AppFormix

Overview and Update

AppFormix

- Overview
- New Features and Extensions

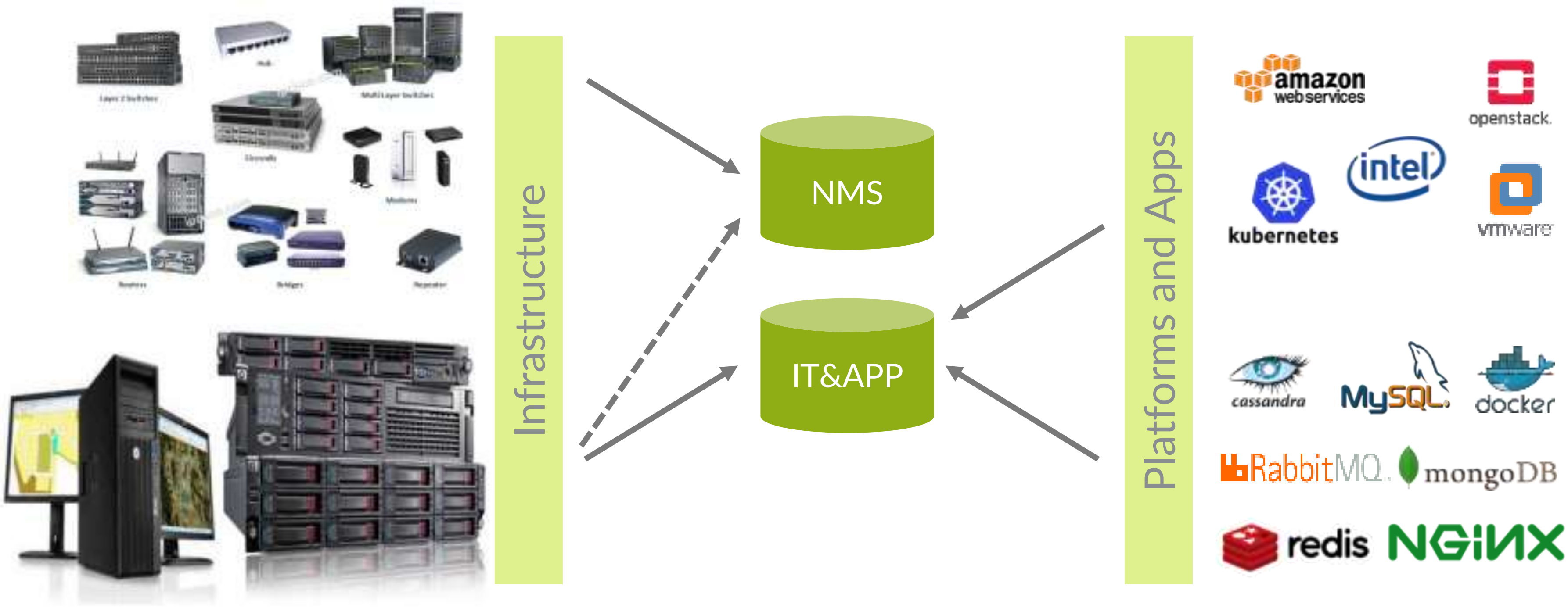
JUNIPER NETWORKS | JUNIPER DAY

16 октября 2018

APPFORMIX OVERVIEW

Single cross-layer monitoring platform

MONITORING: BASE PROBLEM



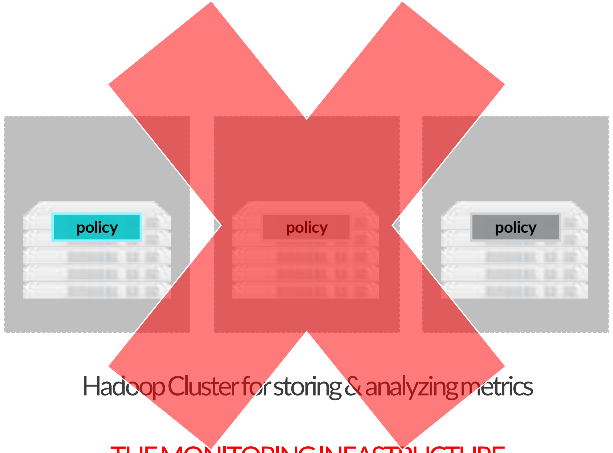
MONITORING: BASE PROBLEM

Monitoring technologies are SLOW! INNEFICIENT! INEFECTIVE!

INEFFICIENT
REQUEST-RESPONSE

Metrics

Compute & Storage
Infrastructure



Hadoop Cluster for storing & analyzing metrics

THE MONITORING INFASTRUCTURE
IS MORE COMPLEX THAN THE INFRASTRUCTURE
THAT
IS BEING MONITORED

Signals
6
MINUTES

Consumed by humans for
after-the-fact analysis

Your OpenStack/Kubernetes

NEED REAL TIME

TOO SLOW TO INFLUENCE
ORCHESTRATION

APPFORMIX: CROSS LAYER MONITORING PLATFORM

Stream analysis to monitor SLAs and predict faults

Data Driven Capacity Planning

APPFORMIX

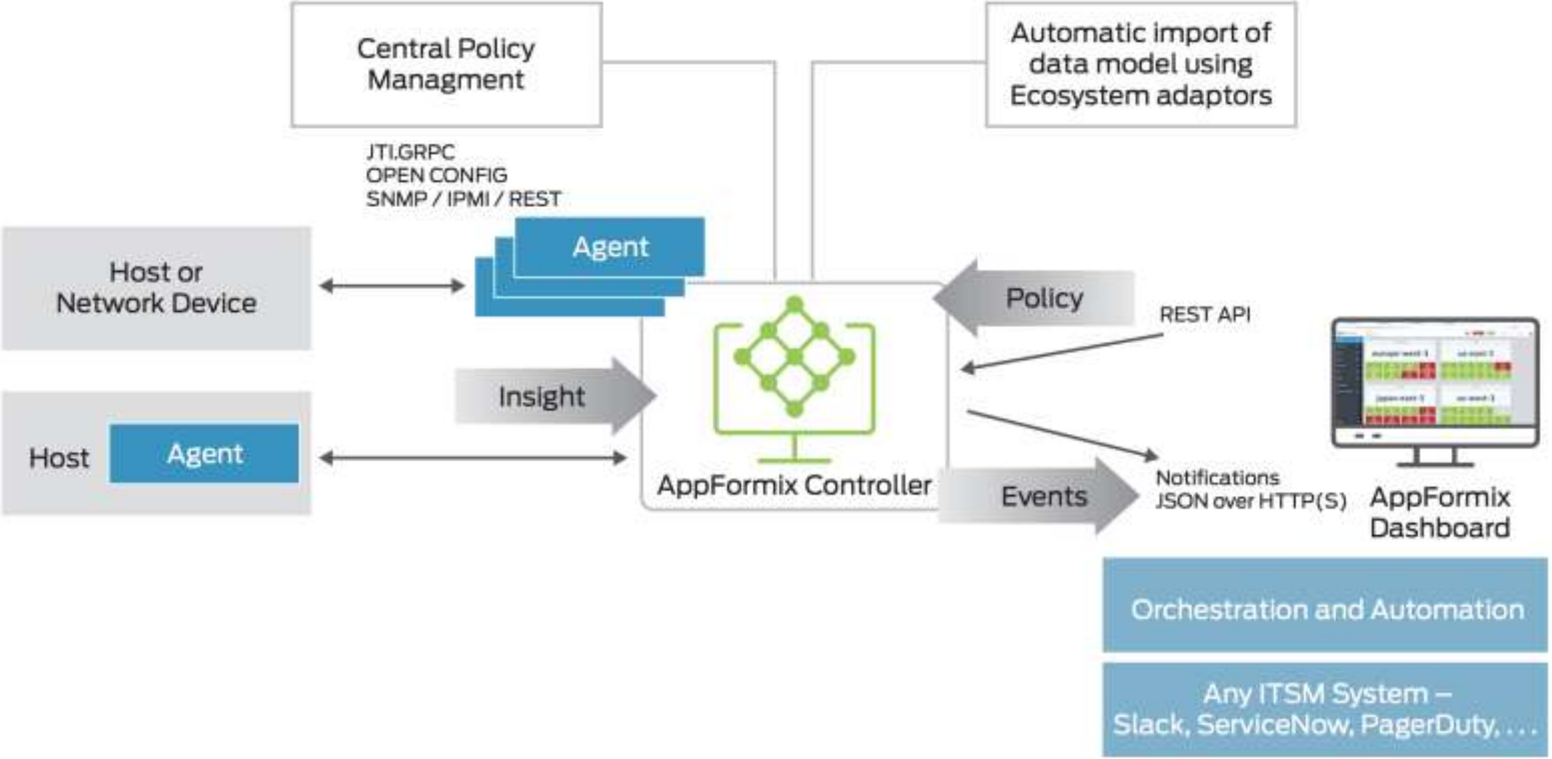
Real-time optimizations to improve efficiency and ensure service availability

