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Model-Driven Instrumentation for Dynamic Analysis of Legacy Software Systems

André van Hoorn[1], Holger Knoche[2], Wolfgang Goerigk[2], and Wilhelm Hasselbring[1]

[1]Software Engineering Group, University of Kiel, Germany

[2]b+m Informatik AG, Melsdorf, Germany

May 03, 2011 @ WSR 2011, Bad Honnef

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Christian-Albrechts-Universität zu Kiel
Technische Fakultät

b+m
business IT management

DynaMod

GEFÖRDERT VOM

Bundesministerium
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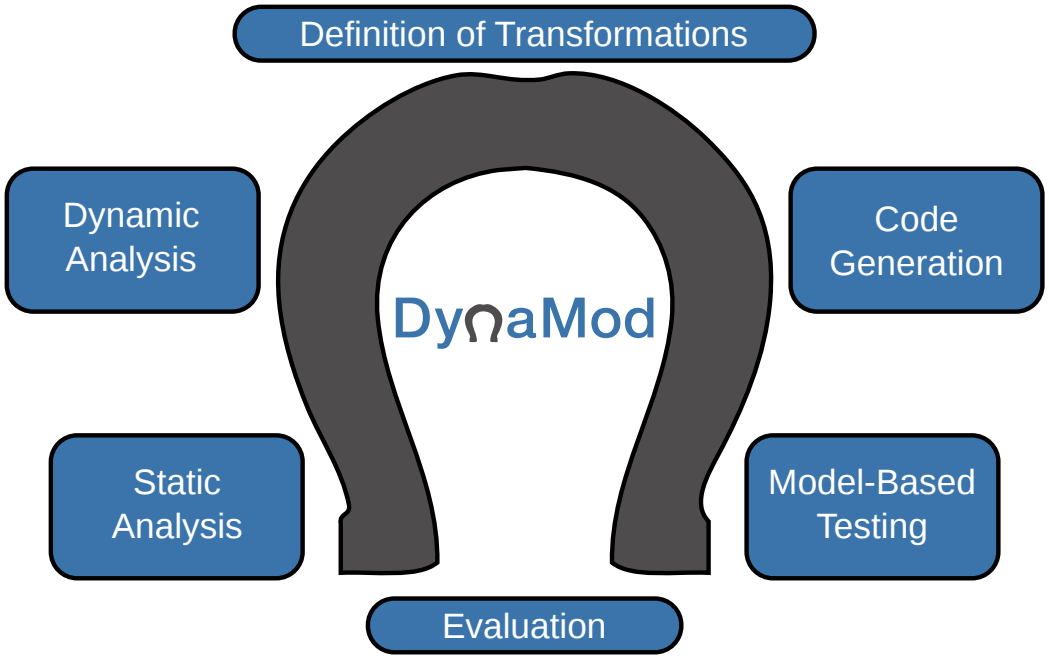
und Forschung

Christian-Albrechts-Universität zu Kiel

DynaMod

Dynamic Analysis for
Model-Driven Software Modernization



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1. **b+m Informatik AG**
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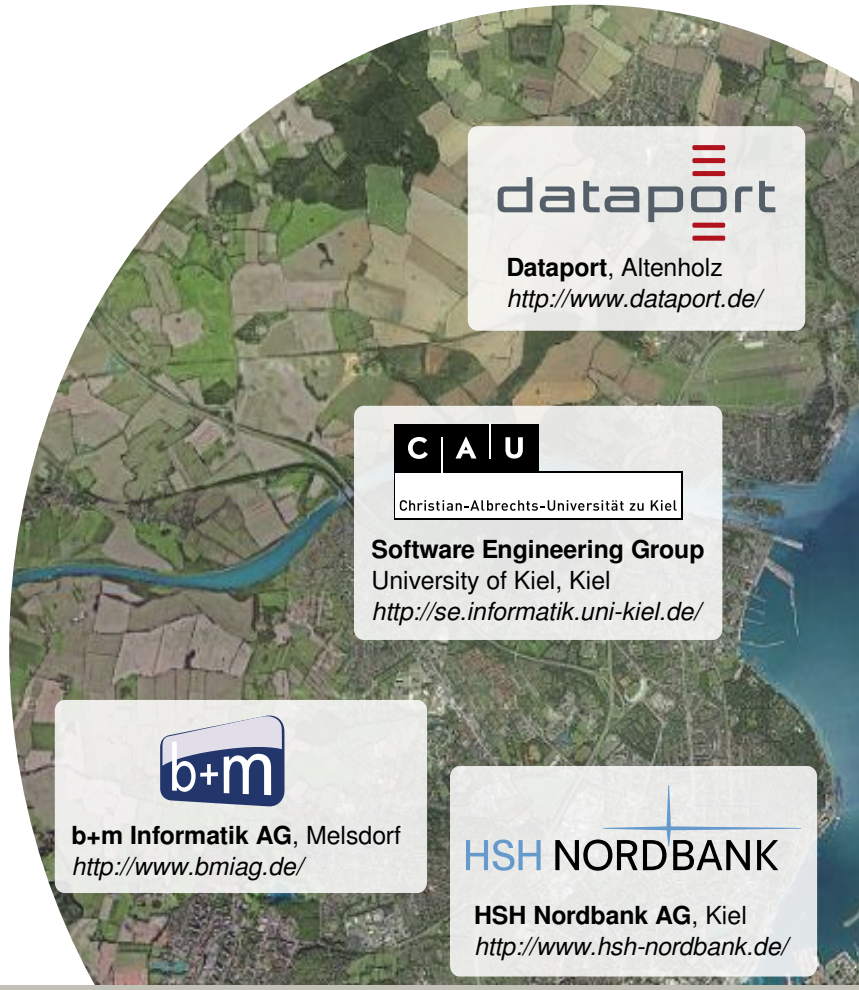
   - Comprehensive MDSD know-how
   - Initiated openArchitectureWare (oAW)



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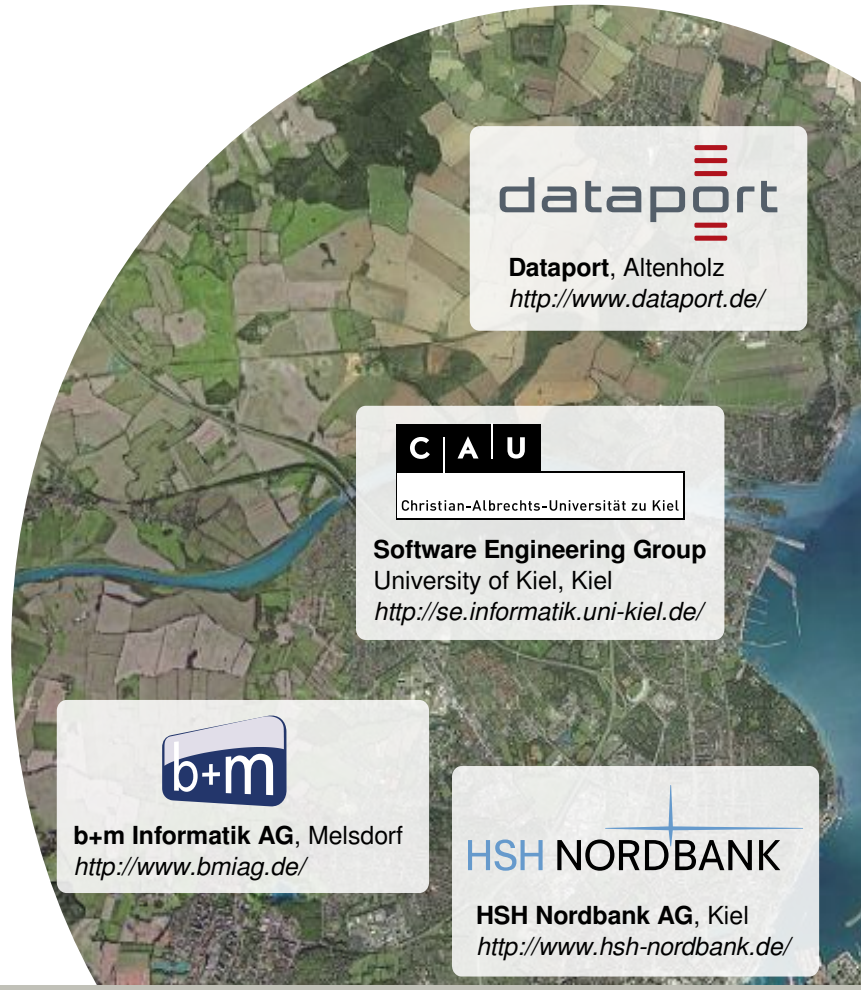
   - Emphasis on software quality (of service)



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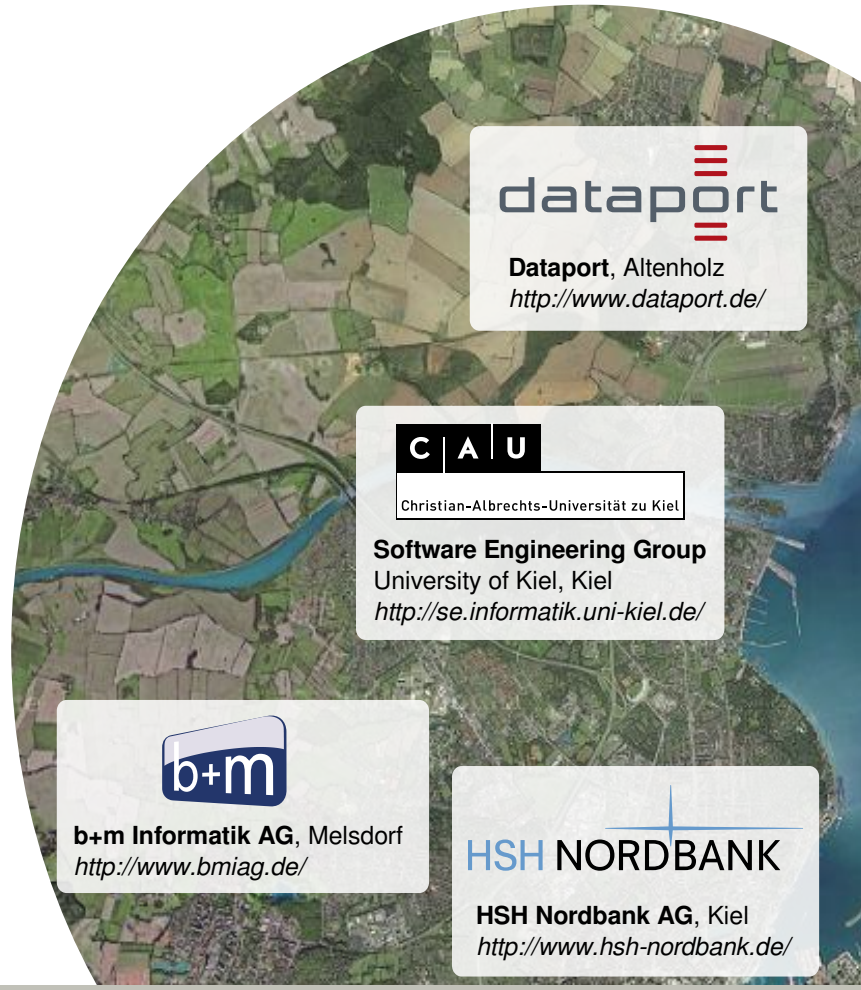

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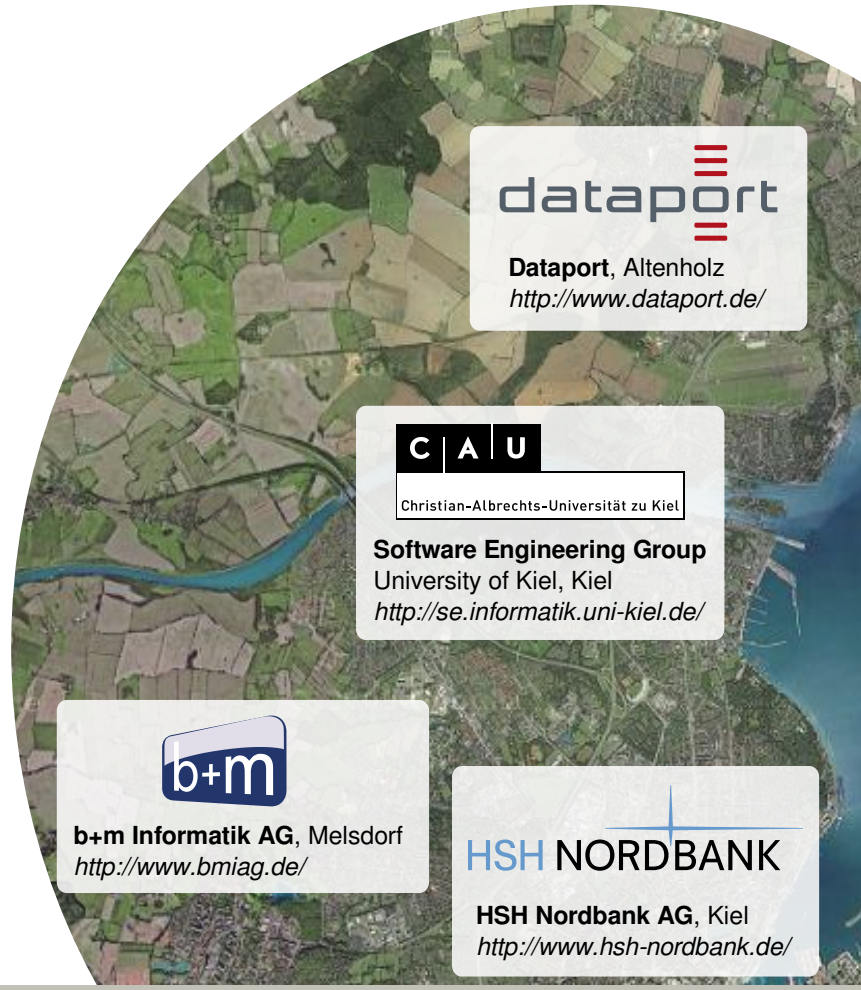
   - Leading bank for corporate and private clients in northern Germany



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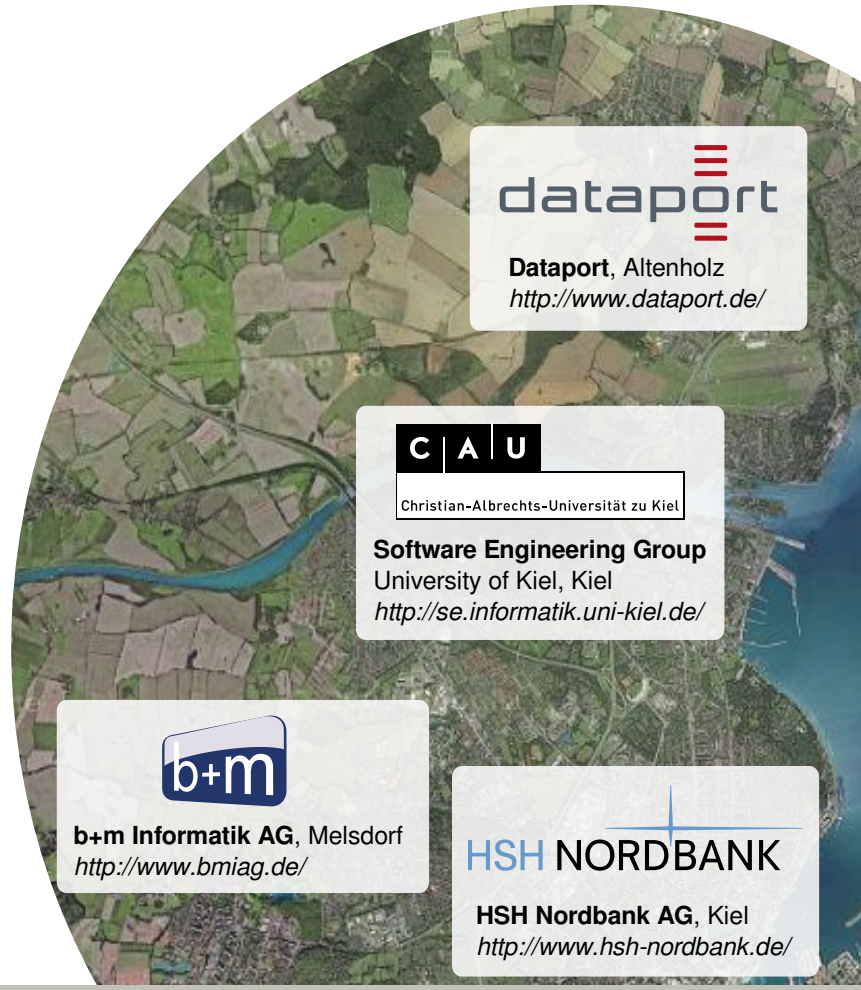

Funding:

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

SPONSORED BY THE
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Under grant no. 01IS10051

Read More:

- `http://kosse-sh.de/dynamod/`
- MDSM @ CSMR 2011 [vHFG+11]

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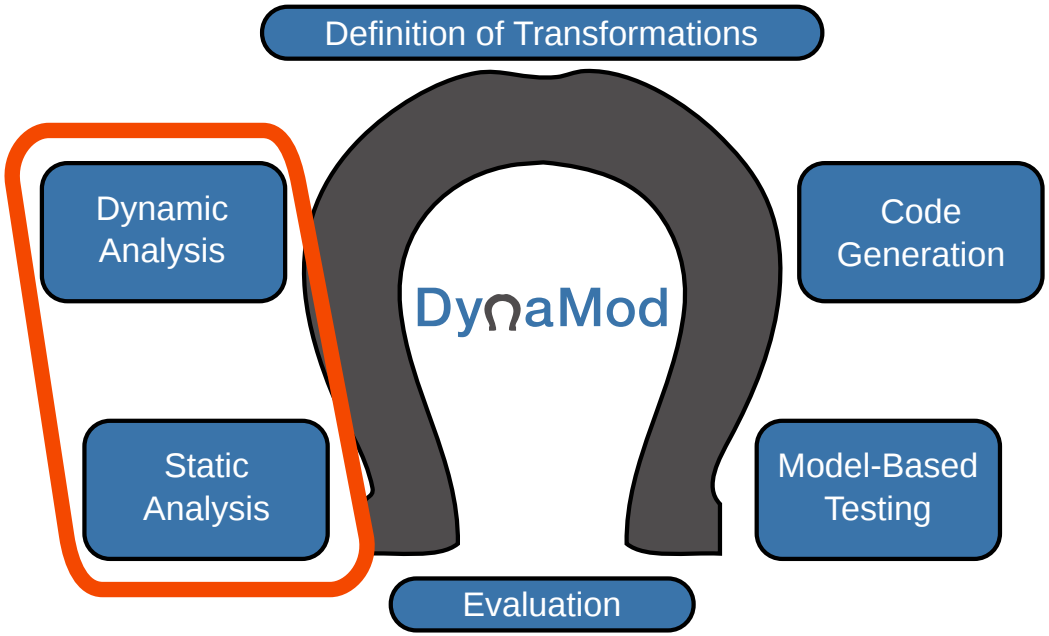

