



Software Is Details

@KevlinHenney



知るべき
97 Things Every Prog

Kevlin Henney 編
李军译 吕骏审校
電子工業出版社
PUBLISHING HOUSE OF ELECTRONICS INDUSTRY
http://www.pri.com.cn

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Collective Wisdom
from the Experts

97 Things Every Programmer Should Know

O'REILLY®

Edited by Kevlin Henney

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JOB
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WILEY SERIES IN
SOFTWARE DESIGN PATTERNS

PATTERN-ORIENTED SOFTWARE ARCHITECTURE

A Pattern Language for
Distributed Computing



Volume 4

Frank Buschmann
Kevlin Henney
Douglas C. Schmidt



WILEY SERIES IN
SOFTWARE DESIGN PATTERNS

PATTERN-ORIENTED SOFTWARE ARCHITECTURE

On Patterns and Pattern Languages



Volume 5

Frank Buschmann
Kevlin Henney
Douglas C. Schmidt

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97 Things Every Java Programmer Should Know



Collective
Wisdom
from the
Experts

Edited by Kevlin Henney
& Trisha Gee



Any program is a model of a
model within a theory of a model
of an abstraction of some portion
of the world or of some universe
of discourse.

Meir M Lehman

"Programs, Life Cycles, and Laws of Software Evolution"

The purpose of abstraction is not to be vague, but to create a new semantic level in which one can be absolutely precise.

Edsger W Dijkstra

It's just semantics.

It's just meaning.

It's just details.

More Programming Pearls

Confessions of a Coder

Jon Bentley



More Programming Pearls

Confessions of a Coder

Jon Bentley

Details count.

Peter Weinberger

**Geeks are people who
love something so much
that all the details matter.**

Marissa Mayer

**We're talking about a very
specific mindset that is crucial
when it comes to the act of
creating.**

Will Gompertz
Think Like an Artist

**It is an attitude that can be
encapsulated in a simple but
demanding rule: always think
both big picture and fine detail.**

