EclipseSource

Papyrus Industry Consortium

Open Source Model-based Engineering Tools in Industry

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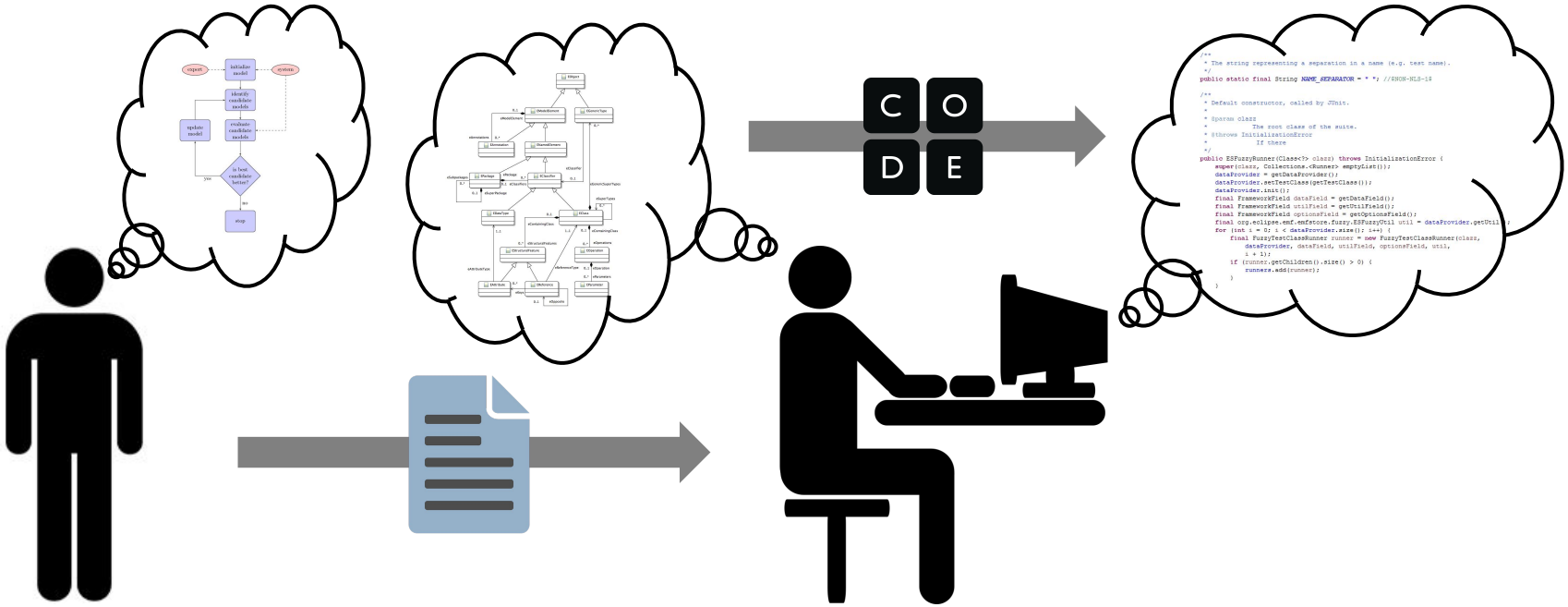
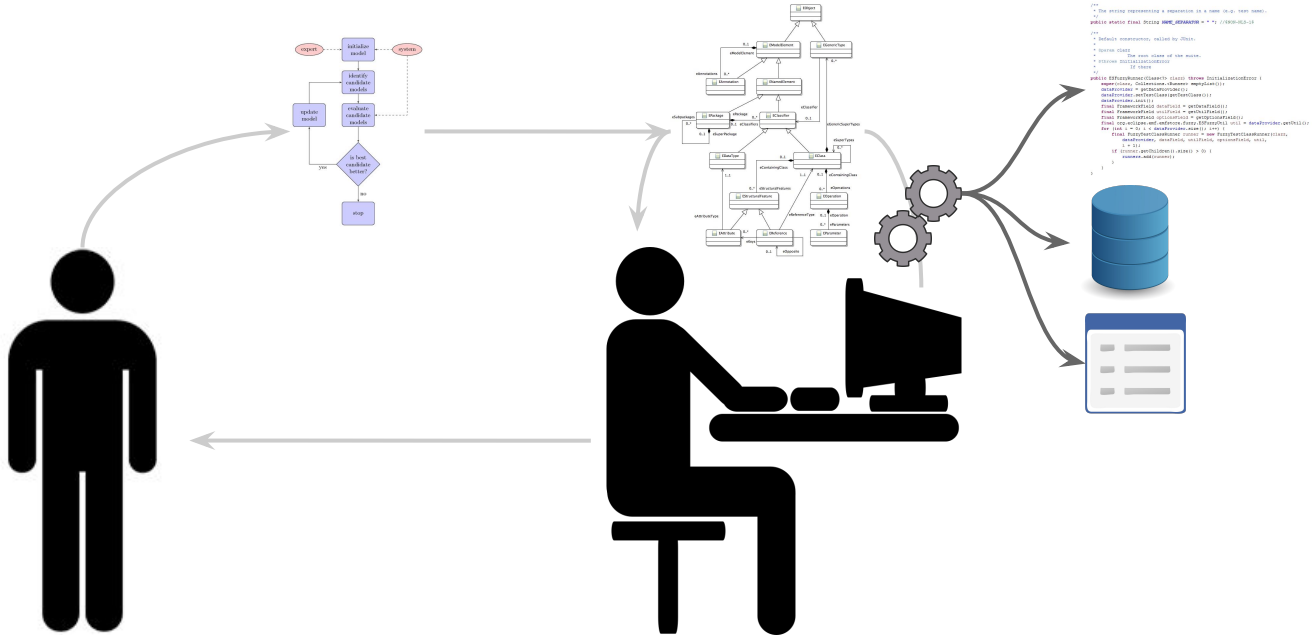
Context: Model-based Engineering (MBE)

