IBM Rational

RSD Extensibility with consideration of UML Debug and Trace

Steven R. Shaw

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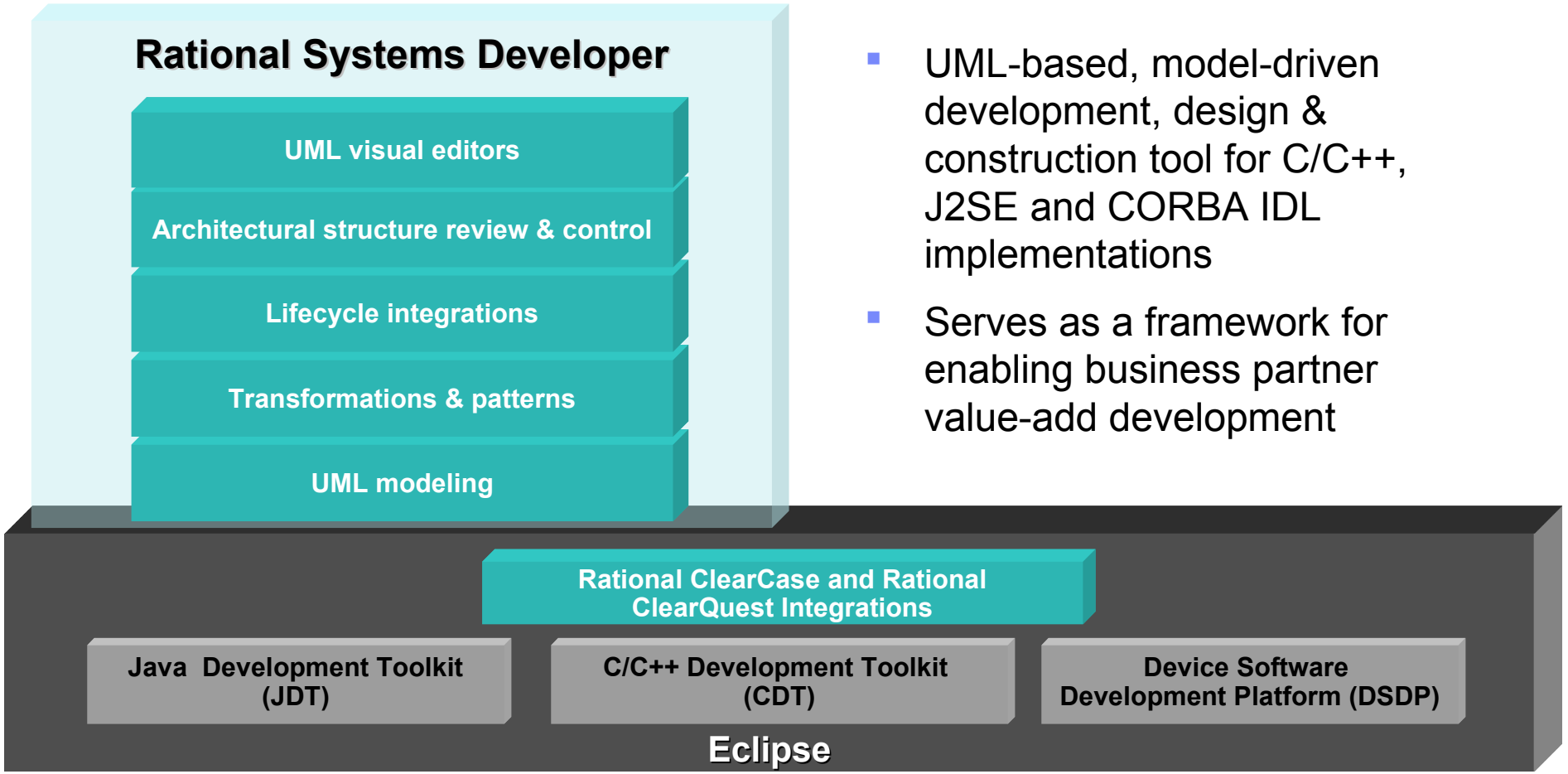
Agenda

- **RSD Tooling Introduction**
- **RSD Architecture**
- **Extensibility API**
  - EMF
  - UML2
  - GEF
  - GMF
  - Modeler (RSM / RSD)
- **Example plug-ins (Walk-through)**

IBM Rational Systems Developer v7.0.5

Leveraging the Eclipse platform…
to provide a complete lifecycle solution for systems development



