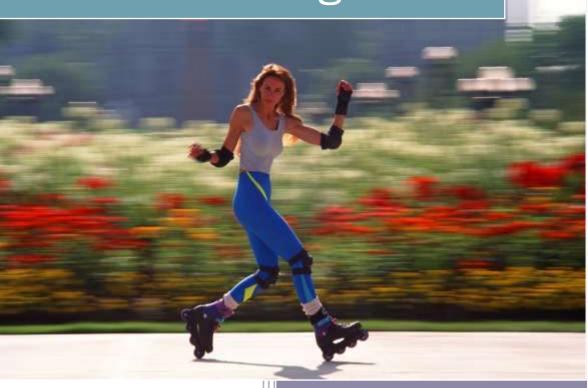# Fast and reliable Network configuration

Medscribbler

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We live in a "wired world" is being replaced by we need to have "mobile everywhere" information. Medscribbler is designed to live in this mobile everywhere world but for this to be a reality we and Medscribbler depend on networks. The frustration of networks has even become part of our culture making an advertising line famous, "Can you hear me now?"

This tag line was in response to voices over a cell phone network, a relatively simple fault tolerant network. After all, even if you lost every fourth word in a conversation you could get the basic meaning of the conversation. With medical information and running a computer program even every four hundredth word would be disaster. Even surfing the Internet at home can easily allow for some "page crashes" without harm. Medscribbler, though, must have zero fault tolerance over networks that tolerate lots of error.

Users of Medscribbler should design their own networks to a standard that allows Medscribbler to provide a zero fault tolerance gold standard. This white paper explains the difficulties that can be introduced by the network into a Medscribbler installation. It also provides solutions and suggestions for particular connection problems.

Running Medscribbler on a Wi-Fi network

When you keep getting a "lost Medscribbler database" message when working wirelessly on Wi-Fi, 99.9 per cent of the time (no exaggeration) it is because you have a "flaky" wireless network, your WLAN. A good majority of the time it is not your equipment (more on this later) but your neighborhood.

So, how do you know that you have a problem from neighboring WLANs and not just something wrong with your own equipment? Take this little test:

- Your "View Available Wireless Networks" window shows wireless networks other than your own - and lots of them
- You keep losing connection to your access point router, even when you're in the same room as the router
- Your wireless connection seems to quit around the same time each day...usually in the late afternoon or early evening
- You overhear your neighbors talking about the problems they are having with their wireless.
- Your office is in a building with lots of other small offices

If any of these sound familiar, then it is a fixable network condition that is not related to Medscribbler but simply the fact that you are using Medscribbler in a hostile environment. You can add defenses and be pro-active to avoid the hostility that is affecting your wireless network connections.

The primary causes of wireless LAN problems in high-density areas are:

- Too many users trying to use the same wireless channel (just like trucker or boat radios there are channels.)
- RF (Radio Frequency) interference from other nearby WLANs or possibly cordless phones and microwaves
- Improper wireless adapter settings (maybe the default settings are not the best.)

The first problem is a capacity issue, i.e. not enough bandwidth to go around. Simply put, there are too many radios trying to use the same channel (i.e. frequency) at the same time in the same area. "High density" is a relative term, but if your office is in a building with a lot of other offices you are definitely in this category. And even if you have a separate building, the distance between your and your neighbors' offices and homes is 50 feet or so, and you know the names (SSIDs) of your neighbors' wireless networks, you're also in this high density category!

An 802.11g network has a best-case useable bandwidth of around 25Mbps. 802.11n can move this up to anywhere between 50 and 100 Mbps. But here is a trap, if there are any 11g wireless computers using a superfast 802.11n router, the signal from the router will be reduced to the slowest computer connected to it. Buying a faster "n" router will not speed up access for "g" computers, or even a "n" wireless computer if there are other connected "g" computers in the network.

The second cause falls into the category of RF-based interference. Though you might think of wireless LAN interference only in terms of 2.4GHz cordless phones and microwave ovens, other wireless routers themselves are the largest category of RF "noise".

Every wireless router has to deal with two components: signal, which is the Medscribbler data, and every other electronic signal, noise. Key attributes of wireless router design are maximizing sensitivity to signal and minimizing sensitivity to noise. Not all wireless routers are created equal in this task.

If you're using 2.4 GHz equipment, you probably know that your access point or router has eleven channels that it can be set to. You may not know, however, that only three of those channels should be used. Without getting in to the technical detail except to say there is an overlap in channel interference, it is best to use one of channels 1, 6 or 11 (or maybe 4 or 8 in some instances)

The take-away from all this is not only do you have to deal with possible problems from microwave ovens and 2.4GHz phones, but neighboring WLANs themselves as interference sources.

