Multicore Processors for Next-Generation Computers
Performance Analysis of MPSoC-based HEVC Implementation
(XJ1c-13)

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PROJECT OVERVIEW

Many people should have the experience in watching HD television programs. The resolution which commonly uses nowadays is 720p and 1080p. In near future, Ultra HD video 4K and 8K, which is 4 times and 16-times resolution compared to 1080p, will be popular.

With large amount of data, the old standard of video encoding, H.264 (also known as MPEG-4 AVC), does not have enough compression power to compress the video image into small size. In order to solve this problem, a new video encoding standard, High Efficiency Video Coding (HEVC), released in January 2013. The development team Joint Collaborative Team on Video Coding (JCT-VC) aimed to have a bit rate reduction of 50% but same quality compared to H.264. Although we know it double the compression power, the performance of implementing HEVC on MultiProcessor System-on-Chip (MPSoC) is still not well known.

Therefore, we aim to determine and analyze the performance of MPSoC-based HEVC implementation.

BACKGROUND INFORMATION

To reduce 50% bit rate, HEVC has several improvements and some highlighted features are:
- Macroblock change to Comp Group Unit and Coder Tree Block.
- In H.264, macroblock is used as the unit to divide the picture. The largest macroblock size is 16x16. But in HEVC, Coder Tree Unit and Coding Tree Block is used and the size is changed to maximum 128x128 and 64x64 is commonly used. CU contains Luma CTB, two Chroma CTBs, and the associated syntax elements. It can split into different Coding Units. Similar to CTU, each CU contains three CUs and associated syntax elements. Each CU can be further divided into Prediction Blocks and Transform Blocks.

METHODOLOGY

In HEVC, asymmetric mode of block partitioning is added into motion estimation of inter-frame prediction. It allows better picture partition and reduces the bit rate when encoding. Both in intra-frame prediction, only symmetric mode is provided, which is similar to H.264.

And to start the simulation, we need to construct an application model - task communication graph. An accurate model is necessary to make sure the result totally reflects the performance. The circles represent the tasks and edges represent data communication.

RESULT

In the application model, total number of tasks is 4059 and total 13767 edges exist in encoding one 4K video. Because HEVC is a very complex algorithm, the simulation for 4K video is still running. Although we do not have any numerical result at this stage, we do know that HEVC provide a stronger compression power comparing to H.264. And also the industry is still modifying the standard to reduce the complexity and speed up the encode and decode process.