

#### SYSTEM MODELING Introduction

2015-09-14

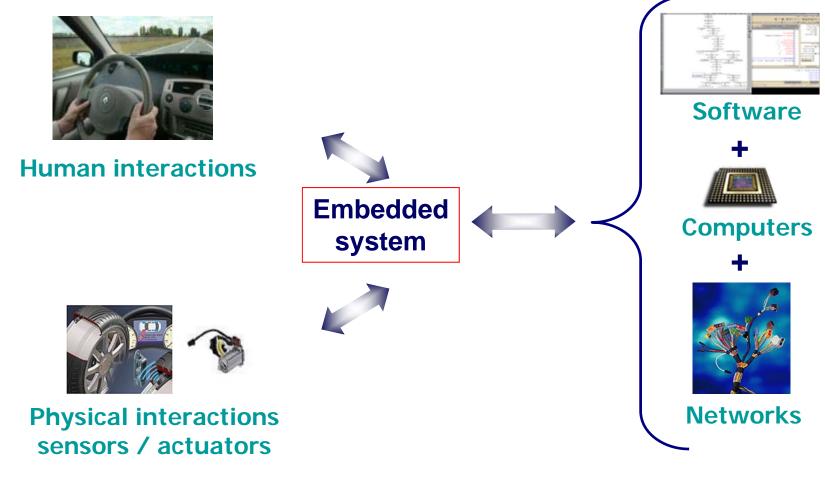


**François Terrier** 

#### FIRST WHAT IS A SYSTEM?

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Complex and heterogeneous systems responding to real-world events



F. Terrier

2014-12-02 2

list



Window Control

unity & Alarm

ators & Temperature

itoring & Control

Automatic Notific

val

Smart End-Us

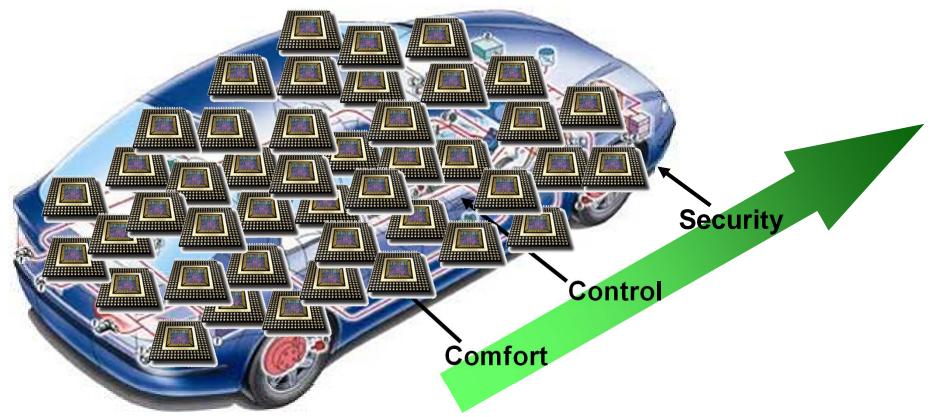


#### Innovation = more functions =



more computing

#### → Some numbers...



→ Tenth of interconnected processors
 → Hundreds of processing in parallel
 → Thousands of exchanged data

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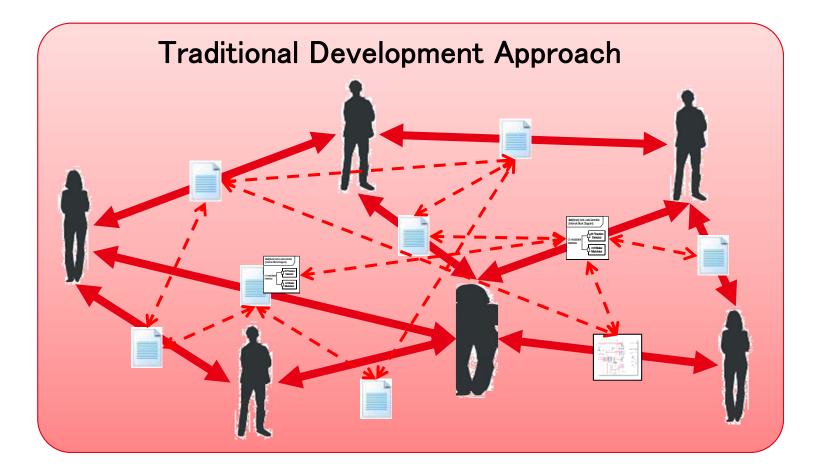
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# Why model driven engineering?



