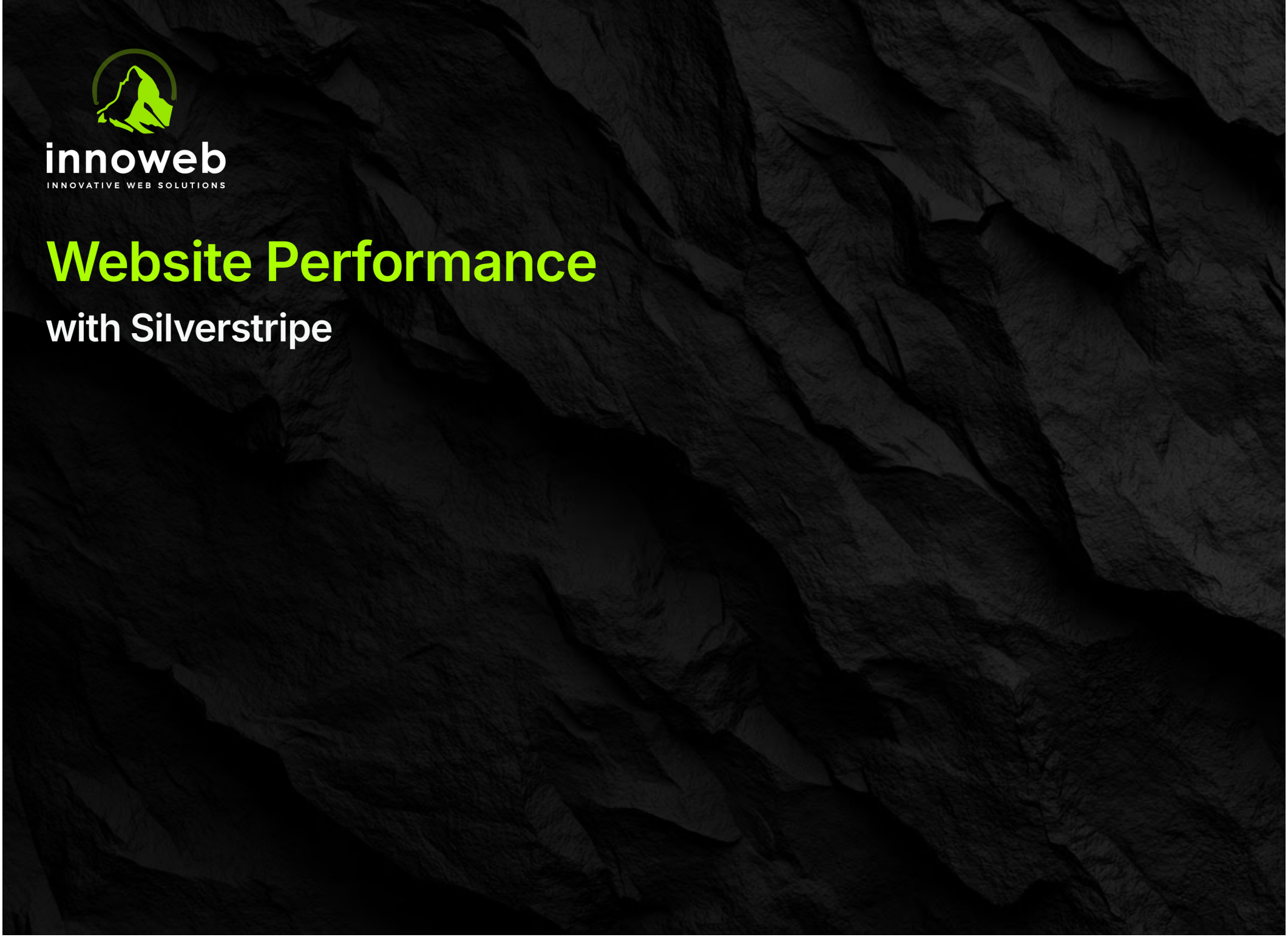
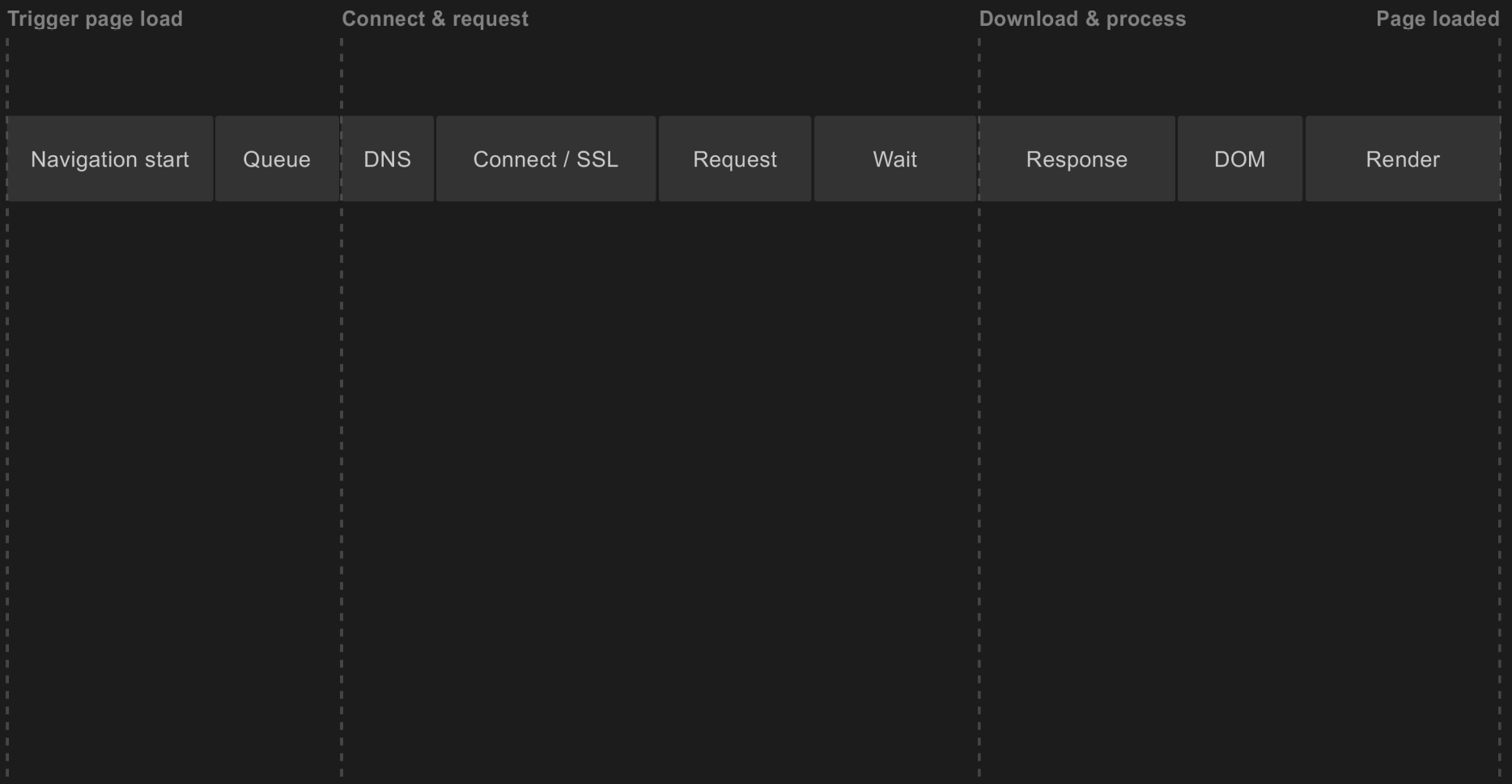

