# INFOTAINMENT: INTRODUCTION TO NXP IVI SOLUTION TO ACCELERATE CUSTOMER TIME-TO-MARKET

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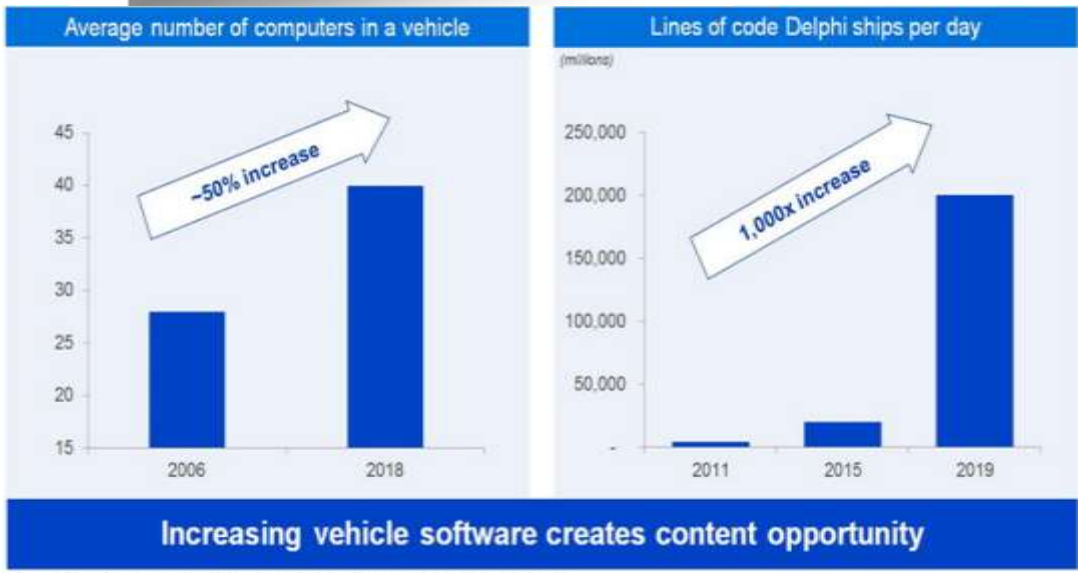
# AGENDA

- Background of NXP IVI Solution
- High level description and variants
- Distributed IVI Platform
- Centralized IVI Platform
- High level roadmap and delivery scheme
- Focus on Fast Boot and SafeAssure RVC
- Licensing options

# Why is NXP engaging on IVI Platform?

- Complexity is increasing abruptly in the IVI market, while TTM has decreased from 5 to 2-3 years over a few product generations.
- Tier 1s are moving from:
  - a close to an open system model (user can install apps)
  - proprietary/close source to standard interfaces/open source.
  - complete ownership of the SW stack to the system architecture/application layer/system validation and qualification
- Riding technologies and features coming from the CE world
- Increasing level of reliance on 3rd party middleware and platform reuse
- **NXP is ideally positioned to offer a significant part of the SW stack used in a typical IVI product.**


Source: Roland Berger and Delphi internal estimates

# How?

- **Providing to Auto Tier 1s**
  - Performance critical parts of the system
  - SW components strongly tied to HW IP
- **Eliminating a costly part of today's Tier 1 development effort, with little end customer perceived value-add**
- **Helping our customers differentiate where it matters:**
  - With a production grade, feature rich SW stack, easily customizable
  - Ready for their development and qualification processes
  - Maintained on the customer specific HW

# IVI Platform - High level description

- **Platform goal**
  - Provide a solid basis on which competitive entry-level to mid-range IVI solutions can be built rapidly and maintained easily by i.MX customers
  - Offer out of the box the low-level bricks (bootloader, kernel and drivers) plus middleware that significantly relies of HW acceleration to achieve required performance
- **Component types**
  - Intrinsic (e.g. always there, such as the bootloader, drivers (UART, SPI), certain middleware (Gstreamer, ALSA))
  - Development licenses for optional Software Technology (Apple CarPlay, Android Auto) and SW Products (AVB, TEE)
- **Productized**
  - License BOM is provided, and maintained
  - Platform components are tested:
    - With tests derived from relevant use cases
    - Including stress testing derived from typical OEM requirements
  - Components are maintained in the platform context
- **Support for two HW Platform variants**
  - Distributed IVI Platform
  - Centralized IVI Platform
  - See next slide for details

