Helix DNA Client

2007 – Atlas

www.helixcommunity.org

Milko Boic - RealNetworks

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Agenda:

1. Environment
2. Architecture
3. Object Basics
4. Code Organization
5. History and Roadmap
6. Demo

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1. Environment

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Helix DNA Client definition

- Building blocks for media service client applications

Mobile 	Desktop 	Living room 
• **Mobile TV** • **Mobile Video** • **Mobile Music** • **Ring Tones**	• **Utility Player** • **Desktop TV** • **Desktop Video** • **Desktop Music** • **PMC Manager**	• **IP-TV** • **Video Center** • **Music Center**

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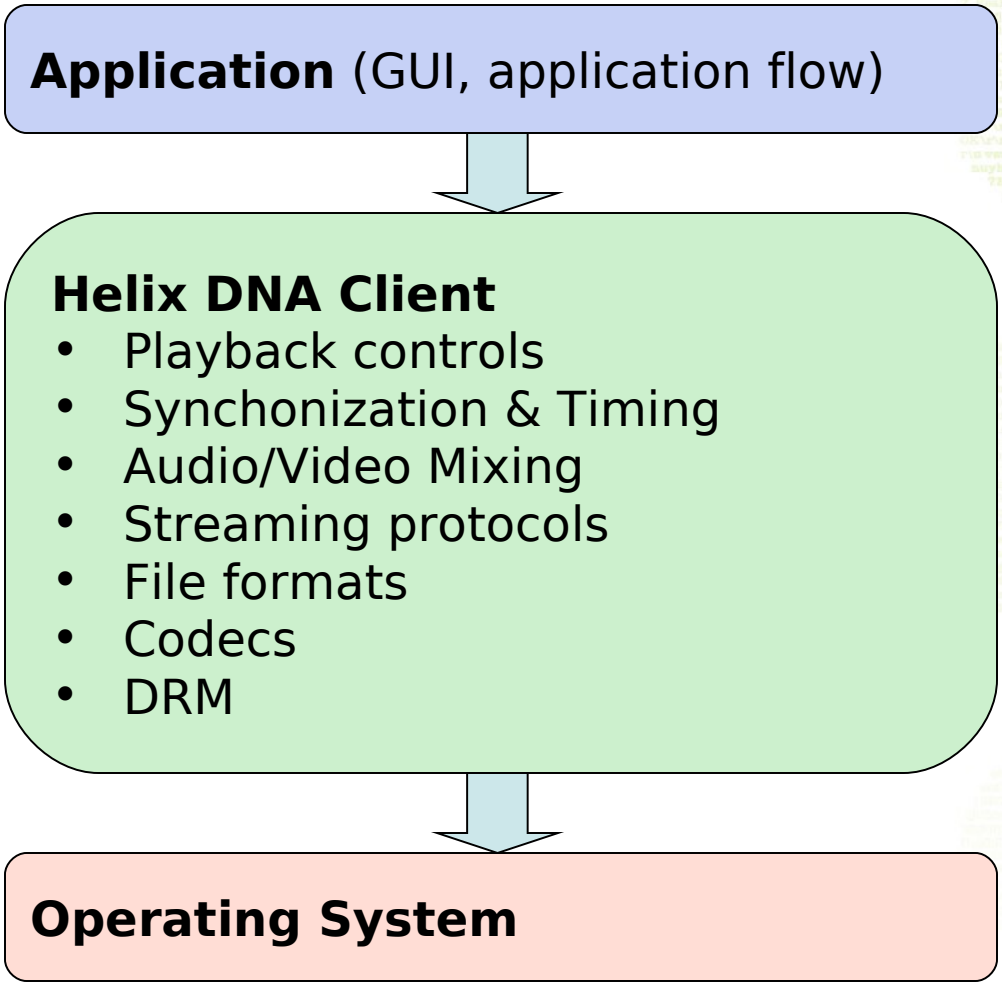
Relationship to other components



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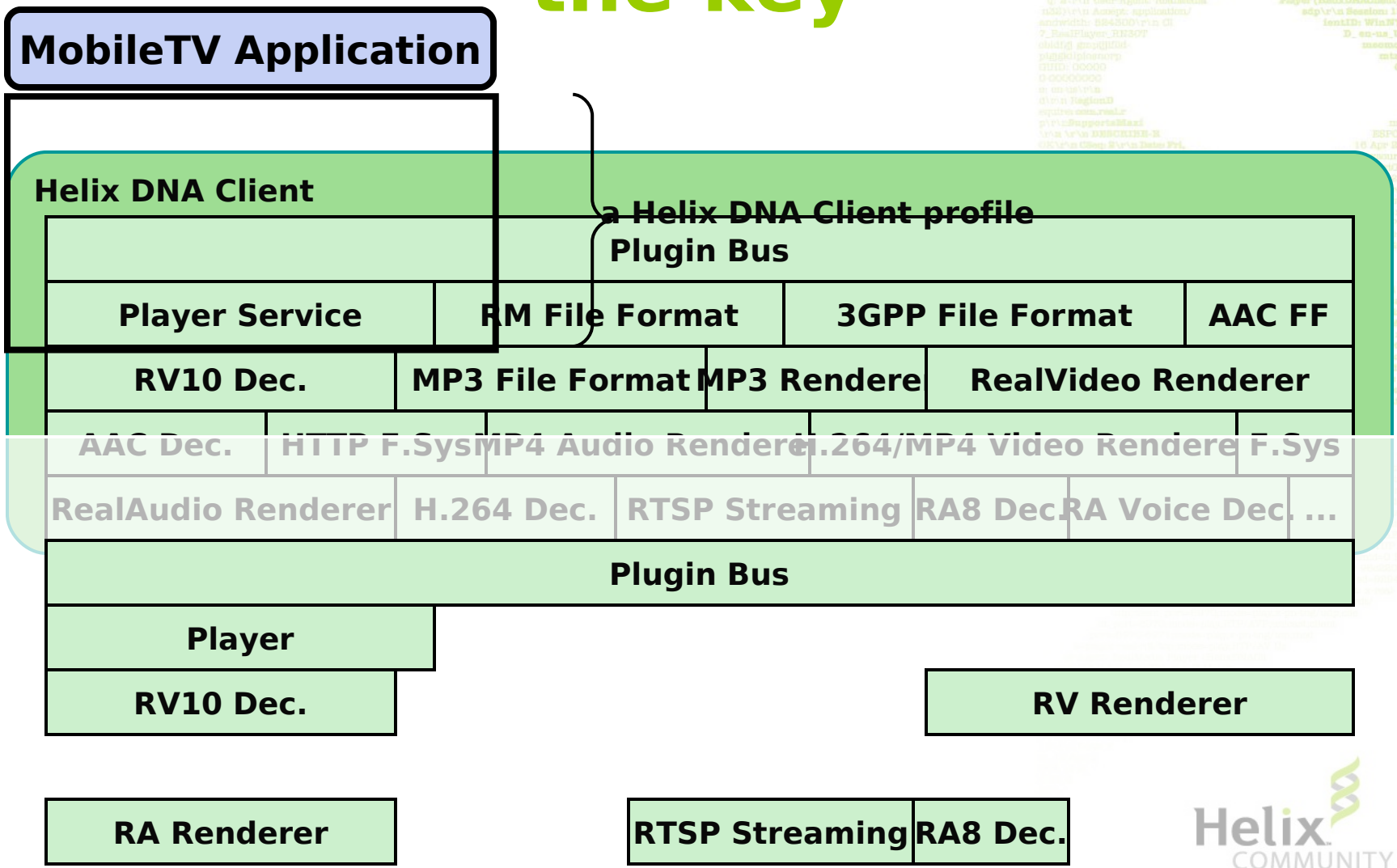
Modularity & Scalability are the key



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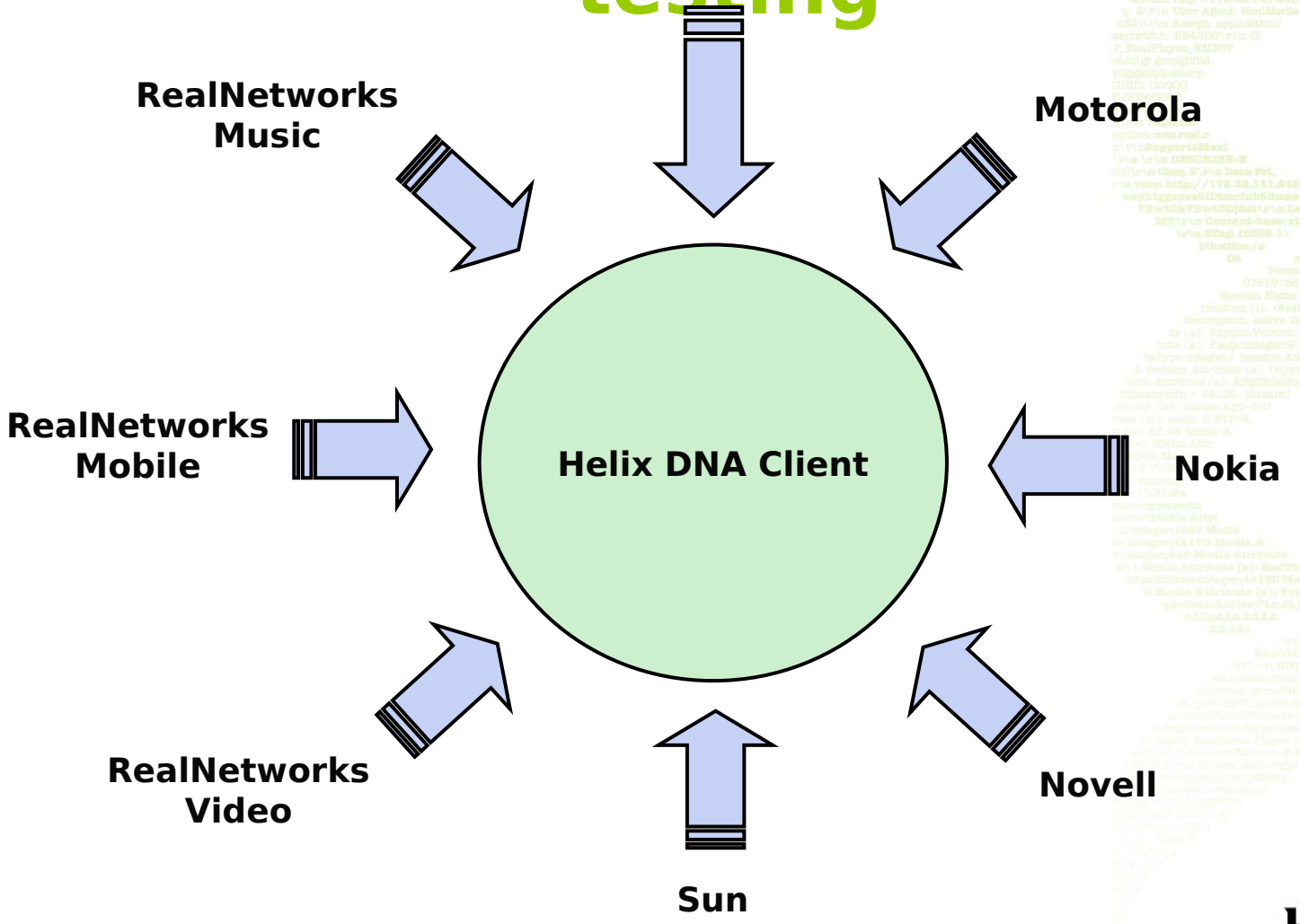
Community development and testing



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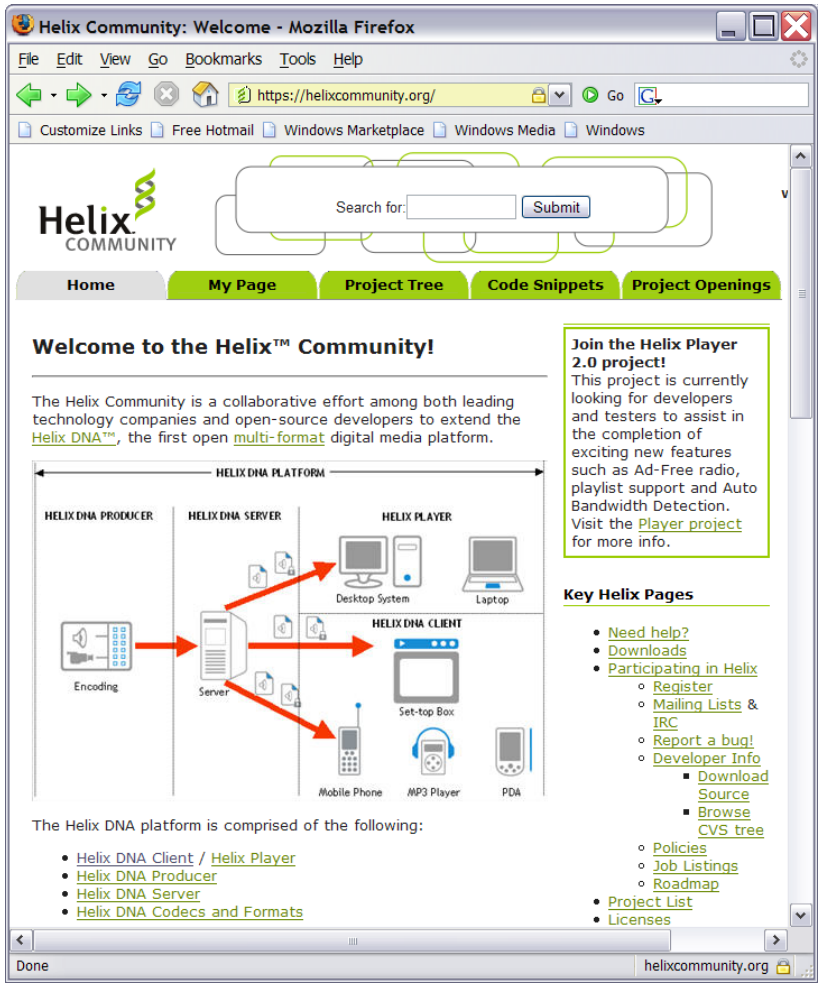

- Tri-licensed: GPL, RPSL, RCSL
- Mailing lists, IRC
- Mail driven Code Reviews
- Bug Tracker
- Project pages
- Search Tool
- Code access via CVS + SSH
- Python based build system

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Helix DNA Client Projects in the Community today

- OLPC – One Laptop Per Child Media Player
- Helix Player for Linux
- Helix Player for Symbian

- Helix DNA Client for 2008 (Brego)

