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Radio Access Network Configuration Of A Huawei Node B (3g Site)

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Abstract- The scripting and configuration of the Radio Access Network (RAN) are essential for integration and maximizing the functionality and performance of a telecommunication site. The effective use of radio resources is ensured by the right configuration of RAN parameters, leading to better coverage, higher throughput, and improved call quality. This paper presents a guide to RAN scripting to configure a Huawei Node B with the nomenclature "UABJ447", our main focus is on BSS parameters required for RAN configuration and scripting, taking into account the various configurations IPs and their functionalities. The command prompts employed demonstrate the use of Huawei manager U2000 and M2000 for RAN configuration. The presented methodology provides RAN engineers with a practical approach to RAN scripting and configuration of Huawei Node B, resulting in enhanced network performance and user experience.

Keywords- Radio Access Network (RAN), Huawei Node B, Radio resources.

I.INTRODUCTION

The Huawei Node B is a widely used equipment for RAN configuration, and its configuration plays a significant role in network performance. The advancement of wireless communication technology has evolved significantly over the past 50 years[1] Radio Access Network (RAN) scripting and configuration are crucial components in the design and deployment of a 3G wireless network.
The scripting and configuration of a Huawei 3G site is a complex task that requires specialized skills and knowledge. The RAN script is a set of commands and parameters that define the behavior of the Huawei **Node B** and its interaction with other network elements. The configuration process involves setting up the network parameters to ensure optimal performance and coverage.

The aim of the paper is to document and explore the scripting and configuration of a Huawei 3G site (UABJ447), with a focus on some important parameters as required for efficient utilization of radio access network resources. The paper will begin with review of relevant literature, which will be followed by overview of the 3G Network, hardware requirement, scripting and configuration of parameters, some basic Huawei commands and scripting. The paper will conclude with recommendations for future research thereby contributing to the understanding of RAN scripting and configuration of a **Node B**.

II.LITERATURE REVIEW

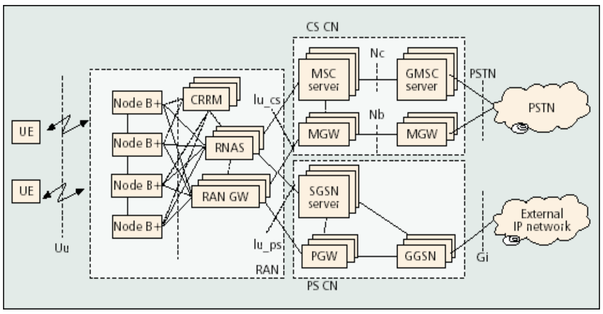

Figure 1: UMTS Network Architecture [9]

The paper titled "Advanced Site Configuration Techniques for Automatic UMTS Radio Network

Design" by G. J. Foschini, P. J. McLane, and H. N. Yee, published in the 2005 IEEE 61st Vehicular Technology Conference (VTC) proceedings, discusses the use of advanced site configuration techniques for the automatic design of Universal Mobile Telecommunications System (UMTS) radio network. The authors suggest that advanced site configuration techniques can help overcome these challenges of interference, radio coverage as well as enhancing network design as referenced in [2]

In the paper "UMTS configuration planning Base station configuration and power budget" by Jarkko Itkonen and Risto Jurva discusses the configuration planning of Universal Mobile Telecommunications System (UMTS) base stations, providing a comprehensive analysis of UMTS network planning, with a focus on base station configuration and power budgeting as referenced in [3] .

II.OVERVIEW OF THE 3G NETWORK

A 3G network [4] refers to a third-generation cellular network that provides mobile internet access and faster data transmission compared to the previous 2G network. NTT DoCoMo introduced the first 3G network in Japan in 2001, and due to its rapid data transfer speeds, it immediately gained popularity[5].
According to the International Telecommunication Union (ITU)[6], 3G is defined as "a wireless communication technology that provides high-speed voice, data, and multimedia services to mobile devices[5]." 3G networks were designed to provide higher data transfer rates, improved voice quality, and increased network capacity compared to 2G networks [6]

Architecture of the 3g Network
The 3G network architecture consists of three primary parts: the Radio Access Network (RAN), the Core Network (CN), and the User Equipment (UE)[7]. Node B is the name of the base that can operate in dual mode, TDD, or FDD mode[8]. The RAN, which includes the RNC and Node B, manages the wireless connection between the UE and the CN [1]. , allowing for voice and data traffic to be transmitted and received across the network. The CN serves as the backbone of the 3G network, offering services such as call routing, mobility management, and packet routing. It consists of various components such as the SGSN, VLR, and HLR. The Iub interface connects a Node B and an RNC, while the Iur logical link connects two RNCs. Figure 1 provides a logical representation of the network architecture.

