

ASAM

HEX-File Management standard

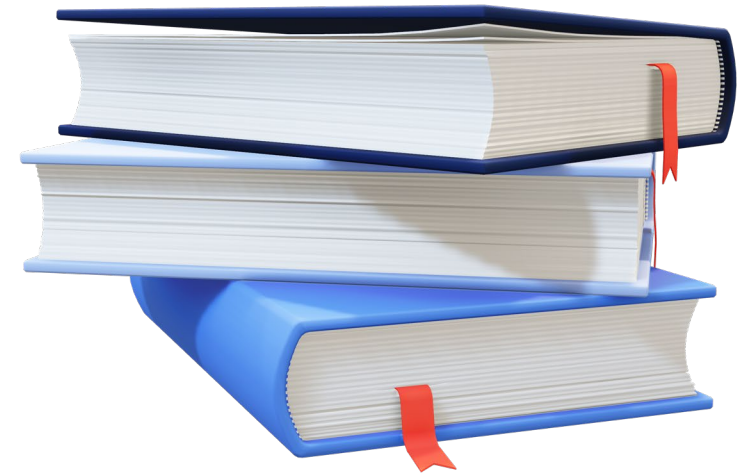
Representative of ASAM Japan
Yoshiaki SHOI

March 27th, 2018
Böblingen

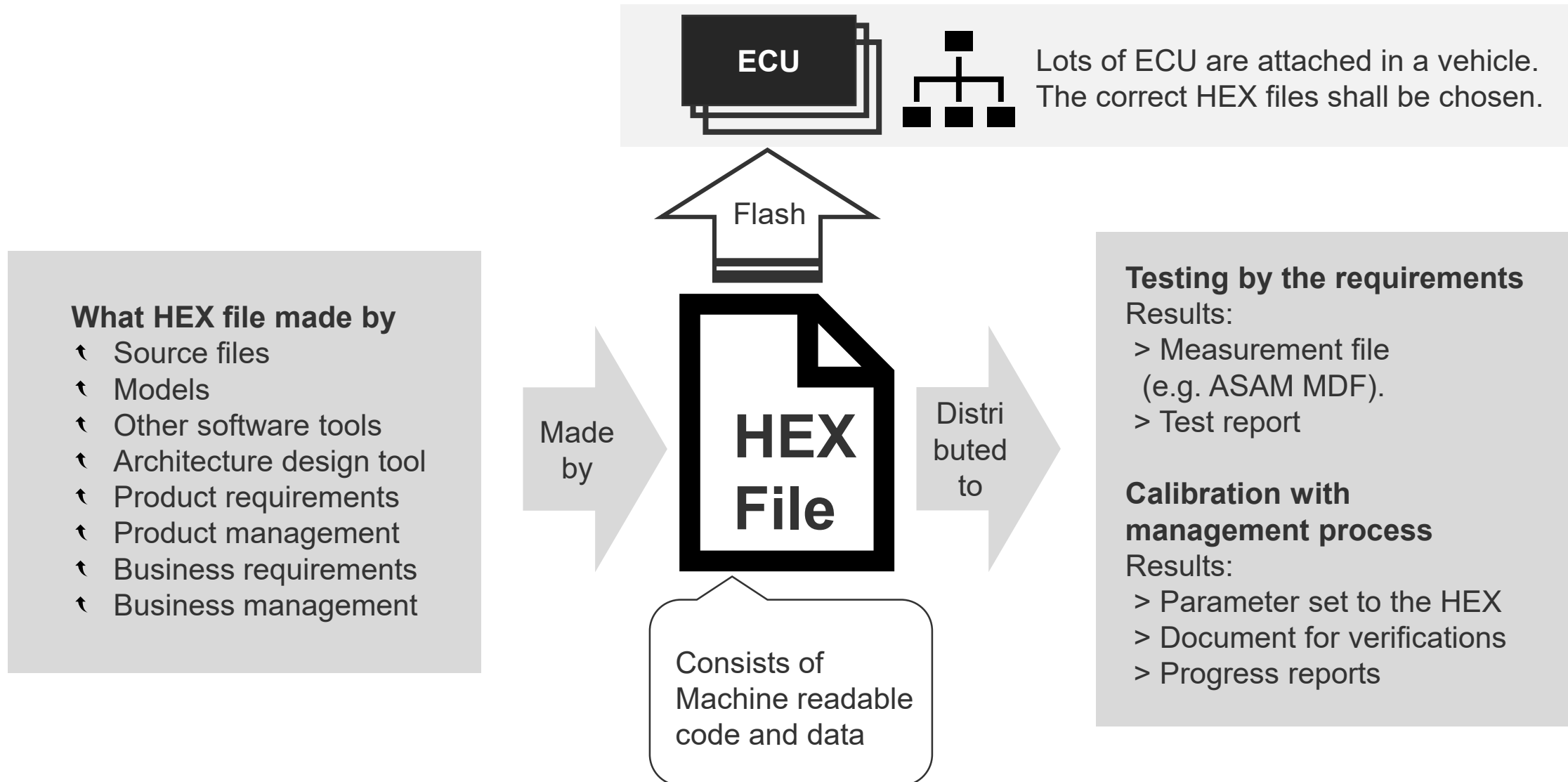


Introduction

- HEX-File Management Standard is on-going new standard project.
- Today, the below contents are shown.
 - Clarification: Answer to what is this?
 - Motivation: Answer to why the standard is needed?
 - Standardization: Standardized domains
 - Explanation: The project and future written by the team leader of the project



HEX-File and relations



What is issue?

The correct HEX files shall be chosen for vehicle development. However,

- HEX file is never recognized to the right one by itself.
- HEX file is just data stream which consists of machine readable code and data.
- Sometimes HEX file is just delivered without any source file by ECU supplier.

Moreover,

- HEX file depends on each other (e.g. ADAS, minimization of energy consumption).
- In the future, degree of the dependency is more.
- It is mandatory that correct HEX file is absolutely chosen.

Overcome the issue: HEX-File Management

Examples relation of HEX file in the other words

- Location: Where HEX-File is located in all ECU of a vehicle, what kind of component is belonged.
- Results: What kind of result are earned by the HEX-File.
- History: What is the origin of the HEX-File.

→ **To manage relation of HEX file is to overcome the issue**

HEX-File management: Root Definition

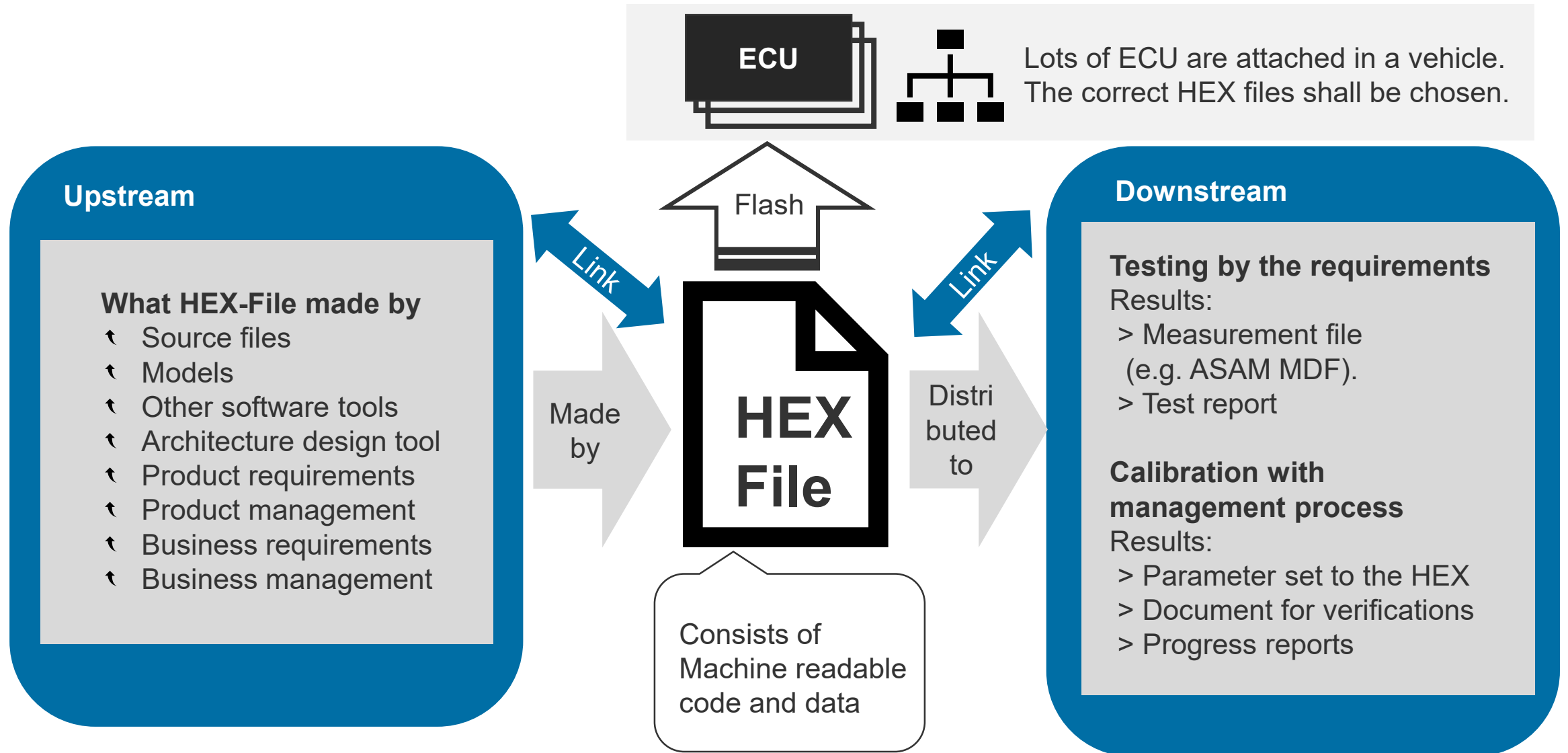
In a theory of system engineering, all system can be defined by Root Definition

Root definition: A system to do X, by Y in order to do Z

In case of HEX-File management:

- X: to correctly distribute HEX files for whole vehicle systems
- Y: linking up- and downstream to all generated HEX files
- Z: To eliminate wrong choice of HEX file

HEX-File and link: HEX-File management



Use case of HEX-File management

Prepare prerequisite information to HEX-File management

- The right picture is a use case of HEX-File management.
- The use case show how prerequisite information is prepared to HEX-File management.
- The information is skimmed by the other system.
- Interface of the other system is standardized.

