ECEN 5653

Final QUIZ REVIEW
Major Concepts

- Real-Time Services (Best Effort, Hard, Soft and Isochronal Real-Time)
  - Difference Between Hard and Soft Real-Time
- POSIX Threading, NPTL
  - FIFO Scheduler and Priority Pre-emptive Run-to-Completion
  - Create, Detach, and Join
- Static Vs. Dynamic Priority (RM Vs. EDF/LLF)
  - Harmonics
  - Advantages of Dynamic for General Utility
- RT Implementation Challenges
  - Shared Resources
  - Blocking – Inversion, Deadlock, Livelock
Major Concepts

Audio and Video Encoding
- Audio PCM Sampling and Encoding
- Video Encoding (Lossy and Lossless)
  - Color Spaces, Models, and Pixel Encoding
  - Frame
  - Sequence

Elementary, Program, and Transport Streams

MPEG Encoding Order of Operations
- RGB->YUV (Lossy)
- Block Level DCT (8x8)
- Quantization (Lossy)
- RLE (Run Length Encoding) and Huffman Encoding
- Macro Block GoP (Group of Pictures), I-frame, B-frame, P-frame

MPEG PS/TS Packets (188 Byte) and Multi-plexing

Broadband (RF Cable/OTA) and Baseband Carriers
Major Concepts

- **IO and Linux Drivers**
  - MMIO
  - Block Drivers
  - Cache Coherency with DMA
  - Drive Abstraction with HW Interface and Application Interface

- **Storage Arrays**
  - RAID-0
  - RAID-1, 10
  - RAID-5, 50
  - RAID-6, 60
New Topics Since Mid-term

Long Tail Digital Media
- Pareto Rule – 80% of Consumers Consume 20% of Available Content (Head)
- Remaining 20% of Consumers Consume Remaining 80% of Unique Content Selections
- Common Wisdom: Invest Most in Head (20%) of Content
- Broadcast Follows Pareto Rule
- On-Demand Has Shown Increased Economic Value in the Tail and Very Large Content Libraries

On-Demand, Time-Shifted (E.g. DVR), Location-Shifted (E.g. Mobile or Web), and Narrowcasting (Very Specific Markets)
New Topics Since Mid-term

- Digital Rights Management
  - Encryption of Digital Media in Transport
  - Decryption Only by Authenticated End-Users
  - Key Management and Conditional Access
  - Triple DES (Data Encryption Standard)
  - Rijndael (“Rhine Doll”) AES-128/256 CBC (Cyphper Block Chaining)

- Content Protection, Revenue Protection (Digital Media Forensics)
  - Watermarking – Original Master Source (Studio, Head-end)
  - Fingerprinting – Addition of Client Information (Set-Top Box, Network)
  - Watermarks/Fingerprints – Hidden in Encoding, Must Not Be Eliminated by Encoding

- Digital Media Rarely Distributed in Resolution Anywhere Near Original Masters
  - E.g. Digital Cinema – 2K, 4K, 6K Resolution
  - HD – 1080p MPEG-2 or MPEG-4 Lossy Encoding
Top 10 Concepts

1. Flynn’s Taxonomy for Processor Scaling
   - MIMD – Multi-Core, Multi-Thread (Native POSIX Threading)
   - SIMD – Vector Processing Instructions (E.g. Many Word Multiply and Accumulate)
   - SPMD – Single Program, Multiple Data Streams (Cell BBE and GPU, GP-GPU)

2. Real-Time Services (Hard Vs. Soft)

3. Dynamic Vs. Static Thread Dispatch and Execution Priority

4. Blocking (Shared Resources in Addition to CPU) and Indefinite Blocking Bugs (E.g. Deadlock)

5. Storage, IO, and CPU Virtualization (RAID, Multi-path IO, VCPUs, Threading, Hypervisors)

6. Digital Video Encoding Order of Operators

7. Lossy Vs. Lossless Video Encoding Steps

8. Digital Rights Management and Digital Forensics

9. Digital Media Delivery – Broadband (E.g. OTA), Baseband (E.g. Internet), Broadcast, On-Demand, Multi-cast, Narrowcast, Time-Shift, Location-Shift

10. Parallel Processing Speed-up (Amdahl’s Law)