Hands-on Tutorial

RapidWright: Unleashing the Full Power of FPGA Technology with Domain-Specific Tooling

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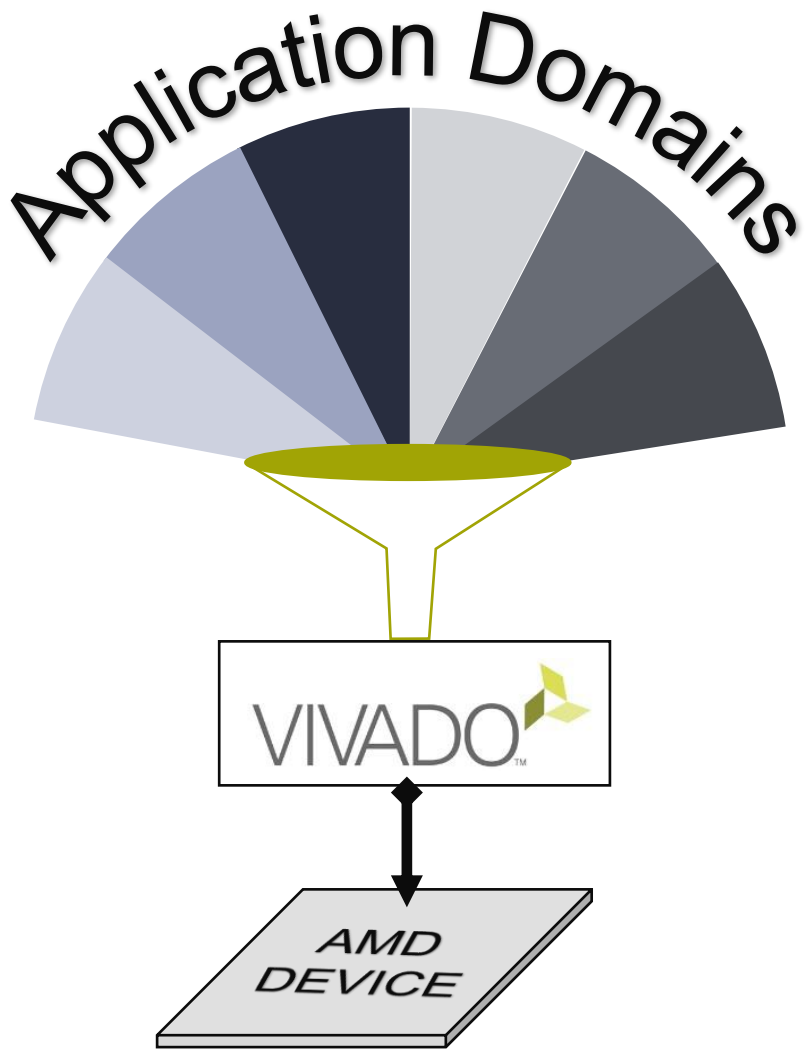
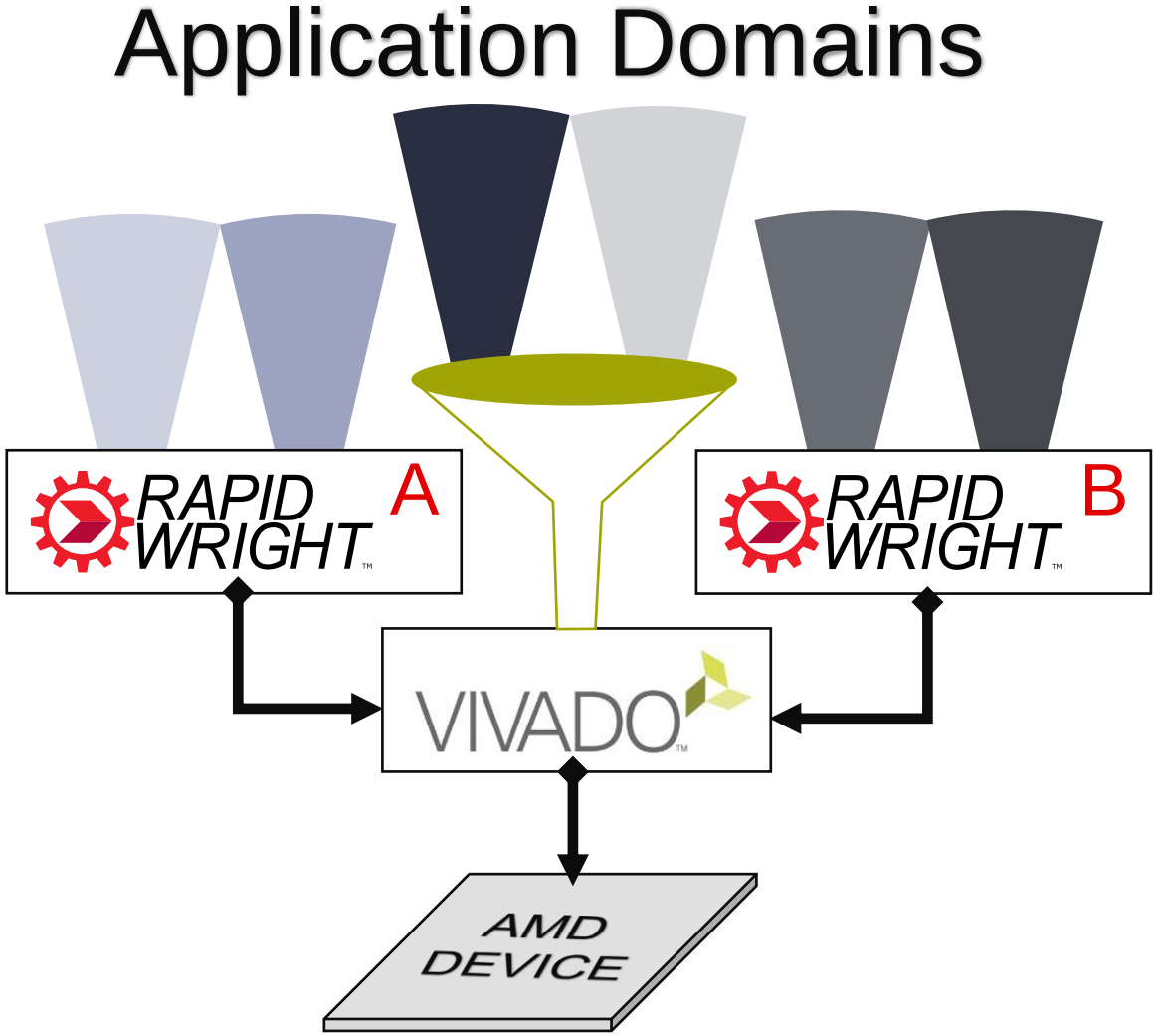
Domain Specific Era Needs Domain Specific Backends

