The Art of counting potatoes (with Linux)

Ricardo Ribalda
Latest Linux
Milestones
Agenda

- Initial Questions
  - Why?
  - Who?
  - How?
- Potato Grader
  - DSP
  - FPGA
  - GPU
- Conclusions
- Open Discussion
Why?
Why Potatoes?

368M tons per year [1].

Price per kg: 0.104 € [2].

Kg per capita:

Europe: 88

World: 31

[1] FAOSTAT 2013
[2] Potato Weekly (yes this exists…. ) 19/01/2015
[3] International Year of the potato 2008 (I do not make up the names)
Why Potatoes?
Why Grade them?
Why Grade them?

- Delirium
- Diarrhea
- Dilated pupils
- Fever
- Hallucinations
- Headache
- Loss of sensation
- hypothermia
- Paralysis
- Shock
- Slow pulse
- Slowed breathing
- Abdominal pain
- Vision changes
- Vomiting

Conclusion: Eat chocolate, not potatoes
Why Grade them?

- Green Spot
- Black Spot
- Scurf
- Golf Ball
- Grey Damage
- Rot
- Fresh Cut
- Potato Fruit
Why?

3 reasons:
Why?

3 reasons:
Why?

3 reasons:

$ €
Why?

3 reasons:

$ € £
Who?
Who?
Who?
How?
How?
How it is done? Computer Vision 101
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Potatoes like diversity
How it is done? Potatoes
Potato Grader
Potato Grader: Initial Approach

- Noise
- Latency
- Framerate
- Low level sensor access
Potato Grader: Industrial Smart Cameras

- Black Box
- Limited selection sensors
- Closed source image processing software
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- Black Box
- Limited selection sensors
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2002
Potato Grader: Celox v2002
Potato Grader: Celox v2002
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Potato Grader: Celox v2002

- Barebone application
  - updates?
  - multithread?
- Expensive
- Complicated
Potato Grader: Celox v2005
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- Linux From Scratch
- Strong Latency Requirements
  - All code in kernel-space
- Difficult to debug
- Difficult to update
- Difficult to replicate
Potato Grader: Celox v2009
Potato Grader: Celox v2009
Potato Grader: Celox v2009
Potato Grader: Celox v2009

- Hardware
  - Modularity
  - Low access to Sensor
- Software
  - Build System
  - Userland
Use case: U-boot

- No upstream support for Embedded PowerPC440
- We managed to use it!
Use case: U-boot

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- Bigger challenge than expected
  - Need to allocate time
  - CodeStyle matters
- Great Benefit
  - Support
Lesson Learned

Remember you need to make this trivial to review in order to get it accepted.

You have to do extra work because of this: our limited resource is reviewers and maintainers, not developers.

Greg Kroah-Hartman
2012

The Epiphany
Potato Grader: Celox v2015

Linux Performance Observability Tools

Credit to: Brendan D. Gregg
Why Standard interfaces?

- Pre documented code :)
- Validation Tools
- Easy to get help in work peaks
Potato Grader: Celox v2012
Potato Grader: Celox v2012

- Two track Strategy
  - Open Source
  - Upstream
Why Upstream?

- Support [1]
- Training experience
- Code Review
- Distro Independent!

[1] Kernel Newbies Autoresponder:

What changes are you making to the kernel that you are sticking with such an old version (X.Y is Z years old now, and over KKK thousand changes have happened to the kernel since then)?
Use case: Kernel

- Great Community
- Infinite Patience
- Port to last version under 2 hours!!
Use case: USB Gadget 3380

- Upstream driver
- Access to engineers from:
  - Samsung
  - Texas Instruments
  - Intel
Video Demo
Today
Qtechnology Contributions

- **Linux Kernel**: 172 patches. Including a 9+ year old bugfix.
- **Yocto project**: 17 patches. Supporting organization of the project.
- **v4l-utils/libv4l2**: 7 patches.
- **Flashrom**: Support for the first board with EEprom memory.
- **Gerbil**: 2 patches.
- **Clpeak**: 2 patches.
- **Video Lan Client**: 1 patch.
More Machines

Batch analyzer

Checkweigher

Spectral Camera
Conclusions

- Upstreaming is extremely beneficial.
  - Even for Small Companies!
  - But Allocate resources!
- Use standard Interfaces
- DO NOT reinvent the wheel
- 1st Portability
  2nd Performance
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