



Hacking SWF

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overview of the swf file format (structure, datatypes, flow in flash player) – as3swf: as3 library to parse swf, create, modify – some stuff i've been working on

SWF 10 Spec

adobe.com/devnet/swf

RTFM !

as3swf

github.com/clus/as3swf

Low level ActionScript 3 class library to
parse, create, modify and publish SWF files.

as3abc

github.com/clus/as3abc

ABC bytecode parser
Contributed by Jim Cheng
Based on code by Joa Ebert (Apparat)

swfassist

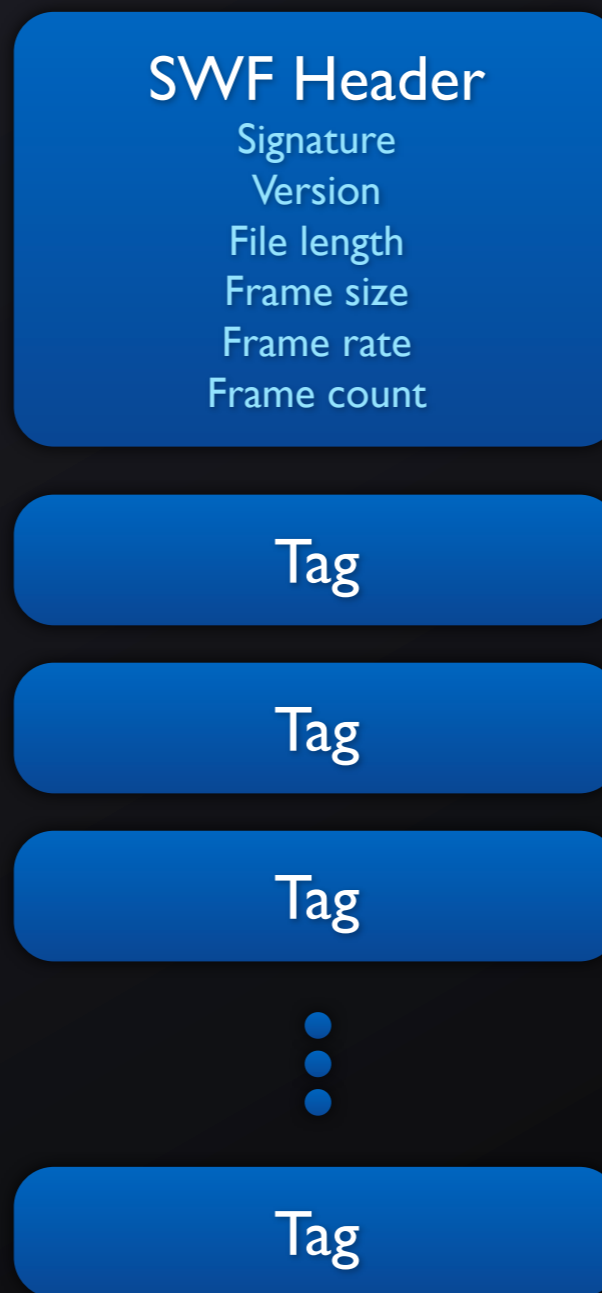
libspark.org/wiki/yossy/swfassist

Low level ActionScript 3 class library to
parse, create, modify and publish SWF files.

