MBSE Deployment

Challenges & feedbacks for two different industrial sectors

“Energy Management” and “Microelectronics”

ESI – IDEW’2021

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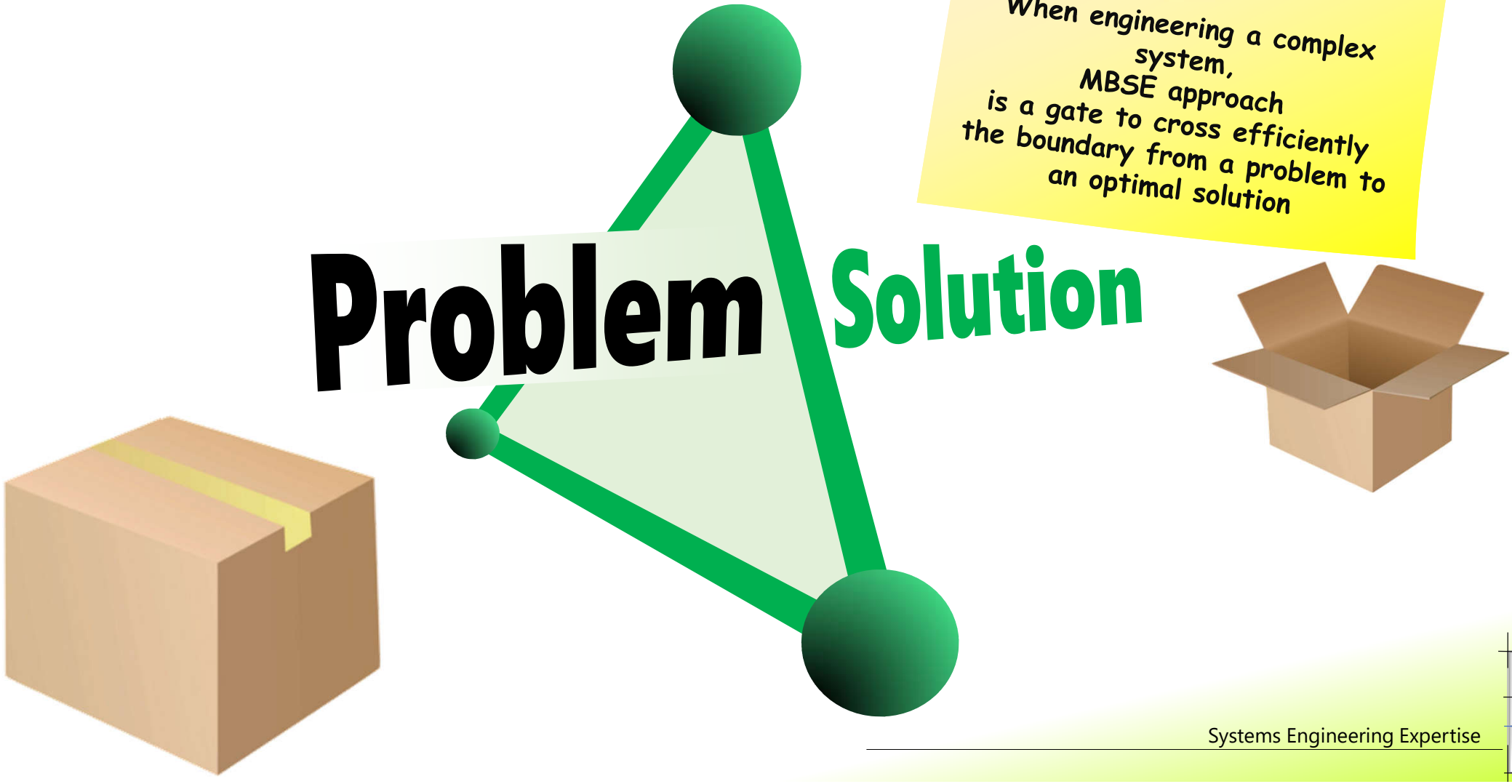
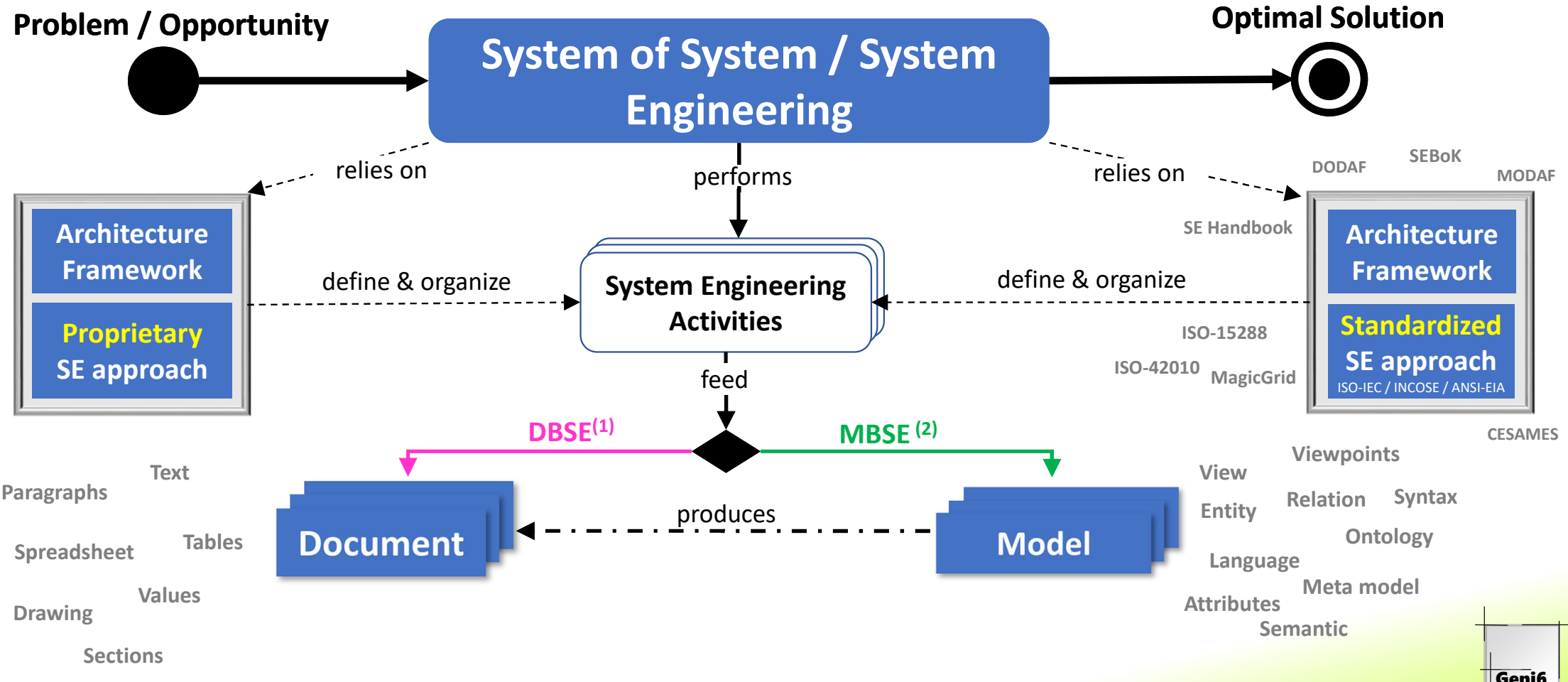
What is MBSE ?

