

## **Active/Active Systems: Theory and Practice Three-Day Seminar**

### **Seminar Description**

This three-day seminar describes how active/active systems comprising two or more servers can provide uptimes measured in centuries. An active/active system is a network of independent, geographically-distributed processing nodes cooperating in a common application. Each node has access to an up-to-date copy of the application database. Should a node or a database copy fail, all that needs to be done is to switch over that node's users to a surviving node. Recovery is in subseconds to seconds.

The underlying concept of active/active systems is "let it fail, but fix it fast." If users never notice an outage, then in effect, an outage hasn't occurred.

### **Seminar Objectives**

Attendees can expect to learn the following:

- Basic availability theory
- The impact of redundancy on availability
- The architecture of active/active systems
- The use of data replication to keep database copies synchronized
- How RPO and RTO are affected by the choice of data-synchronization technique
- Reliable networks
- Data replication products
- Eliminating planned downtime

- Other advantages of active/active architectures
- How active/active systems compare to clusters
- Cloud computing
- Real-life horror stories
- Real-life examples of active/active systems in practice

### **Prerequisites**

Familiarity with transaction-processing systems is required. A knowledge of simple algebra and basic probability theory is recommended though not necessary.

### **Instructor Biography**

Dr. Bill Highleyman brings more than 40 years' experience in the design and implementation of mission-critical computer systems to his position as Chairman of The Sombers Group. Dr. Highleyman, a graduate of Rensselaer Polytechnic Institute and MIT, earned his doctorate degree in electrical engineering from Polytechnic University. He has published extensively on availability, performance, testing, and middleware issues. He is the author of "Performance Analysis of Transaction Processing Systems," published by Prentice-Hall, and is coauthor of the three-volume series, "Breaking the Availability Barrier." Dr. Highleyman holds several patents and publishes the monthly Availability Digest, which focuses on topics related to continuous availability. The Availability Digest is available at [www.availabilitydigest.com](http://www.availabilitydigest.com).

**Active/Active Systems: Theory and Practice  
Day 1**

**Part 1 – Concepts in Availability**

Continuous availability versus high availability  
Active/active systems - an introduction  
Availability, failure rates, and reliability  
The basic availability equation  
The 9s game  
Basic availability relations  
    Serial systems  
    Parallel systems  
    Reliability block diagram  
Availability of dual-node systems  
    Dual-node failure  
    Failover time  
    Failover faults  
Dual-node comparisons  
    Clusters  
    Active/active systems

**Part 2 – Multinode Systems**

The three Rs in MTR  
    Repair  
    Recovery  
    Restore  
Repair strategies  
Multinode systems  
    Process allocation  
    Sparing  
Effect of hardware/software failures  
Approximation errors  
Case study

**Part 3 – Active/Active Systems**

Availability – a review  
    Failures  
    Failovers  
    Failover faults  
RPO and RTO  
Active/passive systems  
Active/active systems  
Why are active/active systems reliable?  
    Redundancy  
    Isolation  
    Dispersion  
    Failover  
Active/active topologies  
    System splitting  
    Disk farms  
    Symmetric systems  
    Asymmetric systems  
    Partitioned systems  
Active/active networking  
    Redundancy  
    Split-brain mode  
    Communication SLAs  
Fast failover  
    User redirection  
    Router redirection  
    Sever redirection  
    DNS redirection  
Application issues  
    Impediments  
    “Sizzling-hot” standby  
Heterogeneous nodes  
Case study

## Active/Active Systems: Theory and Practice Day 2

### **Part 4 – Database Replication**

- Purpose of database replication
- Required characteristics
  - Bidirectional
  - Ping-ponging
  - Capacity expansion
  - Distributed management
  - Automatic failure recovery
  - Create, compare, synchronize
- Asynchronous replication:
  - Replication latency
  - Data loss
  - Data collisions
    - Detection
    - Resolution
  - Calculation of data collision rates
- Synchronous replication
  - Application latency
  - Network transactions
  - Coordinated commits
  - Recovery
- Transaction replication
- Hardware replication
- Replication network
  - Split-brain mode
  - Communication SLA
- Online copy
- Validation and verification
- Database of record

### **Part 5 – Data Replication Engines**

- The replication engine check list
- Asynchronous replication engines
  - Shadowbase
  - Goldengate
  - DRNet
  - Oracle Streams
  - IBM Global Mirror
  - Tungsten Replicator
  - Double-Take
  - Sybase, SQL Server, MySQL
- Synchronous replication engines
  - Shadowbase Plus SR
  - OpenVMS split-site clusters
  - IBM Parallel Sysplex
  - IBM Metro Mirror
- Grow your own

### **Part 6 – Other Advantages of Active/Active Systems:**

- Disaster tolerance for free
- Fast and reliable failover
- Elimination of planned downtime
- Data locality
- Application scaling via symmetric expansion
- Application scaling via asymmetric expansion
- Load balancing
- Lights-out operation
- Efficient use of all capacity
- Elimination of failover decision time
- Risk-free failover testing

**Active/Active Systems: Theory and Practice  
Day 3**

***Part 7 – Comparison to Clusters***

Cluster architectures  
  Cluster resource group  
  Active/standby clusters  
  “Active/active” clusters  
Cluster failover  
Zero-downtime upgrades  
Split-brain mode  
Application constraints  
Application scaling  
  Oracle RAC  
Cluster availability  
Disaster tolerance  
Review of active/active  
Comparison to active/active  
  Availability  
  Split brain  
  Data sharing  
  Application scaling  
  Disaster recovery  
  Heterogeneity  
  Zero downtime upgrades  
  Maturity

***Part 8 – Cloud Computing***

What is the cloud?  
Advantages of the cloud  
Notable cloud failures  
  Compute cloud  
  Storage cloud  
  Hosting cloud  
  Software-as-a-service  
  Platform-as-a-service  
Private clouds  
Cloud SLAs  
Connecting to the cloud  
  Internet reliability  
The compute utility  
The appropriate role of the cloud

***Part 9 – Active/Active Systems in Action***

Financial  
  Bank-Verlag  
  BankServ  
  Fifth Third Bank  
  Banco de Credito  
  Handelsbanken  
Communications  
  Telecom Italia  
  HP OpenCall INS  
  HP Home Location Register  
  Vodacom  
Control systems  
  QEI TDMS-PLUS  
  Chicago MTA  
Other case studies  
  Internet service provider  
  European blood bank  
  New York Racing Association