RIDGE RUN

Open, Scaleable Multimedia Software Platform for Next-Generation Mobile Phones and Internet Connected Devices

DSPLinux™ Demonstration for TI TMS320VC5471 Board Support Package

RidgeRun Contacts

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20+ years sales and program management of silicon systems and embedded systems solutions.

Worldwide Sales, Marketing, Trade Events, Key Customer Accounts, Key OEM Relationships, TI Relationship

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18+ years embedded development and program management in medical and consumer electronics

Marketing, Trade Events, Customer Accounts, Technical Sales Support, 3rd Party Partnerships, TI Relationship

Justin Mayfield

Lead Customer Engineer

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6+ years embedded and IT development and support. Extensive background and experience with Linux in embedded and enterprise applications.

Lead Customer Support, Technical Sales Support, Technical Interface to RidgeRun R&D Lab, Demos and BSP Releases

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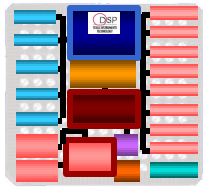
DSPLinux C5471 Presentation

- C5471 Architecture Review – TI Announcements
- RidgeRun – The Company
- Escali – Smartphone Platform
- DSPLinux Overview
- C5471 BSP Overview
- Demonstration – C5471 RidgeRun JukeBox
- Development Environment
- Boot Loader, Linux Kernel & File System
- Summary – Strengths of C5471 and DSPLinux BSP

TI's System-Level DSPs Offers More Integration, Performance and OS Support



Reduces System Size, Cost and Power 40%

- **Integration of DSP+RISC on single chip reduces system size and cost by over 40% and power consumption by nearly 30% compared to discrete RISC + DSP embedded systems**

DSP Performance in RISC-Based Systems

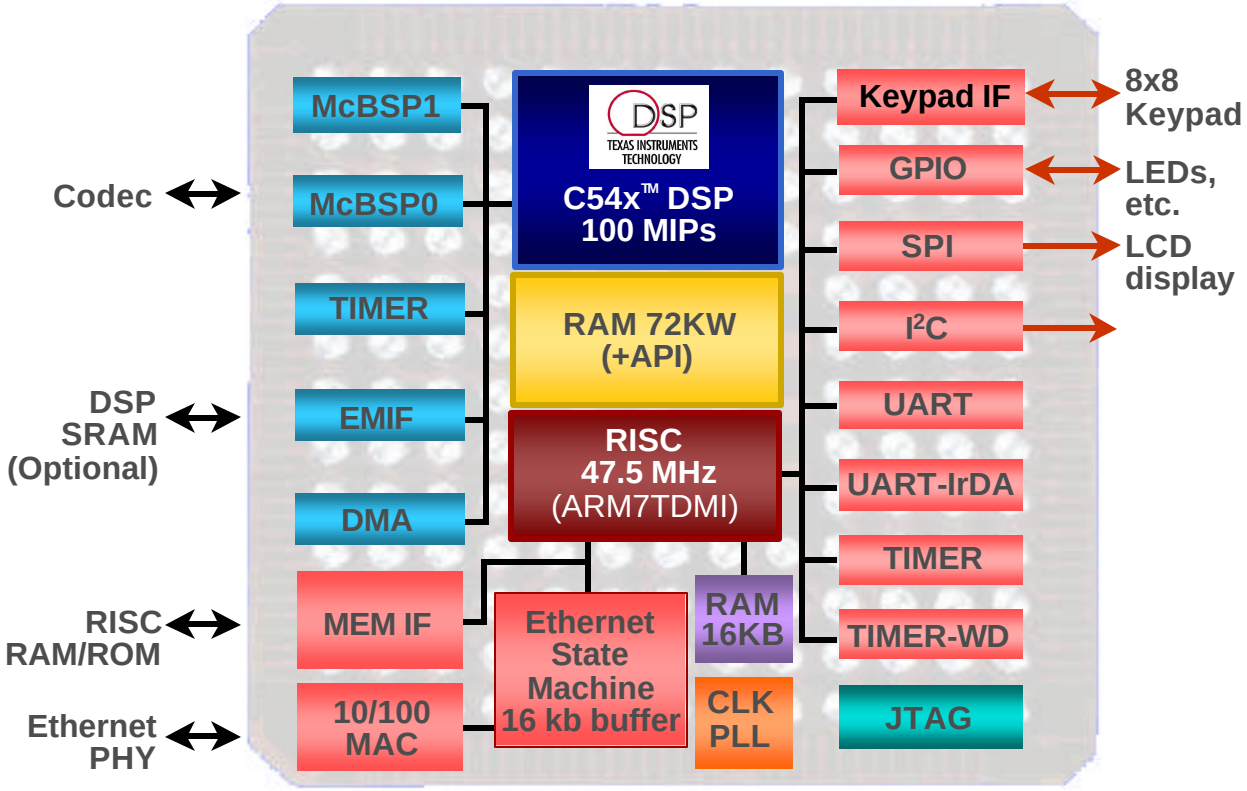
- **Integration enables DSP performance in low cost RISC-based systems without penalty or need to upgrade to more expensive RISC architectures**
- **Heterogeneous dual-core architecture allows optimized task partitioning for increased system performance**

Accelerated Time-to-Market

- **DSPLinux™ OS available now, allows designers to leverage exhaustive IP base, accelerating time-to-market.**
- **Peripheral and OS communication stack availability for 10/100 Ethernet, HPNA, Bluetooth and 802.11b Wireless Lan**

