- USERS
- VERIFIERS

Tests

IPTV Multicast Active Test

HTTP Active Test

HTTP Availability Test

HTTP Multi-Connection Active Test

HTTPS Active Test

ICMP Timestamp Active Test

IMAP Availability Active Test

IPTV Multicast Active Test

LLDP Active Test

Multicast Channel Receiver Active Test (Brix Verifier)

NetGauge NMx by OOKLA Active Test

NTP Active Test

Ping Active Test

POP3 Availability Active Test

PPPoE Session Active Test

RADIUS Active Test

RFC 2544 Turn-Up Test

Service Message

Upgraded 9/2014 to BW8.4 SP6

EXFO

Filter by SLA: Do not filter by SLA

300 seconds

1000 milliseconds

Add

Remove

BRIX dapat melakukan pengukuran parameter Internet, Voice & IPTV. Untuk license pengukuran parameter IPTV belum dimiliki oleh Telkom.

# Services Monitor



← → ↻ 🏠 ⓘ 118.98.91.6:8080/services/index.html ☆ ⓘ 🔍

Services print log out help

BrixWorx «

• HOME

✚ ALERTS

✚ BRIXVISION

✚ ON-DEMAND TESTING

✚ REPORTS

✚ SLAS

✚ SERVICES

• ADD SERVICE

• SERVICE GROUPS

✚ SYSTEM

✚ USERS

✚ VERIFIERS

Service Message  
Upgraded 9/2014 to BW8.4 SP6

Name	🚨	⚠️	🟢	—	📊	Total	Service Groups
Speedy Ping Active Test	0	0	0	0	0	0	0
Service Metro - Ping Test	0	0	0	0	0	0	0
PING training	0	0	0	0	0	0	0
Ping Test - EANTC	0	0	0	0	0	0	0
Ping Mesh RPI L3VPN	1	0	0	0	0	1	0
Ping Mesh Demo	0	0	0	0	0	0	0
Ping Mesh (One Network)	3	0	0	0	0	3	0
Ping Hub Spoke (One Network)	4	0	0	0	0	4	0
PING Full Mesh Measurement L3VPN New Probes	1	0	0	0	0	1	0
PING Full Mesh Measurement	0	0	0	0	0	0	0
Ping Active Test to Brixworx	0	0	0	0	0	0	0
Ping Active Test RPI Indihome	1	0	0	0	0	1	0
Ping Active Test Measurement @RPI Reg1-7	5	0	1	0	0	6	0
Ping Active Test Measurement @PE_Speedy to ME	0	0	0	10	0	10	0
Ping Active Test Measurement	0	0	0	4	0	4	0
Ping Active Test EBR Tsel to PE-Transit	0	0	0	7	0	7	0
Ping Active Tes RPI Transit with TSEL Req	1	0	0	0	0	1	0
Metro Sumbagut Ping Active Test	0	0	0	0	0	0	0
Metro Sumbagsel Ping Active Test	0	0	0	0	0	0	0
Metro KTI Ping Active Test	0	0	0	0	0	0	0
Metro Kalimantan Ping Active Test	0	0	0	0	0	0	0
Metro Jatim Ping Active Test	0	0	0	0	0	0	0
Metro Jateng Ping Active Test	0	0	0	0	0	0	0

EXFO

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# SLA Monitor



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← → ↻ 🏠

118.98.91.6:8080/slas/index.html

☆ ⚙️ 📱

SLA List

print log out help

BrixWorx

«

• HOME

+ ALERTS

+ BRIXVISION

+ ON-DEMAND TESTING

+ REPORTS

+ SLAS

• ACTIVATION LIST

• ADD AN SLA

• SLA GROUPS

• SLA HISTORY

+ SERVICES

+ SYSTEM

+ USERS

+ VERIFIERS

Service Message

Upgraded 9/2014 to BW8.4 SP6

Customer SLAs

Active SLAs

Name	Tag	Result	SLA Groups
! Te lin_HSI 10Mb_RPJ to Top Alexa		1% (partial)	0
🏆 RPJ NW ME POP REG1-7		64%	0
! RPJ NODE REG1-7		1% (partial)	0
! RPJ NODE REG-7		1% (partial)	0
! RPJ NODE REG-6		1% (partial)	0
! RPJ NODE REG-5		1% (partial)	0
! RPJ NODE REG-4		1% (partial)	0
! RPJ NODE REG-3		1% (partial)	0
✅ RPJ NODE REG-2		100% (partial)	0
! RPJ NODE REG-1		1% (partial)	0
! RPJ CDN ME REG 6		1% (partial)	0
🏆 RPJ CDN ME REG 4		70%	0
! RPJ CDN ME REG 2		1% (partial)	0
! RPJ CDN ME REG 1		1% (partial)	0
! RPJ CDN ME PTR REG 7		1% (partial)	0
! RPJ CDN ME PNK REG 7		1% (partial)	0
✅ RPJ CDN ME MTR REG 5		88%	0
! RPJ CDN ME LBG REG 3		1% (partial)	0
! RPJ CDN ME KBL REG 5		1% (partial)	0
! RPJ CDN ME CBN REG 3		1% (partial)	0
✅ One Network VRF Payload HR2 Nusukan - Jember, Madiun, Cirebon, Dago, Soeta		87%	0
✅ One Network VRF Payload HR2 Jember - Nusukan, Madiun, Cirebon, Dago, Soeta		84%	0
✅ One Network VRF Payload		81%	0

