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Features Identifiers Implemented in the Context of Generations of Mobile Cellular Development

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ABSTRACT
This paper examines the international identifiers of mobile devices in the generations and standards of mobile cellular communications. Mobile operators, in the presence of certain equipment, can completely or partially stop servicing a stolen phone, redirect SMS messages from it to another phone Or track its location using GPS. Mobile devices have different identification numbers. Which can be used to find lost phones, monitoring of a certain application settings, generate a digital rights management. International identifiers are implemented in various generations and standards of mobile cellular communications. Let us consider them in terms of generation of mobile cellular communication

Key words : Central register of equipment identification, Central EIR, CEIR, Equipment identity registry, EIR, IMEI, IMSI, MSISDN, GSMA, IMEI DB, duplicate IMEI, Check IMEI, IMEI check, blocking of communication services, registration in the cellular network

1. INTRODUCTION

There are many mobile equipment identifiers shows in Figure-1. Basically, these are electronic numbers that make it possible to describe the physical parameters of a mobile device, giving a description of the subscriber, wireless network equipment and location[1-11].
In the first generation (1G) networks, subscriber identification in the network was carried out using the factory cell phone number - ESN (Electronic Serial Number). MIN (Mobile Identification Number) - mobile identification number. The function of this identifier uniquely identifies the mobile phone; in analog cellular communications, MIN is used to route the call. The MIN identifier contains a 34-bit number, divided into two halves. The lower 10 bits are designated MIN2 and are responsible for storing the area code, the remaining 24 bits are the personal mobile number.[11-25]

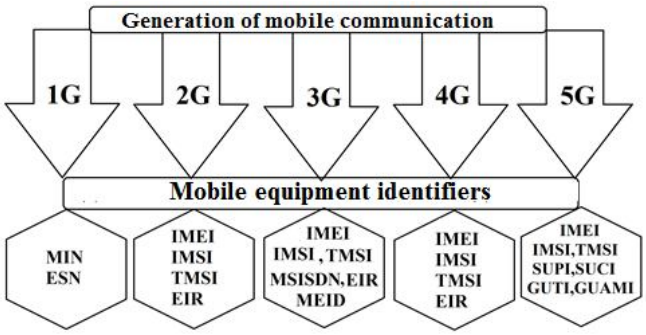

Figure 1: International identifiers generation of mobile communication.

2. MAIN

Thus, both the cell phone and the subscriber were identified by a single code. This approach gave rise to the complete dependence of the subscriber's number and the package of services provided to him on a specific phone instance. Having changed the cell phone (including cases of breakdown and theft of the phone), the subscriber was forced to contact the operator's office in order for the phone to be reprogrammed and its serial number entered into the operator's database, which some operators did for a fee. Obviously, it is more convenient to identify the subscriber, independent of the telephone.
Identifiers users in the second generation (2G).
In the GSM standard, it was proposed to separate the identification of the subscriber (using a SIM card) and equipment (for this, IMEI is used. IMEI plays the role of the serial number of the device and is transmitted over the air when authorizing in the network.

In Figure Equipment identification procedure IMEI
1. MSC / VLR requests IMEI from MS.
2. MS sends IMEI to MSC.
3. MSC / VLR transmits IMEI EIR.
4. As the IMEI is received, EIR checks three lists.

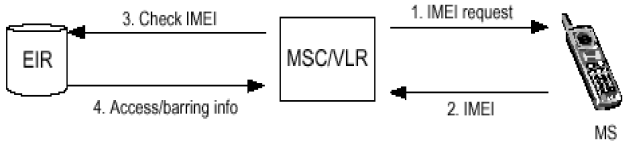

Figure.2: Procedure for identifying equipment by IMEI[12,13,14].

•White list. The white list contains all existing series of equipment identification numbers belonging to different countries and operators
•Black list. This list contains all the numbers IMEI, which is set deny access to a GSM system.
•Gray list. (At the level of the operator) list contains the IMEI phones that are under suspicion..
The result of checking IMEI is passed to MSC / VLR, which decides permitted or not permitted access to the system of the equipment.[3]
Identifiers users in the third generation (3G)
The difference from the fixed-line networks UMTS network must use a lot of numbers and identifiers for various purposes. Identification and addressing of subscribers and their terminals in 3G in fixed networks, the position of subscribers and equipment, as the name suggests, is fixed, and this, in turn, makes many characteristics constant.

