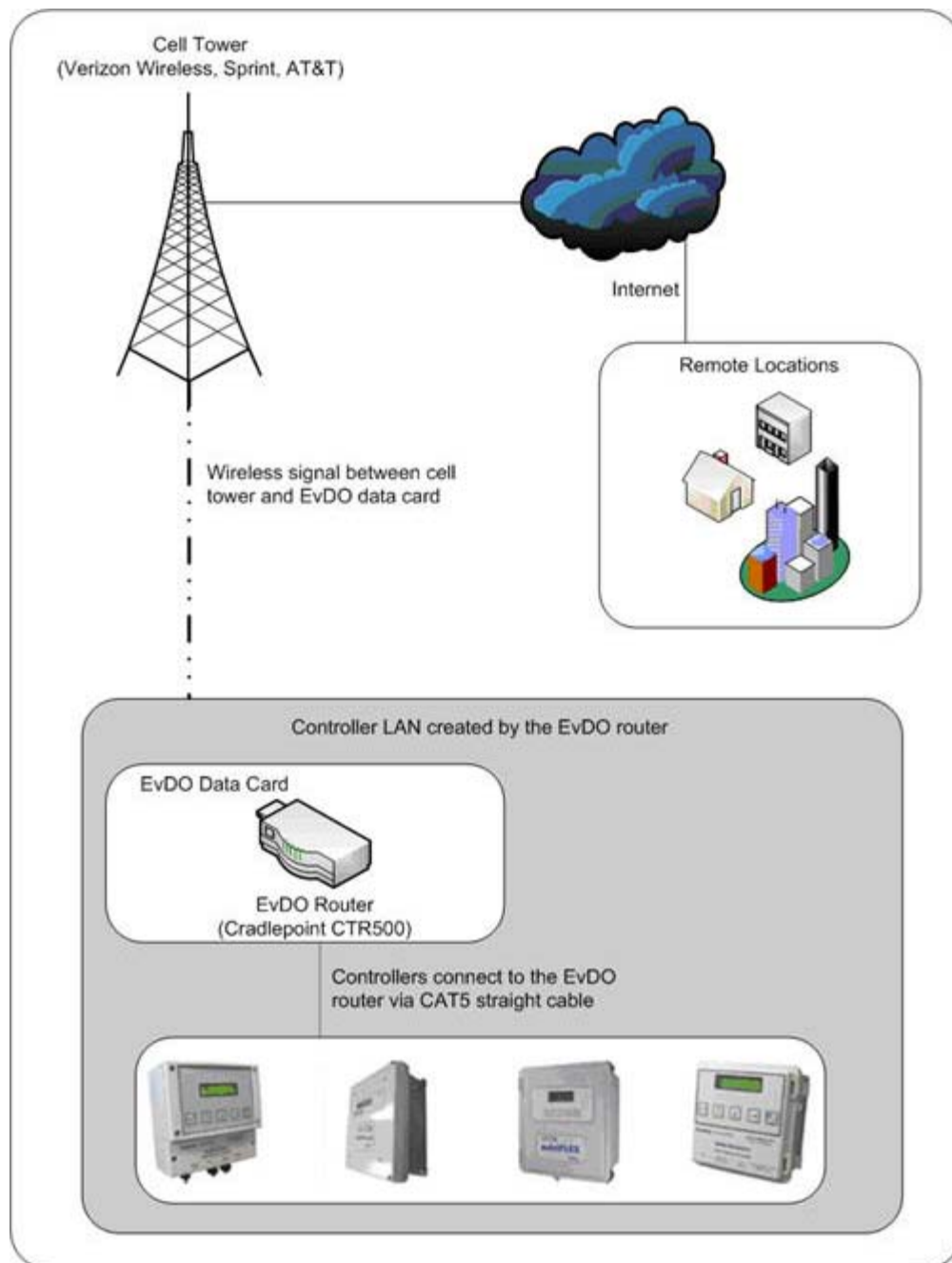# Aquatrac Wireless Communications With EvDO

Abstract

The purpose of this application note is to teach you how to setup an Aquatrac controller so that you may communicate with it from a remote location.

Remote communication example: You have a Multiflex Tower controller installed at ACME University, but you have no way of connecting to that controller from a remote location such as your office or home. Furthermore, you have made a request to the IT department of ACME University to setup a VPN, WAN, or phone line so that you may be able to keep tabs on the controller without the need of being physically at the site location and, for one reason or the other, the IT department rejected your request.

The example above is a very common problem that can be solved relatively easy using wireless technology; namely EvDO.

To be clear here, the wireless technology we are speaking of is wireless broadband Internet access - not to be confused with a wireless local area network that is commonly used in homes and small offices.

Here is a picture that may give you a better idea of the type of wireless signal we are referring to:

Diagram labels:
- Cell Tower (Verizon Wireless, Sprint, AT&T)
- Internet
- Remote Locations
- Wireless signal between cell tower and EvDO data card
- Controller LAN created by the EvDO router
- EvDO Data Card
- EvDO Router (Cradlepoint CTR500)
- Controllers connect to the EvDO router via CAT5 straight cable

Necessary Hardware

In order to implement the EvDO wireless solution, you will need the following hardware equipment:

- Aquatrac Controller (with Ethernet option)
- EvDO Data Card (**assigned with a Static IP Address**)
- EvDO Router
- Ethernet Straight Cable

Being that there are multiple brands of EvDO Data Cards and EvDO Routers, this application note will focus on one data card and one router only. This does not imply that you must use the devices that are discussed here to implement wireless communications with Aquatrac controllers. You can choose to use any EvDO equiment that works best for you.