EXFO



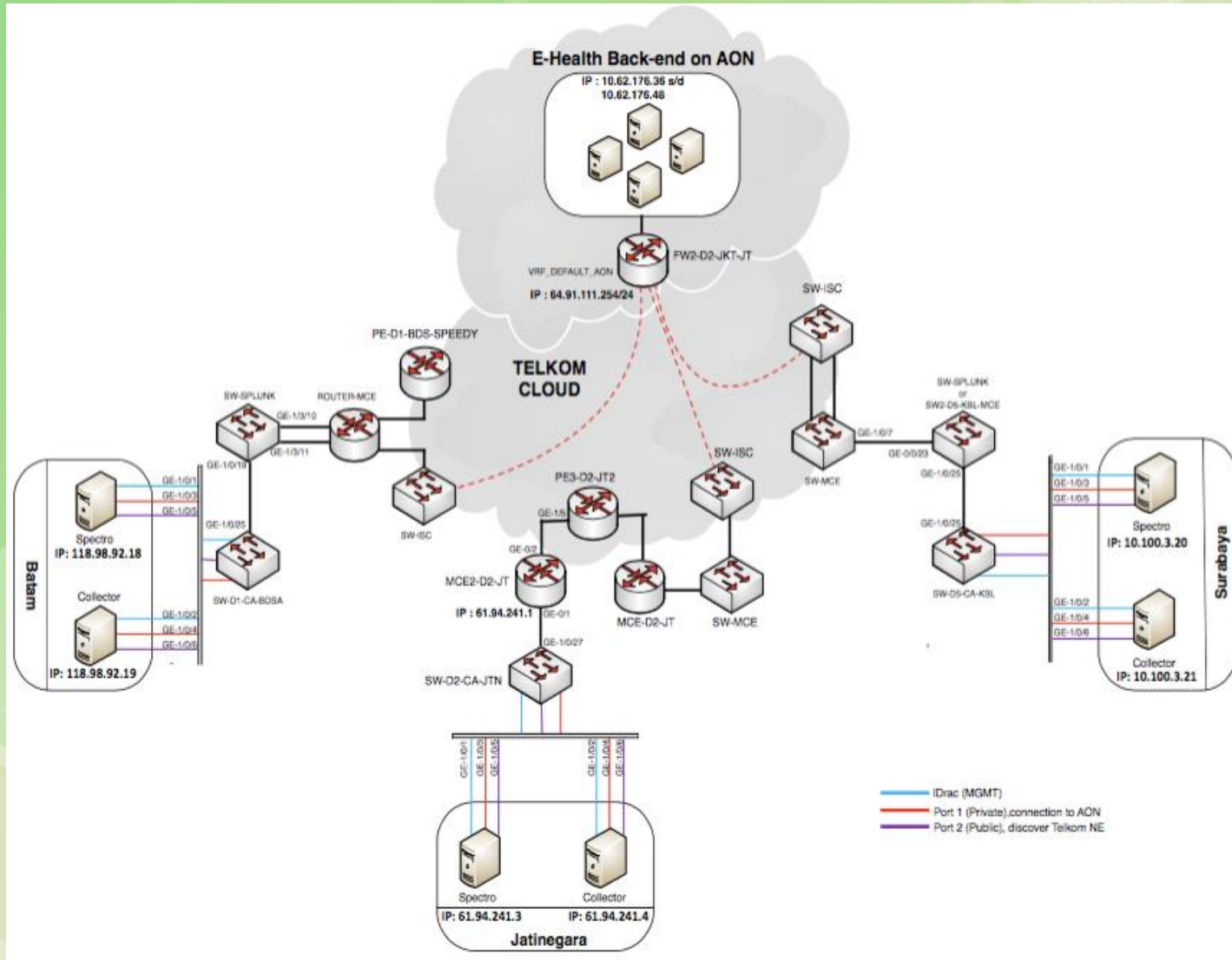


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# CA PM – SPECTRUM - SOI

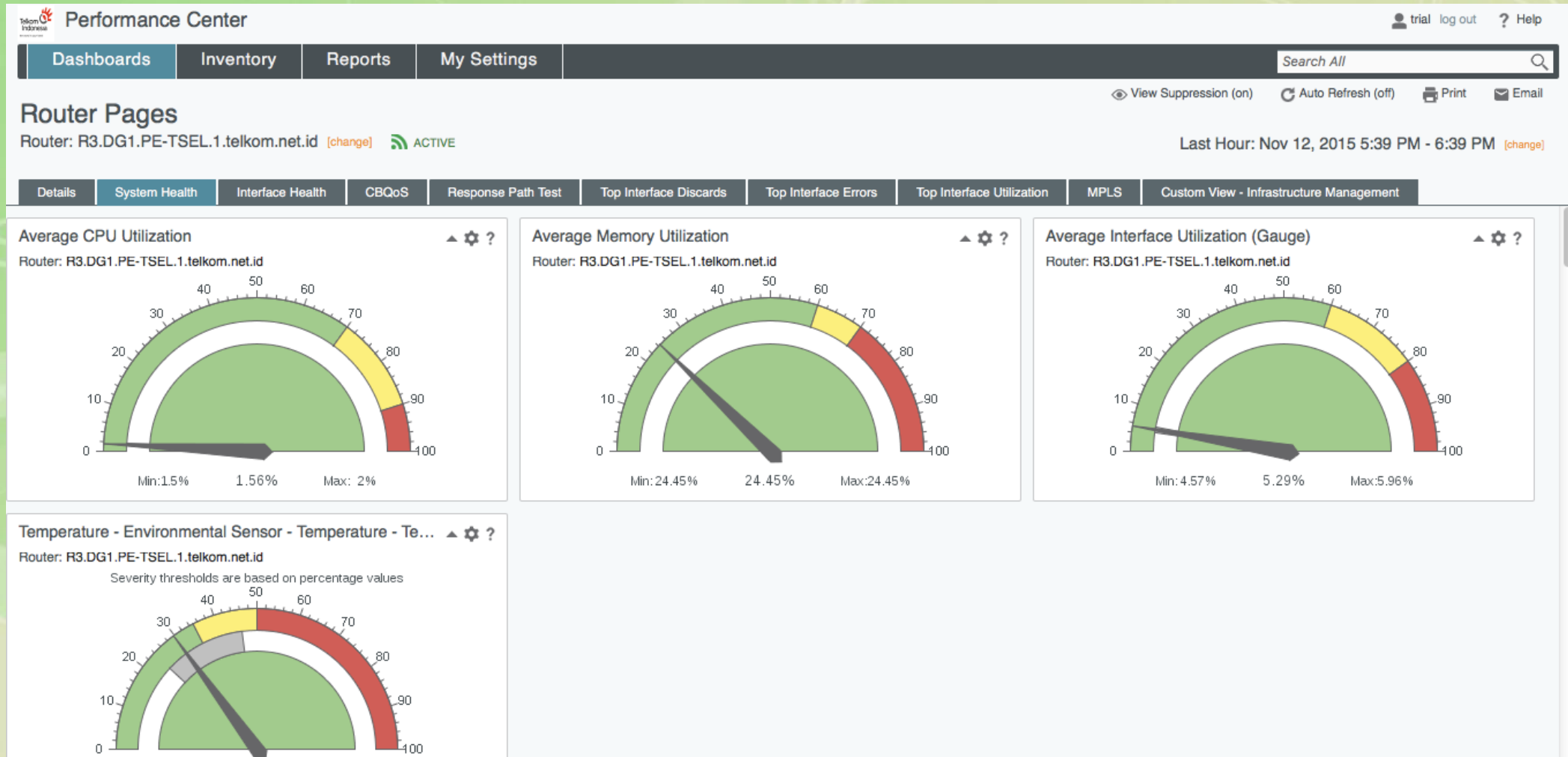
# CA Performance Management/PM (eHealth)



NO	DEVICES	TOTAL DISCOVER
1	PE (VPN,SPEEDY,TRANSIT,INET,SPEEDY)	249
2	TERA	45
3	METRO	1351
4	BRAS	42
5	CES	447
6	CNOP	56
7	WAG	18
8	SW	178
9	REDIRECTOR	69
10	SERVER	26
11	PINGABLE / UNDISCOVER	1225
	<b>TOTAL</b>	<b>3707</b>

Network Elements Performance Monitoring (Passive Parameter) : device health, availability & utilization nodes and links.

# DASHBOARD PERFORMANCE MANAGEMENT CPU-MEMORY-TEMPERATURE





# DASHBOARD PERFORMANCE MANAGEMENT INTERFACE UTILIZATION/DISCARD/TREND



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Interface Dashboard

pm.telkom.co.id:8181/pc/desktop/page?startTime=2017-10-20+09%3A12&mn=3&sid=&pg=2000071&timeRange...

Performance Center

850074 log out ? Help

Dashboards

Inventory

Reports

My Settings

Search All

View Suppression (on)

Auto Refresh (off)

Print

Email

1 More

## Interface Dashboard

Group: REGIONAL [\[change\]](#) Last Hour: Oct 20, 2017 9:31 AM - 10:31 AM [\[change\]](#)

Top Interface Utilization In & Out (Table)

User Group: REGIONAL

Device Name	Name	Description	Speed In - Average	Speed Out - Average	Utilization In - Average	Utilization Out - Average
