Building a GENIVI Head Unit In-House at BMW – An Experience Report

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Achim Demelt

Manager Build & Release Engineering Team, BMW Car IT GmbH

Introduction

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About Me

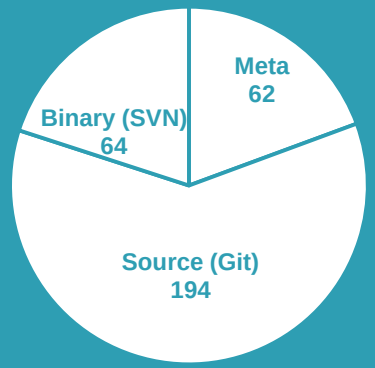
Late 90s
C++, CORBA, UNIX, HPC

2000s
Java, Web, Business Apps, DSL + Framework Design

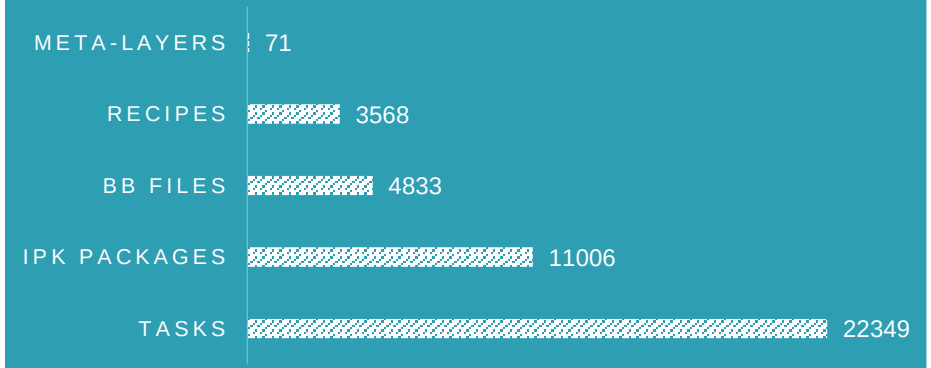
2015+
Lead Build & Release Engineering Team for Infotainment

Facts About MGU*

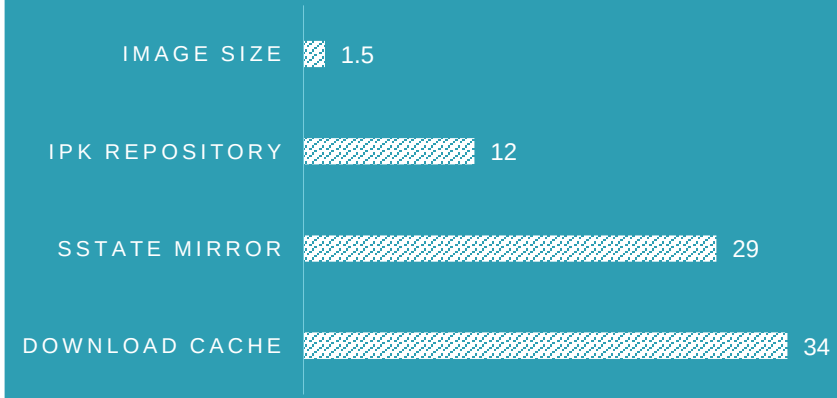
REPOSITORIES



BITBAKE META-DATA



SIZES (GB)



30 PARTITION IMAGES

4 HARDWARE VARIANTS

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*MGU: Next-generation BMW Head Unit

