Best Practices for Progress Reporting

Session 232

Vince Spader Cocoa Frameworks Engineer

Agenda

Introduction

Composition

Cancellation, pausing, and resuming

User interface

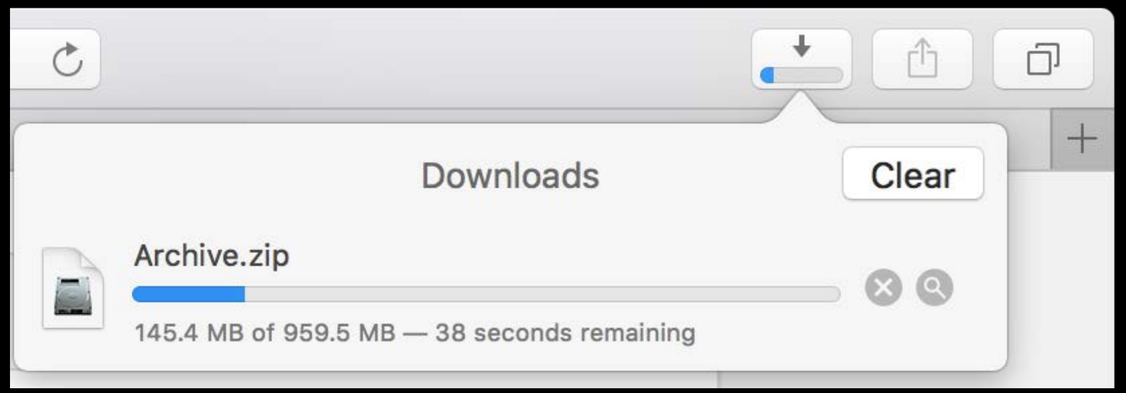
Best practices

Introduction

Introduction

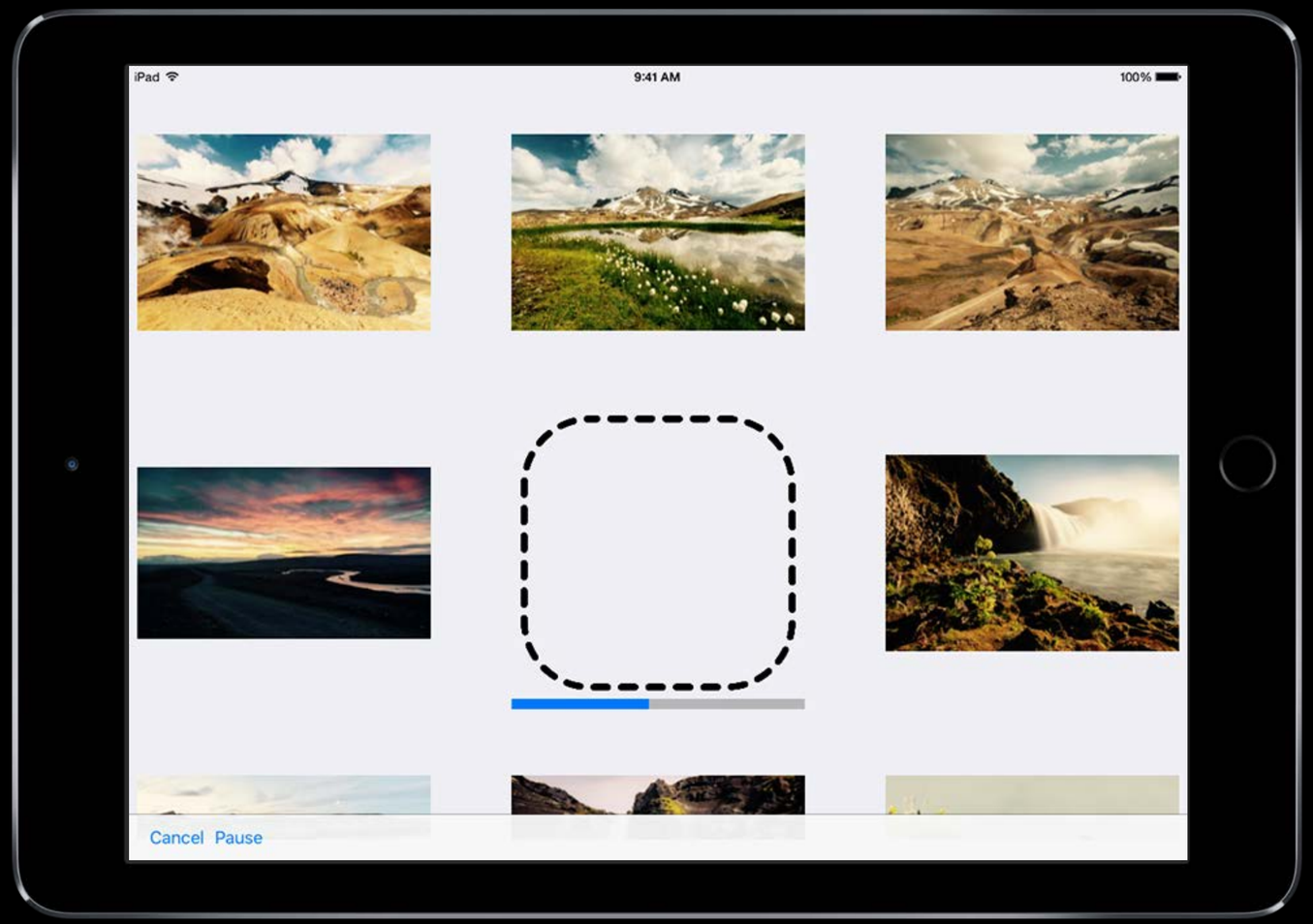
NSProgress represents the completion of some work

Introduction



Introduction

Introduction



Introduction

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Makes it easy to report progress in your app across various components

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Cocoa APIs are reporting their progress via NSProgress

- NSBundleResourceRequest
- UIDocument
- NSData

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Makes it easy to report progress in your app across various components

Cocoa APIs are reporting their progress via NSProgress

- NSBundleResourceRequest
- UIDocument
- NSData

Helps with localization

Introduction

```
var totalUnitCount: Int64
var completedUnitCount: Int64
var fractionCompleted: Double { get }
```

Units

Units

Bytes

Files

Photos

Percentage points

Fraction of work

Anything

Units

```
var indeterminate: Bool { get }
```

Returns true if totalUnitCount < 0 or completedUnitCount < 0

Localization

```
var localizedDescription: String!
var localizedAdditionalDescription: String!
```

Localization

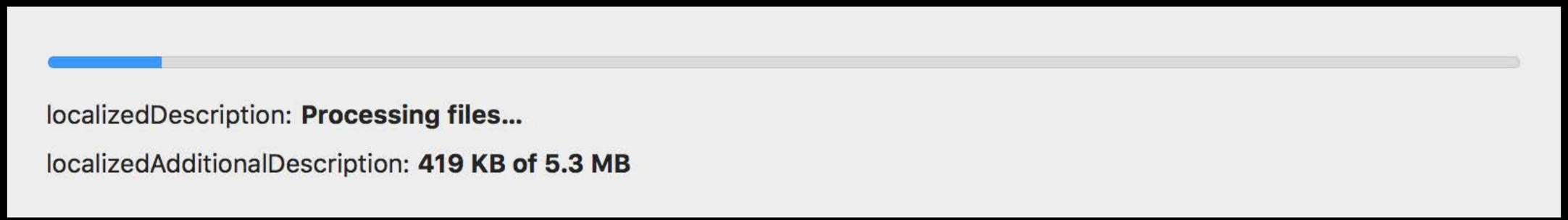
localizedDescription, localizedAdditionalDescription

```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
```

Localization

kind

```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.kind = NSProgressKindFile
```



Localization

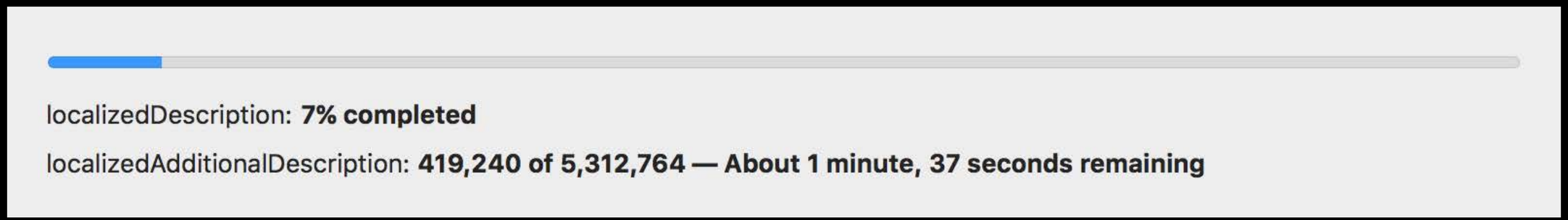
userInfo

```
var userInfo: [NSObject : AnyObject] { get }
func setUserInfoObject(AnyObject?, forKey: String)
```

Localization

userInfo

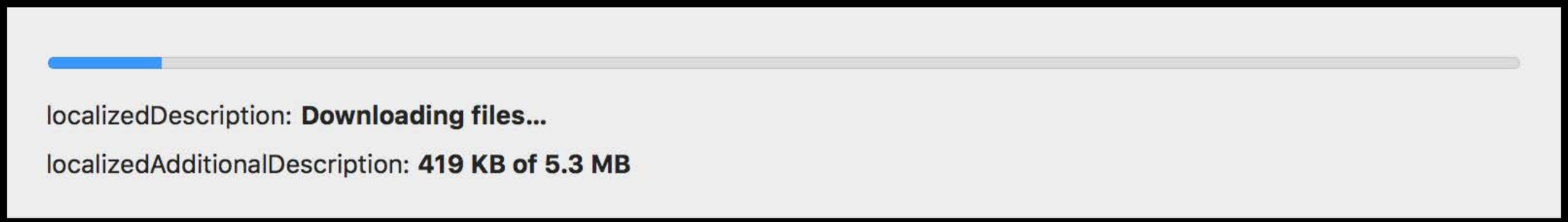
```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.setUserInfoObject(97, forKey: NSProgressEstimatedTimeRemainingKey)
```



Localization

NSProgressKindFile

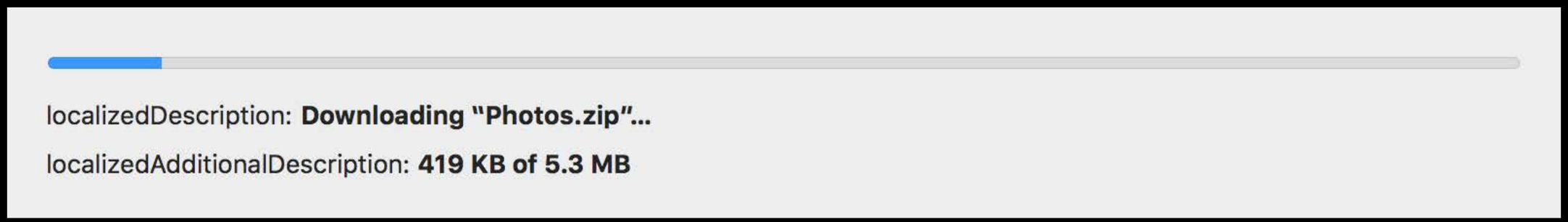
```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.kind = NSProgressKindFile
progress.setUserInfoObject(NSProgressFileOperationKindDownloading,
                           forKey: NSProgressFileOperationKindKey)
```



