19.1 INTRODUCTION

Application of single-mode (SM) optical fiber transmission technology to terrestrial long-distance telecommunication trunk lines is almost universal now, and by 1990 transoceanic submarine cables across the Atlantic and Pacific oceans should be operational as well. Optical fiber cables are cost-effective because of the long repeater spacing, which can exceed 50 km, and the self-checking electronic circuitry built into the system itself. Downtime caused by lightning strikes on optical fiber terrestrial trunk lines is greatly reduced compared to copper-wire-based systems because the optical fiber waveguide is an insulator and there are fewer repeater amplifiers.

The use of SM fiber cables is not limited to intercity trunking but is also being extended to interoffice telephone trunks between telephone central offices, and to T1 (1.544-Mb/s) trunk line services from the central office to office buildings. Almost none of these trunks require a repeater, and the small cable diameters compared to copper cables of equivalent transmission capacity make the optical fiber cable the preferred choice in congested conduits of cities. Of course, the immunity of optical fiber cables to electromagnetic interference (EMI) and radio-frequency interference (RFI) also reinforces the choice of fiber.

Application of optical fiber cables to the telephone subscriber loop is a problem in economics and politics as well as in the selection of the appropriate technology. On the last point of technology, most experts agree on use of SM fiber based on a centrally switched star network where the central
office (CO) is the central node [1]. Most network designers favor the use of subnodes that provide switching services to a group of neighboring subscribers [2] as in the case of current telephone practices, whereas a few favor a completely centralized scheme [3]. The latter preference arises from installation and maintenance considerations, or from the viewpoint of providing new services such as demand access video service, which is discussed later. However, the use of SM fibers is accepted as the most logical choice today [4].

Coherent optical transmission techniques have progressed rapidly during the past few years [5], but their practical implementation is probably 15–20 years away, and there is a window of opportunity for commercial implementation of a broadband integrated services digital network (ISDN) to the subscriber using SM fiber technology.

Establishment of the optical fiber broadband ISDN, which provides telephone, data, audio (radio), cable TV, pay TV, and videotelephone services over a single optical fiber network on a national scale is being pushed by many European countries, notably by the Federal Republic of Germany and France. In Japan, NTT (Nippon Telegraph and Telephone Corporation) also has intentions of fiberizing the telephone subscriber loop to offer broadband ISDN services. However, a regulation that requires cable TV service providers to own the transmission plant has been used by the Ministry of Posts and Telecommunications to prevent NTT's service trials in broadband integrated services.

Canada and the United States have similar regulatory problems, although in the United States, telephone companies can provide transmission facilities to the cable TV operator. This approach of separation of carrier and content should work to the advantage of cable TV operators, provided they are assured of an exclusive franchise in some new video services such as the demand access video service that is discussed below in detail. Actually, without a new service that can generate substantial revenue over and above that supplied by telephone, data, cable TV, and pay TV, the optical fiber broadband ISDN for subscribers may be difficult to realize because of the large capital investment that is needed. It is expected that the demand access video service will provide more than the extra revenue that is required.

Independent of developments in optical fiber technology, the intelligent building market has been growing rapidly, and $3 billion a year in equipment sales is projected for the United States by 1990 [6]. In addition to providing cost-effective telephone and data services through PBXs (private branch exchanges) and local area networks (LANs), an intelligent building also offers efficient energy management of heating, ventilating, and air conditioning (HVAC), lighting, and many other services including access control and video security monitoring [7]. Up to 35% of the cost of wiring a building may be saved by combining telephone, lighting and climate controls, fire alarms, and security into an integrated system [8].