innoweb
INNOVATIVE WEB SOLUTIONS
Website Performance
with Silverstripe

About me

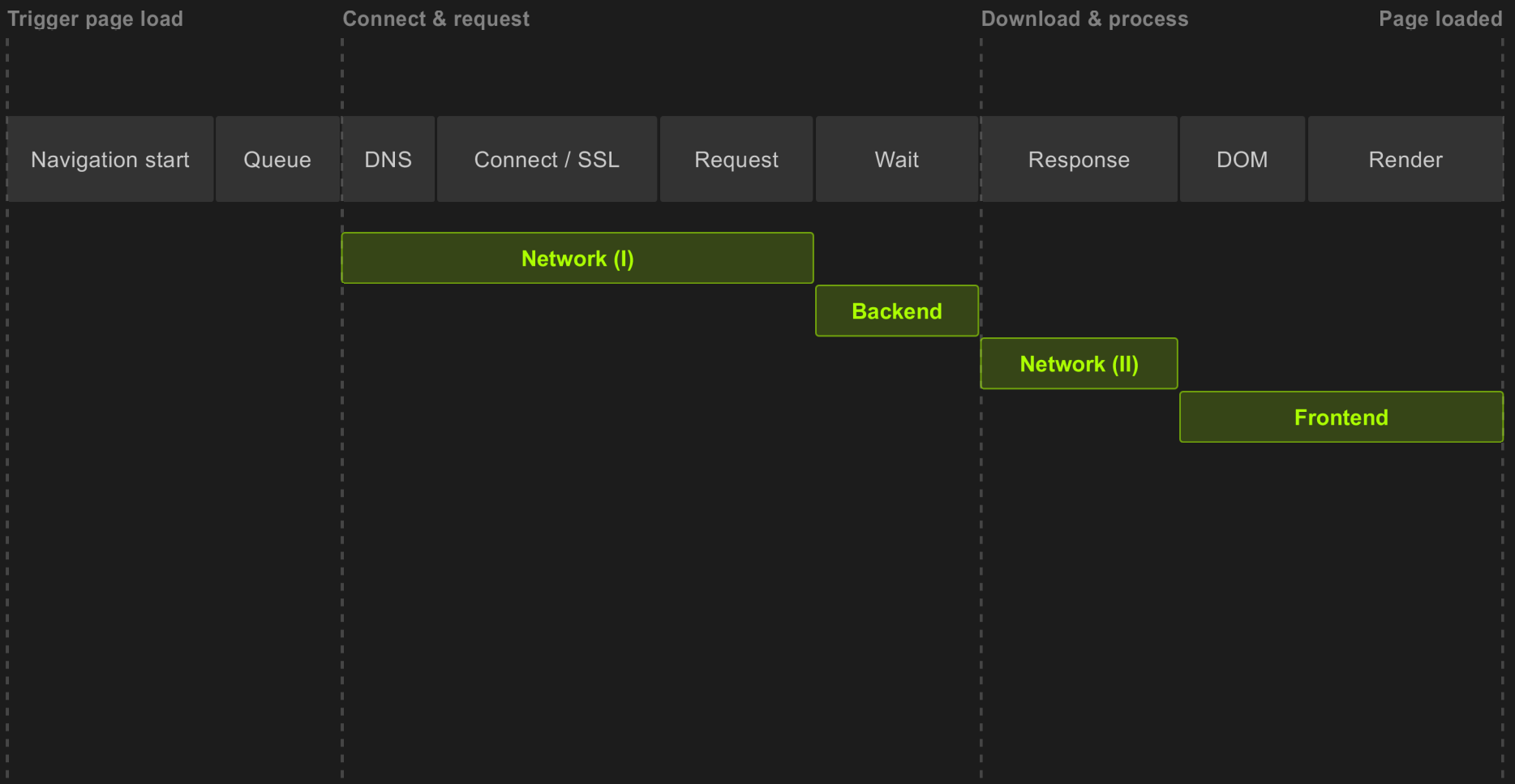
Florian Thoma

- Born in Switzerland, moved to Sydney, Australia 17 years ago.
- Silverstripe development agency innoweb.com.au
- @xini on GitHub

