

Making It Count
Quality is Not an Option

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1986…


DAVE WELCHER/HULTON/GETTY IMAGES

Los Angeles Times

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Shuttle Explodes; All 7 Die

Teacher on Board as Challenger Blows Up on Liftoff



Reagan Postpones Future Flights Pending a Probe

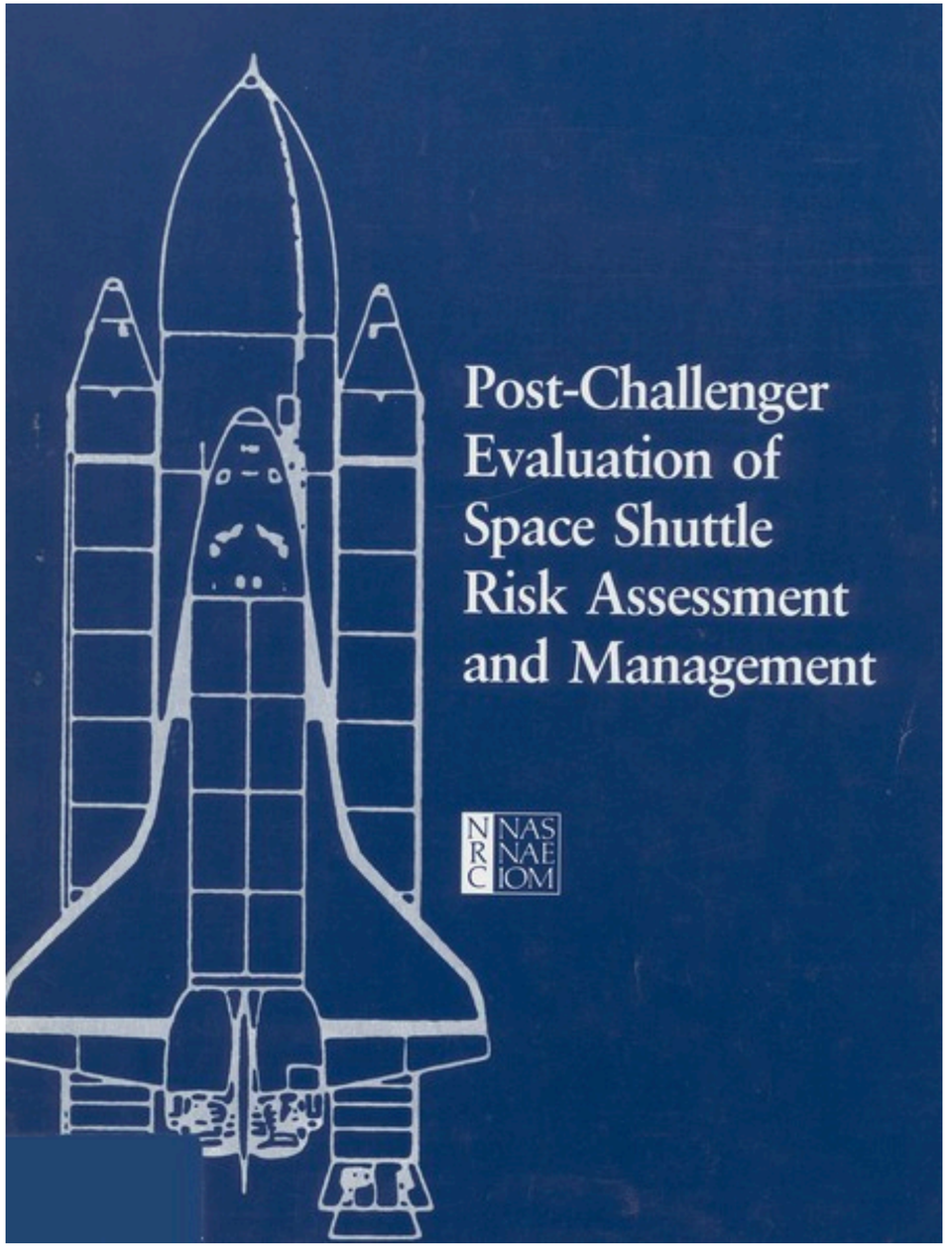
By MICHAEL SEILER and PETER H. KING,
Times Staff Writers

KENNEDY SPACE CENTER, Fla.—The space shuttl Challenger exploded in a huge fireball less than two minute after takeoff today, with all seven crew members—includin New Hampshire teacher Sharon Christa McAuliffe—feare dead.

Airborne paramedics parachuted quickly into the calm waters off Cape Canaveral in a vain search for survivor Though there was no immediate announcement on the fate o the crew, all were believed dead.

The disaster—the worst in the history of America's manned space program—came shortly after the Challenger blasted off on a cold Florida morning on the 25th shuttle

As the contrails formed to th east of Cape Canaveral, a parachut appeared in the clear blue sk giving spectators a small glimm



https://www.nap.edu/catalog/10616/post-challenger-evaluation-of-space-shuttle-risk-assessment-and-management


West Virginia University
NASA IV&V Facility
NASA

IV&V

Independent Verification & Validation



Safety is an emergent property of systems, not a component property.

