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UK Innovate 2010

The Rational Software Conference

Smarter software for a smarter planet.



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Systems Engineering - Accelerating Time to Value with IBM

Dominic Tavassoli



Smarter software for a smarter planet.



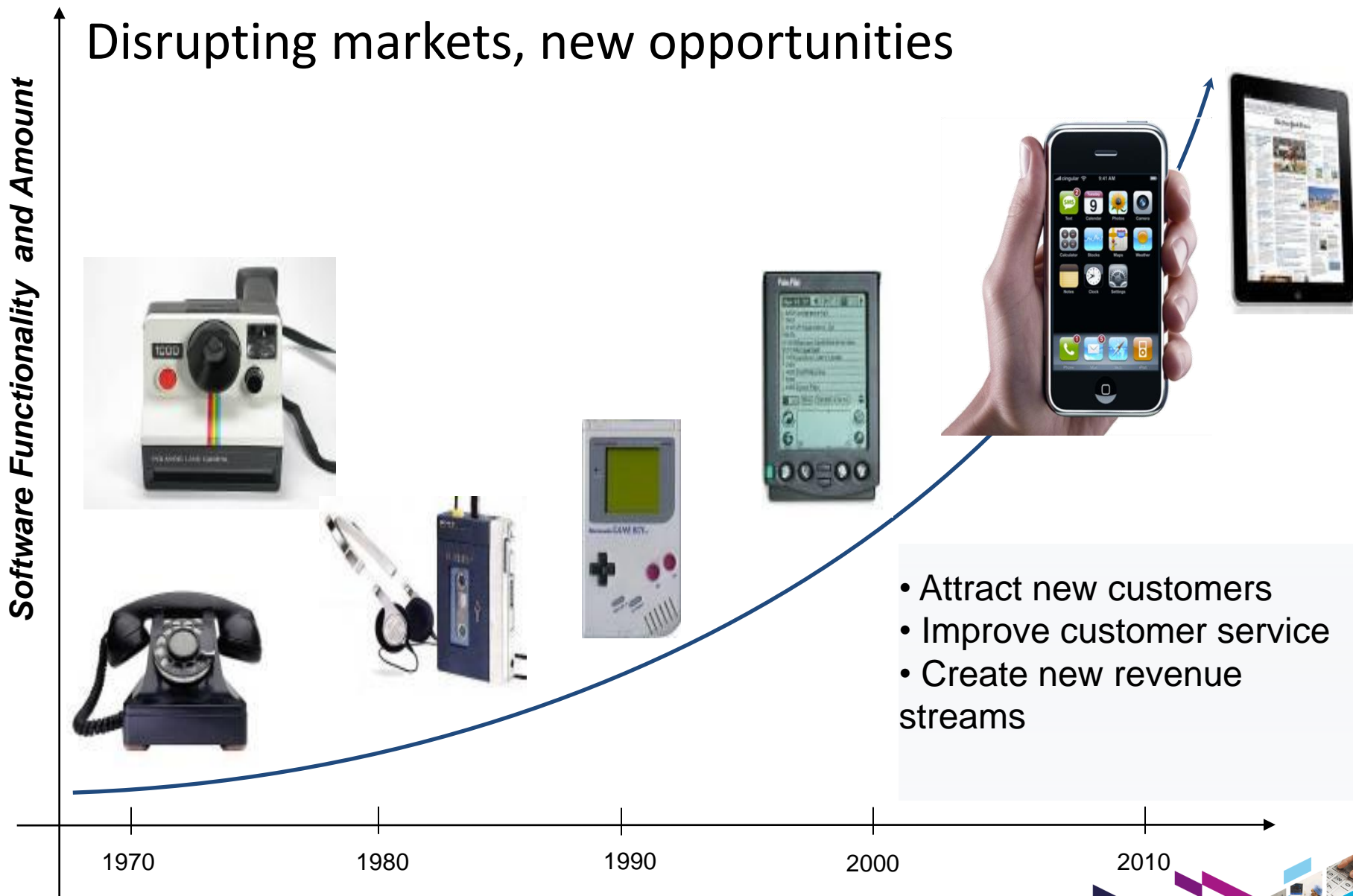


PICARD SEES YOUR IPAD

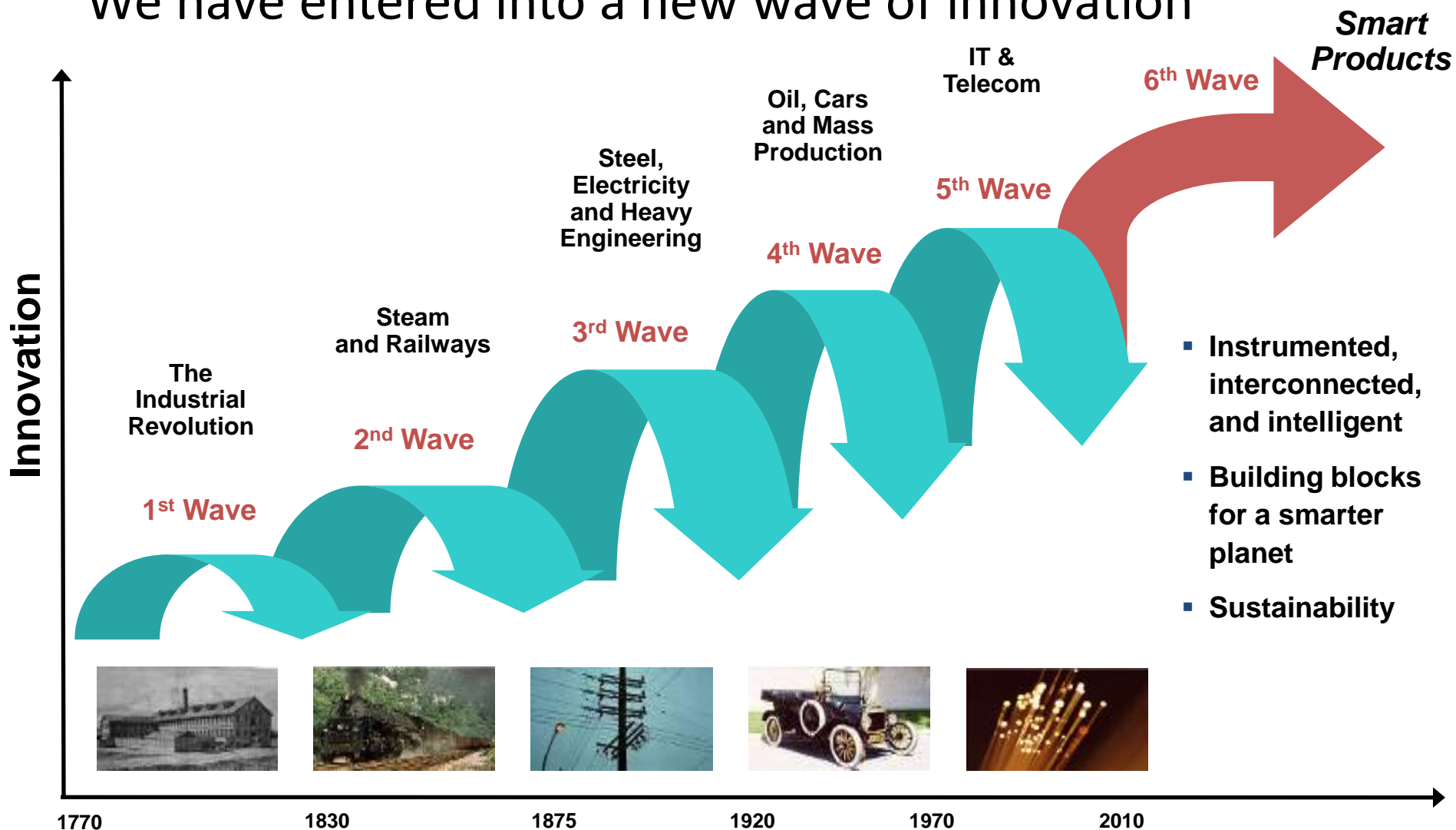
Picard is not impressed.

[VERY DEMOTIVATIONAL .com](http://VERYDEMOTIVATIONAL.com)





We have entered into a new wave of innovation



What hinders innovation?

Customer Speak!

Evolving Business Models

The marketplace is in constant flux, adapting to customer needs, accelerating the speed to enter new markets, adopting new technologies, integrating into new ecosystems.



I need to transform product development to be more collaborative while removing redundant activities

Increasing Product Complexity

Increase in product intelligence enabled by software has led to an exponential leap in product capability, which drives a commensurate increase in risk and complexity.



I need for mechanical, electrical, and software engineering to all be on the same page

Extension of the Enterprise

Disconnected product development applications and processes hinder collaboration among an extended design chain of departmental, partner and supplier teams.



I need a way for all my design and supply partners to participate in a unified process for product development

Disconnect with Operations

Operational and support services are becoming an increasingly strategic profitability lever, yet products aren't being designed with support requirements in mind



I need to ensure that the products I build can be profitably supported and maintained over their lifetime



Product and service innovation requires a new level of collaboration across multiple borders

- Engineering disciplines
- Development teams
- Geographies
- Languages
- Companies, partners and suppliers
- Multi-vendor tools



“Communication and collaboration between hardware, mechanical and software engineering teams can present a significant hurdle - hampering the overall product delivery process and resulting in too much **redundant communication and rework between teams.**”

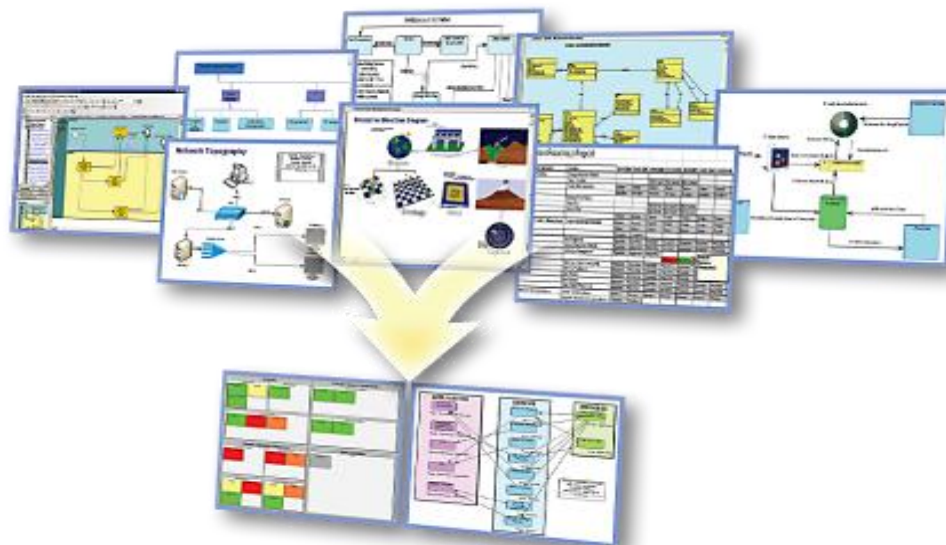
“Smarter Product Enablement”, MWD Advisors, Bola Rotibi, November 2009



Best-in-class product & service companies... ...build a strong competency in systems engineering

Best-of-class produce results:

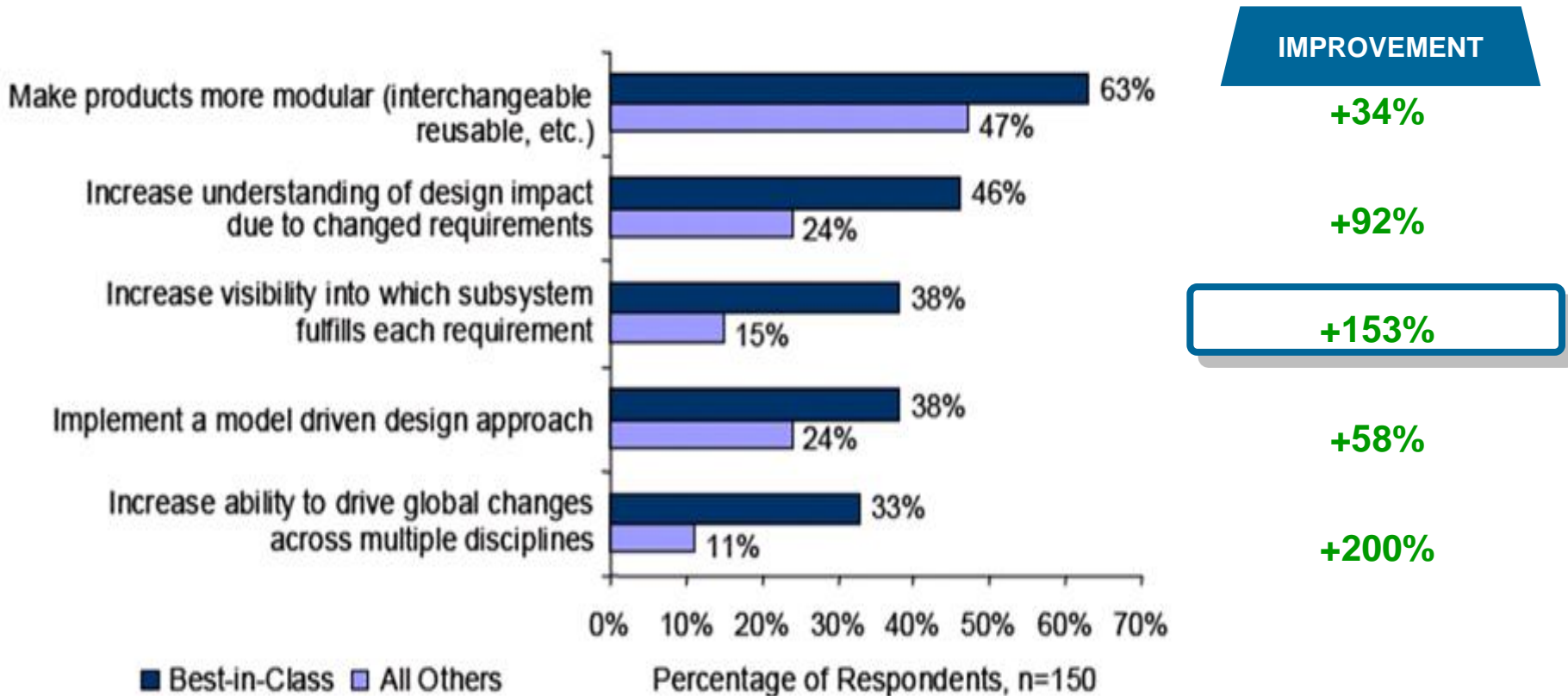
- **19%** more likely to meet revenue targets than the industry average
- **4.4x** more embedded software than competitors
- **50%** fewer defects in embedded software
- **25%** decrease in product development time



Source: "Embedded Systems Development", Aberdeen Group, March 2009



Product and service innovation will need to leverage systems engineering best practices to be successful



Source: "System Engineering", Aberdeen Group, Michelle Boucher, October 2009



Delivery of smarter products will require alignment across software, product and service lifecycles

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



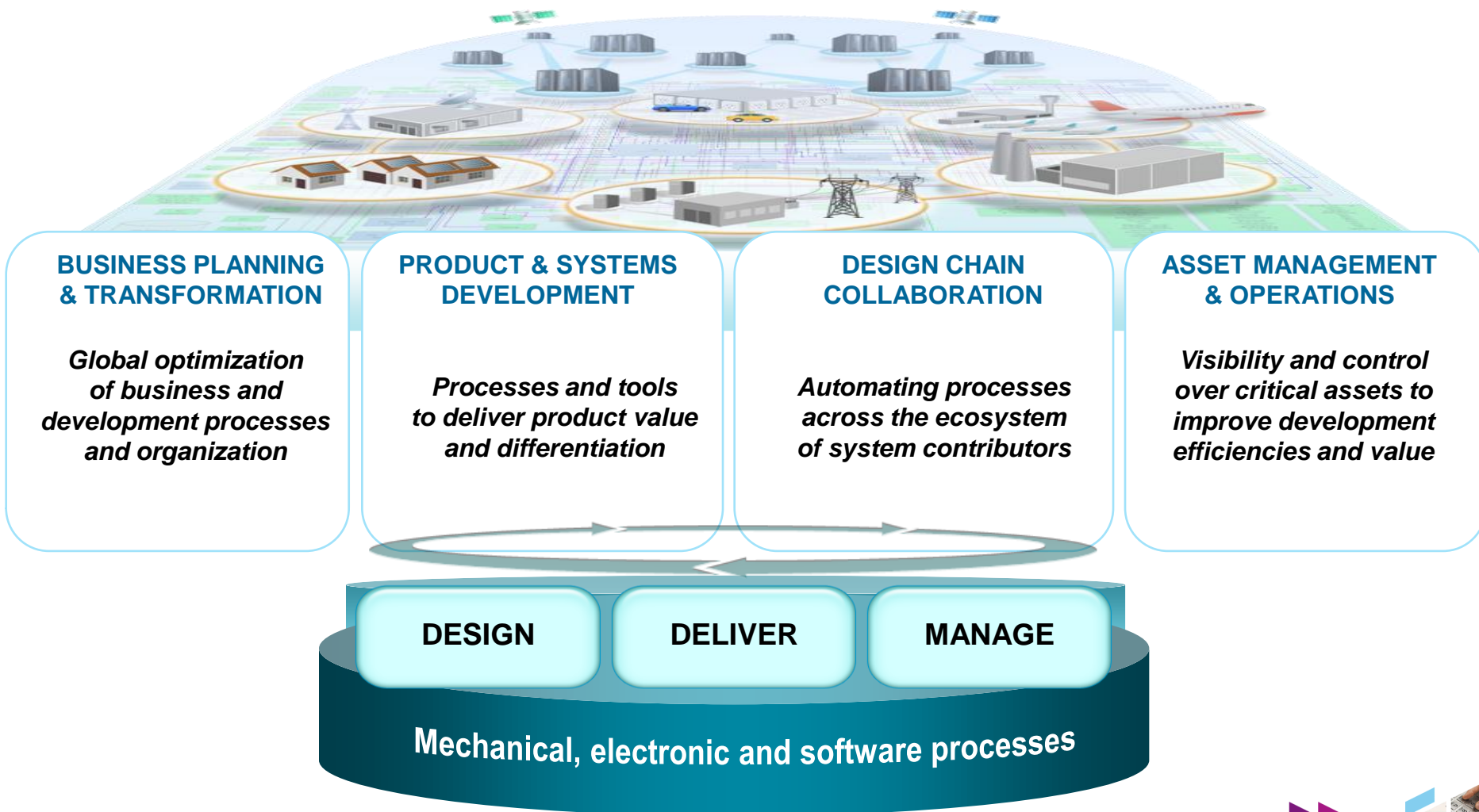
Leverage ***systems engineering*** to accelerate time to market, improve quality and reduce costs



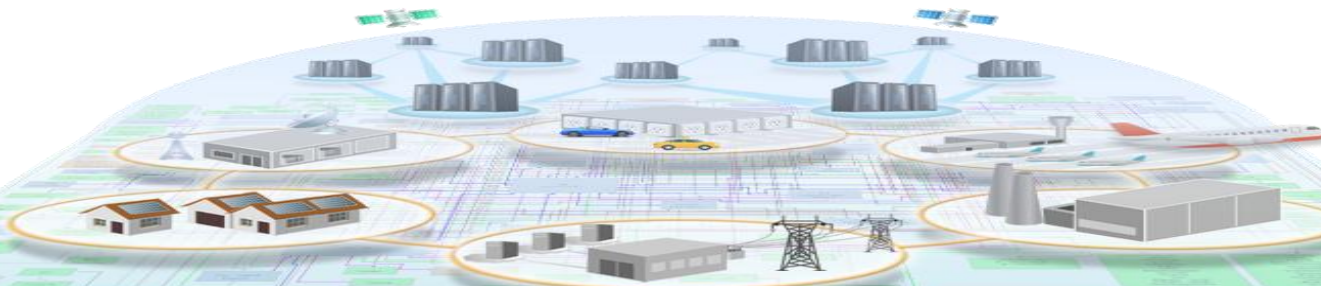
Develop a core competency in ***software delivery*** to produce products that are differentiated



Integrated Product Management provides a Software and Systems Engineering framework to address key design drivers



IPM: Tangible results are providing proof points across the industry in key areas



BUSINESS PLANNING & TRANSFORMATION

- *Business transformation services*
- *Product portfolio mgt*
- *Enterprise architecture*

PRODUCT & SYSTEMS DEVELOPMENT

- *Requirements mgt*
- *Model-driven dvt*
- *Software and systems lifecycle*
- *Quality, security, compliance*

DESIGN CHAIN COLLABORATION

- *Enterprise application integration*
- *Business process mgt*
- *Partner ecosystem mgt*

ASSET MANAGEMENT & OPERATIONS

- *Enterprise asset mgt*
- *Product information mgt and re-use*
- *Application mgt*

Receive up to...

30% reduction
in time-to-market

47% reduction
in development costs

77% less defects
after production



Waters Corporation - Testing equipment for medical, pharmaceutical and food products

What's smart?

- Efficient systems for verifying the purity of drugs, food products and water resources
- Highly accurate blood tests with greater precision for healthcare diagnosis

Smarter business outcomes

- Innovation to enable significant advancements in healthcare delivery, environmental management, food safety, and water quality
- Increased quality and throughput of the assays performed with cost effective technology

How Rational enables smarter products

- Full traceability with an integrated requirements, change, and configuration management solution
- Performance improvement through global collaboration and component-based development



Think Rational

One of many ways Rational enables a smarter planet.

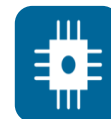
“After about 15 minutes of spending with the auditor, he was just blown away on how effective the Rational tools were in terms of addressing all of his audit questions.”



Transforming the world, one industry at a time... or not?



