HiFive Unleashed Expansion Kit

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Agenda

- RISC-V Marketing Update
- OS backdrop
- Microsemi’s Mi-V Ecosystem
- Mi-V HiFive Unleashed Expansion Board
  - Why?
  - Hardware
  - Tools
  - Availability
RISC-V Marketing Update

- 2018 continues to be about awareness

- Example metrics
  - Web traffic up 44% from Aug ‘17 to March ‘18
  - Tweets up 35%, followers up 15% year to date
  - Linkedin followers up 33% year to date

- Two Key Requests:
  1. Need member companies to communicate why RISC-V for you
  2. Collaboration on porting to RISC-V white paper
Embedded OS Backdrop

- Real Time is still 30% of the market
- Linux adopted by 70% of the embedded market
  - Yocto/Buildroot makes Embedded BSPs easier

### Worldwide Unit Shipments of Embedded/Real-time Operating Systems

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2017</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Linux</td>
<td>6.3%</td>
<td>5.0%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Open Source, Freely and/or Publicly Available Linux</td>
<td>56.2%</td>
<td>64.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Open Source, Freely and/or Publicly Available Real-time OS</td>
<td>7.6%</td>
<td>5.5%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Commerically-Licensed Embedded/Real-Time OS</td>
<td>29.9%</td>
<td>24.8%</td>
<td>9.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>

Note: More than one-third of embedded projects feature no formal OS or an in-house developed OS and are not depicted in the chart above.
Microsemi invests in the RISC-V ecosystem

- Introduced the first soft CPUs for FPGAs
- MI-V ecosystem enabled numerous RTOS
Mi-V RISC-V Soft CPU RTOS Support

- Open Source
  - FreeRTOS
  - Huawei LiteOS
  - MyNewt
  - Zephr (Hifive)

- Commercial
  - ExpressLogic - ThreadX
  - SiLabs - Micrium μC/OSIII

MicroPython
Mi-V Eclipse Based IDE

- A single tool chain for RISC-V and ARM MCUs
  - Easy migration from ARM to RISC-V
- Running on Linux or Windows Hosts
- Bundled with example projects and RTOSs
- [https://github.com/RISCV-on-Microsemi-FPGA](https://github.com/RISCV-on-Microsemi-FPGA)
Mi-V HiFive Unleashed Expansion: Advancing the Ecosystem

- Enables the community to port tools, OS’s, middleware, packages to RISC-V
- Makes software development easier
- Enables standard and custom peripherals

- Supporting the community supports our soft CPUs for our FPGAs
- Supporting the community supports the MI-V ecosystem and vice versa
PolarFire HiFive Unleashed Development Platform

- Designed for Expandability
- Pre-programmed with a ChipLink to PCIe Root Port Bridge
- Enables Root Complex on the HiFive Unleashed Board
- Stay tuned for FPGA developer versions
Microsemi Mi-V HiFive Unleashed Expansion Board
PolarFire Mi-V HiFive Unleashed Development Platform
All the Peripherals You Need to Build a RISC-V PC
Tiny-YOLOv2

- Fully Convolutional Neural Network - 9 Convolutional Layers
  - convolution operation + batch normalisation + activation + pooling
- Trained end-to-end on Pascal VOC dataset
- Quantized and finetuned from provided base network by Joseph Redmon
  - Tiny YOLO @ https://pjreddie.com/darknet/yolo/

Core Deep Learning
an embedded FPGA solution
Core Deep Learning Block Diagram

Core Architecture

Core generator features

- Full pipeline from convolutional neural network description to FPGA implementation
- Network retraining for memory footprint minimisation
- Support for different network layers
  - Convolutional layer
  - Fully connected layer
  - Pooling layer
  - Activation layers
PolarFire Tiny Yolo Video
Porting to RISC-V made easier with the expansion kit

- ARM’s fragmented ecosystem fuels Linux adoption
  - No two ARM SoC’s have the same memory map or peripheral functionality
  - Linux to the rescue!

- Porting an application from ARM to RISC-V is the same effort as porting from one ARM SoC to another
  - No two ARM SoC’s have the same memory map or peripheral functionality
  - Neither will RISC-V SoC’s
Resources

- **Microsemi docs**
  - [https://www.microsemi.com/hifive-unleashed-expansion-board](https://www.microsemi.com/hifive-unleashed-expansion-board)

- **Sifive Docs**

- **SiFive Forum**
  - [https://forums.sifive.com/c/hifive-unleashed](https://forums.sifive.com/c/hifive-unleashed)

- **SiFive Freedom Unleashed SDK**
  - [https://github.com/sifive/freedom-u-sdk](https://github.com/sifive/freedom-u-sdk)
Where to Buy?

- CrowdSupply
  - [https://www.crowdsupply.com/microsemi/hifive-unleashed-expansion-board](https://www.crowdsupply.com/microsemi/hifive-unleashed-expansion-board)

- Shipping by end of May

- MSRP
  - $1999USD
Mi-V HiFive Unleashed Expansion Summary

- Accelerates the RISC-V Linux Ecosystem

- Enable the community to port tools, OS’s, middleware, packages to RISC-V

- Supporting the community supports our soft CPUs for our FPGAs

- Supporting the community supports the MI-V ecosystem and vice versa

- Come see the demo at 6pm!
  - Used Debian Linux, Xserver, OpenCV, V4L, PCIe and more were used
Thank You