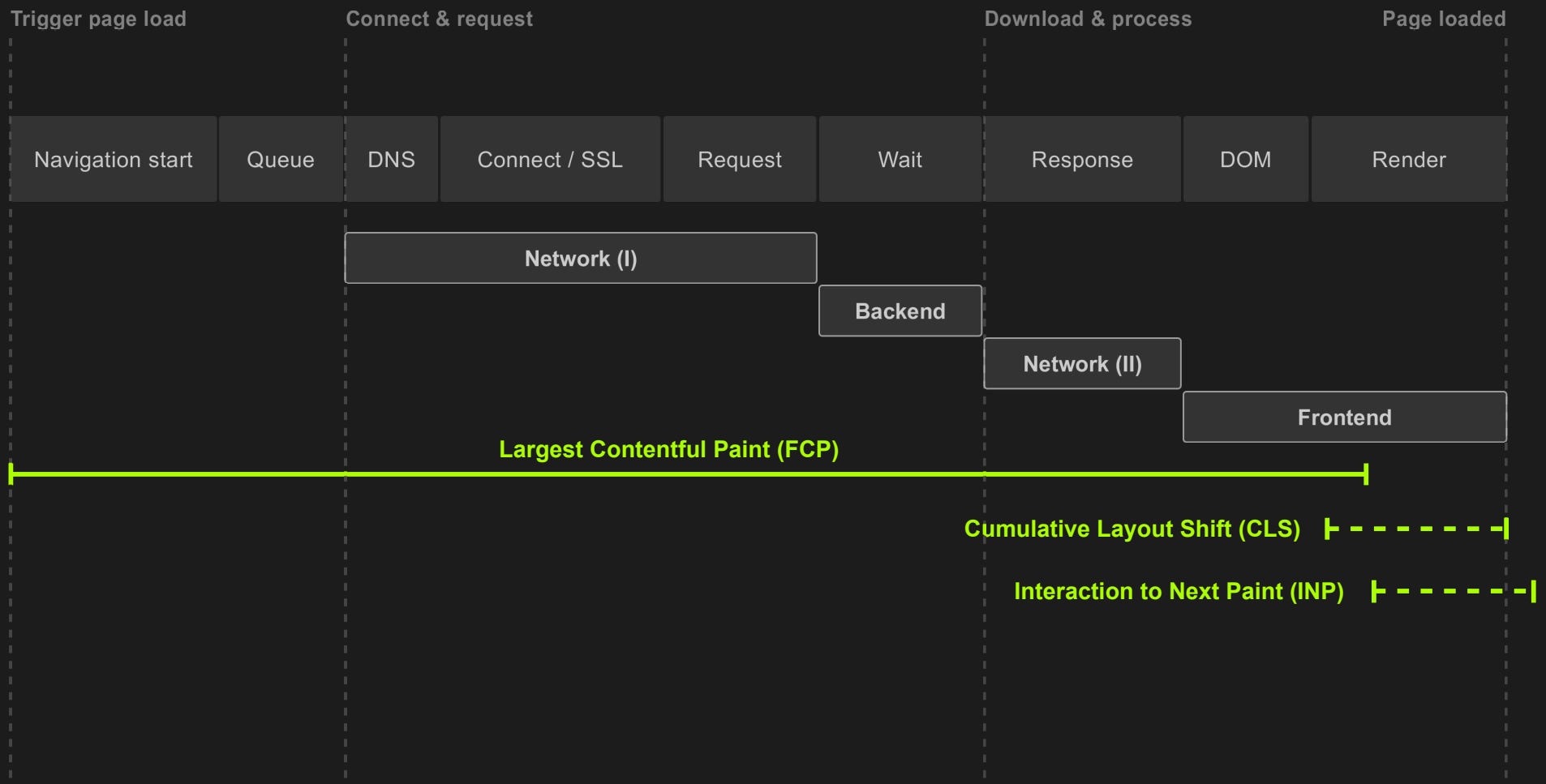
Page load timeline



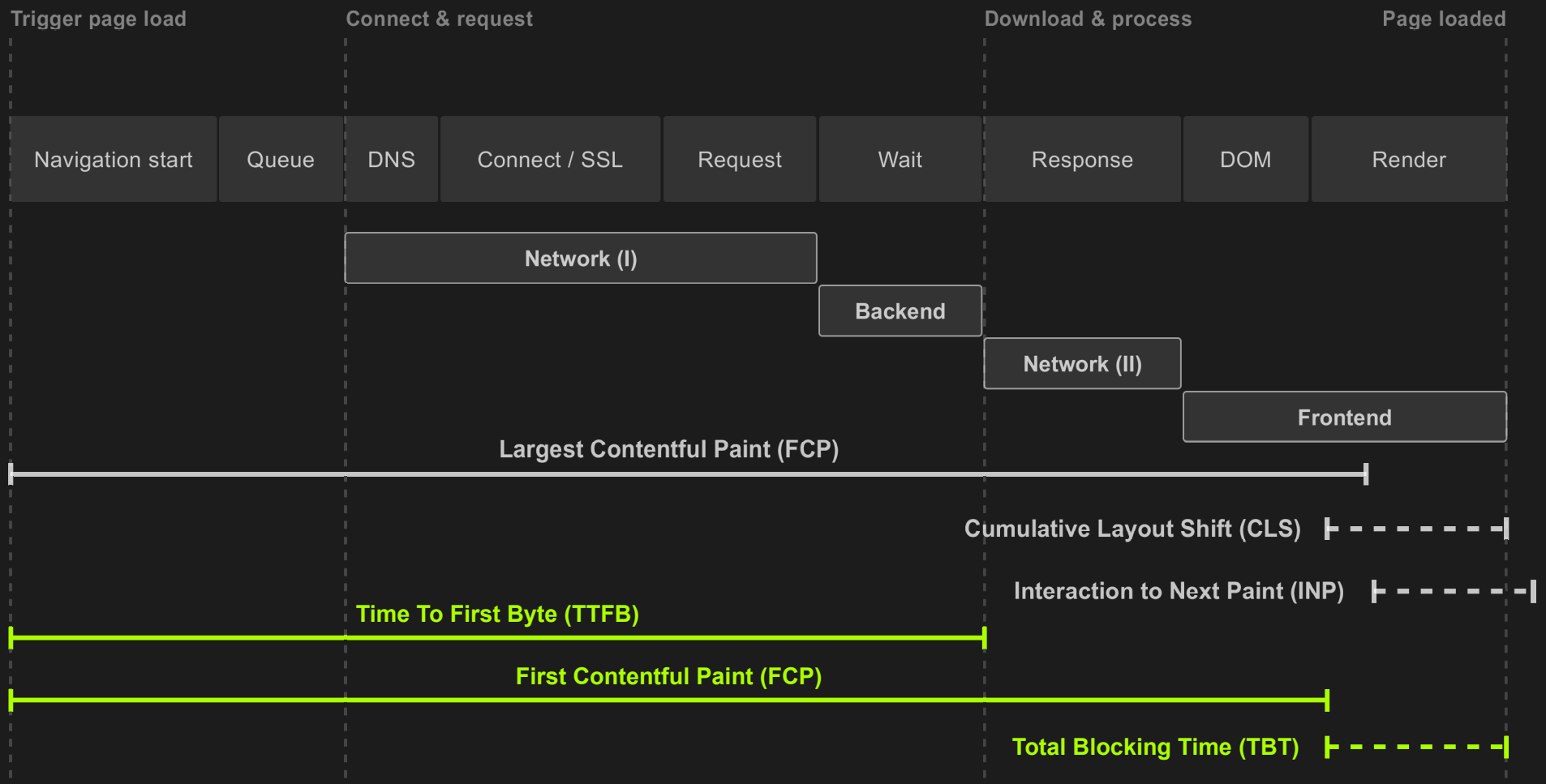
Page load timeline



Page load timeline

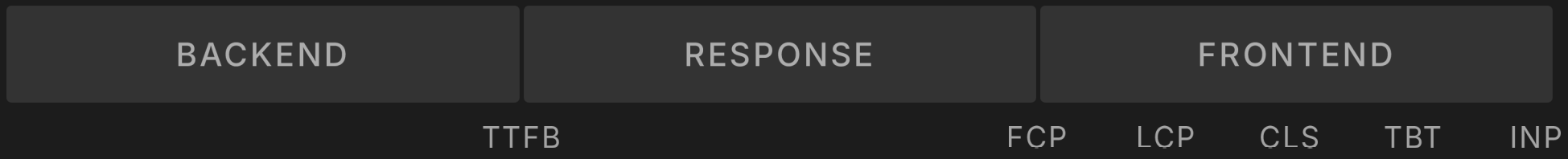


Page load timeline



WHERE WE ARE

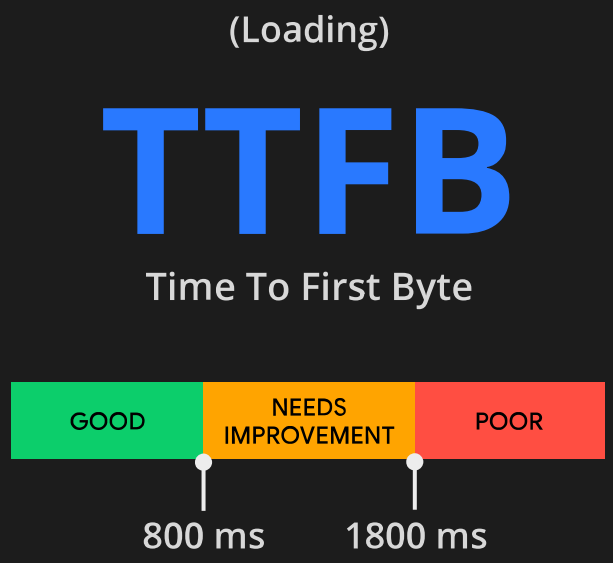
Backend



Answer the request quickly, or try and skip it altogether.

