

Composing

Domain-Specific Languages

Eelco Visser

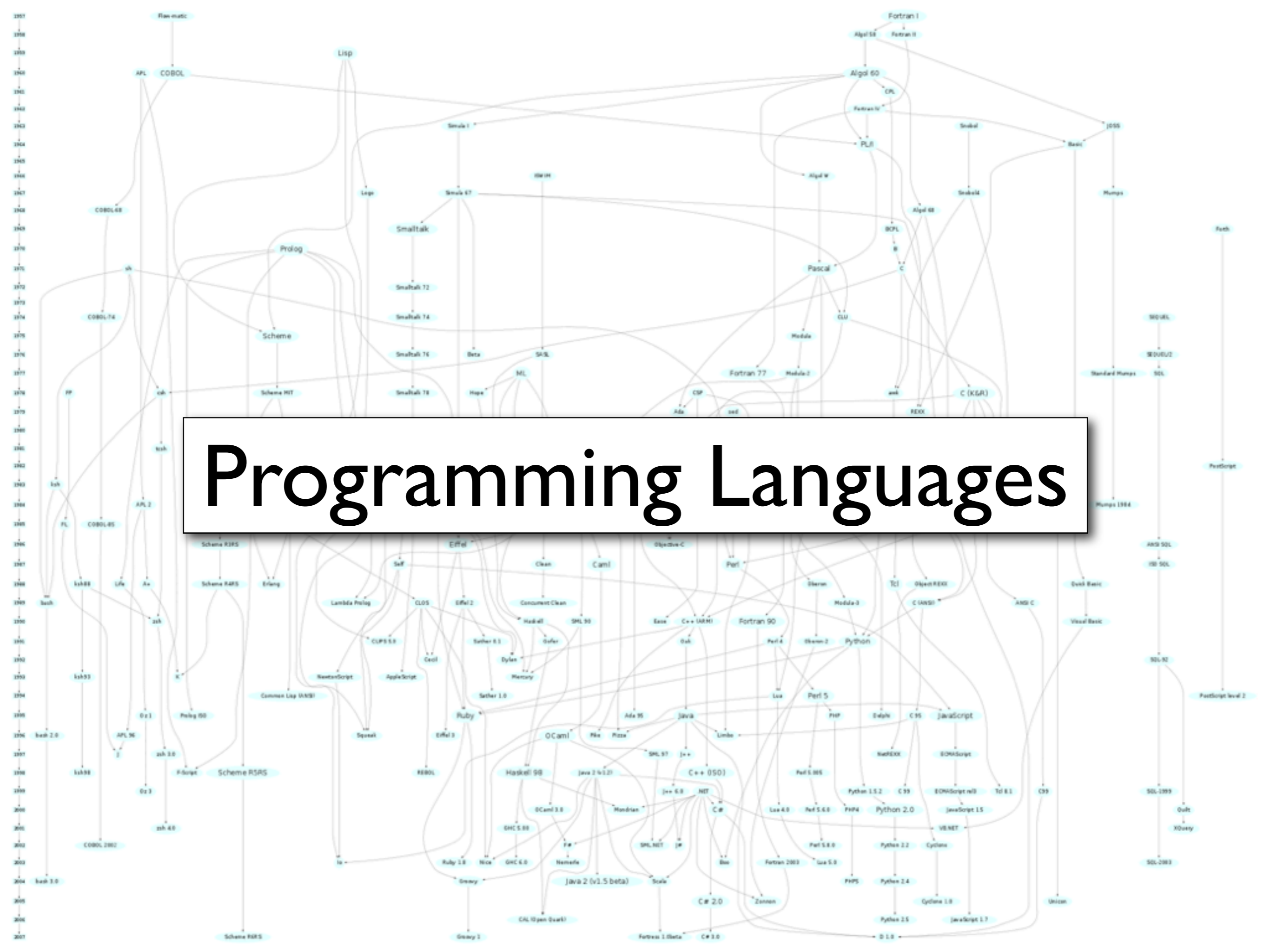
Delft University of Technology

<http://eelcovisser.org>

BLDL Opening 5/11/2009

Bergen University

Programming Languages



