

# EJSR

EUROPEAN JOURNAL OF  
**SCIENTIFIC  
RESEARCH**

**Vol 20 No 4**

**May, 2008**

**USD \$25.00**  
**CAD \$30.00**



**ISSN: 1450-216X**

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## Real Digital TV Accessed by Cellular Mobile System

**Basil M. Kasasbeh**

*Faculty of Information Technology, Applied Science University  
Amman 11931, Jordan  
E-mail: b\_kasasbeh@asu.edu.jo*

**Rafa E. Al-Qutaish**

*Faculty of Information Technology, Applied Science University  
Amman 11931, Jordan  
E-mail: rafa@rafa-elayyan.net*

**Muzhir S. Al-Ani**

*Faculty of Information Technology, Amman Arab University  
Amman 11953, Jordan  
E-mail: muzhir@aau.edu.jo*

**Khalid Al-Sarayreh**

*Faculty of Information Technology, Applied Science University  
Amman 11931, Jordan  
E-mail: khalid\_sar@yahoo.com*

### Abstract

Presently, there is a huge revolution through the use of internet and cellular mobile units, that almost dominant the world by a huge investment in this field. This paper aims at incorporating the digital live TV video to the cellular mobile system. The next generation cellular mobile communication system can have the ability to access the video TV with high resolution. This system is constructed by receiving and multiplexing satellite TV channels to be standby and accessible.

**Keywords:** Wireless Communication, Cellular Networks, Mobile Communication, TV Broadcast, Next Generation Mobile Systems, Multimedia Systems, Video Transmission.

### 1. Introduction

Marconi's invention in 1901 led to start new fields of telecommunications revolution such as radio, TV, satellite, mobile, wireless networking and cellular technology. Nowadays, wireless communications and networks play an important part of communications over the world and led a wonderful growth of market [1].

Wireless and cellular revolution is apparent in the growth of the mobile phone market. In 1990 the mobile phone users were approximately 11 millions but this number is increasing rapidly to 1 billion in 2004. The future predicts billions and billions of users and so of investments. This huge

number of users over the world needs a simple, convenient, standard, compatible, flexible, and wide variety of services [2].

Last few years the cost associated with mobile telephones have been decreasing. Mobile telephone prices have dropped since 1996 and they are an economical way to provide phone service to the population. New types of wireless devices are being introduced that have access to the internet to achieve the services available on the internet. Modern mobiles units consist of elegant and comfortable features that lead to new services.

Nowadays, there is a huge revolution through the use of internet and cellular mobile units, that almost dominant the world by a huge investment in this field. This paper aims at incorporating the digital live TV video to the cellular mobile system. The next generation cellular mobile communication system can have the ability to access the video TV with high resolution. This system is constructed by receiving and multiplexing satellite TV channels to be standby and accessible.

This paper presents an overview the digital TV broadcasting in Section 2 and an overview of the digital satellite TV in Section 3. Section 4 discusses the digital video broadcasting. In section 5, the third generation wireless system is discussed. Section 6 describes the next generation wireless system. Section 7 presents the proposed RD-TV-CM system. Finally, a discussion in Section 8 concludes the paper.

## 2. Digital TV Broadcast

Many attempts have been examined to introduce digital TV with higher resolution, but these affect the huge number of existing old systems. One approach to design a common standard for digital broadcasting TV goes in parallel with mobile communications systems applying video compression [3].

In 1993 the aim of development a common digital TV system for Europe were named Digital Video Broadcasting (DVB) and Digital Audio Broadcasting (DAB). The goal of DVB is to introduce digital television broadcasting using satellite transmission and terrestrial transmission. Different levels of quality are integrated in receiver decoder such as [4]:

- Standard Definition TV (SDTV)
- Enhanced Definition TV (EDTV).
- High Definition TV.
- Multimedia PC.
- High Resolution Systems (HRS).

Transmits data using flexible containers are basically using MPEG-2 frames. DVB sends service information contained in its data stream which specifies the content of a container. The following contents have been defined:

- Network Information Table (NIT) that lists the services of provider set-top boxes.
- Service Description Table (SDT), that lists names and parameters for each service within an MPEG multiplexed channel.
- Event Information Table (EIT) that contains status information about the current transmission and some additional information for set-top boxes.
- Time and Data Table (TDT), that contains update information for set-top boxes.

