

# Seven Secrets of Maintainable Codebases



**@AdamTornhill**

[adam.tornhill@empear.com](mailto:adam.tornhill@empear.com)

<https://codescene.io>

# Let's Turn The Microscope



# Behavioural Data

```
commit b7c90c4a6784acd5bae68b97e1f4a99ad3ace4d5
Author: N. Taylor Mullen <nimullen@microsoft.com>
Date: Mon Mar 28 16:59:48 2016 -0700

    React to aspnet/Razor#719.

2 2 test/Microsoft.AspNetCore.Mvc.Razor.Host.Test/TestFiles/Output/Runtime/ModelExpressionTagHelper.cs
8 8 test/Microsoft.AspNetCore.Mvc.Razor.Test/RazorPageTest.cs
2 2 test/Microsoft.AspNetCore.Mvc.TagHelpers.Test/RenderAtEndOfFormTagHelperTest.cs

commit 529fa67c2ba23198b87c5734275a8fe8dbb7c690
Author: Pranav K <prkrishn@hotmail.com>
Date: Mon Mar 21 15:23:23 2016 -0700

    Adding tests for PrefixContainer

    Fixes #4045

4 4 src/Microsoft.AspNetCore.Mvc.Core/Internal/PrefixContainer.cs
1 1 src/Microsoft.AspNetCore.Mvc.Core/ModelBinding/DictionaryModelBinder.cs
151 9 test/Microsoft.AspNetCore.Mvc.Core.Test/Internal/PrefixContainerTest.cs

commit f9d24a8521fbdc82234544068d4a832ca8f3a53a
Author: Kévin Chalet <kevinchalet@gmail.com>
Date: Wed Mar 9 21:12:23 2016 +0100

    Introduce SignInResult/SignOutResult and ControllerBase.SignIn/SignOut

3 3 src/Microsoft.AspNetCore.Mvc.Core/ChallengeResult.cs
49 46 src/Microsoft.AspNetCore.Mvc.Core/ControllerBase.cs
2 2 src/Microsoft.AspNetCore.Mvc.Core/ForbidResult.cs
26 3 src/Microsoft.AspNetCore.Mvc.Core/Internal/MvcCoreLoggerExtensions.cs
16 0 src/Microsoft.AspNetCore.Mvc.Core/Properties/Resources.Designer.cs
3 0 src/Microsoft.AspNetCore.Mvc.Core/Resources.resx
95 0 src/Microsoft.AspNetCore.Mvc.Core/SignInResult.cs
117 0 src/Microsoft.AspNetCore.Mvc.Core/SignOutResult.cs
7 7 test/Microsoft.AspNetCore.Mvc.Core.Test/ForbidResultTest.cs
86 0 test/Microsoft.AspNetCore.Mvc.Core.Test/SignInResultTest.cs
87 0 test/Microsoft.AspNetCore.Mvc.Core.Test/SignOutResultTest.cs

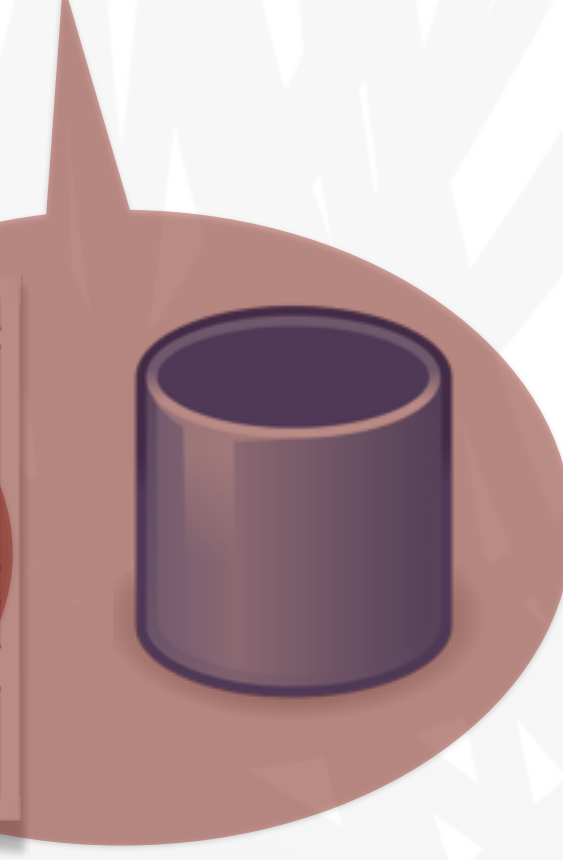
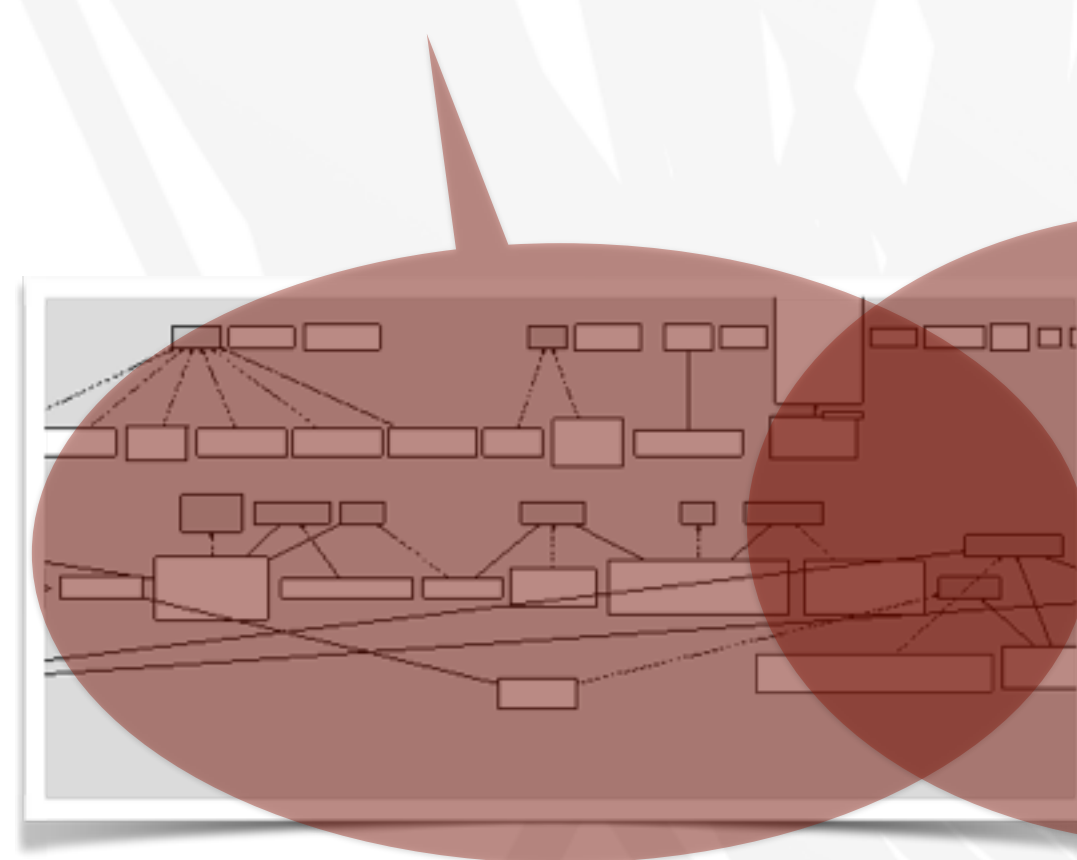
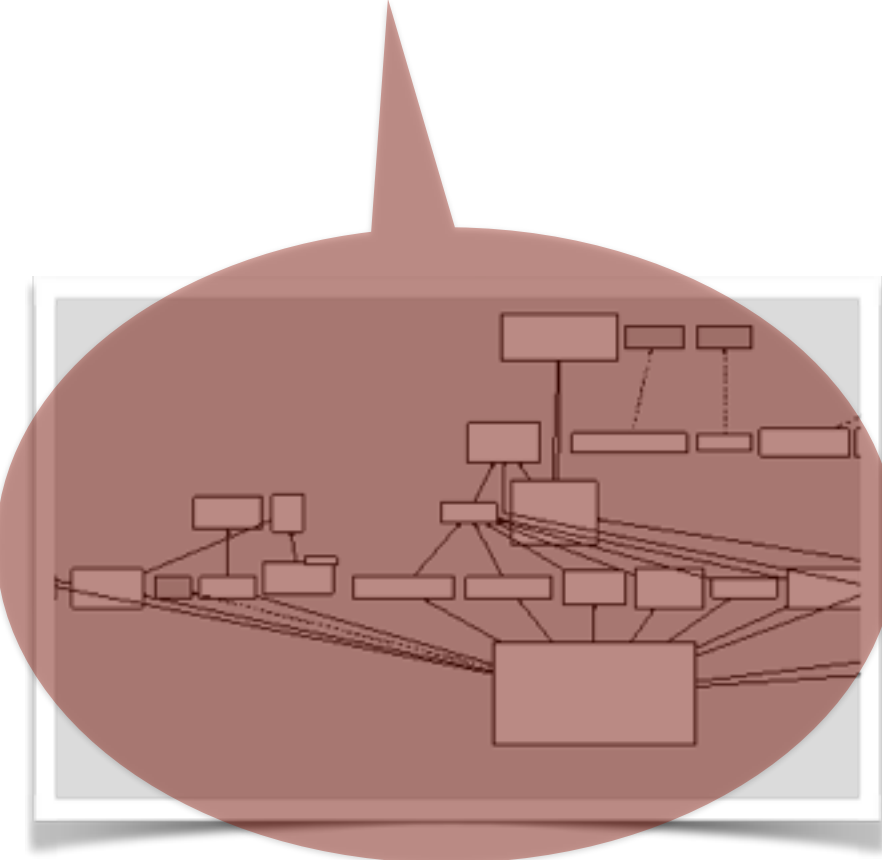
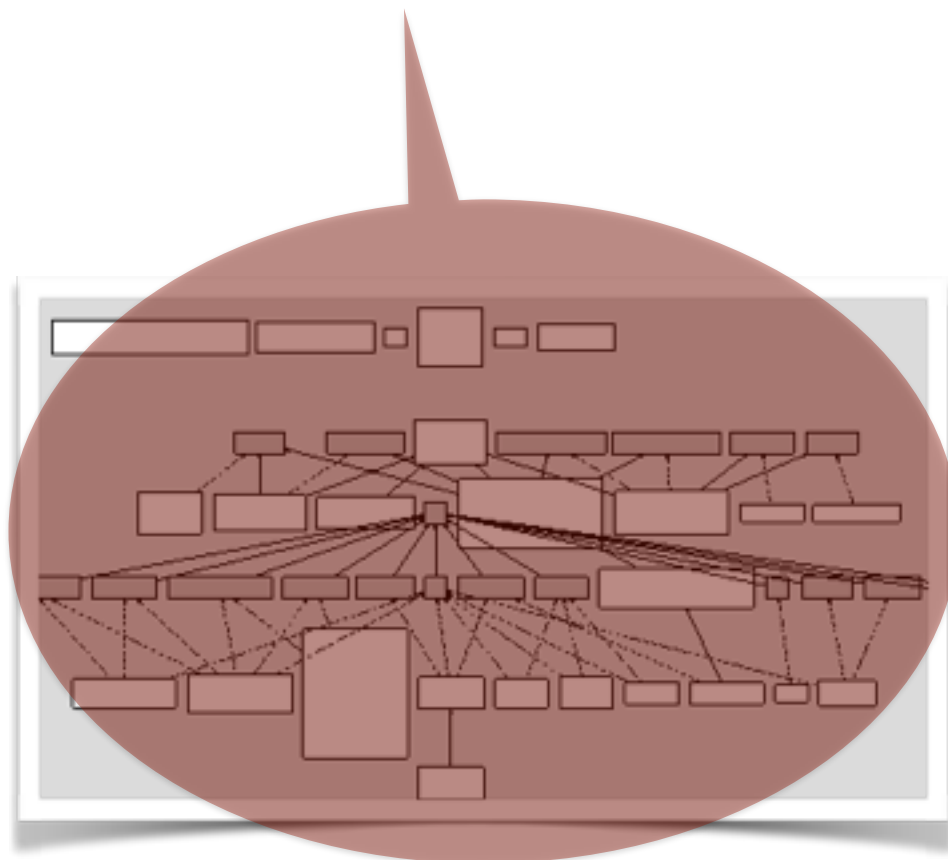
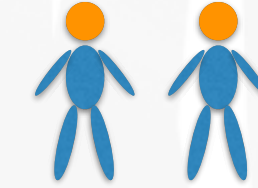
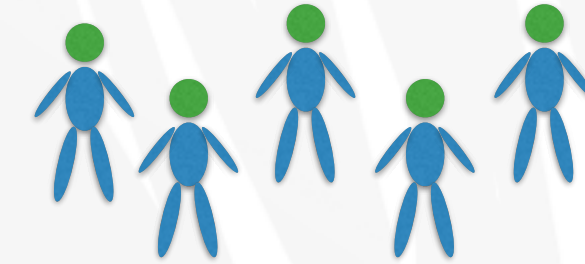
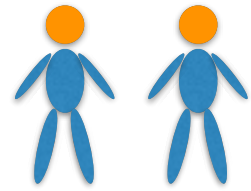
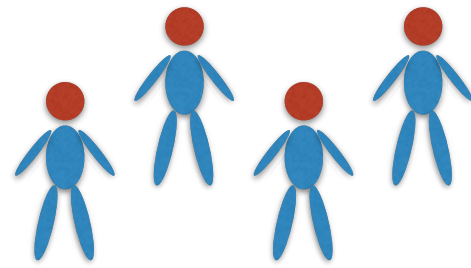
commit 49e0a958c52572af32853426a54ecf79d55046de
Author: Sebastien Ros <sebastienros@gmail.com>
Date: Mon Mar 28 09:59:56 2016 -0700

    Fixing race in unit test

3 0 test/Microsoft.AspNetCore.Mvc.TagHelpers.Test/DistributedCacheTagHelperTest.cs
```

