Introduction to Attributed Strings for iOS

Drawing strings with dramatic expression

Session 222

Aki "I ♡ Unicode" Inoue
Cocoa Engineer

Multi-style String Drawing in UIKit

Multi-style String Drawing in UIKit

You can take it off the wishlist now!

NSAttributedString in UIKit

Agenda

- Attributed string essentials
- Drawing with basic attributes
- UIKit adoption

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Attributed String Essentials

Displaying Strings

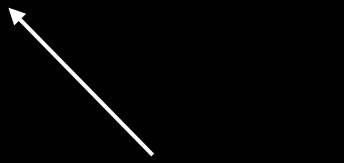
Using UIStringDrawing

I’m a string

Displaying Strings

Using UIStringDrawing

@”I’m a string”



NSString

Displaying Strings

Using UIStringDrawing

I’m a string

Displaying Strings

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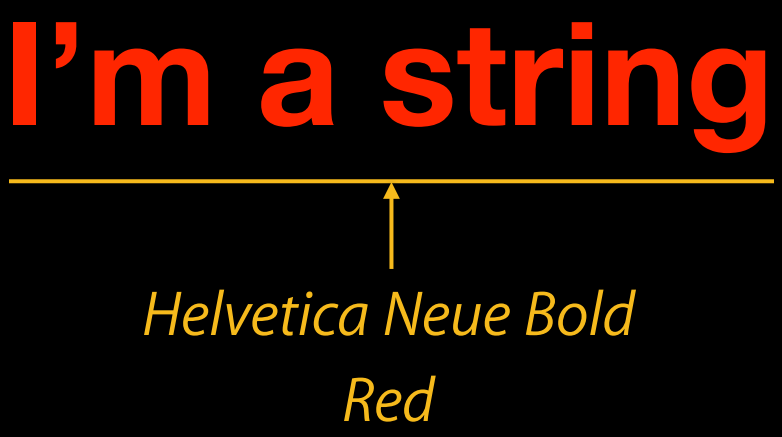

What Is an Attributed String ?

Associating attributes to characters

I’m an attributed string

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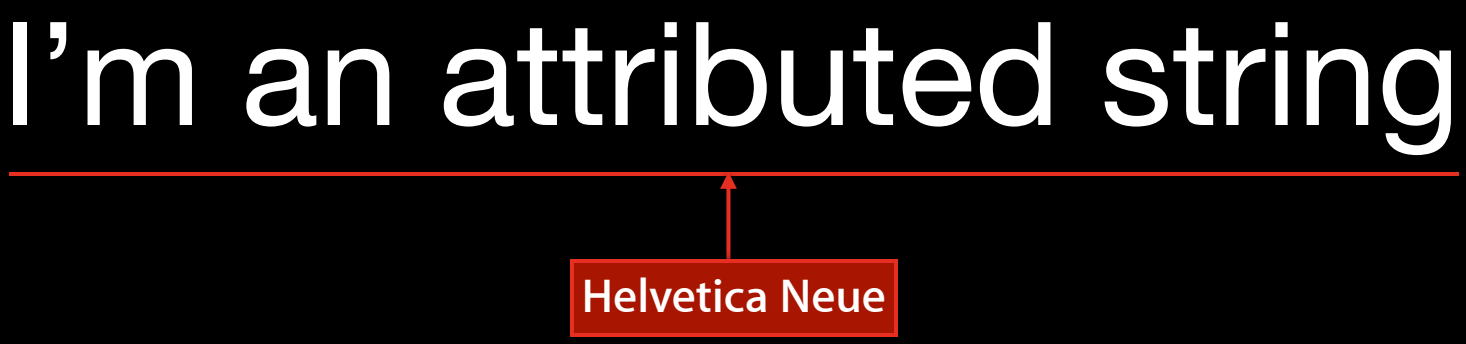
Associating attributes to characters



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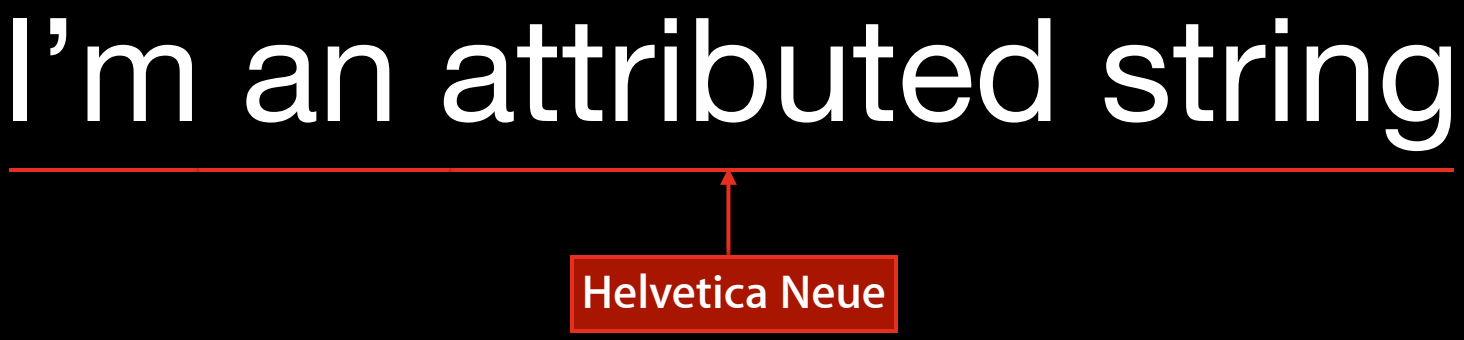

