

MATT ELAND

TWITTER: [@INTEGERMAN](https://twitter.com/integerman)



KILL ALL DEFECTS

Quality Software via Better Code  
[WWW.KILLALLDEFECTS.COM](http://WWW.KILLALLDEFECTS.COM)

[OM](#)

# TECHNICAL DEBT MUST DIE

COMMUNICATING CODE TO BUSINESS STAKEHOLDERS

**Social History:**

Married?  NO  YES    Divorced?  NO  YES    Children?  NO  YES    If yes, number of children \_\_\_\_\_

Family members living in the home:  Mother  Father  Siblings  Others: \_\_\_\_\_

Do you smoke?  Currently  Past  Never    \_\_\_\_\_ packs/day for \_\_\_\_\_ years. Other tobacco use?  NO  YES  
If you do smoke, would you like information about our smoking cessation program?  NO  YES

Do you drink alcohol?  NO  YES  Beer  Wine  Liquor. How many drinks per week? \_\_\_\_\_

How many servings of caffeine per day? \_\_\_\_\_  Coffee  Tea  Sodas

Do you limit salt in your diet?  NO  YES    Do you limit fat?  NO  YES

Any illegal drug use?  NO  YES Type \_\_\_\_\_

**Occupation** Software Engineering Manager**Any known occupational exposures?**Technical Debt / Legacy CodeDo you exercise regularly?  Yes  No    If so, how many times per week? \_\_\_\_\_ Type of exercise \_\_\_\_\_Do you feel safe in your home?  NO  YESSexual Orientation?  Not Applicable  Heterosexual  Homosexual**Preventative Care:**Date of last Colon and Rectal Cancer screening: \_\_\_\_\_  Rectal exam  Sigmoidoscopy  ColonoscopyDate of last eye exam: \_\_\_\_\_ Have you had bone density (DEXA) exam?  NO  YES Date: \_\_\_\_\_Do you use your seat belt?  Yes  No**Immunizations:** \_\_\_\_\_ Date: \_\_\_\_\_**Immunizations:** \_\_\_\_\_ Date: \_\_\_\_\_

Tetanus

Hepatitis A

Influenza

Hepatitis B

Pneumonia

Shingles



Photo by Francisco Venâncio on Unsplash



**TECH  
DEBT  
AHEAD**



# KILL ALL DEFECTS

Quality Software via Better Code



This Guy



Following

## Matt Eland

@integerman Follows you

a front-line .NET and JavaScript software engineering manager with strong focuses on mentoring, architecture, and software quality. My views are my own.

📍 Columbus, OH 🌐 killalldefects.com 🎂 Born September 10  
💻 Joined May 2009

# MOVE HQ

an **updater**, company







programming is coding  
the other 90% is debugging







TS

JS





C#

Angular

SQL

Angular

SQL

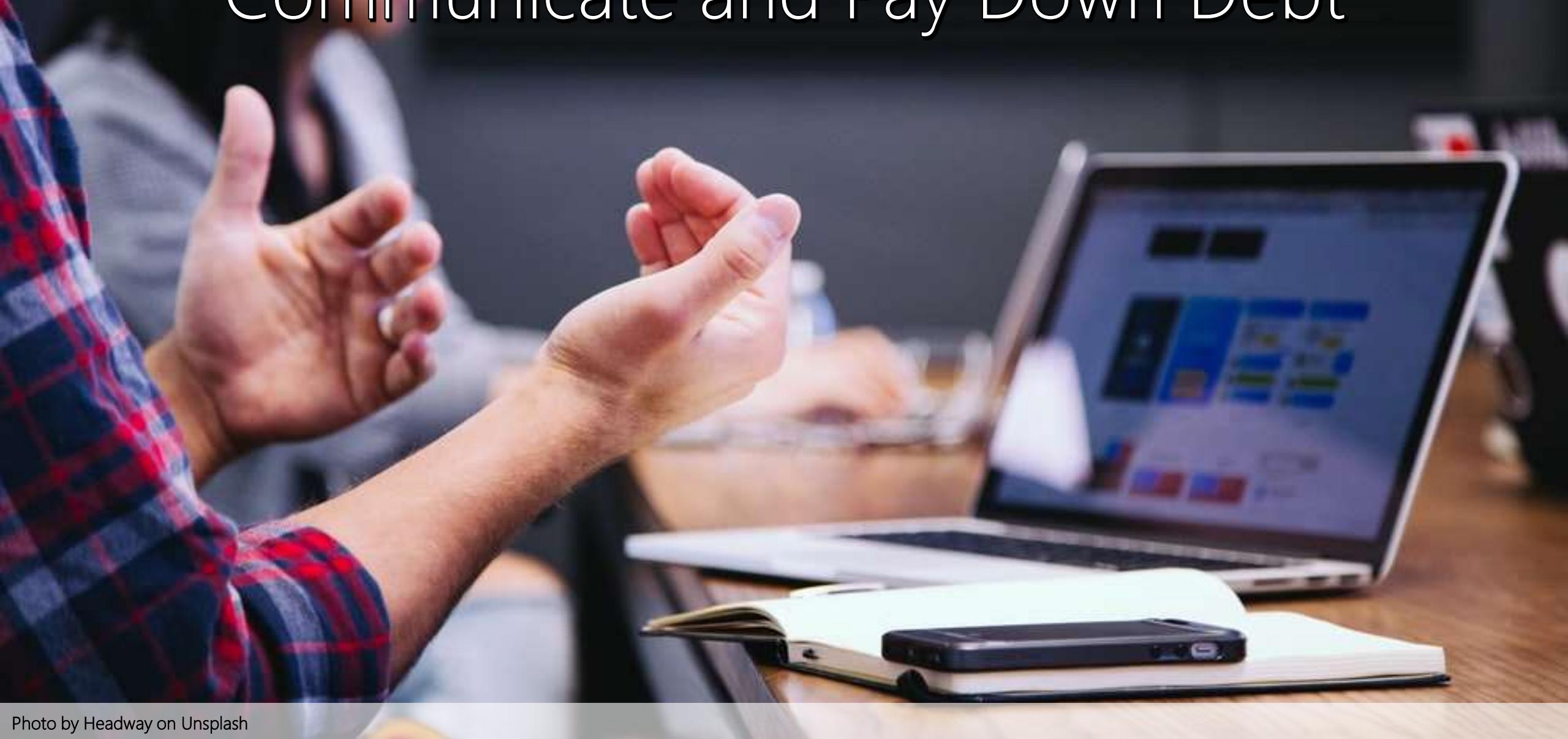
# Understanding Technical Debt



# Analyzing Data to Build Recommendations

A photograph of a female scientist in a white lab coat and blue nitrile gloves looking through the eyepiece of a compound light microscope. She is focused on her work. On the microscope stage, there is a stack of circular petri dishes. In the foreground, a row of small test tubes with orange caps is visible. The background shows a typical laboratory setting with various pieces of equipment and supplies.

# *Work with Management to Communicate and Pay Down Debt*



# How to *safely* pay down debt



# Manage Accumulation



# What is Technical Debt?

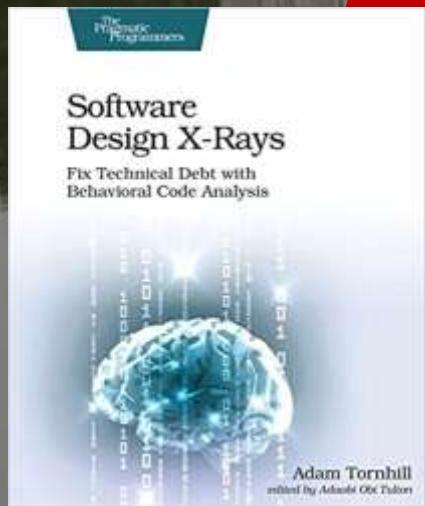
The background of the slide features a photograph of a wooden pier or dock extending from the foreground into a body of water. The water is calm, reflecting the surrounding environment. In the background, there are dense green trees and bushes. The overall atmosphere is somewhat melancholic or reflective, which serves as a metaphor for the concept of technical debt.

A state of unnecessary complexity, duplication, subpar code, or otherwise deficient code that introduces risks in the form of time, quality, security, team morale or other forms.

Typically the result of past action or inaction.

- Matt Eland

# What is Technical Debt?



A state of unnecessary complexity, duplication,

Technical debt is code that's more expensive  
to maintain than it should be.