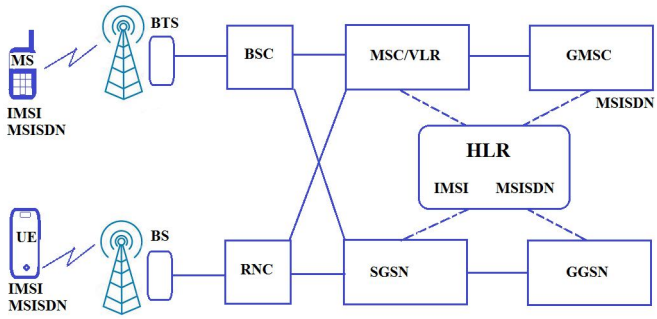

Figure 3: International mobile subscriber identifier - IMSI, MSISDN in 3G generation. [12,13,14]

Figure 3 shows BTS and BS Base Station, BSC Base Station Controller, RNC Radio Network Controller, MSC Mobile Switching Center, GGSN Gateway GPRS Support Node Gateway GPRS Network Core.
The IMSI number is used to uniquely identify the subscriber, and the ISDN number of the mobile subscriber is MSISDN for service separation. Since one subscriber can provide and be activated several services, the MSISDN number acts as a separator between them.[12,13,14]
Identifiers users in the fourth generation (4G)
The identification of the mobile terminal is performed by the MME (Mobility Management Entity) module, and / or the home subscriber data server HSS, and / or the P-GW gateway using the equipment identification register - EIR (Equipment Identity Register) and is intended for authentication used equipment (UE) of subscriber devices. Figure. 4 show UE authentication procedure.

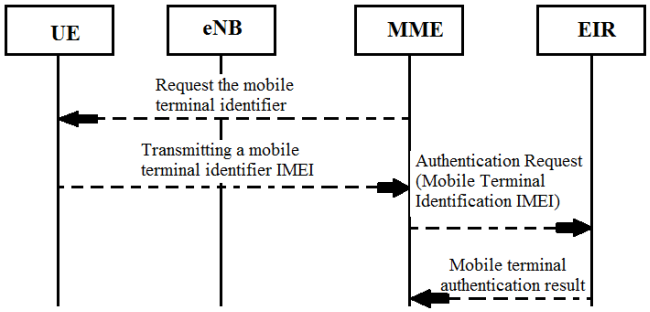

Figure.4: The procedure for identifying a mobile terminal in the LTE network[12,13,14].

Let's note the peculiarity of UE identification in roaming conditions. The identification of the UE is performed by the EIR register of the home network in cases when the guest network receives an Initial Attach request from the UE, except for the case when the Initial Attach request is associated with the execution of the handover procedure. UE identification is also performed in the case of implementation of the TAU procedure in the E-UTRAN network, if the UE was previously in the UTRAN / GERAN network, and the SGSN serving it earlier did not provide information on the UE identification. [12,13,14].
Identifiers users in the fifth generation (5G)
The international permanent subscriber subscription identifier - 5G SUPI (Subscription Permanent Identifier) is assigned to each subscriber of the 5G network and is stored in the unified UDM (Unified Data Management) and USIM (Universal Subscriber Identification Module) user module. The SUPI identifier can be an international mobile subscriber identifier - IMSI (International Mobile Subscriber Identity), or a network access identifier - NAI (Network Access Identifier), the format of which is defined by RFC 4282. [7-8]
Permanent Equipment Identifier (PEI) currently 3GPP defines only one possible PEI format - IMEI. IMEI is a unique numerical sequence and must be assigned to all 3GPP radio access technology UEs upon production.
Hidden User Identifier - SUCI (Subscription Concealed Identifier) is an encrypted copy of the International Permanent Subscriber Subscription Identifier (5G SUPI) and allows you to avoid the transmission of 5G SUPI over the network in the clear, even when the user terminal is initially registered in the network (Initial attach).
The 5G Globally Unique Temporary Identifier (5G Globally Unique Temporary Identifier) is assigned by the Access and Mobility Management (AMF) module regardless of the type of access network (3GPP, non-3GPP). When "going on the air", the user terminal must use exactly 5G-GUTI (except for initial registration in the network - initial attach, as well as

other cases when there is no valid 5G-GUTI). The 5G-GUTI format is shown in Figure 5.

