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Abstract:

This presentation intends to introduce the DESTAR community, purposes, objectives and already obtained outcomes.

Under the umbrella of French Automotive Engineer Society, DESTAR is a partnership between French automotive players involved in AUTOSAR consortium and related activities.

Among them:

PSA Peugeot Citroën
Renault SAS
CEA LIST
Continental Automotive France SAS
Valeo
Delphi France SAS
Freescale Semiconducteurs France SAS
Geensys
Johnson Controls Automotive Electronics SAS
STMicroelectronics

Objectives of DESTAR, supported by French clusters are:

- Strengthen the links across the French automotive value chain in order to ease the deployment of AUTOSAR.
- Hold regular plenary meetings is a key to share AUTOSAR roadmaps and common vision.
- Bring the AUTOSAR ECU development cheaper than traditional ECU development:
  Based on a reference platform, project already launched named Petra, identify and build shared and recognized performances indicators in order to independently assess AUTOSAR implementations.
- Coordinate collaborative projects set up and ensure R&D results industrialization.
  Play a role of accelerator in the learning curve of AUTOSAR approach, identify and implement key topics related to AUTOSAR in collaborative projects (i.e; EDONA, O4A2, MODELISAR).
- Explore impact of AUTOSAR on Business Model:
  Collect existing approaches and compare with automotive specificities. Identify blocking points.

Keywords: DESTAR, AUTOSAR, Software Architecture, Business model, Collaborative Project, Collective action, ECU, Software standardization, Automotive industry.

1. AUTOSAR Introduction

This document has been produced by DESTAR community which includes the automotive manufacturers Renault SA and PSA Peugeot Citroën, the automotive suppliers Delphi France, Johnson Controls and Valeo. The document describes the origin of DESTAR community and the overview of collective action. Also, it focuses on the community AUTOSAR roadmap, PETRA project set up, goals and currents status and highlights business model impacts of AUTOSAR on automotive industry.

AUTOSAR (AUTomotive Open System ARCHitecture) is an open and standardized automotive software architecture, jointly developed by automobile manufacturers, suppliers and tool developers. From 2004 to 2009, three main releases have been delivered. For the third phase (2010 to 2012), it has been decided to introduce selected backward compatible concepts in a 4.04 release instead of delivering a new 4.1 release by end 2012. The current main preoccupation of the consortium is to strengthen the stability of AUTOSAR and stabilize the overall AUTOSAR ecosystem.
2. Origin of DESTAR collective action

In response to embedded software booming context in the automotive industry, AUTOSAR is a historical breakthrough. In the past, automotive industry has built hundreds of different software architectures, but AUTOSAR is the only one shared by all. It generates impacts on every field embedded software is connected to. The software development methodology and associated processes have to be updated as modules configuration and integration become, instead of implementation, the activities where the added value is concentrated. Tooling approach is also deeply impacted; indeed, the massive volume of data involved and the complexity of AUTOSAR modules lead to modify the way configuration has to be done and automation is a key. Also, configuration optimization and checks are mandatory. In addition, it impacts product architecture and vehicle architecture.

In that context, DESTAR collective action has been set up in august 2009, under the umbrella of the French Automotive Engineer Society. After first round of discussions, PSA Peugeot Citroën, Renault SAS, CEA LIST, Continental Automotive France SAS, Valeo, Delphi France SAS, Freescale Semiconducteurs France SAS, See4Sys, Johnson Controls Automotive Electronics SAS and STMicroelectronics bring DESTAR community to life.

DESTAR collective action is organized in nine work-packages which have to explore four critical aspects of AUTOSAR. The Work-package 2 is dedicated to the clarification of the strategic vision of DESTAR community. The objective is to build an up-to-date roadmap and show the major trends in term of usage (projects, tooling, consortium involvement...).

