

Enterprise UML & MDA 2004 conference

The New Connaught Rooms
12 & 13th May 2004



IBM Software Group

Model Driven Software Development Platform using Eclipse, EMF and UML

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Rational. software



ENTERPRISE
UML&MDA
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@business on demand software

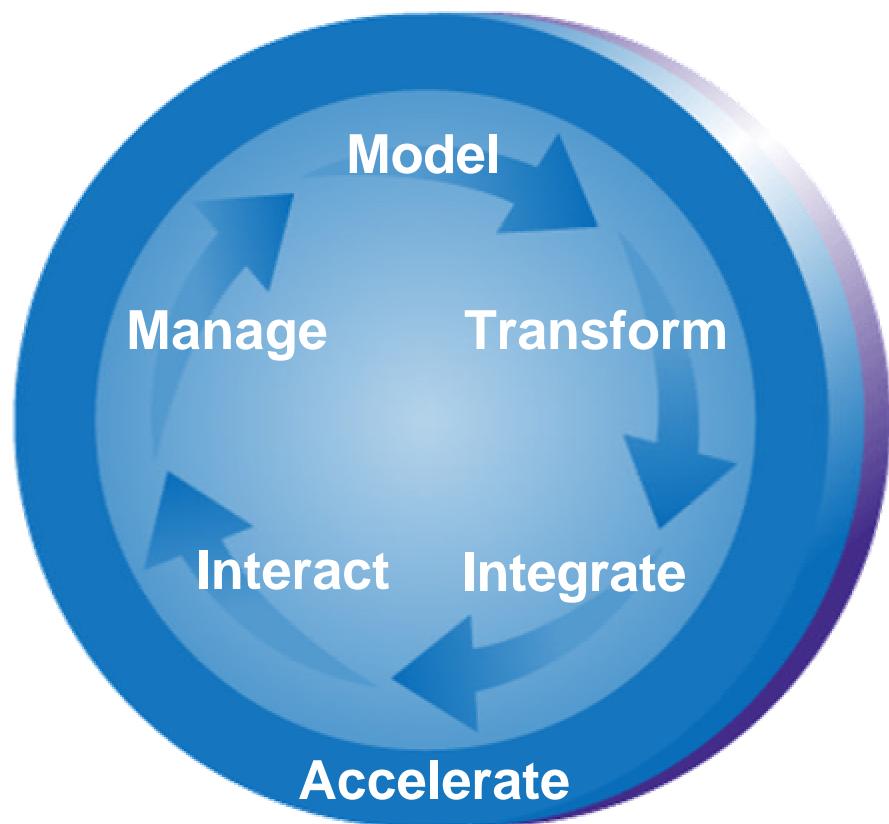
Agenda

- Software Development as a Business Process
 - ▶ Implications for a software development platform
- MDA in a nutshell
 - ▶ Key MDA concepts
 - ▶ Key Standards
- Eclipse in a nutshell
 - ▶ Eclipse core and the plug-in architecture
 - ▶ Eclipse Modeling projects
 - EMF, UML2, Hyades...
- Building a Software Development Platform using Eclipse and MDA

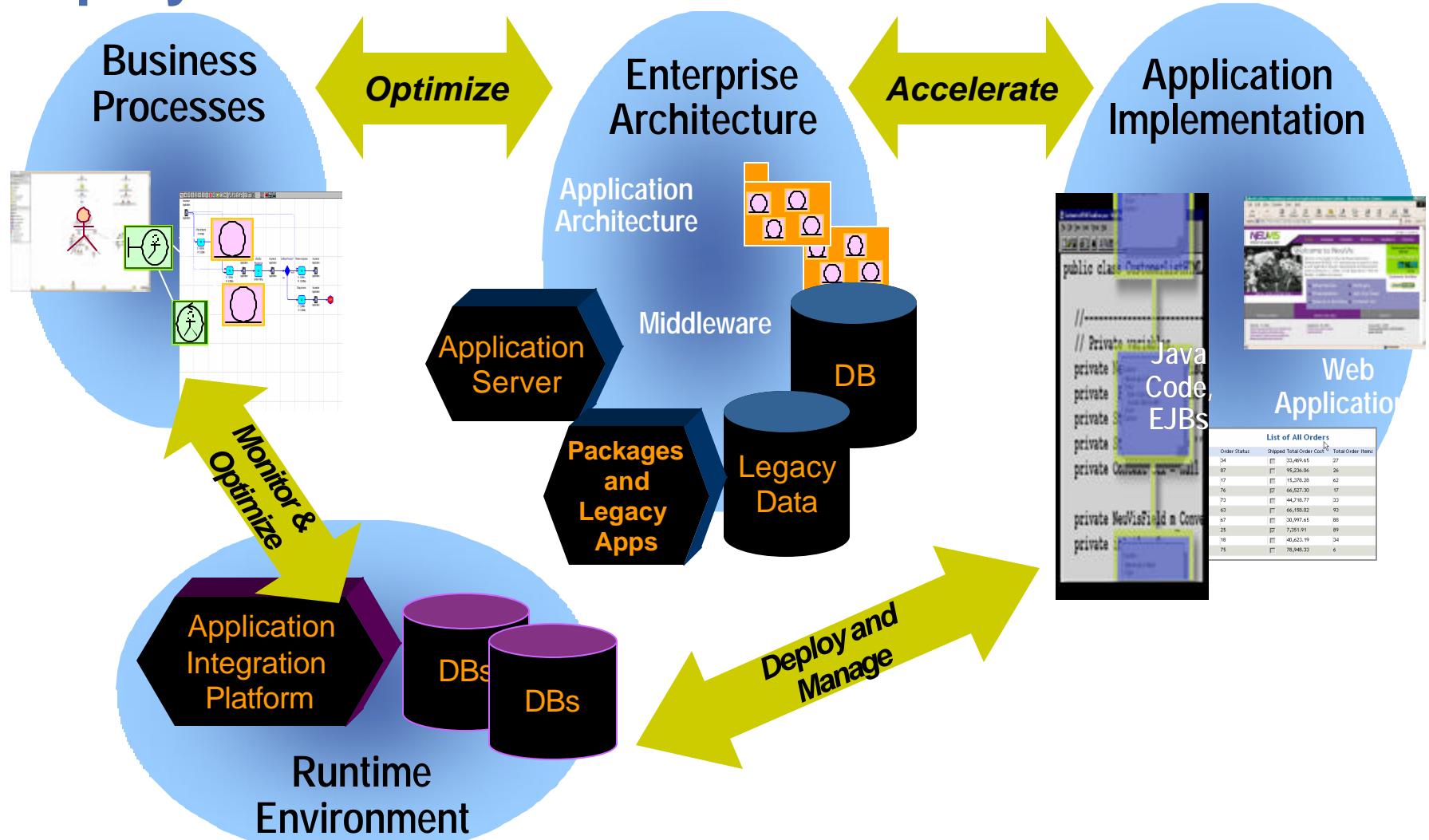


Integration Capabilities for the On Demand Enterprise

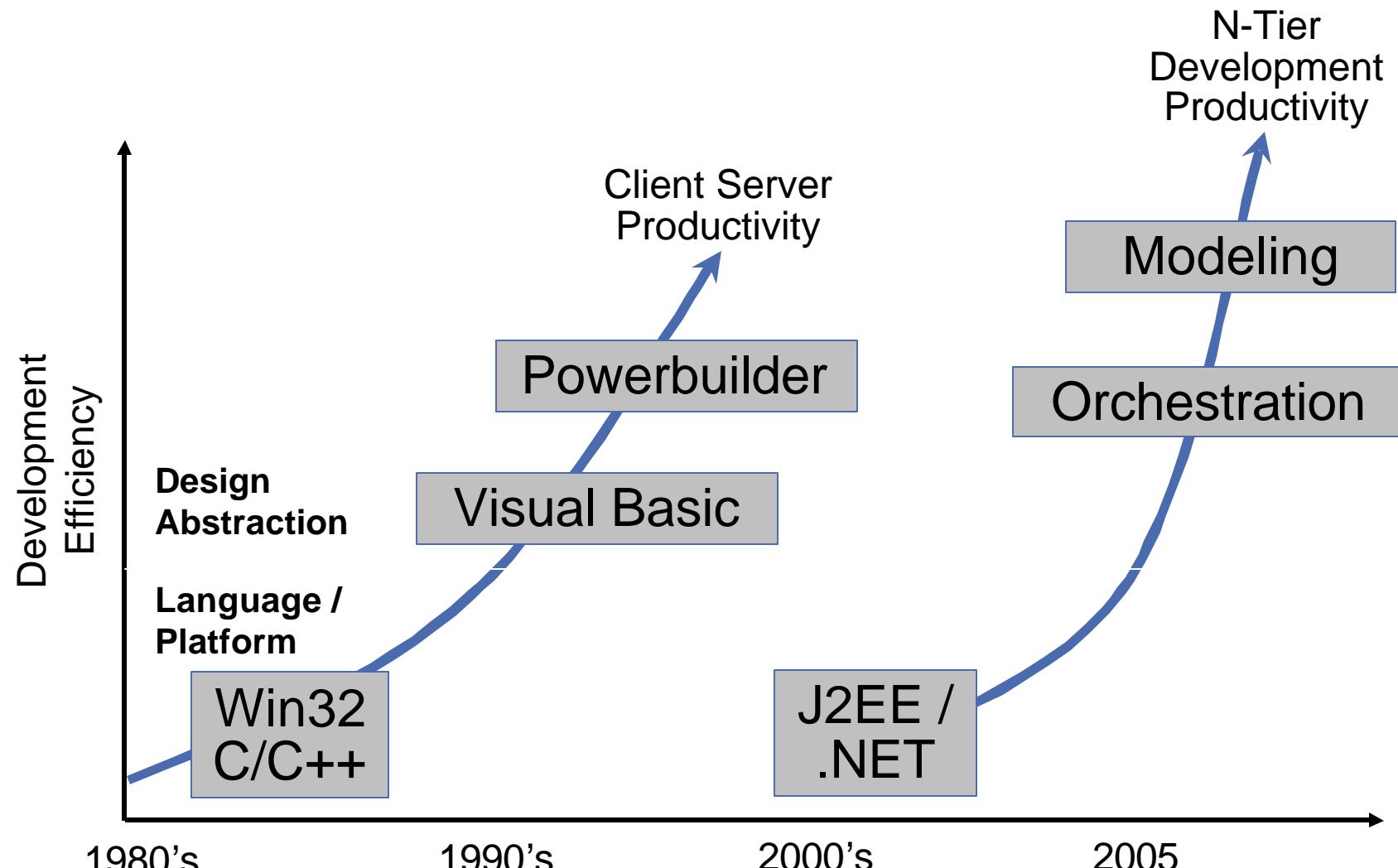
Model	business functions and processes
Transform	applications, processes and data
Integrate	islands of applications, processes and information
Interact	with resources anytime, anywhere with any device
Manage	performance against business objectives
Accelerate	the implementation of intelligent processes



