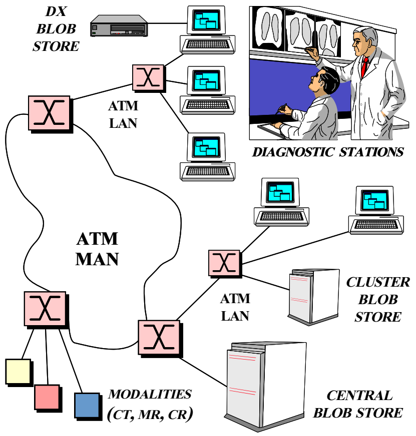
Overview of CORBA Fault Tolerance for TAO

Balachandran Natarajan
bala@cs.wustl.edu
http://www.cs.wustl.edu/∼bala/
Advisor: Dr. Douglas C. Schmidt

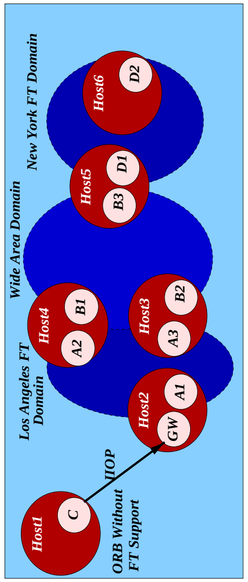
November 17, 1999

Problem: How to Manage Failures in TAO?



- Harmful effects of failures on mission-critical applications
- Some common failures include
  - Network failure, Host, OS
  - Process, Object
- Application developers can attempt to solve the problem
- Application-level solutions are-error prone, non-reusable and, inflexible

Solution: CORBA Fault Tolerant (FT) Spec



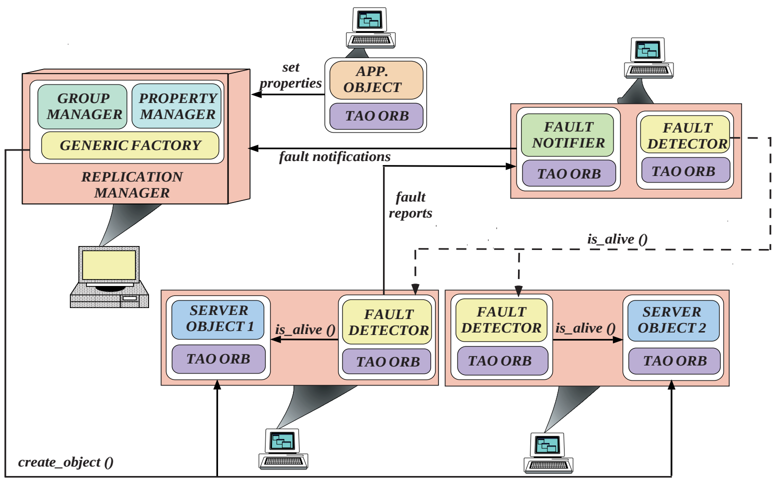
`www.omg.org/techprocess/meetings/schedule/Fault_Tolerance_RFP.html`

- Addresses common problems at the middleware level
- Fault tolerance is transparent the applications
- Provide customizable & reusable components for
  - Fault Detection
  - Fault Containment
  - Fault Masking
  - Fault Compensation
  - Fault Repair

Overview of FT Spec Features

- FT spec addresses the following issues
  - Fault tolerance through redundancy management
  - Eliminating single points of failure
  - Providing a range of Strategies
  - Minimize modifications to application code
  - Replication & fault transparency to the client
- The new concepts added to the CORBA model to provide FT are
  - Replication and grouping
  - Identification of domains
  - Properties for the domain
  - Domain consistency specification

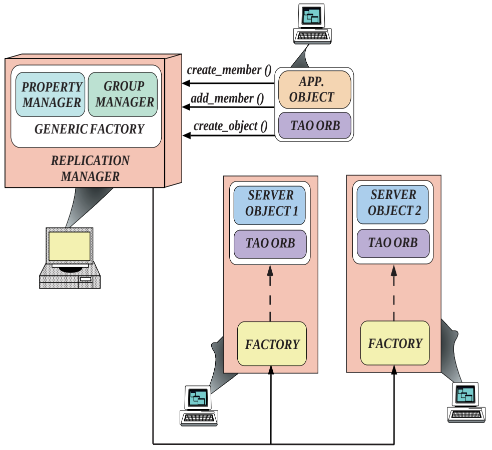
Overview of FT Scenario



FT Service Components

- Replication Manager
  - At least one per-domain
  - Heart of the FT spec
  - All the other components interact with the Replica Manager
  - Inherits the interface of `PropertyManager`, `ObjectGroupManager` and the `GenericFactory`
- Fault Detectors
  - Monitors objects using a “pull” monitoring interface
  - Numbers and arrangement are not restricted
- Fault Notifiers
- Logging and Recovery Managers

