On the relationship between weavers and the build system

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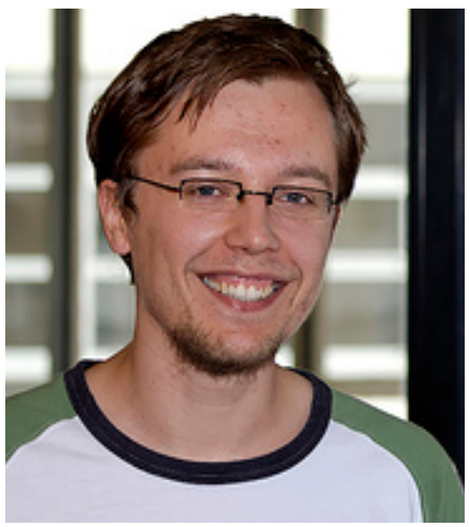


Everything has a Makefile!

How do you bring AOP into your build system?

How to bring AOP in your build system?

- Why a potential problem/challenge?
  - source code modularity vs. build system dependencies
  - existing build system
  - weaver acceleration using build level-tricks

- But: Is there really a problem?

1. Problem Statement
2. Approach
3. Issues:
   a) Platform Dependencies
   b) Module Configuration
   c) Build Integration
   d) Build Order
   e) Incremental Compilation
4. Conclusion