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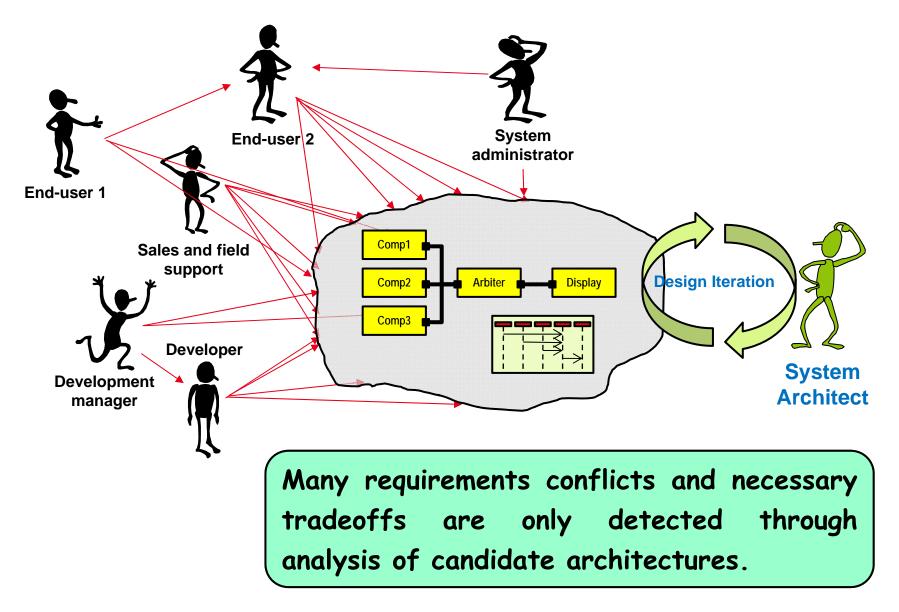
Unreliable / Inefficient / Non-scalable

S. Gérard

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#### HOW ARCHITECTURE HELPS DEFINE REQUIREMENTS



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#### A SYSTEM-LEVEL APPROACH IS NEEDED: ARCHITECTURE!

#### DESIGN THE SYSTEM AS A WHOLE RATHER THAN AS AN AGGREGATE OF SEPARATELY DESIGNED SUB-SYSTEMS

- Provides possibility to ensure system integrity
- Requires a "big picture" approach
- → an architecture specification

#### **ONE DEFINITION OF ARCHITECTURE [IEEE STANDARD 1471] :**

"The **fundamental** organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution"

⇒ Architectural specifications *abstract out* non-fundamental detail

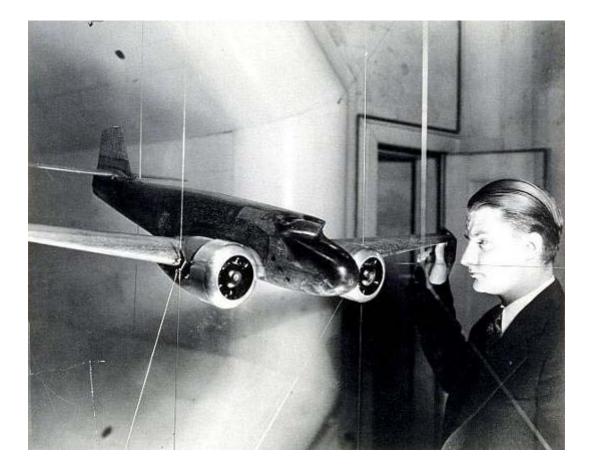


## **BASIS IS MODELING**



Ceatech MODELS IN TRADITIONAL ENGINEERING





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PTI

Extracted from B. Selic presentation

#### **ENGINEERING MODELS**

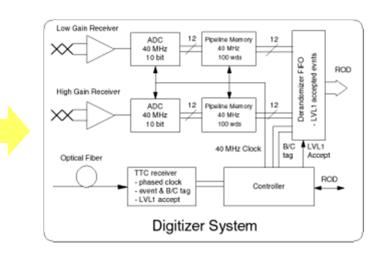


#### **ENGINEERING MODEL**

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• A reduced representation of some system that highlights the properties of interest from a given viewpoint





