ERICSSON

INDUSTRIAL USE OF MBE: LESSONS LEARNED AND FUTURE DIRECTIONS

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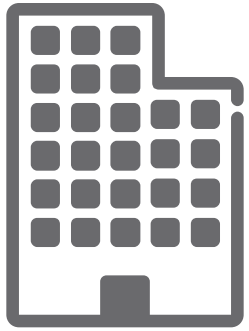
OUTLINE

- PERSONAL BACKGROUND
- ERICSSON USAGE OF MBE
- LESSONS LEARNED
- WHERE DO WE GO FROM NOW?
- FUTURE CHALLENGES
- SUMMARY

PERSONAL BACKGROUND

RESEARCH/
ACADEMIA
10 YEARS

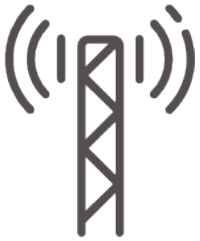
CEO OF SME
10 YEARS



PRODUCT MANAGER
3 YEARS

TEACHING

CONSULTING



TELECOM

SDR

DEFENCE
AEROSPACE

OUR PRODUCTS

Most important component is software

World’s fifth largest software supplier

Large Scale System Development

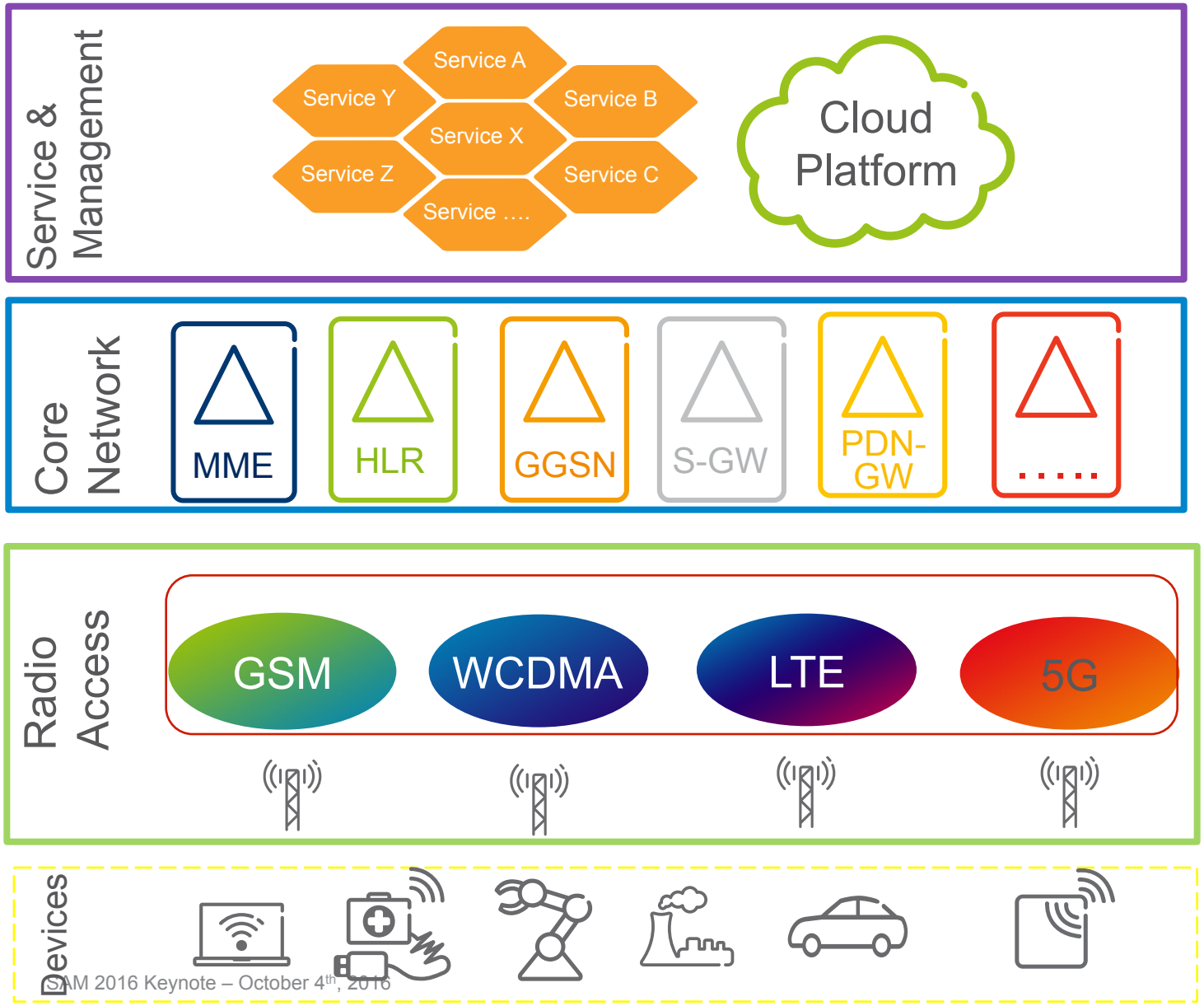
ERICSSON SYSTEM DOMAIN

Software for system management and services

HW platforms and software for core network

Diverse radio access platforms: HW and software

IPR and standards for system access



OPERATION &MAINTENANCE (O&M)

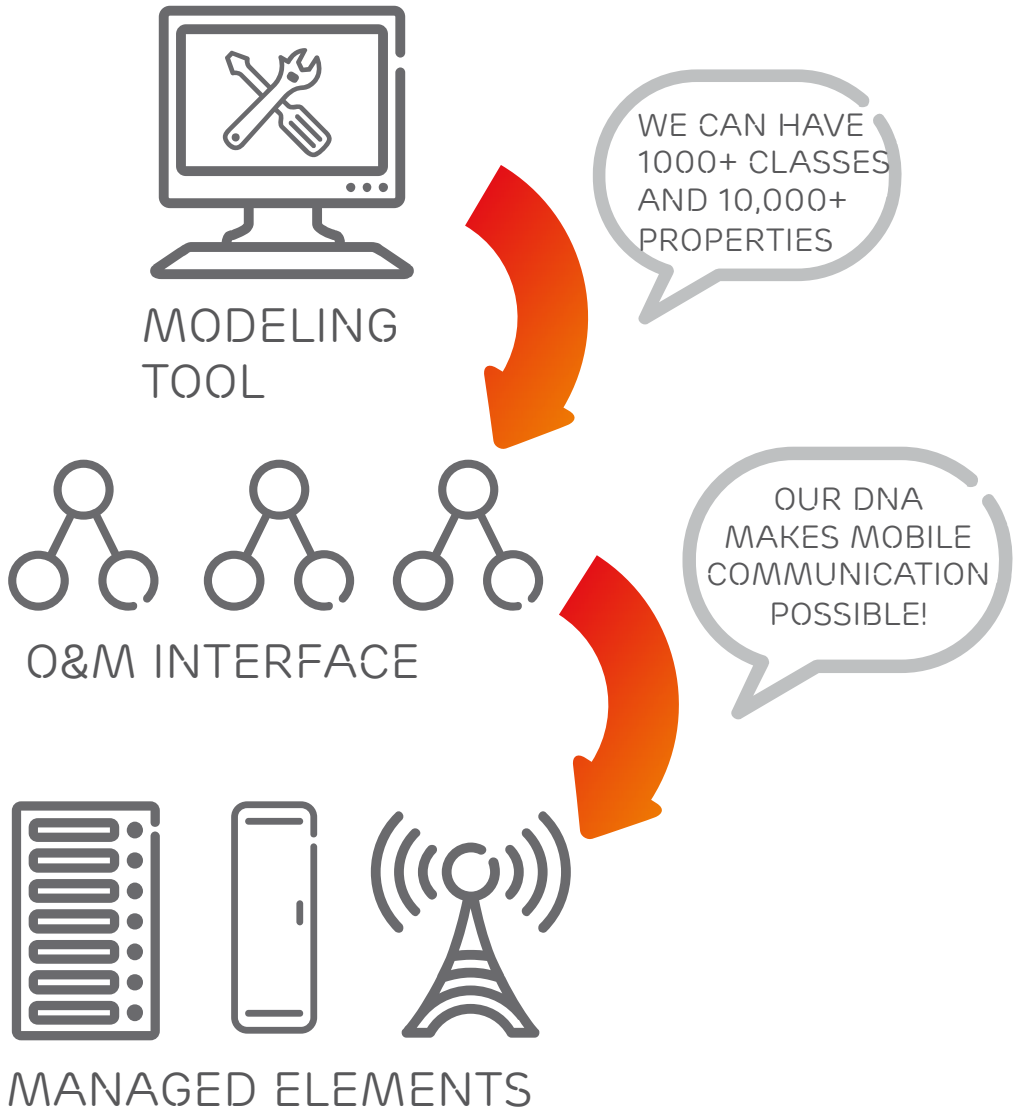
Modeling

Validation

Generation

Benefits

- Support for multiple profiles
- Automated transformations
- Advanced validation



