GStreamer on TI DaVinci and OMAP Platforms

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Agenda

- Overview of GStreamer
- Overview of the TI GStreamer Plugin
- Software Stack for TI GStreamer Plugin
- Portability and Reusability
- Community Model
- Current Status
- Plugin Design

What is GStreamer?

- GStreamer is an open source library for building multimedia applications (media players, capture encoders, etc.).
- Encapsulates existing multimedia software components such as codecs, filters, and platform-specific I/O in order to provide a uniform framework across platforms.
- Modular with the ability to add new functionality via plugins.
- Available for Linux, Windows, and Mac OS X desktop environments.
- GStreamer Web Site: http://gstreamer.freedesktop.org/

Benefits of GStreamer on DaVinci and OMAP

- GStreamer brings value-added features to TI platforms:
  - Audio/Video synchronization.
  - Interaction with a wide variety of open source plugins, including muxers, demuxers, codecs, and filters.
  - Playback of real audio/video clips such as YouTube videos.
- Allows developers to join modular elements together in a pipeline to easily create custom workflows.
  - No need to write a new application for each use-case.
  - Greatly increases testing flexibility by simply modifying the pipeline.
  - xDM-based elements allow plug-n-play codecs. No need for custom code per codec.
- GStreamer is an active open source project with ongoing development.
  - New features are continuously being added.
  - Core libraries are actively supported by the open source community.

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Overview of the TI GStreamer Plugin

- We do not need to significantly modify GStreamer to support TI platforms – we just need to write a plugin for it.

Goals

- Provide a robust, portable baseline implementation that serves as a stable starting point for customer application development.
- Performance:
  - Optimize buffer management where possible.
  - Enable full utilization of the DSP and accelerators on SoC systems (through DMAI).
  - Use multi-threading to allow the ARM and DSP to run in parallel.
- Easy to build and install.
- Minimize custom TI code by using open source solutions wherever possible.
- Enable and promote open source community involvement with plugin development.

Overview of the TI GStreamer Plugin (Cont.)

- The TI GStreamer plugin provides base functionality including:
  - GStreamer elements for using codecs that are shipped with a platform's DVSDK.
  - GStreamer elements for using video and sound drivers not supported by any existing open source plugin.
  - The ability to migrate between xDM versions by simply changing the GStreamer element being used.
- TI is not supporting the productization of GStreamer. Complete products may require additional developement for items such as:
  - Features not specific to TI hardware entitlement that can be addressed by the open source community (demuxers for example).
  - Features beyond basic functionality (visual effects, support for custom boards, etc.).
  - GStreamer-based applications (media players, capture interfaces, etc.).

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Software Stack for TI GStreamer Plugin

- The TI GStreamer plugin interfaces with Codec Engine and other DVSDK components, meeting our goal of a robust baseline.
  - Leverages existing DVSDK components to maximize reuse.
  - The DVSDK serves as a stable starting point for customer application development.
  - DSP is treated as a “black box” for running codecs -- all peripherals are controlled using ARM-side Linux drivers.
- DMAI enables portability to other platforms and newer DVSDK versions with minimal changes to the plugin code base.
- Interfaces with other open source libraries and GStreamer plugins. For example:
  - Demuxers for AVI, TS, MP4.
  - OSS and ALSA audio output.
  - V4L2 video capture.
  - ARM-side MP3 decoding.

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Portability and Reusability

- The TI GStreamer plugin is built on top of the DaVinci Multimedia Application Interface library (DMAI), which makes porting the TI GStreamer plugin to new platforms easier.
- The DMAI library provides a simple software interface, but implements complex device driver and codec engine handshaking under the hood:
  - Uses hardware acceleration where possible without requiring developers to understand the platform specific implementation.
  - Enables all VISA codecs, reducing the need to understand details and differences of xDM versions.
  - Abstracts PSP differences (FBDEV vs. V4L2).
  - Low-level details and error handling are managed for you.
- Using DMAI, plugin code is mostly free of platform-specific code, making it extremely portable.