These different types of data are either contains a single channel for HDTV, multiple channels for EDTV or SDTV, or multimedia data broadcasting [5].

## 3. Digital Satellite TV

The invention of Satellite led to a big revolution in communications that have been used in the following fields: weather forecasting, Radio & TV broadcasting, military applications and navigation.

Motion Picture Expert Group (MPEG) describes a form of compression for digital moving images of TV. This format also allows for audio datastreams synchronizing with the video. Analog satellite TV uses around 27-36 MHz of bandwidth for its FM video and FM audio subcarriers for each channel. So the operators put some separate channels, via a digital datastream into a similar bandwidth. The actual compression ratio can be varied with the needs of suppliers of the video information between Studio needs 12 Mbps, Broadcast needs 8 Mbps and VHS needs 2 Mbps [3].

The Digital data from several channels can be multiplexed into an MPEG Transport Stream (MPEG-TS) along with various audio channels. A package with several channels modulated onto one carrier. The lowest compression ratio will occupy the highest bandwidth but will be needed when the video content requires much detail.

#### **4. Digital Video Broadcast**

Digital Video Broadcast (DVB) is another group that is important and interesting in satellite transmission. DVB or any satellite system must have at least the following features that required for Integrated Receiver Decoder (IRD) (i.e satellite box) [6]:

##### **1. System Recommended Requirements**

- MPEG-2 transport stream is used.
- Service information is based on MPEG-2 program specific information
- Scrambling is defined by CA (Conditional Access) technical group.
- CA uses the MPEG-2 CA-descriptor.

##### **2. Video Recommended Requirements:**

- MPEG-2 main profile at main level is used (1.5-15 Mbps).
- The frame rate is 25 Hz.
- Encoded pictures may have either 4:3 or 16:9 aspect ration.
- IRDs will support 4:3 and 16:9 aspect ratio.
- IRDs must support the use of pan and scan vectors to allow 4:3 monitor to give a full screen display of 16:9 coded picture.
- IRDs must support a full screen display of 720\*576 pixels.
- IRDs must provide appropriate up conversion to produce a full screen display of 544\*576 pixels and 480\*576.

##### **3. Audio Recommended Requirements**

- MPEG-2 layer I and layer II must be supported by the IRD.
- The use of layer II is recommended for the encoded bitstream.
- IRDs must support single channel, dual channel joint stereo and extraction of at least a stereo pair from MPEG-2 compatible multichannel audio.
- IRDs must support sampling rates of 32 kHz, 44.1 kHz and 48 kHz.

#### **5. Third Generation Wireless System**

The objective of the third generation (3G) wireless communications is to provide fairly high speed wireless communications to support multimedia, data, video in addition to voice. The ITU for the year 2000 was developed the IMT-2000 that defined the 3G capabilities as, voice quality, 144 kbps data rate for high speed vehicles, 384 kbps data rate for slowly moving, 2.048 Mbps for office use, symmetrical and asymmetrical data transmission rates, support for both packet switched and circuit switched data

services, adaptive interface to the internet, more efficient use, support for wide variety of mobile equipment and flexibility to allow the introduction of new services and technologies.

Modern communication technology is the trend toward universal personal telecommunications and universal communications access. One concept refers to the ability of a person to identify easily by using any communication system in the country. The other concept refers to the capability of one's terminal in a wide variety of environments to connect to information services. Personal Communications Services (PCSs) and Personal Communications Networks (PCNs) are some concepts of wireless communications and objectives of 3G wireless.

