Ultra Cloud Core 5G Session Management Function, Release 2020.03 - Statistics Reference

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C O N T E N T S

About this Guide

This preface describes the *5G Session Management Function Guide*, how it is organized and its document conventions.

This guide describes the Cisco Session Management Function (SMF) and includes infrastructure and interfaces, feature descriptions, specification compliance, session flows, configuration instructions, and CLI commands for monitoring and troubleshooting the system.

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Conventions Used

The following tables describe the conventions used throughout this documentation.

Notice Type	Description
Information Note	Provides information about important features or instructions.
Caution	Alerts you of potential damage to a program, device, or system.
Warning	Alerts you of potential personal injury or fatality. May also alert you of potential electrical hazards.

Typeface Conventions	Description
Text represented as a `screen display`	This typeface represents displays that appear on your terminal screen, for example: `Login:`
Text represented as **commands**	This typeface represents commands that you enter, for example: **show ip access-list** This document always gives the full form of a command in lowercase letters. Commands are not case sensitive.

Typeface Conventions	Description
Text represented as a **command** *variable*	This typeface represents a variable that is part of a command, for example: **show card** *slot_number* *slot_number* is a variable representing the desired chassis slot number.
Text represented as menu or sub-menu names	This typeface represents menus and sub-menus that you access within a software application, for example: Click the **File** menu, then click **New**

SMF Interface for Metrics

Feature Description

SMF uses Prometheus for gathering statistics or counters from its microservices.

Grafana is used as the user interface to view metrics. It pulls the data from the Prometheus data store. Default graphs for KPI are available using Grafana for rendering a graphical view of the statistics with timelines.

For each microservice, counters and a set of labels are defined. Counters are incremented or decremented with the set of labels depending on the functionality.

The following snapshot is a sample of the Grafana dashboard.

Figure 1: Grafana Dashboard

SMF Rest EP Microservice

This section describes the supported counters and set of labels for the SMF Rest EP microservice.

Counters

The following table lists the counters of the SMF REST EP microservice:

Table 1: SMF REST EP Microservice Counters

Number	Metric	Description
1	smf_restep_http_msg_total	This counter is incremented with every HTTP message received or sent at rest-ep microservice.
2	smf_restep_http_msg	This counter is incremented with every HTTP message received or sent at rest-ep microservice along with the time taken to process the message.

Labels

The SMF REST EP microservice includes the following labels for the counters:

Table 2: SMF REST EP Microservice Labels for Counters

Number	Label	Description
1	NF TYPE	This label can be any 5G Node that interacts with SMF. For example: AMF, PCF, NRF
2	MESSAGE DIRECTION	Displays the direction of the HTTP message with respect to the REST EP microservice. The possible values are: "inbound" "outbound"

Number	Label	Description
3	API NAME	Displays the service name being served. It can be:
		"register_ue"
		"deregister_ue"
		"subscription_req"
		"nf_registration"
		"nf_discovery"
		"slice_selection"
		"amf_create_sm_context"
		"amf_update_sm_context"
		"amf_release_sm_context"
		"amf_n1_n2_transfer"
		"pcf_sm_policy_control_create"
		"pcf_sm_policy_control_update"
		"pcf_sm_policy_control_delete"
		"pcf_sm_policy_control_update_notify"
		"pcf_sm_policy_control_terminate_notify"
4	NF URI	Displays the rest-ep URI used in the HTTP message (can be FQDN).
5	RESPONSE STATUS	Displays the HTTP Response. It can be any 2xx, 4xx or 5xx response.

SMF Service

This section describes the supported counters and set of labels for the SMF service.

Labels

The following table lists the counters of the SMF service labels:

Table 3: SMF Service Labels for Counters

Number	Label	Description
1	PROCEDURE TYPE	This label takes any value depending on the type of procedure queried for the following procedures: pdu_sess_create ue_req_pdu_sess_mod smf_req_pdu_sess_mod pcf_req_pdu_sess_mod ue_req_pdu_sess_rel smf_req_pdu_sess_rel pcf_req_pdu_sess_rel amf_req_pdu_sess_rel
2	STATUS	Displays the status type. Following are the allowed values: attempted success failure
3	PDU CONNECTION TYPE	Displays the PDU connection type. Following are the allowed values: ipv4 ipv6 ipv4v6
4	PDU STATE	Displays the PDU state. Following are the allowed values: idle connected

SMF Protocol Microservice

This section describes the supported counters and set of labels for the SMF Protocol microservice.

Counters

The SMF service includes the following counters:

Table 4: SMF Service Counters

Number	Metric	Description
1	smf_service_stats	This counter is incremented with every query made to the smf-service.
2	smf_service_counters	This counter is a gauge counter and can be incremented or decremented based on the functionality with every query made to the smf-service.

Labels

The SMF Protocol service includes the following labels for the counters:

Labels

C H A P T E R 2

SMF Metrics

Discover Messages Time statistics Category

nf_discover_total_time

Description: Discover Messages Total time statistics

Sample Query: `nf_discover_total_time{nf_type=\"amf\", host=\"http://10.105.227.109:8082/nnrf-nfm/v1\", result=\"timeouOrRPCError\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `result`

  Label Description: result of discover message

  Example: 200, 201, 204, success, timeout_rpc_error, response_parse_failure

Discover Messages statistics Category

nf_discover_messages_total

Description: Discover Messages statistics

Sample Query: `nf_discover_messages_total{nf_type=\"amf\", host=\"http://10.105.227.109:8082/nnrf-nfm/v1\", result=\"timeouOrRPCError\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `result`

