TANZANIA COMMUNICATIONS REGULATORY AUTHORITY

Guidelines on Core Network Elements Performance

ISSUED BY TCRA – JULY 2024

GUIDELINES ON CORE NETWORK ELEMENTS PERFORMANCE

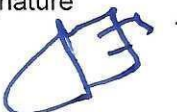Document No: TCRA/DIA/TIM/GUD-CNE/003

Approved by	Title	Signature	Date
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PART I
PRELIMINARY PROVISIONS

1.0   Citation

These guidelines may be cited as Core Network Element performance guidelines, 2024.

2.0   Application

These Guidelines apply to Mobile Network Operators (MNOs) offering mobile services not limited to voice, data and Short Messages (SMS) and Internet Service Providers (ISPs) providing internet services in Tanzania.

3.0   Objectives

The objective of these guidelines is to ensure that consumers can access various communication services provided over various infrastructures deployed by service providers.

3.1   Specific Objectives

The specific objectives of these guidelines include: -

i.   To ensure that service providers can deliver reliable services with minimum service interruptions;

ii.   To enable assessment of the performance level of the core network elements; and

iii. To enable service providers to provide and maintain an acceptable level of quality of service in the face of various challenges to normal operation by providing mitigation measures against failure and reducing the impact of an adverse event on network service delivery.

4.0   Interpretations

For these guidelines, unless the context requires otherwise: -

"Authentication Centre" means a network element responsible for storing subscribers' security-related information for authentication and ciphering;

"Authority" means the Tanzania Communications Regulatory Authority established under the Tanzania Communications Regulatory Authority Act No.12 of 2003;

"Busy Hour" means 60 minutes in a day, during which a communications network experiences its peak traffic;

"Capacity License" means a license installed on a core network and whose usage is restricted to a certain capacity;

"Charging System" means a platform comprised of an Online Charging System and/or an Offline Charging System;

"Online Charging system" means a platform which performs real-time credit control including transaction handling, rating, online correlation and management of subscriber accounts/balances;

"**Offline Charging System**" means a platform that collects and processes offline charging information (CDRs) for billing purposes;

"**Critical Outage**" means service interruption resulting from malfunction of a network element(s) and affecting service provisions to subscribers for more than 15 minutes;

"**Core Router/Switch**" means a router or switch to which a Core Network (CN) element is connected;

"**Diameter Routing Agent**" means a functional element for routing Diameter signaling to several network elements;

"**Equipment Identification Register**" "in its acronym EIR" means an electronic database which holds unique pairs of phone numbers and IMEIs or ESNs in the form of three colour lists as available within the infrastructure of the network service licensee;

"**ENUM**" means a network element which enables translation of E.164 numbers to SIP URIs (Session Initiation Protocol Uniform Resource Identifiers) using DNS (Domain Name System) to enable message routing of IMS sessions;

"**Gateway GPRS Support Node**" means a network element which connects a 2G or 3G mobile user to external Packet Data Networks;

"**Home Location Register**" means a master database for a given 2G or 3G user containing the subscription-related information to support the network entities handling calls/sessions;

"**Home Subscriber Server**" means a master database that contains subscriber profiles for LTE and IMS subscribers. It supports authentication, authorization and mobility management functions;

"**Interrogating Call Session Control Function**" means a session controller responsible for onward routing of SIP messages to the appropriate S-CSCF (Serving CSCF) for a given VoLTE subscriber;

"**Maintenance window**" means a period from 0000 hrs to 0400 hrs during which the planned maintenance that could disrupt services may be performed;

"**Media Gateway**" means a circuit-switched core network element that is controlled by the mobile switching server (MSS) to terminate bearer channels from a circuit-switched network and media streams from a packet network;

"**Mobility Management Entity**" means a key control network element for the LTE network responsible for mobility management and bearer establishment and authentication (in conjunction with the HSS);

"**Mobile Switching Centre Server**" means a circuit-switched (CS) core network element that handles all call control and mobility functions. As such, it is responsible for the control of mobile-originated and mobile-terminated circuit-switched domain calls. It also contains the VLR database that stores subscriber data. The MSS also performs connection control for media channels in a CS Media Gateway;

"Policy Charging and Rules Function - PCRF" means a network element that provides policy control decisions and flow-based charging controls. The PCRF determines how a service data flow will be treated in the enforcement function and ensures that the user plane traffic mapping and treatment is in accordance with the user profiles;

