DynaMod

Dynamic Analysis for Model-Driven Software Modernization

André van Hoorn[1] and Holger Knoche[2]

[1]Software Engineering Group, University of Kiel

[2]b+m Informatik AG, Melsdorf

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b+m business IT management

C A U Christian-Albrechts-Universität zu Kiel Technische Fakultät

dataport

HSH NORDBANK

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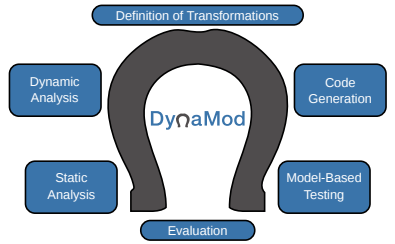
DynaMod

Dynamic Analysis for
Model-Driven Software Modernization

Motivation

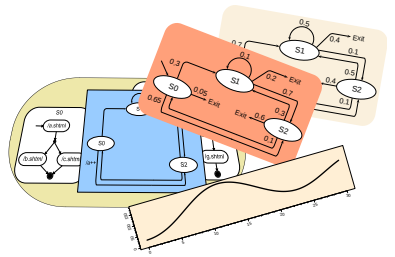
- Long-lived software systems require continuous modernization
- System behavior & usage important for modernization decisions
- MDSD techniques promise high degree of automation

Methodology



- Combining static and dynamic analysis for model extraction
- Model enrichment supporting reverse and forward engineering
- Architectural transformation from outdated to modernized system
- Generating code & tests employing mature MDSD techniques

Expected Results



- Developing resuable methods, techniques, and tools for MDM
- Evaluation by 3 representative case studies
- Sustainable value of models for MDSD-based evolution & operation

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DynaMod

Project Consortium:

1. **b+m Informatik AG**

   (Development partner, consortium leader)

   - Comprehensive MDSD know-how
   - Initiated openArchitectureWare (oAW)

2. **Software Engineering Group, Univ. Kiel**

   (Research partner)

   - Model-driven engineering, operation, and evolution of software systems
   - Emphasis on software quality (of service)

3. **Dataport**

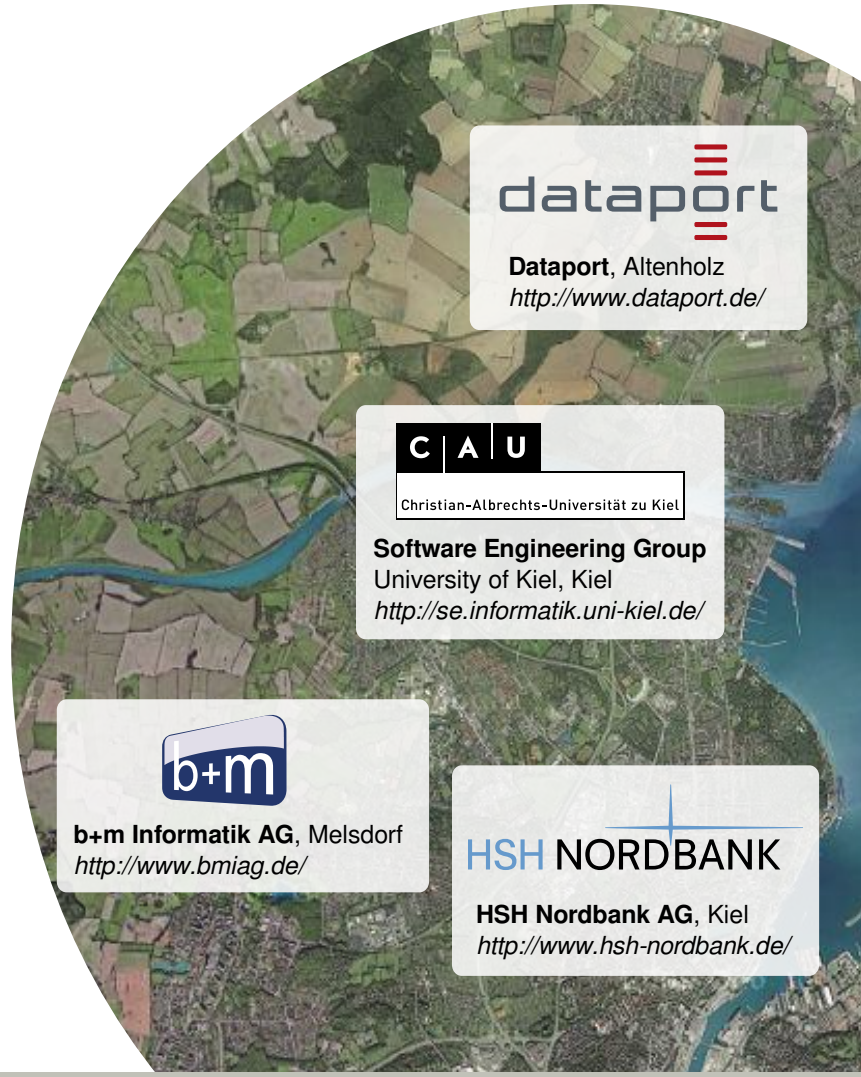
   (Associated partner)

   - Provides ICT services for public/tax administrations

4. **HSH Nordbank AG**

   (Associated partner)

