Mesa i965

Scenes from a Quiet Revolution

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https://www.x.org/wiki/Events/XDC2017/

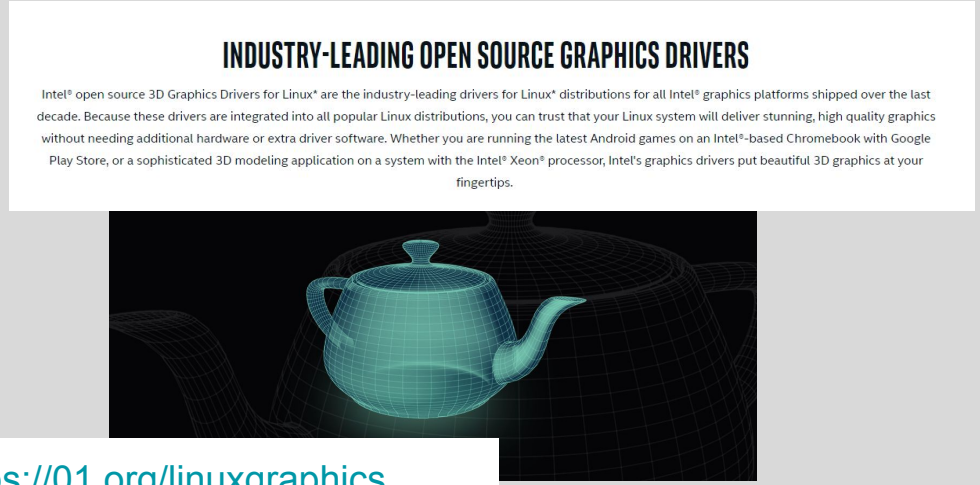
Welcome to the Your Revolution!

My Role:

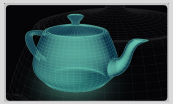
- Manager of Intel's Mesa i965 team since 2011

My Talk today:

- Overview of the past
- State of the present driver
- Challenges of the future

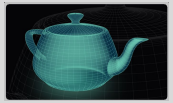


https://01.org/linuxgraphics



A Little History

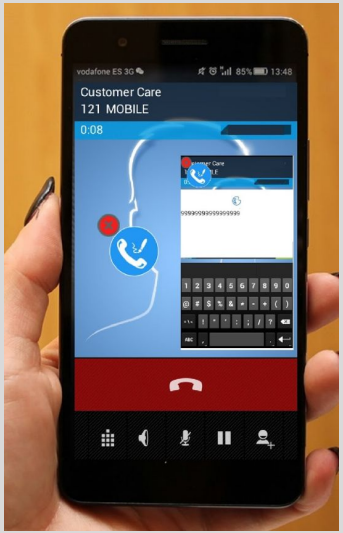
- **1993**: Mesa created by Brian Paul
- **2006**: Intel started contributing to the Kernel i915 and Mesa projects aiming to support for OpenGL® on Intel graphics for all Linux distributions
- **2011**: Chrome OS launched with Mesa
- **2013**: Steam OS launched with Mesa i965 on Intel graphics
- **2013**: Day-1 Khronos certification on OpenGL® ES 3.0
- **2015**: Day-1 Khronos certification on Vulkan® 1.0
- **2017**: Yun OS 6 shipped with Mesa i965
- **2017**: RadeonSI certified for OpenGL® 4.5, picked up by Steam OS
- **Feb 2017**: Khronos certification of Mesa i965 for OpenGL® 4.5, rounding out the *Triple Crown* of 3D computing with OpenGL® ES 3.2 & Vulkan® 1.0



Secret Revealed:

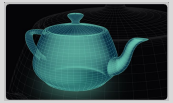
Real Reason To Capture The Triple Crown of 3D computing

- We really like playing games
- Advanced Games
- The more advanced the better
- Play it on your phone, but it's not an app



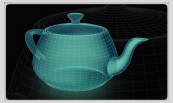
New Game Called:

"*Just Like Mesa!*"



The Rules for playing “Just Like Mesa”

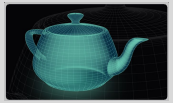
1. Need: Your favorite GPU vendor who only supplies closed source drivers
2. Get them on the phone for a conference call
3. Ask questions, appended with “Just Like Mesa”.