SYSTEM MODELING – MBSE

Modeling

UML RT IBM

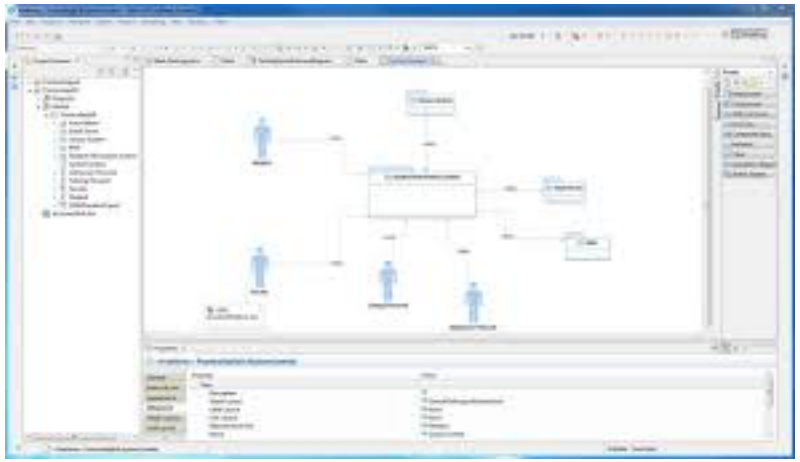
Validation

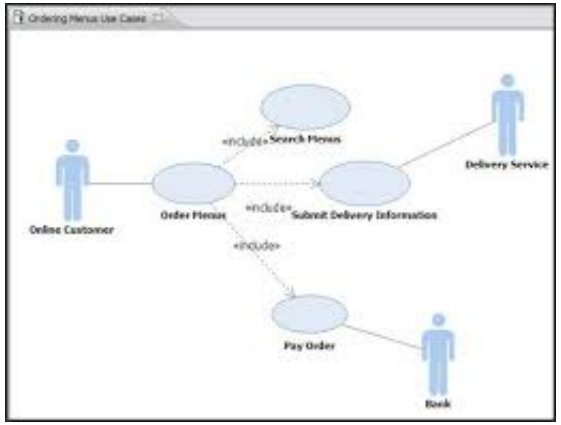
UML RT ADOCUS

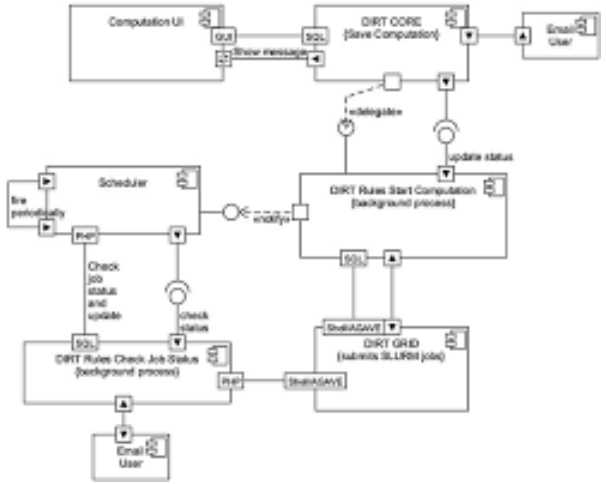
Generation

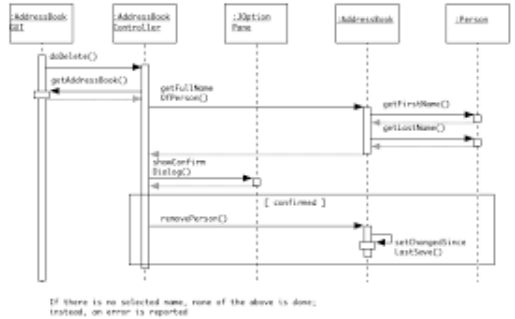
Benefits

- Reduce specification faults
- Move from document-driven process to “single source of information” approach









SW DESIGN/IMPLEMENTATION USING UML-RT

Modeling

UML RT IBM

Validation

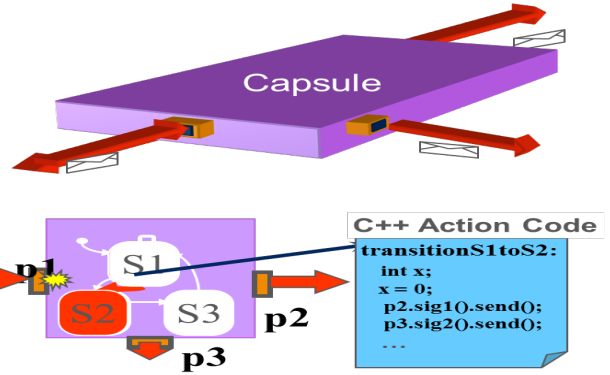
UML RT

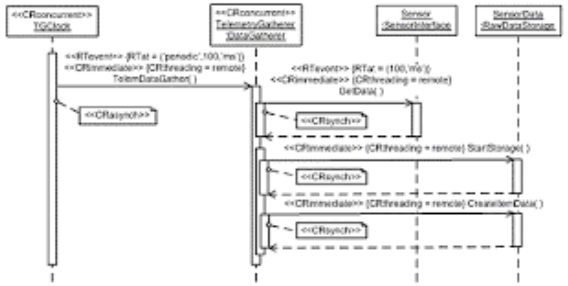
Generation

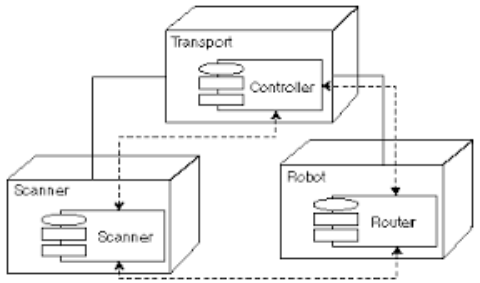
C++ Run-time system abstraction to hide underlying platform

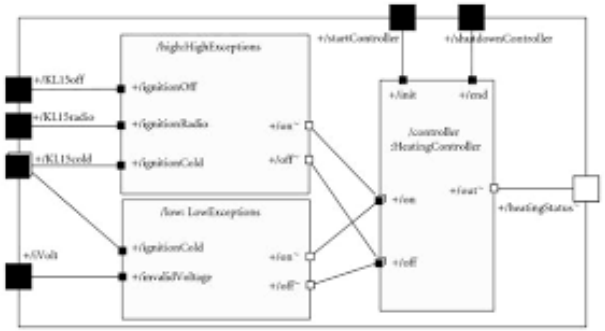
Benefits

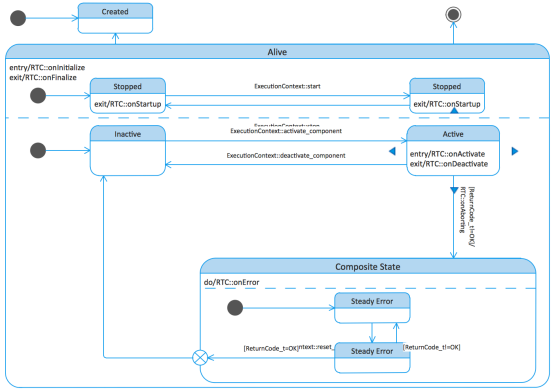
- Battle design implementation complexity using a subset of UML called UML-RT
- Capsule and state-machine abstractions provide very powerful abstractions for dealing with reactive embedded systems.











NETWORK ARCHITECTURE (NWA)

