

SPRINT TECHNICAL REPORT

A COMPARATIVE OVERVIEW OF FRAME RELAY & ATM

Why do businesses migrate from frame relay service to ATM? The two main drivers are:

- ▶ The need for greater capacity than frame relay can handle
- ▶ The need to support mixed-media traffic, especially voice and video

In this Sprint technical report, we will help you sort out your options and look at three successively more sophisticated strategies for migrating from frame relay to ATM.

Each of these possibilities has the advantage of not requiring hardware upgrades to customer premises equipment, at least at remote locations. As a result, users can preserve their investment in existing frame relay equipment.

In this Sprint technical report, you can find information about the following topics:

- ▶ Advantages of ATM
- ▶ Advantages of frame relay
- ▶ Overview of migration strategies
- ▶ Network interworking
- ▶ Service interworking
- ▶ ATM frame user-network interface



A COMPARATIVE OVERVIEW OF FRAME RELAY & ATM

Advantages of ATM

ATM is a connection-oriented “fast packet” technology. It has the following advantages:

- ▶ Provides dynamic bandwidth allocation for more efficient handling of traffic, utilizing the bandwidth when needed for bursty data, predictable data and all other traffic types including voice, video and image
- ▶ Scales from T1 and NxT1 to 45 Mbps up to gigabit speeds
- ▶ Scales in topology from local area networks to campus area networks to wide area networks
- ▶ Protects against technology obsolescence
- ▶ Supports quantifiable “hard” quality of service (QoS) parameters for all traffic types
- ▶ Efficiently supports voice over IP and fully featured voice through ATM adaptation layer type 2 (AAL2) and connectivity to the public switched telephone network
- ▶ Allows integrated network management
- ▶ Can be deployed in public, private or hybrid networks

ATM transmits only fixed-size frames, called cells, not variable-sized frames as frame relay and packet switching do. The standard for ATM cell relay is 53 byte cells (48 bytes or user

data, 5 bytes of header). With only fixed-size cells to process, cell relay switches can perform at a significantly faster pace than frame relay switches. More important, fixed-size cells allow ATM to support quantifiable QoS, which in turn allows it to handle delay sensitive traffic like voice and video conferencing.

Advantages of frame relay

Frame relay has the advantages of being widely supported, well understood, easily adopted and highly cost-effective for a wide

variety of data networks. In particular, frame relay is better suited than ATM for data-only, medium-speed (56/64 Kbps, T1) requirements, such as the following:

- ▶ LAN to LAN interconnection
- ▶ Access to the Internet
- ▶ IBM SNA traffic

For frame relay, the ratio of header size to frame size is typically much smaller than the overhead ratio for ATM, which makes frame

Frame relay versus ATM

	Frame relay	ATM
Dynamic bandwidth allocation	●	●
Frame size	Variable	Fixed
Scalable to high speeds	◐	●
Suitable for WANs, MANs	●	●
Suitable for LANs and campus networks	○	●
Carries data	●	●
Carries voice and/or video	◐	●
Supports quantifiable QoS	○	●
Cost-effective for medium-speed, data-only requirements	●	◐

● Highly suitable ◐ Somewhat suitable ○ Not suitable

Stages in the migration path

Stage	Branch Office	Network	Headquarters	Motivation
1	Frame	Frame	Frame	Low cost
2	Frame	ATM with network interworking	Frame	Benefits to network provider
3	Frame	ATM with network interworking	ATM	Benefits at headquarters
4	FUNI	ATM with FUNI interworking	ATM	Benefits at branch offices
5	ATM	ATM	ATM	End-to-end ATM

relay more efficient. In addition, frame relay will likely be used into the future as an access protocol via service interworking for higher speed ATM networks. Thus, frame relay and ATM are likely to be complementary rather than directly competitive technologies for quite a while to come.

Migration strategies

Once your data or multimedia applications outgrow frame relay's bandwidth limitations, Sprint can assist you in developing a gradual migration path to ATM.

The chart above shows the various stages along the path to end-to-end ATM connectivity. The bottom line is — you can upgrade to ATM when and where it makes sense and still continue to support frame relay at other locations.