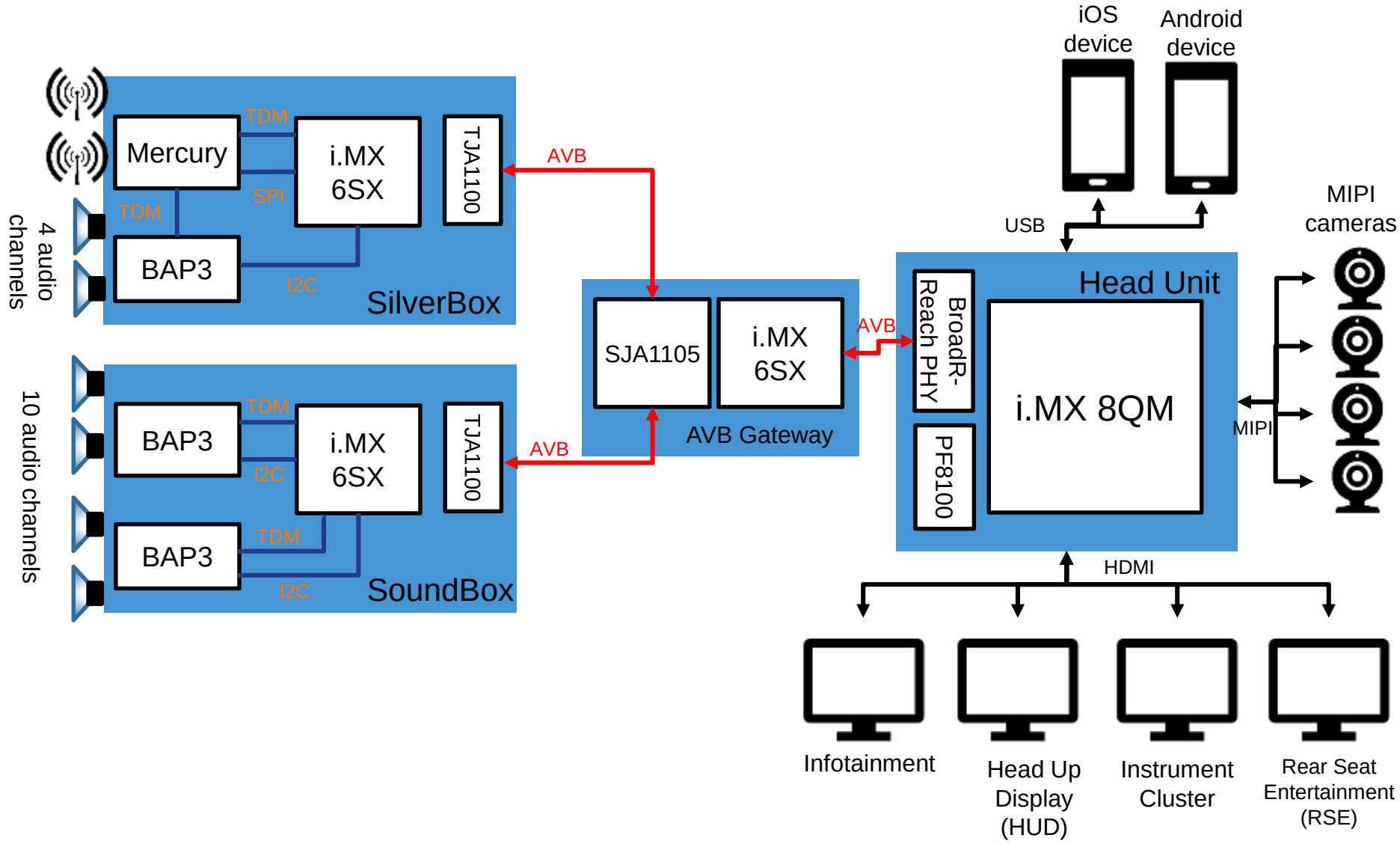
| | | License type | |
|---|---|---|---|
| **Domain** | **Domain component** | **Base GPL/Prod license** | **Add on - Prod license** |
| Boot | Multiple modes (manufacturing, maintenance, dev, recovery) | ■ | |
| | Secure boot | ■ | |
| | Fast boot | ■ | |
| | Boot to RVC analog | ■ | |
| | Boot to RVC AVB | | ■ |
| | Integration with TEE | | ■ |
| BSP | Relevant collection of drivers | ■ | |
| | System libraries | ■ | |
| Connectivity | USB HID, Audio streaming, Mass storage, CDC NCM | ■ | |
| | USB OTG and role switch | ■ | |
| | USB HUB | ■ | |
| | WiFi | ■ | |
| | BT Bluez HFP | ■ | |
| | BT Bluez A2DP, AVRCP, HSP, MAP, PBAP | ■ | |
| | BT Bluez PAN, HID, OPP | ■ | |
| | AVB (including RTP and switch support) | | ■ |
| | ConnMan | ■ | |
| Graphics | High resolution display/compositor/2D+3D | ■ | |
| | Multi high resolution displays/Multi-window/2D+3D | ■ | |
| | Surround view | | ■ |
| | Video codecs (some might require separate licensing) | ■ | |
| Security | TEE stack | | ■ |
| | SHE secure application | | ■ |
| | **Secure Linux** | ■ | |
| Audio | Mercury integration | ■ | |
| | CarPlay ready audio path | ■ | |
| | Radio manager | | ■ |
| | Audio codecs (some might require separate licensing) | ■ | |
| Radio | Software Defined Radio (SDR): AM/FM/DAB/HD/DRM | ■ | |
| | Radio middleware | | ■ |
| Screen mirroring | CarPlay | | ■ |
| | Android Auto | | ■ |
| | **SDL** | | ■ |
| | **Miracast** | | ■ |
| Frameworks | Genivi | ■ | |
| Application | Main HMI, radio, multimedia, nav. | ■ | |
| Infrastructure | Test infra | ■ | |
| | Test suite | ■ | |
| | Delivery infra | ■ | |
| | Documentation | ■ | |