Modeled system

**Functional Model** 

#### WE DON'T SEE EVERYTHING AT ONCE WE USE A REPRESENTATION (NOTATION) THAT IS EASILY UNDERSTOOD FOR THE PURPOSE ON HAND

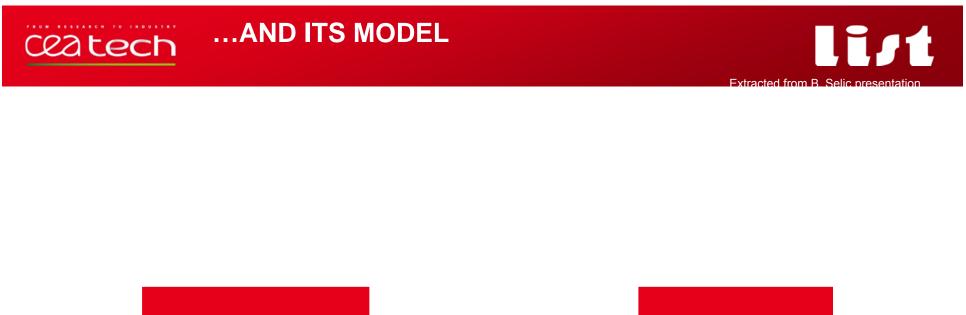
## ceatech A BIT OF SOFTWARE...



```
SC MODULE (producer)
sc outmaster<int> out1;
sc in<bool> start; // kick-start
void generate data ()
for(int i =0; i <10; i++) {</pre>
out1 =i ; //to invoke slave;}
SC CTOR (producer)
SC METHOD (generate data);
sensitive << start;}};</pre>
SC MODULE(consumer)
sc inslave<int> in1;
int sum; // state variable
void accumulate (){
sum += in1;
cout << "Sum = " << sum << endl; }
```

```
SC_CTOR(consumer)
{
SC_SLAVE(accumulate, in1);
sum = 0; // initialize
};
SC_MODULE(top) // container
{
producer *A1;
consumer *B1;
sc_link_mp<int> link1;
SC_CTOR(top)
{
A1 = new producer("A1");
A1.out1(link1);
B1 = new consumer("B1");
B1.in1(link1);};
```

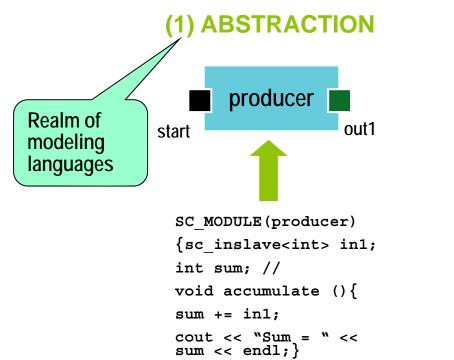
Can you spot the architecture?



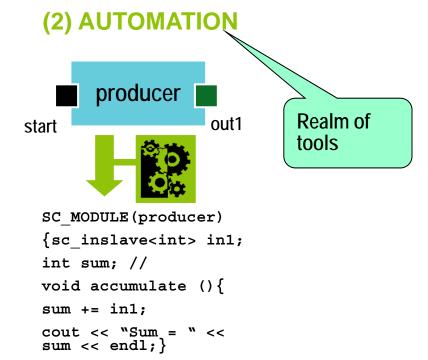


Can you spot the architecture?

