Proposal of shared memory access methods for lambda computing environment

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- Proposal of shared memory access methods for lambda computing environment
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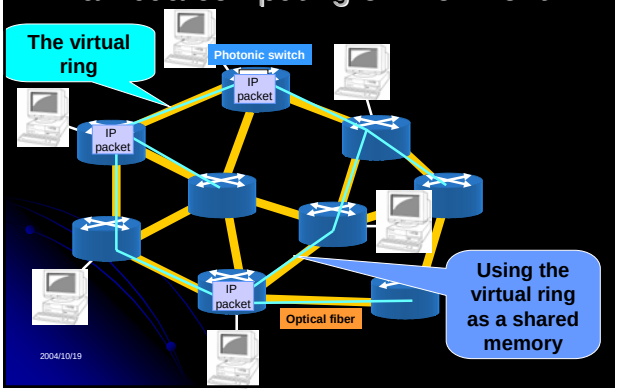
Research background

- Grid computing
  - Uses TCP/IP
    - The overhead of packet processing is high
  - High speed and high reliability communication pipe is needed between end users
  - OptiPuter
    - Builds the Grid environment established on optical networks
    - Uses TCP/IP in multiple wavelengths of light on single optical fibers

Grid computing can not provide an end user with a high speed and high reliability communication pipe as long as using TCP/IP

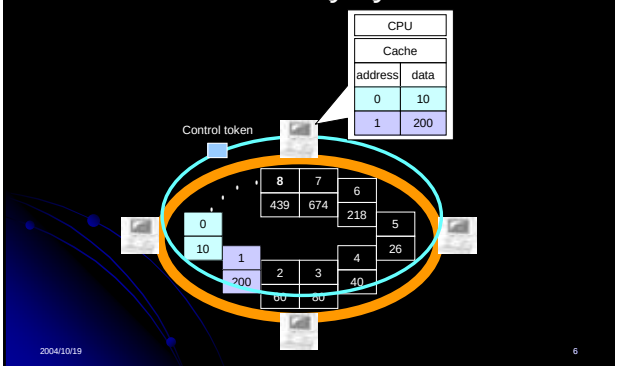
Lambda computing environment



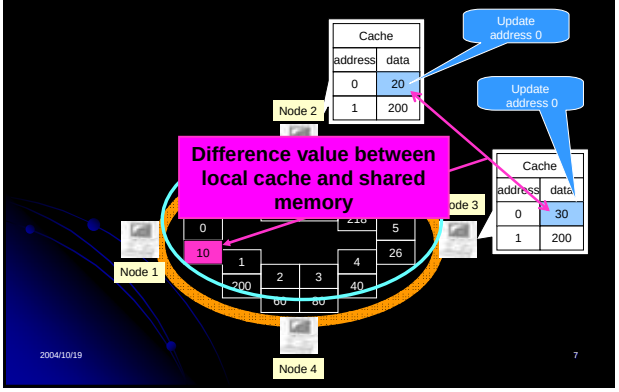
Research target

- Proposal of shared memory access methods for a lambda computing environment
  - Data is exchanged on wavelength paths
  - Using the virtual optical ring as a shared memory
- Evaluation of the method through simulations

Our shared memory system model



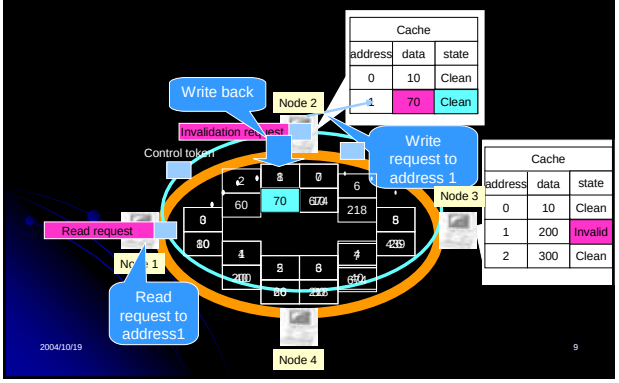
Cache coherency problem



Proposal of shared memory access method

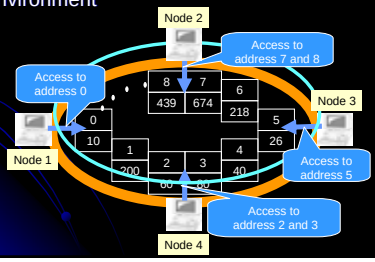
- To solve cache coherency problem
  - Adaptation of snoop cache protocol
- Write back invalidation protocol
  - Attaches the state to each cache data
    - 3 cache states
    - Clean, Dirty, Invalid
  - Invalidates other node's relevant cache data when updates local cache data

Proposal of shared memory access method



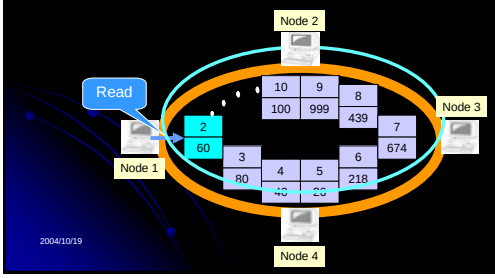
Advantage of proposed method

- Avoidance of contention in shared memory access
  - Contention does not arise in lambda computing environment



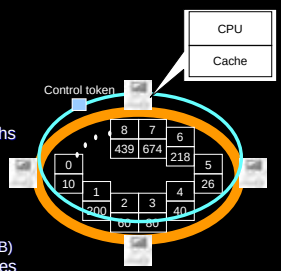
Restriction of proposed method

- Restriction in the timing of shared memory access
  - Because the shared memory is spread out on a long-distance optical fiber



Simulation model

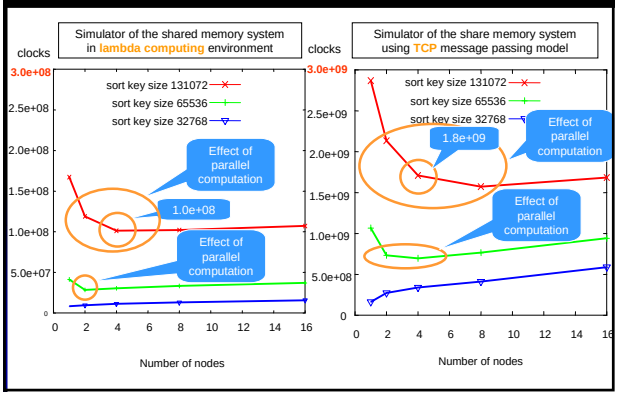
- Node computers are located equidistant on the optical ring
- Performance of computing nodes
  - CPU clock 3GHz
  - level 1 cache size 512KBytes
- The bandwidth of wavelength paths for shared memory
  - 10Tbps
- Propagation delay time
  - 5ns/m
- Total of optical fiber length
  - 1km (shared memory size 6.25MB)
- The processing delay time at nodes is note taken into consideration
- The shared memory system using TCP/IP is used for comparison



Application programs used for evaluation

- Splash2
  - Benchmark programs for parallel computation
- Radix sort
  - Sort the sequence of integer values using the radix sort algorithm
- matrix multiplication
- N-Queen problem

Result of radix sort



Conclusion and future work

- Propose an access method in realizing the shared memory on photonic networks
- The effectiveness of using an optical ring as a shared memory and of parallel processing by the increase in the number of nodes
  - In this example for less than 4 nodes
- Future work
  - An efficient shared memory access method
  - a practical use of a local memory