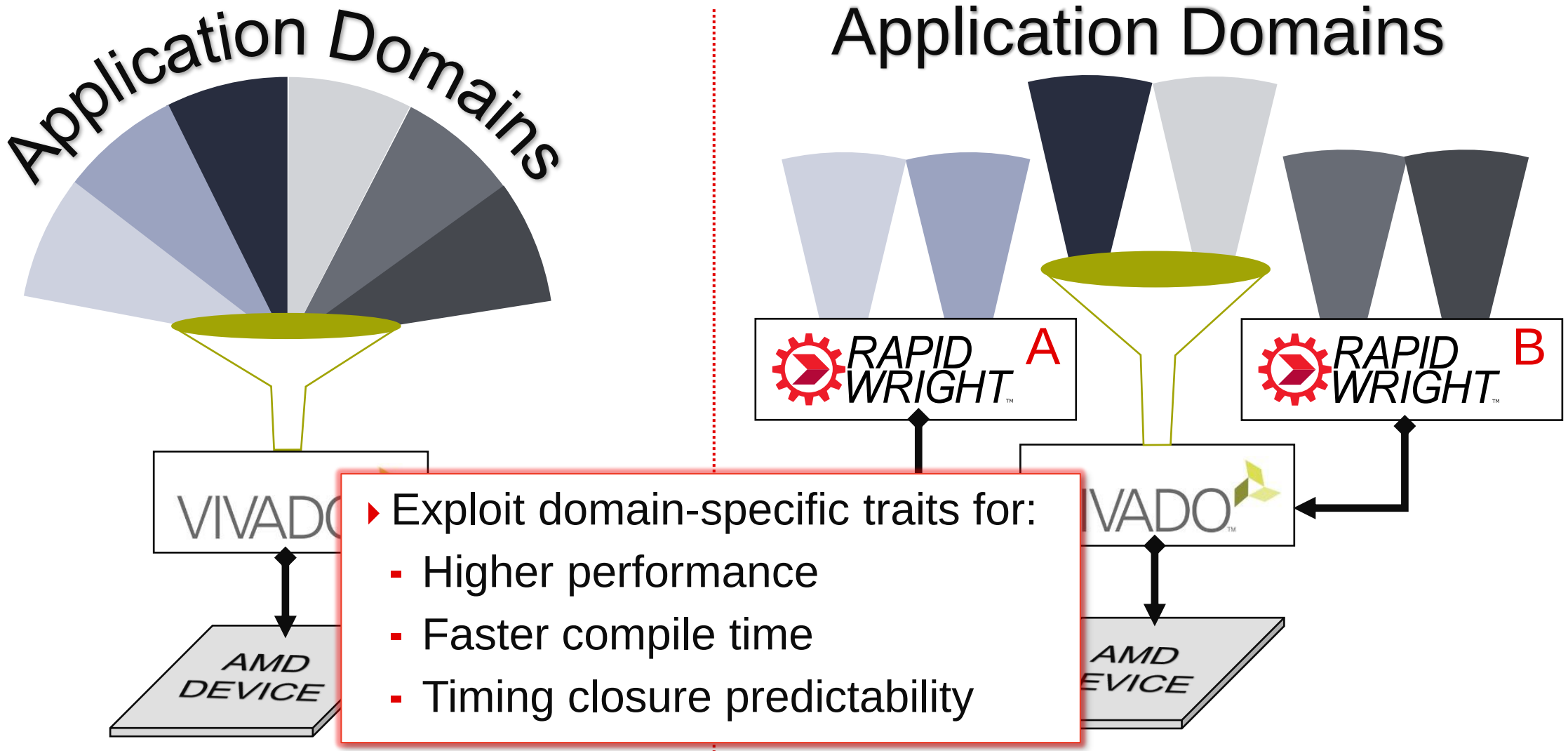


Vivado must ***generalize*** solutions



RapidWright can ***specialize***

Domain Specific Era Needs Domain Specific Backends



- Exploit domain-specific traits for:
  - Higher performance
  - Faster compile time
  - Timing closure predictability

