IBM Rational Software Development Conference

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WHERE TEAMS ARE R-HEROES

Model Management in Team con IBM Rational Software Architect

Mariangela Orme
Solution Architect - IBM Rational Services
morme@it.ibm.com

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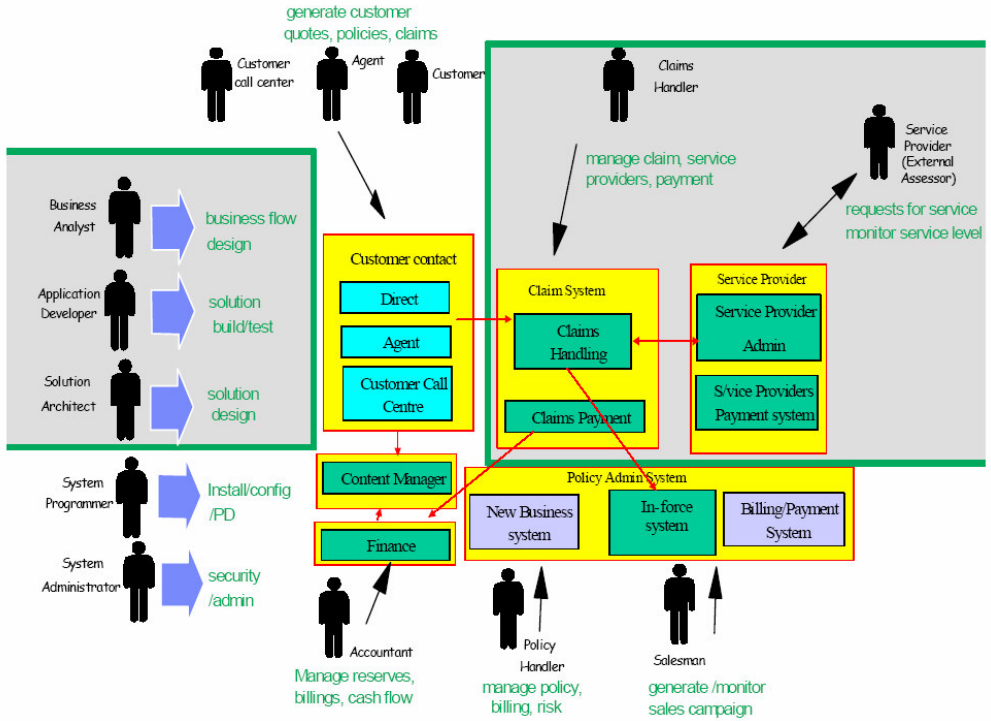
Agenda

- Introduction
- Team Development
- Model Driven Development
- Enterprise Model Management and Partitioning

Why Model?

- Ever-increasing complexity of operational environments
  - C/C++, Java, .Net
  - Web, Handhelds, disconnected
  - Legacy integration, modernizing
- Ever-expanding choices of development solutions
  - Programming Languages, scripting Languages
  - IDE's, testing tools
- Ever-changing nature of software projects
  - Globally development teams
  - Outsourcing
  - Compliance and Regulations



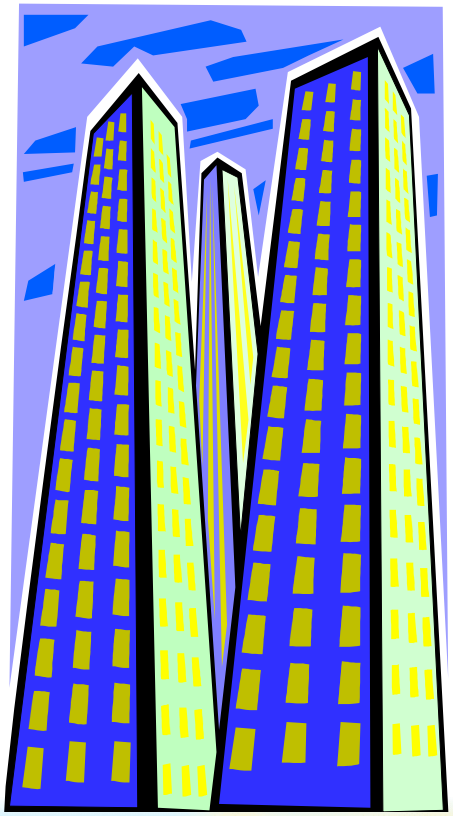
More Layers
More Servers
More Frameworks
More "Moving Parts"

Complexity

Must I Model?

- Modeling is the standard approach in engineering to
  - Manage Complexity
  - Mitigate Risk
- Software development is the same as every other engineering discipline in this respect

Maybe you *must*



Maybe you should

Maybe you shouldn't

Why Manage your Models?

- Models are key corporate assets
  - *They must be stored safely and reliably.*
  - *Every important baseline must be accessible throughout the derived product's legally mandated maintenance period.*
- Models are constructed in teams, with each modeler working in parallel
  - *Model integrity must be maintained when parallel versions collide upon check-in.*

What is Merging?

- For this discussion:
  - **Merge** will mean 3-way merging to resolve parallel versions of a model when the second and all subsequent versions are checked into a repository
    - This operation is automatically invoked by all supported repositories
    - Merge uses the identity of objects to align them for comparison
    - **"Compare with …"** commands within the Eclipse environment use a variation of merge
  - **Fusion** will mean 2-way structural merging to compare two models and capture structural differences from a source model into a target model
    - This operation can be performed ad hoc, by invoking the *combine models* command
    - Or it can be automatically invoked at the end of a code to model transformation
    - Fusion uses the name of an element and its path (list of container names) to align elements for comparison

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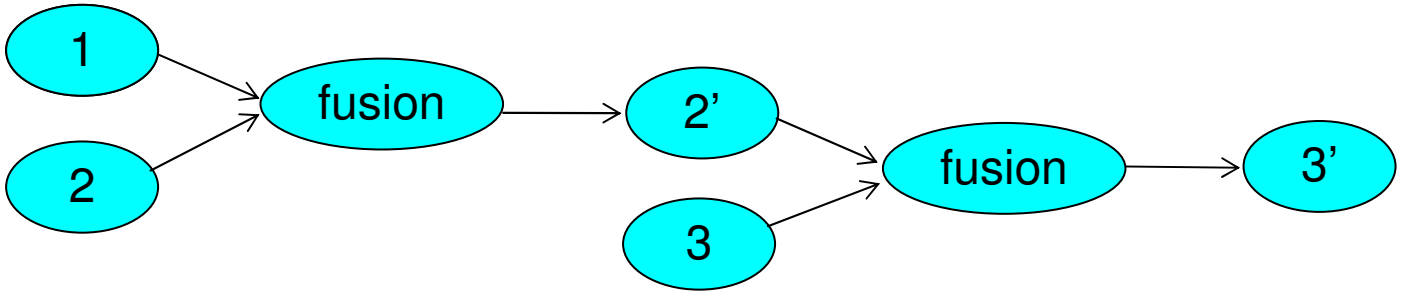
What is Team Development?