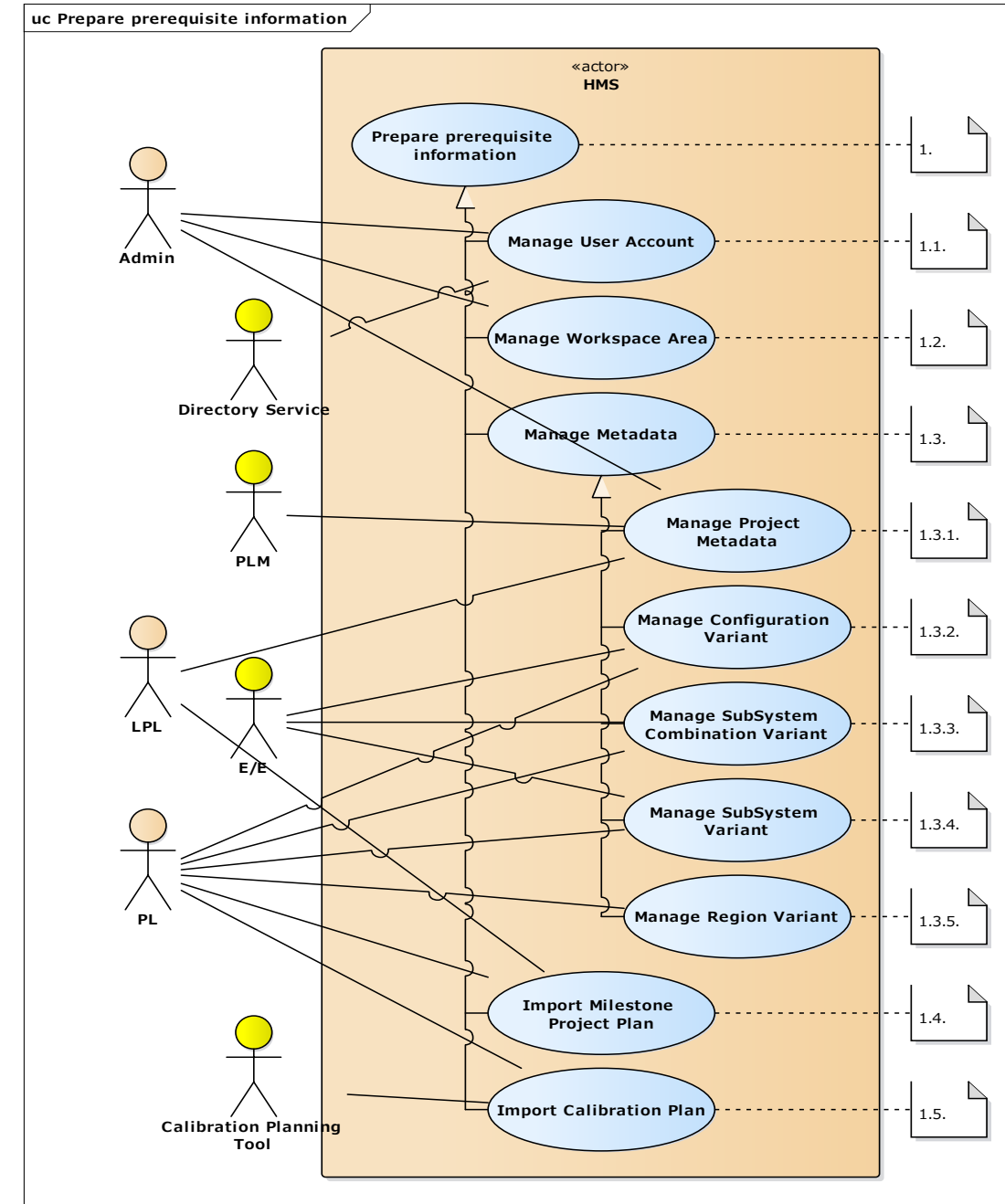
Example of standardization:

- PLM interface is standardized for:
 - API
 - Exchanged data model

Note:

Web API is supposed to be implement.

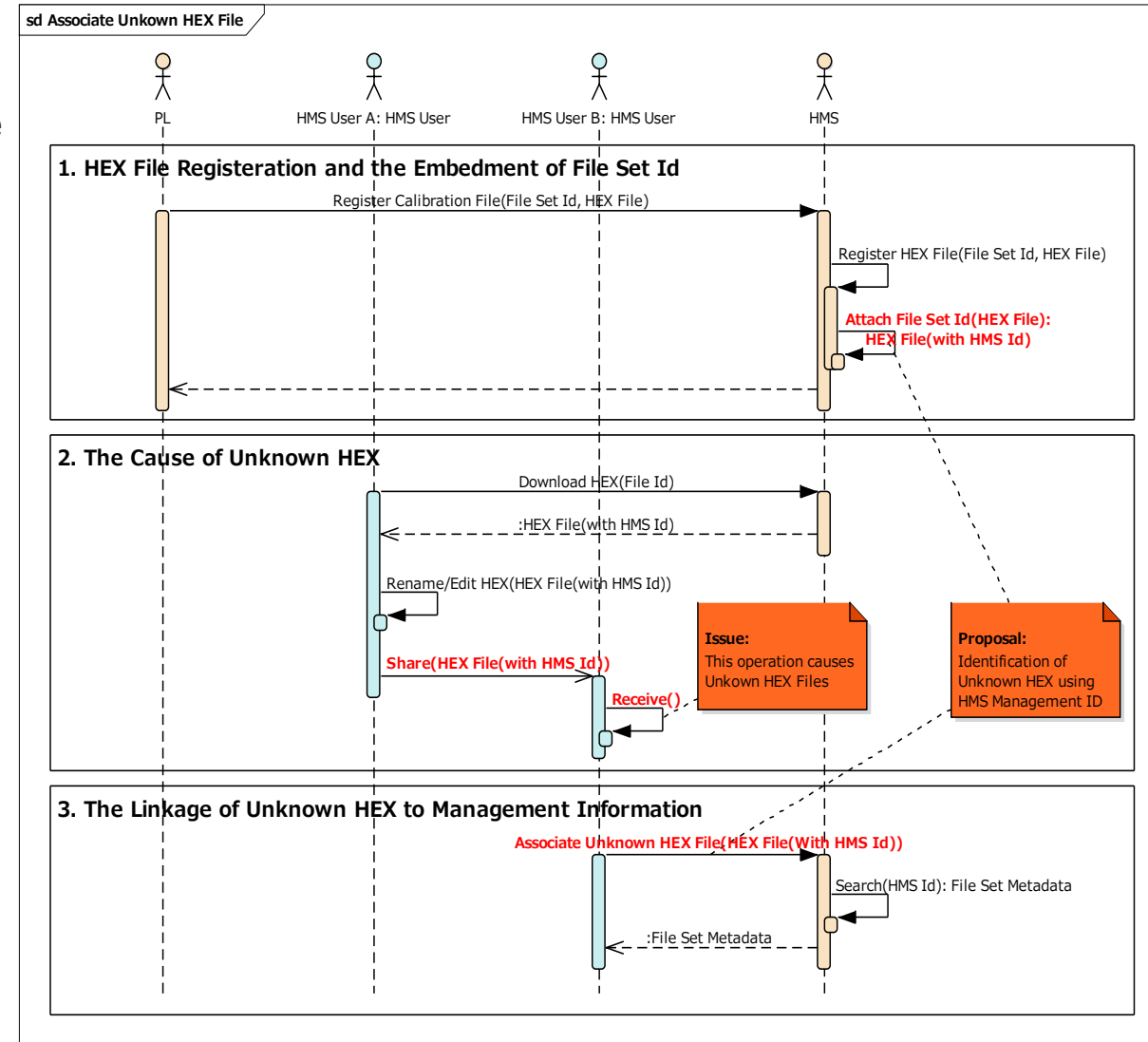
However, API and exchanged data model is just standardized due to technology independent.



Sequence diagram of HEX-File management

Cause of unknown HEX-File and a solution proposal for the problem

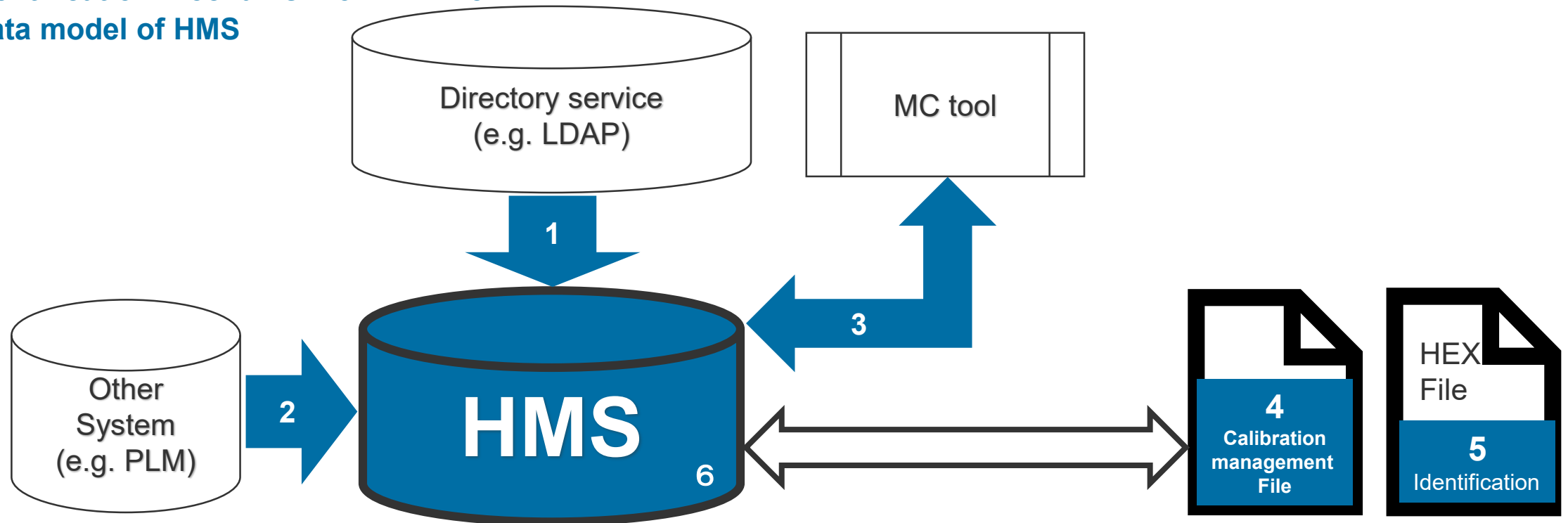
- The right picture is a sequence diagram of HEX-File management.
- The diagram show a cause of unknown hex and association to find unknown hex in HMS (HEX-File management system)
- Once HEX file is downloaded from HMS, It will sent to any other user via any media, and its name could be changed.
- HMS offers association of unknown hex.