Abstraction

structured
control-flow

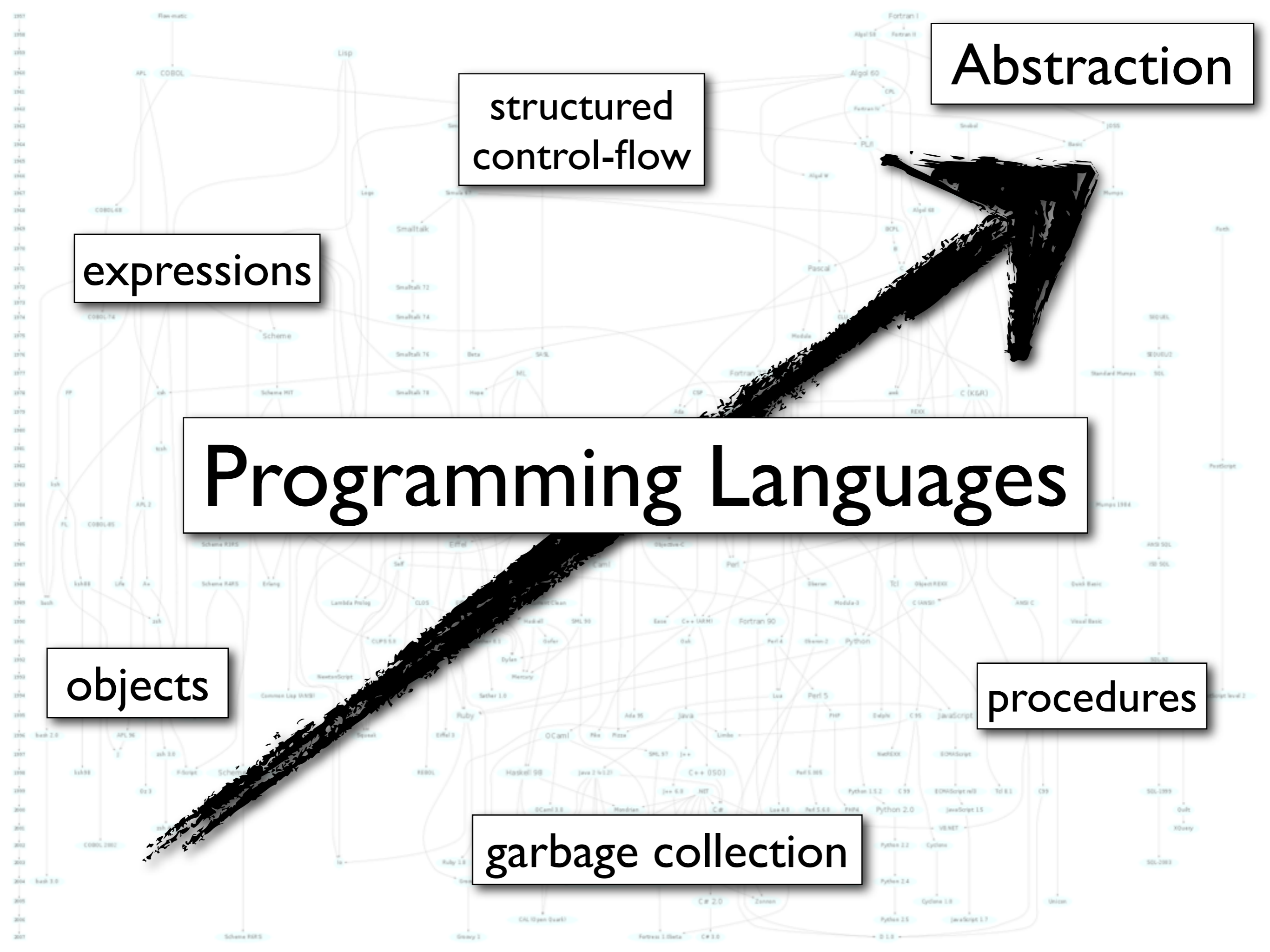
expressions

Programming Languages

objects

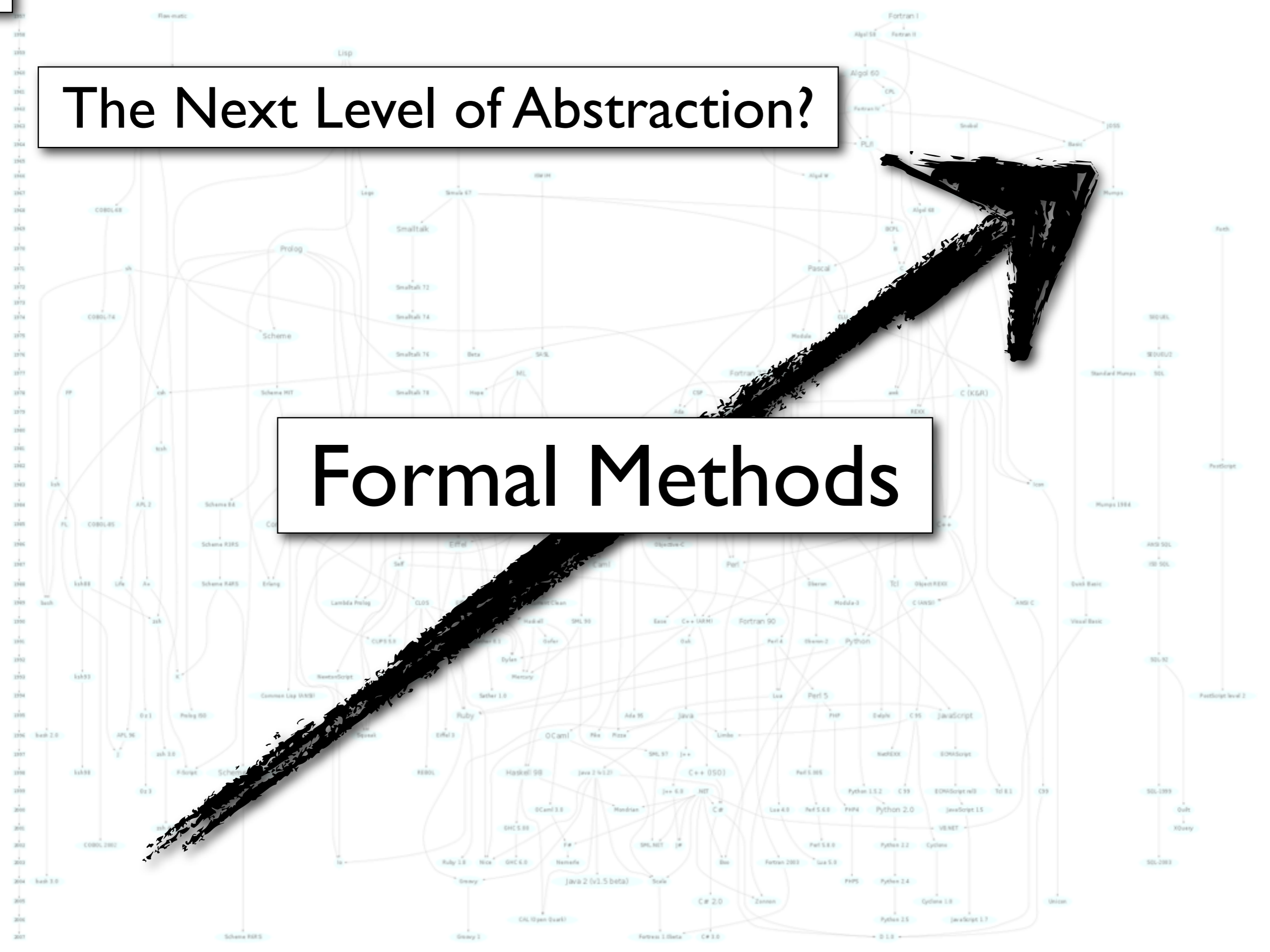
procedures

garbage collection



The Next Level of Abstraction?

