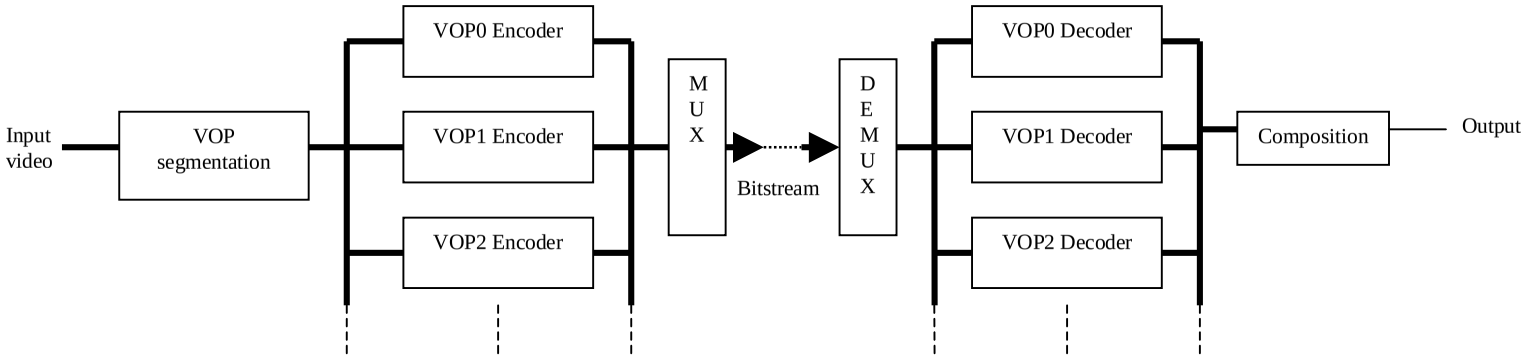
System Modeling and Software Implementation of MPEG-4 Video Encoder

Chen He and Shi Zhong

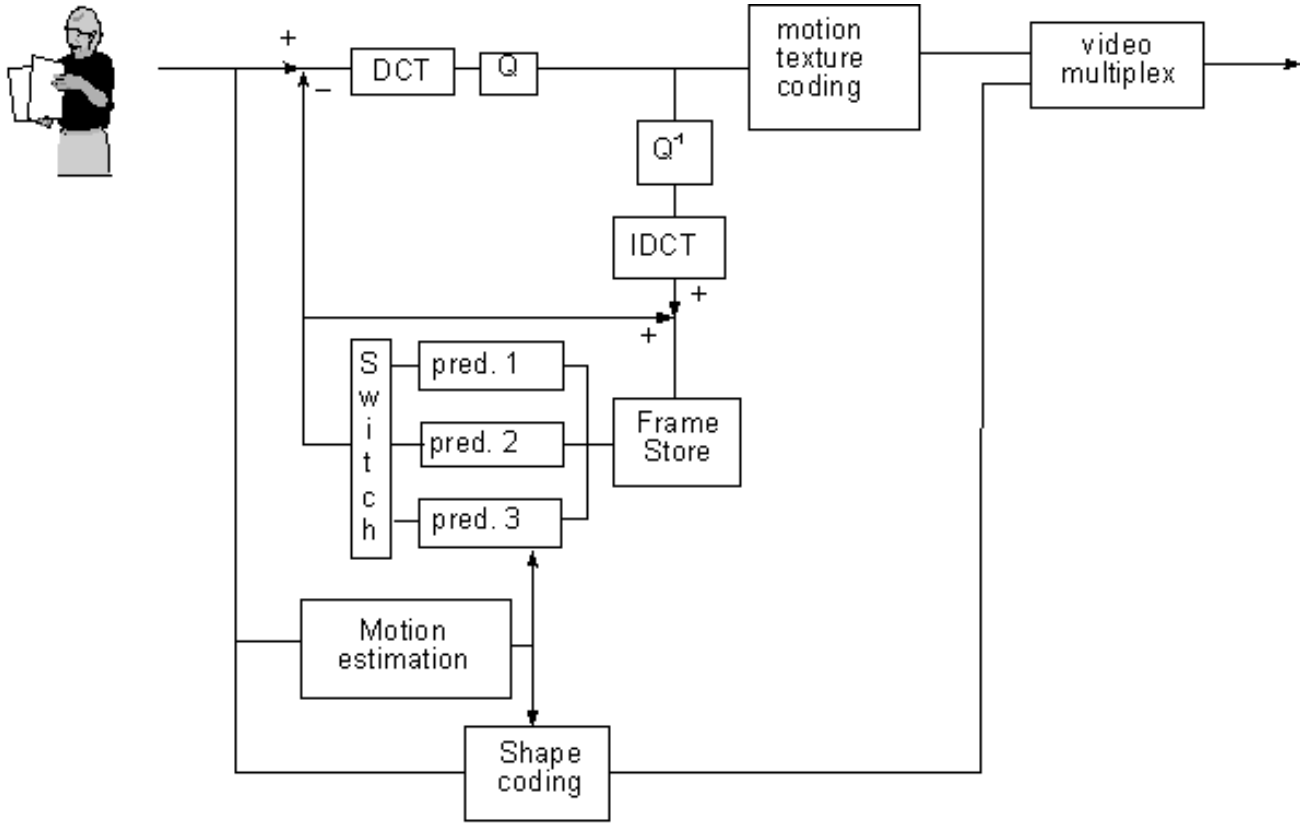
MPEG-4 Video Encoder

- Supports content-based interactivity, high compression, and/or universal accessibility and portability
- Overall structure



- A VOP encoder consists of shape coding (for arbitrarily shaped VOs), motion estimation/compensation, and DCT-based texture coding

MPEG-4 VOP Encoder Diagram



Candidate System-level Models

- SDF - used by Kim and Evans to model a generic video codec system
- Petri-net - a modeling tool for describing systems with concurrent, distributed, and parallel characteristics employed in the software-based MPEG-4 encoder implementation by He et al.
- Process Network - concurrent model of computation
  - correctness, determinacy, complete and bounded execution (bounded scheduling proposed by Parks)
  - reliable formal design methodology for organizing and developing real-time multiprocessor software
  - existing work done by Allen et al in real-time beamformer implementation
  - our choice

Software-based Implementation

- Scheduling for multi-processors - to exploit the control parallelism (VOP segmentation)
- Dynamic data partitioning - to exploit the data parallelism (dividing the work load MacroBlock-wisely)
- Our plan
  - To use process networks to model the encoder system
  - To maximize the parallelism by dividing the tasks and balancing the load in each processing node
  - To demonstrate the feasibility of implementing a real-time MPEG-4 encoder on workstations using the framework constructed by Allen et al