Maintaining Large Software

Welcome to the real world

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StorProg 2010

whoami

- Erwan Lemonnier - erwan@cpan.org
  - 8 years as a free software developer for CPAN
  - 3 years in an IT-security startup,
    100 000 lc, 3-7 developers
  - 5 years at Premiepensionsmyndigheten,
    500 000 lc, 5-20 developers
  - >1 year at Glue Finance AB,
    130 000 lc, 3-6 developers

Topic

In practice, being a developer usually means maintaining code, together with many other developers.

This requires specific tools and skills

Today's menu

- Software development in the real world
- The tools of the trade
  - Development process
  - Bug Tracker
  - Version Control
  - Documentation
  - (coding)
  - Code review
  - Testing

The real-world

The real-world

- Most software positions are maintenance positions
- Typically:
  - You become responsible for a load of code written by someone else
  - You have to fix bugs, implement new features
  - Without breaking anything
  - While coordinating with other developers

An example: Pluto

An example: Pluto

- The core system of the Swedish Premiepension
- Holds one saving account per person
- Performs all fund transactions (buy/sell/switch/dividend/merge/split...)
- Implements the mathematical insurance model
- Manages pension payments
- Etc...

Pluto in numbers (2009)

- 320 000 lines of Perl code (.pl, .pm, .t)
- 68 000 lines of SQL script
- 27 000 lines of shell script
- 26 000 lines of HTML (Mason)
- 230 database tables
- Largest table has 500 000 000 entries
- 750 gigabytes of data in an Oracle database
- Managing 250 000 000 000 SEK (23 billion euros)
- 5.5 million users
- Up to 30 developers over 7 years

Pluto's challenges

- Huge volumes of data
- No bugs allowed
  - A bug triggered by 1 person in a million will occur 5 times!
- High availability: running 24/7
- Tight development deadlines
- Politicians!

Pluto's design: programs

- A batch system
- Many (>100) small programs doing simple things
- Perl programs wrapped in shell scripts
- Simple interfaces between them:
  - Inbox model
  - Database tables
  - A daily run schedule

Pluto's design: database

- Always add, never remove
- The database schema evolves in small steps (migrations)
- Keep a history log of every change
- Trace back every change to a program

Pluto's surroundings

- APIs towards other systems
- A large set of reporting/data mining tools
- Some administrator interfaces (web based)
- Etc...

Your mission is…

- So you start at Pensionsmyndigheten
- You are in charge of Pluto, together with 5 others
- Your first task: “The government has voted a new law. Pluto must support a new kind of funds: a generation fund.”
- Go ahead!

Problems:

- Understand the change specifications
- Understand Pluto
- Translate the specs into actual code changes
- Plan work for the team
- Code/Test
- Meet deadlines
- Don't break anything!

O NO WTF!

Let's give it a try

What would you do?

Strategy:

- Step 1: get the code
- Step 2: run the tests
- Step 3: read the doc
- Step 4: (the difficult part)
  - Hack some code
  - Test it
  - Get it reviewed
  - Commit (goto step 4 until done)

Wait wait wait...

We just defined a development process!

wikipedia:

“A software development process is a structure imposed on the development of a software product”

examples:
waterfall, spiral model, agile development...

Development process

- There are many possible ones
- It is a crucial part of any project!
- Not always explicit
- It usually has flaws
- It is not always followed...
- A social challenge as much as a technical one

Example: Pluto

- Pluto's development process:
  - Pilot study
  - Project planning
  - Change and test specifications
  - Coding
  - Testing
  - Live tests
  - Deployment

Development process

So learn your project's development process and its tools before you start messing around :-)

Or agree on one with your team...

mmmm...