Portability and Reusability (Cont.)

- There is a single code base for the TI GStreamer plugin that is shared by all supported platforms.
- Porting the TI GStreamer plugin to new platforms typically involves creating two new files:
  - gstticodecplugin_<*platform*>.cfg: XDC configuration for codec combos or packages.
  - gstcodecs_<*platform*>.c: C file that maps audio/video stream types to the codec names used by the codec server.
- Using the createFromServer functionality of Codec Engine 2.0 allows developers to interchange codec combos -- often with no changes.
- For example the port to DM355 took 2 days. Most of the time was developing a new element for the VIDDEC2 API.

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Community Model

- The TI GStreamer project is hosted on an external GForge server at http://gstreamer.ti.com. The GForge server provides a collaboration environment which includes:
  - Source control via SVN.
  - Wiki for documentation.
  - Package release system.
  - Issue/Feature tracker.
  - Forums for support/discussion.
- There is an IRC Channel (#gst_ti) at irc.freenode.net for developers interested in GStreamer on TI processors.
- Support is community-based but customers needing extra help in productizing GStreamer can purchase support contracts from RidgeRun.

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Current Status

- General Status
  - Supports xDM 0.9 and xDM 1.x Audio Decoders.
  - Supports xDM 0.9 and xDM 1.x Video Encoders/Decoders.
  - Supports xDM 1.x Imaging Encoders/Decoders.
  - Supports OSS and ALSA sound drivers through open source plugins.
  - Supports FBDEV or V4L2 video output directly through DMAI.
  - Uses the latest GStreamer and supporting open source components.
  - Uses the LSP kernel associated with each DVSDK release, not the open source GIT tree.
  - Supports DM6446/DM6467/DM355/OMAP3 EVMs
- For information on what is supported on the various platforms please see the status matrix at http://gstreamer.ti.com.
- Initial release (0.99.00) with quarterly snapshots to follow.

