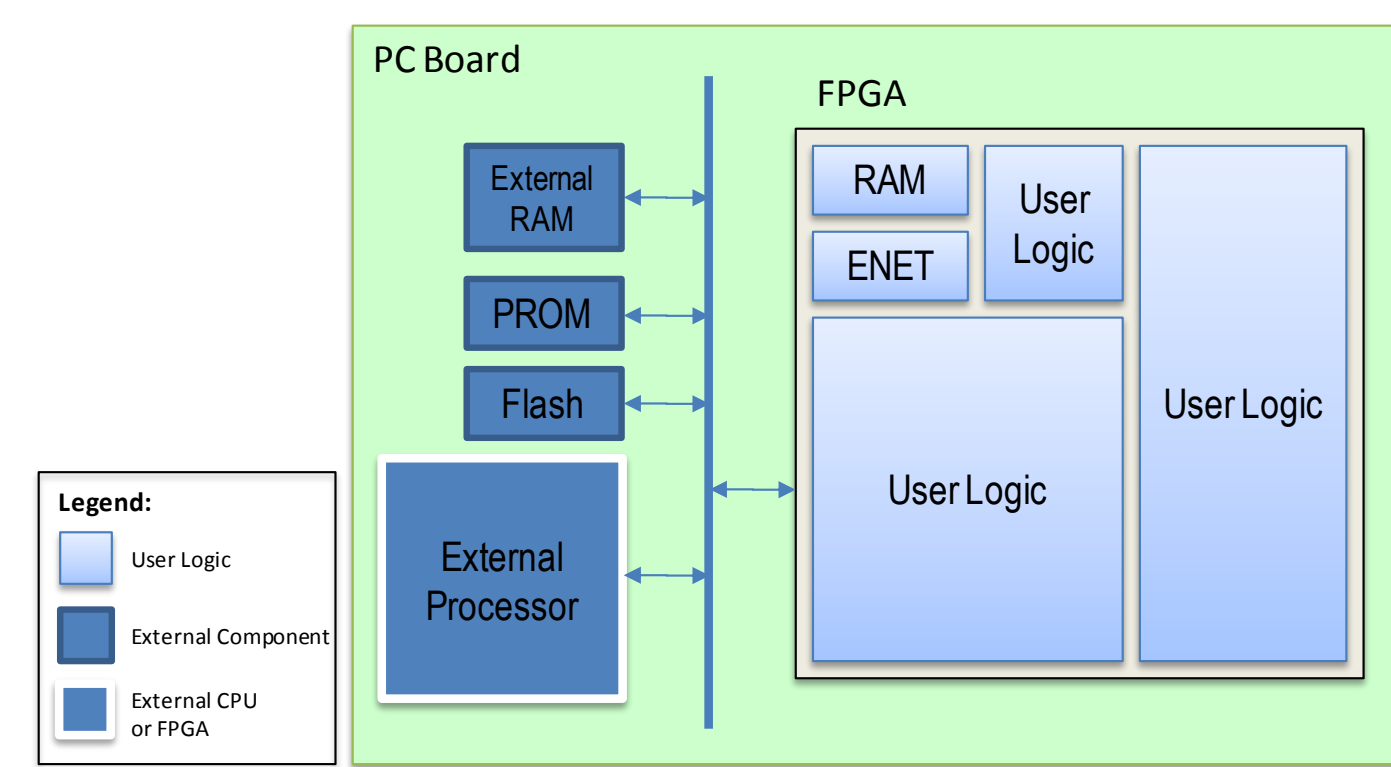


1. Project Description

Dynamic Partial Reconfiguration (PR) of Field Programmable Gate Arrays (FPGAs) is a technology that enables the development of embedded systems and allows hot swappable logic on the FPGA fabric. This means that hardware logic can be swapped in and out on-the-fly. Because PR is still relatively new, taking advantage of this technology requires working with immature tools. This project is aimed at developing FPGA tools – along with Linux – that take advantage of partial reconfiguration and make it easier to dynamically manage FPGA resources.