- Problem
  - Every software/system is built around a model / specification
  - Data model, interactions, protocol specifications, architectures, ...



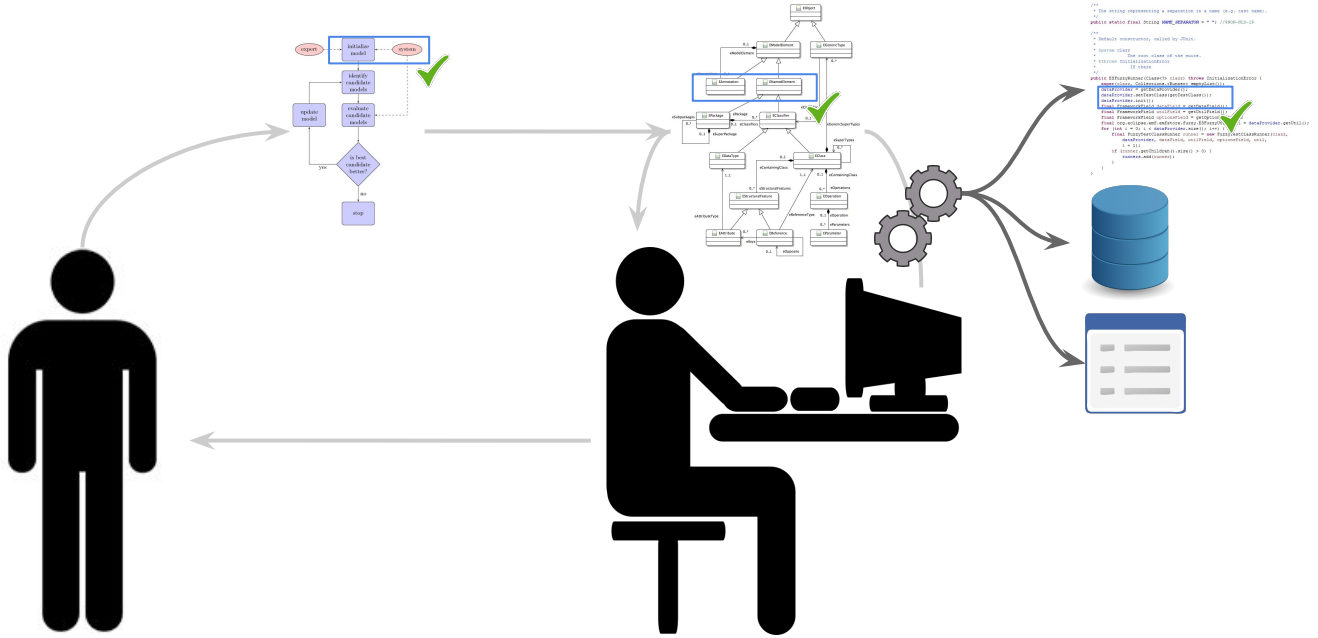
Context: Model-based Engineering (MBE)

