A Study of Mobile Inbound Roamers Data During Occupation Period 2008-2009 In Iraq

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Abstract

Roaming data is an important source of information about the political and social activities of a country. And this is true for Iraq situation after 2003 when the mobile companies started their business. In this paper, data of subscribers roamed onto foreign networks (inbound roamers) is collected; it consists of the name of the Radio Control Point, the counter dealing with this type of information, Mobile Network Code/Mobile Country Code tupel. This data is processed. Results obtained out of this process show the classification of the inbound roamers (according to their countries) during the occupation period (2008-2009). These results reflect the political situation of Iraq at that time. Information resulted from this process is useful for people who make decisions.

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Introduction

On the 13th and 14th of November 2012 the 20th anniversary of the Mobile Roaming World Summit has been held in London. But what is roaming?

Roaming is a general term referring to the extension of connectivity service in a location that is different from the home location where the service was registered at the price of a local call or at a charge considerably less than the regular long-distance charges.

Roaming enables a mobile device to access the Internet and other mobile services when out of its normal coverage area. It also gives a mobile device the ability to move from one access point to another. Roaming is derived from Real-time Optimally Adapting mesh (ROAM) [1].

Roaming ensures that the wireless device is kept connected to the network, without losing the connection. The term "roaming" originates from the GSM (Global System for Mobile Communications) sphere; the term "roaming" can also be applied to the CDMA(Code division multiple access) technology.

Traditional GSM Roaming is defined as the ability for a cellular customer to automatically make and receive voice calls, send and receive data, or access other services, including home data services, when travelling outside the geographical coverage area of the home network, by means of using a visited network. This can be done by using a communication terminal or else just by using the subscriber identity in the visited network. Roaming is technically supported by mobility management, authentication, authorization and billing (payment) procedures [2].

Roamers generally enjoy high quality service and today, subscribers expect all frequently used mobile services to work reliably everywhere in the world. Thus, the quality and availability of services inside and outside the home network becomes increasingly important in the battle for customers.

Objectives of the Research

Producing an informative and reliable report that cover all aspects of roaming process has an advantage for both authorities of that country and managers of the mobile company, for the authorities it would reveal for them

1- the current situation of the country and to assist them to make plans,

2- direct the general communication policy as far as the mobile companies is concerned (if possible).

For the managers it would help them to:

1- Choose among the alternatives of mobile networks in a single country.

2- Review the old roaming agreements and think of new ones.

3- Increase contribution of international roaming to the revenue of the company.

4- Determine if charges of international roaming have impact on choosing this service by a consumer.

5- Decide whether they should offer a number of bundles to help keep the cost of data roaming down to beat competitor networks.

Type of Roaming Authentication Protocol

Dealing with roaming two types of network should be considered home and visited networks the differentiation between home network and visited network is technically given by the type of subscriber entry in a specific network. If a subscriber has no entry in the home subscriber register of the network (e.g. Home Location Register (HLR) in GSM networks or local customer database in WLANs), the required subscriber data must first be requested by the visited network e.g. from the subscriber's home network in order that the subscriber can be authenticated and any authorization for using the network services can be checked. The "visit-

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ing" subscriber acquires an entry in a user database of the visited network (e.g. Visited Location Register (VLR)) and the authorized network services are enabled. GSM/WLAN roaming services can be supplied in two different scenarios. The first One is SIM-based roaming authentication Protocols. This system recognizes when a subscriber roams onto a foreign network and automatically downloads an updated preferred network list onto the SIM (subscriber identification module) .

The SIM Steer system uses an applet on the handset's SIM card. This contains the preference list for roaming partner selection which will cause the handset to read this new list immediately.

This list can be regularly updated to match the region of the world that the subscriber is visiting. SIM Steer monitors the update location requests and, where relevant, downloads an updated list for that region followed by a refresh command to ensure that the list is immediately read by the handset.

