

# Modifizierung der Xcode Toolchain

...am Beispiel einer Diplomarbeit:  
“Abwärtskompatibilität von iOS Apps”

# Agenda

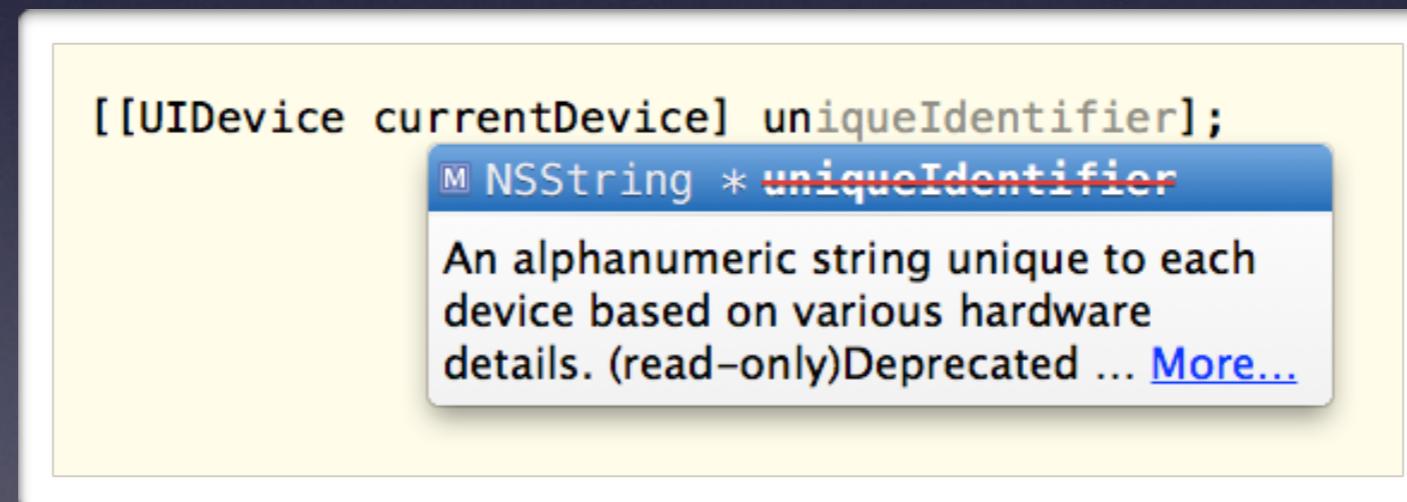
- Motivation der Arbeit
- Das Ergebnis: Demo eines Prototyps
- Der Weg:
  - Konzept
  - Komponenten
  - Einbindung in Xcode

# Motivation

- 93 % aller aktiven iOS-Geräte mit iOS 6
- ...auch 7 % sind Millionen Geräte!
- Ziel:
  - Klare Priorisierung der neusten Version
  - Minimale Funktionalität mit minimalem Aufwand für älteren Versionen sicherstellen

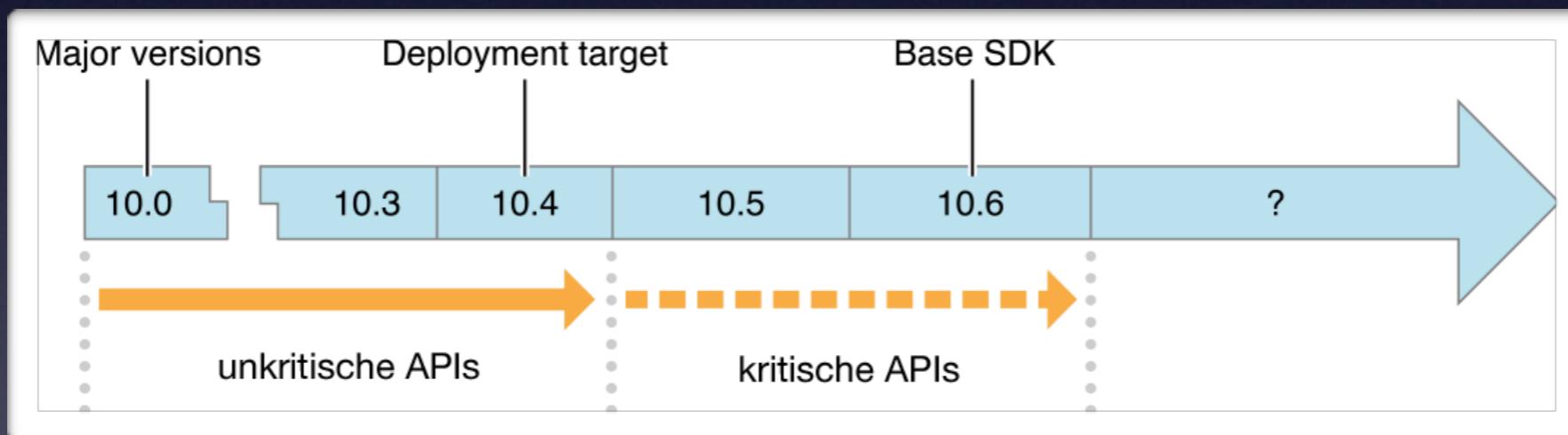
# Das Problem

- ...welche APIs wurden wann eingeführt?
- Xcode warnt nur bei veralteten/entfernten APIs



# Kritische APIs...

- ...sind alle APIs, die nach dem Deployment Target eingeführt worden sind



- Aufruf kritischer API: Crash (meistens)

# Ziel

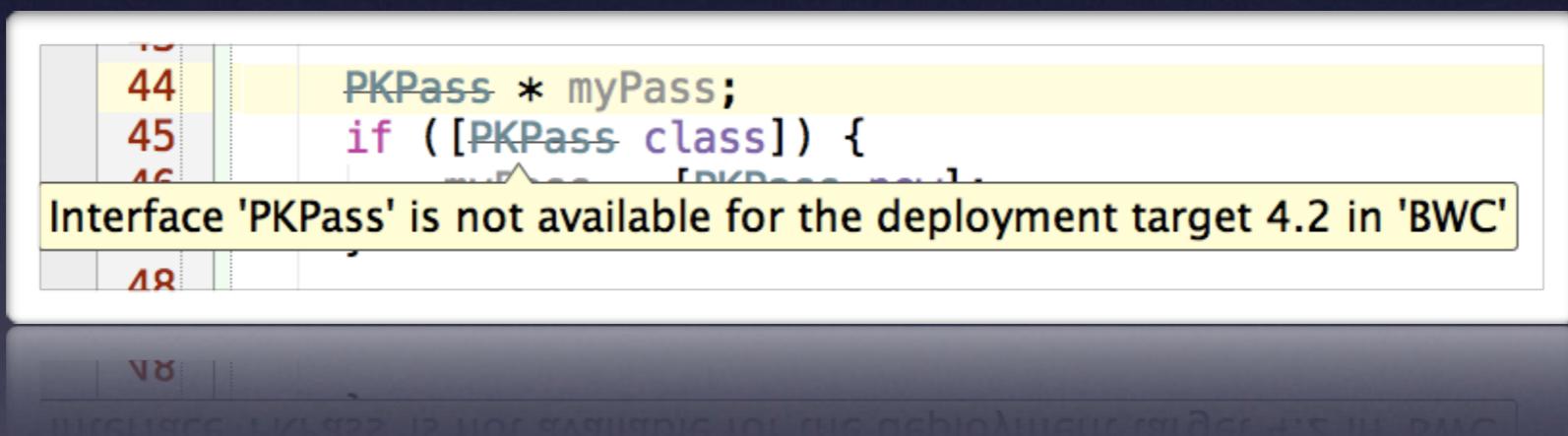
- Xcode soll kritische APIs...
  - finden (**Detektion**) und
  - auflösen (**Auflösung**)