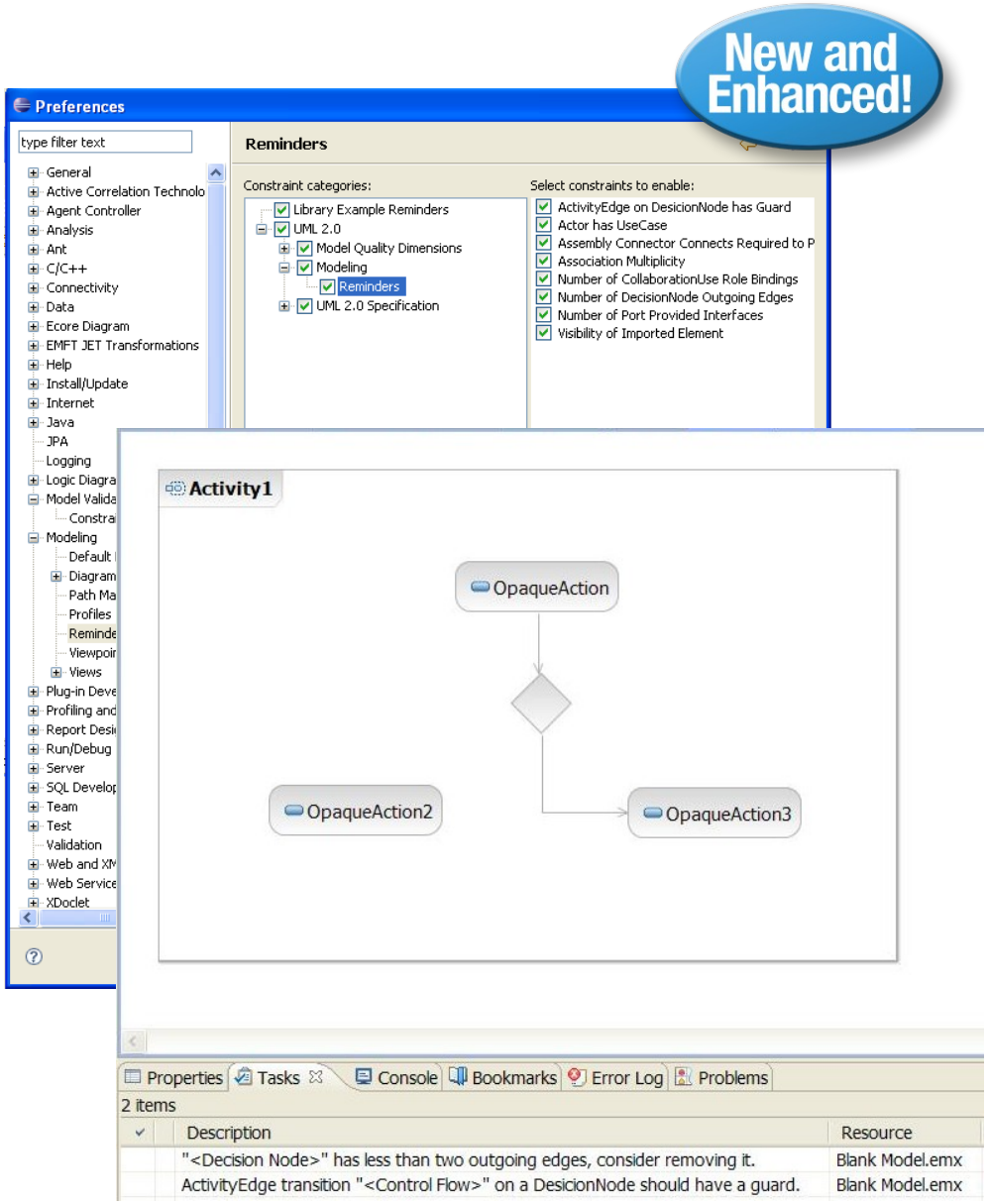
- UML-based, model-driven development, design & construction tool for C/C++, J2SE and CORBA IDL implementations
- Serves as a framework for enabling business partner value-add development

Solution: Extensibility

- Open application program interface (API) to support customizing and extending the modeling environment
- UML profile creation and editing to customize the properties stored in UML models
  - Allows organizations to develop plug-ins and customize the analysis and design tools for their environment and process. Supports the creation of an ecosystem allowing vendors to develop integrations.
- Comprehensive extensibility infrastructure for creating specialized extensions to the product
  - Leverages Open Source API and frameworks (UML 2.1, EMF, GEF)
  - Extension points for UI, menu, layout, command management, query
  - Extensions created in Java using Eclipse plug-ins
  - “Pluglet” support for lightweight scripting using Java
  - Provides User assistance using wizards and samples

Solution: Extensibility

- New reminders framework
  - Built on EMFT Validation Framework, and Model Indexing.
  - Reminders integrate into Tasks View
  - Reminders are always live, keep the user informed about the missing items (best practices, incomplete model) in the model.
- New queries framework
  - Contribute to Explore Palette using System Queries
  - Creation Executors for custom query types
  - Create or reuse result presenters for custom query types
- New model analysis and metrics framework
- APIs for customizing/consuming the model compare-merge framework
- OCL Integration



