Wireless Mesh Explorer Revision 1.0.10

User's Guide

TEXAS INSTRUMENTS

Introduction

1.1 Overview

Wireless Mesh Explorer (WME) is a Microsoft® Windows®-based software tool used for exploring and displaying mesh networks based on the Texas Instruments WiLink™ 8.0 chipset.

1.2 Abbreviations and Acronyms
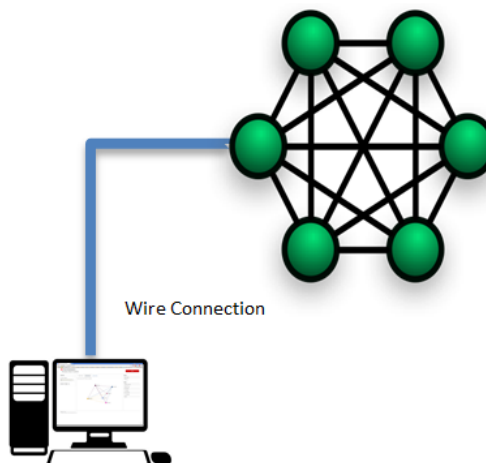
BBB – Beagle Bone Black

WME – Wireless Mesh Explorer

MP – Mesh Point

WLAN – Wireless Local Area Network

DHCP – Dynamic Host Configuration Protocol

1.3 System Requirements

- Operating System: Windows 7, Windows 8, or Windows 10
- Web Browser: Google Chrome or Firefox (latest version)
- Ethernet connection between a laptop or PC and at least one mesh device
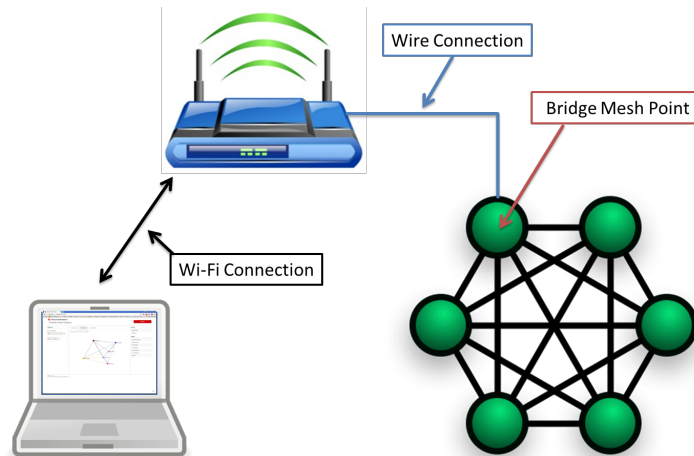

Figure 1-1. Basic Setup Connection Option 1

Or

- Wi-Fi® connection between a laptop or PC and the access point, as well as a Wi-Fi or Ethernet connection between the access point and a mesh device

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Figure 1-2. Basic Setup Connection Option 2

1.4   Installation

1. Download the installer from ti.com.

2. Run the installer as an administrator on Windows 7, Windows 8, or Windows 10.

3. View the new icon created under Start –> All Programs –> Texas Instruments –> Wireless Mesh Explorer, (see Figure 1-3) the icon is also located on the desktop.
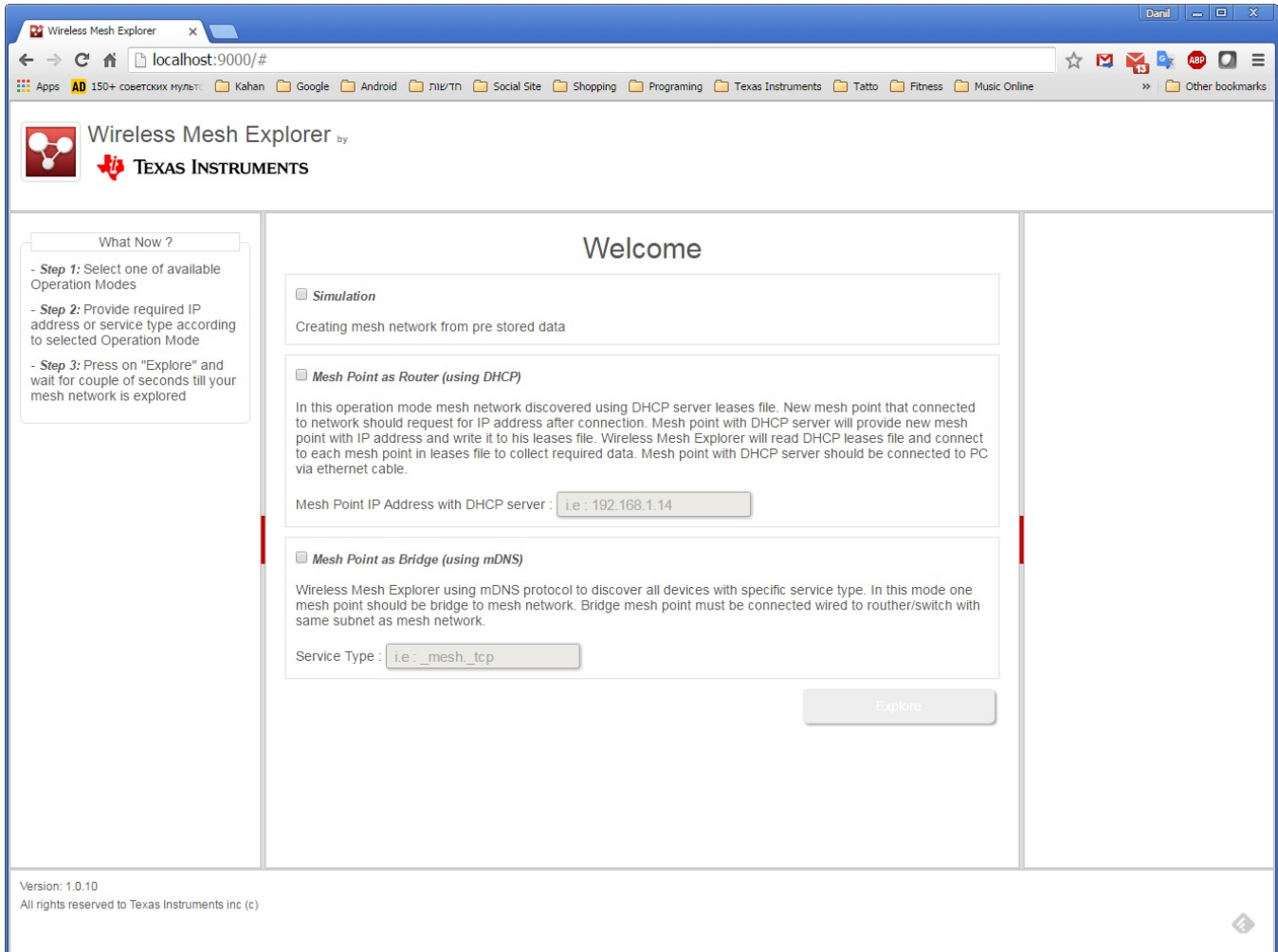

Figure 1-3. Wireless Mesh Explorer Icon

4. Execute *Wireless Mesh Explorer* to open the python web server console, and the default web browser directs to http://localhost:9000/.

