

Application Layer Protocols Lab

Instructions

The purpose of this worksheet is to get you thinking and talking about this module's content. All exercises in this worksheet are to be done collaboratively and synchronously: no divide-and-conquer and no free-loaders.

Tips

The last few questions of this worksheet involve hands-on lab work. These tips are relevant to those questions.

- The three best sources of information as you complete these three problems are:
 1. The examples on the “RFCs and Example Sessions” page on Canvas.
 2. The RFCs on the “RFCs and Example Sessions” page on Canvas.
 3. Searching the web.
- Netcat is a network utility that allows you to send and receive TCP or UDP traffic (among other things). It has a ton of functionality, of which we'll only need to scratch the surface for this worksheet.

- To connect to a listening socket (e.g., bound to port 80) on `www.google.com`, run:

```
1 nc www.google.com 80
2
```

- To open up a listening socket (e.g., on port 36799), run:

```
1 nc -l 36799
2
```

- Once connected, anything that is received on the socket will be printed to the screen. Whatever you type will be sent over the socket when you hit enter.
- HTTP question hint: Sometimes HTTP servers are picky about newlines being `\r\n` instead of `\n`. You can pass the `-C` flag to `nc` to change this newline behavior:

```
1 nc -C www.google.com 80
2
```

- FTP question hint: the format for sending IP addresses and ports can be found in the example session doc for FTP.

Problems

Q1: FTP: (keep and paste a transcript of your shell sessions into your submission to demonstrate that you completed this exercise. Complete these steps: *I was unable to replicate these steps both on my home setup and while SSH'ing into the CS labs.*

- Use `netcat` (not the `ftp` command) to establish a TCP connection with `archive.ubuntu.com` on the standard FTP control connection port.
- Log in with username `anonymous` and password `guest`.
- Change directory into the `ubuntu` subdirectory.
- List the directory contents using passive mode (note: this will require making a new `netcat` connection).
- Change directory into subdirectory `distst/trusty`.
- Retrieve the `Release.gpg` file using passive mode (note: this will require making a new `netcat` connection).
- I mentioned in class that FTP is insecure, but did not tell you why. Do some searching for information and explain in a sentence or two why FTP is insecure. *All data is transmitted in plaintext, including usernames and passwords.*

```

220 FTP server (vsftpd)
USER anonymous
331 Please specify the password.
PASS guest
230 Login successful.
PORT 76,147,184,112,48,57
500 Illegal PORT command.
^[A^[[A^[[B
500 Unknown command.
PORT 76,147,184,112,48,57
500 Illegal PORT command.
PORT 76,147,184,112,48,57
500 Illegal PORT command.
help
214-The following commands are recognized.
ABOR ACCT ALLO APPE CDUP CWD DELE EPRT EPSV FEAT HELP LIST MDTM MKD
MODE NLST NOOP OPTS PASS PASV PORT PWD QUIT REIN REST RETR RMD RNFR
RNT0 SITE SIZE SMNT STAT STOR STOU STRU SYST TYPE USER XCUP XCWD XMKD
XPWD XRMD
214 Help OK.
MODE
504 Bad MODE command.
mode
504 Bad MODE command.
list
425 Use PORT or PASV first.
pasv
227 Entering Passive Mode (0,0,0,0,32,213).
LIST
LIST
HELP
425 Failed to establish connection.
425 Use PORT or PASV first.
214-The following commands are recognized.
ABOR ACCT ALLO APPE CDUP CWD DELE EPRT EPSV FEAT HELP LIST MDTM MKD
MODE NLST NOOP OPTS PASS PASV PORT PWD QUIT REIN REST RETR RMD RNFR
RNT0 SITE SIZE SMNT STAT STOR STOU STRU SYST TYPE USER XCUP XCWD XMKD
XPWD XRMD
214 Help OK.
PASV
227 Entering Passive Mode (0,0,0,0,80,24).
LIST
425 Failed to establish connection.

```

Q2: HTTP: (keep and paste a transcript of your shell sessions into the answer spot below to demonstrate that you completed this exercise).

- Use `netcat` to establish a TCP connection with port 80 on my (perpetually unfinished) website `www.logan-sizemore.com`.