Hardware Requirement for Node-b (UABJ447) RAN Configuration
In general, as an important requirement, a Node B consists of several hardware components that work together to enable the transmission and reception of wireless signals.

1.Base Band Unit (BBU):
The Base Band Unit (BBU)[10] performs the primary function of processing baseband signals, which carry user data, between the NodeB and the Radio Network Controller (RNC).

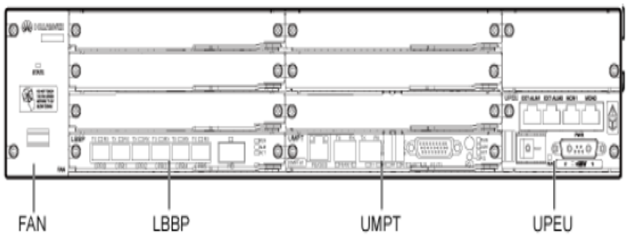

Figure 2: BBU3910

2.Universal Main Processing and Transmission Unit (UMPT)
The universal main processing and transmission unit[11] serve as a main control board. It performs the function of Processing voice and Data traffic, transmitting the traffic over the network, provision of network control functions etc. A Huawei UMPTb1 was installed and configured.

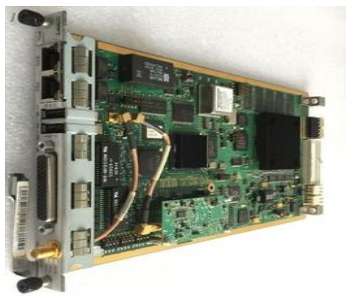

Figure 3: Huawei Umpt B1 Card

1.Universal baseband processing unit (ubbp) the baseband processing board performs the function of multiplexing baseband resources among different modes thereby supporting multimode concurrency, providing cpri ports for communication with rf modules and processing uplink and downlink baseband signals. in uabj447 two (2) ubbpd2 boards were configured in umts single mode each with uplink and downlink ce 512 and 768.

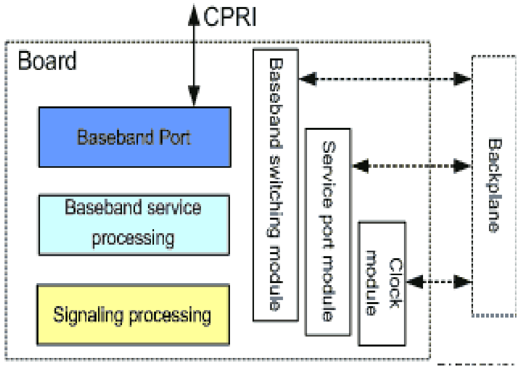

Figure 4: principle of operation of ubbp ce card

1.Remote radio unit (RRU)

the RRU constitute the radio frequency (rf) part of a base station. for the base station in our work UABJ447, the RRU was installed on a mast, close to antennas in order to shorten the feeder length, reduce feeder loss, and improve system coverage provide the functions of modulating and demodulating baseband signals and rf signals, processing data, amplifying power and detecting standing waves. one RRU= 4tx + 4rx. in the 3g, 900mhz, the configuration is 2 transmit, 2 receive (2tx , 2rx)

2.Processes Involved in The Configuration and Integration of a Node B

The configuration procedure often involves a series of steps, some of which are listed below:

- Site survey and design: This entails performing a site survey and designing the site's network to determine the site's coverage and capacity needs. Network optimization department
- Installation and commissioning: This entail the civil works, setting up the network hardware physically and running preliminary tests to make sure everything is working as it should.
- Network configuration: This involves setting up the various network parameters on the Node and RNC by the RAN Engineer
- Integration and testing: This involve integrating network components with other systems and carrying out a final test to make sure the network is operating properly.
- Routine maintenance: This entails keeping an eye on the functioning of the network, making necessary adjustments to network settings, and carrying out routine maintenance procedures to keep the network up and running.

