

## Lab 2

The goal of this lab was to create a webcrawler capable of sending an HTTP get request to a user specified domain over a user specified port and print out the response from the queried site. This was done successfully despite a few minor hiccups, primarily with home setups.

The lab mainly done by repurposing the sockets lab from Operating Systems, which worked fine on SLU's hopper remote machines. However, to troubleshoot any issues that might arise using Wireshark, I attempted to port everything over to Windows, which ended up leading to attempting to fully rewrite the code, import a compiler, and overall being frustrating.

Instead, I followed a classmate's recommendation and setting up a Ubuntu virtual machine. This ended up proving necessary because the initial pass at the program ended up returning incorrect IP addresses, which stood out when checking wireshark packets. Researching solutions for properly extracting an IP address from an addrinfo struct fixed the issue.

```
.....HTTP/1.1 200 OK
Date: Sat, 03 Apr 2021 17:47:07 GMT
Expires: -1
Cache-Control: private, max-age=0
Content-Type: text/html; charset=ISO-8859-1
P3P: CP="This is not a P3P policy! See g.co/p3phelp for more info."
Server: gws
X-XSS-Protection: 0
X-Frame-Options: SAMEORIGIN
Set-Cookie: 1P_JAR=2021-04-03-17; expires=Mon, 03-May-2021 17:47:07
GMT; path=/; domain=.google.com; Secure
Set-Cookie: NID=212=ZlS81T8z2kkKL7mxCNgSUNbQ9T8-0g2h_FKzh5aGiX-
m6WCwdCxcazPOvx1n0R0x5XojviF7xCKq2yUUAiDeZ0vhMLUHF_Ckh7aCRuc9NeU0piguS
Vl1koLf42d4ZWwErrfBL3QdUJKZSQdGFKzJrA-fbez1L5H-0H9QQCgGI9Y;
expires=Sun, 03-Oct-2021 17:47:07 GMT; path=/; domain=.google.com;
HttpOnly
Accept-Ranges: none
Vary: Accept-Encoding
Transfer-Encoding: chunked
```

```
<!doctype html><html itemscope="" itemtype="http://schema.org/WebPage"
lang="en"><head><meta content="Search the world's information,
including webpages, images, videos and more. Google has many special
features to help you find exactly what you're looking for."
name="description"><meta content="noodp" name="robots"><meta
content="text/html; charset=UTF-8" http-equiv="Content-Type"><meta
content="/images/branding/googleg/1x/googleg_standard_color_128dp.png"
itemprop="image"><title>Google</title><script
nonce="QGYWuVN3nSCUFJ6R75wnJA==">(function()
{window.google={kEI:'G6poYNxWy7Hk2g-
LiL3YBw',kEXPI:'0,1302536,56873,954,756,4348,207,2414,2390,2316,383,24
6,5,1128,226,4936,314,7680,1114836,1232,1196555,287,209,328984,51224,1
6114,17444,1953,9287,9188,8384,4859,1361,9290,3023,4745,12841,4020,978
,13228,2054,920,873,4192,6430,1142,13386,4519,2775,919,2277,8,2796,887
,706,1279,2212,530,149,1103,842,515,1466,56,157,4101,3514,606,2023,177
7,520,4269,328,1284,8789,3227,2845,7,5599,6755,5096,7876,4929,108,1483
,1924,908,2,941,5011,1386,6084,1,2842,432,3,346,1244,1,820,1,4624,148,
5992,5331,2652,4,499,1029,2304,1236,1145,4658,74,1717,266,2626,460,155
5,4067,7434,3824,1297,1753,2658,4242,519,912,564,1119,31,3854,3022,108
5,168,3286,2213,1397,910,636,37,1457,3975,4,3,1604,9765,28,11,731,665,
2145,3676,2536,479,512,1055,907,1141,67,99,2090,882,6,908,3,163,3378,1
,1036,2,3136,1175,1207,3098,182,109,500,2726,1539,1,1813,38,245,911,61
,3374,1941,617,1260,1194,2,4298,400,32,2859,424,286,77,1694,2,1112,282
,114,642,659,110,8,1,1272,1565,150,2,488,1922,647,1477,1070,2714,593,3
01,177,450,4,32,4,62,471,978,392,2,332,2,1709,2063,2,61,24,418,175,9,1
58,88,167,464,29,350,2,427,170,240,337,850,80,14,30,520,1494,50,236,41
2,135,51,463,214,822,516,801,21,385,265,1768,1242,811,579,661,63,5,135
,201,190,13,861,1,2,955,2,1682,212,1,259,5665246,1873,1997,35,226,5997