- Adam Tornhill  
Software Design X-Rays

- Matt Eland

# CAUSES OF TECHNICAL DEBT



Lack of Knowledge



Developer Mistakes



Strategic Decisions

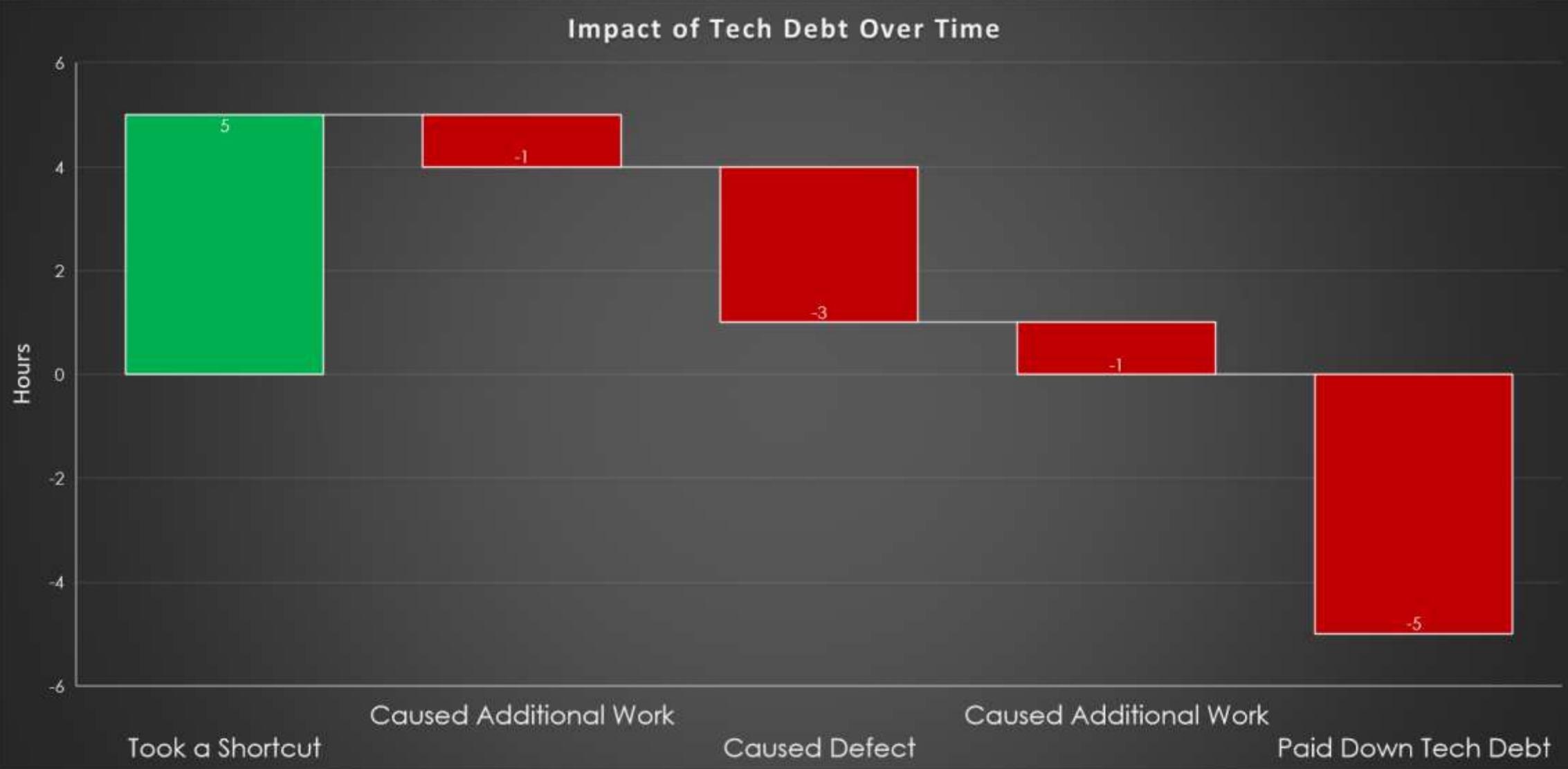


New Technologies / Releases



Requirements Changes

# TECH DEBT - PRINCIPAL & INTEREST OVER TIME



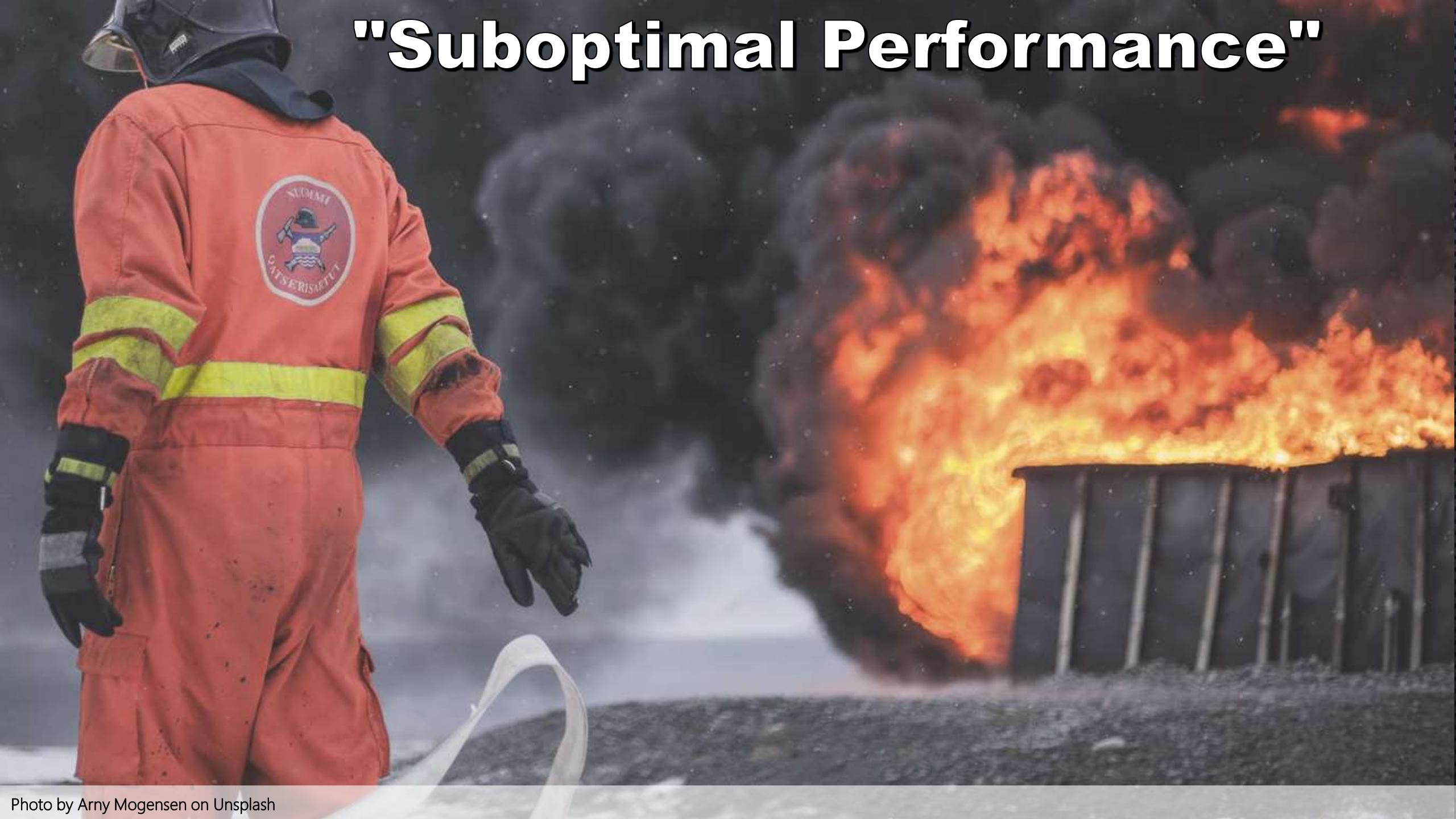
# Story Time

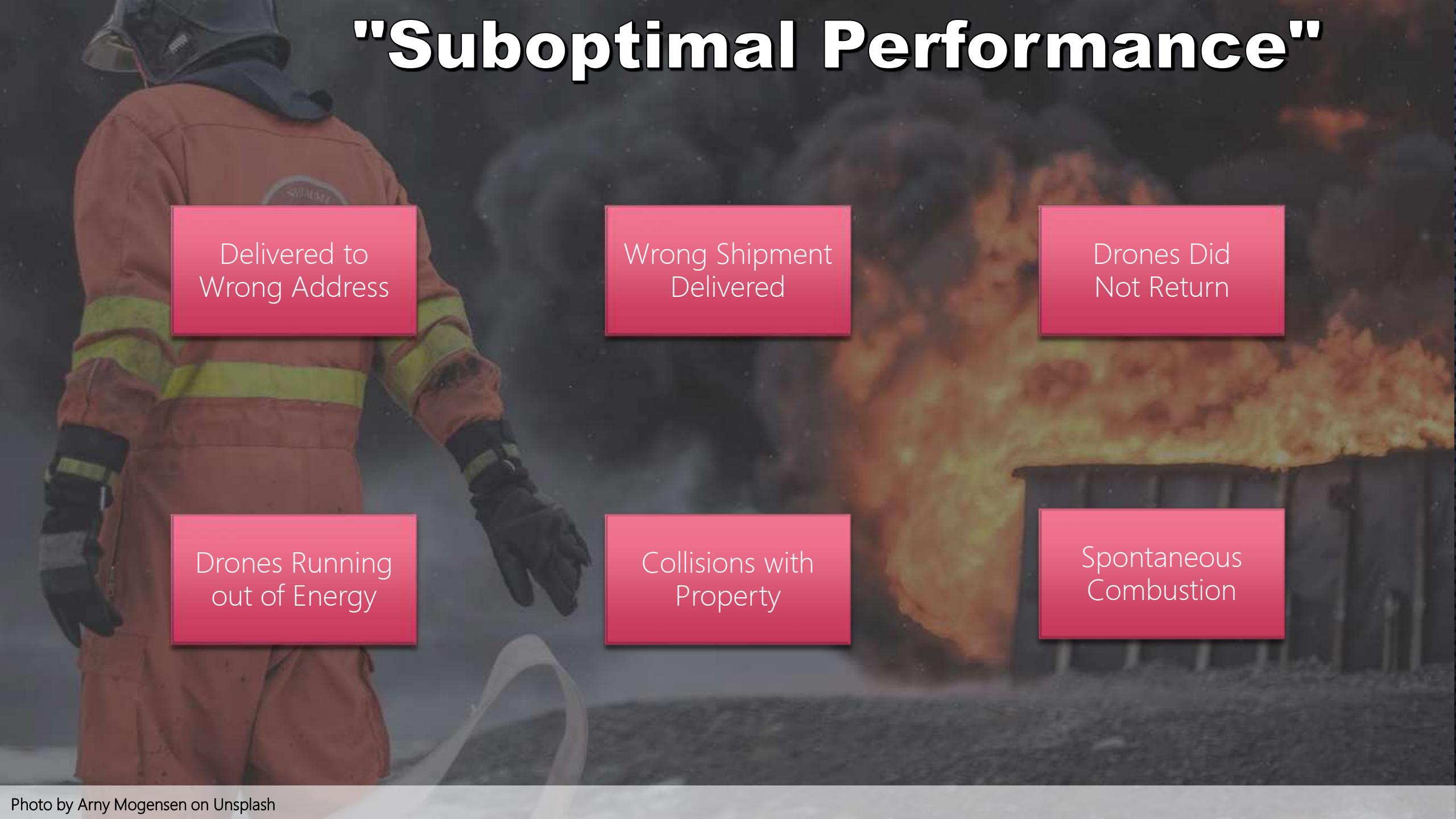




# Cyber Drone Logistics

# "Suboptimal Performance"



A firefighter in full protective gear, including a helmet and oxygen tank, stands next to a large fire. The firefighter's back is to the viewer, showing their gear. In the background, a massive fire with bright orange and yellow flames is visible against a dark sky.

# "Suboptimal Performance"

Delivered to  
Wrong Address

Wrong Shipment  
Delivered

Drones Did  
Not Return

Drones Running  
out of Energy

Collisions with  
Property

Spontaneous  
Combustion

A baby is sitting on a colorful striped blanket in a park. The baby is wearing a white polo shirt with a blue pocket square and light green pants. The background shows a grassy hillside under a clear blue sky.

# Sample Customer

A man with brown hair and a beard is sitting at a desk, screaming into a white corded telephone receiver. He is wearing a light brown blazer over a dark zip-up hoodie. A red bracelet is visible on his left wrist. On the desk in front of him are a pair of glasses and a silver laptop. The background is plain white.

**Fix it.**



WORK ITEMS



SUPPORT  
INCIDENTS



TIME TRACKING



SOURCE CONTROL



BUILD HISTORY



TESTS



ANALYTICS



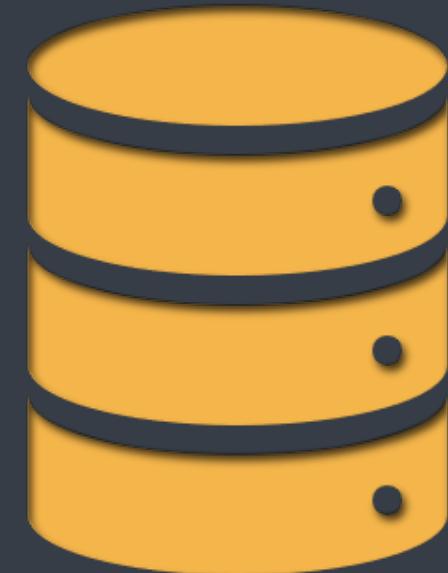
CODE ANALYSIS



APPLICATION  
MONITORING



SURVEYS



## GATHER DATA

Automate it if possible  
Collect stories as well as data

Emergence Dev

# Work Items

[Board](#)[Analytics](#)[Feature Timeline](#)[Epic Roadmap](#)[View as Backlog](#)[Stories](#)

New

Active

3/5

Resolved

2/5

Closed

&lt;

New item



1125 Procedurally Generate Non-Prefab Levels

State

● New

0/3

529 Server API Versioning Scheme

Matt Eland

2

State

● New

0/3

673 Unlock and Lock Encounters based on the current level

Matt Eland

3

State

● New

0/5

582 Randomly arrange levels via prefabs

Matt Eland

13

State

● Active

6/9

584 Add variety to generated prefabs

Matt Eland

3

State

● Active

0/6

579 Scent Debugging Display

Matt Eland

3

State

● Active

0/2

528 Server-Side Event-Based Model

Matt Eland

5

State

● Resolved

0/4

600 Transit the game history instead of the game state

Matt Eland

3

State

● Resolved

1015 Add a mode to simulate player movement by asking the AI for a move using a "player brain"

Matt Eland

3

State

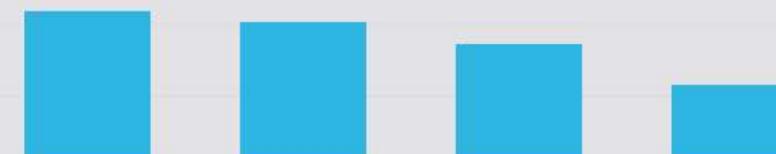
● Closed

1/6

[Reports](#)   [Summary](#)   [Detailed](#)   [Weekly](#) Filter by: [Team](#) [Project](#) [Description](#)  [31 Dec - 06 Jan](#) 

# Time Tracking

Sun 12/31 Mon 1/1 Tue 1/2 Wed 1/3 Thu 1/4 Fri 1/5 Sat 1/6

[Group by Project](#)[and Time Entry](#) Rounding

CLOCKED HOURS

14.32 h

 TITLE

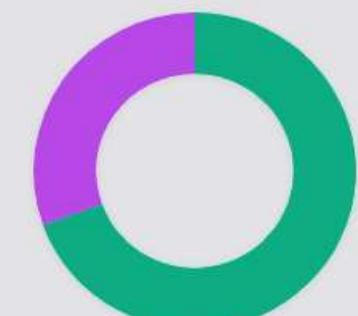
DURATION

1 angularF • Personal

9.94 h

1 Research

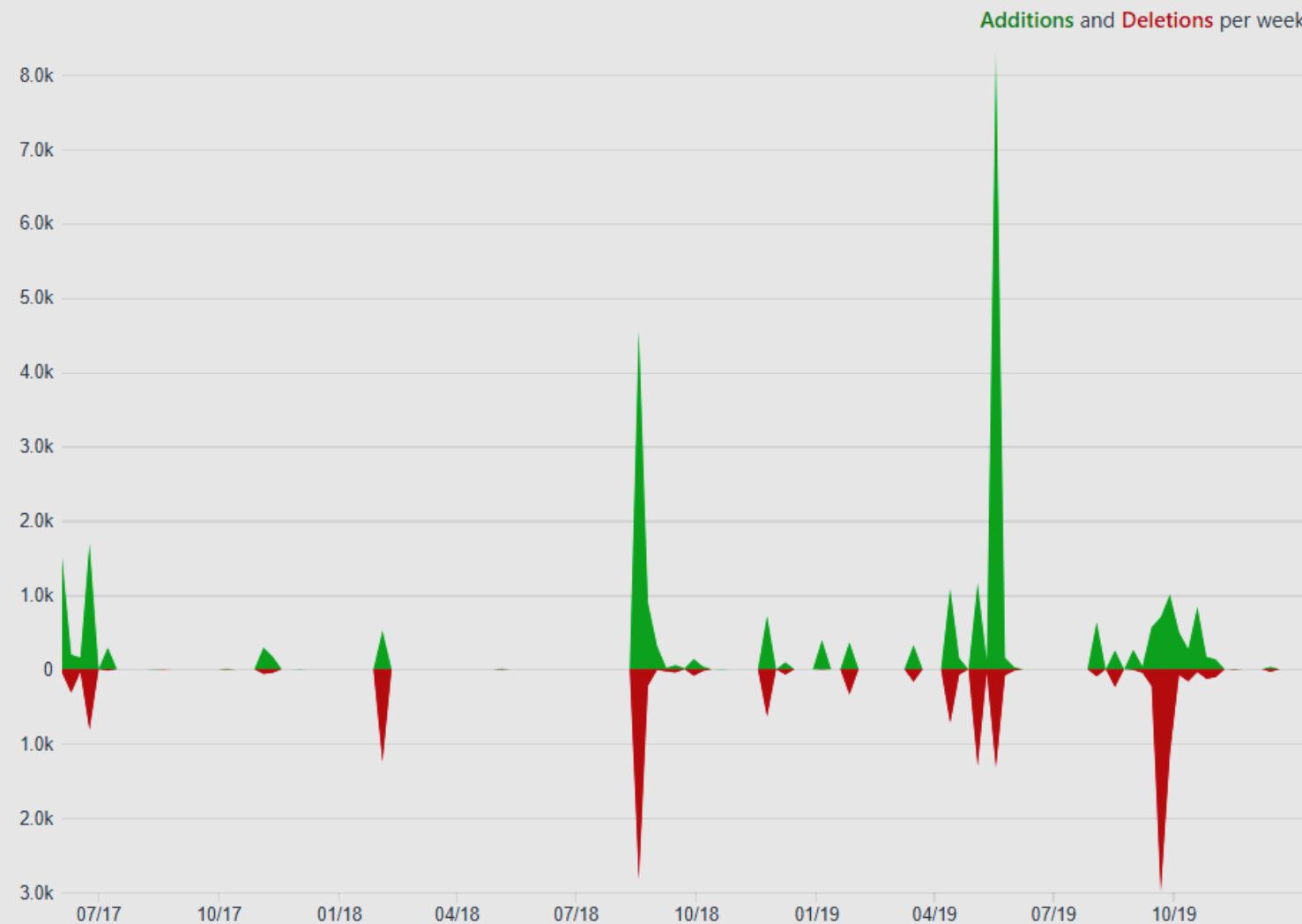
4.37 h



[Code](#)[Issues 20](#)

# Source Control

- [Pulse](#)
- [Contributors](#)
- [Community](#)
- [Commits](#)
- [Code frequency](#)
- [Dependency graph](#)
- [Network](#)
- [Forks](#)



[Overview](#) [Issues](#) [Measures](#) [Code](#) [Activity](#)

