



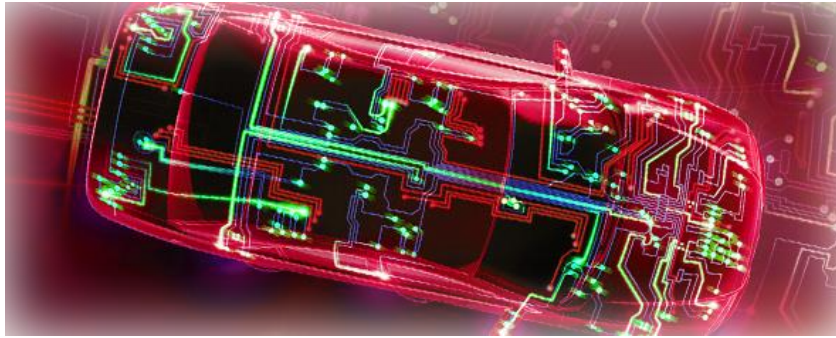
**AUTOMOTIVE  
LINUX SUMMIT**

# **Securing Automotive Graphics**

**Rick Tewell**  
**July 2016**

# VeriSilicon Automotive Technologies





#1 Graphics IP supplier for Automotive LCD Clusters

#2 Graphics IP supplier for In-Vehicle Infotainment Systems

#3 Graphics IP supplier for Rear Seat Entertainment Systems

*Vivante Graphics IP is used by 7 of the top 10 automotive OEMs for IVI systems*

*...and 6 of the top 10 luxury brands for reconfigurable instrument cluster*

**\*\* Over 20 million cars on the road use Vivante GPUs \*\***

# VeriSilicon Automotive Deep Partnerships



android auto



Apple CarPlay



# VeriSilicon Automotive Deep Customer Experience

**DELPHI**

**DENSO**



**Pioneer**

**MAGNETI  
MARELLI**



HYUNDAI  
**MOBIS**

**Continental**

**TechniSat®**



**Autoliv**

**Valeo**

**ALPINE®**

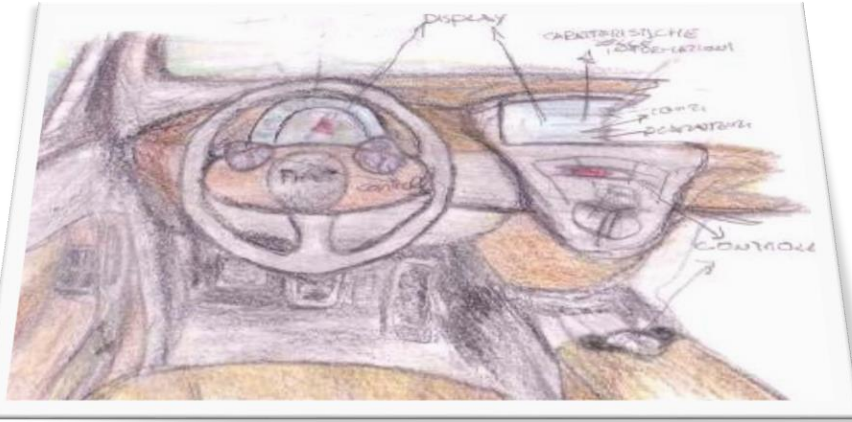
**Panasonic**



**NIPPON SEIKI CO., LTD.**



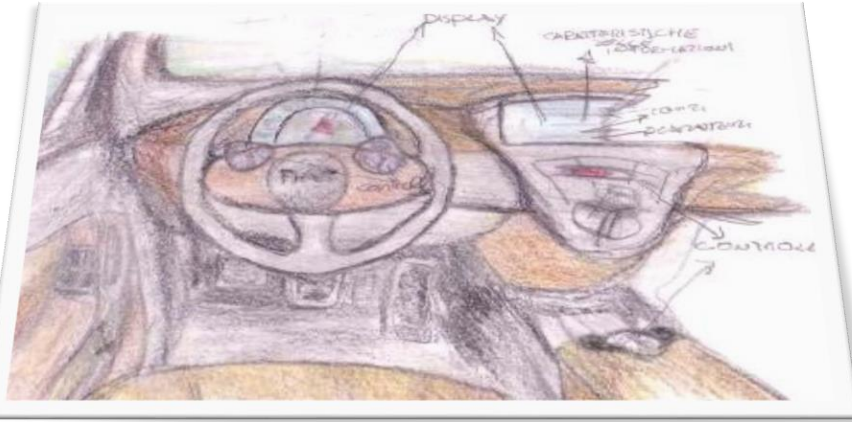
# Automotive Graphics



Automotive OEMs and Tier One Suppliers spend MILLIONS of dollars developing graphics for IVI and Instrument Cluster systems



# Automotive Graphics



Automotive OEMs and Tier One Suppliers spend MILLIONS of dollars developing graphics for IVI and Instrument Cluster systems



In most systems – these graphic assets can be relatively easily hacked, stolen copied or replaced...



# *Automotive Graphics*



Mercedes 2017 E-Class Cockpit

# Automotive Graphics



Mercedes 2017 E-Class Cockpit

# Automotive Graphics

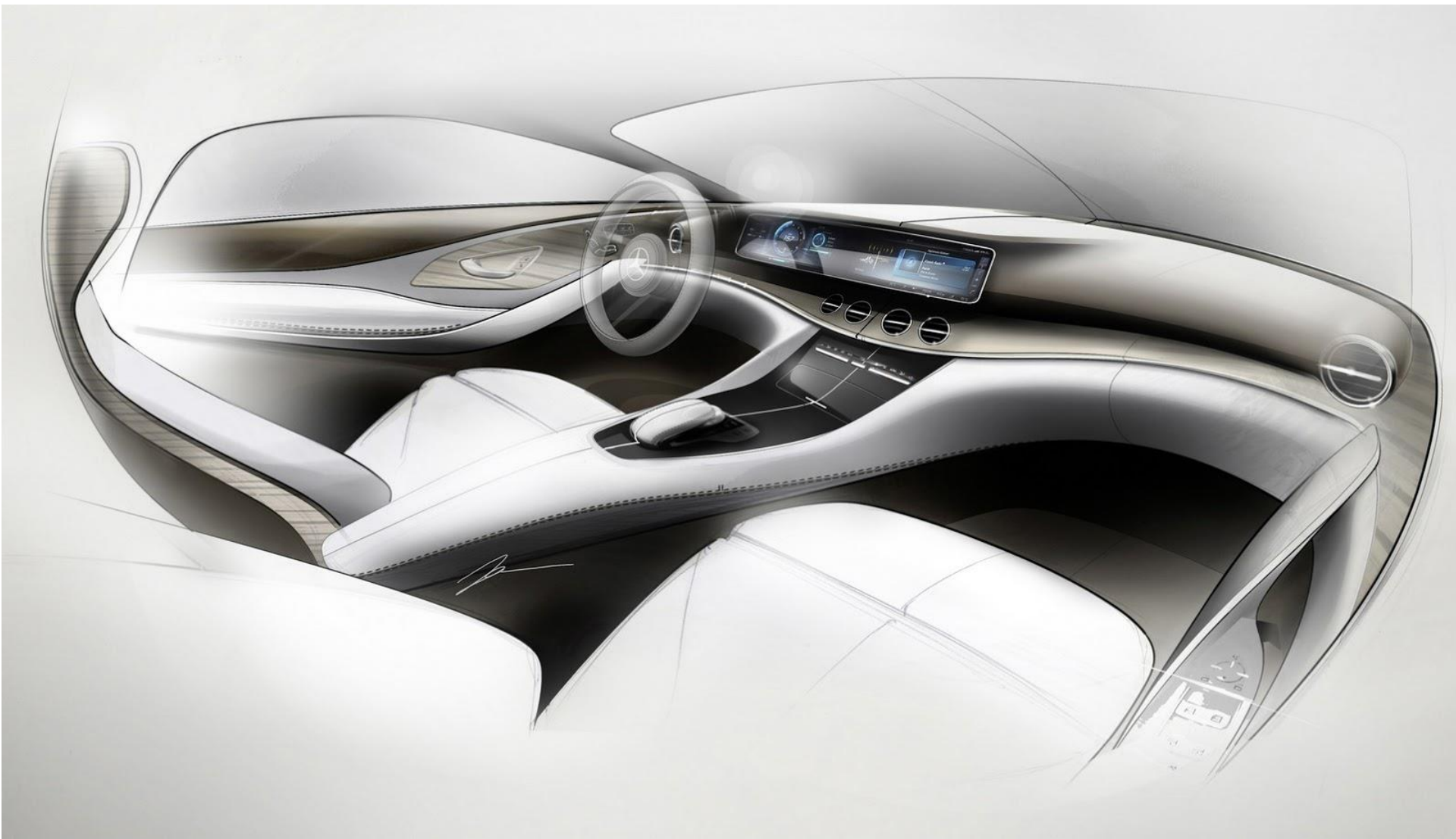


Tesla Model-S "Cluster"