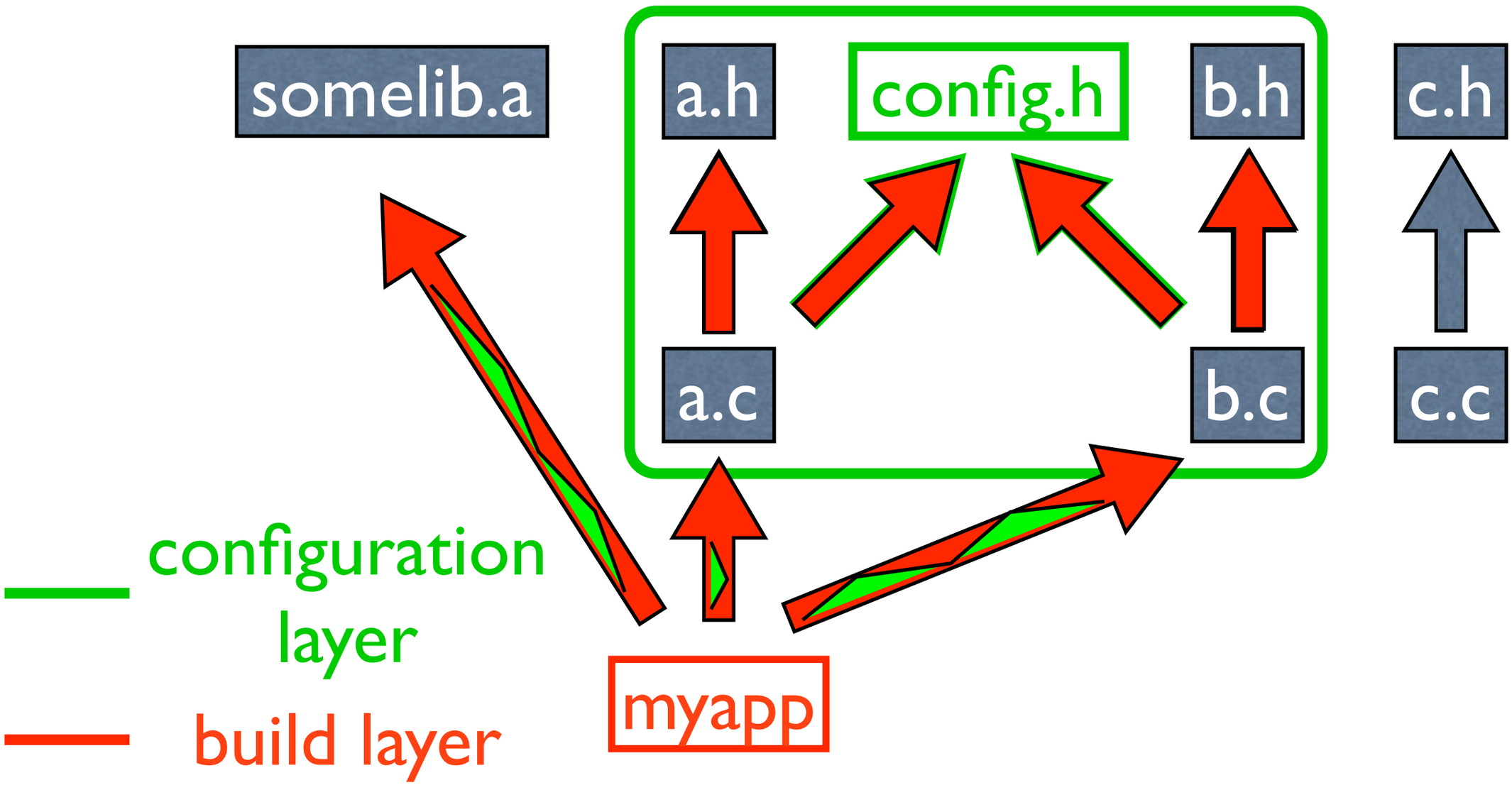
33 surveyed languages

prepro-cessing	Cobble, AspectC, AspectC++, XWeaver, Aspicere, C4, WeaveC, ACC, CaesarJ, Apostle, AHEAD
compile-time	AspectJ, abc, Hyper/J, AspectWerkz2, LogicAJ, Compose*, CARMA
link-time	Aspicere2
load-time	AspectJ, AspectWerkz2, Weave.NET
run-time	AspectC++, μDiner, TinyC, Arachne, TOSKANA, KLASY, TOSKANA-VM, Steamloom, AspectWerkz2, PROSE, Wool, JAC, Handi-Wrap, AspectS, AOP/ST, CARMA

Comparison of AOP approaches

- discover prominent build system issues:
  - effort
  - risks
  - workarounds
- derive lessons learnt for stakeholders
- distill requirements for AOP-aware build system?

Build System ⇒ 5 Issues



a. Resolve Platform-dependencies
b. Module Configuration

c. Build Integration
d. Build Order
e. Incremental Compilation

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a. Resolving platform-dependencies

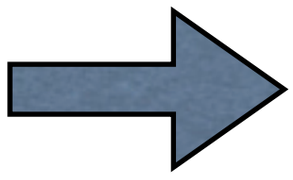
- Configuration layer parameterises:
  - source code:
    - base
    - aspects
  - build layer

abstraction of selected features, compiler, platform, ...

- no real problem ↔ do better than now?

Platform Dependency Issues

<table>
<tr><th></th><th>prepro-cessing</th><th>compile-time</th><th>link-time</th><th>run-time</th><th>load-time</th></tr>
<tr><td>language</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">tool</td><td colspan="3">conditional compilation
AOP in build
build tool support</td><td></td><td></td></tr>
<tr><td colspan="4">library management</td></tr>
<tr><td>user</td><td colspan="3">versioning problems
release management</td><td></td></tr>
</table>



versioned modules/libraries?
other language support?

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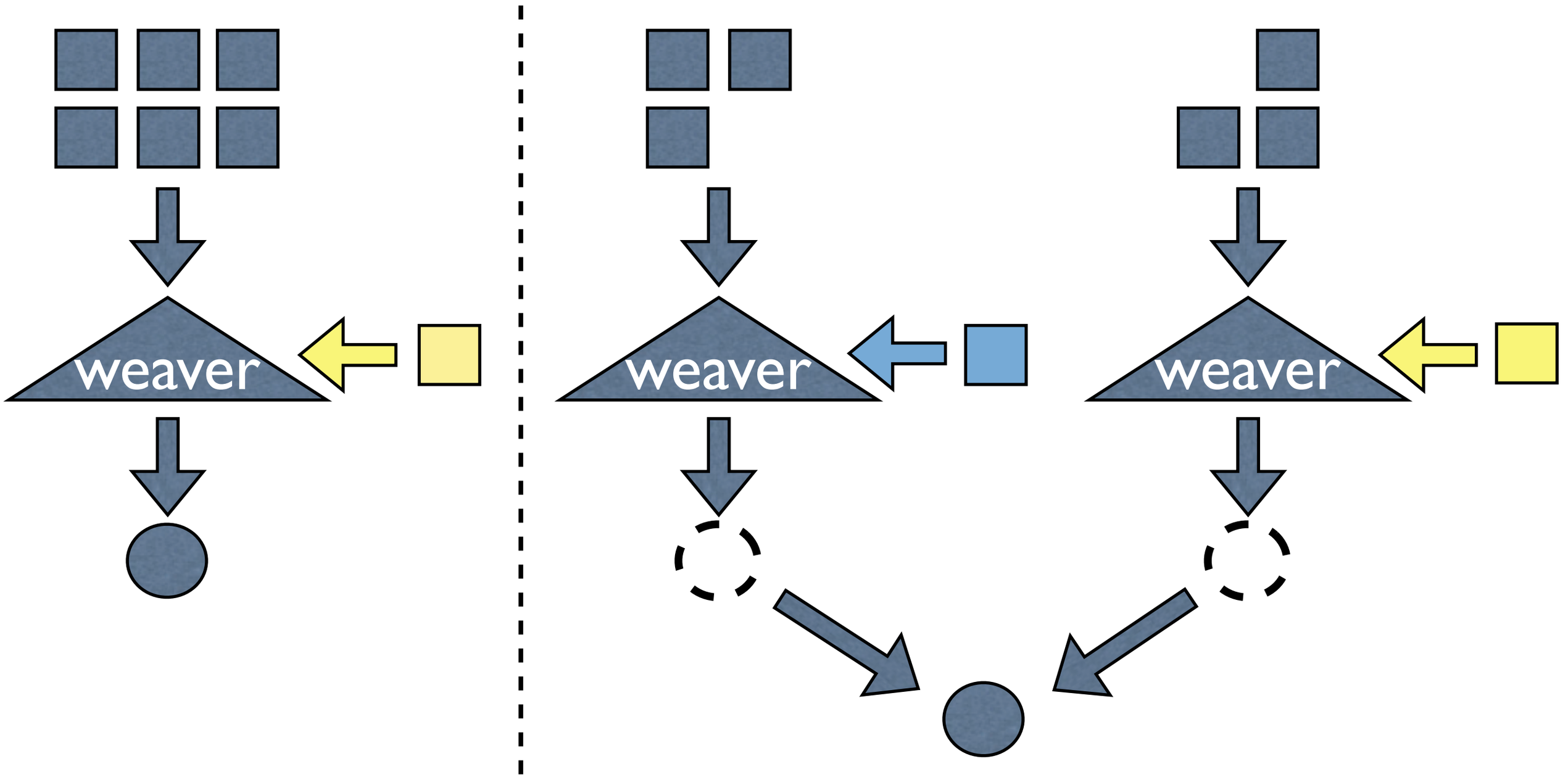
b. Module Configuration