# Status Quo

- Detektion:
  - AppCode

# Status Quo

- Detektion:
- AppCode



# Status Quo

- Detektion:
  - AppCode
  - Deploymate

Deploymate

Analyze Stop Target Deployment OS iOS 4.3 Open in Xcode

CriticalApiApp ~/Desktop

Frameworks 1 issue

FirstViewController.m 8 issues

setBackgroundImage: Available in iOS 5.0

UIBarMetricsDefault Available in iOS 5.0

setShadowImage: Available in iOS 6.0

setAllowsCellularAccess: Available in iOS 6.0

suppressesIncrementalRendering

scrollView Available in iOS 5.0

scrollView Available in iOS 5.0

presentViewControllerAnimated:completion:

SecondViewController.m 24 issues

deferredLocationUpdatesAvailable

allowDeferredLocationUpdatesUntilTraveled:time

```
31 // Only once!
32 self.showPopup = YES;
33 }
34 return self;
35 }
36
37 - (void)viewDidLoad
38 {
39     [super viewDidLoad];
40
41     // Style the navigation bar
42     [self.navigationBar setBackgroundImage:[UIImage imageNamed:@"bg_nav_bar"]
43                                     forBarMetrics:UIBarMetricsDefault];
44     [self.navigationBar setShadowImage:[UIImage imageNamed:@"shadow_tab_bar_grad"]];
45
46     // Set up the web view
47     NSURL *url = [NSURL URLWithString:@"http://inf.tu-dresden.de/"];
48    NSMutableURLRequest *request = [NSMutableURLRequest requestWithURL:url];
49     request.allowsCellularAccess = NO;
50     self.webView.suppressesIncrementalRendering = YES;
51     self.webView.backgroundColor = [UIColor scrollViewTexturedBackgroundColor];
52     self.webView.scrollView.showsHorizontalScrollIndicator = NO;
53     self.webView.scrollView.showsVerticalScrollIndicator = NO;
54     [self.webView loadRequest:request];

```

FirstViewController.m

**setBackgroundImage:forBarMetrics:**

UINavigationBar

Sets the background image for given bar metrics.

**Available in iOS 5.0 and later**

# Status Quo

- Detektion:
  - AppCode
  - Deploymate
- Auflösung:
  - Best Practices/Dokumentation

# “Best Practices”

- Intention des Entwicklers

```
[self.navigationBar setShadowImage:sImage];
```

# “Best Practices”

- Umsetzung

```
if ([self.navigationBar respondsToSelector:@selector(setShadowImage:)]) {  
    [self.navigationBar setShadowImage:sImage];  
}
```

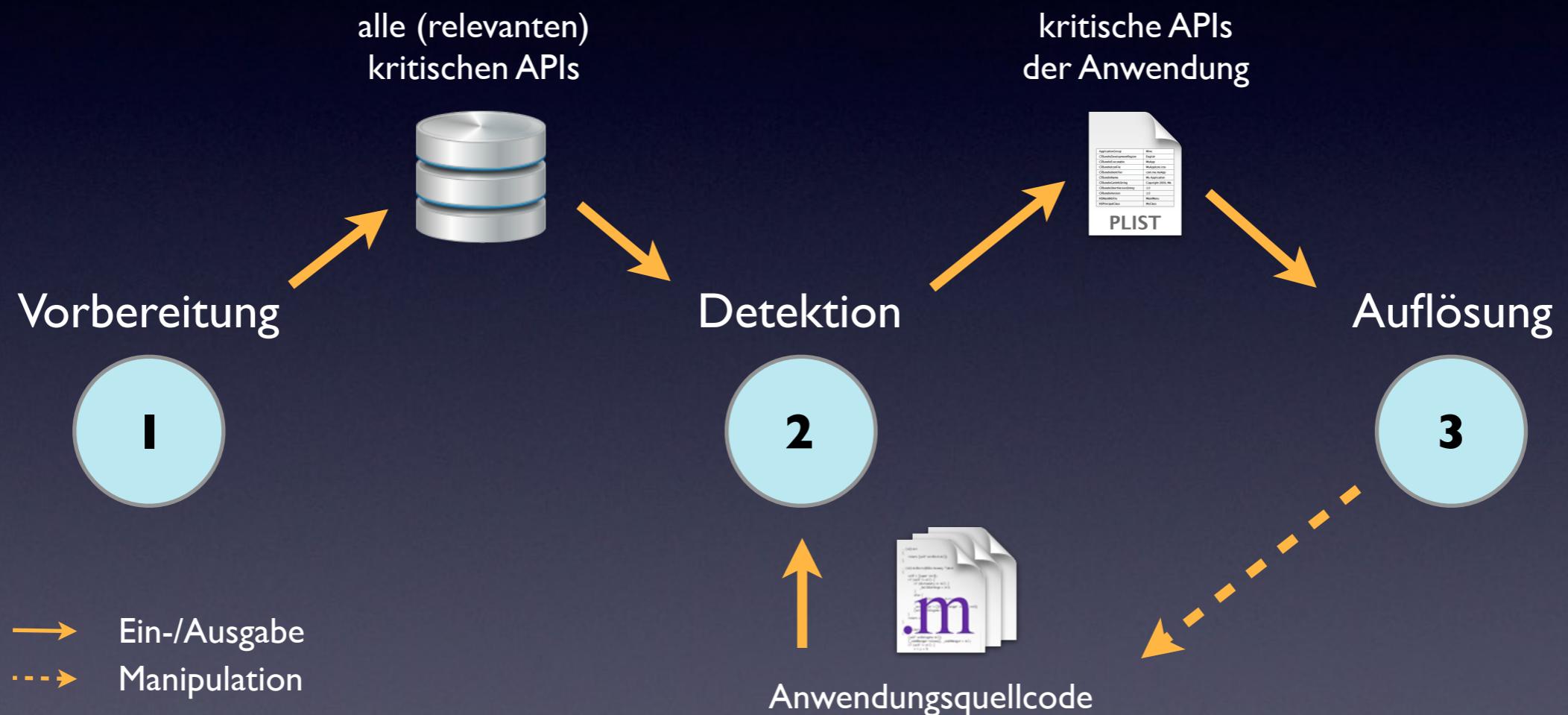
- Overhead in Zeilen: 200 %

# “Best Practices”

```
if ([self.navigationBar respondsToSelector:@selector(setShadowImage:)]) {  
    [self.navigationBar setShadowImage:sImage];  
}  
if ([self.navigationBar respondsToSelector:@selector(setBackgroundImage:forBarMetrics:)]) {  
    [self.navigationBar setBackgroundImage:bImage  
        forBarMetrics:UIBarMetricsDefault];  
} else {  
    self.navigationBar.tintColor = [UIColor greenColor];  
}  
}  
self.navigationBar.tintColor = [UIColor blackColor];
```

