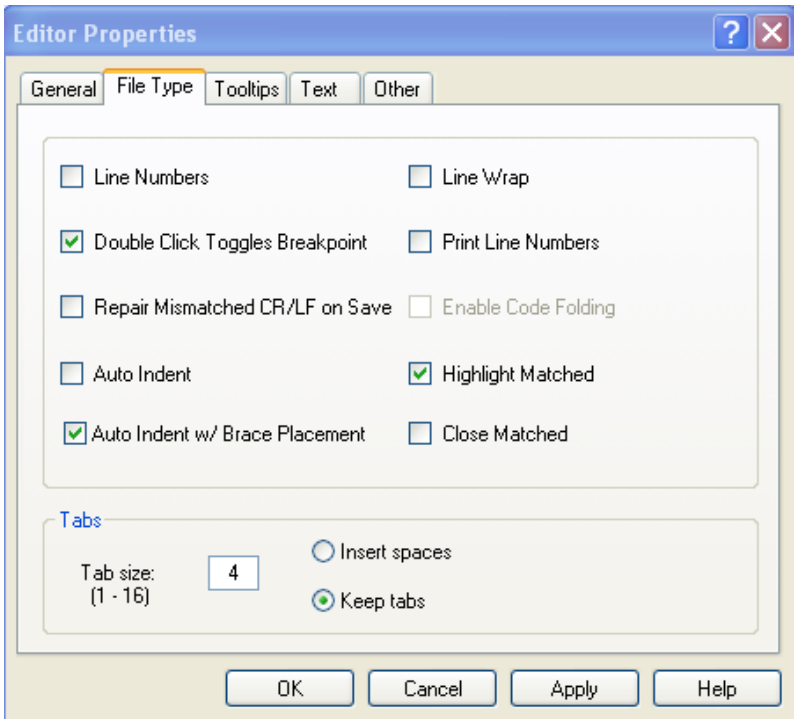
***Please use this document together with the lab 2 note**
----------Section 2 ----------

Try ZigBee networking through PuTTy

1. Open the MPLAB IDE with the coordinator project. Then select "Edit" option; -> properties; -> File Type. You will see the following window:



Please tick the "line number" Option, so that you will see the line number of the source code.

2. Program a device as coordinator. Please pay attention that different types of device should be programed with **different MAC addresses** and **same channel number**!!

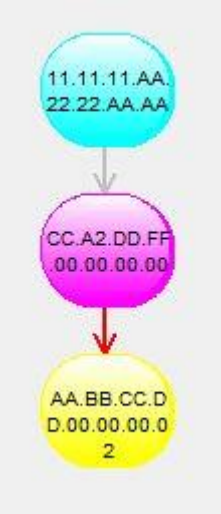
3. (If the connection between ZigBee node and PC is correct, the button will bright, or be grey)

4. Open the router project and program another device as the router. Before doing that, remember each device has a unique MAC address, so you need change the MAC address first in the source code. Go to the "Zigbee.def" file, the

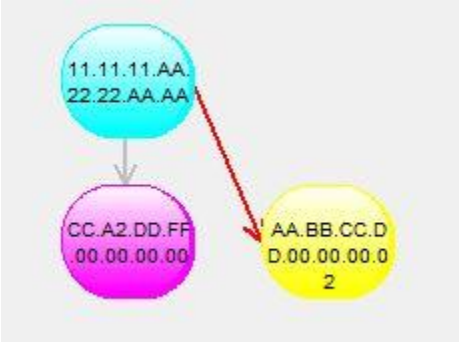
MAC address is defined from line 79 to line 86 of Coordinator workspace (line 84 to line 91 of Router workspace). For experiment, you can change it to any value you prefer.

5. Open the RFD project and program the last device as the RFD node. Power off all the devices (line 77 to line 84 for changing the MAC address).

6. Now you can begin to set up the network. Firstly, you need to know how to control the topology of the network, so that you can construct the network as you want it to be. For example, after you start the coordinator and join one router into the network open the PuTTy console and choose option 1 from the menu. Select "Disable join", so that any new devices will not join the coordinator. By doing this you can have a network with more depth like this:



Rather than a pure star network like this:



where the blue one represents the coordinator, the red one represents the router and the yellow one is the RFD.

You can also try different topologies later.
In this lab, please save the two ZigBee network topology results.

7. Try it yourself with unicast (Option 2 and 4 in the menu) to see how ZigBee network layer handles the routing.

8. You will see a lot of monitored traffic on Zena, and you do not have to understand every detail of it. But you still can find out the routing by only focus on the MAC and NWK header.

MAC Frame Control					Seq	Dest	Dest	Source	NWK Frame Control				Dest	Source	Radius	Seq
Type	Sec	Pend	ACK	IPAN	Num	PAN	Addr	Addr	Type	Ver	Route	Sec	Addr	Addr		Num
DATA	N	N	Y	Y	0xF9	0x1AAA	0x0001	0x0000	DAT	0x2	SUP	N	0x0002	0x0000	0x0A	0x9F

The white part is the MAC header; the Dest and Source address here are the actual single hop (between two nodes) address of the packet being transferred over the air. The green part is the Network header; the Dest and Source address here are showing the true original node and the final destination node of this packet. You can use Zena to save the monitoring record, and play it back. So you can save records about any process you think is important and helpful.

9. There are three routing modes: suppress, enable and force. They are defined in zNWK.h as:
   #define ROUTE_DISCOVERY_ENABLE 0x01
   #define ROUTE_DISCOVERY_FORCE 0x02
   #define ROUTE_DISCOVERY_SUPPRESS 0x00
   So you can modify the "params.APSDE_DATA_request.DiscoverRoute" parameter in the source code. Observe it on Zena. The source code of "option 4" is from line 1587 in "Router.c", actually in the line of 1618.

   SUPPRESS: If a discovered mesh route exists, the message is routed along that route. Otherwise, the message is routed along the tree.
   ENABLE: If a discovered mesh route exists, the message is routed along that route. If a mesh route has not been determined, the router can initiate route discovery. The results from initialization are twofold: 1.The message will be sent along the calculated route. 2. If the router has no route capacity, it will send the message along the tree.
   FORCE: It force initiate route discovery. If the router has route capacity, the message will be sent along the calculated route. Otherwise, it will follow the tree route.

   In this section, you need to program two routers. Through modifying the routing modes, you should be able to observe two different data transmitting modes (**FORCE is no needed, just program using ENABLE and SUPPRESS modes**) using Zena sniffer. So after you can see them, save the packet capturing status.
   For example:

From top picture we can see: The blue circle represents that the router is on SUPPRESS mode and the red one represents that the router is on ENABLE mode.

The different routing modes are needed, be careful.

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