METRIC

Time To First Byte



Everything after has to wait for this.

BACKEND

HTTP caching

The fastest requests are the ones we don't make.

HTTP CACHING

Add caching headers to your web server configuration

```
<ifModule mod_headers.c>
    # media
    <filesMatch "\.(avi|asf|au|bmp|flv|gif|ico|jpeg|jpg|m4a|m4v|mid|midi|mkv|mov|mp3|mp4|mpa|mpeg|mpg|ogg|ogv|pcx|png|ra|ram|rm|tif|tiff|wav|webm|
        Header set Cache-Control "max-age=31536000"
        Header unset Pragma
        Header unset Expires
    </filesMatch>
    # documents and archives
    <filesMatch "\.(aace|arc|arj|brf|bz2|cab|cda|csv|dmg|doc|docx|dotx|gz|hqx|kml|pages|pdf|pps|ppt|pptx|potx|rtf|sit|sitx|tar|tgz|txt|xls|xlsx|xl
        Header set Cache-Control "max-age=86400"
        Header unset Pragma
        Header unset Expires
    </filesMatch>
    # css/js, fonts
    <filesMatch "\.(css|js|woff|woff2)$">
        Header set Cache-Control "max-age=2147483648,immutable"
        Header unset Pragma
        Header unset Expires
        Header unset Last-Modified
        Header unset Etag
    </filesMatch>
</ifModule>
```

HTTP CACHING

For public-facing websites, you can also cache the HTML page itself.

```
class PageController extends ContentController
{
    protected function init()
    {
        HTTPCacheControlMiddleware::singleton()
            ->publicCache()
            ->setMaxAge(600); // 10 minutes

        parent::init();

        ...
    }
}
```

Silverstripe forms disable the page cache automatically.

BACKEND

CDN

- Network of geographically distributed caching servers
- Examples: Cloudflare, Fastly
- Reduce network latency
- Reduce the load on your server
- Improve the availability of your website

CDN

- Static files: uses caching headers
- More advanced: caching whole pages

```
class PageController extends ContentController
{
    protected function init()
    {
        HTTPCacheControlMiddleware::singleton()
            ->publicCache()
            ->setMaxAge(600) // 10 minutes
            ->setSharedMaxAge(3600); // 1 hour

        parent::init();

        ...
    }
}
```

CDN

Silverstripe integration:

- Fastly: `innoweb/silverstripe-fastly`
- Cloudflare: `nswdpc/silverstripe-cloudflare-boilerplate`, `catalyst.net.nz/silverstripe-cloudflare`

BACKEND

PHP OPcache

- Caches compiled bytecode of PHP scripts in memory
- Reduces overhead of parsing and compiling PHP scripts

PHP OPCACHE

```
[opcache]
opcache.enable=1
opcache.enable_cli=1
opcache.memory_consumption=256
opcache.max_accelerated_files=20000
opcache.validate_timestamps=1
opcache.revalidate_freq=30
opcache.revalidate_path=1
```

PHP OPCACHE

- PHP 8: OPCache Just-In-Time compilation (JIT)
- Compiles PHP bytecode directly into CPU native machine code
- `opcache.jit_buffer_size`: half of OPCache memory size
- `opcache.jit`: flags for CPU, register allocation, trigger and optimisation Level
- standard: "tracing" (1254); recommended: `1235`

PHP OPCACHE

```
[opcache]
opcache.enable=1
opcache.enable_cli=1
opcache.memory_consumption=256
opcache.max_accelerated_files=20000
opcache.validate_timestamps=1
opcache.revalidate_freq=30
opcache.revalidate_path=1
opcache.jit_buffer_size=128M
opcache.jit=1235
```

PHP OPCACHE

More on OPCache JIT:

https://php.watch/articles/jit-in-depth

BACKEND

Partial caching

- Caches parts of the page
- Uses cache keys set in template

PARTIAL CACHING

```
<% cached
'navigation',
$List('SilverStripe\CMS\Model\SiteTree').max('LastEdited'),
$List('SilverStripe\CMS\Model\SiteTree').count()
%>
<nav aria-label="Main">
    <ul>
        <% loop $Menu(1) %>
            <li>
                <a href="$Link">$MenuTitle</a>
            </li>
        <% end_loop %>
    </ul>
</nav>
<% end_cached %>
```

PARTIAL CACHING

- Multiple aggregate methods available: count, max, min, avg and sum
- $CurrentReadingMode, and $CurrentUser.ID are included by default

```
SilverStripe\View\SSViewer:
  global_key: '$CurrentReadingMode, $CurrentUser.ID, $CurrentLocale'
```

PARTIAL CACHING

Calculated cache key fragments

```
private function FiveMinuteFragment()
{
    // Returns a new number every five minutes
    return (int)(time() / 60 / 5);
}
```

```
<% cached 'datablock', $FiveMinuteFragment %>
<section>
        <h2>Some data</h2>
        $SomeData
    </section>
<% end_cached %>
```

BACKEND

Database indexing

- Adding a database index can improve data retrieval speed.