# #0: Maintainable Code goes Beyond Technology

# The challenges of Scale



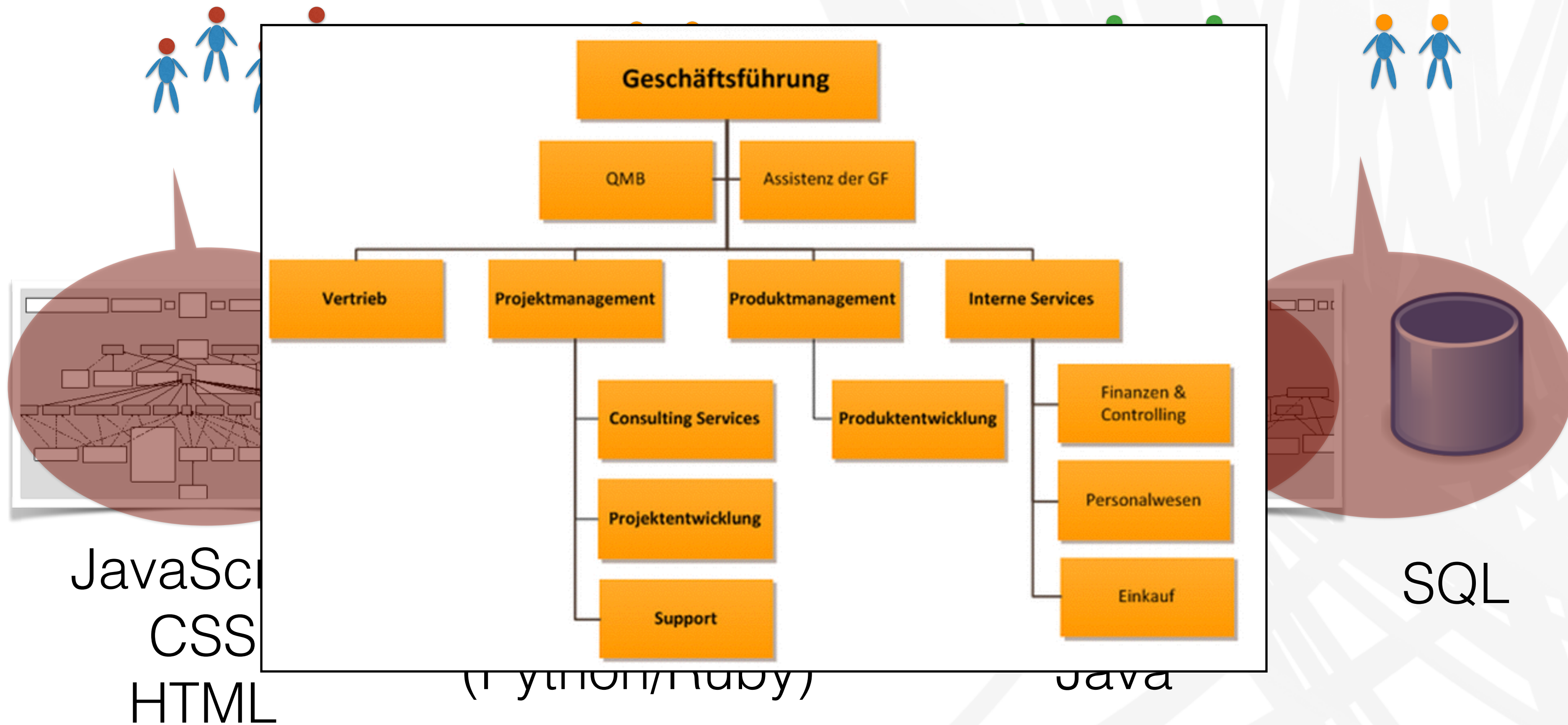
JavaScript  
CSS  
HTML

Automated Tests  
(Python/Ruby)

.NET/  
Java

SQL

# The challenges of Scale



# #1: All Code is Equal

...but some Code is more equal than others\*

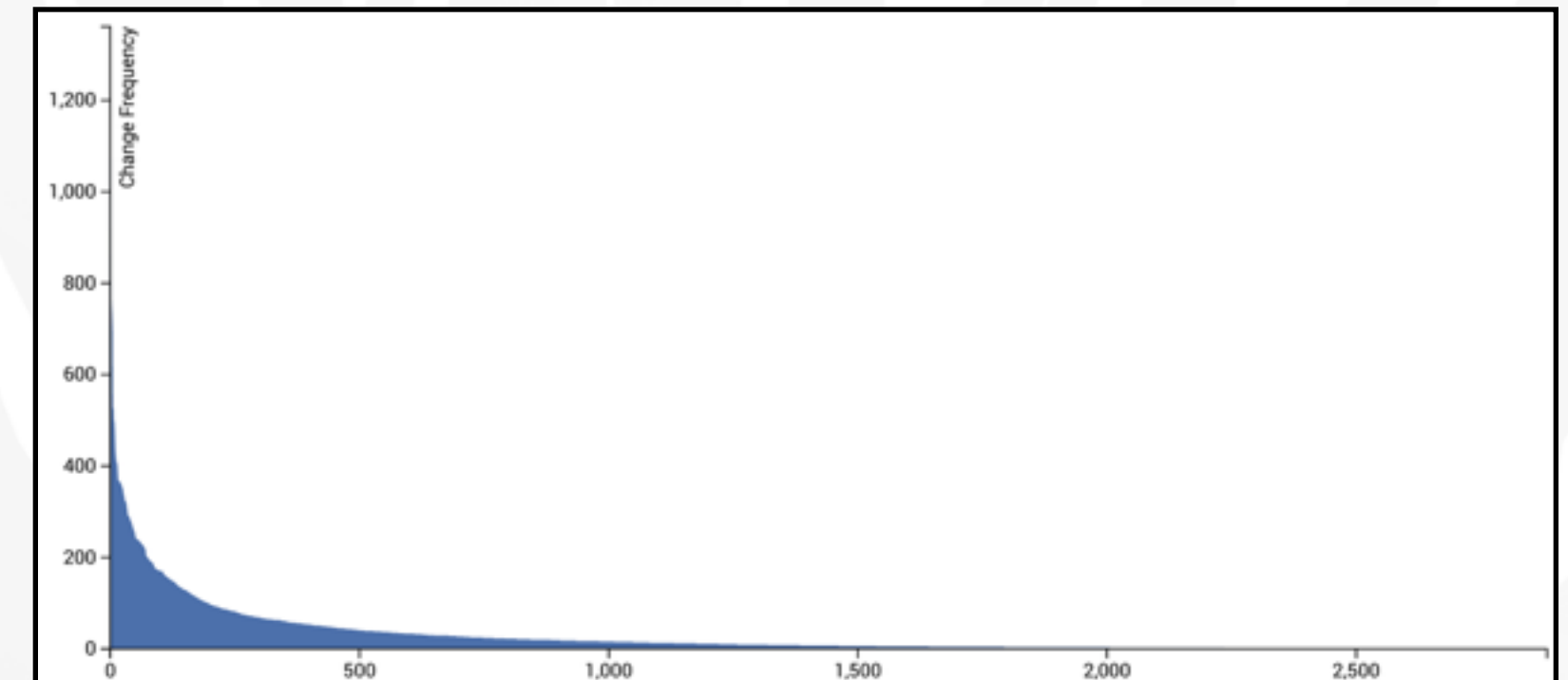
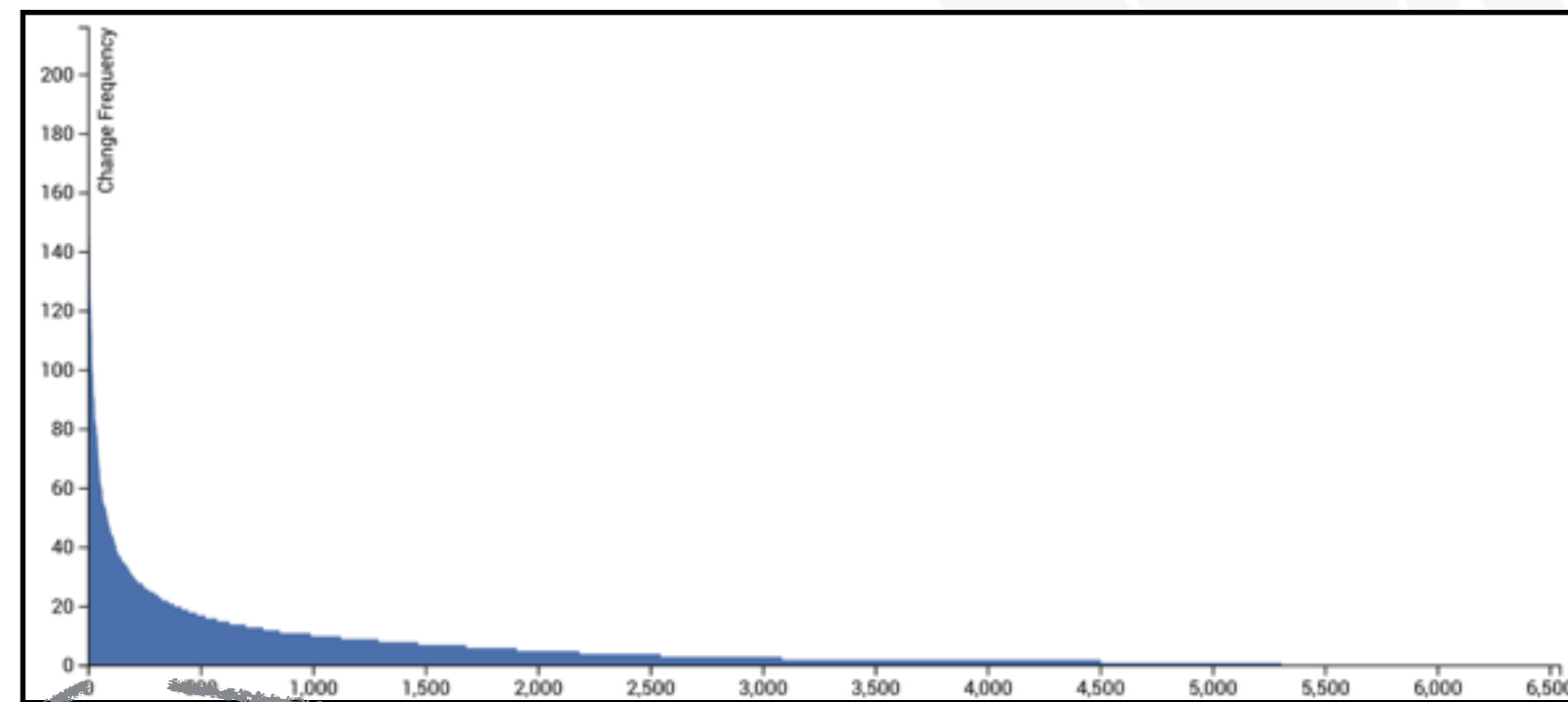
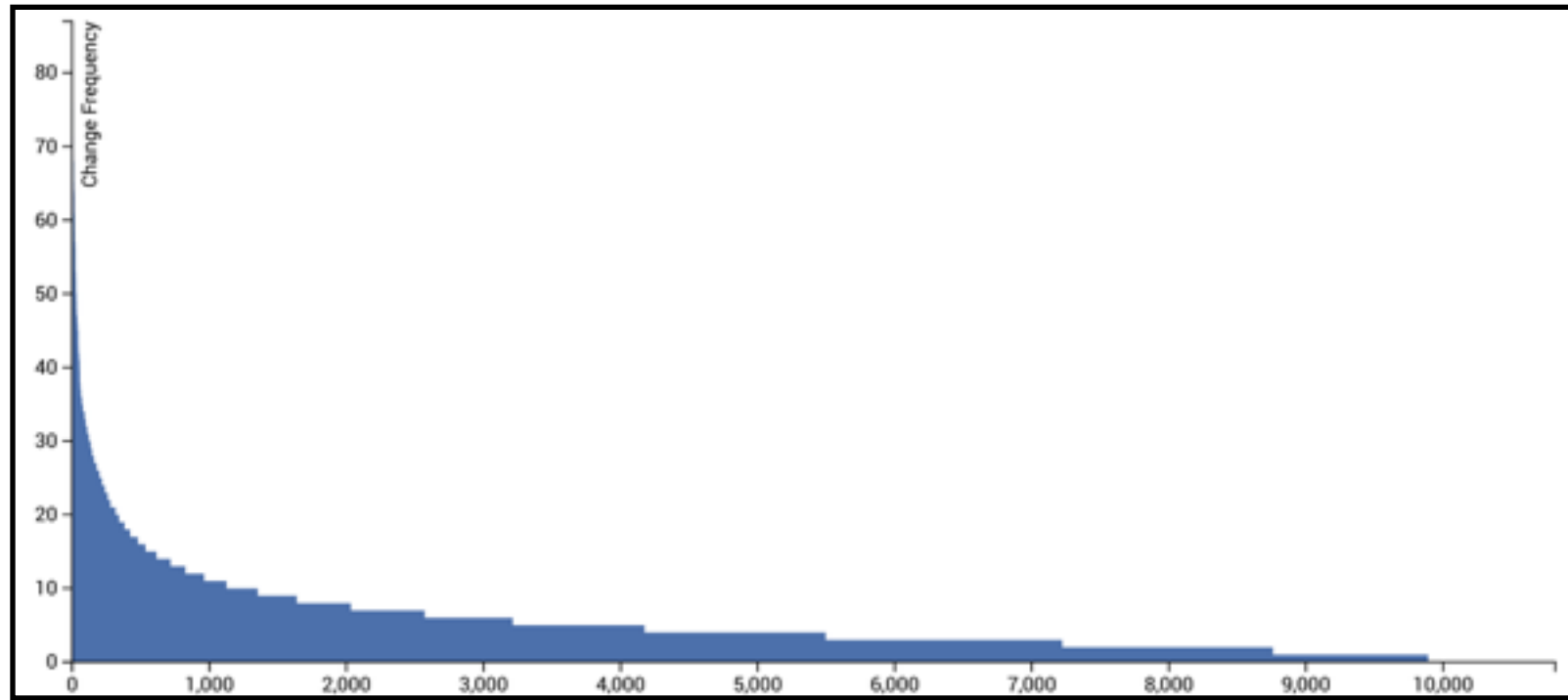
\* Sorry, George Orwell