077,2799384,1324,882,444,1,2,80,1,1796,1,9,2,2551,1,748,141,795,563,1,
4265,1,1,2,1331,3299,843,1,2608,155,17,13,72,338,13,16,46,5,39,97,39,8
,6,20,4,47,38,4,4,111,3,2,2,2,2,2,2,2,2,2,2,2,6,2,2,2,2,2,2,11,1,1
0,2,34,38,7,26,35,50,25,2,23956272,149,2783198,1226926,267,247,193,263
36,26,582,2,372,847',kBL:'1D5i!';google.sn='webhp';google.kHL='en';})
```

```

());(function(){
var f,h=[];function k(a){for(var b;a&&(!a.getAttribute)||
(b=a.getAttribute("eid")));)a=a.parentNode;return b||f}function l(a)
{for(var b=null;a&&(!a.getAttribute)||
(b=a.getAttribute("leid")));)a=a.parentNode;return b}
function m(a,b,c,d,g){var e="";c||-1==b.search("&ei=")||
(e="&ei="+k(d),-1==b.search("&lei=")&&(d=l(d))&&(e+="&lei="+d));d="";!
c&&window._cshid&&-1==b.search("&cshid=")&&"slh"!
=a&&(d="&cshid="+window._cshid);c=c||"/"+(g||"gen_204")+"?
atyp=i&ct="+a+"&cad="+b+e+"&zx="+Date.now()+d;/^http:/
i.test(c)&&"https:"==window.location.protocol&&(google.ml(Error("a"),!
1,{src:c,glmm:1}),c="");return
c};f=google.kEI;google.getEI=k;google.getLEI=l;google.ml=function()
{return null};google.log=function(a,b,c,d,g){if(c=m(a,b,c,d,g)){a=new
Image;var e=h.length;h[e]=a;a.onerror=a.onload=a.onabort=function()
{delete h[e];a.src=c}};google.logUrl=m;}).call(this);(function()
{google.y={};google.sy=[];google.x=function(a,b){if(a)var
c=a.id;else{do c=Math.random();while(google.y[c])}
google.y[c]=[a,b];return!1};google.sx=function(a)
{google.sy.push(a)};google.lm=[];google.plm=function(a)
{google.lm.push.apply(google.lm,a)};google.lq=[];google.load=function(
a,b,c){google.lq.push([a,b,c]);google.loadAll=function(a,b)
{google.lq.push([a,b]);google.bx=!1;google.lx=function()
{}};}).call(this);google.f={};(function(){
document.documentElement.addEventListener("submit",function(b){var
a;if(a=b.target){var c=a.getAttribute("data-
submitfalse");a="1"==c||"q"==c&&!a.elements.q.value?!0:!1}else a=!
1;a&&(b.preventDefault(),b.stopPropagation())},!
0);document.documentElement.addEventListener("click",function(b){var
a;a:{for(a=b.target;a&&a!
=document.documentElement;a=a.parentElement)if("A"==a.tagName)
{a="1"==a.getAttribute("data-nohref");break a}a=!1}
a&&b.preventDefault(),!0);}).call(this);</script><style>#gb{font:
13px/27px Arial,sans-serif;height:30px}
#gbz,#gbg{position:absolute;white-space:nowrap;top:0;height:30px;z-
index:1000}#gbz{left:0;padding-left:4px}#gbg{right:0;padding-right:
5px}
#gbs{background:transparent;position:absolute;top:-999px;visibility:hi
dden;z-index:998;right:0}.gbto #gbs{background:#fff}
#gbx3,#gbx4{background-color:#2d2d2d;background-
image:none;_background-image:none;background-position:0
-138px;background-repeat:repeat-x;border-bottom:1px solid #000;font-
size:24px;height:29px;_height:30px;opacity:
1;filter:alpha(opacity=100);position:absolute;top:0;width:100%;z-
index:990}#gbx3{left:0}#gbx4{right:0}#gbb{position:relative}
#gbbw{left:0;position:absolute;top:30px;width:
100%}.gbtcb{position:absolute;visibility:hidden}#gbz .gbtcb{right:0}
#gbg .gbtcb{left:0}.gbxx{display:none !important}.gbxo{opacity:0 !
important;filter:alpha(opacity=0) !important}.gbm{position:absolute;z-
index:999;top:-999px;visibility:hidden;text-align:left;border:1px
solid #bebebe;background:#fff;-moz-box-shadow:-1px 1px 1px
rgba(0,0,0,.2);-webkit-box-shadow:0 2px 4px rgba(0,0,0,.2);box-shadow:
0 2px 4px rgba(0,0,0,.2)}.gbrtl .gbm{-moz-box-shadow:1px 1px 1px
rgba(0,0,0,.2)}.gbto .gbm,.gbto #gbs{top:29px;visibility:visible}#gbz
.gbm{left:0}#gbg .gbm{right:0}.gbxms{background-
color:#ccc;display:block;position:absolute;z-index:
1;top:-1px;left:-2px;right:-2px;bottom:-2px;opacity:.4;-moz-border-