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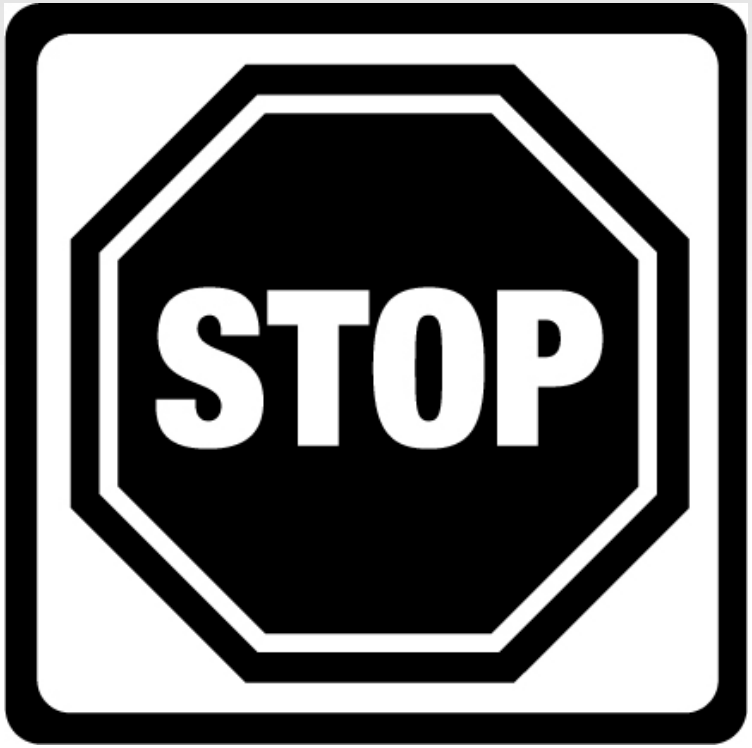
Wait!!!



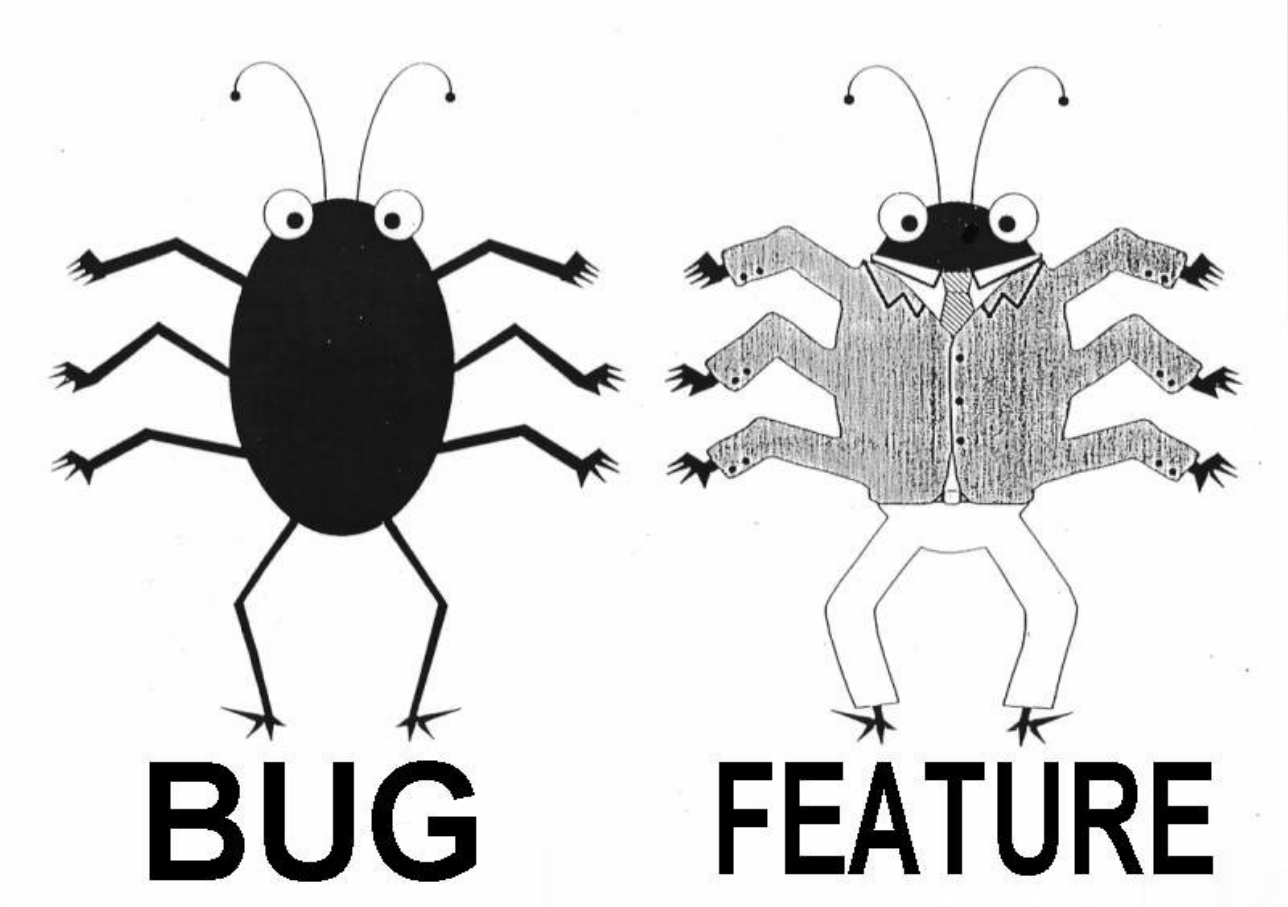
Wait!!