ME-D2-GAN	5/1/1	5/1/1, 10-Gig Ethernet...	10 Gbits per second	10 Gbits per second	<div><div></div></div> 279496	<div><div></div></div> 15.9%
ME-D2-CBI	2/1/4	2/1/4, 10-Gig Ethernet...	10 Gbits per second	10 Gbits per second	<div><div></div></div> 279496	<div><div></div></div> 22.13%
ME-D2-DEP	4/1/2	4/1/2, 10-Gig Ethernet...	10 Gbits per second	10 Gbits per second	<div><div></div></div> 279496	<div><div></div></div> 53.85%
ME-D2-DEP	4/2/5	4/2/5, 10-Gig Ethernet	10 Gbits per second	10 Gbits per second	<div><div></div></div> 256205	<div><div></div></div> 8.51%
ME-D2-CLG	5/1/5	5/1/5, 10-Gig Ethernet	10 Gbits per second	10 Gbits per second	<div><div></div></div> 256205	<div><div></div></div> 2.58%
ME-D2-CLG	lag-2	lag-2, LAG Group	50 Gbits per second	50 Gbits per second	<div><div></div></div> 512414	<div><div></div></div> 2.3%
ME-D2-DEP	lag-3	lag-3, LAG Group, "TR...	60 Gbits per second	60 Gbits per second	<div><div></div></div> 465833	<div><div></div></div> 8.91%
ME-D2-CBI	lag-2	lag-2, LAG Group, "TR...	60 Gbits per second	60 Gbits per second	<div><div></div></div> 465831	<div><div></div></div> 21.53%
PE-D1-BDS-INET.telk...	Gi2/2/0.3562	GigabitEthernet2/2/0.3...	99 kbits per second	99 kbits per second	<div><div></div></div> 16970.1	No Data To Display
PE-D1-BDS-INET.telk...	Gi2/2/0.3563	GigabitEthernet2/2/0.3...	11 kbits per second	11 kbits per second	<div><div></div></div> 782.06%	<div><div></div></div> 8683.55

