Lecture 25 (Optimizing NoC and Performance Analysis)

1 Bypassing

1. If router queues are empty
2. Attempt to directly traverse the switch

2 Speculative VC Allocation

1. Allocate switch and VC simultaneously
2. Saves another stage if VC is found
3. Else, resort to conventional methods

3 Late VC Selection

1. Maintain a queue of free VSc with each outgoing link
2. When head flit traverses the switch, assign it a VC from the queue
3. If free VC is not available, cancel the process and restart the conventional process

4 Non-Uniform Cache (NUCA)

It is better to access data from adjacent cache lines since data traversal time is lesser

4.1 Static NUCA

1. Map cache blocks to cache banks
2. Have mapping as tag ID | bank ID | set ID | byte

4.2 Dynamic NUCA

1. Define a bank set - columns of banks
2. Home bank is the closest bank in the set from the core
3. For searching, we follow one of the three strategies
    i. Sequential

   ii. Two-way
   iii. Broadcast
4. On a hit, we move the block closer to the home bank
5. For eviction, instead of moving it to lower level, we move it away from home bank

5 Performance Aspects

1. Architectural Simulator
2. Synthetic Traffic Based Simulator

5.1 Synthetic Traffic Generation

1. Random traffic
2. Bit-complement - $(D_x, D_y) = (\bar{S_x}, \bar{S_y})$
3. Transpose - $(D_x, D_y) = (S_y, S_x)$
4. Bit-reverse
5. Bit-rotation - left or right shift
6. Shuffle - similar to left shift
7. Tornado - translation of coordinates along some line