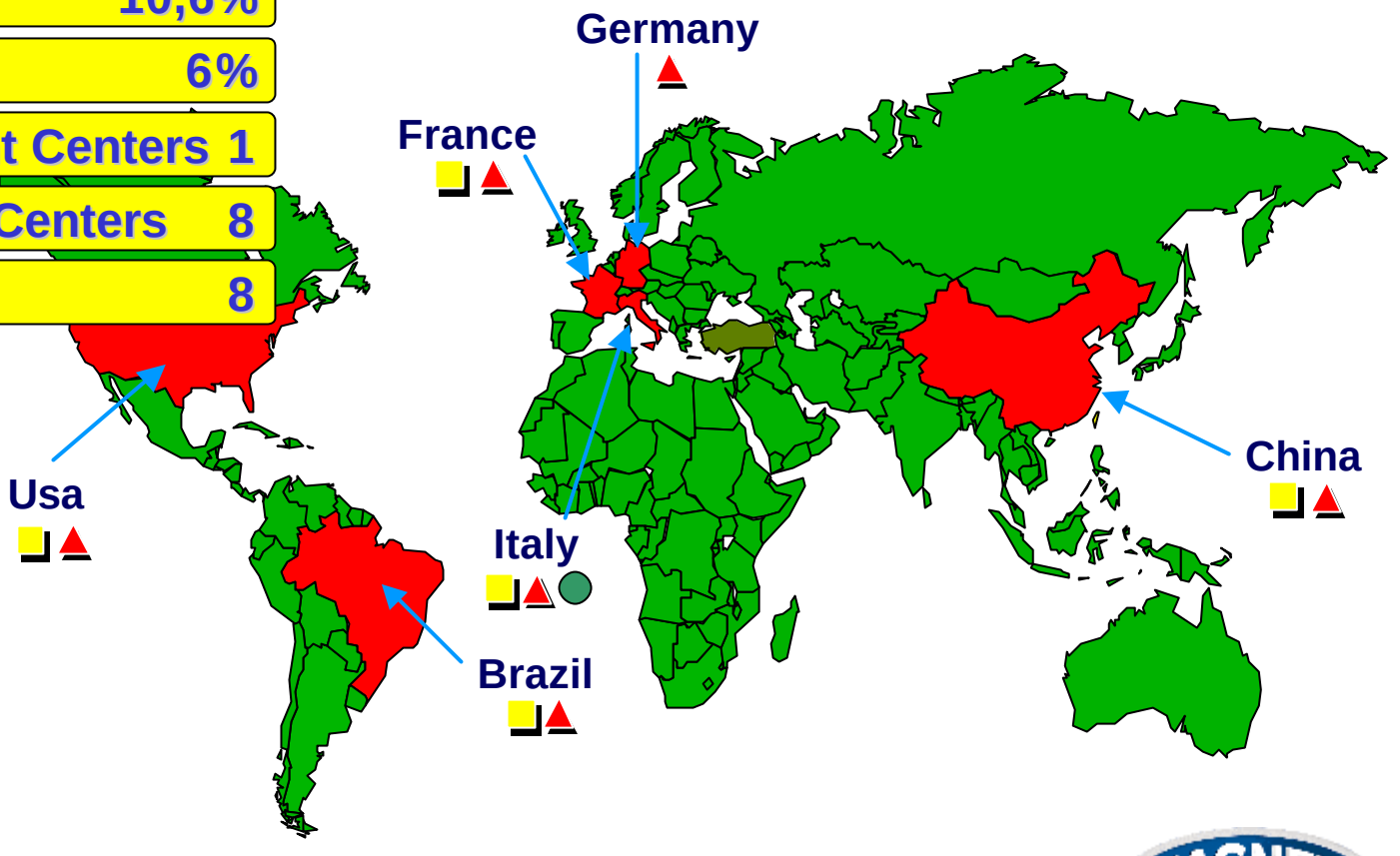
Collaborazione MM-Univirsità 2005

WORLDWIDE PRESENCE

2003 Sales	€742 mln
Employees	4180
R&D	10,6%
Investments	6%
Development Centers	1
Application Centers	8
Plants	8

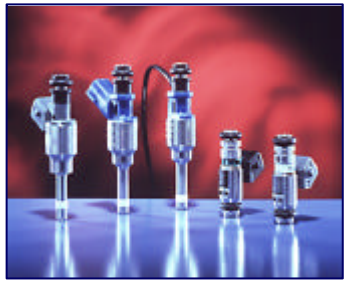


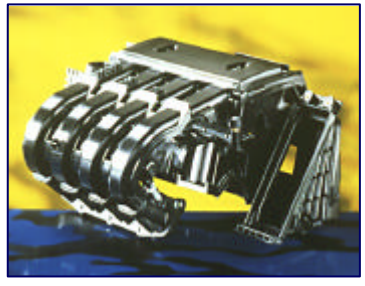
Plant Application center Development center

MAIN PRODUCTS AND TECHNOLOGIES

Gasoline Engine Control

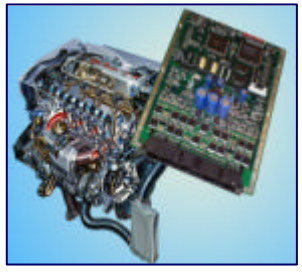
- ECUs
- Injectors
- Throttle bodies
- Intake manifolds
- Fuel rails





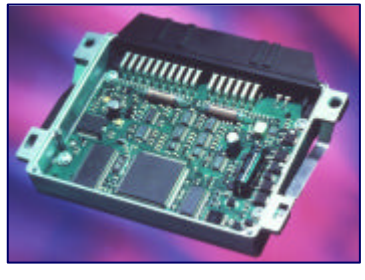
Diesel Engine Control

- ECUs
- System components (buy)

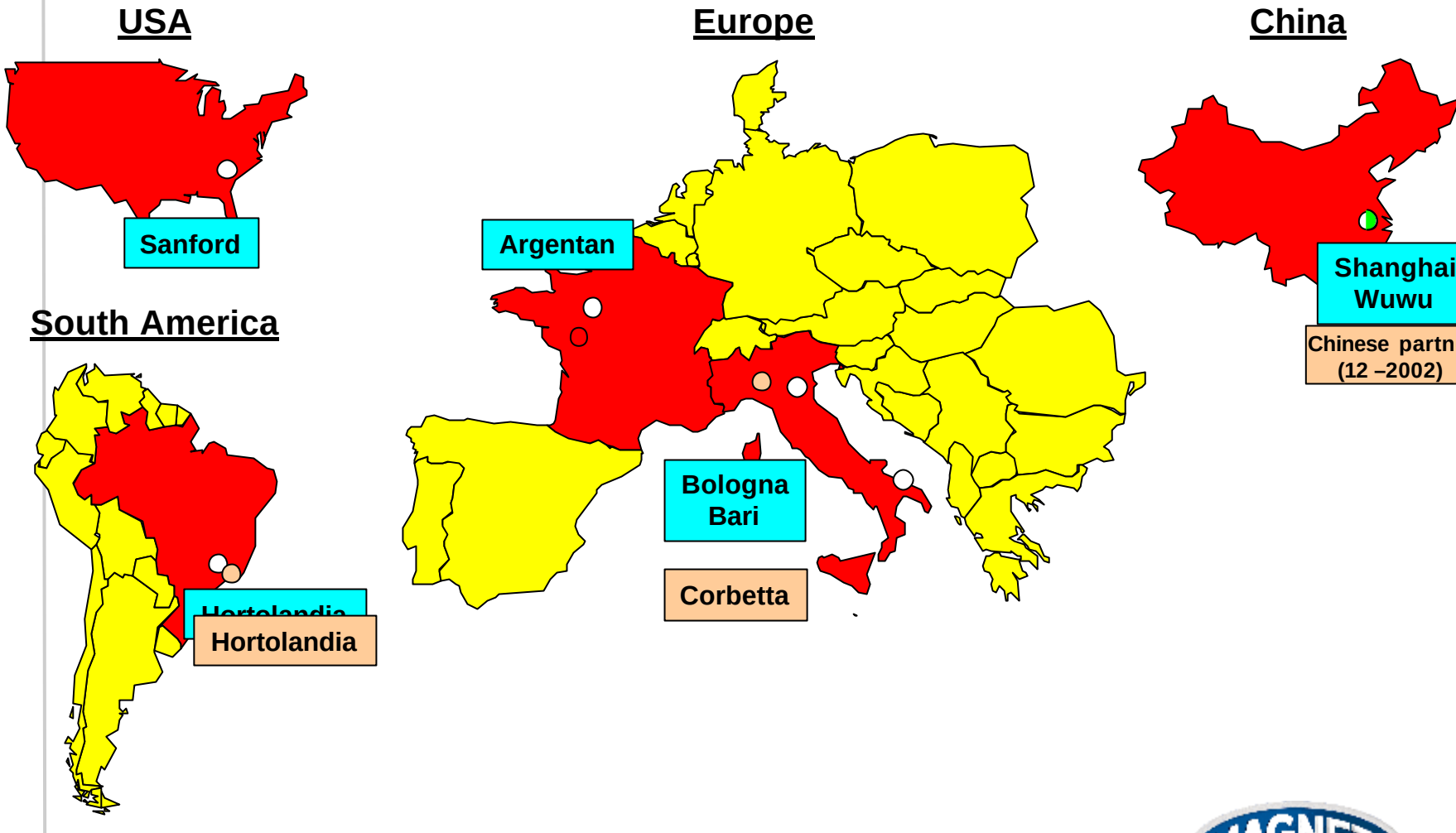


Semi-automatic transmission

- Selespeed:
  - hydraulic power units
  - ECUs



PLANTS LOCATION



MARKET POSITION

NAFTA

2003 turnover: €102 mio

Presence in niche market with high profitability

Clients: DC, GM, Harley Davidson

Europe

2003 turnover: € 498 mio

Market share: 10% (PWT) #3
(AMT) #2

Clients: Fiat, VW, RSA, PSA, DC, GM, BMW, Piaggio, Ducati

Mercosur

2003 turnover: € 87 mio

Market share: 39% (PWT) #1

Clients: Fiat, VW, GM, RSA, DC, PSA, Ford

China

2003 turnover: € 55 mio

Market share: 6% (PWT)