  Label Description: result of discover message

Example: 200, 201, 204, success, timeout_rpc_error, response_parse_failure

NF End point selections Category

nf_endpoint_selections_total

Description: NF End Point Selection Statistics

Sample Query: `nf_endpoint_selections_total{nf_type=\"amf\", host=\"http://10.105.227.109:8082/nnrf-nfm/v1\", req=\"initial\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `req`

  Label Description: req type

  Example: initial, fallback,

NF failure handling stats Category

nf_failure_handling_stats_total

Description: NF Failure handling stats

Sample Query: `nf_failure_handling_stats_total{nf_type=\"amf\", host=\"http://10.105.227.109:8082/nnrf-nfm/v1\", req=\"initial\", response=\"202\", status=\"final\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `req`

Label Description: Request type

Example: initial, fallback,

- Label: `response`

  Label Description: Response from the server

  Example: 200, 201, 204, timeout_rpc_error,

- Label: `status`

  Label Description: Status from the server

  Example: retry, final

NF management message time statistics Category

nf_management_total_time

Description: NF management messages total time taken

Sample Query: `nf_management_total_time{host=\"http://10.105.227.109:8082/nnrf-nfm/v1\",` `direction=\"outbound\", message_type=\"registration\",result=\"timeouOrRPCError\" }`

Labels:

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `direction`

  Label Description: Direction indicates about the message going out or coming in

  Example: inbound, outbound

- Label: `message_type`

  Label Description: Type of Message

  Example: registration, hearbeat, subscription, notification

- Label: `result`

  Label Description: result of discover message

  Example: 200, 201, 204, success, timeout_rpc_error, response_parse_failure, request_parse_failure, invalid_notify_event, invalid_nf_instance_uri, internal_error

NF management messages statistics Category

nf_management_stats_total

Description: NF management messages statistics

Sample Query: `nf_management_stats_total{host=\"http://10.105.227.109:8082/nnrf-nfm/v1\", direction=\"outbound\", message_type=\"registration\",result=\"timeouOrRPCError\" }`

Labels:

- Label: `host`

  Label Description: End Point address

  Example: http://10.105.227.109:8082/nnrf-nfm/v1

- Label: `direction`

  Label Description: Direction indicates about the message going out or coming in

  Example: inbound, outbound

- Label: `message_type`

  Label Description: Type of Message

  Example: registration, hearbeat, subscription, notification

- Label: `result`

  Label Description: result of discover message

  Example: 200, 201, 204, success, timeout_rpc_error, response_parse_failure

NRF Discovery Category

nf_discover_events_total

Description: NF Discover Stats

Sample Query: `nf_discover_events_total{nf_type=\"pcf\", response_type=\"local\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `response_type`

  Label Description: Discovery response choosen from

  Example: local, cache, expired-cache

PDU UE Sync Procedure Category

pdu_ue_sync_proc

Description: PDU UE Sync Procedure counter

Sample Query: `pdu_ue_sync_proc{status=\"attempted\"}`

Labels:

- Label: `status`

    Label Description: call flow procedure status counter

    Example: attempted, success, failures, suspend, resume, abort

Policy control PCF update statistics Category

policy_pcf_updates_total

Description: Statistics for triggers sent to PCF in SmPolicyUpdate Request to PCF

Sample Query: `sum (policy_pcf_updates_total{trigger=\"rat_change\"})`

Labels:

- Label: `trigger`

    Label Description: Trigger sent in the policy update request sent to PCF

    Example: ue_ip_change, plmn_change, res_mod_req, access_type_change , ue_ip_change , credit_mon_sess_fail , def_qos_change , sess_ambr_change , no_credit , serving_area_change , revalidation_timeout ,resoure_release,resource_alloc, rat_change

Policy control current flow Category

policy_pdu_flows_current

Description: QoS flow current counts

Sample Query: `sum (policy_pdu_flows_current{flow_type=\"gbr\"}) by(qos_5qi, arp)`

Labels:

- Label: `rat_type`

    Label Description: RAT type on which the flow is created

    Example: nr, eutran

- Label: `ssc_mode`

    Label Description: SSC mode for the session which created the QoS flow

    Example: one, two, three

- Label: `pdn_type`

    Label Description: PDN type of the session which created the QoS flow

    Example: v4, v6, v4v6

- Label: `dnn`

Label Description: DNN for which the flow is created

Example: cisco.com

- Label: `flow_type`

  Label Description: Flow type for the QoS flow

  Example: gbr, non_gbr

- Label: `qos_5qi`

  Label Description: 5Qi applicable for the QoS flow

  Example: 1, 2, 5

- Label: `arp`

  Label Description: Priority level of ARP applicable for the QoS flow

  Example: 10, 20

Policy control dynamic pcc rule statistics Category

policy_dynamic_pcc_rules_total

Description: PCC Rule total statistics for dynamic rules pushed from PCF

Sample Query: `sum (policy_dynamic_pcc_rules_total{rule_id=\"Rule-1\"}) by(qos_5qi, arp)`

Labels:

- Label: `rule_id`

  Label Description: Rule Id for the received dynamic pcc rule

  Example: PccRule-1

- Label: `operation`

  Label Description: Operation performed on the dynamic pcc rule

  Example: install, modify, remove

- Label: `event`

  Label Description: Event associated with the operation performed on the pcc rule

  Example: attempted, success, failure, abort

- Label: `qos_5qi`

  Label Description: 5Qi applied on the dynamic pcc rule

  Example: 1, 2, 5

- Label: `arp`

  Label Description: Priority level of ARP applied on the dynamic pcc rule

  Example: 10, 20

- Label: `tc_event`

  Label Description: Traffic Control event applied on the dynamic pcc rule

  Example: enabled_ul, enabled_dl, enabled, disabled, removed

- Label: `charging_type`

  Label Description: Charging type applied on the dynamic pcc rule

  Example: online, offline, online-offline

- Label: `charging_method`

  Label Description: Charging method applied on the dynamic pcc rule

  Example: volume, time, vol_time

- Label: `details`

  Label Description: Details on the operation applied on the dynamic pcc rule

  Example: success, validation failure

Policy control pre-defined pcc rule statistics Category

policy_predefined_pcc_rules_total

Description: PCC Rule total statistics for pre-defined rules activated by PCF

Sample Query: `sum (policy_predefined_pcc_rules_total{rule_id=\"Rule-1\"}) by(event, operation)`

