FUTURE OF MBE IN INDUSTRY: OPEN SOURCE IS THE ONLY SOLUTION!

LCCC AND ACCESS WORKSHOP
LUND UNIVERSITY -- MAY 4-5, 2015

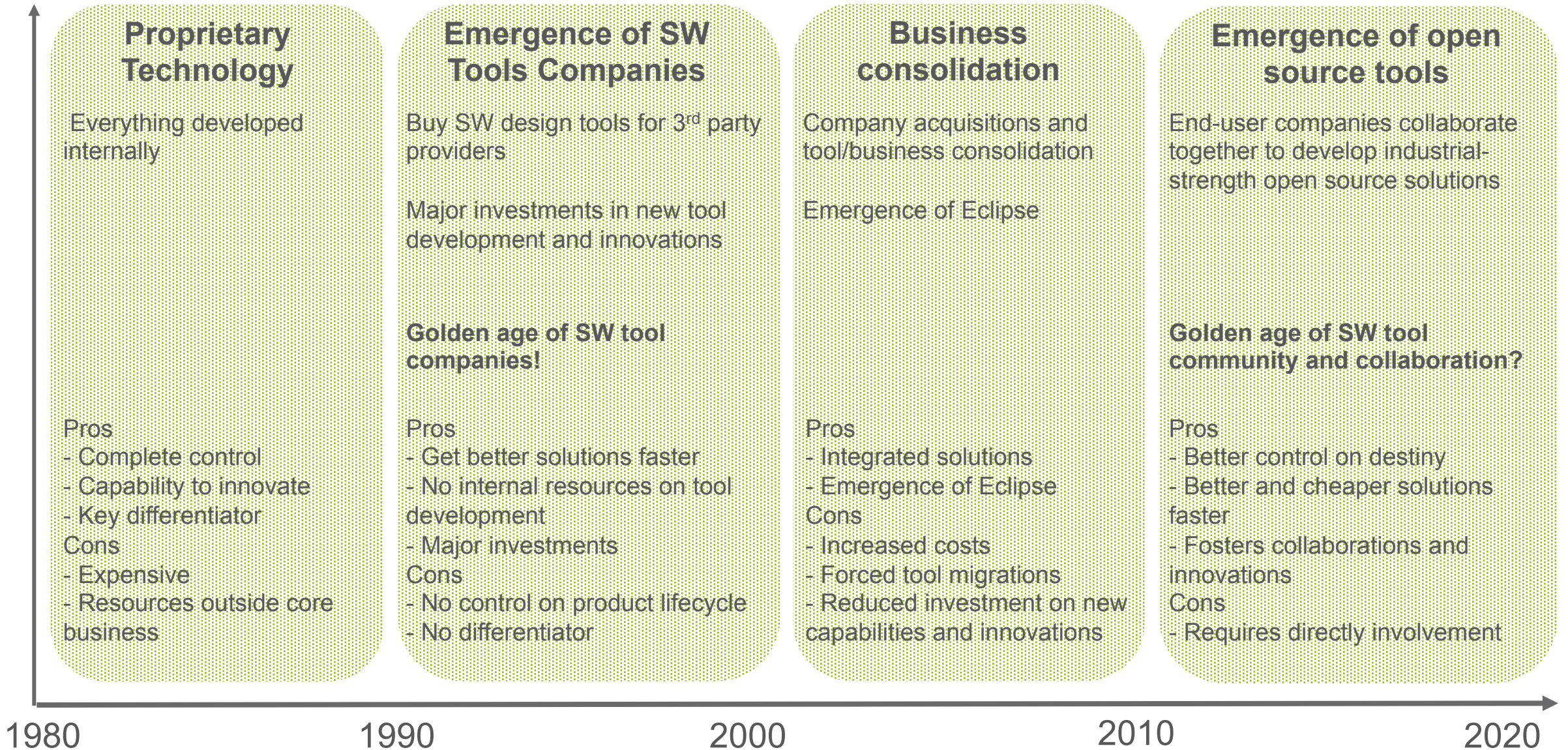Presented by Francis Bordeleau
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ERICSSON

OUTLINE

› Why open source?

› Open source modeling vision

› Papyrus status and plan

› Summary

EVOLUTION OF SW DESIGN TOOLS

Proprietary Technology

Everything developed internally

Pros
- Complete control
- Capability to innovate
- Key differentiator

Cons
- Expensive
- Resources outside core business

Emergence of SW Tools Companies

Buy SW design tools for 3rd party providers

Major investments in new tool development and innovations

Golden age of SW tool companies!

Pros
- Get better solutions faster
- No internal resources on tool development
- Major investments

Cons
- No control on product lifecycle
- No differentiator

Business consolidation

Company acquisitions and tool/business consolidation

Emergence of Eclipse

Pros
- Integrated solutions
- Emergence of Eclipse

Cons
- Increased costs
- Forced tool migrations
- Reduced investment on new capabilities and innovations

Emergence of open source tools

End-user companies collaborate together to develop industrial-strength open source solutions

Golden age of SW tool community and collaboration?

Pros
- Better control on destiny
- Better and cheaper solutions faster
- Fosters collaborations and innovations

Cons
- Requires directly involvement

1980   1990   2000   2010   2020

PROGRESS

Connections (billion)

50

40

30

20

10

15 years
50 billion connected devices

25 years
5 billion connected people

100 years
1 billion connected places

1875   1975   2000   2020

AT A GLANCE

#1

MOBILE INFRASTRUCTURE

OPERATIONS & BUSINESS SUPPORT SOLUTIONS

SERVICES

TV & MEDIA DELIVERY

1 BILLION	Subscribers managed by us
2.5 BILLION	Subscribers supported by us
50%	LTE smartphone traffic handled by our networks

25,000	R&D Employees
180	Countries with customers
114,000	Employees
	*2013 numbers