DEMO

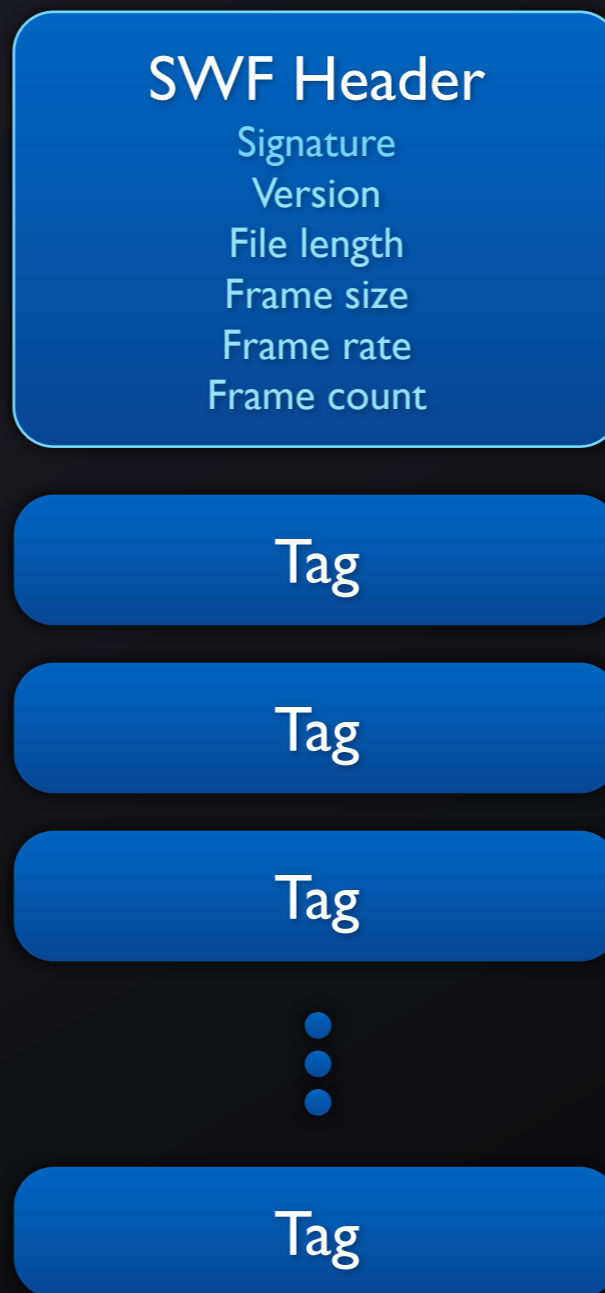
SWF Anatomy

The structure of a SWF



SWF Anatomy

The structure of a SWF



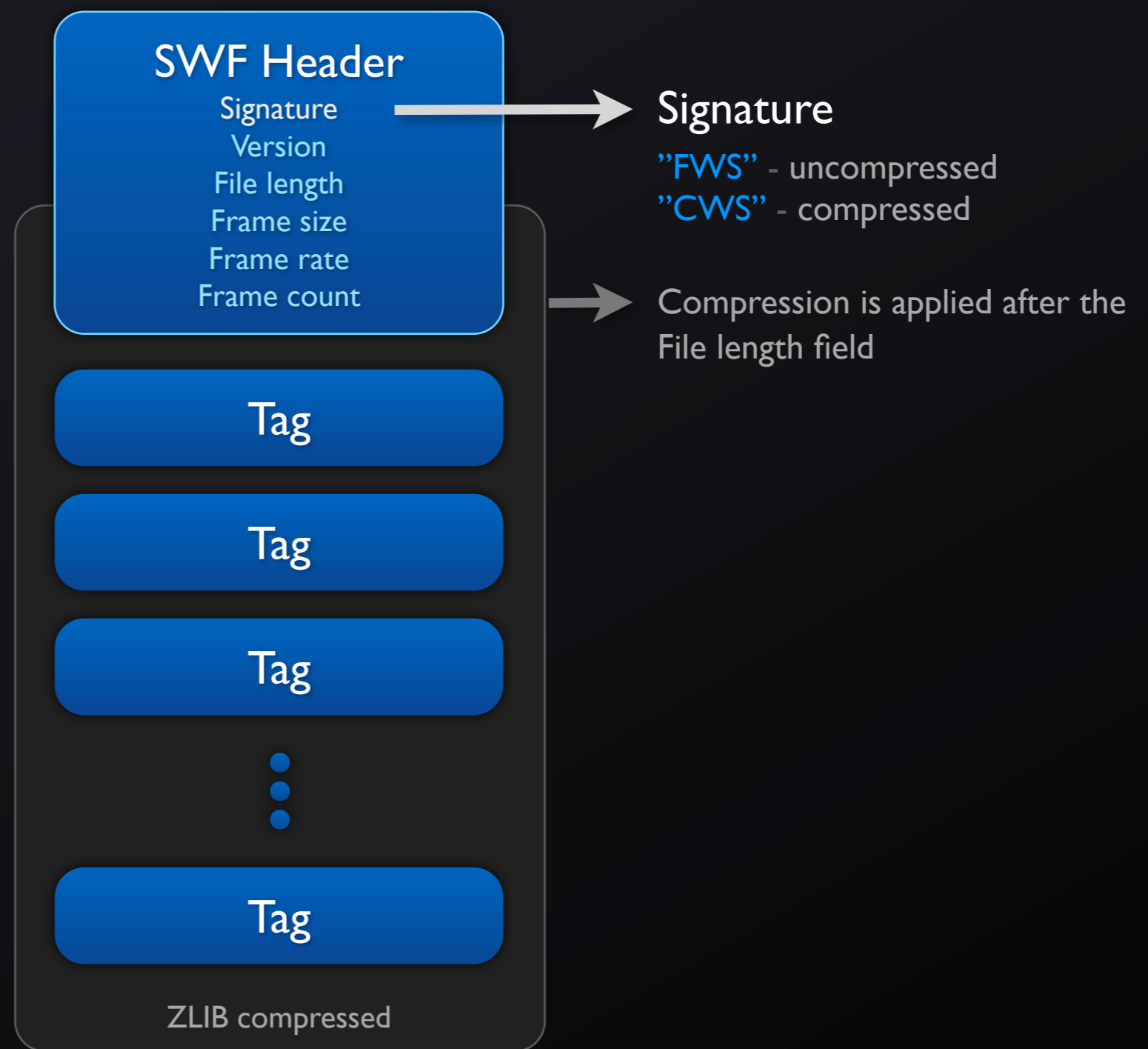
SWF Anatomy

The structure of a SWF



SWF Anatomy

The structure of a SWF



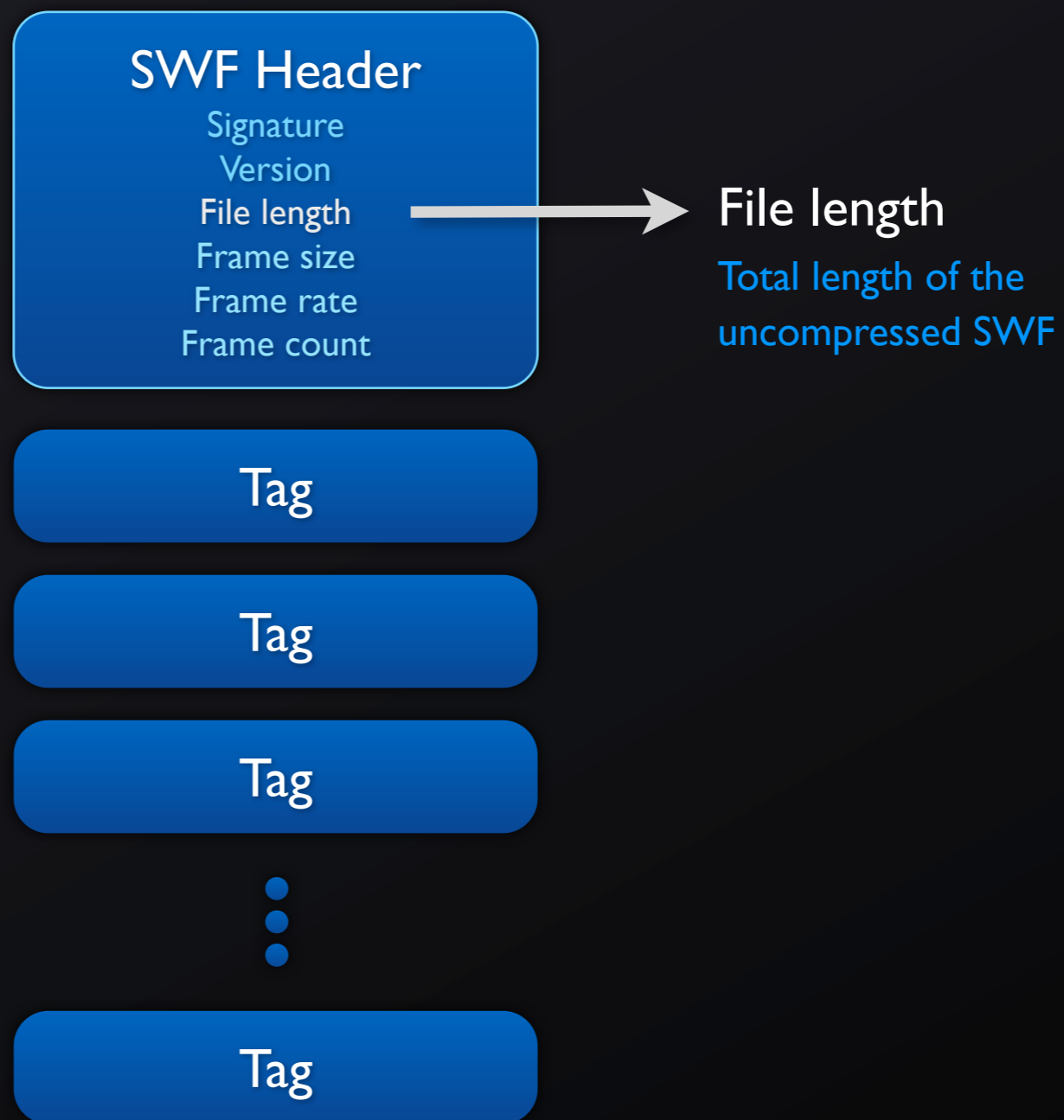
SWF Anatomy

The structure of a SWF



SWF Anatomy

The structure of a SWF



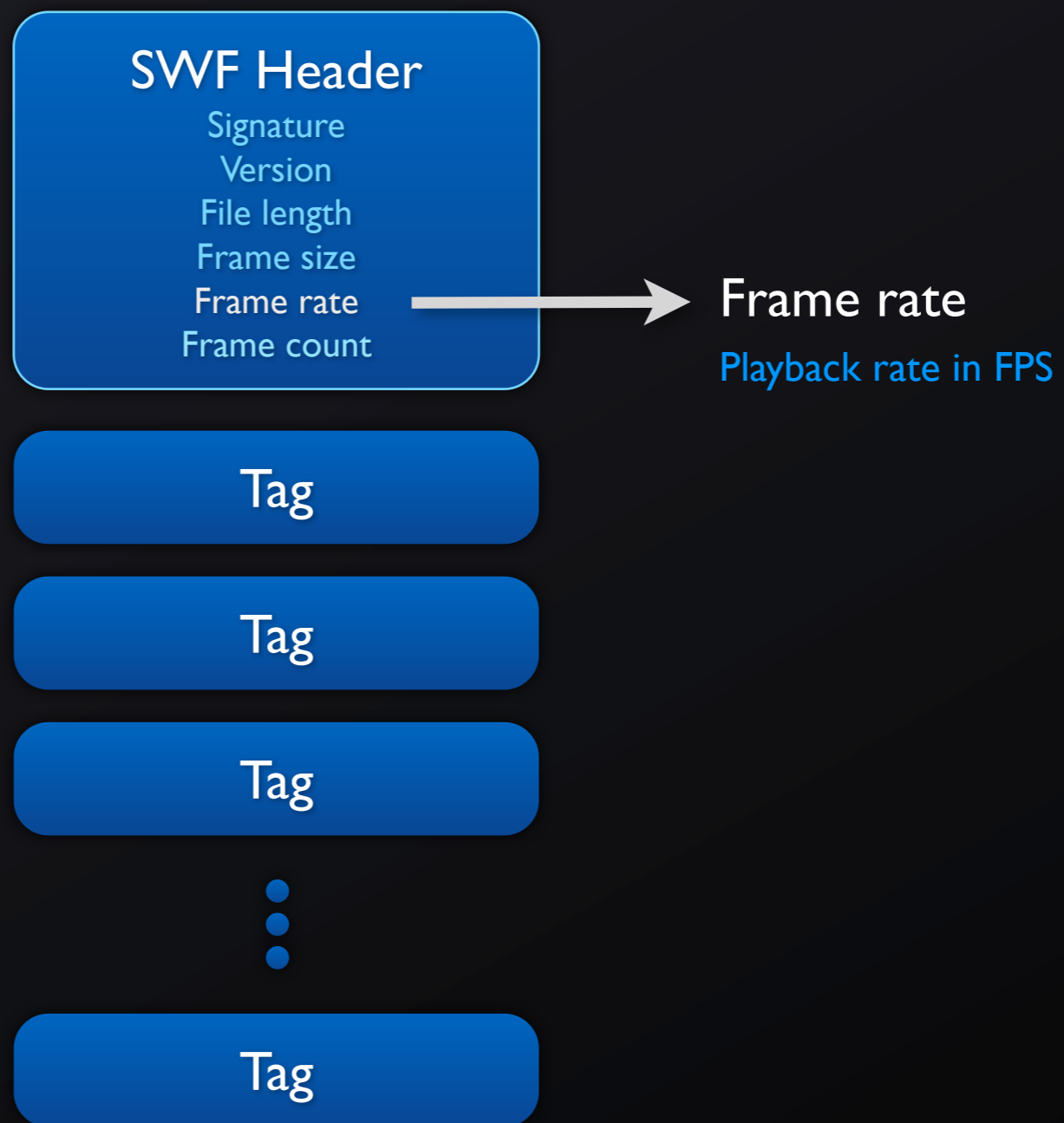
SWF Anatomy

The structure of a SWF



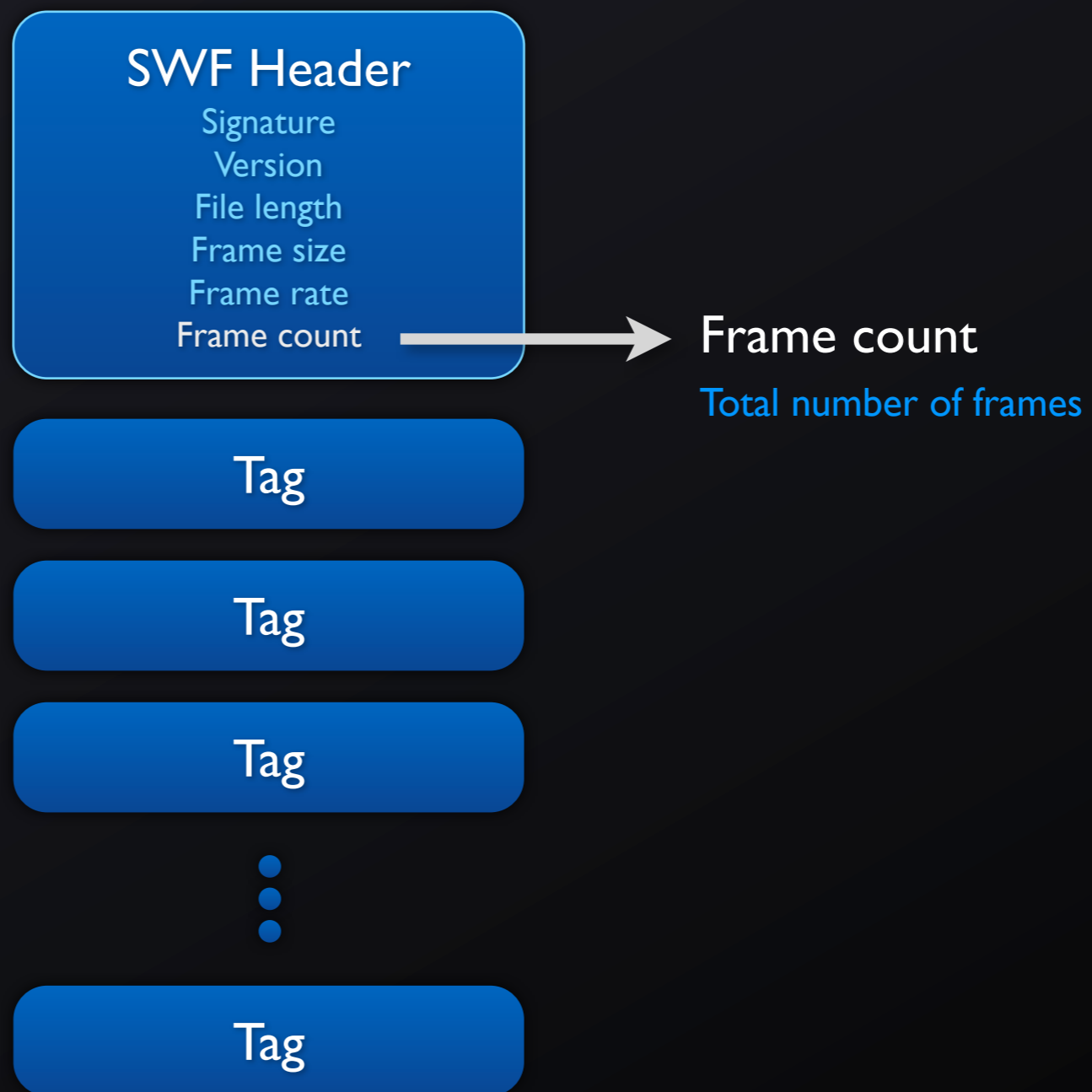
SWF Anatomy

The structure of a SWF



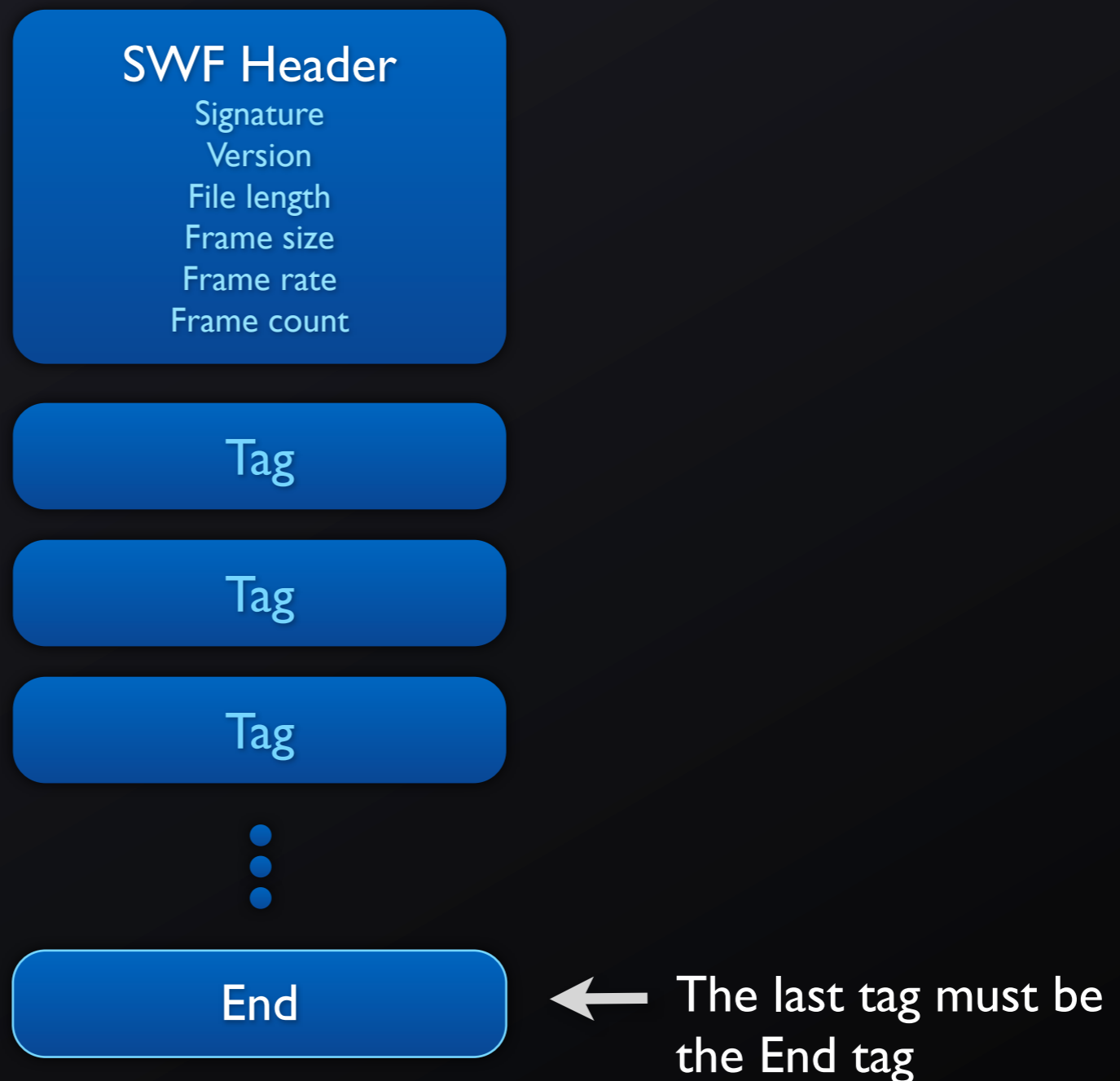
SWF Anatomy

The structure of a SWF



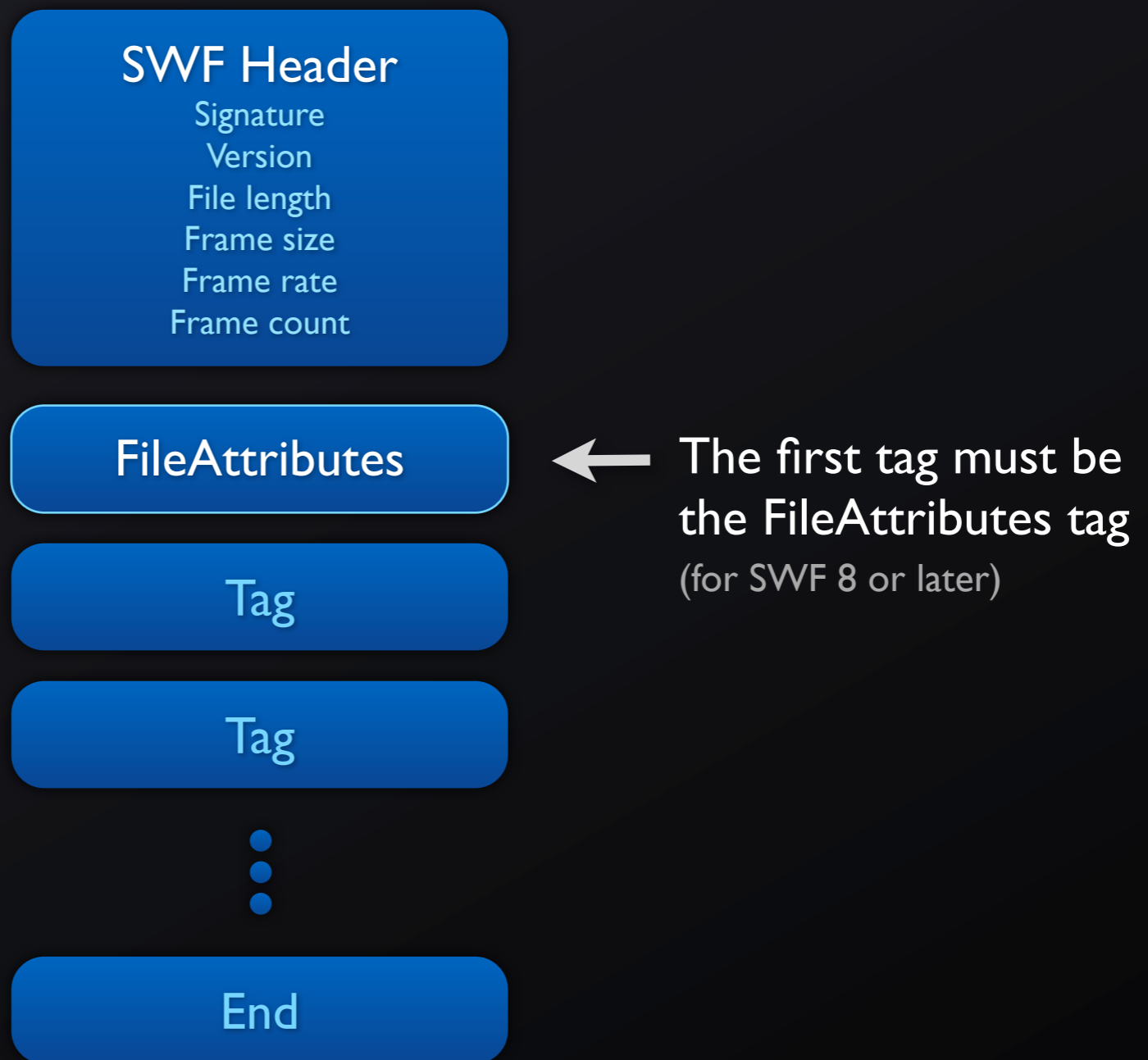
SWF Anatomy

The structure of a SWF



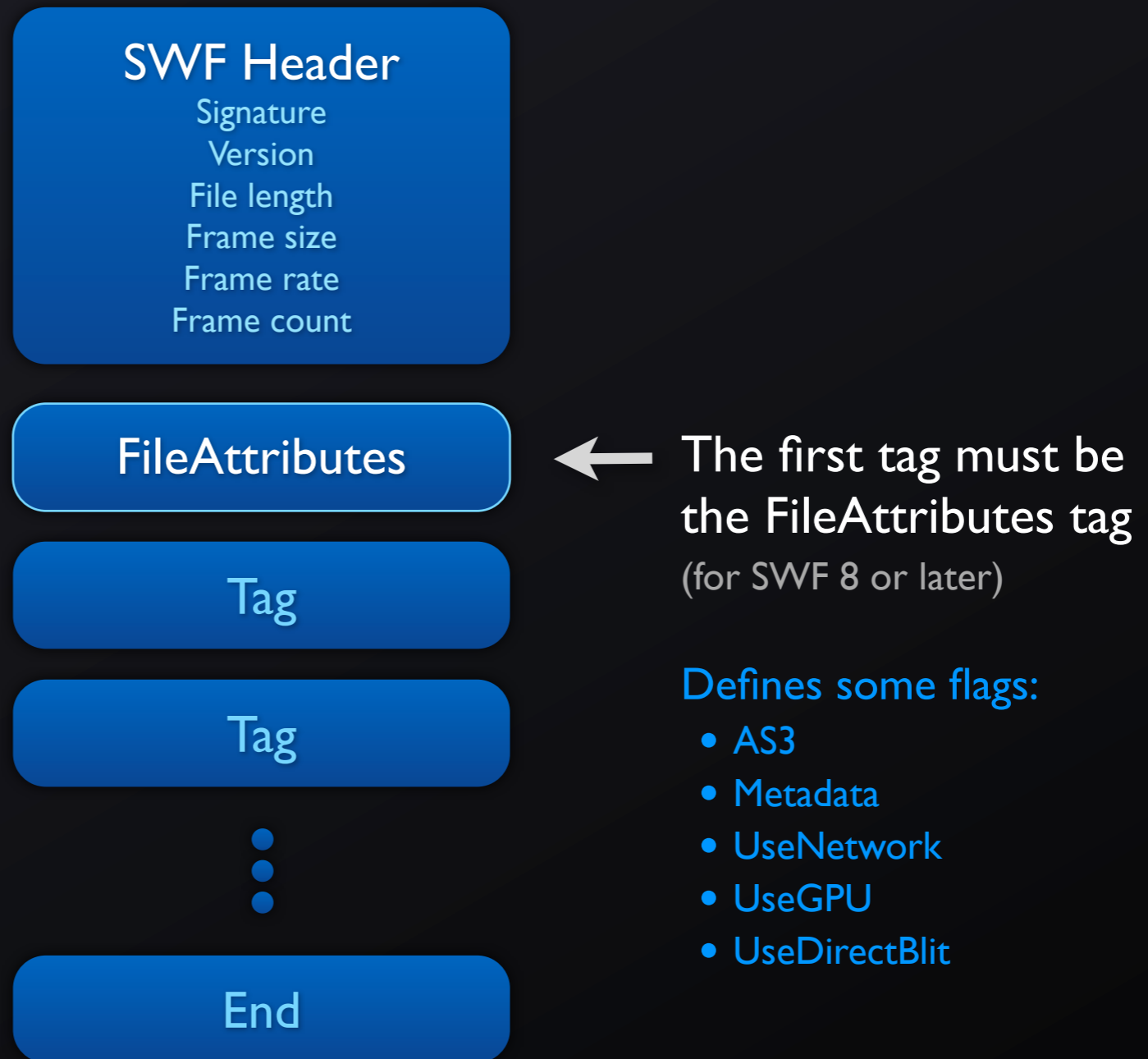
SWF Anatomy

The structure of a SWF



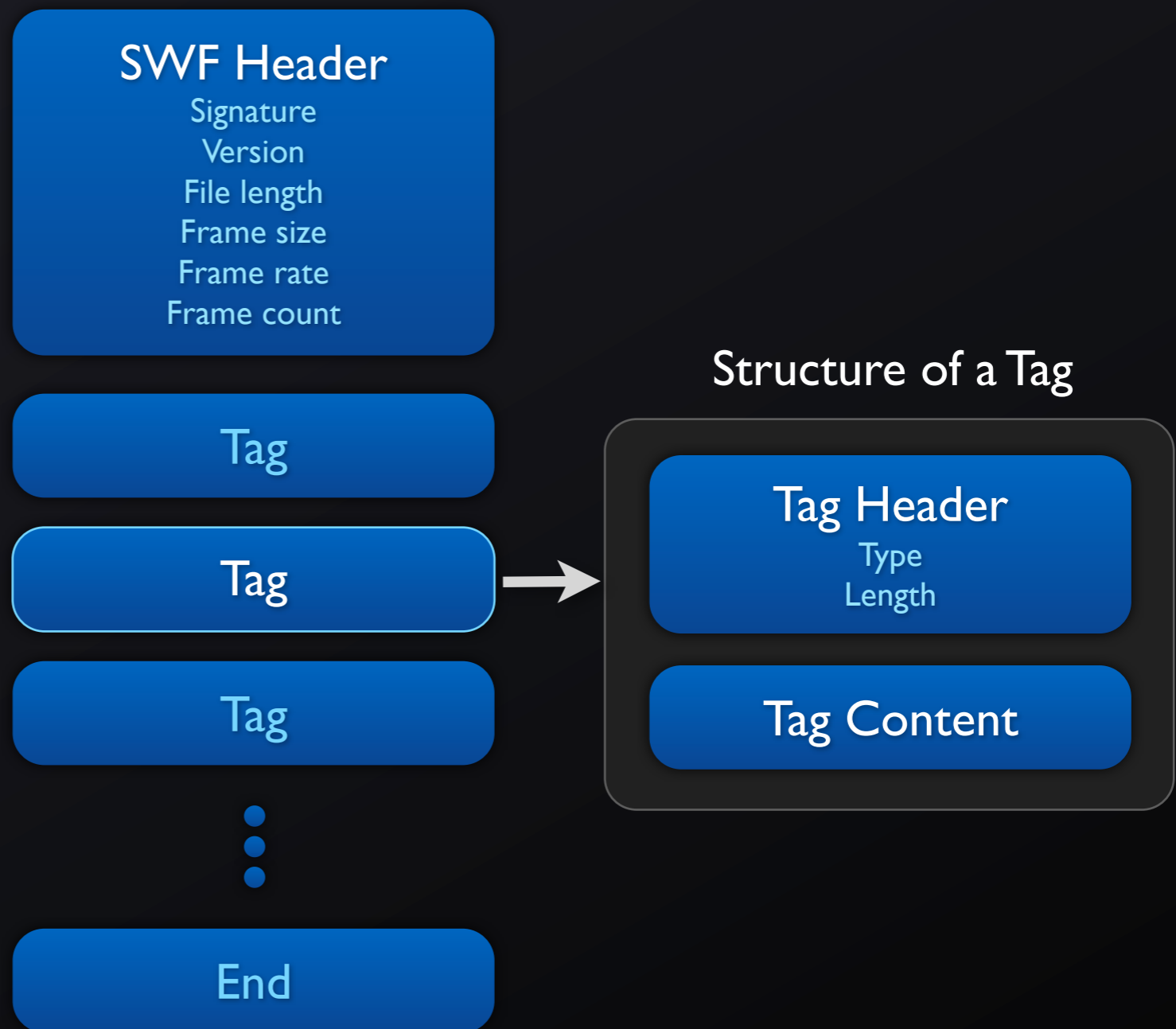
SWF Anatomy

The structure of a SWF



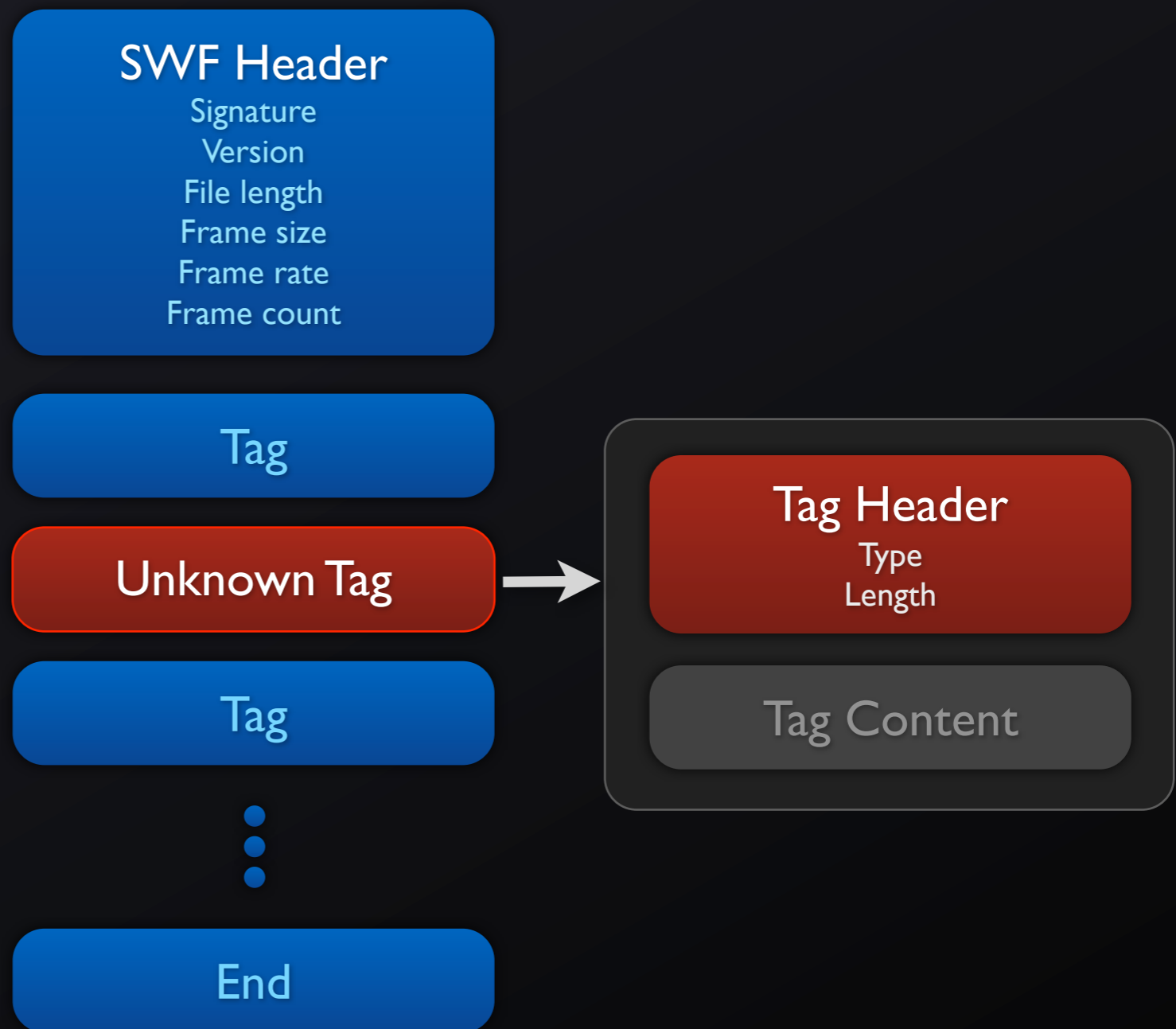
SWF Anatomy

The structure of a SWF



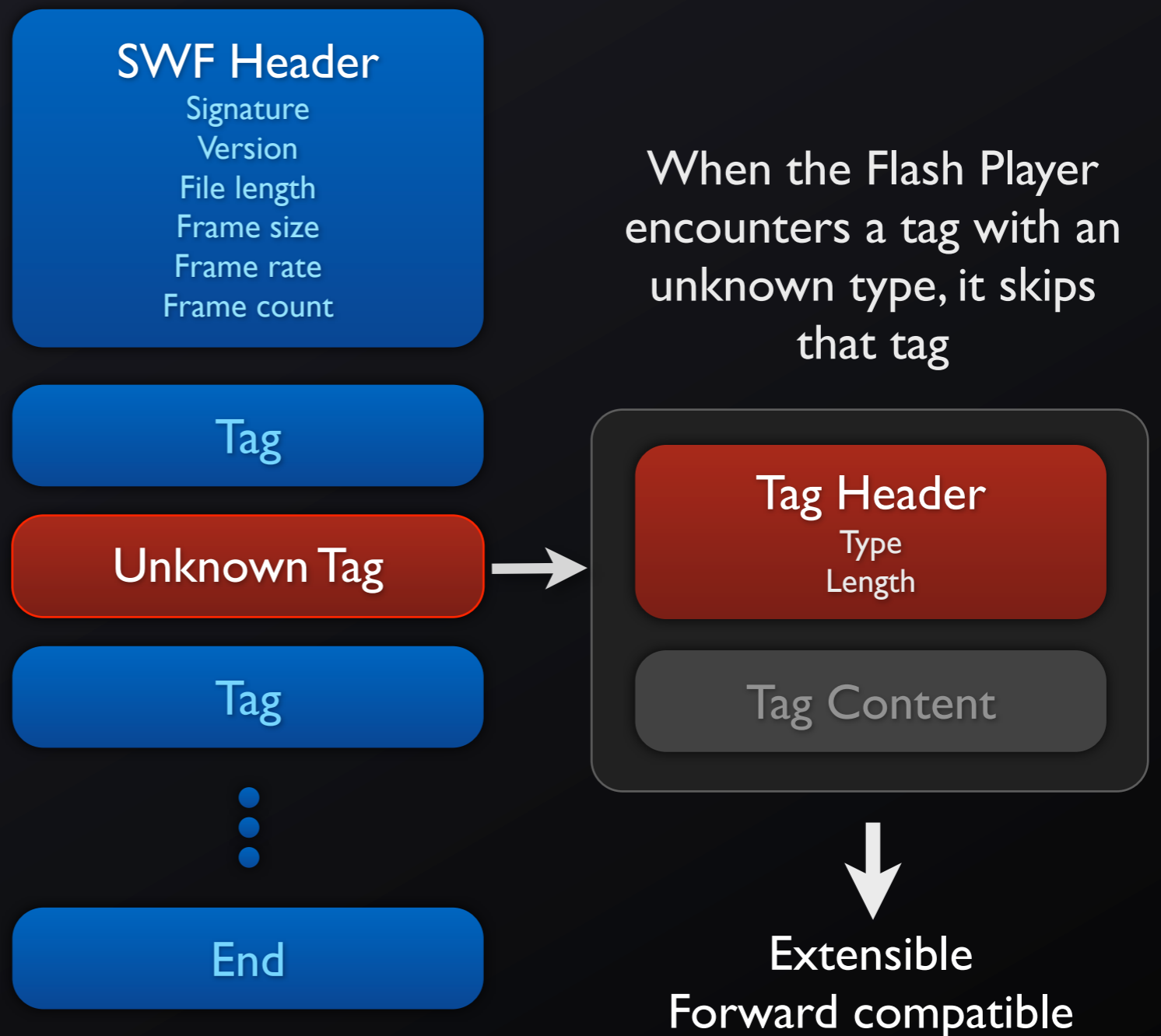
SWF Anatomy

The structure of a SWF



SWF Anatomy

The structure of a SWF



SWF Anatomy

Data types used by SWF

