Networking Appendix

Excellent! You completed this workbook and constructed your game. Still hungry for more? Take some time and review the following resources.

Sources and Further Reading

Other Reference Books

Common Data Network Tools

Go to any forum and you will find questions about:
* How to determine WebSocket server connections.
* How to test the speed (delay) of a connection.
* How fast are the connections and what is a "good" speed?

None of these questions have anything to do with game development and everything to do **with the underlying content delivery network (CDN). In your downloaded Bonus Content,** you should find the Network-Troubleshooting-Tools.pdf. This document provides step-by-step instructions how to use the following tools. Or you might like to watch this 33-minute video about the network tools below.

ipconfig (ifconfig)

It difficult to troubleshoot when you don't know anything about your workstation. Windows O/S ipconfig (ifconfig for all other O/S) lists all the specifics concerning your workstation's network address, who your workstation obtains information about the local network and where all your packets leave your local network. If your MT4/5 terminal is on your local home network you might have a "private" IP address assigned dynamically or configured statically. If you have your MT4/5 terminal deployed in the "cloud" your IP address will be assigned by your hosting provider.

USAGE:
ipconfig [/allcompartments] [/? | /all |
/renew [adapter] | /release [adapter] |
/renew6 [adapter] | /release6 [adapter] |
/flushdns | /displaydns | /registerdns |
/showclassid adapter |
/setclassid adapter [classid] |
/showclassid6 adapter |
/setclassid6 adapter [classid]]

where
adapter Connection name
(wildcard characters * and ? allowed, see examples)

```
Options:
    /?              Display this help message
    /all            Display full configuration information.
    /release        Release the IPv4 address for the specified adapter.
    /release6       Release the IPv6 address for the specified adapter.
    /renew          Renew the IPv4 address for the specified adapter.
    /renew6         Renew the IPv6 address for the specified adapter.
    /flushdns       Purges the DNS Resolver cache.
    /registerdns    Refreshes all DHCP leases and re-registers DNS names
    /displaydns     Display the contents of the DNS Resolver Cache.
    /showclassid    Displays all the DHCP class IDs allowed for the adapter.
    /setclassid     Modifies the DHCP class id.
    /showclassid6   Displays all the IPv6 DHCP class IDs allowed for the adapter.
    /setclassid6    Modifies the IPv6 DHCP class id.
```

The default is to display only the IP address, subnet mask and default gateway for each adapter bound to TCP/IP.

For Release and Renew, if no adapter name is specified, then the IP address leases for all adapters bound to TCP/IP will be released or renewed.

For Setclassid and Setclassid6, if no ClassId is specified, then the ClassId is removed.

Examples:
ipconfig ... Show information
ipconfig /all ... Show detailed information
ipconfig /renew ... renew all adapters
ipconfig /renew EL* ... renew any connection that has its
name starting with EL
ipconfig /release *Con* ... release all matching connections,
eg. "Local Area Connection 1" or
"Local Area Connection 2"
ipconfig /allcompartments ... Show information about all
compartments
ipconfig /allcompartments /all ... Show detailed information about all compartments

net

Windows includes the `net command` (other O/S equivalent click here) for use in displaying and using network resources from the command line. Some of the net commands you can use include:

- net help which displays assistance.

- net use which maps a network drive to a shared resource on the network.

- net view which shows other visible workstations on the local network.

NET command /HELP

Commands available are:

NET ACCOUNTS NET HELPMSG NET STATISTICS

NET COMPUTER NET LOCALGROUP NET STOP

NET CONFIG NET PAUSE NET TIME

NET CONTINUE NET SESSION NET USE

NET FILE NET SHARE NET USER

NET GROUP NET START NET VIEW

NET HELP

NET HELP NAMES explains different types of names in NET HELP syntax lines.

NET HELP SERVICES lists some of the services you can start.