Healthcare



INTERCONNECTED



INSTRUMENTED



INTELLIGENT





INTERCONNECTED



INSTRUMENTED



INTELLIGENT

Healthcare delivery becoming mission-critical system-of-systems

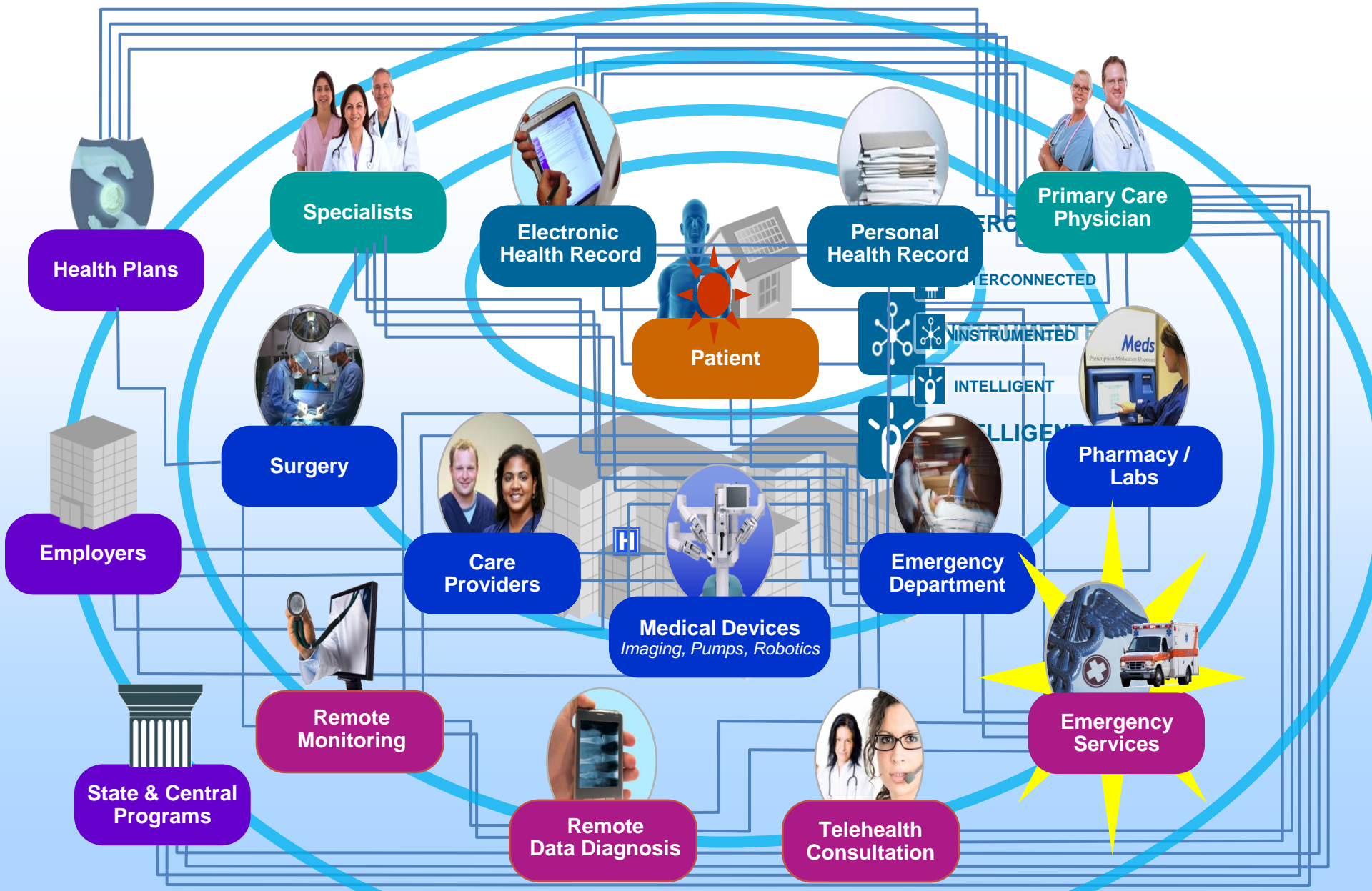
INTERCONNECTED

INSTRUMENTED

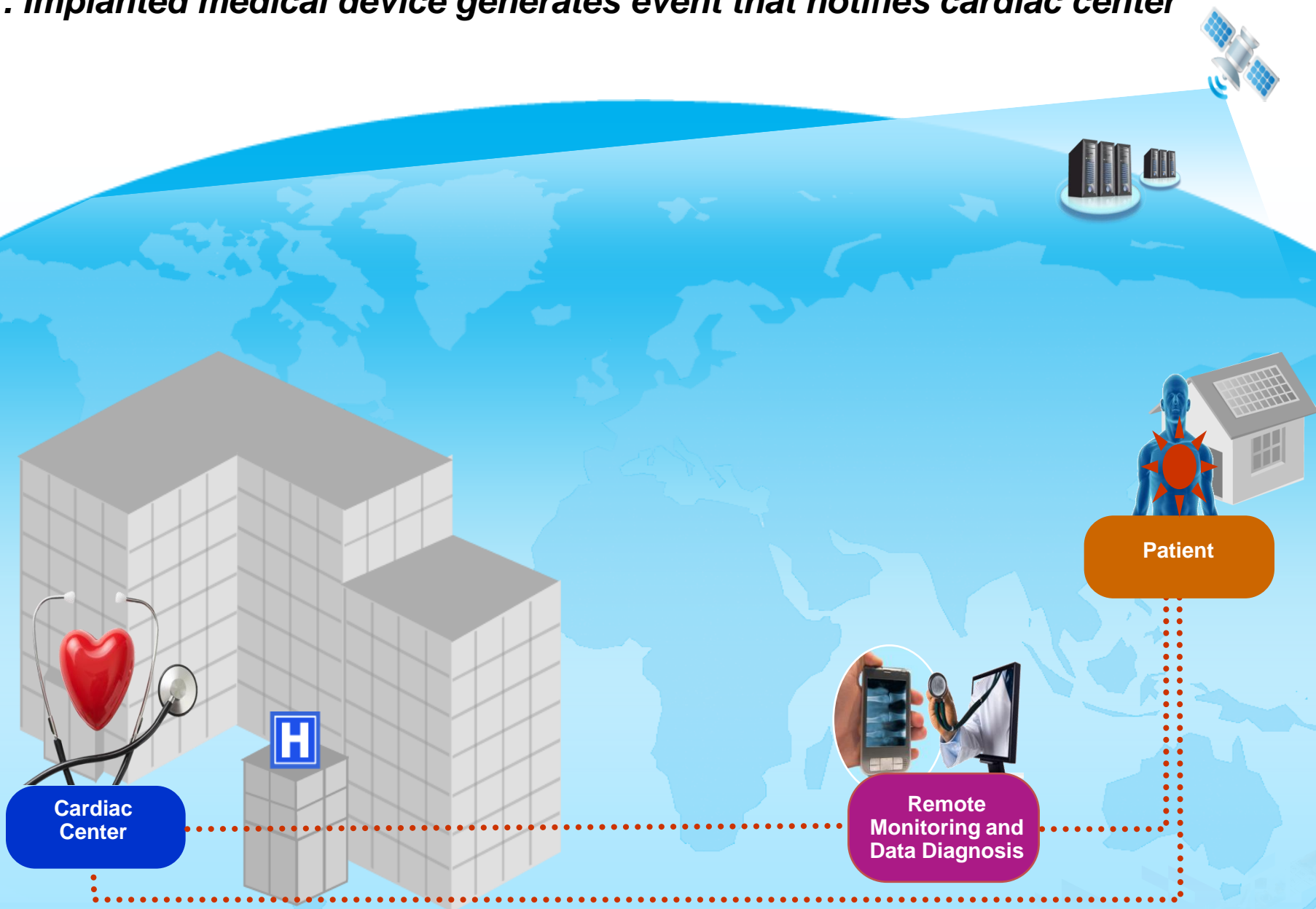
INTELLIGENT



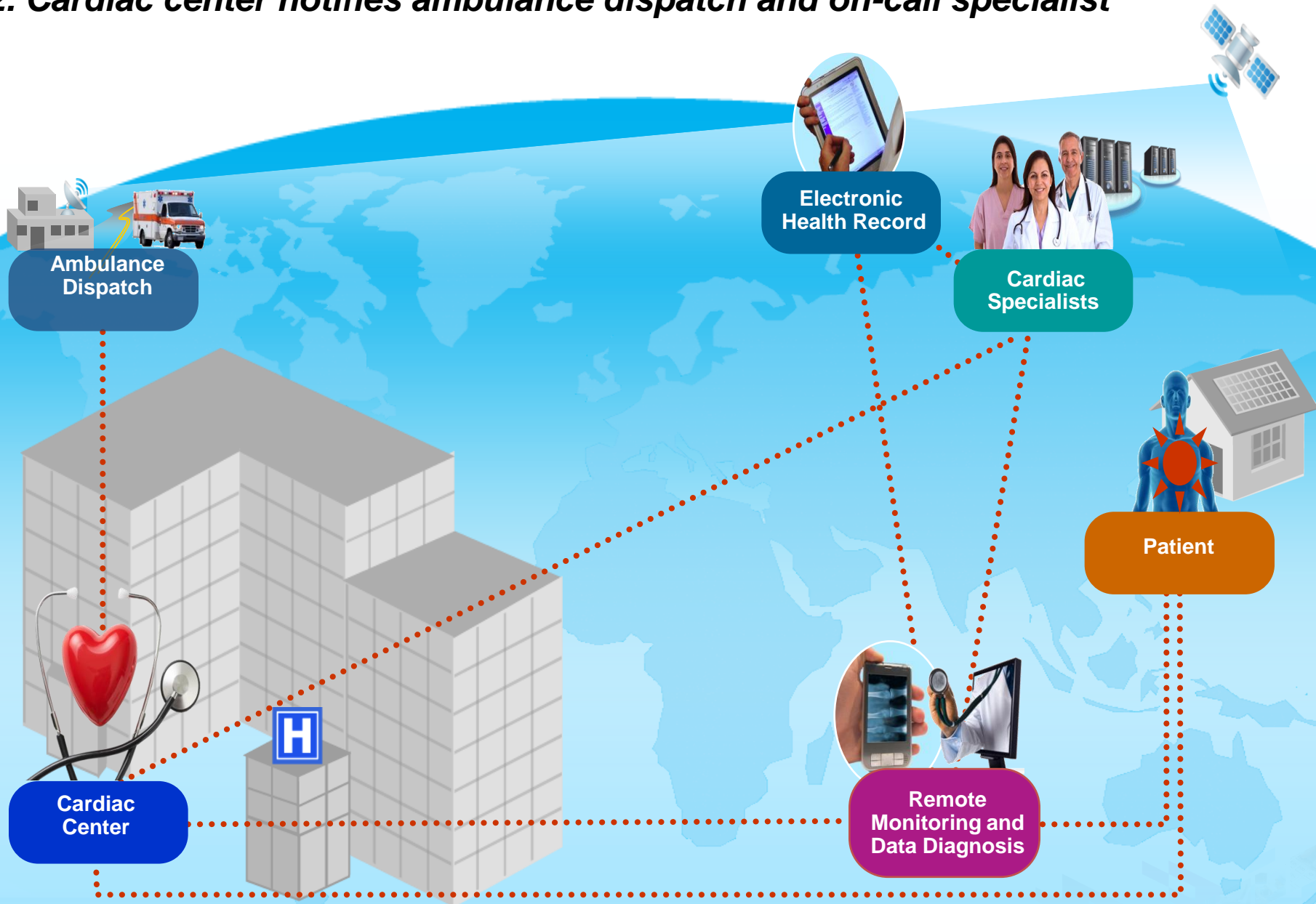
Healthcare delivery becoming mission-critical system-of-systems



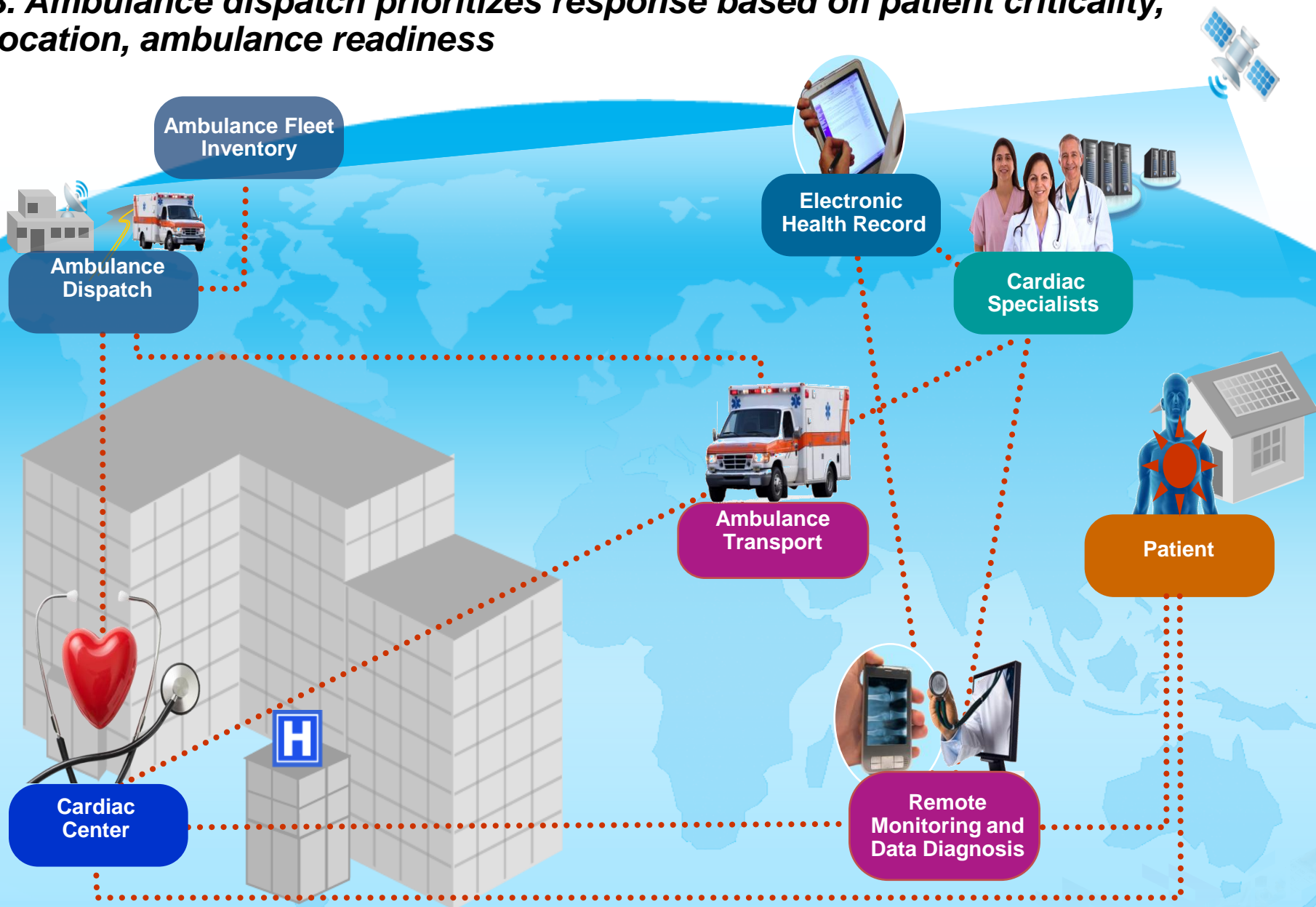
1. *Implanted medical device generates event that notifies cardiac center*



