4.4.3 Hop Reservation Multiple Access Protocol

The hop reservation multiple access protocol (HRMA) [12] is a multichannel MAC protocol which is based on simple half-duplex, very slow frequency-hopping spread spectrum (FHSS) radios. It uses a reservation and handshake mechanism to enable a pair of communicating nodes to reserve a frequency hop, thereby guaranteeing collision-free data transmission even in the presence of hidden terminals. HRMA can be viewed as a time slot reservation protocol where each time slot is assigned a separate frequency channel.

Out of the available L frequency channels, HRMA uses one frequency channel, denoted by f0, as a dedicated synchronizing channel. The nodes exchange synchronization information on f0. The remaining L - 1 frequencies are divided into $M = \frac{[L-1]}{2}$ frequency pairs (denoted by $(\mathbf{f}_i, \mathbf{f}_i^*)$, i = 1, 2, 3, .., M), thereby restricting the length of the hopping sequence to M. fi is used for transmitting and receiving hop-reservation (HR) packets, request-to-send (RTS) packets, clear-to-send (CTS) packets, and data packets. $\mathbf{f}_i^*$ is used for sending and receiving acknowledgment (ACK) packets for the data packets received or transmitted on frequency f_i. In HRMA, time is slotted, and each slot is assigned a separate frequency hop, which is one among the M frequency hops in the hopping sequence. Each time slot is divided into four periods, namely, synchronizing period, HR period, RTS period, and CTS period, each period meant for

transmitting or receiving the synchronizing packet, FR packet, RTS packet, and CTS packet, respectively. All idle nodes, that is, nodes that do not transmit or receive packets currently, hop together. During the synchronizing period of each slot, all idle nodes hop to the synchronizing frequency f0 and exchange synchronization information. During the HR, RTS, and CTS periods, they just stay idle, dwelling on the common frequency hop assigned to each slot. In addition to the synchronization period used for synchronization purposes, an exclusive synchronization slot is also defined at the beginning of each HRMA frame (Figure 4.17). This slot is of the same size as that of the other normal slots. All idle nodes dwell on the synchronizing frequency f0 during the synchronizing slot and exchange synchronization information that may be used to identify the beginning of a frequency hop in the common hopping sequence, and also the frequency to be used in the immediately following hop. Thus the HRMA frame, as depicted in Figure 4.17, is composed of the single synchronizing slot, followed by M consecutive normal slots.

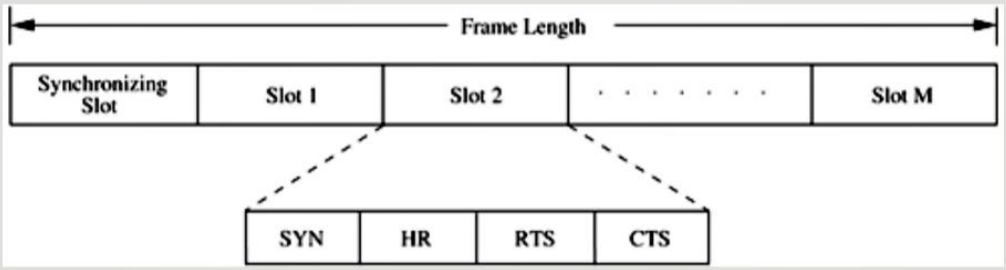

Figure 4.17. Frame format in HRMA.