NET HELP SYNTAX explains how to read NET HELP syntax lines.

netstat

You will recall earlier in this book I mentioned that WebSockets uses TCP/IP. *You might like to find what your traffic is doing inside your workstation. Netstat will help with this by showing the current state of your active network connections.* For example, when verifying the status of your terminal netstat will reveal the incoming (listening) layer 4 port and will reveal what remote server(s) are connected to your terminal and the specific layer 4 ports those servers are using. It also reveals which "other services" are running and their specific ports.

```
netstat [-a] [-e] [-n] [-o] [-p Protocol] [-r] [-s] [Interval]
```

Parameters
-a Displays all active connections and the TCP and UDP ports on which the computer is listening.
-b (Windows) Displays the binary (executable) program's name involved in creating each connection or listening port. (Windows XP, 2003 Server, and newer Windows operating systems; not Microsoft Windows 2000 or older).
-b (macOS, NetBSD) Causes -i to report the total number of bytes of traffic.
-e Displays ethernet statistics, such as the number of bytes and packets sent and received. This parameter can be combined with -s.
-f (Windows) Displays fully qualified domain names for foreign addresses (only available on Windows Vista and newer operating systems).
-f Address Family (FreeBSD) Limits display to a particular socket address family, unix, inet, inet6
-g Displays multicast group membership information for both IPv4 and IPv6 (may only be available on newer operating systems)
-i Displays network interfaces and their statistics (not available under Windows)
-m Displays the memory statistics for the networking code (STREAMS statistics on Solaris).
-n Displays active TCP connections, however, addresses and port numbers are expressed numerically and no attempt is made to determine names.
-o (Windows) Displays active TCP connections and includes the process ID (PID) for each connection. You can find the application based on the PID on the Processes tab in Windows Task Manager. This parameter can be combined with -a, -n, and -p. This parameter is available on Microsoft Windows XP, 2003 Server (and Windows 2000 if a hotfix is applied).
-p protocol (Windows and BSD) Shows connections for the protocol specified by the protocol. In this case, the protocol can be tcp, udp, tcpv6, or udpv6. If this parameter is used with -s to display statistics by protocol, the protocol can be tcp, udp, icmp, ip, tcpv6, udpv6, icmpv6, or ipv6.
-p (Linux) Show which processes are using which sockets (similar to -b under Windows) (you must be root to do this)
-P protocol (Solaris) Shows connections for the protocol specified by the protocol. In this case, the protocol can be ip, ipv6, icmp, icmpv6, igmp, udp, tcp, or rawip.
-r Displays the contents of the IP routing table. (This is equivalent to the route print command under Windows.)
-s Displays statistics by the protocol. By default, statistics are shown for the TCP, UDP, ICMP, and IP protocols. If the IPv6 protocol for Windows XP is installed, statistics are shown for the TCP over IPv6, UDP over IPv6, ICMPv6, and IPv6 protocols. The -p parameter can be used to specify a set of protocols.
-t (Linux) Display only TCP connections.
-W (FreeBSD) Display wide output * doesn't truncate hostnames or IPv6 addresses
-v (Windows) When used in conjunction with -b it will display the sequence of components involved in creating the connection or listening port for all executables.
Interval Redisplays the selected information every Interval seconds. Press CTRL+C to stop the redisplay. If this parameter is omitted, netstat prints the selected information only once.
-h (unix)
/? (windows) Displays help at the command prompt.

Interval: Redisplays the selected information every Interval seconds. Press CTRL+C to stop the redisplay. If this parameter is omitted, netstat prints the selected information only once.

/? : Displays help at the command prompt.

```
Administrator: C:\Windows\system32\cmd.exe

Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Steve>netstat -e
Interface Statistics

                           Received            Sent

Bytes                    2185741992       657042474
Unicast packets             2897748         2253722
Non-unicast packets          420210          586233
Discards                       9225            9225
Errors                            0               0
Unknown protocols                 0

C:\Users\Steve>
```

nslookup

Most of the common networking issues revolve around Dynamic Name System (DNS) address resolution issues. DNS is used by everyone to exchange "human-friendly" domain name URLs (i.e. google.com) into mandatory IP addresses (i.e. 74.125.115.147) for data-packet creation. When the DNS does not work, most of the functionality (that humans use) disappears, as there is no way to "resolve" this information. The nslookup command can "look-up" specific IP address(es) and translate them into "human friendly" domain name. If nslookup stops working then all symptoms point to an issue with the DNS resolver process. In addition to this "yellow pages" service, the nslookup can also ask specific DNS servers anywhere on the Internet.

nslookup mmog.pbmcube.net

Server: modem.Home
Address: 192.168.0.1

```
Name:    mmog.pbmcube.net
Addresses:  46.249.199.74
```

Q>How do I discover my mmog server?

