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UNIVERSITY
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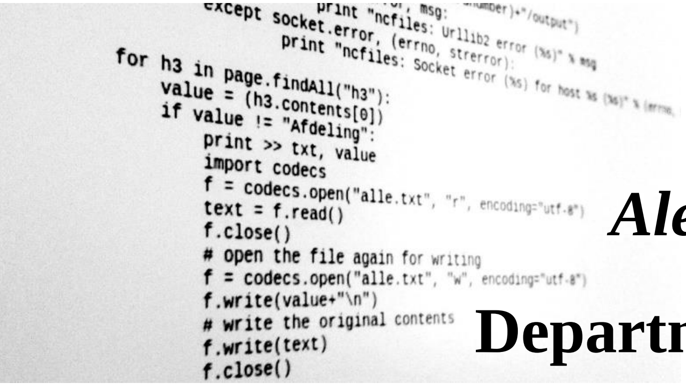
Software Engineering Group
se.uom.gr

Technical Debt in Software Development

Introduction and (some) empirical evidence



```
        print "ncfiles: Urllib2 error (%s)" % msg
except socket.error, (errno, strerror):
        print "ncfiles: Socket error (%s) for host %s (%s)" % (errno,
for h3 in page.findAll("h3"):
    value = (h3.contents[0])
    if value != "Afdeling":
        print >> txt, value
        import codecs
        f = codecs.open("alle.txt", "r", encoding="utf-8")
        text = f.read()
        f.close()
        # open the file again for writing
        f = codecs.open("alle.txt", "w", encoding="utf-8")
        f.write(value+"\n")
        # write the original contents
        f.write(text)
        f.close()
```

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Thessaloniki .NET Meetup

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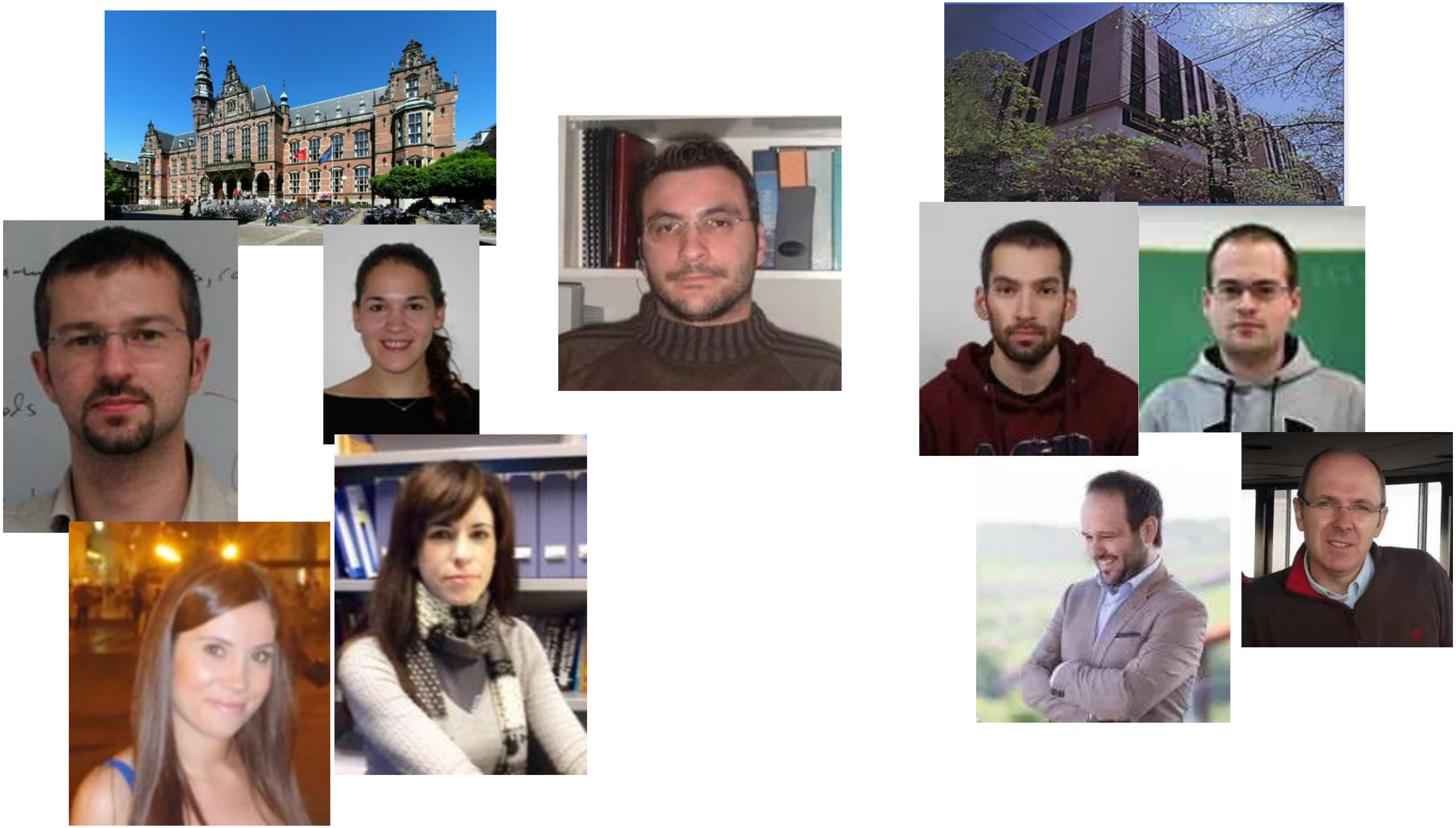
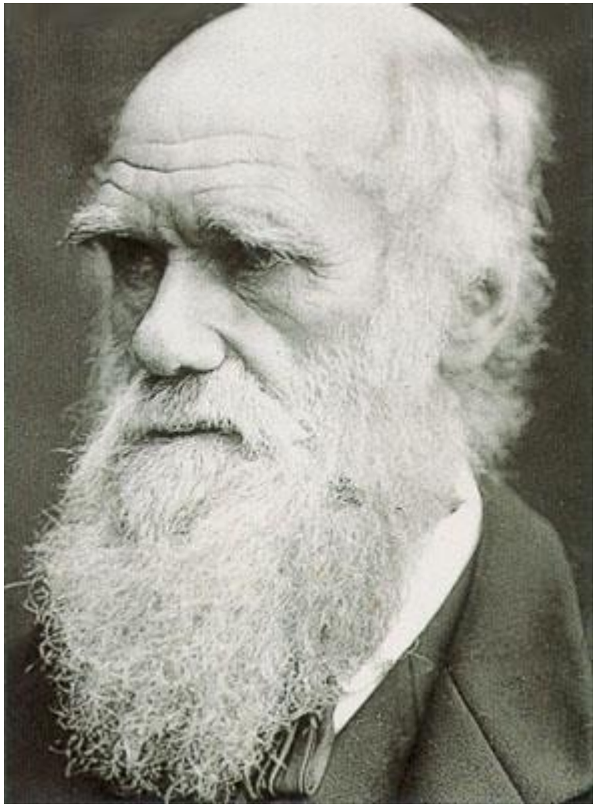
Team