# Automotive Graphics



# *Automotive Graphics*



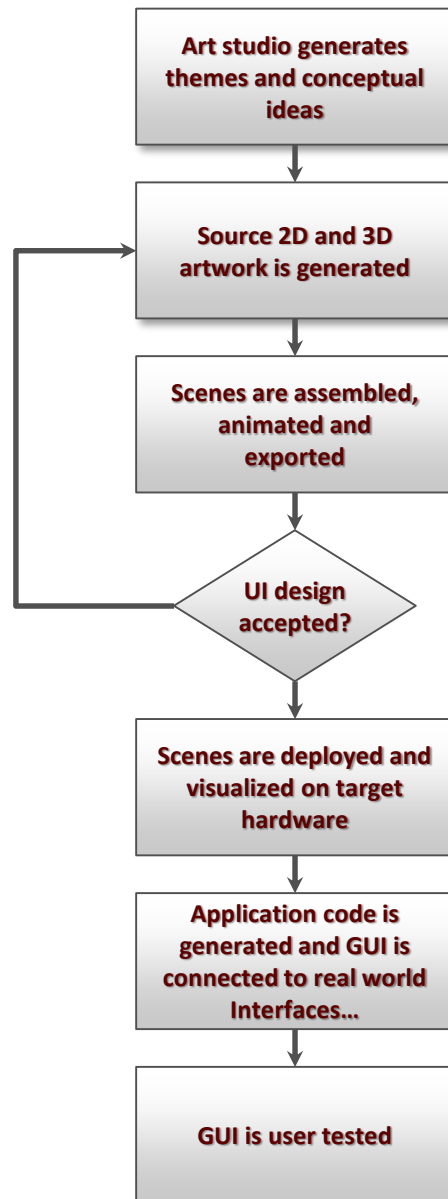
# Automotive Graphics



# Automotive Graphics



# Graphics Iterative Design Process



**Creation**

**Animation**



artists (design studios)

engineers (development labs)

**Visualization**

**Association**















**Validation**













# What's the Big Deal?



# *Top Automotive Brands?*



	#6	Toyota	\$42.1 B	11%	\$165.1 B	\$3.6 B	Automotive
	#14	BMW	\$28.8 B	4%	\$82.8 B	-	Automotive
	#20	Mercedes-Benz	\$26 B	16%	\$105.8 B	-	Automotive
	#23	Honda	\$25.2 B	8%	\$107.7 B	-	Automotive
	#35	Ford	\$14.1 B	12%	\$144.4 B	\$4.3 B	Automotive
	#36	Audi	\$14 B	10%	\$58.9 B	-	Automotive
	#59	Chevrolet	\$9.8 B	10%	\$74.9 B	\$5.1 B	Automotive
	#63	Lexus	\$9 B	13%	\$19.5 B	\$3.6 B	Automotive
	#67	Porsche	\$8.3 B	18%	\$23.9 B	-	Automotive
	#70	Nissan	\$8.2 B	13%	\$94.7 B	\$2.8 B	Automotive
	#71	Hyundai	\$8.1 B	-4%	\$52.8 B	\$1.8 B	Automotive
	#77	Volkswagen	\$7.6 B	-5%	\$132.1 B	-	Automotive

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# How to Protect the Brand?



## Against...

- theft
- attack
- malicious behavior
- replacement
- other bad things

## Types of Encryption

DES

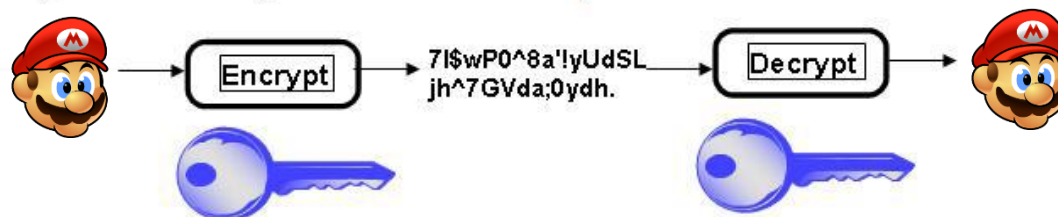
TripleDES

AES

RC5

### Symmetric Keys

- Encryption and decryption use the **same key**.



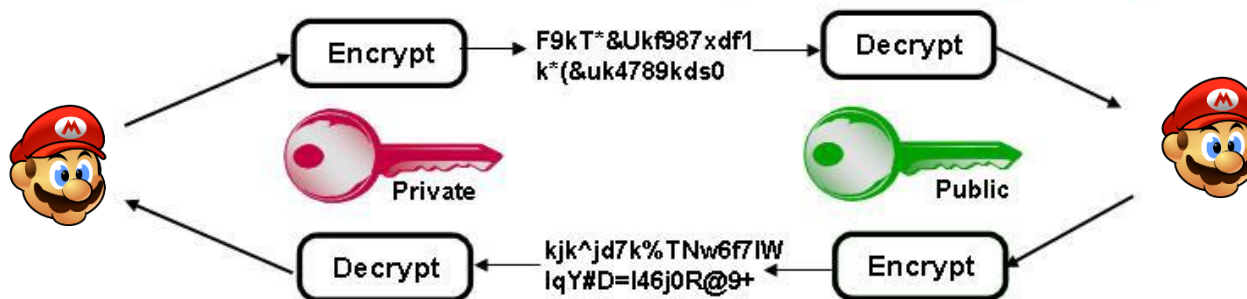
RSA

Elliptic

Curve

### Asymmetric keys

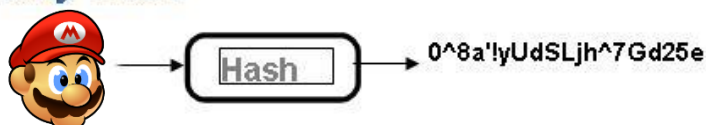
- Encryption and decryption use different keys, a **public key** and a **private key**.



