TECHNISCHE UNIVERSITÄT DRESDEN

ResUbic

QualiFune

Fakultät Informatik Institut für Software- und Multimediatechnik - Lehrstuhl für Softwaretechnologie

Elucidative Development for Model-Based Documentation

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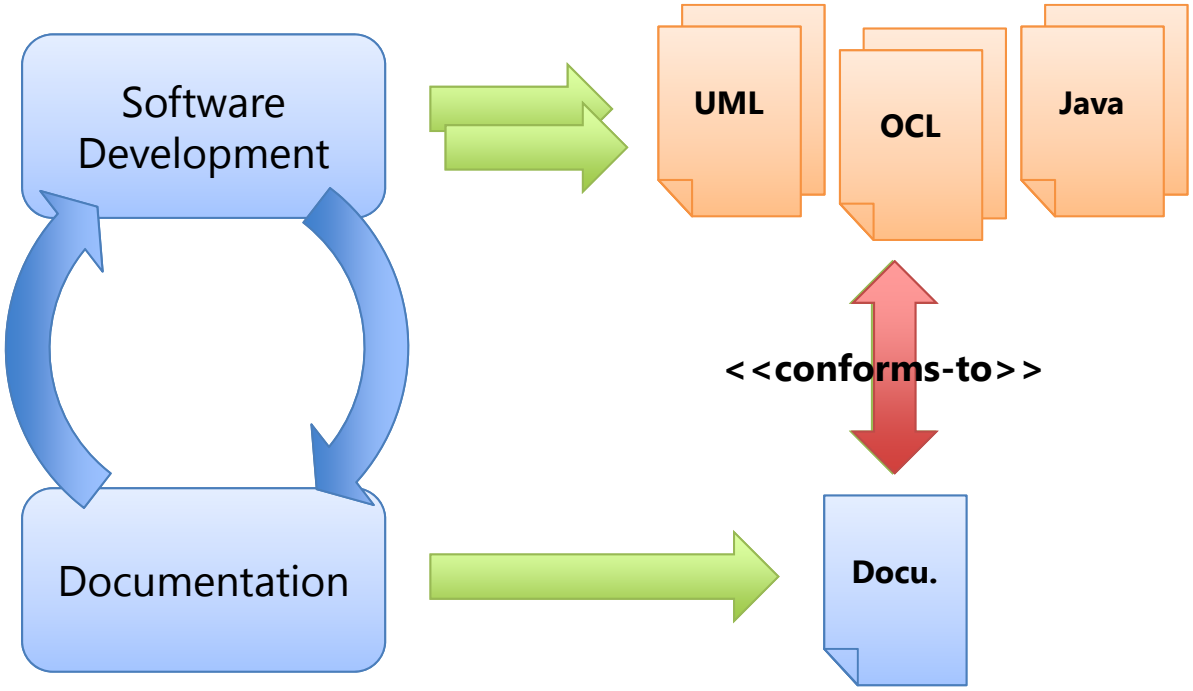
DRESDEN concept Exzellenz aus Wissenschaft und Kultur

PROBLEM


Software Development
Documentation
UML
OCL
Java
<<conforms-to>>
Docu.

