The diagram in Figure 3.1 shows the OSI layers, and compares them with the protocol stack of the four most commonly used building controls protocols, BACnet, LonWorks, Modbus, and KNX (which is an evolution of the BatiBUS and EIB protocols).

**Figure 3.1 Building Control Networking Layer Comparison**

<table>
<thead>
<tr>
<th>OSI Layers</th>
<th>BACnet</th>
<th>LonWorks</th>
<th>ModBus</th>
<th>KNX/EIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Object-oriented structures that defines how message data is presented</td>
<td>Defines network variables, node discovery, logical interfaces, and functional data profiles</td>
<td>MODBUS Application Protocol</td>
<td>Application Layer supports individual and group addresses</td>
</tr>
<tr>
<td>Presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Link</td>
<td>Message routing</td>
<td></td>
<td>MODBUS Serial Protocol</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>4 LAN options (Ethernet, ARCANET, EIA-485, or LonTalk)</td>
<td>(MAC) layer control based on Carrier Sense Multiple Access (CSMA) and provides bit encoding and redundancy</td>
<td>MODBUS Serial Protocol</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>P2P protocol (EIA-232 full duplex interface)</td>
<td>Serial connections are supported using EIA/TIA-232 or EIA/TIA-485 standards</td>
<td></td>
<td>L.L.C: Flow control and error control via datagrams MAC: Uses Carrier Sense Multiple Access (CSMA)</td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Navigant Research)