

# FPGA Region

## Overview

This document is meant to be a brief overview of the FPGA region API usage. A more conceptual look at regions can be found in the Device Tree binding document [1].

For the purposes of this API document, let's just say that a region associates an FPGA Manager and a bridge (or bridges) with a reprogrammable region of an FPGA or the whole FPGA. The API provides a way to register a region and to program a region.

Currently the only layer above `fpga-region.c` in the kernel is the Device Tree support (`of-fpga-region.c`) described in [1]. The DT support layer uses regions to program the FPGA and then DT to handle enumeration. The common region code is intended to be used by other schemes that have other ways of accomplishing enumeration after programming.

An `fpga-region` can be set up to know the following things:

- which FPGA manager to use to do the programming
- which bridges to disable before programming and enable afterwards.

Additional info needed to program the FPGA image is passed in the struct `fpga_image_info` including:

- pointers to the image as either a scatter-gather buffer, a contiguous buffer, or the name of firmware file
- flags indicating specifics such as whether the image is for partial reconfiguration.

## How to add a new FPGA region

An example of usage can be seen in the probe function of [2].

```
[1] (1,2) ../devicetree/bindings/fpga/fpga-region.txt  
[2]      ../../drivers/fpga/of-fpga-region.c
```

## API to add a new FPGA region

- `struct fpga_region` - The FPGA region struct
- `struct fpga_region_info` - Parameter structure for `fpga_region_register_full()`
- `fpga_region_register_full()` - Create and register an FPGA region using the `fpga_region_info` structure to provide the full flexibility of options
- `fpga_region_register()` - Create and register an FPGA region using standard arguments
- `fpga_region_unregister()` - Unregister an FPGA region

The FPGA region's probe function will need to get a reference to the FPGA Manager it will be using to do the programming. This usually would happen during the region's probe function.

- `fpga_mgr_get()` - Get a reference to an FPGA manager, raise ref count
- `of_fpga_mgr_get()` - Get a reference to an FPGA manager, raise ref count, given a device node.
- `fpga_mgr_put()` - Put an FPGA manager

The FPGA region will need to specify which bridges to control while programming the FPGA. The region driver can build a list of bridges during probe time (`(c:expr: fpga_region->bridge_list)`) or it can have a function that creates the list of bridges to program just before programming (`(c:expr: fpga_region->get_bridges)`). The FPGA bridge framework supplies the following APIs to handle building or tearing down that list.

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- `fpga_bridge_get_to_list()` - Get a ref of an FPGA bridge, add it to a list
- `of_fpga_bridge_get_to_list()` - Get a ref of an FPGA bridge, add it to a list, given a device node
- `fpga_bridges_put()` - Given a list of bridges, put them

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```
.. kernel-doc:: include/linux/fpga/fpga-region.h
   :functions: fpga_region
```

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```
.. kernel-doc:: include/linux/fpga/fpga-region.h
   :functions: fpga_region_info
```

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```
.. kernel-doc:: drivers/fpga/fpga-region.c
   :functions: fpga_region_register_full
```

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```
.. kernel-doc:: drivers/fpga/fpga-region.c
   :functions: fpga_region_register
```

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```
.. kernel-doc:: drivers/fpga/fpga-region.c
   :functions: fpga_region_unregister
```

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```
.. kernel-doc:: drivers/fpga/fpga-mgr.c
   :functions: fpga_mgr_get
```

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```
.. kernel-doc:: drivers/fpga/fpga-mgr.c
   :functions: of_fpga_mgr_get
```

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```
.. kernel-doc:: drivers/fpga/fpga-mgr.c
   :functions: fpga_mgr_put
```

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```
.. kernel-doc:: drivers/fpga/fpga-bridge.c
   :functions: fpga_bridge_get_to_list
```

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```
.. kernel-doc:: drivers/fpga/fpga-bridge.c
   :functions: of_fpga_bridge_get_to_list
```

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```
.. kernel-doc:: drivers/fpga/fpga-bridge.c
   :functions: fpga_bridges_put
```