EVOLUTION OF DISPLAYS AND ELECTRONICS FOR CONNECTED CAR

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JANUARY 12TH 2016

HARMAN

AGENDA

1. WHY IT MATTERS?

2. WHAT WILL YOU DRIVE IN 2025?

3. DISPLAYS & ELECTRONICS OF THE FUTURE CONNECTED CAR

4. SUMMARY

WHY IT MATTERS?

- **LOST 20:**
    - Average American spends ~**20**HRS/WEEK in commute

- **UNWANTED TECH:**
    - J.D Power reports that automakers are investing billions into technologies that >40% of consumers are not using..

- **DISRUPTION:**
    - The connected car is forecasted to be the most disruptive force in the technology industry since the smart phone.
    - Connected car slated to be $270B Industry by 2020.
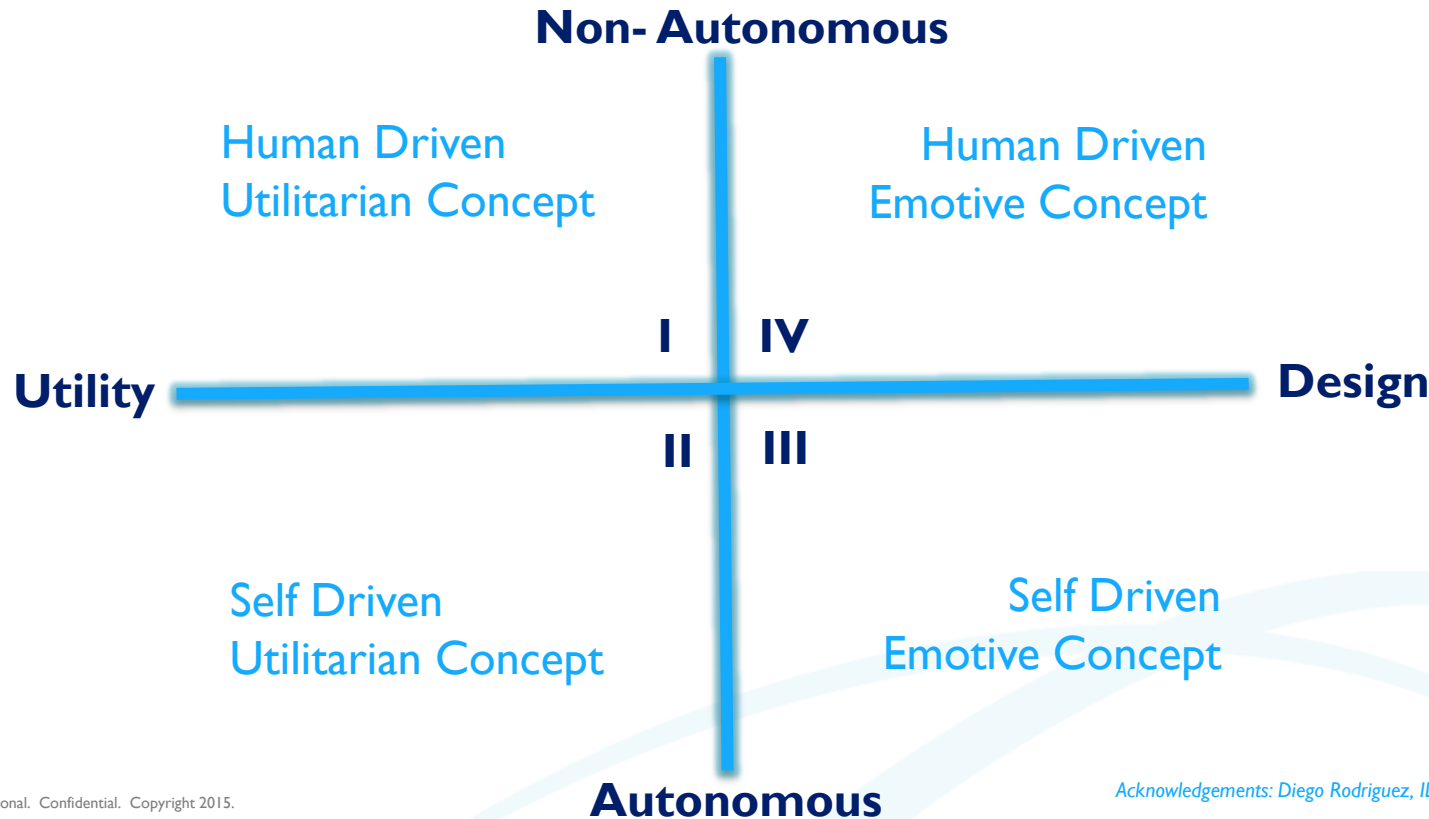   - Change in the relationship with our vehicles.

