Consolidated Display System for Automotive using XenGT

Automotive Linux Summit
1-2 June, Tokyo

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1. Background

- **The smart space for users is expanding over home and especially car, which is the second most friendly space.**

- **The automotive cockpit is constantly challenged to deliver optimum solutions which can effectively provide valuable support to driving and help create a comfortable and safe environment inside the vehicle.**

1)

2)

3)

1) http://www.seriouswonder.com/futuristic-self-driving-car-design-by-rinspeed/
2) http://galleryhip.com/future-car-interior-design.html
3) http://www.theregister.co.uk/Print/2012/03/05/car_week_future_car_tech/

2. Automotive Cockpit Trend

Stand-alone

- Separated Functionality
- No Information Sharing
- Straightforward HMI*

Hyndai Elantra

Connected

- Cross-function Multiple Display
- Information Sharing
- Complicated HMI

1)

2)

Integrated

- Free form Large Display
- Multiple information Integrated
- Intuitive HMI

3)

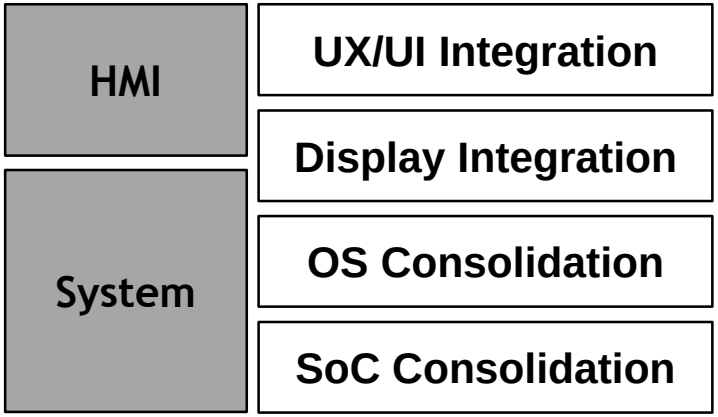
4)

1) http://www.gizmag.com/volkswagen-golf-r-touch/35472/
2) http://www.automotion.lu/article/tesla-insane-mode-les-reactions-en-video
3) http://cartype.com/pages/738/gauge_clusters
4) http://mattfinbowdesign.com

* HMI: Human Machine Interface

3. Advantages & Requirements of Consolidated Display System

▪ Advantages



▪ Benefits

❒ OEM Collaboration for UX Differentiation

❒ Full Re-configurable value creation

❒ Safety & Convenience with Reliability

❒ Efficient Resource Management (CPU & GPU)

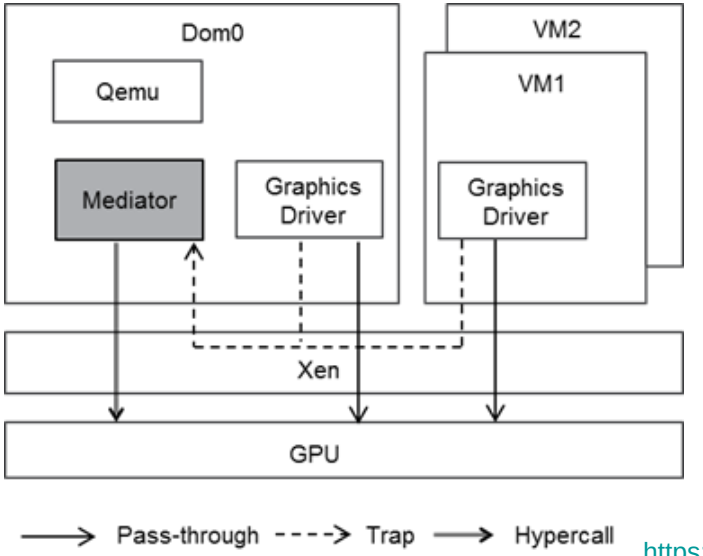
▪ Requirements

- Cluster and IVI can be concurrently displayed on one display.
- Cluster and IVI system can share GPU to show graphical and multiple infortainment.
- They can communicate with each other for display consistency.
- IVI can exploit HMI such as touch.

