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Generative tools for  
automated software  
development and  
modernization

**Delta Software  
Technology**

provides Europe's  
leading companies with  
state-of-the-art software  
generator technology for  
more than 30 years

# Model-Driven Development and Product Lines, Leipzig 2007

## Automation of Automation

Cord Giese

Research Analyst at

Delta Software Technology GmbH

## Programming ...

... 40 years ago

```

BUBBLE:  PROCEDURE (ARRAY,N); /* BUBBLE SORT*/
DECLARE (I,J) FIXED BIN(15);
DECLARE S BIT(1);          /* SWITCH */
DECLARE Y FIXED BIN(15); /* TEMPO */
DO I = N-1 BY -1 TO 1;
  S = '1'B;
  DO J = 1 TO I;
    IF X(J)>X(J+1) THEN DO;
      S = '0'B;
      Y = X(J);
      X(J) = X(J+1);
      X(J+1) = Y;
    END;
  END;
  IF S THEN RETURN;
END;
RETURN;
END SRT;

```

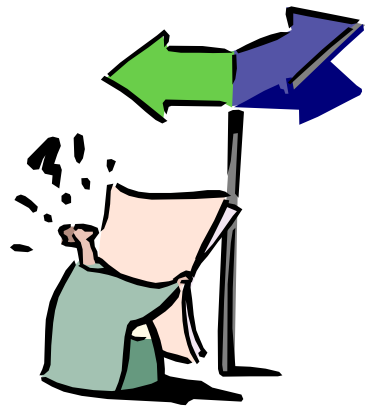
... today

```

.def    A      =r13    ;first value to be compared
.def    B      =r14    ;second value to be compared
.def    cnt2   =r15    ;inner loop counter
.def    cnt1   =r16    ;outer loop counter
.def    endL   =r17    ;end of data array low address
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bubble:
    mov  ZL,endL
    mov  ZH,endH    ;init Z pointer
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i_loop: ld  A,Z      ;get first byte, A (n)
        ld  B,-Z     ;decrement Z and get second byte, B (n-1)
        cp  A,B      ;compare A with B
        brlo L1      ;if A not lower
        st  Z,A      ;store swapped
        std Z+1,B
L1:    dec  cnt2
        brne i_loop  ;end inner loop
        dec  cnt1
        brne bubble ;end outer loop
        ret

```



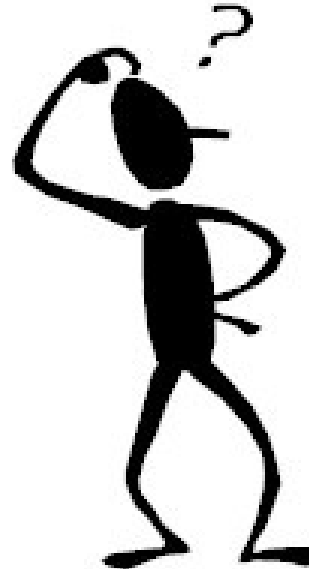
## Automation – Why?

Automation – What?

Automation – How?

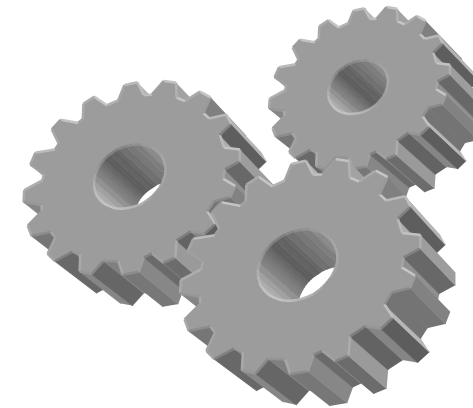
Examples and Strategies

- Improving efficiency of software development and maintenance
  - Quality
  - Productivity
  - ... ?



- Quality improvement through less manual processes
  - Reproducibility
  - Traceability
  - Reliability
- Fulfilling quality standards
  - (Automotive) SPICE – *Software Process Improvement and Capability Determination*
  - CMMI – *Capability Maturity Model Integration*
  - (A)SIL - *(Automotive) Safety Integrity Level*

- Product lines make use of domain-specific
  - Artifacts
  - Frameworks
  - Models
  - **Automation techniques**
  - Tool chains
- Product lines reduce  $\frac{\text{effort}}{\text{variant}}$





Automation – Why?

**Automation – What?**

Automation – How?