There is a solution to the two problems of users and interference. To deal with those neighboring wireless networks you need to set the router and computers to use a channel no one else may be using. Unfortunately, the software in Windows and for network cards only displays other networks, not what channel they are on. To find out which channels are in use wireless network discovery software is required. A good free one is the open-source, inSSIDer, by Metageek which works with Windows Vista, Windows 7, 8 and even 64-bit PCs.

Once the use of the airwaves is known, the countermeasure is simple. Choose one of the channels - 1, 6, or 11 - that is used by the fewest neighboring wireless routers, has the lowest used signal strength of others, is the least busy, or hopefully a clean channel of all three. Then log in to the wireless router and change the channel. The SSID, the wireless network name, should be the same on the wireless computers. On most wireless computers the channel does not need to be set to the same as the router because the channel is assigned from the router, but for the best speed the channel on the wireless computer should also be set as this is the channel it broadcasts on.

Finding unused airspace will solve most neighboring wireless problems. But there are several other problems that might prevent optimum wireless use in your office. Different versions of Windows and different wireless network card software handle the wireless connection in their own way, but there are a few common areas of "problems."

Windows, especially XP, and many network cards software once they connect to a wireless network with a particular name (i.e. SSID), will automatically consider that a "preferred network" and will connect to that network whenever it comes within range. They may also try to connect to the strongest network signal.

This feature particularly becomes a problem in areas where there are multiple wireless network routers with a default SSID and no security! It is surprising how many users actually use the common failsafe, "out of the box," SSID of "default" with no security password. This problem can be multiplied with several routers with the same default SSID. Since a wireless computer has no way of knowing that those other routers with no security actually belong to the neighbors, the computer will be connected for Internet browsing but Medscribbler may give a cannot connect error. It is because the computer is connected to someone else's network!

There is an additional problem with this network software connection "feature." Sometimes the software will find these other SSIDs but they do have security enabled. Medscribbler may appear to "freeze" up but what is happening is the wireless software is trying to connect to a stronger network but in finding the security it drops the connection, then (maybe) reconnects to another in the list. Your real network may be down the list and Medscribbler may give a "cannot connect error" because the network software is taking too long to get to the Medscribbler server. This "fishing" process may also force a Windows or network software rescan for networks and a manual reconnect.

Wireless software allows connection to only a designated network and should be set to connect to the Medscribbler network only and not to search for or allow any other connections. If your wireless computer is moved to another location where wireless networks are present, the network list may be populated with them on return to your normal location. If you have multiple locations, setting the connection software to look for a two or more networks is generally OK because there will be no signal overlap when you are at one location or the other.

Roaming "aircards" or 3G (4G) network software may cause some drops if the software does not navigate easily between the cell network and the local Wi-Fi office network. Again Medscribbler may give a "cannot connect error" while it waits for the computer to figure out what

it wants to do. Mobile 3-4G use can suffer with "aircards" simply when you get a random "cluster" of users in one particular location. (the next section on 3-4G networks contains more information them.)

[Windows 7](#) seemed to have addressed part of these network connection issues and shows multiple instances of the same SSID (the "defaults".) And many manufacturers have helped by having wireless routers generate unique SSIDs defaults, usually with part of the router's MAC address (the hardware number) concatenated with the manufacturer name.

For the wireless computer to connect and remain strongly connected to a Medscribbler network make sure an unique SSID is used, make sure it is the preferred connection and make sure the network software will not attempt to connect to any other network. Consult a manual that applies to the particular network software or Windows version to learn how to do this. There are other considerations for running a strong wireless Medscribbler network.

Other programs and the Internet Service Provider, ISP, can affect wireless network capacity markedly. Programs like Gotomeeting©, Logmein©, Skype© are not designed to run on wireless computers and use large amounts of bandwidth and computer resources. Medscribbler is interactive, carrying lots of medical information using upload speed as well so it is not good to use up bandwidth with chat, messaging programs, music streaming or twitting while you work.

While the theoretical speed of a 11g Wi-Fi wireless network may be 54 Mbps the actual speed is likely closer to half or less. Remote wired connection to a Medscribbler Server in another office may be at only the 1 Mbps download speed of a typical DSL contract making the speed available to wireless computers in a satellite office far less than the wireless capability.