# Change Distribution of Files

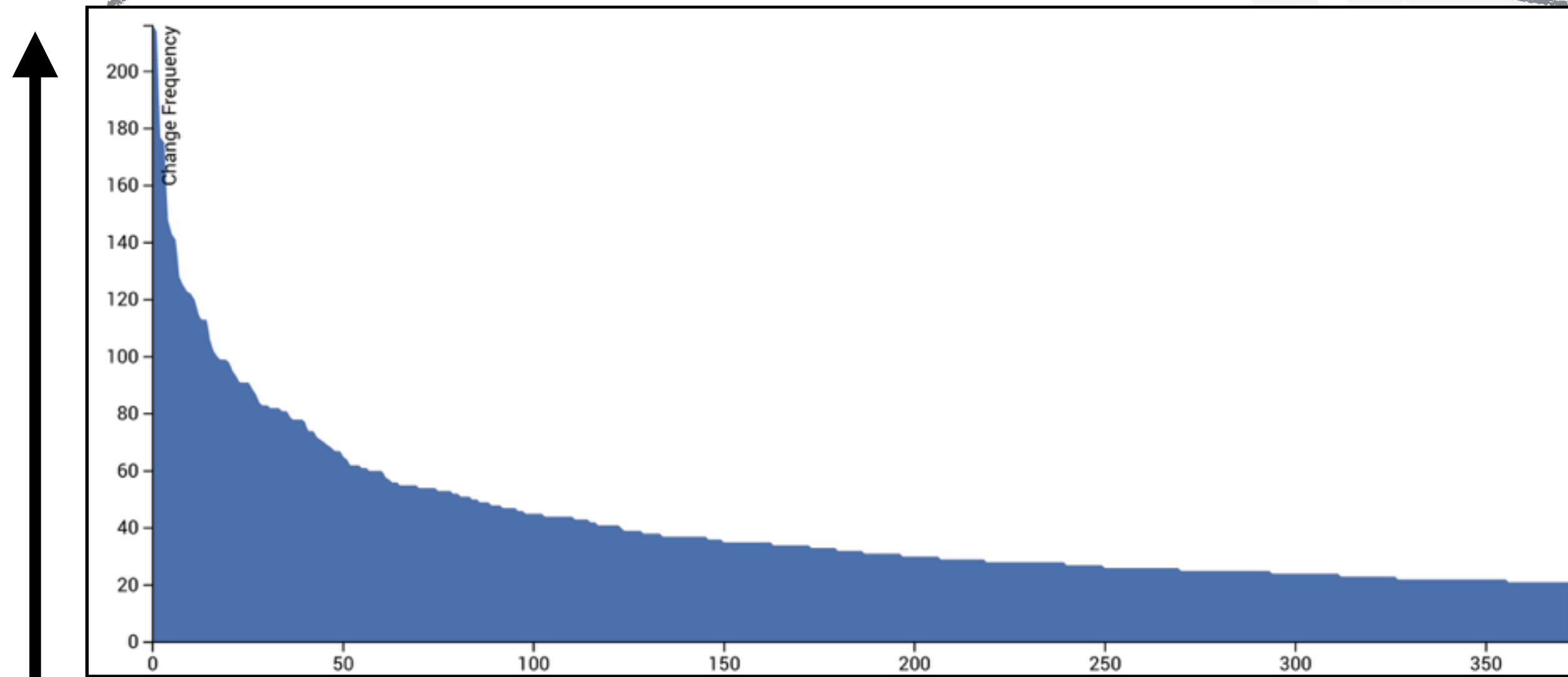
1 Year in Roslyn (C#, VB)

6 Years of Erlang

12 Years of Ruby on Rails

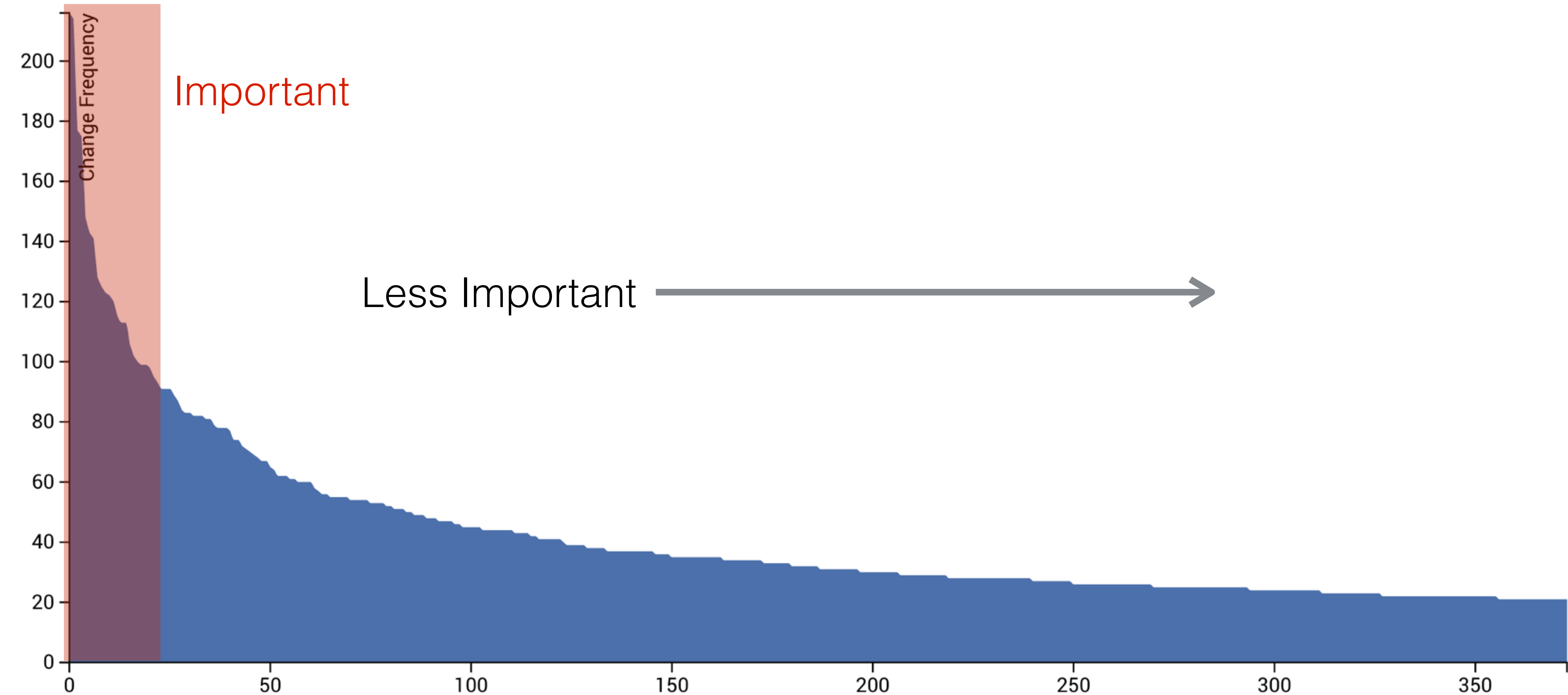


Change Frequency



Each file in the system

# Focus on the Code that Matters



**Reference:** *Predicting fault incidence using software change history* (Graves, et. al, 2000)

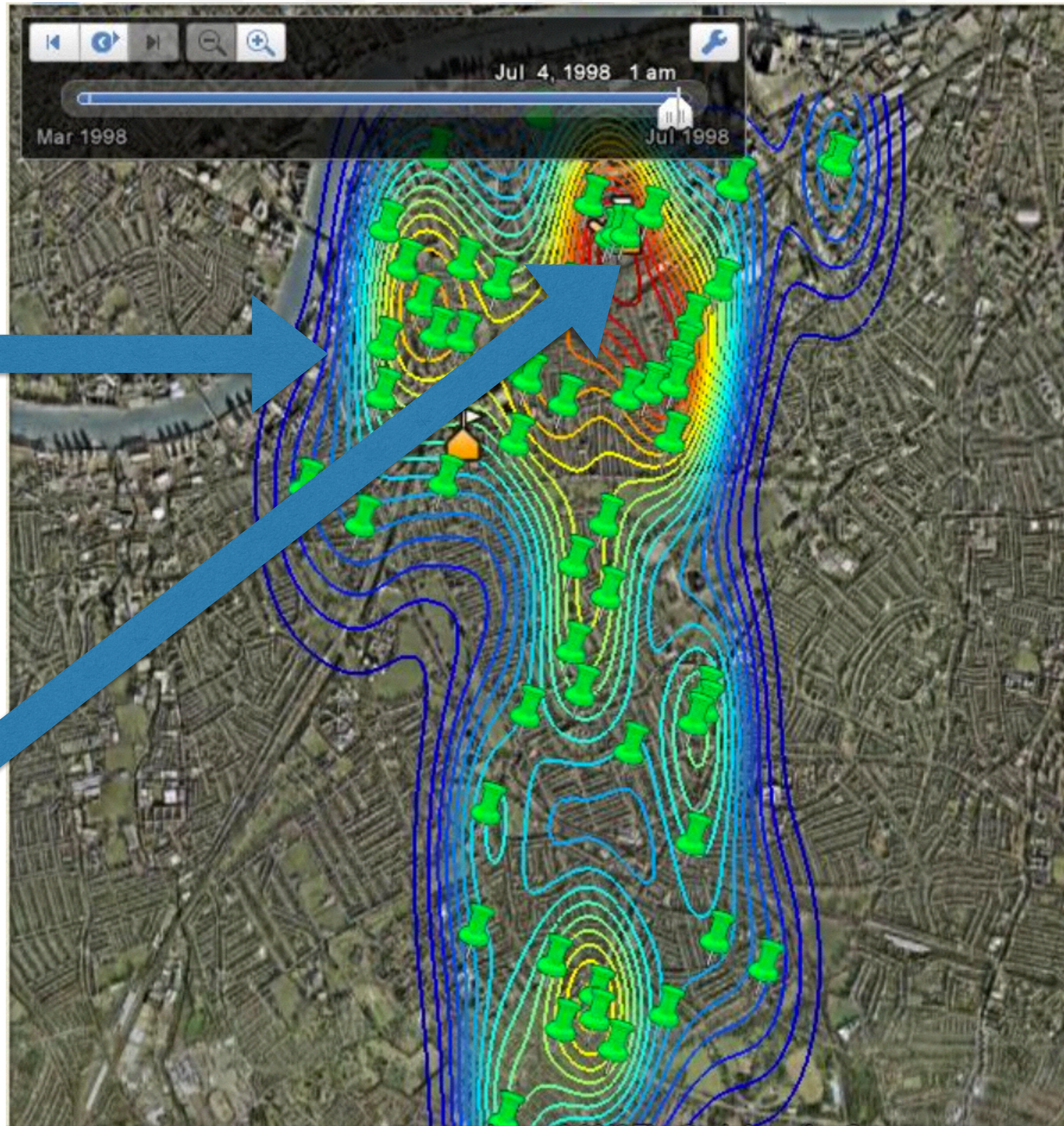
# #2 - Complexity isn't the problem

...at least not on its own.