Formal Methods



Specialization

Domain-Specific Languages

not: general-purpose programming

not: general-purpose logic specifications

Software System



Composition of Specialized Sub-domains

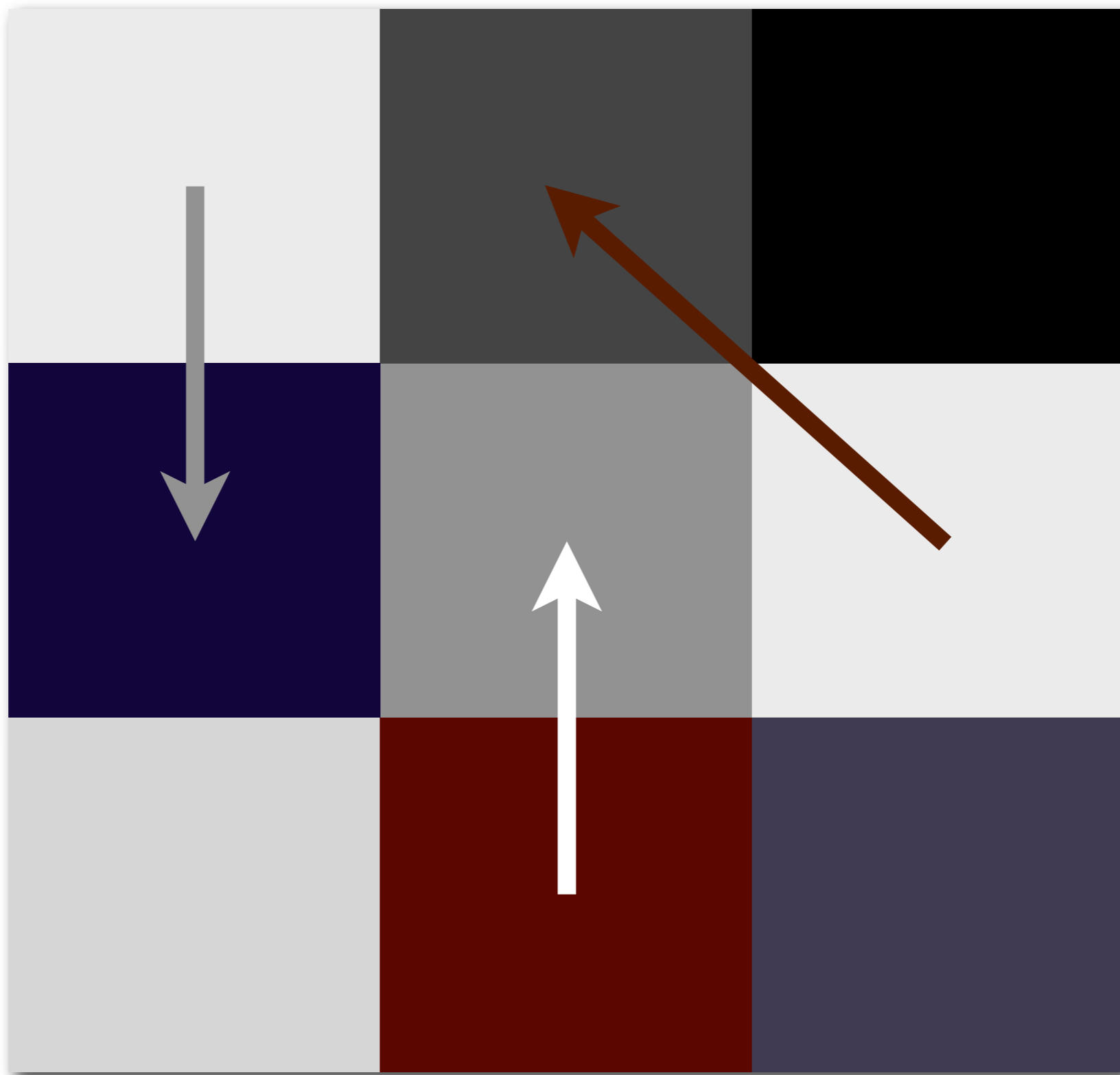
Software System



Separation of Concerns

Composition of Specialized Sub-domains

Loose Coupling



Lack of Static Verification

Thesis

Separation of Concerns

requires

Linguistic Integration

Case
Study

World Wide Web

http://myblog.com/newentry

Create New Blog Entry

my-new-weblanguage

My New Web Language

I'm designing a new language for web programming. It is called WebDSL

Create

http://myblog.com/my-new-weblanguage

My New Web Language 

I'm designing a new language for web programming. It is called WebDSL

Posted by Eelco on November 4, 2009 at 12:05

[Edit](#)


http://myblog.com/edit/my-new-weblanguage


Edit Blog Entry

my-new-weblanguage

My New Web Language

I'm designing a new language for web programming. It is called WebDSL

Eelco 

11/4/2009 

Save



is that URL unique?

where does that link point?

http://myblog.com/newentry

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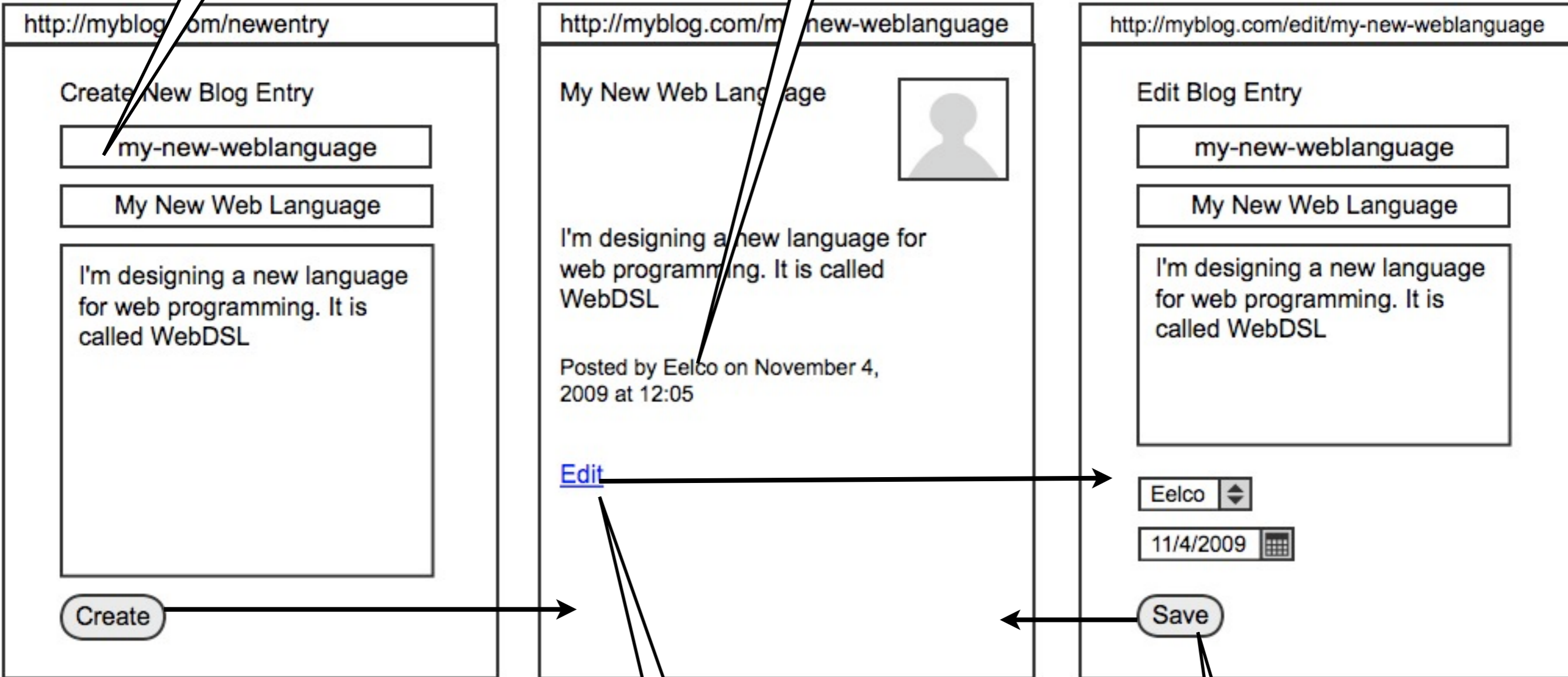
Eelco

