



THINK
LIKE **DEVELOPER**
HUNT IT LIKE **TESTER**

Think Like Developers ..Hunt It like Tester



Introduction to software testing

*Code Quality & Unit Testing for
Software Craftsmanship*

Testing always gives
confidence in the developed
software testing



Why We Are Here Today



Agenda

- Introduction
- Why...Idea
- Code quality
- Unit testing
- Role of testing
- References

Why...The idea

- **Multinationals are driven by**
 - Diversity
 - Distributed teams
 - Collaborative teams

Code Quality

***Why we care about
writing quality code?***

***Let's do
Small development
task***

Function that calculate square of int numbers

For any integer n, square (n) = $n * n$.

```
int square (int x)
{
    return x*2;
}
```

Square (2) = 4

Correct Result

Developer is Happy ☺



Code is moved to Testing phase

For any integer n , $\text{square}(n) = n * n$.

```
int square (int x)
{
    return x*2;
}
```

Square (3) = 6

Failure

Bug

***Let's do another
Small development
task***

Function that takes array of int and display # of Zeros in it

numZero([0,5,0])=1

```
public static int numZero (int[] x) {  
    // Effects: if x == null throw NullPointerException  
    // else return the number of occurrences of 0 in x  
    int count = 0;  
    for (int i = 1; i < x.length; i++) {  
        if (x[i] == 0) {  
            count++;  
        }  
    }  
    return count;  
}
```

Bug

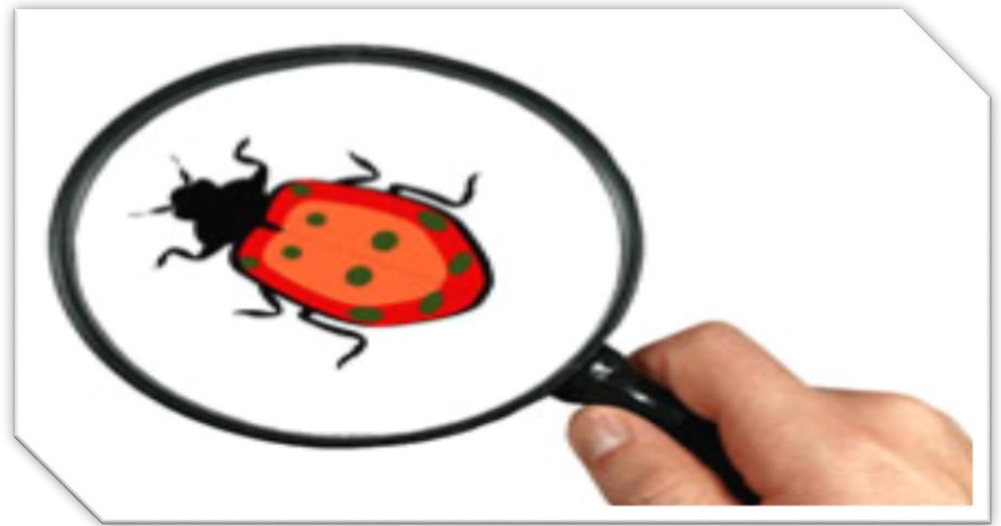
Failure

(numZero[4,5,0])=1

Correct Result

Actual Result != Expected Result

We caught bugs !!



Common SW Bugs

Real SW Business Examples

Examples Of Common SW Bugs (2)



Pepsi - \$42 Billion Error

- In May 1992, Pepsi ran a promotion in the Philippines. It told customers they could win a million pesos (approx. \$40,000) if they bought a bottle of Pepsi and found number 349 stamped on the underside of the bottle cap. Unfortunately, due to a software error, 800,000 bottle caps were produced with number 349 instead of one, which was an equivalent of \$42 billion in prize money. It cost the company dearly as some people pursued their claims through the courts and Pepsi paid out millions of dollars in compensation.
- Now, does it matter if there are mistakes in what we do?
- Does it matter if we don't find some of those flaws?
- We know that some of our mistakes do not matter, and some are very important

Examples Of Common SW Bugs (2)

The Lion King Animated Storybook

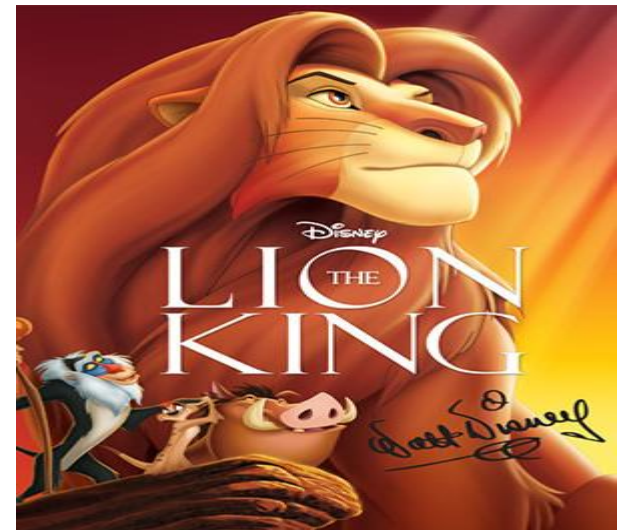
Disney's first multimedia CD-ROM game for kids.

Released at Christmas season.

26th December..... Customer Support's Nightmare.

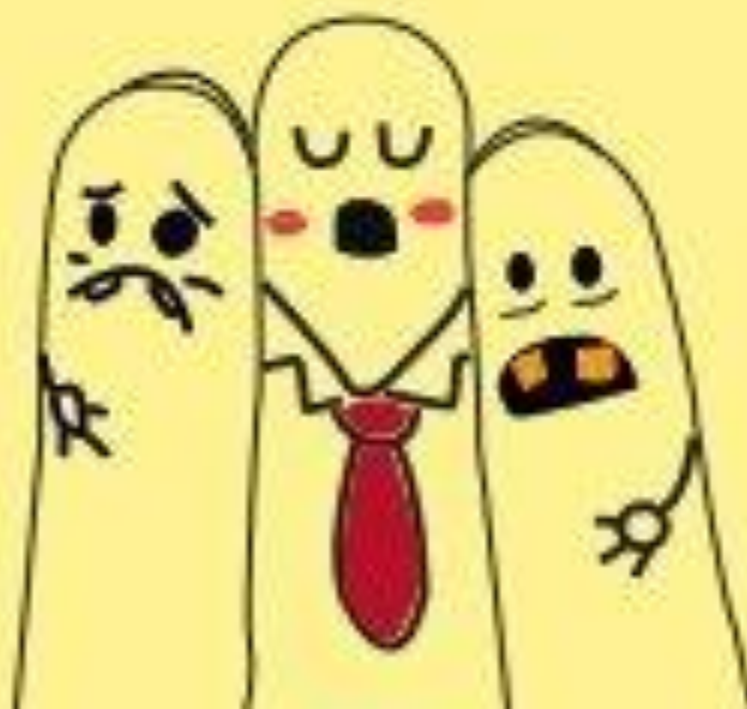
The CD was testing only for specific PC platform.

It failed on many popular PC operating system.



***Because Bugs Costs
A lot ☹***

Beginning of
Difficult Times



Error - bug- Failure

A Developer makes
an *error* ...

... that creates a
bug in the
software ...

