Oracle® Communications

InterWorking and Mediation Function (IWF) Cloud Native User's Guide

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What's New in This Guide

New and Updated Features in Release 1.4:

- IWF to support PCF discovery to find the PCF from BSF for AAA from P-DRA.
- Diameter GW Integration with IWF.

2
Introduction

This document provides information for using InterWorking and Mediation Function in the 5G Core Network.

The Oracle Communications 5G InterWorking and Mediation Function is a Cloud-Native solution based on micro-services architecture enabling 5G Core Network Functions (NF) to communicate with EPC network elements.

The InterWorking and Mediation Function is deployed as an independent network function in the 5G core network or as a part of Oracle 5G core NFs, which include Network Repository Function, Security Edge Protection Proxy, and Service Communication Proxy, as independent micro services within the 5G core NF.

Acronyms and Terminologies

The following table provides information about the acronyms and terminologies used in the document.

Table 2-1   Acronyms and Terminologies

Field	Description
3GPP	3rd Generation Partnership Project
5GC	5G Core Network
5GS	5G System
AF	Application Function
AUSF	Authentication Server Function
BSF	Binding Support Function
CHF	Charging Function
CNE	Cloud Native Environment
EFK stack	Elasticsearch, Fluentd, and Kibana stack
FQDN	Fully Qualified Domain Name
GPSI	Generic Public Subscription Identifier
IWF	InterWorking and Mediation Function
K8s	Kubernetes
NEF	Network Exposure Function
NF	Network Function
NRF	Network Repository Function
NSSF	Network Slice Selection Function
PCF	Policy Control Function
PFD	Packet Flow Description
QFI	QoS Flow Identifier
QoE	Quality of Experience
SBA	Service Based Architecture

Table 2-1   (Cont.) Acronyms and Terminologies

Field	Description
SBI	Service Based Interface
SCP	Service Communication Proxy
SEPP	Security Edge Protection Proxy
SMF	Session Management Function
SUPI	Subscription Permanent Identifier
UDR	Unified Data Repository
UDSF	Unstructured Data Storage Function

Locate Product Documentation on the Oracle Help Center Site

Oracle Communications customer documentation is available on the web at the Oracle Help Center (OHC) site, http://docs.oracle.com. You do not have to register to access these documents. Viewing these files requires Adobe Acrobat Reader, which can be downloaded at http://www.adobe.com.

1. Access the Oracle Help Center site at http://docs.oracle.com.

2. Click `Industries`.

3. Under the Oracle Communications subheading, click the `Oracle Communications documentation` link.

    The Communications Documentation page appears. Most products covered by these documentation sets will appear under the headings "Network Session Delivery and Control Infrastructure" or "Platforms."

4. Click on your Product and then the Release Number.

    A list of the entire documentation set for the selected product and release appears.

5. To download a file to your location, right-click the `PDF` link, select `Save target as` (or similar command based on your browser), and save to a local folder.

My Oracle Support

My Oracle Support (https://support.oracle.com) is your initial point of contact for all product support and training needs. A representative at Customer Access Support can assist you with My Oracle Support registration.

Call the Customer Access Support main number at 1-800-223-1711 (toll-free in the US), or call the Oracle Support hotline for your local country from the list at http://www.oracle.com/us/support/contact/index.html. When calling, make the selections in the sequence shown below on the Support telephone menu:

1. Select **2** for New Service Request.

2. Select **3** for Hardware, Networking and Solaris Operating System Support.

3. Select one of the following options:

    •   For Technical issues such as creating a new Service Request (SR), select **1**.

- For Non-technical issues such as registration or assistance with My Oracle Support, select **2**.

You are connected to a live agent who can assist you with My Oracle Support registration and opening a support ticket.

My Oracle Support is available 24 hours a day, 7 days a week, 365 days a year.

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About InterWorking and Mediation Function

The key capabilities of InterWorking and Mediation Function include:

- **Protocol Translation:**
  - Allows 5GC NF to interwork the EPC network elements or vice versa
  - Supports diameter to HTTP/2 and vice versa protocol conversion capabilities
- **Message Mediation:**
  - Allows API transformation to resolve inter-NF inter-operational issues
  - Allows users to create policy rules to execute mediation transformation

About Mediation Capability

Mediation capability:

- Allows user to perform HTTP/2 signaling API message mediation with vendor-specific implementations and resolve interoperability issues for 5GC inter-NF communication.
- Supports dynamic message transformation based on the configured policy rules.