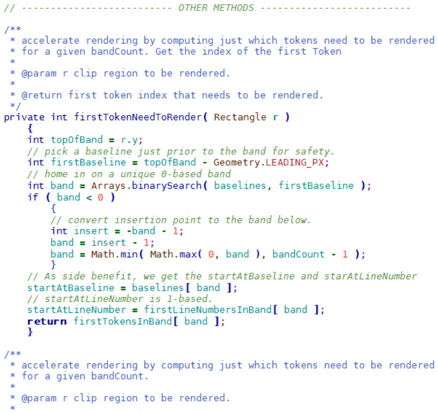
Software Maintenance

"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change"



Charles Darwin

Software Ageing

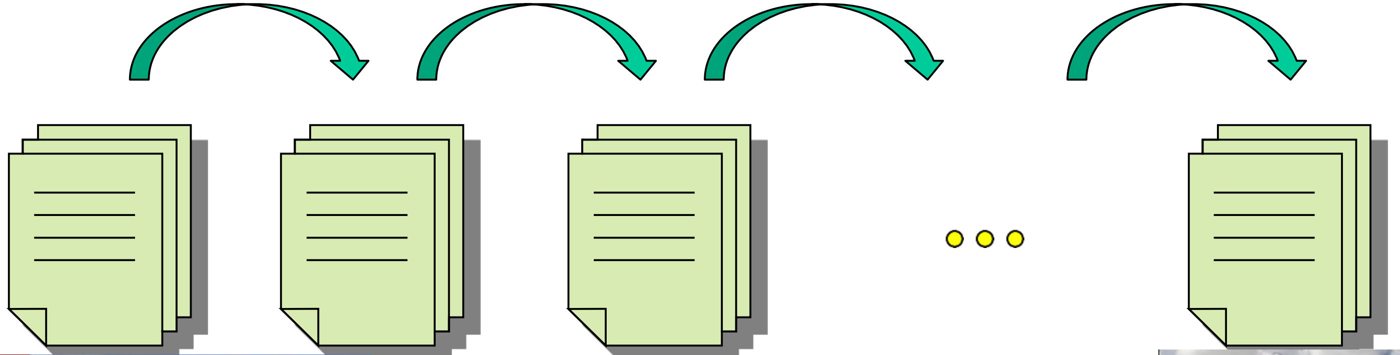


```
// ------------------------- OTHER METHODS -------------------------

/**
 * accelerate rendering by computing just which tokens need to be rendered
 * for a given bandCount. Get the index of the first Token
 *
 * @param r clip region to be rendered.
 *
 * @return first token index that needs to be rendered.
 */
private int firstTokenNeedToRender( Rectangle r )
    {
    int topOfBand = r.y;
    // pick a baseline just prior to the band for safety.
    int firstBaseline = topOfBand - Geometry.LEADING_PX;
    // home in on a unique 0-based band
    int band = Arrays.binarySearch( baselines, firstBaseline );
    if ( band < 0 )
        {
        // convert insertion point to the band below.
        int insert = -band - 1;
        band = insert - 1;
        band = Math.min( Math.max( 0, band ), bandCount - 1 );
        }
    // As side benefit, we get the startAtBaseline and starAtLineNumber
    startAtBaseline = baselines[ band ];
    // startAtLineNumber is 1-based.
    startAtLineNumber = firstLineNumbersInBand[ band ];
    return firstTokensInBand[ band ];
    }

/**
 * accelerate rendering by computing just which tokens need to be rendered
 * for a given bandCount.
 *
 * @param r clip region to be rendered.
 *
```

well-designed code



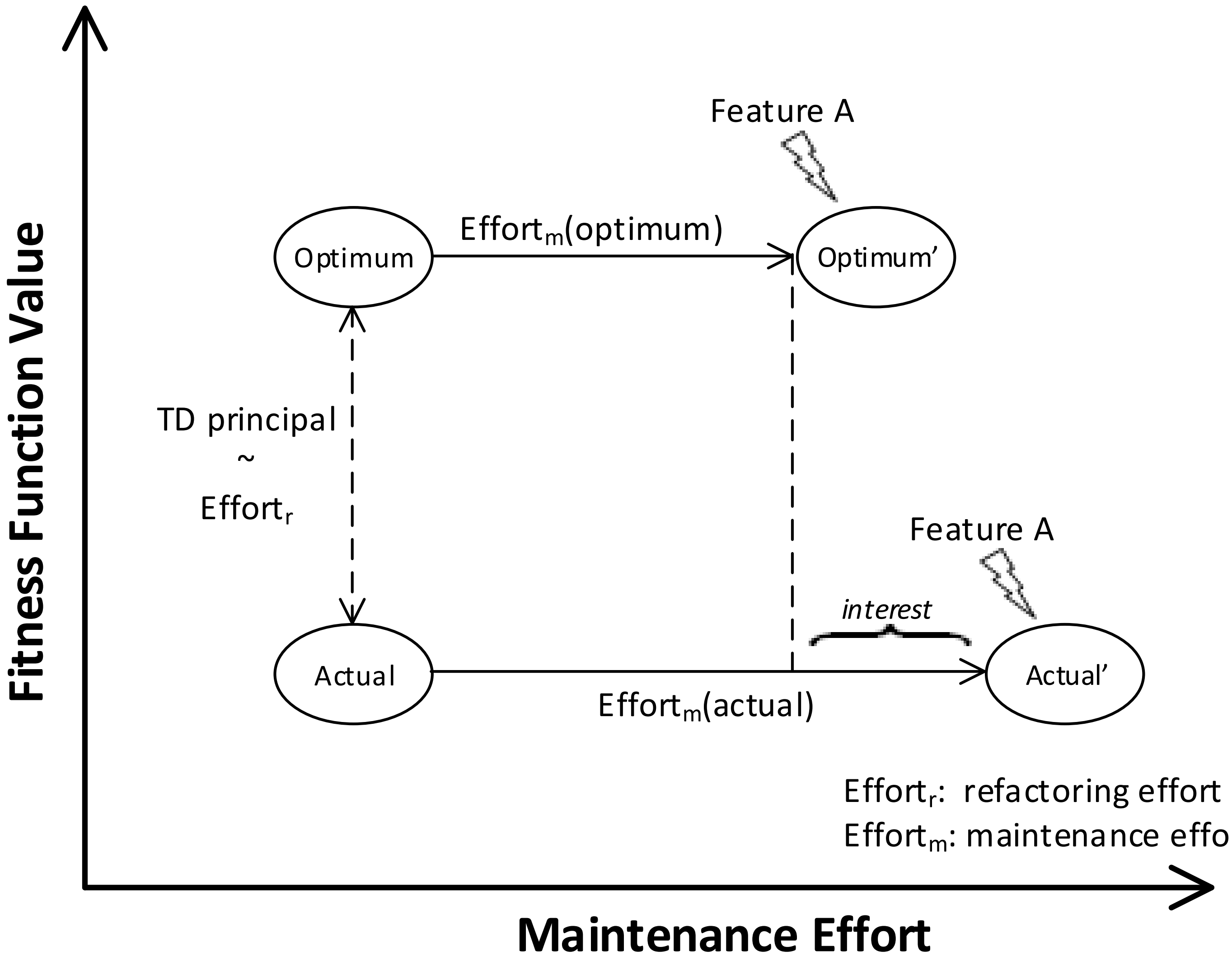
Design quality decays

Τεχνικό Χρέος: Ορισμός

"Shipping first time code is like going into debt. A little debt speeds development so long as it is paid back promptly with a rewrite... The danger occurs when the debt is not repaid. **Every minute spent on not-quite-right code counts as interest on that debt**" *— Ward Cunningham, 1992*