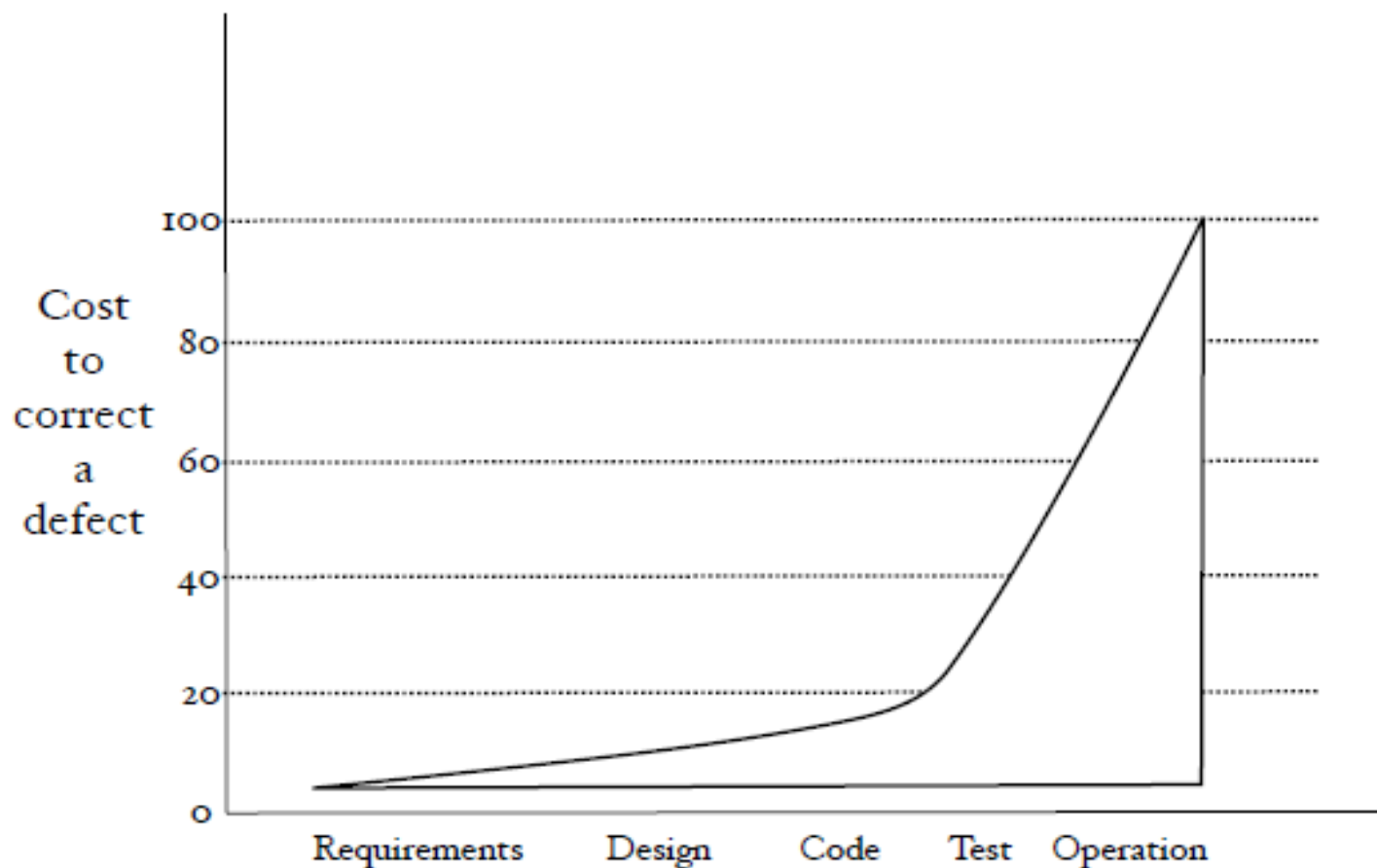


... that can cause
a failure
in operation

Causes of software errors

- Faulty requirements definition
- Client-developer communication failures
- Deviations from software requirements
- Logical design errors
- Coding errors
- Non-compliance with documentation and coding instructions
- shortcomings of the testing process
- documentation errors

Cost of Defect



{BOEH01}

How to write Quality Code?



***It is all about writing
and unit testing your
code for the sake of....***

Reducing Bugs

Lower Maintenance Effort

Ugly code

```
Ext.define('AM.store.fund', {
  extend: 'Ext.data.Store',
  model: 'AM.model.fund',
  requires: [
    'Ext.data.proxy.JsonP'
  ],
  autoLoad: true,

  proxy : {
    type: 'jsonp',
    //callbackKey: 'callback',
    url: 'http://localhost:8090/spring-rest-sample/rest/funds/',
    headers: {
      'Accept': 'application/json'
    },
    reader: {
      type: 'json',
      root: 'data',
      successProperty: 'success'
    },
    afterRequest: function(req, res) {
      console.log("Ahoy!", req.operation.response);
    }
  },
});
```

```
var Ext=Ext||{};if(!Ext.Direct){Ext.Direct={}}if(!Ext.Toolbar){Ext.Toc
main={}}if(!Ext.button){Ext.button={}}if(!Ext.chart){Ext.chart={}}if(
art.series={})if(!Ext.chart.theme){Ext.chart.theme={}}if(!Ext.containe
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={}}if(!Ext.ux){Ext.ux={}}if(!Ext.ux.form){Ext.ux.form={}}if(!Ext.view
=[],m=["constructor","toString","valueOf","toLocaleString"],k={},p={},
;for(r=m.length;r-->0;){q=(1<<r);p[k[q]=m[r]]=q}for(r in p){b|=p[r]}b=
r("config").fn;for(h in c){if(c.hasOwnProperty(h)){l.push(h)}}j.derive
numerableMembers,v=y.prototype,t,w,s,q;if(!u){return}for(t in u){q=u[t]
identityFn){v[t]=w=q;w.$owner=y;w.$name=t}else{v[t]=q}}for(s=1;r;s<=&1
```


Beautiful code

```
// @todo: delete this file after testing

/**
 * # Defines CompanyStore – Only for testing, unrelated to the main app
 *
 *
 * @author Jozef Sakalos, Saki
 * @date 19.8.2013
 * @copyright (c) 2013, Jozef Sakalos, Saki
 * @license This file is proprietary and it is only meant to be
 * run as a part of Omni8.net blog application.
 * All other uses (reading, copying, reverse engineering
 * to name a few) are prohibited.
 */
Ext.define('Od.store.CompanyStore', {
    extend: 'Ext.data.Store'
    ,requires: ['Od.model.CompanyModel']
    ,model: 'Od.model.CompanyModel'
    ,pageSize: 15
    ,remoteSort: true
    ,remoteFilter: true

    /**
     * @return {Boolean} true if the store is dirty, false otherwise
     */
    ,isDirty: function() {
        var dirty = false;
        this.each(function(r) {
            dirty = dirty || r.dirty || r.phantom;
        });
        dirty = dirty || this.getRemovedRecords().length;
        return dirty;
    } // eo function isDirty
});

// eof
```

No more spaghetti code



***Make it Easier to
Extend Good
Code***

***Give your client
the warm and
fuzzy feeling.
Quality Code =
Trust***

***“Testing always
Gives Confidence
In The Developed
Software.”***

Two perspectives on code quality

Does the software correctly implements requirements? Is it easy to use? Does it crash?



