W3C Web & TV Interest Group
GGIE: Glass to Glass Internet Ecosystem
2015 Report

GGIE History

- Taskforce commissioned at 2014 TPAC
  - Bi-weekly meetings from Jan 2015-Oct 2015
- Created to look at Digital Video on the Web
- Digital Video Lifecycle
  - Capture-Edit-Store-Package-Distribute-Find-Watch
  - All levels of video from personal to professional
- Seek GAP points Standards Orgs can work on to advance digital video.
- 5 Focus points:
  - Scalability – Content id – Metadata - Identity - Privacy

… Before we get started, a quick look at 2015 developments…

- Number of creators continued to grow incredibly fast
- Number of viewers grew even faster
- New resolutions & the need for more bandwidth

  SD->HD was the big 2014 transition

  HD->4K is here now

  4K-8K is around the corner

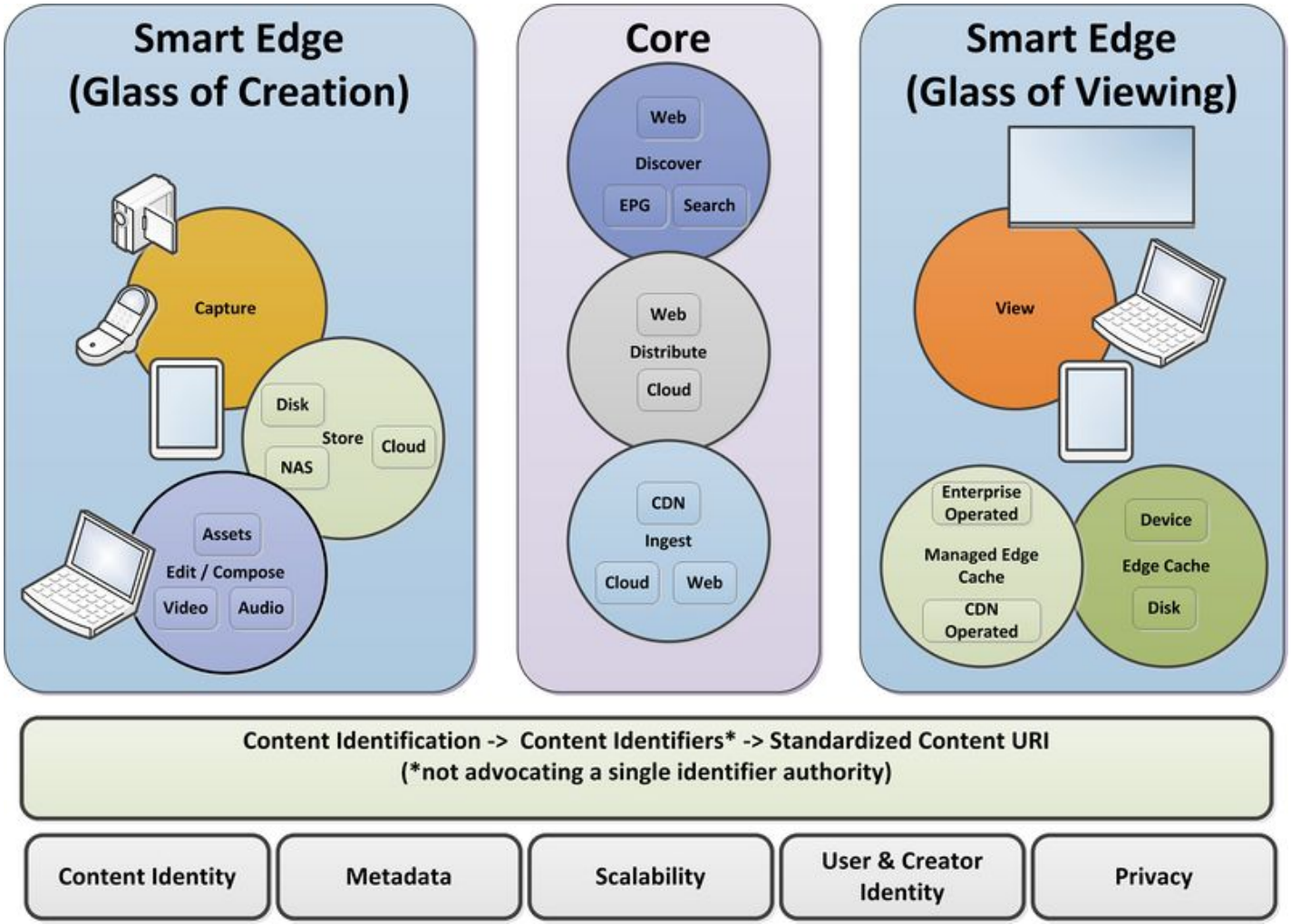
- New devices are capturing content at higher resolutions

  Phones are now capturing at 4K

- New platforms are adding new ways to distribute

  1::Many live video streaming (ex. Periscope)

Glass to Glass Overview



Relevant & Related

- SMPTE Open Binding of ID's to Media
- ATSC 3.0 ACR Watermarking
- IETF NetVC working group (Royalty free codec)
- New alliances have formed

GGIE Taskforce

- Teleconference every 2 weeks Jan'15-Oct'15
- Developed use-cases around:
  - **User Content Discovery/Search/EPG/Media Library**
  - **Viewing**
  - **Content Identification & Measurement**
  - **Network Location and Access**
  - **Content Capture**

GGIE Taskforce Boundaries

GGIE has operated under W3C's Interest Group rules:

- Focus on discussion, not implementation

This created a IP safe zone to foster creative discussion

GGIE requirements from Use Cases -1

- Persistent identifiers
  - Enable intelligent management at all stages
  - Assigned at capture or when distributed
  - Could be in metadata, watermark, fingerprint
  - Each have their pros & cons
  - Systems should support identifiers from different authorities & schemes
    - There will never be one single identifier
    - Examples: Ad-ID, EIDR, ISAN…

GGIE requirements from Use Cases -2

- Identifying content for search, EPG & applications is different than identifying content for streaming, decoding, caching
- Search-EPG-Applications care about
  - "The Work" attributes:
    - Title-Language-Version + metadata (date, actors, director…)
  - Focus is names + work info
- Streaming-Decoding-Caching care about
  - Format & delivery attributes:
    - Codec, Bit-Rate, Resolution, latency....
  - Focus is addresses + codec attributes

GGIE requirements from Use Cases -3

- Content IDs for Applications
  - Need a standard structure to permit applications to flexibly work with many different naming authorities…Basically a URI
  - Need a mechanism to associate the application identifier with the content
    - Could be found by: Metadata or Watermark or Fingerprint
    - Different content system will use different marking means
  - It would be nice if a standard API existed for use by browser applications that enabled applications to extract the Content ID regardless of how it is marked in the content
  - Let's call it a Content URI

GGIE requirements from Use Cases -4

- Content Identifier for Delivery
  - Ideally integrated with the network
  - A single “viewing” of content may involve multiple linked streams going to different devices delivering different codecs and data
    - e.g. HEVC to a screen, but a different audio codec not in the first container
  - One suggestion discussed was a 128 bit identifier that could be carried in an IPv6 address slot
  - Let’s call it a Content Address