   - Leading bank for corporate and private clients in northern Germany



Project Consortium & Funding

DynaMod

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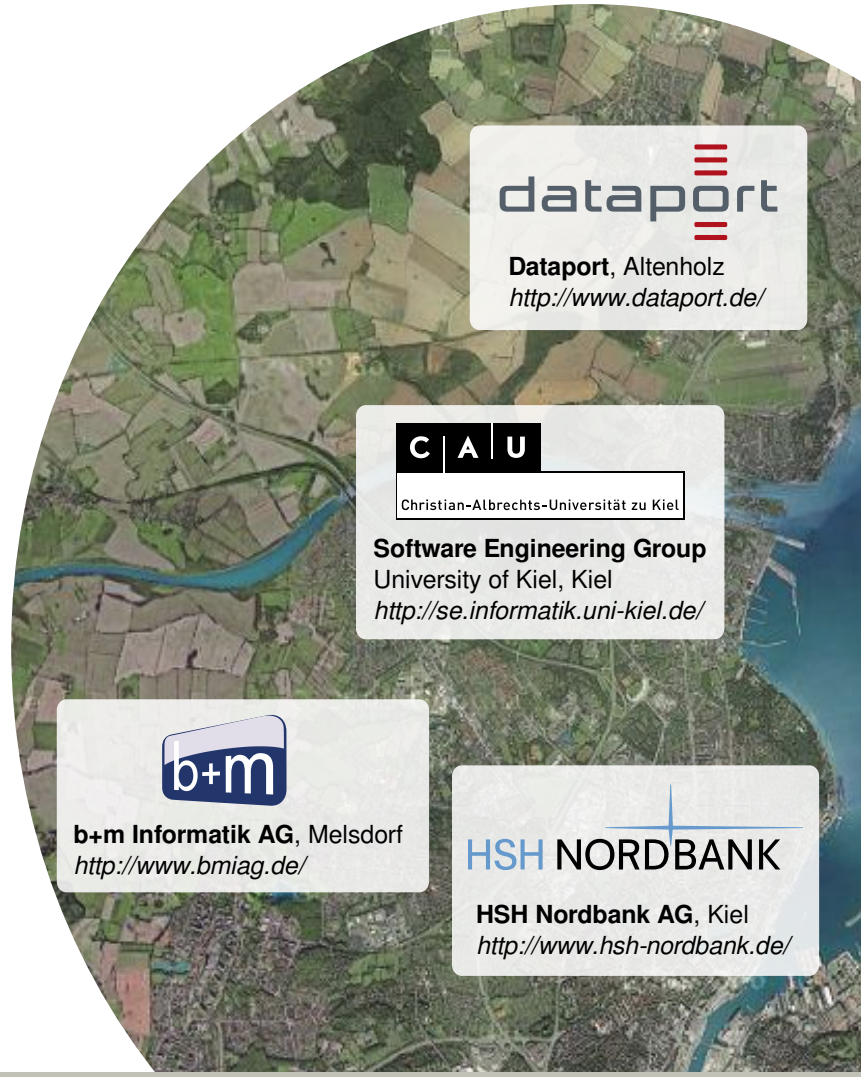


Funding:

- BMBF “KMU-innovativ”
- 2 years (01/11–12/12)

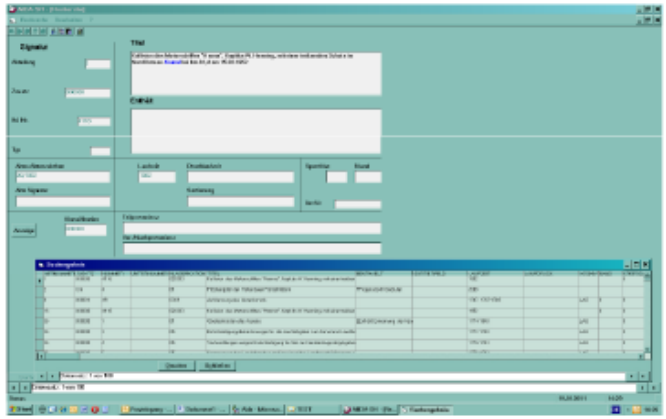
KoSSE
KOMPETENZVERBUND
SOFTWARE SYSTEMS ENGINEERING
SCHLESWIG-HOLSTEIN

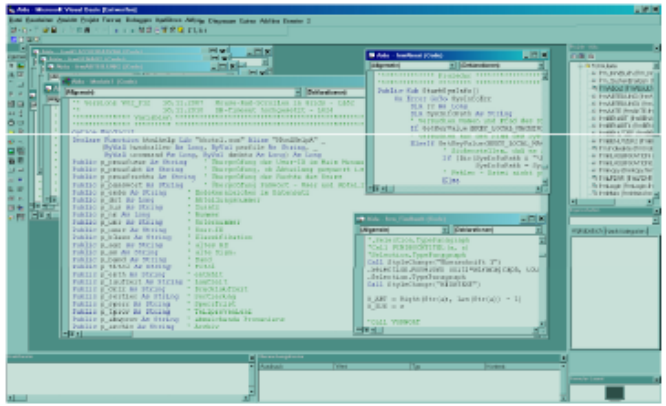
SPONSORED BY THE
Federal Ministry of Education and Research

Under grant no. 01IS10051

1 AIDA-SH (Dataport)

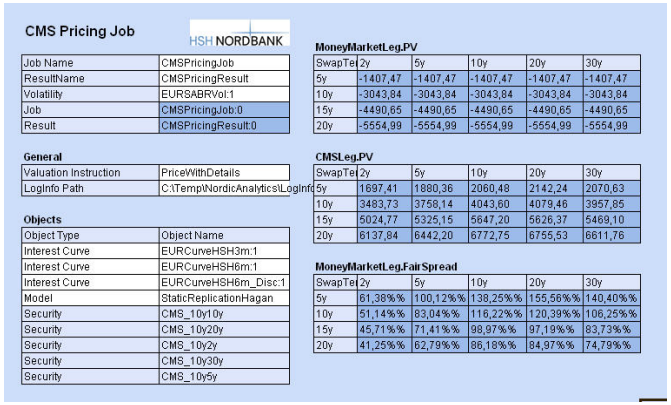
- Information management and retrieval system for inventory data of historical archives
- VB 6, MS SQL Server (7.0, 2000, 2003) and MSDE