RSD Architecture

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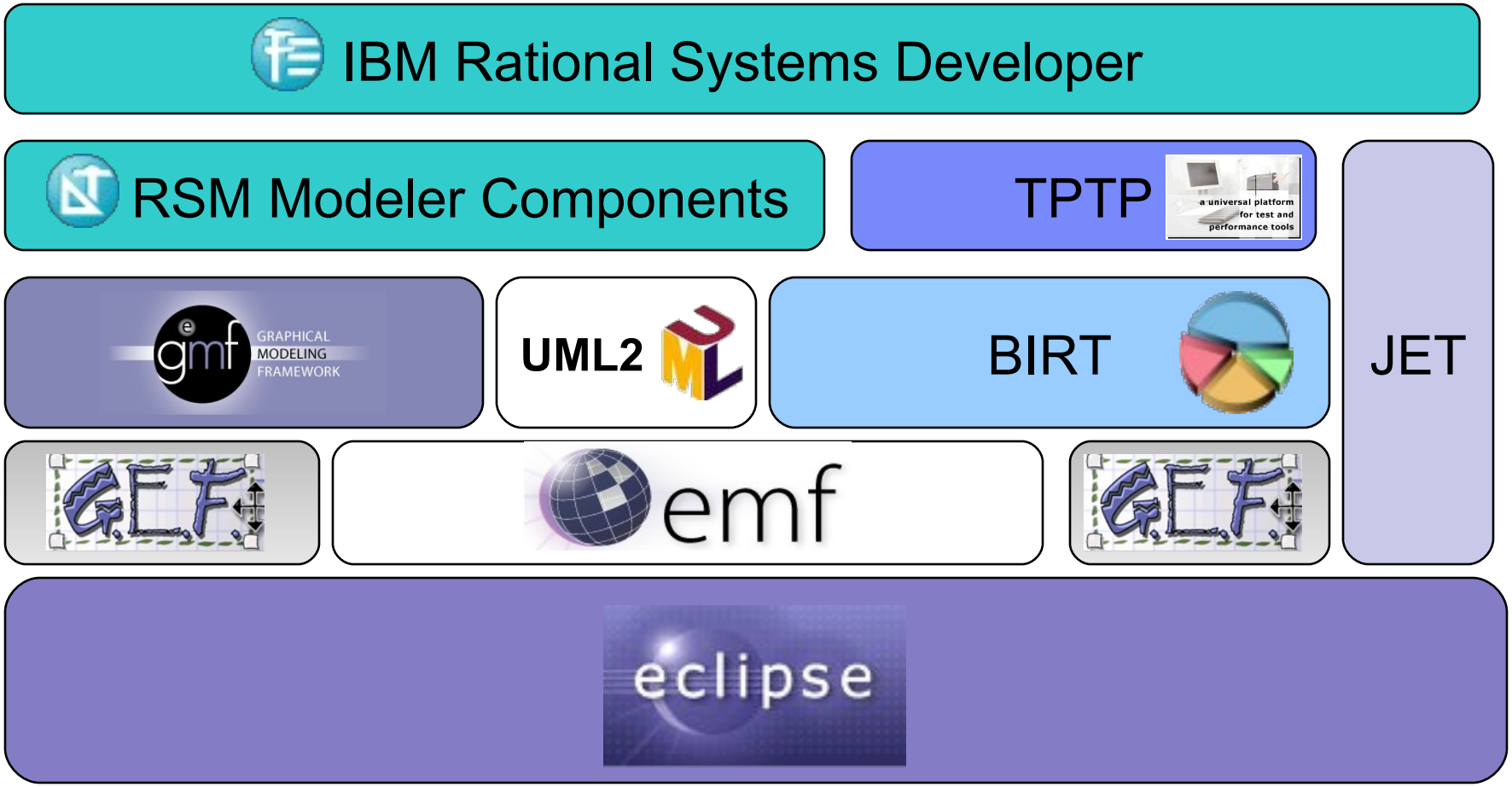
based application.
  - Java / XML foundation allowing multi-platform support
    - i.e. Linux (Redhat / SUSE), Solaris 10, Win32, Vista
  - Allows for vertical or horizontal deployment (individual client vs. shell sharing)
  - Open source components – transparent development of core. Based on open standards, OMG specifications. 3rd party integrations
  - OSGI plug-in architecture – allow for strict versioning, update capability and on-demand loading for enterprise scalability.

RSD Architecture – Open Source Components

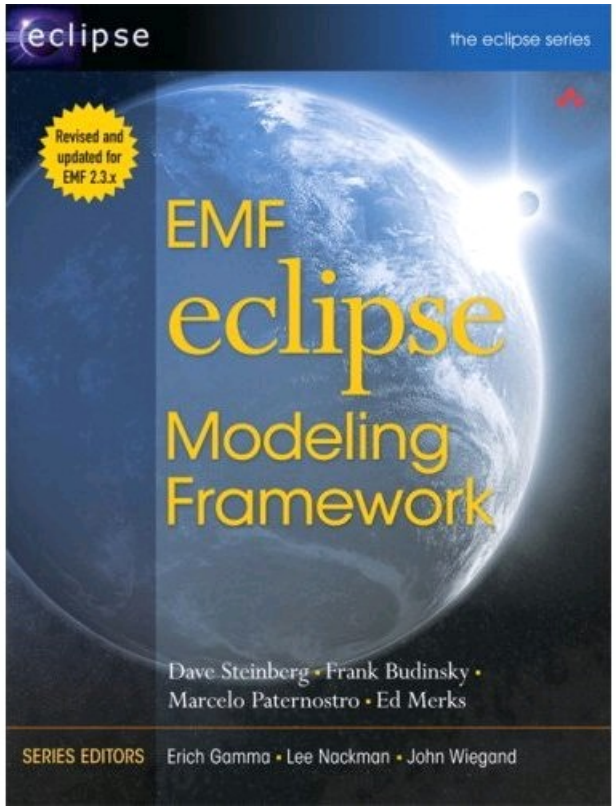
- **RSD is built on a foundation of open source components.**
  - Eclipse platform / SWT / JFace
    - http://www.eclipse.org/platform/
  - GEF (Graphical Editing Framework)
    - http://www.eclipse.org/gef/
  - EMF (Eclipse Modeling Framework)
    - http://www.eclipse.org/modeling/emf/
  - GMF (Graphical Modeling Framework)
    - http://www.eclipse.org/gmf/
  - UML2 (UML meta-model)
    - http://www.eclipse.org/modeling/mdt/?project=uml2
  - Others
    - JET (Transformation Framework)
    - BIRT (Reporting Framework)
    - TPTP (Test and Performance)