Proactive Maintenance

Single operations platform to monitor all layers of the stack

APPLICATION & SERVICES	CLOUD INFRASTRUCTURE	SOFTWARE DEFINED INFRASTRUCTURE	PHYSICAL INFRASTRUCTURE
cassandra MySQL docker RabbitMQ mongoDB redis NGINX	Microsoft Azure amazon web services Google Cloud Platform	openstack vmware kubernetes ScaleIO ceph OPENCONTRAIL	

APPFORMIX ARCHITECTURE



Central Policy Managment

Automatic import of data model using Ecosystem adaptors

JTI.GRPC
OPEN CONFIG
SNMP / IPMI / REST

Host or Network Device

Agent

Host

Agent

Insight

AppFormix Controller

Policy

REST API

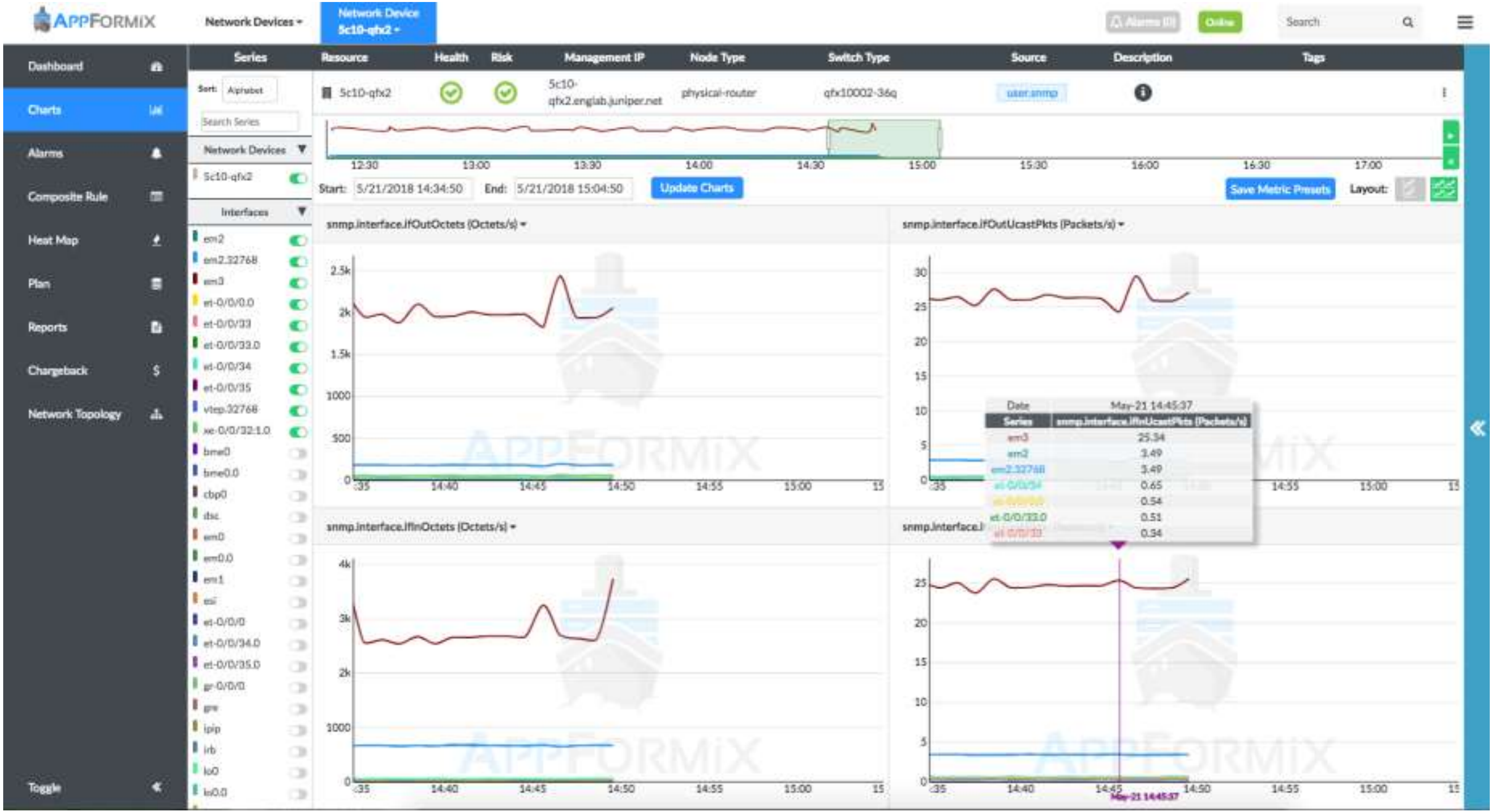
Events

Notifications
JSON over HTTP(S)

AppFormix Dashboard

Orchestration and Automation

Any ITSM System –
Slack, ServiceNow, PagerDuty, . . .

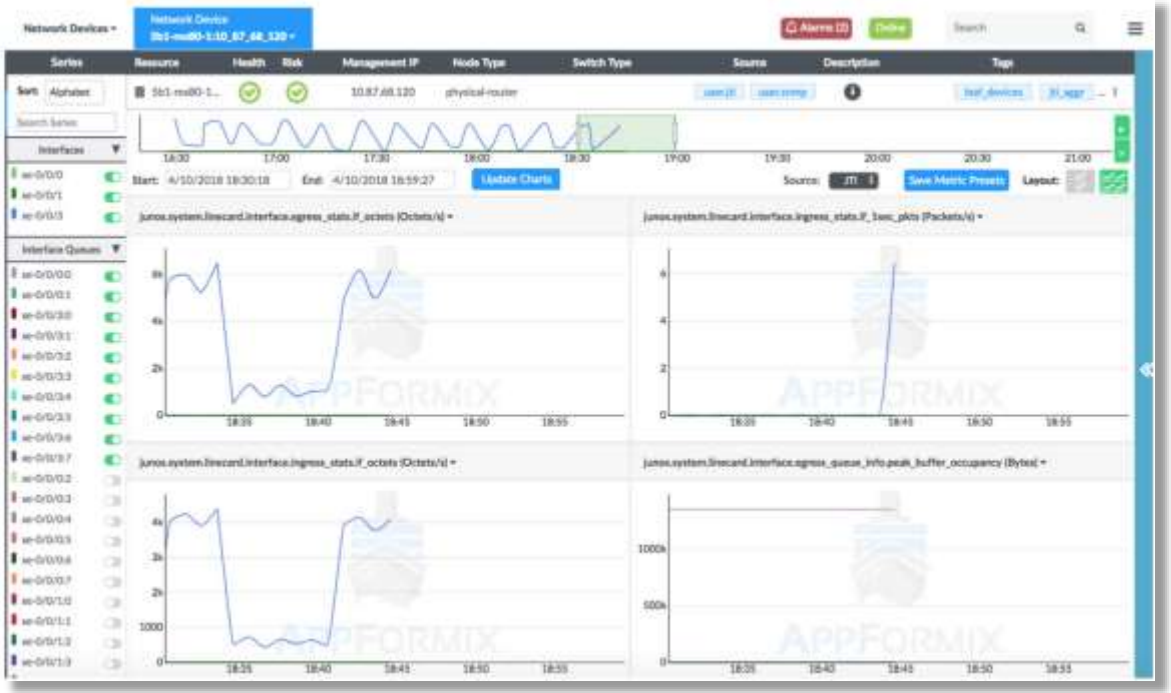


Resource	Health	Risk	Management IP	Node Type	Switch Type	Source	Description	Tags
5c10-qfx2	✓	✓	5c10-qfx2.englab.juniper.net	physical-router	qfx10002-36q	user.snmp	ⓘ	