```

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radius:
3px;filter:progid:DXImageTransform.Microsoft.Blur(pixelradius=5);*opac
ity:1;*top:-2px;*left:-5px;*right:5px;*bottom:4px;-ms-
filter:"progid:DXImageTransform.Microsoft.Blur(pixelradius=5)";opacity
:1\0/;top:-4px\0/;left:-6px\0/;right:5px\0/;bottom:
4px\0/}.gbma{position:relative;top:-1px;border-style:solid dashed
dashed;border-color:transparent;border-top-color:#c0c0c0;display:-moz-
inline-box;display:inline-block;font-size:0;height:0;line-height:
0;width:0;border-width:3px 3px 0;padding-top:1px;left:4px}
#gbztms1,#gbi4m1,#gbi4s,#gbi4t{zoom:
1}.gbtc,.gbmc,.gbmcc{display:block;list-style:none;margin:0;padding:
0}.gbmc{background:#fff;padding:10px 0;position:relative;z-index:
2;zoom:1}.gbt{position:relative;display:-moz-inline-
box;display:inline-block;line-height:27px;padding:0;vertical-
align:top}.gbt{*display:inline}.gbto{box-shadow:0 2px 4px
rgba(0,0,0,.2);-moz-box-shadow:0 2px 4px rgba(0,0,0,.2);-webkit-box-
shadow:0 2px 4px
rgba(0,0,0,.2)}.gbzt,.gbgt{cursor:pointer;display:block;text-
decoration:none !important}
span#gbg6,span#gbg4{cursor:default}.gbts{border-left:1px solid
transparent;border-right:1px solid
transparent;display:block;*display:inline-block;padding:0
5px;position:relative;z-index:1000}.gbts{*display:inline}.gbzt
.gbts{display:inline;zoom:1}.gbto .gbts{background:#fff;border-
color:#bebebe;color:#36c;padding-bottom:1px;padding-top:2px}.gbz01
.gbts{color:#fff;font-weight:bold}.gbtsa{padding-right:9px}#gbz
.gbzt,#gbz .gbgt,#gbg .gbgt{color:#ccc!
important}.gbtb2{display:block;border-top:2px solid transparent}.gbto
.gbzt .gbtb2,.gbto .gbgt .gbtb2{border-top-width:0}.gbtb
.gbts{background:url(https://ssl.gstatic.com/gb/images/
b_8d5afc09.png);_background:url(https://ssl.gstatic.com/gb/images/
b8_3615d64d.png);background-position:-27px -22px;border:0;font-size:
0;padding:29px 0 0;*padding:27px 0 0;width:
1px}.gbzt:hover,.gbzt:focus,.gbgt:hvr,.gbgt:focus{background-
color:#4c4c4c;background-image:none;_background-image:none;background-
position:0 -102px;background-repeat:repeat-x;outline:none;text-
decoration:none !important}.gbpdjs .gbto .gbm{min-width:99%}.gbz01
.gbtb2{border-top-color:#dd4b39!important}#gbi4s,#gbi4s1{font-
weight:bold}#gbg6.gbgt:hvr,#gbg6.gbgt:focus{background-
color:transparent;background-image:none}.gbg4a{font-size:0;line-
height:0}.gbg4a .gbts{padding:27px 5px 0;*padding:25px 5px 0}.gbto
.gbg4a .gbts{padding:29px 5px 1px;*padding:27px 5px 1px}
#gbi4i,#gbi4id{left:5px;border:0;height:24px;position:absolute;top:
1px;width:24px}.gbto #gbi4i,.gbto #gbi4id{top:
3px}.gbi4p{display:block;width:24px}#gbi4id{background-position:-44px
-101px}#gbmpid{background-position:0 0}
#gbmpi,#gbmpid{border:none;display:inline-block;height:48px;width:
48px}#gbmpiw{display:inline-block;line-height:9px;padding-left:
20px;margin-top:10px;position:relative}
#gbmpi,#gbmpid,#gbmpiw{*display:inline}#gbg5{font-size:0}
#gbgs5{padding:5px !important}.gbto #gbgs5{padding:7px 5px 6px !
important}#gbi5{background:url(https://ssl.gstatic.com/gb/images/
b_8d5afc09.png);_background:url(https://ssl.gstatic.com/gb/images/
b8_3615d64d.png);background-position:0 0;display:block;font-size:
0;height:17px;width:16px}.gbto #gbi5{background-position:-6px
-22px}.gbn .gbmt,.gbn .gbmt:visited,.gbnd .gbmt,.gbnd
.gbmt:visited{color:#dd8e27 !important}.gbf .gbmt,.gbf

```