Steering of roaming helps you to choose which partner your roamers attach to in order to get the best price, the best quality and to fulfill your promises to partners. It is a vital function for any roaming operation, especially as prices come under increasing downward pressure. Without steering you will be paying too much and cannot be competitive. You would also be vulnerable to problems on partners' networks and could therefore suffer serious damage to customer satisfaction [3].

The second is username/password based roaming authentication Protocols. Enter a valid home username and a valid password to use the Visited network [4].
The technical term "roaming" also encompasses roaming between networks of different network standards. Device equipment and functionality, such as SIM card capability, antenna and network interfaces, and power management, determine the access possibilities.

Using the example of WLAN/GSM roaming, the following scenarios can be differentiated SIM-based (roaming): GSM subscriber roams onto a Public WLAN operated by:
their GSM Operator, or another Operator who has a roaming agreement with their GSM operator. Username/password based roaming: GSM subscriber roams onto a Public WLAN operated by: their GSM Operator, or another Operator who has a roaming agreement with their GSM Operator.

Types of Roaming

Wireless local area network (WLAN) roaming services are segmented as follows:

- Internal Roaming

This is implemented when a mobile station is transferred with a strong signal between access points, preventing network blockage or interruption from weak signals.

- External Roaming

Implemented when a mobile station shifts to a wireless LAN or other foreign Wireless Internet Service Provider (WISP) to access service. WISP allows users to maintain an Internet connection while moving within a local coverage area.

-Regional roaming

This type of roaming refers to the ability of moving from one region to another region inside national coverage of the mobile operator. Initially, operators may have provide commercial offers restricted to a region (sometimes to a town). Due to the success of GSM and the decrease in cost, regional roaming is rarely offered to clients except in nations with wide geographic areas like the USA, Russia, India, etc., in which there is a number of regional operators.

-National roaming

This type of roaming refers to the ability to move from one mobile operator to another in the same country. For example, a subscriber of T-Mobile USA who is allowed to roam on

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AT&T Mobility's service would have national roaming rights. For commercial and license reasons, this type of roaming is not allowed unless under very specific circumstances and under regulatory scrutiny.

-International roaming

This type of roaming refers to the ability to move to a Foreign Service provider's network. It is, consequently, of particular interest to international tourists and business travelers.

Broadly speaking, international roaming is easiest using the GSM standard, as it is used by over 80% of the world's mobile operators. However, even then, there may be problems, since countries have allocated different frequency bands for GSM communications (there are two groups of countries: most GSM countries use 900/1800 MHz, but the United States and some other countries in the Americas have allocated 850/1900 MHz): for a phone to work in a country with a different frequency allocation, it must support one or both of that country's frequencies, and thus be tri or quad band [5].

-One Network service

The Zain Group has witnessed exponential growth over the last four years, growing from a single operator in Kuwait in 2003 to being a 15,000-employee, US$26.5 billion capitalised company offering a range of advanced mobile voice and data services to over 42.5 million customers. Zain has created a roaming-free market in Africa, with a dozen countries all enjoying one single telecoms market. Since then, Zain has announced a single roaming-free market for its Middle East customers.

This will give Zain customers contiguous local network coverage stretching from Iraq in the east to the Atlantic Ocean in the west, a distance of some 4,000 kilometres [6].

The Roaming process

The details of the roaming process differ among types of cellular networks, but in general, the process resembles the following:

When the mobile device is turned on or is transferred via a handover to the network, this new "visited" network sees the device, notices that it is not registered with its own system, and attempts to identify its home network. If there is no roaming agreement between the two networks, maintenance of service is impossible, and service is denied by the visited network.

The visited network contacts the home network and requests service information (including whether or not the mobile should be allowed to roam) about the roaming device using the IMSI (International Mobile Subscriber Identity) number.

If successful, the visited network begins to maintain a temporary subscriber record for the device. Likewise, the home network updates its information to indicate that the mobile is on the host network so that any information sent to that device can be correctly routed.

If a call is made to a roaming mobile, the PSTN(public switched telephone network) routes the call to the phone's registered service provider, who then must route it to the visited network. That network must then provide an internal temporary phone number to the mobile. Once this number is defined, the home network forwards the incoming call to the temporary phone number, which terminates at the host network and is forwarded to the mobile [2].