Will Gompertz
Think Like an Artist

software

software
architecture

code

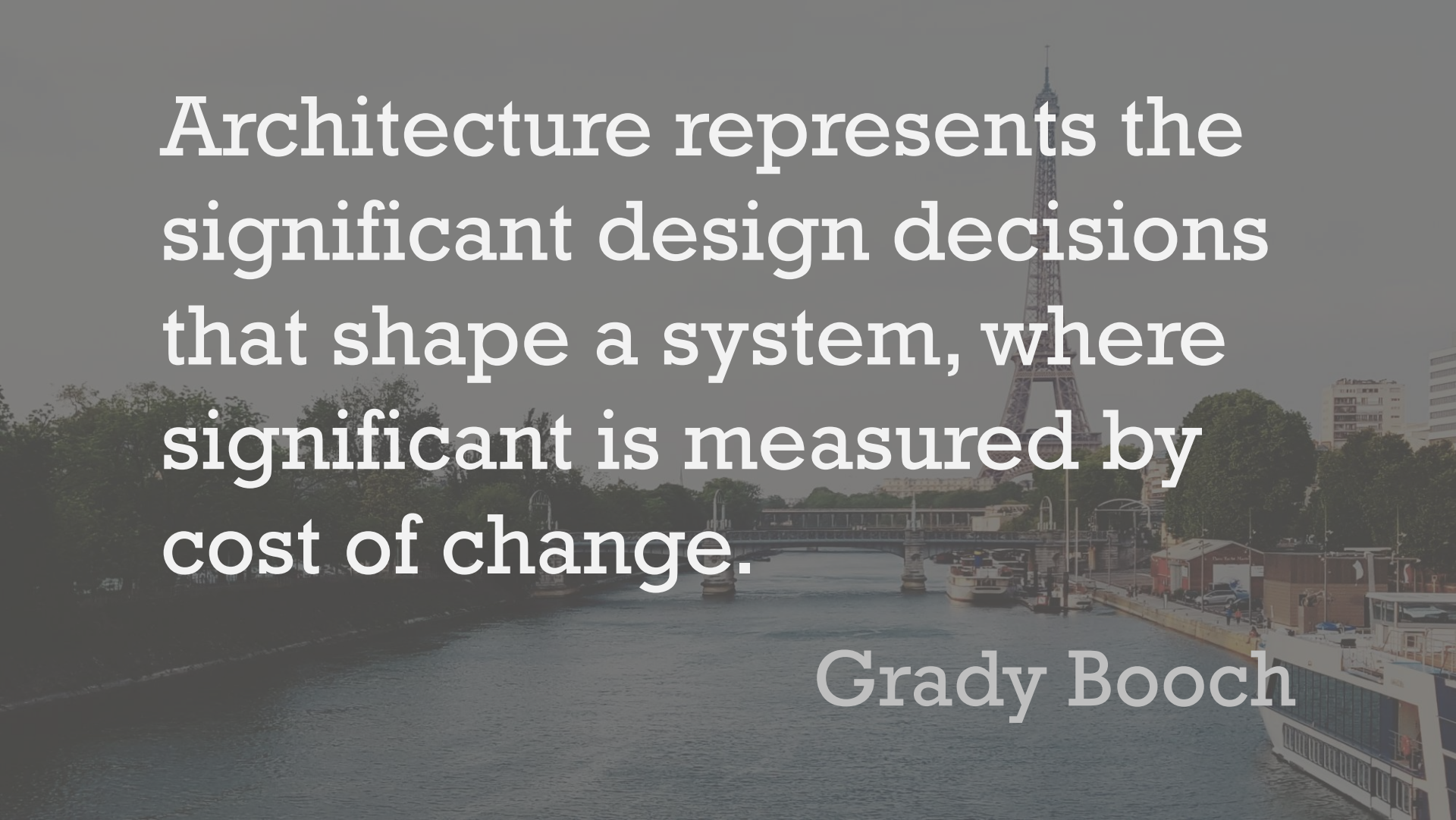
implementation

implementation
details

design
details

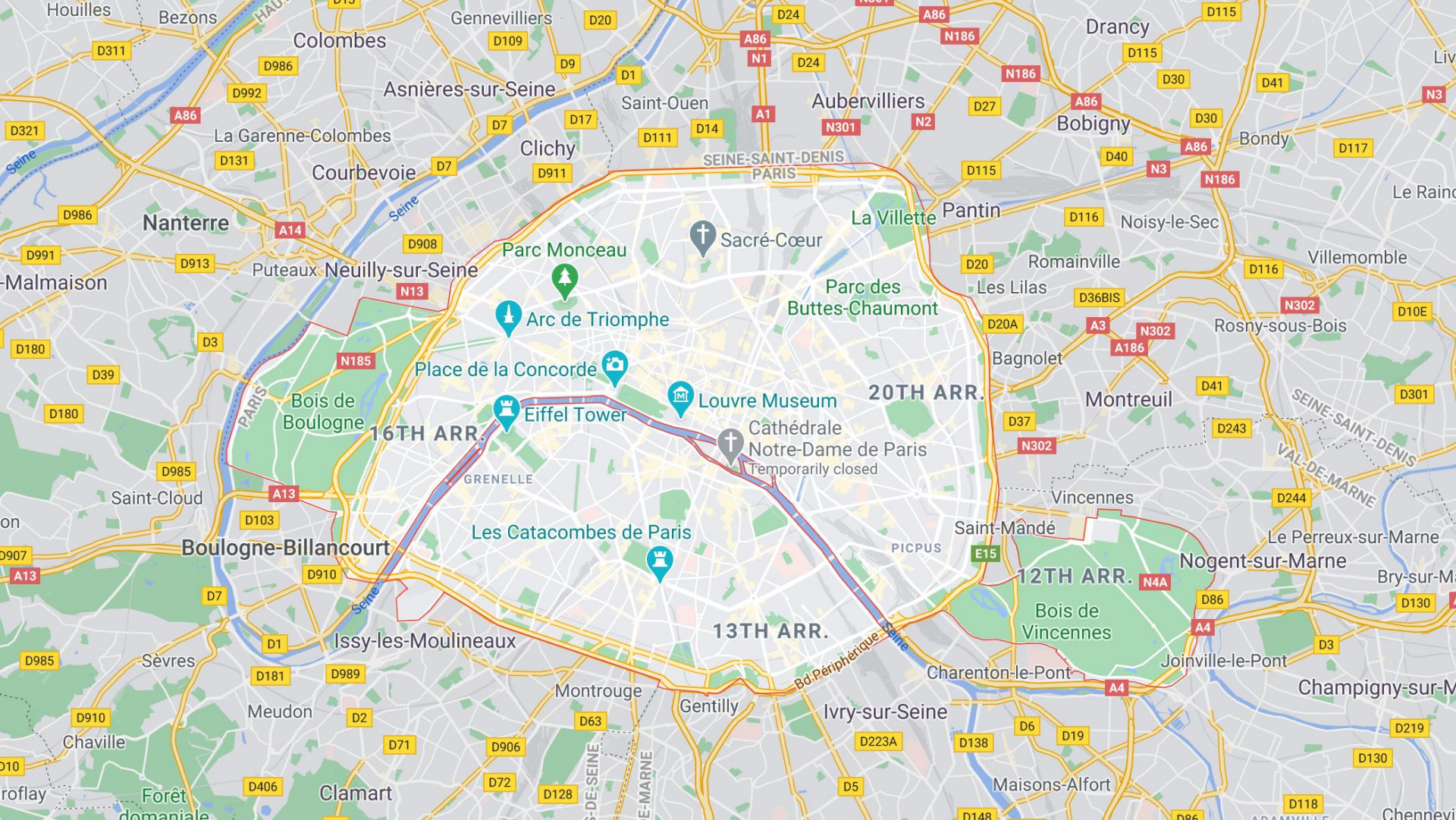
design
decisions

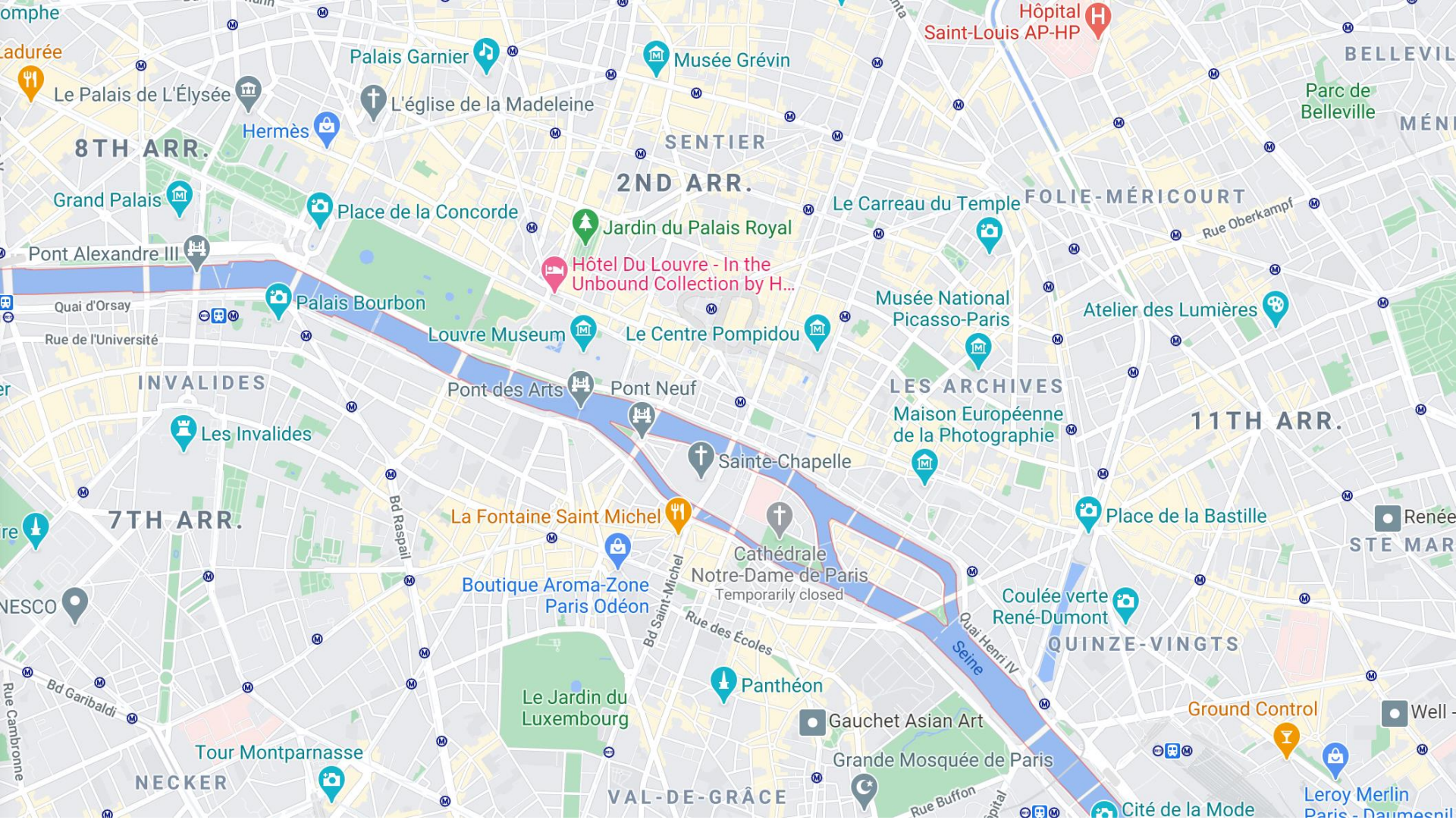


The background of the slide is a grayscale photograph of a Parisian scene. The Eiffel Tower is the central focus, rising behind a bridge over a river. In the foreground, there are boats on the water and buildings along the riverbank. The overall tone is muted and artistic.

Architecture represents the
significant design decisions
that shape a system, where
significant is measured by
cost of change.

Grady Booch





omphie
adurée
Le Palais de L'Élysée
Hermès
Grand Palais
Pont Alexandre III
Quai d'Orsay
Rue de l'Université
INVALIDES
Les Invalides
7TH ARR.
NESCO
Rue Cambronne
Bd Garibaldi
Tour Montparnasse
NECKER
Palais Garnier
L'église de la Madeleine
Jardin du Palais Royal
Hôtel Du Louvre - In the
Unbound Collection by H...
Louvre Museum
Le Centre Pompidou
Pont des Arts
Pont Neuf
Sainte-Chapelle
Cathédrale
Notre-Dame de Paris
Temporarily closed
Rue des Écoles
Panthéon
Gauchet Asian Art
Grande Mosquée de Paris
Rue Buffon
VAL-DE-GRÂCE
Musée Grévin
Le Carreau du Temple
FOLIE-MÉRICOURT
Musée National
Picasso-Paris
Atelier des Lumières
LES ARCHIVES
Maison Européenne
de la Photographie
11TH ARR.
Place de la Bastille
Coulée verte
René-Dumont
QUINZE-VINGTS
Ground Control
Well -
Leroy Merlin
Paris - Daumesnil
Saint-Louis AP-HP
Hôpital
Parc de
Belleville
MÉNI
Rue Oberkampf



**single-threaded
processes
multithreading
processes
actors
coroutines
event-driven
interrupt-driven**

cloneable

Idoneable

clonable



Wiktionary
The free dictionary

Main Page
Community portal
Preferences
Requested entries
Recent changes
Random entry
Help
Glossary
Donations
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Tools

What links here
Related changes
Upload file
Special pages
Permanent link
Page information
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Not logged in [Talk](#) [Contributions](#) [Preferences](#) [Create account](#) [Log in](#)

Entry

Discussion

Citations

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History

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clonable

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1.1 [Alternative forms](#)

1.2 [Etymology](#)

1.3 [Adjective](#)

English

Alternative forms [\[edit\]](#)

- *(especially in computing contexts)* [cloneable](#)

Etymology [\[edit\]](#)

clone + *-able*

Adjective [\[edit\]](#)

clonable (*comparative* **more clonable**, *superlative* **most clonable**)