When engineering a complex system,
MBSE approach
is a gate to cross efficiently
the boundary from a problem to
an optimal solution



MBSE vs DBSE

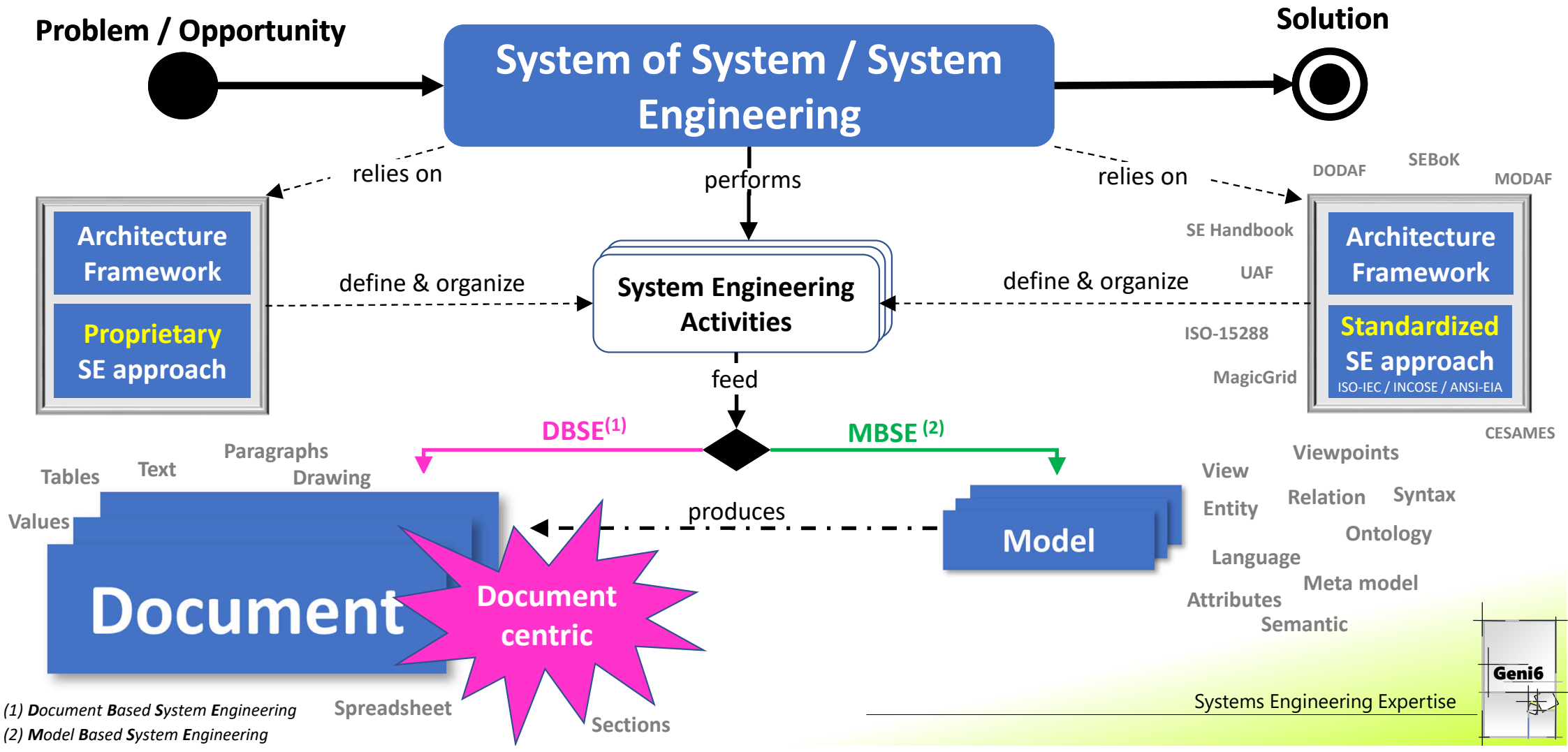


(1) DBSE : **D**ocument **B**ased **S**ystem **E**ngineering

(2) MBSE: **M**odel **B**ased **S**ystem **E**ngineering

http://www.iso-architecture.org/ieee-1471/afs/frameworks-table.html

MBSE overview



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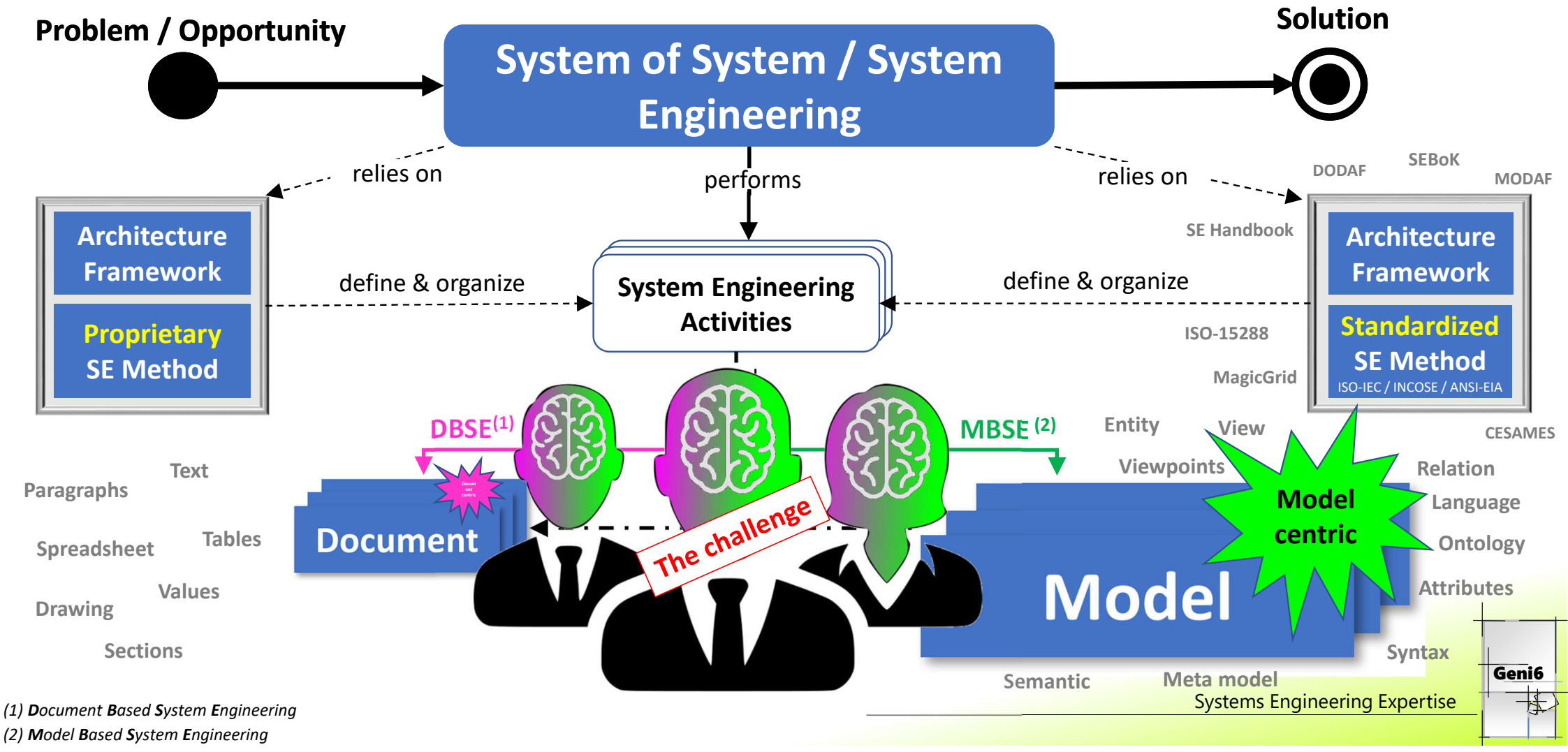
*(2) **M**odel **B**ased **S**ystem **E**ngineering*

MBSE overview



*(1) **D**ocument **B**ased **S**ystem **E**ngineering*
*(2) **M**odel **B**ased **S**ystem **E**ngineering*

Who may have an interest in MBSE ?











