Top 3 pains in professional use of bitbake

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Who's Klaas???

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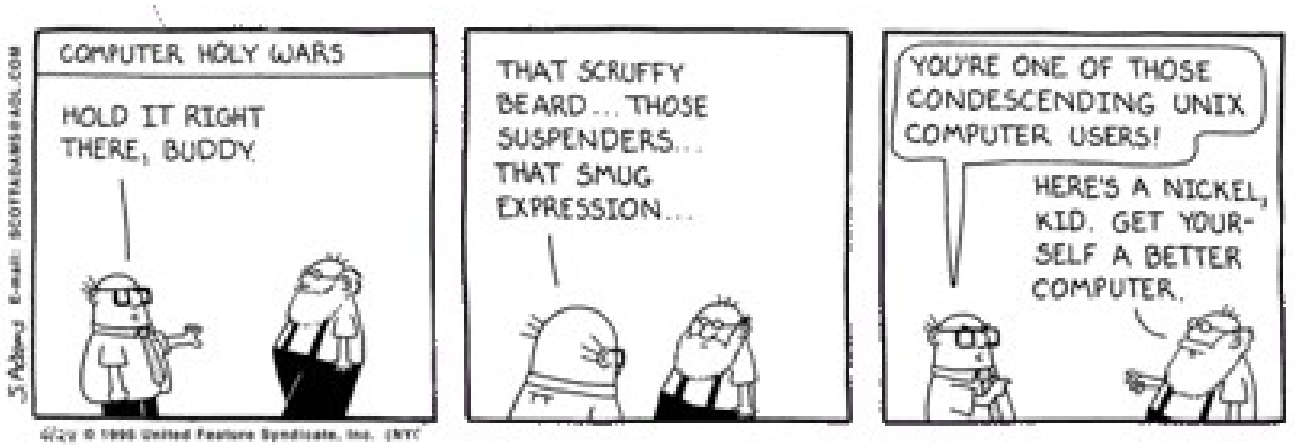
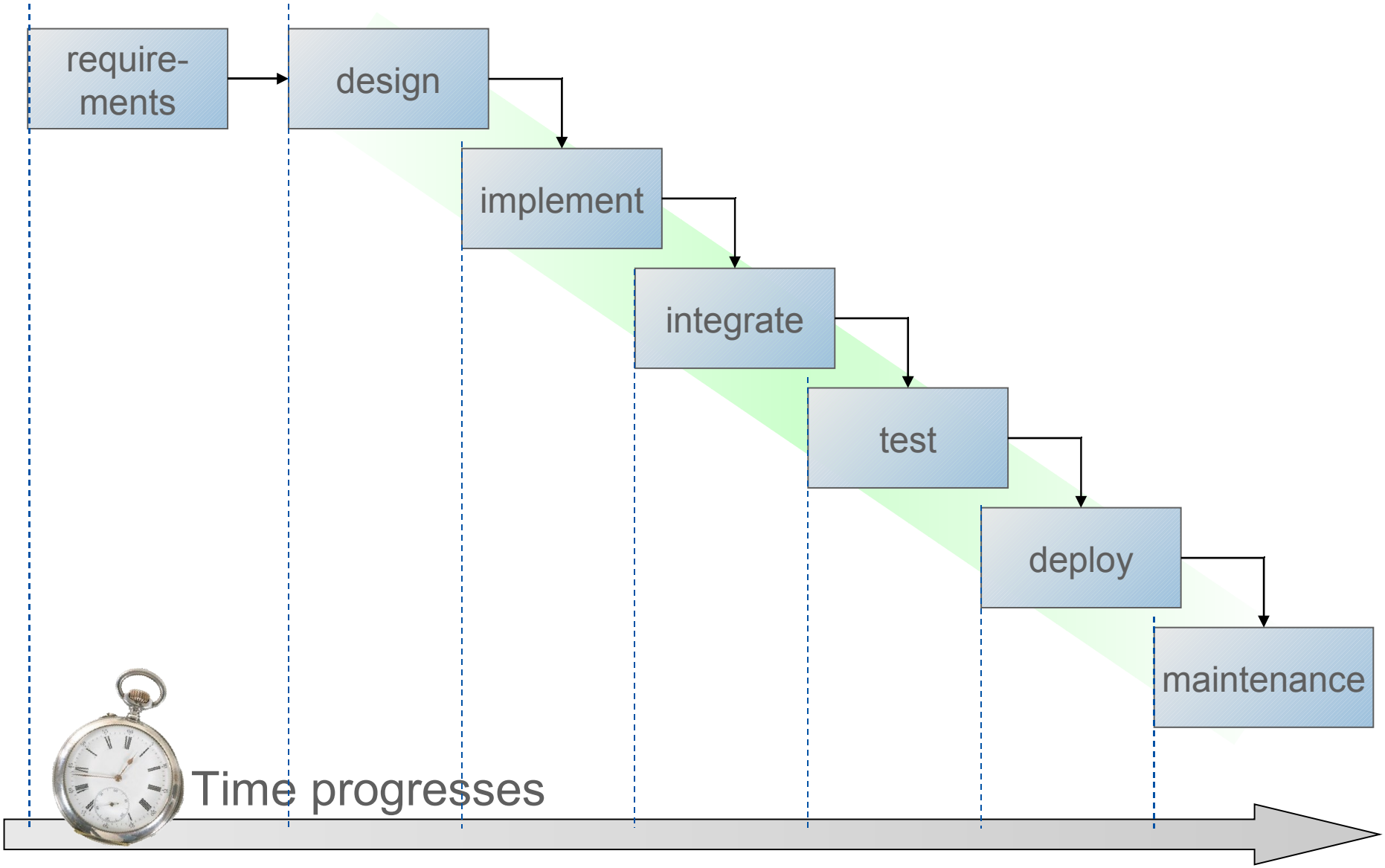
Who are You and why are you here?