TMS320C5471 DSP Provides Easy, Immediate Connection for Ethernet Applications

C5471 DSP- In Production Today



PACKAGE
257 u*BGA 16mm x 16mm

PRICE
$17.57 @ 10Ku

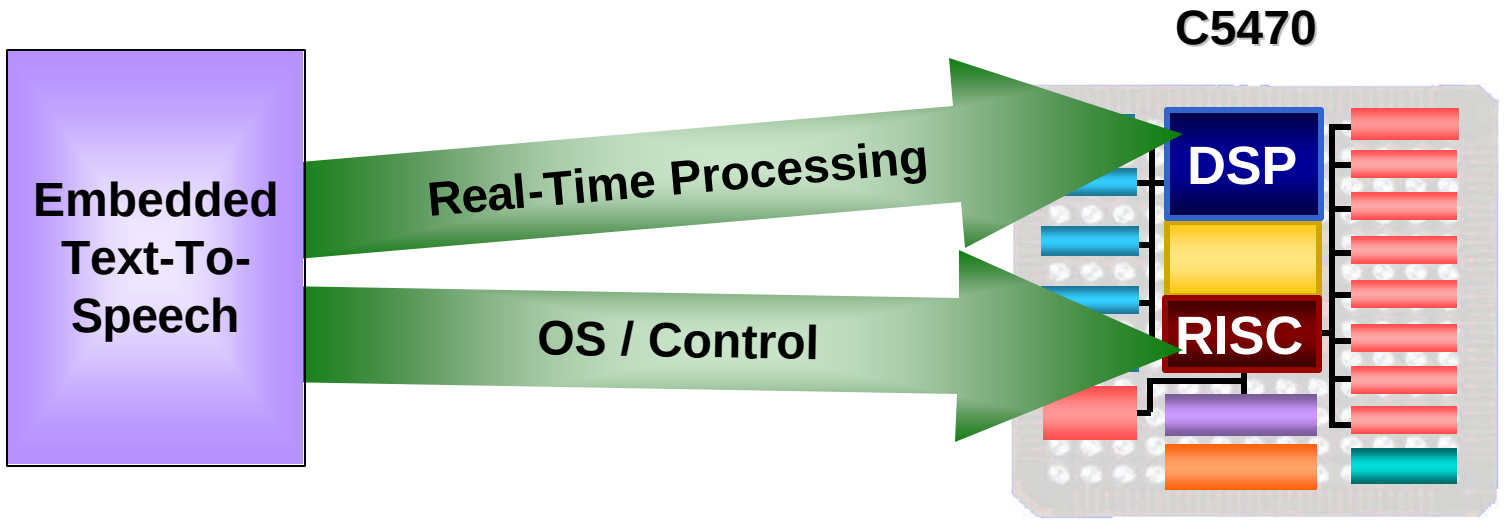
TMS320C54x™ DSP

- 72KW RAM
- 2 Multichannel Buffered Serial Ports (McBSP)
- Direct Memory Access controller (DMA)
- Phase-locked loop
- External Memory Interface
- DSP - Interrupt Handler (INTH)
- ARM Interface (API)

ARM7TDMI

- Memory Interface (SDRAM, SRAM, ROM, Flash)
- ARM - Interrupt Handler (INTH)
- Single-port 10/100 Base-T Ethernet (EIM)
- General purpose I/O (ARMI/O)
- 16C750 UART-IRDA
- 16C750 UART
- Serial Port Interface (SPI)
- I²C Interface
- Clock Management (CLKM)
- 16K byte zero wait-state SRAM

C5470 DSP Hardware Architecture Delivers Optimized Task Partitioning for Embedded TTS



The Right Engine for the Right Task

DSP	RISC
▪Real-Time Tasks	▪OS / Control Tasks
▪Text-to-Speech Synthesizing	▪Linguistic Processing
▪Pre/Post Audio Processing	▪Database Retrieval Operations

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Drives Leading Embedded OS

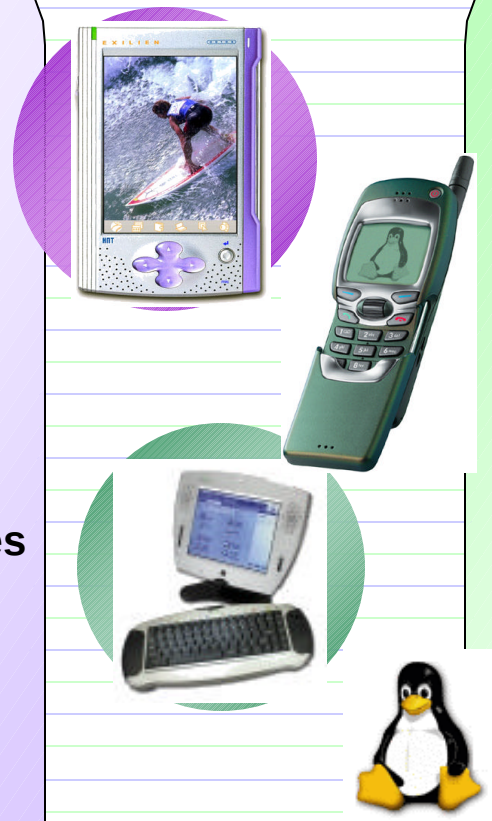
DSPLinux™

WHO WE ARE

Exclusively Focused
- Embedded / Linux
- RISC + DSP
- Connected Appliances

Embedded Expertise
- Embedded Veterans
- Consumer Volumes
- Industry-Leading Executives