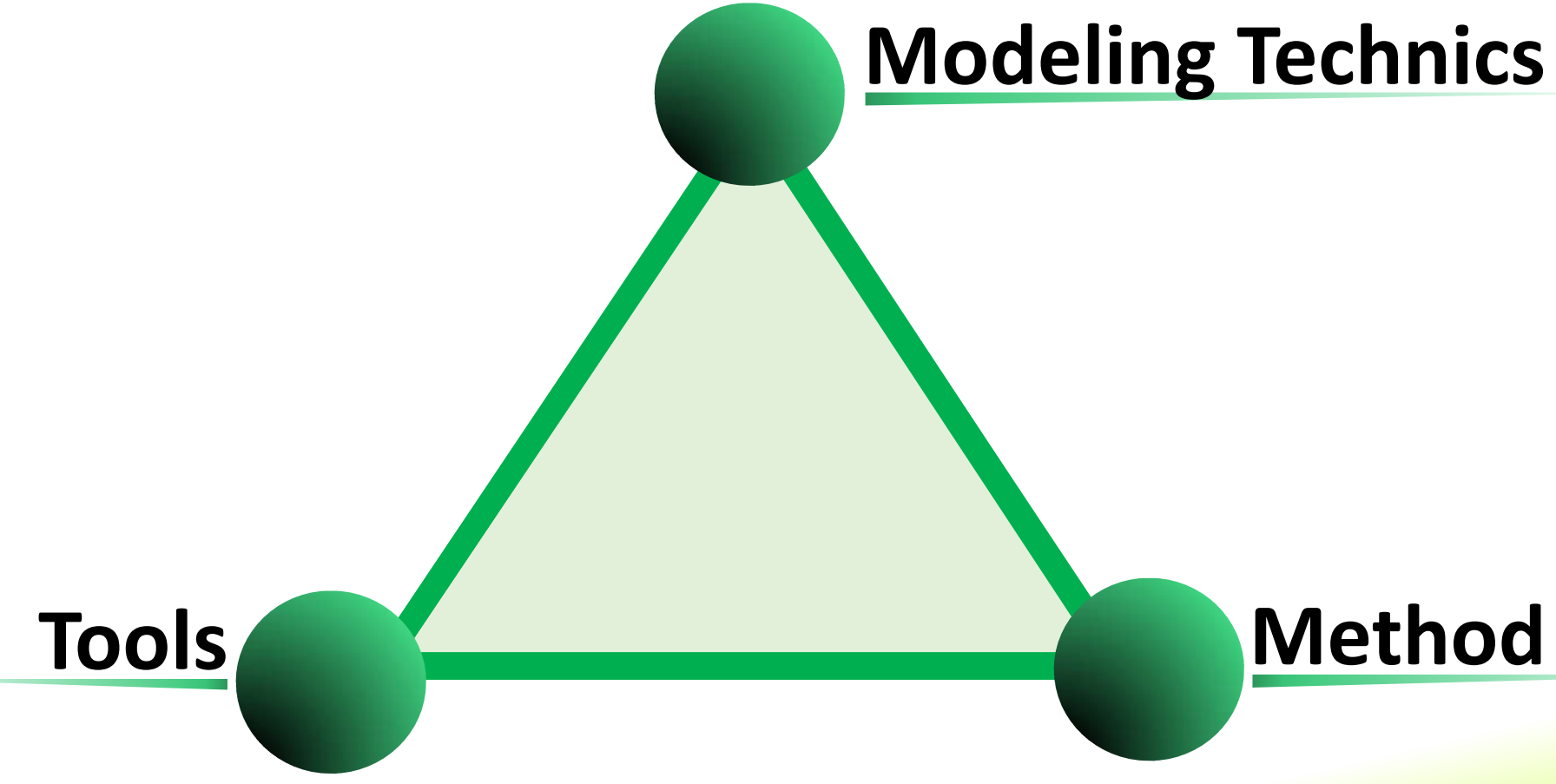


Given the growing system complexity in all industrial fields, MBSE may be an interesting trajectory to explore for staying in the race

crédits photos - stock.adobe.com

Ingredients for an MBSE gate

MBSE key enablers



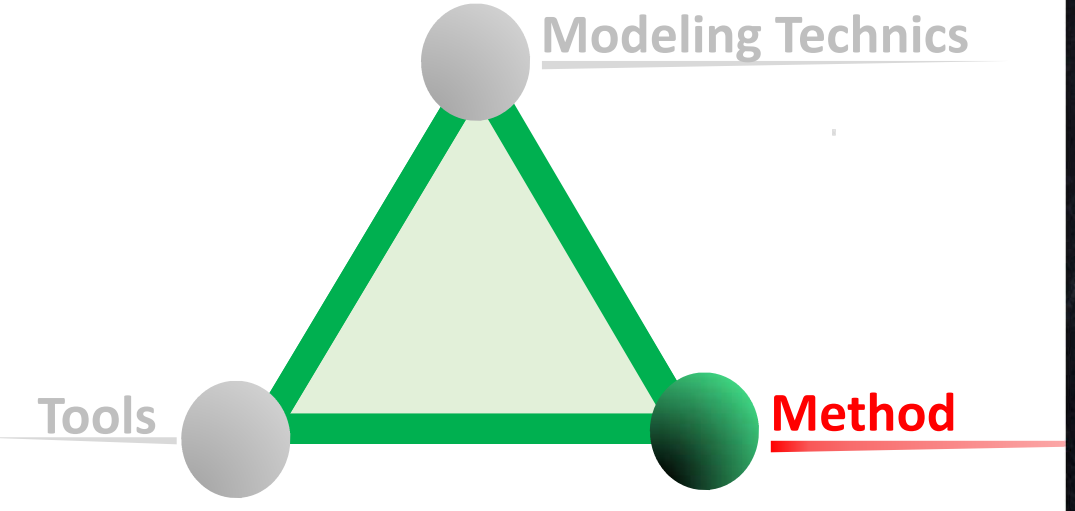
Today’s presentation focus

Energy Management

❑ MBSE actual deployment:

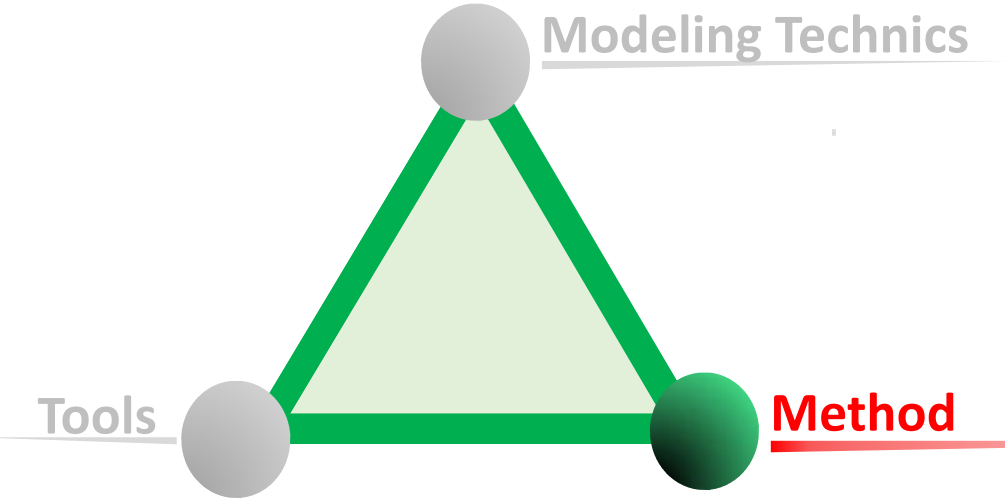
- **Industrial sector:**
  - ✓ Electrical distribution
  - ✓ Energy Management
- **System types**
  - ✓ Products or Services
- **Market segments**
  - ✓ Retail, Data-Center, O&G…
- **Targeted engineering teams**
  - ✓ Europe / US / Canada / China
- **Underlying technologies**
  - ✓ Electrical distribution devices
  - ✓ Digital layers (monitoring, control, analytic)