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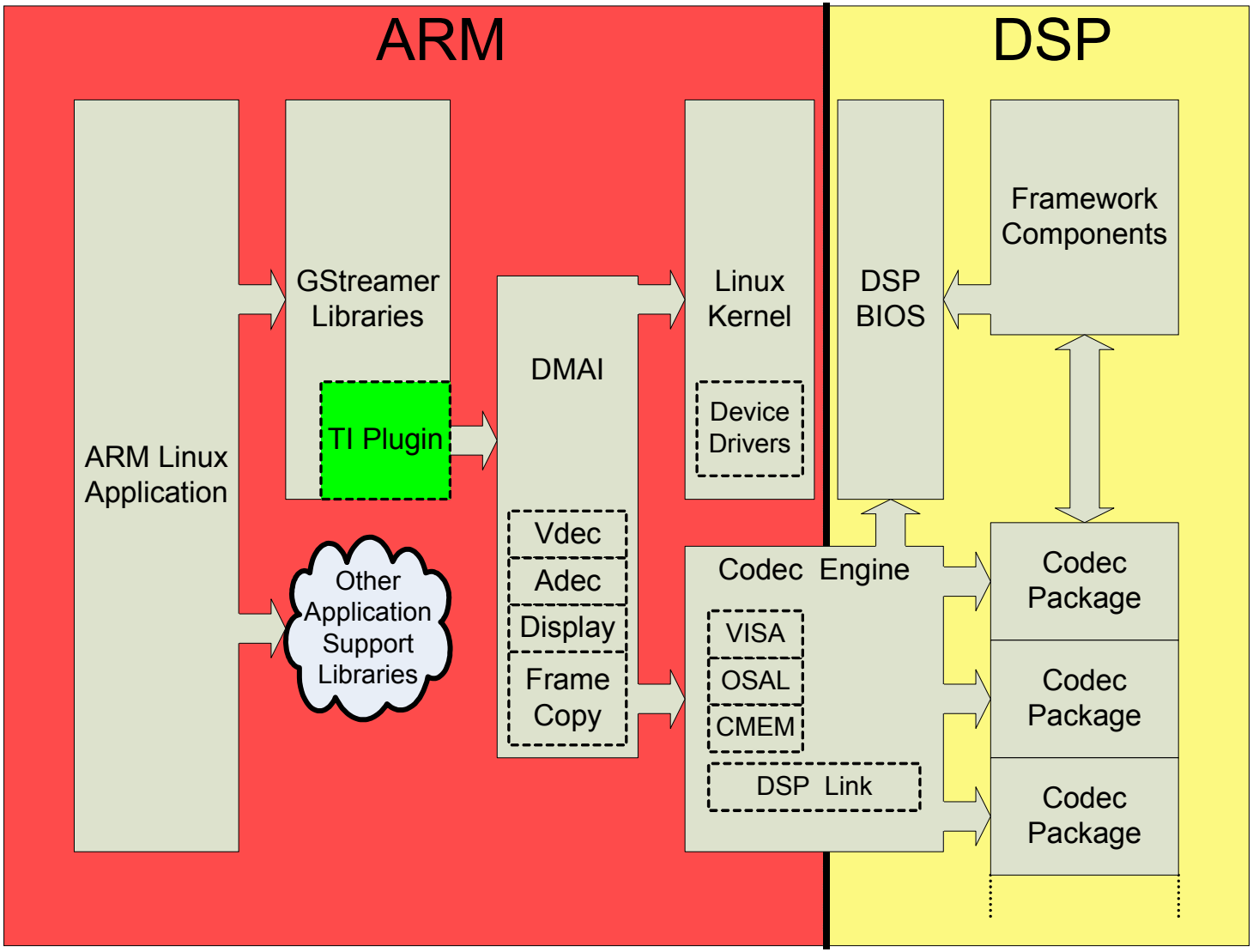
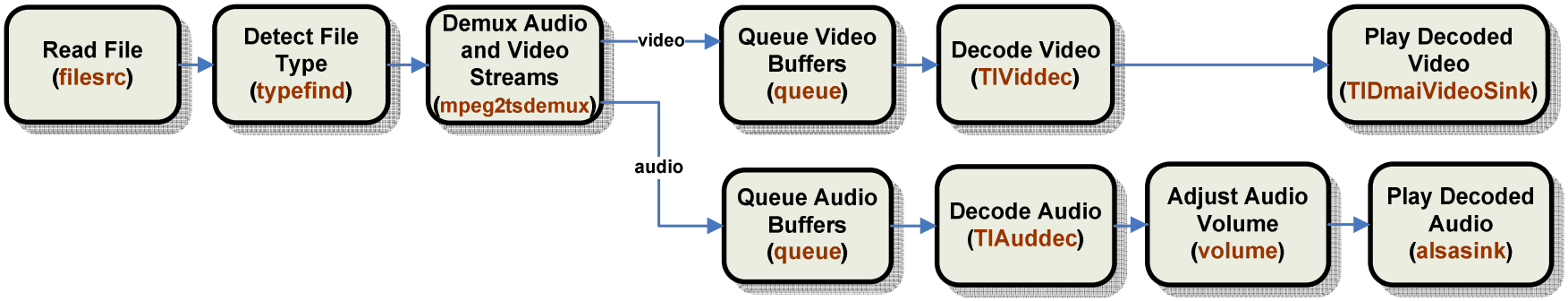
Software Stack on an ARM + DSP System

