| CRC | $C(x)$ |
|---|---|
| CRC-8 | $x^8 + x^2 + x^1 + 1$ |
| CRC-10 | $x^{10} + x^9 + x^5 + x^4 + x^1 + 1$ |
| CRC-12 | $x^{12} + x^{11} + x^3 + x^2 + 1$ |
| CRC-16 | $x^{16} + x^{15} + x^2 + 1$ |
| CRC-CCITT | $x^{16} + x^{12} + x^5 + 1$ |
| CRC-32 | $x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$ |

**Table 2.6 Common CRC polynomials.**

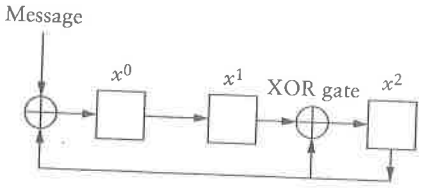


**Figure 2.18 CRC calculation using shift register.**

This is usually accomplished using a combination of two fundamental mechanisms—*acknowledgments* and *timeouts*. An acknowledgment (ACK for short) is a small control frame that a protocol sends back to its peer saying that it has received an earlier frame. By control frame we mean a header without any data, although a protocol can *piggyback* an ACK on a data frame it just happens to be sending in the opposite direction. The receipt of an acknowledgment indicates to the sender of the original frame that its frame was successfully delivered. If the sender does not receive an acknowledgment after a reasonable amount of time, then it *retransmits* the original frame. This action of waiting a reasonable amount of time is called a *timeout*.

The general strategy of using acknowledgments and timeouts to implement reliable delivery is sometimes called *automatic repeat request* (normally abbreviated ARQ). This section describes three different ARQ algorithms using generic language; that is, we do not give detailed information about a particular protocol's header fields.