A tag's **content** is made up of various **data types**

Some those are rather **obscure**

(The exact format for each tag is defined in the SWF spec)

Integers

- UI8
- UI16
- UI24
- UI32
- SI8
- SI16
- SI32
- EncodedU32

Numbers

- FIXED
- FIXED8
- FLOAT
- FLOAT16
- DOUBLE

Bit arrays

- UB[nBits]
- SB[nBits]
- FB[nBits]

Others

- String
- RGB
- RGBA
- RECT
- MATRIX

SWF Anatomy

Data types used by SWF

Example: RECT and bit arrays

01011	000000000000	01000100110	000000000000	00110010000
nBits	Xmin	Xmax	Ymin	Ymax
11	0	550	0	400

SWF Anatomy

Data types used by SWF

Example: RECT and bit arrays

01011	000000000000	01000100110	000000000000	00110010000
nBits	Xmin	Xmax	Ymin	Ymax
11	0	550	0	400

nBits specifies the minimum number of bits needed to represent all values in the array

SWF Anatomy

Data types used by SWF

Example: RECT and bit arrays

01011	000000000000	01000100110	000000000000	00110010000
nBits	Xmin	Xmax	Ymin	Ymax
11	0	550	0	400

nBits specifies the minimum number of bits needed to represent all values in the array

All values are stored as a **bit stream** (no byte boundaries)

