

Intelligent WAN (IWAN)

Performance Routing (PfR)

PfRv3 Reporting - IN PROGRESS

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PfRv3 Navigation

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Overview

Metrics collected by all metering engines can be exported with NetFlow export. We used to have NetFlow version 5 (fixed record definition) and this has evolved toward NetFlow version 9 (Cisco Standard) and now IPFIX (IETF Standard). NetFlow version9 ([RFC3954](#)) and now IPFIX ([RFC7011](#)) are the industry standards to export information to the Network Management Station (NMS). NetFlow export, unlike SNMP, pushes information periodically to the NetFlow reporting collector. Flow export is optional but it's the only method to get a complete view of all NetFlow data in the Cisco device.

PfRv3 exports useful information to Netflow collectors using the NetFlow v9 export protocol. Exports include TCA events, route changes, immitigable events, bandwidth updates and Performance metrics. When the exporter is enabled, there are two different types of exporters created: one in the MC instance (CENT_EXP_MC-#) and one in the BR instance (CENT_FLOW_EXP-#). To globally enable Netflow export, a single command line has to be added on the Hub MC in the Domain configuration. The exporter configuration is distributed through SAF to all MCs and BRs in the domain.

Configuration - Enable Netflow v9 export with destination address and destination port (Default UDP port 9995):

```
domain one
vrf default
  master hub
  collector 10.8.100.100 port 2055
```

Manual config on a specific branch also possible:

```
domain one
vrf default
  border
  source-interface Loopback0
  master local
  collector 10.8.100.100 port 2055
  master branch
  source-interface Loopback0
  hub 10.8.3.3
  collector 10.8.100.100 port 2055
```

Netflow templates can be listed locally on a MC or BR with the following command:

```
R83#sh flow exporter templates
Flow Exporter CENT_EXP_MC-0:
  Client: Option Route Change-0
  Exporter Format: NetFlow Version 9
  Template ID    : 256
  Source ID     : 0
  Record Size   : 46
  Template layout
```

Field	Type	Offset	Size
timestamp absolute monitoring-interval	359	0	8

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ipv4 destination prefix	45	8	4	
application id	95	12	4	
pfr site destination id ipv4	37100	16	4	
pfr site source id ipv4	37099	20	4	
routing vrf output	235	24	4	
pfr br ipv4 address	39000	28	4	
interface output snmp	14	32	4	
interface name long	83	36	8	
ipv4 destination mask	13	44	1	
ip dscp	195	45	1	

[SNIP]

MC Record Templates

TCA Template

Exports every time TCA received (on demand, but TCA triggered every 30 secs if issue persists). TCAs should only contain the metric that was violated.

Fields	Size (Bytes)	ID	Name	Notes
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp	
* FLOW_FIELD_DESTINATION_SITE_ID	4	37100	destination IP	where the export comes from
* FLOW_FIELD_SOURCE_SITE_ID	4	37099	MC IP	source of the export;
FLOW_FIELD_TRNS_CNT_BYTES_LOST_RATE	4	37103	bytes lost	Percentage
FLOW_FIELD_TRNS_CNT_PKTS_LOST_RATE	4	37021	packets lost	Percentage
FLOW_FIELD_ONE_WAY_DELAY	4	37081	one way delay	msec
FLOW_FIELD_RTP_JITTER_INTER_ARRIVAL_MEAN	4	37098	jitter	usec
FLOW_FIELD_TRNS_UNREACHABILITY	4	66	unreachable flag	True/False
FLOW_FIELD_IP_VRF_ID_OUTPUT	4	235	VRF ID	
FLOW_FIELD_IPV4_PFR_BR_ADDR	4	39000	BR IP	
* FLOW_FIELD_INTF_DESC	8	83	service provider	
FLOW_FIELD_IP_DSCP	4	195	DSCP value	
FLOW_FIELD_INTF_OUTPUT_SNMP_INDEX	4	14	if_index	
FLOW_FIELD_PR_LABEL_ID	4	37118	PfR Label Identifier	

(*) Key Fields

Note: - PfR Label Identifier has been introduced with IWAN 2.1 (15.5(3)M and XE 3.16) and support for the Transit Site and Multiple Next Hop per DMVPN.

