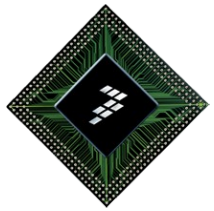
October 9, 2007

Best Collaboration Practices Using Git

How to improve your odds with Open Source



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Outline

- Improve Your Odds
  - Betting Against The House
  - Partner With The House
- Playing The Game
  - Open Source Philosophy
  - The New Three R's
- Aces
- Aces and Eights
- Q & A

Outline: Improving Your Odds

- The Players
- Betting Against The House
  - Kernel Source Code Statistics
  - Traditional Development Model
  - Traditional Development Meets Open Source
  - When Betting Schemes Fail
- Partner With The House
  - Odds In Your Favor

The Players

- The Community
  - Individual Developers
  - Corporations
  - Anyone who participates!
- Not (necessarily) the nerdy kid down the street
- Highly skilled professionals

Betting Against The House

- Fundamentally, The Community does not care if your code is accepted into mainline or not.
- “The code is not ready for public consumption yet!”
  - It is lousy
  - It hasn't been announced yet
- Ignore community feedback...

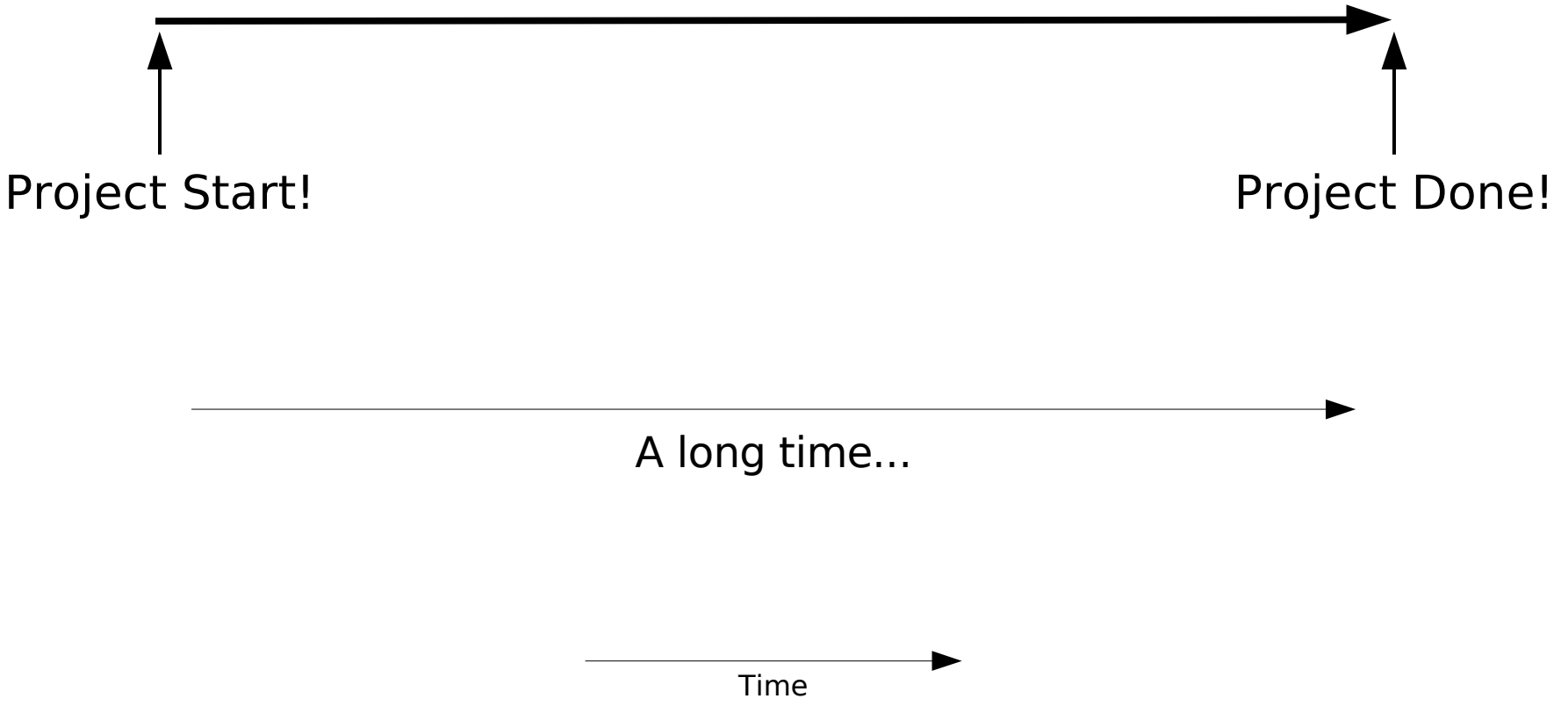
Kernel Statistics

- Rate of change in code base is high
- Number of developers involved is high

- Source: `http://tree.celinuxforum.org/gitstat`

Kernel Release	Number of Developers	Commits per hour	Commits per day	Release Duration Days
2.6.19	836	3.8	91	71
2.6.20	692	3.1	75	67
2.6.21	847	2.9	72	81
2.6.22	883	3.7	89	74
2.6.23				