Roamers calculation

The data handled in this paper is collected in a device compatible with the Alcatel product RCP (Radio Control Point). In a cellular mobile radio network with intelligent network architecture, the Alcatel RCP is a set of counters combines the control part of the Mobile Services Switching Center (MSC) and a Visitor Location Register (VLR) in the same machine.

Data of Iraqna network is accumulated in RCPs , then is collected either for one hour or one day, this depends on the way desired to analyze the data. The data processed in this paper consist of four columns taken for one hour period.

-The first column contains name of RCPs range from RCP03 to RCP17 each one is responsible for a specific area of a town or a country. For example if these RCPs are in Baghdad, one would be for data of Almansur area, the second for Aljadria and so on.

-The second is number's counter of the traffic (calls).

-The third is the Mobile Network Code (MNC) which is used in combination with a Mobile Country Code (MCC) (also known as a "MCC / MNC tuple") to uniquely identify a mobile phone operator/carrier using the GSM, CDMA .[7]

-The fourth is date & time of observations (Table 1).

-Data Processing

MCC is the first three digits of MCC/MNC tuple the last 2 (or last 3 as in US code) is for the network operates in that country.

MCC is extracted as it is the unique key to each country. Since these codes are duplicated (because each RCP may receive traffic for the same country roamed onto the same network or different one), so duplication needs to be removed, then each code compared with the original data to group different networks belongs to a single country. The code 418 is neglected because it is for Iraqna local subscribers.

Grouping different networks belong to a single country will enable us to sum the number of roamers onto these networks giving the total number roamed onto that country with all networks operating in it which have agreement with Iraqna company. Figure (2) shows the flowchart of processing the data. Figure (3) shows part of the VBA program code used to process the data.

Using MCC/MNC manual the code of the country and the code of the its networks
is matched to identify the name of the country and the networks have been roamed onto then, these are listed with all their operational details together with the number of roamers.
Number of inbound roaming shows that the highest roaming is onto USA (Figure4). (Figure 5) shows the percentage of inbound roamers onto different countries, USA then India have the highest percentage above all.

Conclusion

The data taken from mobile companies reflects the political and social behavior of that country at that time. Examining the results showed in Figure(4) and Figure(5) leads to the conclusion that the majority of foreigners who roamed by Iraqna were Americans, Indians then British, this reflects the situation in Iraq in 2008 the year the data was taken in, where US and UK have had the major contribution in the troops who occupied Iraq. But why India? Probably because of the cheap labor which has been offered by Indian companies also the Iraqi interest in having medical treatment in Indian hospital.

Analyzing the results obtained in Figure(4) and Figure(5), would enable the mangers to decide for example' whether to reconsider the roaming agreements with these countries or if it is worth expand it to include other networks or it is just a temporary situation, or to decide if it is beneficial to the company to impose extra charges on a specific network and so on.

Using Visual Basic Application (VBA) in this paper reveals the power of this programming language in processing huge data produced by this kind of activity.

Reporting makes use of data collected through the probing links monitoring the international traffic flowing through the international links. Data collected is analyzed and placed in trace files to compute various statistics and detailed information that are beneficial for the business analysis of the inbound roamers' traffic behavior.

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Radio Control Point	Counter	MNC/MCC	No. of Roamers	Date &Time
RCP03	20454	20210	1	08-02-19_22:50:01
RCP03	20454	20404	5	08-02-19_22:50:01
RCP03	20454	20412	3	08-02-19_22:50:01
RCP03	20454	20420	1	08-02-19_22:50:01
RCP03	20454	20801	1	08-02-19_22:50:01
RCP03	20454	21630	8	08-02-19_22:50:01
RCP03	20454	21803	2	08-02-19_22:50:01
RCP03	20454	21910	2	08-02-19_22:50:01
RCP03	20454	22001	1	08-02-19_22:50:01
RCP03	20454	22201	5	08-02-19_22:50:01
RCP03	20454	22288	1	08-02-19_22:50:01
RCP03	20454	22601	1	08-02-19_22:50:01
RCP03	20454	22610	1	08-02-19_22:50:01
RCP03	20454	23410	14	08-02-19_22:50:01
RCP03	20454	23415	5	08-02-19_22:50:01
RCP03	20454	23420	1	08-02-19_22:50:01
RCP03	20454	23430	1	08-02-19_22:50:01
RCP03	20454	23820	2	08-02-19_22:50:01
RCP03	20454	24007	16	08-02-19_22:50:01