— Nancy Leveson —

AZ QUOTES

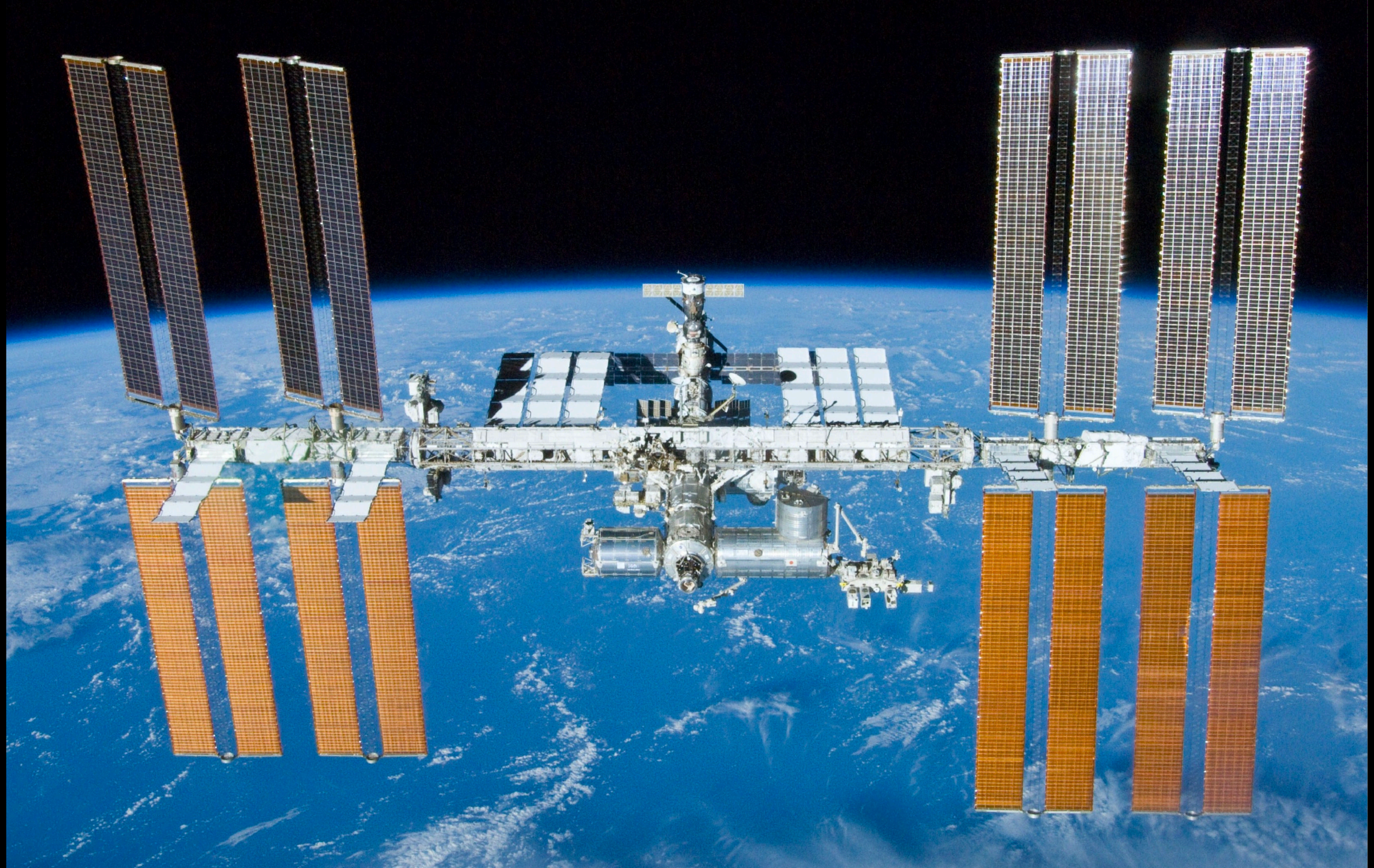
Software Safety

+

Mission Safety


United States
Atlantis

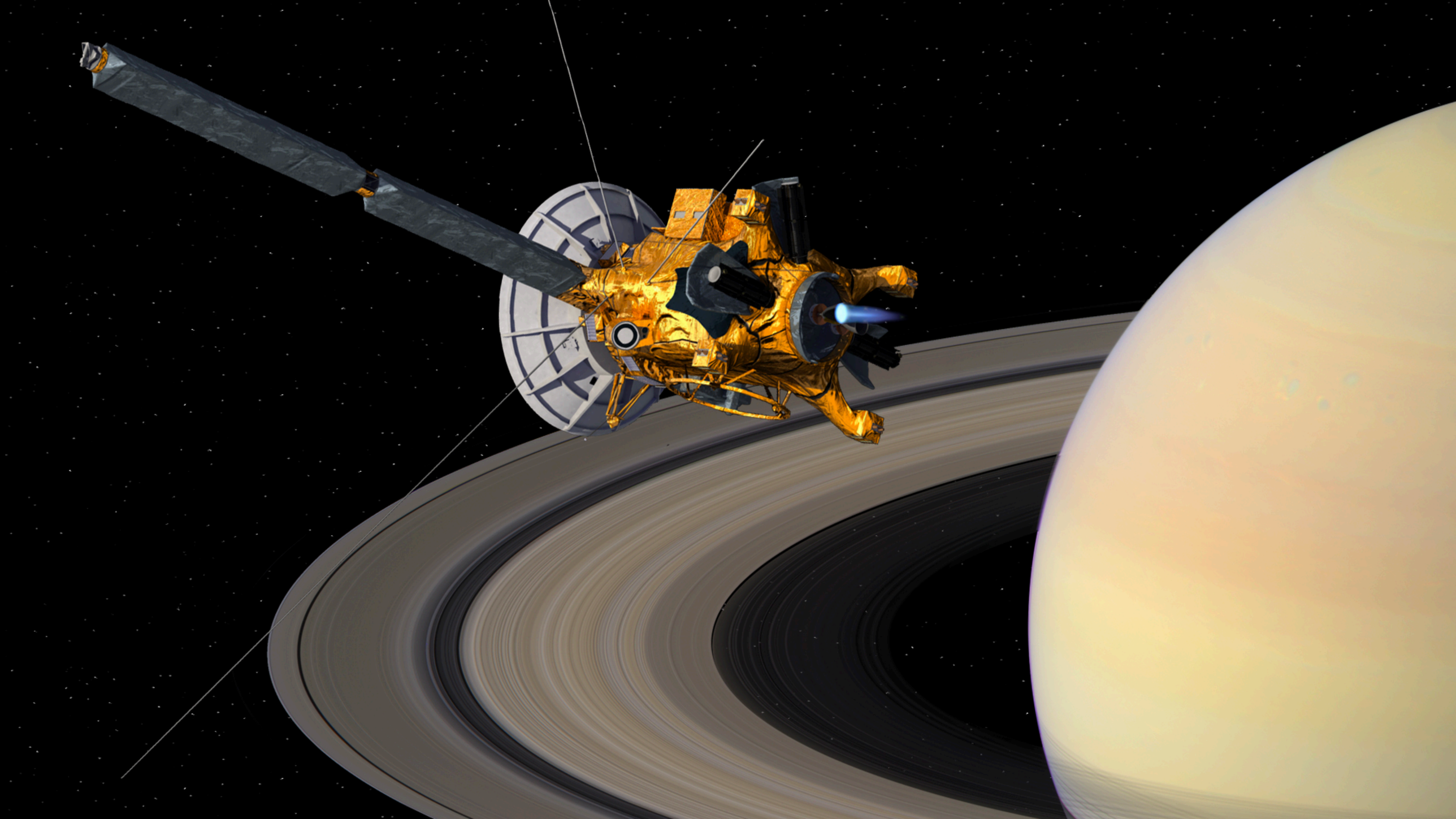

Ben Cooper / LaunchPhotography.com

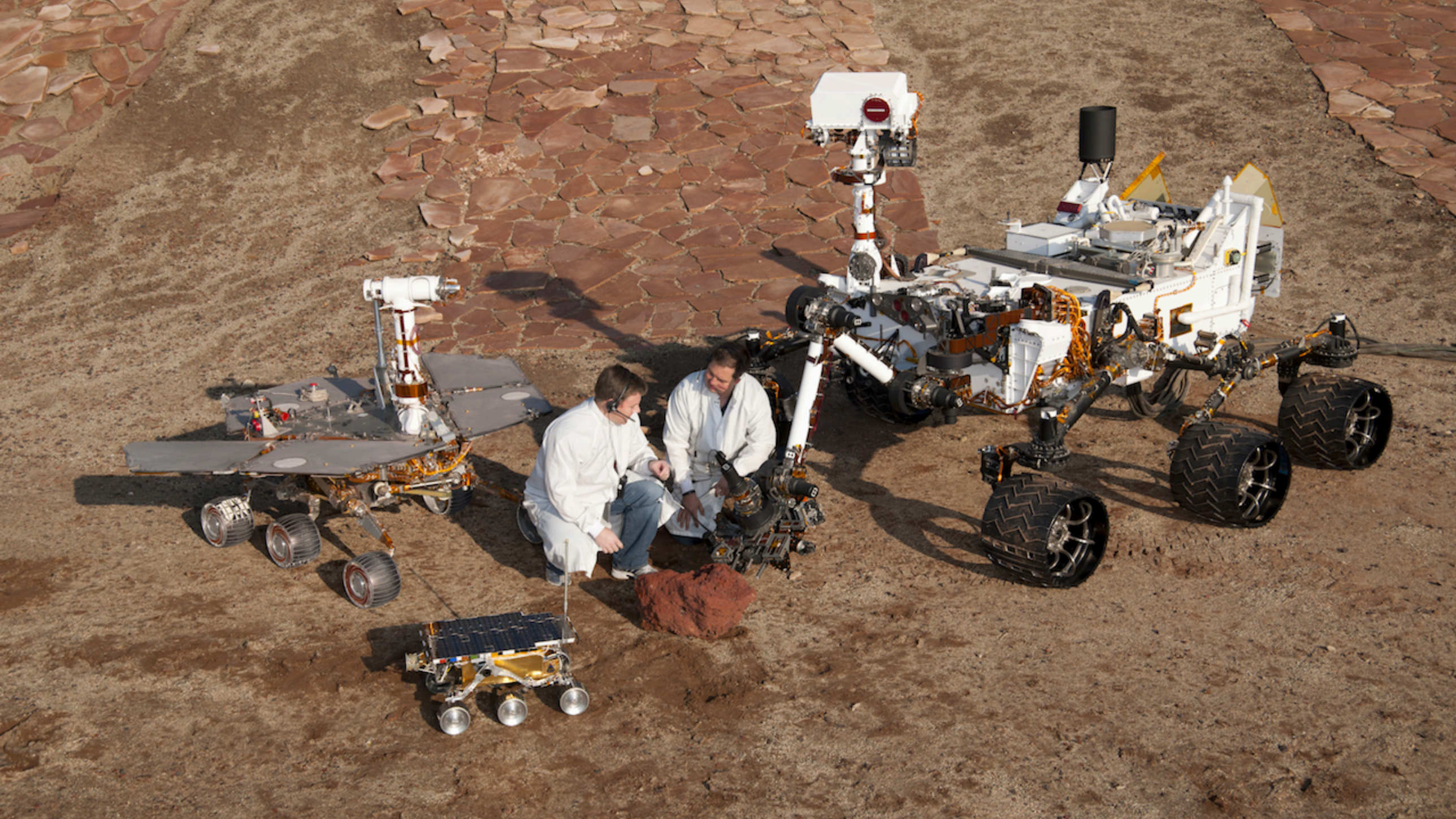


Typically…

Small Teams - 1-2 or 5-6
Small Budgets - if any

Not just when people could die…






0.43
0.38
6.16
1.55
6.79
0.41
5.66
2.99
2673
11457
60658
20200
57918
18775
10383
63487
28635
10580
12734
38918
22.67
2.18
20.15
3.92
2.77
10.97
21.72
12.59
6.98
12.89
15.76
2.63
7.87
16.84
13.03
12.24
15.97
+0.52%
+0.18%
+0.94%

More relevant every day

Tax Day 2018

The IRS' website has recovered from the glitch that took parts of its e-file system down for most of Tuesday. But it's only extending the 2018 tax filing deadline by one extra day — until midnight on Wednesday, April 18.

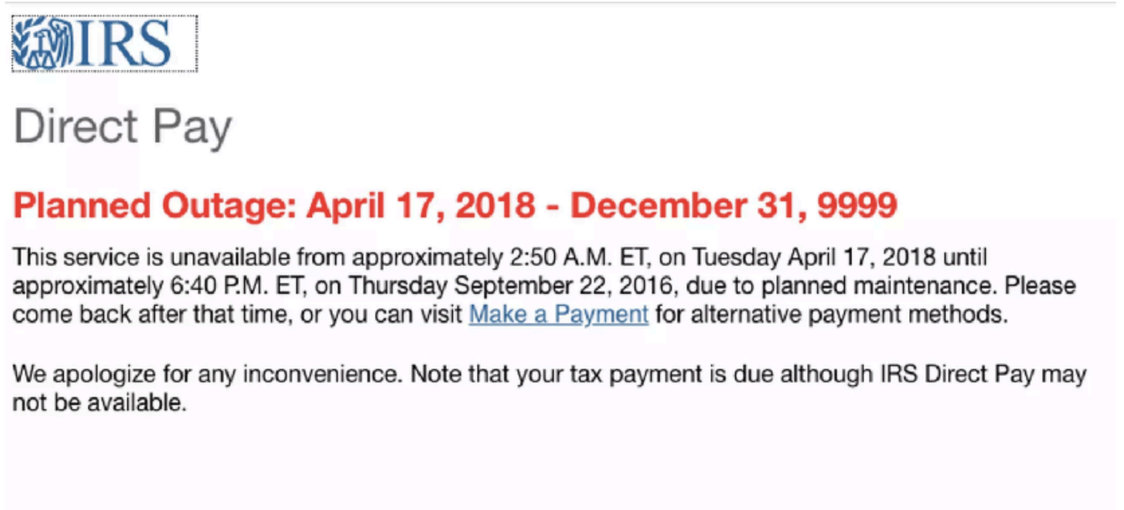
Parts of the tax payment and refund system went down early Tuesday morning because of a glitch on the IRS' servers. They remained down for most of the day — coming back up only barely before the original deadline of midnight Tuesday.

When the glitch was resolved Tuesday evening, the IRS put out a statement that "Individuals and businesses with a filing or payment due date of April 17 will now have until midnight on Wednesday, April 18. Taxpayers do not need to do anything to receive this extra time."

Treasury Secretary Steve Mnuchin told the **Associated Press** on Tuesday that once the system was back up, "We'll make sure taxpayers have extensions once the system comes up to make sure they can use it and it in no way impacts people paying their taxes." But the IRS' statement doesn't indicate whether that includes taxpayers affected by the glitch who don't, or can't, file by midnight Wednesday. If you can't file Wednesday, the safest bet might be to **file for an automatic six-month tax extension**, which will give you until October 15.

Taxpayers who have questions are encouraged to check out the help section of the IRS' website before calling the agency's customer-service phone number — especially because the glitch and its aftermath might be causing more people than usual to call. If you need to call the IRS' help number (800-829-1040 for individuals), make sure you have the **required information** ready so that you can be helped quickly once you reach the front of the queue.

The glitch was extra-confusing to would-be filers because the site's error message that the e-file system is down for a "planned outage." However, the error message also said that the site would be back up either in September 2016 or in December 9999 — meaning the error message indicating a "planned outage" was, itself, an error.



