DEBLOCKING OF IMAGES WITH DCT COMPRESSION

ECE 641 term project

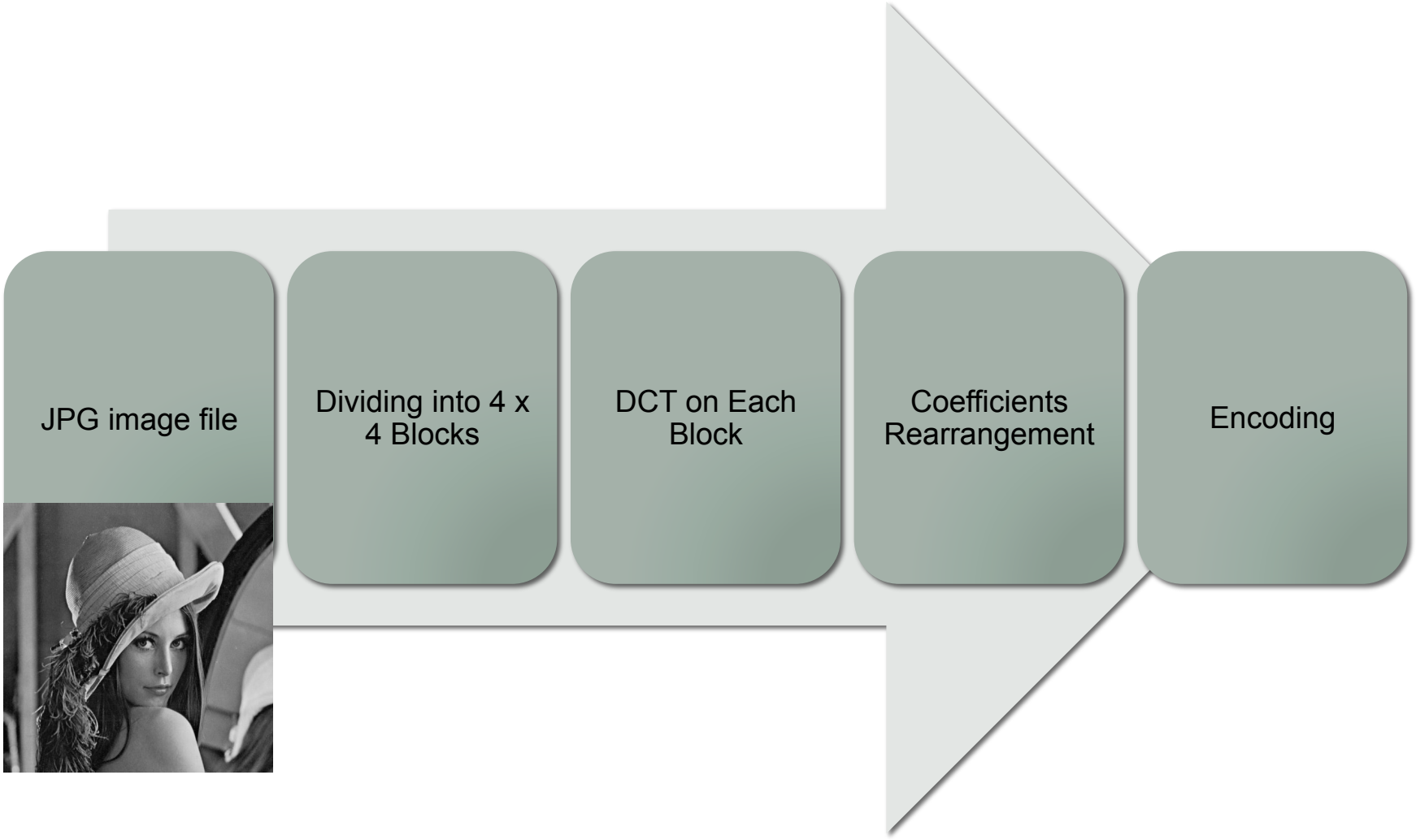
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Introduction

- It is well known that the discrete cosine transform (DCT) is capable of compacting image energy efficiently into a small number of DCT coefficients, thus suitable for image compression . It has been widely adopted by various still and moving image coding standards, such as JPEG and MPEG. Figure 1 shows the procedure for coding an image according to the JPEG standard. In this scheme, first, an image is divided into 4-by-4 blocks and each block is transformed by the DCT. Then, the DCT coefficients are quantized in such a way that the most insignificant coefficients become zero in value. Thereafter, the quantized DCT coefficients are coded for transmission or storage.