- Basic idea
  - Turn those implicit or non-formal models explicit and formal models
  - Ease the communication among domain experts
  - Exploit those along the development process



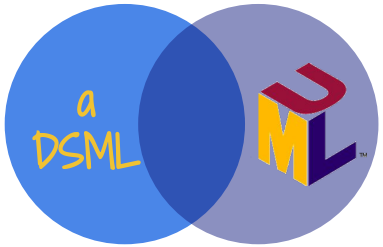
Context: Model-based Engineering (MBE)

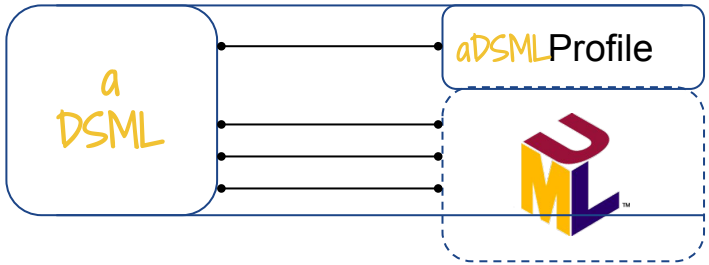
- Basic idea
  - Early validation, simulation & debugging, continuous integration, traceability
  - Automation of the development: codegen, interpretation



Context: Domain-specific Modeling (DSM)

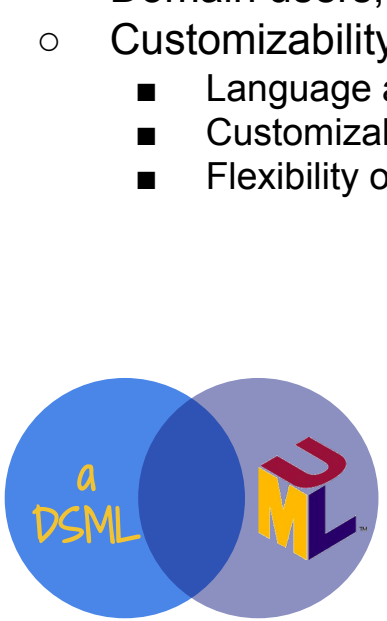
- MBE is most successful if it is *domain-specific*
  - Highly customized modeling environments
  - Directly reflecting specific needs of a domain and its users
  - User roles and their backgrounds (systems architect, electrical engineer, …)
- General-purpose modeling language vs DSM language
  - This is NOT about UML vs. DSML (= non-UML)
  - But about plain UML vs. UML & UML profiles (= DSML)