MD5

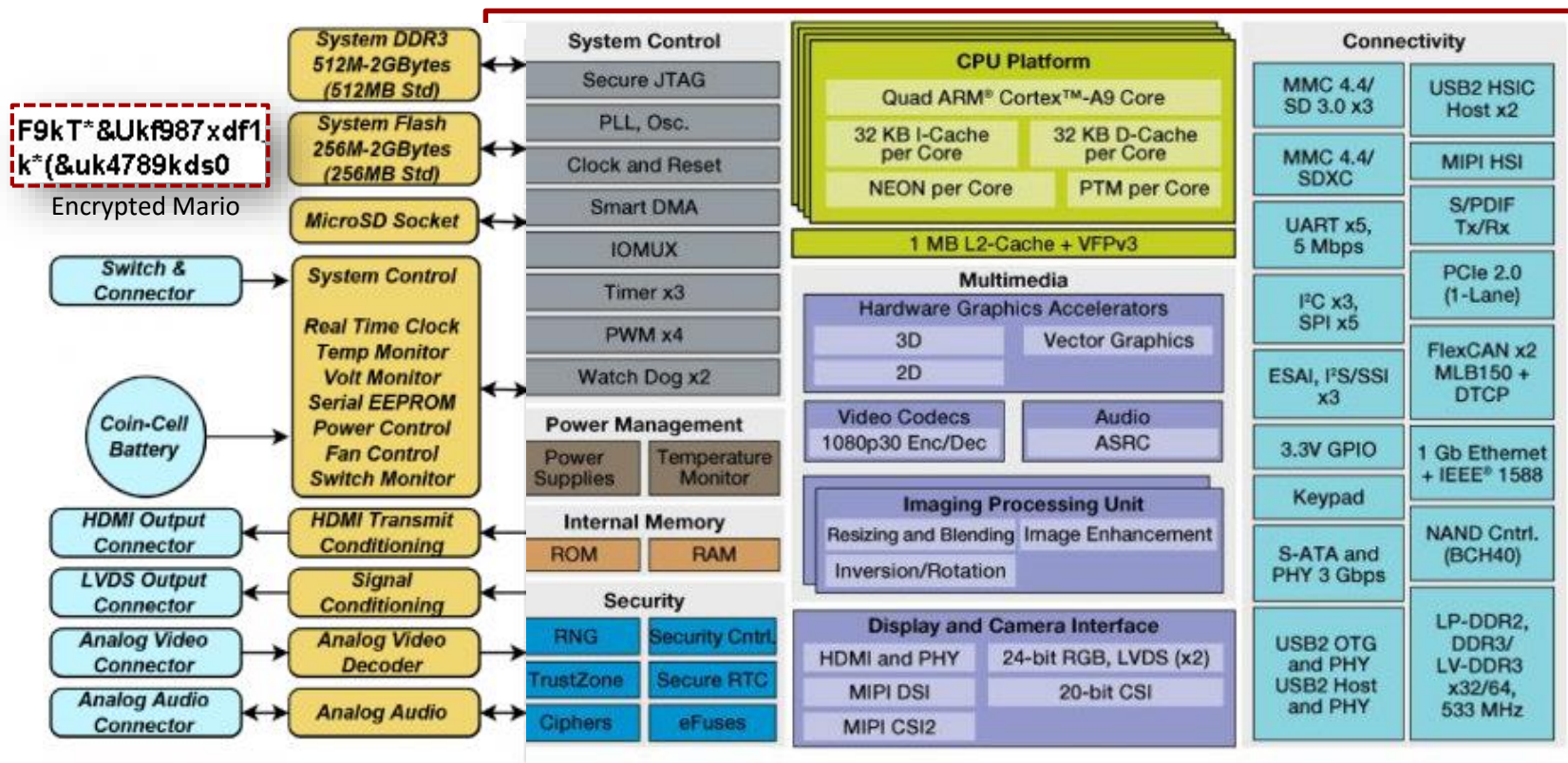
SHA-1

### One-way hash



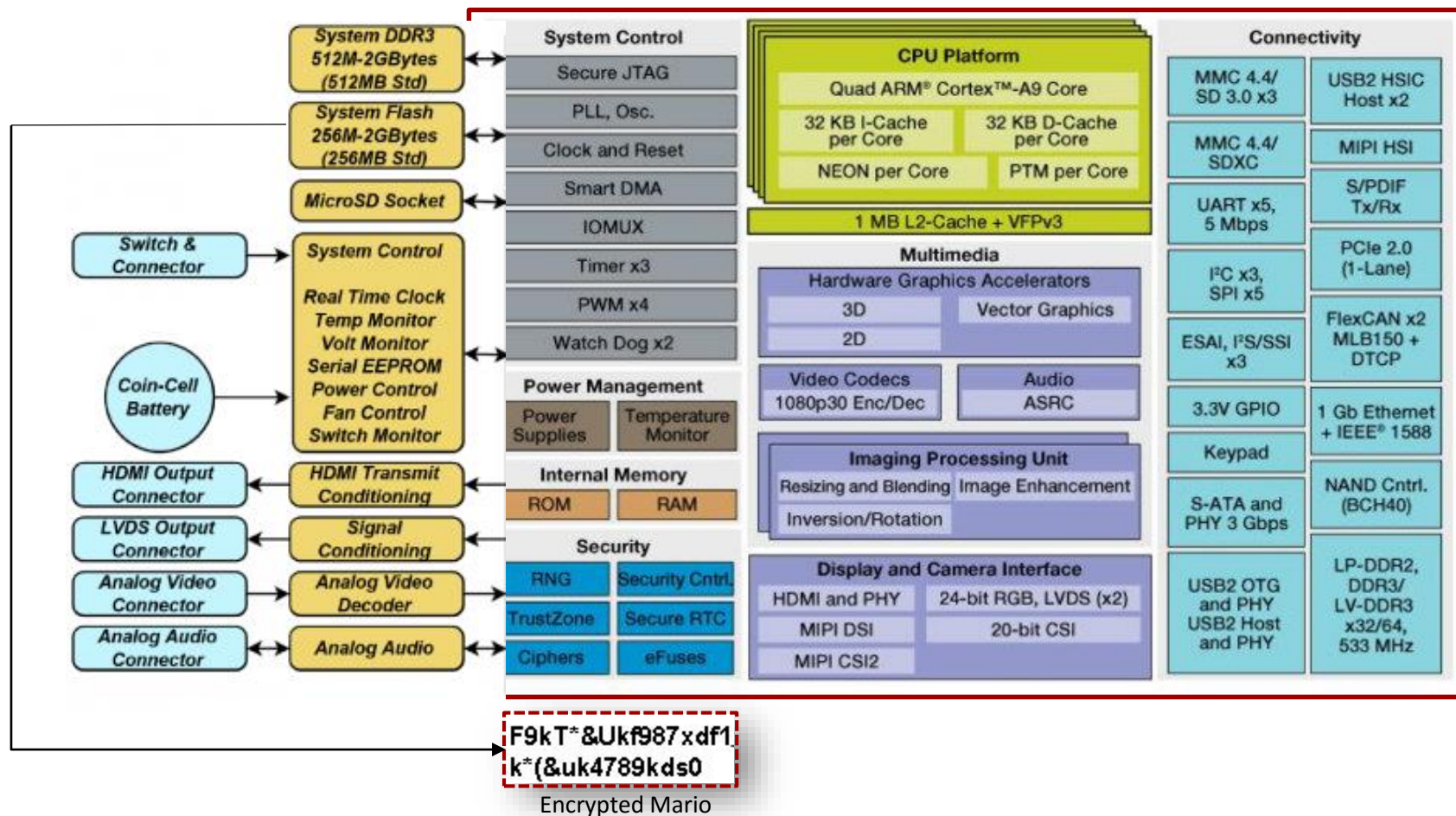
# How to implement encryption?

- Mario is encrypted and stored in flash



# How to implement encryption?

- Mario is encrypted and stored in flash
- Encrypted Mario is read from flash and sent off to security engine for decrypt

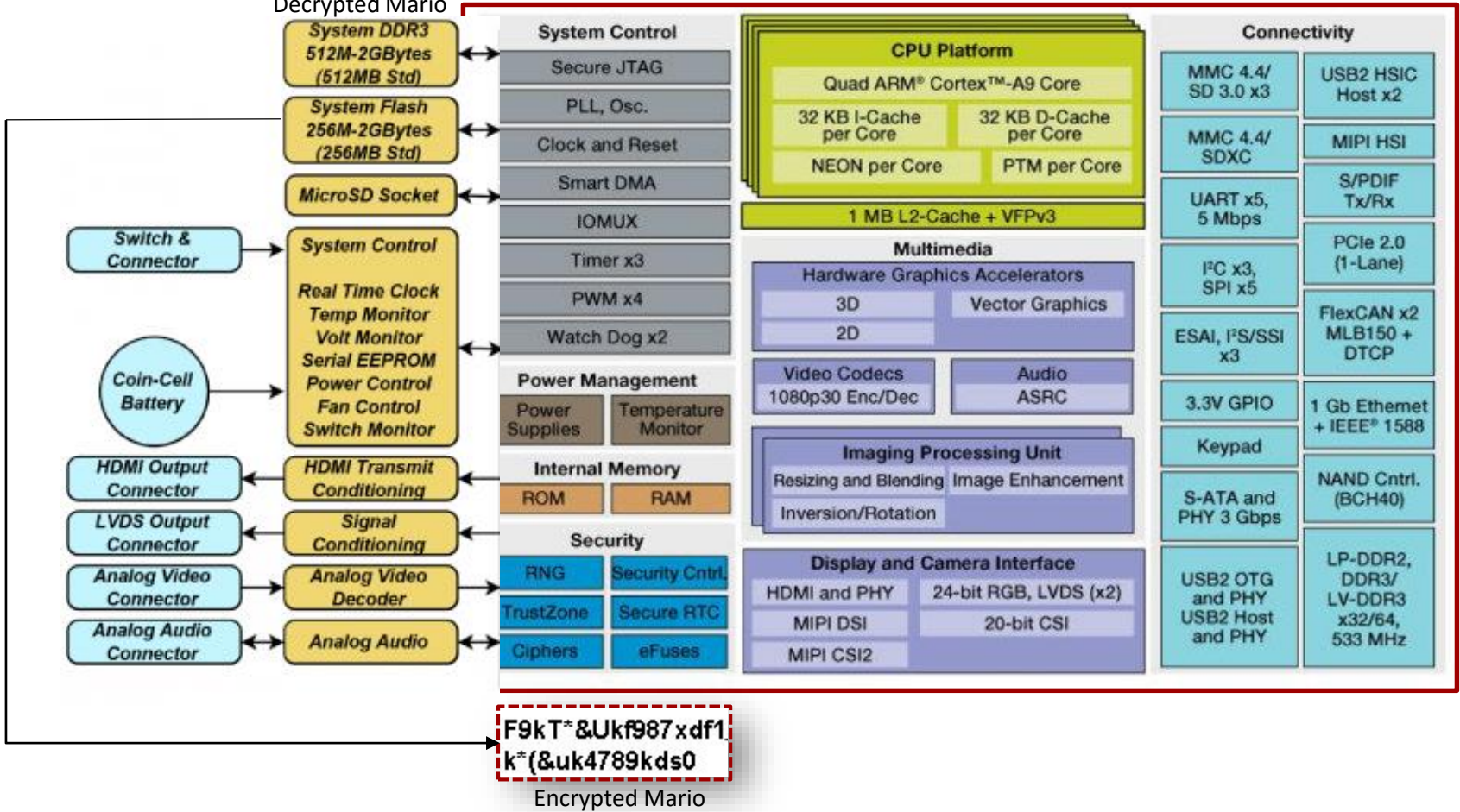


# How to implement encryption?



Decrypted Mario

- Decrypted Mario ends up in DDR

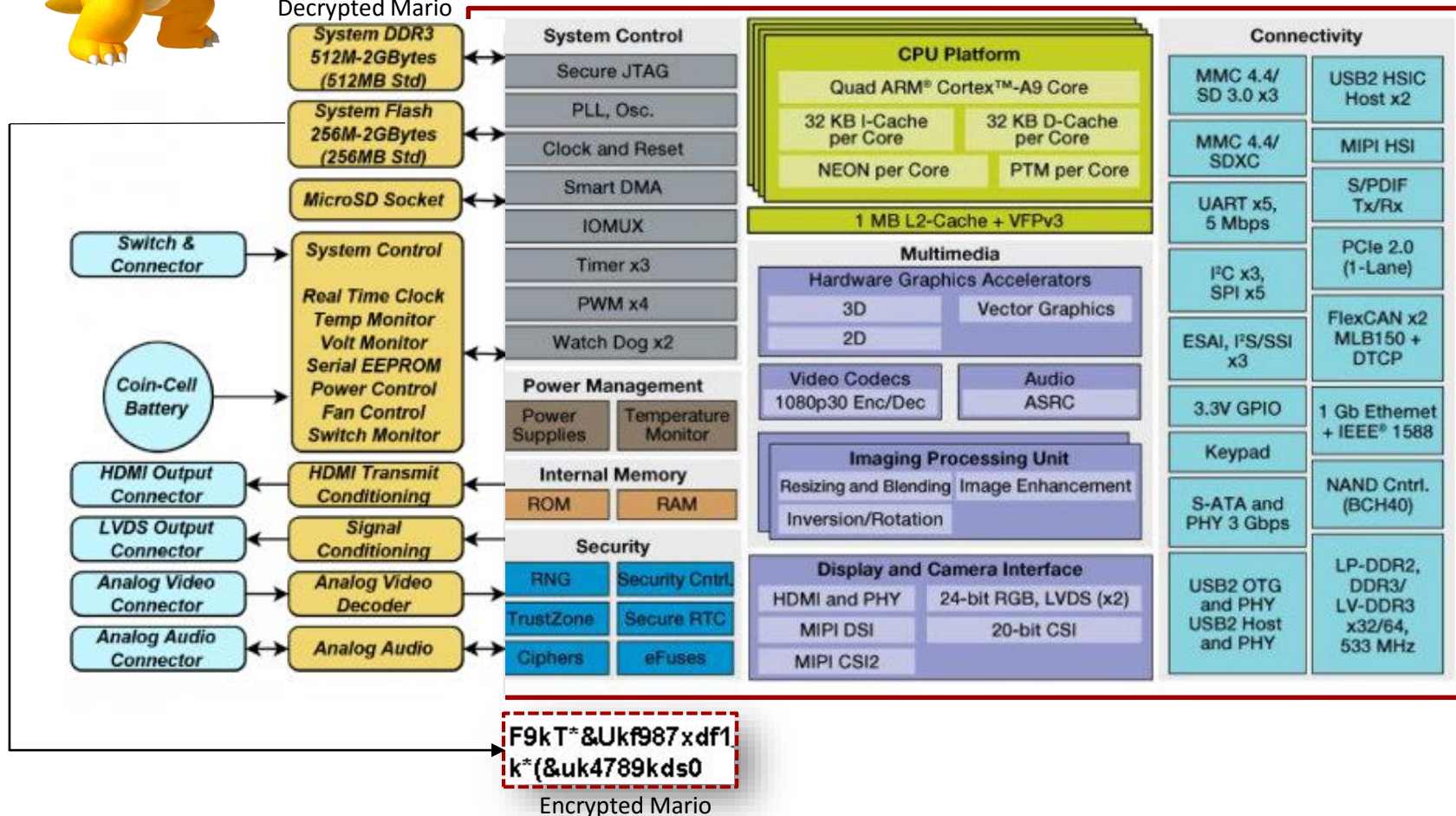


# How to implement encryption?



Decrypted Mario

- Decrypted Mario ends up in DDR
- Which is bad because Bowser is going to get him