- You have been using (Embedded) Linux for years
- You have used OpenEmbedded (or derivatives) and were not entirely satisfied or worse
- You are an OpenEmbedded developer

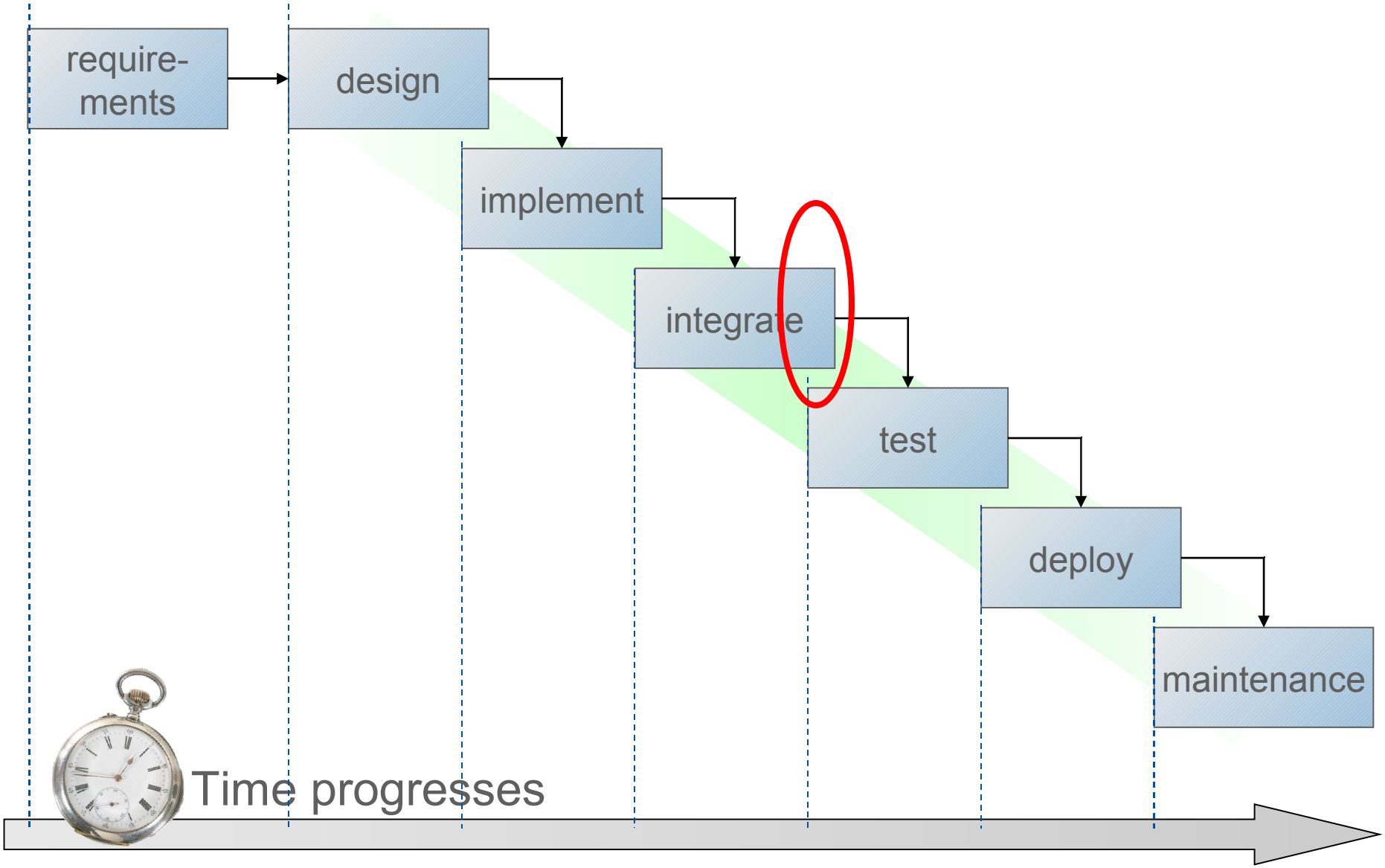
If you do not qualify for more than 60% of the statements, this talk *may* make little sense to you!



