



# DEVELOPMENT OF A MALAYSIAN DIGITAL TV SET-TOP BOX

Mohammed Hakim Othman of SKMM has details of the initiative to bring terrestrial digital TV to our homes.

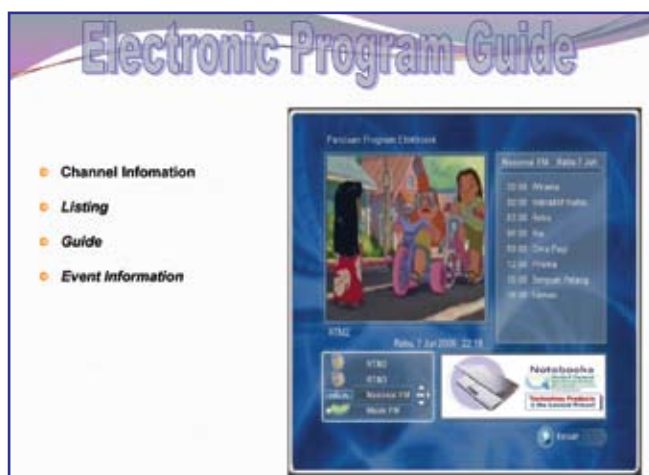
**M**alaysians are pretty familiar with set-top boxes (STB), especially from the time Astro, Malaysia's first direct-to-home broadcast satellite TV service, was launched about 12 years ago in 1996. Today, Astro viewers can enjoy a choice of up to 80 TV channels, 17 radio and four pay-per-view channels.

Malaysians are also well accustomed to digital TV, since Astro's signals are Digital Video Broadcast – Satellite (DVB-S) compliant and are compressed using MPEG-2 (Moving Picture Experts Group-2) standards in Standard Definition (SD) of 720 x 576 pixels in a 4:3 aspect ratio and with Dolby Digital 5.1 surround sound.

However, Astro is a pay-TV service and its signals are encrypted, so only Astro subscribers with the requisite SIM card inserted in their STB can view its programmes.

In 2004, the Malaysian Government endorsed and soon after allocated funding for a pilot project trial of Free-To-Air (FTA) digital TV broadcasts based on the DVB-Terrestrial (DVB-T) standard. In 2005, the communications and multimedia regulator, the Malaysian Communications and Multimedia Commission (SKMM), allocated spectrum in the UHF band to trial broadcast digital terrestrial TV in the Klang Valley - a highly developed urban area, including the capital Kuala Lumpur and all the way to Port Klang on the coast, in which one quarter of Malaysia's population of about 26.45 million persons reside.

A year later, Malaysia's public-sector broadcaster Radio Television Malaysia (RTM) commenced the pilot trial and allocated 2,000 set-top boxes distributed to selected households in Kuala Lumpur and the surrounding areas. Four digital TV channels were made available daily from 7pm to



Electronic Programme Guide (EPG)

midnight including RTM1, RTM2, Arena and Muzik Aktif. Digital radio services were available from 9am to midnight via Radio Active channel which broadcasts RTM's seven analogue FM radio stations in the Klang valley.

Similar to Astro, RTM has selected standard definition (SD) with a 4:3 aspect ratio and MPEG-2 video compression for the trial. An on-screen guide to scheduled broadcast television or radio programmes called Electronic Programming Guide (EPG) was also packaged in the trial.

On the trial Set Top box, a middleware system called Multimedia Home Platform (MHP) was chosen to provide interactive digital TV. MHP is an open middleware system standard designed by the DVB project for STB interactivity. The MHP enables user selection of programmes to view from the EPG. It also can be used to enable user selection of information services, games, interactive voting, e-mail, SMS, shopping and so on.



MHP essentially specifies an application execution environment for digital interactive TV, which is independent of the underlying system hardware and software by using a Java virtual machine layer on top of the system software and with generic APIs (application programming interface) providing access to the interactive digital TV terminal's typical resources and facilities.

The interoperable MHP applications run on top of these APIs, while a Navigator-application – a part of the terminal software – lets user access all MHP applications and other DVB services, including TV and radio.

As of mid-2005, MHP's largest deployments were in Italy and South Korea (DVB-S), with trials or limited deployments in Germany, Finland, Spain, Austria and Australia.

But the main question remains: will MPEG2 compression, SD and MHP as demonstrated in the trial be adopted for the future digital terrestrial broadcasting specifications in Malaysia? The answer is; not quite.