Modeling

With NWA proprietary DSL

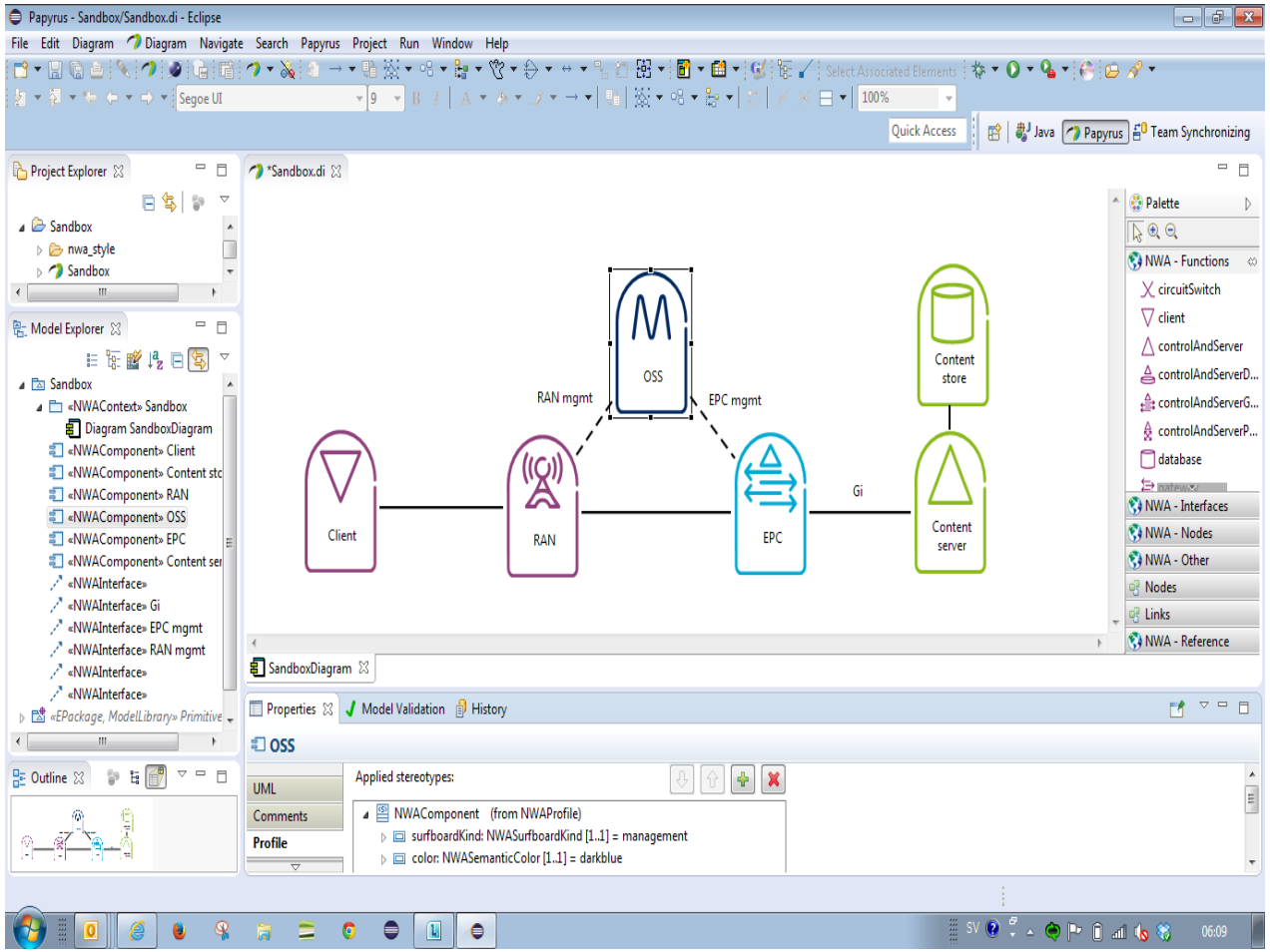
Validation

- In progress

Generation

Benefits

- Replace PowerPoint as main design tool
- Model versioning
- Potential development of advanced validation



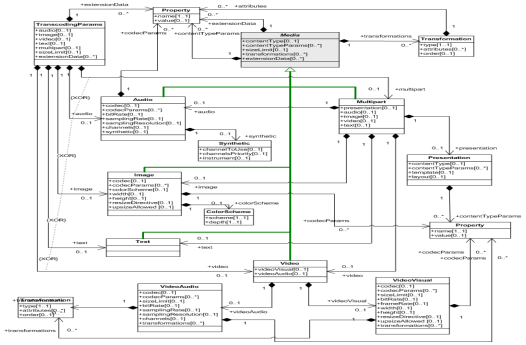
OTHER USAGES

Baseband

Enterprise Architecture

Model-Based Testing

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)

- Now working on development tool plan for 5G

Lessons Learned

TOOLS NEED TO BE FIT FOR THE JOB

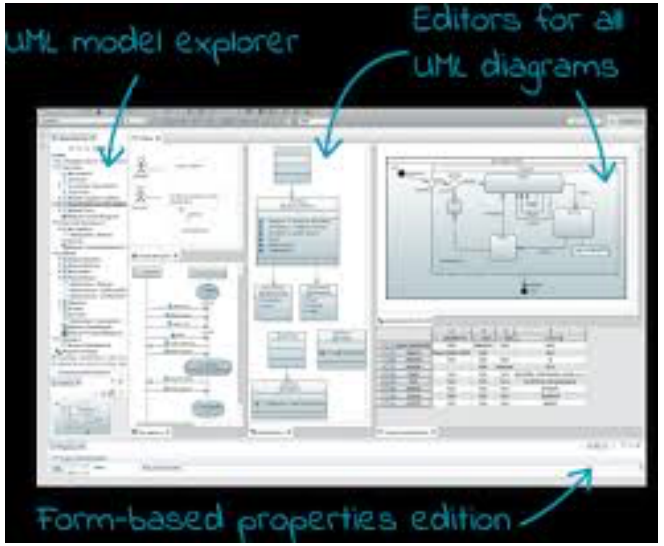
USER EXPERIENCE (UX)?

- Tool usability
- Missing capabilities regarding key aspects
- Support for customization and DSL
- Need more and better integrations

NEED A COMMUNITY

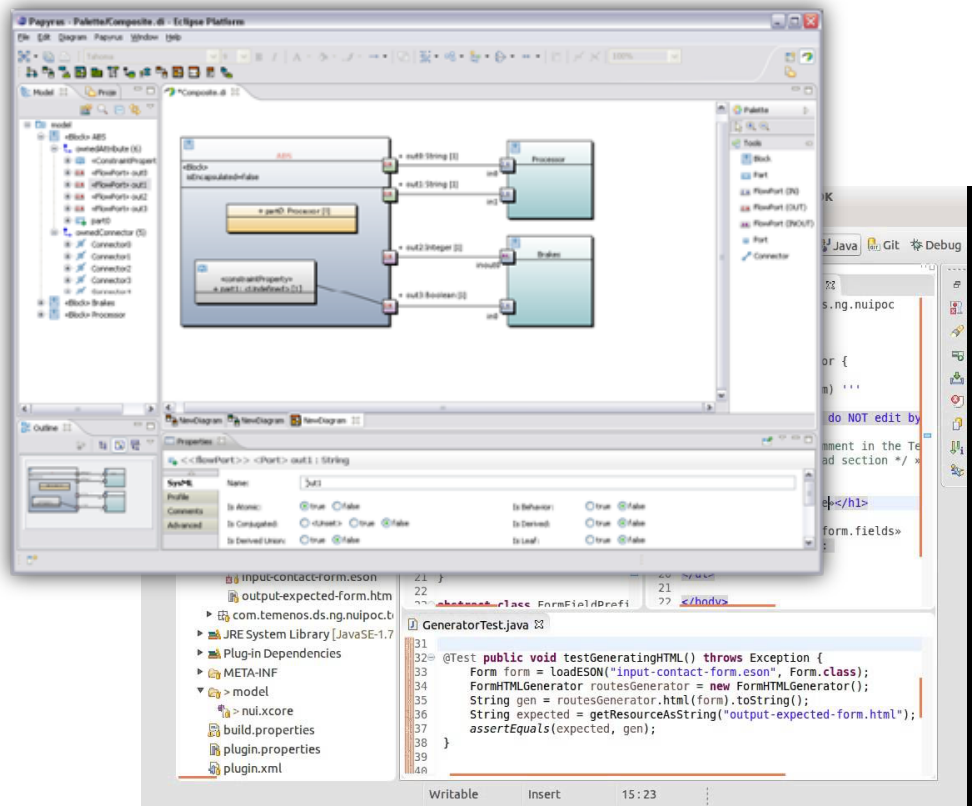
NO SIZE FITS ALL!

MBE OR AGILE?



or

MODELING OR CODING?



