Wireless Mesh Networking
ZigBee® vs. DigiMesh™

White Paper

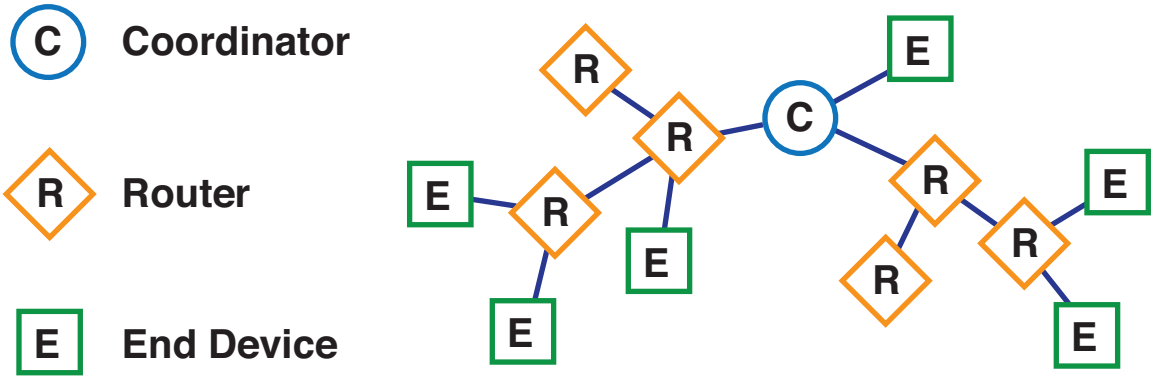
Abstract

Mesh networking is a powerful way to route data. Range is extended by allowing data to hop node to node and reliability is increased by "self healing," the ability to create alternate paths when one node fails or a connection is lost.

One popular mesh networking protocol is ZigBee, which is specifically designed for low-data rate, low-power applications. Digi International offers several products based on ZigBee. Additionally, Digi has developed an alternate mesh protocol named DigiMesh. Both ZigBee and DigiMesh offer unique advantages important to different applications, and this paper discusses those advantages.

ZigBee Nodes

The ZigBee Protocol defines three types of nodes: Coordinators, Routers and End Device, with a requirement of one Coordinator per network. While all nodes can send and receive data, there are differences in the specific roles they play.



Coordinators are the most capable of the three node types. There is exactly one coordinator in each network and it is the device that establishes the network originally. It is able to store information about the network, including security keys.

Routers act as intermediate nodes, relaying data from other devices.

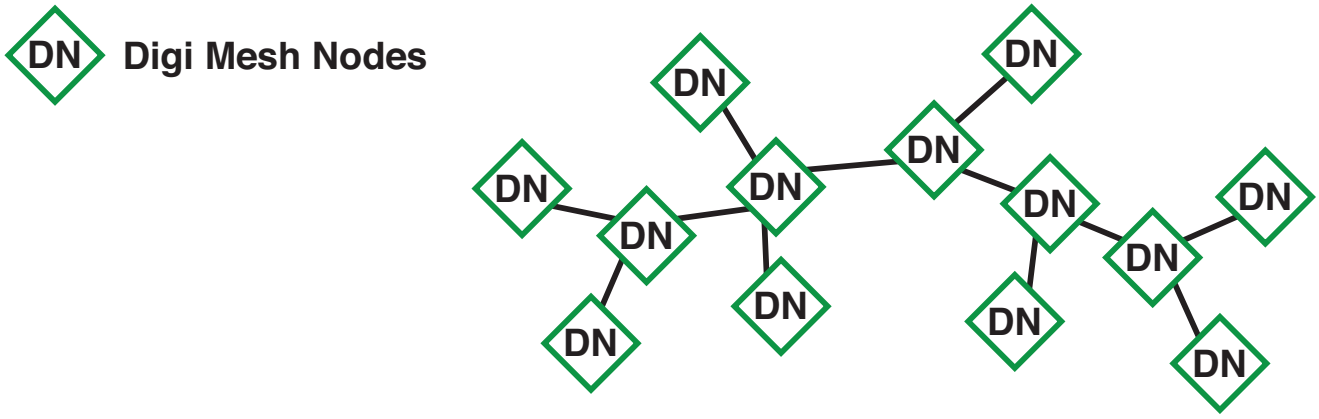
End Devices can be low-power / battery-powered devices. They have sufficient functionality to talk to their parents (either the coordinator or a router) and cannot relay data from other devices. This reduced functionality allows for the potential to reduce their cost.