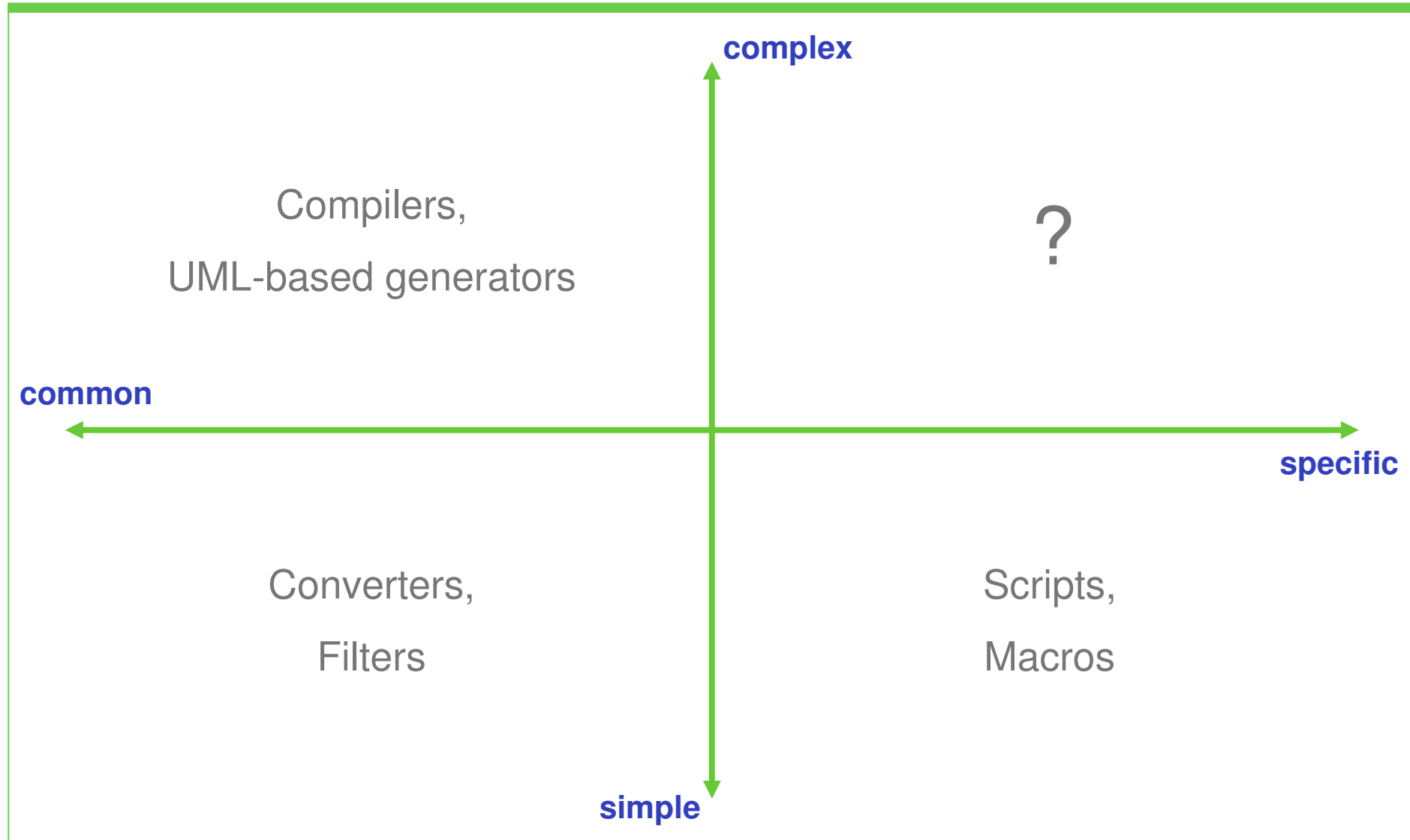
Examples and Strategies



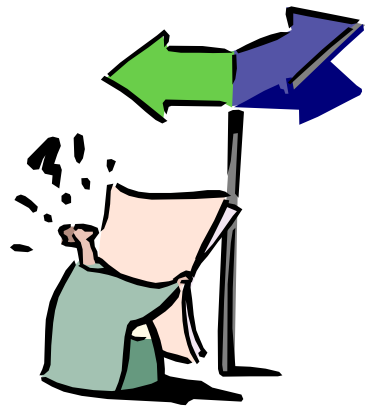
- Limitations of automation?
- (Hard) limitations – defined by philosophy
  - Responsibilities
  - Target definition
- (Soft) limitations – economical and technical aspects
- Automating Software Development
  - Simple and complex,  
domain-specific and common transformation tasks



# Abstraction Gap ↔ Scope



- (Crucial) Question: Interpretation or Code Generation?
  