56 crimes!

Probability surface

Most probable  
home location

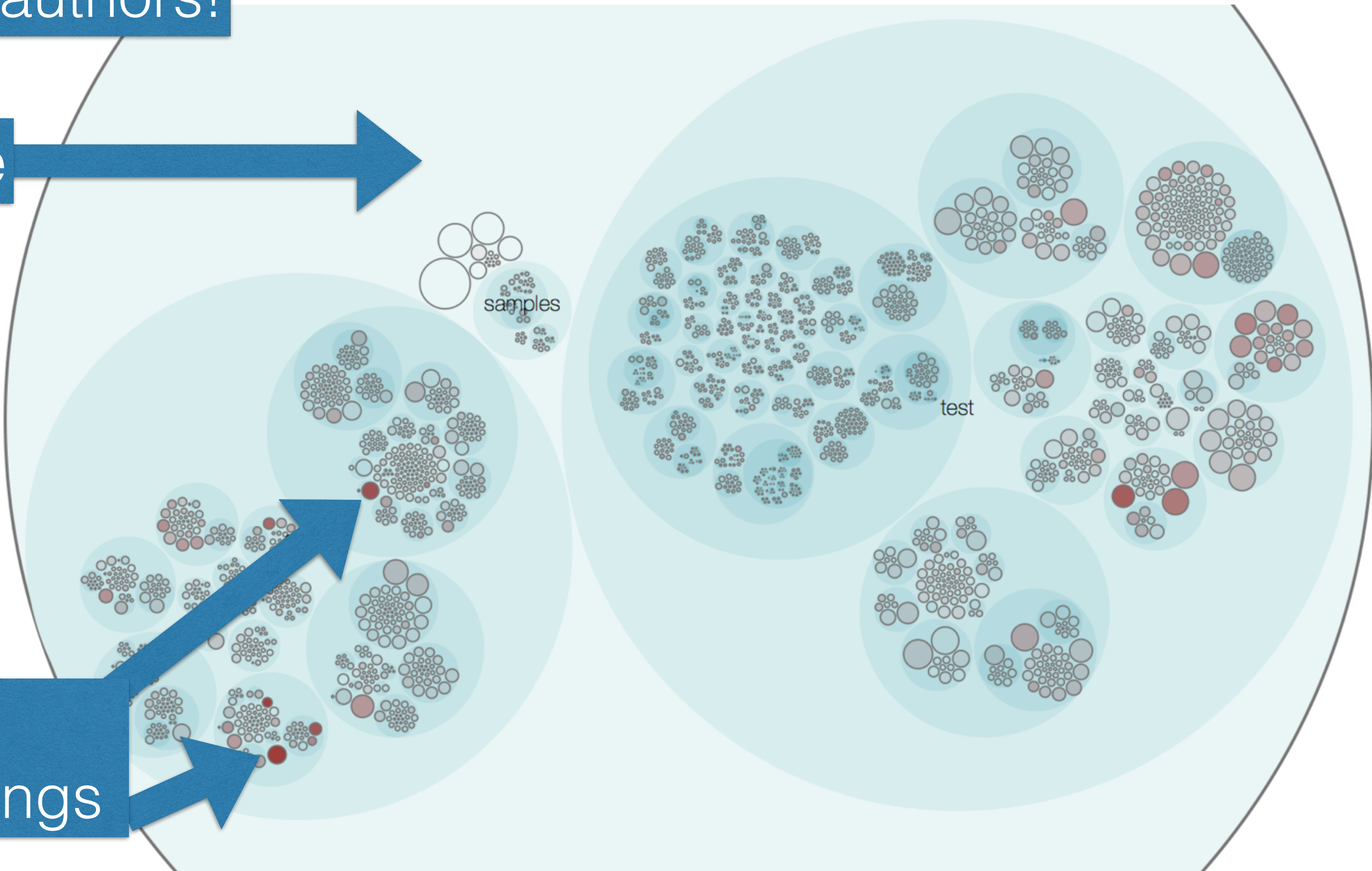


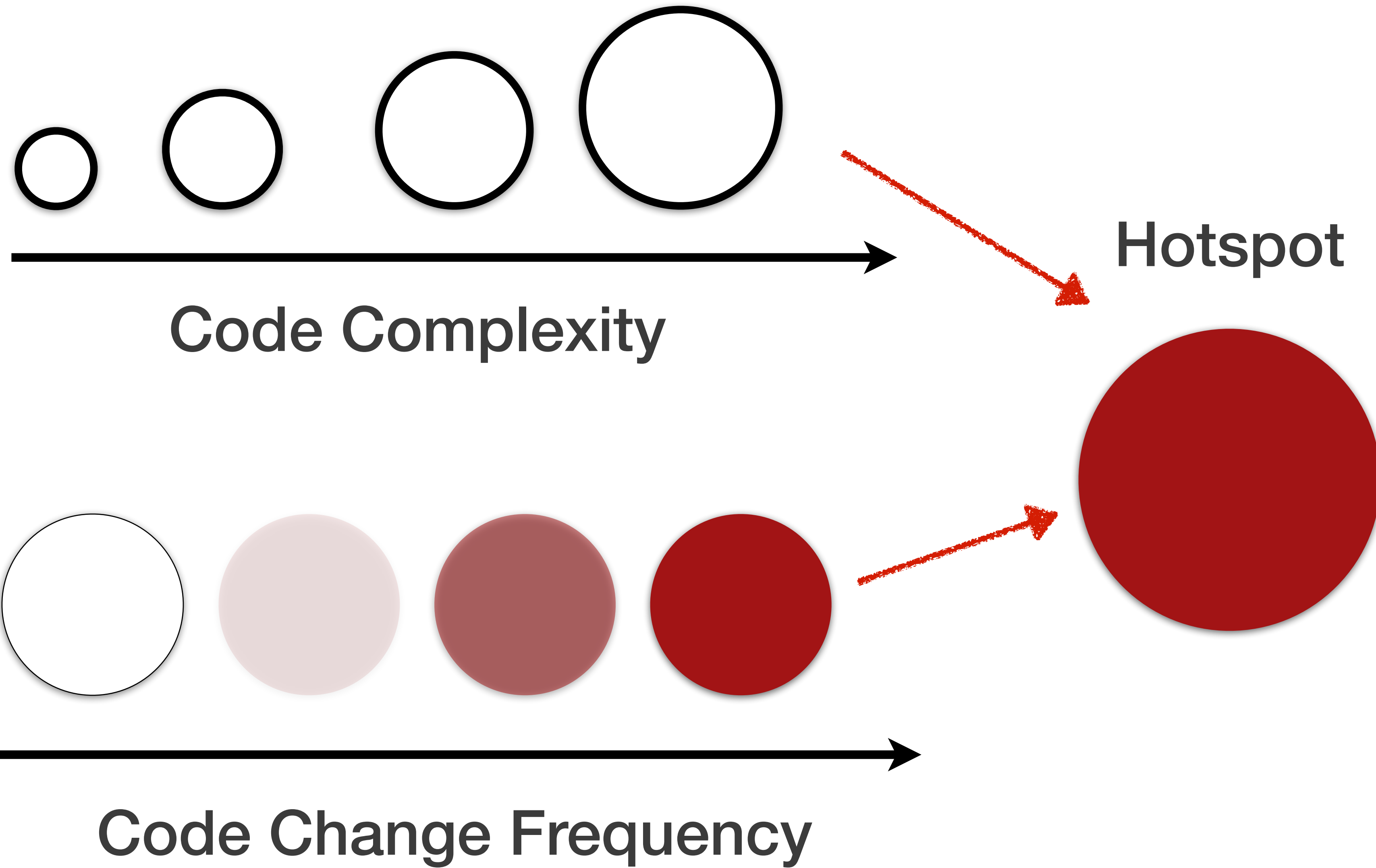
Dagnet screenshot used with permission from David Canter

2437 commits, 67 authors!