Trade-off

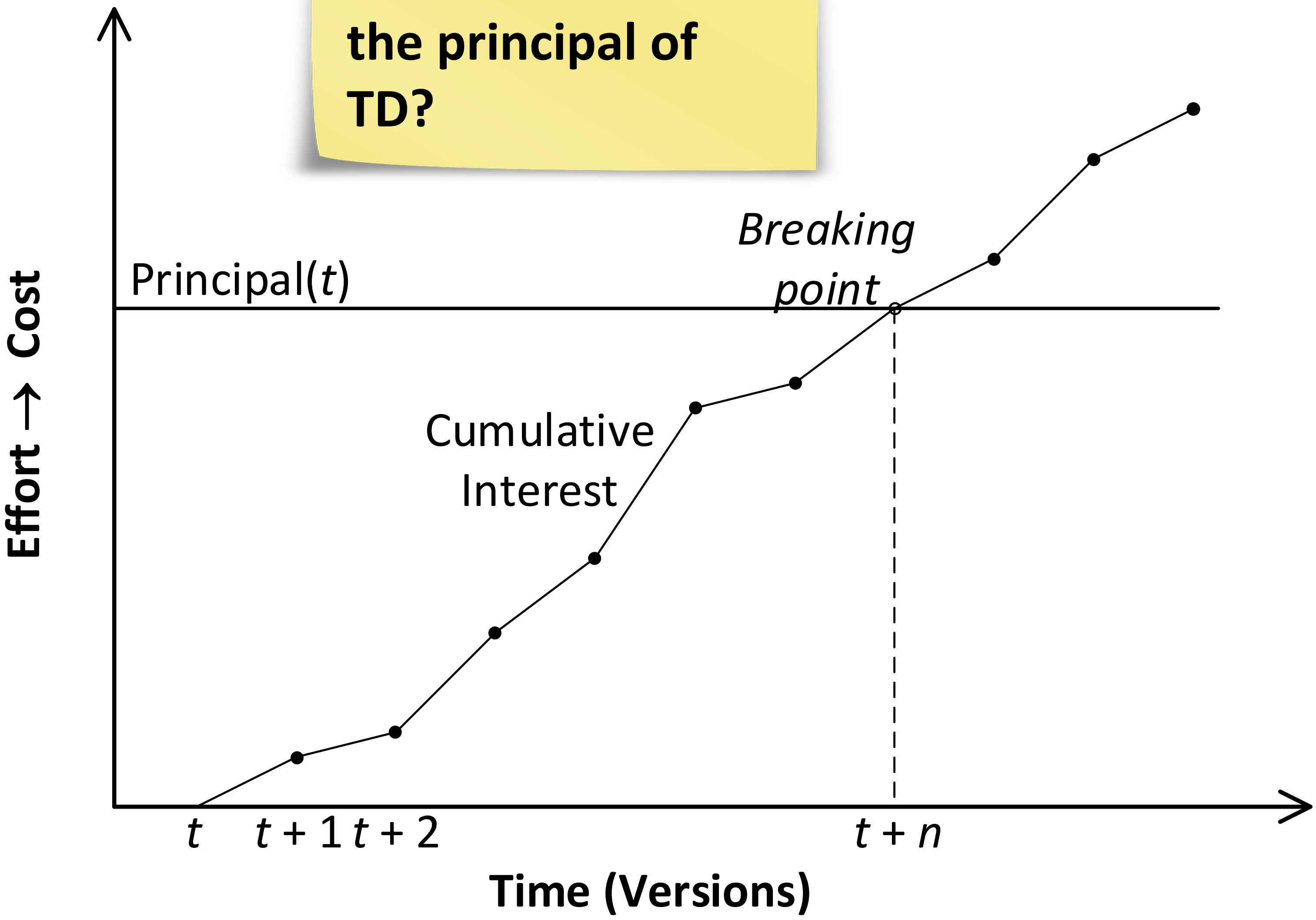
Technical Debt as distance from the ‘optimum’



Effort$_r$: refactoring effort
Effort$_m$: maintenance effort

Does it make sense to allow some debt?

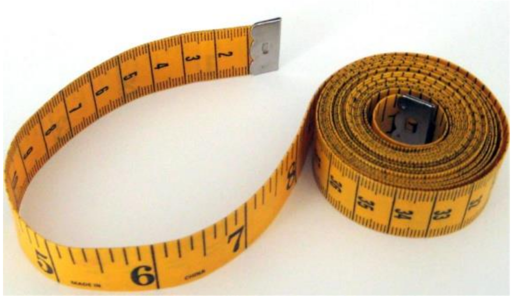
How to measure the principal of TD?



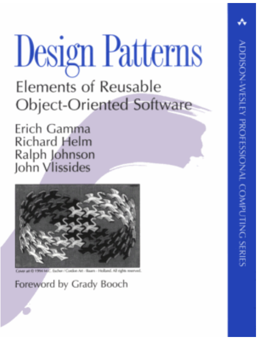
What contributes to TD?

Τους πάπυρους, τους πάπυρους!
Τι εφιάλτης Δία
αιώνες μες στον ύπνο μου
η ίδια τραγωδία.
Τους πάπυρους, τους πάπυρους
απ' τη βιβλιοθήκη
βρείτε μια κρύπτη σύντροφοι,
μια υπόγεια αποθήκη.
Τους πάπυρους, τους πάπυρους
και μέλη αγαλμάτων
καίγεται το Σεράπειο,
το θαύμα των θαυμάτων.
Τους πάπυρους, τους πάπυρους
και τον πολιτισμό μας
περιέχουν το απόσταγμα
της σκέψης των σοφών μας.
Τους πάπυρους, τους πάπυρους,
περγαμηνές, μνημεία
των βάρβαρων φανατικών
κατέστρεψε η μανία.

non-compliance with
design principles



excessive
metric values



lack of
design patterns

violations
of *design*
heuristics

software clones

Fowler's
bad smells

lack of *documentation*

Long Method

Pieces of code with large size, high complexity and low cohesion

```
int i;
int sum = 0;
int product = 1;
for(i = 0; i < N; ++i) {
  sum = sum + i;
  product = product *i;
}
System.out.println(sum);
System.out.println(product);
```

Refactoring: Extract Method

Smells..