Clients: Jinbei, Chery, SVW, DCAC, Nania and others

Electronic Components

- Manufacturing plants in three continents (Europe, South America, Asia):
  - state of the art technology
  - highest level of quality certification
- Gamma products worldwide with localised industrial plants
- Investments:
  - flexibility
  - capacity/capability in multiple locations
  - capacity saturation worldwide

CURRENT ELECTRONIC PRODUCTS

	Europe	Brazil	China
Gasoline Engine Control	✓	✓	✓
Diesel Engine Control	✓		
Transmission Control	✓		

PLANTS DESCRIPTION

Corbetta (Italy)

Area	6,000 m^2
Headcount	
Direct labour	251
Total	345
Certifications	ISO 9001
Products	• SPI, MPI Control unit • DBW Control unit • Selespeed Control unit
Technologies	• PCB process • Hybrid thick film
Main clients served	• FIAT / GM Group • VW • DC • BMW

PLANTS DESCRIPTION

Hortolandia (Brazil)

Area	31,000 m^2
Headcount	
Direct labour	322
Total	535
Certifications	ISO 9000, ISO 14000, AVSQ94
Products	• Throttle bodies • Intake manifolds • Fuel rails • Injectors • Pressure regulators • Oil pumps
Technologies	• Metal forming (die cast) • Plastic (moulding) • Precision machining • Flexible assembly/test
Main clients served	• FIASA • PSA • RSA • Volkswagen

MAGNETIMARELLI POWERTRAIN IN SHANGHAI

Company Established in March, 2000

1st Plant SOP in July 2000

Total Area: 25,000 m^2

100% owned by Magneti Marelli Powertrain S.p.A.

1st phase Investment: $ 30 million (Done)

Location: Shanghai Pudong Waigaoqiao Free Trade Zone

MM POWERTRAIN 2nd PLANT IN Wuhu

2nd Plant SOP in Nov. 2003

Total Area: 25,000 m^2

100% owned by Magneti Marelli Powertrain S.p.A.

2nd phase Investment: $ 30 million

Location: Wuhu High-Tech. Industry Zone,with 4 hours Distance by vehicles away

MM POWERTRAIN
PRODUCT PORTFOLIO
&
TECHNOLOGY ROAD
MAP

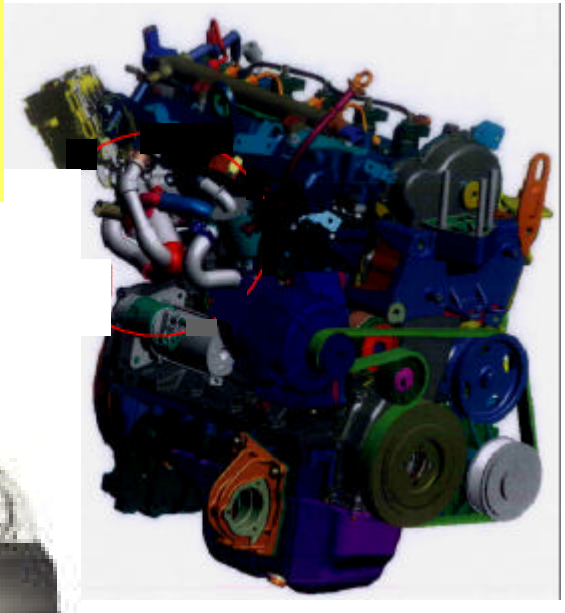
2003 : NEW MPI FLEX FUEL TECHNOLOGY

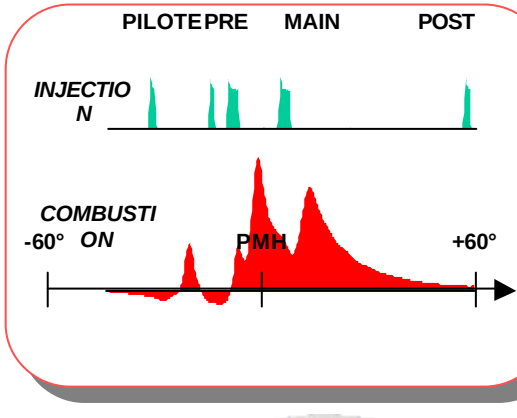
New FLEX FUEL systems can use free Alcool/Gasoline mix (Self-adaptive SW implementation)

ACHIEVEMENT:
Record Market Share in Brasil (> 45% starting MY'05) through consolidation (FIAT – VW) and new awarded bid (FORD)

2004 : DIESEL COMMON RAIL MULTIJET

CRF-MM cooperation has produced a very innovative K.H. , instrumental to the evolution road map





ACHIEVEMENT:
New FIAT 1,3lt Turbo Diesel Multijet Engine

SELESPEED®

MM leader in Automated Manual Transmission Market

Ferrari/Maserati	360 - 550 Spyder-Coupé	 
Alfa Romeo	147-156	 
BMW	3/5/Z Series	 
Fiat	Punto-IDEA Panda-Y	 
RSA	Twingo-Clio SuperTwingo	 
PSA	N.Xsara N.Picasso-308	 

MAGNETI MARELLI

MAGNETI MARELLI SOLUTIONS

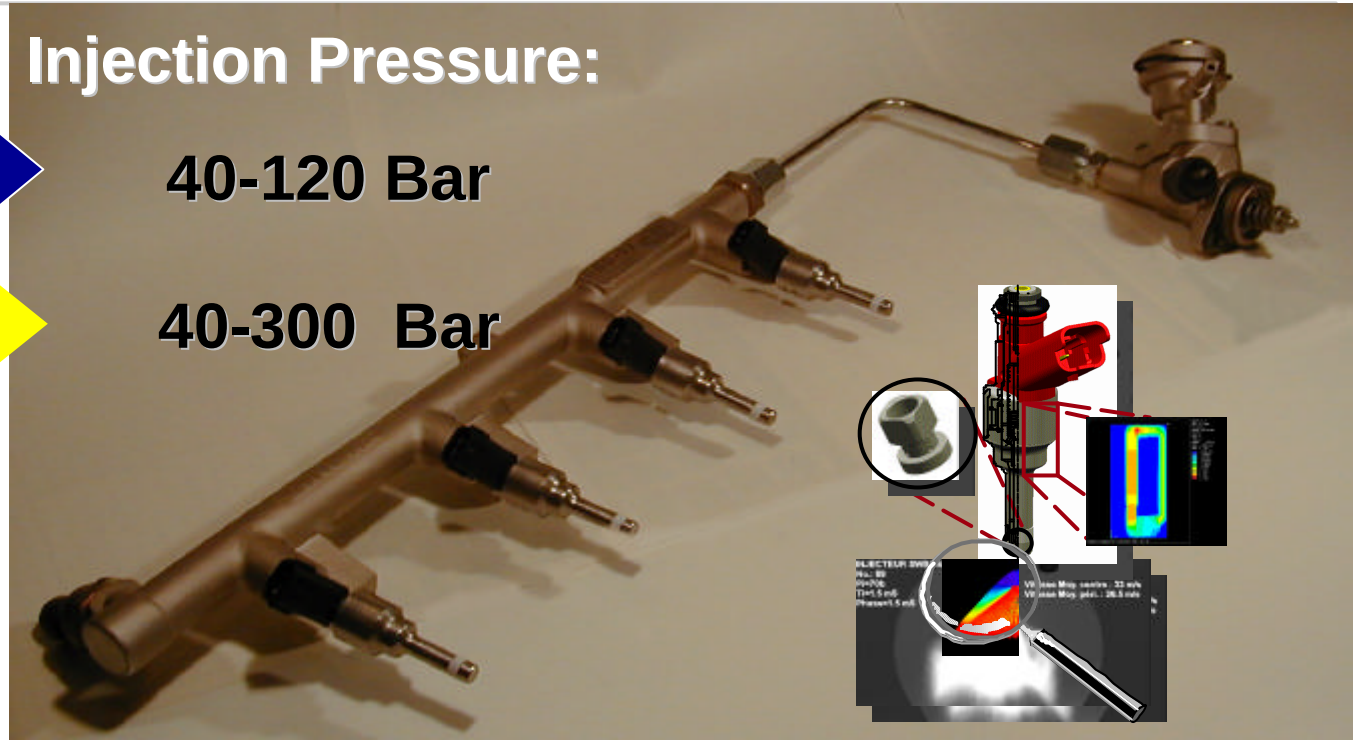
FUEL ECONOMY

- **Direct Fuel Inj**
- **Diesel C.R.Multijet**
- Compress Natural Gas
- **Valve Control**
- **Transmission Control**
- **Hybrid Vehicle**

GASOLINE DIRECT INJECTION

GEN. 1

GEN. 2



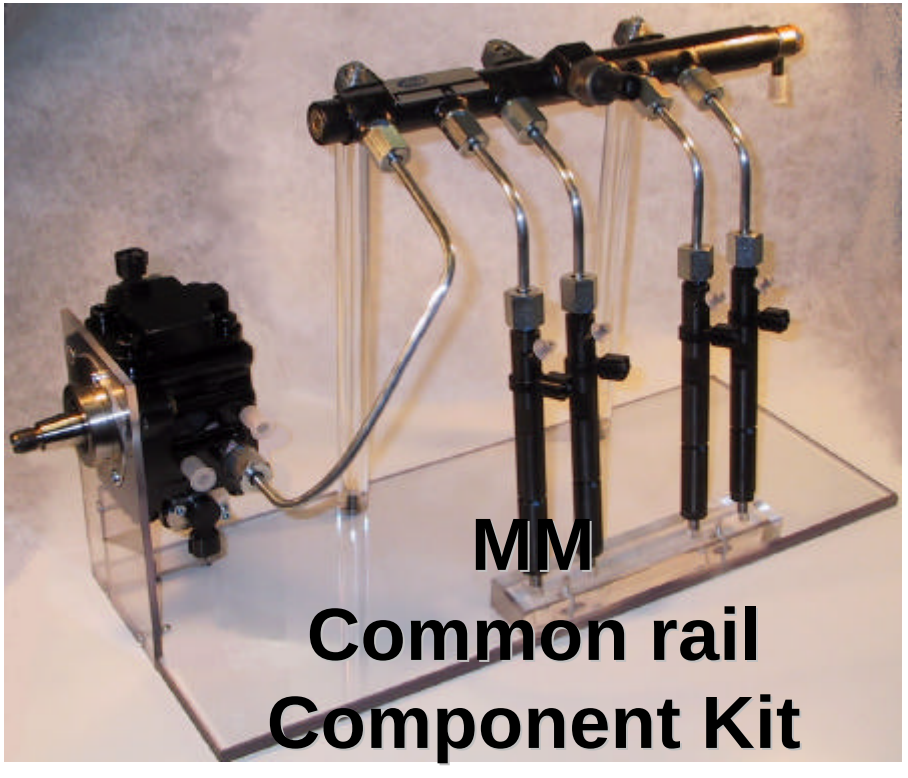
Benefits

- Homo Stoichiometric → N.Aspirated Torque + 4/6%(F.e. 4/5
  Turbo Downsizing F.economy 10/12
- Stratified lean A/F 40-50 → Fuel economy (CO2) 9/11%