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DRIVING IN 2025?

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Non- Autonomous

Human Driven
Utilitarian Concept

Human Driven
Emotive Concept

I IV

Utility ———————————————— **Design**

II III

Self Driven
Utilitarian Concept

Self Driven
Emotive Concept

Autonomous

Acknowledgements: Diego Rodriguez, IDEO and MIT Media Lab

DRIVING IN 2025?

Non-Autonomous

No foreseeable disruption.
Will they exist?
e.g: Taxi cabs, delivery vehicles

Visceral thrill
Antiquated driving experience
How will regulations impact this segment?
e.g: Ferrari 250 GT SWB

I   IV

Utility ————————————————————— **Design**

II   III

Big gains for mass transportation
Robotic delivery vehicles
EV or Fuel Cell
What are likes of Uber, Google upto?
e.g: Google self-driving car; Cody concept Car

Massive Innovation Opportunities
Evoke emotional response.
EV or Fuel Cell
The holy grail?
e.g: Porsche Mission E (concept)

Autonomous

DRIVING IN 2025?

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Utility   **Design**

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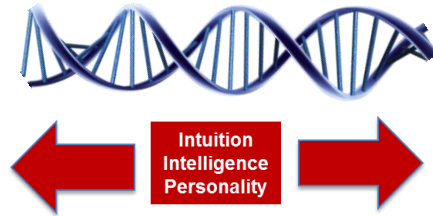
BRAIN OF THE CAR

