

# MediaMesh Shared Memory SDK

## Overview of MediaMesh Shared Memory

**Local Shared Memory.** Applications and containers running on the same host can read/write video, audio and timed metadata to shared memory using the *MediaMesh Shared Memory SDK* documented below in sections 1-7 below.

**Global Shared Memory.** Once a video, audio or timed metadata stream is available in local shared memory, applications can access that stream from anywhere, globally, by calling the *MediaMesh Remote Connection Service* with the *objectID* of that media stream (obtained from the *MediaMesh Object Service*). This access spans cloud Availability Zones (AZs), cloud Regions, cloud accounts, VPCs and even on-premise data centers. [Section 3.5 of the MediaMesh Developer's Guide](#) documents how to use the MediaMesh Remote Connection Service.

Therefore, the MediaMesh shared memory SDK (documented below) not only enables inter-process communication on a single machine, it is also foundational to global shared memory.

## 1. MediaMesh Shared Memory SDK

The MediaMesh Shared Memory SDK is accessible at <https://github.com/tvunetworks-x/tvu-shared-memory>. It includes a binary, libshmmmediawrap-x86\_64, which supports the function calls described in the following sections of the document.

- Section 2 describes calls supporting read/write of video, audio or timed metadata with **constant item size**. These calls begin with the prefix **LibShm**.
- Section 3 describes calls supporting read/write of video, audio or timed metadata with a **variable item size**. These calls begin with the prefix **LibViShm** (“Vi” stands for “variable item”).
- Section 4 describes additional calls useful when reading/writing **timed-metadata**.
- Section 5 documents command sequences for typical shared memory operations.
- Appendices A and B document key structures and supported media types

The GitHub site also contains sample code for shared memory reads and writes.

## 2. LibShm, shared memory APIs for constant sized items

### 2.1 Creating a Shared Memory Handle

**Function:** `LibShmMediaCreate`

Creates (or opens if it exists) a SHM handle for **writing**.

```
libshm_media_handle_t LibShmMediaCreate(const char  
*pMemoryName, uint32_t header_len, uint32_t item_count,  
uint32_t item_length);
```

- `pMemoryName`: Name of SHM.
- `header_len`: Size reserved for header/meta info.
- `item_count`: Number of items.
- `item_length`: Size of each item.

**Returns:** A SHM handle or `NULL` if failed.

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### 2.2 Opening a Shared Memory Handle for Reading

**Function:** `LibShmMediaOpen`

Opens an existing SHM for **reading**.

```
libshm_media_handle_t LibShmMediaOpen(const char *pMemoryName,  
libshm_media_readcb_t cb, void *opaq);
```

- `pMemoryName`: Name of SHM entry
- Takes a callback (`cb`) for read events.

- `opaq` is user-provided opaque data.

**Returns:** A SHM handle or `NULL` if failed.

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## 2.3 Checking If SHM is Sendable

**Function:** `LibShmMediaPollSendable`

**Polls** if SHM is ready to send data (non-blocking wait).

```
int LibShmMediaPollSendable(libshm_media_handle_t h, unsigned int timeout);
```

- `h`: Shared memory handle.
- `timeout`: poll's timeout value in milliseconds

**Returns** `>0` if ready, `0` if not ready, `<0` on error (need to destroy & create the handle again)

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## 2.4 Sending Data

**Function:** `LibShmMediaSendData`

**Sends** media data into SHM.

```
int LibShmMediaSendData(libshm_media_handle_t h, const libshm_media_head_param_t *pmh, const libshm_media_item_param_t *pmi);
```

- `h`: Shared memory handle.
- `pmh`: input head information.
- `pmi`: input data information

**Returns** `>0` send success, size of write, `0` if not ready, `<0` I/O error

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## 2.5 Reading Data

**Function:** `LibShmMediaPollReadData`

**Polls** and **reads** media data from SHM

```
int LibShmMediaPollReadData(libshm_media_handle_t h,  
libshm_media_head_param_t *pmh, libshm_media_item_param_t *pmi,  
unsigned int timeout);
```