Case Study Scenarios

1. AIDA-SH (Dataport)
   - Information management and retrieval system for inventory data of historical archives
   - VB 6, MS SQL Server (7.0, 2000, 2003) and MSDE
2. **Nordic Analytics (HSH Nordbank AG)**
   - Function library for assessment and risk control of finance products
   - C# implementation



CMS Pricing Job — HSH NORDBANK

Job Name	CMSPricingJob
ResultName	CMSPricingResult
Volatility	EURSABRVol:1
Job	CMSPricingJob:0
Result	CMSPricingResult:0

General

Valuation Instruction	PriceWithDetails
LogInfo Path	C:\Temp\NordicAnalytics\LogInfo

Objects

Object Type	Object Name
Interest Curve	EURCurveHSH3m:1
Interest Curve	EURCurveHSH6m:1
Interest Curve	EURCurveHSH6m_Disc:1
Model	StaticReplicationHagan
Security	CMS_10y10y
Security	CMS_10y20y
Security	CMS_10y2y
Security	CMS_10y30y
Security	CMS_10y5y

MoneyMarketLeg.PV

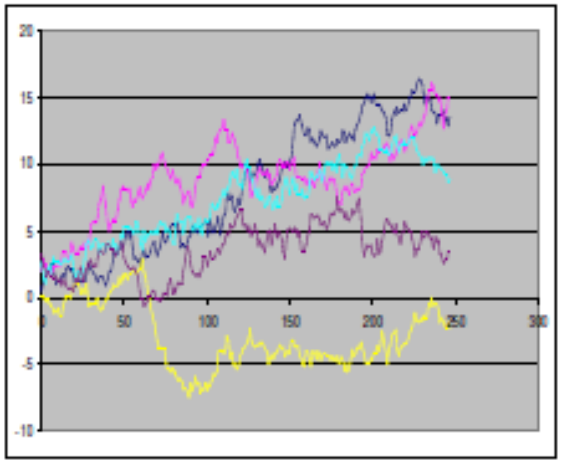
SwapTe	2y	5y	10y	20y	30y
5y	-1407,47	-1407,47	-1407,47	-1407,47	-1407,47
10y	-3043,84	-3043,84	-3043,84	-3043,84	-3043,84
15y	-4490,65	-4490,65	-4490,65	-4490,65	-4490,65
20y	-5554,99	-5554,99	-5554,99	-5554,99	-5554,99

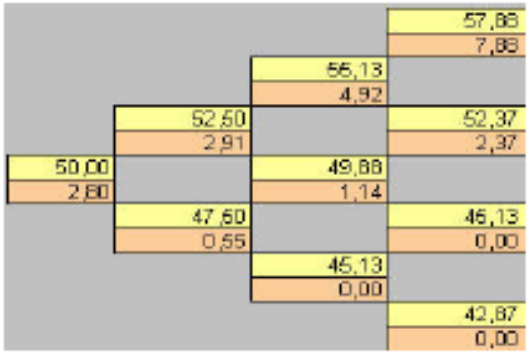
CMSLeg.PV

SwapTe	2y	5y	10y	20y	30y
5y	1697,41	1880,36	2060,48	2142,24	2070,63
10y	3483,73	3758,14	4043,60	4079,46	3957,85
15y	5024,77	5325,15	5647,20	5626,37	5469,10
20y	6137,84	6442,20	6772,75	6755,53	6611,76

MoneyMarketLeg.FairSpread

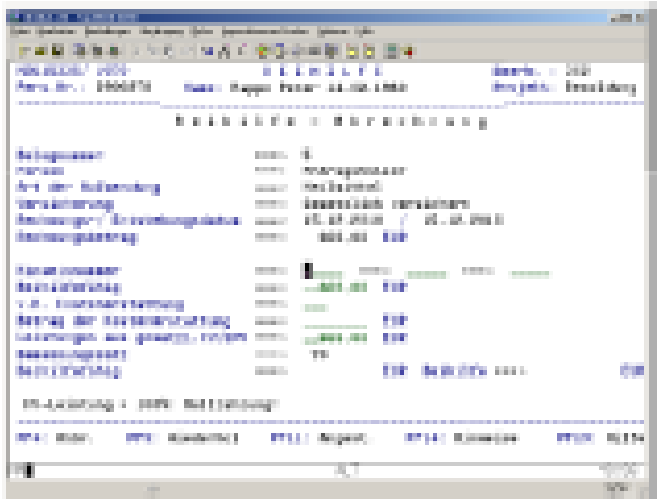
SwapTe	2y	5y	10y	20y	30y
5y	61,38%%	100,12%%	138,25%%	155,56%%	140,40%%
10y	51,14%%	83,04%%	116,22%%	120,39%%	106,25%%
15y	45,71%%	71,41%%	98,97%%	97,19%%	83,73%%
20y	41,25%%	62,79%%	86,18%%	84,97%%	74,79%%