1st awarded business VW : SOP 6/06

MAGNETI MARELLI

DIESEL MULTIJET COMMON RAIL



New Common Rail

Multiple Injections (up to 7)

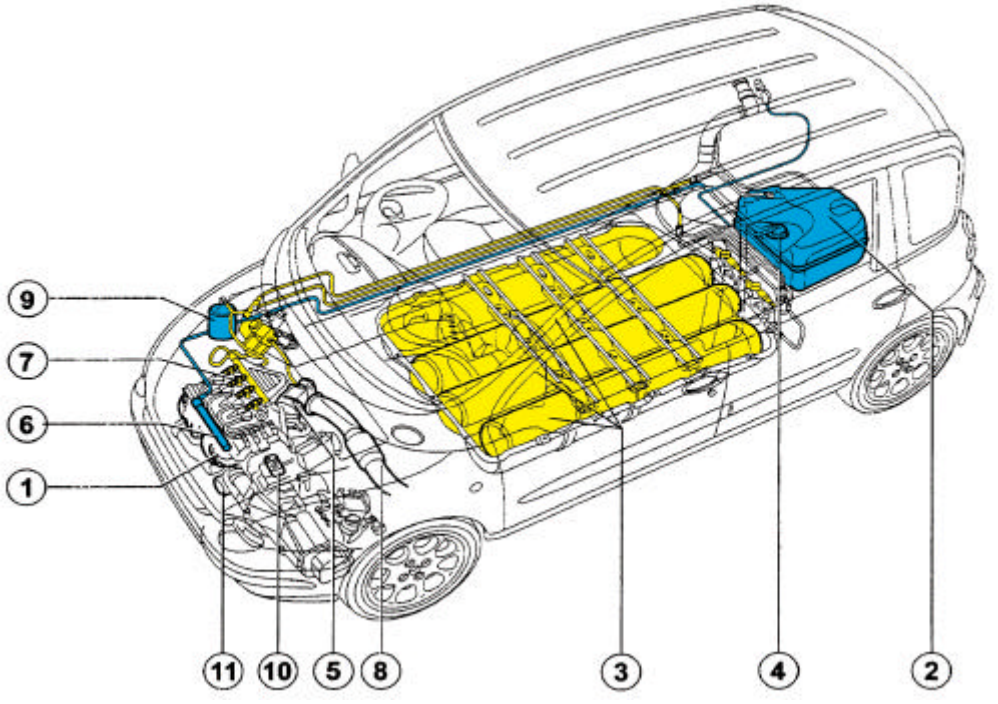
Benefits

Benefits vs. current MULTIJET version:

- **Emission reduction (Fullfill EURO 5)**
- **Combustion noise improvement (especially in cold operation)**
- **Lower cost**

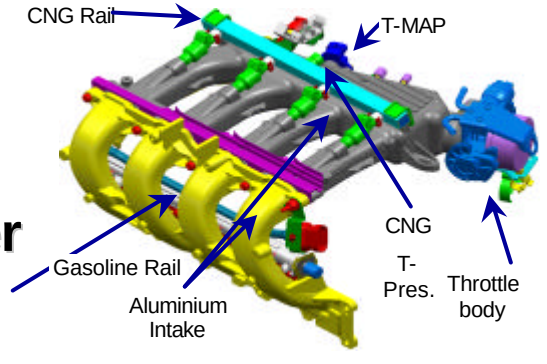
Production on SDE : 2007

Compressed Natural Gas SYSTEMS



Legenda

1. ENGINE N.A. or TURBO
2. GASOLINE TANK AND REIL
3. CNG TANK AND PIPES
4. GASOLINE PUMP
5. INTAKE MANIFOLD
6. GASOLINE RAIL
7. CNG RAIL
8. LAMBDA ON-OFF SENSOR
9. CANISTER SYSTEM
10. ENGINE COOLING
11. ENGINE OIL PUMP



Benefits

Cost Advanteges for EndUser

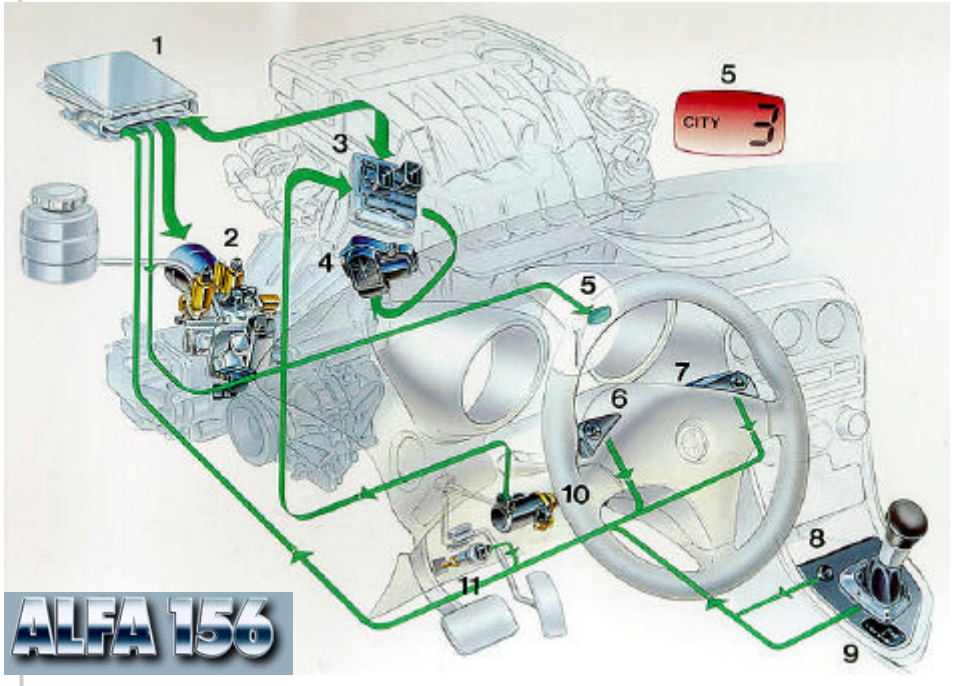
Low CO^2 Emission (-30%)

Possibility to retrofit old car

Bifuel possibility

SOP : Q2/05

SELESPEED®



1	→	Transmission ECU
2	→	Actuation group
3	→	Engine ECU
4	→	DBW
5	→	Active shift display
6-7	→	Up/Down buttons
8	→	City mode button
9	→	Up/Down lever
10	→	Accelerator pedal position sensor
11	→	Brake switch