**Settling on MPEG-4**

A newer compression technology has emerged and claims to be better in spectrum efficiency usage. Also known as H.264, MPEG-4 AVC is a video compression standard jointly developed by the International Telecommunication Union - Telecommunication Standardisation Sector (ITU-T) Video Coding Experts Group and the International Organisation of Standards/International Electrotechnical Commission – Moving Picture Experts Group (ISO/IEC – MPEG).

MPEG-4 compression is said to give up to twice the spectrum efficiency of that of MPEG-2. As spectrum is a limited commodity, MPEG-4 will bring up a huge benefit of freeing up significant amounts of spectrum in the VHF and

UHF bands, and facilitate the opening up of more opportunities to provide new services.

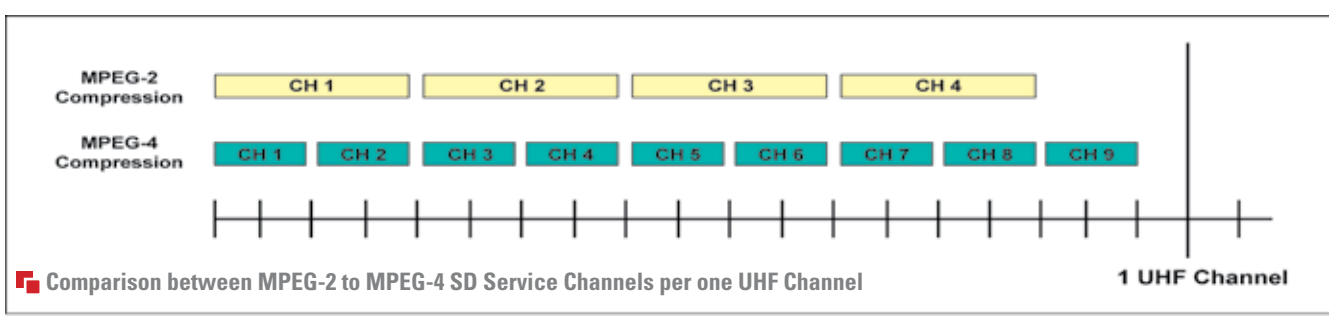
As an example, a single SD service channel may require 4 Mbits per second (Mbps) but with MPEG-4 compression, the capacity may go down to half of that of MPEG-2. A UHF frequency channel of 8 MHz spectrum with a 19 Mbps throughput would allow up to 9 SD service channels compared to 4 SDs on MPEG-2. With this efficiency and benefits, SKMM has taken the initiative in 2006 to mandate MPEG-4 in parcel with mandating DVB-T standard as the Free to Air (FTA) Transmission of Digital Terrestrial Television.

The decision to mandate MPEG-4 was taken to avoid legacy issues in the longer term even though at this time MPEG-4 STB is still very limited and expensive in comparison to the established MPEG-2 STB. But in the long run, it will still be less costly to implement the higher cost STB right away compared to pulling back MPEG-2 STB from the market in the future and replacing it with the more spectrum efficient MPEG-4 STB then. However, with the rapid development of digital technology, it is envisaged that further upgrades in the adopted standards may be required.

On the positive side, many other countries in Europe and Asia have taken similar steps of requiring MPEG-4 compression for STB hence resulting in a faster drop of MPEG-4 STBs prices.

**Multimedia Terminal Work Group**

With the Mandatory Standard decided, further studies were required to work out detailed specifications of the STB so that importers and manufacturers could start importing



Comparison between MPEG-2 to MPEG-4 SD Service Channels per one UHF Channel

1 UHF Channel

or manufacturing compliant STBs for the market. The telecommunications and multimedia industry association, the Malaysian Technical Standards Forum Berhad (MTSFB) was given the responsibility of carrying out this task.

MTSFB was established as a private company limited by guarantee and one of its key objectives is: "To actively promote a co-operative environment to address in a timely manner national or international issues involving technical standards, technical codes and development of operational guidelines for Malaysian communications and multimedia industry." SKMM officially designated MTSFB on 27 October 2004 pursuant to Sections 94 and 184 of the Communications and Multimedia Act 1998. Its ordinary members include Maxis Broadband, Telekom Malaysia, DiGi Telecommunications, Time dotCom, ZTE, MiTV, Realm Energy, Measat Broadcast Network System, the standards body SIRIM, Masers Digital, DIS Technology Holdings, Smart Digital Communications, NTT MSC, telecommunication consultant Orbitage, high-altitude platform provider QucomHaps Malaysia and MIMOS Bhd.