Figure 3-1   Mediation Capability
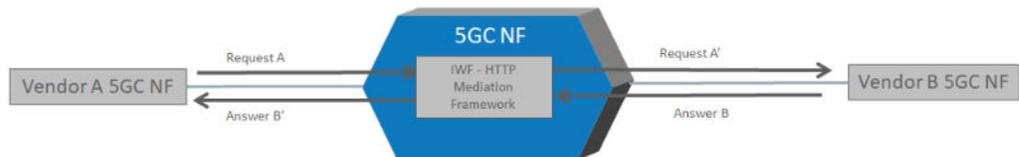
The IWF mediation feature allows the user to configure the mediation policies that are executed on incoming and outgoing NF messages.

The IWF Mediation supports the following capabilities:

- **Header:** Used to make custom changes to the request and/or response headers (add, remove, and modify).
- **Body IEs:** Used to make custom changes to HTTP message bodies.
- **Method/Status Code:** Used to update the method name or status code in messages.
- **URL Rewriting:** Modify any URLs in the API messages.
- **Transformation:** Used to convert between JSON and XML.
- **Message Actions:** Forward/Reject/Drop/Message Copy the messages based on configured rules.

About Protocol Translation

The Protocol Translation enables inter-working between EPC network elements and 5GC NFs. Perform mapping of HTTP/2 to Diameter messages and vice versa.

Figure 3-2   Protocol Translation

Protocol translation enables migration and inter-working strategy for an LTE network by performing protocol translation.

- Diameter-HTTP/2 inter-working is based on generic framework using IE mapping configuration and includes built-in support for the following Diameter-HTTP/2 inter-working use cases.

  – Inter-working between AF(CSCF) & PCF for IMS, QoS Control, SDC, and so on, use cases - Rx to N5

  – Inter-working between NF & PCRF for IMS, QoS Control, SDC, and so on, use cases - N7 to Gx

- Supports for HTTP/2 to HTTP/1.1

- Supports payload transformation - JSON to XML

- Supports customization of inter-working IEs of HTTP/2 and diameter messages

PCF Session Binding Discovery success case
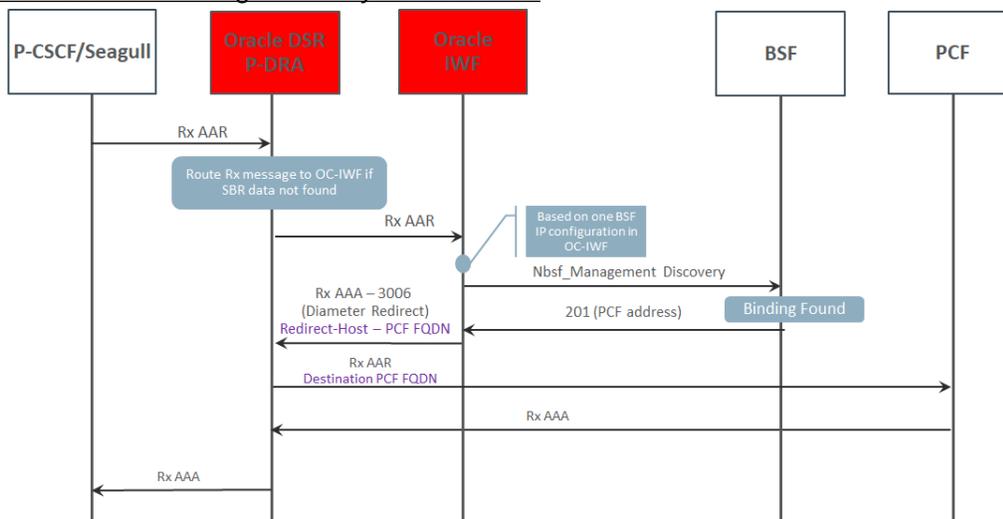
4

User Configurations

The user can perform the following configurations in the InterWorking and Mediation Function:

- Configuring Mediation Rules
- Configuring Mediation Rule for PT
- Configuring Mediation Rule for NF-Mediation
- Configuring Diameter Peer
- BSF Configuration
- Reloading Configurations

Configuring Mediation Rules

User can prepare their own Mediation rules to apply on HTTP Request and Response. Refer to the following sample rules to create new Mediation Rules.