**In bold red components not yet committed.**

# IVI Platform variants

- NXP is currently developing an IVI Platform demonstrator based on its rich Automotive product portfolio with the following two variants
- Distributed IVI Platform
  - Targets High end Infotainment systems
  - Main Application processor: i.MX 8QM
  - Distribution of features accross several sub-systems for best performance and scalability in large scale systems
    - Head Unit sub-system – eCockpit
    - Radio sub-system
    - Audio sub-system
    - Ethernet AVB/BroadR-Reach switch for AVB connectivity between all subsystems
- Centralized IVI Platform
  - Targets Mid range Infotainment systems
  - Main Application processor: i.MX 8QXP
  - Integration of Display, Radio and Audio features as Expansion cards to the main Base and CPU boards for optimal performance and optimization of BOM cost and space

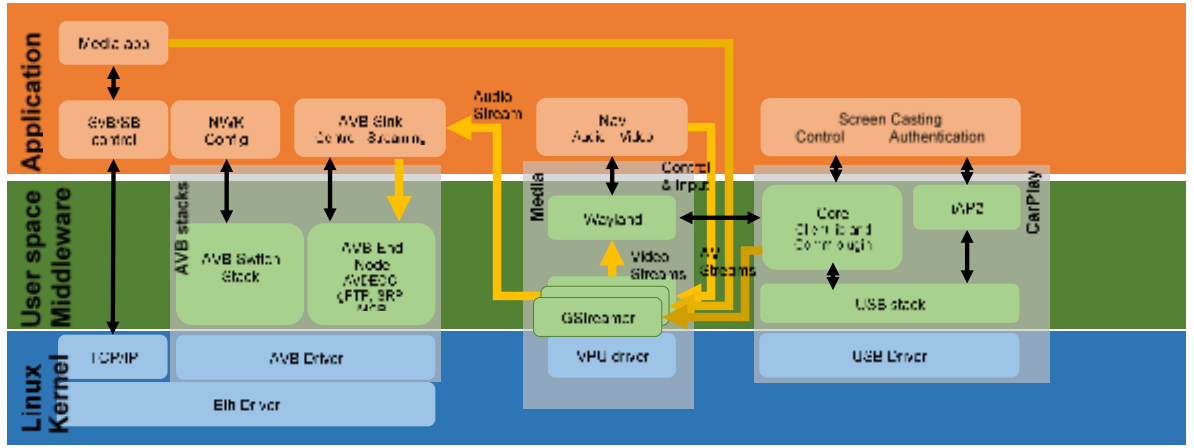
# Distributed IVI Platform – Block diagram



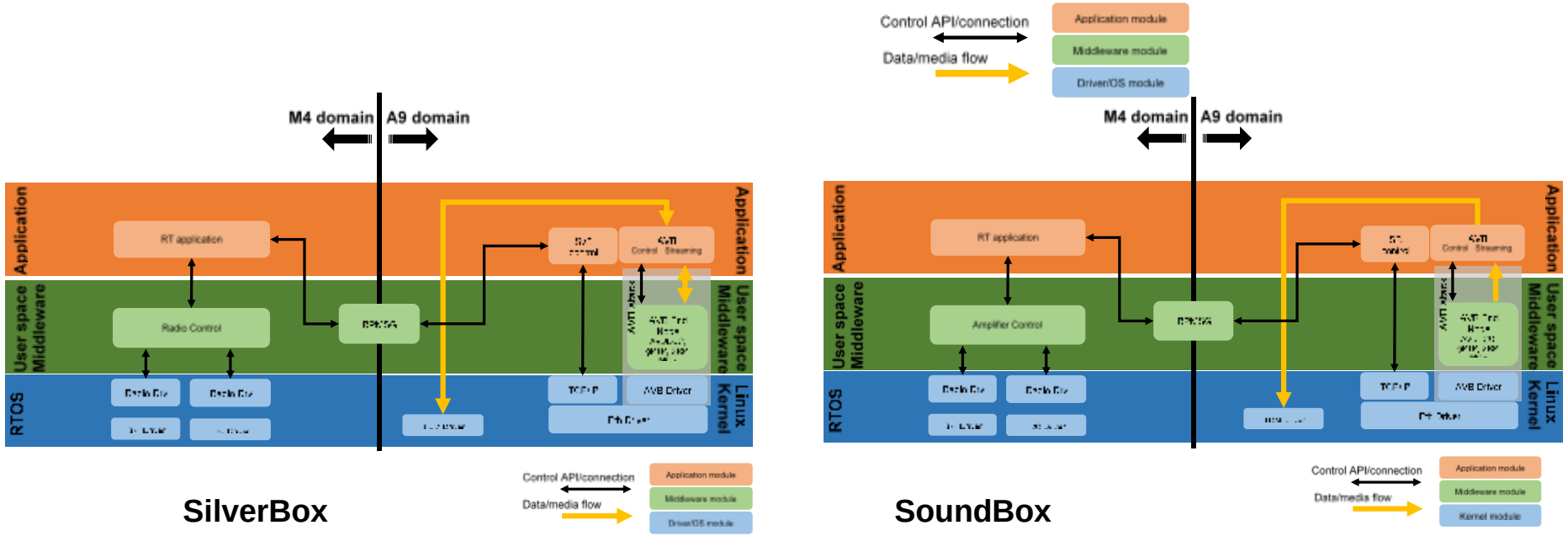
# Distributed IVI Platform – BOM List and features partitioning

