What is OpenCPI?

OpenCPI is a framework for developing and deploying data processing applications for heterogeneous systems consisting of General Purpose Processors (GPPs), Field Programmable Gate Arrays (FPGAs), and other processors. The goal of the OpenCPI framework is to decrease development time and cost for such systems by:

- Maximizing reuse of existing capabilities through use of a component-based architecture
- Simplifying complex integration through standards-based interface code generation
- Enabling code portability through a vendor-neutral build engine and runtime platform

OpenCPI concept of operation

A block diagram of a typical OpenCPI software-defined radio system (SDR) can be seen in Figure 1. It includes a GPP connected to an FPGA with a Radio Frequency (RF) transceiver containing digitizers and transmit and receive functionality. Different categories of hardware can meet this description including tactical radios, commercial SDRs, and FPGA development kits. Examples of such hardware can also be seen in Figure 1. The problem OpenCPI addresses is how to develop applications that can be shared between these types of systems quickly and with minimal effort.

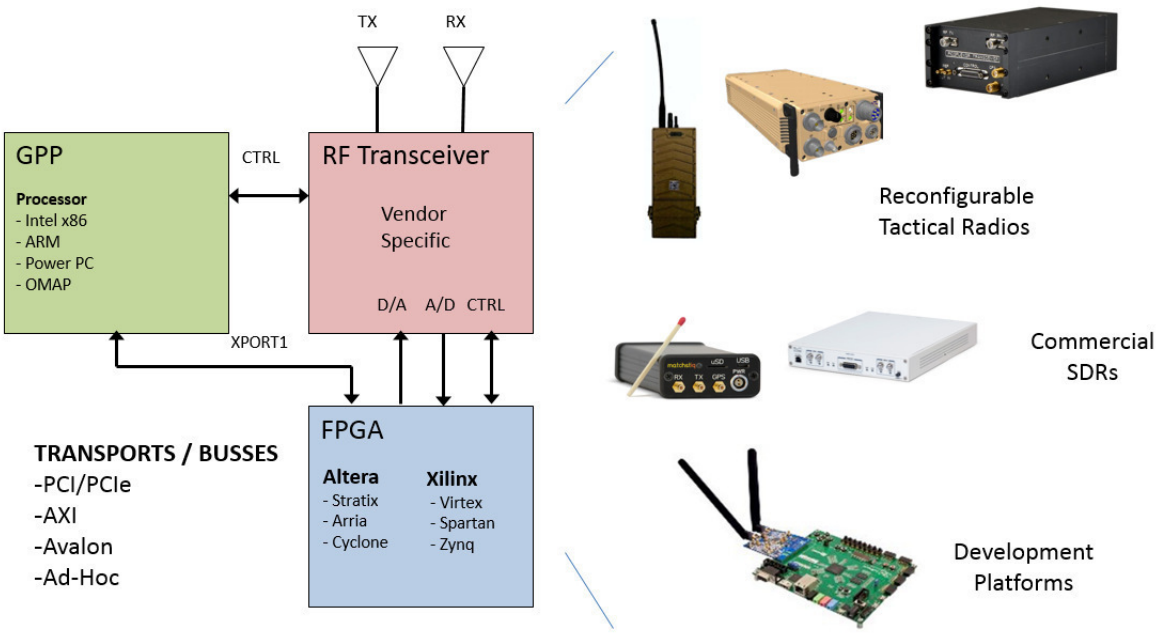

Figure 1: Block diagram of a typical OpenCPI software-defined radio system (left). Examples systems with this block diagram (right)

Figure 2 illustrates OpenCPI's concept of operation. Components are developed as functions independent of intended application and aggregated into libraries. They are developed for a processor type (GPP, FPGA) using C++ or VHDL using portable coding practices so that they can execute on differing system architectures. The framework's code generators wrap the component and generate standardized interfaces for interconnection with other components. OpenCPI applications are comprised of one or more components and can be a mix of GPP and FPGA functions. The framework build engine generates all the required code to connect the components together and uses the vendor compilers to generate executables for the target system.