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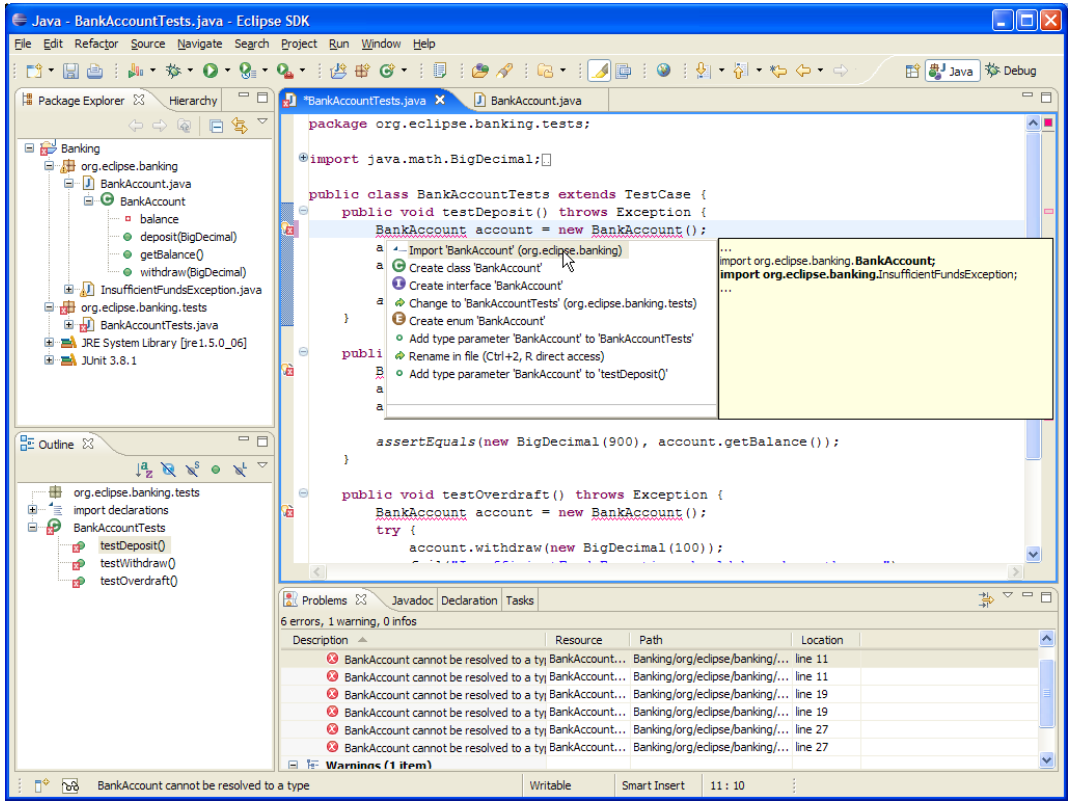
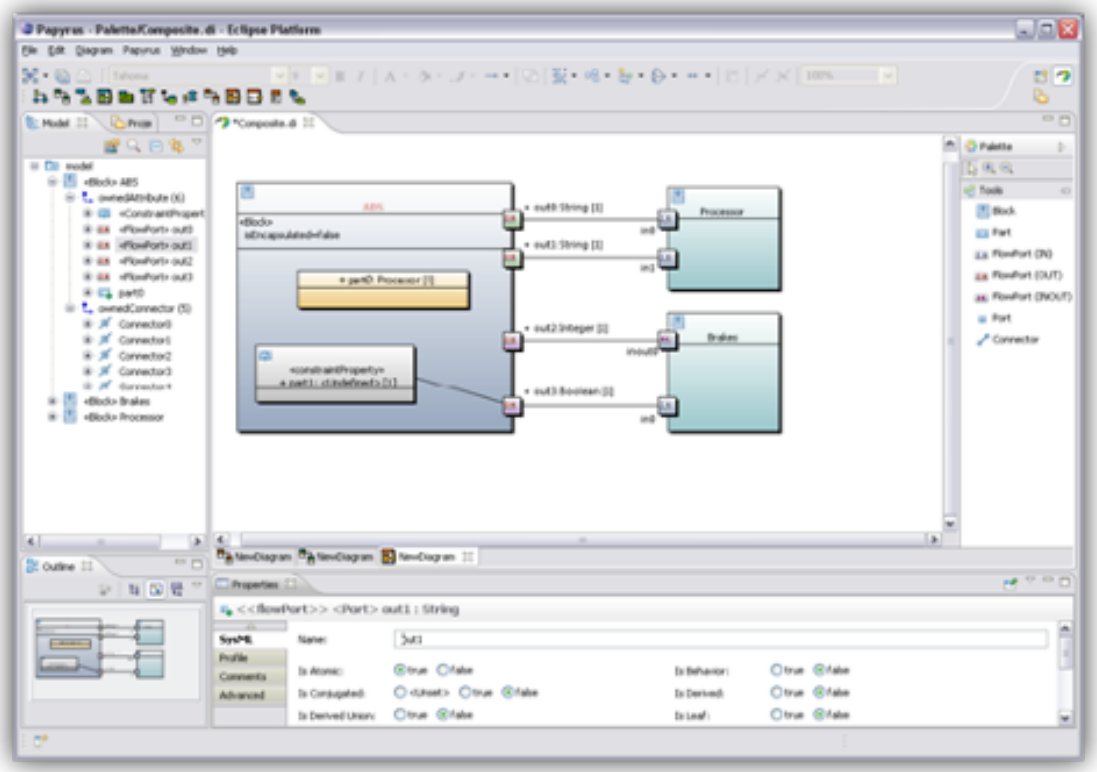


GRAPHICAL OR TEXTUAL?



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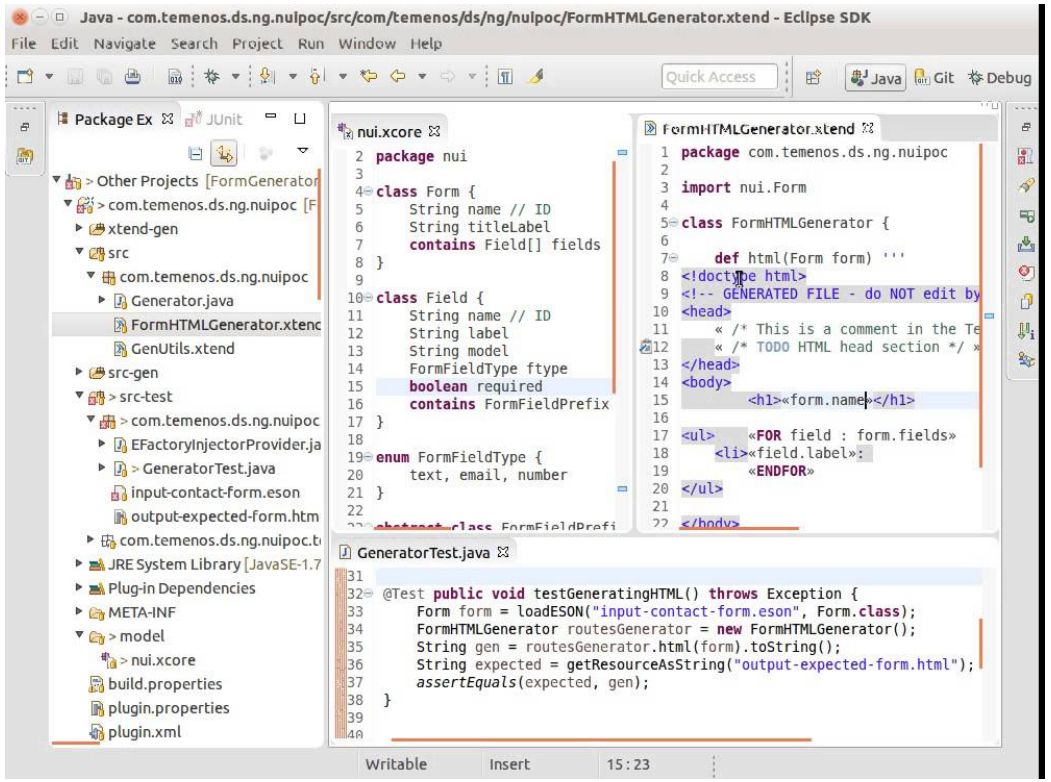


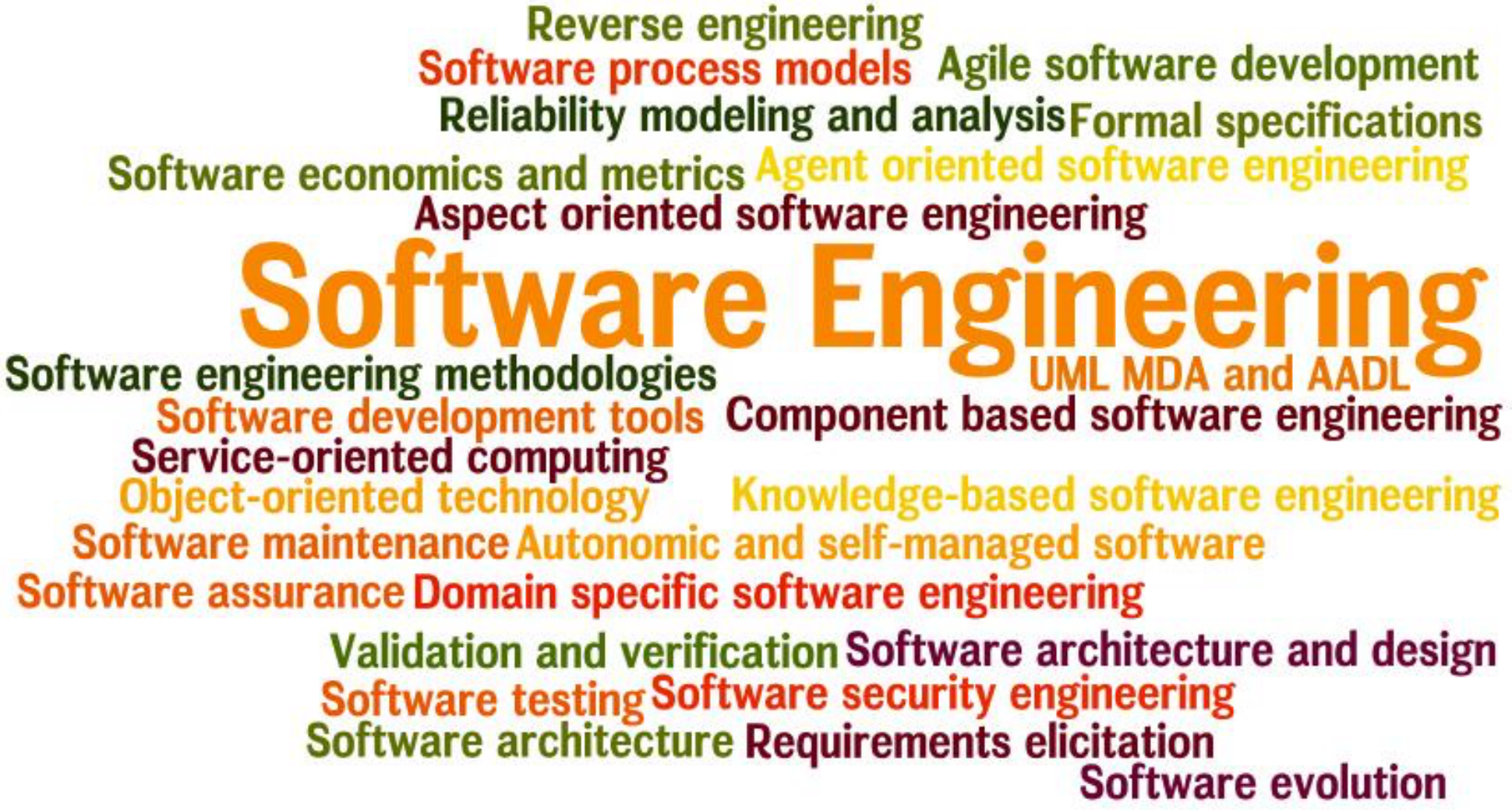
UML OR DSL?