Benefits

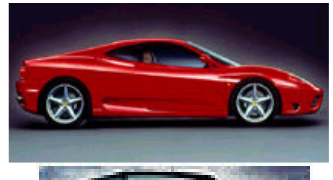
Shorter time on change gear

Low weight

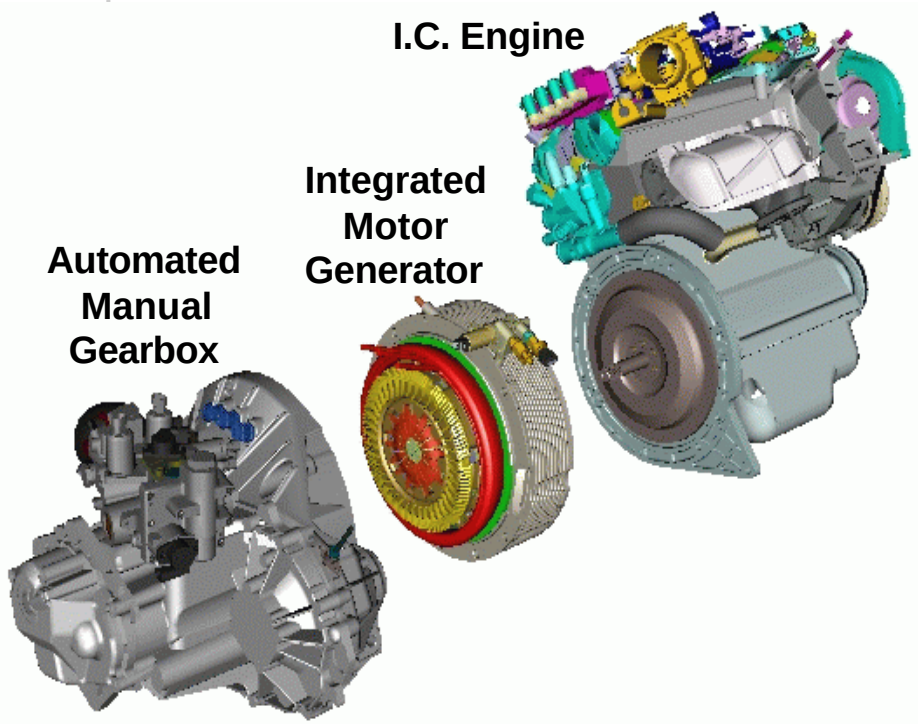
Automatic feature

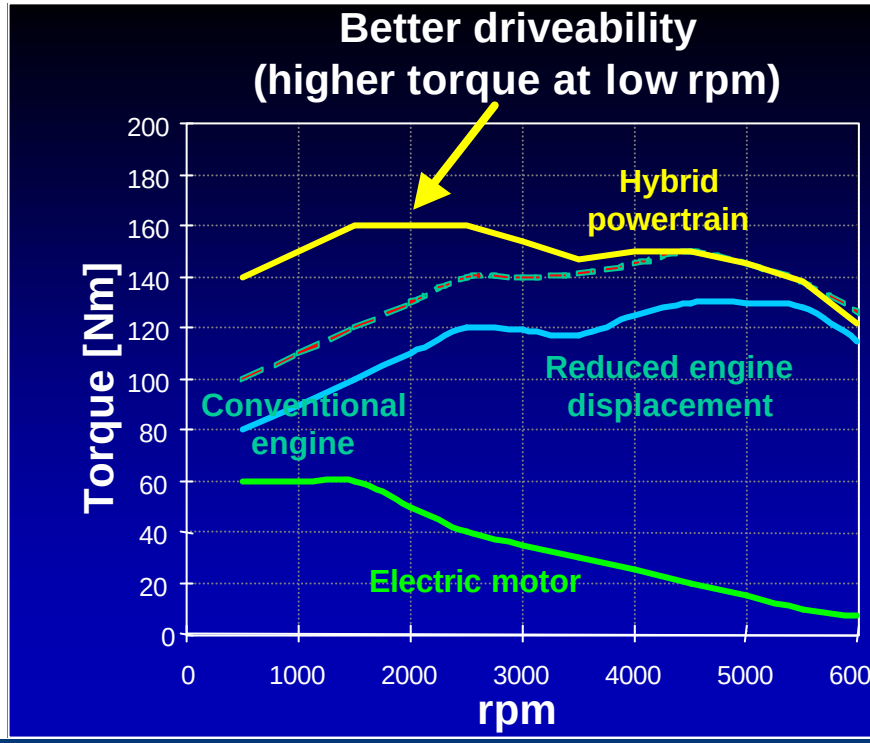
Fuel economy

Gear box reliability



MINIMAL HYBRID PWT SYSTEMS





Functions

- High efficiency electrical generation(>80%)
- Quick and reliable engine cranking
- Stop & start
- Torque booster (+60Nm)
- Regenerative braking
- Minimal electric traction

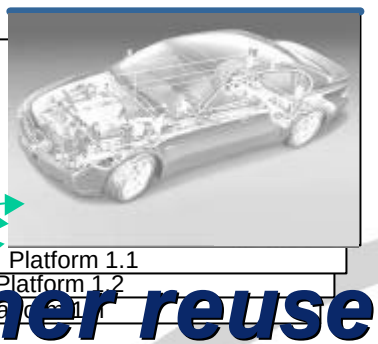
SOP : MY'07

Benefits

- Fuel economy: - 30%
- Reduced emissions: ULEV
- Better driveability:
  higher torque at low rpm

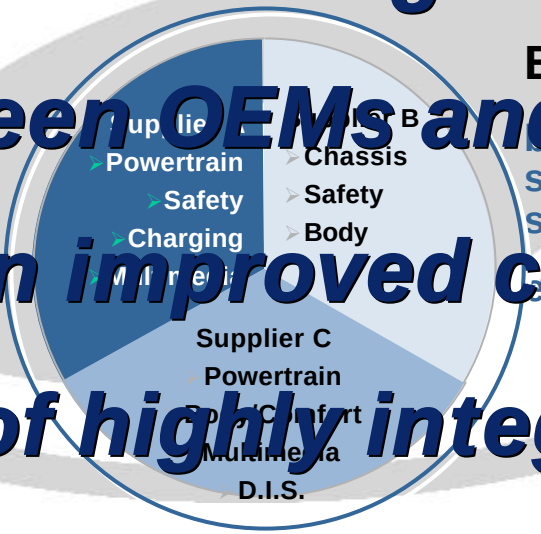
Automotive Trends on System Development

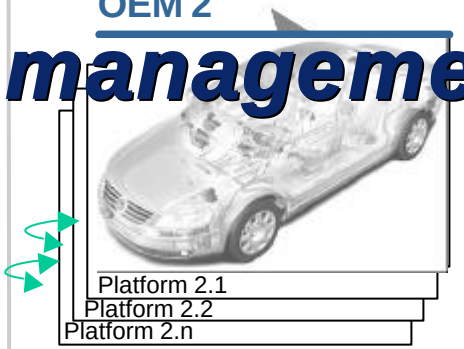
Higher reuse and exchangeability of SW modules between OEMs and suppliers need due to an improved complexity management of highly integrated E/E architectures.

