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PROFESSIONAL ABRIDGEMENT

- An accomplished technology professional with more than 14 years of experience in the field of telecom technologies like 5G Core (AMF, SMF, UPF, UDM, UDR, NRF), 4G(ENB, EPC), 5G NR GNB and private 4G and 5G networks on Nokia cloud and edge platform

PROFESSIONAL SUMMARY

- **14+ years** of extensive professional experience in **5G** and **LTE(4G) Core and Radio protocol testing.**
- Effectively leading a team of 10 members
- Currently Working in **Nokia Networks India Private Limited** on **NDAC** Private **5G (AMF, SMF, UPF,UDM,UDR,NRF)** and **LTE(MME,SGW,PGW,PCRF,HSS)** Core with Docker, Kubernetes(K8s)
- Strong working experience in testing various interfaces in **5G core (N1, N2, N3, N4, N6, Namf, Nsmf, Nausf, Nudm, Nnrf)**
- Strong working experience in testing various interfaces in **4G core (S1-MME, S11, S10, S6a, M3, Sm, S3, SGS, GNGP, S5, S8, Gx, Gy, Gz, Sgmb, Slg, Sls)**
- Extensive working experience in **5G NAS, NGAP, PFCP, HTTP2, GTP** protocols and procedures
- Extensive working experience in **4G NAS, S1AP, X2AP, GTPv2, GTPv1, Diameter, LCSAP, M3AP, DNS, SGSAP** protocols and procedures.
- Working experience in Testing different 5G and 4G network functions on the **cloud native platform** using the latest technologies including **Kubernetes, Docker.**
- Worked in **Radisys India Pvt Ltd** as **SVT** engineer in **5G NR GNB NSA** and **SA** mode testing
- Strong experience in bringing up the **5G NR GNB-CU** pod in cloud environment using **Kubernetes(K8s), Dockers** and **Container** orchestration.
- Worked in **Nokia Networks India Private Limited** in **5G NR GNB NSA** mode and Multi standard **ENB/Femto** Testing.
- Good experience on LTE & 5G **PHY, MAC, RLC, PDCP, SDAP, RRC** protocols
- Experience on Mobility scenarios like **measurements, cell reselection and handover** scenario etc
- Worked in **Samsung research Institute** and **Cisco Systems India Pvt Ltd** in **EPC (MME, SGW, PGW)** testing.
- Extensive Work Experience in **VoLTE**, Inter-Rat Handovers and Inter-working procedures
- Strong working expertise in **LTE eMBMS**, **4G CUPS, LCS** procedures**.**
- Certified from **ISTQB** (International Software Testing Qualifications Board) and **ITB** (Indian Testing Board) as foundation level test engineer.

- Extensively involved in Functional, System Integration, Regression and Interoperability testing.
- Worked in Cisco ASR series Broadband Service Routers like **ASR5000, ASR5500,** Samsung EPC Hardware and **Nokia AirFrame and Airscale (ASIK, ABIK, ABIL)** hardware.
- Received **Nokia Appreciate Excellence Award** multiple times for my contribution to **5G core and Radio testing.**
- Awarded with **Cisco STAR and Cisco Achievement Program** Award for effective testing of **Inter-Rat Handovers** like SRNS, TAU and RAU procedures in MME
- Received **Samsung Spot Award** for effective testing of **Location Services** feature in MME.
- Strong working experience in **IXIA IxLoad**, **Spirent iTest, Lattice** tools and traffic analyzer like **Wireshark**
- Good experience in **HP Quality Center** and **IBM Clearquest** tools.

PROFESSIONAL EXPERIENCE:

14+ years of experience in **5G & LTE** wireless protocol testing

- **Nokia Networks India Private Limited, Bangalore**: Currently working as System Verification Lead for Nokia Digital Automation Cloud (NDAC) private 5G & LTE core since November 2020

- **Radisys India Private Limited, Bangalore**: Worked as Lead Engineer for 5G NR GNB System Verification Team from April 2019 till October 2020

- **Nokia Networks India Private Limited, Bangalore:** Worked as Test Engineer for 5G GNB & 4G ENB System Verification Team from October 2015 till March 2019

- **Samsung Research Institute, Bangalore:** Worked as Lead Engineer for EPC (MME, SGW, PGW) System Verification Team from March 2014 till September 2015

- **Cisco Systems India Private Limited, Bangalore:** Worked as Software QA Engineer for MME System Verification Team from July 2011 till March 2014

- **CSC India Private Limited, Bangalore:** Worked as Engineer for MME System Verification Team from September 2010 till June 2011

EDUCATION

Qualifications	*Percentage*
M.Tech (Networking & Communication) (2008-2010)	**82.25%**
B.E (E.C.E) (2004-2008)	**85.5 %**

