

Review

- What are build tools?
 - What do they do?
- What are examples of build tools?
 - How do they work?
- What are the tradeoffs of continuous integration?

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Developer Collaboration Challenges

- What are challenges when you're working in teams (for development and otherwise)?

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Developer Collaboration Challenges

- Poor communication
- Unclear goals/priorities/next steps
- Lack of participation
- Inability to resolve conflicts

Software tools can help with some of these.

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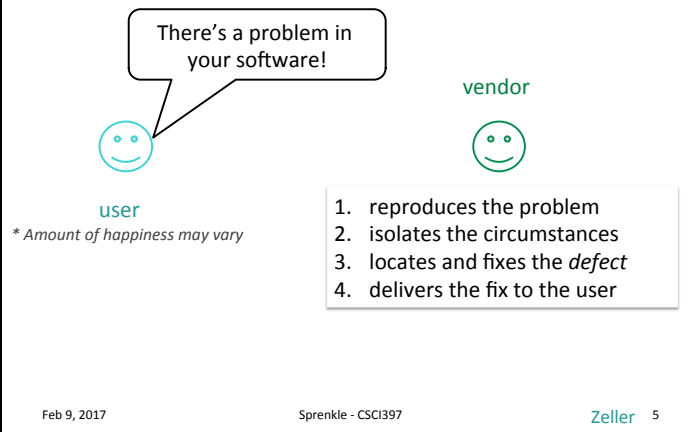
TRACKING PROBLEMS

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Problem Life Cycle



What's a Problem?

- A *problem* is a questionable property of a program run
 - It becomes a *failure* if it's incorrect...
 - ...a *request* for enhancement if missing...
 - ... and a *feature* if normal behavior

It's not a bug, it's a feature!

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Challenges

- How do I organize the life cycle?
- Which problems are currently *open*?
 - Haven't been diagnosed, fixed
- Which are the most severe problems?
- Did similar problems occur in the past?

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Problem Report

- A problem comes to life with a *problem report*
- Includes all information vendor needs to fix problem
- Also known as *change request* or *bug report*

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Example Problem Report

```
From: me@dot.com
To: you@there.org
Subject: Crash
Your program crashed.
(core dumped)
```

- Core dump: recorded state of the working memory of a computer program at a specific time, generally when the program has terminated abnormally (crashed)
- Email content similar to students' emails to me when they want to know why something went wrong in their program


What does the report tell you?

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Example Problem Report #2


```
From: me@dot.com
To: you@there.org
Subject: Re: Crash
Sorry, here's the core
 <core, 14MB>
```

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Example Problem Report #3

```
From: me@dot.com
To: you@there.org
Subject: Re: Crash
You may need this too,
just in case
 <data, 148GB>
```


- What's the problem with these problem reports?

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Example Problem Report #3

```
From: me@dot.com
To: you@there.org
Subject: Re: Crash
You may need this too,
just in case
 <data, 148GB>
```

- What's the problem with the problem reports?
 - Limited information about what the problem is, what caused it
 - Information is scattered across 3 emails

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What To Report

- The product release
- The operating environment
- The problem history
- A one-line summary
- Expected and experienced behavior

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Product Release

- Typically, some *version number* or otherwise unique identifier
 - Required to reproduce the problem
- Perfect Publishing Program 1.1 (Build 7E47)
- Generalize: Does the problem occur only in this release?

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Operating Environment

- Typically, *version information* about the operating system
- Can be simple (“Windows 10”) or complex (“Ubuntu Linux 16.04.1LTS with the following packages...”)
- Generalize: In which environments does the problem occur?

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Problem History

- Steps needed to *reproduce* the problem
 1. Create “bug.ppp”
 2. Print on the default printer...
- If the problem cannot be reproduced, it is unlikely to be fixed
- Simplify: Which steps are relevant?

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Expected Behavior

- What should have happened according to the user:

The program should have printed the document.

- Reality check: What is the understanding of the user?