How is the code organized?
Where is <some>
functionality implemented?

```
void CruiseControl_init(_C_CruiseControl * _C_)
{
    CruiseSpeedMgt_init(&(_C->_C0_CruiseSpeedMgt));
    CruiseStateMgt_init(&(_C->_C3_CruiseStateMgt));
    (_C->_M_conduct_0) = true;
    ThrottleCmd_init(&(_C->_C4_ThrottleCmd));
    (_C->_M_init) = true;
}

/* ===== */
/* MAIN NODE */
/* ===== */

void CruiseControl(_C_CruiseControl * _C_)
{
    bool BrakePressed;
    bool AcceleratorPressed;
    bool SpeedOutOffLimits;
    bool _L19;
    /*#code for node CruiseControl
    /* call to node not expanded DetectPedalsPressed */
    (_C->_Cn_DetectPedalsPressed._I1_Accelerator) = (_C->_Cn_DetectPedalsPressed._I1_Accelerator) =
    DetectPedalsPressed(&(_C->_Cn_DetectPedalsPressed));
    BrakePressed = (_C->_Cn_DetectPedalsPressed._00_BrakePressed);
    AcceleratorPressed =
    (_C->_Cn_DetectPedalsPressed._01_AcceleratorPressed);
    /* call to node not expanded DetectSpeedLimits */
    (_C->_Cn_DetectSpeedLimits._I0_speed) = (_C->_I8_SpeedOutOffLimits);
    DetectSpeedLimits(&(_C->_Cn_DetectSpeedLimits));
    SpeedOutOffLimits = (_C->_Cn_DetectSpeedLimits._00_SpeedOutOffLimits);
    /* call to node not expanded CruiseStateMgt */
    (_C->_C3_CruiseStateMgt._I0_BrakePressed) = BrakePressed;
```

External (user's): *what?*



Internal (programmer's): *how?*

Components of Code Quality

- Writing according to coding standards
- Unit testing your code

Coding Standards

- Pleasant to read and easy to grasp
- Abide by standards
- Modular
- Almost bug-free
- Finished
- Clean
- Documented
- working

Unit Testing

- Test individual units of code
- Isolate each part
- Show that the individual parts are correct
- Document your code
- Executed within a framework(IDE)

***Is Unit Testing
Enough for Software
quality***



IEEE Definition of "Software Quality"

1. The degree to which a system, component, or process meets specified requirements.
2. The degree to which a system, component, or process meets customer or user needs or expectations.

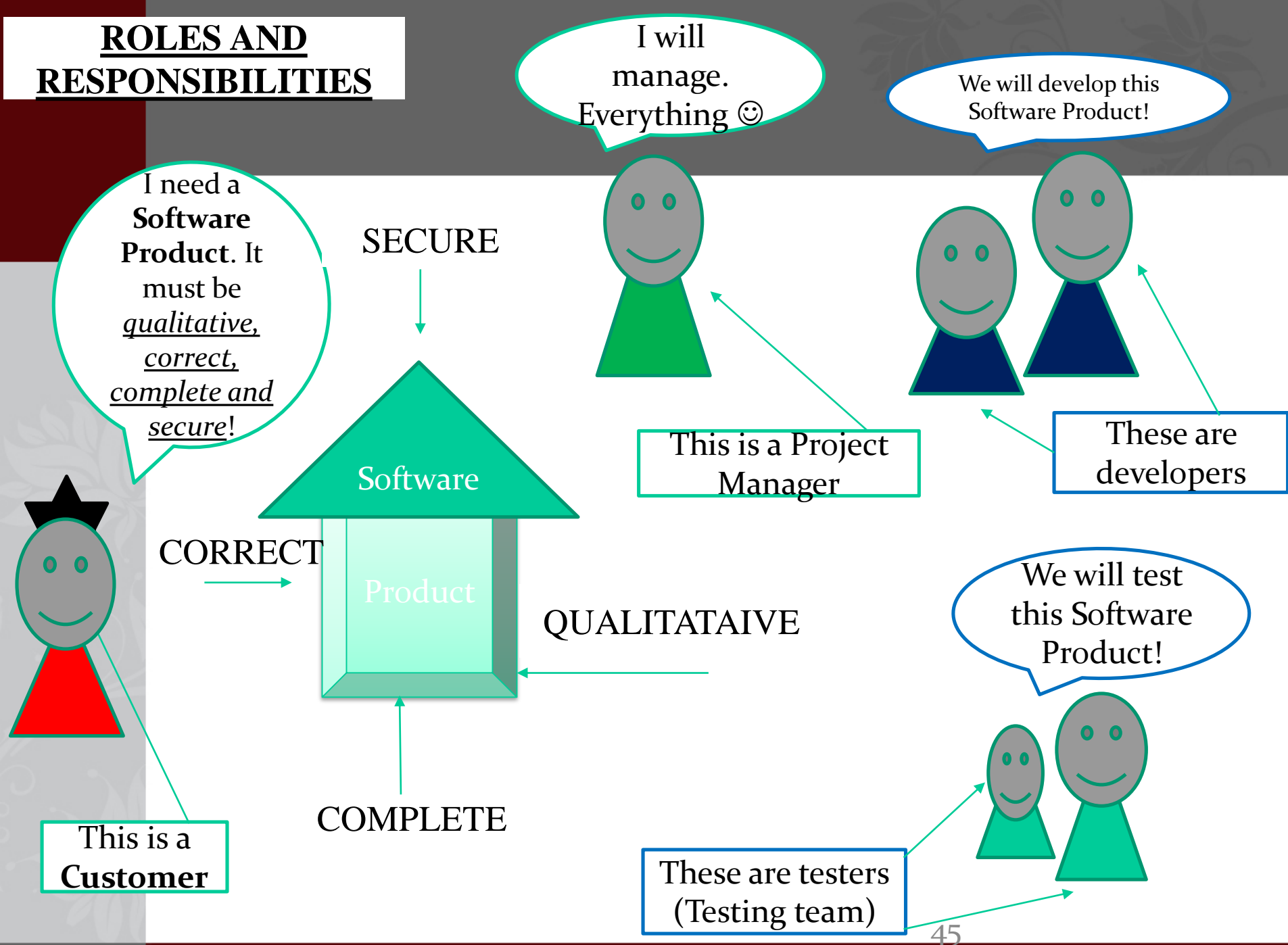
***We need another
detailed oriented Eye***

We need testing team

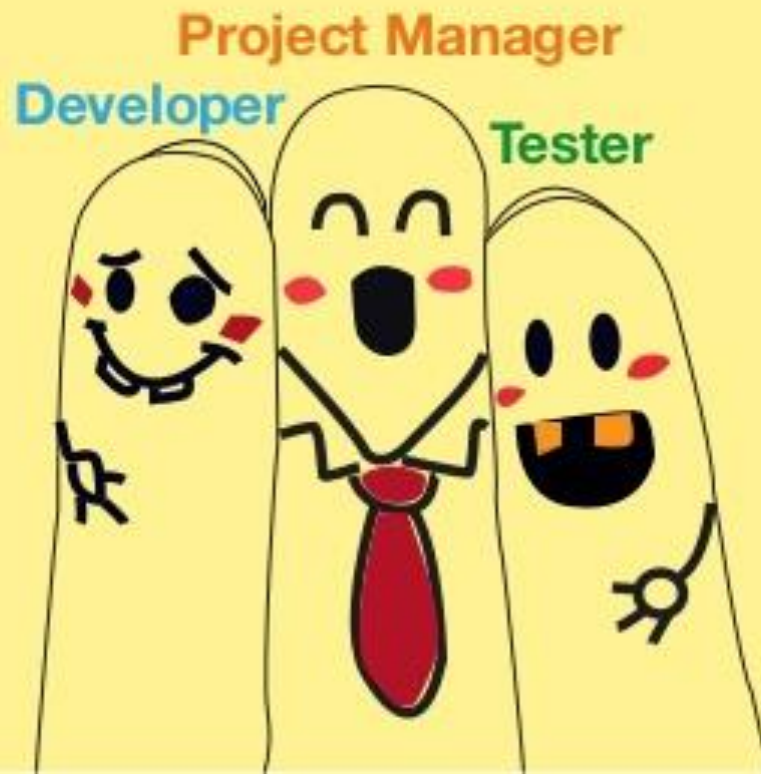
Testers Roles

- Find Bugs after unit testing
- Complete testing at different levels
 - Integration testing
 - System Testing
 - Acceptance testing (Business needs)
- Do all testing types
 - Functional Testing (Requirements)
 - Non Functional
 - Performance Testing
 - Security Testing...