ZigBee offers these advantages:

- Open standard with interoperability between vendors
- Option for lower cost, reduced function end nodes

DigiMesh Nodes

DigiMesh has only one node type. As a homogenous network, all nodes can route data and are interchangeable. There are no parent-child relationships. All can be configured as low-power / battery-powered devices.



DigiMesh offers these advantages:

- Network setup is simpler
- More flexibility to expand the network
- Increased reliability in environments where routers may come and go due to interference or damage

Sleeping Routers

Allowing a node to sleep reduces power consumption, which is especially helpful for nodes that are battery powered. Currently, ZigBee allows for End Devices to sleep but not Routers or Coordinators. DigiMesh allows all nodes to sleep, thereby increasing battery life.

Sleeping is allowed by time synchronization. Some systems require a gateway or coordinator to establish time synchronization. A significant advantage of DigiMesh is it eliminates the single point of failure associated with relying on a coordinator or gateway. Instead, DigiMesh establishes time synchronization through a nomination and election process, enabling the network to operate autonomously.

Additional Differences

Since ZigBee is an open standard, it offers the potential for interoperability with devices made by different vendors. This provides the ability to have over-the-air firmware updates. Furthermore, ZigBee offers established profiles for common applications such as energy management and lighting controls. A good selection of diagnostic support tools, like RF packet sniffers, is also available.

DigiMesh, as a proprietary protocol, allows for tighter control of code space and therefore more room for growth in features. DigiMesh is available on platforms with longer range and more RF data rate options. Frame payload is generally larger, which can improve throughput for applications that send larger data blocks. Additionally, DigiMesh uses a simplified addressing method, which improves network setup and trouble shooting.

Comparison Table

	ZigBee® Mesh	DigiMesh
Node Types, Benefits	Coordinators, Routers, End Devices. End Devices potentially less expensive because of reduced functionality.	One type, homogenous. More flexibility to expand the network. Simplifies network setup. Increases reliability in environments where routers may come and go due to interference or damage.
Sleeping Routers, Battery Life	Only End Devices can sleep.	All nodes can sleep.No single point of failure associated with relying on gateway or coordinator to maintain time synchronization.
Over-the-Air Firmware Updates	Yes	Not currently scheduled.
Long Range Options	Most ZigBee devices have range of less than 2 miles (3.2 km) for each hop.	Available on XTend™, with range of up to 40 miles (64 km) for each hop.
Frame Payload, Throughput	Up to 80 bytes.	Up to 256 bytes, depending on product. Improves throughput for applications that send larger blocks of data.
Code Size	Larger. Less room for growth in features.	Smaller (about half ZigBee PRO). More room for growth in features.
Supported Frequencies and RF Data Rates	Predominantly 2.4 GHz (250 kbps). 900 MHz (40 Kbps) and 868 MHz (20 Kbps) not widely available.	900 MHz (10, 125, 150 Kbps). 2.4 GHz (250 Kbps)*.
Security	AES encryption. Can lock down network and prevent other nodes from joining.	AES encryption.**
Interoperability	Potential for interoperability between vendors.	Proprietary
Interference Tolerance	Direct-Sequence Spread Spectrum (DSSS).	900 MHz: Frequency-Hopping Spread Spectrum (FHSS). 2.4GHz: Direct-Sequence Spread Spectrum (DSSS).
Addressing	Two layers. MAC address (64 bit) and Network address (16 bit).	MAC address (64 bit) only.
Maintenance	More sniffers and diagnostic tools available on market.	Simpler addressing can help in diagnosing problems and setting up a network.

*** 2.4 GHz coming soon**
**** Coming soon to all platforms**

Conclusion

ZigBee and DigiMesh are excellent mesh networking protocols with distinct advantages. So, which is right for you? In general terms, here is a guide.

Choose **ZigBee** if you need:
- Open standard based product
- Potential for interoperability with devices made by different vendors
- Over-the-air firmware upgrades

Choose **DigiMesh** if you need:
- Ability to sleep on all nodes
- Simplified network setup and expansion.
- More robust mesh networks (no Parent/Child dependencies).
- Fast 900 MHz (up to 156 Kbps)
- Longer range options, up to 40 miles (64 km) for each hop
- Larger frame payloads
- Smaller code space to allow more room for specialized features

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