PROBLEM

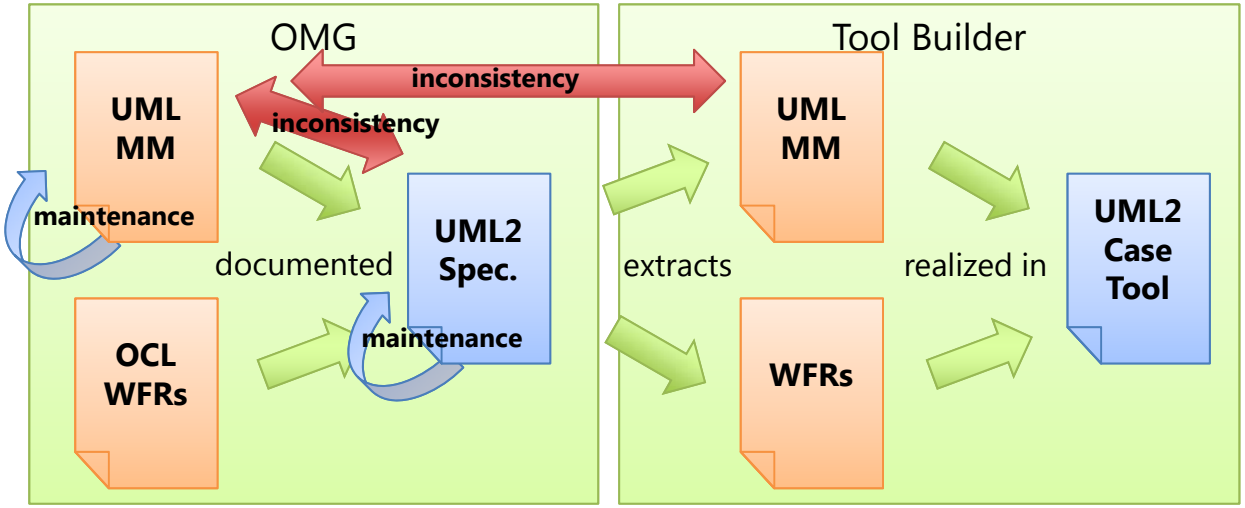
- **Development** and **documentation** activities are **separated**
  - Often, **documentation** is a **postprocess**

- **Documentation** is **maintained manually**

  → **Inconsistencies** are typical

  - Howtos, **code examples**
  - Tutorials, **screenshots**
  - Model examples, **diagrams**
  - Manuals, **specifications**
  - **…**

AN EXAMPLE: UML SPECIFICATION



Target:

- **Consistent** metamodel and **specification**
- **Release** of both **metamodel and specification**
- **Shorter** revision/maintenance **cycles**

AN EXAMPLE: UML SPECIFICATION

- Each **metaclass** has ist own **section**
  - Class diagram
  - Generalizations
  - Description
  - Attributes
  - Associations
  - Constraints
  - Additional Operations

…

Constraints

…

Additional Operations

[1] The query mustBeOwned() indicates whether elements of this type must have an owner.

Package::mustBeOwned() : Boolean

mustBeOwned = false

…

AN EXAMPLE: UML SPECIFICATION

Identified maintenance **problems:**

1. **Graphical representations**
2. **Continous text**
3. **Textual representations**
4. **External references**

Additional Operations

…

[3] The query makesVisible() …

```
pre: self.member->includes(el)
makesVisible =
    (ownedMember->includes(el)) or
    (elementImport>select(ei|
            ei.importedElement = #public)
            ->collect(ei|ei.importedElement)
            ->includes(el)) or
```

…

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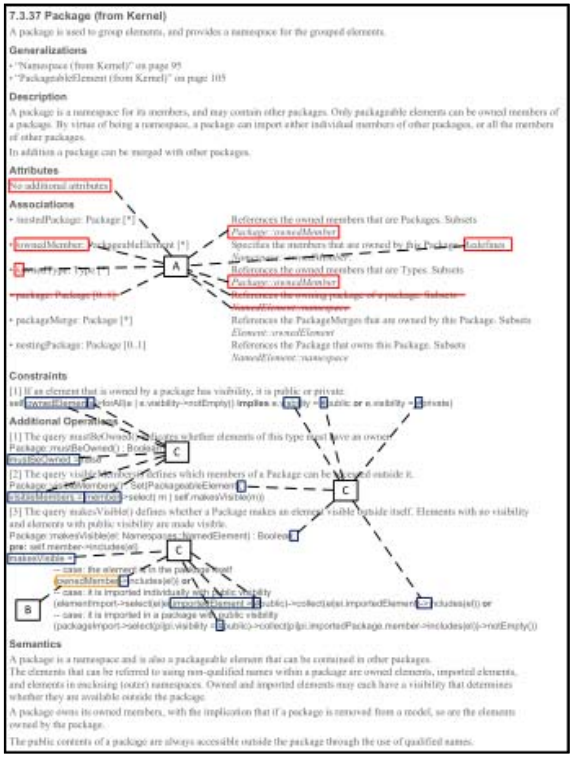
AN EXAMPLE: UML SPECIFICATION