DATABASE INDEXING

```
class BlogCategory extends DataObject
{
    ...

    private static $db = [
        'URLSegment' => 'Varchar(255)',
        'Title' => 'Varchar(50)',
        'Description' => 'Varchar(255)',
    ];

    ...

}
```

DATABASE INDEXING

```php
class BlogCategory extends DataObject
{
    ...

    private static $db = [
        'URLSegment' => 'Varchar(255)',
        'Title' => 'Varchar(50)',
        'Description' => 'Varchar(255)',
    ];

    private static $indexes = [
        'URLSegment' => true,
    ];

    ...

}
```

BACKEND

Query caching

- Store the results of database queries in memory
- Per request only

```
$cachedList = MyDataObject::get()->setUseCache(true);
```

QUERY CACHING

- Automatically cached aggregates: `max`, `avg`, `count` and pagination
- Cleared on:
  - `write()`, `delete()`, `destroy()`, `flushCache()` for DataObject
  - `add()`, `remove()` for DataList
- Use `?showqueries` to identify repeated/slow queries

BACKEND

Object caching

- Uses the PSR-16 standard "SimpleCache"
- Used by core for class manifest, yaml config and yaml translations

```yaml
SilverStripe\Core\Injector\Injector:
  Psr\SimpleCache\CacheInterface.myCache:
    factory: SilverStripe\Core\Cache\CacheFactory
    constructor:
      namespace: "myCache"
```

OBJECT CACHING

usage:

```php
use Psr\SimpleCache\CacheInterface;
use SilverStripe\Core\Injector\Injector;

$cache = Injector::inst()->get(CacheInterface::class . '.myCache');

// save a value in the cache
$cache->set('myCacheKey', 1234);

// retrieve a value from the cache
$myValue = $cache->get('myCacheKey');

// check if a value has been stored for a given cache key
if (!$cache->has('myCacheKey')) {
    // ... item does not exists in the cache
}
```

BACKEND

Cache adapters

- Used by object and partial caching
- Default: `PhpFilesCache` when OPcache is available, else `FilesystemCache`
- In-memory options: Memcached, Redis

CACHE ADAPTERS

Redis:

- Install and configure Redis server
- Install `predis/predis` or `cachewerk/relay` via composer OR use the Redis PHP extension

```
SS_IN_MEMORY_CACHE_FACTORY="SilverStripe\Core\Cache\RedisCacheFactory"
SS_REDIS_DSN="redis://verysecurepassword@yourserver:6379"
```

RECAP

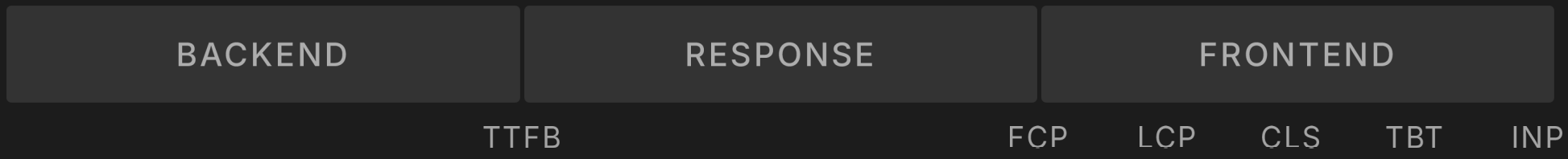
Backend

- HTTP caching
- CDN
- PHP OPcache
- Partial caching

- Database indexing
- Query caching
- Object caching
- Cache adapters

WHERE WE ARE

Response



Send less.

METRIC

First Contentful Paint

Nothing paints before the HTML and the render-blocking CSS have been received and parsed.

RESPONSE

Compression

- Main technique to reduce the size of the data
- gzip or brotli algorithms
- Reduces the size by up to 80%
- Easy to set up

COMPRESSION

```
# Try Brotli First
<IfModule mod_brotli.c>
    # Core web assets
    AddOutputFilterByType BROTLI_COMPRESS text/html text/plain text/css text/xml
    AddOutputFilterByType BROTLI_COMPRESS application/javascript application/json application/manifest+json
    # Feeds and Vector Graphics
    AddOutputFilterByType BROTLI_COMPRESS application/xml application/rss+xml application/xhtml+xml image/svg+xml
    # Web Fonts
    AddOutputFilterByType BROTLI_COMPRESS font/ttf font/otf font/opentype application/vnd.ms-fontobject
</IfModule>
# Fallback to Gzip if Brotli is missing/unsupported
<IfModule mod_deflate.c>
    # Core web assets
    AddOutputFilterByType DEFLATE text/html text/plain text/css text/xml
    AddOutputFilterByType DEFLATE application/javascript application/json application/manifest+json
    # Feeds and Vector Graphics
    AddOutputFilterByType DEFLATE application/xml application/rss+xml application/xhtml+xml image/svg+xml
    # Web Fonts
    AddOutputFilterByType DEFLATE font/ttf font/otf font/opentype application/vnd.ms-fontobject
</IfModule>
```

RESPONSE

Minification

Reduce the amount of data that gets shipped to the client.

- CSS: Use `sass` or `cssnano`
- JS: Use `terser` or `uglifyjs`
- HTML: Use `innoweb/silverstripe-minify-html`

MINIFICATION

before:

```
<!doctype html>
<html lang="en-NZ">
    <head>

        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
        <meta name="generator" content="Silverstripe CMS 6.2">
<meta http-equiv="Content-Type" content="text/html; charset=utf-8">
<meta name="description" content="Silverstripe is the trusted design and technology partner, delivering digital solutions and experiences that have a positive impact for the people of Aotearoa and beyond.">
    <link rel="alternate" hreflang="x-default" href="https://www.silverstripe.com/" />



        <link rel="canonical" href="https://www.silverstripe.com" />



        <title>Home - Silverstripe</title>

        <link rel="apple-touch-icon" sizes="180x180" href="/_resources/themes/app/dist/images/favicon/apple-touch-icon.png?m=1787711619">
        <link rel="icon" type="image/png" sizes="32x32" href="/_resources/themes/app/dist/images/favicon/favicon-32x32.png?m=1787711619">
        <link rel="icon" type="image/png" sizes="16x16" href="/_resources/themes/app/dist/images/favicon/favicon-16x16.png?m=1787711619">
        <link rel="manifest" href="/_resources/themes/app/dist/images/favicon/site.webmanifest?m=1787711619">
        <link rel="mask-icon" href="/_resources/themes/app/dist/images/favicon/safari-pinned-tab.svg?m=1787711619" color="#005ae1">
        <link rel="shortcut icon" href="/_resources/themes/app/dist/images/favicon/favicon.ico?m=1787711619">
        <meta name="apple-mobile-web-app-title" content="Silverstripe">
        <meta name="application-name" content="Silverstripe">
        <meta name="msapplication-TileColor" content="#005ae1">
        <meta name="msapplication-config" content="/_resources/themes/app/dist/images/favicon/browserconfig.xml?m=1787711619">
        <meta name="theme-color" content="#ffffff">

        <meta property="og:locale" content="en_NZ">
<meta property="og:site_name" content="Silverstripe">
<meta property="og:url" content="https://www.silverstripe.com/home/">
<meta property="og:type" content="article">
<meta property="og:title" content="Home">

    <meta property="og:image" content="https://www.silverstripe.com/assets/Uploads/silverstripe-stacked-logo-white.png">

<meta property="og:description" content="Silverstripe is the trusted design and technology partner, delivering digital solutions and experiences that have a positive impact for the people of Aotearoa and
beyond.">



          <meta name="google-site-verification" content="JMdeaYQgd_uV6K_0WtpT_LbCQgDNyeqVY8ZK69CS4zY">


          <!-- Google tag (gtag.js) -->
```

