1. What is Middleware? Middleware is basically software which links two different softwares. It in fact performs the task of a translator between the two softwares. In relation to the Set Top Box (STB), Middleware refers to the software layer that sits on top of the Operating System (OS) in an STB.

2. Before we go into further details of Middleware, it would be relevant, at this stage, to delve into the components of the STB.

3. A Set Top Box is a device that processes digital information, in this case, a number of TV and Radio channels in digital form and provides an audio/video output or RF to the TV.

4. The various constituents of an STB along with inter-relationships are depicted in Figure – 1 below.

5. The STB hardware comprises of the Tuner which is a QAM tuner in Cable TV and QPSK in a DTH box. It contains decoder, which may be referred to as demodulator or demultiplexer, by different authors. The other components are the buffers, synchronisation hardware and software and last, but not the least, the Central Processing Unit (CPU). Add to this the power supply sub-unit, which may be external or internal, and we have the basic set top box.

6. Manufacturers of STBs provide the device drivers and the OS. Generally they are referred to as System Software. It may be noted that the System Software is hardware dependent. This means that the System Software in one type of STB cannot work in another STB of a different make.

7. Most manufacturers of STBs provide the basic
features as part of the System Software. Some of these functions are :-
(a) Automatic tuning in the background.
(b) Channel lists which may be in logical order as given by an MSO, or they may be in alphabetical order or transport stream (frequency) wise. Generally, the logical order is provided with the provision to change to alphabetical order.
(c) User defined "favourite" channel lists. This allows the user to create his own lists. Most STBs provide multiple favourite lists so that the user can create his own groups of channels.
(d) Parental locks, which allowing "locking" of channels so that they cannot be viewed unless a password is provided.
(e) Electronic programme guide (EPG) – generally the EPG displays the programmes for a week for each channel.
(f) Synopsis of programmes, which is a brief description of the programme.
(g) Provision for downloading newer versions of System Software over the network.
(h) Other features which vary from box to box depending upon the manufacturer.

8. The Middleware lies above the System Software and acts as an intermediary between the system software and the Applications. Most Middleware provide sophisticated Application Programme Interface (API).

9. The APIs enable the STB manufacturer and in some cases the Service Provider (MSO) to develop applications that enrich the viewing experience in the STB.

10. It would indeed be difficult to describe all the different Middleware available in this paper, as each one provides a large number of features. For detailed information the reader may go to the web sites of these companies.

11. Digital Video Broadcasting (DVB), is a consortium which lays down the standards for Digital TV transmission for Satellite (DVB-S), Cable (DVB-C), Terrestrial (DVB-T) and Mobile Phones (Handheld) (DVB-H). DVB has, therefore, laid down standards for Middleware, DVB-MHP, where MHP stands for Multimedia Home Platform.

12. In addition to DVB standards, ISO had set up a Multimedia and Hypermedia Experts Group (MHEG) which also lays down the standards for Middleware in terms of storage, display and exchange of Multimedia presentations. MHEG-5 is an OOL (Object Orientated Language) with classes, links and programmes for creation of...
Digital TV applications. MHEG is considered by some as ideal for low end STBs.

13. Middleware, basically, attempts to achieve interoperability by hiding the specifics of hardware and System Software from the actual Digital TV applications. This leads to two classes of Middleware, “open” and “propriety”.

14. Open Middleware.
   (a) Standardised by an industry body or consortiums, such as DVB and MHEG.
   (b) Anyone can implement it.
   (c) Licensing fee is usually small.
   (d) Generally, but not necessarily, used in free TV.

15. Some of the open middleware examples are –
   (a) ACAP – Advance Cable Applications Platform.
   (b) ARIB B23
   (c) DAVIC – MHEG and Java.
   (d) Java TV.
   (e) MHEG.
   (f) MHP.

   (a) Designed by a single company.
   (b) Licensed to STB manufacturers.
   (c) License fee may be high.
   (d) Generally used in Pay TV.

17. Presently there are a large number of Companies providing propriety middleware. To name just a few of the popular ones (known to the author) are –
   (a) Liberate.
   (b) MediaHighway from Canal Plus (Kudleski Group which provides the Nagra CAS).
   (c) NDS Core from NDS who is also a CAS provider.
   (d) Microsoft TV (MSTV).
(e) OpenTV Core – Core3 was recently demonstrated at IBC Exhibition at Amsterdam in 2009.

(f) PowerTV from Scientific Atlanta who also provide CAS.

18. It may be noted that propriety middleware is generally CPU chip dependent. The good part is that if a particular middleware has been posted on a CPU chip of one STB manufacturer, it is easier to port that middleware on a different STB, if it using the same CPU chip.

19. The power of Middleware is best utilised in Interactive STBs and IPTV, where the service provider can offer exotic features such as interactive games, e-commerce, Internet browsing and many others.

20. Advantages of Using Middleware. The advantages of using middleware are –

(a) Features of the STB can be customised as per the business plan of the Service providers.

(b) The graphics (on screen display) can be standardised by the Service Provider so that, irrespective of the STB manufacturer, the display on the TV screen and the navigation through the menus is the same.

(c) One of the major practical advantage as an outcome of (b) above is that training of technicians and customer care staff is greatly simplified. In the absence of standardised displays, the customer care staff have to first ascertain the type of STB held and then guide the customer accordingly.

(d) Enriched features can be provided.

(e) In case of user defined APIs, the Service Provider can develop his own applications, which can then be downloaded in all makes of STBs “over the air”.

21. Considering the advantages of using Middleware, why is it not used by all service providers?
Middleware requires additional memory, both Flash and SDRAM. The zapper STB System Software can generally run on a 2 MB Flash and 4 MB SDRAM. For loading middleware, the minimum memory requirement is a 4 MB Flash and 8 MB RAM. For more sophisticated features higher memory would be required.

(b) For middleware higher CPU processing speeds are required. Most middleware can run on CPUs of 80 MIPs (Mega Instructions per Second) for normal features.

(c) The royalties to be paid for the middleware increases the cost of the STB.

(d) Since the System Software provided by the STB manufacturer provides all the basic features required, service providers do not feel the requirement of middleware.

The basic reason for not using middleware is that it increases the cost of the STB. Considering the Indian environment, most customers, as projected by the Local Cable Operator, are not willing to pay more for the STB. However, this could be circumvented by negotiating a revenue sharing with the STB manufacturer and the middleware provider.

The paper has tried to provide an overview of Middleware and does not constitute a detailed treatise on it since, as mentioned earlier, each middleware has its unique features. It would not be possible to enumerate all of them here.