MBSE Method



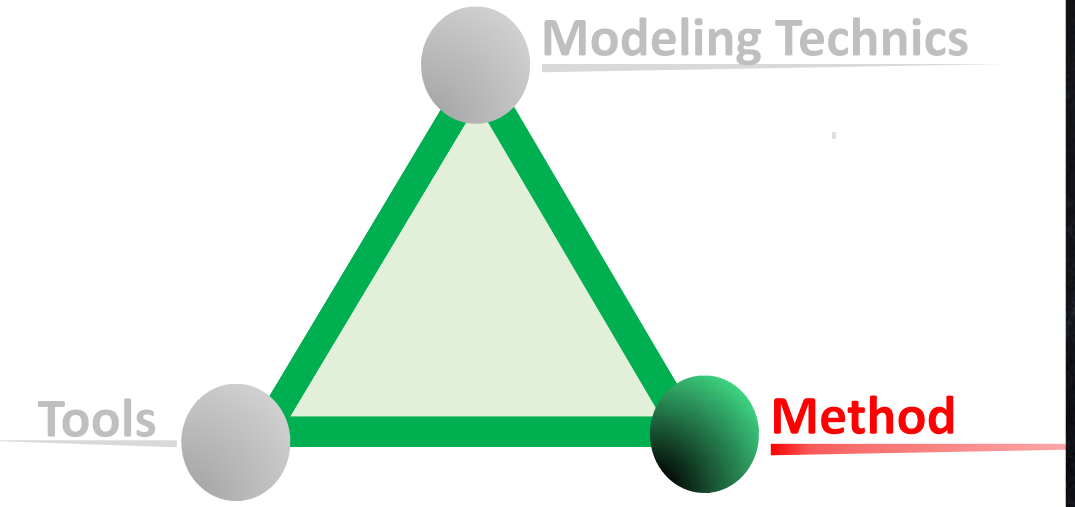
- **Method based upon standardized principle**
  - ISO/IEC 15288 - ISO/IEC 42010
  - SE Handbook
  - SeBOK
- **Method Scope :**
  - Marketing concerns
  - System architecture concerns
  - Design concerns
- **Outcome:**
  - Dedicated **A**rchitecture **F**ramework (AF)
  - An iterative method for engineering a new system (product or service)
  - Training on *Method*:
    - ✓ 350 engineers trained to req. engineering
    - ✓ 100 system architects trained to MBSE Method

MBSE AF



Stakeholder viewpoint	System scope Stakeholder requirements	Life cycle stages	Op. contexts	Op. scenarios
System Architecture viewpoint	System requirements ••• Sub-System requirements	System Logical Architecture Sub-System Logical Architecture	System Physical Architecture Sub-System Physical Architecture	
Design / Implementation viewpoint	Design requirements	End-product Architecture		

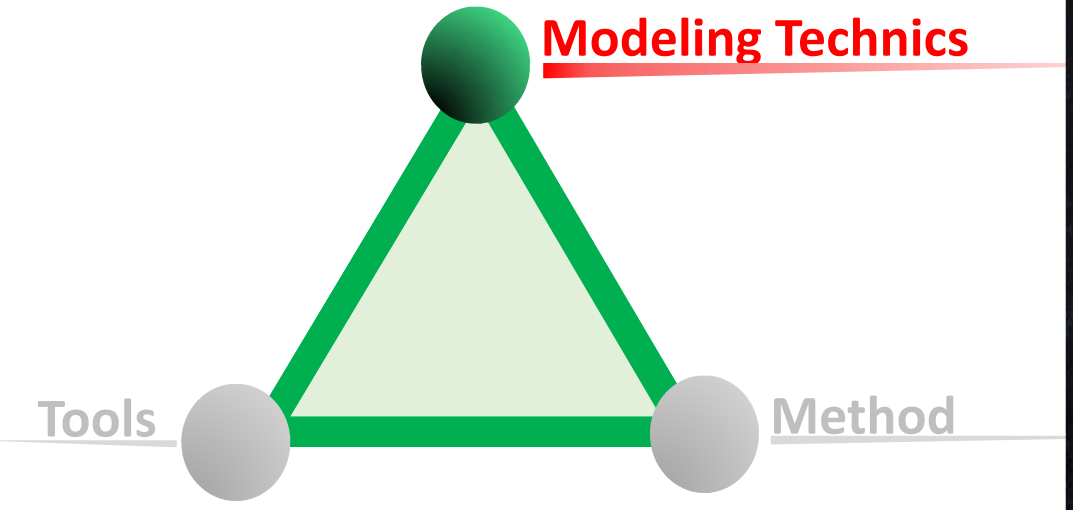
MBSE Method Feedback



- ❑ *System Thinking* is very well perceived
- ❑ An AF is a reference guide for structuring the engineering activities
- ❑ The concept of views helps to get ride of "Where's Wally" type of diagrams
- ❑ Define a shared SE approach

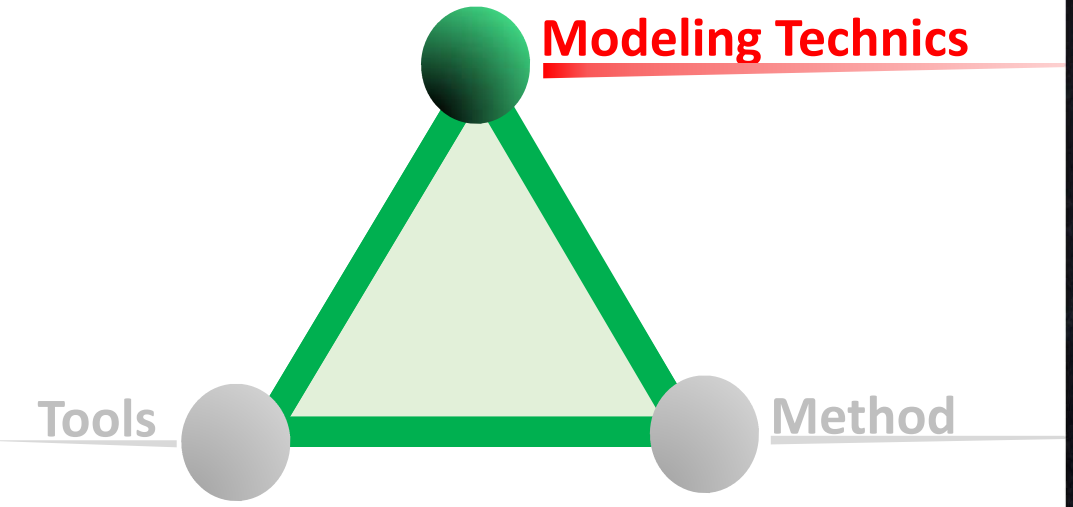
- ❑ Too abstract
- ❑ We know the solution… no need to define a backbox view
- ❑ Perceived as incompatible with Agile
  - ✓ V-Cycle miss-interpretation….
- ❑ Feeling that method is not applicable to running projects