Network interworking

Network interworking is a migration strategy for large organizations that want to build their own enterprise-wide private ATM network. It permits a gradual and transparent conversion of a private backbone network to ATM while continuing to support legacy

Advantages of migrating to an ATM backbone

Migration to ATM backbones for carriers (or private network operators) is attractive because these backbones:

- ▶ Operate at OCn speeds
- ▶ Allow for greater economies of scale because they can support data, video and voice
- ▶ Typically travel over synchronous optical network rings, which are specifically designed for good network management and for rapid self-healing in the event of failure

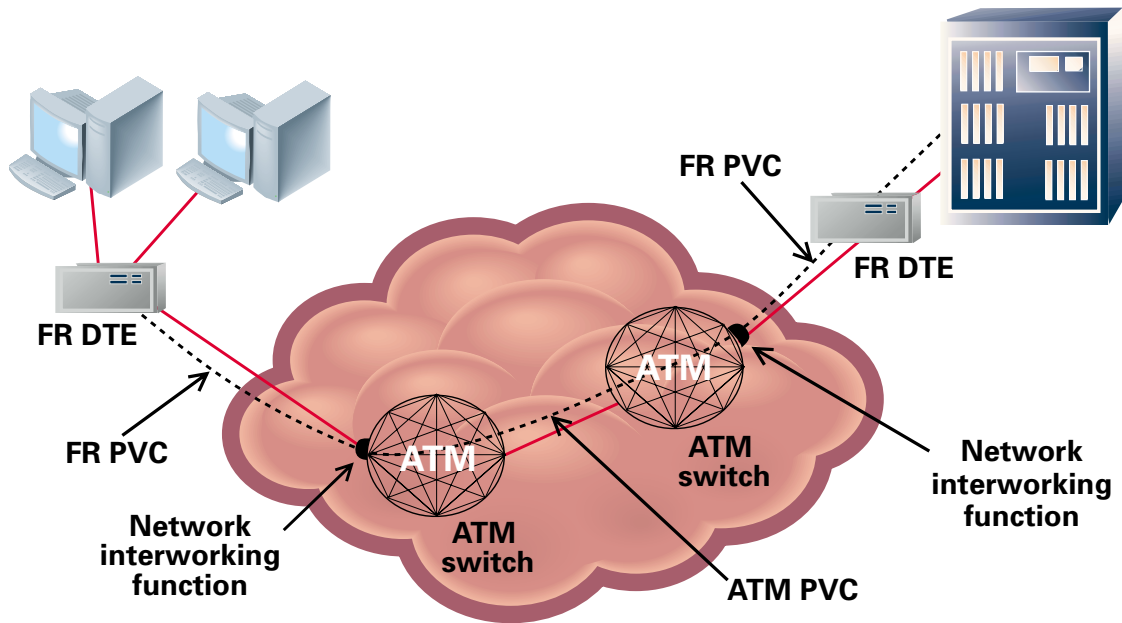


Figure 1: Network interworking with frame relay and ATM

Network interworking allows two frame relay devices to communicate over an ATM backbone using the frame relay protocol.

frame relay devices. This strategy may be especially important for companies that have just purchased a lot of frame relay CPE.

It's also the strategy that Sprint used when creating an ATM over SONET backbone in the mid-1990s. Today our ATM backbone efficiently and cost-effectively supports multiple public network services, including frame relay, IP, voice and video.

In the network interworking scenario, frame relay devices communicate with each other over an ATM backbone, using the frame relay protocol. A network interworking function encapsulates the frames within ATM cells for transmission across the backbone. At the destination ATM switch, another network interworking function recombines the cells into the original frame relay frames and sends them on to the other frame relay

device. In effect, frame relay is being tunneled through the ATM cloud.

Interworking may be implemented as a function of an ATM switch, as shown in Figure 1, as a function of the customer premises equipment, or even as a separate box. Methods for encapsulating frame relay frames have been jointly agreed upon by both the Frame Relay and ATM Forums.