- (i) What is the Content-Length? 2735
- (ii) What is the Content-Type? *text/html; charset=utf-8*
- (b) Make a conditional GET on that same page, only if it was modified since some arbitrary time this morning. What response do you receive? *See transcript (304 Not Modified)*
- (c) GET the following svg file: `www.logan-sizemore.com/projects_logos/sklogo_mono.svg`:
 - (i) What is the Content-Length? 74477
 - (ii) What is the Content-Type? *image/svg+xml*
- (d) Try to GET a file that doesn't exist. What message is returned? *404 Not Found*

```

iboaz@ms-debian:~$ nc -C www.logan-sizemore.com 80
GET / HTTP/1.1
Host: www.logan-sizemore.com

HTTP/1.1 200 OK
Connection: keep-alive
Content-Length: 2735
Server: GitHub.com
Content-Type: text/html; charset=utf-8
Last-Modified: Sun, 22 Oct 2023 04:53:19 GMT
Access-Control-Allow-Origin: *
ETag: "6534aabbf-aaf"
expires: Mon, 02 Dec 2024 06:53:44 GMT
Cache-Control: max-age=600
x-proxy-cache: MISS
X-GitHub-Request-Id: D2A0:9ED5E:104AB61:10D14AB:674D571F
Accept-Ranges: bytes
Age: 0
Date: Mon, 02 Dec 2024 06:43:44 GMT
Via: 1.1 varnish
X-Served-By: cache-bfi-krnt7300055-BFI
X-Cache: MISS
X-Cache-Hits: 0
X-Timer: S1733121824.151195,VS0,VE69
Vary: Accept-Encoding
X-Fastly-Request-ID: af793ec42f011cb06d098bef2eae2e53759cf3b9

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <link rel="stylesheet" href="styles.css">
  <link rel="stylesheet" href="normalize.css" />
  <link href="https://fonts.googleapis.com/css2?family=Libre+Baskerville:ital,wght@0,400;0,700;1,400&display=swap" rel="stylesheet">
  <title>Header Mockup</title>
</head>
<body>
  <header>
    <nav class="nav">
      <h1 class="nav__title">Logan Sizemore</h1>
      <ul class="nav__list">
        <li class="nav__item"><a href="#">About Me</a></li>
        <li class="nav__item"><a href="#">Research</a></li>
        <li class="nav__item"><a href="#">Projects</a></li>
        <li class="nav__item"><a href="#">Resume</a></li>
      </ul>
    </nav>
    <div class="hero">
      <div class="hero__title-container"><h1>About Me</h1></div>
      <div class="hero__text-container"><p>
        I serve as a faculty member in the Computer Science department at Western Washington University, where I also completed m
      </p>
    </div>
    <div class="half-dome">
      <div class="half-dome__decor"></div>
    </div>
  </header>
  <section class="gallery">
    <div class="card">
      <div class="card__title-content"><h2>skeletonkey</h2></div>
      
      <div class="card__info">skeletonkey is a simple, lightweight, and flexible configuration management tool that allows you to
    </div>
    <div class="card">
      <div class="card__title-content"><h2>BOSS Net</h2></div>
      <img src="" alt="bossnet">
      <div class="card__info">Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labor
    </div>
    <div class="card">
      <div class="card__title-content"><h2>APOGEE Net 3</h2></div>
      <img src="" alt="anet">
      <div class="card__info">Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labor
    </div>
  </section>
</body>
</html>