# *Demo*

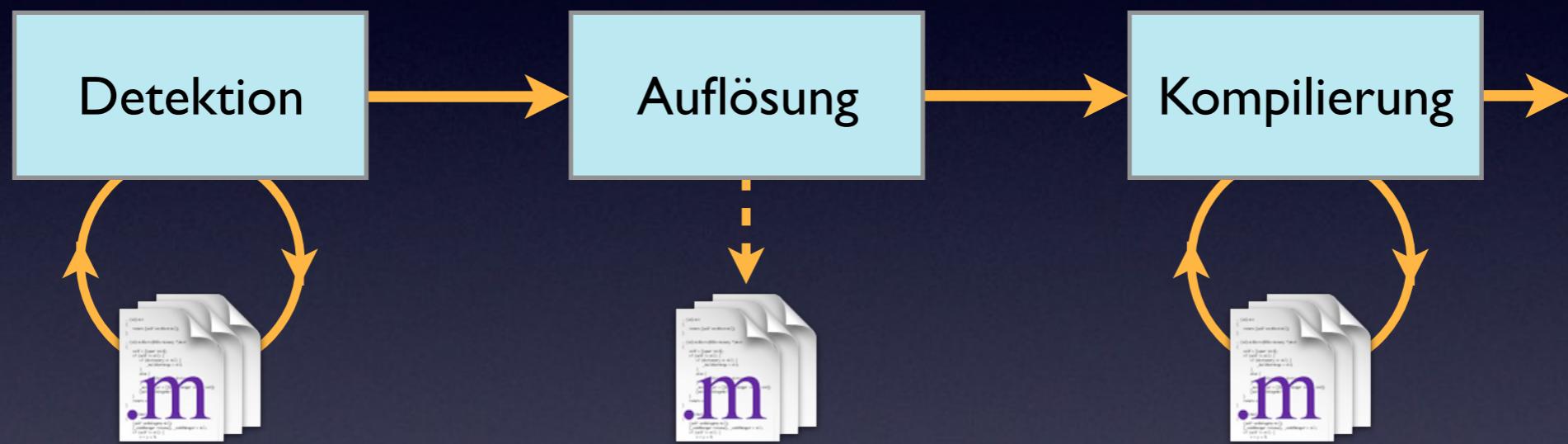
# Konzept: 3 Phasen



# I. Vorbereitung

- Zur Verfügung stehen:
  - API Diffs (HTML)
  - Dokumentation (HTML)
  - Header (C/Objective-C)

# 2. Detektion



Lesender Durchlauf des Quellcodes

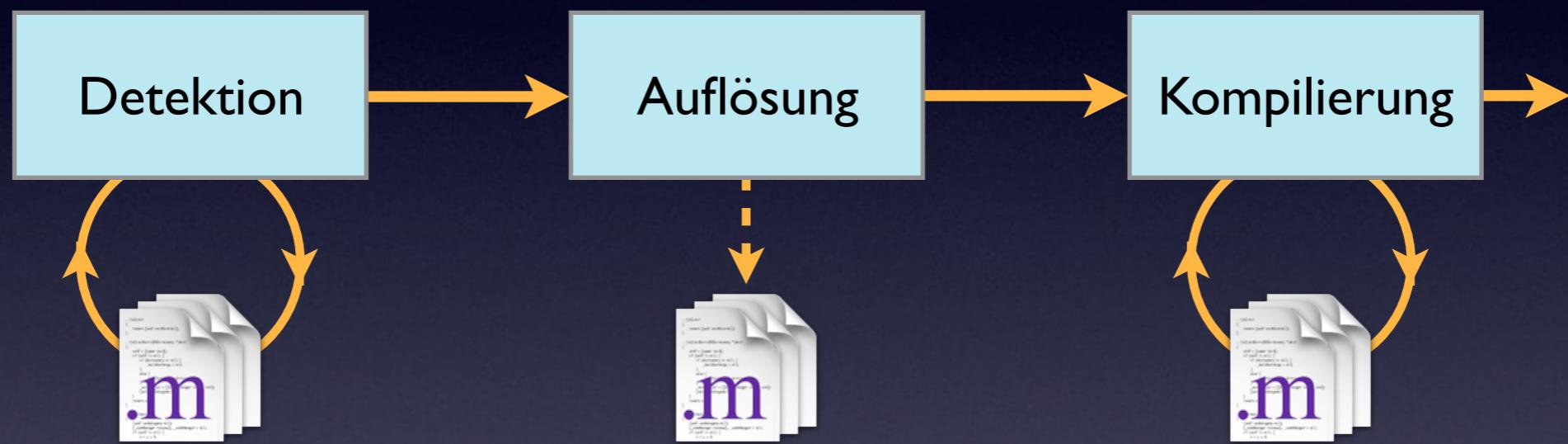


Manipulation des Quellcodes

# 2. Detektion

- Möglichkeiten:
  - Textuelle Suche (`grep`)
  - Symbolische Suche (Compiler-Bibliotheken)
  - Compilierung mit verschiedenen SDKs
  - Redefinition von Verfügbarkeitsmakros
  - ...