Accelerating Development, Integration, and Deployment



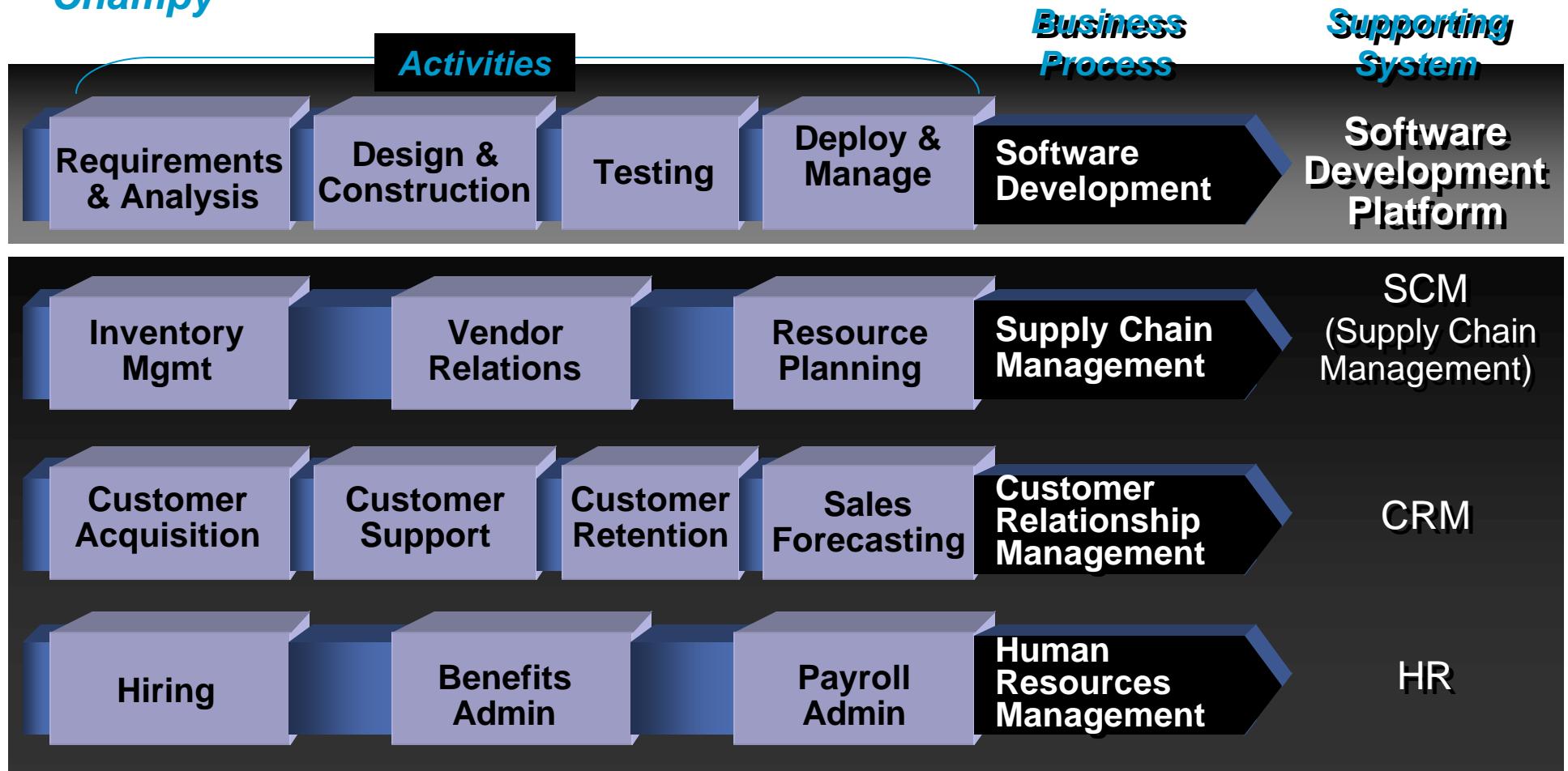
Development Efficiency Is Driving ...



Source: Giga Research

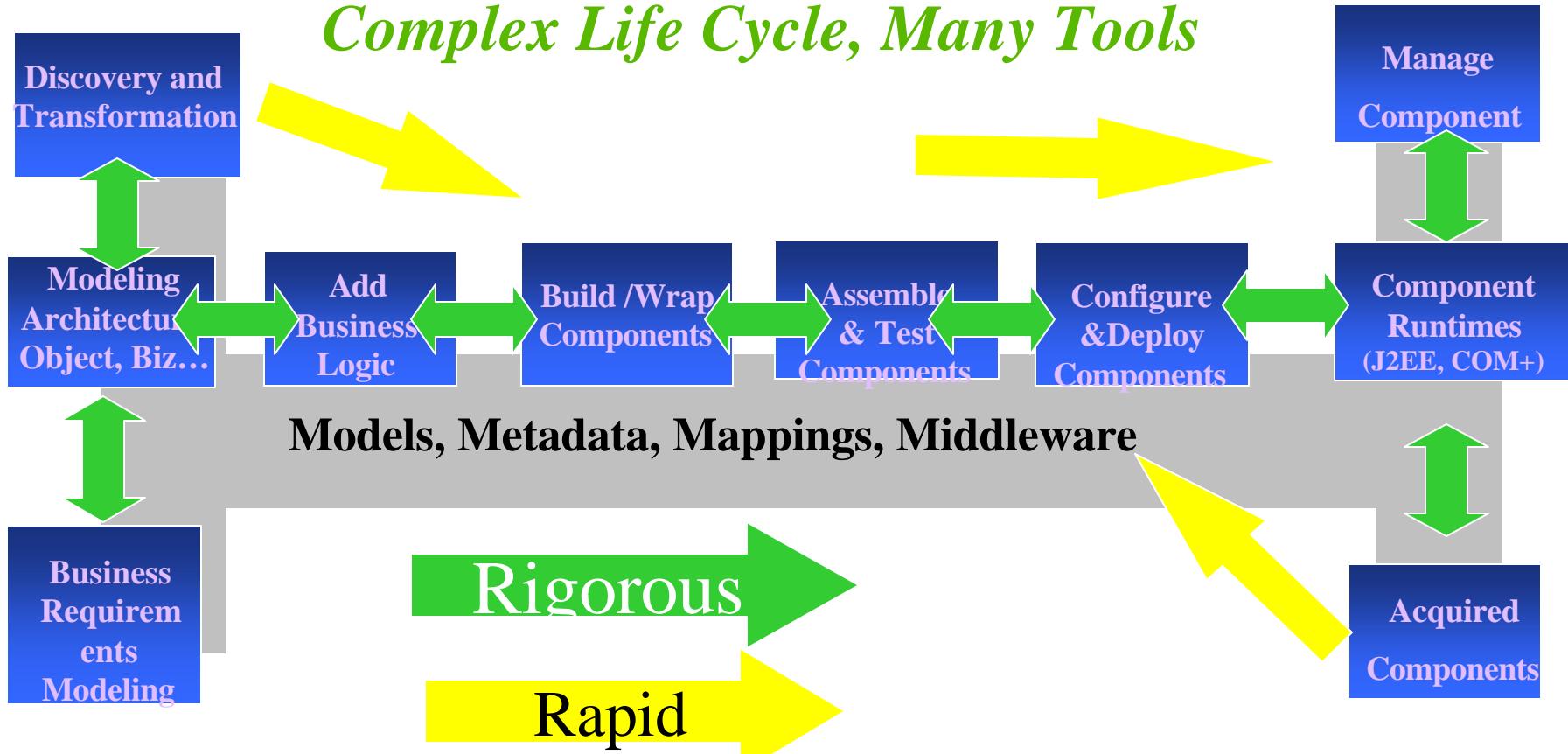
Software Development: A Core Business Process

Business process: “A collection of activities that takes in one or more kind of input and creates an output that is of value to the customer.” Hammer & Champy



An Enterprise Application Development Life Cycle

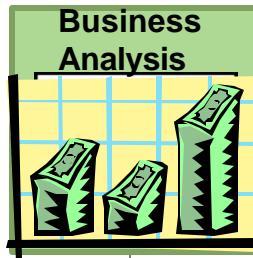
*Architecture Centric, Business driven,
Complex Life Cycle, Many Tools*



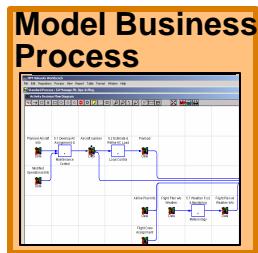
And do this with quality in a distributed environment

The Business Driven Lifecycle

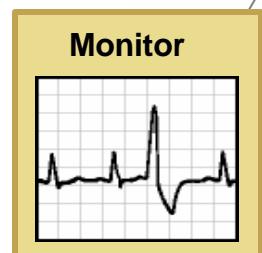
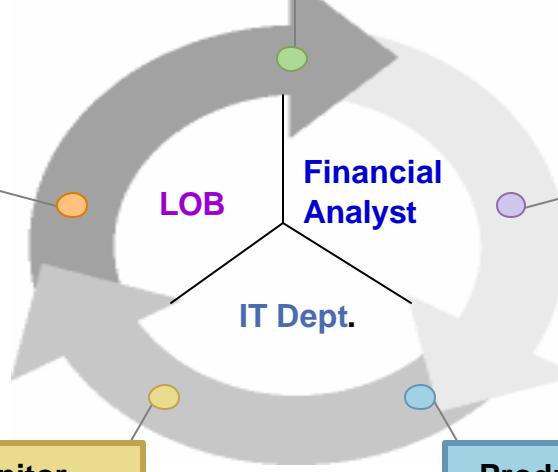
- Document and specify As-Is Process with Metrics
- Specify and construct goals, objectives and requirements
- Apply Technology to Improve the Process
- Model the To-Be Process....



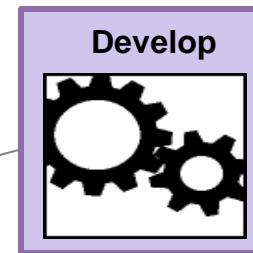
- Model and simulate business processes
- Model Applications and Data
- Analyze the financials & prioritize the areas that bring maximum business value
- Identify / prepare existing assets or reuse



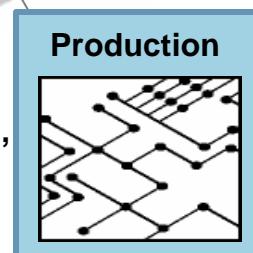
- Audit processes and improvements
- Make Iterative Improvements
- Model the Next As-Is and To-Be Process....



