Verification Games

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What is verification?

The act of assessing the correctness of a program with respect to a certain specification.

Why is it important?

❖ Prove truths about a program

❖ Have guarantees about a task

❖ *Example: Ariane-5 rocket*

Current Concepts

❖ **Flow Jam (Pictured)**
❖ StormBound/Monster Proof
❖ CircuitBot/Dynamakr
❖ GhostMap/GhostMap: Hyperspace

❖ Pipe Jam
❖ Xylem/Binary Fission
❖ Paradox

❖ Other crowdsourced games
  ➢ Fold.it
  ➢ Astro Drone
  ➢ EteRNA

Current Concepts

Where are they?

From proofbygames.bbn.com

Ghost Map: Hyperspace has encountered
an error and will now restart.

We apologize for the inconvenience.

This has been automatically reported to our developers.

Error text: connection fail: 04 connecting to http://
ghostmap.verigames.com/pbgserver/api/games/1/players/
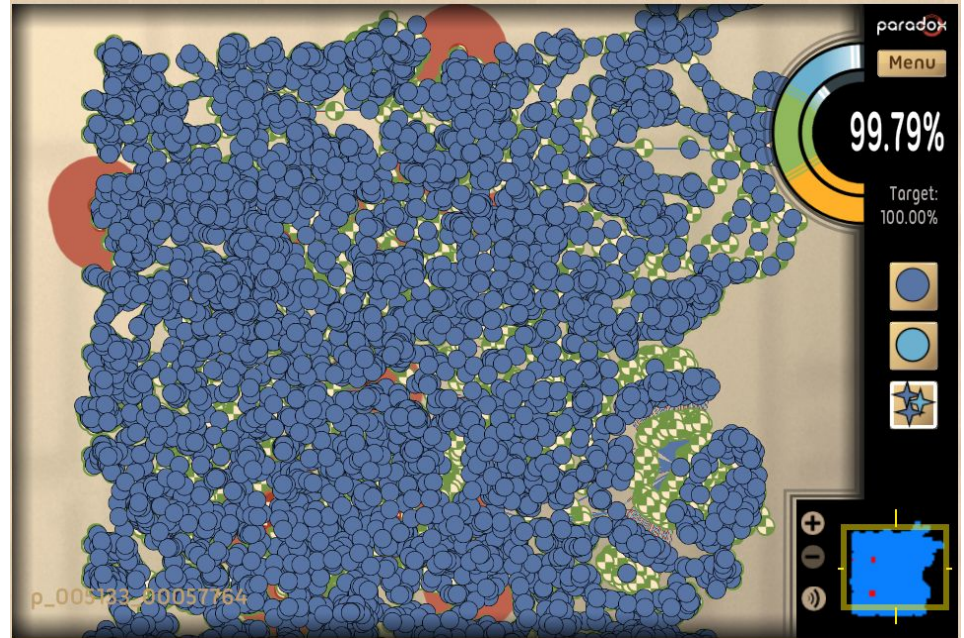0163652b14c60083fe06150c/info/

OK

502 Bad Gateway

nginx/1.4.6 (Ubuntu)