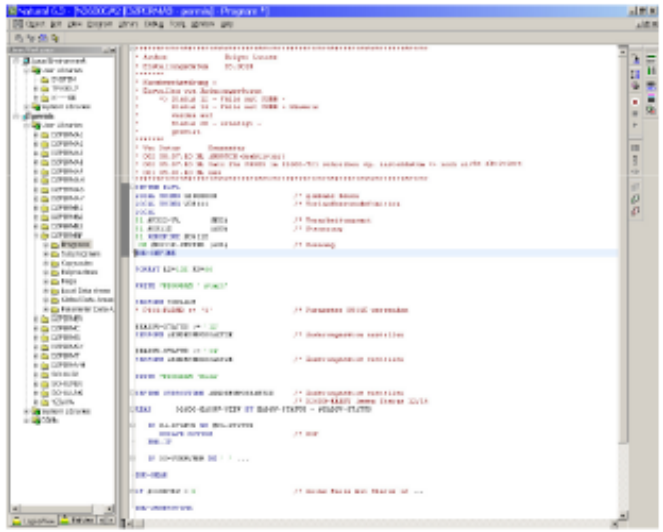


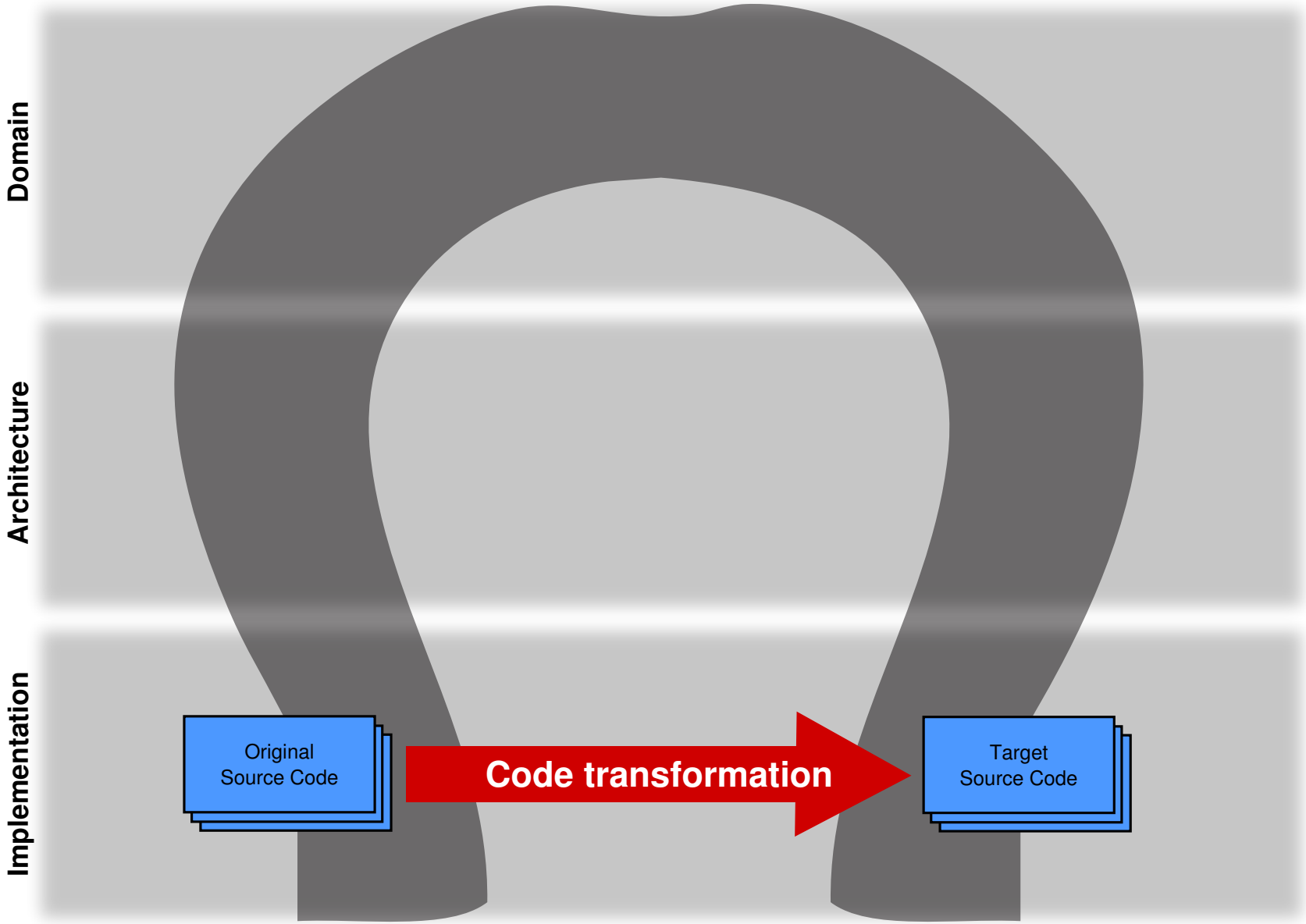


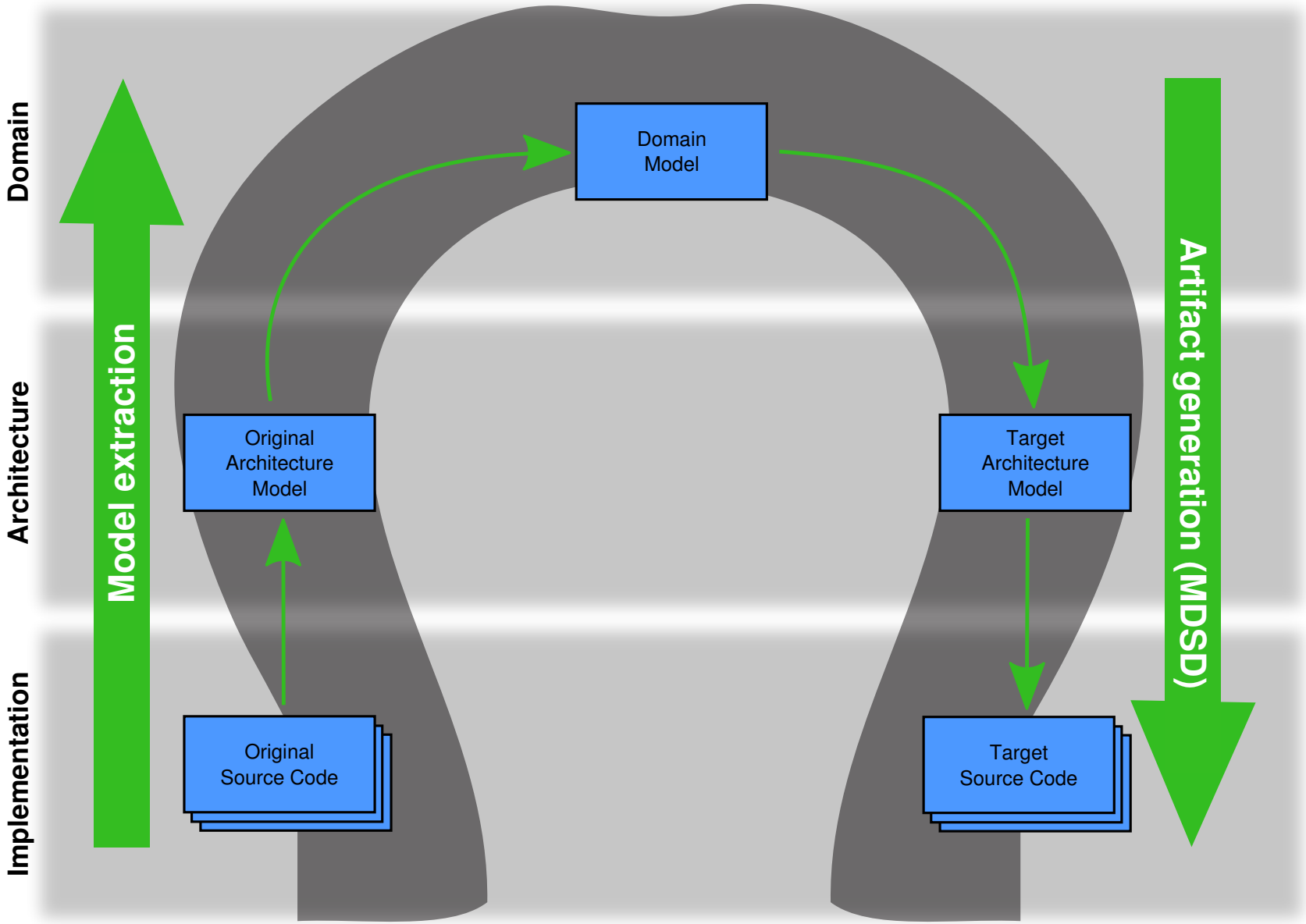
Case Study Scenarios

1. AIDA-SH (Dataport)
   - Information management and retrieval system for inventory data of historical archives
   - VB 6, MS SQL Server (7.0, 2000, 2003) and MSDE
2. Nordic Analytics (HSH Nordbank AG)
   - Function library for assessment and risk control of finance products
   - C# implementation
3. **Permis-B (Dataport)**
   - System for managing health care allowance
   - z/OS (mainframe OS), Adabas-C, Natural & COBOL, EskerTun/HOBLink, ApplinX






Domain
Architecture
Implementation
Original Source Code
Code transformation
Target Source Code


Domain
Architecture
Implementation
Model extraction
Artifact generation (MDSD)
Domain Model
Original Architecture Model
Target Architecture Model
Original Source Code
Target Source Code