Answer: In order to find your broker's server that is talking to your MT4/5 terminal, do the following:

1. Start your MetaTrader 4 terminal.
2. Go to: Files -> Open Data Folder (or combination of left [ALT]+[F] keys and then [D] key).
3. A new window should open. Go to the "config" folder; in there you should see several ".SRV" files. In these files are stored your Brokers' MT4 Server information.
4. Open ".SRV" file with a text editor (such as Notepad). Windows may tell you that it can't open this type of file; so, you need to choose "Select a program" from a list of installed programs. From that listing, you choose the Notepad program.
5. This is a "binary file"; it will be difficult to read. But just look for an IP address (four numbers separated by periods) inside that file. My config files use "Fully Qualified Domain Names" (FQDN) like this:

   - mt4-ng-practice.oanda.com:443

Now I can use nslookup to find my broker's server address.

```
Administrator: C:\Windows\system32\cmd.exe

Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All righ

C:\Users\Steve>nslookup mt4-ng-practice.oanda.com
Server:   modem.Home
Address:  192.168.0.1

Non-authoritative answer:
Name:     mt4-ng-practice.oanda.com
Address:  198.105.27.149


C:\Users\Steve>
```

ping (Packet Internet Groper)

The most commonly used network tool for measuring connectivity and network delay is the Packet Internet Grouper (aka ping) utility. This tool provides basic connectivity testing between the host originating the request and response from the destination host. It uses a layer 3 protocol similar to Internet Protocol (IP); the Internet Control Message Protocol (ICMP) can send an "echo packets" — similar to sonar pings — toward a destination and listen for returning responses.

Usage: ping [-t] [-a] [-n count] [-l size] [-f] [-i TTL] [-v TOS]
[-r count] [-s count] [[-j host-list] | [-k host-list]]
[-w timeout] [-R] [-S srcaddr] [-4] [-6] target_name

Options:
-t Ping the specified host until stopped.
To see statistics and continue * type Control-Break;
To stop * type Control-C.
-a Resolve addresses to hostnames.
-n count Number of echo requests to send.
-l size Send buffer size.
-f Set Don't Fragment flag in the packet (IPv4-only).
-i TTL Time To Live.
-v TOS Type Of Service (IPv4-only. This setting has been deprecated
and has no effect on the type of service field in the IP Header).
-r count Record route for count hops (IPv4-only).
-s count Timestamp for count hops (IPv4-only).
-j host-list Loose source route along host-list (IPv4-only).
-k host-list Strict source route along host-list (IPv4-only).
-w timeout Timeout in milliseconds to wait for each reply.
-R Use routing header to test reverse route also (IPv6-only).
-S srcaddr Source address to use.
-4 Force using IPv4.
-6 Force using IPv6.

The milliseconds recorded are unique to the path between the origin and destination and may change even between "ping" readings as a result of dynamic routing decisions and network conditions.

X>**Exercise:** Compare your network delay to mine in the picture above.

X>**Exercise:** Now test your current broker or potential new brokers network delay.

I>**NOTE:** We will use TTL in our trading advisor dynamically. ***Begin scouring through your Bonus Content downloaded with your purchase.***

pingtest.net

Use Pingtest.net to determine the quality of your broadband Internet connection. Streaming media, voice, video communications, and online gaming require more than just raw speed. Test your connection now to get your Pingtest.net rating and share the result with others!! You can also test from different "source" to "destinations" to check-up on how your Broker connects to his Exchange.