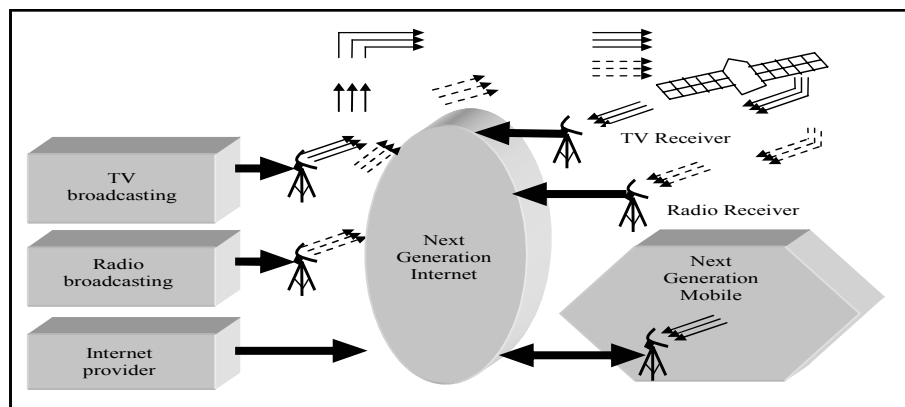
European Telecommunications Standards Institute (ETSI) works to develop a Universal Mobile Telecommunications System (UMTS) as Europe's 3G wireless standard. UMTS includes two standards; one is Wideband CDMA (W-CDMA) to provide high data rate with efficient use of bandwidth. The other standard is known as IMT-TC (TD-CDMA) that is a combination of W-CDMA and TDMA technology [7, 8].

The dominant technology for 3G system is CDMA. Different CDMA schemes share some common such as bandwidth, chip rate and multirate. Bandwidth is an important design goal for 3G system is to limit channel usage to 5 MHz. This value of bandwidth or more improves the receiver's ability to resolve multipath when compared to narrow band. The chip rate depends on desired data rate and bandwidth limitations. A chip rate of 3 Mcps or more is reasonable. Multirate refers to the provision of multiple fixed data rate logical channels to a given user, in which different data rates are provided on different logical channels.

## 6. Next Generation Wireless System

Multimedia broadcasting and DVB can be also used for high bandwidth asymmetrical internet access. Different types of service provider can help to provide information to the customers as illustrated in Figure 1. If the customer wants to download high-volume information, the information provider transmits this information to the satellite provider via service provider.

**Figure 1:** Mobile internet services.



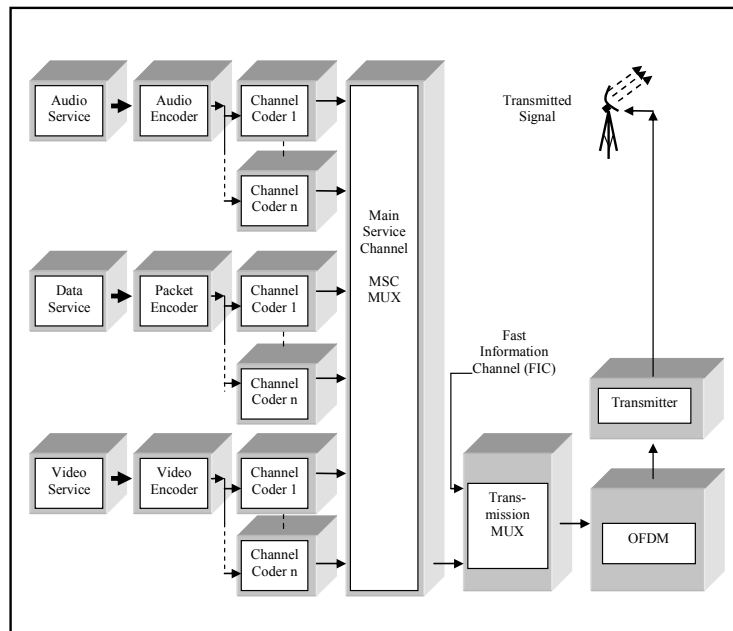
The satellite provider multiplexes a stream of data together with other digital TV channels and transmits it to the customer via satellite and a satellite receiver. The customer can receive the information with the help of a DVB adapter inside a multimedia PC. These information can be encrypted to ensure that the information received by the indicated customer.

The 3G cellular system through the year 2006 is extended over a wide area of the world. The trend of 4G or Next Generation (NG) of mobile cellular systems may be covering all the communications and services over the world. The 4G offers the following views: next generation, new air interface, new network, strict generation, wireless & wireline, technology trends, service providers, wireless internet, higher bit rate, cost reduction, user services and white space.