Question #1

Dear GPU Vendor: Could you please provide your *entire source code* in a living project in an open repo …..

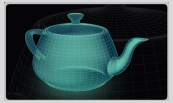
Just like Mesa?



Question #2

Dear GPU Vendor: Could you please license your code in a way that I can modify it in any way I wish, and have the choice of upstreaming or not upstreaming my patches …..

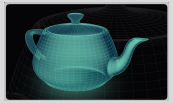
Just like Mesa?



Question #3

Dear GPU Vendor: Could you please provide over 10 years of backward compatibility with any platform I'd like to use, on the latest source code base …..

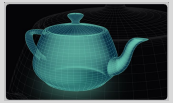
Just like Mesa?



Question #4

Dear GPU Vendor: Could you please provide a regression-free master branch that I can use for releases at my own schedule, instead of waiting for you to make official releases …..

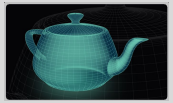
Just like Mesa?



Question #5

Dear GPU Vendor: Could you please give me a complete transcript of discussions among all your developers on new features, improvements, and bug fixes in a fully searchable archive…..

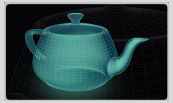
Just like Mesa?



Question #6

Dear GPU Vendor: Could you please provide drivers certified for the latest versions of all three 3D APIs from Khronos, and not just 1 or 2 …..

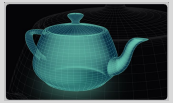
Just like Mesa?



Question #7 - My Favorite

Dear GPU Vendor: Could you please provide a user mode source code base that can work on *any* version of the kernel and can be integrated into *any* Linux-based OS without modification …..

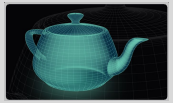
Just like Mesa?



Thank you for Playing and Remember

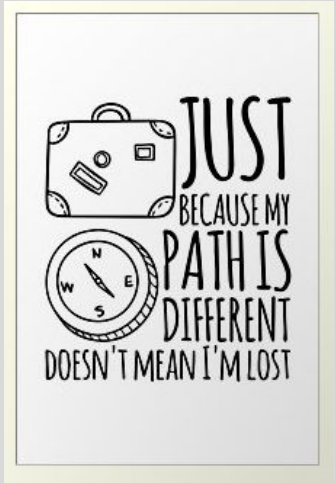
Everybody’s a winner when you play ...

Just like Mesa!

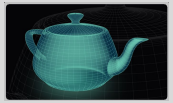


Success Factors

- Years of community support from contributors to early users to OS vendors
- Perseverance and maniacal focus to make Mesa the best driver it could be
- Major productivity boost through Continuous Integration
- The Positive Feedback Loop:
  - Better master branch quality speeded up delivery of features to users
  - Latest improvements allowed advanced apps to run on more platforms
  - More people gained confidence in using a fully open stack
  - Stacks using Mesa advanced rapidly
  - Demand for the use of Mesa kept mushrooming, letting us increase our investment in more features and better quality

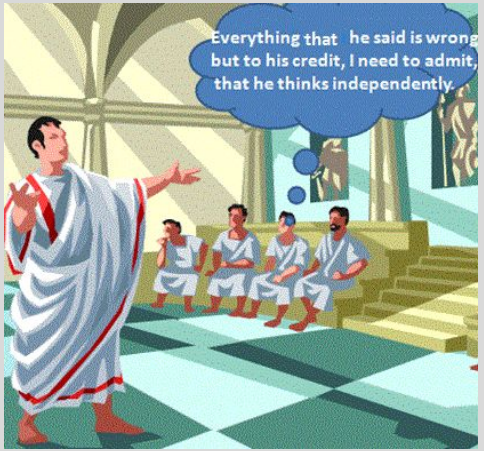


Quote: Gerard Abrams



Inside the Revolution: Lessons Learned

1. Clarity of goals: Baseline of productivity
2. Alignment of upstream and business objective: Essential to investment
3. Open source methodology: Eliminating collaboration barriers
4. Backward compatibility: Big net positive
5. Continuous integration: Secret efficiency weapon
6. Cohesive team: Overcomes all obstacles



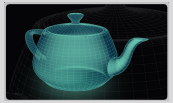
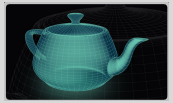