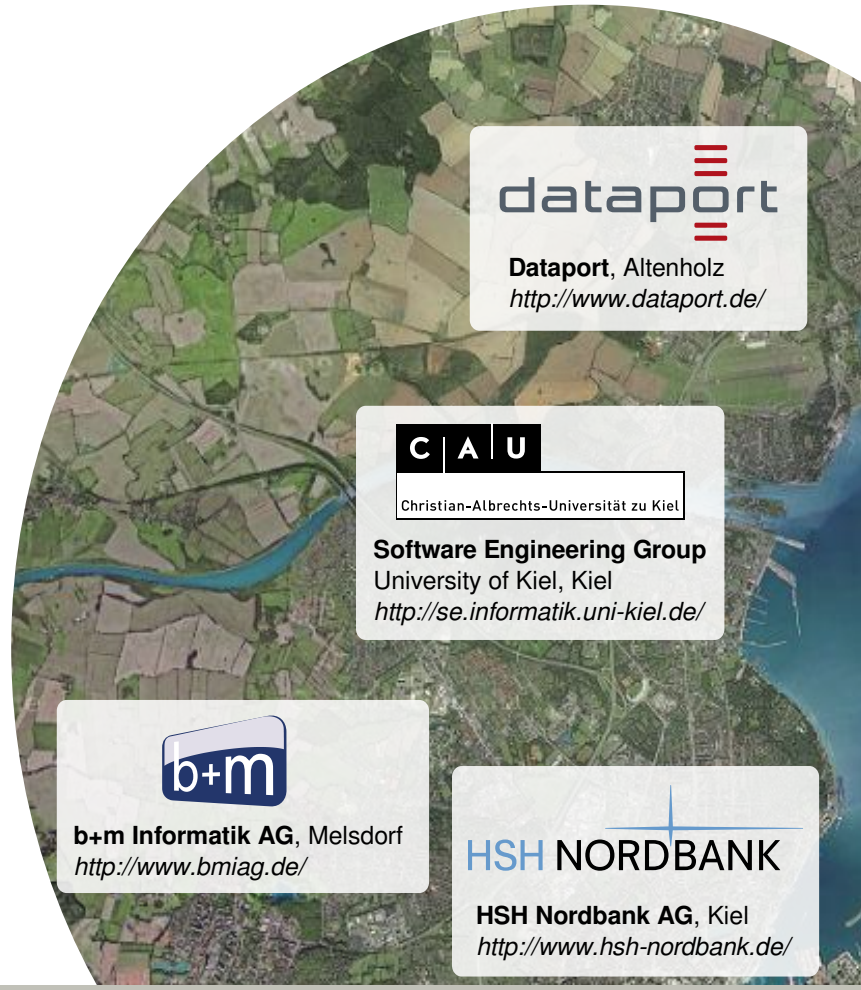

Motivation

Static analysis is not sufficient to study a system's architecture comprehensively

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How to Gather Runtime Data from Executing Systems? — Instrumentation

- Profiling — employed in development environments; considerable performance overhead
- Monitoring — employed in production environments; captures real usage profile

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The obtained monitoring data can, for instance, be used for

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- (Self-)adaptation control (e.g., capacity management)
- Application-level failure detection and diagnosis
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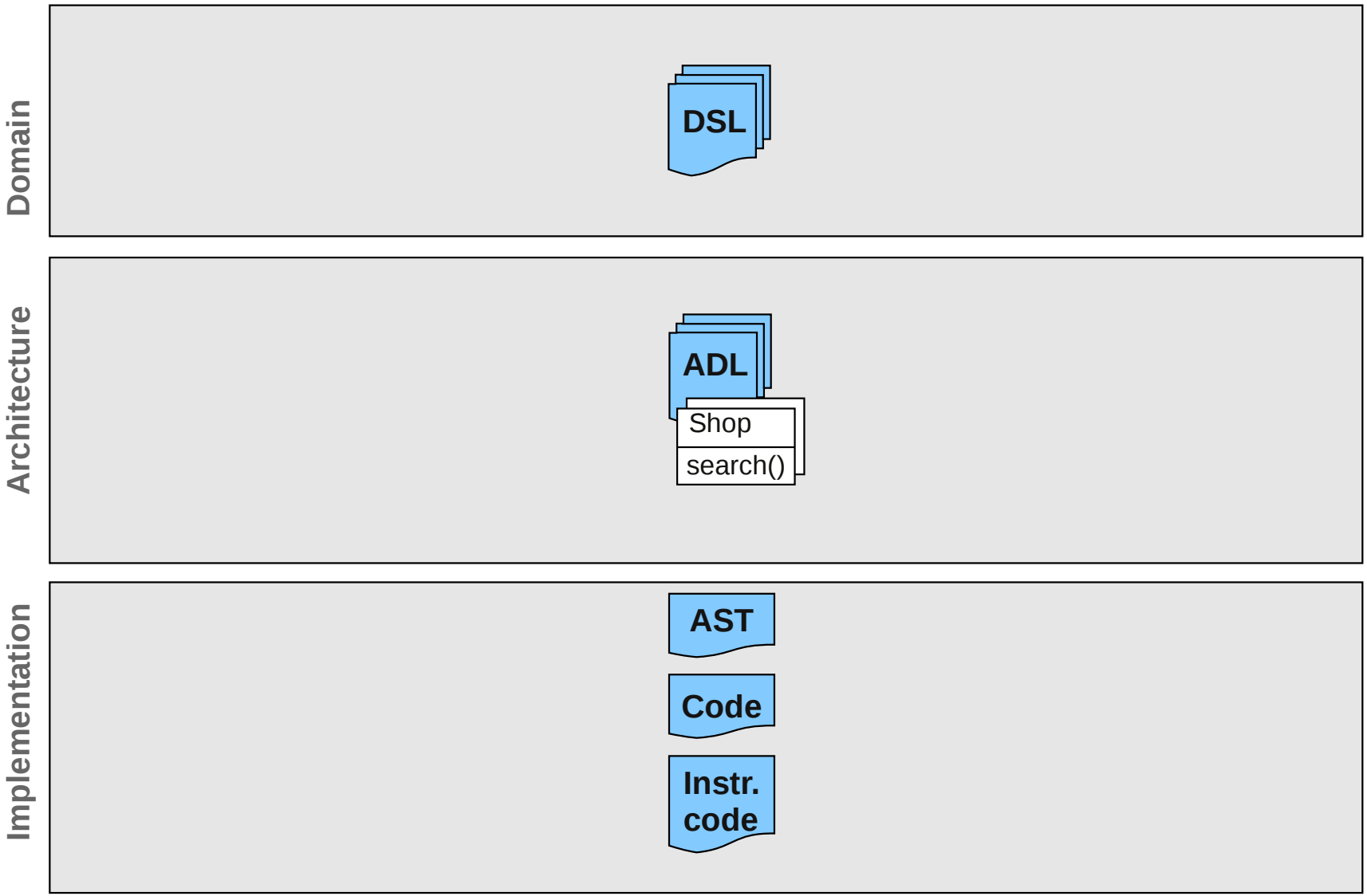
- Application-level failure detection and diagnosis
- Service-level management
- **Software reengineering:** (architecture) reconstruction, modernization

Agenda

Overview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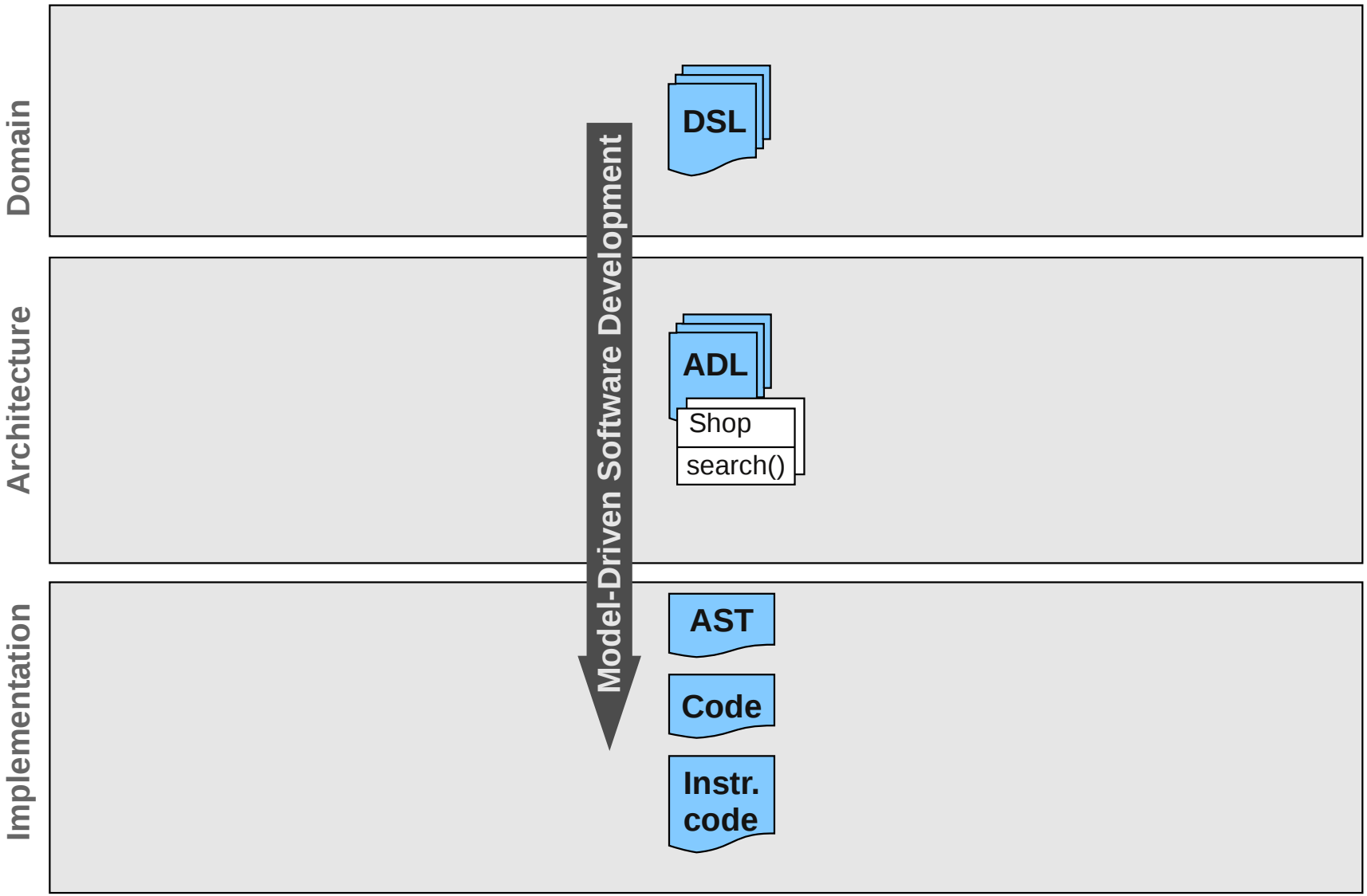
Overview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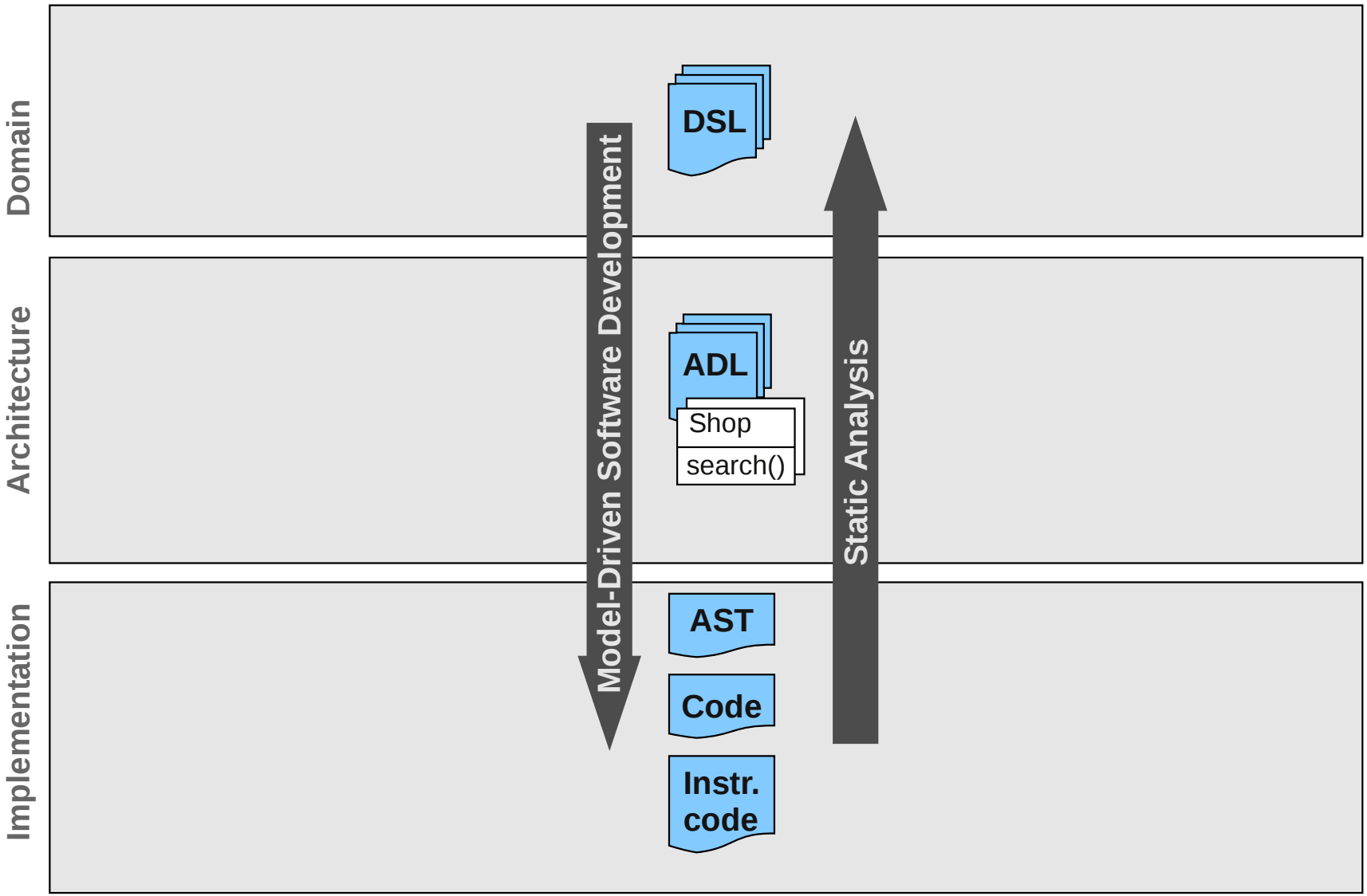
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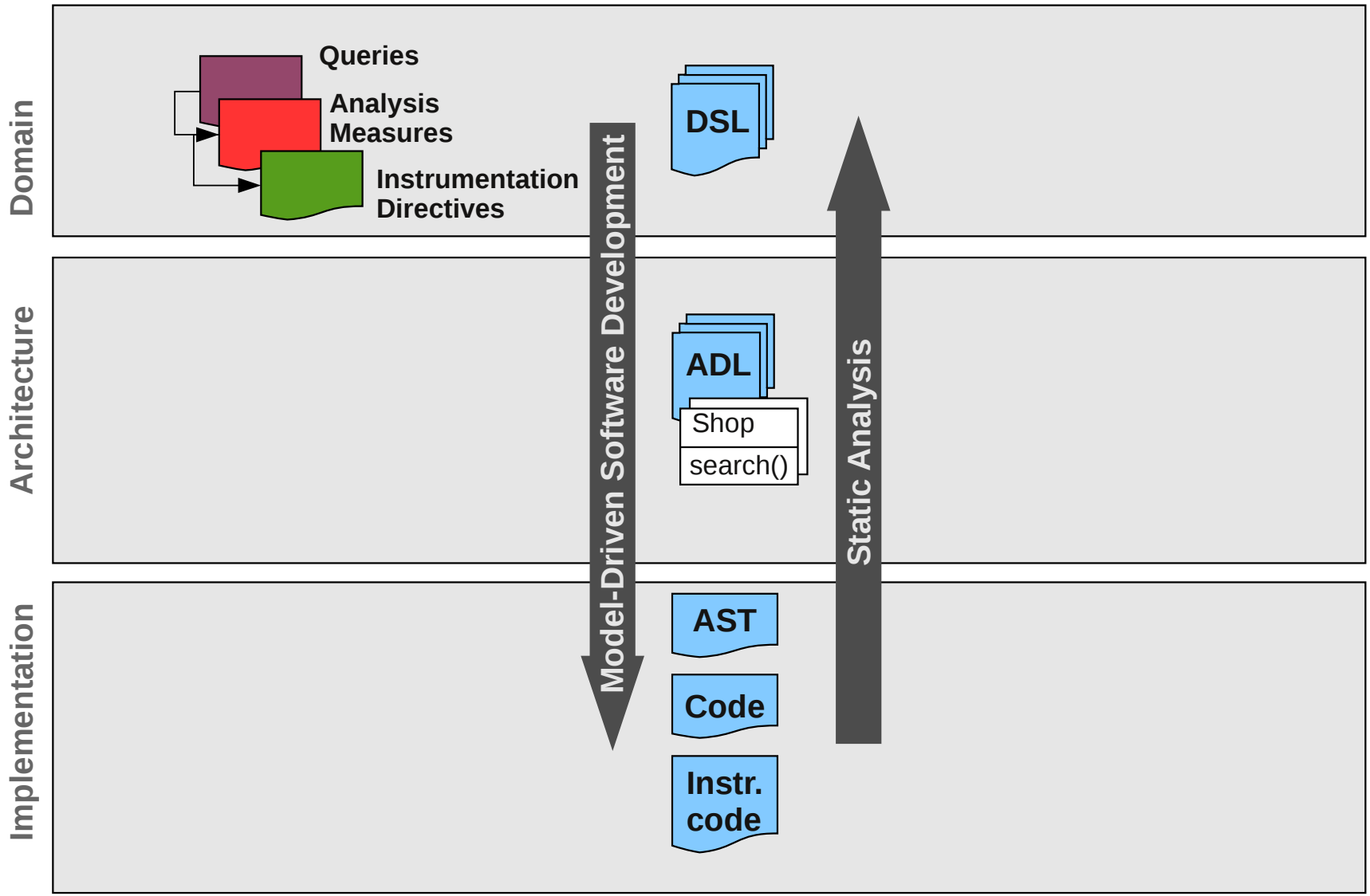
Static Analysis