Traditional Development Model



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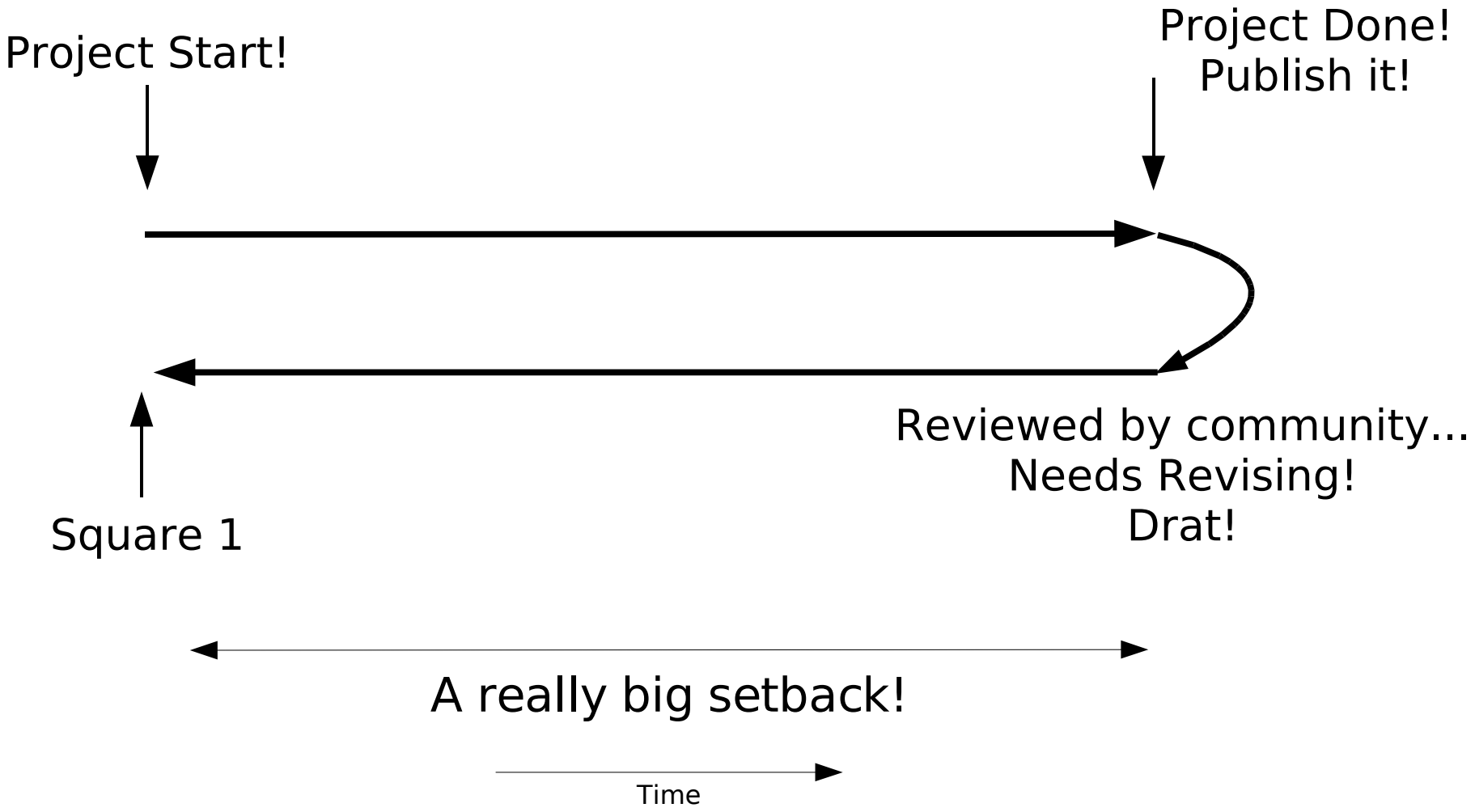
Traditional Development Meets Open Source



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When Betting Schemes Fail

- Hazards: The odds are against you
  - Rate of *other* patch acceptance into kernel!
  - Large merges are problematic
  - Large patches won't be properly reviewed, or accepted
  - Prone to problems that get left unresolved
  - Patches will accumulate over time; never catch up
  - Holding patches creates more, harder, long-term work
  - Likely to do the same work again in the future

