

PCF Application-Based Alerts

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Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Products or Functional Area	PCF
Applicable Platform(s)	SMI
Feature Default Setting	Disabled – Configuration required to enable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
First introduced.	2020.01.0

Feature Description

When the system detects an anomaly, it generates an alert notification. The system statistics are the cause for these alert notifications. You can set an expression to trigger an alert when the expression becomes true.

How it Works

This section describes how this feature works.

The Common Execution Environment (CEE) uses the Prometheus Alert Manager for alerting operations. The CEE YANG model, accessible through CLI or API, allows you to view the active alerts, silenced alerts, and alert history. During the application installation or upgradation, the system adds a set of preset alerting rules. Also, the applications can call the alert API directly to add or clear alerts. The Prometheus Alert Manager API (v2) is the standard API used.

The Prometheus Alerts Manager includes the following options:

- **DefiningAlert Rules**: This option defines the types of alerts that the Alert Manager should trigger. Use the Prometheus Query Language (PromQL) to define the alerts.
- **Defining Alert Routing**: This option defines the action the Alert Manager should take after receiving the alerts. At present, the SNMP Trapper is supported as the outbound alerting. Also, the CEE provides an Alert Logger for storing the generated alerts.

Configuring Alert Rules

This section describes how to configure the alert rules.

To configure the alert rules, use the following configuration:

```
config
   alerts rules group alert_group_name
   rule rule_name
      expression promql_expression
      duration duration
      severity severity_level
      type alert-type
      annotation annotation_name
      value annotation_value
      end
```

NOTES:

- **alerts rules**—Specify the Prometheus alerting rules.
- **group** *alert_group_name*—Specify the Prometheus alerting rule group. One alert group can have multiple lists of rules. *alert-group-name* is the name of the alert group. *alert_group_name* must be a string in the range of 0–64 characters.
- **rule** *rule_name*—Specify the alerting rule definition. *rule_name* is the name of the rule.
- **expression** *promql_expression*—Specify the PromQL alerting rule expression. *promql_expression* is the alert rule query expressed in PromQL syntax. The *promql_expression* must be a string in the range of 0–64 characters.
- **duration** *duration*—Specify the duration of a true condition before it is considered true. *duration* is the time interval before the alert is triggered.

- **severity** *severity_level*—Specify the severity of the alert. *severity-level* is the severity level of the alert. The severity levels are critical, major, minor, and warning.
- **type** *alert_type*—Specify the type of the alert. *alert_type* is the user-defined alert type. For example, Communications Alarm, Environmental Alarm, Equipment Alarm, Indeterminate Integrity Violation Alarm, Operational Violation Alarm, Physical Violation Alarm, Processing Error Alarm, Quality of Service Alarm, Security Service Alarm, Mechanism Violation Alarm, or Time Domain Violation Alarm.
- **annotation** *annotation_name*—Specify the annotation to attach to the alerts. *annotation_name* is the name of the annotation.
- **value** *annotation_value*—Specify the annotation value. *annotation_value* is the value of the annotation.

The following example configures an alert, which is triggered when the percentage of N7 responses is less than the specified threshold limit.

Example:

```
 configure terminal
  alerts rules group PCFN7chk_incr
  interval-seconds 300
  rule PCFN7chk_incr
  expression "sum(increase(inbound_request_total{interface_name=\"N7\",
result_code=~\"2..\"}[3m])) / sum(increase(inbound_request_total{interface_name=\"N7\"}[3m]))<
 0.95"
    severity major
    type "N7 Communications Alarm"
    annotation summary
    value "This alert is fired when the percentage of N7 responses is less than threshold"
    exit
  exit
exit
```

Viewing Alert Logger

The Alert Logger stores the alerts that PCF generates by defualt. You can view these alerts using the following command:

show alert history [filtering]

You can narrow down the result using the following filtering options:

- **annotations**—Specify the annotations of the alert.
- **endsAt**—Specify the end time of the alert.
- **labels**—Specify the additional labels of the alert.
- **severity**—Specify the severity of the alert.
- **source**—Specify the source of the alert.
- **startsAt**—Specify the start time of the alert.
- **type**—Specify the type of the alert.

You can view the active and silenced alerts with the **show alerts active** and **show alerts active** commands.

Example:

```
show running-config alerts
  interval-seconds 300
  rule PCFN7chk_incr
  expression "sum(increase(inbound_request_total{interface_name=\"N7\",
result_code=~\"2..\"}[3m])) / sum(increase(inbound_request_total{interface_name=\"N7\"}[3m]))<
 0.95"
    severity major
    type "N7 Communications Alarm"
    annotation summary
    value "This alert is fired when the percentage of N7 responses is less than threshold‟
    exit
  exit
exit
```

The following example displays the history of the alerts configured in the system:

Example:

```
show alerts history
alerts active PCFN7chk_incr ac2a970ab621
state active
severity major
type "N7 Communications Alarm"
startsAt 2019-11-15T08:26:48.283Z
source System
annotations [ "summary:This alert is fired when the percentage of N7 responses is less than
 threshold.” ]
```

The following example displays the active alerts. The alerts remain active as long as the evaluated expression is true.