HTTP Request Header Manipulation Rule

Following is a sample HTTP request header manipulation rule.

```
rule "Http-Req-Header-Manipulation-Rule"
    salience 20
when
    m : IWFHttpRequest(getUri() matches "http://xyz.com")
then
    m.header(m.ADD,"Header-Name","Value")
    m.header(m.UPDATE,"Header-Name","Value")
    m.header(m.DEL,"Header-Name")
end
```

HTTP Request Body Manipulation Rule

Following is a sample HTTP request body manipulation rule.

```
rule "Http-Req-Body-Manipulation_Rule"
        salience 20
when
        m : IWFHttpRequest(body("Attribute-Name") == "Value")
then
        m.body(m.ADD, "Attribute-Name", "Value")
        m.body(m.UPDATE, "Attribute-Name", "Value")
        m.body(m.DEL,"Attribute-Name", "Value")
end
```

HTTP Response Header Manipulation Rule

Following is a sample HTTP response header manipulation rule.

```
rule "Http-Res-Header-Manipulation-Rule"
    salience 20
when
    m : IWFHttpResponse(header("Header-Name") == "Value")
then
    m.header(m.ADD,"Header-Name","Value")
    m.header(m.UPDATE,"Header-Name","Value")
    m.header(m.DEL,"Header-Name")
end
```

HTTP Response Body Manipulation Rule

Following is a sample HTTP response body manipulation rule.

```
rule "Http-Res-Body-Manipulation_Rule"
        salience 20
when
        m : IWFHttpResponse(body("Attribute-Name") == "Value")
then
        m.body(m.ADD, "Attribute-Name", "Value")
        m.body(m.UPDATE, "Attribute-Name", "Value")
        m.body(m.DEL,"Attribute-Name", "Value")
end
```

Basic Rules APIs for HTTP Message Manipulation

Following are the different ways to manipulate the HTTP Request/Response:

- **Get/Update Http URL:**

  ```
  m.getURL("http://oracle.com")
  m.setURL("http://oracle.com")
  ```

- **Get/Update Http Method:**

  ```
  m.getMethod()
  m.setMethod("POST")
  ```

- **Get/Update Http Status Code:**

  ```
  m.getHttpStatusCode()
  m.setHttpStatusCode(201)
  ```

- **Get/Add/Update/Delete Header:**

  ```
  m.header("Content-Type")  OR m.header(m.GET,"Content-Type"")
  m.header(m.ADD,"Content-Type","application/xml")
  ```

```
m.header(m.UPDATE,"Content-Type","application/xml")
m.header(m.DEL,"Content-Type","application/xml")
```

- **Get/Add/Update/Delete Body:**

```
m.body("tai:tac") OR m.body(m.GET"tai:tac")
m.body(m.ADD,     "tai:tac","000001")
m.body(m.UPDATE, "tai:tac:mnc","281")
m.body(m.DELETE, "nf-id","28145")
```

- **Converting JSON to XML:**

```
m.header(m.UPDATE,"Content-Type","application/xml")
```

- **Converting XML to JSON:**

```
m.header(m.UPDATE,"Content-Type","application/json")
```

- **Regular Expression:**

```
  rule "iwf_test_rule40_3"
        salience 20
        when
              m : IWFHttpResponse(body("company[1]:x") matches "[^A-
Za-z]")
        then
              m.body(m.ADD, "company[2]:y", "sap")
              m.header(m.UPDATE, "Content-Type", "application/json")
        end
```

- **Other Primitive DataTypes (like int, float...):**

```
  rule "iwf_test_rule40_4"
        salience 20
        when
              m : IWFHttpRequest( body("nf-id") == 0.001)
        then
            m.body(m.ADD, "company[2]:y", 1)
            m.header(m.UPDATE, "Content-Type", "application/json")
        end
```

- **Using Functions:**
  - **Function Definition:**

```
   function String charLength(String name) {
                 return name.length();
             }
```

  - **Function Invoked:**

```
  rule "iwf_test_rule40_6"
          salience 20
          when
```

```
                                        m : IWFHttpRequest(charLength(body("nf-id"))
          == "ORACLE")
                  then
                                    m.body(m.ADD, "company[2]:y", 1000)
                  end
```

Configuring Mediation Rule for PT

Add the following rules to the mediation rules.