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2. Architecture

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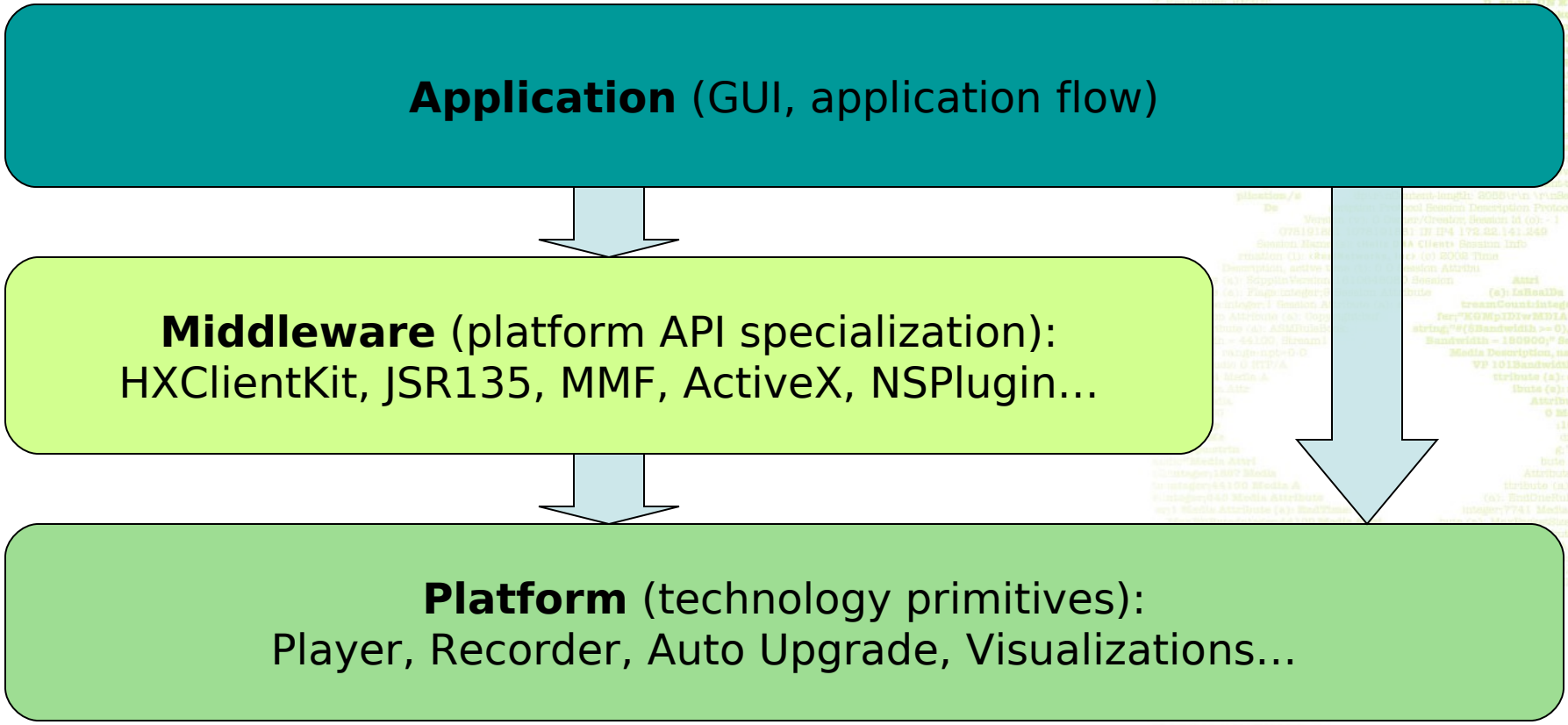
Helix Client Architecture Stack



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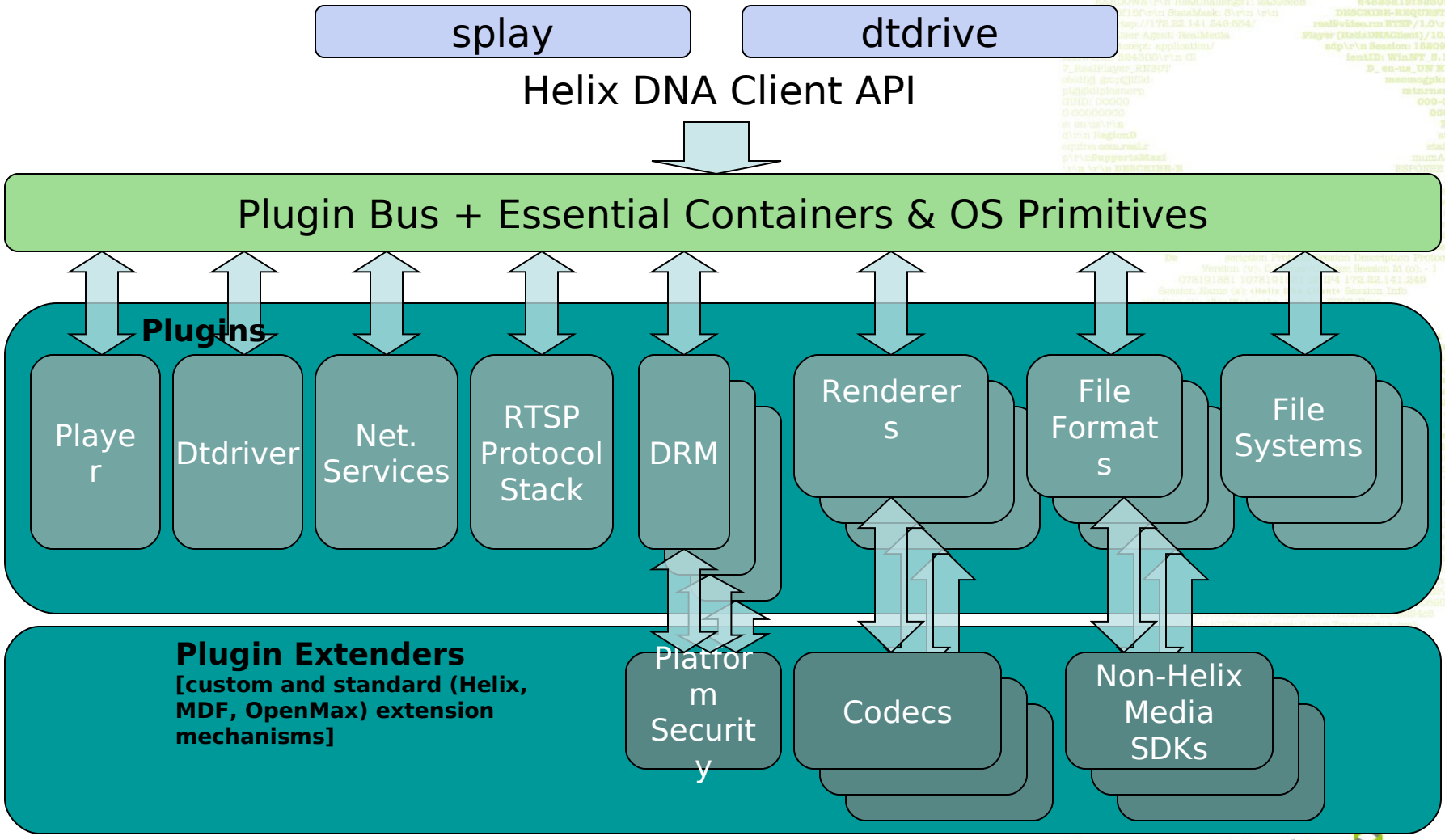
Atlas Platform Architecture



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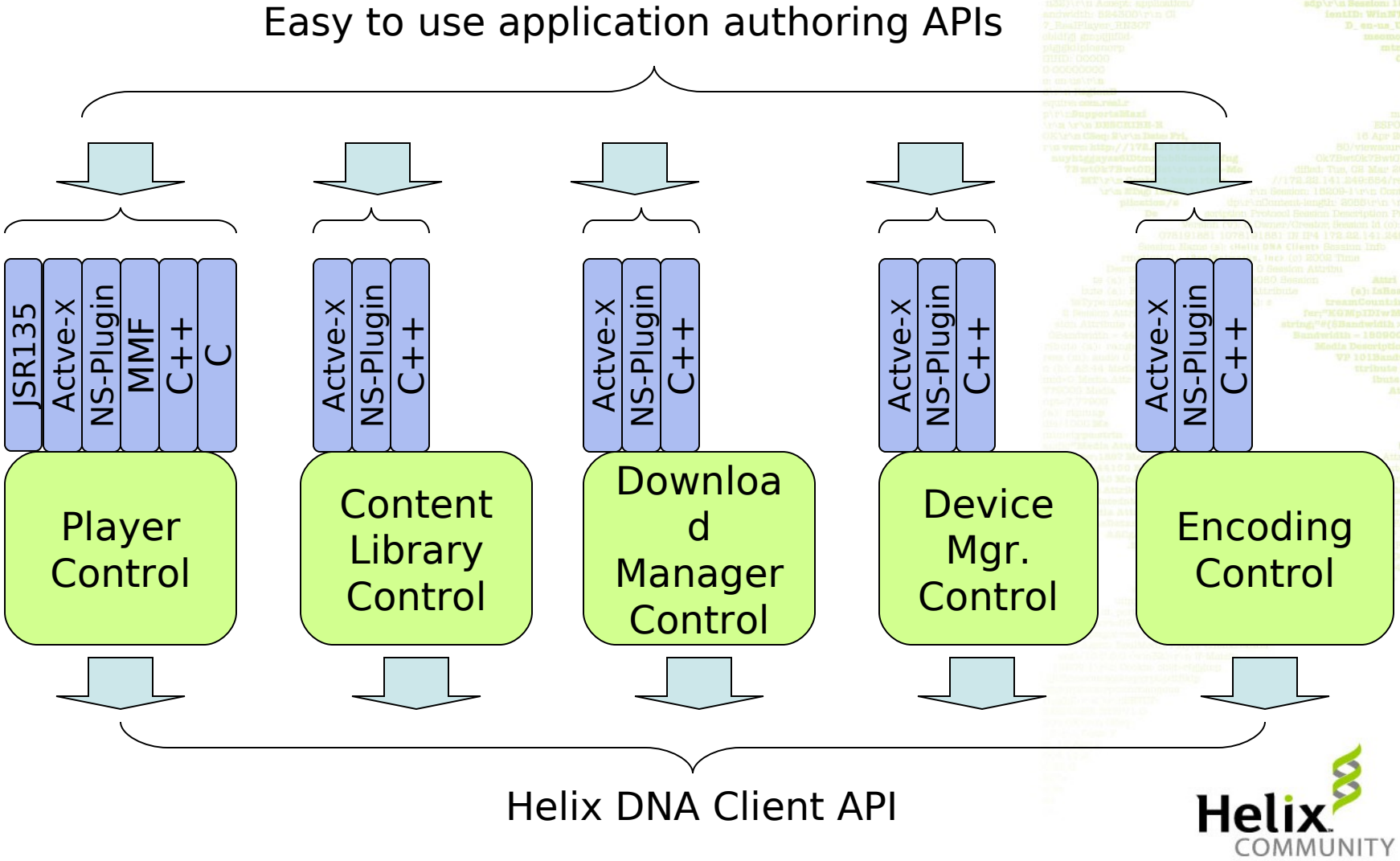
Middleware Architecture Concept



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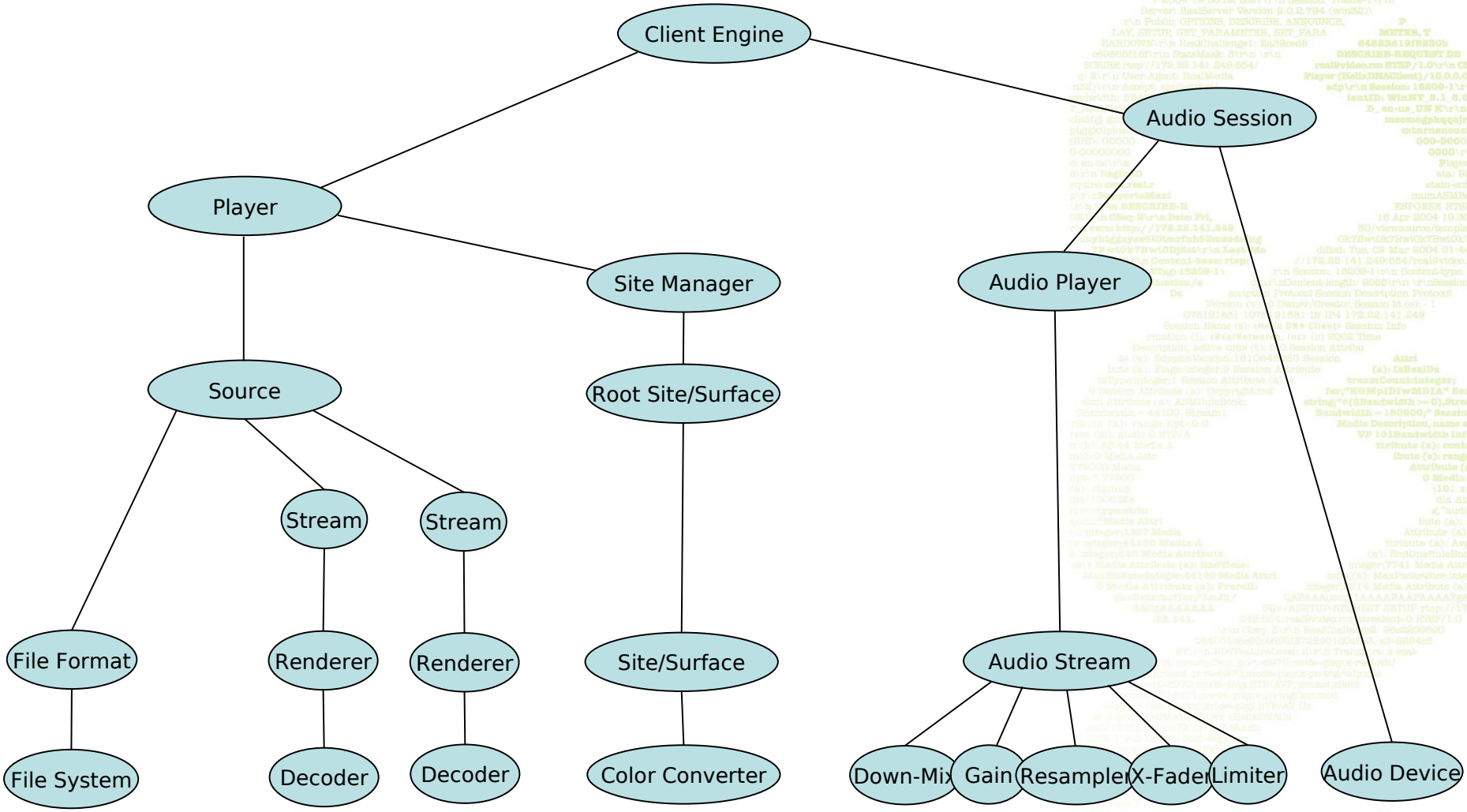
Atlas Playback Objects Control Hierarchy