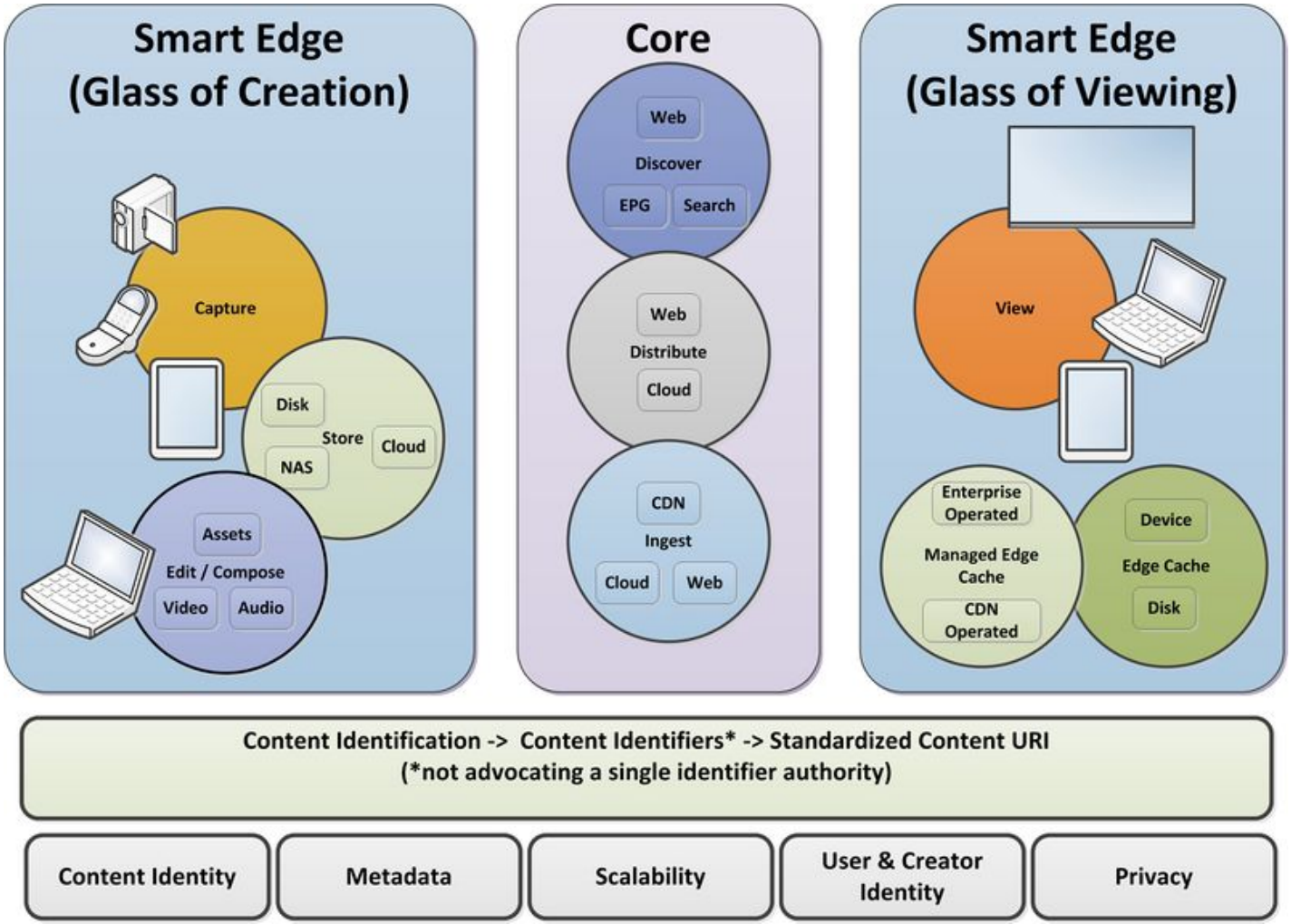
GGIE requirements from Use Cases -5

- Need to translate between Content URI's and Content Addresses
  - Fundamental linkage between finding content & accessing content
- Open protocol based system
- Would provide bi-direction resolution
  - Content URI:: Content Address
    - 1::Many relationship
  - Content Address::Content URI
    - Many::Many relationship

GGIE requirements from Use Cases -6

- Streamed content delivery can be viewed like a composed flow combining many parts
  - Not a simple file copy from source to player
- An orchestrated/composed playback of one or more component streams from one or more addresses to one or more devices over one or more networks
  - Enables rich use cases like Periscope

Glass to Glass Internet Ecosystem



GGIE 2016 @ W3C

- Explore Content Identifier API
  - Possible new CG
  - Enable applications to retrieve Content Identifier via standard common API
  - Retrieval by: Watermark or Fingerprint or Metadata

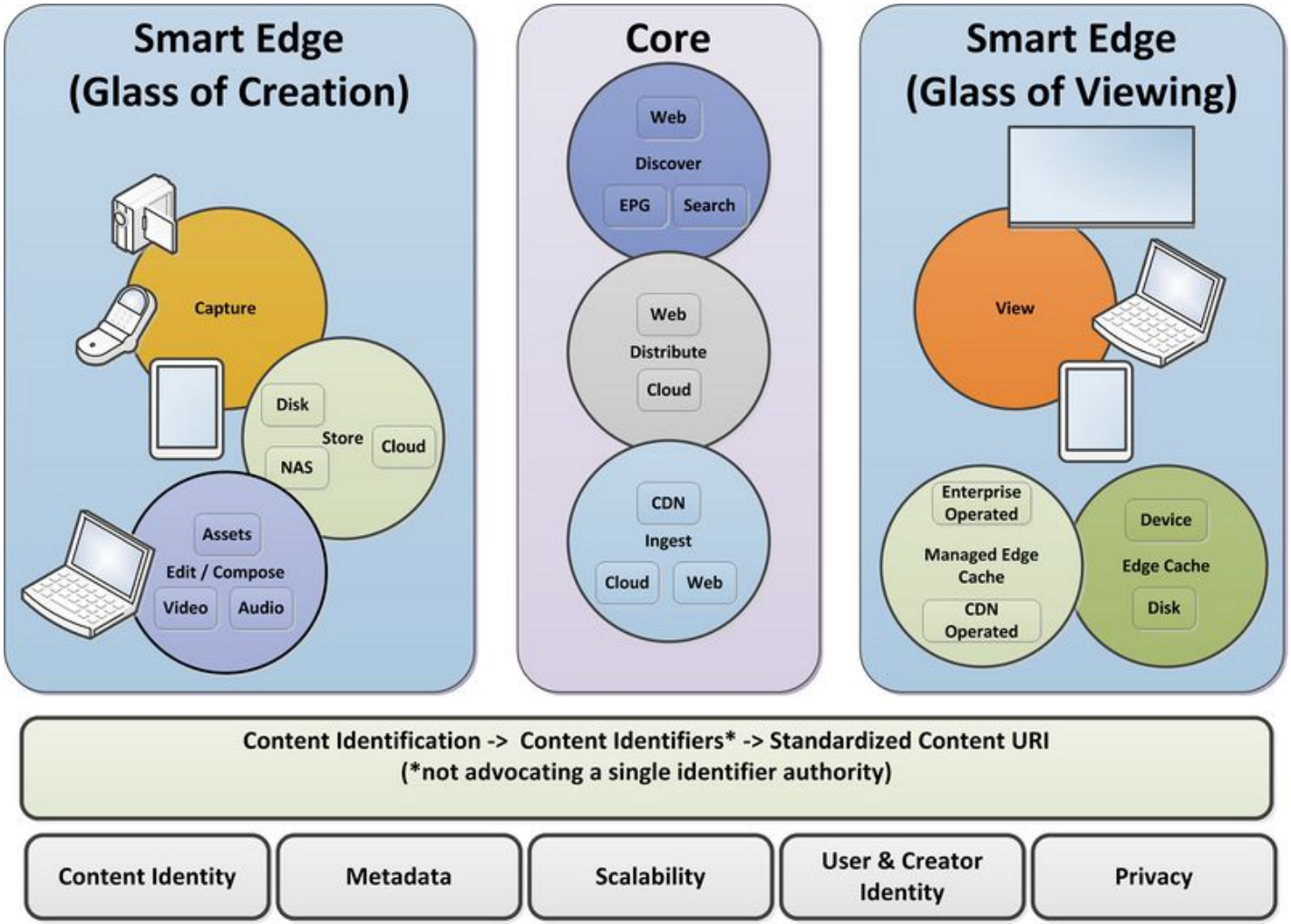
- Continue GGIE Taskforce discussions
  - Many unexplored topics remain including…
    - Viewer and Creator Identity
    - Privacy issues and Privacy mechanisms
    - Metadata and metadata workflows

    + others as suggested by the Web & TV IG members

GGIE 2016 outside W3C

- GGIE informal BoF at IETF94 in Yokohama
  - Introduce IETF community to GGIE
  - Content URIs & Content Addresses
    - Benefits for media caching
    - Benefits for cache discovery & optimization
    - Expose media routing to the network
    - Content address routing and management
    - URI::Content Address mapping
- Engagement with other groups