- Configuration layer selects:
  - which aspects?
  - onto which base modules are aspects applied?
    - explicit mapping
    - implicit mapping (weaving time, ...)
- aspect pluggability ↔ implicit dependencies
- fine-grained control ↔ keep it manageable

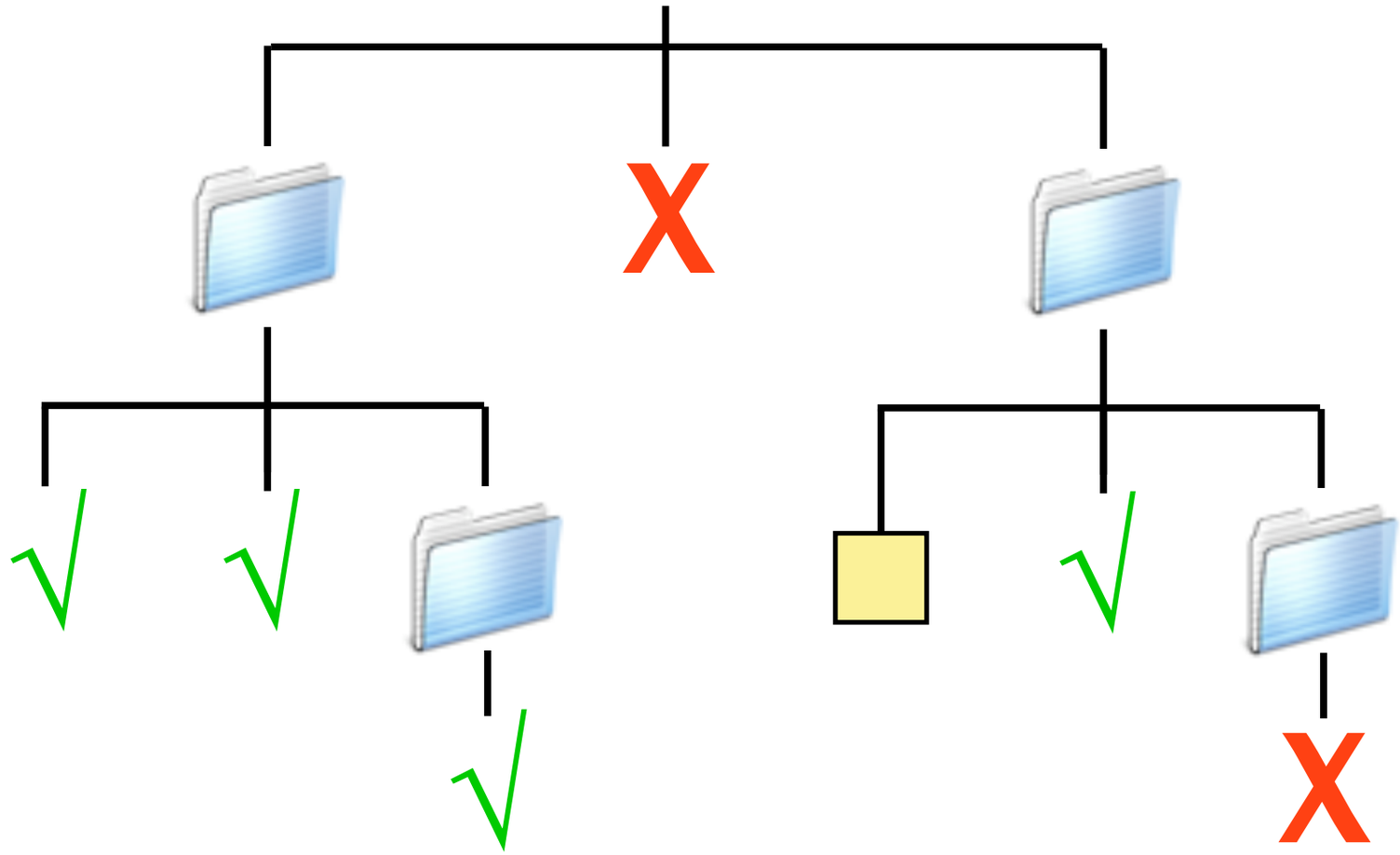
System-wide Configuration vs. Build Decomposition



Conventions

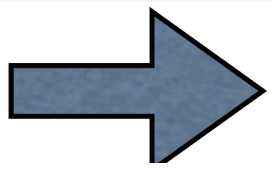
- ACC:
  - which aspects? local ↔ global
  - scope?

current-and-sibling rule



Module Configuration Issues

	prepro-cessing	compile-time	link-time	load-time	run-time
language	no control programmatic				programmatic
	application-wide textual list				
tool	easily enforceable command line switch		weaver complexity		deployment tools
	decompose build conditional compilation				cond. comp.
user		conventions			
	product line				



how to manage dependencies?