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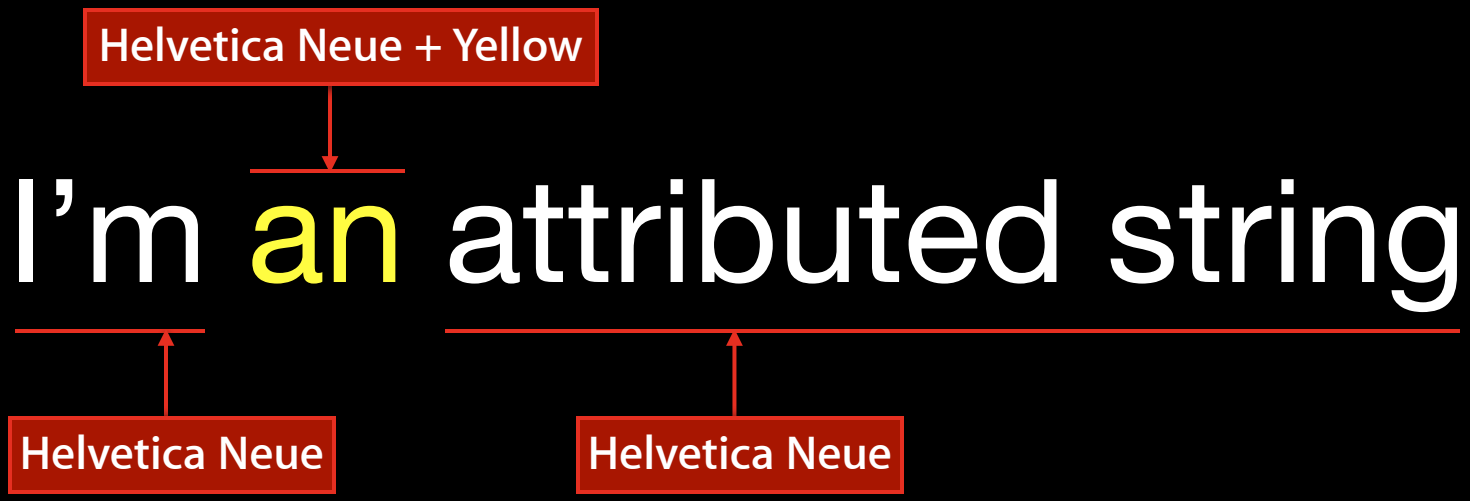

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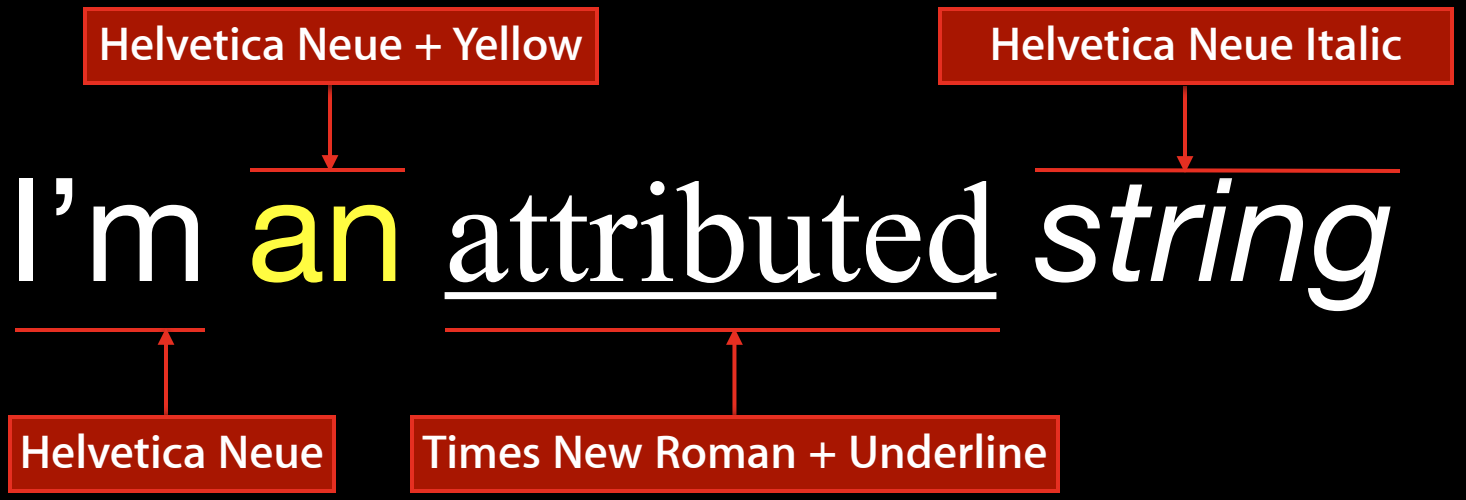
Associating attributes to characters



What Can You Do with It?

Multi-style text

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What Can You Do with It?

More expressive layout options

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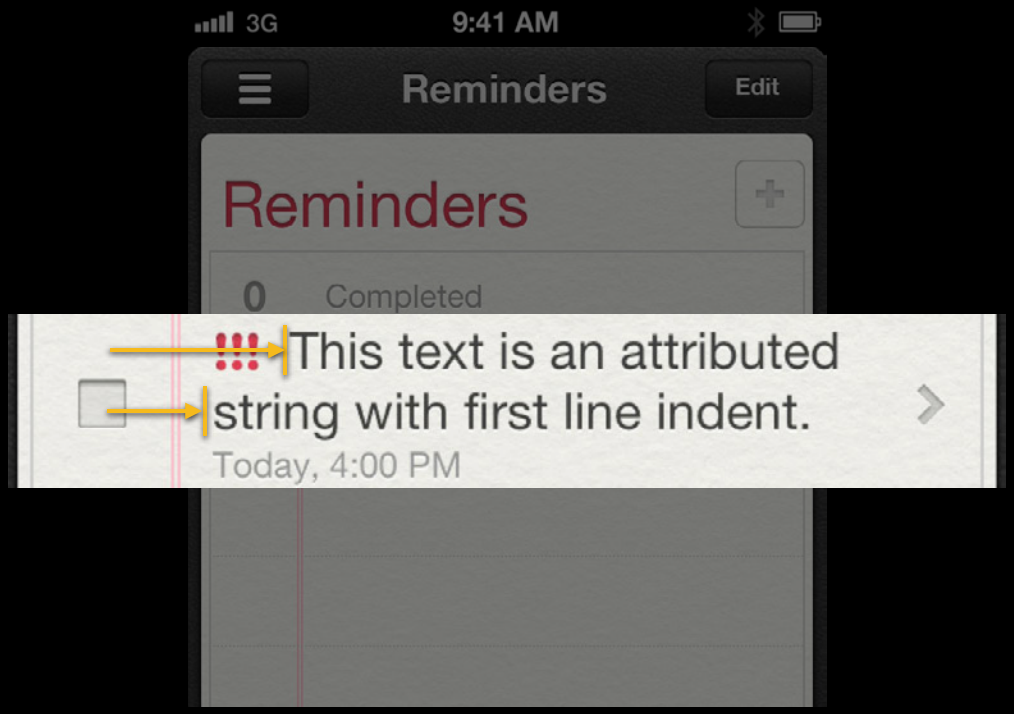
More expressive layout options



What Can You Do with It?