Its associate members include Rohde & Schwarz, Nokia Siemens, Ericsson, Alcatel-Lucent, TMNet, Celcom, Motorola Technology, Electroscop, HAPS Network, AsiaSpace, National Advanced IPv6 Centre (NAV6), Packet One Networks, BT Multimedia, Panasonic R&D, ADA Cellworks and institutions of higher learning including Universiti Teknologi Malaysia, Universiti Putra Malaysia, University Teknologi MARA and Universiti Sains Islam Malaysia.

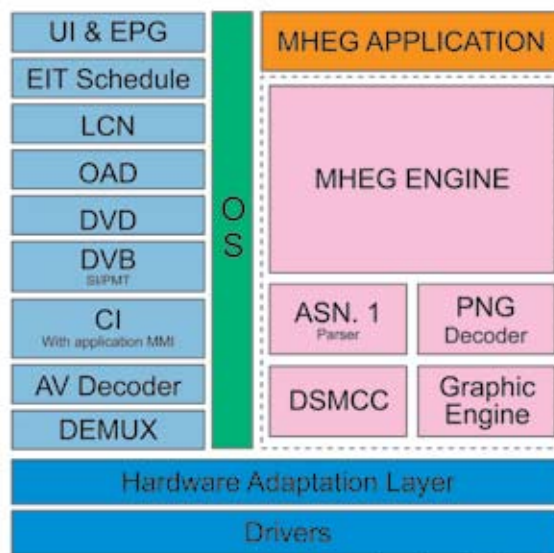
Several working groups were established under the MTSFB, including the Multimedia Terminal Work Group (MT WG) which was given the responsibility of developing the STB specifications.

Since every increase of functionality may increase the price of the STB, each specification had to be studied and debated thoroughly to ensure that the functions are justified and necessary to meet the needs of the viewers as well as the industry.

This challenge was successfully undertaken by the MT WG and a technical specification for FTA Terrestrial Television Receiver (STB) was submitted to SKMM in June 2008 after going through a public consultation. The specification was finally registered by SKMM and taken into effect on 13 August 2008. The following sections will highlight the significant functionalities included in the technical specifications.

## Going HD

HD, in short for High Definition is the capability to display better resolution (minimum of 720 horizontal lines as opposed to 576 lines for SD) than the traditional SD which is the basis of the transmitted television services in Malaysia today. HD would be able to create a superior display presentation especially on big screen televisions for better watching or cinematic experience by viewers. Most of the LCD and Plasma Televisions available in the market are HD ready and can display in full widescreen aspect ratio of 16:9.



Typical MHEG-5 STB Architecture

Currently, the only way to watch HD content is via HD DVD or Blu-Ray video playbacks. Hence with the capability of the STB to process HD signals, HD services would also be available via terrestrial broadcasting.

Nonetheless HD services would require higher bandwidth of around 8 to 12 Mbps per programme service channel when using MPEG-4 compression while MPEG-2 compression will require an entire UHF 8 MHz channel for a service channel. Since spectrum is a limited commodity, HD service channel would only be for unique services and SD service channels would still be necessary and dominant for the current compression capability.

## MHEG-5

Though MHP was selected in the RTM trial, the MT WG which was also represented by RTM has selected MHEG-5 system instead for the middleware.

It must be noted that MHEG-5 does not have the processing power of the MHP which uses Java based technology. Also, MHP is designed by the popular DVB system from which the terrestrial system (DVB-T) has been adopted in many countries including Malaysia.

The reason then for choosing MHEG-5 middleware technology has to do more with commercial implications not only for end users, i.e. STB owners, but also for the broadcasters. Broadcasters will need to pay middleware licenses fee if they use MHP technology. On the other hand, no known license fee is being imposed either for FTA (Free to Air) or subscription broadcasters for MHEG-5, which is being promoted by IMPALA (The International MHEG Promotion Alliance). This, in effect, placed MHP at a disadvantage.

To counter this perceived disadvantage, it was announced in June 2008 that MHP will offer free licenses for FTA broadcasters. However this development has not impressed our local FTA broadcasters as a general survey indicates that they have the intention to also provide subscription services in the future.

For STBs, it appears that only a slightly more expensive one time license fee will be necessary for MHP as compared to MHEG-5. However other considerations such as complexity

and the processing needs will contribute to make the MHP based STB appear as the higher cost option.