Glass to Glass Internet Ecosystem

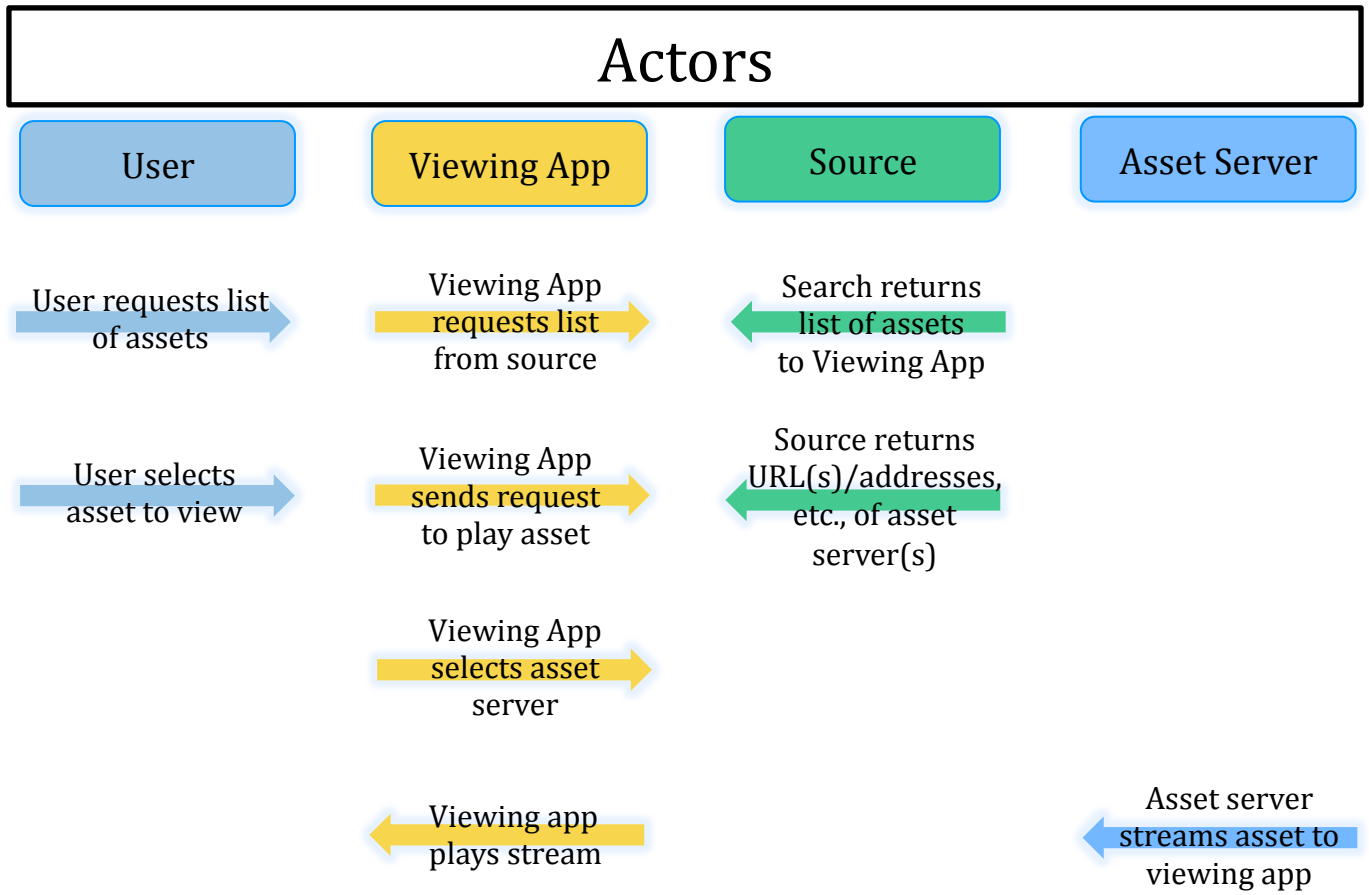


Use Cases….

Use Case Overview Table Of Contents

- Streaming UC-1: Basic Content Viewing
- Streaming UC-1b: Basic Streamed Content Viewing
- User Content Discovery UC-3: User Search Including Client
- User Content Discovery UC-1: User Search for Content Incl. Client Information
- User Content Discovery UC-4: User Asks for Content Recommendations
- User Content Discovery-UC-2: User Search for Content Using Second Screen as UI for TV
- Streaming UC-2: Streamed Content Viewing
- Streaming UC-4&5: Manipulating Streamed Content/Ad Insertion Interstitial Ads
- Identifying Streamed Content using Content ID (C_{ID})
- Adding content identification (Cid) for content identification
- Capture UC-1&2: Basic Video Asset Capture/Assigning a Unique C_{id} at Asset Capture
- Content Id & Measurement UC-1: User Device Retrieval of Content Address(es) Using EPG/Title
- Capture UC-4: 3rd Party Composite Asset From Multiple Sources
- Capture UC-5: Distributing 3rd Party Composite Asset Using Composite Manifest

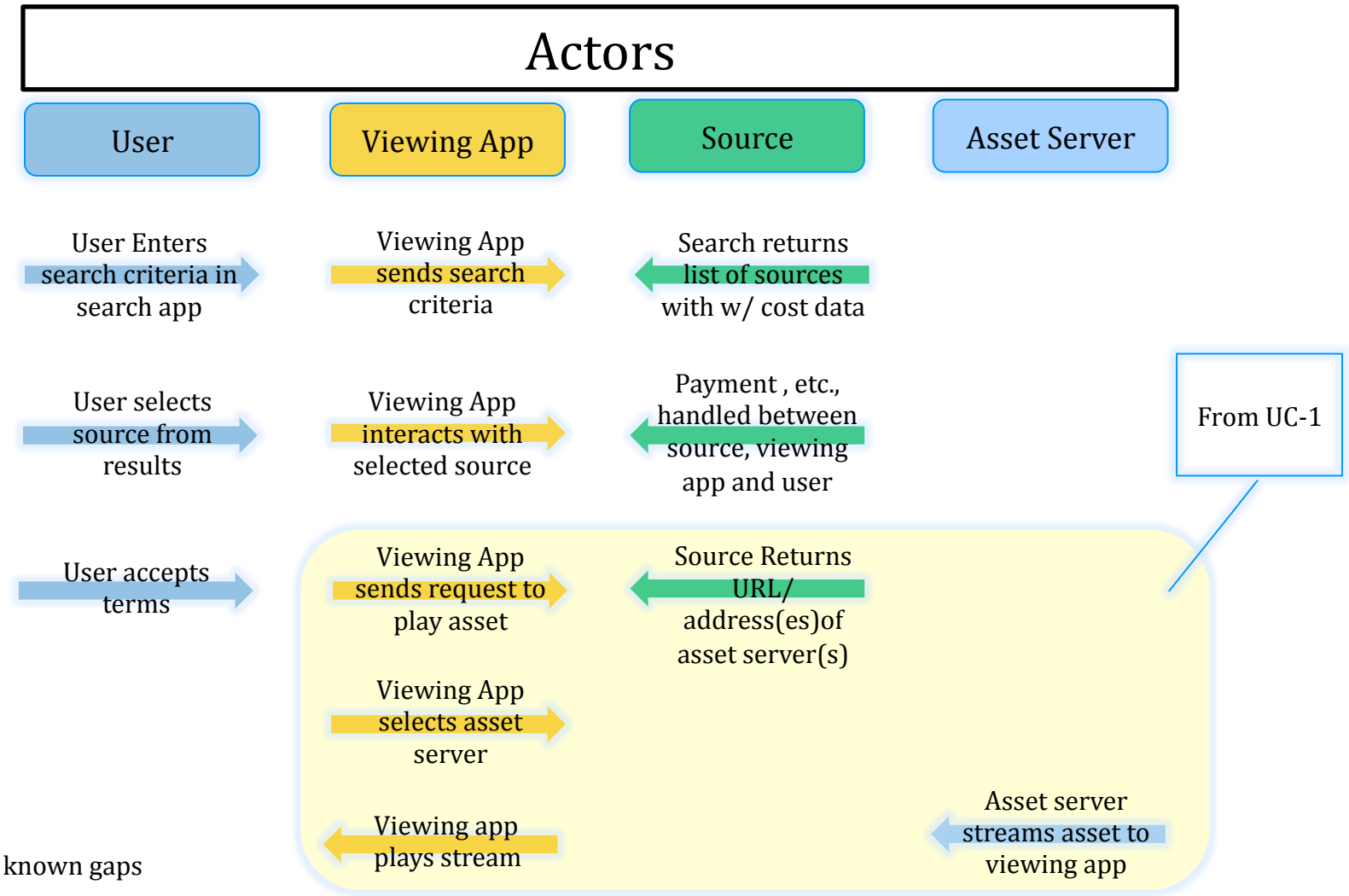
Streaming UC-1: Basic Content Viewing



- No known gaps

This use case is a basic illustrative case to capture basic video streaming concepts