Start: 5/21/2018 14:34:50 End: 5/21/2018 15:04:50

Date	May-21 14:45:37
Series	snmp.interface.ifInUcastPkts (Packets/s)
em3	25.34
em2	3.49
em2.32768	3.49
et-0/0/34	0.65
[illegible]	0.54
et-0/0/33.0	0.51
et-0/0/33	0.34

APPFORMIX: REAL-TIME METRICS AND ALARMS


Network Devices ▾
Network Device
5b1-mx80-1:10_87_68_120 ▾
Alarms (0)
Online
Search
Series
Sort: Alphabet
Search Series
Interfaces
xe-0/0/0
xe-0/0/1
xe-0/0/3
Interface Queues
Update Charts
Source: JTI
Save Metric Presets
Layout:
junos.system.linecard.interface.egress_stats.if_octets (Octets/s) ▾
junos.system.linecard.interface.ingress_stats.if_1sec_pkts (Packets/s) ▾
junos.system.linecard.interface.ingress_stats.if_octets (Octets/s) ▾
junos.system.linecard.interface.egress_queue_info.peak_buffer_occupancy (Bytes) ▾
APPFORMIX

Resource	Health	Risk	Management IP	Node Type	Switch Type	Source	Description	Tags
5b1-mx80-1...	✓	✓	10.87.68.120	physical-router		user.jti user.snmp		leaf_devices jti_aggr ...

Start: 4/10/2018 18:30:18 End: 4/10/2018 18:59:27

Collects and calculates comprehensive metrics in real time (network devices, hosts, instances, storage, services)

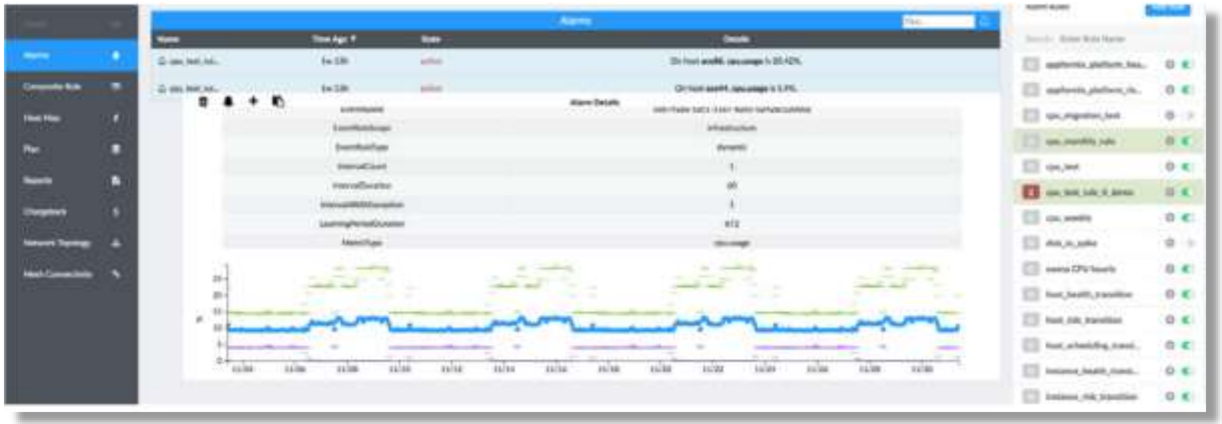
Receive data using JTI native sensors, OpenConfig sensors, SNMP MIBs

Display real-time charts and reports in the AppFormix Dashboard.

Configurable alarms against values or conditions of metrics or groups of metrics.

Alarms notify the operator in real time upon threshold breach. Plotting alarms on charts in both real time and historically

APPFORMIX: MACHINE LEARNING



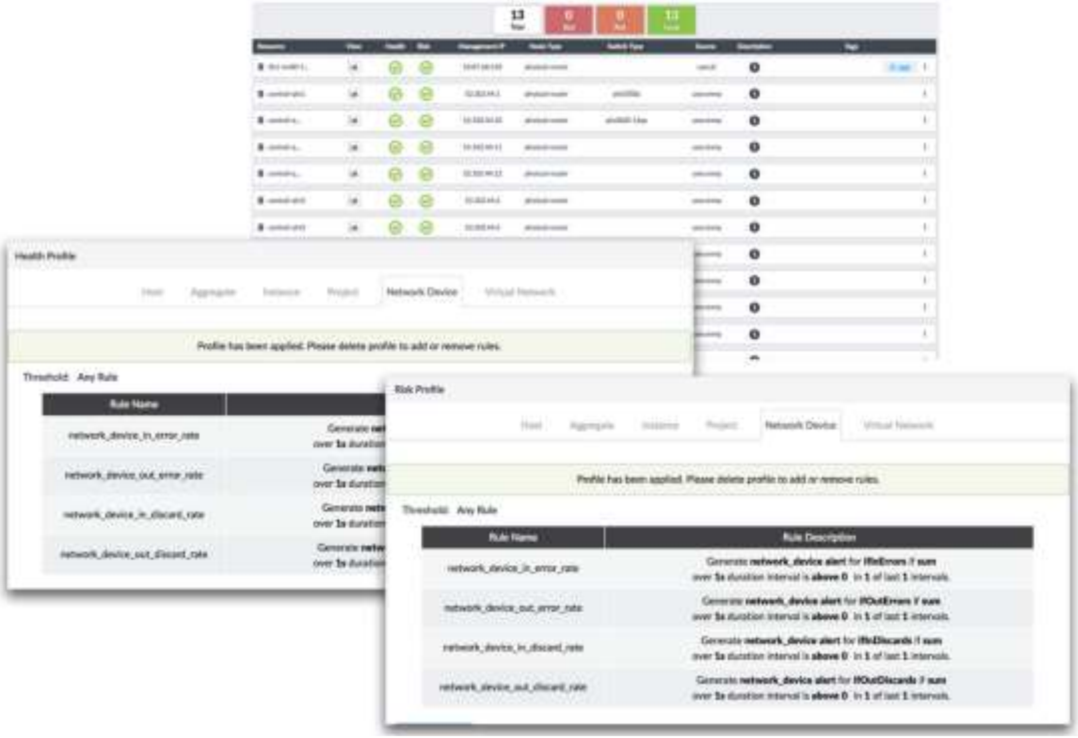
Applies machine learning to dynamically discover and baseline the performance of applications, network, and infrastructure

Generates alarms when real-time metrics deviate from historical trends

Monitoring policy that is aware of the dynamic nature of network traffic

Capability to monitor network elements when the performance profile and operational boundaries are still unknown.

APPFORMIX: SLA MONITORING



Health Profile

Profile has been applied. Please delete profile to add or remove rules.

Threshold: Any Rule

Rule Name	
network_device_in_error_rate	Generate net over 1s duration
network_device_out_error_rate	Generate netw over 1s duration
network_device_in_discard_rate	Generate netw over 1s duration
network_device_out_discard_rate	Generate netw over 1s duration

Risk Profile

Profile has been applied. Please delete profile to add or remove rules.

Threshold: Any Rule

Rule Name	Rule Description
network_device_in_error_rate	Generate **network_device alert** for **IfInErrors** if **sum** over **1s** duration interval is **above 0** in **1** of last **1** intervals.
network_device_out_error_rate	Generate **network_device alert** for **IfOutErrors** if **sum** over **1s** duration interval is **above 0** in **1** of last **1** intervals.
network_device_in_discard_rate	Generate **network_device alert** for **IfInDiscards** if **sum** over **1s** duration interval is **above 0** in **1** of last **1** intervals.
network_device_out_discard_rate	Generate **network_device alert** for **IfOutDiscards** if **sum** over **1s** duration interval is **above 0** in **1** of last **1** intervals.

Dashboard: Quick and intuitive overview of the health and projected risk of the network infrastructure.