- Modelers generally work in parallel on a common set of artifacts
- Manual coordination impedes the smooth flow of changes, so automatic coordination for parallel development is extremely desirable
- RSA directly supports team development through ClearCase, Team Concert and CVS with fully automatic coordination of parallel development
- RSA also supports ad-hoc modeling during the transition to more formal team development practices

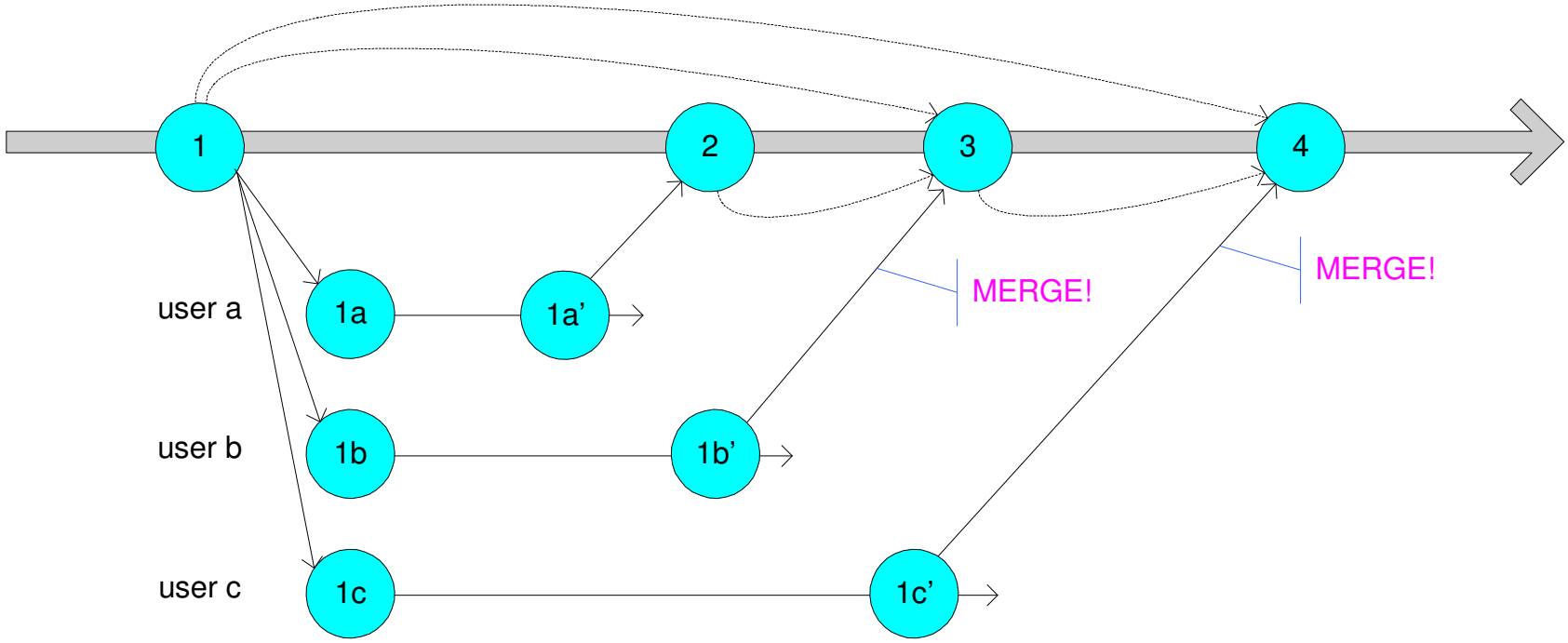
What is Ad Hoc Modeling?

- During the early stages of a project, it is common for several modelers to create similar models with common objects
- Chief characteristics are:
  - the lack of any formal version control;
  - models that were created independently;
  - models that *do not* share ancestry (although copying models to seed other modelers is also supported)



What is Formal Version Control?

- ClearCase, Team Concert and CVS automatically detect the need for a merge!
- Typical behavior in mature projects



Supported Team (SCM) Repositories

- ClearCase
  - Pessimistic locking, must checkout each artifact
  - Can check out all artifacts
  - Runs unconnected with automated hijacking
  - When reconnected, ClearCase will checkout those files that have been hijacked
- CVS
  - Optimistic locking
  - File changes are seen at synchronization time
- Rational Team Concert
  - Optimistic locking
  - File changes are noted in real time or when polled
  - Integrated collaboration tools
  - Integrated work item management
  - Integrated process and work flow management

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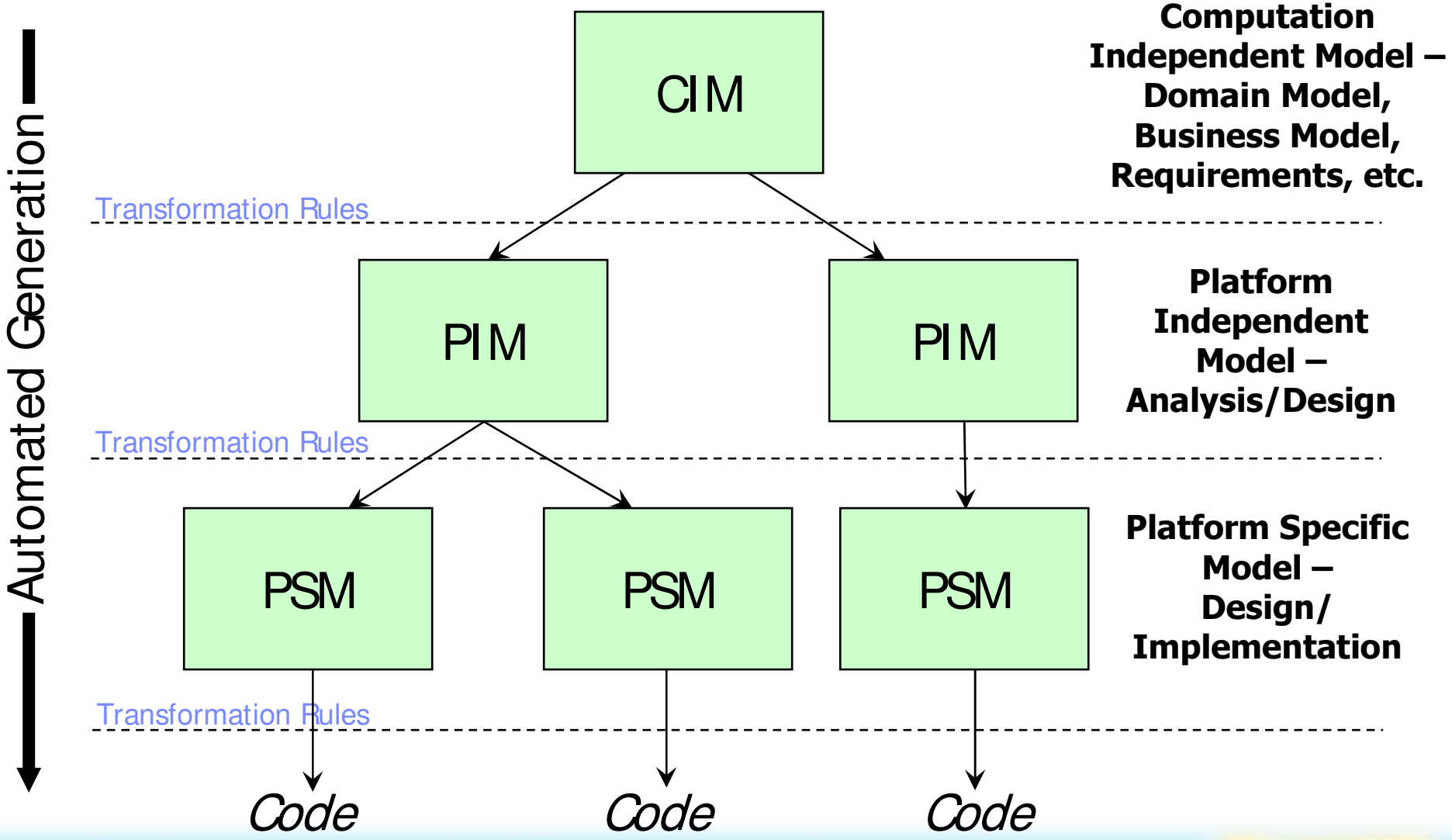
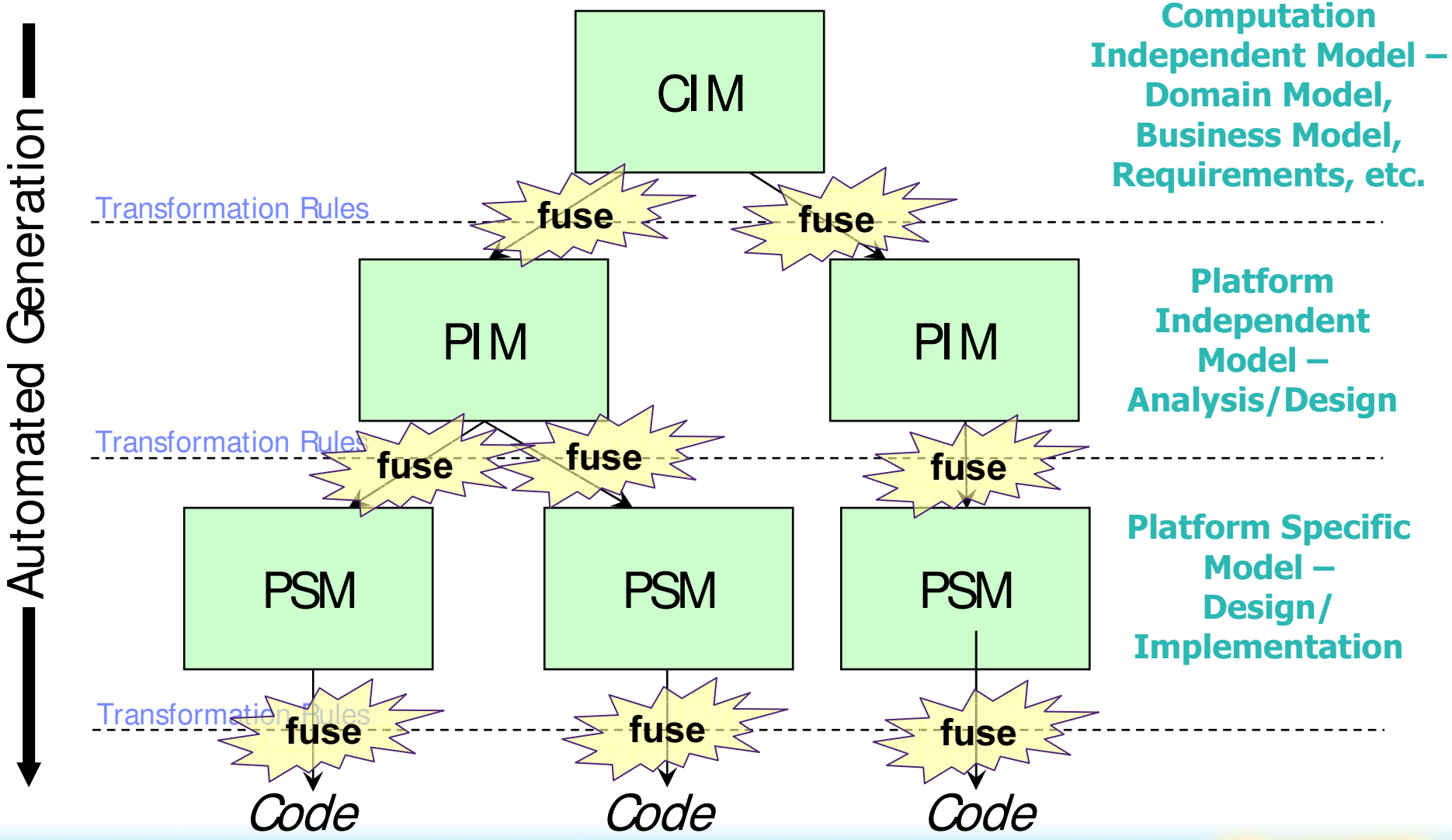
MDA Layering