ROLES AND RESPONSIBILITIES



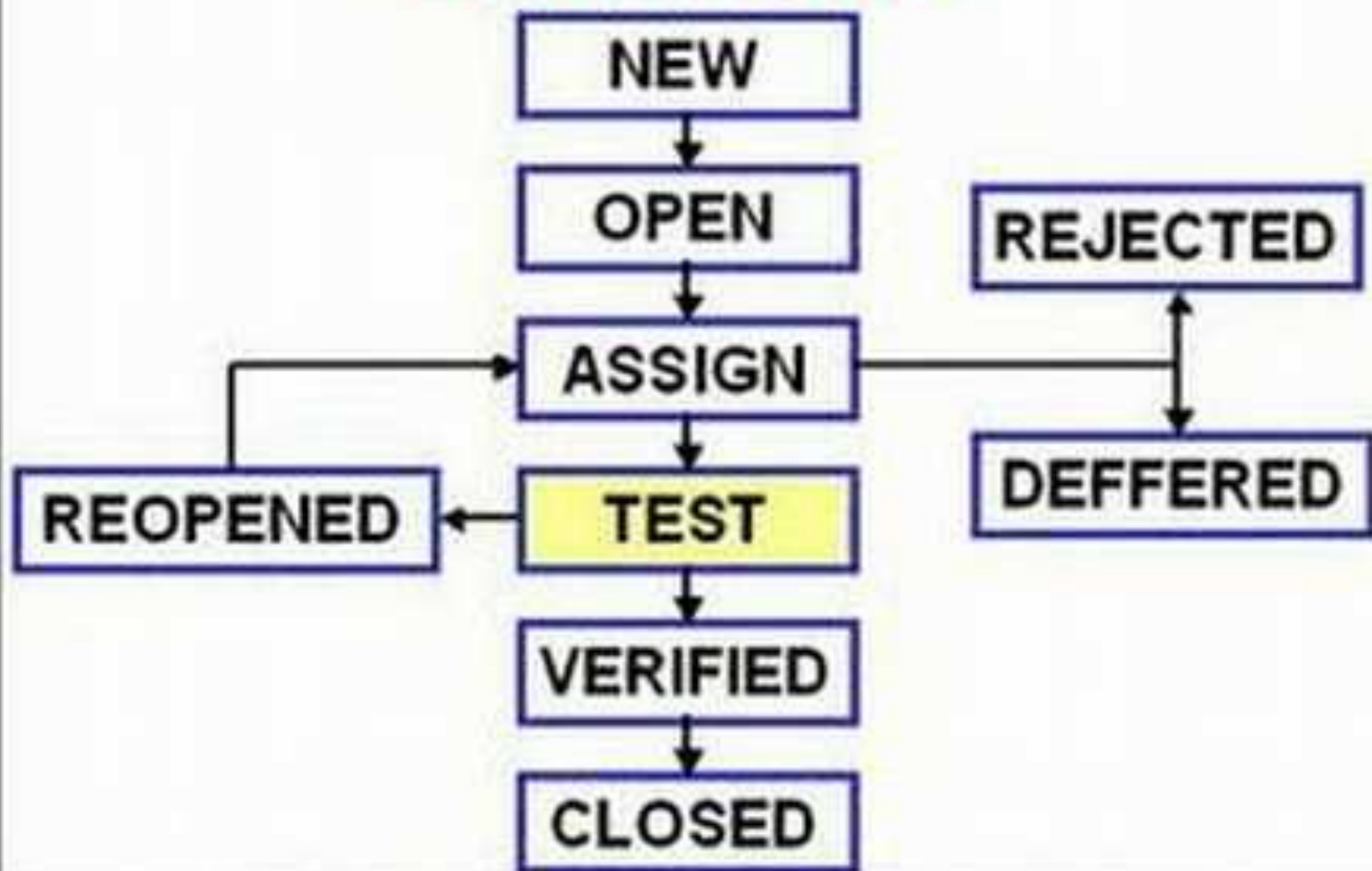
They were all very good friends.



Testing & Bugs

- Testing is all about find Bugs
- The earlier we find them
 - ...the lower will be the cost to fix them
 -the higher will be the quality of SW