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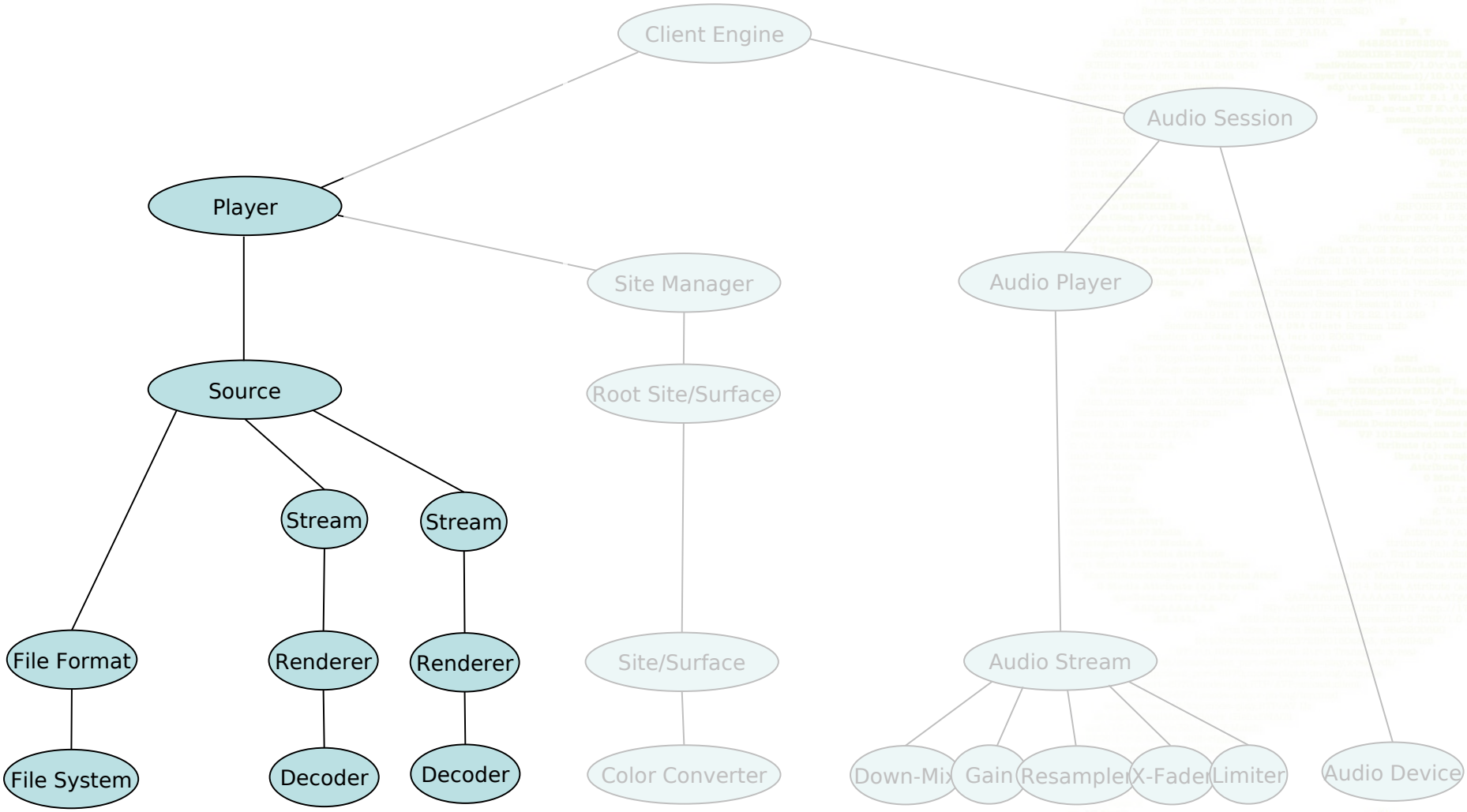
Atlas Playback Input and Rendering Hierarchy



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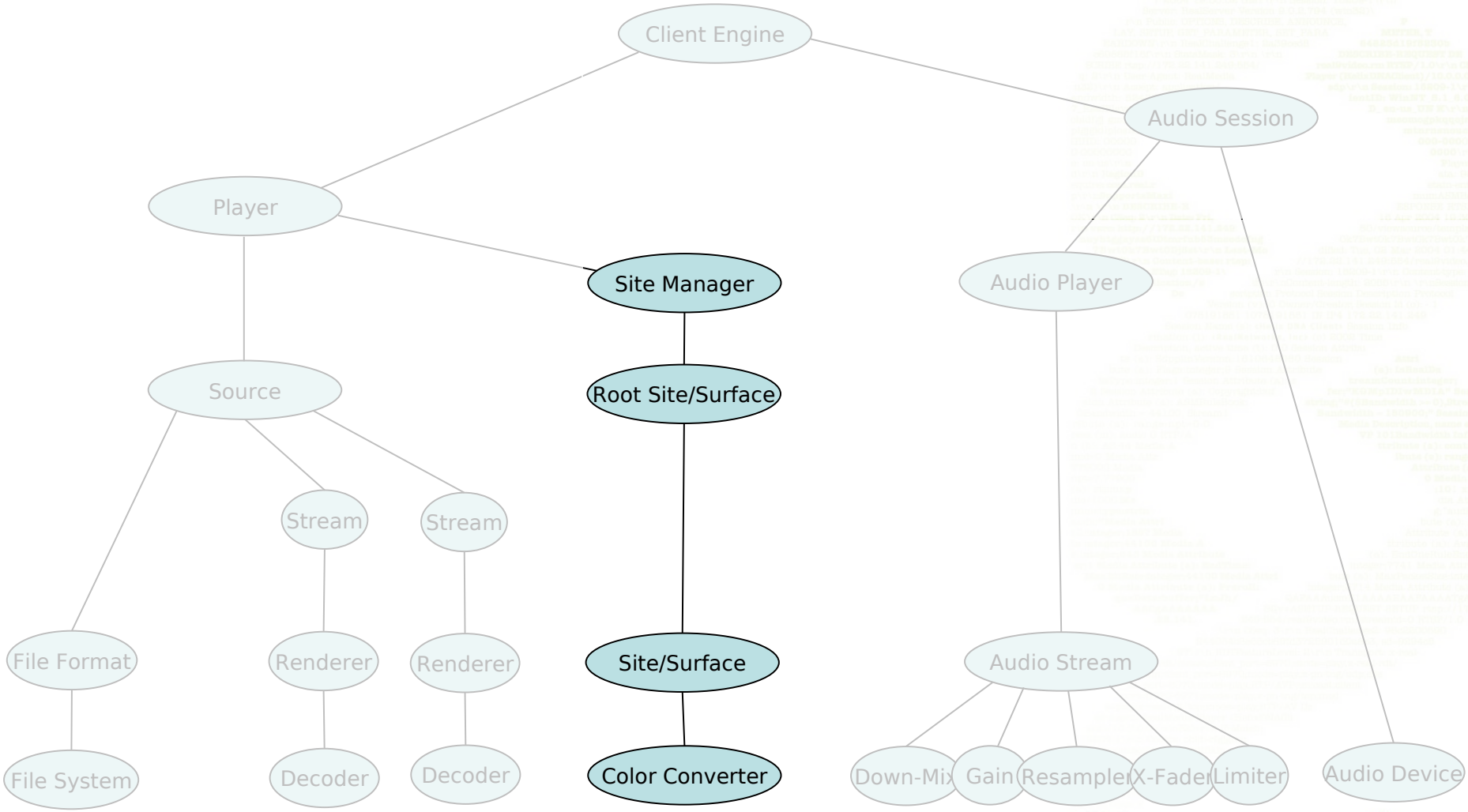
Atlas Playback Objects Control Hierarchy



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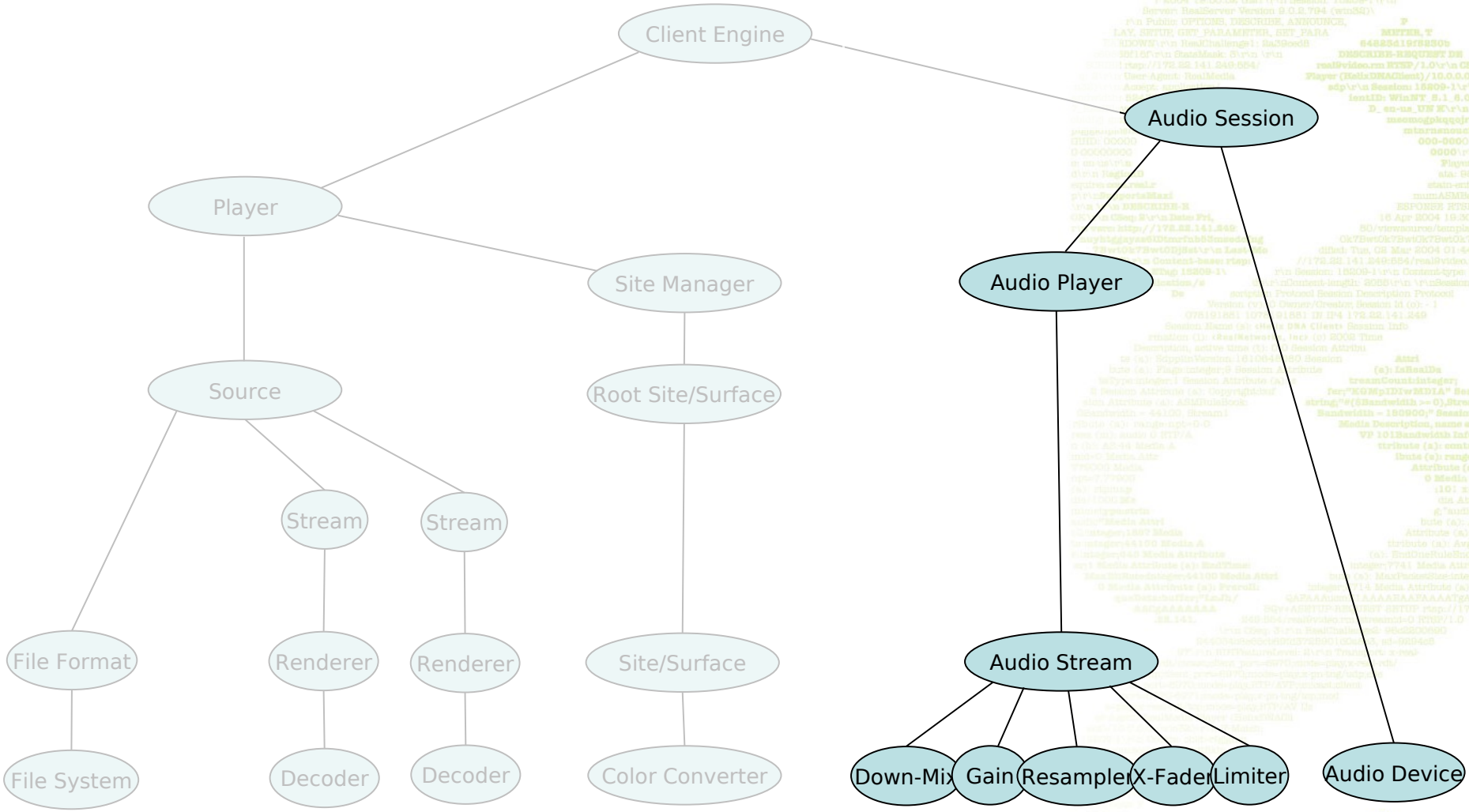
Atlas Playback Objects Control Hierarchy



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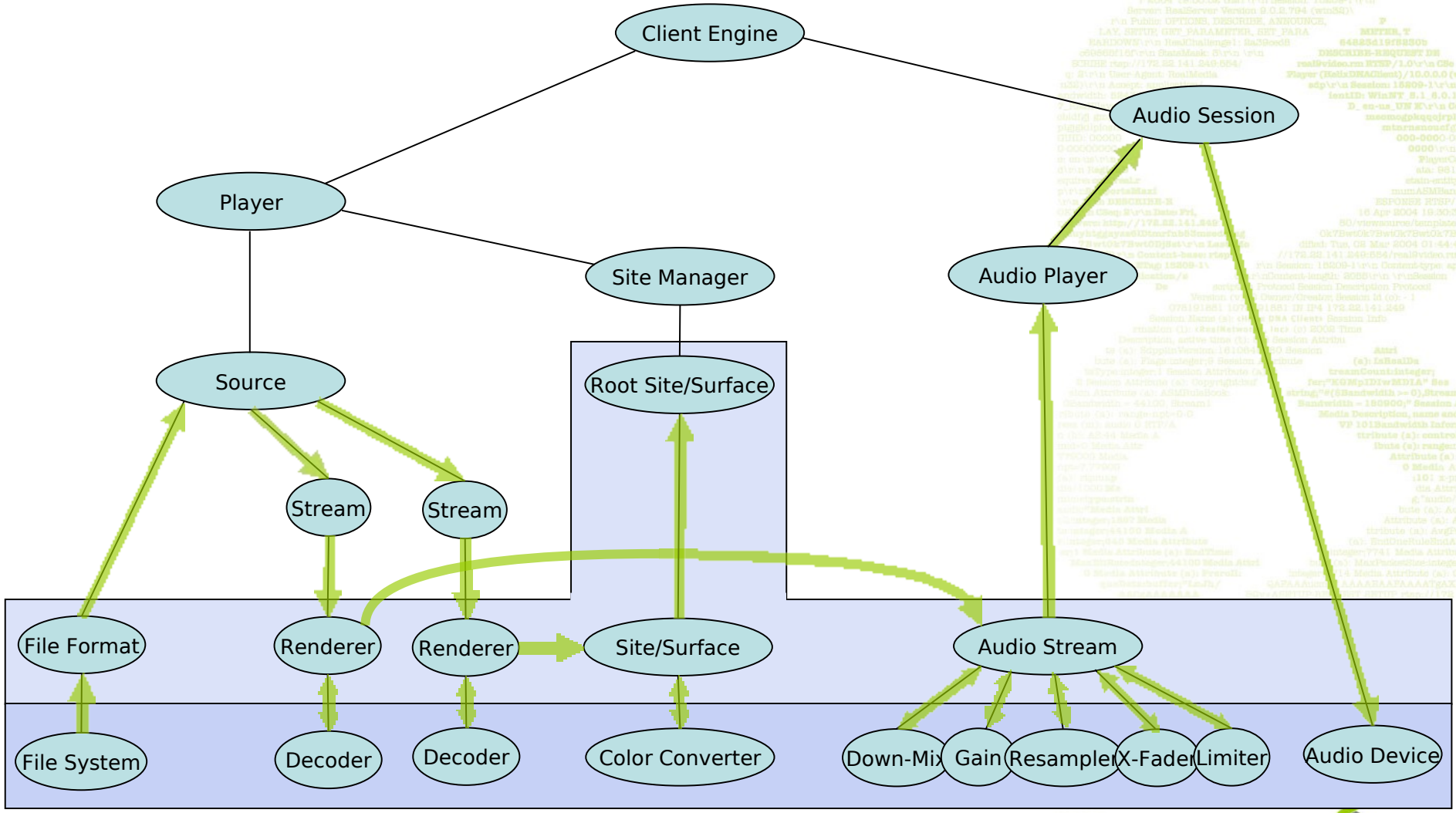

Data Flow

Modules in OpenMax domain easily replaceable by OpenMax components through OpenMax-IL interface

Modules on the fringe of OpenMax domain but sill replaceable by OpenMax components through OpenMax-IL interface