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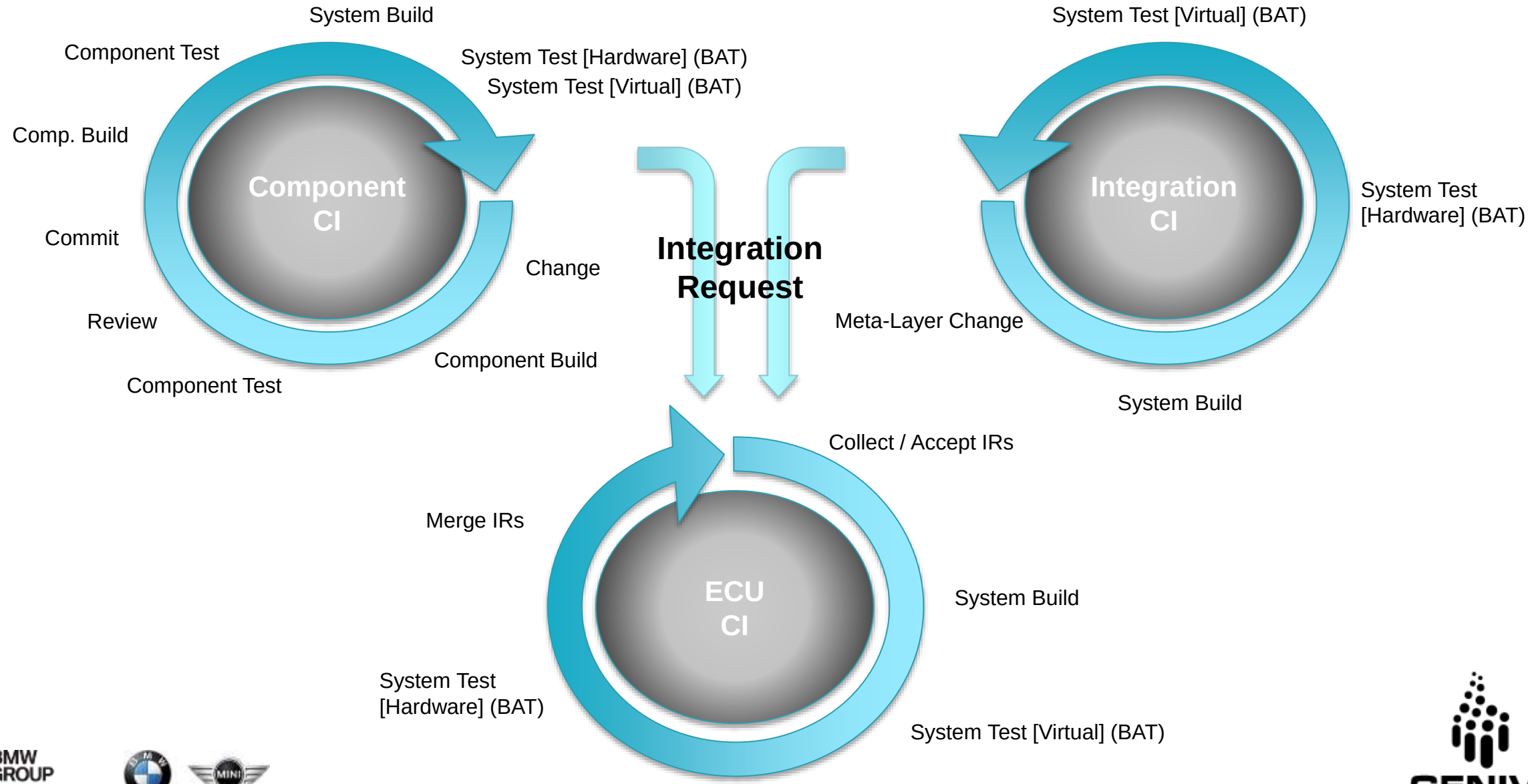
Our Continuous Integration Setup