Vested Interest

- The House has a large backing bank behind it
  - Lots of developers
  - Lots of momentum
  - Lots of staying power
- Corporations have a lot of clout
  - Likely, it is their hardware
  - Or supply Software Development resources
  - Have real money!
- Summary:
  - We all have a large Vested Interest here

Partner With The House

- Let the System work for you!
  - Exploit The Community and individual developers!
  - Leverage the work of others
  - Avoid duplicating the work of others
  - Different perspectives; better ideas survive long term
  - Accept external expertise
  - Keep up to date!
- But help too!
  - Offer your expertise
  - Sanity check ideas prior to major development
  - Better code, fewer initial bugs

Odds In Your Favor

- Sense of (joint) ownership
- Distributed Responsibility
- Common understanding and direction from the start
- The sooner your changes get accepted ...
  - ...the sooner you can forget about them!
- Your changes become the accepted basis
- Enable help from others

Outline: How The Game Is Played

- Open Source Philosophy
- The Kernel Release Cycle
- The Patch Cycle
  - Collaborate _prior_ to publishing!
  - What goes into a patch?
  - Reviews
  - Typical review feedback
  - The New Threes R's

Some Open Source Philosophy

- Anyone with interest can contribute
  - Add a feature, identify a bug, fix a bug, etc
- Publish early, Publish often
- If you want it, why not contribute it?
- Give-and-take, work with The Community
- Hierarchy of sub-system Maintainers

Repository Conventions

- “What repository should I start with?”
- “Local” versus “global” repositories
  - Developer versus published in upstream
- Once “published” it is carved in stone
- It is just convention that a repository is authoritative

Why Develop at Top-of-Tree?

- Target future releases
- Easier to rebase development incrementally
- Maintainers always request patches that apply to ToT
- Upstream maintainers apply patches at ToT
- Reviewers likely to reject patches for old releases
- Certain not to duplicate existing work

Keep Current at Top-of-Tree

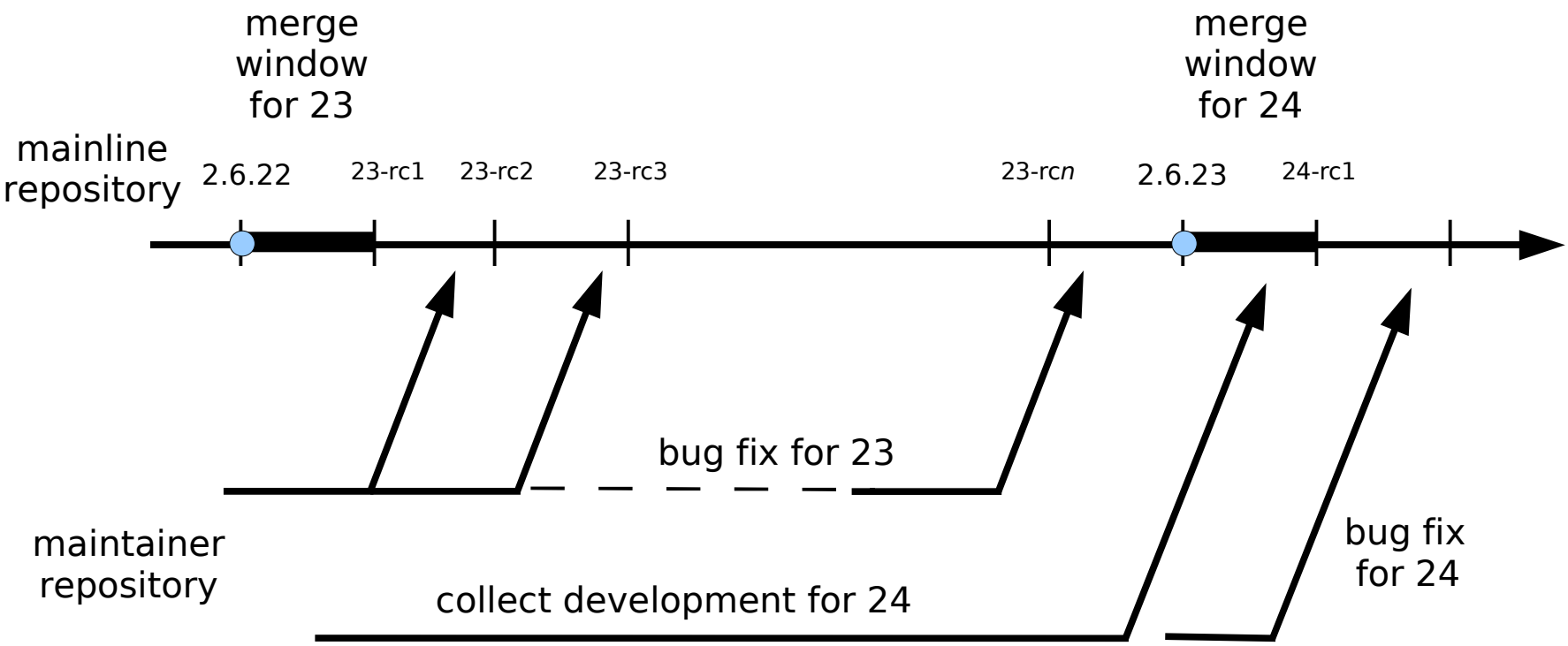
- Git makes it easy to keep up-to-date with ToT
  - `git fetch, git pull`
- Slight variations on “ToT” due to different repositories
  - Use the one appropriate for your development
  - Git supports using more than one if needed
- Development branches can easily be refactored to ToT

