Application-based Alerts

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Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	AMF
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.	2021.04.0

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 - either through CLI or API - allows users to view the active alerts and alert history. 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:

- **Defining Alert 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 the Alert Rules

To configure the alert rules, use the following configuration:

```
config
   alerts rules group alert_group_name
   interval-seconds seconds
   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. The alert-group-name must be a string in the range of 0–64 characters.
- **interval-seconds** *seconds*—Specify the evaluation interval of the rule group in seconds.
- **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.
- **duration** *duration*—Specify the duration of a true condition before it's 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.

Configuration Example

The following is an example configuration.

The following example configures an alert that is triggered when the percentage of registration procedure success is less than the specified threshold limit.

```
config
   alerts rules group AMFProcStatus
   interval-seconds 300
   rule UeRegistration
      expression "sum(amf_procedure_total{proc_type='UE
Registration',proc_status='ProcStatusComplete',status='success'}) /
sum(amf_procedure_total{proc_type='UE Registration',status='attempted'}) < 0.95"
      severity major
      type Communications Alarm
      annotation annotation_name
      value summary
 value "This alert is fired when the UE registration procedure success is below specified
threshold”
      end
```

Configuration Verification

To verify the configuration.

```
show running-config alerts rules group AMFProcStatus
alerts rules group AMFProcStatus
 rule UeRegistration
  expression "sum(amf_procedure_total{proc_type='UE
Registration',proc_status='ProcStatusComplete',status='success'}) /
sum(amf_procedure_total{proc_type='UE Registration',status='attempted'}) < 0.95"
  severity   major
  type       "Communications Alarm"
  annotation summary
   value "This alert is fired when the UE registration procedure success is below specified
 threshold” "
  exit
 exit
exit
```

Viewing Alert Logger

By default, alert logger stores all the generated alerts. You can view the stored alerts using the following **show** command.

show alert history [detail | summary] [filtering]

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

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

Use the following **show** command to view the history of the alerts configured in the system:

```
show alerts history detail
alerts history detail UEReg 11576e6a86da
 severity    major
 type        "Communications Alarm"
 startsAt    2021-10-24T07:56:24.857Z
 endsAt      2021-10-24T08:31:24.857Z
 source      System
 summary     "fired when ue reg fails"
 labels      [ "alertname: UEReg" "cluster: amf-cndp-b19-4_cee-cisco" "monitor: prometheus"
 "replica: amf-cndp-b19-4_cee-cisco" "severity: major" ]
 annotations [ "summary: fired when ue reg fails" "type: Communications Alarm" ]
```

You can view the active alerts using **show alerts active** command. The alerts remain active as long as the evaluated expression is true.

```
show alerts active detail
alerts active detail UeRegistration 92b6dcdd8726
 severity    major
 type        "Communications Alarm"
 startsAt    2021-10-24T14:56:42.732Z
 source      System
 summary     "This alert is fired when the UE registration procedure success is below
specified threshold"
 labels      [ "alertname: UeRegistration" "cluster: amf-cndp-b19-4_cee-cisco" "monitor:
prometheus" "replica: amf-cndp-b19-4_cee-cisco" "severity: major" ]
 annotations [ "summary: This alert is fired when the UE registration procedure success is
 below specified threshold" "type: Communications Alarm" ]
```

Call Flow Procedure Alerts

This section describes commands that are required to configure alerts related to various call flow procedures.

Paging Success

To configure alerts related to the Paging Success procedure, use the following configuration:

```
alerts rules group AMFProcStatus
 rule Paging
  expression
"sum(amf_procedure_total{proc_type='Paging',proc_status='ProcStatusComplete',status='success'})
 / sum(amf_procedure_total{proc_type='Paging',status='attempted'}) < 0.95"
  severity   major
  type       "Communications Alarm"
  annotation summary
   value "This alert is fired when the Paging procedure success is below specified threshold"

  exit
 exit
exit
```

Service Request Success

To configure alerts related to the Service Request Success procedure, use the following configuration:

```
alerts rules group AMFProcStatus
 rule ServiceRequest
  expression "sum(amf_procedure_total{proc_type='Service
Request',proc_status='ProcStatusComplete',status='success'}) /
sum(amf_procedure_total{proc_type='Service Request',status='attempted'}) < 0.95"
  severity   major
  type       "Communications Alarm"
  annotation summary
   value "This alert is fired when the Service request procedure success is below specified
 threshold"
  exit
 exit
exit
```

UE Deregistration Success

To configure alerts related to the UE Deregistration procedure, use the following configuration:

```
alerts rules group AMFProcStatus
 interval-seconds 300
 rule UeDeRegistration
  expression "sum(amf_procedure_total{proc_type='UE
DeRegistration',proc_status='ProcStatusComplete',status='success'}) /
sum(amf_procedure_total{proc_type='UE DeRegistration',status='attempted'}) < 0.95"
  severity   major
  type       "Communications Alarm"
  annotation summary
   value "This alert is fired when the UE deregistration procedure success is below specified
 threshold"
  exit
 exit
exit
```

UE Registration Success

To configure alerts related to the UE Registration procedure, use the following configuration:

```
alerts rules group AMFProcStatus
 interval-seconds 300
 rule UeRegistration
  expression "sum(amf_procedure_total{proc_type='UE
Registration',proc_status='ProcStatusComplete',status='success'}) /
sum(amf_procedure_total{proc_type='UE Registration',status='attempted'}) < 0.95"
  severity   major
  type       "Communications Alarm"
  annotation summary
   value "This alert is fired when the UE registration procedure success is below specified
 threshold”
  exit
 exit
exit
```

Message Level Alerts

This section describes commands that are required to configure alerts related to various message.

N1 Registration Accept

To configure alerts related to the N1 Registration Accept Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN1RegistrationSuccess
  expression
"sum(increase(amf_nas_message_total{message_type=~'N1RegistrationAccept_.*'}[5m])) /
sum(increase(amf_nas_message_total{message_type=~'N1RegRequest_RegType_.*'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Registration Accept sent is lesser than
 threshold.”
  exit
exit
```

N1 Service Accept

To configure alerts related to the N1 Service Accept Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN1ServiceRequestSuccess
  expression "sum(increase(amf_nas_message_total{message_type='N1ServiceAcc'}[5m])) /
sum(increase(amf_nas_message_total{message_type='N1ServiceReq'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Service Accept sent is lesser than
threshold.”
  exit
exit
```

N1 UE Initiated Deregistration

To configure alerts related to the N1 UE Initiated Deregistration Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN1UeInitDeregSuccess
  expression
"sum(increase(amf_nas_message_total{message_type='N1DeRegAccept_UeOriginatingDereg'}[5m]))
 / sum(increase(amf_nas_message_total{message_type='N1DeRegReq_UeOriginatingDereg'}[5m]))
< 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Deregistration Accept sent is lesser
than threshold.”
  exit
exit
```

N1 Network Initiated Deregistration

To configure alerts related to the N1 Network Initiated Deregistration Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN1NwInitDeregSuccess
  expression
"sum(increase(amf_nas_message_total{message_type='N1DeRegAccept_UeTerminatedDereg'}[5m]))
/ sum(increase(amf_nas_message_total{message_type='N1DeRegReq_UeTerminatedDereg'}[5m])) <
0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Deregistration Accept received is lesser
 than threshold.”
  exit
exit
```

N2 ICSR Success

To configure alerts related to the N2 ICSR Success Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN2IcsrSuccess
  expression
"sum(increase(amf_ngap_message_total{message_type='N2InitialContextSetupRsp'}[5m])) /
sum(increase(amf_ngap_message_total{message_type='N2InitialContextSetupReq'}[5m])) < 0.95"

  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Initial Context Setup Response is lesser
 than threshold.”
  exit
exit
```

N2 PDU Setup Success

To configure alerts related to the N2 PDU Setup Success Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN2PduSetupRequestSuccess
```

```
  expression
"sum(increase(amf_ngap_message_total{message_type='N2PduSessResourceSetupRsp'}[5m])) /
sum(increase(amf_ngap_message_total{message_type='N2PduSessResouceSetupReq'}[5m])) < 0.95"

  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Ngap PDU Setup Response is lesser than
 threshold.”
  exit
exit
```

N2 PDU Modify Success

To configure alerts related to the N2 PDU Modify Success Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN2PduModifySuccess
  expression
"sum(increase(amf_ngap_message_total{message_type='N2PduSessResourceModifyRsp'}[5m])) /
sum(increase(amf_ngap_message_total{message_type='N2PduSessResouceModifyReq'}[5m])) < 0.95"

  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Ngap PDU Modify Response is lesser than
 threshold.”
  exit
exit
```

N2 PDU Release Success

To configure alerts related to the N2 PDU Release Success Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN2PduReleaseSuccess
  expression
"sum(increase(amf_ngap_message_total{message_type='N2PduSessResourceReleaseRsp'}[5m])) /
sum(increase(amf_ngap_message_total{message_type='N2PduSessResouceReleaseReq'}[5m])) < 0.95"

  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Ngap PDU Release Response is lesser
than threshold.”
  exit
exit
```

N8 UECM Registration Request

To configure alerts related to the N8 UECM Registration Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8UecmRegSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmUecmRegistrationRsp',
status='success'}[5m])) /
sum(increase(n8_service_stats{message_type='NudmUecmRegistrationReq', status='success'}[5m]))
```

```
 < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of UECM registration  responses received
is lesser than threshold.”
  exit
exit
```