The trends of NG mobile system may be deployed around the year 2010. The aim is to integrate all type of services in a single frame. NG is not necessary defined by specific features but by significant advance in system capability beyond what can be achieved with 3G. The NG data transmission rate are planned to be up to 20 Mbps, which 10 times faster than the 3G. NG will allow high quality smooth video transmission.

Multimedia network illustrated in Figure 2 to cover a huge number of different types of services that are compatible and accessible to the next generation mobile system. The suggestion of a new technologies supported to computers, communications and networking to standardized and merge all forms of data including audio and video in a multimedia streams. The customer can access any service via its IP address identification. This form can be standardized and any sub network can connect via adapted interface to the high speed internet to form a big and huge collection of services over the world that is the Multimedia Broadcast over a Cellular Network (MBCN). The Fast Information Channel (FIC) is transmitted using a special modulation scheme that is a Multi Carrier Modulation (MCM). The last stage before transmitter is the wide band Orthogonal Frequency Division Multiplexing (OFDM) that is able to compact wide band of information [9].

**Figure 2:** Multimedia multiplexing system.



## 7. Proposed RD-TV-CM System

Nowadays, we are looking for a tremendous revolution in mobile system services and applications. Different types of wireless data transmission that applied cellular technology have unsymmetrical characteristics. In order to integrate these different multimedia systems over a standard network, it must be capable to adapt these different types of data. Many important features must be standardized to reach an integrated of all available system. Wide bandwidth, high bit rate and huge amount of capacity are the most important features to recover all multimedia transmissions as well as some specifications for cellular mobile to store and display the received data.

Introduction of mobile IP address offers a new technology of mobile access to all internet services with some retraction of speed. The digital TV channels can be transmitted via satellite and then received by the customer as requested information.

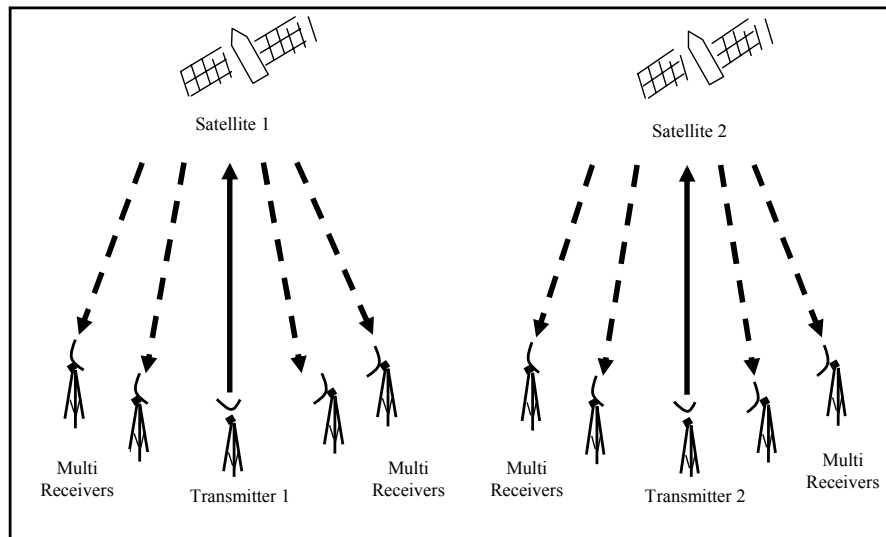
The consumers, looking for near future, through the introduction of new mobile technologies, so by using these devices they can be able to access all the services over a separate air interface. The

proposed Real Digital TV accessed by Cellular Mobile (RD-TV-CM) may be constructed through eight items; the next subsections describe these eight items.

### 7.1. Satellite Configuration

Many configurations can be provided between earth station and satellite antenna, and the suitable one is being used to provide point to point link between base station transmitter and Base Station Mobile Center Receiver (BS-MCR) through the satellite as shown in Figure 3.