When choosing your data card and router, you must make sure that they are compatible with each other. Typically, the router manufacturer will have a list of compatible data cards that it

That being said, if you follow this application note, you should be able take the concepts that you learn here and apply them to any data card and/or router that you decide to implement. Furthermore, for brevity, we will also limit this application note to referencing the Multiflex controller for the wireless setup. However, any Aquatrac controller that supports Ethernet will work with the EvDO solution.

Aquatrac Controller

As was previously stated, this application note will use the Multiflex controller as the example controller for setting up the EvDO wireless solution. The Multiflex controller is the ideal candidate for this application note since it supports both Web Browser and Trackster 3 support - this fact will come into play when we get into setting up the EvDO router.

The only hardware requirement that is necessary to have installed on the Aquatrac controller is the Ethernet option - In other words, if your Aquatrac controller (whether it be an Aegis, Multiflex, Microflex, SmartFlex, etc) has an ethernet port (aka CAT5 jack) on it that allows you to plug in an Ethernet cable, that controller will work with the wireless EvDO equipment.

EvDO Data Card

Although you can use any EvDO Data Card **that is compatible with the EvDO Router**, the EvDO Data Card that we will be using for our example is the Sprint Merlin EX720. Regardless of the data card that you choose, the setup and intialization will be virtually the same as will be specified in this app note.

Regarding data card compatiblity, it is worth mentioning that every EvDO Router out there in the market will support a limited number of different data card models. To determine which data cards are compatible with your router, you will need to refer to the router's instruction manual or contact the vendor.

Another important point to make regarding data cards is; before you choose a data card you will need to determine which EvDO Provider you are going to sign up with - i.e. Verizon, Sprint, etc. The reason for this is, each EvDO Provider has their own set of data cards that they work with - no different than the way wireless providers have their own set of cell phones. In fact, a data card is nothing more than a tweaked cell phone - the data card even has its own phone number!

EvDO Router

The EvDO Router that we will be using for our example is the Cradlepoint CTR500.

The EvDO router is what the Aquatrac controller will be plugged into (via Ethernet cable) as well as the data card.

The way this works is, the data card is the device that brings in the wireless broadband signal and the router is the device that creates the network (LAN). Any device that is plugged into the router will have access to the Internet.

Aquatrac Wireless Communications With EvDO

Choosing a Wireless Provider

Abstract

The purpose of this guide is to help you make the decision on your wireless provider for a specific site.

Choosing a wireless broadband provider boils down to which provider offers the best signal to the location of where the Aquatrac controller is installed. Finding out which provider offers the best signal to the site location breaks down to the following two methods:

1. Guess and Check
2. On-Site Survey

Method 1: Guess and Check

Due to its simplicity, the Guess and Check method is the most common method for deciding which EvDO provider to go with. The only tools that are necessary for this method is a cell phone that is provisioned by either Verizon Wireless, Sprint, or AT&T.

The idea behind the Guess and Check method is; if you can successfully make a cell phone call at the site location of the installed Aquatrac controller, chances are good that the same provider (as the cell phone) will offer a sufficient EvDO signal for a wireless broadband connection.

Here's what to do:
Go to the site location where the controller will be installed. Then, using a cell phone, make a phone call (it doesn't matter who you call). If the phone call was successful and clear, you can "Guess" that the cell phone provider will offer a satisfactory EvDO signal to that site location. In which case, you can move forward in signing up with that provider for the wireless broadband service.

> *NOTE: Most providers offer a trial period. When using the Guess and Check method, this is good to know so that if/when you guessed wrong, you can return the data card and close the contract that you made with the provider at no cost (other than your time) to you.*

However, if the cell phone call failed, you will need to find another cell phone that is provisioned by a different provider than the previous test. For example: The first cell phone test was done with a Verizon Wireless phone and the cell call failed. In the second test you use a cell phone that is provisioned by Sprint Nextel.

Method 2: On-Site Survey

The On-Site Survey method is where you go to the site location and measure the signal strength of each provider. The implication of this method is you will need to have, on hand, a data card from each EvDO provider and a laptop computer. Furthermore, you will need to make a trip out to the site

to run the test - hence, On-Site Survey.

The first task you must do for an On-Site Survey is contact an EvDO vendor and order a data card for Verizon Wireless, Sprint, and AT&T. Then, once you receive the data cards, you will need to install the software that came with each data card onto a laptop computer.

> *NOTE: There are other wireless broadband providers other than Verizon, Sprint, and AT&T, but, out of these three, chances are good that one of them will offer a good signal to your site location.*

Once you have the data cards and software installed on a laptop, you will bring the data cards and laptop to the site location. When you arrive at the location of where the Aquatrac controller will be installed, do the following steps:

1. Insert one of the data cards into the laptop
2. Turn on the laptop
3. Open/Run the software that corresponds with the data card that you inserted (in Step 1)
4. Follow the instructions below (Measuring Signal Strength for your EvDO Card)
5. Repeat with each data card that you have
6. Choose the data card that offered the best signal

Measuring Signal Strength (How to find RSSI) for your EvDO Card

When you run the data card software, you will notice signal bars that represent the signal strength of the wireless signal. However, besides the signal bars, there is a more detailed way to see how strong your signal is. RSSI (Received Signal Strength Indicator) numbers provide a better idea of what your signal strength is. The close the number is to zero, the better your signal strength is. Example: -65 dBm is a much better signal than -95 dBm.