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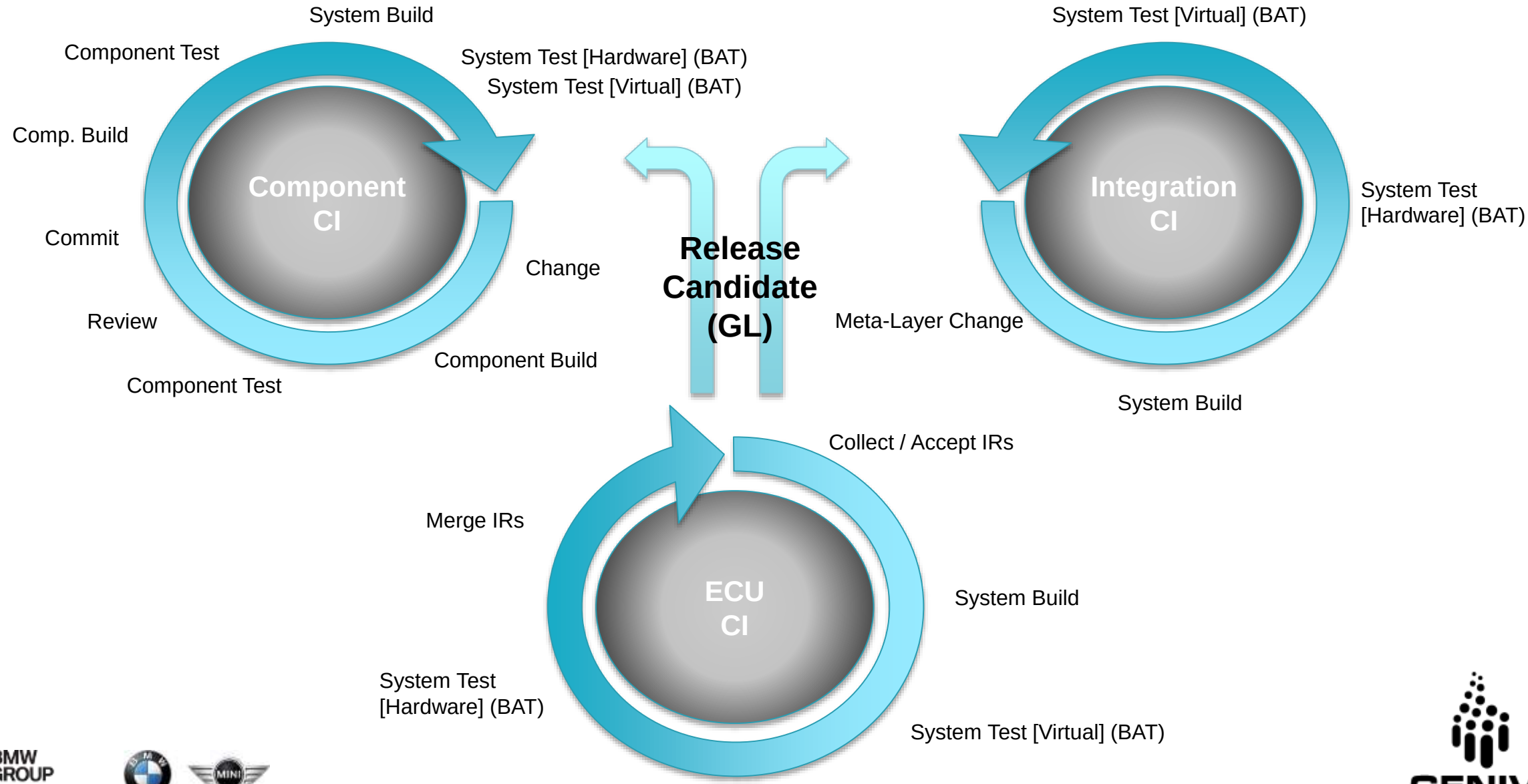
Our Continuous Integration Setup