Overview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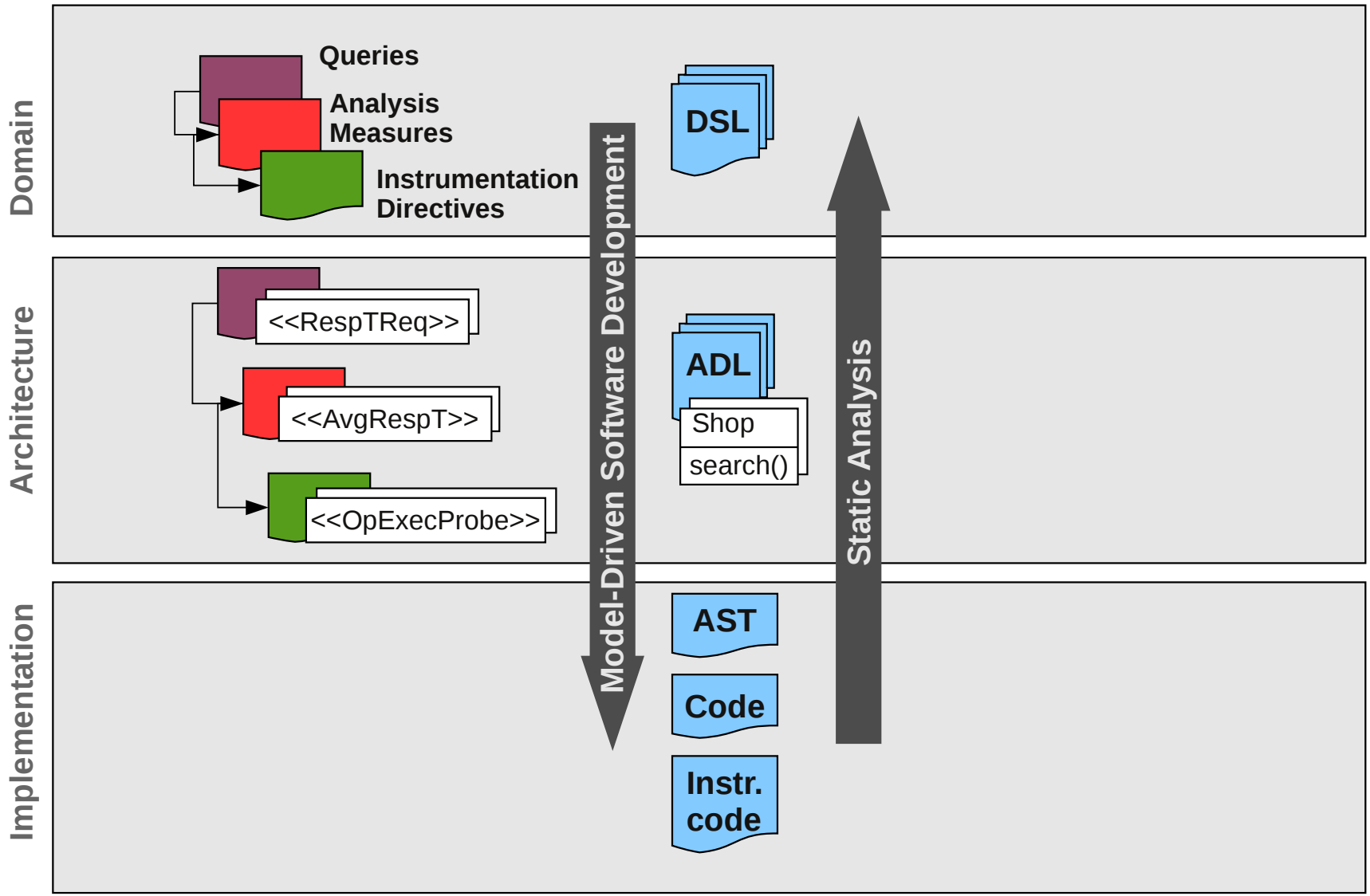
Static Analysis

Overview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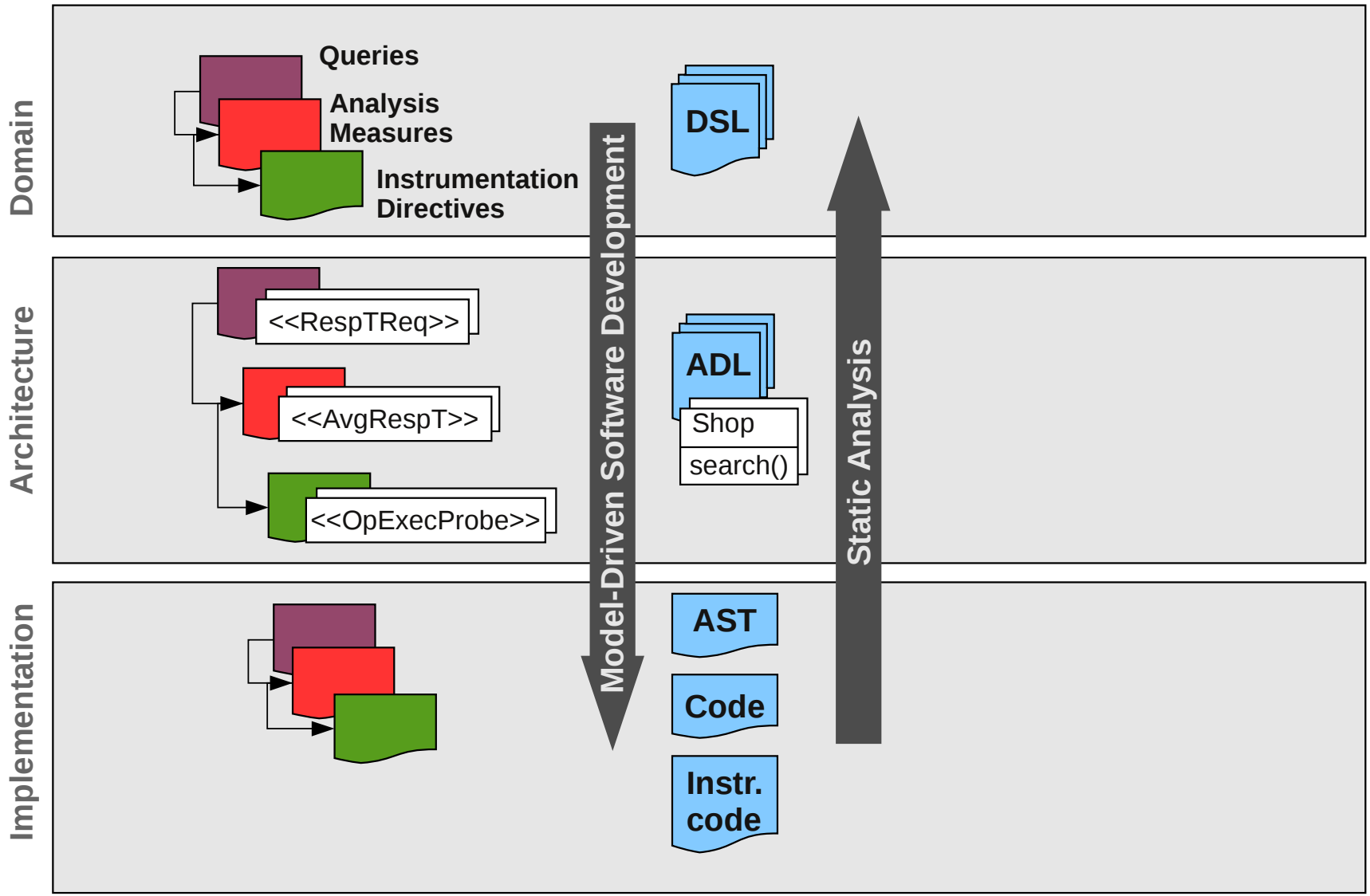
Overview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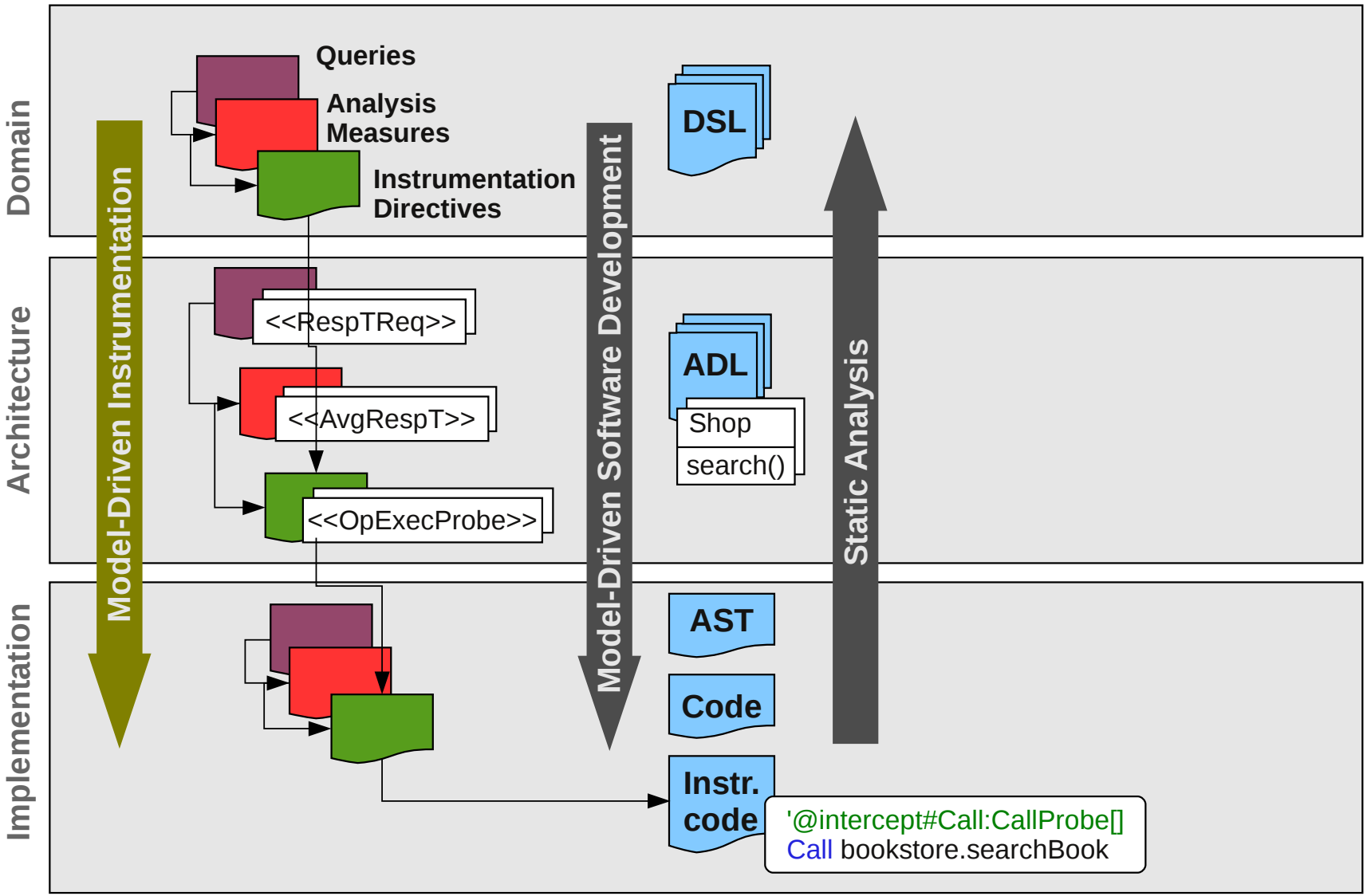
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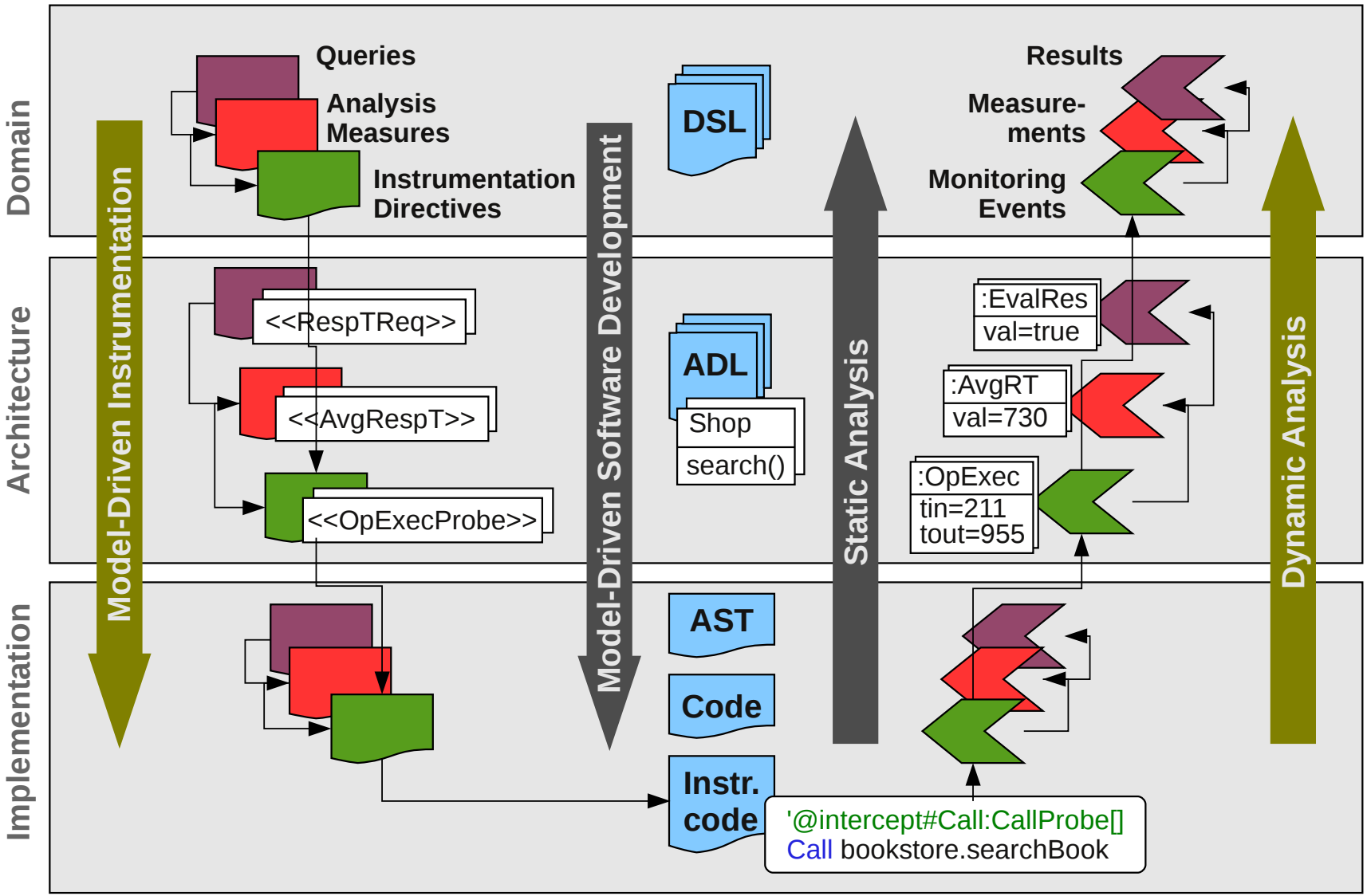
Call bookstore.searchBook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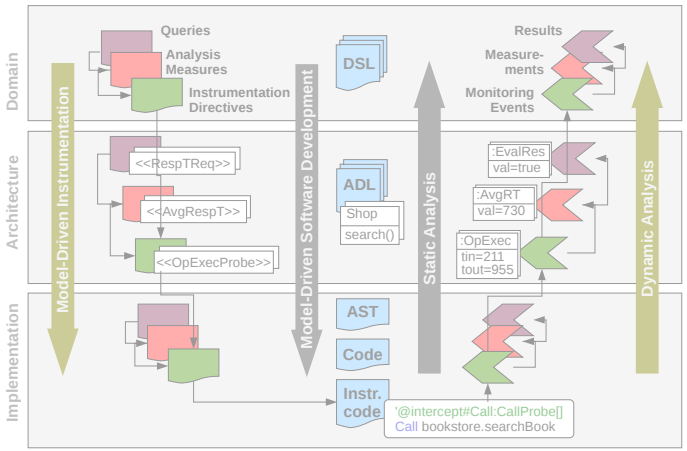
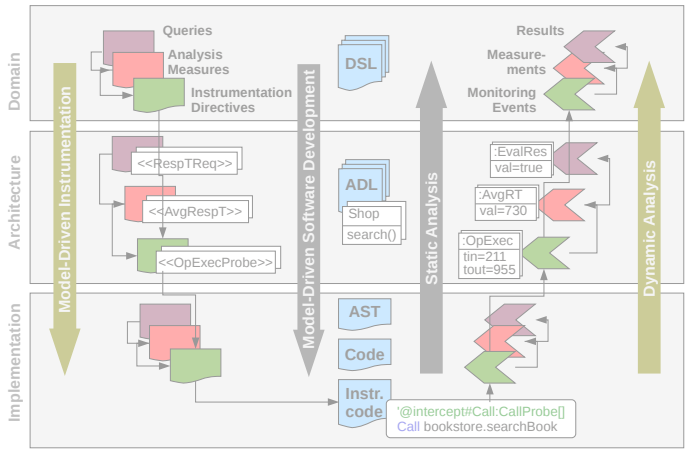
'@intercept#Call:CallProbe[]
Call bookstore.searchBook