The Kernel Release Cycle

- Point release tagged and shipped
- Two week merge window opens
  - Sub-system maintainers push staged patches upstream
- Arbitrary number of Release Candidates
  - Convention: Whim of some trusted person
  - Bug fixes and stabilization
  - Sub-system Maintainers stage next release patches

- Sub-system staged patches accumulate at any time!

Kernel Release Timeline



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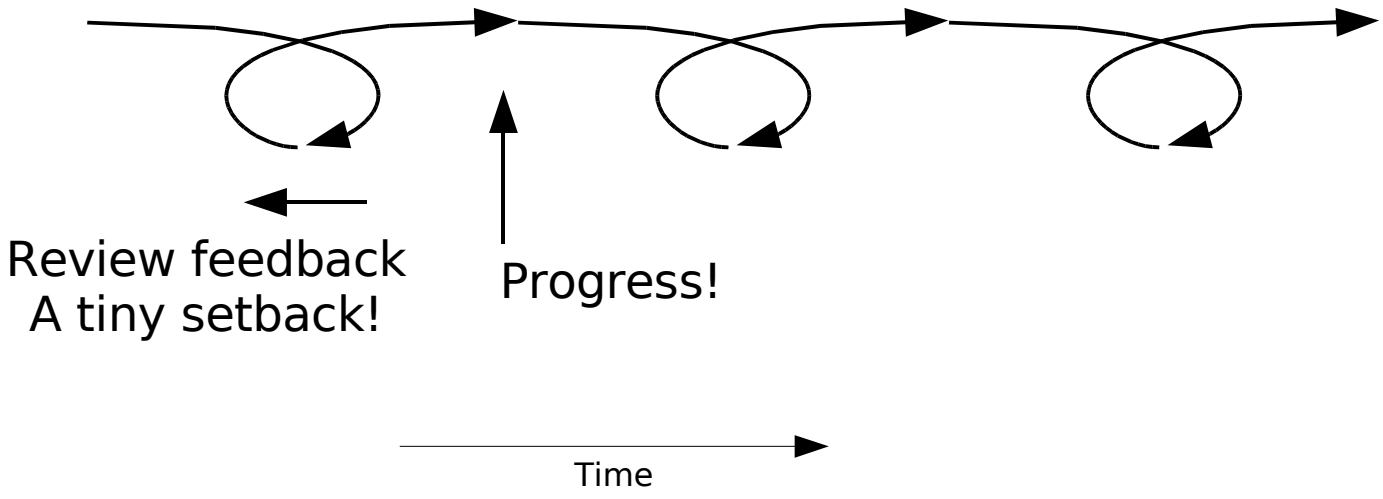
The Patch Cycle

1)Collaborate in advance
2)Implementation
3)Organize patches for Maintainer's Top of Tree
4)Send patches to list, Maintainer for review
5)Receive review feedback from The Community
6)Revise implementation according to feedback
7)Rebase patches to current Top of Tree
8)Re-post revised patches
9)Rinse, lather, repeat until accepted

- Publishing patches is not the end of the development
  - It is the beginning!