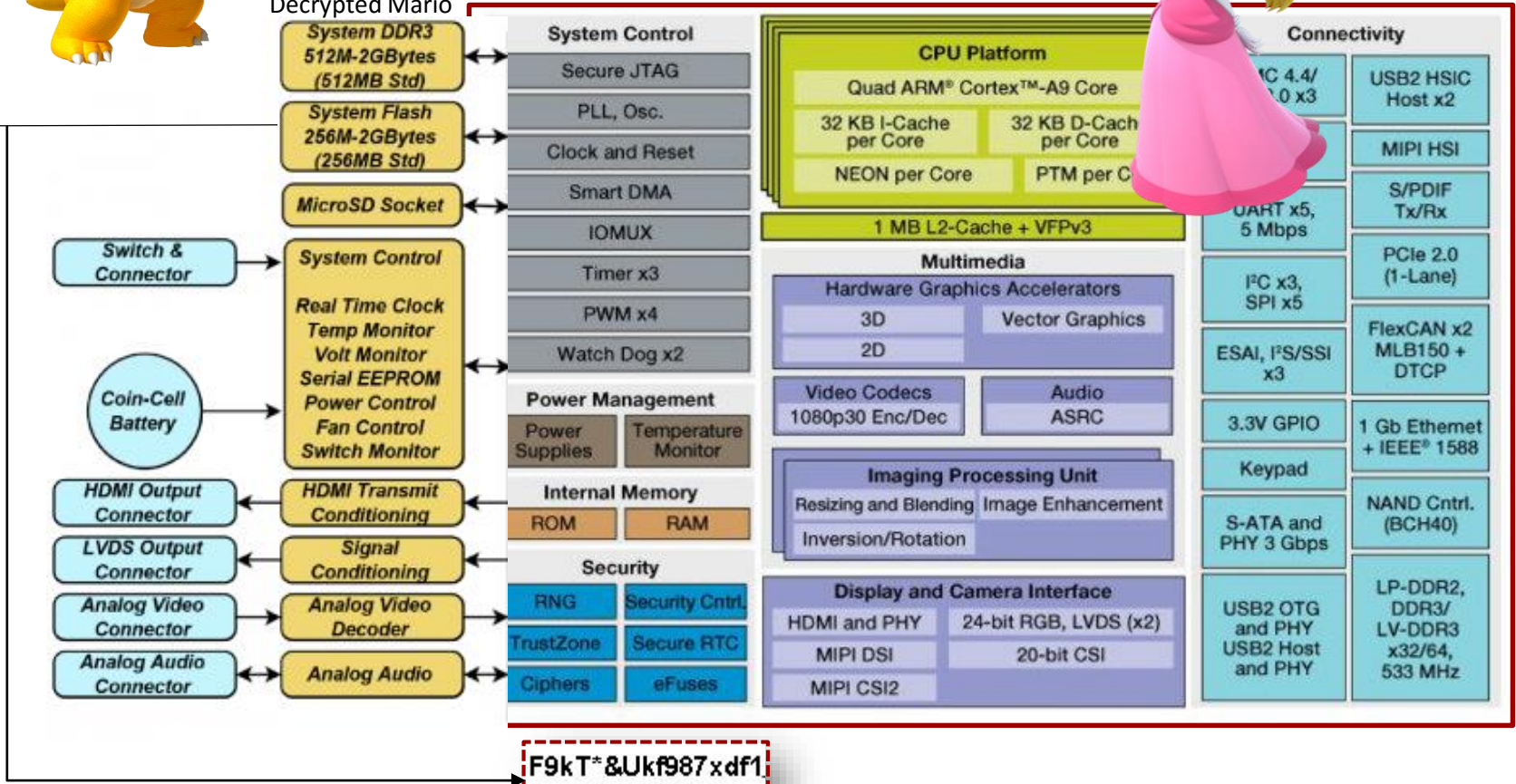
# How to implement encryption?



We need a better plan!!!