RSD Architecture – Dependency Block diagram



Extensibility API – EMF

- **org.eclipse.emf.***
  - Data management: Persistence mechanism using XML, Robust editing, generative capabilties
  - Whole books have been written on EMF extensibility!
  - In a nutshell: domain semantics are defined using a meta-meta-model ECore. This is generated into a set of interfaces and corresponding implementation classes. Interfaces are public. A Factory class is used to instantiate the implementation and an interface is returned.
  - EPackage class define constants
  - Other useful utility classes - EcoreUtil

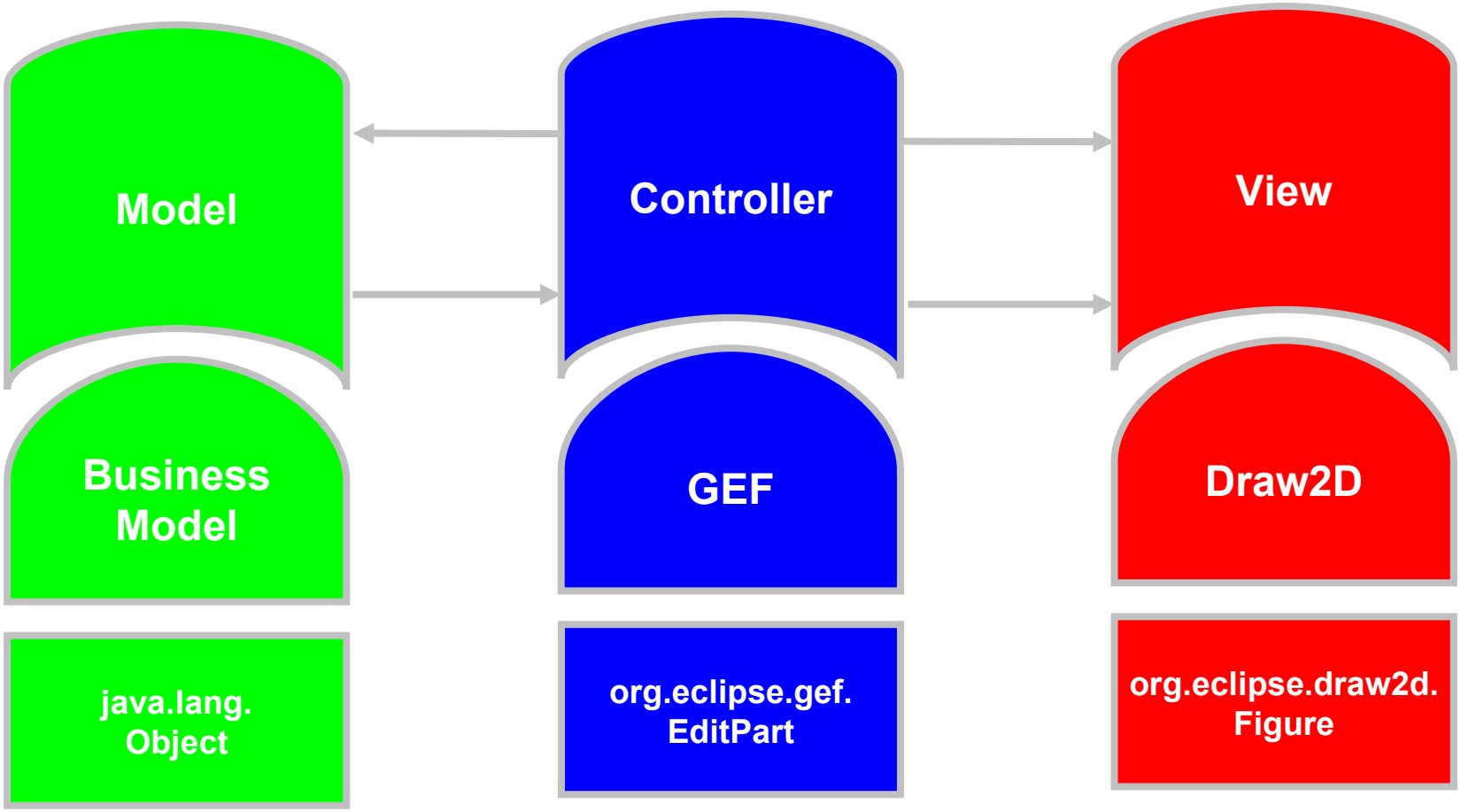


Extensibility API – UML2

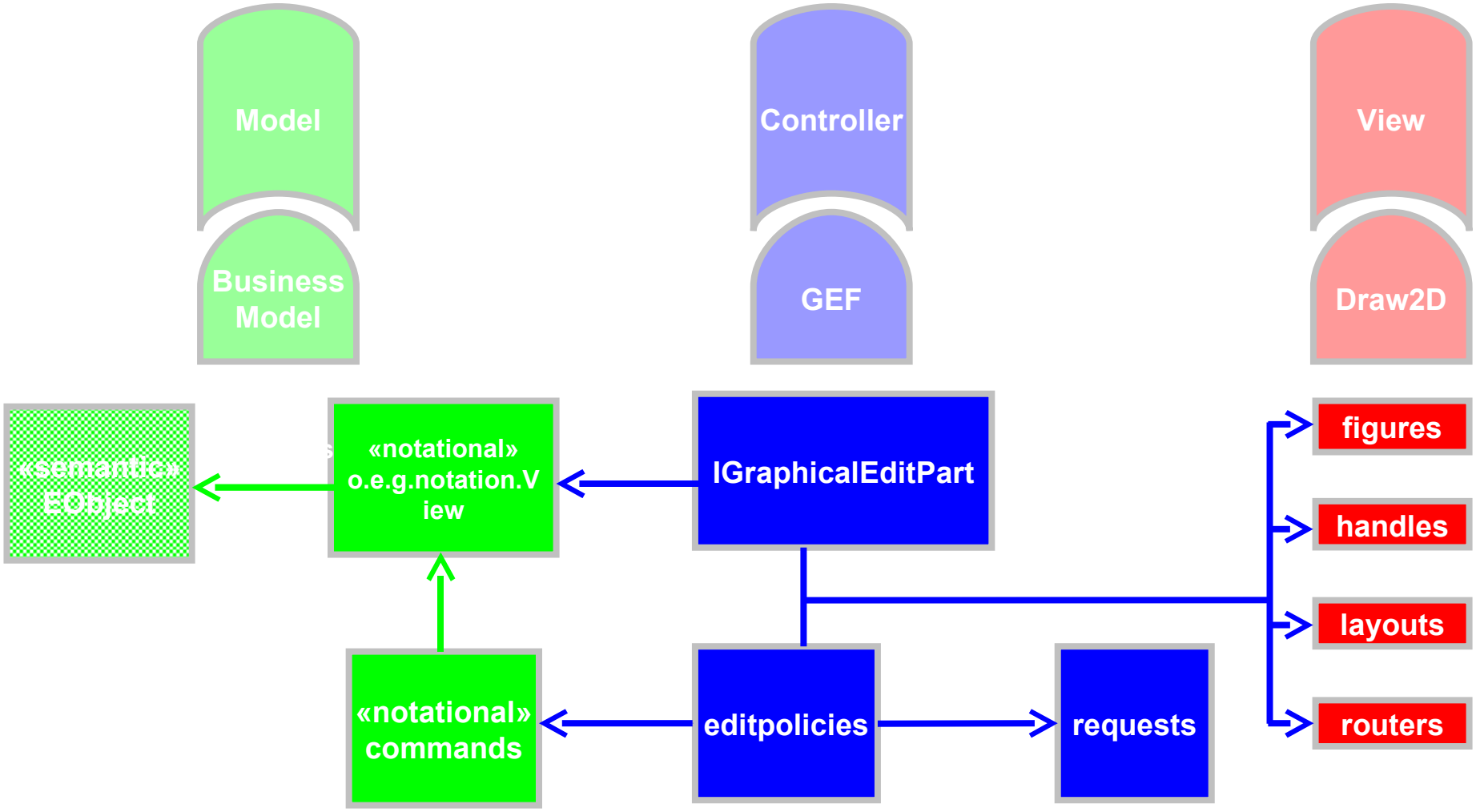
- **org.eclipse.uml2.uml.***
  - UML2 meta-model is generated using EMF.
  - Set of interfaces with utility methods for creation
  - UMLPackage
    - EClass constants
    - StructuralFeature constants
  - UMLUtil – more advanced function for package merge etc.

Overview of GEF (Graphical Editing Framework)