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c. Build integration

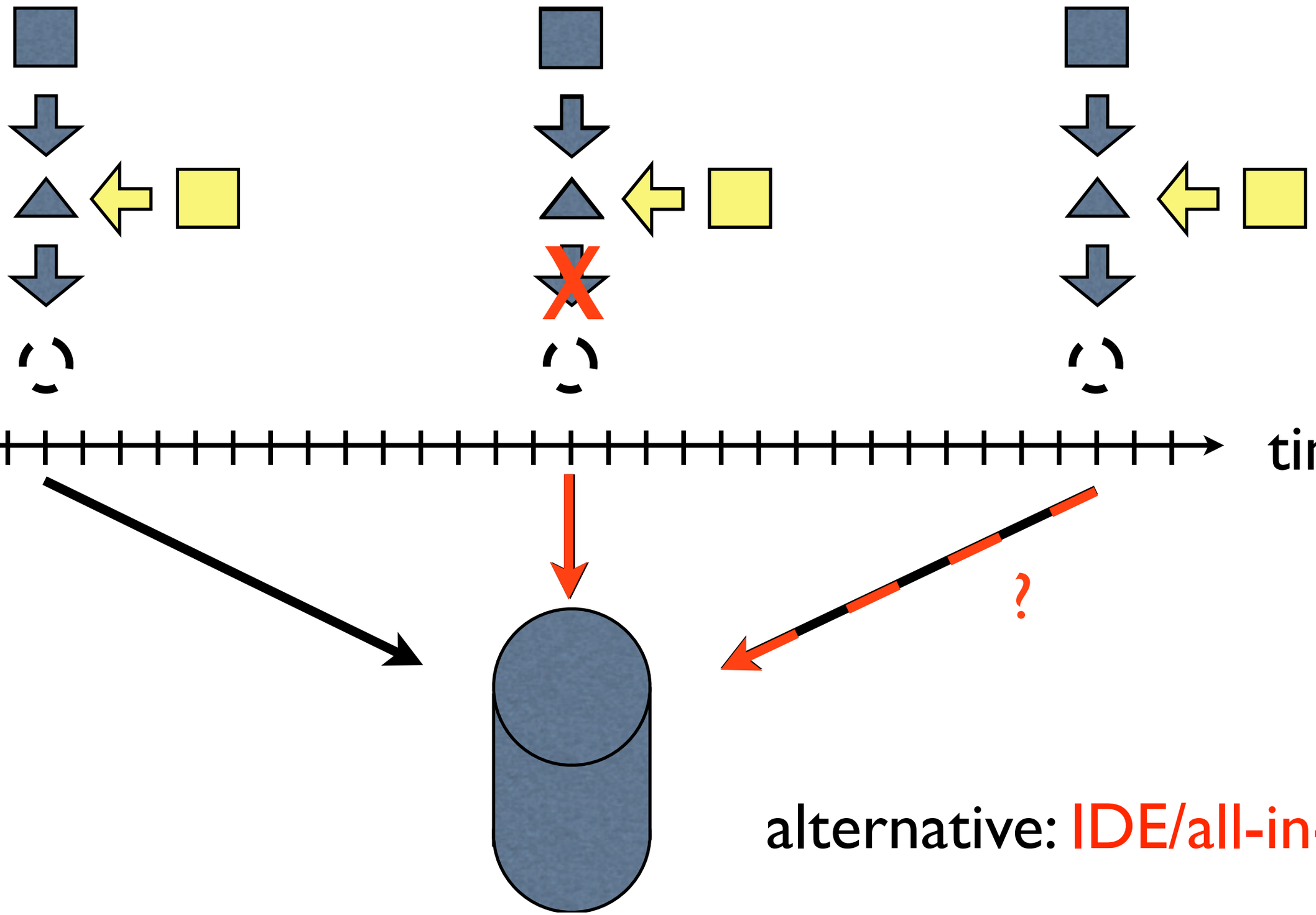
- pre-AOP:
  - file-level composition

current build systems

- AOP:
  - subfile-level, dynamic composition
  - whole-program view needed

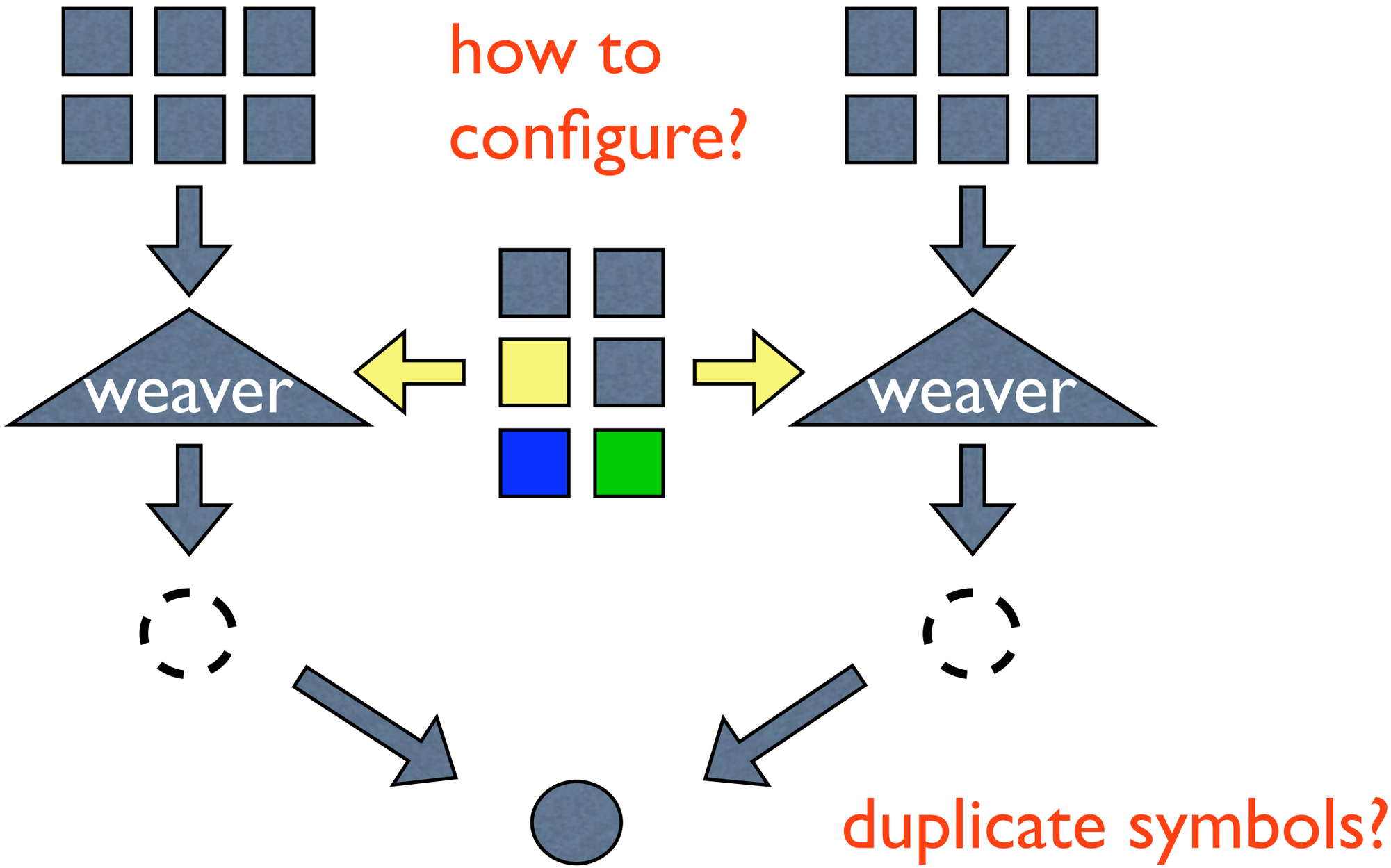
AOP-aware build systems

Repository

