

The logo for WILLERT features the word "WILLERT." in white, all-caps, sans-serif font, centered within a solid red square.

WILLERT.

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# BRIDGING EMBEDDED GAP

DEVELOPMENT OF REAL-TIME SYSTEMS WITH ENTERPRISE ARCHITECT



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**Let us go step by step**

# What does Embedded mean?

- ✘ **Software on the chip**  
 Sometimes even no operating system
- ✘ **Blue screen (system deadlock) is not an option**
- ✘ **Realtime - have to respond in fixed defined time**
- ✘ **Limited Resources**



# What Gap?

# Complexity

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ELEMENTS

1

CONNECTIONS

0



# Complexity

ELEMENTS

2

CONNECTIONS

1



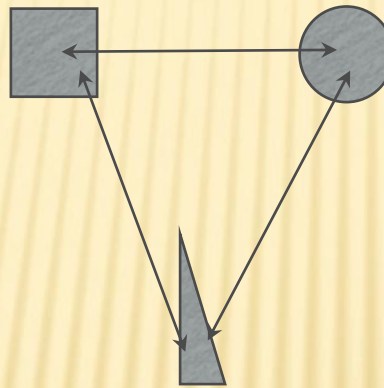
# Complexity

ELEMENTS

3

CONNECTIONS

3



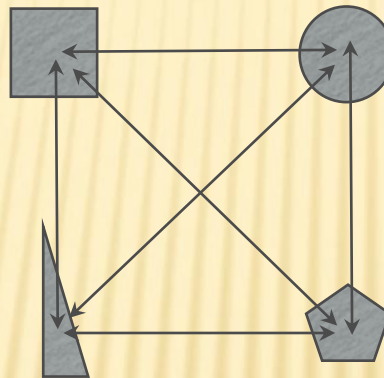
# Complexity

ELEMENTS

4

CONNECTIONS

6



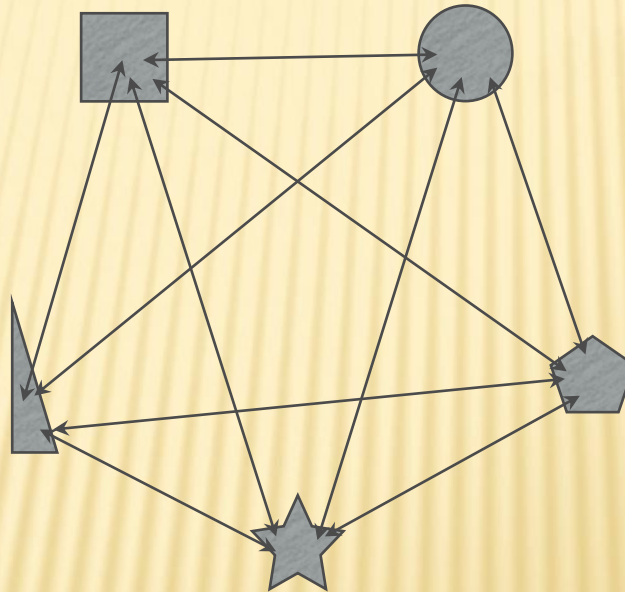
# Complexity

ELEMENTS

5

CONNECTIONS

10



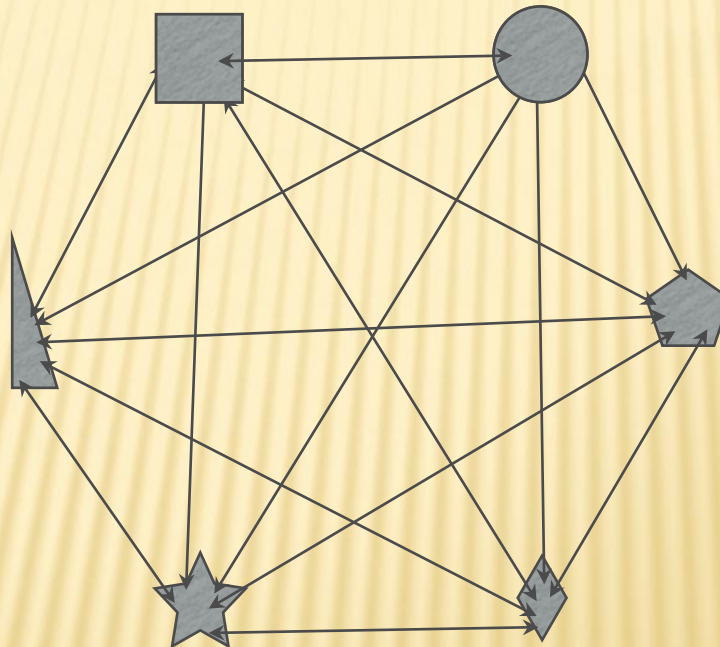
# Complexity

ELEMENTS

6

CONNECTIONS

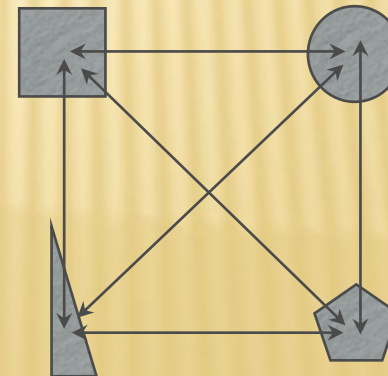
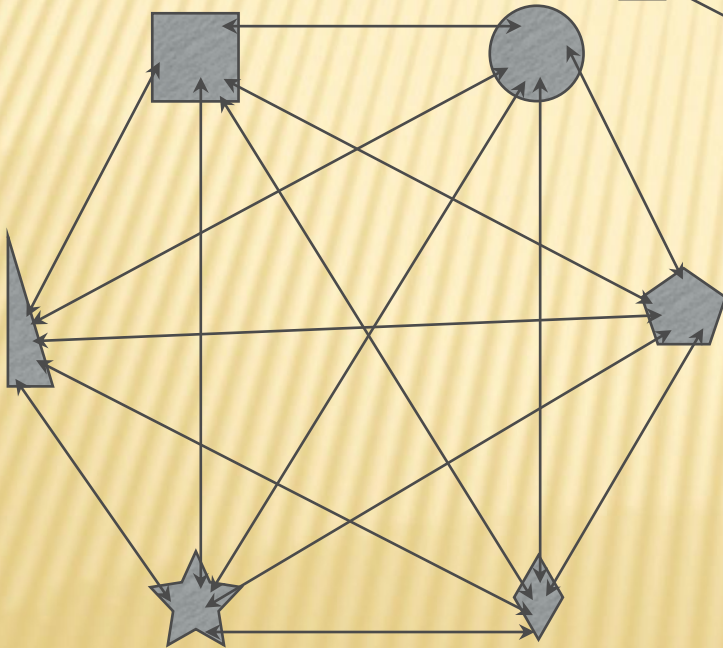
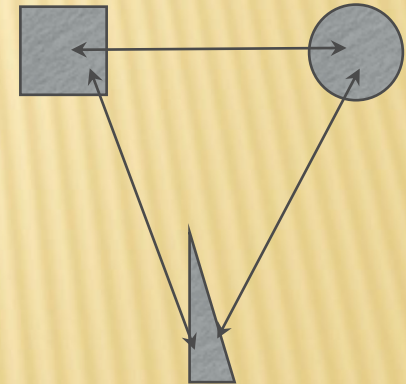
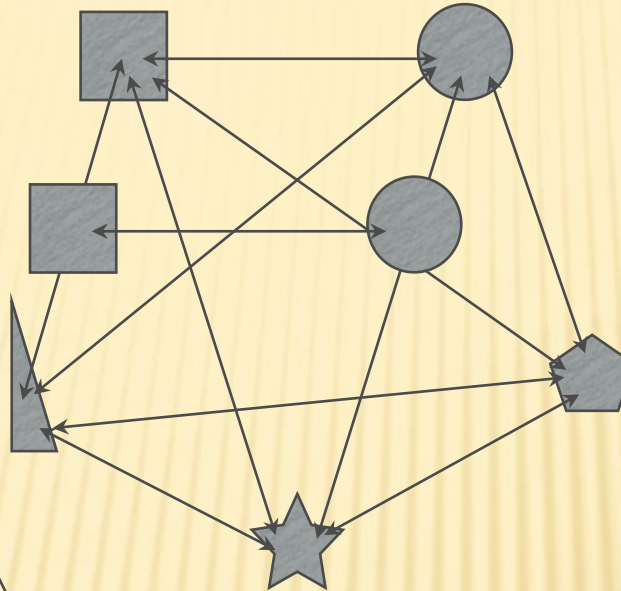
15