Localization

NSProgressKindFile

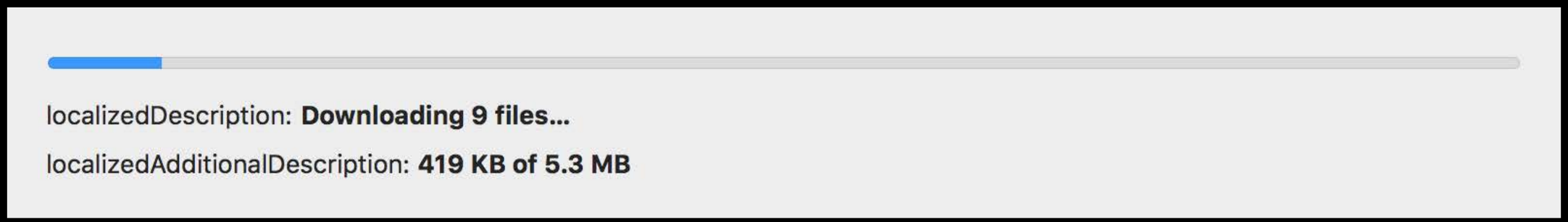
```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.kind = NSProgressKindFile
progress.setUserInfoObject(NSProgressFileOperationKindDownloading,
                           forKey: NSProgressFileOperationKindKey)
progress.setUserInfoObject(url, forKey: NSProgressFileURLKey)
```



Localization

NSProgressKindFile

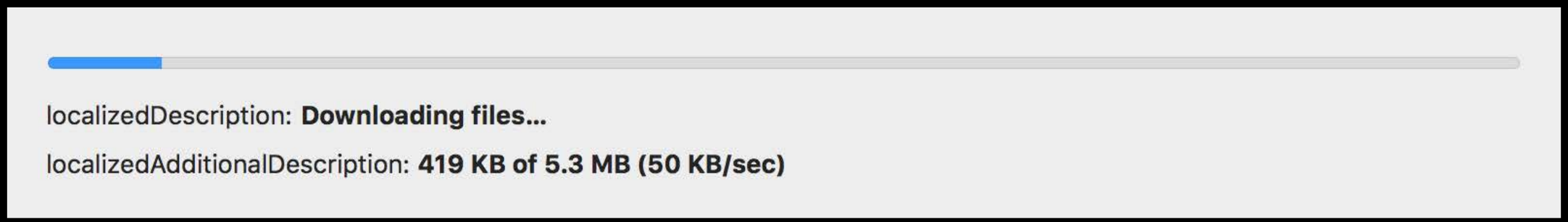
```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.kind = NSProgressKindFile
progress.setUserInfoObject(NSProgressFileOperationKindDownloading,
                           forKey: NSProgressFileOperationKindKey)
progress.setUserInfoObject(7, forKey: NSProgressFileCompletedCountKey)
progress.setUserInfoObject(9, forKey: NSProgressFileTotalCountKey)
```



Localization

NSProgressKindFile

```
let progress = NSProgress()
progress.totalUnitCount = 5_312_764
progress.completedUnitCount = 419_240
progress.kind = NSProgressKindFile
progress.setUserInfoObject(NSProgressFileOperationKindDownloading,
                           forKey: NSProgressFileOperationKindKey)
progress.setUserInfoObject(50443, forKey: NSProgressThroughputKey)
```



Responsibilities

For creators

If you create a progress, you are responsible for updating it

`totalUnitCount`
`kind`
`userInfo`
`completedUnitCount`

Responsibilities

For clients

If you receive a progress, do not update it

```
totalUnitCount { get }
completedUnitCount { get }
fractionCompleted { get }
localizedDescription { get }
localizedAdditionalDescription { get }
```

NSProgressReporting

NEW

```
protocol NSProgressReporting : NSObjectProtocol {
    var progress: NSProgress { get }
}
```

NSProgressReporting

NEW

```
protocol NSProgressReporting : NSObjectProtocol {
    var progress: NSProgress { get }
}
```

Demo

Introduction

Composition

Composition

Composition

What you're tracking might not be a single operation's progress

Composition

What you're tracking might not be a single operation's progress

Download

Composition

What you're tracking might not be a single operation's progress

Download

Verify

Composition

What you're tracking might not be a single operation's progress

Composition

What you're tracking might not be a single operation's progress

Download | Verify | Decompress

But, the user only sees one progress bar

Composition

What you're tracking might not be a single operation's progress

But, the user only sees one progress bar

Composition

Composition

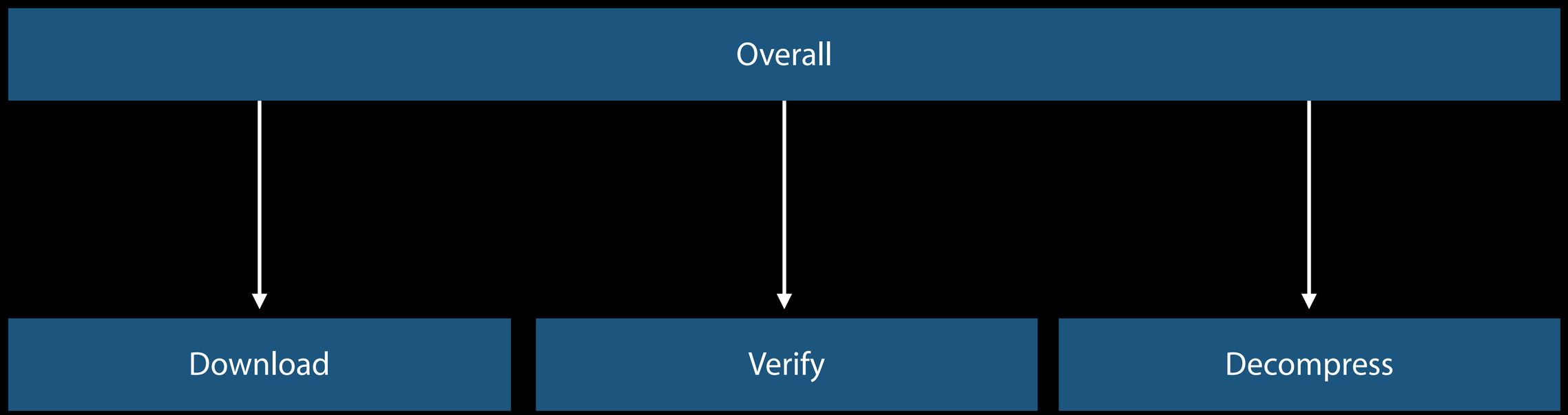
Overall

Download

Verify

Decompress

Composition



Composition

Portions of a parent's totalUnitCount can be assigned to a child progress object, referred to as pendingUnitCount

- This is in terms of the parent's units, not the child's
- The parent's pendingUnitCount is assigned to the child

Composition

When a child finishes, the parent's completedUnitCount is incremented by the pendingUnitCount