Graphics effects as text styles

NSAttributedString

- An attribute dictionary per character
  - `- (NSString *)string`
  - `- (NSDictionary *)attributesAtIndex:(NSUInteger)location`
    `effectiveRange:(NSRangePointer)range;`

NSAttributedString

- An attribute dictionary per character

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NSAttributedString

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- Instantiating with a string and attributes dictionary
  - `- (id)initWithString:(NSString *)string attributes:(NSDictionary *)attrs;`

NSAttributedString

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```
- (NSString *)string
- (NSDictionary *)attributesAtIndex:(NSUInteger)location
                     effectiveRange:(NSRangePointer)range;
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- Instantiating with a string and attributes dictionary

```
- (id)initWithString:(NSString *)string attributes:(NSDictionary *)attrs;
```

Instantiating an Attributed String

Specifying a font

- Using NSFontAttributeName

```
NSAttributedString *string = [[NSAttributedString alloc]
      initWithString:@"Hello World!!"
      attributes:@{ NSFontAttributeName : [UIFont systemFontOfSize:12.0f }];
```

Instantiating an Attributed String

Specifying a font

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NSAttributedString *string = [[NSAttributedString alloc]
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Hello World!!

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- Instantiating with a string and attributes dictionary
  - `- (id)initWithString:(NSString *)string attributes:(NSDictionary *)attrs;`
- No attribute for an empty string

NSMutableAttributedString

- Changing attributes
- Modifying string contents

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NSMutableAttributedString

Changing attributes

- Mutable methods for attributes
  - `- (void)setAttributes:(NSDictionary *)attrs range:(NSRange)range;`

NSMutableAttributedString

Changing attributes

- Mutable methods for attributes

```
- (void)setAttributes:(NSDictionary *)attrs range:(NSRange)range;

- (void)addAttributes:(NSDictionary *)attrs range:(NSRange)range;
- (void)addAttribute:(NSString *)key value:(id)value range:(NSRange)range;
- (void)removeAttribute:(NSString *)key range:(NSRange)range;
```

NSMutableAttributedString

Changing attributes

- Mutable methods for attributes

```
- (void)setAttributes:(NSDictionary *)attrs range:(NSRange)range;

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- (void)removeAttribute:(NSString *)key range:(NSRange)range;
```

- Modifying existing attributes
- Creating multi-style string

Creating Multi-style String

Emphasizing a range

- Using NSForegroundColorAttributeName

```
NSMutableAttributedString *string = [[NSMutableAttributedString alloc]
      initWithString:@"Dentist at 9:15am."
      attributes:@{ NSFontAttributeName : [UIFont systemFontOfSize:12.0f }];

[string addAttribute:NSForegroundColorAttributeName
      value:[UIColor redColor]
      range:NSMakeRange(11, 6)]; // Change the time, 9:15am, to red
```

Creating Multi-style String

Emphasizing a range

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Modifying string contents

- Mutable methods for string contents
  - `- (void)replaceCharactersInRange:(NSRange)range withString:(NSString *)str;`

NSMutableAttributedString

Modifying string contents

- Mutable methods for string contents

```
- (void)replaceCharactersInRange:(NSRange)range withString:(NSString *)str;

- (void)replaceCharactersInRange:(NSRange)range
            withAttributedString:(NSAttributedString *)attributedString;
- (void)insertAttributedString:(NSAttributedString *)attributedString
                       atIndex:(NSUInteger)location;
- (void)appendAttributedString:(NSAttributedString *)attributedString;
- (void)deleteCharactersInRange:(NSRange)range;
```

NSMutableAttributedString

Modifying string contents

- Mutable methods for string contents

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- (void)replaceCharactersInRange:(NSRange)range withString:(NSString *)str;

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- (void)appendAttributedString:(NSAttributedString *)attributedString;
- (void)deleteCharactersInRange:(NSRange)range;
```

Modifying String Contents

- Moving the appointment time 1 hour early

```
NSMutableAttributedString *string; // a mutable string

[string replaceCharactersInRange:NSMakeRange(11, 6) withString:@”8:15am”];
```

Modifying String Contents

- Moving the appointment time 1 hour early

```
NSMutableAttributedString *string; // a mutable string

[string replaceCharactersInRange:NSMakeRange(11, 6) withString:@”8:15am”];
```

Dentist at 9:15am.

Modifying String Contents

- Moving the appointment time 1 hour early

```
NSMutableAttributedString *string; // a mutable string

[string replaceCharactersInRange:NSMakeRange(11, 6) withString:@"8:15am"];
```

Dentist at 8:15am.

Modifying String Contents

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Dentist at 8:15am.

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[string replaceCharactersInRange:NSMakeRange(11, 6) withString:@"8:15am"];
```

Dentist at 8:15am.

Modifying String Contents

- Moving the appointment time 1 hour early

```
NSMutableAttributedString *string; // a mutable string

[string replaceCharactersInRange:NSMakeRange(11, 6) withString:@"8:15am"];
```

Dentist at 8:15am.

Attributes Preserved

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- Attributes are preserved during string content replacement

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  1. When replacing, the new characters inherit attributes from the first character of the range being replaced
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  3. When inserting at the beginning, the attributes at index 0 are used

NOTE: Remember the "no character, no attributes" rule

Modifying String Contents

Replacement rule samples

- Insertion

```
[string replaceCharactersInRange:NSMakeRange(3, 0) withString:@”ABC”];
```

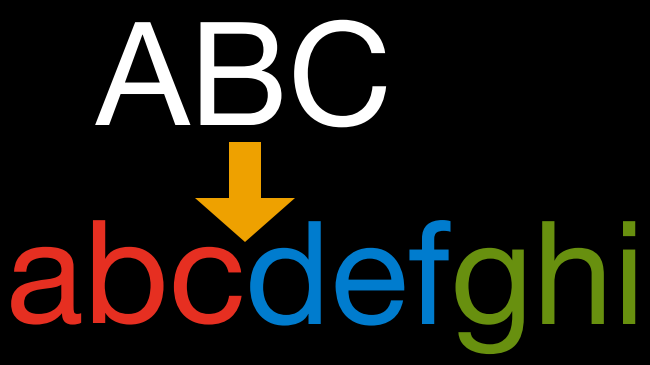
abcdefghi

Modifying String Contents

Replacement rule samples

- Insertion

```
[string replaceCharactersInRange:NSMakeRange(3, 0) withString:@”ABC”];
```



Modifying String Contents

Replacement rule samples

- Insertion

```
[string replaceCharactersInRange:NSMakeRange(3, 0) withString:@”ABC”];
```

abcABCdefghi

Modifying String Contents

Replacement rule samples

- Insertion at the beginning

```
[string replaceCharactersInRange:NSMakeRange(0, 0) withString:@”ABC”];
```

abcdefghi

Modifying String Contents

Replacement rule samples

- Insertion at the beginning

```
[string replaceCharactersInRange:NSMakeRange(0, 0) withString:@”ABC”];
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Modifying String Contents

Replacement rule samples

- Insertion at the beginning