| Sub-System | NXP Component | Main Functionality | Features |
|---|---|---|---|
| Head Unit | i.MX 8QM | Main IVI Application processor | • eCockpit application – HMI for up to 4 displays (Infotainment, Instrument Cluster, Rear Seat Entertainment, Head Up Display)<br>• Screen replication - AndroidAuto, Apple CarPlay<br>• Media - Surround View, Audio/Video decode<br>• Connectivity - Wifi/BT, USB, AVB/Ethernet<br>• Security |
| | PF8100/8200 | PMIC | |
| SilverBox | Mercury | Radio and Audio | • Multi-standard scalable Software Defined Radio (SDR): AM/FM/DAB/HD/DRM<br>• Audio processing<br>• Tuners |
| | BAP3 | Audio Class D amplifier | |
| | i.MX 6SX | Application processor | • Radio control<br>• Connectivity AVB/Ethernet |
| | TJA1100 | Broad-R Reach PHY | |
| SoundBox | BAP3 | Audio Class D amplifier | |
| | i.MX 6SX | Application processor | • Radio control<br>• AVB/Ethernet |
| | TJA1100 | BroadR-Reach PHY | |
| AVB Gateway | SJA1105 | BroadR-Reach switch | |
| | i.MX 6SX | Application processor | • AVB/Ethernet |

