The Art of counting potatoes (with Linux)

Ricardo Ribalda
Latest Linux Milestones
Agenda

- Initial Questions
  - Why?
  - How?
  - Who?
- 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 [3]:

- 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?

THE MARTIAN
ANDY WEIR

A NOVEL
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

Solanine

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:

$ € £
How?
How?
How it is done? Computer Vision 101
How it is done? Computer Vision 101
How it is done? Computer Vision 101
Potatoes like diversity
How it is done? Potatoes
Who?
Who?
Who?
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
Potato Grader: Industrial Smart Cameras

- Black Box
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Potato Grader: Celox v2002
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- Barebone application
- updates?
- multitask?
- Expensive
- Complicated
2005
Potato Grader: Celox v2005
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- Linux From Scratch
- (Very) Low Latency Requirements
  - All code in kernel-space
- Difficult to debug
- Difficult to update
- Difficult to replicate
2009
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

- No upstream support for Embedded PowerPC440
- We managed to use it!

CHALLENGE ACCEPTED
Use case: U-boot

- 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

HEAD
Sensor

LVDS

FPGA

PCle

AMD APU

PCle

GPU

SOFTWARE

User Application

Open Source API

Yocto Project Distro

Video4Linux2
Linux
OpenCL
Why Standard interfaces?

- Pre documented code :)
- Validation Tools
- Easy to get help in work peaks
Potato Grader: Celox v2015
Potato Grader: Celox v2015
Potato Grader: Celox v2015

Linux Performance Observability Tools

Credit to: Brendan D. Gregg
Potato Grader: Celox v2012

Openembedded Architecture Workflow

- Upstream Source
- Metadata/Inputs
- Build system
- Output Packages
- Process steps (tasks)
- Output Image Data

User Configuration
Metadata (.bb + patches)
Machine (BSP) Configuration
Policy Configuration

Source Fetching
Output Analysis for package splitting plus package relationships
.rpm Generation
.deb Generation
.ipk Generation

Package Feeds
Image Generation
SDK Generation
Images
Application Development SDK
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.
- **Gstreamer**: 1 patch accepted. CHECK OUT GSTREAMER CONFERENCE.
- **Flashrom**: Support for the first board with EEeprom 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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