Search

Page 1 of 98

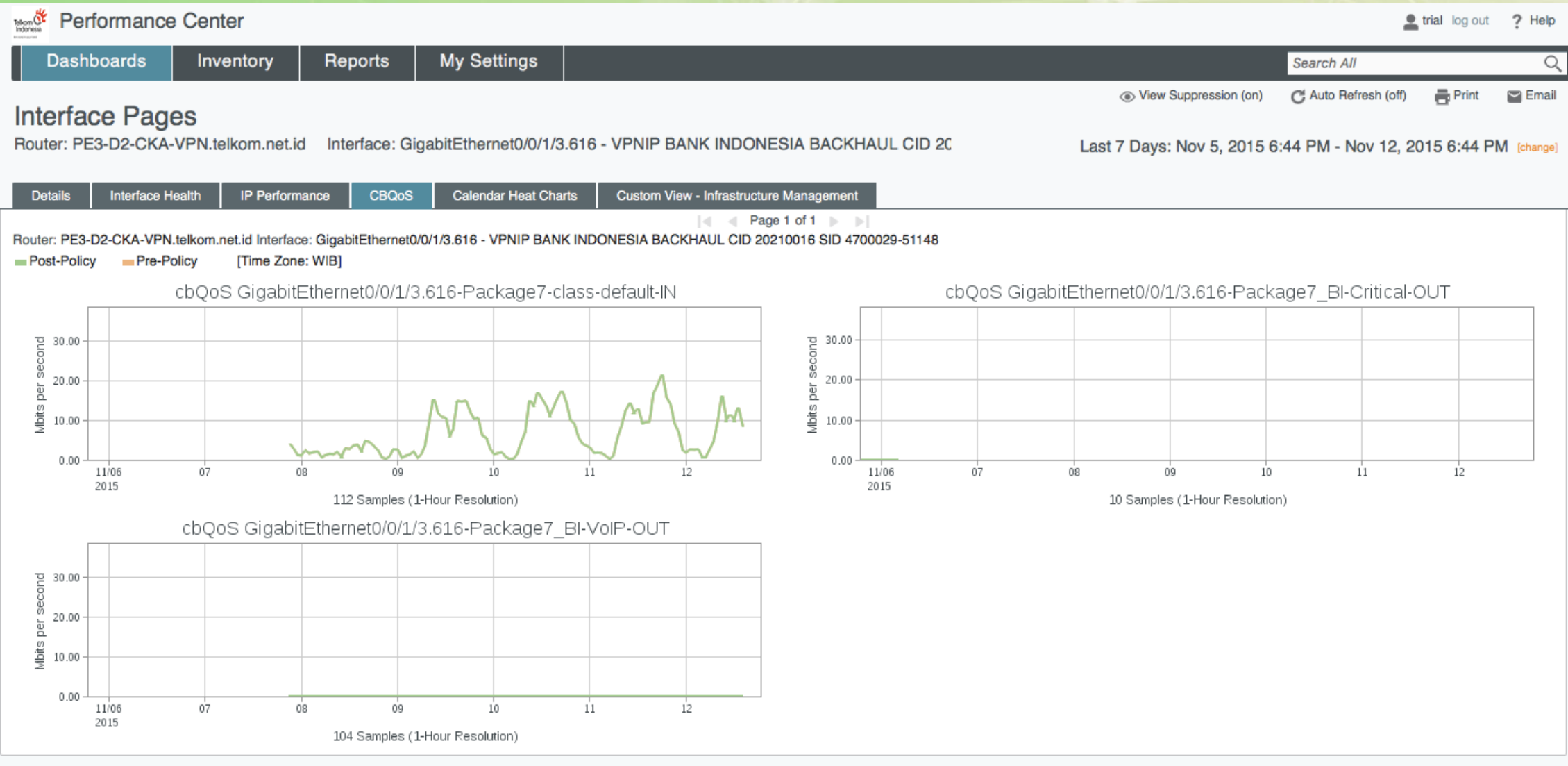
Displaying 1 - 10 of 977

Max Per Page 10

# DASHBOARD PERFORMANCE MANAGEMENT QOS PACKAGE



DIGITAL SERVICE



# DASHBOARD PERFORMANCE MANAGEMENT RESPONSE PATH



Response Path Dashboard

10.62.176.36:8181/pc/desktop/page?startTime=2016-03-22+13%3A40&mn=3&sid=&pg=2000110&timeRange=0&GroupID=&er

Search

Performance Center

System health: good admin log out ? Help

Dashboards Inventory Reports Admin My Settings

Search All

View Suppression (on) Auto Refresh (off) Print Email 5 More

## Response Path Dashboard

Group: All Groups [change]

Last Hour: Mar 22, 2016 1:40 PM - 2:40 PM [change]

