IBM 시스템 개발 솔루션 및 자동차고객 성공 사례 소개
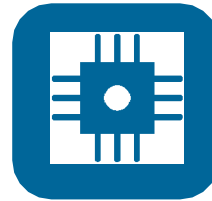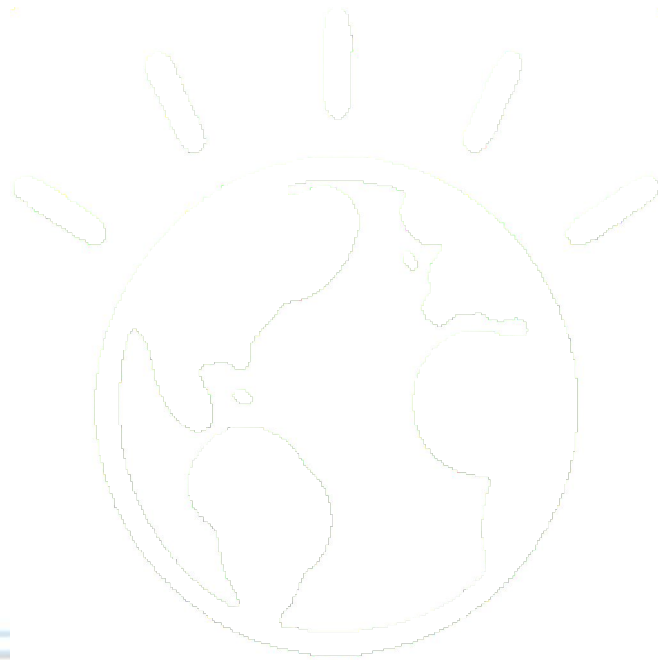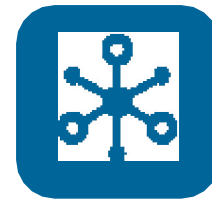
IBM Rational

김대승 부장

Contents

Smart Planet :
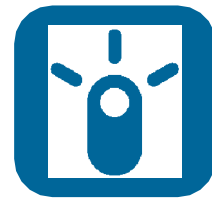## 세상은 점점 좁아지고 스마트해지고 있음

INSTRUMENTED

점점 모든 것에 대해 정확히
측정할 수 있게 됨

Interconnected

사람과 시스템간에 전혀 새로운
방식으로 소통을 하기 시작함

Intelligent

변화에 대해 빠르고 신속하게
대응할 수 있음
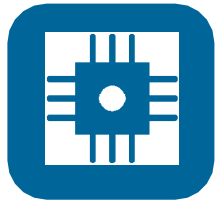
Smart Planet :
세상은 점점 좁아지고 스마트해지고 있음

INSTRUMENTED

일인당 **10**억개의 트랜지스트를 사용

2010년까지 **RFID**수가 **300**억개를 넘어설 전망

Interconnected

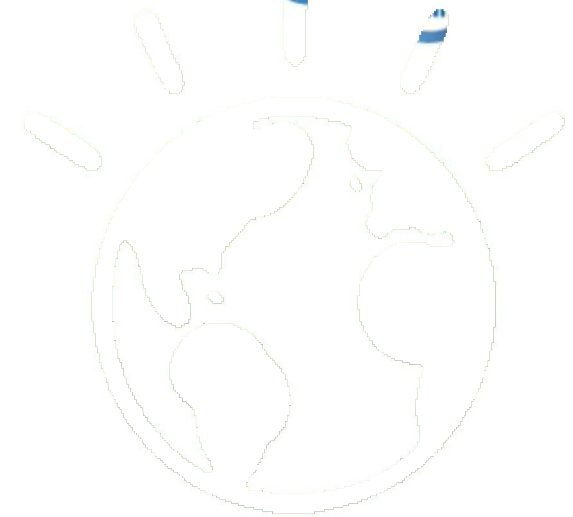**2011**년엔 약 **20**억명이 인터넷으로 연결되고 **1**조가 넘는 개체(자동차, 가전, 도로 등)가 네트웍으로 연결

휴대폰 가입자 수가 **40**억을 넘음(**2008**년)

Intelligent

매일 **15 petabyte(10^{15})**의 정보가 생성(미국의 모든 도서관의 정보량의 **8**배에 해당)

1000명정도의 회사가 연간 필요한 정보를 찾는데 드는 비용이 **60**억이 넘음.

도전 과제

Executive Management

"기술혁신을 저해하지 않고 저비용, 고품질 및 time to market을 달성해야 한다."

- **개발 비용은 지속적으로 증가 추세**
- 품질의 이슈는 매우 비싼 대가 감수(리콜, 보상, 회사 이미지 실추)
- 점점 증가하는 관련 법규 및 규제
- 치열한 경쟁(time-to-market, pricing)

Systems Engineering

"시스템 요구사항 수집/분석 및 아키텍쳐를 효과적으로 공유할 수 있는 다양한 방법이 필요하다."

- **시스템의 복잡도는 급속히 증가**
- 단절된 개발 환경(서로 다른 프로세스, 도구)
- 협력업체간 효과적인 의사소통 수단
- 테스팅 생산성 향상 필요(Early V/V)

Project or Product Management

"다양한 전문분야 및 부서, 협력업체와의 효과적인 협업 수단이 필요하다. "

- **각 부서(SW, mechanical, EE등)간 단절된 개발 방식(서로 다른 도구, 프로세스)**
- 재사용성 증대
- Product line management 필요

Embedded Software Engineering

"우리가 개발중인 embedded 코드가 전체 시스템에 어떤 영향을 주는 지를 알고 빨리 검증할 수 있어야 한다."