MINIFICATION

after:

```
<!DOCTYPE html>
<html class="no-js" dir="ltr" lang="en-US"><head><base href="https://www.sfmi.local/"><title>Smith, Fause &amp; McDonald, Inc.</title><meta charset="utf-8"><meta content="width=device-width, initial-scale=1" name="viewport"><meta content="Silverstripe CMS" name="generator"><meta content="We design Audiovisual Systems, Educational Technology, AV Systems, Communications Systems, Structured Cabling Systems, Wi-Fi Networks, Telephone VoIP Systems, Electronic Security Systems, Environmental and Architectural Acoustics and Noise Control." name="description"><meta content="noindex, nofollow" name="robots"><link href="/favicon-96x96.png" rel="icon" sizes="96x96" type="image/png"><link href="/favicon.svg" rel="icon" type="image/svg+xml"><link href="/favicon.ico" rel="shortcut icon"><link href="/apple-touch-icon.png" rel="apple-touch-icon" sizes="180x180"><meta content="SFMI" name="apple-mobile-web-app-title"><link href="/site.webmanifest" rel="manifest"><meta content="PhZkGa1SNEmtQjgw2DmZ94J3kfI2OwN_-eF6UdKDT7k" name="google-site-verification"><link href="/assets/_combinedfiles/app-31cc166591ce19a71c955a9279a4fe1b.css" media="all" rel="stylesheet"><link href="/assets/_combinedfiles/app-above-480-b7c156b7a1458648270e01ddf6b550dc.css" media="screen and (min-width:480px)" rel="stylesheet"></head><body><header id="navbar" role="banner"><div class="container"><a class="home" href="/"><img alt="Smith, Fause &amp; McDonald, Inc. logo, to the home page" height="67" src="/assets/_combinedfiles/logo-web-transparent-5b7b8885cf70607dc3c097a19529aa52.png" width="147"></a> <nav aria-label="Main" class="main-nav"><ul class="js-menu-pplus main-nav-list"><li><a class="current" href="/">Home</a></li> <li><a class="link" href="/services">Services</a></li> <li><a class="link" href="/projects">Projects</a></li> <li><a class="link" href="/news">News</a></li> <li><a class="link" href="/about-us">About</a></li> <li><a class="link" href="/contact-us">Contact</a></li></ul></nav> <form action="/home/SiteSearchForm" class="SearchForm__form js-no-validation" enctype="application/x-www-form-urlencoded" id="SiteSearchForm_SiteSearchForm" method="GET"><p class="message" id="SiteSearchForm_SiteSearchForm_error" style="display: none"></p> <fieldset><div class="field text" id="SiteSearchForm_SiteSearchForm_Phrase_Holder"><label class="form-label left" for="SiteSearchForm_SiteSearchForm_Phrase">Site search</label> <div class="middleColumn"><input class="text" id="SiteSearchForm_SiteSearchForm_Phrase" name="Phrase" placeholder="Search by keywords" type="search"></div></div> <input class="hidden" id="SiteSearchForm_SiteSearchForm_EngineID" name="EngineID" type="hidden"> <input class="hidden" id="SiteSearchForm_SiteSearchForm_SourcePageID" name="SourcePageID" type="hidden" value="1"> <div class="clear"><!-- --></div></fieldset> <div class="btn-toolbar"><button class="action" id="SiteSearchForm_SiteSearchForm_action_doSearch" name="action_doSearch" type="submit" value="search"><span>search</span></button></div></form></div></header> <main id="layout"><div class="container"><div class="typography"><div class="bannerimage"><picture><source srcset="/assets/_combinedfiles/hero-34822e51289b89844a9bf69098f9e8a9.avif" type="image/avif"><source srcset="/assets/_combinedfiles/hero-10b0b5aa08cb9665da7305c29ec69fcc.webp" type="image/webp"><img alt="" fetchpriority="high" height="493" src="/assets/_combinedfiles/hero-576ebe4dd88cc623b0be661137e6ef91.jpg" width="900"></picture> <h1><span class="bannerbox intro">Design For</span> <span class="bannerbox"><a href="/services/audiovisual-systems">Audiovisual Systems</a></span> <span class="bannerbox"><a href="/services/acoustics">Acoustical Engineering</a></span> <span class="bannerbox"><a href="/services/communications">IT &amp; Telecommunications</a></span> <span class="bannerbox"><a href="/services/security">Electronic Security Systems</a></span> <span class="bannercta"><a href="/projects">See our work</a></span></h1></div> <div class="projects"><div class="proj"><p><a href="/projects/municipal"><picture><source srcset="/assets/sf-city-hall-chambers__ResizedImageWzQ1MCwzMDRd_ExtRewriteWyJqcGciLCJhdmlmIl0_QualityWzYwXQ.avif" type="image/avif"> <source srcset="/assets/sf-city-hall-chambers__ResizedImageWzQ1MCwzMDRd_ExtRewriteWyJqcGciLCJ3ZWJwIl0_QualityWzgwXQ.webp" type="image/webp"> <img alt="" class="image leftAlone ss-htmleditorfield-file" height="304" loading="lazy" src="/assets/sf-city-hall-chambers__ResizedImageWzQ1MCwzMDRd.jpg" width="450"></picture></a></p> <h3>Council Chamber Projects<br>San Francisco Bay Area</h3> <p>SFMI has designed new <span>and upgraded </span>audiovisual systems in several recently completed council chamber projects, including those for the City of Mountain View, the City of San Mateo, and the County of Santa Clara Board of Supervisors Chamber. Under current construction are our designs for the Boardroom at the Foothill De Anza College District New District Offices, and the El Camino Hospital District Boardroom, among others. </p> <p style="text-align: right;"><a href="/projects/municipal"><span class="st">LEARN MORE <span class="st">»</span></span></a></p> <p> </p> <p> </p></div> <div class="proj"><p><a href="news/article/sfmi-project-new-warriors-arena-108/"><picture><source srcset="/assets/warriors-arena__ResizedImageWzQ1MCwyNzBd_ExtRewriteWyJqcGciLCJhdmlmIl0_QualityWzYwXQ.avif" type="image/avif"> <source srcset="/assets/warriors-arena__ResizedImageWzQ1MCwyNzBd_ExtRewriteWyJqcGciLCJ3ZWJwIl0_QualityWzgwXQ.webp" type="image/webp"> <img alt="" class="image leftAlone ss-htmleditorfield-file" height="270" loading="lazy" src="/assets/warriors-arena__ResizedImageWzQ1MCwyNzBd.jpg" width="450"></picture></a></p> <h3>Warriors Arena<br>San Francisco, CA</h3> <p>SFMI is working with Manica Architecture and Kendall/Heaton Associates on the development of the exciting new Golden State Warriors Sports and Entertainment Arena in Mission Bay. The 12-acre mixed-use site—which includes an 18,000-seat arena, office towers, and retail space—will host sporting events, concerts, and conventions, among other events.</p> <p style="text-align: right;"><a href="news/article/sfmi-project-new-warriors-arena-108/">LEARN MORE <span class="st">»</span></a></p> <p style="text-align: right;"> </p></div> <div class="proj"><p style="text-align: left;"><a href="news/article/sfmi-begins-wi-fi-design-111/"><picture><source srcset="/assets/wifi-mapping__ResizedImageWzQ1MCwyODdd_ExtRewriteWyJqcGciLCJhdmlmIl0_QualityWzYwXQ.avif" type="image/avif"> <source srcset="/assets/wifi-mapping__ResizedImageWzQ1MCwyODdd_ExtRewriteWyJqcGciLCJ3ZWJwIl0_QualityWzgwXQ.webp" type="image/webp"> <img alt="" class="image leftAlone ss-htmleditorfield-file" height="287" loading="lazy" src="/assets/wifi-mapping__ResizedImageWzQ1MCwyODdd.jpg" width="450"></picture></a></p> <h3>Wi-Fi Design</h3> <p style="text-align: left;">SFMI is pleased to pioneer the use of enhanced Wi-Fi modeling in our design of new approaches to communications infrastructure. Using Ekahau software to produce detailed diagrams of coverage, we are able to provide our clients with better integrated design and a clearer understanding of their project site.</p> <p style="text-align: right;"><a href="news/article/sfmi-uses-wi-fi-mapping-111/">LEARN MORE <span class="st">»</span></a></p></div> <div class="currentproj"><h4 class="colorbox">On the Boards:</h4> <ul><li class="mysmlists">California Supreme Court Courtrooms - San Francisco, Sacramento &amp; Los Angeles</li> <li class="mysmlists">City of Pleasant Hill Council Chambers</li> <li class="mysmlists"><a href="http://www.measurewssfcivic.com/" title="South San Francisco Community Civic Campus">City of South San Francisco Community Civic Campus</a></li> <li class="mysmlists"><a href="http://www.solano.edu/measureq/2017/-%20%20Library%20LRC%20RFQP%20-%2018-002.pdf" title="Solano Community College Library/Learning Resource Center">Solano Community College Library/Learning Resource Center</a> </li> <li class="mysmlists">U.C Santa Cruz Student Housing Phase 2 (90 buildings)</li> <li class="mysmlists"><a href="https://its.ucsc.edu/project-management/tiu/phase-d.html" title="UCSC TIU Phase D">U.C Santa Cruz Telecommunications Infrastructure Upgrade, Phase D</a></li> <li class="mysmlists">Yorba Linda Public Library and Arts Center</li></ul> <h4 class="colorbox">Under Construction:</h4> <ul><li class="mysmlists"><a href="news/article/sfmi-project-new-warriors-arena-108/" title="SFMI designs communications and electronic security systems for new Warriors Arena">Golden State Warriors, San Francisco Arena</a></li> <li class="mysmlists"><a href="https://www.cityofsanrafael.org/public-safety-center/" rel="noopener noreferrer" target="_blank" title="City of San Rafael Public Safety Center">City of San Rafael Public Safety Center</a></li> <li class="mysmlists"><a href="https://www.elcaminohospital.org/about-us/campus-development/integrated-medical-office-building" title="El Camino Hospital Integrated Medical Office Building">El Camino Hospital Integrated Medical Office Building</a></li> <li class="mysmlists">Foothill De-Anza Community College District New District Office</li> <li class="mysmlists">1500 Mission Office Building, San Francisco</li> <li class="mysmlists"><a href="https://its.ucsc.edu/project-management/tiu/index.html" title="UCSC TIU Phase C">U.C Santa Cruz Telecommunications Infrastructure Upgrade, Phase C (121 Buildings)</a></li></ul></div></div></div></main> <footer id="footer"><div class="container"><p>© 1986 - 2026 Smith, Fause &amp; McDonald, Inc., all rights reserved. | SFMI - design for expression and connection </p></div></footer> <script src="/assets/_combinedfiles/app-d2b9044beca5f69f625563e3b8d1cdda.js" type="module"></script></body></html>
```