- Code generation provides ...
  - Differentiation concerning time and place
  - Optimized solutions for limited resources (like AVR processors)
  
- Global decision impossible
  - In this case: focus on optimizing the SE process
  - → **Domain-specific generator (DSG)**



Automation – Why?

Automation – What?

**Automation – How?**

Examples and Strategies

*Thomas J. Watson, the founder of IBM, is reported to have said in 1943:*

*"I think there is a world market for about five computers"*

- Didn't IBM's founder have a clue of computers?
- Surely he had – he was only a realist
- Computers were extremely expensive, there was only a limited market for them
- Hardly imaginable in 1943:
- Cheap and small computers for everyone
- What has this got to do with generators? ...

- If you can decrease the costs for the development and usage of generators dramatically ...
  - ... then generators will even pay off in smaller but highly specialized projects

■ We have to consider the construction of generators as a specific domain in itself

- → Need for specific methodology + tool support
- → Model-based Development
  - WITH Generators
  - FOR Generators

- Developing generators with generators means to automate the automation.
- An automation less than 100% is no automation, only a kind of helper tool.
  - **We do not discuss**
    - One-shot code generation
    - Partial code generation
    - Generation of skeletons
    - Code generated into marked sections
    - ...

- **HyperSenses™**
  - Development of DSGs
  - Model-based product families (top-down)
    - OMG standards MOF and XMI
- **Pattern By Example™**
  - Code pattern definition (bottom-up)
- **ANGIE™**
  - Integrated tool chain implementation



Automation – Why?

Automation – What?

Automation – How?