- Manage testing, requirements, configuration, and project management



- Rapid integration and/or application development
- Visual construction and programmatic code generation
- Functional and load testing
- Generate XML code & manage UML blueprints & Automated Workflow
- Apply Patterns to Accelerate Development

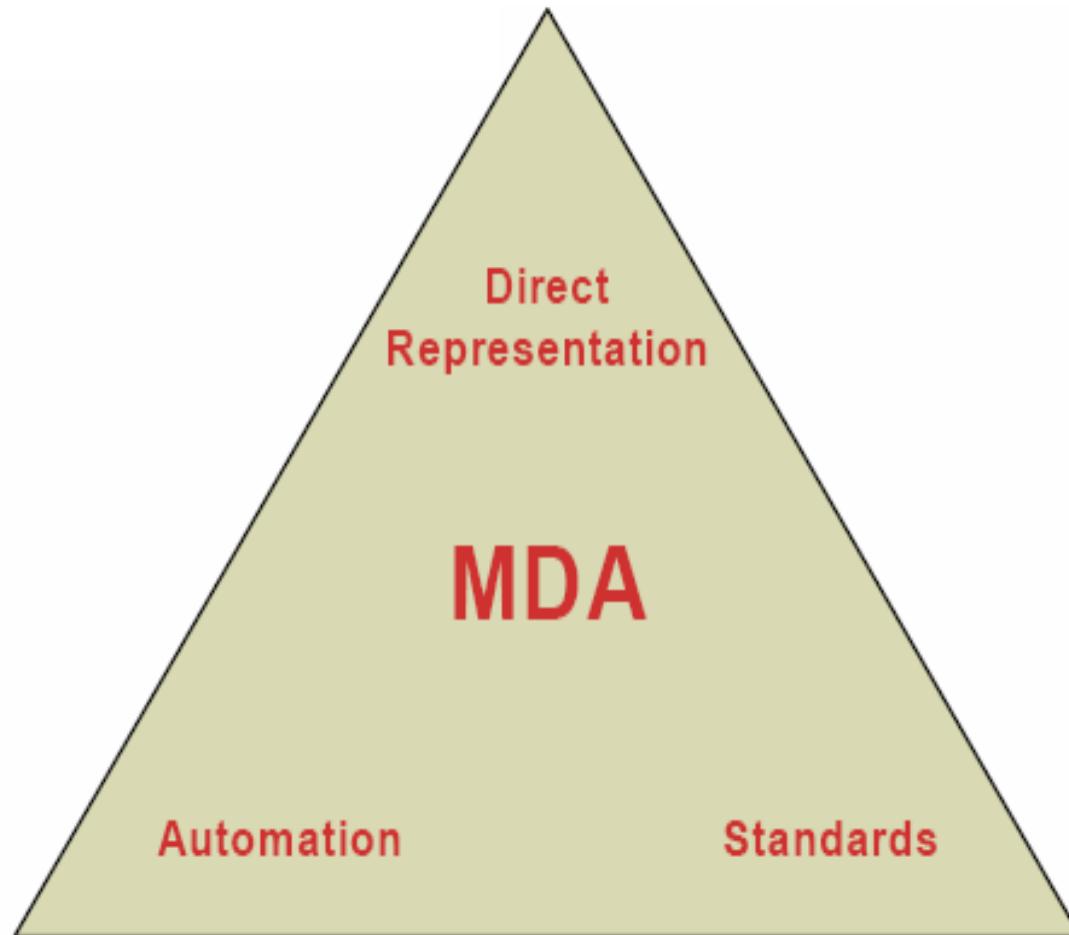


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The MDA Manifesto

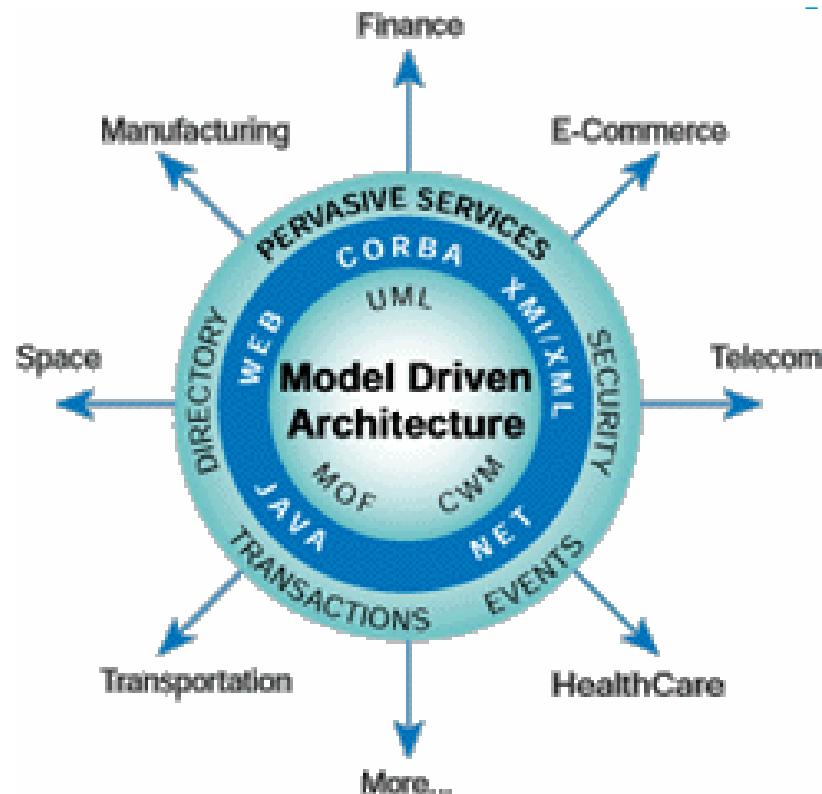


www.bptrends.com

(Booch, Brown, Selic, Rumbaugh, Iyengar)



A Solution for Managing IT Complexity: Model Driven Architecture (MDA)TM



Source: OMG

- An integration of **best practices in Modeling, Middleware, Metadata, and Software Architecture**

Model Driven (UML, MOF, CWM...)

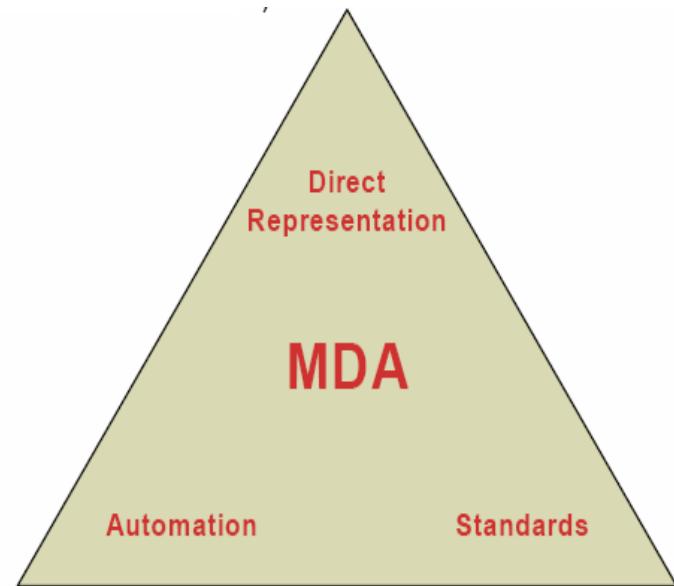
- ▶ Platform Independent Models (PIM) – Technology or increasingly Business Models
- ▶ Platform Specific Models (PSM) - J2EE, .Net, SQL
- ▶ Mappings : PIM<->PIM, PSM<->PSM, PIM<->PSM
- ▶ Applies across the software life cycle

Key Benefits

- ▶ Improved Productivity for Architects, Designers, Developers and Administrators (Faster, Consistent)
- ▶ Lower cost of Application Development and Management (Cheaper)
- ▶ Enhanced Portability and Interoperability (Open)
- ▶ Business Models and Technologies evolve at their own pace on platform(s) of choice (Responsive)

The ‘MDA Manifesto’

- Direct Representation
 - ▶ Speak the language of the stake holder (UML, MOF, XSD, Business Process, Business Rule or specific Industry Domain Model)
 - ▶ Be as precise and formal as needed
 - ▶ Abstract away irrelevant detail
- Automation
 - ▶ Transform models to models, code and other artifacts
 - ▶ Interpret/Execute models when the models are complete enough
- Standards and Open Source
 - ▶ Customer choice
 - ▶ Innovation
 - ▶ Interoperability

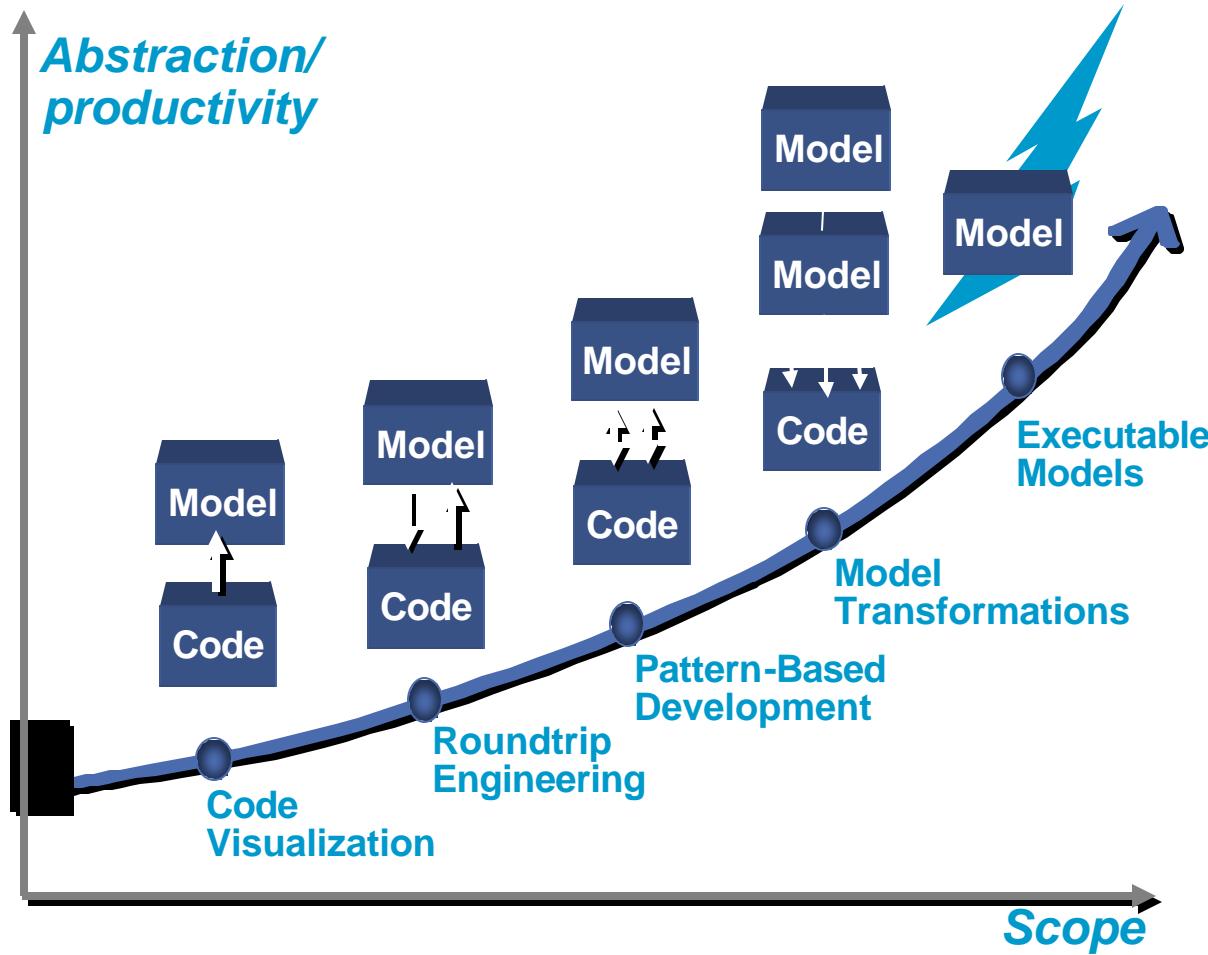


www.bptrends.com

Booch et al



Adopt The Right Modeling Paradigm For Your Needs



MDA Standards-

Supports multiple:

- ▶ Development languages
- ▶ Operating environments
- ▶ Skill levels
- ▶ Modeling paradigms
- ▶ Modeling Languages
 - ▶ General Purpose
 - ▶ Domain Specific
- ▶ Model & Metadata based

Open Standards: The Foundation of MDA

- Unified Modeling Language (UML)
 - ▶ For describing the problem domain and the solution architecture
- Meta Object Facility (MOF)
 - ▶ For describing and manipulating general or domain specific modeling and metadata languages
- XML Model Interchange (XMI)
 - ▶ For exchanging model information in XML format and generating XSD
- Common Warehouse Model (CWM)
 - ▶ For describing data mappings and database schemas
- Supported by UML profiles
 - ▶ For customizing UML to specific domains (e.g., J2EE, EAI, Real-time, Systems Engineering...)
- Technology and Industry Domain Specific Standards