> **✎ Note:**
>
> In the following rules, replace **PCF_loadBalancerIP_and_Port** and
> **IWF_loadBalancerIP_and_Port** with appropriate values.

```
rule "pt_d2h_AAR_rule_N5_To_Rx"
salience 20
when
m : IWFHttpRequest(header("pt_dest_uri") != null)
then
m.setUri(m.header("pt_dest_uri").replace("pcf.com","10.178.246.13:1000/
simulation"))   //"PCF_loadBalancerIP_and_Port"
m.header(m.DEL,"pt_dest_uri")
end

rule "pt1_h2d_RAR_rule_N5_To_Rx"
salience 20
when
  m : IWFHttpRequest(getUri() matches ".*(npcf-
policyauthorization)*(v1)*(notification)*(notify).*")
then
 m.forwardPath = IWFConsts.FORWARD_TO_H2D
 m.header(m.ADD,"diameterApplicationId","16777236")
 m.header(m.ADD,"diameterCommandCode","258")
 m.header(m.ADD,"original-req-uri",m.getUri())
end

rule "pt1-d2h_ASR_rule_N5_To_Rx"
salience 20
when
m : IWFHttpRequest(getUri() matches ".*(npcf-
policyauthorization)*(v1)*(notification)*(terminate).*")
then
m.forwardPath=IWFConsts.FORWARD_TO_H2D
m.header(m.ADD,"diameterApplicationId","16777236")
m.header(m.ADD,"diameterCommandCode","274")
m.header(m.ADD,"original-req-uri",m.getUri())
end

rule "pt_d2h_AAR_Update_Rx_To_N5"
salience 21
```

```
when
m : IWFHttpRequest(m.body("ascReqData:notifUri") != null)
then
m.body(m.UPDATE,"ascReqData:notifUri",update(m.body("ascReqData:notifUri"))
.replace("iwf.com","10.178.254.158:30079"))  //IWF_loadBalancerIP_and_Port
m.body(m.UPDATE,"ascReqData:evSubsc:notifUri",update(m.body("ascReqData:evS
ubsc:notifUri")).replace("iwf.com","10.178.254.158:30079"))  //
IWF_loadBalancerIP_and_Port
end

rule "pt_h2d_ccri_rule_N7_To_Gx"
salience 20
when
m : IWFHttpRequest(getUri() matches ".*(npcf-smpolicycontrol/v1/sm-
policies)(/$|$)")
then
m.forwardPath=IWFConsts.FORWARD_TO_H2D
m.header(m.ADD,"diameterApplicationId","16777238")
m.header(m.ADD,"diameterCommandCode","272")
m.header(m.ADD,"requestType","CREATE")
end

rule "pt_h2d_ccru_rule_N7_To_Gx"
salience 21
when
m : IWFHttpRequest(getUri() matches ".(npcf-smpolicycontrol/v1/sm-
policies/)(.)(/update)(/$|$)")
then
m.forwardPath=IWFConsts.FORWARD_TO_H2D
m.header(m.ADD,"diameterApplicationId","16777238")
m.header(m.ADD,"diameterCommandCode","272")
m.header(m.ADD,"requestType","UPDATE")
m.header(m.ADD,"original-req-uri",m.getUri())
end

rule "pt_h2d_ccrt_rule_N7_To_Gx"
salience 21
when
m : IWFHttpRequest(getUri() matches ".(npcf-smpolicycontrol/v1/sm-
policies/)(.)(/delete)(/$|$)")
then
m.forwardPath=IWFConsts.FORWARD_TO_H2D
m.header(m.ADD,"diameterApplicationId","16777238")
m.header(m.ADD,"diameterCommandCode","272")
m.header(m.ADD,"requestType","DELETE")
m.header(m.ADD,"original-req-uri",m.getUri())
end
```

Configuring Mediation Rule for NF-Mediation

Extracting the group name and the trigger point from the URLs provided below:

> **Note:**
>
> In rules, the "agenda-group" is used to categories the rule group using the group name and the trigger point that is provided in the URL.

URL Type 1: `[http://{apiRoot}/nmediation-http/v1]`

- The above URL does not have any group name or trigger point. So the rules that are without agenda-group are applicable on this.

- From the below reference rules, the rule `default` will be applied.