Keep in mind that to get a good RSSI reading, your device should actually be moving data when the reading is taken. You might want to be doing a speedtest at http://speedtest.net and then record those speeds with the corresponding RSSI value, for your comparisons.

FYI, a good target RSSI is -80 dBm indoors. At that point, it is highly likely you are getting the full speeds that the tower you are connected to, will provide.

If you are using Apple's WWAN support to connect to the EVDO network, then hold down the Option Key while in the WWAN drop down menu.
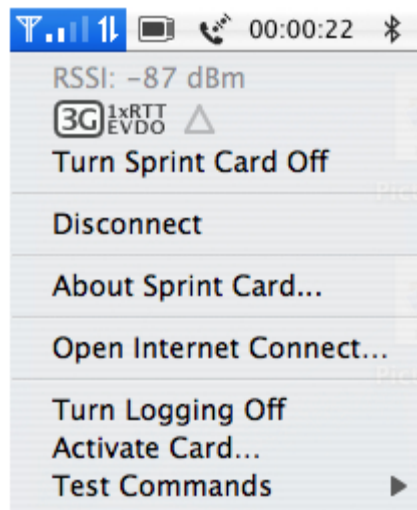
If you are using VZAccess Manager or Sprint Connection Manager, simply place your mouse cursor over the signal bars in the connection manager software as shown below.
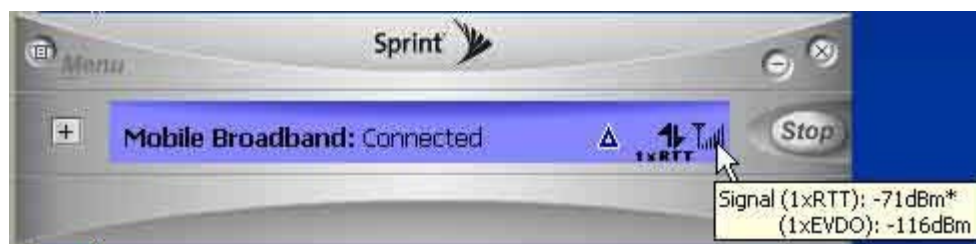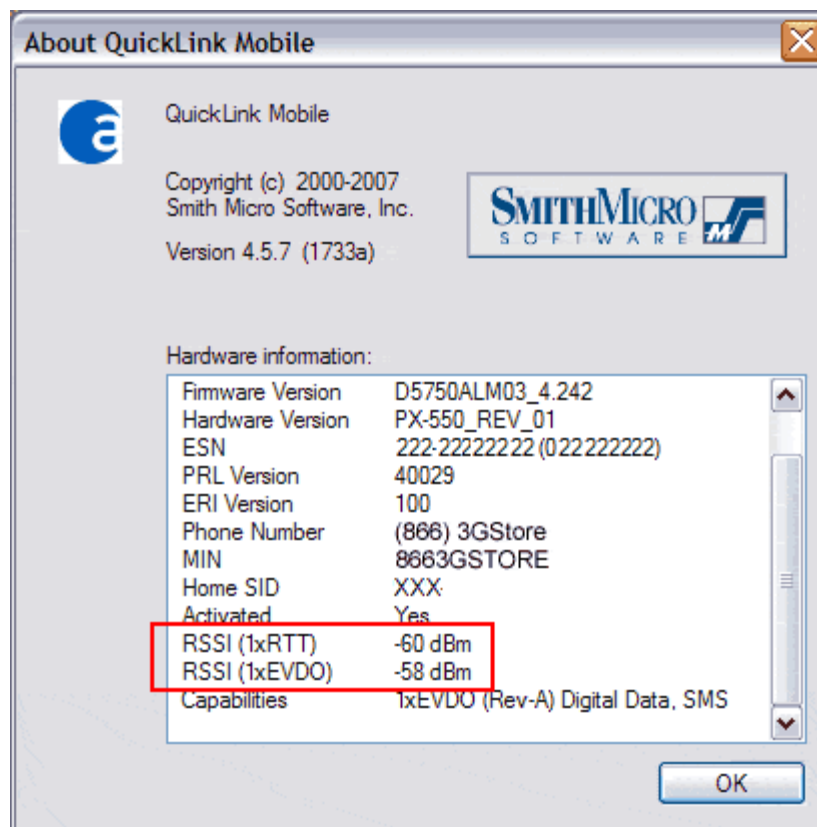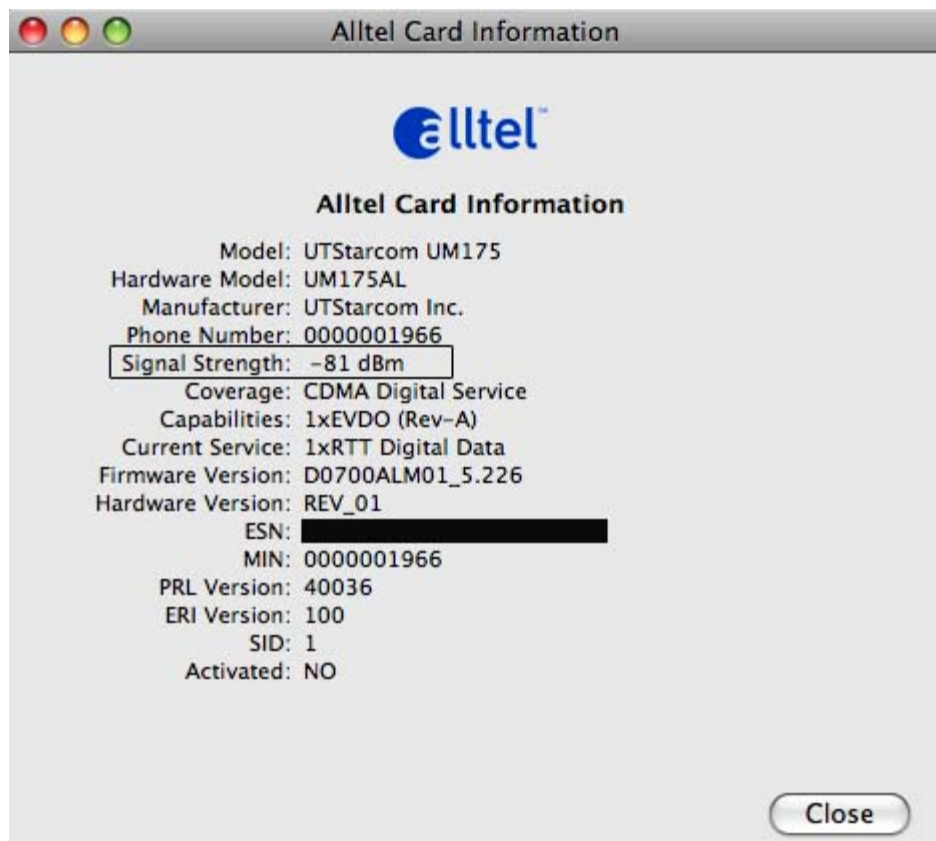
OS X:
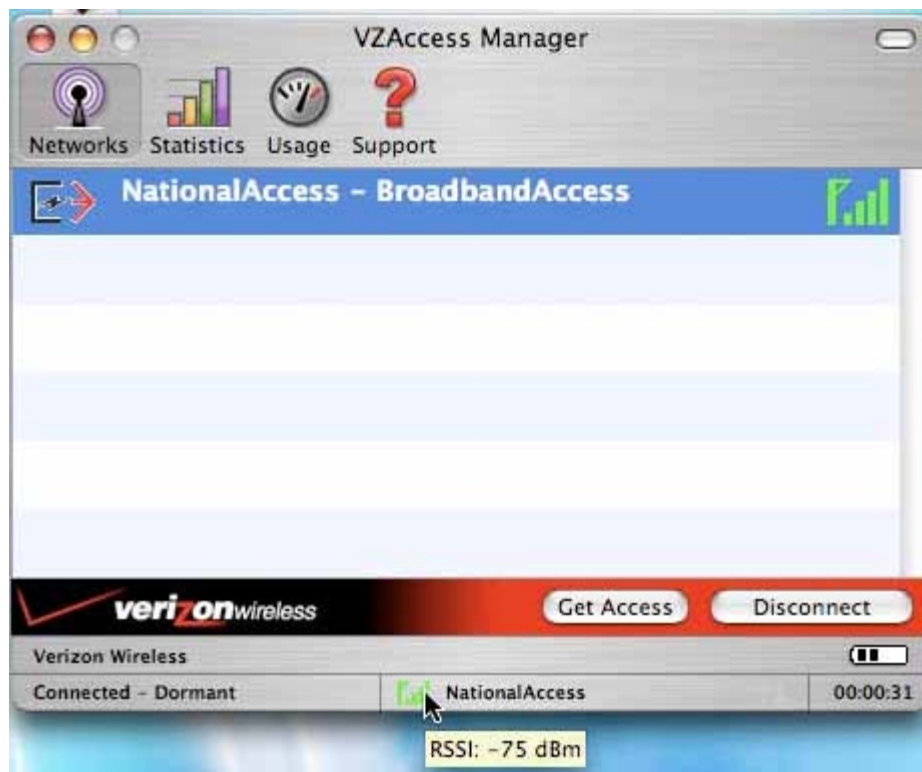
Windows:

Verizon:

Sprint:

the new SmartView connection manager puts RSSI under the bars

Alltel: (In your QuickLinkMobile panel, go to HELP)

Alltel (Mac):

Alltel Card Information

Model: UTStarcom UM175
Hardware Model: UM175AL
Manufacturer: UTStarcom Inc.
Phone Number: 0000001966
Signal Strength: −81 dBm
Coverage: CDMA Digital Service
Capabilities: 1xEVDO (Rev–A)
Current Service: 1xRTT Digital Data
Firmware Version: D0700ALM01_5.226
Hardware Version: REV_01
ESN: ▮▮▮▮▮▮▮▮▮
MIN: 0000001966
PRL Version: 40036
ERI Version: 100
SID: 1
Activated: NO

Close

AT&T:

Aquatrac Wireless Communications With EvDO

Activating the EvDO Data Card

Abstract

Regardless of the data card that you are using, all data cards will need to be activated before you install it in the router. The activation process can be narrowed down to two different methods:

1. Activated by the vendor who sold you the data card
2. Activated by you using software that came with the data card

The purpose of this document is to inform you on the two different activation methods and what you must do in order to start using the data card with the router and Aquatrac controller.

Static IP Address Assignment

Before you activate the data card, it is important that you have a **Static IP Address** assigned to your data card.

By default, EvDO providers assign a **Dynamic** IP Address to your data card - meaning that the IP Address of your data card can and will change at any given time.

> *NOTE: The problem with having a Dynamic IP Address assigned to your data card is that you will never know what the IP Address is and, therefore, you will not know what IP Address to use when you want to connect to your controller.*

To get a Static IP Address assigned to your data card you must explicitly request it when you sign up with your data provider (Spring, Verizon, etc). Most likely there will be an extra charge for the Static IP Address and that charge varies between data providers.

It is worth mentioning that there is a solution for succesfully implementing remote data services without the need for a Static IP Address assignment called "Dynamic DNS". The Dynamic DNS topic is outside the scope of this white paper, but you can learn more about it at DynDNS.com. If you plan on implementing Dynamic DNS, then you will need to make sure that the router you choose supports it.

Activation By Vendor

If the data card has been activated by the vendor, there is nothing you need to do to the data card. You can simply install the data card into the EvDO router.

Manual Activation

> *NOTE: To manually activate your data card, you will need to plug it into your computer.*

Therefore, your computer must have the correct port that supports the data card. For example: The Merlin EX720 is an Express Card form factor, therefore your computer must have an Express Card port.

If your data card has not been activated, you will need to activate it using the software that came with your data card.

Regardless of the data card model, the manual activation process is usually done in the following steps:

1. Install the software that came with your data card (usually on a CD) onto your computer
2. After the software is installed, insert your data card into the data card port located on your computer.
3. Open/run the data card software, then follow the onscreen instructions to start the activation process
4. After the initialization process is complete, you can insert the data card into the EvDO router

Aquatrac Wireless Communications With EvDO

Setting up the EvDO Router

Abstract

This section will show you the settings that need to be made on the router (Cradlepoint CTR500) to allow for remote communications to the Aquatrac controller.

NOTE: This section assumes the following:

- *The Aquatrac controller used in this example is a Multiflex*
- *The IP Address of the Multiflex is 10.10.6.106*
- *The EvDO Router used in this example is the Cradlepoint CTR500*
- *The Data Card used in this example is the Merlin EX720*
- *You know how to make changes to the controller's communications (i.e. IP Address, Port Numbers, etc)*
- *The data card is initialized*
- *The data card has a Public IP Address assigned to it*
- *The data card is installed in the EvDO router*
- *The state of the Cradlepoint router is in its default settings (out of the box)*

Step 1: Change the LAN IP Address of the Router

1. Using an Ethernet Straight cable (CAT5), connect your computer to the Cradlepoint CTR500
2. Allow two to five minutes for the router to assign an IP Address to your computer (Note: your computer must be in DHCP mode)
3. Open a web browser (Internet Explorer, Firefox, Chrome, etc)
4. Go to http://192.168.0.1 (this is the default address of the Cradlepoint CTR500 router)

5. Enter the password of the router (the default password for the Cradlepoint is the last six characters of the Cradlepoint's MAC Address)
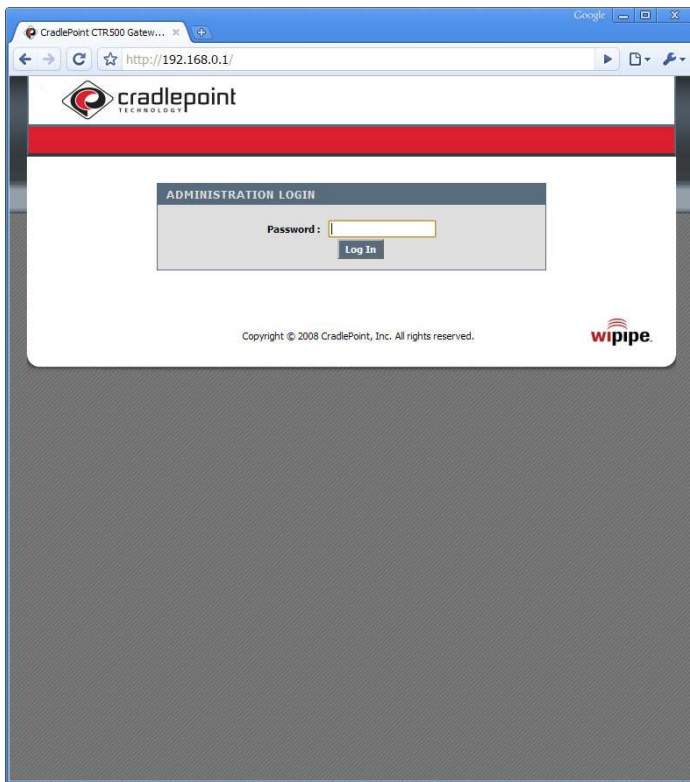
6. In the Cradlepoint admin pages, go to Basic > Network
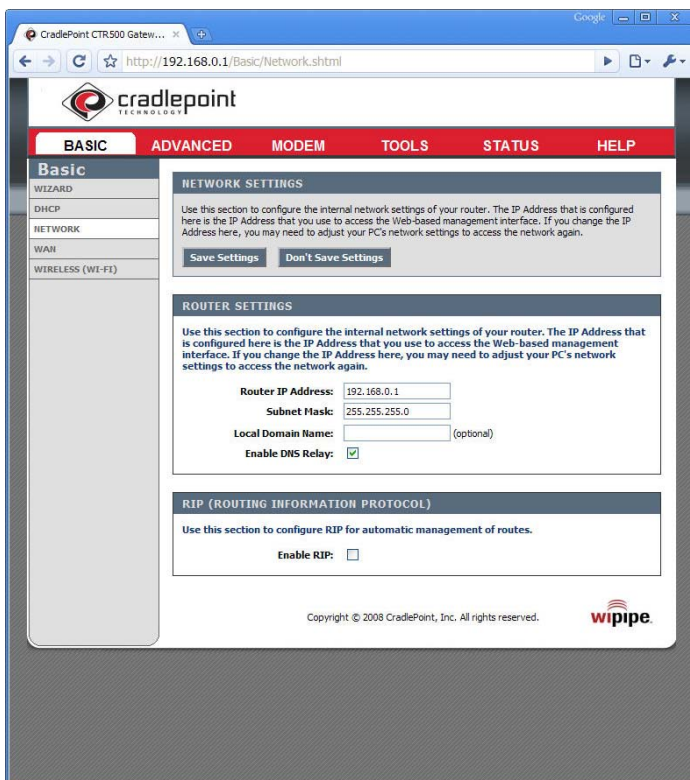
7. Change the IP Address of the Cradlepoint from 192.168.0.1 to 10.10.6.1, then click "Save Settings"