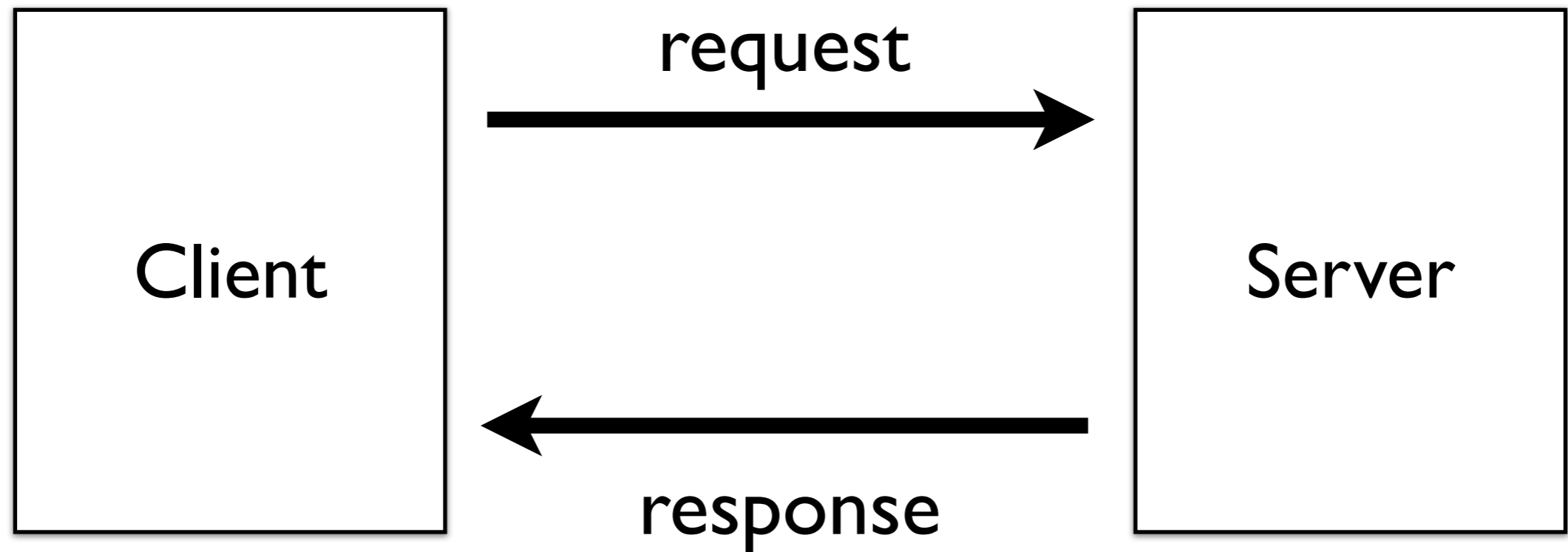
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who may edit this entry?

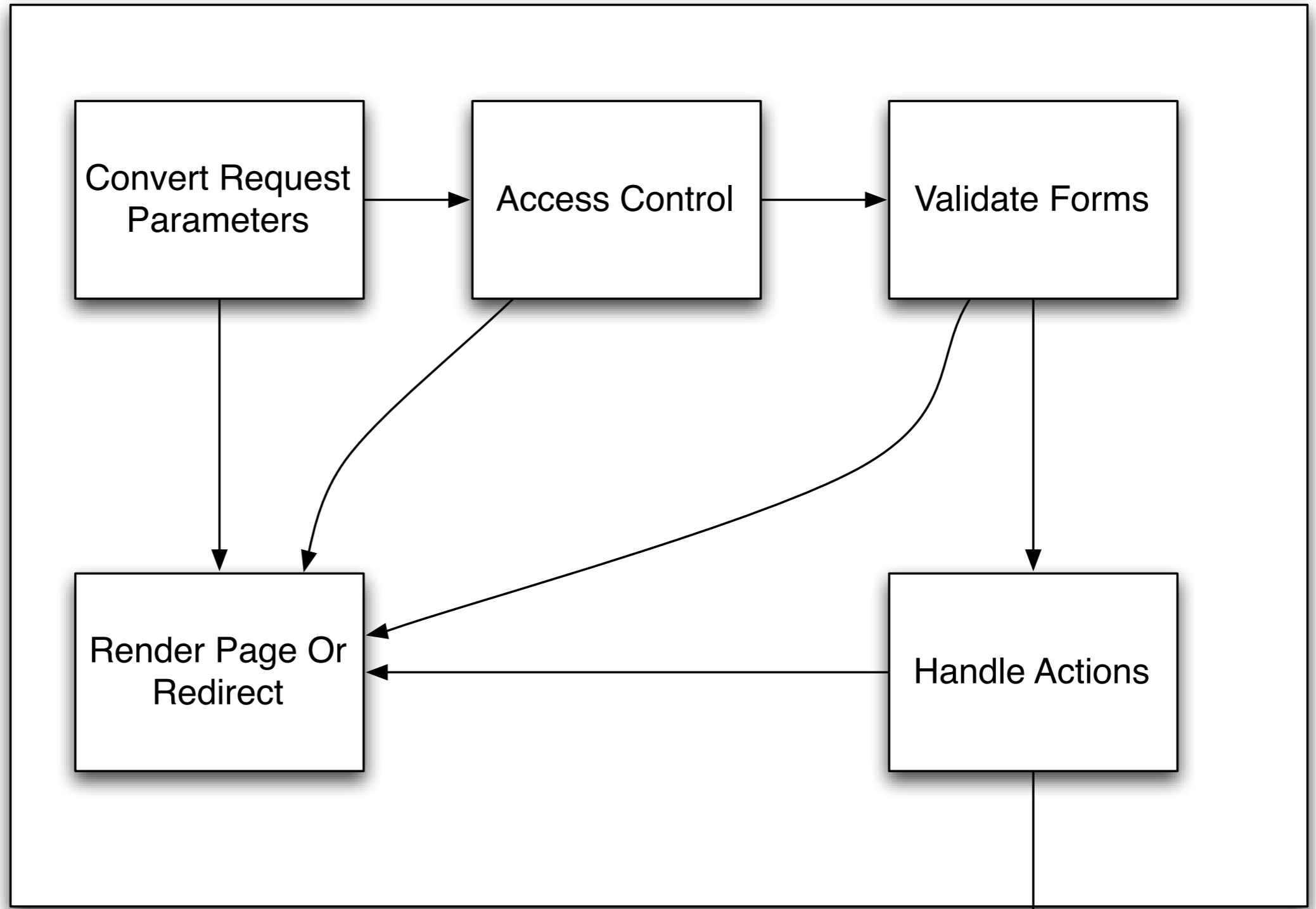
where is data stored?