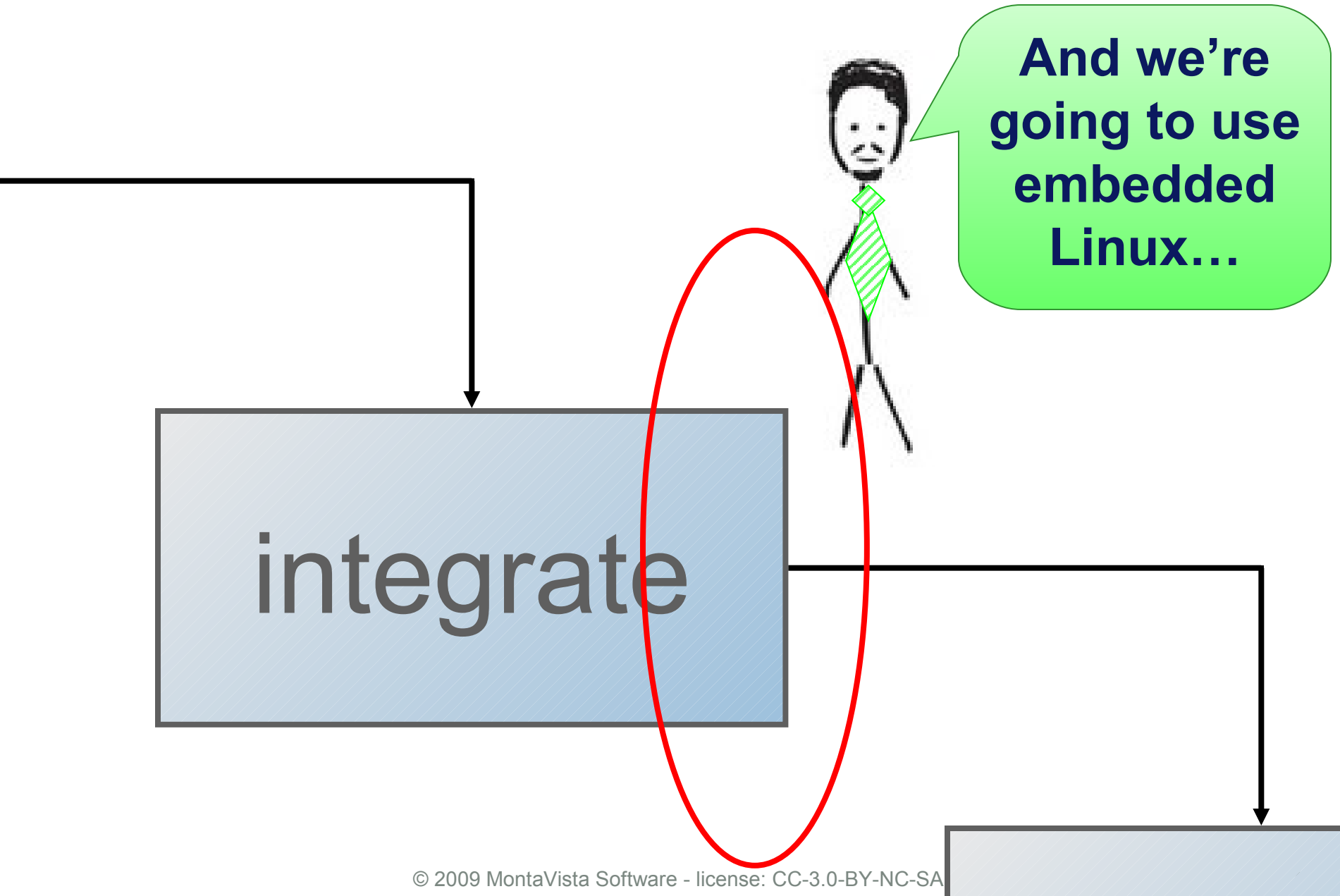
Development Life Cycle – “utopia”