OUR PRODUCTS

Most important component is software

World's fifth largest software supplier

MODELING CONTEXT

› Modeling has been used at Ericsson since mid 90's
  − Different aspects, including software design, system, network, information/data, business process modeling
  − Large user base (thousands of designers)
  − Currently relying on commercial proprietary tools
    › e.g. RSA, RSA RTE, Rhapsody, BridgePoint, EA, PowerPoint, etc
› Modeling has demonstrated key benefits in many different contexts
› But, evolution and broader adoption has been limited by the lack of proper tool support
  − Tool usability
  − Support for customization and Domain Specific Modeling Language (DSML)
  − Missing capabilities regarding a number of different aspects
  − More and better integrations
› Competing tools from different tool vendors instead of collaboration

WHY MODELING AT ERICSSON?
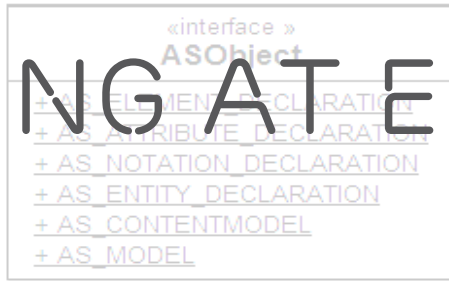
› Excellent development efficiency
  – Quality
  – Lead Time
  – Flexibility
› Single source of information supporting different views
› Abstraction
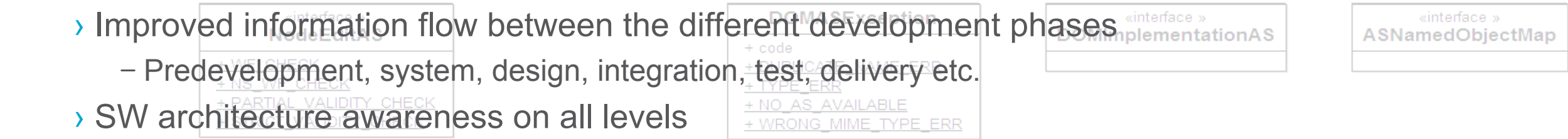› Improved information flow between the different development phases
  – Predevelopment, system, design, integration, test, delivery etc.
› SW architecture awareness on all levels
› Early design execution / simulation / validation
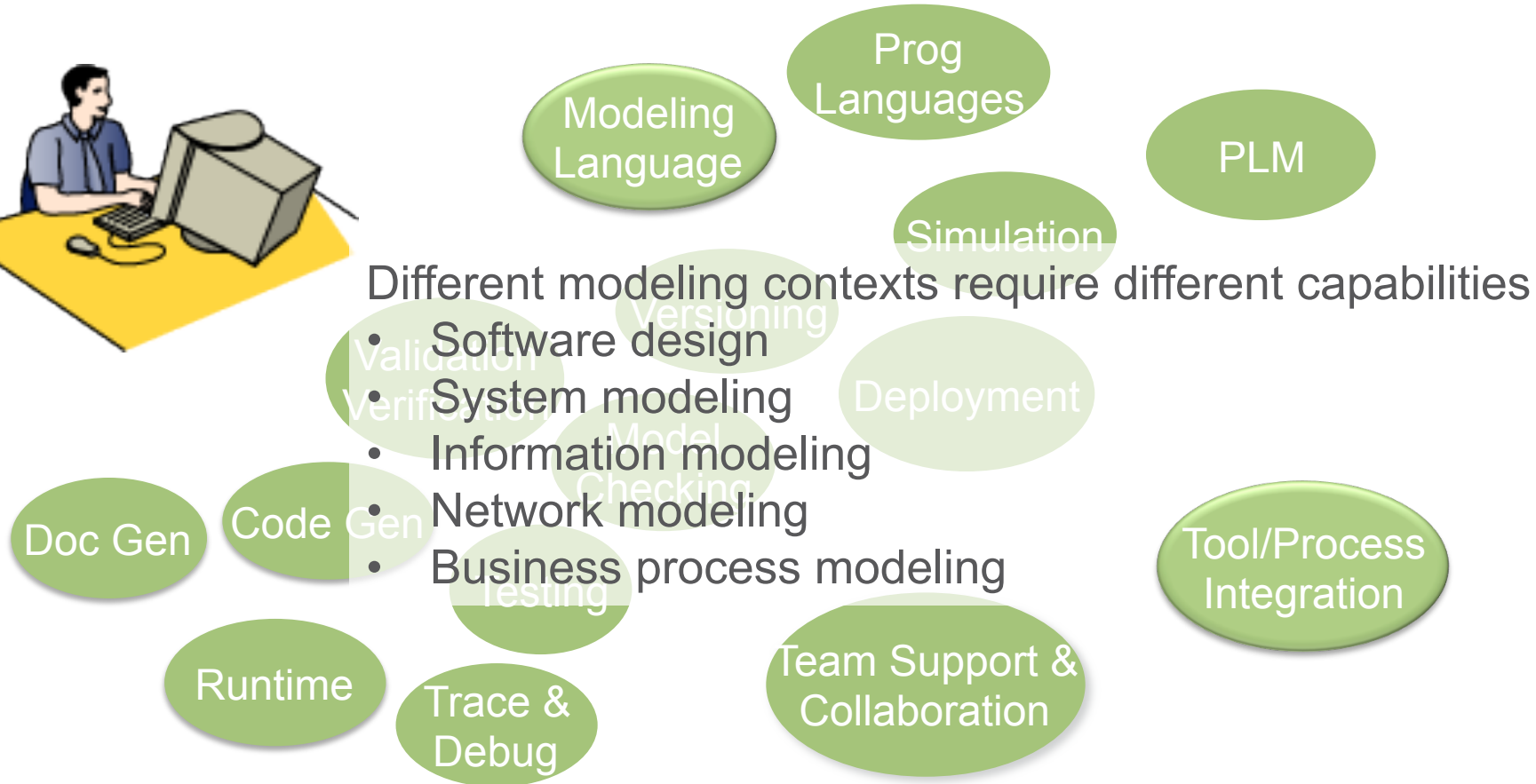› Extensive use of automation, validation and generation
› Supports simplified processes (e.g. Agile)
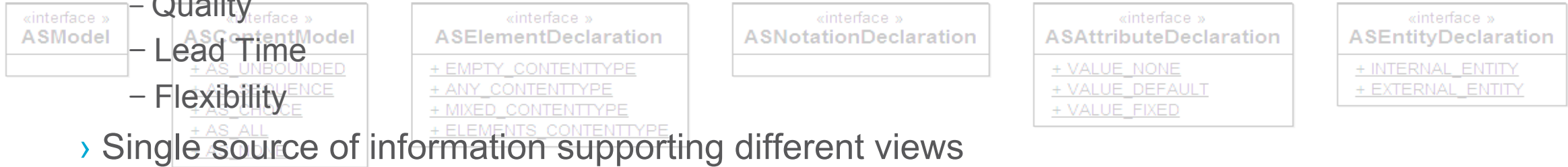
THE IMPORTANCE OF MODELING