innoweb/silverstripe-minify-html

MINIFICATION

Example:

HTML minification of innoweb.com.au

- from 20.52 kB to 18.95 kB (compressed)
- reduction by 8%

RESPONSE

Combining CSS and JS

HTTP/2 multiplexing allows multiple files to download simultaneously.

Combining files still has benefits:

- Improved compression efficiency
- TCP Slow Start
- Shortened dependency "waterfall"
- Less load on the server

Best solution: "smart bundling".

RESPONSE

Loading of CSS

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::themedCSS('dist/styles/app.css');

        ...
    }
}
```

LOADING OF CSS

include CSS link in the HTTP header of the page:

`dorsetdigital/silverstripe-enhanced-requirements`

LOADING OF CSS

Solution:

```php
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::css(
            ThemeResourceLoader::inst()->findThemedCSS(
                'dist/styles/app.css'
            ),
            'all',
            [
                'push' => true,
            ]
        );

        ...
    }
}
```

LOADING OF CSS

- Reduce CSS for mobile by splitting CSS by media query
- All styles above 480px get moved to separate CSS file

LOADING OF CSS

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::css(
            ThemeResourceLoader::inst()->findThemedCSS(
                'dist/styles/app.css'
            ),
            'all',
            [
                'push' => true,
            ]
        );
        Requirements::css(
            ThemeResourceLoader::inst()->findThemedCSS(
                'dist/styles/app-above-480.css'
            ),
            'screen and (min-width:480px)'
        );

        ...
    }
}
```

RESPONSE

Image optimisation

- Install `axllent/silverstripe-image-optimiser`
- The module relies on the JpegOptim, Optipng, Pngquant 2 & Gifsicle binaries
- Debian: `sudo apt-get install jpegoptim optipng pngquant gifsicle`
- WEBP (save 30%) and AVIF (save 50%) supported by all modern browsers.

RESPONSE

Modern image formats

Override `SilverStripe/Assets/Storage/DBFile_Image.ss`:

```
<picture>
    <source type="image/avif" srcset="$Convert('avif').Quality(60).URL">
    <source type="image/webp" srcset="$Convert('webp').Quality(80).URL">
    <img $AttributesHTML>
</picture>
```

MODERN IMAGE FORMATS

Remove WEBP and AVIF from uploadable MIME types:

```
HTTP::config()->set(
    'MimeTypes',
    array_diff_key(
        HTTP::config()->get('MimeTypes'),
        [
            'webp' => 'image/webp',
            'avif' => 'image/avif',
        ]
    )
);
```

RESPONSE

Lazy loading of images

- Content images should be lazy loaded
- Native lazy loading in Silverstripe since 2021 (version 5.4)

```
<img src="$Image.ScaleWidth(300).URL"
     width="300" height="$Image.ScaleWidth(300).Height"
     loading="lazy">
```

RESPONSE

Responsive images

`heyday/silverstripe-responsive-images`

RESPONSIVE IMAGES

```
<picture>
    <% loop $Sizes %>
        <source media="$Query" srcset="$Image.URL">
    <% end_loop %>
    <img src="$DefaultImage.URL" alt="$DefaultImage.Title.ATT"
         width="$DefaultImage.Width" height="$DefaultImage.Height"
        <% if $ExtraClasses %> class="$ExtraClasses"<% end_if %>>
</picture>
```