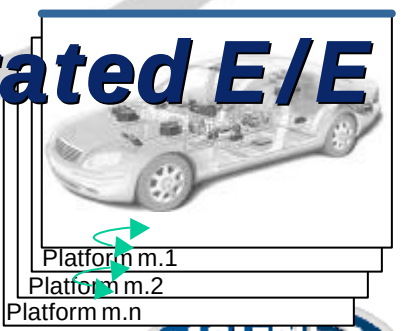


Exchangeability
between manufacturer's applications
e.g.: Diesel engine

Exchangeability
between supplier's solutions
e.g.: Battery system



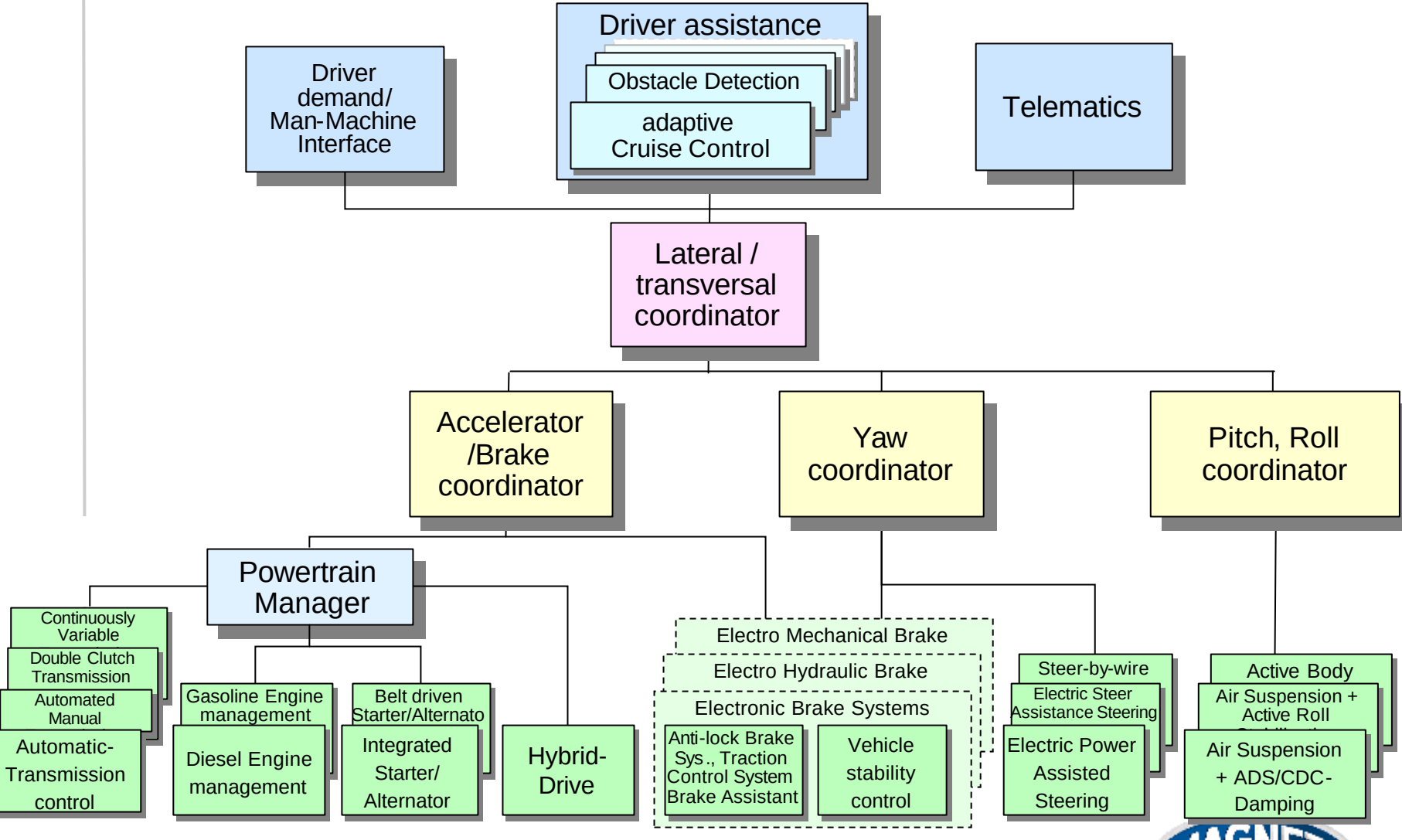




Exchangeability
between vehicle platforms
e.g.: Transmission system

AUTOSAR constellation

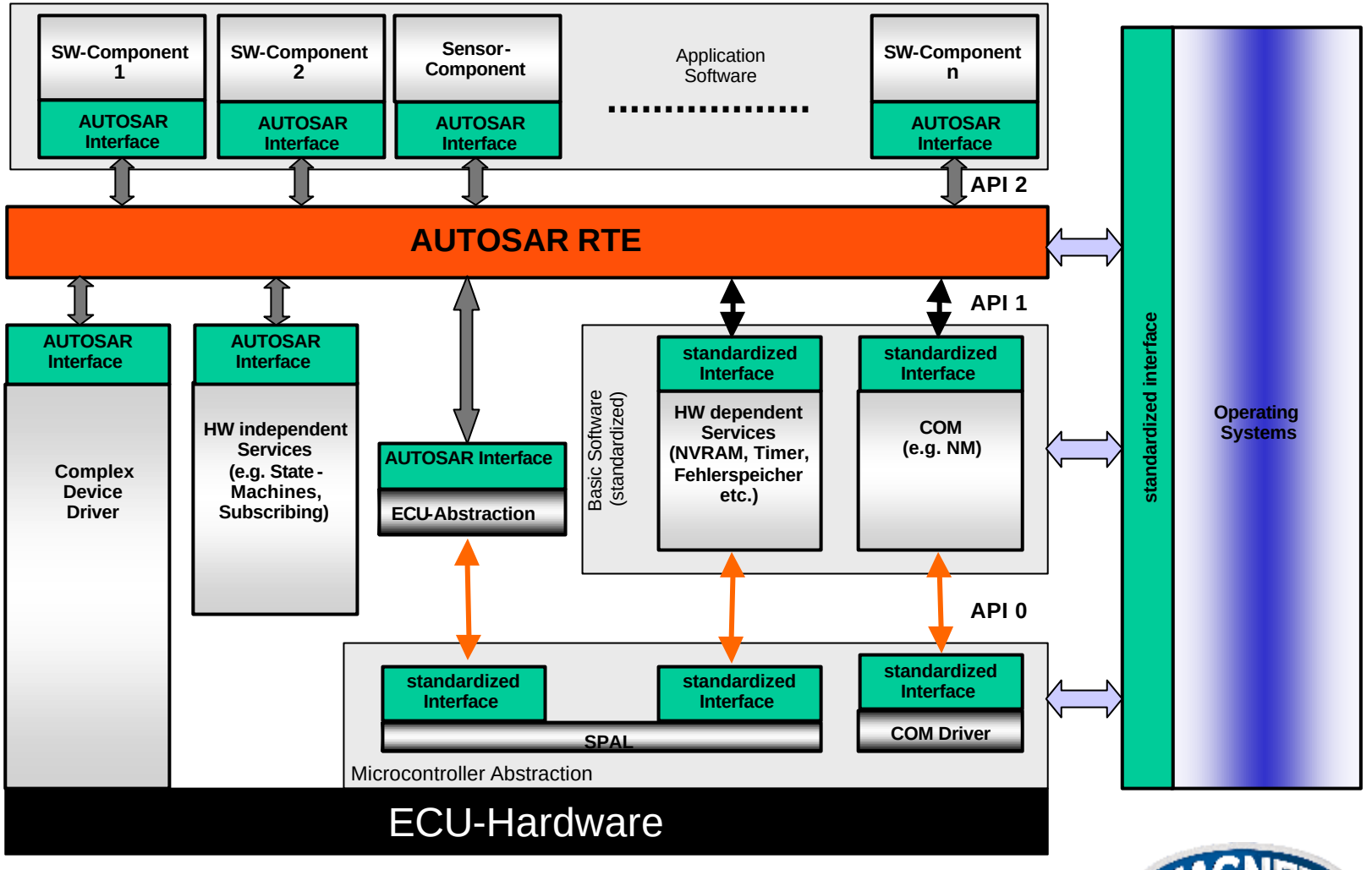
Towards in car systems integration



AUTOSAR

MAGNETI MARELLI

AUTOSAR Layered Architecture

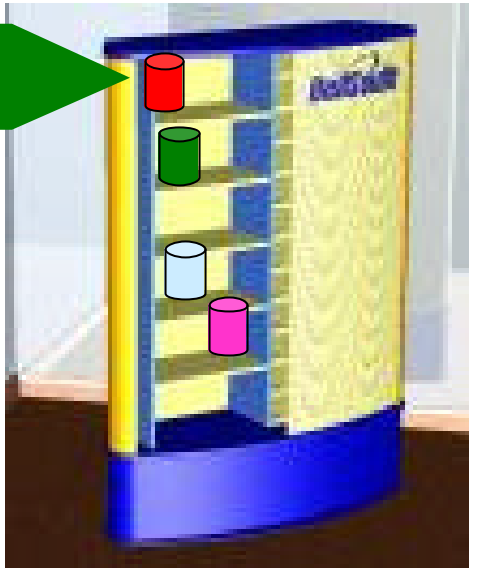


New Organization Outcome

SDC

BAS

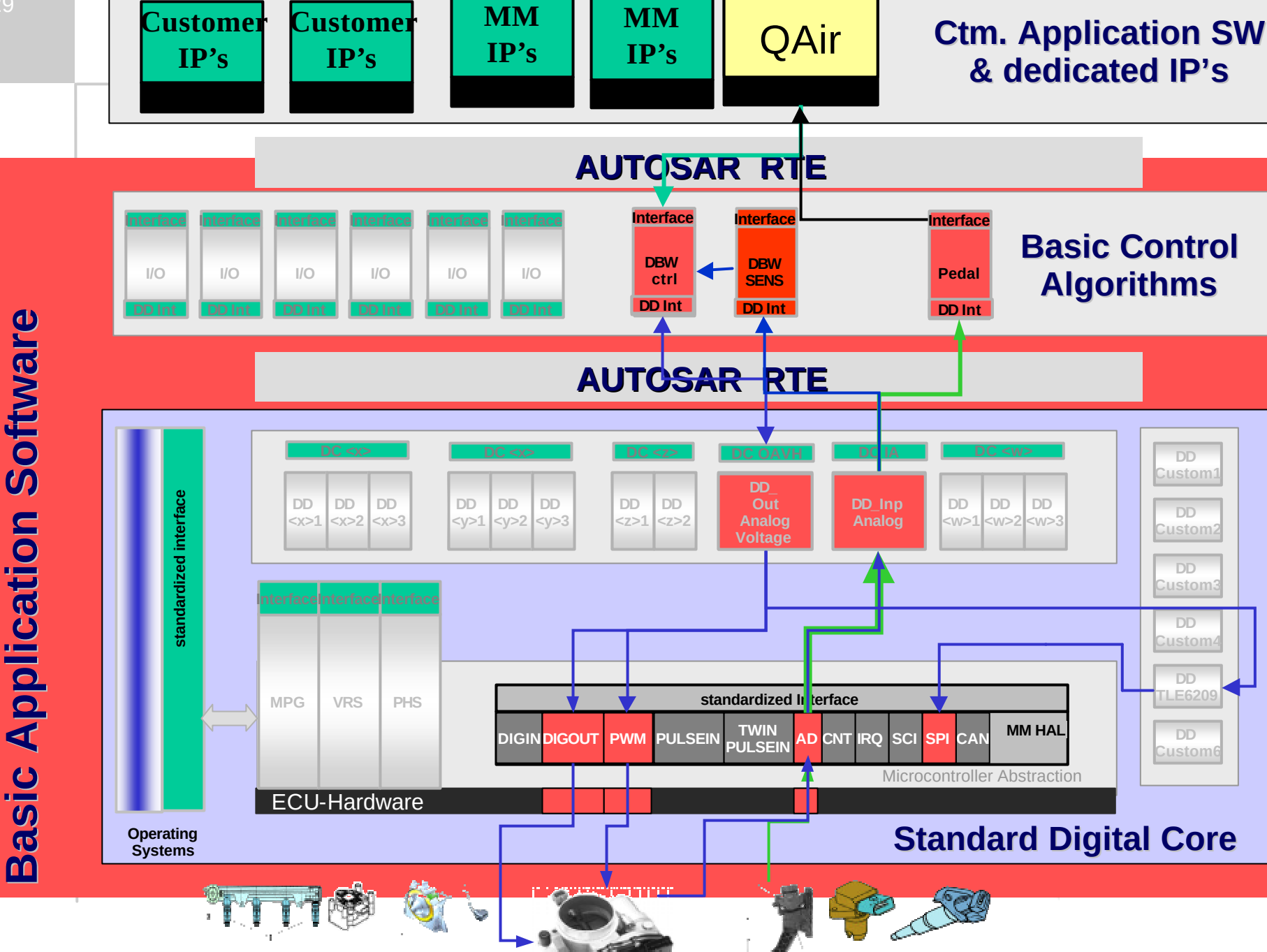
Off the shelf development
“bug free”



Sviluppo Sistema

MAGNETI MARELLI

CORE


Customer IP's
Customer IP's
MM IP's
MM IP's
QAir
Ctm. Application SW & dedicated IP's
AUTOSAR RTE
I/O
DD Int
Interface
DBW ctrl
DBW SENS
Pedal
Basic Control Algorithms
AUTOSAR RTE
DD <x1>
DD <x2>
DD <x3>
DD <y1>
DD <y2>
DD <y3>
DD <z1>
DD <z2>
DD_ Out Analog Voltage
DD_Inp Analog
DD <w1>
DD <w2>
DD <w3>
DD Custom1
DD Custom2
DD Custom3
DD Custom4
DD TLE6209
DD Custom6
standardized interface
MPG
VRS
PHS
standardized Interface
DIGIN
DIGOUT
PWM
PULSEIN
TWIN PULSEIN
AD
CNT
IRQ
SCI
SPI
CAN
MM HAL
Microcontroller Abstraction
ECU-Hardware
Operating Systems
Standard Digital Core
Basic Application Software

JRAUM & INNOVAZIONE
Grandi tematiche per 2005

T6 - INNOVATION (Ausiello sponsor)

Abate / Cristiani / Giorgetta / Marceca / Nesci / Reggiani / Rocchelli / Serra / Sola

Status as by Year 2004

La cooperazione era spezzettata in 30 differenti contratti

13 Dipartimenti Universitari coinvolti

La crescita dei rapporti con le università ha raggiunto anno dopo anno una dimensione di notevole impatto sul Budget della Powertrain

Budget 2004
0,65 M€

OBIETTIVI

Razionalizzare la cooperazione con le UNIVERSITA'

- **Focus su RICERCA DI BASE e INNOVAZIONE**

Formare ed addestrare una generazione di nuovi tecnici destinati ala assunzione e alla integrazione in PWT mediante :

- **MASTER in Ingegneria del Veicolo**

  Progetti di sviluppo o di supporto basati sul concetto del " learning on the JOB" all'interno della azienda o della Università

Fornire una "exchange area " tra tecnici della Marelli e docenti Universitari

Dare spazio e supporto a progetti gestiti direttamente dalla università

ACRONIMUS

JOINT RESEARCH AREA UNIVERSITY MARELLI

J RAUM

Raum in tedesco significa SPAZIO ,

quindi

l'immagine che vogliamo formare è quella di uno spazio di Collaborazione tra M.Marelli e il sistema Università

JRAUM : Joint Space

La organizzazione è basata su 5 Aree Disciplinari

- **4 di esse saranno collocate a Bologna,**
  INFORMATICA & CONTROLLI
  MATERIALI
  MECCANICA and MECCATRONICA
  FLUIDODINAMICA e TERMODINAMICA

- **L'area di progettazione HW sarà collocata a Venaria**

JRAUM facilities

600 m2 nella palazzina centrale (Officina 1)

- **JRAUM Badge daranno accesso ai locali e alle aree di lavoro previste**

25 posti di lavoro con Working Station

Sale riunioni e studi per Visiting Professors

Auditorium per training and scambio di informazioni in azienda

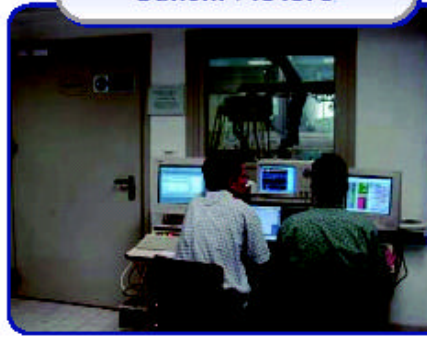
Alcune Facilities saranno condivise (2 turni per Giorno)

