Implementation and Evaluation of Shared Memory System for Establishing λ Computing Environment

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- Research background
  - Grid computing environment
  - λ computing environment
- Research objective
- Implementation of shared memory system
- Evaluation
- Conclusion and future work

Grid computing environment
- Grid computing environment
  - Computing nodes share CPU and storage by utilizing network
  - QoS demands of Grid computing environment
    - Wide range, large-scale distributed computing
    - High-speed transmission of volume data
  - Computing nodes communicate by TCP/IP
  - The overhead of packet processing
  - Decreasing of transmission rate

It is difficult to achieve high-quality communication

λ computing environment
- In the Lambda computing environment
  - Connect each computing node and router with optical fiber
  - Utilize wavelength path for communication
  - Treat wavelength as degree of granule treating information
- Provide high-speed, high-reliability communication pipe to end users
  - High-speed data sharing at hardware level
- We can apply the lambda computing environment to distributed computing and data sharing

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Research objective

- Implementation of the shared memory system
- Evaluation of the shared memory system

Implementation of the shared memory system

- Design and implement some functions
- Synchronization
- Memory allocation for shared variable
- Source code modification for applying to AWG-STAR system

AWG-STAR system

- AWG-STAR system is an information sharing platform realized by
  - WDM technology
  - Wavelength routing using AWG routers
  - The AWG router processes signals without O-E-O transforming
- Computing nodes
  - are connected to AWG router
  - configure physical start topology but have logical ring topology
  - each node is equipped with a shared memory board
- Shared memory contains the identical data at the same address over all computing nodes.
- Information of data changed on the shared memory is transmitted to other computing nodes by using optical ring and update other computing node’s shared memory.

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Application

- MPI
- TCP/IP
- Ethernet

Lambda computing environment

- Application
- Implemented functions
- AWG-STAR

MPI: Message Passing Interface, generally used for distributed-parallel computing.
Experiment configuration

- Specification of the computing node
  - The maximum number of computing nodes: 3
  - Distance between computing nodes: 20 m
  - CPU: Xeon 3.0 GHz
  - OS: Redhat 7.3

- Specification of the shared memory board
  - Network interface: 2Gbps
  - Transmission frame size: 1KB
  - Access speed to shared memory from local host: 60MB/s

CPU: Xeon 3.0 GHz
OS: Redhat 7.3

Experimental result: LU matrix decomposition program

- Many accesses to shared memory
- Few accesses to shared memory

Performance improvement strategy

- Hardware improvement
  - Undergoing

- Software improvement
  - Decrease the number of accesses
  - Access to shared memory in unit of blocks not in elements (first improvement)
  - Utilize the local memory as cache for shared memory (second improvement)

Conclusion and future work

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