

```
<link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/primer-primitives-dc7ca6859c
<link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/primer-f96b923db733.css" />
<link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/global-b4711dbbb32e.css" />
<link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/github-b3c70377846b.css" />
```

```
<meta name="hovercard-subject-tag" content="repository:83222441" data-turbo-transient>
```

```
<meta name="google-site-verification" content="Apib7-x98H0j5cPqHwSMm6dNU4GmODRoqxLiDzdx9I">
```

```
<meta name="user-login" content="">

<meta name="viewport" content="width=device-width">

<meta name="description" content="Learn how to design large-scale systems. Prep for the system design interview. Includes Anki fl

<link rel="search" type="application/opensearchdescription+xml" href="/opensearch.xml" title="GitHub">

<link rel="fluid-icon" href="https://github.com/fluidicon.png" title="GitHub">
<meta property="fb:app_id" content="1401488693436528">
<meta name="apple-itunes-app" content="app-id=1477376905, app-argument=https://github.com/donnemartin/system-design-primer/blob/mast

<meta name="twitter:image" content="https://opengraph.githubassets.com/e3b3a94ae5a1bfd65c8d8344d4046e24e1413474e54b6922643e2ad1eef
```

```
<meta name="hostname" content="github.com">

<meta name="expected-hostname" content="github.com">
```

```
<meta name="turbo-cache-control" content="no-cache" data-turbo-transient>

<meta data-hydrostats="publish">
```

```
<meta name="turbo-body-classes" content="logged-out env-production page-responsive">
```

```
<div class="position-relative header-wrapper js-header-wrapper ">
  <a href="#start-of-content" data-skip-target-assigned="false" class="px-2 py-4 color-bg-accent-emphasis color-fg-on-emphasis show-
  <span data-view-component="true" class="progress-pjax-loader Progress position-fixed width-full">
<span style="width: 0%;" data-view-component="true" class="Progress-item progress-pjax-loader-bar left-0 top-0 color-bg-accent-empha
```

```
<react-partial partial-name="keyboard-shortcuts-dialog" data-ssr="false" data-attempted-ssr="false" data-react-profiling="false"
```

Navigation Menu

Toggle navigation



```
<a class="mr-lg-3 color-fg-inherit flex-order-2 js-prevent-focus-on-mobile-nav"
  href="/"
  aria-label="Homepage"
  data-analytics-event="{"category":"Marketing nav";"action":"click to go to homepage";"
<svg height="32" aria-hidden="true" viewBox="0 0 24 24" version="1.1" width="32" data-view-component="true" class="octicon octicon-home">
<path d="M12 1C5.923 1 1 5.923 1 12c0 4.867 3.149 8.979 7.521 10.436 5.5096.756-.233.756-.522 0-.262-.013-1.128-.013-2.049-2.764 5.09
```

```
<div class="d-flex flex-1 flex-order-2 text-right d-lg-none gap-2 flex-justify-end">
  <a
    href="/login?return_to=https%3A%2F%2Fgithub.com%2Fdonnemartin%2Fsystem-design-primer%2Fblob%2Fmaster%2FREADME.md"
    class="HeaderMenu-link HeaderMenu-button d-inline-flex f5 no-underline border color-border-default rounded-2 px-2 py-1 color-
    data-hydro-click="{&quot;event_type&quot;:&quot;authentication.click&quot;,&quot;payload&quot;:{&quot;location_in_page&quot;:
    data-analytics-event="{&quot;category&quot;:&quot;Marketing nav&quot;,&quot;action&quot;:&quot;click to Sign in&quot;,&quot;
  >
  Sign in
</a>
  <div class="AppHeader-appearanceSettings">
<react-partial-anchor>
  <button data-target="react-partial-anchor.anchor" id="icon-button-9a880040-7bf0-4738-bc40-e80801c0a86b" aria-labelledby="tooltip-b
<path d="M15 2.75a.75.75 0 0 1-.75.75h-4a.75.75 0 0 1 0-1.5h4a.75.75 0 0 1 .75.75zm-8.5.75v1.25a.75.75 0 0 0 1.5 0v-4a.75.75 0 0 0-1
```

```
<template data-target="react-partial-anchor.template">
  <link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/primer-react.ccd7aec5fe9
```

```
<react-partial partial-name="appearance-settings" data-ssr="false" data-attempted-ssr="false" data-react-profiling="false"
```

```
</template>
</react-partial-anchor>
```

```
</div>
</div>

<div class="HeaderMenu js-header-menu height-fit position-lg-relative d-lg-flex flex-column flex-auto top-0">
  <div class="HeaderMenu-wrapper d-flex flex-column flex-self-start flex-lg-row flex-auto rounded rounded-lg-0">
    <nav class="HeaderMenu-nav" aria-label="Global">
      <ul class="d-lg-flex list-style-none">

        <li class="HeaderMenu-item position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-1">
          <button type="button" class="HeaderMenu-link border-0 width-full width-lg-auto px-0 px-lg-2 py-lg-2 no-wrap d-flex flex-items-center align-items-center">Platform
            <svg opacity="0.5" aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="me-2">
              <path d="M12.78 5.22a.749.749 0 0 1 0 1.06l-4.25 4.25a.749.749 0 0 1-1.06 0L3.22 6.28a.749.749 0 1 1 1.06-1.06L8.939 13.72-3.719a.749.749 0 0 1 0 1.06l4.25 4.25a.749.749 0 0 1 1.06 0L12.78 5.22z">
```

```
<div class="HeaderMenu-dropdown dropdown-menu rounded m-0 p-0 pt-2 pt-lg-4 position-relative position-lg-absolute left-0 left-lg-n
    <div class="HeaderMenu-column pl-lg-4 px-lg-4">
        <div class="">
            <ul class="list-style-none f5" >
                <li>
```



