



# **Testing Red Hat Enterprise Linux the Microsoft way**

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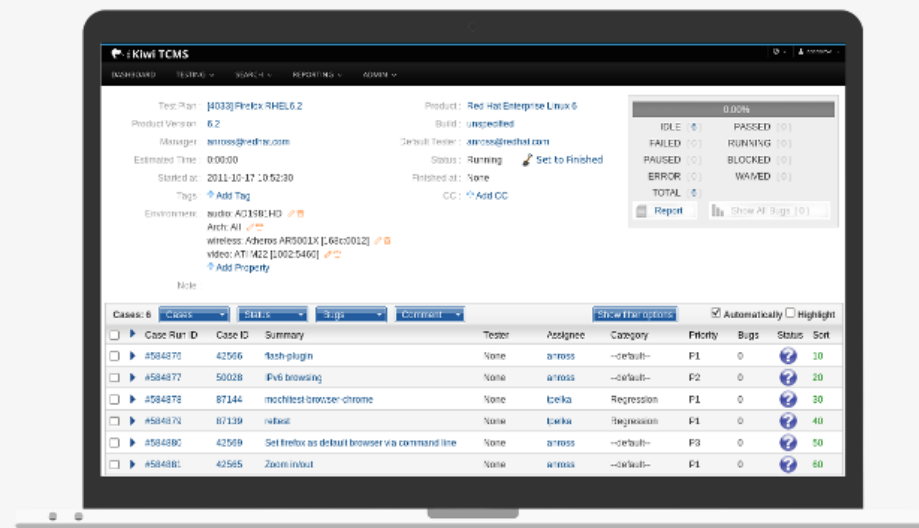




## Kiwi TCMS

the leading open source  
test case management system

- Efficiently manage test cases, plans and runs
- Improve testing productivity & reporting
- Integrates with popular issue trackers
- External API interface
- GPL 2 licensed

[Checkout Demo](#)[See Features](#)

*Open source test case management system, with a lot of great features, such as bug tracker integration, fast search, powerful access control and external API.*

### Everyday testing

Use the dashboard to see pending work. Execute tests, mark results and report bugs. Collect automation results!

### Django 2 & Python 3

### Test management

Define test plans and cases, track progress and assign work across multiple teams. Perform peer reviews.

### Patternfly & jQuery

### Reporting

See who's doing what and provide status report to stakeholders. Centralize your acceptance books!

### Docker

### Integration

Integrated with Bugzilla, JIRA and GitHub. The API interface provides full access so you can get creative!

### Tested



# What is pairwise testing



Glass Roof



19" Silver Slipstream Wheels

Paint

Roof & Wheels

Interior

## Model S

**75D**

75 kWh  
Up to 259 miles  
EPA range

**100D**

100 kWh  
335 miles  
EPA range

**P100D**

Zero to 60 in **2.5 sec**  
315 miles  
EPA range



- Wheels
  - 19" or 21"
- Battery (if you remember)
  - 60 kWh, 75 kWh, 85 kWh or 100 kWh
- Engine
  - Single or Dual
- Performance mode
  - Yes or No



**2 x 2 x 2 x 4 == 32 combinations**



Wheels	Battery	Engine	Performance mode
19 “	60 kWh	Single	Yes
19 “	75 kWh	Single	Yes
19 “	85 kWh	Single	Yes
19 “	100 kWh	Single	Yes
21 “	60 kWh	Dual	No
21 “	75 kWh	Dual	No
21 “	85 kWh	Dual	No
21 “	100 kWh	Dual	No



# Pairwise Testing

## Combinatorial Test Case Generation

Pairwise (a.k.a. all-pairs) testing is an effective test case generation technique that is based on the observation that most faults are caused by interactions of at most two factors. Pairwise-generated test suites cover all combinations of two therefore are much smaller than exhaustive ones yet still very effective in finding defects. [Learn more](#)

### $L_4 (2^3)$ Orthogonal Array

Expt. No.	Column		
	1	2	3
1	1	1	1
2	1	2	2
3	2	1	2
4	2	2	1

★ What's New

[Effectiveness of Pairwise](#)

[Research Papers](#)

[Available Tools](#)

[About this Website](#)



**I've pairwise tested  
Red Hat Enterprise Linux install  
during the entire test campaign!  
across all product variants!**

A decorative pattern of small, pixelated squares in orange and blue colors, arranged in a wavy, horizontal line across the top of the slide.