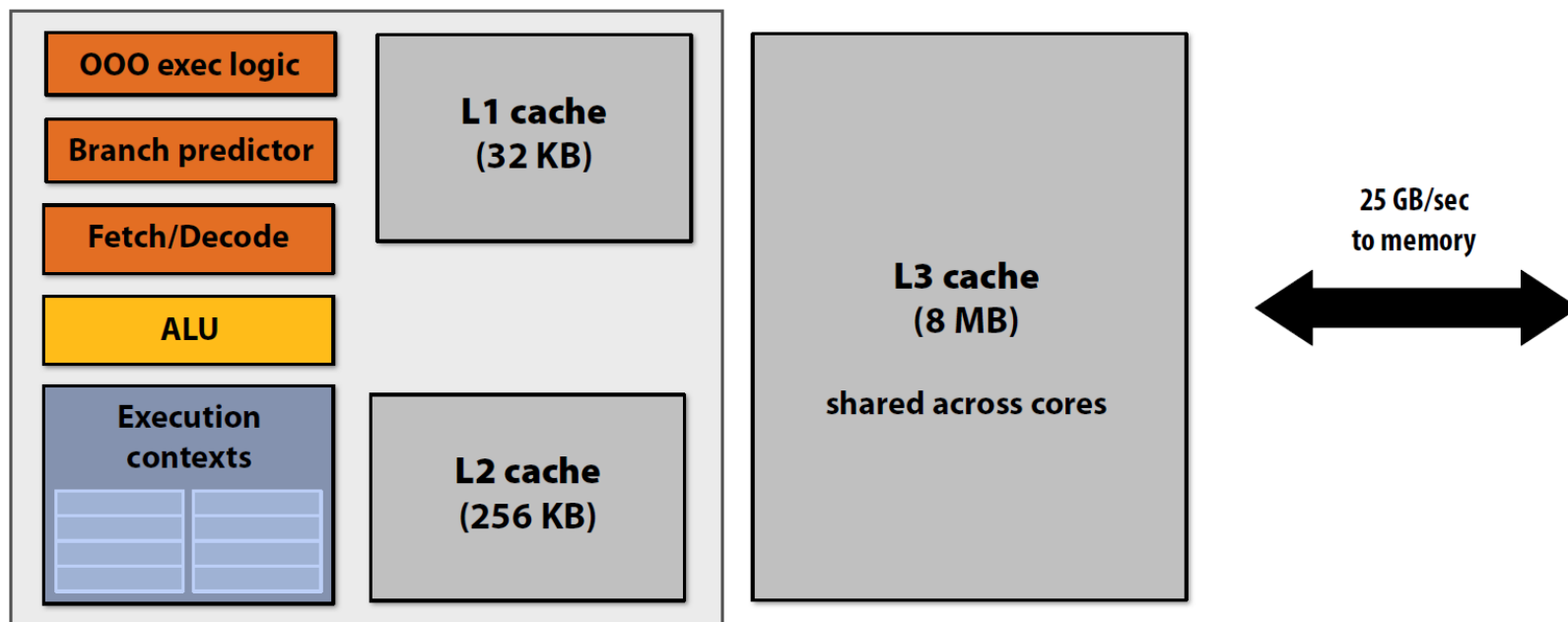
Decrypted Mario



F9kT\*&Ukf987xdf1  
k\*(&uk4789kds0

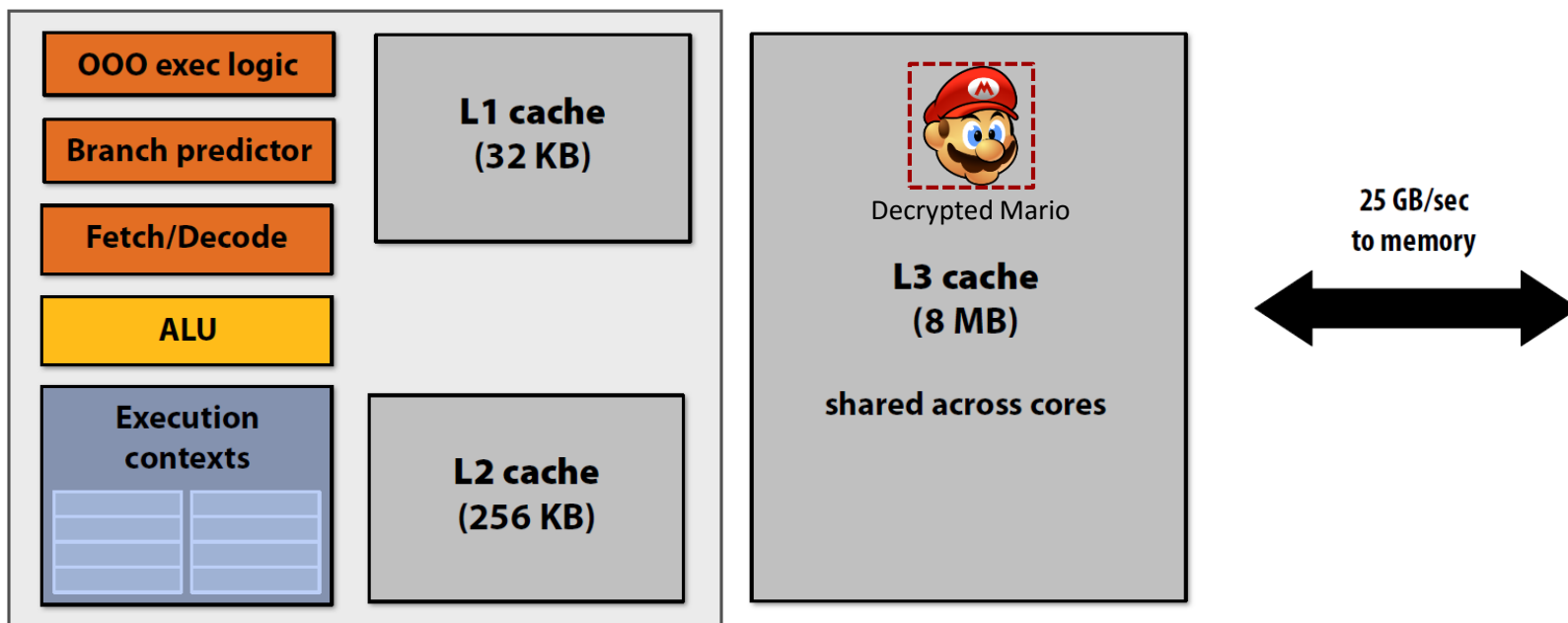
Encrypted Mario

# CPU Memory Organization



# Decrypt into L3 cache

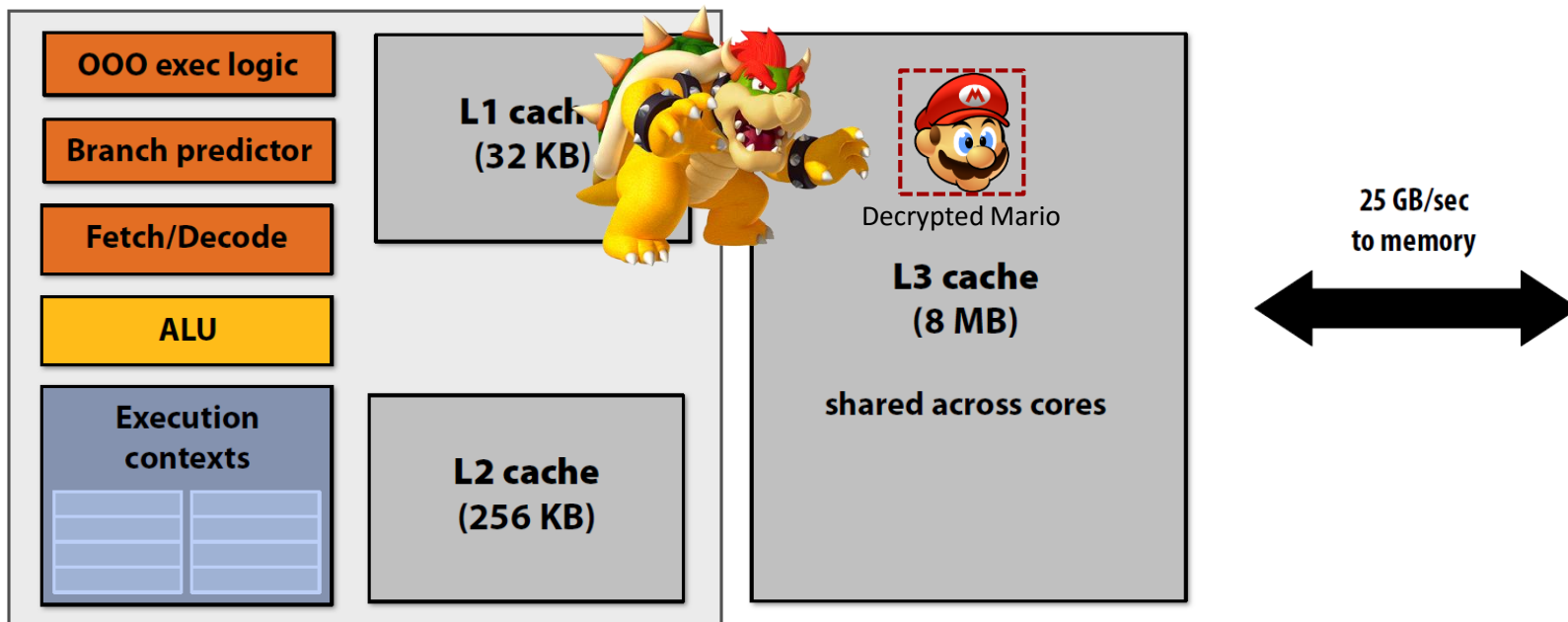
Force decryption into L3 cache  
by using clever, special software...



# Decrypt into L3 cache

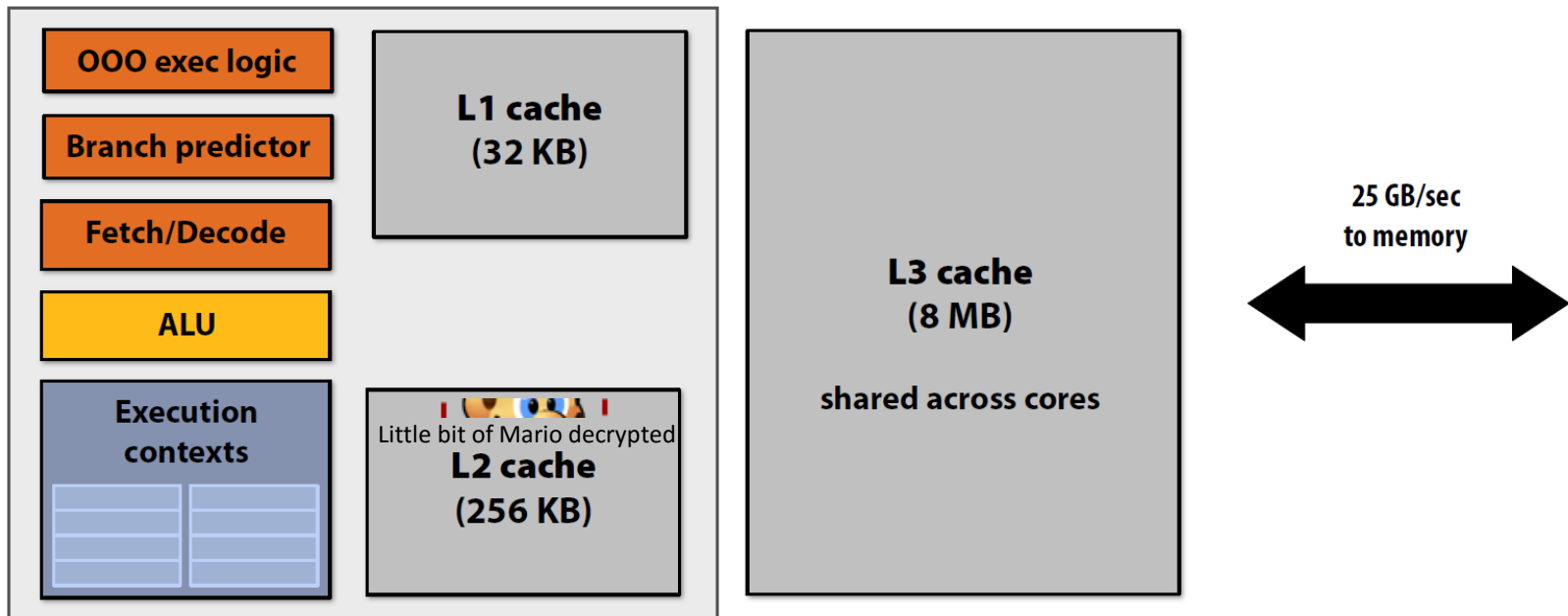
Force decryption into L3 cache  
by using clever, special software...

Bowser can still get at him...but it  
is more difficult



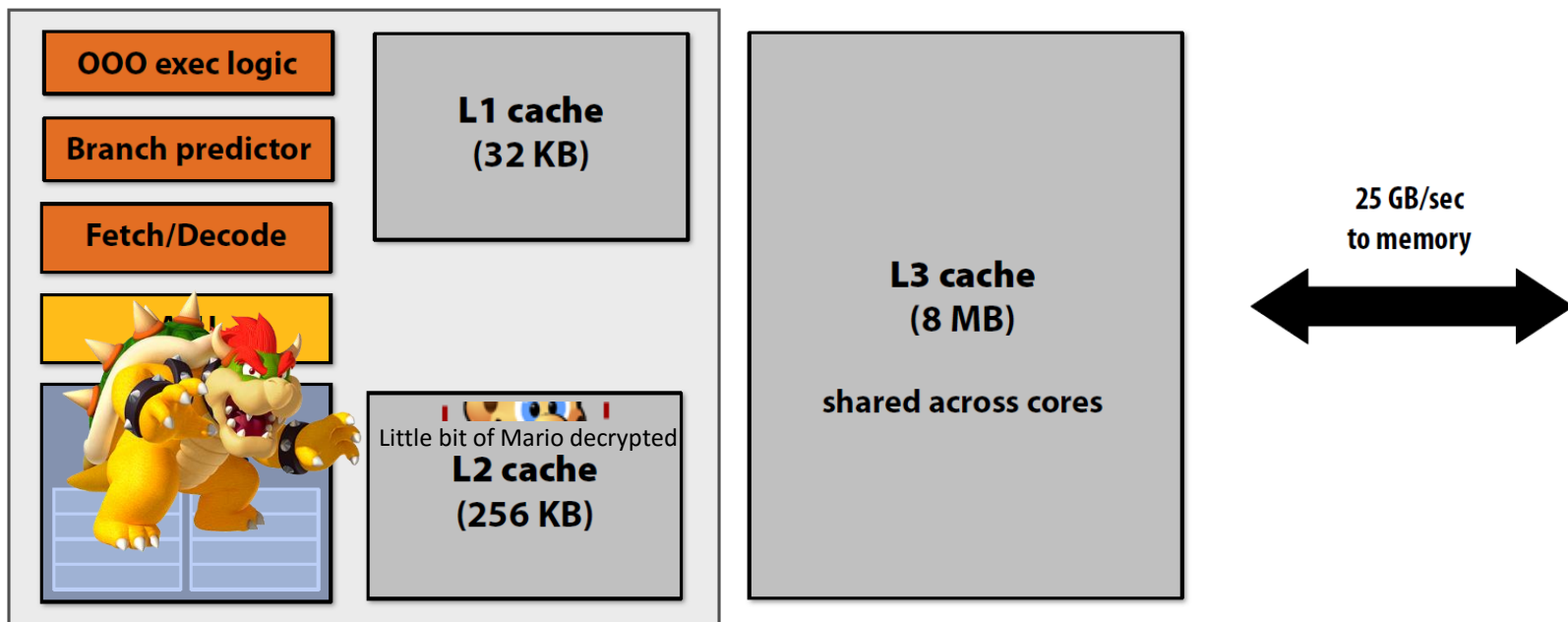
# Decrypt into L2 cache

Force little by little decryption of Mario into L2 cache  
by using clever, special software...