Overall

Vulnerabilities

0

A

Rating

Remediation Effort

0

Security Hotspots

0

Review Rating

A

**Maintainability** [OVERVIEW](#)[Overview](#)

On new code

Code Smells

0

Debt

0

Debt Ratio

0.0%

Rating

A

Overall

Code Smells

6

Debt

1min

Debt Ratio

0.0%

Rating

A

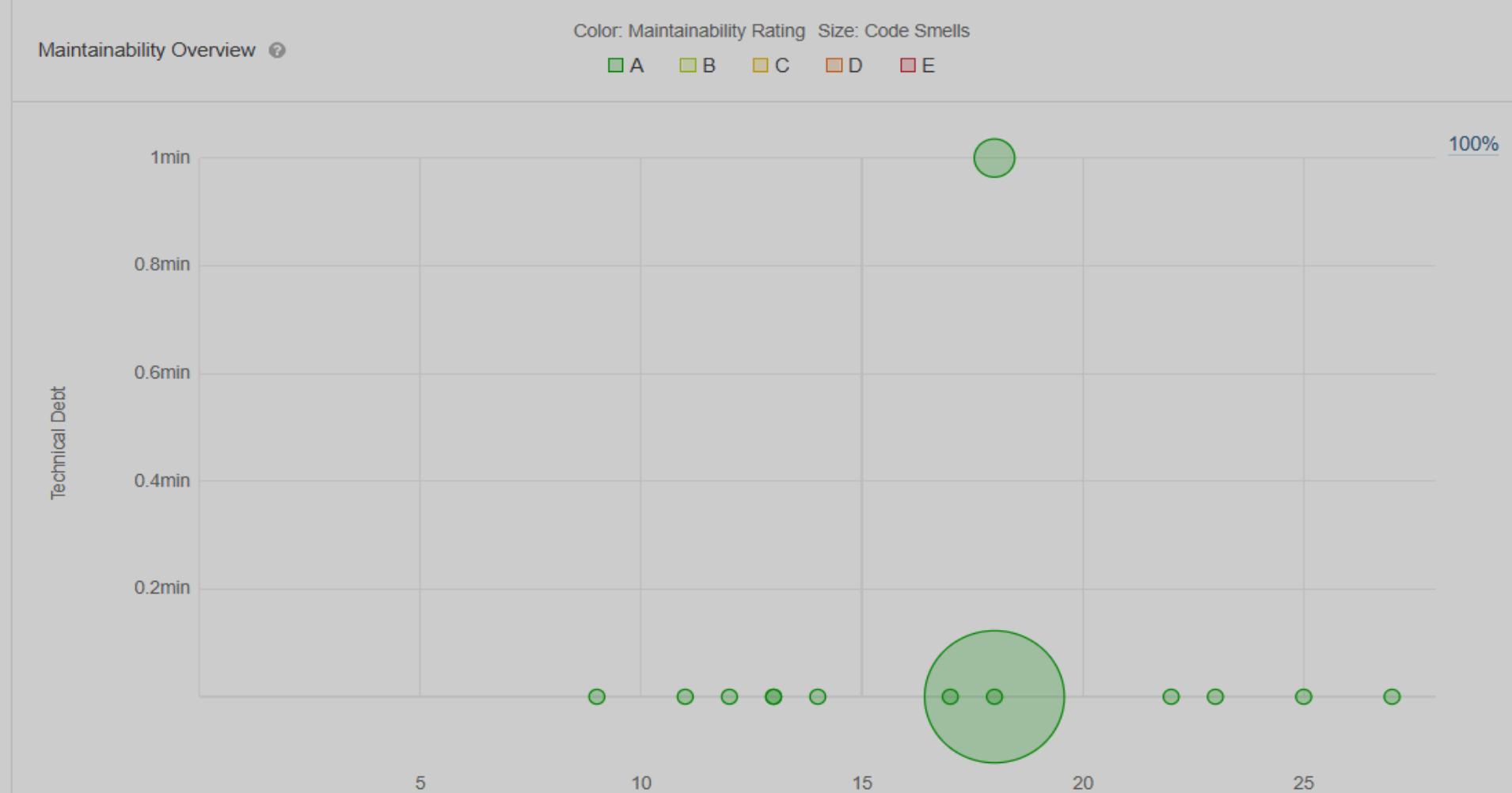
Effort to Reach A

0

**Coverage****Duplications****Size****Complexity** **Issues**

# Code Analysis

New code: last 30 days



# Lines of Code

The screenshot shows the SonarCloud interface with a large title "Lines of Code". Below it, a code editor displays a C# file with various annotations. A navigation bar at the bottom includes links for "Issues", "Source: SonarCloud", and page numbers 5, 10, 15, 20, and 25.

```
// This method has two main purposes: (1) it marks points inside the
// portion that are within the radius as in the field of view, and
// (2) it computes which portions of the following column are in the
// field of view, and puts them on a work queue for later processing.
private static void ComputeFovForColumnPortionT4(
    int x,
    DirectionVector topVector,
    DirectionVector bottomVector,
    Func<int, int, bool> isOpaque,
    Func<int, int, T> setFieldOfView,
    decimal radius,
    Queue<ColumnPortion> queue)
{
    // Search for transitions from opaque to transparent or
    // transparent to opaque and use those to determine what
    // portions of the <next> column are visible from the origin.

    // Start at the top of the column portion and work down.
    var topY = CalculateTopY(x, topVector);

    // Note that this can find a top cell that is actually entirely blocked by
    // the cell below it; consider detecting and eliminating that.
    var bottomY = CalculateBottomY(x, bottomVector);

    // A more sophisticated algorithm would say that a cell is visible if there is
    // some straight line segment that passes through *any* portion of the origin cell
    // and any portion of the target cell, passing through only transparent cells
    // along the way. This is the "Permissive Field Of View" algorithm, and it
    // is much harder to implement.

    bool? wasLastCellOpaque = null;
    for (int y = topY; y > bottomY; --y)
    {
        bool inRadius = CheckInRadiusAndSetFieldOfViewAsNeeded(x, y, setFieldOfView, radius);

        // A cell that was too far away to be seen is effectively
        // an opaque cell; nothing "above" it is going to be visible.
        // in the next column, so we might as well treat it as
        // an opaque cell and not scan the cells that are also too
        // far away in the next column.

        bool currentIsOpaque = inRadius || isOpaque(x, y);
        if (wasLastCellOpaque == null)
        {
            if (currentIsOpaque)
            {
                // We've found a boundary from transparent-to-opaque. Make a note
                // of it and revisit it later.
                if (!wasLastCellOpaque.Value)
                {
                    // The new bottom vector touches the upper-left corner of
                    // an opaque cell that is below the transparent cell.
                    queue.Enqueue(new ColumnPortion(
                        x + 1,
                        bottom: new DirectionVector(-x + 1 - 1, -(y + 2 + 1)),
                        topVector));
                }
            }
            else if (wasLastCellOpaque.Value)
            {
                // We've found a boundary from opaque-to-transparent. Adjust the
                // top vector so that when we find the next boundary or do
                // the bottom cell, we have the right top vector.

                // The new top vector touches the lower-right corner of the
                // opaque cell that is above the transparent cell, which is
                // the upper-right corner of the current transparent cell.
                topVector = new DirectionVector(-x + 1 + 1, -(y + 2 + 1));
            }
            wasLastCellOpaque = currentIsOpaque;
        }
        // Make a note of the lowest opaque->transparent transition, if there is one.
        if (wasLastCellOpaque == null || !wasLastCellOpaque.Value)
        {
            queue.Enqueue(new ColumnPortion(x + 1, bottomVector, topVector));
        }
    }
}
```

[Overview](#) [Issues](#) [Assures](#) [Code](#) [Activity](#) [Administration](#)

Overall

Vulnerabilities

Rating

Remediation Effort

Security Hotspots

Review Rating

**Maintainability** [OVERVIEW](#)

Overview

On new code

Code Smells

Debt

Debt Ratio

Rating

Overall

Code Smells

Debt

Debt Ratio

Rating

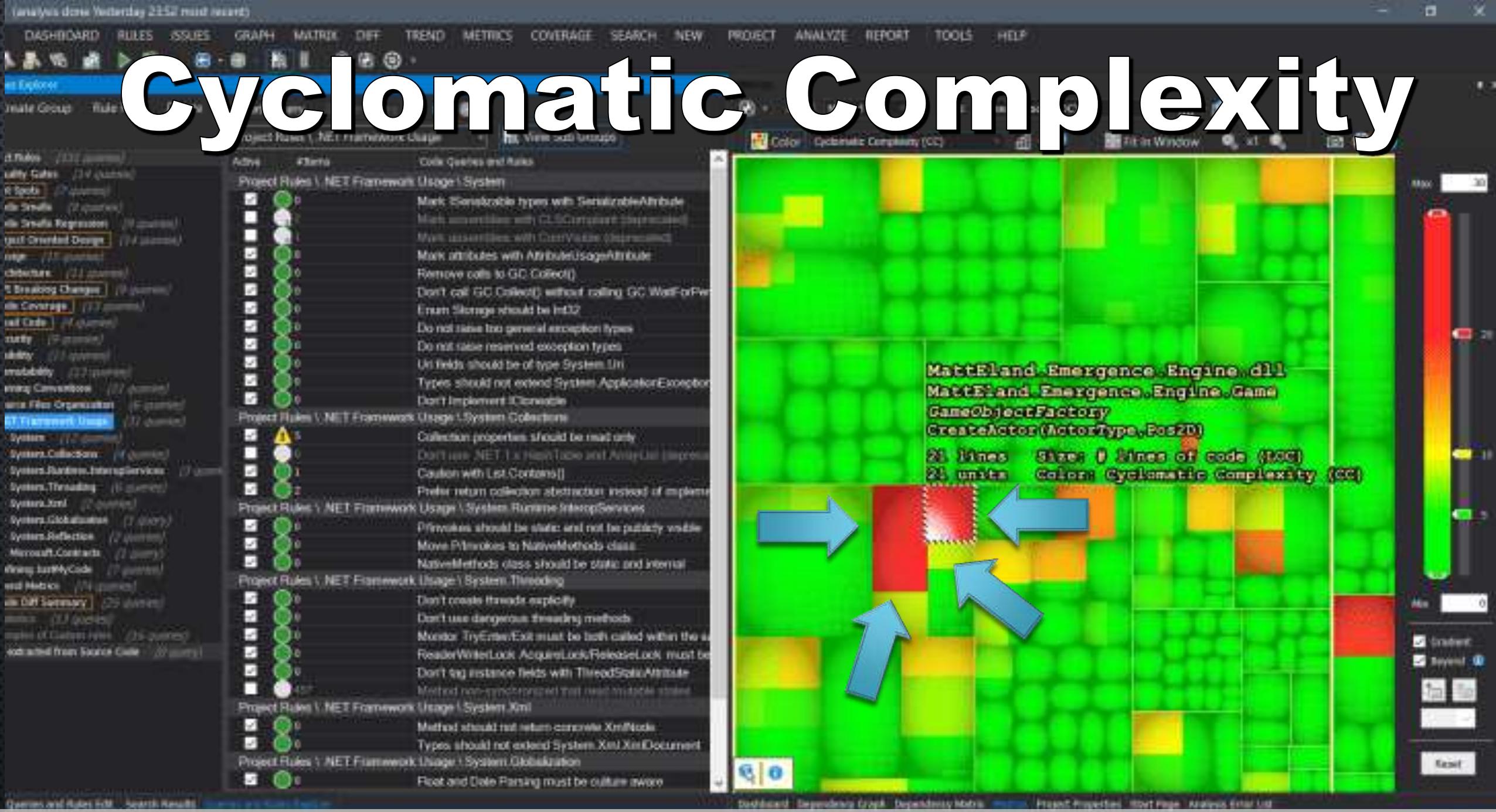
Effort to Reach A

**Coverage****Duplications****Size****Complexity****Issues**

Source: SonarCloud

# Cyclomatic Complexity

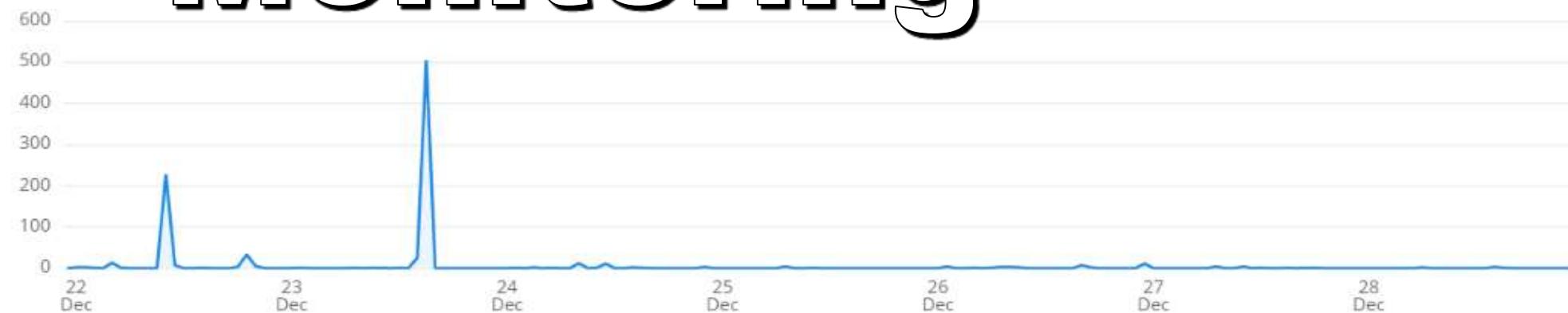
```
1 public static void SpreadCorruption(GameContext context, int maxCells)
2 {
3     // Grab random cells from the level
4     var cells = new List<GameCell>(maxCells);
5     for (int i = 0; i <= maxCells; i++)
6     {
7         var cell = context.Level.Cells.GetRandomElement(context.Randomizer);
8         if (cell.Corruption > 0 && !cells.Contains(cell))
9             cells.Add(cell);
10    }
11   }
12   }
13   }
14   }
15   // If no corrupted cells were found, carry on.
16   if (!cells.Any())
17   {
18       return;
19   }
20   }
21   // If we have more than we can process, just randomly order them and pick as much as we can handle
22   if (cells.Count > maxCells)
23   {
24       cells = cells.OrderBy(c => context.Randomizer.GetDouble()).Take(maxCells).ToList();
25   }
26   }
27   // Spread corruption to the cells in question
28   foreach (var candidate in cells)
29   {
30       SpreadCorruptionOnCell(candidate, context);
31   }
32 }
```





# Monitoring

Errors by hour



Kill All Defects

Search errors...

Advanced search

Invite team

Crash Reporting

Settings

Inbound filters

Reports

Export

Real User Monitoring

APM

Users

Deployments

Application settings

Integrations

What's New

My errors 0   Active 12   Resolved 0   Ignored 0   Permanently ignored 0

		Last seen	Count	Users	
<input type="checkbox"/>	Message				
<input type="checkbox"/>	Script error in /	9 hours ago	296	36	
<input type="checkbox"/>	TypeError: document.querySelectorAll("[data-load-more-btn]").forEach is not a funct...	10 hours ago	2	2	
<input type="checkbox"/>	SyntaxError: Unexpected identifier 'i'. Expected either 'in' or 'of' in enumeration synt...	10 hours ago	2	2	
<input type="checkbox"/>	Block-scoped declarations (let, const, function, class) not yet supported outside stric...	17 hours ago	14	2	
<input type="checkbox"/>	undefined is not a function	17 hours ago	13	2	
<input type="checkbox"/>	Object doesn't support property or method 'forEach'	a day ago	5	4	
<input type="checkbox"/>	AJAX Error: error GET unknown	a day ago	4	4	