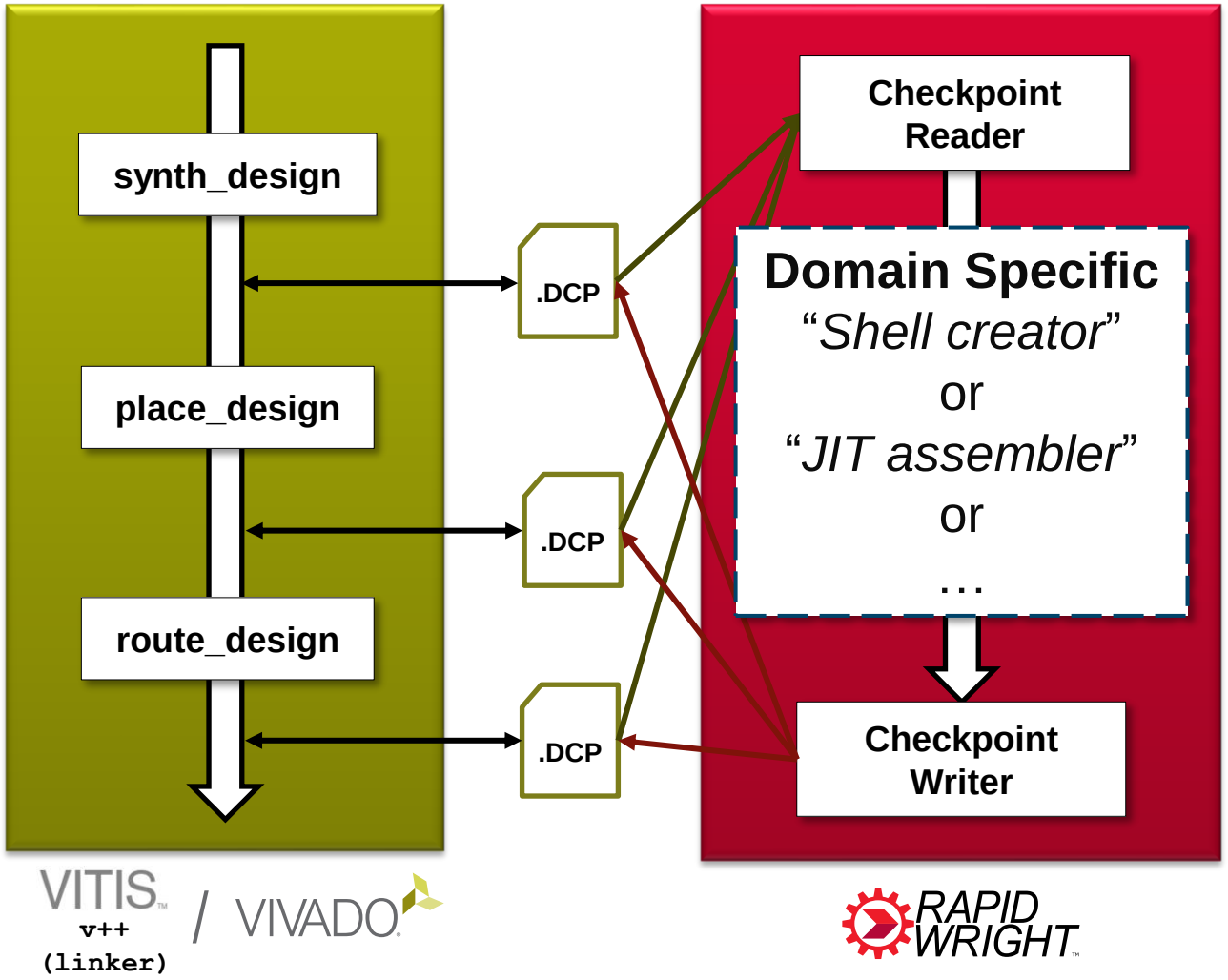
Vivado must ***generalize*** solutions

RapidWright can ***specialize***

What is RapidWright?

```
pip install rapidwright
```

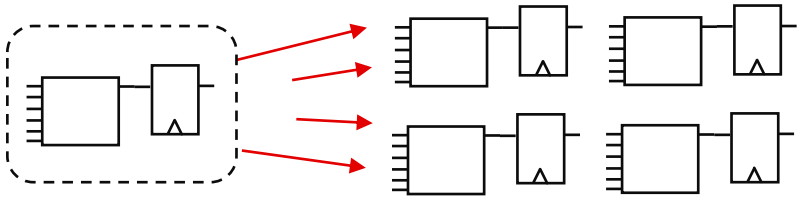
- Companion framework for Vivado
  - Fast, light-weight, open source
  - Java code, Python scripting
  - All public devices supported
- Enables targeted solutions
  - Reuse & relocate pre-implemented modules
  - Create shells & overlays
- Power user ecosystem
  - Customized bottom-up flows
  - Rapid prototyping of CAD concepts