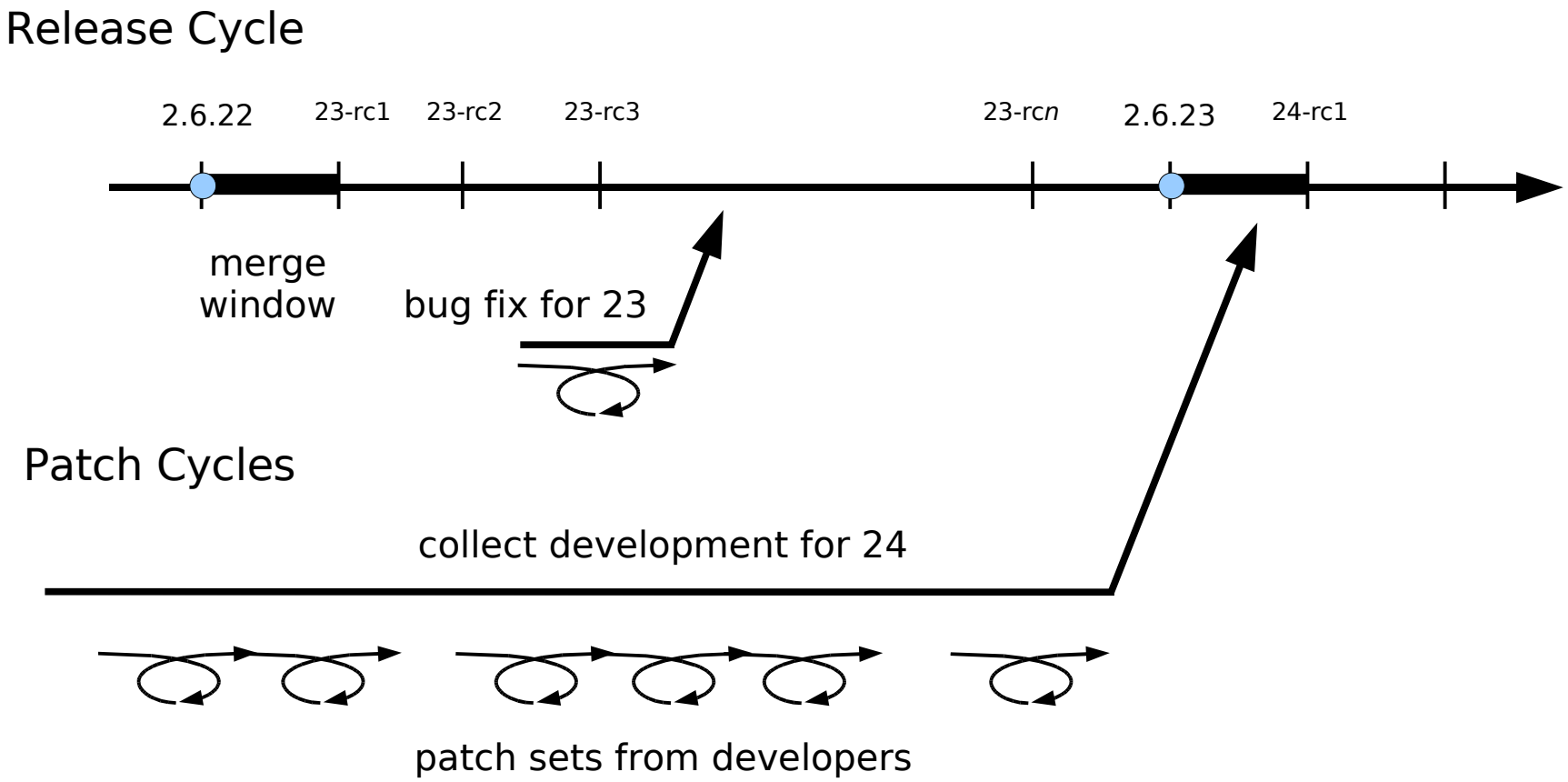
Patch Feedback Cycle



Git Facilitates Short Patch Cycles

- Key to cycle time is picking small, concise well-defined and easily understood units of development.
- Git helps organize concise patch sets in topic branches
  - `git branch`
- Easy for branches to contain single development topics
  - Short cycles <==> “early and often” motto
- Hoarding/holding patches leads to more work
  - Long cycles lead to lost patches
  - Long cycles lead to harder merges later
  - Repeated work

Combined Development Cycles



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Coordinate Prior to Publishing

- Make an RFC
- Determine if it is already being worked on
- Set expectations for developers and Community

- Pick the right basis repository
- Determine correct upstream maintainer for patches

- Exploit prior expertise and experience
- Avoid duplicate development
- Avoid heading down the wrong path

What is in a patch?

- Small, self-contained units of development
  - `git commit`
- Arrange patch sets into “Keep it working” order
  - `git bisect`

- Something easily reviewed!
- Follow code and style guidelines
- Good Change Log entry
- Follow Sign-off policy
- Use checkpatch.pl
- Isolate changes into patch sets
  - `git format-patch, git diff`
  - `git commit`

Mailing patches

- Use git's built-in commands
  - `git format-patch, git send-email`

- Send only your changes
- Use a one line “commit summary” in Subject:
- Post to correct list and Maintainer

- Use plain ASCII inline text
- Avoid attachments or encoded text
- Don't cut-and-paste diffs

- Redmond-based SW is fragile

Reviews

- Reviews are the path to mainline acceptance
- Concise patches are required for a good review
- Reviewers will:
  - Ask for some improvement
  - Invariably ask to have patches rebased to ToT
  - Invariably need patches to be respun after an review
  - Endlessly nit-pick some stupid typo

Typical Review Feedback

- Prevent latent bugs from being introduced
- Encourage good long-term direction
- Provide explanations, request explanations
- Help avoid common pitfalls
- Suggest better coding practices
- Enforce standards
- Style, typo corrections