Example:

```
show alerts active
alerts active PCFN7chk_incr ac2a970ab621
state active
severity major
type "N7 Communications Alarm"
startsAt 2019-11-15T08:26:48.283Z
source System
annotations [ "summary:This alert is fired when the percentage of N7 responses is less than
 threshold.” ]
```

Sample Alerts Configuration

This section provides sample configurations that are defined in PCF.

Interface-Specific Alerts

N7 Interface Inbound

Use the following commands to configure alerts related to an inbound N7 interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFN7Inbound
   expression sum(increase(inbound_request_total{interface_name=\”N7\”,
result_code=~\”2..\”}[5m])) /sum(increase(inbound_request_total{interface_name =\”N7\”}[5m]))
 <0.90
```

```
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N7 responses sent is lesser
threshold.
   exit
exit
```

N7 Interface Outbound

Use the following commands to configure alerts related to an outbound N7 interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFN27outbound
   expression sum(increase(outgoing_request_total{interface_name
=\"N7\",response_status=~\"2..\"}[5m])) /sum(increase(outgoing_request_total{interface_name
 =\"N7\"}[5m])) <0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success N7 responses received is lesser
 threshold.
   exit
exit
```

N28 Interface Inbound

Use the following commands to configure alerts related to an inbound N28 interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFN28Inbound
   expression
sum(increase(inbound_request_total{interface_name=\"N28\",response_status=~\"2..\"}[5m]))
/sum(increase(inbound_request_total{interface_name =\"N28\"}[5m])) <0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N28 responses sent is lesser
 threshold.
   exit
exit
```

N28 Interface Outbound

Use the following commands to configure alerts related to an outbound N28 interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFN28outbound
   expression sum(increase(outgoing_request_total{interface_name
=\"N28\",response_status=~\"2..\"}[5m])) /sum(increase(outgoing_request_total{interface_name
 =\"N28\"}[5m])) <0.90
   severity major
```

```
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N28 responses received is
lesser threshold.
   exit
exit
```

Diameter Rx Interface Inbound

Use the following commands to configure alerts related to an inbound Diameter Rx interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFNRxInbound
   expression
sum(increase(diameter_responses_total{command_code=\"AAA|STA\",response_status=~\"2001\"}[5m]))
 /sum(diameter_responses_total(outgoing_request_total{command_code=\"A AA|STA\"}[5m])) <
0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success Rx responses Send is lesser
threshold.
   exit
exit
```

Diameter Rx Interface Outbound

Use the following commands to configure alerts related to an outbound Diameter Rx interface.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule PCFNRxOutbound
   expression
sum(increase(diameter_responses_total{command_code=\"RAA|ASA\",response_status=~\"2001\"}[5m]))
 /sum(diameter_responses_total(outgoing_request_total{command_code=\"AAA|STA\"}[5m])) <
0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success Rx responses received is lesser
 threshold.
   exit
exit
```

Message-Level Alerts

N7 Create Request

Use the following commands to configure alerts related to N7 Create Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule N7CreateRequest
```

```
  expression sum(increase(inbound_request_total{interface_name=\"N7\", command=\"Create\",
 result_code=~\"2..\"}[5m])) / sum(increase(inbound_request_total{interface_name =\"N7\",
command=\"Create\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N7 Create responses sent is
lesser threshold.
   exit
exit
```

N7 Update Request

Use the following commands to configure alerts related to N7 Update Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule N7UpdateRequest
  expression sum(increase(inbound_request_total{interface_name=\"N7\", command=\"Update\",
 result_code=~\"2..\"}[5m])) /sum(increase(inbound_request_total{interface_name =\"N7\",
command=\"Update\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N7 Update responses sent is
lesser threshold.
   exit
exit
```

N7 Delete Request

Use the following commands to configure alerts related to N7 Delete Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule N7DeleteRequest
  expression sum(increase(inbound_request_total{interface_name=\"N7\",command=\"Delete\",
 result_code=~\"2..\"}[5m])) /sum(increase(inbound_request_total{interface_name
=\"N7\",command=\"Delete\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N7 Delete responses sent is
lesser threshold.
   exit
exit
```

N7 Notify Request

Use the following commands to configure alerts related to N7 Notify Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 60
   rule N7NotifyUpdate
   expression sum(increase(outgoing_request_total{interface_name
=\"N7\",command=\"Notify\", response_status=~\"2..\"}[5m]))
```

```
/sum(increase(outgoing_request_total{interface_name =\"N7\",command=\"Notify\"}[5m])) <
0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N7 Notify responses received
 is lesser threshold.
   exit
exit
```