We are not writing a system from scratch.

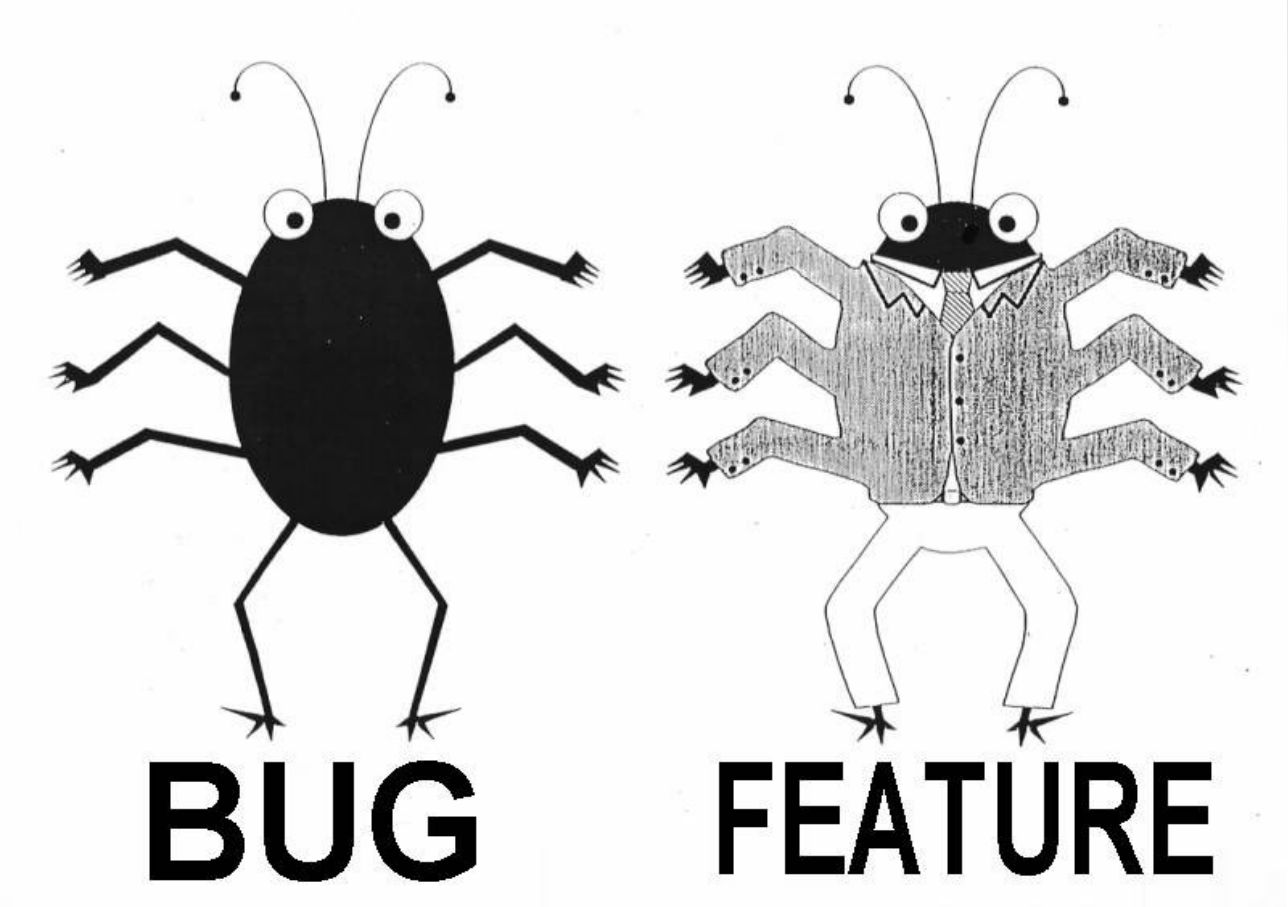
We are modifying an already existing one.