Service interworking

Service interworking is a strategy that Sprint frame relay customers can use to gradually migrate to the Sprint ATM public network service while preserving their investment in customer premises networking equipment. It allows conversion of selected customer sites to native ATM while still maintaining the ability to communicate with legacy sites that have not yet converted to ATM.

The frame relay customer premises device uses the frame relay protocol to send and receive data. The ATM customer premises device uses ATM protocols to do this. A service interworking function residing in the carrier's network performs the protocol conversion so that both end devices can continue to function independently as either ATM or frame relay devices without the need to upgrade the frame relay location to ATM.

Mapping frame relay service into ATM service is fairly easy, but mapping ATM service into frame relay may degrade the service quality of ATM. For that reason, service interworking between frame relay and ATM is limited to the lowest common denominator, which is usually the frame relay functionality.

Standards for service interworking have also been jointly agreed upon by the Frame Relay and ATM Forums.

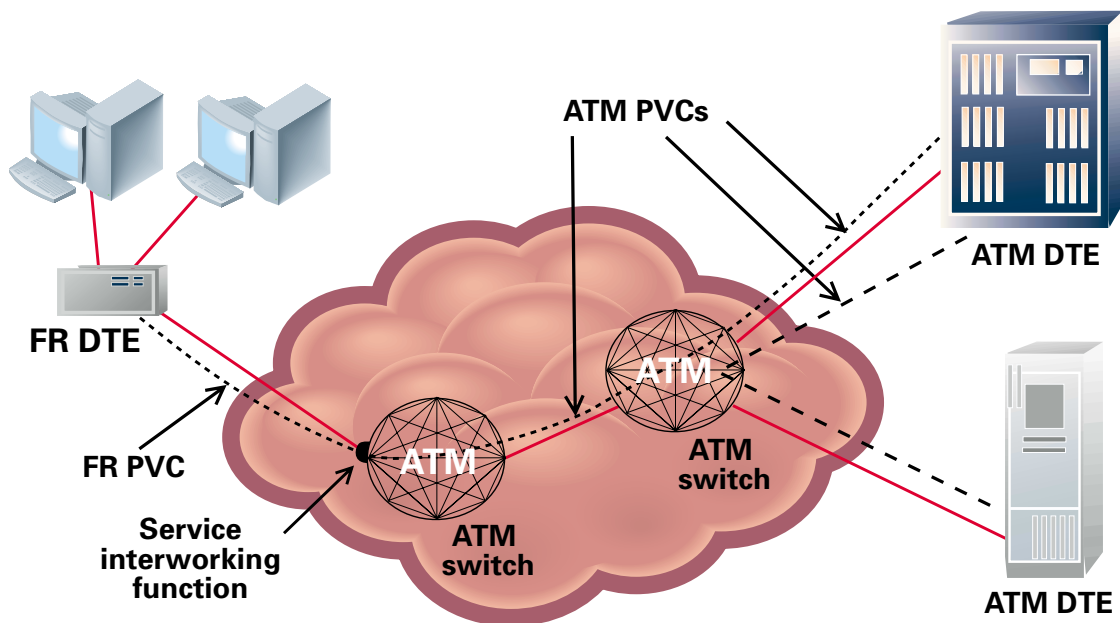


Figure 2: Service interworking with frame relay and ATM

Service interworking allows a frame relay device to communicate with a native ATM device over an ATM network.