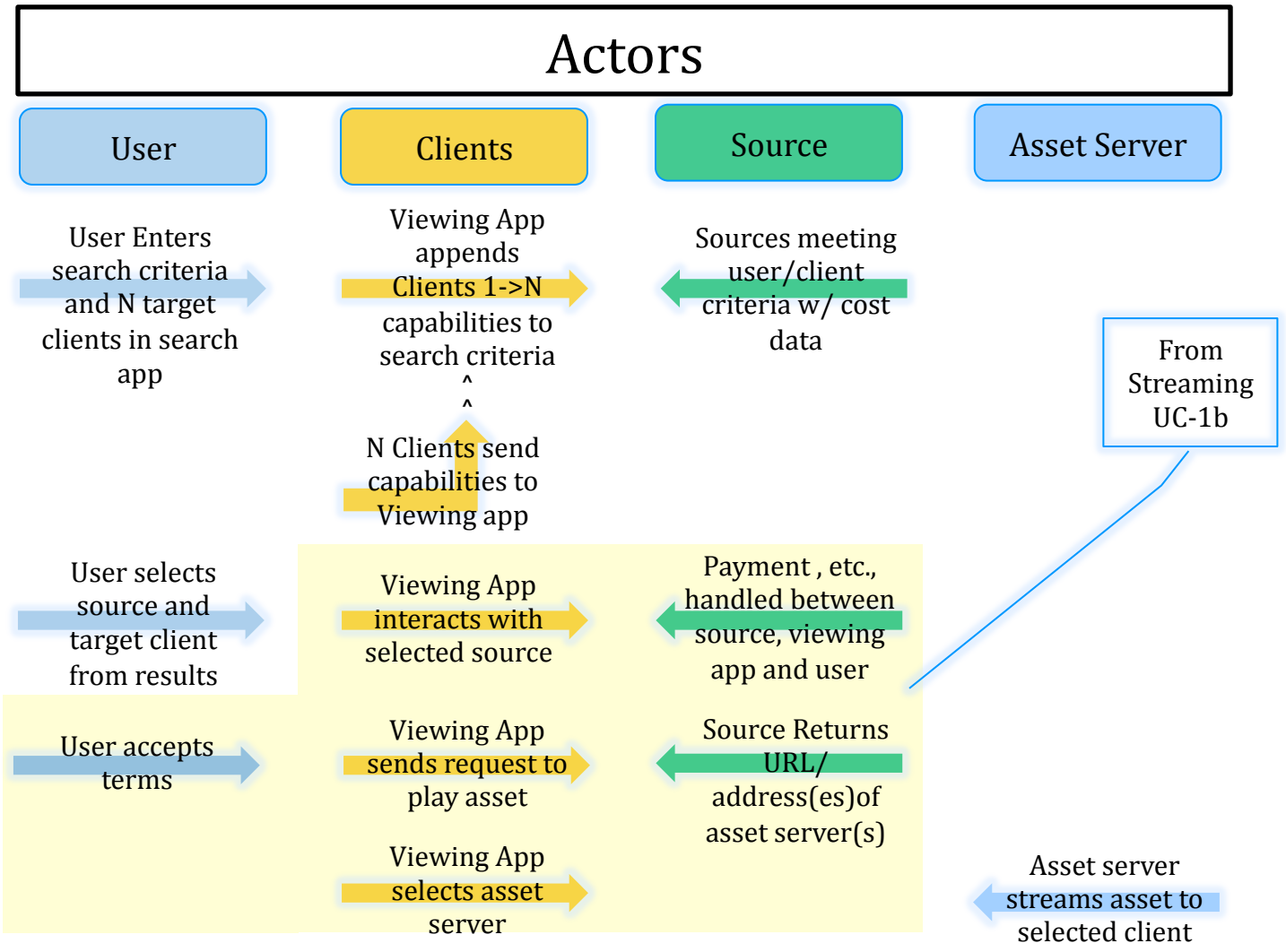
Streaming UC-1b: Basic Streamed Content Viewing



Gaps: No known gaps

Notes: User Content Discovery UC-1 builds on this UC by appending client capabilities such as decoders, formats/ resolution, DRM support, etc., to search criteria. Source returns content meeting both user search and client criteria. Alternatively source returns all assets and client flags unsupported assets. See User Discovery UC-3 for gaps.

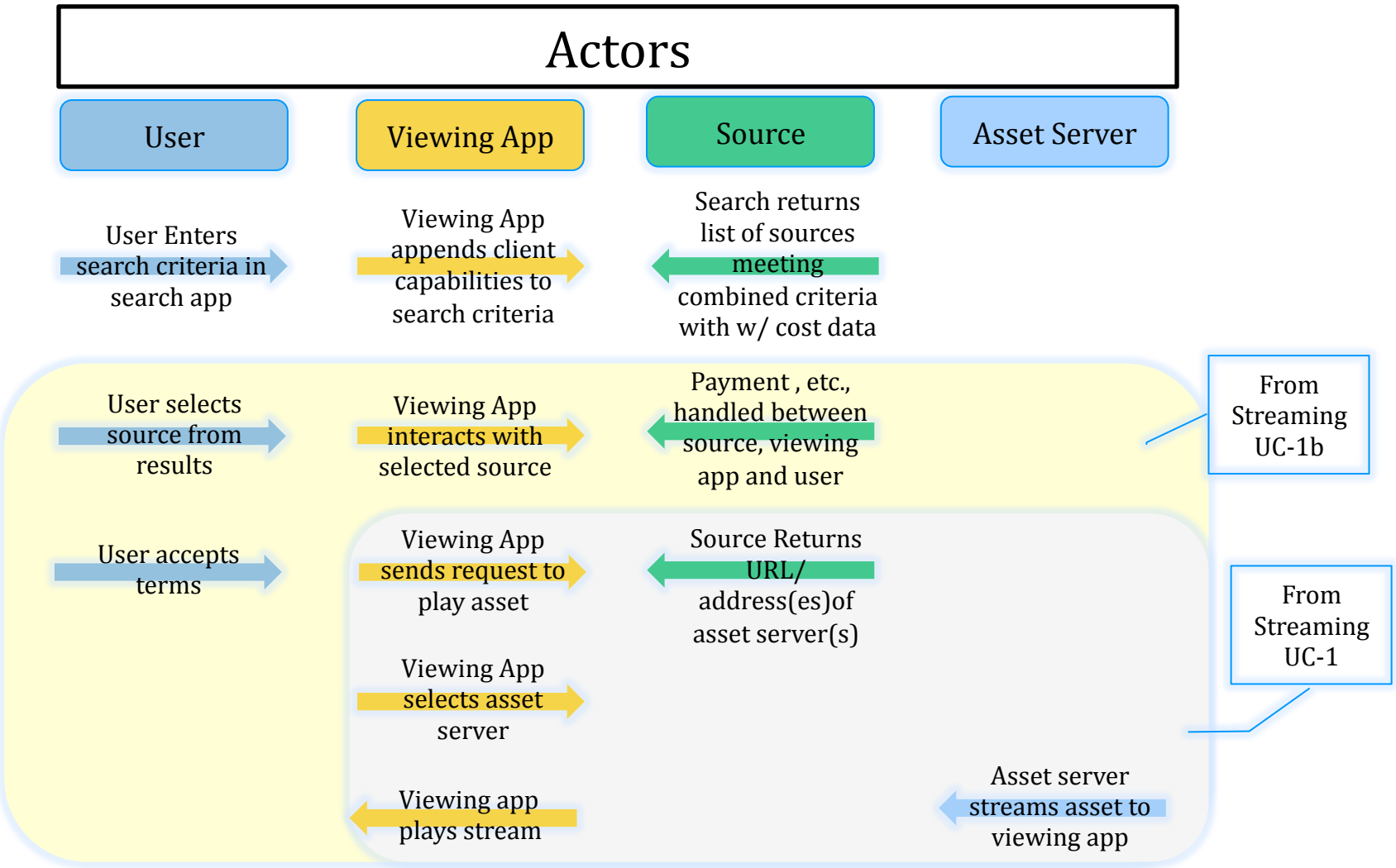
User Content Discovery UC-3: User Search Including Client Info



Gaps: No known Standard

- for device profiles (client criteria) such as decoder(s) and formats supported, existing content licenses, DRM support, etc.
- for transport of multiple device profiles as part of discovery
- to respond to requests that include multiple device profiles