Architecture

request



Convert Request
Parameters

Access Control

Validate Forms

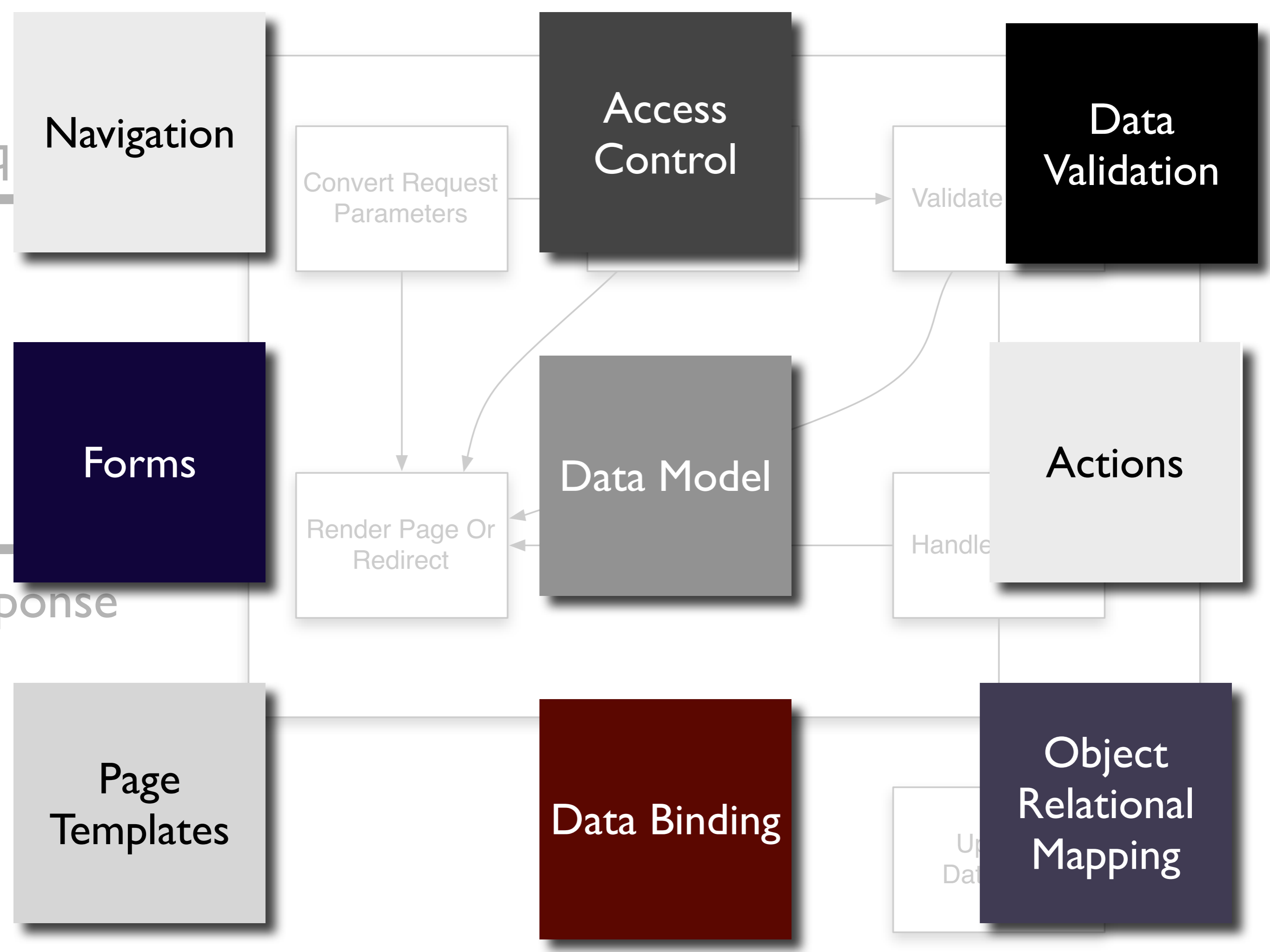
Render Page Or
Redirect

Handle Actions

response



Update
Database



Navigation

Access Control

Data Validation

Forms

Data Model

Actions

Convert Request Parameters

Validate

Render Page Or Redirect

Handle

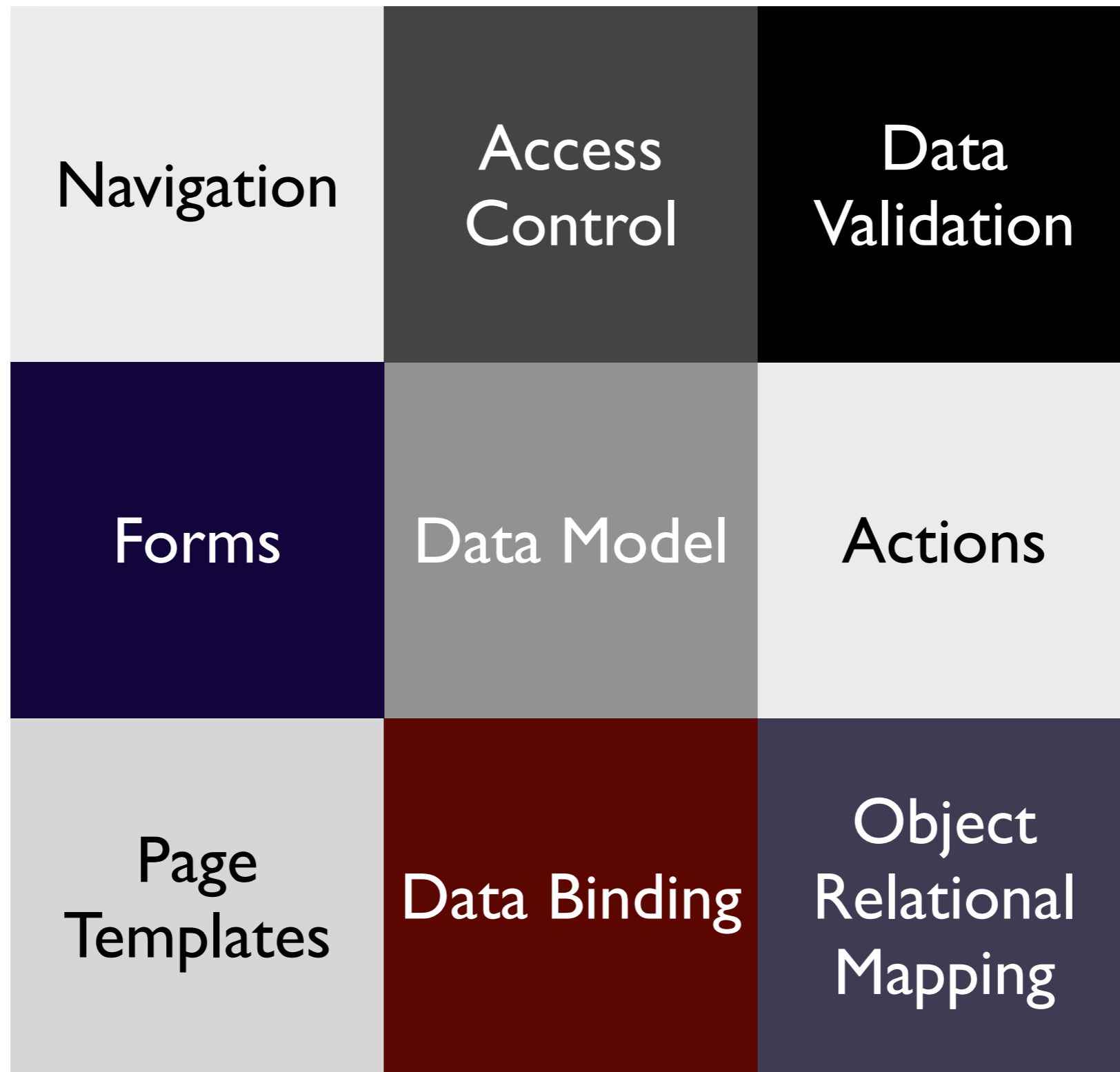
Page Templates

Data Binding

Object Relational Mapping

Up Date

Response



(Some) Concerns in Web Applications

Navigation	Access Control	Data Validation
Forms	Data Model	Actions
Page Templates	Data Binding	Object Relational Mapping



data model	entity class	classes
orm	JPA	active record
actions	Java/Seam	Ruby
data validation		
navigation	servlets	controllers
page templates	JavaServer Faces	
forms	JSF tags	embedded html
data binding	JSF + Seam	
access control	Acegi	