CHECK SHEETS



FISHBONE  
DIAGRAM



PARETO CHARTS



HISTOGRAM



RUN CHART



CONTROL CHART

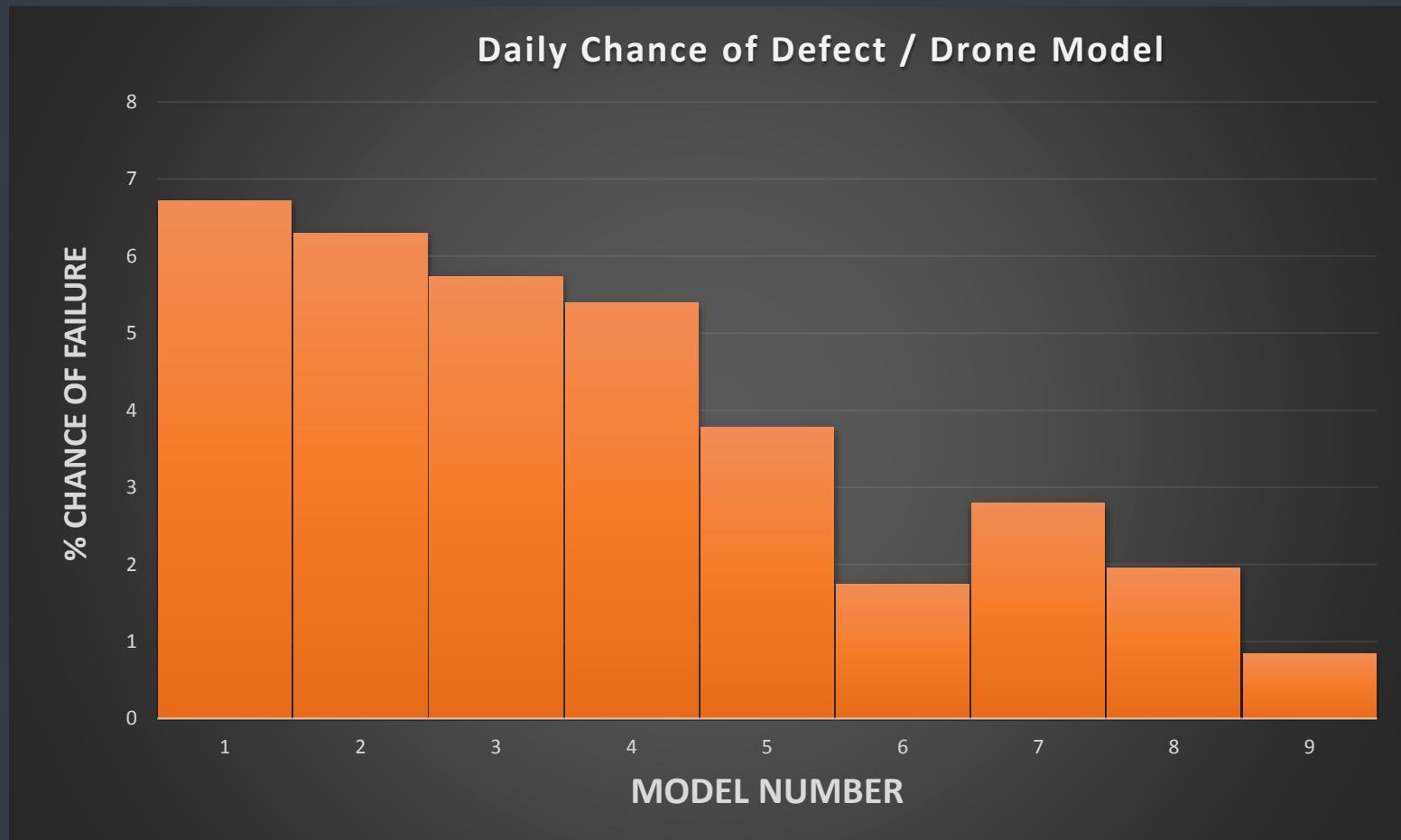


SCATTER PLOT

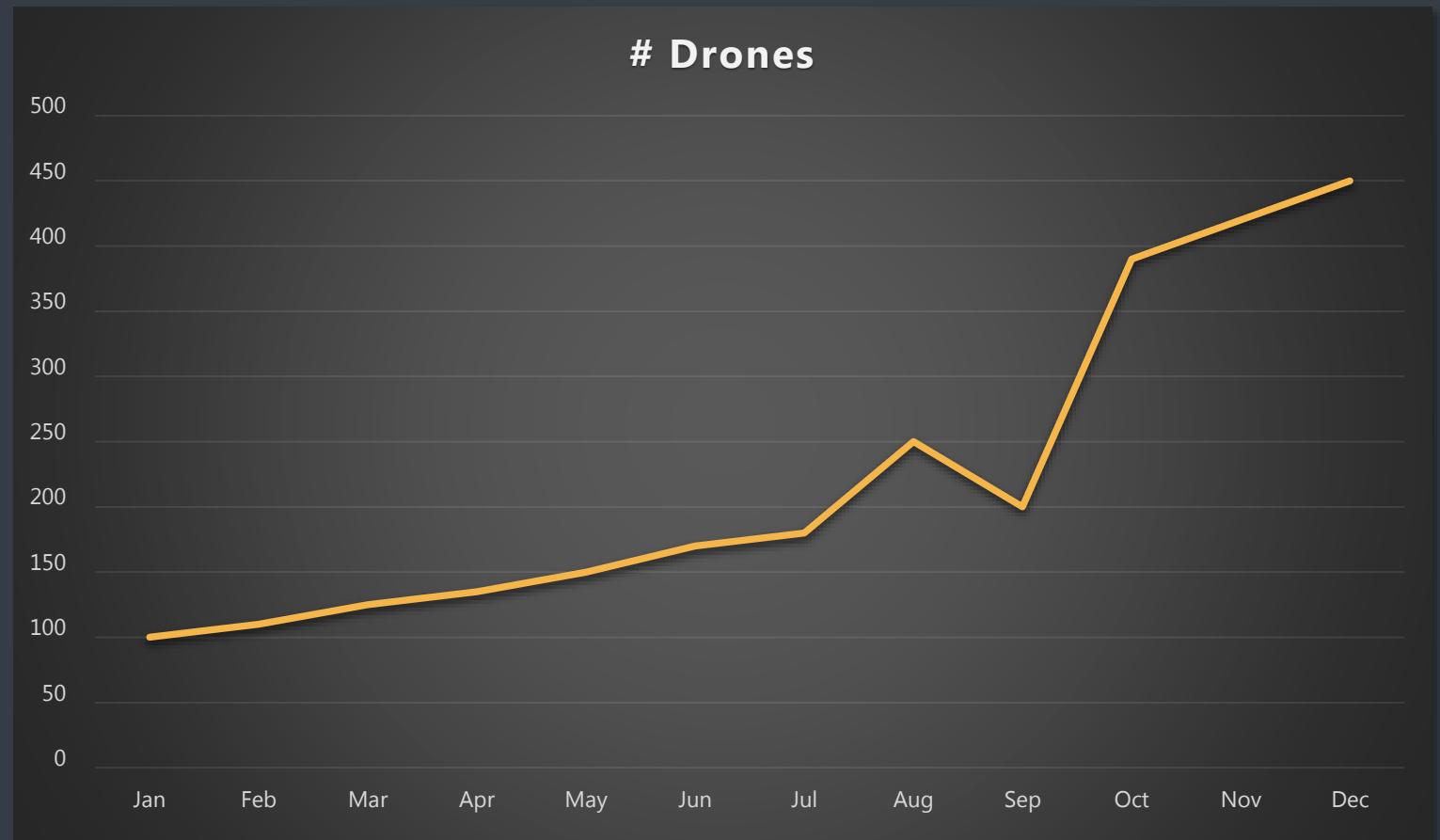
# ANALYZING DATA

7 BASIC TOOLS OF SOFTWARE QUALITY

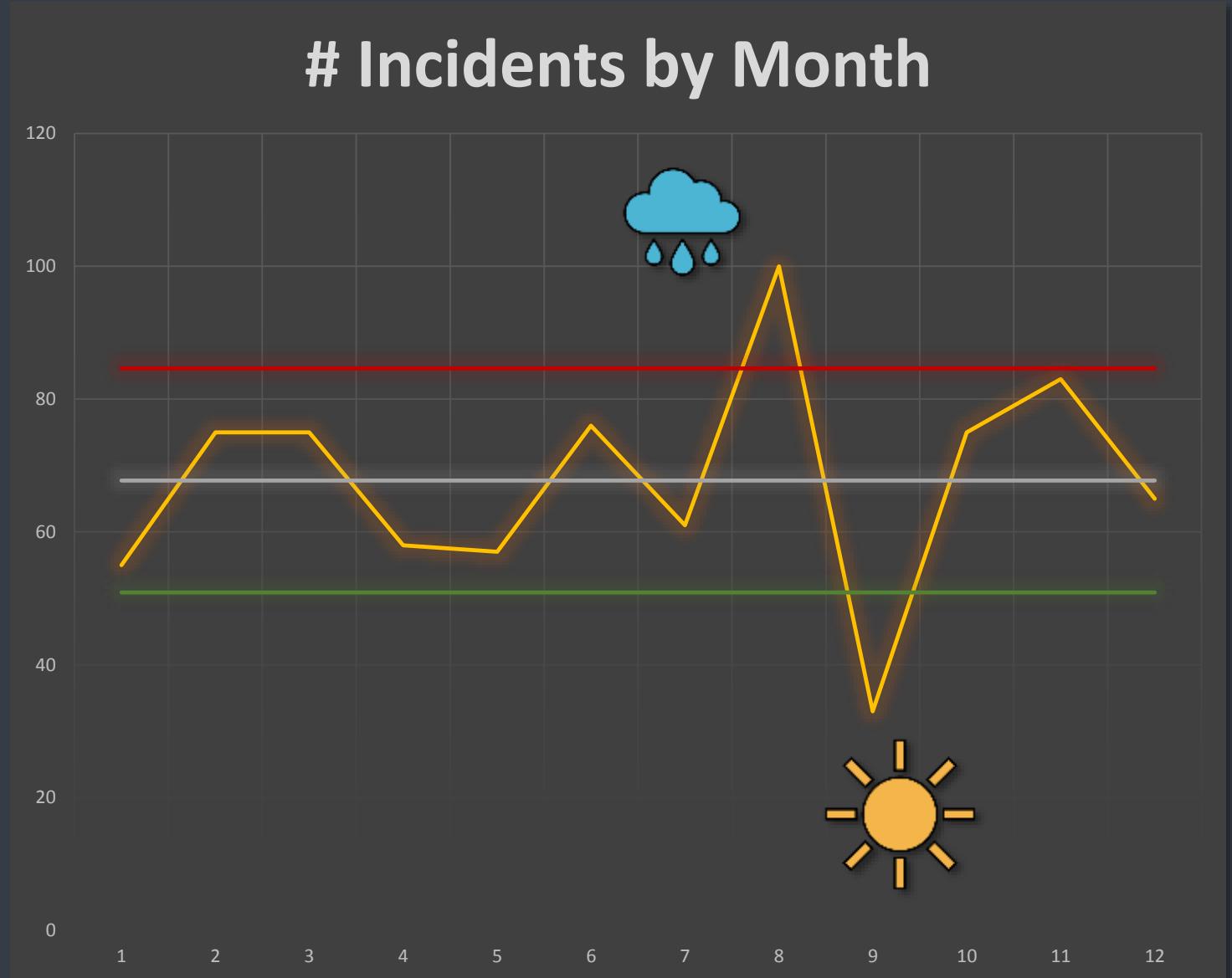
# HISTOGRAMS



# RUN CHARTS



# CONTROL CHARTS

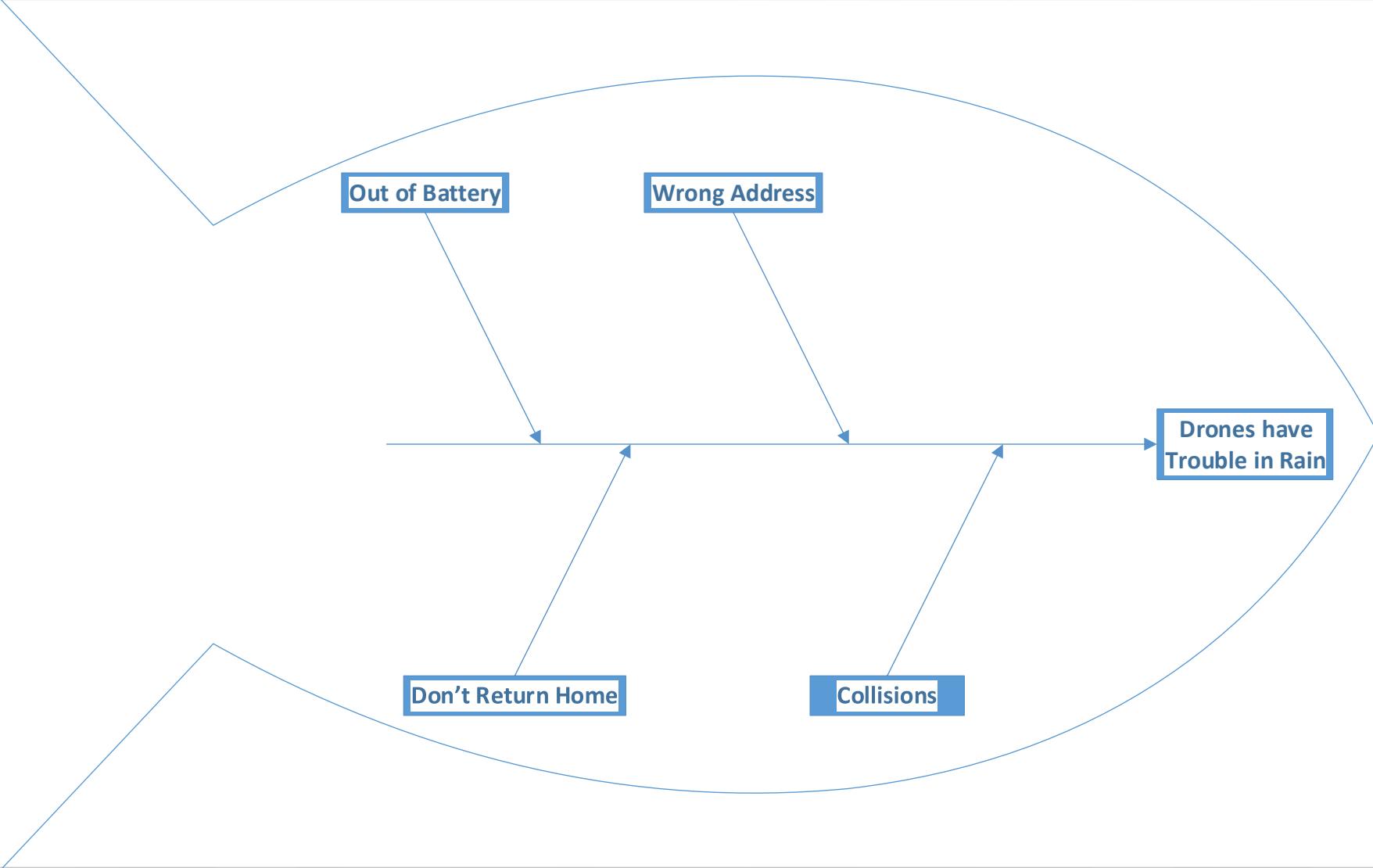


# CHECK SHEETS

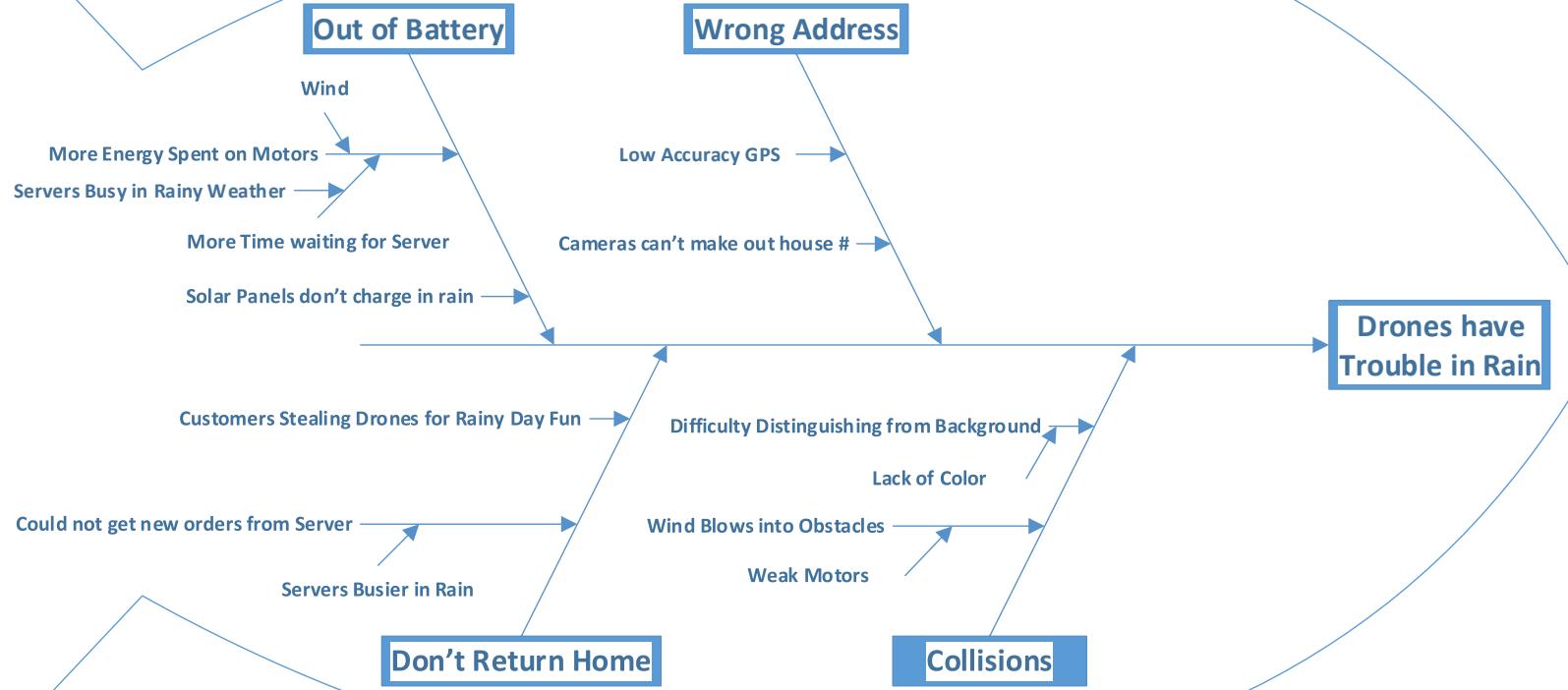
Issue	Sunny	Cloudy	Rain	Snow	Total
Delivered to Wrong Address	15	56	87	95	253
Wrong Shipment Delivered	35	31	18	28	112
Drones Did Not Return	17	13	24	35	89
Ran out of Battery	12	37	89	45	183
Collisions with Property	10	25	35	50	120
Spontaneous Combustion	17	5	8	1	31
<b>Total</b>	<b>106</b>	<b>167</b>	<b>261</b>	<b>254</b>	<b>788</b>