010110000000000000001000100110000000000000000000110010000

SWF Anatomy

Data types used by SWF

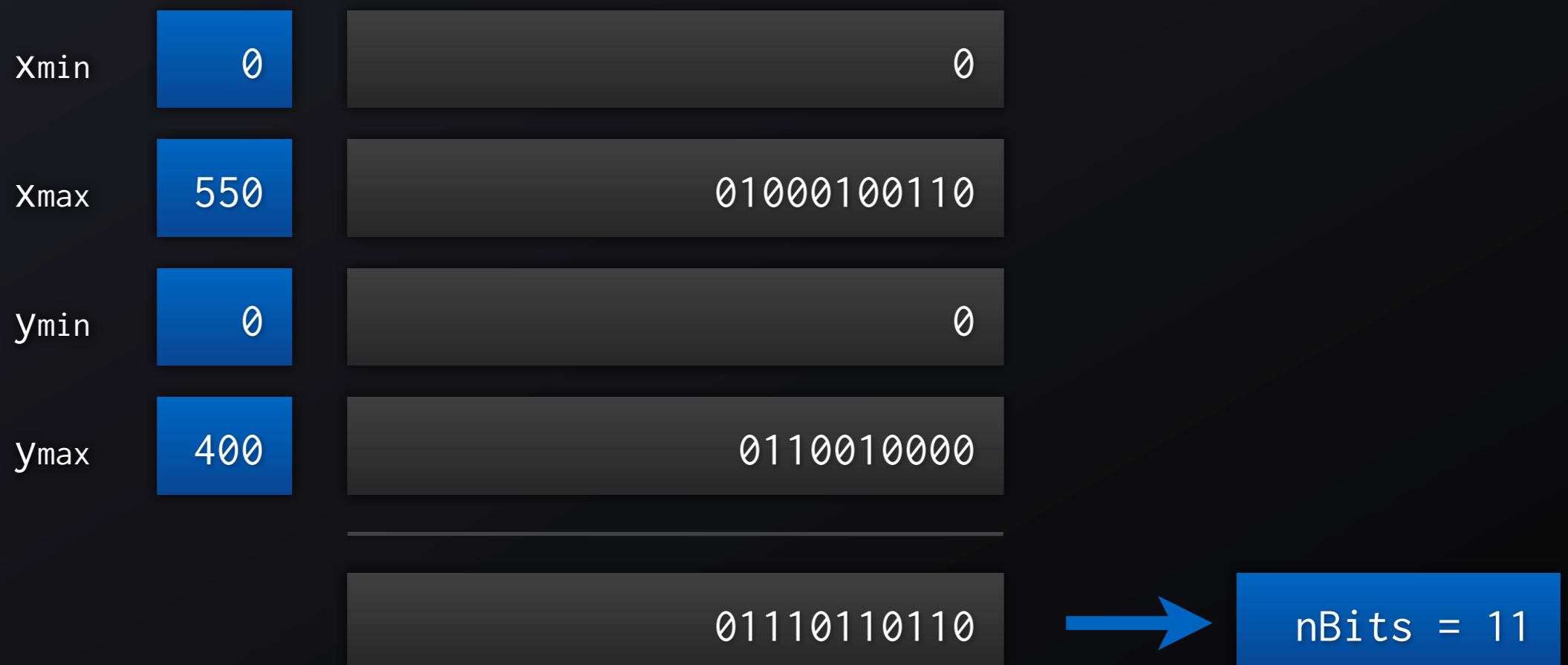
Example: RECT and bit arrays

Xmin	0	0
Xmax	550	01000100110
ymin	0	0
ymax	400	0110010000

SWF Anatomy

Data types used by SWF

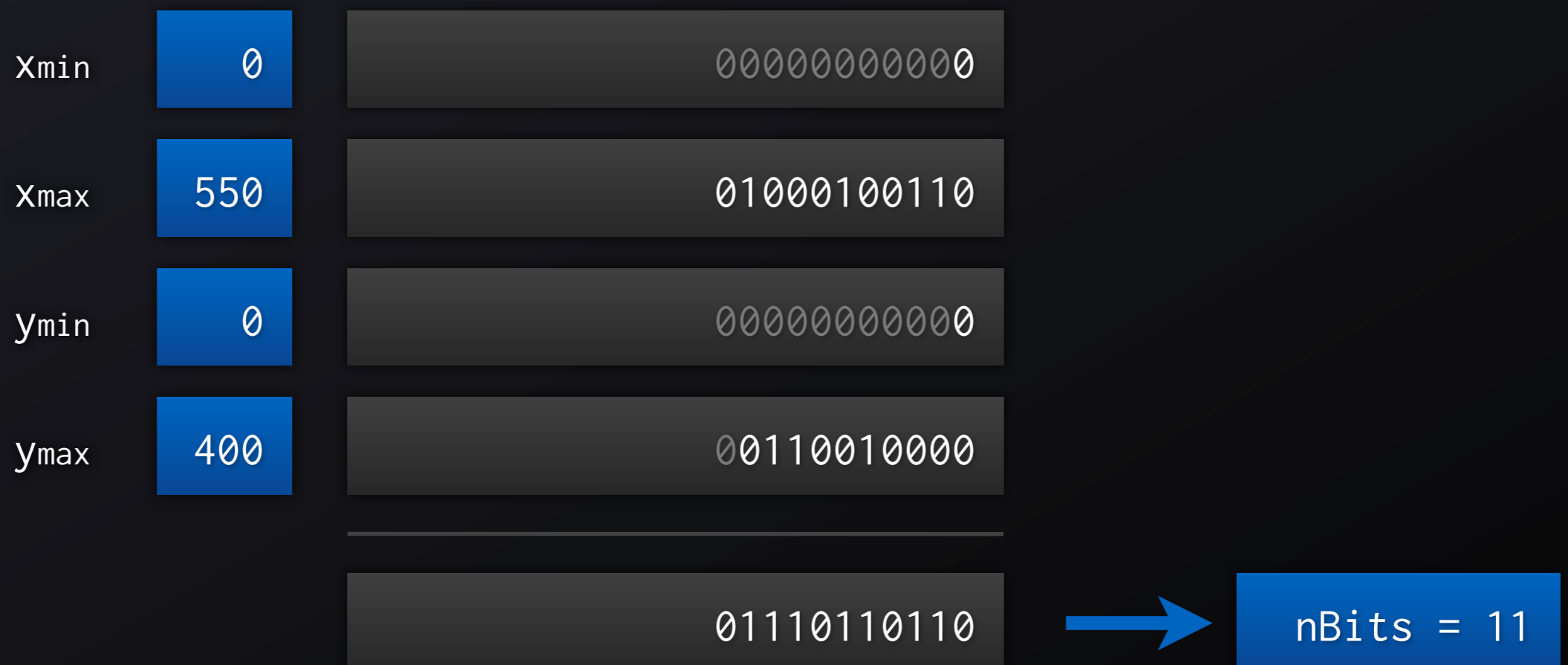
Example: RECT and bit arrays



SWF Anatomy

Data types used by SWF

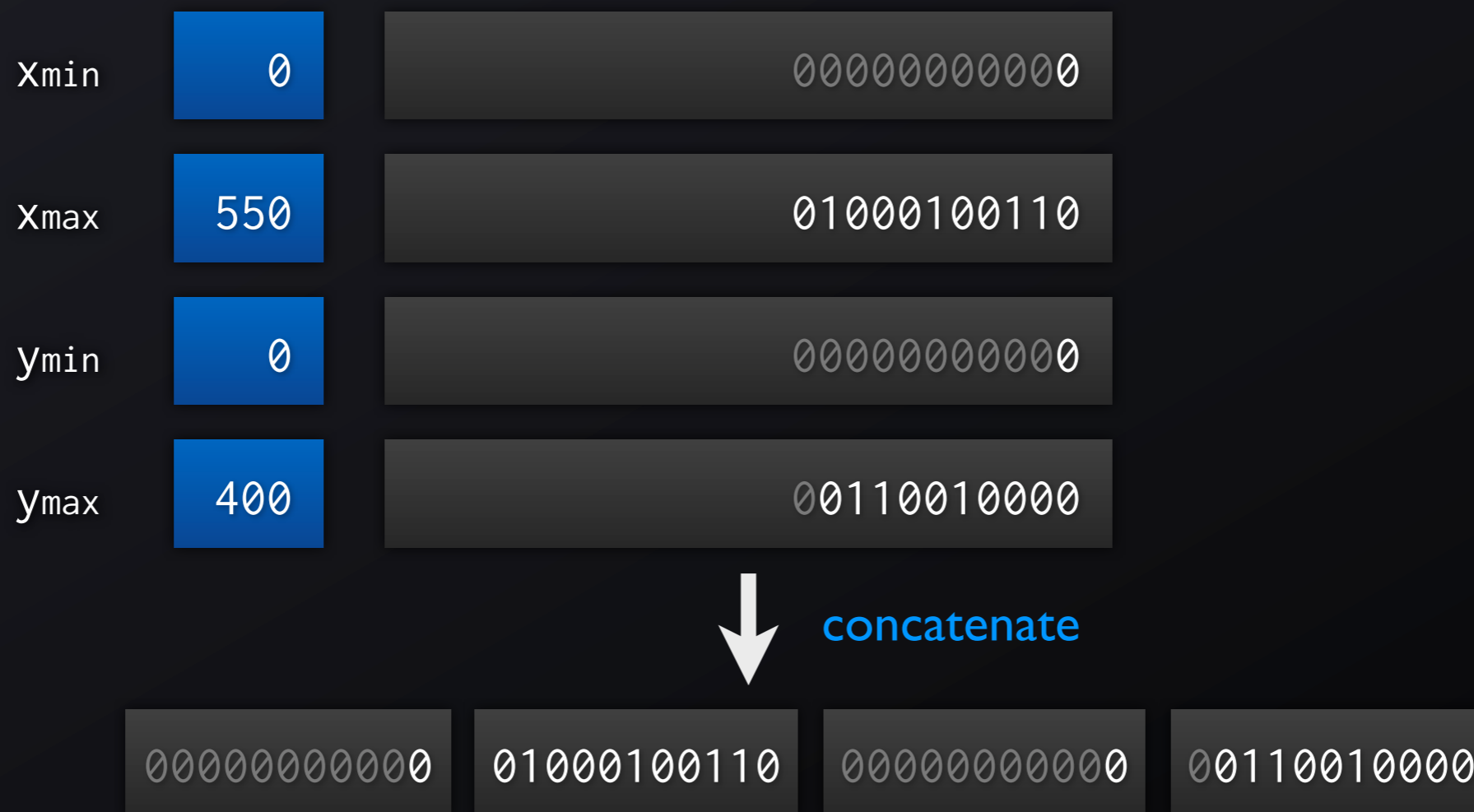
Example: RECT and bit arrays



SWF Anatomy

Data types used by SWF

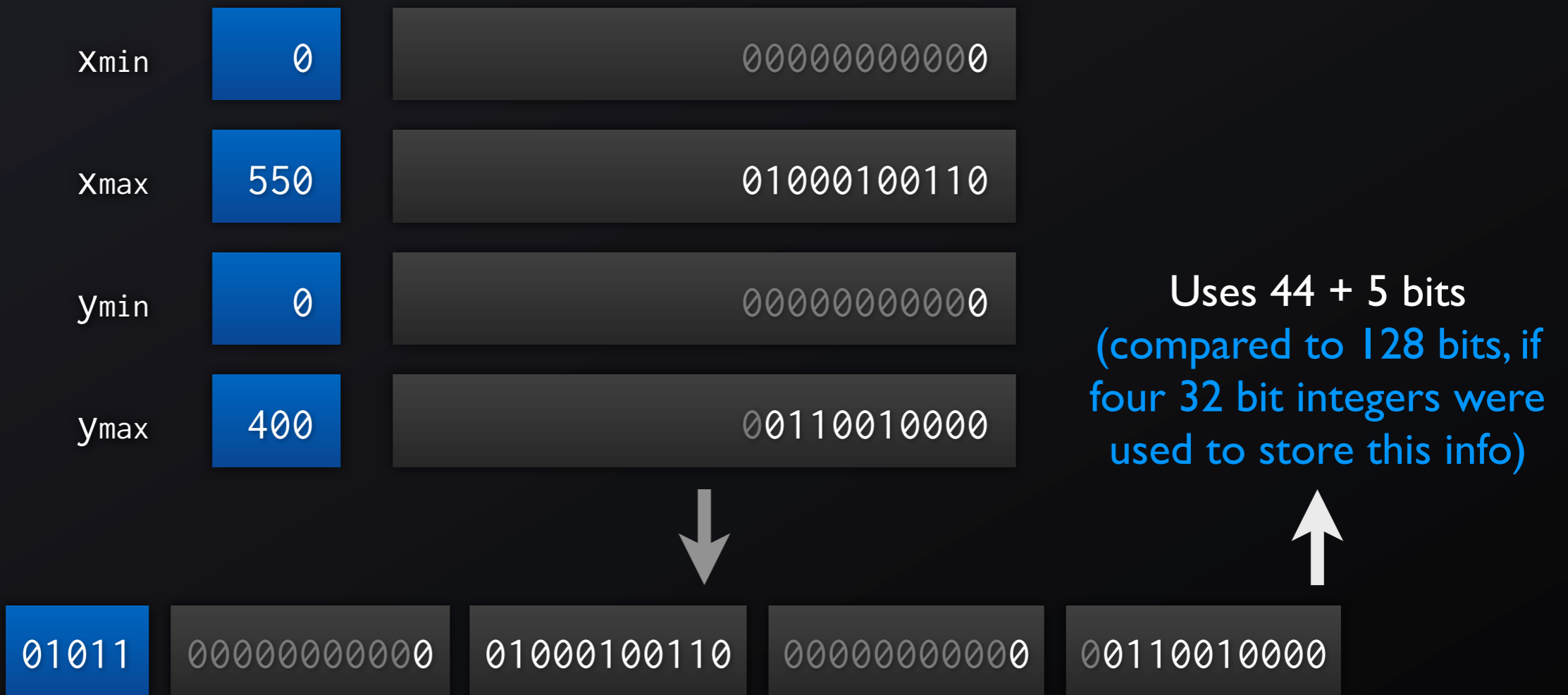
Example: RECT and bit arrays



SWF Anatomy

Data types used by SWF

Example: RECT and bit arrays



SWF Tag Evolution

SWF 10 defines a total of 64 different tags

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

SWF Tag Evolution

SWF 1

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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Shapes (DefineShape), Buttons (DefineButton), Embedded fonts, static text (DefineFont/FontInfo/Text), JPEGs (DefineBits/JPEGTables), Event and streaming sound, Place/RemoveObject, ShowFrame

SWF Tag Evolution

SWF 2

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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DefineBitsJPEG2 gets rid of JPEGTables, adds GIF and PNG, DefineButtonSound defines sounds played on state transitions, DefineShape2: more styles, multiple style lists

SWF Tag Evolution

SWF 3

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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DoAction: first simple scripting model!!, DefineSprite: Movieclips!!, DefineBitsJPEG3/
DefineBitsLossless2: adds alpha channel for JPEG, DefineButton2: button actions,
PlaceObject2: tweens, DefineMorphShape: shape tweens

SWF Tag Evolution

SWF 4

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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dynamic/input text!!, Extended action model (variables, expressions, branching and looping)
stack based virtual machine

SWF Tag Evolution

SWF 5

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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Import/ExportAssets: adds ability to import characters from loaded swfs

SWF Tag Evolution

SWF 6

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

SWF Tag Evolution

SWF 7

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

SWF Tag Evolution

SWF 8

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

Saturday, 28. August 2010

DefineFont3: better resolution for glyph shapes (20x), DefineShape4: joints/caps, stroke fills, PlaceObject3: cacheAsBitmap, blend modes, filters

SWF Tag Evolution

SWF 9

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

SWF Tag Evolution

SWF 10

CSMTextSettings	DefineFont4	DefineText2	PlaceObject2
DefineBinaryData	DefineFontAlignZones	DefineVideoStream	PlaceObject3
DefineBits	DefineFontInfo	DoABC	Protect
DefineBitsJPEG2	DefineFontInfo2	DoAction	RemoveObject
DefineBitsJPEG3	DefineFontName	DoInitAction	RemoveObject2
DefineBitsJPEG4	DefineMorphShape	EnableDebugger	ScriptLimits
DefineBitsLossless	DefineMorphShape2	EnableDebugger2	SetBackgroundColor
DefineBitsLossless2	DefineScalingGrid	End	SetTabIndex
DefineButton	DefineSceneAnd...	ExportAssets	ShowFrame
DefineButton2	DefineShape	FileAttributes	SoundStreamBlock
DefineButtonCxform	DefineShape2	FrameLabel	SoundStreamHead
DefineButtonSound	DefineShape3	ImportAssets	SoundStreamHead2
DefineEditText	DefineShape4	ImportAssets2	StartSound
DefineFont	DefineSound	JPEGTables	StartSound2
DefineFont2	DefineSprite	Metadata	SymbolClass
DefineFont3	DefineText	PlaceObject	VideoFrame

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DefineFont4: new text engine, embedded fonts in CFF format (previously: swf shapes)

SWF Tag Families

Definition tags

Define the SWF's content

Assign a unique character id

(characters are stored in a dictionary for use/reuse)