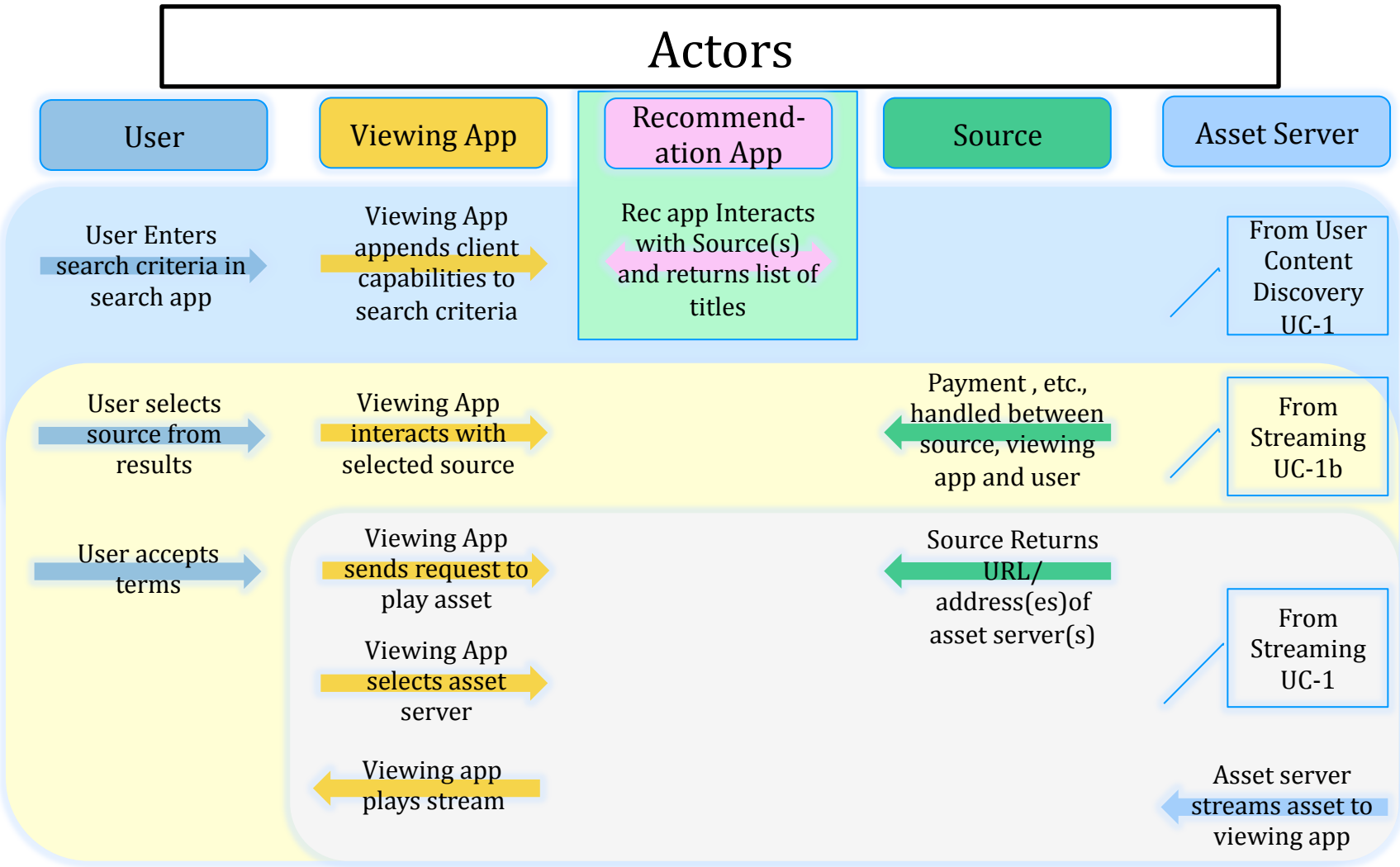
User Content Discovery UC-1: User Search for Content Incl. Client Information



Gaps: No known gaps

Notes: Client capabilities include features such as decoders, formats/resolution, DRM support, etc. Source returns content meeting both user search and client criteria. Alternatively source returns all assets and client flags unsupported assets. See User Discovery UC-3 for gaps.

User Content Discovery UC-4: User Asks for Content Recommendations

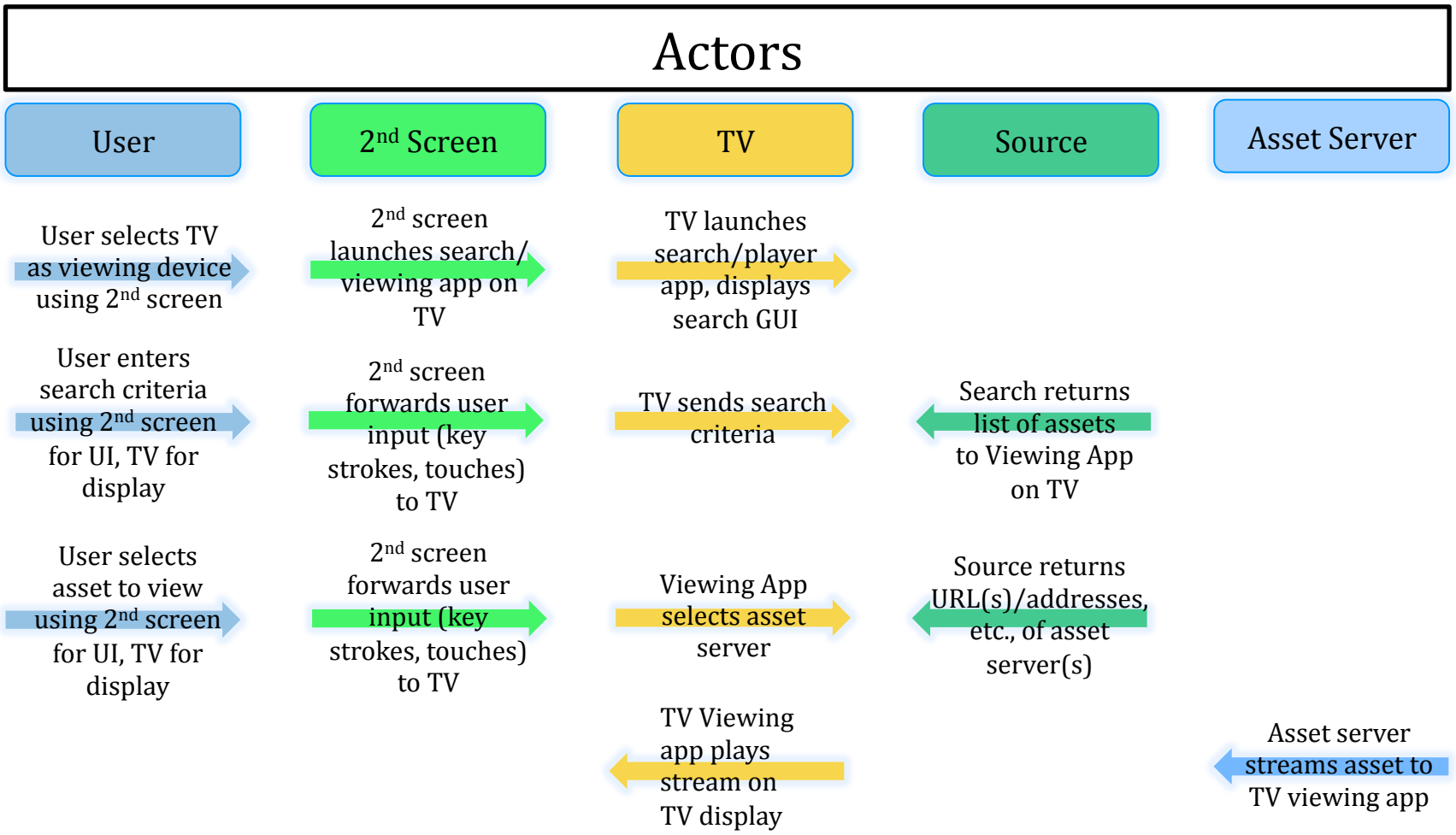


Gaps: No known gaps

Notes:

- Recommendation app may reside on the client, a remote location or both.
- Rec app can use content-based recommendations, collaborative (user) based, or some combination