DynaMod Working Packages

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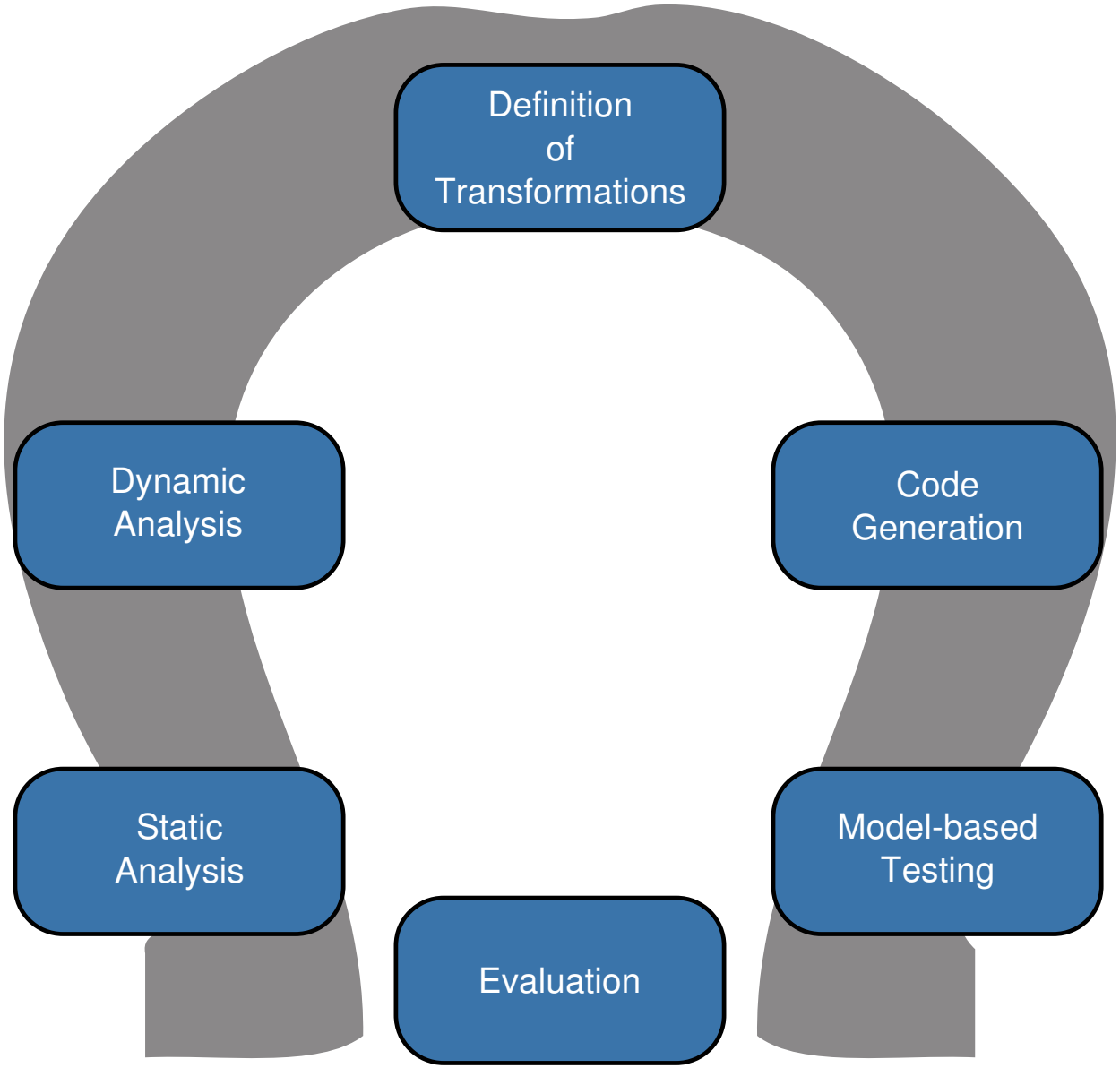