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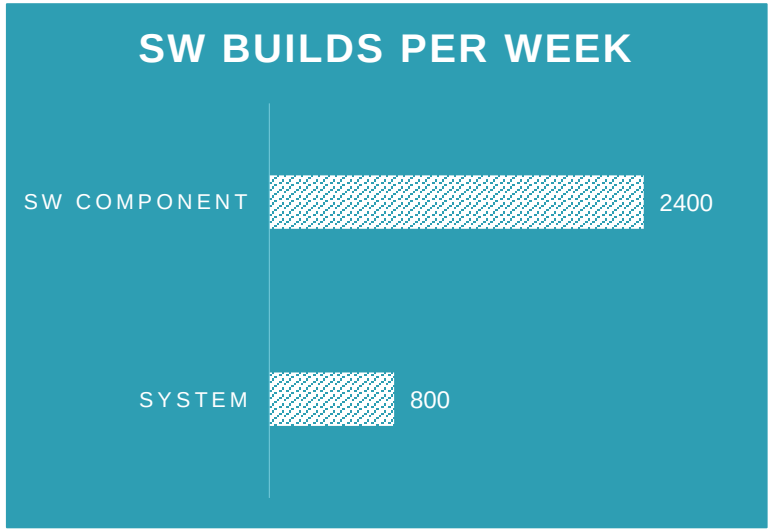
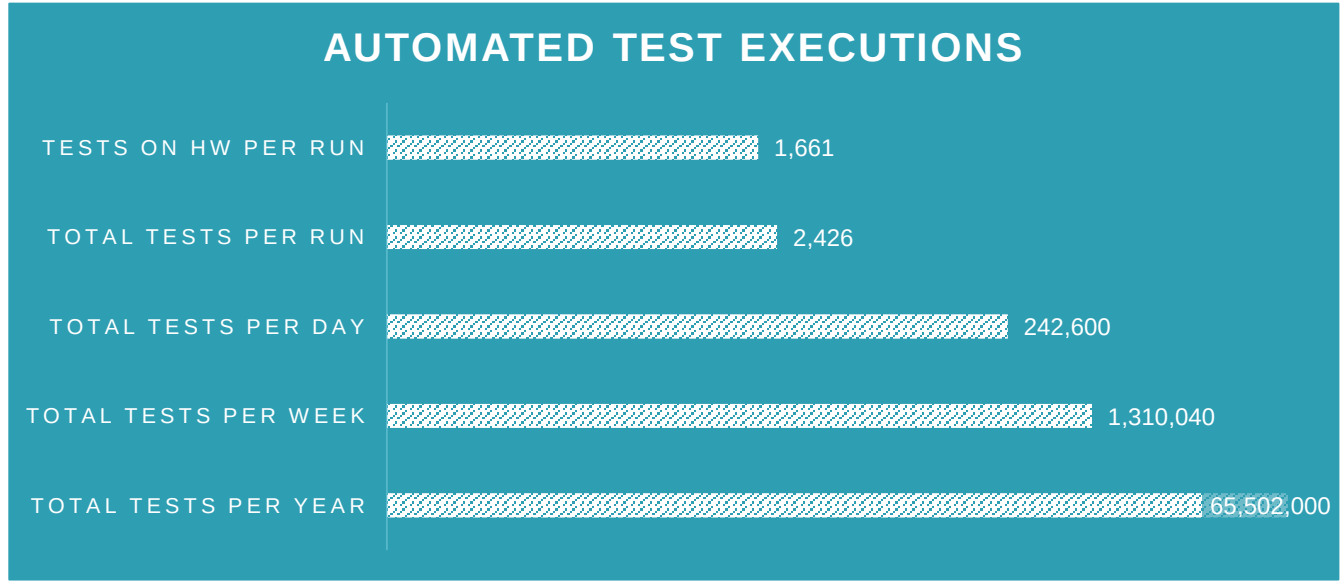
More Facts About MGU





UP TO 5 RELEASE CANDIDATES PER DAY FROM 2 BRANCHES.

119 VIRTUAL MACHINES RUNNING ON 1808 vCORES WITH >5 TB RAM, CONSUMING 140 TB STORAGE.

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Lesson 1

Git Gud?

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Image Credit: Faces Of Open Source / Peter Adams, CC-BY-NC-SA, http://facesofopensource.com/linus-torvalds-2/

Git Gud?

"I didn’t really expect anyone to use [Git] because it’s so hard to use, but that turns out to be its big appeal. No technology can ever be too arcane or complicated for the black t-shirt crowd.„

[Source: http://typicalprogrammer.com/linus-torvalds-goes-off-on-linux-and-git]

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Lesson 1

Train your people!

