Oracle® Communications

Cloud Native Core, Security Edge Protection Proxy Benchmarking Guide

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Oracle Communications Cloud Native Core, Security Edge Protection Proxy Benchmarking Guide, Release 24.1.0

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Contents

Acronyms

The following table lists the acronyms and the terminologies used in the document:

Table Acronyms and Terminologies

Acronym	Description
Cat-0	Cat-0 SBI Message Schema Validation Feature
Cat-1	Cat-1 Service API Validation Feature
Cat-2	Cat-2 Network ID Validation Feature
CNC Console	Oracle Communications Cloud Native Configuration Console
CRD	Custom Resource Definition
CNE	Oracle Communications Cloud Native Core, Cloud Native Environment
cSEPP/C-SEPP	Consumer Security Edge Protection Proxy
DB	Database
DNS	Domain Name System
EGW	Egress Gateway
FQDN	Fully Qualified Domain Name
Hosted SEPP	Hosted SEPP functionality provides selective routing in Roaming Hub Mode
IGW	Ingress Gateway
IPX	Internetwork Packet Exchange
K8s	Kubernetes
Local PLMN	PLMN managed by Local SEPP
Local SEPP	SEPP in Local PLMN
MNO	Mobile Network Operator
NDB	Network Database
NF	Network Function
Network Function	A functional building block within a network infrastructure, which has well defined external interfaces and well defined functional behavior. In practical terms, a network function is often a network node or physical appliance.
NF Consumer	A generic way to refer to an NF which consumes services provided by another NF. Example: An AMF acts as a Consumer NF that consumes AMPolicy services provided by the PCF.
NF Instance	A specific instance of a network function type.
NF Producer or NF Provider	A generic way to refer to an NF which provides services that can be consumed by another NF. Example: A PCF acts as a Producer NF that provides AMPolicy Services to the AMF.
NRF	Oracle Communications Cloud Native Core, Network Repository Function
OHC	Oracle Help Center
OSDC	Oracle Software Delivery Cloud
PDB	PodDisruptionBudget
PLMN	Public Land Mobile Network
pSEPP/P-SEPP	Producer Security Edge Protection Proxy
Remote PLMN	PLMN managed by Remote SEPP
Remote SEPP	SEPP in Remote PLMN

Table (Cont.) Acronyms and Terminologies

Acronym	Description
Remote SEPP Set	Set of Remote SEPPs to allow alternate routing across Remote SEPPs
REST API	Representational State Transfer Application Programming Interface
Roaming Hub	Roaming Hub is the deployment mode of SEPP. Roaming Hub is used as an intermediate proxy. Each SEPP connects to the Roaming Hub which further connect to another SEPP. All the Remote SEPPs can communicate with each other through roaming hub.
Scaling	Ability to dynamically extend or reduce resources granted to the Virtual Network Function (VNF) as needed. This includes scaling out and in or scaling up and down.
SCM	Security Coutermeasure
SEPP	Oracle Communications Cloud Native Core, Security Edge Protection Proxy
SVC	Service
TLS	Transport Layer Security
TH	Topology Hiding
TUH	Topology Unhiding
TPS	Transactions Per Second

What's New in This Guide

This section introduces the documentation updates for Release 24.1.x.

Release 24.1.0 - F96170-02, July 2024

Updated the Overall Summary table.

Release 24.1.0 - F96170-01, April 2024

Added Configurations for the 62K MPS, 16Hrs run with no features enabled and with 7 Gateway pods and 50ms delay.

1 Overview

Security Edge Protection Proxy (SEPP) is a key component of the 5G Service Based Architecture. It is a proxy Network Function (NF) which is used for the secured communication for inter Public Land Mobile Network (PLMN) messages.

For more information about the SEPP architecture, see *Oracle Communications Cloud Native Core, Security Edge Protection Proxy User Guide*.

SEPP can be deployed, upgraded, and rolled back using Continuous Delivery Control Server (CDCS) or Command Line Interface (CLI) procedures as described in *Oracle Communications Cloud Native Core Security Edge Protection Proxy Installation, Upgrade, and Fault Recovery Guide*. CDCS provides continuous delivery functionality for multi site Cloud Native Core (CNC) installations. For more information about CDCS, see *Oracle Communications Cloud Native Core, Continuous Delivery Control Server User Guide*.

The user can install either SEPP or Roaming Hub/Hosted SEPP.

> **Note**
>
> The performance and capacity of the SEPP system may vary based on the call model, Feature/Interface configuration, and underlying CNE and hardware environment.