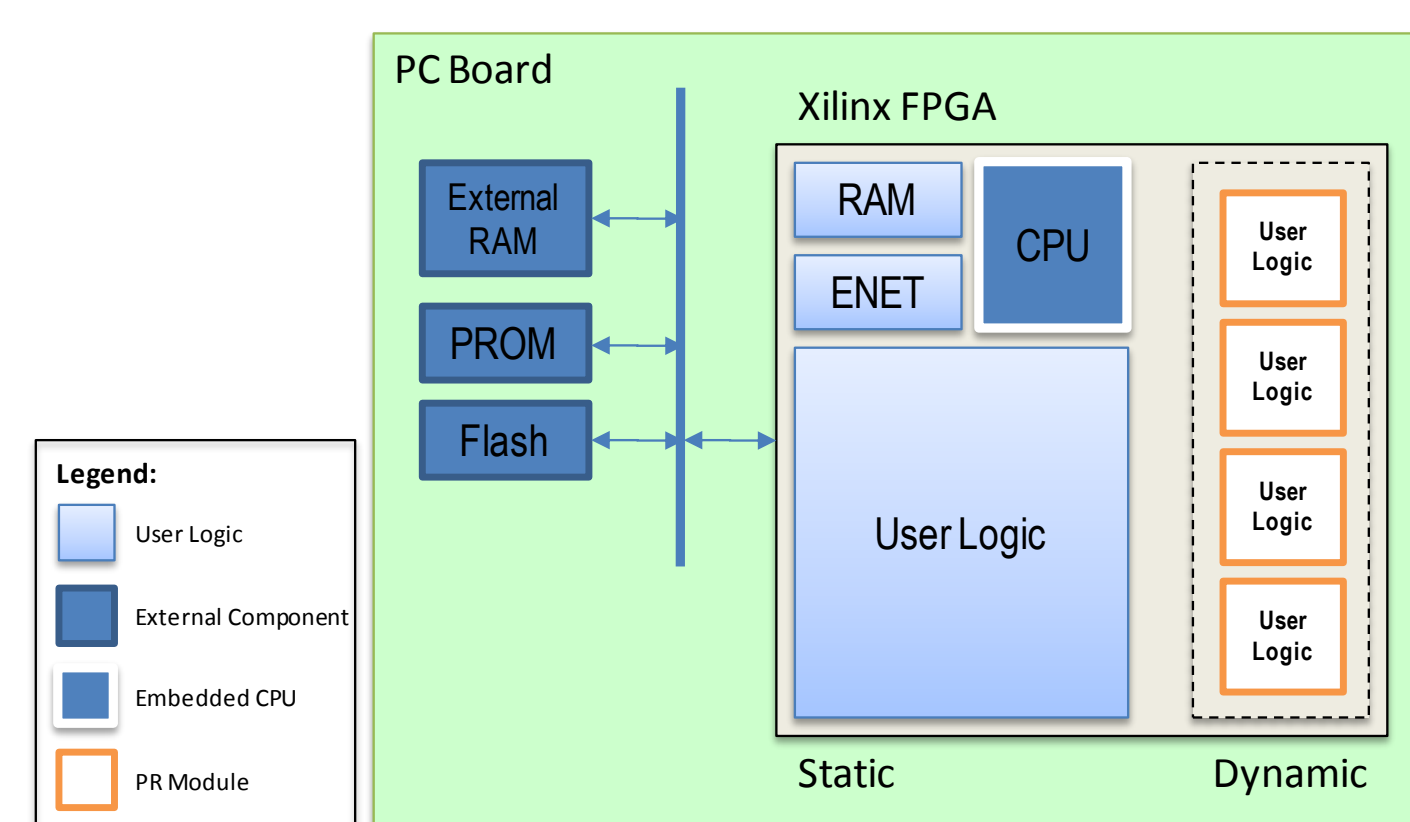
2. Partial Reconfigurable FPGAs and the Path Forward

FPGA without PR and External Support (Past)