Vertical Expertise
- Internet & Java
- Multimedia & Imaging
- Compression, Security, Power Management



WHAT WE OFFER

Open Source uClinux Kernel
- ARM7 & ARM9 Optimized
- Efficient Footprint
- Bullet-Proof Reliability

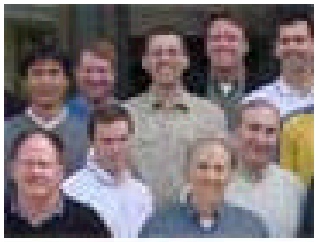
Complete Drivers/Utilities
- Full Ethernet Support
- I/O, Timers, Power Mgmt.
- NFS Root Mounting
- TCP/IP Stacks
- Servers

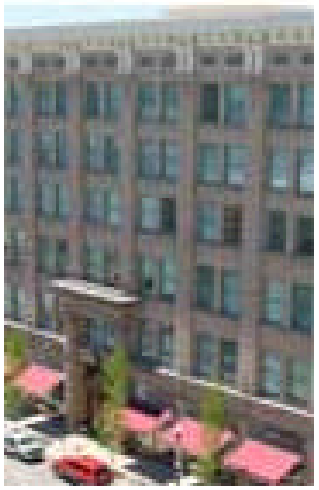
Full Linux Tool Chain
- GNU ARM Code Gen
- TI C5000™ Code Gen
- GDB Symbolic Debug

SW Appliance Simulator

RidgeRun – The Company

- **Founded May ’00 – HP LaserJet Embedded Team**
- **Series A Funding Closed $5 Million 12/00**
- **30+ Employees – Extensive Years Embedded SW**
- **HQ in Boise, ID; Offices in San Jose, CA and Osaka, Japan**
- **Focus on TI Dual-Core Architectures**
- **Core Business Models**
  - **BSPs and Tools**
  - **Affordable Run-Time Licenses for High Volume Products**
  - **Professional Services & Customer Training**
- **Dual Business Paths**
  - **Current: TI Catalog and Multimedia Vertical Appliance Markets**
  - **Future: Complete Vertical Solution in Mobile Handset Markets**





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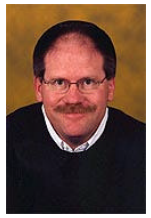
Experienced Management Team




Rudy Prince	Pat Sewall	Phil Verghese	Dan George	Rick Seger	Gary Oliverio	Jim Knight
CEO	**Pres. / Founder**	**CTO / Founder**	**VP Product Dev.**	**VP Far East Sales**	**VP Escali Mktg.**	**CFO / General Counsel**
eFax.com Entropic	HP	HP	HP	Motorola Intel	Red Hat Cygnus Motorola	A&K Law Triarc
21 yrs.	21 yrs.	10 yrs.	18 yrs.	15 yrs.	18 yrs.	10 yrs.

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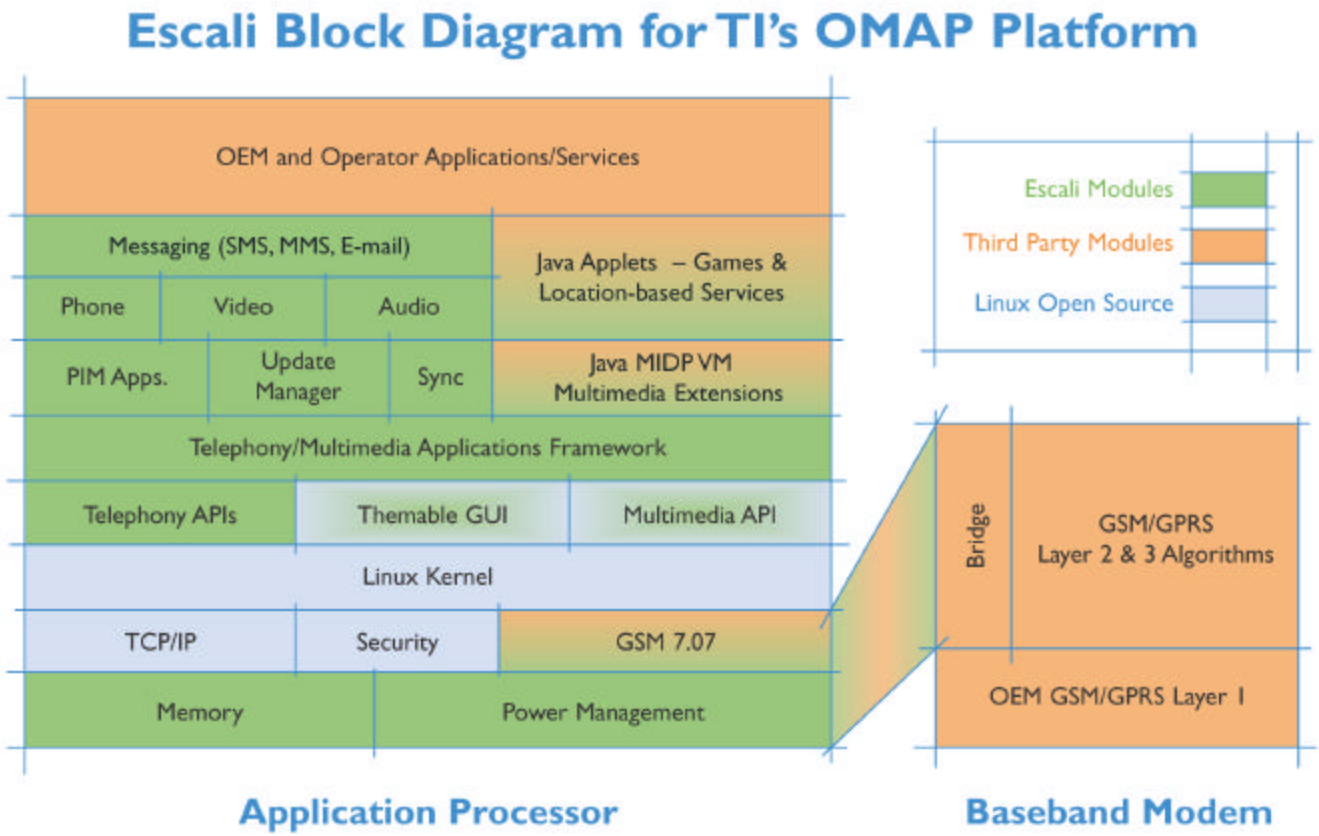
Escali™