```

.gbmt:visited{color:#900 !
important}.gbmt,.gbml1,.gbmlb,.gbmt:visited,.gbml1:visited,.gbmlb:visi
ted{color:#36c !important;text-decoration:none !
important}.gbmt,.gbmt:visited{display:block}.gbml1,.gbmlb,.gbml1:visi
ted,.gbmlb:visited{display:inline-block;margin:0
10px}.gbml1,.gbmlb,.gbml1:visited,.gbmlb:visited{*display:inline}.gbml
1,.gbml1:visited{padding:0 10px}.gbml1-
hvr,.gbml1:focus{outline:none;text-decoration:underline !important}
#gbpm .gbml1{display:inline;margin:0;padding:0;white-
space:nowrap}.gbmlb,.gbmlb:visited{line-height:27px}.gbmlb-
hvr,.gbmlb:focus{outline:none;text-decoration:underline !
important}.gbmlbw{color:#ccc;margin:0 10px}.gbmt{padding:0
20px}.gbmt: hover,.gbmt: focus{background:#eee;cursor:pointer;outline:0
solid black;text-decoration:none !
important}.gbm01,.gbm01:visited{color:#000 !important;font-
weight:bold}.gbmh{border-top:1px solid #bebebe;font-size:0;margin:10px
0}#gbd4 .gbmc{background:#f5f5f5;padding-top:0}#gbd4 .gbsbic::-webkit-
scrollbar-track:vertical{background-color:#f5f5f5;margin-top:2px}
#gbmpdv{background:#fff;border-bottom:1px solid #bebebe;-moz-box-
shadow:0 2px 4px rgba(0,0,0,.12);-o-box-shadow:0 2px 4px
rgba(0,0,0,.12);-webkit-box-shadow:0 2px 4px rgba(0,0,0,.12);box-
shadow:0 2px 4px rgba(0,0,0,.12);position:relative;z-index:1}#gbd4
.gbmh{margin:0}.gbmtc{padding:0;margin:0;line-height:27px}.GBMCC:last-
child:after,#GBMPAL:last-child:after{content:'\0A\0A';white-
space:pre;position:absolute}#gbmps{*zoom:1}#gbd4 .gbpc,#gbmpas
.gbmt{line-height:17px}#gbd4 .gbpgs .gbmtc{line-height:27px}#gbd4
.gbmtc{border-bottom:1px solid #bebebe}#gbd4 .gbpc{display:inline-
block;margin:16px 0 10px;padding-right:50px;vertical-align:top}#gbd4
.gbpc{*display:inline}.gbpc .gbps,.gbpc .gbps2{display:block;margin:0
20px}#gbmplp.gbps{margin:0 10px}.gbpc .gbps{color:#000;font-
weight:bold}.gbpc .gbpd{margin-bottom:5px}.gbpd .gbmt,.gbpd
.gbps{color:#666 !important}.gbpd .gbmt{opacity:.
4;filter:alpha(opacity=40)}.gbps2{color:#666;display:block}.gbp0{displ
ay:none}.gbp0 .gbps2{font-weight:bold}#gbd4 .gbmcc{margin-top:
5px}.gbpmc{background:#fef9db}.gbpmc .gbpmtc{padding:10px 20px}
#gbpm{border:0;*border-collapse:collapse;border-spacing:0;margin:
0;white-space:normal}#gbpm .gbpmtc{border-top:none;color:#000 !
important;font:11px Arial,sans-serif}#gbpms{*white-
space:nowrap}.gbpms2{font-weight:bold;white-space:nowrap}
#gbmpal{*border-collapse:collapse;border-spacing:0;border:0;margin:
0;white-space:nowrap;width:100%}.gbmpala,.gbmpalb{font:13px
Arial,sans-serif;line-height:27px;padding:10px 20px 0;white-
space:nowrap}.gbmpala{padding-left:0;text-align:left}.gbmpalb{padding-
right:0;text-align:right}#gbmpasb .gbps{color:#000}#gbmpal
.gbqfbb{margin:0 20px}.gbp0 .gbps{*display:inline}a.gbiba{margin:8px
20px 10px}.gbmpiaw{display:inline-block;padding-right:10px;margin-
bottom:6px;margin-top:
10px}.gbxv{visibility:hidden}.gbmpiaa{display:block;margin-top:
10px}.gbmpia{border:none;display:block;height:48px;width:
48px}.gbmpnw{display:inline-block;height:auto;margin:10px 0;vertical-
align:top}
.gbqfb,.gbqfba,.gbqfbb{-moz-border-radius:2px;-webkit-border-radius:
2px;border-radius:2px;cursor:default !important;display:inline-
block;font-weight:bold;height:29px;line-height:29px;min-width:
54px;*min-width:70px;padding:0 8px;text-align:center;text-
decoration:none !important;-moz-user-select:none;-webkit-user-
select:none}.gbqfb:focus,.gbqfba:focus,.gbqfbb:focus{border:1px solid

```