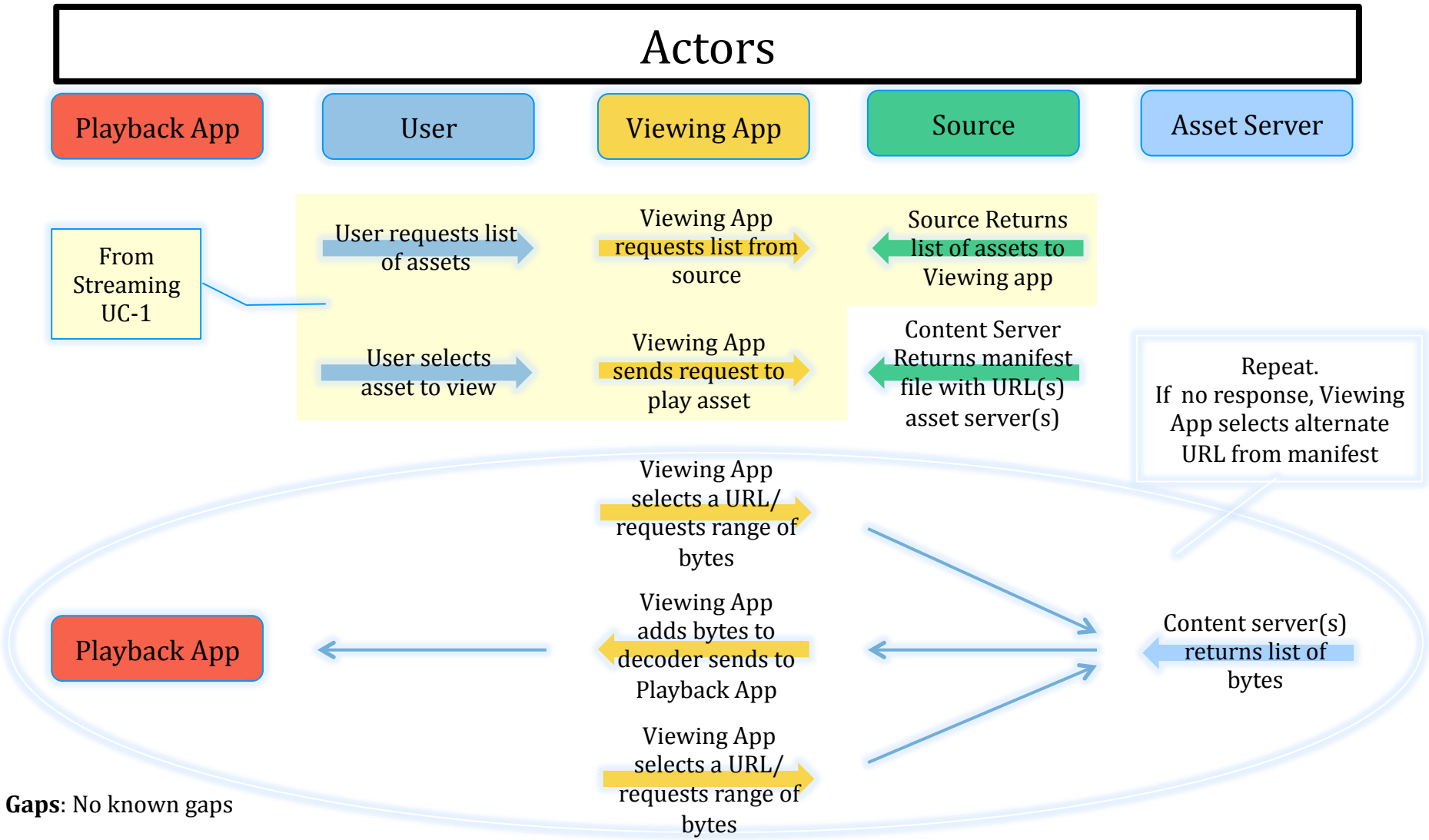
User Content Discovery-UC-2: User Search for Content Using Second Screen as UI for TV



Gaps: Standardized method to convey and coordinate second screen user input with TV display/search/viewing app.

Notes: Identical to UC-1 except for second screen used as input to TV.

Streaming UC-2: Streamed Content Viewing



Gaps: No known gaps

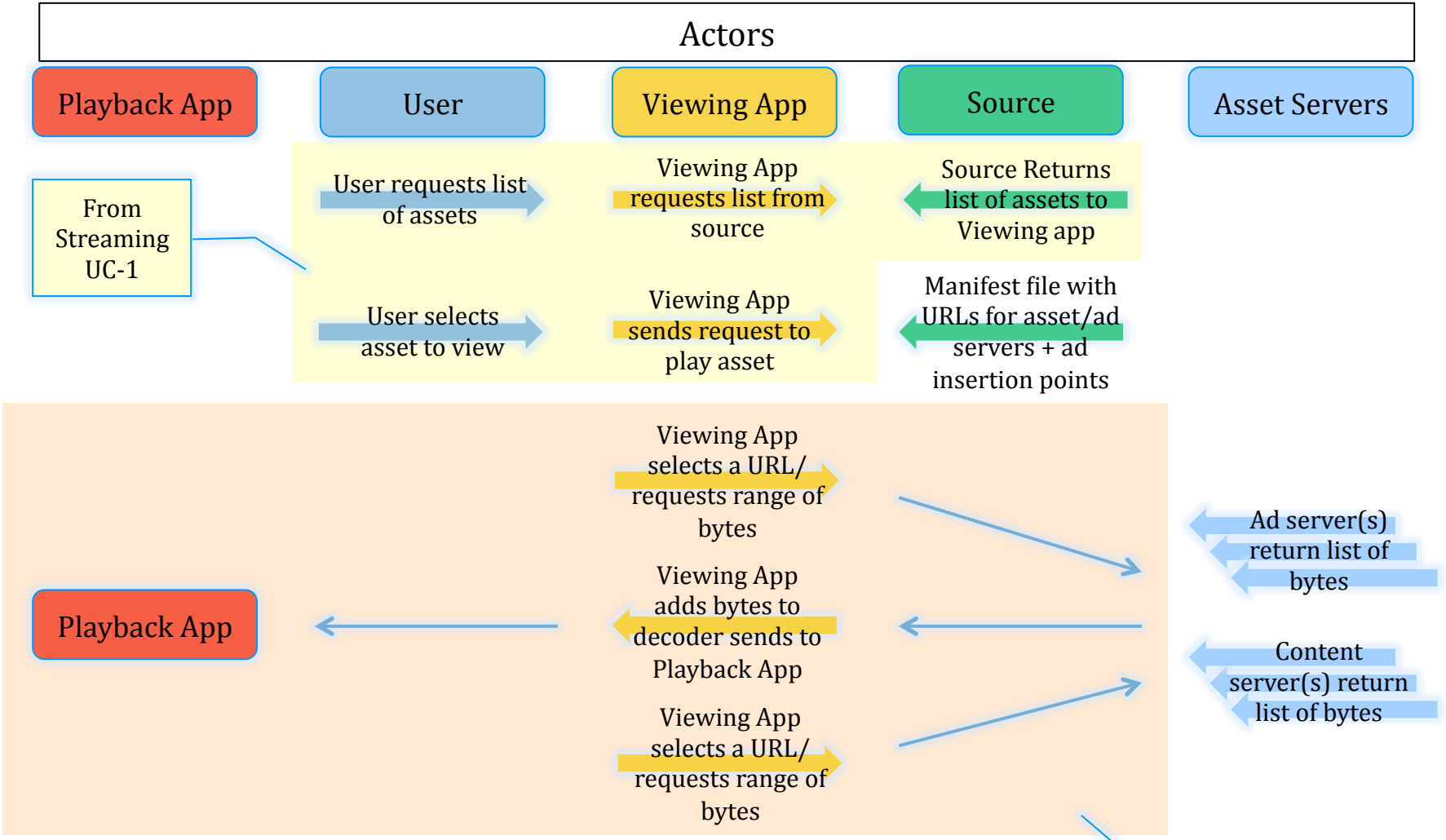
Notes:

•App may use separate thread to manage buffers during playback.

• Application can offer trick play by altering requested range of bytes.

• Application can receive event streams assoc. with the content stream and provide interactions with user.

Streaming UC-4: Manipulating Streamed Content
Streaming UC-5: Streamed Content Ad Insertion Interstitial Ads



Gaps: Ad insertion for non-professional content

Notes:
- When viewing device encounters ad insertion point, it fetches the ad instead of the content
- Ads may be cached on the viewing device which can replace ads streamed from the asset servers

Identifying Streamed Content

Adding content identification (C_{id}) for content identification
(Taken from Streaming UC-3)

• Cid is a foundational concept for GGIE that enables many of the benefits and new concepts being discussed

•Cid is added to commercial and private content in the form of a

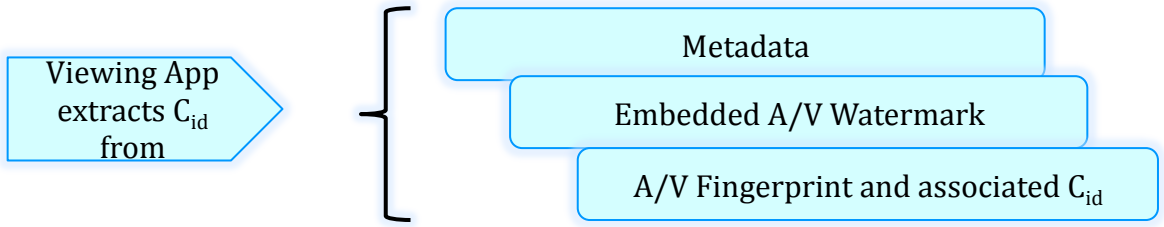
- Audio or video Watermark
- Audio or video Fingerprint
- Metadata