So before even getting the code, we need to keep track of the functionality change at a project level.

Bug Tracking System



Who has used one?



Bug/Ticket/Feature tracker

- RT, bugzilla, redmine, trac, github...
- Usually have:
  - bug/feature/issue list
  - comments/attachments/links
  - Each ticket moves between states
    - (hence enforcing a development process)

Edit

Bookmarked Tickets

Edit

10 highest priority tickets I own

Edit

#	Subject	Priority	Queue	Status
36912	Missing test plan error in latest Hook::Filter	0	Hook-Filter	open

Bugs in My Distributions

Edit

#	Subject Queue	Severity Priority	Last Updated By Owner	Last Updated Created
19785	IO::Handle error in t/lib//MockDB/DBI.pm Class-DBI-AutoIncrement	 0	DAVIDRW Nobody	4 years ago 4 years ago
36912	Missing test plan error in latest Hook::Filter Hook-Filter	 0	david@davidfavor.com ERWAN	2 years ago 2 years ago
35865	Test::More broke Hook::Filter Hook-Filter	Normal 0	ANDK Nobody	2 years ago 2 years ago
49623	Finance::Math::IRR differ from Excel's XIRR Finance-Math-IRR	 0	kcheung@adamsstreetpartners.com Nobody	12 months ago 12 months ago
41108	tough to trap errors in taint mode IPC-Open3-Simple	Normal 0	MARKLE Nobody	2 years ago 2 years ago
19788	backwards compatible tests Class-DBI-AutoIncrement	 0	DAVIDRW Nobody	4 years ago 4 years ago

10 newest unowned tickets

Edit

Quick ticket creation

Subject:

Queue: Owner: ERWAN

Requestors: erwan@cpan.org

Content:

Create

Quick search

Edit

Queue	new	open	stalled
Class-DBI-AutoIncrement	2	0	0
DBIx-QueryByName	0	0	0
Finance-Math-IRR	1	0	0
Finance-SE-PPM	0	0	0
Hook-Filter	1	1	0
IPC-Open3-Simple	1	0	0
Jifty-DBI-Record-AutoIncremented	0	0	0
later	0	0	0
Log-Localized	0	0	0
Math-Polynom	0	0	0
Python-Decorator	0	0	0
Sub-Contract	0	0	0
XML-IDMEF	0	0	0

Refresh

Don't refresh this page.

Go!

Back to Pluto

- In Pluto's case:
- We register a new ticket: “implement law XYZ”
- The ticket will go through states mirroring the development process:
    - Pilot study
    - Project planning
    - Change and test specifications
    - Coding
    - Testing
    - Live tests
    - Deployment

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Getting the code...

Meet the VCS

Survey

Who has used one?

Which one?

The VCS jungle

- cvs, svn, svk, git, darcs, mercurial, bitkeeper
- Different workflows:
  - central repository vs distributed
  - atomic commits vs not
  - branches or not
  - different merge algorithms
  - etc.