Configuration of Parameters

BSS parameters in Table 1 were configured as issued by Network planning

Table -1: Configured BSS parameters

Sector Name	Downlink Uarfcn	Uplink Uarfcn	Sac	Local Cell Id	Psc
S1	10613	9663	17041	1017041	351
S2	10613	9663	17042	1017042	367
S3	10613	9663	17043	1017043	383
S4	10638	9688	17044	1017044	351
S5	10638	9688	17045	1017045	367
S6	10638	9688	17046	1017046	383

•

Other configured BSS Parameters include:

RNC ID = 130, LAC= 1500, RAC = 150, MCC = 621, MNC = 50

Transmission Parameters for UABJ447

Node B IP address: This is the IP address assigned to the Huawei Node B for communication with other network elements. The IP 10.143.178.28 was configured.

NODE B Management IP Address: This is the supervision IP of the site. 10.143.178.29 was configured on the Node B.

NEXT HOP IP: This is the gateway IP of the Node B. 10.143.178.1 is configured on the Node B

Other IP addresses configured include RNC IP address: This is the IP address of the Radio Network Controller (RNC) that manages the Huawei Node B, DHCP server IP address which is the IP address of the Dynamic Host Configuration Protocol (DHCP) server, NTP server IP address which is the IP address of the Network Time Protocol (NTP) server, which synchronizes the time across network devices.

Configuration of Neighbor Relations.

Accurate configuration of neighbor relation is important for cell handover and reselection [12]. An ongoing connection could be lost or transferred to the incorrect neighbor cell as a result of incorrect or absent neighbor relations. Missing neighbors also result in unnecessary poor signal to noise ratio.

Below is the list of some neighbors as defined in the configuration.

(a) UMTS INTRA-FREQUENCY NEIGHBORS: Intra-frequency neighbors are used for cell reselection, soft handover, softer handover and intra frequency hard handover.

MMLCommand: ADD UINTRAFREQNCELL. i.e., when the above command is imputed for one of the

Neighbors of UABJ447_S1, the following variables are also required:
RNC ID of Cell=130; RNC ID of Neighboring Cell=130; CELL ID= 17041; CELL ID of Neighboring Cell=17045

(b) UMTS INTER-FREQUENCY NEIGHBORS: These are 3G cells on a different frequency than the serving cell.MML command: ADD UINTERFREQNCELL.
the following parameters are required: RNC ID of Cell=130; RNC ID of Neighboring Cell=130; CELL ID= 17041; CELL ID of Neighboring Cell=17045

MML SCRIPT:
ADD UINTERFREQNCELL:RNCID = 130, CELLID = 17042, NCELLRNCID = 130, NCELLID = 10575, CIOOFFSET = 0, SIB11IND = TRUE, IDLEQOFFSET1SN = 0, IDLEQOFFSET2SN = 0, SIB12IND = FALSE, TPENALTYHCSRESELECT = D0, HOCOVPRIO = 2, BLINDHOFLAG = FALSE, NPRIOFLAG = FALSE, DRDECN0THRESHHOLD = -18, MBDRFLAG = FALSE, MBDRPRIO = 0, DRDORLDRFLAG = TRUE, INTERNCELLQUALREQFLAG = FALSE, INTERFREQADJSQHCS = 20, CLBFLAG = FALSE, UINTERNCELLSRC = USER, DRDTARGETULCOVERLIMITTHD =15, DYNCELLSHUTDOWNFLAG = FALSE, NCELLCAPCONTAINER = CO_COVERAGE_FLAG-0&BLACKLIST_FLAG-0&ANR_WHITELIST_FLAG-0;

(c) GSM NEIGHBORS: UMTS cells have a GSM neighbor list that specifies the potential GSM cells to which calls can hand over when required. Incomplete and incorrect GSM neighbor lists can cause dropped calls when the 3G network needs to handover to the GSM network because of interference or poor radio conditions. The Huawei MML command used is ADD U2GNCELL.
MML SCRIPT:
ADD U2GNCELL: RNCID = 130, CELLID = 17041, GSMCELLINDEX = 20011, CIOOFFSET = 0, QOFFSET1SN = 0, QRXLEVMIN = -50, TPENALTYHCSRESELECT = D0, TEMPOFFSET1 = D3, BLINDHOFLAG = FALSE, DRDECN0THRESHHOLD = -18, SIB11IND = TRUE, SIB12IND = FALSE, NPRIOFLAG = FALSE, MBDRFLAG = FALSE, MBDRPRIO = 0, SRVCCSWITCH = OFF, INTERRATADJSQHCS = 20, NIRATOVERLAP = FALSE, HOPRIO = 0, U2GNCELLSRC = USER;