N8 UECM Deregistration Request

To configure alerts related to the N8 UECM Deregistration Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8UecmDeRegSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmUecmDeRegistrationRsp',
status='success'}[5m])) /
sum(increase(n8_service_stats{message_type='NudmUecmDeRegistrationReq',
status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of UECM deregistration  responses received
 is lesser than threshold.”
  exit
exit
```

N8 SDM Data Request

To configure alerts related to the N8 SDM Data Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8SdmDataReqSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmSdmDataRsp',
status='success'}[5m])) / sum(increase(n8_service_stats{message_type='NudmSdmDataReq',
status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of SDM Data responses received is lesser
than threshold.”
  exit
exit
```

N8 SDM Subscription Request

To configure alerts related to the N8 SDM Subscription Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8SdmSubscriptionSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmSdmSubscriptionRsp',
status='success'}[5m])) / sum(increase(n8_service_stats{message_type='NudmSdmSubscriptionReq',
 status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of SDM Subscription responses received is
```

```
 lesser than threshold.”
  exit
exit
```

N8 SDM Unsubscribe Request

To configure alerts related to the N8 SDM Unsubscribe Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8SdmUnSubscriptionSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmSdmUnSubscriptionRsp',
status='success'}[5m])) /
sum(increase(n8_service_stats{message_type='NudmSdmUnSubscriptionReq', status='success'}[5m]))
 < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of SDM UnSubscription responses received
is lesser than threshold.”
  exit
exit
```

N8 PCSCF Restoration Request

To configure alerts related to the N8 PCSCF Restoration Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN8PcscfRestorationSuccess
  expression "sum(increase(n8_service_stats{message_type='NudmPcscfRestorationRsp',
status='success'}[5m])) /
sum(increase(n8_service_stats{message_type='NudmPcscfRestorationReq',
status='attempted'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Pcscf Restoration responses sent is
lesser than threshold.”
  exit
exit
```

N11 SM Create

To configure alerts related to the N11 SM Create Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN11SMCreateSuccess
  expression
"sum(increase(rpc_response_total{msg_type='PostSmCtxtsRequestPB',rpc_name='SMF',status_code='201'}[5m]))/
sum(increase(rpc_response_total{msg_type='PostSmCtxtsRequestPB',rpc_name='SMF'}[5m])) <
0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Update SM context responses received
is lesser than threshold.”
  exit
exit
```

N11 SM Release

To configure alerts related to the N11 SM Release Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN11SMReleaseSuccess
  expression
"sum(increase(rpc_response_total{msg_type='PostSmCtxtsReleaseRequest',rpc_name='SMF',status_code='204'}[5m]))
 /
sum(increase(rpc_response_total{msg_type='PostSmCtxtsReleaseRequest',rpc_name='SMF'}[5m]))
  <  0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Release SM context responses received
is lesser than threshold.”
  exit
exit
```

N11 SM Update

To configure alerts related to the N11 SM Update Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN11SMUpdateSuccess
  expression
"sum(increase(rpc_response_total{msg_type='PostSmCtxtsModifyRequestPB',rpc_name='SMF',status_code=~'200|204'}[5m]))
 / sum(increase(rpc_response_total{msg_type='PostSmCtxtsModifyRequestPB',rpc_name='SMF'}[5m]))
 <  0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value This alert is fired when the percentage of Update SM context responses received is
 lesser than threshold.”
  exit
exit
```

N12 UeAuth Req

To configure alerts related to the N12 UeAuth Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN12UeAuthReqSuccess
  expression "sum(increase(n12_service_stats{message_type='NausfUeAuthRsp',
status='success'}[5m])) / sum(increase(n12_service_stats{message_type='NausfUeAuthReq',
status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Ausf UE Auth responses received is
lesser than threshold.”
  exit
exit
```

N15 AM Policy Control Create

To configure alerts related to the N15 AM Policy Control Create Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN15PolicyControlCreateSuccess
  expression "sum(increase(n15_service_stats{message_type='NpcfAmPolicyControlCreateRsp',
status='success'}[5m])) /
sum(increase(n15_service_stats{message_type='NpcfAmPolicyControlCreateReq',
status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of Policy control create  responses received
 is lesser than threshold.”
  exit
exit
```

N15 AM Policy Control Delete

To configure alerts related to the N15 AM Policy Control Delete Request, use the following configuration:

```
alerts rules group AMFSvcStatus
 interval-seconds 300
 rule AMFN15PolicyControlDeleteSuccess
  expression "sum(increase(n15_service_stats{message_type='NpcfAmPolicyControlDeleteRsp',
status='success'}[5m])) /
sum(increase(n15_service_stats{message_type='NpcfAmPolicyControlDeleteReq',
status='success'}[5m])) < 0.95"
  severity major
  type "Communications Alarm"
  annotation summary
  value "This alert is fired when the percentage of  Policy control delete responses received
 is lesser than threshold.”
  exit
exit
```