**Examples and Strategies**





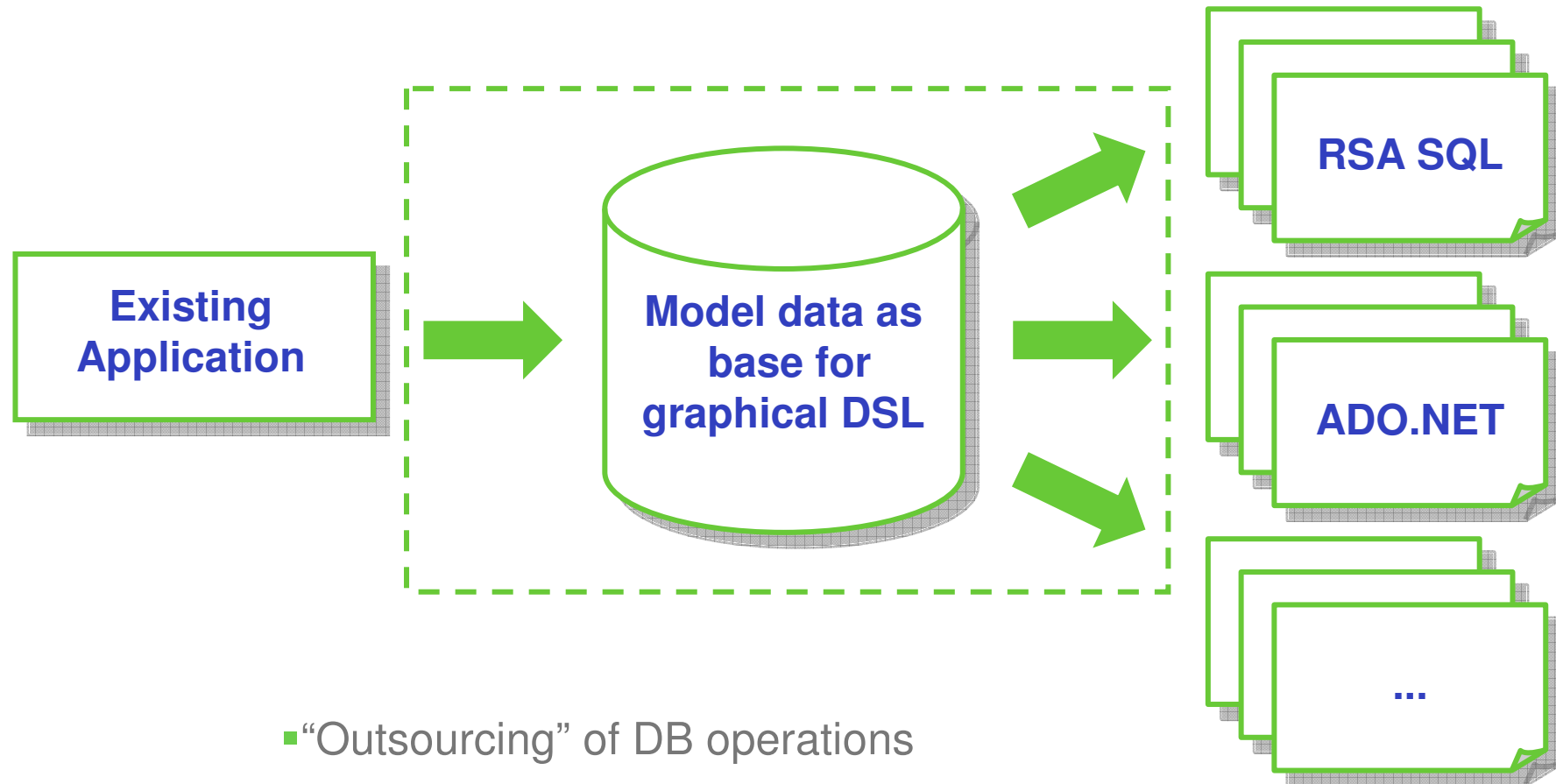
RDW

- RDW
- Central vehicle authority of The Netherlands
- Founded 1949, privatised 1996
- Responsible for central registration and administration of all vehicles, approvals and driving licences

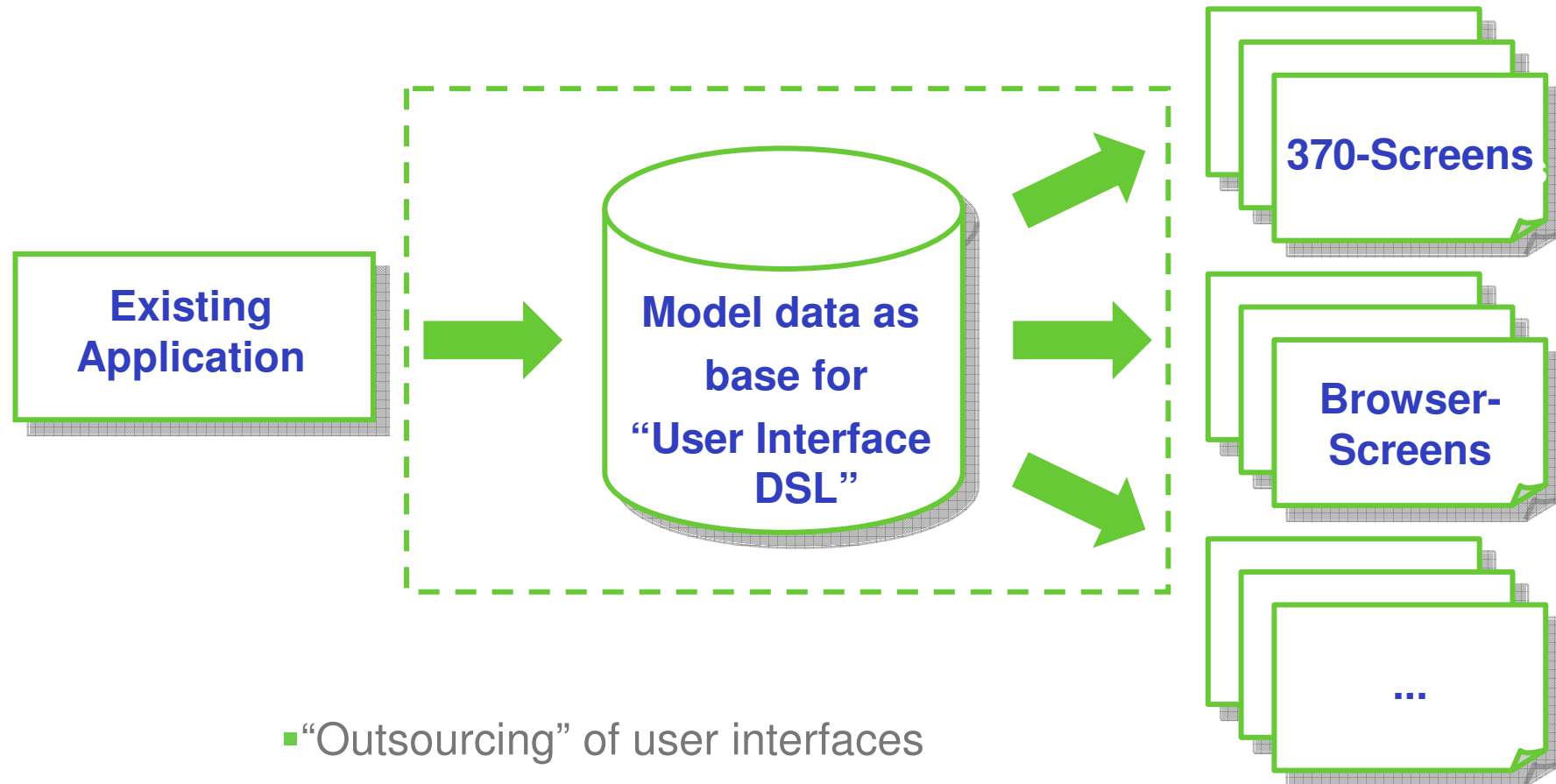
- The task: migration of mainframe applications (Unisys OS 2200) to ?
  - First step: make entire applications platform-independent