DNA Link

Intuition
Intelligence
Personality

Brain
- Sight
- Sound
- Feel
- Taste
- Memory
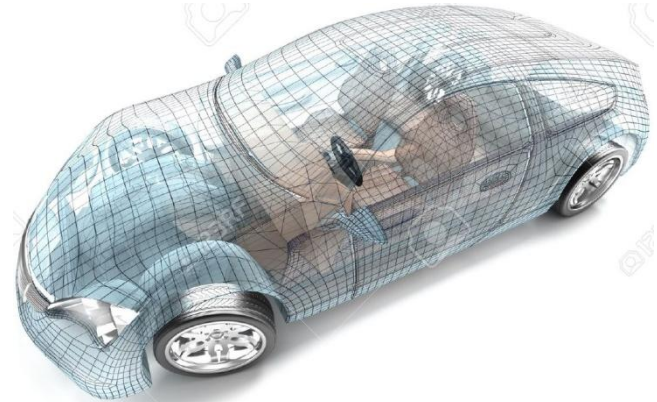
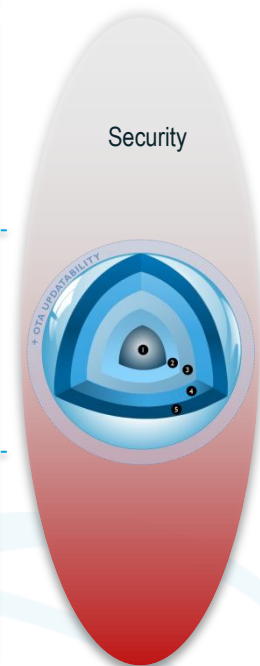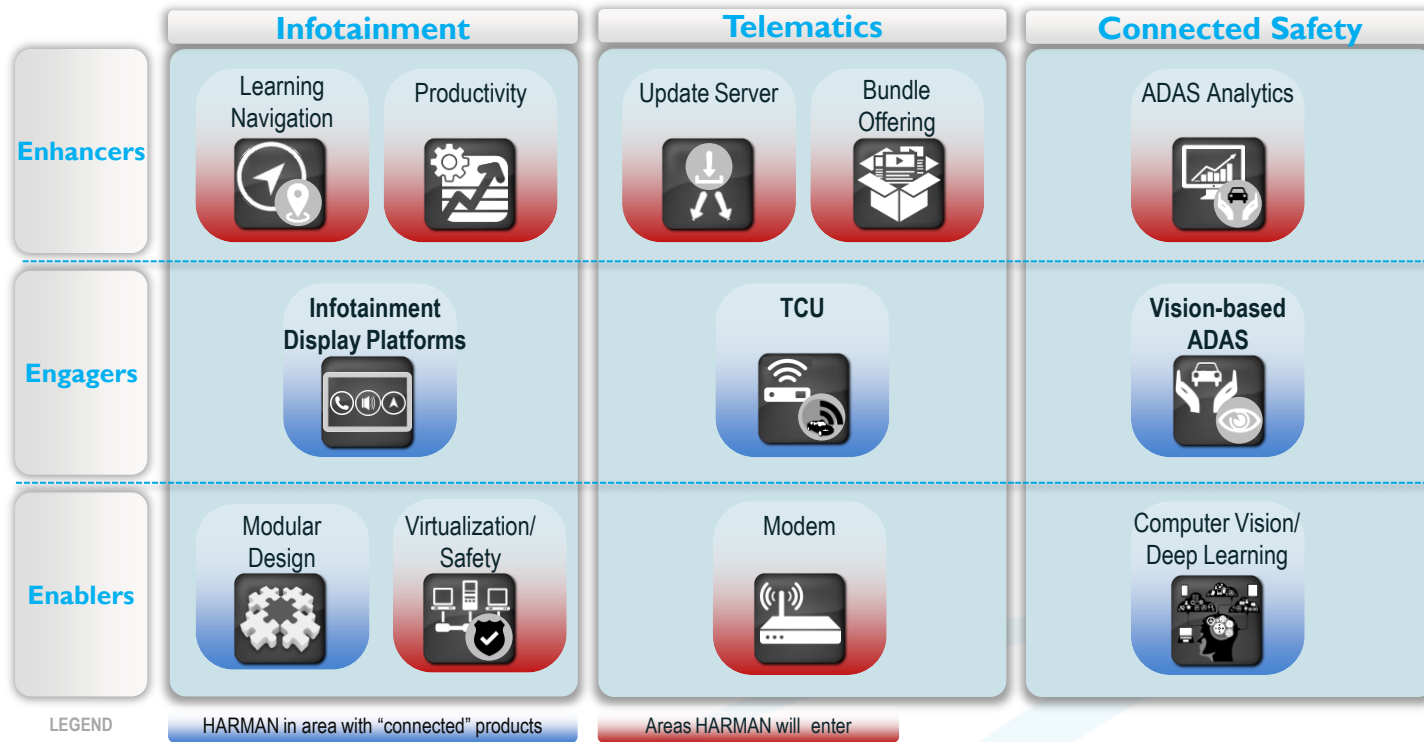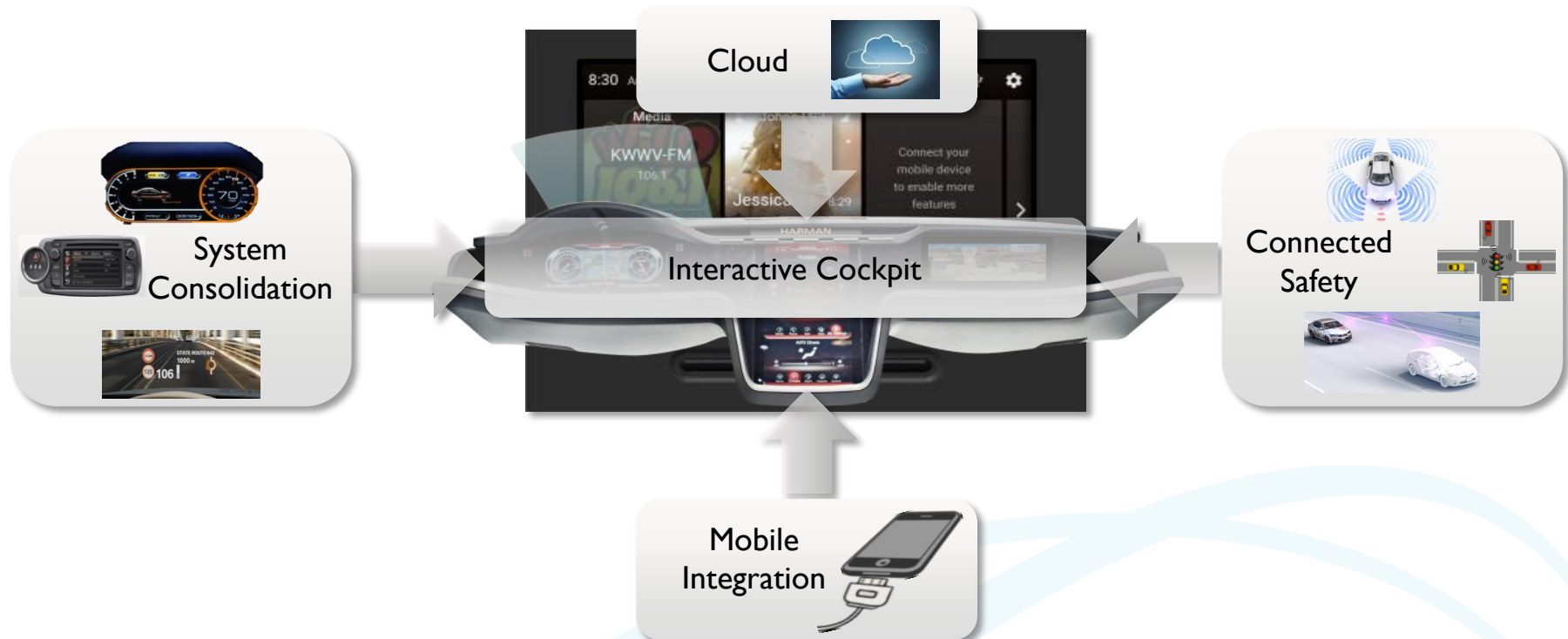## Headunit
- Displays and Sensors
- Data
- V2I Infrastructure
- Cloud
- Connectivity