- Do not update the completedUnitCount manually
- Assign everything to children

Composition

Composition

Import

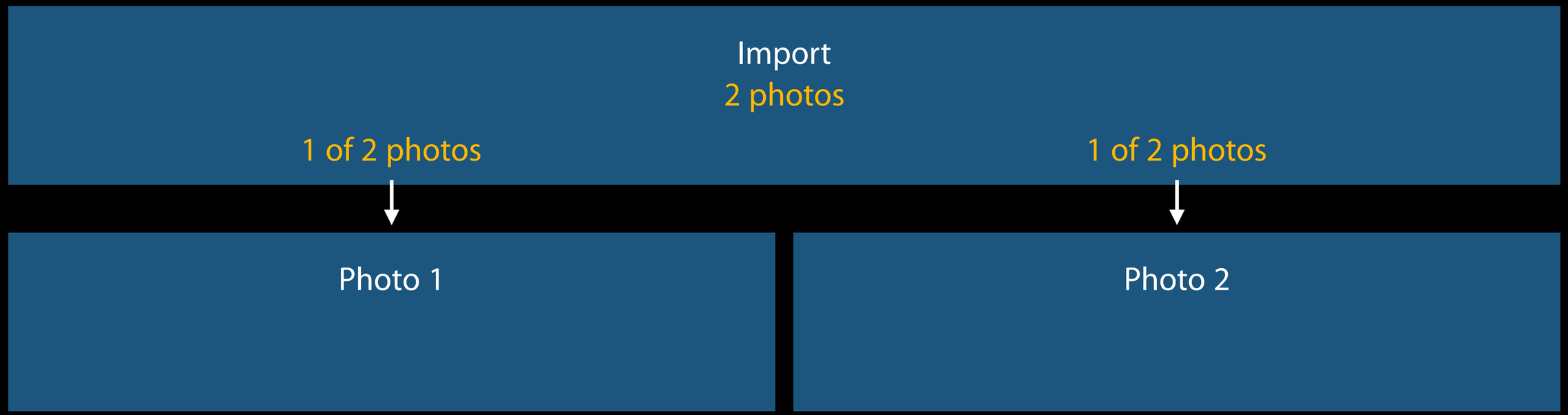
Composition

Import
2 photos

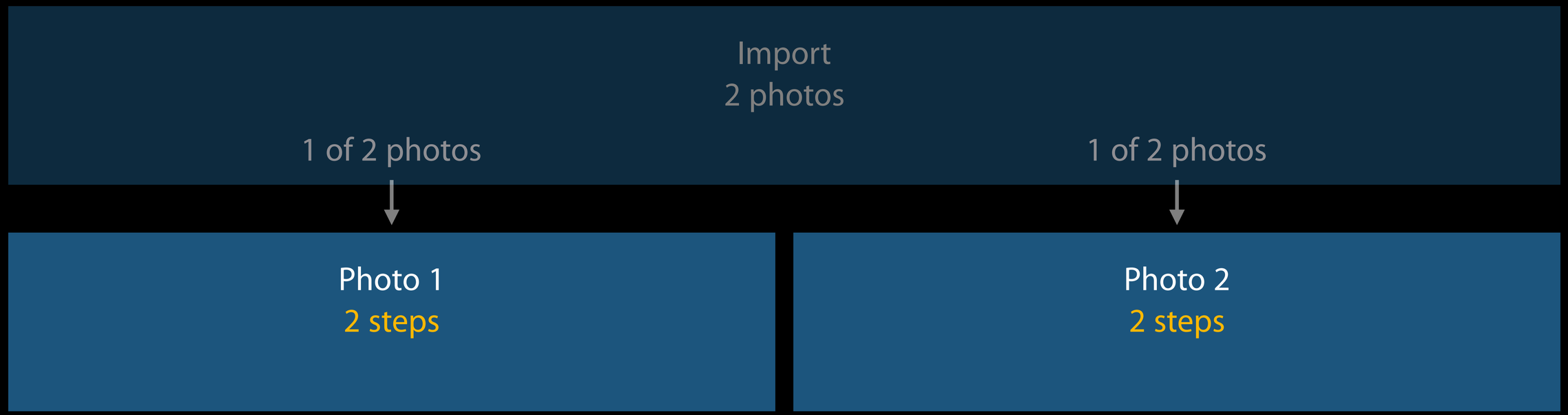
Composition

Import
2 photos

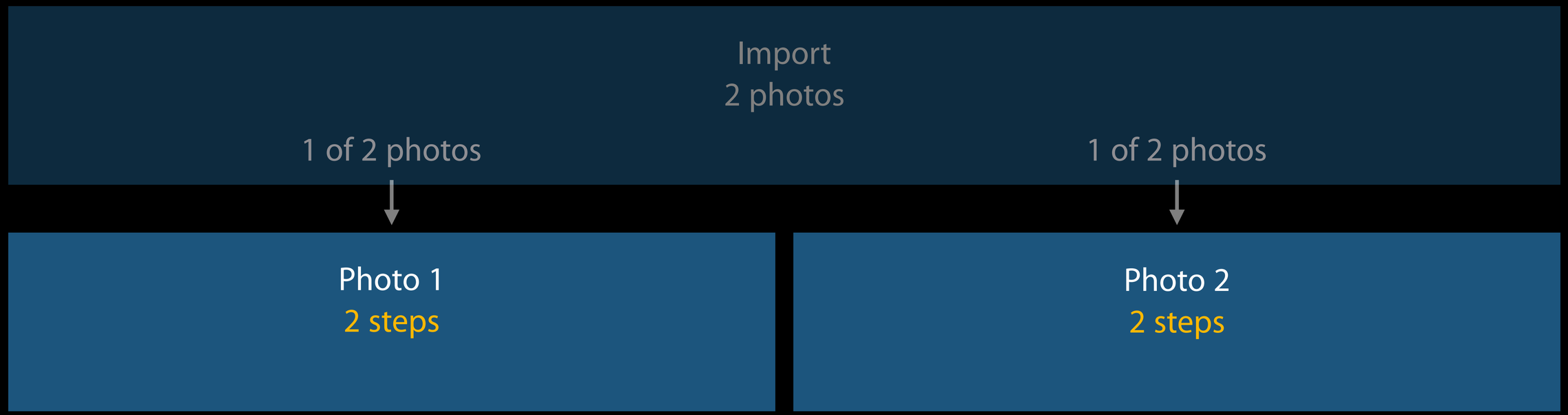
Composition



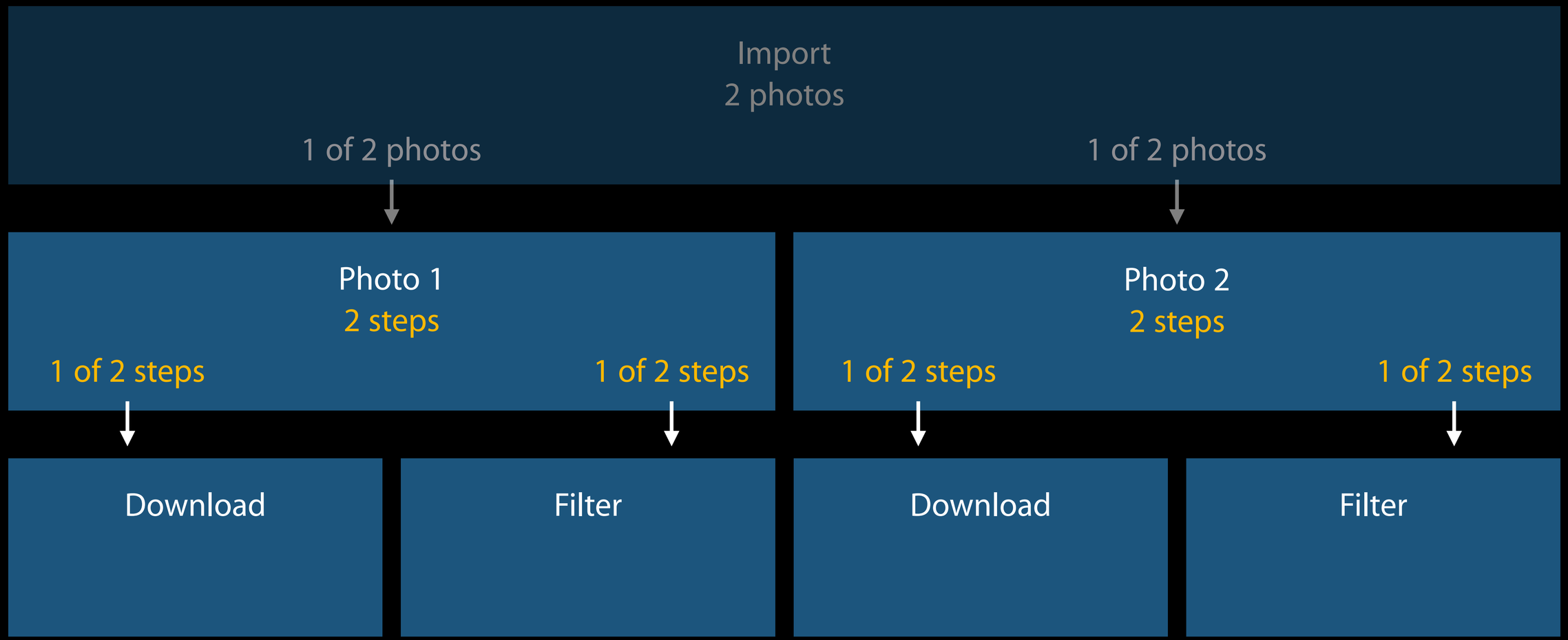
Composition