Health status to indicate if a resource is operating outside a user-specified performance policy,

Risk uses historical data to determine whether a resource may be unhealthy in the future.

Default and customized SLA health and risk profiles to suit unique environments.

LOT OF PREDEFINED METRICS AND RULES

1000+ PRE-DEFINED METRICS

- Various metrics for applications and network devices
- Customer may add their own metrics if needed

ALARM RULES AND ACTIONS

- Pre-defined alarm rules for applications and network
- Custom rules with configurable action
- Machine learning events and actions

AUTOMATION & ORCHESTRATION

- Orchestrate external resources (NorthStar, Contrail etc) when needed

"Works off the shelf with no engineering effort"

PLATFORM INTEGRATION

vmware

amazon web services

openstack.

kubernetes

intel

INDUSTRY RECOGNITION

TECHNOLOGY TO WATCH
MITSloan CIO Symposium

Best of Interop
2016 GRAND AWARD WINNER

Best of Interop
2016 CLOUD/VIRTUALIZATION WINNER

THE CHANNEL CO. CRN
EMERGING VENDORS
2016

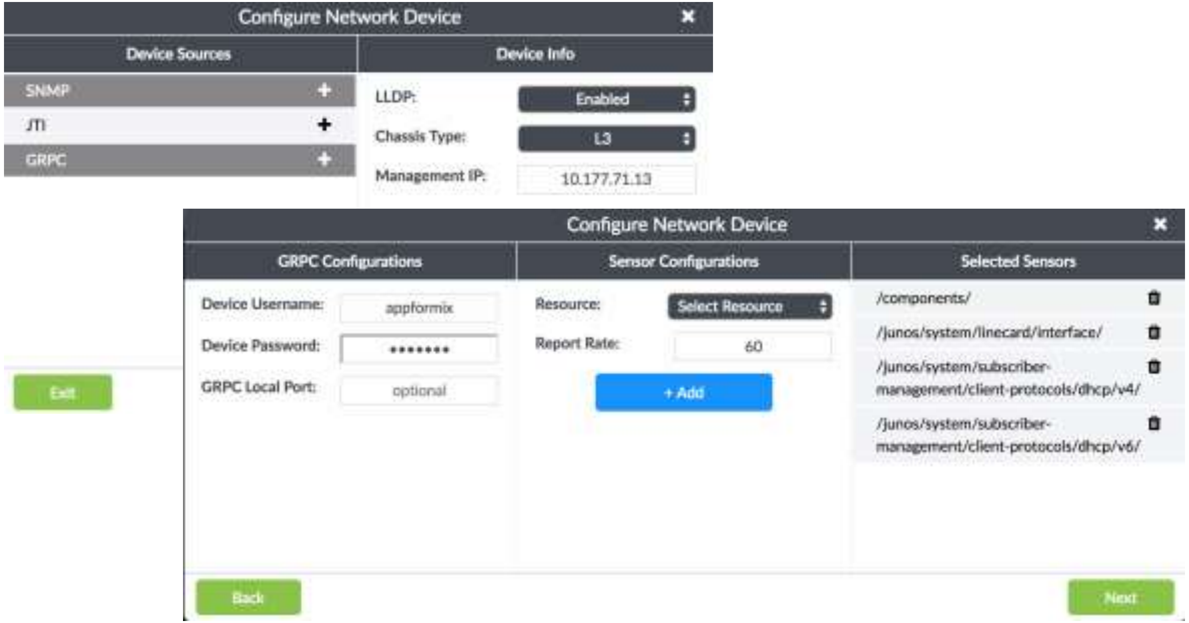
THE GOLDEN BRIDGE AWARDS
SILVER
BEST 2016
BUSINESS WORLD

JUNIPER DAY

16 октября 2018

NEW FEATURES AND EXTENSIONS

APPFORMIX: NETWORK DEVICE SUPPORT



Configure Network Device

Device Sources: SNMP +, JTI +, GRPC +

Device Info

LLDP: Enabled

Chassis Type: L3

Management IP: 10.177.71.13

Exit

Configure Network Device

GRPC Configurations

Device Username: appformix

Device Password: •••••••

GRPC Local Port: optional

Sensor Configurations

Resource: Select Resource

Report Rate: 60

+ Add

Selected Sensors

/components/

/junos/system/linecard/interface/

/junos/system/subscriber-management/client-protocols/dhcp/v4/

/junos/system/subscriber-management/client-protocols/dhcp/v6/

Back

Next

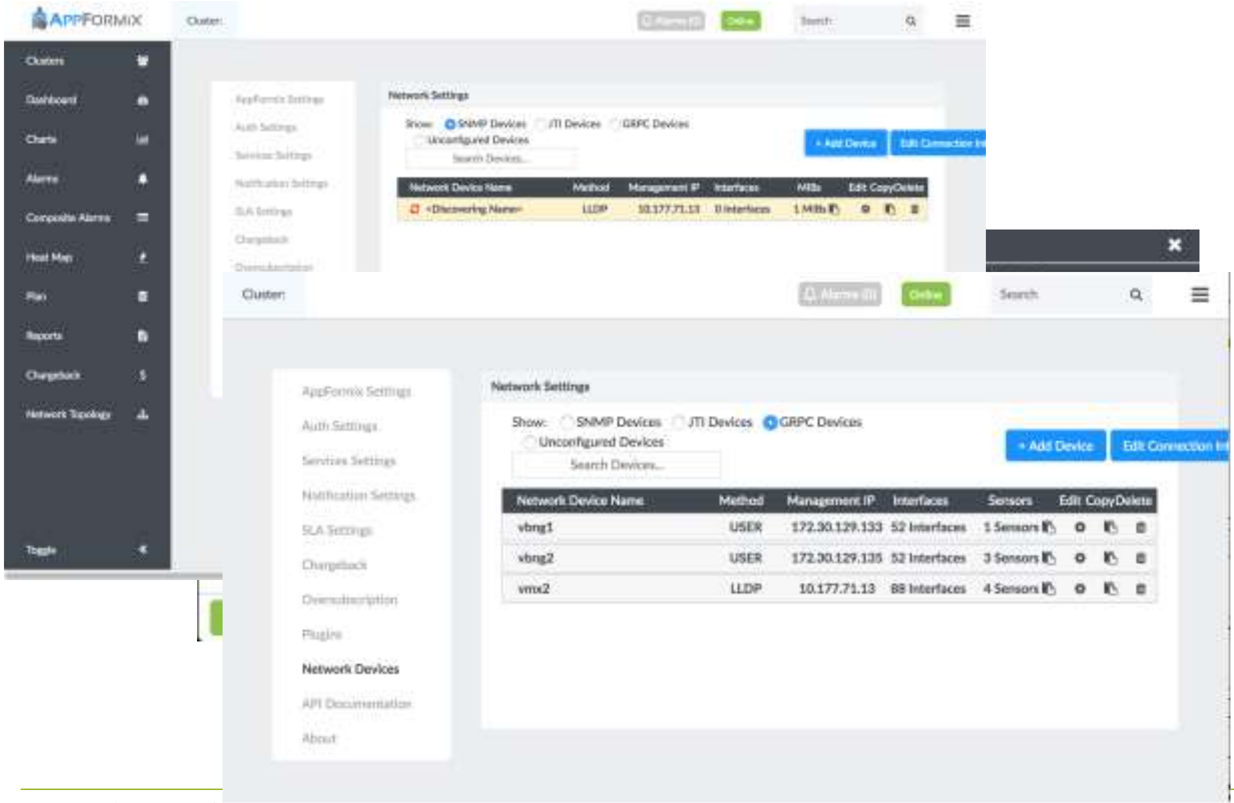
Ability to add network devices through GUI from dashboard settings

Edit network connection map via GUI

Auto discover network device entities: interfaces, routing engines, interface queues, etc.