Labels:

- Label: `rule_id`

  Label Description: Rule Id for the received pre-defined pcc rule

  Example: PccRule-1

- Label: `rulebase`

  Label Description: Rulebase to which this pre-defined rule belongs

  Example: Rulebase-1

- Label: `operation`

  Label Description: Operation performed on the pre-defined pcc rule

  Example: install, modify, remove

- Label: `event`

  Label Description: Event associated with the operation performed on the pre-defined rule

  Example: attempted, success, failure

- Label: `qos_5qi`

  Label Description: 5Qi applied on the pre-defined pcc rule

Example: 1, 2, 5

- Label: `arp`

  Label Description: Priority level of ARP applied on the pre-defined pcc rule

  Example: 10, 20

- Label: `charging_type`

  Label Description: Charging type applied on the pre-defined pcc rule

  Example: online, offline, online-offline

- Label: `charging_method`

  Label Description: Charging method applied on the pre-defined pcc rule

  Example: volume, time, vol_time

Policy control session rule statistics Category

policy_session_rules_total

Description: Session total statistics for session rules applied

Sample Query: `sum (policy_session_rules_total{rule_id=\"SessRule-1\"})`

Labels:

- Label: `rule_id`

  Label Description: Rule Id for the received session rule from PCF

  Example: SessRule-1

- Label: `operation`

  Label Description: Operation performed on the session rule

  Example: install, modify, remove

- Label: `event`

  Label Description: Event associated with the operation performed on the rulebase

  Example: attempted, success, failure

Policy control static pcc rule statistics Category

policy_static_pcc_rules_total

Description: PCC Rule total statistics for static rules activated via rulebase

Sample Query: `sum (policy_static_pcc_rules_total{rulebase=\"Rulebase-1\"})`

Labels:

- Label: `rulebase`

  Label Description: Rulebase to which the static rules belong

  Example: Rulebase-1

- Label: `operation`

  Label Description: Operation performed on the rulebase

  Example: install, remove

- Label: `event`

  Label Description: Event associated with the operation performed on the rulebase

  Example: attempted, success, failure

Policy control total flow statistics Category

policy_pdu_flows_total

Description: QoS flow total statistics

Sample Query: `sum (policy_pdu_flows_total{flow_type=\"gbr\"}) by(qos_5qi, arp)`

Labels:

- Label: `operation`

  Label Description: Operation performed on the QoS flow

  Example: install, modify, remove

- Label: `event`

  Label Description: Event associated with the operation performed on QoS flow

  Example: attempted, success, failure, abort

- Label: `rat_type`

  Label Description: RAT type on which the flow is created

  Example: nr, eutran

- Label: `ssc_mode`

  Label Description: SSC mode for the session which created the QoS flow

  Example: one, two, three

- Label: `pdn_type`

  Label Description: PDN type of the session which created the QoS flow

  Example: v4, v6, v4v6

- Label: `dnn`

  Label Description: DNN for which the flow is created

Example: cisco.com

- Label: `flow_type`

  Label Description: Flow type for the QoS flow

  Example: gbr, non_gbr

- Label: `init_or_ho`

  Label Description: Flow operation phase

  Example: initial, ho

- Label: `qos_5qi`

  Label Description: 5Qi applicable for the QoS flow

  Example: 1, 2, 5

- Label: `arp`

  Label Description: Priority level of ARP applicable for the QoS flow

  Example: 10, 20

SLA Transaction Category

smf_sla_transaction_stats

desription: Transaction SLA stats

Sample Query: `sum(smf_sla_transaction_stats) by (smf_sla_transaction_stats,smf_proc_type,status, message_type)`

Labels:

- Label: `smf_proc_type`

  Label Description: procedure type counter

  Example: pdu_sess_create

- Label: `status`

  Label Description: gives status of the procedure

  Example: abort

- Label: `message_type`

  Label Description: gives the message type received during sla transaction

  Example: IntSelfTxnSla

SMF ALWAYS ON PDU SESSION Category

metrics: SMF_ALWAYS_ON_SESSION_STATS

Description: Always On Pdu Session Statistics

- Label: `status`

  Label Description: always on status statistics

  Example: pdusetup_req_alwayson_requested, pdusetup_acc_alwayson_allowed, pdusetup_acc_alwayson_not_allowed, pdumod_req_alwayson_requested, pdumod_cmd_alwayson_allowed, pdumod_cmd_alwayson_not_allowed, pdumod_cmd_nw_init_alwayson_allowed, pdu_utwifi_to_nr_alwayson_requested, pdu_utwifi_to_nr_alwayson_allowed, pdu_utwifi_to_nr_alwayson_not_allowed

- Label: `rat_type`

  Label Description: Type of the radio access associated with the request

  Example: EUTRA, NR, WLAN, VIRTUAL, rat_type_unknown

- Label: `pduType`

  Label Description: name of the nssai associated with the request

  Example: ipv4, ipv6, ipv4v6, unknown

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `sscMode`

  Label Description: Type of ssc mode associated with the request

  Example: ssc_mode_1, ssc_mode_2, ssc_mode_3, ssc_mode_unknown

SMF Charging Application Error Stats Category

chf_appl_err_stats

Description: Statistics for application error received from CHF

Sample Query: `chf_appl_err_stats{appl_err_code=\"HTTP_STATUS_CODE_403_FORBIDDEN\"}`