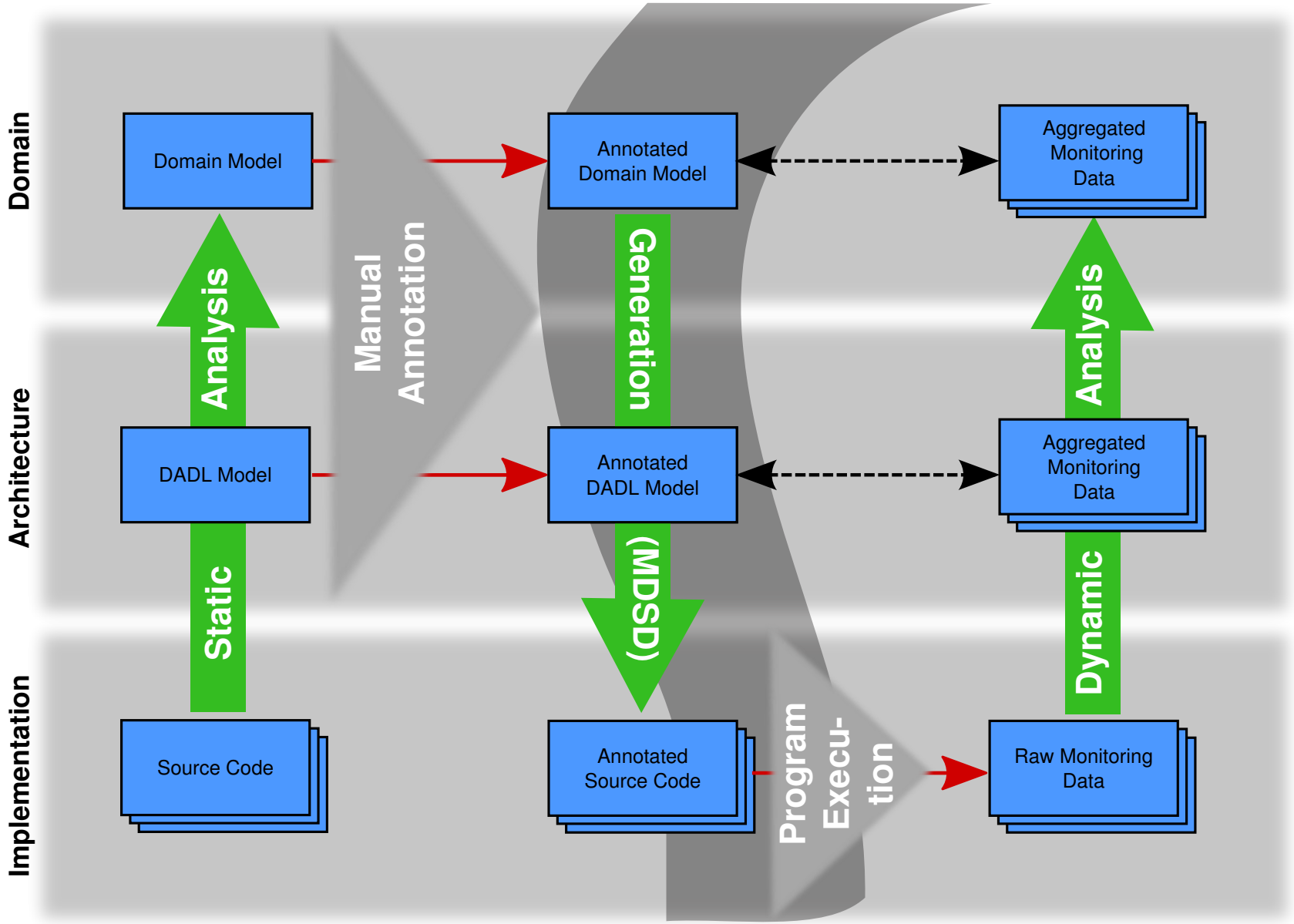
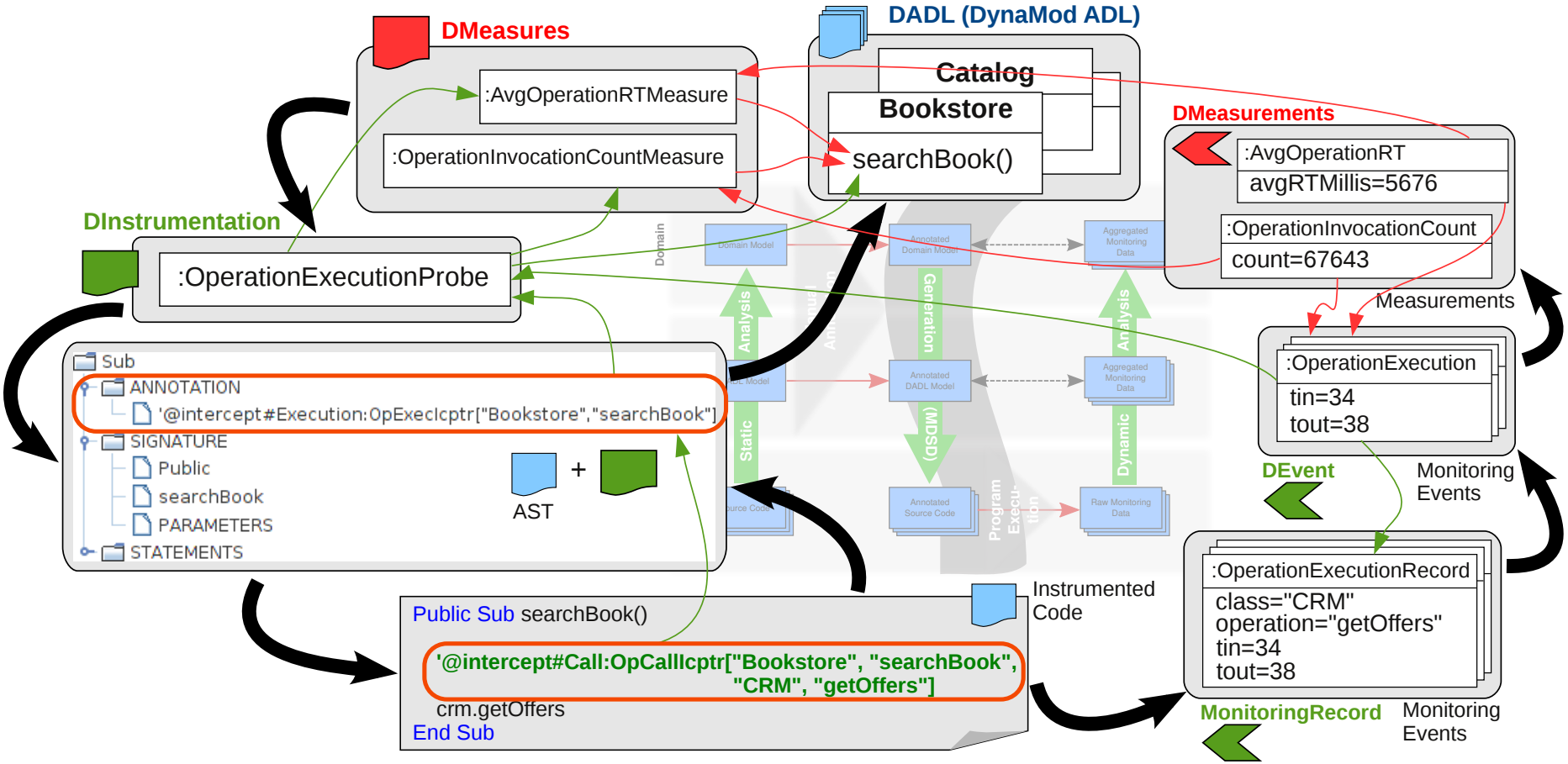