CONNECTED CAR DISPPLAYS & ELECTRONICS

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	Infotainment		Telematics		Connected Safety
Enhancers	Learning Navigation	Productivity	Update Server	Bundle Offering	ADAS Analytics
Engagers	Infotainment Display Platforms		TCU		Vision-based ADAS
Enablers	Modular Design	Virtualization/ Safety	Modem		Computer Vision/ Deep Learning

Security

LEGEND — HARMAN in area with "connected" products — Areas HARMAN will enter

CONNECTED CAR DISPLAYS & ELECTRONICS

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Cloud

Interactive Cockpit

System Consolidation

Connected Safety
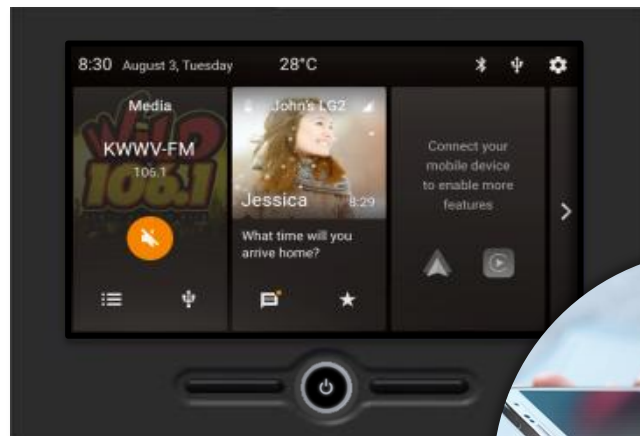
Mobile Integration

QUADRANTS I, II, III

ENTRY LEVEL

SMART DISPLAY

HIGHLIGHTS

- Highly cost effective,
- Meet CarPlay, GAL specs
- Ready to go with cutting edge HMI design
- OTA Updates & Cyber Security