Add remove JTI/GRPC sensors for network devices in GUI

APPFORMIX: NETWORK DEVICE SUPPORT



Network Settings

Show: ● SNMP Devices ○ JTI Devices ○ GRPC Devices ○ Unconfigured Devices

Network Device Name	Method	Management IP	Interfaces	MIBs	Edit	Copy	Delete
<Discovering Name>	LLDP	10.177.71.13	0 Interfaces	1 MIBs			

Network Settings

Show: ○ SNMP Devices ○ JTI Devices ● GRPC Devices ○ Unconfigured Devices

Network Device Name	Method	Management IP	Interfaces	Sensors	Edit	Copy	Delete
vbng1	USER	172.30.129.133	52 Interfaces	1 Sensors			
vbng2	USER	172.30.129.135	52 Interfaces	3 Sensors			
vmx2	LLDP	10.177.71.13	88 Interfaces	4 Sensors			

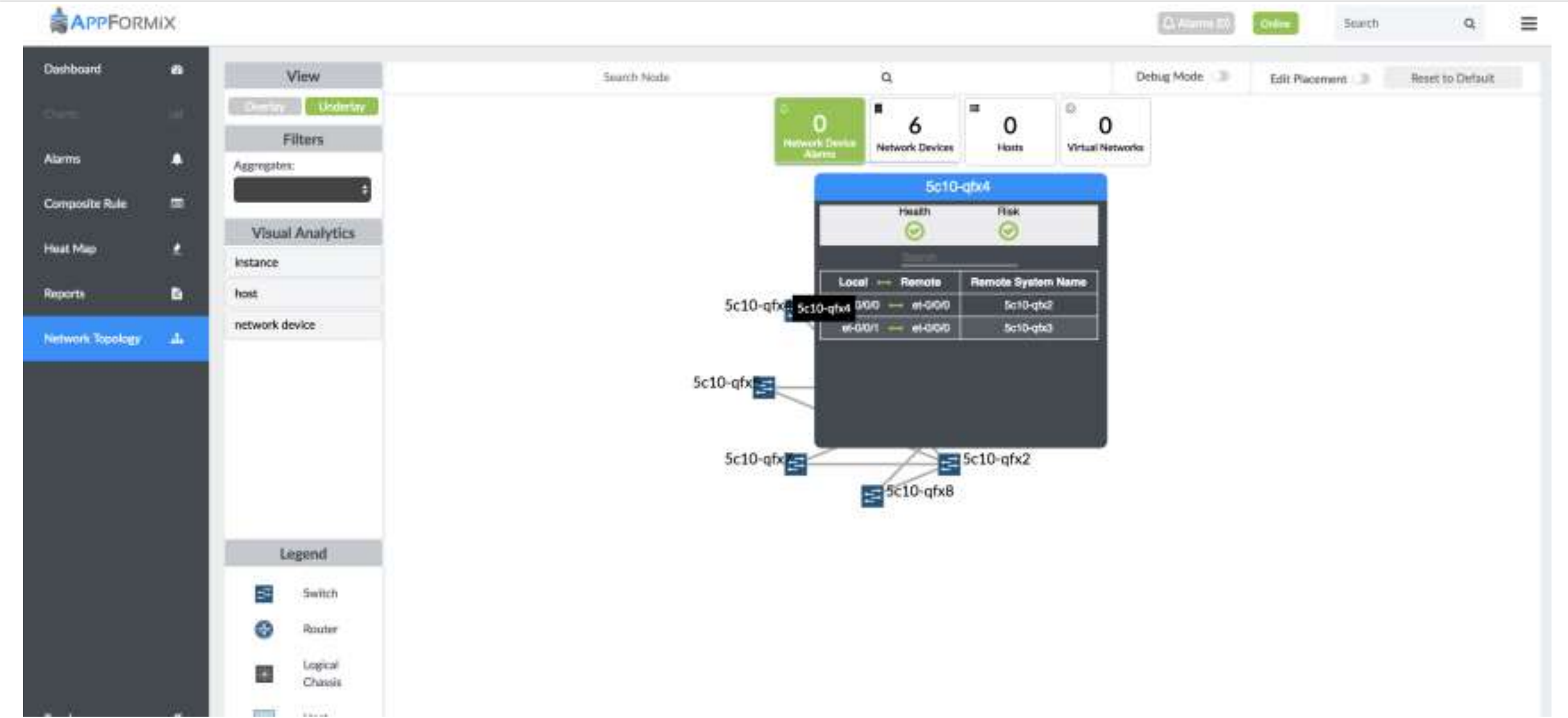
Ability to add network devices through GUI from dashboard settings

Edit network connection map via GUI

Auto discover network device entities: interfaces, routing engines, interface queues, etc.

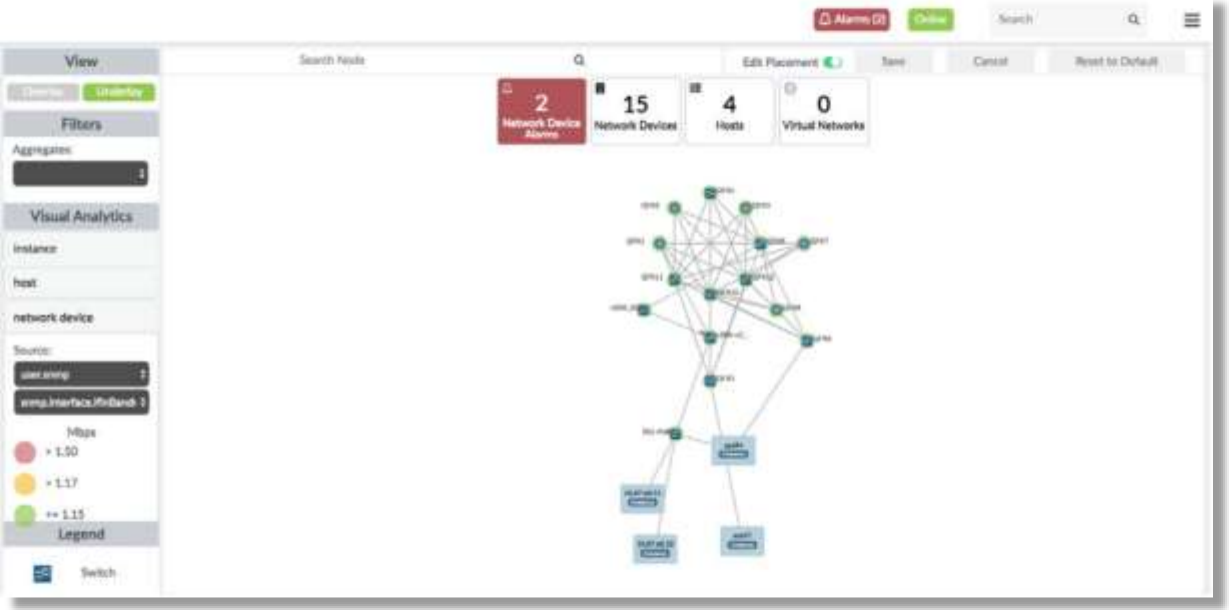
Add remove JTI/GRPC sensors for network devices in GUI

APPFORMIX: TOPOLOGY



Local ⟷ Remote	Remote System Name
0/0/0 ⟷ et-0/0/0	5c10-qfx2
et-0/0/1 ⟷ et-0/0/0	5c10-qfx3

