



# Grid Fault Tolerance Service for Quality of Service

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This work was granted by University Research Program supported by Ministry of Information & Communication in republic of Korea.

## Abstract

This paper proposes fault tolerance service to satisfy quality of service (QoS) requirement in grid computing. Since the failure of resources affects job execution fatally, fault tolerance service is essential in grid computing. And grid services are often expected to meet some minimum levels of QoS for desirable operation. In order to provide fault tolerance service and satisfy QoS requirement, we expand the definition of failure, such as process failure, processor failure, and network failure. And we propose fault detection service and fault management service.

## Types of Failures

### Process failure

1. A process stop
2. A starvation of process (QoS failure)

### Processor failure

1. A processor crash
2. A decrease of processor throughput due to burst jobs (QoS failure)

### Network failure

1. Network disconnection and partition
2. A decrease of network bandwidth due to communication traffic (QoS failure)

## Expansion of Failure Definition

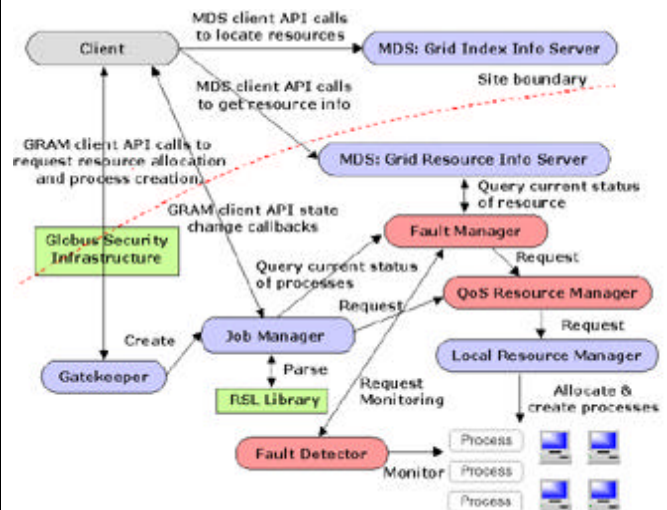
In grid computing, it is significant that fault tolerance service deals with various types of resources failure to satisfy QoS requirements. Thus we expand definition of failure in order to provide fault tolerance service for QoS.

### [Definition] Failure

It is a failure if and only if one of the following two conditions is satisfied.

1. Resources stops due to resource crash.
2. Availability of resource does not meet the minimum levels of QoS.

## Modified Resource Management



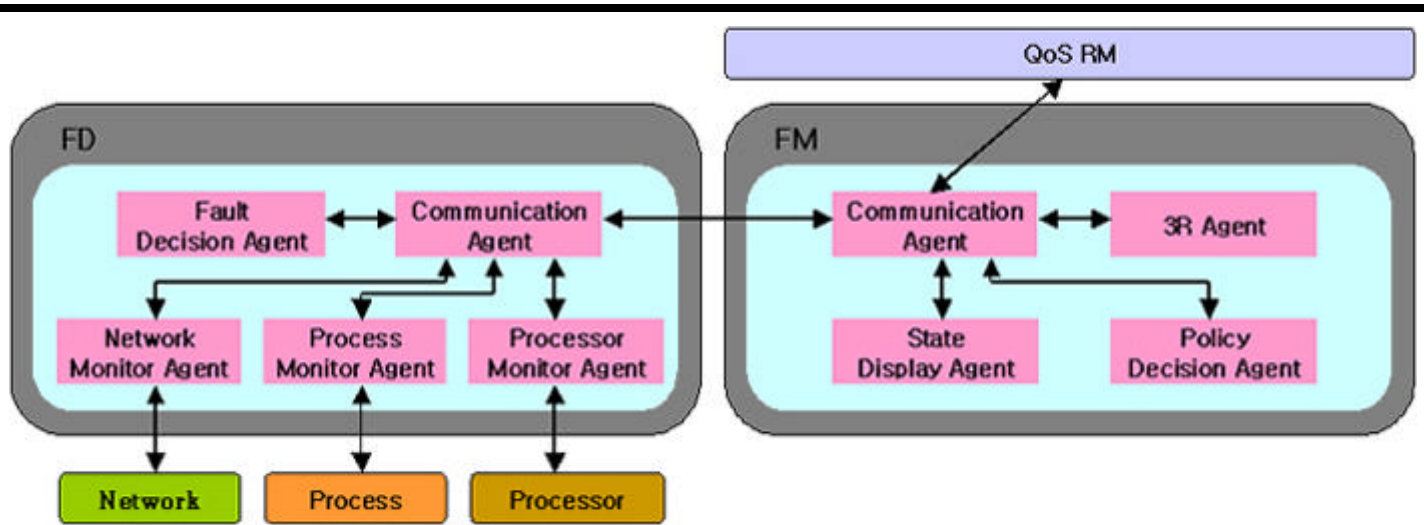


Fig. 1 Components of fault detector (FD) and fault manager (FM)

## Fault Detection Service

Fault detector provides the following fault detection services.

- Monitoring service, which monitors resource states

- Fault detection service, which decides the failure occurrence

- Communication service

For fault detection service, the fault detector consists of process monitor agent, processor monitor agent, network monitor agent, fault decision agent, and communication agent.

## Fault Management Service

Fault manager provides the following fault management services.

- Display service, which displays each resource state to user

- Policy service, which applies fault management method

- Communication service

For fault management service, the fault manager consists of state display agent, policy decision agent, resource reallocation request (3R) agent, communication agent.

## Simulation Results

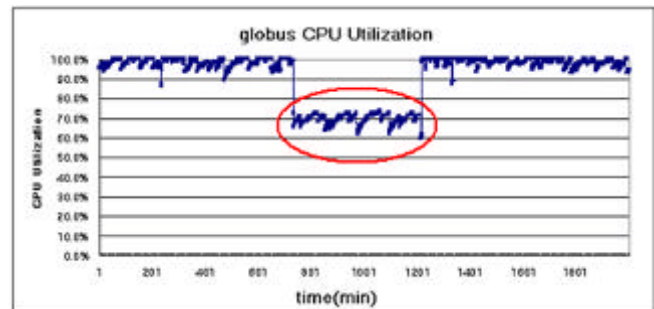


Fig. 2 Available CPU utilization state information

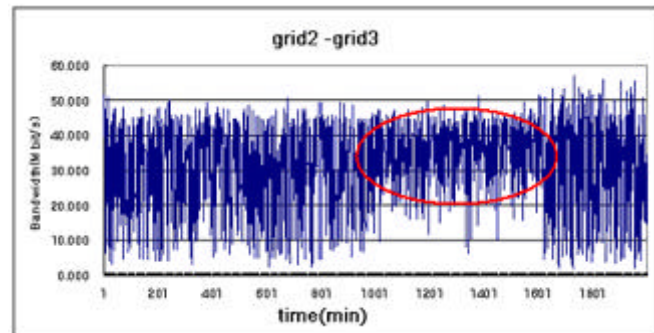


Fig. 3 Network bandwidth state information

## Future Work

We will implement our fault tolerance service in Globus toolkit.

We will design the QoS resource manager for fault tolerance service and quality of service on various types of resources.