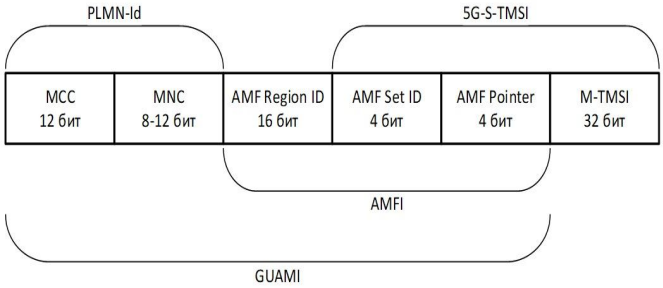

Figure 5. Global temporary unique identifier of the subscriber 5G-GUTI (5G Globally Unique Temporary Identifier)

In Figure 5:

• GUAMI (Globally Unique AMF Identifier) - the global (international) identifier of the AMF access and mobility control module;

• MCC - mobile country code;

• MNC - mobile network code;

• AMF Region ID - the identifier of the region served by the AMF module;

• AMF Set ID - unique identifier of a group of AMF modules within a region;

• AMF Pointer - unique identifier of the AMF module within the AMF Set ID group;

• AMFI - unique (within the network) AMF identifier;

• 5G-TMSI (5G Temporary Mobile Subscription Identifier) - temporary identifier of a 5G mobile subscriber (unique within AMF);

5G-S-TMSI is a unique (within the region) temporary identifier of a 5G mobile subscriber.[17-30].

3.CONCLUSION

The main types of mobile equipment identifiers are permanent and temporary identifiers widely used by various specific mobile devices. It is shown that the need to use one or another method of identifying mobile devices in an information system mainly ensures the safety of users of mobile devices in a mobile communication system. IMEI control makes it possible to radically solve these problems, which is demonstrated by the experience of many countries where such control is introduced by legislation of information systems for identifying mobile devices by IMEI