Image credit: https://myprobetothink.wordpress.com/tag/think/

Clarity of Goals: Standard APIs

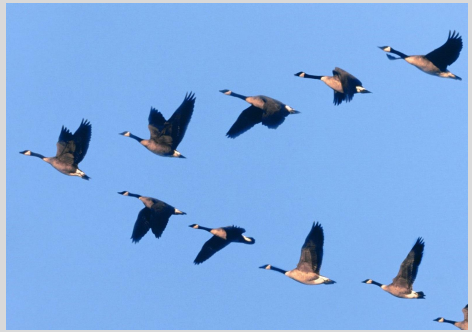
- Great for app developers
- Also very helpful to driver writers
- Avoids spec confusion presenting extra challenges for similarly large software projects without an industry spec

Image Credit: http://i.huffpost.com/gen/1107790/images/o-CLARITY-facebook.jpg



Alignment of Upstream and Internal Business Goals

- Open source processes allow multiple companies to share the cost of development and productization, delivering great ROI for each
- Critical mass of commercial investment is required to be successful
  - Efficiency is not enough, business goals needs to be met to justify corporate investment
  - Without substantial corporate investment, Mesa would lack critical mass and would be back to the low development speeds of the past.
- Our pragmatic and business-savvy developers understand this, and have helped ensure continual alignment



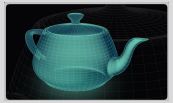
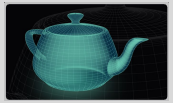


Image credit: http://duiops.net/seresvivos/

Open Collaboration w/ partners and customers

- GPU-agnostic code is shared among all drivers
  - The wheel is invented once, used by everyone
- Everyone knows exactly what driver developers know
  - Progress on features
  - Bugs
- Anyone can contribute features
  - Or make their own private branch if they wish
- Option of zero-turnaround-time for bugs
  - Customers can fix the bugs they care about themselves
  - Without bug tickets, phone calls, NDAs, etc.



Backward Compatibility: Big Net Positive

- Carries some extra cost
  - Subcomponents need to consider multiple GPU generations
  - Regressions on old platforms might delay patches that work on new platforms
- Benefits far outweigh the costs
  - Some features and bug fixes automatically ripple back to the old generations,
    - Makes existing platforms more robust and performant at no extra cost
  - Eliminates need for separate sustaining teams for old releases
    - Developers focused mostly on new features and optimizations
  - Driver for new platform is 90%+ done before the platform is available

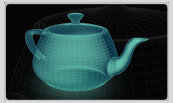
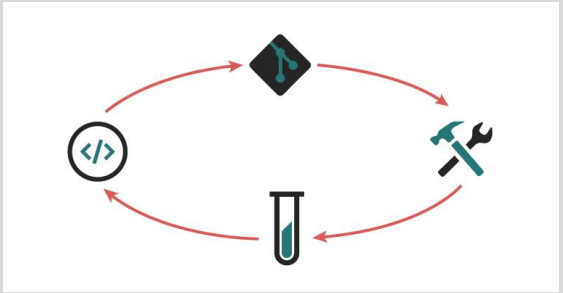


Image credit: https://www.youtube.com/watch?time_continue=201&v=_sWYENsJ3O4

Continuous Integration: Productivity Turbocharger

- Confluence of Benefits, resulting in a big win
- Regression-free master branch
  - Unlimited “releases” for optimal time-to-market for OS vendors and stack integrators
- Regression bug fixing time dramatically reduced (usually to negative!)
- Lifting a major context-switch psychological burden off developers
- Ensuring that “Mesa just works”



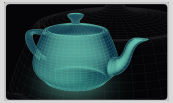


Image credit: https://www.shippable.com/continuous-integration.html

Cohesive Team: Best Antidote for Obstacles

- Individuals care *personally* about Mesa's features and quality
- Closely collaborate with each other and the community
  - Optimal mix of email/IRC and in-person collaboration
- Understand the entire graphics stack, not just Mesa
- Lightweight and pragmatic management practices
  - Developers drive the project's technical direction
  - Management team provides priorities to align with business goals
  - Oversight and reporting is light, and at high level
  - Clear distinction between upstream and downstream activities
  - Never hired people just to hire people (and yes, we're hiring!)

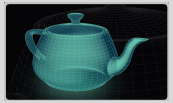


Image credit:
https://www.asme.org/career-education/articles/team-building/teaching-teamwork-to-engineers

Now What?