Labels:

- Label: `http2_err_code`

  Label Description: HTTP2 error code received from CHF

  Example: HTTP_STATUS_CODE_403_FORBIDDEN

- Label: `appl_err_code`

  Label Description: Application error code received from CHF

  Example: END_USER_REQUEST_REJECTED, QUOTA_LIMIT_REACHED,CHARGING_FAILED, USER_UNKNOWN, END_USER_REQUEST_DENIED, QUOTA_LIMIT_REACHED, CHARGING_NOT_APPLICABLE

- Label: `appl_err_action`

  Label Description: Action taken on failure from CHF

  Example: Terminate, Drop Traffic, Disable Charging

- Label: `appl_err_exchg_type`

  Label Description: CHF Exchange in which failure occurred

  Example: update, initial

SMF Charging Quota Event Stats Category

chf_quota_event_stats

Description: The current count for quota event received from CHF

Sample Query: `chf_quota_event_stats{quota_type=\"initial\"}`

Labels:

- Label: `quota_method`

  Label Description: Quota method received from CHF

  Example: time, volume, time_volume

- Label: `quota_status`

  Label Description: Resutlt for the quota received from CHF

  Example: SUCCESS, END_USER_SERVICE_DENIED, QUOTA_MANAGEMENT_NOT_APPLICABLE, QUOTA_LIMIT_REACHED, END_USER_SERVICE_REJECTED, RATING_FAILED

- Label: `quota_type`

  Label Description: Quota type as received from CHF

  Example: intial, update, initial_final, update_final, fail

- Label: `quota_fail_action`

  Label Description: Action on quota failure

  Example: No Action , Disable charging, Drop Traffic, Offline Converted

- Label: `rating_group`

  Label Description: Rating group for which quota is received from CHF

  Example: Any string

SMF Charging Usage Report Stats Category

chf_usage_report_stats

Description: The current count for usage reports towards CHF

Sample Query: `chf_usage_report_stats{charging_method=\"offline\"}`

Labels:

- Label: `charging_method`

  Label Description: Metering method for the PDU Session

  Example: online, offline, online_offline

- Label: `charging_trigger_type`

  Label Description: Trigger for usage report

  Example: QUOTA_THRESHOLD, QHT, FINAL, QUOTA_EXHAUSTED, VALIDITY_TIME, OTHER_QUOTA_TYPE, FORCED_REAUTHORISATION, UNIT_COUNT_INACTIVITY_TIMER, ABNORMAL_RELEASE, QOS_CHANGE, VOLUME_LIMIT, TIME_LIMIT, EVENT_LIMIT, PLMN,CHANGE, USER_LOCATION_CHANGE, RAT_CHANGE, UE_TIMEZONE_CHANGE, TARIFF_TIME_CHANGE, MAX_NUMBER_OF_CHANGES_IN_CHARGING_CONDITIONS, MANAGEMENT_INTERVENTION, CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA, CHANGE_OF_3GPP_PS_DATA_OFF_STATUS, SERVING_NODE_CHANGE, REMOVAL_OF_UPF, ADDITION_OF_UPF, START_OF_SERVICE_DATA_FLOW, AMBR_CHANGE

- Label: `rating_group`

  Label Description: Rating Group for which usage is being reported

  Example: Any string

- Label: `service_identifier`

  Label Description: Service Identifier for which usage is being reported

  Example: Any string

SMF Disconnect stats Category

smf_disconnect_stats

Description: SMF Disconnect stats counters

Sample Query: `smf_disconnect_stats{reason=\"disc_pdurel_amf_init_detach\"}`

Labels:

- Label: `reason`

  Label Description: The reason associated with an call disconnect

Example:

- disc_pdusetup_create_over_create: Create-Over-CreateRelease.

- disc_pdusetup_admin_clear: SMF initiated PDU release.

- disc_pdusetup_n1_decode_failure: PDU setup failure due to NAS decoding failure in SM Context Create Request message

- disc_pdusetup_n1_content_not_found: PDU setup failure when NAS content is not present in SM context create request message.

- disc_pdusetup_sess_abs_timeout: PDU setup failure due to session absolute timer timeout.

- disc_pdusetup_ssc_mode_not_supported: Failure in PDU setup procedure because SSC mode is not supported or when neither UDM nor configuration has information on supported SSC mode.

- disc_pdusetup_ssc_mode_denied: Failure in PDU setup procedure when the UE requested SSC mode is not allowed either by the UDM or the local configuration.

- disc_pdusetup_identity_conflict: PDU setup procedure failure due to mismatch in PDU session ID present in N11 and N1 content of SM Context Create Request message.

- disc_pdusetup_pdutype_unsupported: Failure in PDU setup procedure when the PDU type could not be derived from both configuration and UDM.

- disc_pdusetup_pdutype_denied: Failure in PDU Setup procedure when the UE requested PDN type is not allowed as per the PDU types provided by UDM.

- disc_pdusetup_init_chg_data_err: Failure in PDU setup due to charging data failure.

- disc_pdusetup_ip_alloc_failed: PDU release due to IP allocation failure.

- disc_pdusetup_pdu_fetch_failure: Failure due to error in fetching PDU context for the incoming request.

- disc_pdusetup_udm_reg_failed: Failure in PDU setup procedure due to failure in UDM Registration procedure.

- disc_pdusetup_udm_sub_fetch_failure: Failure in PDU setup procedure due to UDM Get subscription procedure failure.