You can also test for "jitter". Once you understand ping, jitter should also make sense. Jitter is merely the variance in measuring successive ping tests. Zero jitter means the results were exactly the same every time, and anything above zero is the amount by which they varied. ***THIS IS NEEDED IN YOUR EXPERT ADVISOR CALCULATIONS for Elliot's Wave Theory.*** Like the other quality measurements, a lower jitter value is better; in other words, your market information is arriving in a "steady consistent manner". And while some jitter should be expected over the Internet, having it be a small fraction of the ping result is ideal.

route

This command displays the current routing table status.

```
route PRINT

===========================================================================
Interface List
11...00 1d 60 e0 df c1 ......NVIDIA nForce 10/100 Mbps Ethernet
  1...........................Software Loopback Interface 1
 13...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter
 12...00 00 00 00 00 00 00 e0 Teredo Tunneling Pseudo-Interface
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      192.168.0.1      192.168.0.2     20
```

```
    127.0.0.0        255.0.0.0         On-link         127.0.0.1    306
    127.0.0.1  255.255.255.255         On-link         127.0.0.1    306
   127.255.255.255  255.255.255.255        On-link         127.0.0.1    306
   192.168.0.0  255.255.255.192         On-link       192.168.0.2    276
   192.168.0.2  255.255.255.255         On-link       192.168.0.2    276
  192.168.0.63  255.255.255.255         On-link       192.168.0.2    276
    224.0.0.0        240.0.0.0         On-link         127.0.0.1    306
    224.0.0.0        240.0.0.0         On-link       192.168.0.2    276
  255.255.255.255  255.255.255.255        On-link         127.0.0.1    306
  255.255.255.255  255.255.255.255        On-link       192.168.0.2    276
===========================================================================
Persistent Routes:
  None

IPv6 Route Table    ===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    306 ::1/128                  On-link
 11    276 fe80::/64                On-link
 13    281 fe80::5efe:192.168.0.2/128
                                    On-link
 11    276 fe80::51ec:95a:774d:cf90/128
                                    On-link
  1    306 ff00::/8                 On-link
 11    276 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

speedtest.net

Ookla Speedtest puts the most sophisticated broadband testing and analysis tools into the hands of anyone interested in finding out just how connected they actually are. This *free service from Ookla* opens hundreds of testing locations around the world to anyone curious about the performance of their Internet connection. Use their service to view your broker service's performance history, then share and compare with others near you * or around the globe. Performing over 50 million tests every month, http://Speedtest.net is the global standard in Internet connection testing. Available on the web and on the iPhone and Android mobile platforms, the data collected powers Speedtest Awards where you can browse top bandwidth speed by country.

tracert

I like to use this command after ping to ensure the destination is "reachable". Windows o/s Tracert tool —or traceroute (UNIX, Linux or MAC O/S)— reveals more specific information about the data communication equipment in the path toward the destination; it includes the route the packet took and the response time of each intermediate device. As with the ping command, the milliseconds recorded are unique to the path between the origin and destination and may change even between "ping" readings as a result of dynamic routing decisions and network conditions.

Wireshark

Finally, the tool you have been waiting for! Data Packet captures! Here's what they say, "Wireshark is the world's foremost and widely-used network protocol analyzer. It lets you see what's happening on your network at a microscopic level and is the de facto (and often de jure) standard across many commercial and non-profit enterprises, government agencies, and educational institutions. Wireshark development thrives thanks to the volunteer contributions of networking experts around the globe and is the continuation of a project started by Gerald Combs in 1998."home page.

"So, can I capture packets and look at them?", I hear you thinking. The answer is yes! "Oh, wait! if I can capture packets, can I create a packet to interact with the server", you need to think more quietly? No, you can't; Wireshark does not the ability to "inject" packet data. Before you ask your next question, download their free Book supplements or their freetroubleshooting checklist that describes how to Detect and Prioritize Network Delays. See what else Wireshark can do:

- Deep inspection of hundreds of protocols, with more being added all the time
- Live capture and offline analysis
- Standard three-pane packet browser

- Multi-platform: Runs on Windows, Linux, macOS, Solaris, FreeBSD, NetBSD, and many others
- Captured network data can be browsed via a GUI, or via the TTY-mode TShark utility
- The most powerful display filters in the industry
- Rich VoIP analysis
- Read/write many different capture file formats: tcpdump (libpcap), Pcap NG, Catapult DCT2000, Cisco Secure IDS iplog, Microsoft Network Monitor, Network General Sniffer® (compressed and uncompressed), Sniffer® Pro, and NetXray®, Network Instruments Observer, NetScreen snoop, Novell LANalyzer, RADCOM WAN/LAN Analyzer, Shomiti/Finisar Surveyor, Tektronix K12xx, Visual Networks Visual UpTime, WildPackets EtherPeek/TokenPeek/AiroPeek, and many others
- Capture files compressed with gzip can be decompressed on the fly
- Live data can be read from Ethernet, IEEE 802.11, PPP/HDLC, ATM, Bluetooth, USB, Token Ring, Frame Relay, FDDI, and others (depending on your platform)
- Decryption support for many protocols, including IPsec, ISAKMP, Kerberos, SNMPv3, SSL/TLS, WEP, and WPA/WPA2
- Coloring rules can be applied to the packet list for quick, intuitive analysis
- Output can be exported to XML, PostScript®, CSV, or plain text

Robtex Research (old school method)

Let's pick on your ForEx broker in this tool. I am going to Google and performing a search for .....