Configuration

The three types of configurations are each described as follows:

Figure 2-1. Welcome Page

2.1 Operation Mode: Simulation

The simulation mode is available for users to explore the different features of the WME without connecting to an actual mesh network.

2.1.1 Procedure

The WME uses pre-stored data from six mesh devices.

This data is at: *c:\Program Files (x86)\Texas Instruments\Wireless Mesh Explorer\simData*

2.2 Operation Mode: Mesh Point as Router (Using DHCP)

In the Mesh Point (MP) as router operation, one MP acts as a router with a Dynamic Host Configuration Protocol (DHCP) server running. This MP assigns IP addresses to all other MPs and devices connected to it.

The computer with the WME connects to an MP through the Ethernet. The MP acts as a router for the wireless mesh network. The WME software then gathers data about the entire mesh network.

2.2.1 Procedure

1. Ensure that all the connected MPs request an IP address from the MP with the DHCP server (Section 2.2.5).
2. Connect the PC or laptop with the WME to the Ethernet port of the MP that is running the DHCP server.
3. Check Mesh Point as Router, and enter the IP address of the MP which is connected through the Ethernet.
4. The WME connects to the MP and reads the DHCP leases file.
5. After reading all IPs, the WME attempts to connect to each of the MPs through the SSH, and collects all necessary data for network analysis.
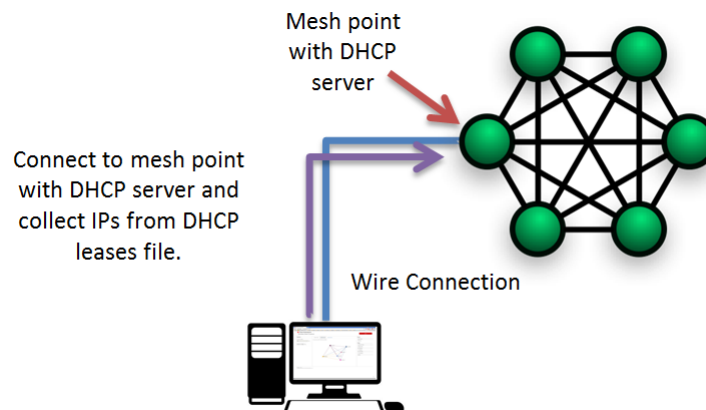
NOTE: The Ethernet IP between the PC or laptop and the mesh network IP should be in different subnets.

2.2.2 The MP as Router Operation Mode

Figure 2-2 shows the connection of the MP to the DHCP server. Figure 2-3 shows the connection to the next MP.

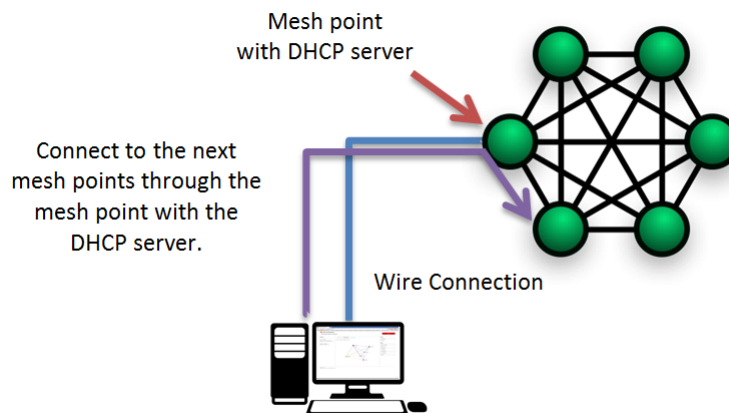**Figure 2-2. Connecting to the Mesh Point With the DHCP Server**

Figure 2-3. Connecting to the Next Mesh Point

2.2.3 Configure the DHCP Server Configuration File

Edit /usr/share/wl18xx/udhcpd.conf on the MP with the DHCP server. If the DHCP server is already running, restart it. Table 2-1 lists parameters that must be included in udhcp.conf

Table 2-1. DHCP Important Parameters

Parameter Name	Parameter Value	Example	Meaning
start	xx.xx.xx.yy	192.168.43.20	The start of the IP lease block
end	xx.xx.xx.zz	192.168.43.254	The end of the IP lease block
interface	<interface name>	mesh0	The interface that udhcpd will use
lease_file	<path to leases file>	/var/lib/misc/udhcpd.leases	The location of the leases file
auto_time	<refresh time in seconds>	10	The time period at which udhcpd will write leases file
option dns	<IP address>	8.8.8.8	
option subnet	<IP address>	255.255.255.0	
option router	<IP address>	192.168.43.1	

2.2.4 Start the DHCP Server

To start the DHCP server, run the following commands on the MP that hosts the DHCP server. Open a serial terminal with the device and change the directory to /usr/share/wl18xx

Start the DHCP server daemon command on the first MP:

```
udhcpd /usr/share/wl18xx/udhcpd.conf
```

2.2.5 Start the DHCP Client

Request the IP from the DHCP server using the following command on each of the other MPs in the network:

```
udhcpc –i mesh0
```

NOTE: If this process does not end within 1 to 3 minutes, stop it by pressing Ctrl + C, and check:
   • If the MP is connected to the mesh network
   • If the MP with the DHCP server is running (ps / grep [u]dhcpc)

2.2.6 Read the DHCP Leases File

Read the DHCP leases file command on the MP with the DHCP server:

```
dumpleases -a -f /var/lib/misc/udhcpd.leases
```

2.3   Operation Mode: MP as Bridge (Using mDNS)

In the MP as Bridge operation, the WME software discovers each MP using the mDNS protocol. Each MP in the network should be configured to advertise itself with a unique name and service type.

Once the computer running the WME is connected to the MP as bridge, the WME uses zeroconf to discover all other MPs. When discovery is complete, the WME gathers data on each point to create the network.