- **개발 단계 중 설계에러를 늦게 발견** (예, 타겟 HW가 가용한 시점에 발견)
- 기 개발된 자산의 효과적인 재사용

E/E 및 embedded 소프트웨어 사용으로 복잡도 급속한 증가

기술 혁신의 90%는 전기/전자장치에서 나오며, 이 중 80% 는 Embeded SW에서 나옵니다.[2]

	1997	2000	2005	2010
기타	11			
내장	15			
바디 및 외장	20			
파워트레인	32			
전자 시스템	22%	25%	29-33%	33-40%

<자동차 생산비용 중 전자비중(%)>[1]

시스템 및 소프트웨어 복잡도

새로운 기능 의 SW로 구현 부분
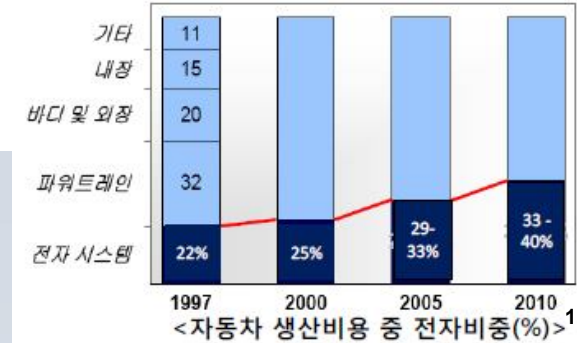
1977

Oldsmobile Toronado 는 점화플러그 시간제어를 위한 **1**개의 **ECU**

2011

현재의 차는 수십개 이상의 **ECU**를 사용하고 있으며 백만 라인 이상의 **SW**코드가 사용됨

[1]차세대 자동차동향과 임베디드 SW 역활, 현대오토에버, 2010

[2]Original Equipment Suppliers Association, AMR and Automotive Design Line, 2010

Who is IBM?

Stop

Selling what we have

Start

Selling what the clients need

IBM is

시스템 엔지니어링 솔루션 **Provider**

Smarter Products and Services
시장 *경쟁력을 갖추기 위한 핵심 역량*

Connect multiple products and services into a *"system of systems"* to deliver unique value

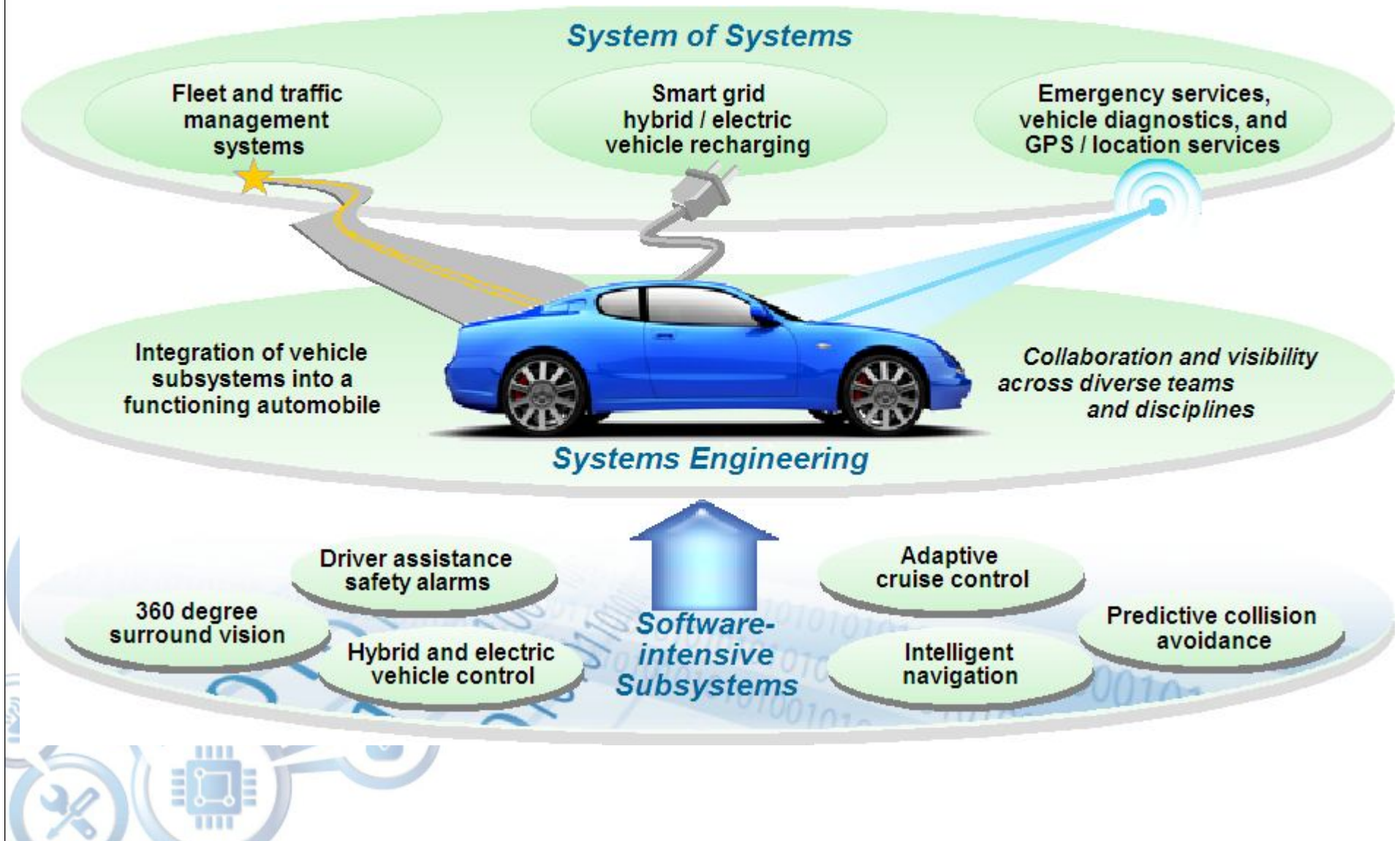Leverage *systems engineering* to accelerate time to market, improve quality and reduce costs

Develop a core competency in *software delivery* to produce products that are differentiated

Smarter Products and Services – 자동차 예제
시장 경쟁력을 갖추기 위한 핵심 역량

실제 개발 현장의 상황(예시)
수 많은 도구를 사용하고 있으며, 이들의 통합에 어려움(No Silver bullet)