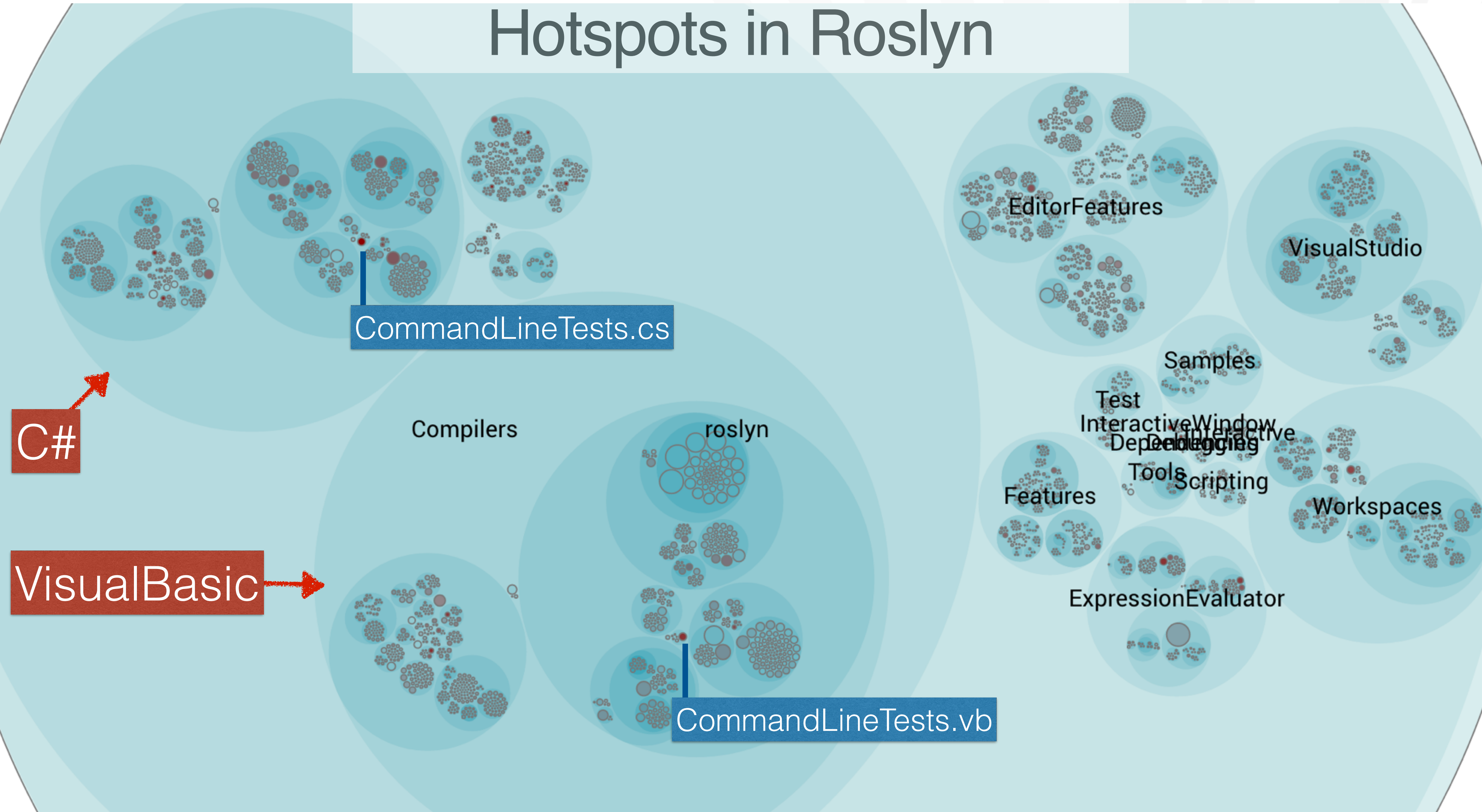
Probability surface

Most probable maintenance savings





# Hotspots in Roslyn



CommandLineTests.cs

C#

VisualBasic

CommandLineTests.vb

Compilers

roslyn

EditorFeatures

VisualStudio

Samples

Test

InteractiveWindow

Dependencies

Tools

Scripting

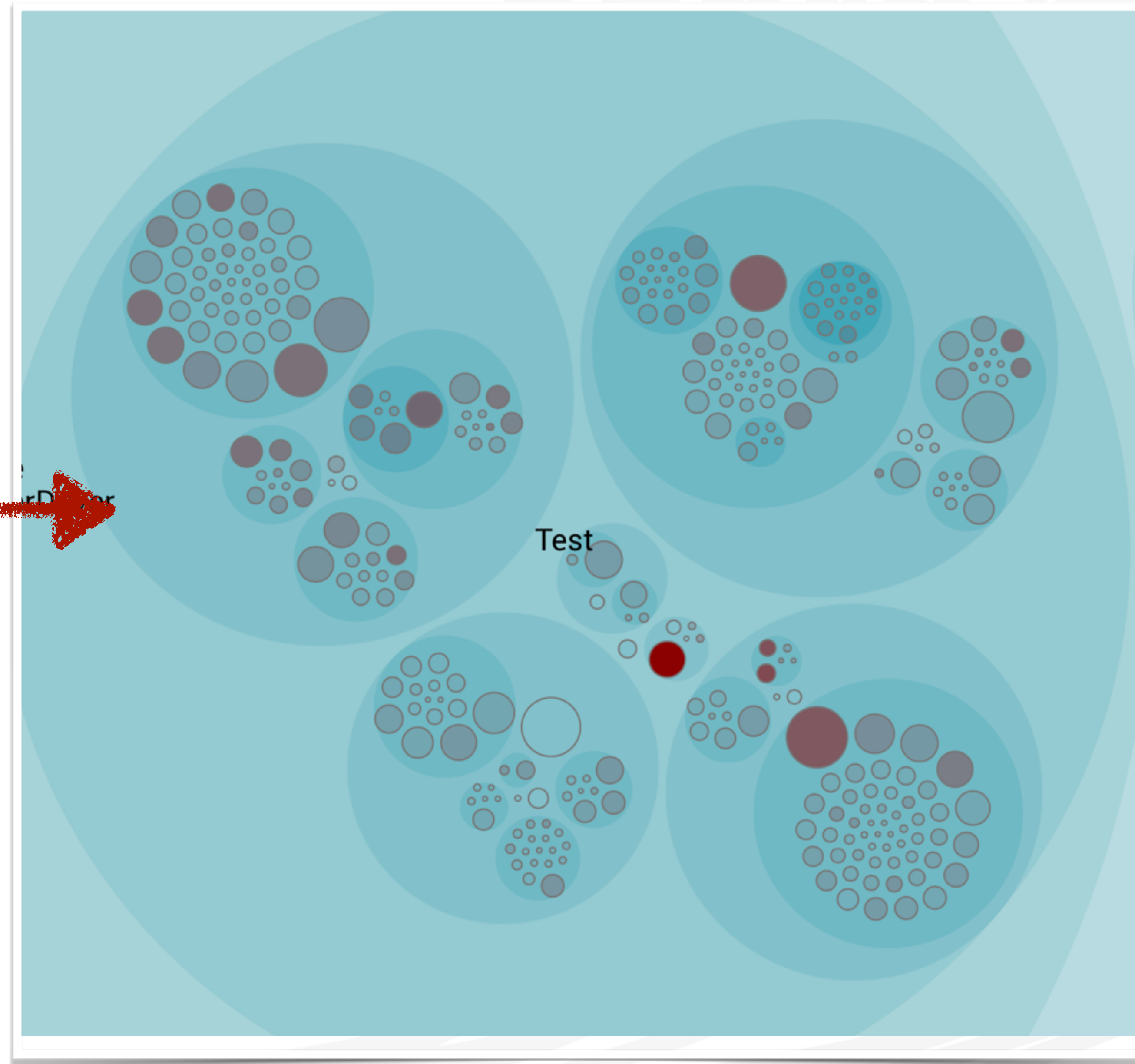
Workspaces

Features

ExpressionEvaluator

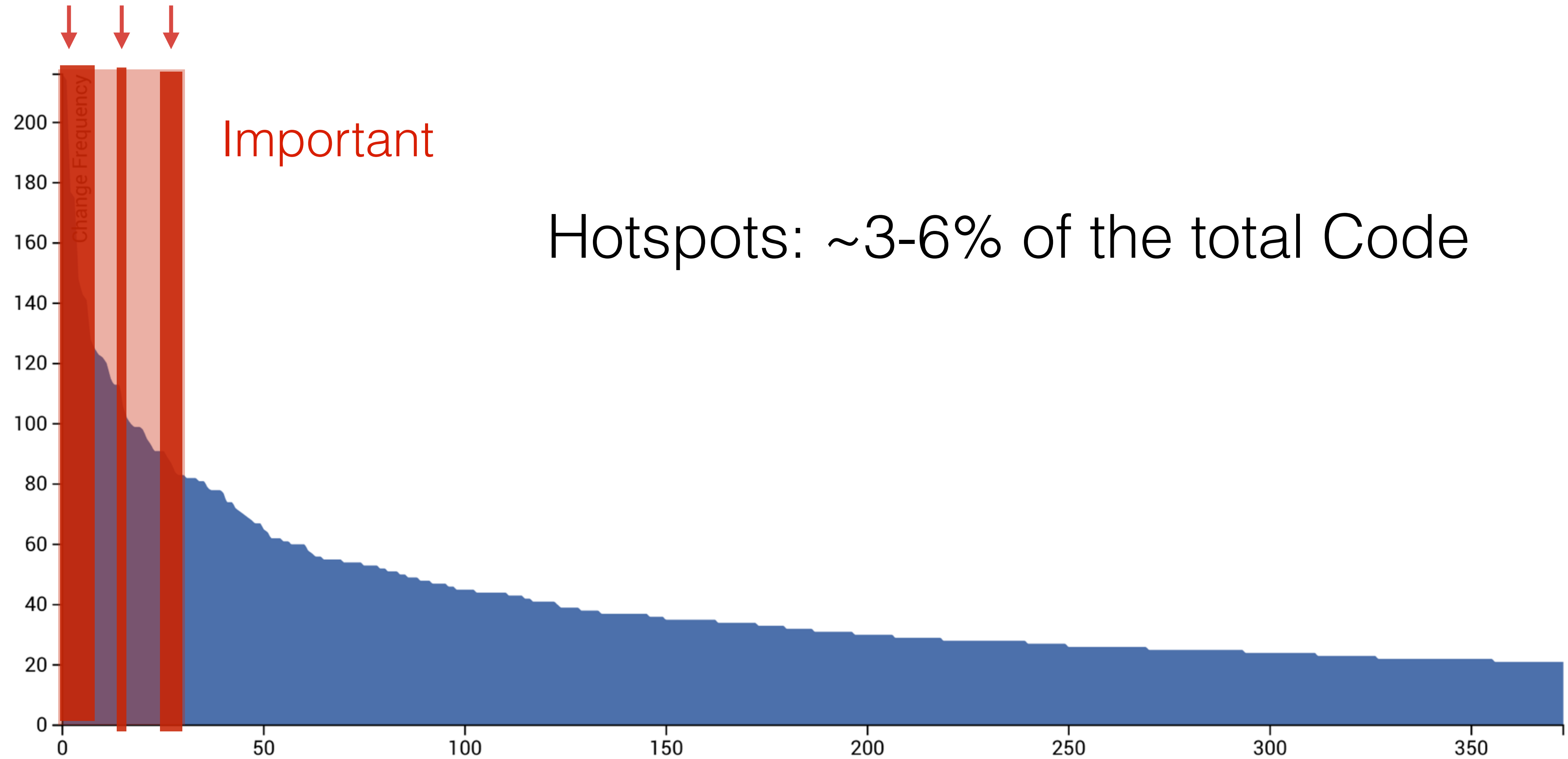
# Different Kinds of Code?

Automated Checks →



# Prioritize with Hotspots

Complex Code



# #3 Your Brain is not your friend

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# Where Are your Hotspots?





# Where's the **Gorilla** in *your* **Code**?

```
    mailbox_ptr actual_mailbox> mbox(new actual_mailbox(*this, make_pid(), io_service));
    {
        mutex_guard guard(mailboxes_lock);
        mailboxes.insert(std::make_pair(mbox->self(), mbox)).second;
        Loki::ScopeGuard insert_guard = Loki::MakeGuard(bind(&actual_node::remove, this, ::_1), mbox);
        registered_mailboxes.insert(std::make_pair(registered_name, mbox));
        insert_guard.Dismiss();
    } return mbox;

void actual_node::close_mailbox(const e_pid& id, const std::string& name)
{
    close_mailbox(id, name, reason = "normal");
}

// This function is invoked as a mailbox gets closed due to an exception.
// We must take extreme care not to fire another exception, which would
void actual_node::close_mailbox_async(const e_pid& id, const std::
{
    const std::string reason = "error";
    io_service.post(bind(&actual_node::close_mailbox
```

We Don't **Know What** We Do



# Bonus



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Support Your Decisions with Data



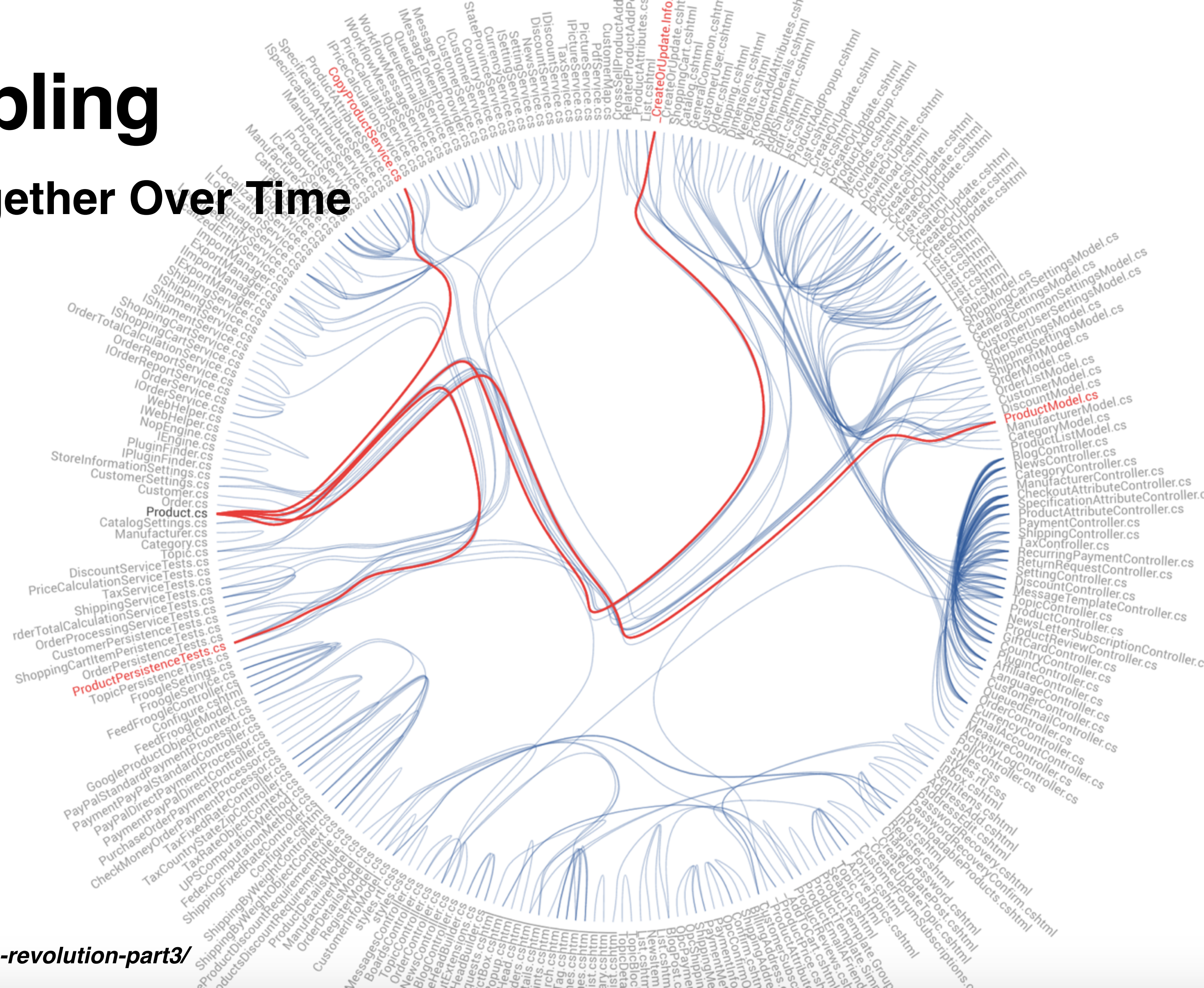
# #4 - Know Your Change Patterns

# The Cost of Surprise

```
VRTSTART  TS WCHVERT
# Page 801
   CAF  TWO          # WCHPHASE = 2 ----> VERTICAL: P65, P66, P67
   TS WCHPHOLD
   TS WCHPHASE
   TC BANKCALL      # TEMPORARY, I HOPE HOPE HOPE
   CADR STOPRATE    # TEMPORARY, I HOPE HOPE HOPE
   TC DOWNFLAG      # PERMIT X AXIS OVERRIDE
   ADRES  XOVINFLG
   TC DOWNFLAG
   ADRES  REDFLAG
   TCF  VERTGUID
```