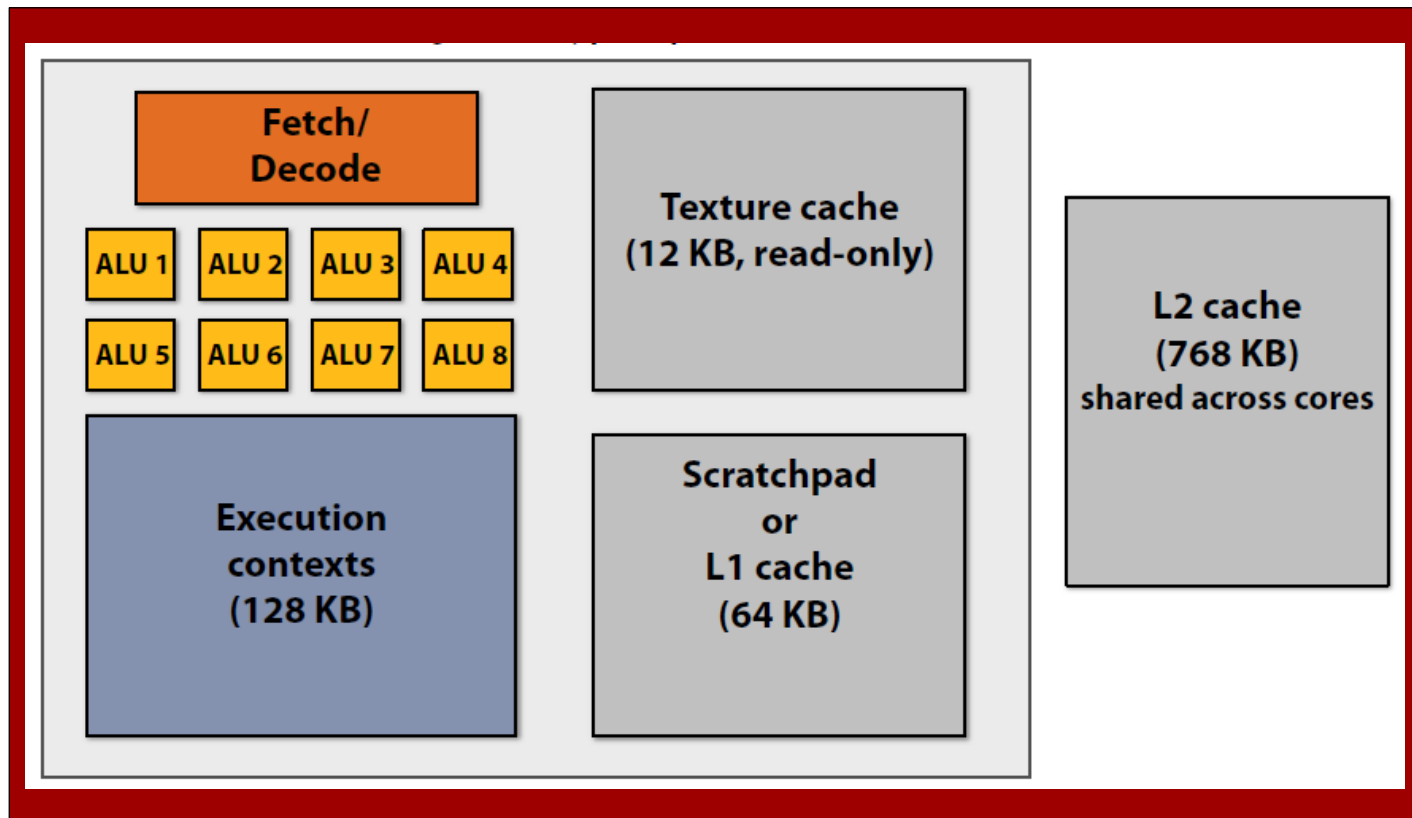
# Decrypt into L2 cache

Force little by little decryption of Mario into L2 cache  
by using clever, special software...



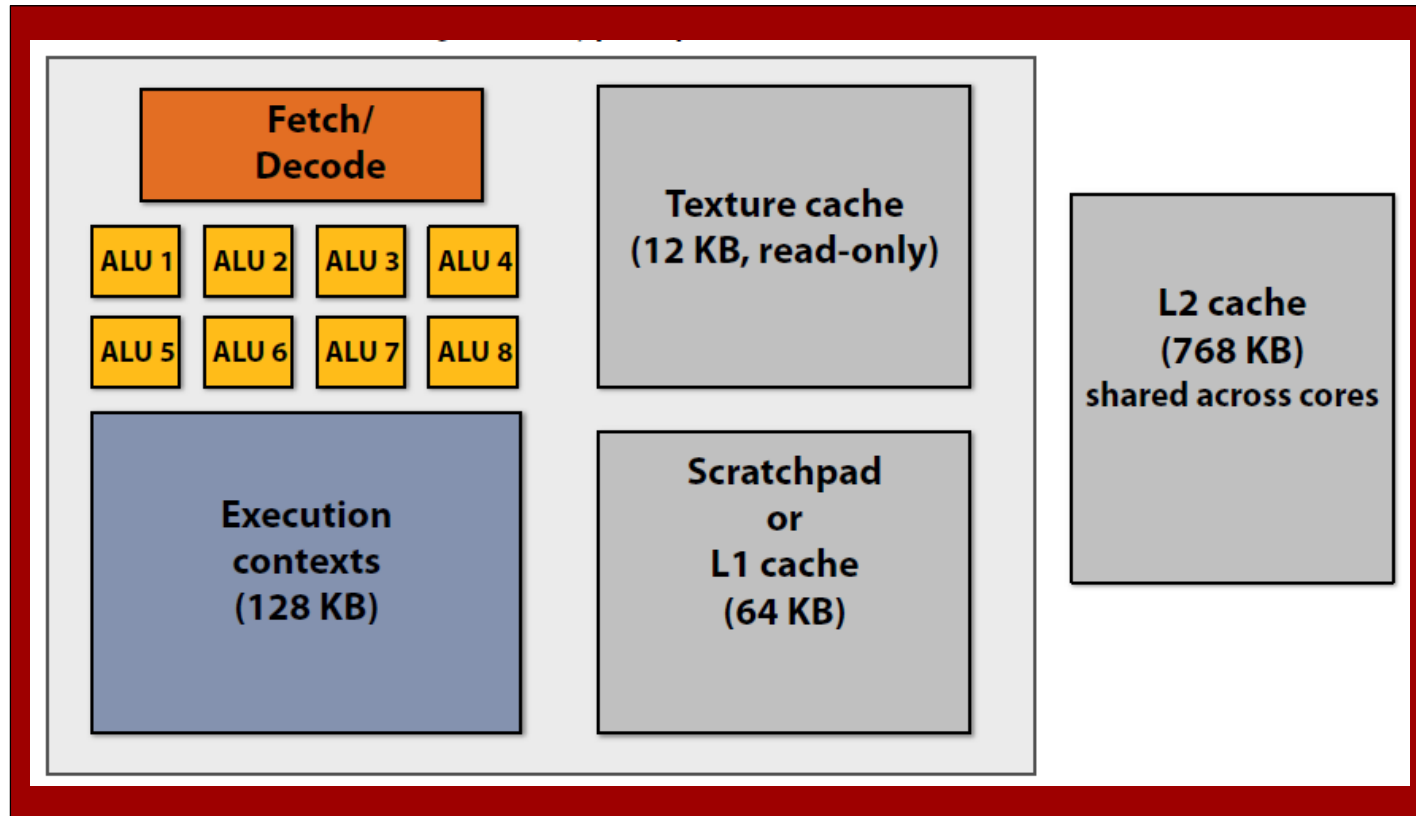
Bowser can still get at him...but it is *even* more difficult  
Mario has to be “assembled” from little pieces...so this is not a bad option for current automotive SoCs...and something that VeriSilicon is looking into currently...