DCP = Design Checkpoint (Netlist, Placement & Routing Data)

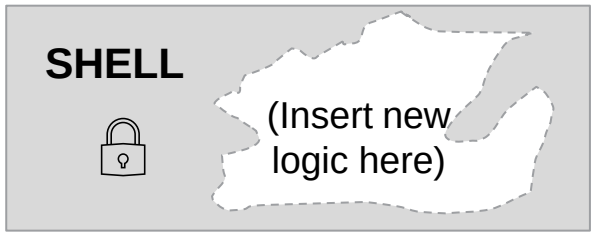
RapidWright Differentiators

REUSE



Copy & Paste

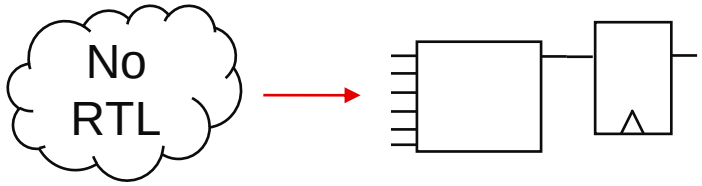
Replicate and relocate placed & routed circuits



Reuse Timing Closure

Create non-standard shells to preserve difficult-to-close circuits

SPEED



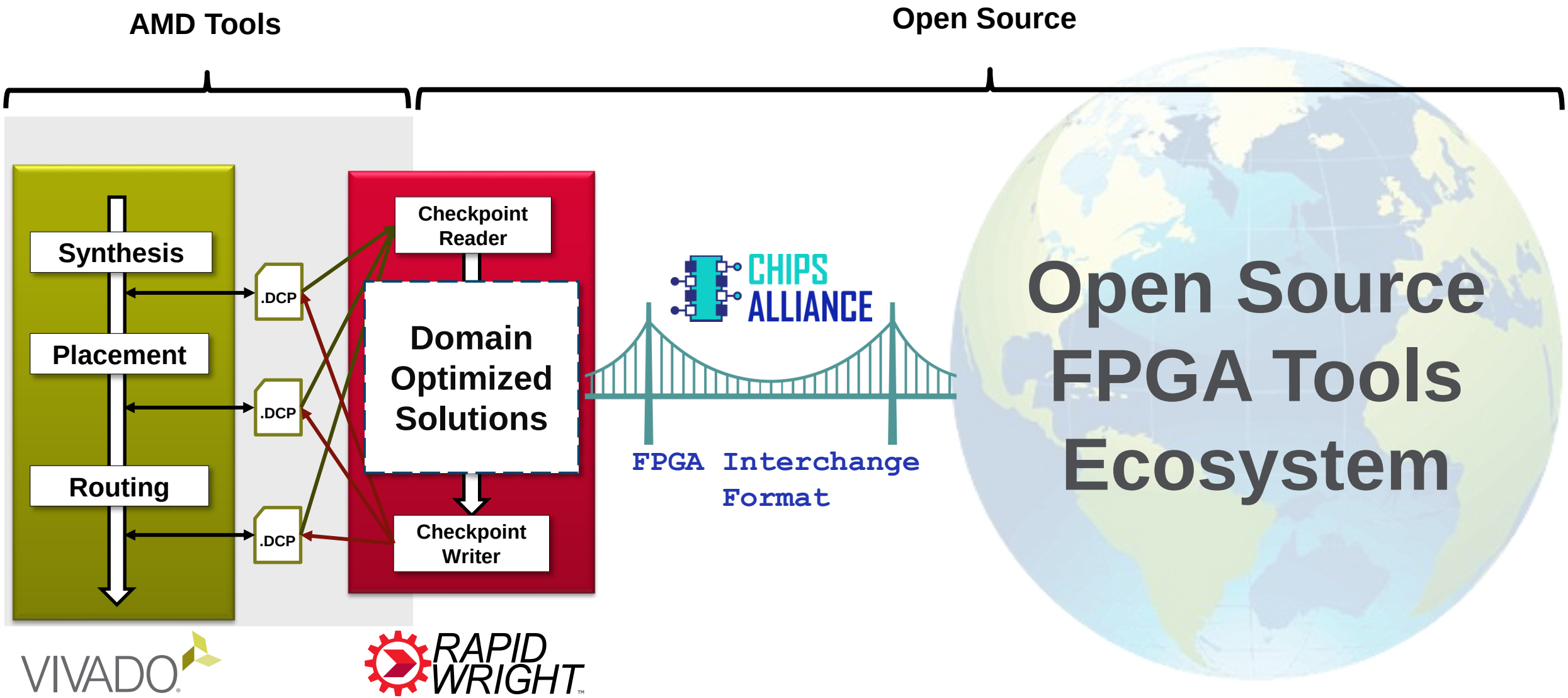
Circuits in Seconds

Generate well-formed P&R circuits from scratch in seconds

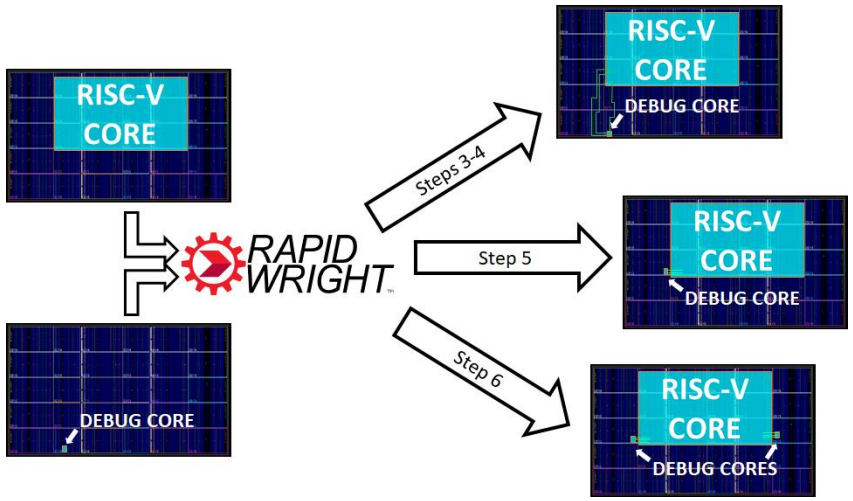