MID & HIGH LEVEL

Cloud

System Consolidation

Connected Safety

Mobile Integration

MID & HIGH LEVEL

SAFETY | CAR | ENTER-TAINMENT

HYPERVISOR

HIGHLIGHTS

System integration
including Cluster and Safety

Augmented Reality and learning Navigation

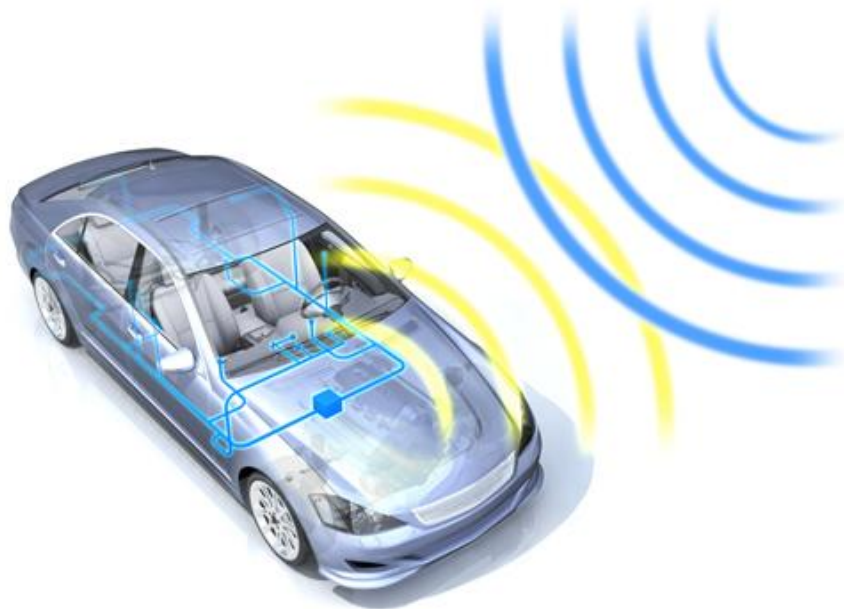**Productivity Suite**
Including email, calendar and other office apps

Autonomous Driving

OTA Updates & Cyber Security

CONNECTIVITY

HIGHLIGHTS

Increase competitiveness
by own modem development

Update server
for entire vehicle

Bundle offering
for hardware and services

PASSIVE-ACTIVE-CONNECTED

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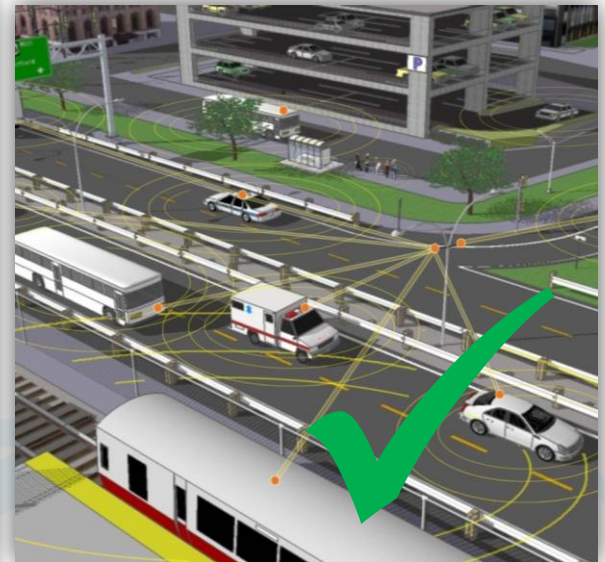
Passive Safety