› UML modeling is currently used within Radio development unit for the following systems:

  – WCDMA – 80-90% of the SW + System design RBS
  – LTE – Large parts of the SW
  – GSM – System design RBS
  – Platform – 20% of the SW + System design parts

› The above business based on MBE corresponds to around 60% of the Ericsson yearly turnover of more than 200 Billion SEK ($ 27 Billion)

KEY ASPECTS

› Usability

› Customizability

› Performance

› Scalability – large models/large teams

› Integration

MODELING NEEDS

Prog Languages

Modeling Language

PLM

Simulation

Different modeling contexts require different capabilities

Versioning

- Software design

Validation
Verification

- System modeling

Deployment

- Information modeling

Model Checking

- Network modeling

Doc Gen

Code Gen

- Business process modeling

Testing

Tool/Process Integration

Runtime

Trace & Debug

Team Support & Collaboration

Each aspect is associated with a set of complex capabilities

No single company can provide everything we need!

UNIFIED MODELING LANGUAGE

UML VISION

Profile

Testing · Trace & Debug · Validation Verification · Model Checking · Runtime · Code Gen · Simulation · Deployment · Model Integration · PLM
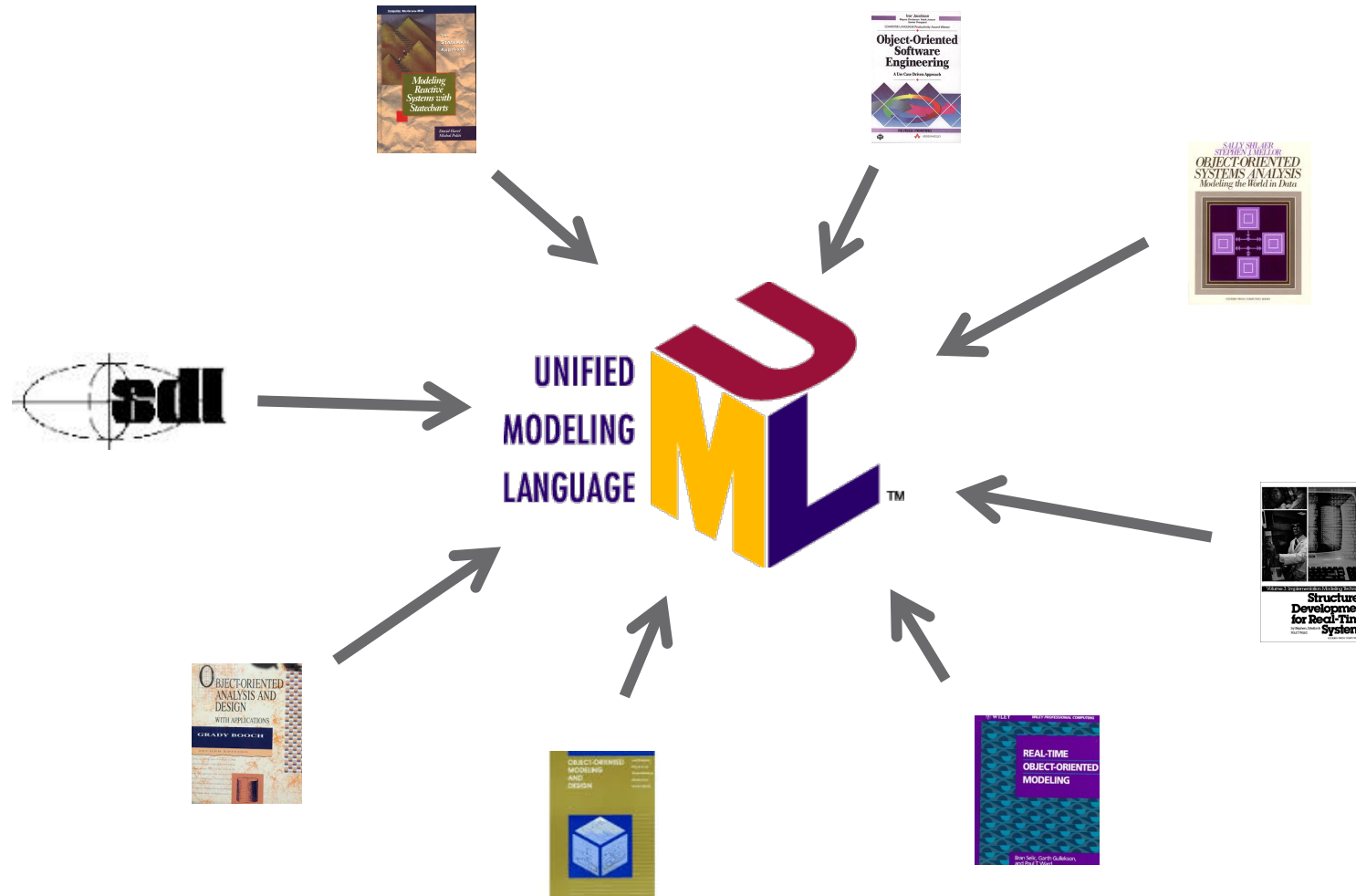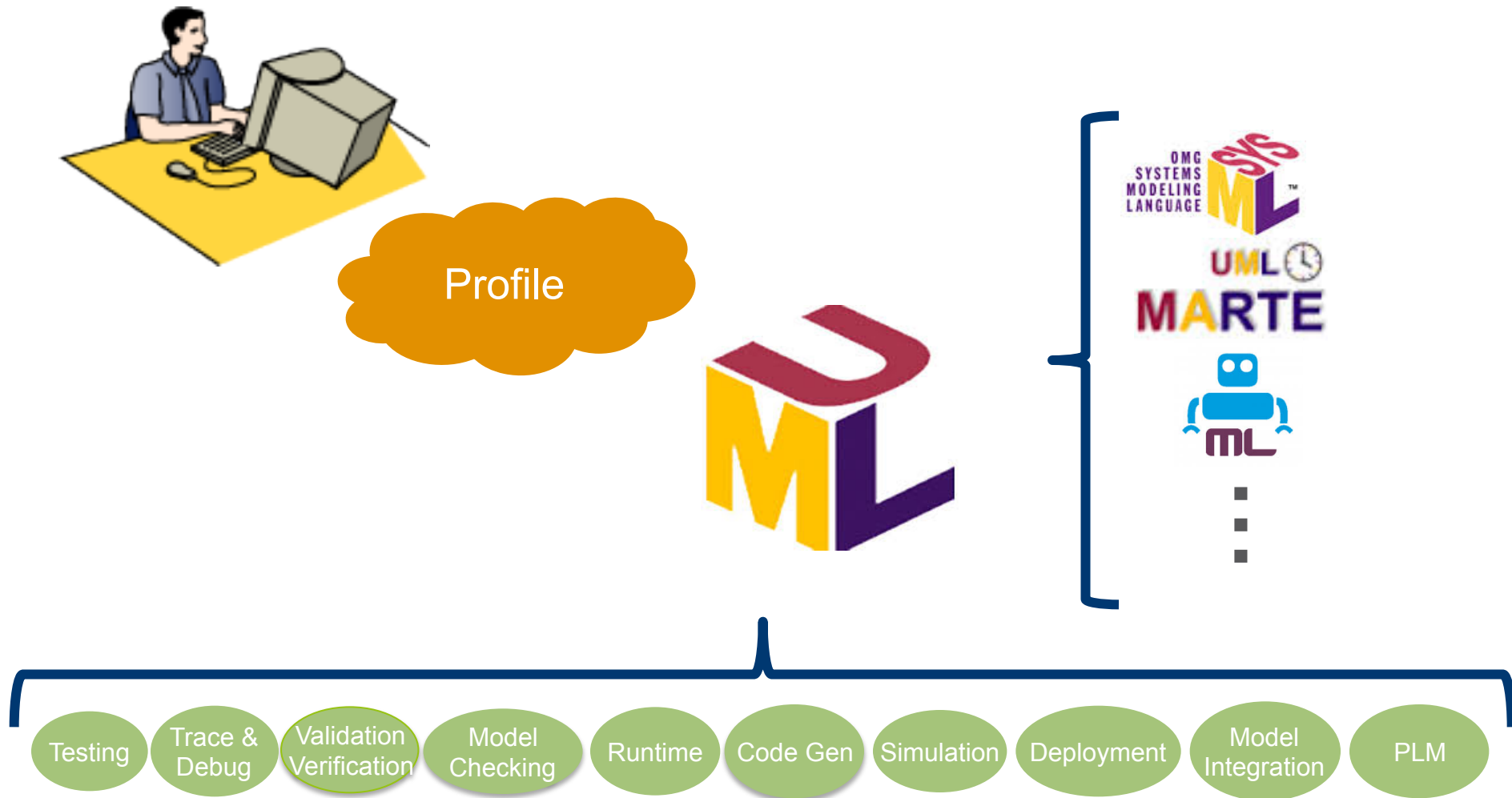
UML TOOL REALITY