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Observed Behavior

- The *symptoms* of the problem — in contrast to the expected behavior

```
The program crashed with the following information:  
*** STACK DUMP OF CRASH (LemonyOS)  
  
Back chain  ISA  Caller  
00000000  SPC  0BA8E574  
03EADF80   SPC  0B742428  
03EADF30   SPC  0B50FDDC  PrintThePage+072FC  
SnicketPC unmapped memory exception at  
0B512BD0 PrintThePage+05F50
```

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A One-Line Summary

- Captures the essence of the problem

PPP 1.1 crashes when printing

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If we're developing a large software application, as good as we may be, we're going to have bugs...

A lot of them....

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Managing Problems

- Alternative #1: *A Problem File*
 - Only one person at a time can work on it
 - History of earlier (fixed) problems is lost
 - *Does not scale*
- Alternative #2: *A Problem Database*
 - Examples: Bugzilla, JIRA

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Classifying Problems

- Severity
- Priority
- Identifier
- Comments
- Notification

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Problem Severity

- **Enhancement.** A desired feature
- **Trivial.** Cosmetic problem
- **Minor.** Problem with easy workaround
- **Normal.** “Standard” problem
- **Major.** Major loss of function
- **Critical.** Crashes, loss of data or memory
- **Showstopper.** Blocks development

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Priority

- Every new problem is assigned a *priority*
- The higher the priority, the sooner the problem will be addressed
- Priority is *independent* from severity
- Prioritizing problems is the main tool to control development and problem solving

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Identity

- Every new problem is assigned an *identifier*
 - Also known as PR—problem report—number or bug number
- The identifier is referenced in all documents during the debugging process

Subject: PR #3427 is fixed?

- Included in your commit comments

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Comments

- A developer can attach *comments* to a problem:

I have a patch for this. It's just an uninitialized variable, but I still need a review.

- Comments may also include files, documents, etc.

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Notification

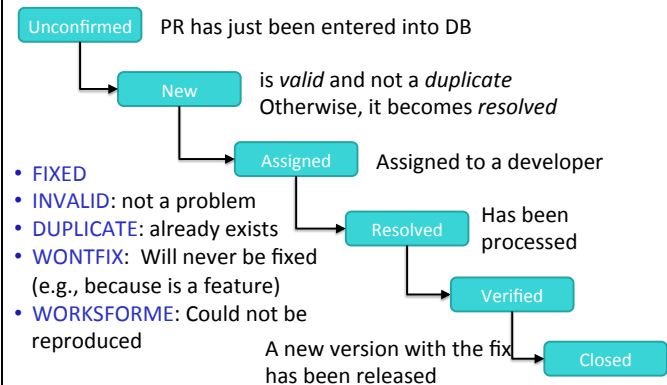
- Developers and users can attach an e-mail address to a problem report
- They will be notified every time the report changes

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Simplified Problem Lifecycle



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Management

- Who enters problem reports?
- Who classifies problem reports?
- Who sets priorities?
- Who takes care of the problem?
- Who closes issues?

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Summary

- Reports about problems encountered in the field are stored in a *problem database*
- A problem report must contain everything relevant to reproduce the problem
- It is helpful to set up a standard set of items that users must provide (product release, operating environment...)

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Problem Reports Summary

- An effective problem report...
 - is well-structured
 - is reproducible
 - has a descriptive one-line summary
 - is as simple and general as possible
 - is neutral and stays with the facts

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Summary

- A typical problem life cycle starts with an *unconfirmed* status
- It ends with a *closed* status and a specific resolution (such as fixed or workforme)

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ISSUE TRACKING TOOLS

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Issue Tracking Tools

- Bugzilla
 - <https://bugzilla.mozilla.org/>
- JIRA
 - <https://bugs.mojang.com/browse/MC>
- TRAC (+ wiki)
 - <https://trac.filezilla-project.org/>
- <https://developers.facebook.com/bugs/>

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Evaluating Issue Trackers

- What are the common tasks?
 - How easy is it to perform each task in the tool?
 - Which tool does it best?
- How does the implementation map to the theory presented earlier?
- Compare and contrast the tools
- Summarize: which tool would you recommend under given circumstances?

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JIRA

<http://csjira.wlu.edu>

- Collaboration tool
- Issue Tracking Tool
 - One of few proprietary tools we'll use

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