Git is hard to use. Really.

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Lesson 2

The **day**

EVERYONE *complained*

about *LOOONG* build times…

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… was caused by this:

```
BB_HASHBASE_WHITELIST += “LD_CONFIG”
```

which should have been this:

```
BB_HASHBASE_WHITELIST_append = “ LD_CONFIG”
```

… obviously.

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Lesson 2

Train your people even more!

Yocto is a tool from experts for experts. There are so many ways to do things… wrong.

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Lesson 3

Continuous Integration

“Every change is built and validated fully automatically. Developers receive immediate feedback about their changes.”

Reality: Well, you know that.

Ponyhof: In German pop-culture, a place where the grass is green, the skies are blue, and children play happily with their little ponies.

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Reality Check

BUILD TIMES UP TO **150** MINUTES.

10 MINUTES FLASHING TIME.

30-50 MINUTES TO EXECUTE A SUBSET OF BUILD ACCEPTANCE TESTS.

So much for fast feedback…

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Lesson 3

Textbook CI is extremely challenging for a system that is sufficiently large & complex.

Design your build & release pipelines well.

Building and testing take a long time.

Decide what to build and test, when and how.

Strengthen virtual validation.

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Lesson 4

Testing

“Every feature shall have sufficient, automated test coverage.”

Reality: Well, you know that.

Ponyhof: In German pop-culture, a place where the grass is green, the skies are blue, and children play happily with their little ponies.

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Reality Check

AT TIMES, 14% OF ALL CI RUNS FAILED BECAUSE OF RANDOM TEST FAILURES DUE TO AN UNSTABLE BASELINE.

14% doesn't sound like much, could be worse…

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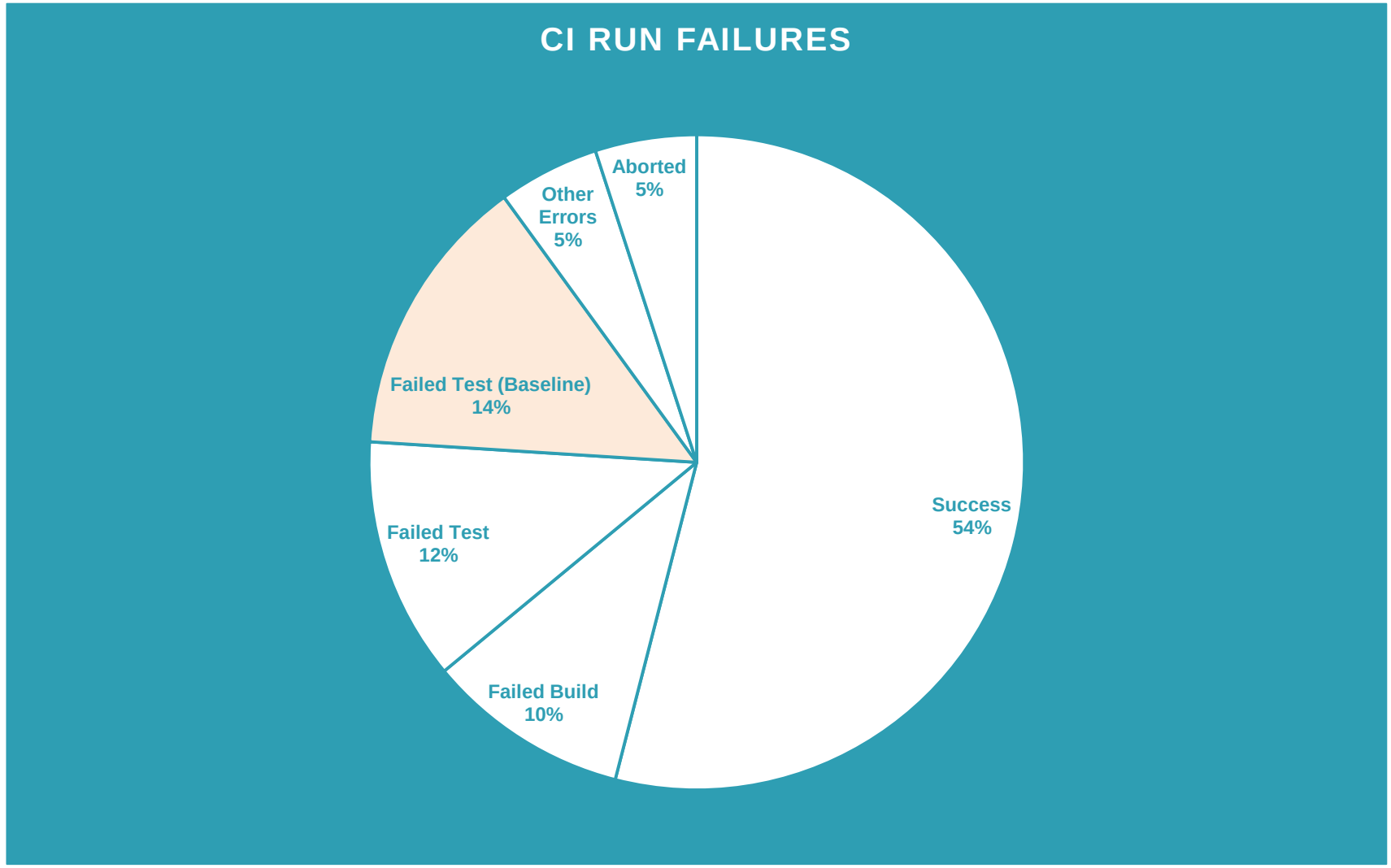
Reality Check – In Perspective