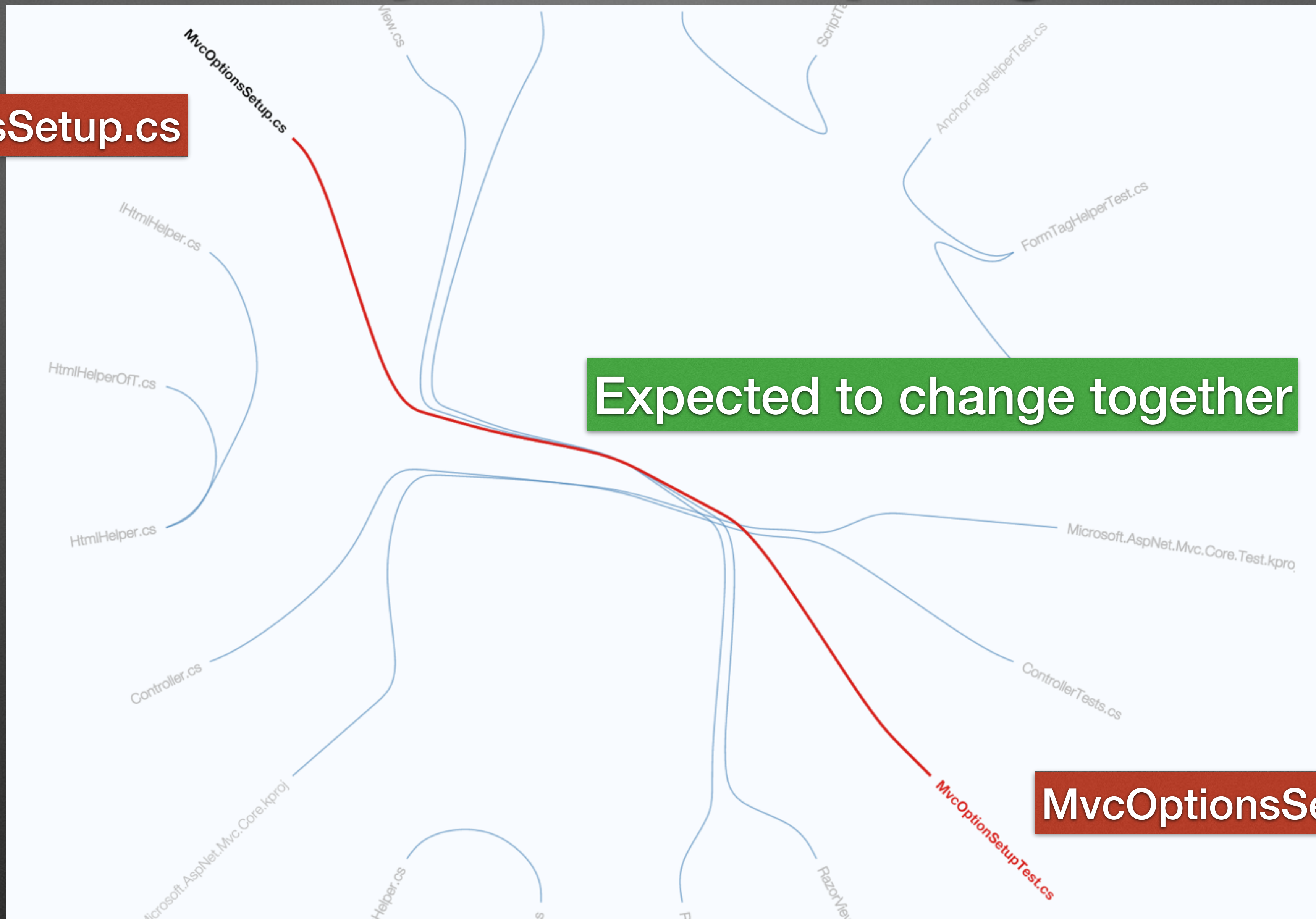
# Temporal Coupling

Code That Changes Together Over Time



# Physical Coupling

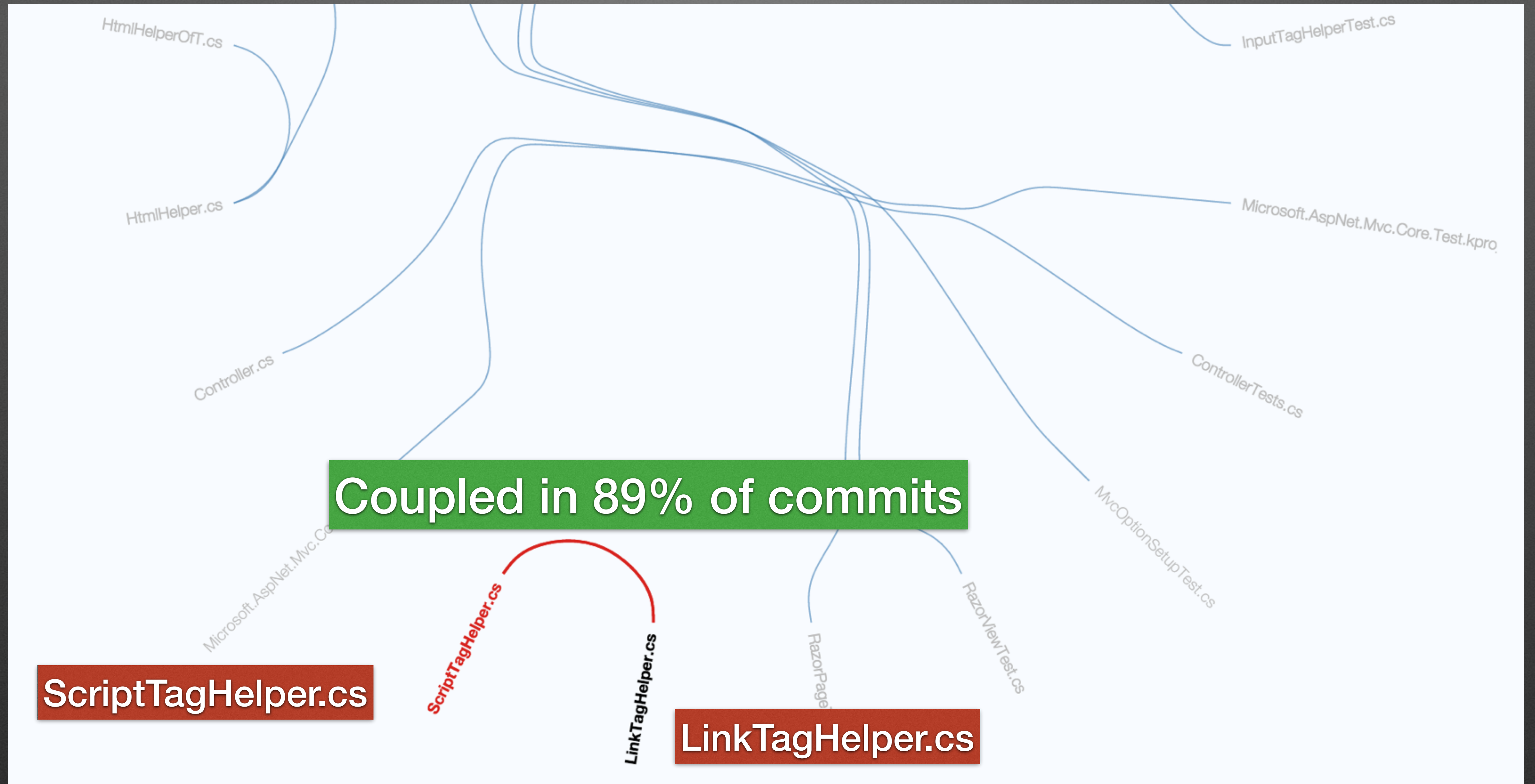
MvcOptionsSetup.cs



Expected to change together

MvcOptionsSetupTests.cs

# Logical Coupling



```
/// <inheritdoc />
public override void Process(TagHelperContext context, TagHelperOutput output)
{
    if (context == null)
    {
        throw new ArgumentNullException(nameof(context));
    }

    if (output == null)
    {
        throw new ArgumentNullException(nameof(output));
    }

    // Pass through attribute that is also a well-known HTML attribute.
    if (Src != null)
    {
        output.CopyHtmlAttribute(SrcAttributeName, context);
    }

    // If there's no "src" attribute in output.Attributes this will noop.
    ProcessUrlAttribute(SrcAttributeName, output);

    // Retrieve the TagHelperOutput variation of the "src" attribute in case other
    // pipeline have touched the value. If the value is already encoded this Src
    // not function properly.
    Src = output.Attributes[SrcAttributeName]?.Value as string;

    var modeResult = AttributeMatcher.DetermineMode(context, ModeDetails);
    modeResult.LogDetails(Logger, this, context.UniqueId, ViewContext.View.Path);

    if (!modeResult.FullMatches.Any())
    {
        // No attributes matched so we have nothing to do
        return;
    }

    // NOTE: Values in TagHelperOutput.Attributes may already be HTML-encoded.
    var attributes = new TagHelperAttributeList(output.Attributes);

    if (AppendVersion == true)
    {
        EnsureFileVersionProvider();

        if (Src != null)
        {
            output.Attributes[SrcAttributeName].Value = _fileVersionProvider.Add
        }
    }
}
```

```
/// <inheritdoc />
public override void Process(TagHelperContext context, TagHelperOutput output)