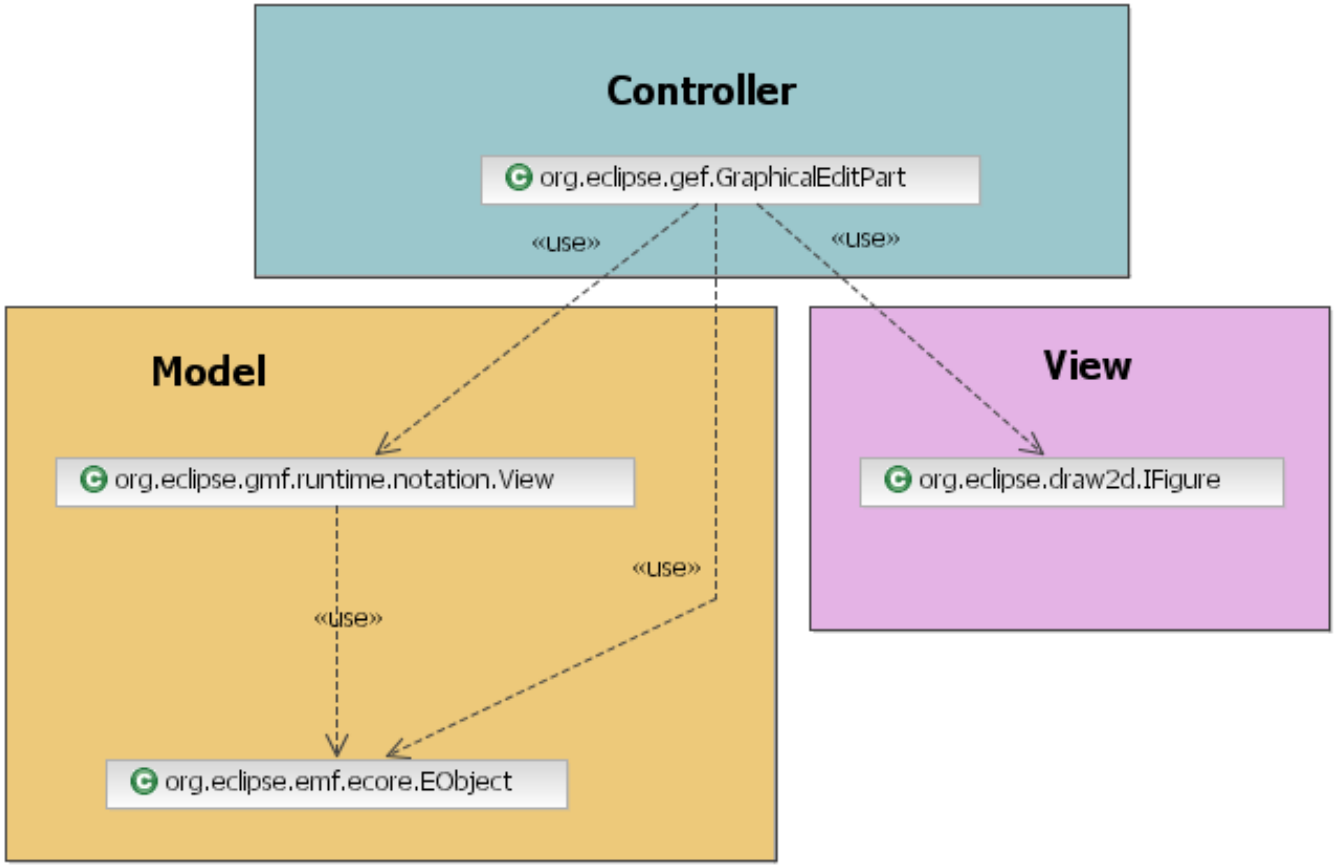
- **Model – View – Controller Architecture**