# Distributed IVI Platform – SW Architecture



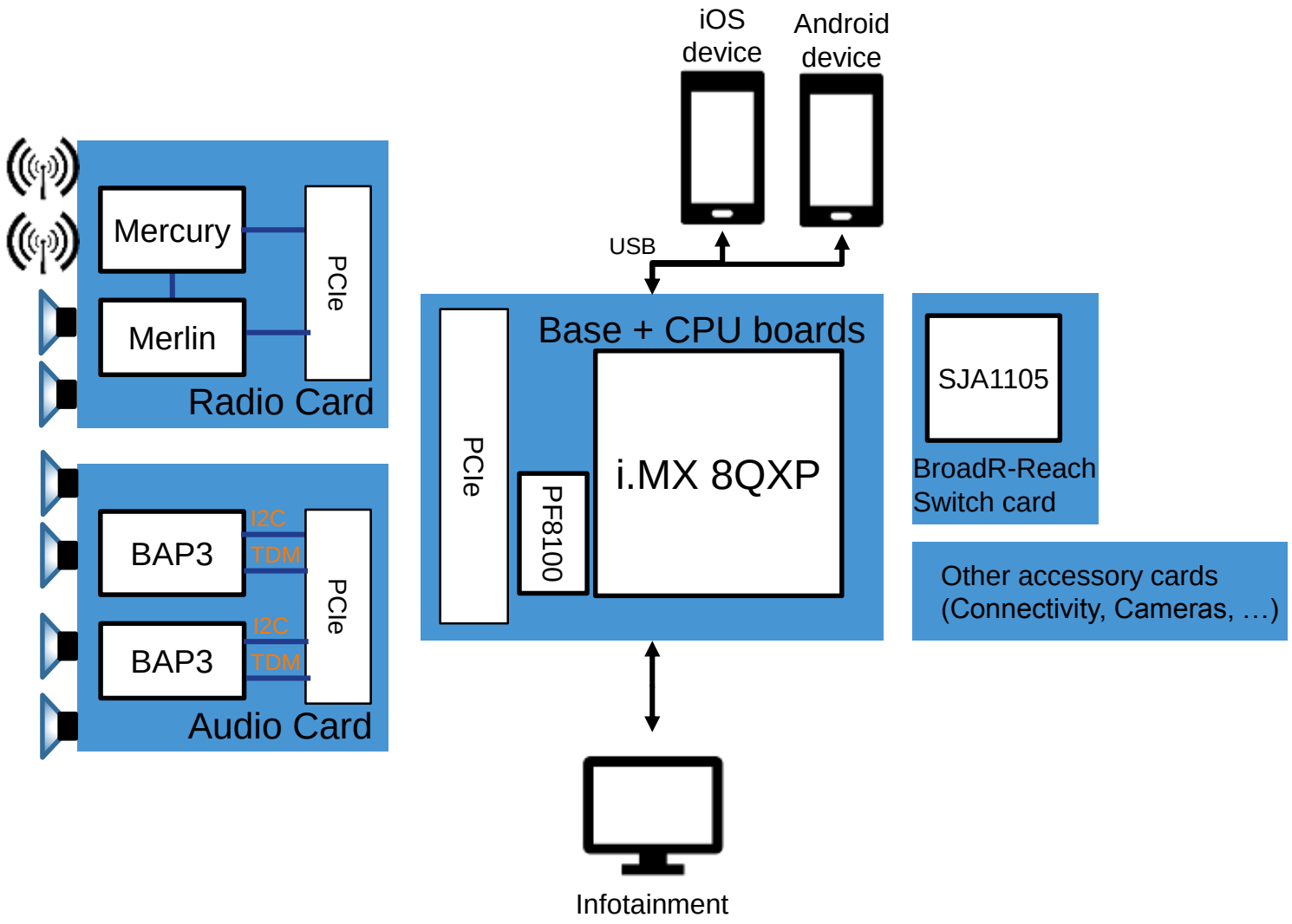

**Head Unit i.MX 8QM**




**SilverBox**

**SoundBox**

# Centralized IVI Platform – Block diagram

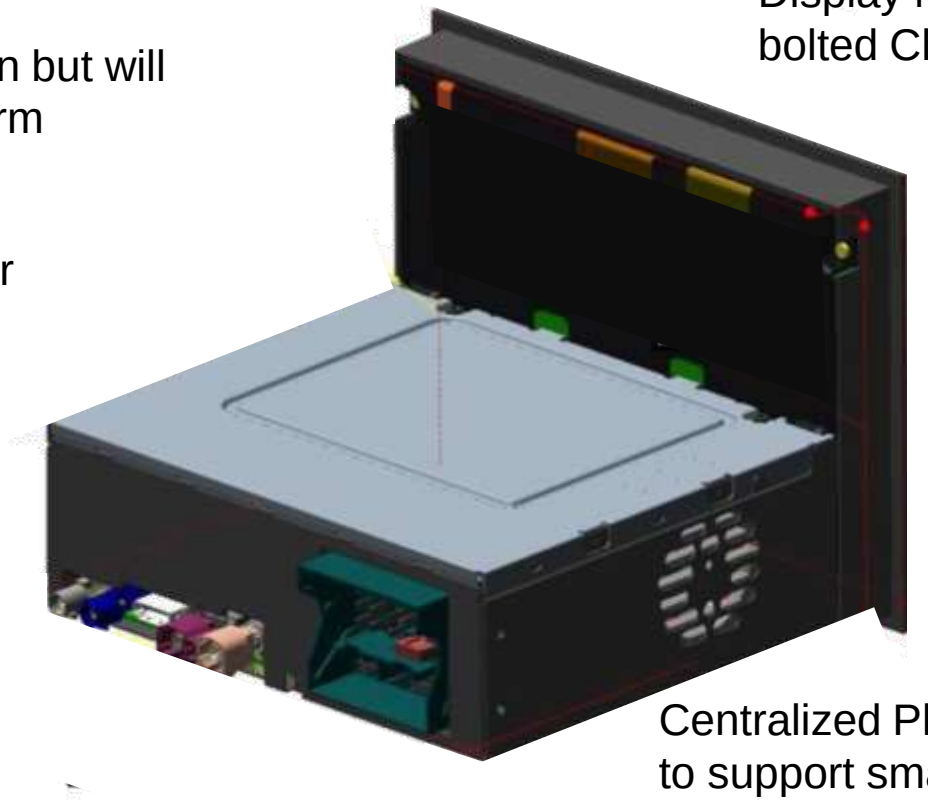


# Hardware Concept Example

MIPI/LVDS 1080p Display (i.MX 8)
Display Module is a separate unit
bolted Chassis box