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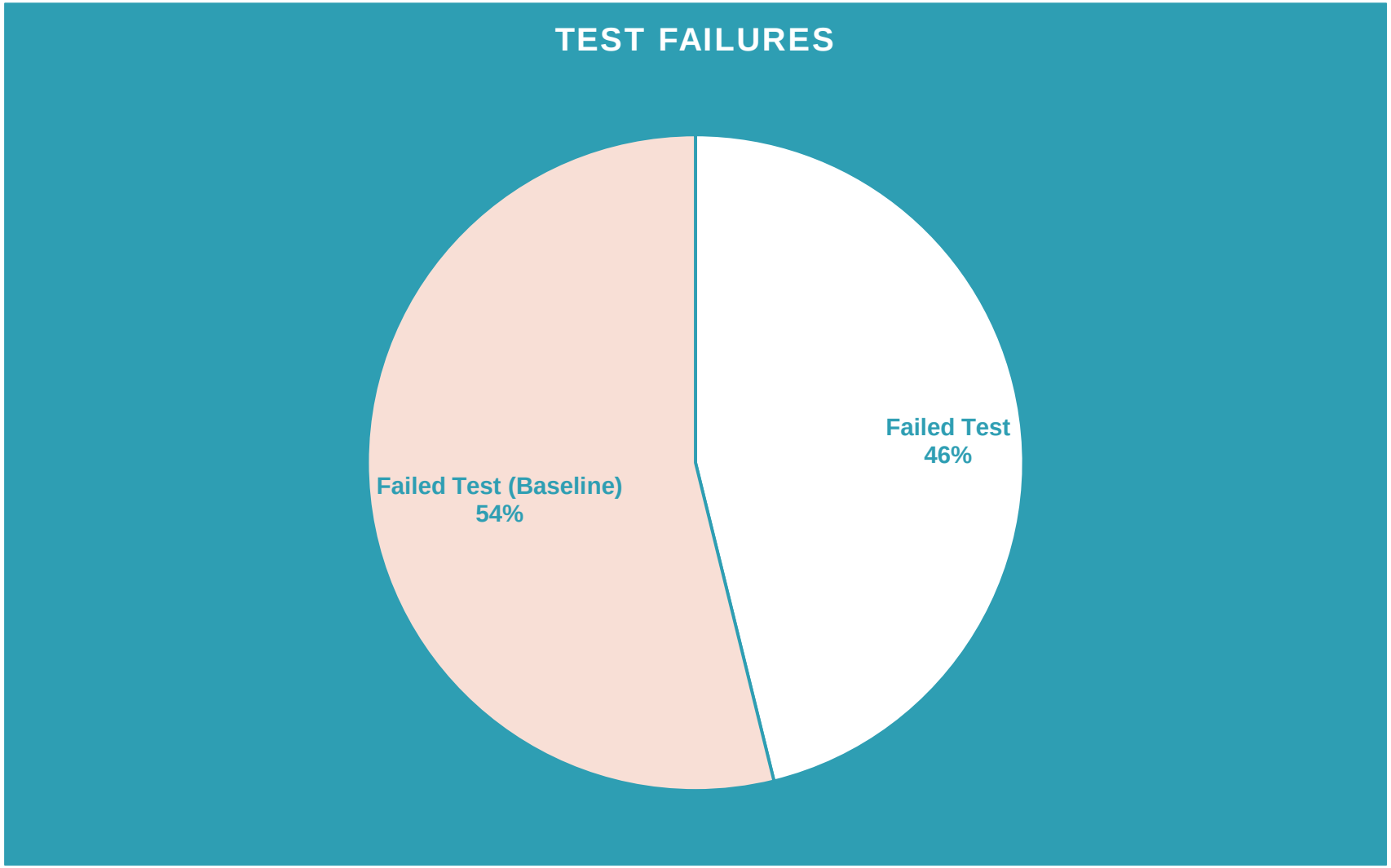
Reality Check – In Perspective