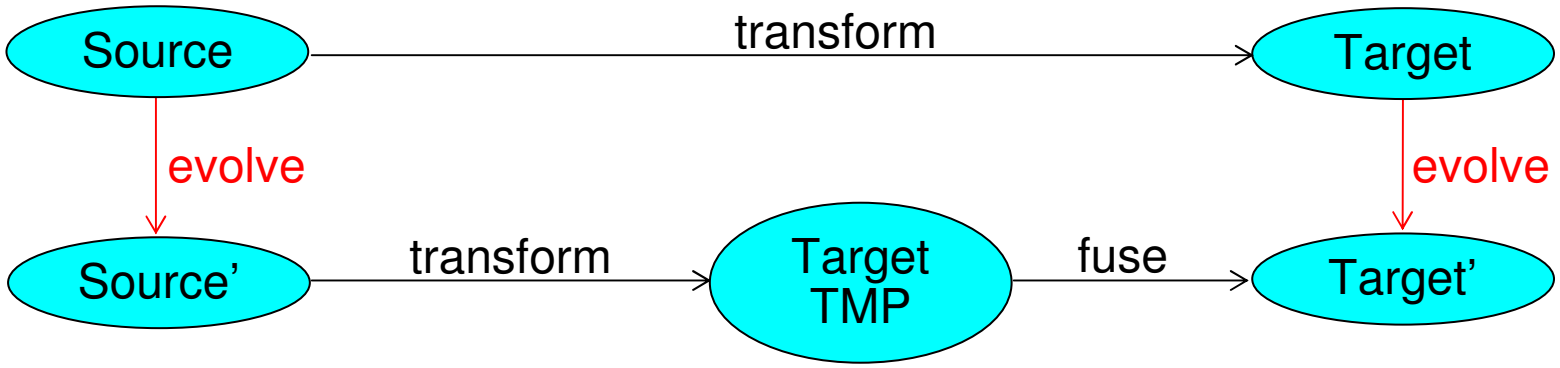


MDD with Fusion



Fusion at the Transformation Target

- Iteration is possible at every transformation stage
- Change the source model, and you must transform again
- Change the target (in parallel,) and the next transformation will have to be merged
- There is therefore a **fusion** step in each transformation



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- Model Management Best Practices

Tip: Allocate Sufficient Heap Space

- The default heap space for RSA is not sufficient for the largest models
- The maximum heap space of 1.6GB will help with merging of these models
- Change this parameter in your eclipse.ini file (in the installation folder):

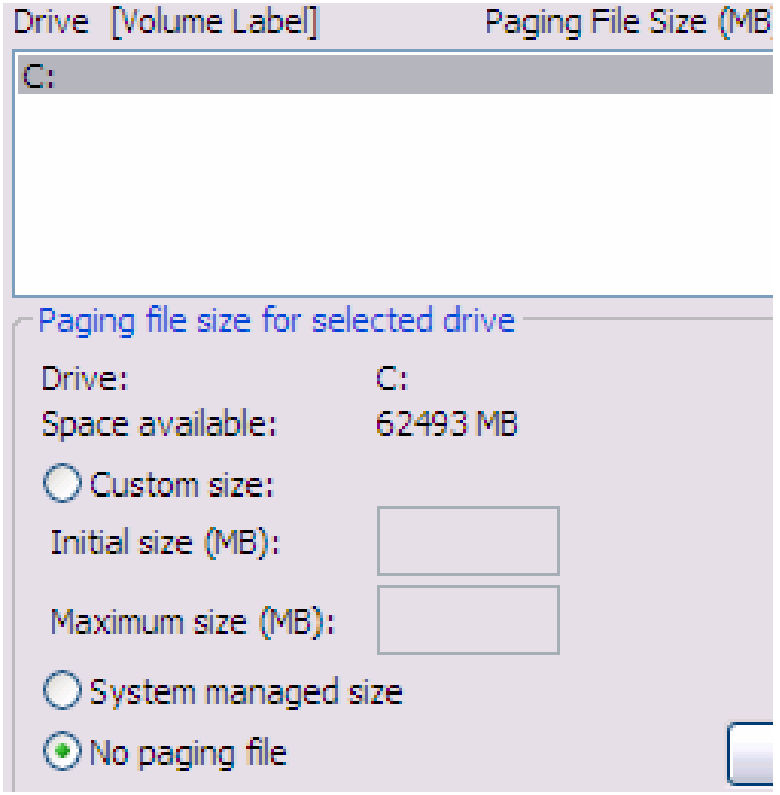
```
-vm
C:\Program Files\IBM\SDP70\jdk\jre\bin\javaw.exe
-vmargs
-Xquickstart
-Xms40m
-Xmx768m
-Xgcpolicy:gencon
-Xscmx96m
-Xshareclasses:singleJVM,keep
-Xnolinenumbers
-XX:MaxPermSize=512M
```

Change to -Xmx1600M

The maximum changes by operating system and JVM version. Java 1.6 is pushing to 2GB (win32), 3GB (Linux32) or 4GB (64bit.) Next SR will have 20-30 GB heaps on 64bit platforms!