- Some review issues can be mitigated in advance

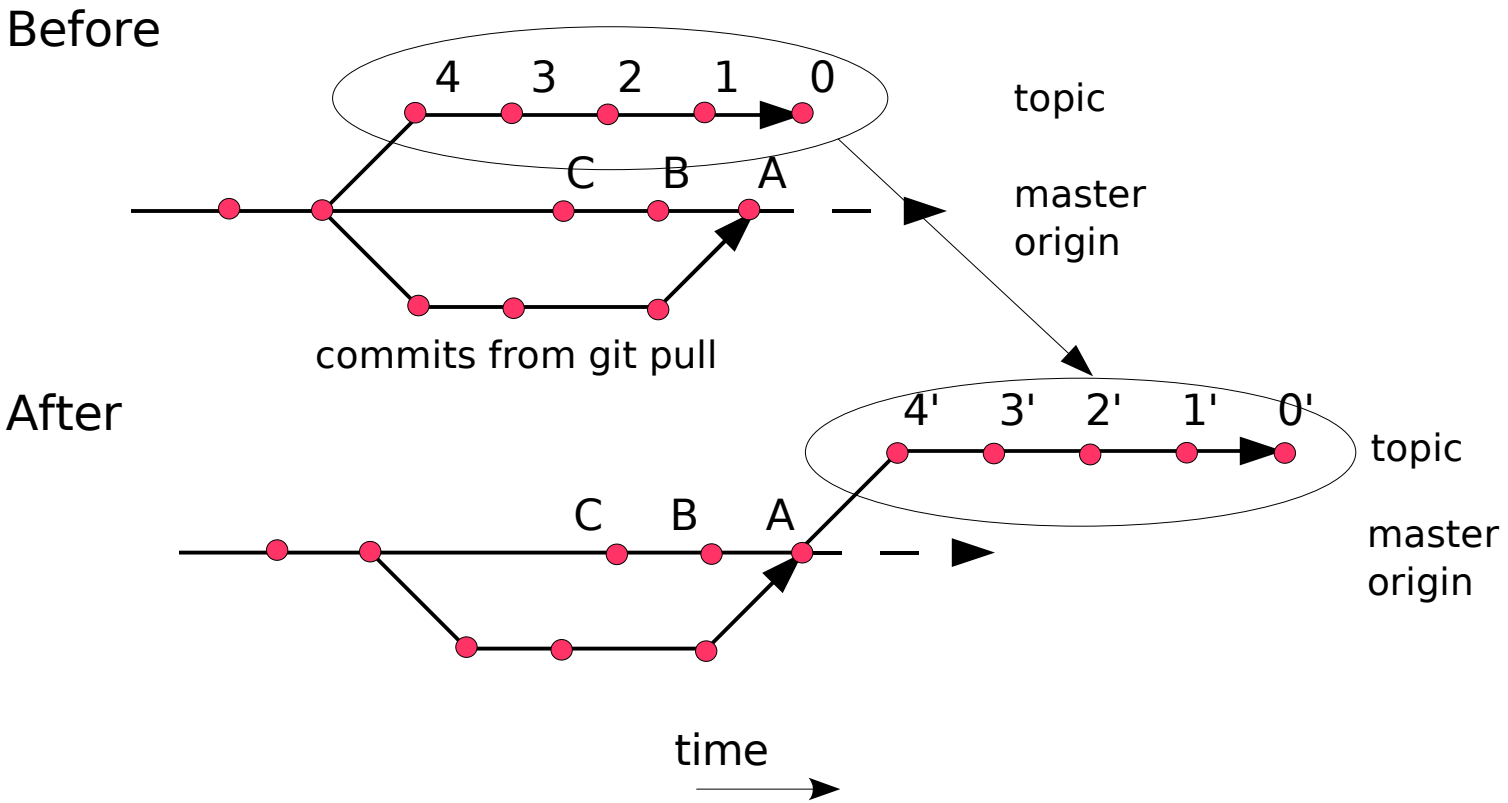
- Feel free to push back and defend your patch!
- Put your ego in check

The New Three R's

- Revise your patches
  - `git cherry-pick, git commit –amend`
  - `git gui, git rebase –interactive`
- Rebase your patches
  - `git rebase, git fetch, git cherry-pick`
- Repost your patch set
  - `git format-patch, git send-email`

Rebase: Before and After

- Rebase commits 0 – 4 of `topic`
  Onto `master` branch at A as 0' – 4'



Outline: Aces

- Participate with The Community
- Develop at the Top of Tree
- Post patches early and often
- Follow code standards, submission guidelines
- Revise, Rebase and Re-post patches after a review

Outline: Aces and Eights

- Don't start with old releases for new development
- Don't post patches that apply to old releases
- Don't hold/hoard patches
- Don't do tarball based development
- Avoid Redmond based environments

Outline: Questions And Answers?