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```
<s:link view="/entry.xhtml"
  value="#{entry.title}"
  propagation="none">
  <f:param name="entry" value="#{entry.id}"/>
</s:link>
```

```
@Name("entry")
public class EntryBean implements EntryBeanInterface {
  @RequestParameter("entry")
  private Long entryId;
}
```

Navigation	Access Control	Data Validation
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data model	<p>boilerplate code</p> <p>loose coupling</p> <p>no/little static verification</p>
orm	
actions	
data validation	
navigation	
page templates	
forms	
data binding	
access control	

Navigation	Access Control	Data Validation
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Web DSL

```
entity Page {  
  title :: String  
  authors -> set<Person>  
  ...  
}  
entity Person {  
  name :: String(name)
```

- separate languages for separate concerns
- linguistically integrated
- compile-time consistency checking
- 100% code generation (no scaffolding)

Navigation	Access Control	Data Validation
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```
entity Blog {
  name    :: String (id)
  entries -> Set<Entry>
  authors -> Set<User>
}

entity Entry {
  url      :: String (id)
  title    :: String (name)
  text     :: WikiText
  blog     -> Blog (inverse=Blog.entries)
  author   -> User (inverse=User.entries)
  created  :: DateTime
}

entity User {
  username :: String
  password :: Secret
  blogs    -> Set<Blog> (inverse=Blog.authors)
  entries  -> Set<Entry> (inverse=Entry.author)
}
```

Navigation	Access Control	Data Validation
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http://myblog.com/my-new-weblanguage

My New Web Language 

I'm designing a new language for web programming. It is called WebDSL

Posted by Eelco on November 4, 2009 at 12:05

[Edit](#)

```

define page entry(e : Entry) {
  header{output(e.title)}

  output(e.text)

  “Posted by “ output(e.author)
  “ on “ output(e.created)

  navigate(editentry(e)) {“Edit”}
}

```

Navigation	Access Control	Data Validation
Forms	Data Model	Actions
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http://myblog.com/edit/my-new-weblanguage

Edit Blog Entry

my-new-weblanguage

My New Web Language

I'm designing a new language for web programming. It is called WebDSL

Eelco

11/4/2009

Save

```
define page editentry(e : Entry) {
  form{
    input(e.url)
    input(e.title)
    input(e.text)
    input(e.author)
    input(e.created)
    action("Save", action{
      return entry(e);
    })
  }
}
```

Navigation	Access Control	Data Validation
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http://myblog.com/edit/my-new-weblanguage

Edit Blog Entry

▾

📅

```
entity Entry {
  url validate(isUniqueEntry(this),
    "Entry with that URL already exists")
}
```


Navigation	Access Control	Data Validation
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access control rules

principal is User

with credentials username, password

```
rule page entry(e : Entry) {
  !e.private
  || principal in e.blog.authors
}
```

```
rule page newentry(b : Blog) {
  principal in e.blog.authors
}
```

```
rule page editentry(e : Entry) {
  e.author == principal
}
```

http://myblog.com/edit/my-new-weblanguage

Edit Blog Entry

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Save

Navigation	Access Control	Data Validation
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Web DSL

The logo for 'Web DSL' features the word 'Web' in a large, bold, red font and 'DSL' in a large, bold, grey font enclosed in a black rectangular box. The background is filled with faint, semi-transparent snippets of code, including 'entity Page { title :: String authors -> list<Person> ...', 'Person { name :: String(name)', and 'er'.

- separate languages for separate concerns
- linguistically integrated
- compile-time consistency checking
- 100% code generation (no scaffolding)
- order of magnitude decrease in code size

Declarative Access Control for WebDSL: Combining Language Integration and Separation of Concerns

Danny M. Groenewegen, Eelco Visser. Declarative Access Control for WebDSL: Combining Language Integration and Separation of Concerns. In Daniel Schwabe, Francisco Curbera, Paul Dantzig, editors, *Proceedings of the Eighth International Conference on Web Engineering, ICWE 2008, 14–18 July 2008, Yorktown Heights, New York, USA*. pages 175–188, IEEE, 2008.

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Abstract

In this paper, we present the extension of WebDSL, a domain-specific language for web application development, with abstractions for declarative definition of access control. The extension supports the definition of a wide range of access control policies concisely and transparently as a separate concern. In addition to regulating the access to pages and actions, access control rules are used to infer navigation options not accessible to the current user, preventing the presentation of inaccessible links. The extension is an illustration of a general approach to the design of domain-specific languages for different technical domains to support separation of concerns in application development, while preserving linguistic integration. This approach is realized by means of a transformational semantics that weaves separately defined aspects into an integrated implementation.

[\[Edit abstract\]](#)

External Links

- DOI
 - DBLP
 - Technical Report (PDF)
 - WebDSL
 - Google
 - Google Scholar
- [\[Edit links\]](#)

Cite Key

- GroenewegenV08

Tags

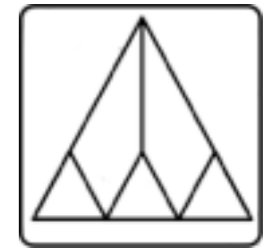
- WebDSL [X]
- access control [X]
- aspect weaving [X]
- dsl [X]

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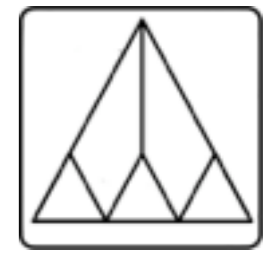
Navigation	Access Control	Data Validation
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Stratego/XT

Domain-Specific Language Engineering

Navigation	Access Control	Data Validation
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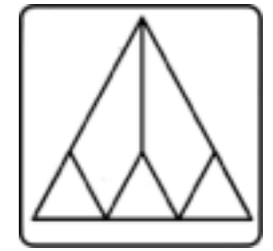
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WebDSL