- First version (**2.0**) released **in 2005**
- **Since then**
  - **Continuous evolution**
  - **Manual maintenance**
  - Several **inconsistencies**


7.3.37 Package (from Kernel)

A package is used to group elements, and provides a namespace for the grouped elements.

Generalizations

- "Namespace (from Kernel)" on page 95
- "PackageableElement (from Kernel)" on page 105

Description

A package is a namespace for its members, and may contain other packages. Only packageable elements can be owned members of a package. By virtue of being a namespace, a package can import either individual members of other packages, or all the members of other packages.

In addition a package can be merged with other packages.

Attributes

No additional attributes

Associations

- importedPackage: Package [*]
- ownedMember: PackageableElement [*]
- ownedType: Type [*]
- package: Package [0..1]
- packageMerge: PackageMerge [*]
- nestingPackage: Package [0..1]

References the owned members that are Packages. Subsets Package::ownedMember

Specifies the members that are owned by this Package. Subsets Namespace::ownedMember

References the owned members that are Types. Subsets Package::ownedMember

References the owning package of a package. Subsets NamedElement::namespace

References the PackageMerges that are owned by this Package. Subsets Element::ownedElement

References the Package that owns this Package. Subsets NamedElement::namespace

Constraints

[1] If an element that is owned by a package has visibility, it is public or private.

Additional Operations

[1] The query mustBeOwned() indicates whether elements of this type must have an owner.

Package::mustBeOwned() : Boolean

[2] The query visibleMembers() defines which members of a Package can be visible outside it.

Package::visibleMembers() : Set{PackageableElement}

[3] The query makesVisible() defines whether a Package makes an element visible outside itself. Elements with no visibility and elements with public visibility are made visible.

Package::makesVisible(e: NamespaceOwnedElement) : Boolean

Semantics

A package is a namespace and is also a packageable element that can be contained in other packages.

The elements that can be referred to using non-qualified names within a package are owned elements, imported elements, and elements in enclosing (outer) namespaces. Owned and imported elements may each have a visibility that determines whether they are available outside the package.