APPFORMIX: NETWORK TOPOLOGY AND HEAT MAP



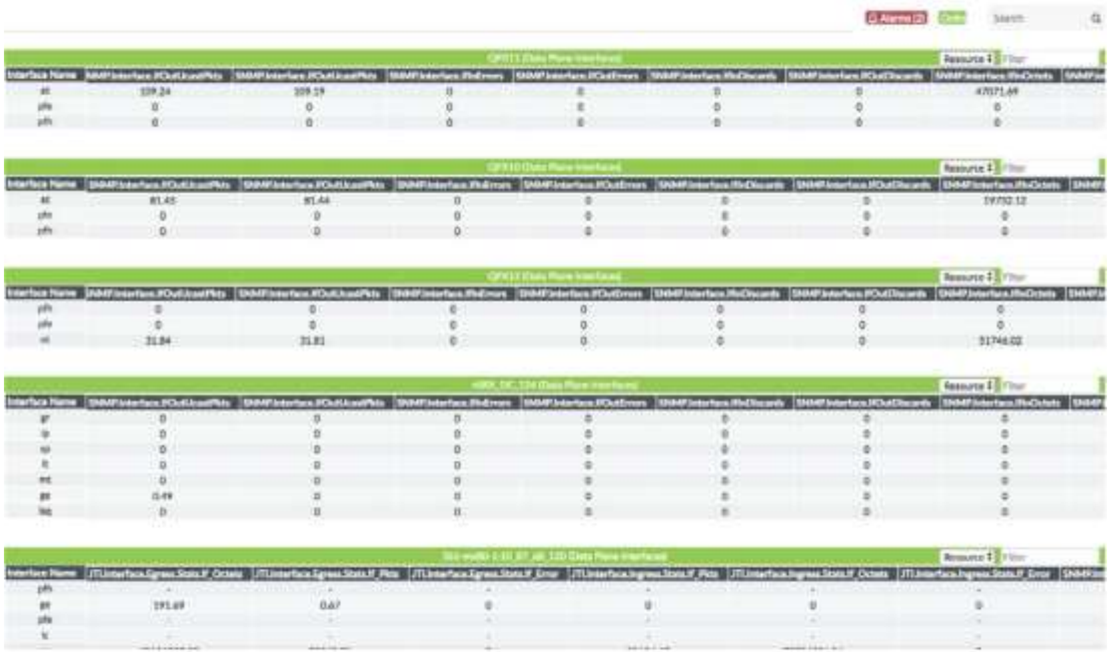
Determines network topology through automatic discovery and user-defined input

Builds a holistic, correlated network performance and resource heat map on top of the network topology

Provides info such as network device status and utilization, network and link throughput, and interface or buffer errors and drops.

Identify and pinpoint network traffic congestion, hot spots, resource constraints

APPFORMIX: NETWORK DEVICE REPORTS



QFX11 (Data Plane Interfaces)

Interface Name	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifInErrors	SNMP.interface.ifOutErrors	SNMP.interface.ifInDiscards	SNMP.interface.ifOutDiscards	SNMP.interface.ifInOctets	SNMP
et	109.24	109.19	0	0	0	0	47071.49	
pfe	0	0	0	0	0	0	0	
pfh	0	0	0	0	0	0	0	

QFX10 (Data Plane Interfaces)

Interface Name	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifInErrors	SNMP.interface.ifOutErrors	SNMP.interface.ifInDiscards	SNMP.interface.ifOutDiscards	SNMP.interface.ifInOctets	SNMP
et	81.45	81.44	0	0	0	0	19732.12	
pfe	0	0	0	0	0	0	0	
pfh	0	0	0	0	0	0	0	

QFX12 (Data Plane Interfaces)

Interface Name	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifInErrors	SNMP.interface.ifOutErrors	SNMP.interface.ifInDiscards	SNMP.interface.ifOutDiscards	SNMP.interface.ifInOctets	SNMP
pfh	0	0	0	0	0	0	0	
pfe	0	0	0	0	0	0	0	
et	31.84	31.81	0	0	0	0	31746.02	

vMX_DC_124 (Data Plane Interfaces)

Interface Name	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifOutUcastPkts	SNMP.interface.ifInErrors	SNMP.interface.ifOutErrors	SNMP.interface.ifInDiscards	SNMP.interface.ifOutDiscards	SNMP.interface.ifInOctets	SNMP
gr	0	0	0	0	0	0	0	
ip	0	0	0	0	0	0	0	
sp	0	0	0	0	0	0	0	
lt	0	0	0	0	0	0	0	
mt	0	0	0	0	0	0	0	
ge	0.49	0	0	0	0	0	0	
lsq	0	0	0	0	0	0	0	

[illegible] 120 (Data Plane Interfaces)

Interface Name	JTI.interface.Egress.Stats.IF_Octets	JTI.interface.Egress.Stats.IF_Pkts	JTI.interface.Egress.Stats.IF_Error	JTI.interface.Ingress.Stats.IF_Pkts	JTI.interface.Ingress.Stats.IF_Octets	JTI.interface.Ingress.Stats.IF_Error	SNMP
pfh	-	-	-	-	-	-	
ge	191.69	0.67	0	0	0	0	
pfe	-	-	-	-	-	-	
lc	-	-	-	-	-	-	

Reports allow users to analyze how the network and infrastructure are performing and how resources were consumed over time.

Reports may be generated over a specified time period and organized by categories such as network device, host, instance, project.

Shows performance statistics and resource utilization for the specified scopes.

Download report data as an HTML-formatted report, raw CSV file, or JSON-formatted data for further analysis.

TELEMETRY: ALTERNATIVE TO LEGACY SNMP

PUSH vs PULL

PULL MODEL (SNMP)

Traditional model for monitoring the network health is based on a so-called “**pull**” model.

Uses SNMP, CLI or API calls to periodically poll network elements.

Not scalable; high processing power & memory.

Typical polling cycle is 5 mins.

Inefficient encoding.

PUSH MODEL (TELEMETRY)

Next-generation network monitoring.

Real-time understanding of network state.

“**Push**” model to asynchronously deliver data as a stream to a downstream collector.

More scalable: Monitoring of thousands of objects in a network with granular resolution (up to 2sec frequency; sub-second for higher grade MPCs).

APPFORMIX: GRPC/OPENCONFIG SUPPORT

Juniper supports two types of Telemetry formats:

For Streaming Efficiency

Juniper Native	Data Model	Juniper
	Encoding	GPB, Structured
	Transport	UDP

- Compact and **efficient**, very high performance and little overheads
- Best suitable for the export from the network processor
- Defined by Juniper, using .proto files
- Used by select performance management systems partners and Juniper developed applications, such as Northstar

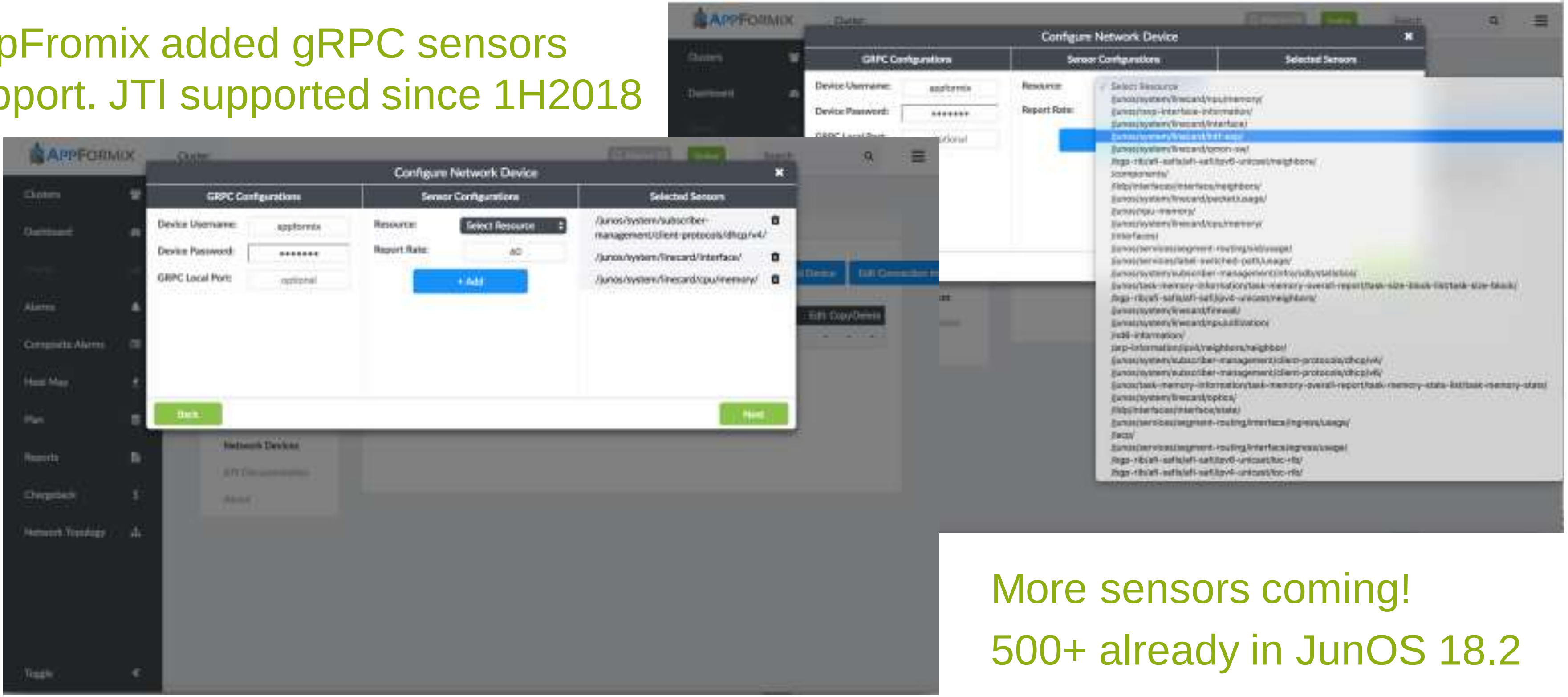
For (Evolving) Standard Compliance

OpenConfig	Data Model	OpenConfig
	Encoding	GPB, Key/Value
	Transport	gRPC over HTTP/2

