

## Highly Available Systems: Concepts and Practice One-Day Seminar

### Seminar Description

This one-day seminar describes how highly available systems with annual downtimes measured in minutes or seconds can be implemented. The secret to high availability is fast failover to a redundant backup system.

An introduction to basic availability concepts leads to methods for implementing highly available systems. Fundamental to all highly available systems is data replication to a remote site. Various data replication techniques are studied, and commercially available data replication engines are described.

Highly available architectures that support a wide range of availability characteristics are presented. They include active/active systems that can provide uptimes measured in centuries by recovering from a fault in seconds.

Several case studies demonstrate successful implementations. Sprinkled throughout the seminar are many “never again” educational stories of disastrous failures of critical systems.

We will tailor the content of the seminar to meet your needs and interests.

### Seminar Objectives

Attendees can expect to learn the following:

- Real examples of what can go wrong.
- Basic availability concepts
- The impact of redundancy on availability

- The use of data replication for database synchronization
- Data replication products
- How RPO and RTO is affected by the choice of data-replication technique
- Highly available architectures
- Active/active systems
- Eliminating planned downtime
- Real-life examples of highly available systems in practice

### Prerequisites

Familiarity with transaction-processing systems and knowledge of simple algebra is recommended.

### 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 free monthly Availability Digest available at [www.availabilitydigest.com](http://www.availabilitydigest.com).

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### **9:00 – 10:30: Concepts in Availability**

MTR, MTBF, Availability, and their relationship  
The 9s game – Measuring availability as 9s  
The impact of redundancy on availability  
Failure modes – what are they and what is their affect on availability  
Calculating availability  
Node failures  
Effects of failover times and faults

### **10:30 – 10:45: Break**

### **10:45 – 12:15: Data Replication**

Synchronizing database copies with data replication  
Asynchronous replication:  
Replication latency  
Data loss following a node failure  
Data-collision detection and resolution  
Synchronous replication:  
Application latency  
Network deadlocks  
Recovery Time Objective (RTO) and Recovery Point Objective (RPO)  
The importance of redundant, reliable networks  
Other uses for data replication:  
Disaster recovery  
Application integration  
Replication does not eliminate backups  
Replication products:  
GoldenGate  
Shadowbase  
DRNet

### **12:15 – 1:15: Lunch**

### **1:15 – 2:45: Highly Available Architectures**

Fault-tolerant systems (single node)  
HP NonStop  
Stratus  
Active/standby systems:  
Magnetic tape  
Virtual tape  
Active/passive systems:  
Unidirectional replication  
Unidirectional async replication  
Active/active systems:  
Bidirectional synchronous replication  
Bidirectional async replication  
Eliminating planned downtime  
Fast failover  
Other advantages of active/active  
Elimination of failover decision time  
Disaster tolerance for free  
Efficient use of all capacity  
Risk-free failover testing  
Application scaling  
Load balancing  
Lights-out operation

### **2:45 – 3:00: Break**

### **3:00 – 4:30: Highly Available Systems in Action**

Financial case studies  
Telecommunication case studies  
Other case studies  
The impact of virtualization  
Cloud computing  
More “Never Again” disaster stories