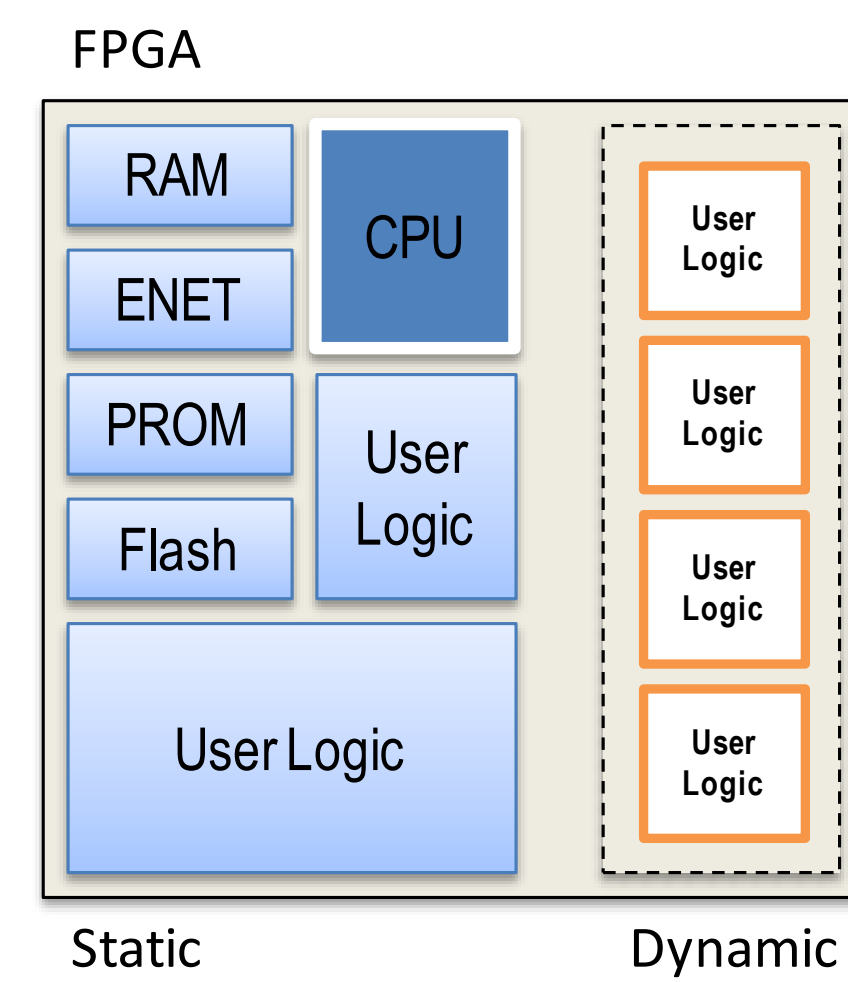
Hardware cores are synthesized and loaded onto an FPGA. Management of the FPGA and its cores are done via external on-board (off FPGA) components.

FPGA with PR and External Support (Present)



Hardware cores are synthesized and loaded onto both static and dynamic parts of the FPGA. Management of the FPGA is performed by external on-board components, whereas the FPGA's dynamic cores are managed by the static part of the FPGA.

FPGA with PR and No External Support (Future)