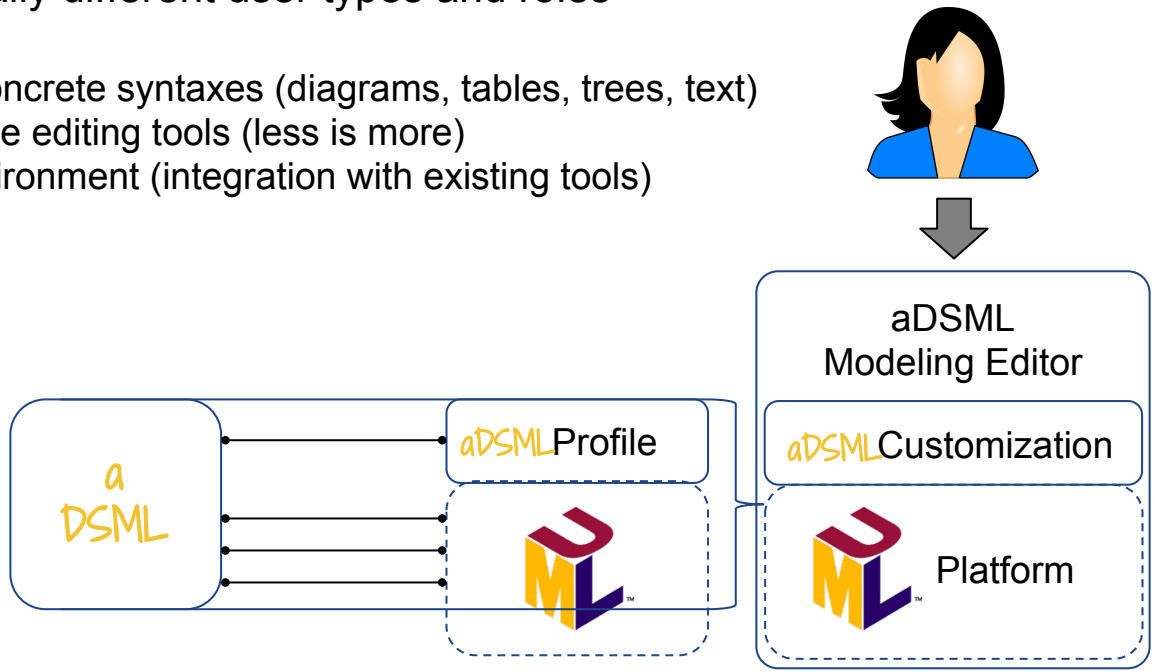




Context: Domain-specific Modeling (DSM)

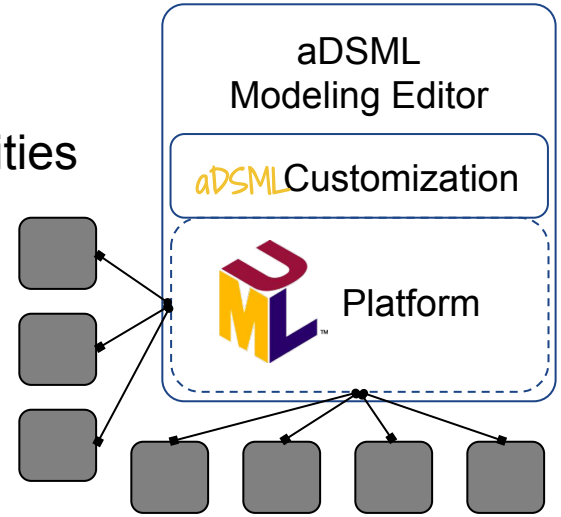
- A DSML is not enough
  - DSML and its modeling tool is one single product
  - Factor in users' domain, objectives, and their background
  - Domain users, potentially different user types and roles
  - Customizability is key
    - Language and its concrete syntaxes (diagrams, tables, trees, text)
    - Customizability of the editing tools (less is more)
    - Flexibility of the environment (integration with existing tools)





Why Open Source Platform?

- An off-the-shelf modeling tool is not enough
- Industrial use cases require lots of additional capabilities
  - CodeGen
  - Validation, simulation
  - Model checking, model testing
  - Collaborative modeling, PLM
  - ...
- Flexibility and customizability is key
- Commercial off-the-shelf tools cannot provide all that
  - No single organization has the capacity and expertise to create all those capabilities
  - Off-the-shelf modeling tools are not customizable enough
  - They cannot grow a community that fills those gaps



Why Open Source Platform?

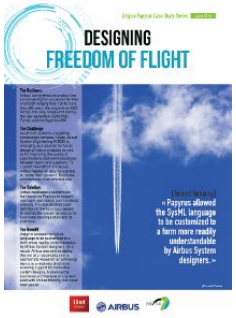
- Open Source is not free
- Shared maintenance costs of shared parts

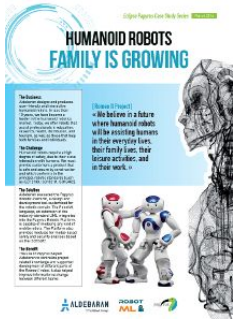
- It is not about the money, it is about flexibility and evolution
  - Innovation in MBE development techniques don't depend on single SW vendors
  - Closed source → inflexible, hard to extend, customize, adapt, ...
  - Vendor lock-in is a huge long-term risk

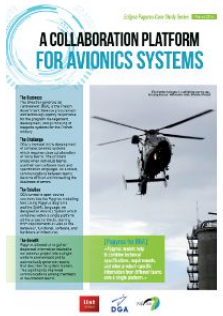
- Consumers usually don't gain a USP from the modeling environment itself
  - Value is in the domain-specific models, DSMLs and what the they are used for
  - Customizations are key though

