Multimedia Data Processing Elements for Digital TV and Multimedia Services in Home Server Platform

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Why digital TV not analog TV?

Conventional TV:
- 4:3 aspect ratio
- Limited resolution
- Limit color fidelity
- Flick
- Color mixing
- Analog transmission

Digital HDTV:
- Wide screen 16:9 aspect ratio
- High resolution (41000 Lines)
- Digital sound (Dolby AC-3)
- No artifacts
- Improve color fidelity
- Digital transmission
History of television

- First Monochrome Broadcast of Electronic Television in England, 1936
- Introduction of Color Television based on the three primary colors, ~1968
- Digital Television is the next big revolution in television, ~2000-2006
  - Multimedia standards converge under the digiTV standards
  - Services can be experienced whenever, and wherever the consumer wants
  - Enhanced quality, multiplication of channels, interactivity, access to Internet services
  - Interacting with content is the major issue
**TV - a few Definitions...**

**Digital Television:**
“transmitting a broadcast signal by encoding it as 0s and 1s—the digital code used in computers. DTV can be compressed to provide four, five, or more channels in the same bandwidth required for one channel of the current standard television, better sound, and about five times more picture information (picture elements, or pixels) than conventional television”
Comparison of Classic Analog and Modern Digital TV

- Digital TV requires many technological changes (e.g. digital broadcast signal or digital production)
- Digital TV requires many new thoughts in how content models and service concepts
- Program maps or schedules limit the possibilities of new content and services in analog TV
- The degree of freedom for the consumer (e.g. Internet access, additional home theatre like-equipment) is higher in digital TV
DigiTV Scenario: In-House streaming

1) DVB-SI
2) Feedback
3) MPEG-2 PSs
Various kinds of wired and wireless home network standard

- IEEE 1394:
  "The Multimedia Connection"
  Speeds up to 400 Mbps
Various kinds of wired and wireless home network standard (cont’d)

HomePNA:
is the high-speed, reliable networking (LAN) technology that uses the existing phone wires in your home to share a single Internet connection with several PCs in your home.

PLC (power line communications):
The PLC is used to connect white appliances like microwave ovens, refrigerators, and washing machines.
Concept of home server and home digital service environments
Architecture of home server platform
Block diagram of D-TV receiver module
Multimedia Codec Module

- D-TV receiver can send VGA (640*480 pixels/frame)
- The multimedia codec module reduces the resolution of the video data to common intermediate format (352*288 pixels/frame)
- Should process at least 15 frames for CIF size video (difficult to expect adequate quality of service)
- Using a **DSP** and a field programmable gate array (**FPGA**) to reduce the load on the main processor and to support the required codec performance continually.
Main topic for this paper

Main processor broad can handle and manage all different signal?

- In order to expect quality of service (QoS)
- Reduce the load on the main processor
- Main the required performance

HOW?
What is FPGA

FPGA (field programmable gate array):

- a type of logic chip that can be programmed.
- They are especially popular for prototyping integrated circuit designs.
- Once the design is set, hardwired chips are produced for faster performance.
How can we implement program into FPGA

- Development Broad: Xilinx, Alter, etc. platform
- Development Tool (EDA): Cadence, Synopsys, Mentor Graphic (OSU)
- VHDL (Very High Speed ICs Hardware Description Language)
  
  Description Circuit and Synthesize and Simulation the design
FPGA is?
FPGA enough?

IP Solution:

• IP (Intellectual Property) core is hard to acquire
• Development tool not 100% exactly
• Real Hardware assembly conflict
Block diagram of multimedia codec module
Video input flow
Block diagram of the FPGA module

- System and internal bus
- Connected by a multiplexer
- Data for current frame, previous frame, reconstruction frame can interface with DSP via the system memory
Architecture of open service platform

Open Service Platform (OSGi Framework)

Java Virtual Machine (JVM)

Embedded Real-time OS

Hardware
Home server platform
D-TV receiving result

(a) Received D-TV picture and  (b) EPG browsing result
Architecture of instant message service
Configuration of home server side
Configuration of service provider side
Conclusion

- Established the concept of a home server platform
- Home server can present various multimedia services and control various information appliances, at anytime and anywhere.
- It can manage all information within a home, and present information communication methods among family members.