MBSE Modeling Technics



- **Modeling Technics based upon SysML**
  - SysML Language applied to AF
- **Modeling Technics Scope:**
  - Architecture Framework grid elements
- **Outcome:**
  - SysML Profile that matches the AF
  - SysML language subset
  - SysML diagrams superset
  - Representation choices : Block vs Activity
  - Training on *Modeling Technics*
    - 100 system architects trained to MBSE Modeling Technics

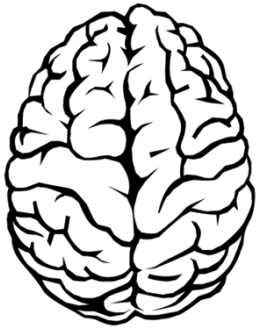
MBSE Modeling Technics



- SysML **applied** to AF: well perceived
  - SysML demistified
- Dedicated SysML profile & Customized diagrams help for the language adoption
- A common system engineering language is there !

- Frustration for some SysML experts
  - Dedicated profile
  - Language subset
- Perceived as a constraint for marketing

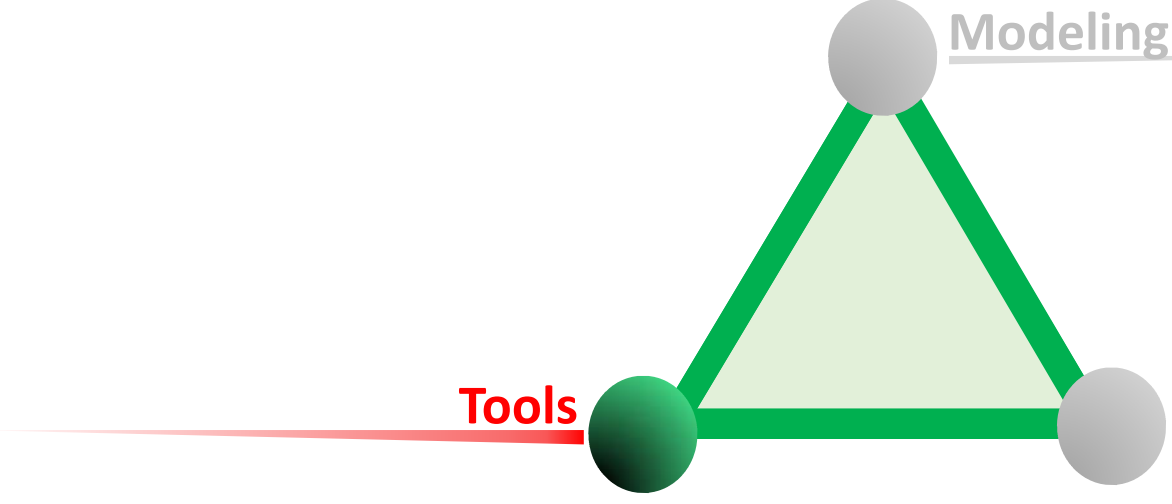
MBSE Tools



DASSAULT SYSTEMES

CAMEO SYSTEMS MODELER™

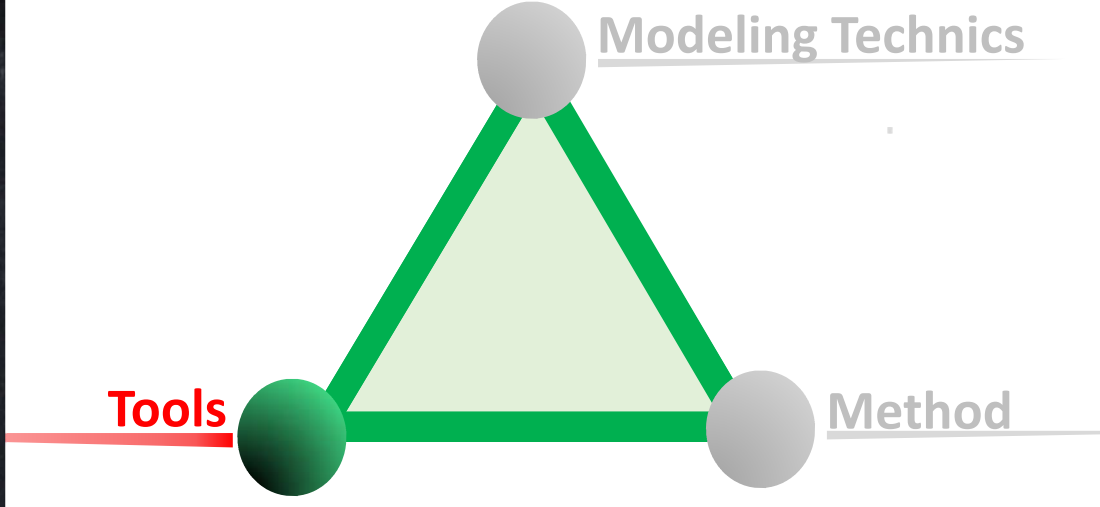
Teamwork Cloud



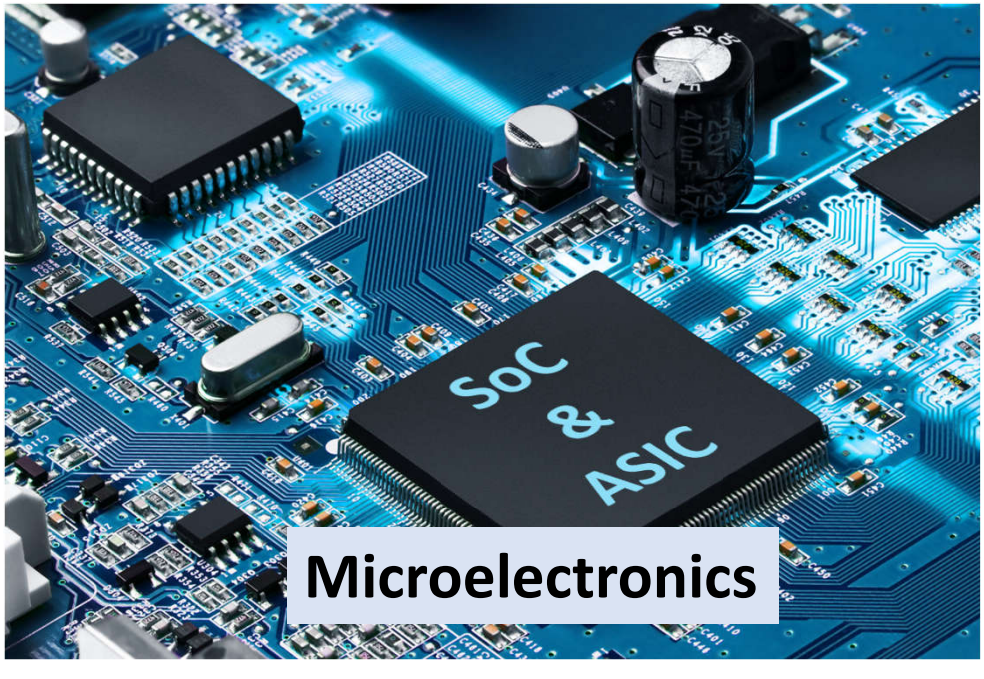
MBSE Tools

- ✓ Ergonomy
- ✓ Robustness
- ✓ Collaborative environment
- ✓ Model sharing & reuse
- ✓ Scalable solution
- ✓ SysML standard compliancy
- ✓ V&V support (evaluation script, simulation, parametric execution…)
- ✓ Req/Arch Interoperability via import/export or ReqIF
- ✓ Interop with Multiphysics simulation