REFERENCES

1. Yu.V. Banin, D.M. Kizilov. D.E. **Namiot about finding the owner of a mobile phone**, *International Journal of Open Information Technologies* ISSN: 2307-8162 vol. 2, no.8, 2014, http://injoit.org/index.php/j1/article/view/135
2. Namiot D., Sneps-Sneppe M. **On Database for Mobile Phones Ownership**. *Proceedings of the 15th Conference of Open Innovations Association FRUCT, Saint-Petersburg, Russia. Publisher ITMO university publisher house*, ISBN 978-5-7577-0463-0
3. Michael Gregg. **Certified Ethical Hacker (CEH) Version 9 Cert Guide**. *Pearson Education, Inc*.2017.P.360-363.
4. Xusanovna, T. D., Imomaliyevna, K. L., & Baxadirovna, F. B. (2020). **Sensor networks and their development algorithm.** *Journal of Critical Reviews*, 7(12), 952-954. doi:10.31838/jcr.07.12.167.
5. Davronbekov.D.A.,Aliev .U.T.Isroilov.J.D. **Using the energy of electromagnetic radiation as a source of power** // *International Conference on Information Science and Communications Technologies (ICISCT) Applications, Trends and Opportunities*, 2nd, 3rd and 4th of November 2017, Tashkent, Uzbekistan. (Scopus) DOI: 10.1109/ICISCT.2017.8188565
6. Pulatov.Sh.U, Aliev.U.T.Isroilov.J.D.. **Energy harvesters wireless charging technology** // *International Conference on Information Science and Communications Technologies (ICISCT) Applications, Trends and Opportunities*, 2nd, 3rd and 4th of November 2017, Tashkent, Uzbekistan. (Scopus) DOI: 10.1109/ICISCT.2017.8188566
7. Davronbekov.D.A., Aliev .U.T.,Isroilov.J.D., Alimdjanov X.F**. Power providing methods for wireless sensor** // *International Conference on Information Science and Communications Technologies ICISCT 2019*, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011850
8. I.Kh.Siddikov., Kh.E.Khujamatov., D.T.Khasanov., E.R.Reypnazarov. **Modeling of monitoring systems of solar power stations for telecommunication facilities based on wireless nets**// *"Chemical technology. Control and management" International scientific and technical journal*, 2020, №3 (93) pp.20-28.
9. I.Kh. Siddikov., Kh.A. Sattarov., Kh.E. Khujamatov. **Modeling of the Transformation Elements of Power Sources Control** // *International Conference on Information Science and Communications Technologies (ICISCT) Applications, Trends and Opportunities*, 2nd, 3rd and 4th of November 2017, Tashkent, Uzbekistan. (Scopus) DOI: 10.1109/ICISCT.2017.8188581
10. Muradova A.A. Khujamatov Kh.E. **Results of Calculations of Parameters of Reliability of Restored Devices of the Multiservice Communication Network** // *International Conference on Information Science and Communications Technologies ICISCT 2019*, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011932
11. Khujamatov Kh.E. Khasanov D.T., Reypnazarov E.N. **Modeling and Research of Automatic Sun Tracking System on the bases of IoT and Arduino UNO** // *International Conference on Information Science and Communications Technologies ICISCT 2019*, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011913