- `h`: Shared memory handle
- `pmh`: Destination header information structure.
- `pmi`: Destination data information structure
- `timeout`: poll's timeout value in milliseconds

**Returns** `>0` if success, `0` if not ready (wait & try again), `<0` if failure

---

## 2.6 Destroying SHM

**Function:** `LibShmMediaDestroy`

**Cleans up** and **destroys** a SHM handle.

```
void LibShmMediaDestroy(libshm_media_handle_t h);
```

- `h`: Shared memory handle
- 

# 3. LibViShm, Shared Memory APIs for Variable Sized Items

For SHMs where **items are variable-sized**. (The “Vi” in these function calls stands for “variable item”).

### 3.1 Creating a Variable SHM Handle

#### Function: `LibViShmMediaCreate`

Creates (or opens if it exists) a SHM handle for **writing** variable sized data. Unlike the similar call for constant sized item shared memory, this function takes as an argument the *total size* of a shared memory rather than the *item size*.

```
libshm_media_handle_t LibViShmMediaCreate(const char  
*pMemoryName, uint32_t header_len, uint32_t item_count,  
uint64_t total_size);
```

- `pMemoryName`: Name of SHM.
- `header_len`: Size reserved for header/meta info.
- `item_count`: Number of items.
- `total_size`: total size of SHM

**Returns:** A SHM handle or `NULL` if failed.

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### 3.2 Opening Variable SHM for Reading

#### Function: `LibViShmMediaOpen`

Opens an existing variable item SHM for **reading**.

```
libshm_media_handle_t LibViShmMediaOpen(const char  
*pMemoryName, libshm_media_readcb_t cb, void *opaq);
```

- `pMemoryName`: Name of SHM entry
- Takes a callback (`cb`) for read events.
- `opaq` is user-provided opaque data

**Returns:** A SHM handle or `NULL` if failed.

---

### 3.3 Polling Sendability

**Function:** `LibViShmMediaPollSendable`

This behaves like the corresponding call for constant SHM, but for variable sized item SHM. **Polls** if SHM is ready to send data (non-blocking wait).

```
int LibShmViMediaPollSendable(libshm_media_handle_t h, unsigned int timeout);
```

- `h`: Shared memory handle.
- `timeout`: poll's timeout value in milliseconds

**Returns** `>0` if ready, `0` if not ready, `<0` I/O error (need to destroy/create the handle again)

---

### 3.4 Sending Data

**Function:** `LibViShmMediaSendData`

**Sends** media variable item sized data into SHM.

```
int LibShmViMediaSendData(libshm_media_handle_t h, const libshm_media_head_param_t *pmh, const libshm_media_item_param_t *pmi);
```

- `h`: Shared memory handle.
- `pmh`: input header structure information.
- `pmi`: input data structure information

**Returns** `>0` send success, size of write, `0` if not ready, `<0` I/O error.

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## 3.5 Destroying Variable SHM

**Function:** `LibViShmMediaDestroy`

```
void LibViShmMediaDestroy(libshm_media_handle_t h);
```

- `h`: Shared memory handle

**Cleans up** and **destroys** a SHM handle.

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## 4. Metadata Extension APIs

MediaMesh supports **user-defined metadata** to extend shared memory capabilities. **Note:** To ensure interoperability and proper testing, metadata extensions must be approved by TVU Networks.

### 4.1 Estimating Buffer Size

**Function:** `LibShmMediaEstimateExtendDataSize`

Determines how much buffer space is needed for metadata.

```
int LibShmMediaEstimateExtendDataSize(/*IN*/const libshmmmedia_extend_data_info_t* pExtendData);
```

- `pExtendData[ IN]`: source external data information structure

**Returns** `>0` buffer size, `0` no buffer needed, `<0` failed

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### 4.2 Writing Extended Data

**Function:** `LibShmMediaWriteExtendData`

Writes external metadata into a buffer..

```
int LibShmMediaWriteExtendData(/*OUT*/uint8_t dataBuffer[], /*IN*/int bufferSize, /*IN*/const libshmmmedia_extend_data_info_t* pExtendData);
```

- `dataBuffer[OUT]`: Destination buffer
- `buffersize[IN]`: Destination buffer size
- `pExtendData[IN]`: source external data information structure

**Returns** `>=0` actual size of buffer write, `<0` write failure

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## 5. Typical Workflows

The examples below outline the sequence of LibShm commands for typical workflows.