What is standardized?

Planned standardized domains in HEX-File management standard

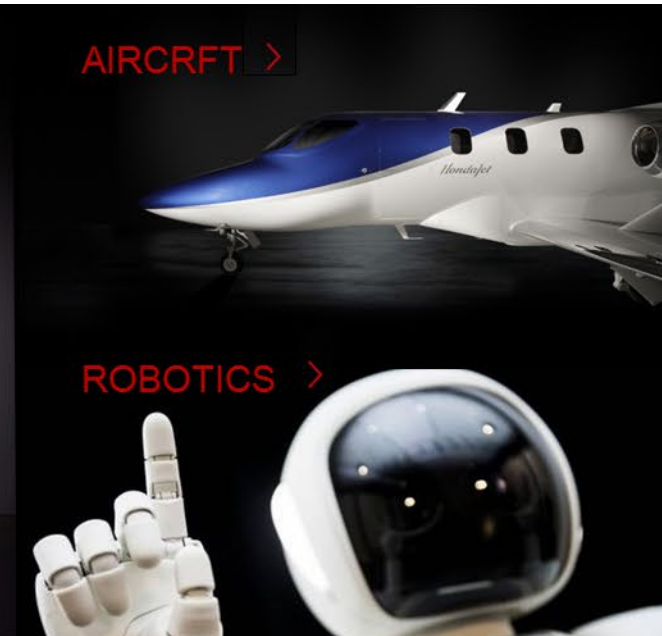
1. Interface of directory service to skim user and user role in HMS
2. Interface of other system to skim metadata of HEX file (e.g. product information is skimmed via PLM system)
3. Interface of MC tool: It is successor of eCDM interface.
4. File format of calibration process management information
5. Identification mechanism of HEX file
6. Data model of HMS



HMS Project and Future

HMS : HEX-file Management Service
No : 2017-01 Submitter

Hiroshi Samezawa
HONDA R&D Co.,Ltd



Introduction

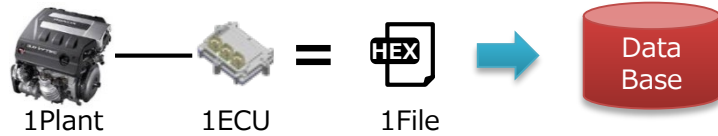
Introduction

We are working on the concept of standardizing HEX-File management system which is company asset. The goal of HEX-File management is to properly select and distribute all the HEX-Files of the vehicle. For that purpose, I think it is important to associate the necessary information with the HEX-File correctly. In addition, you must also carefully consider historical management, etc., that accompany changes in daily conformance data. The HMS concept project standardizes the intersection of potential OEMs of HEX-File management.

Issues & Concept of HEX-File Management

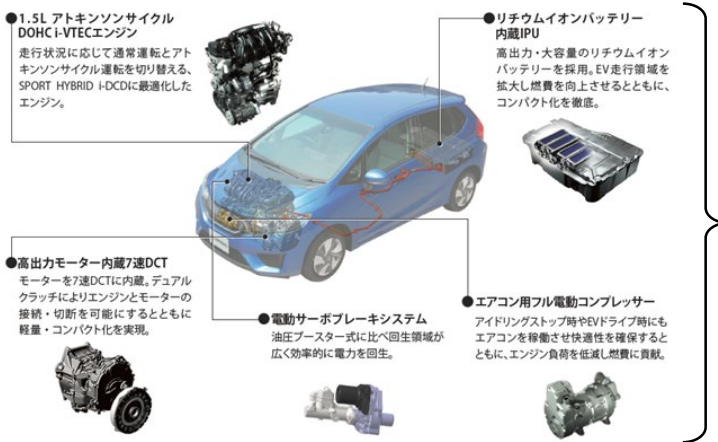
Issues

- ✓ One to one relationship (old days)



Management of domain (local) units can be done without problems!

- ✓ Multiple dependencies (current)



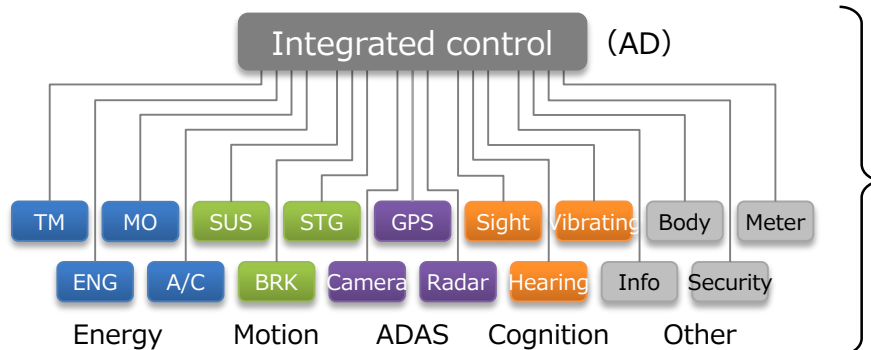
Considerable load



Management of domain (local) units Multiple relationships are handled by engineers hard

- We struggle to manage Ver & Rev
- Struggle for derivation and combination management (not well done)
- Find the latest HEX Dead time
- Dead time to fail test with old HEX

- ✓ Complex dependency (after a few years)

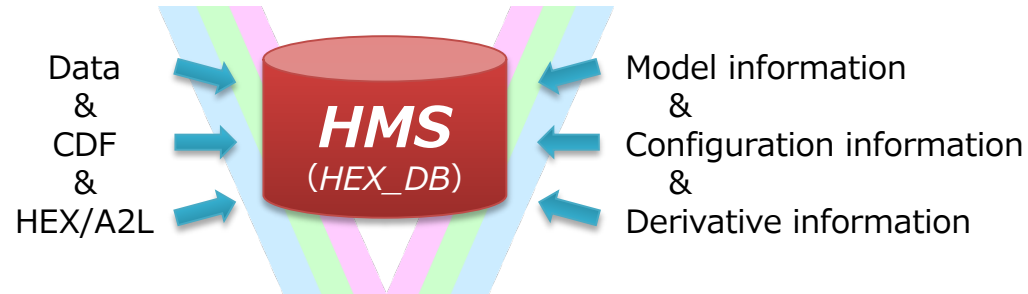


Management is done on a domain (local) basis is the limit. This is an obvious "problem". (Collapse)

There is a limit to the management method by domain, and the mechanism of one vehicle management is urgent!

Concept

- 1.Information is essential for HEX-File management
(Just gathering information is hard work)



HEX file is managed together with information!

3. Digital data is desirable for information
(Digital data makes post-process easier)



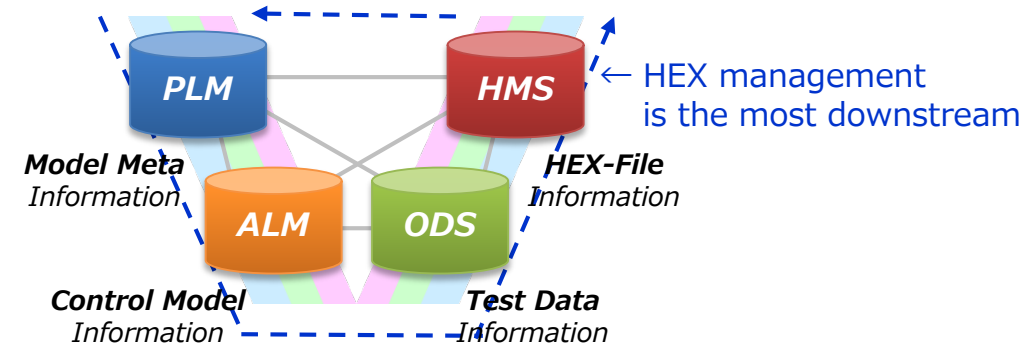
Information processing is IT work!

- 2.File base is not good for information linkage
(The possibility of human error is large in the file)



Analog of information is the source of failure!

4. Improve efficiency through information linkage
(I want a connection mechanism)



Concentrate on HEX management!

HMS is to make information collaboration and to "store, find and understand" the HEX-File!

