Subject: Telescope Remote Control over Wireless IP Networks

Introduction
Having recently become the proud owner of a Meade LX200GPS telescope and living in the New England area, I've encountered a frustrating situation in that the brutal winters here are not conducive to comfortable operating conditions. This situation led me to investigate the possibility of using Meade Instruments Corporation's new Autostar Suites software as a means to remotely control my backyard telescope. The following details describe a work in progress but one that shows promise for providing a more comfortable method of enjoying our wonderful amateur astronomy hobby.

Autostar Suites Software
Meade claims the Autostar Suites + LPI (Lunar-Planetary Imager) package will permit remotely controlling a Meade telescope capable of supporting the telescopes that use the Autostar 497 and Autostar II Handbox Controllers. While this is true, experimenting with this capability has pointed out some weaknesses that were not readily apparent. The Autostar Suites remote control feature is activated by establishing a direct RS232 serial data (and optionally an LPI USB) connection between a host computer and a nearby ETX, LX90 or LX200GPS telescope. The Autostar Suites software installed on the host computer is then configured to invoke the "server" mode. Establishing TCP/IP continuity between this computer and a remote computer running Autostar Suites software then permits activating telescope controls over the data networking link between the remote and host computers. If the LPI Imager is connected to the host computer, it is possible to view images captured by the LPI Imager connected to the telescope eyepiece holder and save these images to the host computer using the remote control capabilities built into the Autostar Suites software. This does indeed represent a powerful feature of the Autostar Suites and LPI package.

Remote Control Operation
As part of testing these Autostar Suites features it soon became apparent that configuring and using these features provided less than optimum performance. The first problem encountered was a failure to reset the serial data interface when switching between the different serial data communications options. For example, one of the Autostar Suites features permits using a "Remote Handbox Control" mode where all Autostar Handbox functions are provided in a Windows interface. After using this feature and switching to one of the other telescope control features, e.g., the "Control Panel" interface, the system would not allow re-establishing a serial data connection between the host computer and the telescope. This seems like a problem associated with resetting the host computer serial port UART since the error message presented indicated the serial port was already open. Also it was noted that the Control Panel mode incurs a significant control delay (latency) which renders slow telescope pointing movements very difficult to manage. The Autostar Suites help documentation mentions that the Control Panel feature was primarily intended for use with older LX200 systems but did not mention the latency problem. Use of the Remote Handbox Control feature to accomplish slewing and guiding operations, including adjustment of the Microfocuser, showed very minor delays and did not present serious difficulties while attempting to make minor pointing or focusing adjustments over a remote control link.

Practical Networking Applications
As part of using these innovative Autostar Suites features and while attempting to meet my remote control needs, I experimented with various data networking remote control configurations. Below are some of these experiences that some might find informative.

First, while it is certainly possible to establish remote control over the Internet, most computers connected to the Internet have firewall protection installed which renders connecting a personal computer directly to the Internet somewhat impractical, certainly if any kind of protection against malicious misuse is desired.

Also, don't forget that it is possible to slew the telescope against its mechanical hard stops (both RA and Dec) and possibly damage the instrument if care is not exercised.

A more practical configuration in my case was to use off-the-shelf wireless network adapters and establish IP continuity using an already established home fixed and wireless networking infrastructure. This approach also eliminates the need to run CAT 5 Ethernet cabling from the inside computer to the outside host computer. Hence within the distance limits imposed by typical 802.11 wireless interfaces, it is possible to establish a solid wireless IP connection between a host computer connected to my LX200GPS telescope (outside) and my inside desktop computer without the need to run Ethernet, serial data or camera control cables between the house and outside telescope location. Note that there are a number of low cost 802.11b (2.4 GHz) wireless adapters available since the higher bandwidth 802.11g adapters are now available but at higher prices. I doubt the increase in bandwidth between 802.11b and the more versatile 802.11g wireless adapters warrants the higher cost.

Figure 1 below shows the basic concept involved in establishing an IP wireless link between an inside (remote) computer and an outside (host) computer connected to a telescope capable of being controlled by a computer.