{
    if (context == null)
    {
        throw new ArgumentNullException(nameof(context));
    }

    if (output == null)
    {
        throw new ArgumentNullException(nameof(output));
    }

    // Pass through attribute that is also a well-known HTML attribute.
    if (Href != null)
    {
        output.CopyHtmlAttribute(HrefAttributeName, context);
    }

    // If there's no "href" attribute in output.Attributes this will noop.
    ProcessUrlAttribute(HrefAttributeName, output);

    // Retrieve the TagHelperOutput variation of the "href" attribute in case other TagHelpers in the
    // pipeline have touched the value. If the value is already encoded this LinkTagHelper may
    // not function properly.
    Href = output.Attributes[HrefAttributeName]?.Value as string;

    var modeResult = AttributeMatcher.DetermineMode(context, ModeDetails);
    modeResult.LogDetails(Logger, this, context.UniqueId, ViewContext.View.Path);

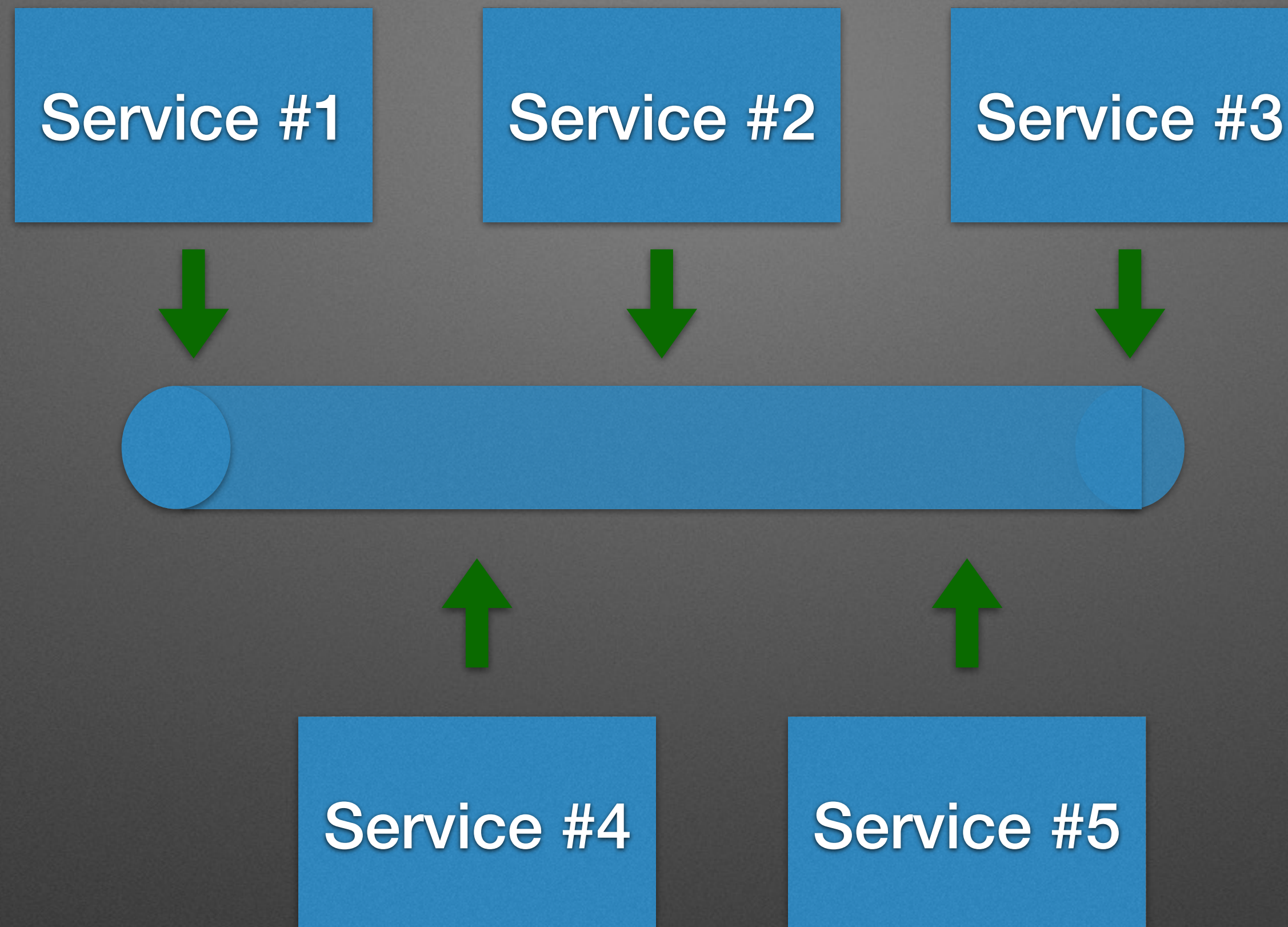
    if (!modeResult.FullMatches.Any())
    {
        // No attributes matched so we have nothing to do
        return;
    }

    // NOTE: Values in TagHelperOutput.Attributes may already be HTML-encoded.
    var attributes = new TagHelperAttributeList(output.Attributes);

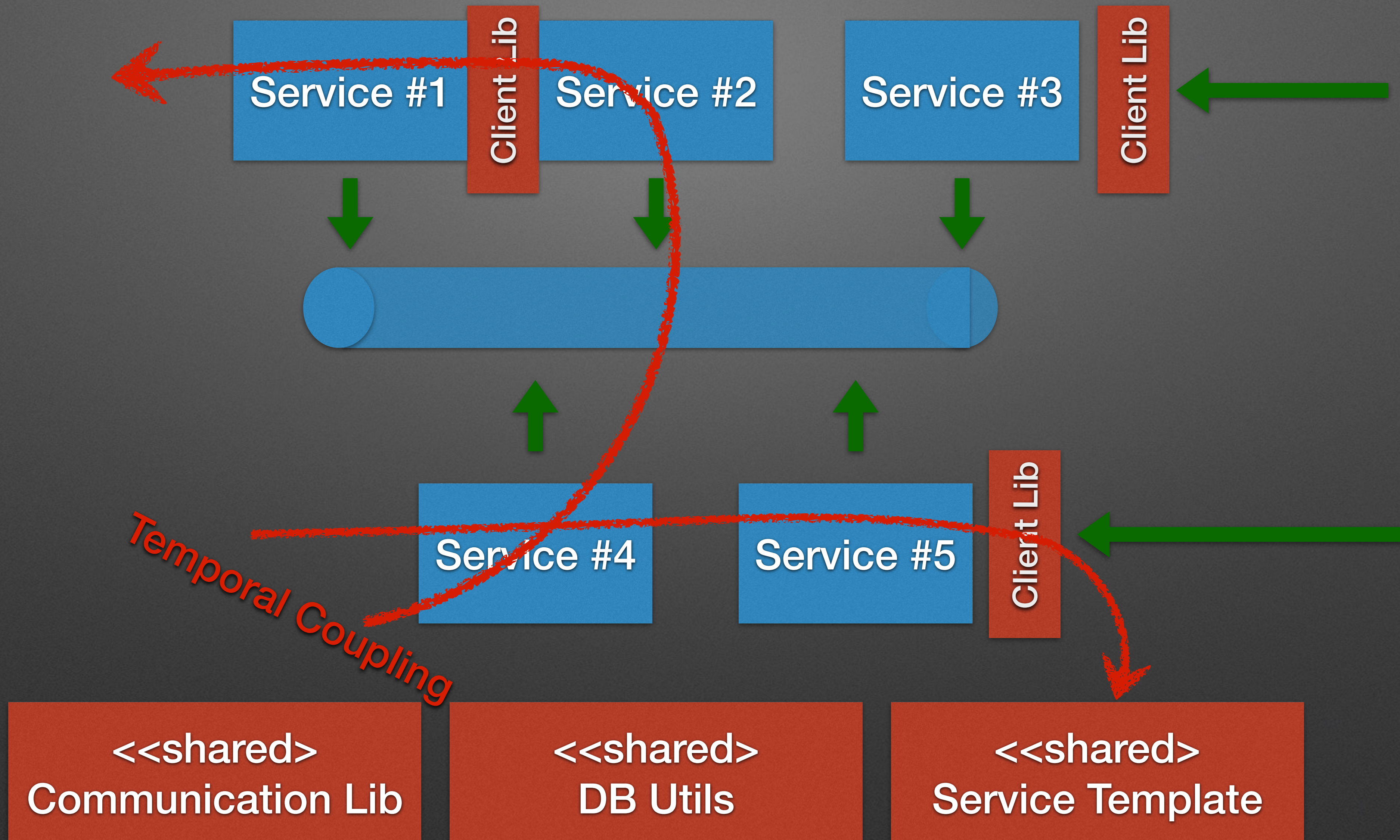
    if (AppendVersion == true)
    {
        EnsureFileVersionProvider();

        if (Href != null)
        {
            output.Attributes[HrefAttributeName].Value = _fileVersionProvider.AddFileVersionToPath(Href);
        }
    }
}
```

# Analyzing Architectures



# Analyzing Architectures

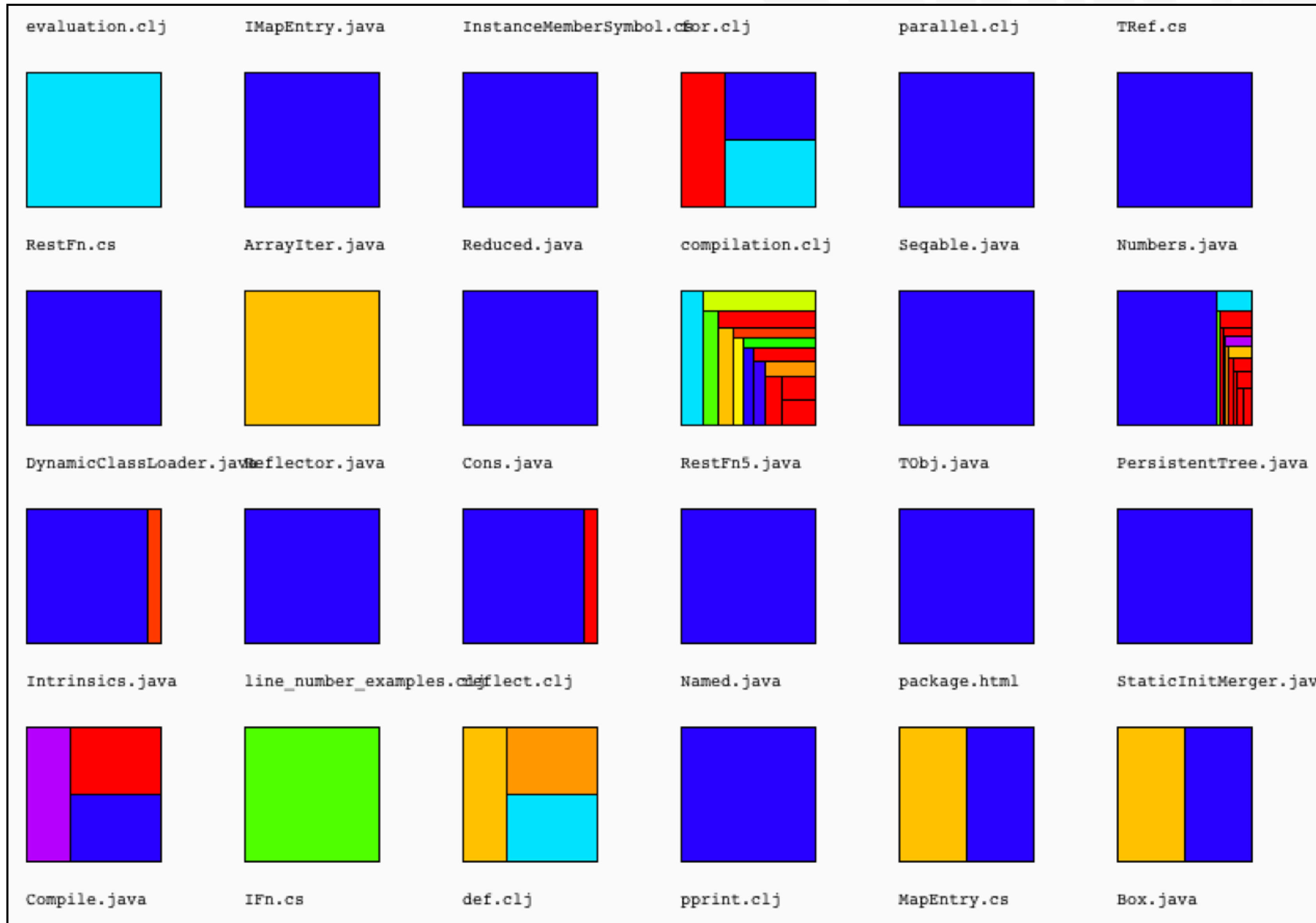


# #5 - Organizational problems are mistaken as technical issues

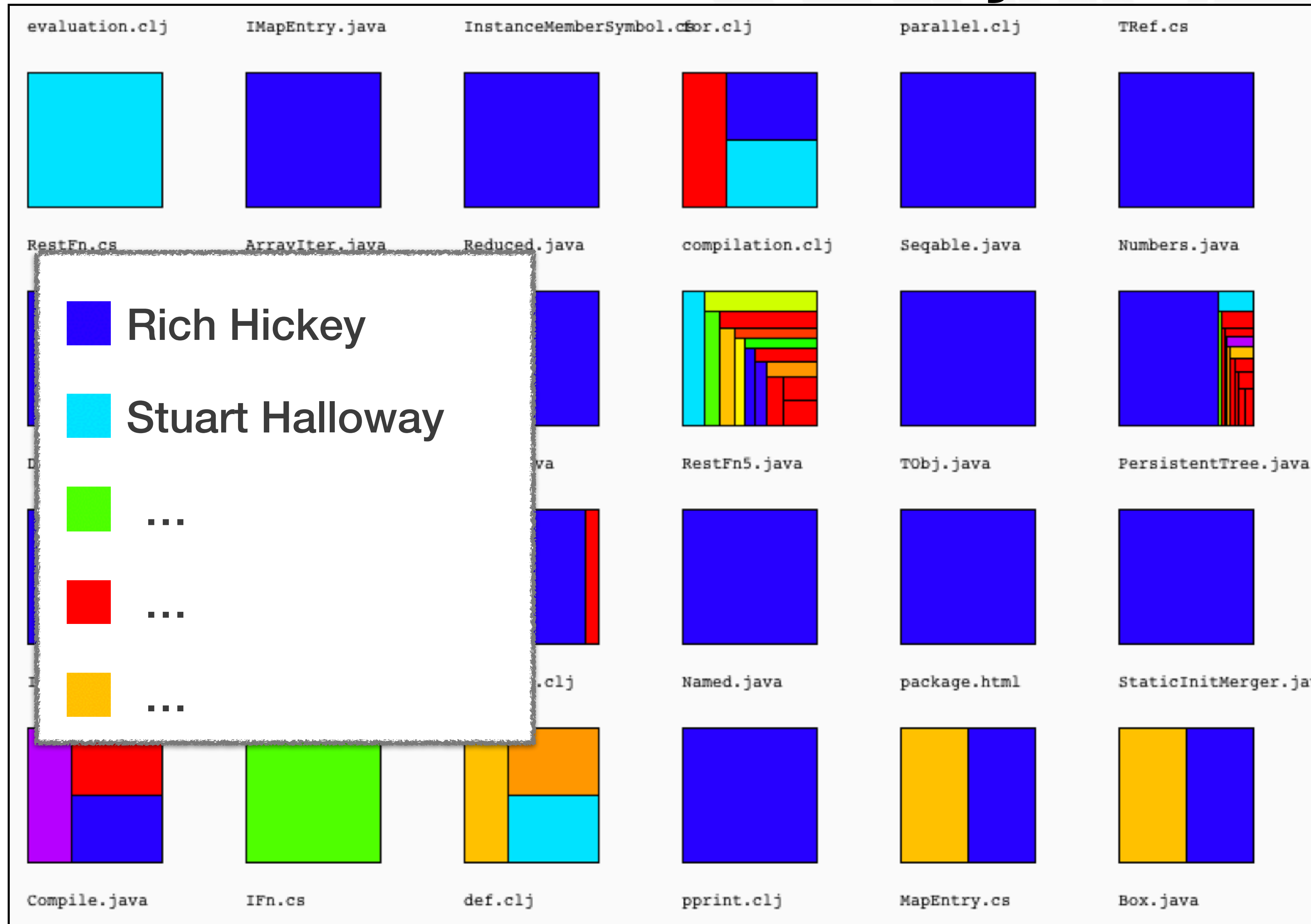
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# A Social View of Clojure