# 2. Detektion

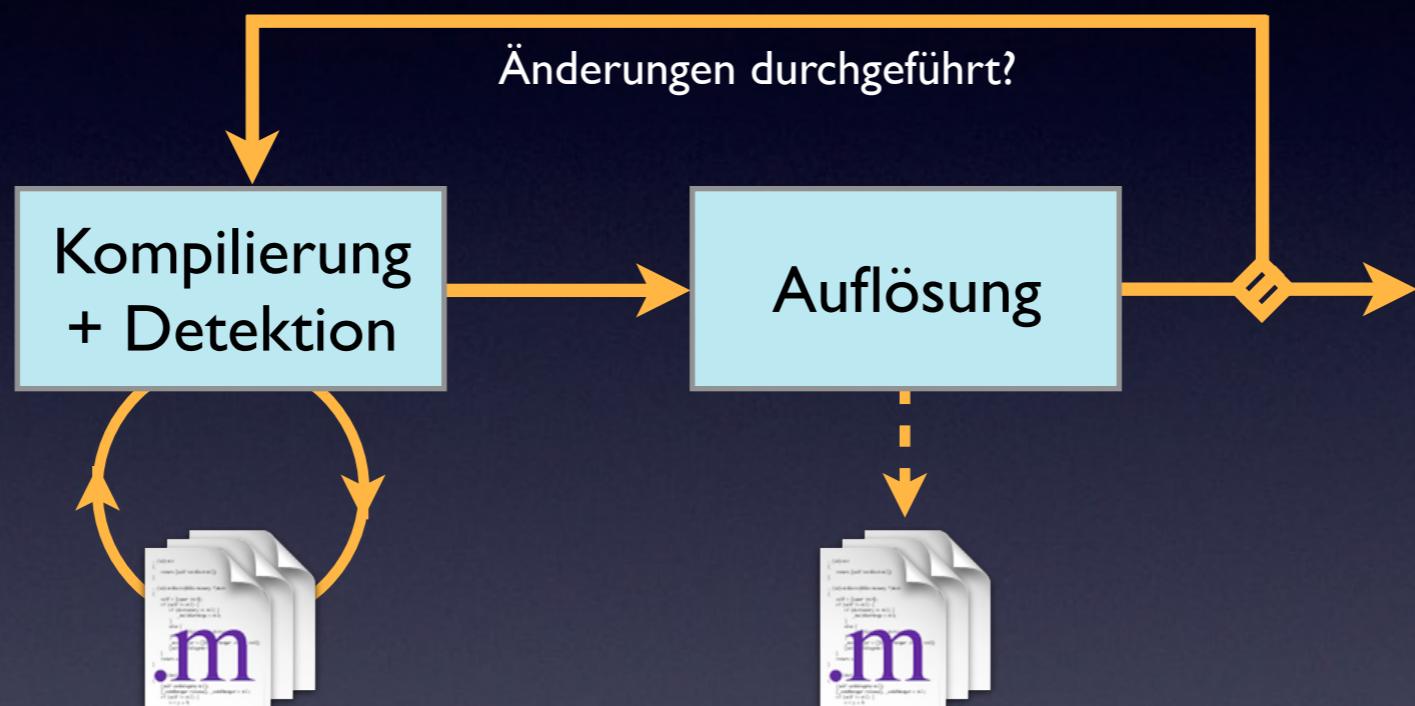


Lesender Durchlauf des Quellcodes



Manipulation des Quellcodes

# 2. Detektion

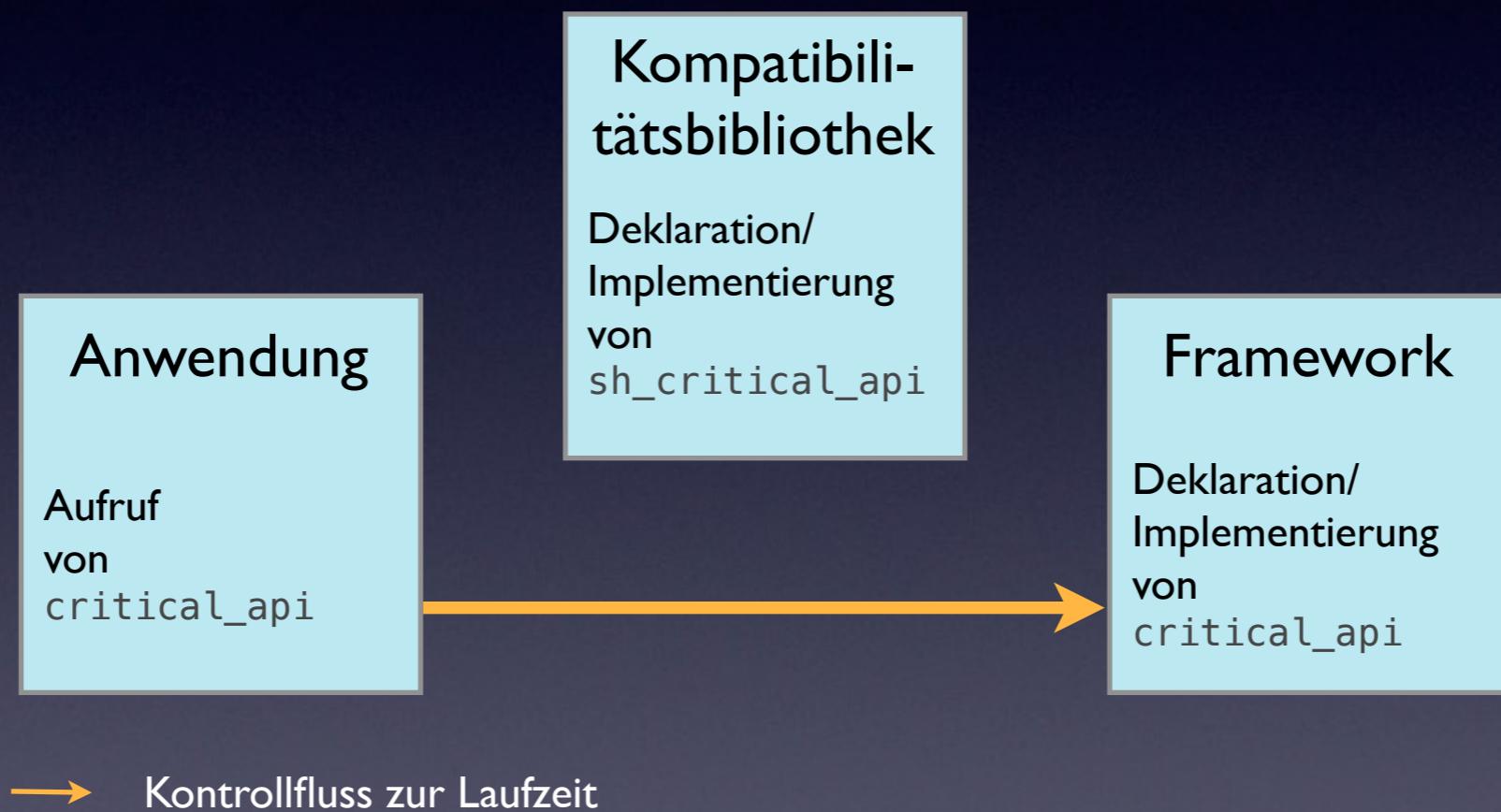


⟳ Lesender Durchlauf des Quellcodes

---> Manipulation des Quellcodes

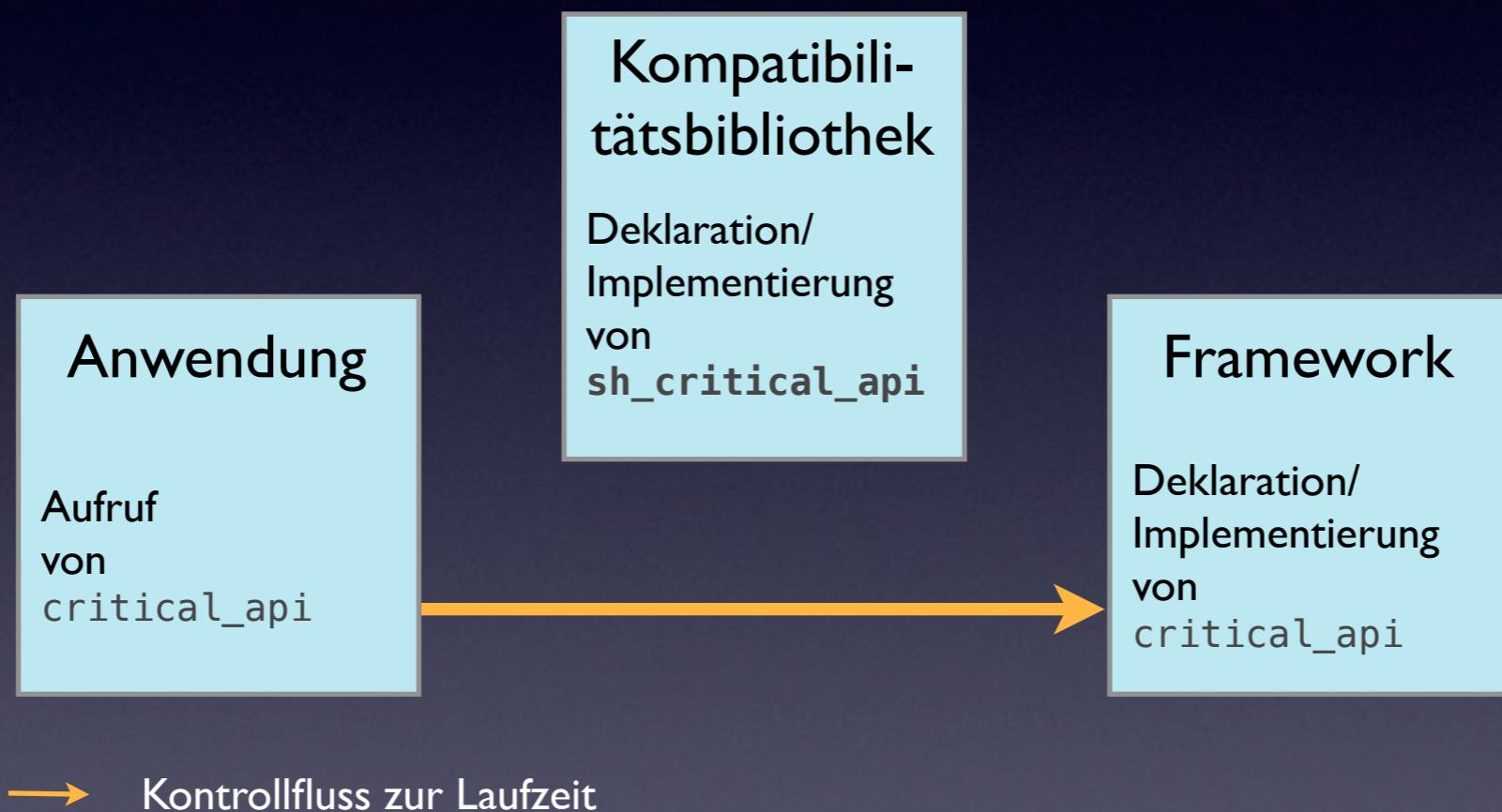
# 3. Auflösung

## Generierung einer Bibliothek



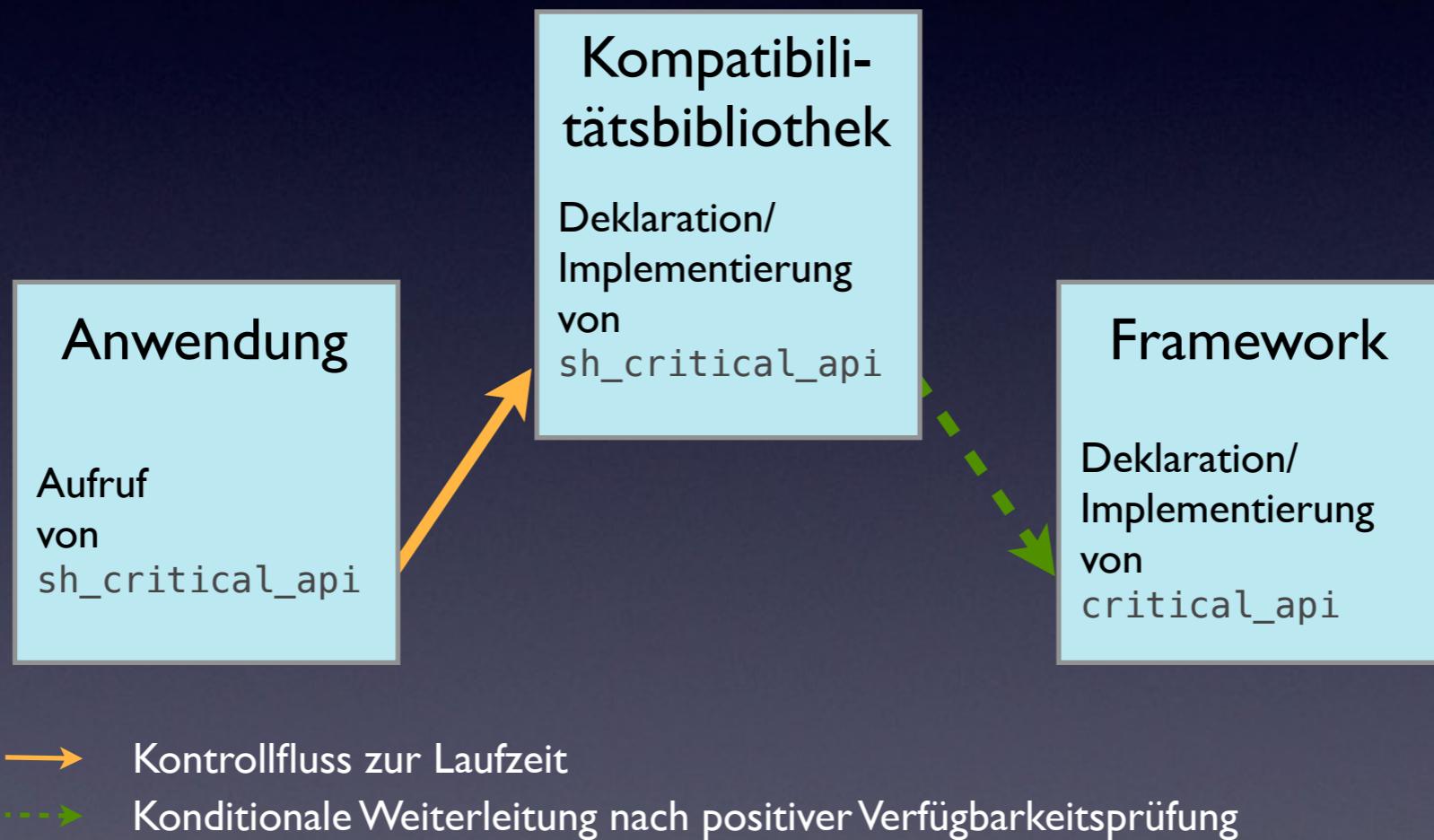
# 3. Auflösung

## Generierung einer Bibliothek



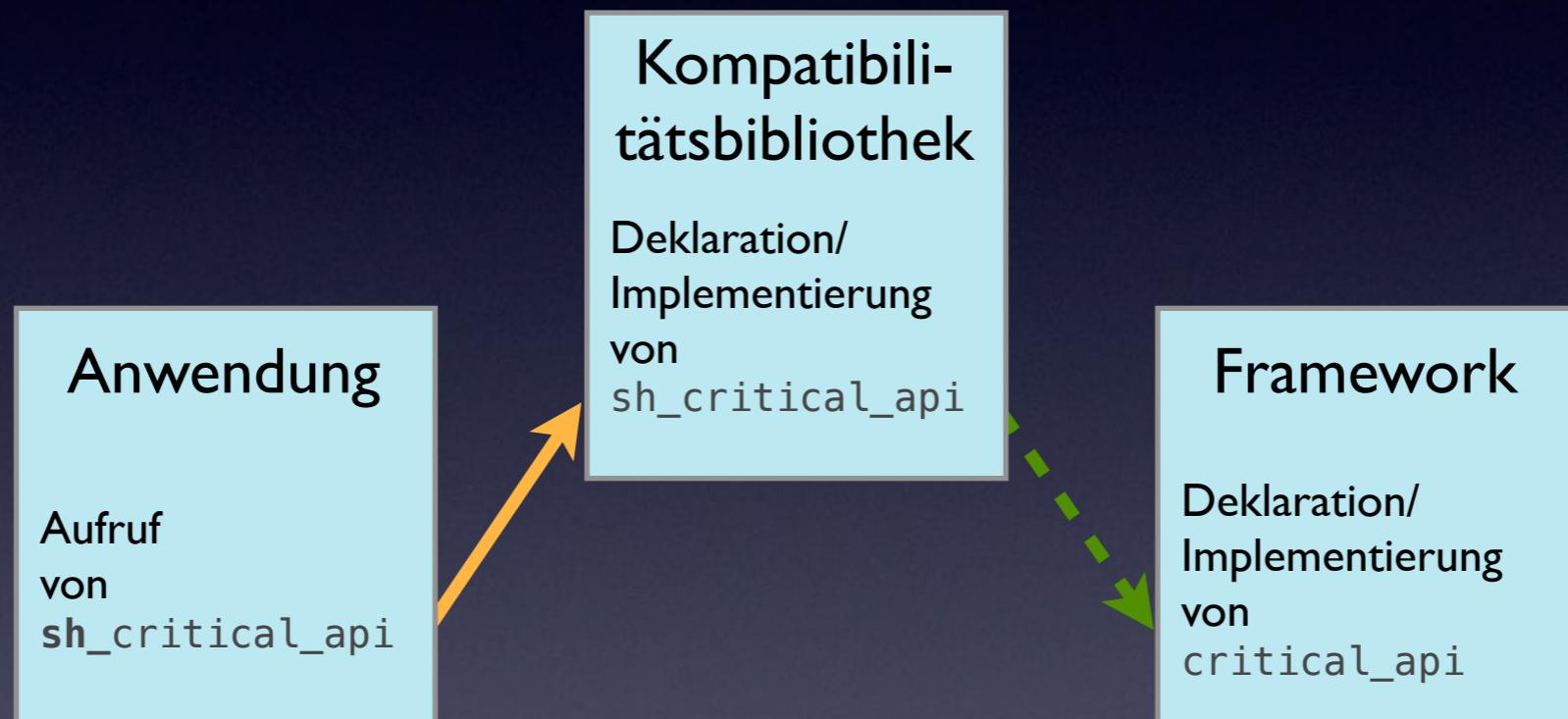
# 3. Auflösung

## Statische Umleitung (senderseitig)



# 3. Auflösung

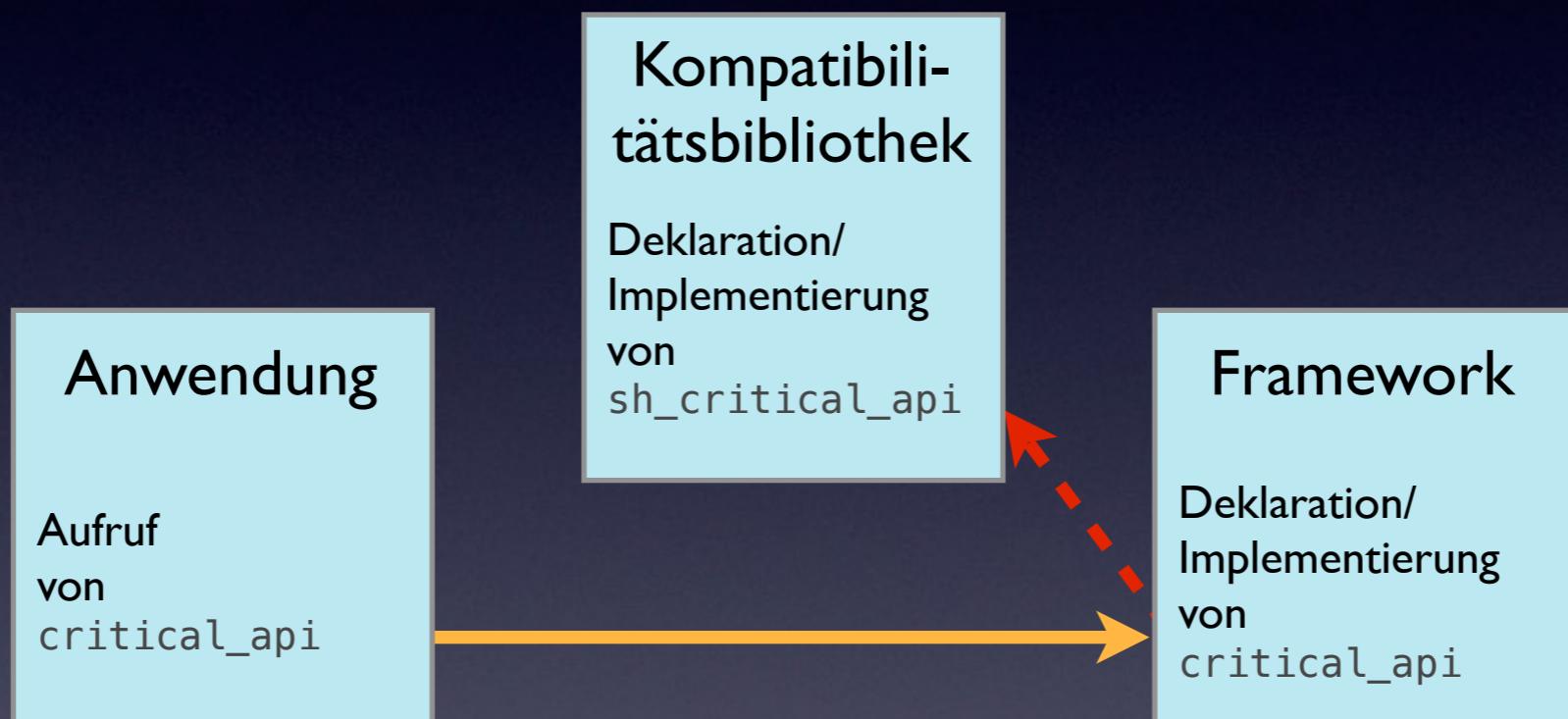
## Statische Umleitung (senderseitig)



- Kontrollfluss zur Laufzeit
- Konditionale Weiterleitung nach positiver Verfügbarkeitsprüfung

# 3. Auflösung

## Dynamische Umleitung (empfängerseitig)



- Kontrollfluss zur Laufzeit
- Konditionale Weiterleitung nach negativer Verfügbarkeitsprüfung

# Komponenten

- `xcodeprojectcheck`:
  - Detektion in Konfigurationsdateien
- Clang Compiler (modifiziert):
  - Vorbereitung (implizit) & Detektion
- `unsafeApiResolver`:
  - Codegenerierung & Einbindung

# Build Phasen

- ▶ Target Dependencies (0 items)
- ▶ Compile Sources (2 items)
- ▶ Link Binary With Libraries (3 items)
- ▶ Copy Bundle Resources (4 items)

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# Build Phasen

- ▶ Target Dependencies (0 items)
- ▶ xcodeprojectcheck
- ▶ Compile Sources (2 items) 
- ▶ unsafeApiResolver
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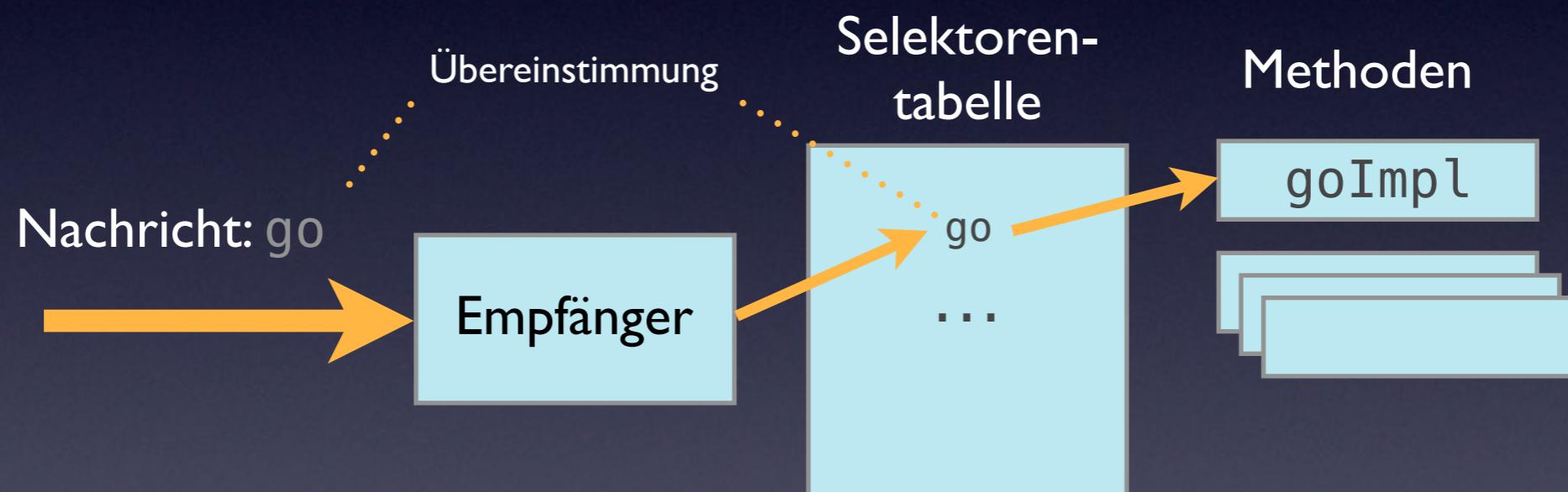
# Compiler einbinden

```