Project Member & Schedule

OEM



HONDA

2 Person



TOYOTA

2 Person



HINO

2 Person

Tool Vendor



1 Person



1 Person



1 Person



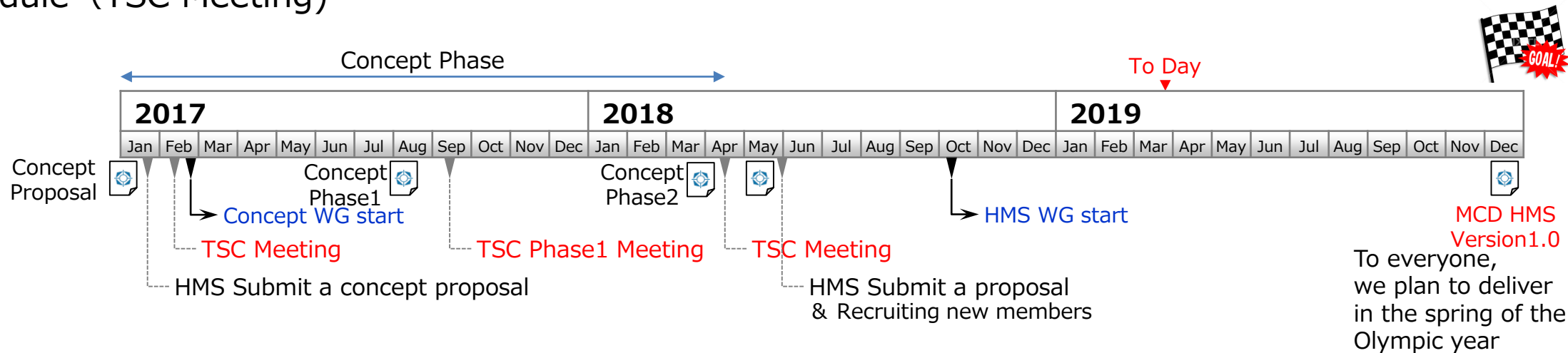
2 Person



3 Person

【Service Provider】

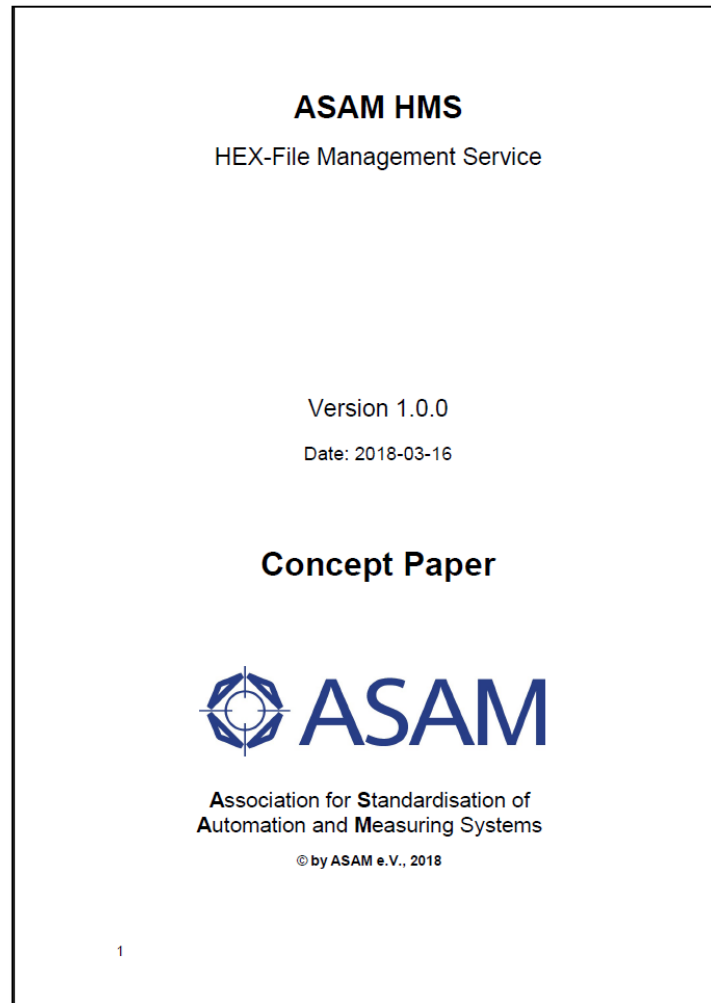
Schedule (TSC Meeting)



15 Persons from 8 Companies hold a meeting in each month.

HMS Concept Paper

ASAM HMS Completion of Concept Paper (Completion)



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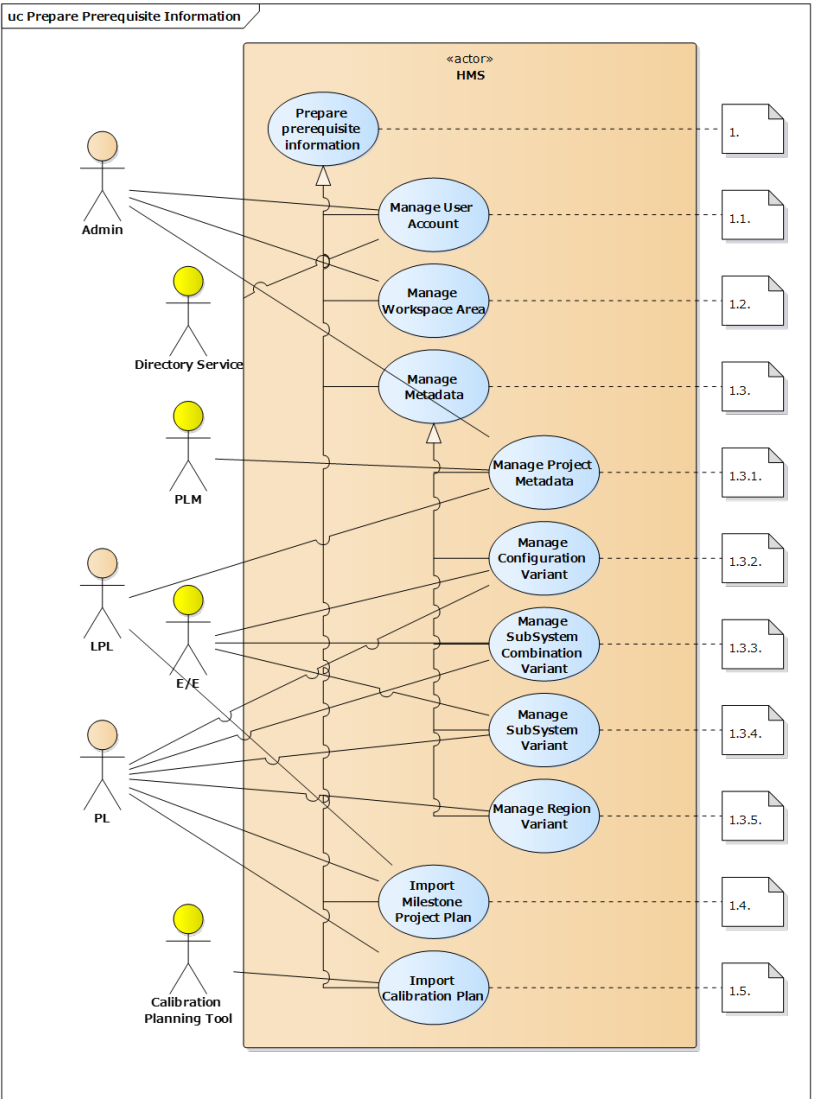
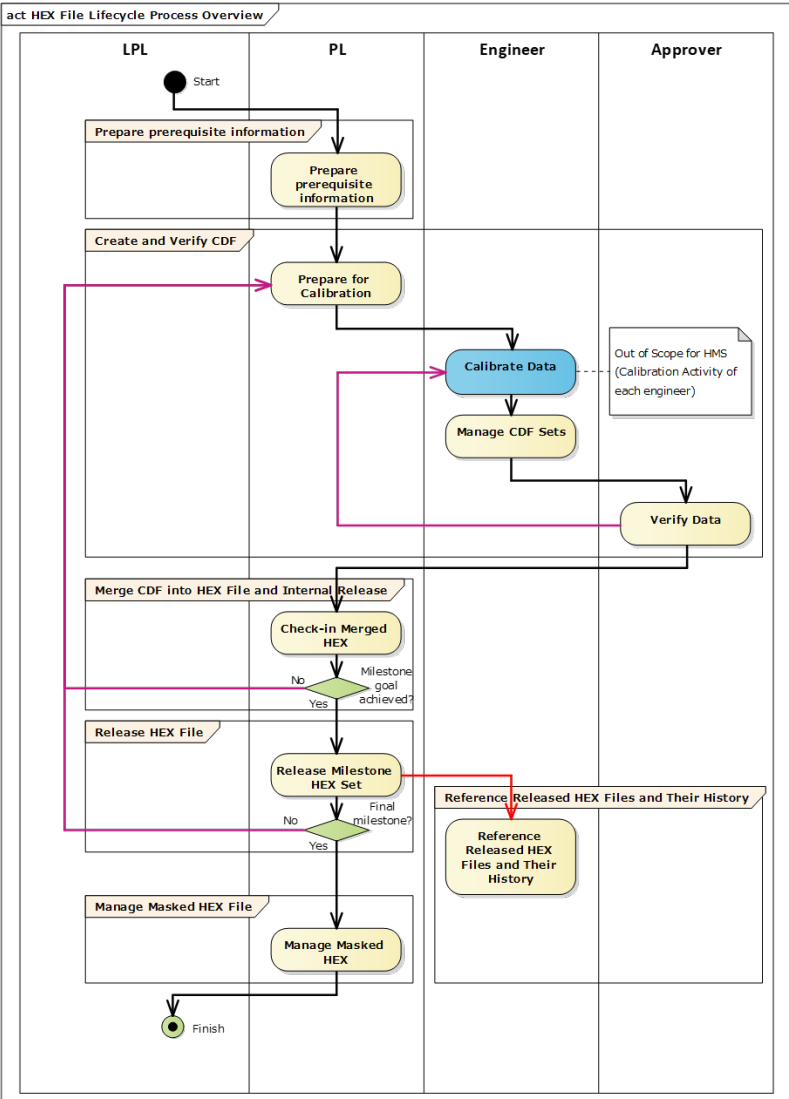
- In HEX-File management work in Japan, there was no big difference between each OEM, the use case was nearly divided, so it was able to proceed smoothly.
- Because I do not understand the EU OEM use case, although I am a bit uneasy, I have been able to come so far by support of ASAM members (Mr. Thomsen, Mr. Shoi). I also thank you for the ASAM Technical Steering Committee's activities.