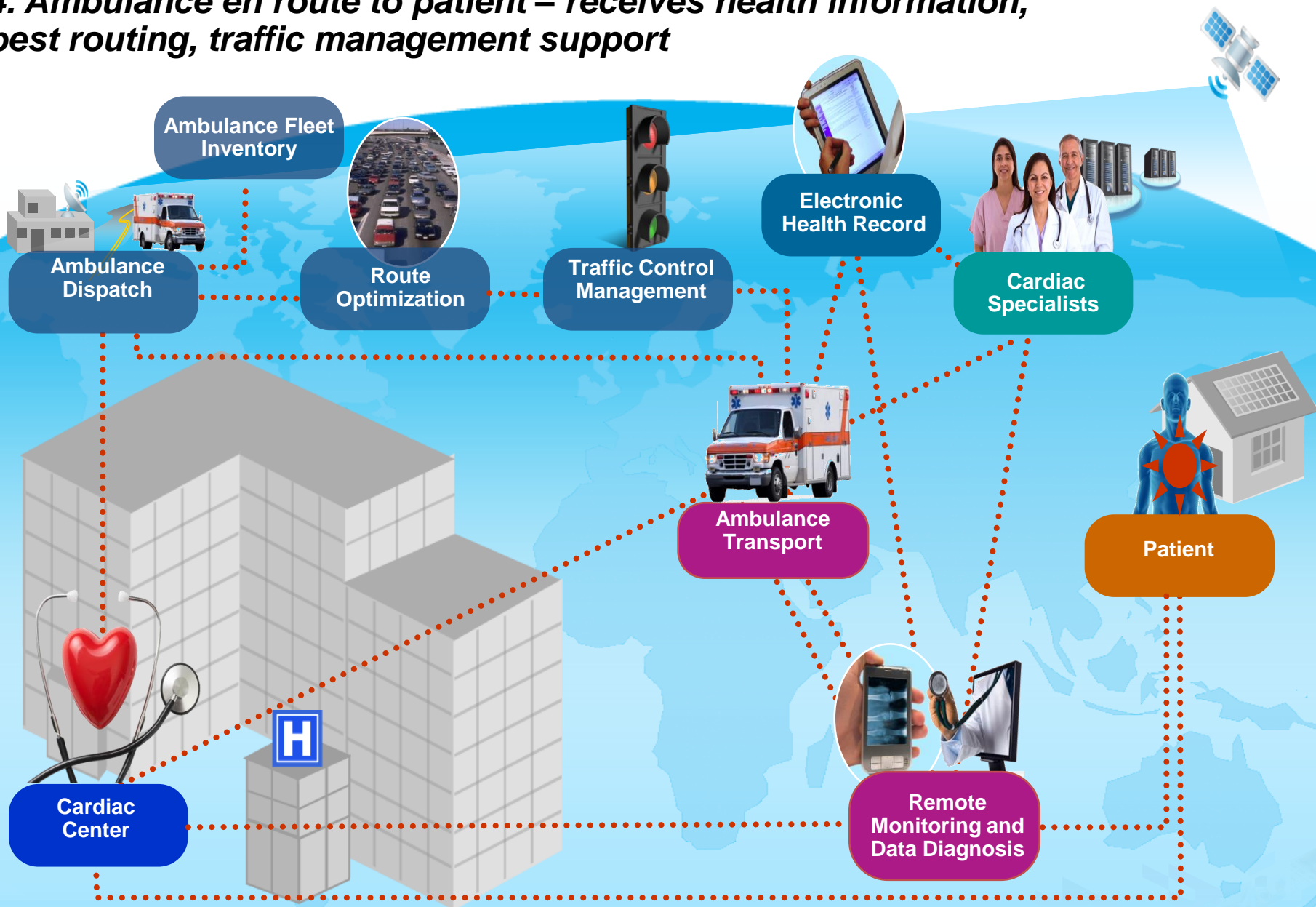
2. Cardiac center notifies ambulance dispatch and on-call specialist



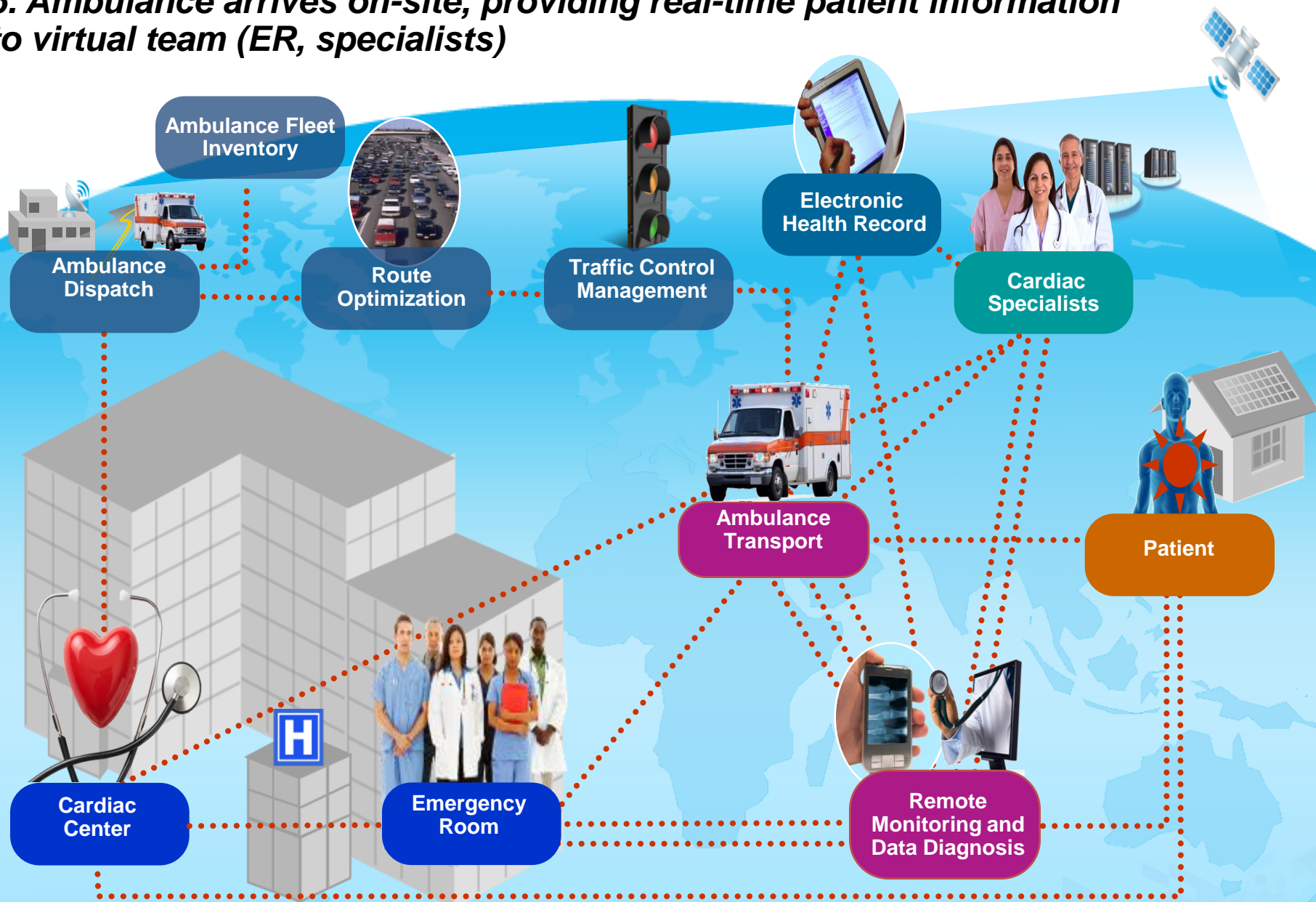
3. Ambulance dispatch prioritizes response based on patient criticality, location, ambulance readiness



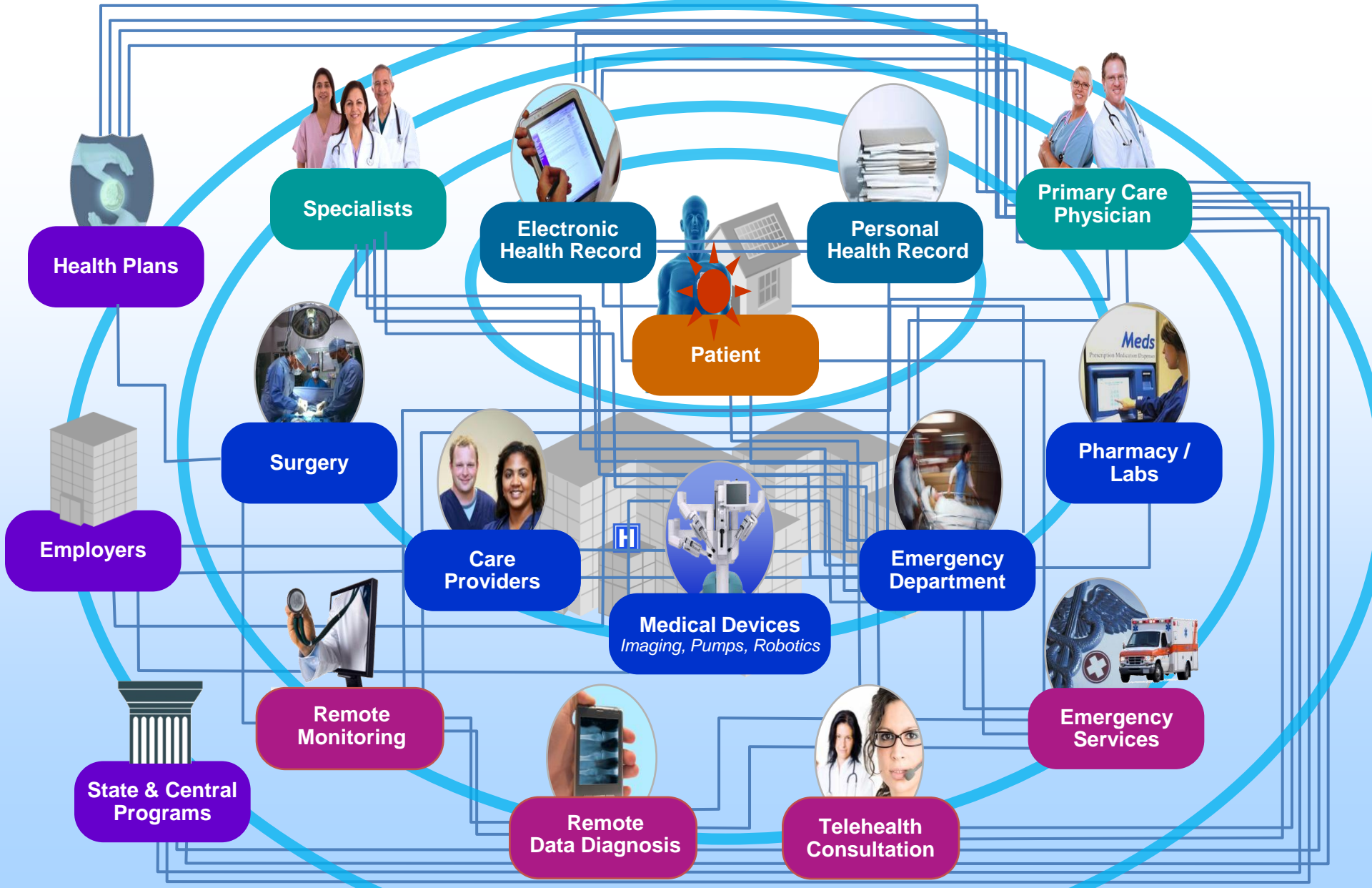
4. Ambulance en route to patient – receives health information, best routing, traffic management support