2.3.1 Procedure

1. Start the mDNS server on each MP with a unique name and mDNS server type. For example, name *MP1* with server type *_mesh._tcp* (for more information about mDNS daemon, click here).
2. Connect the PC or laptop with the WME to the Ethernet port of the MP set as bridge. This MP is the bridge between the Ethernet and mesh interfaces (for more information about mesh bridges, click here).
3. Check *Mesh Point as Bridge* and enter the server type (for example: *_mesh._tcp*).
4. Click the Explore button.
5. The WME uses zeroconf to find the IP addresses of all the devices using the specified service (for more information about zeroconf, click here).
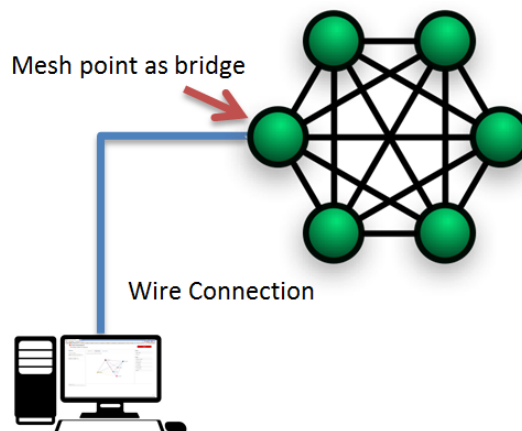6. The WME connects to all discovered MPs and collects the required data to analyze the mesh network.

> NOTE: The Ethernet IP between the PC or Laptop and the mesh network IP should be in the same subnet (for more information about mDNS, read here or here).
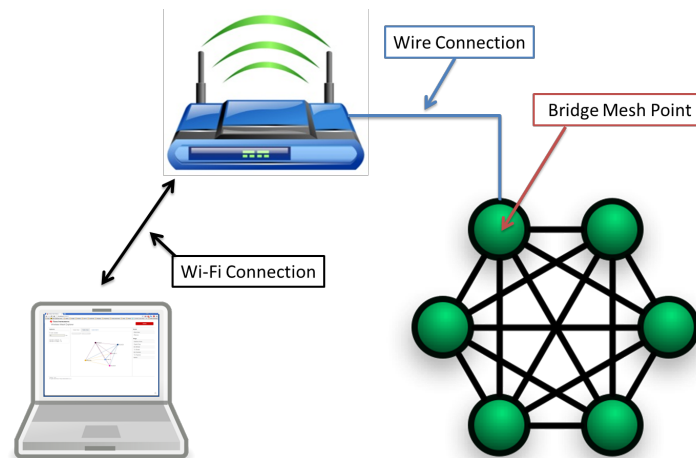
2.3.2 The MP as Bridge Operation Mode

Figure 2-4 and Figure 2-5 show basic diagrams for the MP as bridge.

Figure 2-4. Basic Diagram for Mesh Point as Bridge

Figure 2-5. Another Basic Diagram for Mesh Point as Bridge

2.3.3 Start the mDNS server on MP Using Avahi

To start the mDNS server, rub the following commands on each MP in the network:

```
avahi-publish -s <Mesh Point Name><Service Type><Port><Free Text> &
```

For example:

```
avahi-publish -s MP1 _mesh._tcp 7777 "free text" &
```

2.3.4 Set MP as Bridge

If the Ethernet interface of the MP is *eth0* and the mesh interface is *mesh0* the command should be:

```
brctl addbr br0
brctl addif br0 mesh0
brctl addif br0 eth0
brctl stp br0 on
```

> **NOTE:** The Ethernet interface of the MP *eth0* and the mesh interface *mesh0* should not have any IP. IP should be set on bridge interface. Example commands follow:
>
> ```
> ifconfig eth0 0.0.0.0
> ifconfig mesh 0.0.0.0
> ifconfig br0 xx.xx.xx.xx netmask 255.255.255.0
> ```