1. Able to be [cloned](#).

<windows.b>

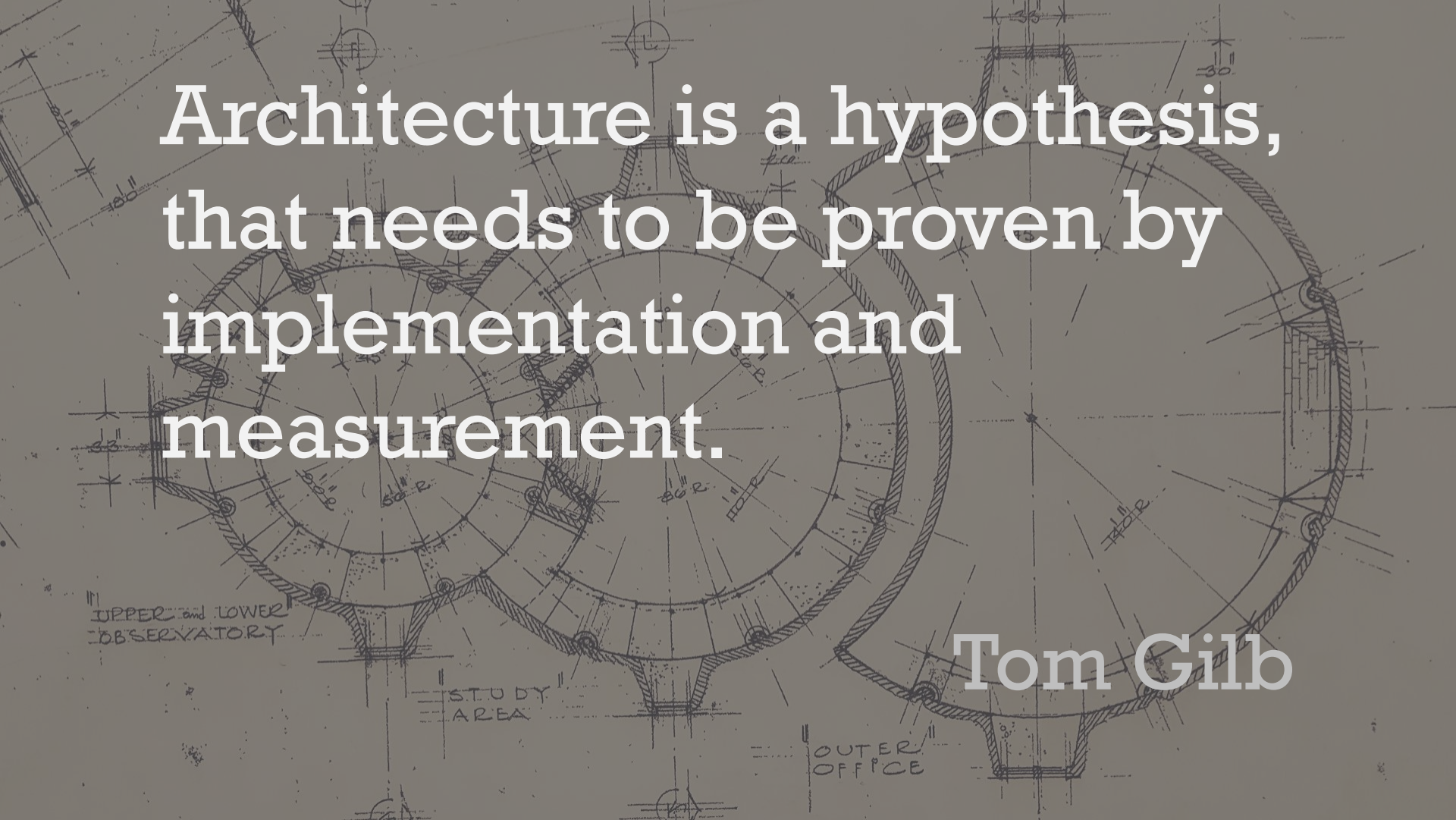
10-bit

32-bit

04-bit

LLP04

LP04



Architecture is a hypothesis,
that needs to be proven by
implementation and
measurement.

The background is a detailed architectural drawing of a circular building plan. It features concentric circles and radial lines, creating a grid-like structure. Various dimensions are noted throughout the drawing, such as 100", 80", 60", 40", 30", and 20". The drawing is divided into several distinct zones, each labeled with text. The outermost zone is labeled "OUTER OFFICE". The next zone inward is labeled "STUDY AREA". The innermost zone is labeled "UPPER and LOWER OBSERVATORY". The drawing is a technical sketch, likely a pencil or light ink on paper, showing the layout of a circular building or structure.

Tom Gilb

ROBERT MCKEE
story

Substance, structure, style,
and the principles of screenwriting



ROBERT McKEE

story

substance, structure, style,
and the principles of screenwriting

If a plot works out exactly as
you first planned, you're not
working loosely enough to
give room to your imagination
and instincts.



Oxford
Dictionary of
English

A Romp through
Some of the Most Used
Words in the English Language
— Barbara Wallraf
Senior Editor
The Atlantic Monthly Press
The Wordsworth
Book of Intriguing
Words
The insomniac's dictionary
of the outrageous, odd and unusual
Paul Hellweg

REFERENCE
CONCISE OXFORD DICTIONARY OF
English Etymology
T. F. HOAD
word origins

BILL
BRYSON
TROUBLESOME
WORDS
'Combines
the virtues of a
first-class work
of reference
with the
pleasure of
a good read'
The Times
FULLY REVISED
AND UPDATED

Joie de vivre n.
Joy of living; exuberance. 19C.
Joy of living, from joie joy + de of +
COMPILED BY ADRI
A COMPREHENSIVE
WORD-FINDING
DICTIONARY
Chambers

COLLINS
REFERENCE DICTIONARY
MATHEMATICS
E. J. BOROWSKI AND J. M. BORWEIN
on hot bricks 75
WORDS
BOTHER ME
JEFFREY KACIRK
AUTHOR OF Forgotten English