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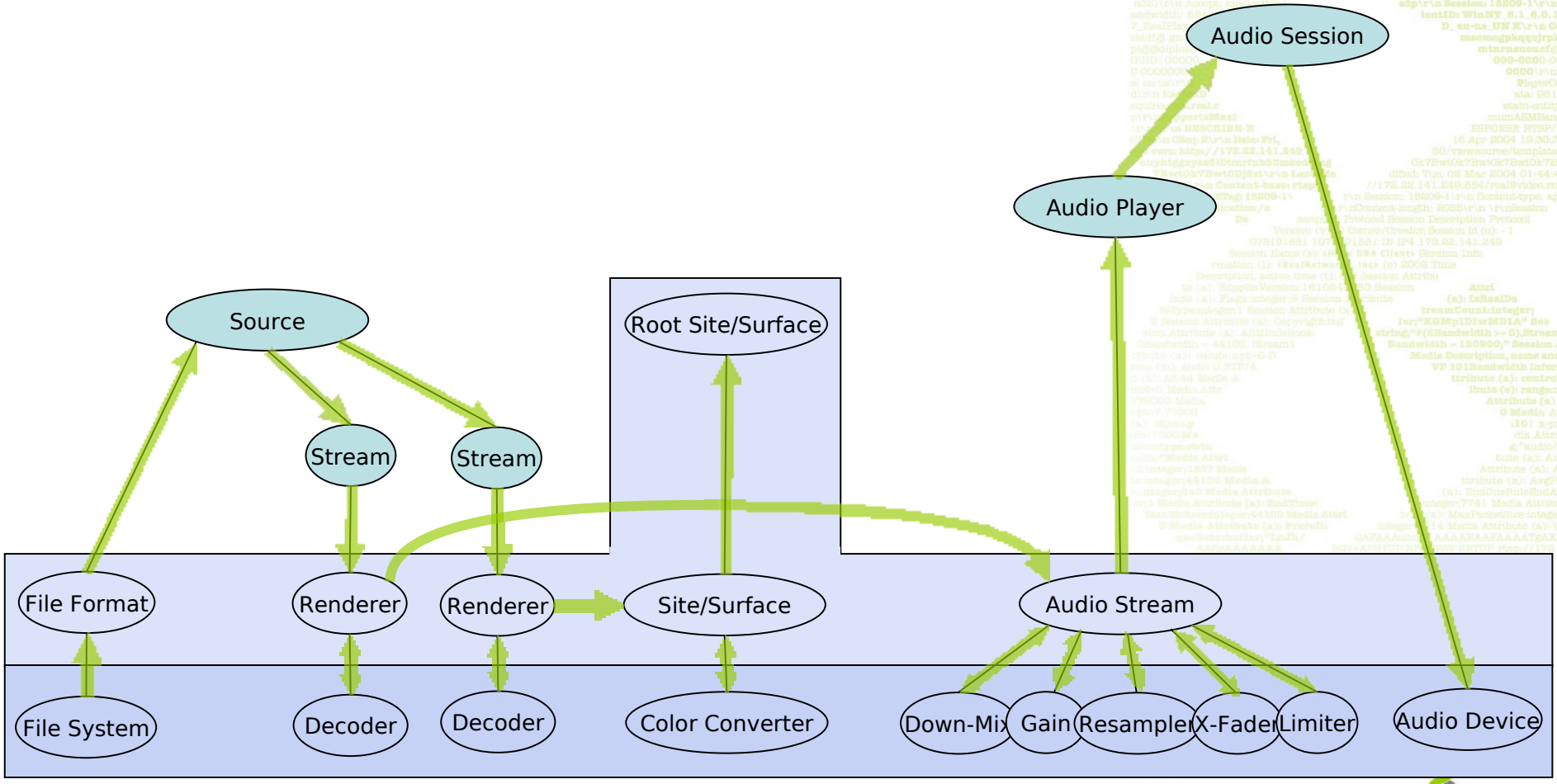
Atlas Playback Objects Control Hierarchy



Data Flow

Modules in OpenMax domain easily replaceable by OpenMax components through OpenMax-IL interface

Modules on the fringe of OpenMax domain but sill replaceable by OpenMax components through OpenMax-IL interface

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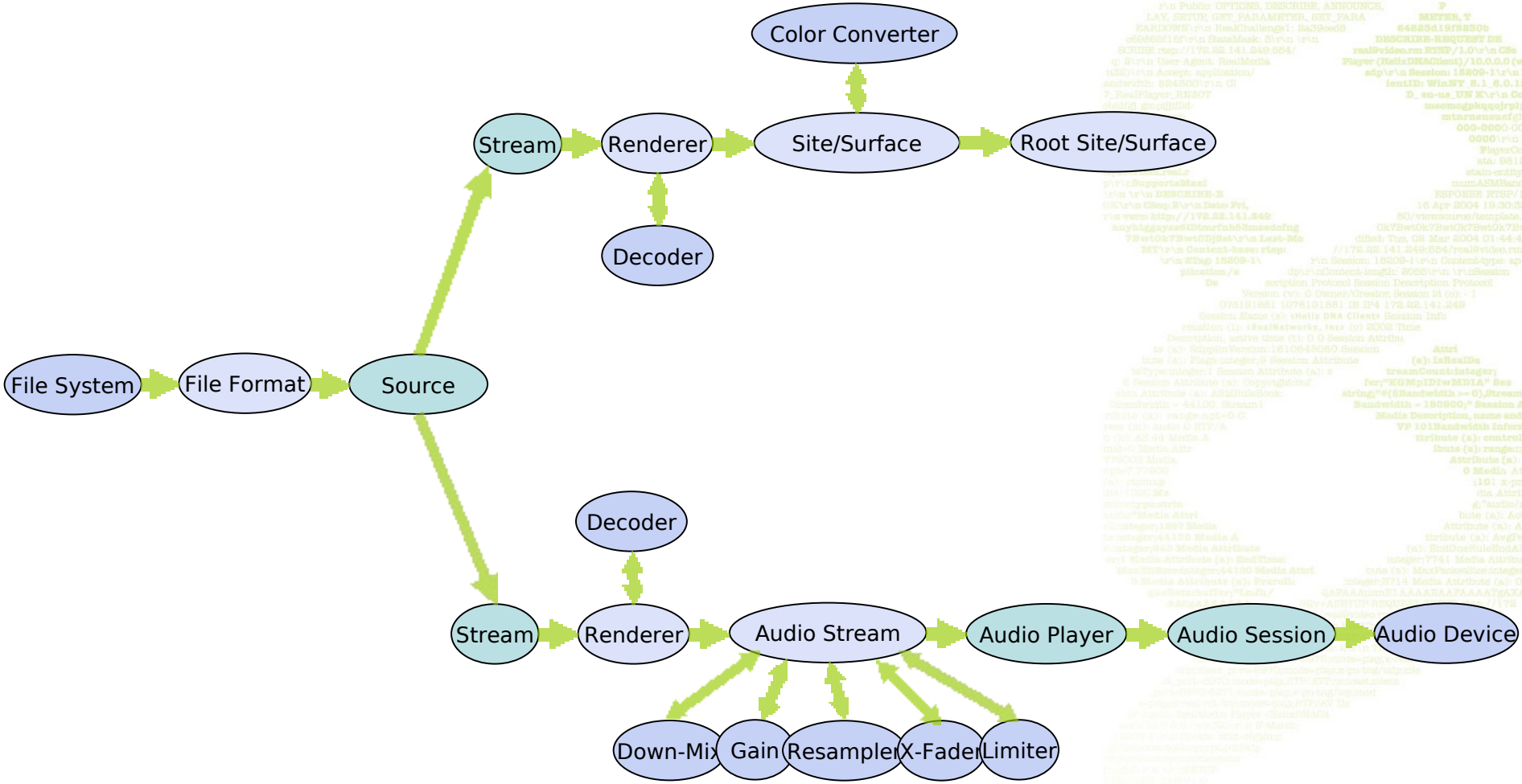
Media Data Flow through Atlas Playback Objects



Data Flow

M s in OpenMax domain easily replaceable by OpenMax components through OpenMax-IL interface

Mo on the fringe of OpenMax domain but sill replaceable by OpenMax components through OpenMax-IL interface

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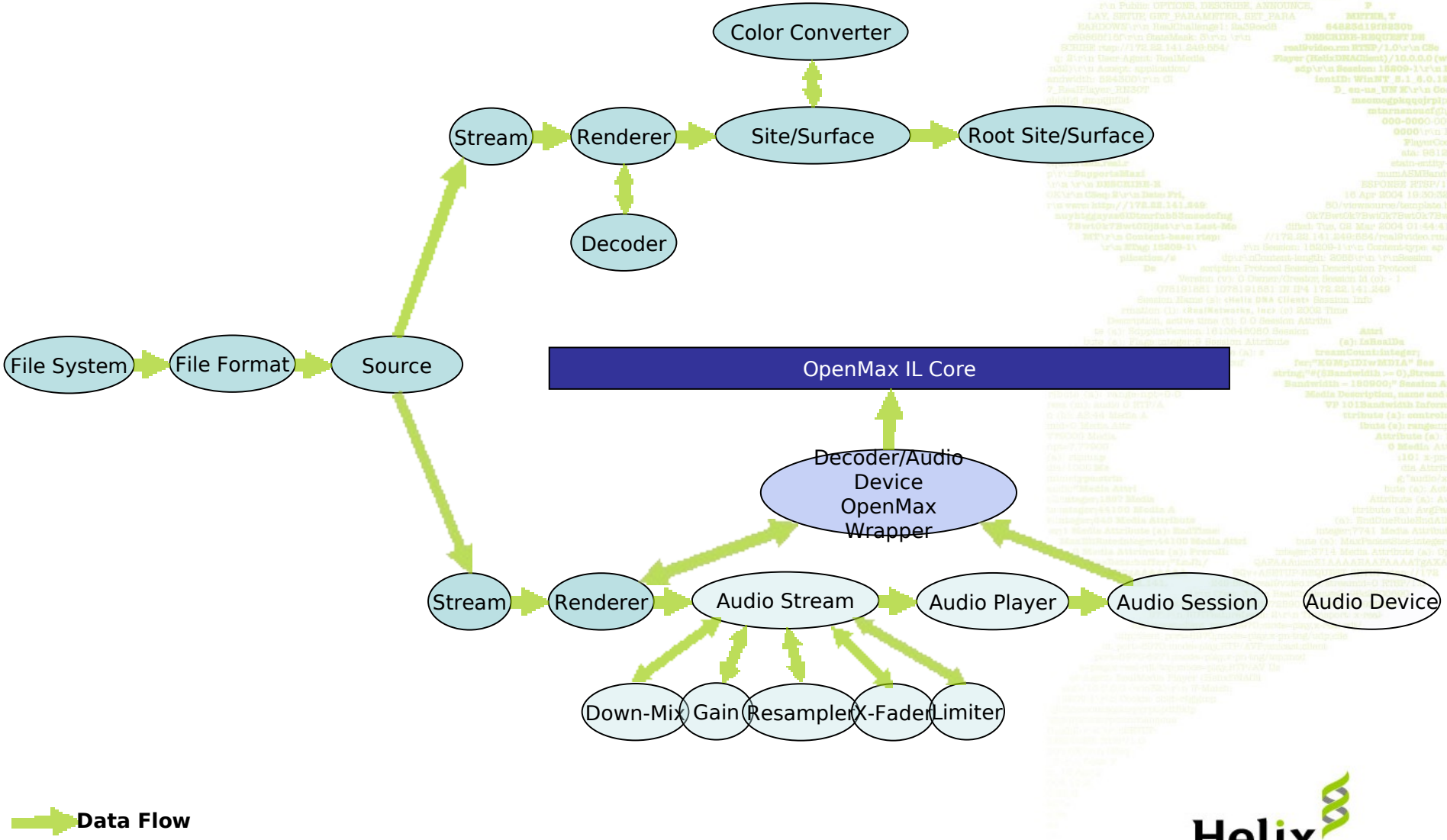
Atlas Playback Objects with OpenMax Audio Pipeline



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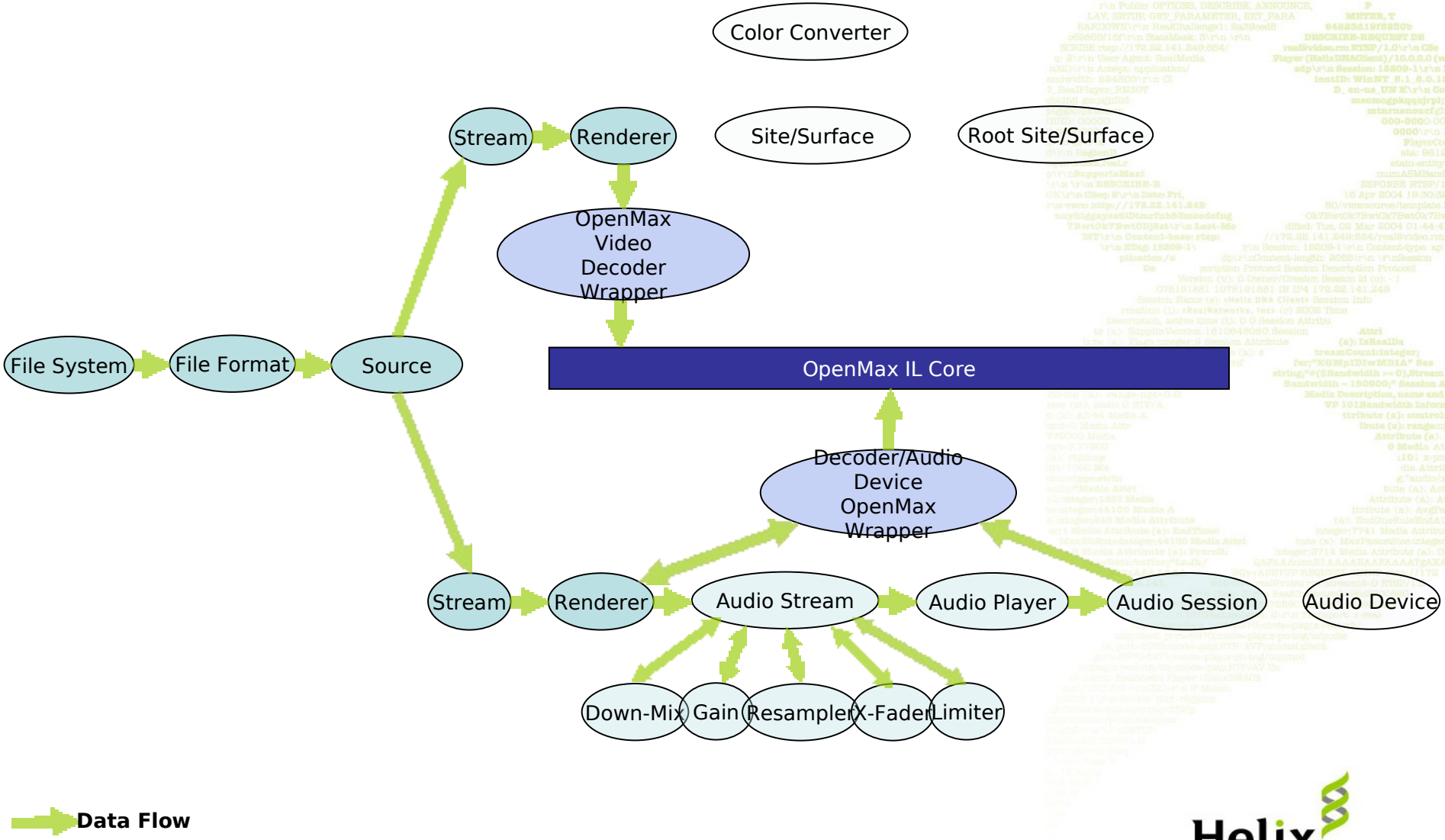
Atlas Playback Objects with OpenMax Audio and Video Pipeline



