VSATs

very small aperture terminals

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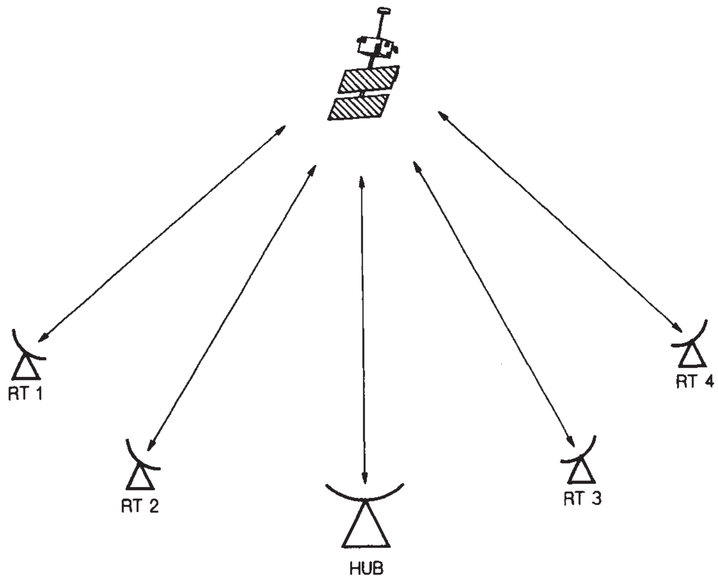

Fig. 19.1 *Network with a single central station*

RT = rural terminal

19.2.1 *System architecture*

The first and most important step in the network design is the selection of a suitable system architecture [4]. The choice of architecture would depend upon the expected pattern of traffic flow in the system and expandability of a given architecture.

There are a number of possible architectures for messaging systems but only the following alternatives are considered to be important.

19.2.1.1 *Fully connected network* In this architecture, all terminals in the network can transmit to all other terminals directly via the satellite channel. The transponder capacity can be divided into dedicated channels operating between different pairs of terminals or the transponder can be shared by all terminals in a multiaccess mode on a single channel at an adequate rate. This architecture is attractive from the end user point of view as messages can be sent directly to all other terminals in the network. However, it is very difficult to implement a fully connected network at the present time with low cost earth stations because of high transmit power requirements and large aperture of the antennas.

19.2.1.2 *Network with a single hub (star network)* This is the most common architecture, depicted in Fig. 19.1, using VSATs because of minimal demands on the rural terminals. The central station (or hub) also acts as a post office where messages can be left for users who are currently unable to communicate. It also acts as a central database for remote access to information and as a computing resource.

This system is a two hop system; i.e. initially the message is transmitted to the

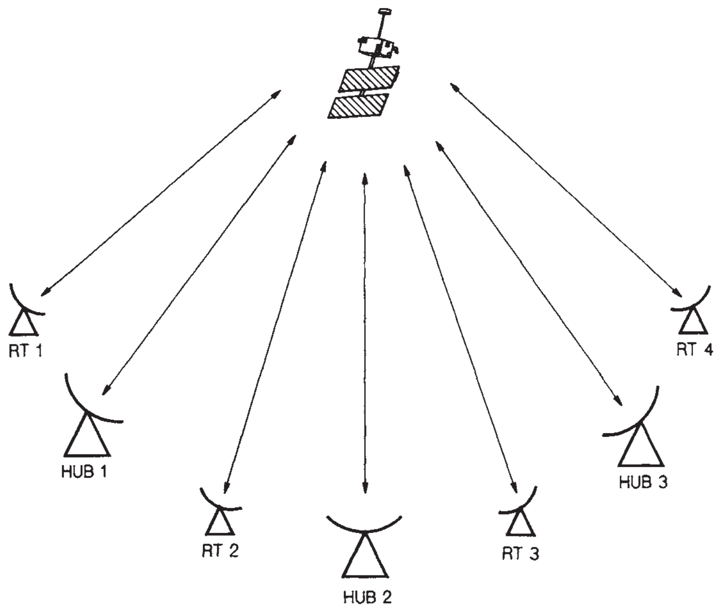

Fig. 19.2 *Network with multiple hubs*

hub and from there to the destination rural terminal. In this case the transponder capacity can be divided into many channels for communication to and from the hub to the rural terminals, or the transponder can be shared by all terminals in the network in a multiaccess mode. The channel(s) for communication from hub to rural terminals can follow different rules than the channel(s) from rural terminals to hub.