Tip: Consider Disabling the Swap File

- When a workstation has 2GB or preferably 3GB or more, it is a candidate
- Windows performs dynamic paging of memory to disk to simulate a much larger memory space and allow many applications to share the CPU, but paging is slow, manifesting as random pauses or slow response when bringing a new application to the foreground
- Java applications aggravate the situation
- Paging can be turned off in the System Control Panel.



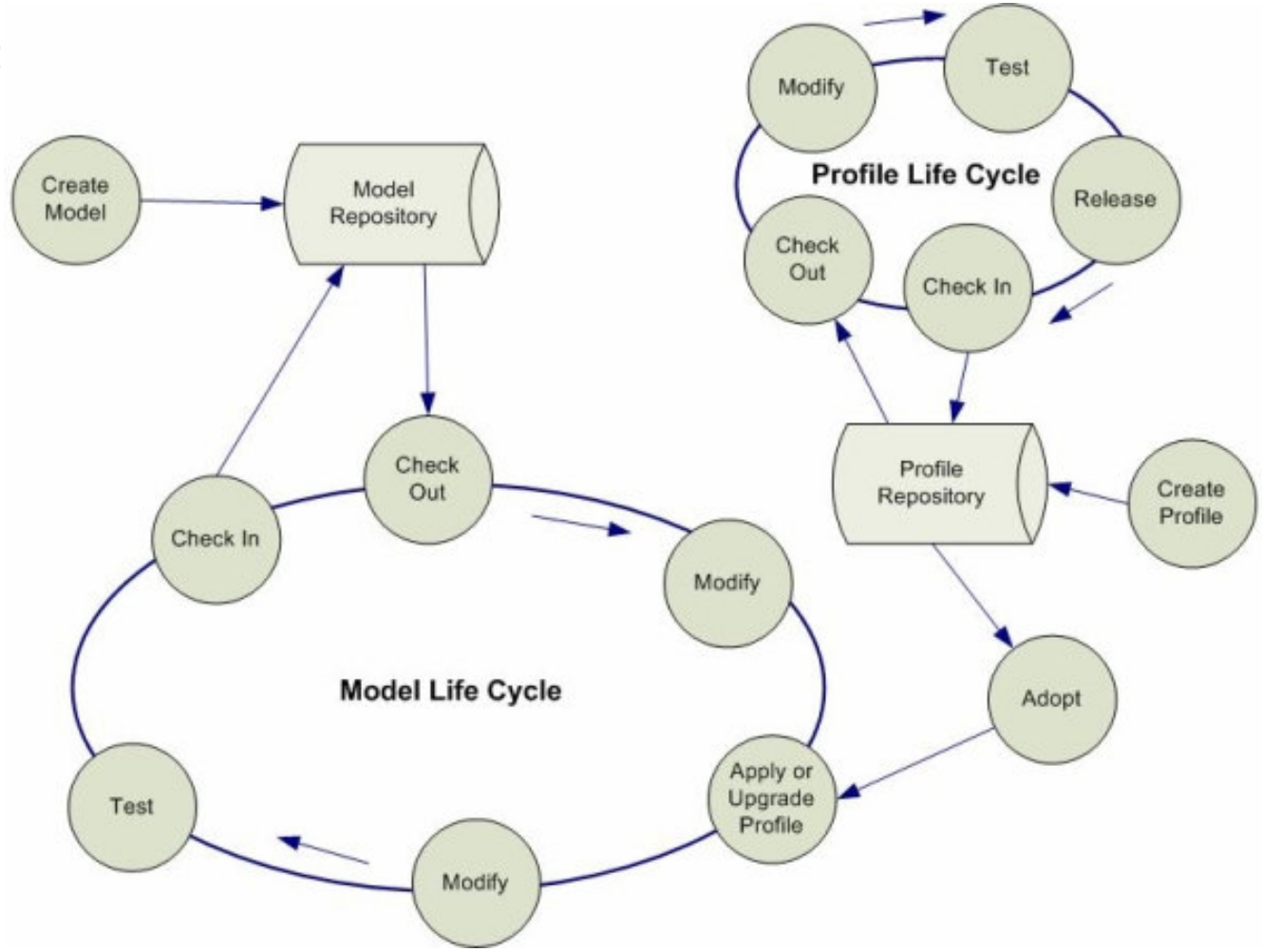
WARNING: Smaller memory sizes or running several concurrent applications can cause an out of memory error and applications may crash. This technique should be considered on a case by case basis for advanced users only! The author has used the technique since 2004, but it carries some risk.

Best Practice: Strictly Control Custom Profiles

- Extend the UML meta-model with a custom profile to adapt a model to a domain
- A custom profile *changes a model's meta-model once applied*
  - At this point, the profile is as important as the UML meta-model itself
- Separate the custom profile's life cycle from the models to which it is applied
- Follow the formal process for custom profile development as defined in the profile authoring guide and the team development guide
  - http://www.ibm.com/developerworks/rational/library/05/0906_dusko/
  - http://www.ibm.com/developerworks/rational/library/05/0823_Letkeman/
- Deploy your custom profiles as plugins with pathmaps!
  - Deploying profiles that are under **active development** into a workspace project alongside the models under development is an **anti-pattern** – it promotes loose upgrade and migration practices, which leads to subtle model corruption that shows up during merging sessions

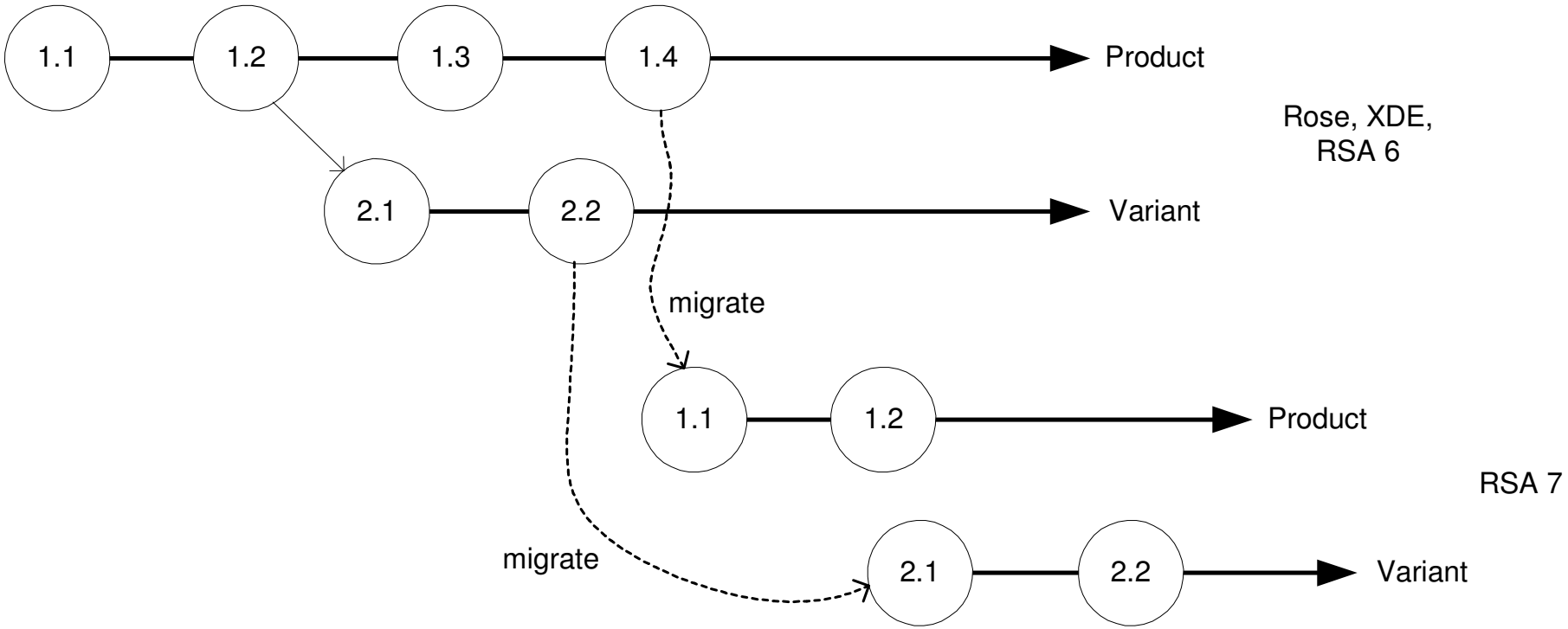
Best Practice: Separate the Custom Profile and Model Life Cycles

- It is *very important* that these life-cycles be separated.
- Profiles should be stored separately from models.
- Failure to follow these guidelines can result in models that cannot be opened.
- More information is available in Part 6 of the compare merge article series.