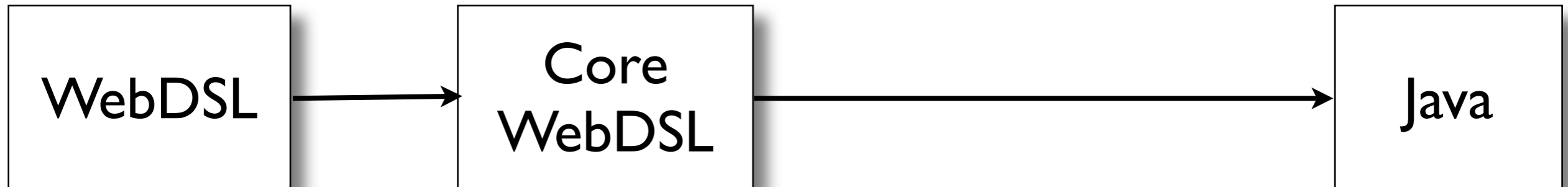


Java

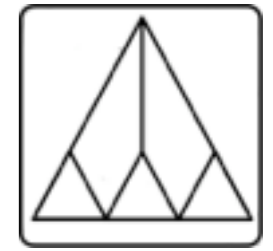
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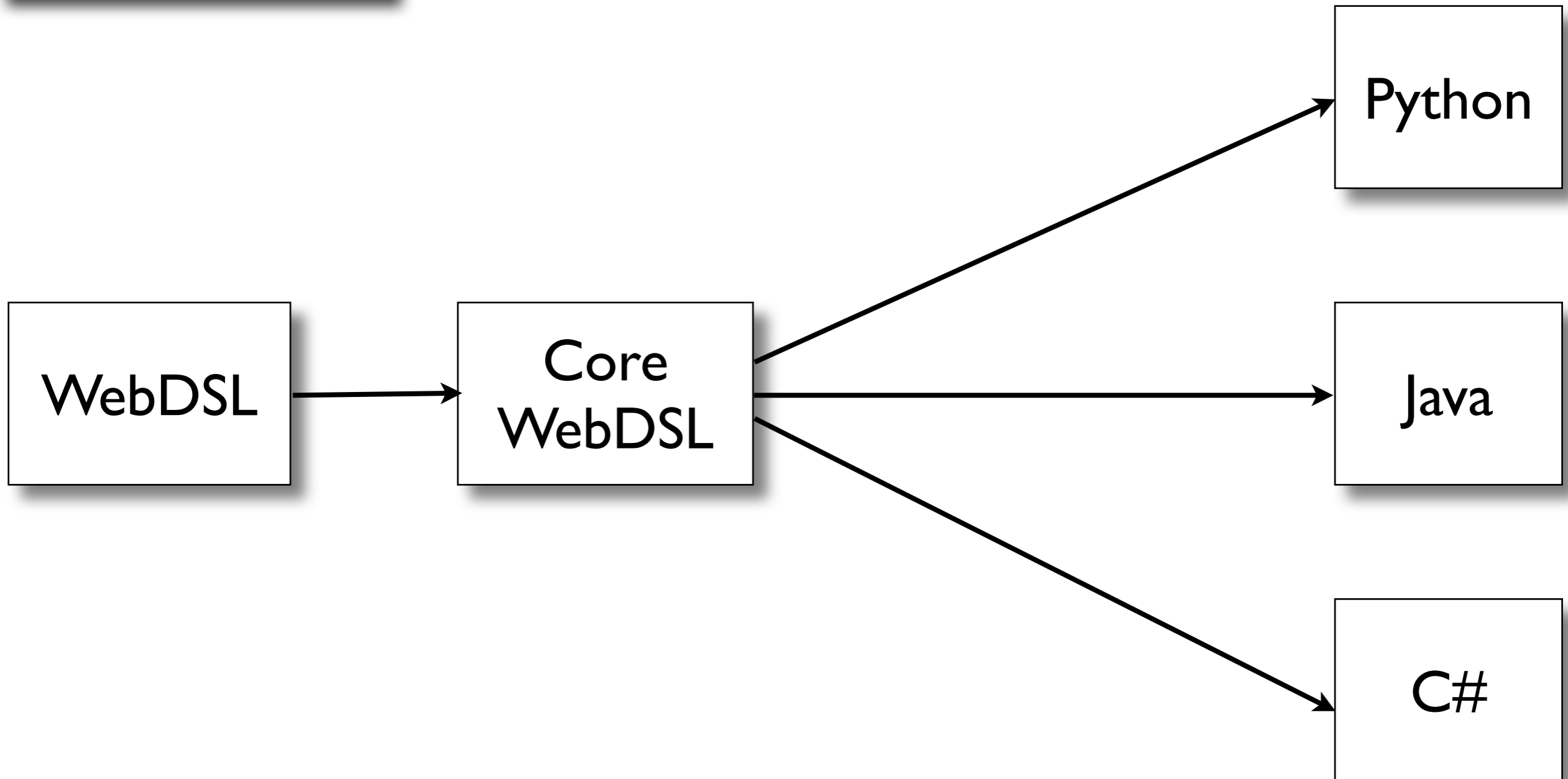
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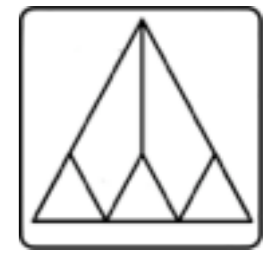
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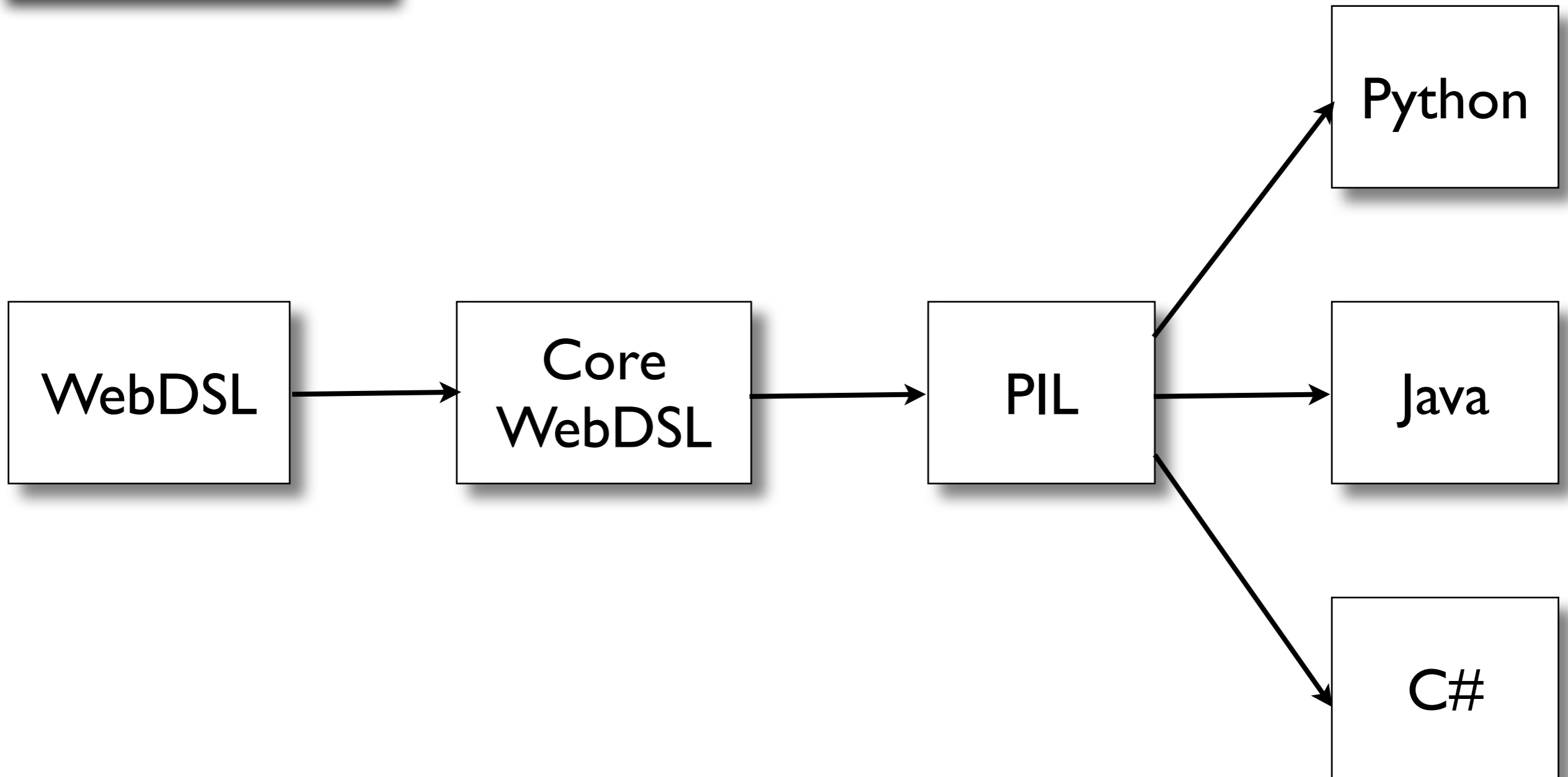
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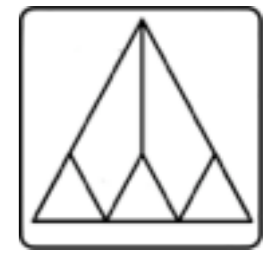
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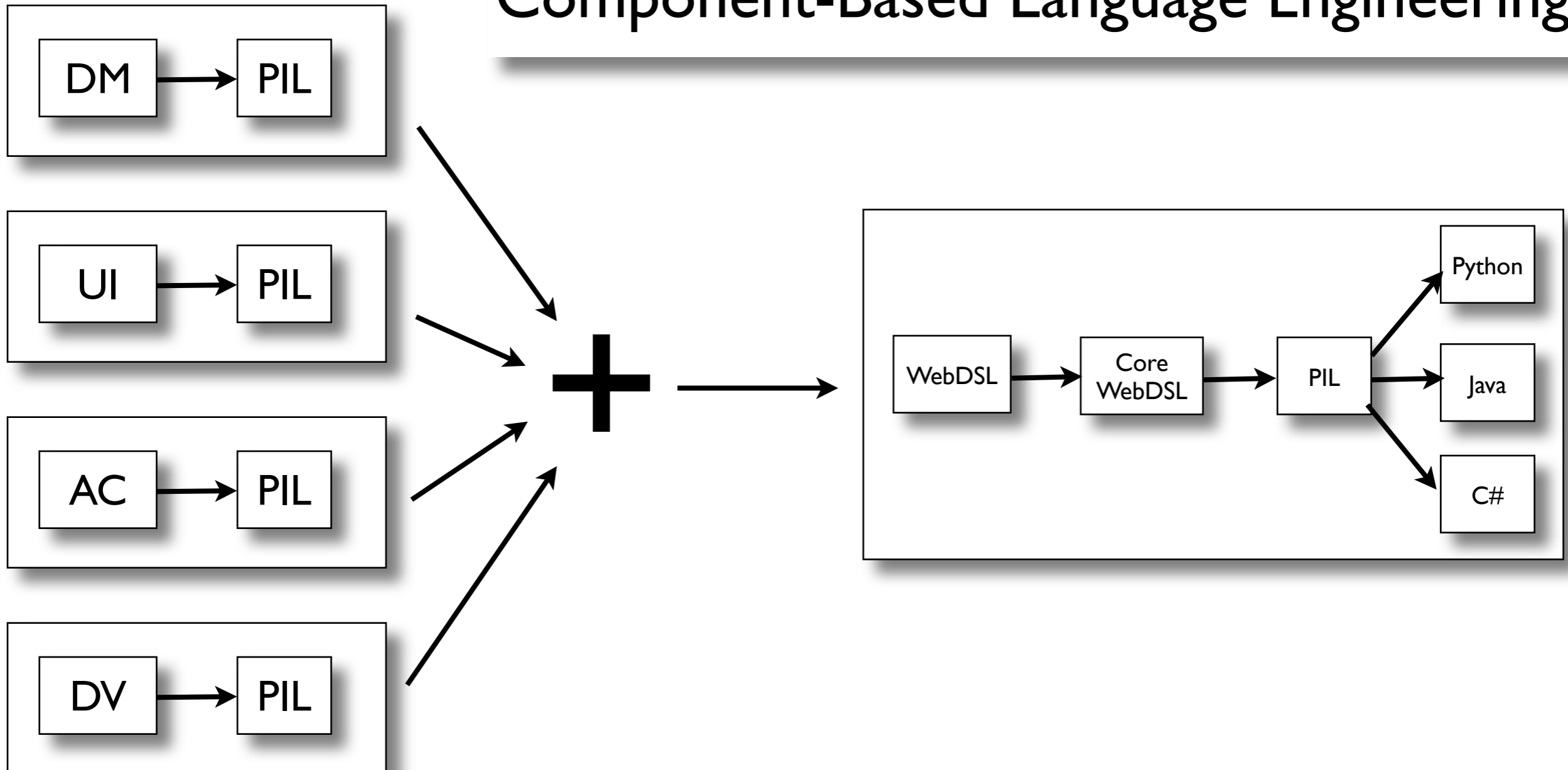


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Stratego/XT

Component-Based Language Engineering

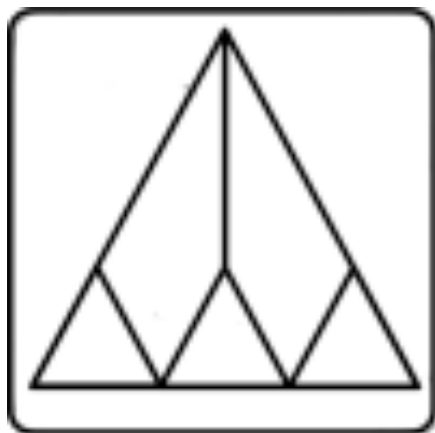


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- separate languages for separate concerns
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<http://webdsl.org>



<http://strategoxt.org>

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Danny M. Groenewegen, Eelco Visser. Declarative Access Control for WebDSL: Combining Language Integration and Separation of Concerns. In Daniel Schwabe, Francisco Curbera, Paul Dantzig, editors. *Proceedings of the Eighth International Conference on Web Engineering, ICWE 2008, 14-18 July 2008, Yorktown Heights, New York, USA*, pages 175-188. IEEE, 2008.

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