Bug Life Cycle



Raise Bugs

How to raise bugs in 3 simple steps

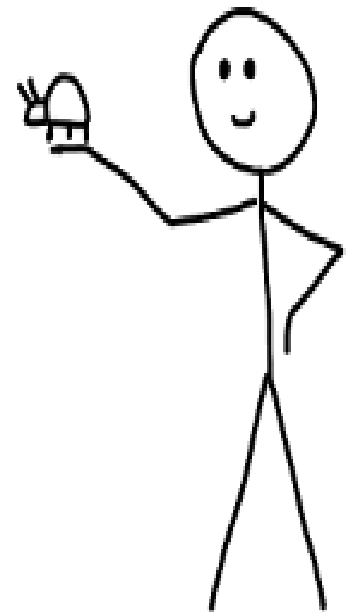
1 SPOT



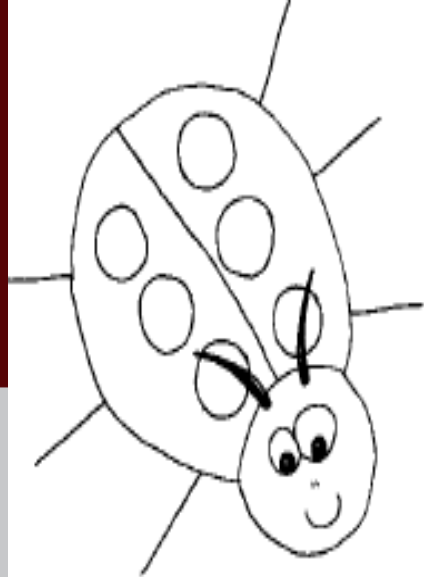
2 APPROACH



3 RAISE



AG



Bug Priority

- How important is it?
 - Urgent
 - Not Urgent

- Define Priority Scheme

- P1

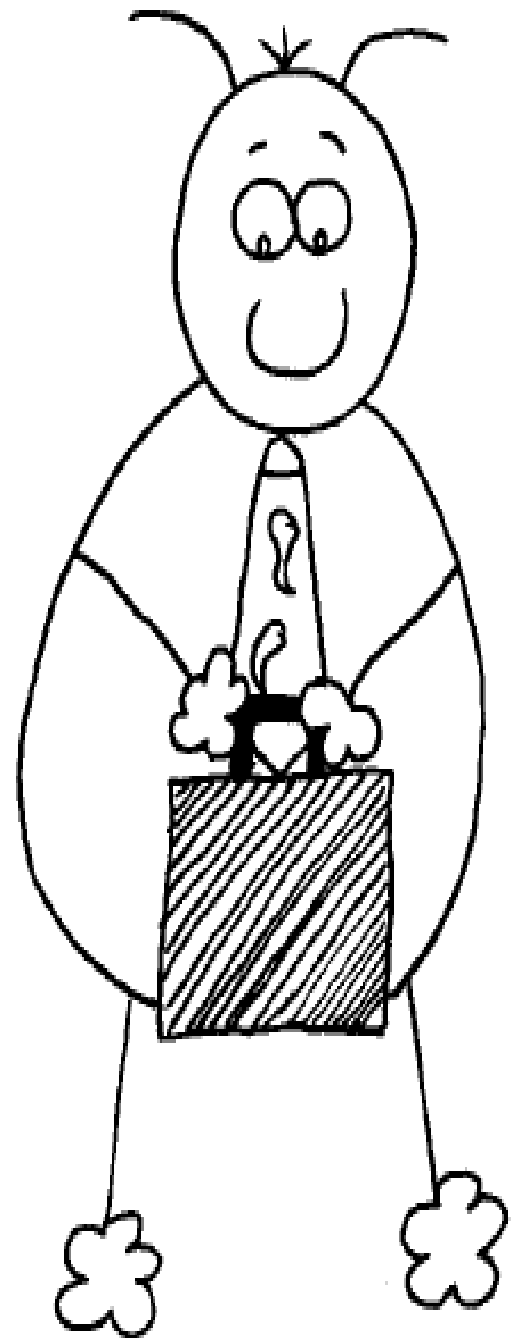
- _____

- P2

- _____

- P3

- _____

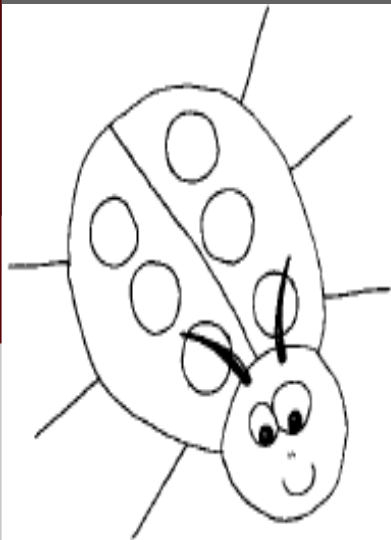


Priority

P1 - Fix it now

P2 - Fix it later

P3 - Don't fix it



Bug Severity

- How much damage it causes
 - severe
 - not severe

- Define Severity Scheme

- S1

-

- _____

- S2

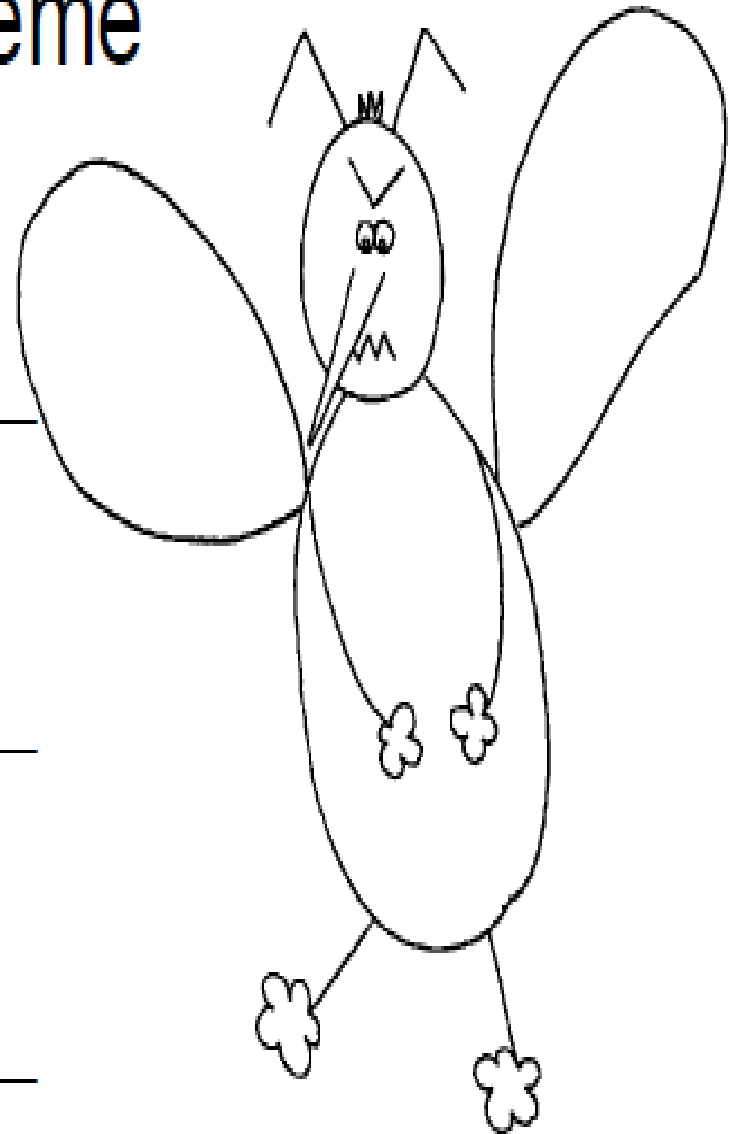
-

- _____

- S3

-

- _____



- Severity Scheme

- S1

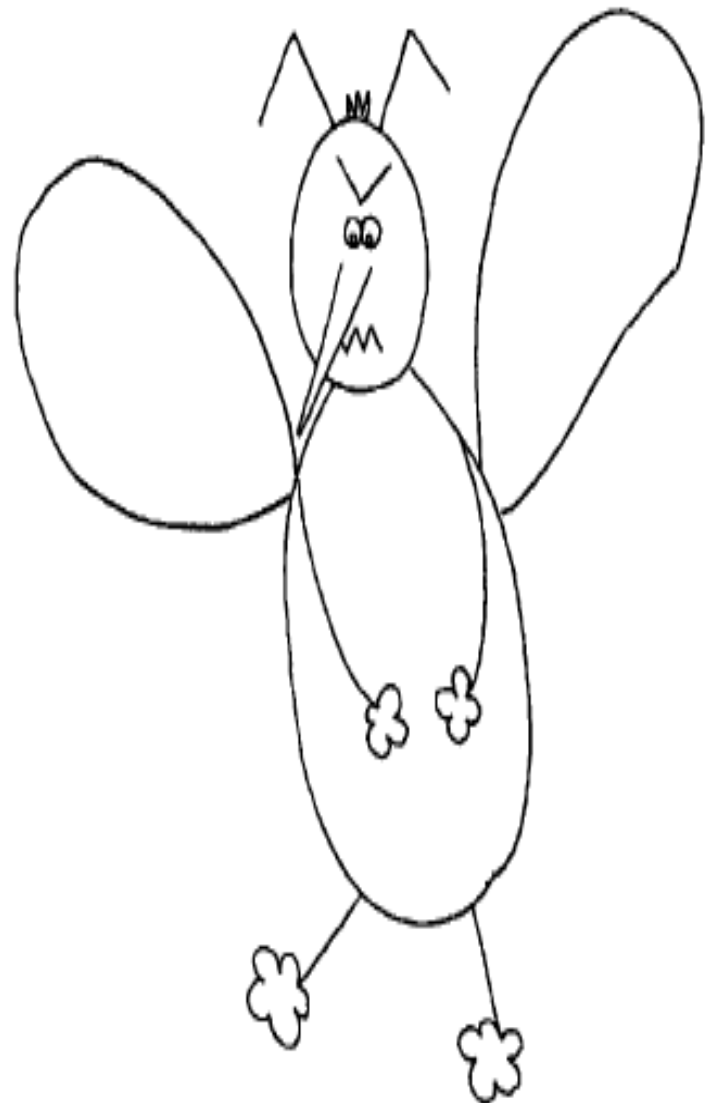
- Unusable no straight forward work around