The IRS' error message on April 17, 2018, when the e-file system went down hours before the 2018 tax deadline. | Screenshot via IRS.gov

https://www.vox.com/2018/4/17/17247614/irs-glitch-2018-delays

S'pore's 1st bitcoin lawsuit: Judge asks if laws enough to deal with IT errors

By WONG PEI TING

Error by Knight Capital rips through stock market

Huge Intel CPU Bug Allegedly Causes Kernel Memory Vulnerability With Up To 30% Performance Hit In Windows And Linux

Software Quality

Most people don't expect software to work*

* - Seriously, ask people about this…

Large Projects

Software Project Success Rates

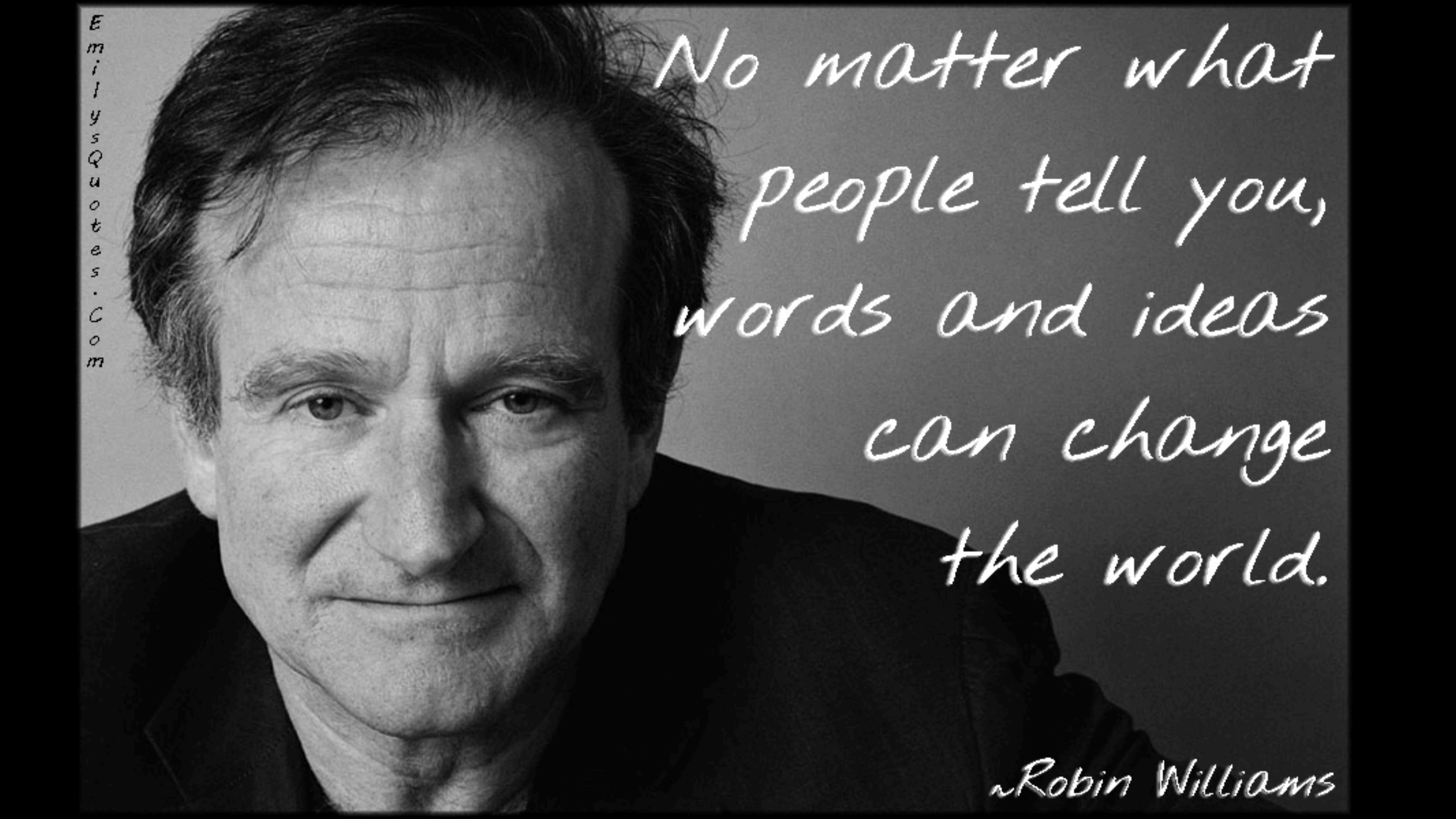
Successful: 32%
Challenged: 44%
Failure: 24%

- Standish Group Chaos Report 2010

EULAs

Software Quality

Systems meeting
Functional Requirements


EmilysQuotes.Com
No matter what people tell you, words and ideas can change the world.
~Robin Williams


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SENIOR CITIZENS
$15.95

“Non”-Functional Requirements?

Performance
Quality
Robustness
Safety
Stability
Usability

https://en.wikipedia.org/wiki/Non-functional_requirement

When not met
is the
system not “Non-Functional”?

Examples [edit]

A system may be required to present the user with a display of the number of records in a database. This is a functional requirement. How up-to-date [update] this number needs to be, is a non-functional requirement. If the number needs to be updated in real time, the system architects must ensure that the system is capable of updating the [displayed] record count within an acceptably short interval of the number of records changing.

Sufficient network bandwidth may be a non-functional requirement of a system. Other examples include:

- Accessibility
- Auditability and control
- Availability (see service level agreement)
- Backup
- Capacity, current and forecast
- Certification
- Compliance
- Configuration management
- Dependency on other parties
- Deployment
- Documentation
- Disaster recovery
- Efficiency (resource consumption for given load)
- Effectiveness (resulting performance in relation to effort)
- Emotional factors (like fun or absorbing or has "Wow! Factor")
- Environmental protection
- Escrow
- Exploitability
- Extensibility (adding features, and carry-forward of customizations at next major version upgrade)
- Failure management
- Fault tolerance (e.g. Operational System Monitoring, Measuring, and Management)
- Legal and licensing issues or patent-infringement-avoidability
- Interoperability
- Maintainability (e.g. Mean Time To Repair - MTTR)
- Management
- Modifiability
- Network topology
- Open source
- Operability
- Performance / response time (performance engineering)
- Platform compatibility
- Price
- Privacy (compliance to privacy laws)
- Portability
- Quality (e.g. faults discovered, faults delivered, fault removal efficacy)
- Readability
- Reliability (e.g. Mean Time Between/To Failures - MTBF/MTTF)
- Reporting
- Resilience
- Resource constraints (processor speed, memory, disk space, network bandwidth, etc.)
- Response time
- Reusability
- Robustness
- Safety or Factor of safety
- Scalability (horizontal, vertical)
- Security (cyber and physical)
- Software, tools, standards etc. Compatibility
- Stability
- Supportability
- Testability
- Throughput
- Transparency
- Usability (Human Factors) by target user community

https://en.wikipedia.org/wiki/Non-functional_requirement

“Non”-Functional Requirements
Are
Unspoken / Incomplete
Functional Requirements

Quality

At best,
is an afterthought!