Overview—DynaMod Examples



Overview—DynaMod Examples

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Public Sub searchBook()
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   crm.getOffers
End Sub
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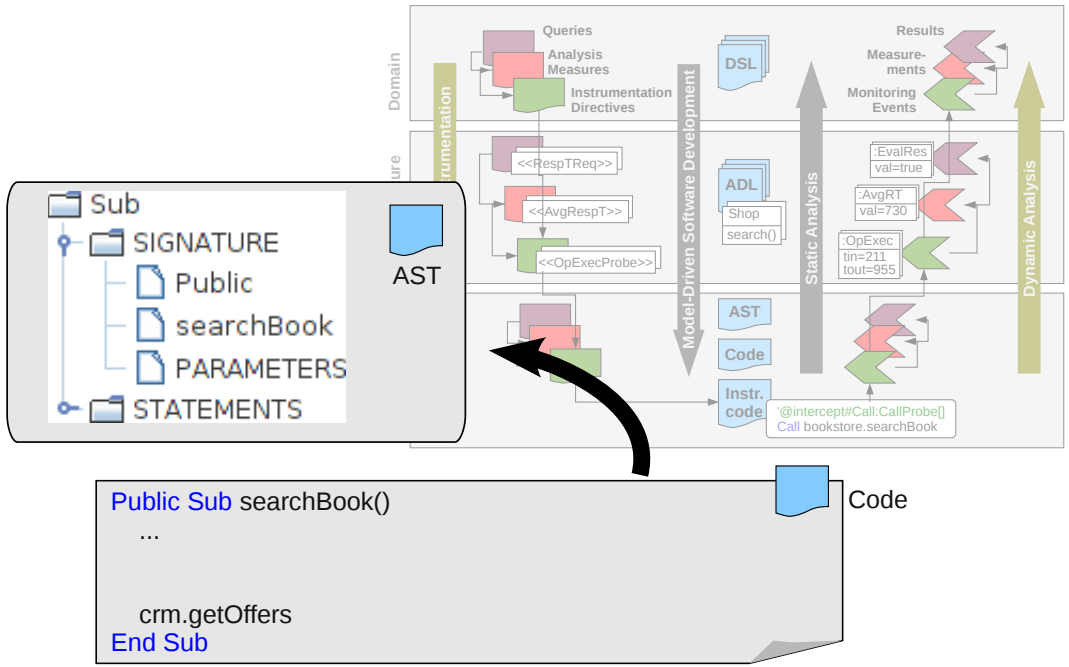
Code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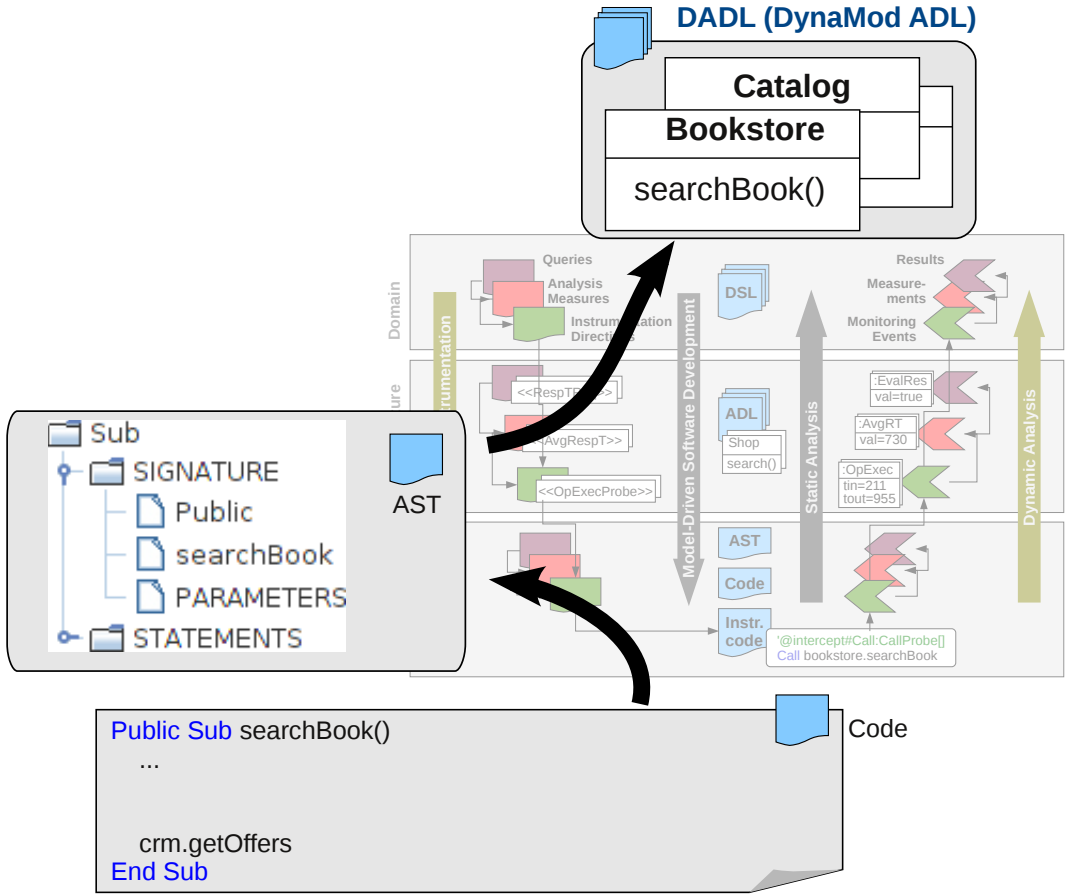
...
crm.getOffers
End Sub
Code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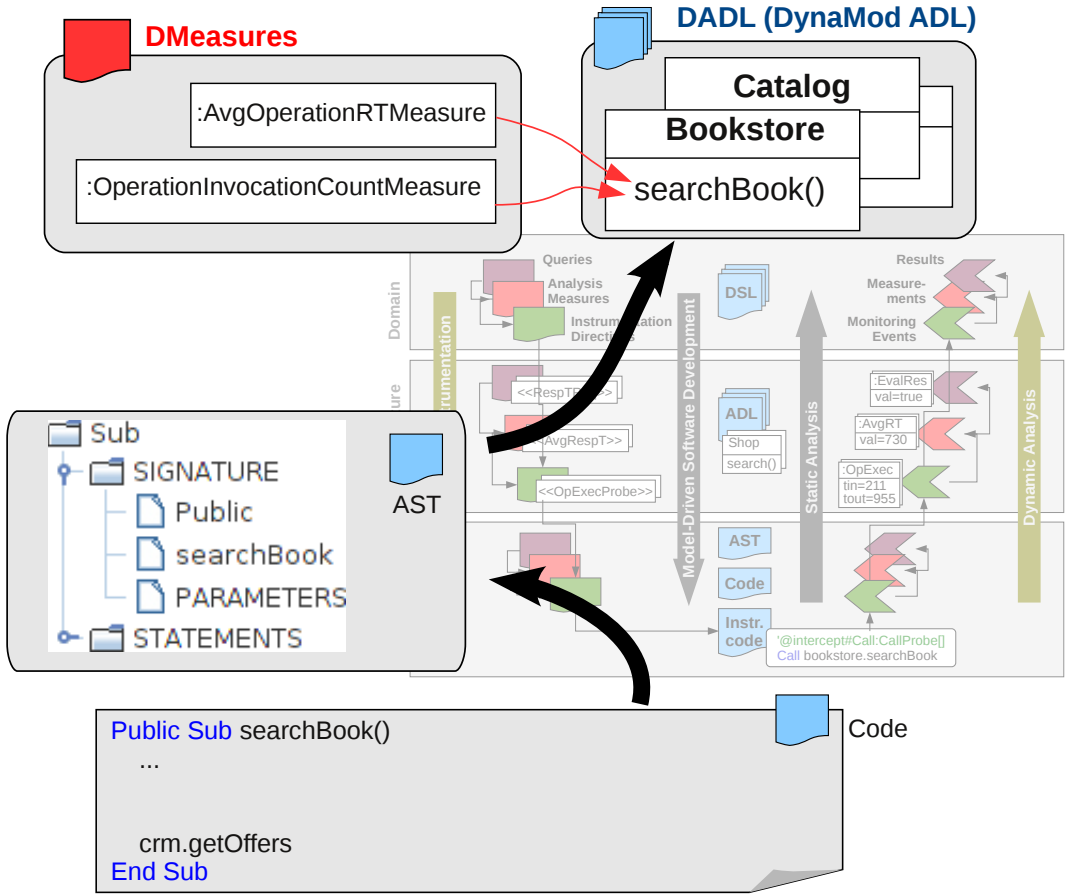
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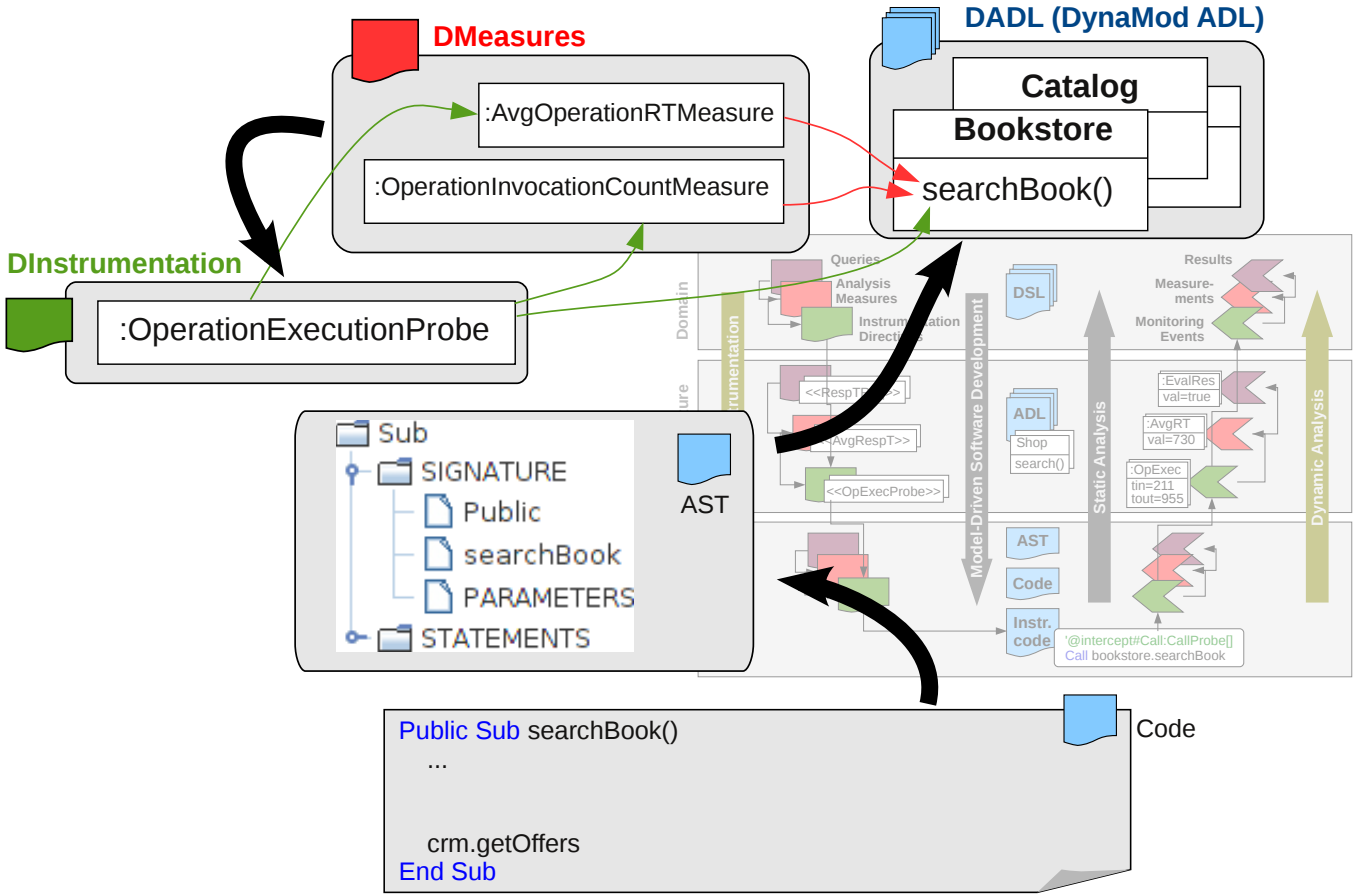
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End Sub
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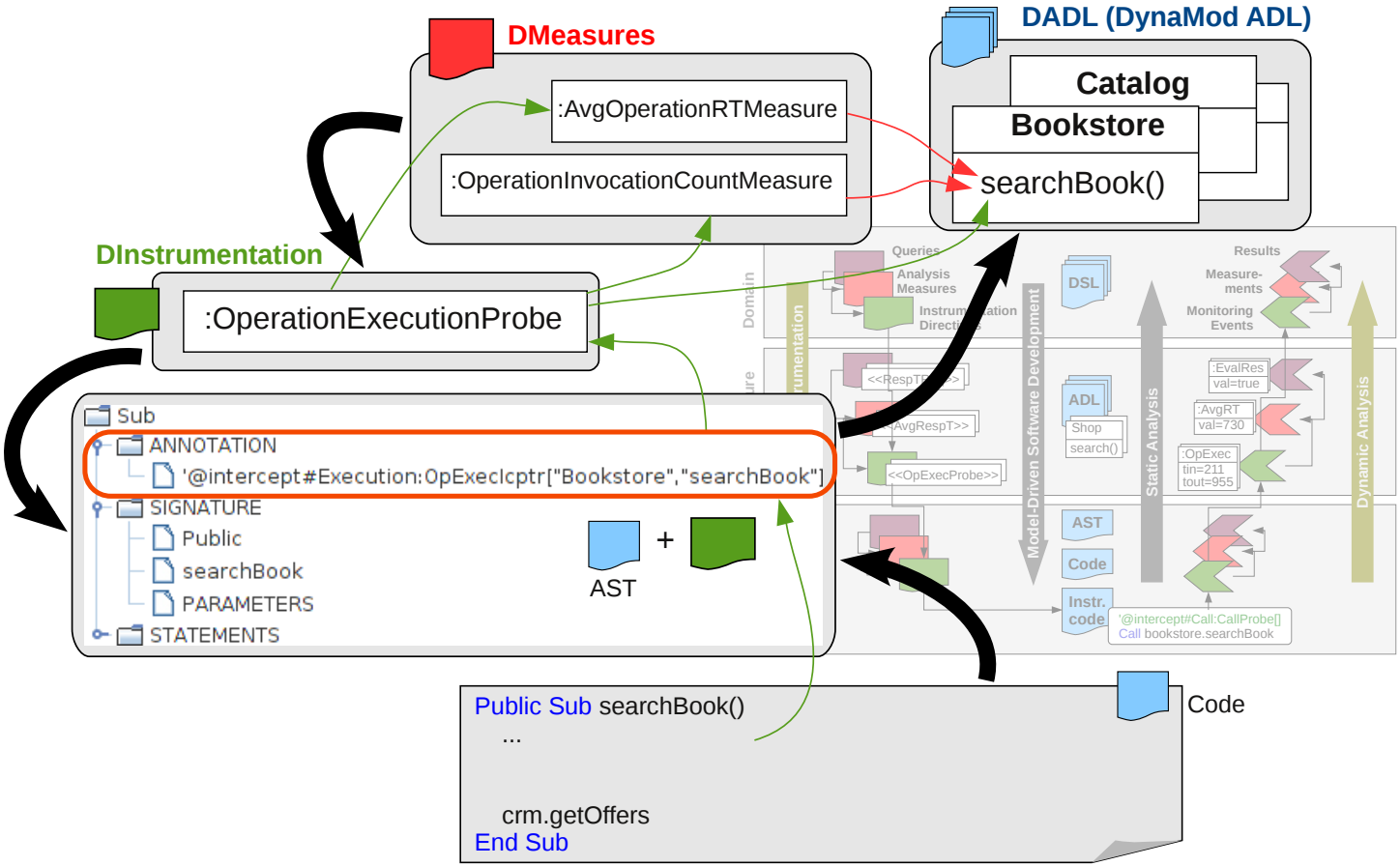
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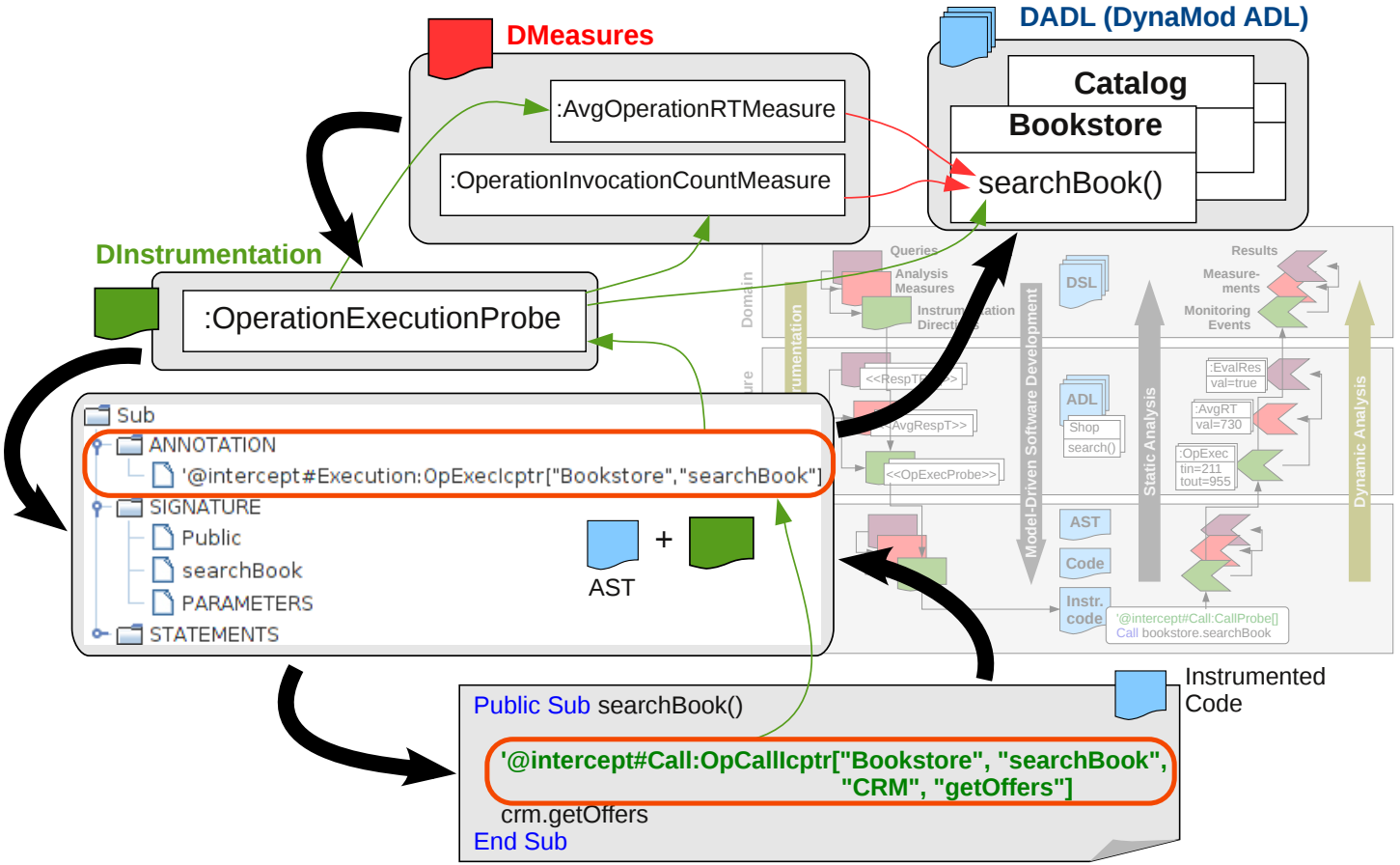
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crm.getOffers
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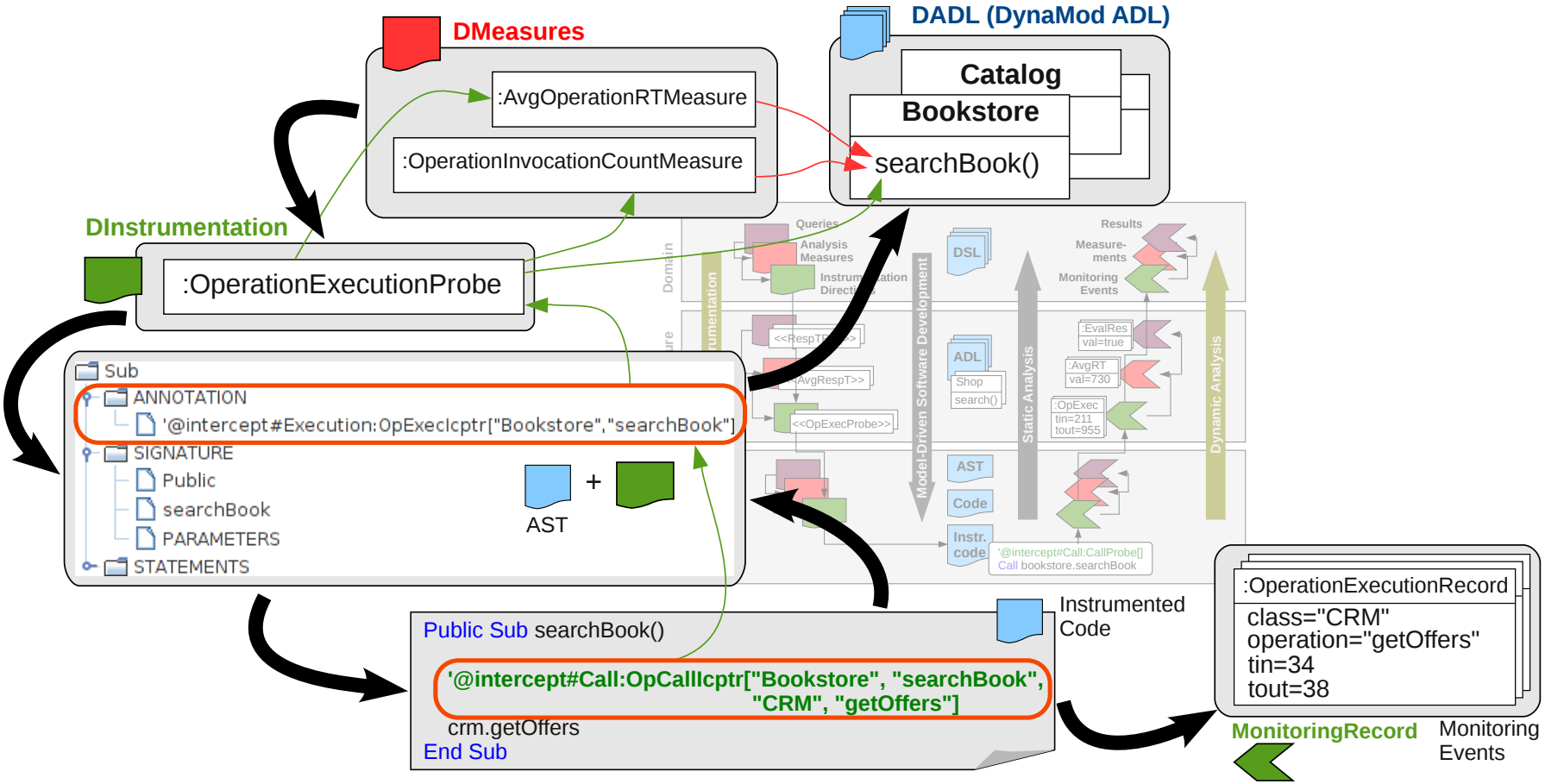
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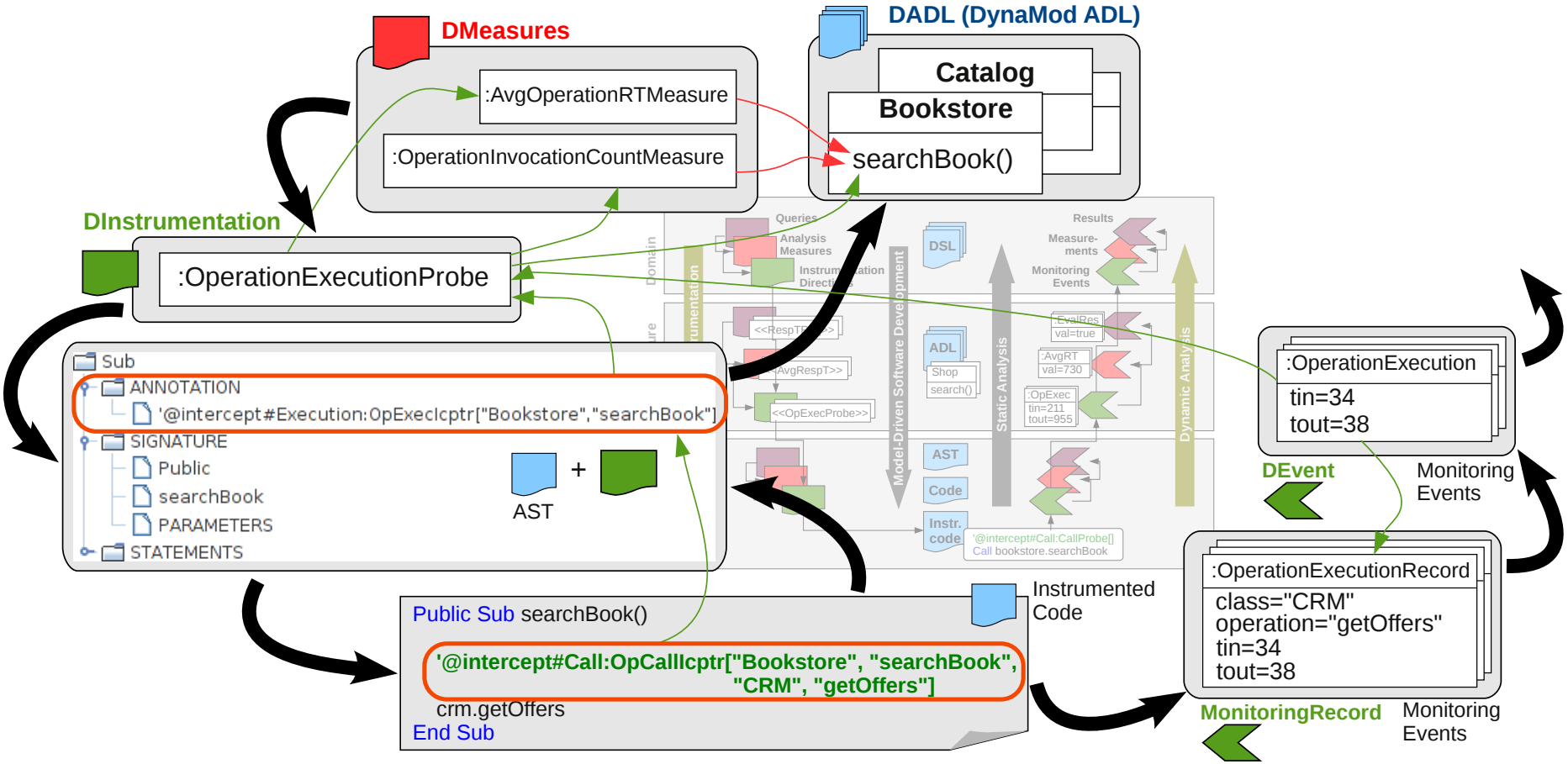
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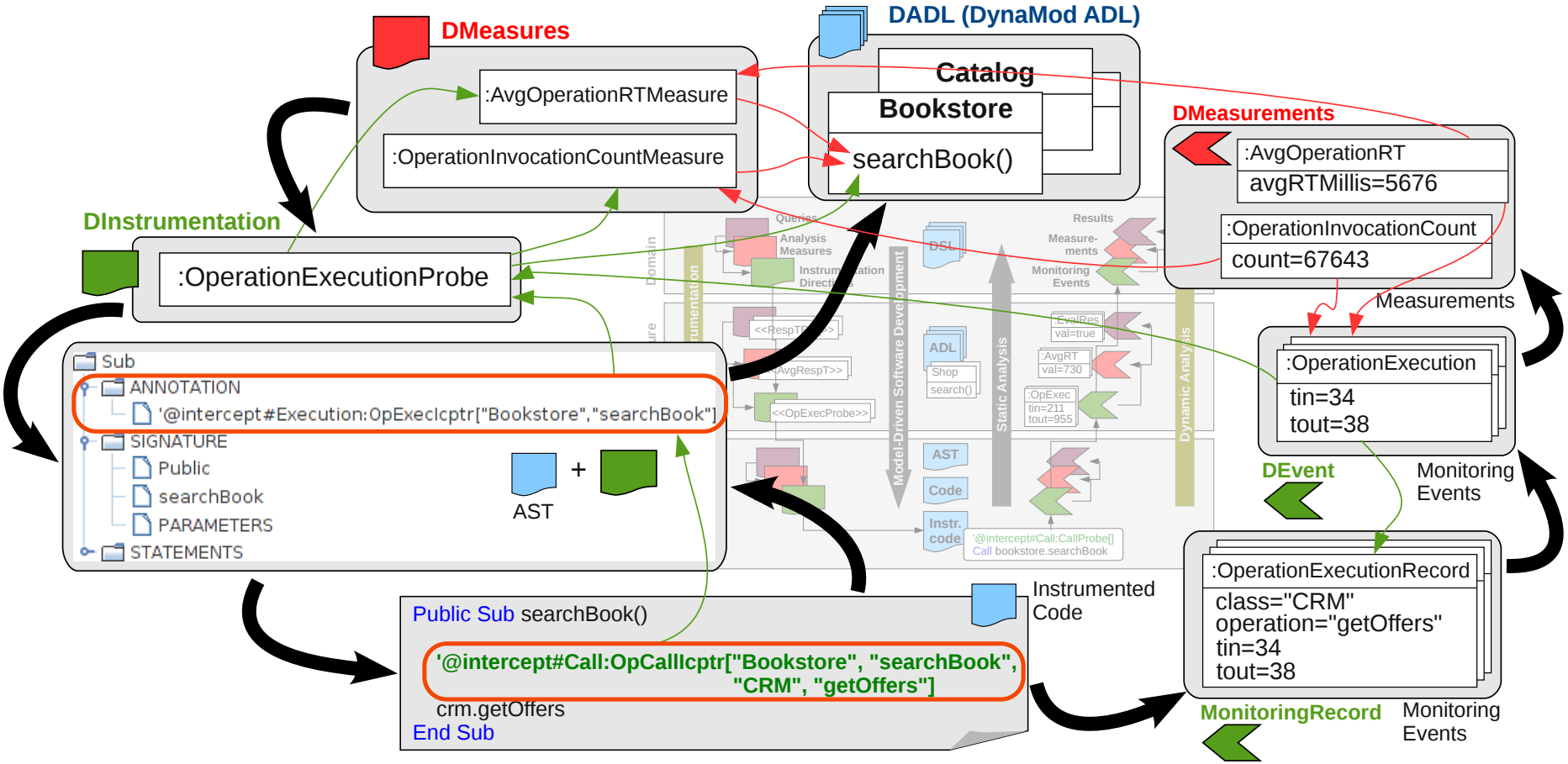
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Static Analysis
Dynamic Analysis