Members of OMG are driving the core MDA standards

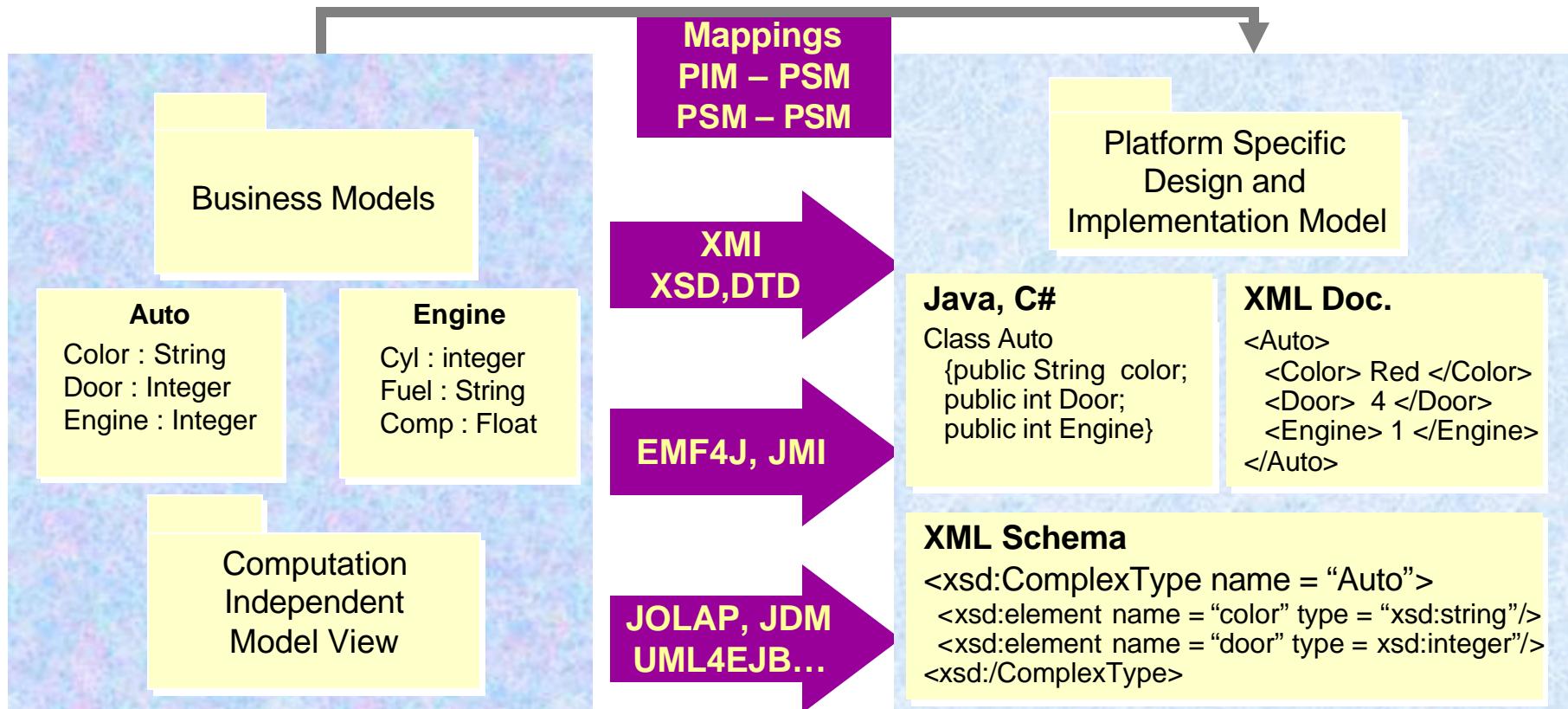
Members of Eclipse Foundation are driving pragmatic implementation of MDA

What Is MDA?

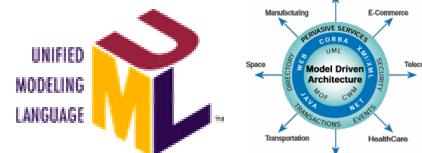
- Development through transformation of models using metadata
 - ▶ Usually refinement of more abstract models to more concrete models
 - ▶ Refinement can be incremental & iterative or a bulk transformation
- A process & philosophy for developing and integrating software
 - ▶ Rational XDE pattern transformation, Rational Rapid Developer and Rose Technical Developer for full code generation, and Rose's Extensibility Interface support MDA implementations
 - ▶ **Rational XDE MDA Toolkit available to implement MDA transformations as Eclipse plug-ins**
 - ▶ Eclipse EMF uses core MDA standards and concepts to enable model driven tool integration
- Models are defined in context of “Platforms”
 - ▶ Platforms are technology choices at some level; e.g., J2EE for middleware, SQL for data management etc.
- Transformations are usually between models - Platform Independent Model (PIM) to a Platform Specific Model (PSM)
- Can be between two PSMs (J2EE & .Net)



Model Transformations using OMG Model Driven Architecture (MDA)



Platform Independent Models (PIM)



Platform Specific Models (PSM)

Mappings to UDDI, WSDL, BPEL4WS in progress

MDA as an ‘Architectural Style’ for Model Driven Development & Integration

- Understand the problem domain (technology or business)
- Model the problem domain
 - ▶ Use UML for the visual modeling, analysis & design of the application
 - ▶ Use UML profiles & Domain Specific Metamodels/Languages as needed
 - ▶ Note: DSLs can be defined using UML, MOF, XSD, Java and transformed to MOF (See www.eclipse.org/emf)
- Formally represent the **models and metadata** using UML, MOF & XML
 - ▶ Simple class modeling is all you need to know
 - ▶ OCL (Object Constraint Language) can capture additional semantics
 - ▶ Reverse engineer existing DTD, XSD, XMI, Java to MOF (jump start)
- Use Standard transformation (**mappings & patterns**) for
 - ▶ Metadata Interchange (XMI – MOF to XML, DTD, XSD)
 - ▶ Metadata Interfaces (JMI – MOF to Java, EMF4J, MOF to WSDL etc.)
- Use open source modeling frameworks for **model integration and management**
 - ▶ Eclipse EMF : www.eclipse.org/emf , Eclipse UML : www.eclipse.org/uml2
 - ▶ Summary : Understand, Model, Map and Manage metadata to integrate



IBM Rational software - Model Driven Architecture® (MDA®) - Microsoft Internet Explorer

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Software > Rational > MDA Resource Center

Model Driven Architecture

Rational. software

All software products

Rational

- Trials and betas
- Literature
- Technical resources
- News
- How to buy
- Software support
- Success stories
- Services
- Training and certification

Related links:

- DB2 Information Management
- Lotus
- Tivoli
- WebSphere

Warranty info

IBM product support for MDA

IBM Rational has several products that support MDA®. These tools fall into two basic categories:

- Domain-specific – The tool supports specialized modeling and transformations for certain types of applications or software industries and includes a high degree of ready-made automation for those domains.
- General-purpose – The tool supports various styles of model-driven development and can be customized to support the MDA style of model definitions and transformations.

In the domain-specific category, [IBM Rational Rapid Developer](#) is a full implementation of the spirit of MDA. It allows developers to ignore many of the technical details involved in a scalable J2EE application, while focusing most of the development effort on the models at a higher level of abstraction. Rational Rapid Developer is most appropriate for customers who want to build scalable J2EE applications and their development staff has minimal J2EE technical background.

Product resources

- UML documentation
- Practice the UML
- UML thought leaders

Highlights

- See what's happening with the UML 2.0 effort
- Read what Grady Booch says in *.NET Magazine*
- Read the latest work from Terry Quatrani: *Introduction to the Unified Modeling Language*
- [Subscribe to the Rational developer news feed](#)

IBM and MDA

<http://www-306.ibm.com/software/rational/mda/index.html>

based design and development environment for embedded applications developed in C or C++. Rational Rose Technical Developer supports several of the new elements of the [UML 2.0 specification](#), including structured classes and

Communities

- Rational Developer Domain

<http://www-106.ibm.com/developerworks/rational/library/3100.html>

In the general purpose category, IBM offers [Rational Rose XDE Developer](#), which provides broad support for patterns-based development of distributed systems using the MDA approach.

→ IBM Business Partners

Internet

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The Eclipse Project

- Eclipse is an open extensible Universal Tooling Platform
- Now an Independent Eclipse Foundation (Feb 2004)
- Universal Tooling Platform has been open sourced:
 - Licensed via Common Public License
 - Managed via the Eclipse Project (www.eclipse.org)
- IBM contributed \$40M software/R&D as initial Eclipse technology
- Enables customers to develop, customize and integrate tools and repositories via open standards
 - Provides frameworks for tool builders to focus on tool development (not infrastructure)
- Initial consortium members include:
 - IBM, RedHat, SuSE, Rational, Merant, QNX, TogetherSoft, WebGain, and Borland

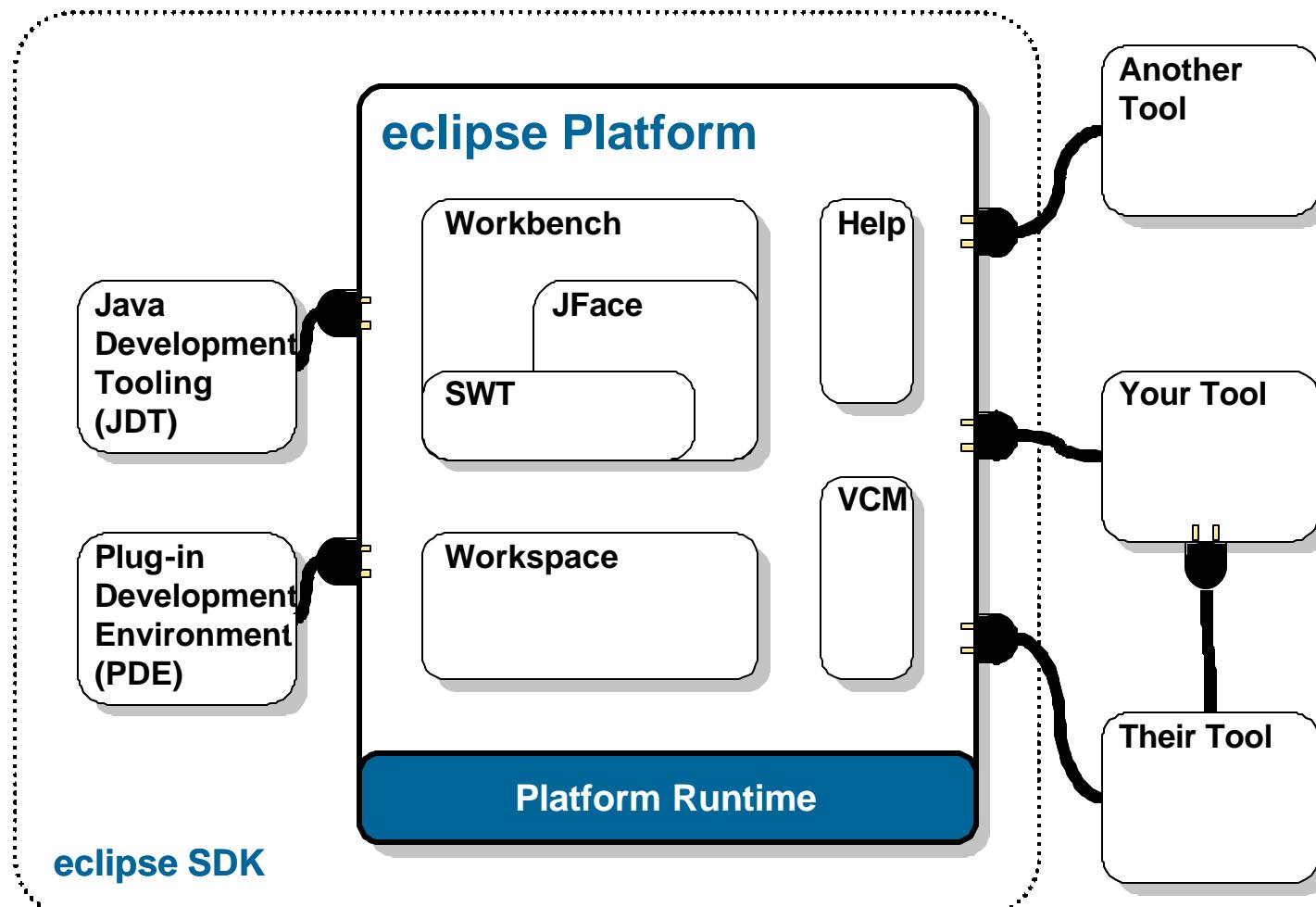


Eclipse: A Universal Platform for Development Tools.

