

# Communication Advances



## Network Architecture Options

Trane®'s portfolio of control products offer a wide range a capabilities for both wired and wireless applications, including daisy chain, star and wireless/mesh.

Of the variations, architecture selection is normally dependent on careful consideration of the benefits and drawbacks of each. At higher levels of the architecture, greater bandwidth is often required. For those applications, Ethernet solutions provide the most capability, either star or ring topology. While ring topology appears to be a viable option in at least some cases, industry adoption is still quite limited and the networks are often proprietary. Ethernet networks require cooperation with local IT to ensure robust network design, sustainability, and ongoing troubleshooting.

At the unit controller and end device levels of the architecture, both wired and wireless options exist. Compared to higher levels, bandwidth requirements at these levels are normally reduced. While traditional daisy chain products and installations are widely recognized in the industry, wireless/mesh solutions offer a tremendous advantage. Customers value flexible and low total installed costs which a wireless solution ensures.

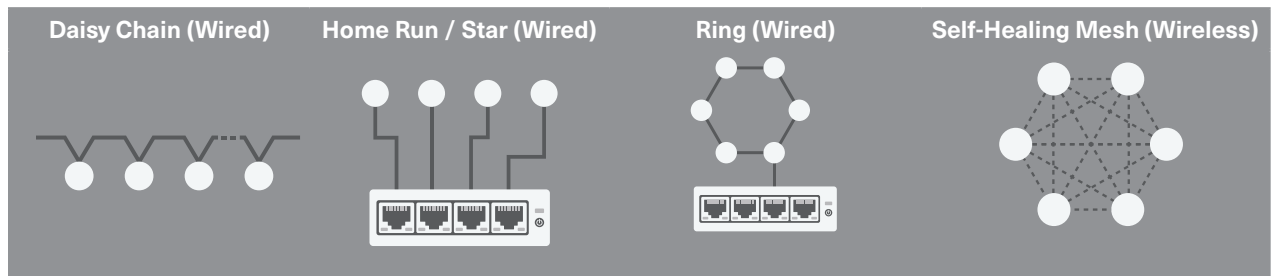
## Choose the Appropriate Topology

Trane promotes the selection of communication network topologies in order to deliver the best performance, reliability and cost. BACnet IP, BACnet MS/TP, and wireless all have an appropriate application in today's data driven building.

Trane will continue to leverage open, standard communication protocols recognized by ASHRAE®. To offer the greatest flexibility and capability to customers, Trane has established preference for Air-Fi® Wireless (BACnet Zigbee®) at the device and sensor levels. Air-Fi Wireless offers customers the lowest installed cost and tremendous installation and relocation flexibility. The preferred solution at the building/LAN level of the architecture is BACnet IP.

Trane's consideration of other communication technologies and topologies will be ongoing, especially as the industry adoption of any given technology gains sufficient market acceptance. Designing a controls system around industry standard open protocols offers owners purchasing flexibility, true interoperability, expandability and ease of future device replacement.

## Network Architecture Considerations



	Daisy Chain (Wired)	Home Run / Star (Wired)	Ring (Wired)	Self-Healing Mesh (Wireless)
<b>Protocols</b>	<ul style="list-style-type: none"> <li>• BACnet® (MS/TP, IP)</li> <li>• LonTalk®</li> <li>• Modbus®</li> <li>• Proprietary</li> </ul>	<ul style="list-style-type: none"> <li>• BACnet (IP)</li> <li>• Modbus (TCP)</li> <li>• Proprietary</li> </ul>	<ul style="list-style-type: none"> <li>• BACnet (IP)</li> <li>• Proprietary</li> </ul>	<ul style="list-style-type: none"> <li>• BACnet Zigbee (Air-Fi® Wireless)</li> <li>• Proprietary (Wi-Fi mesh)</li> </ul>
<b>Applications</b>	<ul style="list-style-type: none"> <li>• Device-level hardwired network</li> </ul>	<ul style="list-style-type: none"> <li>• System-level hardwired network</li> </ul>	<ul style="list-style-type: none"> <li>• Industrial applications</li> </ul>	<ul style="list-style-type: none"> <li>• Device and sensor-level wireless network</li> </ul>
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• Traditional, recognized, trusted</li> <li>• Wide adaptation and adoption</li> </ul>	<ul style="list-style-type: none"> <li>• Network speed (if IP)</li> <li>• Familiar to IT personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Network speed (if IP)</li> <li>• Redundancy (up to 2 paths)</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple paths of redundancy</li> <li>• Flexibility to relocate</li> <li>• Ease of replacement</li> <li>• Lower cost of installation</li> <li>• Quicker installation speed</li> </ul>
<b>Drawbacks</b>	<ul style="list-style-type: none"> <li>• Single point of failure</li> <li>• Difficult to troubleshoot</li> <li>• Slower speeds (BACnet MS/TP)</li> </ul>	<ul style="list-style-type: none"> <li>• High cost of installation</li> <li>• Difficult to manage addressing schemes</li> <li>• Scalability adds high complexity</li> </ul>	<ul style="list-style-type: none"> <li>• High cost of installation</li> <li>• Difficult to manage addressing schemes</li> <li>• Scalability adds high complexity</li> <li>• Often proprietary</li> </ul>	<ul style="list-style-type: none"> <li>• Application network design</li> </ul>