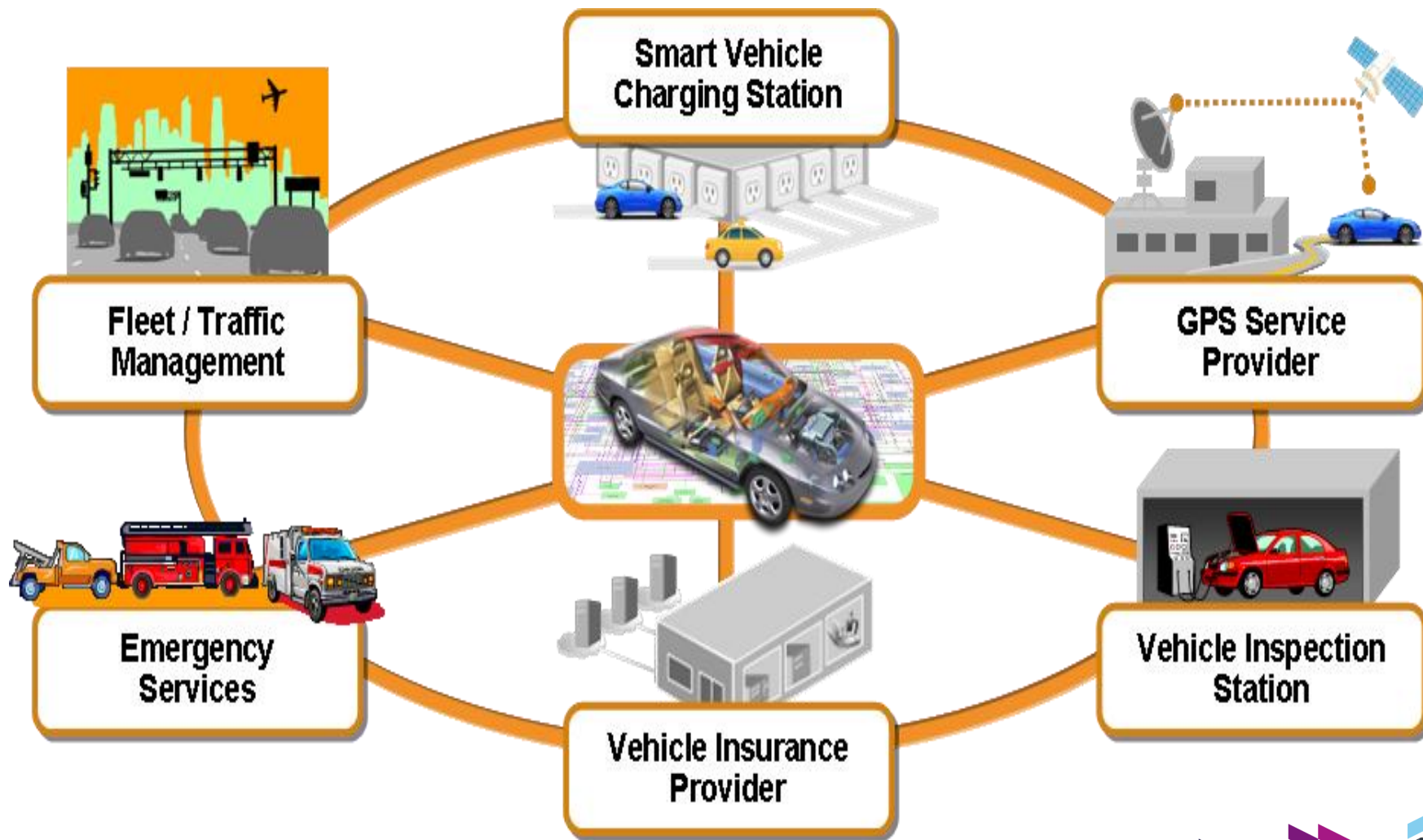
5. Ambulance arrives on-site, providing real-time patient information to virtual team (ER, specialists)



One industry, thousands of systems-of-systems scenarios

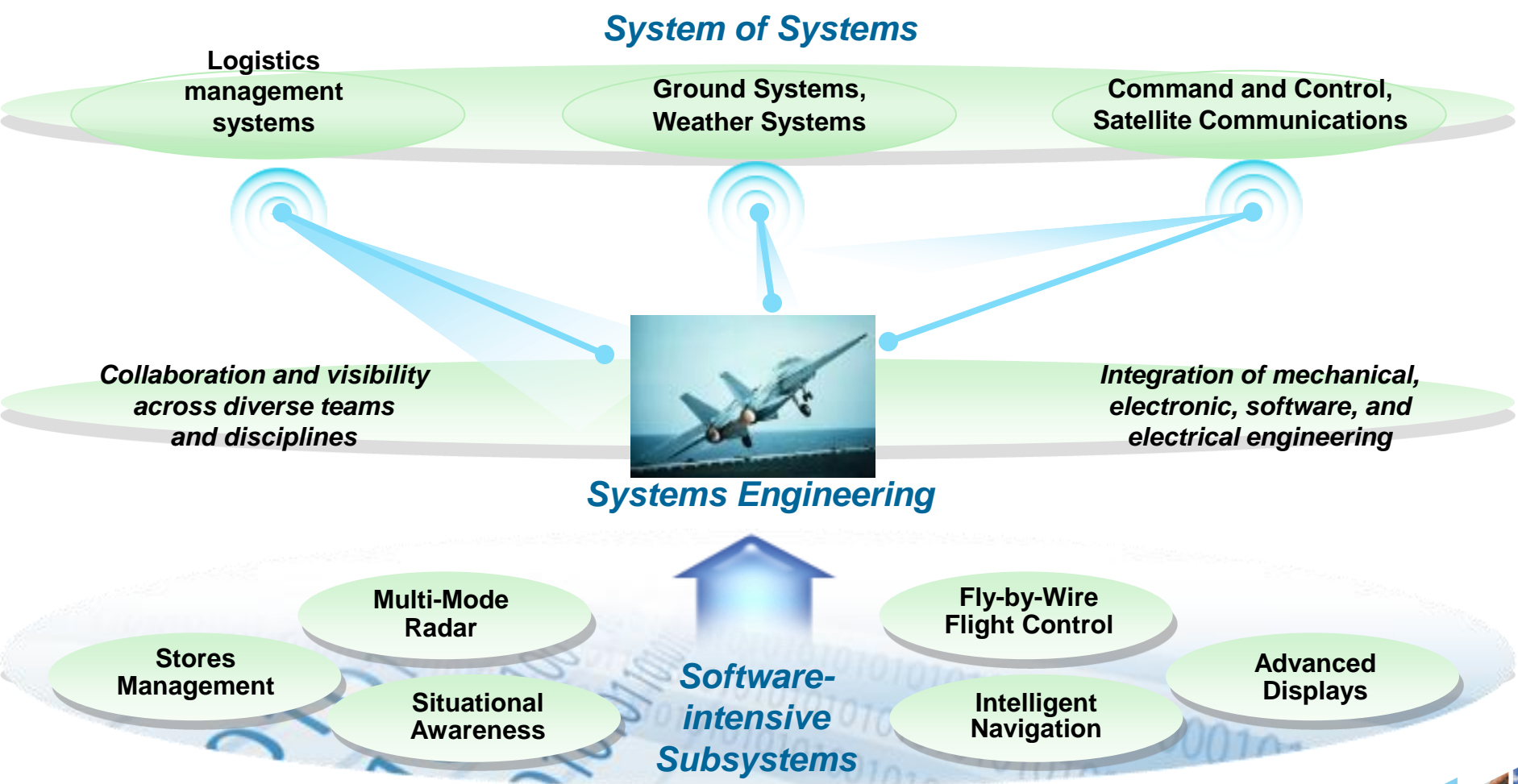


An Instrumented, Interconnected and Intelligent System of Systems



Complexity Increases The Difficulty and Value of Innovation*

From sophisticated in-device software, to complex "system of systems" ecosystems, products will continue to get smarter



*Dr. Donna Rhodes, MIT



IBM focus on Industry solutions - 4 keys to success in A&D

High Impact Pain Points:

Issues with requirements

Late breakage

Poor communications &
collaboration

Graying workforce

*Draft results of the IBM Systems
Engineering survey*

Get requirements right with IBM
Rational DOORS

Model early, often and execute your
models with IBM Rational Rhapsody

Integrate, then test to reduce risk
with IBM Rational Quality Manager

Use a collaborative platform—
Rational Team Concert



Continental Automotive

Automated tire pressure and temperature monitoring

What's smart?

Innovative tire information system that monitors tire pressure and temperature
Alerts driver in case of air leak, low pressure, or out-of-range-temperature, including for spare tire

Smarter business outcomes

Up to 3% CO2 reduction; optimization of fuel consumption; extended tire life
Improved driving safety through tire pressure and temperature monitoring