GMF (Graphical Modeling Framework) Diagram Architecture



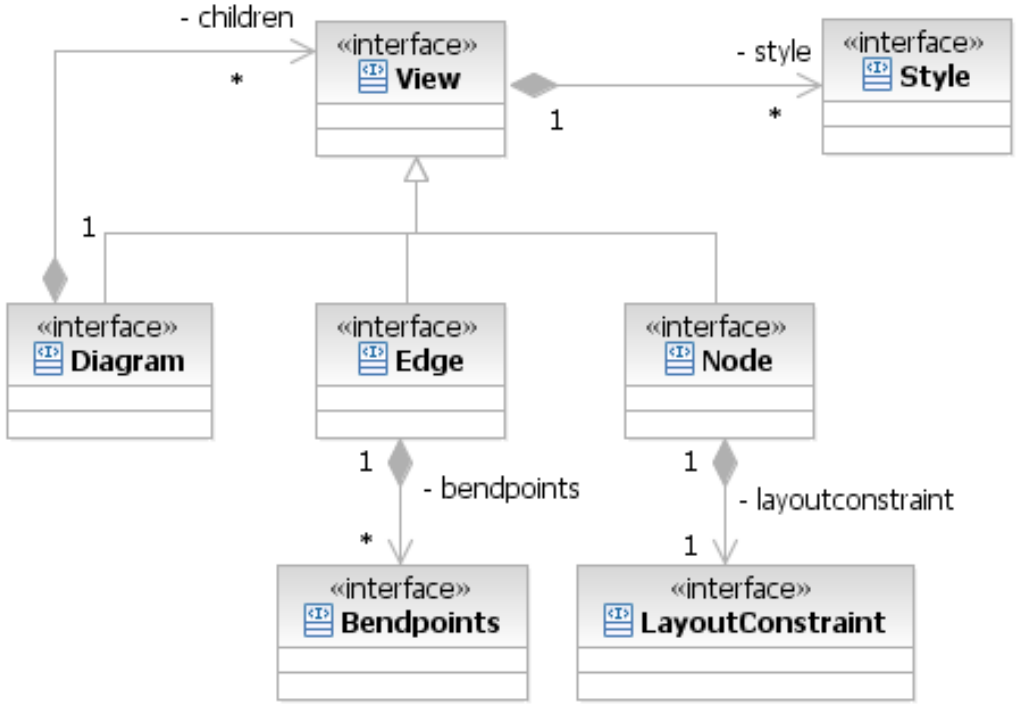
GMF Diagram runtime dependency diagram



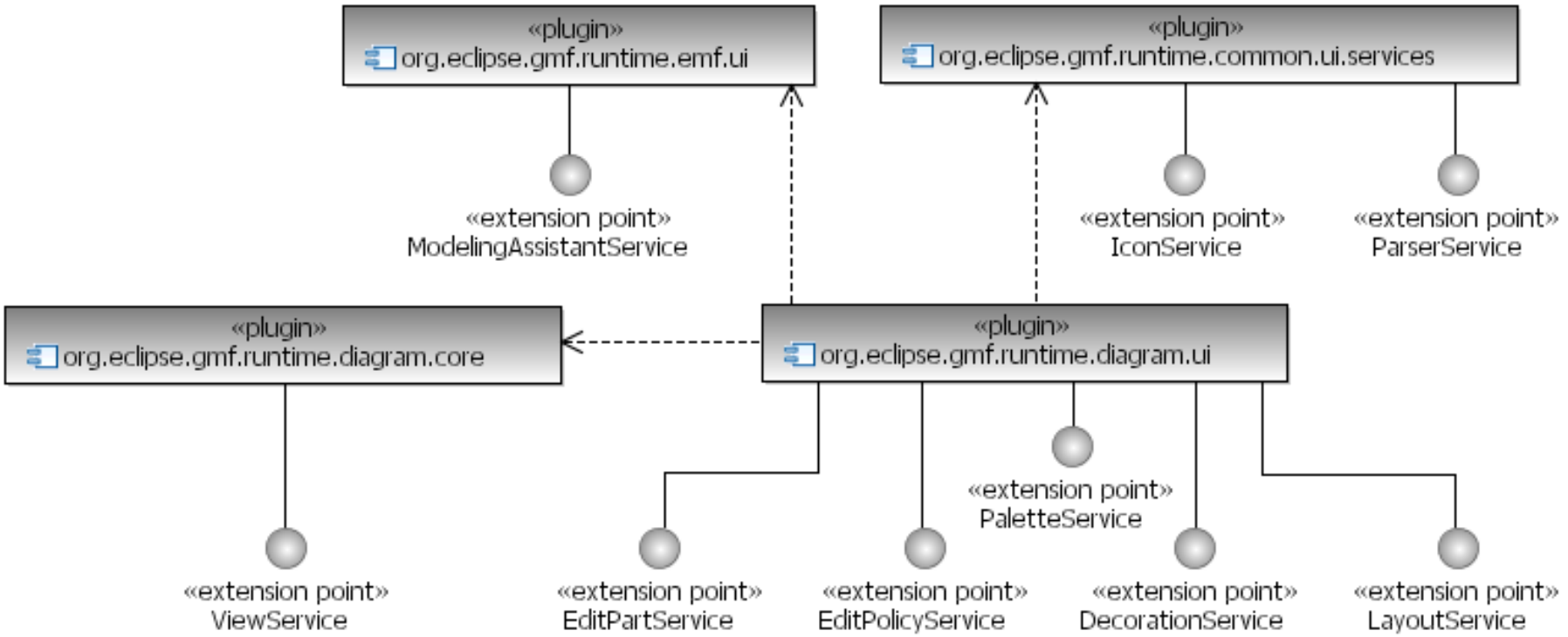
GMF Notation meta-model

- **org.eclipse.gmf.runtime.notation.***

- **Separate meta-model from semantic model (UML2). Allows for separation of concerns. Can target different semantic models.**
- **Common utilities:**
  - ViewUtil



Services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ViewService
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EditPartService
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EditPolicyService
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DecorationService
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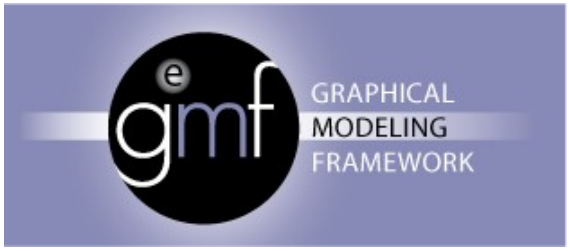
LayoutService

Services



- **IconService: retrieve an icon based on an element type**
- **ParserService: retrieve a parser for an element type**
- **ModelingAssistantService: diagram assistant for a diagram**
- **ViewService: retrieve view factory to construct view**
- **EditPartService: gets the controller for a given view**
- **EditPolicyService: allows installation of an editpolicy on existing editparts**
- **PaletteService: definition and customization of palette drawers**
- **DecorationService: decoration of a EditParts with adornments.**
- **LayoutService: layout / arrange a diagram**

Extensibility API – Modeler (RSM / RSD)