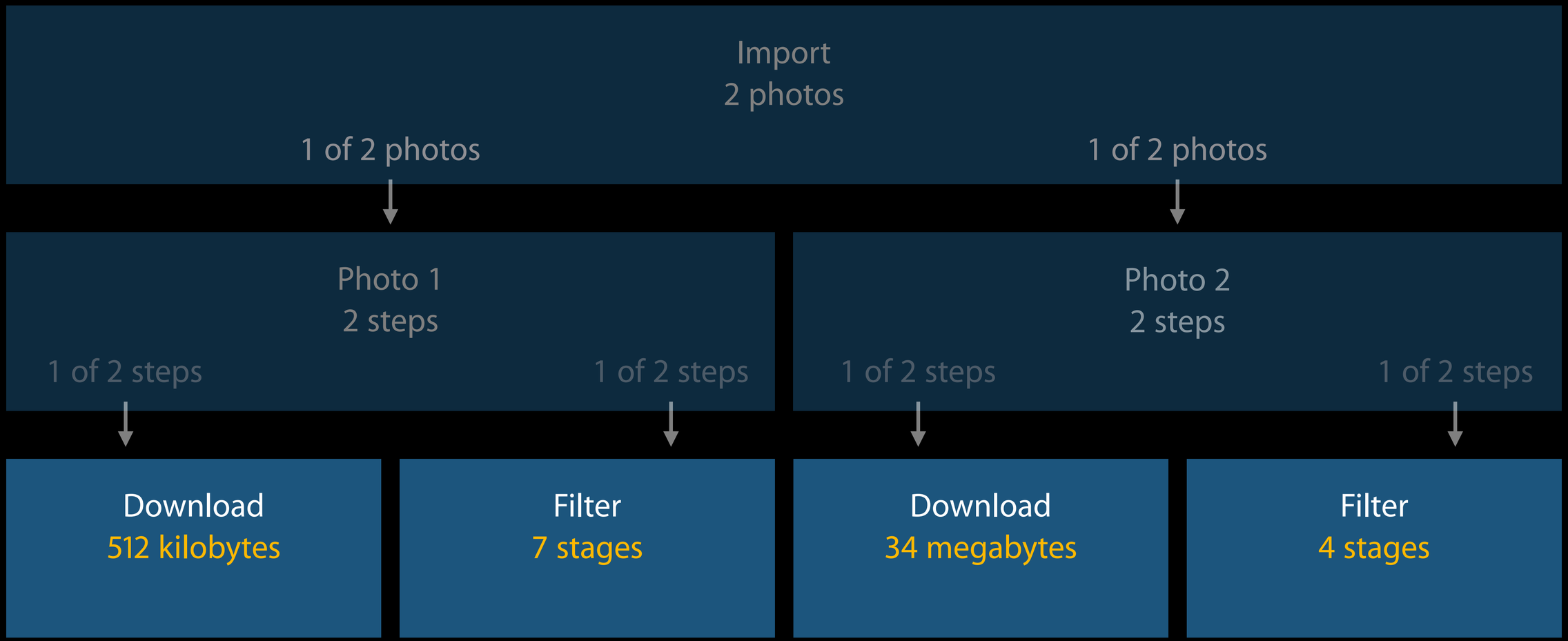
Composition



Composition



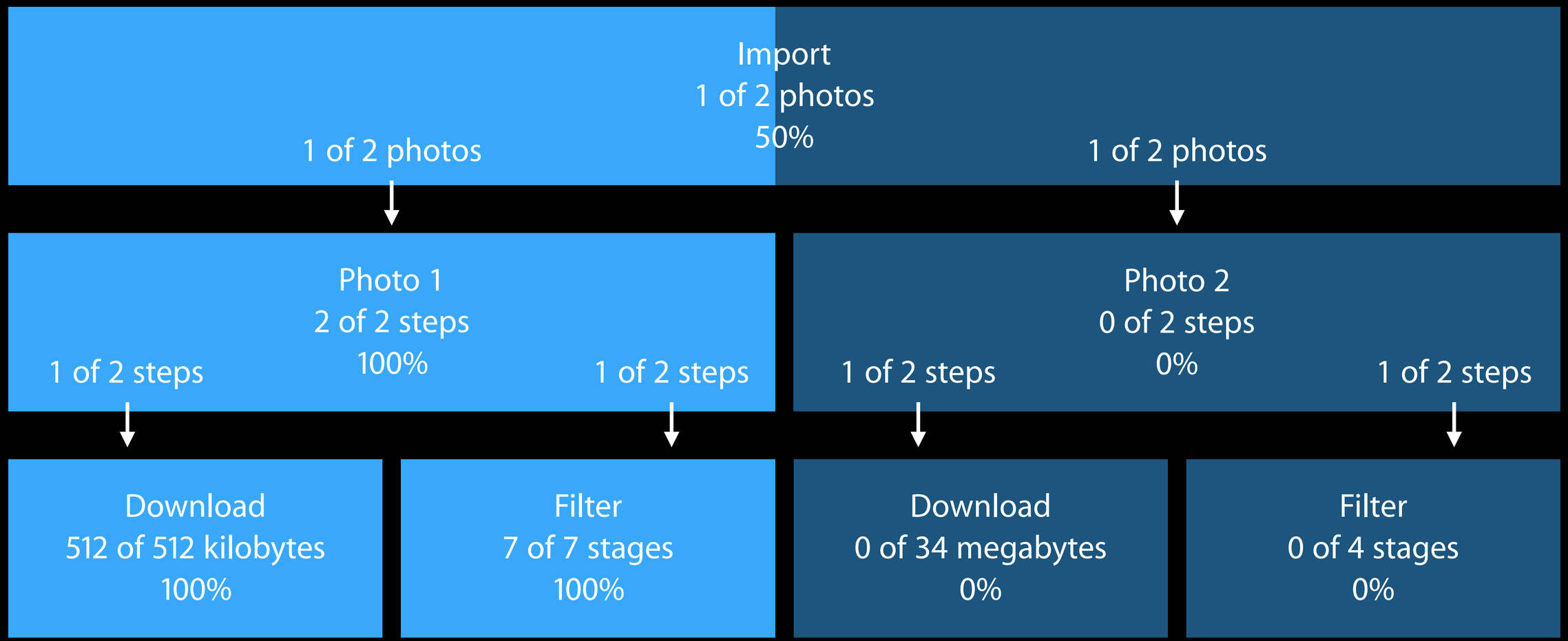
Composition



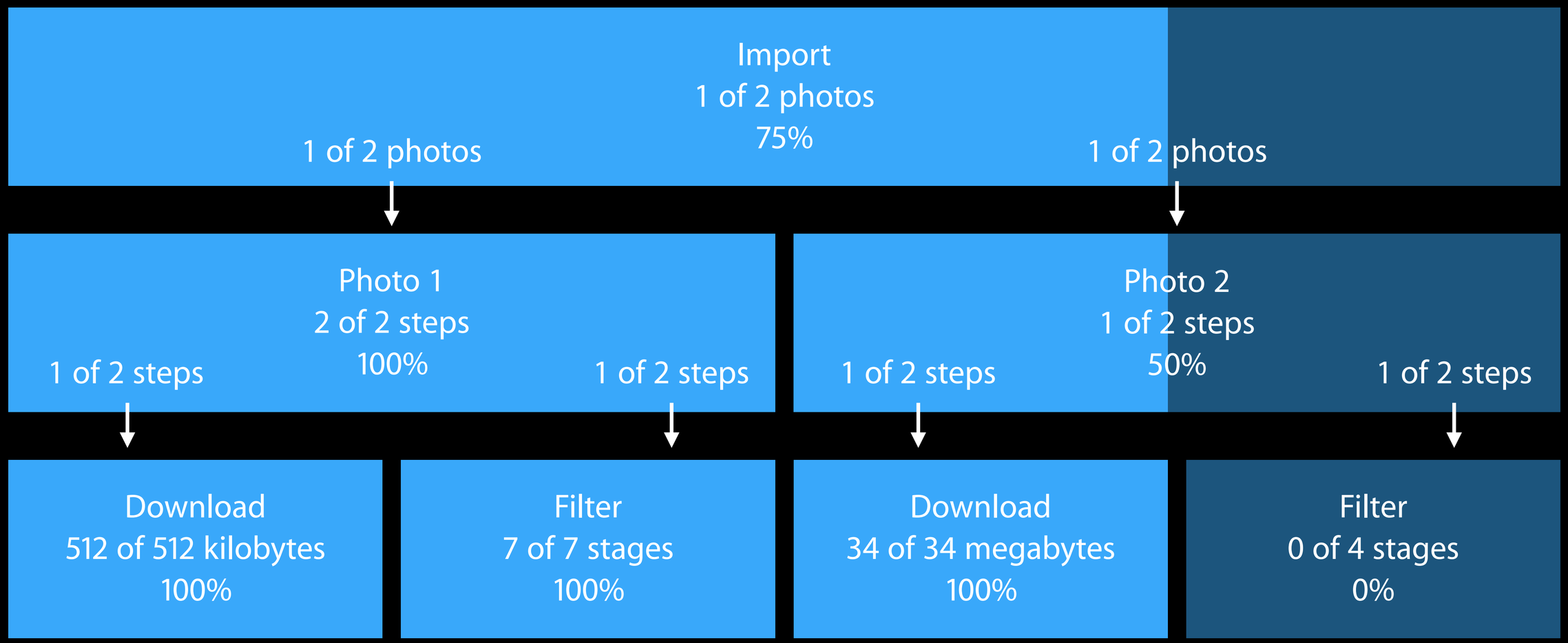
Composition

Composition

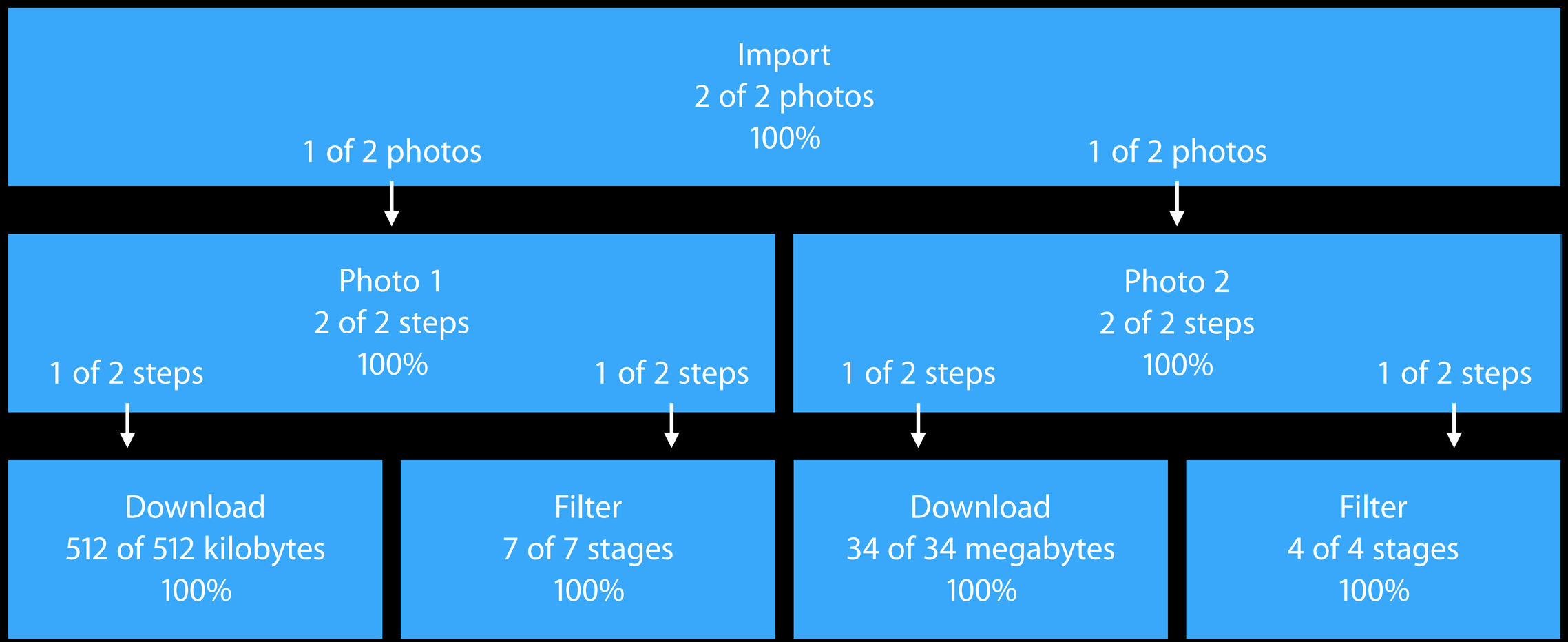
Composition



Composition

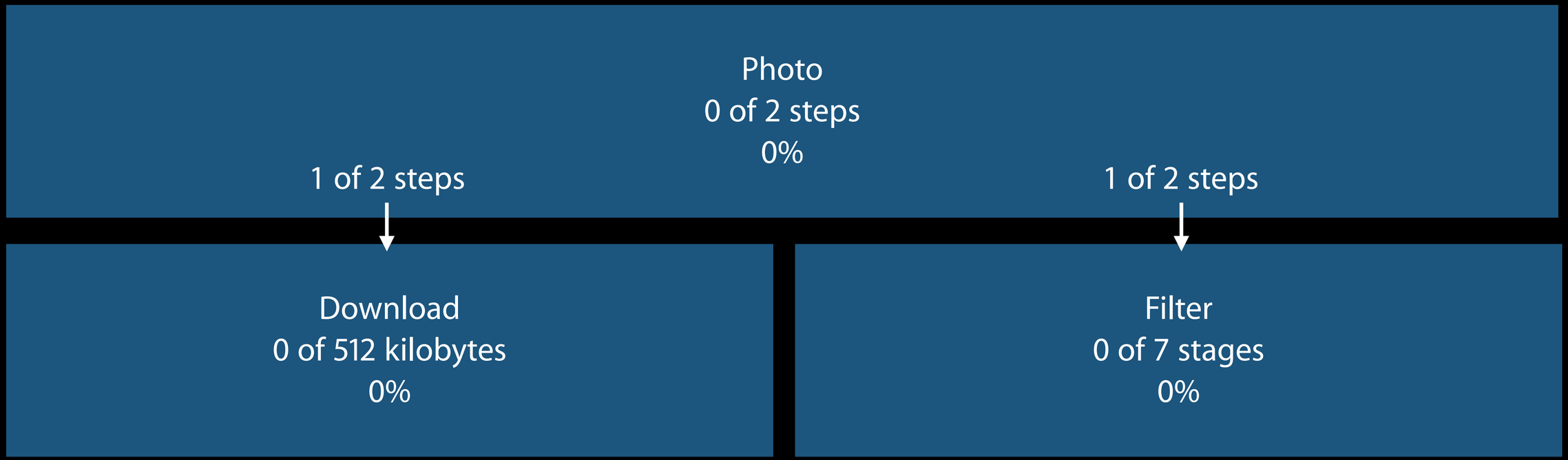


Composition



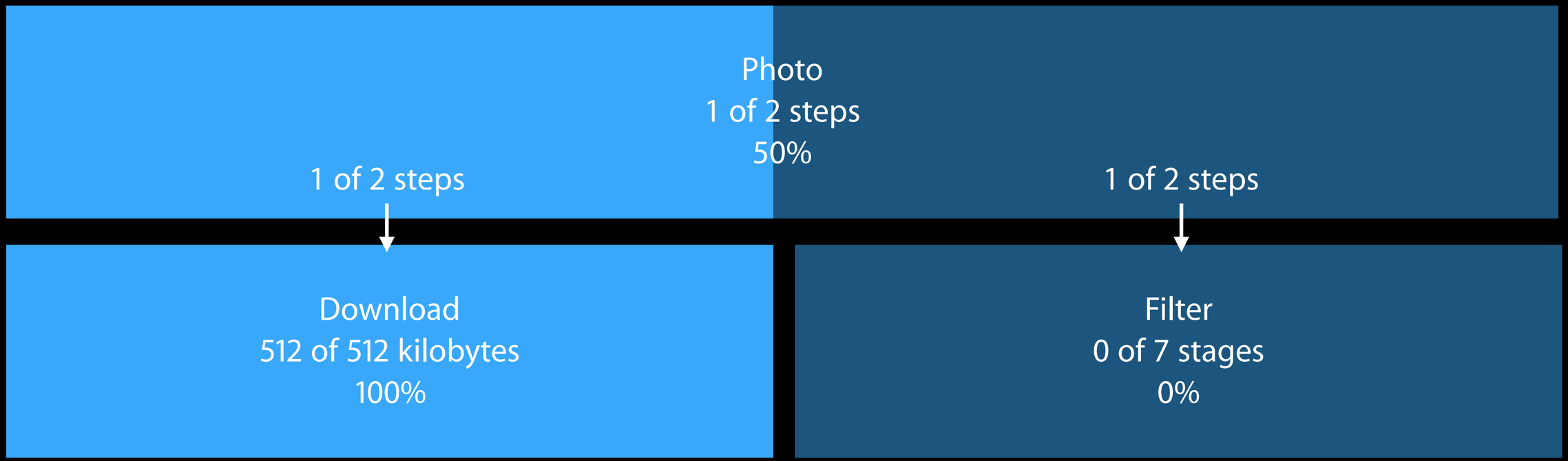