### IM Table (Top) - Response Path Test ICMP

Device Name	Name	Average Response Time - Average	Maximum Response - Average	Minimum Response - Average
PE4-D2-JT2	Cisco Rttmon ICMP: 0.0.0.0-61.5.13.50 : 1	24.2 ms	28 ms	23 ms
PE4-D2-JT2	Cisco Rttmon ICMP: 0.0.0.0-61.5.13.50 : 5	24 ms	27 ms	23 ms
PE4-D2-JT2	Cisco Rttmon ICMP: 0.0.0.0-61.5.15.4 : 2	16 ms	20 ms	15 ms
PE4-D2-JT2	Cisco Rttmon ICMP: 0.0.0.0-61.5.15.25 : 3	10 ms	28 ms	8 ms
PE-D5-KLM-VPN.telkom.net.id	Cisco Rttmon ICMP: -172.18.40.6 : 1	2.1 ms	5 ms	1 ms
PE2-D6-PTK	Cisco Rttmon ICMP: 0.0.0.0-172.18.40.46 : 1	0 ms	0 ms	0 ms
PE-D5-KUT	Cisco Rttmon ICMP: 0.0.0.0-172.18.40.6 : 1	0 ms	0 ms	0 ms
PE2-D7-BAL.telkom.net.id	Cisco Rttmon ICMP: 0.0.0.0-172.18.40.66 : 1	0 ms	0 ms	0 ms
PE4-D5-KBL	Cisco Rttmon ICMP: 61.5.15.149-61.5.15.74 : 6	0 ms	0 ms	0 ms
PE4-D5-KBL	Cisco Rttmon ICMP: 61.5.15.149-61.5.15.47 : 3	0 ms	0 ms	0 ms

Search

Page 1 of 1

Displaying 1 - 10 of 10

Max Per Page 10

Untuk digunakan sebagai tools active yang mengukur parameter performansi layanan jaringan, CA PM mengambil data dari pengukuran yang dilakukan oleh perangkat setelah diaktifkan IP SLA nya. Saat ini baru dapat dilakukan pada perangkat Cisco. Sementara untuk platform lain, diperlukan network engineering atau skema bisnis yg lain.



# CA Spectrum – Fault Management



Console - CA Spectrum OneClick

File View Tools PT Telkom Help

Device Search:  Go ☒ by IP Address

Navigation: Explorer Locater Users

My Spectrum

Name	Severity	Count	Alarm Title
Global Collections (43)	46	17	117
Batam Domain (322)	12	5	10
BRAS D1 (7)	7		
BRAS D2 (5)	5		
BRAS D3 (2)	2		
BRAS D4 (2)			
BRAS D5 (2)			
BRAS D6 (5)			
BRAS D7 (18)	1	2	
Default Domain (590)	13	5	13
Metro D1 (289)	4		
Metro D2 (276)	1	2	
Metro D3 (134)	1	1	
Metro D4 (121)			46
Metro D5 (246)	3		11
Metro D6 (90)	1	3	
Metro D7 (80)	1	4	
PE D1 (21)	5	1	10
PE D2 (27)	2	1	9
PE D3 (5)	1	2	
PE D4 (21)	2	2	
PE D5 (46)	5	12	
PE D6 (41)	1	5	
PE D7 (52)	9	2	11
PE IPTV			
PE SPEEDY (38)	11	4	35
PE Transit (24)	1		13
Surabaya Domain (752)	21	7	94

Contents: My Spectrum

Alarms Topology List Events Information

Filtered By: Severity, Alarm Title Available Filters: polling reduced

Severity	Date/Time	Name	Alarm Title
Minor	Mar 22, 2016 12:48:12 PM ICT	PE2-D5-KBL-TRANSIT	MPLS LSP DOWN
Major	Mar 22, 2016 12:40:36 PM ICT	ME4-D2-JT	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Major	Mar 22, 2016 12:35:32 PM ICT	ME2-D2-DEP	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Major	Mar 22, 2016 12:22:21 PM ICT	ME-D1-PGPA	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Major	Mar 22, 2016 12:22:21 PM ICT	ME-D1-IDLA	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Major	Mar 22, 2016 12:22:21 PM ICT	ME-D1-PL3A	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Major	Mar 22, 2016 12:22:21 PM ICT	ME-D1-SKTA	A Threshold Violation event has been raised on 'CPU'. (Profile Name: CPU Ut
Critical	Mar 22, 2016 12:13:47 PM ICT	PE-D7-MRK.telkom.net.id_Gi0/3	BAD LINK DETECTED

Component Detail: PE-D5-RKT-SPEEDY of type MX960

Alarm Details Information Impact Host Configuration Root Cause Interfaces Performance Alarm History Neighbors Events Path View

AUTHENTICATION FAILURE TRAP RECEIVED  
Mar 21, 2016 3:24:20 PM ICT  
A(n) JuniperJUNOSRtr device, named PE-D5-RKT-SPEEDY

Severity Minor  
Impact 0  
Acknowledged [set](#)  
Clearable Yes  
Trouble Ticket ID [set](#)

Symptoms An authenticat  
Probable Cause An application is  
Actions Use a network