- Moderate efficiency
- Industry standards based
- Reliable and secure transport based on Google RPC
- gRPC is modern bi-directional machine talking language

APPFORMIX: GRPC/OPENCONFIG SUPPORT

AppFromix added gRPC sensors support. JTI supported since 1H2018



Configure Network Device

GRPC Configurations	Sensor Configurations	Selected Sensors
Device Username: appformix	Resource: Select Resource	/junos/system/subscriber-management/client-protocols/dhcp/v4/
Device Password: *******	Report Rate: 60	/junos/system/linecard/interface/
GRPC Local Port: optional	+ Add	/junos/system/linecard/cpu/memory/

Back

Next

Configure Network Device

GRPC Configurations	Sensor Configurations	Selected Sensors
Device Username: appformix	Resource:	
Device Password: *******	Report Rate:	
GRPC Local Port: optional		

Select Resource
/junos/system/linecard/npu/memory/
/junos/npu-interface-information/
/junos/system/linecard/interface/
/junos/system/linecard/intf-exp/
/junos/system/linecard/cmon-sw/
/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/
/components/
/lldp/interfaces/interface/neighbors/
/junos/system/linecard/packet/usage/
/junos/npu-memory/
/junos/system/linecard/cpu/memory/
/interfaces/
/junos/services/segment-routing/sid/usage/
/junos/services/label-switched-path/usage/
/junos/system/subscriber-management/infra/sdb/statistics/
/junos/task-memory-information/task-memory-overall-report/task-size-block-list/task-size-block/
/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/
/junos/system/linecard/firewall/
/junos/system/linecard/npu/utilization/
/nd6-information/
/arp-information/ipv4/neighbors/neighbor/
/junos/system/subscriber-management/client-protocols/dhcp/v4/
/junos/system/subscriber-management/client-protocols/dhcp/v6/
/junos/task-memory-information/task-memory-overall-report/task-memory-stats-list/task-memory-stats/
/junos/system/linecard/optics/
/lldp/interfaces/interface/state/
/junos/services/segment-routing/interface/ingress/usage/
/lacp/
/junos/services/segment-routing/interface/egress/usage/
/bgp-rib/afi-safis/afi-safi/ipv6-unicast/loc-rib/
/bgp-rib/afi-safis/afi-safi/ipv4-unicast/loc-rib/

More sensors coming!

500+ already in JunOS 18.2

APPFORMIX: BNG MONITORING

Juniper BNG solution: Serving over 0.5M subscribers with MX BNG routers

PROBLEM: Too many metrics to monitor and some is not available via SNMP

SOLUTION

- JTI sensors for export real-time data
- AppFormix receive JTI streams
- Machine learning monitors number of subscribers and react if finds anomaly

PLATFORM

- MX BNG and vBNG
- AppFormix and Contrail
- NPU/Line card CPU and memory
- Fabric statistics

METRICS

- LC CPU and Memory
- RE CPU and Memory
- DHCP v4/v6 packet rates and sessions
- Subscriber DB statistics

OUTCOMES

- Early fault isolation
- Pro-active fault monitoring
- Root-cause discovery and isolation

2 second Reporting granularity

40 000 Metrics / Second

Positive Performance Impact

Goal: *Make broadband services more stable and available*

APPFORMIX: GRPC CUSTOM SENSORS

What is I need custom gRPC sensor?

- Some gap exists between JunOS and AppFormix in number of sensors supported
- Adding support for non-standart devices (IoT, Industrial apps etc)

AppFormix custom plug-in

- Written in Python with only one function!
- Defines metrics and maps them to Protobuf keys
- Same approach as built-in AppFormix GRPC sensors (may be used as example)

Create plug-in configuration file in Python

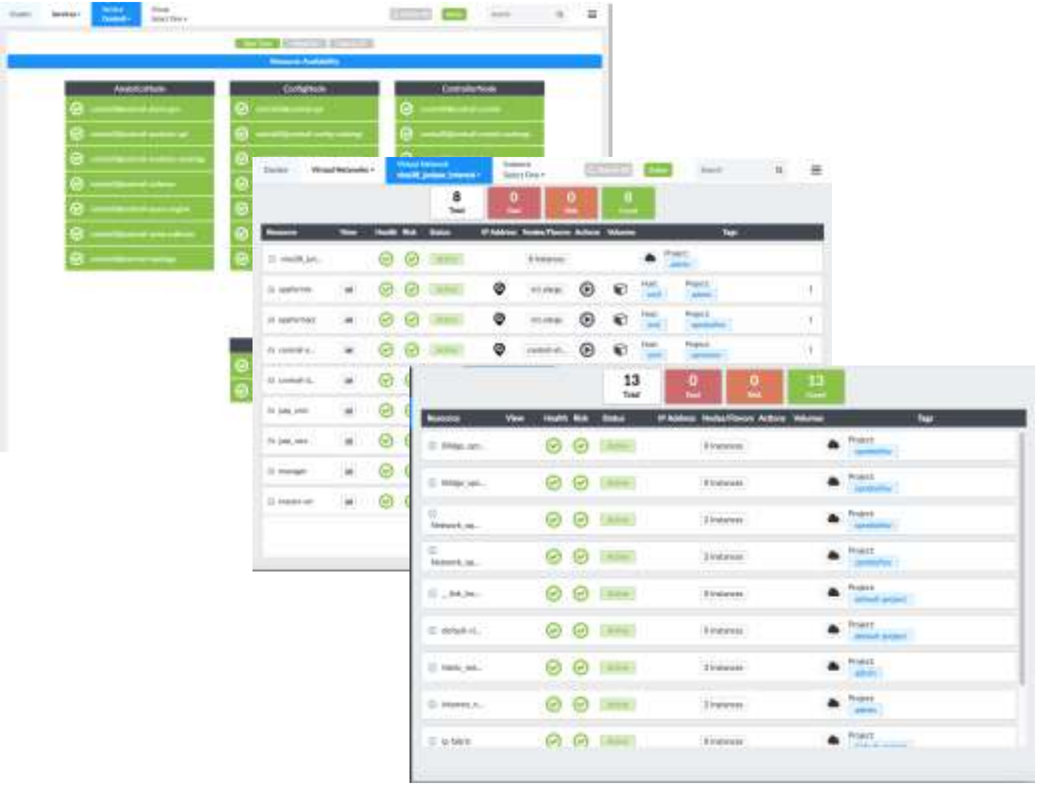
```
SENSOR_NAME = ’/powermeter’
SENSOR_TYPE = ’ device_entity’
COLLECTION_NAME = ’ESP_POWER’
ENTITY_TYPE = [‘network_device’]
METRIC_LIST = [   {       'Name': ’L1_Amp',       'Units': ’Amps',
'CalculationMethod': 'value'    }]
def parse_data(json_data):
  curr_list = {}
  metric_list = [entry['Name'] for entry in METRIC_LIST]
  data = json_data['kv']
  for entry in data:
    ....
  curr_list[resource_name][metric] = value
return {ENTITY_TYPE: {'post_data': [curr_list.values()],
'series_list': [curr_list.keys()]}}
```