URL Type 2: `[http://{apiRoot}/nmediation-http/v1/scp]`

- The above URL has only the group name. So the rules that are under the agenda-group `scp` is applicable.

- From the below reference rules, the rule `scp-rule-header-1` will be applied.

URL Type 3: `[http://{apiRoot}/nmediation-http/v1/scp/triggerpoint2]`

- The above URL has both the group name `scp` and the trigger point `triggerpoint2`. So the rules that are under the agenda-group `scp-triggerpoint2` are applicable.

- From the below reference rules, the rule `scp-rule-header-2` and `scp-rule-body-1` will be applied.

Add the below rules to the mediation rules:

```
rule "default"
when
    m : NFHttpRequest(m.header("source") == "pcf")
then
    m.header(m.DEL, "custom-header-bad")

end

rule "scp-rule-header-1"
    salience 20
    agenda-group "scp"
when
    m : NFHttpRequest(m.header("custom-key") == "123")
then
    m.header(m.ADD, "custom-value", "pcf-nrf")
        m.header(m.UPDATE, "name", "nf","pcfnf")
end

rule "scp-rule-header-2"
    salience 20
    agenda-group "scp-triggerpoint2"
when
    m : NFHttpRequest(m.header("custom-key") == "123")
then
    m.header(m.ADD, "custom-value", "pcf-nrf")
        m.header(m.UPDATE, "name", "nf","pcfnf")
end
```

```
rule "scp-rule-body-1"
    salience 21
    agenda-group "scp-triggerpoint2"
when
    m : NFHttpRequest( (m.body("nfType") == "PCF") &&
                        (m.body("fqdn") matches "^(cisco).*") )
then
    m.body(m.ADD, "pcfInfo:supiRangeList[1]:end", "2000000000")
    m.body(m.ADD, "pcfInfo:supiRangeList[1]:start", "1000000000")

    m.body(m.UPDATE, "nfServices[1]:ipEndPoints[1]:ipv4Address",
"10.75.213.100")

    m.body(m.DEL, "nfServices[1]:apiPrefix")
end
```

Configuring Diameter Peer

The peer nodes are configured in the `configmap-pcf-diam-gateway-service-diameter.yaml` file present in the location `chart pcf/templates`.

> **✎ Note:**
>
> The IWF does not listen for incoming connections, as the connection with diameter peer is always initiated by IWF.

Following is a sample yaml file.