```

```
GET / HTTP/1.1
Host: www.logan-sizemore.com
If-Modified-Since: Fri, 01 Dec 2024 08:00:00 GMT
```

```
HTTP/1.1 304 Not Modified
Connection: keep-alive
Date: Mon, 02 Dec 2024 06:44:47 GMT
Via: 1.1 varnish
Cache-Control: max-age=600
ETag: "6534aabf-aaf"
Expires: Mon, 02 Dec 2024 06:53:44 GMT
Age: 63
X-Served-By: cache-bfi-krnt7300055-BFI
X-Cache: HIT
X-Cache-Hits: 1
X-Timer: S1733121888.507160,VS0,VE2
Vary: Accept-Encoding
X-Fastly-Request-ID: a617e6d8120abaf86ab5270457f9f9fba67a6361
GET /projects_logos/sklogo_mono.svg HTTP/1.1
Host: www.logan-sizemore.com
```

```
HTTP/1.1 200 OK
Connection: keep-alive
Content-Length: 74477
Server: GitHub.com
Content-Type: image/svg+xml
Last-Modified: Sun, 22 Oct 2023 04:53:19 GMT
Access-Control-Allow-Origin: *
ETag: "6534aabf-122ed"
expires: Mon, 02 Dec 2024 06:55:33 GMT
Cache-Control: max-age=600
x-proxy-cache: MISS
X-GitHub-Request-Id: C724:47307:15B33E7:166DBB4:674D578D
Accept-Ranges: bytes
Age: 0
Date: Mon, 02 Dec 2024 06:45:33 GMT
Via: 1.1 varnish
X-Served-By: cache-bfi-krnt7300055-BFI
X-Cache: MISS
X-Cache-Hits: 0
X-Timer: S1733121934.689342,VS0,VE72
Vary: Accept-Encoding
X-Fastly-Request-ID: 8b6874ac55cf86b8d5f22f09469e524e7fb2ae82
```

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!-- Created with Inkscape (http://www.inkscape.org/) -->
```

```
<svg
  version="1.1"
  id="svg1"
  width="1024"
  height="1024"
  viewBox="0 0 1024 1024"
  sodipodi:docname="sklogo_mono.svg"
  inkscape:version="1.3 (0e150ed6c4, 2023-07-21)"
  xml:space="preserve"
  xmlns:inkscape="http://www.inkscape.org/namespaces/inkscape"
  xmlns:sodipodi="http://sodipodi.sourceforge.net/DTD/sodipodi-0.dtd"
  xmlns="http://www.w3.org/2000/svg"
  xmlns:svg="http://www.w3.org/2000/svg"><defs
  id="defs1" /><sodipodi:namedview
  id="namedview1"
  pagecolor="#ffffff"
  bordercolor="#000000"
  borderopacity="0.25"
  inkscape:showpageshadow="2"
  inkscape:pageopacity="0.0"
  inkscape:pagecheckerboard="0"
  inkscape:deskcolor="#d1d1d1"
  inkscape:zoom="0.50000001"
  inkscape:cx="580.99998"
  inkscape:cy="486.99999"
  inkscape:window-width="1920"
  inkscape:window-height="1012"
  inkscape:window-x="0"
  inkscape:window-y="34"
  inkscape:window-maximized="1"
  inkscape:current-layer="g1"
  inkscape:lockguides="true" /><g
  inkscape:groupmode="layer"
  inkscape:label="Image"
  id="g1"><path
  id="rect13-8"
  style="display:inline;fill:#000000;fill-opacity:1;stroke-width:1.08164"
  d="m 598.78477,361.84463 c -5.12537,-5.55852 -13.84246,-5.85801 -19.47023,-0.66892 -5.28509,4.87354 -5.96402,12.85293 -1.78143,19.47023"
  id="path3"
  style="display:inline;fill:#000000;fill-opacity:1"
  d="m 544.63347,418.65698 c -1.14236,1.06137 -480.807232,450.21929 -480.807232,450.21929 0,0 -3.621914,47.10722 -4.319478,56.11111"
  sodipodi:nodetypes="cc"
  id="path14"
  style="display:inline;fill:#000000;fill-opacity:1;stroke:none;stroke-opacity:1"
  d="M 783.35352 59.789062 C 717.5678 58.628939 658.75738 85.778291 630.33008 110.38086 C 579.39325 154.46442 557.79742 238.6002 557.79742 238.6002"
  id="path16-4-3-2-3-1-0-1-1-1-4-2-7-0"
  style="display:inline;fill:#000000;fill-opacity:1;stroke-width:0.835561"
  d="m 392.7319,712.24627 -4.58077,4.15692 25.59762,27.7643 c -1.34306,0.26444 -2.63615,0.73855 -3.83185,1.40493 1 -24.55703,-26.55703,-26.55703"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
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  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.68992,85.20867 c -0.46605,0.43784 -0.48871,-0.46605 -0.46605,0.43784 15.18662,0 24.13993,-6.57331 24.13993,-17.67994 0,-20.62661 -31.16657,-13.59996 -31.16657,-22.8932"
  id="rect885"
  style="fill:#000000;fill-opacity:1;stroke:none;stroke-width:0.922526;stroke-opacity:1"
  d="m 514.02761,402.8678 c -0.43784,-0.46605 -1.16562,-0.48871 -1.63163,-0.0508 1 -90.6
```