# Complexity

ELEMENTS  
**N**

CONNECTIONS  
 **$N(N-1)/2$**



# Complexity

- × Software-levels
  - × Time
  - × Data
  - × Behavior
  - × Priority
- × Application-levels
  - × Operation mode
  - × Variants
  - × Versions
  - × Networking with outside
  - × ...

# Project Manager Solution

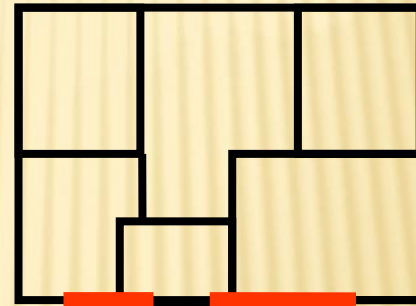
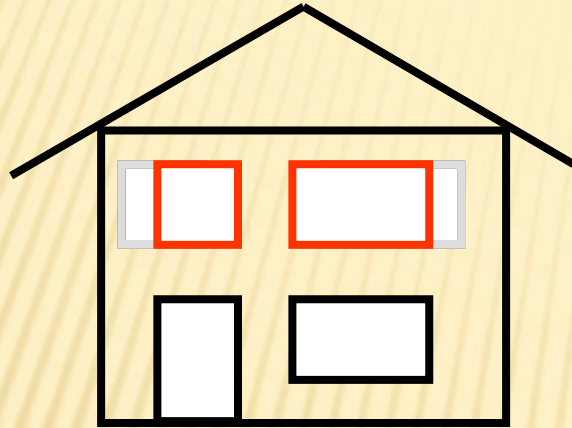
- |                 |    |                           |
|-----------------|----|---------------------------|
| 1 DEVELOPER     | -> | 1 YEAR DEVELOPMENT TIME   |
| 2 DEVELOPERS    | -> | 1/2 YEAR DEVELOPMENT TIME |
| 12 DEVELOPERS   | -> | 1 MONTH DEVELOPMENT TIME  |
| 240 DEVELOPERS  | -> | 1 DAY DEVELOPMENT TIME    |
| 1920 DEVELOPERS | -> | 1 HOUR DEVELOPMENT TIME   |

THAT WOULD MEAN THAT A TEAM WITH 1920 Bangalore DEVELOPERS, WORKING ACCORDING TO CMMI LEVEL 5, WOULD IMPLEMENT THIS PROJECT WITHIN 1 HOUR.