DefineShape

DefineButton

DefineSprite

DefineBits

DefineFont

DefineText

DefineSound

DefineVideoStream

SWF Tag Families

Control tags

Control the flow of the SWF

Create and manipulate instances of objects on the display list

PlaceObject

RemoveObject

ShowFrame

SWF Tag Families

Control tags

Control the flow of the SWF

Create and manipulate instances of objects on the display list

PlaceObject

Places a character from the dictionary on the display list

Modifies a character that was previously placed on the display list

RemoveObject

ShowFrame

SWF Tag Families

Control tags

Control the flow of the SWF

Create and manipulate instances of objects on the display list

PlaceObject

Places a character from the dictionary on the display list

Modifies a character that was previously placed on the display list

RemoveObject

Removes a character from the display list

ShowFrame

SWF Tag Families

Control tags

Control the flow of the SWF

Create and manipulate instances of objects on the display list

PlaceObject

Places a character from the dictionary on the display list

Modifies a character that was previously placed on the display list

RemoveObject

Removes a character from the display list

ShowFrame

Tells the Flash Player to render the display list

The Flow

A simple example

SWF

DefineShape
ID 1

DefineSprite
ID 2

PlaceObject
ID 1 at depth 1

PlaceObject
ID 2 at depth 2

ShowFrame

RemoveObject
from depth 1

ShowFrame

Dictionary

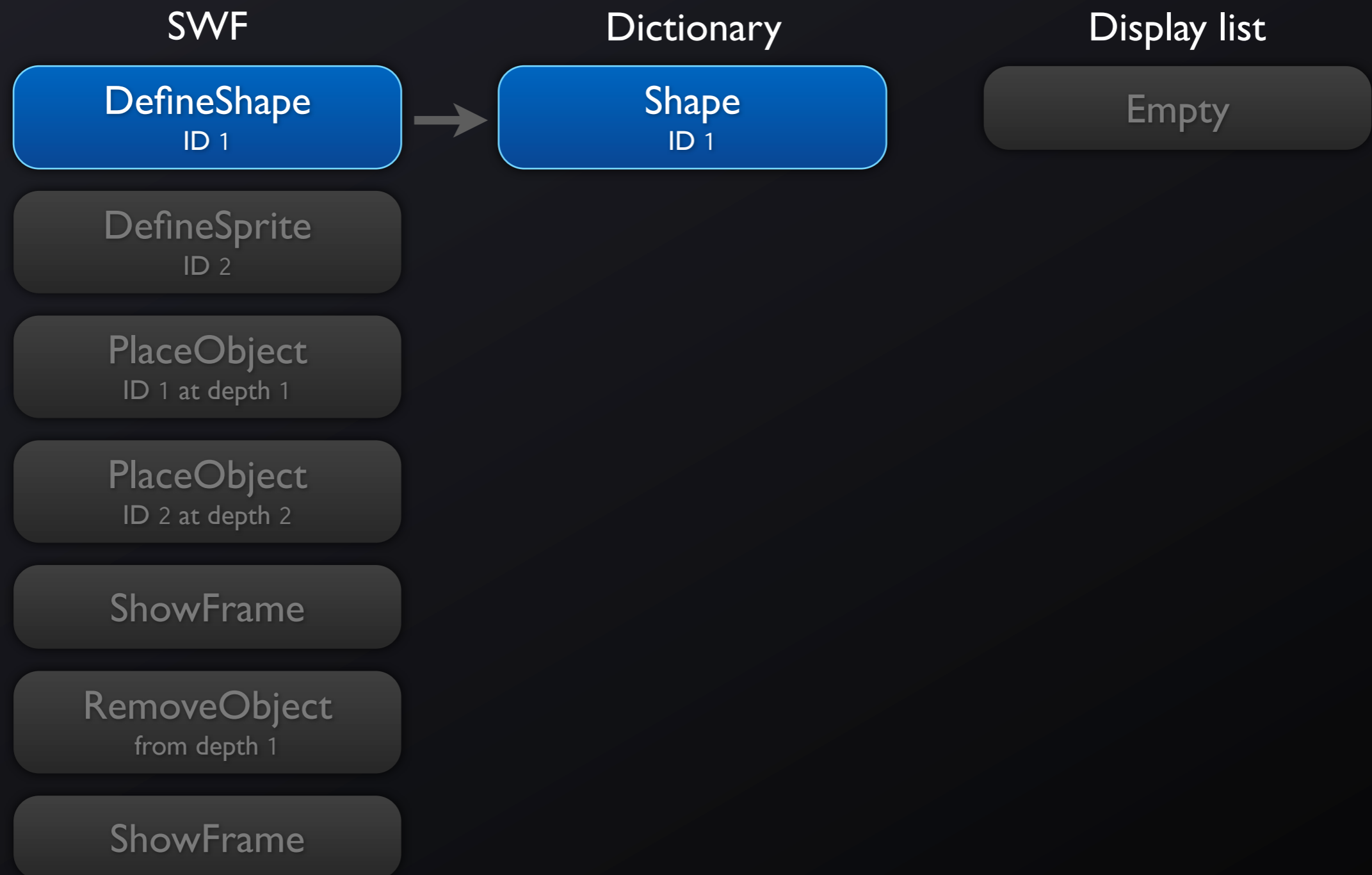
Empty

Display list

Empty

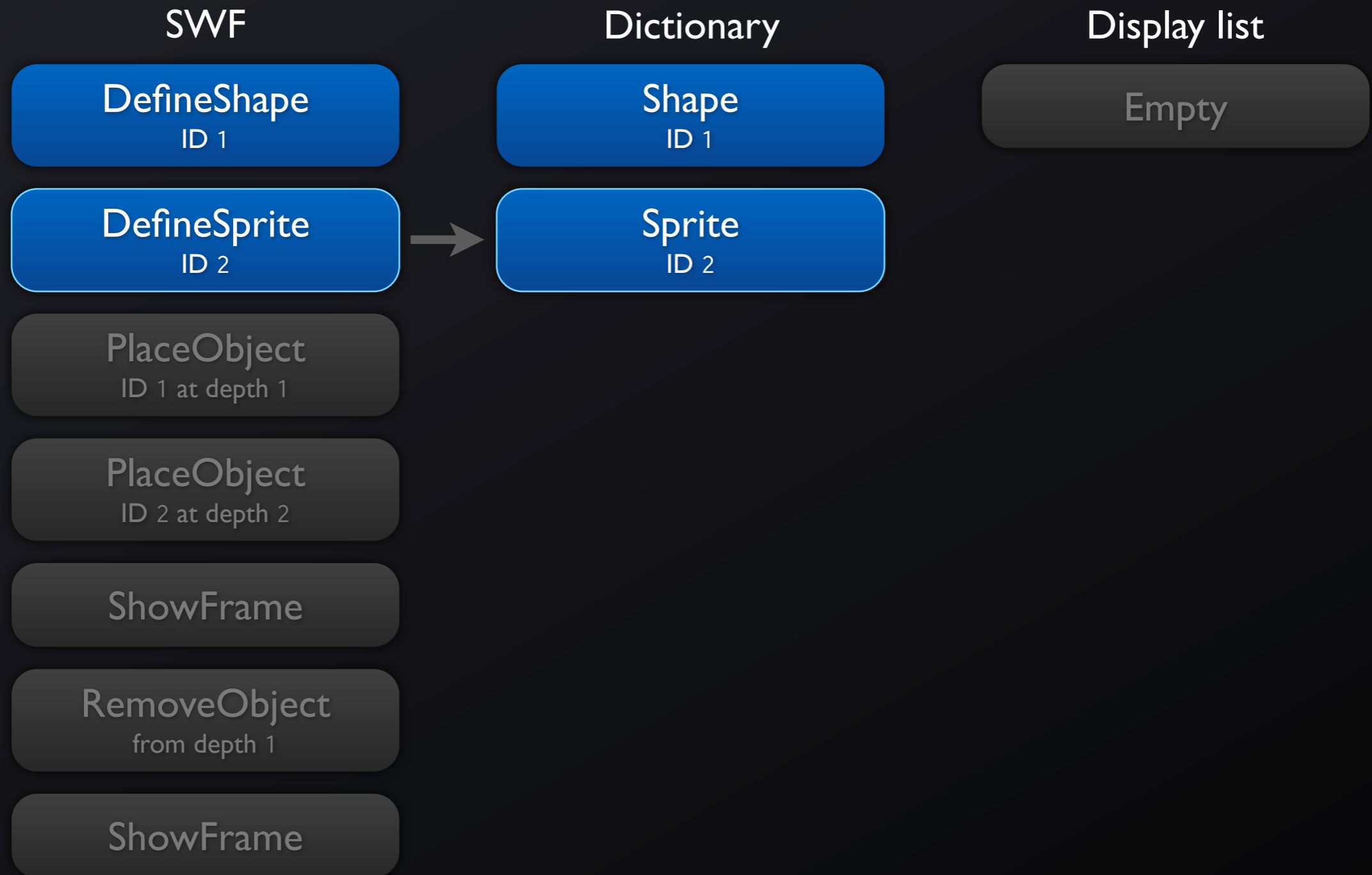
The Flow

A simple example



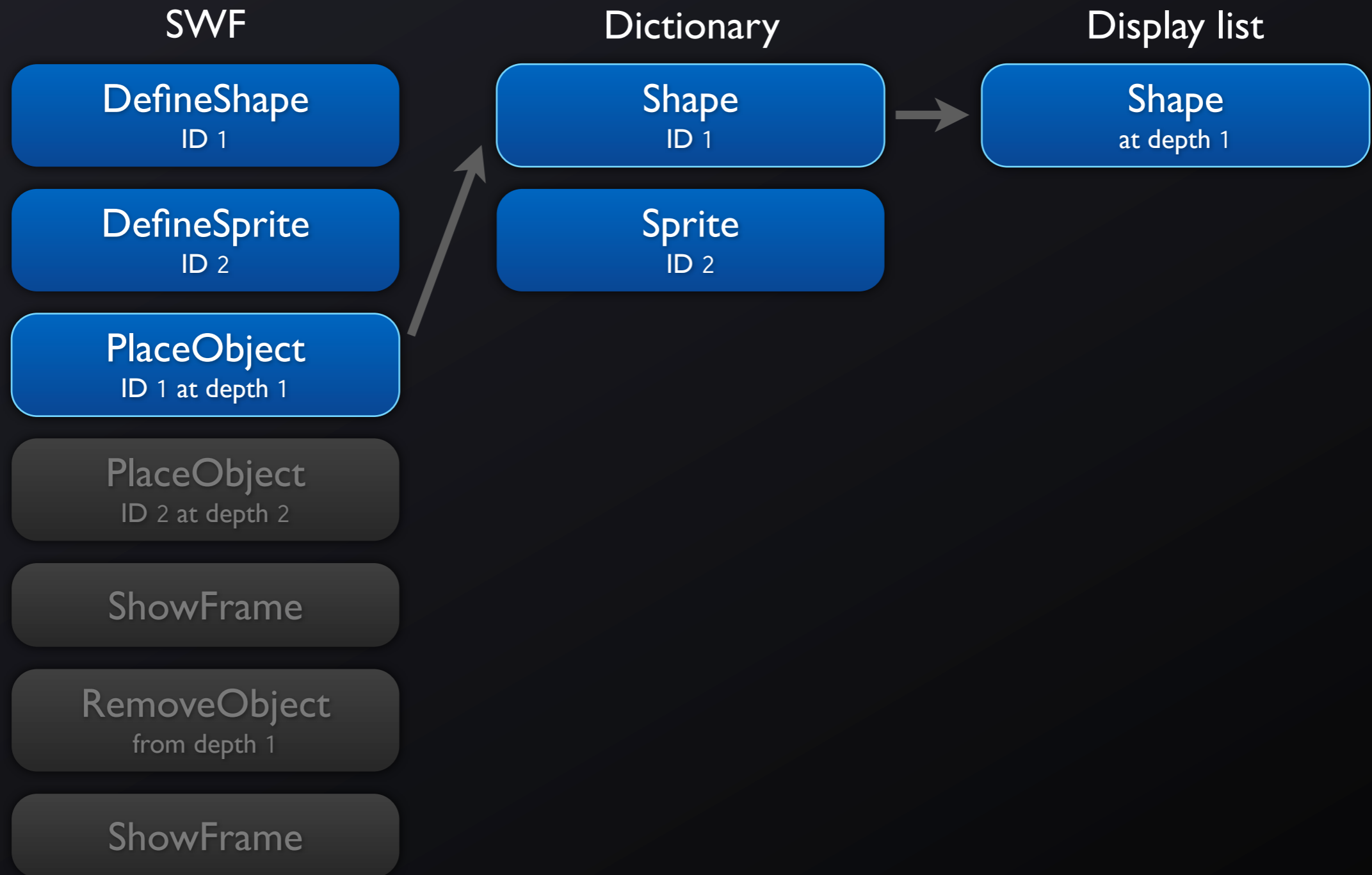
The Flow

A simple example



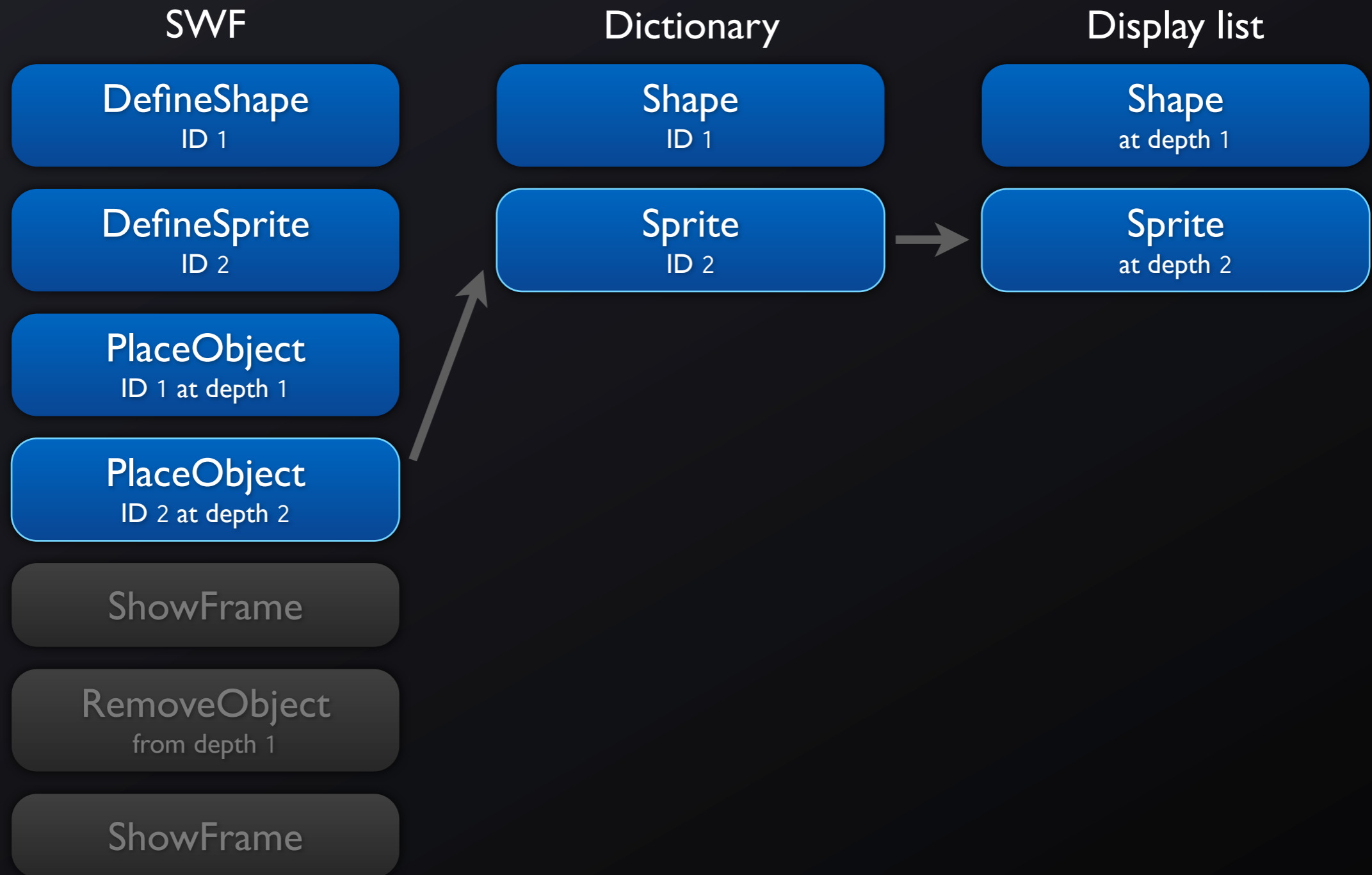
The Flow

A simple example



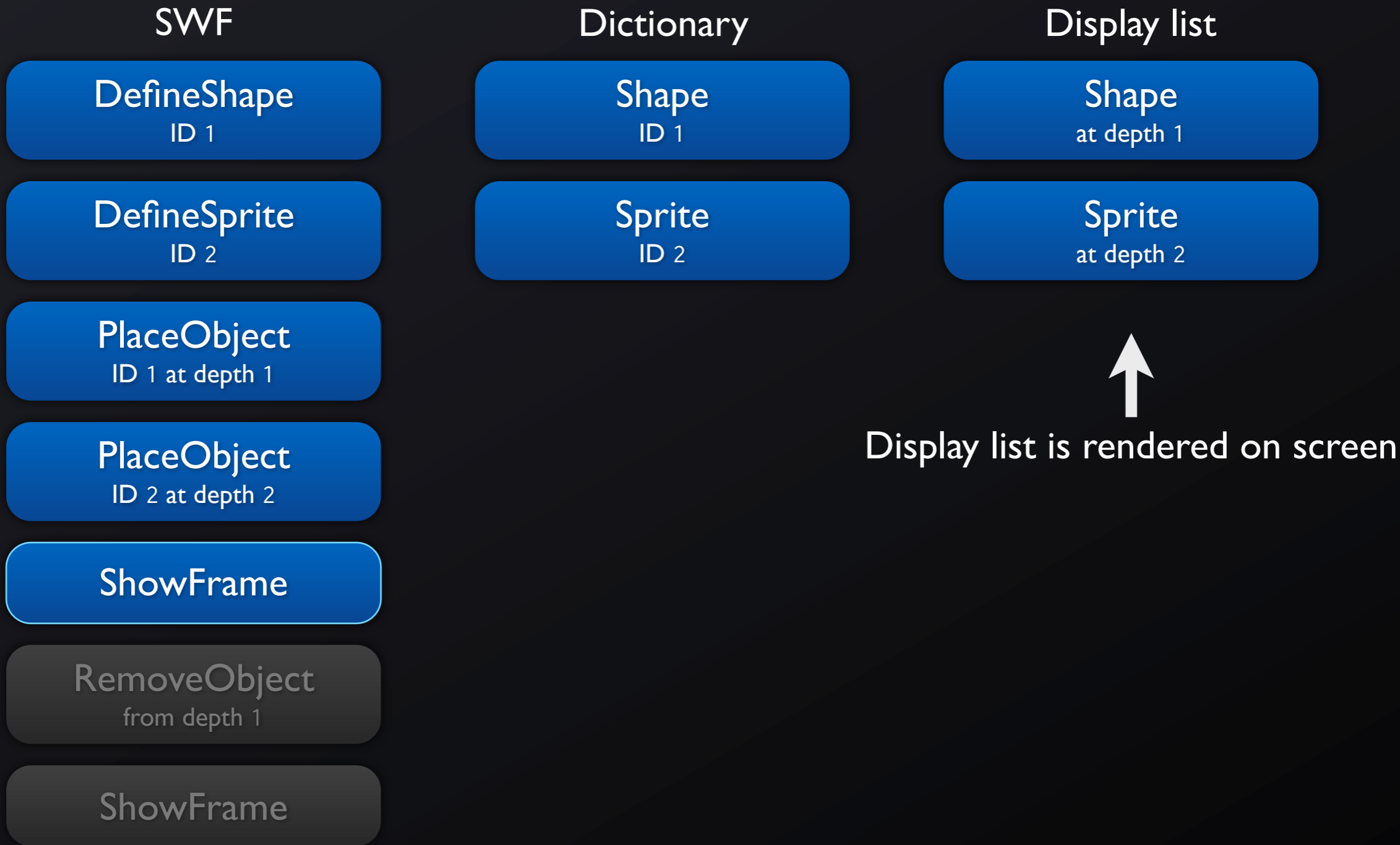
The Flow

A simple example



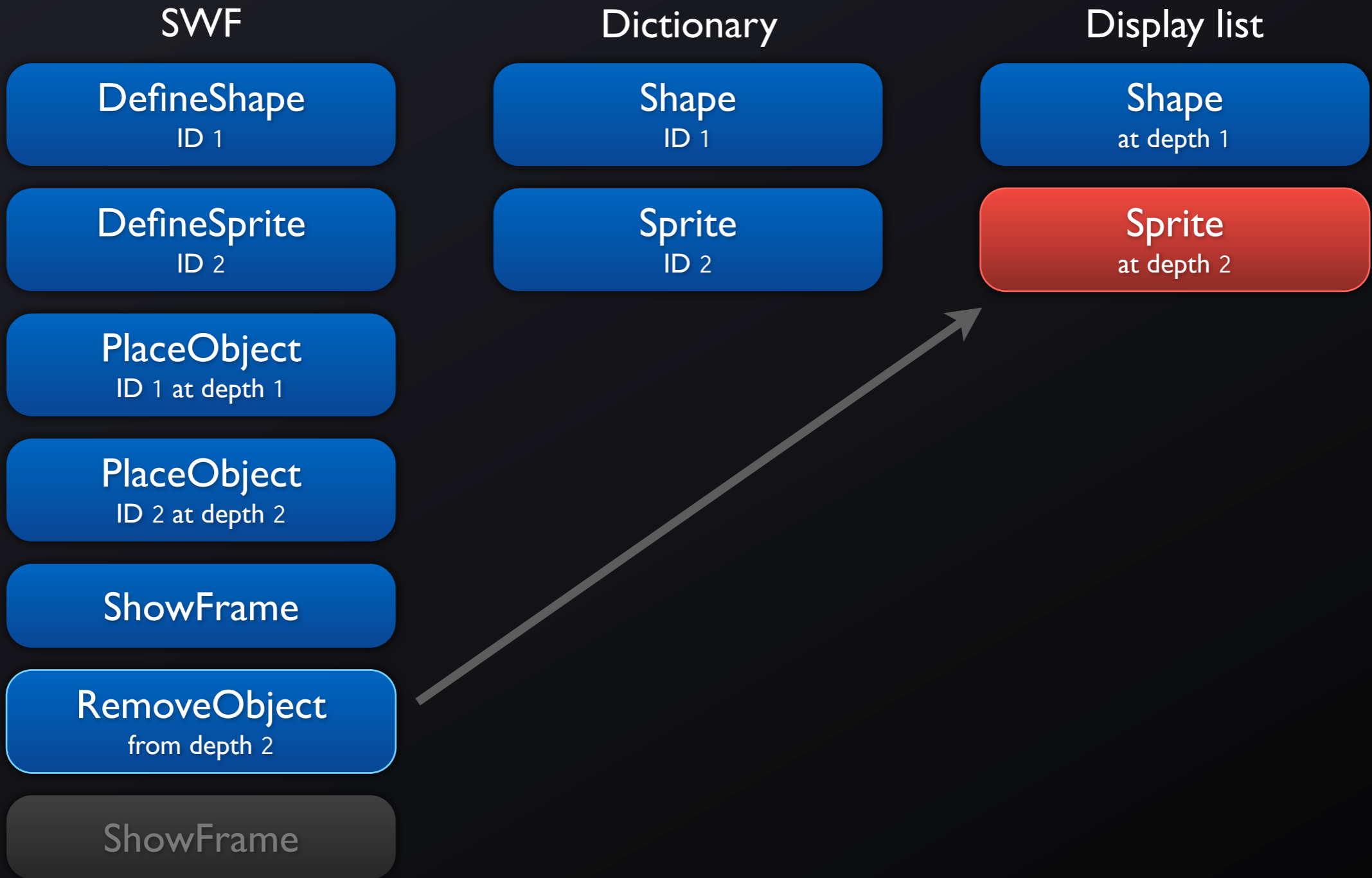
The Flow

A simple example



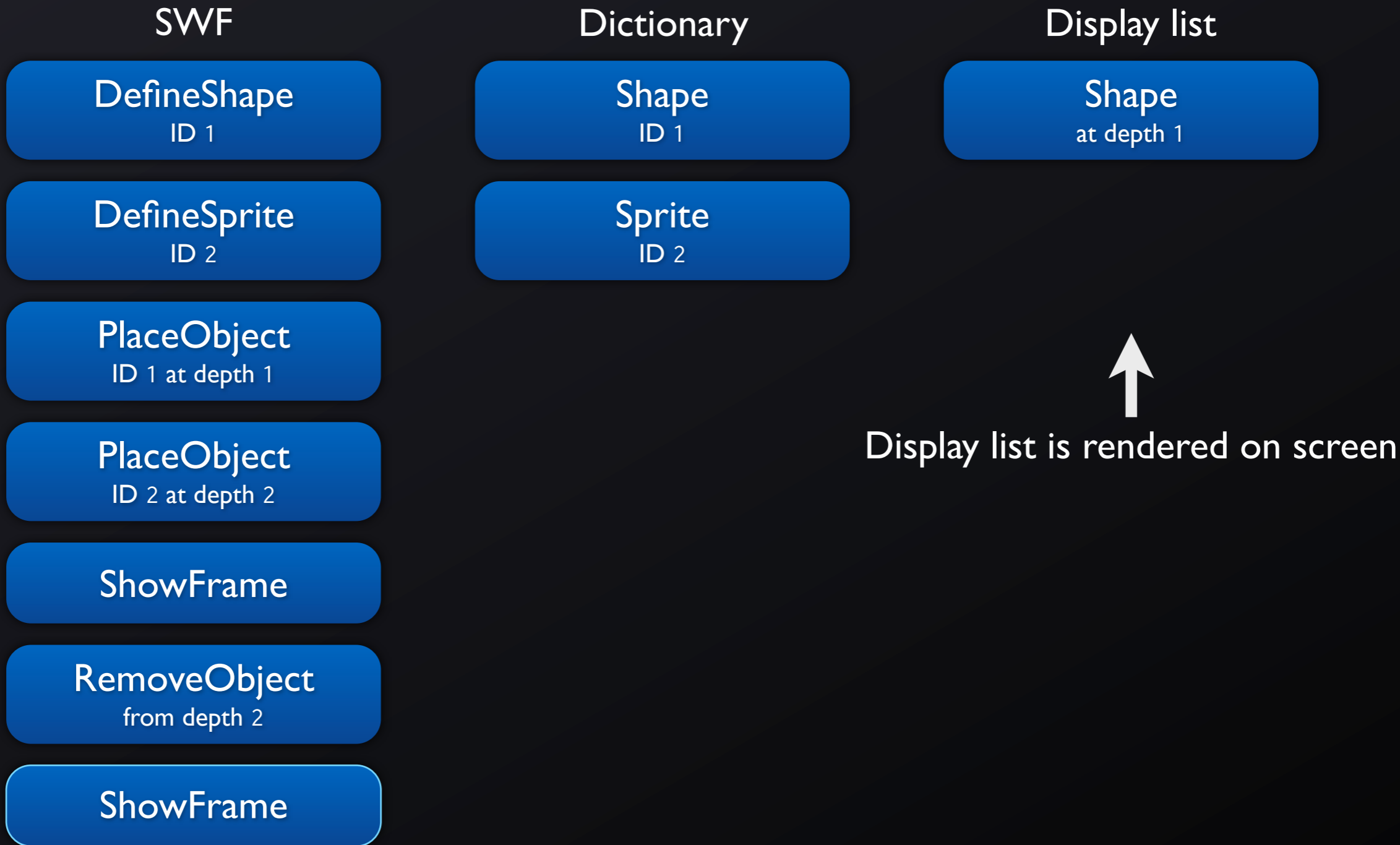
The Flow

A simple example



The Flow

A simple example