GitHub Copilot

Write better code with AI

(<https://github.com/features/copilot>)

(<https://github.com/features/copilot>)



[GitHub Spark New](#)
[Build and deploy intelligent apps](#)
(<https://github.com/features/spark>)
(<https://github.com/features/spark>)



[GitHub Models New](#)
[Manage and compare prompts](#)
(<https://github.com/features/models>)
(<https://github.com/features/models>)



[GitHub Advanced Security](#)
[Find and fix vulnerabilities](#)
(<https://github.com/security/advanced-security>)
(<https://github.com/security/advanced-security>)



[Actions](#)
[Automate any workflow](#)
(<https://github.com/features/actions>)
(<https://github.com/features/actions>)

```
</ul>
</div>
</div>
<div class="HeaderMenu-column pl-lg-4 px-lg-4 pb-3 pb-lg-0">
  <div class="border-bottom border-lg-bottom-0 pb-3">

    <ul class="list-style-none f5" >
      <li>
```



[Codespaces](#)
[Instant dev environments](#)
(<https://github.com/features/codespaces>)
(<https://github.com/features/codespaces>)



[Issues](#)
[Plan and track work](#)
(<https://github.com/features/issues>)
(<https://github.com/features/issues>)



Code Review

Manage code changes

<https://github.com/features/code-review>

<https://github.com/features/code-review>



Discussions

Collaborate outside of code

<https://github.com/features/discussions>

<https://github.com/features/discussions>



Code Search

Find more, search less

<https://github.com/features/code-search>

<https://github.com/features/code-search>

```
</ul>
</div>
</div>
<div class="HeaderMenu-column pl-lg-4 border-lg-left pr-lg-7">
  <div class="border-bottom border-lg-bottom-0 border-bottom-0">
    <span class="d-block h4 color-fg-default my-1" id="platform-explore-heading">Explore</span>

    <ul class="list-style-none f5" aria-labelledby="platform-explore-heading">
      <li>
```

Why GitHub (<https://github.com/why-github>)

<https://github.com/why-github>

All features (<https://github.com/features>)

<https://github.com/features>

Documentation

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-link">
  <path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 0-.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1 0 1.5" />
```

<https://docs.github.com>

GitHub Skills

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-link">
  <path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 0-.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1 0 1.5" />
```

<https://skills.github.com>

[Blog](#)

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-l
<path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 0-.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1
```

(<https://github.blog>).