Current Concepts

The Exception: Paradox

❖ Full program view

❖ Change variables to
   eliminate conflicts

Our Approach

1. Resurrect Flow Jam

2. Port existing code to Haxe

3. Restructure to an entity-component-system design
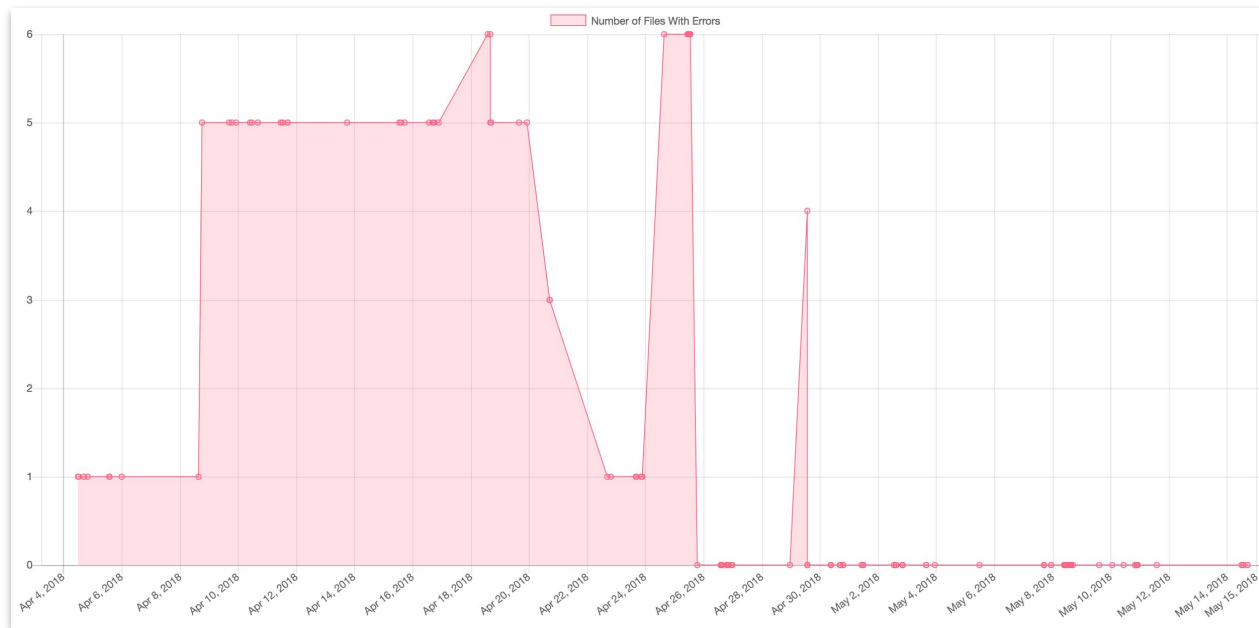
Port

❖ Current codebase: **ActionScript3**

  ➢ Adobe Flash Player

  ➢ 2020 End-of-Life

❖ New codebase: **Haxe**

  ➢ Open source

  ➢ Cross platform support

  ➢ as2hx

Port History

Port History

New Problems

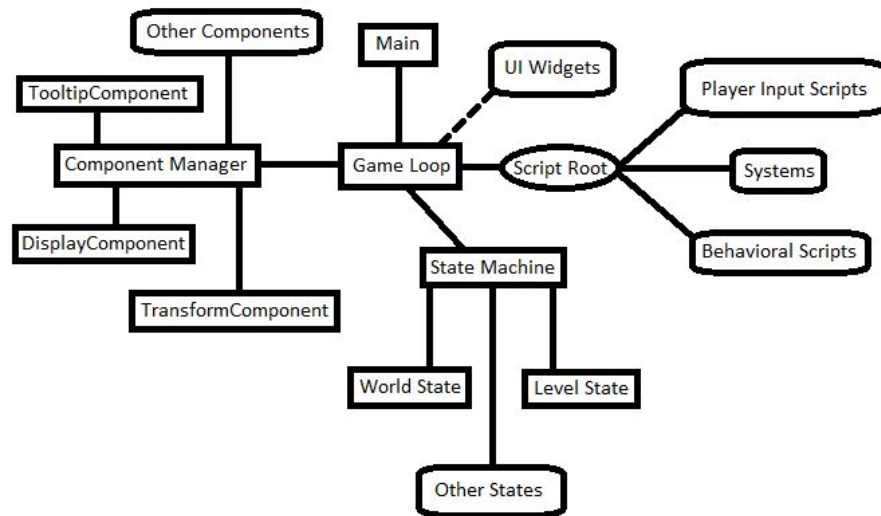# Restructure