1.1 Purpose and Scope

This document is designed to help operators measure the capacity and performance of SEPP, SEPP microservices, and deployment environment setup software such as Cloud Native Environment (CNE) and cnDBTier.

This document provides SEPP performance and capacity data. It is recommended that SEPP is run through a benchmark on the target cloud native infrastructure to determine the capacity and performance in the target infrastructure. This information can be used to adjust the initial deployment resources and to help predict resource requirements when SEPP is scaled up.

1.2 References

For more information on Security Edge Protection Proxy (SEPP), refer to the following documents:

- *Oracle Communications Cloud Native Core, Security Edge Protection Proxy Installation, Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core, Security Edge Protection Proxy User Guide*
- *Oracle Communications Cloud Native Core, Security Edge Protection Proxy REST Specification Guide*
- *Oracle Communications Cloud Native Core, Security Edge Protection Proxy Troubleshooting Guide*

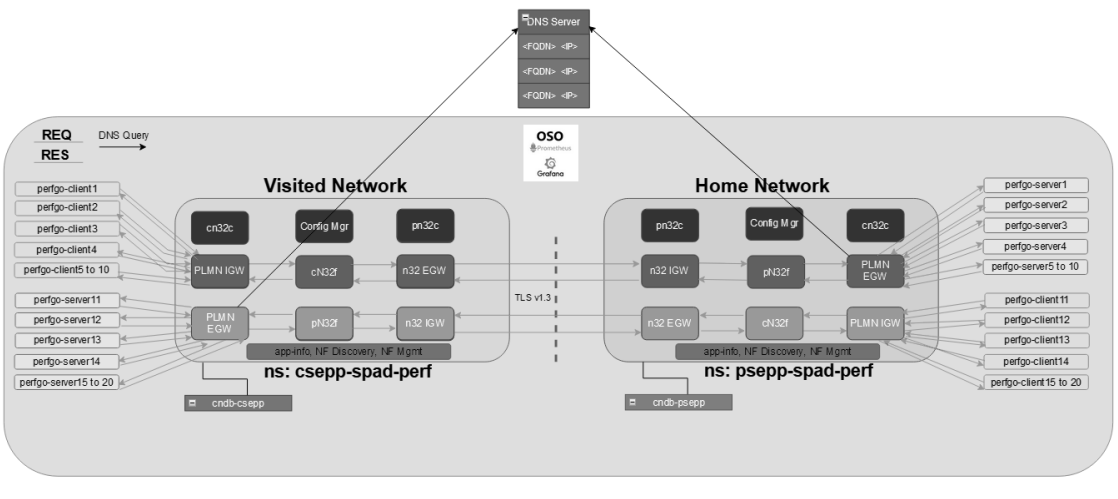
- *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*
- *Oracle Communications Cloud Native Core, cnDBTier User Guide*

2 Deployment Environment

This section provides information about the cloud native infrastructure used for SEPP benchmarking.

The following diagram represents the deployment configurations of SEPP:

Figure 2-1 Deployment Diagram



The details about the deployment configurations are as follows:

- cnDBTier, cSEPP, pSEPP, perfgo-client, and perfgo-server are deployed in same cluster
- DNS server is running on a standalone VM in a different cluster
- cSEPP to pSEPP n32 TLS 1.3 connection is on External IP (metalLB)
- perfgo-client is sending traffic on SEPP external IP
- SEPP to perfgo-server connection is using External IP (metalLB)
- Both SEPP have 30 local PLMNs
- Network delay of 50 ms on server side

2.1 Overall Summary of Benchmarking Configurations

The following table lists the overall summary of benchmarking configurations.

Overall Summary

Table 2-1 Overall Summary

Summary	Values
SL. No	Run 1
Execution Time	16 Hours
SEPP Release	csepp-24.1.0-rc1 and psepp-24.1.0-rc1
CNC C Release	24.1.0-rc1
cnDBTier Release	24.1.0-rc5
ASM Enabled/Disabled	Disabled
OSO Installed	Yes
HA Proxy Installed	NA
Cluster	Hard_head 1
Site 1 (Ingress Traffic)	31K
Site 2 (Egress Traffic)	31K
Overall MPS	62K
Network Delay on server side	50ms
Features Enabled	NA
Status	PASS
Remarks	NA

> **Note**
>
> The maximum throughput is 62k

2.2 Deployed Components

Deployment Platform

Oracle Communications Cloud Native Environment (OCCNE) 24.1.0 and BareMetal are used for performing benchmark tests.