```
<li class="HeaderMenu-item position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-1">
<button type="button" class="HeaderMenu-link border-0 width-full width-lg-auto px-0 px-lg-2 py-lg-2 no-wrap d-flex flex-items-center">
  Solutions
  <svg opacity="0.5" aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="
<path d="M12.78 5.22a.749.749 0 0 1 0 1.061-4.25 4.25a.749.749 0 0 1-1.06 0L3.22 6.28a.749.749 0 1 1 1.06-1.06L8.93913.72-3.719a.7
```

```
<div class="HeaderMenu-dropdown dropdown-menu rounded m-0 p-0 pt-2 pt-lg-4 position-relative position-lg-absolute left-0 left-lg-n-1" style="background-color: #f8d7da; border: 1px solid #f5c6cb; border-radius: 5px; padding: 10px 15px 10px 0; width: 100%; z-index: 1000;">
  <div class="HeaderMenu-column pl-lg-4 px-lg-4 pb-3 pb-lg-0">
    <div class="border-bottom border-lg-bottom-0 mb-3 pb-3">
      <span class="d-block h4 color-fg-default my-1" id="solutions-by-company-size-heading">By company size</span>
      <ul class="list-style-none f5" aria-labelledby="solutions-by-company-size-heading">
        <li>
```

Enterprises (<https://github.com/enterprise>).

(<https://github.com/enterprise>)

Small and medium teams (<https://github.com/team>)

(<https://github.com/team>).

Startups (<https://github.com/enterprise/startups>)

(<https://github.com/enterprise/startups>).

[Nonprofits \(/solutions/industry/nonprofits\)](#)

(/solutions/industry/nonprofits)

```

        </ul>
    </div>
    <div class="border-bottom border-lg-bottom-0 pb-3">
        <span class="d-block h4 color-fg-default my-1" id="solutions-by-use-case-heading">By use case</span>

        <ul class="list-style-none f5" aria-labelledby="solutions-by-use-case-heading">
            <li>

```

[DevSecOps \(/solutions/use-case/devsecops\)](#)

```
((solutions/use-case/devsecons)
```


[DevOps \(/solutions/use-case/devops\)](/solutions/use-case/devops)
[\(/solutions/use-case/devops\)](/solutions/use-case/devops)

[CI/CD \(/solutions/use-case/ci-cd\)](/solutions/use-case/ci-cd)
[\(/solutions/use-case/ci-cd\)](/solutions/use-case/ci-cd)

[View all use cases \(/solutions/use-case\)](/solutions/use-case)
[\(/solutions/use-case\)](/solutions/use-case)

```
</ul>
</div>
</div>
<div class="HeaderMenu-column pl-lg-4 border-lg-left pr-lg-7">
  <div class="border-bottom border-lg-bottom-0 pb-3 pb-lg-0">
    <span class="d-block h4 color-fg-default my-1" id="solutions-by-industry-heading">By industry</span>

    <ul class="list-style-none f5" aria-labelledby="solutions-by-industry-heading">
      <li>
```

[Healthcare \(/solutions/industry/healthcare\)](/solutions/industry/healthcare)
[\(/solutions/industry/healthcare\)](/solutions/industry/healthcare)

[Financial services \(/solutions/industry/financial-services\)](/solutions/industry/financial-services)
[\(/solutions/industry/financial-services\)](/solutions/industry/financial-services)

[Manufacturing \(/solutions/industry/manufacturing\)](/solutions/industry/manufacturing)
[\(/solutions/industry/manufacturing\)](/solutions/industry/manufacturing)

[Government \(/solutions/industry/government\)](/solutions/industry/government)
[\(/solutions/industry/government\)](/solutions/industry/government)

[View all industries \(/solutions/industry\)](/solutions/industry)
[\(/solutions/industry\)](/solutions/industry)

```
</ul>
</div>
</div>

<div class="HeaderMenu-trailing-link rounded-bottom-2 flex-shrink-0 mt-lg-4 px-lg-4 py-4 py-lg-3 f5 text-semibold">
  <a href="/solutions">
    View all solutions
    <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon">
      <path d="M6.22 3.22a.75.75 0 0 1 1.06 0 14.25 4.25a.75.75 0 0 1 0 1.06l-4.25 4.25a.75.75 0 0 1-1.04-.018.751.751 0 0 1-.018-.042L
```

```
<li class="HeaderMenuItem position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-1">
  <button type="button" class="HeaderMenu-link border-0 width-full width-lg-auto px-0 px-lg-2 py-lg-2 no-wrap d-flex flex-items-center">
    Resources
    <svg opacity="0.5" aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="
  <path d="M12.78 5.22a.749.749 0 0 1 0 1.061-4.25 4.25a.749.749 0 0 1-1.06 0L3.22 6.28a.749.749 0 0 1 1.06-1.06L8 8.939l3.72-3.719a.7
```

