



DATA CENTER

Simplifying Virtualization through Adaptive Networking Technology

Brocade Adaptive Networking Services align fabric intelligence with application service levels, automatically adjusting fabric resources as virtual servers move within server pools.

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The Brocade® Data Center Fabric (DCF) architecture provides a flexible framework for designing, building, and transforming enterprise data centers into strategic assets. One advanced Brocade DCF technology is Adaptive Networking Services, which are essential when virtual servers and storage consolidate applications in a unified network or data center fabric.

THE VIRTUALIZATION OF THE DATA CENTER

As IT organizations increasingly deploy virtual servers and storage to consolidate resources and improve utilization, they must be able to dynamically provision applications on virtual servers and move them non-disruptively as workloads change. However, this increased mobility of application workloads can sometimes create unpredictable congestion in the networks connecting server-to-storage traffic, server-to-server clusters, and storage-to-storage replication.

To address this challenge, Brocade Adaptive Networking Services monitor, anticipate, and detect congestion—then dynamically adjust bandwidth and fabric resources to meet application service levels. As a result, fabric intelligence can monitor resource usage at the application level rather than just at the port level.

Adaptive Networking Services help simplify fabric management and improve resource utilization while enabling superior performance, higher availability, and non-disruptive scalability—critical requirements for virtual server and storage environments. As such, it is a key technology in the Brocade DCF architecture, whose goals include:

- Extending physical connectivity to devices using intelligent virtual connections to pools of shared resources
- Implementing virtual partitions to provide flexible management
- Integrating application service levels within the fabric for more flexible provisioning, higher resource utilization, and adaptive networking applications
- Extending data management policies into the fabric to unify, control, and scale data mobility applications (such as replication, migration, and copy)
- Consolidating networks and protocols onto a single fabric capable of integrating emerging technologies such as Fibre Channel over Ethernet (FCoE) and Data Center Ethernet (DCE)

Adaptive Networking Services support each of these goals and simplify key tasks such as provisioning, configuration management, capacity planning, security management, and fault isolation for evolving virtual data centers. The ultimate benefits of this approach are reduced management, lower operating costs, and a dynamic infrastructure that can evolve at the same speed as the business.

THE FOUNDATION FOR APPLICATION-AWARE FABRICS

Replacing static, dedicated connections between physical servers and storage with dynamic connections between virtual machines and storage can create unexpected congestion in the fabric. To address this challenge, the data center fabric must be able to assign application workloads to an appropriate service level and flexibly allocate resources as these workloads move within the server resource pool.

The key technology connecting virtual servers to virtual storage is innovative Brocade virtual channel technology, a fundamental building block for Adaptive Networking Services. Virtual channels create virtual connections within physical links that logically connect virtual servers to virtual storage. Sets of virtual channels are assigned a specific fabric Quality of Service (QoS) priority. Fabric bandwidth and resources are assigned to each of three fabric QoS priorities (low, medium, and high), helping to ensure consistent delivery as workloads vary. Fabric QoS improves network utilization, simplifying virtual server and storage provisioning, and also reduces network configuration tasks as application workloads move between virtual servers.

Over time, fabric QoS will evolve into application-aware QoS by using a point of presence in the server where Adaptive Networking Services can align with application service levels. This presence requires a new device category, known as an Intelligent Server Adapter (ISA), which provides greater intelligence than traditional Host Bus Adapters (HBAs). The ISA extends the physical fabric connection at the server into a logical connection delivering application-aware QoS, traffic management, and security services.

ADAPTIVE NETWORKING TECHNOLOGY OVERVIEW

Adaptive Networking Services can extend fabric intelligence to the application, enabling fabric-wide application service level monitoring and management that automatically reacts to changes in virtual server workloads. This approach enables the fabric to dynamically allocate shared resources as changes occur in the data flows between virtual servers and virtual storage. If congestion occurs (or is predicted), the fabric can adjust bandwidth and other resources according to defined service levels—helping to ensure that higher-priority workloads receive the resources they need.

Adaptive networking introduces the following new services:

- **Fabric QoS:** Enables granular allocation of fabric resources to applications based on the relative importance of the application as defined by the assigned QoS. When applications become dynamic, the QoS priority must follow the applications as they move between physical server and fabric connections. Brocade virtual channel technology enables Adaptive Networking Services to monitor resource usage, detect (or predict) congestion in the data path, and dynamically adjust resources to avoid congestion based on the QoS priority.
- **Traffic management services:** Provide congestion management to support application service levels. They can also provide automatic ingress rate limiting and advanced queuing algorithms to remove congestion and dedicate bandwidth to specific applications.
- **Fabric dynamic profiling services:** Provide end-to-end analysis of individual application data flows and resource usage, supplying in-depth information about the impact on overall fabric performance. These services identify points of congestion, and monitor and report on numerous statistics counters for physical resource utilization—useful information for provisioning, capacity planning, and end-to-end fault isolation tools that simplify fabric management.
- **Policy management services:** Prevent buffer credit exhaustion (buffer credits provide fabric flow control) and detect under-utilized shared physical resources, reclaiming them or reallocating them to optimize application flow according to defined policies.