Tip: Multi-stream Model Upgrades

- Variations of a set of models can exist on multiple streams or branches
- When these models are upgraded to RSA 7, many thousand new elements are created more than once, and they **do not match**

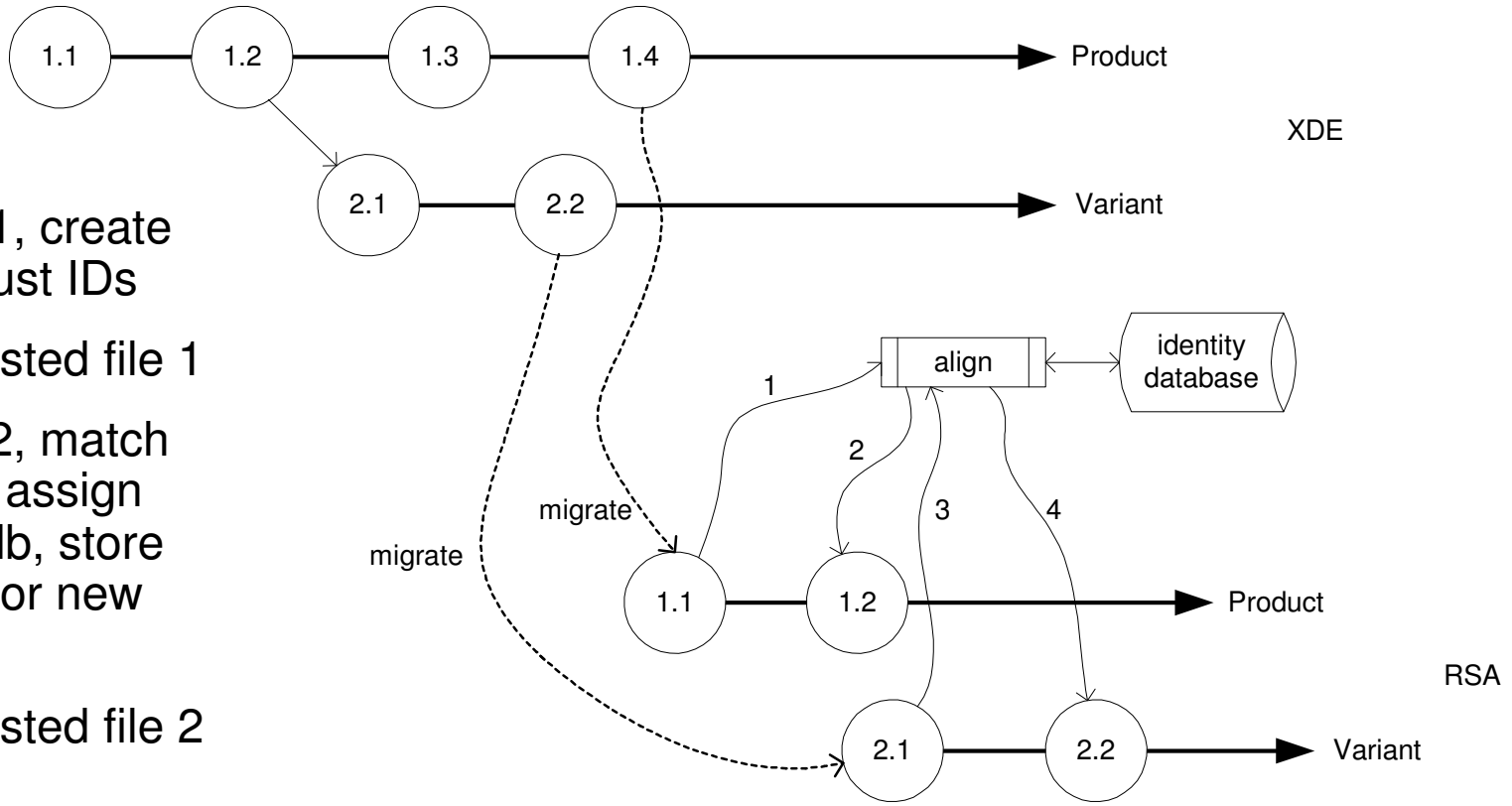


Tip: Multi-stream Model Upgrades (2)

- Upgrading from XDE or Rose to RSA, or from RSA 6 to RSA 7 changes UML and notational meta-models
- These meta-model changes require the creation of many new elements that did not exist in previous UML generations – we've seen 10,000 per model
- These new elements have new identifiers and the same new elements are created in each stream; each have a new unique identifier – *but these will not match during a compare!*
- RSA 7 includes technology to realign identities in a series of models, effectively recreating the element ancestry relationships from stream to stream ad infinitum
- After running the model alignment tool between two such streams, any two models will have the same identifiers for any element that is intended to be the same, thus superfluous differences are removed

Tip: Multi-stream Model Upgrades (3)

- The model alignment tool workflow looks like:



1. Read file 1, create ID db, adjust IDs
2. Write adjusted file 1
3. Read file 2, match elements, assign IDs from db, store IDs in db for new elements
4. Write adjusted file 2

Best Practice: Understand the Factors that Affect Physical Model Organization

- Team structure
  - Hierarchy within enterprise, all sharing common models?
    - One enterprise model set in a UCM environment
  - Separate teams delivering components to a common system?
    - Multiple smaller model sets in a distributed SCM environment
- Projected model size
  - Small models?
    - Any organization will work
  - One huge model?
    - Fragmented will perform best

Best Practice: Understand the Factors that Affect Physical Model Organization

- Computing power available
  - Resource constricted machines?
    - Fragments will perform best
- Preferred operational mode
  - Prefer to share a stream and operate live on one model copy?
    - Fully fragmented (exploded) model on a single shared integration stream with dynamic views and enforced reserved checkouts
  - Prefer to isolate modelers from one another and merge the work later?
    - Consider UCM or any equivalent branching mechanism with fragmented models
    - Smaller models need not be fragmented