```

#4d90fe;-moz-box-shadow:inset 0 0 0 1px rgba(255, 255, 255, 0.5);-
webkit-box-shadow:inset 0 0 0 1px rgba(255, 255, 255, 0.5);box-
shadow:inset 0 0 0 1px rgba(255, 255, 255, 0.5);outline:none}.gbqfb-
hvr:focus,.gbqfba-hvr:focus,.gbqfbb-hvr:focus{-webkit-box-shadow:inset
0 0 0 1px #fff,0 1px 1px rgba(0,0,0,.1);-moz-box-shadow:inset 0 0 0
1px #fff,0 1px 1px rgba(0,0,0,.1);box-shadow:inset 0 0 0 1px #fff,0
1px 1px rgba(0,0,0,.1)}.gbqfb-no-focus:focus{border:1px solid
#3079ed;-moz-box-shadow:none;-webkit-box-shadow:none;box-
shadow:none}.gbqfb-hvr,.gbqfba-hvr,.gbqfbb-hvr{-webkit-box-shadow:0
1px 1px rgba(0,0,0,.1);-moz-box-shadow:0 1px 1px rgba(0,0,0,.1);box-
shadow:0 1px 1px rgba(0,0,0,.1)}.gbqfb::-moz-focus-inner,.gbqfba::-
moz-focus-inner,.gbqfbb::-moz-focus-inner{border:
0}.gbqfba,.gbqfbb{border:1px solid #dcdcdc;border-
color:rgba(0,0,0,.1);color:#444 !important;font-size:
11px}.gbqfb{background-color:#4d90fe;background-image:-webkit-
gradient(linear,left top,left
bottom,from(#4d90fe),to(#4787ed));background-image:-webkit-linear-
gradient(top,#4d90fe,#4787ed);background-image:-moz-linear-
gradient(top,#4d90fe,#4787ed);background-image:-ms-linear-
gradient(top,#4d90fe,#4787ed);background-image:-o-linear-
gradient(top,#4d90fe,#4787ed);background-image:linear-
gradient(top,#4d90fe,#4787ed);filter:progid:DXImageTransform.Microsoft
.gradient(startColorStr='#4d90fe',EndColorStr='#4787ed');border:1px
solid #3079ed;color:#fff!important;margin:0 0}.gbqfb-hvr{border-
color:#2f5bb7}.gbqfb-hvr:focus{border-color:#2f5bb7}.gbqfb-hvr,.gbqfb-
hvr:focus{background-color:#357ae8;background-image:-webkit-
gradient(linear,left top,left
bottom,from(#4d90fe),to(#357ae8));background-image:-webkit-linear-
gradient(top,#4d90fe,#357ae8);background-image:-moz-linear-
gradient(top,#4d90fe,#357ae8);background-image:-ms-linear-
gradient(top,#4d90fe,#357ae8);background-image:-o-linear-
gradient(top,#4d90fe,#357ae8);background-image:linear-
gradient(top,#4d90fe,#357ae8)}.gbqfb:active{background-color:inherit;-
webkit-box-shadow:inset 0 1px 2px rgba(0, 0, 0, 0.3);-moz-box-
shadow:inset 0 1px 2px rgba(0, 0, 0, 0.3);box-shadow:inset 0 1px 2px