- S2

- Work around possible

- S3

- Cosmetic

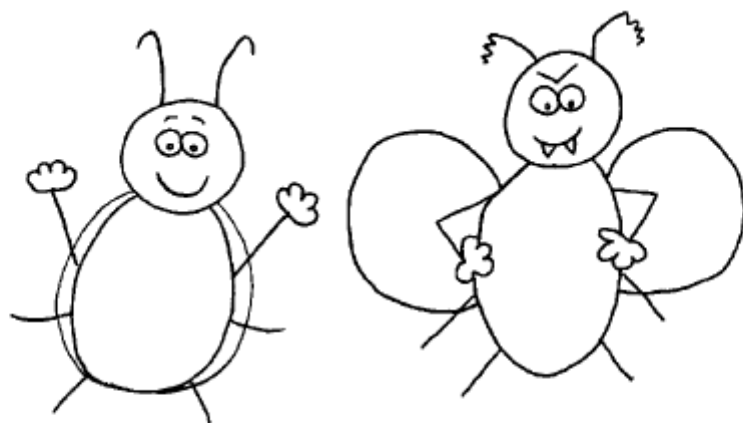


Severity

S1 - Show Stopper

S2 - Work around

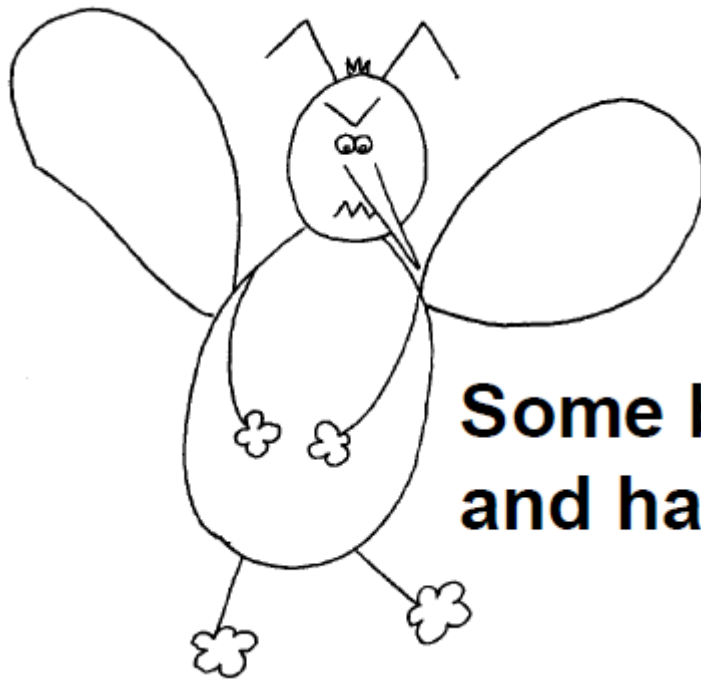
S3 - Cosmetic



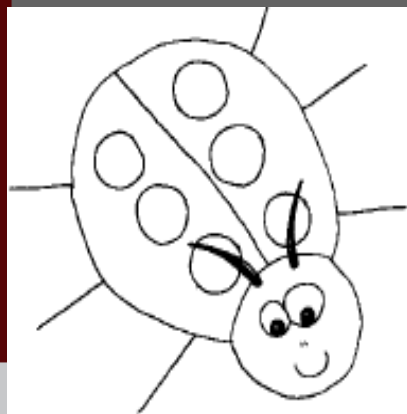
Bugs are not Good or Bad

**Some bugs are important
and have a high priority!**



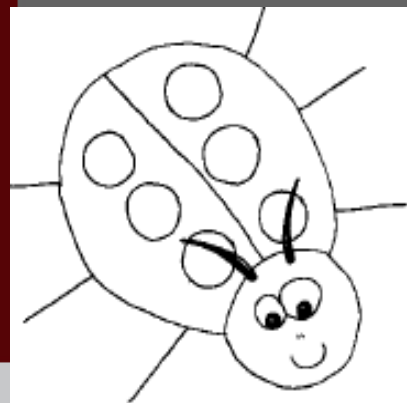


**Some bugs are dangerous
and have a high severity!**



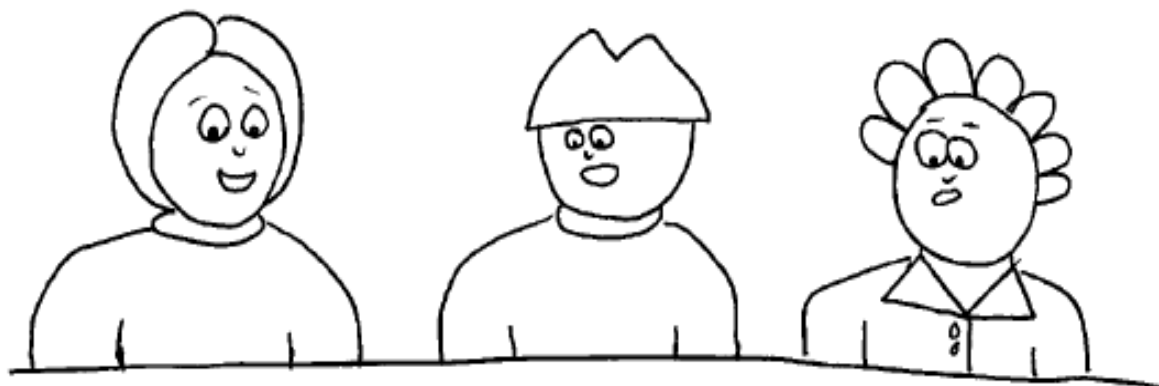
Bug Quadrants

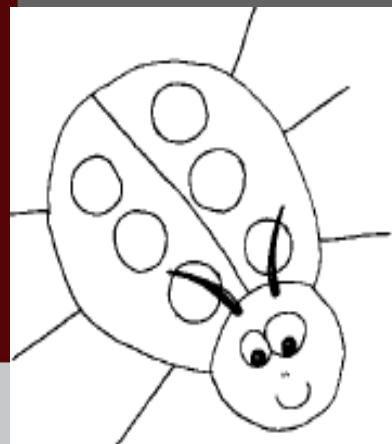
Urgent Severe	Urgent Not Severe
Not Urgent Severe	Not Urgent Not Severe



Finished?

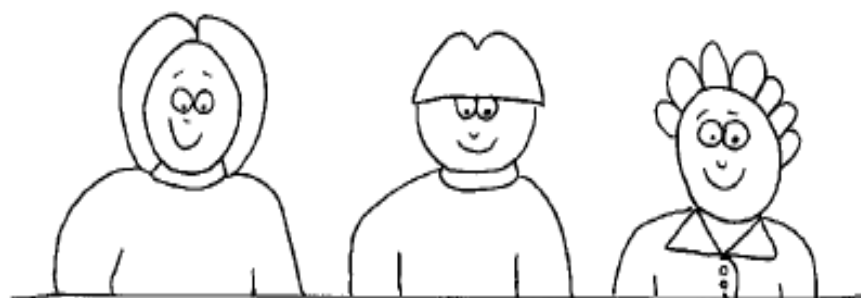
- How do you know you are finished?