• C_{id} Properties

- Unique within domain it belongs to
- Non-ambiguous
- If C_{id} A == C_{id} B then content A and B have identical scenes and time sequences
- C_{id} conveys no info about content format – encoding, bit rate, resolution, etc.
- C_{id} A == C_{id} B yields no info about comparative format properties

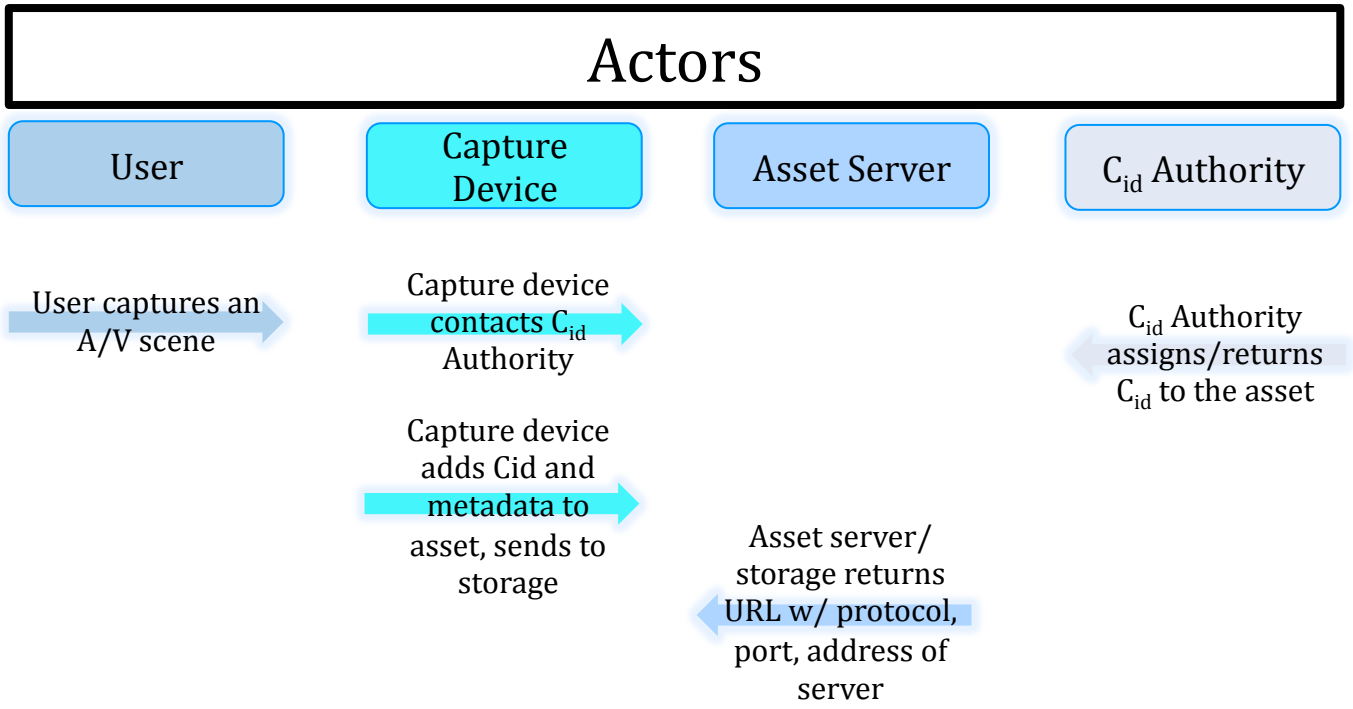
Identifying Streamed Content

Adding content identification (Cid) for content identification



- Applications can record/report detection of the C_{id} for measurement and logging purposes
- Applications can use the C_{id} to form a URI that can be used with other video content sources to uniquely identify the content being viewed
- Gaps: No existing standard to references for
  - C_{id} URIs
  - Extracting C_{id} from content metadata
  - Retrieving imbedding C_{id} as content watermark
  - Computing fingerprints of content
  - Retrieving a C_{id} based on a content fingerprint

Capture UC-1: Basic Video Asset Capture and Capture UC-2: Assigning a Unique C_{id} at Asset Capture

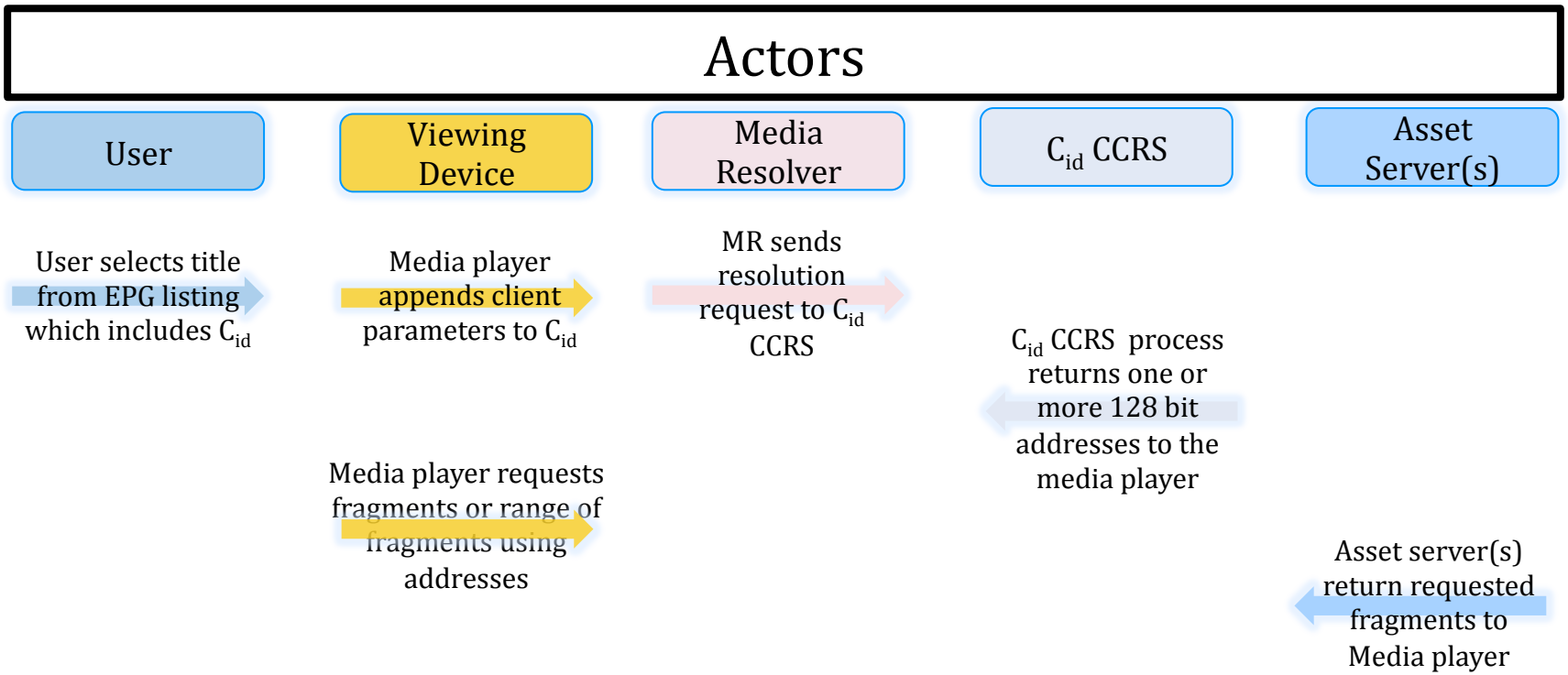


Gaps: Standardized C_{id} and Issuing Authority

Notes

- Metadata may consist of capture information that is part of the asset file itself (e.g. resolution, bit rate, etc.) as well as other metadata that is external to the digital asset such as time, data, copyright, etc.
- To simplify the diagram the source and asset server/storage device are combined in the above diagram.
- The Issuing Authority may be EIDR or Ad-ID, a cloud server for non-commercial content, etc.
- The C_{id} may be added to the asset container or in the file name.
- Alternative methods for adding the C_{id} include calculating an audio and/or video fingerprint and registering it with the C_{id} Authority as described inContent UC-3, or by adding an audio or video watermark.