4. GPU virtualization of XenGT

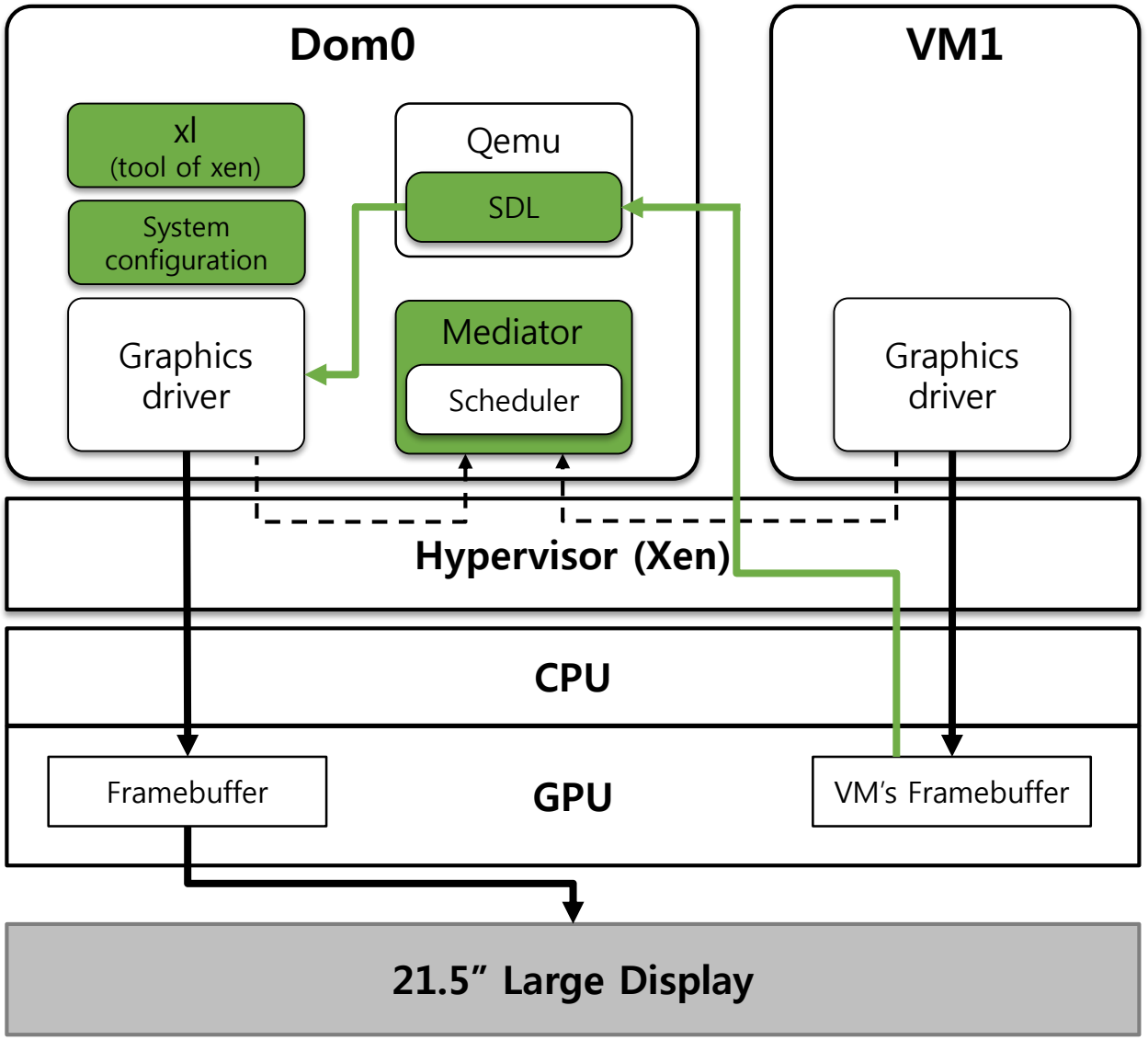
- **XenGT is a GPU Virtualization Technology.**
  - **Qemu** is a emulator that supports virtualization when executing under the Xen hypervisor. The Xen uses Qemu to emulate PC hardware, including BIOS, IDE disk controller.
  - **Dom0** is a privileged domain which contains drivers for hardware, as well as the toolstack to control VMs. Domain 0 is often referred to as Dom0.
  - **VM** is unprivileged domain with no access to the hardware.
  - **Xen** is an open-source (GPL) type-1 or baremental hypervisor.