SOURCE: TOM DE MARCO

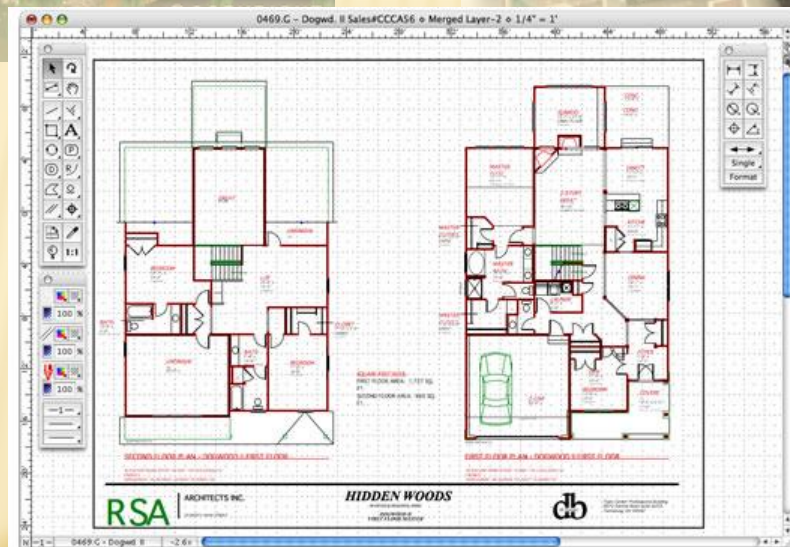
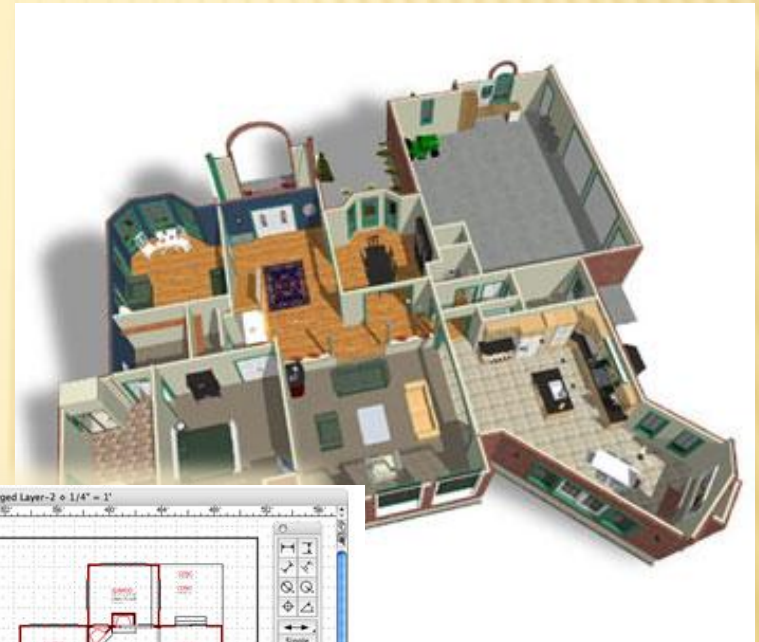


# Alternative Solution



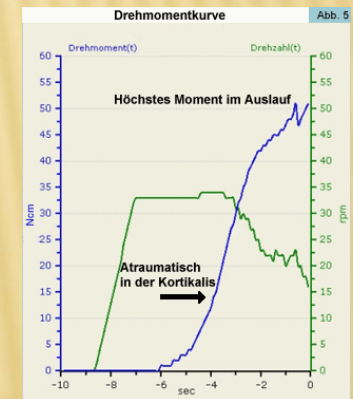
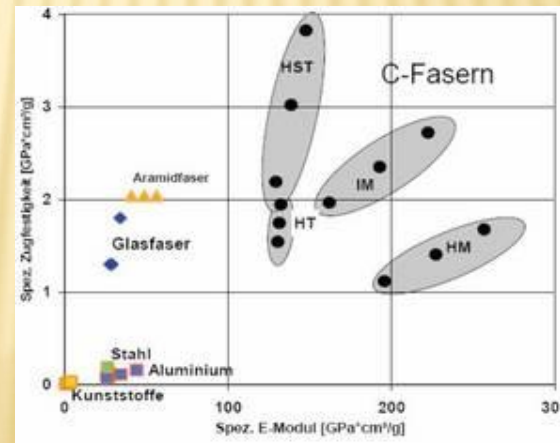
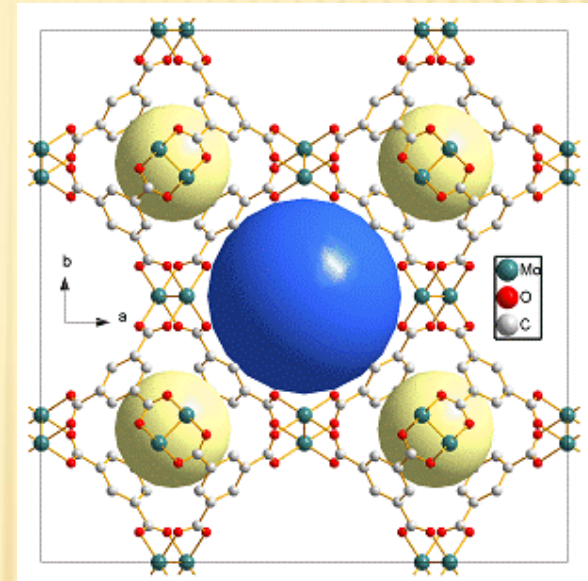
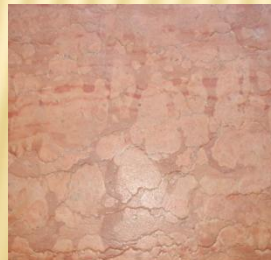
- ✘ So a Change in the front view
- ✘ causes
- ✘ a change in floor plan