Agenda

AOP Framework—VB6 Example

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```
Public Sub searchBook()
    ...


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AOP Framework—VB6 Example

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```
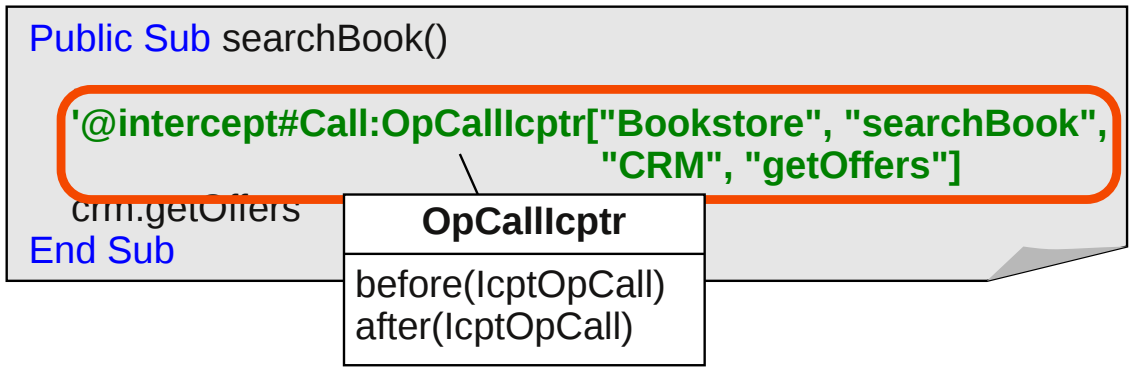

AOP Framework—VB6 Example



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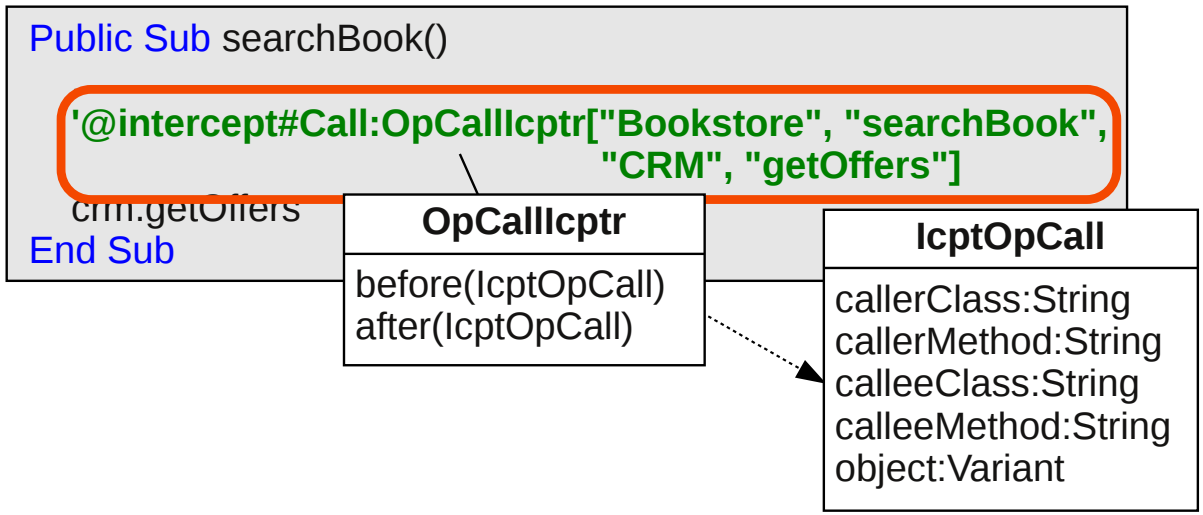