# CHECK SHEETS

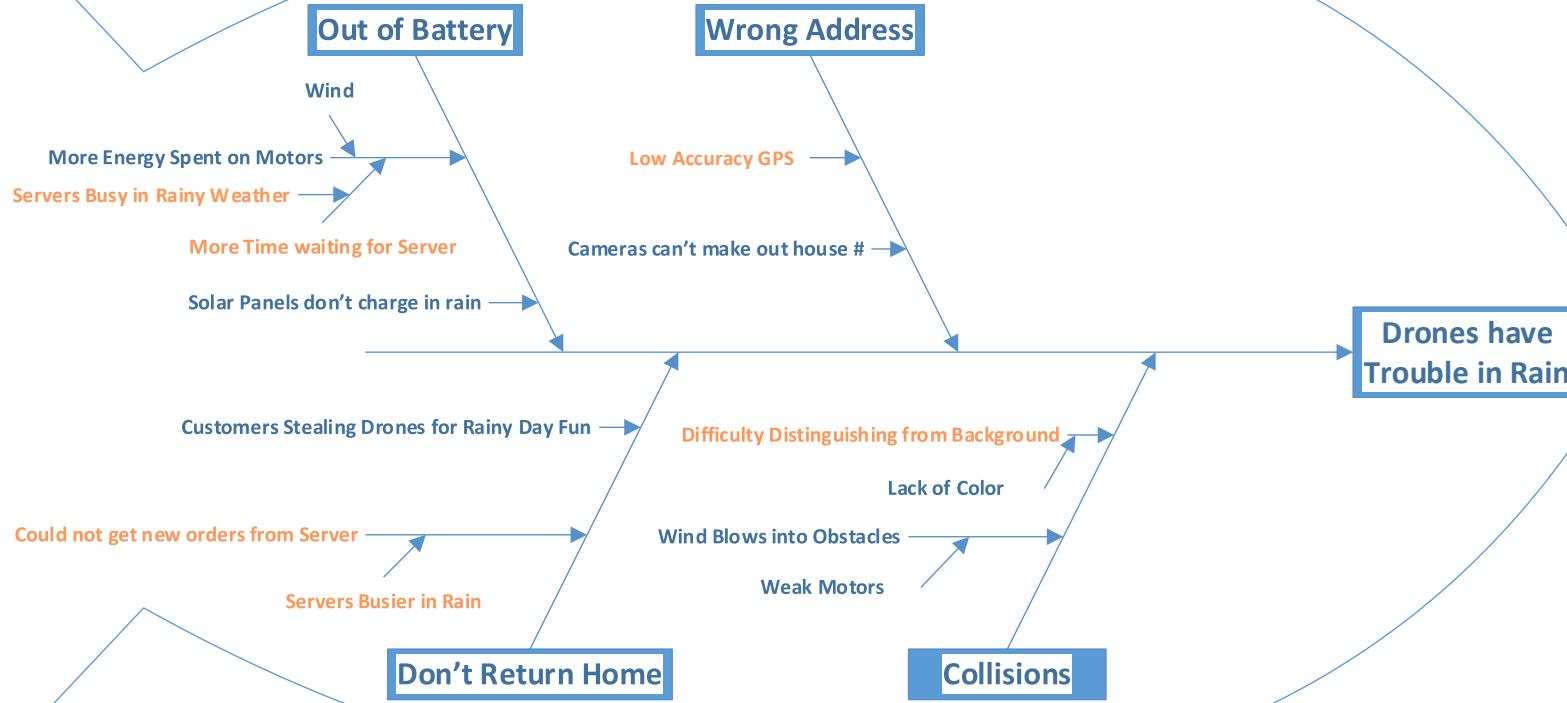
Issue	Sunny	Cloudy	Rain	Snow	Total
Delivered to Wrong Address	15	56	87	95	253
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# FISHBONE DIAGRAM