```
[string replaceCharactersInRange:NSMakeRange(0, 0) withString:@”ABC”];
```

ABCabcdefghi

Modifying String Contents

Replacement rule samples

- Cross-run replacement

```
[string replaceCharactersInRange:NSMakeRange(2, 3) withString:@”ABC”];
```

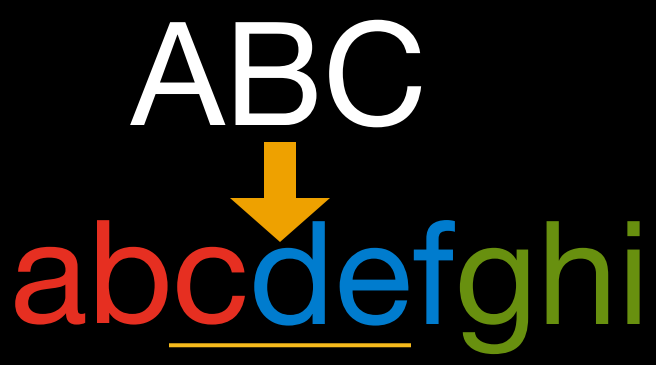
abcdefghi

Modifying String Contents

Replacement rule samples

- Cross-run replacement

```
[string replaceCharactersInRange:NSMakeRange(2, 3) withString:@”ABC”];
```



Modifying String Contents

Replacement rule samples

- Cross-run replacement

```
[string replaceCharactersInRange:NSMakeRange(2, 3) withString:@”ABC”];
```

abABCfghi

Modifying String Contents

Replacement rule samples

- No character, no attributes

```
[string deleteCharactersInRange:NSMakeRange(0, 9)];

[string replaceCharactersInRange:NSMakeRange(0, 0) withString:@”ABC”];
```

abcdefghi

Modifying String Contents

Replacement rule samples

- No character, no attributes

```
[string deleteCharactersInRange:NSMakeRange(0, 9)];
```

```
[string replaceCharactersInRange:NSMakeRange(0, 0) withString:@”ABC”];
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abcdefghi

Modifying String Contents

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Modifying String Contents

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ABC

Querying Attributes

- An attribute dictionary per character
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Querying Attributes

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Not guaranteed to return the maximum range

Querying Attributes

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Querying Attributes

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```
- (NSDictionary *)attributesAtIndex:(NSUInteger)location
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```

```
NSRange range;
NSDictionary *dict = [string attributesAtIndex:4 effectiveRange:&range];
```

abcdefghi

Querying Attributes

- An attribute dictionary per character

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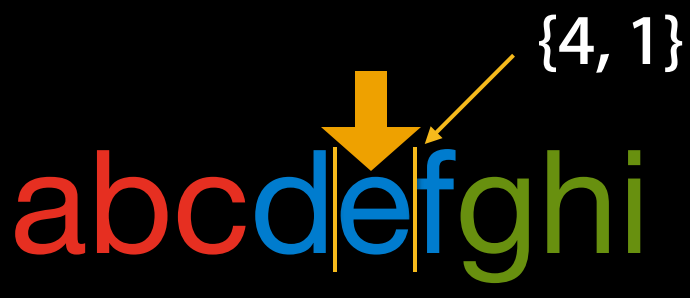

Getting Contiguous Run Range

Using longest effective range methods

- Variants of attribute query methods

```
- (NSDictionary *)attributesAtIndex:(NSUInteger)location
             longestEffectiveRange:(NSRangePointer)range
                           inRange:(NSRange)maximumRange;

- (id)attribute:(NSString)attribute
                           atIndex:(NSUInteger)location
             longestEffectiveRange:(NSRangePointer)range
                           inRange:(NSRange)maximumRange;
```

Getting Contiguous Run Range

Using longest effective range methods

- Getting the contiguous range for attributes

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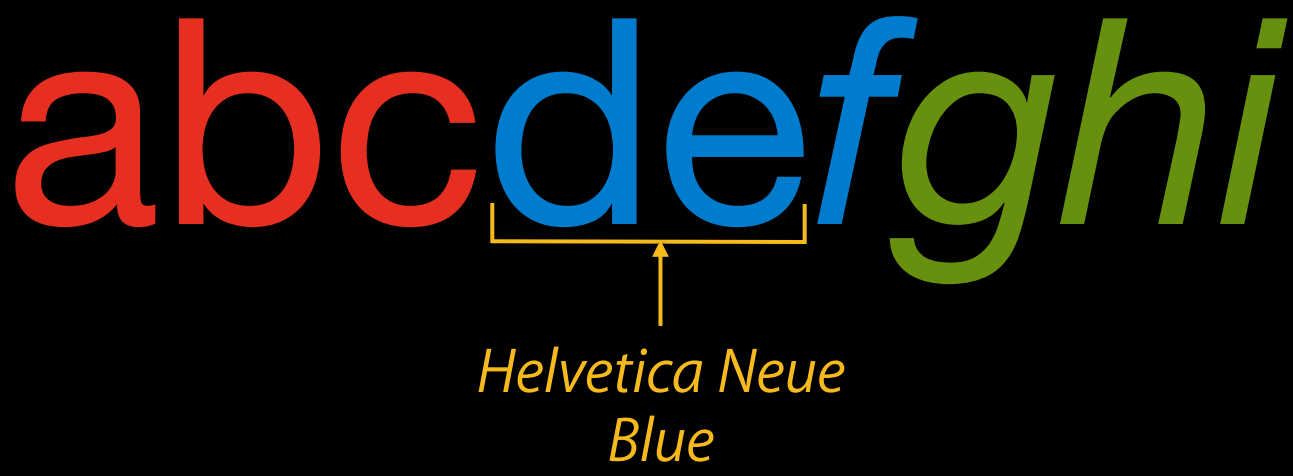
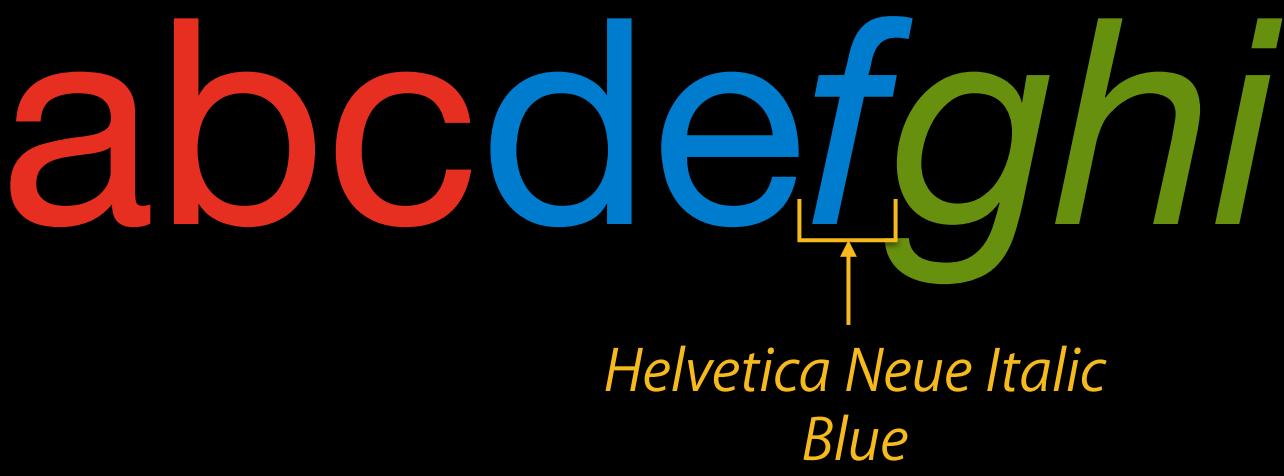