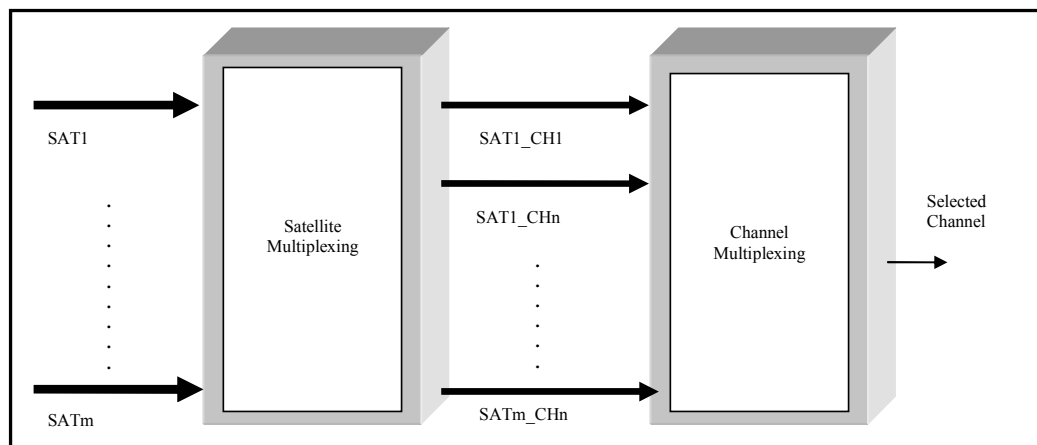
**Figure3:** Broadcasting TV satellite.



### 7.2. Channels Distribution

The construction of BS-MCR is built to receive several satellite sits from different areas over the world. These multiple receivers are fixed on their specific areas and each sub receiver is concentrated on a number of channels. This is built through a two set of nested multiplexers, one set for satellite and the other for channels as shown in Figure 4.

**Figure 4:** Multiplexing channel system.

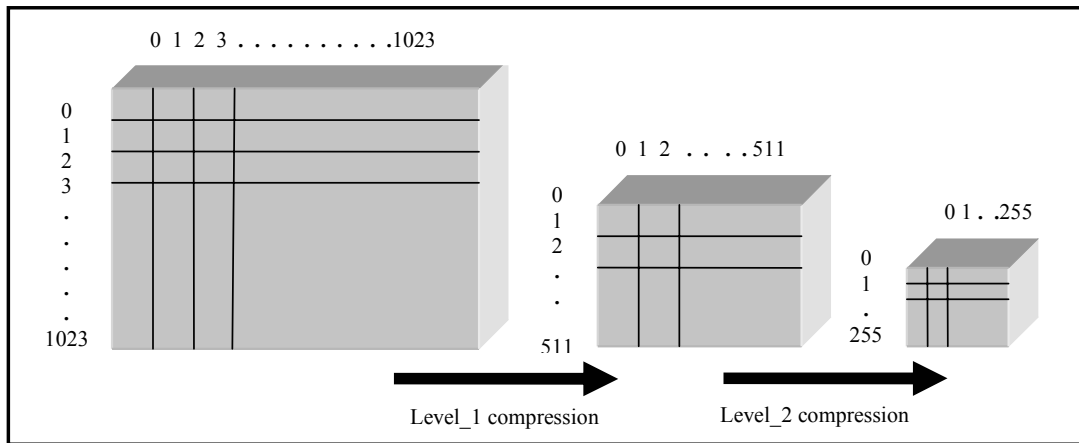


### 7.3. Image Compression

High digital TV image is at least 1024\*1024 pixels. So retransmitted this form needed a huge capacity as well as high speed. The aim is to introduce this image in new form to be adapted with the suggested

system. The best form of reduction that referred to new mobile technology is to reduce the size by a factor of 4. This can be implemented by two level of compression to generate a new image size of 265\*256 as shown in Figure 5.

