

## Comprehensive Fibre Channel

This course is a combination of the “In-depth Fibre Channel” and “Fibre Channel Topologies” courses. It is one of Solution Technology’s most popular courses because it educates the participant on all architectural issues of Fibre Channel technology. The student will not only learn Fibre Channel fundamentals but will also gain insight into the Arbitrated Loop and Switch Fabric topologies.

### Course Outline

#### **Introduction, Concepts & Terminology**

The need for a new interface  
Parallel I/O limitations  
Serial interface alternatives  
Technology assumptions  
Key Fibre Channel objectives  
I/O and Network convergence

#### **FC-0: Physical Interface**

Physical interface concepts  
Link rates & distances  
Optical or electrical  
Optical interfaces  
Single-mode optical fiber  
Multi-mode optical fiber  
Electrical interfaces  
Fibre Channel connectors

#### **FC-1: Data Link Control**

8B/10B encoding/decoding  
Disparity  
Special characters  
Ordered sets  
Frame delimiters  
Primitive signals  
Primitive sequences  
Link Level Protocols

#### **FC-2: Transport Protocol**

Transport protocol concepts  
Exchange management  
Sequence management  
Frame structure  
Link Control frames  
Flow control  
Classes of service

#### **FC-3 Fibre Channel Services**

Common services  
Basic link services  
Extended link services  
Session management  
Login services  
World-wide names  
Service parameters  
Port login trace example  
The Name Server

#### **FC-4: Protocol Mappings**

Protocol mapping concepts  
Information sets  
Protocol Information Units

SCSI-3 architectural model  
SCSI protocol data objects  
SCSI protocol functions  
SCSI Fibre Channel Protocol  
SCSI-3 mapping concepts  
Command information set  
Transfer ready information set

Data information set  
Response information set  
FCP Information Units  
FCP command flowchart  
Inquiry command trace  
Write command trace

#### **Topology Overview**

Topology concepts  
Point-to-Point  
Arbitrated Loop (FC-AL)  
Switched Fabric  
**What is Arbitrated Loop?**  
Arbitrated Loop Applications  
Configurations  
Loop vs. Other Fibre Channel Topologies  
Loop Port Types

#### **Arbitrated Loop Concepts**

Loop Initialization  
Arbitration and Fairness  
Opening a Loop Circuit  
Closing a Loop Circuit  
Transferring a loop circuit  
Loop Addressing  
New FC-AL Ordered Sets  
**Loop Port State Machine**  
Purpose and Operation of the LPSM

#### **Loop Initialization Process**

Purpose of Initialization  
**Arbitration and Fairness**  
How Arbitration works  
The fairness protocol

#### **Opening a Loop Circuit**

Full-duplex open (OPNyx)  
Half-duplex open (OPNy)

#### **Flow Control**

Alternate BB\_Credit model  
Use of zero BB\_Credit

#### **High Availability Loops**

Strategies for robustness  
Arbitrated Loop hubs

#### **Switched Fabric Concepts**

Fabric elements  
Class-of-Service Behavior  
Frame Routing  
Frame Delivery Order  
Fibre Channel Port Types  
**Fibre Channel Addresses**  
Node Port Address Assignment  
Address Space Partitioning

#### **Node Port Initialization**

Determination of Port Operating Mode  
Fabric Login (FLOGI)  
State Change Registration  
Port Discovery  
N\_Port Login

#### **Fibre Channel Services**

Fibre Channel Common Transport Protocol

#### **Directory Server**

The Name Server  
Name Server Database  
Name Server Registration  
Name Server Queries

#### **Switched Fabric Internals**

Switch Internal Link Services  
Inter-switch Links (ISLs)  
ISL Initialization  
Determination of Port Operating Mode  
Exchanging Link Parameters

#### **Fabric Configuration**

Build and Reconfigure Fabric  
Principal Switch Selection  
Domain\_ID Assignment  
Merging Fabrics

#### **Routing Protocols**

Fabric Shortest Path First (FSPF)  
Hello Message  
Link State Records  
Link State Updates  
Link State Acknowledgements

#### **ISL Flow Control**

R\_RDY Flow Control

#### **Distributed Services Model**

Distributed Name Server  
Distributed Fabric Configuration Server  
Distributed State Change Notification

#### **High-Availability Fabrics**

Redundant Links  
Redundant Switches  
Alternate Path Routing

**Who Should Attend:** This seminar is targeted towards developers, integrators, managers and others with a need for a comprehensive, in-depth understanding of the Fibre Channel technology including Fibre Channel Arbitrated Loop and Switch Fabric topologies. The audience includes product architects, development team hardware, firmware, software, and test engineers, product planners, managers, or others involved in planning, implementation, analysis, or testing of Fibre Channel products.

**Prerequisites:** An understanding of current computer interfaces or networks is desirable, although not necessary.

**Course Length:** 5 Days