Getting Contiguous Run Range

Using longest effective range methods

- Getting the contiguous range for attributes



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Getting Contiguous Run Range

Using longest effective range methods

- Getting the contiguous range for NSFontAttributeName

Getting Contiguous Run Range

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Getting Contiguous Run Range

Using longest effective range methods

- Getting the contiguous range for NSForegroundColorAttributeName

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Using longest effective range methods

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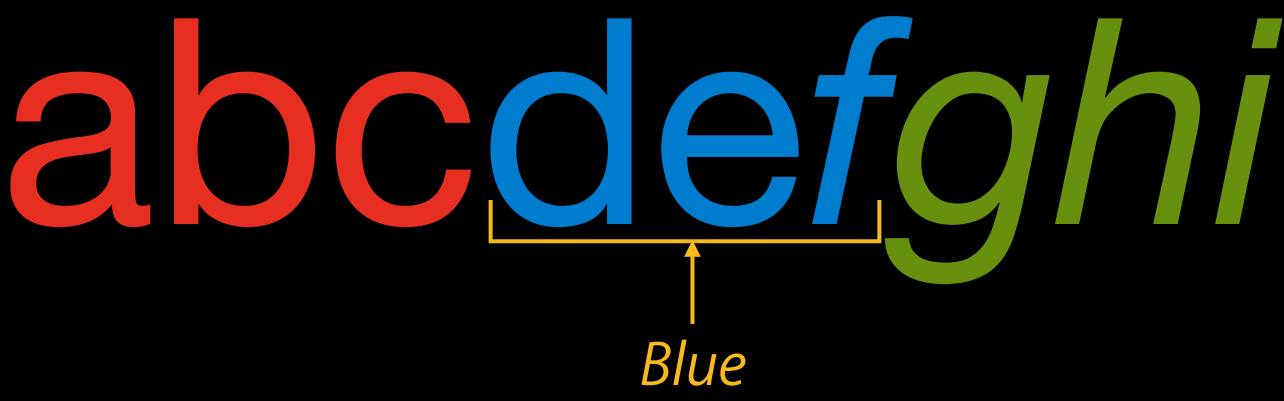

Getting Contiguous Run Range

Using longest effective range methods

- Getting the contiguous range for NSForegroundColorAttributeName

Querying Attributes

Querying Attributes

- Enumeration methods

```
-enumerateAttributesInRange:options:usingBlock:
-enumerateAttribute:inRange:options:usingBlock:
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Querying Attributes

- Enumeration methods

```
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- Changing attributes based on existing attributes

Querying Attributes

- Enumeration methods

```
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- Changing attributes based on existing attributes
- Modifying string contents while preserving the attributes

Querying Attributes

- Enumeration methods

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```

- Changing attributes based on existing attributes
- Modifying string contents while preserving the attributes

Enumerating for Modification

Uppercase while preserving attributes

```
NSMutableAttributedString *attrString;
NSLocale *locale = [NSLocale currentLocale];

[attrString enumerateAttributesInRange:NSMakeRange(0, [attrString length])
  options:0
  usingBlock:^(NSDictionary *attrs, NSRange range, BOOL *stop) {
     NSString *string = [[attrString string] substringWithRange:range];

     [attrString replaceCharactersInRange:range
                 withString:[string uppercaseStringWithLocale:locale]];
}];
```

abcdefghi

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Uppercase while preserving attributes

```
NSMutableAttributedString *attrString;
NSLocale *locale = [NSLocale currentLocale];

[attrString enumerateAttributesInRange:NSMakeRange(0, [attrString length])
  options:0
  usingBlock:^(NSDictionary *attrs, NSRange range, BOOL *stop) {
     NSString *string = [[attrString string] substringWithRange:range];

     [attrString replaceCharactersInRange:range
                 withString:[string uppercaseStringWithLocale:locale]];
}];
```

abcdefghi

Enumerating for Modification

Uppercase while preserving attributes

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ABCDE*fghi*

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ABCDEFGHI

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     [attrString replaceCharactersInRange:range
                 withString:[string uppercaseStringWithLocale:locale]];
}];
```

Drawing Attributed Strings

Drawing an Attributed String

```
NSAttributedString *string = [[NSAttributedString alloc]
      initWithString:@”Hello World!!”
      attributes:@{ NSFontAttributeName : [UIFont systemFontOfSize:12.0f }];
```

Drawing an Attributed String

```
NSAttributedString *string = [[NSAttributedString alloc]
      initWithString:@"Hello World!!"
      attributes:@{ NSFontAttributeName : [UIFont systemFontOfSize:12.0f }];

[string drawAtPoint:NSMakePoint(10.0f, 10.0f)]; // rendering at 10,10
```

NSStringDrawing API

- Simple drawing/sizing methods
  - `(void)drawInRect:(CGRect)rect;`
  - `(void)drawAtPoint:(CGPoint)point;`
  - `(CGSize)size;`
- Extended drawing/sizing methods
  - `(void)drawWithRect:(CGRect)rect options:(NSStringDrawingOptions)options context:(NSStringDrawingContext *)context;`
  - `(CGRect)boundingRectWithSize:(CGSize)size options:(NSStringDrawingOptions)options context:(NSStringDrawingContext *)context;`

NSStringDrawing API

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```
- (void)drawInRect:(CGRect)rect;

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```

NSStringDrawing API

- Simple drawing/sizing methods

```
- (void)drawInRect:(CGRect)rect;
-drawInRect:withFont:lineBreakMode:alignment:

- (void)drawAtPoint:(CGPoint)point;


- (CGSize)size;
```