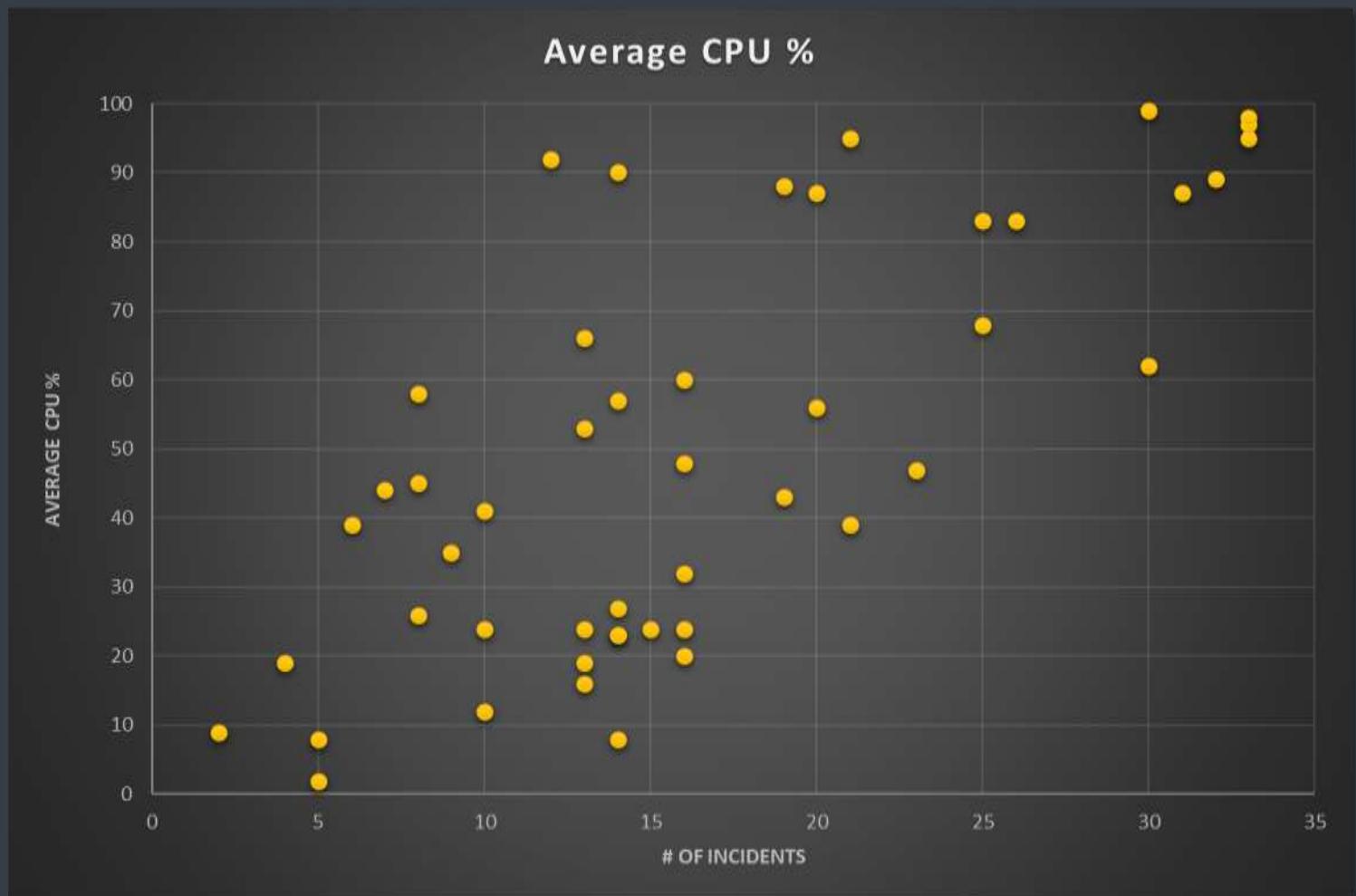


# FISHBONE DIAGRAM

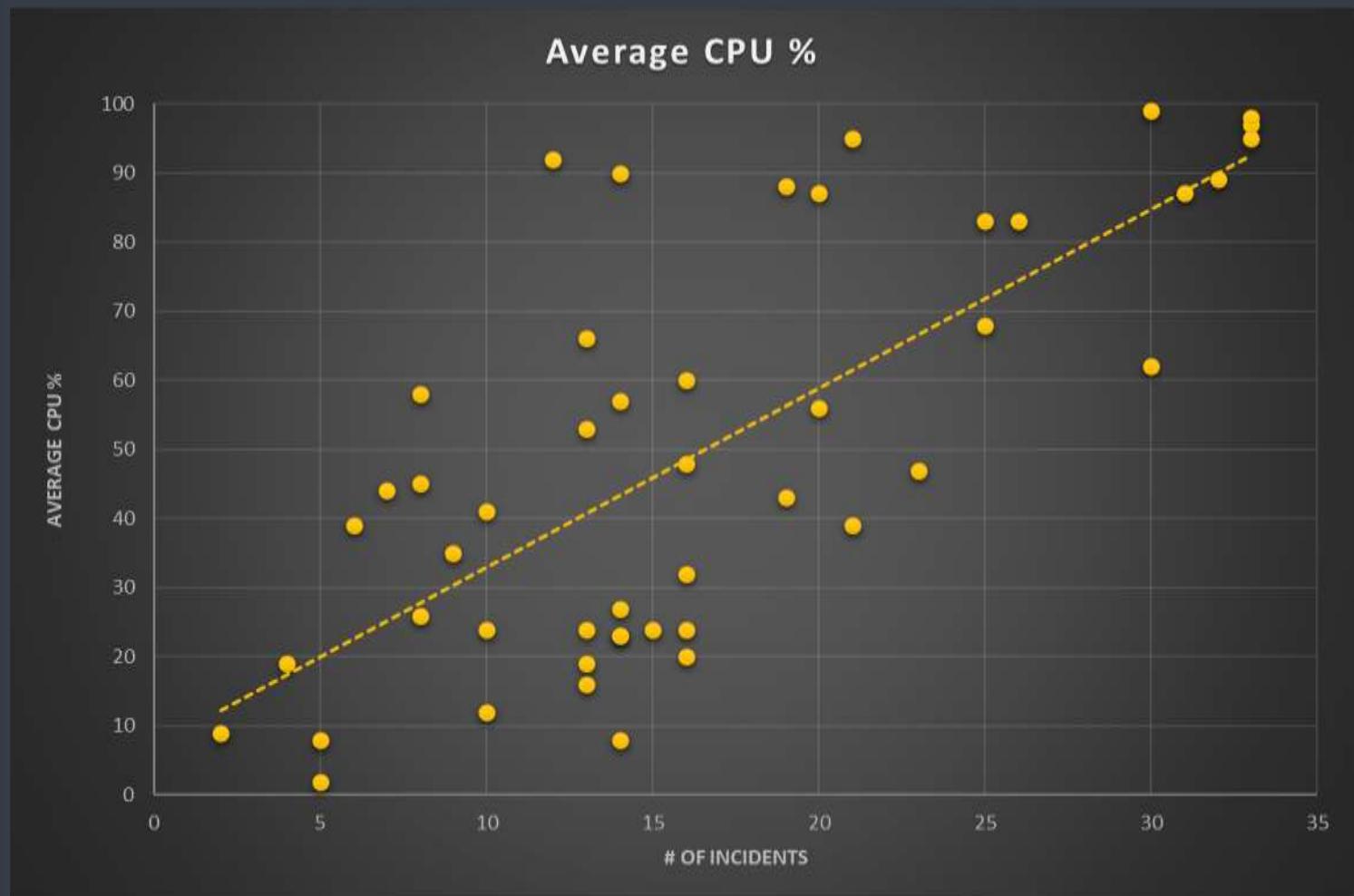


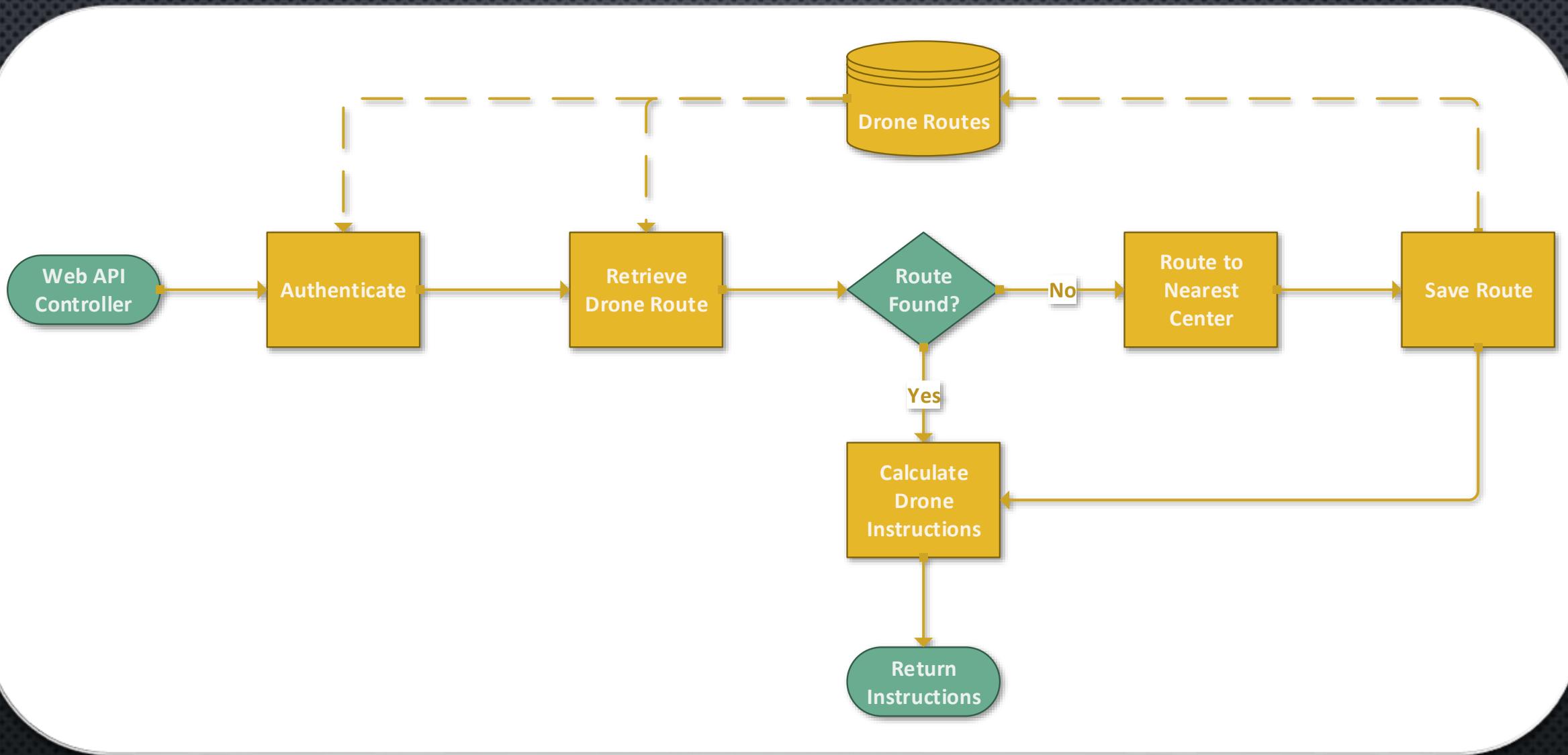
# FISHBONE DIAGRAM

# SCATTER PLOT

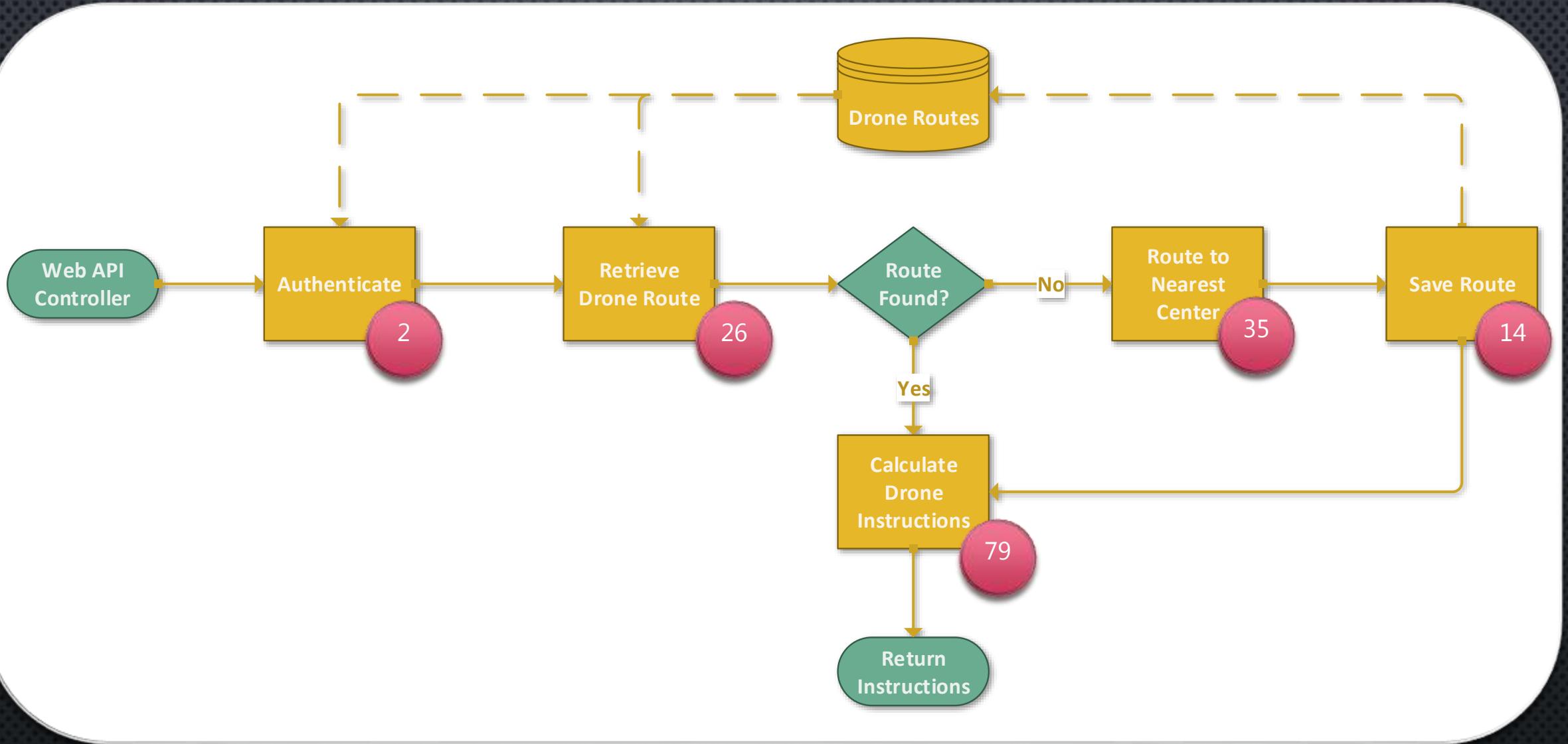


# SCATTER PLOT

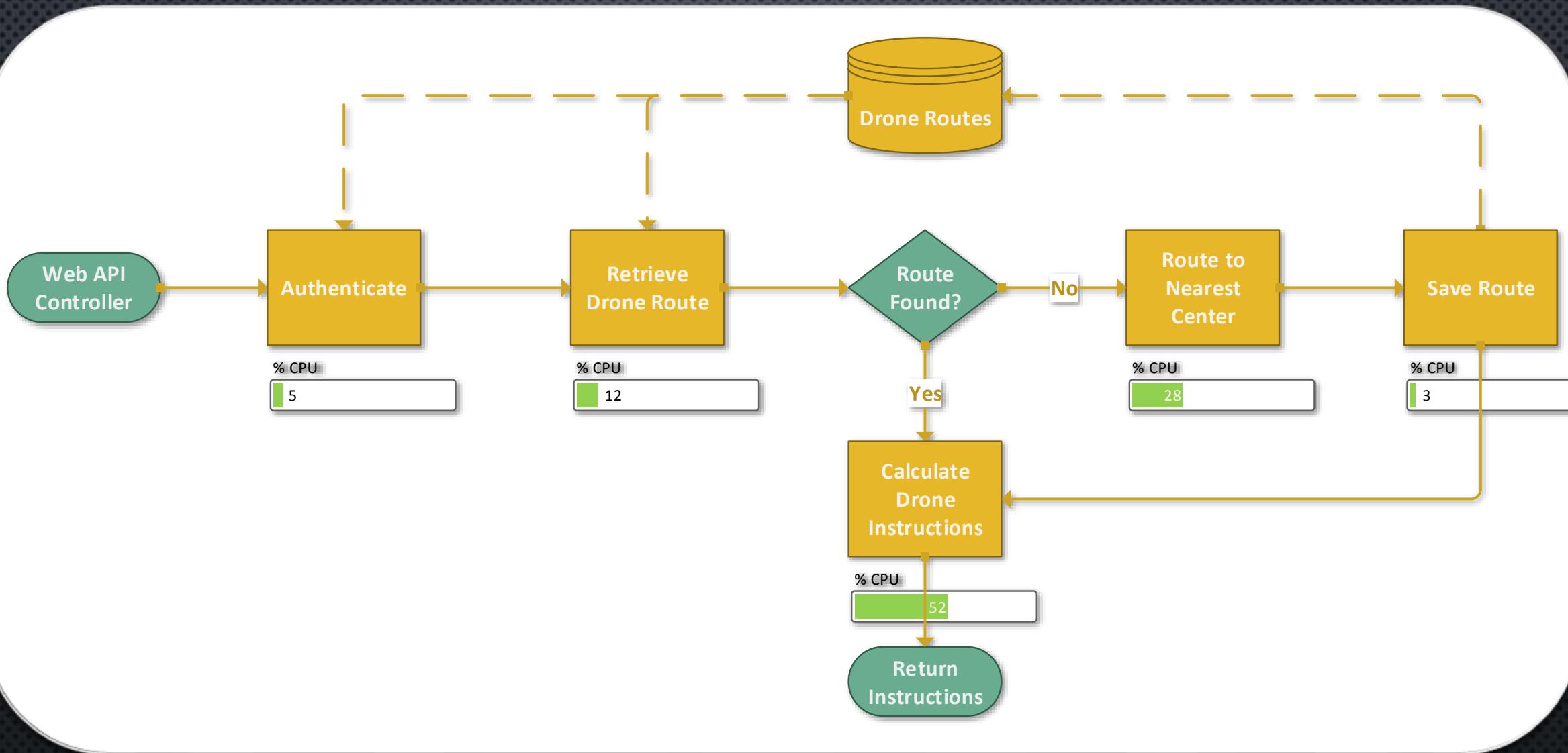




# FLOWCHARTS

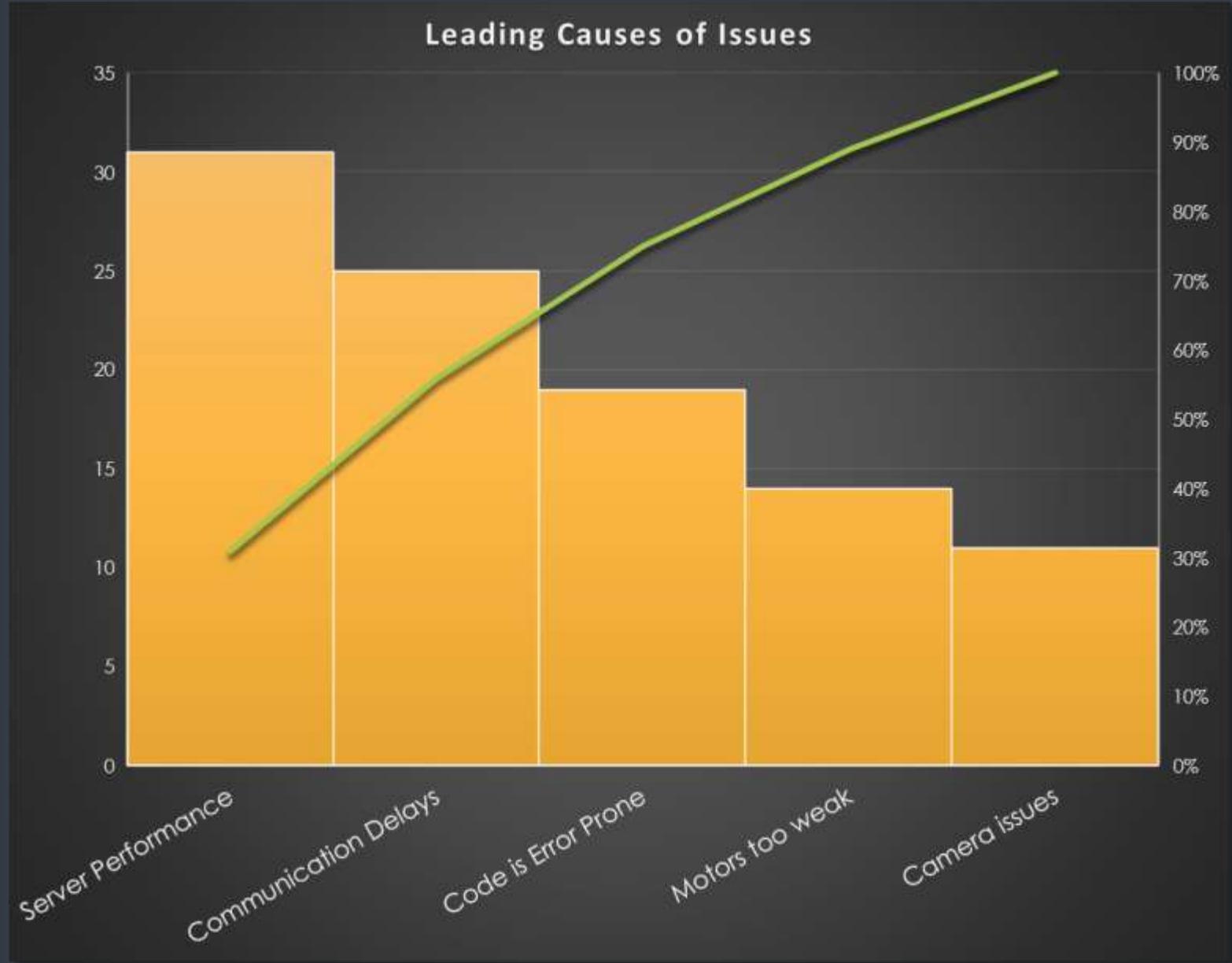


# FLOWCHARTS

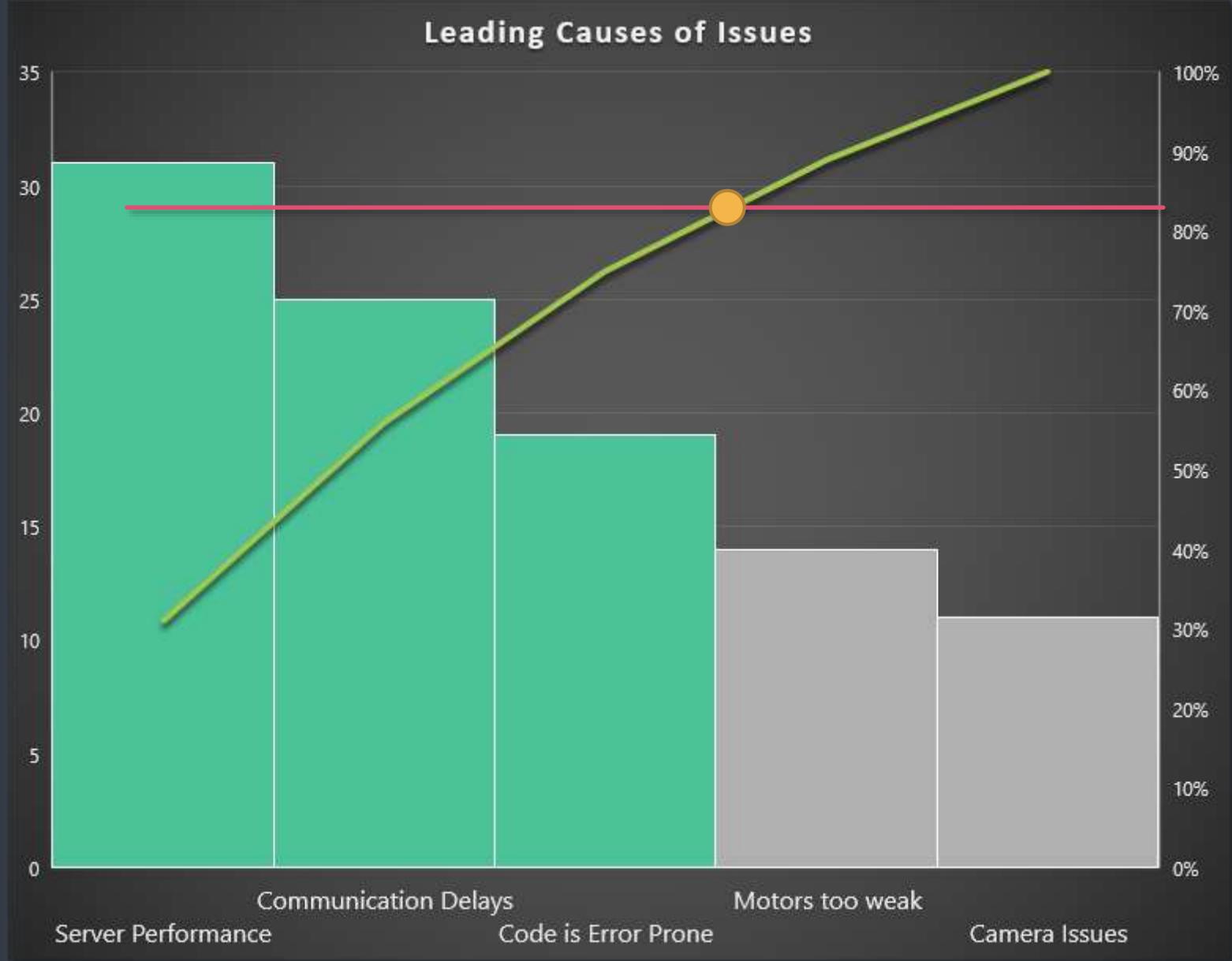


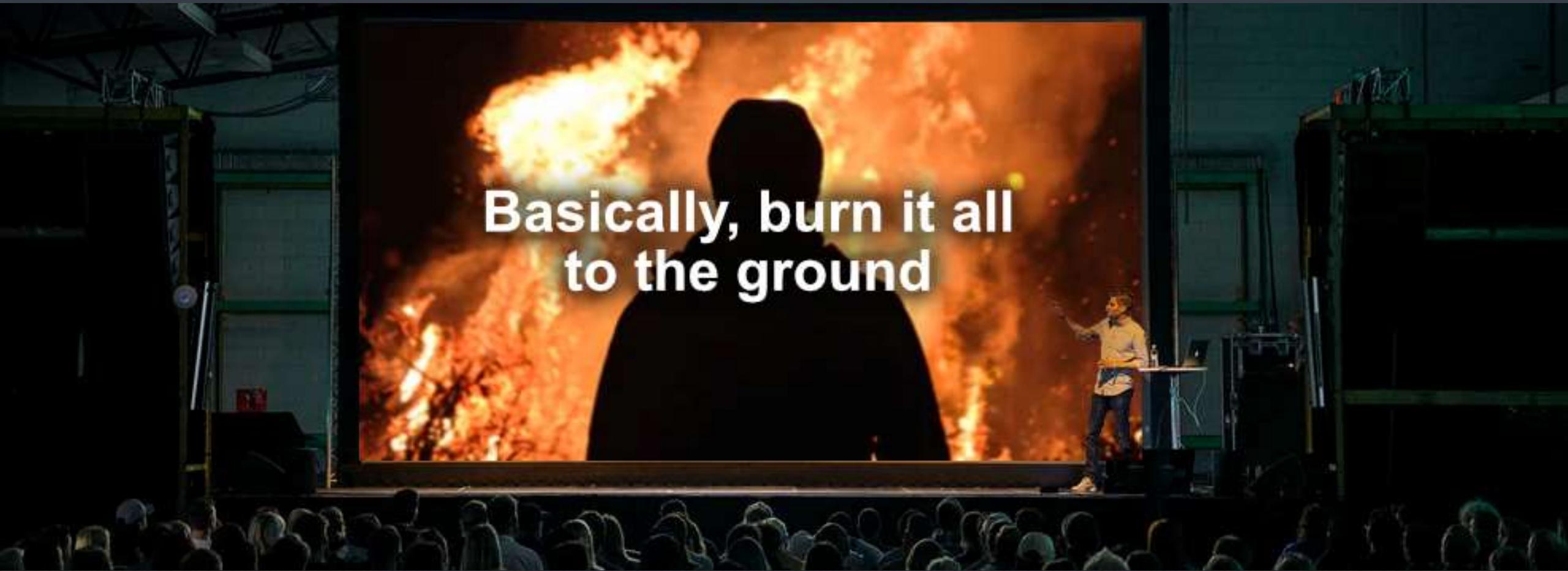
# FLOWCHARTS

# PARETO CHART



# PARETO CHART





**Basically, burn it all  
to the ground**

# PRESENTING

COMMUNICATING TECHNICAL DEBT



CAN I KEEP OUR USERS  
HAPPY?