Work-package 4, 6 and 9 are dedicated to technical aspect. The work-package 4 derives directly from the Work-package 1. In the first approach, the objective is to establish a shared AUTOSAR reference platform specification and in a second time make this platform a reality through a dedicated collaborative project. Work-package 6 objectives are to benchmark existing actions and material (trainings, AUTOSAR Lab) and identify complementary items (cost, planning information) to take into consideration for a migration toward AUTOSAR architecture. Work-package 9 permits to share and optimize DESTAR community involvement within the AUTOSAR Consortium.

AUTOSAR deployment impacts the business model and the way software métier is organized. Work-package 5 has the objective to envision the creation of a shared infrastructure where resources are co-localized and means shared. Work-package 7 is a study on the different business models in the context of the embedded software value chain. Finally, the R&D collaborative project aspects are covered by work-package 3 and 8; these work-packages perform the assessment of R&D projects results and the way to industrialize them. It is also an opportunity to have an overview on French and European projects dedicated to AUTOSAR, and to support the coordination and to launch new R&D project.
3. DESTAR Community roadmap

Drawing a shared strategy about AUTOSAR needs at first to define precisely the fields on which partners have common objectives and then, are able to cooperate on. Consequently, the “Deployment road map” produced by DESTAR gives macroscopic informations on five items that are:

- **AUTOSAR Standard application**:
  In that road map, we focus on past, present and future AUTOSAR applications either on proof of concept or on serial projects. The main information is the AUTOSAR release used in order to avoid scattering efforts on every AUTOSAR releases. In synthesis, it seems that the target release is 4.0x for most companies, but with a big interest in release 3.1 for short term developments.

- **Participation in satellite projects**:
  Here, the objective is, first of all to avoid the risk to work twice on the same items, but also to increase the chances to convince the funding organizations to support those projects.

- **Participation in the AUTOSAR Consortium**:
  Human workload for AUTOSAR construction has been rather high, especially during phases 1 and 2. We thought interesting exchanging on our respective implications in order to optimize the overall efforts.

- **The tooling associated with AUTOSAR developments**:
  Using AUTOSAR requires very specialized tools build by companies that needs a certain ROI to remain in the race. It’s vital for them to be able to focus customer needs but also to increase their market volume.

  The main tooling challenges driven by AUTOSAR are the following:
  - Model Based Design is mandatory for AUTOSAR developments
  - Tools interoperability is still critical
  - Wide offer for system and software integration tools
  - Small offer for RTE and BSW configuration tools

- **Business models associated to AUTOSAR deployment**:
  AUTOSAR gives technical solutions to manage embedded software components in many different ways. At the end, the main driver is more economical than technical. DESTAR doesn’t claim to have defined a completely shared and unique business model, but at least it was important to exchange on the different use cases. At the moment, the more common business model is multi sourced SW-C and BSW integration on a single ECU done by the tier1. HW/SW integration by the OEM is a trend already in place at PSA on two main ECUs.

For DESTAR, this work package has been a very rich input for other work packages by giving common trends around AUTOSAR deployment means. Thanks to that, it has been possible to build a shared reference platform description (WP4) and to focus on operational business models (WP7) as detailed further in that article.
4. PETRA project

PETRA means “Plateforme d’Execution de Reference AUTOSAR” (AUTOSAR Reference Platform Execution).

This collaborative project supported by French clusters (Systematic Paris region, Moveo, ID4car) is the first concrete deliverable of DESTAR collective action.

WP4 - PETRA Project

As it happened

- October 2009 DESTAR Launch
- February 2010 Preliminary Specifications available
- August 2010 Specifications Delivered
- December 2009 Objectives & perimeter consolidated
- September 2011 DESTAR Project End
- March 2010 PETRA File submitted to Clusters
- October 2010 PETRA Launch
- October 2012 PETRA Project End
- May 2010 PETRA File submitted to Funded body

WP4 - Reference Platform specifications PETRA Project

WP2 Partners roadmaps available

Figure 5: PETRA project construction

Why PETRA?