```
<div class="HeaderMenu-dropdown dropdown-menu rounded m-0 p-0 pt-2 pt-lg-4 position-relative position-lg-absolute left-0 left-lg-n1" style="background-color: #f8f9fa; border: 1px solid #dee2e6; padding: 5px 0; width: 100%; z-index: 1000;">
  <div class="HeaderMenu-column pl-lg-4 px-lg-4 pb-3 pb-lg-0">
    <div class="border-bottom border-lg-bottom-0 pb-3">
      <span class="d-block h4 color-fg-default my-1" id="resources-topics-heading">Topics</span>
    </div>
    <ul class="list-style-none f5" aria-labelledby="resources-topics-heading">
      <li>
```

[AI \(/resources/articles/ai\)](#).

(/resources/articles/ai).

-

DevOps (/resources/articles/devops).

(./resources/articles/devops).

-

[Security \(/resources/articles/security\)](/resources/articles/security)

(/resources/articles/security.)

-

Software Development (/resources/articles/software-development)

[./resources/articles/software-development](/resources/articles/software-development).

-

[View all \(/resources/articles\)](/resources/articles).

([/resources/articles](#)).

```

        </ul>
    </div>
</div>
<div class="HeaderMenu-column pl-lg-4 border-lg-left pr-lg-7">
    <div class="border-bottom border-lg-bottom-0 border-bottom-0">
        <span class="d-block h4 color-fg-default my-1" id="resources-explore-heading">Explore</span>

        <ul class="list-style-none f5" aria-labelledby="resources-explore-heading">
            <li>

```

Learning Pathways

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-l
<path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 -0.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1
```

(<https://resources.github.com/learn/pathways>).

-

Events & Webinars

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-link">
<path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 0-.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1 0 1.5" data-bbox="3.75 2 12.5 12.5"/>
```

(<https://resources.github.com>).

[Ebooks & Whitepapers \(https://github.com/resources/whitepapers\)](https://github.com/resources/whitepapers)

(<https://github.com/resources/whitepapers>).

[Customer Stories \(https://github.com/customer-stories\)](https://github.com/customer-stories)

(<https://github.com/customer-stories>).

[Partners](#)

```
<svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-link">
<path d="M3.75 2h3.5a.75.75 0 0 1 0 1.5h-3.5a.25.25 0 0 0-.25.25v8.5c0 .138.112.25.25.25h8.5a.25.25 0 0 0 .25-.25v-3.5a.75.75 0 0 1 0 1.5" data-bbox="3.75 2 12.5 12.5"/>
```

(<https://partner.github.com>).

[Executive Insights \(https://github.com/solutions/executive-insights\)](https://github.com/solutions/executive-insights)

(<https://github.com/solutions/executive-insights>).

```
</ul>
</div>
</div>

</div>
```

```
<li class="HeaderMenu-item position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-row">
  <button type="button" class="HeaderMenu-link border-0 width-full width-lg-auto px-0 px-lg-2 py-lg-2 no-wrap d-flex flex-items-center">
    Open Source
    <svg opacity="0.5" aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon-link">
<path d="M12.78 5.22a.749.749 0 0 1 0 1.06l-4.25 4.25a.749.749 0 0 1-1.06 0L3.22 6.28a.749.749 0 1 1 1.06-1.06L8.939 13.72-3.719a.749.749 0 0 1 0 1.06" data-bbox="12.78 5.22 12.78 12.78"/>
```

```
<div class="HeaderMenu-dropdown dropdown-menu rounded m-0 p-0 pt-2 pt-lg-4 position-relative position-lg-absolute left-0 left-lg-neg-100px">
  <div class="HeaderMenu-column px-lg-4">
    <div class="border-bottom mb-3 mb-lg-3 pb-3">
      <ul class="list-style-none f5">
        <li>
```

[GitHub Sponsors](#)

[Fund open source developers](#)

([sponsors](#)).

([sponsors](#)).