- disc_pdusetup_udm_sub_notify_failed: Failure in PDU setup procedure due to UDM subscribe to notify procedure failure.

- disc_pdusetup_upf_setup_cause_not_accepted: Failure in PDU setup procedure when N4 Session establishment response has cause code other than "Request Accepted".

- disc_pdusetup_sm_cxt_invalid: Failure in PDU Setup procedure when SM Context create request has any invalid message content.

- disc_pdusetup_sm_cxt_invalid_ie: Failure in PDU Setup procedure when any mandatory IE processing fails in SM context create request.

- disc_pdusetup_sm_cxt_sess_id_err: Failure in PDU setup procedure due to error in PDU session ID/SUPI IEs.

- disc_pdusetup_sm_cxt_invalid_json: Failure in PDU Setup procedure when SM Context create request processing fails.

- disc_pdusetup_sm_cxt_n1_process_failed: Failre in PDU setup due to n1 process failed.

- disc_pdusetup_sm_cxt_man_param_missing: Failure in PDU setup due to context param missing.

- disc_pdusetup_pcf_create_exchg_failure: Failure in PDU setup procedure due to SM Policy create procedure failure with PCF.

- disc_pdusetup_pcf_create_rsp_failure: Failure in PDU setup procedure due to any failure response or failure in processing of SM Policy create response from PCF.

- disc_pdusetup_rm_exchg_failure: Resource allocation failure in SMF during PDU setup.

- disc_pdusetup_rm_rsp_failure: Failure in PDU setup procedure due to RM response failure.

- disc_pdusetup_pcf_update_exchg_failure: Failure in PDU setup procedure due to SM Policy update procedure failure with PCF.

- disc_pdusetup_pcf_update_rsp_failure: Failure in PDU setup procedure due to any failure response or failure in processing of SM Policy update response from PCF.

- disc_pdusetup_chf_data_exchg_failure: Failure in PDU setup procedure due to CHF data exchange failure.

- disc_pdusetup_chf_data_rsp_failure: Failure in PDU setup procedure due to CHF data response failure.

- disc_pdusetup_upf_setup_exchg_failure: Failure in PDU setup procedure due to N4 Setup exchange failure.

- disc_pdusetup_upf_setup_rsp_failure: Failure in PDU setup procedure when N4 Setup response failure is received from UPF.

- disc_pdusetup_n1n2_transfer_exchg_failure: Failure in PDU setup procedure due to N1N2 Transfer exchange failure.

- disc_pdusetup_n1n2_transfer_rsp_failure: Failure in PDU Setup procedure due to decoding error in N1N2 transfer response message.

- disc_pdusetup_n1n2_transfer_failure_rsp_code: Failure in PDU Setup procedure due to failure response from AMF for N1N2 Transfer message.

- disc_pdusetup_amf_assign_ebi_failure: Failure in PDU Setup procedure due to EBI Assignment failure.

- disc_pdusetup_upf_modify_exchg_failure: Failure in PDU setup procedure due to modify exchange failure.

- disc_pdusetup_upf_modify_rsp_failure: Failure in PDU setup procedure when N4 Modification response failure is received from UPF.

- disc_pdusetup_upf_modify_failed: Failure in PDU setup procedure due to N4 Modification exchange failure.

- disc_pdusetup_upf_serv_data_nill: Failure in PDU Setup procedure when UPF information retrieval internal to SMF fails.

- disc_pdusetup_upf_dl_tunnel_info_not_found: Failure in PDU Setup procedure when Dl Tunnel Info is not found in PduSessionSetupResponseTransfer.

- disc_pdusetup_upf_tunnel_id_not_found: Failure in PDU setup procedure when gNB tunnel ID lookup fails internally in SMF.

- disc_pdusetup_upf_mod_gnb_tun_params_failed: Failure in PDU Setup procedure when there is any internal failure in gNB tunnel processing for N4 session modification request with UPF.

- disc_pdusetup_upf_mod_rsra_tun_params_failed: Failure in PDU Setup procedure when there is any internal failure in rs-ra tunnel processing for N4 session modification request with UPF.

- disc_pdusetup_upf_mod_tun_param_tos-failed: Failure in PDU setup UPF modification tunnel param tos-failed.

- disc_pdurel_amf_sends_ue_not_found: Failure in UE initiated PDU release in AMF.

- disc_pdusetup_dnn_missing: Failure in PDU setup procedure when DNN is not allowed.

- disc_pdurel_ue_init_detach: PDU release due to UE detach initiated.

- disc_pdurel_amf_init_detach: PDU release due to AMF detach initiated.

- disc_pdurel_pcf_init_detach: PDU release due to PCF detach initiated.

- disc_pdurel_udm_init_detach: PDU release due to UDM detach initiated.

- disc_pdurel_gnb_init_detach: PDU release due to gNB detach initiated.

- disc_pdurel_chf_init_detach: PDU release due to CHF detach initiated.

- disc_n2ho_n4_modify_failed: PDU release due to N4 modification failure in N2 HO procedure.

- disc_n26_4g_5g_ho_n4_modify_failed: 4G to 5G handover failure due to failure in N4 modification.

- disc_pdumodify_context_not_found: Failure in PDU modify procedure when PDU context retrieval fails.

- disc_pduim_context_not_found: Failure in PDU IM procedure when PDU context retrieval fails.

