

APPLICATION NOTE

Microchip MiWi Wireless Protocol Stack

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Abstract

This application note will give the user an overview of MiWi, a new wireless technology we will be using in our design. It will cover the definition of MiWi, key words, device types, network configurations, application layers and security. Using this information will help our team choose the suitable MiWi configurations in order to link the simulated sensors to the cellular device in a cost effective manner. MiMac and MiApp are the two software applications that are vital in creating the phone-sensor link. MiMac is the layer of programming that provides the access for transmitting and receiving data from the application nodes. The MiApp application helps create the correct configuration for linking the two devices. It also allows for maximum flexibility in choosing any wireless protocol at any stage, and also reduces the need for software development since there are many configurations to test. (1) (2) (3)

Keywords

MAC, PHY, DDL, FFDs, RFD, WPAN, PAN coordinator, End devices, cluster, socket

Introduction

Nowadays with the wireless networking technology rapidly changing in quality and expenditure, choosing the right network for certain project become a challenge task. The Microchip MiWi Wireless Networking Protocol Stack is a simple protocol designed for low data rate, short distance, low-cost networks based on IEEE 802. 15.4 Which is a standard for Wireless Personal Area Networks (WPANs). Recently MiWi took the spotlights from other wireless protocols because it is easily accessible and can communicate between various Microchip families. It also supports all Microchip Radio frequency transceivers on different frequency bands. (3)

Objective

The purpose of our project is to develop a method of communication between a core sensor and several sensors through the use of a smart phone as a common node. To control the core sensor, the smart phone controller must be able to send commands, monitor the status, and alert the operator if the sensor detected a problem. In order for us to perform this project we need to find the suitable configuration and implement a MiMac layer that provides the basic channel access, addressing and data transmitting functionalities. MiApp is an important element of our project as it defines the programming interfaces between the application layer(MiMac layer) and Microchip proprietary wireless communication protocols. (2)

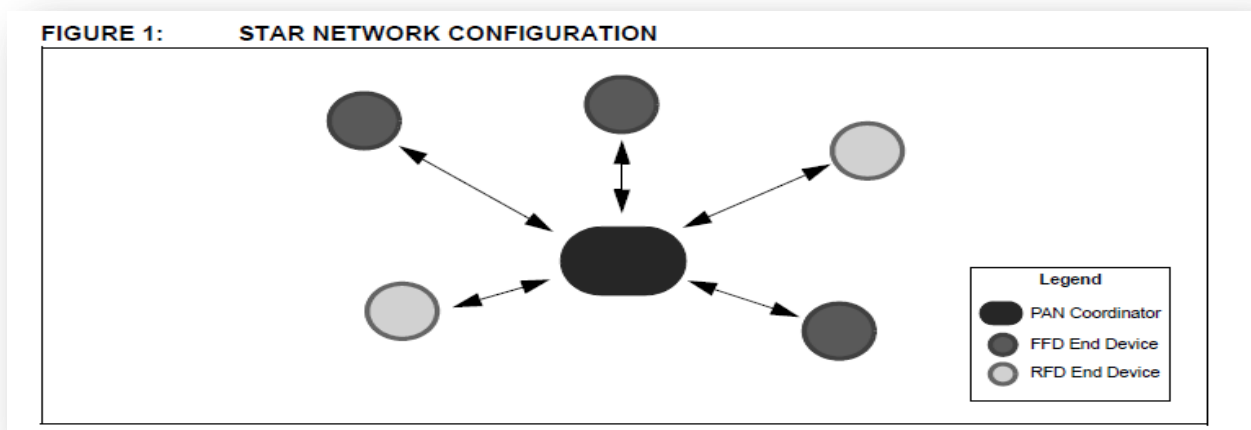
Network Devices

PAN Coordinator: It is the device that starts the Network, select the channel and the PAN ID of the network. (3)

FFD and RFD: Full and reduced function devices. The major difference between them is that the RFDs can communicate through multiple nodes. However, RFDs can only communicate between itself and one other node. (3)