PE-D7-MRK.telkom.net.id\_Gi0/3 of type ethernet

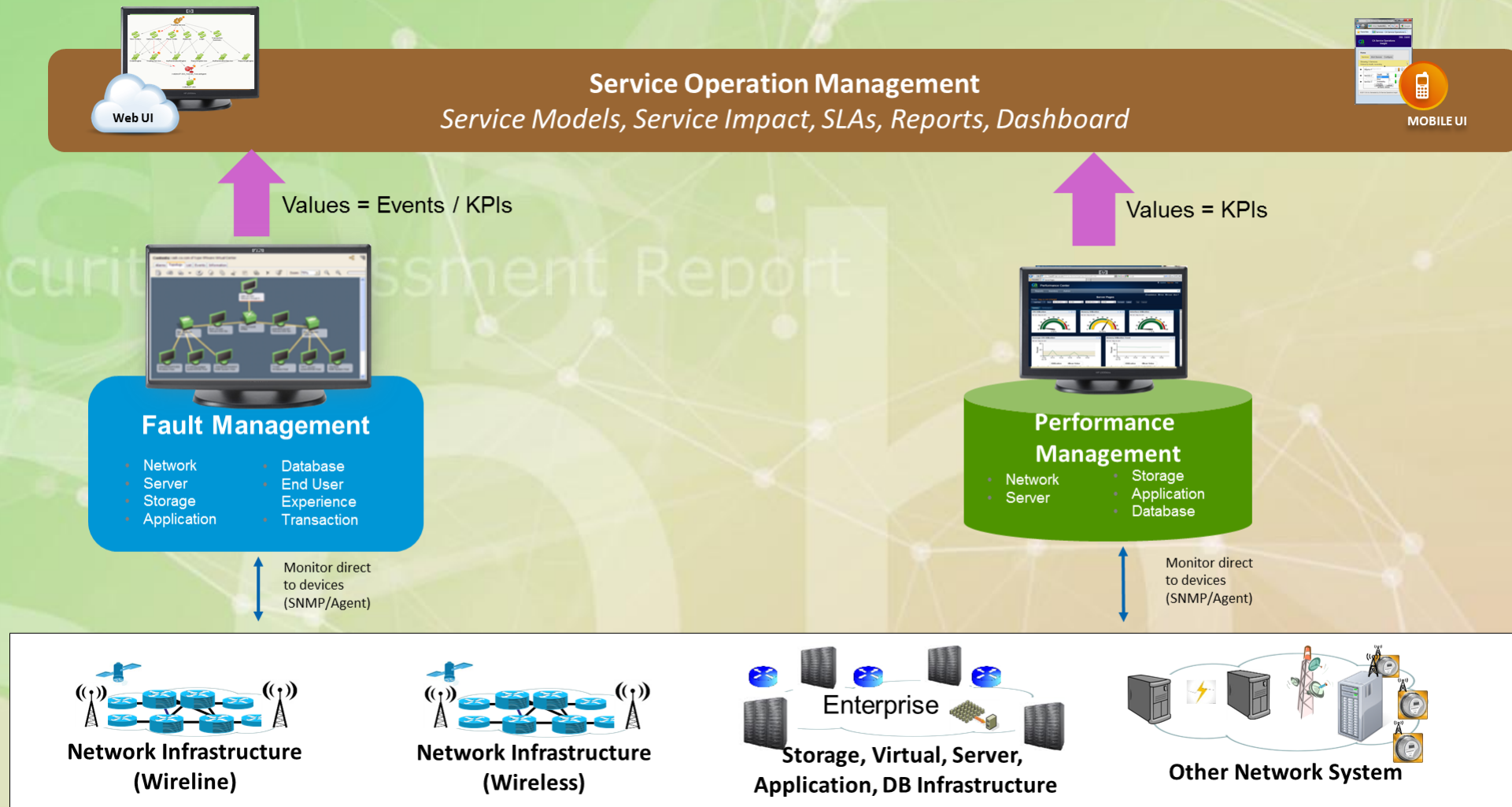
Alarm Details Information Impact Host Configuration Root Cause Interfaces Performance Alarm History Neighbors Events Path View

BAD LINK DETECTED  
Mar 22, 2016 12:13:47 PM ICT  
The link status of port (name - PE-D7-MRK.telkom.net.id\_Gi0/3, type - Gen\_IF\_Port) is now "bad".

Severity Critical  
Impact 0  
Acknowledged [set](#)  
Clearable Yes  
Trouble Ticket ID [set](#)  
Assignment  
Landscape ca-d5-klbl-cs (0x600000)  
Status [set](#)  
Web Context URL

Symptoms A port is reporting a BAD link.  
Probable Cause 1) Cable is not connected.  
2) A backplane interface is broken, disallowing data flow.  
Actions 1) Make sure the cable is fastened securely on both ends.  
2) Ensure that the cable is not broken.  
3) Check backplane of device.  
\*\* If the connection on this port is modeled the devices and ports in question can be obtained from the link view. The link view is avail

