

EkoTek Low Power Radio Mesh Networking





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1/ Scope

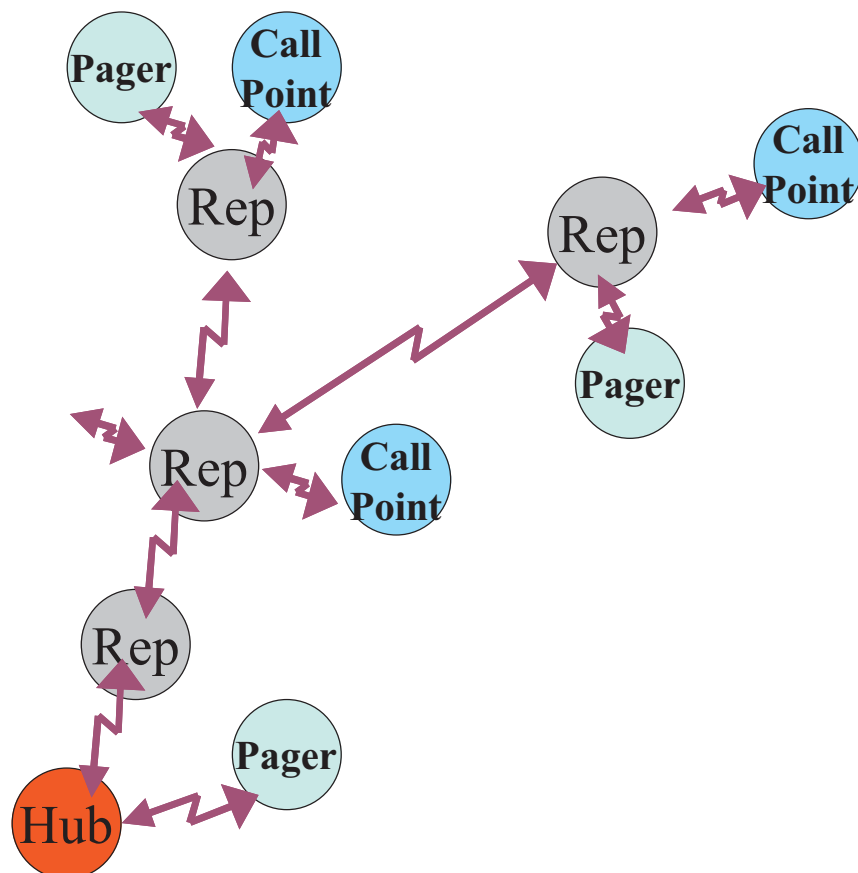
This document gives an overview of a radio mesh network and the low power technology that can be used for implementation of the network.

2/ Background

A mesh network is a type of network where co-operating nodes form connections that are used for traffic flow through the network. The term “mesh” is used as traffic may have more than one potential route through the network, providing the possibility of traffic load sharing and resilience.

The Internet is a well known mesh network, where Internet Routers form the network nodes that handle the traffic flow.

This document is specifically concerned with low power radio mesh networking and describes an implementation used by Multitone Electronics in its EkoTek range of products.





3/ Requirements

Key requirements for a low power radio mesh network are :

- ◆ Battery powered with long battery life : as multiple nodes form the mesh network, installation costs would be high if each node required a mains power supply. Battery powering allows nodes to be installed quickly and easily with a very low installation cost.
- ◆ Resilience : failure of any node should not cause the network to fail. The network should automatically route around a failed node.
- ◆ Self-configuration : the number of potential radio paths available in a radio mesh network can be considerable. This makes the network robust but means that manual configuration is not practical. The network must automatically configure routes through the network.
- ◆ Ease of expansion : changes to the network must be straightforward to implement

4/ Radio Technology

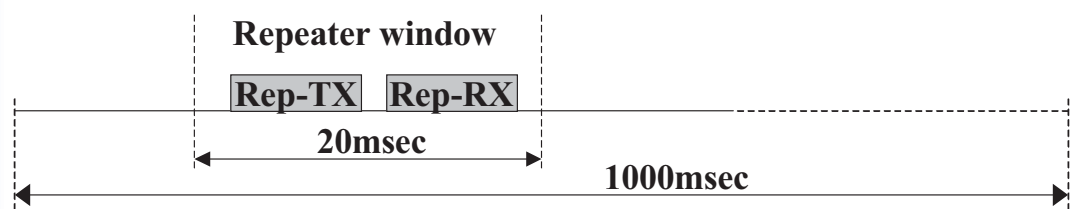
A number of radio technologies exist that could be used to create mesh networking products. For Multitone's EkoTek range of products, the requirement for battery powering with a battery life of at least 2 years meant that the latest technology low power radio devices were the appropriate solution.

The chosen radio technology is IEEE 802.15.4 which specifies a radio technique specifically aimed at battery operated devices and giving a long battery life.

5/ Meeting the Requirements

5.1/ Battery power : IEEE 802.15.4

This specification defines a radio system that may be used in various ways. In order to minimise power consumption, the ON time of the radio transmitter and receiver must be minimised. This is achieved by operating the node radio in beacon mode.