<https://www.asam.net/project-detail/hex-file-management-service/>

HMS GLOSSARY

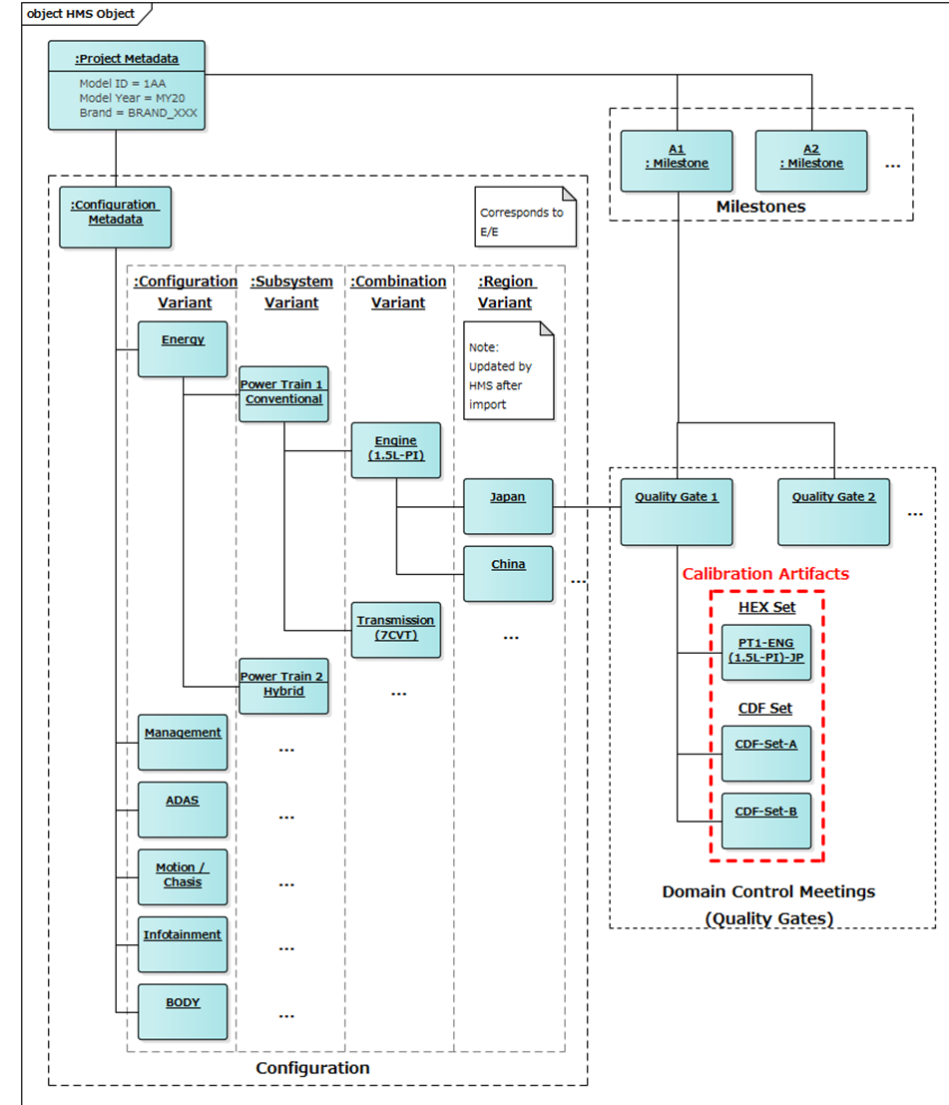
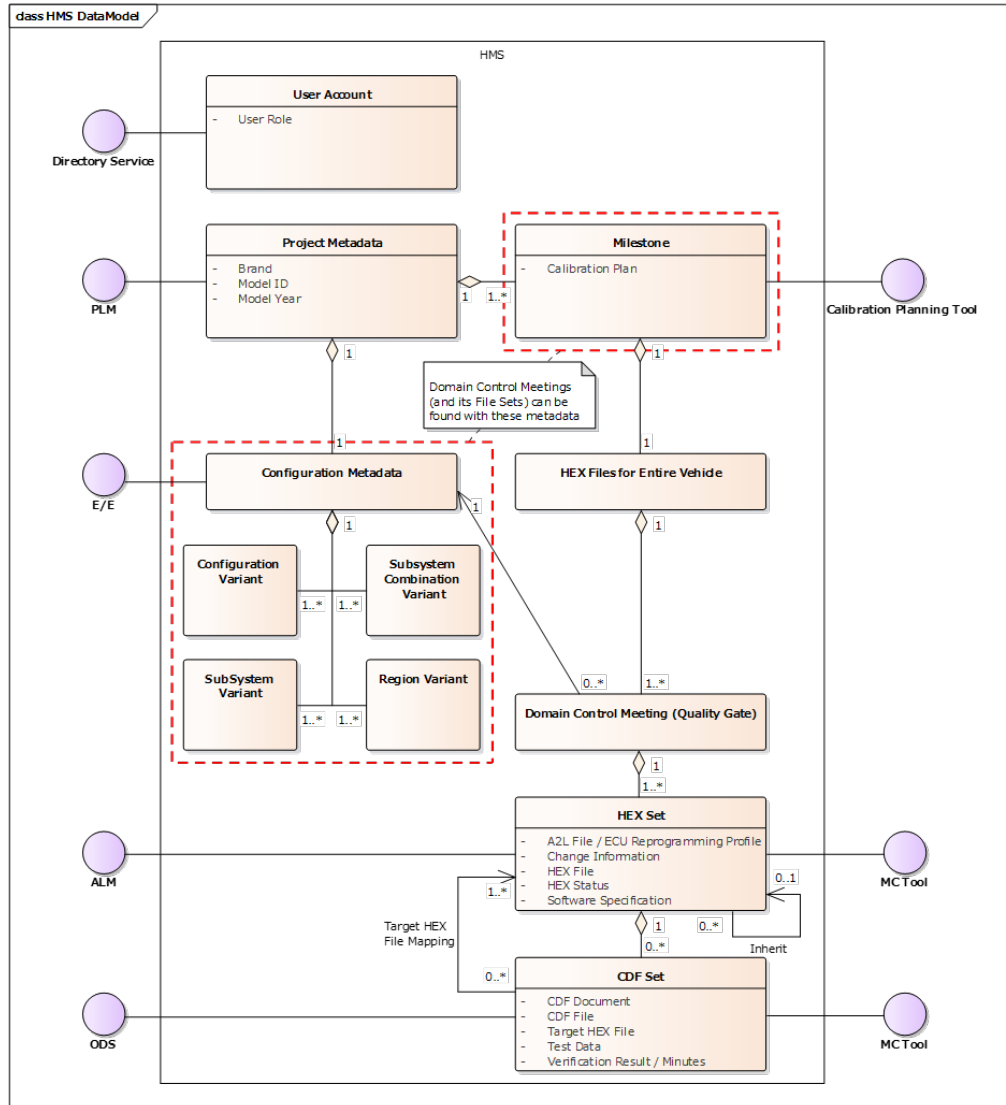
No	Category	Term	Abbr	Description	Related Contents
1	HMS basic term	HEX Management Service	HMS	The name of the system to be considered for carrying out the centralized development of the entire vehicle.	
2	HMS basic term	Automobile		All types of ground-transportation vehicles and trucks.	
3	HMS basic term	Project		All activities to develop a specific Automobile Project denotes the activities to oversee development and test activities of multi-company-wide vehicle development.	
4	HMS basic term	Domain		Area that represents a functional unit that denotes the development team responsible (Examples: engine, transmission, motor conditioning, etc.)	
5	HMS basic term	Calibration		The step of determining a control parameter program of the ECU. (Example: Adapt performance such as exhaust performance, optimizing the as ignition timing and fuel injection amount)	
6	HMS basic term	HEX-File		File to be flashed in ECU memory, which contains executable control program (code) and parameters (data). HEX-Files typically, which is defined by semiconductor vendor microcontrollers.	
7	HMS basic term	A2L File		The A2L file format (ASAP-2 Language) necessary meta information to describe calibration data in an ECU. The file format to flash the ECU memory file format has been standardized by VDA.	
8	HMS basic term	CDF File		File to represent the values of control parameters. The control parameters can be grouped. Since a HEX-File includes multiple control parameters, Calibration often has to be carried out in different areas of responsibility. Artifacts for each responsible area are collected in and merged into the HEX-File. The file format has been standardized by VDA.	
9	HMS basic term	HEX Set		Set of supplementary files that belong to the files of the HEX Set have been used for the HEX-File, or contain information about the HEX-File, or contain information about the test status of the HEX-File.	
10	HMS basic term	CDF Set		Set of supplementary files that belong to the files of the CDF Set have been used for the determination of control parameters. The files of the CDF Set have been used for the determination of control parameters. The files of the CDF Set have been used for the determination of control parameters.	
11	HMS basic term	File Set		A File Set consists of a group of files, which are related to each other in their respective development. Typically, the files of the File Set include the CDF File, and further files with related metadata, source files, additional information, and status. (A generic term of "HEX Set" and "CDF Set")	
13	Actor (User Role)	HMS User		A generic term for all HMS users.	
14	Actor (User role)	Large Project Leader	LPL	Vehicle Development Project Leader (entire vehicle).	
15	Actor (User role)	Domain Project Leader	PL	Vehicle Development Project Leader responsible for a Domain).	
16	Actor (User role)	Domain Engineer	Engineer	Engineers who modify HEX Sets. For Calibration Engineers: Person in charge of work (to create the CDF File and report the Target HEX-File). Test Engineers: Person in charge of the actual hardware, including ECUs appropriate HEX-Files.	
17	Actor (User role)	Domain Approver	Approver	Person in charge to verify the CDF Set HEX-File and to give approval for the responsible for.	
18	Actor (External System)	External System		A generic term for all systems that are connected to the HMS.	
19	Actor (External System)	Directory Service		Generic name of the external system intranet and their attributes. Example: Active Directory.	
20	Actor (External System)	Product Lifecycle Management	PLM	Generic name of the external system of a product.	
21	Actor (External System)	Application Lifecycle Management	ALM	Generic name of the external system of the application software, primarily program.	
22	Actor (External System)	Open Data Service	ODS	Generic name of the external system measurement data.	
23	Actor (External System)	Electrical and Electronic Architecture	E/E	Generic name of the external system architecture that contains the configuration of the electronic and electrical components. E/E information includes the entire configuration of a specific model and its variants.	
24	Actor (External System)	Measurement and Calibration Tool	MC Tool	Tools for Calibration work, which is used to collect data and to edit values of control parameters.	
25	Actor (External System)	Calibration Planning Tool		Tools for Calibration planning (Example: number of parameters to be calibrated).	
26	Lifecycle stage of HEX-File	Initial HEX		The first HEX-File produced by the program development.	
27	Lifecycle stage of HEX-File	Base HEX		Since parameter values are not verified, this HEX-File is not flashed into ECU memory.	
28	Lifecycle stage of HEX-File	Merged HEX		The HEX-File prepared as a base to create a new HEX-File. This is made from the Initial HEX-File parameter values. Verification is not required.	
29	Lifecycle stage of HEX-File	Milestone HEX		The HEX-File created by importing CDF values from multiple CDF Files as a result of a process. This file includes the results of Calibration work in the Domain. This HEX-File is used for verification stage of the development process to confirm whether it is possible to release the Domain.	
30	Lifecycle stage of HEX-File	Masked HEX		The HEX-File verified to meet the goal for a given Milestone.	
31	System Service Management	User Account		Information for describing the user account.	
32	System Service Management	Workspace Area		User and its role information for using the service.	
33	Metadata for HEX	Configuration Metadata		Workspace to be allocated on the system for HEX management activities. Location to place the HEX Set and the CDF Set on the system.	
34	Metadata for HEX	Project Metadata		Metadata for identifying the HEX-File. A generic term of the information (metadata) for describing the system configuration of all the ECU's of an entire vehicle, and the variations of HEX-Files (combination of subsystems, regions, etc.). This can be expressed by inheriting the structure of the E/E Architecture.	
35	Metadata for HEX	Configuration Variant		Metadata for identifying the HEX-File. Information for describing the vehicle to be developed. (Example: brand, model year, model name, model code, model type, etc.)	
36	Metadata for HEX	Subsystem Combination Variant		Metadata for identifying the HEX-File. Information for describing the system configuration of the control program of the vehicle to be developed (i.e. the E/E architecture). (Example: ADAS, energy, movement, information, Body, etc.)	
37	Metadata for HEX	Region Variant		Metadata for identifying the HEX-File. Information for describing the combination of subsystems that make up a particular Configuration Variant. Each component of the configuration has a name. (Example: powertrain name, subsystem name, etc.)	
38	Project management	Milestone		Metadata for identifying the HEX-File. Information for identifying the destination of the vehicle for which it is developed. This is typically a region. (Example: Japan, North America, China, Europe, South America, etc.)	
39	Project management	Calibration Plan		Sub-goals for progress management of the vehicle development Project. Milestones are specific development steps used for Project management up to the final step of readiness for production of the HEX-File. HEX-Files for an entire vehicle are stored in the HMS as artifacts for each Milestone.	
40	Project management	Progress Information		Plan for carrying out the Calibration work. (Example: list of parameters to be calibrated for each Milestone)	
41	Project management	Domain Control Meeting (Quality Gate)		Information that indicates the progress of the Calibration work. (Example: numerical values showing the actual progress against a Calibration Plan)	
42	Project management	Verify Data		Various meetings held in each Domain as the quality gate of the Calibration artifacts (CDF, etc.) to verify whether the Calibration work results have reached the specified quality goals. (Example: meetings for verification of Base HEX, CDF Files, Mask HEX)	
43	Attached info for HEX	ECU Reprogramming Profile		Work of verification whether the artifacts (CDF, Reports, etc.) have reached the specified quality goals. Judgments of OK/NOK are recorded as the status information of CDF Sets.	
44	Attached info for HEX	Software Specification		Communication and memory address information required to read and write the HEX-File to the ECU.	