# Common Perceptions, Considerations, and Takeaways

Common Perceptions	Considerations	Takeaways
“Wireless communication isn’t as...”	<ul style="list-style-type: none"> <li>The bandwidth and range of Air-Fi® Wireless are designed for both device and sensor level communication.</li> <li>The <b>installed cost of Air-Fi Wireless is normally more attractive</b> compared to any of the wired alternatives.</li> <li>The <b>majority of Trane installations include Air-Fi Wireless</b>, confirming the product effectiveness, reliability, savings, and overall benefit of the technology.</li> <li><b>Air-Fi Wireless leverages ASHRAE® Standard 135 BACnet Zigbee®.</b></li> <li>Air-Fi Wireless complies with IEEE® standard 802.15.4, and is designed to coexist with 802.11 (Wi-Fi).</li> </ul>	Air-Fi Wireless Communication’s flexibility, reliability, and performance have proven to be the preferred technology for the majority of all Trane installations.
“BACnet IP is needed throughout...”	<ul style="list-style-type: none"> <li>While some providers offer BACnet IP at the device level, the <b>installed cost is generally higher</b> compared to other solutions.</li> <li>The bandwidth of BACnet IP is only an advantage when the transfer of large amounts of data is necessary. <b>BACnet IP is not needed at the device level</b> for typical HVAC applications.</li> <li>When specified, <b>Trane can provide BACnet IP device-level solutions</b> for most applications—especially with the UC600 programmable controller.</li> </ul>	Ethernet wiring associated with BACnet IP can add unnecessary costs to projects where alternative technologies can cost-effectively meet performance expectations.
“BACnet networks are not secure...”	<ul style="list-style-type: none"> <li>BACnet MS/TP networks are dedicated and provide secure automation and control infrastructure.</li> <li>The security of BACnet IP for dedicated network applications is robust. For shared network instances, the security of BACnet IP continues to evolve.</li> </ul>	When properly installed, utilizing documented IT best practices, BACnet IP does not present any significant risk to the BAS or other network systems.
“Ethernet Ring is preferred because...”	<ul style="list-style-type: none"> <li>While the installed cost of Ethernet Ring can be more attractive compared to star topologies, <b>the installed cost of Air-Fi Wireless and wired BACnet MS/TP are normally lower.</b></li> <li>Ethernet Ring currently offers no BACnet standard for interoperability. There are multiple ways to engineer a ring network.</li> <li><b>The adoption rate of Ethernet Ring for HVAC is low;</b> products are offered by only a small number of manufacturers in the HVAC industry.</li> </ul>	The adoption rate of Ethernet Ring solutions for HVAC is low, limiting the ability to select products that are best in class.



## Specification Language

### Wireless Topology

Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.

### Wired Topology

Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet protocol with an Ethernet (IEEE® 802.3, 802.11) or RS485 (EIA-485) physical interface and an appropriate data link technology as defined in ANSI®/ASHRAE® Standard 135-2012. (e.g. BACnet IP, BACnet IPv6, BACnet MS/TP).

Learn more at [trane.com](https://trane.com)



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