SMF GTPC messages Category

smf_gtpc_app_events

Description: SMF GTPC message counter

Sample Query: `smf_gtpc_app_events{service_name=\"gtpc-ep\"}`

Labels:

- Label: `event_type`

  Label Description: Gtpc Event type

  Example: NumRxCreateSessionReq, NumTxCreateSessionRes, NumRxDeleteSessionReq, NumTxDeleteSessionRes, NumRxModifyBearerReq, NumTxModifyBearerRes, NumTxDeleteBearerReq, NumRxDeleteBearerRsp, NumTxCreateBearerReq, NumRxCreateBearerRes, NumTxUpdateBearerReq, NumRxUpdateBearerRes, NumTxModifyBearerFailureInd, NumModifyBearerTimeout, NumRxDeleteBearerCmd, NumCreateBearerFailure, NumCreateBearerSuccess, NumCreateSessionSuccess, NumCreateSessionFailure, NumDeleteSessionSuccess,

NumDeleteSessionFailure, NumCreateBearerReqRetrans, NumUpdateBearerReqRetrans, NumDeleteBearerReqRetrans

SMF IPAM Address Events Current Counter Category

IPAM_address_allocations_current

Description: Current state of SMF IPAM Address allocations

Sample Query:

IPAM_address_allocations_current{dnn=\"dnn1\",servingArea=\"area1\",nssai=\"slice1\",pool=\"p1\",allocationType=\"dynamic\",addressType=\"IPv4\",upf=\"upf1\"}

Labels:

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `servingArea`

  Label Description: name of the serving area associated with the request

  Example: Any string

- Label: `nssai`

  Label Description: name of the nssai associated with the request

  Example: Any string

- Label: `pool`

  Label Description: name of the pool associated with the request

  Example: Any string

- Label: `allocationType`

  Label Description: type of allocation associated with the request

  Example: static/dynamic

- Label: `addressType`

  Label Description: address type associated with the request

  Example: IPv4/IPv6PD

- Label: `upf`

  Label Description: upf identifier associated with the request

  Example: Any string

SMF IPAM Address Events Total Counter Category

IPAM_address_events_total

Description: Total number of SMF IPAM Address events

Sample Query:

IPAM_address_events_total{dnn=\"dnn1\",servingArea=\"area1\",nssai=\"slice1\",pool=\"p1\",eventType=\"Allocation\",allocationType=\"dynamic\",addressType=\"IPv4\",upf=\"up1\"}

Labels:

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `servingArea`

  Label Description: name of the serving area associated with the request

  Example: Any string

- Label: `nssai`

  Label Description: name of the nssai associated with the request

  Example: Any string

- Label: `pool`

  Label Description: name of the pool associated with the request

  Example: Any string

- Label: `eventType`

  Label Description: type of event associated with the request

  Example: Allocation/Release

- Label: `allocationType`

  Label Description: type of allocation associated with the request

  Example: static/dynamic

- Label: `addressType`

  Label Description: address type associated with the request

  Example: IPv4/IPv6PD

- Label: `upf`

  Label Description: upf identifier associated with the request

  Example: Any string

SMF IPAM Chunk Events Current Counter Category

IPAM_chunk_allocations_current

Description: Current state of SMF IPAM Address Chunk allocations

Sample Query:

`IPAM_chunk_allocations_current{dnn=\"dnn1\",servingArea=\"area1\",nssai=\"slice1\",pool=\"p1\",addressType=\"IPv4\",upf=\"dp1\"}`

Labels:

- Label: `dnn`

    Label Description: name of the dnn associated with the request

    Example: Any string

- Label: `servingArea`

    Label Description: name of the serving Area associated with the request

    Example: Any string

- Label: `nssai`

    Label Description: name of the nssai associated with the request

    Example: Any string

- Label: `pool`

    Label Description: name of the pool associated with the request

    Example: Any string

- Label: `addressType`

    Label Description: address type associated with the request

    Example: IPv4/IPv6PD

- Label: `upf`

    Label Description: upf identifier associated with the request

    Example: Any string

SMF IPAM Chunk Events Total Counter Category

IPAM_chunk_events_total

Description: Total number of SMF IPAM Address Chunk events

Sample Query:

`IPAM_chunk_events_total{dnn=\"dnn1\",servingArea=\"area1\",nssai=\"slice1\",pool=\"p1\",eventType=\"Allocation\",addressType=\"IPv4\",upf=\"dp1\"}`

Labels:

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `servingArea`

  Label Description: name of the serving area associated with the request

  Example: Any string

- Label: `nssai`

  Label Description: name of the nssai associated with the request

  Example: Any string

- Label: `pool`

  Label Description: name of the pool associated with the request

  Example: Any string

- Label: `eventType`

  Label Description: type of event associated with the request

  Example: Allocation/Release

- Label: `addressType`

  Label Description: address type associated with the request

  Example: IPv4/IPv6PD

- Label: `upf`

  Label Description: upf identifier associated with the request

  Example: Any string

SMF PDU Status Category

smf_service_counters

Description: The current count of SMF pdu sessions

Sample Query: `smf_service_counters{pdu_state=\"all_pdu\"}`

Labels:

- Label: `pdu_state`

  Label Description: PDU session status indicated by N3 UPF tunnel status

  Example: all_pdu, idle, connected

SMF Procedure Category

smf_service_stats

Description: SMF call flow procedure counters

Sample Query: `smf_service_stats{procedure_type=\"pdu_sess_create\"}`

Labels:

- Label: `procedure_type`

  Label Description: The procedure type associated with an call flow procedure

  Example: pdu_sess_create, ue_req_pdu_sess_mod, smf_req_pdu_sess_mod, pcf_req_pdu_sess_mod, udm_req_pdu_sess_mod, gnb_req_pdu_sess_mod, ue_req_pdu_sess_rel, smf_req_pdu_sess_rel, pcf_req_pdu_sess_rel, amf_req_pdu_sess_rel, udm_req_pdu_sess_rel, gnb_req_pdu_sess_rel, chf_req_pdu_sess_rel, admin_req_pdu_sess_rel, ue_req_active_to_idle, ue_req_idle_to_active, nw_req_service_active, upf_notify_downlink_data, xn_path_switch,pdn_sess_create,pdn_5g_4g_handover,pcf_req_ded_brr_create, pcf_req_ded_brr_delete, pcf_req_ded_brr_mod, n2_handover, xn_handover, n26_4g_to_5g_handover, n26_4g_to_5g_im_mobility, pdu_im, pdn_sess_create, pcf_req_ded_brr_create, pcf_req_ded_brr_delete, pcf_req_ded_brr_mod, pcf_initiated_pdn_detach, smf_initiated_pdn_detach, upf_initiated_pdn_detach

- Label: `status`

  Label Description: call flow procedure counter

  Example: attempted, success, failures

- Label: `pdu_type`

  Label Description: Type of pdu session

  Example: ipv4, ipv6, ipv4v6, unknown

- Label: `dnn`

  Label Description: Dnn requested by UE

  Example: intershat, cisco.com

- Label: `reason`

  Label Description: Reason for failure status. For sucessess and attempted it will be Empty

  Example: udm_registration_failure, udm_subscription_fetch_failure, udm_subscribe_notify_failure, pcf_create_failure, pcf_update_failure, charging_data_failure, pdn_5g_4g_handover, idft_setup_failure, mbr_setup_failure, sgw_failure, upf_failure, pcf_req_ded_brr_mod, pcf_req_ded_brr_create, pcf_req_ded_brr_delete, ue_req_ded_brr_mod, udm_req_ded_brr_mod, smf_req_ded_brr_mod, rm_failure, upf_setup_failure, upf_modify_failure, ebi_assign_failure, n1n2_transfer_failure, smcontext_modify_req_processing_failure, session_setup_timer_expired, pcf_update_exchg_failure, create_over_create, sm_cxt_sess_id_err, sm_cxt_invalid_json, sm_cxt_invalid_ie, sm_cxt_invalid, sm_cxt_n1_process_failed, n1n2_transfer_exchg_failure, n2ho_pdu_not_establised, n2ho_ie_validation_failed, n2ho_n4_ho_preparing_failed, n2ho_n4_ho_prepared_failed, n2ho_n4_ho_completed_failed, n2ho_ho_cancelled, n2ho_resource_alloc_unsuccess_transfer, n2ho_invalid_state, n2ho_preparation_unsuccess_transfer, n2ho_n1n2_transfer_failure, ,

xnho_pdu_not_establised, xnho_tobe_switched_flag_not_set, xnho_dl_tunnel_info_not_found, xnho_invalid_accepted_qfi_list, xnho_n4_modification_failed, xnho_n1n2_transfer_failure, xnho_pdu_ctx_not_found, , n26ho_5g_4g_n1n2_transfer_failure, n26ho_5g_4g_invalid_state, n26ho_5g_4g_n4_failed_prepared_state, n26ho_5g_4g_resource_alloc_unsuccess_transfer, n26ho_5g_4g_n4_failed_completed_state, n26ho_5g_4g_handover_cancelled, n26ho_5g_4g_pdu_ctx_not_found, n26ho_5g_4g_n4_failed_preparing_state, n26ho_5g_4g_n4_modify_failed, n26ho_5g_4g_invalid_eps_pdn_connlist, , pduim_n1n2_transfer_failure, pduim_n1n2_txfr_failure_notification, pduim_n4_modification_failed, pduim_misc_error, pduim_suspended_procedure, pduim_amf_ctx_not_found, pduim_internal_error, pduim_upstate_not_in_deactivated_state, n26ho_4g_5g_no_eps_5gs_continuity, n26im_mobility_4g_5g_no_eps_5gs_continuity, n26im_mobility_4g_5g_default_eps_bearer_inactive, pduimn26mob_n2_setup_response_sucess, pduimn26mob_n2_setup_response_failure

SMF Protocol message counters Category

smf_proto_udp_req_msg_total

Description: SMF Protocol message statistics

Sample Query: `smf_proto_udp_req_msg_total{message_direction="inbound",status="accepted"}`

Labels:

- Label: `message_name`

  Label Description: name of N4 interface message

  Example: n4_session_establishment_req, n4_session_establishment_res, n4_session_modification_req, n4_session_modification_res, n4_session_report_req, n4_session_report_res, n4_session_deletion_req, n4_session_deletion_res, n4_association_setup_req, n4_association_setup_res, n4_association_update_req, n4_association_update_res, n4_association_release_req, n4_association_release_res, n4_prime_pfd_management_req, n4_prime_pfd_management_res, n4_heartbeat_req, n4_heartbeat_res, n4_node_report_req, n4_node_report_res

- Label: `message_direction`

  Label Description: direction of message from SMF perspective

  Example: inbound, outbound

- Label: `status`

  Label Description: status of message processing

  Example: accepted, denied, discarded not present

smf_proto_udp_res_msg_total

Description: SMF Protocol message statistics

Sample Query: `smf_proto_udp_res_msg_total{message_direction="inbound",status="accepted"}`

Labels:

- Label: `message_name`

Label Description: name of N4 interface message

Example: n4_session_establishment_req, n4_session_establishment_res, n4_session_modification_req, n4_session_modification_res, n4_session_report_req, n4_session_report_res, n4_session_deletion_req, n4_session_deletion_res, n4_association_setup_req, n4_association_setup_res, n4_association_update_req, n4_association_update_res, n4_association_release_req, n4_association_release_res, n4_prime_pfd_management_req, n4_prime_pfd_management_res, n4_heartbeat_req, n4_heartbeat_res, n4_node_report_req, n4_node_report_res