- ✓ Too complicated for non-expert
- ✓ Not as flexible as a drawing tool
- ✓ Simulation is poor compare to other environments (normal, we are at system level)



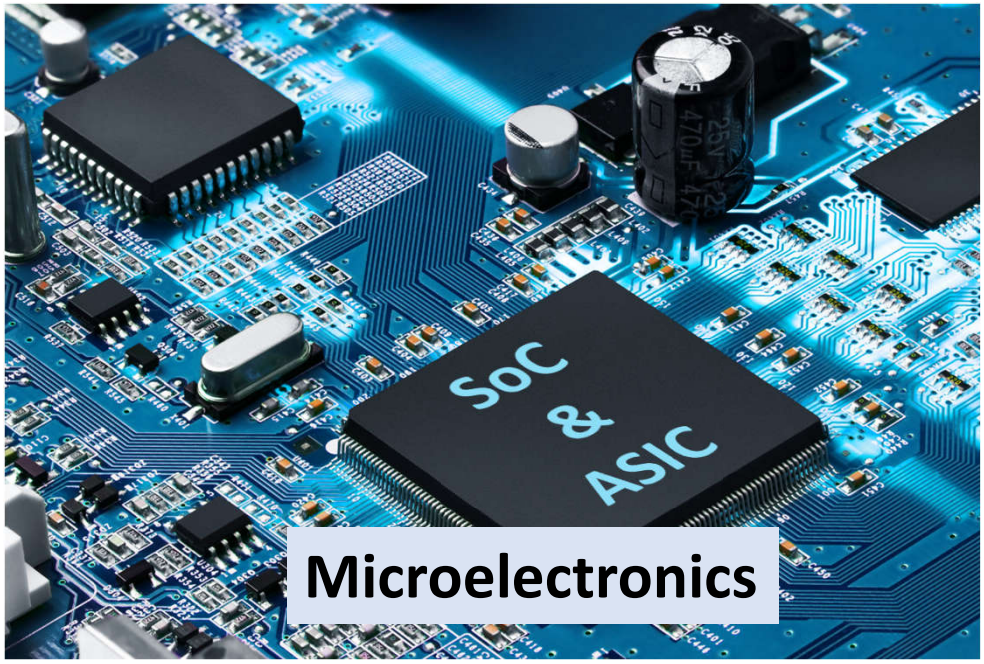
Microelectronics

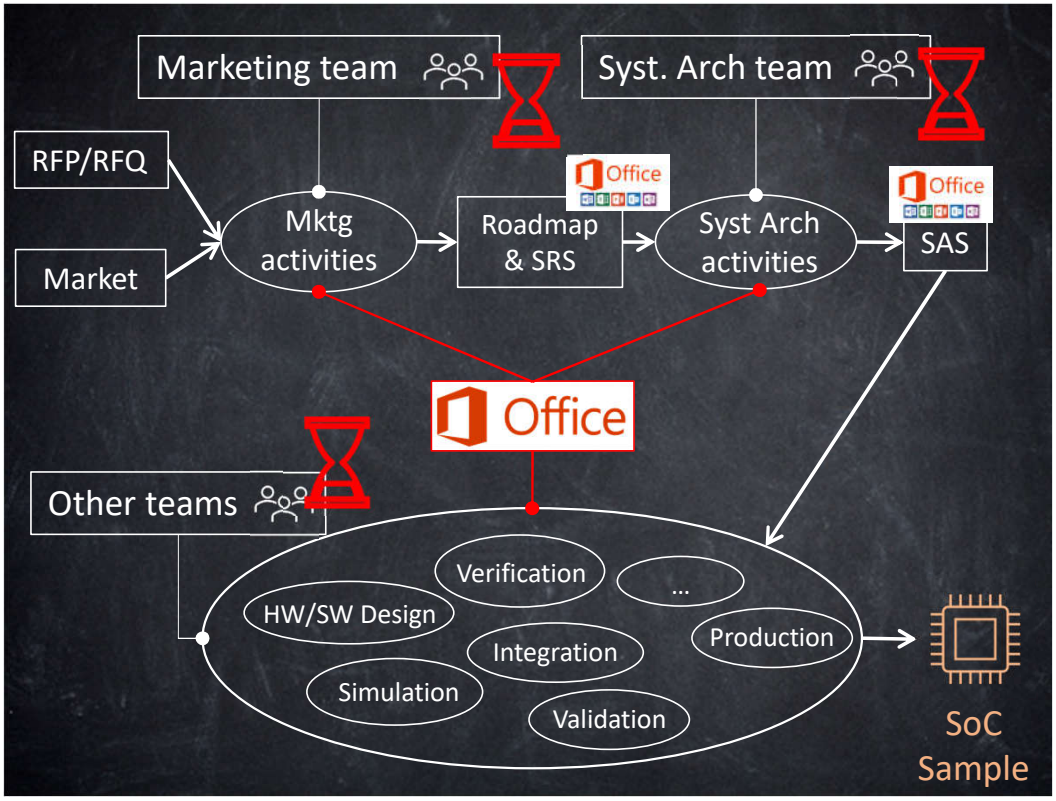


❑ MBSE **potential** deployment:

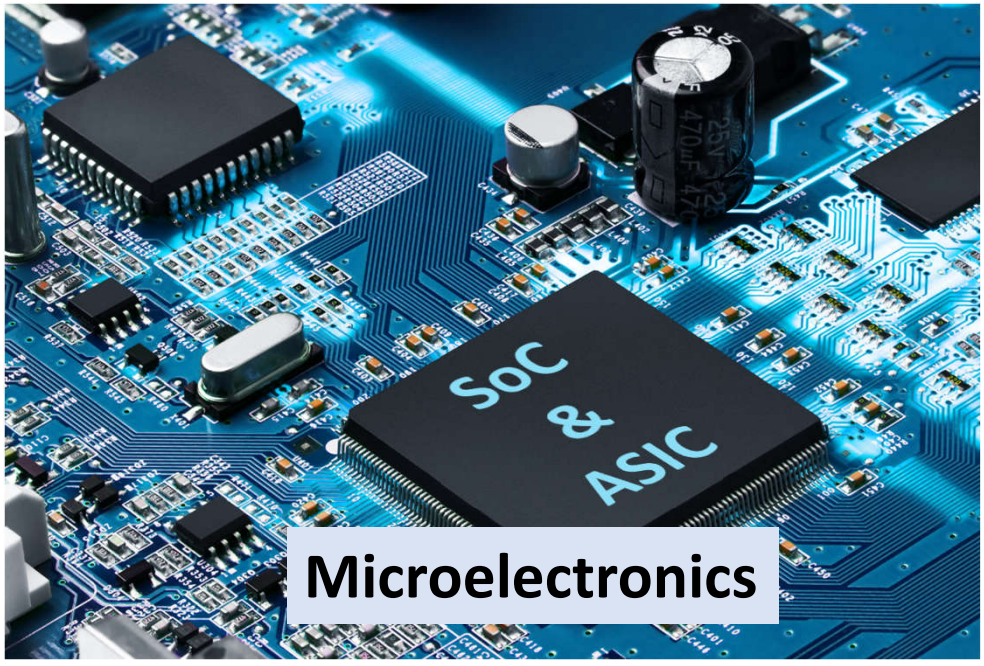
- **Industrial sector:**
  - ✓ Microelectronics
- **System types**
  - ✓ Products (SoC / ASIC)
- **Market segments**
  - ✓ Consumer, IoT, Telecom,
  - ✓ Automotive, Space & Defense, Aeronautic
- **Targeted engineering teams**
  - ✓ Marketing, System Architect