The use of DCT for JPEG image coding



The DCT of a vector of *N* elements can be calculated in *O(N* log2 *N*) operations via an *N* -point FFT using β(n):

$$v(k) = \alpha(k) \sum_{n=0}^{N-1} u(n) cos \frac{\pi(2n+1)k}{2N}, 0 \leq k \leq N-1$$

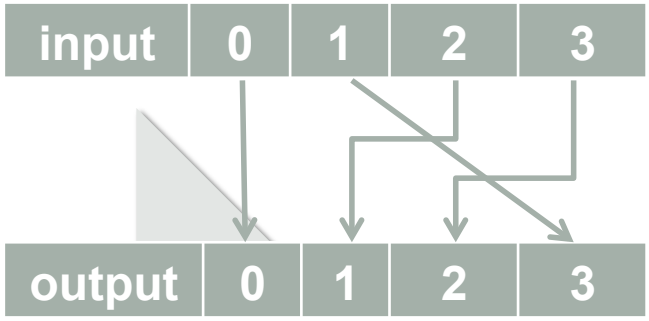
$$\alpha(0) = \sqrt{\frac{1}{N}} \quad \alpha(k) = \sqrt{\frac{2}{N}}$$

- β(n) = α(2n)
  β(N−n−1)= α(2n+1), where0≤n≤ *N/2* −1
- The transform sequence *v(k)* is given by:

$$v(k) = Re[\alpha(k) W_{2N}^{\frac{k}{2}} \text{ DFT } (\beta(k)_N)]$$

- So, the DCT is the real part of the DFT of the sequence β(k) multiplied by α(k) and a twiddle factor of W_{2N} .