The Upgradeable, Reliable Multimedia-Ready Smartphone Software Platform

Value-Added Platform Solution



- **Open APIs**
- **Custom User-Interfaces**
- **Linux IP Networking**
- **Remote Upgradability**
- **PIM / Messaging Applications**

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Enabling Next-Generation Functionality

Enhanced Messaging

- SMS to MMS
- Voice Replies to SMS / Email
- Photo Sharing
- Email Access Anywhere / Anytime

Entertainment

- Interactive Gaming via Java Applet Downloads
- MP3 Player
- MPEG4 Videos

Data and PIM Applications

- Contact / Calendar Management
- Secure Access to Corporate Data / VPNs

Escali

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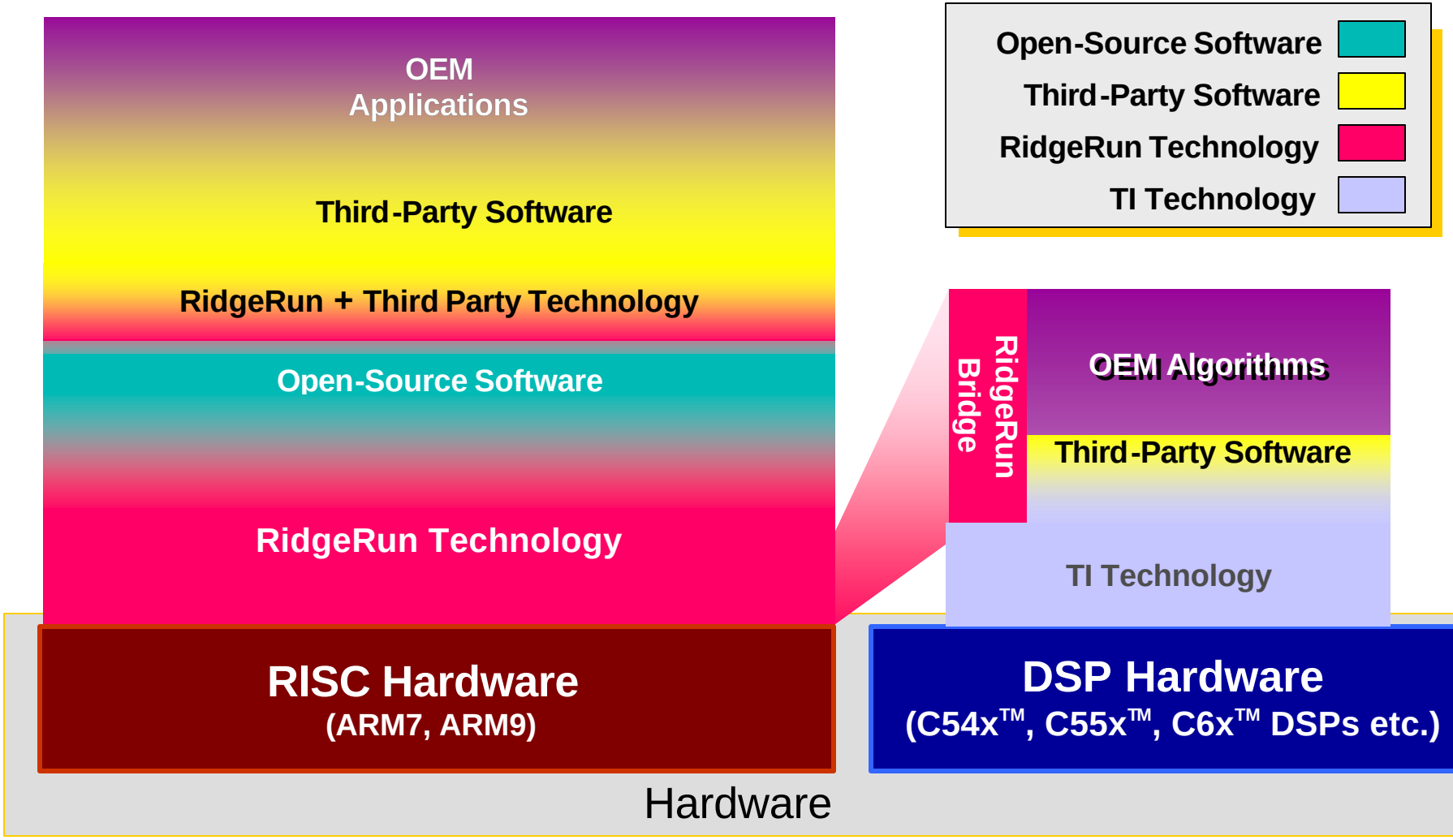
DSPLinux™

