

CISCO *Live!*

GO BEYOND

#CiscoLiveAPJC



Reduce Resolution Time with a Service-Centric Approach to Troubleshooting

Paola Arosio, Director Product Management
@arosio_paola
BRKSPG-2474

Cisco Webex App

Questions?

Use Cisco Webex App to chat with the speaker after the session

How

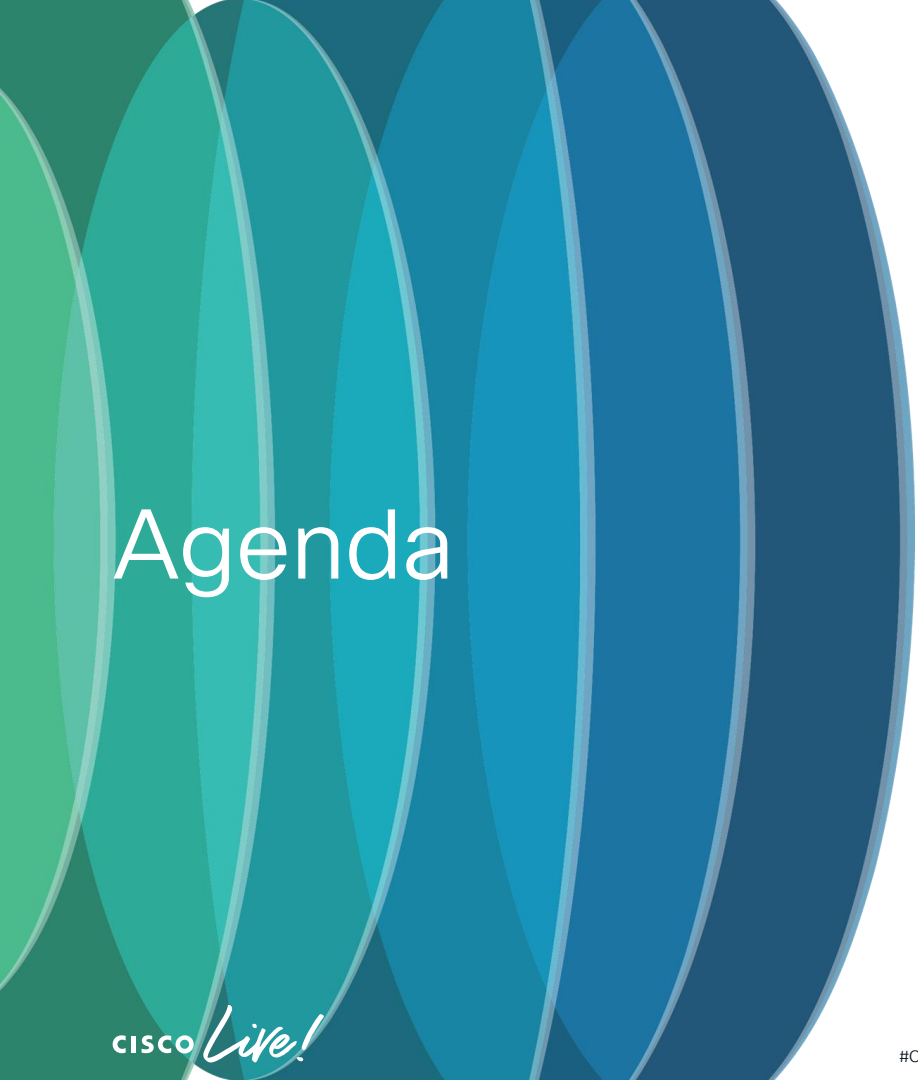
- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated by the speaker until November 15, 2024.



<https://ciscolive.ciscoevents.com/ciscolivebot/#BRKSPG-2474>

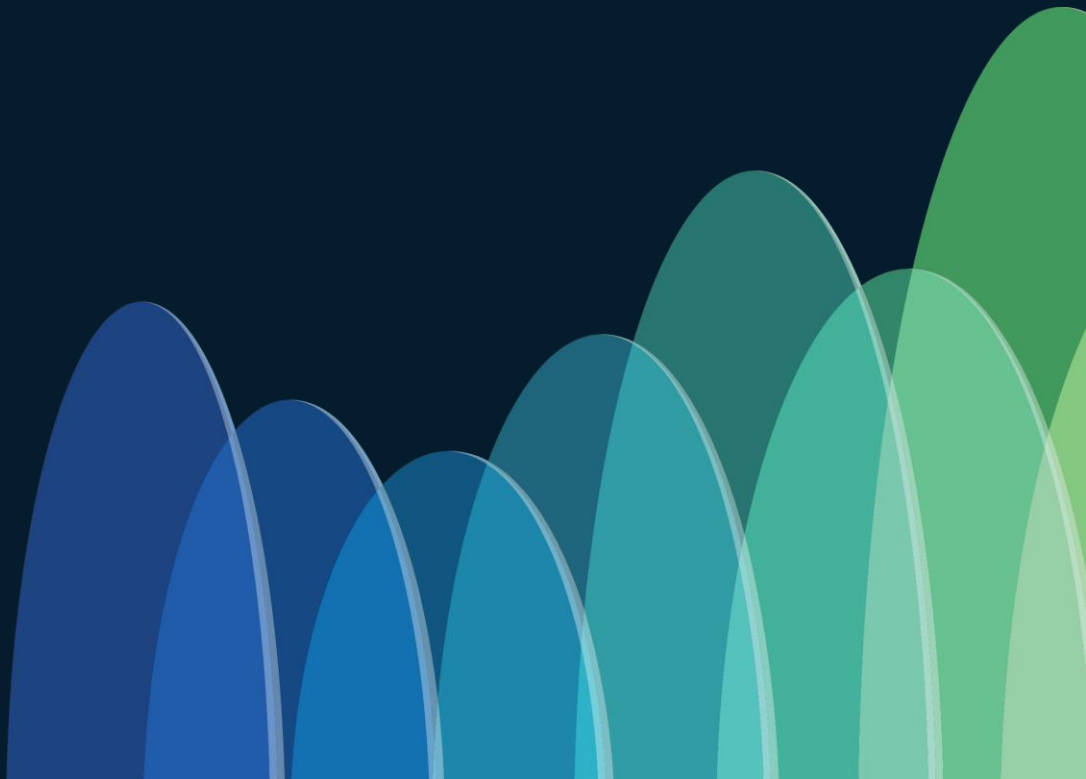




Agenda

- Today, Operator Challenges
- The Concept of Heuristic Package
- Codify Know How
- Intent Based Networking
- The Operator Experience
- Know How Extension
- Conclusion

Today, Operator Challenges



Operational Challenges in Numbers

80%

**MTTI/MTTK*

VISIBILITY /
AGILITY

74%

**Issue found
by end-user*

CUSTOMER
EXPERIENCE

30%

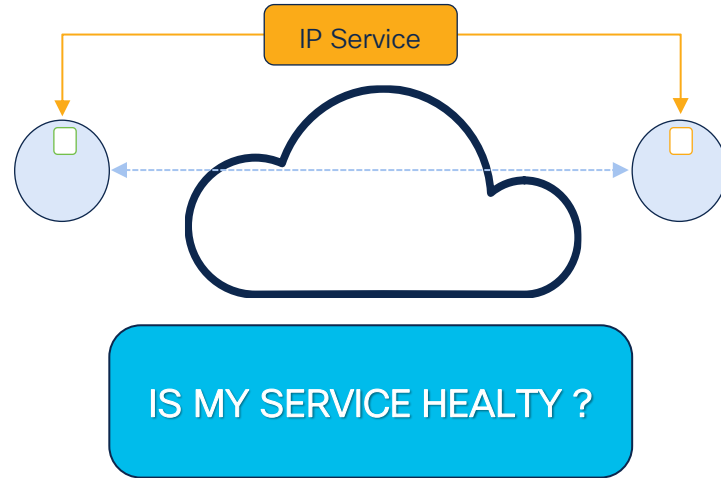
*Repetitive
Issues*

PRODUCTIVITY

VISIBILITY/ AGILITY Challenge



VISIBILITY /
AGILITY

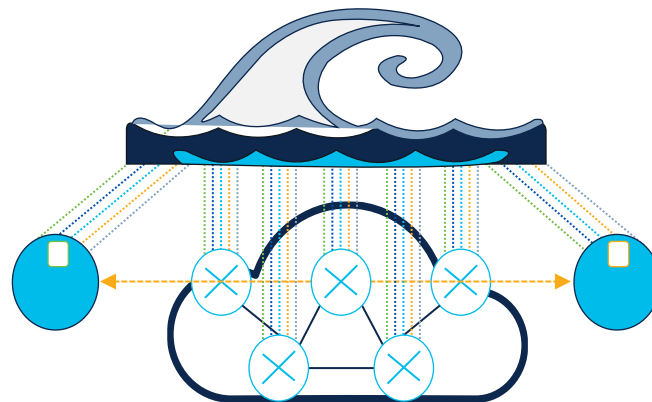


CUSTOMER EXPERIENCE Challenge

74%

*Issue found
by end-user*

CUSTOMER
EXPERIENCE



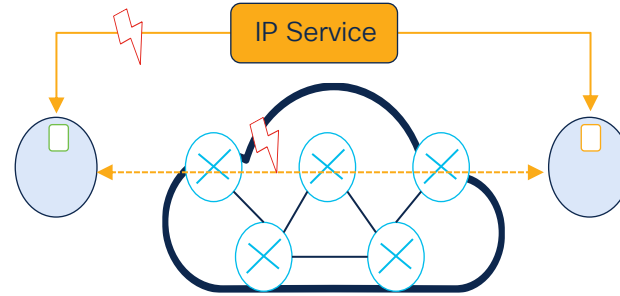
IS MY SERVICE
MEETING SLA ?

PRODUCTIVITY Challenge

30%

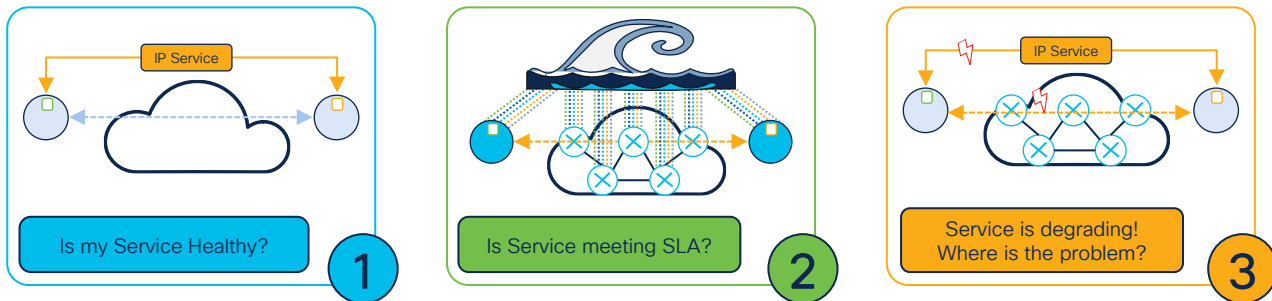
*Repetitive
Issues*

PRODUCTIVITY



SERVICE IS DEGRADING.
WHERE IS THE PROBLEM ?

A Different Approach is Needed ...



Challenge		Requirement	How
1	Visibility	End-to-end service visibility	Intent-based Networking
2	Insight	Bridge customer experience to network health	Dynamically tie Intent to telemetry
3	Action	Expedite MTTI/MTTK	Capture knowledge to automate troubleshooting

Automated Assurance Use Cases

Know your Customer Personas: Role and Know-How its different

QUESTIONS TO ANSWER

AGILITY /
VISIBILITY

First Level
*Service Operation
Center*



Is the service **degrading**?
Is the service meeting **SLAs**?

Services & SLA
Dashboard

CUSTOMER
EXPERIENCE

Second Level
*Network Operation
Center*



Service is **DEGRADING**!
WHERE is the problem and **WHY**?
I see a congestion in the network,
WHAT is the cause?

Hierarchical
Controller

PRODUCTIVITY

Domain SME



Is the infrastructure **OPERATING**
according to planned
performance objectives ?

Domain Controller

Domain Controller

Domain Controller

Automated Assurance Use Cases

Know your Customer Personas: Role and Know-How its different

QUESTIONS TO ANSWER

AGILITY /
VISIBILITY

First Level
*Service Operation
Center*



Is the service **degrading**?
Is the service meeting **SLAs**?



CUSTOMER
EXPERIENCE

Second Level
*Network Operation
Center*



Service is **DEGRADING**!
WHERE is the problem and **WHY**?
I see a congestion in the network,
WHAT is the cause?