**TOP
SECRET**

The ProductInfo tag

Compile time/date, info about compiler used

```
[41:ProductInfo]
```

```
ProductID: 3
```

```
Edition: 6
```

```
Version: 4.0.0.14159
```

```
CompileDate: Wed Apr 21 03:23:16 GMT-0400 2010
```

ProductID (UI32)

0: Unknown

1: Macromedia Flex for J2EE

2: Macromedia Flex for .NET

3: Adobe Flex

Edition (UI32)

0: Developer Edition

1: Full Commercial Edition

2: Non Commercial Edition

3: Educational Edition

4: Not For Resale (NFR) Edition

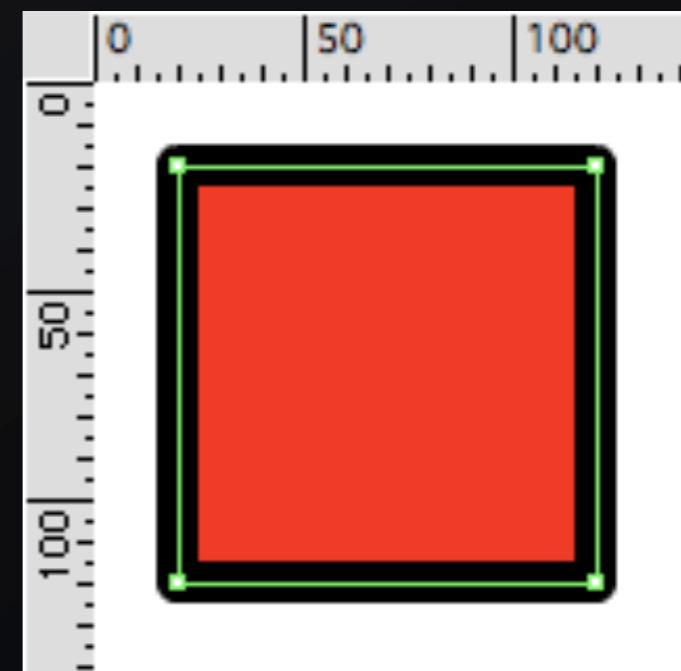
5: Trial Edition

6: None

The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,125,15,125, EdgeBounds: 20,120,20,120
FillStyles:
  [1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
LineStyle:
  [1] [SWFLineStyle2] Width: 10, Color: 000000
ShapeRecords:
  [SWFShapeRecordStyleChange] MoveTo: 120,20, FillStyle1: 1, LineStyle: 1
  [SWFShapeRecordStraightEdge] Vertical: 100
  [SWFShapeRecordStraightEdge] Horizontal: -100
  [SWFShapeRecordStraightEdge] Vertical: -100
  [SWFShapeRecordStraightEdge] Horizontal: 100
  [SWFShapeRecordEnd]
```



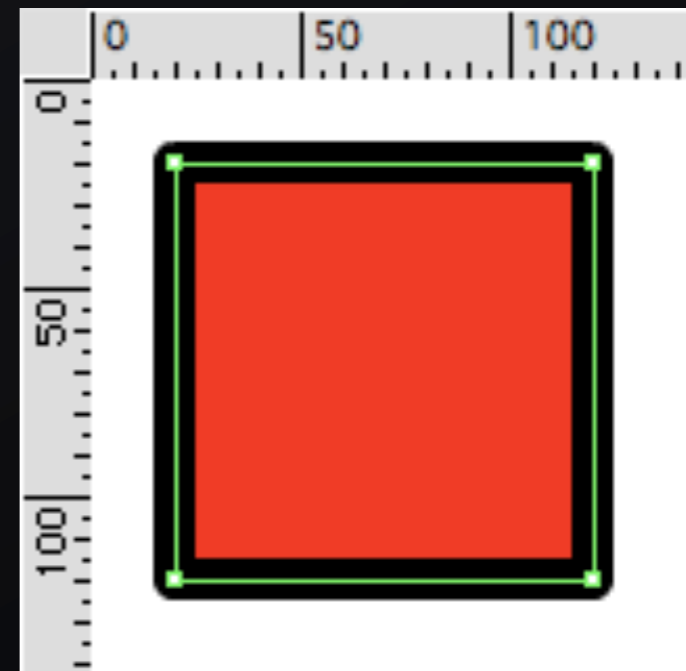
The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,125,15,125, EdgeBounds: 20,120,20,120
FillStyles:
  [1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
LineStyle:
  [1] [SWFLineStyle2] Width: 10, Color: 000000
ShapeRecords:
  [SWFShapeRecordStyleChange] MoveTo: 120,20, FillStyle1: 1, LineStyle: 1
  [SWFShapeRecordStraightEdge] Vertical: 100
  [SWFShapeRecordStraightEdge] Horizontal: -100
  [SWFShapeRecordStraightEdge] Vertical: -100
  [SWFShapeRecordStraightEdge] Horizontal: 100
  [SWFShapeRecordEnd]
```



Shape records are **not** drawing instructions!
They **define** the **geometry** of the shape.



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

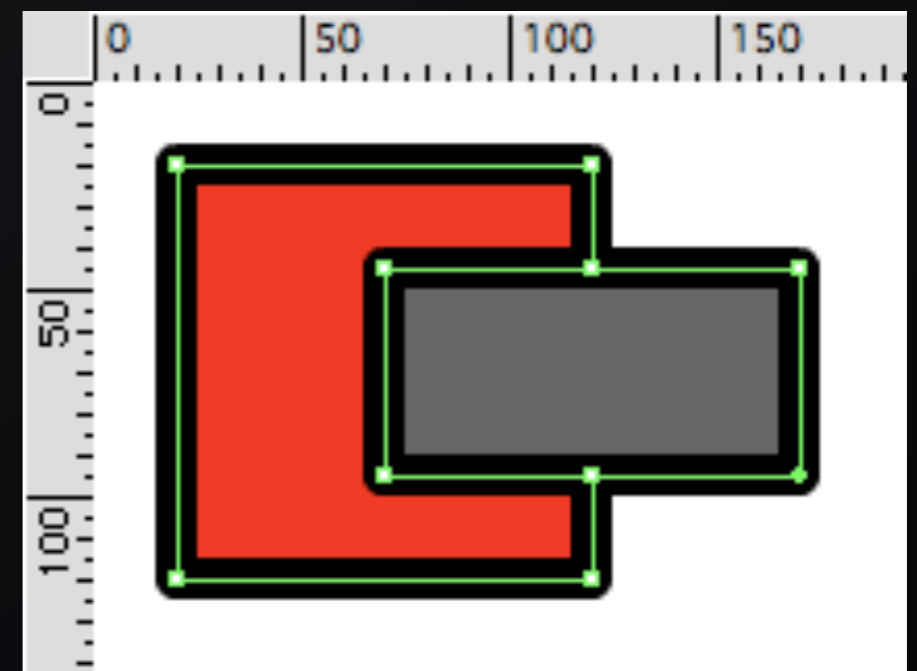
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

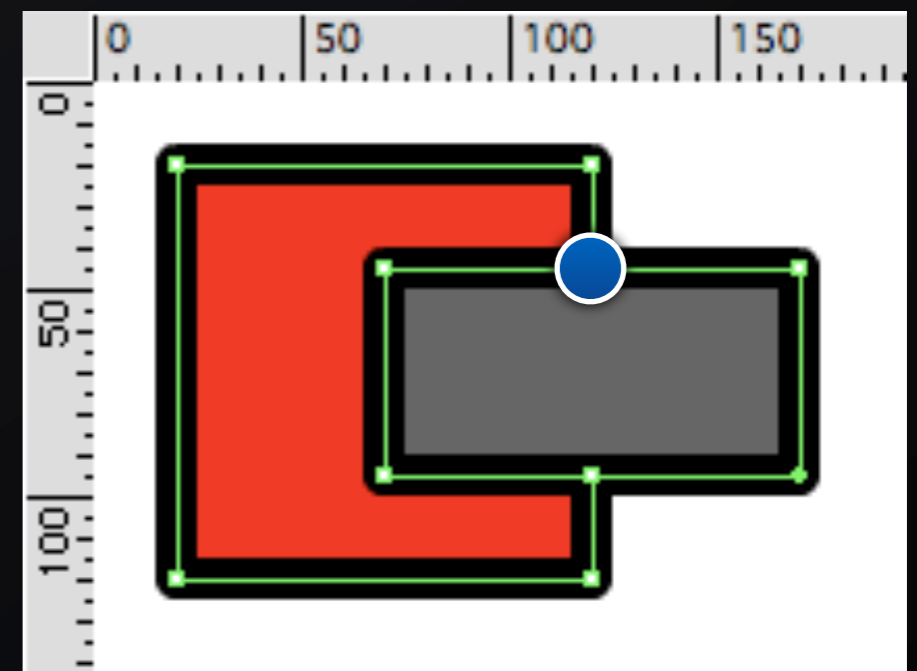
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