19.2.1.3 *Network with multiple hubs* A single hub architecture fails completely if the hub becomes unserviceable. Accordingly, the presence of more than one hub, indicated in Fig. 19.2, in a network is desirable for establishing a high level of system reliability by virtue of in-built system redundancy. In a star network, the hub can rapidly become overloaded if demand outgrows the hub capacity. The multiple hub architecture can provide a more timely warning of impending congestion in the network and the system capacity can be increased by upgrading existing hubs or increasing the number of hubs. This can be a valuable feature in large national systems.

In this case, there are two possible alternatives depending upon the way hubs transmit to each other and to rural terminals. The hubs can communicate with each other on the same channel(s) as the one used to communicate with rural terminals, or the hubs can use separate channels reserved for communication between hubs.

19.2.1.3.1 *Single/multiple hubs with asymmetric channel* In this case, shown in Fig. 19.3, the satellite channel is asymmetric and different inbound (from rural terminals to hub) channels are allocated to groups of users. Each channel in a group is shared by a number of users who contend for it in multiaccess mode. The

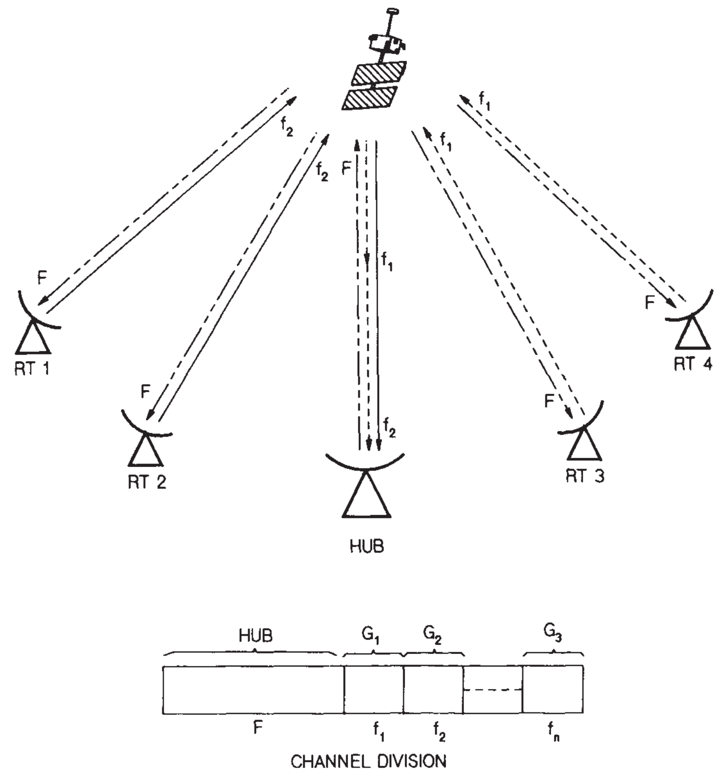

Fig. 19.3 *Single hub with asymmetric channel*

outbound (from hub to rural terminals) channel is a multiplexed channel and the messages transmitted reach all earth stations in the network. Messages are displayed only if they are intended for the specific station/user. Either, a preassigned timeslot scheme or addressing information at the beginning of messages can be used for distinguishing the destination of a message. The inbound subchannels are relatively low capacity, typically less than 64 kbit/s, whereas the outbound channel is high capacity, typically 512 kbit/s.

This configuration gives full connectivity in two hops as every terminal can transmit to every other terminal on the network via hub(s). The advantages are the capability to support a very large number of users and incremental network expansion by adding more subchannels with increase in demand. This architecture takes full advantage of the high transmit power of a hub to support a high speed outbound channel compared with the inbound channel which is easily provided by rural terminals.

19.2.1.3.2 *Multiple hubs with symmetric channels* In this architecture, depicted in Fig. 19.4, the rural terminals are able to transmit to a limited number of hubs; either one or two. The hubs transmit among themselves on separate channel(s) reserved for the purpose. The messages from one rural terminal to another take three hops in the worst case.

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