- 전통적으로 도구 마다 별도의 **UI, Logic, storage**를 가짐
  - **UI** - Web and desktop presentations of views and tasks
  - **Logic** – Workflow, process, search, query, scale, security and collaboration
  - **Storage** – individual files on workstation or servers: how to ensure availability and traceability?
- 그 결과…
  - 연동이 어렵고,
  - 개발 부서간의 단절(Silos)
  - 높은 유지보수 비용
  - 낮은 재사용

How do you solve this
- lack of integration
- lack of management

Work Items
Portfolio Management
Requirement Management
Project Plan
Workflow Management
FMEA
E/E Architecture
AUTOSAR Modeling
SW Design
SW Coding
Verification
Control Loop Models
Complier/Debugger
Emulators
Change Management
SW Unit Test
Process Management
Software Configuration Mgmt
Reporting
AUTOSAR ECU Configurator
Quality Management
HIL Testing
MIL Testing
SILTesting

Jazz : 소프트웨어 통합 플랫폼을 제공하여 협업 기반 제공

복잡도의 지수적(exponential)인 증가

미들웨어 서비스 기반의 툴간의 협업
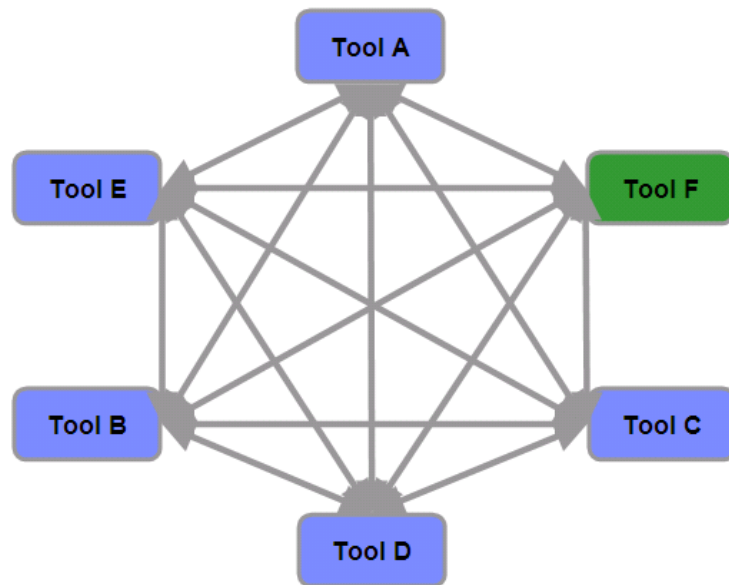
지금까지, 연동 플랫폼을 구축한다는 것은 모든 툴간의 이해를 필요로 했음: 각각의 연동 툴들은 각각의 다른 툴에 대해 알고 있어야 했음
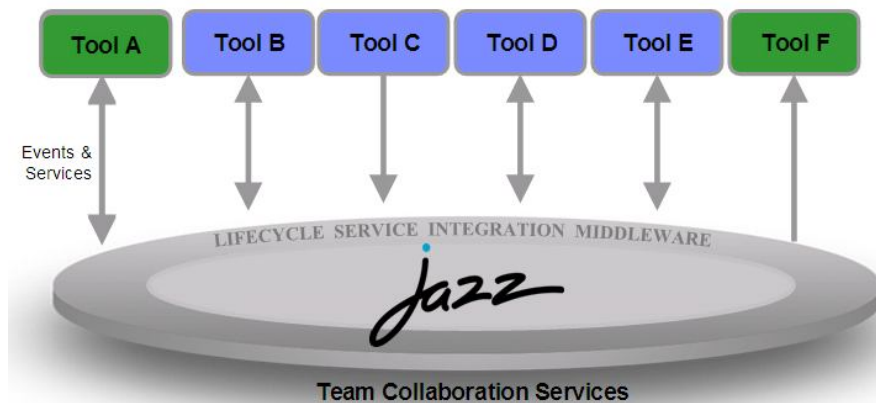
Jazz 플랫폼을 통해, 툴들은 단지 플랫폼하고만 통신하면 됩니다.

Open and extensible on

jazz

✓ 프로세스 기반 협업
✓ 적절한 통제
✓ 실질적 개발 활동

Open Jazz플랫폼은 웹의 개념과 동일하게 모든 엔지니어링 데이터를 표준인터페이스**(OSLC)**로 연결**(Link)**함.

Single point of truth ≠ Single repository

Loosely coupled web with data and tools

ECUs
tests
baselines
requirements
parts
project plans
documents
change requests
Electronics
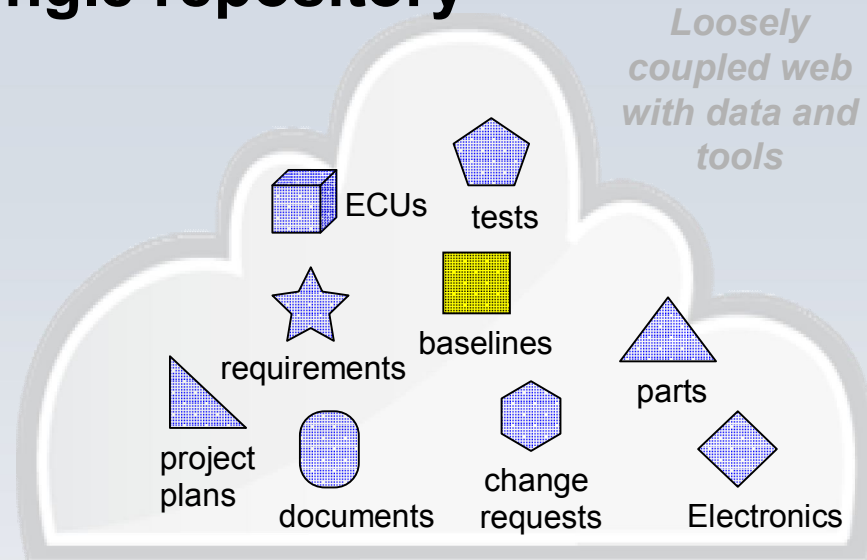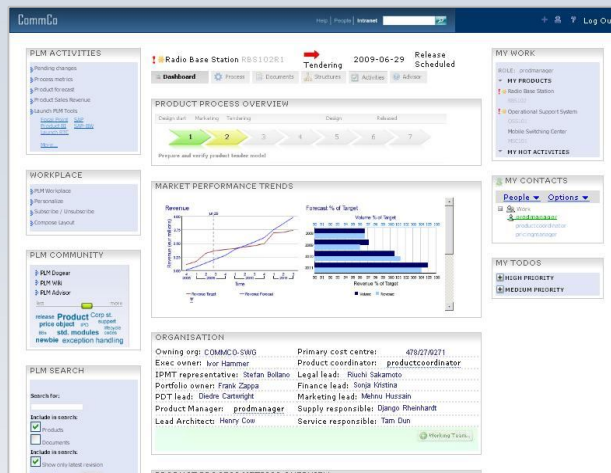
역할에 따라 다양한 데이터 소스로부터 필요한 정보를 가져와 원하는 웹 화면을 만들 수 있음.