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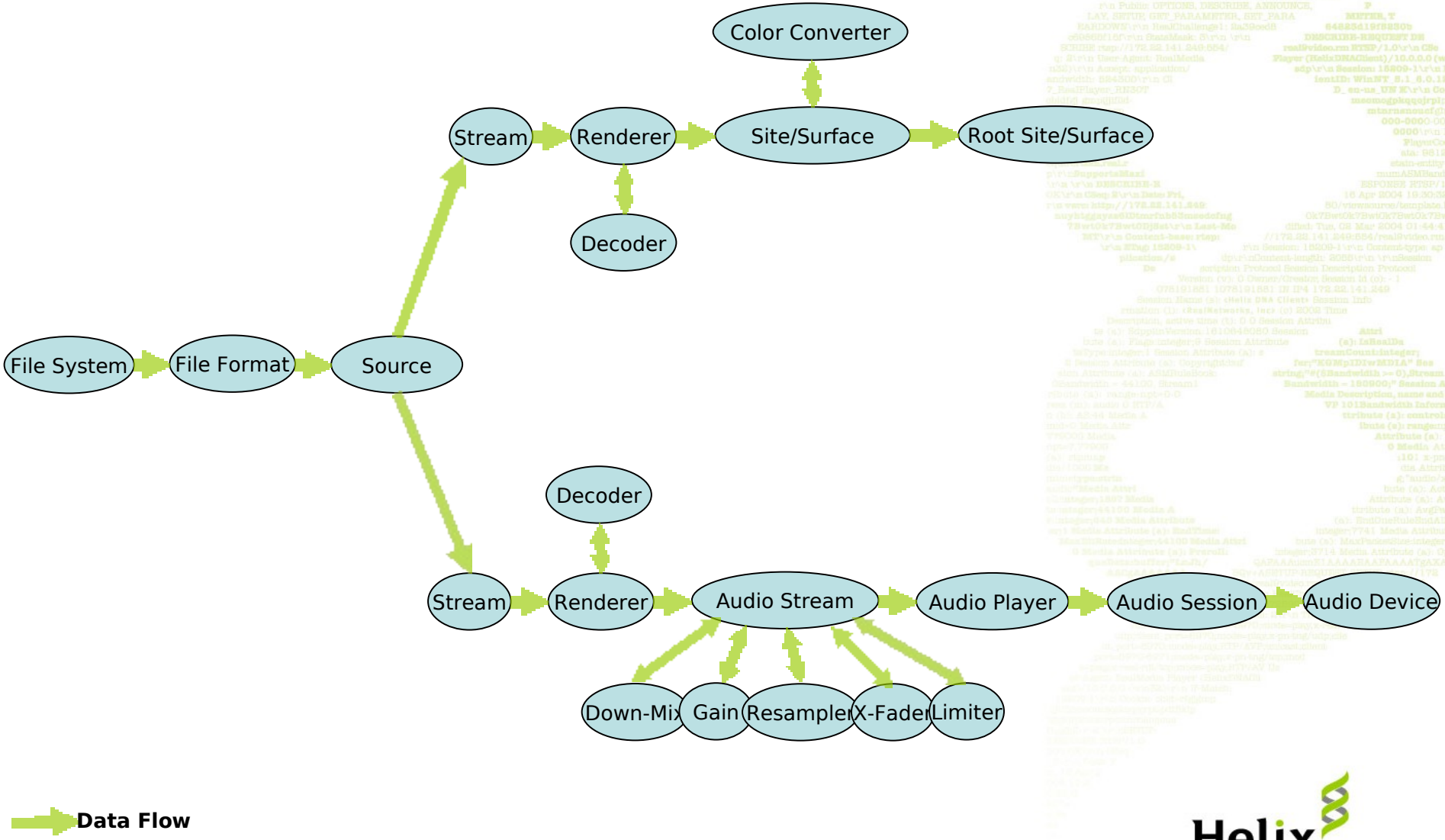
Media Data Flow through Atlas Playback Objects



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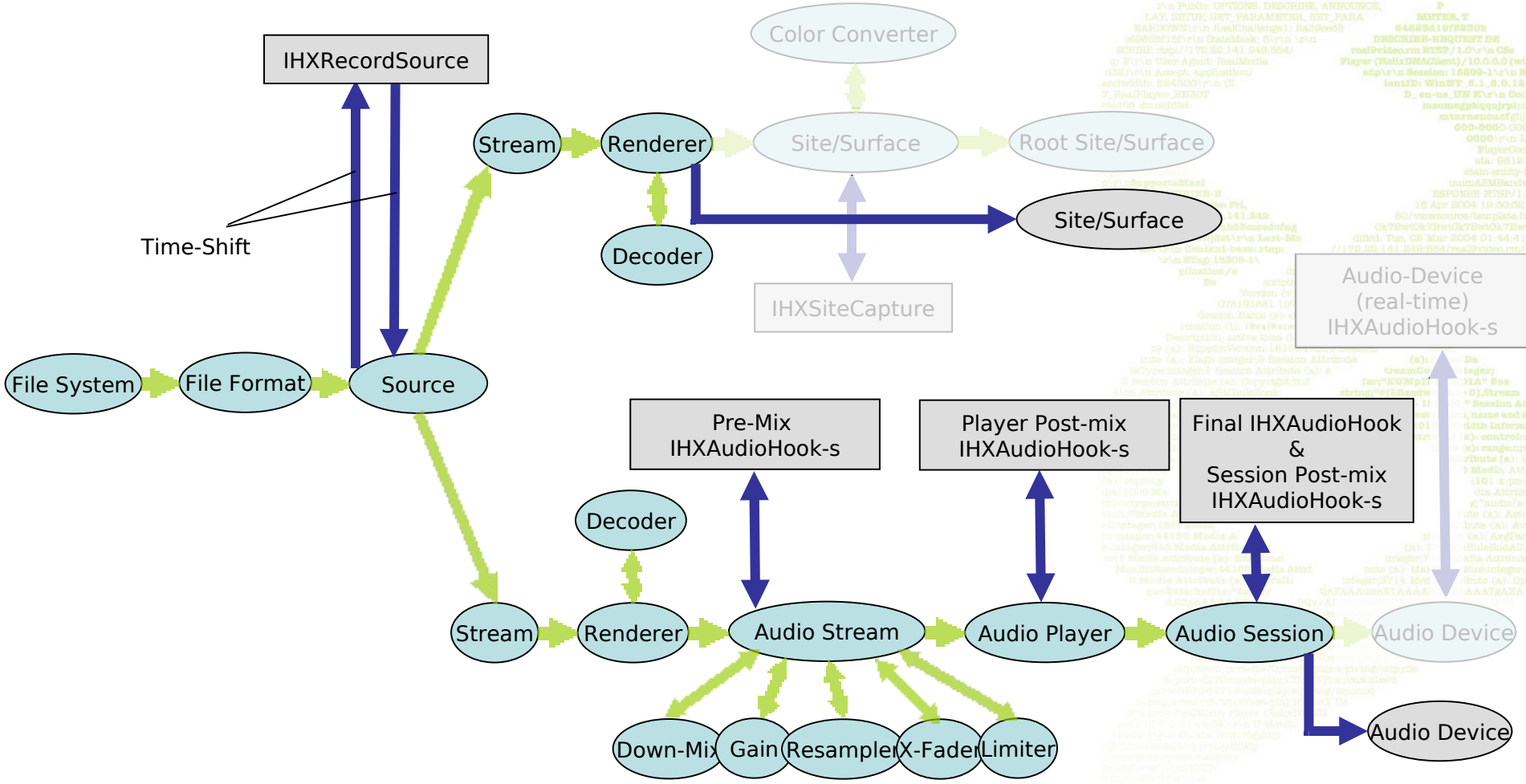
Media Hooks in Playback path



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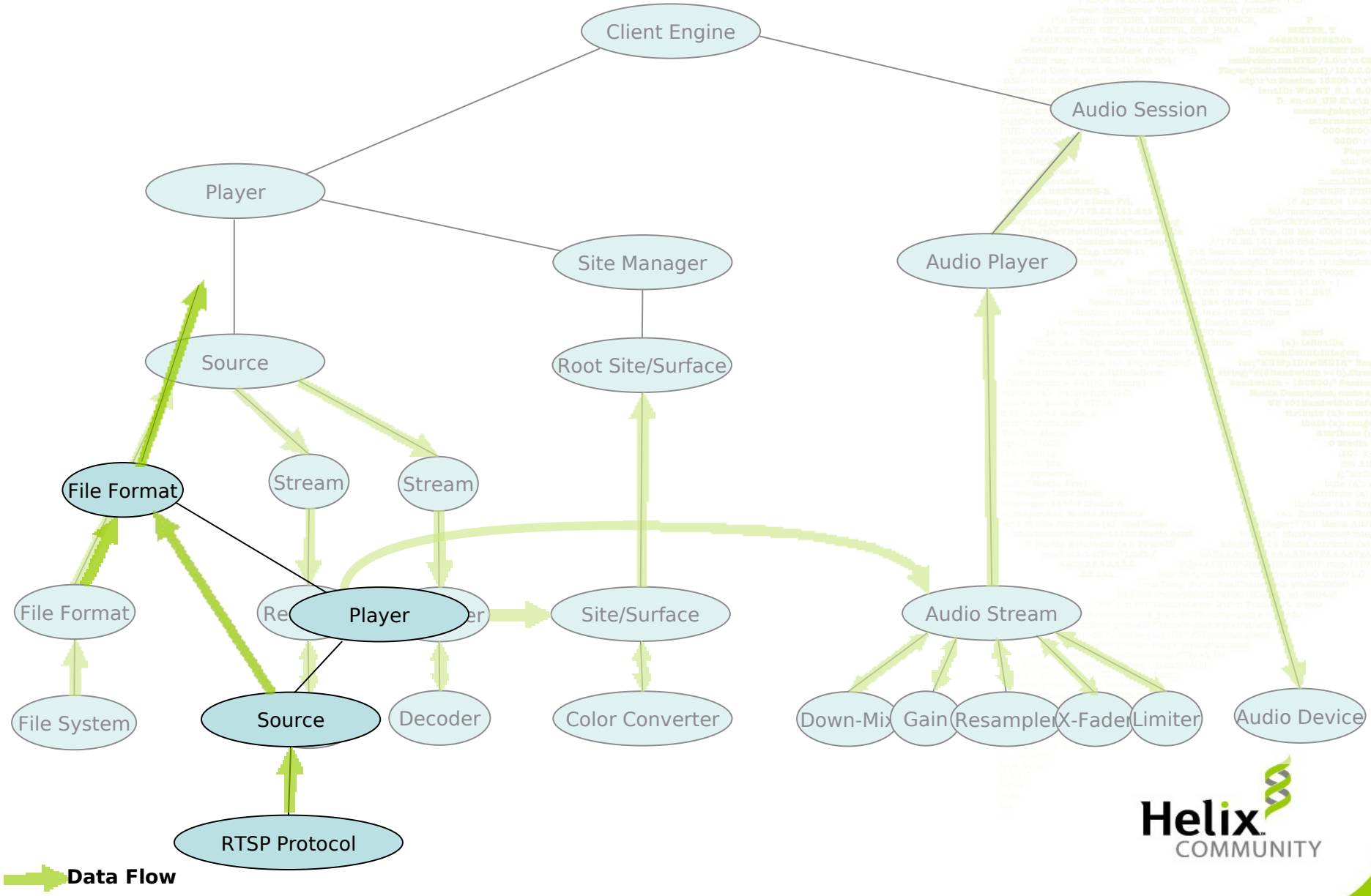
Repurposing the Control Hierarchy



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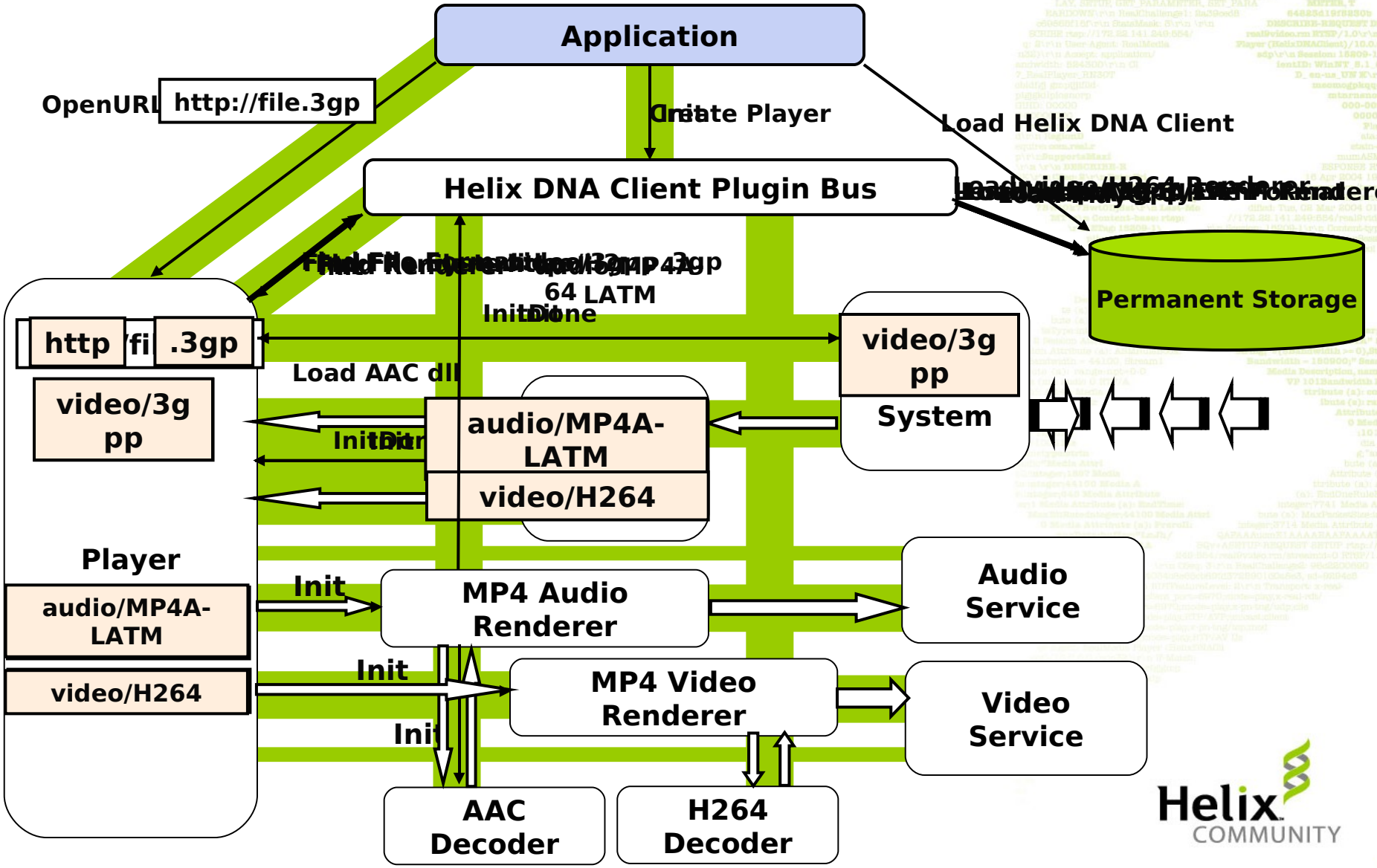
Media Path building



3. Object Basics

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Implementation Foundation

- Object Oriented Approach
  - Framework is written in C++
  - COM-like model
- Interfaces are generally asynchronous
- Platform Adaptation Layer
  - Thread/Mutex and Timing Primitives
  - Audio Device, Video Surface Abstractions
  - Network Services Abstractions
  - DLL Access Abstraction
  - File I/O Abstraction

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Threads

- Player Engine Threads:
  - Main Thread (application interface)
  - Core Thread (supplemental - engine only)
  - Optimized Scheduler Thread (high priority)
  - Network Thread
  - Plugin specific threads
  - Engine can run with Main Thread only

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Plugin Buss

- Primary Interface (IHXMediaPlatform):

```
DECLARE_INTERFACE_(IHXMediaPlatform, IUnknown)
{
    STDMETHOD(GetVersion)                   (THIS_
                                UINT32* pVersion) PURE;

    STDMETHOD(AddPluginPath)                (THIS_
                                const char* pszName,
                                 const char* pszPath) PURE;
    STDMETHOD(Init)                         (THIS_
                                IUnknown* pContext) PURE;

    STDMETHOD(Close)                        (THIS)        PURE;

    STDMETHOD(Reset)                        (THIS_
                                IUnknown* pContext,
                                HXBOOL      bPlatformOnly) PURE;

    STDMETHOD(Purge)                        (THIS)        PURE;

    STDMETHOD(CreateChildContext)       (THIS_
                                IHXMediaPlatform** ppChildContext) PURE;
};
```