Quality isn't an Issue

...

Until it (suddenly) is

s/Quality/Security… s/Quality/Scalability…

“What could possibly go wrong?”

“Oh… It went wrong… what to do?!”

“Throw testers at it!”
“Patch/Hot Fix!”
“Source Code Reviews”
“Bug Triage Meetings”


PLACEBO

What Quality ISN’T

Agile/Waterfall/Scrum/etc.
Language Choice
Framework/Library Choice
Formal Methods
Functional vs. Imperative/OOP
Reference Enterprise Architecture
Vendor Stack


SNAKE
OIL

...

“never” / “always”

Recruiting Process

Web Scale Architecture

Distributed Algorithm

AI / Big Data / IoT / Reactive / OSS / ...

...

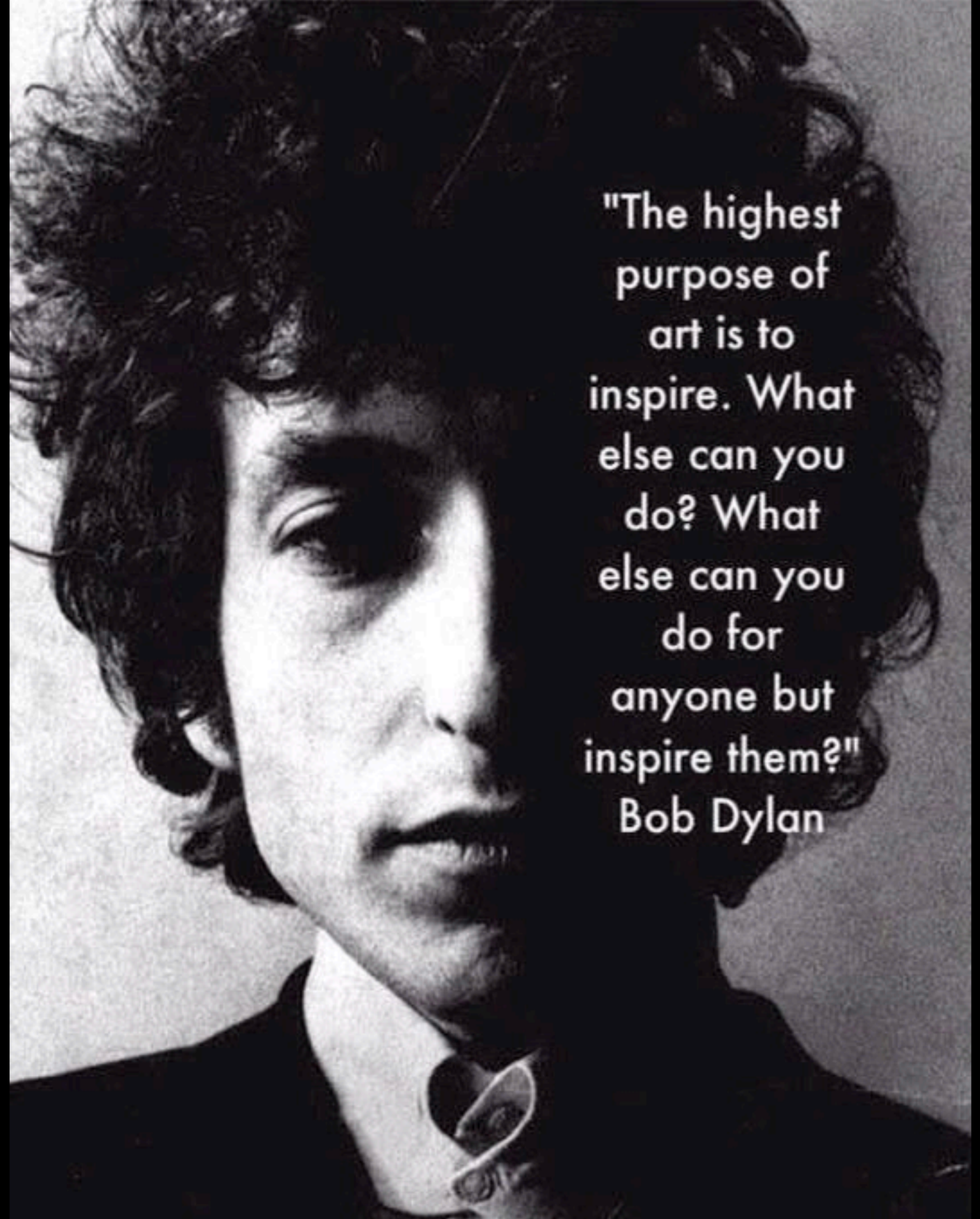
Source Code Reviews

Bug Triage Meetings

Code Coverage

Comprehensive Test Plan

Dogma is Anathema to Quality


"The highest purpose of art is to inspire. What else can you do? What else can you do for anyone but inspire them?"
Bob Dylan

Languages are Inspirational

Java, C/C++, C#, Python, Erlang, OCaml, Ada, etc.

Even JavaScript…

Technologies are Inspirational

Microservices, Reactive, SOA, CRDTs, Blockchain, etc.

Even ORM, DI, RPC, …

No Silver Bullet

Essence and Accidents of Software Engineering

Frederick P. Brooks, Jr.

University of North Carolina at Chapel Hill

Fashioning complex conceptual constructs is the *essence;* *accidental* tasks arise