■ Is it possible to automise such a modernisation task?

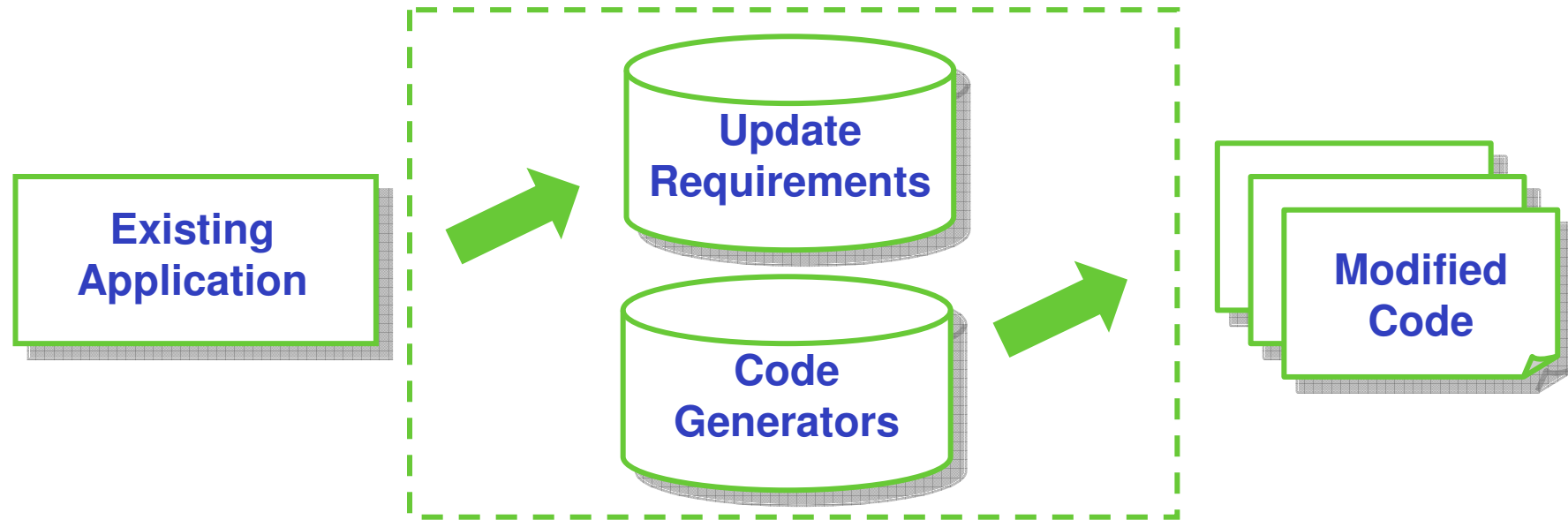
- Let us consider these 3 POIs:
  - DB operations
  - User interfaces
  - Platform-specific application code



- “Outsourcing” of DB operations
- ... into DSL data, here by means of SCORE<sup>®</sup> Data Architecture Integration<sup>™</sup>

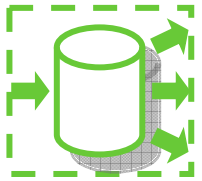


- “Outsourcing” of user interfaces
- ... into DSL data, here by means of Delta Screen™



- Replacing platform-specific code
- Analysing the sources, extracting update requirements, applying many (project-specific) code generators