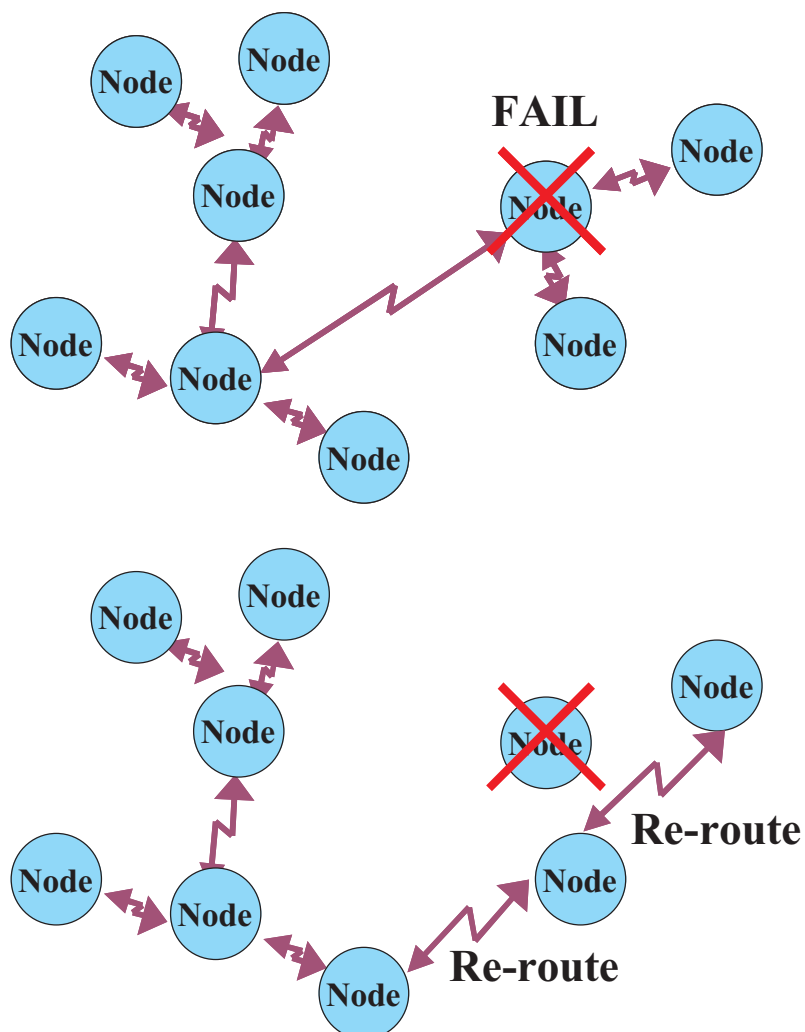


In beacon mode each node (Repeater) has a specific time window in which it transmits/receives. Outside of this window the node is inactive and therefore battery consumption is minimised. In the above example the node window lasts for 20 msec and repeats every 1000msec.

As the window is of relatively short duration, the tx/rx data rate must be relatively high to ensure that sufficient data can flow during the window period :in the case of IEEE 802.15.4 it is 250 kbit/s.

5.2/ Resilience

Traffic links to neighbouring nodes are continuously tested. Should a link fail, that link is dropped and the node automatically looks for a new link to another node.

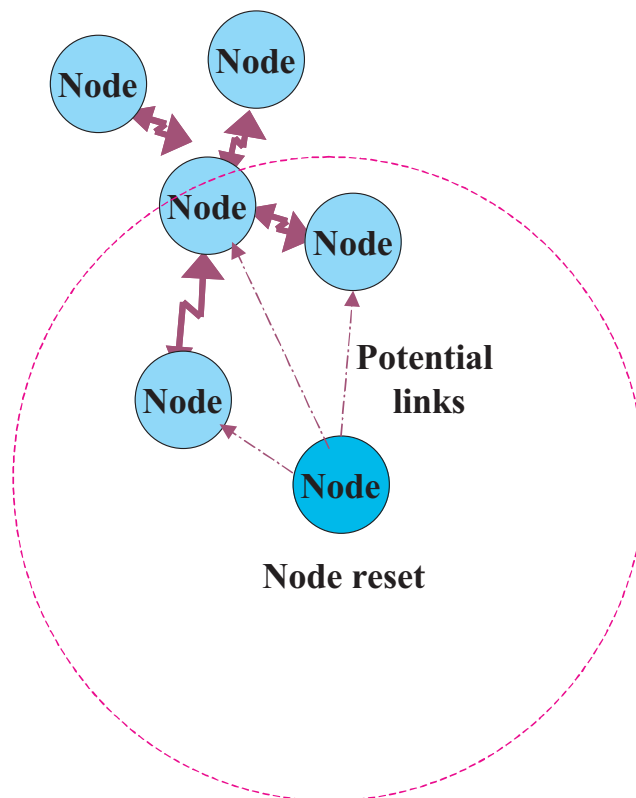




5.3/ Self-Configuration

When a node resets or on failure of a link to an adjacent node, the node performs a radio scan and selects an adjacent node with good signal strength as a route to pass traffic via the network.

In the above example, the node that has reset has performed a scan and detected three neighbouring nodes that could potentially be used for traffic links. One of these will be selected, normally based on link testing and signal strength.



5.4/ Ease of Expansion

Changes to the network, normally expansion but may also involve moving part of the network, must be straightforward to implement. Traditional 1-hop radio networks suffer from the single hop radio path normally requiring multiple wired base stations to provide site coverage, making expansion costly and difficult. A mesh network is easily expanded simply by adding additional nodes (Repeaters) in the required location. In addition, as EkoTek's Repeaters are battery powered, no wires are required to be installed for expansion, making the task very quick and easy.



6/ **Summary**

The IEEE 802.15.4 radio network chosen for Multitone's EkoTek range of products provides the following :

- ◀ Ease and low cost of installation due to the use of battery powered nodes (Repeaters).
- ◀ Long battery life using beacon window tx/rx.
- ◀ Ease of installation as the network self-configures at startup.
- ◀ Resilience as the network automatically re-configures on node or link failure.
- ◀ Easy expansion simply by adding battery powered nodes (Repeaters) where required.

