

DISPLAYPORT COMPLIANCE Fixing Black Screens on Linux

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Every end user's dream – no black screens

Make Intel graphics kernel driver **DisplayPort*** compliant and **upstream** it







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What happens when you connect a DP cable?





Display Port Link Training

- Main Link Parameters:
 - Lanes 1, 2 or 4
 - Link Rate 1.62 , 2.7, 5.4 or 8.1 Gbps/lane
- Link Training:
 - DP source configures the main link through link training sequence





How to test DP compliance?





Atomic KMS – Making Kernel and GPU play nicely

An attempt of making "Every Frame Perfect"







Finally got the ball rolling!!! Did we fix black screens ????





"Anything that can go wrong, will go wrong"





Problem: Does the Atomic KMS driver handle link failures?

Link Failures, black screen...





Solution:

Stable link = Successful Modeset = Perfect frame





Failure is always an Option....

- 1. Atomic check guarantees the requested mode
 - Can only check GPU parameters, not the physical DP cable
 - Link training can still fail
- 2. Link Failure can be asynchronous
 - Link might fail after a successful modeset
- 3. Atomic allows non blocking commits
 - Return to userspace before modeset has completed

*Asynchronous handling of link failures extremely critical



Entire graphics stack testing





Intel GPU Tools - DP Compliance Tool



(intel

Software

Future steps

- Replace Unigraf's DPR-120 with Google's Chamelium Board
 - □ Allows testing all connector types (external displays)
 - □ Open Source HW extend to add all corner cases
- Port the DP compliance test suite (as per VESA CTS) to Chamelium
- Port the IGT intel_dp_compliance tool to Chamelium testing tool.
- Add DP Compliance testing to Pre-merge CI systems



Software

Thanks to Open Source Community!

- Kernel Daniel Vetter, Jani Nikula, Ville Syrjala, Rodrigo Vivi, Jim Bride, Matt Roper, Harry Wentland, Sean Paul
- X Martin Peres, Chris Wilson, Eric Anholt, Adam

Jackson

IGT - Petri Latvala



We are DP Compliant as of Linux Kernel 4.12 and xorg-server-1.19.3 DisplayPort

Questions?

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What is DP Compliance?





Kernel's Responsibility - Mode setting

Process of setting up clocks, scanout buffers, initializing the chip and lighting up displays





Atomic KMS – Making Kernel and GPU play nicely

An attempt at making "Every Frame Perfect"

An Atomic Operation is the one that appears to take place as a single indivisible operation



"A journey of a thousand miles begins with a single step"



Upstreaming Challenge - Coordinating Compliance





- Old Userspace with new Kernel Not Compliant
- New Userspace with old Kernel Not Compliant

*Both Userspace and Kernel responsible to ensure 100% DP Compliance



Who is responsible for DP Compliance?