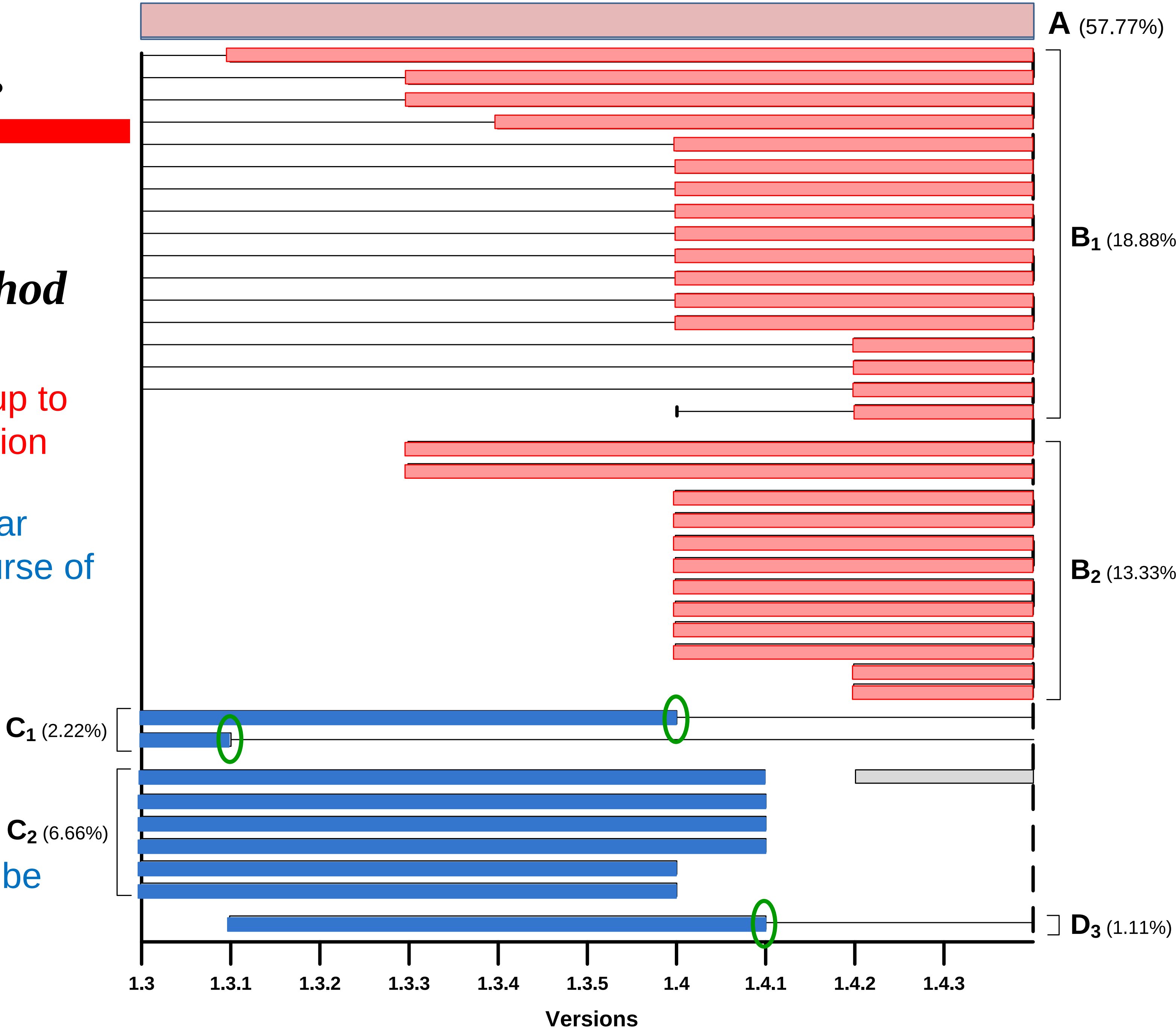
JFlex

Long Method

-90% extend up to the latest version

-10% disappear during the course of the project

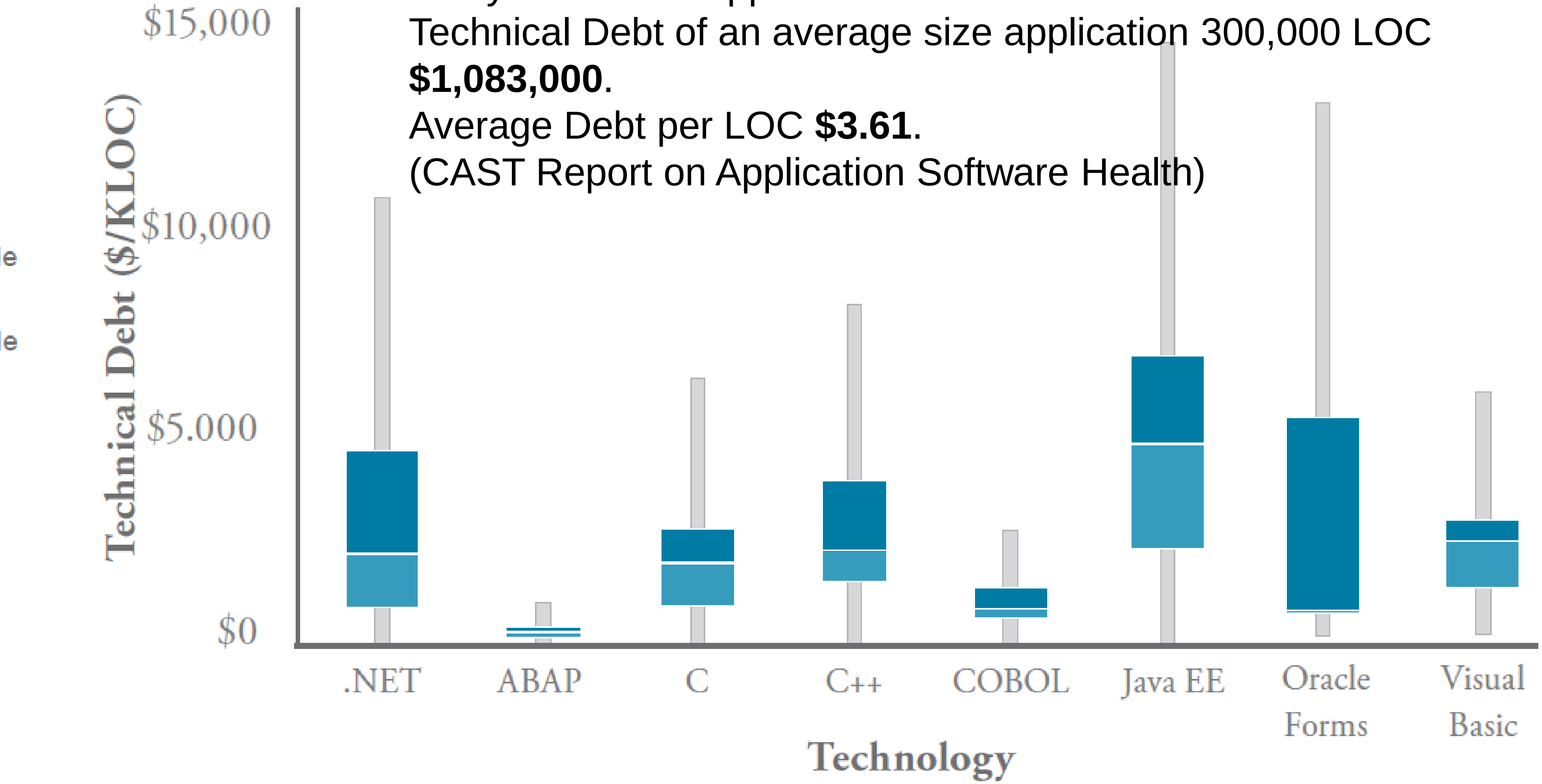
-3.33% smell removal



- no case can be regarded as application of refactoring

How much debt?

Technical Debt within Each Technology



Analysis of 1400 applications with 550 million LOC

Technical Debt of an average size application 300,000 LOC **$1,083,000**.

Average Debt per LOC **$3.61**.

(CAST Report on Application Software Health)

Types of Technical Debt

Unintentional	Intentional
Bad design choices Low code quality (non-strategic debt)	Informed Decisions to take on some technical debt in order to achieve a more important goal Optimization for the present and not for the future