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Lesson 4

Be smart about your testing!

Focus on tests and quality from the very beginning. It will haunt you if you don’t.

Test the right thing at the right time. As early as possible.

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Lesson 5

Infrastructure

“Virtual servers in the cloud are great!”

Infrastructure

“Virtual servers in the cloud are great…

… but not for large-scale high-performance software builds.”

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Truth is…

EVERY MEASUREMENT WE MAKE INDICATES THAT VIRTUALIZED HARDWARE IS 25%-100% SLOWER THAN BARE-METAL MACHINES.

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Lesson 5

Use the best, non-virtualized build hardware you can afford!

Every minute wasted in the build is wasted time for the developer.

Btw, this also applies for developers' machines.

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Lesson 6

Emergency Mode

The Number To Know

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Things that broke…

HDD

Network

Gerrit

VPN

NAS

VSAN

Firewall

Jenkins

Yocto

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Lesson 6

Be prepared to enter emergency mode!

High load breaks every system. Eventually.

Establish procedures and working modes to address outages and other problems.

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Lesson 7

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The Ultimate Question

"*Why* is EVERYTHING

so **slooooow**?"

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Wrong Answer

“I don’t know.”

Lesson 7

Measure everything!

You can’t fix what you don’t know.

Measure from within and without.

Visualize!

Battle randomness with statistics.

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Lesson 8

They'll keep asking…

"*Why* is EVERYTHING

so **slooooow**?"

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Lesson 8

Be willing to invest in continuous improvement!

Plan for constant effort to optimize.

You are never finished.

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Summary

Lessons Learned

Lesson 1: Train your people!
Lesson 2: Train your people even more!
Lesson 3: Textbook CI is extremely challenging for a system that is sufficiently large & complex!
Lesson 4: Be smart about your testing!
Lesson 5: Use the best, non-virtualized build hardware you can afford!
Lesson 6: Be prepared to enter emergency mode!
Lesson 7: Measure everything!
Lesson 8: Be willing to invest in continuous improvement!

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Final Lesson

It is absolutely worth it!

Thank you!

Visit GENIVI at http://www.genivi.org or http://projects.genivi.org

Contact us: help@genivi.org

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