# Computer Aided Design (CAD)



# Material-Design

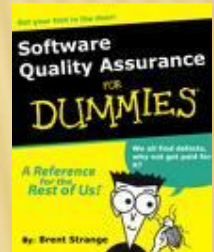
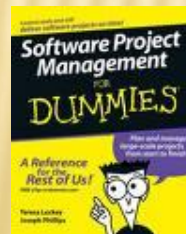
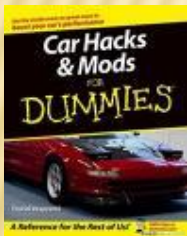
- Tensile strength
- u.t.s.
- Viscosity
- UV resistance
- Temperature-resistance
- colour
- ...



# That is the Gap!



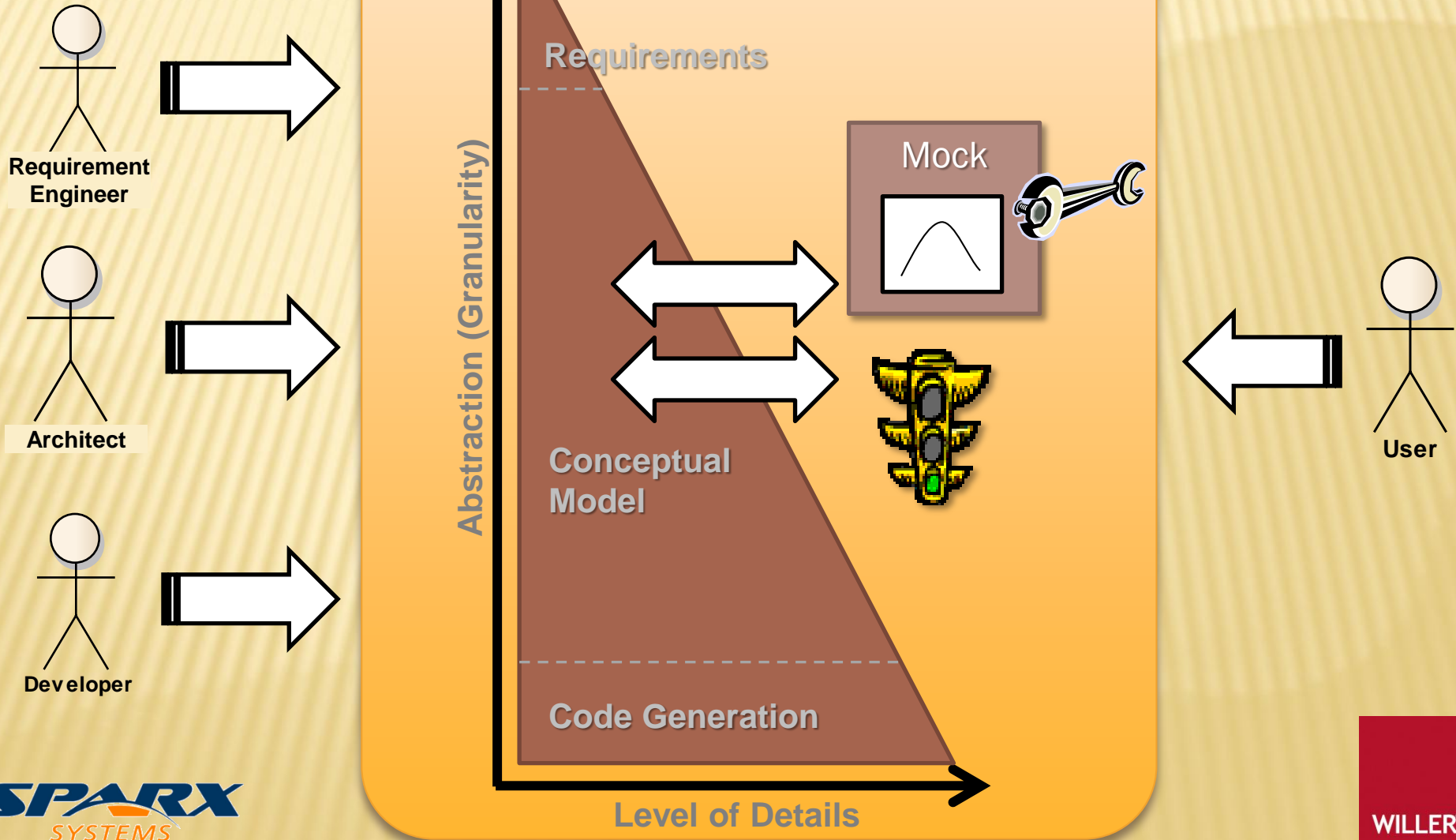
## NETWORKING OF MULTIPLE CONTROLERS STILL PROGRAMMED IN 'C'...?!?