Usage

1. Run the WME as an administrator on Windows 7, Windows 8, or Windows 10.
2. Select one of the required operation modes, and click the Explore button. The WME analyzes collected data, and then displays the mesh network.
3. Click the Explore button to get the latest mesh network.
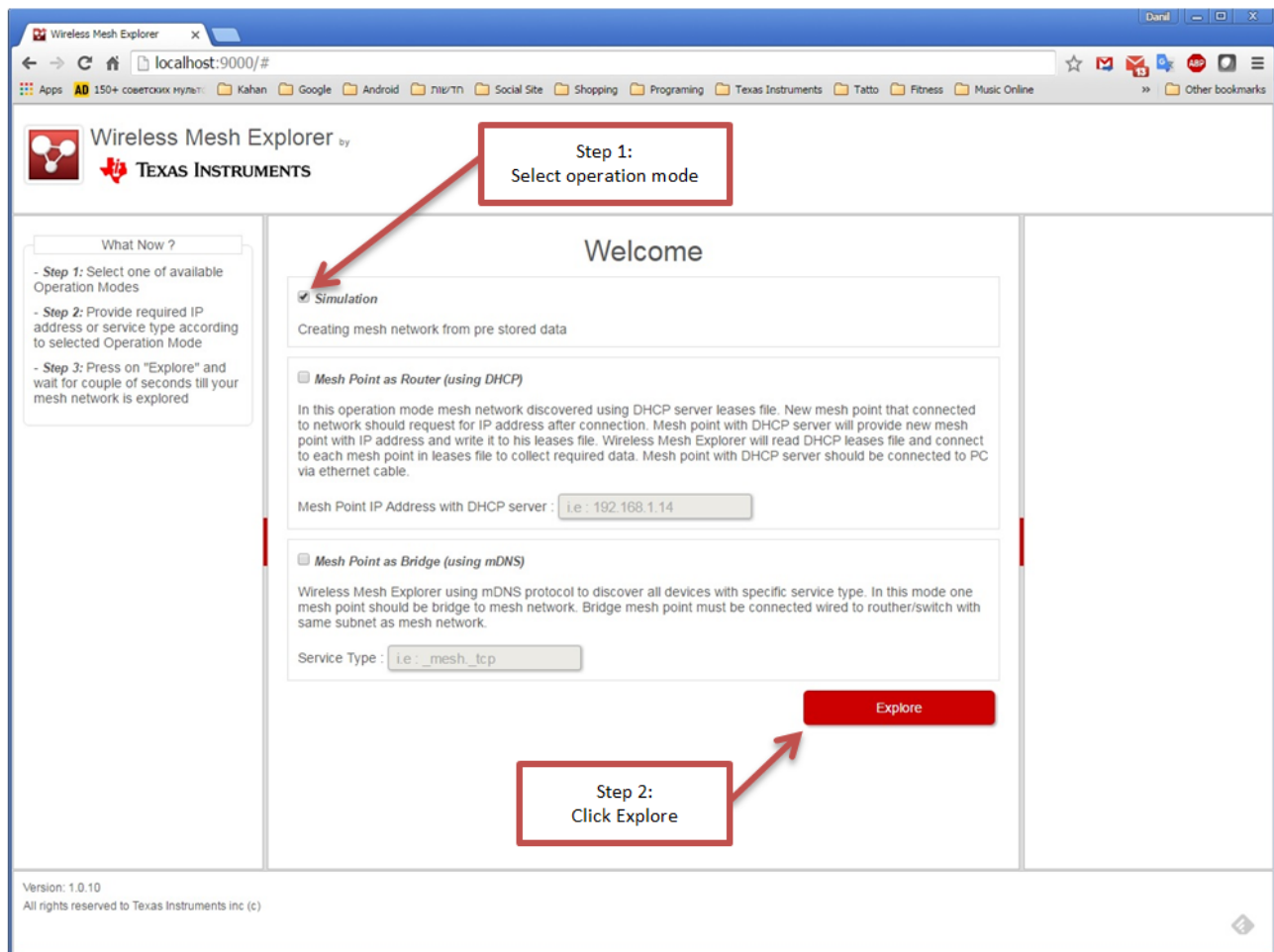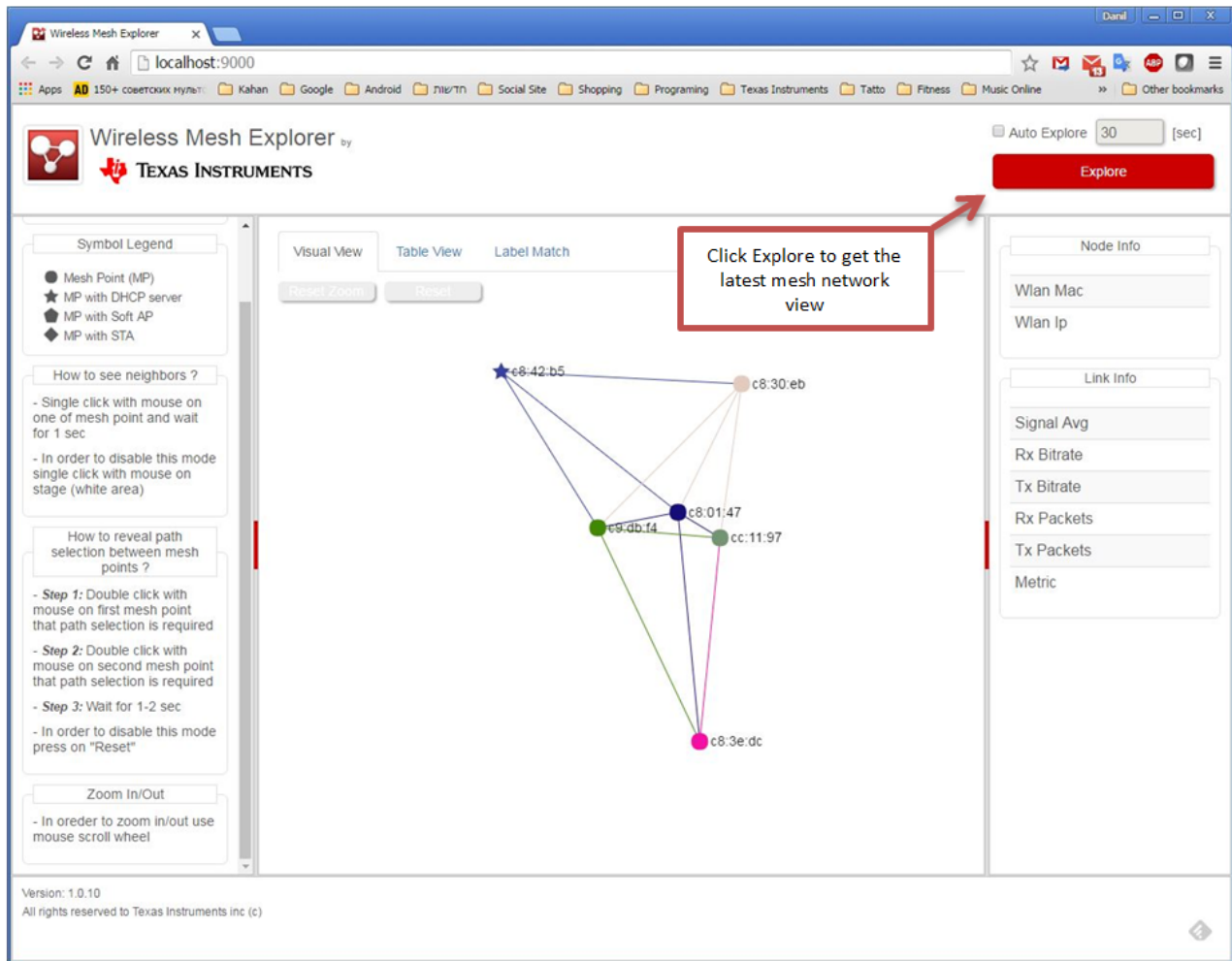