# Installation testing 101

## LOCALIZATION



## DATE &amp; TIME

*Americas/New York timezone*

## KEYBOARD

*English (US)*

## LANGUAGE SUPPORT

*English (United States)*

## SOFTWARE



## INSTALLATION SOURCE

*[http://download.lab.b...tion/x86\\_64/os](http://download.lab.b...tion/x86_64/os)*

## SOFTWARE SELECTION

*GNOME Desktop*

## SYSTEM



## INSTALLATION DESTINATION

*Automatic partitioning selected*

## NETWORK &amp; HOSTNAME

*Not connected*

Quit

Begin Installation

*We won't touch your disks until you click 'Begin Installation'.*

Please complete items marked with this icon before continuing to the next step.

Done

 us

Help!

## New Red Hat Enterprise Linux 7.1

## Installation

DATA

SYSTEM

**/boot**

sda1

476 MiB

**/**

vda2

4420 MiB &gt;

**swap**

rhel-swap

1020 MiB

## vda2

Mount Point:

/

Desired Capacity:

4420 MiB

Device Type:

RAID

☐ Encrypt

File System:

xfs

☒ Reformat

Label:

Device(s):

Virtio Block Device (vda) and 1 other

Modify...

RAID0 (Performance)

RAID1 (Redundancy)

RAID4 (Error Checking)

RAID5 (Distributed Error Checking)

RAID6 (Redundant Error Checking)

RAID10 (Performance, Redundancy)

root

Update Settings

*Note: The settings you make on this screen will not be applied until you click on the main menu's 'Begin Installation' button.*

+

-

↺

⚙

AVAILABLE SPACE

327.34 MiB

TOTAL SPACE

6246.4 MiB

[2 storage devices selected](#)

Reset All

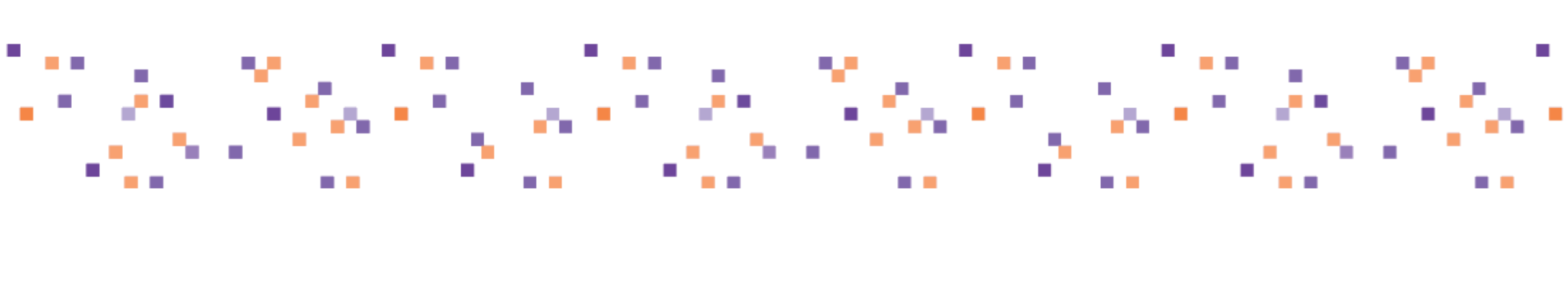


# 9 different product variants

*I consider them platform independent*




**3 test groups: Tier #1, #2 and #3**



**6000 test case executions**





**“Insanity -  
doing the same thing  
over and over  
and expecting  
different results.”**

Albert Einstein



**1) Take all platform dependent tests (pairwise where possible)**



## **2) Pairwise all tests with parameters**



***storage / iSCSI / No authentication / Network init script***

***storage / iSCSI / CHAP authentication / Network Manager***

***storage / iSCSI / Reverse CHAP authentication / Network***

- **Authentication type:** None, CHAP, reverse CHAP (3)
- **Networking system:** NetworkManager or SysVinit (2)



- $3 \times 2 == 6$
- *Pairwise*:  $3 \times 2 == 6$
- Across all variants:  $9 \times 3 \times 2 == 54$
- **Pairwise across all variants**:  $9 \times 3 == 27$



### **3) Randomize tests without parameters**



## *Partitioning / swap on LVM*

- **No parameters!**
- **Pairwise can't reduce variant as parameter**
  - $9 \times 1 == 9$
- **Execute on random product variant each time!**



# Acceptance criteria





**Less test case executions**



# Don't miss existing bugs \*

*how does pairwise compare to full test suite  
wrt defect finding abilities ?*



# Don't increase product risk \*

*how many critical defects would I miss  
if I don't execute the full test suite ?*