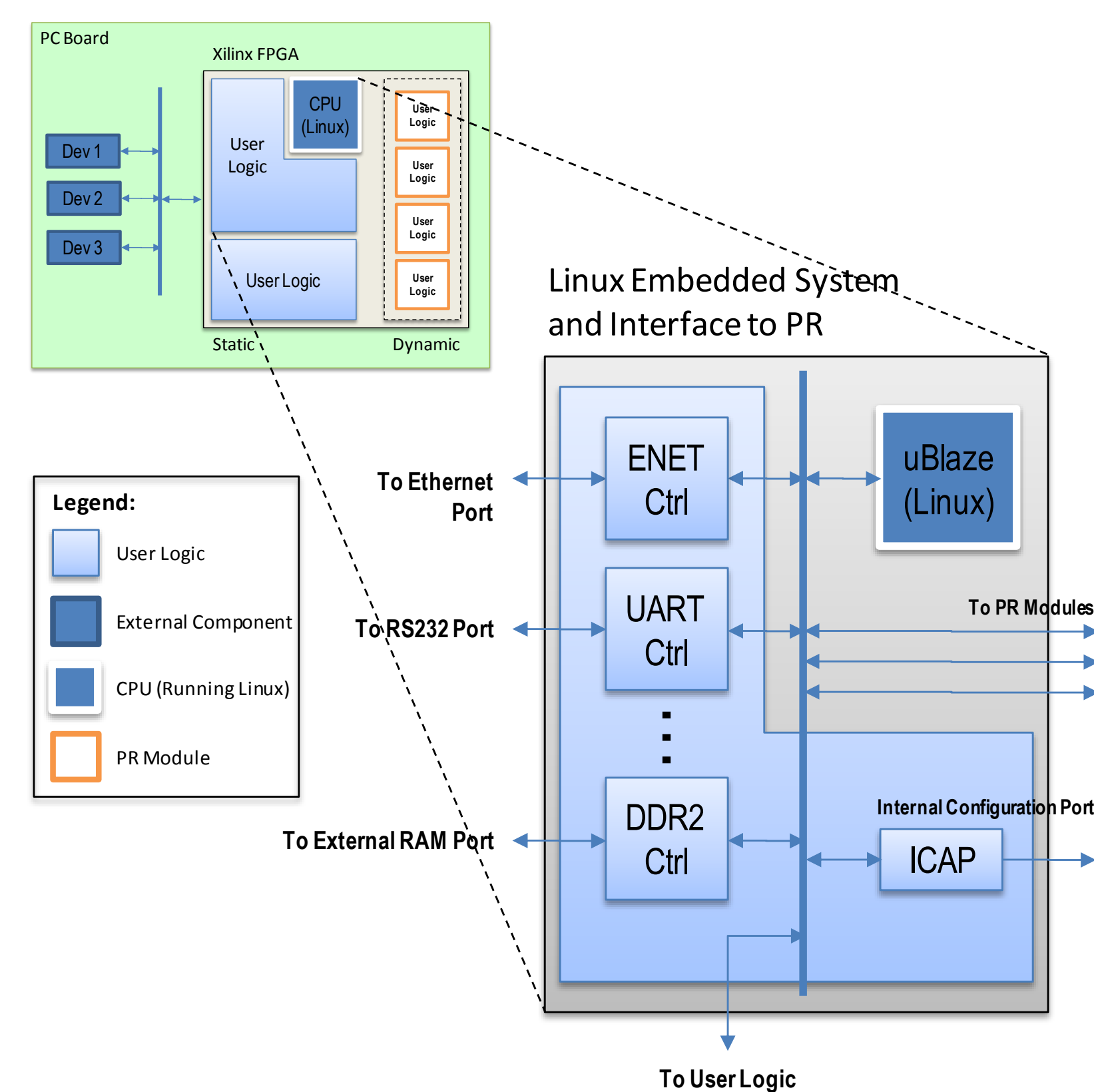


All management logic and user logic reside entirely on the FPGA fabric creating the ultimate solution of a System-on-a-Chip (SoC).

3. How Linux is Used on FPGAs Today; Data Processing

Linux on FPGA

Linux is used today on FPGAs to facilitate the communication and services required between the individual FPGA's hardware resources and its external environment.



Limitation of Linux

Native Linux on FPGAs is set up only as a communications gateway. There is no facility to manage PR regions, i.e., deciding, scheduling and maintaining which hardware resources should be run.