**Figure 5:** Image compression.

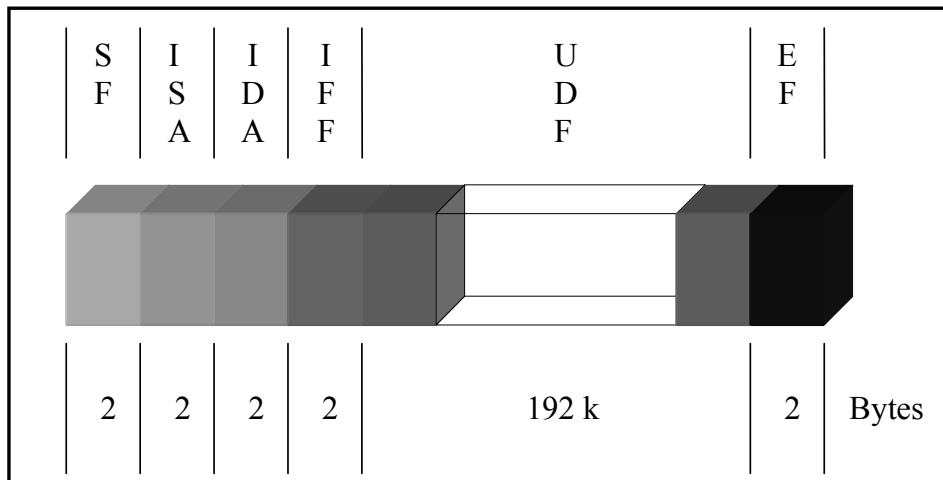


**7.4. Frame Format**

The suggested frame format shown in Figure 6 consists of the following fields :

- Start Frame (SF), 2 bytes length.
- -\*Identification Source Address (ISA), 2 bytes length.
- Identification Destination Address (IDA), 2 bytes length.
- Identification Function Frame (IFF), 2 bytes length, identifies the purpose of frame.
- User Data Frame (UDF), 64\*3 kbytes length.
- End Frame (EF), 2 bytes length.

**Figure 6:** Frame format structure.



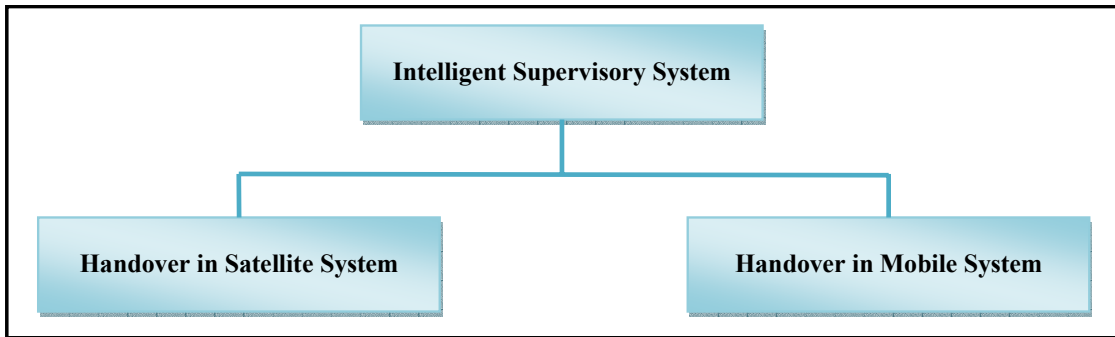
**7.5. Rate Specification**

The frame length is 16 bytes of synchronization and identification and 64\*3 bytes for data. The 64 kbytes comes from 256\*256 pixels image size. So the total frame length is 1536128 bits. Acceptable live TV must be transmitted at least 25 frame per second. The permitted bit rate in this case is 38.403200 Mbps.

### 7.6. Handover

The aim of handover in a Cellular system should not cause a cut-off and keep call in best quality, during the mobility of mobile out of the BTS range or crossing the boundaries of the cell. When a mobile phone access the satellite TV broadcasting, so it must be adapted to any movement of mobile phone as well as the satellite movements. This is done by an Intelligent Supervisory System (ISS) to compare between all the parameters as shown in Figure 7.