- Automated mass changes with AMELIO Modernization Platform™
  - More than 1 million individual changes



- The whole process as a closed automat

- Agreement about 2% exceptions, but ...
- ... if a program is processed by AMELIO, then there are no subsequent manual changes
- → **100% automation**

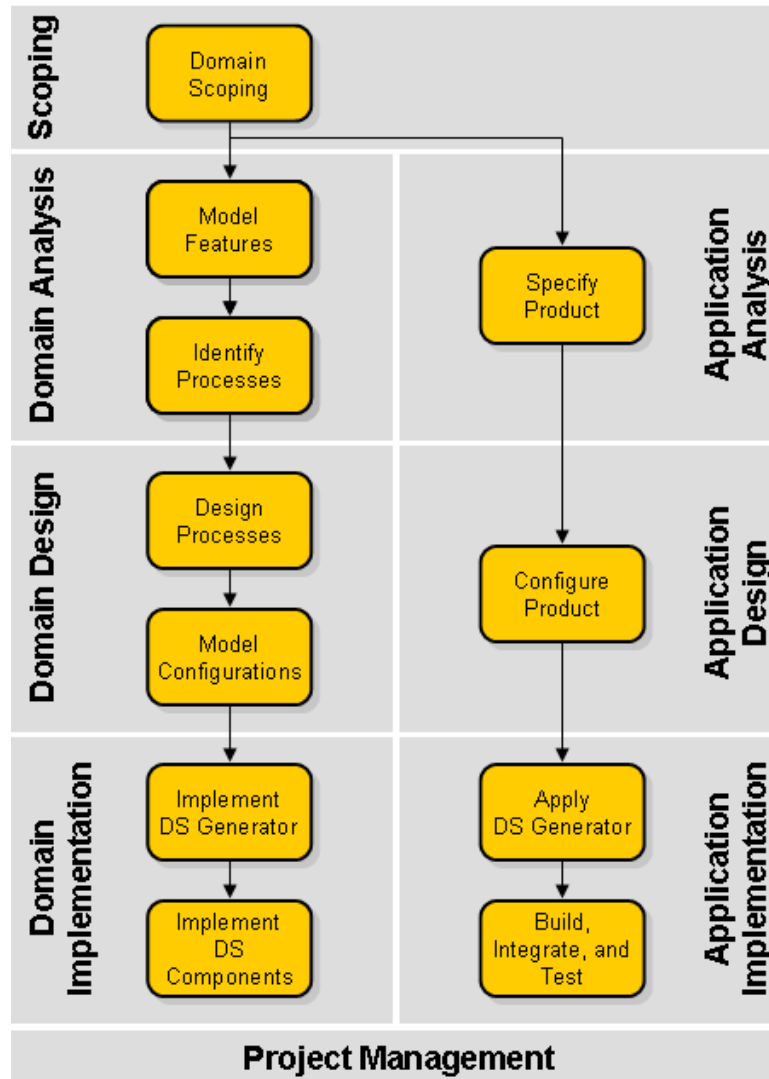
- Main benefit: automation in itself
  - Safeness: what works 1 million times, works also many times more
  - Reduction of test efforts by 90 %
  - Reduction of time efforts
  - No blocking of ongoing business operations
- ... only possible by 100% automation!



- MINT
  - Model-driven integration of information systems
- Delta @ MINT: Integration of data objects
  - Investigation of connecting relational legacy databases via code generators
- SCORE® Data Architecture Integration™
  - Deriving generators from models via HyperSenses™

■ → SCORE DAI for C#





- Process Family Engineering in Service-Oriented Applications
  - Product line architecture for variant-rich processes
  - Tool chains for application areas **e-Business** and **Automotive**
  - [www.PESOA.org](http://www.PESOA.org)
- Delta Software Technology:
  - Generator concepts and techniques
  - HyperSenses™

# Returning to “No Advancement?”

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            DO J = 1 TO I;
              IF X(J)>X(J+1) THEN DO;
                S = '0'B;
                Y = X(J);
                X(J) = X(J+1);
                X(J+1) = Y;
              END DO;
            END DO;
          END PROCEDURE;
  
```

Revisited

... today

```

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```

- Using automation there is a chance to negate this question.

- Consider that things could be performed automatically!
- If you decide to benefit from automation ...  
... think about the tools for it!
- If you decide to do it ...  
... do it 100%!
  
- Thank you very much!
- [www.D-S-T-G.com/MDD2007](http://www.D-S-T-G.com/MDD2007)