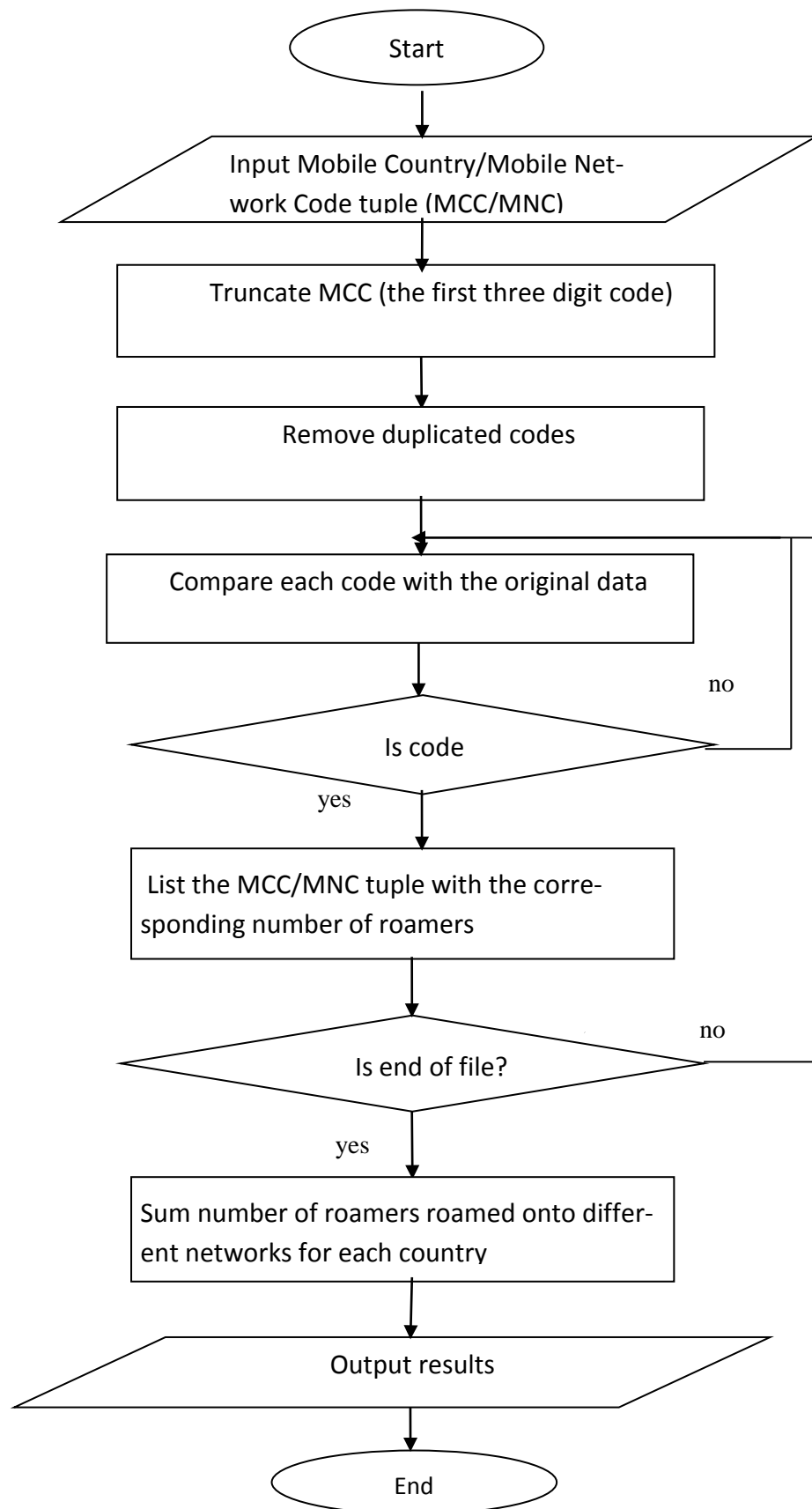**Table (1): A Sample of the Raw Data Taken From RCP03**