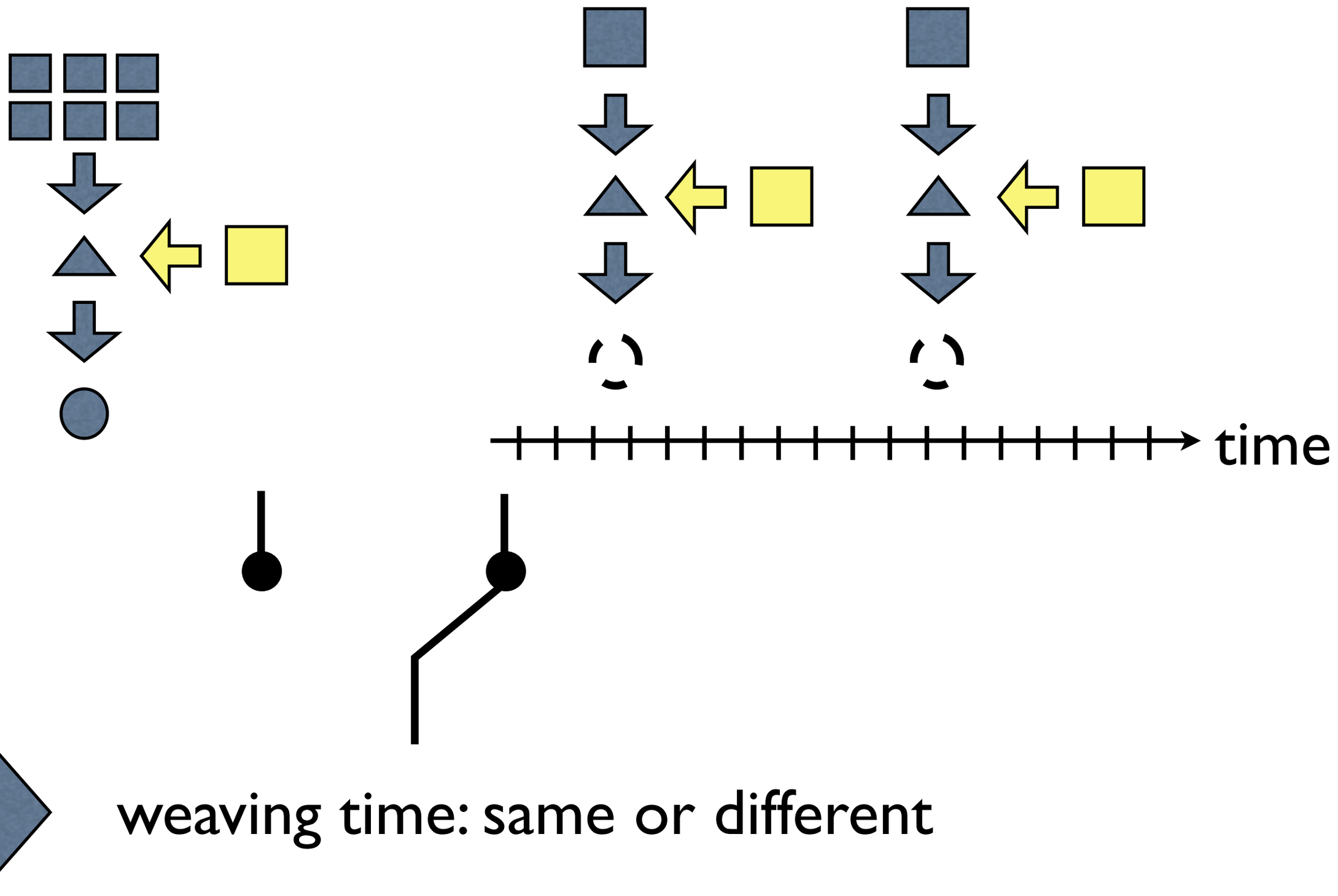


alternative: IDE/all-in-one

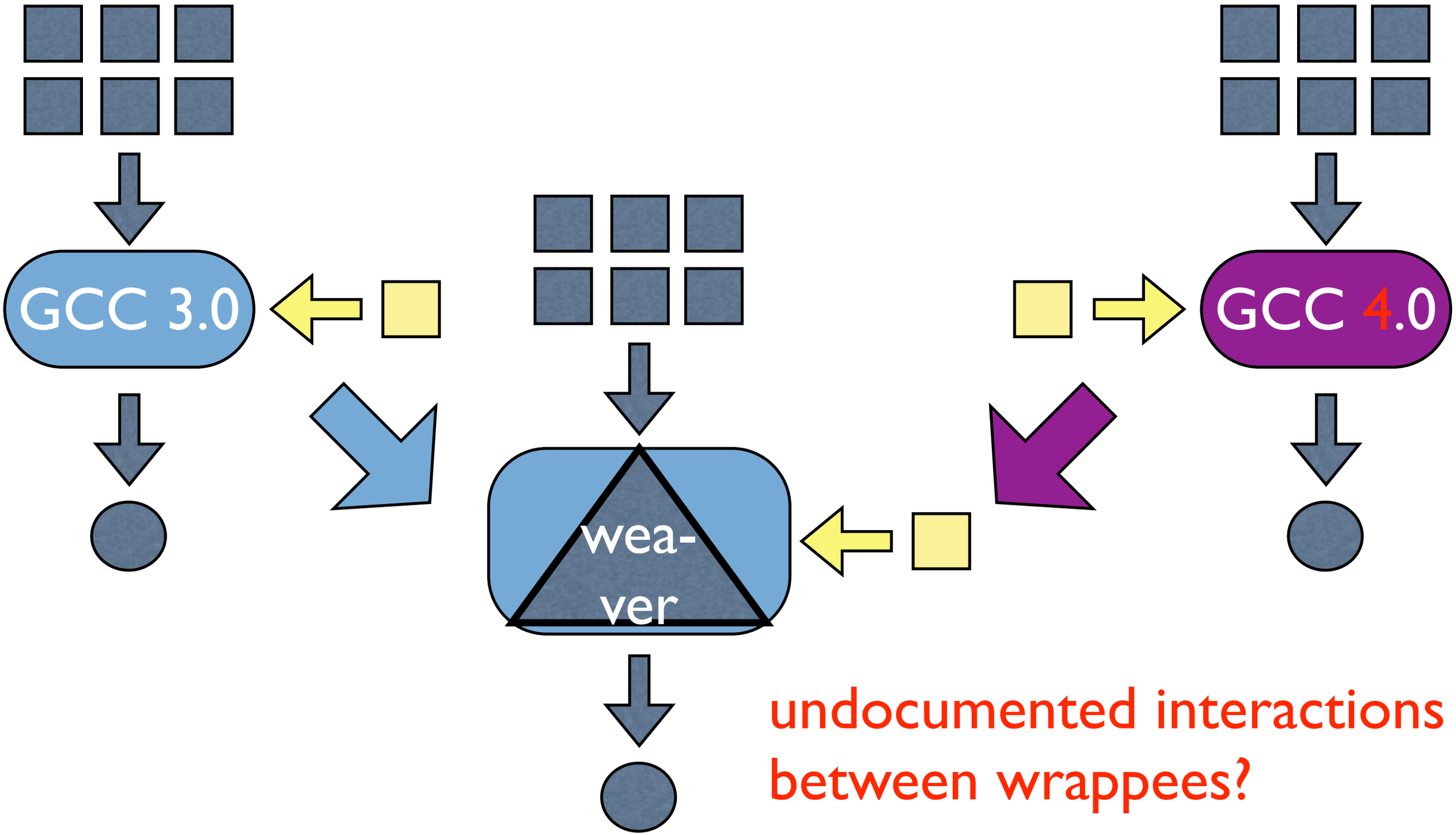
Support code



Switching between 2 or more weavers



Wrappers



undocumented interactions between wrappees?

Modes

- AspectC++:
  - whole-program ↔ single-translation unit
- ACC:
  - batch ↔ sequential weaving

	simple	complex