```

        </ul>
    </div>
    <div class="border-bottom mb-3 mb-lg-3 pb-3">

        <ul class="list-style-none f5" >
            <li>

```

[The ReadME Project](https://github.com/readme)
[GitHub community articles](https://github.com/readme)
[\(<https://github.com/readme>\)](https://github.com/readme)
[\(<https://github.com/readme>\)](https://github.com/readme)

```
</ul>
</div>
<div class="border-bottom border-bottom-0">
  <span class="d-block h4 color-fg-default my-1" id="open-source-repositories-heading">Repositories</span>

  <ul class="list-style-none f5" aria-labelledby="open-source-repositories-heading">
    <li>
```

Topics (<https://github.com/topics>)

(<https://github.com/topics>)

Trending, (<https://github.com/trending>).

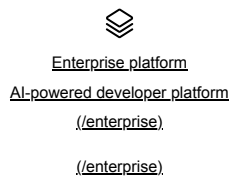
(<https://github.com/trending>).

Collections (<https://github.com/collections>).

(<https://github.com/collections>).

```
<li class="HeaderMenu-item position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-1">
  <button type="button" class="HeaderMenu-link border-0 width-full width-lg-auto px-0 px-lg-2 py-lg-2 no-wrap d-flex flex-items-center">
    Enterprise
    <svg opacity="0.5" aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="
  <path d="M12.78 5.22a.749.749 0 0 1 0 1.061-4.25 4.25a.749.749 0 0 1-1.06 0L3.22 6.28a.749.749 0 1 1 1.06-1.06L8.93913.72-3.719a.7
```

```
<div class="HeaderMenu-dropdown dropdown-menu rounded m-0 p-0 pt-2 pt-lg-4 position-relative position-lg-absolute left-0 left-lg-n-1">  
  <div class="HeaderMenu-column px-lg-4">  
    <div class="border-bottom mb-3 mb-lg-3 pb-3">  
  
      <ul class="list-style-none f5" >  
        <li>
```



```
</ul>
</div>
<div class="border-bottom border-bottom-0">
  <span class="d-block h4 color-fg-default my-1" id="enterprise-available-add-ons-heading">Available add-ons</span>

  <ul class="list-style-none f5" aria-labelledby="enterprise-available-add-ons-heading">
    <li>
```



[GitHub Advanced Security](#),
[Enterprise-grade security features](#)
(<https://github.com/security/advanced-security>)
(<https://github.com/security/advanced-security>)

```
<li>
```



[Copilot for business](#)
[Enterprise-grade AI features](#)
(</features/copilot/copilot-business>)
(</features/copilot/copilot-business>)

```
<li>
```



[Premium Support](#)
[Enterprise-grade 24/7 support](#)
(</premium-support>)
(</premium-support>)

```
</ul>
</div>
</div>

</div>
```

```
<li class="HeaderMenu-item position-relative flex-wrap flex-justify-between flex-items-center d-block d-lg-flex flex-lg-1">
  <a class="HeaderMenu-link no-underline px-0 px-lg-2 py-3 py-lg-2 d-block d-lg-inline-block" data-analytics-event="{&quot;location&quot;:&quot;Enterprise&quot;}" href="/enterprise">Enterprise</a>
```

```
</ul>
</nav>

<div class="d-flex flex-column flex-lg-row width-full flex-justify-end flex-lg-items-center text-center mt-3 mt-lg-0 text-lg-left">
```



Search or jump to...



```
<input type="hidden" name="type" class="js-site-search-type-field">
```

Search code, repositories, users, issues, pull requests...

</div>

<custom-scopes data-target="qbsearch-input.customScopesManager">

Cancel Create saved search

```
<div class="position-relative HeaderMenu-link-wrap d-lg-inline-block">
  <a
    href="/login?return_to=https%3A%2F%2Fgithub.com%2Fdonnemartin%2Fsystem-design-primer%2Fblob%2Fmaster%2FREADME.md"
    class="HeaderMenu-link HeaderMenu-link--sign-in HeaderMenu-button flex-shrink-0 no-underline d-none d-lg-inline-flex border
    style="margin-left: 12px;"
    data-hydro-click="{"event_type":"";authentication.click";,"";payload";:"";location_in_page";"";category";"";Marketing nav";,"";action";"";click to go to homepage";""
    data-analytics-event="{"category":"";Marketing nav";,"";action";"";click to go to homepage";""
  >
    Sign in
  </a>
</div>