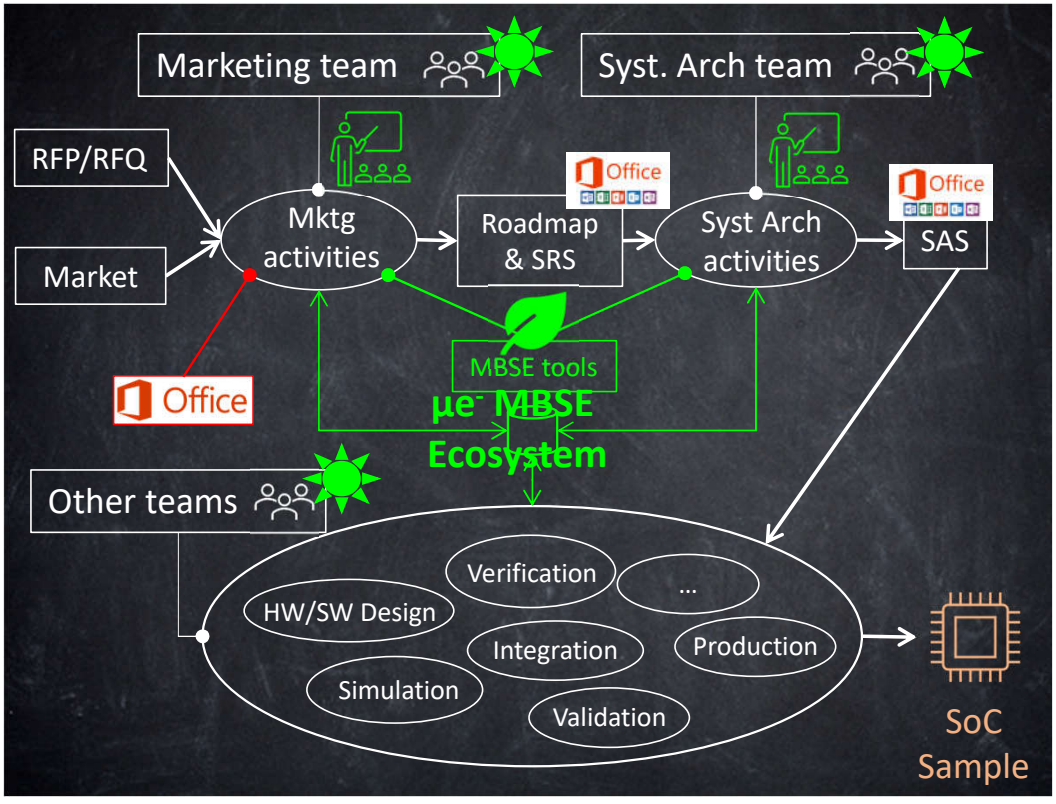
Microelectronics flow without MBSE



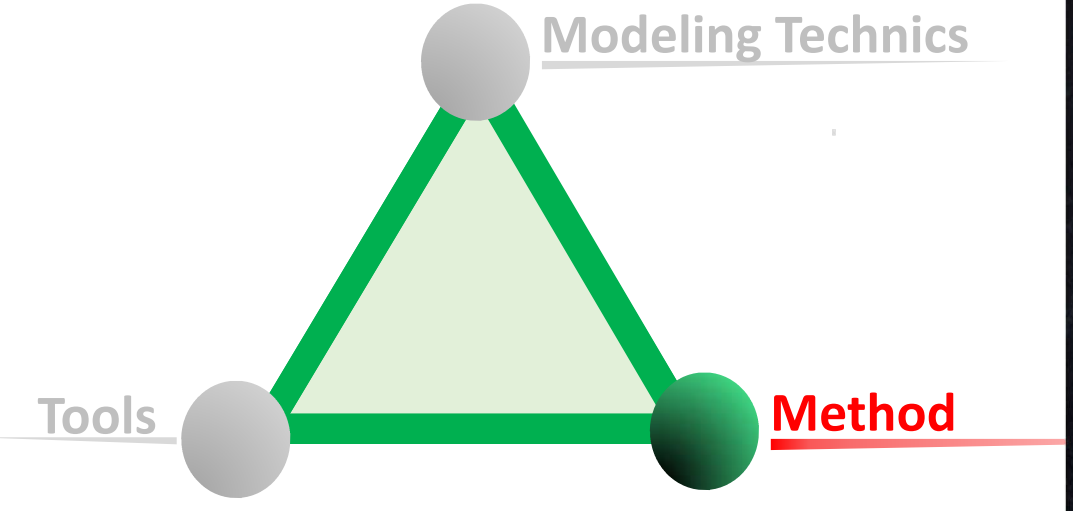


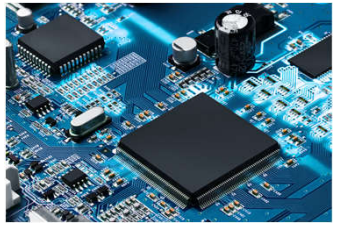
Microelectronics flow with MBSE





MBSE Method





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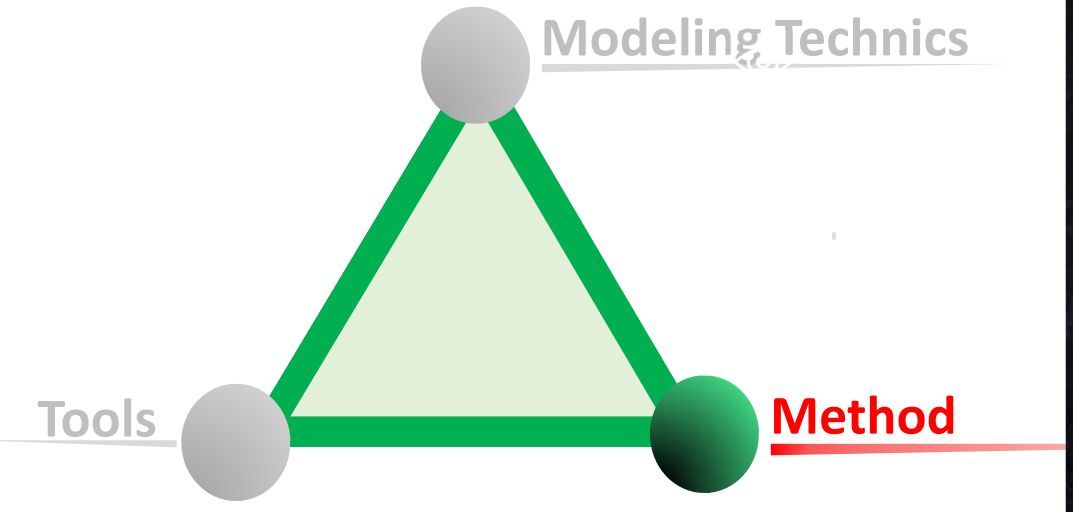
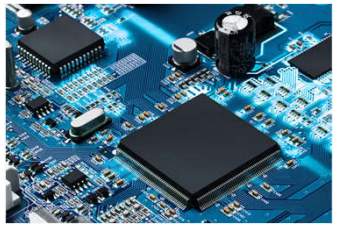
  - SE Handbook
  - SeBOK
- **Method Scope :**
  - Marketing concerns (MRD, SRS)
  - System Architecture concerns (SysArch)
  - Design/Implementation concerns
- **Outcome:**
  - Dedicated µe- **A**rchitecture **F**ramework (**µe-AF**)
  - An iterative method for engineering a new SoC / ASIC