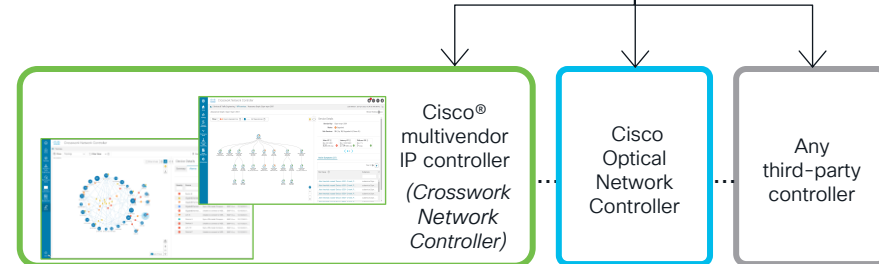


PRODUCTIVITY

Domain SME



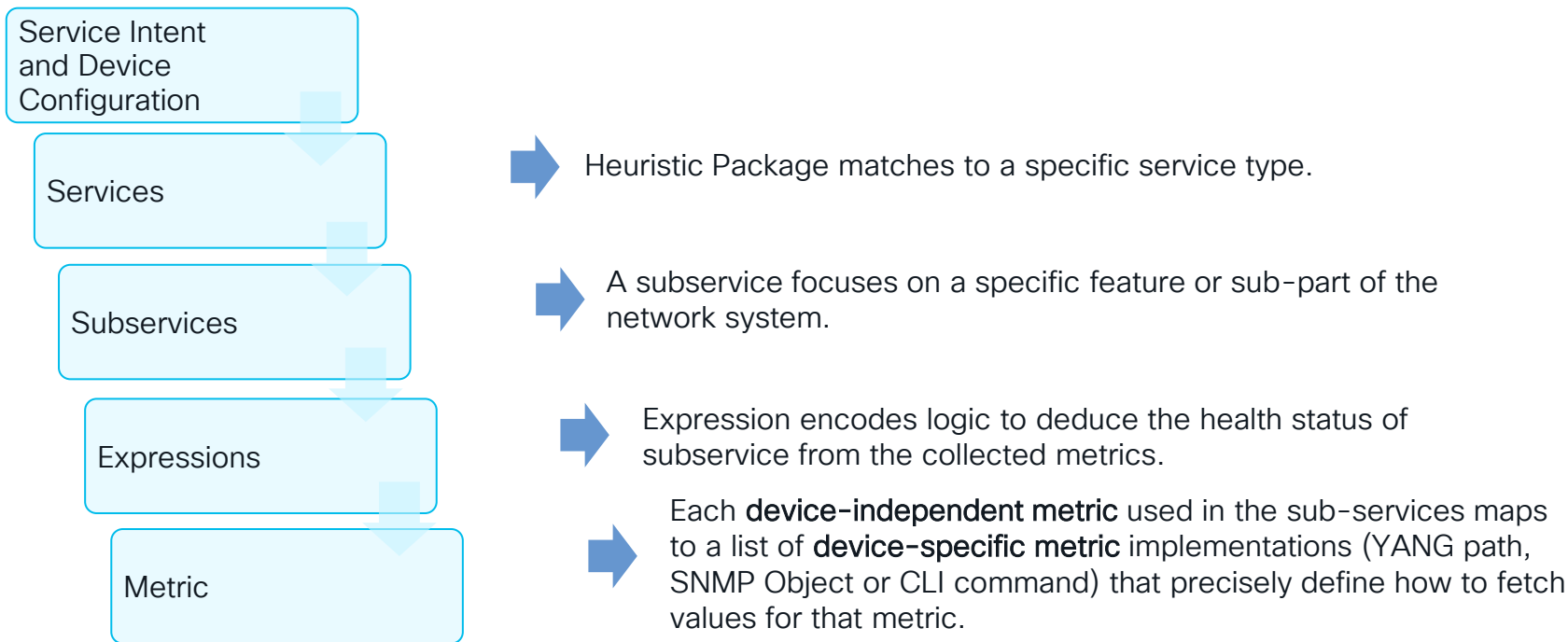
Is the infrastructure **OPERATING**
according to planned
performance objectives ?



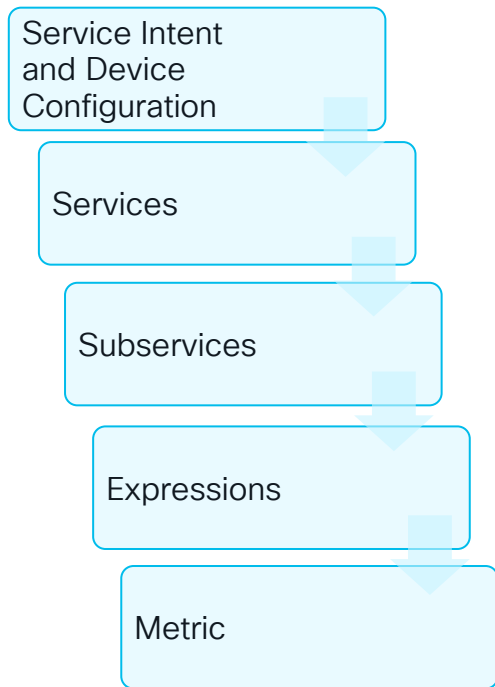
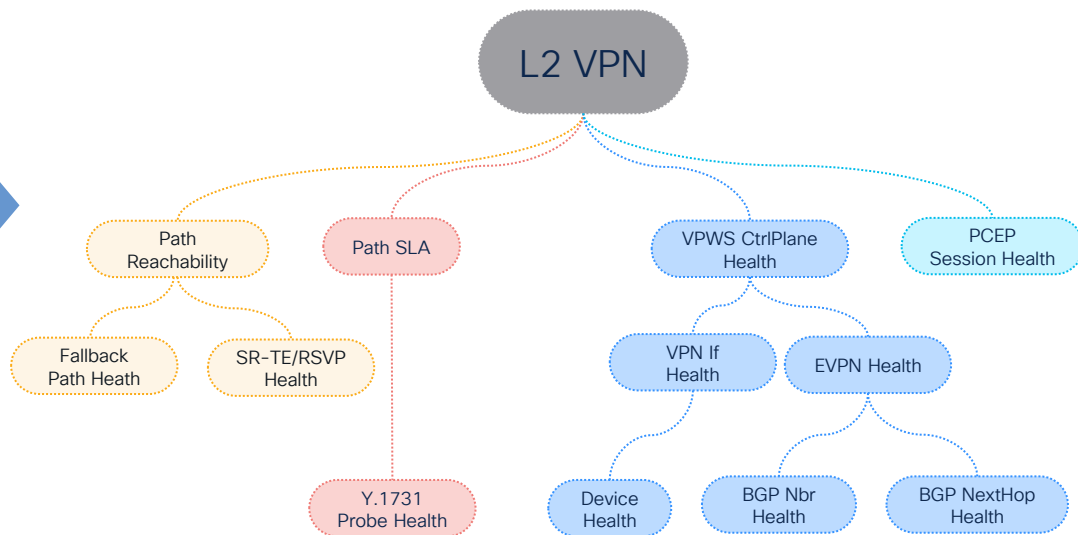
The Concept of Heuristic Package

What is the Heuristic Package ?

The **Heuristic Package** tie intent to telemetry



From Heuristic Package to Assurance Graph



Service Assurance for Intent-Based Networking Architecture

SAIN: [IETF RFC 9417](#)

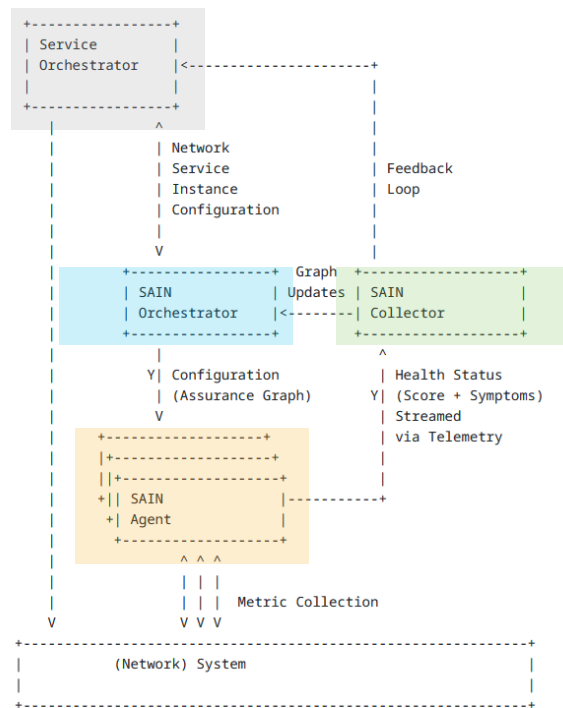


Figure 1: SAIN Architecture

Service Orchestrator is the system that implement the service , i.e. decompose the service, described by an abstract model, into specific network element configuration.

SAIN orchestrator is in charge of fetching the configuration specific to each service instance and converting it into an assurance graph.

SAIN agent communicates with a device, a set of devices, to build an expression graph from a received assurance graph and perform the corresponding computation of the health status and symptoms.

SAIN collector fetches or receives the computer-consumable output of the SAIN agent(s) and process it locally (including displaying it in a user-friendly form).

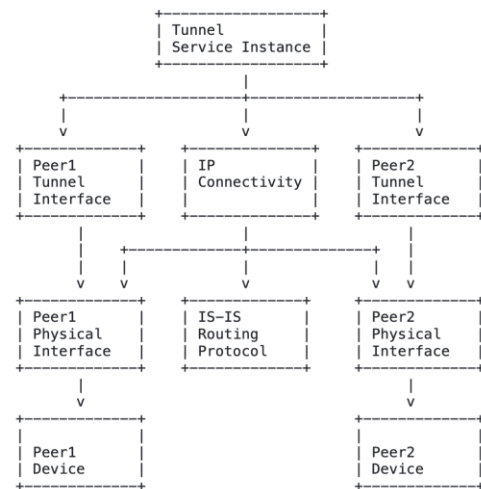
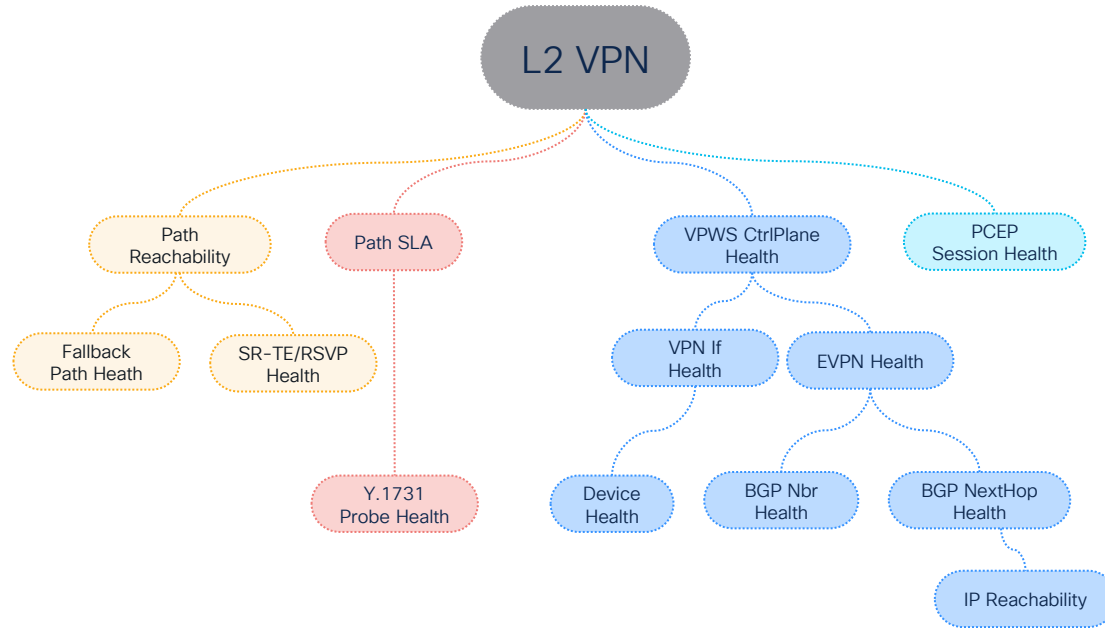


Figure 2: Assurance Graph Example

Codify Know How

Troubleshooting a L2 VPN



Check Service Status

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show l2vpn xconnect
Fri Feb 12 19:10:32.844 EST
Legend: ST = State, UP = Up, DN = Down, AD = Admin Down, UR = Unresolved,
SB = Standby, SR = Standby Ready, (PP) = Partially Programmed
XConnect Segment 1 Segment 2
Group Name ST Description ST Description ST
-----
l2vpn-xc-2601 p2p-2601 UP Te0/0/0/2.2601 UP EVPN 2601,2,10.255.255.103 UP
-----
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

*This need to be done on both PEs

If the Status is DOWN then we need to further check possible causes:

- The Attachment Circuit interface could be DOWN
- The Control Plane info from remote PE could be DOWN
- Possible Crossconnect issues on Local-PE

Check Attachment Circuit Status

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show int Ten0/0/0/2.2601
Fri Feb 12 19:21:16.351 EST
TenGigE0/0/0/2.2601 is up, line protocol is up
Interface state transitions: 3
Hardware is VLAN sub-interface(s), address is 008a.966e.6808
Description: L2VPN-Dynamic-02
Layer 2 Transport Mode
MTU 1518 bytes, BW 10000000 Kbit (Max: 10000000 Kbit)
reliability Unknown, txload Unknown, rxload Unknown
Encapsulation 802.1Q Virtual LAN,
Outer Match: Dot1Q VLAN 2601
Ethertype Any, MAC Match src any, dest any
loopback not set,
Last link flapped 00:00:14
Last input never, output never
Last clearing of "show interface" counters never
0 packets input, 0 bytes
0 input drops, 0 queue drops, 0 input errors
0 packets output, 0 bytes
0 output drops, 0 queue drops, 0 output errors
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

Check Attachment Circuit sub-interface, and if DOWN check also the Interface.