사용자는 데이터를 클릭하면 해당 도구로 이동

Federated integration architecture

Enables easy upgrade

Provides common, cross-product capabilities (search, query, report, process, etc.)

IBM Rational Solution for Systems and Software Engineering

Product Development and Verification Life Cycle

DEFINITION / DEVELOPMENT	TEST / VERIFICATION

Project Planning and Assessment

Requirements Capture and Analysis

Validating the Product

System Acceptance

← Traceability for Test Coverage →

Requirement Traceability

System Analysis and Design

Verifying the System

System/Subsystem Integration and Test

Systems Engineering

Engineering Test (Quality)

Requirement Traceability

Software Design

Qualifying the Components

Component Integration and Test

iterations

Requirement Traceability

Implementation

Software Unit Test

Software Engineering

Change/Configuration Management

Best Practice and Services

jazz

산업계 표준 지원

- Avionics/aerospace
  - **DO-178B** / ED-12B (RTCA/EUROCAE)
  - 현재 상용 항공기 소프트웨어를 위한 일반적인 표준 인증(항공기 시스템에 사용되는 SW개발 표준)
- Medical
  - FDA 510(k) and IEC 60601
- Functional safety in process industry
  - IEC 61508
- Automotive
  - **ISO-26262** and MISRA-C
- Railway systems
  - EN50128 and EN50129
- Nuclear
  - IEC 880, IEC 60880, IEC 61513, IEC 62138

Contents

PLM BEST PRACTICE Conference 2012

IBM has a huge base of professionals worldwide supporting leading Automotive OEMs and suppliers

| Light Vehicle OEM | Heavy Truck OEM | Heavy Equipment OEM | Suppliers |
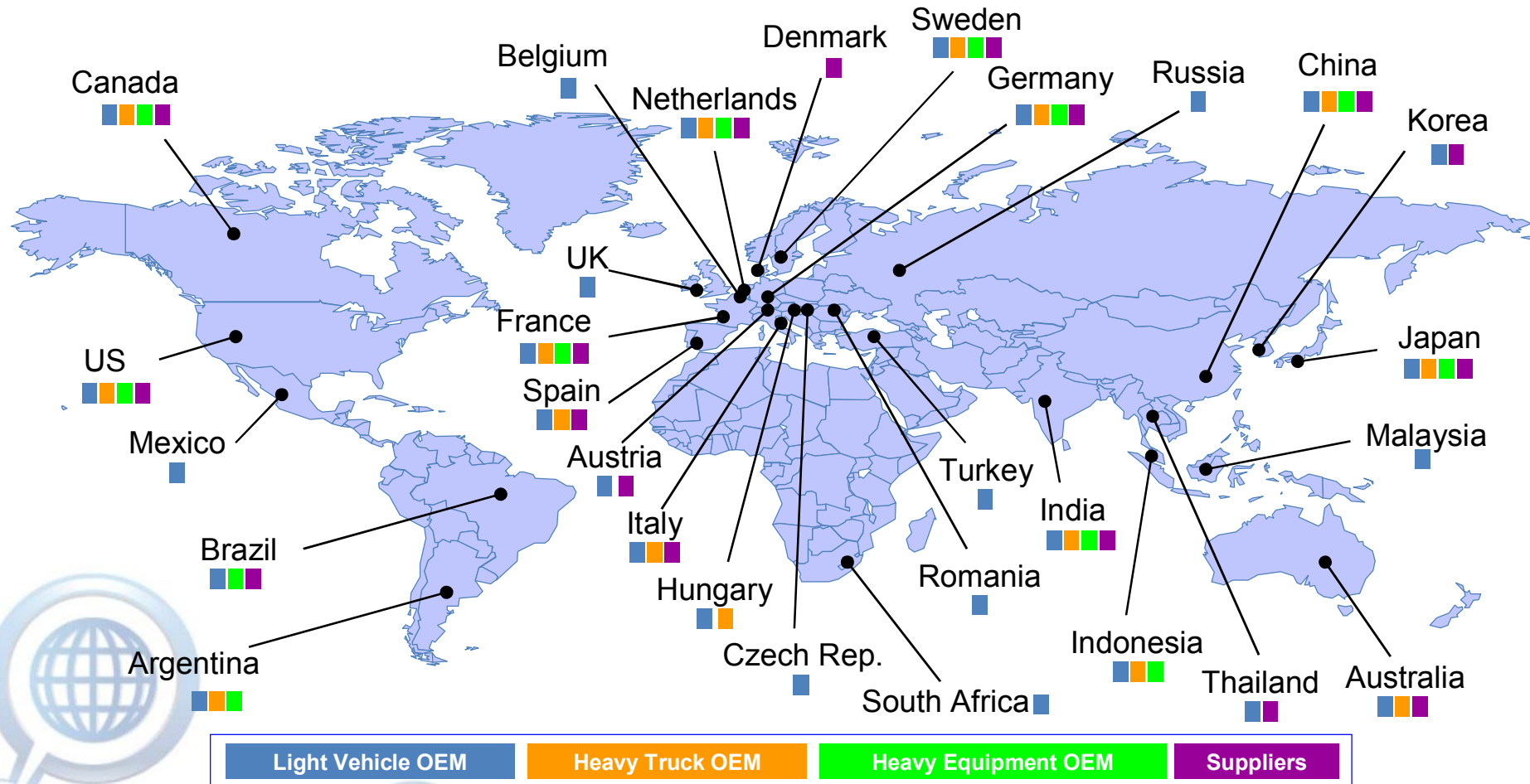
- 23 of top 25 OEMs are IBM clients – including all of the top 15
- 46 of top 50 global suppliers are IBM clients

Who Uses Rational?