Tools

sonarqube

OSS

Code quality: duplicated code, coding standards, unit tests, code coverage, code complexity, comments, bugs, and security vulnerabilities.

Technical Debt Ratio (e.g.. 50% implies that in order to pay off debt 50% of the total effort spent so far in the project is required)

20 languages

CAST

Achieve Insight. Deliver Excellence.

Application Intelligence Platform (SaaS or on premises)

Over 1200 rules

28+ languages

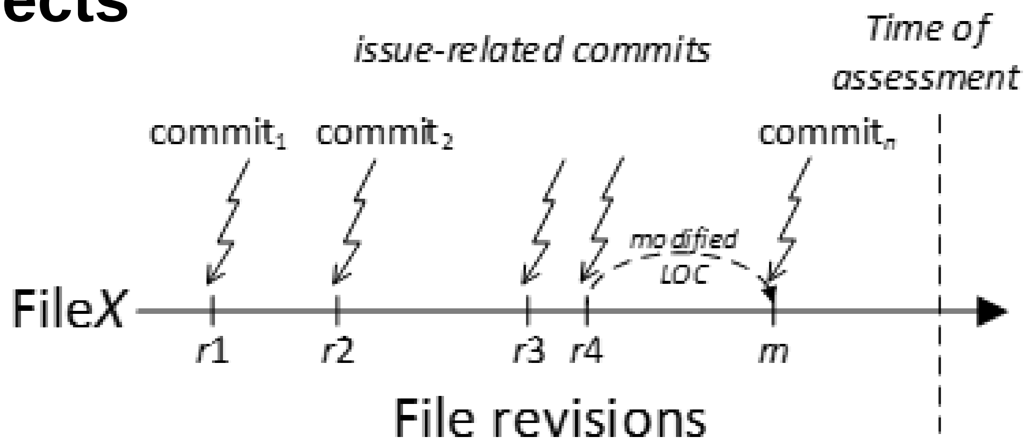
Violations ranked based on criticality

Dashboard with Health Measures (Efficiency, Changeability, Complexity etc)

Empirical Study 1

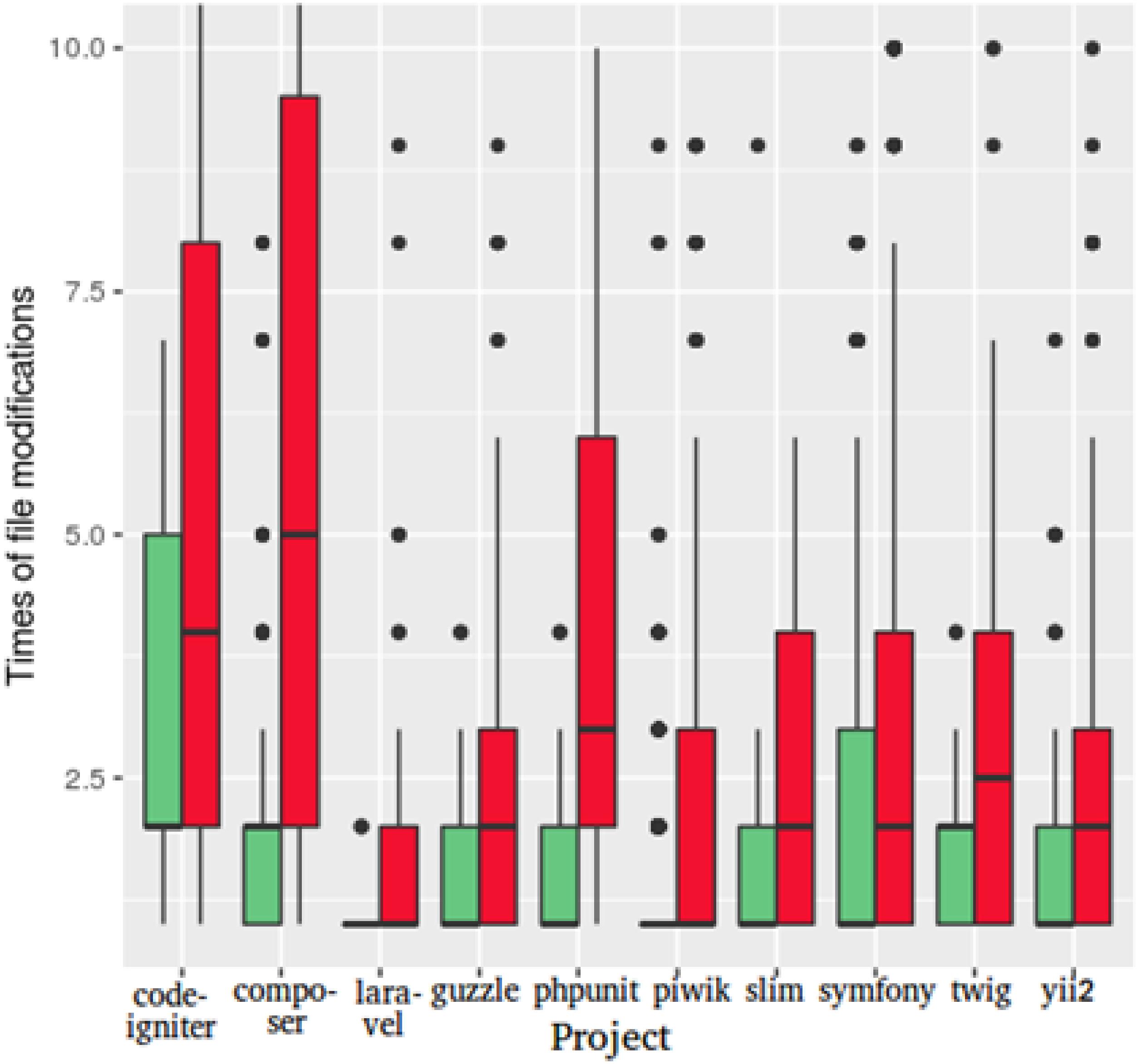
Is Technical Debt REALLY a problem?