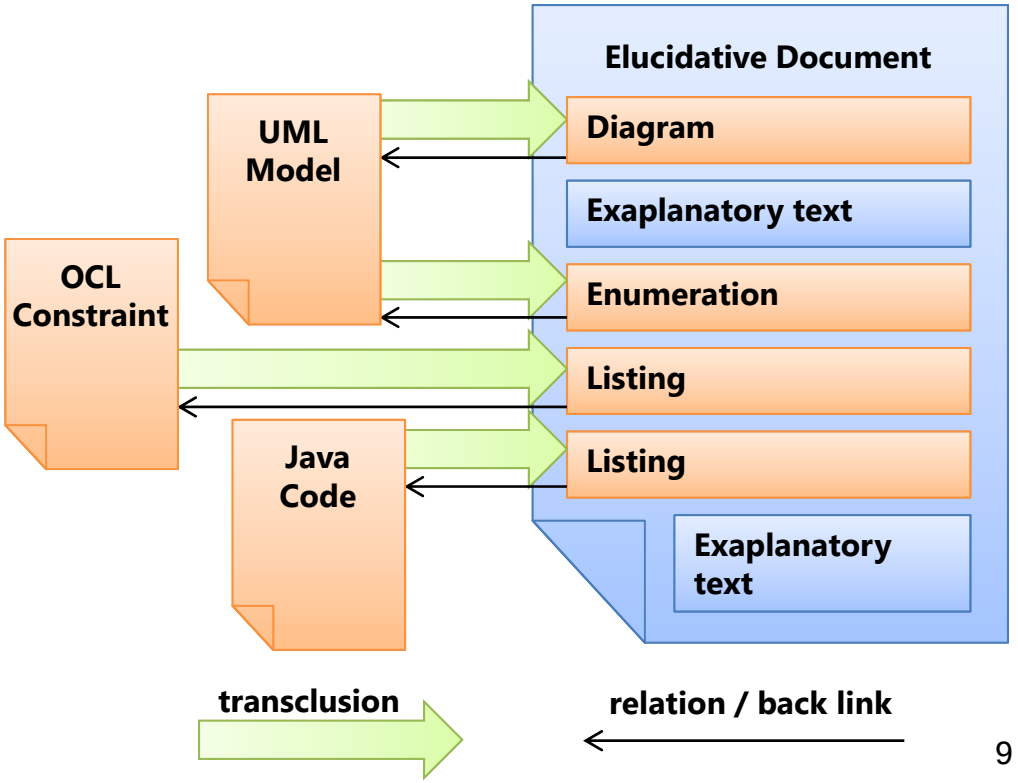
A package owns its owned members, with the implication that if a package is removed from a model, so are the elements owned by the package.

The public contents of a package are always accessible outside the package through the use of qualified names.