If Interface is DOWN possible causes are:

- Admin shut down
- Fiber or Cable issues
- Remote switch/optical shut down

Check EVPN Control Plane

Discover BGP identity

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show bgp l2vpn evpn summary
Fri Feb 12 19:24:35.296 EST
BGP router identifier 10.255.255.102, local AS number 65001
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0x0 RD version: 0
BGP main routing table version 819
BGP NSR Initial initsync version 1 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs
BGP is operating in STANDALONE mode.
Process RcvTblVer bRIB/RIB LabelVer ImportVer SendTblVer StandbyVer
Speaker 819 819 819 819 819 0
Neighbor Status Codes: m - Under graceful maintenance
Neighbor Spk AS MsgRcvd MsgSent TblVer InQ OutQ Up/Down St/PfxRcd
10.255.255.143 0 65001 101083 101065 819 0 0 3d23h 1
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

Any neighbors shown, means that there is no single active BGP session to a EVPN Route Reflector.

Possible value for St/PfxRcd:

- Not a number but something like Active or Idle, then BGP session to the Route Reflector is not UP.
- PfxRcd is 0 (from EVPN Router Reflector) then session is fine, but we did not get any EVPN route. Normally redundant RRs are deployed so we need to get non-zero routes from at-least one RR.
- PfxRcd is **not** 0 then we look at all routes with Route Distinguisher our BGP ID and EVI (EVPN instance ID) specified for this service instance.

Data Plane Troubleshooting

Is traffic going via SRTE or IGP path ?

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show l2vpn xconnect detail
Fri Feb 12 19:32:32.803 EST
Group l2vpn-xc-2601, XC p2p-2601, state is up; Interworking none
AC: TenGigE0/0/0/2.2601, state is up
  Type VLAN; Num Ranges: 1
  Rewrite Tags: []
  VLAN ranges: [2601, 2601]
  MTU 1504; XC ID 0x1; interworking none
  Statistics:
    packets: received 0, sent 0
    bytes: received 0, sent 0
    drops: illegal VLAN 0, illegal length 0
EVPN: neighbor 10.255.255.103, PW ID: evi 2601, ac-id 2, state is up ( established )
XC ID 0xc0000001
Encapsulation MPLS
Source address 10.255.255.102
Encap type Ethernet, control word enabled
Sequencing not set
Preferred path Active : SR TE srte_c_2002_ep_10.255.255.103, Statically configured, fallback disabled
Tunnel : Up
  EVPN          Local          Remote
  -----
  Label         24011          24005
  MTU           1504          1504
  Control word  enabled      Encamp
  AC ID         1            2
  EVPN type     Ethernet     Encamp
  -----
Create time: 12/02/2021 19:04:51 (00:27:41 ago)
Last time status changed: 12/02/2021 19:21:02 (00:11:30 ago)
Last time PW went down: 12/02/2021 19:14:58 (00:17:34 ago)
Statistics:
  packets: received 0, sent 0
  bytes: received 0, sent 0
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

The service labels are shown which should be as learned from BGP EVPN in previous step.

Check Statistics

Check Packet counters on the service and service labels

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show l2vpn forwarding interface tenGigE 0/0/0/2.2601 detail location 0/0/CPU$
Fri Feb 12 19:38:54.984 EST
Local interface: TenGigE0/0/0/2.2601, Xconnect id: 0x1, Status: up
  Segment 1
    AC, TenGigE0/0/0/2.2601, status: Bound
    Statistics:
      packets: received 0, sent 0
      bytes: received 0, sent 0
      packets dropped: PLU 0, tail 0
      bytes dropped: PLU 0, tail 0
  Segment 2
    MPLS, Tunnel interface: srte_c_2002_ep_10.255.255.103, status: Bound
    Local Pseudowire label: 24011
    Remote Pseudowire label: 24005
    Control word enabled
    Statistics:
      packets: received 0, sent 0
      bytes: received 0, sent 0
      packets dropped: PLU 0, tail 0, out of order 0
      bytes dropped: PLU 0, tail 0, out of order 0
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

Check Packet counters

Check SR-TE Health

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show segment-routing traffic-eng policy name srte_c_2002_ep_10.255.255.103
Fri Feb 12 19:41:01.871 EST
```

```
SR-TE policy database
-----
```

```
Color: 2002, End-point: 10.255.255.103
Name: srte_c_2002_ep_10.255.255.103
Status:
  Admin: up Operational: up for 00:40:51 (since Feb 12 19:00:10.611)
Candidate-paths:
  Preference: 101 (configuration) (active)
  Name: srte_c_2002_ep_10.255.255.103
  Requested BSID: dynamic
  PCC info:
    Symbolic name: cfg_srte_c_2002_ep_10.255.255.103_discr_101
    PLSP-ID: 1
  Dynamic (pce 10.255.255.141) (valid)
    Metric Type: TE, Path Accumulated Metric: 30
    24002 [Adjacency-SID, 10.102.141.1 - 10.102.141.2]
    24000 [Adjacency-SID, 10.141.143.1 - 10.141.143.2]
    24000 [Adjacency-SID, 10.103.143.2 - 10.103.143.1]
Attributes:
  Binding SID: 24010
  Forward Class: Not Configured
  Steering BGP disabled: no
  IPv6 caps enable: yes
```

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

Since the service is bound to a SRTE Policy, check the SR TE Policy

Check SR-TE Health

```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show segment-routing traffic-eng forwarding policy name
srte_c_2002_ep_10.255.5
Fri Feb 12 19:42:45.899 EST
```

```
SR-TE Policy Forwarding database
```

```
-----
Color: 2002, End-point: 10.255.255.103
Name: srte_c_2002_ep_10.255.255.103
Binding SID: 24010
Active LSP:
  Candidate path:
    Preference: 101 (configuration)
    Name: srte_c_2002_ep_10.255.255.103
    Local label: 24009
    Segment lists:
      SL[0]:
        Name: dynamic
        Packets/Bytes Switched: 0/0
        Paths:
          Path[0]:
            Outgoing Label: 24000
            Outgoing Interface: TenGigE0/0/0/1
            Next Hop: 10.102.141.2
            Switched Packets/Bytes: 0/0
            FRR Pure Backup: No
            ECMP/LFA Backup: No
            Label Stack (Top -> Bottom): { 24000, 24000 }
          Path[1]:
            Outgoing Label: 16141
            Outgoing Interface: TenGigE0/0/0/47
            Next Hop: 10.101.102.1
            Switched Packets/Bytes: 0/0
            FRR Pure Backup: Yes
            ECMP/LFA Backup: No
            Label Stack (Top -> Bottom): { 16141, 24000, 24000 }
        Policy Packets/Bytes Switched: 0/0
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

Check the packet counters on the policy, and verify if it is going through desired path or is it via Loop Free Alternate path (LFA)

Check SR-TE Health

Check Fallback

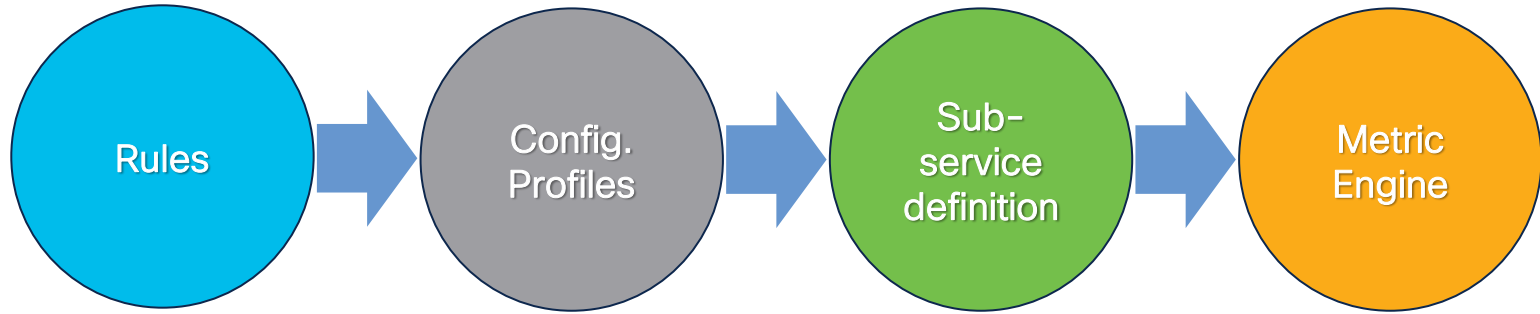
```
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show route 10.255.255.103
Fri Feb 12 19:48:23.330 EST

Routing entry for 10.255.255.103/32
  Known via "isis sitel", distance 115, metric 30, labeled SR, type level-2
  Installed Feb  9 23:00:06.797 for 2d20h
  Routing Descriptor Blocks
    10.101.102.1, from 10.255.255.103, via TenGigE0/0/0/47, Backup (Local-LFA)
      Route metric is 40
    10.102.141.2, from 10.255.255.103, via TenGigE0/0/0/1, Protected
      Route metric is 30
  No advertising protos.
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#show cef 10.255.255.103
Fri Feb 12 19:48:30.033 EST
10.255.255.103/32, version 5610, labeled SR, internal 0x1000001 0x83 (ptr 0x97dbf268) [1], 0x0 (0x97f83f68),
0xa28 (0x98f8e768)
Updated Feb  9 23:00:06.801
local adjacency 10.102.141.2
Prefix Len 32, traffic index 0, precedence n/a, priority 1
  via 10.101.102.1/32, TenGigE0/0/0/47, 16 dependencies, weight 0, class 0, backup (Local-LFA) [flags 0x300]
    path-idx 0 NHID 0x0 [0x98e239b0 0x0]
    next hop 10.101.102.1/32
    local adjacency
      local label 16103      labels imposed {16103}
  via 10.102.141.2/32, TenGigE0/0/0/1, 8 dependencies, weight 0, class 0, protected [flags 0x400]
    path-idx 1 bkup-idx 0 NHID 0x0 [0x9966db30 0x0]
    next hop 10.102.141.2/32
      local label 16103      labels imposed {16103}
RP/0/RP0/CPU0:vtstmesr1-ncs5k-2#
```

If Fallback is enabled Check RIB (Routing Information Base) and FIB (Forwarding Information Base)

Heuristic Package = Codify Know-How

Heuristic Package codify the troubleshooting “Know How”



..... so that all the manual tasks can be automated !

Heuristic Package = Codify Know-How

Rules: Define “what to monitor”

Rules

Capture the assurance schema that applies to a specific type(s) of services: what are the subservices to be created, their payload and their dependency relationship. This schema gets applied to dynamically discovered service instances to generate their respective *Service Assurance Graphs*.

Rule Example

L2 Point2Point VPN Health Status depends:

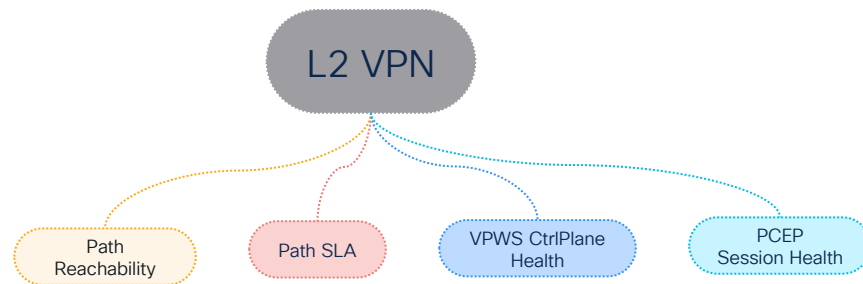
- Connectivity between the VPN endpoints A & B

Translates to Subservice called *XconnectHealth:A-B*

- Health status of each endpoint devices A & B

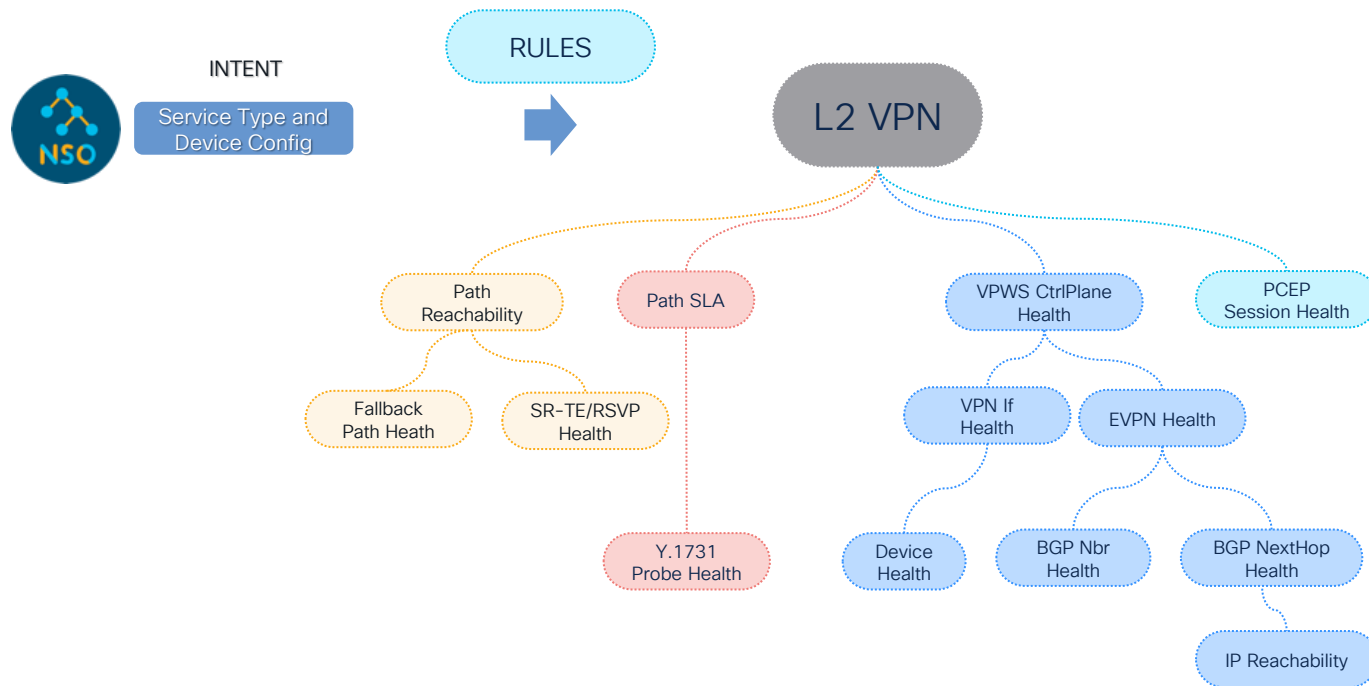
Translates to 2 Subservices - *DeviceHealthA* & *DeviceHealthB*