ADAPTIVE NETWORKING ARCHITECTURE

The Brocade DCF architecture enables Adaptive Networking Services by leveraging innovative ASIC technology and flexible firmware functions—managed from a unified management layer (see Figure 1).

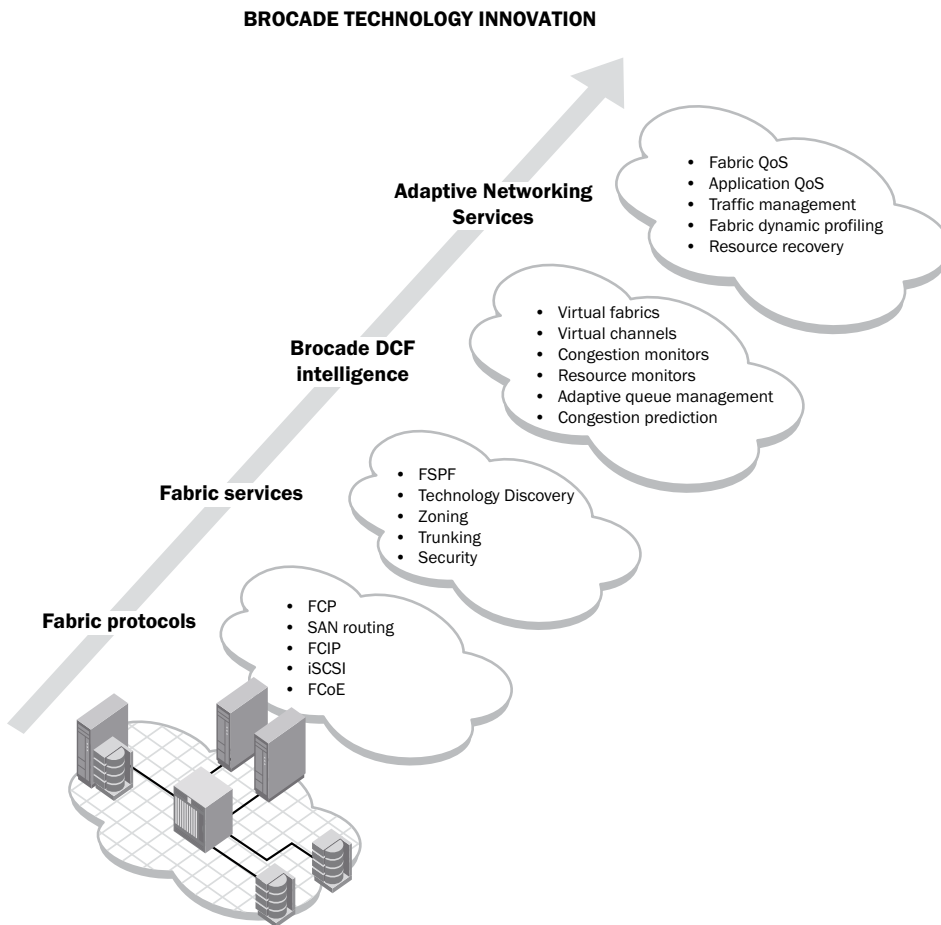


Figure 1. Adaptive Networking Services in the Brocade DCF architecture.

MANAGEMENT OF ADAPTIVE NETWORKING SERVICES

A primary goal of Adaptive Networking Services is to simplify fabric management. As organizations create more dynamic application workloads with virtualization, the fabric intelligence must provide more in-depth knowledge about the state of fabric-wide resource utilization. It must also be able to associate resource usage with application workloads (data flows) across all virtual devices.

Organizations can utilize device and fabric management software—such as Brocade Fabric Manager and Brocade Enterprise Fabric Connectivity Manager (EFCM)—to simplify configuration and management of Adaptive Networking Services. As application QoS (in addition to fabric QoS) capabilities become available, the management layer will further be able to integrate with advanced tools in higher-level management applications such as IBM Tivoli Storage Manager, HP OpenView, EMC ECC, and Microsoft Management Console.

CURRENT AND PLANNED ADAPTIVE NETWORKING SOLUTIONS

Today, Adaptive Networking Services such as fabric QoS, traffic isolation, and “Top Talkers” are part of the Brocade Fabric OS® 6.0 release.

The long-term Brocade DCF strategy includes advanced Adaptive Networking Services, such as application-aware QoS, that simplify fabric management. Brocade also plans to introduce Adaptive Networking Services for multiprotocol data center fabrics. In addition, Brocade is working with virtual server vendors (such as VMware, Microsoft Virtual Server, and XenSource) to develop the software interfaces for simplifying virtual server, virtual channel, and virtual storage provisioning.

To learn more about how the Brocade DCF architecture and Adaptive Networking Services can provide a unified logical fabric for cost-effective, scalable, and secure virtualized connectivity, visit www.brocade.com.

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