Route Change Template

Exported to signal a route change due to a TCA received. BR IP address and Interface Index are from the new path found.

Fields	Size (Bytes)	ID	Name	Notes
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp	
FLOW_FIELD_IPV4_DST_PREFIX	4	45	destination prefix	
FLOW_FIELD_APP_NAME	4	95	app id	
* FLOW_FIELD_DESTINATION_SITE_ID	4	37100	destination IP	source of TCA
* FLOW_FIELD_SOURCE_SITE_ID	4	37099	MC IP	source of the export
FLOW_FIELD_IP_VRF_ID_OUTPUT	4	235	VRF ID	
FLOW_FIELD_IPV4_PFR_BR_ADDR	4	39000	BR IP	
* FLOW_FIELD_INTF_DESC	8	83	service provider	
FLOW_FIELD_IPV4_DST_MASK	1	13	destination pfx mask	
* FLOW_FIELD_IP_DSCP	1	195	DSCP value	
FLOW_FIELD_INTF_OUTPUT_SNMP_INDEX	4	14	Interface index	
FLOW_FIELD_PR_LABEL_ID	4	37118	PfR Label Identifier	

(*) Key Fields

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Immitigatable Event Summary template

Exported to summarize all events where no good route was found after a TCA. This shows a major event that PfR was unable to solve.

- IME Performance Count: when the reason why the routes are considered bad are due to performance.
Ex, delay policy threshold at 100msec, actual >100msec

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- IME Bandwidth Count: when BW capacity is reason why routes are bad
- Export frequency: whenever policy decision is ran and PfRv3 cannot find a good route

Fields	Size (Bytes)	ID	Name
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp
* FLOW_FIELD_DESTINATION_SITE_ID	4	37100	destination IP
* FLOW_FIELD_SOURCE_SITE_ID	4	37099	MC IP
FLOW_FIELD_PFR_EVENT_TC_NOMITIGATION_ERR_PERFORMANCE_COUNT	4	37108	IME Performance Count
FLOW_FIELD_PFR_EVENT_TC_NOMITIGATION_ERR_BW_COUNT	4	37106	IME Bandwidth Count
FLOW_FIELD_IP_VRF_ID_OUTPUT	4	235	VRF ID
FLOW_FIELD_IPV4_PFR_BR_ADDR	4	39000	BR IP
* FLOW_FIELD_INTF_DESC	8	83	service provider
* FLOW_FIELD_IP_DSCP	1	195	dscp
FLOW_FIELD_INTF_OUTPUT_SNMP_INDEX	4	14	Interface index

(*) Key Fields

Bandwidth

Intent of this template is to capture the bandwidth of each external interface. Given that an external interface is mapped to a path name, this gives the amount of bandwidth per Path Name (Provider).

Fields	Size (Bytes)	ID	Name	Notes
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp	
FLOW_FIELD_INGRESS_BW_LONG	8	39017	Ingress bandwidth	
FLOW_FIELD_MAX_INGRESS_BW	8	39018	Ingress bandwidth capacity	
FLOW_FIELD_EGRESS_BW_LONG	8	39019	Egress bandwidth	
FLOW_FIELD_MAX_EGRESS_BW	8	39020	Egress bandwidth capacity	
FLOW_FIELD_SOURCE_SITE_ID	4	37099	MC IP	

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FLOW_FIELD_IPV4_PFR_BR_ADDR	4	39000	BR Loopback IP address
FLOW_FIELD_INTF_OUTPUT_SNMP_INDEX	4	14	Interface index
FLOW_FIELD_IP_VRF_ID_OUTPUT	4	235	VRF Id
FLOW_FIELD_INTF_DESC	8	83	Service Provider
FLOW_FIELD_PR_LABEL_ID	4	37118	PfR Label Identifier

Note: - PfR Label Identifier has been introduced with IWAN 2.1 (15.5(3)M and XE 3.16) and support for the Transit Site and Multiple Next Hop per DMVPN.