LOCK
Stock

Samuel
Johnson's

f / WordFriday

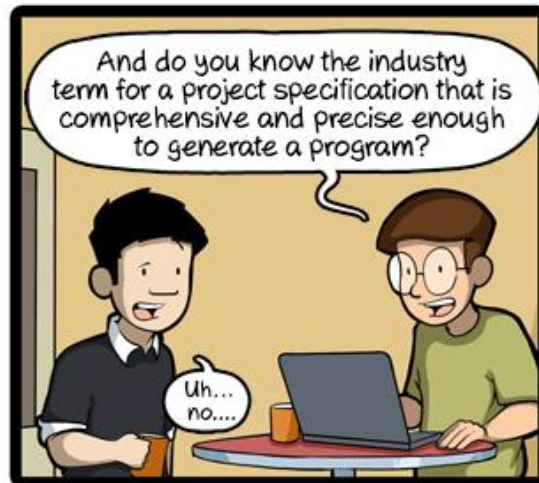


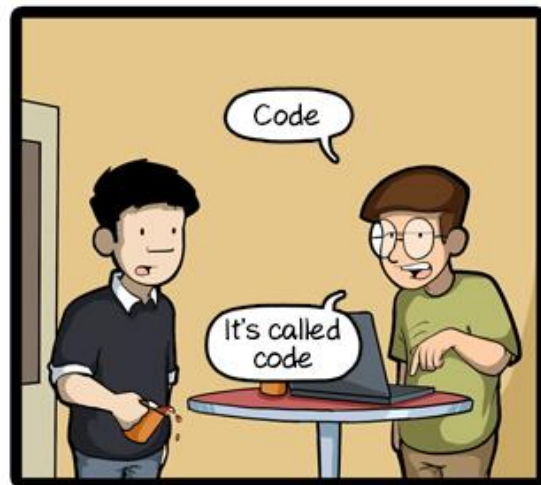
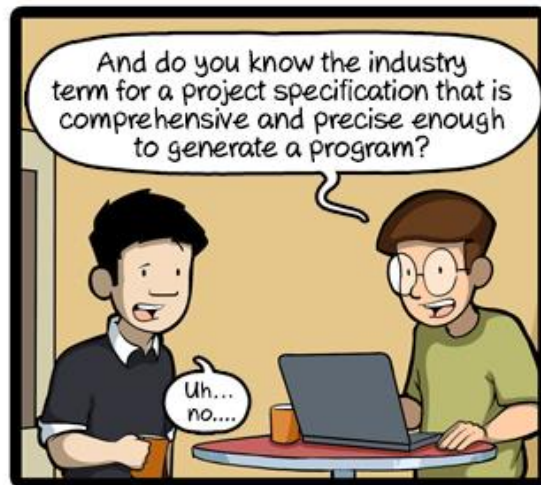
pantser, *noun*

- Writer who writes by the seat of their pants.
- In contrast to a plotter, a pantser doesn't work to (or have) an outline.









Programming is
a design activity.

Jack W Reeves
What Is Software Design?

... premature optimization is
the root of all evil (or at least
most of it) in programming.

Donald Knuth

... premature optimization is
the root of all evil (or at least
most of it) in programming.

Donald Knuth

... premature optimization is
the root of all evil (or at least
most of it) in programming.

Donald Knuth

sort

```
def is_sorted(seq):  
    pairs = zip(seq, islice(seq, 1, None))  
    return all(i <= j for i, j in pairs)
```

```
sort = sorted  
assert is_sorted(sort([3, 1, 4, 1, 5, 9]))
```

$$O(n \log n)$$

$$O(n^2)$$

```
def is_sorted(seq):  
    pairs = zip(seq, islice(seq, 1, None))  
    return all(i <= j for i, j in pairs)
```

```
sort = permutation_sort  
assert is_sorted(sort([3, 1, 4, 1, 5, 9]))
```



```
def is_sorted(seq):  
    pairs = zip(seq, islice(seq, 1, None))  
    return all(i <= j for i, j in pairs)  
  
def permutation_sort(seq):  
    return next(  
        each for each in permutations(seq)  
        if is_sorted(each))  
  
sort = permutation_sort  
assert is_sorted(sort([3, 1, 4, 1, 5, 9]))
```

$$O(n!)$$

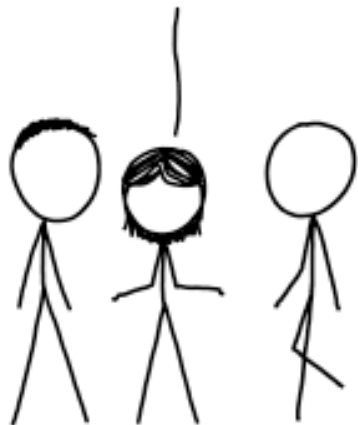
```
def is_sorted(seq):  
    pairs = zip(seq, islice(seq, 1, None))  
    return all(i <= j for i, j in pairs)  
  
def bogosort(seq):  
    while not is_sorted(seq):  
        seq = random.sample(seq, len(seq))  
    return seq  
  
sort = bogosort  
assert is_sorted(sort([3, 1, 4, 1, 5, 9]))
```

OMG!

```
$ cat > sleepsort
while [ -n "$1" ]
do
    (sleep $1; echo $1) &
    shift
done
wait
$ chmod +x sleepsort
$ ./sleepsort 3 1 4 1 5 9
1
1
3
4
5
9
```


$$O(n)$$

OUR FIELD HAS BEEN
STRUGGLING WITH THIS
PROBLEM FOR YEARS.



STRUGGLE NO MORE!
I'M HERE TO SOLVE
IT WITH *ALGORITHMS!*



SIX MONTHS LATER:

WOW, THIS PROBLEM
IS REALLY HARD.

YOU DON'T SAY.



How one developer just broke Node, Babel and thousands of projects in 11 lines of JavaScript

Code pulled from NPM – which everyone was using



Careful, careful ... Don't fumble this like the JS world (Credit: Claus Rebler)

23 Mar 2016 at 01:24, Chris Williams



1322

Updated Programmers were left staring at broken builds and failed installations on Tuesday after someone toppled the Jenga tower of JavaScript.

A couple of hours ago, Azer Koçulu unpublished more than 250 of his modules from [NPM](#), which is a popular package manager used by JavaScript projects to install dependencies.