WILL WE STILL HIT OUR  
STRATEGIC GOALS?



WILL CHANGING IT CAUSE  
MORE BUGS?



DO WE HAVE THE RIGHT  
PEOPLE?

## BUSINESS CONCERN

# YOUR GOALS



COMMUNICATE CRITICAL  
NEEDS



UNDERSTAND BUSINESS  
NEEDS

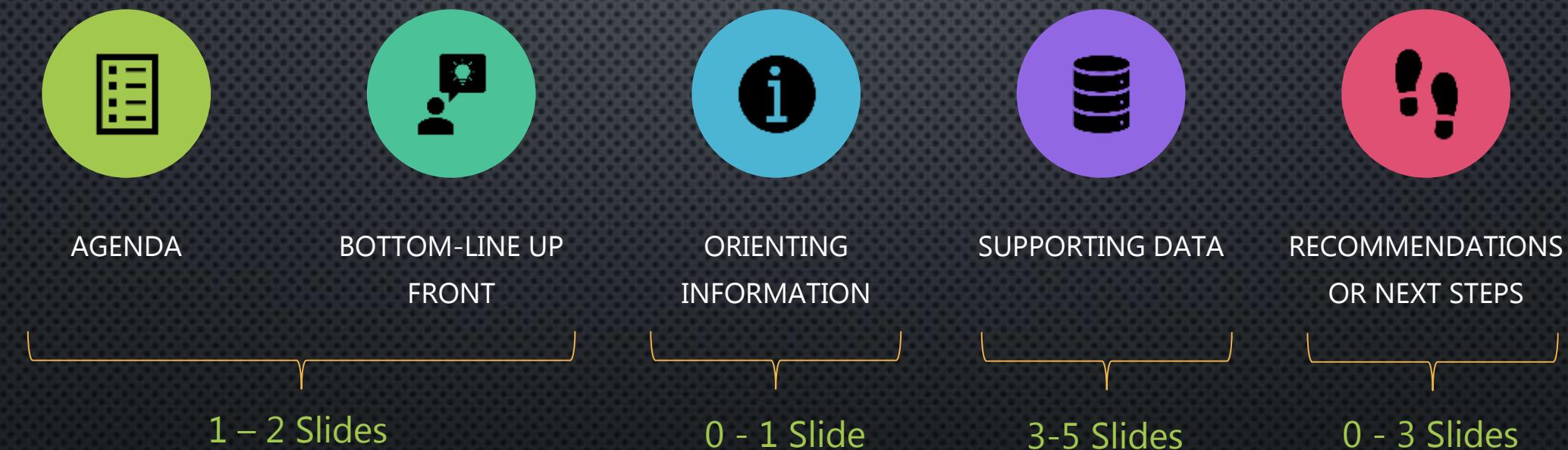


START AN HONEST  
CONVERSATION



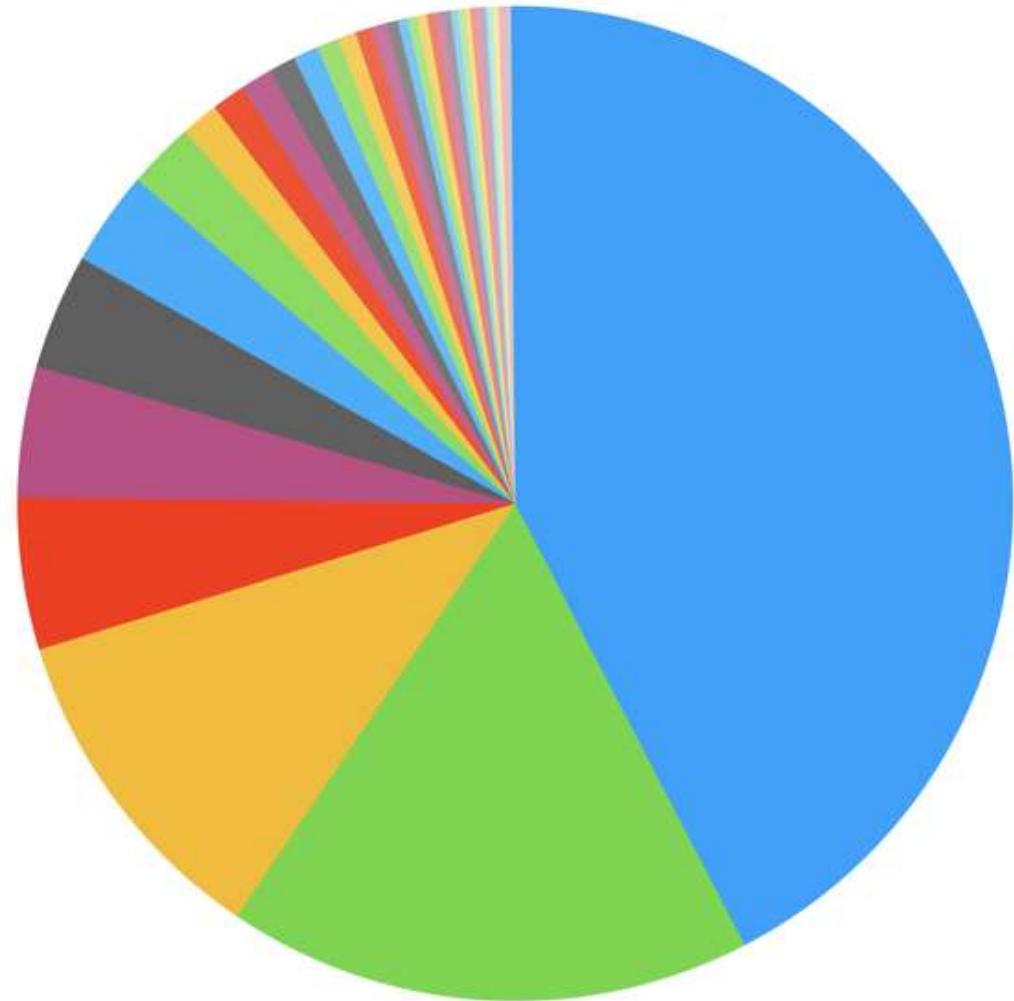
MEET CURRENT AND  
FUTURE NEEDS

# PRESENTATION STRUCTURE



## Which game(s) have you played the most?

3,994 responses



- Zelda
- The Legend of Zelda: Breath of the Wild
- Breath of the Wild
- BOTW
- Botw
- Breath of the wild
- BotW
- zelda
- Legend of Zelda: Breath of the Wild
- Legend of Zelda
- Zelda BOTW
- BoTW
- botw
- Zelda: Breath of the Wild
- Zelda BotW
- Zelda Breath of the Wild
- The Legend of Zelda
- Breath of The Wild
- The Legend of Zelda Breath of the Wild
- Zelda: BOTW
- Zelda: BotW
- Breath of the Wild
- Zelda breath of the wild
- Breath Of The Wild
- Legend of Zelda Breath of the Wild
- LoZ
- LoZ: BotW
- Zelda botw
- zelda botw
- breath of the wild
- Legend of zelda
- legend of zelda
- LoZ BOTW
- The Legend of Zelda: Breath of The Wild
- The legend of Zelda: breath of the wild
- ZELDA
- Zelda: BoTW

VISUALS  
MATTER

# Personalities Matter



## OTHER TIPS



Anticipate Objections / Questions



Handle Questions Gracefully



Be Prepared for a No

# No?!?



# Debt as Risk

SHARK  
SIGHTED

ID	Name	Status	Component	Strategy	Probability	Impact	Priority
R1	Drone Routing Large Methods	Open	Drone API / Routing	Reduce	High	Medium	Med / High
R2	Drone API Performance	New	Drone API	Avoid	Medium	Medium	Medium
R3	Drones may burn houses down	Closed	Hardware	Transfer	Low	High	Medium
R4	Duplication leads to Bugs	Open	Drone API	Accept	Medium	Low	Med / Low



# SAFELY PAY DOWN TECHNICAL DEBT

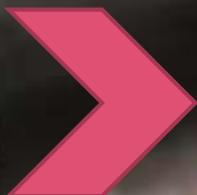
HOW TO NOT GET THE ENTIRE COMPANY MAD AT YOU WHILE IMPROVING CODE

# Test Plans



# Pinning Tests

```
{  
  "score": 720,  
  "comments": "The loan was approved",  
  "requiresReview": false  
}
```



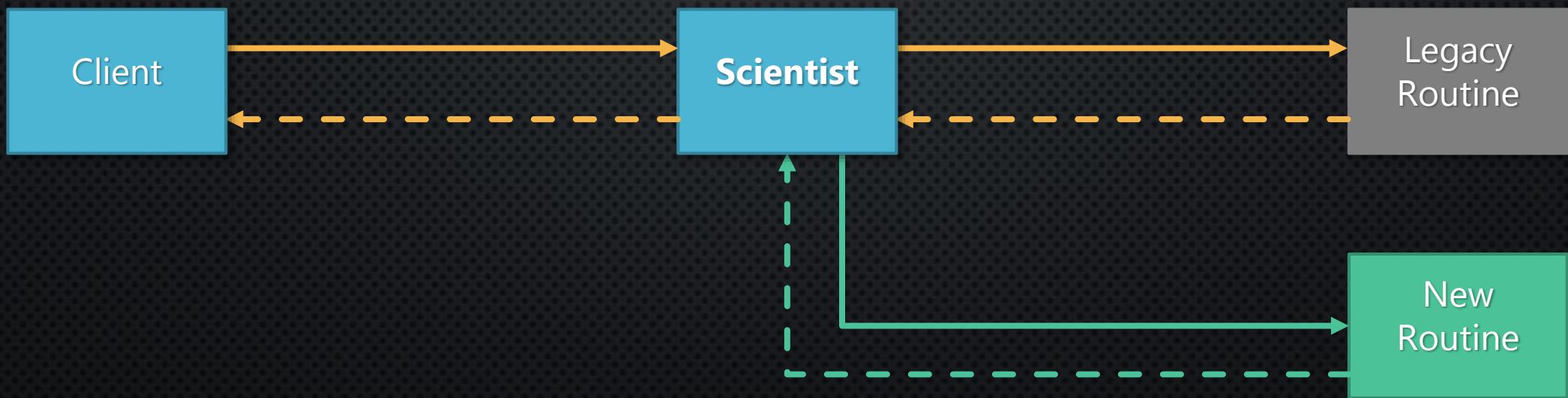
```
{  
  "score": 630,  
  "comments": "The loan is pending review",  
  "requiresReview": true  
}
```



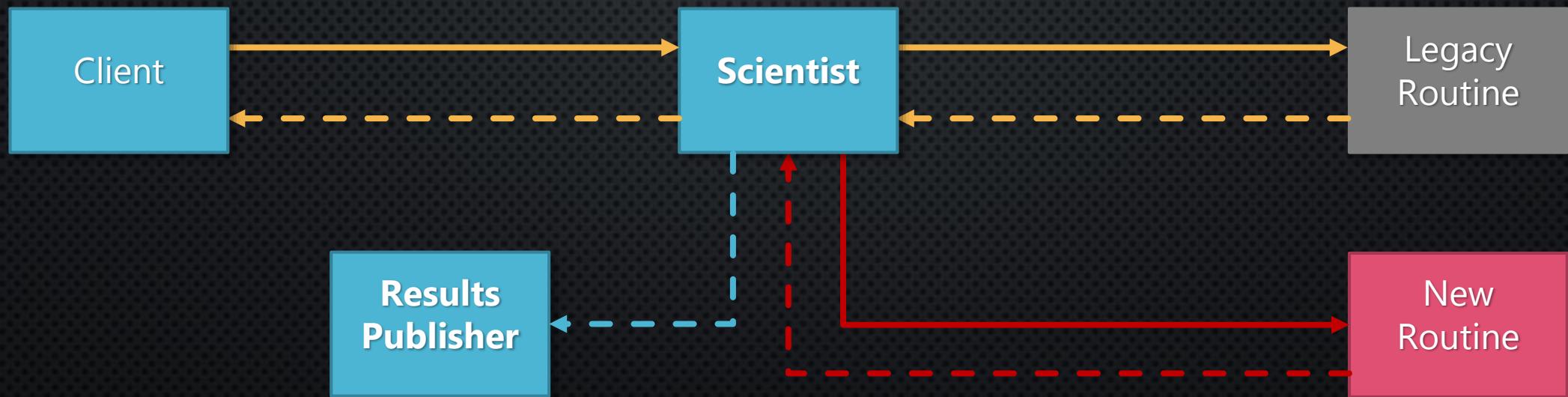
A young girl with long brown hair tied back, wearing a white lab coat over a purple shirt, is looking through the eyepiece of a compound light microscope. She is wearing blue nitrile gloves. The microscope is mounted on a light-colored wooden stand. In the foreground, there is a stack of petri dishes and several small test tubes with orange caps. The background is a blurred laboratory setting.