Network Configurations

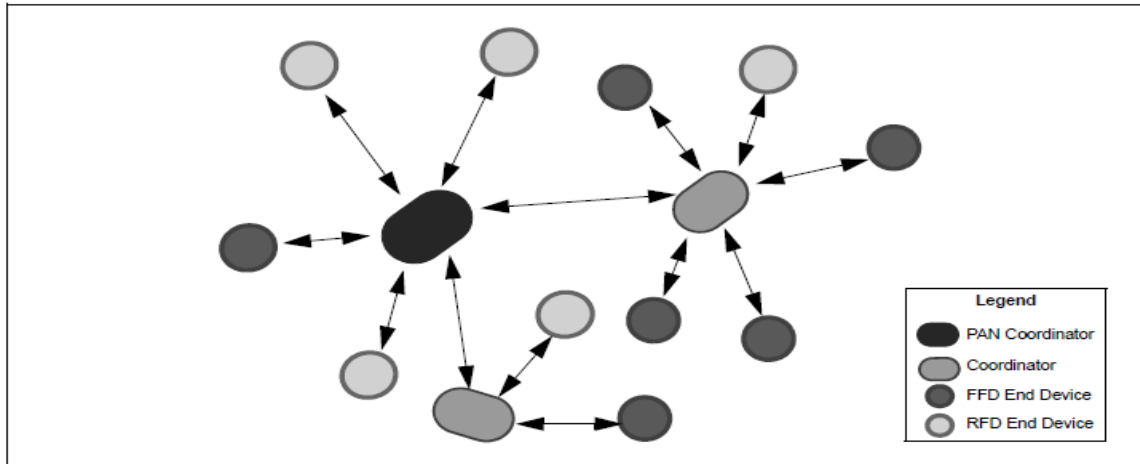
- A star network configuration consist of one PAN coordinator and one or more end nodes. All end nodes communicate with the PAN coordinator. If an end node want to transfer data to another end node. It transfer its data to the PAN coordinator which in turn, retransfer the data to the other end node. (3)



- A Cluster Network Configuration consists of one PAN coordinator. However, other coordinators are allowed to join the network. This forms a tree like structure where the

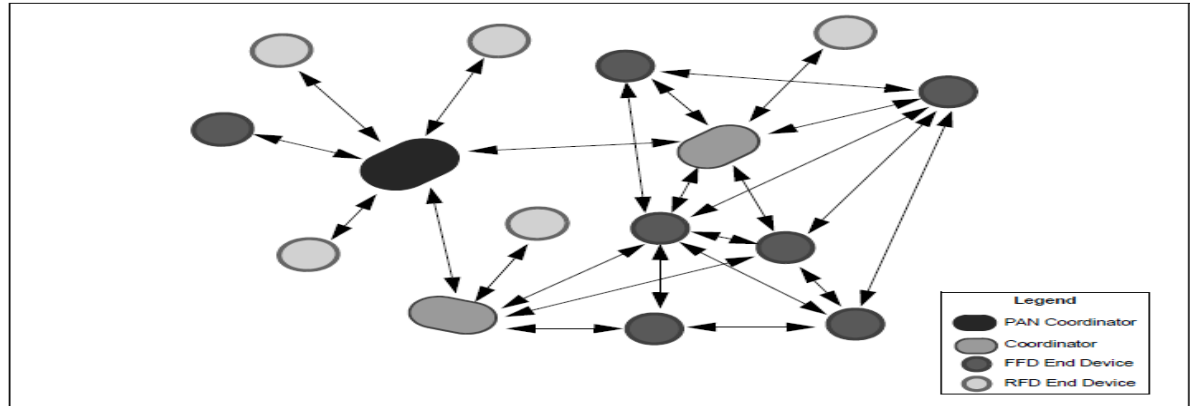
PAN coordinator is the root of the tree, coordinators are the branches of the tree and end nodes are the leaves of the tree. In this configuration, all the messages sent through the network follow the path of the tree structure. (3)

FIGURE 2: CLUSTER TREE TOPOLOGY



- A Mesh Network is similar to a cluster tree network configuration; except that the full function devices (FFDs) can send messages directly to other FFDs instead of following the tree structure. (3)

FIGURE 3: MESH NETWORK



Application layers

There are three layers of configurations for application protocol stacks and RF transceiver. (1)

- **Application Configurations**

The main advantage of this configuration is the ability to change between devices in the same application according to their hardware design and their task in the network. (1)