Code written by some stranger on the internet is always perfect



Taking on Needless Dependencies

Fragile Development Guide

O RLY?

@ThePracticalDev

```
function leftpad (str, len, ch) {  
  str = String(str);  
  
  var i = -1;  
  
  if (!ch && ch !== 0) ch = ' '  
  
  len = len - str.length;  
  
  while (++i < len) {  
    str = ch + str;  
  }  
  
  return str;  
}
```



```
var cache = [
    '',
    '\n',
    '\n\n',
    '\n\n\n',
    '\n\n\n\n',
    '\n\n\n\n\n',
    '\n\n\n\n\n\n',
    '\n\n\n\n\n\n\n',
    '\n\n\n\n\n\n\n\n',
    '\n\n\n\n\n\n\n\n\n',
    '\n\n\n\n\n\n\n\n\n\n',
    '\n\n\n\n\n\n\n\n\n\n\n'
];

function leftPad(str, len, ch) {
    // convert `str` to `string`
    str = str + '';
    // `len` is the `pad`s length now
    len = len - str.length;
    // doesn't need to pad
    if (len <= 0) return str;
    // `ch` defaults to ` ` 
    if (!ch && ch !== 0) ch = ' ';
    // convert `ch` to `string`
    ch = ch + '';
    // cache common use cases
    if (ch === ' ' && len < 10) return cache[len] + str;
    // `pad` starts with an empty string
    var pad = '';
    // loop
    while (true) {
        // add `ch` to `pad` if `len` is odd
        if (len & 1) pad += ch;
        // divide `len` by 2, ditch the remainder
        len >>= 1;
        // "double" the `ch` so this operation count grows logarithmically on `len`
        // each time `ch` is "doubled", the `len` would need to be "doubled" too
        // similar to finding a value in binary search tree, hence O(log(n))
        if ((len) ch += ch;
        // `len` is 0, exit the loop
        else break;
    }
    // pad `str`!
    return pad + str;
}
```

```
function leftpad(content, length, pad) {  
  content = String(content)  
  pad = String(pad || pad === 0 ? pad : ' ')[0]  
  var left = Math.max(length - content.length, 0)  
  return pad.repeat(left) + content  
}
```

```
truths = {
    "Padding an empty string to a length of 0 results in an empty string":
        leftpad("", 0, "X") === "",
    "Padding a non-empty string to a shorter length results in the same string":
        leftpad("foobar", 3, "X") === "foobar",
    "Padding a non-empty string to a negative length results in the same string":
        leftpad("foobar", -3, "X") === "foobar",
    "Padding a non-empty string to its length results in the same string":
        leftpad("foobar", 6, "X") === "foobar",
    "Padding to a longer length with a single character fills to the left":
        leftpad("foobar", 8, "X") === "XXfoobar",
    "Padding to a longer length with surplus characters fills using only first":
        leftpad("foobar", 10, "XY") === "XXXXfoobar",
    "Padding to a longer length with an empty string fills with space":
        leftpad("foobar", 8, "") === "  foobar",
    "Padding to a longer length with no specified fill fills with space":
        leftpad("foobar", 9) === "   foobar",
    "Padding to a longer length with integer 0 fills with 0":
        leftpad("foobar", 7, 0) === "0foobar",
    "Padding to a longer length with single-digit integer fills with digit":
        leftpad("foobar", 10, 1) === "1111foobar",
    "Padding to a longer length with multiple-digit integer fills with first digit":
        leftpad("foobar", 10, 42) === "4444foobar",
    "Padding to a longer length with negative integer fills with -":
        leftpad("foobar", 8, -42) === "--foobar",
    "Padding a non-string uses string representation":
        leftpad(4.2, 5, 0) === "004.2",
}
```

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truths = {
    "Padding an empty string to a length of 0 results in an empty string":
        leftpad("", 0, "X") === "",
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        leftpad("foobar", 8, -42) === "--foobar",
    "Padding a non-string uses string representation":
        leftpad(4.2, 5, 0) === "004.2",
}
```



```
toMap = object => new Map(Object.entries(object))

format = (proposition, ok) =>
  proposition.fontcolor(ok ? "green" : "red") + "<br>"

present = truths =>
  toMap(truths).forEach(
    (ok, proposition) => write(format(proposition, ok)))