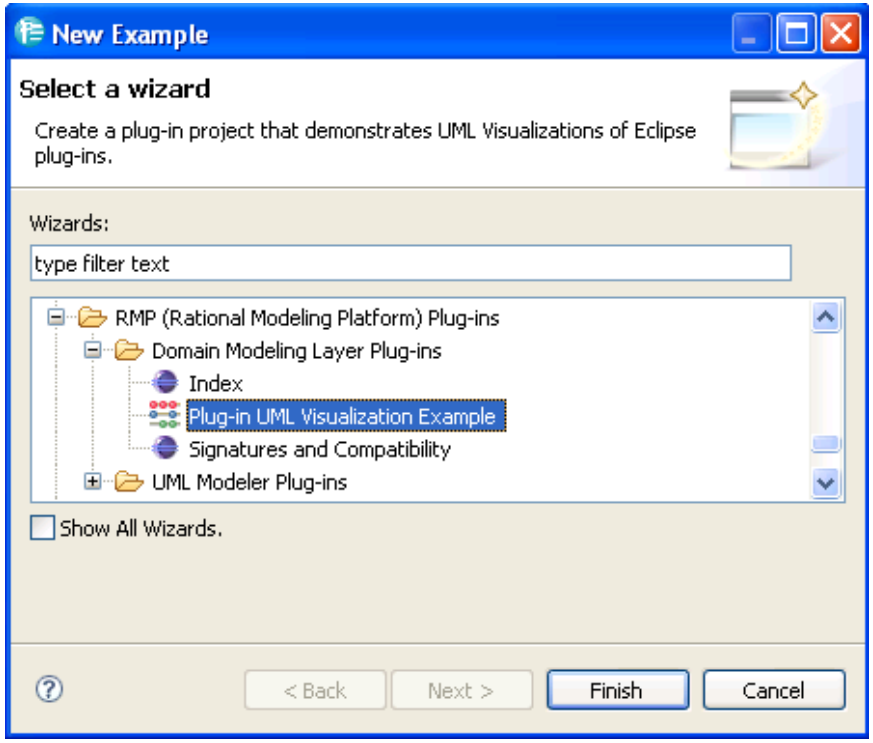
- **com.ibm.xtools.modeler.ui.UMLModeler**
  - Main static entry point for model creation, save and open.
  - Sub helper interfaces
    - IUMLHelper – search methods
    - IUMLDiagramHelper – diagram, notation element creation / layout
    - IQueryHelper – EMF query API
    - IOclQueryHelper – OCL query API

Examples: plug-in walk-through

- **Parsing Trace Data**
  - Assumption: some trace data exists in some proprietary format. The trace information describes some behavior of the system that occurred during period of time.
  - Requirement: we want to visualize the trace information as a UML diagram (either Activity or Sequence / Interaction diagrams).
- **Decorating Diagrams**
  - Assumption: some diagrams exist that have representation / traceability into a runtime system.
  - Requirement: need to decorate elements in the diagram that are being traced
- **Animating Diagrams**
  - Assumption: trace execution can be played back or data can be retrieved during runtime
  - Requirement: diagram that corresponds semantically to the trace execution (activity / state / interaction etc.) will animate / highlight the elements showing the flow of execution.

Example: Parsing Trace Data

1. **Visualize the trace data directly.**
   - Data is in proprietary format – need to provide a mapping of that data to UML. There is an example plug-in in RSD that demonstrates how to do this →
   - Allows data files to be opened and visualized in UML format.



Example: Parsing Trace Data

1. **Generate a domain specific editor using the GMF generative framework.**
   - Assumes trace data is persisted using an EMF meta-model.
   - Can work well for “class diagram-like” domain visualizations.
     - End user not as concerned with UML compatibility
   - Possible to use Model-to-Model transformation framework in RSD to persist to UML model.
   - Compatible with RSD – allows co-visualization of domain specific models with UML.

Example: Parsing Trace Data

1. Trace data is persisted in UML format already
   - Programmatically create UML semantics by parsing trace data.
   - Extensibility will allow creation of diagram and “canonically” create diagram views.

   - Example → com.ibm.xtools.mdsdp.example.trace
     - Command handler – generates trace data (simulating trace execution data capture).
     - Diagram is created for semantic data and layout is invoked


WinZip File

Example: Decorating Diagrams

- **com.ibm.xtools.mdsdp.example.decorate**
  - Utilizes the Decoration service. A decorator provider is registered (through xml)
  - Provider (TraceDecoratorProvider) “provides” for specific semantic elements (OpaqueAction)
  - Decorator displays symbol on shape. (TraceDecorator)
  - Decorator listens for semantic changes to determine where symbol should be displayed or not.

Example: Animating Diagrams

- **com.ibm.xtools.mdsdp.example.animate**
  - Action is registered through objectContribution to start the trace animation from a certain element (OpaqueAction)
  - From the semantic element (model), the corresponding IGraphicalEditPart (controller) is found. From the editpart, the IFigure (view) is used to change the color of the foreground color temporarily.
  - Semantic object is used to navigate to next element through the ActivityFlow.

IBM Rational Partner Program

- **No requirements to extend RSD**
- **Partner program provides web-site publication and extensibility validation**
  - IBM PartnerWorld
    - http://www-304.ibm.com/jct09002c/isv/rational/readyfor.html

Challenges

- **Extensibility**
  - Generic Open source vs. Modeler API. When to use each?
- **Trace:**
  - Data capture in EMF is expensive. Trace data could overwhelm the system.
    - Realistically a conversion process from optimized trace format to EMF is a prerequisite before visualization.
    - Drinking from a fire hose! What aspect of trace data should be visualized as UML.
- **Animation:**
  - Realtime animation is not practical since state changes can occur much faster then humans can process the visual data.
    - More practical for trace playback.

End