**CTCP: Coded TCP "How To" for Debian Squeeze**

**1. INSTALLATION**

Install CTCP using:

sudo dpkg -i ctcp\_1.0\_amd64.deb

if a 64bit distribution, or using

sudo dpkg -i ctcp\_1.0\_i386.deb

if 32bit. If unsure, you can use

dpkg-architecture

to find out which architecture you are using from the value reported for DEB\_BUILD\_ARCH.

**2. STARTUP**

Start CTCP proxies using:

proxy\_remote start

proxy\_local start

Check that listening on ports using:

netstat -a

The output should include two lines similar to the following:

tcp 0 0 \*:socks \*:\* LISTEN

tcp 0 0 \*:1081 \*:\* LISTEN

The commands man ctcp, man proxy\_local, man\_proxy\_remote provide further information.

**3. INITIAL TESTING**

Install proxychains (http://proxychains.sourceforge.net/) using:

sudo apt-get install proxychains

Edit file /etc/proxychains.conf as follows:

1. Uncomment the line containing dynamic\_chain
2. Comment out strict\_chain
3. Uncomment quiet\_mode
4. Comment out line proxy\_dns
5. Comment out last line socks4 127.0.0.1 9050
6. Add line: socks5 127.0.0.1 1080

Proxychains will now redirect connections via the CTCP proxy. Now check that CTCP proxy is functioning by typing:

proxychains telnet 127.0.0.1 22

This will connect to the local SSH port via the CTCP proxy. The output should look similar to:

ProxyChains-3.1 (http://proxychains.sf.net)

Trying 127.0.0.1...

Warning while making the logs directory: No such file or directory

Request for a new session: Client address 127.0.0.1 Client port 53628

Connected to 127.0.0.1.

Escape character is '^]'.

SSH-2.0-OpenSSH\_5.5p1 Debian-6+squeeze3

To exit the connection just press the <enter> key. Now check external connection via the proxy by typing:

proxychains wget -4 www.google.com

(if need be, install wget first using apt-get install wget; note that the "-4" option ensures use of IPv4 since the CTCP proxy currently is untested with IPv6). The output should look similar to:

ProxyChains-3.1 (http://proxychains.sf.net)

--2013-02-24 19:25:20-- http://www.google.com/

Resolving www.google.com... Request for a new session: Client address 127.0.0.1 Client port 45634

173.194.66.104

Connecting to www.google.com|173.194.66.104|:80... Request for a new session: Client address 127.0.0.1 Client port 53983

connected.

HTTP request sent, awaiting response... 302 Found

Location: http://www.google.ie/ [following]

--2013-02-24 19:25:20-- http://www.google.ie/

Resolving www.google.ie... Request for a new session: Client address 127.0.0.1 Client port 55852

173.194.67.94

Connecting to www.google.ie|173.194.67.94|:80... Request for a new session: Client address 127.0.0.1 Client port 41543

connected.

HTTP request sent, awaiting response... 200 OK

Length: unspecified [text/html]

Saving to: `index.html'

[ <=>] 10,811 --.-K/s in 0.02s

2013-02-24 19:25:20 (528 KB/s) - `index.html' saved [10811]

and if successful there will be a file index.html saved to the current directory.

**4. TESTING ACROSS A NETWORK PATH**

The setup we consider here is with two CTCP proxy servers, a local proxy running on the client machine and a remote proxy running on the server machine.

Client APP <-----> proxy\_local <----------------------> proxy\_remote <-----> Server

The local proxy listens on a local port and forwards connections from the client app to the remote proxy, which in turn passes the connection on to the content server e.g. a web server. The downlink connection from the remote proxy to the local proxy uses the CTCP transport, and so is protected against packet loss. Other connections (between client application and local proxy, between remote proxy and content server) use standard TCP and are not protected against packet loss.