- Rational is used by 9 of the Fortune Top 10 companies, 45 of the Fortune Top 50 companies, and 93 of the Fortune Top 100 companies.
- Rational is used by all of the top 10 **automotive manufacturers** worldwide
- Rational is used by all of the top 10 **banking institutions** worldwide
- Rational is used by 9 of the top 10 *healthcare payers* as listed in the Fortune 1000
- Rational is used by all of the top 10 *insurance companies* worldwide based on market capitalization
- Rational is used by all of the top 10 *medical device companies* worldwide
- Rational is used by 9 of the top 10 *pharmaceutical companies* worldwide
- Rational is used by all of the top 10 *semiconductor companies* worldwide
- Rational is used by all of the top 10 *smart phone manufacturers* worldwide

AUT⊙SAR

Automotive SPICE©

CMMi

ISO

IBM is recognized as a global leader providing a broad range of solutions to Automotive OEMs and the OEM Supplier Base

Below are some of our clients

1

질 문 – 아래의 시스템은?

- 사용된 소프트웨어 코드량 : F-35전폭기, Boeing Dreamliner 787보다 많음

- 독립된 IP Address를 가지고 있음

- 7인치 터치스크린 지원

- 스마트 폰으로 조작 가능

General Motors leverages Rational tools to develop innovative products

What's smart?

- Innovative electric drive system uses software and electronics to control interaction of electric motors and gasoline engine
  - "System of systems" seamlessly integrates electric drive system with powertrain and body controllers
  - **>10 million lines of code in car; nearly 100 microprocessors**

Smarter business outcomes

- Smarter products delivered in less time
  - Volt was delivered in <5 years, compared to typical 10+ year development cycle for new vehicle technology

How IBM helps GM develop smarter products

- Rational DOORS for requirements management
- Rational Rhapsody for model-driven development
- Rational Team Concert for team collaboration
- Rational Asset Manager for engineering asset management
- Rational Professional Services for technical services
- IBM Global Services for business transformation services

"The IBM Rational platform enables our globally distributed teams to collaborate in real-time to develop innovative software and electronics for our vehicles. GM's use of the Rational platform will deliver business results in efficiency, time-to-market, quality, and overall customer satisfaction."

General Motors

View the video, "Volt for a Smarter Planet" on YouTube
http://www.youtube.com/watch?v=CjjASGV36mw

General Motors: 프로세스 & 툴 재구성을 위한 첫 단계

시도 배경

- GM은 in-house로 개발된 Chassis와 Powertrain 관련 SW 도구가 다수 있었음.
- 증가하는 SW 복잡성으로 SW 도구 팀과 개발팀의 업무량이 과도하게 증가하였음.
- 이로서 GM은 전기/전자용 소프트웨어 개발 프로세스와 툴 체인 개선의 필요성을 느낌.

재구성 범위와 작업량

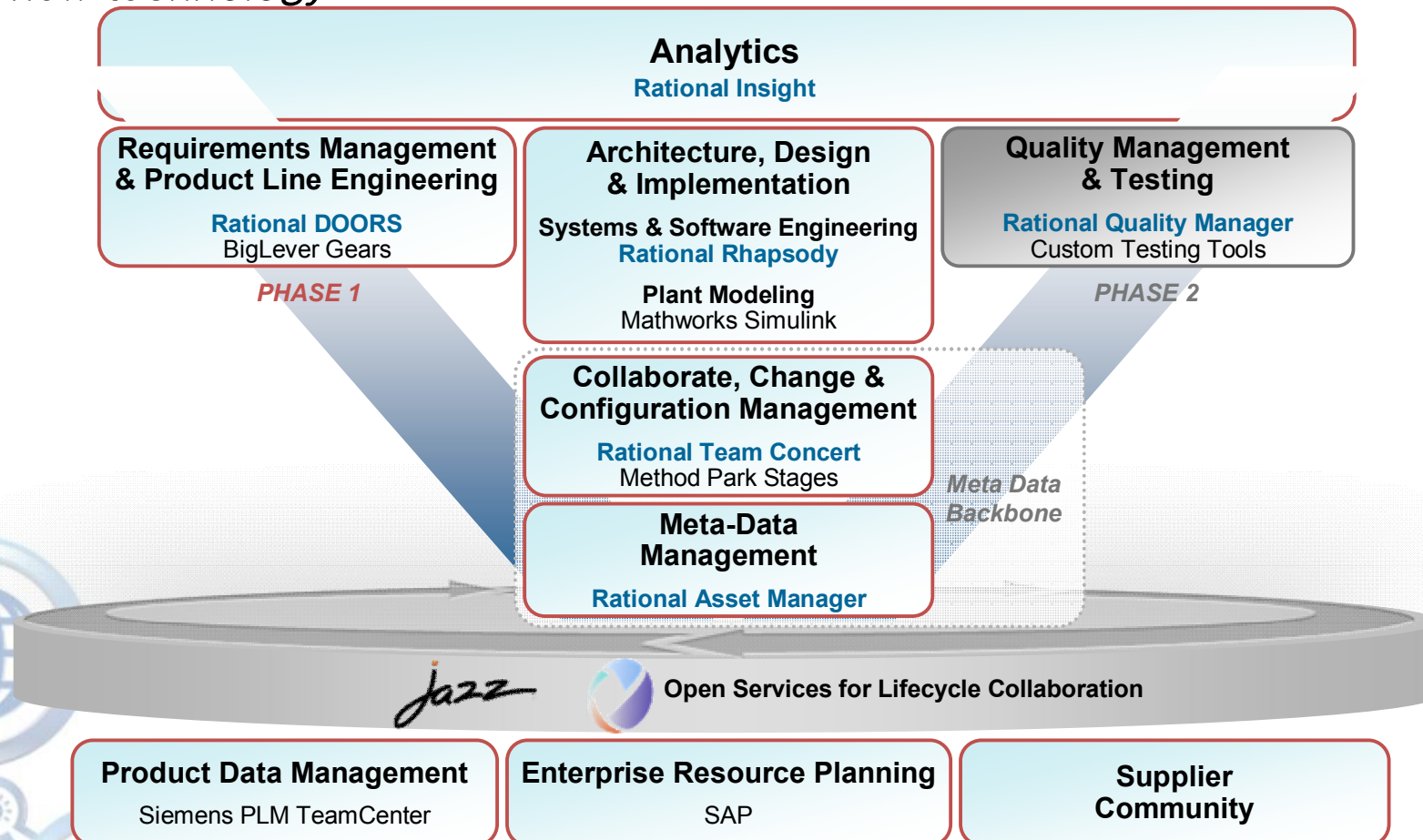|	Function / Performance	Mechanical		Validation	Manufacture	Assembly / Service
Mechanical Parts	Function / Performance	Mechanical		Validation	Manufacture	Assembly / Service
Electro-Mechanical Parts	Function / Performance	Elec	Mec	Validation	Manufacture	Assembly / Service
Electro-Mechanical Parts w/managed SW	Function / Performance	Elec / SW	Mec	Integrate / Val	Manufacture	Assembly / Service
Soft Parts	Function / Performance	Software		Validation	Manufacture	Assembly / Service