4. How Linux on FPGAs Can be Used; Intelligent Control

Making Linux Work Better with FPGAs

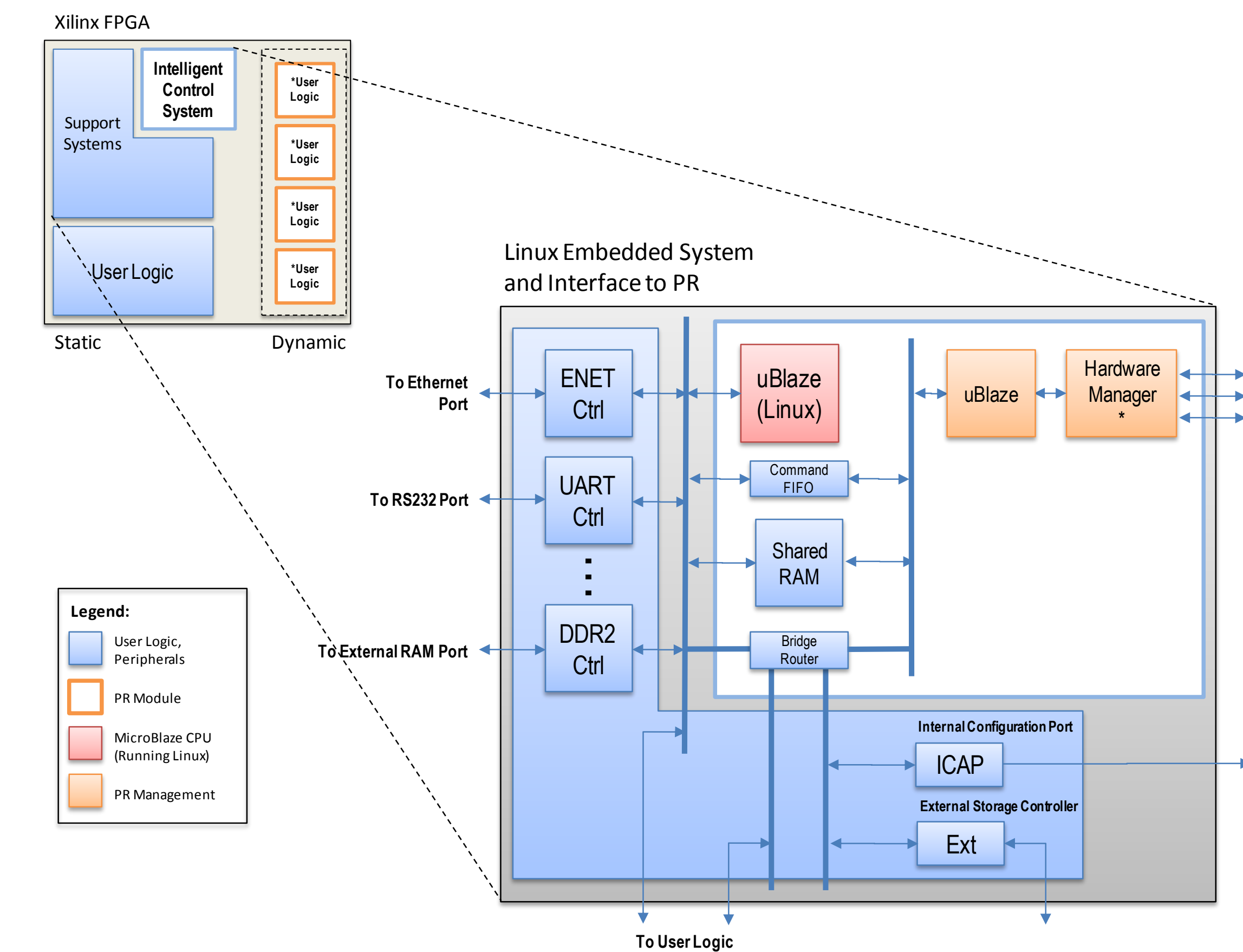
By including resources on the FPGA and within Linux, it is possible to manage and administer PR modules.

FPGA Intelligent Control System for PR (FICS)