Nonetheless, at the end of the day, the price and availability of both middleware STB types lie in the take-up globally. Hence both middleware marketers are aggressively marketing each of their systems.

Currently, MHEG-5 is adopted by broadcasters in UK, New Zealand and Hong Kong and a few evaluations are ongoing in other countries. Freeview UK and New Zealand are two FTA brand names utilising MHEG-5 middleware.

## ASEAN Initiatives

The ASEAN initiative on broadcasting is pioneered by the ASEAN Digital Broadcasting (ADB) cooperation. In technical terms, a harmonised technology is pursued to ensure economy of scale in bringing down equipment prices in STBs. The first success story was getting an agreement on adopting DVB-T standards by member countries. The ASEAN Ministers Responsible for Information (AMRI) has endorsed the decision taken by ADB in June 2007.

The next step was to have harmonised STB specifications among member countries which is currently ongoing. Naturally, the issue of middleware is among the heavily discussed subjects. A member country is pressing for MHP whereas some countries are observing the debate. In the ADB meeting held in Bali in Dec 2008, claims were made that DVB is prepared to drop all license requirements. However this announcement is yet to be confirmed. This move indicates that the battle for dominance in middleware is expected to go all the way as it will probably determine the growth or survival of either middleware technology.

Currently at the time of writing, Malaysia is still at its present position of adopting MHEG-5 and will further conduct a wide industry trial in 2009 as well as monitoring and watching further developments in both middleware technologies globally.

## Conditional Access

Conditional Access (CA) is a security feature in protection of content by requiring certain criteria to be met before granting access to the content. CA is required for subscription services. There are a few major vendors providing CA service including NDS, Conax, Irdeto, and NagraVision. One vendor might fulfill the CA requirement of a broadcaster better than another thus DVB has developed Conditional Interface (CI) for STB to interact with different CA vendors which would be embedded in modules called Conditional Access Module (CAM). CI was made a requirement in the technical specification.

The availability of the CI would enable the FTA STB to provide subscription services by inserting the CAM of the subscription broadcaster. It will avoid the need to have multiple STBs in a household to receive FTA and subscription services.

## Output Interfaces

The primary output for the STB will be HDMI (High-Definition Multimedia Terminal) to match with the standard



■ Samples of Conditional Access Modules (CAMs)

interface adopted in new TV sets. Though it is termed as HD, it is downward compatible and would be able to support on a single cable any TV or PC video format including standard, enhanced, and high-definition video along with up to 8 channels of digital audio.

The requirement also stated the need for the HDMI to have HDCP (High-Bandwidth Digital Content Protection) which encrypts the signal if required by the source. HDCP is a form of digital copy protection developed by Intel Corporation to prevent copying of digital audio and video content as it travels across the HDMI. More and more content developers and owners are requiring HDCP functionality to be provided by broadcasters before they would sell them their contents. HDCP is also seen as robust and reliable as FCC has approved HDCP as a “Digital Output Protection Technology” and European Information, Communications, and Consumer Electronics Technology Industry Associations (EICTA) announced that HDCP is a required component of the European “HD ready” label.

The secondary output would be the usual 3 RCA connectors Red, White and Yellow. Red would carry right audio, white would be left audio and video would be carried by the yellow connector. Dolby Digital AC-3 is also a requirement which is carried out through either optical and/or Coaxial Digital Audio Outputs. Other standard video and audio outputs than those mentioned above are optional.