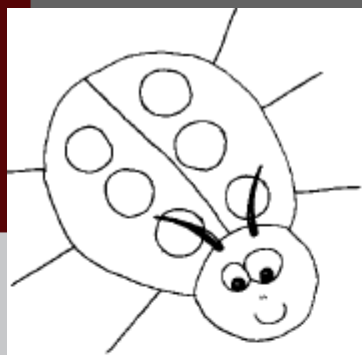




You know you are finished when ...

- ... the only bugs left are the ones that are acceptable (based on objective SQA input) ...

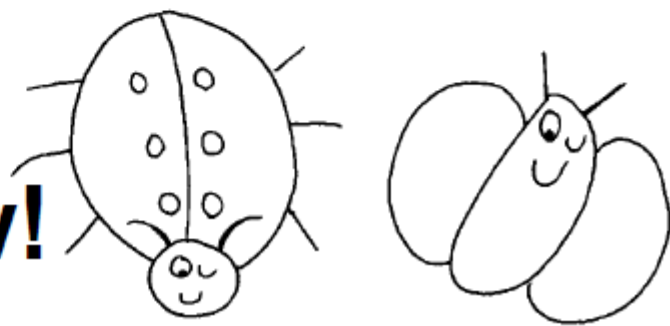




You know you are finished when ...

- ... the only bugs left are the ones that are acceptable (based on objective or was it subjective? input) ...

At least for now!



Bug Tracking Tool

Introduction to Mantis

View Issue - After Reporting Issue

Browser address bar: http://localhost/mantis/view_all_bug_page.php Google

mantis
bug tracking system

Logged in as: *kmwang* (reporter) 08-30-2006 17:27 CST Project: Mantis Tutorial

[Main](#) | [My View](#) | [View Issues](#) | [Report Issue](#) | [Change Log](#) | [Docs](#) | [My Account](#) | [Logout](#)

Reporter:	Monitored By:	Assigned To:	Category:	Severity:	Resolution:	Profile:
any	any	any	any	any	any	any
Status:	Hide Status:	Product Build:			Priority:	
any	closed (And Above)	any			any	
Show:	View Status:	Show Sticky Issues:	Changed(hrs):	Use Date Filters:	Relationships:	
50	any	Yes	6	No	any	
Sort by:	Last Update Descending					

[[Advanced Filters](#)]

Viewing Issues (1 - 1 / 1) [[Print Reports](#)] [[CSV Export](#)]

	P	ID	#	Category	Severity	Status	Updated	Summary
		0000001		Funcnional	minor	new	08-30-06	First Issue

new	feedback	acknowledged	confirmed	assigned	resolved	closed
---------------------	--------------------------	------------------------------	---------------------------	--------------------------	--------------------------	------------------------

Mantis 1.0.5[[^](#)]
Copyright © 2000 - 2006 Mantis Group
webmaster@example.com

mantis
bug tracking system

Issue Details

The screenshot shows the Mantis Bug Tracking System interface. At the top, the browser address bar displays `http://localhost/mantis/view.php?id=1`. The Mantis logo and "bug tracking system" tagline are visible. The user is logged in as "wanwan (developer)" on "08-30-2006 18:39 CST". The project is set to "All Projects". A navigation bar includes links for Main, My View, View Issues, Report Issue, Change Log, Docs, My Account, and Logout. The main content area is titled "Viewing Issue Simple Details" and includes links for Jump to Notes, Send a reminder, View Advanced, Issue History, and Print. A table displays issue details for ID 0000001, including Category, Severity, Reproducibility, Date Submitted, Last Update, Reporter, Assigned To, Priority, Status, Summary, Description, and Additional Information. At the bottom, there are buttons for Update Issue, Assign To (with a dropdown menu showing [Myself]), Change Status To (with a dropdown menu showing feedback), Monitor Issue, Create Clone, Move Issue, and Delete Issue.

mantis
bug tracking system

Logged in as: wanwan (developer) 08-30-2006 18:39 CST Project: All Projects Switch

Main | My View | View Issues | Report Issue | Change Log | Docs | My Account | Logout Jump

Viewing Issue Simple Details [Jump to Notes] [Send a reminder] [View Advanced] [Issue History] [Print]

ID	Category	Severity	Reproducibility	Date Submitted	Last Update
0000001	[Mantis Tutorial] Funcnional	minor	always	08-30-06 17:27	08-30-06 17:27
Reporter	kmwang	View Status	public		
Assigned To					
Priority	normal	Resolution	open		
Status	new				
Summary	0000001: First Issue				
Description	For demo only.				
Additional Information					
Attached Files					

Update Issue Assign To: [Myself] Change Status To: feedback Monitor Issue Create Clone Move Issue Delete Issue

Issue is Assigned

The screenshot shows the Mantis bug tracking system interface. The browser address bar displays `http://localhost/mantis/view.php?id=1`. The Mantis logo and "bug tracking system" text are visible. The user is logged in as "wanwan (developer)" on "08-30-2006 18:41 CST". The project is set to "All Projects". The navigation menu includes links for Main, My View, View Issues, Report Issue, Change Log, Docs, My Account, and Logout. A red arrow points to the "My View" link. The main content area shows "Viewing Issue Simple Details" for issue ID 0000001. The issue details table includes fields for ID, Category, Severity, Reproducibility, Date Submitted, Last Update, Reporter, Assigned To, Priority, Resolution, and Status. The "Assigned To" field is highlighted with a green box, showing "wanwan". The "Status" field is also highlighted with a green box, showing "assigned". The summary and description are provided at the bottom. The interface includes buttons for "Update Issue", "Assign To:", "Change Status To:", "Monitor Issue", "Create Clone", "Move Issue", and "Delete Issue".

mantis
bug tracking system

Logged in as: wanwan (developer) 08-30-2006 18:41 CST Project: All Projects Switch