or

DSL

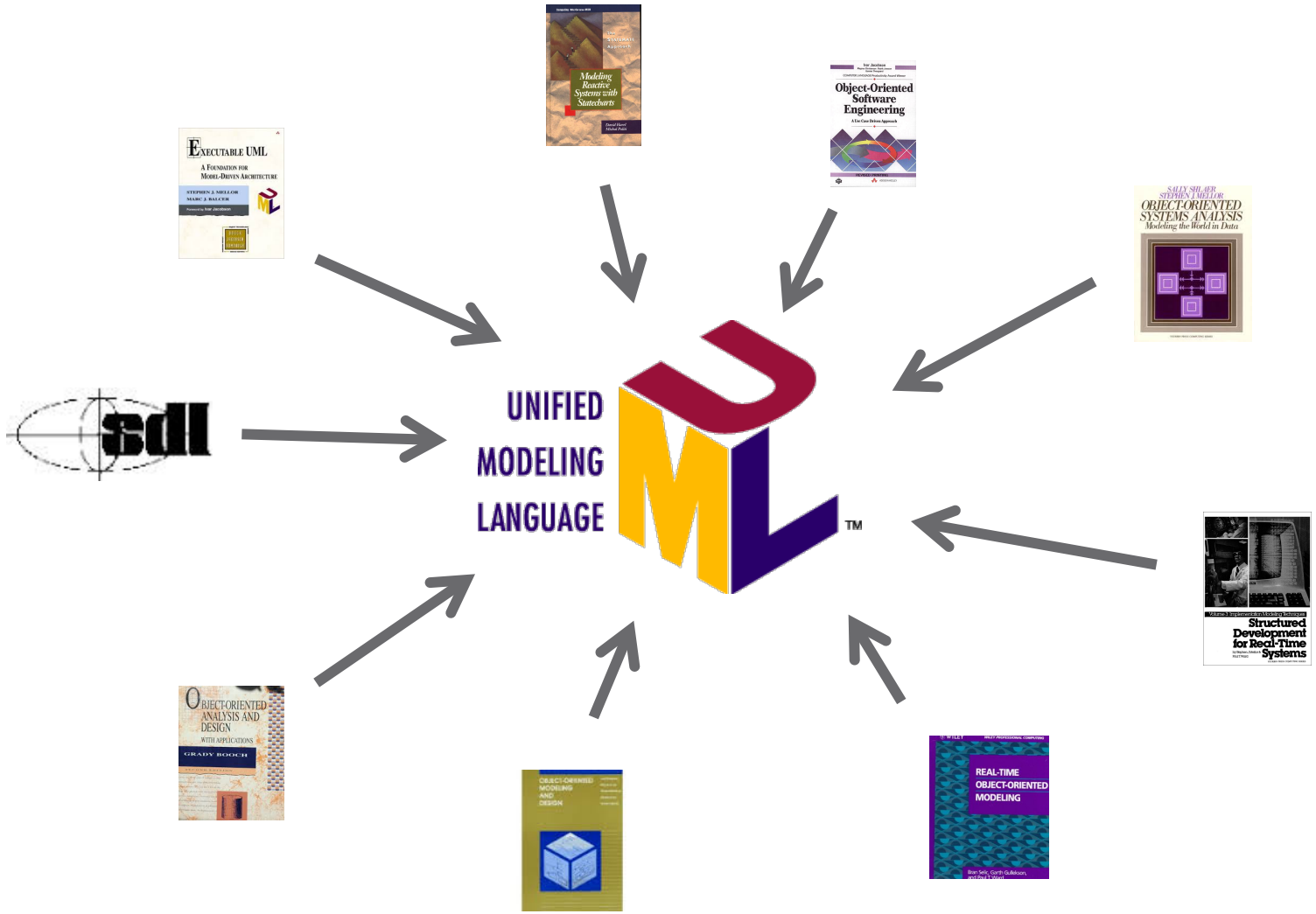
This is a misleading question!

COMPLEX WORLD



ONLY GOAL IS TO HAVE THE BEST DEVELOPMENT ENVIRONMENT!

MODELING LANGUAGE EVOLUTION



TOOL EVOLUTION

ObjecTime
I-Logix
Rational software
IBM
artisan
Telelogic
Mentor Graphics
SPARX SYSTEMS
Microsoft
magicdraw

- Each tool is providing a different specific set of capabilities
- A lot of investment… but no real evolution!
- Lack of key capabilities
- Why? Lack of research results?

RESEARCH/TECH TRANSFER: VERY LOW ROI

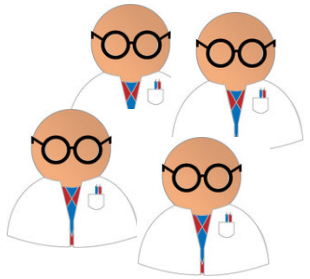
X Vendor lock-in
X No ability to independently develop required capabilities

Commercial Tools

X Proprietary technology
X Legal and business issues

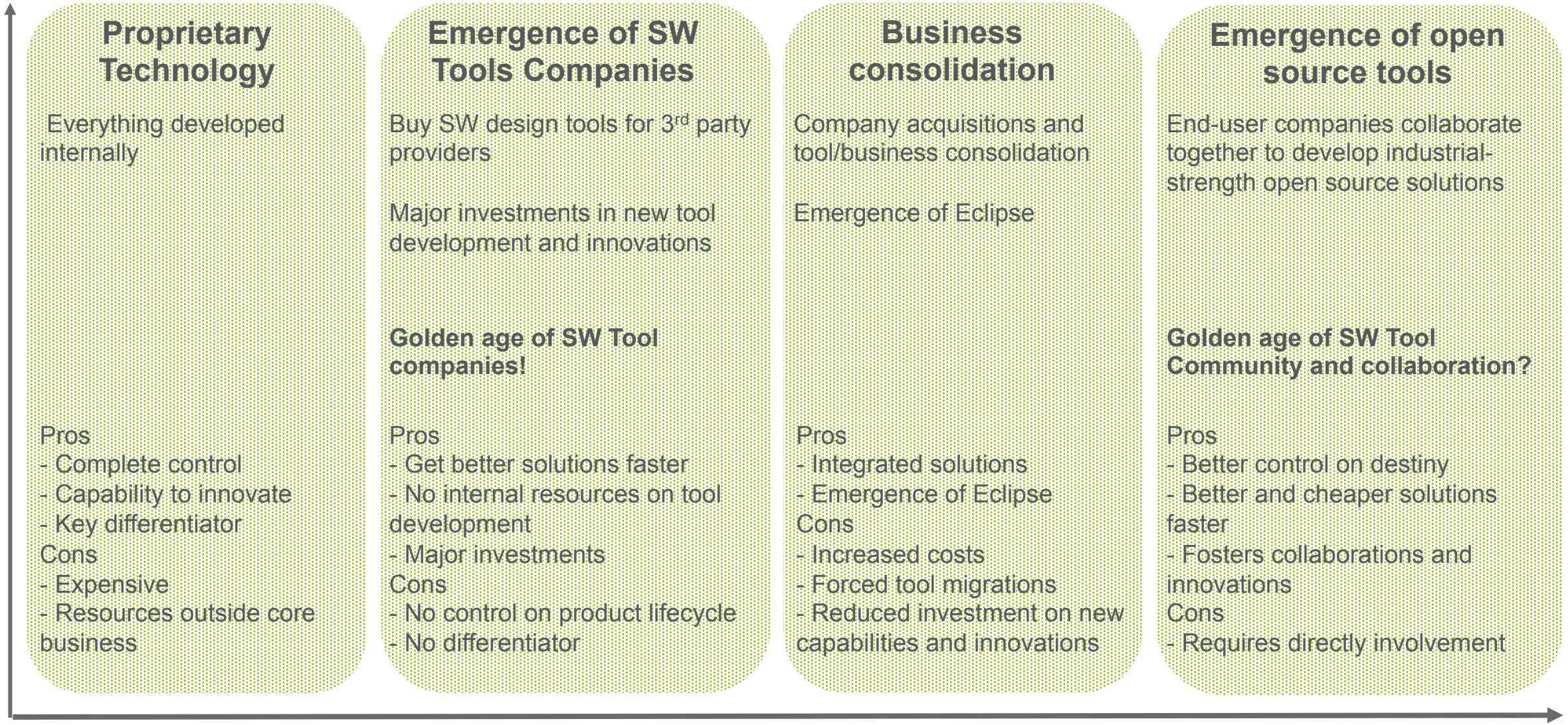
X No open access to commercial tools

Research Tools



Testing | Trace & Debug | Validation | Prog Languages | Runtime | Code Gen | Simulation | Deployment | Model Integration | PLM

EVOLUTION OF SW DESIGN TOOLS



Where do we go from now?