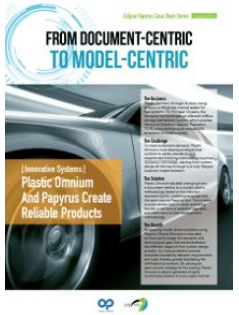
Papyrus

- Eclipse-based modeling platform
  - Standards-based: UML, SysML, OCL, fUML, Alf, MARTE, …
  - Domain-specific languages with UML Profiles
  - Truly open: Eclipse Public License at Eclipse License EPL 1.0
  - Customizable concrete syntax: diagrams, tables, trees, text
  - Enabler for model-based technologies
    - simulation, formal testing, safety analysis, trade-offs analysis, exploration, ...
- Many successful industrial applications
  - https://eclipse.org/papyrus/testimonials.html

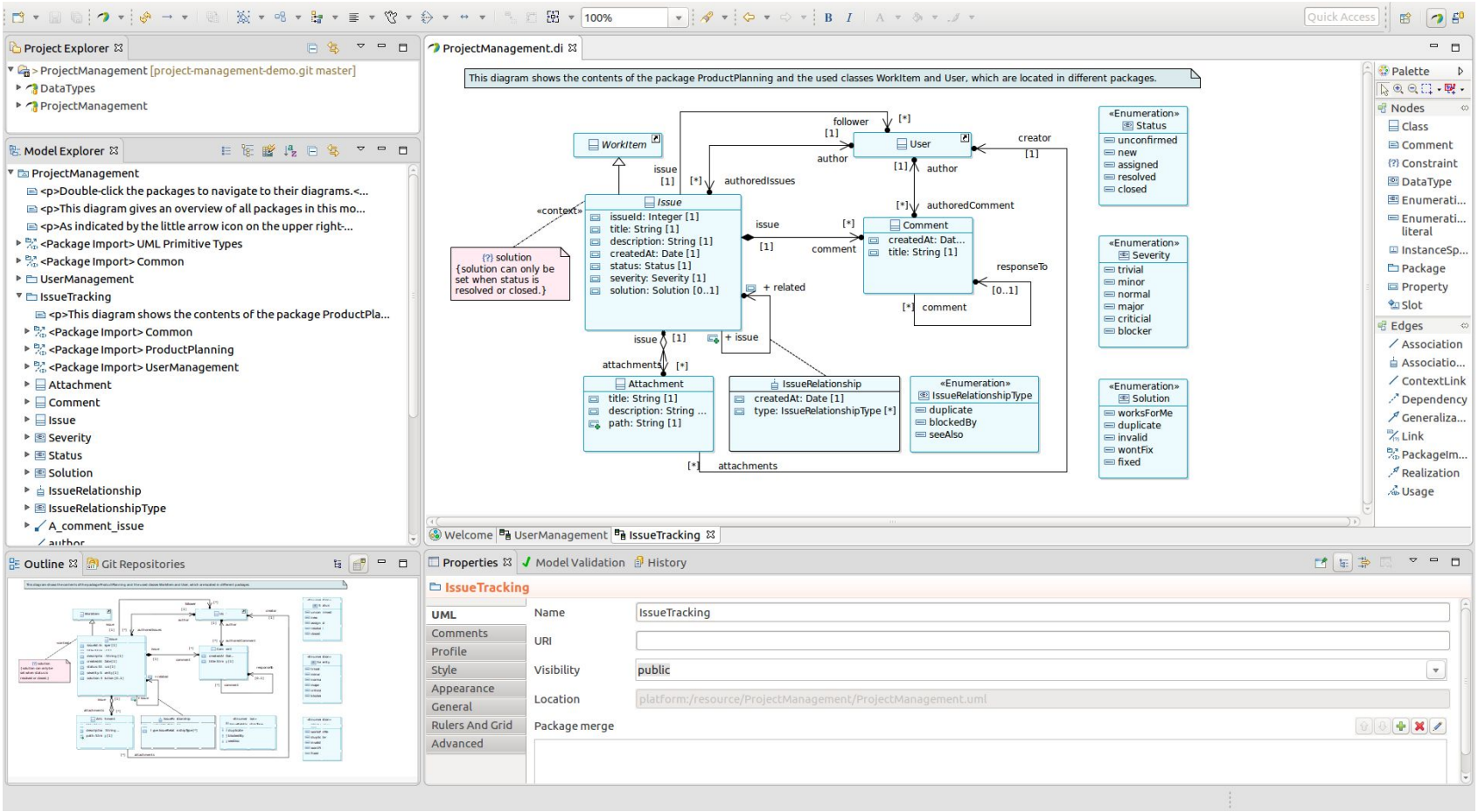




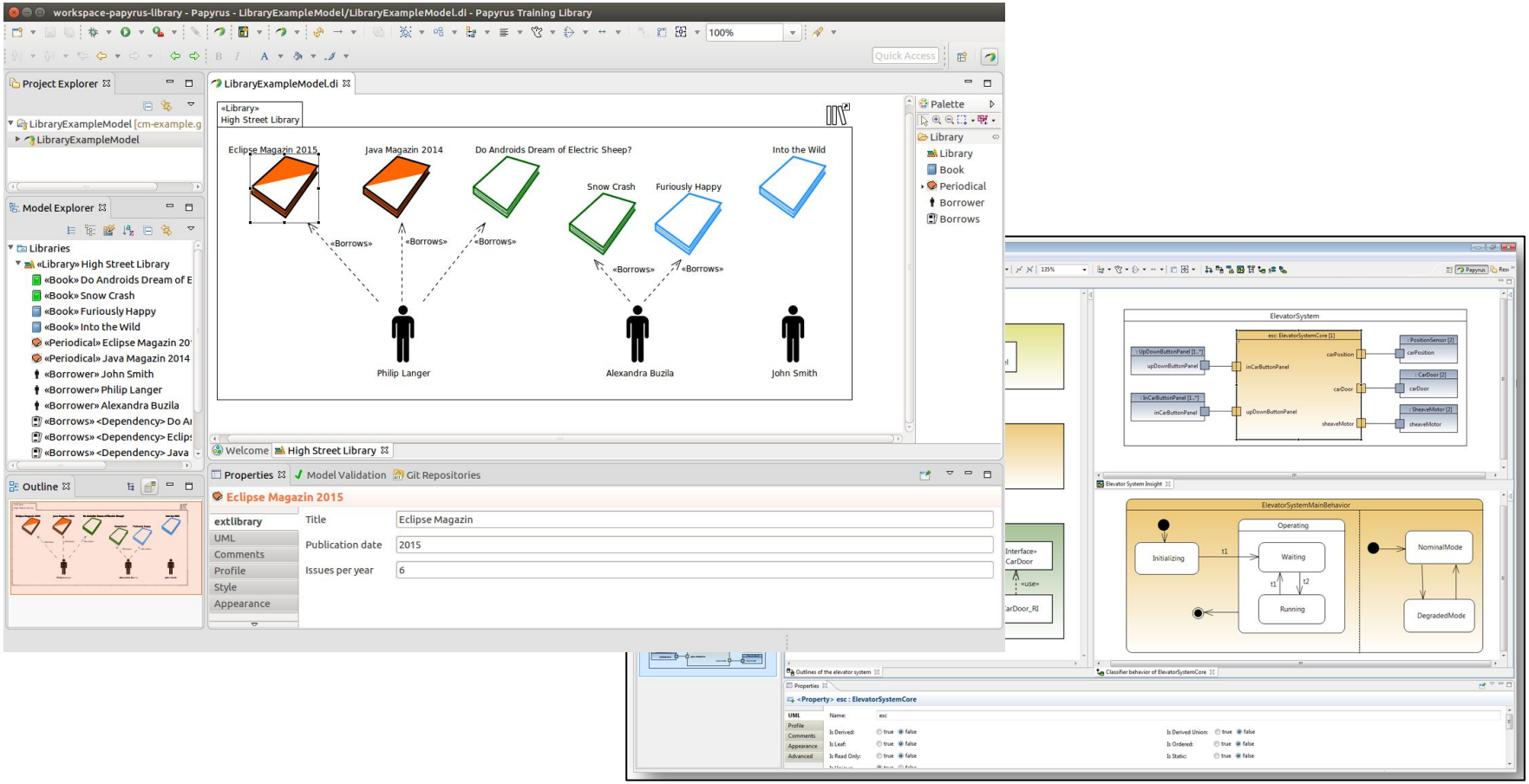




Papyrus


Project Explorer
ProjectManagement [project-management-demo.git master]
DataTypes
ProjectManagement
Model Explorer
ProjectManagement
<p>Double-click the packages to navigate to their diagrams.<...
<p>This diagram gives an overview of all packages in this mo...
<p>As indicated by the little arrow icon on the upper right-...
<Package Import> UML Primitive Types
<Package Import> Common
UserManagement
IssueTracking
<p>This diagram shows the contents of the package ProductPla...
<Package Import> Common