By default (i.e. after initial installation as above), the local proxy binds to port 1080 on the local machine and the remote proxy binds to port 1081 on the local machine. That is, the CTCP transport is being used across an internal network path, which is high bandwidth and zero loss.

To test across an external path, two machines are needed a client machine and a server machine. Firstly, install CTCP on both machines as described above. On the client machine, type:

proxy\_remote shutdown

to stop the remote proxy running on the client machine. On the server machine, type:

proxy\_local shutdown

to stop the local proxy running on the server. We should now have only the proxy\_local daemon running on the client machine, and only the proxy\_remote daemon running on the server machine.

We need to tell the proxy\_local daemon where the proxy\_remote daemon is running. To do this, edit file /etc/ctcp/proxy\_local.conf on the client machine and change the UP\_PROXY\_ADDR entry to equal to IP address of the server machine. Restart proxy\_local by typing

proxy\_local shutdown; proxy\_local start

on the client machine. We can now test that a connection has been successfully established between the client proxy\_local daemon and the server proxy\_remote daemon by typing:

proxychains telnet 127.0.0.1 22

on the *client* machine. Since traffic is sent via the proxies, this should establish a connection between the client machine and the SSH port 22 on the server machine (note that the 127.0.0.1 is interpreted by proxy\_remote to be its local machine i.e. the server machine). On the client machine, type:

netstat -a

and the output should be similar to the following:

tcp 0 0 localhost:socks localhost:51691 ESTABLISHED

tcp 0 0 localhost:51691 localhost:socks ESTABLISHED

tc 0 0 149.157.192.240:59093 149.157.192.3:1081 ESTABLISHED

The first two lines are the connection to the local client proxy proxy\_local. The third line is the connection between proxy\_local and proxy\_remote (in this example the server machine running proxy\_remote has IP address 149.157.192.3 and proxy\_remote is listening on port 1081, the client machine running proxy\_local has IP address 149.157.192.240). On the server type:

netstat -a

and the output should be similar to the following:

tcp 0 0 149.157.192.3:1081 149.157.192.240:59093 ESTABLISHED

tcp 0 0 localhost:ssh localhost:55100 ESTABLISHED

tcp 0 0 localhost:55100 localhost:ssh ESTABLISHED

The first line is the connection between proxy\_local and proxy\_remote and mirrors the third line above from the client machine. The second and third lines are the connection from proxy\_remote to the content server, which in this case is SSH listening on port 22 of the server machine.

**5. EMULATING A LOSSY PATH**

For testing, loss, latency and bandwidth restrictions can be artificially introduced into a path using either Linux command tc or iptables. Using the tc command on the server machine (running proxy\_remote):

tc qdisc add dev eth1 root handle 1: tbf rate 10mbit burst 2kb latency 10ms

tc qdisc add dev eth1 parent 1: netem limit 1000 loss 5% delay 25ms

introduces 5% packet loss on outgoing traffic , a delay of 25ms and a rate limit of 10Mbps. To change the link loss rate to e.g. 10% use:

tc qdisc change dev eth1 parent 1: netem limit 1000 loss 10% delay 25ms

To remove traffic shaping use:

tc qdisc del dev eth1 root

and use tc qdisc show dev eth1 to confirm. For example, using tc to add 5% loss and 25ms delay on a link we can compare the download throughput achieved with and without CTCP by first running:

proxychains wget -4 http://cdimage.debian.org/debian-cd/6.0.7/amd64/iso-cd/debian-6.0.7-amd64-CD-1.iso

to obtain the throughput using CTCP. With 5% loss on a link, the above command achieves a net download rate of about 8Mbps. Without CTCP, the download rate achieved is about 1 Mbps.

**Notes:**

1. To increase the diagnostic output provided by proxy\_remote, edit /etc/ctcp/proxy\_remote.conf and change the value of DEBUG to 3.
2. The current proxy code is currently not optimized and is limited to a rate of around 20Mbps. It will operate at somewhat higher rates, but performance may be unreliable.