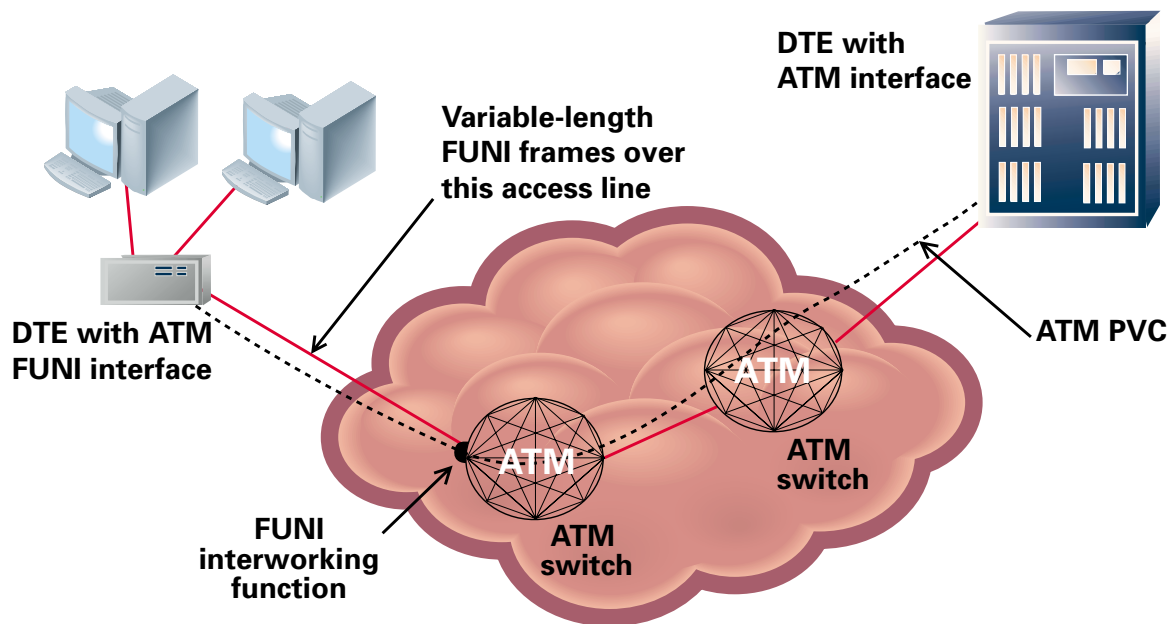


Figure 3: ATM frame user-network interface (FUNI)

FUNI is a variable frame-length version of the ATM user-network interface.

ATM frame user-network interface (FUNI)

FUNI may provide a useful migration path for frame relay users who need to upgrade their service levels and network management but who do not wish to upgrade their hardware. FUNI offerings are still in the very early stages, especially for public services.

FUNI is a modification of the standard ATM service provided by the ATM user-network interface (UNI). FUNI allows the customer equipment to submit variable-length frames to the ATM switch instead of just 53-byte cells. An interworking function at the ATM switch translates the FUNI frames to standard ATM cells and sends them on through the ATM network.

FUNI is similar to frame relay in that both allow variable-length frames across the access circuit. But FUNI supports ATM network operations and network management, which is more extensive and more standardized than frame relay network management.

Comparing FUNI

FUNI has two advantages compared to ordinary cell-based ATM. Its lower overhead makes it as efficient as frame relay over low-speed access lines. Plus, the customer equipment that supports FUNI is typically less expensive than ordinary ATM interfaces. FUNI does not require hardware upgrades. Instead, FUNI can simply be constructed by software frames.

FUNI's disadvantage is that it is limited to AAL5 for the ATM adaptation layer at the FUNI interworking function on the ATM switch. AAL5 supports ordinary delay-tolerant traffic better than it supports voice or video traffic. Combined with the variable-length frames, use of AAL5 means that FUNI has the same problems with carrying voice and video that frame relay has.

Conclusion

The decision of when to use ATM and when to use frame relay largely depends on the applications businesses want to run over their enterprise networks, the amount of bandwidth they need and their performance requirements. ATM is ideally suited for converged voice, data and video networks because it assures quality of service. It also provides the high amounts of bandwidth that businesses are increasingly demanding for data and other applications.

Frame relay, on the other hand, continues to be a highly economical and reliable choice, especially for medium-speed, data-only applications.

Once your company has decided that it's time to migrate to ATM, Sprint will help you develop a gradual migration plan that will help maximize your existing investment in networking equipment while providing the higher bandwidth and other advantages of ATM on a site-by-site basis.

**For more information, talk to
your Sprint representative or
call 1-800-816-7325.**

**Visit Sprint on the Internet:
www.sprintbiz.com**