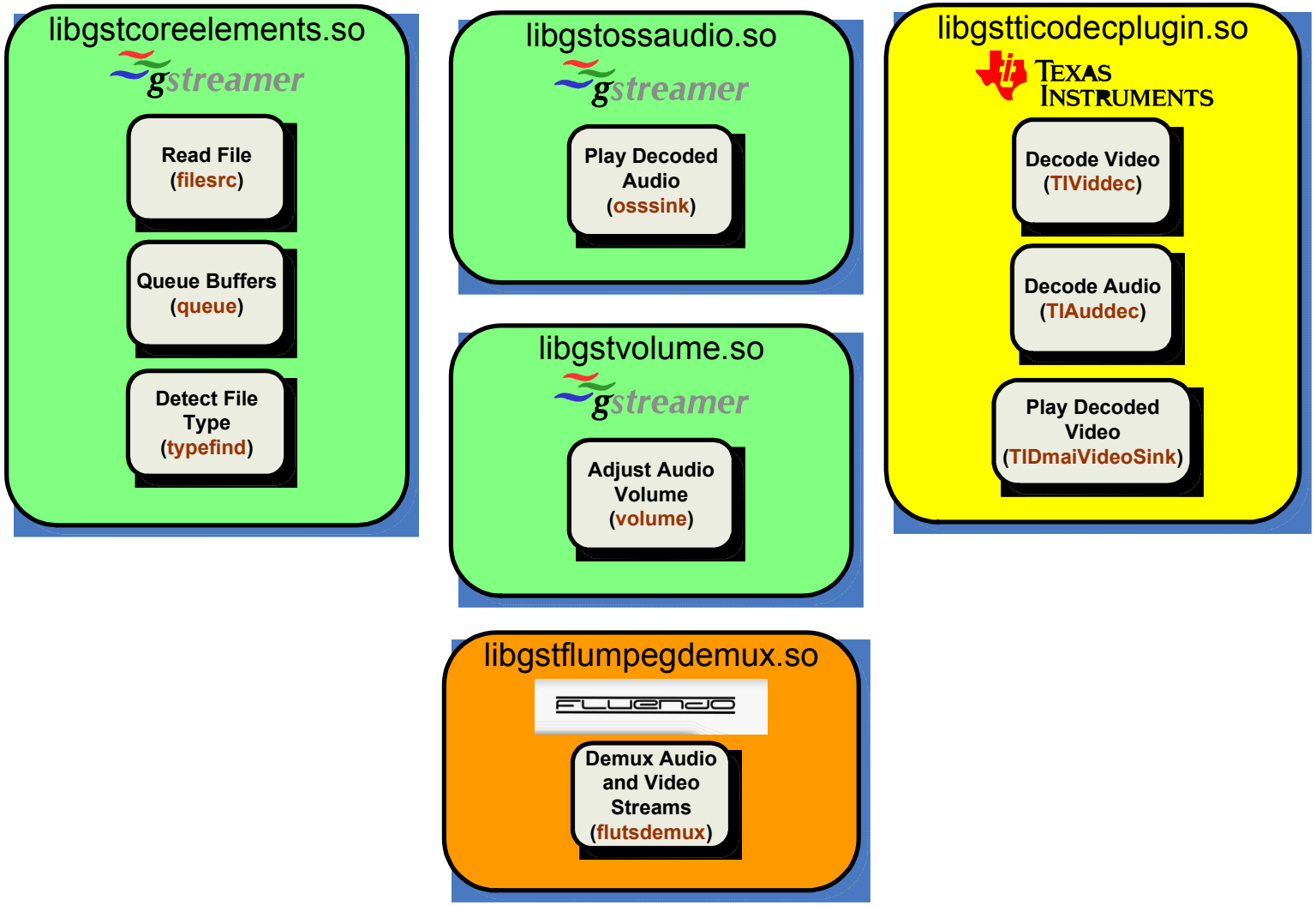


Example GStreamer Pipeline

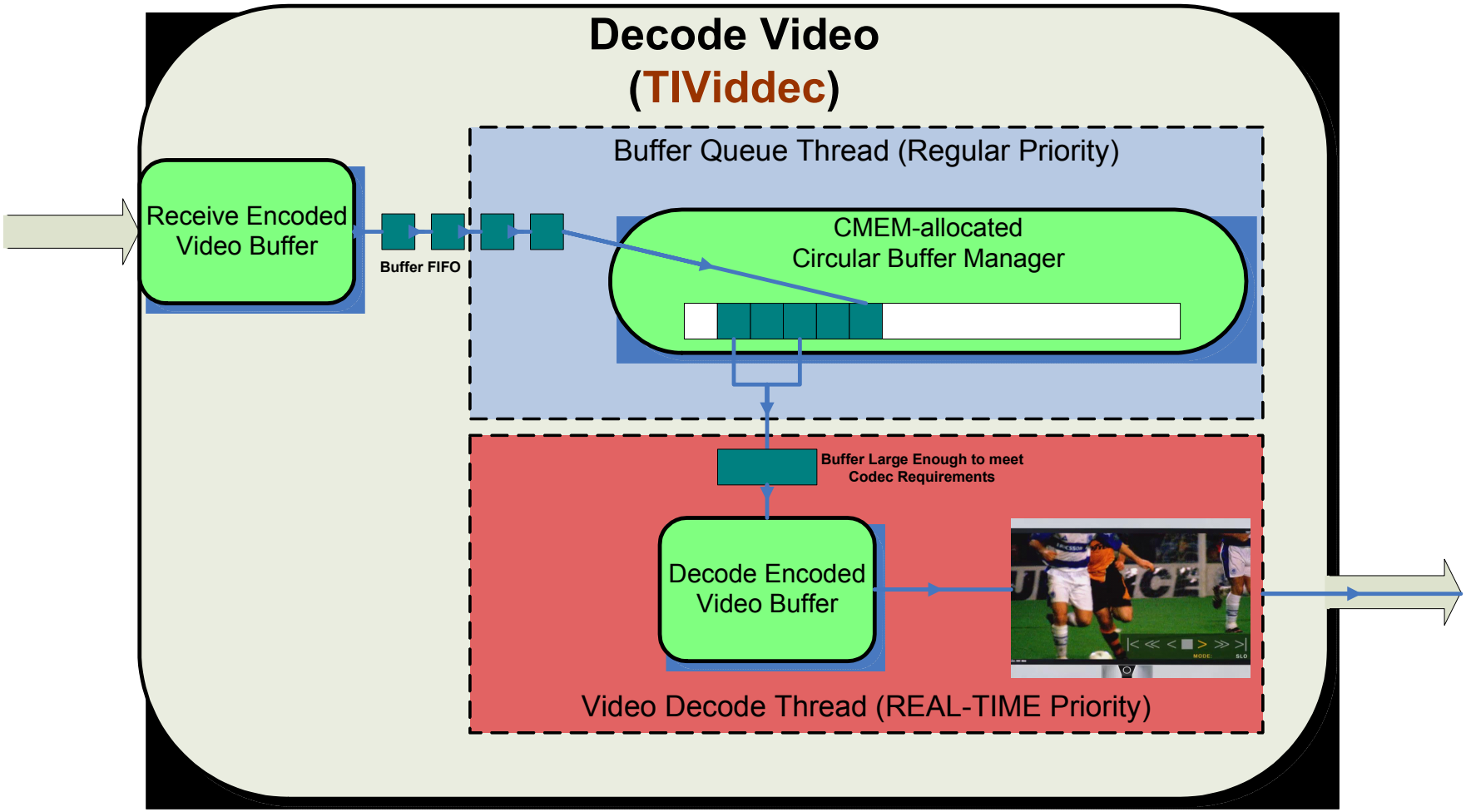



```
gst-launch filesrc location="video.ts" ! typefind ! mpeg2tsdemux name=demux \
    demux. ! 'video/x-h264' ! queue ! TIViddec ! TIDmaiVideoSink \
    demux. ! 'audio/mpeg'   ! queue ! TIAuddec ! volume volume=5  ! alsasink
```