- Payload is Device Name for each end point



Codify Know How = Heuristic Package

Rules: Define “what to monitor” and Model it in an Assurance Graph



Heuristic Package = Codify Know-How

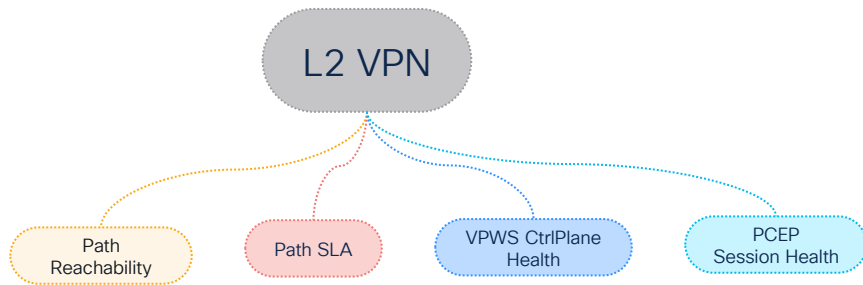
Configuration Profiles: Define Thresholds

Config.
Profiles

Capture the thresholds against which I want to monitor the services and sub-services. To the operator we are exposing only the thresholds related to the service intent.

Thresholds
Example

```
MEMFREE_THRESHOLD_MIN
Description: Threshold for minimum free memory to be
available on the device
Type: VAL_FLOAT
floatVal {2}
Unit: GB
Val: 10
```



Heuristic Package = Codify Know-How

Sub-service definition - Dependencies

Sub-service definition

Subservice definition will specify the underlying Metrics and details about how the health status for that subservice needs to be computed. Subservice Fields includes:

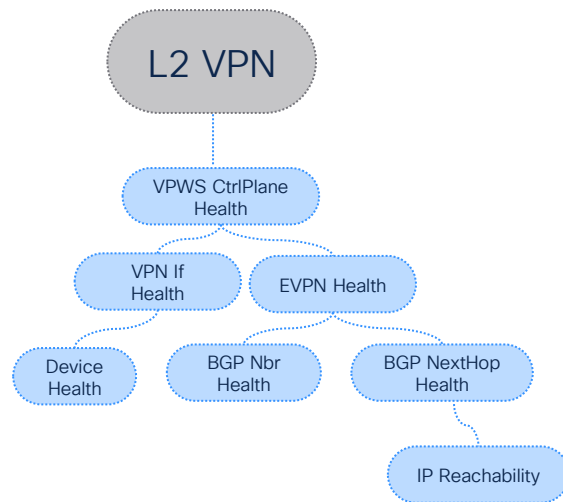
- **Dependencies:** List of Subservices and/or Metric Instances, Soft/Hard Dependency
- **Subservice Eval Expression:** How to derive the health status
- **Symptoms:** Subservice evaluates underlying metrics and subservices and records symptoms when prescribed expression is violated.

Dependencies

SubserviceClass/subserviceVpwsCpHealth.json :: Checks whether XConnect is up (Checks for both AC and EVPN segment status)

Supporting Metrics:

- MetricClass/metricXConnectState.json
- MetricClass/metricXConnectAcState.json
- MetricClass/metricXConnectEvpnState.json



Heuristic Package = Codify Know-How

Sub-service definition – Subservices Eval Expression

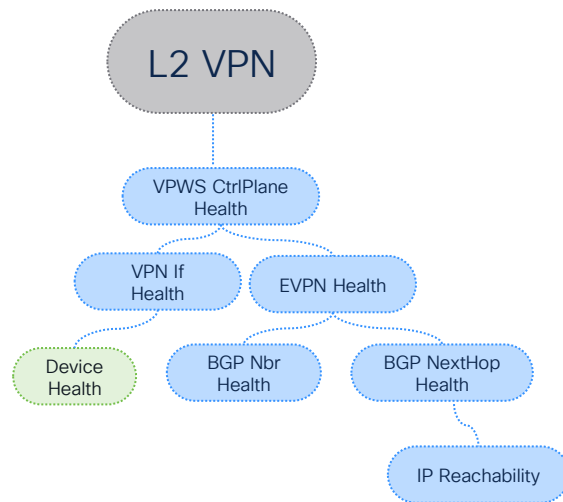
Sub-service definition

Subservice definition will specify the underlying Metrics and details about how the health status for that subservice needs to be computed. Subservice Fields includes:

- **Dependencies:** List of Subservices and/or Metric Instances, Soft/Hard Dependency
- **Subservice Eval Expression:** How to derive the health status
- **Symptoms:** Subservice evaluates underlying metrics and subservices and records symptoms when prescribed expression is violated.

Eval Expression

```
"rootExpressions": ["cpu_healthy && memory_healthy"],  
"dependencies": [  
  {  
    "type": "DEP_TYPE_EXPRESSION",  
    "label": "cpu_healthy",  
    "eval_expression": "cpu_load <= 80" },  
  {  
    "type": "DEP_TYPE_EXPRESSION",  
    "label": "memory_healthy",  
    "eval_expression": "memory_free > 1000" }]
```



Heuristic Package = Codify Know-How

Sub-service definition - Symptoms

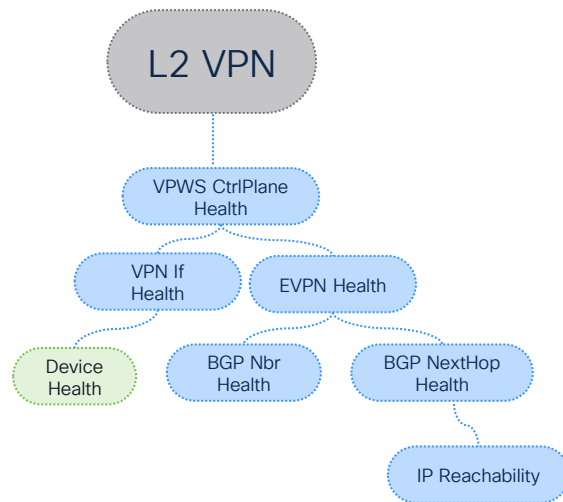
Sub-service definition

Subservice definition will specify the underlying Metrics and details about how the health status for that subservice needs to be computed. Subservice Fields includes:

- **Dependencies:** List of Subservices and/or Metric Instances, Soft/Hard Dependency
- **Subservice Eval Expression:** How to derive the health status
- **Symptoms:** Subservice evaluates underlying metrics and subservices and records symptoms when prescribed expression is violated.

Symptoms

```
"rootExpressions": ["cpu_healthy && memory_healthy"],  
  
"symptom" : {  
  "format_string" : "Heavier than expected resource consumption on  
the device.",  
  "level" : "DEGRADED"  
}
```



Device Health

Symptoms

Eval Expression

Dependencies

```
{
  "name": "subservice.device.health",
  "namespace": "system",
  "params": [ {
    "name": "DEVICE",
    "type": "PARAM_TYPE_NON_LIST" } ],

  "symptom" : {
    "format_string" : "Heavier than expected resource consumption on the device.",
    "level" : "DEGRADED" },

  "rootExpressions": ["cpu_healthy && memory_healthy"],

  "dependencies": [
    { "type": "DEP_TYPE_EXPRESSION",
      "label": "cpu_healthy",
      "eval_expression": "cpu_load <= 80" },
    { "type": "DEP_TYPE_EXPRESSION",
      "label": "memory_healthy",
      "eval_expression": "memory_free > 1000" },
    { "type": "DEP_TYPE_METRIC",
      "label": "cpu_load",
      "eval_expression": "metric.device.cpu.load",
      "paramMap": { "device": "DEVICE" } },
    { "type": "DEP_TYPE_METRIC",
      "label": "memory_free",
      "eval_expression": "metric.device.memory.free",
      "paramMap": { "device": "DEVICE" } }
  ]
}
```

Heuristic Package is encoded in human readable format (json) and is designed to be extended in the field by experts to cover variations in service bringing in flexibility to customers.

Codify Know-How: Heuristic Package

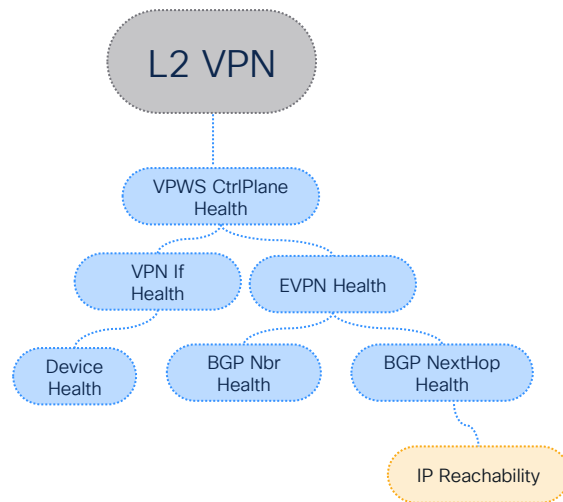
Metric Engine

Metrics Engine

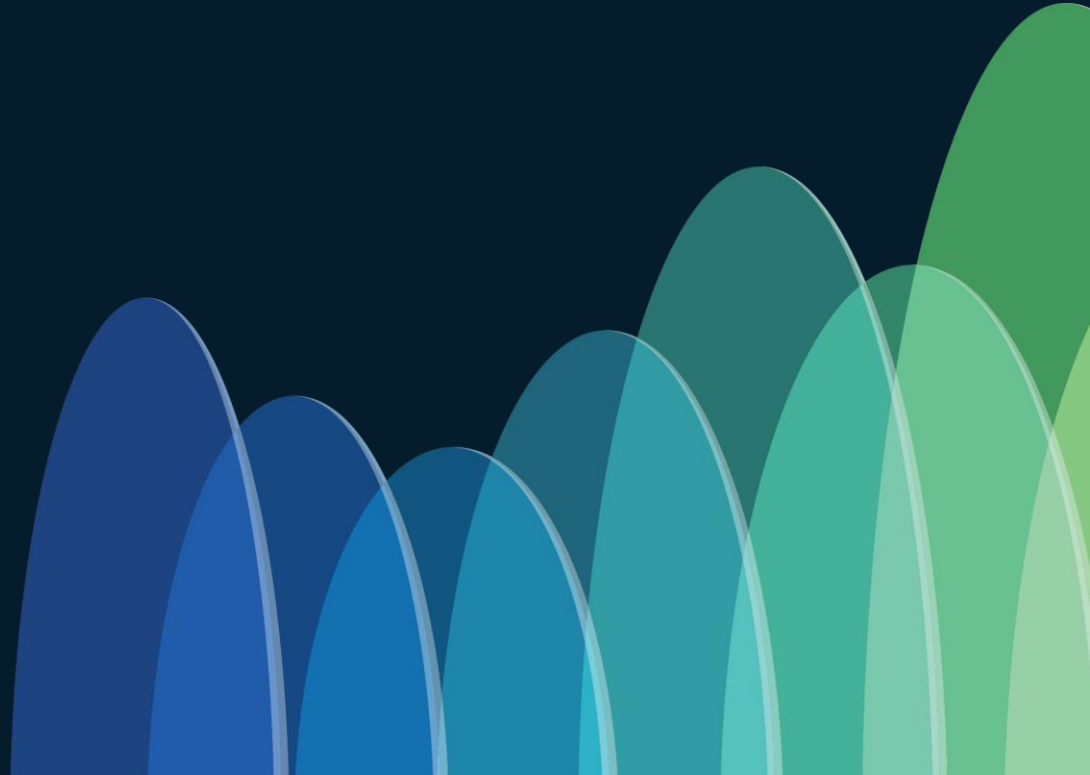
Metric defines the methods to fetch different operational data from different device types. Depending on the platform, different methods may be supported. Each metric definition specifies the different query methods supported for different device platform types.