❖ **Current architecture:**   Inconsistent, non-modular system

❖ **New architecture:**   Entity-Component-System

❖ 3 Core classes

➤   GridViewPanel

➤   Level

➤   World

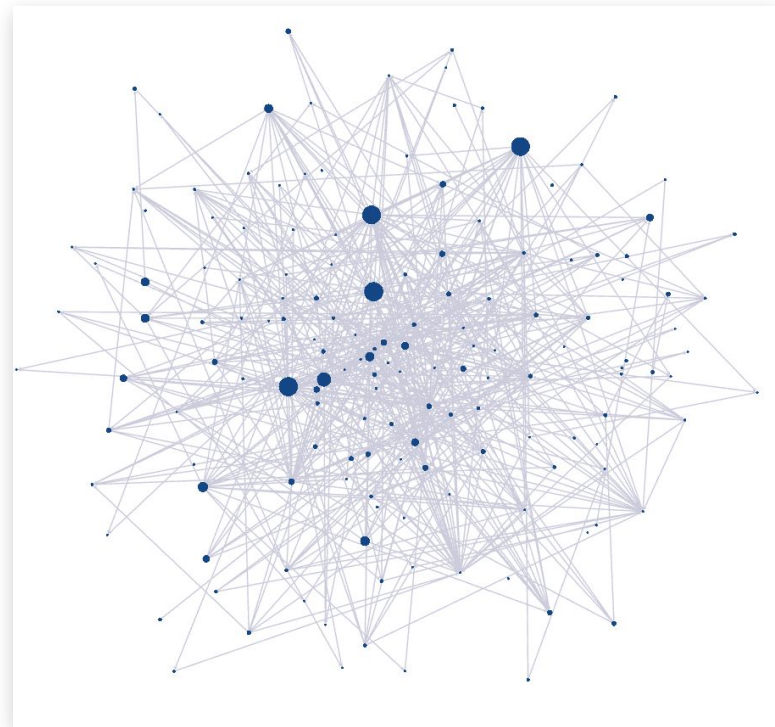# Restructure

❖ Module understandability

❖ Hierarchical codebase

❖ Comprehensibility and maintainability

❖ Entity-Component-System standardization

Restructure

❖ Number of Classes: **154**

❖ Average Outdegree: **3.24**

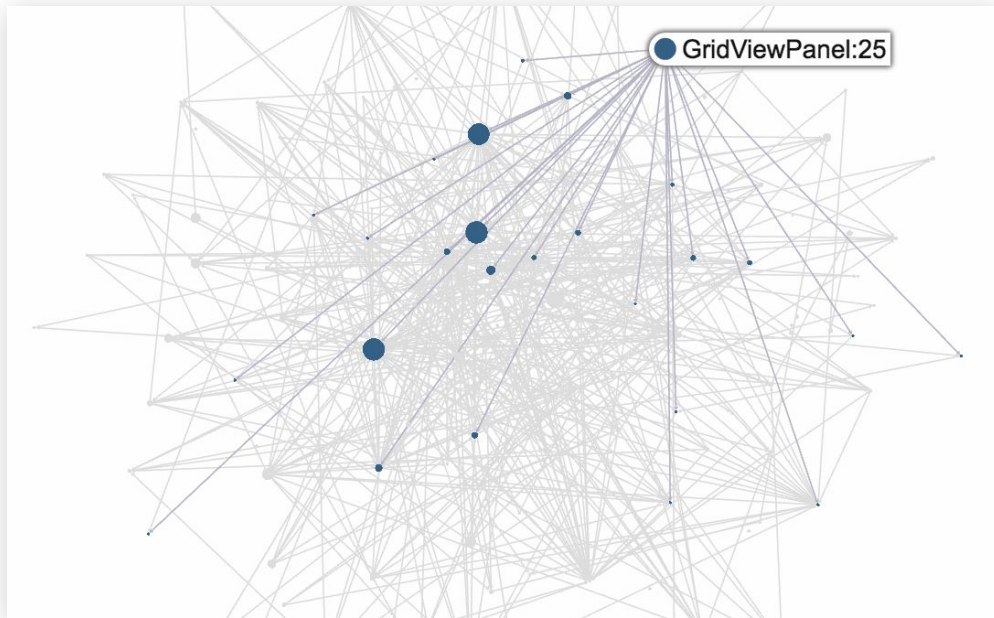❖ Max Outdegree: **32 (World)**

❖ 3-Cycles found: **33**