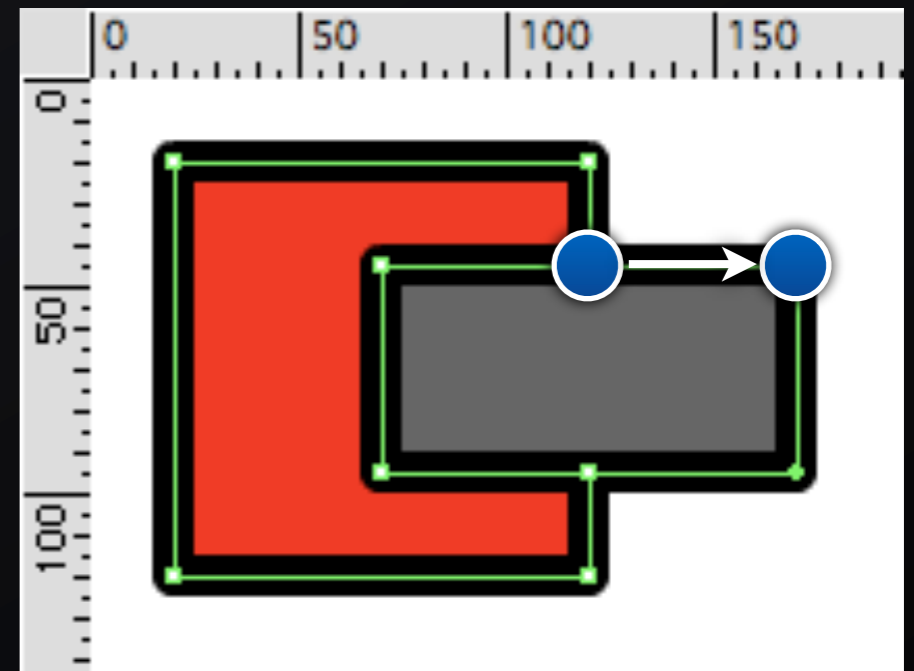
```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
FillStyles:
  [1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
  [2] [SWFFillStyle] Type: 0 (solid), Color: 666666
LineStyle:
  [1] [SWFLineStyle2] Width: 10, Color: 000000
ShapeRecords:
  [SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
  [SWFShapeRecordStraightEdge] Horizontal: 50
  [SWFShapeRecordStraightEdge] Vertical: 50
  [SWFShapeRecordStraightEdge] Horizontal: -50
  [SWFShapeRecordStyleChange] FillStyle1: 1
  [SWFShapeRecordStraightEdge] Vertical: 25
  [SWFShapeRecordStraightEdge] Horizontal: -100
  [SWFShapeRecordStraightEdge] Vertical: -100
  [SWFShapeRecordStraightEdge] Horizontal: 100
  [SWFShapeRecordStraightEdge] Vertical: 25
  [SWFShapeRecordStyleChange] FillStyle0: 2
  [SWFShapeRecordStraightEdge] Horizontal: -50
  [SWFShapeRecordStraightEdge] Vertical: 50
  [SWFShapeRecordStraightEdge] Horizontal: 50
  [SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

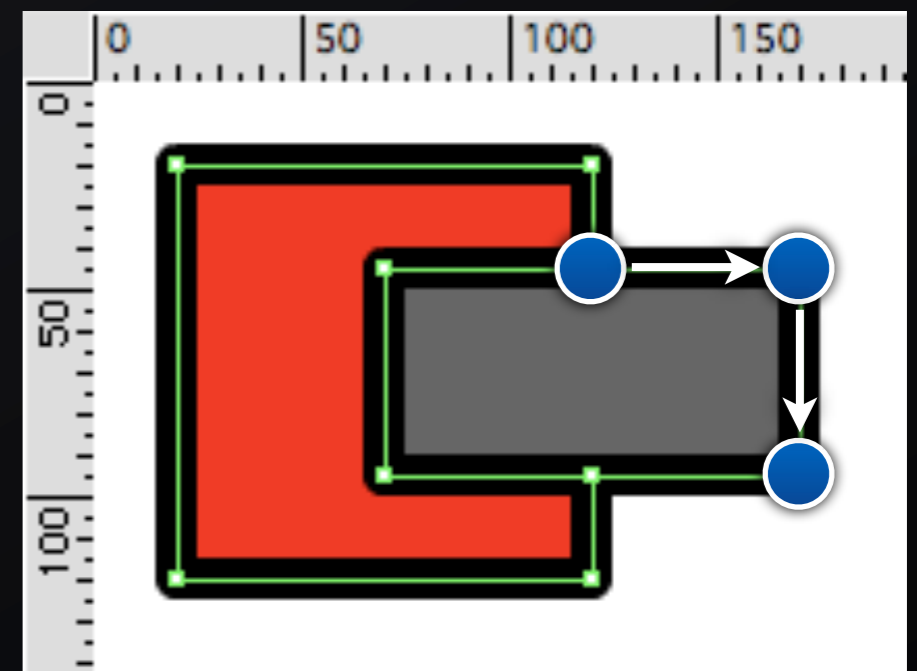
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

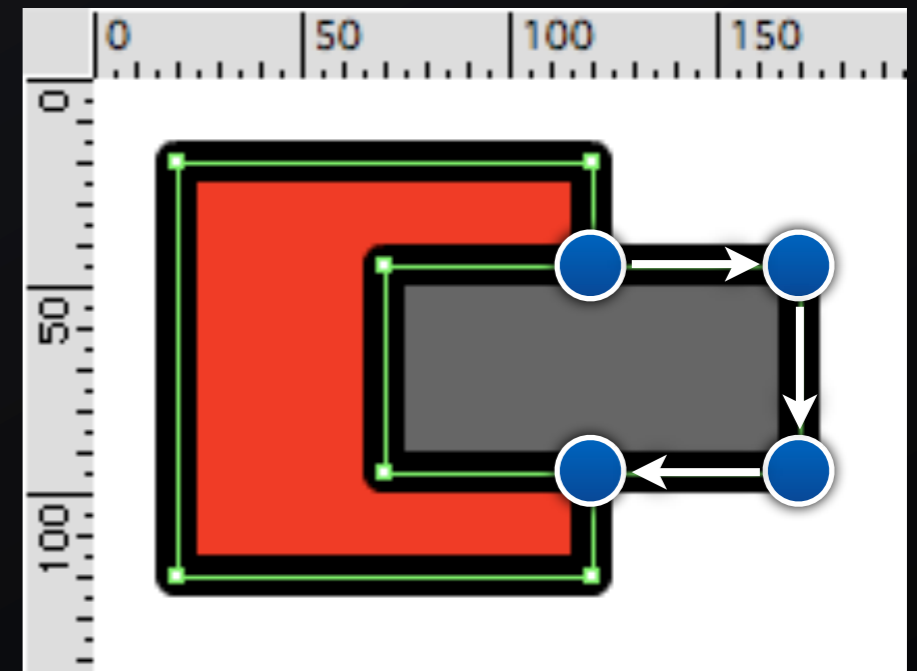
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

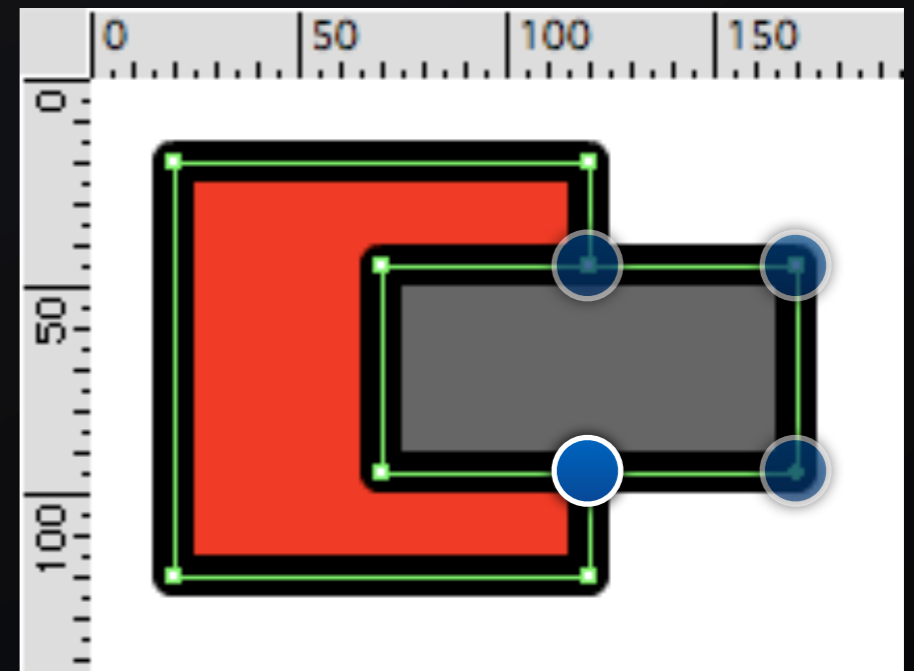
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

FillStyles:

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

LineStyle:

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

ShapeRecords:

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

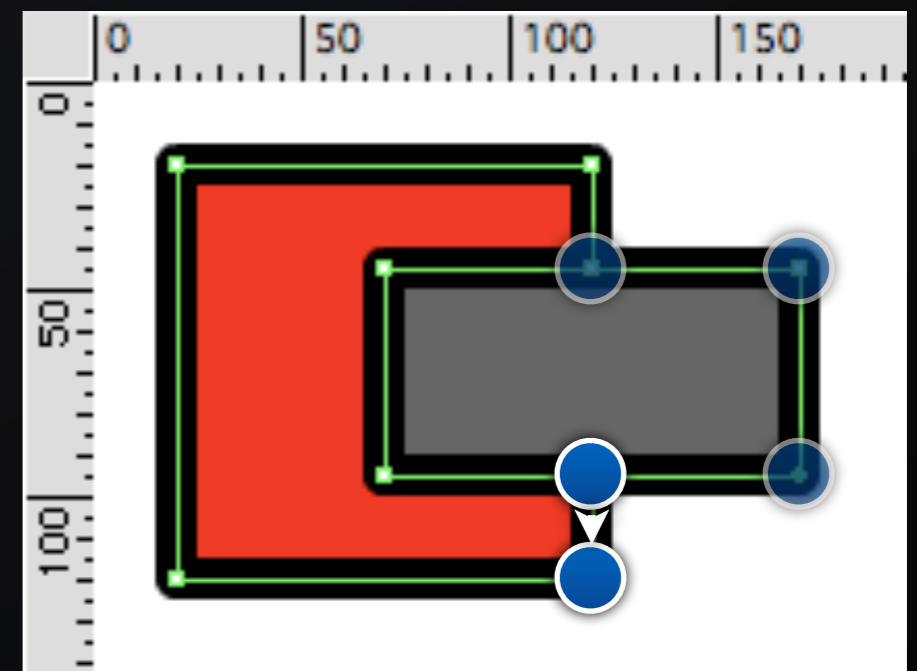
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

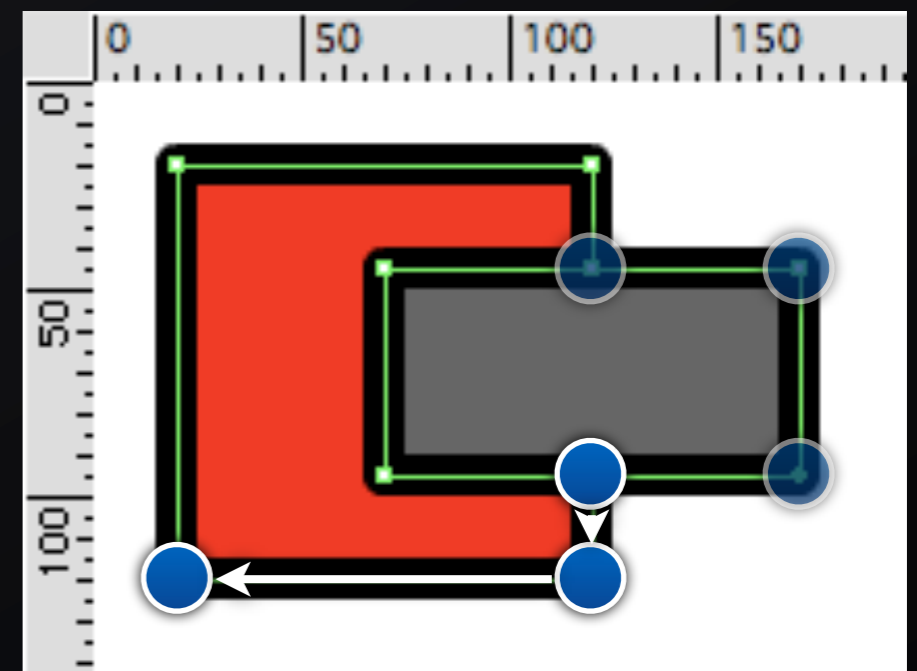
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

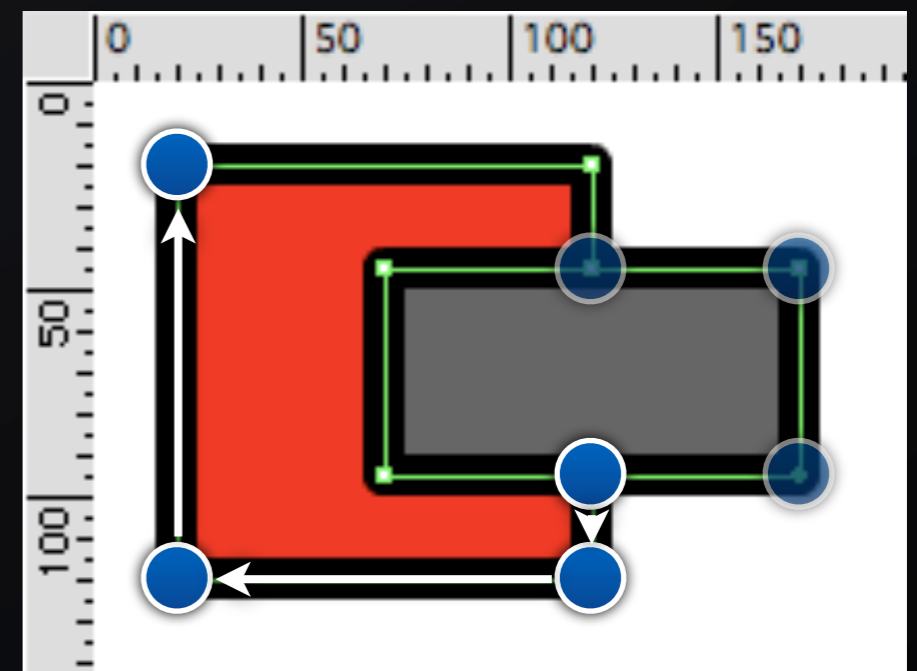
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

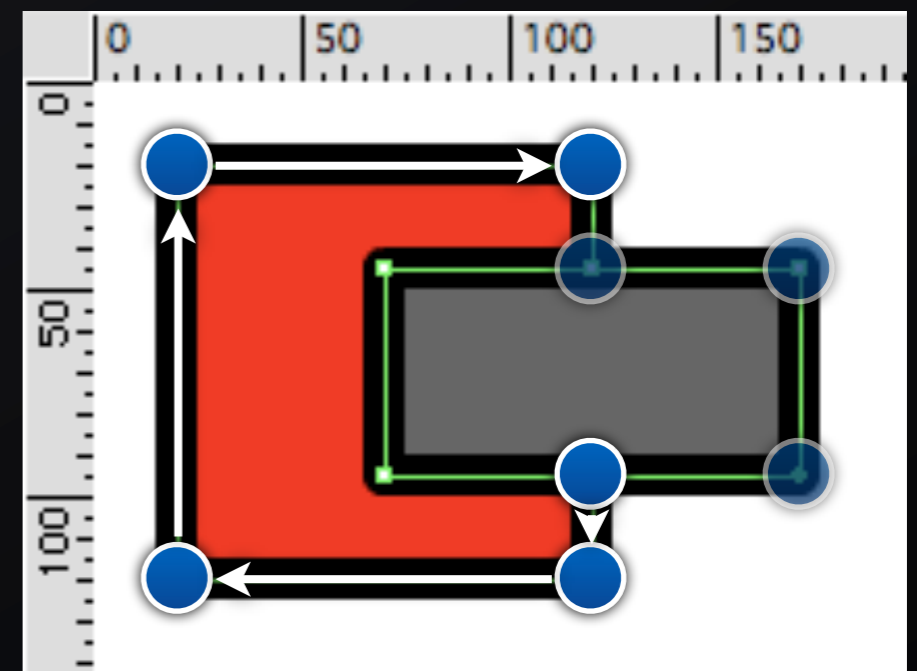
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

FillStyles:

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

LineStyle:

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

ShapeRecords:

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

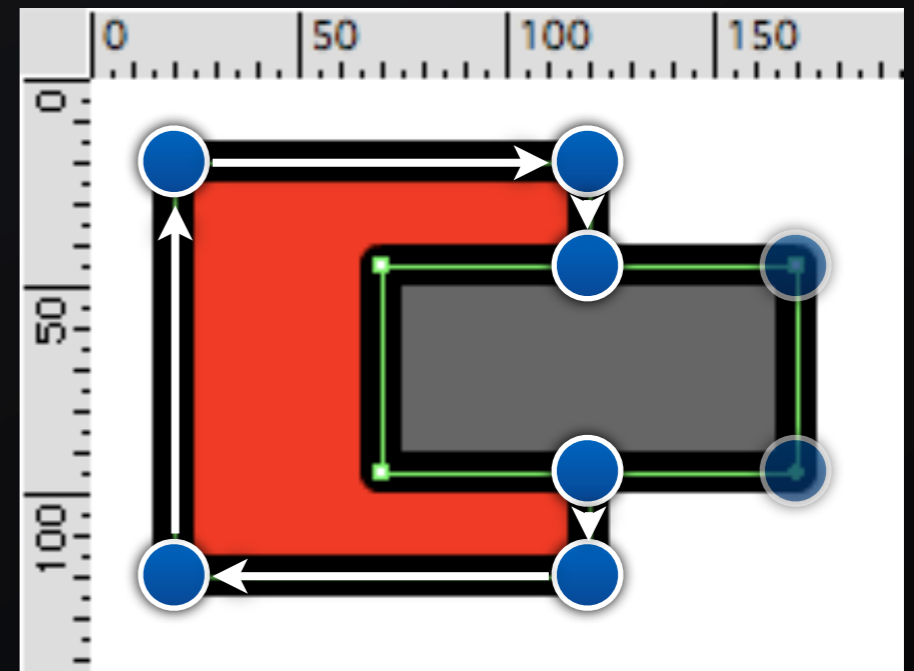
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

FillStyles:

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

LineStyle:

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

ShapeRecords:

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

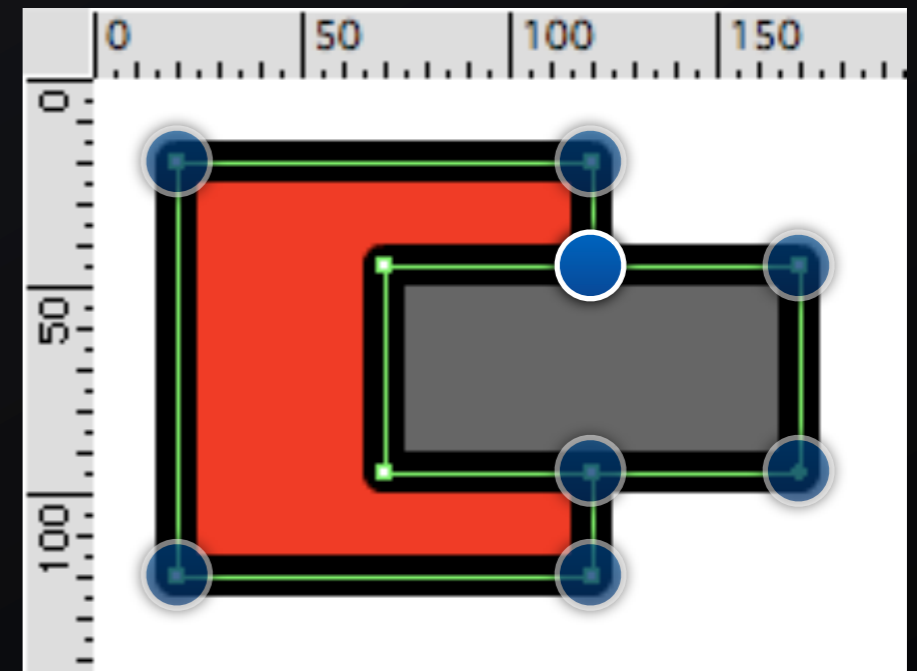
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

So what about those two FillStyles?!



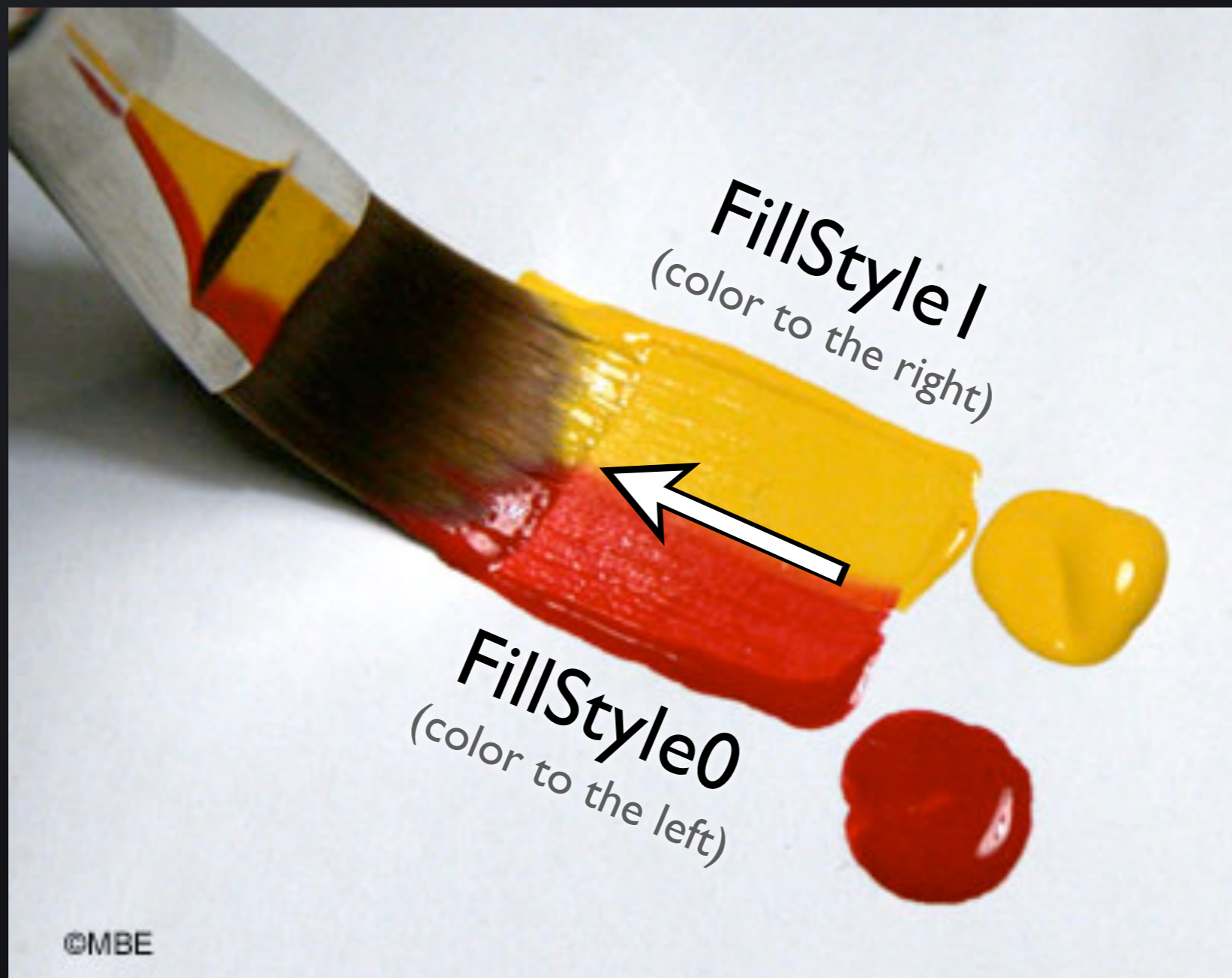
The DefineShape tag

So what about those two FillStyles?!



The DefineShape tag

So what about those two FillStyles?!



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

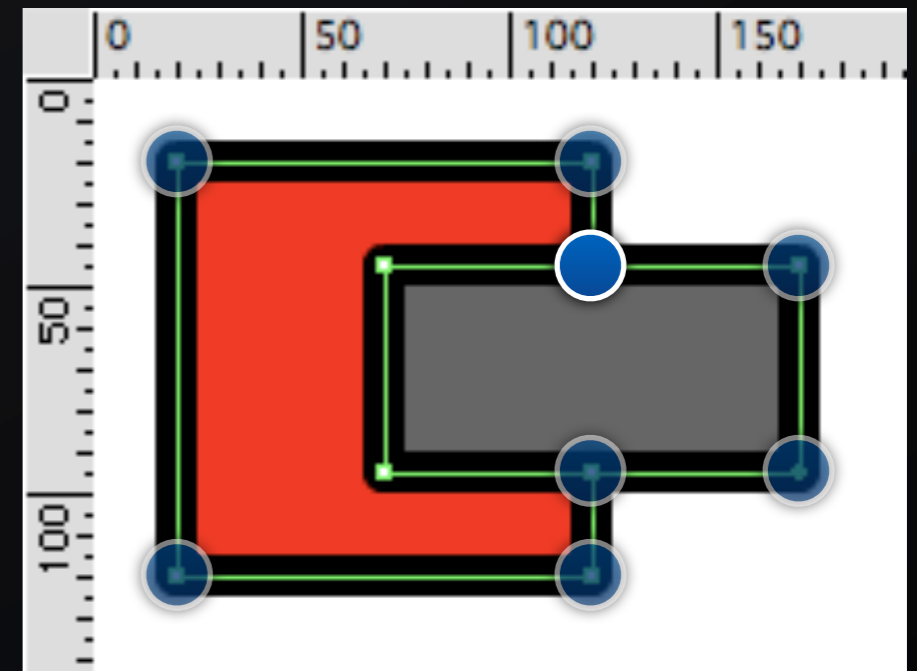
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

FillStyles:

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

LineStyle:

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

ShapeRecords:

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

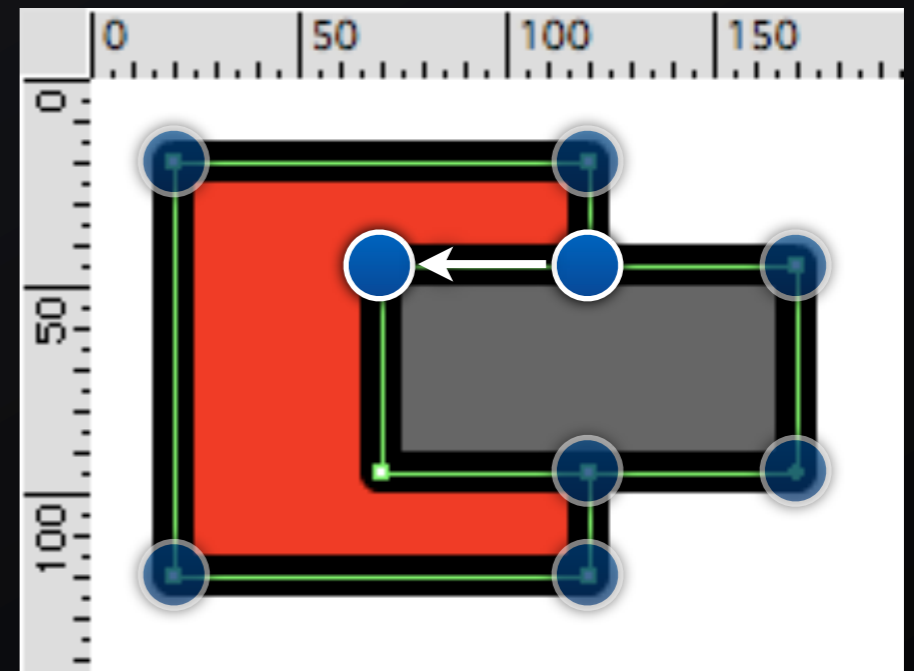
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

FillStyles:

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

LineStyle:

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

ShapeRecords:

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

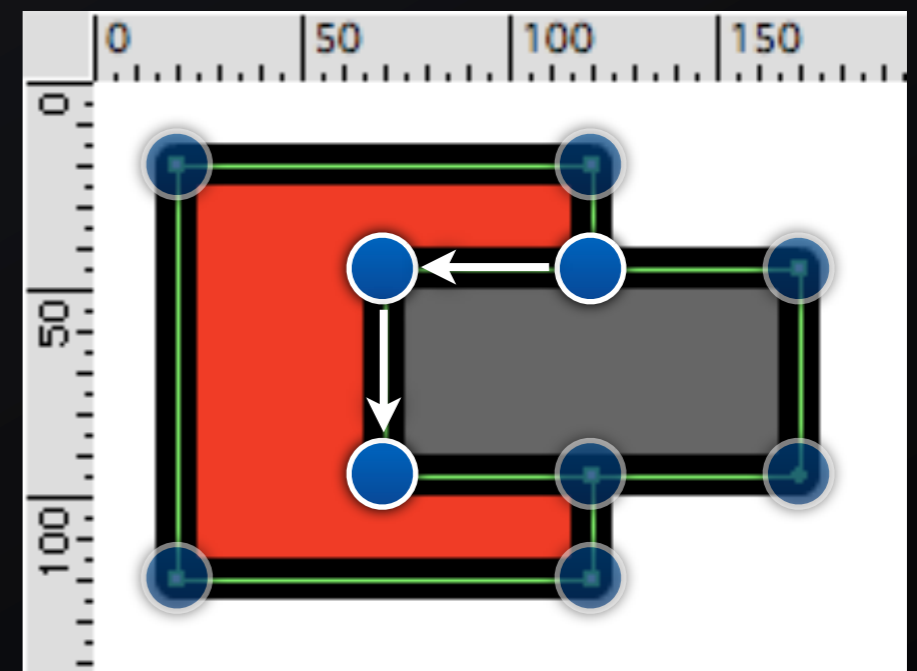
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



The DefineShape tag

Defines styles and geometry of a shape