Metric Mapping

```
implementations": {
  "generic IOS XR": {
    "MDTMetric": {
      "sensor_path": "Cisco-IOS-XR-ifmgr-oper:interface-properties/... /
        interface[interface-name=GigabitEthernet{gigEthIfId}]/state",
      "precedence": 2  },
    "SNMP IOS XR": {
      "SNMPMetric": {
        "oid": "IF-MIB:ifOperStatus",
        "key": "GigabitEthernet{gigEthIfId}",
        "mapping_oid": "IF-MIB:IF-MIB/ifTable/ifEntry" },
      "precedence": 20  } } }
```

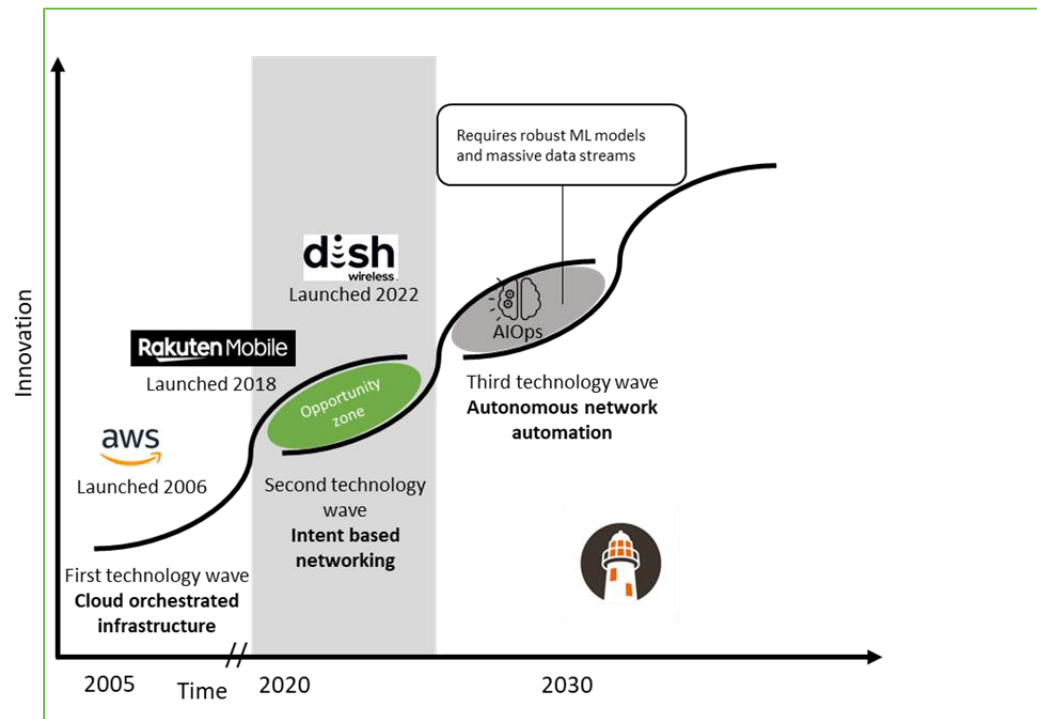


Intent Based Networking





Automated Assurance in the Programmable Network



Source: White Paper by Appledore Research: ['Intent-based Networking: Automated Assurance Critical Success Factor'](#)

- Entering 2nd wave of Intent-based Networking

Ability to define a service level and, more importantly, assure that the network can maintain that state regardless of anything that happens in the network

- Cloud & distributed network functions deliver increased scale but also complexity
- Independent technology silos will be replaced with closed loop automation (CLA)

Intent-Based Networking in SDN Transport

Assure Each Layer Independently

Slice health



Slice

Slice Health based on subtending transport service health

Service health



VPN Service

[IETF RFC 9417](#): Service Assurance for Intent Based Networking Architecture
Data Plane Verification through probing

Transport policy health



Transport

Policy verification with SR-PM: a TWAMP based tool

Infrastructure health



Infrastructure

Visibility & Monitoring: Device Inventory, Fault, Performance Metrics
Model Driven Telemetry

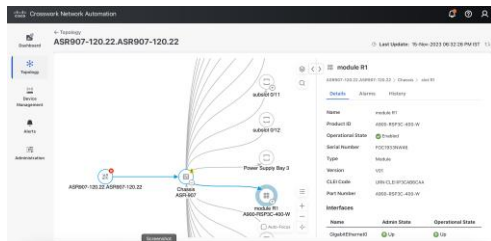


Infrastructure Health

Assure Each Layer Independently

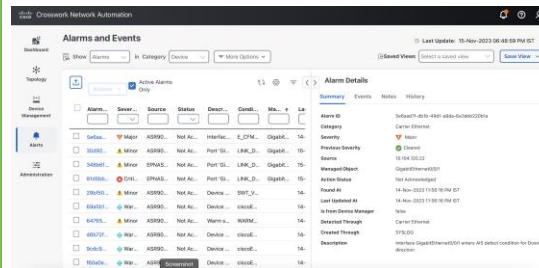
Deep Inventory Visibility

Clearly identify **interface** -> **pluggable** -> **port** -> **line card**. Complete topology information with detailed physical location of an interface.



Device Fault and Events

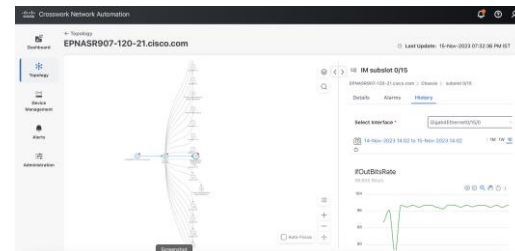
Align alarm/events to a single format that operator can sort and filter.
Ability to overlay Alarm Status on topology



TCA Policy Generation.

Key Metric

Out of the box metrics to track health of Device, Pluggable and Interface. Historical trending and API to stream data to external system.



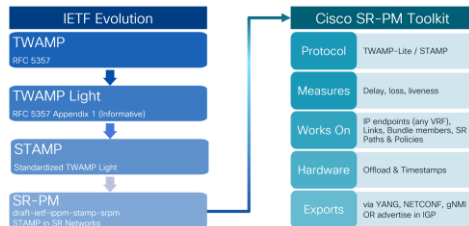


Policy Health

Policy verification with SR Performance Monitoring

SR-PM: A TWAMP based tool

Through SP-PM we can gain visibility into policy, link and IP end point health. SR-PM is standard based and as such it can interact with any responder.

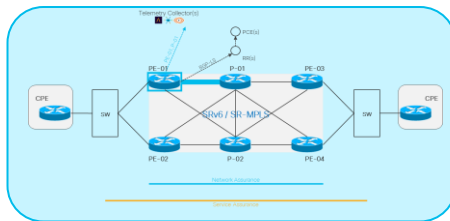


Link Health Monitoring via SR-PM

Measure the distance between PE-01 and P-01 (optical distance via HW timestamping)

Behaviors:

1. Provide min, max, avg, variance, loss via telemetry
2. **Update IGP** with min for routing decisions (SRTE, Flex-Algo)



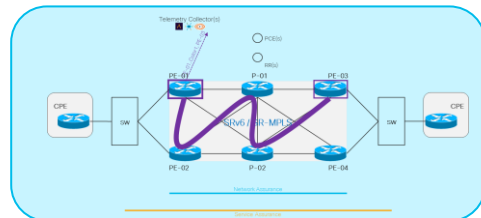
API for metric integration
external OSS system

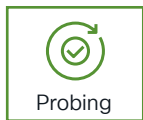
Policy Monitoring via SR-PM

Measure delay for specific SR-TE policy

Behaviors:

1. Provide min, max, avg, variance, loss via telemetry
2. Endpoints any TWAMP reflector**

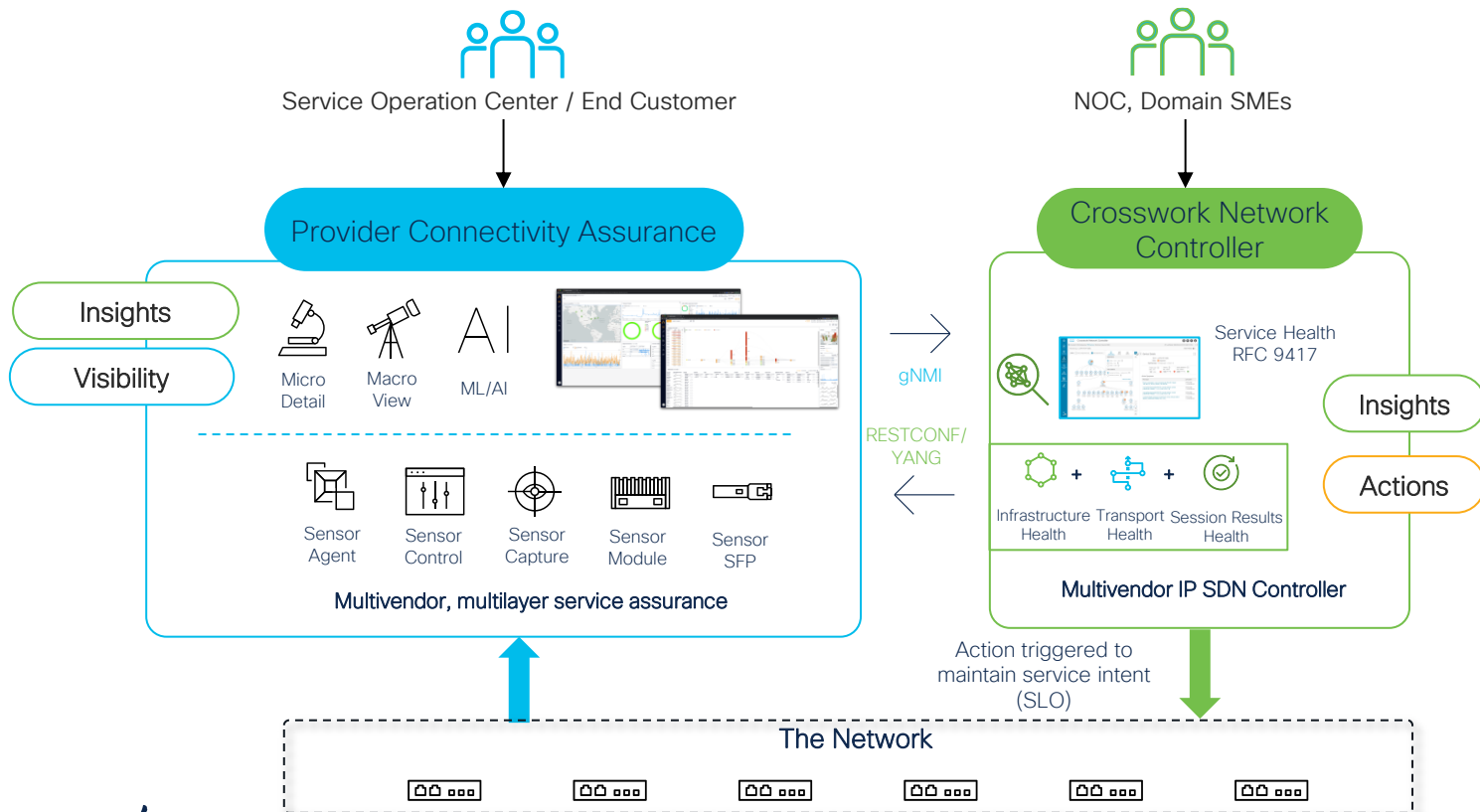




Probing

Deliver Your Service with Confidence

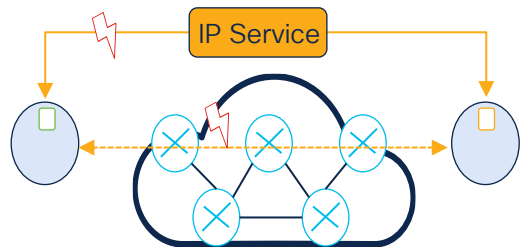
External Probe Integration



cisco *Live!*

Service Health

Intent Based Approach – productization of [IETF RFC 9417](#)



If the service is broken or degraded, **WHERE** and **WHY**?

If a network component is degrading/failing **WHICH** are the services impacted ?