Composition

Weighting



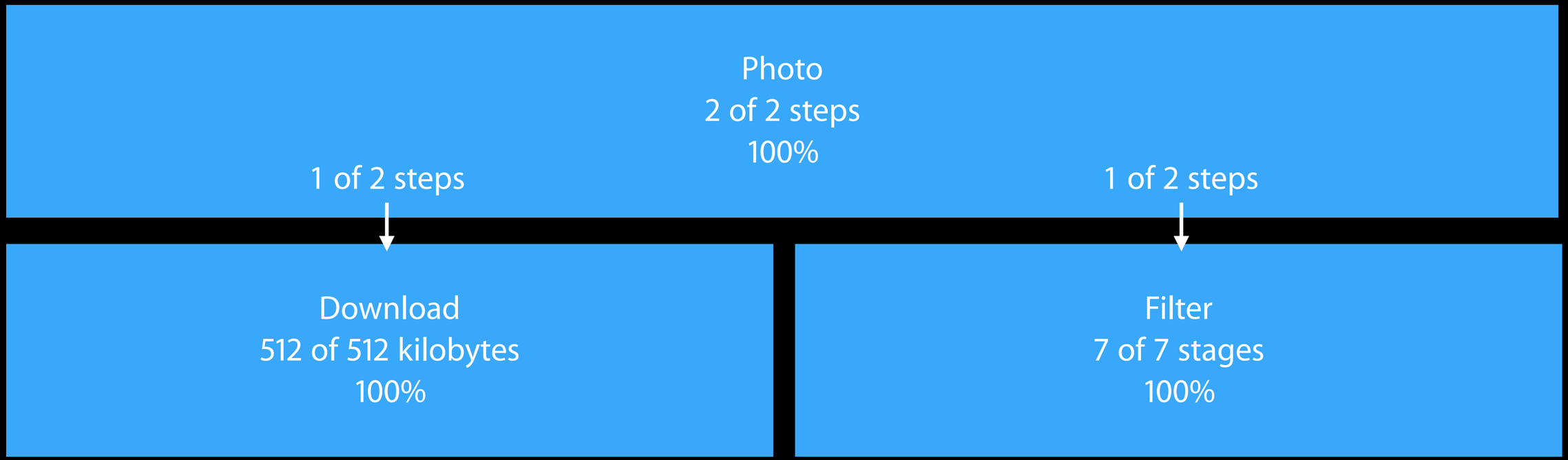
Composition

Weighting



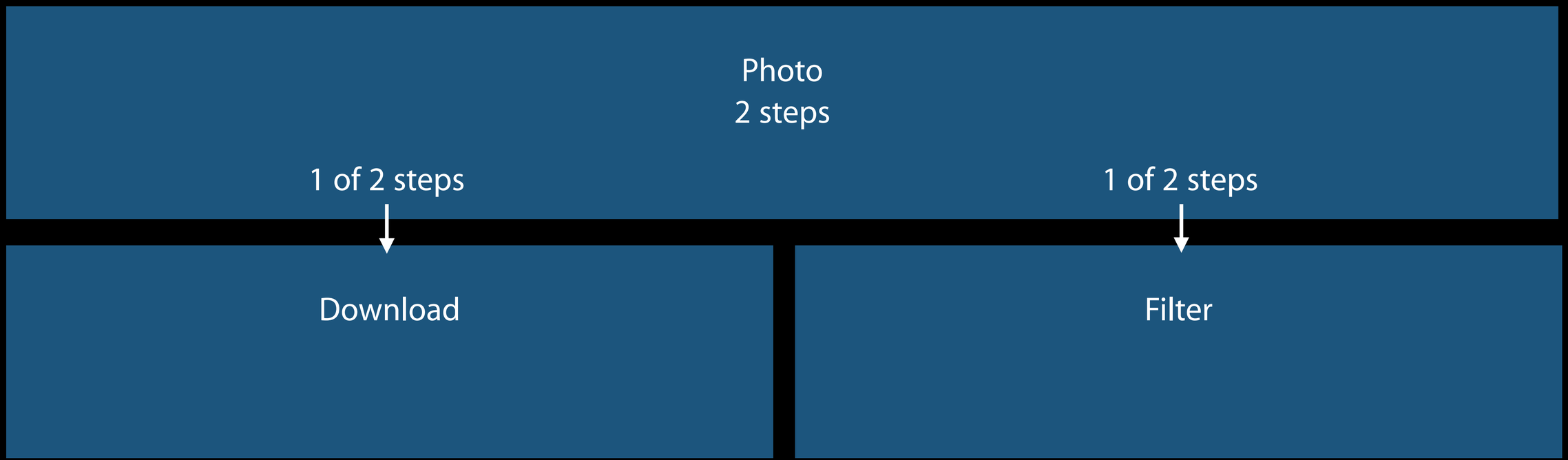
Composition

Weighting



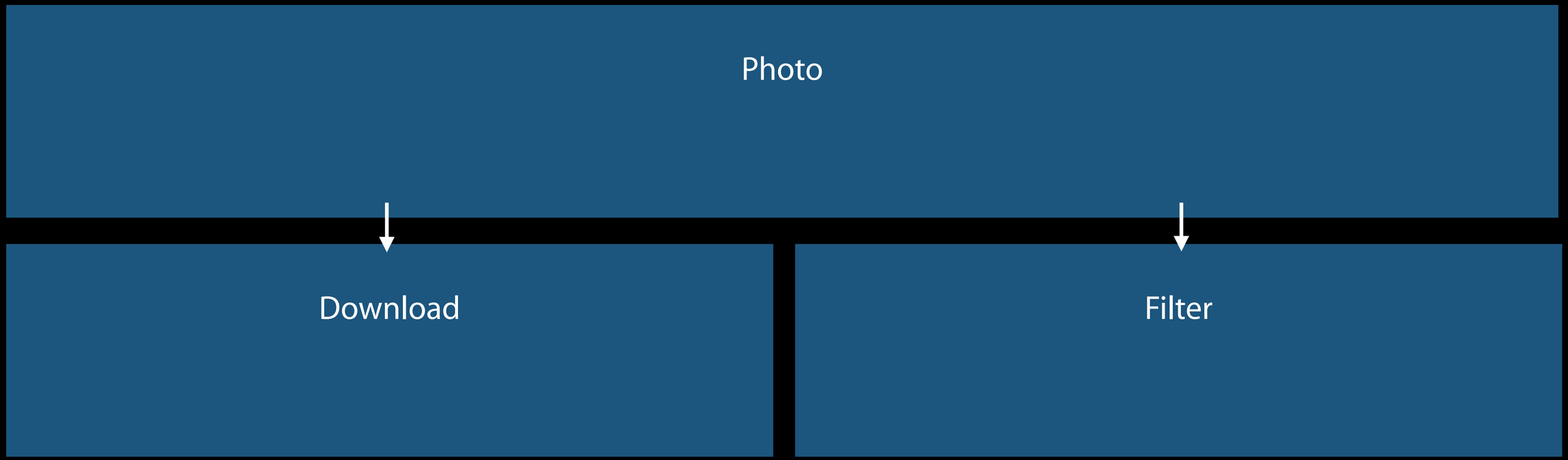
Composition

Weighting



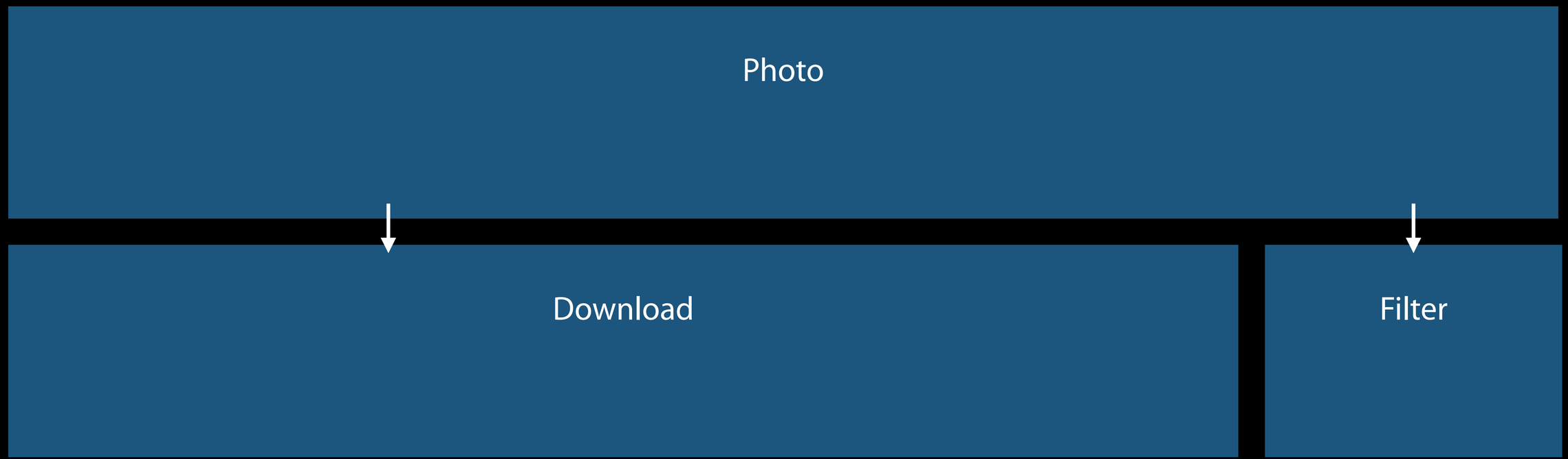
Composition

Weighting



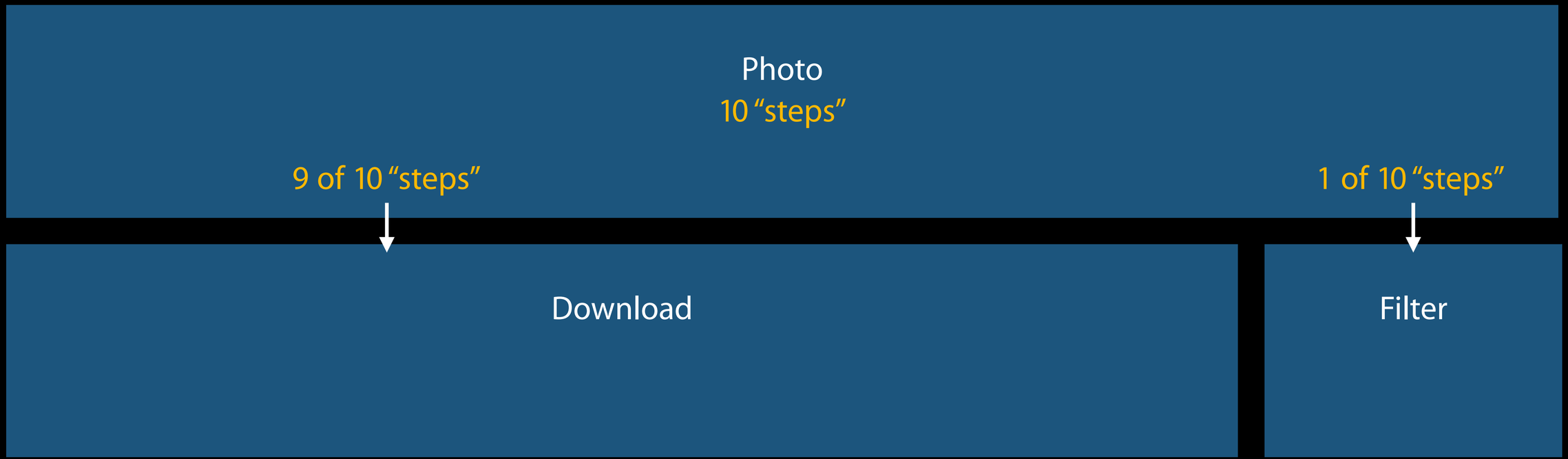
Composition

Weighting



