# Applying CORBA Fault Tolerant Mechanisms to Network Management

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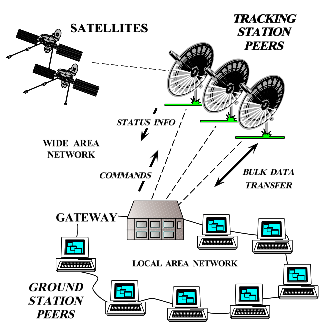
## Typical Telecommunications Applications



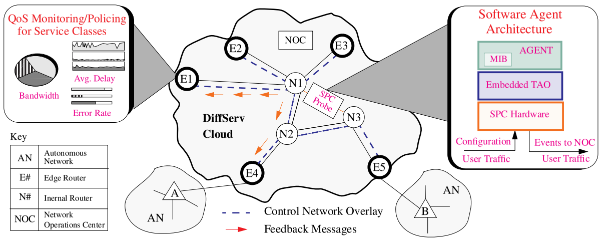

**Common Requirements**

- Network Management
  - QoS Monitoring
  - Network visualization and control
- High Availability
  - 99.999% typical
  - Achieved through monitoring and redundancy





## Network Management - The Big Picture




- **Problems**
  - QoS Monitoring
  - Data collection, Control and Visualization
- **Solution**
  - DOVE





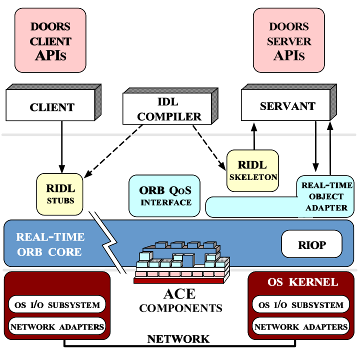
## Fault Tolerance

- **Problems**
  1. Developing highly reliable software
  2. Emphasis on components and applications for telecom
- **Forces**
  1. Standard COTS middleware
  2. Rapid development cycles
  3. Multi-platform support (heterogeneity)
- **Solution**
  - **ACE/TAO/DOORS integration**





## Integrated ACE/TAO/DOORS Platform




**DOORS** →

- A CORBA service that supports fault-tolerant CORBA Objects

**TAO (The ACE ORB)** →

- High-performance, real-time CORBA-compliant ORB

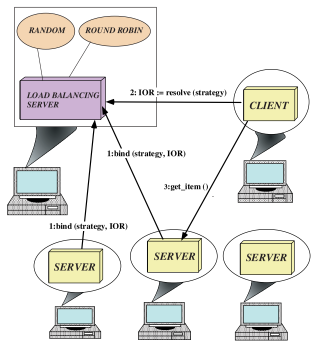
**ACE** →

- Portable OO framework for communications software
- Implements core *patterns*





## Example Application: Load Balancing Service



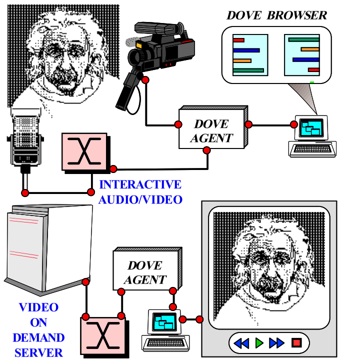

**Service Overview**

- Improve overall application perfomance by balancing load
  - *e.g.*, supports both *random* and *round-robin* strategies

**Fault Tolerance Issues**

- Single point of failure
- Replication for high availability
- Failure detection/recovery