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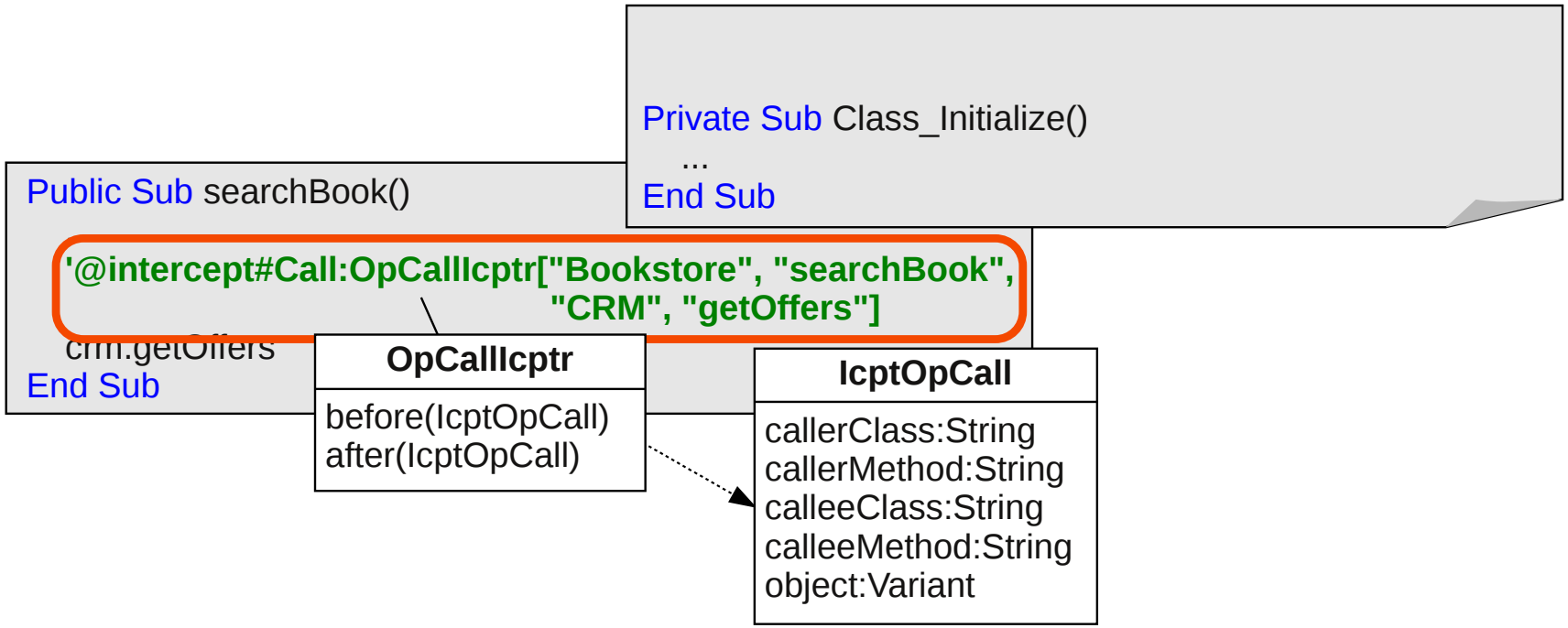
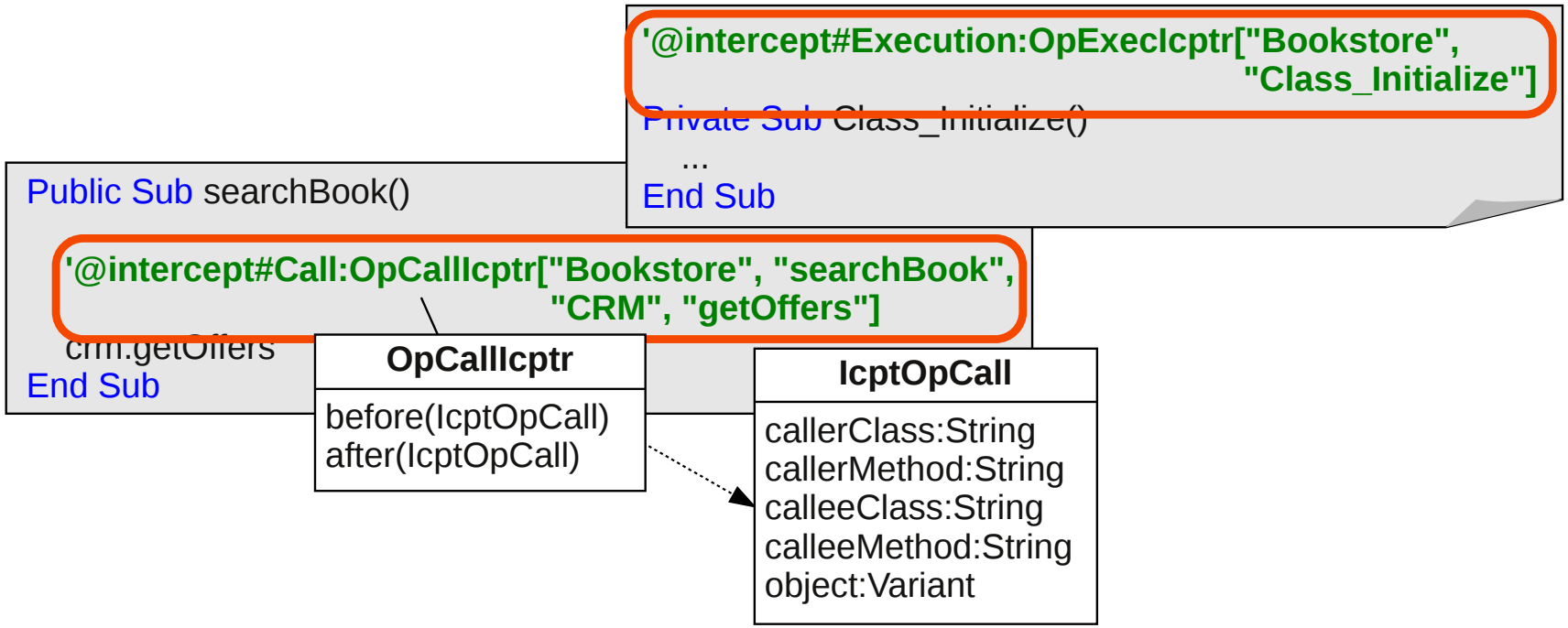


AOP Framework—VB6 Example



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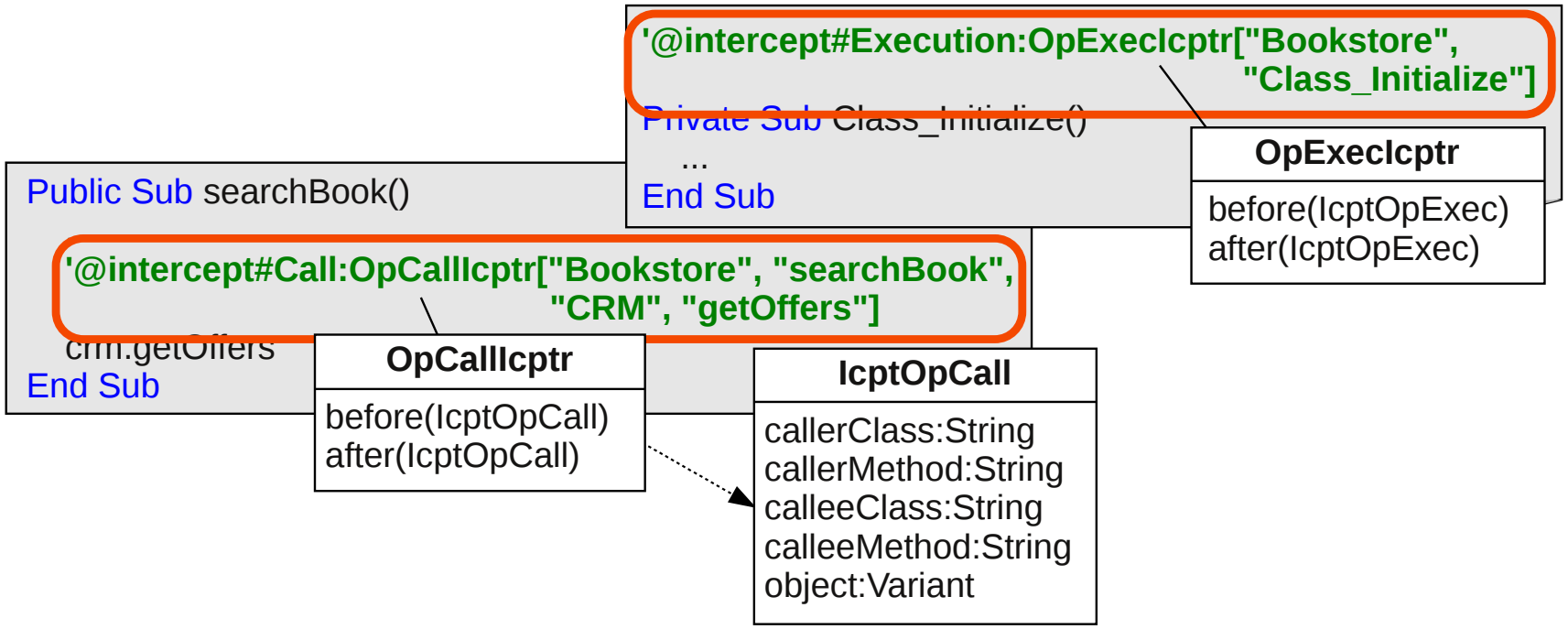

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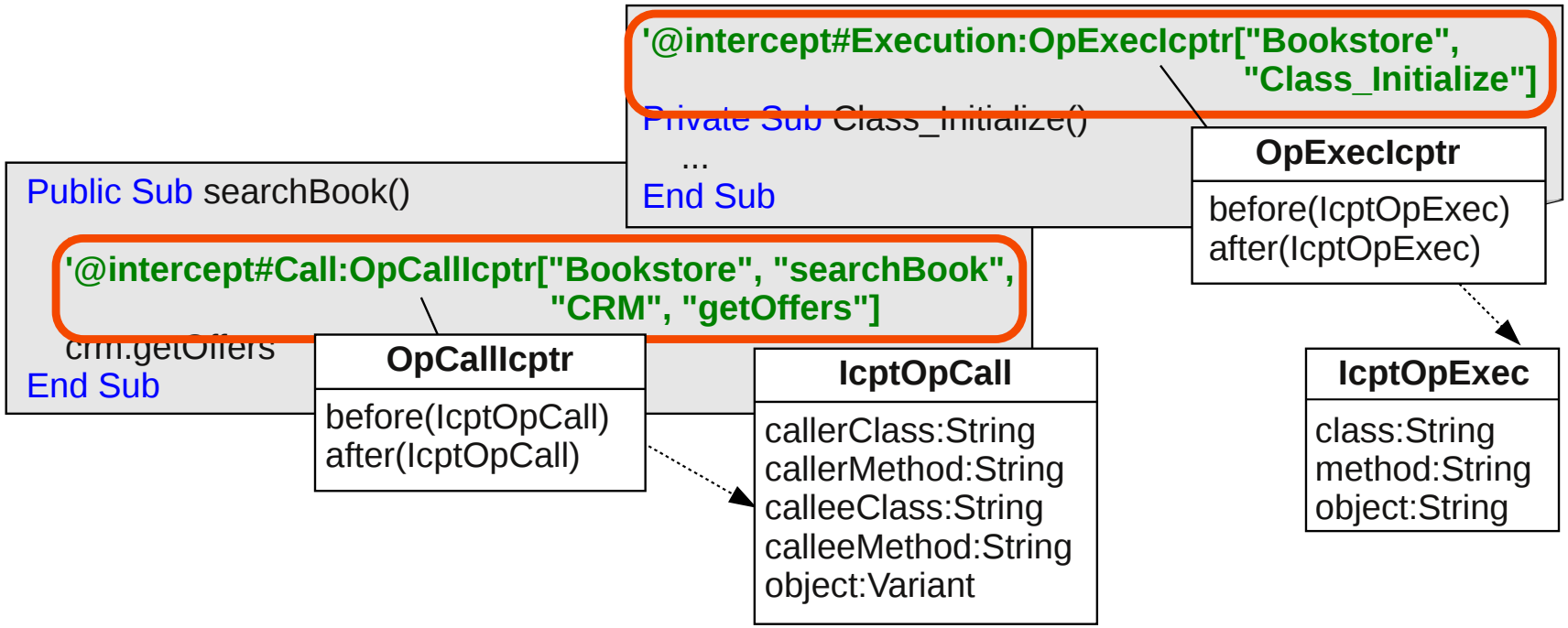

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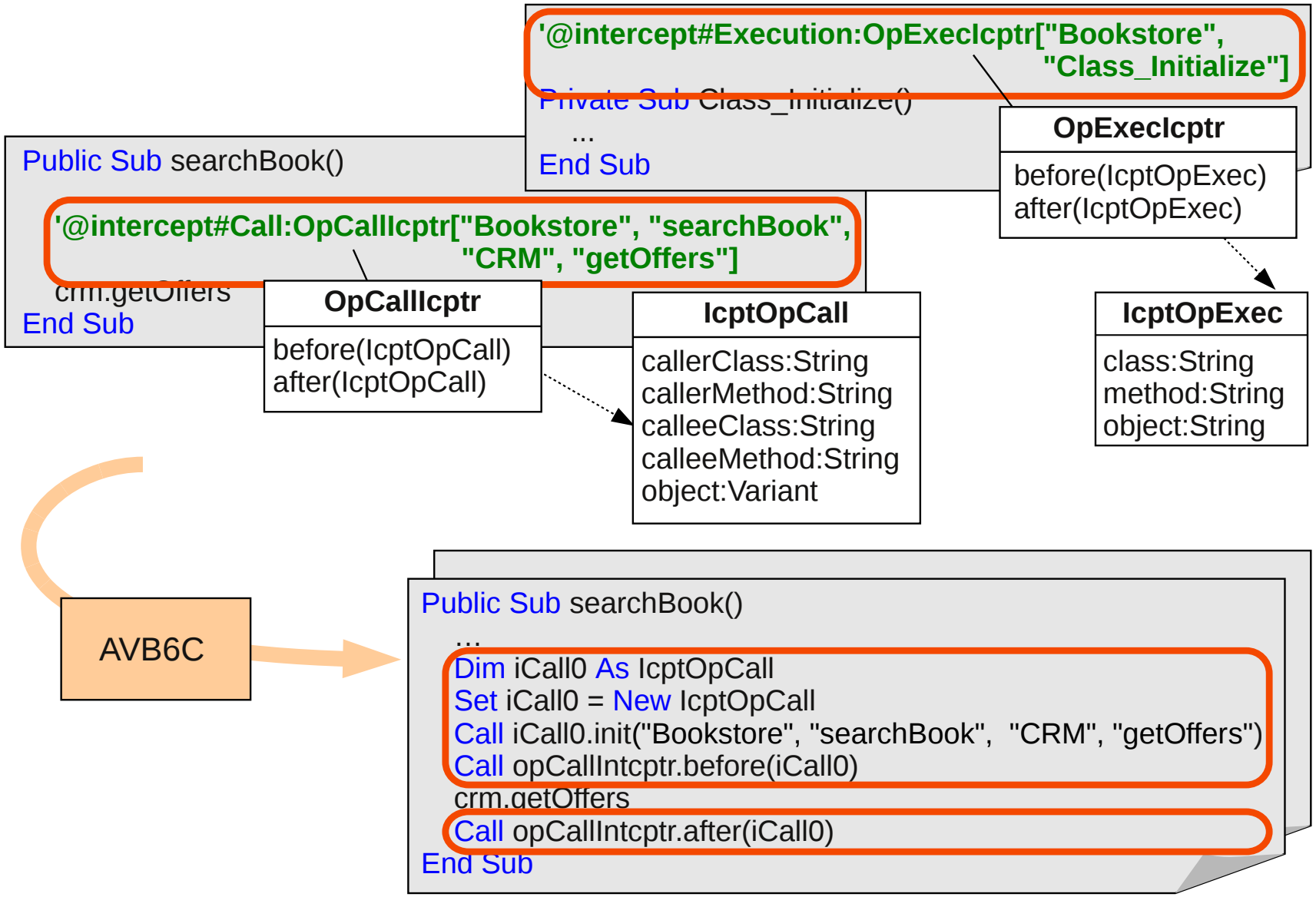
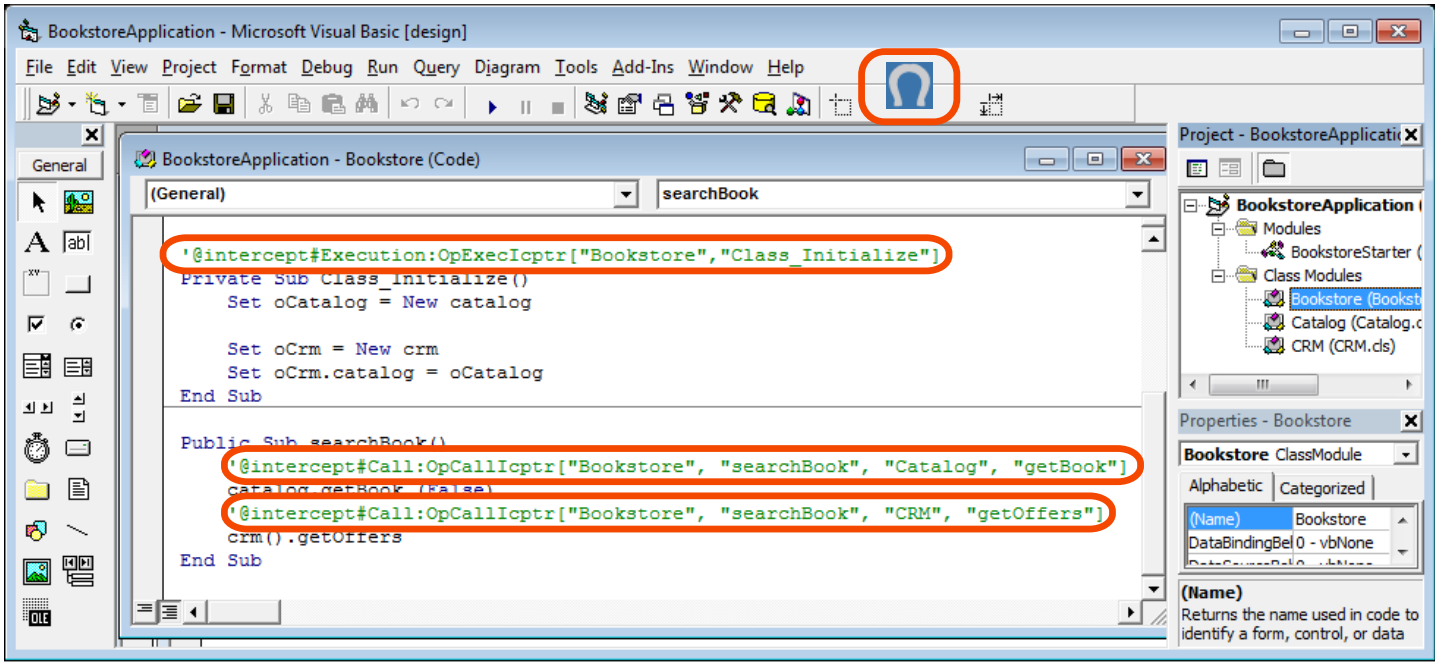


