This is an interactive process of trial and error. It entails much work. The effort can be minimized by carefully preparing cost equations for the different equipment solutions (see Figure 11.2) and by using a computer (see foregone boxed-in information). The time spent in finding an optimum will nearly always be paid back several times over by the savings that result from finding the optimum.

11.2 Subscriber Access

The distribution of subscribers in the service area usually exerts the most influence on the process of selecting a subscriber access system.

Subscriber distribution refers to

- the total number of subscribers in the area to be served,
- the physical size of the area to be served,
- the number of subscriber clusters,
- the subscriber demand (number of telephone lines needed) in each cluster,
- the physical size (radius) of clusters,
- distances between clusters, and
- any significant distribution patterns.

Figure 11.3 shows various distribution possibilities.

By examining subscriber distribution, you can select a likely subscriber access system and lay it out in a promising configuration. If the total subscriber base in the service area is large (say over 200), then all large clusters (say with more than 50 subscribers) should be considered for collection points or rural exchanges.

The flowchart in Figure 11.4 shows a typical decision-making process. Each system design should be tested against all key requirements, some of which could include:

- future growth (capacity needed in 5 to 10 years),
- subscriber loop attenuation and signalling limits,
- availability of sufficient spectrum (for radio systems),
- traffic handling capacity (for systems with concentration), and
- power consumption.

As described in the preceding subsection, a few iterations may be required to optimize the configuration of the subscriber access system.

11.3 Exchanges and Collection Points

If optimizing the subscriber network indicates that the larger clusters should be considered for collection point or exchange equipment, the next step is to select systems for these locations. Ideally, these locations should be close to existing transmission facilities, have access to commercial power, and have land available for an equipment building, container, or cabinet.

Subscriber multiplex systems, remote line units, remote switching units, and satellite exchanges may be used at collection points. The distinction between these different systems is somewhat arbitrary. Sophisticated digital multiplex systems can flexibily provide concentration, stand-alone switching, and direct digital interfacing to suitable host exchanges as well as standard analog line interfacing with any exchange. This class of equipment can reduce inventories of different equipment types, while maintaining maximum flexibility.

A rural exchange, as opposed to remote units or subscriber multiplex, may be indicated, if the following conditions exist:

- high subscriber demand or high growth rate;
- high community interest, therefore a high incidence of local calling; and
- long or difficult transmission path to the nearest host exchange.

Where an existing host exchange is analog, capping its growth and installing an adjacent digital exchange may be economically advantageous. The digital exchange can provide an efficient host for remote units and eventually replace the analog exchange. The final decision between systems will likely be based on cost over the study period and consideration of any analog-to-digital conversion policy.