Intent-Based
Network Provisioning



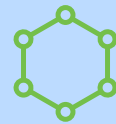
Intent-Based
Network Assurance



End to End
Probing



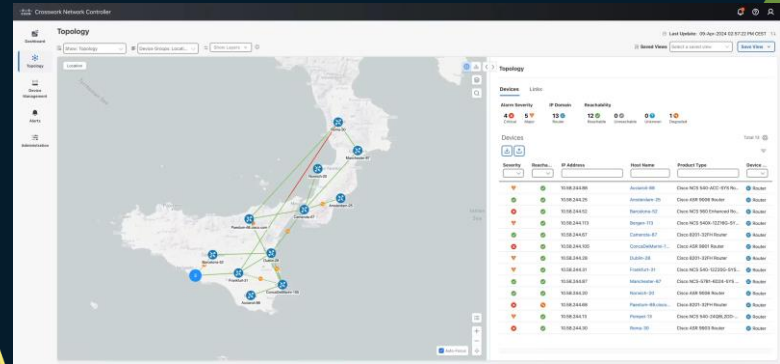
Transport
Health



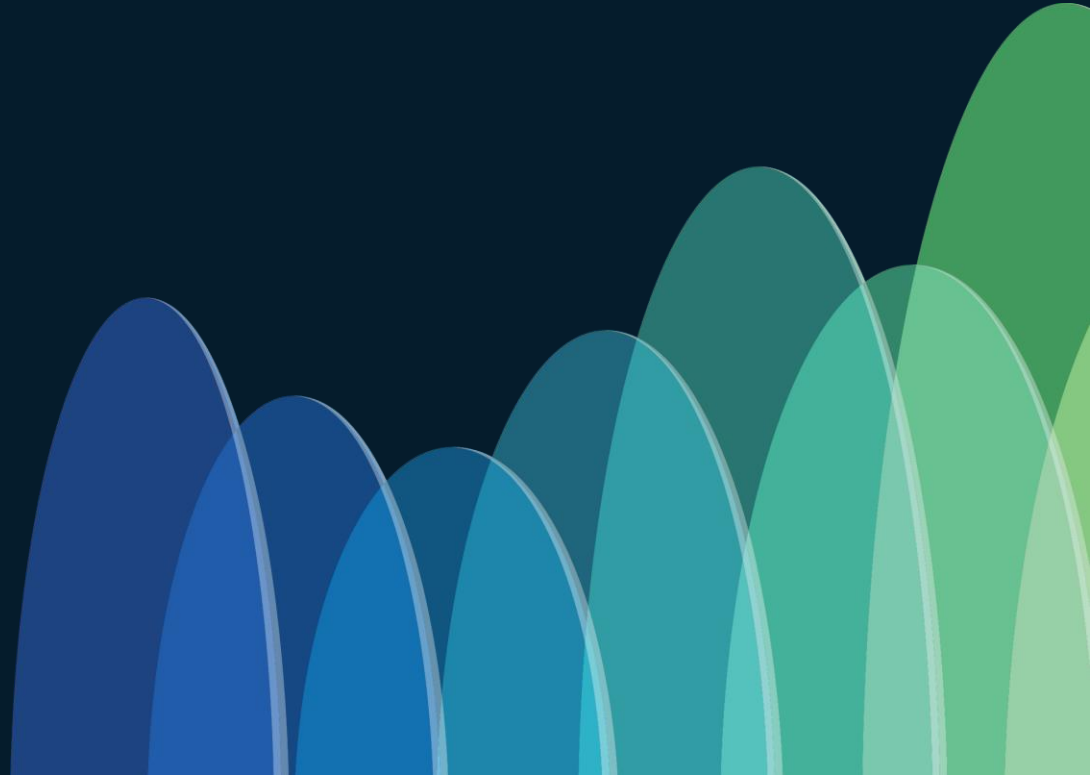
Infrastructure
Health

Video: Infrastructure Visibility

CISCO *Live!*



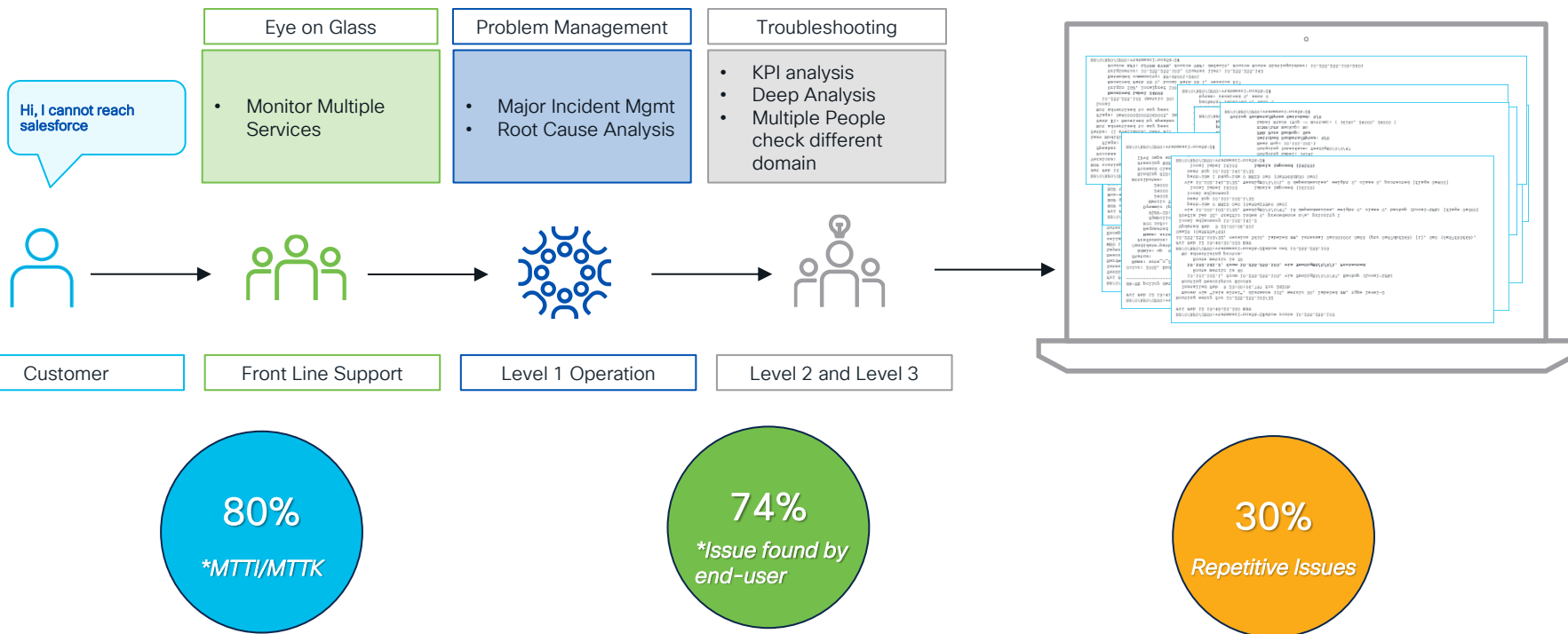
The Operator Experience



Today's Operation Experience ...



MTTI/MTTK



Enable Service Monitoring

Enable for selected service with a specific policy/profile.

The screenshot displays the Cisco Crosswork Network Controller interface. The left sidebar contains navigation icons for Home, Topology, Network Automation, Performance Alerts, Services & Traffic Engineering, Device Management, and Administration. The main content area is titled "VPN Services" and shows a map of the United States with various network nodes (e.g., n5501-1-me4, n5501-2-me4, n5501-3-me4, n5501-4-me4) connected by lines. A right-hand panel provides a summary of service health and a table of individual services.

VPN Services Summary:

- Provisioning: 6 Success, 0 Failed, 0 In-Progress
- Health (Monitoring: 3 services): 1 Good, 2 Degraded, 0 Down
- Total: 6

VPN Services Table:

Health	Service Key	Type	Provisioning ...	Last ...	A...
✓	l2nm-p2p	L2vpn-Ser...	✓ Success	26-Jan-...	...
⚠	l2vpn-evpn-2...	L2vpn-Ser...	✓ Success	23-Feb-...	...
⚠	l2vpn-evpn-4...	L2vpn-Ser...	✓ Success	12-Apr-...	...
⚠	l2vpn-evpn-4...	L2vpn-Ser...	✓ Success	12-Apr-...	...
⚠	vpn-102	L3vpn-Ser...	✓ Success	15-Apr-...	...
⚠	vpn-103	L3vpn-Ser...	✓ Success	15-Apr-...	...

A context menu is open over the "vpn-102" row, showing options: "View Details", "Edit/Delete", and "Start Monitoring".

Enable Service Monitoring

Enable for selected service with a specific policy/profile.

The screenshot displays the Cisco Crosswork Network Controller interface. The left sidebar contains navigation icons for Home, Topology, Network Automation, Performance Alerts, Services & Traffic Engineering, Device Management, and Administration. The main panel shows a map of North America with a network topology overlay. A 'Monitor Service' dialog box is open, allowing the user to select a monitoring profile for a service. The dialog has four radio button options: 'Gold_L2VPN_ConfigProfile system' (selected), 'Silver_L2VPN_ConfigProfile system', 'Gold_L2VPN_ConfigProfile custom', and 'Demo_L2VPN_ConfigProfile custom'. The 'Gold_L2VPN_ConfigProfile system' option is expanded, showing a table of thresholds for Gold L2VPN services.

Thresholds to use for Gold L2VPN services	
Cpu Threshold Max	70.5 %
Jitter Rt Threshold	80 sec
Latency 1way Threshold	500 sec
Latency Rt Threshold	500 sec
Max Acceptable In Out Pkt Delta	100
Memfree Threshold Min	10

At the bottom of the dialog are 'Start Monitoring' and 'Cancel' buttons. In the background, a table lists VPN services with their status (e.g., Success, In-Progress, Good, Degraded, Down) and a 'Start Monitoring' button is visible for one of the services.

Service Health Status reported

Indication on Service Detailed view

The screenshot displays the Cisco Crosswork Network Controller interface. The left sidebar contains navigation icons for Home, Topology, Network Automation, Performance Alerts, Services & Traffic Engineering, Device Management, and Administration. The main content area is titled 'VPN Services' and includes a map of the United States and Canada with various network nodes and connections. A 'Show VPN Services' dropdown is set to 'All Locations'. A 'Show Participating Only' checkbox is present. The 'VPN Services' panel on the right shows a 'Health (Monitoring: 3 services)' summary with 0 Good, 3 Degraded, and 0 Down status. Below this is a table of services with their health status, service key, type, provisioning status, and last update time.

Health	Service Key	Type	Provisioning ...	Last ... ①	A...
⚠	I2nm-p2p	L2vpn-Ser...	✓ Success	26-Jan-...	...
⚠	I2vpn-evpn-2...	L2vpn-Ser...	✓ Success	23-Feb-...	...
⚠	I2vpn-evpn-4...	L2vpn-Ser...	✓ Success	13-Apr-...	...
⚠	I2vpn-evpn-4...	L2vpn-Ser...	✓ Success	13-Apr-...	...
⚠	vpn-102	L3vpn-Ser...	✓ Success	20-Apr-...	...
⚠	vpn-103	L3vpn-Ser...	✓ Success	15-Apr-...	...

Health

Path Health Status

Tracked as part of the service health details view.

Crosswork Network Controller

Services & Traffic Engineering / VPN Services

Last Refresh: 28-Apr-2022 10:22:48 AM GMT+2

Show VPN Services Device Groups All Locations

Service Details

Name: (Zvpn-vpn-2001)

Provisioning: Success

Health: Degraded Monitoring Profile: Gold_L2VPN_ConfigProfile cus...

Health Transport Configuration Path Query

Jitter-RT (1) Latency-RT (1) PacketLoss-DS (1)

Max: 800 USEC Max: 10000 MSEC Max: 1%

824 usec avg 2619 msec avg 0 % avg

Active Symptoms (20) Total 20

Root Cause	Subservice	Prior	Last Updated
Jitter threshold cro...	subservice (Zvpn...	255	24-Apr-2022
Jitter threshold cro...	subservice (Zvpn...	255	18-Apr-2022
Jitter threshold cro...	subservice (Zvpn...	255	16-Apr-2022
Jitter threshold cro...	subservice (Zvpn...	255	14-Apr-2022

Crosswork Network Controller

Services & Traffic Engineering / VPN Services

Last Refresh: 28-Apr-2022 10:24:18 AM GMT+2

Show VPN Services Device Groups All Locations

Service Details

Name: (Zvpn-vpn-2001)

Provisioning: Success

Health: Degraded Monitoring Profile: Gold_L2VPN_ConfigProfile cus...

Health Transport Configuration Path Query

SR POLICY

Health	Head...	Ends...	Color	Ad...	Op...	Actions
☐	h5501...	h5501...	2001	1	1	...
☒	h5501...	h5501...	2001	1	1	...

Service details with symptoms

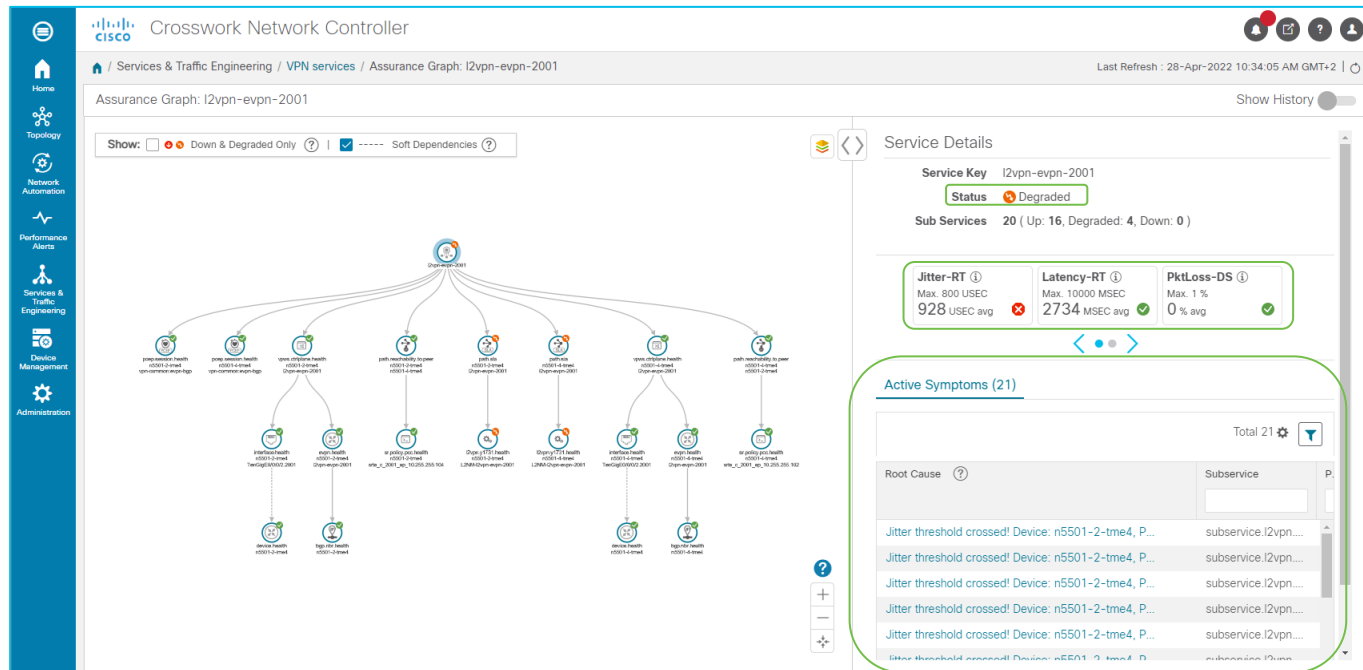
Expedite troubleshooting by pointing to possible symptoms