Out of Scope | Boundary | In Scope

IBM의 접근 방법

- Rational과 GBS (Global Business Service) 가 협력하여 GM의 개발 프로세스를 분석하고, 문제점을 찾고 개선하는 작업을 같이 진행하였음.
- 57번의 기술 workshop 을 아래의 주제로 진행.
  - GM의 현 프로세스를 분석하여 문서화 (GBS)
  - GM과 협력하여 이상적인 개발 프로세스를 도출 (GBS)
  - GM의 현 개발 프로세스 성숙도에 맞추어 프로세스와 툴 체인의 향후 개선 roadmap 설정 (GBS + Rational)
  - GM 개발진과 실제 프로젝트를 진행하면서 프로세스와 툴 체인의 customization & evaluation (GBS + Rational + GM Developers)

GM and IBM Rational's Engineering Lifecycle Management

Chevy Volt designed and engineered in 29 months vs. typical 5–10 year cycle for new technology

Analytics
Rational Insight

Requirements Management & Product Line Engineering

Rational DOORS
BigLever Gears

PHASE 1

Architecture, Design & Implementation

Systems & Software Engineering
Rational Rhapsody

Plant Modeling
Mathworks Simulink

Quality Management & Testing

Rational Quality Manager
Custom Testing Tools

PHASE 2

Collaborate, Change & Configuration Management

Rational Team Concert
Method Park Stages

Meta-Data Management

Rational Asset Manager

Meta Data Backbone

Jazz **Open Services for Lifecycle Collaboration**

Product Data Management
Siemens PLM TeamCenter

Enterprise Resource Planning
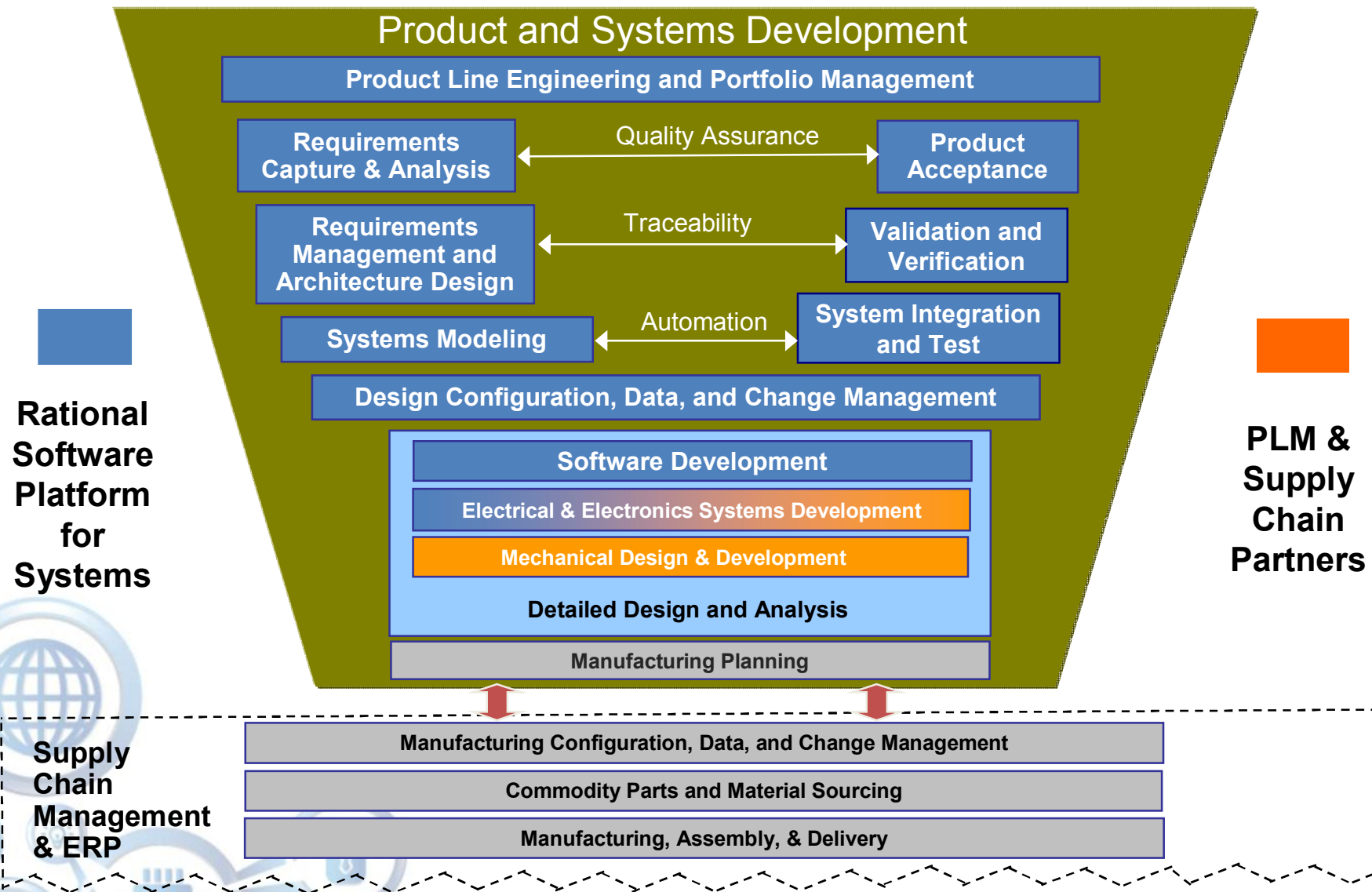SAP

Supplier Community

"GM's use of the Rational platform will deliver business results in efficiency, time-to-market, quality, and overall customer satisfaction."
Eric Gassenfeit - Global Director, Electrical, Controls & Software Development, General Motors
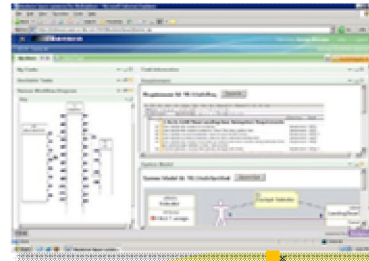
GM's View of Global Product Development Tooling

Product and Systems Development

Product Line Engineering and Portfolio Management

Requirements Capture & Analysis ←— Quality Assurance —→ **Product Acceptance**

Requirements Management and Architecture Design ←— Traceability —→ **Validation and Verification**

Systems Modeling ←— Automation —→ **System Integration and Test**

Design Configuration, Data, and Change Management

Software Development

Electrical & Electronics Systems Development

Mechanical Design & Development

Detailed Design and Analysis

Manufacturing Planning

Rational Software Platform for Systems

PLM & Supply Chain Partners

Supply Chain Management & ERP

Manufacturing Configuration, Data, and Change Management

Commodity Parts and Material Sourcing