✓ Compile main.m ...in /Users/Hagi/Desktop/CriticalApiApp/CriticalApiApp
CompileC /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/Objects-normal/armv7/main.o CriticalApiApp/main.m normal armv7 objective-c com.apple.compilers.llvm.clang.1_0.compiler
cd /Users/Hagi/Desktop/CriticalApiApp
setenv LANG en_US.US-ASCII
setenv PATH "/Applications/Xcode.app/Contents/Developer/Platforms/iPhoneOS.platform/Developer/usr/bin:/Applications/Xcode.app/Contents/Developer/usr/bin:/usr/bin:/bin:/usr/sbin:/bin:/sbin"
/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/bin/clang -x objective-c -arch armv7 -fmessage-length=0 -std=gnu99 -fobjc-arc -Wno-trigraphs -fpascal-strings -O0 -Wno-missing-field-initializers -Wno-missing-prototypes -Wreturn-type -Wno-implicit-atomic-properties -Wno-receiver-is-weak -Wduplicate-method-match -Wformat -Wno-missing-braces -Wparentheses -Wswitch -Wno-unused-function -Wno-unused-label -Wno-unused-parameter -Wunused-variable -Wunused-value -Wempty-body -Wuninitialized -Wno-unknown-pragmas -Wno-shadow -Wno-four-char-constants -Wno-conversion -Wconstant-conversion -Wint-conversion -Wenum-conversion -Wno-shorten-64-to-32 -Wpointer-sign -Wno-newline-eof -Wno-selector -Wno-strict-selector-match -Wno-undeclared-selector -Wno-deprecated-implementations -DDEBUG=1 -isysroot /Applications/Xcode.app/Contents/Developer/Platforms/iPhoneOS.platform/Developer/SDKs/iPhoneOS6.1.sdk -fstrict-aliasing -Wprotocol -Wdeprecated-declarations -g -Wno-sign-conversion -miphoneos-version-min=4.3 -iquote /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/CriticalApiApp-generated-files.hmap -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/CriticalApiApp-own-target-headers.hmap -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/CriticalApiApp-all-target-headers.hmap -iquote /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/CriticalApiApp-project-headers.hmap -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Products/Debug-iphoneos/include -I/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/include -I/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/include -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/DerivedSources/armv7 -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/DerivedSources -F/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/DerivedSources/armv7 -I/Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Products/Debug-iphoneos -include /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/PrecompiledHeaders/CriticalApiApp-Prefix-beprxuneeoslezfszbkhxxrbvaj/CriticalApiApp-Prefix.pch -MMD -MT dependencies -MF /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/Objects-normal/armv7/main.d --serialize-diagnostics /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/Objects-normal/armv7/main.dia -c /Users/Hagi/Desktop/CriticalApiApp/CriticalApiApp/main.m -o /Users/Hagi/Library/Developer/Xcode/DerivedData/CriticalApiApp-cwvcpfqpkpohxhehdnkdaxjaldlq/Build/Intermediates/CriticalApiApp.build/Debug-iphoneos/CriticalApiApp.build/Objects-normal/armv7/main.o
```

