This chapter presents two further variations of PSR-based architectures, namely, the scalable-PSR (S-PSR) architecture and the dynamic-PSR (D-PSR) architecture. The S-PSR architecture is proposed to provide scalability in the size of the TDM frame construction problems that can be solved, and the D-PSR architecture is introduced for handling dynamic capacity demands, i.e., connections can be established and terminated dynamically.

Depending on the time one is willing to wait, there is a practical limit to the maximum size of a problem that can be solved with the TDM frame construction algorithms developed in Chapters 3–5. One way to increase the maximum problem size is to design more efficient algorithms, and another one is to simply allocate more computing resources to a problem. A different approach is followed with the S-PSR architecture. The S-PSR architecture supports the division of a potentially unsolvable TDM transmission frame construction problem into a number of solvable problems of a smaller size. This is achieved by decomposing a network into subnetworks that are interconnected by means of gateway nodes. In order to allow independent solution of the TDM frame construction problem for each of the subnetworks, a gateway provides the functions of time-slot interchanging and wavelength interchanging. In Section 7.1, the scalable-PSR network architecture is defined, and it is proven that the TDM frame construction problem for an S-PSR network can be solved by independently solving the TDM frame construction problems for the subnetworks.

When the capacity demand between end node pairs varies significantly over time, it may be a waste of network resources to establish static (permanent) connections. Under such conditions, a better utilization of network resources can be achieved by dynamically establishing and terminating connections upon request of the network users. This is possible with the D-PSR architecture, which is defined in Section 7.2. In Section 7.3, a performance analysis is made.
of D-PSR networks by determining call blocking probabilities. A summary and conclusions of this chapter are given in Section 7.4.

### 7.1 Scalable-PSR Architecture Definition

The scalable-PSR, or S-PSR, architecture is most conveniently defined as a generalization of the upgradable-PSR architecture (Section 4.1). In addition to the access nodes and switching nodes, which can both be implemented either as a PSR type or an IWS type node, there exist gateway nodes. A scalable-PSR network consists of subnetworks that conform to the specification of the U-PSR architecture. Subnetworks are interconnected by means of gateway nodes. An example of a scalable-PSR network is shown in Figure 7.1. It consists of five subnetworks $N_1, N_2, \ldots, N_5$, interconnected by gateway nodes $G_1, G_2, G_3,$ and $G_4$.

#### 7.1.1 Gateway Node Functions

Gateway nodes can perform the functions of an IWS type node, i.e., wavelength separation, wavelength space switching, and wavelength combining (Section 4.1.1). In addition, a gateway node provides the following functions:

- **Wavelength Channel Switching**: a connection can be switched from one wavelength channel to another one.

- **Time-Slot Switching**: a connection can be switched from one time-slot channel to another one.