The DCT transform reorder unit in the architecture

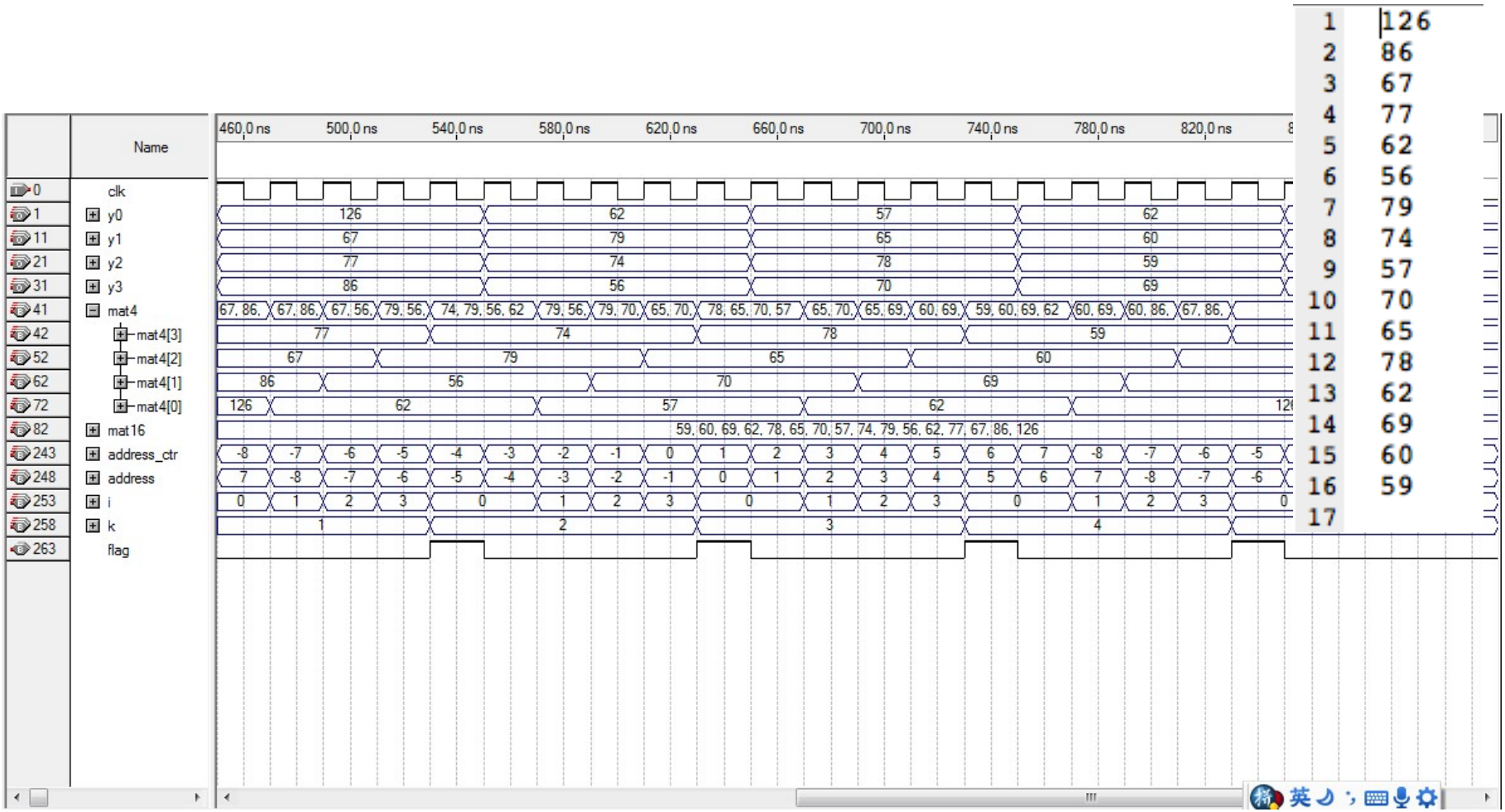


series input from ram

parallelize and reorder

4 parallel outputs to FFT each clock cycle

Figure 1 Inputs and simulation after reorder



the architecture for DCT processing using FFT

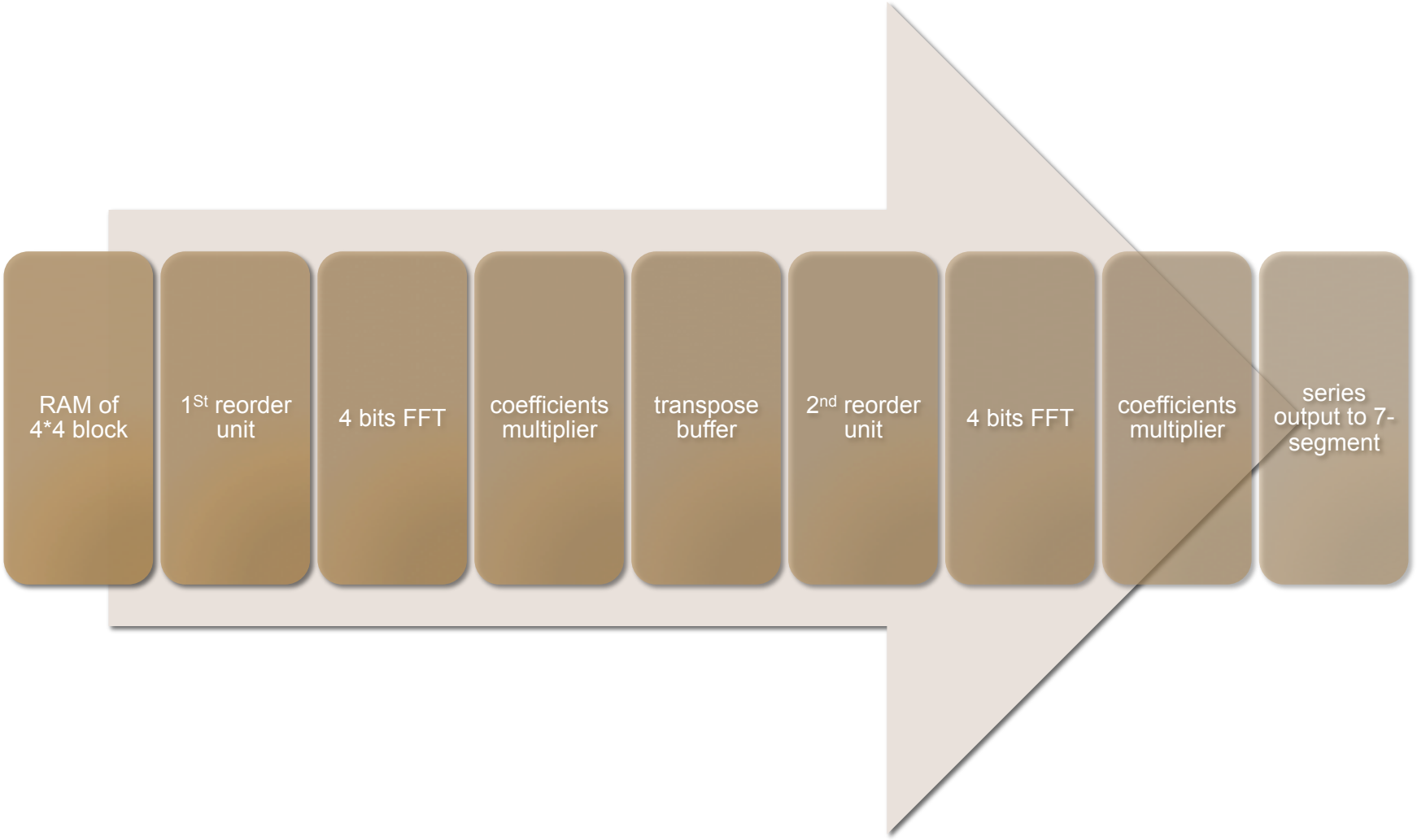