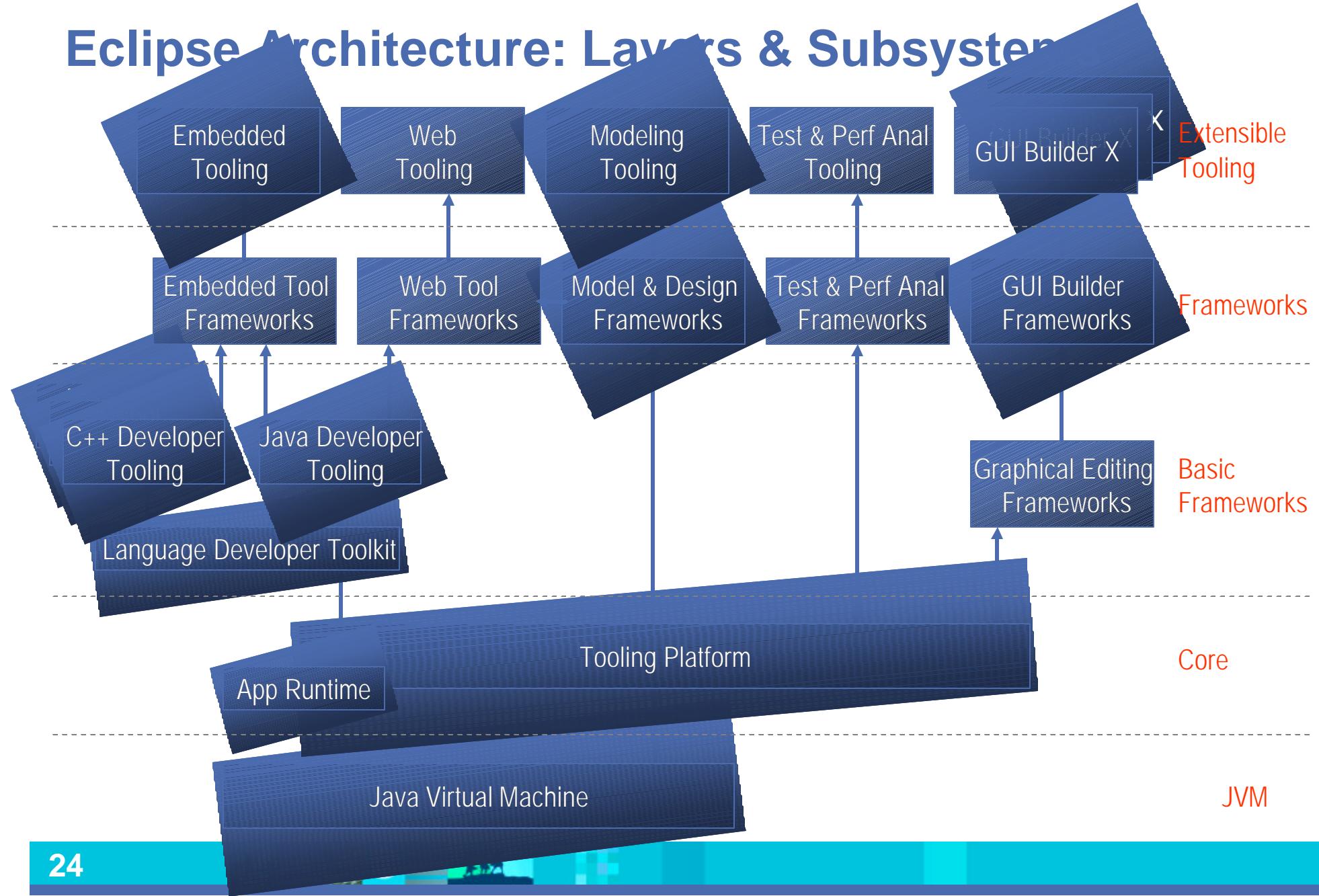
- Open, extensible architecture based on plug-ins
- Highly extensible by design
- Out-of-box functionality and quality to attract developers
- Endorsed by major tool vendors
- Open-source



Eclipse Structure



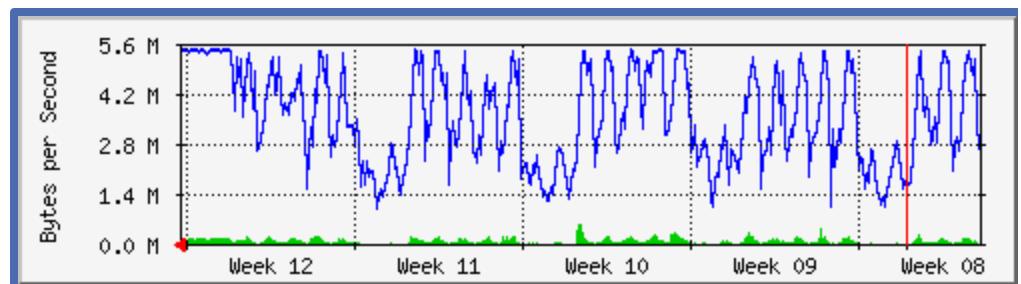
Eclipse Architecture: Layers & Subsystems



Lights Dimmed When Eclipse 2.1 Went Live

- Grassroots enthusiasm from developers
 - ▶ 18 Million downloads to date,
90 TB data*
 - ▶ T3 saturated for 60 hours
at 2.1 launch
- Expanding Vendor community
 - ▶ Over 175 vendors
 - ▶ 50 Eclipse Innovation Grants approved
- Plug-ins growing exponentially
 - ▶ C/C++ IDE plug-in for Linux underway
 - ▶ 395: eclipse-plugins.2y.net
 - ▶ 130: eclipse-workbench.com
 - ▶ 100+ : SourceForge.net
 - ▶ 28: freshmeat.net

Downloads
(Weekly Thirty Minute Average)



*The development
community is
embracing Eclipse!*



Who's on Board? – 49 Industry Leaders Join Forces

Metanology

**CNX**
Build a more reliable world

slickedit.

SYBASE

COLLABNET

codefarm™

teamstudio®

**Borland** QA SYSTEMS
The Software Health Company

M ERANT

 Scapa
Technologies

ORACLE

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FUJITSU THE POSSIBILITIES ARE INFINITE

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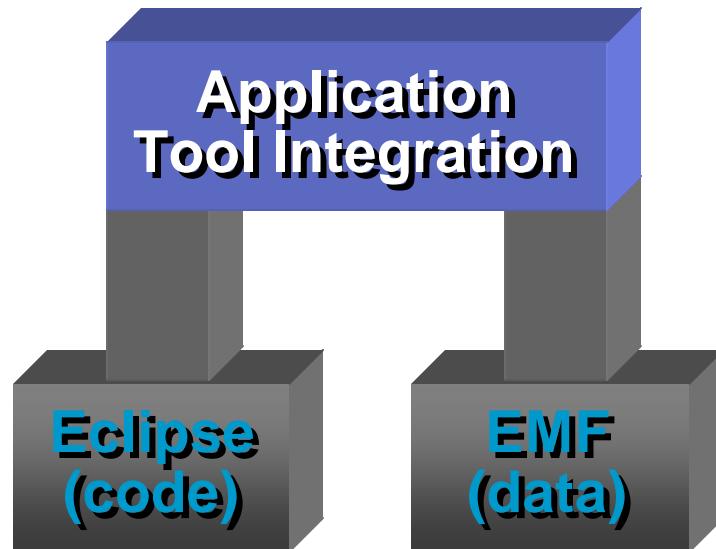
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Eclipse Modeling Framework

What is EMF?



- Supplies the **data integration** technology for Eclipse
 - ▶ Eclipse supplies **code integration**
- Transforms models into efficient, correct, and customizable Java code
 - ▶ The middle ground in the modeling vs. programming world
 - ▶ An infrastructure to use models effectively in code
- Open source project
 - ▶ EMF is free
 - ▶ Integrates UML, XML and Java

www.eclipse.org/emf



EMF Benefits

- The industry's leading platform for integrating tools based on common model & semantics
 - ▶ In addition to just common APIs and presentation (as in VS.Net)
 - ▶ Java interfaces, implementations as well as XML serialization & simple UI is automatically generated from the model
 - ▶ Simplifies development & more importantly integration of tools into a unified suite
 - ▶ Accelerates the move of Eclipse from Java tools platform to an application life cycle tools platform
- Bridges the gap between modeling and programming
 - ▶ From schema to model to eclipse tool with little programming
 - ▶ Works with Java, XML, UML
- Improved productivity, time to value for the Eclipse community in building a compelling integrated tool suite
- Implementation of OMG XMI2 and MOF2 (EMOF)



Eclipse Hyades Project

- Provides key integration points for cross vendor tooling, focusing on Automated Software Quality (ASQ) and Problem Determination
 - ▶ EMF based models for data integration across the domain
 - Test model based on UML2 Test Profile (base for the UML2TP workgroup)
 - Allows test design in a language and execution environment neutral way
 - Trace/profiling model for performance analysis
 - Statistical model for trend collection and analysis
 - Common Base Event logging model for generic log analysis and problem determination (base for Oasis proposal)
 - Symptom Database for CBE analysis and capturing autonomic response definitions
 - ▶ Open distributed execution and monitoring framework for runtime management and analysis
 - ▶ Extension points for UI integration across the domain
- Several offerings already do or plan to leverage subsets of the project so they can be extended by other vendors and offerings, as well as avoid writing common code.