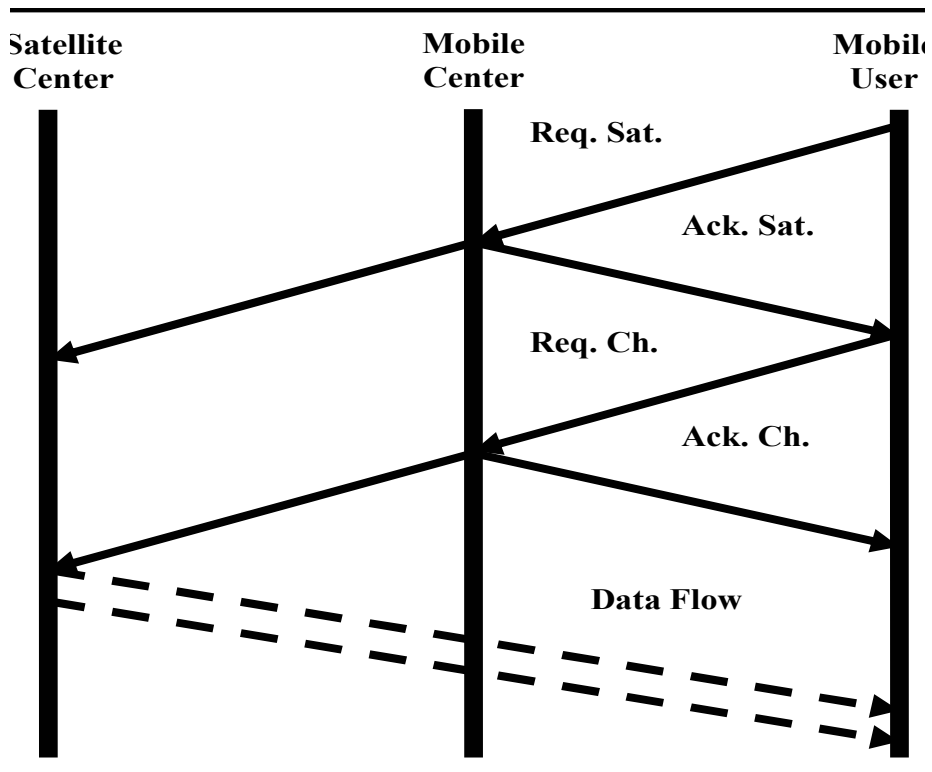
Figure 7: Intelligent Handover.



### 7.7. Operation

The company mobile center installed a many receivers to receive a certain satellites. The next generation mobile unit is built to load and excite TV software. The operation started firstly when a mobile user requesting a specific satellite TV, that is confirmed by MSC company. Secondly the mobile user requesting a specific channel, that is also confirmed by MSC. When all the lows are in order, so the requested service has been in the hand of the mobile user as shown in Figure 8.

Figure 8: Transmitting of data.



## 7.8. System structure

The structure of the system can be divided into the following five subsystems:

1. Satellite Antenna (SA),
2. Satellite Receiver (SR),
3. Multiplexing System (MS),
4. Mobile Network (MN), and
5. Mobile Subscriber (MS).

The MS demand a specific satellite then a certain channel by the software executed over the mobile phone. These informations transmitted to the MS through the MN. The MS pointed to the indicated satellite and channel and insure a line from the requested channel to the subscriber.

## 8. Conclusion

Currently, there is a huge revolution through the use of internet and cellular mobile units, that almost dominant the world by a huge investment in this field. This paper aims at incorporating the digital live TV video to the cellular mobile system. The next generation cellular mobile communication system can have the ability to access the video TV with high resolution. This system is constructed by receiving and multiplexing satellite TV channels to be standby and accessible.

Huge amount of money invested in the market of Wireless telecommunications networks that leads to new technologies to serve this field. The impaction of all multimedia data in a single channel can be accessed from mobile unit is a strong and power technology which is an elegant face of the next generation mobile system. The system is simple and depends on the multiplexing of different multimedia services that can be accessed by the subscriber. This distribution is flexible and compatible that permits the customer to access any services from its own mobile unites at any site over the world. This system must be intelligent to avoid loaded capacity when a huge number of subscribers need to access the same service. This system can be reach its maximum efficiency, when the next generation well be reachable and accessible with their adaptable high speed of transmission, high verity of services, high capacity of channels, high quality and performance of mobile units with high screen resolution.

## Acknowledgement

This work was supported by the Applied Science University, Amman, Jordan.

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