<a href="/signup?ref_cta=Sign+up&ref_loc=header+logged+out&ref_page=%2F%3Cuser-name%3E%2F%3Crepo-name%3E%2Fblob%2F
  class="HeaderMenu-link HeaderMenu-link--sign-up HeaderMenu-button flex-shrink-0 d-flex d-lg-inline-flex no-underline border
  data-hydro-click="{"event_type":"";authentication.click";,"";payload";:"";location_in_page";"";category";"";Sign up";,"";action";"";click to sign up for account";""
  data-analytics-event="{"category":"";Sign up";,"";action";"";click to sign up for account";""
  >
    Sign up
  </a>

  <div class="AppHeader-appearanceSettings">
<react-partial-anchor>
  <button data-target="react-partial-anchor.anchor" id="icon-button-199a0661-4025-433b-bd27-efcee480e2fb" aria-labelledby="tooltip-d
<path d="M15 2.75a.75.75 0 0 1-.75.75h-4a.75.75 0 0 1 0-1.5h4a.75.75 0 0 1 .75.75zm-8.5.75v1.25a.75.75 0 0 0 1.5 0v-4a.75.75 0 0 0-1
```

```
<template data-target="react-partial-anchor.template">
  <link crossorigin="anonymous" media="all" rel="stylesheet" href="https://github.githubassets.com/assets/primer-react.ccd7aec5fe9
```

<react-partial partial-name="appearance-settings" data-ssr="false" data-attempted-ssr="false" data-react-profiling="false"

```
</template>
</react-partial-anchor>
```

```
<button type="button" class="sr-only js-header-menu-focus-trap d-block d-lg-none">Resetting focus</button>
</div>
</div>
</div>
```

```
<div hidden="hidden" data-view-component="true" class="js-stale-session-flash stale-session-flash flash flash-warn flash-full">

  <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon octicon
<path d="M6.457 1.047c.659-1.234 2.427-1.234 3.086 0l6.082 11.378A1.75 1.75 0 0 1 14.082 15H1.918a1.75 1.75 0 0 1-1.543-2.575zm1.763
```

```
<button id="icon-button-3f618646-3c9b-4bd5-9ad8-43f70a91e138" aria-labelledby="tooltip-a83ffalf-f538-4713-9de1-0a007f32f2c6" type="button"
<path d="M3.72 3.72a.75.75 0 0 1 1.06 0L8 6.9413.22-3.22a.749.749 0 0 1 1.275.326.749.749 0 0 1-.215.734L9.06 8.13.22 3.22a.749.749 0
```

<div id="js-flash-container" class="flash-container" data-turbo-replace>

```
<div class="d-flex flex-nowrap flex-justify-end mb-3 px-3 px-lg-5" style="gap: 1rem;">




  <div class="flex-auto min-width-0 width-fit">
```

 [donnemartin \(/donnemartin\) / system-design-primer \(/donnemartin/system-design-primer\)](#)

```
</span></span><span class="Label Label--secondary v-align-middle mr-1">Public</span>
```

```
</div>


<div id="repository-details-container" class="flex-shrink-0" data-turbo-replace style="max-width: 70%;">
  <ul class="pagehead-actions flex-shrink-0 d-none d-md-inline" style="padding: 2px 0;">
```

-  [Notifications \(/login?return_to=%2Fdonnemartin%2Fsystem-design-primer\)](#)
-  [Fork 52k \(/login?return_to=%2Fdonnemartin%2Fsystem-design-primer\)](#)
-
-  [Star 318k \(/login?return_to=%2Fdonnemartin%2Fsystem-design-primer\)](#)