- Questions?

Outline: Backup Slides

- Backup slides

Git Concepts: Repositories

- Git repository is self-contained, local and complete
  - Doesn't require external content
  - No centralized repository
  - Includes complete history of every file and change log
- Git repository is not distributed
  - No: part here, part there, part over there...
- No git repository is inherently authoritative
  - Only authoritative by convention and agreement

Git Concepts: Distributed Development

- Development can be distributed
  - Multiple repositories can create different histories and changes
    - Even if they originated from a common ancestor
  - Multiple repositories with different development can be combined
- Development can be shared
  - Multiple developers can use and update a common repository
    - No matter if the repository is local or remote
- Development can be private
  - Revision control your Address List at home

Git Concepts: Branches in git

- Cheap, fast and easy
- Topic/Development Branches
  - Stable, development, bug-fix, testing branches
  - Small development lines, per-feature, per-developer, etc
  - Collect, reorder or organize changes
  - Cherry-pick particular patches
- Tracking Branches
  - Follow upstream changes in local repository
  - Don't commit to tracking branches
  - Identified as RHS of `Pull:` refspecs
- Branch names refer to the current branch HEAD revision
- Branches don't have a “beginning” per se

```
$ git merge-base <original-branch> <branch-name>
```

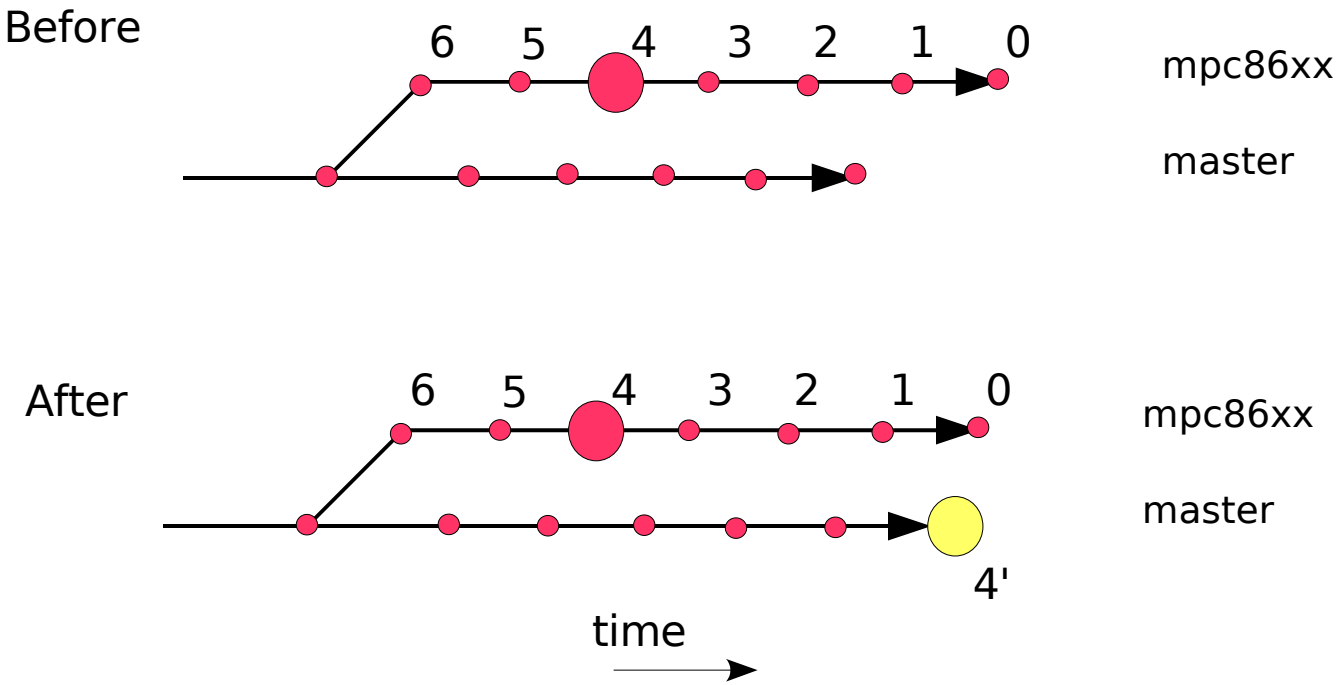
Cherry Picking Example

- You want one or more particular commits from some other branch applied to your current branch
  - Bug fix from some other branch
  - Transfer partial functionality from development branch
- Get that commit into your repository
  - Already present on a different branch
  - Perhaps using `git fetch` from another repository
- Cherry-pick it into appropriate branch

```
$ git checkout master
$ git cherry-pick 9ad494
```

Cherry Picking: Before and After

- Branch Timeline Picture
  - 4' is a different commit with the same content as 4