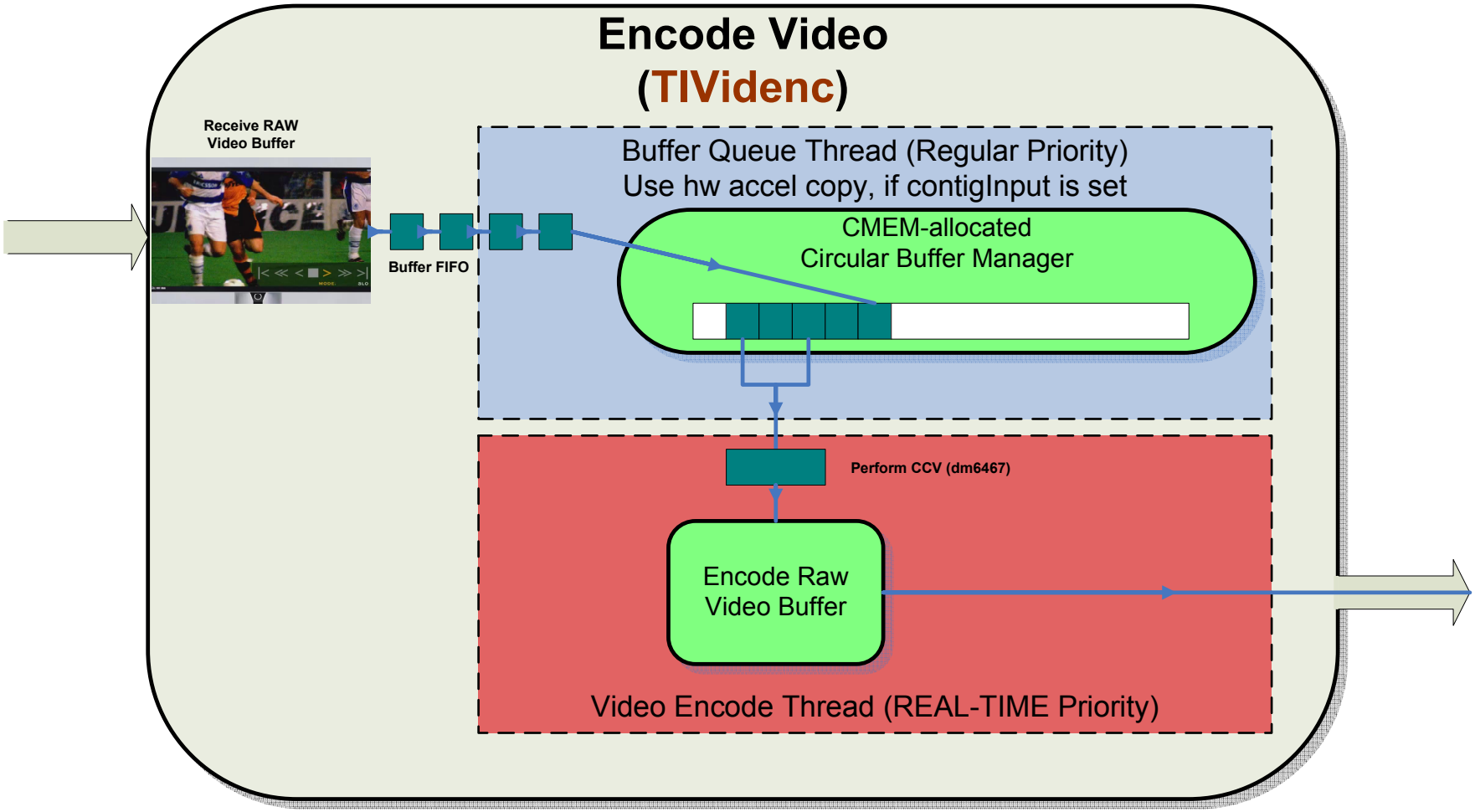
GStreamer Plugins are Shared Object Libraries