Running Medscribbler over a [mobile 3-4G or other data network](#)

Speed is the parameter that every Medscribbler user expects to have without any hindrances. Every wireless data network service provider specifies speed by geographic area, aka cell tower. It is impossible for Medscribbler to improve the raw speed at any particular place but Medscribbler is built to manage poor data network connections. It compensates for network speed variations, but even then it sometimes appears slow or even appears frozen!

It is not Medscribbler but the slowness of the network connection. Medscribbler compensates for a weak or dropped signal without shutting Medscribbler down completely. It automatically "fills in the blanks" of a lost network connection which may make it appear slow. Medscribbler doesn't blindly stop working with "flaky" or slow networks. There is nothing that can be done about the phone company data network speed except complain about the differences between what is paid for and what is provided. Network monitoring software will give the "ammunition" to get past the nameless customer "service" drone.

There is no guarantee of getting the paid for coverage for many reasons. A busy city with tall buildings may block signals. Outlying areas with greater distances from the network tower make weak signals. Buildings with thick walls or multiple walls make interior signals weak. There may be a full strength signal outside the front door, but only a limited 2G or 3G data connection indoors. This is a common problem for mobile broadband users and is a physical limitation of

the radio network itself, not Medscribbler. Another reason for poor connection speeds may be network traffic. When there are too many users connected to a cell tower, the connection may drop down to 2G or worse speeds.

While 4G is being advertised today no real 4G networks will be operational for a few years yet. The International Telecommunications Union's strict definition of 4G is 100mbps download. So-called 4G now is really 3G the way it should be deployed, so some 3G networks will actually be better than some advertised 4G. For the 3G and 4G networks with some vendors claiming 7.5 Mbps for 4G, they actually come in at a median 800 kbps (yes, that is right, kilobits.) Studies also show over half of wireless ISP connections are below this speed. Worse, 300 kbps is the best speed for about 20 per cent of users on the vendor claimed 4G 7.5Mbps network! Upload speed is typically one quarter of download, limited by the ISP's network. Yikes!

The good news is there is something that can be done. The signal reception can be improved through hardware to prevent Medscribbler from having to devote resources to "compensation."

Many of the popular 3G and better network USB dongles and cards sold by the mobile operators have a connection for an external aerial. This connection will give a good signal boost from an externally mounted aerial. An universal 3G or better clip-on antenna will work with any 3G data card or USB dongle and can conveniently clip on to the screen of a tablet PC, extending the range and boosting the data network signal. The clip-on antenna is Omni-directional, meaning it works in all directions and is a low gain antenna. This makes it suitable for situations where there already is a good signal, but maybe it's a bit weak in certain parts of the building. If there is no signal at all indoors, high gain antennas may be the answer.

High gain 3G antennas are meant for places where a lot of boosting is required. The operation of this antenna is very similar to that of clip-on antennas except they are larger. Some are 10in by 10in plastic squares and others are wires 10 or 15 inches long. There is another solution, especially for mobile medical units or home visiting practices. This is a 3G router that can connect to a cellular data network but allow users to connect through more reliable Wi-Fi.

A user creates a secure wireless 802.11g (108G) Wi-Fi network to provide access to the Internet and Medscribbler using a cellular signal. By connecting a 3G card to the 3G mobile router, an Internet connection can be accessed and shared virtually anywhere within a wireless broadband, Wi-Fi, network. For example, a 3G mobile router with Wi-Fi can be set up in a vehicle and the wireless computer with Medscribbler connects to it while the provider is in a building. This allows for high strength reception antennas to be employed for the 3G or other network and high strength broadcast Wi-Fi antennas to be used to blast through building walls.

Once a signal is established to the 3G network signal strength is usually stable and consistent. Also, there are many inexpensive options that can greatly boost the output of the Wi-Fi broadband for a strong signal. The user is not encumbered with the extra antennas or devices, they can be left in a vehicle or even on a cell tower facing window sill in a building. There might actually be a cost saving as several users can share a 3G data network account.

Using a 3G signal boost repeater is not a good option because the boosted signal has a limited range of only up to about 20 feet.

Medscribbler is constantly adding better network management techniques to deal with the massive amount of data that must securely pass between the user and the database. Medscribbler already is by far the most advanced technologically in the industry for network management. Our goal is to make users not even be aware of the network.

Here are some hardware suggestions for mobile 3G connection (users must decide for themselves on suitability for their situation.)