Greater Agility

Explore new P&R algorithms, faster design & ECO changes

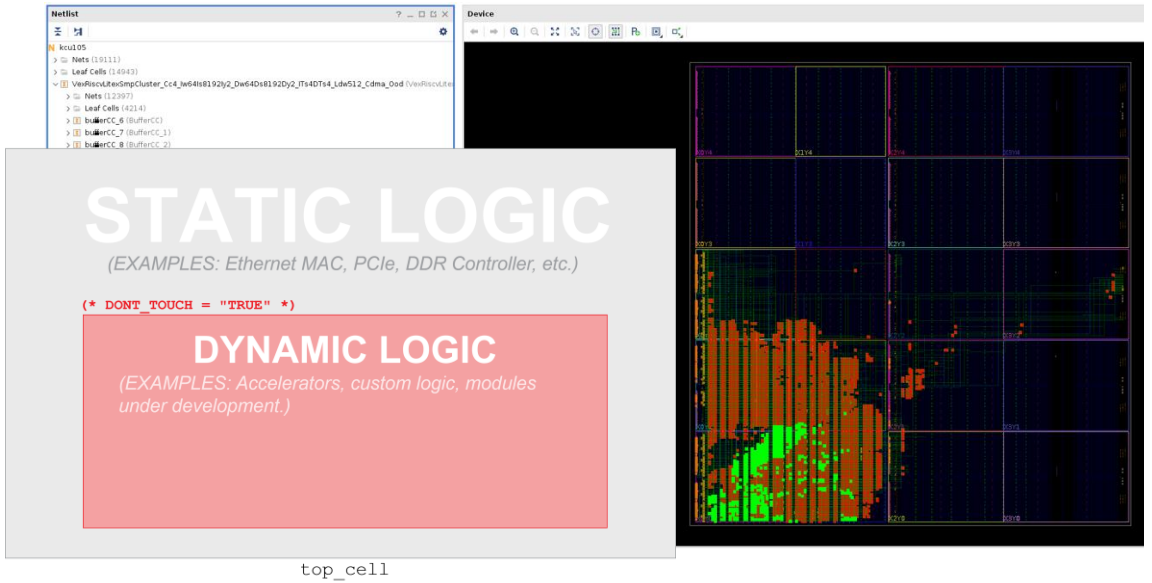
Backend Open Source & Open Standards Efforts



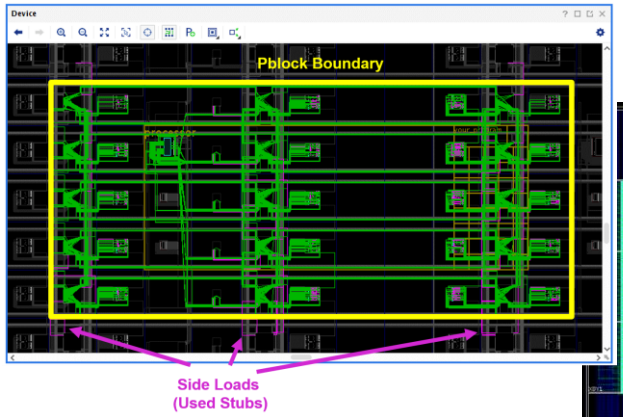
Inserting and Routing a Debug Core As An ECO