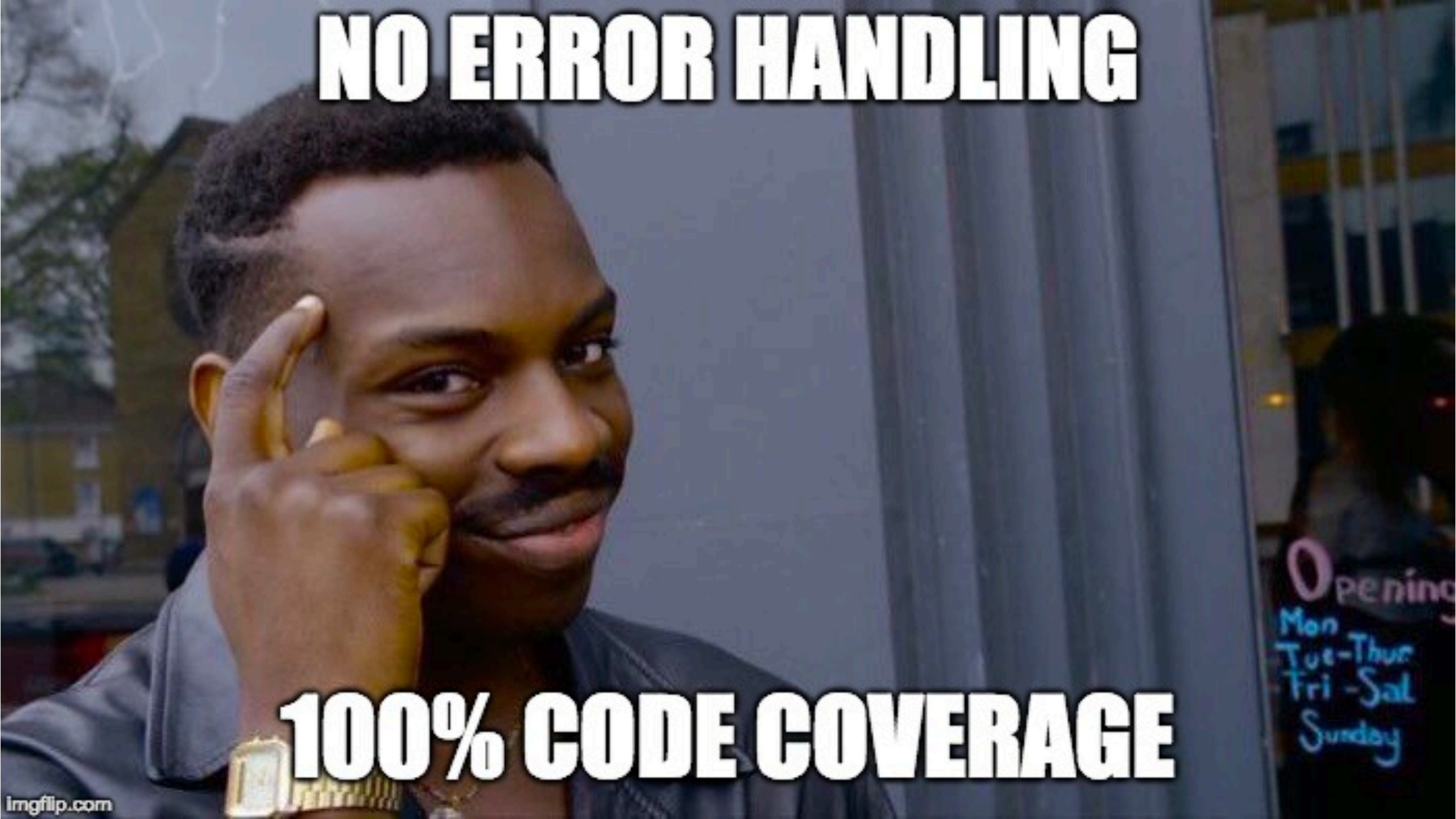
Of all the monsters that fill the nightmares of our folklore, none terrify more than werewolves, because they transform unexpectedly from the familiar into horrors. For these, one seeks bullets of silver that can magic-

throughs—and indeed, I believe such to be inconsistent with the nature of software—many encouraging innovations are under way. A disciplined, consistent effort to develop, propagate, and exploit these innovations should indeed yield an order-

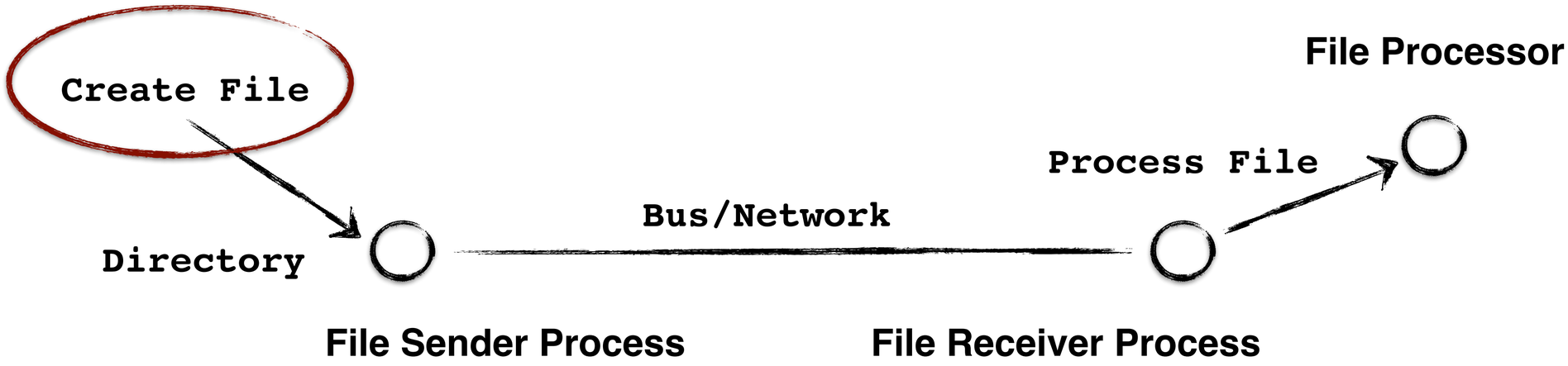
Case Studies

* - Even when you do everything else well…

100% code coverage


NO ERROR HANDLING
100% CODE COVERAGE
Opening
Mon
Tue-Thur
Fri -Sat
Sunday
imgflip.com

Error Handling (is hard)


Create File
Directory
Bus/Network
File Processor
Process File
File Sender Process
File Receiver Process

```
    // create empty file

    // check params

    // fill file

     return 0;

error:
    unlink(file);
    return -1;
```

That is C

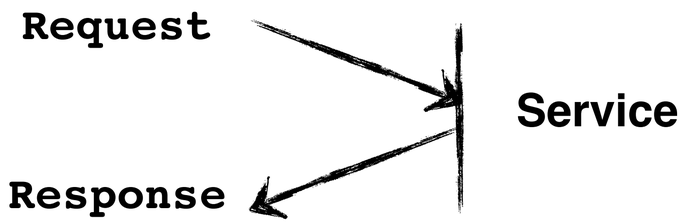
```
try
{
    // create empty file
    // check params
    // fill file
}
catch (final Exception ex)
{
    file.delete();
}
```

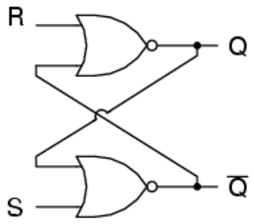
It was Java

Keeping up-to-date

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Version    |     Flags     |                                ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Version    |S|R|   Flags   |                                ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

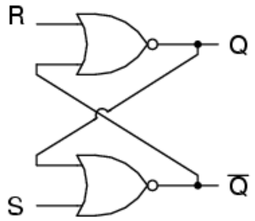




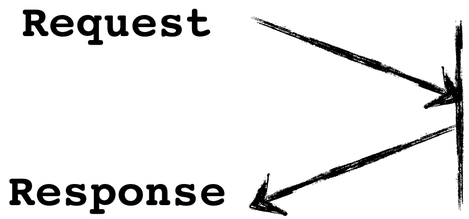
S	R	Q	$\overline{Q}$
0	0	latch	latch
0	1	0	1
1	0	1	0
1	1	0	0

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Version    |1|0|   Flags   |                                 ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

“Service must have Q=1 now!”