10 projects



Corrective maintenance

Frequency of fixes vs. Technical Debt

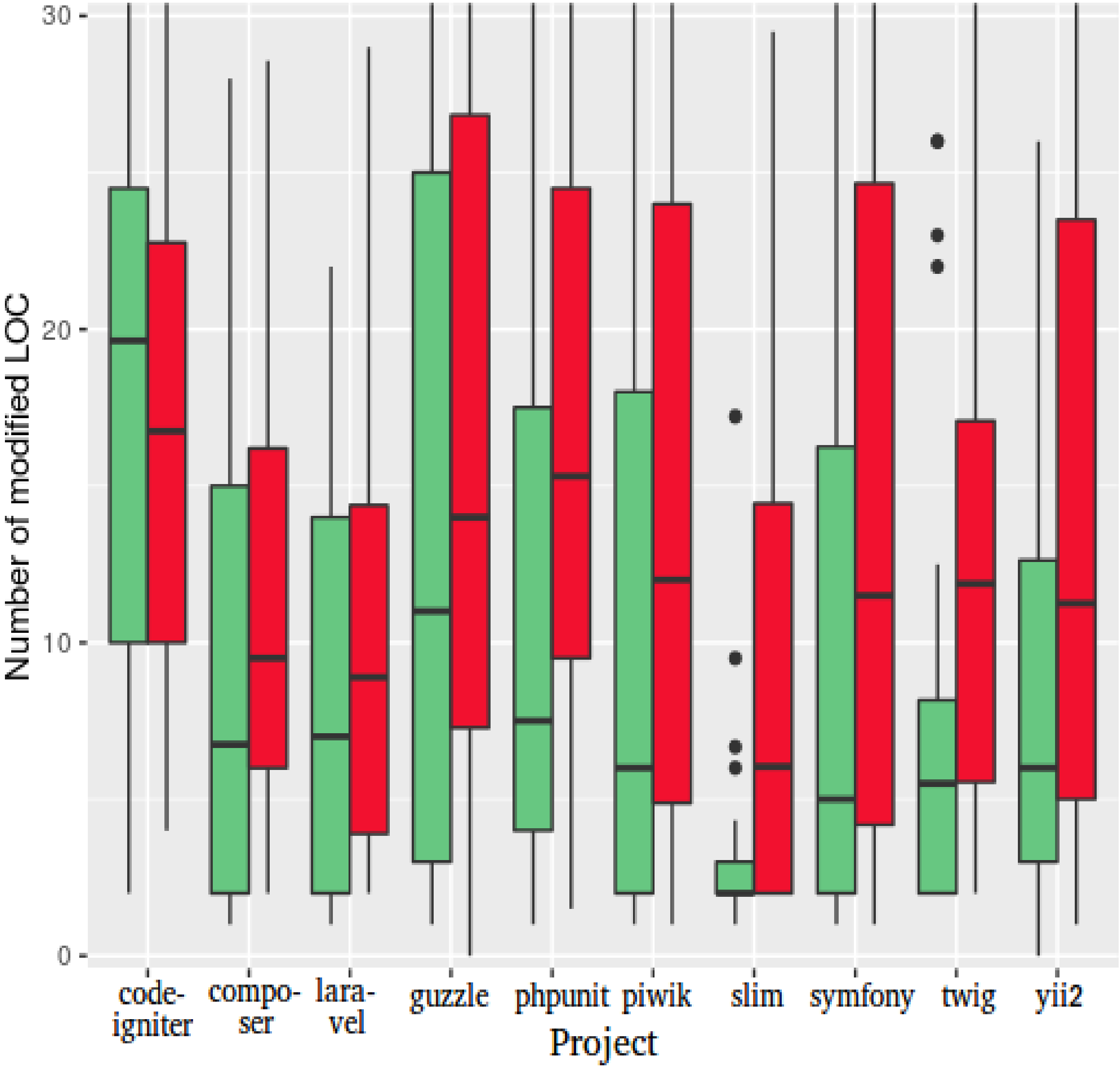


High TD files

are modified

1.9 times more often

Extent of fixes vs. Technical Debt



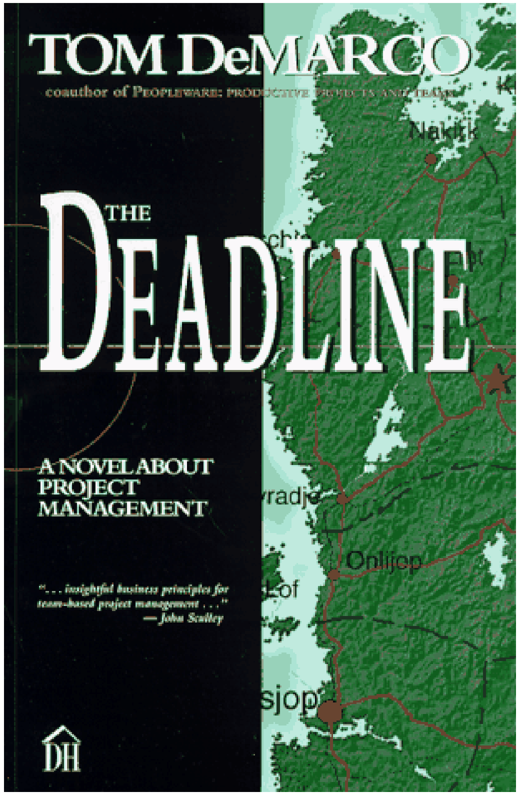
Extent of change in

High TD files

2.4 times higher

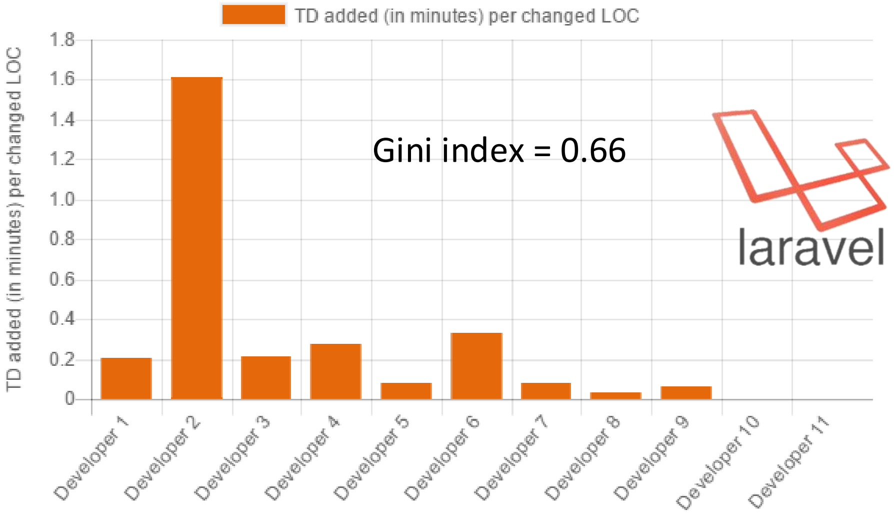
Empirical Study 2

- ***TD reduces the velocity during evolution***
- ***TD can be assessed on artifacts***
- ***However, it's people that do projects***