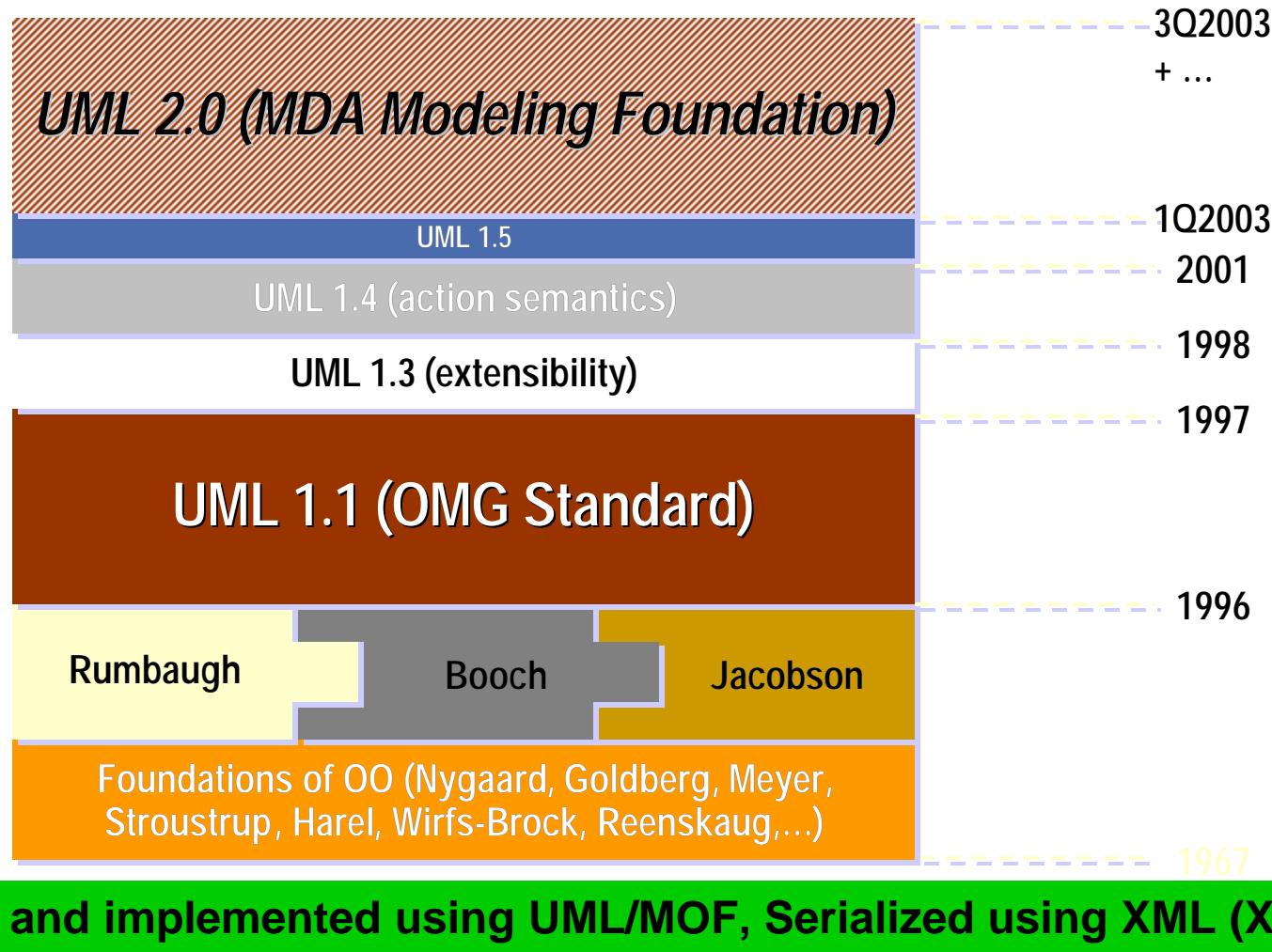


Eclipse UML2 Project

- Coupled with EMF provides a solid foundation for Model Driven Development and Integration
- UML tools
 - ▶ Tools that exploit specific UML Profiles
 - ▶ The Metamodel, XML Interchange (XMI) and Java APIs (EMF Java Interfaces) are available for download at www.eclipse.org/uml2
 - Several vendors (IBM included) are building development, design and integration tools using this foundation
- Foundation for Domain Specific Modeling Solutions and Frameworks
- Will implement (and is influencing) the results of UML2 standardization efforts at OMG

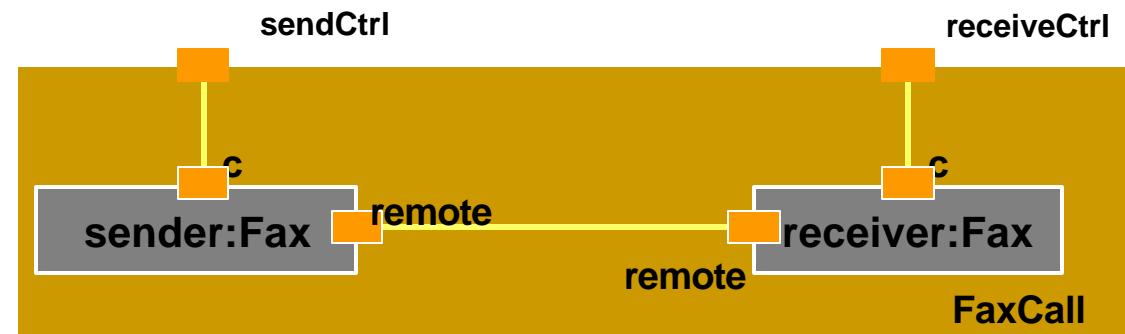


UML: The Modeling Foundation of MDA



UML 2.0: Reusability and Scalability

- Most significant release since the original standard
- Addresses scalable development
- A major enhancement in UML2 is Structured Classes
 - Structuring concepts come from IBM Rational Rose RealTime
- Modular
- Improved support for Business Modeling, Components and SOA
- UML 2.0 FTF to complete Sep 2004



IBM's implementation : Rose/XDE (UML 1.4), www.eclipse.org/uml (UML2)

New in Eclipse 3.0 – Mid 2004

- A new look and feel
 - ▶ Not just for IDEs anymore!
- Rich Client Support
 - ▶ Equinox project
- OSGi runtime & more
- The momentum continues to grow
- Previewed at EclipseCon2004 : 600+ attendees
- Download at www.eclipse.org (milestone 8)

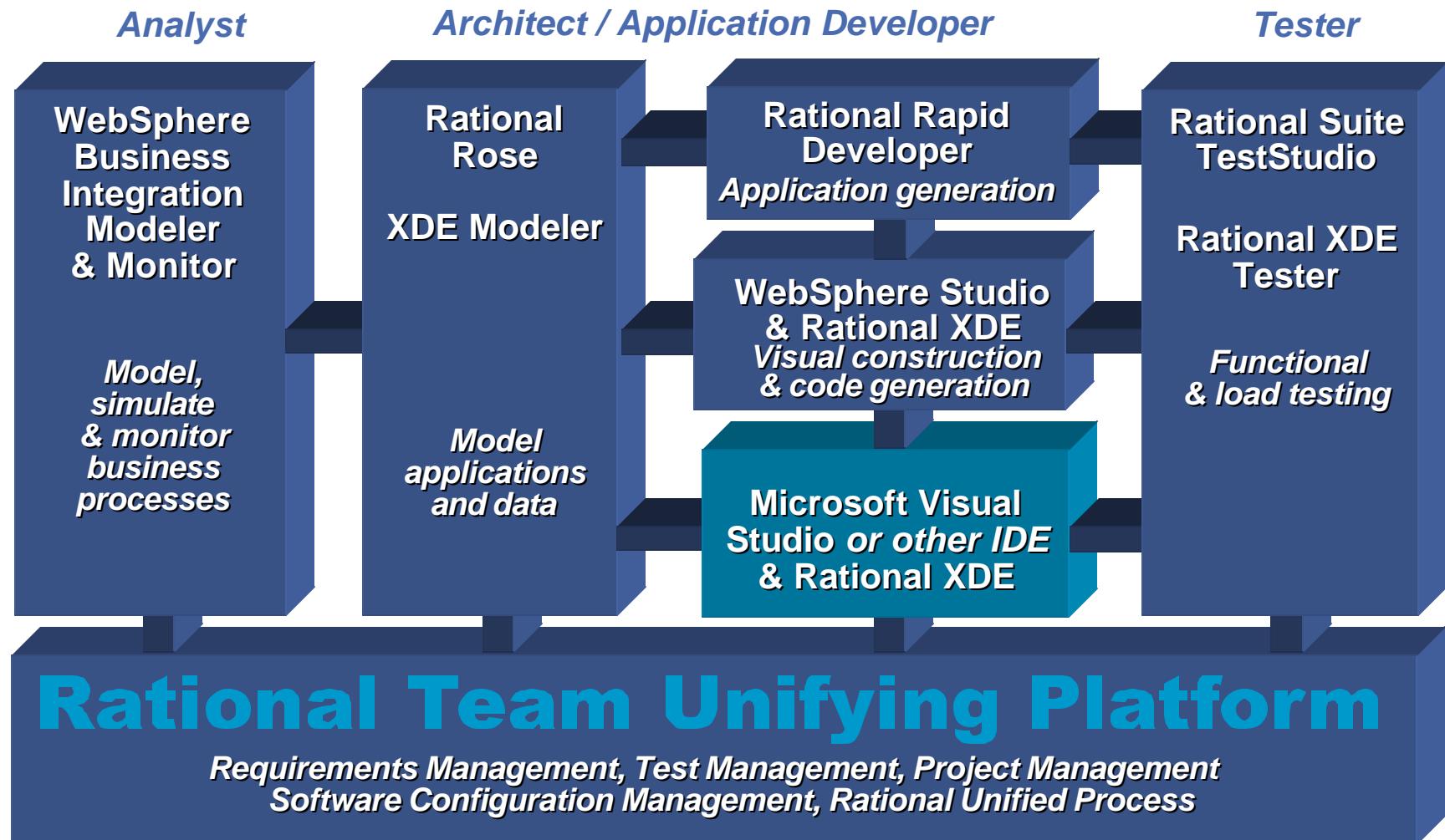


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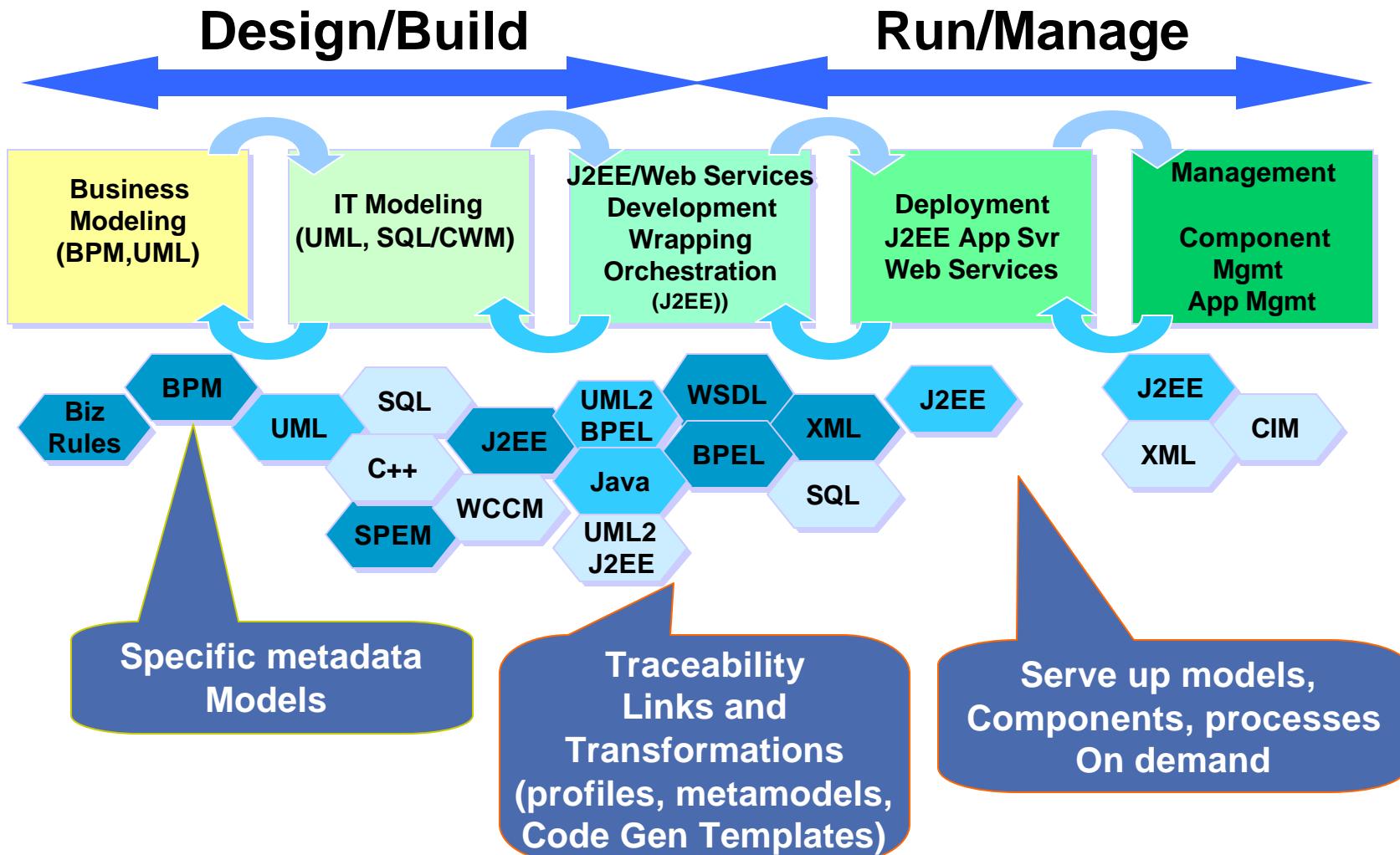
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 - ▶ IBM Software Development Platform example