Manufacturing, Assembly, & Delivery

Rational-PLM Integration

Role Based View
of Project Data

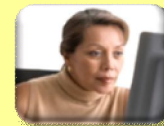Engineering
Manager

Project Metrics
and KPI's

Roles
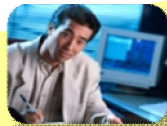
Req'ts
Engineer

Systems
Engineer
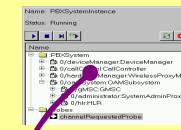
Software
Supplier

Wiring
Engineer

Hardware
Engineer
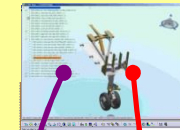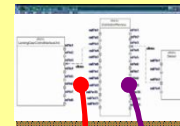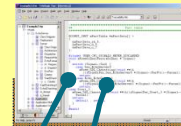
Field
Maintenance

Applications

Assets

Assets

Assets

Assets

Assets

Assets

Assets

ALM Relationship Mgmt

OSLC

Process Orchestration and Control

Data Model
Relationship
Mgmt.
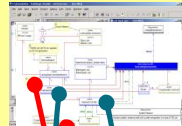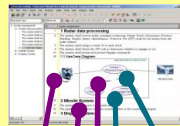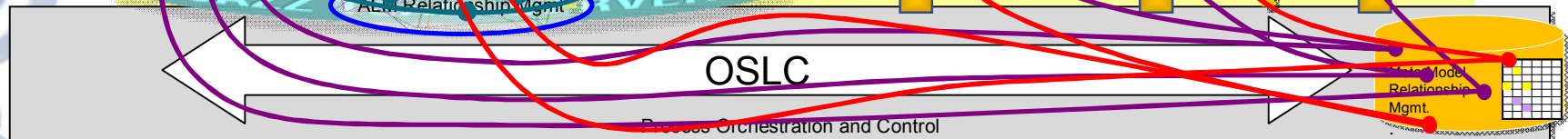
Joint marketing activities with General Motors

- Volt Unplugged test drive event at IBM RTP
  - ~650 IBMers participated in event
  - Presentations by GM Executive Director Micky Bly, **SWG SVP Robert LeBlanc, Rational Marketing VP Gina Poole**
  - Stories published by **CBS News, CNET, eWeek, TheStreet.com, ZDNet, International Business Times, GreenTech** & many others
- Press release issued in conjunction with Volt test drive event
  - Picked up by **NY Times, Wall St Journal, Forbes, Bloomberg, CNBC, MarketWatch, Embedded Computing Design** & others
- "Volt for a Smarter Planet" video premier
  - **6,500+ views on YouTube as of Nov 11**
- In progress: IBM.com home page story, w3 story, Rational newsflash, additional videos from Volt Unplugged event, IBM.com web page, auto industry newsflash…

You Tube · Search · Brov

The Chevrolet Volt: IBM Rational Software Helps GM Deliver Smarter Products
IBMRational 114 videos Subscribe

Micky Bly
Executive Director
Electrical Systems, Hybrid Electric Vehicles,
Batteries and OnStar Engineering
General Motors

0:33 / 4:04

Link to GM video on YouTube

Like 6,526

Let's build a smarter planet.

Smarter products for a smarter planet.

CBSNEWS
TECH
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NOVEMBER 1, 2010, 12:00 P.M. ET

IBM Software Helps GM Speed Global Development of New Vehicles, Including 2011 Chevrolet Volt

CHEVROLET VOLT
VOLT UNPLUGGED

Contents

맺음말

IBM Rational 은 좀 더 똑똑한 제품을 개발하고 적기에 시장에 출시할 수 있도록 도와주는 통합 Systems/SW 플랫폼을 제공합니다.