Figure 3-1. Welcome Page Step by Step

Figure 3-2. Visual View of the Mesh Network

3.1 Useful Features

3.1.1 Auto Explore

To avoid repeatedly clicking the Explore button to get the latest mesh network, users can check the Auto Explore check box on the top-right corner, and set a time interval in seconds. Now the WME performs self-explore every required interval.
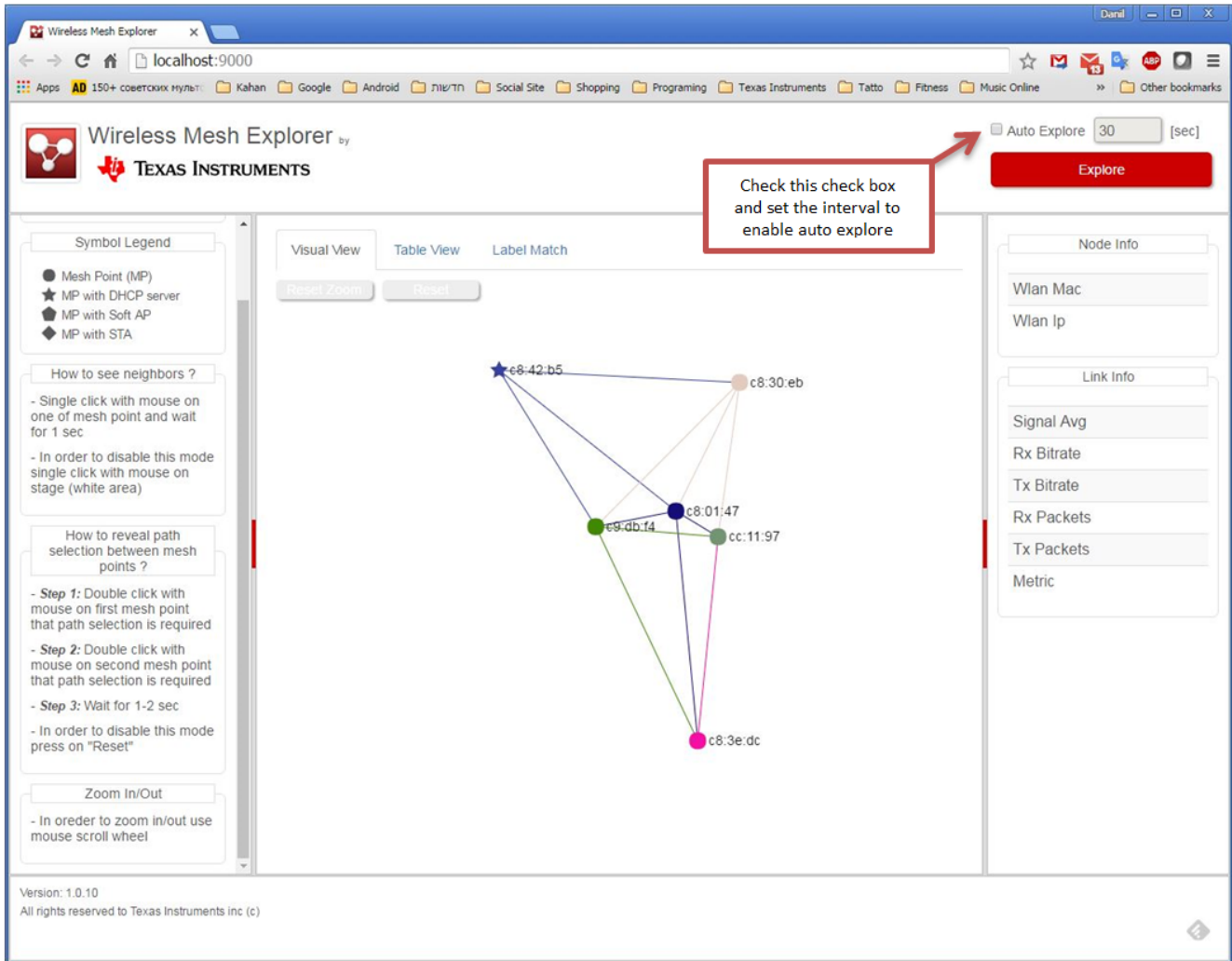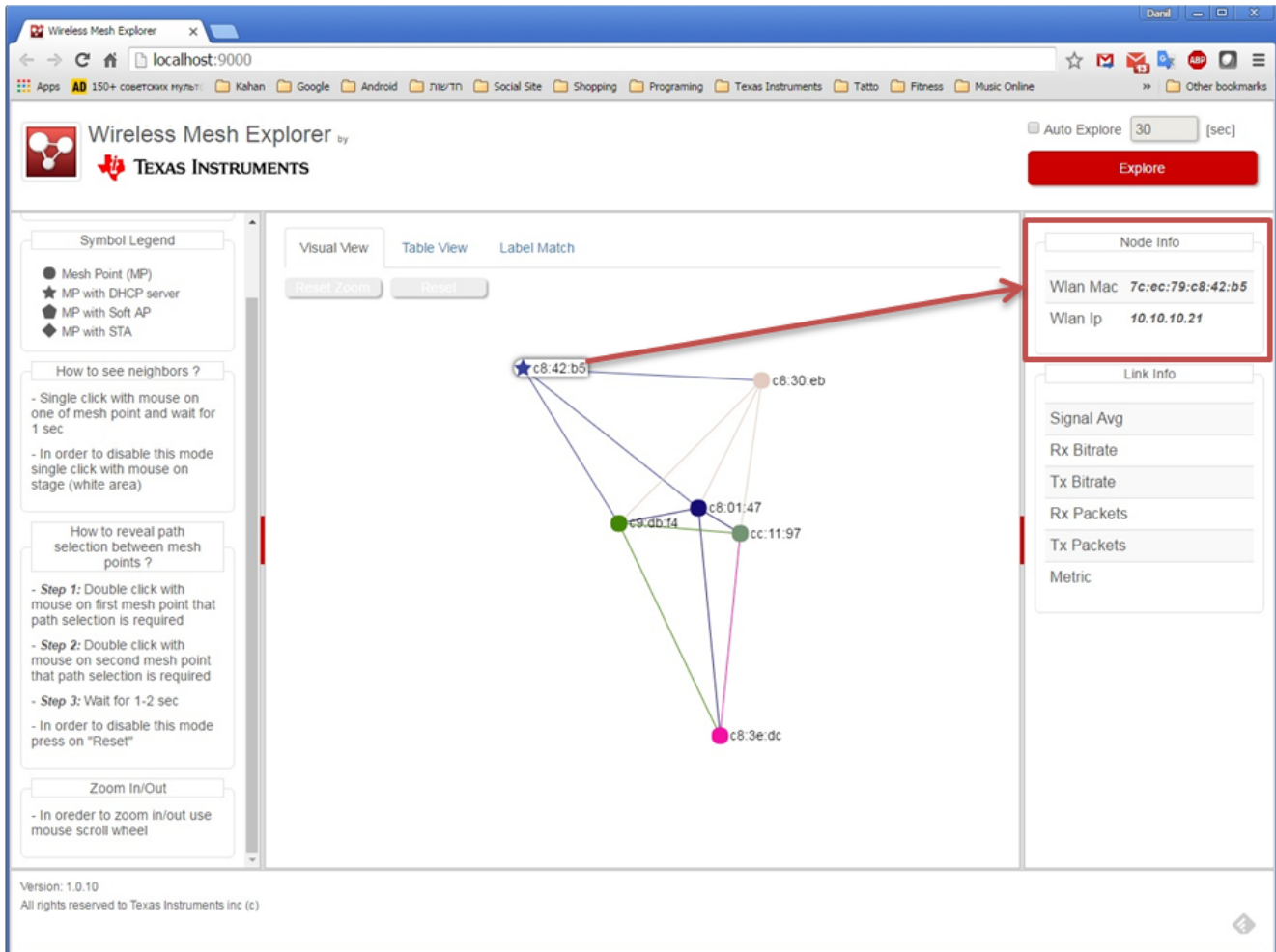
Figure 3-3. Visual View

3.1.2 Hover Over Node

To display information for a specific MP, use the mouse and hover over a founded MP (without clicking on it). The WME displays the selected mesh label in bold. The WME shows relevant data for the selected MP on the right side of the page.