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

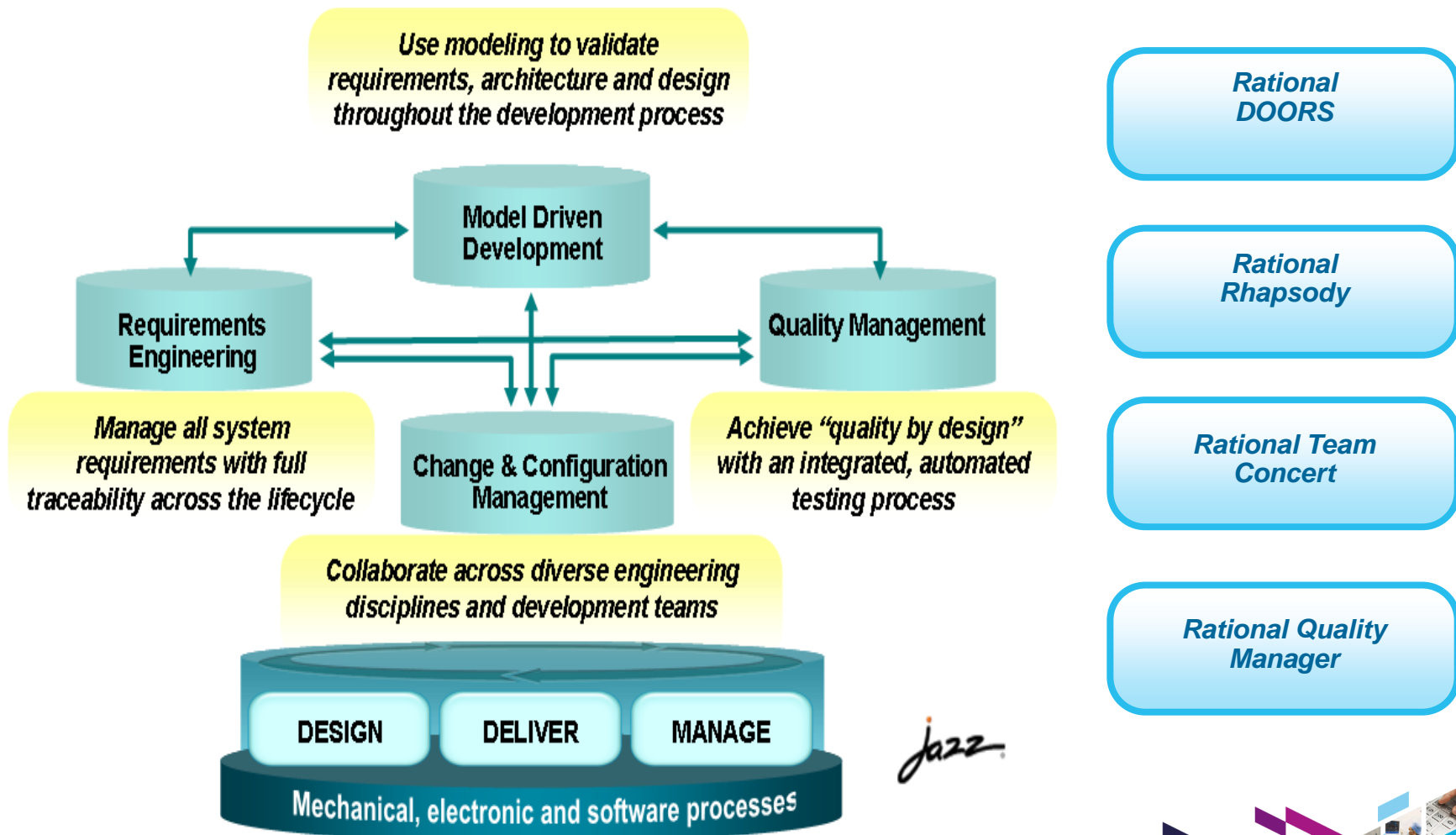


“IBM Rational DOORS and Rhapsody helped us to streamline our formerly fragmented development environment, allowing us to better manage the complex architectures of our products.”

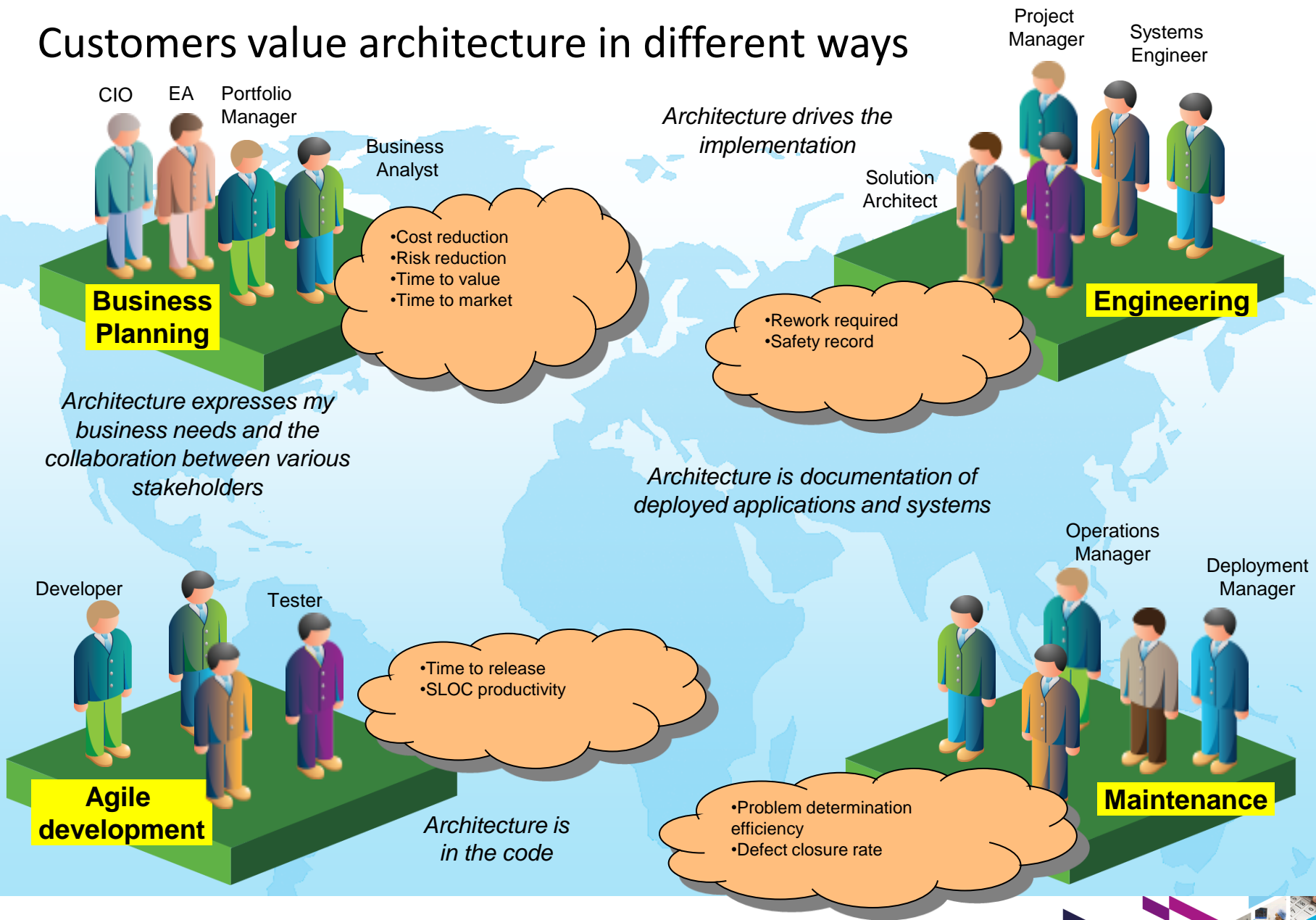




Collaborative systems engineering and software development best practices



Customers value architecture in different ways



Rational's Architecture Management strategy

1. Taking the core disciplines of enterprise architecture and model-based design & development
 2. Integrating with the management services of asset management & lifecycle management
 3. Creating a more collaborative approach to creation and management of the architecture for software applications & systems
- ✓ Improve communication, integration and governance across the stakeholder community
 - ✓ Align business objectives & strategy with implementation & deployment
 - ✓ Faster time-to-value and overall cost savings

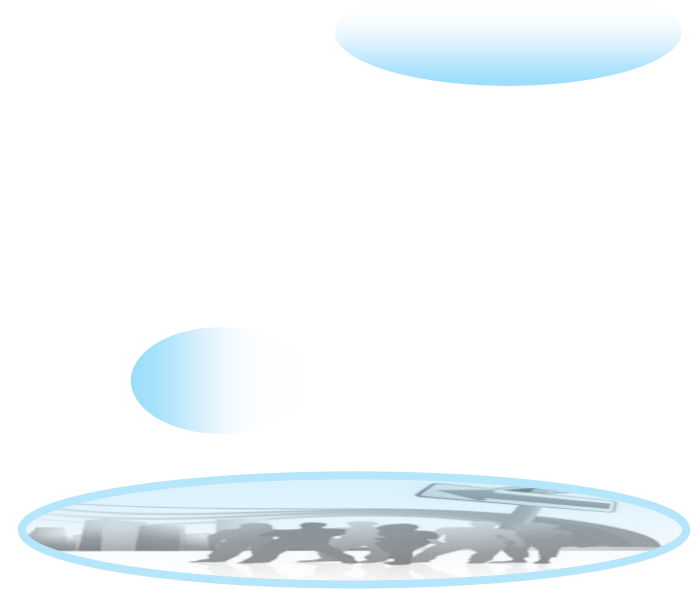


Principles for our architecture management roadmap

Product Family comprised of **IT focused** and **Systems & Embedded focused** modeling specializations

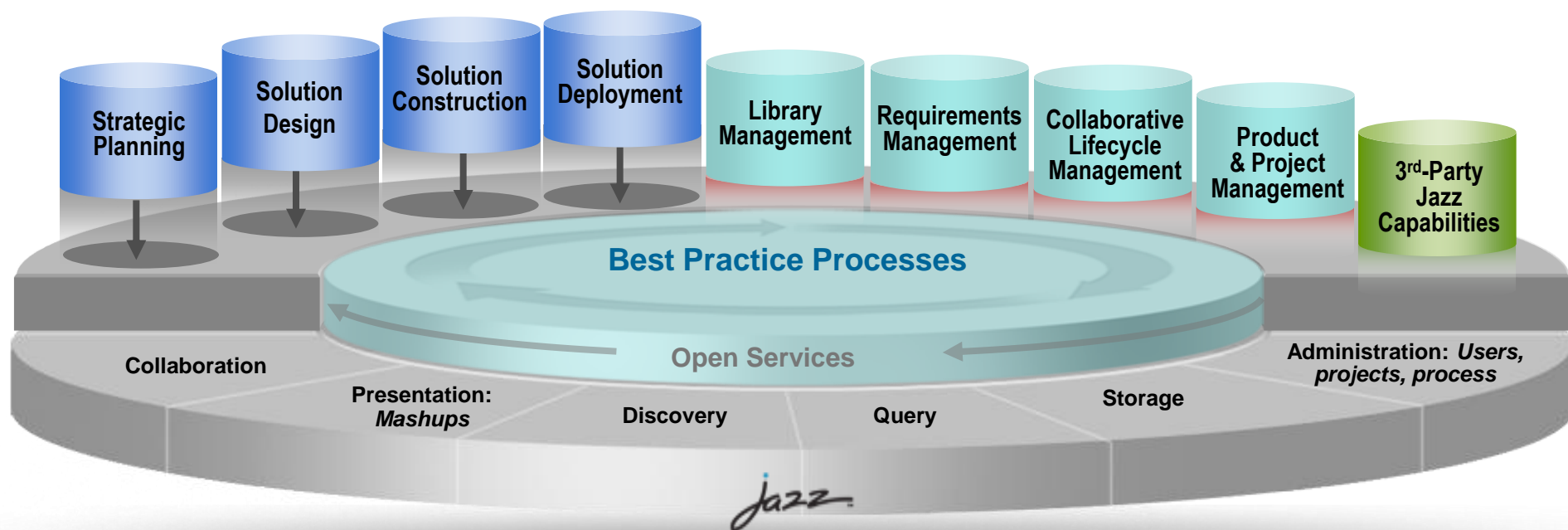
Accelerate innovation and **time to market**, and **improve quality** of solutions by utilizing **common technologies and components**

Leverage Jazz technology to enhance integration and team collaboration and improve core product reliability, scalability and security



Building on the Foundation

Extending Jazz for supporting Architecture Management



Collaborative Architecture Management provides:

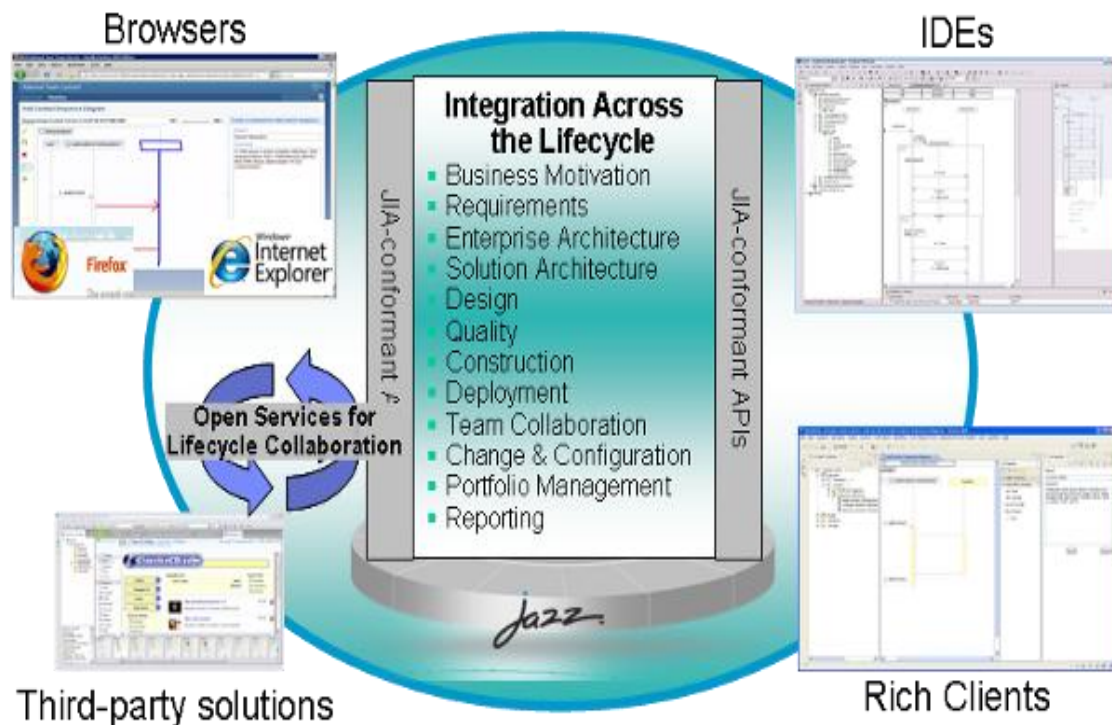
Improved communication, integration and governance across the product/project team to align business objectives and strategy with solution implementation and deployment