HMS Use Case

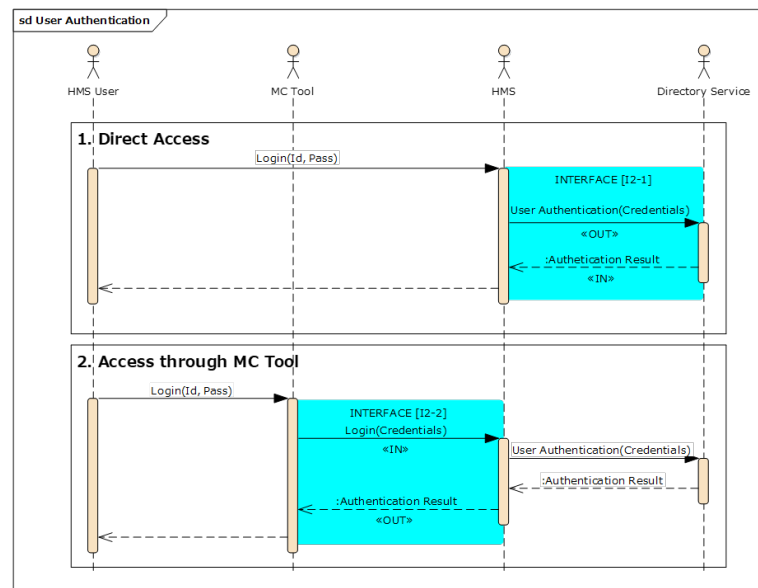
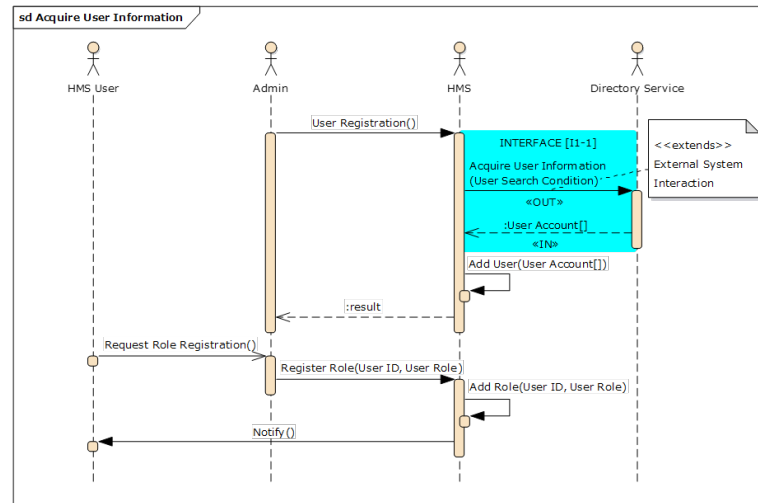
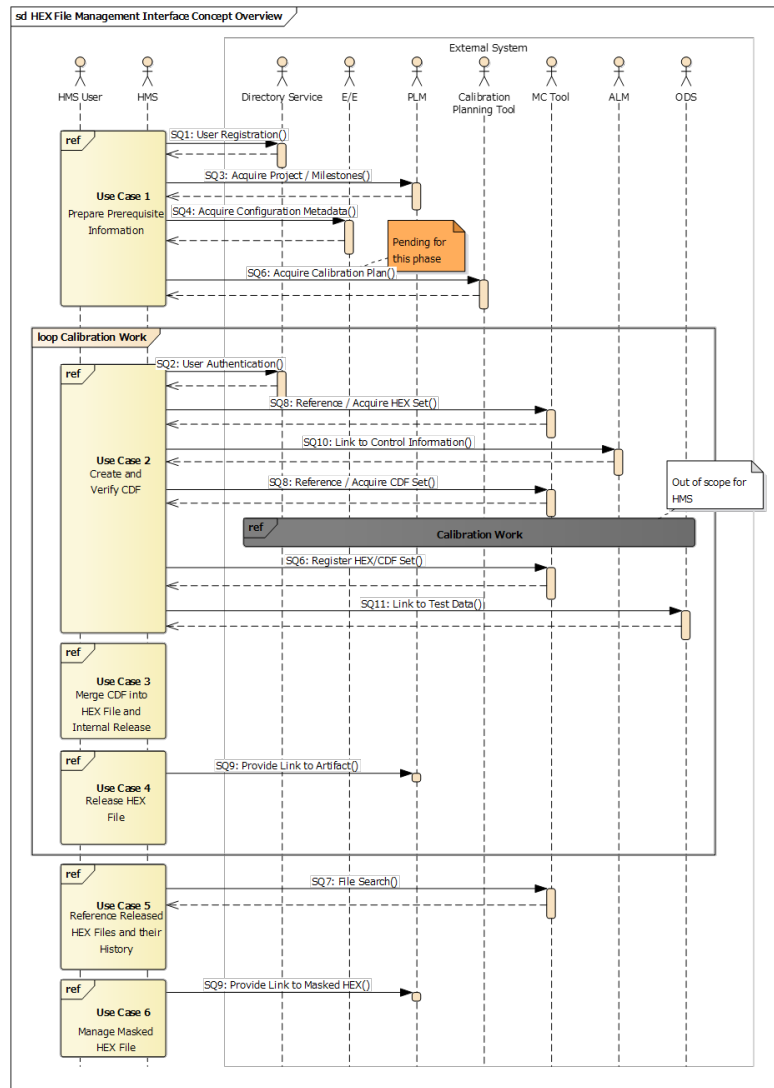


No.	Title	Description
1.	Prepare prerequisite information	Enter information, which is necessary for HEX-File management. (e.g. User registration, Metadata for HEX, etc.)
1.1.	Manage User Account	Enter User Accounts and assign roles to them.
1.2.	Manage Workspace Area	Prepare work area to manage HEX Sets and CDF Sets on this system.
1.3	Manage Metadata	Define metadata to identify HEX-Files. About following use cases on 1.3.1 – 1.3.5 : These are examples of metadata to manage HEX-Files, and they can be changed depend on each organization's business styles.
1.3.1.	Manage Project Metadata	Import and define HEX metadata of each Automobile development Projects. (Brand, Model Year/Name/Code...)
1.3.2.	Manage Configuration Variant	Import and define HEX metadata of E/E configuration. (ADAS, Energy, Infotainment, Body...)
1.3.3.	Manage Subsystem Combination Variant	Define HEX metadata of Subsystem combinations. (Powertrain name, Subsystem name, etc.)
1.3.4.	Manage Subsystem Variant	Define HEX metadata of Subsystems. (Engine, Transmission, Motor, Battery...)
1.3.5.	Manage Region Variant	Define HEX metadata of regions. (Japan, North America, Europe...)
1.4.	Import Milestone Project Plan	Import Milestone Project plan to develop each Automobile. The plan is created by an external system (e.g. PLM / Calibration Planning Tool).
1.5.	Import Calibration Plan	Import Calibration Plans that have been already approved by appropriate Approvers. The plans are created by an external system (e.g. Calibration Planning Tool) for each Milestone.