Why doesn't it work in practice?
- The problem is not UML, but the UML tools!
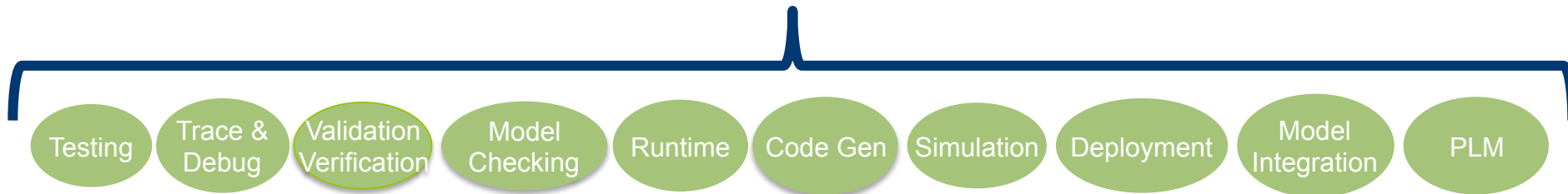- Commercial proprietary tools only support (very!) small portion of overall vision

Profiles

OMG SYSTEMS MODELING LANGUAGE SysML™

UML MARTE

ML

Testing | Trace & Debug | Validation Verification | Model Checking | Runtime | Code Gen | Simulation | Deployment | Model Integration | PLM
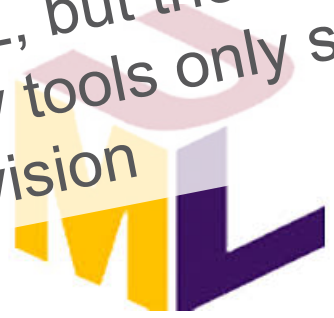
UML TOOL ISSUES!

Tools must focus on user needs
- End user should not have to deal with the UML spec
- Tools should provide users the UML subset they need
- Tools must provide proper support for DSML
- Tools must deliver more capabilities

Profile

UML

OMG SYSTEMS MODELING LANGUAGE

MARTE

ML

Testing | Trace & Debug | Validation Verification | Model Checking | Runtime | Code Gen | Simulation | Deployment | Model Integration | PLM

LAST 30 YEARS -- TOOLS

Why don't we have better tools today?
Why don't we have access to more capabilities?
Lack on investment?
Lack of research?