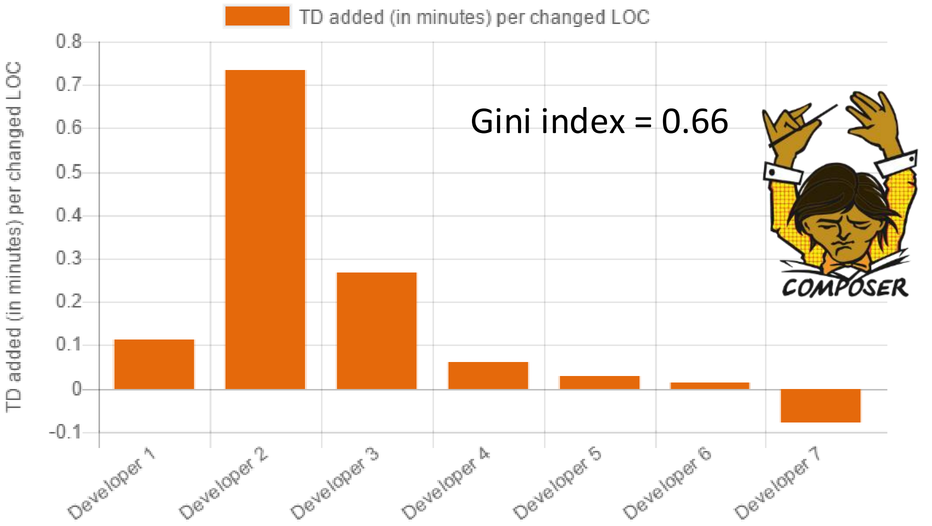

TOM DeMARCO
coauthor of PEOPLEWARE: PRODUCTIVE PROJECTS AND TEAMS
THE DEADLINE
A NOVEL ABOUT PROJECT MANAGEMENT
"... insightful business principles for team-based project management ..." — John Sculley
DH