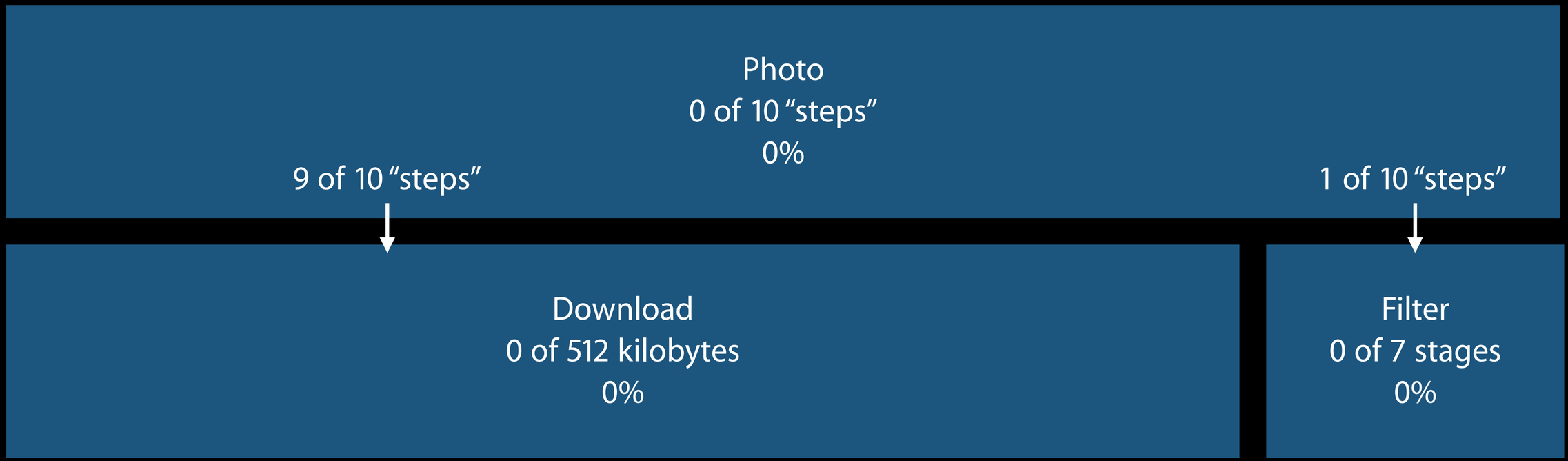
Composition

Weighting



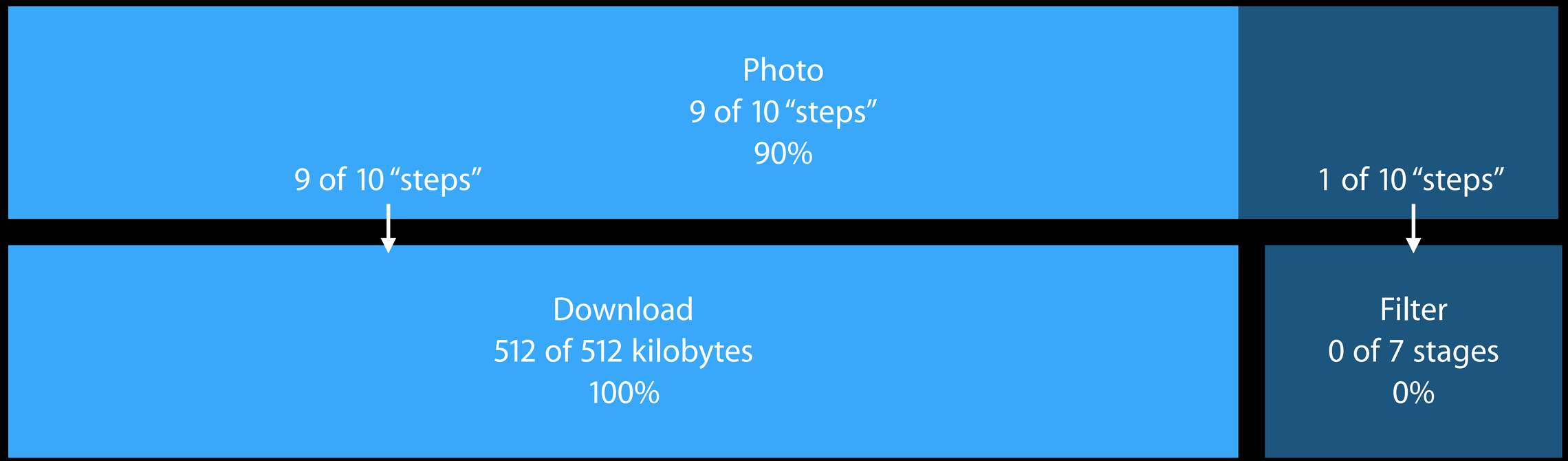
Composition

Weighting



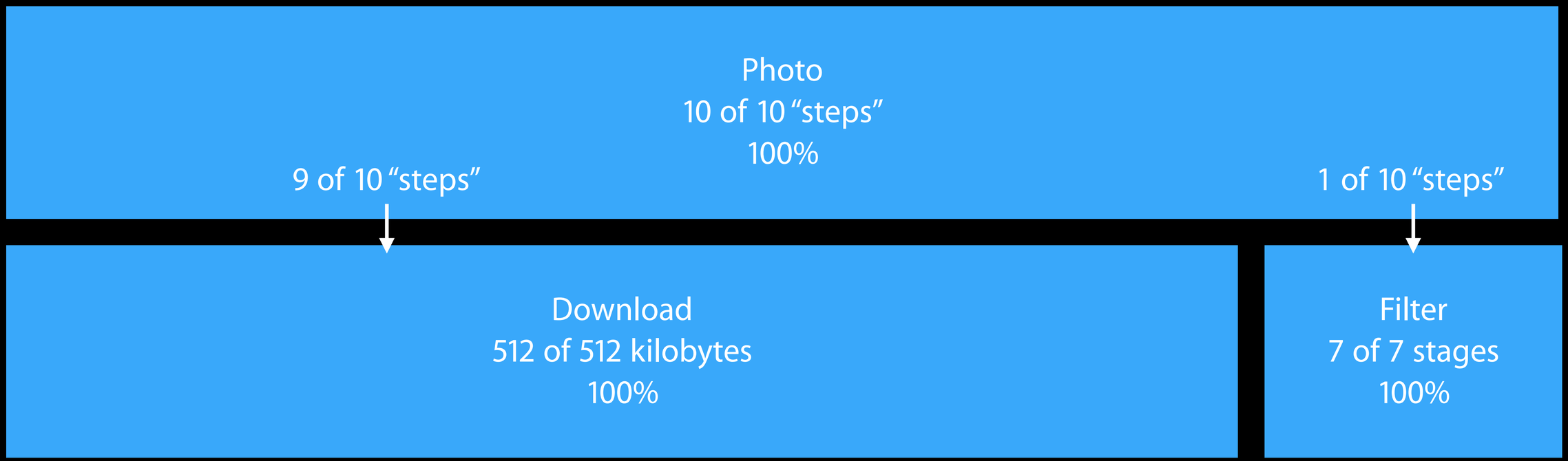
Composition

Weighting



Composition

Weighting



Composition

Implicit

Composition

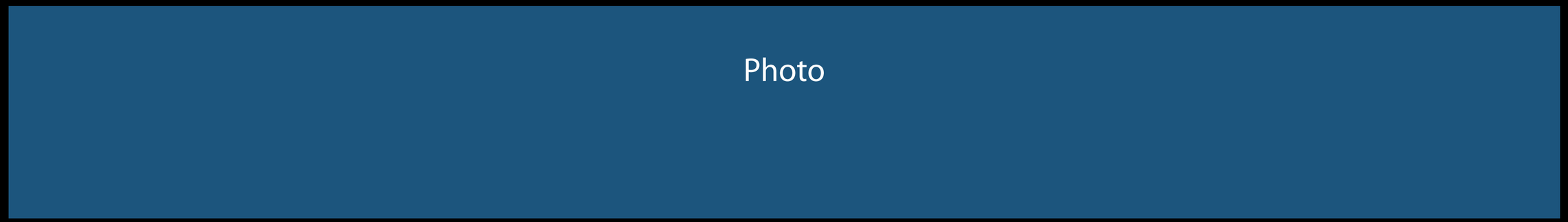
Implicit

```
let photoProgress = NSProgress()
```