Replication Manager

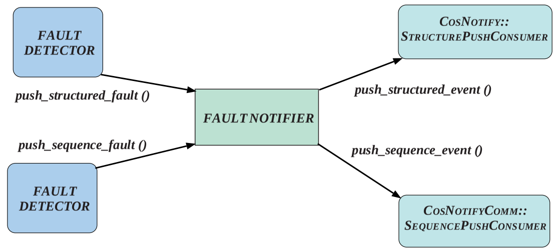


- Property Manager provides methods to add, edit, query & delete
  - Replication style - Stateless, Cold, Warm, Active
  - Membership & Consistency sty - Application or Infrastructure
  - Fault monitoring style and granularity
  - Factory information
  - Initial and minimum number of replicas
  - Fault monitor interval
  - Check point interval

Replication Manager (Contd..)

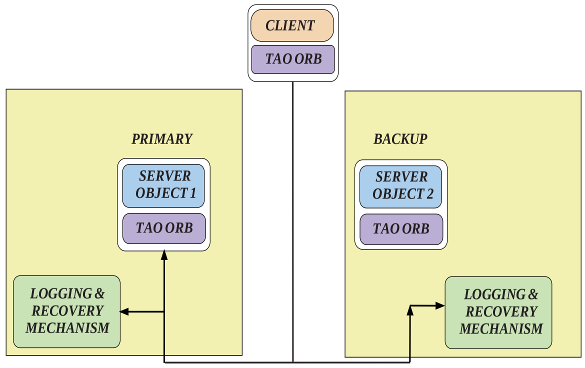
- Object Group Manager:
  - Add a member to the group
  - Remove a member from the group
  - Control the locations of members of the group
  - Obtain current reference of a group
- Generic Factory :
  - Creation of replicated object groups
  - Creation of replicas
  - Creation of unreplicated objects
  - Implemented by the applications

Fault Management Components



- Fault detectors
  - atleast one & usually more than 1
  - not shared across FT domains
  - monitors objects by providing a Pull based interface
- Fault notifier
  - interacts with detectors
  - gets reports from the detectors
  - filters reports
  - publishes reports to consumers
- Fault analyzer
  - application dependent

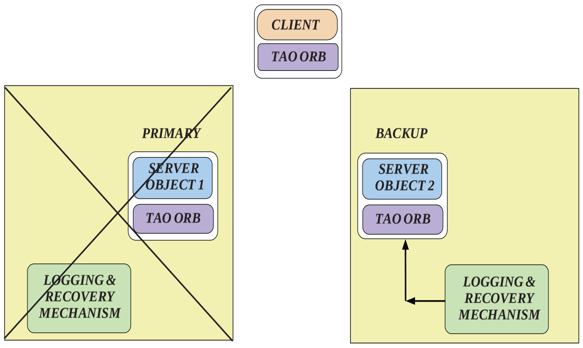
State Management



LOGGING PROCESS IN WARM_PASSIVE STATE

- The first stage is
  - Journaling or Logging during normal operations
    * provides an interface for check pointing
    * journals could be local or distributed
    * distributed logging necessitates a reliable totally-ordered multicast for recovery
    * journal management

State Management (Contd..)



RECOVERY PROCESS IN WARM_PASSIVE STATE

- The second stage is
  - Recovery after a fault
    * provides an interface for updation
    * journal is read to restore state
    * defined semantics for restoration based on replication style

Changes in TAO to Support FT Spec

- TAG_ALTERNATE_IIOP_ADDRESS component needs to be used
- Addition of the following to the standard IOR components
  - TAG_GROUP, TAG_PRIMARY, TAG_HEARTBEAT_ENABLED
- Addition of service context
  - GROUP_VERSION, REQUEST
- Policy identifiers
- LocationForward/Object Forward
- An extended failover semantics
- Addition of FT service components