"Packet Data Network Gateway" means a network element that provides connectivity between the user equipment (UE) and external packet data networks. It provides the entry and exit point of traffic for the UE;

"Proxy Call Session Control Function" means a SIP proxy that is the first point of contact for session signaling for the IMS-enabled VoLTE UE;

"Scheduled maintenance" means planned changes carried out in the core network elements involving configuration changes or software/hardware upgrades;

"Session Border Controller" means a device deployed by service providers to control SIP sessions and media resources for VoIP calls. It is used to hide the internal network topology of the service provider when connecting to external networks;

"Service Provider" means a licensed communications service provider;

"Serving Call Session Control Function" means a session controller that provides session set-up, session tear-down, session control and routing functions;

"Serving GPRS Support Node" means a network element responsible for the delivery of data packets from and to the mobile stations within its geographical service area. Its tasks include packet routing and transfer, mobility management (attach/detach and location management), logical link management, and authentication functions;

"Serving Gateway" routes and forwards user data packets, while also acting as the mobility anchor for the user plane during inter-eNodeB handovers and as the anchor for mobility between LTE and other 3GPP technologies;

"Short Message Service Centre" means a network element that stores, forwards, and delivers SMS messages to mobile network users;

"Signaling Transfer Point" means a network element responsible for transfers of SS7 messages between interconnected nodes (signaling endpoints) based on information contained in the SS7 address fields;

"Telephony Application Server" means an IMS Application Server providing support for a minimum set of mandatory Multi-Media Telephony (MMTel) services;

"Unstructured Supplementary Services Data Gateway" means a platform responsible for handling USSD sessions between a subscriber and a particular service application;

PART II

PERFORMANCE REQUIREMENTS

5.0   Performance Requirement for Core Network Elements

A licensee will ensure that all CN elements meet the availability target of 99.99% (excluding scheduled maintenance). Other minimum requirements and performance specifications for the optimal operation of the CN elements will be as follows: -

5.1   MSS

Performance Indicator	Requirements
Redundancy	The MSSs may be configured in an MSS POOL as specified in 3GPP TS 23.236
BHCA utilization	The BHCA utilization of the MSS need not to exceed 80%
VLR capacity utilization	The VLR database need not to exceed 80% utilization
Average CPU load	The average CPU load of computer units need not to exceed 80%
Memory usage	The memory usage for all computer units needs to be below 90%
Capacity License utilization	The utilization of all capacity licenses need not to exceed 80%
Disk Utilization	The disk utilization need not to exceed 90%
MSRN utilization	The utilization of the MSRN pool need not to exceed 90%

5.2   MGW

Performance Indicator	Requirements
Redundancy	In case the NNSF function is in the MGW, the MGWs may be clustered as per RFC 4666
BHCA utilization	< 80%
Average CPU load	The average CPU load of signaling units and media processing units need not exceed 80% and 85%, respectively
Memory usage	< 90%
Capacity License utilization	< 80%
SS7 average link load	The average link load of SS7 links need not exceed 0.2 Erlangs (40%) during off-peak hours and 0.4 Erlangs (80%) during busy hours
H.248/GCP context reservation success rate	> 99%
Disk utilization	< 80%

5.3 HLR, HSS, AuC & EIR

A layered architecture for the deployment of these CN elements is recommended. These network elements will meet the following performance requirements: -

Performance Indicator	Requirements
FE Redundancy	>= N+1
Centralized DB redundancy	>= 2N
Average CPU load	< 80%
Memory usage	< 90%
Capacity License utilization	< 80%
Disk Utilization	< 80%
Response time	< 100 ms

5.4 SMSC

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Average CPU load	< 80%
Memory usage	< 90%
Capacity License utilization	< 80%
Busy Hour utilization	< 80%
Disk Utilization	< 80%

5.5 STP & DRA

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Average CPU load	< 80% for MSU and Diameter processors
Memory usage	< 90%
Capacity License utilization	< 80%
Busy Hour utilization	< 80%
Disk Utilization	< 80%

5.6 SBC/P-CSCF

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Average CPU load	< 80%
Memory usage	< 90%
Capacity License utilization	< 80%
Busy Hour session utilization	< 80%
Disk Utilization	< 80%
RTP packet loss	< 1% as per 3GPP TS 23.203

5.7   SGSN & MME

The SGSN and MME are usually realized as a single network element and will have the following performance parameters: -