AN APPROACH TO SOFTWARE DEVELOPMENT IN WHICH THE FOCUS AND PRIMARY ARTIFACTS OF DEVELOPMENT ARE MODELS (AS OPPOSED TO PROGRAMS) AND BASED ON TWO TIME-PROVEN METHODS



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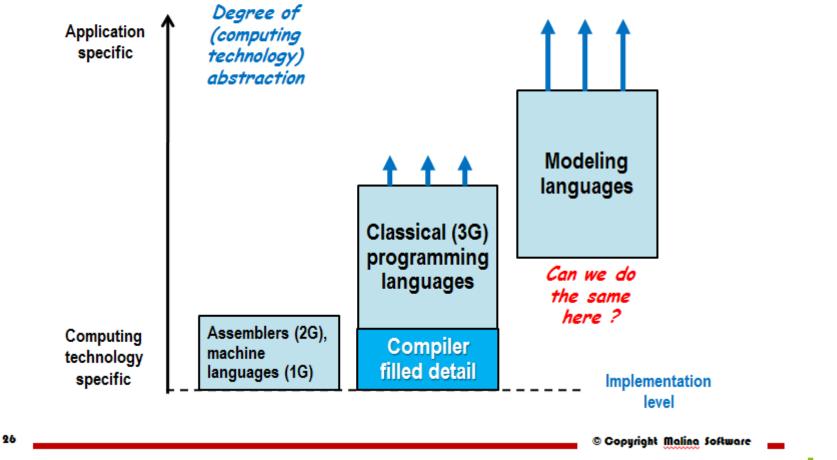
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# list

## The Evolution of Computer Languages

 Much of the evolution of computer languages is motivated by the need to be more human-centric (i.e., descriptive)





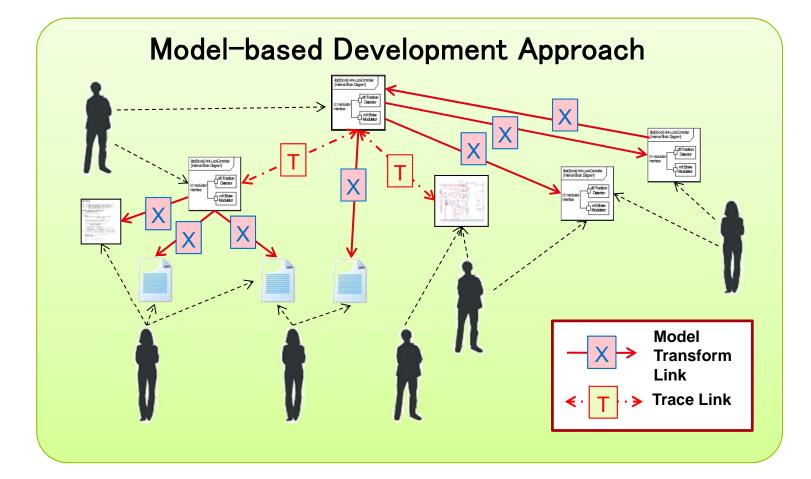
#### TWO MAIN PRINCIPLES BEHIND MDE



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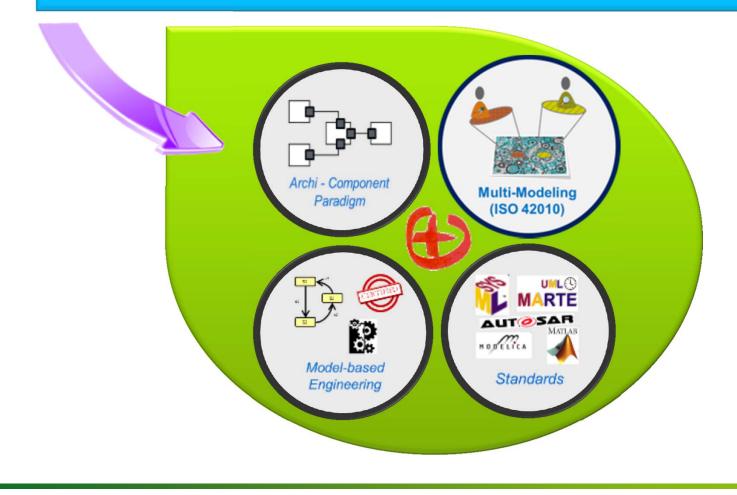


More efficient, More reliable, and More scalable.