rgba(0, 0, 0, 0.3)}.gbqfba{background-color:#f5f5f5;background-image:-
webkit-gradient(linear,left top,left
bottom,from(#f5f5f5),to(#f1f1f1));background-image:-webkit-linear-
gradient(top,#f5f5f5,#f1f1f1);background-image:-moz-linear-
gradient(top,#f5f5f5,#f1f1f1);background-image:-ms-linear-
gradient(top,#f5f5f5,#f1f1f1);background-image:-o-linear-
gradient(top,#f5f5f5,#f1f1f1);background-image:linear-
gradient(top,#f5f5f5,#f1f1f1);filter:progid:DXImageTransform.Microsoft
.gradient(startColorStr='#f5f5f5',EndColorStr='#f1f1f1')}.gbqfba-
hvr,.gbqfba-hvr:active{background-color:#f8f8f8;background-image:-
webkit-gradient(linear,left top,left
bottom,from(#f8f8f8),to(#f1f1f1));background-image:-webkit-linear-
gradient(top,#f8f8f8,#f1f1f1);background-image:-moz-linear-
gradient(top,#f8f8f8,#f1f1f1);background-image:-ms-linear-
gradient(top,#f8f8f8,#f1f1f1);background-image:-o-linear-
gradient(top,#f8f8f8,#f1f1f1);background-image:linear-
gradient(top,#f8f8f8,#f1f1f1);filter:progid:DXImageTransform.Microsoft
.gradient(startColorStr='#f8f8f8',EndColorStr='#f1f1f1')}.gbqfbb{backg
round-color:#fff;background-image:-webkit-gradient(linear,left
top,left bottom,from(#fff),to(#fbfbfb));background-image:-webkit-
linear-gradient(top,#fff,#fbfbfb);background-image:-moz-linear-
gradient(top,#fff,#fbfbfb);background-image:-ms-linear-

```

```
gradient(top,#fff,#fbfbfb);background-image:-o-linear-  
gradient(top,#fff,#fbfbfb);background-image:linear-  
gradient(top,#fff,#fbfbfb);filter:progid:DXImageTransform.Microsoft.gr  
radient(startColorStr='#ffffff',EndColorStr='#fbfbfb')}.gbqfbb-  
hvr,.gbqfbb-hvr:active{background-color:#fff;background-image:-webkit-  
gradient(linear,left top,left  
bottom,from(#fff),to(#f8f8f8));background-image:-webkit-linear-  
gradient(top,#fff,#f8f8f8);background-image:-moz-linear-  
gradient(top,#fff,#f8f8f8);background-image:-ms-linear-  
gradient(top,#fff,#f8f8f8);background-image:-o-linear-  
gradient(top,#fff,#f8f8f8);background-image:linear-  
gradient(top,#fff,#f8f8f8);filter:progid:DXImageTransform.Microsoft.gr  
radient(startColorStr='#ffffff',EndColorStr='#f8f8f8'
```