<Package Import> ProductPlanning
<Package Import> UserManagement
Attachment
Comment
Issue
Severity
Status
Solution
IssueRelationship
IssueRelationshipType
A_comment_issue
author
ProjectManagement.di
This diagram shows the contents of the package ProductPlanning and the used classes WorkItem and User, which are located in different packages.
WorkItem
User
Issue
Comment
Attachment
IssueRelationship
«Enumeration» Status
«Enumeration» Severity
«Enumeration» IssueRelationshipType
«Enumeration» Solution
Palette
Nodes
Edges
Welcome
UserManagement
IssueTracking
Outline
Git Repositories
Properties
Model Validation
History
IssueTracking
UML
Comments
Profile
Style
Appearance
General
Rulers And Grid
Advanced
Name
IssueTracking
URI
Visibility
public
Location
platform:/resource/ProjectManagement/ProjectManagement.uml
Package merge

Papyrus


workspace-papyrus-library - Papyrus - LibraryExampleModel/LibraryExampleModel.di - Papyrus Training Library
Project Explorer
LibraryExampleModel.di
«Library»
High Street Library
Eclipse Magazin 2015
Java Magazin 2014
Do Androids Dream of Electric Sheep?
Snow Crash
Furiously Happy
Into the Wild
«Borrows»
Philip Langer
Alexandra Buzila
John Smith
Palette
Library
Book
Periodical
Borrower
Borrows
Model Explorer
Libraries
Outline
Welcome
High Street Library
Properties
Model Validation
Git Repositories
Eclipse Magazin 2015
extlibrary
UML
Comments
Profile
Style
Appearance
Title
Eclipse Magazin
Publication date
2015
Issues per year
6
ElevatorSystem
ElevatorSystemMainBehavior
Operating
Initializing
Waiting
Running
NominalMode
DegradedMode

Papyrus Industry Consortium (PIC)

- Open consortium with a common goal
  - Developing a universal, industry-ready, open-source MBE solution
  - Based on Eclipse Papyrus and many other open-source components
- Independent of the domain
  - Systems modeling
  - Architecture modeling
  - Enterprise modeling
  - Internet of Things
  - CPS
  - …
- Strong collaboration
  - Tool users
  - Tool suppliers
  - Research and academia

PIC Objectives

- Development of industrial-grade open source solution
- Joint development financing
- Knowledge sharing
- Promotion of open source solution
- Development of the community
- Standardization
- Collaboration on research projects
- Contribution to MBE education and training
- ...

Papyrus Industry Consortium (PIC)