The screenshot displays the Cisco Crosswork Network Controller interface. The left sidebar contains navigation icons for Home, Topology, Network Automation, Performance Alerts, Services & Traffic Engineering, Device Management, and Administration. The main content area is titled 'Services & Traffic Engineering / VPN Services'. It features a map of North America with two locations highlighted: 'n5501-2-tm4' in California and 'n5501-4-tm4' in Texas. A purple line connects these two locations. The right panel, titled 'Service Details', shows the service 'I2vpn-evpn-2001' with a 'Provisioning Success' status. The 'Health' section indicates 'Degraded' status. Below this, there are three performance metrics: Jitter-RT (824 USEC avg), Latency-RT (2619 MSEC avg), and PktLoss-DS (0 % avg). The 'Active Symptoms (20)' section shows a table of symptoms, with the first four rows visible:

Root Cause	Subservice	Prior...	Last Updated
Jitter threshold cro...	subservice.I2vpn...	255	24-Apr-2022 ...
Jitter threshold cro...	subservice.I2vpn...	255	18-Apr-2022 ...
Jitter threshold cro...	subservice.I2vpn...	255	16-Apr-2022 ...
Jitter threshold cro...	subservice.I2vpn...	255	14-Apr-2022 ...

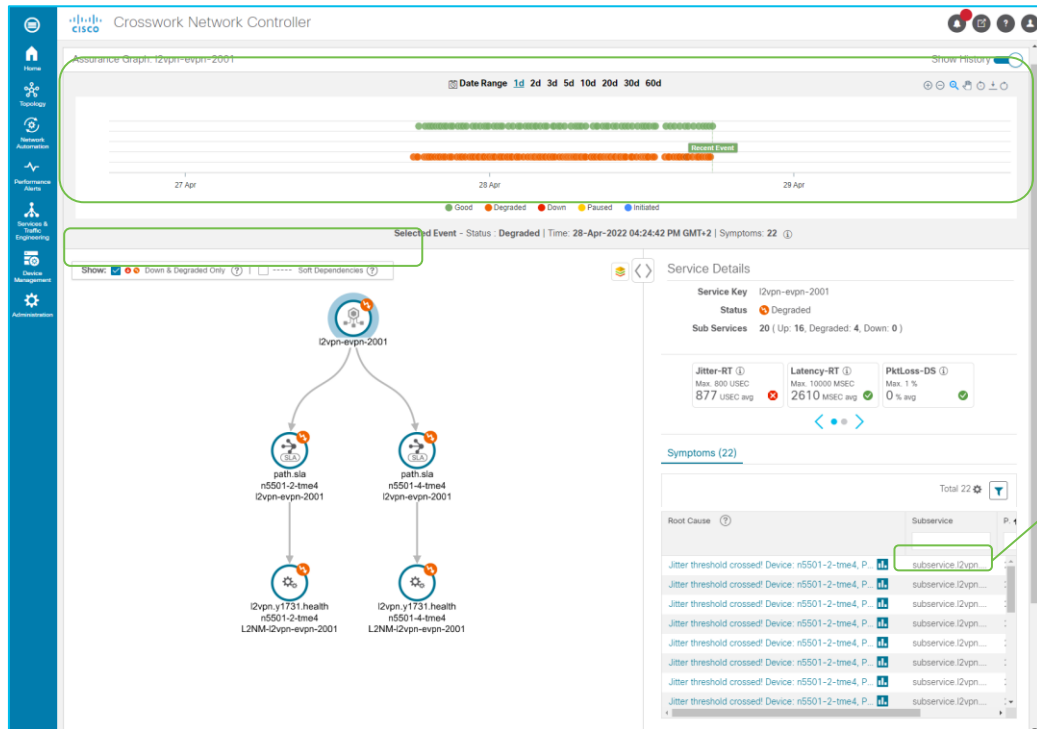
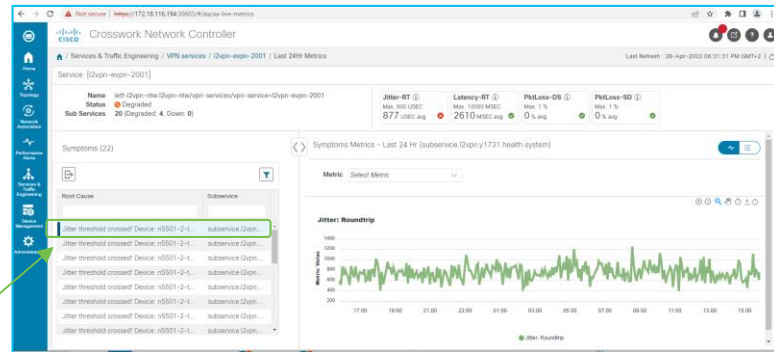
Assurance graph rendering

Help in pin-point the sub-services impacting the help of the service



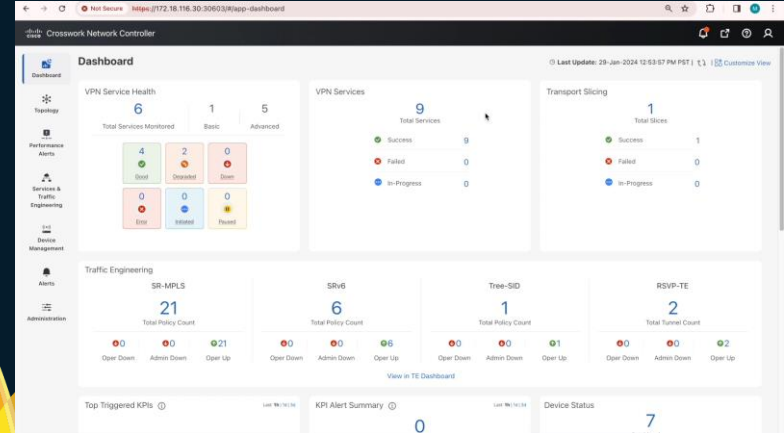
Timeline View

Ability to browse through snapshot of the service/sub-service status across timeline – up to 60 days



Video: Sneak view on Service Health

(Including integration with
external probes)



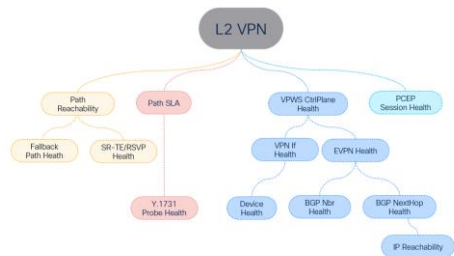


Service Health

Intent Based Approach – productization of [IETF RFC 9417](#)

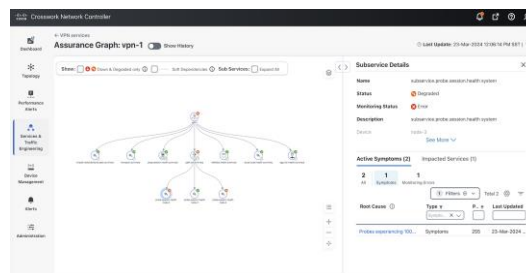
Describe Intent and networking physical and logical components

Each networking component is assured independently (i.e. monitoring metrics, healthy rule, and symptoms).



Issues Isolation

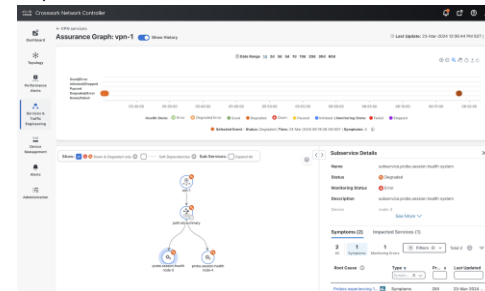
Assurance Graph help in pin-point the networking component impacted and relationship with the intent. Expedite troubleshooting by pointing to possible symptoms



Notify health status and symptoms

Timeline View

Ability to browse through snapshot of the component status across timeline

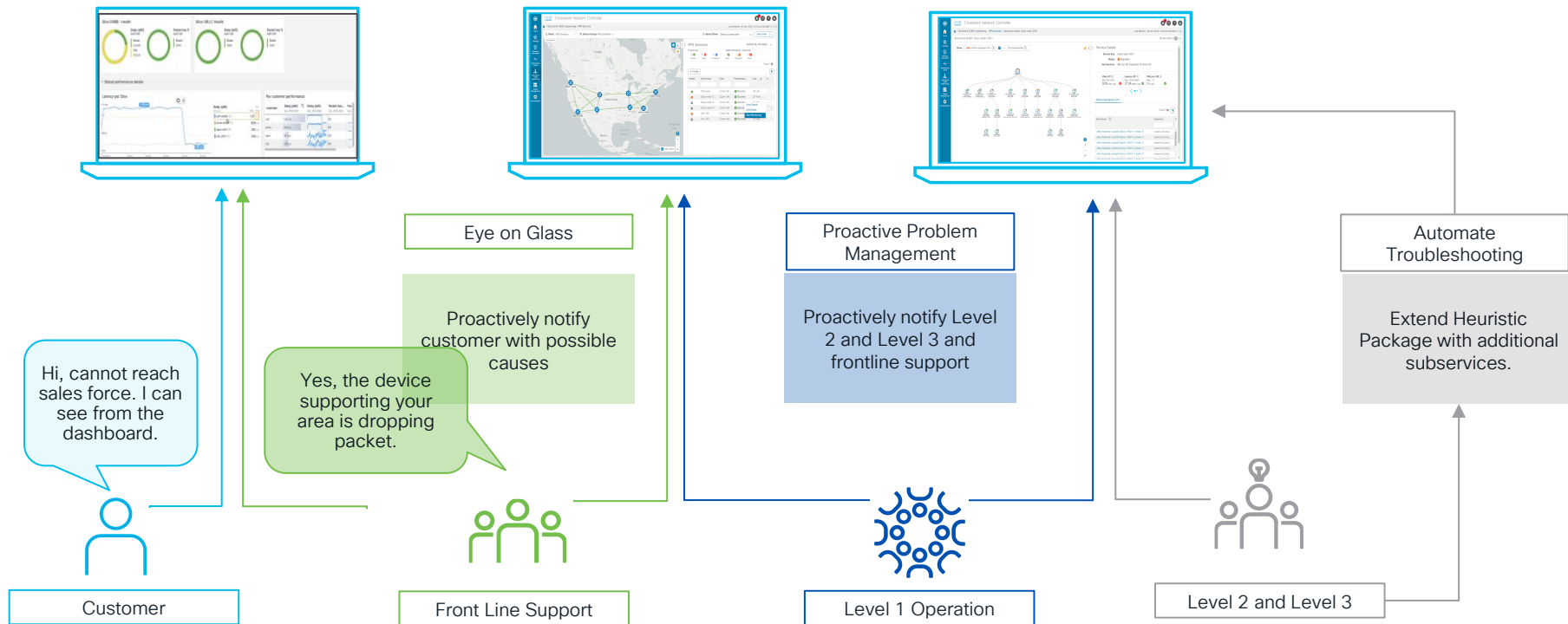


Tomorrow's Operation Experience ...

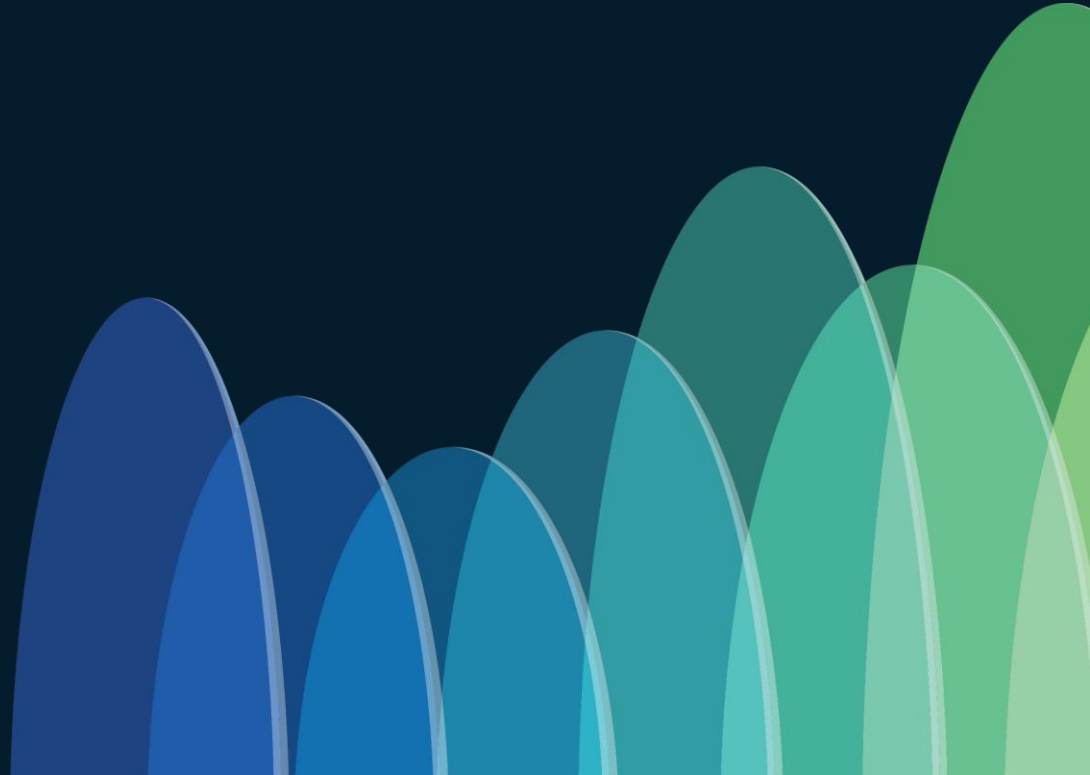


MTTI/MTTK

End to End View of the services shared across operator and adapted to the operator knowledge.