Observability Services

The following table lists observability services and their versions that are used for SEPP benchmark tests. These services fetch SEPP metrics, alerts, logs, and traces.

Table 2-2 Observability Services

Service	Version
Fluentd	1.16.2
Kibana	7.9.3
Prometheus	1.51.1
Grafana	9.5.3
Jaeger	1.52.0

Cloud Native Orchestrator

Kubernetes 1.27.x is used for managing application pods across the cluster.

cnDBTier

cnDBTier 24.1.0 is used for performing benchmark tests.

For more information about above mentioned components, see *Oracle Communications Cloud Native Core, Security Edge Protection Proxy Installation, Upgrade, and Fault Recovery Guide*.

2.3 Deployment Resources

The performance and capacity of SEPP can vary based on the chosen environment and how SEPP is deployed. This section provides information about CNE resources used to perform benchmark tests.

2.3.1 Resource Requirements for CNE Observability Services

The following table provides information about the number of pods required by each CNE service.

Table 2-3 Resource Requirements for CNE Observability Services

Service Name	Number of Pods
Prometheus Server	1
Prometheus-pushgateway	1
Alert Manager	2
Fluentd	1 per worker node
Prom-node-exporter	1 per worker node
MetalLB speaker	1 per worker node
ES Data/Master	3/3
ES Curator	1
ES-exporter	1
Grafana	1
Kibana	1
kube-state-metrics	1
jaeger-agent	1 per worker node
jaeger-collector	1
jaeger-query	1
rook-ceph-osd	1 for each raw disk available to OS on all worker nodes
rook-ceph-mgr	1
rook-ceph-mon	3
rook-ceph-osd	1

3
SEPP Benchmark Testing

This section provides information about the SEPP testcases run in different scenarios.

3.1 Test Scenario 1 - SEPP Performance for the 62K MPS, 16Hrs run with no features enabled and with 7 Gateway pods and 50ms delay at Server end.

This test scenario describes performance and capacity of SEPP and provides the benchmarking results for 62K MPS,16Hrs without feature enabled and with 7 Gateway pods and 50ms delay at Server end.

3.1.1 Testcase and Setup Details

Traffic Model Details:

Call Mix:

Table 3-1 Call Mix

NF-Consumer	NF-Producer	Reference Point ID	Traffic %
vAMF	hUDM	N8	33.33
vAMF	hAUSF	N12	9.09
vNRF	hNRF	N27	12.12
vNSSF	hNSSF	N31	3.03
vPCF	hPCF	N24	12.12
vSMF	hUDM	N10	9.09
vSMF	hSMF	N16	18.18
vSMSF	hUDM	N21	3.03

Call Rate: Total 62K MPS: 31K MPS (Home PLMN) + 31K MPS (Visited PLMN)

Table 3-2 Setup Details

Set up Details	
Active User	NA for SEPP
Execution Timeline	16Hrs
Environment	VCNE
Cluster	Groove2
Bastion-1 IP	10.148.209.173
OCCNE Version	24.1.0

Table 3-2 (Cont.) Setup Details

Set up Details	
cnDBTier	24.1.0
cSEPP	24.1.0
pSEPP	24.1.0
CNC Console	24.1.0
Set up Configuration	• Both SEPPs are deployed in Model-B. • cnDBTier is deployed in two-site georedundancy in each site.
List of SEPP Features enabled	None. This execution is done on vanilla SEPP deployment.

Resource Footprint for cSEPP

Table 3-3 Resource Footprint for cSEPP

Services	Replicas	CPU Limit Per Pod	CPU Limit Per Pod	Memory Request Per Pod (Gi)	Memory Limit Per Pod (Gi)
Site1-ocsepp-alternate-route/ alternate-route	2	2	2	4Gi	4Gi
Site1-ocsepp-appinfo/appinfo	2	1	1	2Gi	1Gi
Site1-ocsepp-cn32c-svc/ cn32c-svc	2	2	2	2Gi	2Gi
Site1-ocsepp-cn32f-svc/ cn32f-svc	7	5	5	8Gi	8Gi
Site1-ocsepp-coherence-svc/ coherence-svc	1	1	1	2Gi	2Gi
Site1-ocsepp-config-mgr-svc/ config-mgr-svc	1	2	2	2Gi	2Gi
Site1-ocsepp-n32-egress-gateway/n32-egress-gateway	**7**	5	5	5Gi	5Gi
Site1-ocsepp-n32-ingress-gateway/n32-ingress-gateway	**7**	6	6	5Gi	5Gi
Site1-ocsepp-nf-mediation/nf-mediation	2	8	8	8Gi	8Gi
Site1-ocsepp-ocpm-config/ config-server	2	1	1	1Gi	1Gi