Example: checking out

```
# cvs
cvs -d :pserver:bob@dev.bleh.com:/cvs login
cvs checkout bigbrother

# svn
svn co –username=bob https://dev.bleh.com/svn

# git
git clone git://perl5.git.perl.org/perl.git
```

Example: commit

```
# cvs/svn
(cvs|svn) commit file1 file2 dir1


# git
git fetch dev
git merge master..dev/master
git add file1 file2 dir1
git commit
git push ssh://bob@perl5.git.perl.org/perl.git
master:master
```

VCS in practice

- You will use an editor with vcs support (eclipse, emacs, textmate...)
- Your project will use only a subset of the vcs features
- The VCS might be integrated with:
  - bug/ticket tracker
  - continuous integration server

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The art of testing

Survey

Who has run automated tests?

Who has written some?

Why regression testing?

- Manual testing is almost worthless
  - Time consuming
  - Error prone
  - Depend on knowledge transfer
- Maintaining software without regression tests is like skydiving without a parachute
- Regression testing an art is,
  Mastering it you MUST!

Regression testing

- Many frameworks for testing
  - unitests
  - TAP
- Usually language specific
- Many levels of testing
- If you inherit a project without tests, write some before you change anything!

Example: perl

```
erwan@foo:~/perl-5.8.9$ ./Configure
(...)
erwan@foo:~/perl-5.8.9$ make
(...)
erwan@foo:~/perl-5.8.9$ make test
(...)
t/pod/plainer.....................................ok
t/pod/pod2usage...................................ok
t/pod/pod2usage2..................................ok
t/pod/poderrs.....................................ok
t/pod/podselect...................................ok
t/pod/special_seqs................................ok
t/pod/twice.......................................ok
t/x2p/s2p.........................................ok
All tests successful.
u=1.33  s=2.49  cu=149.17  cs=42.89  scripts=1106
tests=133451
```

Semi test-driven development

- Develop code in small steps
- So the code can run at every step
- Run it within a test file
- Add new tests to validate its behavior
- Run the whole test suite to see nothing got broken

=> You know at every step that your code runs and is correct!

Advanced regression testing

- Continuous Integration:
  - Build/test continuously
  - Or after each commit
  - Fast and targeted feedback!
- Test coverage

mmmm...

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Documentation

“Real programmers don't comment their code. If it was hard to write, it should be hard to understand and harder to modify.” *anonymous*

Documentation

- Is there a documentation?
- What kind?
  - Inline in the code?
  - API specs?
  - Software design (high level)?
  - End-user manual?
  - Wiki? Mail archive? Forum?
- Each has a different target
- Each is important!

Real world documentation

- Documentation is often a rush work at the end of the project
- The documentation is seldom maintained and becomes outdated

What would you do?

Real world documentation

- Talk to the other developers:
  - In the flesh
  - IRC/mailing lists
- Read changelogs (file, vcs log, bug tracker)
- Read the source
- Start a wiki

Maintaining documentation

- Problems:
  - Keep doc and code synchronized
  - Documentation coverage
- Solutions:
  - Auto-generate some doc
  - Regression tests for doc coverage
  - Make it part of the development process

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Before coding...

Respect the project's structure

- Directory structure
- File naming conventions
- README?
- Changelog?
- Commit messages

Example: a perl module

```
$ cd ~/projects/MyNewModule
$ find *
Changes
lib
lib/My/New/Module.pm
Makefile.PL
MANIFEST
t
t/fork.t
t/pod.t
t/pod-coverage.t
t/query.t
```

Respect the code standard

- Might not be explicit
- If none, create one

Talk to the gurus

- Always discuss your changes with the experienced developers
- This will save 80% of your time

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Coding aaahhhhh :-)

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Code Review

Do Not Be Afraid.

Code Review

- Ask for it
- Ask a guru
- You will learn A LOT!
- Review others code too
- Creates the social fabric of a dev team

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So...

Now, what did we forget?

Today's menu

- Software development in the real world
- The tools of the trade
  - Development process
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  - Version Control
  - Documentation
  - (coding)
  - Code review
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Questions?

Thank you!

Glue Finance has work for you!