Figure 2 The RTL Block of DCT

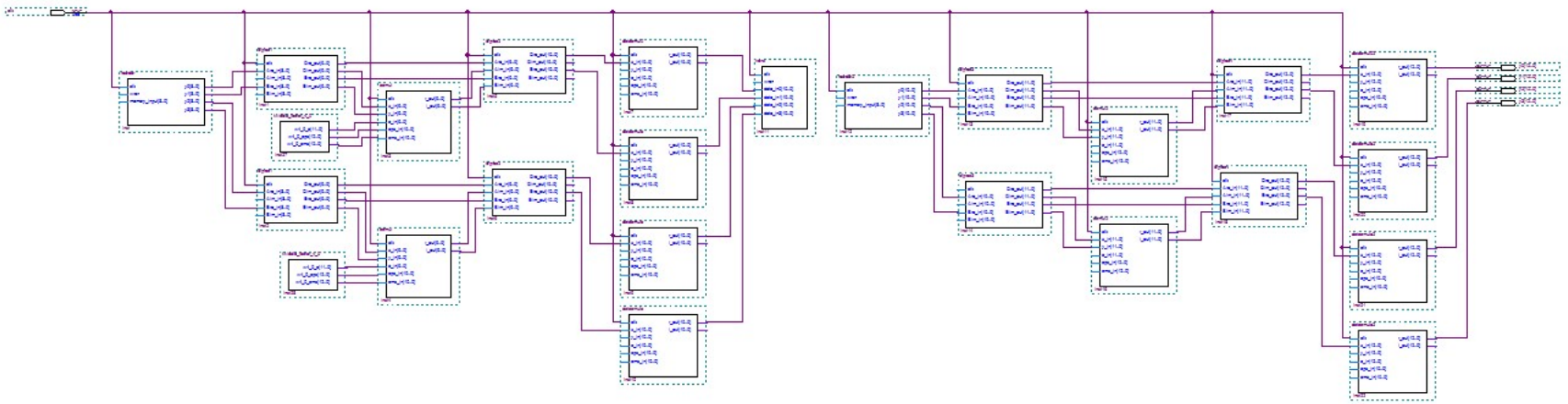
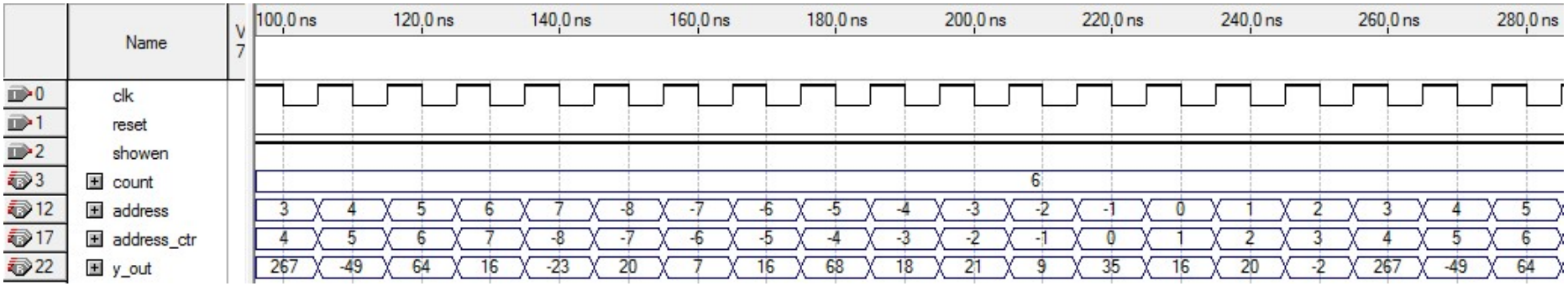


Figure 3 Output simulation and expected output



Therotical Result

266.7389	-49.1144	64.0498	15.8868
-22.4915	20.2893	7.3039	16.4454
68.1734	18.1935	21.2132	8.8727
34.6157	15.5690	20.4956	-2.2414