AVB6C — IDE Integration

Christian-Albrechts-Universität zu Kiel



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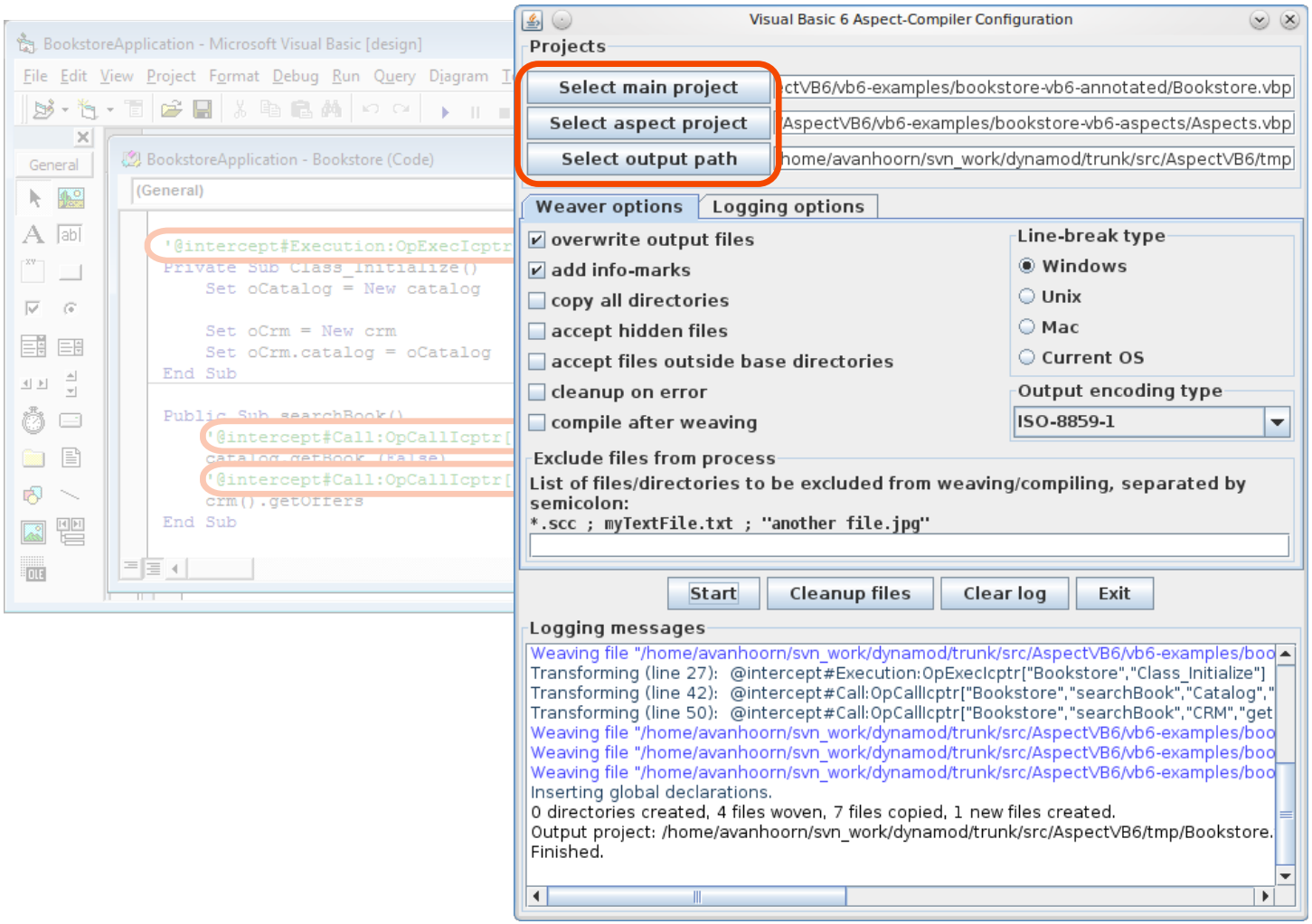

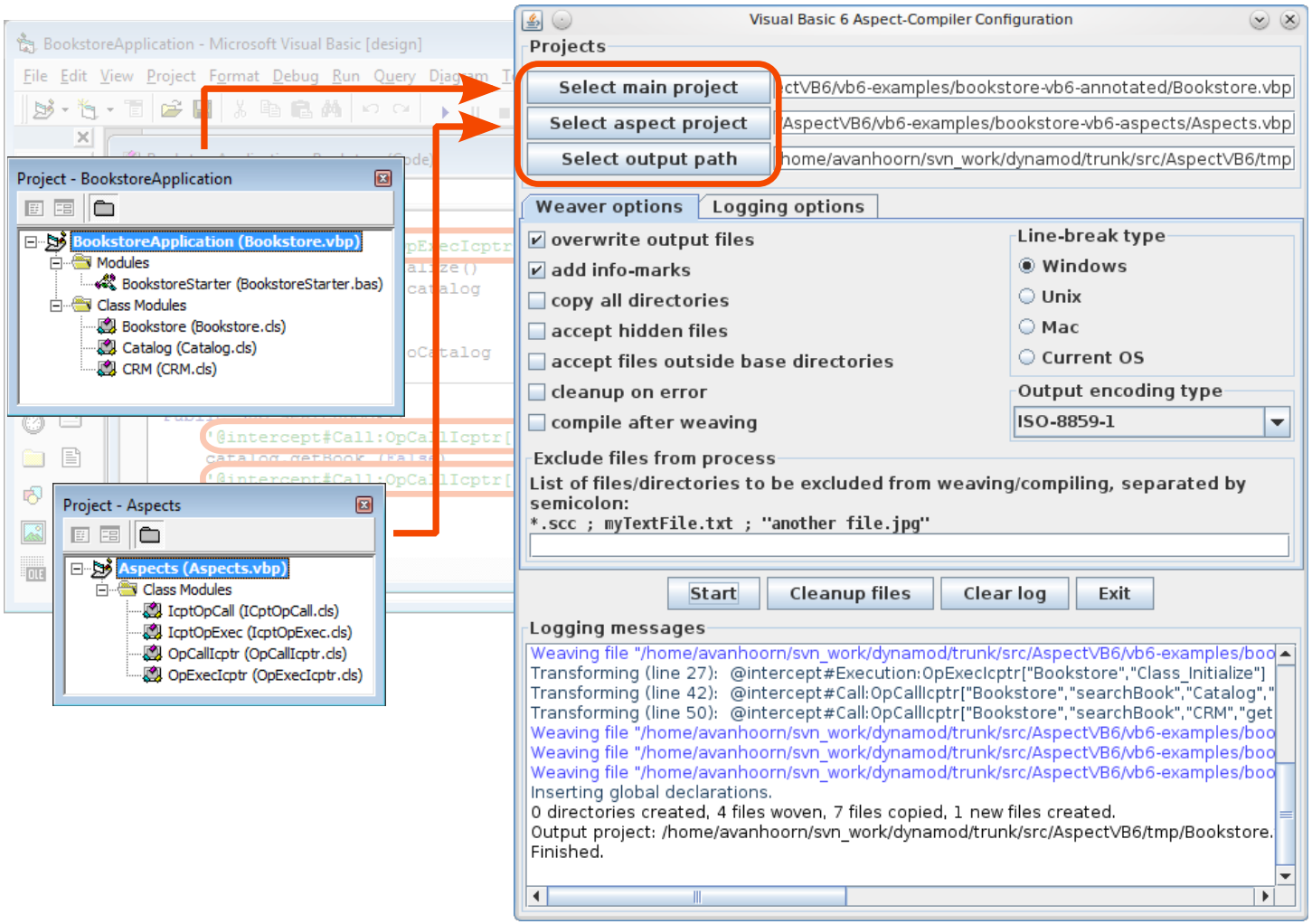
BookstoreApplication - Microsoft Visual Basic [design]
File Edit View Project Format Debug Run Query
Project - BookstoreApplication
BookstoreApplication (Bookstore.vbp)
Modules
BookstoreStarter (BookstoreStarter.bas)
Class Modules
Bookstore (Bookstore.cls)
Catalog (Catalog.cls)
CRM (CRM.cls)
Project - Aspects
Aspects (Aspects.vbp)
Class Modules
IcptOpCall (ICptOpCall.cls)
IcptOpExec (IcptOpExec.cls)
OpCallIcptr (OpCallIcptr.cls)
OpExecIcptr (OpExecIcptr.cls)
Visual Basic 6 Aspect-Compiler Configuration
Projects
Select main project
ctVB6/vb6-examples/bookstore-vb6-annotated/Bookstore.vbp
Select aspect project
AspectVB6/vb6-examples/bookstore-vb6-aspects/Aspects.vbp
Select output path
home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/tmp
Weaver options
Logging options
overwrite output files
add info-marks
copy all directories
accept hidden files
accept files outside base directories
cleanup on error
compile after weaving
Line-break type
Windows
Unix
Mac
Current OS
Output encoding type
ISO-8859-1
Exclude files from process
List of files/directories to be excluded from weaving/compiling, separated by semicolon:
*.scc ; myTextFile.txt ; "another file.jpg"
Start
Cleanup files
Clear log
Exit
Logging messages
Weaving file "/home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/vb6-examples/boo
Transforming (line 27): @intercept#Execution:OpExecIcptr["Bookstore","Class_Initialize"]
Transforming (line 42): @intercept#Call:OpCallIcptr["Bookstore","searchBook","Catalog","
Transforming (line 50): @intercept#Call:OpCallIcptr["Bookstore","searchBook","CRM","get
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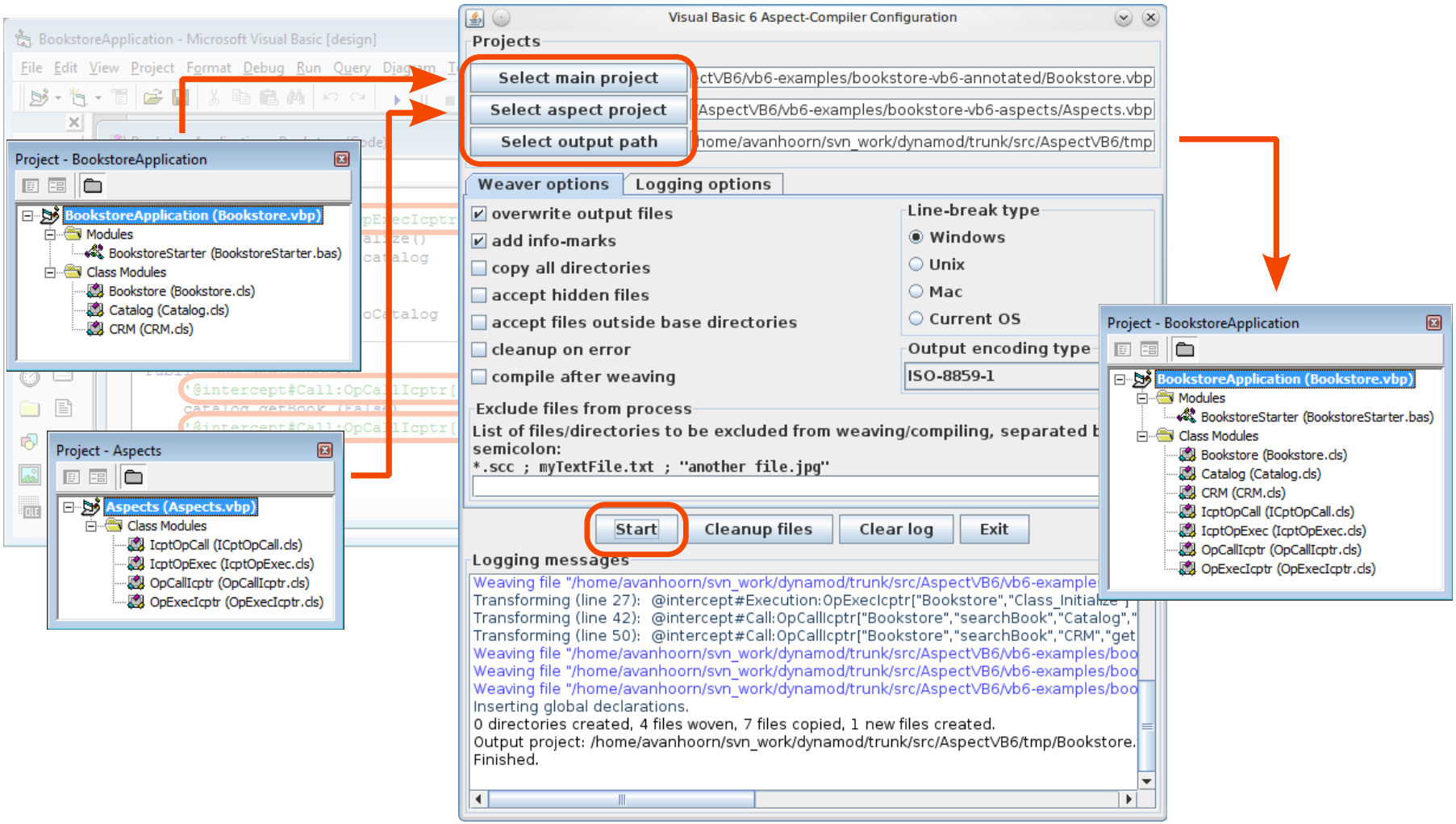
Weaving file "/home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/vb6-examples/boo
Weaving file "/home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/vb6-examples/boo
Inserting global declarations.
0 directories created, 4 files woven, 7 files copied, 1 new files created.
Output project: /home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/tmp/Bookstore.
Finished.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add info-marks
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accept files outside base directories
cleanup on error
compile after weaving
Line-break type
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Mac
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Output encoding type
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Exclude files from process
List of files/directories to be excluded from weaving/compiling, separated b
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Start
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Exit
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Weaving file "/home/avanhoorn/svn_work/dynamod/trunk/src/AspectVB6/vb6-example
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Project - BookstoreApplication
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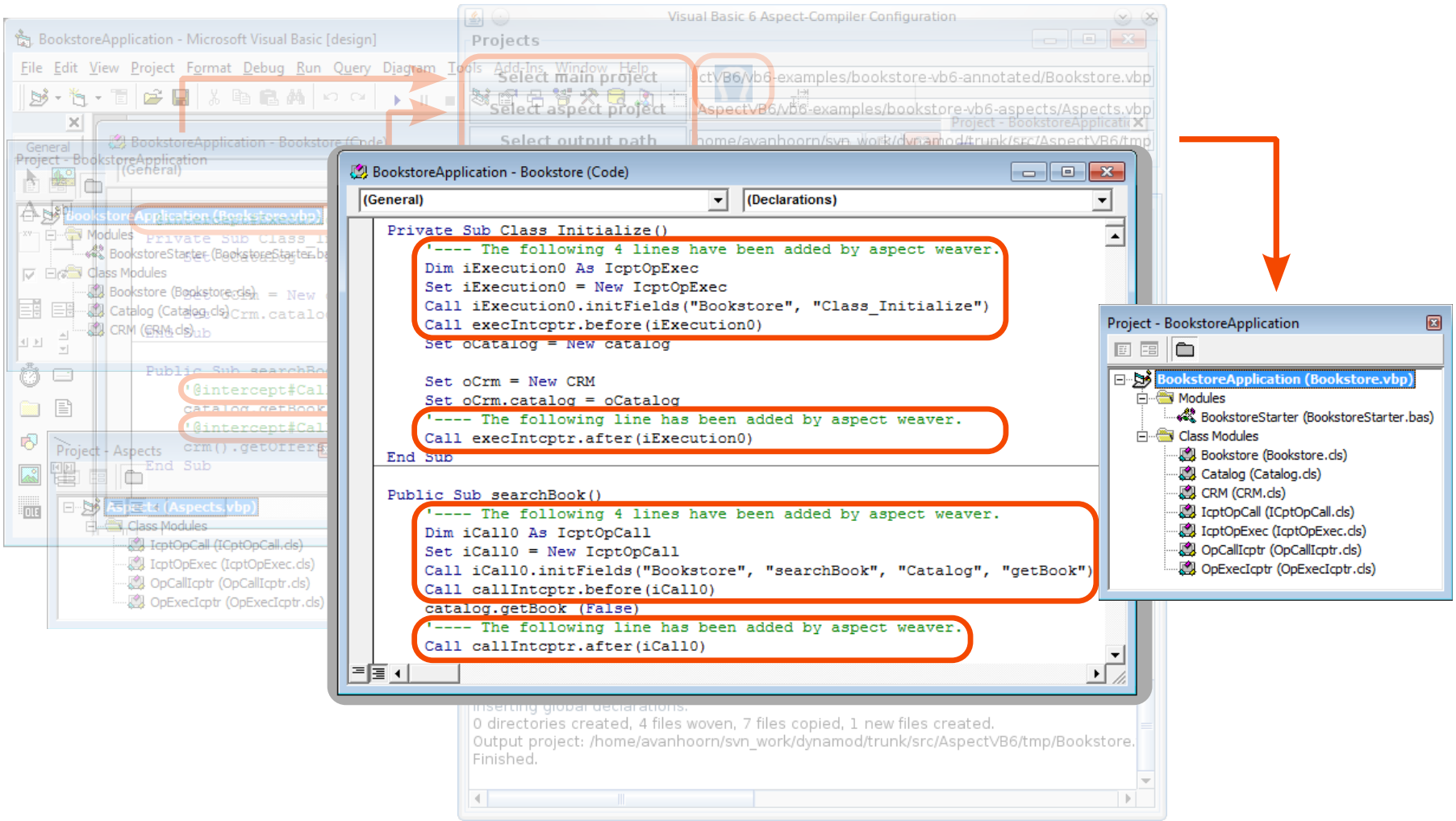
BookstoreApplication - Bookstore (Code)
(General)
(Declarations)
Private Sub Class_Initialize()
'---- The following 4 lines have been added by aspect weaver.
Dim iExecution0 As IcptOpExec
Set iExecution0 = New IcptOpExec
Call iExecution0.initFields("Bookstore", "Class_Initialize")
Call execIntcptr.before(iExecution0)
Set oCatalog = New catalog
Set oCrm = New CRM
Set oCrm.catalog = oCatalog
'---- The following line has been added by aspect weaver.
Call execIntcptr.after(iExecution0)
End Sub
Public Sub searchBook()
'---- The following 4 lines have been added by aspect weaver.
Dim iCall0 As IcptOpCall
Set iCall0 = New IcptOpCall
Call iCall0.initFields("Bookstore", "searchBook", "Catalog", "getBook")
Call callIntcptr.before(iCall0)
catalog.getBook (False)
'---- The following line has been added by aspect weaver.
Call callIntcptr.after(iCall0)
Project - BookstoreApplication
BookstoreApplication (Bookstore.vbp)
Modules
BookstoreStarter (BookstoreStarter.bas)
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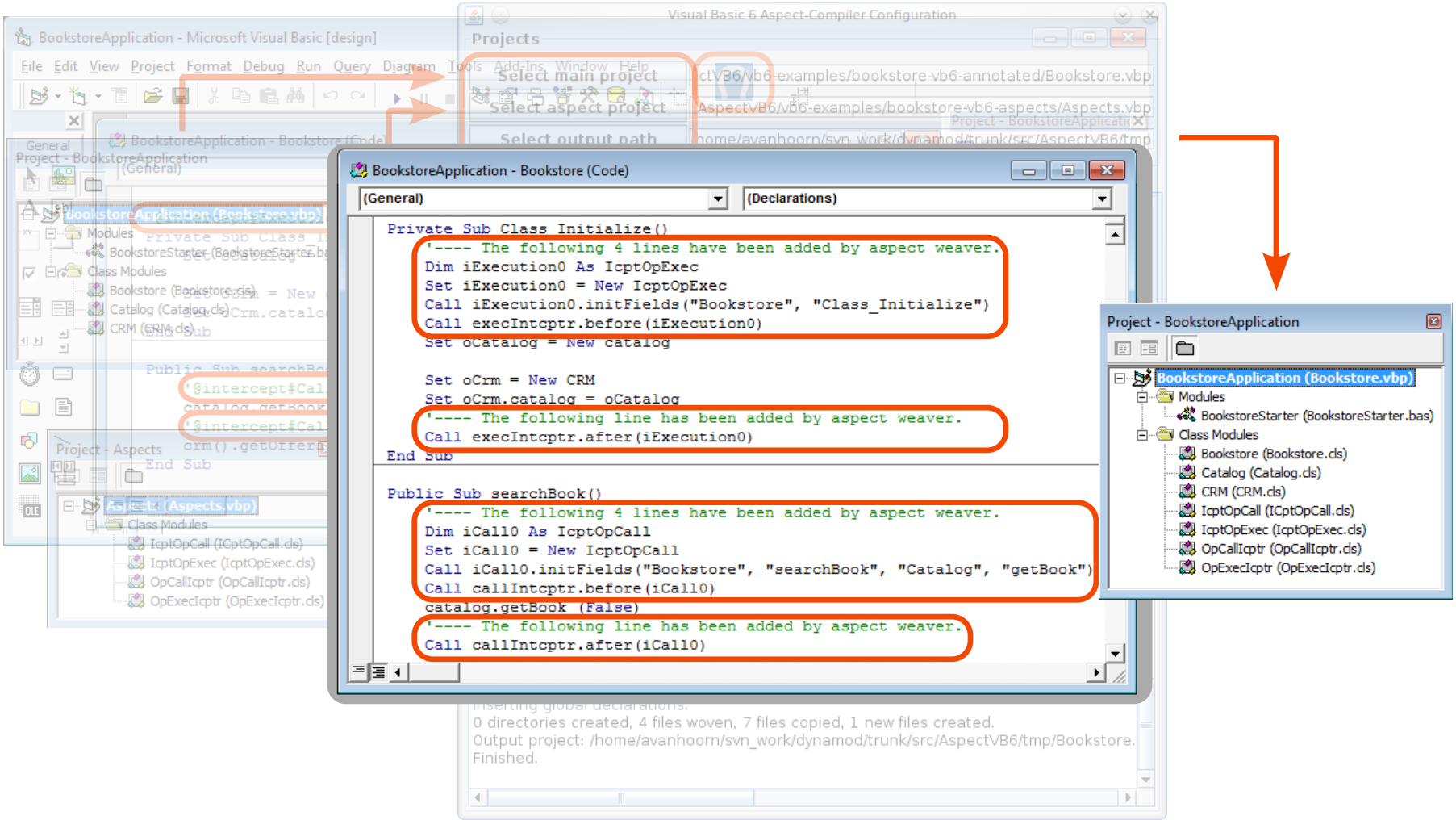
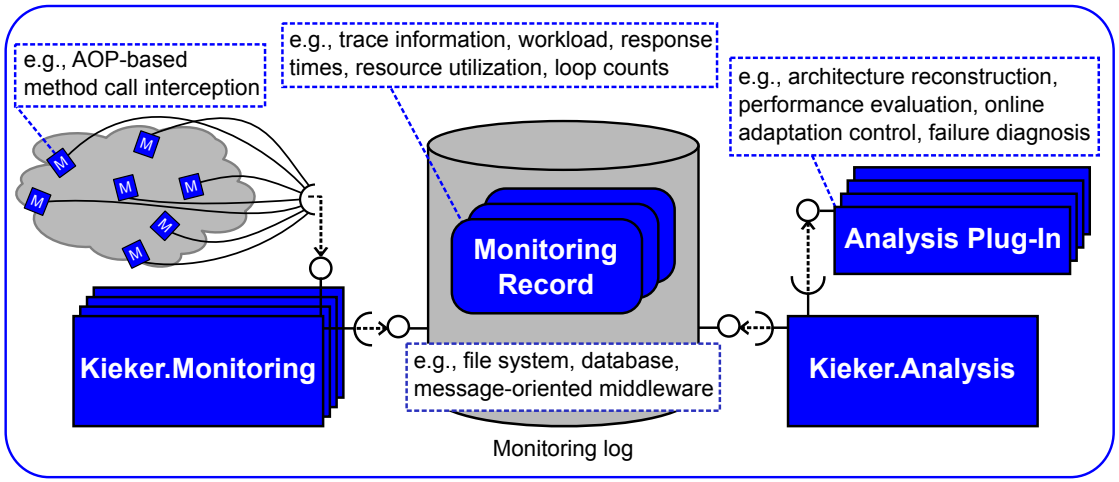
Finished.