HMS Data Model & HMS Object



HMS Sequence



User Search Condition:
 { "Organization Unit": "Development" }

IN:
 User Account:
 [{
 "User Id": "john_smith",
 "E-mail": "smith.john@asam.net",
 "Common Name": "John Smith",
 "Organization Unit": "Development"
 },
 ...
]

Related Use Case:
 UC1 Prepare Prerequisite Information

Background
 It has also been considered that HMS would independently manage the user information, but assuming that most OEM's already use a Directory Service within their company, HMS will refer to the user information registered to the Directory Service. Though the implementation technology will not be decided yet, "LDAP", a widely used communications protocol can be assumed to be used. (See Appendix 1.2 "User Management Information Interaction : LDAP")

I would like to make compliance plan and progress management

※When viewed with the HEX data editor tool

Name	Description	Value	Hex	Unit	責任区	担当者	いつまでに	ステータス	コメント
NOBJ0	[NEGO]アイドル目標NEコントロール(F_ASTN=1時)	1500	05DC	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		1500	05DC	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		1300	0514	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		1100	044C	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		1000	03E8	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		900.0	0384	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		800.0	0320	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ
		700.0	02BC	rpm	1G3実車Gr	磯野	F2	🔵	2HS流用データ

Calib's meta information

Sample provision HONDA R&D

【Progress management】

I can understand the current state
(Editing is also possible in the editor)

← Information that engineers want to know

※ASAM CDF

1. Start data
2. Sand type confirmation data
3. Mold confirmation data
4. Overall confirmation data

✓ OEM単位で自由記述

CDF combined file→



Calibration
Status
Management-File

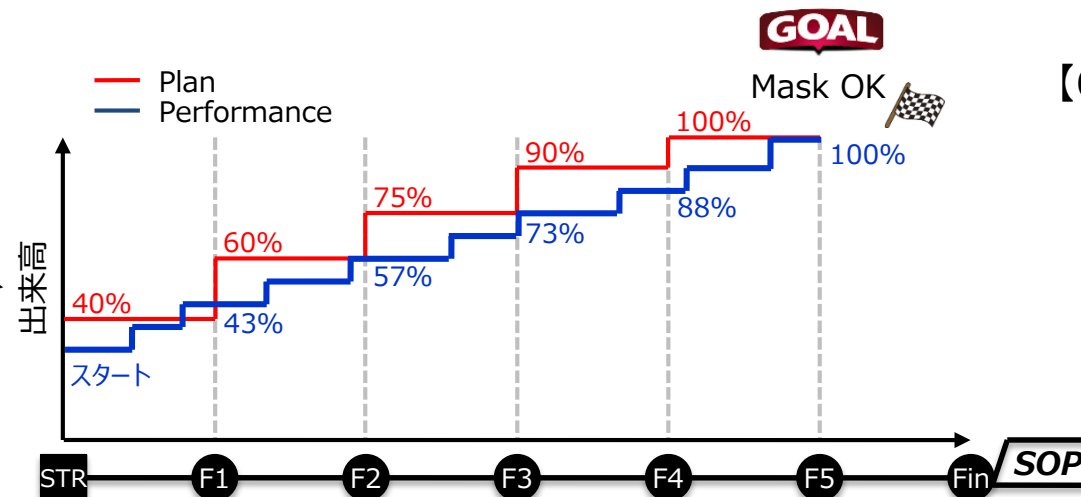


【Overall volume management】

I want to see the progress of the entire HEX
(Study visualization across models)

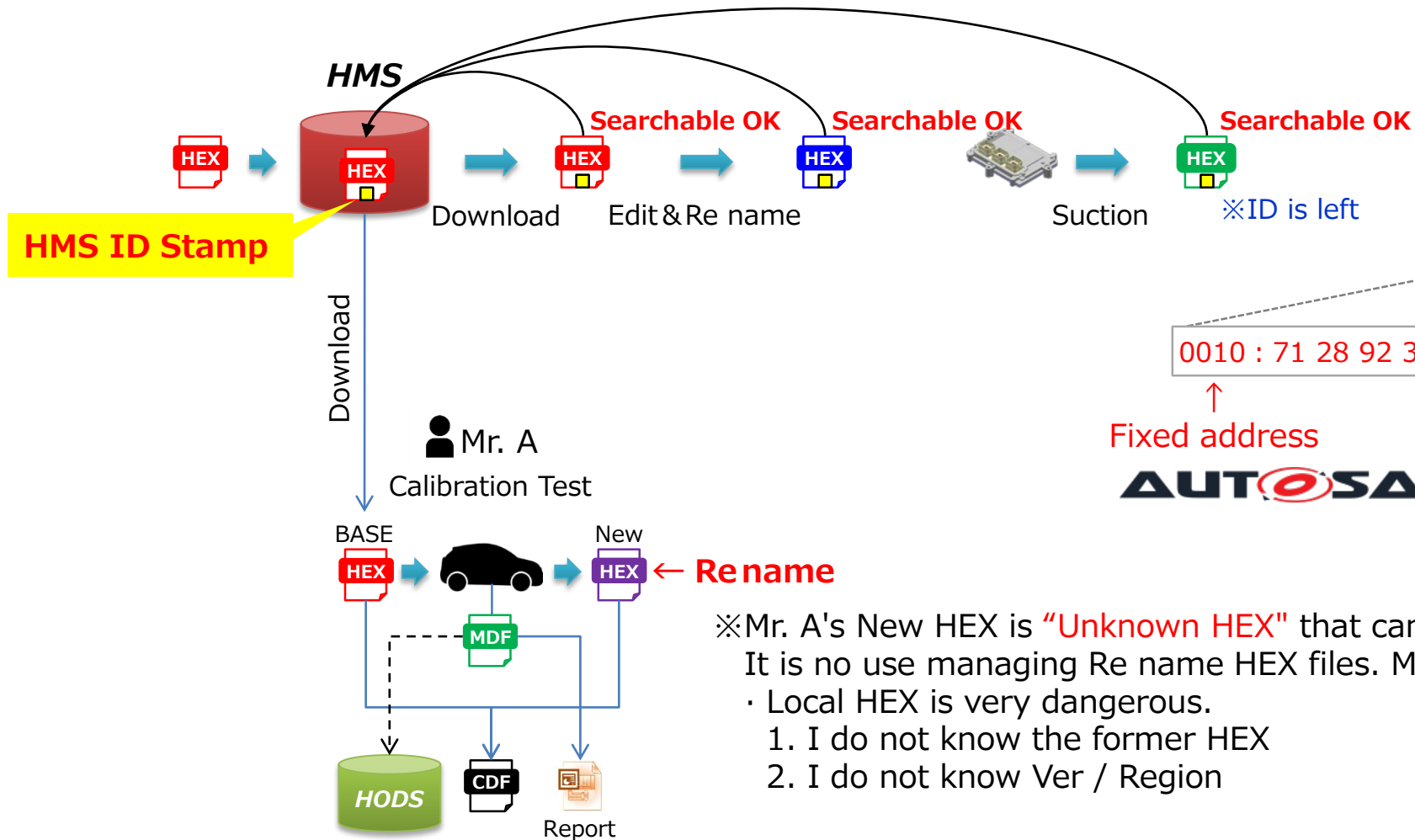
← Management wants to know information

Count up the number of ● ,
It is possible to manage
volume management



I want to eliminate Unknown HEX

~ When HEX is viewed in hexadecimal number ~



```

0000 : 3A 30 32 30 30 30 30 30 34 41 30 30 30 35 41 0D
0001 : 0A 3A 31 30 30 30 30 30 30 30 39 44 38 30 38 30
0002 : 31 30 39 43 31 31 31 30 46 30 41 38 31 31 31 30
0003 : 46 30 38 30 31 35 31 30 46 30 34 38 0A 0A 3A 31
0004 : 30 30 30 31 30 30 30 46 46 32 30 30 30 35 41 30
0005 : 32 33 34 31 30 30 30 44 48 49 44 47 45 48 49 50
0006 : 33 44 55 66 77 88 DE E0 80 70 60 50 20 22 29 8A
0007 : 44 4A 32 5E 6F 8E BB F0 E0 E2 A0 00 5D 3B 11 00
0008 : 30 32 33 33 33 83 84 88 40 53 32 45 66 91 49 44
0009 : 22 37 37 40 44 32 4A 90 82 74 69 6B 6C AA 0A 01
000A : 48 44 82 91 20 2A 3D E0 FF C0 C1 B2 A9 88 72 67
000B : 44 92 95 82 77 E0 B1 F0 A0 1A 22 80 87 93 60 55
000C : 33 38 70 99 9A 91 B6 77 D0 2B B8 74 7B 66 52 2C
000D : 3E 69 73 74 62 88 2B A2 CC BD E0 F8 D2 87 93 D5
000E : 3B 44 81 84 93 7F F3 58 C3 D3 44 52 73 8D 87 5A
000F : 22 83 7D E8 A8 6D BB C8 38 41 66 7A BA 68 78 33
0010 : 71 28 92 38 88 64 40 30 72 17 69 82 33 54 48 28
    
```