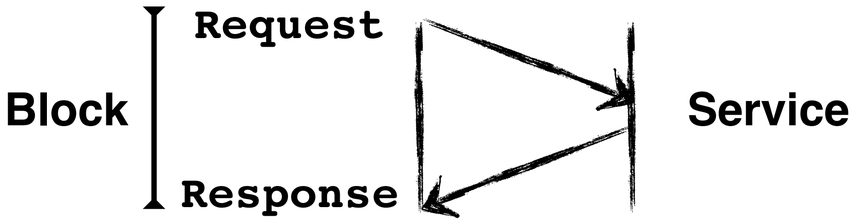
S	R	Q	$\overline{Q}$
0	0	latch	latch
0	1	0	1
1	0	1	0
1	1	0	0

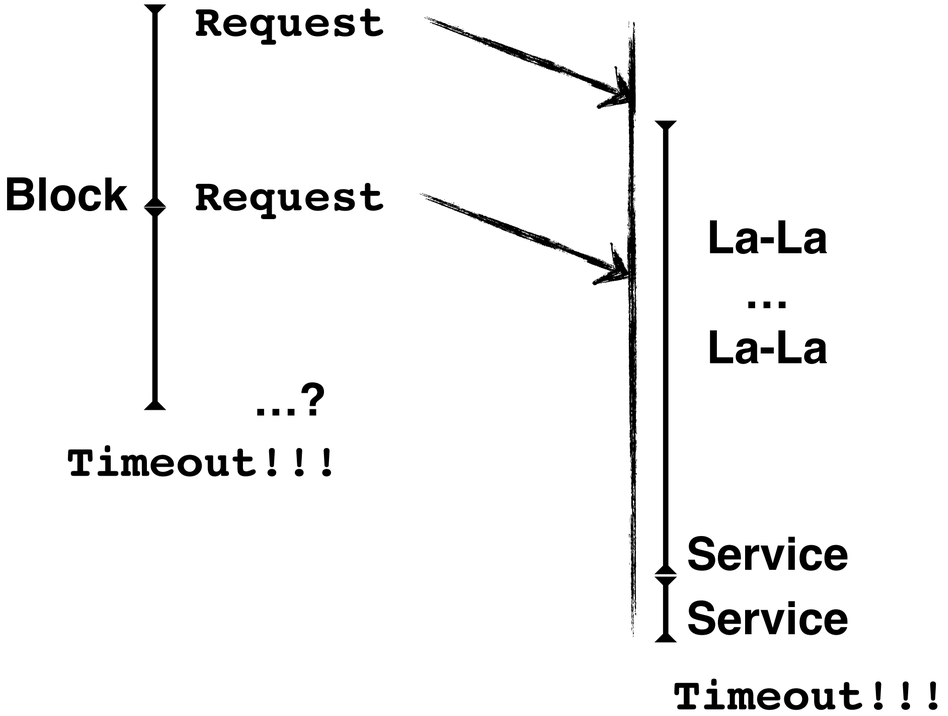


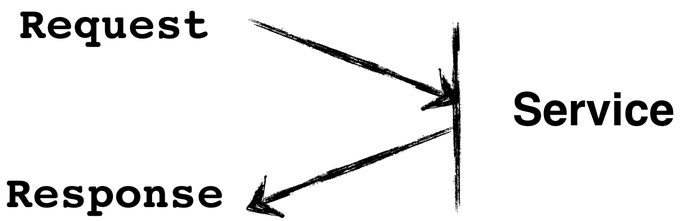
“I know nothing of your … logic”