TECHNICAL SKILL SET

Protocols (Core and Radio)	5G SA (NAS, NGAP, GTP, SCTP, HTTP2-JSON, PFCP) LTE EPC (NAS, S1AP, S6a, M3AP, Sm, GTPv2(S11, S5, S10, S2b, S1U)) LTE-UE and eNodeB (NAS, PDCP, ROHC, RRC, RLC), SNMP, 4G CUPS, NAT, DNS, DHCP, L2/L3protocols.
Hardware	Cisco ASR 5000, ASR 5500, Samsung EPC, Nokia AirFrame and Airscale (ASIK, ABIL,ABIK), HP EL-1000, Dell XR11, HP DL-110
Programming Languages	Python
Automation Framework	ROBOT
Network Analyzer	Wireshark, QXDM, QCAT
Operating Systems	Linux, Windows
Tools	Spirent iTest, Lattice (LFS and LPS), SDC simulator and other Simulators for PCRF, OCS, CG, BMSC, Airphone Simulator, PRISMA, HP Quality Center, IBM Clearquest, Polaris EPC, Amarisoft MME & UE simulator, Ixia IxLoad, Iperf, Spirent Landslide,MegaD
Cloud Technologies	Kubernetes service cluster, LaaS (Lab as service), OpenStack, testing different 5G/4G network functions on the cloud native platform using Kubernetes and Dockers, Kibana, Yaml, Grafana, Prometheus, Cassandra DB
Bug Tracking and Test Tools	JIRA, Confluence, IBM Clearquest, CDETS, TIMS, Starent Network Test Database, HP Quality Center
OAM	KPI, Alerts, Alarms, Bulk Stats

PROJECTS SUMMARY

Project 1   **: NDAC private 4G and 5G Core**
Location   **:** Nokia Networks India Pvt Ltd
Duration   **:** Nov'20 to present
Team Size   **:** 10

Features Worked:
1. **Routing behind UE (RBUE) in 5G SA and 4G CUPS**
   Responsibilities:
   - ➢ Bring up of RBUE setup in 5G SA and 4G CUPS in cloud environment using Kubernetes and Dockers
   - ➢ Verification of RBUE attach and DL/UL data transfer to RBUE subnets
   - ➢ Verification of behavior in case of failover scenarios like pod restarts etc
   - ➢ Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification
2. **Multi PDU session establishment in NDAC Private 5G core**
   Responsibilities:
   - ➢ Bring up of 5G SA NDAC core setup in cloud environment using Kubernetes and Dockers
   - ➢ Verification of Multi PDU session establishment with multiple QOS flows (non-GBR)
   - ➢ Verification of throughput on the QOS flows
   - ➢ Verification of behavior in case of failover scenarios like pod restarts etc
   - ➢ Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification
3. **Network Slicing in 5G**
   Responsibilities:
   - ➢ Bring up of 5G SA NDAC and Radio setup in cloud environment using Kubernetes and Dockers with network slices
   - ➢ Verification of 5G UE Registration and PDU session establishment with slice
   - ➢ Verification of Slice addition,deletion and updation scenarios
   - ➢ Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification
4. **5G QOS Flows**
   Responsibilities:
   - ➢ Bring up of 5G SA NDAC and Radio setup in cloud environment using Kubernetes and Dockers
   - ➢ Verification of 5G UE PDU session establishment with multiple qos flows and UL/DL throughput on all the qos flows
   - ➢ Verification of qos flows addition,deletion and updation scenarios
   - ➢ Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification

Project 2   **: 5G NR NodeB (5GNB) NSA and SA mode Testing**

Location   **:** Radisys India Pvt Ltd

Duration   **:** Apr'19 to Oct'20

Team Size   7

Features Worked:

1. **MeNB initiated SgNB Addition, Modification, release and Change procedures:**
   Responsibilities:
   - Bring up of 5G NodeB to achieve x2 link and cell setup in Non-Standalone Mode 3x, 3a and 3 Options
   - Verification of Non-Standalone (NSA) call and SGNB addition procedure
   - Verification of SgNB addition, Modification, release and Change procedures in various NSA options like 3, 3a and 3x.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.

2. **Bandwidth Part (BWP) in 5G:**
   Responsibilities:
   - Configuring and testing of multiple BWP in 5G NSA and SA modes
   - Verification of multiple BWP in various NSA options (3,3a,3x)
   - Verification of BWP switch
   - Verification of multiple BWP in sub6ghz and mmwave DU. (mu=0, mu=1, mu=3)
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.
   - Log analysis using QXDM and QCAT

3. **Link Adaptation:**
   Responsibilities:
   - Verification of PRB and MCS allocation by GNB scheduler on varying CQI values in sub6ghz and mmwave DU. (mu=0, mu=1, mu=3)
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.