8. Reboot the router
9. Wait two to five minutes for the router to assign your computer a new IP Address

Step 2: Configure Router for Controller Remote Access

1. In your web browser, go to http://10.10.6.1 then login to the router
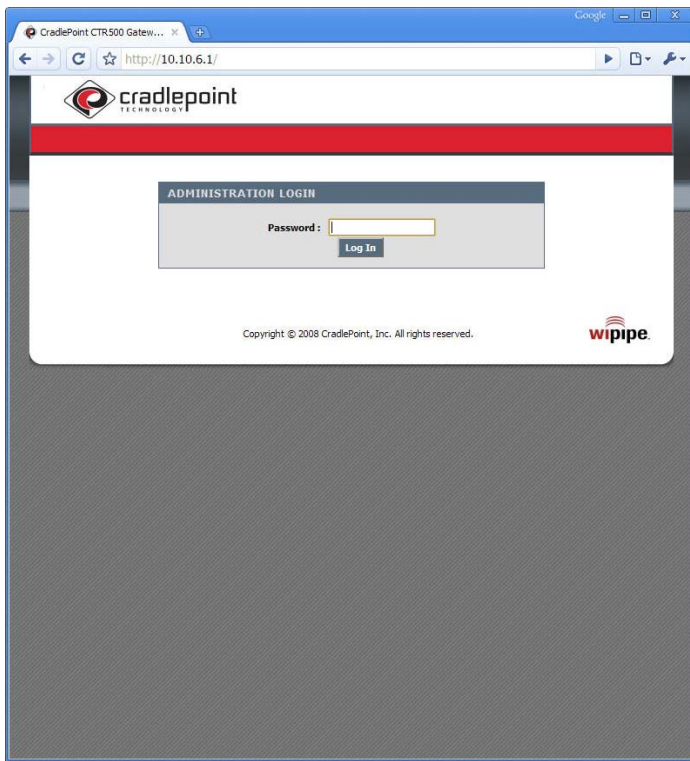
2. In the Cradlepoint admin pages, go to Advanced > Virtual Server
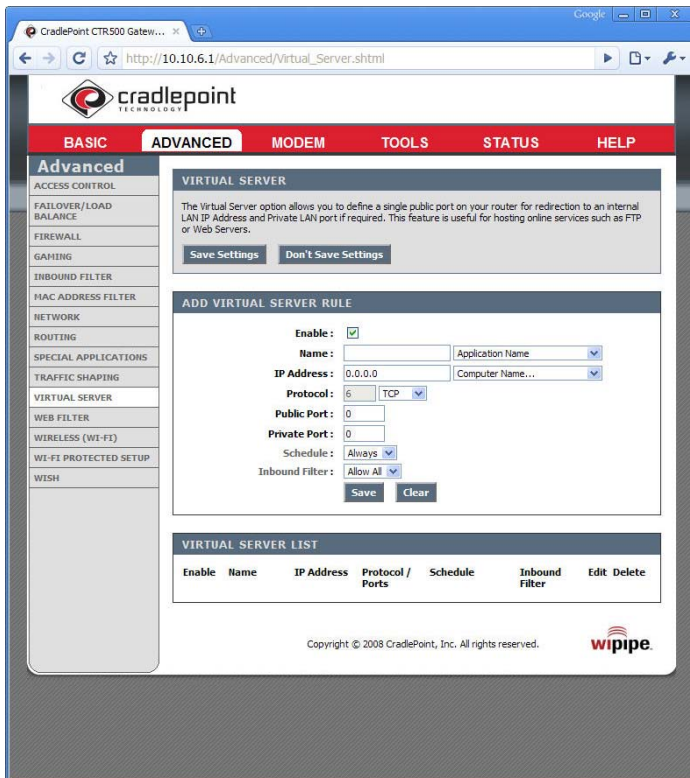
3. In the "ADD VIRTUAL SERVER RULE" section, enter the following information:

   - **Enable:** Selected (Checked)
   - **Name:** MFlex Trackster
   - **IP Address:** 10.10.6.106 (This is the IP Address of the Aquatrac controller)
   - **Protocol:** TCP
   - **Public Port:** 23 - Remember this Public Port number! (This is the Port number that the Aquatrac controller communicates with Trackster (or Telnet))

- **Private Port:** 23 (This is the Port number that the Aquatrac controller communicates with Trackster (or Telnet))
- **Schedule:** Always
- **Inbound Filter:** Allow All

4. Click the "Save" button.

5. In the "ADD VIRTUAL SERVER RULE" section, enter the following information:

- **Enable:** Selected (Checked)
- **Name:** MFlex Browser
- **IP Address:** 10.10.6.106 (This is the IP Address of the Aquatrac controller)
- **Protocol:** TCP
- **Public Port:** 800 - Remember this Public Port number! *(The reason for setting a port number of 800 is due to the fact that many EvDO Providers block Port 80. To work around this problem, we are using an arbitrary Port Number.)*
- **Private Port:** 80 (This is the Port number that the Aquatrac controller communicates with your web browser)
- **Schedule:** Always
- **Inbound Filter:** Allow All
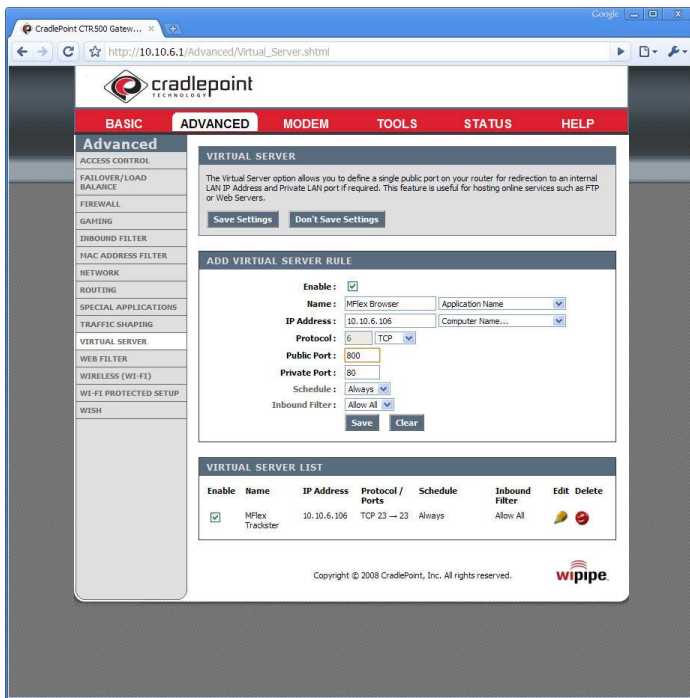
6. Click the "Save" button.
7. Click the "Save Settings" button

Step 3: Change Logon Passwords

1. In the Cradlepoint admin pages, go to Tools > Admin
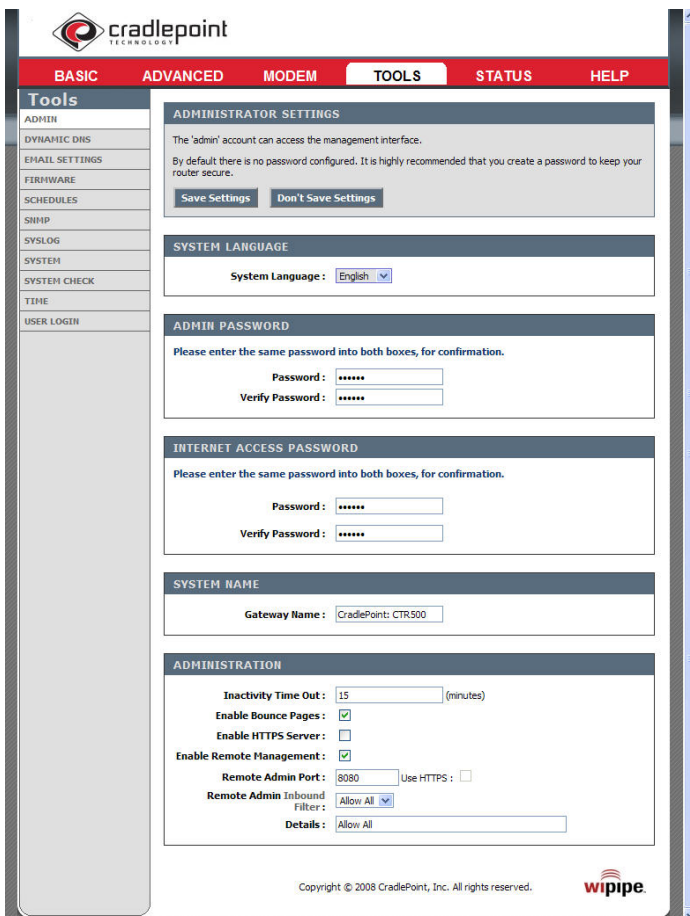
1. In the "ADMIN PASSWORD" section, enter a new password (Remember this password for future use!)