# Compiler einbinden

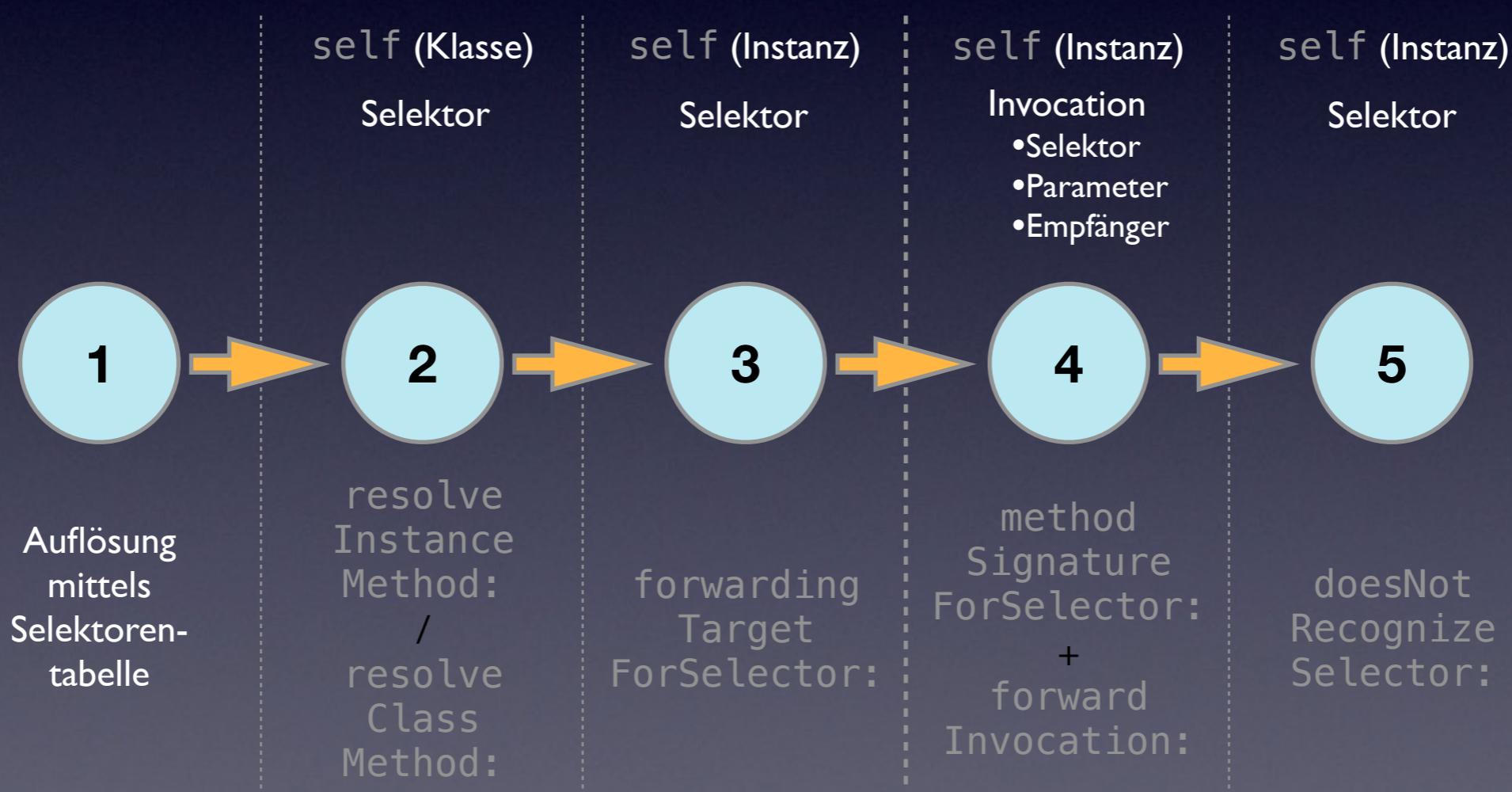
- Überschreiben, inkl. LibClang
- Plugin
- CC
- Neues Verzeichnis: ARC-Bibliotheken und Header in `../lib` platzieren