Composition

Implicit

```
let photoProgress = NSProgress()
```



Composition

Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
```

Photo
2 steps

Composition

Implicit

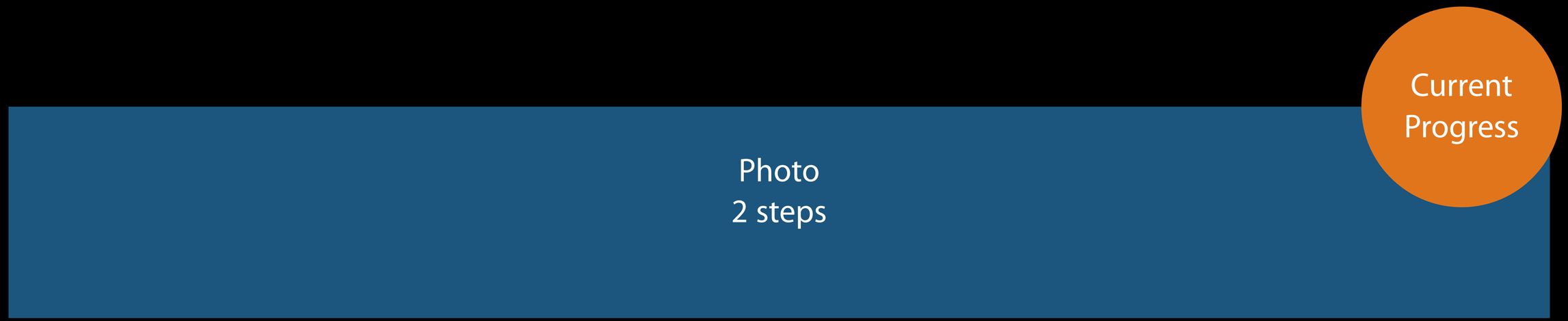
```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
```

Photo
2 steps

Composition

Implicit

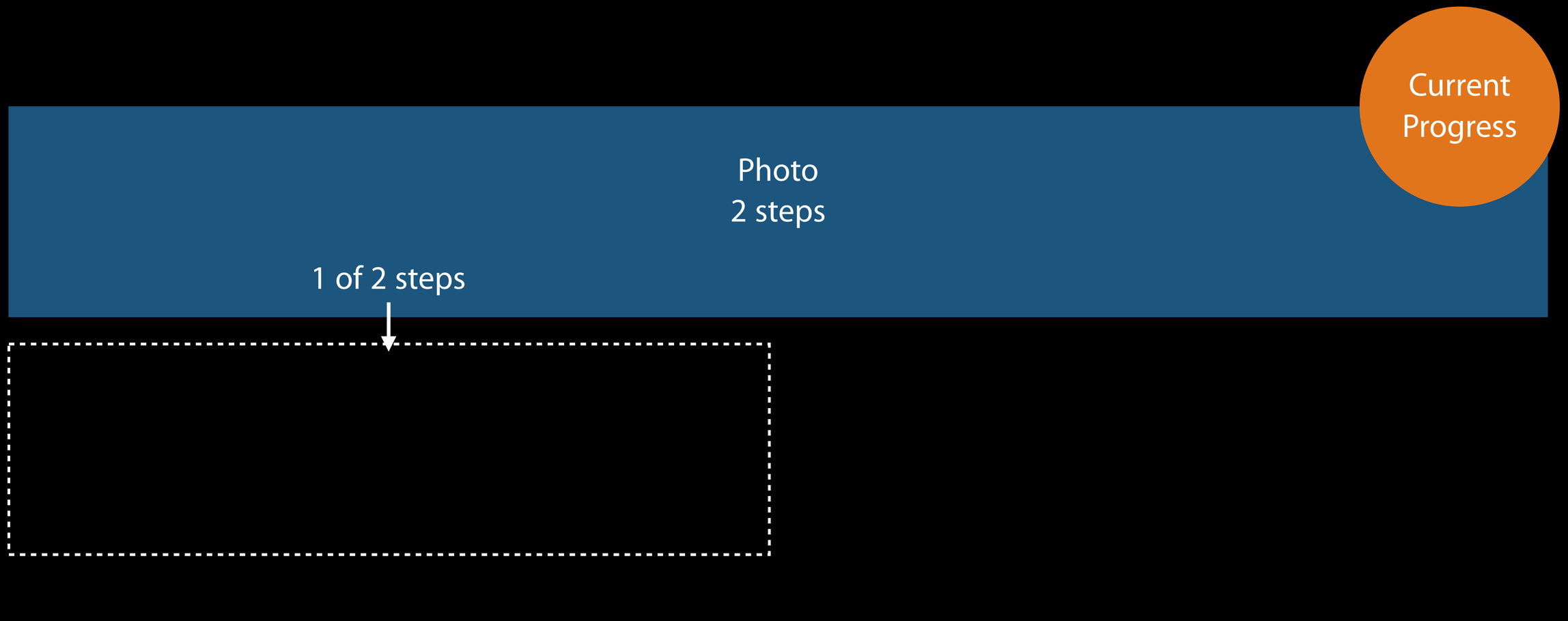
```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
```



Composition

Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
```



Composition

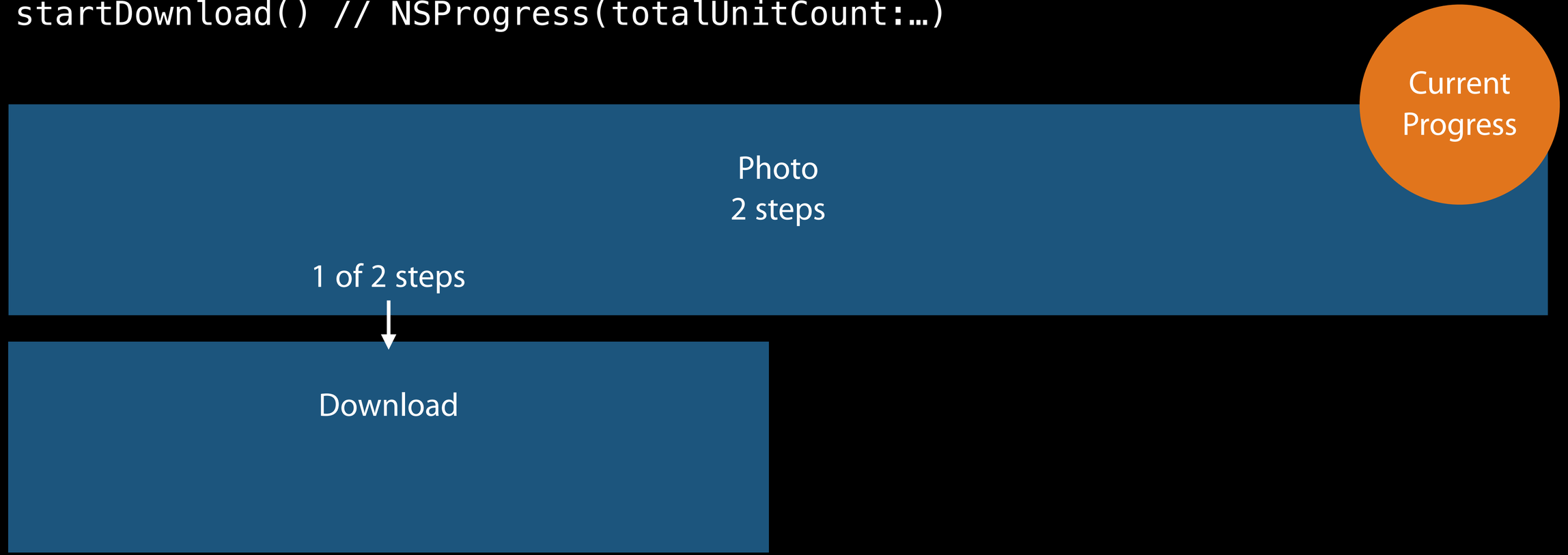
Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
startDownload() // NSProgress(totalUnitCount:…)
```

Composition

Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
startDownload() // NSProgress(totalUnitCount:…)
```



Composition

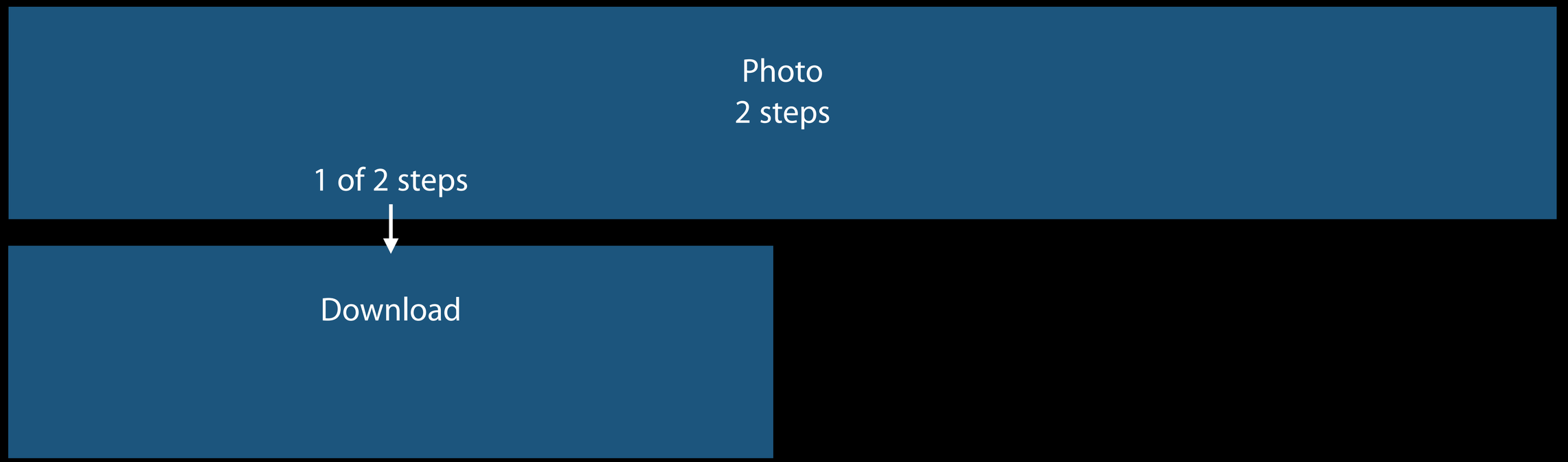
Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
startDownload() // NSProgress(totalUnitCount:…)
photoProgress.resignCurrent()
```

Composition

Implicit

```
let photoProgress = NSProgress()
photoProgress.totalUnitCount = 2
photoProgress.becomeCurrentWithPendingUnitCount(1)
startDownload() // NSProgress(totalUnitCount:…)
photoProgress.resignCurrent()
```



Composition

Implicit

Composition

Implicit

If you support implicit composition

- Create with NSProgress(totalUnitCount:) immediately
- Document it

Composition

Implicit

If you support implicit composition

- Create with NSProgress(totalUnitCount:) immediately
- Document it

If no child is added

- resignCurrent will mark the pendingUnitCount as finished
- The completedUnitCount will be updated

Composition

Explicit

NEW

Composition

Explicit

NEW