2. In the "INTERNET ACCESS PASSWORD" section, enter a new password (Remember this password for future use!)
3. In the "ADMINISTRATION" section, select "Enable Remote Management"
4. Take note of the "**Remote Admin Port**" number. The default value is 8080. This port number is critical when you need to access the router Admin Pages from a remote location.

Step 4: Determine IP Address of Device

1. In the Cradlepoint admin pages, go to Status > Device Info

2. In the "WAN" section, write down the "**IP Address**" of the device. This will be the IP Address that you use to connect to the controller from a remote location.

> *NOTE: If an IP Address is not defined, you will need to initialize your Data Card*

Step 5: Router Configuration Done!

Now that you have configured the router, you should be able to communicate with the router and the Aquatrac controller via the Internet. Here's how...

1. Disconnect the Ethernet cable from your computer and plug it into the Aquatrac Controller's

Ethernet port (CAT5 Jack)
2. Connect your computer to the Internet
3. Open a web browser (Internet Explorer, Firefox, etc)

4. **Connect to Router Admin Pages**

   In your web browser, go to the IP Address of the router (actually, it's the IP Address of the data card) that you wrote down in Step 4 and make sure you append the "**Remote Admin Port** to the IP Address. For example: http://72.62.206.164**:8080**
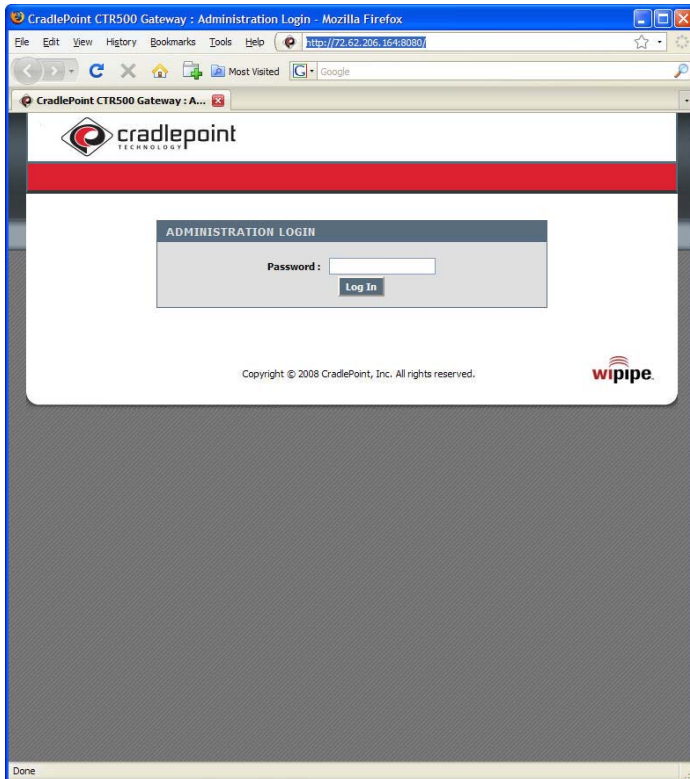
5. Logon to the router using the "**INTERNET ACCESS PASSWORD**" you defined in Step 3.

Connect to Multiflex

1. In your web browser, go to the IP Address of the router (actually, it's the IP Address of the data card) that you wrote down in Step 4 and make sure you append the "**Public Port** of the "MFlex Browser" setting that you wrote down in Step 2.5 to the IP Address. For example: http://72.62.206.164**:800**
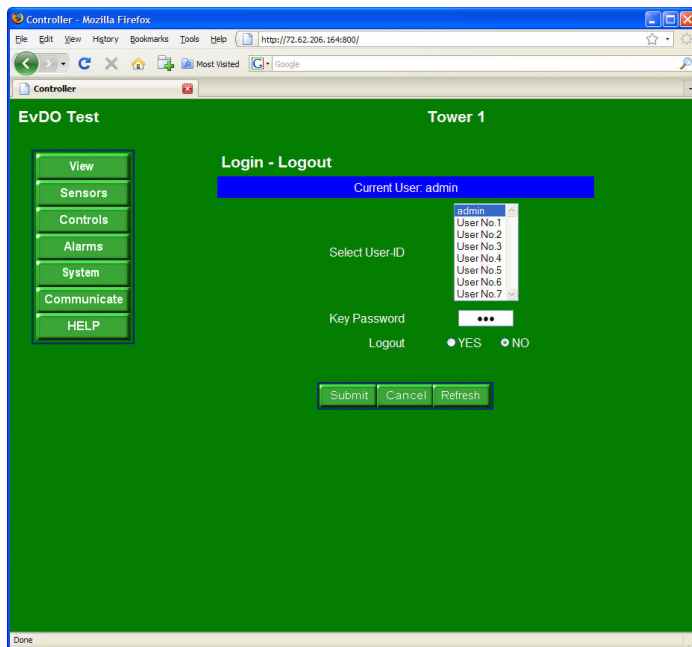
2. Congratulations! You now have full access to the Aquatrac controller from a remote location.

Aquatrac Wireless Communications With EvDO

Where To Buy EvDO Products

EvDO technology has become mainstream such that finding a retail store is not difficult. You can quickly find many vendors of EvDO products by doing an internet search for ["Where to buy evdo products"](#).

That being said, Aquatrac Instruments recommend [3GStore.com](#) for all your EvDO needs