ARC Freedom 6" Booster Antenna

12" Magnetic Mount Antenna

Wilson Tri-Band Yagi 700Mhz - 2500Mhz (Verizon/Sprint/Alltel/AT&T) – 304411

Cradlepoint PHS300 3G/WiMAX Router (Mobile solution - Includes Extra Battery)

Cradlepoint MBR1400 3G/4G Router

D-Link 3G Mobile Router DIR-450

Novatel MiFi 2200 Personal Hotspot (Verizon, Sprint)

<u>Considerations for the wired office network</u>

Even the equipment for wired computers in a Medscribbler network needs to be considered. The weakest point in an office is usually what is called the router, the distribution device for all the network wires. There are three basic devices used in networks; hubs, switches and routers. Many have the wrong name for a device including manufacturers. For a good network understanding what the names of devices mean is important to understanding network function. What we commonly call routers, even previously in this paper, are actually hubs.

A hub is the cheap device that most use to connect multiple computers in an office network. A hub is a 'dumb' device. It broadcasts data packets to each and every networked computer, and not just a target computer. Therefore, if you have a piece of data coming from the Medscribbler database because of a request from one computer in the network, the data packets will come into the network and then be sent to every computer in the office network, whether they requested them or not. Also, hubs are half-duplex devices, i.e. both, data transmission and reception cannot take place simultaneously. Using hubs with VOIP (Skype©, Gotomeeting©) will seriously slow the local network down for other traffic by gobbling bandwidth.

A hub is often called a router but it is not. A router is used to connect computers belonging to one network with those belonging to another network. A router connects two or more different networks. This is what the ISP provides to connect the office to the internet. Often these devices also have "network ports" These are usually just a cheap built in hub (some, but not commonly, are switches.) A router is not really a device for an one location office other than connecting to

the ISP network. Just to confuse things even more many call routers modems, which usually they are not. A modem, short for Modulator/Demodulator, is a device to turn an analog signal into digital, used in old networks.

A switch does the same job of connection but is much more sophisticated than a hub. It transmits the data packets from the source computer to only those network computers to which the data packets are originally intended. Switches are full-duplex devices, i.e. both, data transmission and reception can take place simultaneously. So a piece of data requested from a computer and sent from the Medscribbler database is sent to a specific computer not every computer. This allows more bandwidth to be available for other tasks.

Switches come in two "flavors," managed and unmanaged. Newer ones now have something called auto negotiation. This is important because of something called "flow control." Because switches are designed to manage individual computer data transmissions and most networks have network cards of 10, 100 and 1000 mbps, the switch will drop down to the lowest speed of any network connected device for all connections. This can be overcome in a managed switch by setting the flow control for individual connections both in the switch and the device. It is a problem with some network cards as they don't have flow control settings. These can be replaced. A bigger problem is with devices such as network printers or scanners which might mean network degradation or replacing the device. Auto negotiation over comes this problem, so an unmanaged switch with auto negotiation is a cost effective solution for much better network speed. They are often called smart switches.

There are other advantages of managed switches though. Managed switches also allow the prioritization of the types of data being sent over the network. For example, VOIP traffic can be given a higher priority than Internet web surfing.

Gigabit switches are now becoming more widely available at lower prices. In purchase consider total throughput which the best should be 2000 megabits, that is 1000 megabits for transmitting data and 1000 megabits for receiving data. Cheaper ones may be mislabeled and not true gigabit switches, check the specifications. Also to take advantage of their speed two things are needed. First the network cards and other devices need to be able to handle the added speed, Gb network cards. Secondly the office wiring should be Cat 6, although tests have shown in the short run office good quality Cat 5 is not much different.

The final piece of the puzzle for an office network is a DHCP server, the handing out of IP addresses and managing multiple computer connections to the internet. These are built into wireless "internet routers" usually. But remember they are really hubs. They are also only mini computers to run DHCP services and may compromise network speed. For a small office with limited VOIP use they are fine. For multi-provider offices a DHCP server should be located on a computer with a Gb network connection.

Conclusion

For most, particularly solo providers, Medscribbler on the wired and wireless office network experiences no issues. It was designed this way, to overcome network weaknesses. But as time

passes some of the Medscribbler connection issues start to develop, often just after an upgrade. Medscribbler constantly handles a tremendous amount of data interchanged between computers. All this data strains cheaper or lower quality equipment. It is common for wireless "routers" to start to become unreliable over time. All the data over time or more data in an upgrade basically pushes the lower quality electronic components over the edge. The equipment may not fail outright but start to have random malfunctions. This unreliability is often reported as "an unable to connect" error in Medscribbler.

A solid network is key to any digital office and is the most important staff member you have as everyone is dependent on its work. A good network is easy to set up, it just requires some technical manual reading. Getting the right plan is where to start. The network needs a "big picture" plan.

If you or your technician need more information on the network or its configuration please contact technical support at Medscribbler.

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