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Plugin Buss - Services

- Intrinsic
  - IHXMediaPlatform
  - IHXMediaPlatformKicker
  - IHXPluginHandler
- Extendable
  - IHXCommonClassFactory
- Replaceable Services
  - IHXScheduler
  - IHXMutex
  - IHXOptimizedScheduler
  - IHXPreferences
  - IHXRegistry
  - IHXNetServices
  - IHXSiteEventHandler

Plugin Buss – Factory Supported Objects

- Intrinsic
  - CLSID_IHXBuffer
  - CLSID_IHXPacket
  - CLSID_IHXValues
  - CLSID_IHXRequest
  - CLSID_IHXList
  - CLSID_IHXThread
  - CLSID_IHXMutex
  - CLSID_IHXEvent
  - CLSID_IHXAsyncTimer
  - CLSID_IHXDLLAccess
  - CLSID_IHXPreferences
  - CLSID_IHXRegistry

  …
- General
  - Based on component plugins
  - E.g.: CLSID_IHXClientEngine

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Player Controls

- Player Management: IHXClientEngine
  - CreatePlayer(), ClosePlayer()
- Playback Control: IHXPlayer
  - Begin(), Pause(), Seek(), Stop(), SetVelocity()
- Playback Notifications: IHXClientAdviseSink
  - OnBegin(), OnBuffering(), OnPause(), OnStop(), OnPosLegth()…
- Reference Clock distributed to all renderer plugins
  - OnTimeSync()

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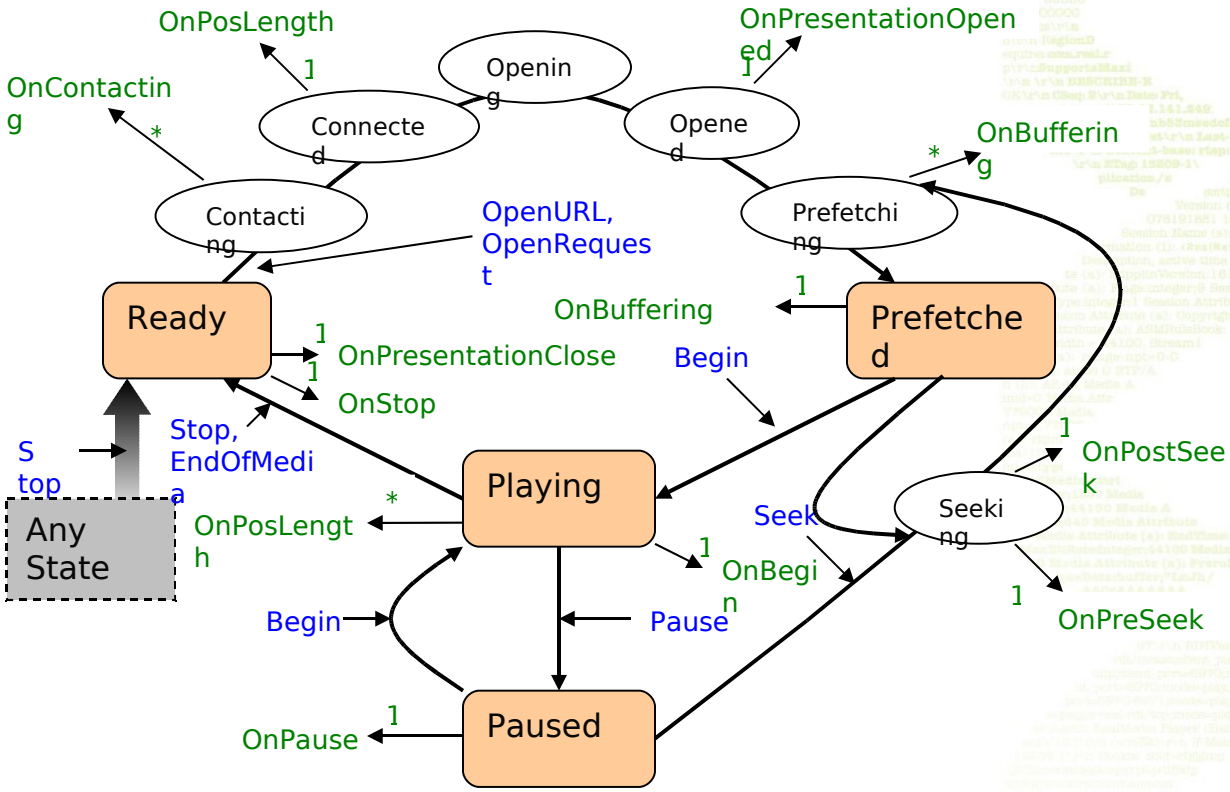
Player State Machine



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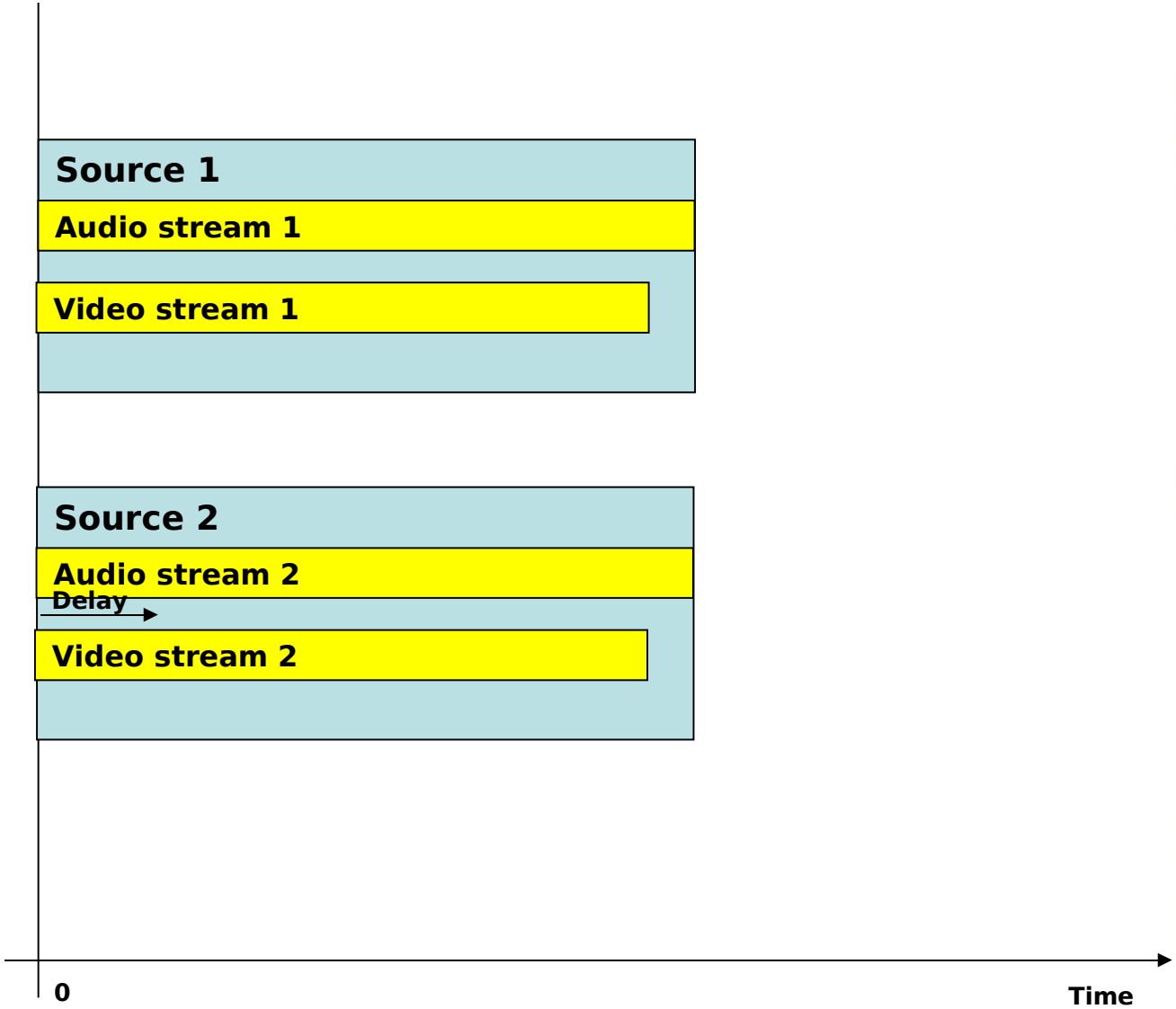
Player Media Timing



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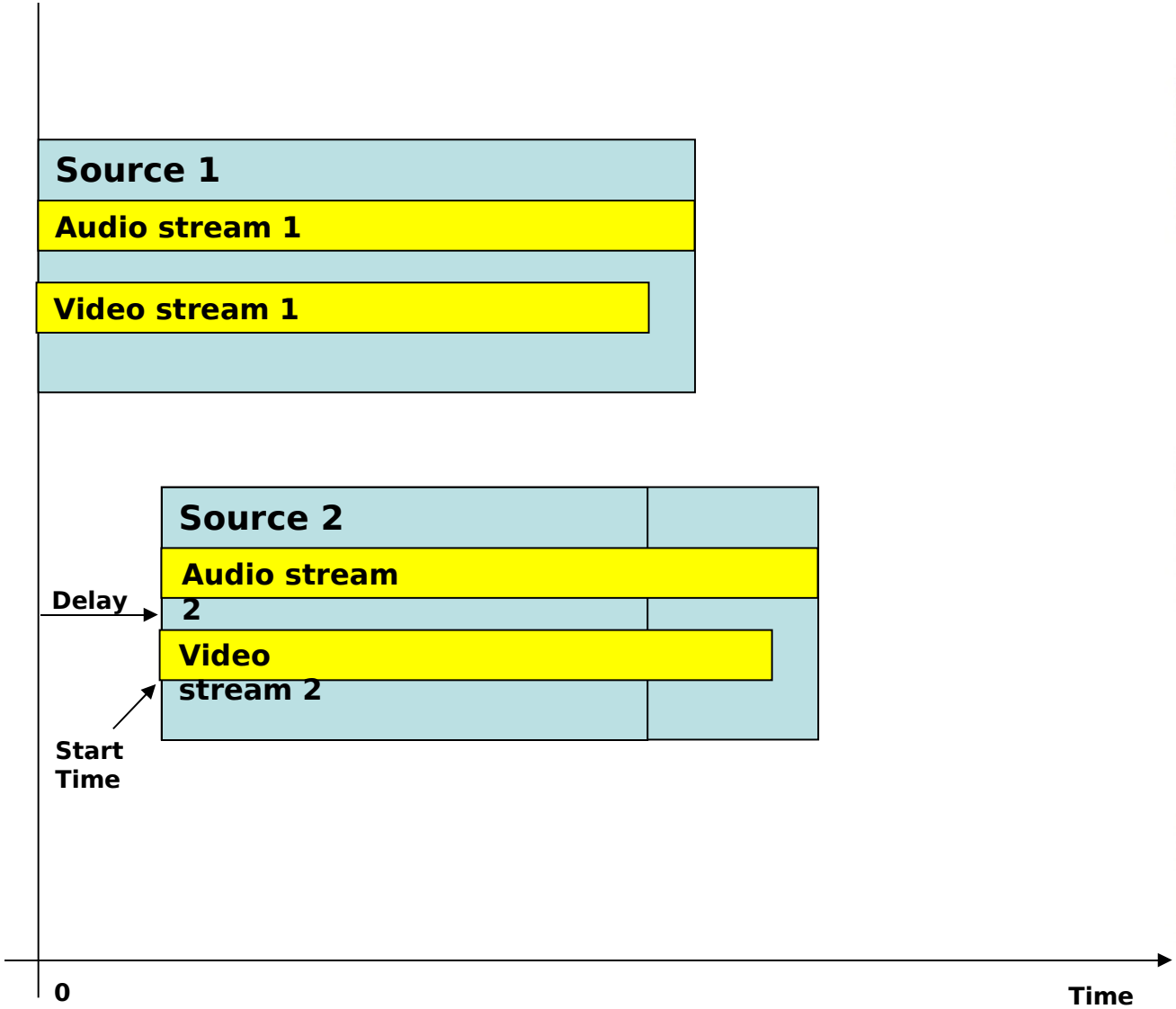

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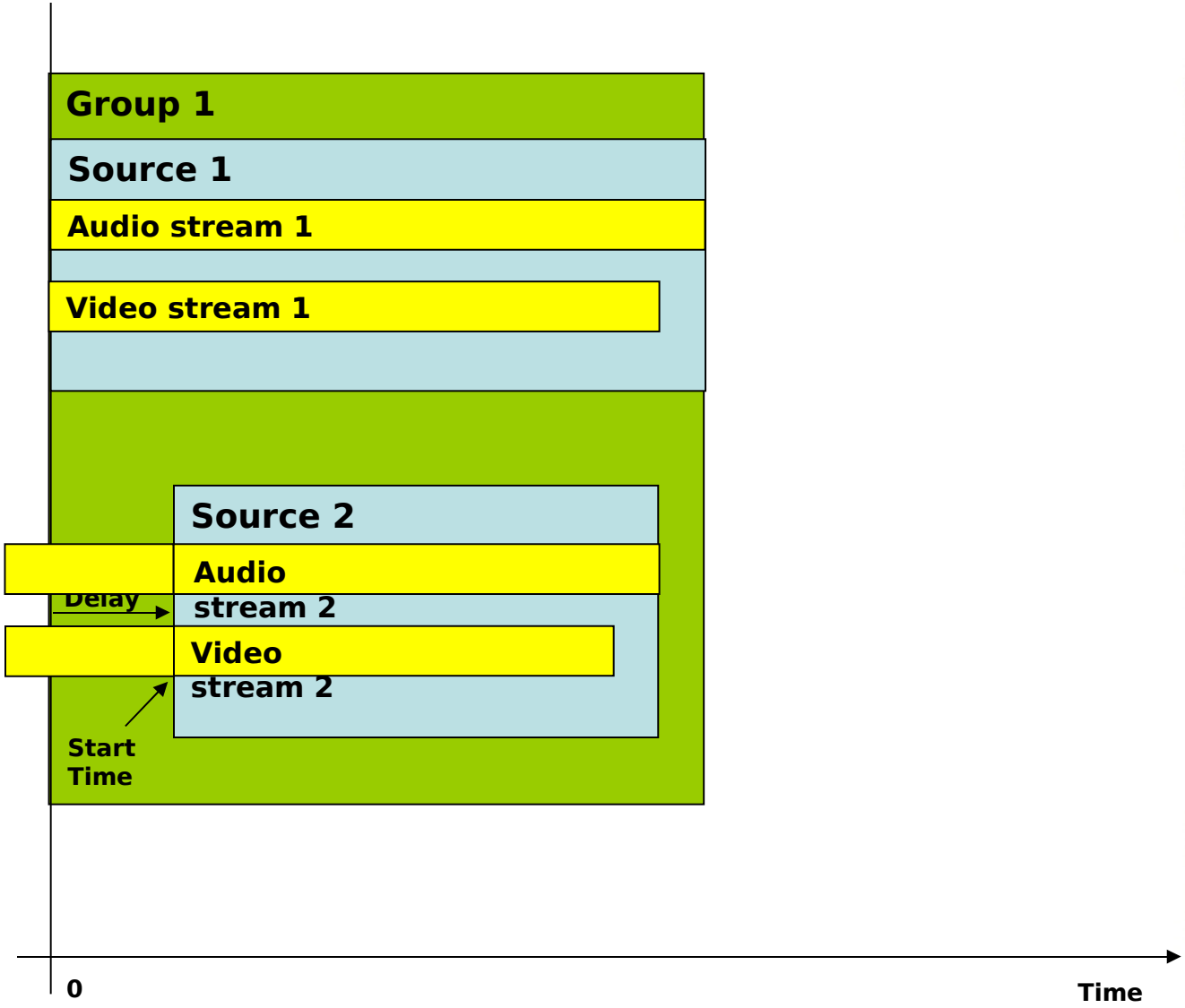