Agenda


Domain
Architecture
Implementation
Domain Model
DADL Model
Source Code
Analysis
Static
Manual Annotation
Annotated Domain Model
Annotated DADL Model
Annotated Source Code
Generation (MDSD)
Program Execu-tion
Aggregated Monitoring Data
Aggregated Monitoring Data
Raw Monitoring Data
Analysis
Dynamic


DMeasures
:AvgOperationRTMeasure
:OperationInvocationCountMeasure
DADL (DynaMod ADL)
Catalog
Bookstore
searchBook()
DMeasurements
:AvgOperationRT
avgRTMillis=5676
:OperationInvocationCount
count=67643
Measurements
DInstrumentation
:OperationExecutionProbe
Sub
ANNOTATION
'@intercept#Execution:OpExecIcptr["Bookstore","searchBook"]
SIGNATURE
Public
searchBook
PARAMETERS
STATEMENTS
AST
:OperationExecution
tin=34
tout=38
DEvent
Monitoring Events
Public Sub searchBook()
'@intercept#Call:OpCallIcptr["Bookstore", "searchBook", "CRM", "getOffers"]
crm.getOffers
End Sub
Instrumented Code
:OperationExecutionRecord
class="CRM"
operation="getOffers"
tin=34
tout=38
MonitoringRecord
Monitoring Events