Enable plug-in in Ansible inventory: group_vars/all

```
appformix_control_plane_plugin_config_files:
- { config_file_name: `powermeter.py`, type:
`device_entity` }
```

kubernetes openstack vmware

APPFORMIX: CONTRAIL SUPPORT



MONITORING HEALTH OF CONTRAIL CLOUD

- Cross-view through Openstack/VMWare/Contrail/Ceph etc
- Monitoring KPIs of Contrail Components (Cassandra, Rabbit etc)

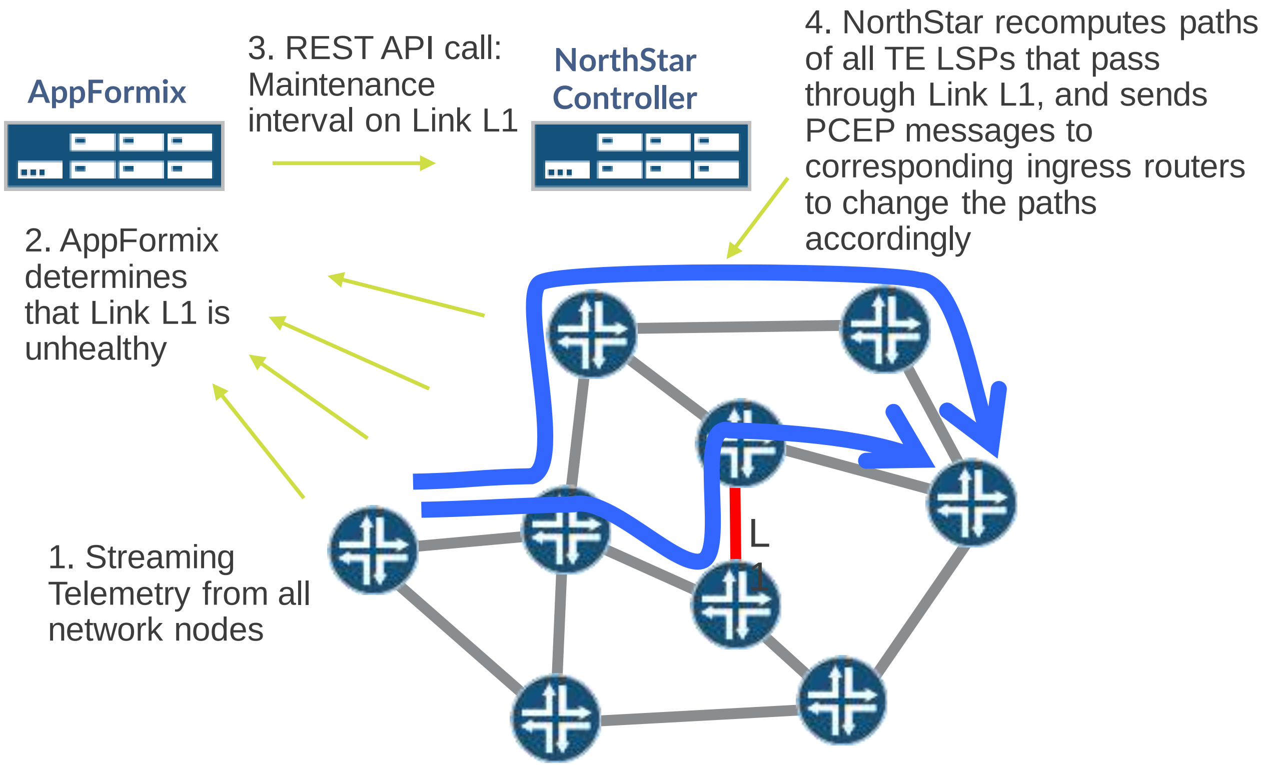
CLOUD AUTOMATION

- Using Contrail Analytics Data (flows, bandwidth) as metrics for AppFormix
- VNF Health monitoring and self-healing
- Elastic scale of VNFs based on bandwidth data

ACCOUNTING AND PLANNING OF CLOUD RESOURSES

- Granular reports for Cloud Resources Utilization
- Planning extensions based on machine learning

APPFORMIX: NORTHSTAR INTEGRATION



3. REST API call: Maintenance interval on Link L1

4. NorthStar recomputes paths of all TE LSPs that pass through Link L1, and sends PCEP messages to corresponding ingress routers to change the paths accordingly

2. AppFormix determines that Link L1 is unhealthy

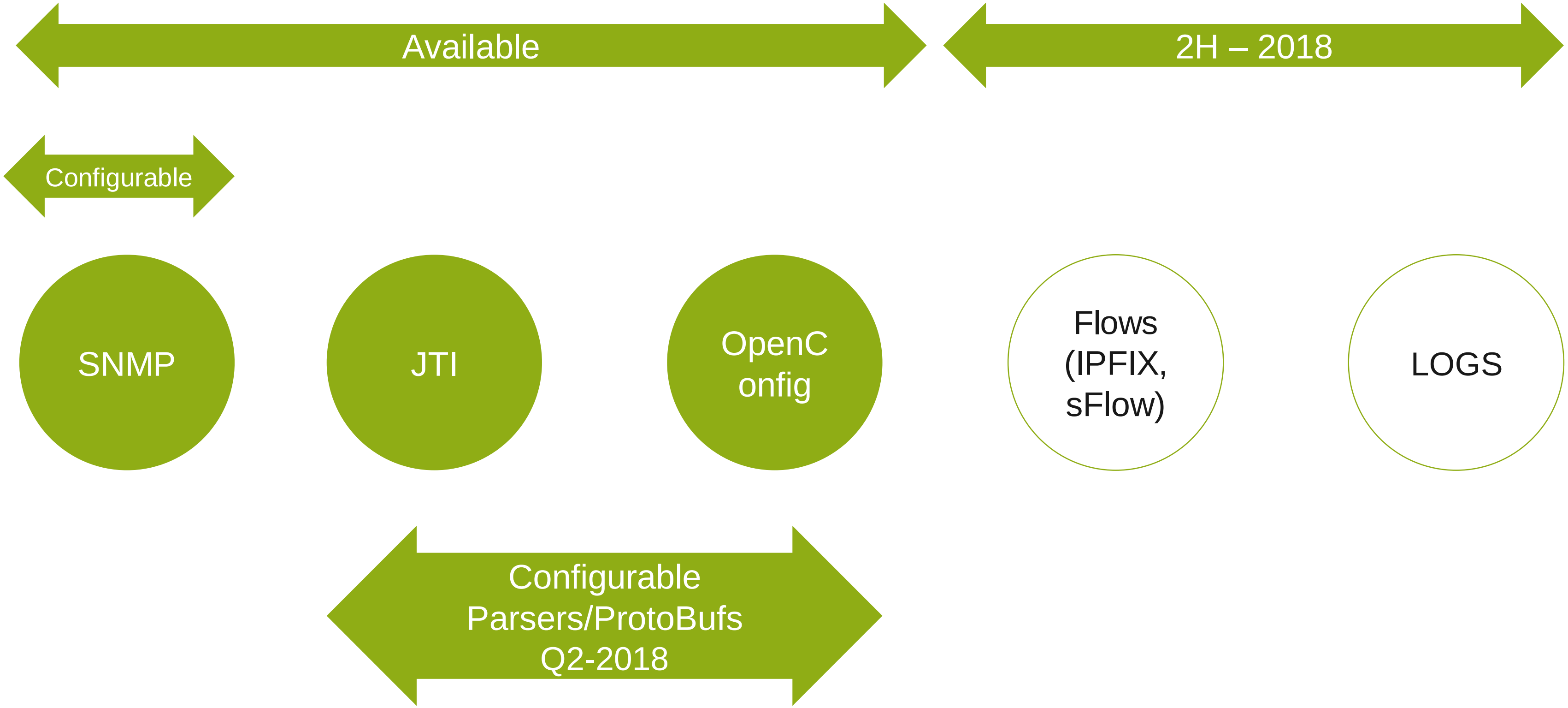
1. Streaming Telemetry from all network nodes

Machine learning based TE++

Discovers network devices from NorthStar data

Self-Healing Network

WHAT’S SUPPORTED TODAY?



Available

2H – 2018

Configurable

SNMP

JTI

OpenC
onfig

Flows
(IPFIX,
sFlow)

LOGS

Configurable
Parsers/ProtoBufs
Q2-2018

THANK YOU

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