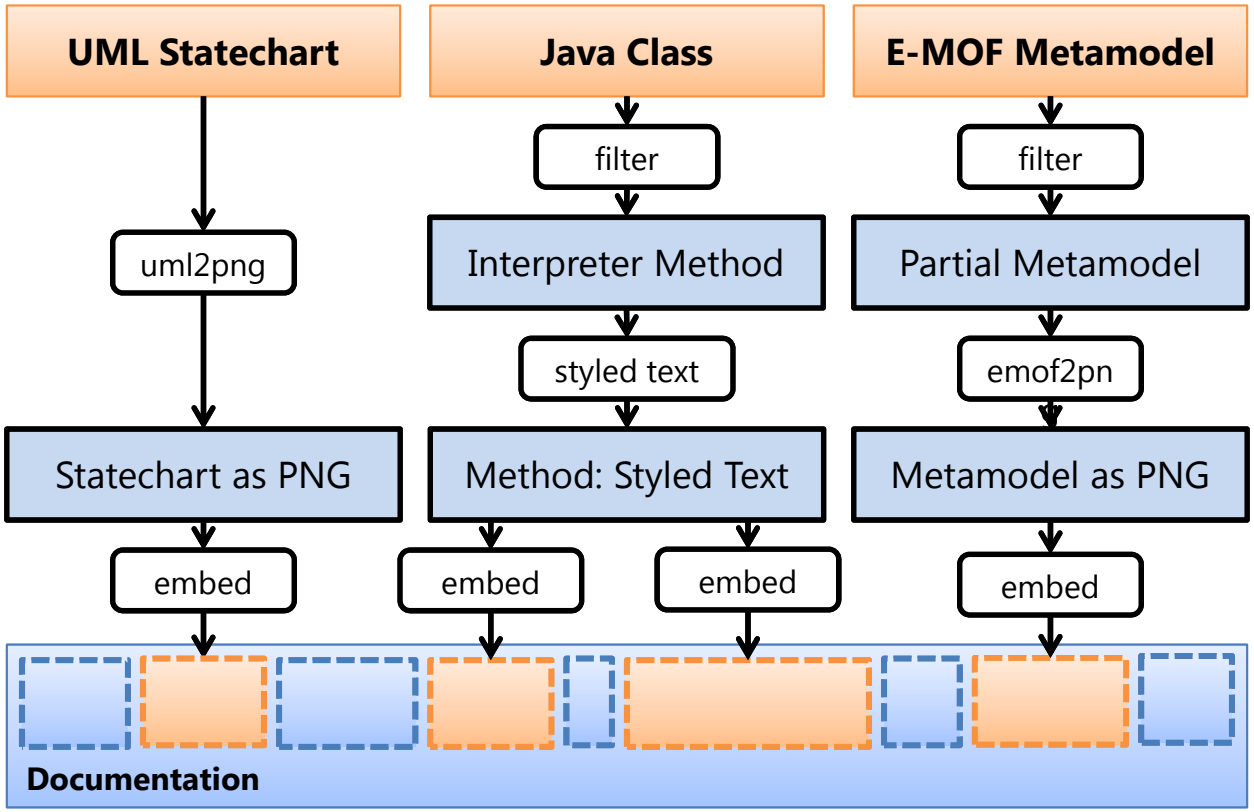
ELUCIDATIVE DEVELOPMENT

ELUCIDATIVE DEVELOPMENT

- **Transclusion:** content propagation from one document to another
- **Transconsistency:** updates are triggered when artifacts change and changes are transcluded to the document (**hot update**)