# Details: Dynamische Auflösung

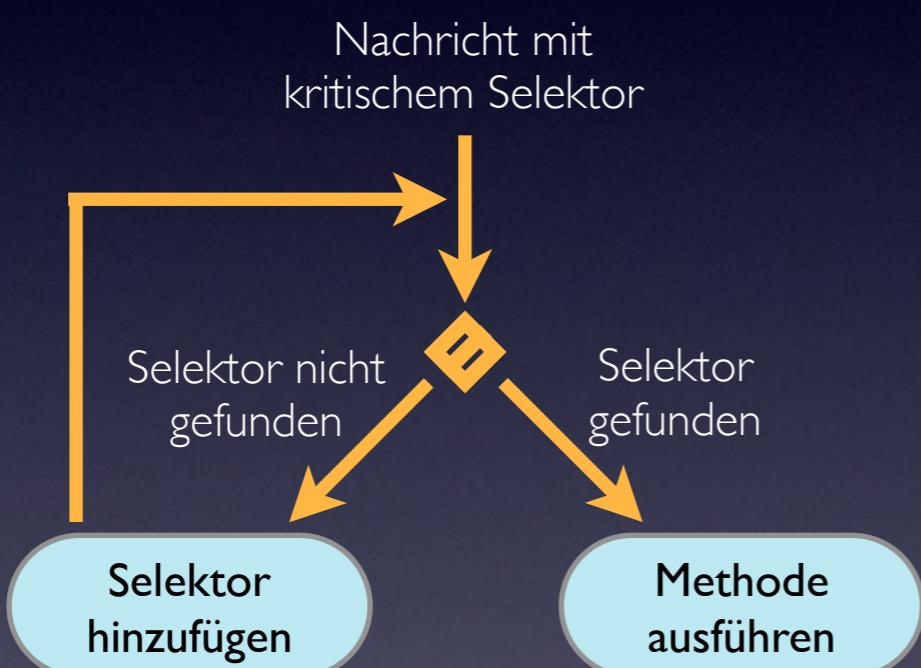


# Details: Dynamische Auflösung

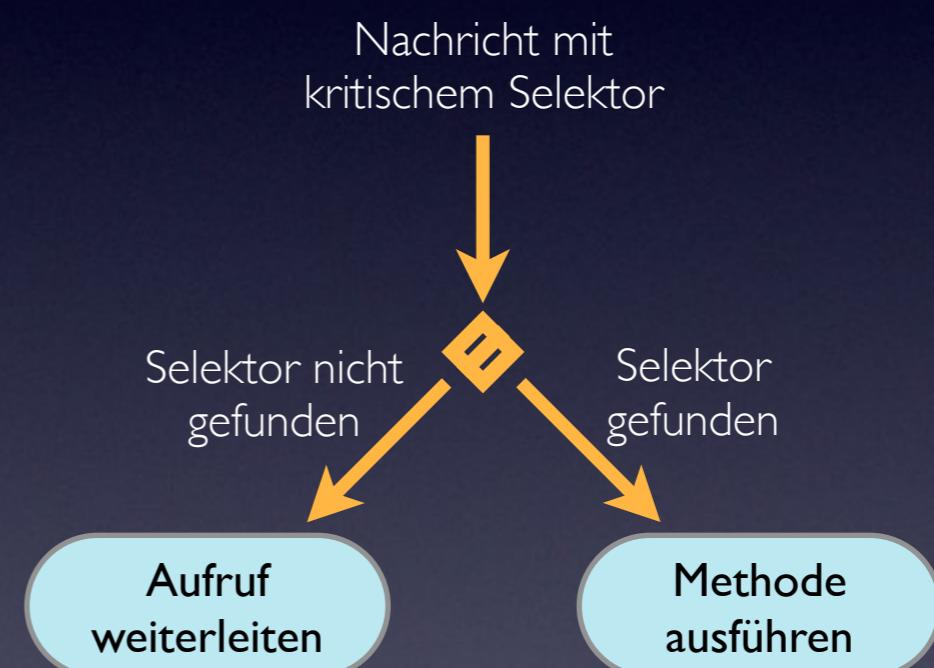
Verfügbarer Kontext:



# Details: Dynamische Auflösung



Stufe 2: Permanente Auflösung  
(`resolveInstanceMethod:`)



Stufe 3: Unmittelbare Weiterleitung  
(`forwardingTargetForSelector:`)

# Details: Dynamische Auflösung



Auswirkungen einer Category "MyObject"

# Details: Dynamische Auflösung



Selektoren vertauschen: Method Swizzling

# Details: Warnungen

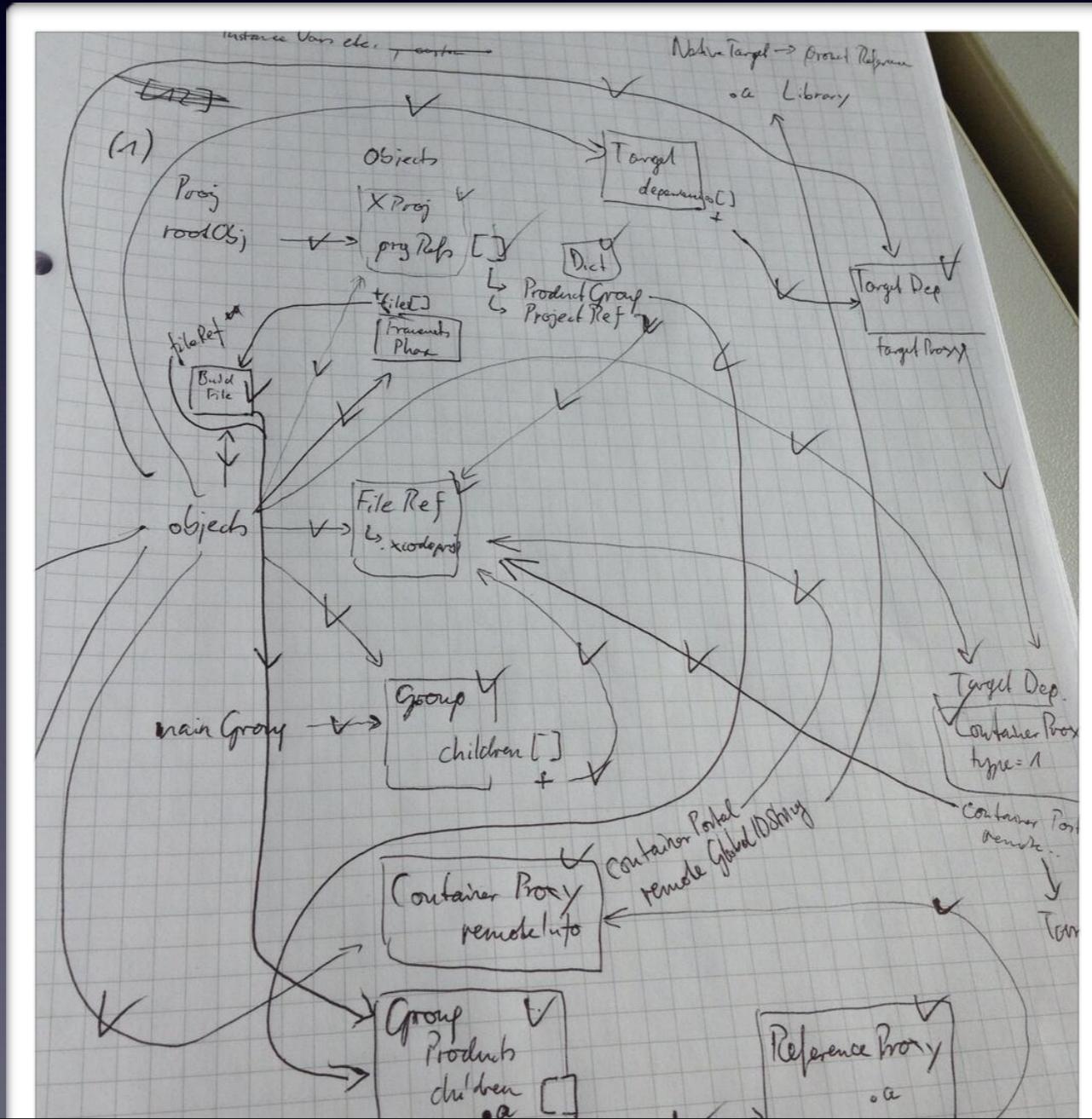
- Clang: Nutzung des vorhandenen Diagnose-Mechanismus, inkl. Flags, Fix-Its & Konventionen (Unterdrückung, Deaktivierung, Gruppierung,...)
- Skripte/Command Line Tools:

```
printf("%s:%d: warning: Your text with parameter %s goes here.\n",
    [fileName UTF8String],
    lineNumber,
   [@"foo" UTF8String]
);
```

# Details: AppleScript

- Ziel: Neustart eines Builds
- Xcode 4 verspricht umfangreiche Script-API: Nicht implementiert
- Lösung: GUI-Scripting

# Projektdateien bearbeiten



# Projektdateien bearbeiten

- Eigentliche Projektdatei: project.pbxproj
- Format: PLIST
- Kommentare bei Änderungen schwer zu erhalten, aber Xcode schreibt Datei bei Änderungen neu

# Fazit

- Build Phasen: Hohe Flexibilität
- Begrenzte Möglichkeit, Xcode-GUI direkt zu beeinflussen
- Zusammenspiel vieler Technologien, um vorgefertigte Werkzeuge umfassend zu modifizieren
- Kaum Dokumentation

Fragen?

# Links

- Eigenen Compiler einbinden: [[Stackoverflow](#)]
- Objective-C, simplified: eero [[Webseite](#)]
- Unsafe API Resolver [[Repository](#)]
- Feedback: [shagedorn.dd@gmail.com](mailto:shagedorn.dd@gmail.com) /  
<http://twitter.com/hagidd>