Development Life Cycle – “utopia”



Development went smoothly, until…



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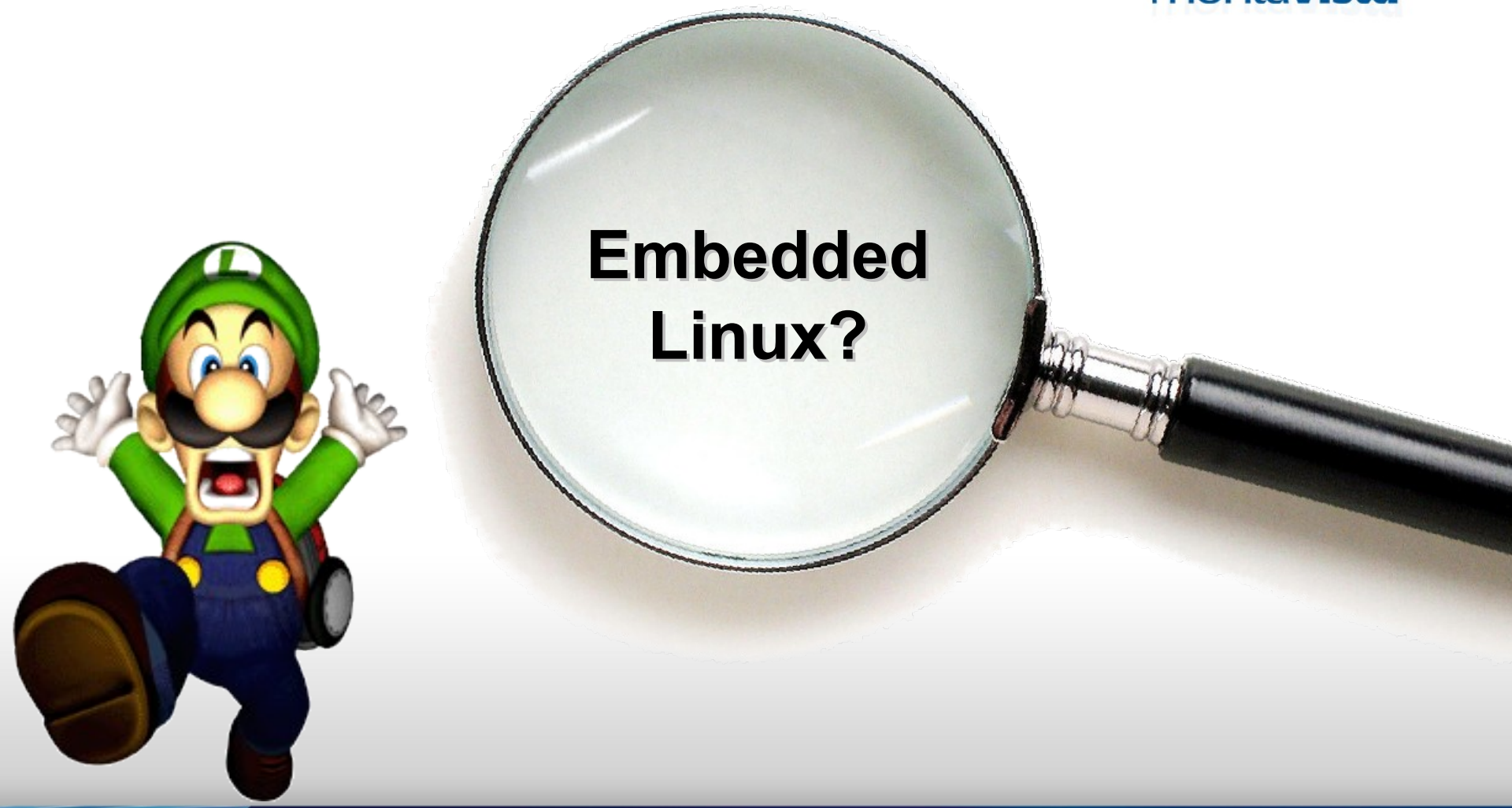
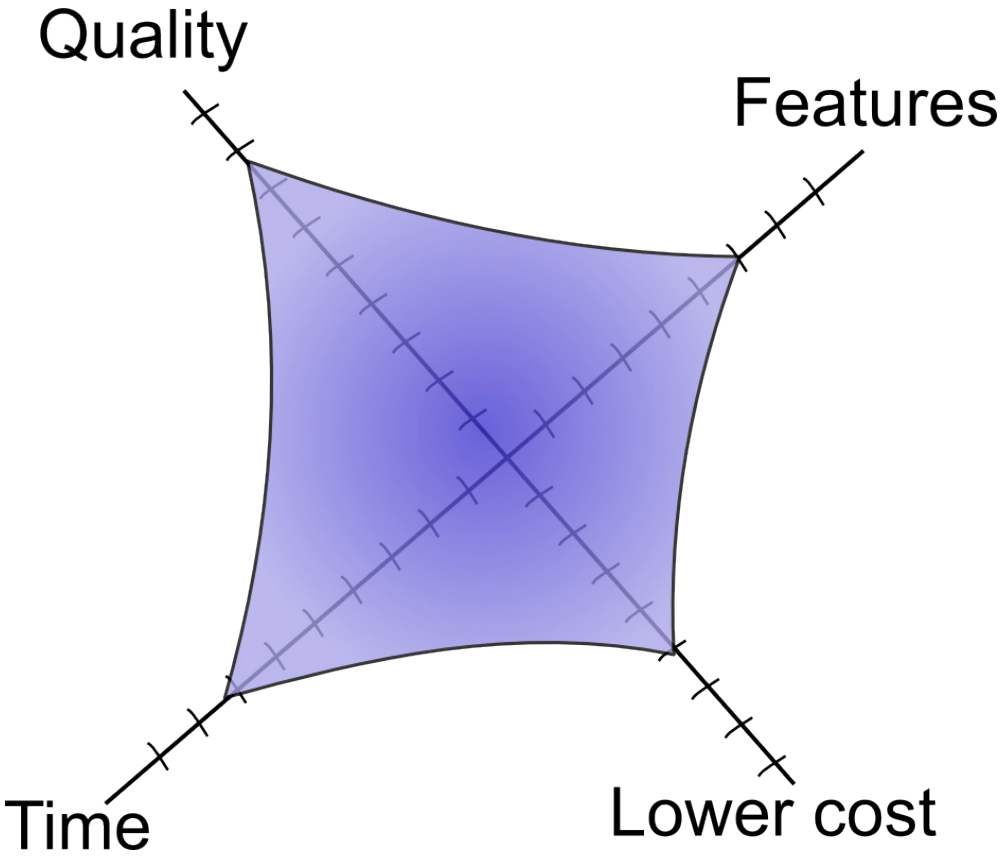