Other Configuration Parameters
These are set of commands used by the RAN engineer to configure the network elements of a 3G site. These scripts are essential for the proper functioning of the site, optimizing network performance, and ensuring seamless connectivity for users.
Huawei's iManager M2000 is used to create these scripts. Hundreds of scripts are required to bring up a Node, only few are shown below (1-4)

ADD UNODE B:
ADD UNODE B: LOGICRNCID = 130, NODE BNAME = "UABJ447", NODE BID = 1704, TNLBEARERTYPE = IP_TRANS, TRANSDELAY = 10, SATELLITEIND = FALSE, NODE BPROTCLVER = R9, RSCMNGMODE = SHARE, NODE BTRACESWITCH = ON, HOSTTYPE = SINGLEHOST, SHARINGTYPE = DEDICATED, CNOPINDEX = 0, DSSFLAG = FALSE, AUTOHOMINGFLAG = TRUE, SIGNALCREATETYPE = USER_CREATE, IUBFLEXFLAG = FALSE, NODE BAUTOREDUNDANCYFLAG = FALSE, REMARK = "-";

TO ADD LOCAL CELL;
ADD ULOCELL: LOGICRNCID = 130, IDTYPE = BYID, NODE BID = 1704, LOCELL = 1017041;
TO **ADD CELL BASIC INFORMATION:**
ADD UCELLSETUP:LOGICRNCID = 130, CELLID = 17041, CELLNAME = "UABJ447_S1", MAXTXPOWER = 447, BANDIND = BAND1, CNOPGRPINDEX = 0, UARFCNUPLINKIND = TRUE, UARFCNUPLINK = 9663, UARFCNDOWNLINK = 10613, TCELL = CHIP0, NINSYNCIND = 8, NOUTSYNCIND = 8, TRLFAILURE = 50, DLTPCPATTERN01COUNT = 10, PSCRAMBCODE = 351, TXDIVERSITYIND = FALSE, SPGID = 1, NODE BNAME = "UABJ447", LOCELL = 1017041, LAC = 1500, SAC = 17041, CFGRACIND = REQUIRE, RAC = 150, CIO = 0, VPLIMITIND = FALSE, DSSFLAG = FALSE, DSSSMALLCOVMAXTXPOWER = 430, CCHCNOPINDEX = 255, DPGID = 255, CELLHETFLAG = FALSE, NEEDSELFPLANFLAG = FALSE, REMARK = "-", SPLITCELLIND = No_SplitANT, CELLCOVERAGETYPE = Outdoor, FLEXUEGROUPNETLAYERID = 255;

To Add Neighboring Lte Cell;
ADD ULTENCELL: RNCID = 130, CELLID = 17041, LTECELLINDEX = 11481, BLINDFLAG = FALSE, ULTENCELLSRC = USER;

RECOMMENDATION

It is highly recommended for the incorporation of automatic fault management functions such as Self-Organizing Networks (SON) for the purpose of self-configuration, self-optimization, and self-healing functions by Huawei and other telecom vendors for enhancing operation and minimizing costs in future networks.

RAN engineers face difficulties in identifying and fixing faults due to the inaccuracy of some alarms in identifying the exact probable cause. Some faults occur without triggering system alarms due to incorrect parameter configurations. A more intelligent system can reduce downtime caused by such failures.

V.CONCLUSION

In conclusion, the Node B's Radio Access Network (RAN) configuration is important for the effective operation of a mobile network, and it involves setting parameters that determine how the Node B connects with User Equipment (UE) and the main network. The configuration must be optimized to provide optimal network performance in terms of coverage, capacity, and quality of service (QoS). A well-configured Node B can increase network capacity, revenue growth for operators, and enhance user experience, making it a crucial component for the success of a mobile network. Therefore, a radio access network engineer must configure the Node B appropriately to provide users with the best network experience.

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