Performance Indicator	Requirements
Redundancy	>= 2N or N+1 or SGSN/MME POOL as per 3GPP TS 23.236 and 3GPP TS 23.401
Average CPU load	< 80%
Memory Utilization	< 90%
Attached subscriber capacity	< 90%
Maximum active PDP context or EPS bearer contexts	< 80%
Disk Utilization	< 80%
GN Interface Utilization	< 80%

5.8   GGSN, P-GW & S-GW

The GGSN, P-GW and S-GW can also be realized as a single network element and as such, will have the following performance requirements: -

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Average CPU load	< 80%
PDP context resources or EPS bearer context usage	< 80%
Disk Utilization	< 80%
Gi Interface Utilization	< 80%

5.9   PCRF

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Peak Hour TPS (Throughput)	< 80%
Average CPU load	< 80%
Memory Utilization	< 90%
Disk Utilization	< 85%

5.10   CHARGING SYSTEM

Performance Indicator	Requirements
Redundancy	2N
Busy-Hour Utilization	< 80%
Average CPU load	< 80%
Memory Utilization for rating and charging nodes	< 90%
Capacity License Utilization	< 80%
Disk Utilization for rating and charging nodes	< 80%
Response Time for rating and charging nodes	< 100 ms for busy hour period

5.11 S-CSCF/I-CSCF

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Busy Hour Session Utilization	< 80%
Average CPU load	< 80%
Memory Utilization	< 90%
Disk Utilization	< 80%

5.12 TAS

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Busy Hour Utilization	< 80%
Average CPU load	< 80%
Memory Utilization	< 90%
Disk Uutilization	< 85%

5.13 ENUM/DNS

Performance Indicator	Requirements
Redundancy	>= 2N or N+1
Busy Hour Query Throughput	< 90%
Average CPU load	< 80%
Memory Utilization	< 90%
Query Response Time	< 100 ms
Disk Utilization	< 85%

5.14 USSD GW

Performance Indicator	Requirements
Redundancy	>=2N or N+1
Busy Hour Query Throughput	< 80%
Average CPU load	< 80%
Memory Utilization	< 90%
Query Response Time	< 100 ms
Disk Utilization	< 85%

5.15 CORE ROUTERS/SWITCHES

Performance Indicator	Requirements
Redundancy	>=2N
Interface availability	> 99.95%
Interface usage	< 80%
Average CPU load	< 80%
Memory Utilization	< 90%
Packet Loss	< 1%

5.16 MOBILE MONEY PLATFORM

Parameter	Requirements
Redundancy	>=2N
Average CPU load	< 80%
Memory Utilization	< 90%
Response time	< 100 ms
Busy hour throughput	< 80%

PART III

REQUIREMENT FOR MAINTENANCE

6.0   Preventative Maintenance

The preventative maintenance is the regular and routine maintenance of equipment to keep it running and prevent any unplanned downtime from unexpected network/equipment failure. A service provider will: -

i.   Perform health check of the CN elements daily;

ii.   Perform preventive maintenance regularly without interfering with normal operations of the CN elements;

iii.   Ensure that all CN elements are continuously monitored to detect faults or anomalies; and

iv.   Take a backup of the CN elements and keep at least one copy of the backup off-site.

7.0   Outages

The following procedures are applicable in handling major service interruptions resulting from malfunction of CN elements: -

7.1   Outages from Scheduled Maintenance

Where service interruption is expected to occur from scheduled maintenance, the following will be considered: -

i.   Issue advance notice to customers 48 hours before carrying out the activity;

ii.   Carry out the maintenance activities within the maintenance window;

iii.   Notify the Authority in writing at least 72 hours before the planned service affecting maintenance; and

iv.   Clearly state the affected services, area, impact and duration of the outage.

7.2 Critical Outages

Where a critical outage has occurred, the following will be considered: -

i. Notify the Authority within three (3) hours of the outage, stating the affected services, service areas, number of subscribers, impact and expected duration of service restoration;

ii. Notify the affected subscribers of the outage after its restoration;

iii. Continue to provide updates to the Authority every three (3) hours providing details on progress in service restoration; and

iv. Within 48 hours of service restoration, provide the Authority with a formal report with details on the root cause of the failure, the observed impact, the actions taken to remedy the situation and measures taken to prevent the same from happening again.

8.0 Amendment

These guidelines may be reviewed from time to time by the Authority as deemed fit.

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