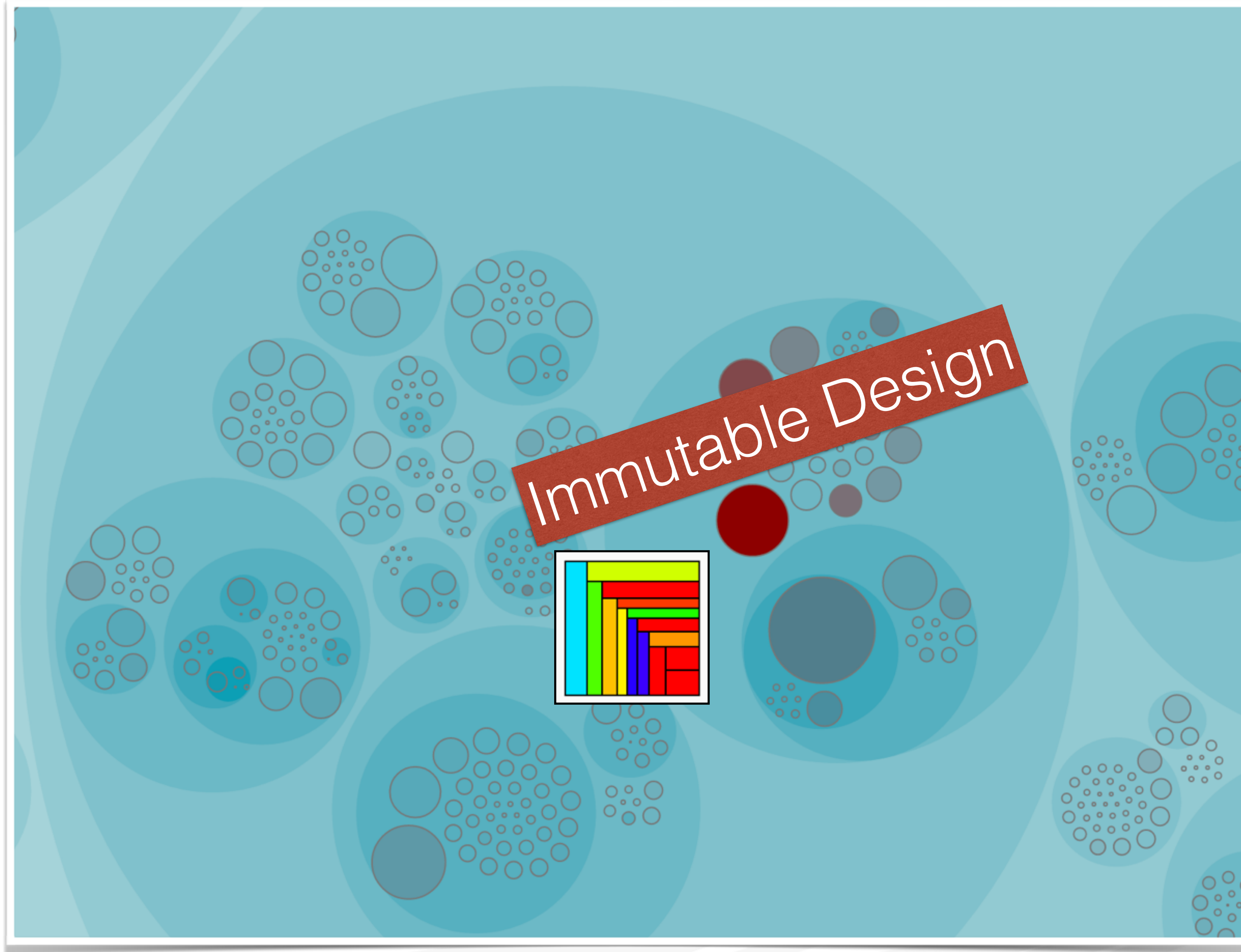
# A Social View of Clojure



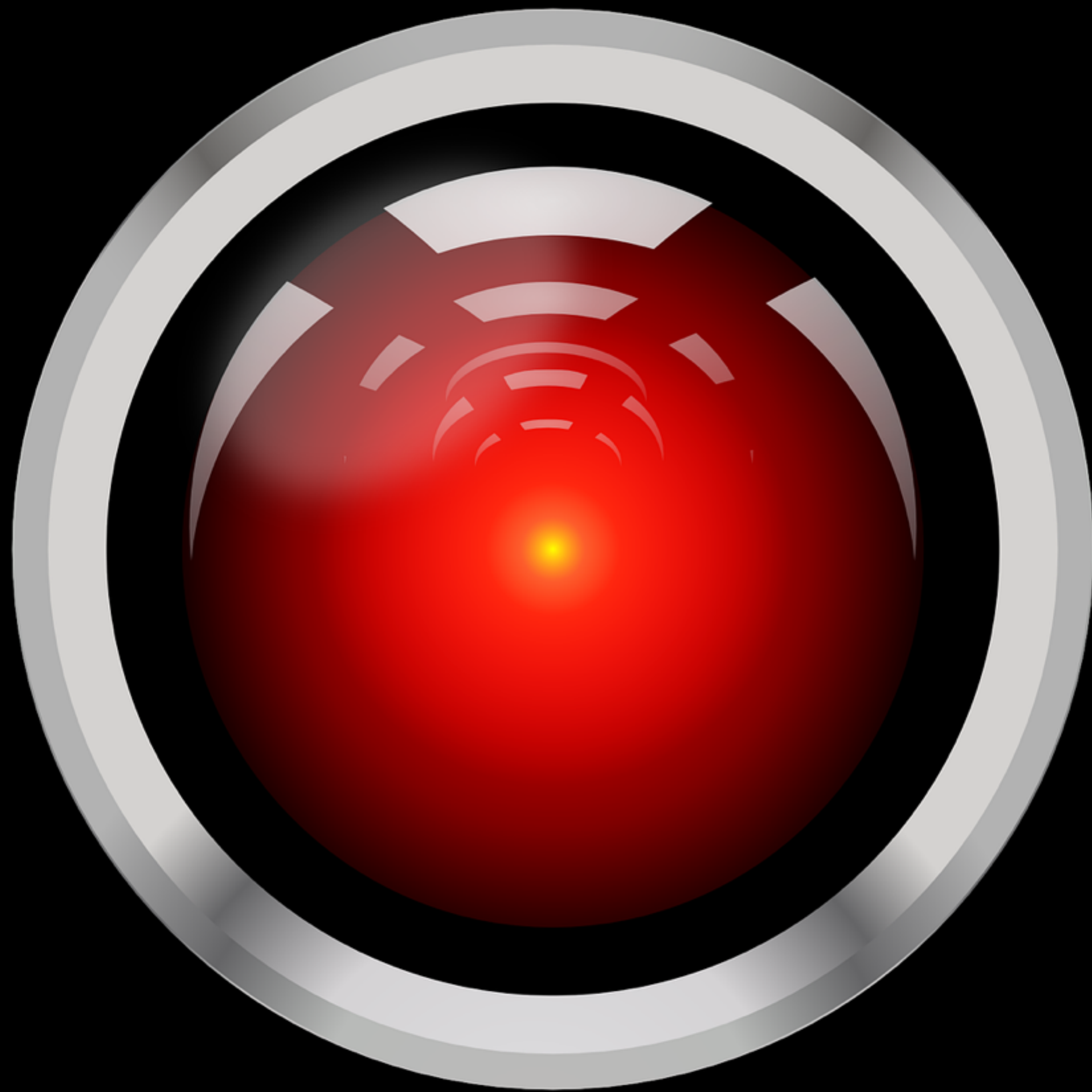
# Excess Parallel Work?



# Why Hotspots stay where they are



# #6 - Find Your Blind Spots



# A Main Developer leaves Scala



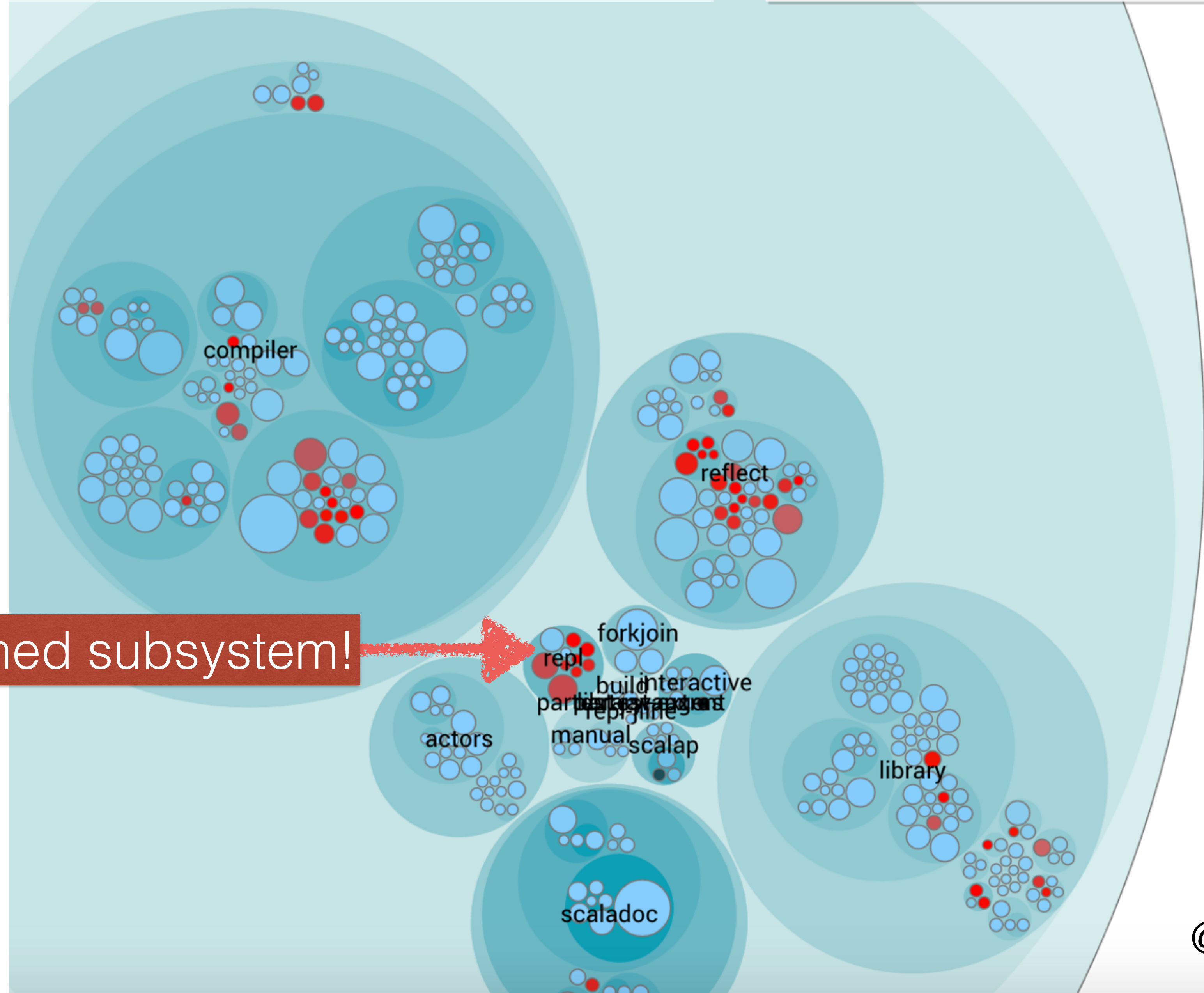
<https://www.youtube.com/watch?v=uiJycy6dFSQ>



# A Main Developer leaves Scala

- Abandoned by inactive developers
- Maintained by active developers
- Unknown status (most work before analysis start date)

Abandoned subsystem!



# #7 - Make it Fun

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## **CodeScene: The Analyses as a Service**

<https://codescene.io/>

## **Read The Book: Your Code As A Crime Scene**

<https://pragprog.com/book/atcrime/your-code-as-a-crime-scene>

## **Time - The Hidden Dimension of Software Design**

<http://www.empear.com/blog/software-revolution-part3/>

## **The Day I Parsed A Monster**

<http://www.empear.com/blog/parse-a-monster/>

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