The "System" in System-Level



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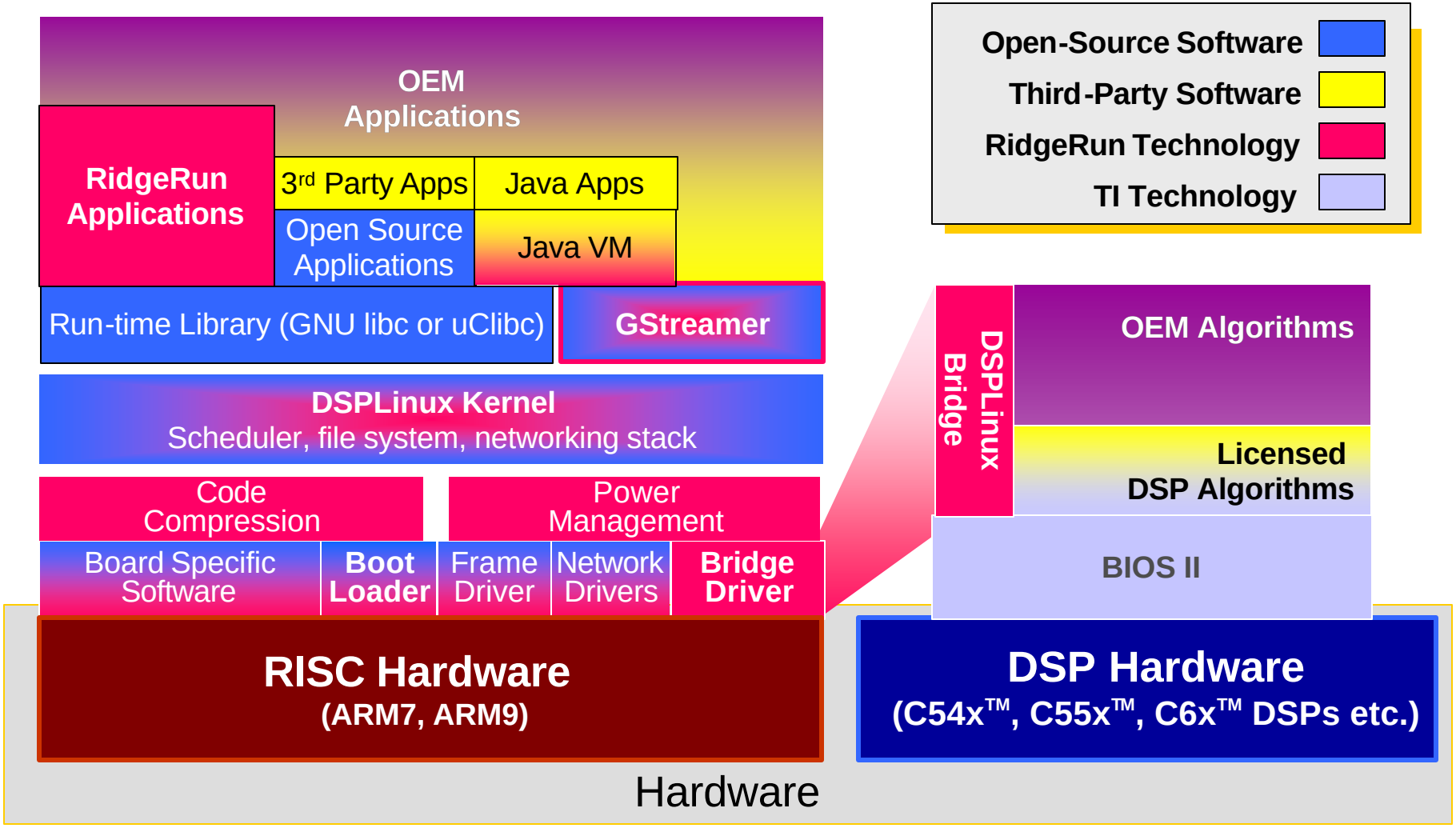
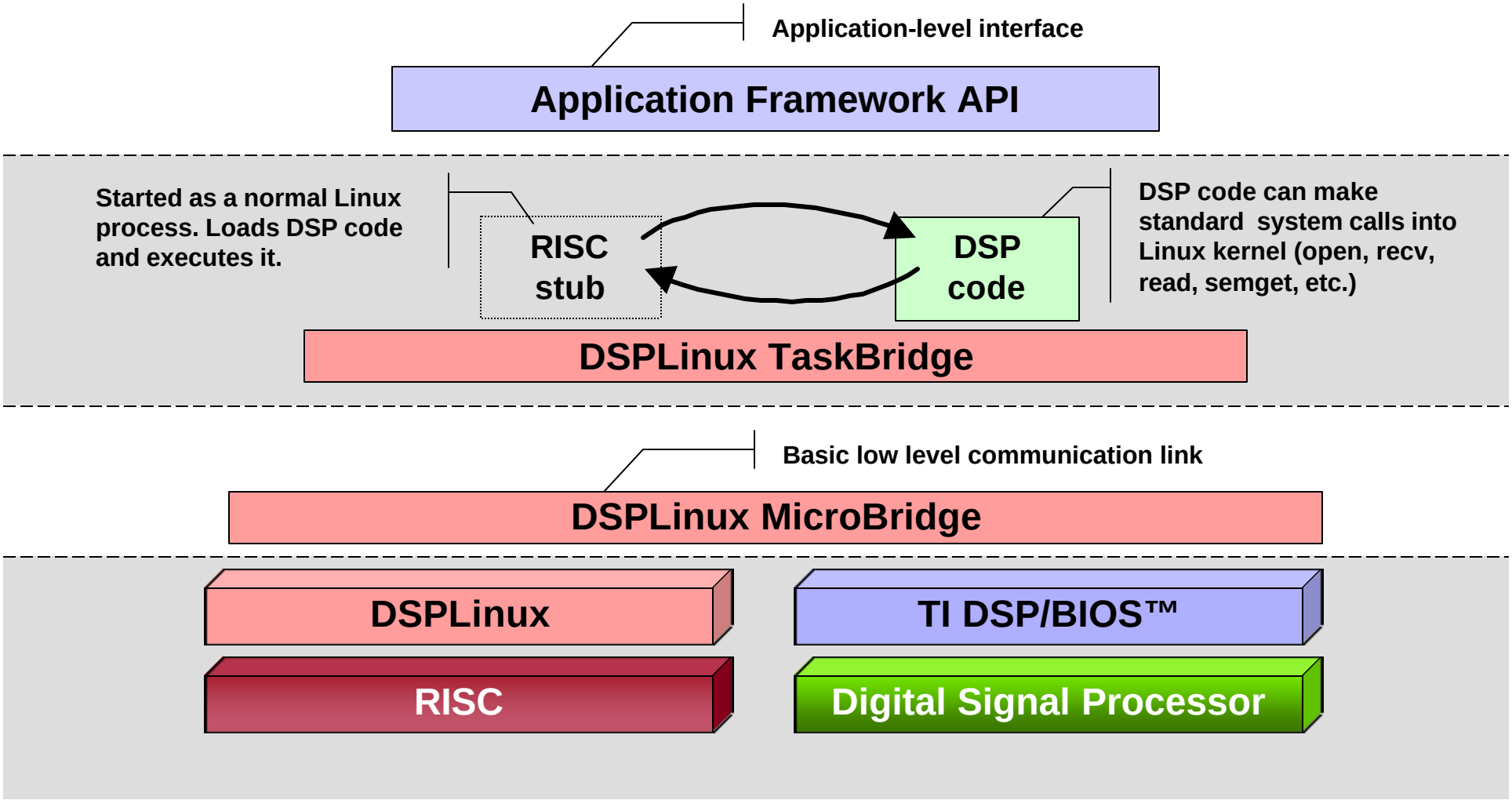
DSPLinux™