Figure 3-4. Hover Over Node

3.1.3 Hover Over Link

To display link information, use the mouse and hover over the link between two MPs (without clicking on it). The WME displays the selected link and labels of both MPs in bold. The WME shows relevant data for the selected link on the right side of the page.
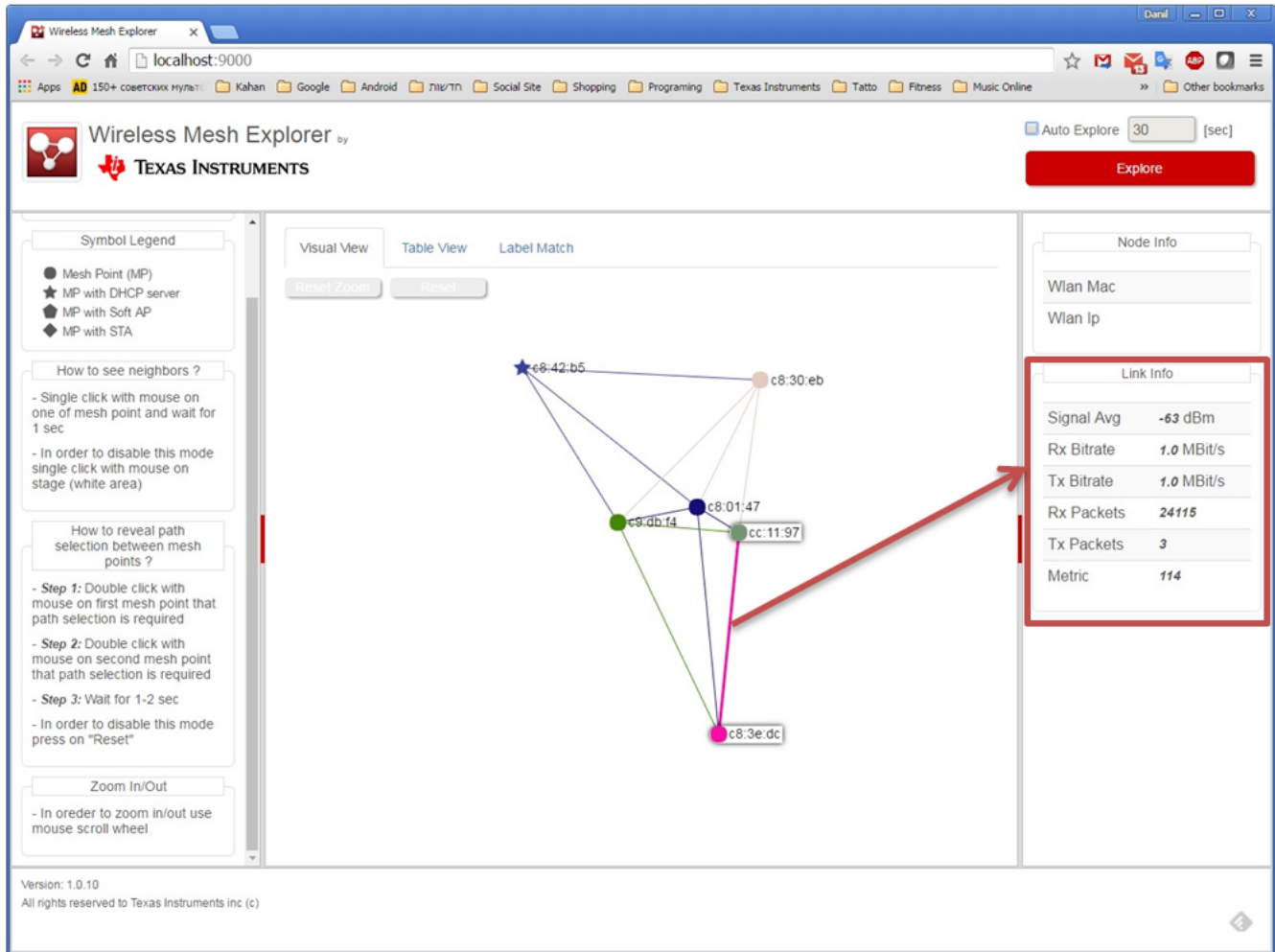

Figure 3-5. Hover Over Link

3.1.4 Show MP Links

To display the connections for a specific MP, single-click the desired MP. The WME marks all unnecessary links in light gray, and displays the relevant MPs and links. Single-click in the white area to exit this mode.
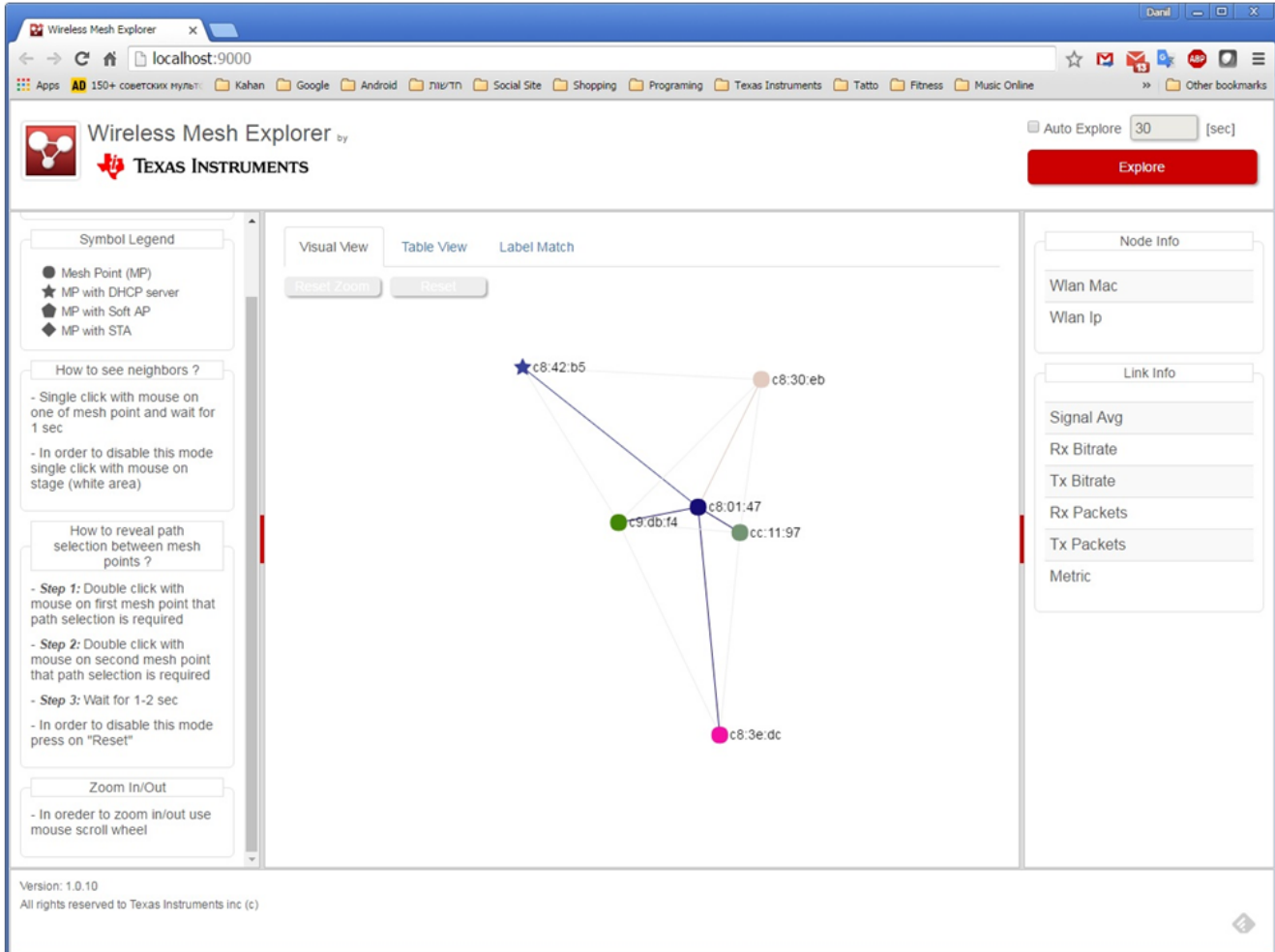