The analysis of roadmaps shared within the Work-package 2 of DESTAR collective action demonstrated the strong need to build a reference AUTOSAR platform (Hardware + Software) in France.

First, the availability of such a reference platform is a strong lever to give French ecosystem, in particular SMEs, an opportunity to demonstrate and communicate their AUTOSAR know how through out the delivery of AR3.1 and AR4 implementations. Also, in a context where AUTOSAR commercial solutions on the market are many, (collaborate on specification, compete on implementation is the AUTOSAR partnership principle), It is an opportunity to share a recognized benchmark tool (performance, resources consumption) to support convergence toward best implementation and help players to identify best AUTOSAR implementation.

Another major stake is the deployment of the new automotive safety norm: ISO 26262; Embedded software products are impacted by ISO 26262 (mainly chapter 6) as basic software must support key safety mechanisms and feature to ensure compliancy to ASIL requirements.

The main objectives of PETRA are:

- Build a compliant AUTOSAR platform (hardware and Software) in line with Automotive requirements
- Implementation of 3.x and 4.x AUTOSAR specification
- Development of associate tooling in order to configure the platform
- Realize an implementation compliant with multi core hardware platform
- Support the optimization approach of the stacks configuration
- Identify performance criteria’s in order to obtain a first and shared assessment of existing platforms

Figure 6: PETRA community

PETRA Current standings

AUTOSAR AR3.1 ICC3 Reference platform is available for partners. This platform is already integrated on a Freescale/ST Leopard dual core microcontroller. The implementation of AR4.0.2 is on going and a beta version is expected April 2011. In term of time to market, the trend shows that third quarter 2012 will see the real start of OEM AR 4.0 mass production projects. PETRA assets are well positioned to support eco-system effort and industrial demonstrators deliverables expected in PETRA.

A list of criteria have been identified and frozen in order to build a tool to benchmark AUTOSAR solution on the market and support decision making.
5. Impact of business Model

The initial objective of this work package was to identify the impact of Autosar on the business models between the main players involved in the development of an embedded software.

The following tasks have been performed:

1. Define all the activities to be done:

   1. Define all the activities to be done:

      - AUTOSAR Added Value Activities (only use case: ECU supply, no system supply to OEM)

      - Hardware Component Provider (MCAL, OS)

      - BSW Provider (HW + BSW)

      - Middleware Integration (HW + BSW)

      - Application Software Integration (SW-C's)

      - Manufacturing & delivery (ECU)

      - Vehicle Assembly

2. Identify players potentially involved:

   - OEM (Vehicle Integration & Assembly)
   - Tier1 (Complete ECU Provider: manufacturing & delivery to OEM)
   - Hardware Component provider (suppliers of all electronic components)
   - Software provider (suppliers of all BSW, SW-C, AR Tools)
   - Service provider (HW or SW Integrator, maintenance & support, consulting*)

      - HW integrator: ECU board design, design verification
      - Middleware integrator: HW + BSW integration & validation with application stubs
      - Application SW integrator: SW integration and validation on host (simulated environment, MIL/SIL)
      - HW/SW integrator: System architecture, integration/validation MW & SW (HIL) + BSW configuration, ECU product validation, EMC validation, mechanics

   and the types of actors involved: (OEM, Tier1, tool vendor, independent SW supplier, ...)

3. List all the possible business models between all the potential players within a project. An example is shown below:

    - OEM stand point 3: OEM as Application Software integrator
      (PSA case: BSI)

      - Hardware Component Provider (MCAL, OS)
      - BSW Provider (HW + BSW)
      - Middleware Integration (HW + BSW)
      - Application Software Integration (SW-C's)

      - Manufacturing & delivery (ECU)
      - Vehicle Assembly

4. Interview partners of the Destar project to determine the current types of business models and the new ones that people could use by taking advantage of some of the Autosar advantages (such as modularity; reuse, ...). Intellectual properties and responsibilities have also been taken into consideration.