MBSE Method - µe-AF

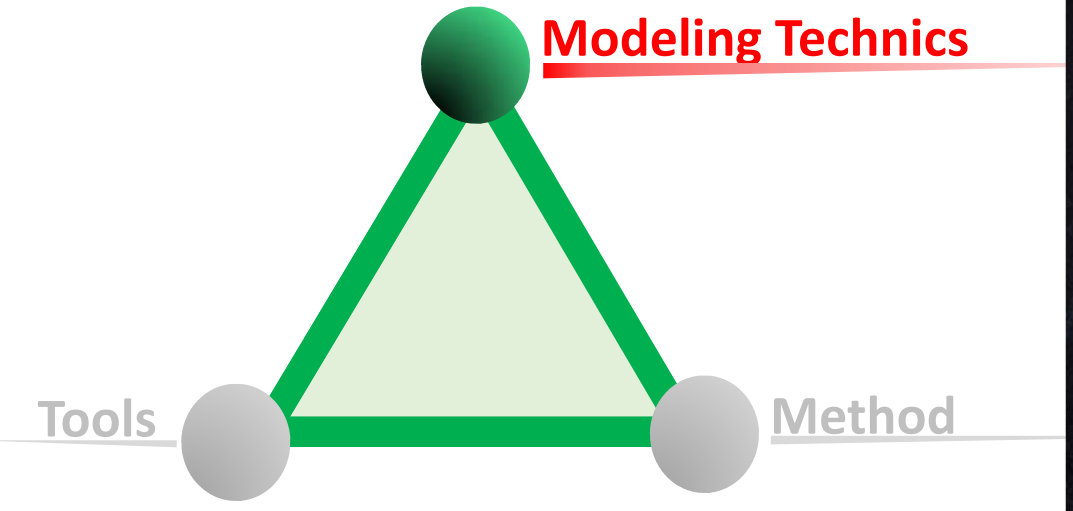


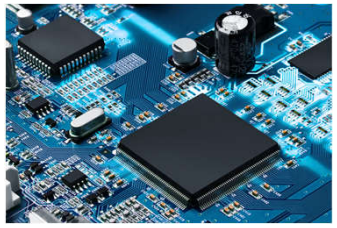


Strategic Marketing viewpoint	Market segment	Product roadmap	Product Lines		
Stakeholder viewpoint	Stakeholder requirement	SoC / ASIC Platforms	Op. contexts	Op. scenarios	SoC top page
System Architecture viewpoint	SoC requirements	SoC Logical Architecture	SoC Physical Architecture		
	...				
	Sub-System requirements	Sub-System Logical Architecture	Sub-System Physical Architecture		
Implementation viewpoint	SW Implementation	HW Implementation			
IPs viewpoint	SW IPs	HW IPs			

Very often missing part

MBSE Modeling Technics





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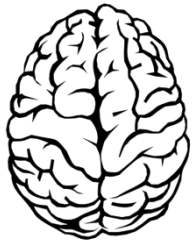
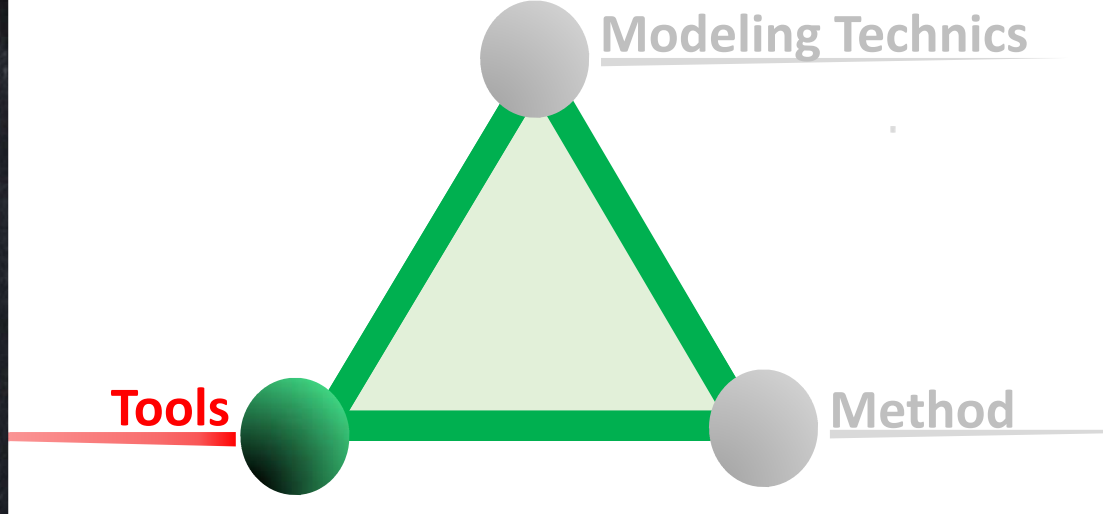
MBSE Tools

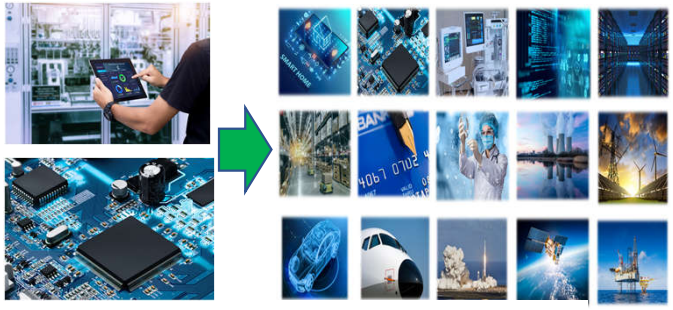


- The Human Brain

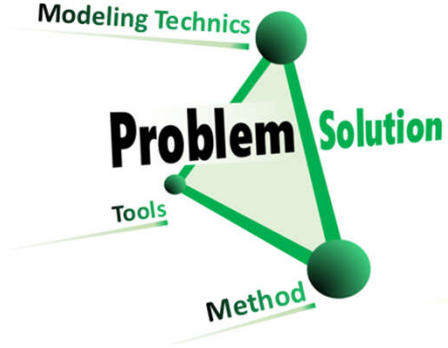
- Architecture Modeling
  - GENESYS 2020 R2 Collaborative Ed.
- Collaboration & Models repository
  - GENESYS 2020 Server
- Model publication / review
  - MS Office document automation



MBSE Key takeaways



MBSE common practices



Schneider Electric

- **7** very active MBSE projects since 2 years
- **2020** : + 25 new projects converted to MBSE
- **Various type of System**:
  - Electro-Mechanical complex products
  - Digital products
  - Services

❑ **Method**
- Define a scope
- Define an AF
- Rely on standard
- Method is Iterative
- Method is abstract
- Do not evangelizes everyone

❑ **Modeling Technics**
- SysML is our good choice
- SysML subset definition
- Diagram superset & customization
- Modeling rules shall serve your AF

❑ **Tools**
- Collaborative environment
- Support Arch. model execution for
  - ✓ V&V, evaluation, trade-off…
- Interoperability
- Customization
- Efficient document automation

MBSE journey takes time…
Follow a step-by-step approach
Don't give-up !

❑ Trade-off / Choices ❑ Training ❑ SE Community

❑ Management sponsor ❑ Project-Follow-up ❑ Cross fertilization ❑ Continuous improvement