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Figure No. (2): Flowchart of Roamers Calculation Process

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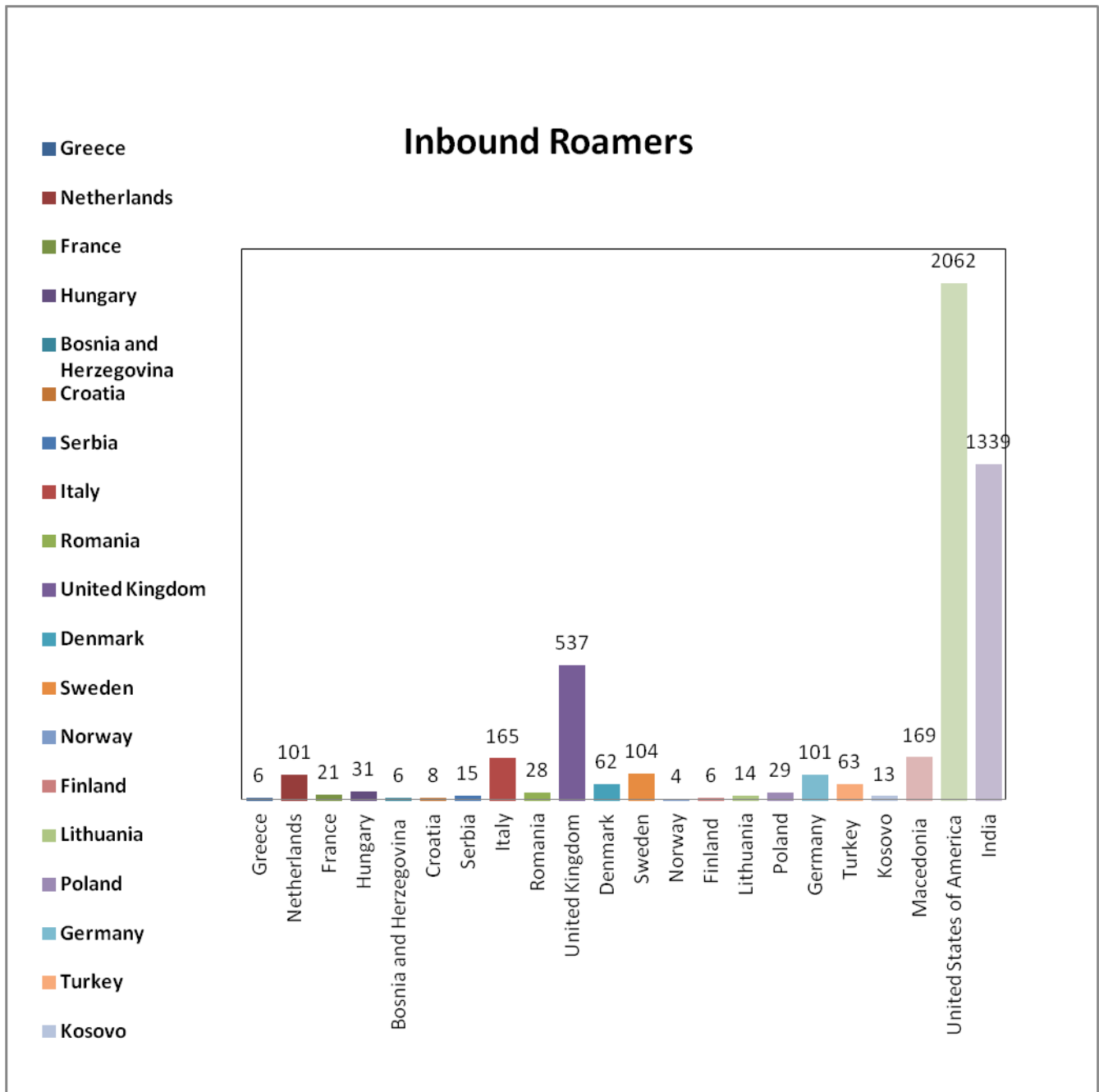مجلة إبن الهيثم للعلوم الصرفة و التطبيقية