# Experiment results



# 65 % less test case executions !

*2119 test cases in pairwise test plan*



# 76 % execution completion rate

*previous releases are around 85%*





# 30 % of bugs found by Tier #1

*good job, test cases not included in experiment*





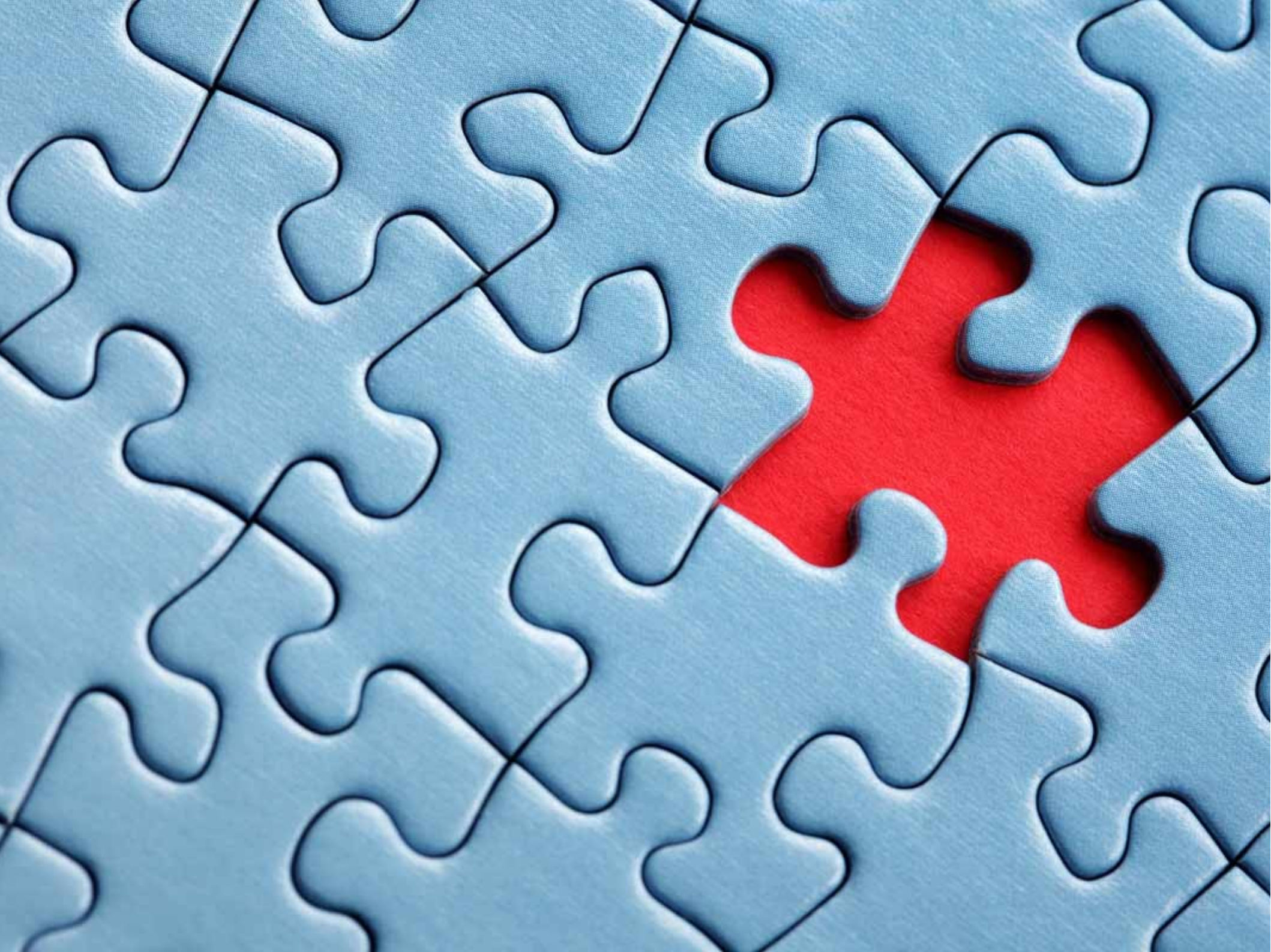
# 30 % of bugs found by Pairwise


*same were detected by following regular test plan*




# 30 % of bugs found by ET

*we don't have test cases for them! Ouch !*



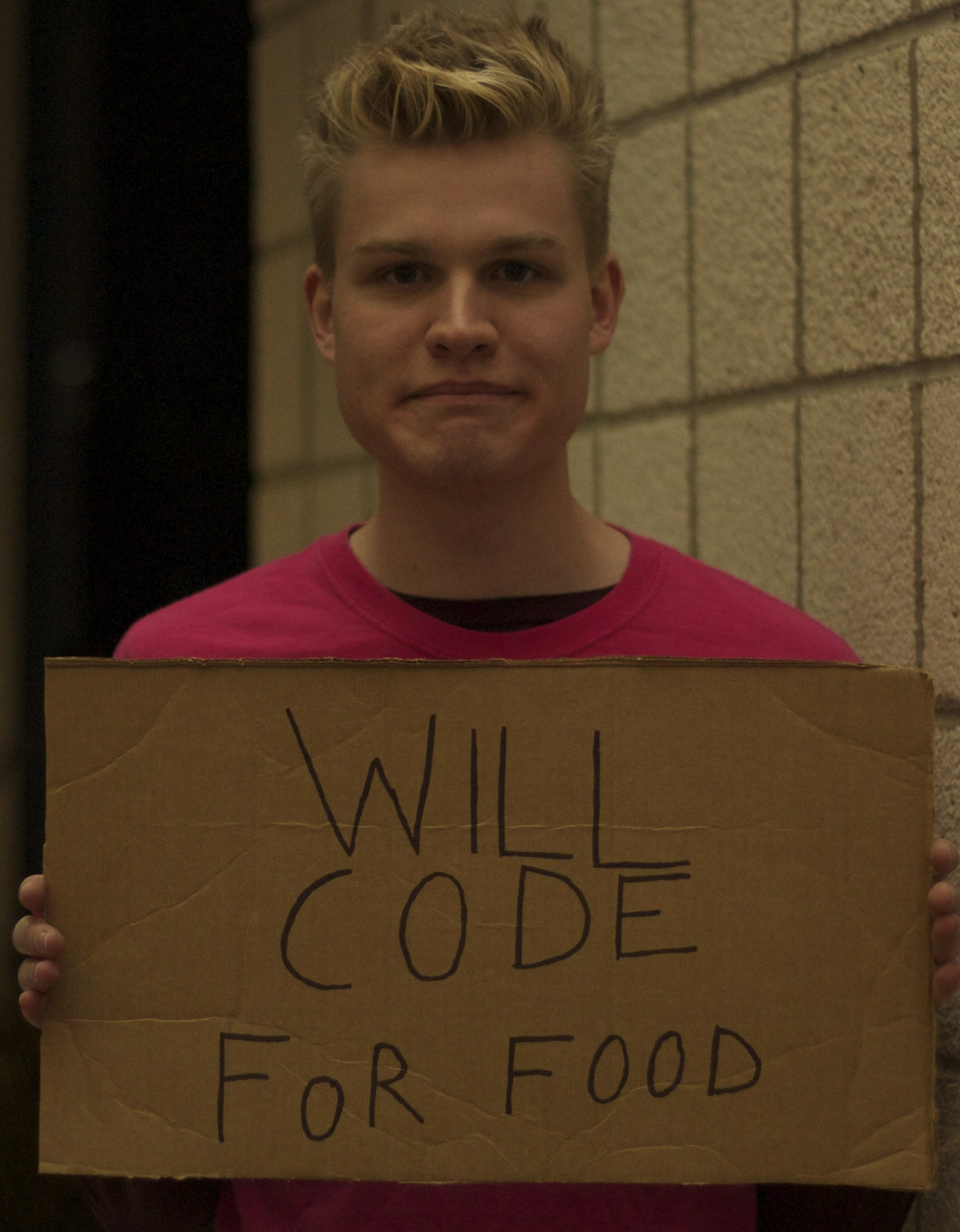
- 
- *#1396949 - After installation with ibft the default route is missing*
    - *gPXE, firmware dependent*
  - *#1421039 - Anaconda fails to get kickstart from nfs on s390x*
    - *Corner case on s390x*
    - *IPv6 != IPv4*

- 
- *#1400844 - Interface binding makes iscsi connection fail*
    - *Waived due to bad infrastructure setup*
    - *Waived again b/c ComputeNode doesn't support Specialized Storage*
  - *#1420300 - Certmonger scriptlet outputs errors to update.log during anaconda upgrade*
    - *tested and not being re-tested*



# Lessons learned





WILL  
CODE  
FOR FOOD





# Perform test review regularly

**found hidden parameters in tests**

**found (sort of) duplicate test cases**





# Observed optimization patterns

**combine or pipeline independent TCs**

**common set-up for multiple TCs across variants**

**... and pairwise, pairwise, pairwise**



# Risk of not detecting regressions

risk is significant in Snapshots phase

due to historical aggregation of results



# Ask me anything !



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