The "System" in System-Level



DSPLinux Bridge: Simplifying Multiprocessor Interaction



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Appliance Simulator
SW Development Now, Hardware Later

- DSPLinux™ runs as a virtual machine on the host computer
- Simulation of operating system, drivers, and peripherals
- The Appliance Simulator allows programmers to develop final software by simulating “target” hardware
- Rapid compile-link-debug-test development cycle by compiling native to the Linux workstation
- Easily created software test harnesses to ensure overall product quality
- Allows for product usability testing to begin early in the product lifecycle

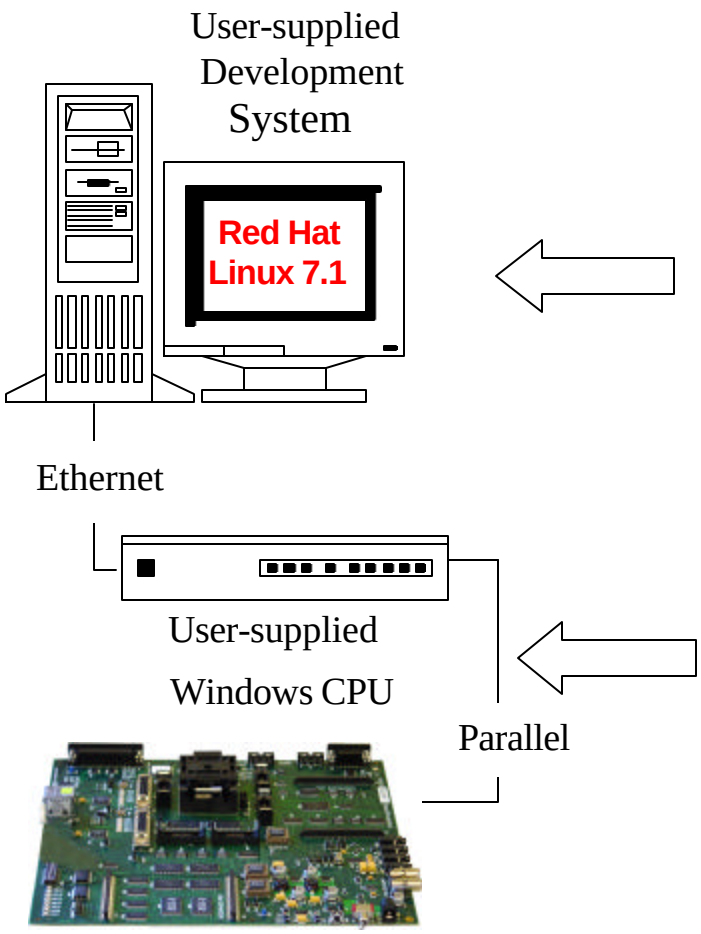
DSPLinux C5471 Bundle

Complete Out-of-the-Box Linux for C5471 and C5470 DSPs

Component	License
▪ Boot Loader	Open Source
▪ uClinux Kernel v2.0.38	Open Source
▪ TCP/IP Network Stack	Open Source
▪ NFS Root-Mount File Sys.	Open Source
▪ C5471 EVM Device Drivers	
Serial Port Driver	Open Source
Watchdog Timer Driver	Open Source
Ethernet Driver	RidgeRun
Timer Driver	RidgeRun
Clock Control Driver	RidgeRun
Power Management Driver	RidgeRun
▪ DSPLinux MicroBridge	RidgeRun
▪ DSPLinux TaskBridge	RidgeRun