- **2 Banchi Motori**
- **2 Banchi prova Componenti**
- **2 Banchi a rulli**
- **Laboratorio Chimico**

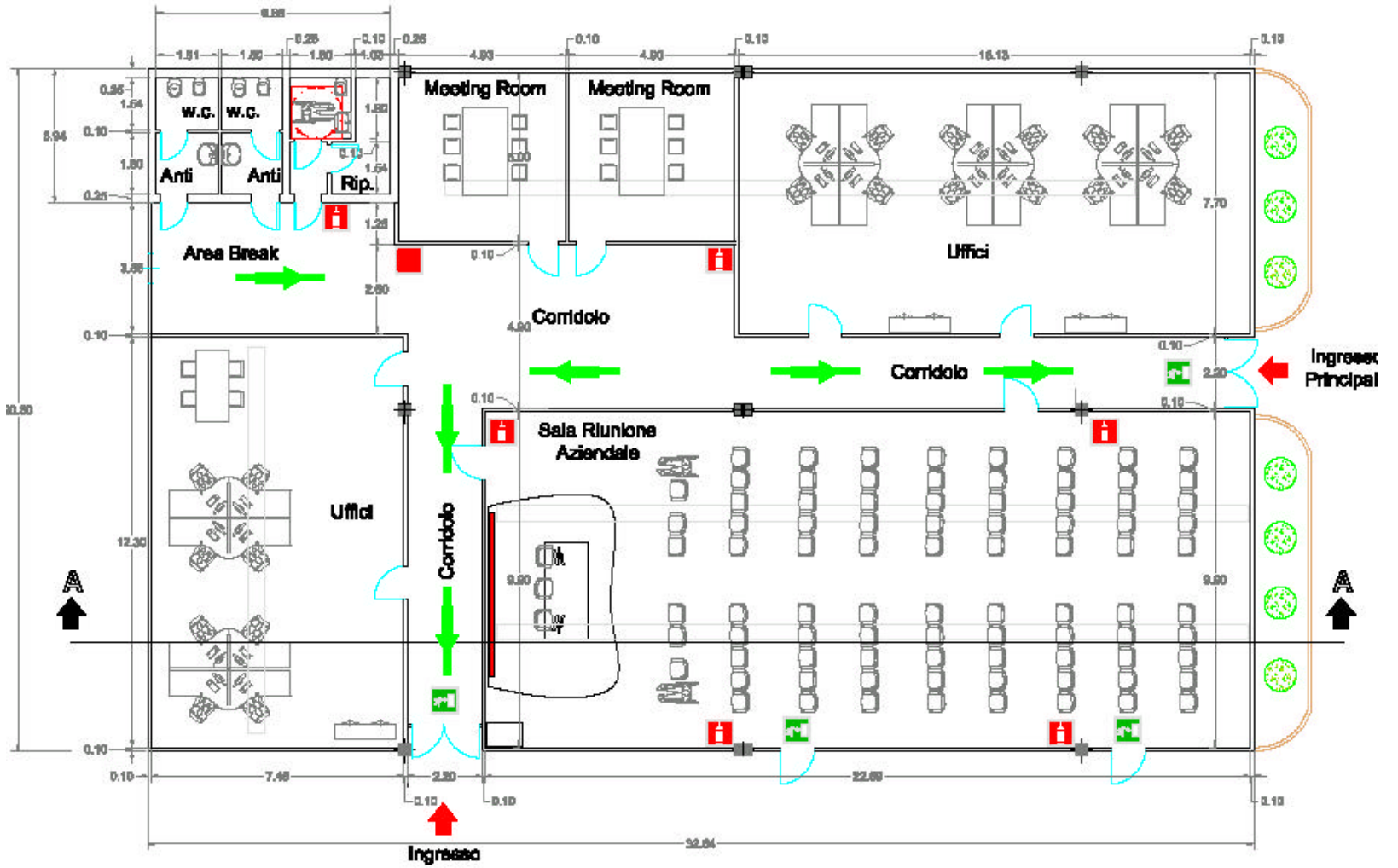
JRAUM COLLOCATION

Banchi a rulli

Banchi Motore



JRAUM Collocation



JRAUM entra nel sistema HI-MECH

L'Emilia –Romagna si sta dotando di una rete di Laboratori nel settore della Meccanica e Meccatronica

La Società Consortile ASTER (Regione + Università) cui MM PWT si è associata nel 2004 è il punto di raccordo tra il LAB-NET e le industrie

IL laboratorio JRAUM entra nella rete HI-MECH nei prossimi mesi

NET LAB

Si articolerà in 3 cluster a partecipazione di soggetti Universitari e di soggetti industriali per rafforzare il sistema produttivo regionale con attività di ricerca applicata, di sviluppo precompetitivo e di innovazione finalizzate .

1) Sistemi Meccanici e Intelligenti,
2) Metodi Innovativi per l'Ingegneria Meccanica,
3) Materiali Nanostrutture e Superfici

JRAUM entra nel sistema HI-MECH

E' in corso il bando di finanziamento 2005 con fondi legati alla legge 297

Tali Fondi saranno erogabili alle industrie collegate a LAB NET

Complessivamente nel 2005 sono previste erogazioni di

- **25 M€ regionali ai NET LAB**
- **25 M€ Ministeriali (MIUR) allocabili alle industrie Emiliane**

NET LAB

Si articolerà in 3 cluster a partecipazione di soggetti Universitari e di soggetti industriali per rafforzare il sistema produttivo regionale con attività di ricerca applicata, di sviluppo precompetitivo e di innovazione finalizzate .

1) Sistemi Meccanici e Intelligenti,
2) Metodi Innovativi per l'Ingegneria Meccanica,
3) Materiali Nanostrutture e Superfici

TEMI INNOVAZIONE PER JRAUM

- **A) MOTORI A BASSO IMPATTO AMBIENTALE**
  Diesel EURO V

- **B) SVILUPPO VETTURE IBRIDE**
  Powertrain (Motore e Trasmissione)

- **C) SVILUPPO ECU GENERAZIONE 8**
  Autosar compliant PWT system

- **D) FORMAZIONE RISORSE E TRAINING ON THE JOB**
  Master
  Dottorati

Standard Digital Core (SDC)
&
Basic Application Software (BAS)