RESPONSE

Combination of techniques

```
<picture>
    <% loop $Sizes %>
        <source media="$Query"
                type="image/avif"
                srcset="$Image.Convert('avif').Quality(60).URL"
                width="$Image.Width" height="$Image.Height">
        <source media="$Query"
                type="image/webp"
                srcset="$Image.Convert('webp').Quality(80).URL"
                width="$Image.Width" height="$Image.Height">
        <source media="$Query"
                srcset="$Image.URL"
                width="$Image.Width" height="$Image.Height">
    <% end_loop %>
    <img src="$DefaultImage.URL" alt="$DefaultImage.Title.ATT"
         width="$DefaultImage.Width" height="$DefaultImage.Height"
        <% if $ExtraClasses %> class="$ExtraClasses"<% end_if %>
        loading="lazy">
</picture>
```

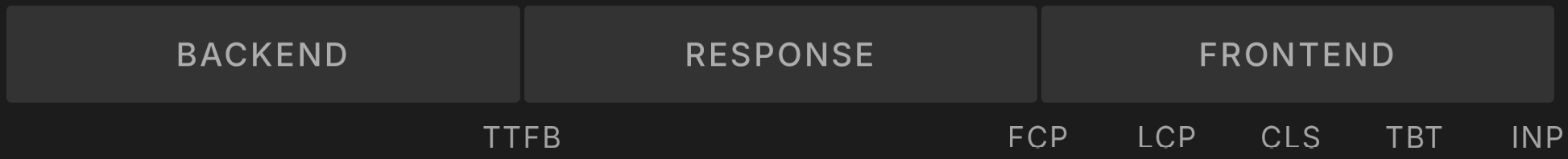
RECAP

Response

- Compression
- Minification
- Combining CSS and JS
- Loading of CSS
- Image optimisation
- Modern image formats
- Lazy loading of images
- Responsive images

WHERE WE ARE

Frontend



Render what we've received.

METRIC

Largest Contentful Paint

Represents the most important content for the user.

FRONTEND

Loading of LCP images

- Never lazy-load LCP images
- Browser considers multiple candidates to determine LCP element
- Threshold introduced to ignore low-entropy images
- At least 0.05 bits of data per pixel displayed

FRONTEND

Loading of LCP images

- Harry Roberts' "The Ultimate Low-Quality Image Placeholder Technique"

https://csswizardry.com/2023/09/the-ultimate-lqip-lcp-technique/

- `innoweb/silverstripe-image-placeholders` "LCP Low Quality Image Placeholder" method `LCPLQIP()`

LOADING OF LCP IMAGES

```
<img src="$Image.URL.ATT"
     style="background: #eee url($Image.LCPLQIP.URL.ATT) no-repeat; background-size: cover;"
     alt="$Image.AltText.ATT"
     width="$Image.Width"
     height="$Image.Height">
```

```
<link rel="preload" as="image" href="$Image.LCPLQIP.URL.ATT" fetchpriority="high">
```

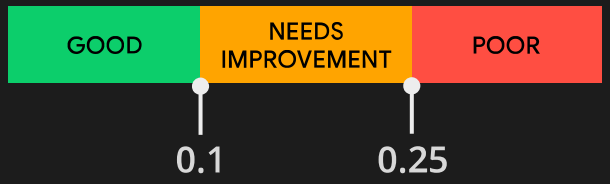
METRIC

Cumulative Layout Shift

(Visual stability)

CLS

Cumulative Layout Shift



Reserve the space before the content arrives.

FRONTEND

Aspect ratio

- images: width and height attributes

```
<img src="$Image.ScaleWidth(300).URL"
     width="300" height="$Image.ScaleWidth(300).Height">
```

- frame, object, embed:
  width and height attributes or CSS aspect-ratio

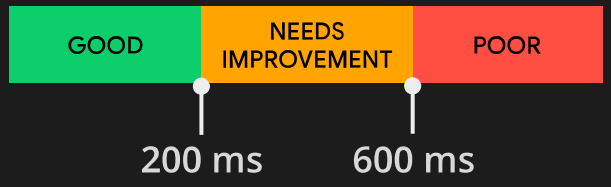
METRICS

Total Blocking Time and Interaction to Next Paint

(Interactivity)

TBT

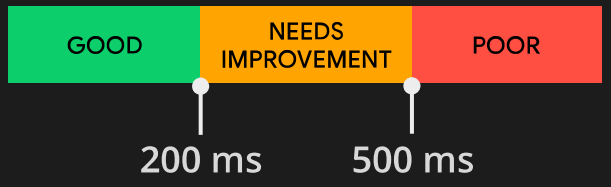
Total Blocking Time



(Interactivity)

INP

Interaction to Next Paint



TBT is the lab proxy for INP.

FRONTEND

Loading of JavaScript

Render blocking by default.

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::themedJavascript('dist/js/main.js');

        ...
    }
}
```

LOADING OF JAVASCRIPT

Solution for older browsers:

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::set_force_js_to_bottom(true);

        Requirements::themedJavascript('dist/js/main.js');

        ...
    }
}
```

LOADING OF JAVASCRIPT

Solution for newer browsers:

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::set_force_js_to_bottom(true);

        Requirements::javascript(
            ThemeResourceLoader::inst()->findThemedResource('dist/js/main.js'),
            ['defer' => true]
        );

        ...
    }
}
```

LOADING OF JAVASCRIPT

Solution for newer browsers using JS modules:

```
class PageController extends ContentController
{
    protected function init()
    {
        parent::init();

        Requirements::set_force_js_to_bottom(true);

        Requirements::javascript(
            ThemeResourceLoader::inst()->findThemedResource('dist/js/main.js'),
            ['type' => 'module']
        );

        ...
    }
}
```

FRONTEND

Lazy loading of embeds

- iFrames: Use the `loading="lazy"` attribute
- Other embeds: use JavaScript and IntersectionObserver

FRONTEND

CSS content-visibility

Problem: Browsers render every block.

- Long tasks in the rendering pipeline
- High Total Blocking Time (TBT)
- A sluggish feel for users, especially on mobile devices

CSS CONTENT-VISIBILITY

Solution: CSS `content-visibility`

```
.block {
    content-visibility: auto;
    contain-intrinsic-size: 800px;
}
```

- `content-visibility: auto;` skips layout and paint of off-screen content.
- `contain-intrinsic-size: 800px;` provides a placeholder height

RECAP

Frontend

- Loading of LCP images
- Aspect ratio
- Loading of JavaScript
- Lazy loading of embeds
- CSS content-visibility

RECAP

Performance optimisation is a compromise

- Optimisation trade-offs
- Test every change
- Every website is different
- Find compromise that delivers meaningful improvements for users

Danke schön!

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