present(truths)
```

Padding an empty string to a length of 0 results in an empty string

Padding a non-empty string to a shorter length results in the same string

Padding a non-empty string to a negative length results in the same string

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Padding to a longer length with multiple-digit integer fills with first digit

Padding to a longer length with negative integer fills with -

Padding a non-string uses string representation

The connections between modules are the assumptions which the modules make about each other.

David Parnas

Market

Customers, product requirements, domain, governance, etc.



Platform

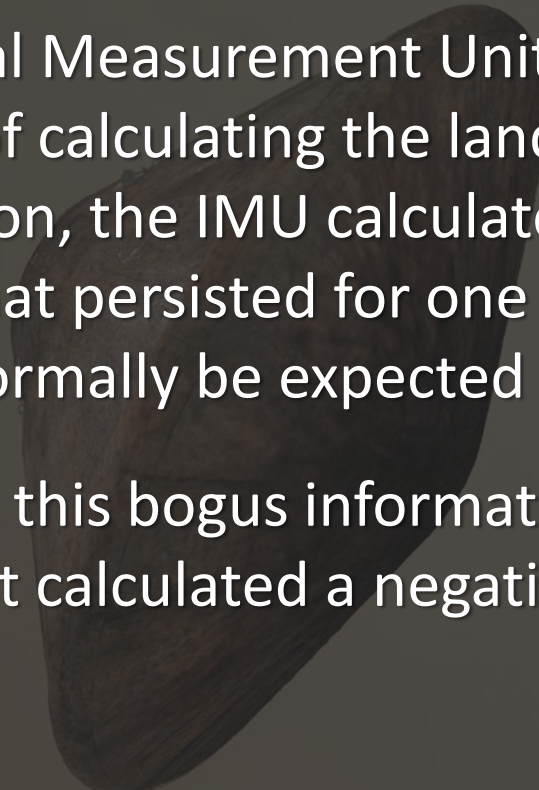
Programming languages, operating systems, middleware, services, etc.

Simple Testing Can Prevent Most Critical Failures

*An Analysis of Production Failures in
Distributed Data-Intensive Systems*

<https://www.usenix.org/system/files/conference/osdi14/osdi14-paper-yuan.pdf>



A dark, triangular lander, likely the Mars Science Laboratory Curiosity rover, is positioned in the center of the frame. It is oriented with its base towards the bottom and its nose towards the top. The lander has a complex, angular shape with various protrusions and recesses. The background is a solid, dark grey color.

Schiaparelli's Inertial Measurement Unit (IMU) went about its business of calculating the lander's rotation rate. For some reason, the IMU calculated a saturation-maximum period that persisted for one second longer than what would normally be expected at this stage.

When the IMU sent this bogus information to the craft's navigation system, it calculated a negative altitude.

<http://gizmodo.com/a-crazy-miscalculation-doomed-the-schiaparelli-lander-1789319670>



DOCUMENT

EXOMARS 2016 - Schiaparelli Anomaly Inquiry



Because of the error in the estimated attitude that occurred at parachute inflation, the GNC Software projected the RDA range measurements with an erroneous off-vertical angle and deduced a negative altitude (cosinus of angles > 90 degrees are negative).

EXOMARS 2016 - Schiaparelli Anomaly Inquiry

cos(off_vertical)

$$\cos(off_vertical) \geq 0$$

Assumption:

$$\cos(off_vertical) \geq 0$$

Assumption:

$$\textit{off_vertical} \leq \frac{1}{2}\pi$$

Therefore:

$$\cos(\textit{off_vertical}) \geq 0$$



Kevlin Henney

@KevlinHenney

Epistemologically speaking, assumptions are the barefoot-trodden Lego bricks in the dark of knowledge. You don't know they're there until you know that they're there. And even if you know there are some there, you don't know exactly where and you'll still end up stepping on some.

♡ 26 2:29 PM - Apr 22, 2020

<https://twitter.com/KevlinHenney/status/1252952622128128000>

Precondition:

$$\textit{off_vertical} \leq \frac{1}{2}\pi$$

Postcondition:

$$\cos(\textit{off_vertical}) \geq 0$$