12. Khujamatov Kh.E. Khasanov D.T., Reypnazarov E.N. **Research and Modelling Adaptive Management of Hybrid Power Supply Systems for Object Telecommunications based on IoT** // *International Conference on Information Science and Communications Technologies ICISCT 2019*, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011831
13. Davronbekov D.A.,IsroilovJ.D., Akhmedov B.I. **Principle of organizing database identification on mobile devices by IMEI**, *International conference on information science and communications technologies applications, trends and opportunities*, 4-6 november, 2019year.Scopus indexed, ICISCT 2019, www.icisct2019.org/] DOI: 10.1109/ICISCT47635.2019.9012000.
14. D. A. Davronbekov, Z. S. Abdimuratov and Z. D. Manbetova, **Measurement Of Electromagnetic Radiation Levels From Mobile Radiotelephones**, *International Conference on Information Science and Communications Technologies* (ICISCT), Tashkent, Uzbekistan, 2019, pp. 1-4, doi: 10.1109/ICISCT47635.2019.9012052.
15. Davronbekov.D.A., Seultonova.M.O., Isroilov.J.D, "**Analysis of software determination IMEI mobile devicesв**"3(9)/2019, *Descendants of Mohammed Al-Khwarizmi, Scientific-practiacal and information-analiytical journal*.p.67-71
16. Davronbekov.D.A., Seultonova.M.O., Isroilov.J.D, **"IMEI system for protection of mobile terminals"** *Descendants of Mohammed Al-Khwarizmi, Scientific-practiacal and information-analiytical journal*.ISSN-2181-9211 3(5)/2018, p.94-97.
17. Toshtemirov, D., Muminov, B., Saidov, J. **Fundamentals of compilation of electronic tasks for students to test and strengthen their knowledge of database.** *International Journal of Scientific and Technology Research* 9(4), c. 3226-3228. 2020.
18. Muminov, B., Nasimov, R., Mirzahalilov, S., Sayfullaeva, N., Gadoyboyeva, N. **Localization and Classification of Myocardial Infarction Based on Artificial Neural Network.** *Information Communication Technologies Conference*, ICTC2020 p. 245-249.
19. D. Davronbekov, A. Kiriakidi, D. Yelkin, J. Isroilov, M. Nurmatova**. State And Analysis Of The Mobile Devices Market For Creation Of Uniform Base Of Identification Of Mobile Devices On IMEI**, *SCIENCE AND WORLD, International scientific journal*,№ 11 (63), 2018, Vol. I
20. D. Davronbekov, K. Abdurakhmanov, Z. Khakimov, J. Isroilov, A. Kiriakidi, D. Yelkin. **Some Issues Of Registration And Accounting Of Mobile Devices By IMEI**, *Science and World International Scientific Journal* № 8 (72), 2019]
21. Ramjee Prasad. **Towards a Global 3G System: Advanced Mobile Communications in Europe**, *volume 1. Artech.* 2001. P 75-84..
22. Stefan Rommer, Peter Hedman, Magnus Olsson, Lars Frid, Shabnam Sultana, Catherine Mulligan**.** ***5G Core Networks: Powering Digitalization.*** .Elsevier.Academic Press.2020. p.1-470.
23. Afsar Kamal, Khaleel Ahmad, Rosilah Hassan, Khujamatov Khalim. **NTRU Algorithm: Nth Degree Truncated Polynomial Ring Units** // *Functional Encryption (Springer book chapter).*
24. Khalim Khujamatov, Khaleel Ahmad, Ernazar Reypnazarov, Doston Khasanov. **Markov Chain Based Modeling Bandwith States of the Wireless Sensor Networks of Monitoring System**//*International Journal of Advanced Science and Technology*, Vol.29, No.4, (2020),pp.4889–4903.
25. 9. I.Kh Siddikov., Kh.A. Sattarov., Kh.E. Khujamatov. **Modeling and research circuits of intelligent sensors and measurement systems with distributed parameters and values**// "*Chemical technology control and management" International scientific and technical journal, Tashkent* 4-5/2018/ pp. 50-55.
26. R. R. Ibraimov and M. O. Sultonova, "**Reliability of Open Optical Transmission Systems in the Backbone Core Cellular Networks of Cellular Communication,**" *2019 International Conference on Information Science and Communications Technologies (ICISCT),* Tashkent, Uzbekistan,2019, pp. 1-4, doi: 10.1109/ICISCT47635.2019.9011952.
27. Ibraimov, R., & Sultonova, M. (2019). **5G transit connections**. *Compusoft*, 8(5), 3135-3139.
28. Khdhir, Radhia. (2019). **5G LTE-A Cognitive Multiclass Scheduling Scheme for Internet of Things**. *International Journal of Advanced Trends in Computer Science and Engineering.* 8. 2485-2491. 10.30534/ijatcse/2019/94852019.
29. Singh, P. & Gill, Nasib. (2019). **A Secure and Power-Aware Protocol for Wireless Ad Hoc Networks.** *International Journal of Advanced Trends in Computer Science and Engineering.* 8. 34-41. 10.30534/ijatcse/2019/07812019.
30. Setyo, Josua. (2019). **Challenge of 5G Network Technology for Telemedicine and Telesurgery.** *International Journal of Advanced Trends in Computer Science and Engineering.* 8. 3680-3683. 10.30534/ijatcse/2019/154862019.
31. Matyokubov U.K., Davronbekov D.A. **The Impact of Mobile Communication Power Supply Systems on Communication Reliability and Viability and Their Solutions**//*International Journal of Advanced Science and Technology*. Vol.29, No.5, (2020), pp.3374–3385. http://sersc.org/journals/index.php/IJAST/article/view/12023
32. Davronbekov D.A., Matyokubov U.K. **Reliability of the BTS-BSC System with Different Types of Communication Lines Between Them**//*International*

Journal of Advanced Trends in Computer Science and Engineering. Vol. 9, No. 4, (2020), pp. 6684 – 6689. http://www.warse.org/IJATCSE/static/pdf/file/ijatcse362942020.pdf DOI: 10.30534/ijatcse/2020/362942020

33. Rakhimov T.O., Ismailov Sh.K., Matyokubov U.K., Eschanov U.K., Kuchkarov V.A. **Modeling Discrete Channels Based on Gilbert Model using MATLAB Software**//*International Journal of Engineering and Advanced Technology*. *Vol.9*,No.2,(2019),pp. 3568-3571.ISSN:2249–8958 DOI: 10.35940/ijeat.B2302.129219