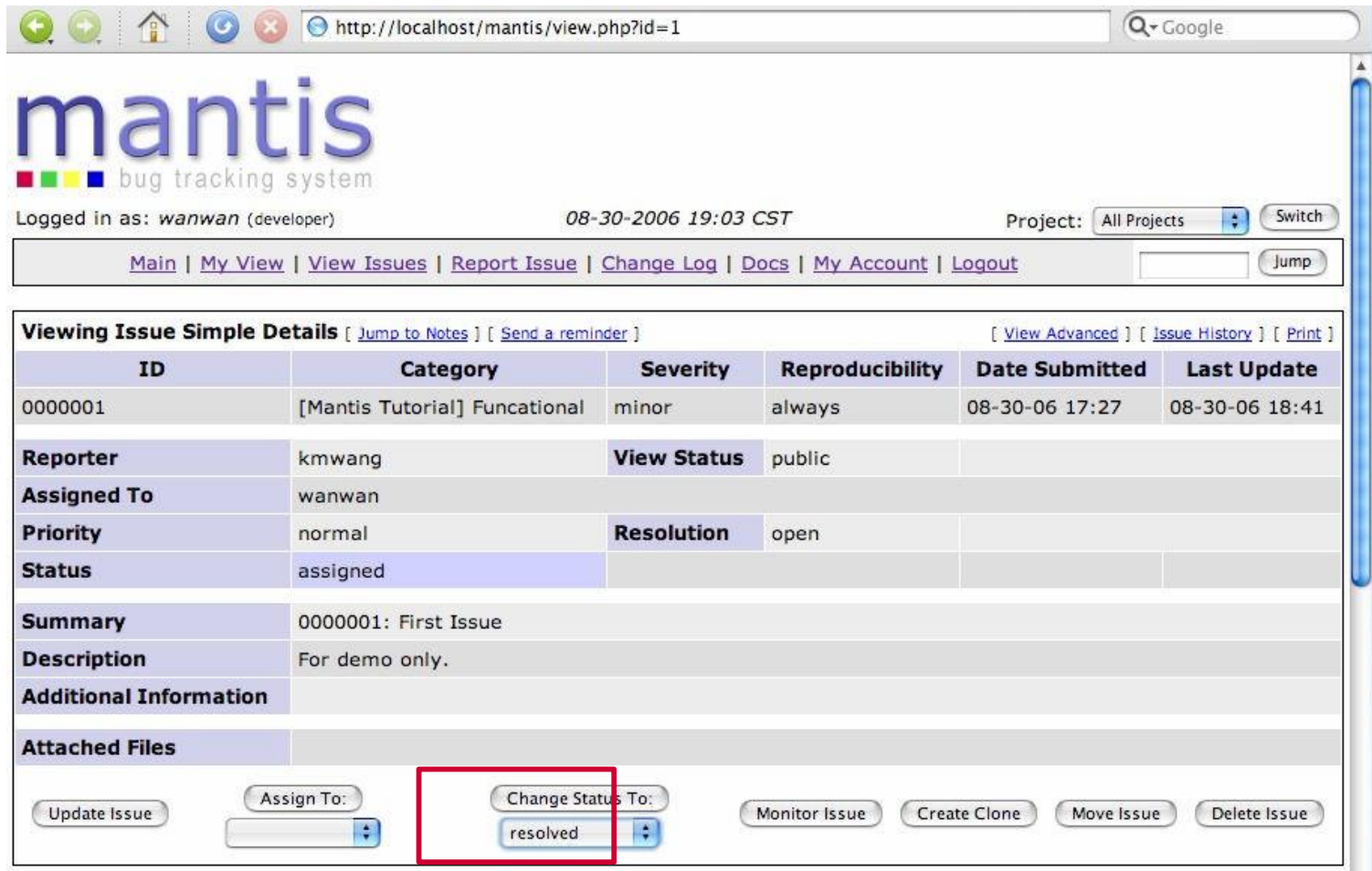
Main | My View | View Issues | Report Issue | Change Log | Docs | My Account | Logout

Viewing Issue Simple Details [Jump to Notes] [Send a reminder] [View Advanced] [Issue History] [Print]

ID	Category	Severity	Reproducibility	Date Submitted	Last Update
0000001	[Mantis Tutorial] Funcational	minor	always	08-30-06 17:27	08-30-06 18:41
Reporter	kmwang	View Status	public		
Assigned To	wanwan				
Priority	normal	Resolution	open		
Status	assigned				
Summary	0000001: First Issue				
Description	For demo only.				
Additional Information					
Attached Files					

Update Issue Assign To: Change Status To: Monitor Issue Create Clone Move Issue Delete Issue

Select New Status



The screenshot shows the Mantis bug tracking system interface. The browser address bar displays `http://localhost/mantis/view.php?id=1`. The Mantis logo and "bug tracking system" text are visible. The user is logged in as "wanwan (developer)" on "08-30-2006 19:03 CST". The project is set to "All Projects".

The main content area displays "Viewing Issue Simple Details" for issue ID 0000001. The issue details are as follows:

ID	Category	Severity	Reproducibility	Date Submitted	Last Update
0000001	[Mantis Tutorial] Funcnional	minor	always	08-30-06 17:27	08-30-06 18:41

Additional details for the issue:

Reporter	kmwang	View Status	public
Assigned To	wanwan		
Priority	normal	Resolution	open
Status	assigned		

The issue summary is "0000001: First Issue" and the description is "For demo only.".

The bottom section contains several action buttons: "Update Issue", "Assign To:", "Change Status To:", "Monitor Issue", "Create Clone", "Move Issue", and "Delete Issue". The "Change Status To:" dropdown menu is highlighted with a red box, showing the current status as "resolved".

Enter Note of Resolution

The screenshot shows the Mantis Bug Tracking System interface. The browser address bar displays `http://localhost/mantis/bug_change_status_page.php`. The page header includes the Mantis logo and the text "bug tracking system". The user is logged in as "wanwan (developer)" on "08-30-2006 19:20 CST". The project is set to "All Projects". The navigation bar contains links: [Main](#), [My View](#), [View Issues](#), [Report Issue](#), [Change Log](#), [Docs](#), [My Account](#), and [Logout](#). A search bar with a "Jump" button is also present.

The "Resolve Issue" form is displayed with the following fields:

- Resolution:** A dropdown menu with "fixed" selected.
- Duplicate ID:** An empty text input field.
- Add Note:** A text area containing the note "This bug has been fixed."
- View Status:** A checkbox labeled "private" which is currently unchecked.

A "Resolve Issue" button is located at the bottom of the form. Red arrows indicate the sequence of actions: selecting the resolution, adding a note, and clicking the resolve button.

Viewing Issue Simple Details

Issue be Resolved

Browser address bar: <http://localhost/mantis/view.php?id=1> Google

mantis

bug tracking system

Logged in as: *wanwan* (developer) 08-30-2006 19:28 CST Project: All Projects

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Viewing Issue Simple Details [[Jump to Notes](#)] [[View Advanced](#)] [[Issue History](#)] [[Print](#)]

ID	Category	Severity	Reproducibility	Date Submitted	Last Update
0000001	[Mantis Tutorial] Funcational	minor	always	08-30-06 17:27	08-30-06 19:28
Reporter	kmwang	View Status	public		
Assigned To	wanwan				
Priority	normal	Resolution	fixed		
Status	resolved				
Summary	0000001: First Issue				
Description	For demo only.				
Additional Information					
Attached Files					

My View After Resolving

← → 🏠 ↻ ✖ http://localhost/mantis/my_view_page.php 🔍 Google

mantis

bug tracking system

Logged in as: *wanwan* (developer) 08-30-2006 19:33 CST Project: All Projects

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new

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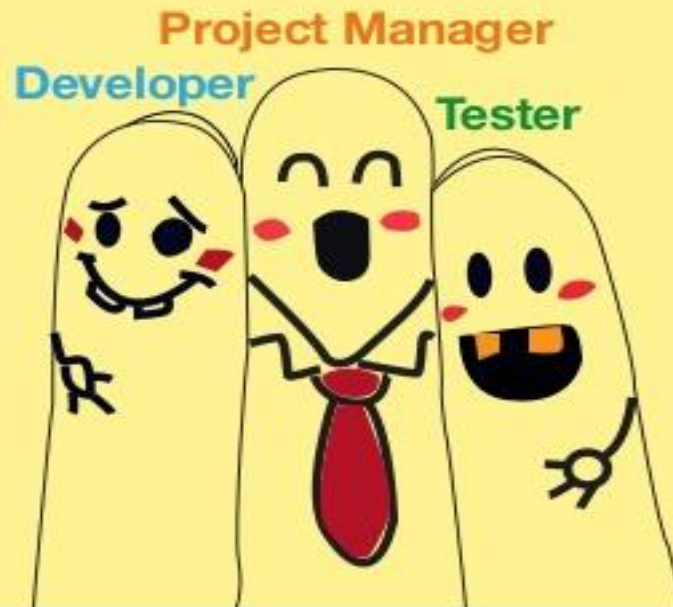
closed

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Testing Team are here for supporting you

They were all very good friends.



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Contacts

E-mail:-

amanyshousha@gmail.com

Linked in:-

<https://www.linkedin.com/in/amanyshousha/>

**Mostly, its been about
helping others ...
Thank You**

[illegible]