N28 Subscribe (Initial) Request

Use the following commands to configure alerts related to N28 Subscribe Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 60
   rule N28Subscribe
   expression sum(increase(outgoing_request_total{interface_name
=\"N28\",command=\"Subscribe\", response_status=~\"2..\"}[5m]))
/sum(increase(outgoing_request_total{interface_name =\"N28\",command=\"Subscribe\"}[5m]))
< 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N28 Subscribe (Initial)
responses received is lesser threshold.
   exit
exit
```

N28 Subscribe (Update) Request

Use the following commands to configure alerts related to N28 Subscribe Update Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 60
   rule N28SubscribeUpdate
   expression sum(increase(outgoing_request_total{interface_name =\"N28\",
command=\"Subscribe_Update\", response_status=~\"2..\"}[5m])) /
sum(increase(outgoing_request_total{interface_name =\"N28\",
command=\"Subscribe_Update\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success N28 Subscribe (Update) responses
 received is lesser threshold.
   exit
exit
```

N28 Notify Request

Use the following commands to configure alerts related to N28 Notify Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 60
   rule N28Notify
   expression sum(increase(outgoing_request_total{interface_name =\"N28\",
```

```
command=\"Notify\", response_status=~\"2..\"}[5m])) /
sum(increase(outgoing_request_total{interface_name =\"N28\", command=\"Notify\"}[5m])) <
0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success N28 Notify responses send is
 lesser threshold.
   exit
exit
```

Rx AAR Request

Use the following commands to configure alerts related to Rx AAR Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule RxAAR
   expression sum(increase(diameter_responses_total{command_code=\"AAA\",
response_status=~\"2001\"}[5m])) /
sum(diameter_responses_total(outgoing_request_total{command_code=\"AAA\"}[5m])) < 0.90"
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success Rx AAR responses send is lesser
 threshold.
   exit
exit
```

Rx STR Request

Use the following commands to configure alerts related to Rx STR Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule RxSTR
   expression
sum(increase(diameter_responses_total{command_code=\"STA\",response_status=~\"2001\"}[5m]))
 /sum(diameter_responses_total(outgoing_request_total{command_code=\"STA\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success Rx STA responses send is lesser
 threshold.
   exit
exit
```

Rx RAR Request

Use the following commands to configure alerts related to Rx RAR Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule RxSTR
   expression sum(increase(diameter_responses_total{command_code=\"RAA\",
response_status=~\"2001\"}[5m]))
```

```
/sum(diameter_responses_total(outgoing_request_total{command_code=\"RAA\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the percentage of Success Rx RAR responses Received is
 lesser threshold.
   exit
exit
```

Rx ASR Request

Use the following commands to configure alerts related to Rx ASR Request.

```
alerts rules group PCFSvcStatus
   interval-seconds 300
   rule RxASR
   expression
sum(increase(diameter_responses_total{command_code=\"ASA\",response_status=~\"2001\"}[5m]))
 /sum(diameter_responses_total(outgoing_request_total{command_code=\"ASA\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the percentage of Success Rx ASR responses send is lesser
 threshold.
   exit
exit
```

Process-Level Alerts

CDL Endpoint Down

Use the following commands to configure alerts related to CDL endpoint down.

```
alerts rules group cdl-ep-change
   rule pod-down
   expression up{pod=~'cdl-ep.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value CDL EP Pod Down
   exit
exit
```

CDL Slot State Change

Use the following commands to configure alerts related to CDL slot state change.

```
alerts rules group cdl-slot-change
   rule pod-down
   expression up{pod=\"cdl-slot-session-c1-m1-0\"} == 0
   severity major
   type Equipment Alarm
```

```
   annotation description
   value CDL Pod Slot Change
   exit
exit
```

Diameter Endpoint State Change

Use the following commands to configure alerts related to Diameter endpoint state change.

```
alerts rules group diamter-ep-change
   rule pod-down
   expression up{pod=~'diameter-ep.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value Diameter EP Change
   exit
exit
```

ETCD State Change

Use the following commands to configure alerts related to etcd state change.

```
alerts rules group ep-mapping-change
   rule pod-down
   expression up{pod=~'etcd-pcf.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value EP Mapping Change
   exit
exit
```

Grafana Dashboard State Change

Use the following commands to configure alerts related to Grafana dashboard state change.

```
alerts rules group grafana-dashboard-change
   rule pod-down
   expression up{pod=~'grafana-dashboard.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value Grafana Dashboard Change
   exit
exit
```

Kafka State Change

Use the following commands to configure alerts related to Kafka state change.

```
alerts rules group kafka-change
   rule pod-down
   expression up{pod=~'kafka.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value Kafka Changed
   exit
exit
```