## Example Application Architecture: DOVE



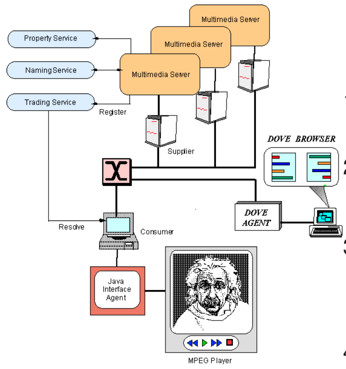

**Distributed Object Visualization Environment (DOVE)**

1. QoS performance monitoring
2. Fault tolerance
3. Real-time processing
4. Multi-platform





## Application Management with DOVE



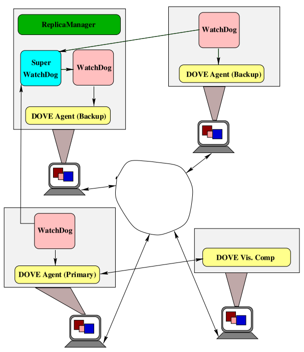

**Multimedia Service Management**

1. Integrated application management
2. DOVE agent
   - Event propagation
3. DOVE Browser
   - Visualize server performance
   - Customizable visualization
4. Fault tolerance through DOORS





## Fault Tolerance using DOORS

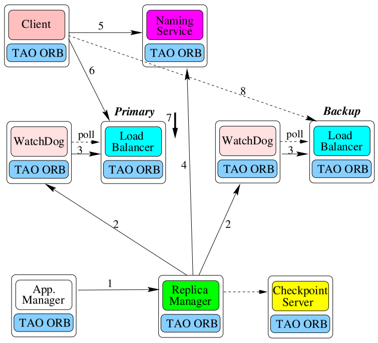



- **ReplicaManager**
  - Replica configuration and management
- **WatchDog and SuperWatchDog**
  - WatchDog - Local failure detection – *polling, heartbeat*
  - SuperWatchDog - Host-level detection
  - Failure notification
- **Client side failure handling**
  - Transparent switchover from Primary to Backup





## Applying DOORS to Load Balancing Service



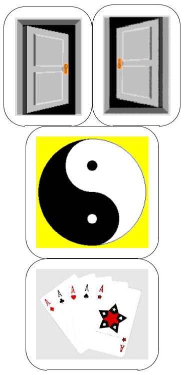

- Usage
  1. Application registered with RM
  2. RM registers appl. with WatchDog
  3. WD starts Appl. and polls
  4. RM generates IOR and binds to Name Service
  5. Client resolves IOR from Name Service
  6. Client talks to Primary
  7. Primary fails
  8. Client transparently talks to Backup





## Ongoing and Future Work

- Systematic empirical benchmarks to measure impact of fault tolerance on efficiency and predictability
- Integrate DOORS/TAO with a variety of telecom applications
- Enhance DOORS and TAO to conform to forthcoming OMG CORBA fault tolerance spec (November 1999)
- Solicit feedback from Lucent Business Units

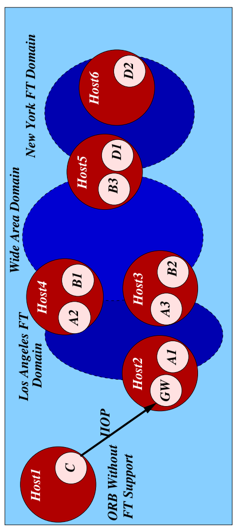




## Overview Of CORBA Fault Tolerance

**Objectives**

- Wide range of fault tolerance
  - Simple low cost clients
  - Highly reliable servers
- Passive and Active replication
- Automatic and application-controlled FT mechanisms
- Strong replica consistency




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

# Concluding Remarks

- **Summary**
  - Cost-effective reliability is important to next-generation telecom applications
  - Benefits of DOORS/TAO integrated framework
    - Provides the desired fault-tolerance
    - Enables rapid application development
    - Uses standards-based COTS CORBA middleware
- **URLs**
  - `www.cs.wustl.edu/~schmidt/TAO.html`
  - `www.cs.wustl.edu/~schmidt/nmvc.html`
  - `www.cs.wustl.edu/~schmidt/dove.html`
  - `www.bell-labs.com/~shalini/papers/doors97.doc`