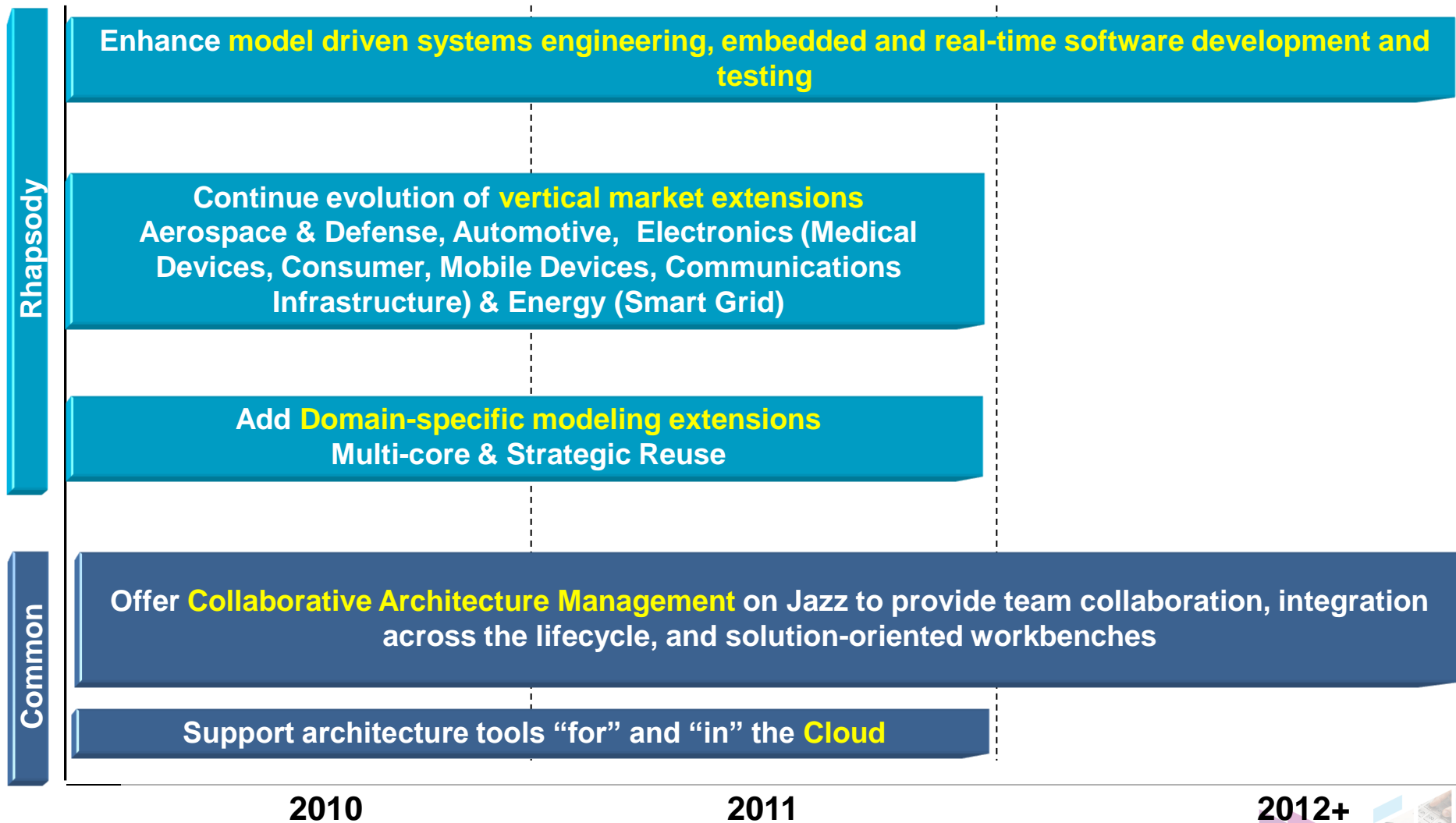
Target: Full realization of Collaborative Architecture Management

Seamless access for the entire stakeholder team:

- Smooth integration across the lifecycle
- Robust bi-directional traceability, impact analysis, navigation, co-visualization
- Integrated reporting and statistics
- Asynchronous, model-based team collaboration



Rational Rhapsody roadmap themes



Rational Rhapsody: Highlights of future releases

Systems Engineering

Integration between parametric diagrams and mathematical solvers to perform trade-off analysis

SysML 1.2 support

Foster Systems Model as a multi-discipline system framework

Refined process coverage from Systems thru Software, Electrical and Mechanical

Leverage Jazz to utilize System Model as the hub of engineering data

Hardware/Software co-design

Rhapsody on Jazz

Web access to modeling data

View, comment and mark-up of models, review and approval process

Establish and trace links to CLM data and RSA and SA model data

• Software Engineering

- Create a Model Driven Development environment for Android
- Provide automation and dynamic analysis for designs targeting multi-core
- Provide integration with DDS and support for DoDAF 2.0
- C# (architectural code)
- Continual improvements for safety critical development (MISRA C, MISRA C++, Ada)
- Advanced legacy code modernization – architectural mining
- Provide Support for UML Action Language

• Model-Driven Testing

- Expand areas of Model-Driven Test coverage (code-centric, Java, Ada, etc)
- Enhance Integration with test management (RQM) and code validation tools



Océ N.V. - Smarter printing solutions

What's smart?

- Improved communication within and across teams
- Conducted early hardware and software loop testing to help ensure quality
- Produced the world's fastest cut sheet duplex printer at the time it was introduced

Smarter business outcomes

- Océ can now reuse more than 50 percent of its software components from project to project
- Built a working prototype of a new printer in just two months—a process that previously took eight months.

How Rational enables smarter products

- Model driven development to increase efficiency, improve quality and decrease time to market
- Software change and configuration management to build embedded systems

Think Rational

One of many ways Rational enables a smarter planet.

"With IBM solutions for model-driven development, all of our engineers can talk to each other in the same language. Because it is far easier to understand a UML model than a piece of code, model-driven development stimulated dialogue within the organization as a whole."

“Too Much Plane”



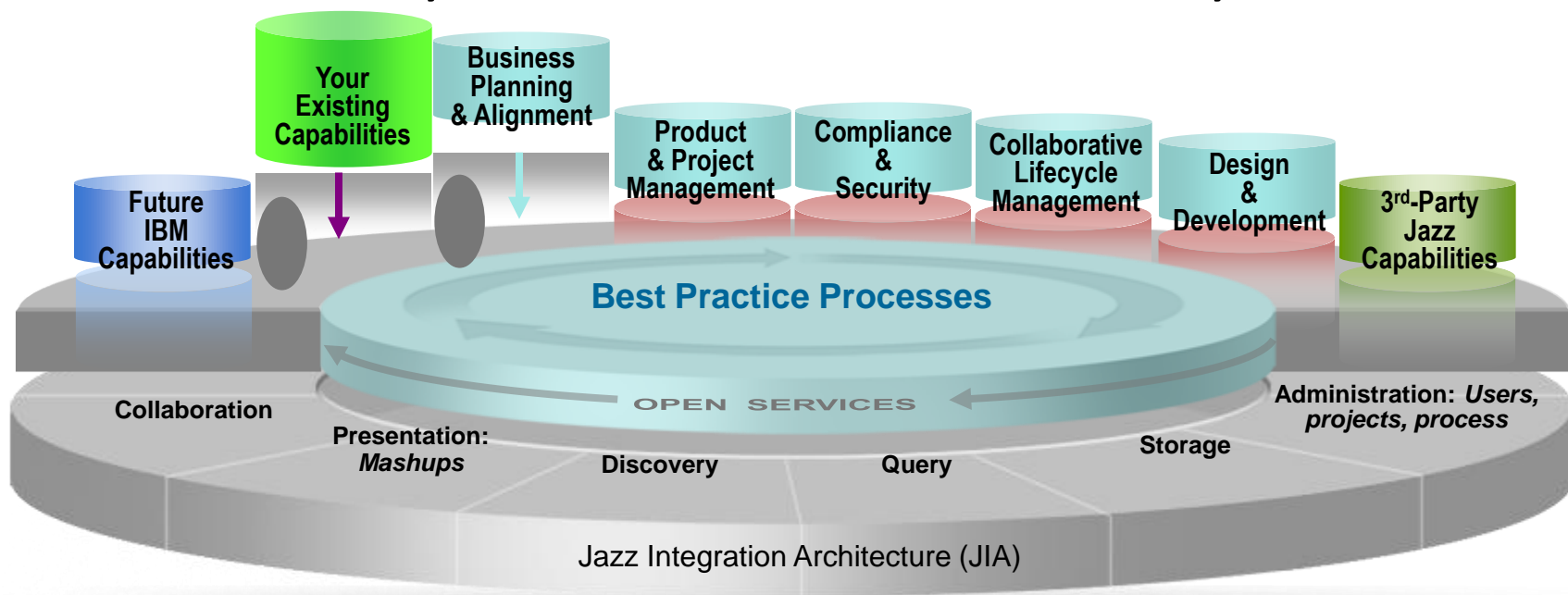
- Boeing Model 299 (ultimately the B-17)
- US Army Air Corps new bomber competition
- October 30, 1935; Dayton, Ohio
- Elevator lock was not properly released
- NY Times reported “*too much plane for one man to fly*”



- Solution: Creation of a *Pilot Checklist*



Jazz provides an extensible framework built on open standards for systems and software delivery