The Three B's

- **Buy?**
  Go to a commercial Linux vendor
- **Build?**
  Develop yourself
- **Borrow?**
  Use Open Source



What software packages to select? From which source?

- **System Software is usually more than one application**
- **Everything has been implemented before**
  - Where to find them? How to build?
- **Division between kernel space and user space**
  - Driver design – debugging, performance, licensing
- **Software Licensing**

What package versions to use? And what are dependencies?

- **Nearly every open source project uses SCM**
  - Stable / unstable / CVS / alpha / beta ?
  - Is the project alive? Is that version community supported?
  - When to freeze your platform?
- **Packages require features from other packages…**
  - “Dependency Hell”
  - 12 different programming languages on a system?
- **How to compare packages?**

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The Solution:

Bitbake + OpenEmbedded?

Open Embedded

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“Everybody” uses it:

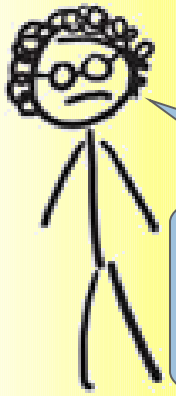
- OpenZaurus
- OpenMoko
- PokyLinux
- Ångström
- KOAN software
- Beagleboard.org

openmoko

poky

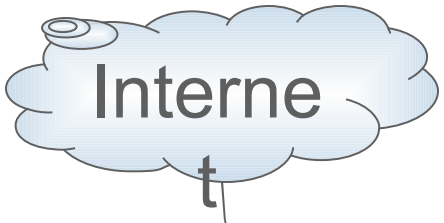
beagleboard.org

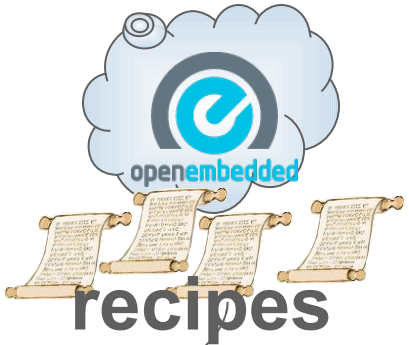
KOAN



So it must be good, right?