Product Development and Verification Life Cycle

DEFINITION / DEVELOPMENT | TEST / VERIFICATION

- Project Planning and Assessment
- Requirements Capture and Analysis
- System Acceptance
- Validating the Product
- ← Traceability for Test Coverage →
- Requirement Traceability
- System Analysis and Design
- Verifying the System
- System/Subsystem Integration and Test
- Systems Engineering
- Engineering Test (Quality)
- Requirement Traceability
- Software Design
- Qualifying the Components
- Component Integration and Test
- iterations
- Requirement Traceability
- Implementation
- Software Unit Test
- Software Engineering
- Change/Configuration Management
- Best Practice and Services

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Backup

Customer Success: Create and sustain market demand
Hydraulic hybrid delivery vehicles - Eaton & UPS

What's smart?

- Innovative technology for urban delivery trucks in stop-and-go traffic

- Smart software to optimize energy usage and reduce greenhouse gases

Smarter business outcomes

- 60-70% increase in fuel economy, according to EPA

- 40% reduction in CO_2 emissions

### How Rational enables smarter products

- Software modeling to optimize system performance

- Automatic generation of in-vehicle software code

Think Rational

One of many ways Rational enables a smarter planet.

"The suite of Rational tools, including Rhapsody, DOORS, ClearCase and ClearQuest, provides Eaton an integrated software framework that allows us to deliver innovative products more quickly and efficiently."
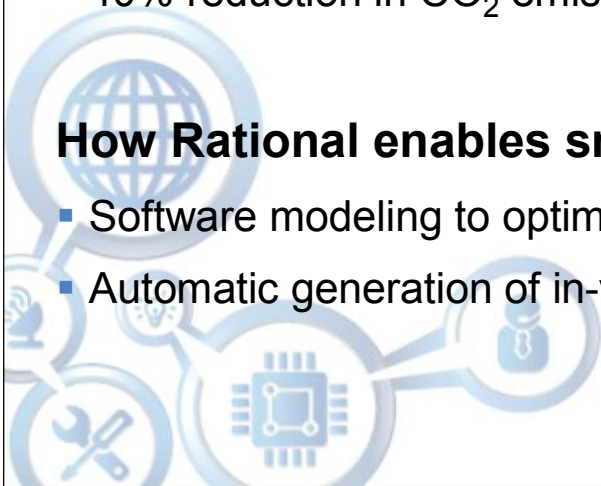
Customer Success: Smarter products require efficient processes

Complex systems for automotive - Delphi Corporation

What's smart?

- First prepackaged airbag assembly within a steering wheel

- Teams in 35 countries collaborating on parallel releases using shared requirements

Smarter business outcomes

- Successful introduction of prepackaged airbag/steering wheel in the Smart Fortwo vehicle made by Daimler

How Rational enables smarter products

- Requirements sharing across globally distributed teams and projects

- Component reuse enabled by automated requirements management

Think Rational

One of many ways Rational enables a smarter planet.

"DOORS has helped Delphi improve development team communication, resulting in meeting customer requirements faster and more accurately."

Customer Success: Smarter products for "System-of-Systems" *Interconnecting products through advanced technologies and solutions – Daimler Fleetboard*

What's smart?

- Smart end-to-end system optimizing vehicle usage and routing
- Innovative technology for advanced telematic solutions

Smarter business outcomes

- 5-10% reduction in fuel consumption due to optimized vehicle management
- 10% reduction in telecommunications costs due to increased automation

How Rational enables smarter products

- Improve collaboration in the product portfolio planning process
- Automate release planning balancing cost, risk and reward

"Rational Focal Point helps us discover the optimal set of customer features and balance those against the needs of our business, allowing us to deliver continual enhancements to our telematic solution."

Customer Success: Smarter products for "System-of-Systems" *Leveraging IBM to provide smarter products & services - Hughes Telematics, Inc*

What's smart?

- Onboard sensing and communications system detects crash conditions; automatically seeks emergency help and guides to accident location
- "Reverse 911 call" allows call center to contact occupants through onboard device

Smarter business outcomes

- Faster delivery of new services (30 days) as compared with proprietary systems (6 months+)
- Enablement of services from non-OEM providers, (insurance companies, banks, governments, etc.)

How IBM enables smarter products

- Business consulting to design and deploy a flexible systems and process infrastructure that can be easily adapted to new telematics opportunities
- Requirements management to ensure that all system requirements, processes, and test cases are documented and fulfilled

Think Rational

One of many ways Rational enables a smarter planet.

"When we entered the telematics market, we had the unique opportunity to build our systems and processes right the first time. The depth of IBM's telematics and process expertise has put us on a firm footing for future success."

Customer Success: Integrated automotive control systems
Continental Automotive Body & Security Group
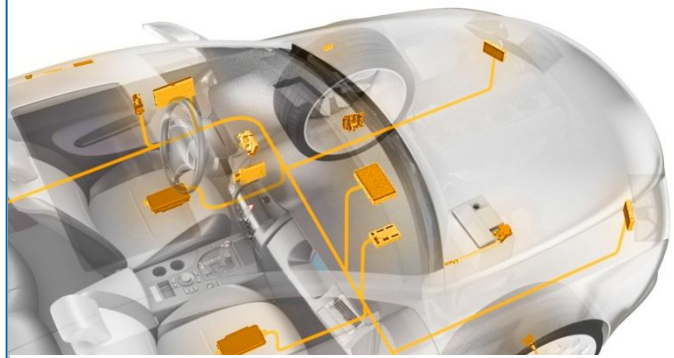
What's smart?

- Passive start and entry systems, remote keyless entry, and more - in one integrated system
- Enhanced driver experience with intelligent safety and convenience features

Smarter business outcomes

- Cost-optimized flexible system solution
- Reduced development costs based on use of standardized hardware and software components

How Rational enables smarter products

- Requirements management across development teams and with vehicle manufacturers
- Streamlined development environment with model-driven systems and software development supporting **AUTOSAR**

Think Rational

One of many ways Rational enables a smarter planet.

Continental

"IBM Rational DOORS and Rhapsody are essentially helping us prevent fragmentation of our development environment and enabling us to better manage the complex architectures of our products."