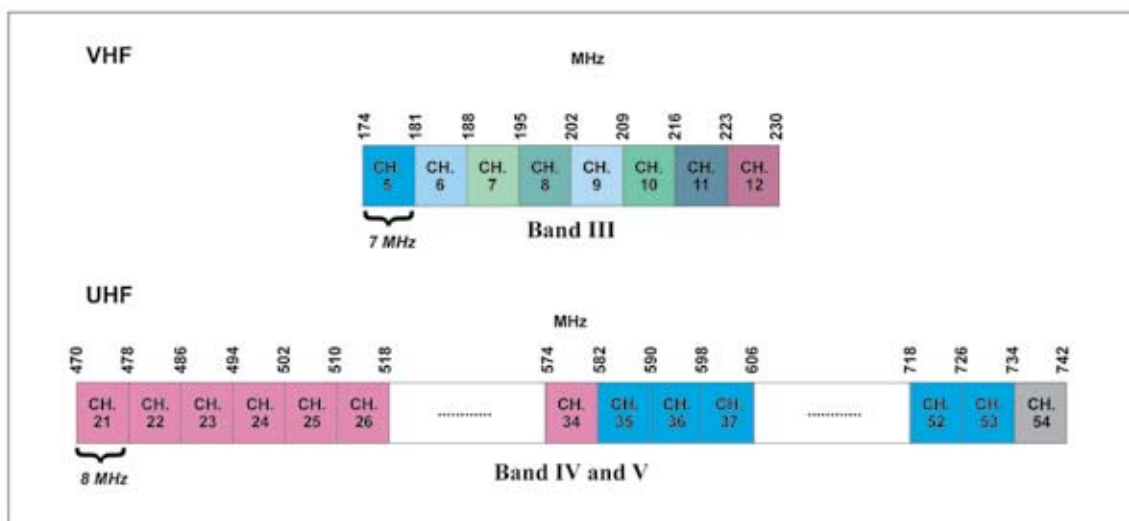
Either USB (Universal Serial Bus) or RJ 45 data interface is required to perform software upgrades and interactivity. Lastly, an STB would not be complete without a remote control.

## Frequency Band

DVB-T systems are designed for both VHF bands (Band III, 174-230 MHz) and UHF band (Band IV and V, 470-860 MHz). Thus the STB specification includes the VHF band as this has been included in the spectrum planning and reserved for future use of broadcasting. The GE06 Agreement (harmonisation agreement in Europe) has also allocated parts of the VHF band for Digital Terrestrial Television Services.

## Integrated Digital Television (IDTV)

In a global development, convergence between STB and Digital Television called IDTV (Integrated Digital Television) has become prevalent among digital television



**Malaysian VHF Band III & UHF Band IV and V**

manufacturers. Major names such as Sony, Panasonic, Philips, Samsung and others have shown great interest on developing IDTV. In effect, many have the opinion that at some point in the future, STB would be obsolete due to IDTV. However, certain other quarters feel that STB will remain simply because one does not need to change one's television set for a hardware upgrade on the STB portion.

Perhaps certain common functionalities will remain in IDTV and extra requirements will be available on purchase of STB. Or STB could be made into PCMCIA (Personal Computer Memory Card International Association) card size which would be inserted in television sets and which would be replaceable at any time. Even the relevancy of the "Set-Top-Box" term becomes a discussion point looking at the space available on top of the modern LCD or Plasma Televisions. Perhaps a better term would be SST (Set-Side-Box) or just digital TV tuner/receiver. Whatever the opinions; the debates continue. But one surety is that analogue TV switch-off is a certainty which has already been completed in some countries.

### Future Outlook

MyICMS 886, the Malaysian strategic blueprint for the Information, Communications and Multimedia Services 2006-2010, identified Digital Multimedia Receivers (Set-Top Box) as one of 6 growth areas.

It is expected that the availability of low cost and wide range of choices for STB will stimulate the quick migration towards digital services reaching the desired penetration rate. Though the MyICMS goal for medium term (2008) of 60% household coverage has not been met, the momentum towards meeting the 2015 analogue shut off is still on target through the hope of shortening the very costly simulcast period. Simulcast is the period where both analogue and digital signals are broadcasted for every FTA service channel.

Currently the price of STBs similar to the specification set out for Malaysia is still expensive. In New Zealand, an STB with MPEG 4, MHEG-5 and HD capability cost between RM800-RM1000. However, in South Africa, it is targeted at a price below US\$200 (RM700). As an economics rule of thumb, the longer a product is in the market and the bigger is the take up rate; the price will go down reciprocally. An observation done in Australia on MPEG-2 STB prices since 2001 show that prices have dropped to 5% of the original value in a period of 8 years and are still falling. It is expected that the prices of STB for Malaysia and globally will follow a similar trend.

Post 2009 sees the extension of the RTM initiated trial, albeit with the upgrading of MPEG-4 compression with HD capability. The extension trial, funded by SKMM, will include around a thousand STBs with MHEG-5 middleware. The transmission for the trial will be provided by Telekom Malaysia with the participation of other private broadcasters as content providers. The trial is expected to last a year followed by a national digital broadcast network roll out. Evaluation and testing will be done during the trial and if need be, the technical specifications for the STB will be reviewed at the end of the trial before the national digital roll out. As it is, there is already a functionality identified which may need to be reviewed in the STB specification. This is the CI functionality because a more secured CI+ is now available. [.my](http://www.mmc.gov.my)

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