Best Practice: Strong Ownership

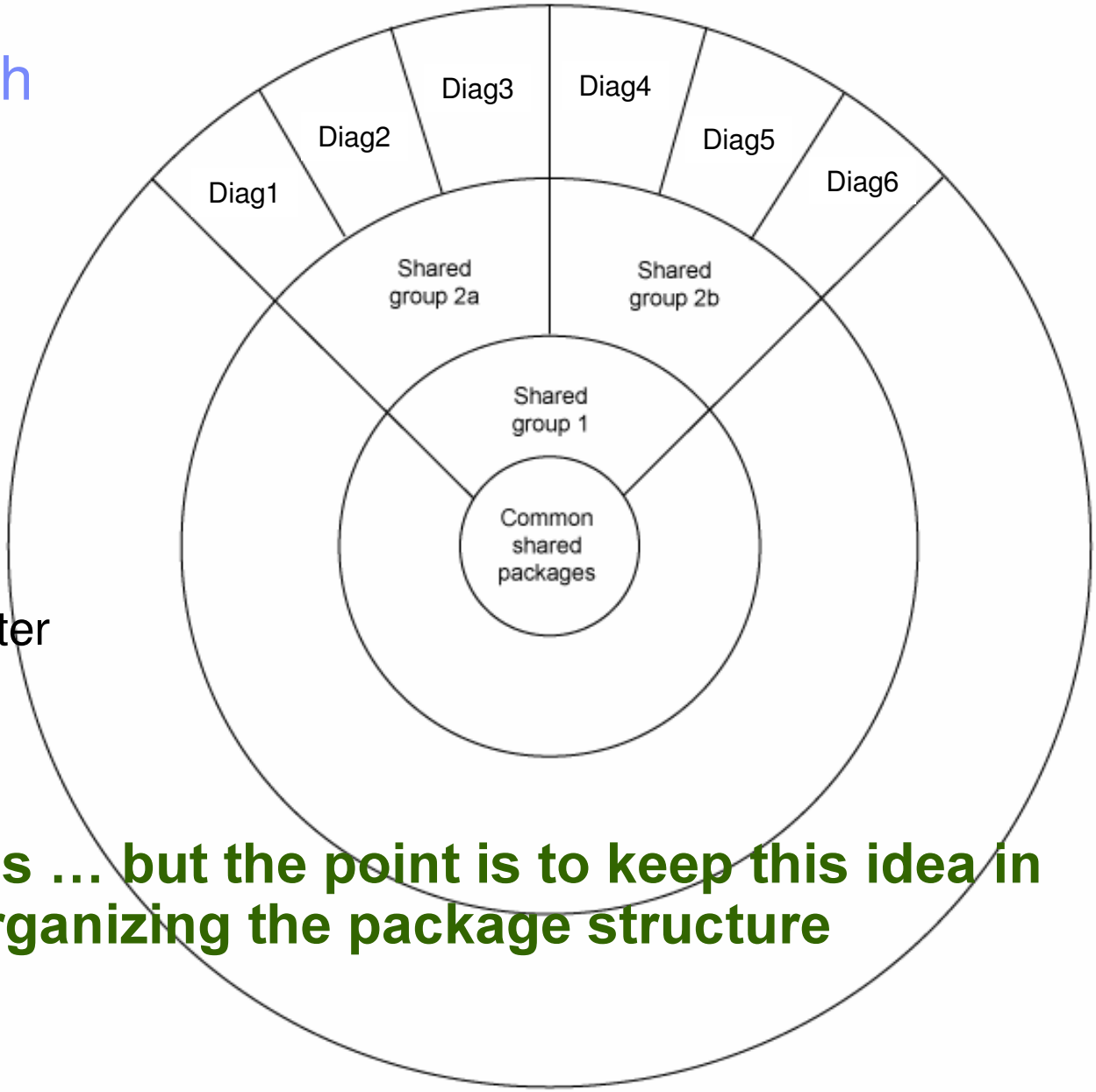
- When people work on the same packages and diagrams, model element conflicts are inevitable
- When conflicts at the element level occur, the SCM system can no longer get a successful automatic merge; instead, a visual merge is launched and user intervention is required
- If strong ownership is practiced, and people's work is separated more effectively, most merges are automatic and convenient
- It is not necessary to fragment a model to practice strong ownership, simply organizing the package structure effectively can enable this behavior

Best Practice: Layer Your Model Packages

- Think of a target, wheel or onion. Higher levels of sharing occupy the center, while packages with lesser sharing move further outward in rings or layers.
- Ideally, references to elements always flow inward between rings, never sideways within a ring.
- Diagrams tend to occupy the outer ring in separate “spokes.”
  - Packages used by diagrams tend to flow from less shared to more shared.
- When correctly partitioned, separation into models is easily accomplished if necessary. Strong ownership is easily applied as well.

Layered Approach

- Common actors, classes, etc in the center.
- Packages less commonly shared moving outward.
- Diagrams in the outer layer.

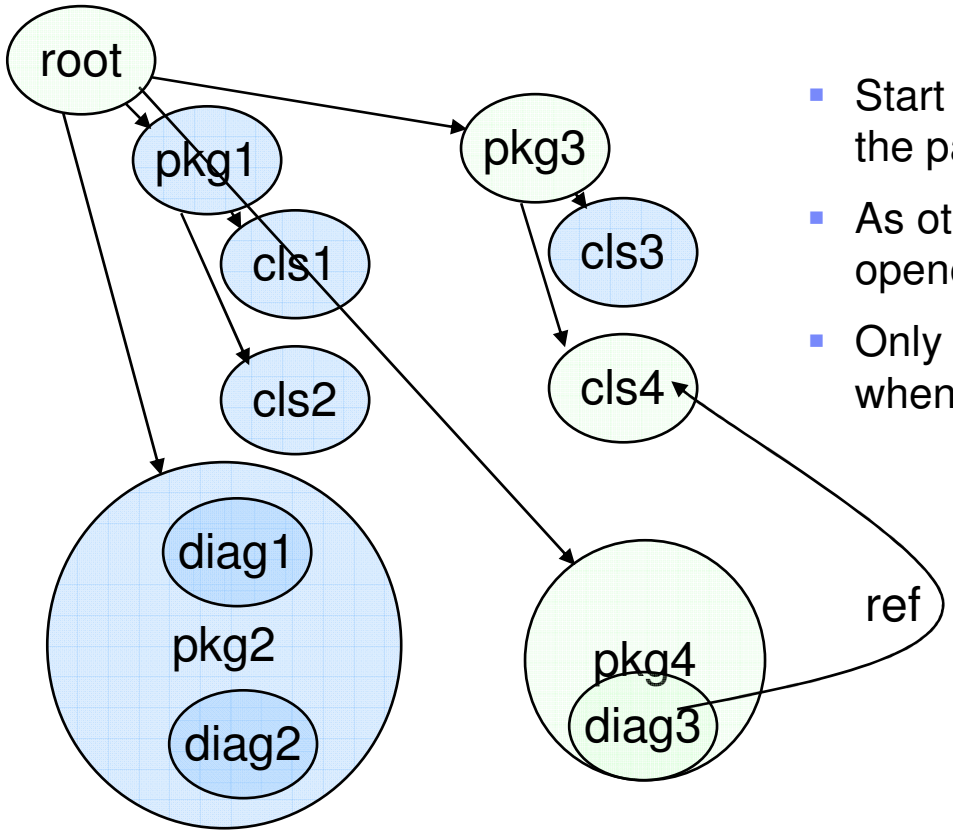


Simplistic, yes … but the point is to keep this idea in mind while organizing the package structure

Best Practice: Fragmentation of Large Models

- Break the model into tiny fragments down to classifiers and diagrams
- Does not preclude appropriate package layering
- Supports strong ownership
- **Very small memory footprint**
  - a small number of fragments in memory at any one time
- Complete hierarchy is visible within the model explorer
  - In 7.5, expand in place for imported packages makes this a reality for separate models as well, allowing both techniques to be mixed and matched
- With strong ownership, file by file merge is safe when certain rules are followed
- Full-context merge is perfectly safe under all circumstances
- **In 7.5, full-context sparse merge is available so that arbitrarily large models can be merged!**