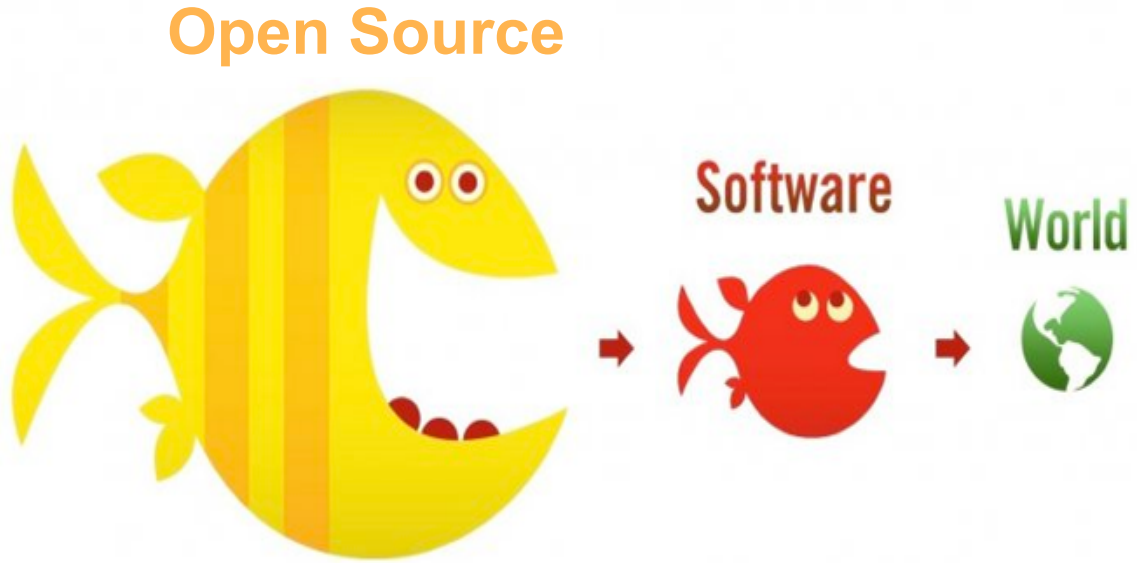
SW IS EATING THE WORLD
… OPEN SOURCE IS EATING THE SW WORLD

Market for highly specialized modelling tools starts to collapse.

Tool vendor development investments shrinks or stops. No velocity on new features.

“Work-in-progress” open source tools are favored.

Company strategy veers towards favoring open source tools.



OPEN SOURCE IS A NECESSARY CONDITION!

DSML

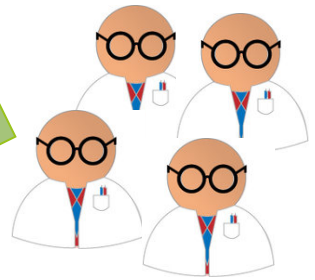
☑ No vendor lock-in
☑ Ability to independently develop required capabilities

☑ Open technologies
☑ Much simplified legal and business context
☑ Enables fruitful collaborations and tech transfer

eclipse

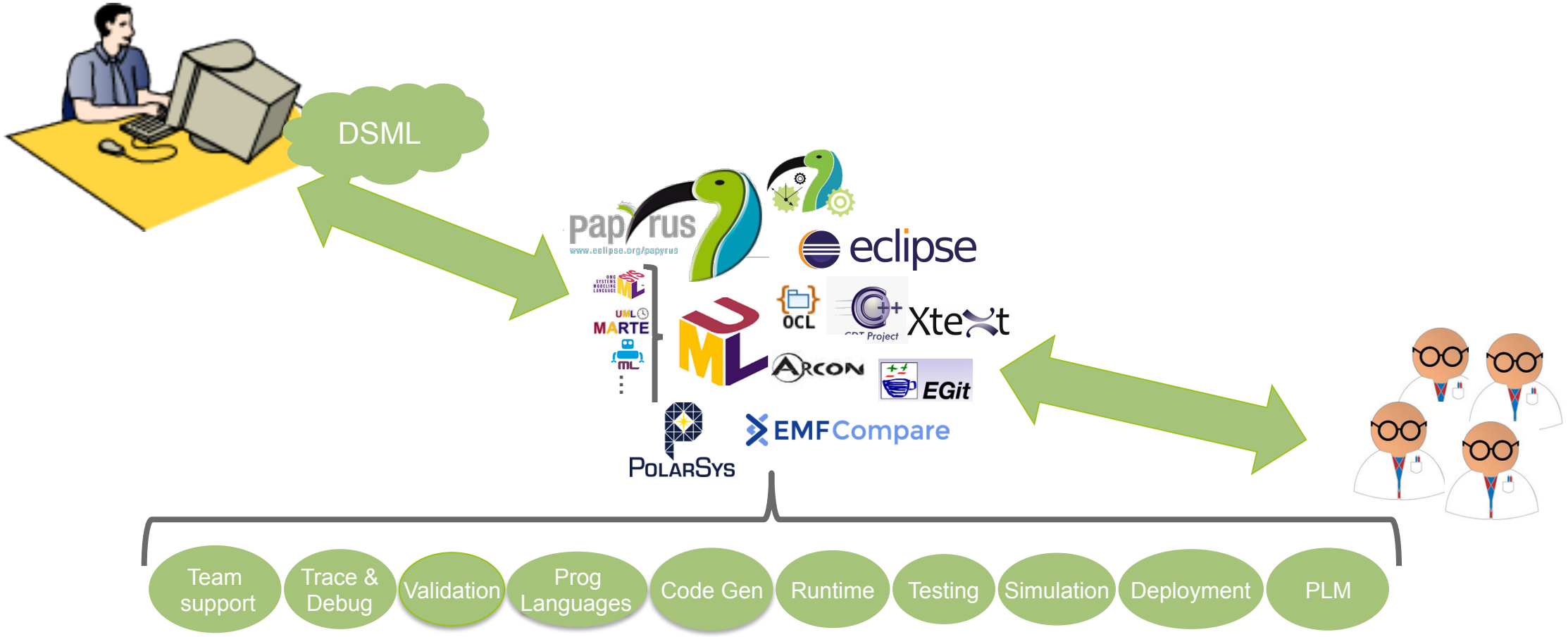
Industrial Open Source Tool Platform

☑ Open access to industrial tools

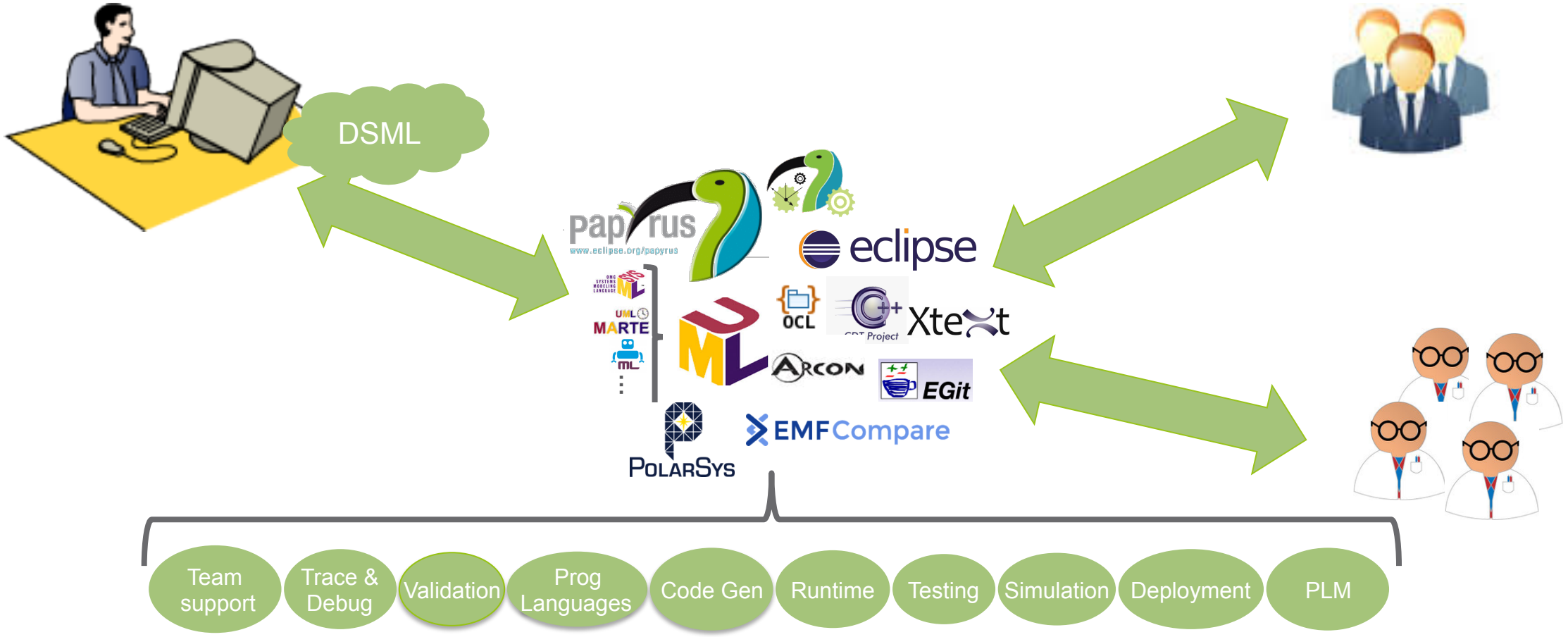


Testing | Trace & Debug | Validation | Prog Languages | Runtime | Code Gen | Simulation | Deployment | Model Integration | PLM