Table 3-3 (Cont.) Resource Footprint for cSEPP

Services	Replicas	CPU Limit Per Pod	CPU Limit Per Pod	Memory Request Per Pod (Gi)	Memory Limit Per Pod (Gi)
Site1-ocsepp-performance/perf-info	2	2	2	4Gi	200Mi
Site1-ocsepp-plmn-egress-gateway/plmn-egress-gateway	**7**	5	5	5Gi	5Gi
Site1-ocsepp-plmn-ingress-gateway/plmn-ingress-gateway	**7**	5	5	5Gi	5Gi
Site1-ocsepp-pn32c-svc/pn32c-svc	2	2	2	2Gi	2Gi
Site1-ocsepp-pn32f-svc/pn32f-svc	7	5	5	8Gi	8Gi
Site1-ocsepp-sepp-nrf-client-nfdiscovery/nrf-client-nfdiscovery	2	1	1	2Gi	2Gi
Site1-ocsepp-sepp-nrf-client-nfmanagement/nrf-client-nfmanagement	1	1	1	1Gi	1Gi

Resource Footprint for pSEPP

Table 3-4 Resource Footprint for pSEPP

Services	Replicas	CPU Limit Per Pod	CPU Limit Per Pod	Memory Request Per Pod (Gi)	Memory Limit Per Pod (Gi)
Site2-ocsepp-alternate-route/alternate-route	2	2	2	4Gi	4Gi
Site2-ocsepp-appinfo/appinfo	2	1	1	2Gi	1Gi
Site2-ocsepp-cn32c-svc/cn32c-svc	2	2	2	2Gi	2Gi
Site2-ocsepp-cn32f-svc/cn32f-svc	7	5	5	8Gi	8Gi

Table 3-4 (Cont.) Resource Footprint for pSEPP

Services	Replicas	CPU Limit Per Pod	CPU Limit Per Pod	Memory Request Per Pod (Gi)	Memory Limit Per Pod (Gi)
Site2-ocsepp-coherence-svc/ coherence-svc	1	1	1	2Gi	2Gi
Site2-ocsepp-config-mgr-svc/ config-mgr-svc	1	2	2	2Gi	2Gi
Site2-ocsepp-n32-egress-gateway/n32-egress-gateway	**7**	5	5	5Gi	5Gi
Site2-ocsepp-n32-ingress-gateway/n32-ingress-gateway	**7**	6	6	5Gi	5Gi
Site2-ocsepp-nf-mediation/nf-mediation	2	8	8	8Gi	8Gi
Site2-ocsepp-ocpm-config/ config-server	2	1	1	1Gi	1Gi
Site2-ocsepp-performance/ perf-info	2	2	2	4Gi	200Mi
Site2-ocsepp-plmn-egress-gateway/plmn-egress-gateway	**7**	5	5	5Gi	5Gi
Site2-ocsepp-plmn-ingress-gateway/plmn-ingress-gateway	**7**	5	5	5Gi	5Gi
Site2-ocsepp-pn32c-svc/ pn32c-svc	2	2	2	2Gi	2Gi
Site2-ocsepp-pn32f-svc/ pn32f-svc	7	5	5	8Gi	8Gi
Site2-ocsepp-sepp-nrf-client-nfdiscovery/nrf-client-nfdiscovery	2	1	1	2Gi	2Gi
Site2-ocsepp-sepp-nrf-client-nfmanagement/ nrf-client-nfmanagement	1	1	1	1Gi	1Gi

Resource Footprint for cnDBTier

Table 3-5 Resource Footprint for cnDBTier

Services	Replicas	CPU Limit Per Pod	CPU Limit Per Pod	Memory Request Per Pod (Gi)	Memory Limit Per Pod (Gi)
Site1-mysql-cluster-db-backup-manager-svc/db-backup-manager-svc	1	100m	100m	128Mi	128Mi
Site1-mysql-cluster-db-monitor-svc/db-monitor-svc	1	1	1	1Gi	1Gi
Site1-ndbappmysqld/mysqlndbcluster	2	8	8	10Gi	10Gi
Site1-ndbappmysqld/init-sidecar	2	100m	100m	256Mi	256Mi
Site1-ndbmgmd/mysqlndbcluster	2	4	4	10Gi	8Gi
Site1-ndbmgmd/db-infra-monitor-svc	2	100m	100m	256Mi	256Mi
Site1-ndbmtd/mysqlndbcluster	4	10	10	18Gi	16Gi
Site1-ndbmtd/db-backup-executor-svc	4	100m	100m	256Mi	256Mi
Site1-ndbmtd/db-infra-monitor-svc	4	100m	100m	256Mi	256Mi