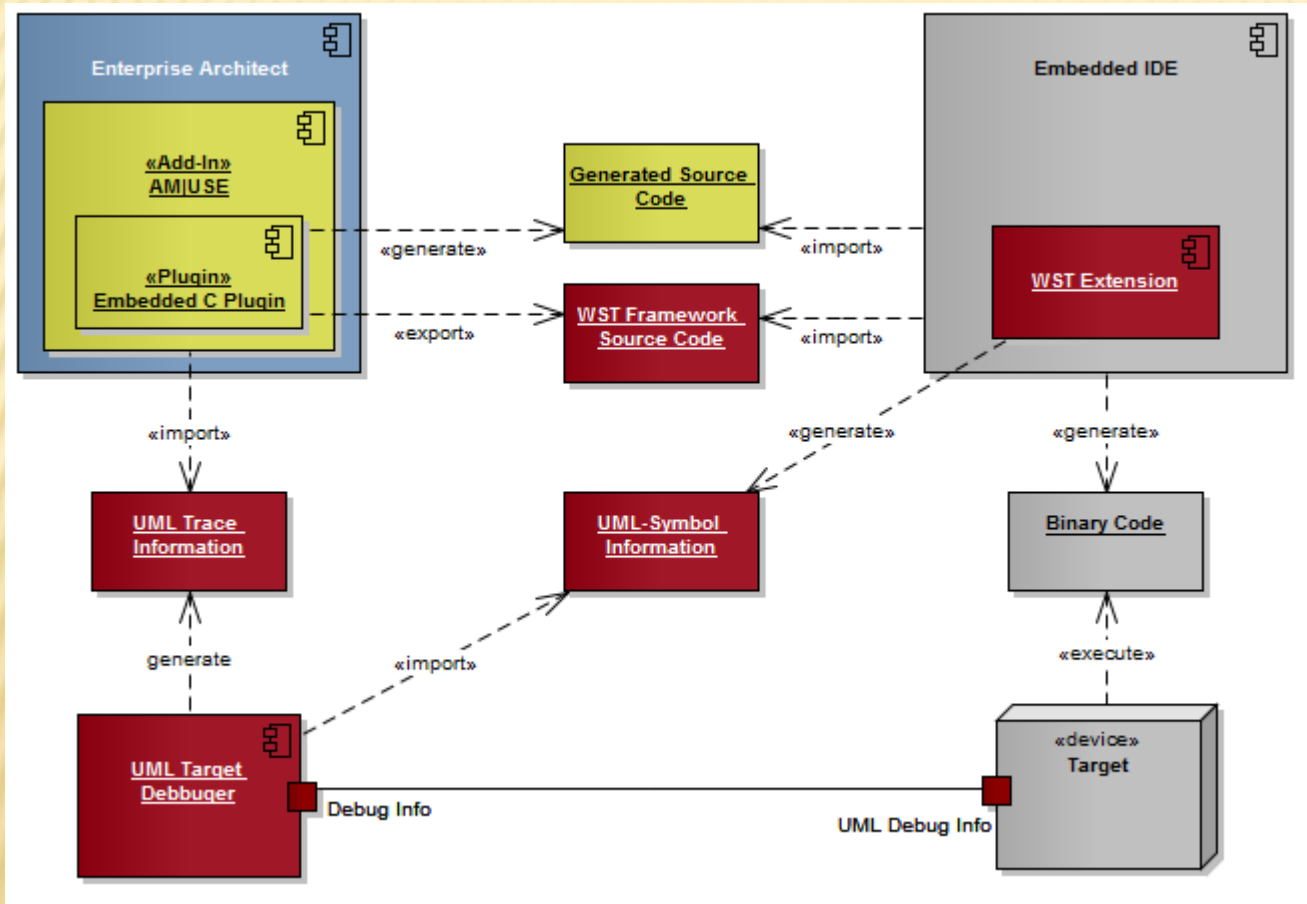
# Affordable Solution for Embedded Systems