### 5.1 Writing Data to SHM

1. **Create** SHM: call `LibShmMediaCreate` to obtain shared memory handle
  2. **Poll** sendable: call `LibShmMediaPollSendable` to determine if the shared memory handle is ready to send.
  3. **Send** data: Once the shared memory handle is ready (step 2 above), call `LibShmMediaSendData` to send data to shared memory.
  4. **Destroy** SHM if unused: If the shared media handle is no longer needed, call `LibShmMediaDestroy` to destroy it.
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### 5.2 Reading Data from SHM

1. **Open** SHM: call `LibShmMediaOpen` to open the shared memory and obtain the shared memory handle.
  2. **Poll and read**: call `LibShmMediaPollReadData` to read data from shared memory.
  3. **Destroy** SHM after use: call `LibShmMediaDestroy` if the handle is no longer needed to destroy it.
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## 5.3 Writing Timed Metadata (such as SCTE, CC, timecode, etc)

1. Define a `libshmmmedia_extend_data_info_t` object as myExt.
2. Initialize the object and set the desired fields, carefully evaluating the length and pointers of structure members.
3. Call `LibShmMediaEstimateExtendDataSize` to obtain the buffer size.
4. Allocate buffer according to the size returned by step #3.
5. Call `LibShmMediaWriteExtendData` to write metadata to the buffer.
6. For the members `p(userData)` and `i(userDataLen)` of `libshm_media_item_param_t`, verify that the data you want to attach is consistent with these values, and set the `i(userDataType)` field explicitly to the constant `LIBSHM_MEDIA_TYPE_TVU_EXTEND_DATA_V2`.
7. Call `LibShmMediaSendData` to write the contents of the buffer (metadata) as well as associated video and audio to shared memory.

## 5.4 Parsing Timed Metadata (such as SCTE, CC, timecode, etc.)

1. Define a `libshmmmedia_extend_data_info_t` object as myExt.
2. Initialize the object to zero.
3. call `LibShmMeidaParseExtendData` to parse the extension data point to `libshmmmedia_extend_data_info_t` structure.

## Appendix A

### A.1 Media Head Structure

Describes media-level parameters (dimensions, codecs, sample rate, etc).

```
typedef struct SLibShmMediaHeadParam
{
    uint32_t      u_structSize; // struct size for extension compatibility
    int32_t       i_vbr;        // can be ignored to set.
    int32_t       i_sarw;       // codec sarw (sample aspect ratio width)
    int32_t       i_sarh;       // codec sarh (sample aspect ratio height)
```

```

int32_t      i_srcw;      // source codec width
int32_t      i_srch;      // source codec height
int32_t      i_dstw;      // output YUV width
int32_t      i_dsth;      // output YUV height
uint32_t     u_videofourcc;
int32_t      i_duration;
int32_t      i_scale;
uint32_t     u_audiourcc;
int32_t      i_channels;
int32_t      i_depth;
int32_t      i_samplerate;
}libshm_media_head_param_t;