- User Lead Members

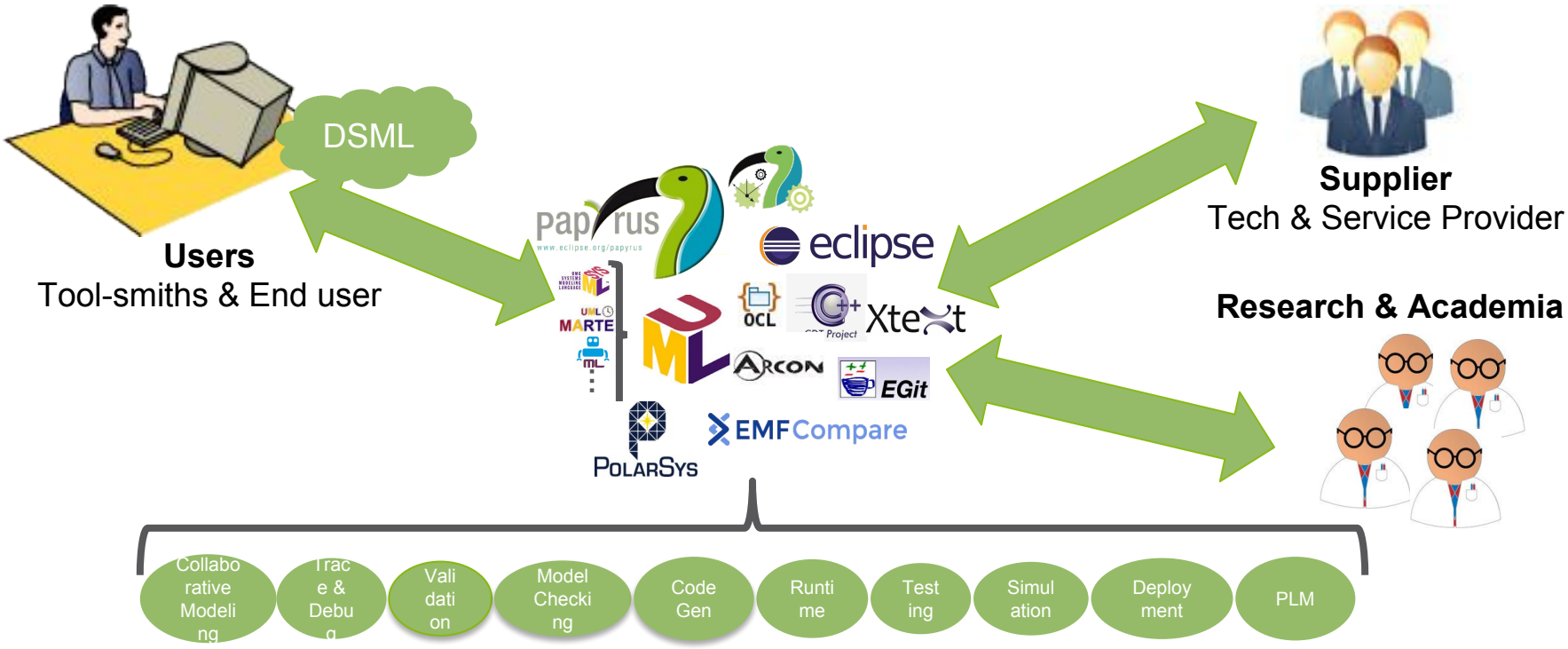
- Supplier Lead Members

- Participant Members

....

PIC Ecosystem

Papyrus IC



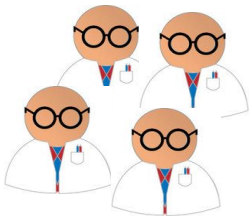
PIC Ecosystem

- Users: Tool smiths and end users
  - Customizable open tool platform
  - Free to evolve, extend, and use
  - Independent from single vendors
  - Distribution of development and maintenance costs
  - Coordination of objectives and investments
  - Exchange of experiences and best practices

PIC Ecosystem

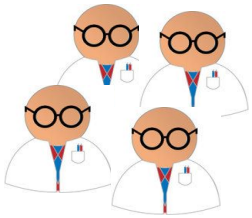
- Supplier: Technology/Service Provider
  - Allows to focus on expertise
  - Open-source is proof-of-expertise
  - Open market without non-technical entry barriers
  - Knowledge and reputation is everything
  - Independence from other technology providers

- Research & Academia
  - Open access to platforms for research prototype
  - Without being able to modify the platform it is hard to innovate
  - Easier transfer of requirements from practice
  - Enables more direct evaluations and case studies in practice
  - Easier knowledge and technology transfer into practice



Many challenging research topics

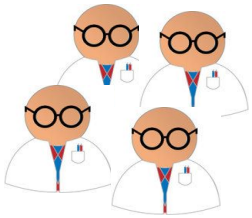
- Hybrid modeling
  - Synchronized graphical and textual modeling
- Collaborative modeling
  - Model review, concrete syntax oriented diff / merge
- Quality assessment of models
- Security in modeling and security modeling
- Several more
  - See https://wiki.polarsys.org/Papyrus_IC/Research_Academia/Research_priorities



Summary

Papyrus IC

- Open source is the only practical way to full MBE
- Eclipse, EMF, and Papyrus provide the basis for this vision
- A vibrant and extensive community is key
- Contributions from research & academia are essential
- An outstanding opportunity for all of us



Invitation to join us

- Open source collaboration License EPL 1.0

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