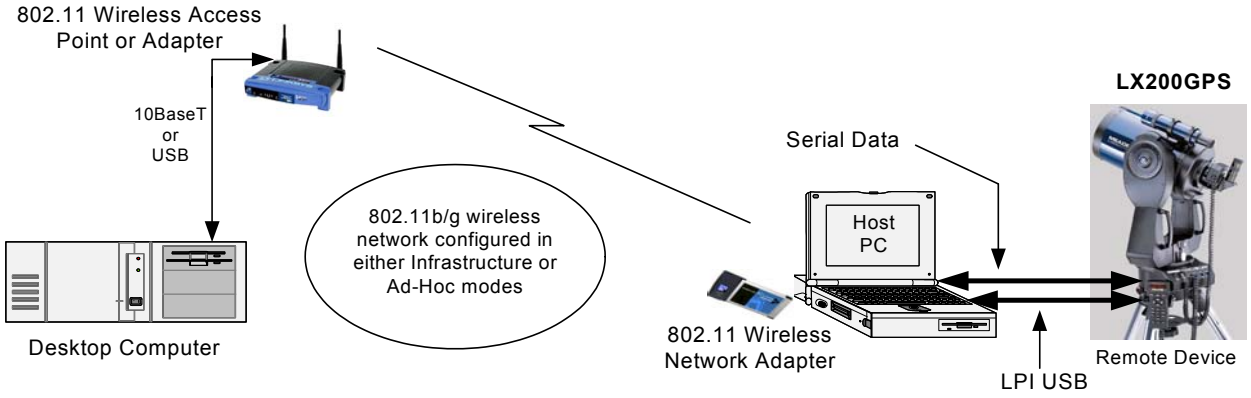

Figure 1 – Telescope Remote Control over a Wireless Data Network

Wireless Networking Options

If an existing household data network contains a wireless access point interface, i.e., one that accommodates existing computers connected to wireless network adapters, it is possible to simply add a similar wireless network adapter to the host computer and integrate this computer into the existing household data network. Assuming you are able to deal with allowing access to the host computer over the Internet at large, you can in fact provide access to your telescope controls to anyone who has access to your household private network. In this case the wireless portion of your household network would utilize the "Infrastructure" mode, one that assumes this network includes a router capable of dynamically assigning DHCP IP addresses to any computer connected to the local network. In a typical home network configuration, the router handles both dynamic assignment of IP addresses and routes packets to the Internet if a cable or DSL modem is connected.

If you do not wish to include remote telescope control between a remote and host computer as part of an existing data network, it is possible to configure the remote and host computers with wireless network adapters using the Ad-Hoc (point-to-point) mode in which case these two computers can establish IP continuity only between themselves. Figure 2 below shows how this configuration might be established.

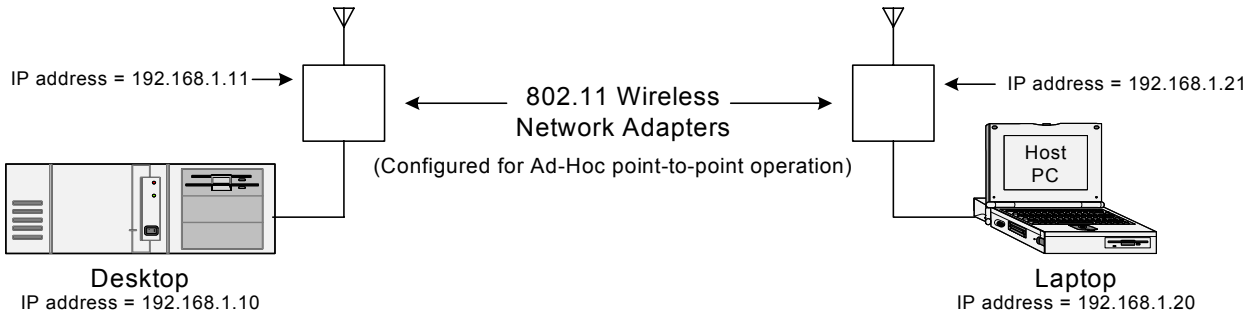

Figure 2 – Typical Wireless Ad Hoc Data Network Configuration

In this case, since a router capable of dynamically assigning IP addresses is not included, the individual networking interfaces have their IP addresses assigned using static IP addresses. The example shown above shows that so long as the assigned IP addresses are contained in the same subnet, data networking continuity between the two computers is established.

Practical Considerations

Considering the less-than-optimum operation encountered using two computers running Autostar Suites software, a more practical solution was to consider using remote computer control software. A freeware package tried was the "Real VNC" (http://www.realvnc.com/download.html) software which showed decent overall performance. Since I have a licensed copy of Symantec's "pcAnywhere" remote control software, I compared the performance between the RealVNC and pcAnywhere applications. It should not come as a surprise that the commercial application showed better overall performance than the freeware version over the same data network although it might be argued that the difference in performance might not warrant opting for the commercial version.

Using remote control software to directly access the host computer showed me that this option provided a better means to directly control the Autostar Suites software and eliminate any problems or shortcomings that might be encountered using the Autostar Suites internetworking feature.

Summary

I am very pleased that Meade Instruments Corporation has offered the ability to remotely control their telescopes using the new Autostar Suites software. This software contains innovative features that provide capabilities most telescope owners heretofore have not had available, certainly not for the price offered by Meade. While remote control of a telescope is not a trivial exercise, it has the potential for adding a new dimension to amateur astronomy, particularly when Mother Nature does not provide a moderate environment in which to enjoy this pursuit.

Be prepared to conduct a lot of experimenting, particularly where you use the LPI Imager to capture viewed images is concerned. Based on my preliminary use of these capabilities, only your imagination and operating skills are required to enhance remotely controlling your backyard telescope with a reasonable investment.

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