global	accmake	tacc (aspects in base directory)
		manually
local	manually	

	preprocessing	compiling	link-time	load-time	run-time
language					context?
tool	require all input repository weaver intelligence weaver modes		whole-program view (in theory)		
	all-in-one build/IDE MAKAO				
user	technical integration wrappers				
	preprocessing				idem
	intermediate files				
	library/support code				
	switch weavers test woven code				

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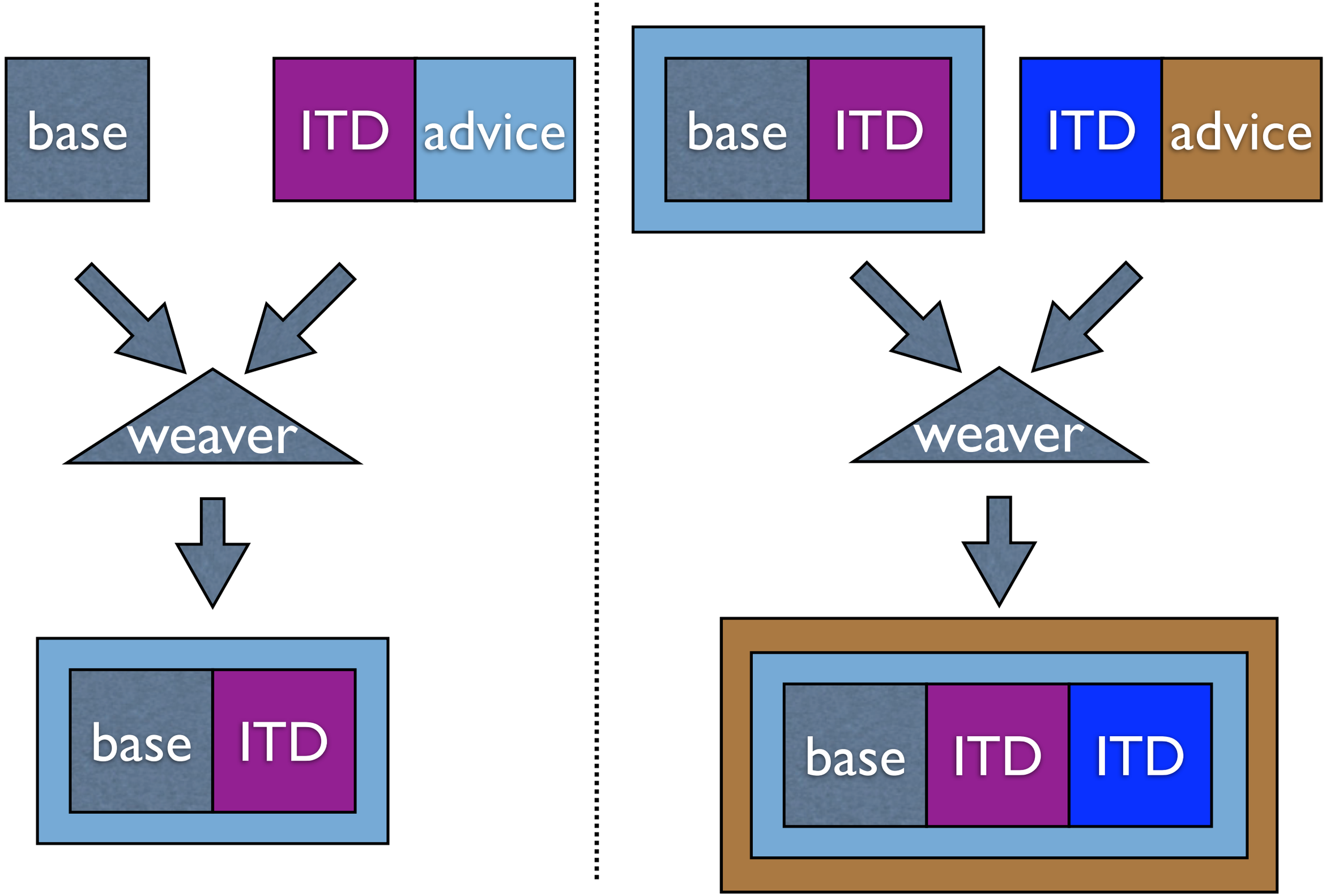
d. Build order

- pre-AOP:
  - separate compilation (Modula)
  - independent compilation (C/C++/Java)

- AOP: order of aspects
  - explicit control?
  - weaver implementation-dependent?