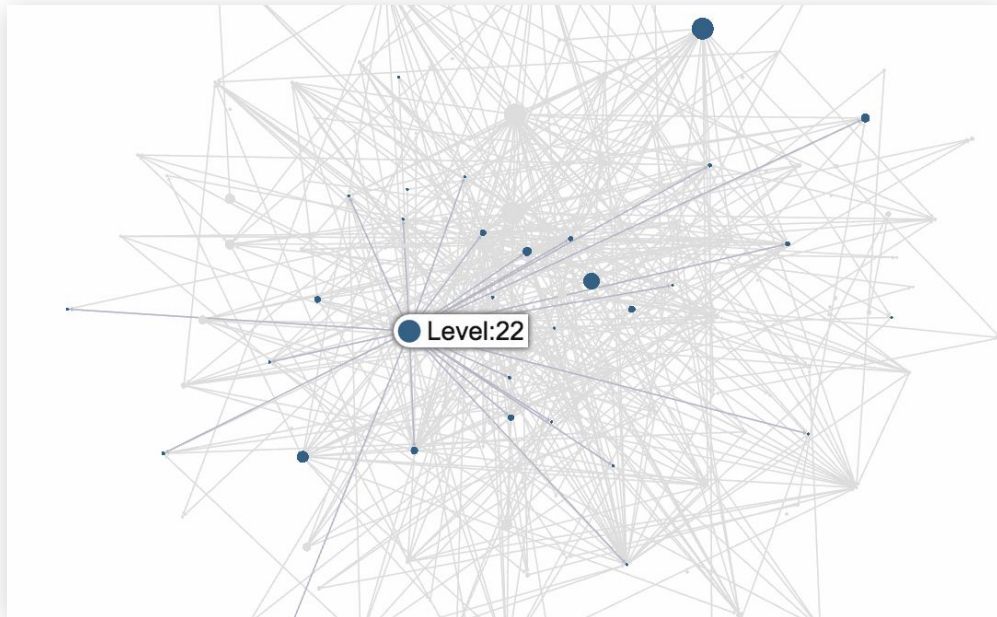# Restructure
GridViewPanel

References 25 other classes.

❖ **Should handle:**

➢ Displaying level components

❖ **Currently handles:**

➢ Mouse input

➢ Level loading

➢ Tutorial messages

➢ Particle effects

➢ UI

GridViewPanel:25

Restructure
Level

References 22 other classes.

- ❖ **Should handle:**
  - ➢ Level gameplay objects
  - ➢ Nodes and edges model
- ❖ **Currently handles:**
  - ➢ Own display
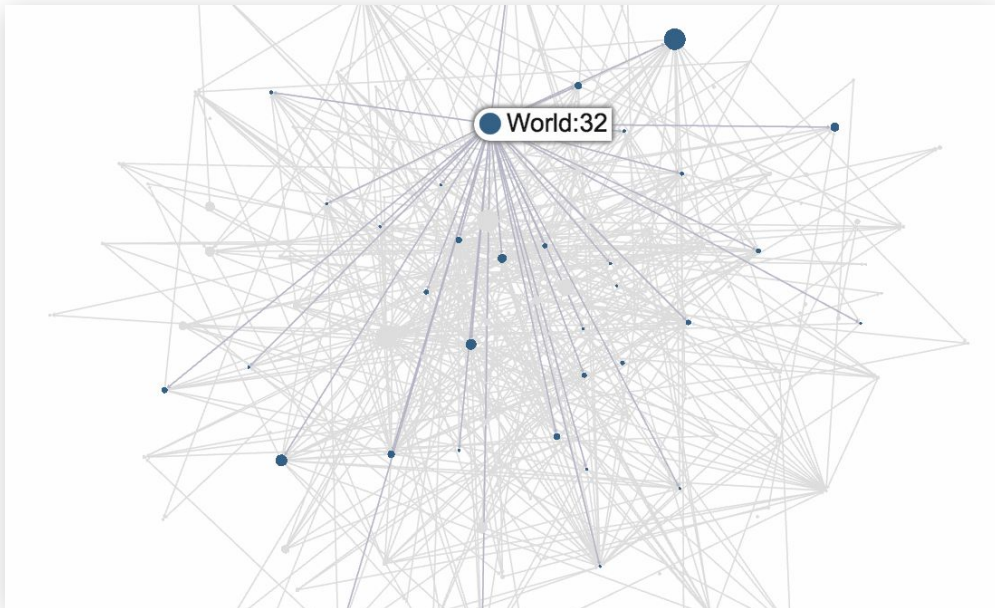 - ➢ File loading
  - ➢ Score tracking