Component	License
▪ Utilities and Applications	
Optimized Shared uClibc	Open Source
TCP / IP Support Stack	Open Source
Busybox + Gkermit	Open Source
Tinylogin	Open Source
Web Server	Open Source
FTP Server	Open Source
Telnet Server	Open Source
▪ ARM7 Code Gen Tools (gcc, gas, binutils, gdb)	Open Source
▪ C54x™ DSP Code Gen Tools (TI command line for Linux)	RidgeRun
▪ DSPLinux Appliance Simulator (RH 7.x Linux Desktop + ARM Cross Compile)	RidgeRun

Physical Development Setup



TI C5471 EVM with
On-board JTAG Emulator

DSPLinux C5471 Board Support Package (BSP)

- Code Generation – GNU ARM7 and TI™ C5000
- GNU GDB Debugger – ARM7 and C54x
- Flexible DSPLinux Bootloader
- uCLinux kernel v2.0.38 with full TCP/IP Ethernet
- Rd/Wr Root file system in On-board Flash
- Drivers for GPIO, Timers, Serial, Power Management
- DSPLinux Appliance Simulator with x86 Cross Tools
- JTAG Emulator Support – ARM7 and C54x
- IDE – User Choice of Linux Open Source Options

- SD Server – GDB Server Emulator for Parallel-to-JTAG
- JTAG Emulator Driver – via Parallel Com
- Texas Instruments™ C5471 EVM
  Manufactured by Spectrum Digital Inc. for TI™

Texas Instruments — The World Leader in DSP and Analog

Jukebox Demo – Basic Setup

VM Ware Environment

Monitor Cable

LAN

Windows PC
Web Browser +
Parallel-To-JTAG Code
Development Driver

Linux PC
IceCast Streaming
MP3 Server + Code
Development Demo

TFT Display or DLP Projector

Keyboard & Mouse

Parallel
(for JTAG)

LAN Hub

LAN

Ethernet Hub
Or Crossover
If VM Ware

Speakers

Speakers

TI C5471 EVM
(RR or TI Supplied TBD)

Jukebox C5471 Demo Main Page

Main Web Page Served Up by C5471

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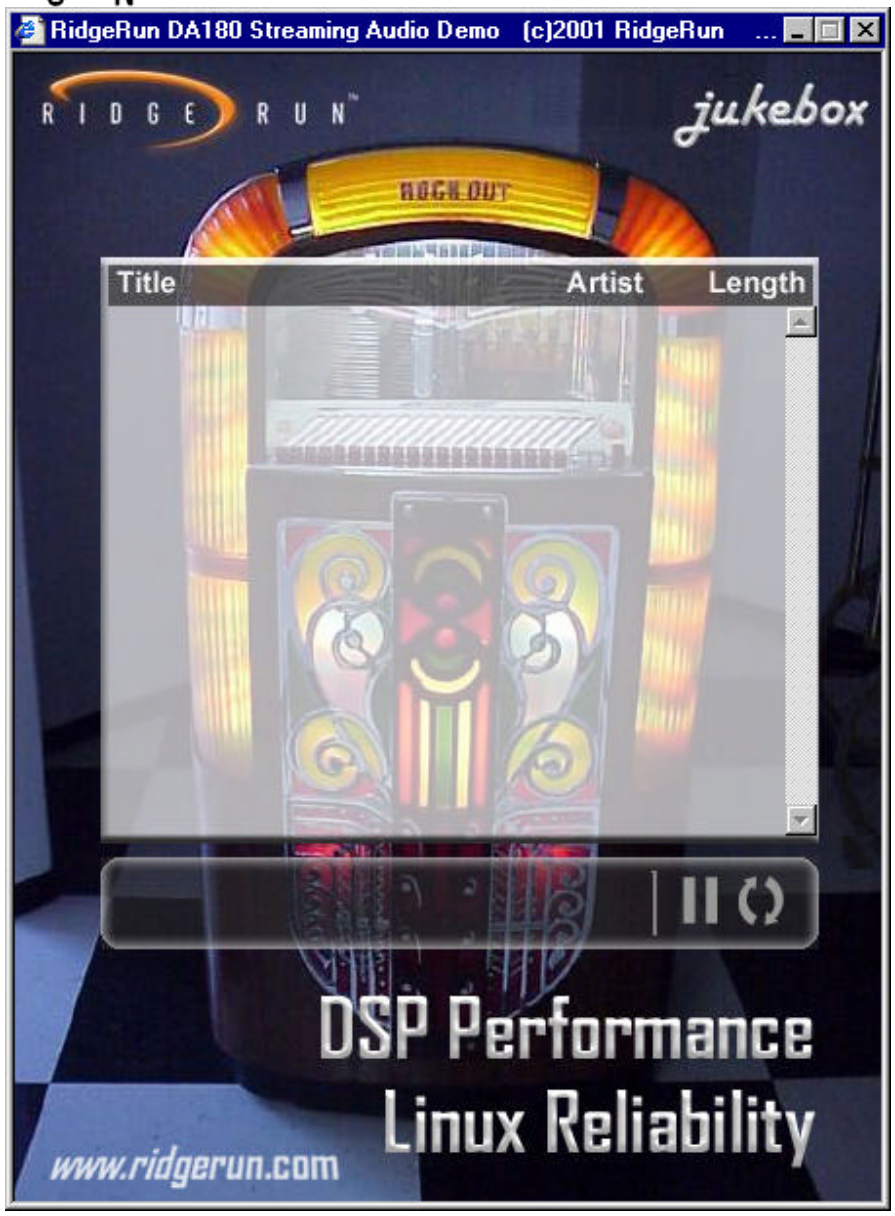
Secondary Web Page:

Served up when Jukebox is Launched –

Actual song list from Linux IceCast server will appear, songs are selected from that list, played, paused, etc.



Jukebox C5471 Demo Song List Page

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C5471 DSPLinux User's Guide

- **Chapters 1 – 4: Intro, Installation, HW, and Code Gen Tools**
  - **RidgeRun's Customer Commitment – Get them through these chapters.**
  - **BSP customer gets through GDB with "Hello" and "LED's"**
  - **Ready to "go to application development".**
  - **Exception is Appliance Simulator – Chapter 12, 13, and 14.**
- **Chapters 5 – 10: Detailed Developer's Info For EVM, BSP, C54x Device**
  - **High value to customers with this level of detail information.**
  - **Information not just specific to Linux and BSP but HW device and EVM.**
  - **These chapters are nearly worth cost of package alone.**
- **Chapter 11: Details of RidgeRun's Boot Loader**
  - **Extensive Loader Program**
  - **Would take many good embedded teams 6+ weeks alone to develop.**
  - **Large numbers of options and flexibility further enhances capabilities.**

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C5471 DSPLinux User's Guide

- **Chapters 12 - 13: DSPLinux Appliance Simulator**
  - **How to Setup The SW Simulator – Virtual DSPLinux on Linux Desktop**
  - **How to Do Application Development with Appliance Simulator**
  - **Power of Adding Simulator to Development Tool Suite**
- **Chapter 14 – DSPLinux Tools Chain and Simulator x86 Cross Tools**
  - **More In-Depth Discussion on Tools Supplied with BSP**
  - **How to Cross-Build from Simulator to Target Device**
- **Appendix A: Details Jumper Settings for C5471 EVM**

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DSPLinux C5471 – Development

- PC Installations
- VM Ware Setup
- Red Hat 7.2 Installation and Setup
- C5471 DSPLinux BSP – Installation
- Spectrum Digital – SD Server Installation
- Physical Connections To EVM

DSPLinux C5471
Installing DSPLinux BSP

1. Go to the RH Linux Desktop – Full Screen Mode
2. Open GNOME Terminal. This is your home directory.
3. Follow instructions in Chapter 2 – User's Guide
4. From page 5 - Get access to CD ROM

   $ cd /mnt/cdrom
5. Choose name for development, such a /home/demo

   $ ./INSTALL <development directory>

   e.g.: $ ./INSTALL /dsplinux

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DSPLinux C5471 – Examples

- RR Boot Loader - Overview
- Code Generation Example – RR Boot Loader
- Emulation Example – rrloader to Flash

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DSPLinux C5471 – Examples

- Code Generation Example – Kernel
- Code Generation Example – File System
- Example – Kernel & File System to Flash
- Sample – Add “Time” Function To File System

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DSPLinux C5471 – Examples

- ARM7 Code Generation – “Hello” Application
- ARM7 Emulation Session – “Hello” Application
- C54x Code Generation - “Blink” Application
- C54x Emulation Session – “Blink” Application

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DSPLinux C5471 BSP Summary

- Out-Of-The-Box Ready To Go To Applications
- Optimized for C5471 - Full TCP/IP + On-Chip Drivers
- Bridge Technology for dual-core (GPP + DSP)
- Complete Tool Chain For Development
  - ARM Compilers & TI™DSP C54x Compilers
  - Shared Libraries (Solves LGPL concerns)
  - 3 GDB Debuggers
    - ✓ ARM/Linux Apps
    - ✓ JTAG ARM
    - ✓ JTAG DSP

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DSPLinux C5471
Pricing & Availability

- EVM and full DSPLinux BSP Available Now
- Bundle Price - $8,999 (EVM and full Linux BSP)
- EVM stand-alone (unbundled) - $2,999
- DSPLinux BSP SW (unbundled) - $7,499

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DSPLinux C5471 – Value Statement

Value Comparison:

$7,499 = EVM only ($2,999) and CCS 2.0 ($4,499)

- EVM
- Code Generation Tools for ARM7 and C54x DSP
- Nothing else – No code (Loader, OS, Filesystem, Network)

$8,999 = DSPLinux Bundle

$1,500 = Difference for full system and tools

- Bootloader, Kernel, Filesystem, Utilities, Full Networking, Code Generation, Debuggers, Documentation and Install Support
- Customer does not spend time / energy generating basics
- They go straight to application

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DSPLinux C5471 – Q & A

That's it … Please send comments or follow up questions to Tom via email or give me a call.

Appreciate your time and interest!