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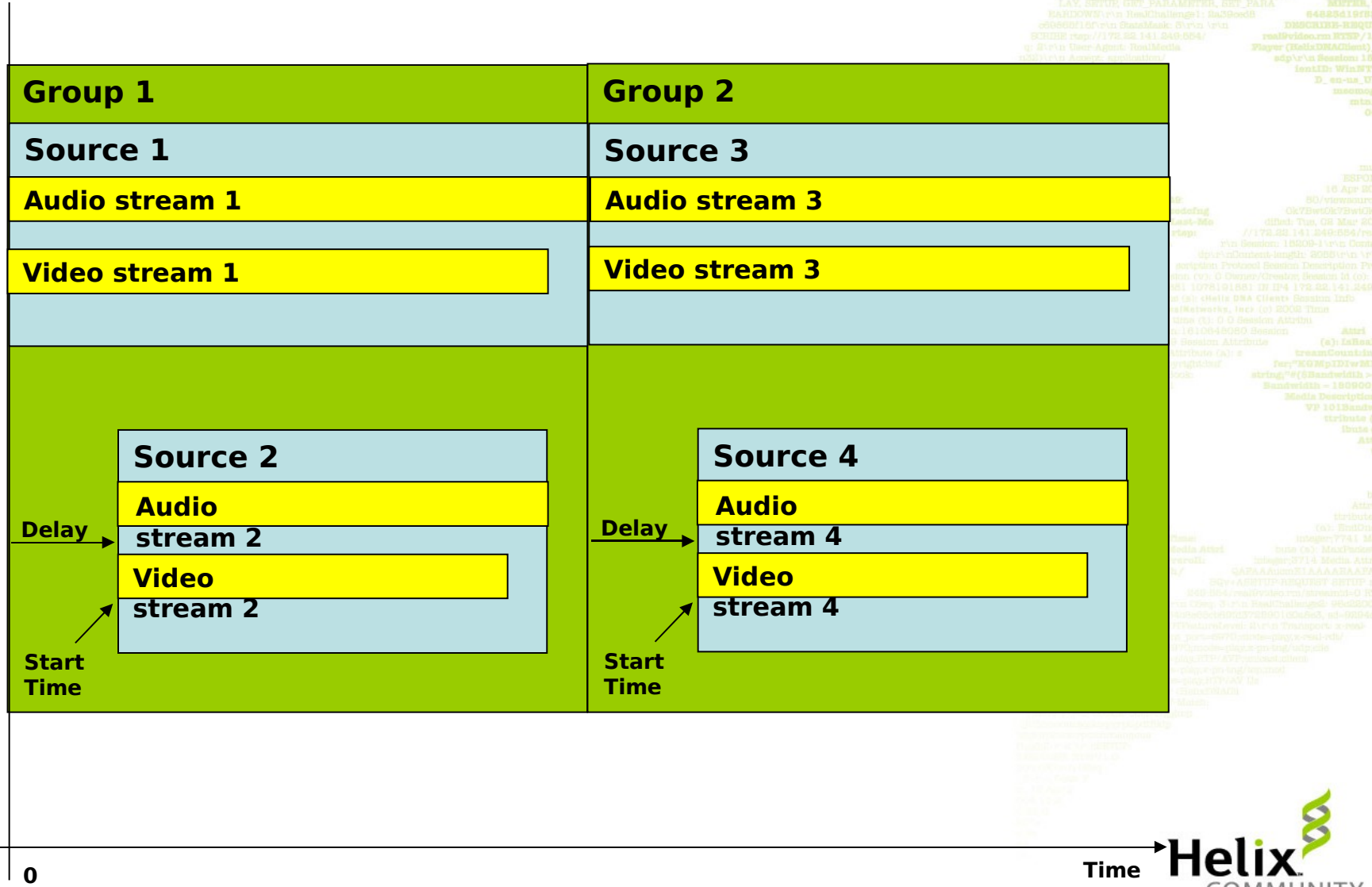
Player Media Timing



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File Format – direct data (source) supplier

```
DECLARE_INTERFACE_(IHXFileFormatObject, IUnknown)
{
    STDMETHOD(GetFileFormatInfo)    (THIS_
                                     REF(const char**)          /*OUT*/ pFileMimeTypes,
                                     REF(const char**)          /*OUT*/ pFileExtensions,
                                     REF(const char**)          /*OUT*/ pFileOpenNames
                                     ) PURE;

    STDMETHOD(InitFileFormat)
                                     (THIS_
                                     IHXRequest*                /*IN*/  pRequest,
                                     IHXFormatResponse*         /*IN*/  pFormatResponse,
                                     IHXFileObject*                     /*IN*/  pFileObject
                                     ) PURE;

    STDMETHOD(GetFileHeader)                    (THIS) PURE;

    STDMETHOD(GetStreamHeader)      (THIS_
                                     UINT16 unStreamNumber) PURE;

    STDMETHOD(GetPacket)                        (THIS_
                                     UINT16 unStreamNumber) PURE;

    STDMETHOD(Seek)                 (THIS_
                                     ULONG32 ulOffset) PURE;

    STDMETHOD(Close)                (THIS) PURE;
};
```

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File Format Response

```
DECLARE_INTERFACE_(IHXFormatResponse, IUnknown)
{
    STDMETHOD(InitDone)                 (THIS_
                                        HX_RESULT       status) PURE;

    STDMETHOD(PacketReady)              (THIS_
                                        HX_RESULT       status,
                                        IHXPacket*      pPacket) PURE;

    STDMETHOD(SeekDone)                 (THIS_
                                        HX_RESULT       status) PURE;

    STDMETHOD(FileHeaderReady)          (THIS_
                                        HX_RESULT       status,
                                        IHXValues*      pHeader) PURE;

    STDMETHOD(StreamHeaderReady)        (THIS_
                                        HX_RESULT       status,
                                        IHXValues*      pHeader) PURE;

    STDMETHOD(StreamDone)               (THIS_
                                        UINT16          unStreamNumber) PURE;
};
```

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Structure of Source Data - Headers

```
====== Begin File Header
================================================
======
Duration                        = 30060
Height                          = 288
StreamCount                     = 2
Width                           = 352
Abstract                        = <Buffer>
Author                          = <Buffer>
Copyright                       = <Buffer>
Title                                   = <Buffer>
====== End File Header
================================================
========
------ Begin Stream Header = 0 ----------------------------------------------
AvgBitRate                      = 150879
Duration                        = 29999
FramesPerMSecond                = 25000833
Height                          = 288
RTPPayloadType                  = 96
SamplesPerSecond                = 90000
StreamNumber                    = 0
Width                           = 352
ASMRuleBook                     = Marker=0;Marker=1;
MimeType                        = video/X-HX-AVC1
StreamName                      = Video Track
OpaqueData                      = <Buffer>
------ End Stream Header = 0 ------------------------------------------------
------ Begin Stream Header = 1 ----------------------------------------------
AvgBitRate                      = 40000
Duration                        = 30060
MaxBitRate                      = 40000
RTPPayloadType                  = 96
SamplesPerSecond                = 22050
StreamNumber                    = 1
ASMRuleBook                     = Marker=0;Marker=1;
MimeType                        = audio/X-RN-MP4-RAWAU
StreamName                      = Audio Track
OpaqueData                      = <Buffer>
------ End Stream Header = 1 ------------------------------------------------
```

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Structure of Source Data - Packets

```
..... Start Packets .....
Strm# ___Time____ Rule# Lst  Flgs  BufferSize
__RTPTime__
S=  0 T=       0     R=  1  L=F F=03 B=    2859  t=
    0
S=  1 T=       0     R=  1  L=F F=03 B=       6  t=
    0
S=  0 T=      40     R=  1  L=F F=02 B=     657  t=
3597
S=  1 T=      46     R=  1  L=F F=03 B=     230  t=
1024
S=  0 T=      80     R=  1  L=F F=02 B=     698  t=
7197
S=  1 T=      93     R=  1  L=F F=03 B=     237  t=
2048
S=  0 T=     120     R=  1  L=F F=02 B=    1013  t=
10797
S=  1 T=     139     R=  1  L=F F=03 B=     230  t=
3072
S=  0 T=     160     R=  1  L=F F=02 B=    1201  t=
14397
S=  1 T=     186     R=  1  L=F F=03 B=     230  t=
4096
S=  0 T=     200     R=  1  L=F F=02 B=    1527  t=
17997
S=  1 T=     232     R=  1  L=F F=03 B=     236  t=
```

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Renderer – datatype powerhouse

```
DECLARE_INTERFACE_(IHXRenderer, IUnknown)
{
    STDMETHOD(GetRendererInfo)      (THIS_
                                     REF(const char**)      /*OUT*/ pStreamMimeTypes,
                                     REF(UINT32)            /*OUT*/ unInitialGranularity
                                     ) PURE;
    STDMETHOD(StartStream)                  (THIS_
                                     IHXStream*             pStream,
                                     IHXPlayer*             pPlayer) PURE;
    STDMETHOD(EndStream)                    (THIS) PURE;
    STDMETHOD(OnHeader)                     (THIS_
                                     IHXValues*             pHeader) PURE;
    STDMETHOD(OnPacket)                     (THIS_
                                     IHXPacket*             pPacket,
                                     LONG32                 lTimeOffset) PURE;
    STDMETHOD(OnTimeSync)                   (THIS_
                                     ULONG32                ulTime) PURE;
    STDMETHOD(OnPreSeek)                    (THIS_
                                     ULONG32                ulOldTime,
                                     ULONG32                ulNewTime) PURE;
    STDMETHOD(OnPostSeek)                   (THIS_
                                     ULONG32                ulOldTime,
                                     ULONG32                ulNewTime) PURE;
    STDMETHOD(OnPause)              (THIS_
                                     ULONG32                ulTime) PURE;
    STDMETHOD(OnBegin)              (THIS_
                                     ULONG32                ulTime) PURE;
    STDMETHOD(OnBuffering)                  (THIS_
                                     ULONG32                ulFlags,
                                     UINT16                 unPercentComplete) PURE;
    STDMETHOD(GetDisplayType)               (THIS_
                                     REF(HX_DISPLAY_TYPE)   ulFlags,
                                     REF(IHXBuffer*)        pBuffer) PURE;
    STDMETHOD(OnEndofPackets)       (THIS) PURE;
}
```

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A/V Controls

- Audio Controls
  - Volume, Mute
  - Sound level offset (level normalization)
  - Advise Sink (Observer)
- Video Controls
  - Size, Position
  - Z-Order
  - Alpha-blending
  - Brightness, Hue, Saturation, Contrast, Sharpness
  - Site Watcher (Observer)