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: pcf-diam-gateway-config-peers
data:
  diameter-config-peers: |
    version: '0.3'
    kind: 'diameter-config'
    metadata:
      label: 'diameter-config-peers'
    setting:
      reconnectDelay: 3
      responseTimeout: 5
      connectionTimeOut: 3
      watchdogInterval: 6
      transport: 'TCP'
    # type: [af, dra]
    nodes:
      - name: 'P-CSCF'
        type: 'pcrf'
        responseOnly: true
        host: '10.75.215.205'
        port: 3880
```

The tool `ociwf-rule-download_tool.sh` can be used to download the rule config map in a folder(folder name will be configmap name). It needs namespace as well as required configmap name. These rules then can be changed accordingly.

The tool `ociwf-rule-upload_tool.sh` can be used to upload the rule config map from the existing config map folder. It needs namespace as well as required configmap name to be uploaded.

•If rules changed on nf active mediation then use `ociwf-nf-mediation-config-active` as the name of the configmap.

•If rules changed on nf test mediation then use `ociwf-nf-mediation-config-test` as the name of the configmap.

5
Metrics, and KPIs

This section provides the details of the Metrics and KPIs applicable for InterWorking and Mediation Function.

- Metric Reference
- KPI Reference

Metric Reference

The table *IWF Metric Reference* provides the information about IWF Metrics.

Table 5-1　IWF Metric Reference

Metric Details	IWF Micro Service	Metric
Number of the incoming request to DP from PDRA	DP	pdraIngressCounter
Number of successfully converted messages by D2H	D2H	iwfd2h_conversionSuccess_messages_total
Number of successful conversion from http to diameter	H2D	iwfh2d_h2dConversion_Success_total
Number of successful conversion from diameter to http	H2D	iwfh2d_d2hConversion_Success_total
Number of success Outgoing responses from PcfDiscovery	PcfDiscovery	pcfDiscSuccessResponseCounter
Number of success Outgoing responses from BSF	PcfDiscovery	bsfSucessResponseCounter
Number of responses received from mediation	D2H	iwfd2h_mediation_response_total
Number of responses from mediation to D2H	Mediation	iwfd2h_mediation_response_total
Number of Response	All	IWF Egress Request rate
Number of requests sent to mediation from D2H	D2H	iwfd2h_mediation_outgoing_total
Number of requests sent to D2H from DP	DP	iwfdiameterproxy1_d2h_outgoing_total
Number of Request	All	IWF Ingress Request rate
Number of outgoing responses from H2D to mediation	Mediation	iwfmediation_h2d_response_total
Number of outgoing responses from mediation	Mediation	iwfmediation_outgoing_response_total
Number of outgoing requests from mediation	Mediation	iwfmediation_outgoing_request_total
Number of messages going from PDRA to PCF	DP	pdraPcfEgressCounter

Table 5-1   (Cont.) IWF Metric Reference

Metric Details	IWF Micro Service	Metric
Number of Incoming responses to PcfDiscovery	PcfDiscovery	pcfDiscRequestCounter
Number of incoming responses to mediation	Mediation	iwfmediation_incoming_response_total
Number of incoming responses to BSF	PcfDiscovery	bsfRequestCounter
Number of incoming requests to mediation	Mediation	iwfmediation_incoming_request_total
Number of incoming requests from mediation to H2D	Mediation	iwfmediation_h2d_outgoing_total
Number of incoming requests from D2H to mediation	Mediation	iwfd2h_mediation_incoming_total
Number of incoming messages to D2H from diameter Proxy Service	D2H	iwfd2h_incoming_messages_total
Number of failures while sending message to mediation from D2H	D2H	iwfd2h_mediation_error_total
Number of failure Outgoing responses from PcfDiscovery	PcfDiscovery	pcfDiscFailureResponseCounter
Number of failure Outgoing responses from BSF	PcfDiscovery	bsfFailureResponseCounter
Number of failed response (responses other than 200OK)from PCF Discovery to DP	DP	failedResponseToPdraCounter
Number of diameter requests sent to diameter proxy	H2D	iwfh2d_diameter_request_outgoing_total
Number of Diameter requests sent to Diameter peer	DP	iwfdiameterproxy1_diameter_outgoing_total
Number of Diameter requests received from H2D	DP	iwfdiameterproxy1_h2d_incoming_total
Number of Diameter requests received from Diameter peer	DP	iwfdiameterproxy1_diameter_incoming_total
Number of diameter request send error occurred	H2D	iwfh2d_diameter_error_total
Number of diameter answers received from diameter proxy	H2D	iwfh2d_diameter_response_incoming_total
Number of 200OK responses from PCF Discovery to DP	DP	successResponseToPdraCounter

The table *Mediation Metric Reference* provides the information about Mediation Metrics.

Table 5-2   Mediation Metric Reference

Metric	Metric Description	Mediation Micro Service
Mediation Ingress Request rate	Number of Request	All

Table 5-2   (Cont.) Mediation Metric Reference

Metric	Metric Description	Mediation Micro Service
Mediation Egress Request rate	Number of Response	All
iwfmediation_incoming_request_total	Number of incoming requests to iwf mediation	iwf-mediation
iwfmediation_outgoing_response_total	Number of outgoing responses from iwf mediation	iwf-mediation
iwfd2h_mediation_incoming_total	Number of incoming requests from D2H to iwf mediation	iwf-mediation
iwfd2h_mediation_response_total	Number of responses from iwf mediation to D2H	iwf-mediation
iwfmediation_h2d_outgoing_total	Number of incoming requests from iwf mediation to H2D	iwf-mediation
iwfmediation_h2d_response_total	Number of outgoing responses from H2D to iwf mediation	iwf-mediation
iwfmediation_outgoing_request_total	Number of outgoing requests from iwf mediation	iwf-mediation
iwfmediation_incoming_response_total	Number of incoming responses to iwf mediation	iwf-mediation
nfmediation_incoming_request_total	Number of incoming requests to nf mediation	nf-mediation
nfmediation_outgoing_response_total	Number of outgoing responses from nf mediation	nf-mediation

KPI Reference

Table 5-3 provides the details of KPI information for IWF.

Table 5-3   KPI Reference

KPI Details	IWF Micro Service	Service Operation	KPI	Response Details
Requests/sec	All	All	IWF Ingress Request Rate	Note Applicable