- Label: `message_direction`

  Label Description: direction of message from SMF perspective

  Example: inbound, outbound

- Label: `status`

  Label Description: status of message processing

  Example: accepted, denied, discarded not present

SMF REST message exchange time Category

smf_restep_http_msg

Description: SMF REST time between request and response messages

Sample Query: `smf_restep_http_msg{message_direction=\"inbound\",nf_type=\"amf\"}`

Labels:

- Label: `nf_type`

  Label Description: Network Function type

  Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `message_direction`

  Label Description: direction of message from SMF perspective

  Example: inbound, outbound

- Label: `api_name`

  Label Description: API name

  Example: register_ue, deregister_ue, subscription_req, sdm_subscription_req, sdm_data_change_notify, nf_registration, nf_discovery, slice_selection, amf_create_sm_context, amf_update_sm_context, amf_release_sm_context, amf_n1_n2_transfer, amf_n1_n2_transfer_notify_failure, amf_assign_ebi, amf_status_notify, pcf_sm_policy_control_create, chf_charging_data_request, pcf_sm_policy_control_update, pcf_sm_policy_control_delete, pcf_sm_policy_control_update_notify, cisco_control_clear_subscriber, cisco_control_show_subscriber, pcf_sm_policy_control_terminate_notify, chf_abort_notify

- Label: `nf_uri`

  Label Description: Network Function URI

Example: actual HTTP URI of the message

- Label: `response_status`

Label Description: HTTP response status code

Example: 200, 201, 204

SMF REST messages Category

smf_restep_http_msg_total

Description: SMF REST message counter

Sample Query: `smf_restep_http_msg_total{message_direction=\"inbound\",nf_type=\"amf\"}`

Labels:

- Label: `nf_type`

Label Description: Network Function type

Example: nrf, udm, amf, pcf, chf, ciscocontrol

- Label: `message_direction`

Label Description: direction of message from SMF perspective

Example: inbound, outbound

- Label: `api_name`

Label Description: API name

Example: register_ue, deregister_ue, subscription_req, sdm_subscription_req, sdm_data_change_notify, nf_registration, nf_discovery, slice_selection, amf_create_sm_context, amf_update_sm_context, amf_release_sm_context, amf_n1_n2_transfer, amf_n1_n2_transfer_notify_failure, amf_assign_ebi, amf_status_notify, pcf_sm_policy_control_create, chf_charging_data_request, pcf_sm_policy_control_update, pcf_sm_policy_control_delete, pcf_sm_policy_control_update_notify, cisco_control_clear_subscriber, cisco_control_show_subscriber, pcf_sm_policy_control_terminate_notify, chf_abort_notify

- Label: `nf_uri`

Label Description: Network Function URI

Example: actual HTTP URI of the message

- Label: `response_status`

Label Description: HTTP response status code

Example: 200, 201, 204

SMF Session counters Category

smf_session_counters

Description: SMF current acitve Session counters

Sample Query:
`smf_session_counters{ratType=\"rat_type_4g\",pduType=\"ipv4\",dnn=\"dnn1\",sscMode=\"ssc_mode_1\"}`

Labels:

- Label: `rat_type`

  Label Description: Type of the radio access associated with the request

  Example: rat_type_2g, rat_type_3g, rat_type_4g, rat_type_5g, rat_type_4g_5g, rat_type_wifi, rat_type_unknown

- Label: `pduType`

  Label Description: name of the nssai associated with the request

  Example: ipv4, ipv6, ipv4v6, unknown

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `sscMode`

  Label Description: Type of ssc mode associated with the request

  Example: ssc_mode_1, ssc_mode_2, ssc_mode_3, ssc_mode_unknown

- Label: `always_on`

  Label Description: always on status

  Example: enable, disable

SMF Session stats Category

smf_session_stats

Description: SMF Session stats counters

Sample Query:
`smf_session_stats{ratType=\"rat_type_4g\",pduType=\"ipv4\",dnn=\"dnn1\",sscMode=\"ssc_mode_1\",status=\"attempted\"}`

Labels:

- Label: `rat_type`

  Label Description: Type of the radio access associated with the request

Example: rat_type_2g, rat_type_3g, rat_type_4g, rat_type_5g, rat_type_4g_5g, rat_type_wifi, rat_type_unknown

- Label: `pduType`

  Label Description: name of the nssai associated with the request

  Example: ipv4, ipv6, ipv4v6, unknown

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `sscMode`

  Label Description: Type of ssc mode associated with the request

  Example: ssc_mode_1, ssc_mode_2, ssc_mode_3, ssc_mode_unknown

- Label: `status`

  Label Description: PDU session status indicated at SMF

  Example: attempted, success, setup

SMF User Plane Session counters Category

smf_up_session_counters

Description: SMF current active User Plane Sessions

Sample Query:
`smf_up_session_counters{ratType=\"rat_type_4g\",pduType=\"ipv4\",dnn=\"dnn1\",sscMode=\"ssc_mode_1\"}`

Labels:

- Label: `rat_type`

  Label Description: Type of the radio access associated with the request

  Example: rat_type_2g, rat_type_3g, rat_type_4g, rat_type_5g, rat_type_4g_5g, rat_type_wifi, rat_type_unknown

- Label: `pduType`

  Label Description: name of the nssai associated with the request

  Example: ipv4, ipv6, ipv4v6, unknown

- Label: `dnn`

  Label Description: name of the dnn associated with the request

  Example: Any string

- Label: `sscMode`

  Label Description: Type of ssc mode associated with the request

Example: ssc_mode_1, ssc_mode_2, ssc_mode_3, ssc_mode_unknown