Figure 3-6. Show Mesh Point Links

3.1.5 Show Path Selection

To display the path selection between two MPs, follow these steps:

1. Double-click one MP (the selected MP enlarges).
2. Double-click a second MP. The WME marks all unnecessary links in light gray, and then displays the relevant links for the selected path.
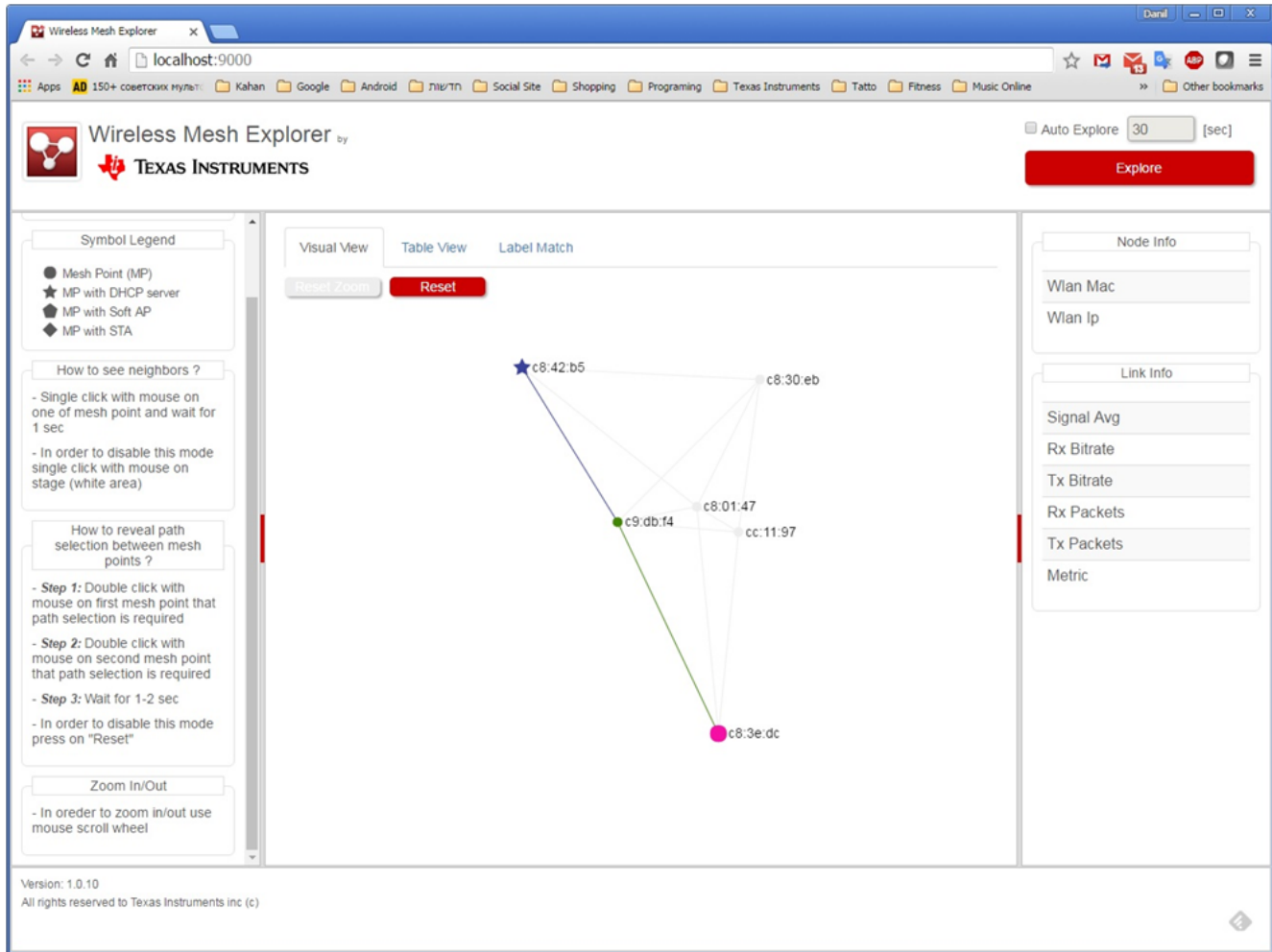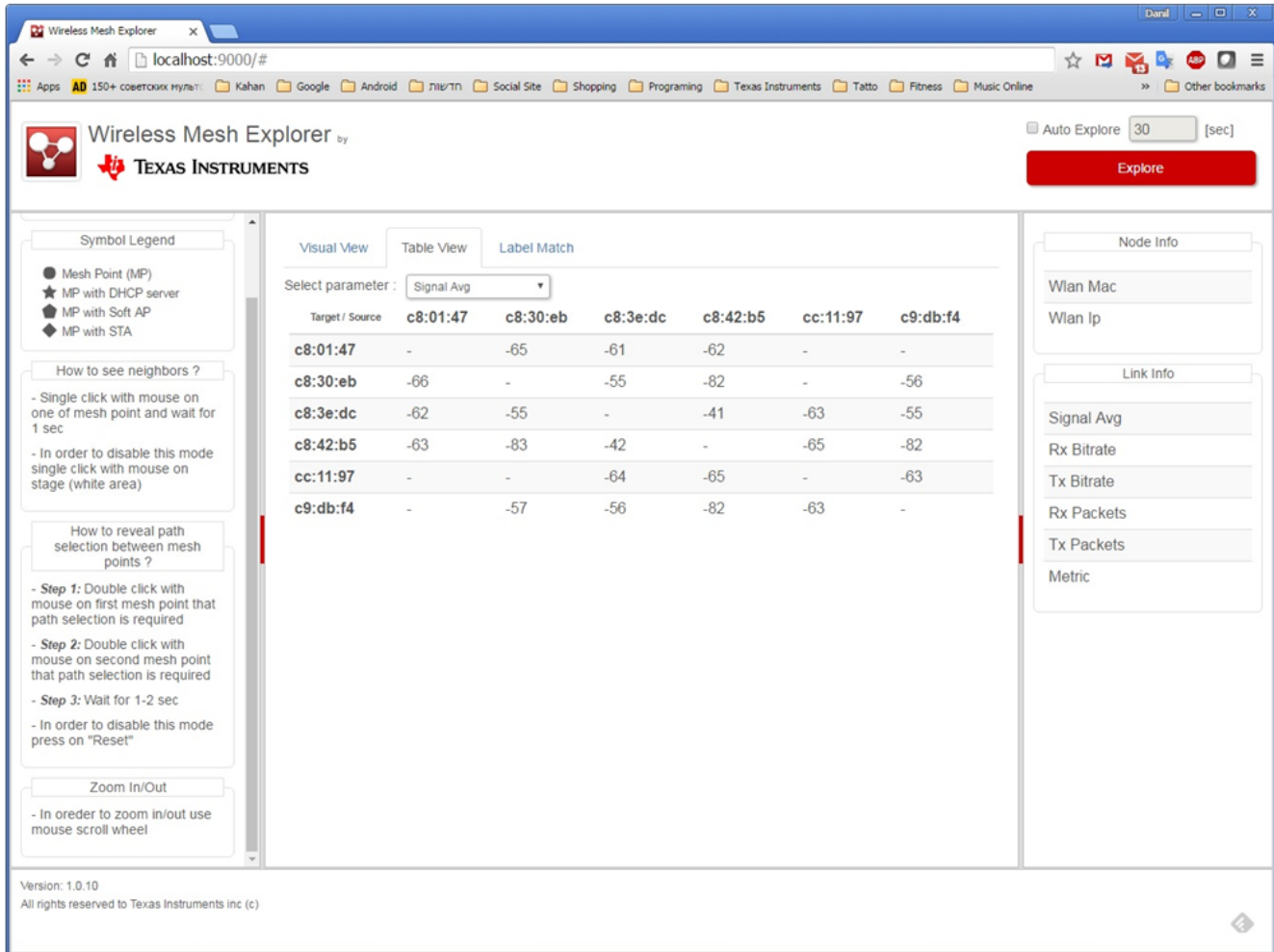3. Click the reset button to return to the previous screen.