Acknowledgment: Our DynaMod student assistants, **Eike Schulz and Benjamin Schnoor**, are responsible for large parts of the implementation!

Agenda

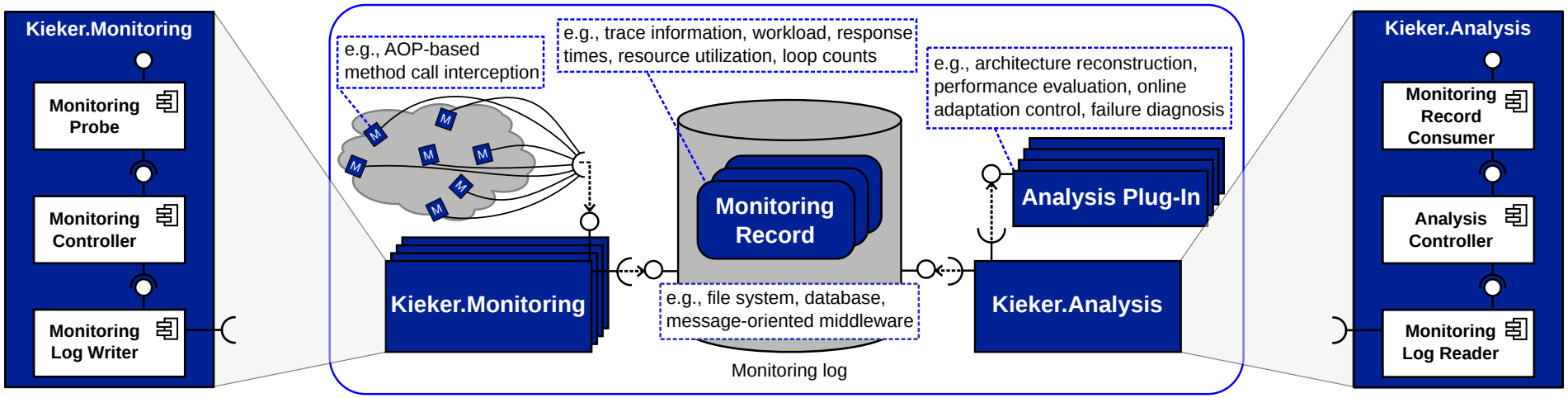


Kieker Framework — Core Characteristics [vHRH+09]

- Flexible architecture (custom *probes*, *readers*, *writers*, *analysis plug-ins*)
- Integrated & extensible *record* type model for monitoring & analysis
- Logging, reconstruction, analysis/visualization of (distributed) traces
- Low overhead (designed for continuous operation in multi-user systems)
- Evaluated in industry case studies

Kieker

http://kieker.sourceforge.net



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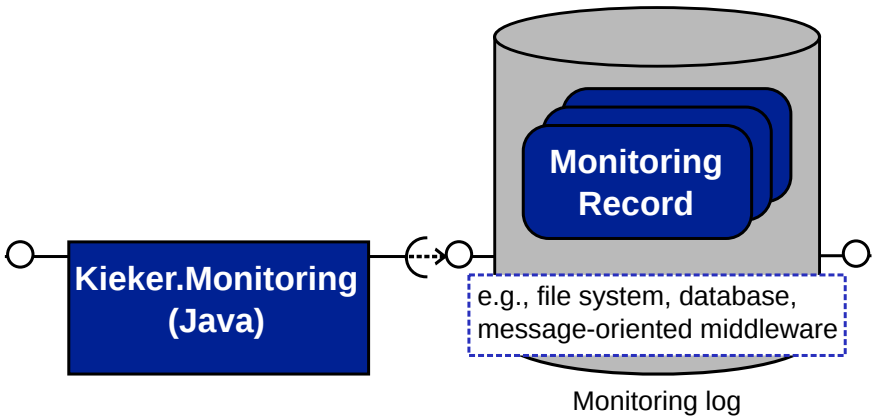
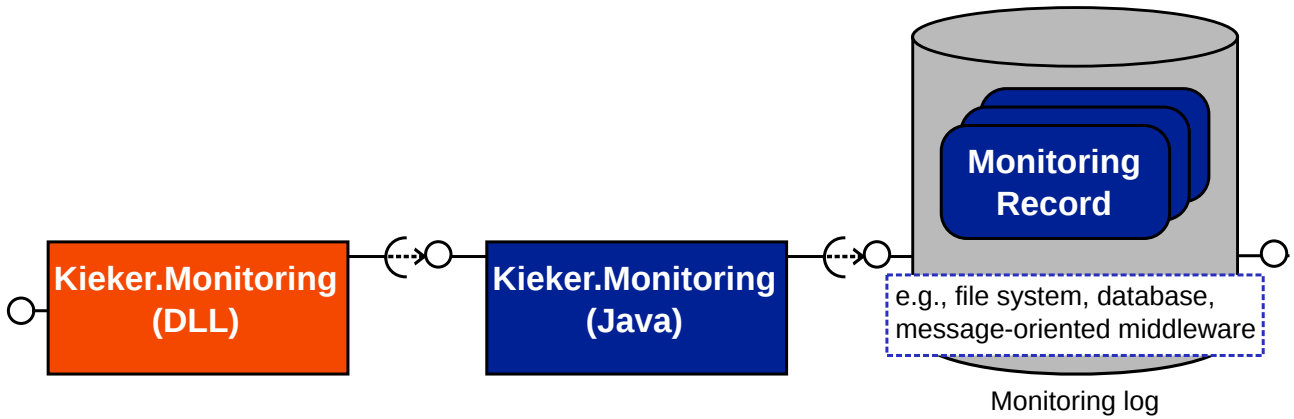


- Goal: Reuse existing Java-based Kieker.Monitoring component



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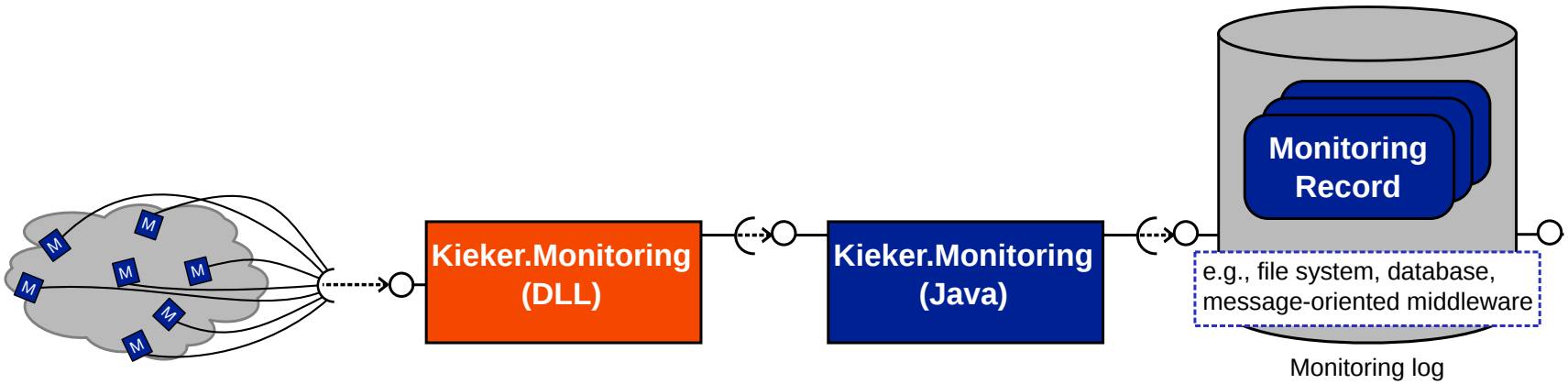
- Requires communication bridge among legacy language and Java



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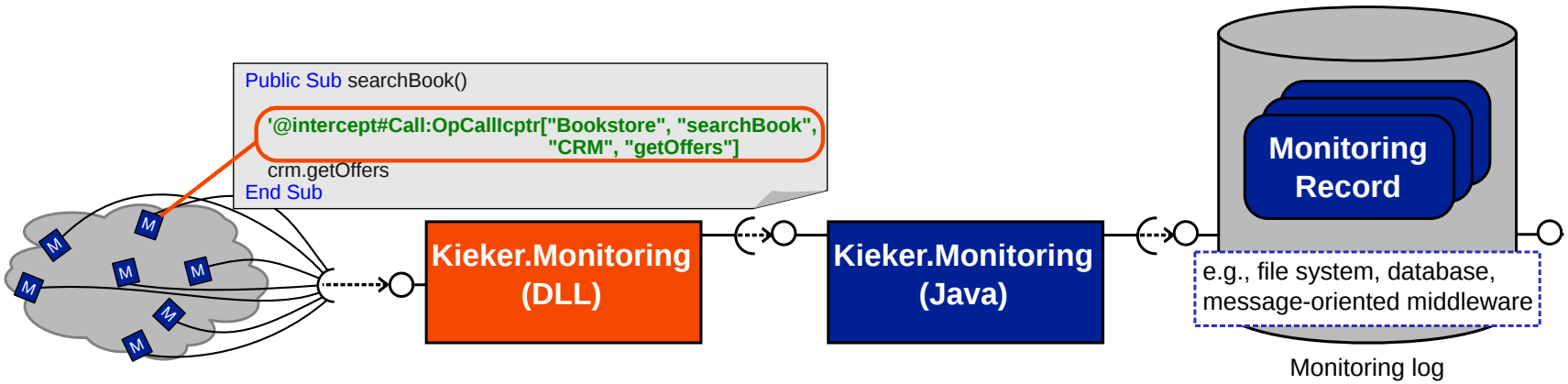

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- Developed proof-of-concept implementation for VB6

Instrumentation of Legacy Languages

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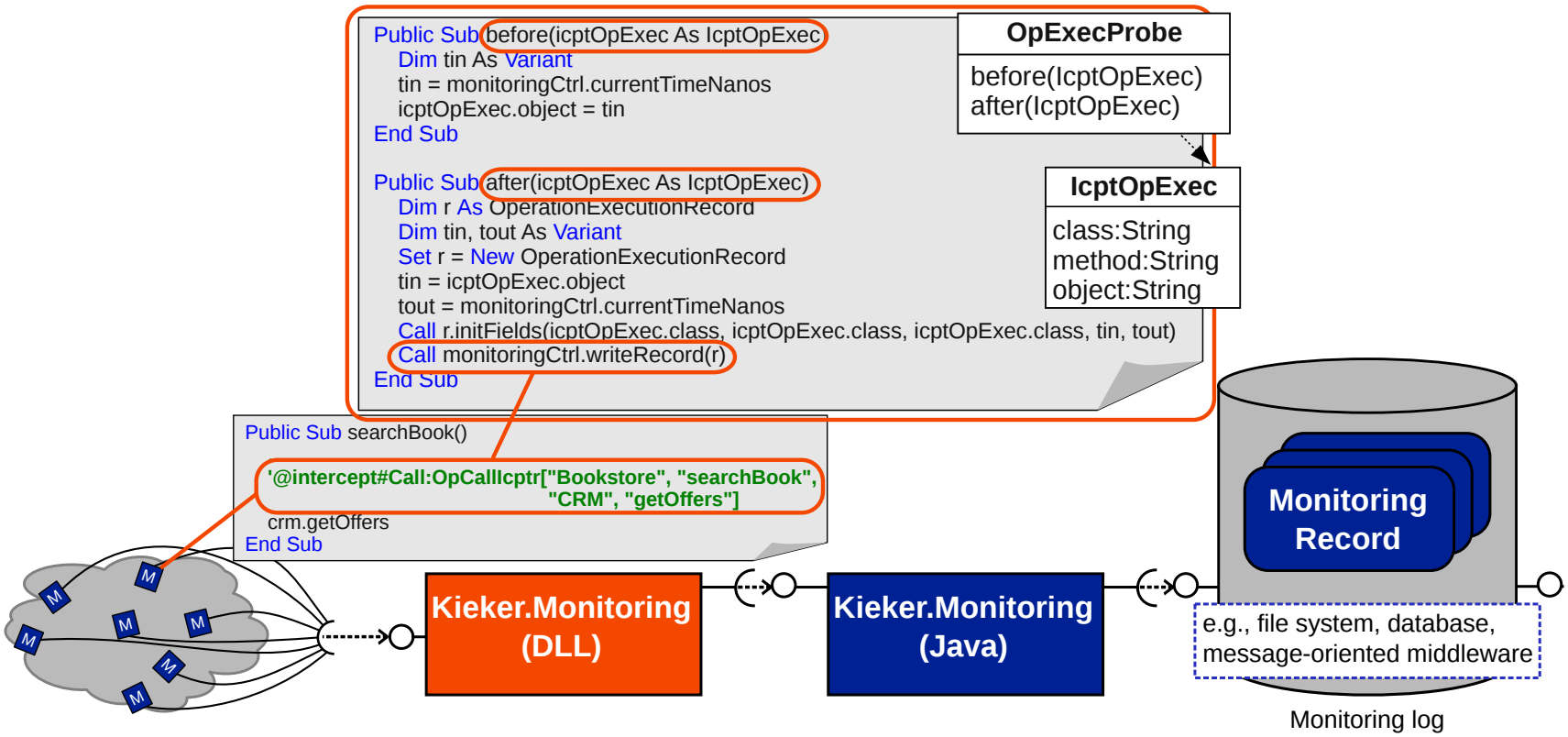

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- Model-driven instrumentation for dynamic analysis
- AOP for legacy languages
- Monitoring instrumentation employing AOP framework and Kieker
- Current focus on Visual Basic 6

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- Additional AOP features — e.g., loops, branches
- Additional programming languages — e.g., COBOL, Natural, Structured Text
- Study performance overhead

Literature

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)*, 2011.

André van Hoorn, Matthias Rohr, Wilhelm Hasselbring, Jan Waller, Jens Ehlers, Sören Frey, and Dennis Kieselhorst.

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