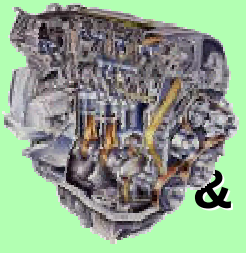
Basic Controls
& Calibration

HAL

Device
Drivers

SDC

BAS



Ctm & MM PWT
IP's Integration
& In-Vehicle Tuning

Throttle Body Control

Customer IP's

MM IP's

QAir

Application software

AUTOSAR RTE

Interface I/O DD Int

Interface DBW ctrl DD Int

Interface Pedal DD Int

Interface I/O DD Int

Basic application software

AUTOSAR RTE

standardized interface

DC <x>

DD <x>1 DD <x>2 DD <x>3

DC <y>

DD <y>1 DD <y>2 DD <y>3

DC <z>

DD <z>1 DD <z>2

DC QAVH

DD_ Out Analog Voltage

DC IA

DD_Inp Analog

DC <w>

DD <w>1 DD <w>2 DD <w>3

DD Custom1

DD Custom2

DD Custom3

DD Custom4

DD TLE6209

DD Custom6

Interface Interface Interface

MPG VRS PHS

standardized Interface

DIGIN DIGOUT PWM PULSEIN TWIN PULSEIN AD CNT IRQ SCI SPI CAN MM HAL

Microcontroller Abstraction

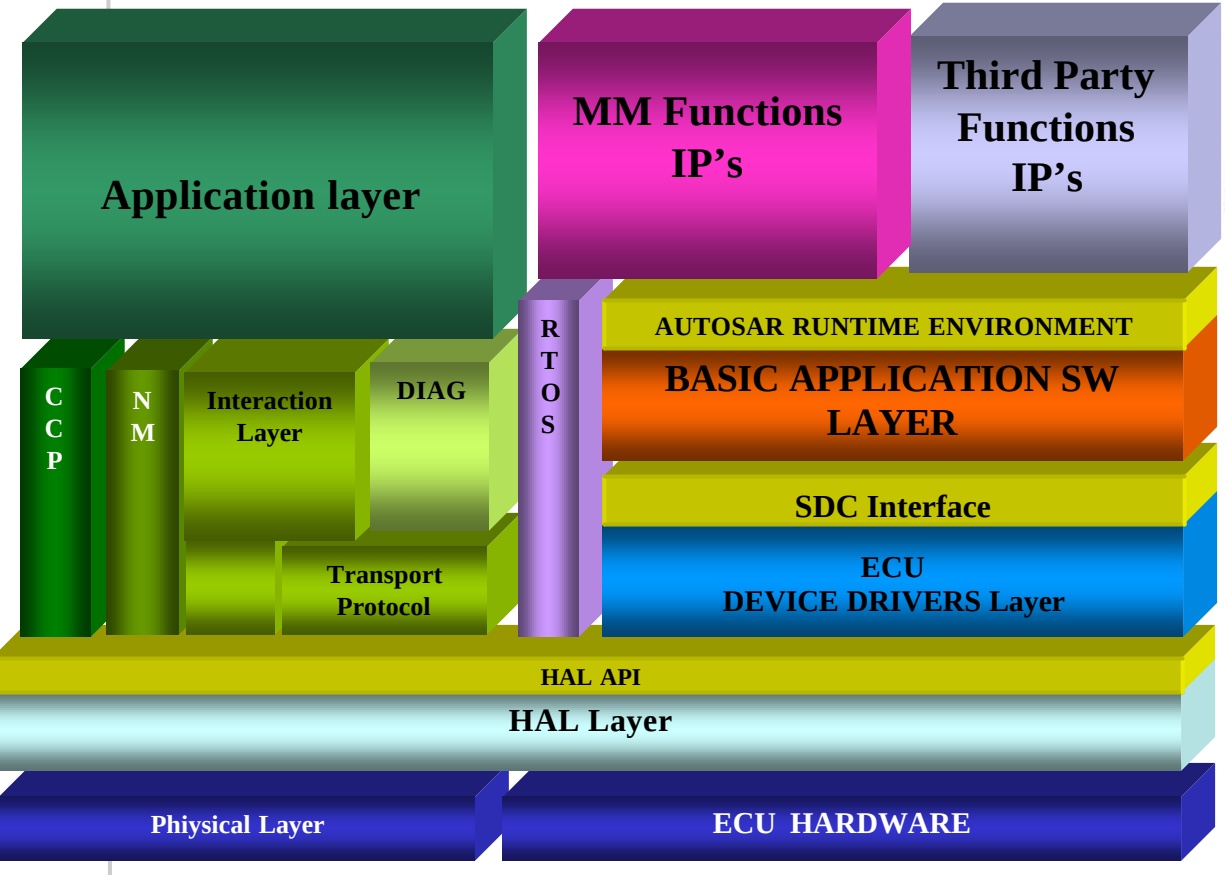
ECU-Hardware

Operating Systems

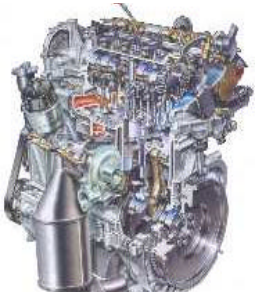
Standard Digital Core

Extended Standard Digital Core

MM Generation 8 : Concetti base



Application Layer



- Virtualizzazione del Plant (Motore, Trasmissio assetto veicolo)
- Integrazione di IP' di terze parti