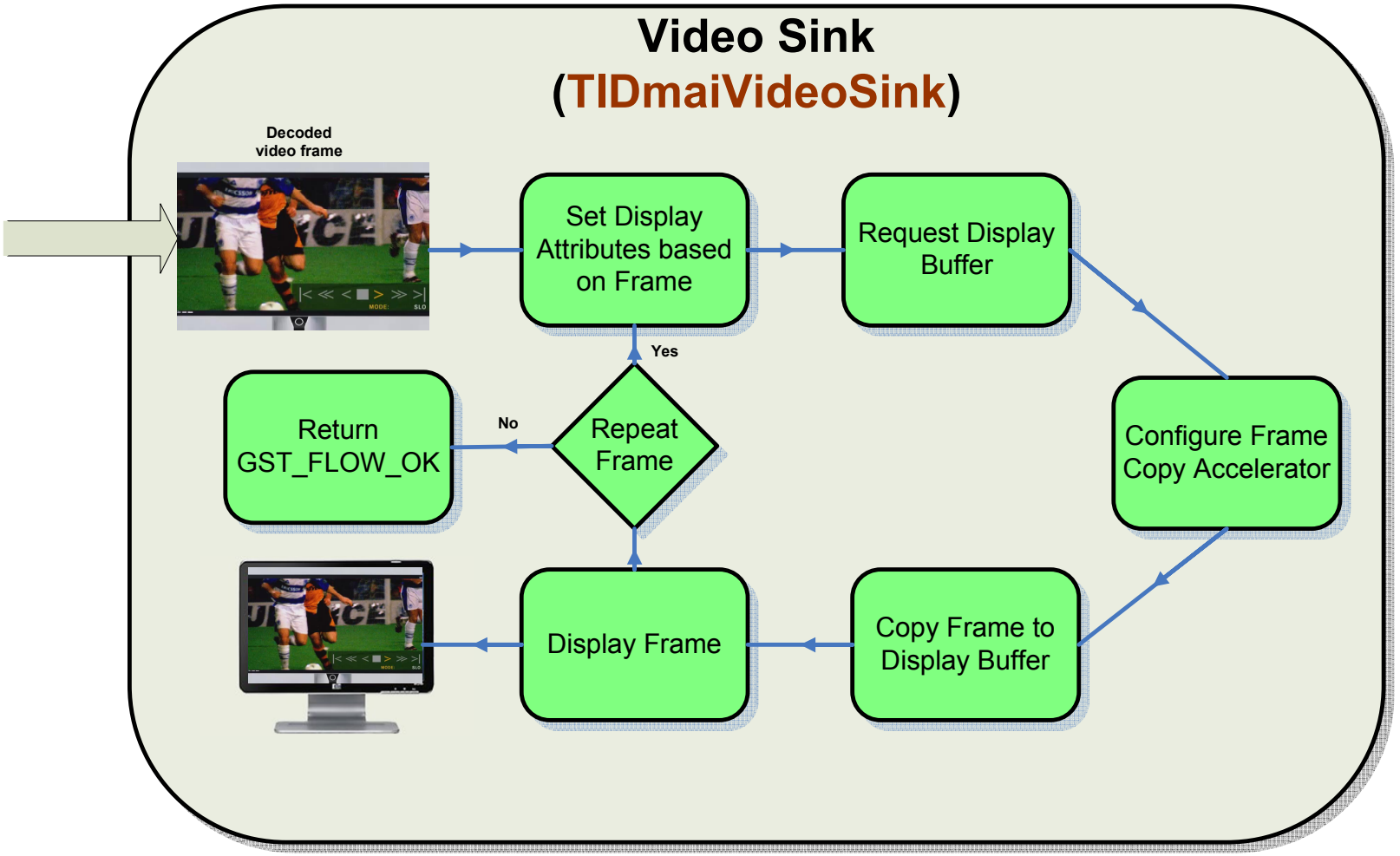
Decode Element Design



Encode Element Design



Video Sink Design



Thank You!

- Visit us online at http://gstreamer.ti.com