Bounded quantification



Build Order

	prepro-cessing	compile-time	link-time	load-time	run-time
language	lexical and configuration-based conventions language control (precedence)				programmatic
tool	CT's (base code-independent) GROOVE (whole-program view needed) feature map				
	bounded quantification				
				class loader	
user	build configuration flow				

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e. Incremental Compilation

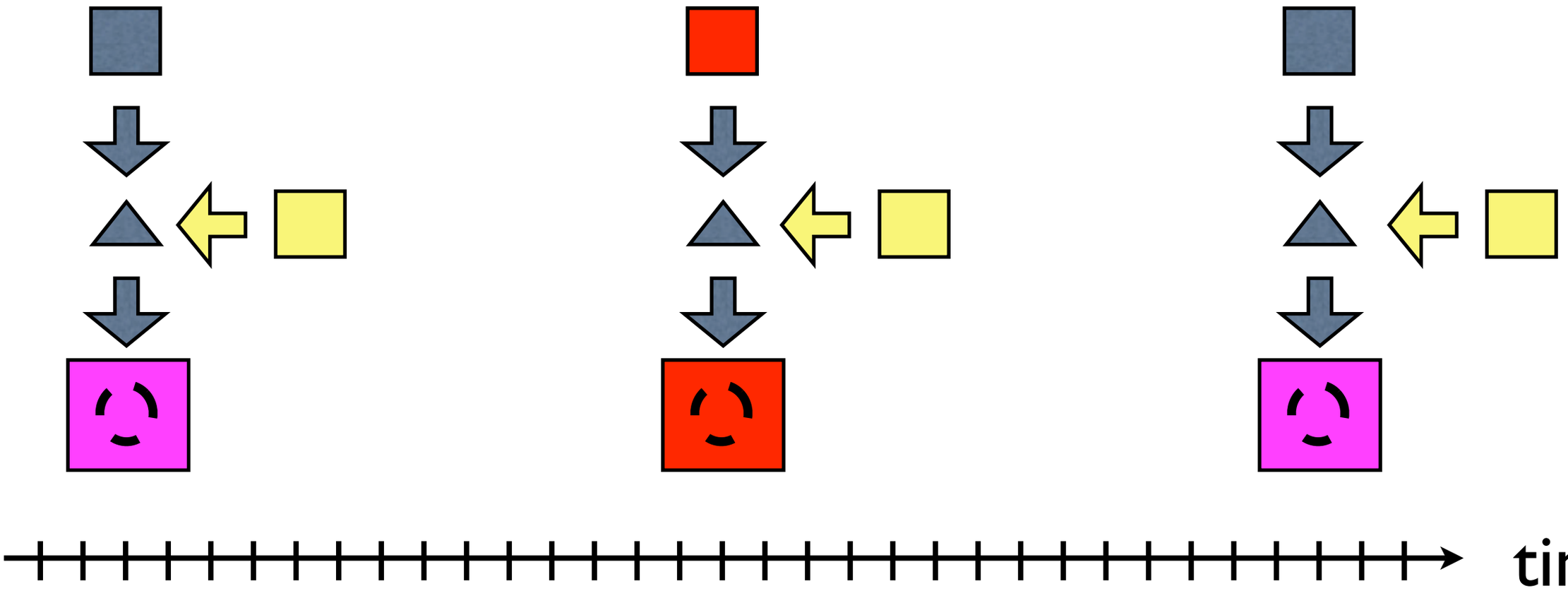
	X build time
WeaveC	2 (→1.3)
Aspicere1	70
C4	4 (→2)
AspectJ	“4”
abc	8
Compose*	→<2

- Problems:
  - no weaver from scratch
  - whole-program reasoning
  - traditional incremental compilation not applicable

Aspect configuration

- limit scope of aspects in build configuration:
  - extra/missing matches
  - implicit dependencies?
  - weaver-dependent
- partition base code (e.g. AspectJ)
  - according to non-interacting aspects
  - weave into binary form

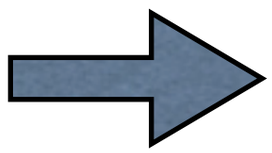
Caching



- source-to-source weavers (AspectC++)
- compile-time (AspectJ)

Incremental Compilation

	prepro-cessing	compile-time	link-time	load-time	run-time
language					
tool	caching			by design	
	explicit weaver support				
user	aspect configuration				
	partitioning system				



limit expressivity aspect language?

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Conclusion

- No structural solutions for build integration
- Many open questions... ⇒ opportunities for research :-)
- AOP-aware build system?

QUESTIONS?