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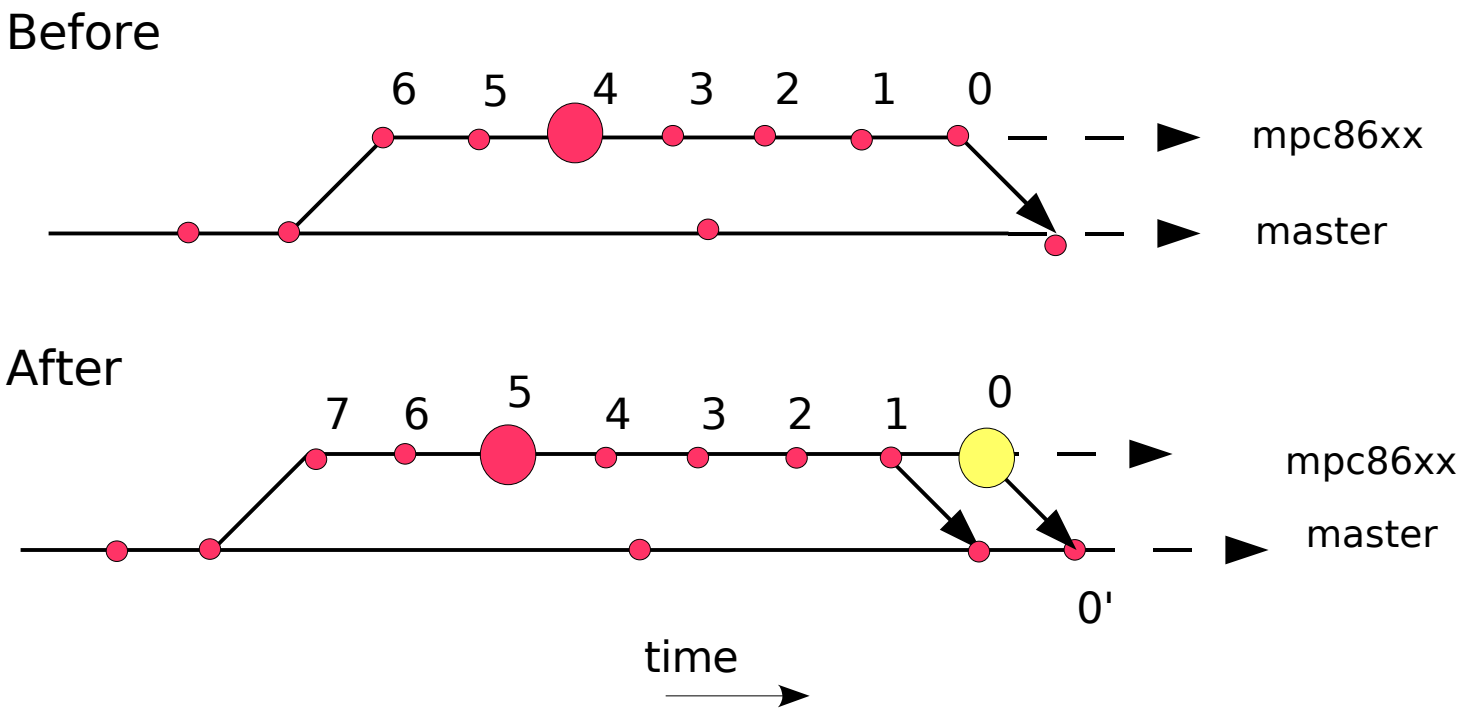
Revert: Before and After

- Commit 4 is reverted, creating commit 0 in yellow
- Commit 0 is merged to master as commit 0'



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Rebase Local Changes Example

- Situation:
  - You have done development work on your topic branch
  - You pull in upstream `origin` and merge it to `master`
  - You don't want to merge `master` into your topic branch
  - You don't want to merge your topic into the `master` branch
  - No one else has cloned your topic branch!
    - Why? Don't rewrite history
  - But you want to send your topic branch patches upstream!
- This is a job for `git rebase`

Rebase: Commands

- Rebase Commands

```
$ git checkout topic
$ git rebase master
```

- Creates a series of patches from `topic` to be applied to `master`
- May have to resolve conflicts at each step due to merge operation

```
git rebase --continue
git rebase --skip
git rebase --abort
```

Git Resources

- Sources and Documentation:
  - `git.kernel.org` -- Git sources, documentation, repositories
  - `git.or.cz/gitwiki` -- The Git Wiki
- Front-ends and Viewers:
  - `gitk, git-gui`
  - Stacked Git: `www.procode.org/stgit`
  - Guilt: `git.kernel.org`
  - QT Gui viewer: `sourceforge.net/project/qgit`
- Mail List: `git@vger.kernel.org`
- IRC: `freenode.net #git`


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