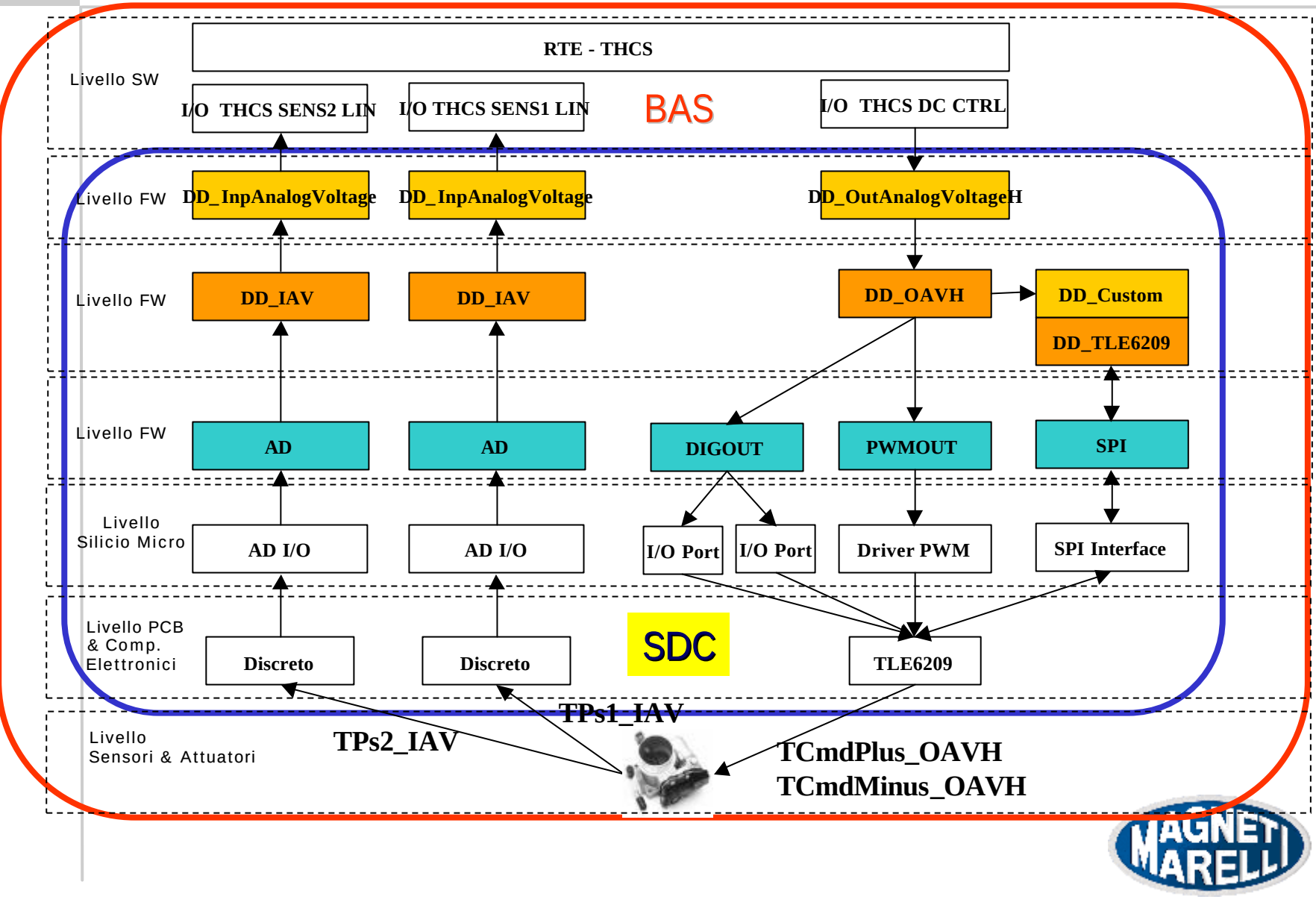
BAS & SDC Layer

- Virtualizzazione sensori/attuatori

- Virtualizzazione dell'architettura elettronica

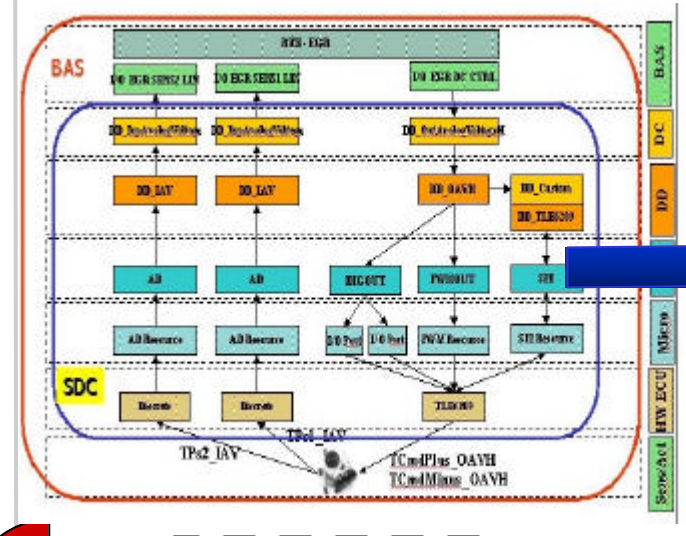
- Virtualizzazione del microcontrollore

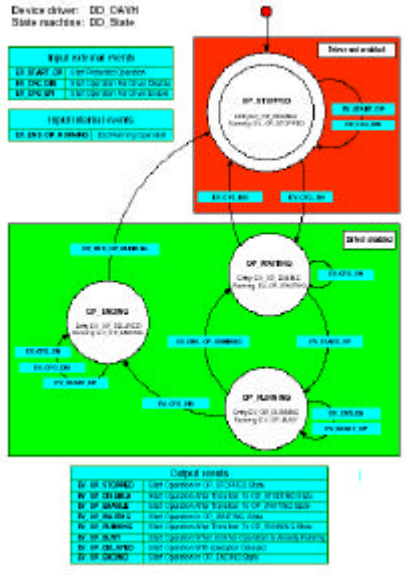
Esempio: Controllo Corpo Farfallato

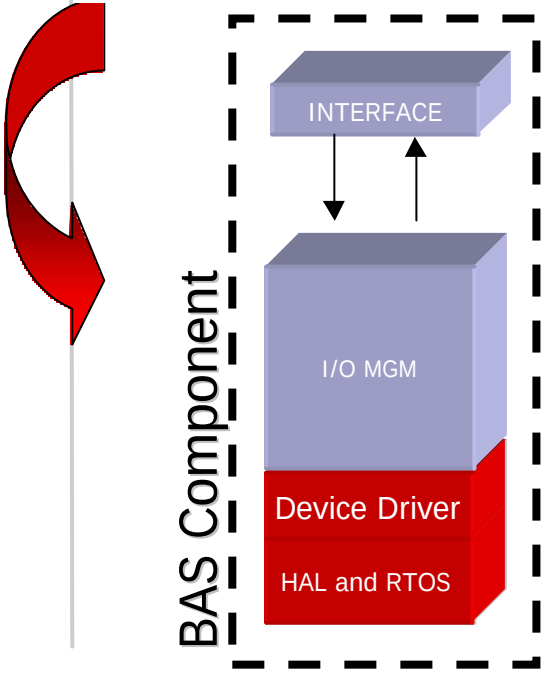


Esempio: EGR con DC Motor 8DX – MJ2 Progettazione FIRMWARE

Cluster realizzativo



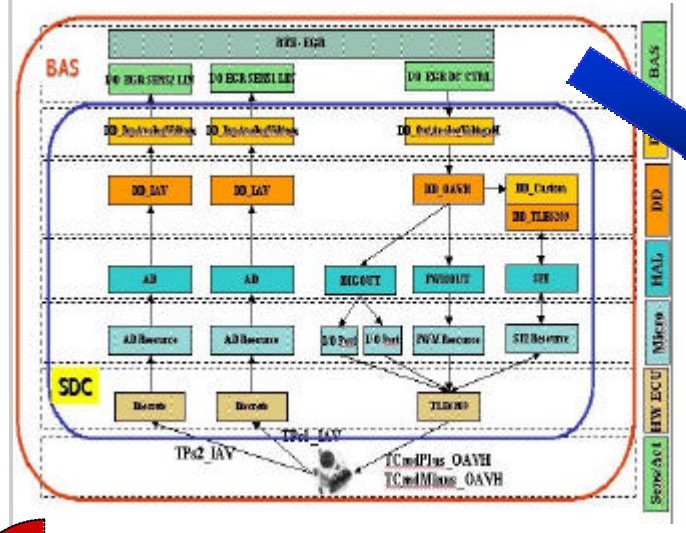


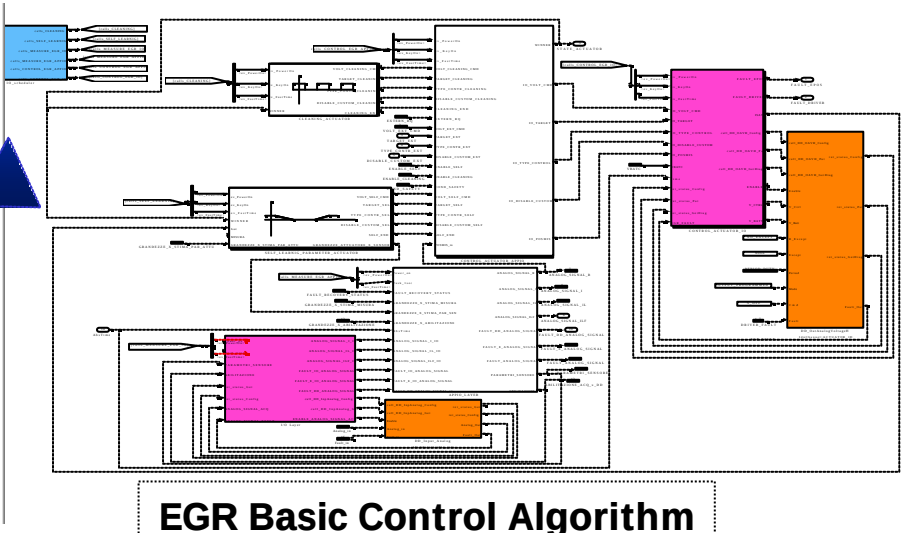



```
/*$------------------------------------------------------------------------------------------ $*/
/*$ SOURCE FILE NAME : DD_OAVH.c                                                             $*/
/*$ FUNCTION NAME    : DD_OAVH_Excep                                                         $*/
/*$ CREATION DATE    :                                                                       $*/
/*$ SW WRITER        :                                                                       $*/
/*$ UNIPHASE         :                                                                       $*/
/*$ DESCRIPTION      : - Exception management, request from the device driver at the end of command period,
used for diagnosis validity.$*/
/*$------------------------------------------------------------------------------------------ $*/
void DD_OAVH_Excep(t_DD_OutAnalogVoltageH *Obj)
{
  /* Data Declaration Section */

  /* Data Init Section */
  t_DD_OAVH_PrivateData *PtrPrivateData = Obj->PrivateData;
  t_DD_OAVH_CfgStat     *PtrCfgStat     = Obj->CfgStat;

  /* Function body */
}

  #ifdef DEBUG_ACTIVE
  void DD_OAVH_Debug(t_DD_OutAnalogVoltageH *Obj)
  {
    a DebugData;
    PrivateData *PtrPrivateData = Obj->PrivateData;
    t_DD_OAVH_CfgStat     *PtrCfgStat     = Obj->CfgStat;

    DebugData.DD_Obj   = (longword)&Obj;
    DebugData.DD_State = (unsigned_word)PtrPrivateData->DD_State;
    DD_InternalDebug(&DebugData);
  }
```

Esempio: EGR con DC Motor 8DX – MJ2 Progettazione SOFTWARE

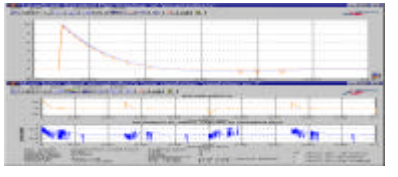
Cluster realizzativo

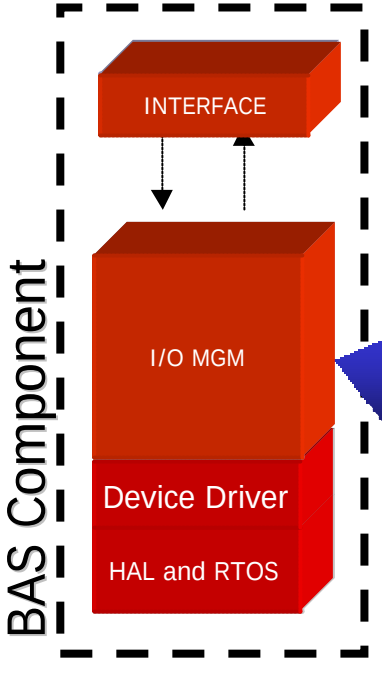




EGR Basic Control Algorithm

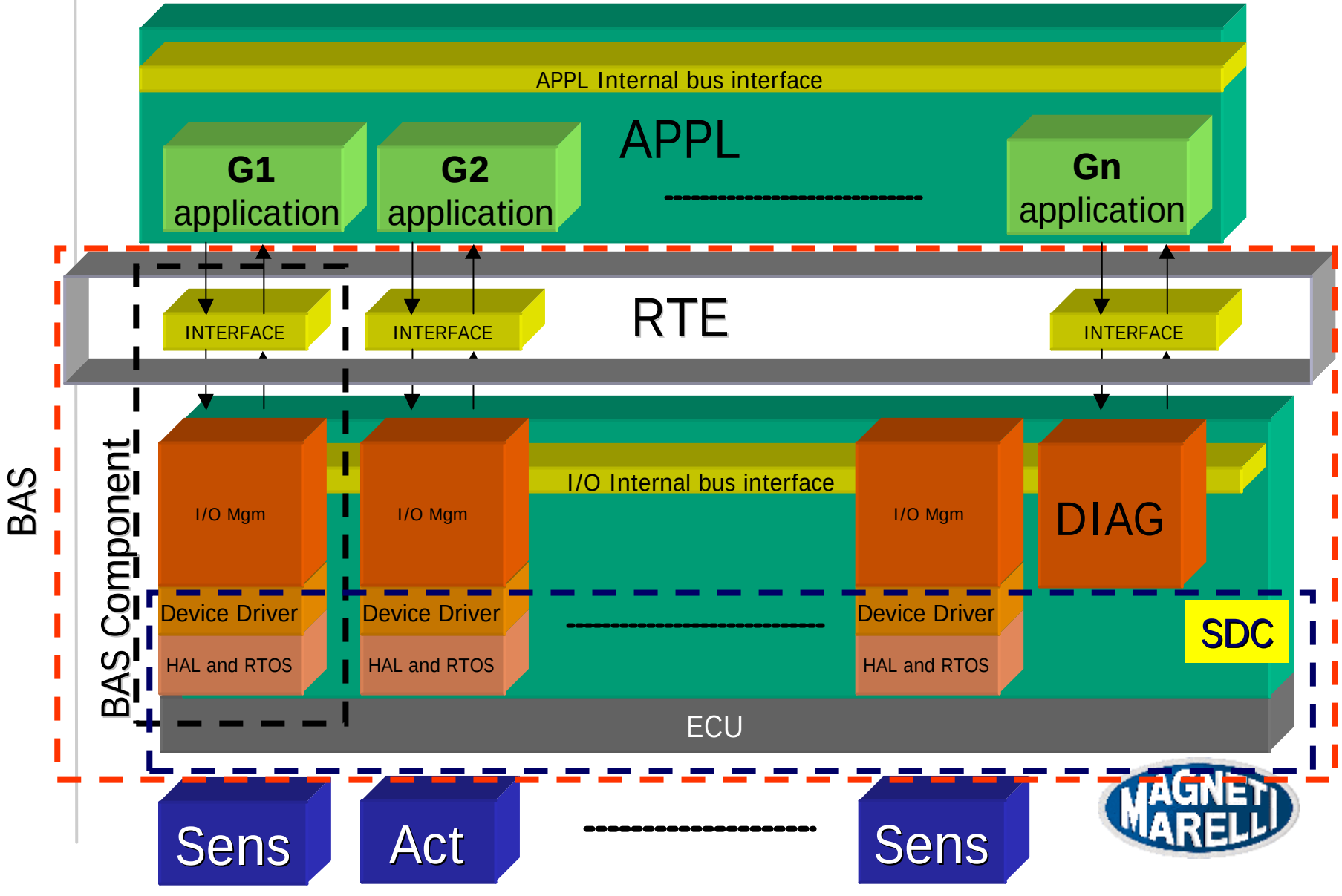
Target Link Autocode Environment






```
void integratutto4_initializer( void )

{
  /* Initialize machine's broadcast event variable */
  _sfEvent_ = CALL_EVENT;

  _integratutto4MachineNumber_ =
    sf_debug_initialize_machine("integratutto4","sfun",0,3,0,0,0);
  sf_debug_set_machine_event_thresholds(_integratutto4MachineNumber_,0,0);
  sf_debug_set_machine_data_thresholds(_integratutto4MachineNumber_,0);
}
```

INTEGRAZIONE BAS COMPONENTS - APPLICATIVO



TEMI JRAUM Informatica

"**Esplorazione e sviluppo di soluzioni software, firmware e di configurazione prodotti informatici per applicazioni Powertrain su Piattaforme Elettroniche rispondenti ai requisiti AUTOSAR** "

La ricerca verterà in particolare sui seguenti argomenti:

- Studio, partendo da algoritmi di controllo floating esistenti, di una metodologia di trasformazione che sia in grado di generare una rappresentazione intera che soddisfi le precisioni richieste e minimizzi l'utilizzo delle risorse di calcolo disponibili per un dato microcontrollore ;
- Analisi dei principali fornitori di ambienti di sviluppo dei protocolli di comunicazione (ETAS, VECTOR,...) per identificarne la copertura e l'applicabilità all'interno del ciclo di sviluppo del software Magneti Marelli sviluppando customizzazioni ed integrazioni mancanti
- Definizione dei pattern di test necessari per la verifica del prodotto SW integrato in ambiente di simulazione veicolo (HIL D_Space) e sviluppo nell'ambiente nativo (linguaggio Phyton) dei pattern di test definiti
- Esplorazione, definizione ed utilizzo di linguaggi di specifica formali per la descrizione comportamentale, la simulazione ed il test di componenti firmware (HAL) ;
- Analisi, progetto e test dei componenti di comunicazione RTE definiti nell'ambito del Consorzio Intenazionale AUTOSAR con particolare riguardo applicazioni Powertrain
- Esplorazione, studio ed integrazione o implementazione sistemi operativi embedded rispondenti agli standard automotive con particolare riferimento ad OSEK ed AUTOSAR