Going further for developing modern complex systems & software requires new advanced and innovative methods and tools

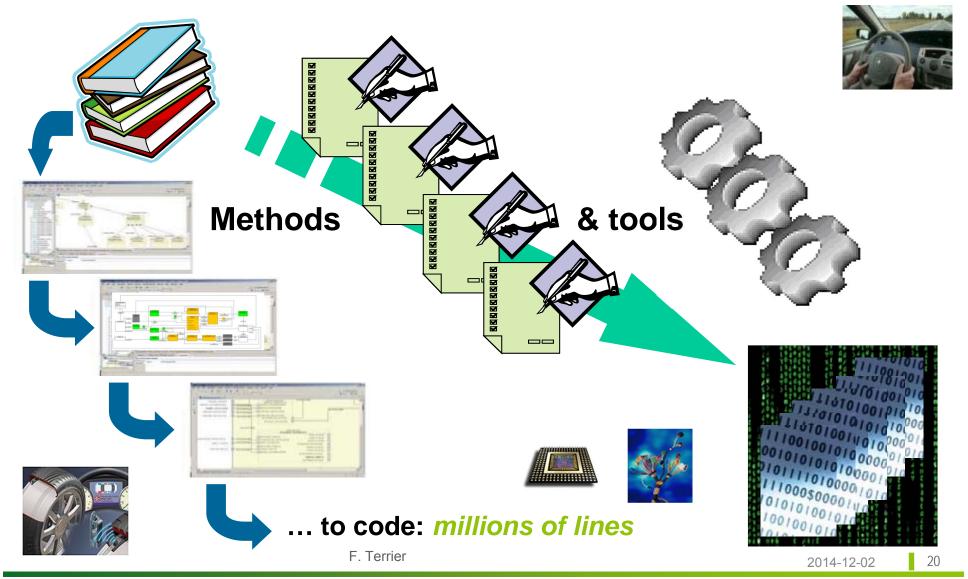


# → NUMEROUS, COMPLEX & INTERDEPENDENT SOFTWARE

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#### From requirement document: Hundreds of pages

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## Modeling with which language?



# Standards have traditionally provided major boosts to technological progress !

#### **BUT STANDARDS ENABLE ALSO VENDOR INDEPENDENCE**

• Users have a choice of different vendors (no vendor "tie-in")

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• Forces vendors into competing and improving their products

# THE OBJECT MANAGEMENT GROUP (OMG) HAS CREATED THE MODEL-DRIVEN ARCHITECTURE INITIATIVE:

 A comprehensive set of standards in support of MBE including standard modeling languages:



#### "For standard-based modeling, UML is a GOOD choice."

list

#### Mature modeling language

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- Initially based on very experienced modeling language designers: the three amigos, Booch, Jackobson and Rumbaugh but also Coleman, Desfray, Embley, Gamma, Harel, Meyer, Odell, Selic, Shaer-Mellor, Wirfs-Brock, etc.
- A 20 year old modeling languages (current version: 2.5) continually maintained and updated by very advanced experts coming from vairous origin: end users, tool providers and academics.

#### A rich modeling languages covering a large set of concerns

e.g., architecture, automata, data-flow, scenario and use case.

#### Internationally popular and in-use

• UML is widely educated, disseminated and implemented...





#### BUT UML IS ALSO A CUSTOMIZABLE STANDARD!

#### ORIGINALLY INTENDED FOR MODELING SOFTWARE-INTENSIVE SYSTEMS

- UML models capture different views of a software system (information model, run-time structure/behavior, packaging, deployment, etc.)
- Inspired primarily by the concepts from object-oriented languages (class, operation, object, etc.)

#### HOWEVER, THE GENERAL NATURE A LARGE SCOPE OF ITS CONCEPTS MADE UML SUITABLE FOR EXTENSIONS TO OTHER DOMAINS.



# THANK YOU





#### www.eclipse.org/papyrus

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