..and it's people that introduce TD

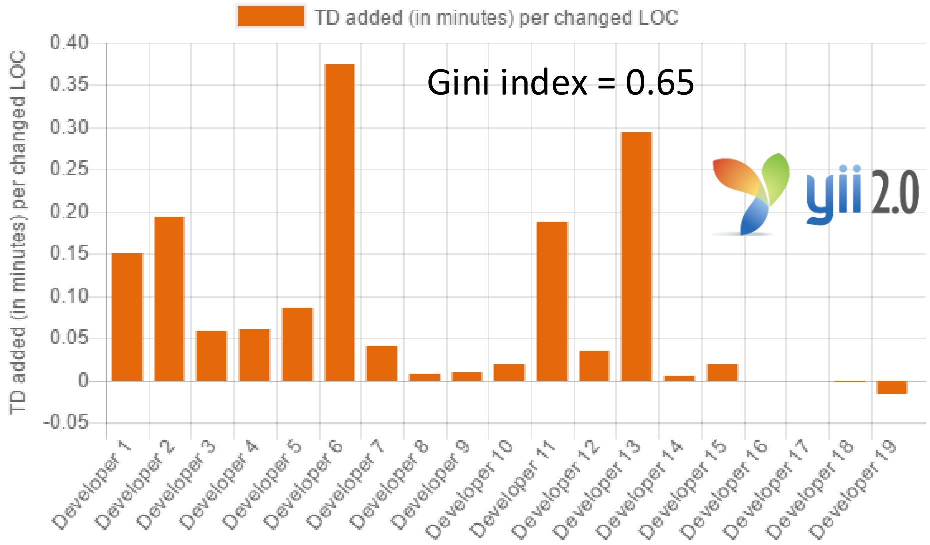
Distribution of TD among Developers



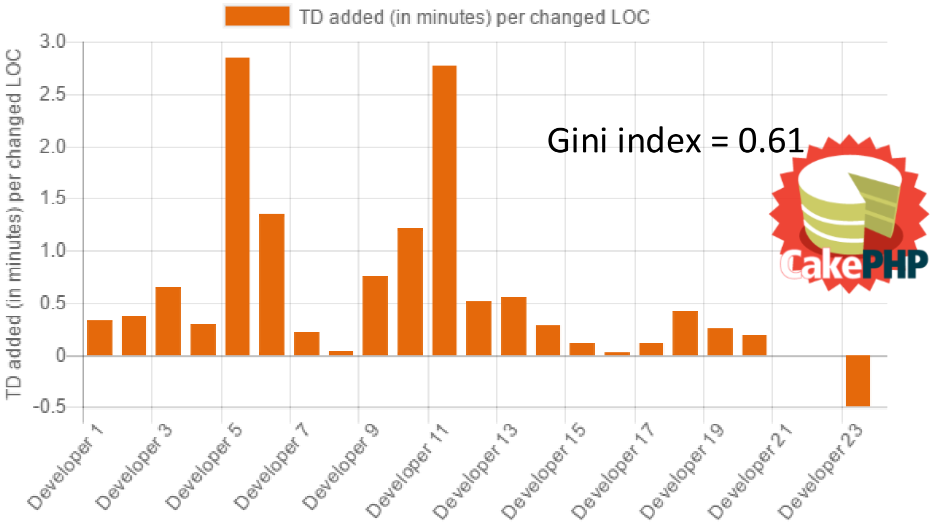
Gini index = 0.66



Gini index = 0.66

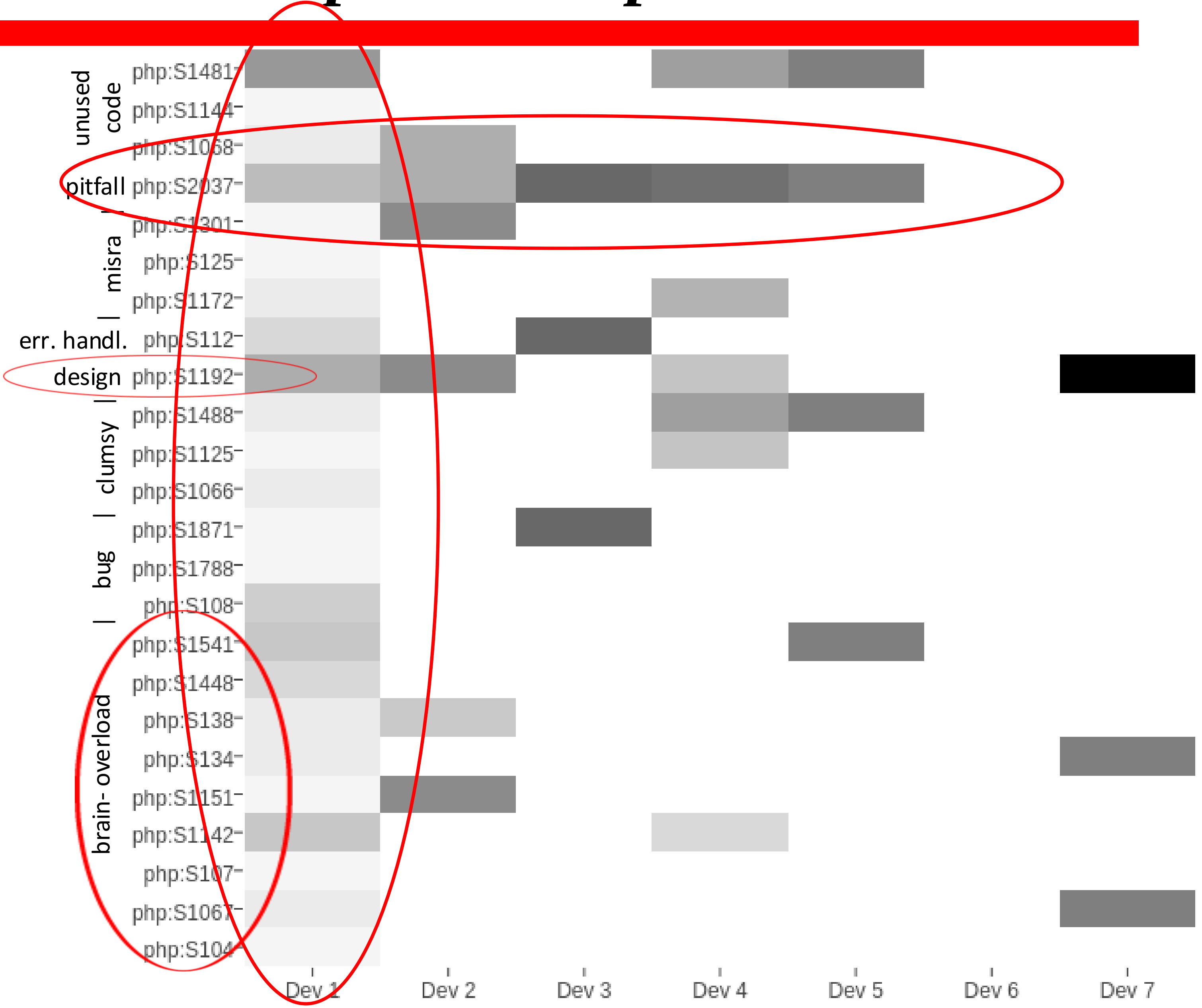


Gini index = 0.65

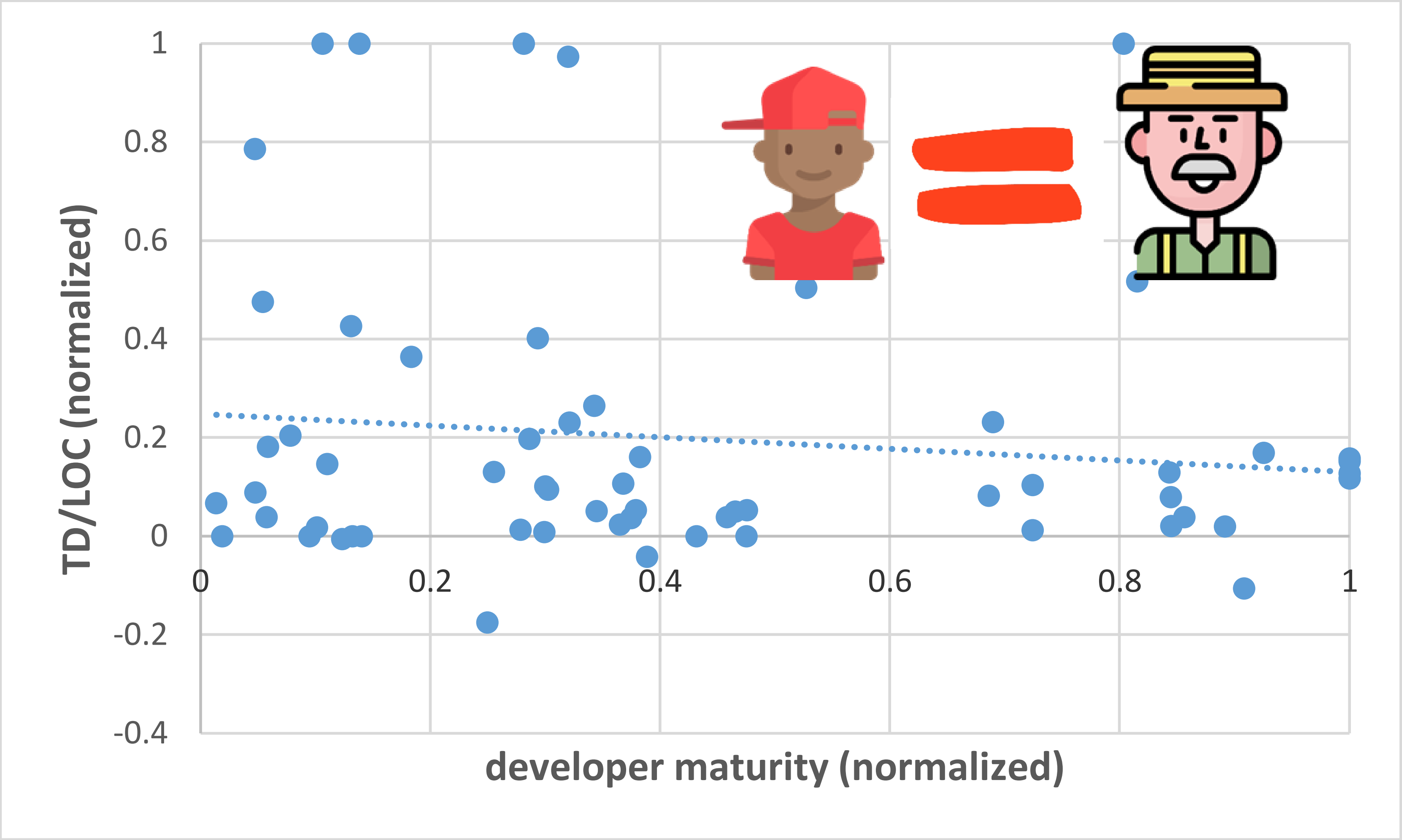


Gini index = 0.61

TD violations per Developer



TD vs. Developer Maturity



Strategies for dealing with debt

- Do nothing, it gets worse
- Replace, high cost/risk
- Incremental refactoring, commitment to invest

Thank you for your attention!