Fragmentation Memory Footprint

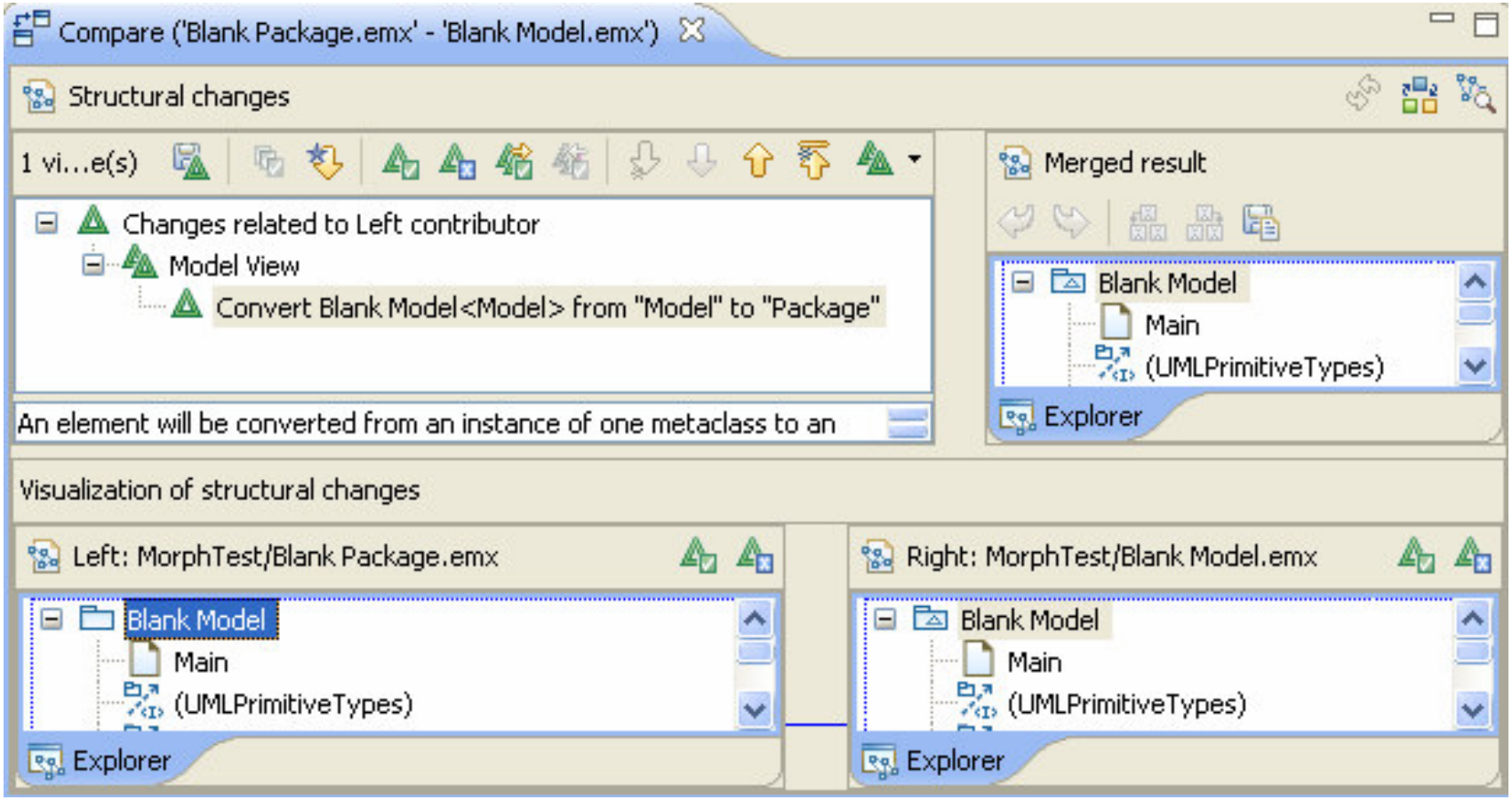


- Start at the root element and drill down into the packages until the diagram is opened.
- As other fragments are needed, they are opened automatically.
- Only changed fragments are rewritten when model is closed.

memory footprint

New in 7.5: Shared Fragments are Back!

NEW

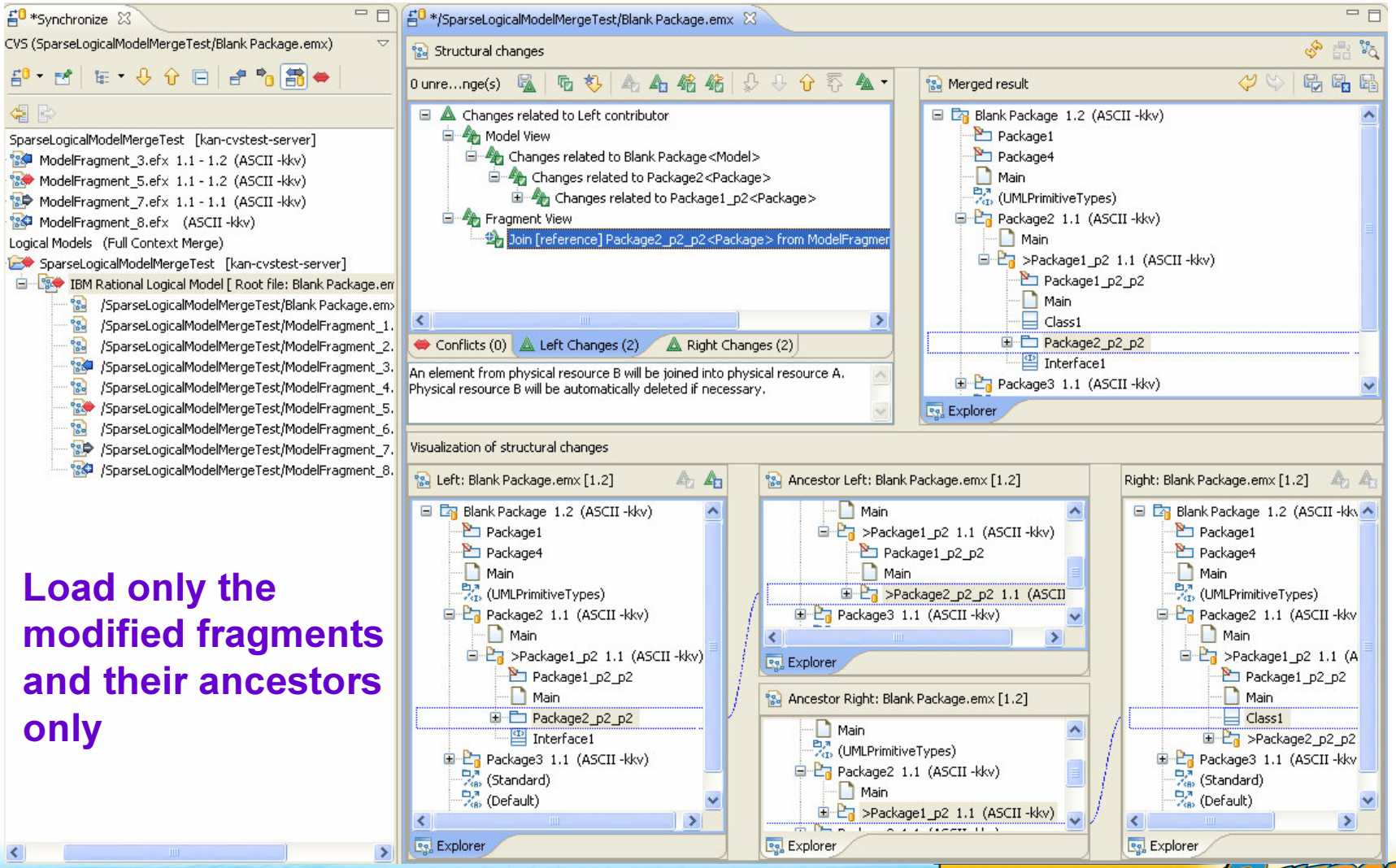


Best Practice: Shared Fragments

- It is once again possible in release 7.5 to separate your packages into independent fragments.
- Packages can, in fact, be the root of a fragmented model made of up many separate files.
- Packages can be imported into several models, effectively sharing them across models
- Packages will be expanded in place in the project explorer