LDAP Endpoint State Change

Use the following commands to configure alerts related to LDAP endpoint state change.

```
alerts rules group ldap-change
   rule pod-down
   expression up{pod=~'ldap-pcf.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value LDAP Pod Changed
   exit
exit
```

PCF Engine State Change

Use the following commands to configure alerts related to PCF Engine state change.

```
alerts rules group pcf-engine-change
   rule pod-down
   expression up{pod=~'pcf-engine-pcf.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value PCF Engine Changed
   exit
exit
```

REST Endpoint State Change

Use the following commands to configure alerts related to REST endpoint state change.

```
alerts rules group pcf-rest-ep-change
   rule pod-down
   expression up{pod=~'pcf-rest-ep.*'} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation description
   value PCF Rest EP Change
```

```
   exit
exit
```

Call Flow Procedure Alerts

LDAP Query Request

Use these commands to configure alerts related to LDAP Query Request.

```
alerts rules group PCFProcStatus
   interval-seconds 300
   rule LDAPQuery
  expression sum(increase(message_total{type=~\".*_ldap_query\", status=\"success\"}[5m]))
 /sum(increase(message_total{type=~\".*_ldap_query\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the success percentage of ldap query request is lesser
 threshold.
   exit
exit
```

LDAP Modify Request

Use these commands to configure alerts related to LDAP Modify Request.

```
alerts rules group PCFProcStatus
   interval-seconds 300
   rule LDAPModify
  expression sum(increase(message_total{component=\"ldap-ep\", type=~\".*_ldap_modify\",
 status=\"success\"}[5m])) / sum(increase(message_total{component=\"ldap-ep\",
type=~\".*_ldap_modify\"}[5m])) < 0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the success percentage of ldap modify request is lesser
 threshold.
   exit
exit
```

PLF Query Request

Use these commands to configure alerts related to PLF Query Request.

```
alerts rules group PCFProcStatus
   interval-seconds 300
   rule PLFRequest
   expression
sum(increase(message_total{type=~\"ldap_search-res_success\",status=\"success\"}[5m]))
/sum(increase(message_total{type=~\"ldap_search-res_.*\"}[5m])) <0.90
   severity major
   type Communications Alarm
   annotation summary
  value This alert is fired when the success percentage of PLF request is lesser threshold.
```

```
   exit
exit
```

NAP Notification Request

Use these commands to configure alerts related to NAP Notification Request.

```
alerts rules group PCFProcStatus
   interval-seconds 300
   rule NAPNotification
   expression sum(increase(message_total{type=~\"ldap_change-res_success\",
status=\"success\"}[5m])) /sum(increase(message_total{type=~\"ldap_change-res_.*\"}[5m]))
<0.90
   severity major
   type Communications Alarm
   annotation summary
   value This alert is fired when the success percentage of NAP request is lesser threshold.

   exit
exit
```

System Alerts

Disk Full Alert

Use the following commands to configure alerts related to disk full alert.

```
alerts rules group
   rule node-disk-running-full
   expression node_filesystem_usage > 0.0001
   duration 5m
   severity critical
   type Processing Error Alarm
   annotation disk_full
   value test
   exit
exit
```

VM Down Alert

Use the following commands to configure alerts related to virtual machine down alert.

```
alerts rules group vm-state-change
   rule vm-down
   expression up{pod=~\"node-expo.*\"} == 0
   duration 1m
   severity major
   type Equipment Alarm
   annotation summary
   value VM Down
   exit
exit
```

High Memory Usage

Use the following commands to configure alerts related to high memory usage.

```
alerts rules group memory-util-high
   rule mem-util-high
   expression avg(node_memory_MemAvailable_bytes /node_memory_MemTotal_bytes * 100) by
(hostname) < 20
   duration 1m
   severity critical
   type Processing Error Alarm
   annotation mem_util_high
   value Hig Memory Usage
   exit
exit
```

High Disk Usage

Use the following commands to configure alerts related to high disk usage alert.

```
alerts rules group disk-util-high
   duration 1m
   rule disk-util-high
   expression avg (node_filesystem_avail_bytes{mountpoint =\"/\"}
/node_filesystem_size_bytes{mountpoint =\"/\"} *100) by (hostname) <20
   severity critical
   type Processing Error Alarm
   annotation description
   value Hig Memory Usage
   exit
exit
```

High CPU Usage

Use the following commands to configure alerts related to high CPU usage alert.

```
alerts rules group cpu-util-high
   rule cpu-util-idle
   duration 1m
   expression avg(rate(node_cpu_seconds_total{mode='idle'}[1m])) by (hostname) *100 < 50

   severity critical
   type Processing Error Alarm
   annotation description
   value Hig CPU
   exit
exit
```