```

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## A.2 Media Item Structure

Describes an individual media item (frames, timestamps, metadata).

```

typedef struct SLibShmMediaItemParam
{
    uint32_t      u_structSize; // struct size for extension compatibility
    int          i_totalLen; // can be unset
    const uint8_t *p_vData; // video's data point
    int          i_vLen; // video frame len
    int64_t      i64_vpts; // video frame pts
    int64_t      i64_vdts; // video frame dts
    int64_t      i64_vct; // video frame's create time.
    const uint8_t *p_aData; //audio data point.
    int          i_aLen; // audio length
    int64_t      i64_apts; // audio frame pts
    int64_t      i64_adts; // audio frame dts
    int64_t      i64_act; // audio frame create time.
    const uint8_t *p_sData; // subtitle data point
    int          i_sLen; // subtitle data length
    int64_t      i64_spts; // subtitle pts
    int64_t      i64_sdts; // subtitle dts
    int64_t      i64_sct; // subtitle create time
    const uint8_t *p_CCData; // closed caption data point
    int          i_CCLen; // closed caption data length
    const uint8_t *p_timeCode; // timecode data point
    int          i_timeCode; // timecode data length
    uint32_t     u_frameType; // frame type
    uint32_t     u_picType; // picture type
    const uint8_t *p_userData; // metadata
    int          i_userDataLen; // metadata length

```

```

int64_t      i64_userDataCT;// meta data create time.
int         i_userDataType; // user data type
uint32_t     i_interlaceFlag; // interlace flag. 1-progressive,
2-interlace
    uint32_t     u_copied_flags; //shows the status of write actions by
datatype

#define LIBSHM_MEDIA_VIDEO_COPIED_FLAG      0x01
#define LIBSHM_MEDIA_AUDIO_COPIED_FLAG      0x02
#define LIBSHM_MEDIA_SUBTITLE_COPIED_FLAG   0x04
#define LIBSHM_MEDIA_EXT_COPIED_FLAG        0x08
#define LIBSHM_MEDIA_CLOSED_CAPTION_COPIED_FLAG 0x08
#define LIBSHM_MEDIA_USER_DATA_COPIED_FLAG   0x10

    uint32_t     u_read_index;
    void          *p_opaq;
    libshm_media_process_handle_t       h_media_process;
}libshm_media_item_param_t;

```

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## Appendix B: MediaMesh Supported Media Types

MediaMesh supported video and multimedia file types are defined by the following four character code (FourCC) identifiers:

**Video Formats** are defined as `ETVUPixfmtVideoFourCC` in `tvu_fourcc.h`

<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUV420P</code>	<code>= _TVU_LE_FOURCCTAG('I', '4', '2', '0'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUYV422</code>	<code>= _TVU_LE_FOURCCTAG('V', '4', '2', '2'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_RGB24</code>	<code>= _TVU_LE_FOURCCTAG('R', 'G', 'B', 24 ),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_BGR24</code>	<code>= _TVU_LE_FOURCCTAG('B', 'G', 'R', 24 ),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUV422P</code>	<code>= _TVU_LE_FOURCCTAG('I', '4', '2', '2'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUV444P</code>	<code>= _TVU_LE_FOURCCTAG('I', '4', '4', '4'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUV410P</code>	<code>= _TVU_LE_FOURCCTAG('I', '4', '1', '0'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUV411P</code>	<code>= _TVU_LE_FOURCCTAG('I', '4', '1', '1'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_GRAY8</code>	<code>= _TVU_LE_FOURCCTAG('G', 'R', 'E', 'Y'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_MONOWHITE</code>	<code>= _TVU_LE_FOURCCTAG('B', '1', 'W', '0'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_MONOBLACK</code>	<code>= _TVU_LE_FOURCCTAG('B', '0', 'W', '1'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_PAL8</code>	<code>= _TVU_LE_FOURCCTAG('P', 'A', 'L', '8'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUVJ420P</code>	<code>= _TVU_LE_FOURCCTAG('J', '4', '2', '0'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUVJ422P</code>	<code>= _TVU_LE_FOURCCTAG('J', '4', '2', '2'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_YUVJ444P</code>	<code>= _TVU_LE_FOURCCTAG('J', '4', '4', '4'),</code>
<code>K_TVU_PIXFMT_VIDEO_FOURCC_UYVY422</code>	<code>= _TVU_LE_FOURCCTAG('U', 'Y', 'V', 'Y'),</code>

**Audio Formats** are defined as `ETVUPixfmtAudioFourCC` in `tvu_fourcc.h`

```
K_TVU_AUDIO_FOURCC_WAVE_48K_16      = _TVU_LE_FOURCCTAG('W', 'A', 'V', '1')
```