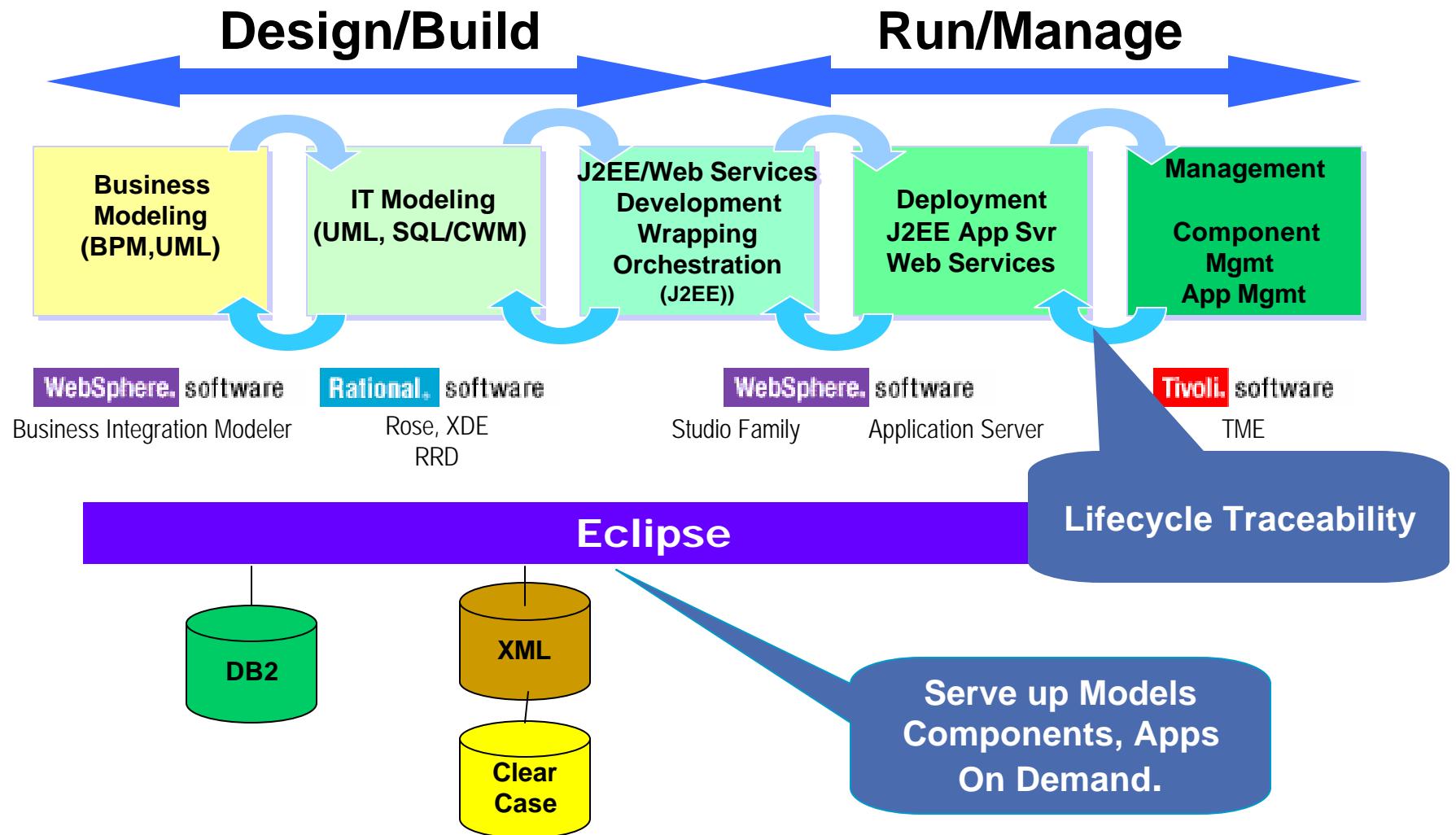
Today's IBM Software Development Solution



Model Driven Business Integration: Managed Models

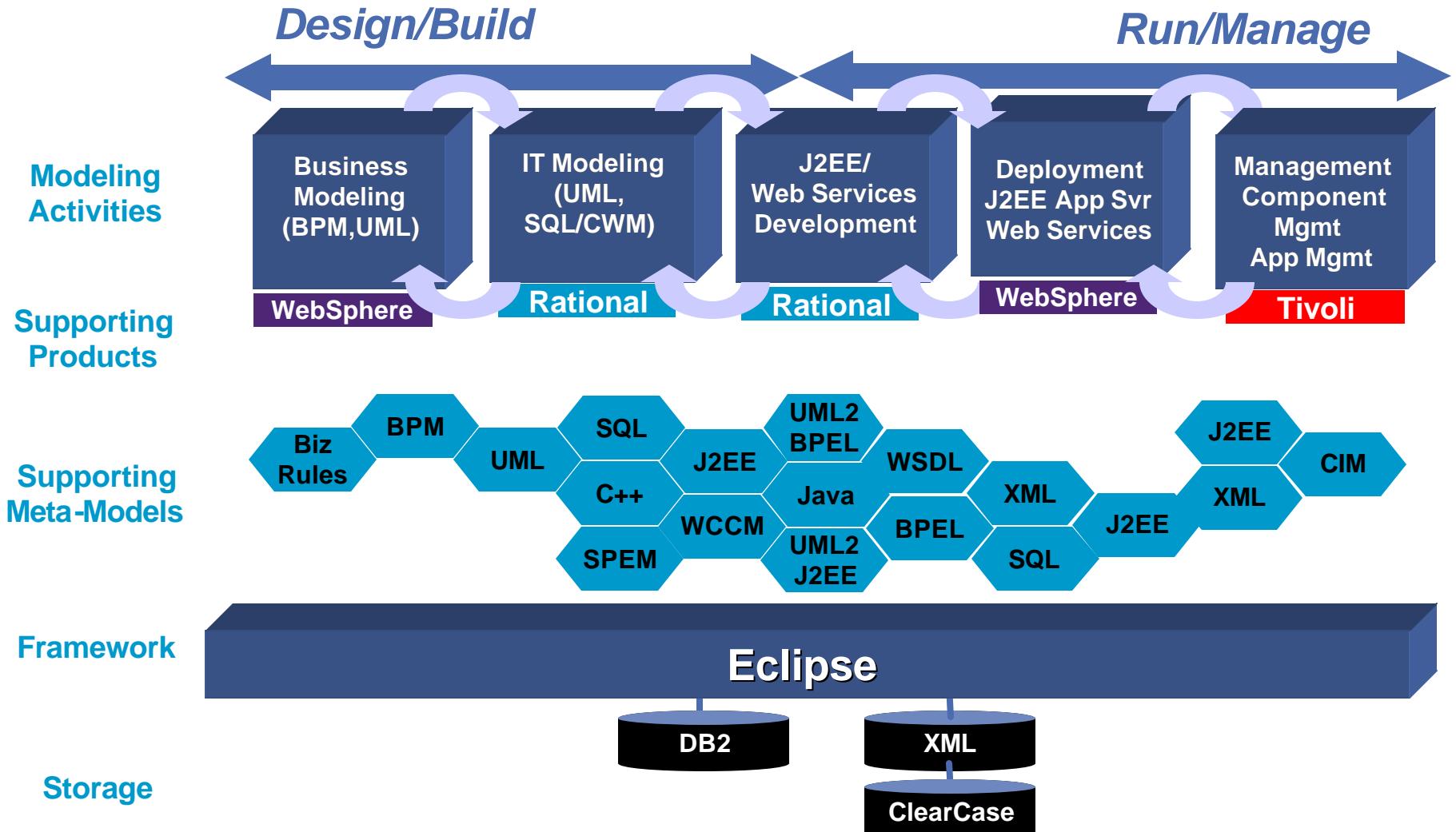


Model Driven Business Integration: Full Lifecycle



Model Driven Business Integration

Bridging the gap between business, IT, and operations teams



Eclipse MDD Platform Evolves

Open Source

Vendor Value Add

Language Tooling
(J2EE, Web Services,
Deployment)

**Diagrams &
Visualization**

MDD Core
(Code Generation,
Pattern Engine)

Content
(Pattern
Templates)

Common Service (Reporting, etc...)

Model Services (UML2 ext, other Meta-Models, Code Gen APIs, ...)

Hyades

J2EE, WS* UML2 Models

CM, Merge, Traceability....

GEF

EMF

JDT/CDT

Team

Eclipse Core

Team Unifying Platform (Portal, App Server, Database, Collaboration)



Evolving the IBM Software Development Platform



Business Architect

Business process and information modeling



IT Architect

Application logic and data modeling, Pattern creation



Developer

*Traditional
Corporate
J2EE, DB2
.Net
Technical*



Tester

Functional and load testing

Eclipse Platform, EMF (UML, J2EE, Web Services...) models
(Integration with Team Unifying Platform)

Team Unifying Platform

*Requirements Management, Test Management, Change Management Software
Configuration Management, Rational Unified Process
Integrate with WebSphere Portal, DB2 and Lotus WorkPlace*