# CA Service Operation Insight (SOI)



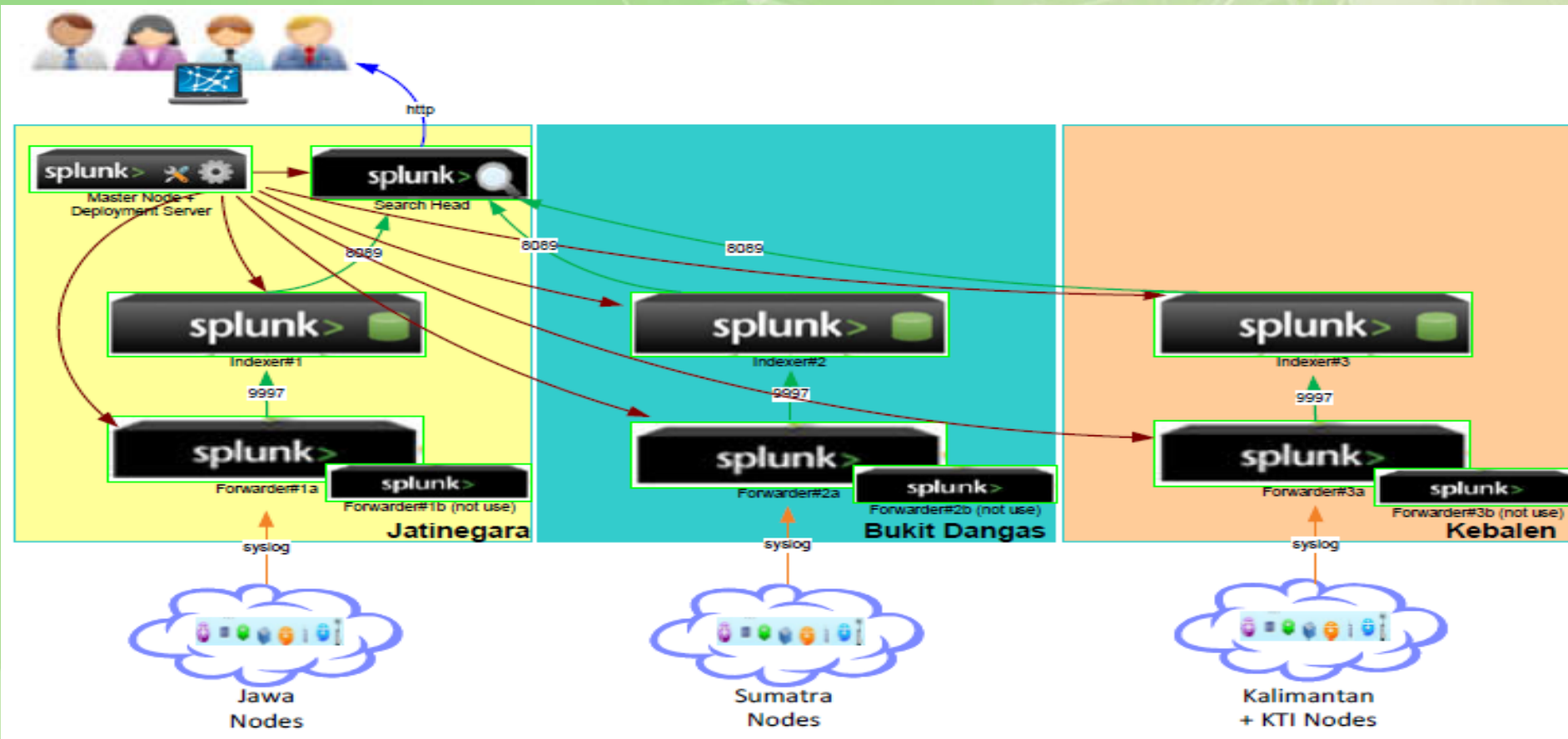


DIGITAL SERVICE

Security Assessment Report

SPLUNK





## Splunk Enterprise stack [Learn more](#)

Licenses	Volume	Expiration	Status	
Splunk Enterprise	51,200 MB	Jan 19, 2038 3:14:07 AM	valid	<a href="#">Delete</a>
Splunk Enterprise	5,120 MB	Jan 19, 2038 10:14:07 AM	valid	<a href="#">Delete</a>
Splunk Enterprise	51,200 MB	Jan 19, 2038 10:14:07 AM	valid	<a href="#">Delete</a>
Effective daily volume	107,520 MB			

Pools	Indexers	Volume used today	
auto_generated_pool_enterprise	<div></div>	19,052 MB / 107,520 MB	<a href="#">Edit</a>   <a href="#">Delete</a>