How does it work (in 1 slide)?



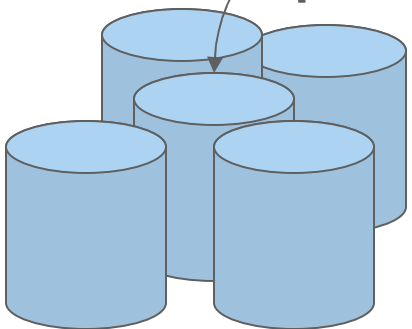


1. Figures out build order

2. Downloads & patches source code

Bitbake

3. Cross-compiles source & builds packages



4. Builds image(s)

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The pain

Yawn…

```
$OEBASE="/home/me/oe"; mkdir $OEBASE; cd $OEBASE
svn co svn://svn.berlios.de/bitbake/branches/bitbake-1.8/\
  bitbake
git clone git://git.openembedded.net/openembedded
# write a decent local.conf and add required host packages
bitbake helloworld-image
```

And then… the long wait…

827 tasks…

Build host support:

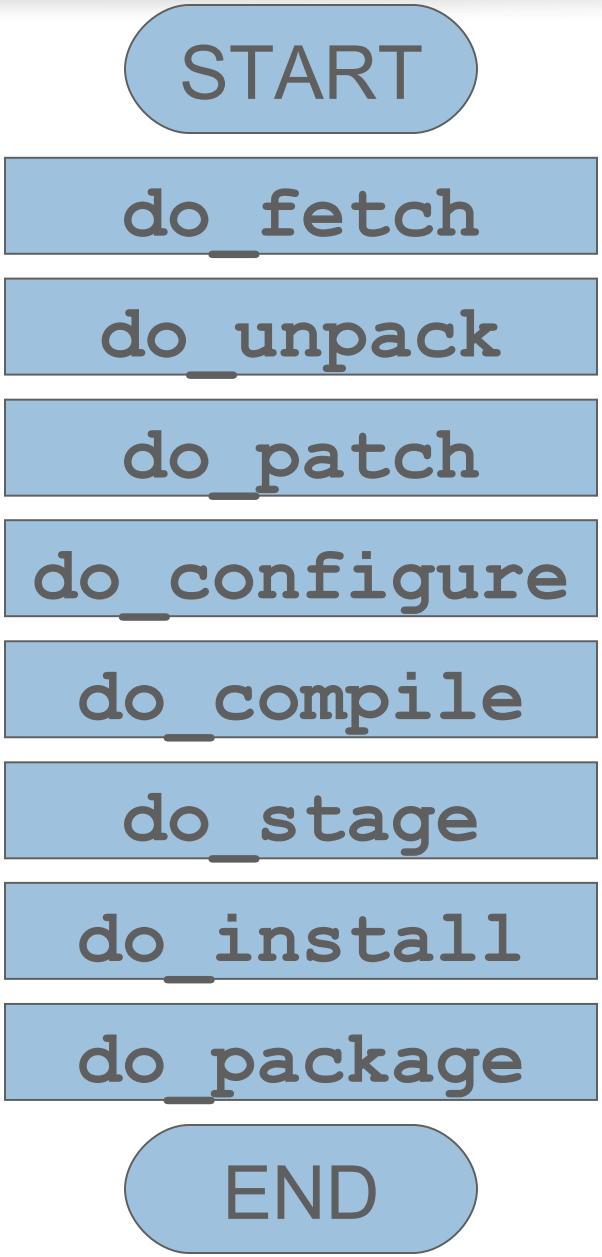
- **native perl, curl, python, perl, OpenSSL, GTK-doc, bzip2, libxm2, ncurses**
- **cross gcc, binutils**
- **But the sanity check required `diffstat` and `help2man` on my host?**

On target FS:

- **hello-world (statically linked)**
- **sysvinit**
- **udev**
- **libc + supporting libs**
- **libcurl**
- **Opkg**

Much more than expected…

Fetching or compiling



Bitbake:

- **Sequentially**
- **Per package**

System is idle during fetch

- **Unless (undocumented?):**
  - BB_NUMBER_THREADS
  - PARALLEL_MAKE="-jX"

But that's not for the newbie…

"404 errors":

- **Very annoying if a download fails just after you went home!**
- **Why 5x re-try down mirrors**
- **Why try *all* Debian local mirrors?**

What does a newbie want?