**We have to stop reinventing the wheel
… and focus on adding value!**

KEY ISSUES

Vendor lock-in

No ability to independently develop required capabilities

Commercial Tools
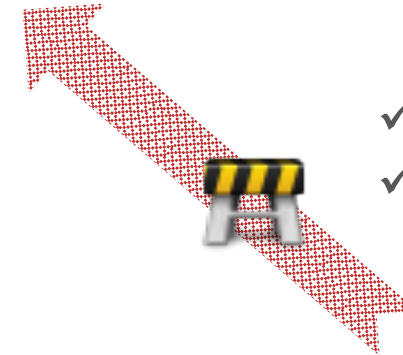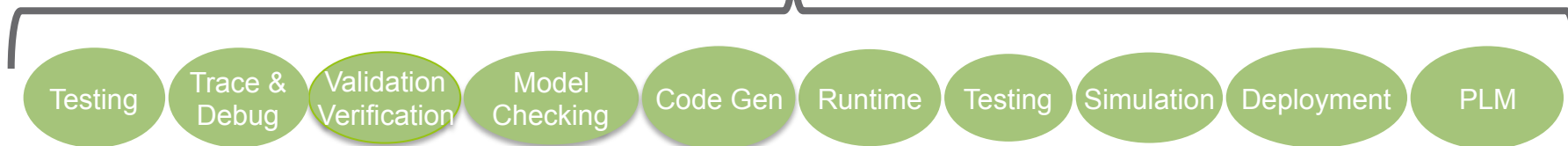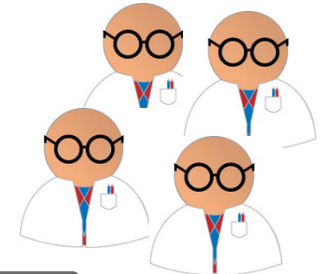
Proprietary tool

IP protection

Research Tools

Testing

Trace & Debug

Validation Verification

Model Checking

Runtime

Code Gen

Simulation

Deployment

Model Integration

PLM
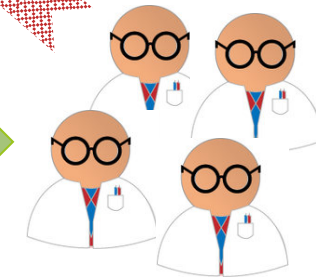
ERICSSON OBJECTIVES

› An industrial-grade open source alternative

› Control of own destiny regarding modeling tools evolution
  - Eliminate vendor lock-in
  - Ensure long-term availability of key modeling tools
  - No forced migration
  - Ability to develop new tool features and integrations as required

› Long-term viability of open source modeling tools
  - Engage other end-user enterprises in core development of open source modeling tools around Papyrus
  - Encourage the use of open source modeling tools by academia and research institutions
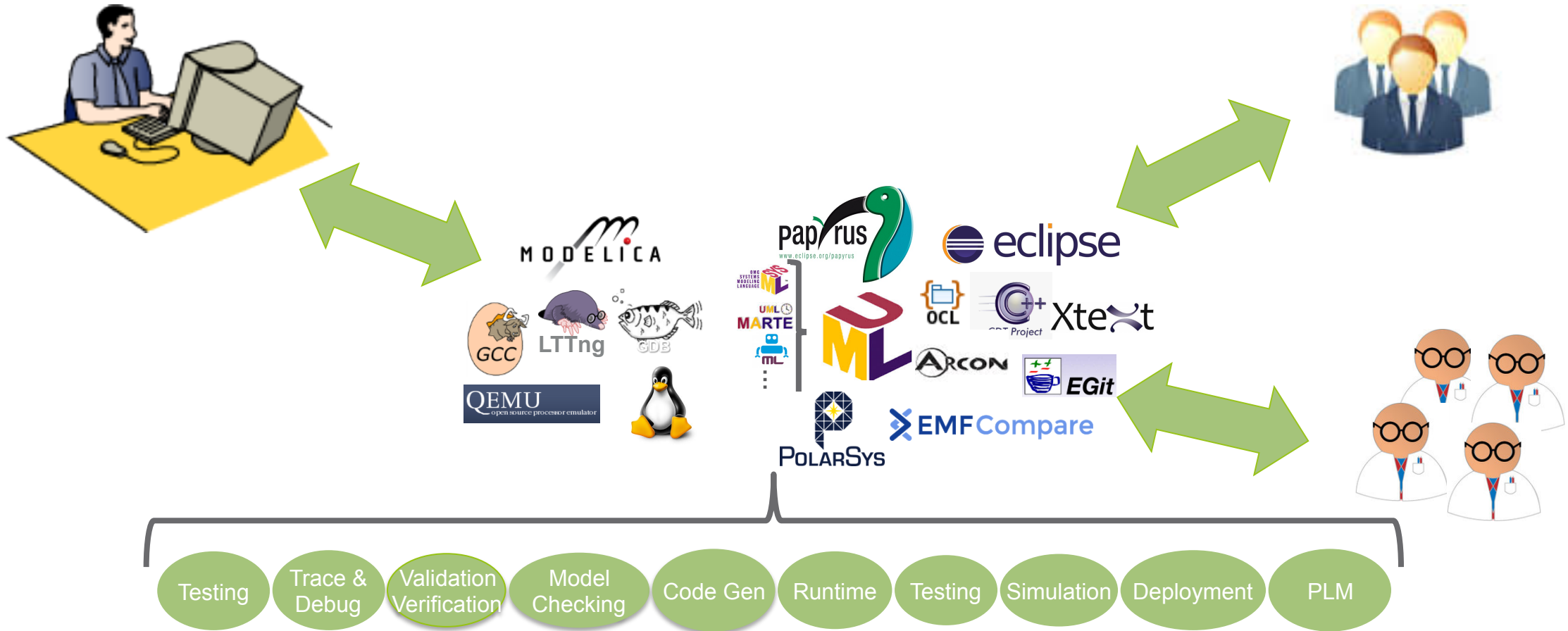 - Collaborate with academia and other research institutions in developing key MBE solutions
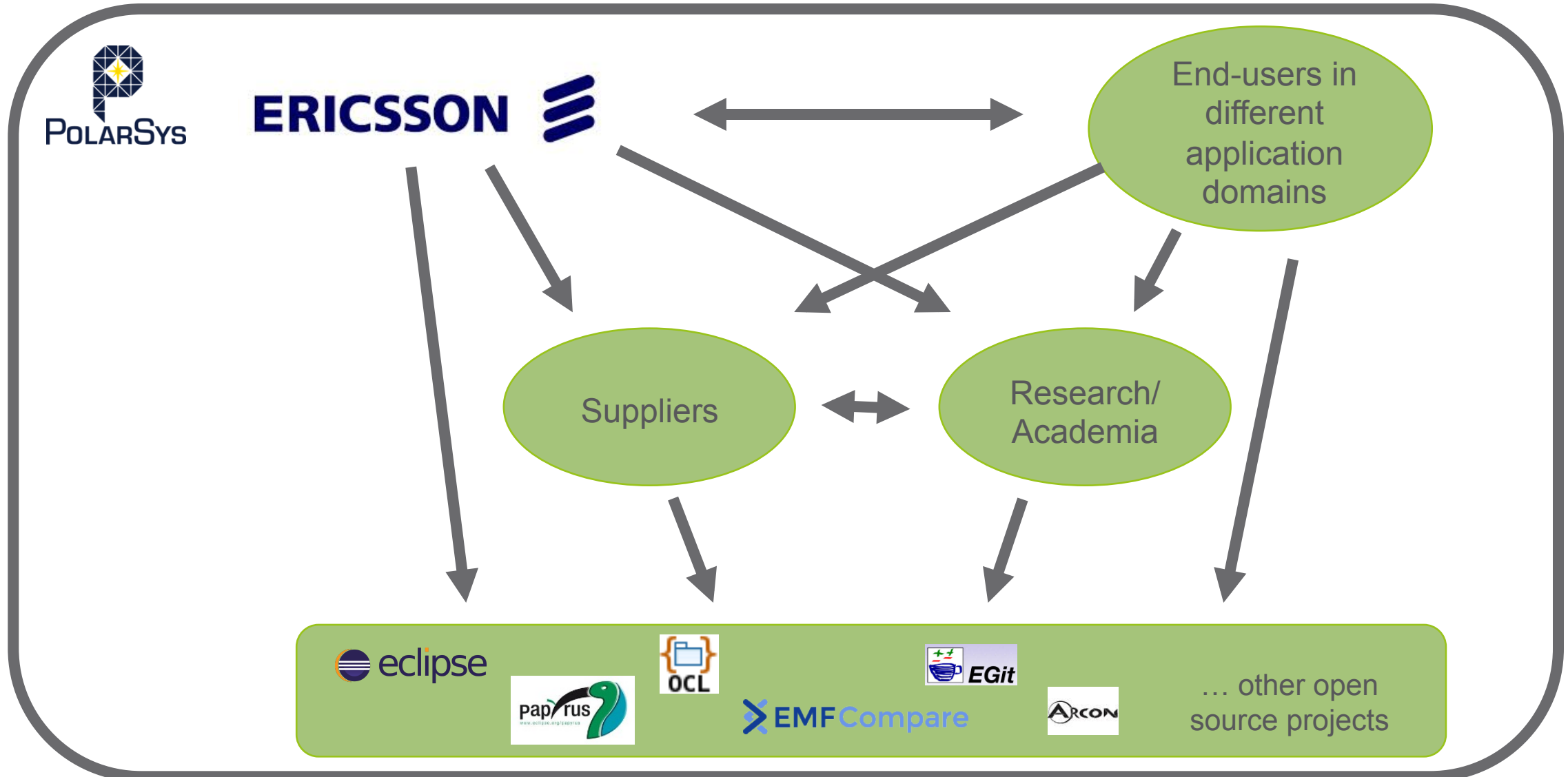
OPEN SOURCE MODELING VISION