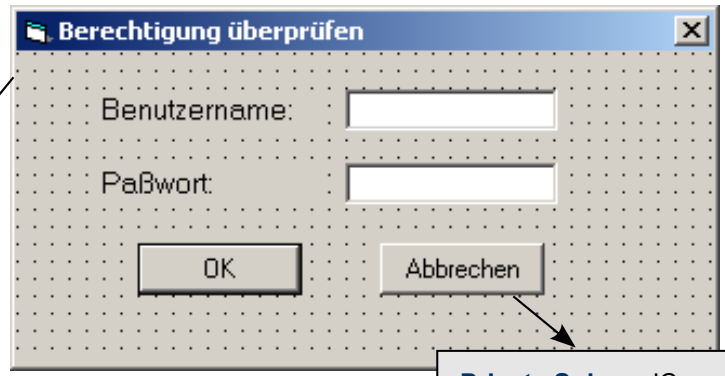
Microsoft Visual Basic 6

- No formal grammar exists
- MSDN documentation of language features incomplete

Challenging language features (examples)

- **Meta-data mixed with source code in module files**

```
VERSION 5.00
Begin VB.Form frmAuth
   BorderStyle     =   3  'Fester Dialog
   Caption         =   "Berechtigung überprüfen"
   ...
   Begin VB.CommandButton cmdCancel
      Cancel          =   -1  'True
      Caption         =   "Abbrechen"
      Height          =   360
      ...
      Width           =   1140
   End
   ...
End
Attribute VB_Name = "frmAuth"
...
```




```
Private Sub cmdCancel_Click()
   Ok = False
   Me.Hide
End Sub
```

Microsoft Visual Basic 6

- No formal grammar exists
- MSDN documentation of language features incomplete

Challenging language features (examples)

- Meta-data mixed with source code in module files
- **Syntactic ambiguities due to inconsistent calling conventions**

```
sub_a x, y, z

func_a (x, y, z)

Call sub_a (x, y, z)
```

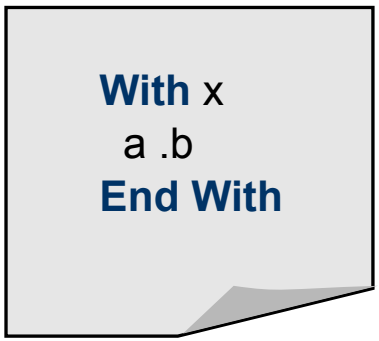
```
sub_b (3+5)

func_b (3+5)
```

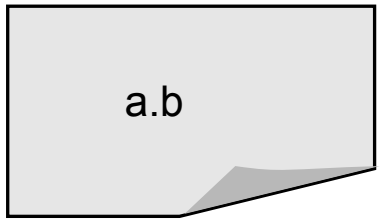
Microsoft Visual Basic 6

- No formal grammar exists
- MSDN documentation of language features incomplete

Challenging language features (examples)

- Meta-data mixed with source code in module files
- Syntactic ambiguities due to inconsistent calling conventions
- **Whitespaces relevant**





Microsoft Visual Basic 6

- No formal grammar exists
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Challenging language features (examples)

- Meta-data mixed with source code in module files
- Syntactic ambiguities due to inconsistent calling conventions
- Whitespaces relevant
- **Colon (':') used as end of statement as well as label delimiter**

```
On Error GoTo x

If a = 7 Then
  ...
Else:
  ...
End If

 x: foo
```

DynaMod

Dynamic Analysis for Model-Driven Modernization

Additional Information:

- `http://kosse-sh.de/dynamod` (in German)
- A. van Hoorn, S. Frey, W. Goerigk, W. Hasselbring, H. Knoche, S. Köster, H. Krause, M. Porembski, T. Stahl, M. Steinkamp, and N. Wittmüss.
  DynaMod project: Dynamic analysis for model-driven software modernization.
  In Proc. 1st International Workshop on Model-Driven Software Migration (MDSM) 2011, vol. 708 of CEUR Workshop Proceedings, pages 12-13, March 2011
- A. van Hoorn, H. Knoche, W. Goerigk, and W. Hasselbring.
  Model-Driven Instrumentation for Dynamic Analysis of Legacy Software Systems.
  In Proc. 13. Workshop Software-Reengineering (WSR 2011), pages 26-27, May 2011

Literature

Rick Kazman, Steven G. Woods, and S. Jeromy Carrière.

Requirements for integrating software architecture and reengineering models: CORUM II.
In *Proceedings of the Working Conference on Reverse Engineering (WCRE'98)*, WCRE '98, pages 154–, Washington, DC, USA, 1998. IEEE Computer Society.

Thomas Stahl and Markus Völter.

Model-Driven Software Development – Technology, Engineering, Management.
Wiley & Sons, 2006.

André van Hoorn, Sören Frey, Wolfgang Goerigk, Wilhelm Hasselbring, Holger Knoche, Sönke Köster, Harald Krause, Marcus Porembski, Thomas Stahl, Marcus Steinkamp, and Norman Wittmüss.
DynaMod project: Dynamic analysis for model-driven software modernization.
In Andreas Fuhr, Wilhelm Hasselbring, Volker Riediger, Magiel Bruntink, and Kostas Kontogiannis, editors, *Joint Proceedings of the 1st International Workshop on Model-Driven Software Migration (MDSM 2011) and the 5th International Workshop on Software Quality and Maintainability (SQM 2011)*, volume 708 of *CEUR Workshop Proceedings*, pages 12–13, March 2011.
Invited paper.

André van Hoorn, Holger Knoche, Wolfgang Goerigk, and Wilhelm Hasselbring.

Model-driven instrumentation for dynamic analysis of legacy software systems.
In *Proceedings of the 13. Workshop Software-Reengineering (WSR '11)*, pages 26–27, 2011.