- **XenGT implements a mediated pass-through architecture, running a native graphic driver in VMs to archieve high performance.**



https://01.org/xen/blogs/srclarkx/2013/graphics-virtualization-xengt

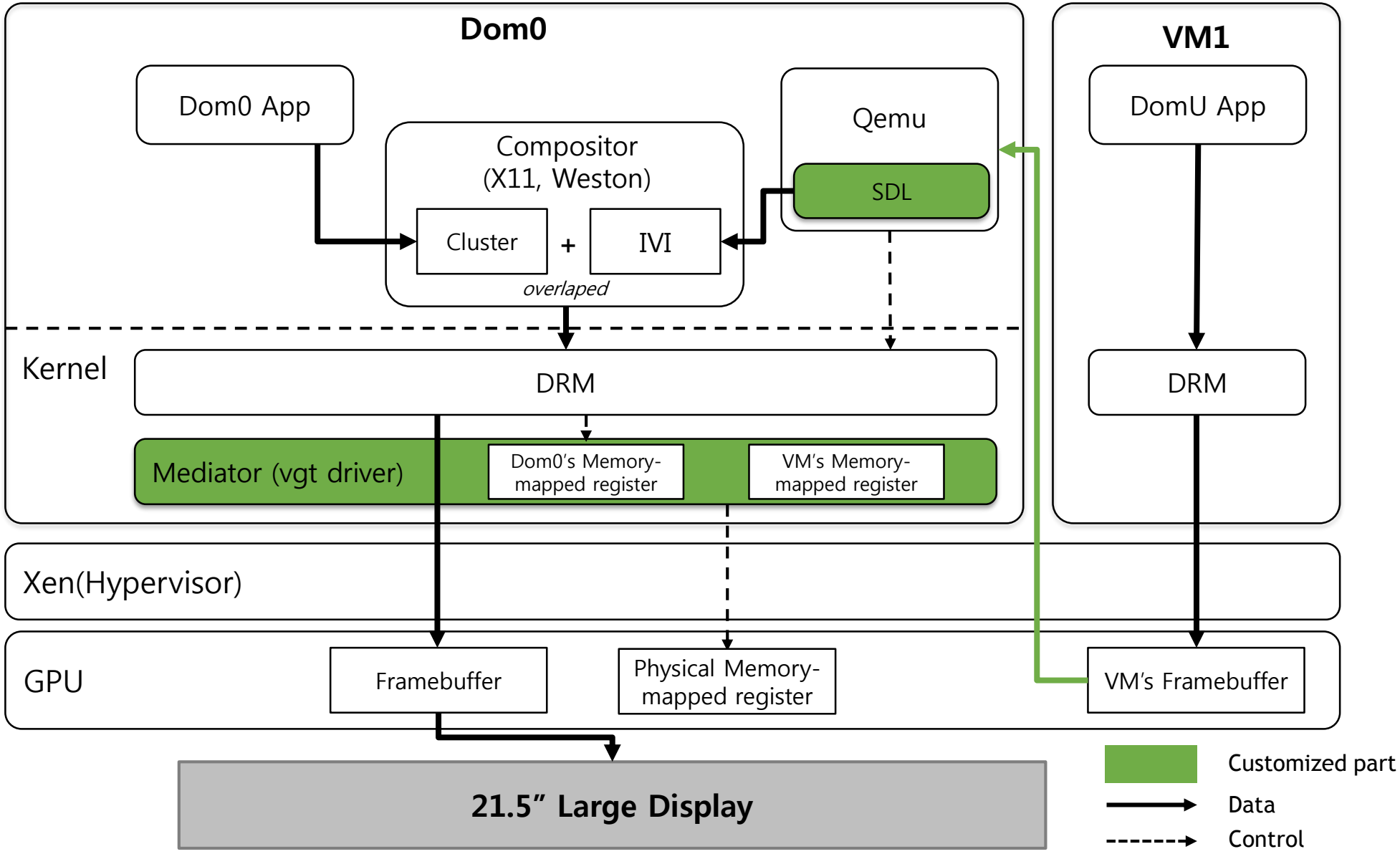
5. Overall Architecture



Factor	Feature
CPU	Intel Core i3-4010U
Memory	8G RAM
Hypervisor	XenGT (based on XEN)
OS	Dom0: Ubuntu 14.04 VM: Ubuntu 14.04