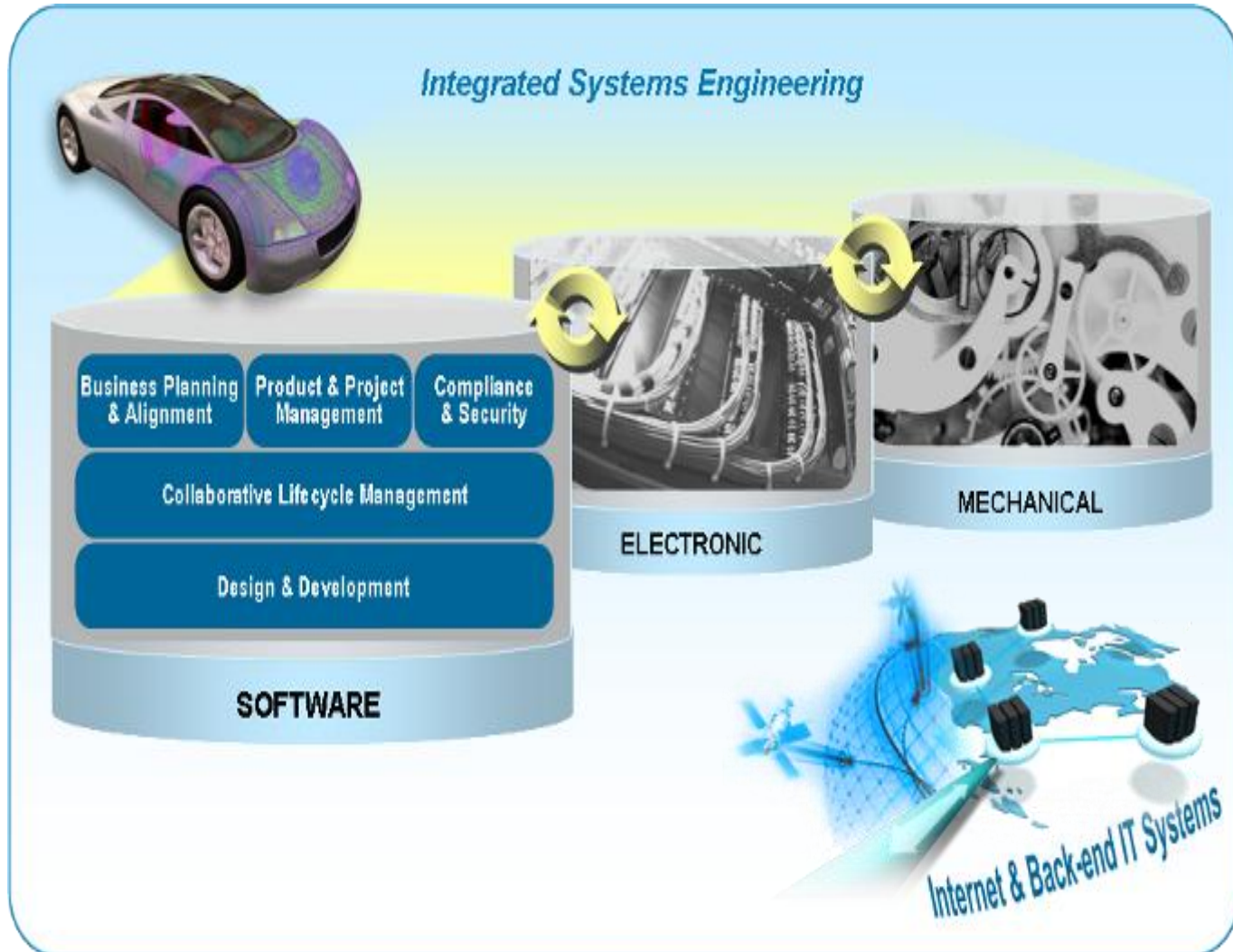


Jazz is... Open Services for Lifecycle Collaboration (OSLC)

- A scalable, extensible team collaboration platform
- A community at Jazz.net where you can see Jazz-based products being built
- An integration architecture enabling mashups and non-Jazz based products to participate
- Built on industry standards



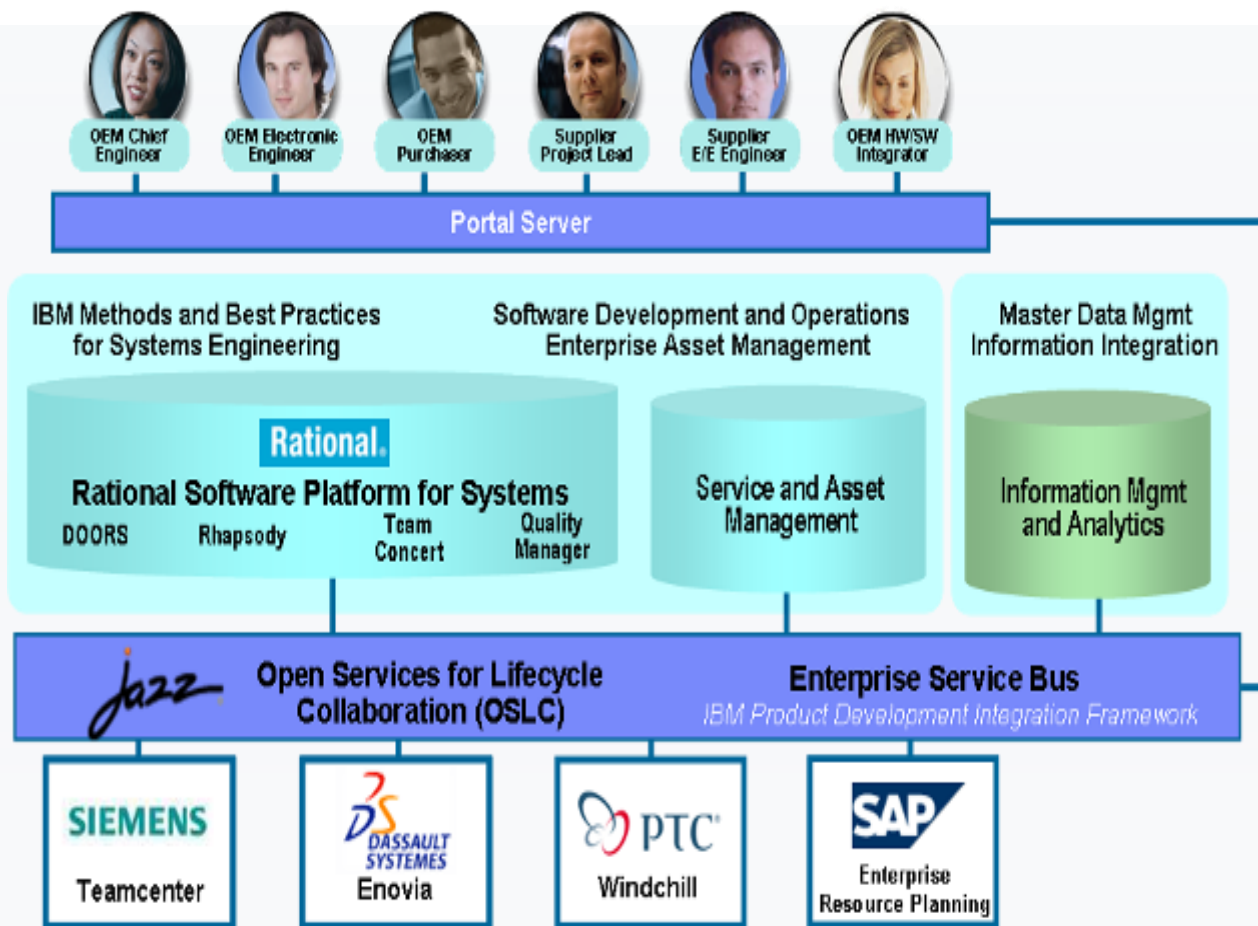
Unification for Innovation: integrating ALM & PLM



- Processes and best practices for measured improvement
- Integrated software, electronic and mechanical
- Rich set of modular, easy to adopt tools



Leverage existing investments including the linkage to mechanical packages



Simplifying collaboration across the software & systems lifecycle



Open Services for Lifecycle Collaboration

An industry initiative for making it easier to use software and systems delivery tools in combination.

Open interfaces. Open possibilities.

Barriers to sharing resources across the lifecycle

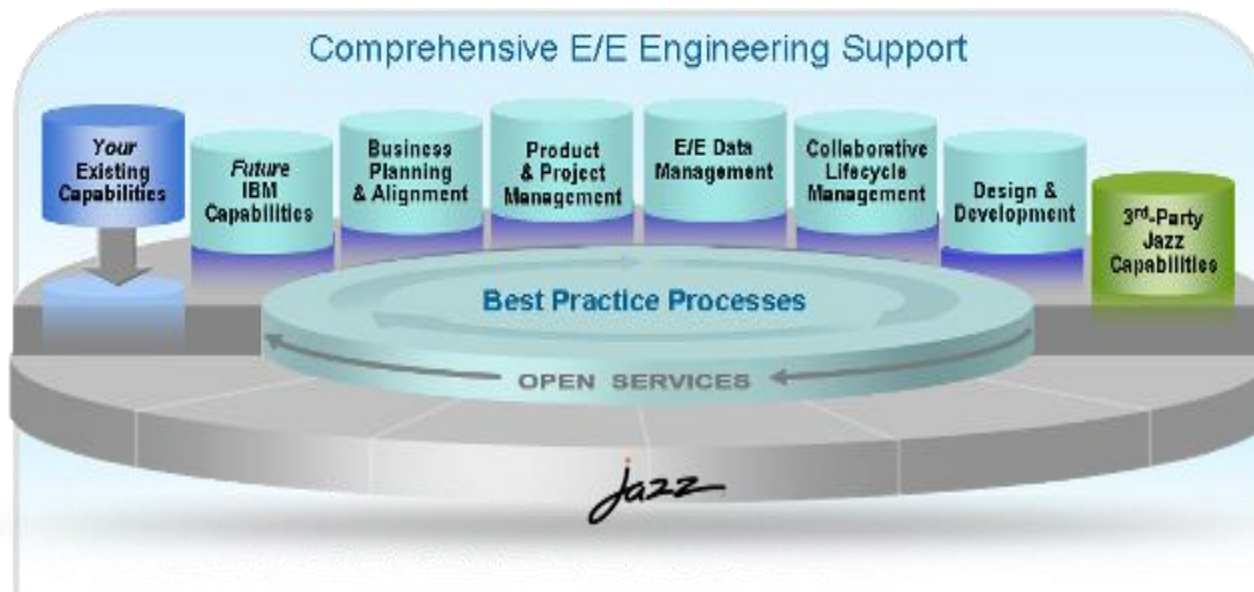
- ▶ Multiple vendors, open source projects, and in-house tools
- ▶ Private vocabularies, formats and stores
- ▶ Entanglement of tools and data

▶ The Open Services initiative:

- **Building** a community of software and systems vendors, open source projects, integrators, and corporate IT teams, operating at **open-services.net**
- **Creating** public specifications of resources and services for sharing the things that teams rely on, like change requests, test cases, defects, requirements and user stories
- **Delivering** loosely coupled resource formats and services with “just enough” standardization



First class Electrical/Electronic lifecycle management



- A single environment for the creation, access and management of Electrical/Electronic Engineering developed with *your* client input
 - ▶ 80-90% commonality with other industry verticals
 - ▶ Currently working with multiple OEM's on delivery
 - ▶ Based on our 6 year, \$100m+ investment on our Jazz platform
 - ▶ Project management visibility and reporting
 - ▶ Design chain collaboration
 - ▶ E/E artifact management
 - ▶ Easily extensible
 - ▶ Full, standards-based, integrated development environment



Ikerlan: Smarter wind power solutions

What's smart?

- Wind turbine systems that automatically optimize performance based on environmental factors
- Customized product variations that address the needs of a global energy market

Smarter business outcomes

- 90% reduction in development time for each customized wind turbine model
- 25% reduction in cost of development for wind turbine control systems

How Rational enables smarter products

- Model driven development for optimization of wind turbine control systems
- Product line engineering to more efficiently produce software-based product variations

Think Rational

One of many ways Rational enables a smarter planet.

"Our use of Rational Rhapsody for model-driven development, integrated with BigLever Gears for product line engineering, allows us to reuse software assets and manage variations at a pace that lets us keep up with market requirements."



Curtiss-Wright Controls Embedded Computing

Unmanned aerial vehicles

What's smart?

- Ruggedized computer systems for unmanned aerial vehicles (UAVs)
- Interconnectivity with on-board and ground systems

Smarter business outcomes

- Unmanned aircraft increase precision and reduce risk of casualty
- Speed, reliability and accuracy of onboard systems allow unmanned aircraft to fly 30 hours at altitudes of greater than 50,000 feet

How Rational enables smarter products

- Manage requirements and change across multiple product variants
- Reuse software components to increase reliability and reduce costs



Think Rational

One of many ways Rational enables a smarter planet.

"With our set of Rational tools we're able to go from cradle to grave, from the requirements through the change requests down to the code base and back up, and we can prove that we've met our customer requirements."

Summary

Value migration is disrupting the current design and delivery life cycle of products and services.

New approaches are required to manage the complexity – combining the fundamentals of systems engineering disciplines with software delivery principles.

IBM and its partners are pioneering the next generation of software and systems engineering technologies based on open standards and leveraging out clients existing investments.

Clients are already reaping tangible results that are measurable and sustainable.





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