105 GB

Fault Management : Monitoring  
& Troubleshooting Tools via log

# The Power of Splunk

**COLLECT DATA  
FROM ANYWHERE**

**SEARCH  
AND ANALYZE EVERYTHING**

**GAIN REAL-TIME OPERATIONAL  
INTELLIGENCE**

**splunk**>

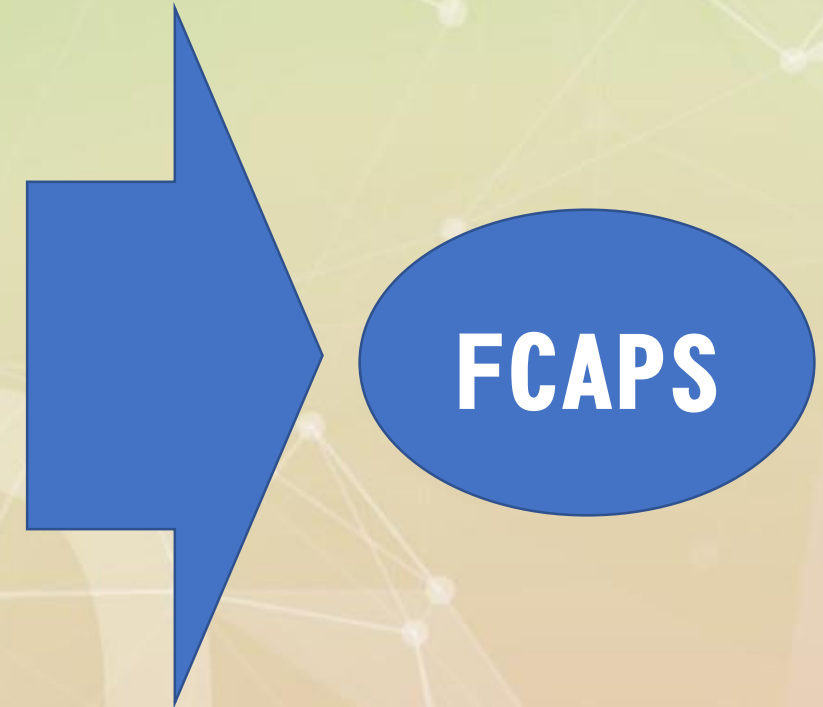
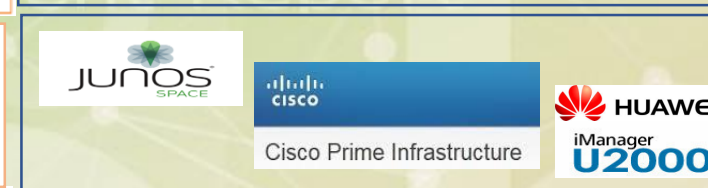
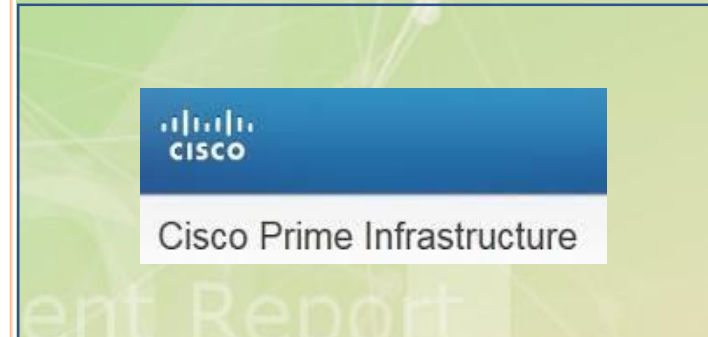
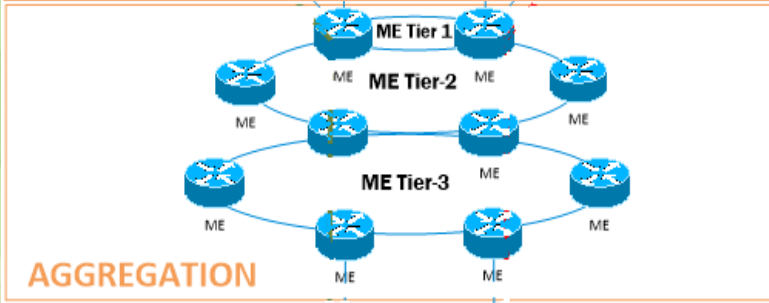
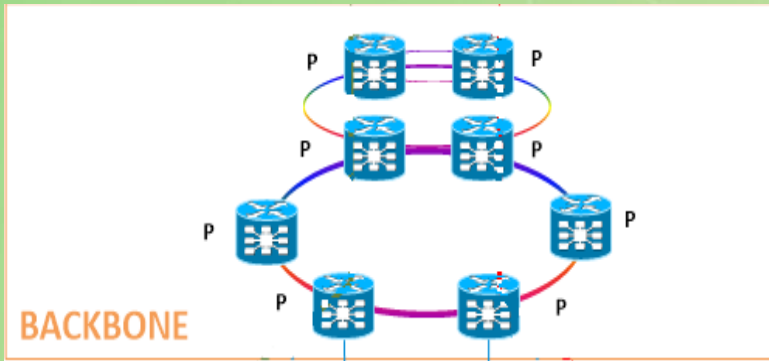


DIGITAL SERVICE

# Security Assessment Report

## NMS

# NMS
























DIGITAL SERVICE

Security Assessment Report







# Matrix Tools vs NE

# Parameter vs NE vs Tools

	Delay, TP, PL, Jitter	Avail. Nodes	Avail. Links	Util. Nodes	Util. Links	Fault Manage.
						
						
						
						

\* Secara teori CA mampu mendapatkan hasil pengukuran parameter tsb di semua perangkat, namun diperlukan skema teknis & bisnis tersendiri untuk memperoleh MIB file dari platform selain Cisco

# Parameter Service vs Tools

Service Application	Active Test & Moonitoring Tools		
Internet			
VPN & Astinet			
VoIP			
IPTV		iQAS ZTE	SQM HW

# Kesimpulan

- Pemanfaatan tools yg sudah implemented sudah cukup memonitor semua node dalam segmen IP & Backbone dan mencakup parameter-parameter yang dibutuhkan.
- Active Tools untuk memonitor parameter service :
  - BRIX – EXFO dengan probe dan fitur yang diaktifkan masih terbatas,
  - CA PM baru dapat digunakan pada perangkat Cisco, untuk perangkat lain perlu skema teknis & bisnis tertentu untuk memperoleh file MIB agar fungsi ini dapat berjalan.
- Passive Tools untuk memonitor performansi nodes & links :
  - CA PM, MRTG, Splunk dan NMS untuk masing-masing platform.
- Fault Management menggunakan CA Spectrum & Splunk.



# Rekomendasi

- Melihat pada kesesuaian matrix Network Performance Monitoring , yang paling mendekati kebutuhan end-to-end adalah CA (PM, Spectrum dan SOI), perlu dievaluasi kembali skema bisnis yg tepat agar CA dapat memperoleh data MIB dari setiap perangkat yang dibutuhkan untuk dapat menjalankan fungsinya dengan baik.
- Untuk Service Quality Monitoring (berbasis per layanan) dapat mengeksplorasi lebih lanjut kapabilitas Brix (active tools) pada layanan Internet, Voice dan IPTV.
- Dengan kapabilitas log analyzer yang dimilikinya, Splunk lebih tepat diposisikan sebagai Data Analytc Tools.



DIGITAL SERVICE

# Terimakasih



Security