5. Define advantages, drawbacks and potential blocking point of the most common ones. In the example above, the OEM integrates all the software components developed internally and with the support of several sub contractors, the OEM masters the tools, but responsibility on the software is shared.

6. Identify the main business models trends:

   - Frequent model
     - Black box complete ECU: classical business model (saleable physical product, no IP transfer, due conformance to requirements)
     - OEM as application software provider: SW-C provided by OEM and "n" software providers (COTS)

   - Some cases
     - OEM as complete software integrator: Responsibility sharing in HW/SW Integration phase

   - Possible cases
     - Build-to-Print ECU: Tier 1 is responsible for manufacturing only

   - No case
     - OEM as Hardware Integrator: OEM is responsible for Hardware design
     - OEM as MW Integrator: OEM is responsible for the BSW integration into the Hardware

7. Finally, propose some characteristics for the 3 main economical models based on the needs of
the automotive industry and specificities of software developments. Coming back to the example shown above, 2 business cases are possible:
- “Material” business model
  o From an economical point of view, selling price = material + added value + R&D expenses + warranty, R&D expenses include software licenses for specific parts bought by the supplier
  o From a juridical point of view, supplier’s responsibility is limited to conformance to user requirements, no transfer of intellectual property, responsibility of the Tier1 limited only to products or services given
  o From a quality point of view, contractual answer on quality levels requested by the OEM
- “Service” business model
  o From an economical point of view, selling price based on time spent for integration
  o From a juridical point of view, no responsibility
  o From a quality point of view, conformance to quality standards

This study will ease the relationships between OEM, Tier1, software providers, tool vendors, and may open opportunities for new comers in the business (Small and Medium Enterprises or laboratories).

6. Conclusion

The main objectives of the French collective initiative DESTAR project, launched in September 2009 for 2 years, were:
- Strengthen AUTOSAR coordination across the French ecosystem: DESTAR gave an good overview of all the French projects on AUTOSAR, and the knowledge of current activities and future Roadmap of all the partners. DESTAR also helps building a common and shared proposal for the future “SystemX IRT”.
- Make the AUTOSAR ECU development cheaper than traditional ECU: many information were given by the different partners, a training session may be developed by SIA.
- Coordinate collaborative project set up and ensure R&D result industrialization: launch of PETRA is a good example of collaborative project launch together, enlarging to other companies that were not initially involved in DESTAR.
- Explore AUTOSAR’s impact on Business Model: templates that have been written are very useful for detailed exchanges between all the players involved in a business relationship.

These main objectives were almost completely fulfilled since each Work Package delivered a complete and detailed report, and a synthesis of its main conclusions.

The PETRA project, launched as additional to DESTAR in order to deliver Autosar reference platforms, is still on going. Most of the players involved in DESTAR are also involved in PETRA, which gives an opportunity for them to continue collaborative exchanges. But on a medium / long term scale, nothing has been decided yet even though each company had expressed the need to find a way to keep on these exchanges and launch together new collaborative projects. Launch of SystemX Research Technology Institute may be an answer since it will give a mean to work together on research and advanced engineering subjects in a common location.

7. Glossary
COTS: Commercial, off-the-shelf is a term for software or hardware, generally technology or computer products, that are ready-made and available for sale, lease, or license to the general public. They are often used as alternatives to in-house developments or one-off government-funded developments. The use of COTS is being mandated across many government and business programs, as they may offer significant savings in procurement and maintenance. However, since COTS software specifications are written by external sources, government agencies are sometimes wary of these products because they fear that future changes to the product will not be under their control.
Automotive manufacturer: is a company that uses a component made by a second company in its own product, or sells the product of the second company under its own brand. It constitutes a federally-licensed entity required to warrant and/or guarantee their products, unlike “aftermarket” which is not legally bound to a government-dictated level of liability.
Supplier: automotive components manufacturer.
ISO 26262: Is an emerging ISO standard for safety systems in road vehicles engine (http://www.iso.org/)