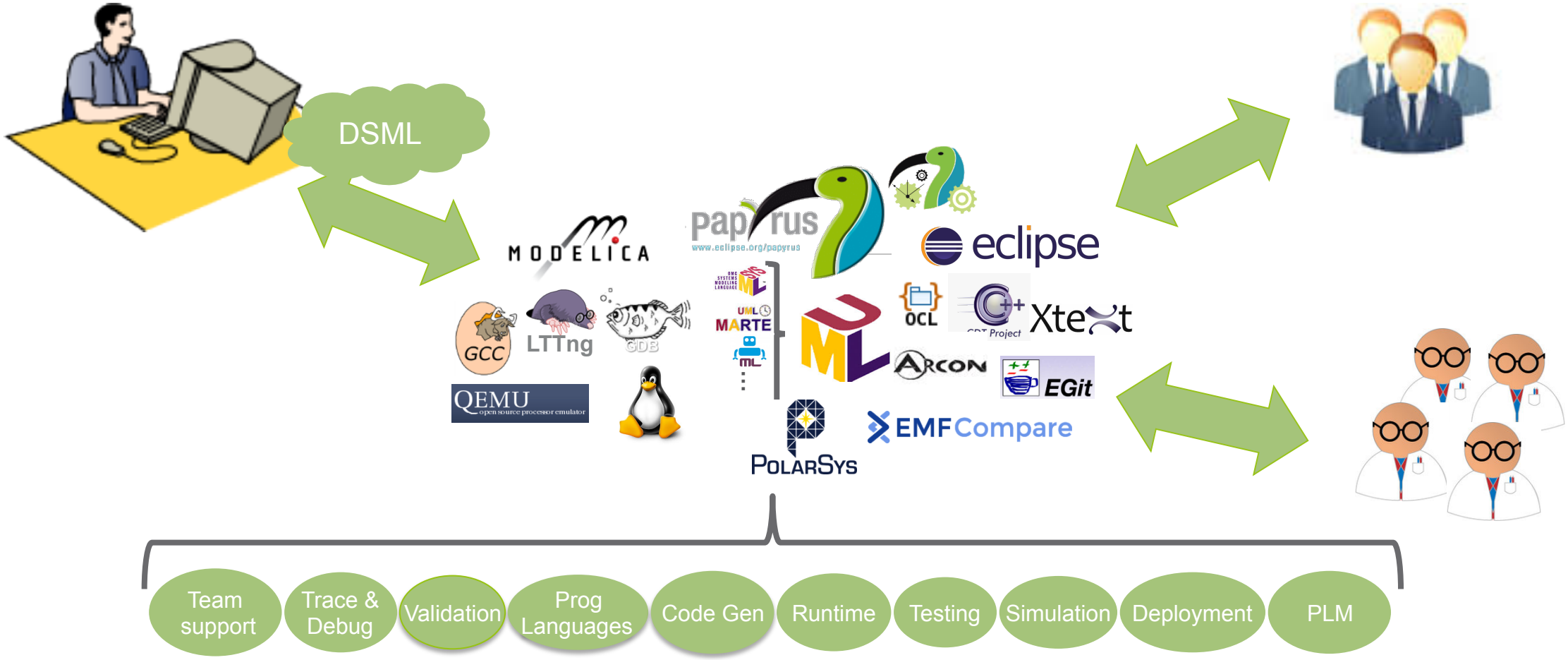
ECLIPSE AND PAPYRUS PROVIDE THE BASIS



… BUT OPEN SOURCE IS NOT SUFFCIENT! WE ALSO NEED A VIBRANT COMMUNITY!

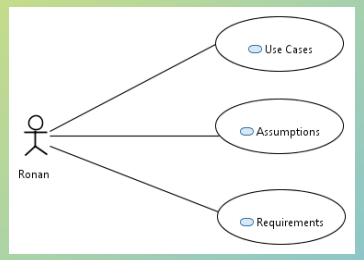


… AND AN OPEN ENVIRONMENT

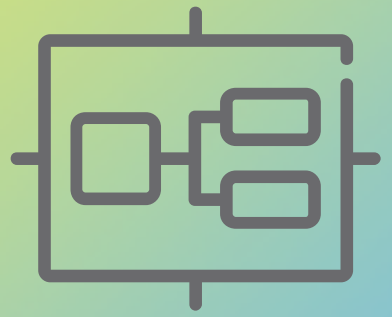


END-USER CONTRIBUTION

CODE



USE CASES



TEST MODELS

$$$

TESTING

BUGZILLA REPORTS

EXPERIENCE

PAPYRUS IC

› Eclipse Polarsys IC founded in Jan 2016 – https://wiki.polarsys.org/Papyrus_IC

› User Lead members

› Supplier Lead members

› Participant members

MISSION/VISION

WHAT it does

Develop a **customizable and extensible industrial-grade open source MBE tool suite** based on the Papyrus/Eclipse platform, other key open source technologies, and leading industry standards

WHO it does it for

For companies developing software-based systems, from **Enterprise Software** to **Internet of Things (IoT)** and **Cyber-Physical Systems (CPS)**

HOW it does what it does

By fostering and leveraging collaborations between members of a **vibrant community** composed of **end-users**, **suppliers**, and **research/academia**