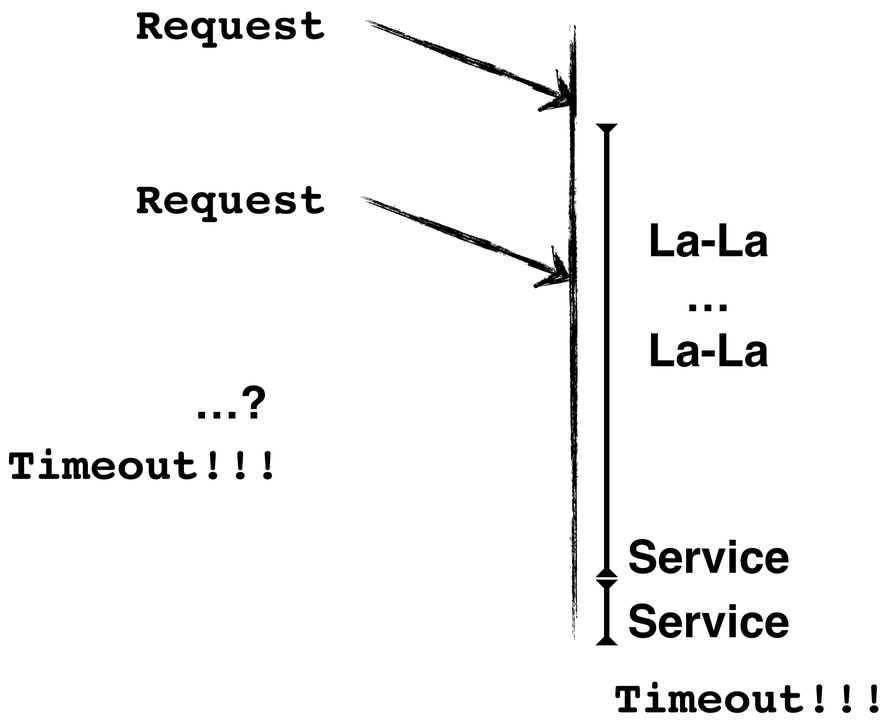
```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Version    |     Flags     |                                 ...
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

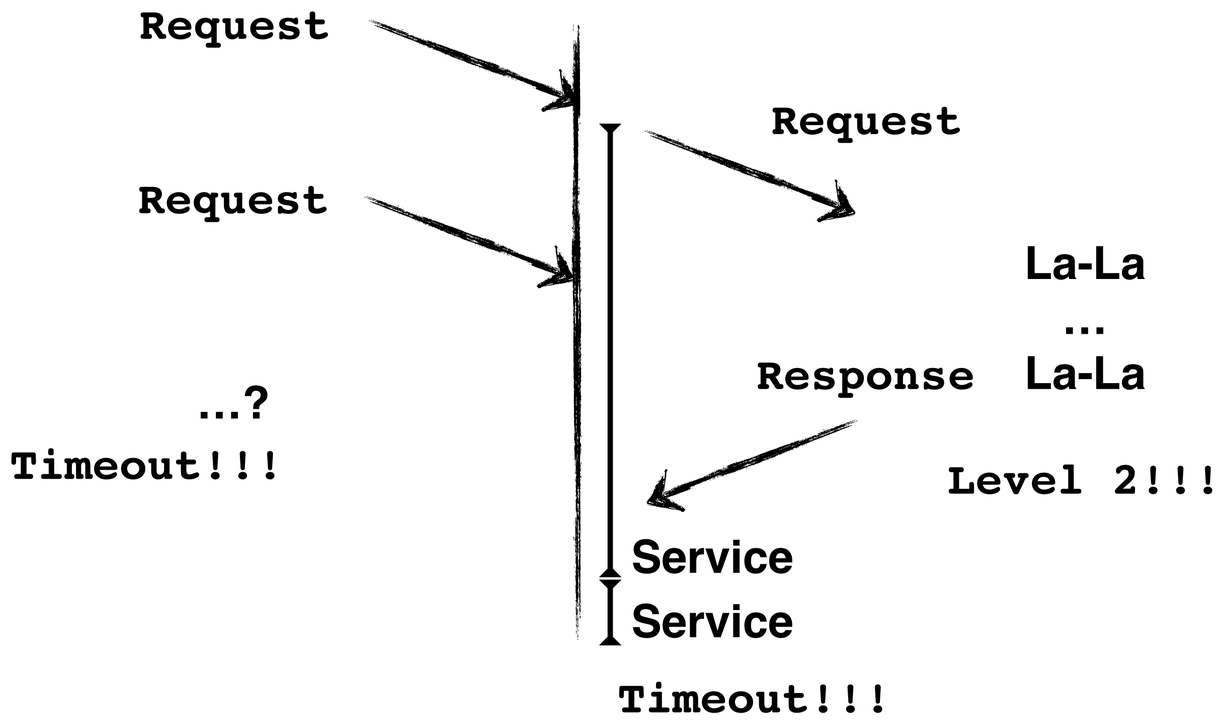
Async all the things!


Block
Request
Response
Service


Block
Request
Request
...?
Timeout!!!
La-La
...
La-La
Service
Service
Timeout!!!


Request
Service
Response


Request
Request
La-La
...
La-La
...?
Timeout!!!
Service
Service
Timeout!!!


Request
Request
Request
...?
Timeout!!!
La-La
...
La-La
Response
Level 2!!!
Service
Service
Timeout!!!

Root Cause Matters

What Quality IS

One uncomfortable truth…

One (un)comfortable truth…

Pride
Ownership
Responsibility


Pride is a personal commitment.
It is an attitude which separates
excellence from mediocrity.
William Blake
quotefancy

“I do this…”

“It does this…”

We do this…



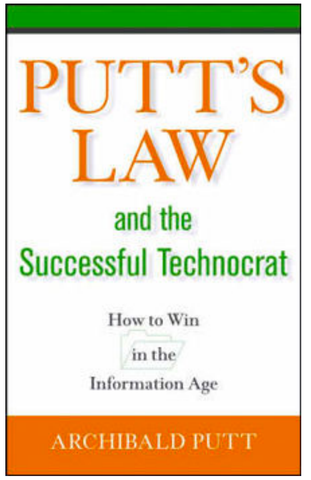
Responsibility equals accountability equals ownership. And a sense of ownership is the most powerful weapon a team or organization can have.

— Pat Summitt —

AZ QUOTES

Putt's Law: "Technology is dominated by two types of people: those who understand what they do not manage and those who manage what they do not understand."

Putt's Corollary: "Every technical hierarchy, in time, develops a competence inversion." with incompetence being "flushed out of the lower levels" of a technocratic hierarchy, ensuring that technically competent people remain directly in charge of the actual technology while those without technical competence move into management.



https://en.wikipedia.org/wiki/Putt's_Law_and_the_Successful_Technocrat

We take responsibility, or…

DETROIT — A Volkswagen engineer was sentenced on Friday to 40 months in prison for his role in the German automaker's decade-long scheme to cheat on federal emissions tests for diesel-powered cars sold in the United States.

The engineer, James Liang, is the first company employee sent to prison in the vast scandal that has tainted Volkswagen's reputation and cost it more than $20 billion in fines and settlements with consumers.

Mr. Liang, who helped develop the software that concealed high levels of pollutants generated by Volkswagen's diesel engines, reached a plea deal with prosecutors last year after agreeing to assist in the government's investigation of the company.

But even after that pledge, Mr. Liang received a harsher sentence than the government recommended for pleading guilty to conspiracy to defraud the United States and violating the Clean Air Act.

Federal prosecutors recommended a three-year sentence and a $20,000 fine, but Judge Sean F. Cox of the United States District Court for the Eastern District of Michigan gave Mr. Liang a longer sentence, as well as two years of supervised release and a $200,000 fine.

https://www.nytimes.com/2017/08/25/business/volkswagen-engineer-prison-diesel-cheating.html



Pointy-Haired Boss Takeaway

ROI

Return on Investment

ROI

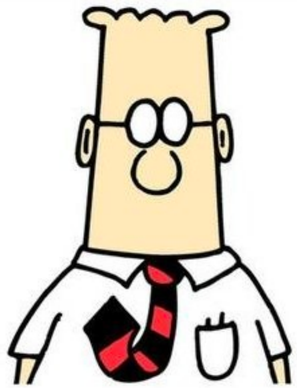
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- *https://www.nasa.gov/centers/ivv/dynamic_analysis_roi.html*
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- *http://www.iceaaonline.com/ready/wp-content/uploads/2014/03/Software-Test-Cost-and-ROI-Galorath-Feb-14-Hunt.pdf*
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- *http://dau.dodlive.mil/2014/12/19/the-path-to-software-cost-control/*
- *https://books.google.com/books?id=6LcpBgAAQBAJ&pg=PA114&lpg=PA114&dq=return+on+investment+nasa+ivv&source=bl&ots=nwVRBx47aO&sig=1YEozo_huDJL4QfGI_5BgkFQou4&hl=en&sa=X&ved=0ahUKEwj6-Lanx5PWAhWGjlQKHTqCAcUQ6AEITzAI#v=onepage&q=return%20on%20investment%20nasa%20ivv&f=false*
- *http://media.govtech.net/Events/2006Events/2006Pennsylvania/6_230_IndependentValidationandVerificationIVV_HURLEY.ppt*
- *http://catal0g.info/downloads/nasa-iv-v-metrics.pdf*

Allen Nikora
https://scholar.google.com/citations?user=K-c0IEUAAAAJ&hl=en

Leslie Lamport
https://lamport.azurewebsites.net/pubs/pubs.html

Martin Feather
https://trs.jpl.nasa.gov/browse?value=Feather%2C+Martin+S.&type=author
http://www.sciencedirect.com/science/article/pii/S1877050914001124

Specifications as Communication
Early Requirements Analysis
Early Domain Expertise
Culture of Accountability



Some Suggestions

TDD/BDD - The Spec?
Agile - Intent!
Language - Rise Above!
Functional/OOP - Rise Above!
Dogma - holds you back



Plans are nothing; planning is everything.

— Dwight D. Eisenhower —

AZ QUOTES

The Spec is Nothing

The writing of the Spec is EVERYTHING

Develop Good Taste

Taste Matters



When you're a carpenter making a beautiful chest of drawers,
you're not going to use a piece of plywood on the back,
even though it faces the wall and nobody will ever see it.
You'll know it's there, so you're going to use
a beautiful piece of wood on the back.
For you to sleep well at night, the aesthetic, the quality,
has to be carried all the way through.

- Steve Jobs

Questions?



Twitter: @toddlmontgomery

Thank You!