```
[83:DefineShape4] ID: 1, ShapeBounds: 15,175,15,125, EdgeBounds: 20,170,20,120
```

```
FillStyles:
```

```
[1] [SWFFillStyle] Type: 0 (solid), Color: FF0000
```

```
[2] [SWFFillStyle] Type: 0 (solid), Color: 666666
```

```
LineStyle:
```

```
[1] [SWFLineStyle2] Width: 10, Color: 000000
```

```
ShapeRecords:
```

```
[SWFShapeRecordStyleChange] MoveTo: 120,45, FillStyle1: 2, LineStyle: 1
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStyleChange] FillStyle1: 1
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

```
[SWFShapeRecordStraightEdge] Horizontal: -100
```

```
[SWFShapeRecordStraightEdge] Vertical: -100
```

```
[SWFShapeRecordStraightEdge] Horizontal: 100
```

```
[SWFShapeRecordStraightEdge] Vertical: 25
```

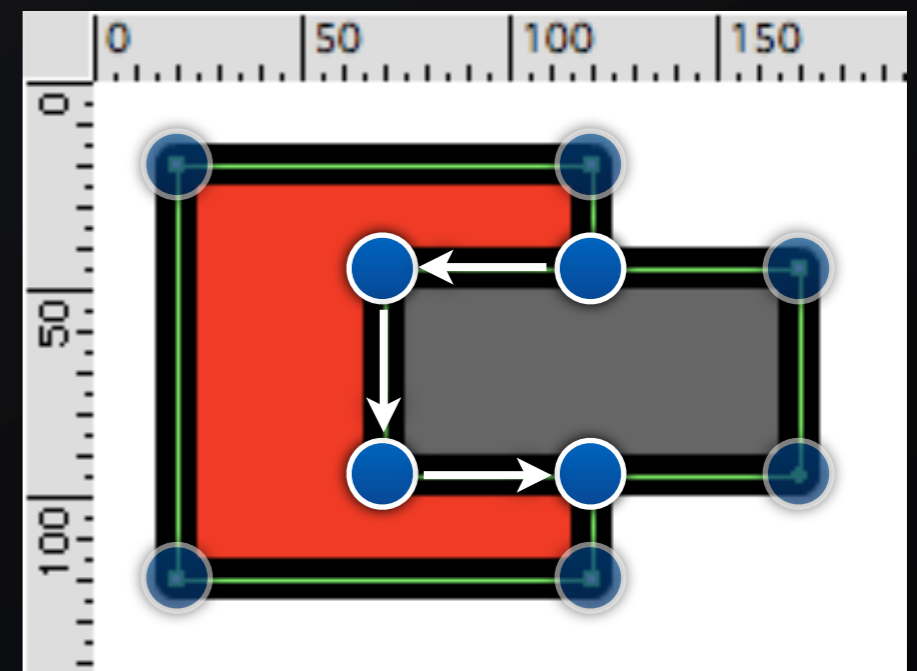
```
[SWFShapeRecordStyleChange] FillStyle0: 2
```

```
[SWFShapeRecordStraightEdge] Horizontal: -50
```

```
[SWFShapeRecordStraightEdge] Vertical: 50
```

```
[SWFShapeRecordStraightEdge] Horizontal: 50
```

```
[SWFShapeRecordEnd]
```



DEMO

Thanks!

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