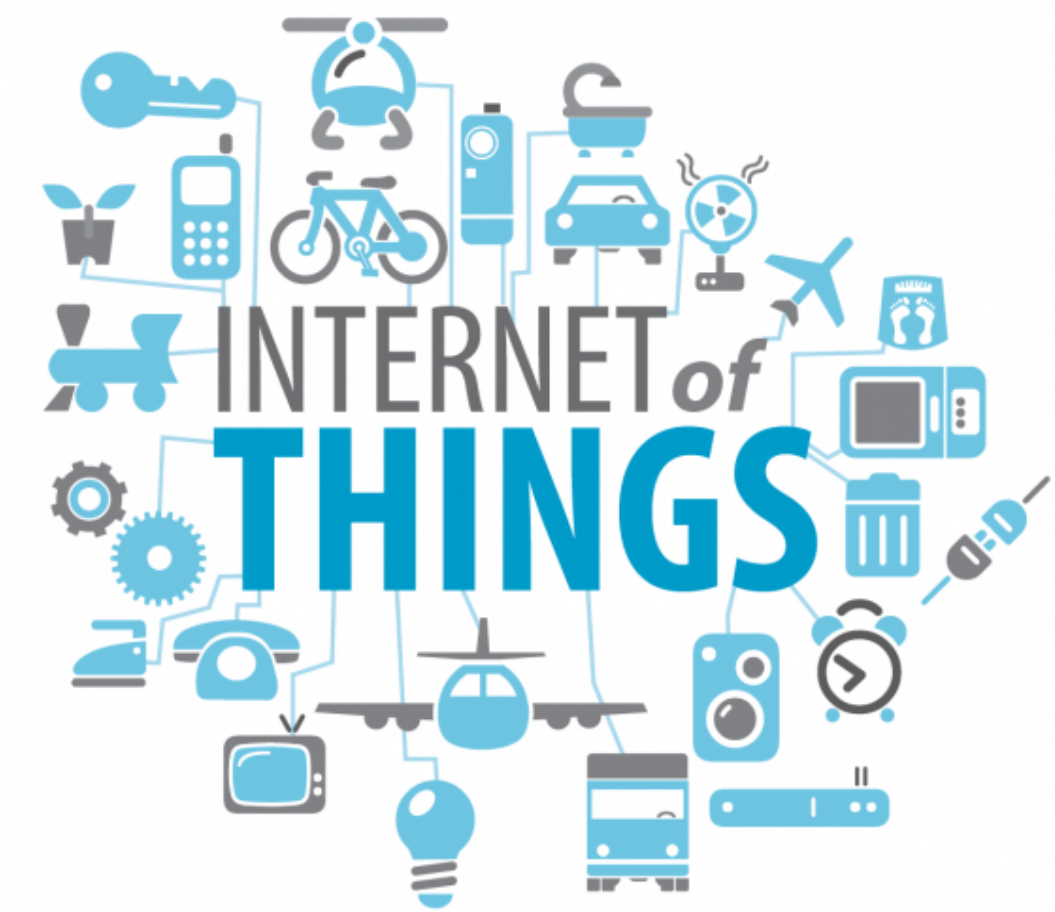
OVERALL GOALS

- 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

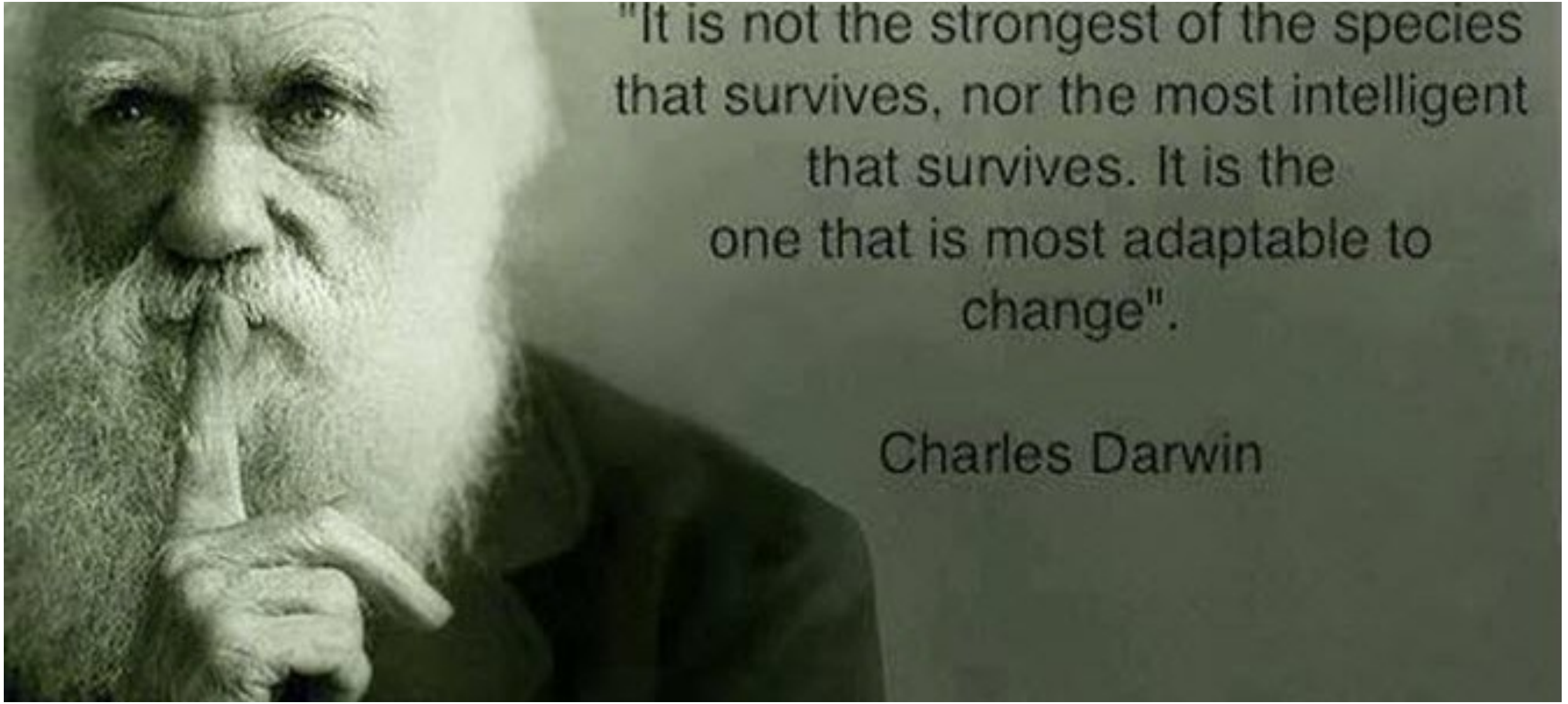
Future Challenges

5G AND IOT


What 5G will provide
Foundation for efficient industries and society
Multi domain performance
Massive machine type of communications
Energy Performance
Mass market personalized TV
Global standard
Critical machine type of communications


INTERNET of THINGS

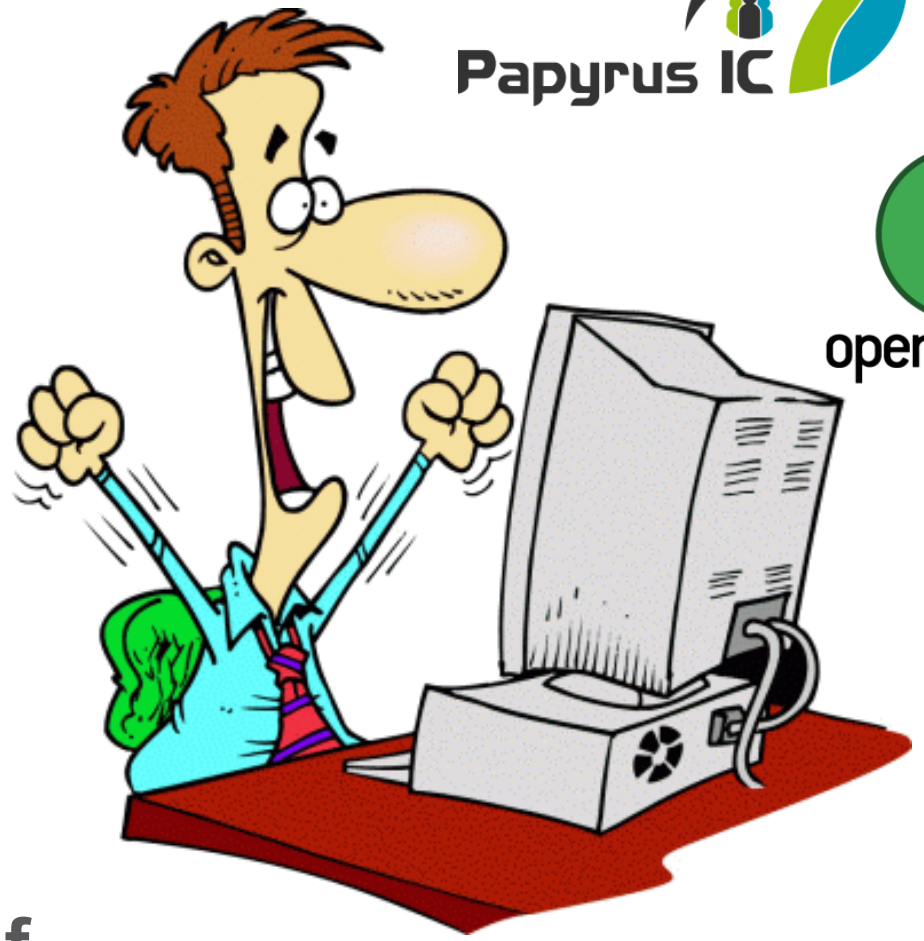
BUSINESS AGILITY



WHAT IS THE ROLE OF MBE?

MBE IS KEY

- Improved tool usability
- More capabilities regarding key aspects
- First-class support for customization and DSL
- More and better integrations



Papyrus IC

open source™

Can’t achieve the required level of business and development agility without MBE!

KEY CHALLENGES

- Company culture
  - Culture change – migration to open source requires a real culture change
- Community
  - Provide the required infrastructure to enable the growth of the community
  - Creation of a consortium to lead/govern the development of Papyrus and open source modeling solution
- Product management/Governance
  - Manage requirements and priorities
  - Ensure delivery of top industrial-grade solution
- Papyrus to support a broad range of customizations and DSMLs
  - Ensure that we don’t create a set of divergent products

Open source is not free, it requires involvement and investment

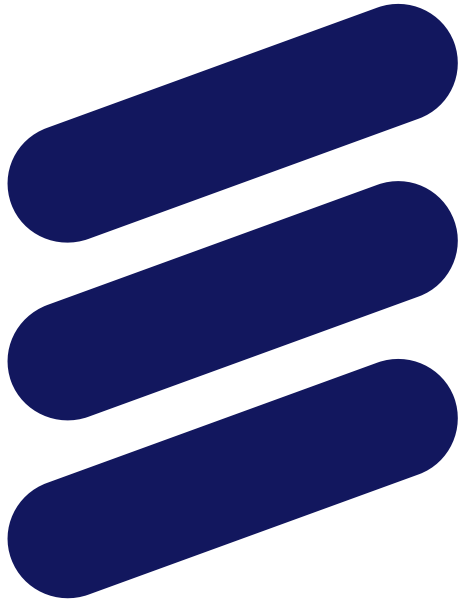
Unfortunately, it is not a silver bullet!

SUMMARY

- Ericsson has been using MBE at a large scale for over 20 years
- Lots of benefits, but tools are still a main issue
- 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 we all need

Success is the only option!

There is no alternative!



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