Figure 3-7. Show Path Selection

3.1.6 Table View

Table view extends the information users can get on their network.

1. Click the Table View button.
2. Select the parameter to track from the combination box. The WME shows all the data according to the selected parameter for all the MPs in all directions.

Figure 3-8. Table View

3.1.7 Set a Label to an MP

By default, the WME uses the last 3 bytes of an MP MAC address as the label. To change the label, follow these steps:

1. Click the Label Match button

2. Type a new label in the text box for each MP, and then click the Save button. The new labels immediately appear in the *Table View* and *Visual View* tabs.

3. Click Default, and then Save, to restore the original labels.
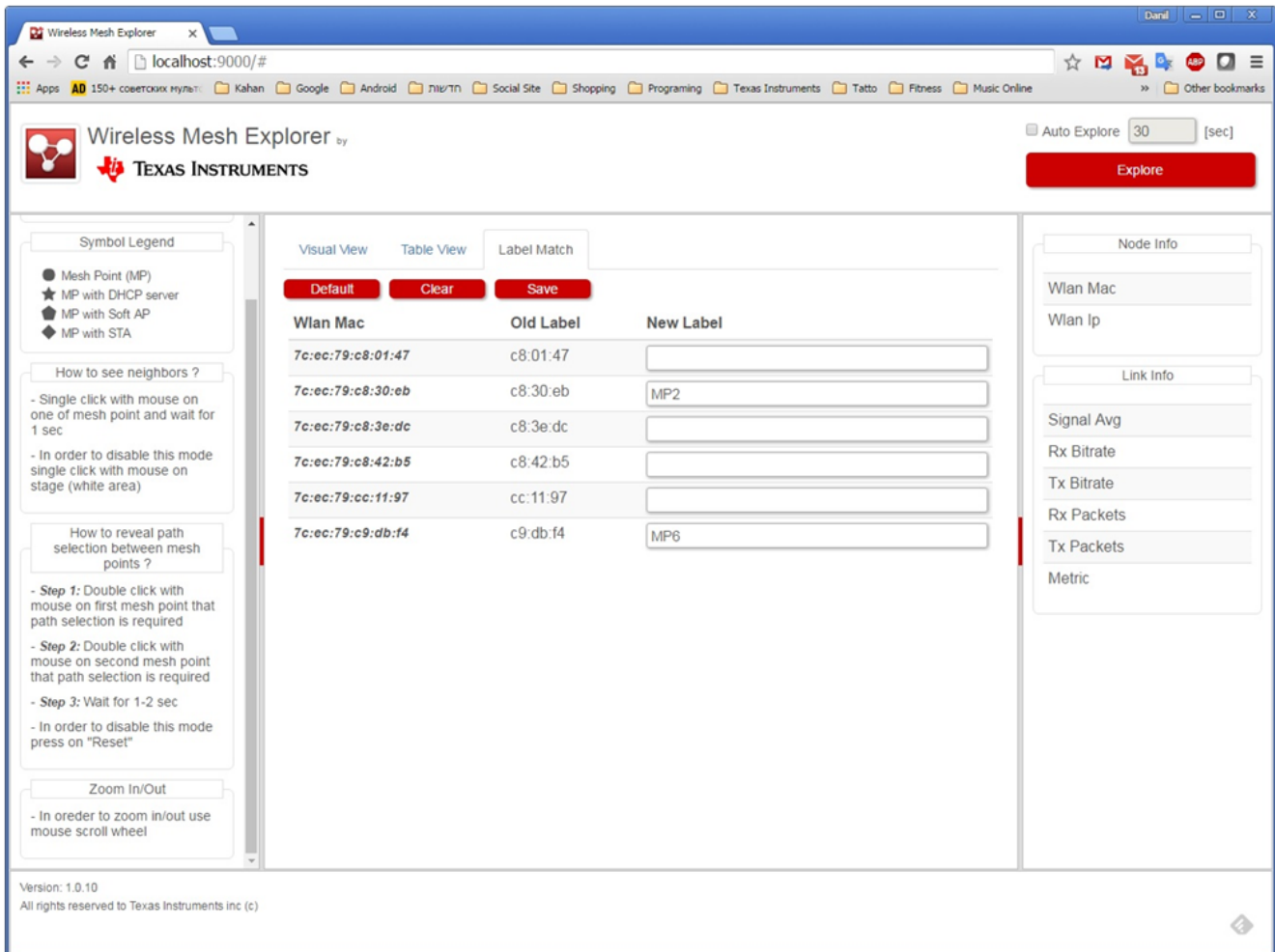
Figure 3-9. Set Label To Mesh Point

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