```
let filterProgress = filter.progress
```

Composition

Explicit

NEW

```
let filterProgress = filter.progress
```

Composition

Explicit

NEW

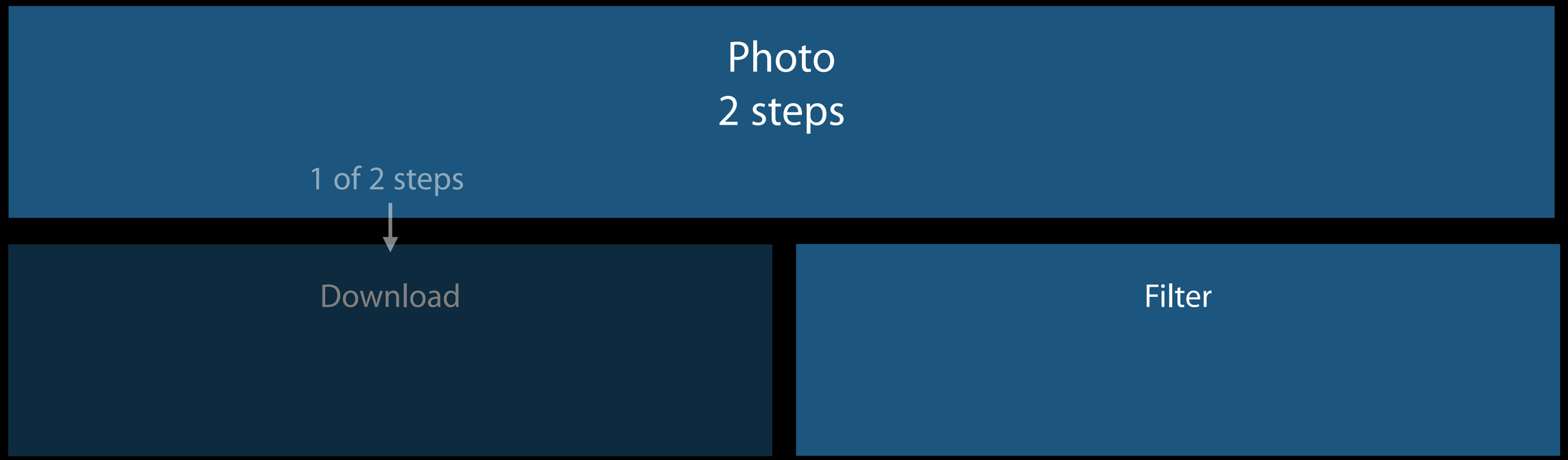
```
let filterProgress = filter.progress
let photoProgress = …
```

Composition

Explicit

NEW

```
let filterProgress = filter.progress
let photoProgress = …
```

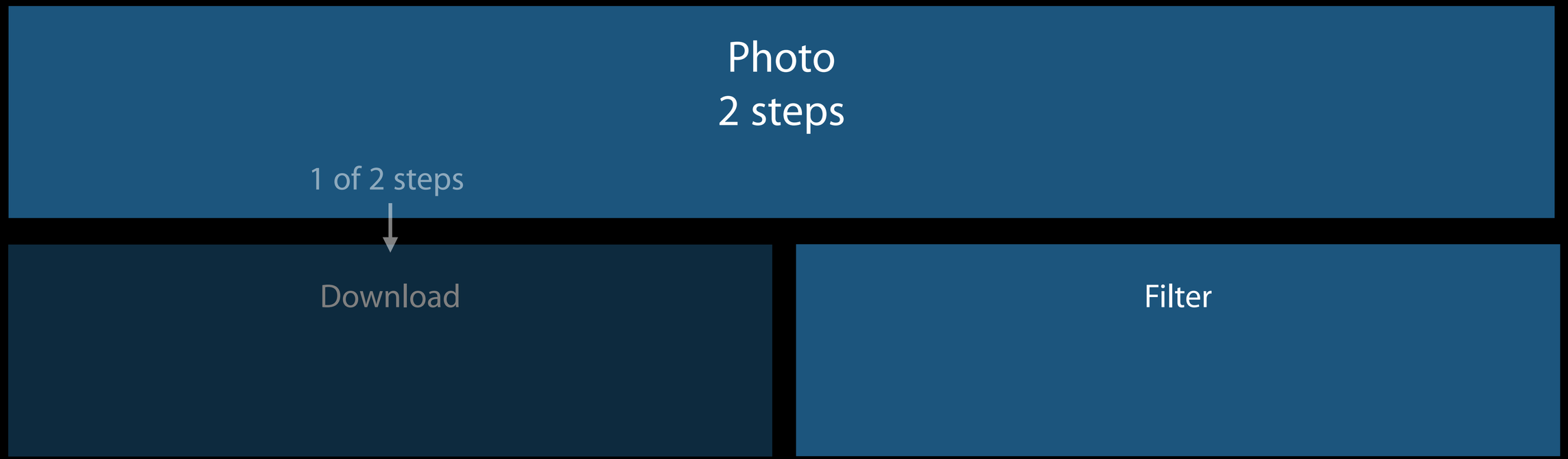


Composition

Explicit

NEW

```
let filterProgress = filter.progress
let photoProgress = …
photoProgress.addChild(filterProgress, withPendingUnitCount:1)
```

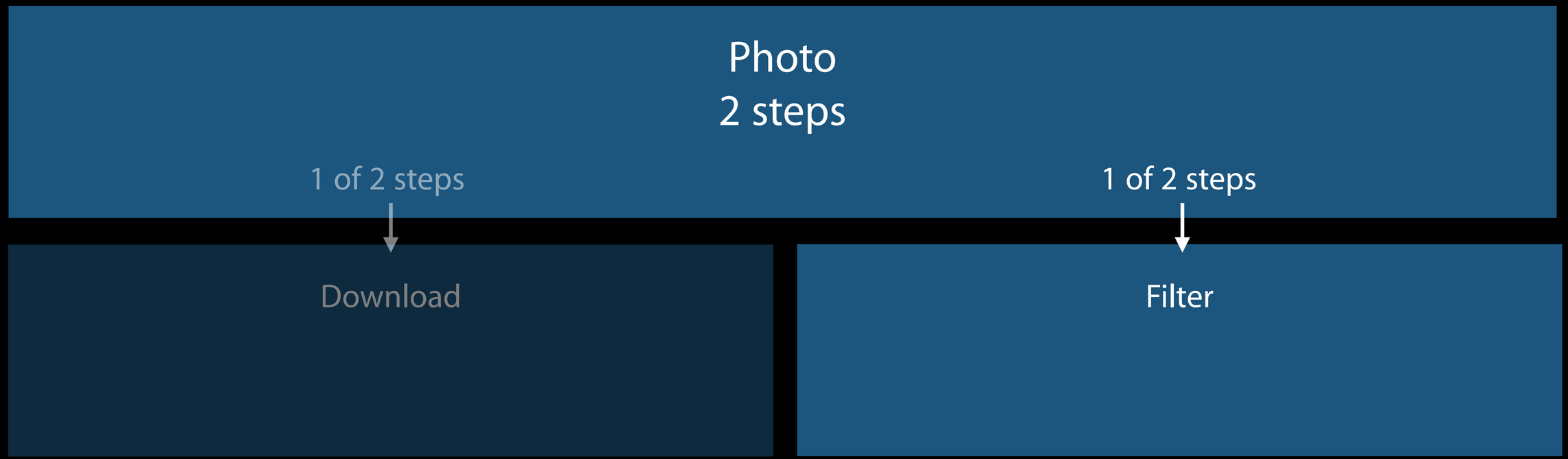


Composition

Explicit

NEW

```
let filterProgress = filter.progress
let photoProgress = …
photoProgress.addChild(filterProgress, withPendingUnitCount:1)
```



Composition

Implicit vs. explicit

Use implicit composition if

- You have a method that can't return the NSProgress
- Releases older than OS X10.11 and iOS 9

Otherwise, use explicit composition

Demo

Composition

Cancellation, Pausing, and Resuming

Cancellation

Creators

```
var cancellable: Bool
var cancellationHandler: (() -> Void)?
var cancelled: Bool { get }
```

Cancellation

Clients

```
func cancel()
```

- Sets cancelled to true
- Invokes the cancellationHandler
- Cancellation flows down to children
- It’s permanent

Pausing and Resuming

Creators

```
var pausable: Bool
var pausingHandler: (() -> Void)?
var resumingHandler: (() -> Void)?
var paused: Bool { get }
```

Pausing and Resuming

Clients

```
func pause()
func resume()
```

- Sets paused to true/false
- Invokes the pausingHandler/resumingHandler
- Pausing/resuming flows down to children

Demo

Cancellation, pausing, and resuming

User Interface

User Interface

NSProgress properties are key value observable

- Add KVO observers to update your UI
- Not necessarily called on main thread

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)
```

```
override func observeValueForKeyPath(keyPath: …, object: …, …, context: …) {
  if context == &observationContext && keyPath == "fractionCompleted" {
      NSOperationQueue.mainQueue().addOperationWithBlock {
          let progress = (object as! NSProgress)
          progressView.progress = Float(progress.fractionCompleted)
      }
  }
  else {
      super.observeValueForKeyPath(…)
  }
}
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)
```

```
override func observeValueForKeyPath(keyPath: …, object: …, …, context: …) {
  if context == &observationContext && keyPath == "fractionCompleted" {
      NSOperationQueue.mainQueue().addOperationWithBlock {
          let progress = (object as! NSProgress)
          progressView.progress = Float(progress.fractionCompleted)
      }
  }
  else {
      super.observeValueForKeyPath(…)
  }
}
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)

override func observeValueForKeyPath(keyPath: …, object: …, …, context: …) {
  if context == &observationContext && keyPath == "fractionCompleted" {
      NSOperationQueue.mainQueue().addOperationWithBlock {
          let progress = (object as! NSProgress)
          progressView.progress = Float(progress.fractionCompleted)
      }
  }
  else {
      super.observeValueForKeyPath(…)
  }
}
```

User Interface

Example

```
progress.addObserver(self, forKeyPath: "fractionCompleted",
                     options: [], context: &observationContext)

override func observeValueForKeyPath(keyPath: …, object: …, …, context: …) {
  if context == &observationContext && keyPath == "fractionCompleted" {
      NSOperationQueue.mainQueue().addOperationWithBlock {
          let progress = (object as! NSProgress)
          progressView.progress = Float(progress.fractionCompleted)
      }
  }
  else {
      super.observeValueForKeyPath(…)
  }
}
```

Best Practices

Best Practices

Don’t use fractionCompleted to determine completion

- It’s a float
- Use completedUnitCount >= totalUnitCount instead
  (unless indeterminate or zero)

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NSProgress instances cannot be reused

Make a new instance and provide an additional mechanism so clients know

Performance

Don’t update completedUnitCount in a tight loop

Don’t forget that final update to 100%

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Properties are KVO observable

More Information

Documentation

NSProgress Class Reference
Progress Indicator Programming Topics
iOS Human Interface Guidelines
OS X Human Interface Guidelines

Sample Code

PhotoProgress

http://developer.apple.com/library/

Technical Support

Apple Developer Forums
Developer Technical Support

General Inquiries

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