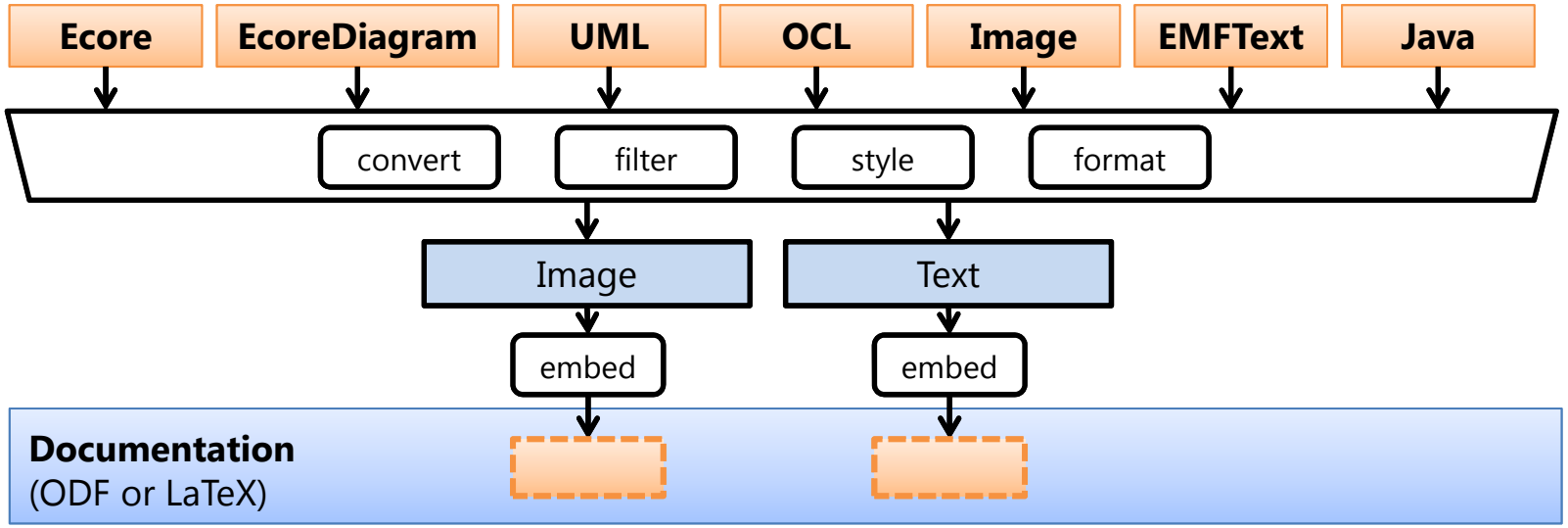


EXAMPLE ELUCIDATIVE DOCUMENT



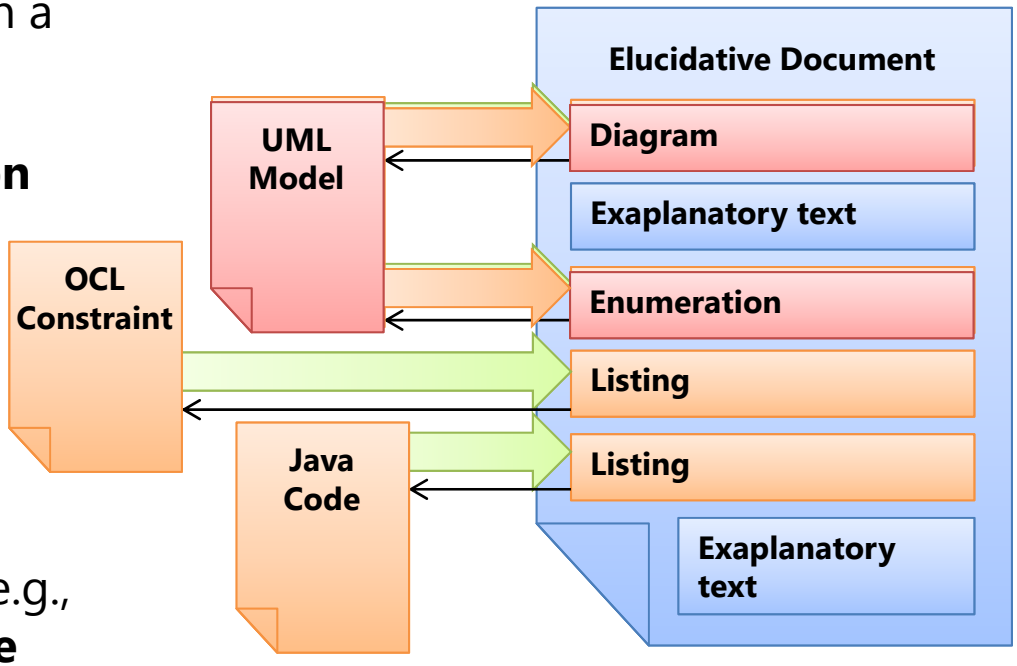
DEFT

- Prototypical **creation and maintenance** of **elucidative documents**
- **Hot update** and **notifications**
- **Several** typical **MDSD artifacts**
- http://deftproject.org/



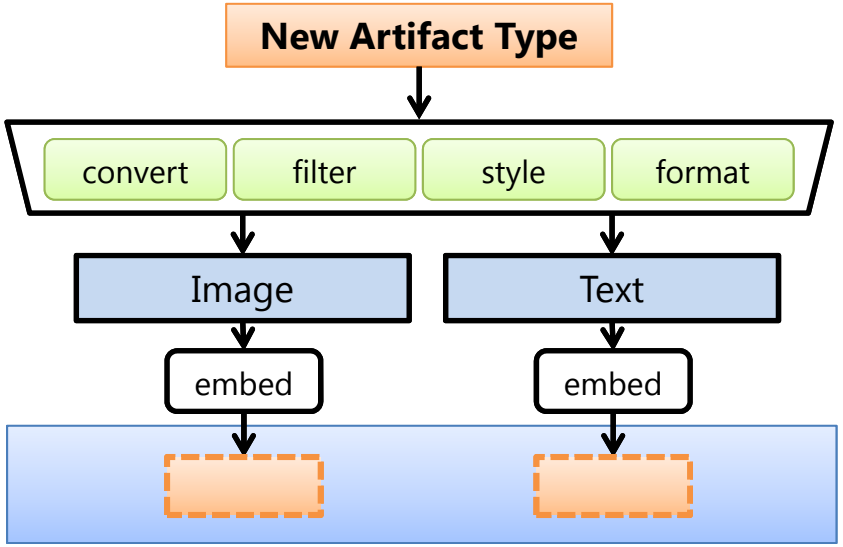
CHANGE DETECTION IN DEFT

- **Artifacts** maintained in a **repository**
- Basic **change detection** based **on timestamps**
  - → **Transclusion** of new content
  - → Author **notification**
- **Extension** with **diffs** (e.g., EMFCompare) **possible**