Content Identification and Measurement UC-1
User Device Retrieval of Content Address(es) Using EPG/Title



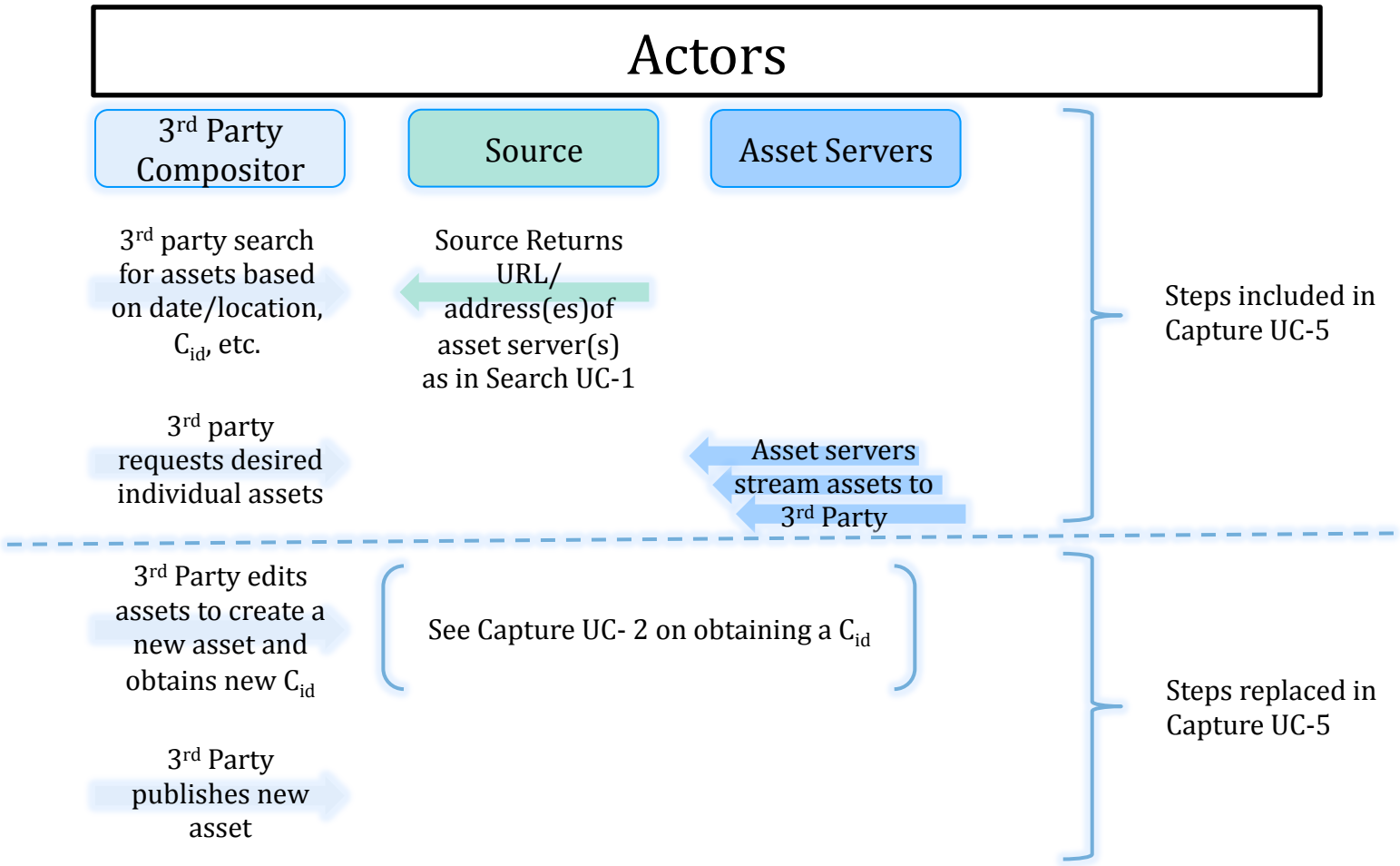
Gaps

- Not all content is issued a C_{id} / URL by an issuing authority
- No defined method of assigning a unique prefix address for C_{id} with each encoding, etc. receiving a unique prefix.
- No defined method of addressing content fragments based on content prefixes
- No method for propagating content addresses

Notes

- Each encoding, bit rate, etc., associated with a Title has a unique prefix. This enables the C_{id} CCRS process to return only prefixes that meet the Title and client parameters requested.
- Viewing device includes Media Player, EPG, Media Resolver
- C_{id} CCRS (Content Cache Resolution Service) actor may include one or more external CCRS servers , the C_{id} issuing authority and the content owner CCRS.

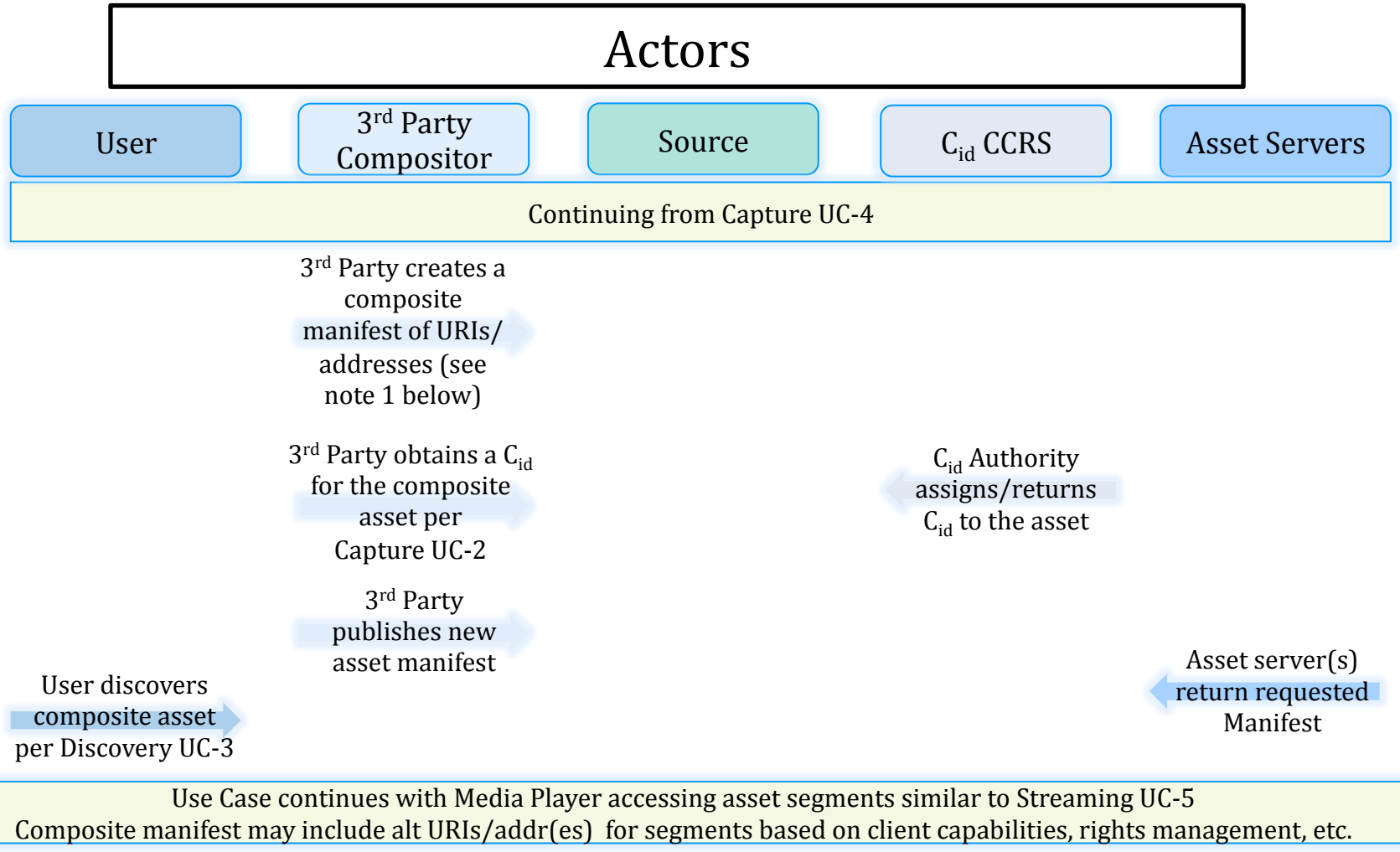
Capture UC-4: 3rd Party Composite Asset From Multiple Sources



Gaps:

- Standardized content identifier and issuing authority(s)
- Reliable means to associate the unique identifier with an asset
- Reliable means to associate IDs from original sources with the composite asset ID for search and discovery and for Rights Management

Capture UC-5: Distributing 3rd Party Composite Asset Using Composite Manifest



Gaps: Mechanism to ensure the client can access and decode the asset(s) prior to initiating playback to avoid interruptions.

Notes:

1. The manifest includes the URIs/addresses of the various segments from the original assets, including ads, audio, etc., that together comprise the composite asset, along with any necessary timing information, ad insertion points, new audio, etc.

https://www.w3.org/2011/webtv/wiki/GGIE_TF/UseCases