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```
Private Sub CommandButton1_Click()
For k = 2 To 700
Sheets("Sheet3").Cells(k, 10) = Left(Cells(k, 3), 3)
Next k
Sheets("Sheet3").Cells(2, 11).Value = Sheets("Sheet3").Cells(2, 10).Value
j = 2
For c = 3 To 700
 flag = 0
For d = 2 To c - 1
If Sheets("Sheet3").Cells(d, 11).Value = Sheets("Sheet3").Cells(c, 10).Value Then
flag = 1   Exit For  End If   Next d
If flag = 0 Then   j = j + 1
Sheets("Sheet3").Cells(j, 11) = Sheets("Sheet3").Cells(c, 10)
End If   Next c   jjj = 2
For jj = 2 To 700
Sheets("Sheet3").Cells(jj, 17).Value = Left(Cells(jj, 3), 3)
For mm = 2 To 700
If Sheets("Sheet3").Cells(jj, 11).Value = Sheets("Sheet3").Cells(mm, 17).Value Then
jjj = jjj + 1
Sheets("Sheet3").Cells(jjj, 12).Value = Sheets("Sheet3").Cells(mm, 3).Value
Sheets("Sheet3").Cells(jjj, 13).Value = Sheets("Sheet3").Cells(mm, 5).Value
End If   Next mm   Next jj   f = 2
For i = 1 To 63
Do While Left(Cells(f, 12), 3) = Left(Cells(f + 1, 12), 3)
Sum = Sum + Cells(f, 13).Value   f = f + 1   Loop
Sum = Sum + Cells(f, 13)
Cells(f, 14) = Sum   Sum = 0
f = f + 1   Next i
```

Figure No. (3): Part of The ProgramCode for Processing Roamers Data

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Figure No. (4): Inbound Roamers with Iraqna Company onto Corresponding Countries at 19.00-20.00 hour on 2nd of August 2008