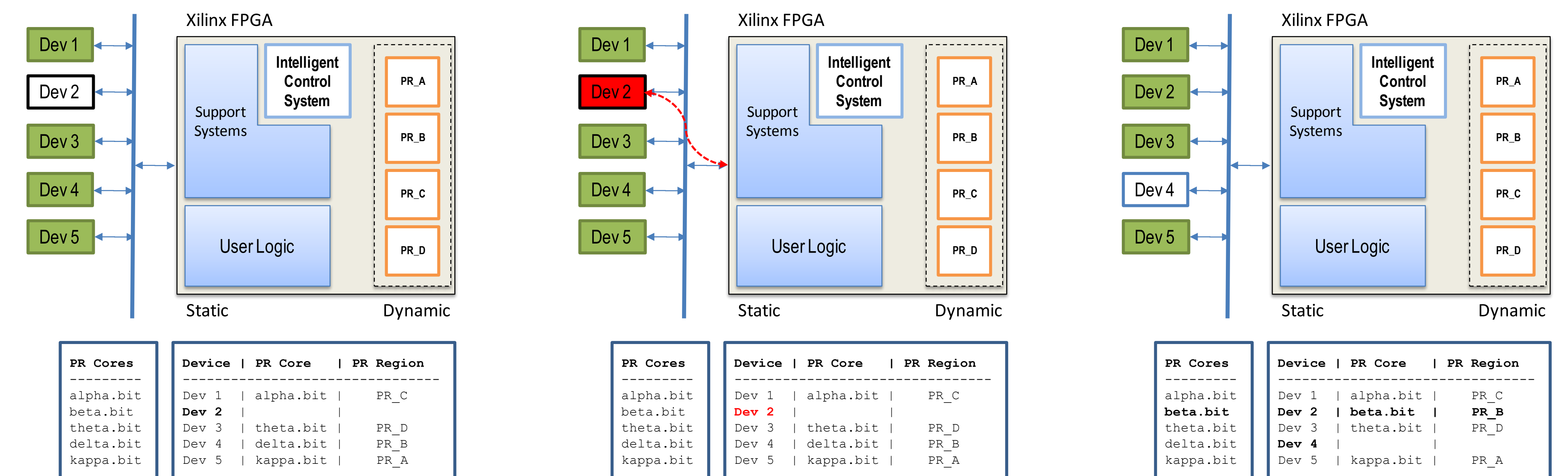
FICS is a set of static hardware cores that will enable interfacing of FPGA PR resources and Linux software resources.

Enhanced Linux Support for PR (LPR)

LPR is a collection of drivers, kernel modules, and libraries that will enable application software running on Linux to manage, administer, and interface with PR modules through FICS.



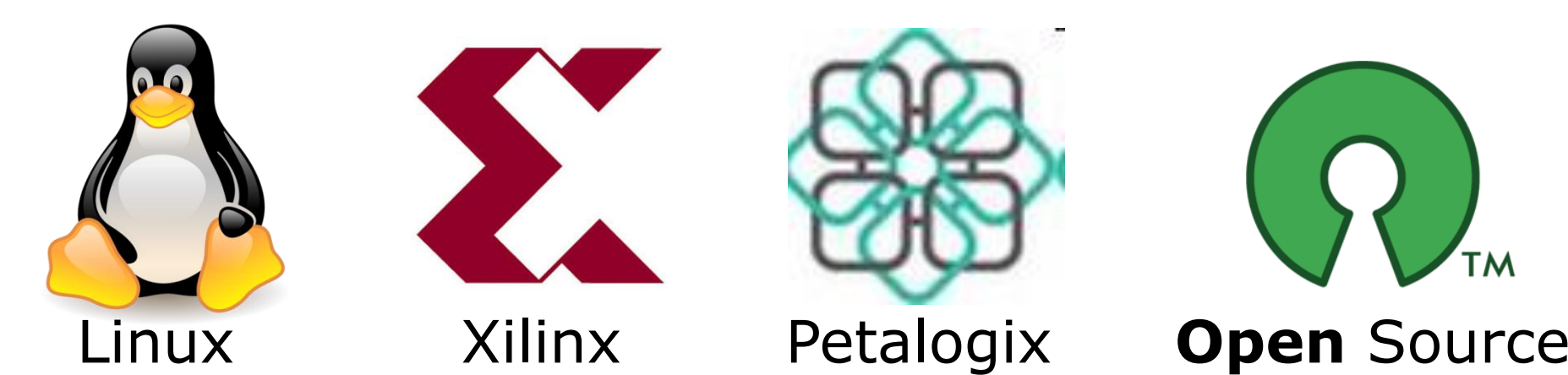
Hot Swapping Hardware Core Example



Devices 1, 3, 4, and 5 each have their hardware cores running in the PR domain. Device 2 does not require hardware resources.

Device 2 requests attention. The LPR package running on Linux must determine how to accommodate the request.

Device 2 has been allocated PR resource B, whereas Device 4's hardware core has been unloaded because it is not being used at this time. Thus, we can support more devices than PR modules.



5. Contacts

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