Sparse Logical Model Merge

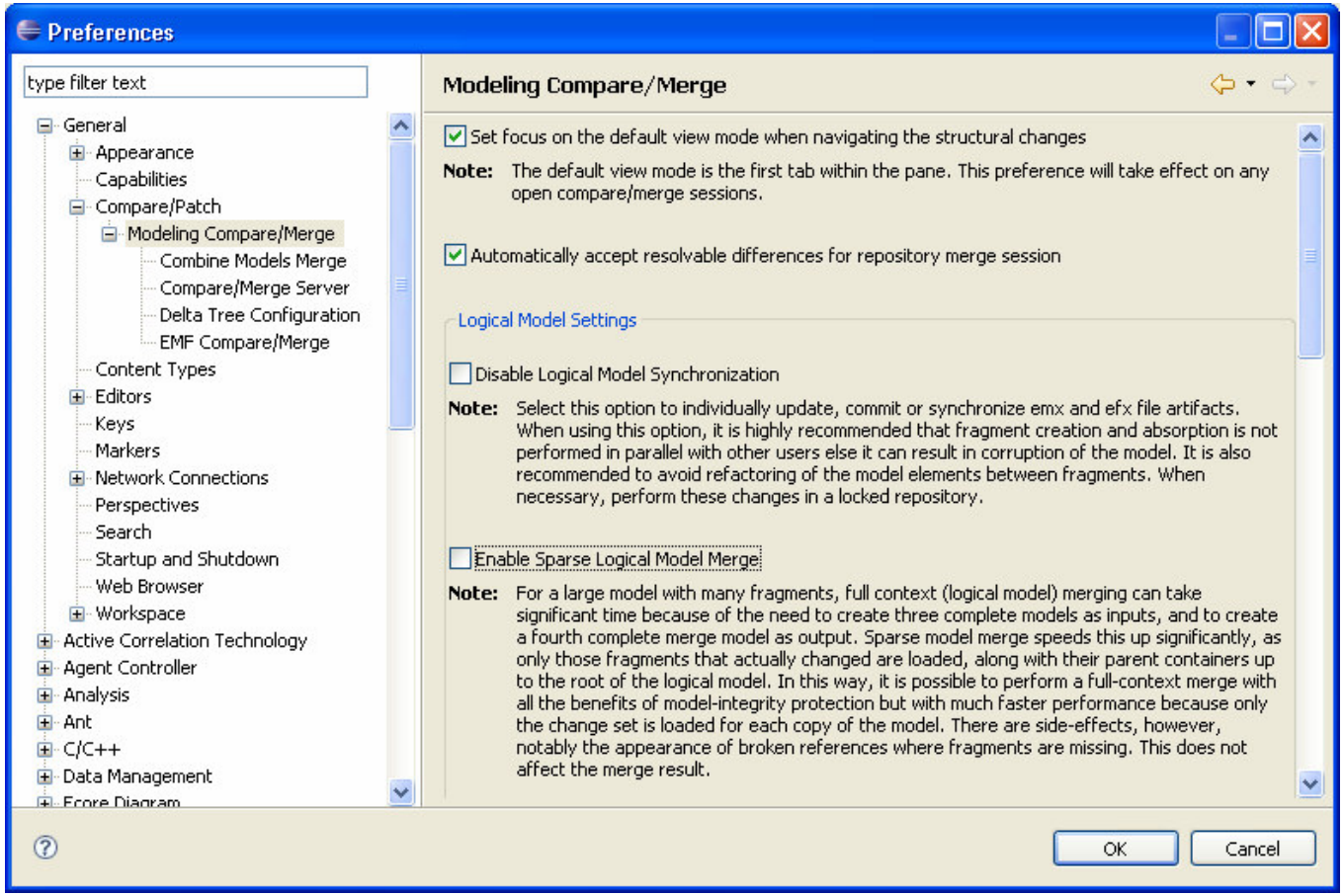
NEW



Load only the modified fragments and their ancestors only

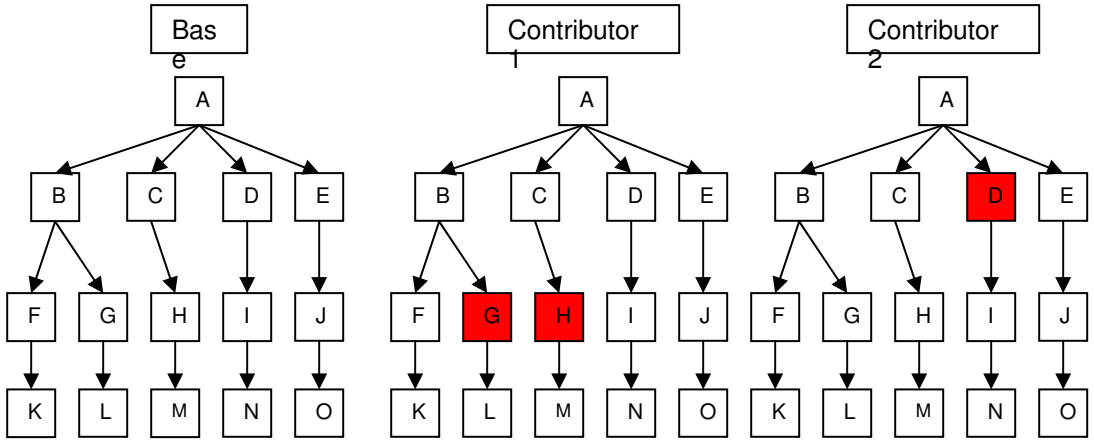
Enable Sparse Logical Model Merge option

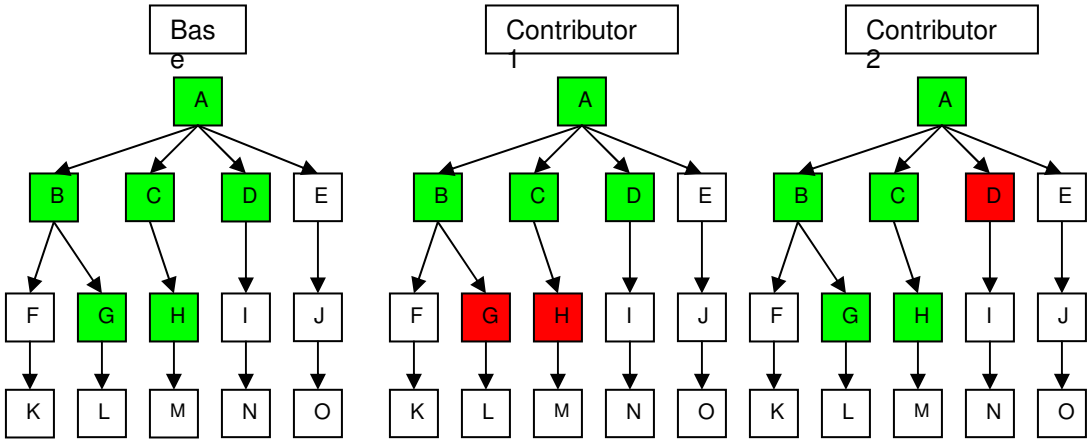
- Available in RSA 7.0.0.7, RSD and RSM 7.0.5.2, and RSA 7.5
- Works in findmerge and UCM with CCRC 7.1
- Works in CVS
- For RTC 1.0, disable logical model mode instead, and practice strong ownership!



How Does Sparse Merge Help?

- By merging a complete subset of the models! All changes appear, all unchanged files are ignored.





- Full subset identified for merge.
- All the white files left out. This scales to any sized models, since the majority are ignored!

Reference Materials

- Comparing and merging UML models in IBM Rational Software Architect – Kim Letkeman
  - Part 1 – Comparing models with local history
    - http://www-128.ibm.com/developerworks/rational/library/05/712_comp/
  - Part 2 – Merging models using "compare with each other"
    - http://www-128.ibm.com/developerworks/rational/library/05/712_comp2/
  - Part 3 – A deeper understanding of model merging
    - http://www-128.ibm.com/developerworks/rational/library/05/802_comp3/
  - Part 4 – Parallel model development with CVS
    - http://www-128.ibm.com/developerworks/rational/library/05/0809_CVS4/
  - Part 5 – Model management with IBM Rational ClearCase and IBM Rational Software Architect Version 7 and later
    - http://www.ibm.com/developerworks/rational/library/07/0703_letkeman/

Reference Materials

- Comparing and merging UML models in IBM Rational Software Architect – Kim Letkeman
  - Part 6 – Parallel model development with custom profiles
    - http://www-128.ibm.com/developerworks//rational/library/05/0823_Letkeman/
  - Part 7 – Ad-hoc modeling – Fusing two models with diagrams
    - http://www-128.ibm.com/developerworks/rational/library/07/0410_letkeman/
- Related Articles
  - Authoring UML profiles using Rational Software Architect and Rational Software Modeler – *Dusko Misic*
    - http://www.ibm.com/developerworks/rational/library/05/0906_dusko/
  - Model Structure Guidelines for Rational Software Modeler and Rational Software Architect – *Bill Smith*
    - http://www.ibm.com/developerworks/rational/library/04/r-3155/

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Mariangela Orme
Solution Architect - IBM Rational Services
morme@it.ibm.com

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