Everybody focused on a common objective
Development of a complete MBE solution

Testing · Trace & Debug · Validation Verification · Model Checking · Code Gen · Runtime · Testing · Simulation · Deployment · PLM

NEED TO ADDRESS OTHER ASPECTS

Testing | Trace & Debug | Validation Verification | Model Checking | Code Gen | Runtime | Testing | Simulation | Deployment | PLM
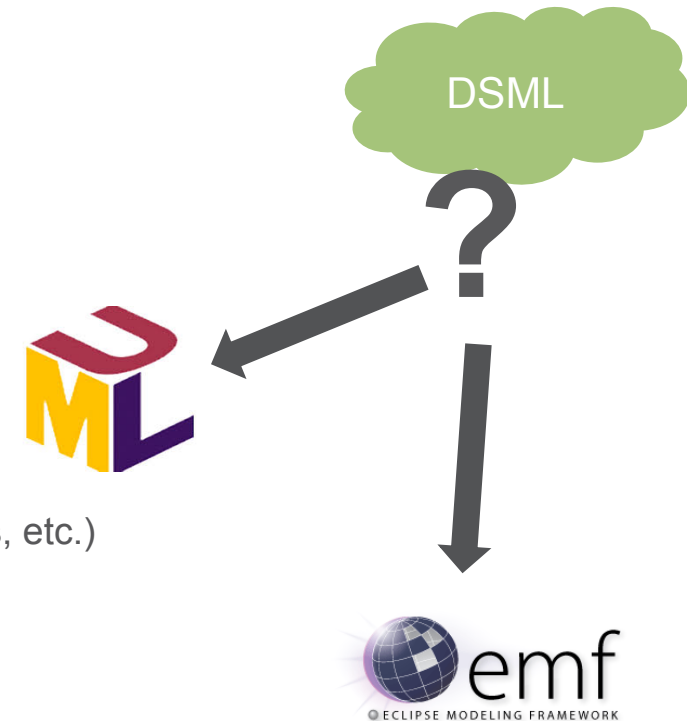
THE COMMUNITY

DSML

UML or DSML?

›Wrong question! You can have both!