Increase chance of surviving a crash

Active Safety

Mitigate or prevent an imminent crash

Connected Safety

Stay out of trouble

CONNECTED SAFETY

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Knowledge Fusion

Vision-based ADAS

LDW	FCW
TLR	PWS

V2X

E-Horizon

A milestone on the path to autonomous driving

POTENTIAL ATTACK VECTORS

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ATTACK SOURCES

- JTAG Tools
- Dealer Diagnostic Tools
- Networked Multimedia Devices
- Other ECUs

Debug Ports
OBD II Port
AVB/MOST
CAN/LIN

INFOTAINMENT

Platform, Content & Connectivity Networks

BT/Wi-Fi/USB
Cellular
DSRC

ATTACK SOURCES

- Consumer Device (USB pen-drive, Phone)
- Remote Server (Downloadable apps, FOTA image, Telematics Functions)
- V2X Comm.
- CD/DVD/Blu-ray

ATTACK SURFACES

ATTACK VECTORS

18

CONNECTED CAR SECURITY

3. OS ACCESS CONTROL

Policy driven secure control of access to peripherals, storage and memory

1. SECURE HARDWARE PLATFORM

HW supported Trusted Execution Environment & protected key store

2. HYPERVISOR

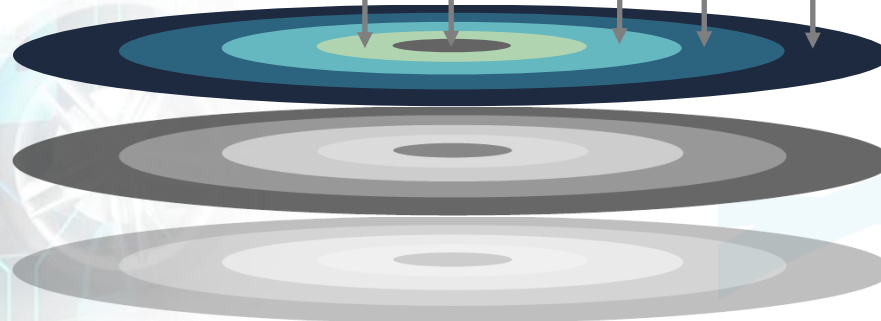Type-1 Hypervisor – isolation between execution domains

4. APPLICATION SANDBOXING

Resource Isolation between applications
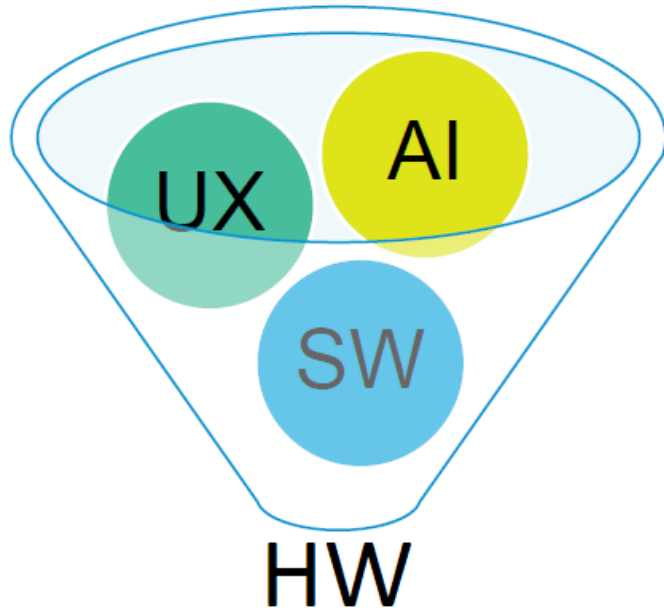
5. NETWORK PROTECTION

Secure communications for internal networks and external world

+1 OTA UPDATEABILITY

INTERCONNECTED INNOVATION

THANK YOU