Introduction

This chapter provides an introduction to the Reference Frameworks for eXpressDSP™, recently introduced by TI\(^1\). The reference frameworks use both DSP/BIOS and the TMS320 DSP Algorithm Standard, also known as XDAIS. The C6713 and C6416 DSK’s both include a tutorial book\(^2\) on this subject, however the frameworks can be used on the C5510 and C6711 DSK’s as well.

In 1999 TI introduced the eXpressDSP software technology which includes:

- **DSP/BIOS**, a optimized, scalable, and extensible software kernel

- **TMS320 DSP Algorithm Standard** (XDAIS), which sets rules and guidelines for algorithm developers, thus making life easier for system integrators

- **A network of third-party suppliers**, to provide eXpressDSP compliant algorithms and eXpressDSP compli-

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ant plug-ins for CCS
Simply put, “The reference frameworks contain design-ready, reusable, C language source code for TMSC5x and C6x DSPs”. A developer can then build on top of this framework with confidence that the components will work together. In application note SPRA795A TI defines the reference framework as:

- Generic DSP starterware source code using DSP/BIOS and the TMS320 DSP Algorithm Standard
- Customers can adapt the framework and populate it with eXpressDSP-compliant algorithms to achieve application-specific solutions

Beyond the eXpressDSP for Dummies book TI application notes SPRA094A, SPRA793D, and SPRA795A, provide descriptions of the reference frameworks ranging from an overall white paper, details on a Compact Static System (RF1), A Flexible, Multi-Channel, Multi-Algorithm, Static System (RF3), to An Extensive, High-Density System (RF5) respectively.
The Software and Entry Points

**eXpressDSP Reference Application**

- Memory Mgmt / Overlays
- Channel Abstraction
- Algorithm Manager

**Framework Starterware**

- DSP/BIOS driver (e.g. IOM-based codec driver for RF Levels 1, 3, & 5)
- Application-Specific Code
  - Application-specific behavior (e.g., digital hearing aid [RF 1] or client-side telephony [RF 3])
- TMS320 Algorithm Standard
  - Replace FIR_TI with eXpressDSP-compliant algorithms from multiple vendors (e.g., G.723 from vendor ABC and DTMF from vendor XYZ)

**Reference Framework Starterware**

- Skeletal "blueprint" starterware
- Algorithm "containers"
- Optimized for intended system complexity (e.g., single vs. multi-channel)
- Reusable components

**Custom DSP/BIOS I/O Drivers**

- Additions/mods to IOM mini-driver
- Additional drivers (e.g., UART, DAA)

**Customer target hardware (e.g., 'C55x)**
### Frameworks Overview

Presently there are three frameworks levels:

<table>
<thead>
<tr>
<th>Design Parameter</th>
<th>RF1</th>
<th>RF3</th>
<th>RF5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute minimum memory footprint</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static configuration</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Dynamic object creation (e.g., DSP/BIOS objects)</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td>Static memory management</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Dynamic memory allocation</td>
<td>❌</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Number of channels recommended</td>
<td>1-3+</td>
<td>1-10+</td>
<td>1-100+</td>
</tr>
<tr>
<td>Number of eXpressDSP-compliant algorithms recommended</td>
<td>1-3+</td>
<td>1-10+</td>
<td>1-100+</td>
</tr>
<tr>
<td>Uses DSP/BIOS real-time analysis</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uses DSP/BIOS scheduling kernel</td>
<td>❌</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Uses Chip Support Library</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Uses XDAIS algorithms</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Portable to other devices, ISAs, boards</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Supports multiple execution rates and priorities</td>
<td>❌</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Supports thread blocking</td>
<td>❌</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td>Implements control functionality</td>
<td>❌</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Implements DSP-GPP functionality</td>
<td>❌</td>
<td>❌</td>
<td>✗</td>
</tr>
</tbody>
</table>

All Reference Frameworks are application-agnostic. Each framework can be used for many applications, including telecommunication, audio, video, and more.
Applications Suited to RF 1

A Digital hearing Aid System

A Low-Cost Internet Audio Player Running a Single Audio Decoder (MP3)
Applications Suited to RF 3

A Web Phone

Figure 2. Internet Audio Player
Applications Suited to RF 5

Other applications for which RF5 can be adapted include:

- 3G wireless infrastructure devices
- Video infrastructure devices, for example, security applications
- Interactive TV server
- Universal Port Switch