***But HEY! The GPU is doing the drawing...***



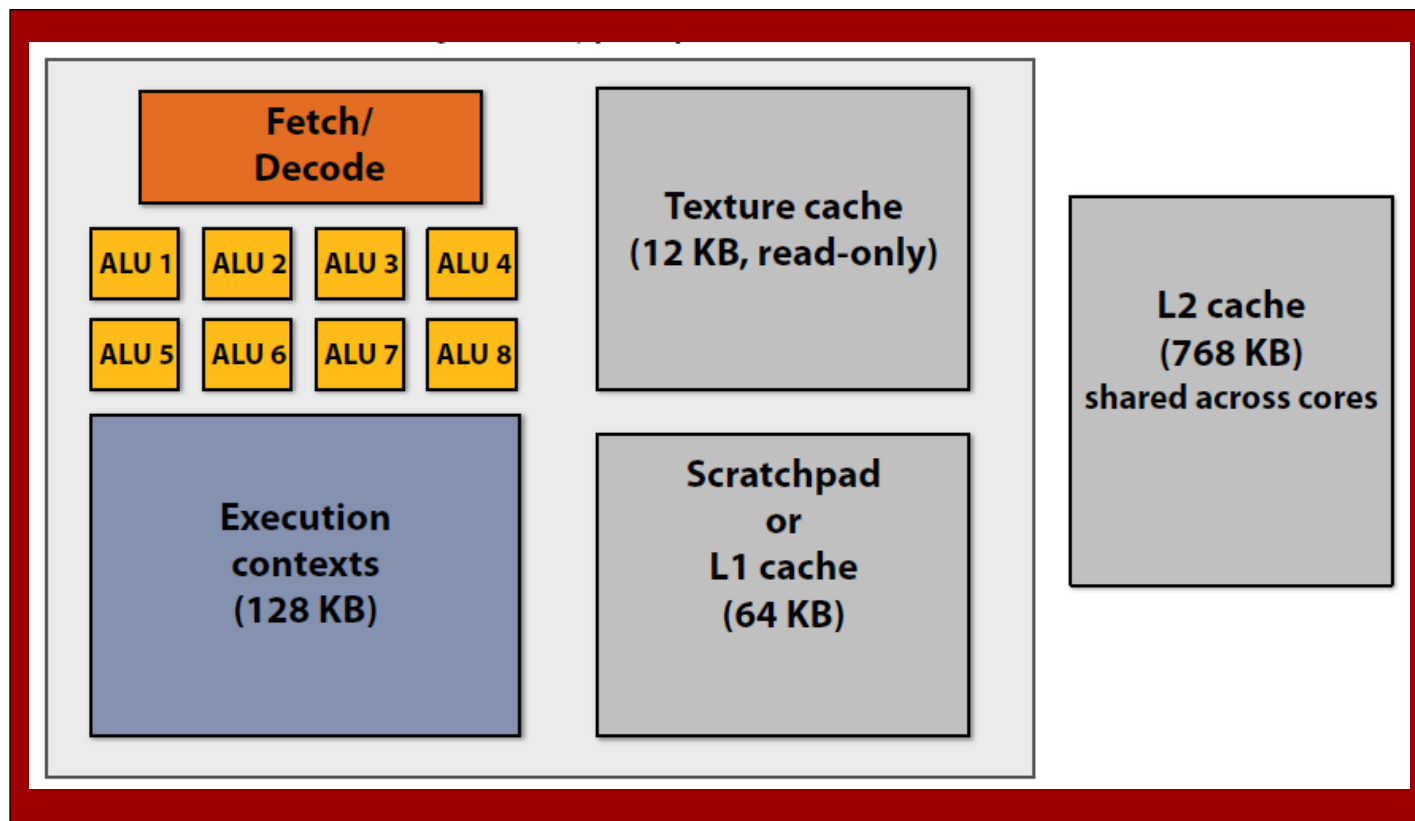
# *But HEY! The GPU is doing the drawing...*

Decrypt using a shader program?

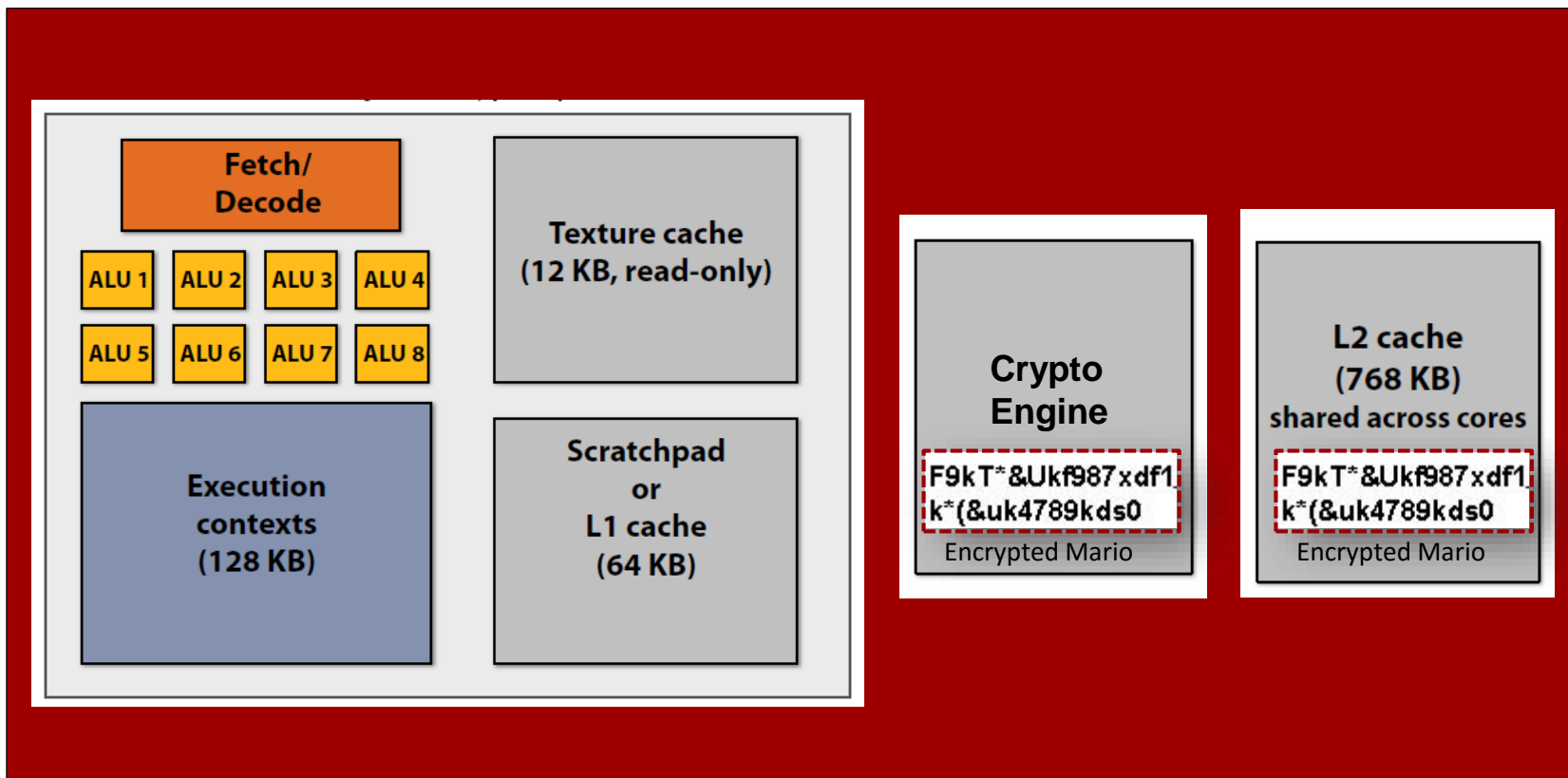


# ***But HEY! The GPU is doing the drawing...***

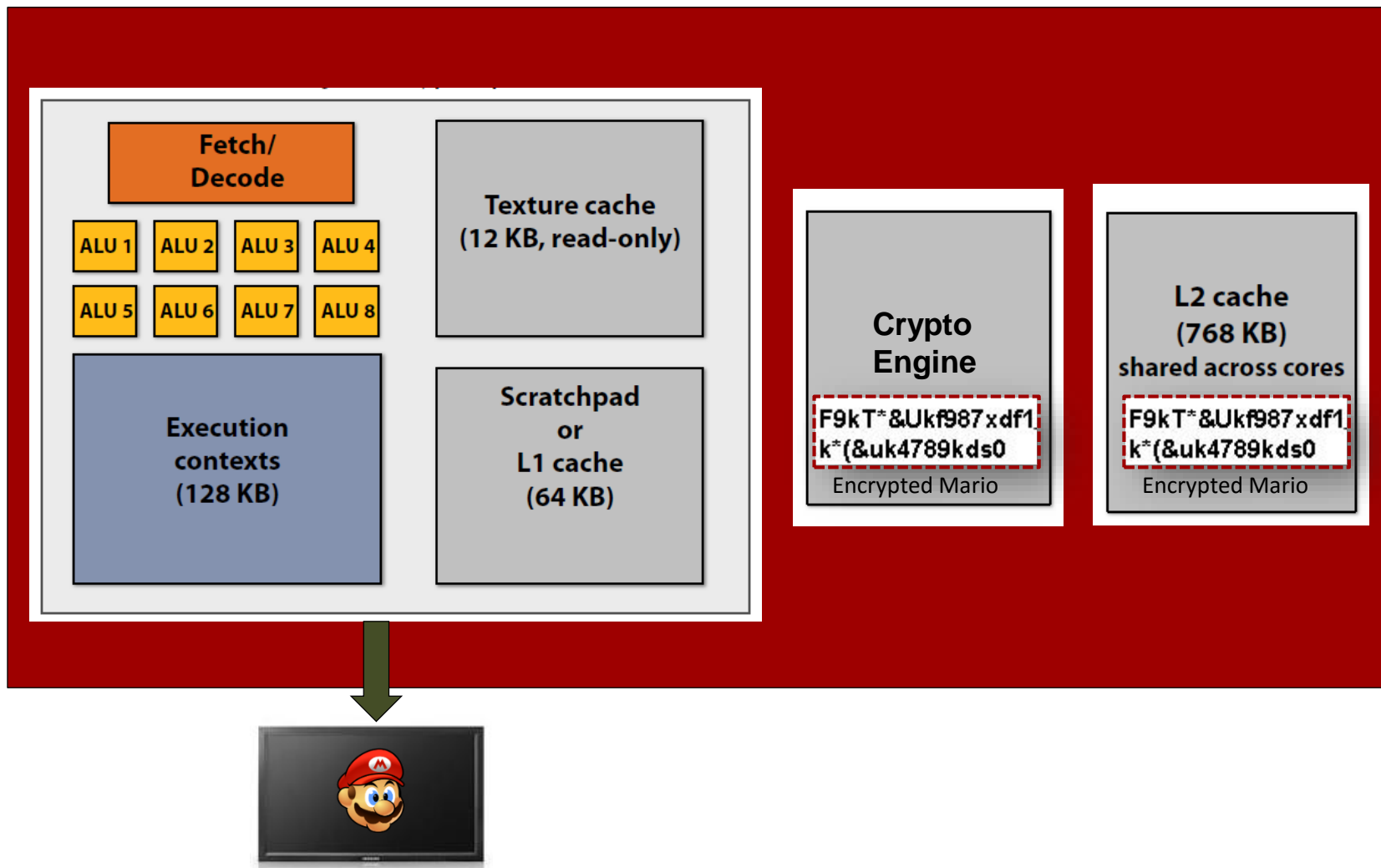
Decrypt using a shader program?  
*Your performance would be bad...*