```

id="text886"
style="font-weight:bold;font-size:113.333px;line-height:0;font-family:Cantarell;-inkscape-font-specification:'Cantarell Bold';
transform="rotate(-43.266256)"
aria-label="skeletonkey" /></g></svg>
GET /foobar.barfoo HTTP/1.1
Host: www.logan-sizemore.com

HTTP/1.1 404 Not Found
Connection: keep-alive
Content-Length: 9379
Server: GitHub.com
Content-Type: text/html; charset=utf-8
Access-Control-Allow-Origin: *
ETag: "64d39a40-24a3"
Content-Security-Policy: default-src 'none'; style-src 'unsafe-inline'; img-src data:; connect-src 'self'
x-proxy-cache: MISS
X-GitHub-Request-Id: E79D:97093:238F0B6:24C5A1A:674D57F2
Accept-Ranges: bytes
Age: 0
Date: Mon, 02 Dec 2024 06:47:22 GMT
Via: 1.1 varnish
X-Served-By: cache-bfi-krnt7300055-BFI
X-Cache: MISS
X-Cache-Hits: 0
X-Timer: S1733122043.713403,VS0,VE65
Vary: Accept-Encoding
X-Fastly-Request-ID: 86e32b3d0a3f44aeb675a6692aab75a74b094d4

<!DOCTYPE html>
<html>
  <head>
    <meta http-equiv="Content-type" content="text/html; charset=utf-8">
    <meta http-equiv="Content-Security-Policy" content="default-src 'none'; style-src 'unsafe-inline'; img-src data:; connect-src 'self'>
    <title>Page not found &middot; GitHub Pages</title>
    <style type="text/css" media="screen">
      body {
        background-color: #f1f1f1;
        margin: 0;
        font-family: "Helvetica Neue", Helvetica, Arial, sans-serif;
      }

      .container { margin: 50px auto 40px auto; width: 600px; text-align: center; }

      a { color: #4183c4; text-decoration: none; }
      a:hover { text-decoration: underline; }

      h1 { width: 800px; position: relative; left: -100px; letter-spacing: -1px; line-height: 60px; font-size: 60px; font-weight: 100; }
      p { color: rgba(0, 0, 0, 0.5); margin: 20px 0; line-height: 1.6; }

      ul { list-style: none; margin: 25px 0; padding: 0; }
      li { display: table-cell; font-weight: bold; width: 1%; }

      .logo { display: inline-block; margin-top: 35px; }
      .logo-img-2x { display: none; }
      @media
      only screen and (-webkit-min-device-pixel-ratio: 2),
      only screen and ( min--moz-device-pixel-ratio: 2),
      only screen and ( -o-min-device-pixel-ratio: 2/1),
      only screen and ( min-device-pixel-ratio: 2),
      only screen and ( min-resolution: 192dpi),
      only screen and ( min-resolution: 2dppx) {
        .logo-img-1x { display: none; }
        .logo-img-2x { display: inline-block; }
      }

      #suggestions {
        margin-top: 35px;
        color: #ccc;
      }
      #suggestions a {
        color: #666666;
        font-weight: 200;
        font-size: 14px;
        margin: 0 10px;
      }
    </style>
  </head>
  <body>

    <div class="container">

      <h1>404</h1>
      <p><strong>File not found</strong></p>

      <p>
        The site configured at this address does not
        contain the requested file.
      </p>

      <p>
        If this is your site, make sure that the filename case matches the URL
        as well as any file permissions.<br>
        For root URLs (like <code>http://example.com/</code>) you must provide an
        <code>index.html</code> file.
      </p>

      <p>
        <a href="https://help.github.com/pages/">Read the full documentation</a>
      </p>
    </div>
  </body>
</html>

```

```
    for more information about using <strong>GitHub Pages</strong>.
  </p>

  <div id="suggestions">
    <a href="https://githubstatus.com">GitHub Status</a> &mdash;
    <a href="https://twitter.com/githubstatus">@githubstatus</a>
  </div>

  <a href="/" class="logo logo-img-1x">
    
    <img width="32" height="32" title="" alt="" src="
  </a>
</div>
</body>
</html>
```