BR Record Templates

From the border router, 2 types of performance metric templates are exported (Ingress and Egress) and two option table templates (interface and application). The ingress and egress records are the same as what is exported from BRs to MCs.

Egress Measurement Template

Exports the metrics from the egress performance monitor that captures Traffic Class aggregate bandwidth.

Fields	Size (Bytes)	ID	Name	Notes
* FLOW_FIELD_IPV4_DST_PREFIX	4	45	destination prefix	
* FLOW_FIELD_IPV4_DST_MASK	1	13	destination prefix mask	
* FLOW_FIELD_DESTINATION_SITE_PREFIX	4	37110	dest site prefix	
* FLOW_FIELD_DESTINATION_SITE_PREFIX_MASK	1	37114	dest site prefix mask	
* FLOW_FIELD_APP_NAME	4	95	Application Name (only available if app based policy configured)	
* FLOW_FIELD_IP_DSCP	1	195	dscp	
FLOW_FIELD_INTF_OUTPUT_SNMP_INDEX	4	14	Interface index	
FLOW_FIELD_CNT_BYTES_LONG	8	1	bytes	
FLOW_FIELD_CNT_PKTS_LONG	8	2	packets	
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp	
FLOW_FIELD_IP_PROT	1	4	ip protocol	
FLOW_FIELD_DESTINATION_SITE_ID	4	37100	destination site id	

FLOW_FIELD_SOURCE_SITE_ID	4	37099	source site id
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(*) Key Fields

Ingress Measurement Template

Exports the metrics from the ingress performance monitor that captures the performance metrics per channel.

Fields	Size (Bytes)	ID	Name	Notes
* FLOW_FIELD_SOURCE_SITE_ID	4	37099	source site id	
* FLOW_FIELD_DESTINATION_SITE_ID	4	37100	destination site id	
* FLOW_FIELD_IP_DSCP	1	195	DSCP value	
* FLOW_FIELD_INTF_INPUT	4	10	Interface index	
* FLOW_FIELD_POLICY_PERF_MON_CLASS_HIERARCHY	24	41000	class hierarchy	
FLOW_FIELD_TRNS_CNT_PKTS_LOST_RATE	4	37021	packets lost	
FLOW_FIELD_TRNS_CNT_BYTES_LOST_RATE	4	37103	bytes lost	
FLOW_FIELD_ONE_WAY_DELAY	4	37081	one way delay	
FLOW_FIELD_NETWORK_DELAY_AVG	4	37063	network delay	
FLOW_FIELD_RTP_INTER_ARRIVAL_JITTER_MEAN	4	37098	jitter	
FLOW_FIELD_CNT_BYTES_LONG	8	1	bytes count	
FLOW_FIELD_CNT_PKTS_LONG	8	2	packets count	
FLOW_FIELD_TIME_ABS_MONITOR_START	8	359	timestamp	
FLOW_FIELD_PR_LABEL_ID	4	37118	PfR Label Identifier	

(*) Key Fields

Note: - PfR Label Identifier has been introduced with IWAN 2.1 (15.5(3)M and XE 3.16) and support for the Transit Site and Multiple Next Hop per DMVPN.

Option Templates

Option templates are used to export non-traffic related information to NetFlow collectors or reporting tools. This is typically used to send Application Name to Application ID mapping or Interface name to Interface ID mapping to the collector. Option Templates are exported from the BRs.

Interface Table Option Template

A very common option template that gives the mapping between the Interface Index exported and the real interface name.

Fields	Size (Bytes)	ID	Name	Notes
v9-scope system	4	1		
interface input snmp	4	10	Interface Index	
interface name short	32	82	Interface Name	
interface name long	64	83	Interface Name	

Application Name Table Option Template

A very common option template that gives the mapping between the Application Identifier exported by the router and the real application name.

Fields	Size (Bytes)	ID	Name	Notes
v9-scope system	4	1		
application id	4	95	Unique Application Identifier	
application name	24	96	Application Name	
application description	55	94	Application Description	