3.1.2 CPU and Memory Utilization

This section lists the CPU and memory utilization at both site1 and site2 for Consumer SEPP (csepp) and Producer SEPP (psepp).

csepp

Table 3-6 csepp

Microservice/ Container	Pod Count	Overall CPU	Overall Memory
ocsepp-appinfo/appinfo	2	0.05 (2.5%)	0.48 (24%)
ocsepp-cn32c-svc/ cn32c-svc	2	0.01 (0.25%)	0.96 (24%)
ocsepp-cn32f-svc/cn32f-svc	7	12.23 (34.94%)	9.61 (17.16%)
ocsepp-config-mgr-svc/ config-mgr-svc	1	0.01 (0.5%)	0.58 (29%)
ocsepp-n32-egress-gateway/n32-egress-gateway	**7**	15.36 (43.89%)	11.8 (33.71%)
ocsepp-n32-ingress-gateway/n32-ingress-gateway	**7**	12.68 (30.19%)	14.94 (42.69%)
ocsepp-ocpm-config/ config-server	2	0.01 (0.5%)	0.65 (32.5%)
ocsepp-performance/ perf-info	2	0.05 (1.25%)	0.28 (70%)
ocsepp-plmn-egress-gateway/plmn-egress-gateway	7	12.15 (34.71%)	13.05 (37.29%)
ocsepp-plmn-ingress-gateway/plmn-ingress-gateway	7	12.51 (35.74%)	15.96 (45.6%)
ocsepp-pn32c-svc/ pn32c-svc	2	0.01 (0.25%)	0.86 (21.5%)
ocsepp-pn32f-svc/pn32f-svc	7	12.9 (36.86%)	10.38 (18.54%)
ocsepp-sepp-nrf-client-nfdiscovery/nrf-client-nfdiscovery	2	0.01 (0.5%)	0.84 (21%)
ocsepp-sepp-nrf-client-nfmanagement/nrf-client-nfmanagement	1	0 (0%)	0 (0%)
ocsepp-nf-mediation/nf-mediation	2	0 (0%)	1.03 (6.44%)
ocsepp-coherence-svc/ coherence-svc	1	0 (0%)	0.24 (12%)
ocsepp-alternate-route/ alternate-route	2	0 (0%)	0.74 (9.25%)

psepp

Table 3-7 psepp

Microservice/ Container	Pod Count	Overall CPU	Overall Memory
ocsepp-appinfo/appinfo	2	0.05 (2.5%)	0.5 (25%)
ocsepp-cn32c-svc/ cn32c-svc	2	0.01 (0.25%)	1.04 (26%)
ocsepp-cn32f-svc/cn32f-svc	7	10.8 (30.86%)	10.41 (18.59%)
ocsepp-config-mgr-svc/ config-mgr-svc	1	0.01 (0.5%)	0.5 (25%)
ocsepp-n32-egress-gateway/n32-egress-gateway	**7**	15.27 (43.63%)	12.17 (34.77%)
ocsepp-n32-ingress-gateway/n32-ingress-gateway	**7**	12.85 (30.6%)	14.56 (41.6%)
ocsepp-ocpm-config/ config-server	2	0.01 (0.5%)	0.66 (33%)
ocsepp-performance/ perf-info	2	0.06 (1.5%)	0.28 (70%)
ocsepp-plmn-egress-gateway/plmn-egress-gateway	**7**	13.04 (37.26%)	13.1 (37.43%)
ocsepp-plmn-ingress-gateway/plmn-ingress-gateway	**7**	11.86 (33.89%)	16.15 (46.14%)
ocsepp-pn32c-svc/ pn32c-svc	2	0.01 (0.25%)	0.82 (20.5%)
ocsepp-pn32f-svc/pn32f-svc	7	12.38 (35.37%)	9.71 (17.34%)
ocsepp-sepp-nrf-client-nfdiscovery/nrf-client-nfdiscovery	2	0.01 (0.5%)	0.83 (20.75%)
ocsepp-sepp-nrf-client-nfmanagement/nrf-client-nfmanagement	1	0 (0%)	0 (0%)
ocsepp-nf-mediation/nf-mediation	2	0 (0%)	0.96 (6%)
ocsepp-coherence-svc/ coherence-svc	1	0 (0%)	0.25 (12.5%)
ocsepp-alternate-route/ alternate-route	2	0 (0%)	0.72 (9%)