Project 3   **: 5G NR NodeB (5GNB) NSA mode Testing**
Location   **:** Nokia Networks India Private Limited
Duration   **:** Oct'17 to Mar'19
Team Size   17

Features Worked:
1. 5G NR NodeB Non-Standalone (NSA) Call:
   Responsibilities:
   - Bring up of 5G NodeB to achieve x2 link and cell setup in Non-Standalone Mode 3x Option
   - Verification of SGNB addition and RACH procedure in NSA
   - Verification of DL/UL throughput in NSA 3x option
   - Verification of Non-Standalone (NSA) call with third party simulator PRISMA
   - Verification of SGNB Release procedures in NSA mode of operation
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.

Project 4   **: 3GPP Multi Standard (3G & 4G) Femto/Small Cell Testing**
Location   **:** Former Alcatel-Lucent India Private Limited (now Nokia Networks India Pvt Ltd)
Duration   **:** Oct'15 to Oct'17
Team Size 11

Features Worked:

1. Intra and Inter Freq Handovers in LTE:
   Responsibilities:
   - Verification of measurement gaps and Inter Freq handovers in Femto.
   - Verification of Intra Frequency handovers with different RLC UM and AM configuration
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.
   - Log analysis using QXDM and QCAT

2. LTE Carrier Aggregation:
   Responsibilities:
   - Verifying throughput with different CA band combinations of 2CC,3CC
   - Verifying RRC connection reconfiguration messages with respective serving cell.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification.
   - Log analysis using QXDM and QCAT

Project 5   **: 3GPP EPC- Mobility Management Entity (MME) Testing**
Location   **:** Cisco Systems India Private Limited
Duration   **:** Jul'11 to Mar'14.
Team Size   25

Features Worked:

1. **Inter-Rat Handovers SGSN, MME<->MME:**
   Responsibilities:
   - Testing of Inter RAT handovers with and without SGW change and IDFT for MME
   - Testing of Inter MME handovers, 3G to 4G TAU, 4G to 3G RAU, SRNS handovers.
   - Testing of various collision scenarios with respect to Inter-Rat Handovers.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification and Automation.

2. **Topology/Colocation based PGW/SGW pair and SGSN selection and fallback using DNS:**
   Responsibilities:
   - Testing of Topology/Colocation based PGW/SGW pair selection in various procedures like Attach, Handover and TAU with SGW change.
   - Testing of SGSN selection and different fallback mechanisms using DNS in 3G to 4G Attach/TAU and 4G to 3G SRNS handover procedures
   - Testing of behavioral changes between Gn and S3.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification and Automation

3. **Circuit Switch Fallback (CSFB):**
   Responsibilities:
   - Testing various call flows of CSFB like Combined Attach, Combined TAU, MO/MT Voice and SMS
   - Testing of various collision scenarios with respect to CSFB call flows.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification and Automation.

4. **Session tracing:**
   Responsibilities:
   - Testing of Management (MME) initiated trace activation and signaling (HSS) initiated trace activation across different interfaces like S11, S6a, and S1.
   - Testing the generation and transfer of trace xml file.
   - Testing of trace using IMSI and IMEI for various interfaces.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification

Project 6   **: 3GPP EPC-Evolved Packet Core (MME,SGW,PGW) Testing**
Location   **:** Samsung Research Institue Bangalore (SRI-B)
Duration   **:** Mar'14 to Sep'15
Team Size   15

Features Worked:

1. **Location Services (LCS):**
   Responsibilities:
   - Testing of Mobile Origination Location Reporting (MO-LR), Mobile Terminating Location Reporting (MT-LR), Network Induced Location Reporting (NI-LR) procedures.
   - Testing of LCS procedures with different positioning protocols like LPP, LPPa
   - Testing of various location services procedures with IMSI, MSISDN, IMEI and different LCS Qos and priorities.
   - Testing of various collision scenarios with respect to Location services and Normal LTE procedures.
   - Test strategy planning, Test case preparation, Execution, Feature reviews, Raising Defects, Verification and Automation.

2. **Dedicated Bearer Creation, Updation, Deletion and QoS Throttling using static and Dynamic Rules:**
   Responsibilities:
   - Testing of Dedicated bearer Creation, Updation, Deletion by triggering Re Auth Request (RAR) from PCRF.
   - Testing of Dedicated Bearer Creation, Updation, Deletion by sending Rule Names, RuleBase, Dynamic rule from PCRF.
   - Testing of Bearer creation by configuring PCC rules in PGW (Static)
   - Flow control testing by enabling and disabling Flow Status in PCC rules.
   - Flow testing using IP, Port configured in PCC rules.
   - DPI testing of various applications

3. **Evolved Multimedia Broadcast Multicast service (EMBMS) and restoration:**
   Responsibilities:
   - Testing of eMBMS session start, update and stop procedure.
   - Testing of eMBMS restoration procedures
   - Testing of eMBMS procedures with Nonstandard QCI values.