NSStringDrawing API

- Simple drawing/sizing methods

```
- (void)drawInRect:(CGRect)rect;

- (void)drawAtPoint:(CGPoint)point;
  -drawAtPoint:withFont:

- (CGSize)size;
```

NSStringDrawing API

- Simple drawing/sizing methods

```
- (void)drawInRect:(CGRect)rect;


- (void)drawAtPoint:(CGPoint)point;


- (CGSize)size;
  -sizeWithFont:
```

Available Attributes

- Font
- Text color
- Paragraph style
- Text background color
- Ligature, kerning, and baseline offset
- Underline and strike-through
- Stroke width and color
- Shadow

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Available Attributes

- Font — `NSFontAttributeName (UIFont)`
- Text color — `NSForegroundColorAttributeName (UIColor)`
- Paragraph style — `NSParagraphStyleAttributeName (NSParagraphStyle)`

Available Attributes

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- Text color — `NSForegroundColorAttributeName (UIColor)`
- Paragraph style — `NSParagraphStyleAttributeName (NSParagraphStyle)`

A missing attribute implies its default value.

Available Attributes

Attribute default value

- Font `[UIFont systemFontOfSize:[UIFont systemFontSize]]`
- Text color `[UIColor blackColor]`
- Paragraph style `[NSParagraphStyle defaultParagraphStyle]`

Missing Attributes

Quartz graphics state independent

```
NSAttributedString *string;

// No attribute specified
string = [[NSAttributedString alloc] initWithString:@”Hello World!!”];

// Leaving CGContext color properties with red color
[[UIColor redColor] set];
UIRectFill(rect);

[string drawAtPoint:point];
```

Missing Attributes

Quartz graphics state independent

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NSAttributedString *string;

// No attribute specified
string = [[NSAttributedString alloc] initWithString:@”Hello World!!”];

// Leaving CGContext color properties with red color
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```
NSAttributedString *string;

// No attribute specified
string = [[NSAttributedString alloc] initWithString:@"Hello World!!"];

// Leaving CGContext color properties with red color
[[UIColor redColor] set];
UIRectFill(rect);

[string drawAtPoint:point]; // Renders with system font in black
```

Available Attributes

- Font — `NSFontAttributeName (UIFont)`
- Text color — `NSForegroundColorAttributeName (UIColor)`
- Paragraph style — `NSParagraphStyleAttributeName (NSParagraphStyle)`

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- Font — `NSFontAttributeName (UIFont)`
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Layout Text Like Pages Documents

NSParagraphStyle

Layout Text Like Pages Documents

NSParagraphStyle

- Encapsulates various paragraph-wide style attributes

Layout Text Like Pages Documents

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- Encapsulates various paragraph-wide style attributes
- Allows richer word processor like text formatting

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- The paragraph style for the first character is used for the rest of paragraph

Layout Text Like Pages Documents

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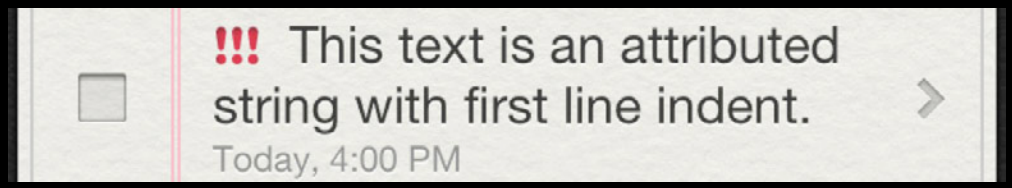
- The paragraph style for the first character is used for the rest of paragraph



NSParagraphStyle

- Line break mode
- Alignment
- Spacings
- Indentation
- Line height control
- Hyphenation
- Base writing direction

NSParagraphStyle

- Line break mode
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NSParagraphStyle

Line break mode

- Very similar to UILineBreakMode

```
@property NSLineBreakMode lineBreakMode;


  NSMutableParagraphStyle *style = [[NSMutableParagraphStyle alloc] init];

  style.lineBreakMode = NSLineBreakByTruncatingTail;

  NSMutableAttributedString *string = [[NSMutableAttributedString alloc]
         initWithString:@"Hello World!!"
         attributes:@{ NSParagraphStyleAttributeName : style }];
```

NSParagraphStyle

Line break mode

- Very similar to UILineBreakMode

```
@property NSLineBreakMode lineBreakMode;
```

```
NSMutableParagraphStyle *style = [[NSMutableParagraphStyle alloc] init];

style.lineBreakMode = NSLineBreakByTruncatingTail;

NSMutableAttributedString *string = [[NSMutableAttributedString alloc]
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style.lineBreakMode = NSLineBreakByTruncatingTail;

NSMutableAttributedString *string = [[NSMutableAttributedString alloc]
       initWithString:@"Hello World!!"
       attributes:@{ NSParagraphStyleAttributeName : style }];
```

NSParagraphStyle

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@property NSLineBreakMode lineBreakMode;
```

```
NSMutableParagraphStyle *style = [[NSMutableParagraphStyle alloc] init];

style.lineBreakMode = NSLineBreakByTruncatingTail;

NSMutableAttributedString *string = [[NSMutableAttributedString alloc]
        initWithString:@"Hello World!!"
        attributes:@{ NSParagraphStyleAttributeName : style }];
```

Hello Wor…

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;

   NSTextAlignmentLeft
```

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;

   NSTextAlignmentLeft
   NSTextAlignmentCenter
```

Hello World!!

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;

   NSTextAlignmentLeft
   NSTextAlignmentCenter
   NSTextAlignmentRight
```

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;
```

```
NSTextAlignmentLeft
NSTextAlignmentCenter
NSTextAlignmentRight
NSTextAlignmentJustified
```

This paragraph shows the new alignment mode, justification.