cnDBTier_csepp

Table 3-8 csepp-cndb-spad-perf

Microservice/ Container	Pod Count	Overall CPU	Overall Memory
mysql-cluster/db-backup-manager-svc	1	0 (0%)	0.05 (39.06%)
mysql-cluster/db-monitor-svc	1	0 (0%)	0.36 (36%)
ndbappmysqld/init-sidecar	2	0.01 (5%)	0 (0%)
ndbappmysqld/ mysqlndbcluster	2	0.04 (0.5%)	4.29 (26.81%)
ndbmgmd/db-infra-monitor-svc	2	0 (0%)	0.05 (9.77%)
ndbmgmd/ mysqlndbcluster	2	0.02 (0.1%)	0.06 (0.19%)
ndbmtd/db-backup-executor-svc	4	0 (0%)	0.19 (18.55%)
ndbmtd/db-infra-monitor-svc	4	0.01 (2.5%)	0.1 (9.77%)
ndbmtd/mysqlndbcluster	4	0.13 (0.33%)	59.83 (93.48%)

cnDBTier_psepp

Table 3-9 psepp-cndb-spad-perf

Microservice/ Container	Pod Count	Overall CPU	Overall Memory
mysql-cluster/db-backup-manager-svc	1	0 (0%)	0.06 (46.88%)
mysql-cluster/db-monitor-svc	1	0.03 (3%)	0.33 (33%)
ndbappmysqld/init-sidecar	2	0.01 (5%)	0 (0%)
ndbappmysqld/ mysqlndbcluster	2	0.04 (0.5%)	3.05 (19.06%)
ndbmgmd/db-infra-monitor-svc	2	0 (0%)	0.05 (9.77%)
ndbmgmd/ mysqlndbcluster	2	0.02 (0.1%)	0.05 (0.16%)
ndbmtd/db-backup-executor-svc	4	0 (0%)	0.19 (18.55%)
ndbmtd/db-infra-monitor-svc	4	0.01 (2.5%)	0.1 (9.77%)
ndbmtd/mysqlndbcluster	4	0.12 (0.3%)	59.78 (93.41%)

3.1.3 TPS and DB Statistics

This section lists the TPS (Transactions Per Second) and DB (Database) Statistics for Consumer SEPP (csepp) and Producer SEPP (psepp).

TPS (Transactions Per Second)

Table 3-10 TPS (Transactions Per Second)

TPS	cSEPP	pSEPP
PLMN IGW	15.5K TPS	15.5K TPS
CN32F	15.5K TPS	15.5K TPS
N32 EGW	15.5K TPS	15.5K TPS
N32 IGW	15.5K TPS	15.5K TPS
PN32F	15.5K TPS	15.5K TPS
PLMN EGW	15.5K TPS	15.5K TPS

DB (Database) Statistics

Table 3-11 DB (Database) Statistics

DB Stats	csepp-cndb-spad-perf	psepp-cndb-spad-perf
Read Rate	14.32	13.9
Write Rate	0.25	0.25
Commit Rate	0.82	0.73

csepp: NF Service Latency

Table 3-12 csepp: NF Service Latency

NF Service Latency	Min.	Max.	Avg.
GW(T2) (s)	0.006	0.007	0.006
pn32f(T3) (s)	0.01	0.02	0.012
cn32f (T4) (s)	0.4	0.63	0.51
EGW(T5) (s)	0.06	0.062	0.061
Procedural Latency(Perfgo)(T1) (s)	NA	NA	0.068

psepp: NF Service Latency

Table 3-13 psepp: NF Service Latency

NF Service Latency	Min.	Max.	Avg.
IGW(T2) (s)	0.006	0.01	0.006
pn32f(T3) (s)	0.02	0.029	0.01
cn32f (T4) (s)	0.4	0.65	0.52
EGW(T5) (s)	0.059	0.062	0.06

Table 3-13 (Cont.) psepp: NF Service Latency

NF Service Latency	Min.	Max.	Avg.
Procedural Latency(Perfgo)(T1)(s)	N/A	N/A	0.068

3.1.4 Results

PerfGo Avg Latency

csepp: 0.068s

psepp: 0.068s

Call Success

csepp: 100%

psepp: 100%