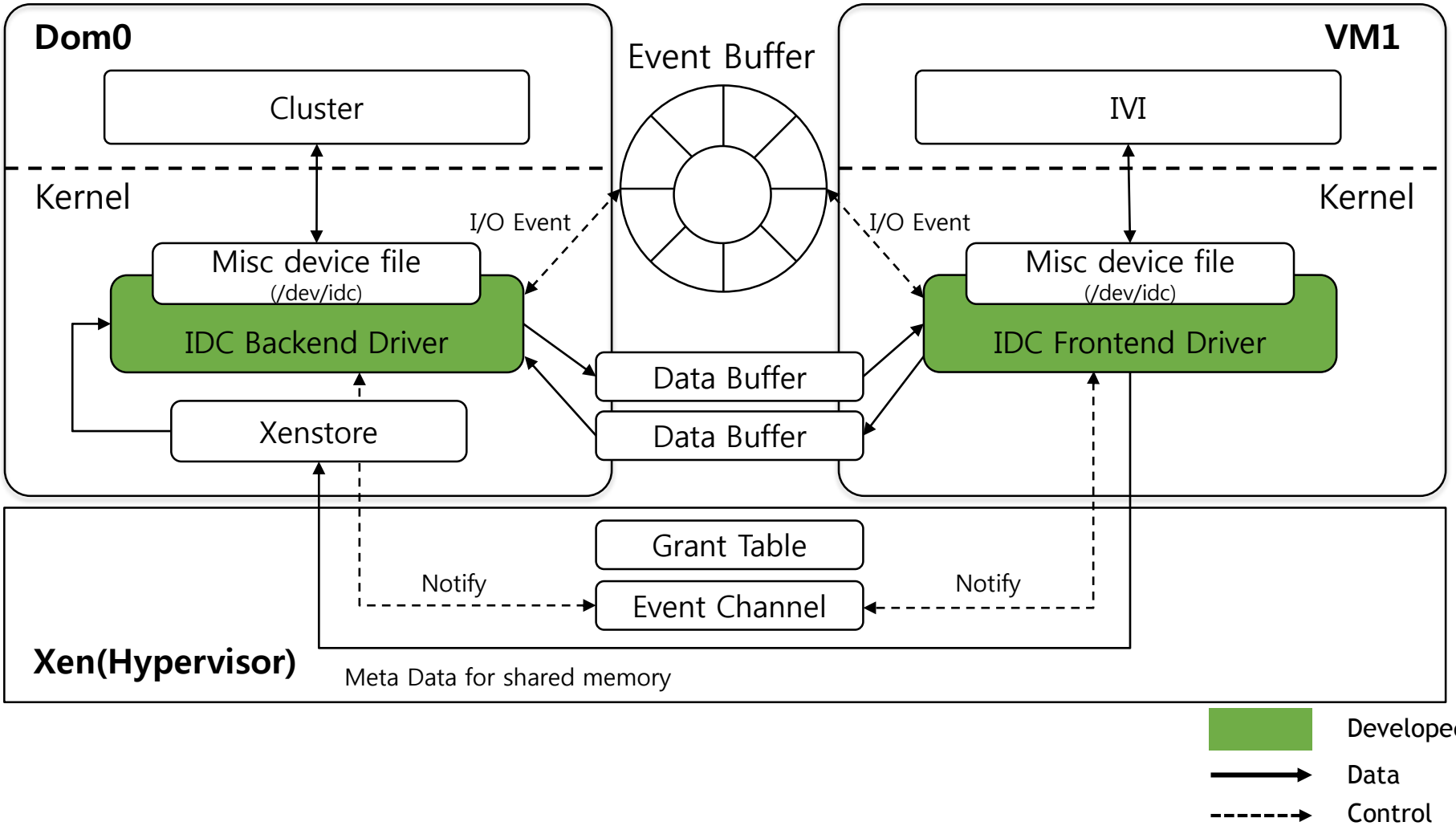
http://events.linuxfoundation.org/sites/events/files/slides/XenGT-LinuxCollaborationSummit-final_1.pdf