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;

   NSTextAlignmentLeft
   NSTextAlignmentCenter
   NSTextAlignmentRight
   NSTextAlignmentJustified
   NSTextAlignmentNatural
```

Hello World!!

NSParagraphStyle

Alignment

- Additional alignments introduced

```
@property NSTextAlignment alignment;
```

```
NSTextAlignmentLeft
NSTextAlignmentCenter
NSTextAlignmentRight
NSTextAlignmentJustified
NSTextAlignmentNatural
```

مرحبا العالم!!

Drawing Attributed Strings

Rest of drawing options

- Extended NSStringDrawing methods
- Advanced attributes
- …and more

Drawing Attributed Strings

Rest of drawing options

- Extended NSStringDrawing methods
- Advanced attributes
- …and more

Attributed Strings in UIKit

How do I get this stuff in my labels?

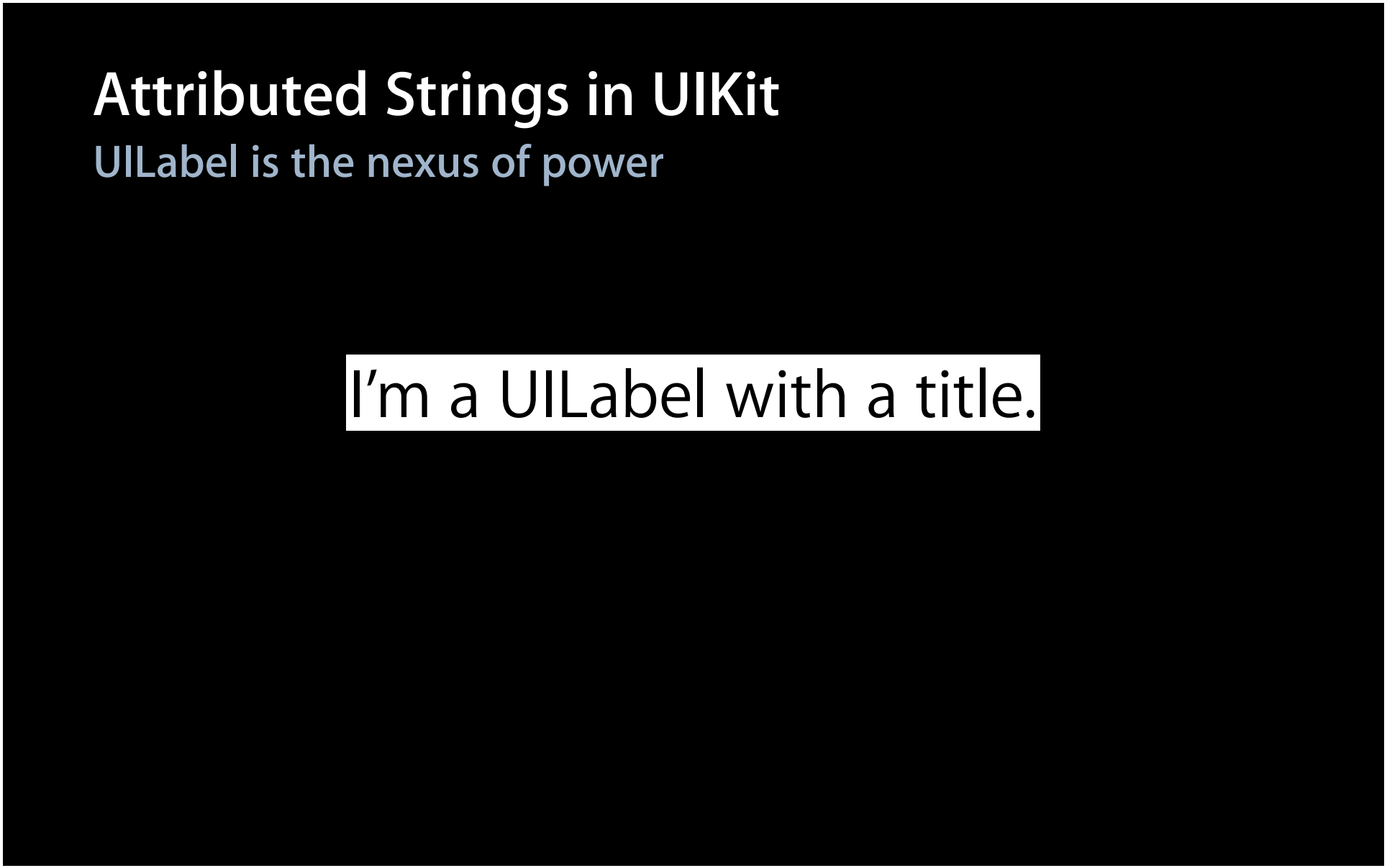
Ian Baird
Label Engineer

Attributed Strings in UIKit

UILabel is the nexus of power

Attributed Strings in UIKit

UILabel is the nexus of power



Attributed Strings in UIKit

UILabel is the nexus of power

Attributed Strings in UIKit

UILabel

- Existing properties

Attributed Strings in UIKit

UILabel

- Existing properties

  `text`

Big red dog.

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
```

Big red dog.

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
textColor
```

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
textColor
textAlignment
```

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
textColor
textAlignment
lineBreakMode
```

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
textColor
textAlignment
lineBreakMode
shadowColor
```

Attributed Strings in UIKit

UILabel

- Existing properties

```
text
font
textColor
textAlignment
lineBreakMode
shadowColor
shadowOffset
```

Attributed Strings in UIKit

UILabel

- New properties:

```
attributedText
minimumScaleFactor
adjustsLetterSpacingToFitWidth
```

Attributed Strings in UIKit

UILabel

- New properties:

```
attributedText
minimumScaleFactor
adjustsLetterSpacingToFitWidth
```

Big red dog.

Attributed Strings in UIKit

UILabel

- New properties:

  `attributedText`

Big *red* dog.

Attributed Strings in UIKit

UILabel

- New properties:

```
attributedText
minimumScaleFactor
```

Big *red* ...

Attributed Strings in UIKit

UILabel

- New properties:

```
attributedText
minimumScaleFactor
adjustsLetterSpacingToFitWidth
```

Attributed Strings in UIKit

UILabel

- Deprecated property

Attributed Strings in UIKit

UILabel

- Deprecated property

```
minimumFontSize
```

Attributed Strings in UIKit

UILabel

- Deprecated property

  `minimumFontSize`

- Instead use

Attributed Strings in UIKit

UILabel

- Deprecated property

  `minimumFontSize`

- Instead use

  `minimumScaleFactor`

Attributed Strings in UIKit

UILabel

Attributed Strings in UIKit

UILabel

- Style properties apply style to entire attributed string, for example

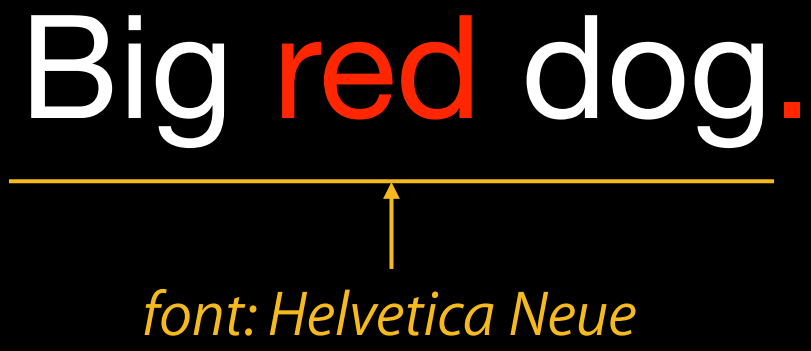
Big red dog.