- ✘ **Modeling Platform - Enterprise Architect**
  - + covers the whole development lifecycle including Business Process Modeling, Requirement Engineering, Architecture, Code Generation, Test- and Project-Management at one data base
  
- ✘ **LieberLieber AM | USE**
  - + means **Interactive UML** and **rich Simulation** Capabilities
  - + **footprint optimized ANSI C** Code Generation
  
- ✘ **Willert Tools**
  - + hardware abstraction layer with **extremely small footprint**
  - + UML Target Debugger **without any code Instrumentalization**

# From the Concept to the Product



# Whole Development ONE Abstraction Level



**Legend**

- Sparx EA 8.0 System Engineering
- LieberLieber Responsibility
- Willert Responsibility
- 3'd Party Responsibility

# Some facts

## ✘ Supported IDE's / Compilers

- + Keil C166, Keil MDK ARM, IAR EWARM, IAR M16C, IAR M32C, Analog Devices Visual DSP++, GNU gcc, Tasking C166 V8.x, TI CodeComposer, IAR Microchip dsPIC/PIC24, Microchip MPLABC32, Altera NIOS II gcc, MS Visual Studio 2008

## ✘ Supported RTOS

- + CMX-RTX, OO-RTX, RL-ARM, embOS, VDK, Linux, EUROS, DSP/BIOS, Windows

Stromverbrauch: 13  $\mu$ A  
The compiled code 3,5 kb



Source: <http://www.willert.de/unterstuetzte-zielplattformen/>

# Opportunity

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- ✘ The embedded market is one of the most competitive areas
- ✘ Lower rework risk and decrease time-to-market
- ✘ Be better than your competitors!

# Thank you for your Interest!

Did you try to learn a programming language by reading books and writing code without compilation ?

Why to do so with UML ? Interactive UML helps

Let your models speak for you

Why get lost in Abstraction? Use AM|USE for simplification!

Get the best from your models

Create, test and deliver your idea

# Extend Simulation by connecting external Systems