6. Graphic overlay architecture using XenGT



7. Inter-Domain Communication

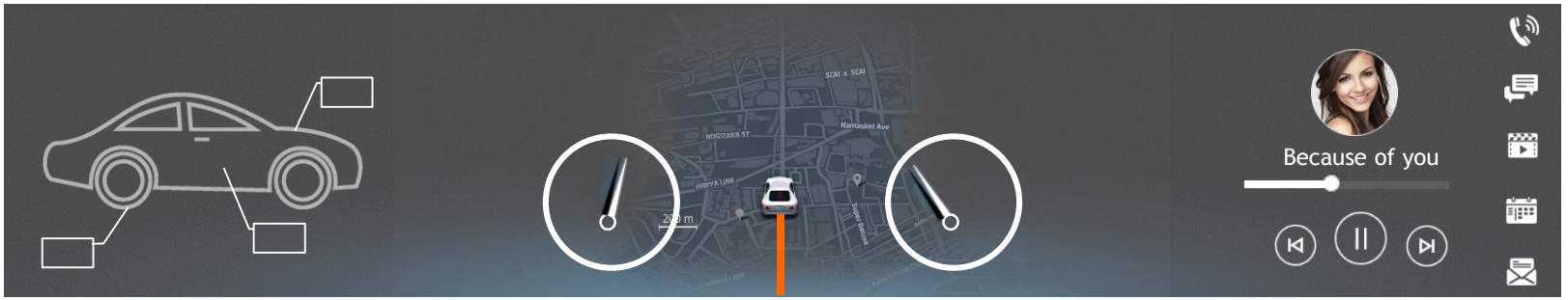
- **This module provides message-based communication mechanism between Dom0 and VM.**

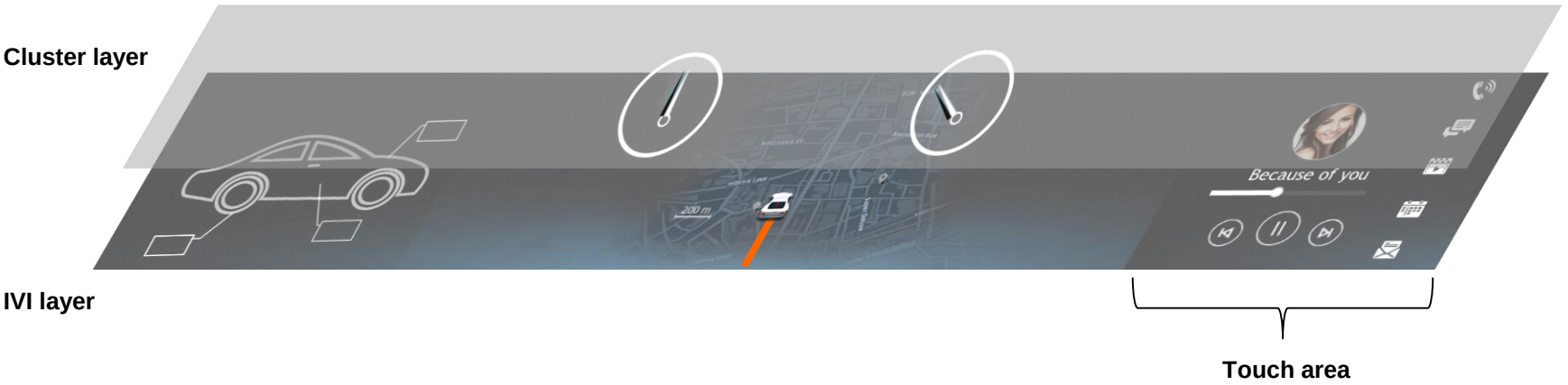


8. Demo

- **We displayed the result of system in CES 2015.**

※ This figure is not real image because the output is a LGE confidential.





9. Conclusions

- **Consolidated display system is based on virtualization technology.**
- **Cluster and IVI system can directly access to GPU for graphical and multiple information integration.**
- **The cluster and IVI screen are overlayed, it allows us to use digital cluster and IVI at the same time.**

10. Future work

- **Micro-kernel and Real-time kernel approach for Dom0**
  - Fast boot
- **Para-Virtualization Drivers for specific SoC**

- **Guest OSes**
  - Support compatibility Linux-based OS

    Such as Android, QNX, GENIVI and webOS

- **ISO 26262 certification**

Thank you

Questions?

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