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4. Code Organization

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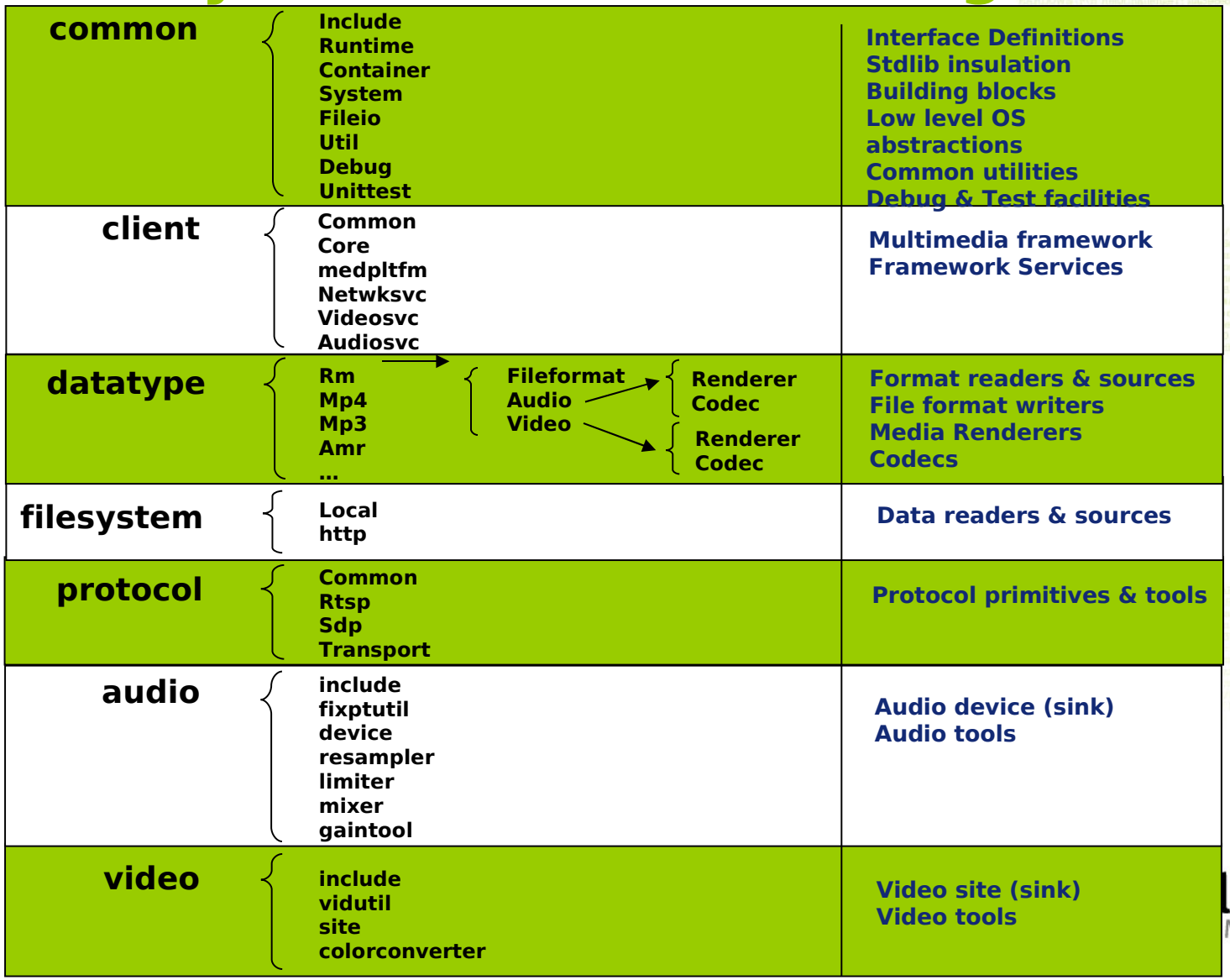
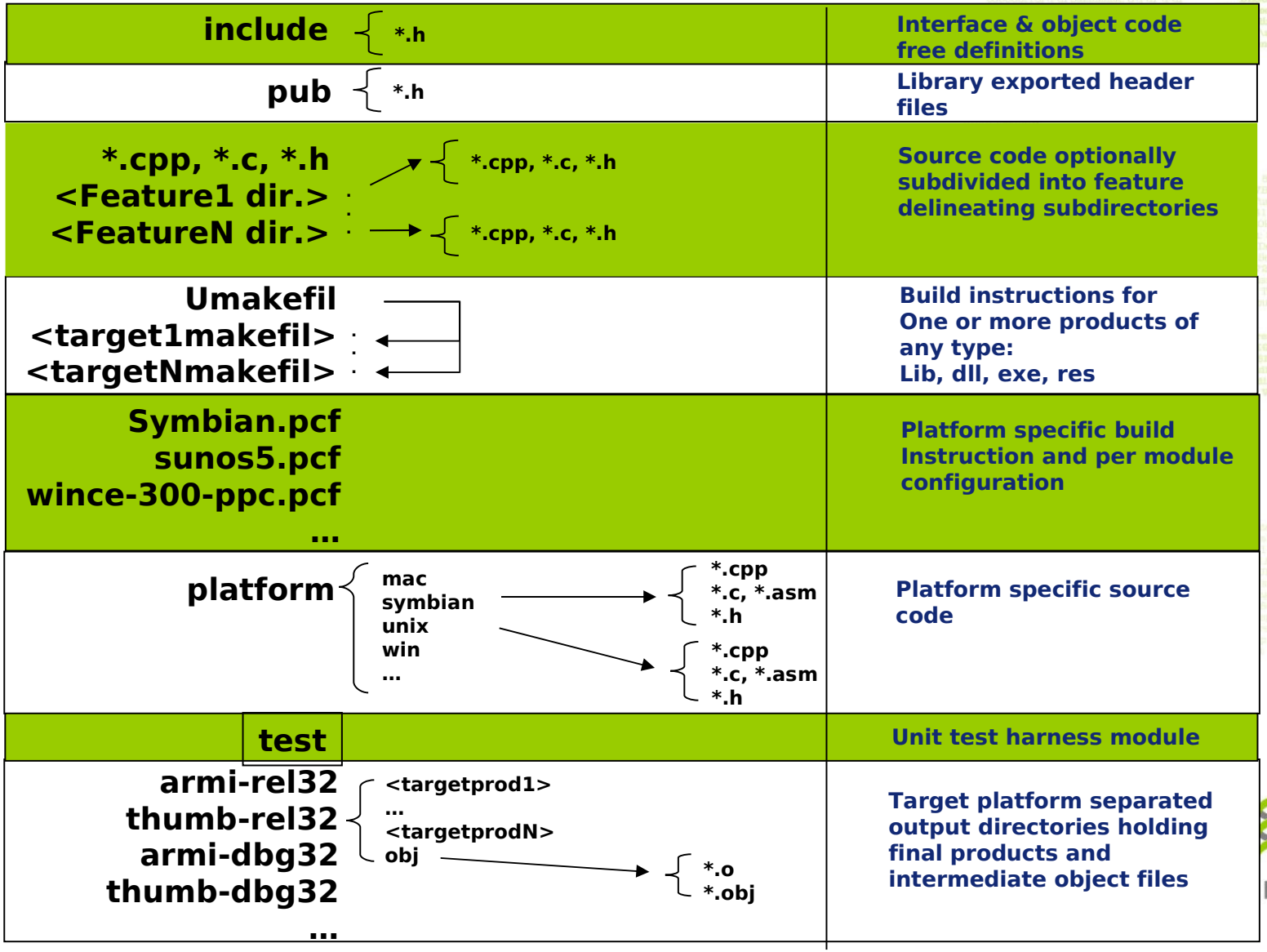
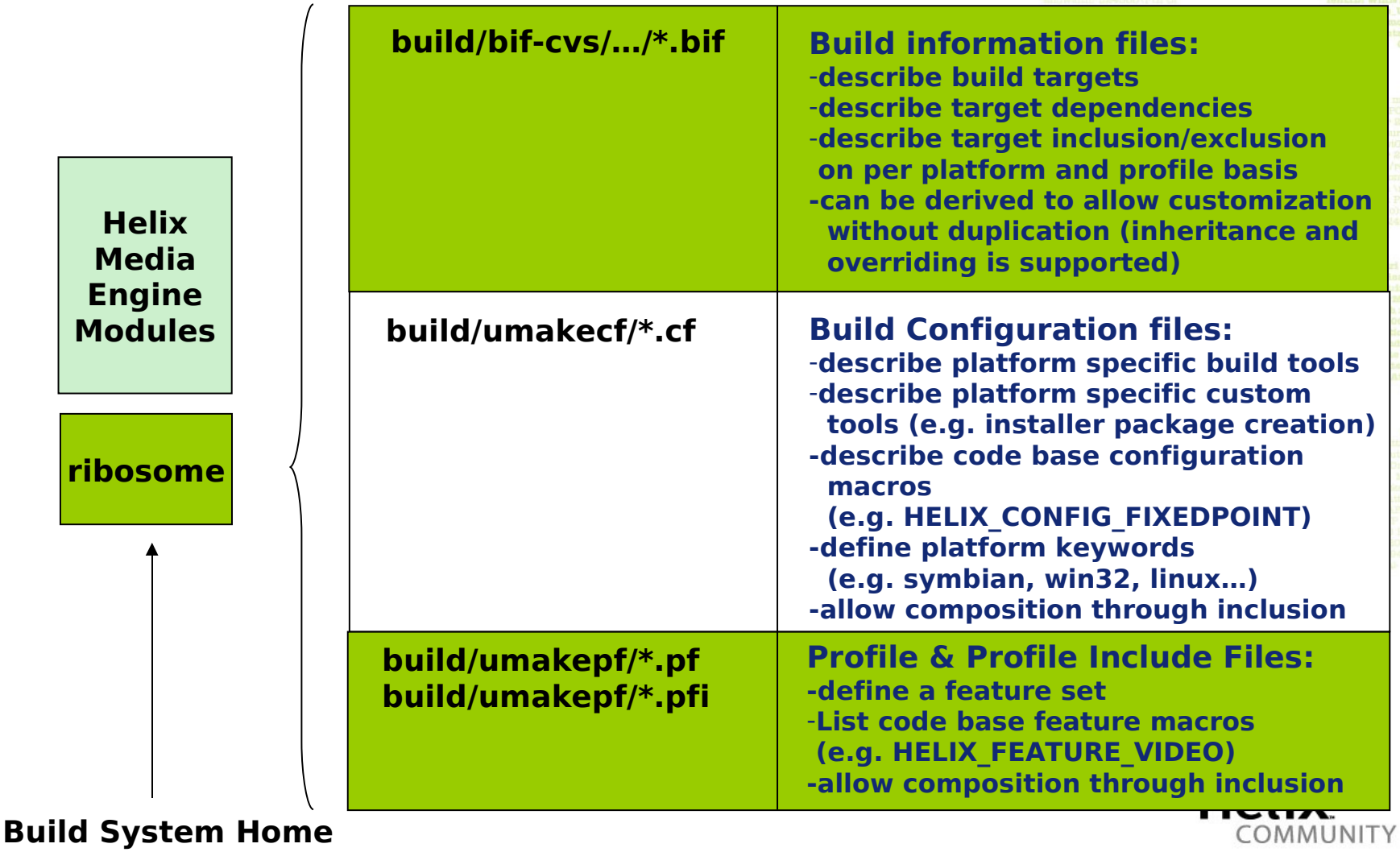
Code Layout: inter-module organization



Code Layout: intra-module organization



Build System Configuration



Profiles and Modularization

- Modularization – coding pattern solutions:
  - Abstract Interfaces
  - Derivation
  - Inline code selection (only where necessary)
- Module selection:
  - Target definitions in Build Information Files
- Module scalability
  - Conditional macros
  - Macro definitions are packaged into profile subsets (.pfi files) which are combined to form profiles (.pf files)

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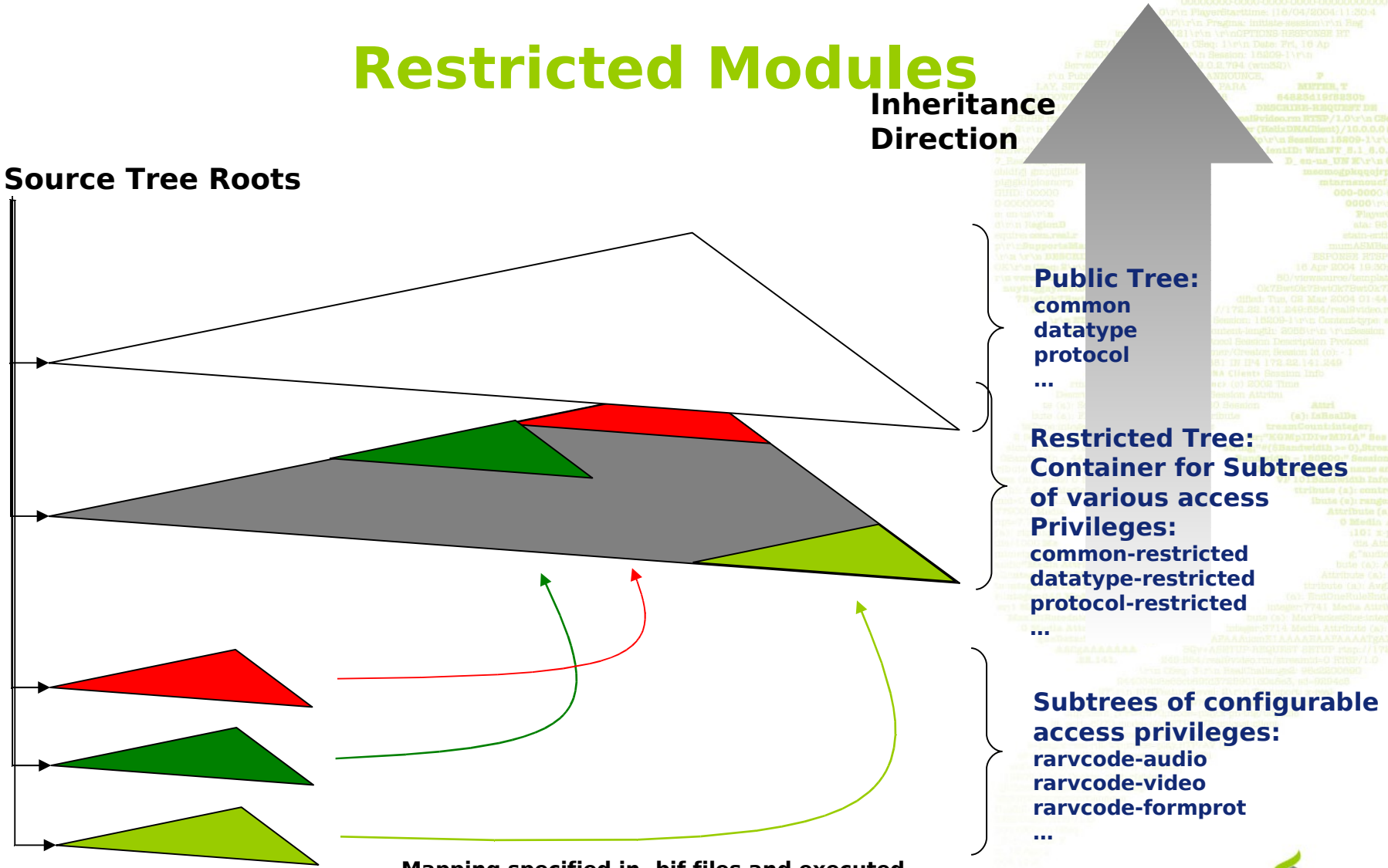
Restricted Modules



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5. History and Roadmap

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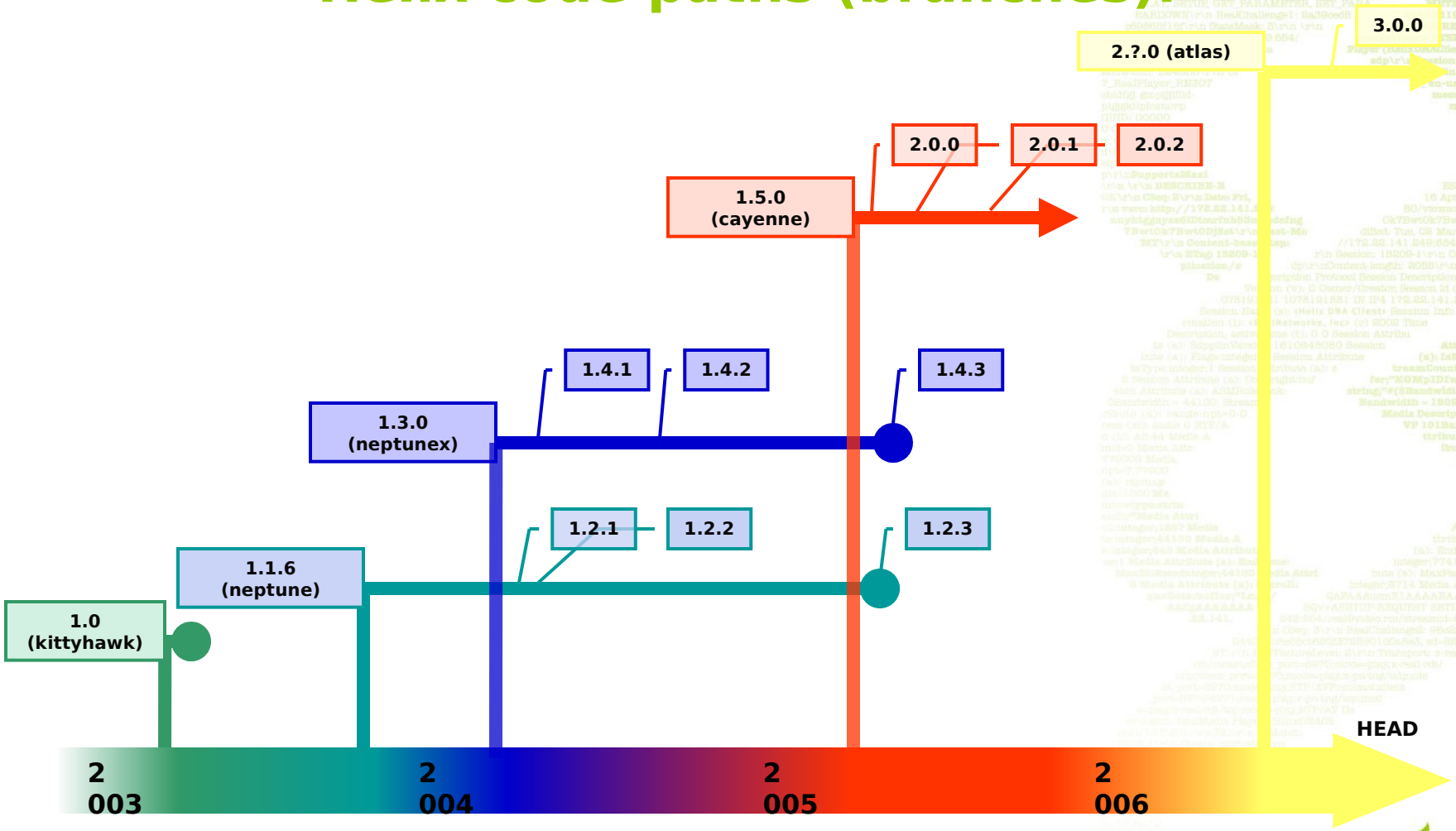
Helix code paths (branches):



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Incremental Features in ‘05 and ‘06:

Helix DNA Client ‘05 - Cayenne

- 3GPP-Rel6
- PlayNow 1.0
- TrueLive
- IPv6
- TrickPlay
- Auto Bandwidth Detection
- Progressive Download Enhancements

Helix DNA Client ‘06 - Atlas

- Atlas Architecture
- H.264
- JSR135 support
- PlayNow2.0
- Windows Media

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Incremental Features in ’07:

Helix DNA Client ‘07 - Brego ☑

- WMDRM ☑
- Flash Integration
- Rhapsody Module
- Capture – Helix Producer integration ☑
- PlayNow 3.0 (3GPP-PSS standard based)

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6. Demo

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