FF FF : 9A 2C 21 45 81 A7 11 F0 33 21 48 61 52 97 48 78

Expansion

0010 : 71 28 92 38 88 64 40 30 72 17 69 82 33 54 48 28

↑
Fixed address

※ID information is stamped on the HMS,
and it is subject to search

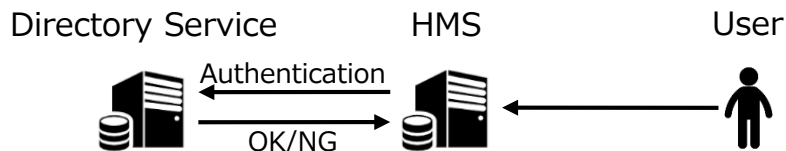
- ※Mr. A's New HEX is "Unknown HEX" that can not be handled by third parties.
It is no use managing Re name HEX files. Mr. A will forget anything.
- Local HEX is very dangerous.
 - I do not know the former HEX
 - I do not know Ver / Region

HMS Other standards collaboration

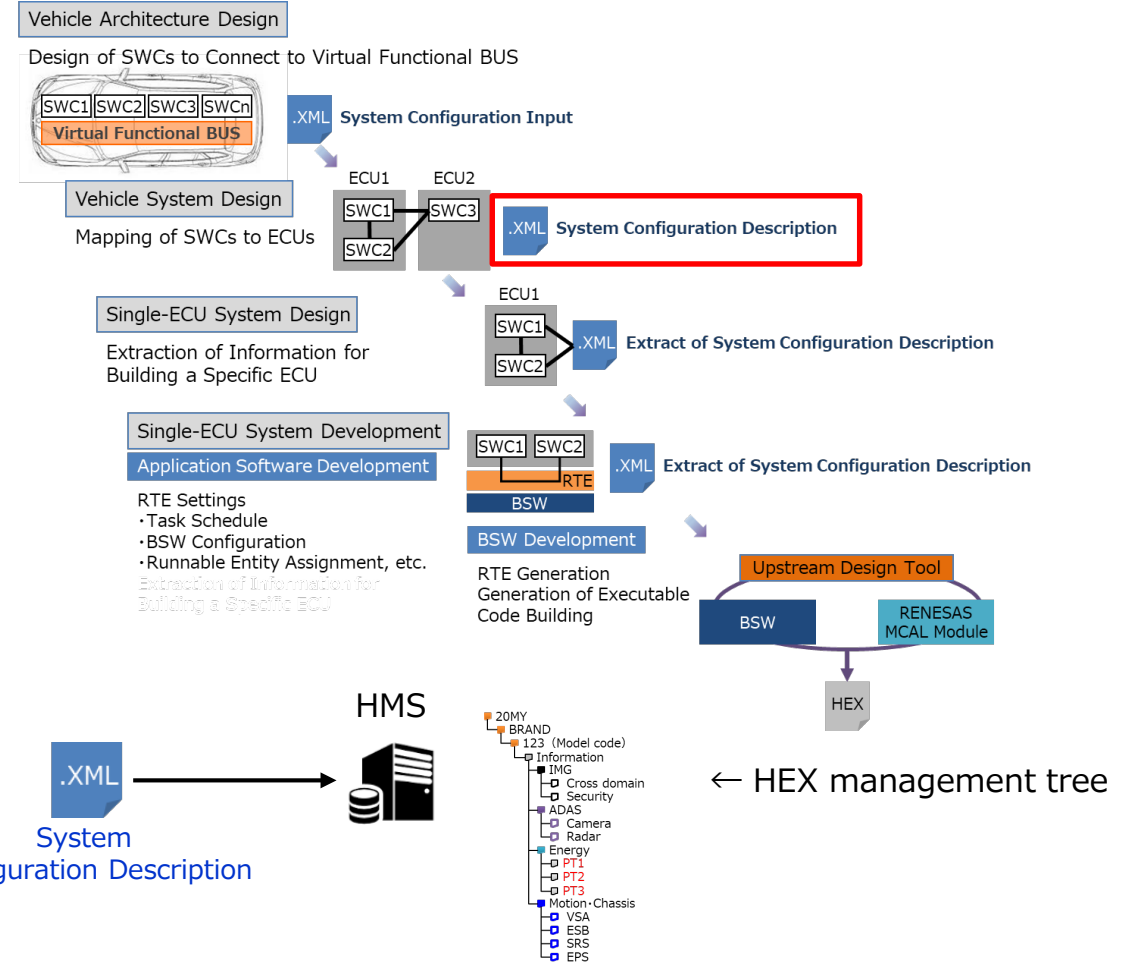


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 - [Quick Start Guide](#)
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LDAP stands for Lightweight Directory Access Protocol, a protocol for accessing directory services.



AUTOSAR Methodology



The future of HMS

The future of HMS1

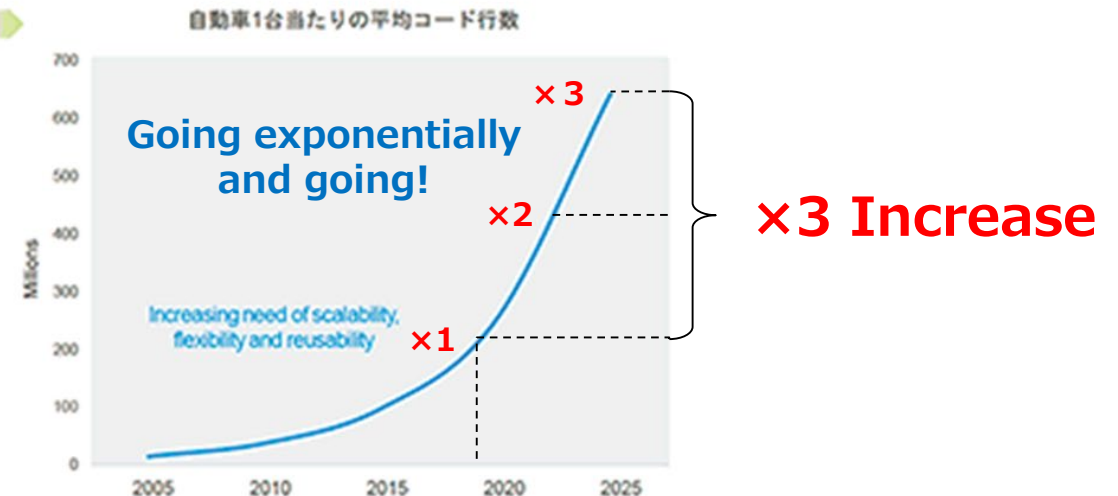
Current high-end cars have software code that exceeds tens of millions of lines and ECUs that process these software. This software scale exceeds the code number of large aircraft and PC OS. You can see how the car's function depends greatly on software. Furthermore, it is expected that the on-vehicle software will be further increased in size with megatrends of "Connectivity", "Motorization", "Auto Drive", "Environmental Regulation", "Safety" and "Security".



Current Car



Next generation Car

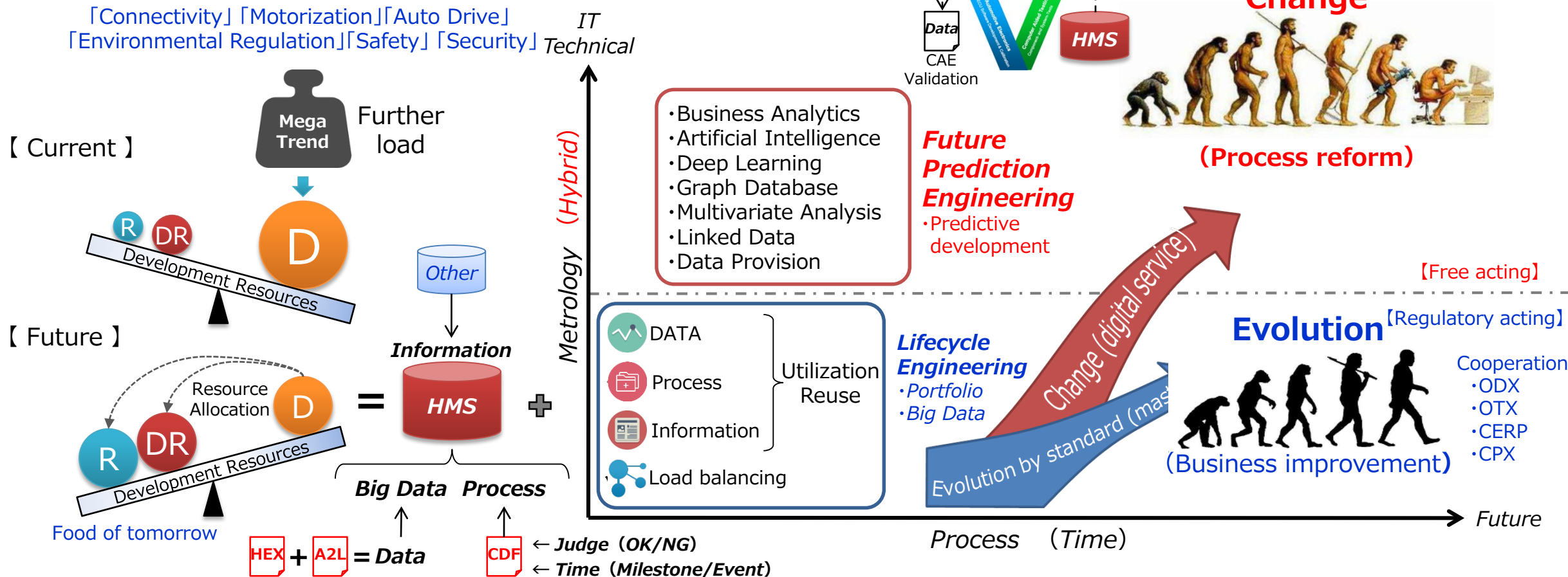


Many people are saying the same thing ⇒



The future of HMS2

✓ IT technology in recent years has evolved dramatically



Evolution and change are necessary based on HMS in order to become a figure you desire

Summary

Summary

- ✓ Each OEM company is troubled with daily HEX-File management.
- ✓ We will promote the standardization of HMS according to ASAM policy.
- ✓ Thanks to your cooperation, I was able to create HMS concept paper.
- ✓ We will continue to promote HMS standardization in the future.
- ✓ But for OEM HMS is not a goal. From now on, in order to do "evolution and change", everyone's cooperation is necessary.

Thank you!

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