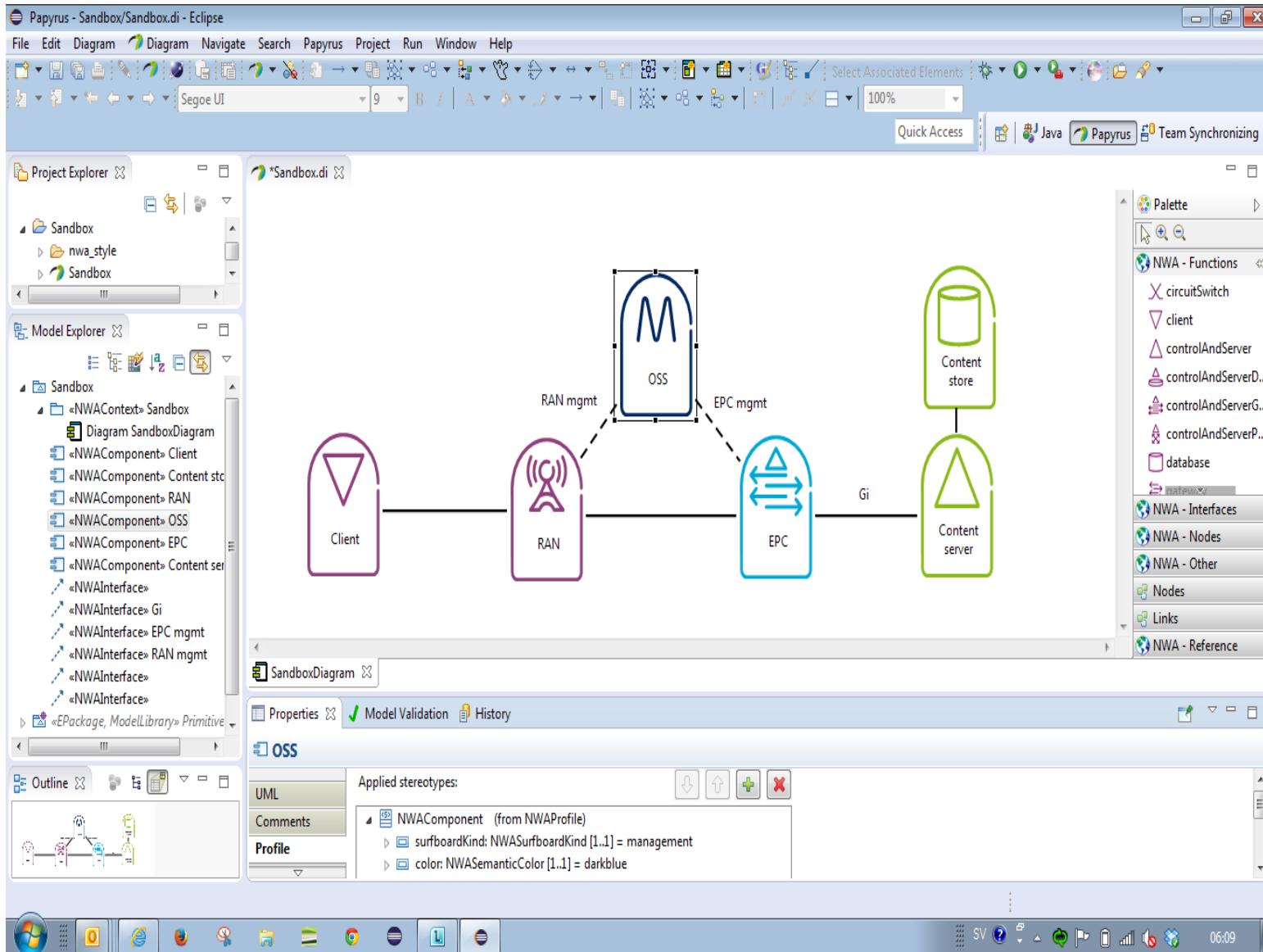›Real question: "what do you want to base your DSML on?

›UML-based:
- Leverages the UML foundations work
  › Result of years of work of top experts
  › Facilitates integration with other languages
- Benefits from the different UML-based technologies (present and future)
- More complex to define that "pure" DSML – UML expertise required
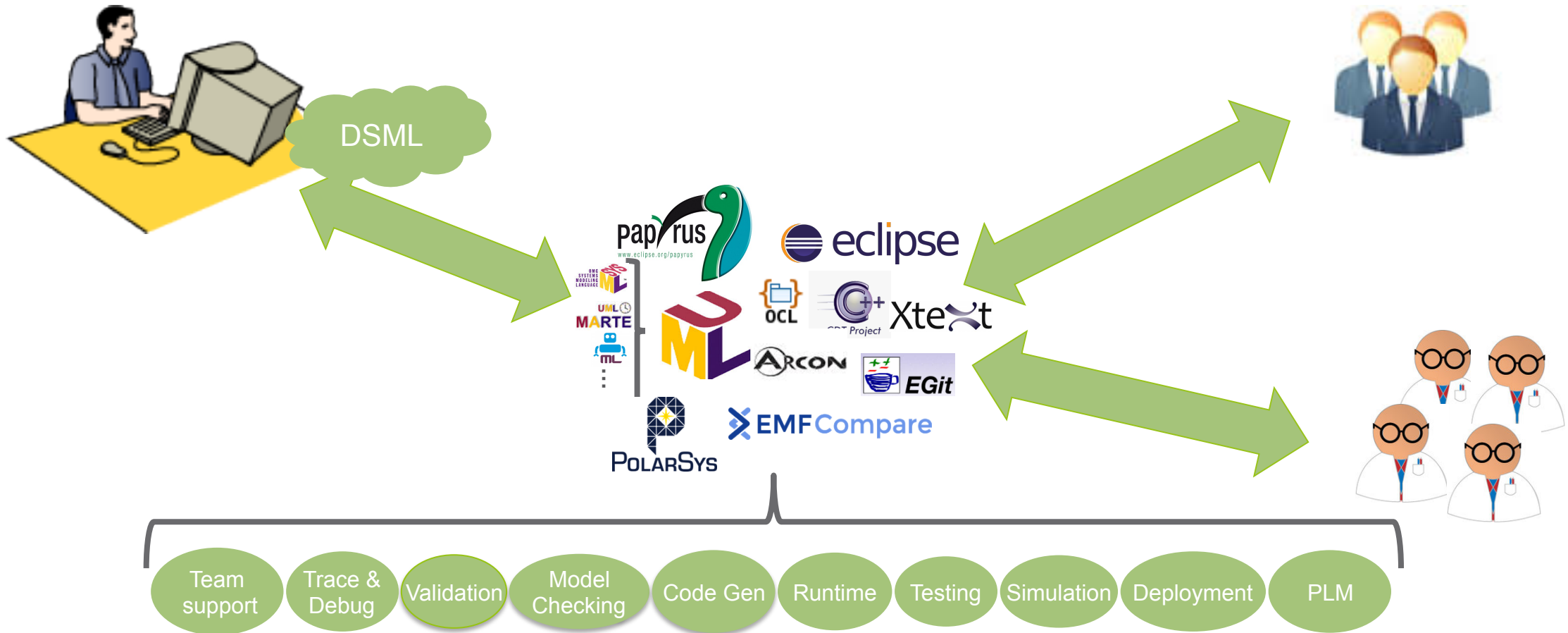
›"Pure" DSML
- Customized: no UML expertise required
- Need to develop full language support infrastructure (editors, debuggers, compilers, etc.)
- But in some cases, it is the right solution!