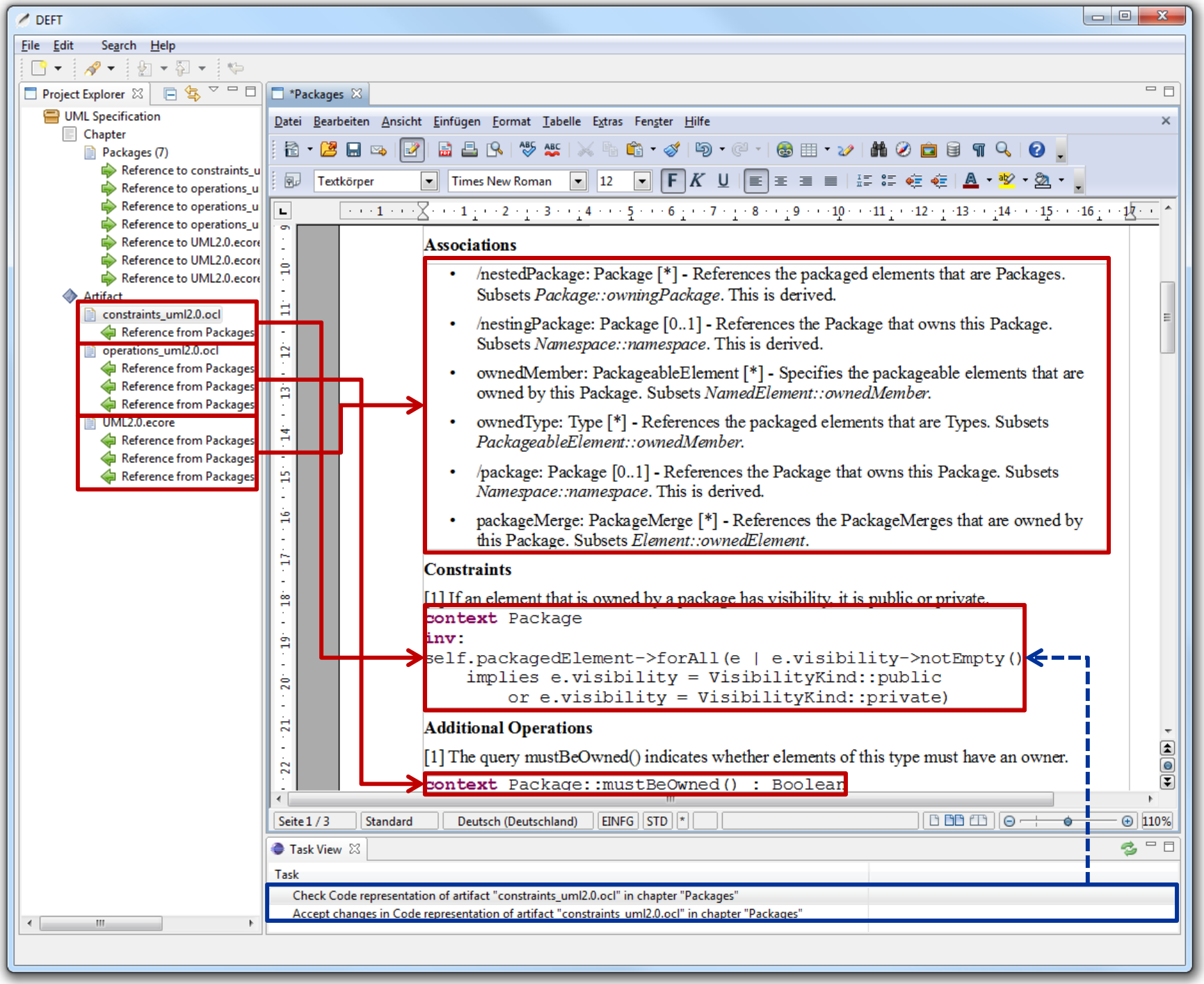


INTEGRATION OF NEW ARTIFACT TYPE

- Simple **implementation of operators** required for transclusion
- **Either**
  - Artifact-**to-Text** or
  - Artifact-**to-Image**
- **Optional**
  - Filter
  - Style
  - Format



ELUCIDATIVE DEVELOPMENT FOR UML


DEFT
File Edit Search Help
Project Explorer
UML Specification
Chapter
Packages (7)
Reference to constraints_u
Reference to operations_u
Reference to operations_u
Reference to operations_u
Reference to UML2.0.ecore
Reference to UML2.0.ecore
Reference to UML2.0.ecore
Artifact
constraints_uml2.0.ocl
Reference from Packages
operations_uml2.0.ocl
Reference from Packages
Reference from Packages
Reference from Packages
UML2.0.ecore
Reference from Packages
Reference from Packages
Reference from Packages
*Packages
Datei Bearbeiten Ansicht Einfügen Format Tabelle Extras Fenster Hilfe
Textkörper
Times New Roman
12
Associations
/nestedPackage: Package [*] - References the packaged elements that are Packages. Subsets Package::owningPackage. This is derived.
/nestingPackage: Package [0..1] - References the Package that owns this Package. Subsets Namespace::namespace. This is derived.
ownedMember: PackageableElement [*] - Specifies the packageable elements that are owned by this Package. Subsets NamedElement::ownedMember.
ownedType: Type [*] - References the packaged elements that are Types. Subsets PackageableElement::ownedMember.
/package: Package [0..1] - References the Package that owns this Package. Subsets Namespace::namespace. This is derived.
packageMerge: PackageMerge [*] - References the PackageMerges that are owned by this Package. Subsets Element::ownedElement.
Constraints