Modeling Languages, Metamodels and DSLs

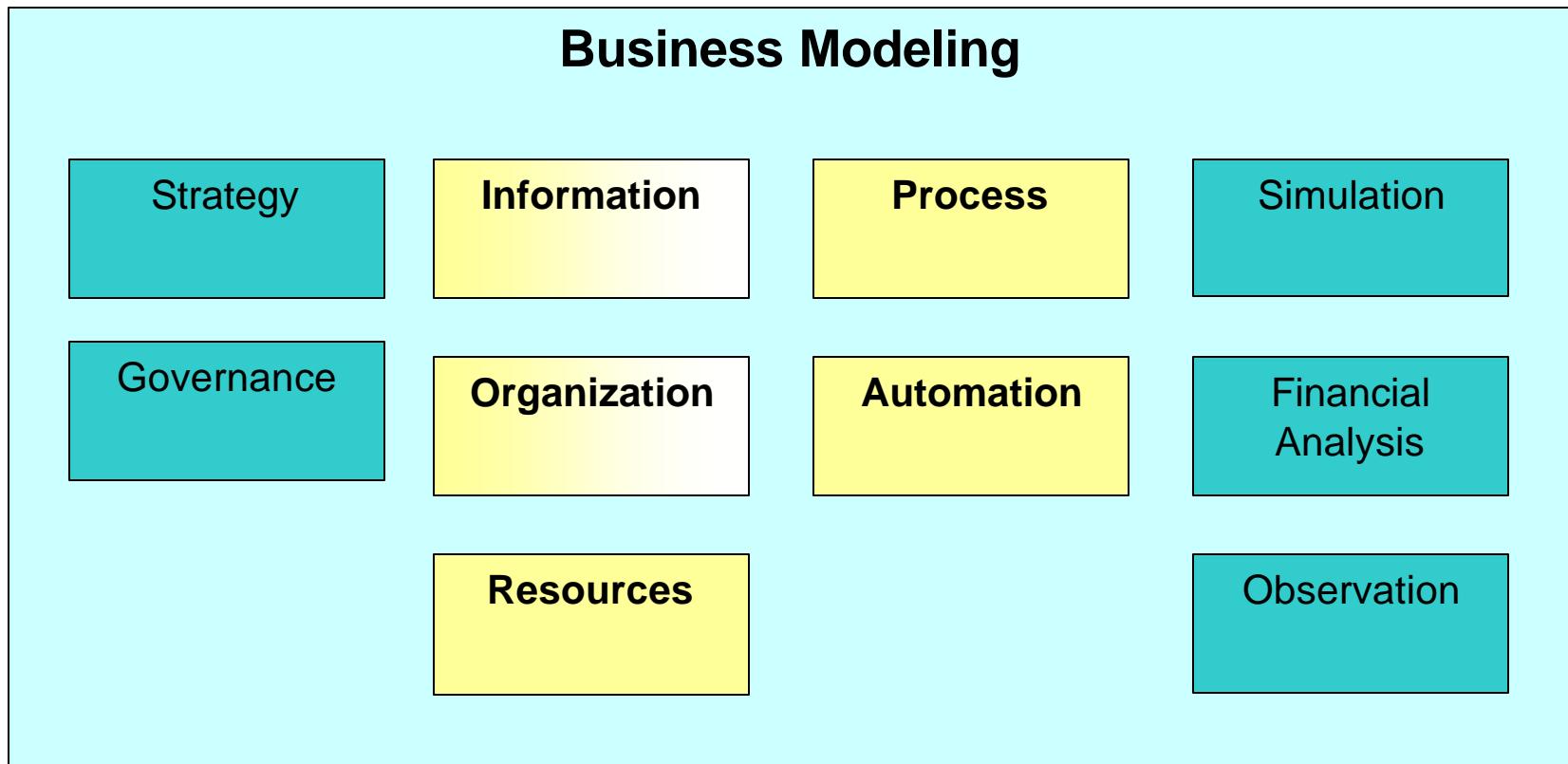
- Both general purpose modeling languages (UML), programming languages (Java, C++, ...) as well as custom languages (for scripting) for industry specific domains (life sciences, systems engineering, software radio...) continue to evolve
 - ▶ Recent increase in interest on Domain Specific Languages (DSLs) using purpose built XML Schemas
 - Problem : How do you use these schemas together and integrate them when integration across domains is needed
 - ▶ We recommend the use of UML Profiles and MOF to build DSLs.
 - Where the domain is close to the modeling concepts in UML, use a UML profile
 - Where the domains are diverse and need integration using MOF to define a domain specific Metamodel
 - Can be bootstrapped from UML models, XML Schemas, Annotated Java, XMI etc
 - Define and manage the metadata needed for model transformations
 - Advantage of starting from a UML model – much richer set of modeling constructs for structural and behavioral modeling
- The modeling artifacts and related metadata are the lasting intellectual capital – protect and manage it (RAS)



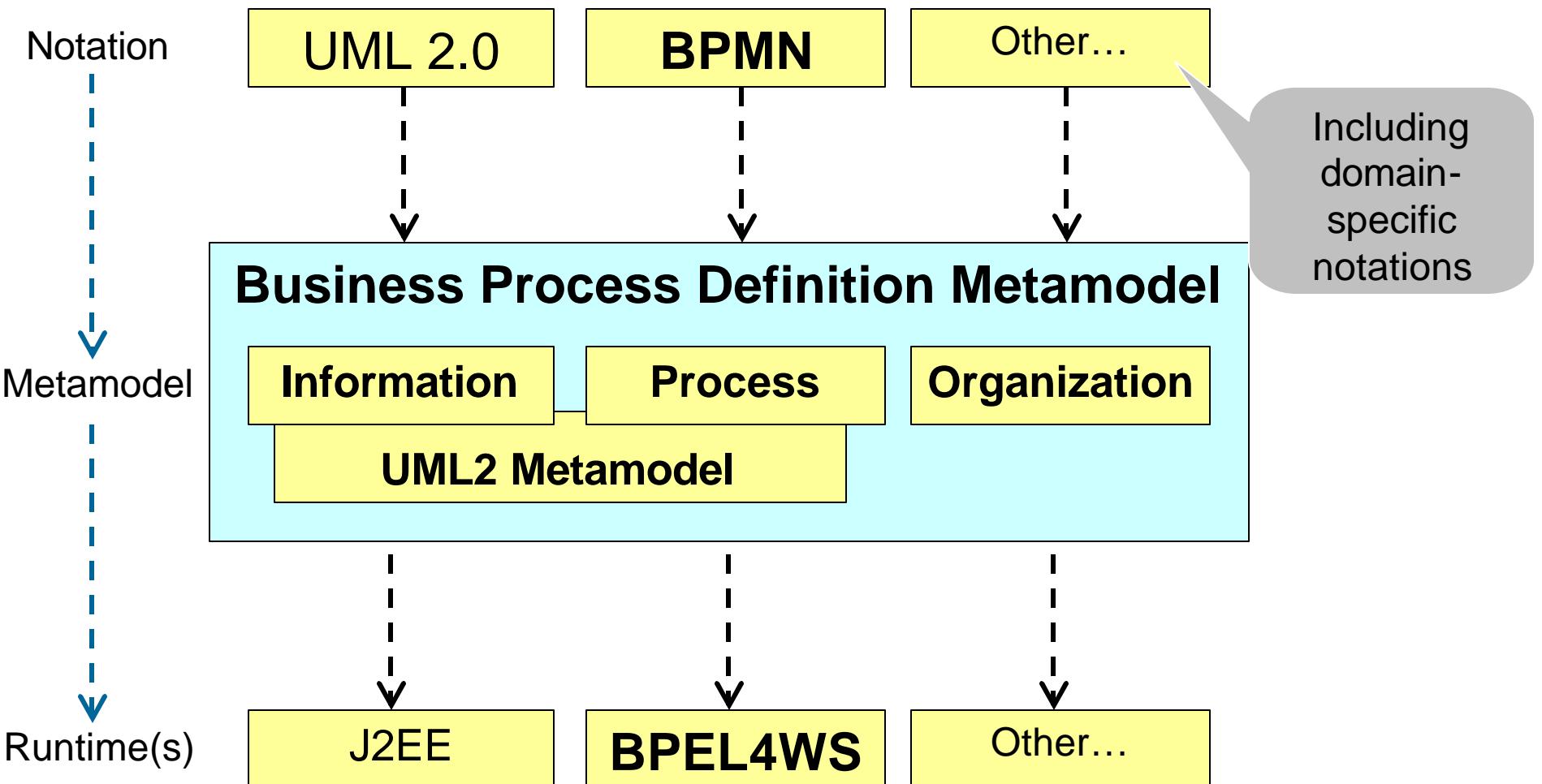
How are Metamodels (some call these DSLs!) defined and implemented now?

Terminology	MDA Representation	IBM Implementation using Eclipse
Notation	UML, Custom (See BPD for example : BPMN or UML Notation for process models)	UML or Custom depending on domain (text, graphical... use GEF for JSF- Graphical Editing Framework to build up)
Concepts	UML Profiles, MOF Metamodels (with XML serialization)	EMF models (J2EE, Web Services, UML...)
Well Formedness Rules	OCL, BSBR (Business Rules)	Simple constraints in EMF, rest in Java implementation
Serialization Formats	XML (based on XMI for Metamodel) or as defined by W3C, OASIS...	XML (based on XMI for Metamodel) or as defined by W3C, OASIS...
Interactive Behavior	UML Behavioral models, Custom MOF models	UML Behavioral models, Custom MOF models
Mapping & Transforms	MOF Q/V/T (coming) Custom profiles, generators	EMF mapping framework, Custom profiles, generators using JET, Velocity...
Tools for tool implementors	Implementations of MOF, UML, XMI	www.eclipse.org : Eclipse core, EMF, GEF, XSD, CDT, JDT, UML....

Business Modeling Context : Example Domain Specific Metamodels in development (in IBM)



MDA Spec proposal with multiple notations, multiple target platform mappings (BPD spec : IBM, BEA, Borland...)



IBM Rational software - Model Driven Architecture® (MDA®) - Microsoft Internet Explorer

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Model Driven Architecture

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- News
- How to buy
- Software support
- Success stories
- Services
- Training and certification

Related links:

- DB2 Information Management
- Lotus
- Tivoli
- WebSphere

Warranty info

IBM product support for MDA

IBM Rational has several products that support MDA®. These tools fall into two basic categories:

- Domain-specific – The tool supports specialized modeling and transformations for certain types of applications or software industries and includes a high degree of ready-made automation for those domains.
- General-purpose – The tool supports various styles of model-driven development and can be customized to support the MDA style of model definitions and transformations.

In the domain-specific category, [IBM Rational Rapid Developer](#) is a full implementation of the spirit of MDA. It allows developers to ignore many of the technical details involved in a scalable J2EE application, while focusing most of the development effort on the models at a higher level of abstraction. Rational Rapid Developer is most appropriate for customers who want to build scalable J2EE applications and their development staff has minimal J2EE technical background.

Product resources

- UML documentation
- Practice the UML
- UML thought leaders

Highlights

- See what's happening with the UML 2.0 effort
- Read what Grady Booch says in *.NET Magazine*
- Read the latest work from Terry Quatrani: *Introduction to the Unified Modeling Language*
- Get involved in the Rational User Group

IBM and MDA

<http://www-306.ibm.com/software/rational/mda/index.html>

based design and development environment for embedded applications developed in C or C++. Rational Rose Technical Developer supports several of the new elements of the [UML 2.0 specification](#), including structured classes and

Communities

- Rational Developer Domain

<http://www-106.ibm.com/developerworks/rational/library/3100.html>

In the general purpose category, IBM offers [Rational Rose XDE Developer](#), which provides broad support for patterns-based development. Rational Rose XDE Developer is a general-purpose

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Summary

- A unique integration of open standards (MDA, Web Services and J2EE) & open source (Eclipse, Linux, Apache) is well underway
- MDA is moving from a set of ideas and standards to reality as vendors implement, validate and improve standards
 - ▶ Work in progress
- MDA, J2EE and Web Services Standards are being implemented in the IBM Software Development Platform
- Use a combination of general purpose modeling languages and Domain specific modeling languages (built using UML profiles and MOF metamodels) for integrating across the application lifecycle
 - ▶ Serialization is usually an XML language (can also be SQL, Java...)
- IBM and members of OMG as well as eclipse.org are pragmatically integrating modeling, middleware, web services and metadata technologies
 - ▶ Come join the party
- The software development platform is evolving as a core business process that supports businesses
 - ▶ Built using open standards and open source



Who's on Board? – 49 Industry Leaders Join Forces

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