PAPYRUS DSML FOR NWA

OPEN SOURCE MODELING VISION

| Team support | Trace & Debug | Validation | Model Checking | Code Gen | Runtime | Testing | Simulation | Deployment | PLM |

PAPYRUS UPDATE

› Papyrus 1.0 was released as part of Eclipse Luna at the end of June 2014
  - This was a key milestone for Papyrus … and Ericsson
  - Major improvements in last year regarding both the technical and the project management aspects
  - Current focused on Papyrus v1.1 and Papyrus-RT to be released in June 2015 as part of Eclipse Mars

› World-class development team
  - **CEA (project lead)**, All4Tec, Combitech, EclipseSource, IncQuery, Obeo, Montages, Tieto, Zeligsoft
  - Technology experts – includes Eclipse project leads/committers and world-renowned modeling experts
    › C Damus, E Seidewitz, B Selic, E Willink, J Wolfe
  - University/research institutes: CRIM, fortiss, MDH, Queen's University
  - Currently have technology experts involved in all main aspects

› We are also involved in non-technical aspects:
  - Development of community, governance, promotion and marketing
  - Establishment of Papyrus Industrial Consortium

CURRENT FOCUS

› Papyrus
  − Overall improvements, scalability (large teams, large models), usability, customizability and DSML
› Papyrus-RT
  − New Eclipse project to support the UML-RT/ROOM paradigm -- to be released June 2015 as part of Eclipse Mars
  − Includes UML-RT C++ Runtime and associated C++ Code Generator
› RSA/RSA-RTE Import
  − Dealing with very large model import
› Team Support
  − Includes Git/EGit, EMF Compare, EGerrit Model Review
› Proprietary DSML's
› Testing/QA framework
› Develop Papyrus-RT extensions to include main concepts of xtUML and RT-UML
› Other aspects: Code-centric MDD, model-based testing, validation framework

All of these projects are developed in collaboration with 3rd parties

OTHER CEA PROJECTS FOR 2015

› Support for Alf (Ed Seidewitz)

› Model execution and animation (Moka)

› Platform-based design (Papyrus Qompass extension)

› Model-based testing (New open source project - Diversity)

› BPMN

› Others
  - SysML 1.4
  - Papyrus for requirement engineering
  - Model-based safety/security analysis
  - CDO integration

DIFFERENT MODELING CONTEXT

› Network architecture modeling – 100 to 150 users
  − Focus: Proprietary DSL
  − Status: Currently used by 22 active architects. Working on key improvements to enable broader deployment

› O&M modeling – ~ 200 users
  − Focus: Conventional UML with many proprietary profiles
  − Status: Preparing for deployment

› SW development for proprietary multicore baseband platform – 200 to 400 users
  − Focus: Proprietary DSL based on UML-RT structure modeling and activity diagrams
  − Status: In development, pilot project planned for H2

› System Modeling – ~ 200 users
  − Focus: System modeling based on UML-RT
  − Status: In development, pilot project planned for H2

› SW Design – over 1000 users
  − Focus: SW development based on complete UML-RT dev environment, including code generation and runtime
  − Status: In development, pilot project planned for 2016

› Overall MBE development process based on model executable
  − Focus: Support for executable UML
  − Status: Language definition

KEY CHALLENGES

› Internal Ericsson
  – Culture change – migration to open source requires a real culture change

› Community
  – Provide required infrastructure to enable the growth of the community (end-users, suppliers, and research/academia)
  – Creation of a Papyrus Industrial Consortium to lead/govern the development of Papyrus and open source modeling solution

› Papyrus to support a broad range of customizations and DSMLs
  – Ensure that we don't create a set of divergent products

› Papyrus-RT to provide an alternative to exiting commercial UML tools for distributed real-time embedded systems (DRES) and cyber-physical systems (CPS)
  – With associated customizable runtime and code generator
  – Model executability and integrated testing

Open source is not free, it requires involvement and investment

Unfortunately, it is not a silver bullet!

BUSINESS IMPACT

› The conventional proprietary model has failed to deliver the expected business value

› A different business model is required
  - Need a scalable open source business model
  - Need a community of providers
    › … we need to establish a proper business model
  - … also need to include the research community in the business model, we need innovations – Nothing if free in this world … not even research!

› Opportunity to establish a win-win-win business model

WHERE DO WE GO NEXT?

› Next generation MBE software development IDE
  - True MBE IDE
  - Integration of both textual and graphical modeling
  - Integration of formal methods and advanced validation technics
  - Generation of different types of artifacts, not only code!

› Deployment Analysis and Design Space Exploration
  - We need to maximize the potential of the platforms for different products

› Product Line Management
  - Variability modeling

› Tool/Model integration
  - We live in an heterogeneous world … and we will always do!
  - We need different modeling technics/tools for different aspects.

› Continuous Modeling
  - From BPM to detailed design
  - This is the ultimate vision!

SUMMARY

› Open source is the only practical way to full MBE

› Papyrus provides the proper basis for this vision

› A vibrant and extensive community is key

› Contributions from research/academia are essential

› An outstanding opportunity to put in place the solution all of us need!

Failure is not an option!

There is no alternative!