- Tens of Millions of installed base devices with Mesa
- Going forward, where can we make the most impact?
- Here’s an idea:
  - What OS out-ships every other OS in the industry?
  - What Linux-based OS has almost no device shipping with an open source graphics stack?

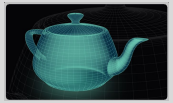
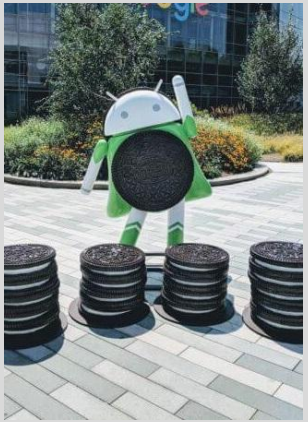
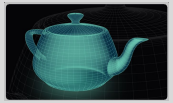


Image credit: http://www.kreatit.dk/dk/Info/Hjaelp

You Are Correct: Android Is the Next Frontier

- 1.2 Billion devices in 2016*
  - Primarily Phones and tablets
- Just getting started
  - Android Things
  - Android Automotive
- Huge opportunity to prove value of open source graphics
  - Faster time to market
  - Flexibility to innovate
  - Lower cost to develop and maintain a full stack
  - Mesa i965 already enabling Google Play Store and Android apps on Chromebooks





*Source: Image credit: https://plus.google.com/u/0/+LouisGray/posts/AQ5mmaMcJXe

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Areas of Focus For Success in Android

- Developers, Lots of Developers!
  - Encourage new developers; Be the project that emerging developers want to join:
    - Blog overviews of the stack for newbies
    - List simple projects to help them get started
    - Take time to answer basic questions on the mailing list and IRC
  - Did I mention we are hiring?
- Tools
  - Make sure your tools work on Android
  - Develop new tools to speed up stack debugging
    - Especially for performance
    - Android OEMs really care about synthetic benchmark performance
- Experiment with platforms with open source graphics drivers
  - Experimental stack for all recent Intel platforms: https://01.org/android-IA

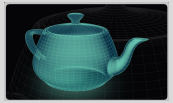
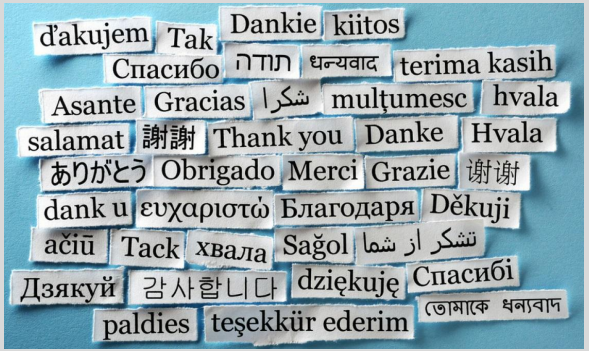


Image credit: http://www.oftalmologiatrestorres.com/las-dioptrias-que-son-y-como-se-miden/

Thank You For Getting Us Here!

- **Volunteers** who contribute time and talent because they believe in Mesa
- **OS Vendors** who have invested and supported open source graphics
  - Even when it wasn't as good as is it today
- **Consulting companies** who invest in open source graphics
  - Even when they don't have a paying client
- **Developers** who have chosen to devote their careers to Mesa
  - Even when it seemed hopelessly behind
- **Kernel and kernel graphics** community
  - Without which no user mode driver could run
- **Intel & other GPU vendors** for investments
  - And publishing HW specs openly
- **Personal Thanks to the Mesa i965 team**
  - My team at Intel
  - Teams at Igalia and Collabora



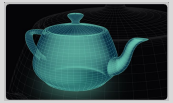


Image credit: http://blog.oxforddictionaries.com/2015/11/thank-you-in-other-languages/

Call To Action

- Get started page for new Mesa developers:
  - https://01.org/3Dcollab
  - If I didn't mention before, we are hiring!
- My blog on my experiences:
  - https://KavehNasri.com

Mesa's Best is Yet to Come!

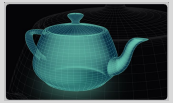


Image credit:
http://www.lawyersmutualnc.com/blog/now-is-a-good-time-for-a-malpractice-policy-review

Thank You!