**Stand Back; I'm  
Going to try Scientist!**

# Scientist



# Scientist

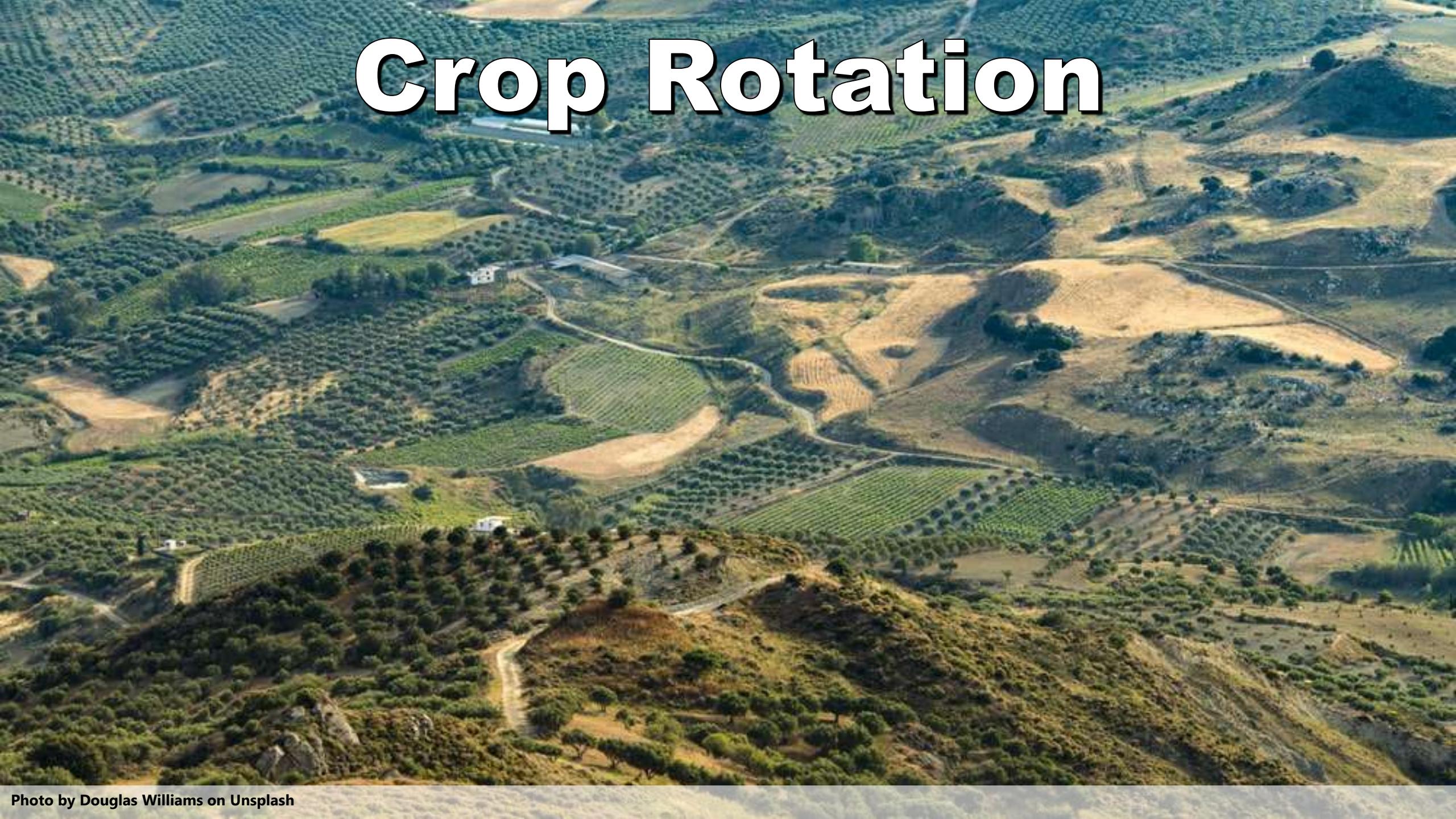




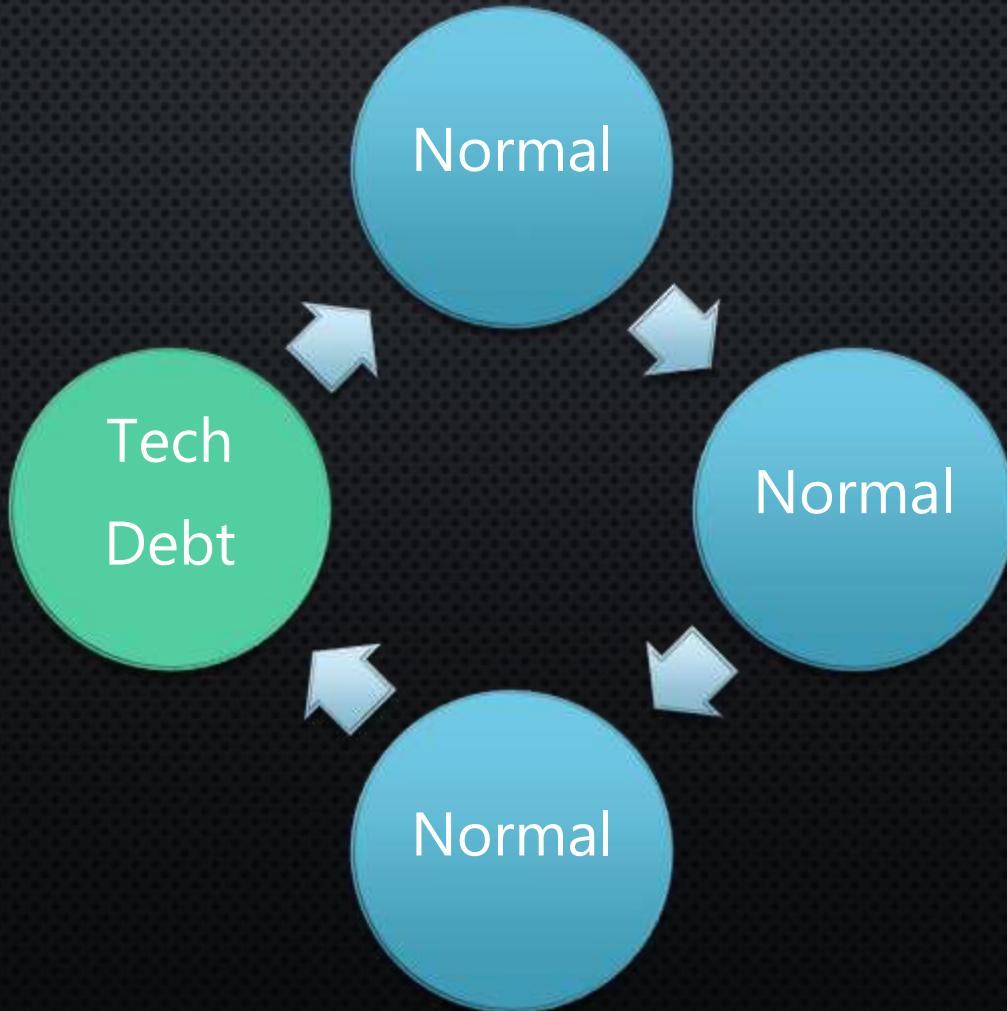
# STRATEGIES FOR DEBT RELIEF

BECAUSE NOT EVERYTHING IS A REWRITE

# Crop Rotation



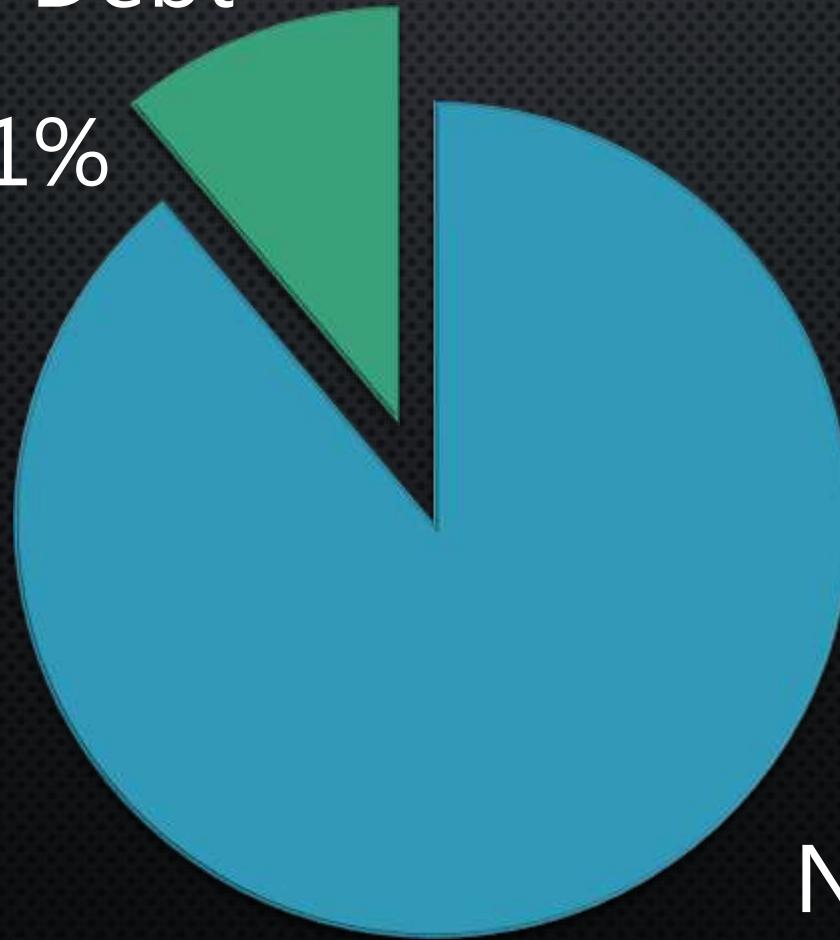
# Tech Debt Sprints



# Dedicated Capacity

Tech Debt

11%



Normal Work...

# Dedicated Resource



Dev 1 – Normal Work



Dev 2 – Normal Work

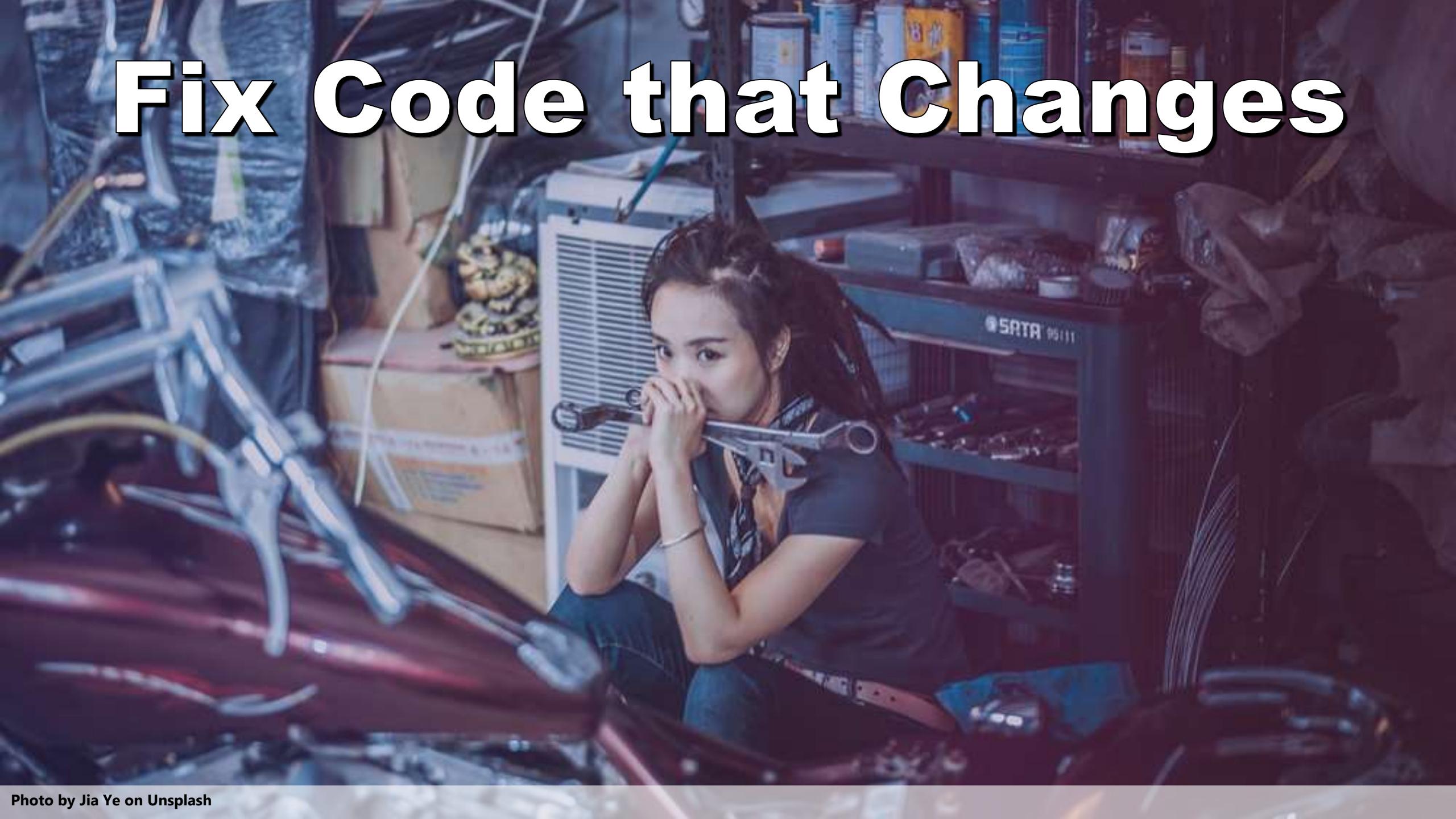


Dev 3 – Normal Work



Dev 4 – Tech Debt

# Fix Code that Changes



# CLOSING



САМОЕ  
БЫСТРОЕ  
СОВРЕМЕННОЕ  
СИГНАЛИЗАЦИОННОЕ  
ПРИБОРЫ

# BENEFITS OF COMMUNICATION



Building Trust



Gaining Understanding



Meeting the  
Organization's Needs



Paying off the **right**  
technical debt

# LEARNING RESOURCES

The screenshot shows the homepage of the Kill All Defects website. At the top, there's a navigation bar with a camera icon, the text "KILL ALL DEFECTS", and the subtitle "Quality Software via Better Code". Below the navigation are links for "Featured", ".NET", "Architecture", "JavaScript", and "Soft Skills". The main content area has two sections: "Recent" and "Featured". The "Recent" section contains a code snippet about the nameof operator in C# and a post about migrating to TypeScript. The "Featured" section contains an article titled "Victimless Canary Testing with Scientist" featuring a yellow bird image.

**KILL ALL DEFECTS**  
Quality Software via Better Code

Recent

`private int _favoriteNumber = 42;  
public int FavoriteNumber {  
 get => _favoriteNumber;  
 set {  
 if (_favoriteNumber != value) {  
 _favoriteNumber = value;  
 OnPropertyChanged(nameof(FavoriteNumber));  
 }  
 }  
}`

**Safer C# with the nameof operator**  
October 29, 2019  
C# 6 introduced an operator that can prevent several issues. Let's look at the nameof operator and how it improves ... Read More

**Migrating to TypeScript**  
October 27, 2019  
Action-oriented C# is great, but it's time to move on. TypeScript is a superset of JavaScript that adds type safety and other features to make development easier. Read More

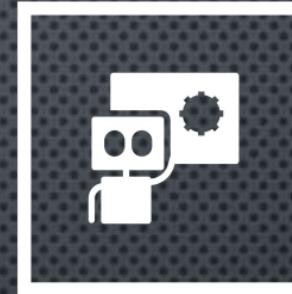
**Cyclomatic Complexity is the Mind Killer**  
October 25, 2019

Featured

**Victimless Canary Testing with Scientist**  
August 27, 2019  
Scientist offers a way to improve existing code without introducing users to new bugs. Learn how Scientist offers a safer ... Read More

**A Love Letter to .NET**  
September 23, 2019

**Action-Oriented C#**  
September 15, 2019



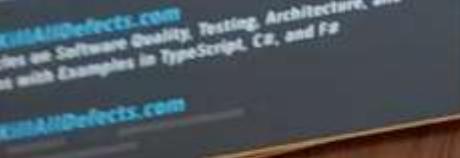
**KILL ALL DEFECTS**  
Quality Software via Better Code

[WWW.KILLALLDEFECTS.COM](http://WWW.KILLALLDEFECTS.COM)

## TECHNICAL WRITING ON:

- SOFTWARE QUALITY
- TOOLS & PROCESSES
- TESTING STRATEGIES
- ARCHITECTURE
- SQUIRREL BRAINS & GENETIC ALGORITHMS

# ALSO... STICKERS!





Zambezi

Thu, January 9th, 8:00 AM - 9:00 AM

## Technical debt must die - Communicating code to business stakeholders

● Project Leadership/Soft Skills



Be the first to rate this session!

✓ 2 Check-ins



Note



Added



Bookmarked



Photo

### Surveys



Session Survey



### Community Photos



DON'T  
FORGET!

# ANY QUESTIONS?



**KILL ALL DEFECTS**  
Quality Software via Better Code

[www.KillAllDefects.com](http://www.KillAllDefects.com)

MATT ELAND

TWITTER: [@INTEGERMAN](https://twitter.com/INTEGERMAN)