[1] If an element that is owned by a package has visibility, it is public or private.
context Package
inv:
self.packagedElement->forAll(e | e.visibility->notEmpty()
implies e.visibility = VisibilityKind::public
or e.visibility = VisibilityKind::private)
Additional Operations
[1] The query mustBeOwned() indicates whether elements of this type must have an owner.
context Package::mustBeOwned() : Boolean
Seite 1 / 3
Standard
Deutsch (Deutschland)
EINFG
STD
110%
Task View
Task
Check Code representation of artifact "constraints_uml2.0.ocl" in chapter "Packages"
Accept changes in Code representation of artifact "constraints_uml2.0.ocl" in chapter "Packages"

UML SPECIFICATION WITH DEFT

1. **Graphical representations** transcluded ✓
2. **Continuous text** transclusion possible in some cases ✓
   (manual proofreading might be necessary)
3. **Textual representations** transcluded ✓
4. **External references** can be checked for consistency ✓
   (integration of existing tooling, e.g., OCL parsers)

UML SPECIFICATION WITH DEFT

- **Continuous maintenance** of **metamodel and specification**

→ **Identification** of **inconsistencies**

→ **Fast release**, of **up-to-date specifications** possible

→ **Artifacts** (e.g., metamodel) **can be shipped** with the specification

CONCLUSION

CONCLUSION

- Elucidative Development for **continuous**, **transconsistent documentation**
  - Several kinds of artifacts
  - Multiple development phases
- Application to **UML specification** as one usage example
  - Specification process improved
  - Identification of inconsistencies
- **Future work**
  - Further **case studies**
  - **Product line** engineering
  - **Language processing** for descreptive text