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- **It must work the first time**
  - no errors – newbie cannot solve them yet!
- **Usually time pressure**
  - Has to deliver a first working platform to team
  - And has to prove himself ☺
- **Contains "all he needs"**
  - For a first image, helloworld-image is a good start!
  - It contains much more – but no ssh client or shell ☹

Building from source?

- **Just putting binaries together works for newbie!**
- **Koen's Angstrom on-line builder:**

  http://amethyst.openembedded.net/~koen/narcissus/

Enlarge + Shrink down the image

- **The resulting image for `helloworld-image` is 5.9MB...**
- **And we don't have a shell nor ssh yet**
- **85 `*-image.bb` files in `recipes/images`**
  - Reading other image recipes and `classes/image.bbclass` really helps understanding the mechanism
  - Reading the (fine!) OpenEmbedded manual helps

- **Now poor newbie will have to start creating his own image file and build it.**

What does a newbie want? – part II

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- **Size not so relevant during prototyping**
- **NFS mount ! ?**
- **But easily reduce image size later in the process**
  - No man, info, doc
  - Debugging symbols / strip
  - Remove packages
    - Dependency hell
    - Graphviz ?
  - Reduce/Remove locales (IMAGE_LINGUAS)

- **Good tools would really help here**
  - List all dependencies
  - List what is in an image
  - List what needs to built on the host

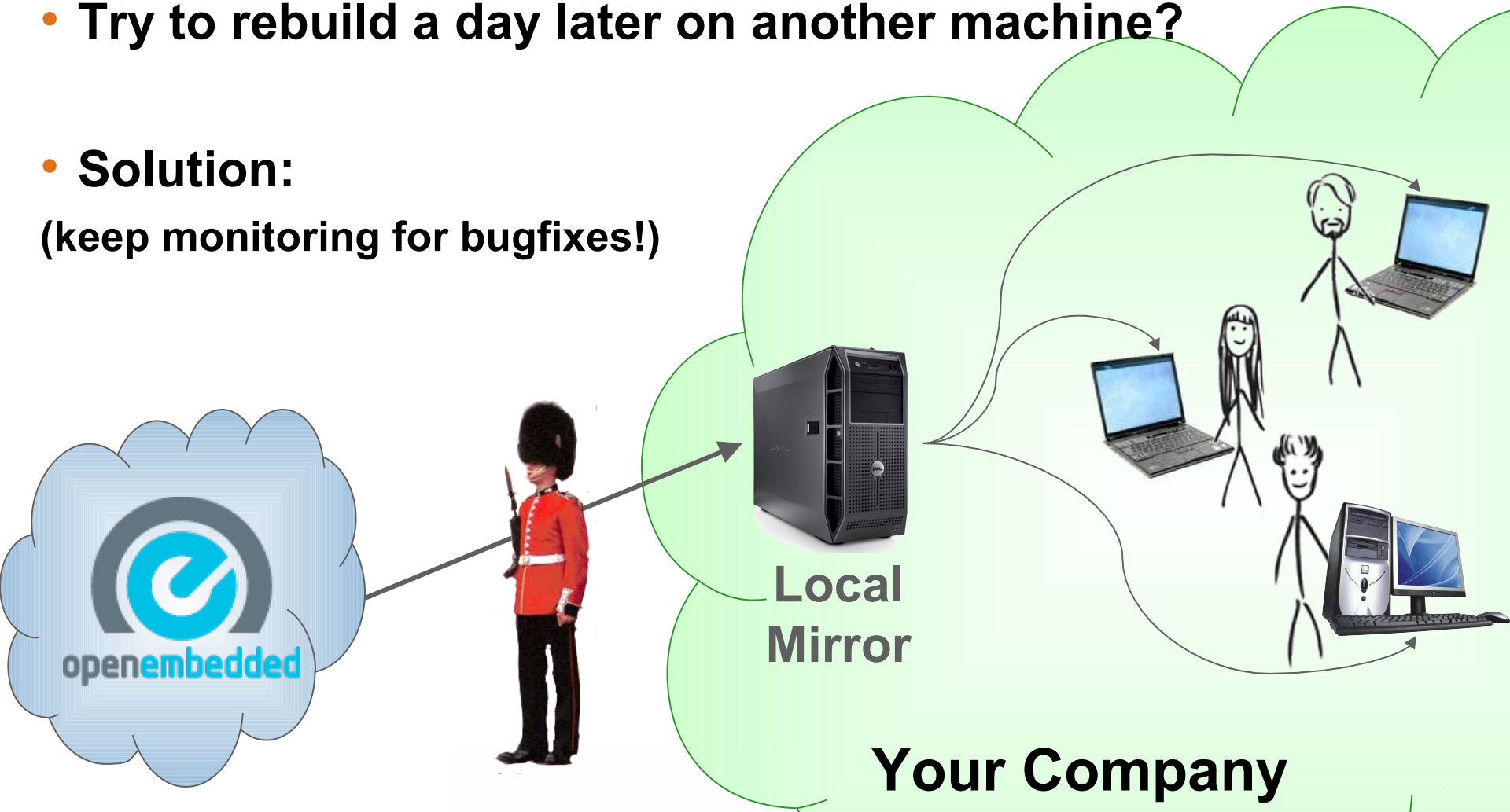
Reproducability

```
git clone
  git://git.openembedded.net/openembedded
```