Level:22

Restructure
World
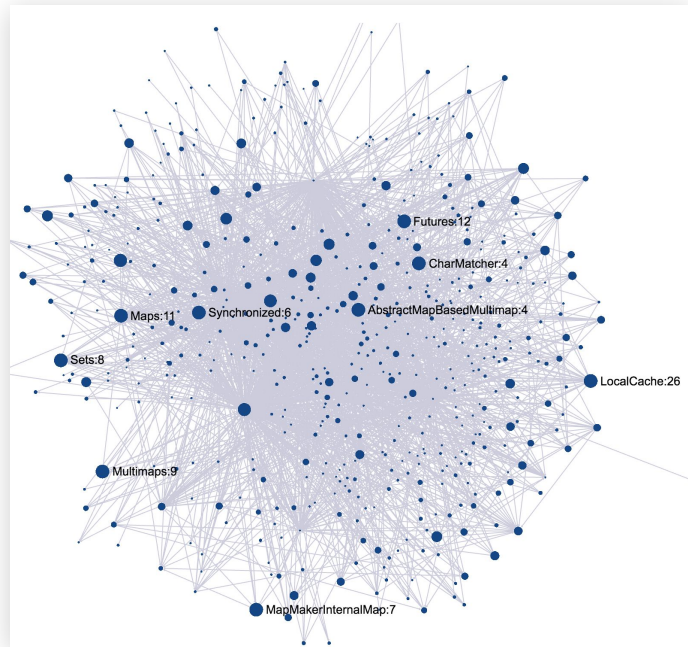
References 32 other classes.

❖ **Should handle:**
   ➢ Program representation
   ➢ Level interaction
❖ **Currently handles:**
   ➢ Own display
   ➢ Achievements
   ➢ High scores
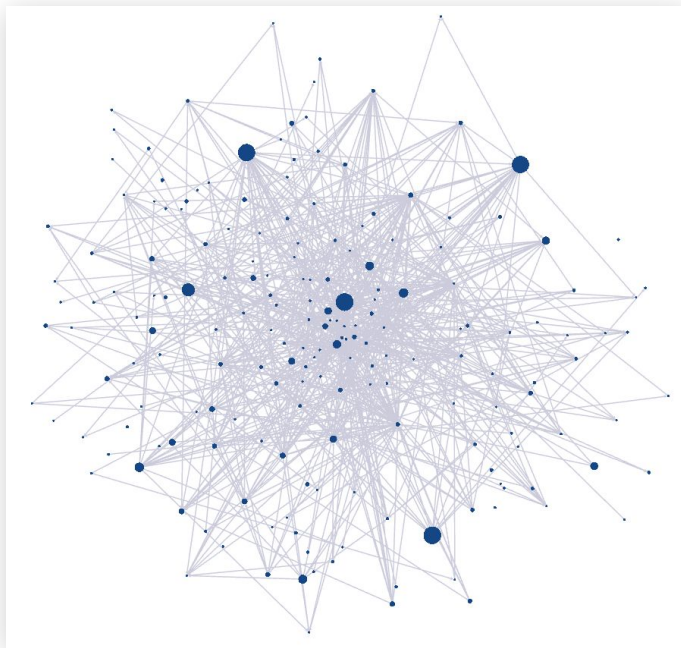
Example Target:
Google Guava (vs. FlowJam)

❖   Number of Classes: **524**   (vs. **154**)

❖   Average Outdegree: **3.31** (vs. **3.24**)

❖   Max Outdegree: **26**   (vs. **32**)

❖   3-Cycles found: **6**   (vs. **33**)

Refactor Results:
Old → New

- ❖ Number of Classes: **154** → **191**

- ❖ Average Outdegree: **3.24** → **3.15**

- ❖ Max Outdegree: **32** → **25**

- ❖ 3-Cycles found: **33** → **24**

Conclusions

- ❖ Maintainability and future-proofing

- ❖ Good architecture

- ❖ Accessibility = Success