1 DIN format shown but will
be 2 DIN in final form

Chassis with Clear
Plexiglas Lid



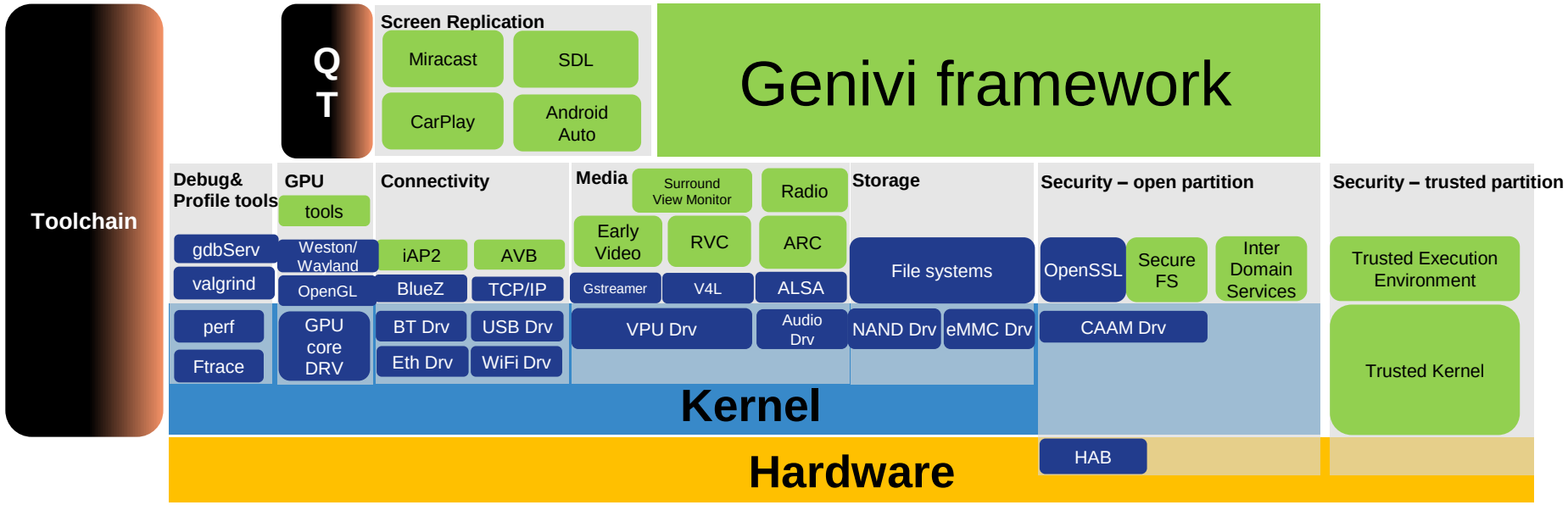
Front face double DIN = 180 x 100 mm

Centralized Platform with ability
to support smart antenna
designs over Ethernet AVB

# Centralized IVI Platform – BOM List and features partitioning

| Board | NXP Component | Main Functionality | Features |
|---|---|---|---|
| CPU boards | i.MX 8QXP | Main IVI Application processor | • Genivi based framework and applications (main HMI, Radio, Multimedia Navigation)<br>• Screen replication - AndroidAuto, Apple CarPlay<br>• Media - Surround View, Audio/Video decode, Radio Manager, Audio Manager, EarlyRVC & RVC,<br>• Connectivity - Wifi/BT, USB, AVB/Ethernet<br>• Security |
| | PF8100/8200 | PMIC | |
| SDR board | Mercury | Radio and Audio | • Multi-standard scalable Software Defined Radio (SDR): AM/FM/DAB/HD/DRM<br>• Audio processing<br>• Tuners |
| Speaker Amp board | BAP3 | Audio Class D amplifier | |