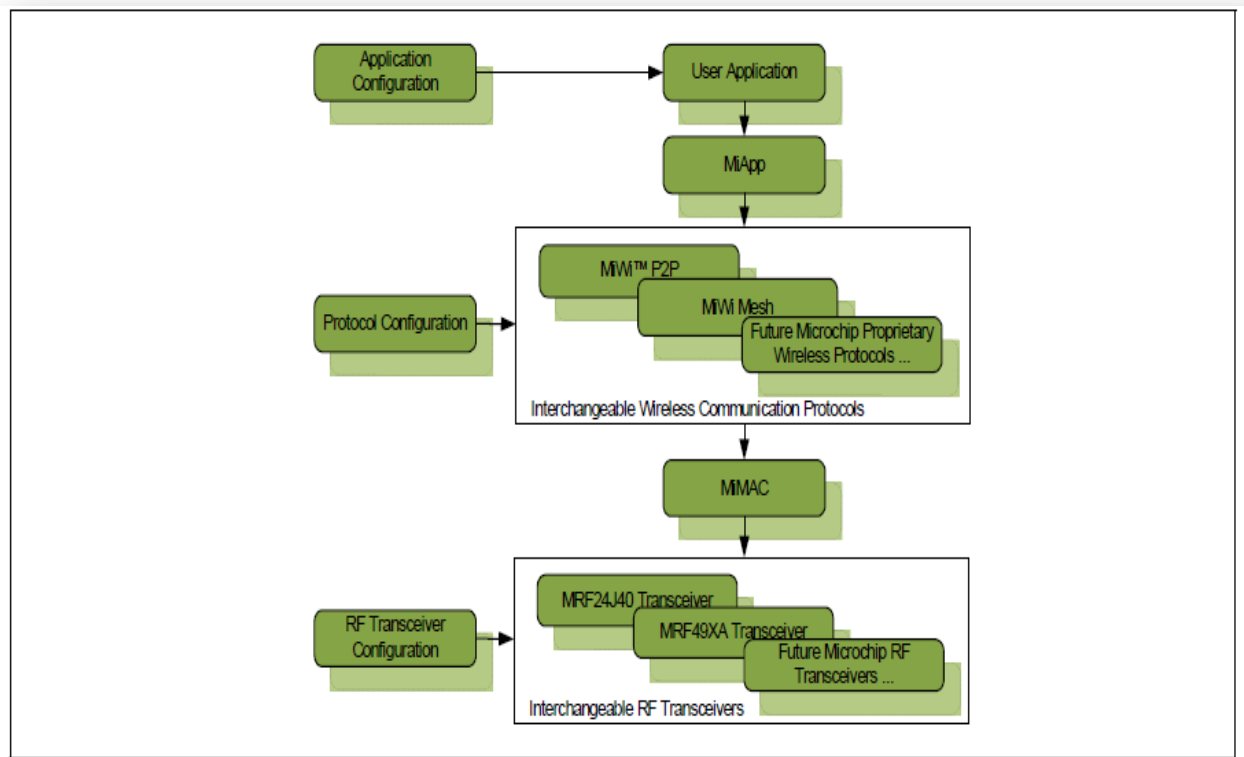
- **Protocol Stack Configurations**

Fine tune the behavior of the protocol stack. The majority of the configurations in the stack level are to set the timing of the stack, specify the routing mechanism, etc. (1)

- **Transceiver Configurations**

Define the frequency band, data rate and other RF related features of the RF transceiver (1)

Figure 4: demonstrates the Microchip MiWi solution. (1)



Security

Users are encouraged to implement some form of key handling procedure in the application layer with a separate report type and ID. One method of doing it is to transfer the security key and key sequence number every time a node joins the network, and store the keys and key sequence in RAM. This approach only meets the minimum requirement of a secured network, since the security key is transmitted every time a node joins the network. Another approach is to set a default key for every device and use the default key to secure the transferred key which provides minimum protection for the keys. A third safe approach is to add a new function to store data to the NVM during run time. By choosing this approach, the key and key sequence number only need to be transfer once when the device initially joins the network.

Conclusion

We can conclude with the fact that MIWI protocol is the perfect match for our project due to the ease of use for short range networking and the low-cost of the product. In my opinion the most suitable configuration for our project will be the star network configuration since will be using less complicated system where we only need to set a wireless network between a smart phone and a sensor.

References

- (1) Microchip Application Note AN1283, *"Microchip Wireless Media Access Controller – MiMAC"* <http://www.microchip.com/miwi>
- (2) Microchip Application Note AN1284, *"Microchip Wireless Application Programming Interface – MiAPP"* <http://www.microchip.com/miwi>
- (3) Microchip Application Note AN1066, *"Microchip Wireless Networking Protocol Stack– MiMAC"* <http://www.microchip.com/miwi>