```
</div>
</div>

<div id="responsive-meta-container" data-turbo-replace>
```

```
<nav data-pjax="#js-repo-pjax-container" aria-label="Repository" data-view-component="true" class="js-repo-nav js-sidenav-cont
```

-  [Code \(/donnemartin/system-design-primer\)](#)

[\(/donnemartin/system-design-primer\)](#)

- <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon"><path d="M8 9.5a1.5 1.5 0 1 0 0-3 1.5 1.5 0 0 0 0 3z"></path><path d="M8 0a8 8 0 1 1 0 16A8 8 0 0 1 8 0zM1.5 8a6.5 6.5 0 1 0 13 0"/>

[Issues 250 \(/donnemartin/system-design-primer/issues\)](#)

[\(/donnemartin/system-design-primer/issues\)](#)

- <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon"><path d="M1.5 3.25a2.25 2.25 0 1 1 3 2.122v5.256a2.251 2.251 0 1 1-1.5 0V5.372A2.25 2.25 0 0 1 1.5 3.25zM5.677-1.777L9.573 6.777A"/>

[Pull requests 265 \(/donnemartin/system-design-primer/pulls\)](#)

[\(/donnemartin/system-design-primer/pulls\)](#)

- <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon"><path d="M8 0a8 8 0 1 1 0 16A8 8 0 0 1 8 0zM1.5 8a6.5 6.5 0 1 0 13 0 6.5 6.5 0 0 13 0 0-13 0zM4.879-2.773 4.264 2.559a2.25 2.25 0 0 1 0"/>

[Actions \(/donnemartin/system-design-primer/actions\)](#)

[\(/donnemartin/system-design-primer/actions\)](#)

- <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon"><path d="M0 1.75C0 .784 784 0 1.75 0h12.5C15.216 0 16 .784 16 1.75v12.5A1.75 1.75 0 0 1 14.25 16H1.75A1.75 1.75 0 0 1 0 14.25ZM"/>

[Projects \(/donnemartin/system-design-primer/projects\)](#)

[\(/donnemartin/system-design-primer/projects\)](#)

- <svg aria-hidden="true" height="16" viewBox="0 0 16 16" version="1.1" width="16" data-view-component="true" class="octicon"><path d="M7.467 1.33a1.748 1.748 0 0 1 1.066 0 15.25 1.68A1.75 1.75 0 0 1 15 3.48V7c0 1.566-.32 3.182-1.303 4.682-.983 1.498-2.58"/>

([/donnemartin/system-design-primer/security/](https://donnemartin.com/system-design-primer/security/)).

- [Insights \(/donnemartin/system-design-primer/pulse\)](https://donnemartin.com/system-design-primer/pulse).

(/donnemartin/system-design-primer/pulse).

</main>

```
<footer class="footer pt-8 pb-6 f6 color-fg-muted p-responsive" role="contentinfo" >
```



```
<nav aria-label="Footer">
  <h3 class="sr-only" id="sr-footer-heading">Footer navigation</h3>

  <ul class="list-style-none d-flex flex-justify-center flex-wrap mb-2 mb-lg-0" aria-labelledby="sr-footer-heading">

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to Terms&quot;;&quot;label&quot;:&quot;Footer Terms&quot;}" href="#terms" >Terms</a>
    </li>

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to privacy&quot;;&quot;label&quot;:&quot;Footer Privacy&quot;}" href="#privacy" >Privacy</a>
    </li>

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to security&quot;;&quot;label&quot;:&quot;Footer Security&quot;}" href="#security" >Security</a>
    </li>

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to status&quot;;&quot;label&quot;:&quot;Footer Status&quot;}" href="#status" >Status</a>
    </li>

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to docs&quot;;&quot;label&quot;:&quot;Footer Docs&quot;}" href="#docs" >Docs</a>
    </li>

    <li class="mx-2">
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to contact&quot;;&quot;label&quot;:&quot;Footer Contact&quot;}" href="#contact" >Contact</a>
    </li>

    <li class="mx-2" >
      <a data-analytics-event="{&quot;category&quot;:&quot;Footer&quot;;&quot;action&quot;:&quot;go to help&quot;;&quot;label&quot;:&quot;Footer Help&quot;}" href="#help" >Help</a>
    </li>
  </ul>
</nav>
```

[Manage cookies](#)

</nav>

```
<ghcc-consent id="ghcc" class="position-fixed bottom-0 left-0" style="z-index: 999999"
  data-locale="en"
  data-initial-cookie-consent-allowed=""
  data-cookie-consent-required="true"
></ghcc-consent>
```

```
<template id="site-details-dialog">
```



```
<div class="Popover js-hovercard-content position-absolute" style="display: none; outline: none;">
```

```
<template id="snippet-clipboard-copy-button">
```



```
</div>
<div id="js-global-screen-reader-notice" class="sr-only mt-n1" aria-live="polite" aria-atomic="true" ></div>
<div id="js-global-screen-reader-notice-assertive" class="sr-only mt-n1" aria-live="assertive" aria-atomic="true"></div>
```