# Centralized IVI Platform – SW Architecture

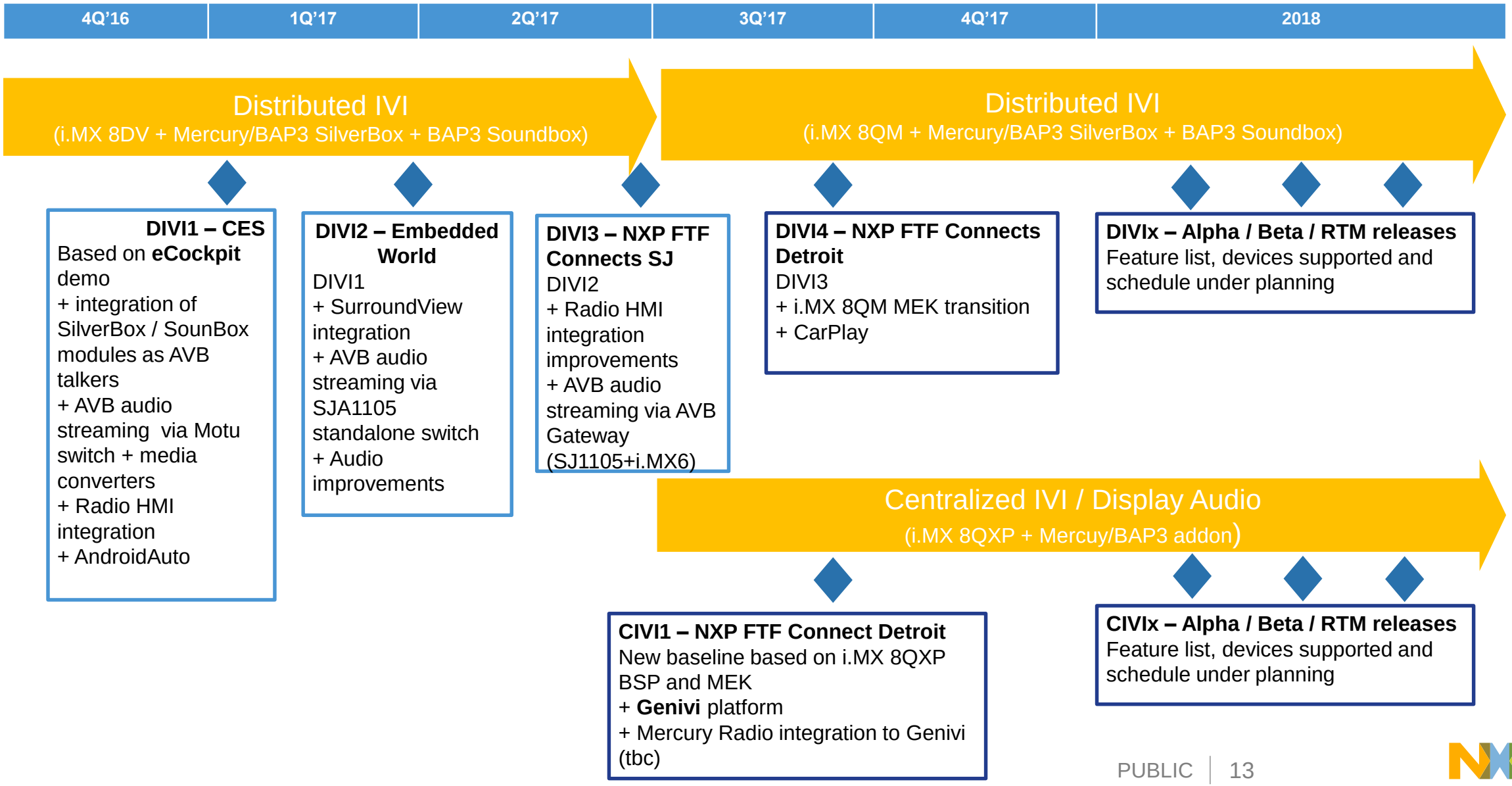



XYZ Part of Software Development Kit. Requires IVI Platform Dev & Production licenses

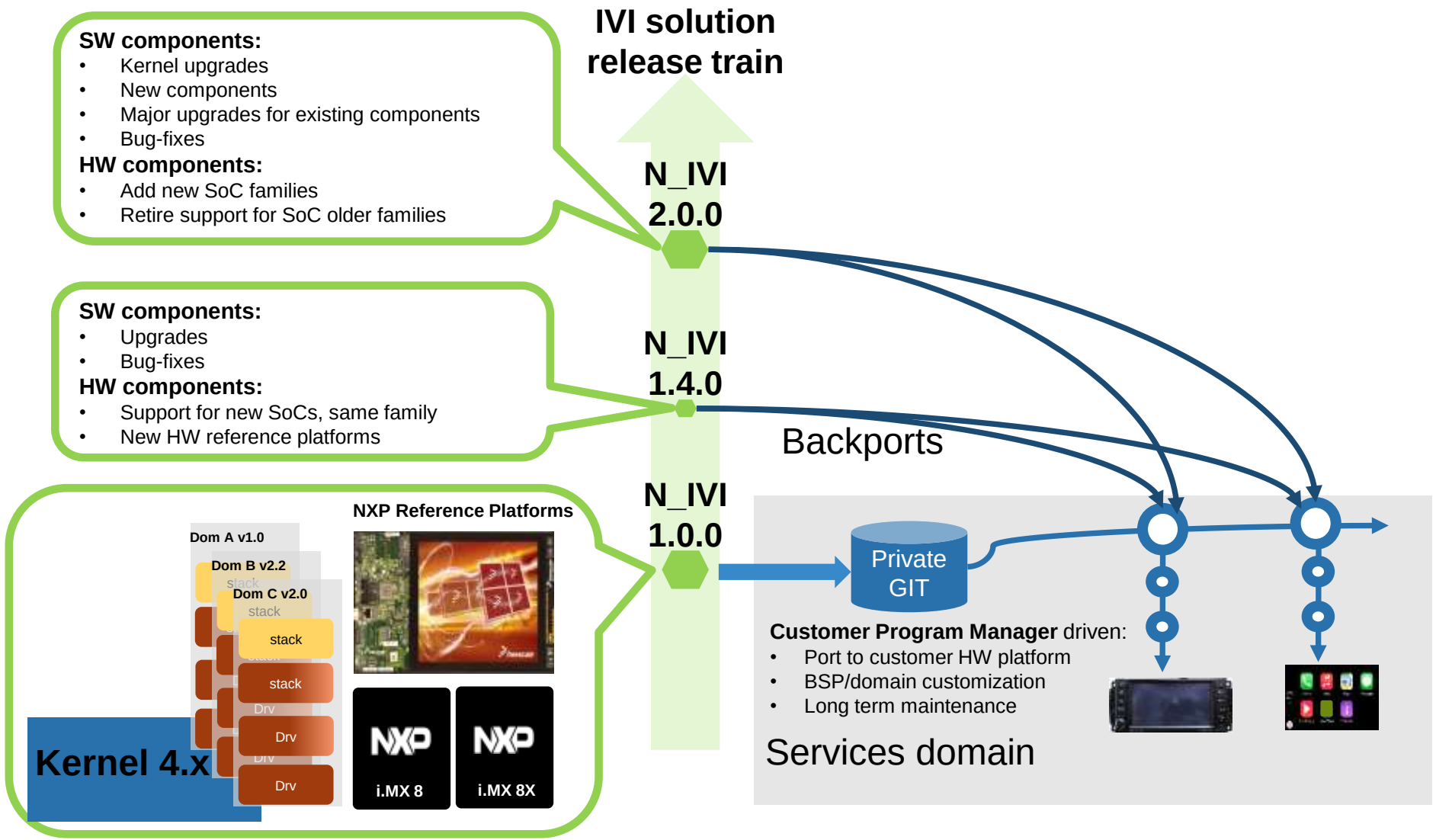
XYZ Part of Application Development Kit. Requires Add on Dev & Production licenses

XYZ 3rd party productized component. Optimizations for NXP silicon possible.