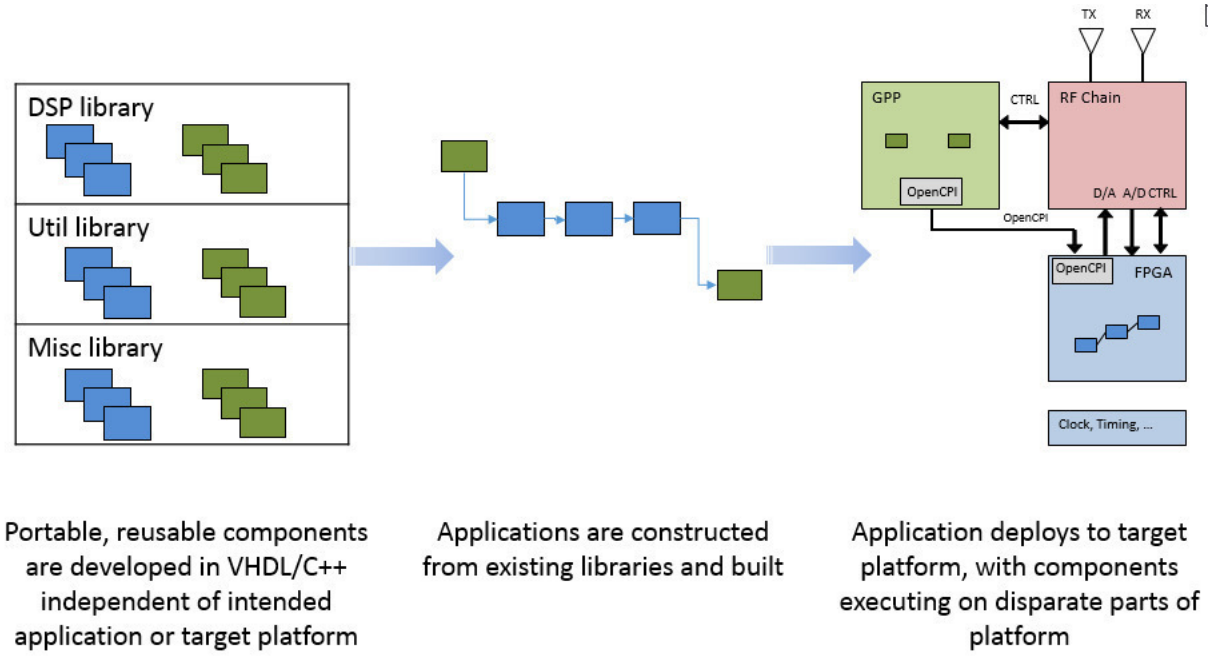

Figure 2: OpenCPI concept of operation

During application deployment, the OpenCPI runtime platform manages the application from start to finish, including identifying the requirements of the application, detecting available systems, loading component executables to matching processors, setting up control and data pathways, and configuring the RF transceiver.

What knowledge is needed to use OpenCPI?

There are three types of OpenCPI development:

1. Application development
2. Component development
3. Platform development

Application development using existing component libraries only requires knowledge of the OpenCPI framework. Component development involves creating new components and requires knowledge of C++ for software development or VHDL for FPGA development and knowledge of the framework. Platform development is the process of enabling a system to execute OpenCPI applications. It requires both Application and Component development skills as well as more specialized knowledge of system interconnect architecture and OpenCPI framework interfaces.

What is included with OpenCPI?

All of the following are included in an OpenCPI release:

- RPMs for installation
- Integrated development environment(IDE)

- Projects with example components and reference applications
- Documentation including installation guides, user guides, and component data sheets

How can I learn more about OpenCPI?

There are a number of resources for learning more about the OpenCPI framework. It is recommended to start with the Installation and Introductory Resources, and the other resources can be used depending on skill set and type of development being performed.

Installation and Introductory Resources

- *Acronyms and Definitions*
- *Installation Guide*
- *Getting Started Guide*
- *OpenCPI Application Development*
- *OpenCPI Component Development*
- *IDE Guide*

In addition to these documents, there are platform specific Getting Started Guides which can be used to begin developing on existing OpenCPI platforms.

FPGA Component Development Resources

These resources are related specifically to FPGA development in the framework.

- *FPGA Vendor Tools Installation Guide*
- *OpenCPI HDL Development*

GPP Component Development Resources

These resources are related specifically to GPP development in the framework.

- *OpenCPI RCC Development*

Platform Development Resources

These resources are related specifically to platform development in the framework.

- *OpenCPI Platform Development*

Support Resources

In addition to these documents, there is more specialized documentation included with the OpenCPI release. Please refer to the documentation package for further information. Additionally, questions and further support for the framework can be obtained via email at discuss@lists.opencpi.org.

OpenCPI Application and Component Developer Training

OpenCPI Application and Component Developer Training Materials are available which include labs and lecture slides. The training reviews how to create an OpenCPI project, create GPP components in C++ and FPGA components in VHDL, and how to develop and execute applications on the Epiq Matchstiq Z1 SDR all using the ANGRYVIPER IDE. It is intended to be self-guided, but instructor led training is offered occasionally on request.