Given:

$$\textit{off_vertical} \leq \frac{1}{2}\pi$$

Then:

$$\cos(\textit{off_vertical}) \geq 0$$

If:

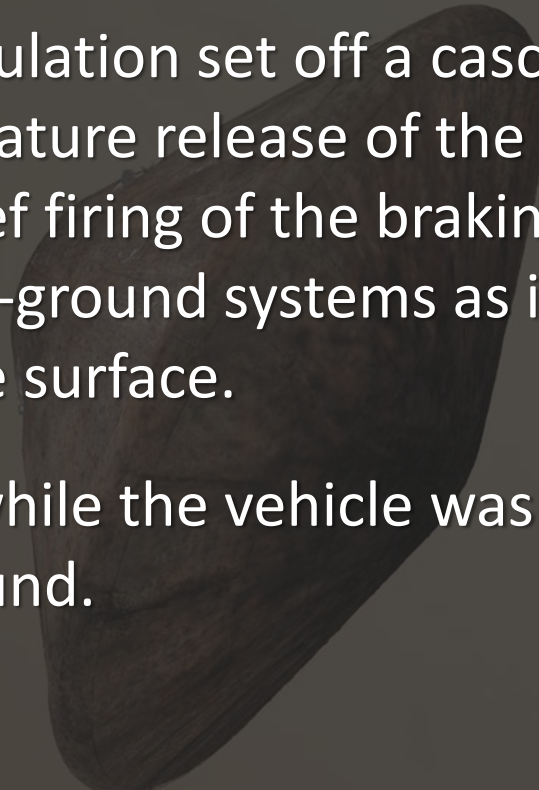
$$\textit{off_vertical} \leq \frac{1}{2}\pi$$

Then:

$$\cos(\textit{off_vertical}) \geq 0$$

Else:

?



That fateful miscalculation set off a cascade of despair, triggering the premature release of the parachute and the backshell, a brief firing of the braking thrusters, and activation of the on-ground systems as if Schiaparelli had already reached the surface.

This all happened while the vehicle was still two miles (3.7 km) above ground.

<http://gizmodo.com/a-crazy-miscalculation-doomed-the-schiaparelli-lander-1789319670>

Almost all catastrophic failures
are the result of incorrect
handling of non-fatal errors
explicitly signalled in software.

A majority of the production failures (77%) can be reproduced by a unit test.



知るべき
97 Things Every Prog

Kevlin Henney 編
李军译 吕骏审校
電子工業出版社
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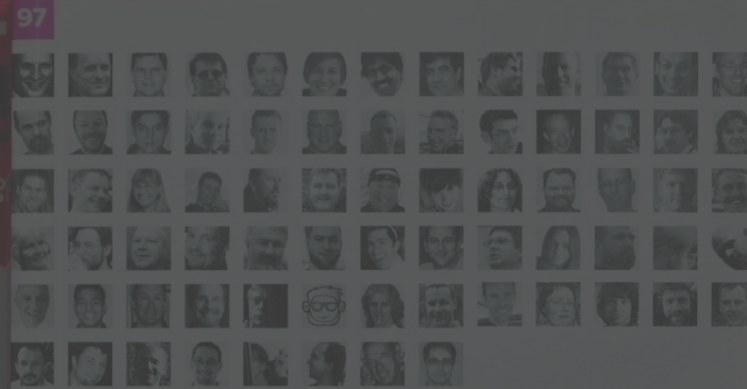
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JOB

MMICT



Testing Is the Engineering Rigor of Software Development



Collective Wisdom
from the Experts

97 Things Every
Programmer
Should Know

Neal Ford

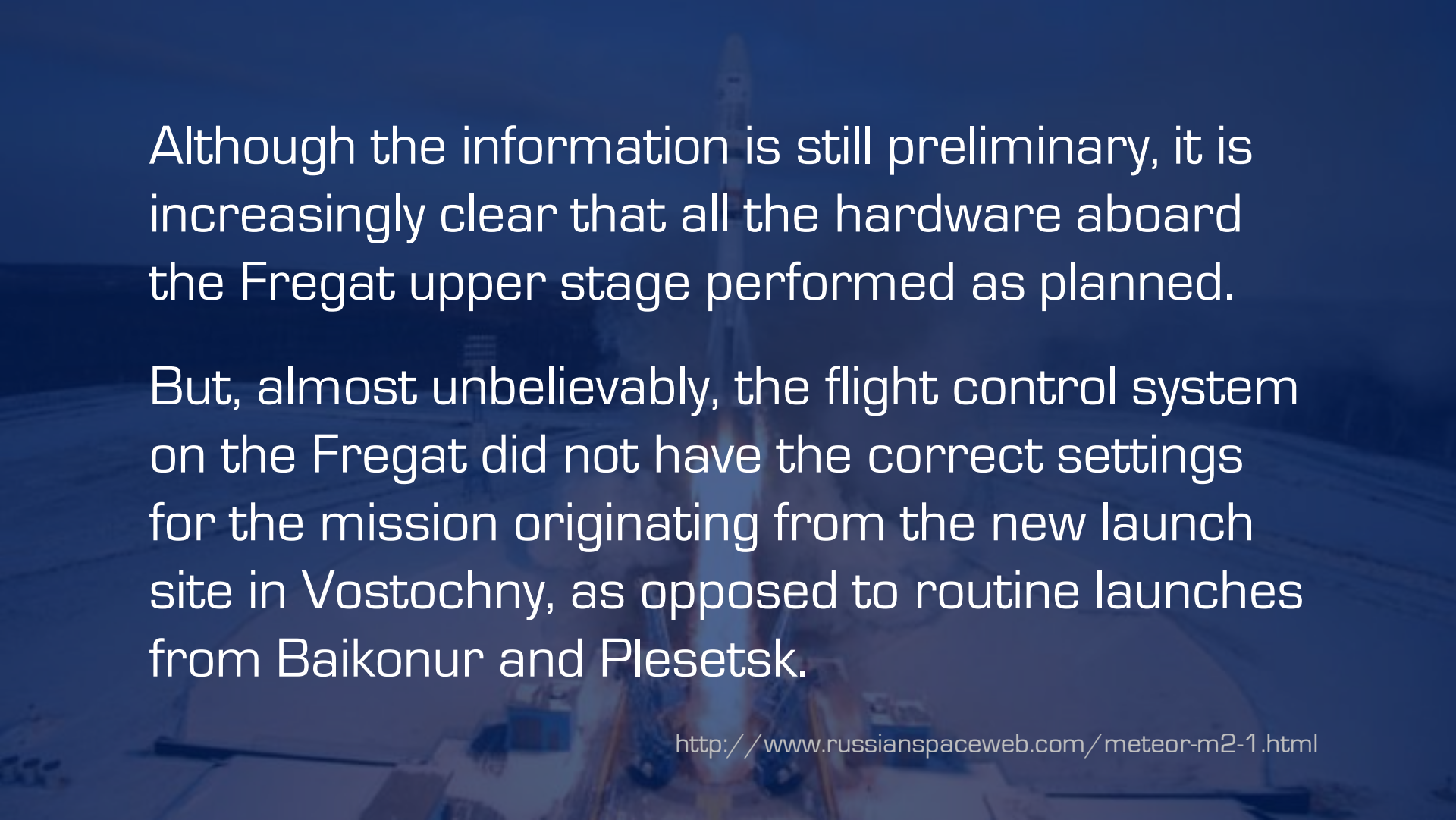
O'REILLY®

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Soyuz fails to deliver 19 satellites from Vostochny

<http://www.russianspaceweb.com/meteor-m2-1.html>



Although the information is still preliminary, it is increasingly clear that all the hardware aboard the Fregat upper stage performed as planned.

But, almost unbelievably, the flight control system on the Fregat did not have the correct settings for the mission originating from the new launch site in Vostochny, as opposed to routine launches from Baikonur and Plesetsk.

<http://www.russianspaceweb.com/meteor-m2-1.html>

configuration

code

Early Detection of Configuration Errors to Reduce Failure Damage

<https://www.usenix.org/system/files/conference/osdi16/osdi16-xu.pdf>

Our study shows that many of today's mature, widely used software systems are subject to latent configuration errors in their critically important configurations.

Normally screws are so cheap and small and simple you think of them as unimportant. But now, as your Quality awareness becomes stronger, you realize that this one, individual, particular screw is neither cheap nor small nor unimportant.

Robert M Pirsig

Zen and the Art of Motorcycle Maintenance

Right now this screw is worth exactly the selling price of the whole motorcycle, because the motorcycle is actually valueless until you get the screw out.

With this reevaluation of the screw comes a willingness to expand your knowledge of it.

Robert M Pirsig

Zen and the Art of Motorcycle Maintenance



Software Is Details