Know How Extension



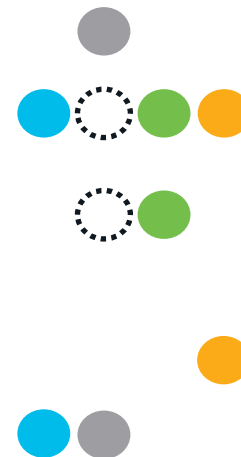
Know How Extension

Customization and extension for greenfield deployment

- Adjust threshold settings; ex. add a bronze config profile
- Add more metrics to monitor; ex. TWAMP Light metrics for L3VPN, QoS related metrics
- Reduce number of out-of-the-box metrics monitoring to conserve device resource consumption when applicable

Extension to support additional Cisco and 3rd party platforms

Customization and extension for NSO brownfield deployment



 Rules  Config Profiles  Sub-service definition  Metric Engine

Know How Extension

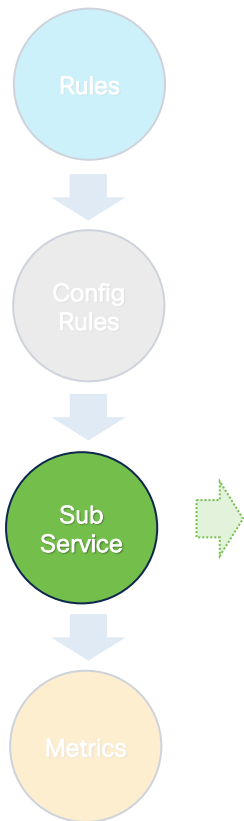
Use Case: Include mtu size for interface health of a l2vpn service.



```
"MTU_SIZE":{
  "description": "MTU Size for Jumbo frames"},
  "type": "VAL_INT"
  "intVal":{
    "unit": "NA",
    "val": 4000
  }
}
```

Know How Extension

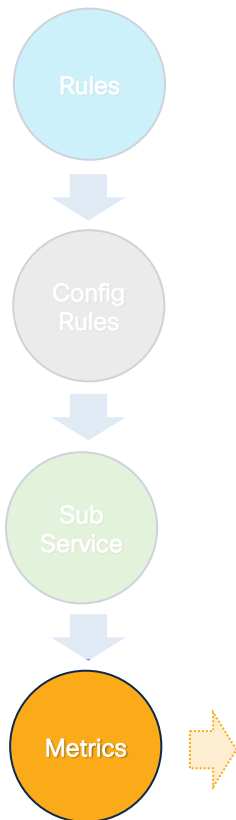
Use Case: Include mtu size for interface health of a l2vpn service.



```
{
  "name": "subservice.interface.health",
  "namespace": "custom",
  "description": "Subservice to reflect interface health",
  "params": [
    { "name": "device" },
    { "name": "ifID" }
  ]
  "rootExpressions": [
    { evalExpression: "oper_up && low_in_errors && low_in_discards && low_out_errors && low_out_discards && mtu_size_4k" }
  ],
  "dependencies": [
    { --
    }
    { --
    }
    { "type": "DEP_TYPE_METRIC",
      "label": "mtu_size_4k",
      "eval_expression": "metric.interface.mtu",
      "paramMap": {
        "device": "device"
        "gigaEthIfId": "ifId"
      }
    }
  ]
}
```

Know How Extension

Use Case: Include mtu size for interface health of a l2vpn service.



```
{
  "name": "metric.interface.mtu",
  "namespace": "custom",
  "description": "Interface MTU",
  "display label": "ifMTU",
  "parameters": {
    "device": { "description": "Device to which the interface belongs" },
    "gigEthIfId": { "description": "Gigabit Ethernet Interface Id. Includes subinterface id." },
  }
  "m_type": {
    "int_t": {}
  }
  "implementation ": {
    "SNMP IOS XR": {
      "SNMPMetric": {
        "oidPathConfig": "IF-MIB:IF-MIB/ifTable/ifEntry",
        "oidPathExact": "IF-MIB:IF-MIB/ifTable/ifEntry[ifName={gigEthIfId}]/ifMTU",
      }
    }
  },
  "matches ": {
    "implementation ": "SNMP IOS XR", {
      "conditions": {
        "os_model": {
          "type": "exact_match",
          "match": ["Cisco IOS XR"]
        }
      }
    }
  }
}
```

CX focus is to match the unique needs of each customer

CX Customization Use Cases

Customization and extension for greenfield deployment



- Adjust threshold settings; ex. add a bronze config profile
- Add more metrics to monitor; ex. TWAMP Light metrics for L3VPN, QoS related metrics
- Reduce number of out-of-the-box metrics monitoring to conserve device resource consumption when applicable

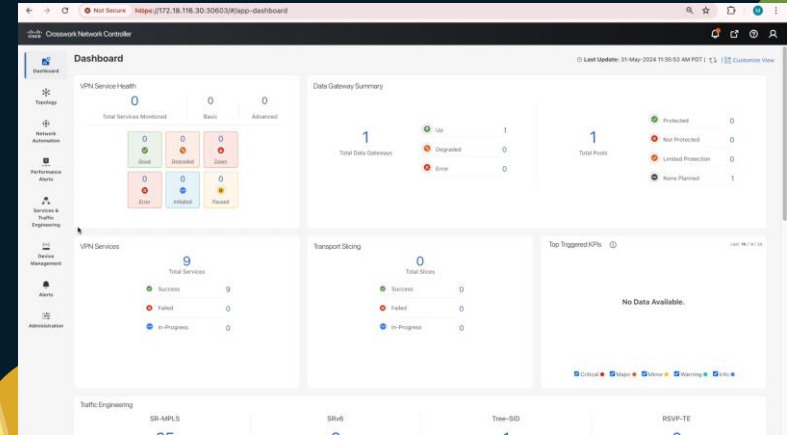


Extension to support additional Cisco and 3rd party platforms

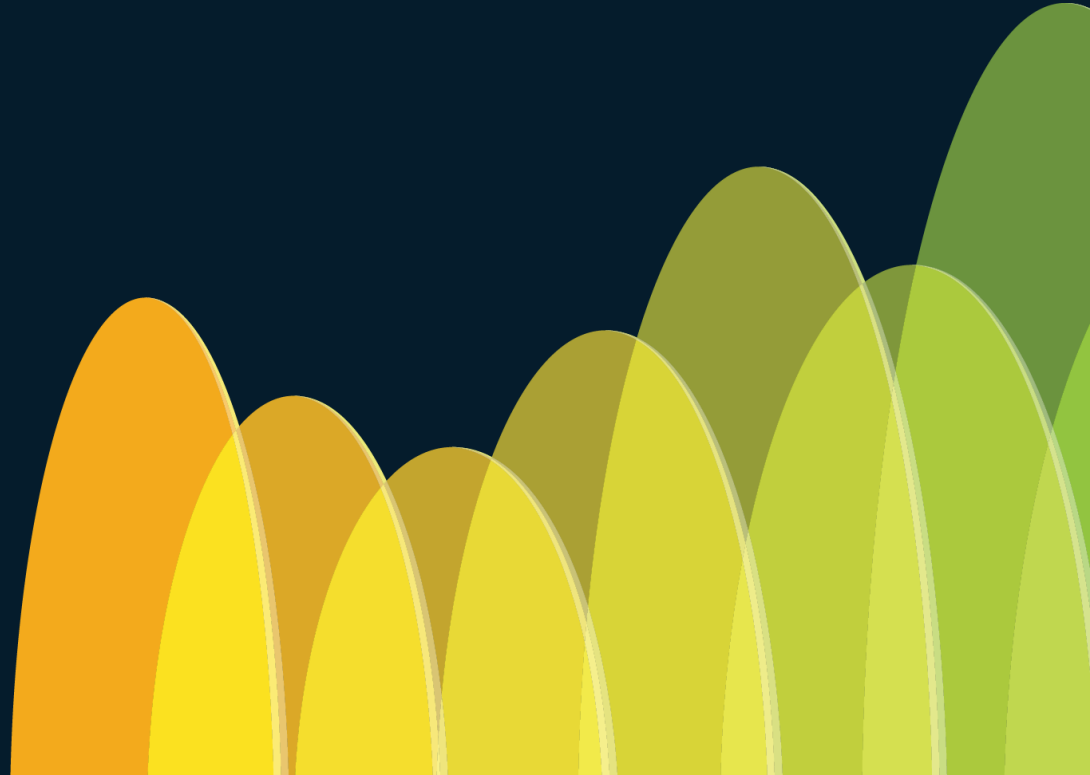


Customization and extension for brownfield deployment

Video: Custom Heuristic Package



Conclusion



Automated Assurance Use Cases

Avoid service disruptions with a holistic, **service-centric approach** to mitigating service-impacting issues

Business Outcome

- Reduction in time-to-detect service issues and remediation
- Improved user experience and operator productivity



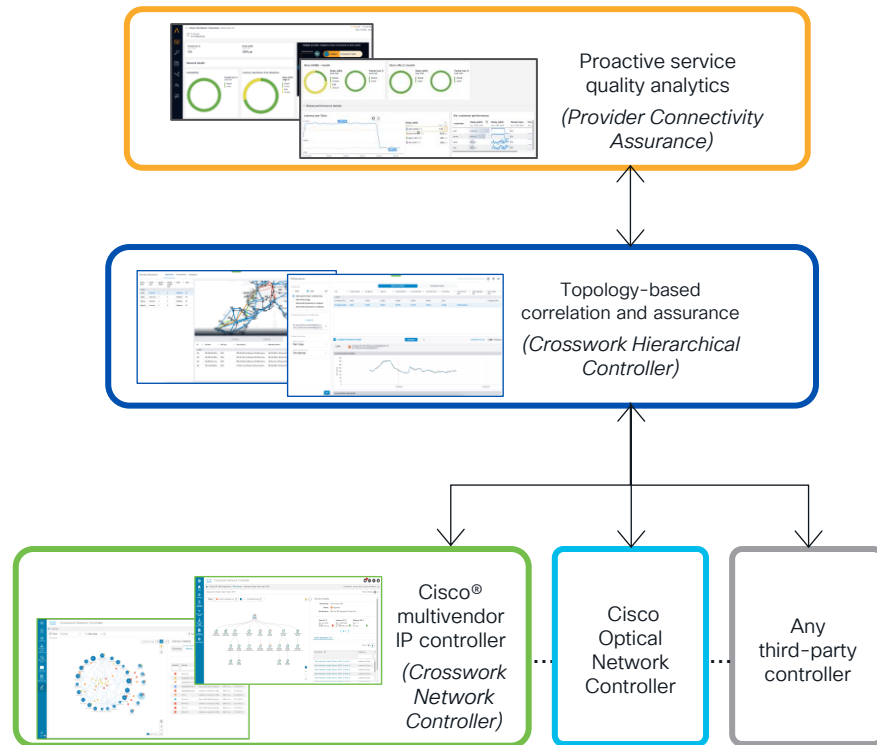
Visibility: Expedite troubleshooting by providing deep visibility aligned to operator knowledge and tasks



Insights: True Service Impact by combining empirical data plane verification with infrastructure health status in a single view



Actions: Codified Assurance Intent and Network “Know-How” enable to automate troubleshooting step. Trigger close loop automation



Keynote Deep Dives

Wednesday
10:30am – 11:30am



Experiences Amplified:
How AI Can Fuel
Better Employee
and Customer
Experiences

Level 1
Room 106



Smart, Secure,
Seamless:
Transforming
Experiences with
Next-Generation
Networking

Level 2
Room 204



Harness a Bold
New Era:
Transform Data
Centre and
Service Provider
Connectivity

Level 2
Room 203



Securing User to
Application and
Everything in
Between

Level 2
Melbourne Room 2



Unlocking
Digital Resilience
through Unified
Observability

The HUB
Centre Stage

Complete Your Session Evaluations



Complete a minimum of 4 session surveys and the Overall Event Survey to claim a **Cisco Live T-Shirt**.



Complete your surveys in the **Cisco Live mobile app**.



Continue your education



- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

Contact me at: parosio@cisco.com



Thank you

CISCO *Live!*

#CiscoLiveAPJC

CISCO *Live!*

GO BEYOND

#CiscoLiveAPJC