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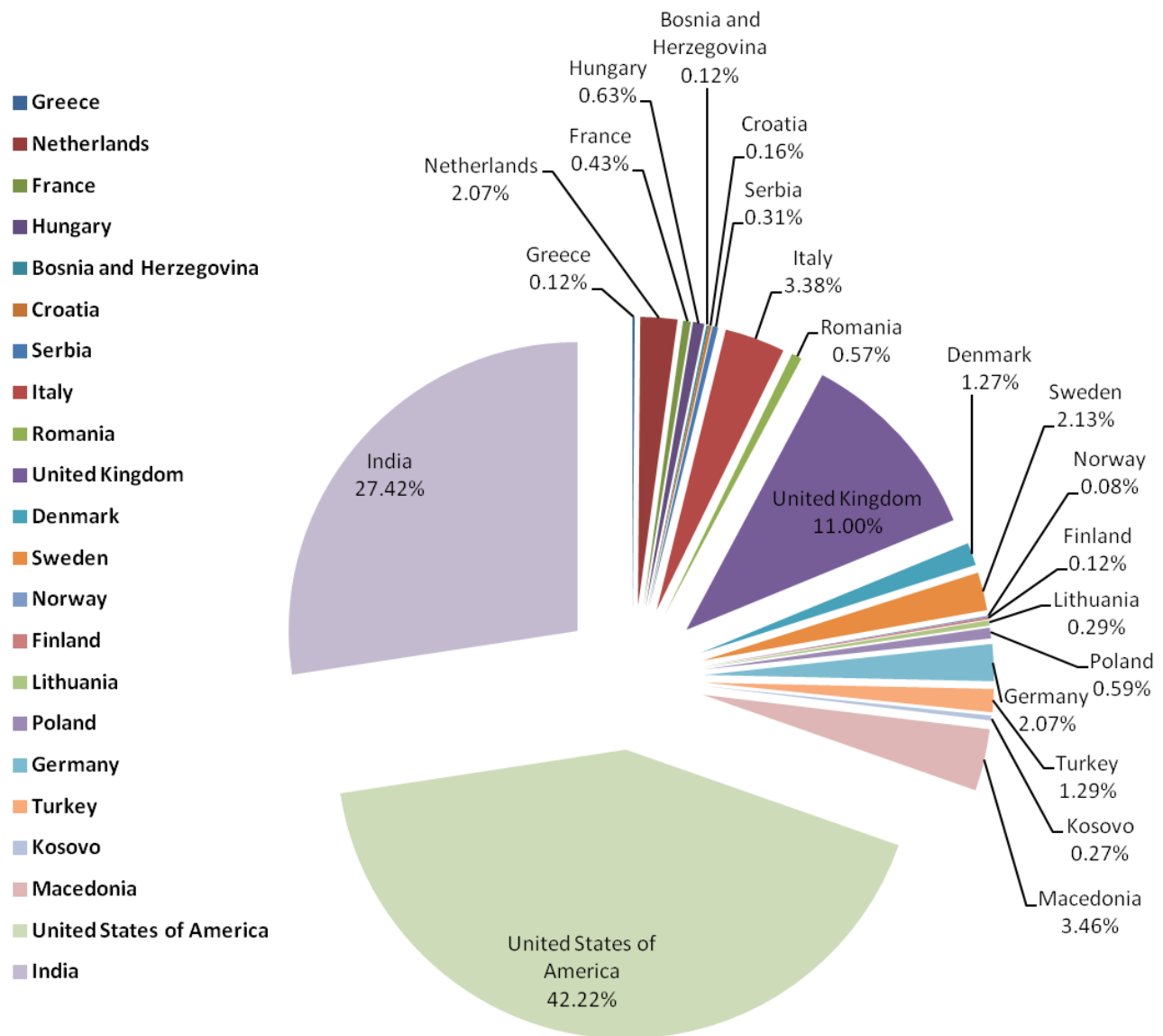
Figure No. (5): Percentage of Inbound Roamers Roaming onto Different Countries

دراسة لبيانات متجولي الهاتف النقال (الواردين) خلال مدة الاحتلال (2008-2009) في العراق

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الخلاصة

تعد بيانات التجوال مصدرا مهما للمعلومات حول النشاطات السياسية والاجتماعية لدولة ما. وهذا ينطبق على وضع العراق بعد 2003 عندما بدأت شركات الموبايل اعمالها.

فى هذا البحث جمعت بيانات المشتركين الذين يتجولون على الشركات الاجنبيه (المتجولين الواردين) وتتضمن اسم نقطه السيطره الراداويه،والعداد الذى يتعامل مع هذا النوع من البيانات، وزوج رمز موبايل الشبكه/ رمز موبايل الدوله .وعولجت هذه البيانات. اما النتائج المستحصله من هذه المعالجه فتظهر تصنيف المتجولين الواردين(وفقا لدولهم) خلال مدة الاحتلال (2008-2009) اذ تعكس هذه النتائج الوضع السياسي في العراق في ذلك الوقت. المعلومات الناتجه من هذه العمليه تكون مفيدة للاشخاص الذين يصنعون القرار.

اعلام :ان البيانات التى تمت معالجتها فى هذا البحث بيانات حقيقيه تعود الى شركه عراقنا للموبايل التى عملت فى العراق سابقا فى المدة 2003-2009 . وحاولنا الحصول على بيانات جديدة من شركتي زين واسياسيل لكنها باءت بالفشل. وهذه موثقة مع الكلية التى اعمل فيها.

Keywords: GSM, ISP, WLAN, MSC, CDMA, HLR, VLR, PSTN, MCC, MNC TAP, SMS.