```
google search: similar: gaincapital.com
```

Here's what was recommended. Copy their URL http://www.advfn.com/forex or jot it down. Now let's surf to a little-known Information Technology site:

```
http://www.robtex.com
```

I typed in advfn.com and robtex.com gave me a list of 100 similar sites. I clicked on the advfn.comm and now the magic begins. RobTex provides:

- What their IP address(s) are and other names they use
- What their name servers (DNS) and eMail servers are, and
- ***Who else is using the same hosting server***
- ***BUT MORE IMPORTANTLY: a map of how they connect to their WAN!***

This Internet map is my focus, and on the far right side, you should find an "AS" and a number. The "AS" is autonomous system and the number is the registration serial number with Internet Assigned Numbers Authority (IANA). Optimally, this AS# should be one of major (aka Tier 1) internet backbone providers (click this link for a list with AS numbers) or perhaps they are co-located at one of Internet exchange points List of Internet exchange points by size.

If your game server is not directly connected to either of these, your data exchange will directly reflect the additional length/time it takes to reach one of the Data Centers throughout the world.

X>*Exercise:* Practice researching Game Data Centers. Use Google Play as an example. Discover their proximity to their Tier 1 network providers using http://www.robtex.com

NetBrain (new school *real-time dynamic network maps*)

NetBrain builds dynamic (i.e., real-time) network maps as topology changes — a must see 4:42 minute video!

> During the network discovery, NetBrain collects information about the network's topology as well as its underlying design – taking into account configuration, routing, MAC/ARP tables, MPLS design, and much more. The discovery provides a baseline of information which NetBrain uses to build its dynamic maps. The information in the maps can be further enriched through live performance monitoring and customized with NetBrain Apps.

Development Tools

- Chrome Logger (formerly known as ChromePHP)
- Developer Companion
- Firebug
- Firebug Extension for AJAX Development

- GoJS: Interactive JavaScript Diagrams in HTML
- IntelXDK App Builder
- uiKit * A lightweight and modular front-end framework for developing fast and powerful web interfaces.
- Online Regular Expression Editor
- Regular Express 101

DNS prefetching

- controlling DNS prefetching
- Prefetching, preloading, prebrowsing
- The Chrome Project: DNS Prefetching

Storage

- Firebase: Firebase provides a real-time database and backend as a service. Firebase Storage provides secure file uploads and downloads for your Firebase apps, regardless of network quality. Firebase Hosting is a static asset web hosting service that launched on May 13, 2014. It supports hosting static files such as CSS, HTML, JavaScript and other files that do not change dynamically.
- ForeRunnerDB: A JavaScript database with a mongo-like query language, data-binding support, runs in browsers and hybrid mobile apps as a client-side DB or on the server via Node.js!
- PouchDB: PouchDB is a pocket-sized database. PouchDB is an open-source JavaScript database inspired by Apache CouchDB that is designed to run well within the browser.
- SQLitev3: SQLite is an in-process library that implements a self-contained, serverless, zero-configuration, transactional SQL database engine. The code for SQLite is in the public domain and is thus free for use for any purpose, commercial or private. SQLite is the most widely deployed database in the world with more applications than we can count, including several high-profile projects.

Structured Data

- Schema.org Structured Data
- Structured Data for Dummies
- Getting started with structured data *by Google*