Attributed Strings in UIKit

UILabel

- Style properties apply style to entire attributed string, for example

  `font`



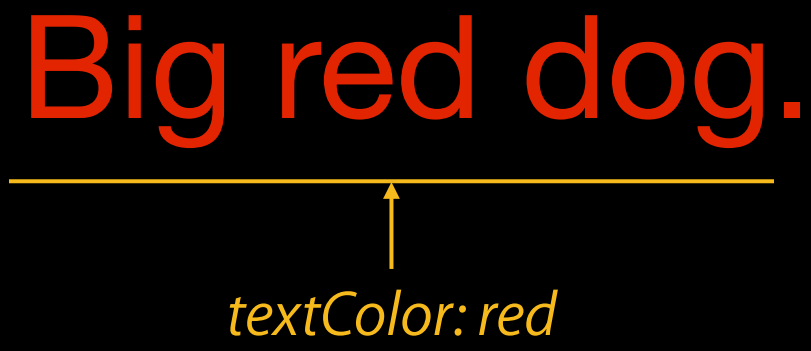
Attributed Strings in UIKit

UILabel

- Style properties apply style to entire attributed string, for example

  `font`

  `textColor`



Attributed Strings in UIKit

UIButton

- Existing method

Attributed Strings in UIKit

UIButton

- Existing method

```
setTitle:forControlState:
```

Attributed Strings in UIKit

UIButton

- Existing method

  `setTitle:forControlState:`

- New method

Attributed Strings in UIKit

UIButton

- Existing method

  `setTitle:forControlState:`

- New method

  `setAttributedTitle:forControlState:`

Attributed Strings in UIKit

UIButton

- Existing method

  `setTitle:forControlState:`

- New method

  `setAttributedTitle:forControlState:`

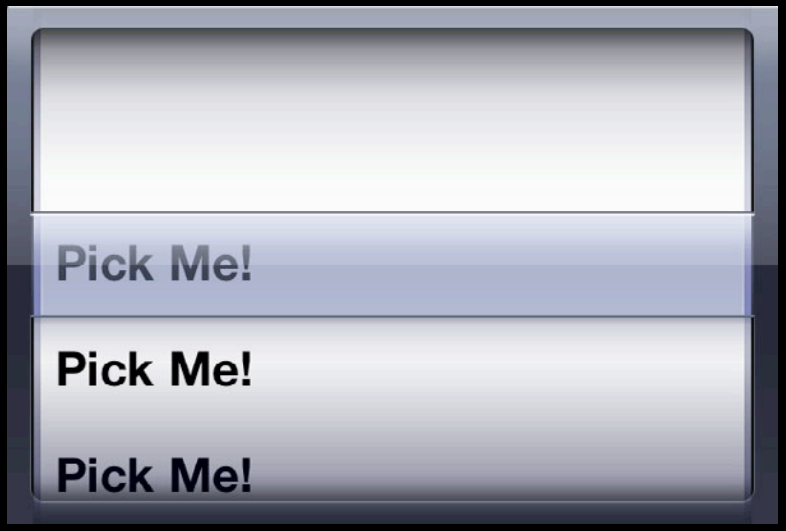
- Attributed title takes precedence

Attributed Strings in UIKit

UIPickerView

Attributed Strings in UIKit

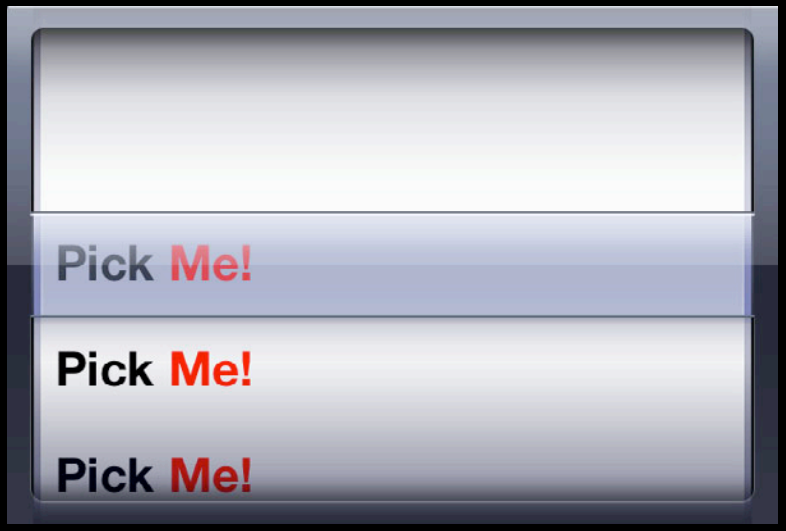
UIPickerView




```
pickerView:titleForRow:forComponent:
```

Attributed Strings in UIKit

UIPickerView




```
pickerView:attributedTitleForRow:forComponent:
```

Attributed Strings in UIKit

UITextView

- Added properties

Attributed Strings in UIKit

UITextView

- Added properties

  `attributedText`

Attributed Strings in UIKit

UITextView

- Added properties

```
attributedText
allowsEditingTextAttributes
```

Attributed Strings in UIKit

UITableView

Attributed Strings in UIKit

UITableView

- No new properties or methods

Attributed Strings in UIKit

UITableView

- No new properties or methods

  Just set `attributedText` on the cell or header view's `textLabel`.

Demo

Johannes Fortmann
UIKit Engineer

Attributed Strings in UIKit

Demo summary

- Drawing text using attributed string

  `drawInRect:`

- Enhancing existing labels

  `NSMutableAttributedString, addAttribute:value:range:`

- Formatting paragraphs

  `NSMutableParagraphStyle`

Summary

Summary

- Attributed string essentials

Summary

- Attributed string essentials
- Drawing and use

Summary

- Attributed string essentials
- Drawing and use
- UIKit adoption

More information

Jake Behrens
UI Frameworks Evangelist
behrens@apple.com

Documentation
UIKit Documentation
https://developer.apple.com/library/ios

Apple Developer Forums
http://devforums.apple.com

Related Sessions

Advanced Attributed Strings for iOS	Mission Thursday 10:15am
Keyboard Input in iOS	Russian Hill Wednesday 2:00PM
Core Text and Fonts	Russian Hill Wednesday 4:30PM

Labs

Attributed Strings & Text Lab	Essentials Lab A Thursday 11:30AM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