# High level IVI Platform roadmap



# IVI Platform delivery scheme



# Automotive Fast Boot Linux Scenarios

- Full Graphics Instrument cluster
  - Cold start to needles within 900ms
  - High Assurance Boot to authenticate the booted image

- Fast CAN response
  - Receive and store CAN messages in ~50m from a cold start.
  - A fast boot solution on i.MX allows eliminating the CAN management microcontroller.

- Rearview camera:
  - Cold start to camera image in less than 1s.

# Fast Boot is Customer Specific Engagement

- No off-the-shelf “fast boot solution” or number
- Dependent on the boot memories, power sequencing, image sizes, etc.
  - NOR is generally faster
  - eMMC can vary significantly
  - i.MX device (CPU speed)
- Definition of “booted” varies based on application
- Authentication takes time!

# **RVC** (Rearview Camera) **Market and Legal Requirements**

- Automotive rear view camera is a new requirement by law according to the National Highway Traffic Safety Administration (NHTSA) as of May 2018.
- All vehicles under 10,000 lbs. will include a backup camera to show a 10 by 20-foot zone behind the vehicle.
- The camera image must display within 2.0 seconds after the driver places the vehicle in the reverse direction.
- The requirement of rear view backup camera requires a level of robustness and determinism that must ensure that images displayed are accurate, timely, and not frozen.
- Safeguarding the video stream to be accurate and useful requires analysis and modes of operation with degraded quality to avoid impediments caused by failures in the pipeline.

# High Level Product Description for SafeAssure RVC Solution

- **Solution Goal:**
  - Robust RVC Software Solution removing the need for an external video analysis IC and providing Video Input/Output fault detection.
  - Provide a solid basis on which a competitive solutions can be built rapidly and maintained easily by i.MX 8 customers
  - Offer out of the box low-level and middleware SW Components that utilizes the iMX 8 M4 core to achieve required functionality
- **Safety Components**
  - Mcore Low-Level drivers
  - Mcore executable functionality- Application
  - Mcore Rendering Library (lines, bitmaps, debugging text)
  - Video Analysis Monitoring
  - Watchdog timers
  - Display Processing Unit (DPU) Remote Procedure Call (RPC)
  - Debugging and Diagnostic Application
  - I2C Remote Procedure Call (RPC)
- **Non-Safety Components**
  - Configuration Tools for RVC Deliverables
  - Documentation for all drivers, User manual
  - Test Suite

# Licensing Options

| License | Description | Support & Maintenance | Upgrade options |
|---|---|---|---|
| **Evaluation (Free)** | Binary version of the product, running on NXP reference HW only, for a limited time, for evaluation purposes. | Limited to the replication of the evaluation setup. | To any other license. |
| **Development license, 6 months unlimited support (tbd)** | Provides all necessary elements to start developing, on any supported NXP silicon and OS. Limited deployment – not suitable for production. | 6 months of support, and 1 year of maintenance. | To any production license. |
| **Single Product License (tbd)** | One Customer Target Project on one NXP Target Product. Closes down the OS/SoC/IP combination. | 1 year support and maintenance, 20% of the license price after. | To any higher priced production license. Additional OS/SoC at a discount. |
| **Product Line License (tbd)** | One Customer Target Product Line on one NXP Product Family: OS fixed, SoC/IP varies in the same family. | 1 year support and maintenance, 20% of the license price after. | To any higher priced production license. Additional OS/SoC at a discount. |
| **Multi-Product Line License (tbd)** | Multiple Customer Projects/Products on one NXP Product Family: OS fixed, SoC/IP varies in the same family. | 1 year support and maintenance, 20% of the license price after. | Additional OS/SoC at a discount. |
| **Volume License (tbd)** | Prepaid per unit License. | Commercial support only. Free maintenance. | N/A |

## Definitions:

**Customer Target Project:** one customer project for one customer specific product. For example a Head Unit for a specific car model. The project will be identified in the license agreement.
**Customer Target Product Line:** several customer projects in the same line of customer products. For example a Head Unit platform targeted for multiple car models/OEMs.
**NXP Target Product:** one specific product in the NXP product portfolio. For example the i.MX6SX.
**NXP Product Family:** a family of package/memory/IP blocks. For example, a product family is Vybrid, or i.MX6, or Kinetis K series.

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