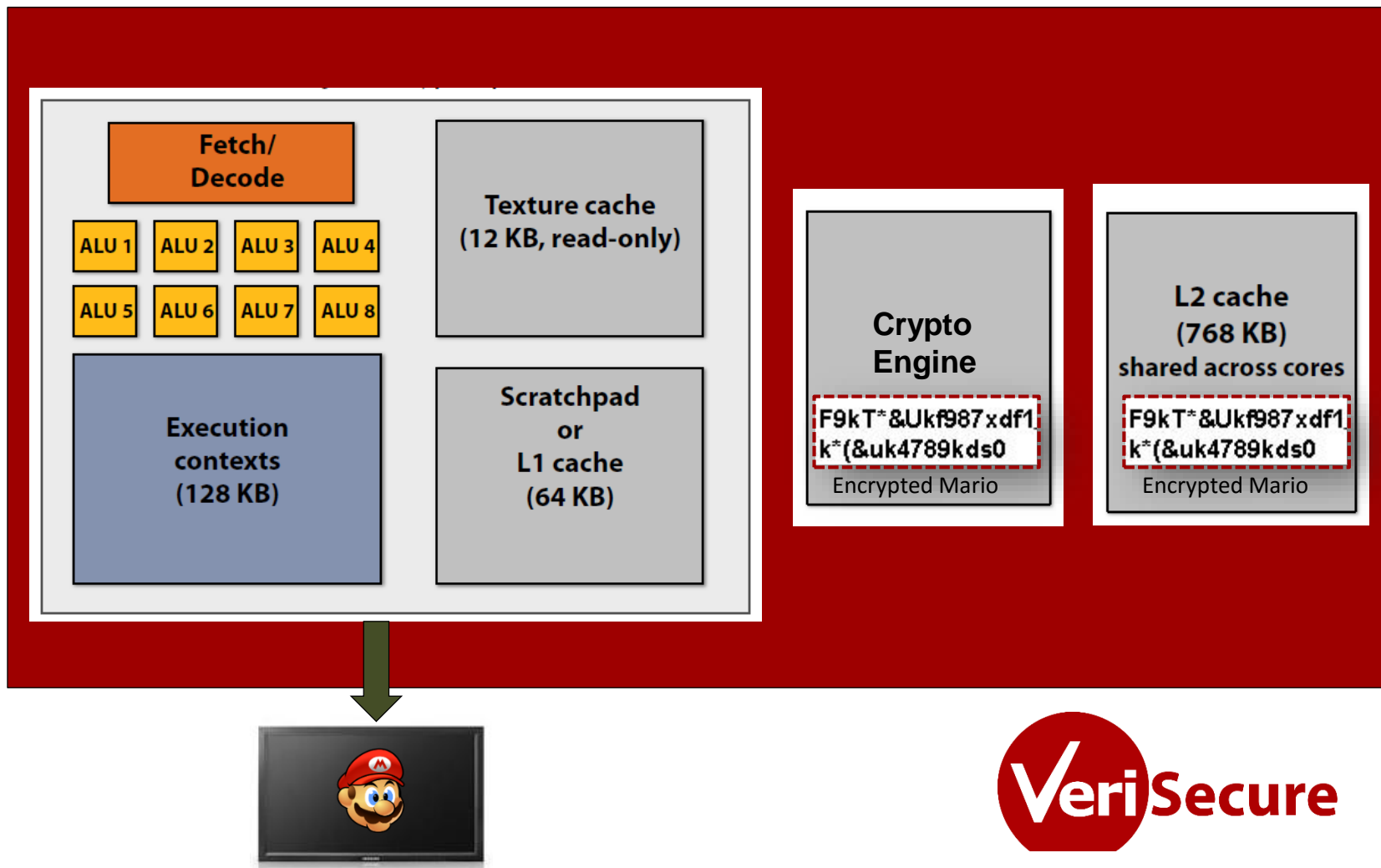
# Put the decryption block *INSIDE* the GPU?



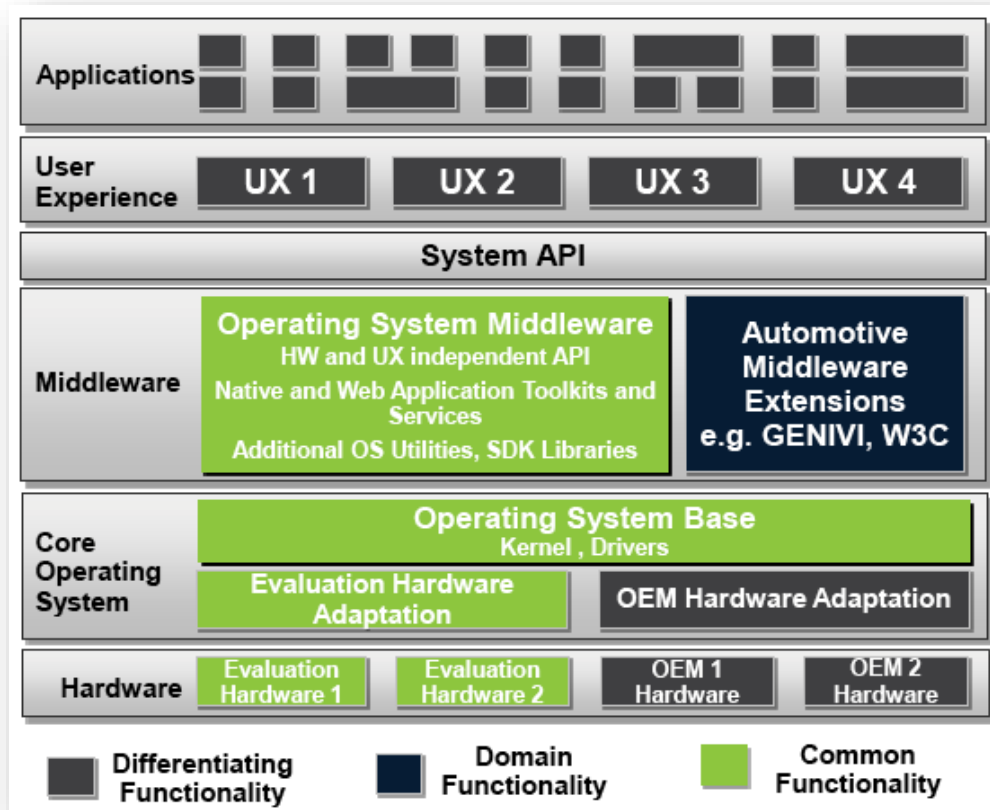
# Put the decryption block *INSIDE* the GPU!



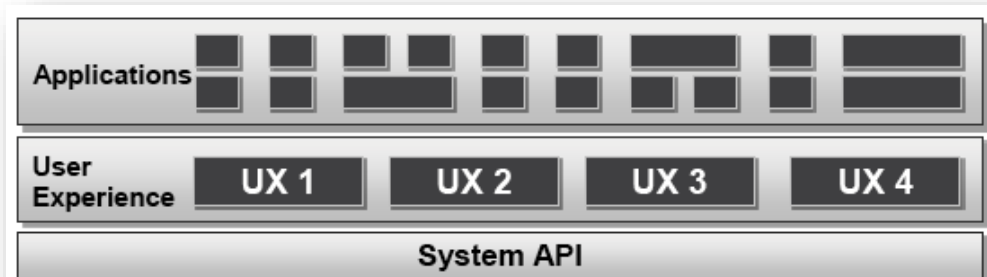
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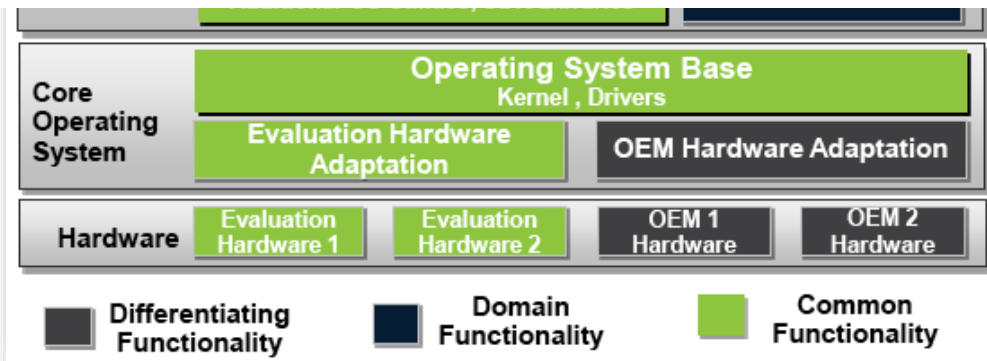
# AGL Built on Linux



# AGL Built on Linux



VeriSilicon looks forward to working with the AGL members to help secure automotive graphics...



# Questions

