Security for Connected Cars

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www.imgtec.com
A global technology leader

A technology powerhouse for multimedia, processors, communications and cloud IP

Driving IP innovation with unrivalled portfolio

- Recognised leader in graphics, GPU compute and video IP
- Leading alternative mainstream CPU processor IP
- Leader in emerging RPU communications IP market
- #3 design IP company world-wide*

* source: Gartner

Enabling unique IP platforms

- Transforming TTM (time to market)
- Leveraging customer IP to maximise differentiation

Supporting and driving major markets

- Helping our partners to create successful solutions
- Influencing new and emerging opportunities
- Showcasing and proving our technology with real products
Quick facts

One of the world’s top 3 electronics IP providers

More than 8bn units shipped
- Over 3.5m per day
- Around 1.4bn in past year

Products

Revenues
FY15: £177m (US$ 277m)
- Profit: £21m (US$33m)

People
>1,700 people world-wide
- 23 offices; HQ in UK
- >80% of staff are engineers

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Imagination’s IP portfolio

Comprehensive range to create connected SoC solutions

Each IP core is a class leader
Lowest power; smallest silicon area
Open and customer-centric business model
MIPS CPUs in ADAS

- Mobileye – Israel based company
- Targeted aftermarket as an add-on ADAS unit on dashboard
- Integrated into ~4m cars (e/o 2014)
- Will be in over 230 models (20 OEMs) in 2016
- Working with a range of tier-1 suppliers (Autoliv, Delphi, TRW, Magna, Gentex, Calsonic…)
- Deployed in BMW, Audi, Ford, PSA, JLR, GM, Honda, Kia, Hyundai, Volvo, Scania…
- MIPS CPUs in EyeQ processor gens 2 to 4
PowerVR GPUs in infotainment/consoles

- **Renesas: RCar H1/2**
  - RCAR V2H ‘Product of the year 2014’ Electronics Products. ADAS
  - Licensee since 2004

- **Texas Instruments: DRA65X/74X - Jacinto 5 and 6**
  - High profile wins with Ford Sync3
  - Long term partner of Imagination in mobile and automotive; licensing PowerVR GPUs since 2004
Autonomous connected car

Imagination’s IP helps to build differentiated, secure and safety critical solutions

- The connected car market is growing at a CAGR of 45% — 10x faster than overall car market
- The connected car is morphing into a mobile device
- Market needs complex computing solutions based on video, vision, GPU, CPU, wireless connectivity and cloud services
- Imagination’s broad IP portfolio can help members in the automotive value chain deliver leading edge, secure, safe solutions
We are now connected – but how about security?

We need to enable secure connected cars

**HACKERS REMOTELY KILL A JEEP ON THE HIGHWAY**

- There are many security components – from authentication in the cloud to hardware security in the SoC
- The main SoC has a central control and management function and must ensure that connected devices can connect to only where they are allowed to connect!
- This can be achieved by a rigorous approach to SoC virtualization augmented by secure, authenticated boot
- In Imagination we call this

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OmniShield

How to secure a platform?

- Hardware supported virtualized CPU
- + Hardware supported virtualized GPU
- + Secure fabric
- + Trusted hypervisor
- + Virtualized or para-virtualized connectivity and offloads
- + Root of Trust

= OmniShield

Deployment of multiple containers fully isolated and protected
Automotive AP - true isolation

Virtualization benefits

- Mature and proven technology
- H/W firewall $\rightarrow$ high level of security
- Secure services can only affect their container
- Highest flexibility and performance
- IP protection provided through system partitioning
Virtualization vs Realtime

Intersection of isolation and concurrency

**Isolation**

Virtualization

Hypervisor switches context enforcing CoS, QoS and isolation. Response time adequate for many applications.

H/W multi-threading enables concurrent operation of applications. Context switch at rate of CPU clock.

**Concurrency**

Multi-Threading

Hypervisor switches context enforcing CoS, QoS and isolation. Response time adequate for many applications.

H/W multi-threading enables concurrent operation of applications. Context switch at rate of CPU clock.
Real time secure operation in virtual environment

Concurrent multi-domain execution environment

**Zero** overhead & real-time

**Isolation**

Virtualization

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<th>OS</th>
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| Hypervisor  
Single Core  
Single Thread  
H/W VZ |

**Concurrency**

Virtualized Multi-.Threading

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Multi-Threading

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</table>
| Single Core  
Quad Thread |

Context Switch

CPU 100%

Guest OS OS RTOS RTOS OS RTOS

Hypervisor OS OS OS OS RTOS RTOS

CPU 100%

Guest

OS RTOS RTOS RTOS OS

Hypervisor

OS RTOS RTOS RTOS

CPU 100%

Guest

OS RTOS RTOS RTOS

Hypervisor

OS RTOS RTOS RTOS

CPU 100%

Concurrent

H/W Thread

CPU 100%

OS OS RTOS RTOS

CPU 100%

OS RTOS RTOS RTOS OS

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Real time secure operation in virtual environment

Automotive system use case

Navigation Linux
Lower Priority / Framerate

Infotainment Linux/Android
Medium Priority / Framerate

Cluster Secure RTOS
High Priority 60 FPS

ADAS Linux
Variable Priority GPU Compute

T3  T2  T1  T0

Single Core
Quad Thread

OS  OS  RTOS  OS

Hypervisor

T0  T1  T2  T3

Time(t)

OS  OS  RTOS  OS  OS  RTOS  OS

CPU

100%

Guest

Root

Time(t)
Conclusions

*Imagination’s automotive advantage – security for connected cars*

- Imagination’s IP is already widely used in automotive: ADAS, infotainment, consoles, and more – with numerous tier-one players

- Imagination can enable next generation autonomous connected cars with existing IP blocks for video, vision, GPU, CPU, wireless connectivity and cloud services

- OmniShield is enabling a new levels of advanced security for connected cars
Imagination

Thank You