- Try to rebuild exact platform a year later?
- Try to rebuild a day later on another machine?

- Solution:

(keep monitoring for bugfixes!)



404 revisited

Upstream communities move forward, too

- **Not every project keeps all releases around**
  - Example: `fakeroot`
- **Repositories move**

Same solution applies:

- **Locally mirror all “pristine sources” + patches**
- **Do this for the whole repository !**
- **Not trivial !**
  - svn: cvs: http: https: ftp:
- **Talk to your SCM administrator before committing many MBs of tar.gz files!**

More reproducibility worries

- **Rebuild a single package**
  - Useful if you are modifying that package's configuration
  - (OE manual page 35):
    - `bitbake -b <bb-file> -c clean`
    - `bitbake -b <bb-file>`
  - Does not inherit everything previously built

- **Does it matter?**
  - Not if you have nightly builds ?!?
  - Don't tell your boss…

Dependencies

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In recipes:

- **DEPENDS - must be present at *compile time***
- **RDEPENDS - must be present at *run time***
  - Usual shared libraries are detected automatically: “shlibs”
  - Only dlopen()’ed libs in RDEPENDS
  - Loose coupling: `wvdial` depends on `ppp`
  - Unrelated packages, e.g. font files
- **RRECOMMENDS**
  - lists recommendations that can be overridden by the user
- **Also: RCONFLICTS and RREPLACES**

Problem:

- **Full dependency information only available *after* building of the image…**

Community direction?

- Where is the community going?
- Which community?

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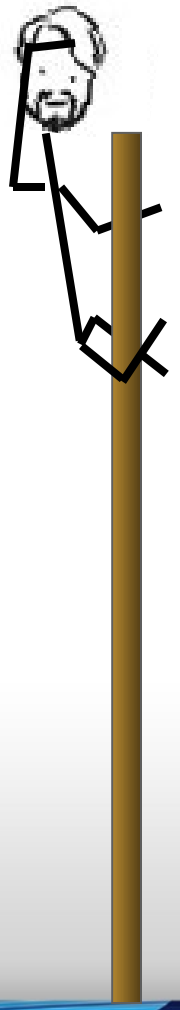

Back to 10,000 ft…

Conclusions?

- **In many projects, embedded Linux is not an thorough engineering decision**
  - Though it fits nicely!
- **OpenEmbedded + Bitbake fits professional use better than "Linux from Scratch"**
  - Re-use of community knowledge
  - Wide variety of packages available
  - Community is large and active
- **Bitbake has steep learning curve**
  - Less of a problem if your boss pays for time **and** you do not have deadline tomorrow

Summary: The Top 3 Pains

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#	Pain	Cause	Solution
1	404 on repositories and/or recipes	“Community”	•Local mirrors
2	Dependency hell	Community	•Know your components •Start small •A graphical tool would help
3	Reproducability, speed and caching	Bitbake	•Keep local repositories •Cache builds
4	Divergent communities	Community	•Switch to Windows CE?

Final statement: bitbake is “great”, but everybody else is making it a pain???

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Kaa-ching on Meld (http://meld.mvista.com/)