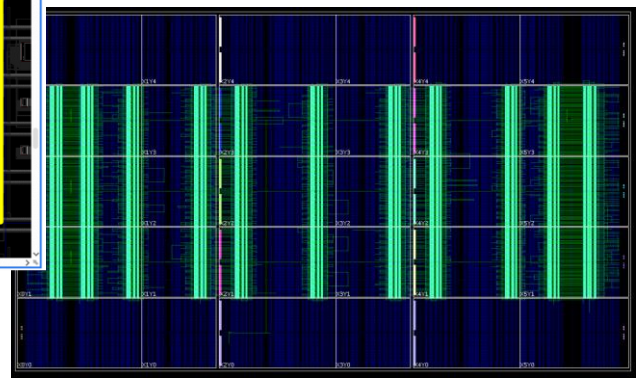
Reuse Timing-closed Logic As A Shell



Pre-implemented Modules (Part I & II): PicoBlaze Array

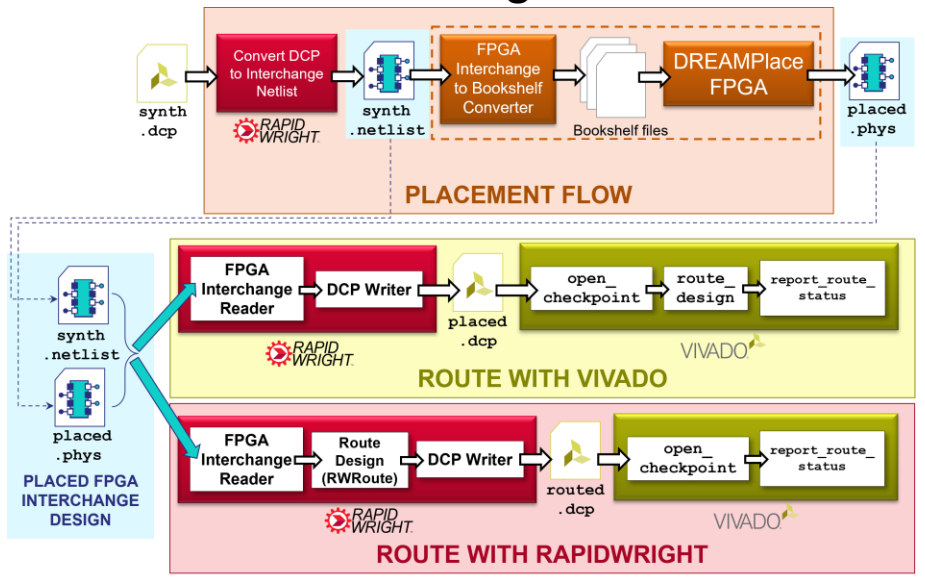


Pre-implemented PicoBlaze



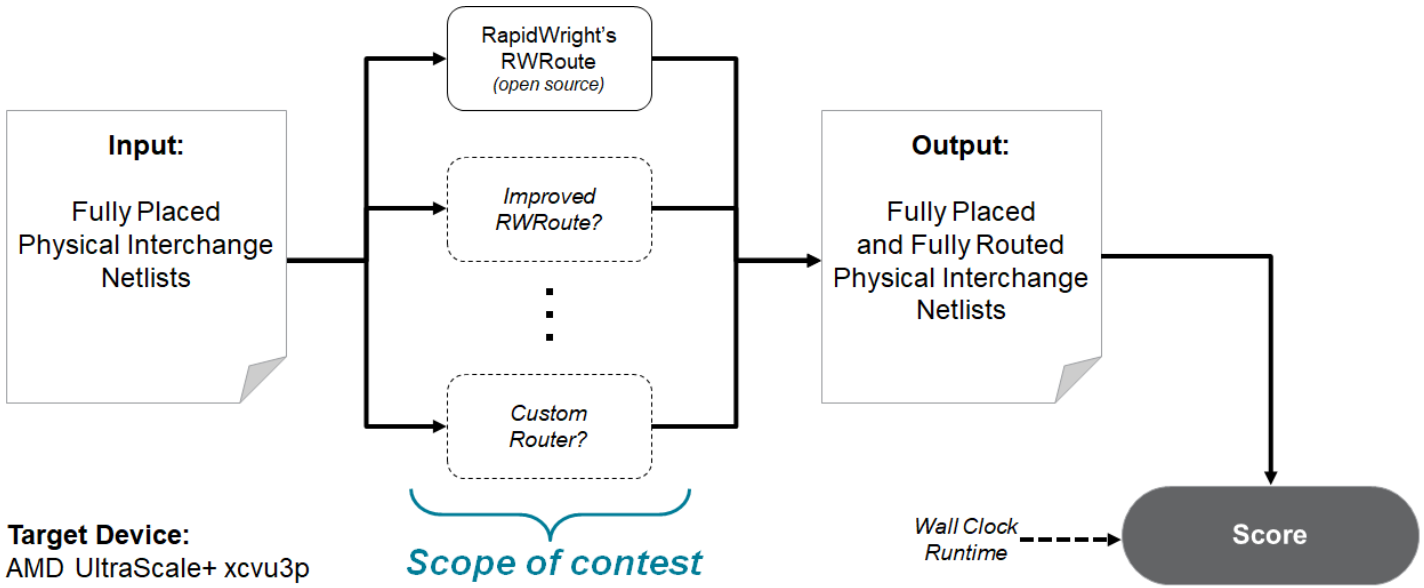
396 Replicated PicoBlaze Array

Use DREAMPlaceFPGA to Place a Netlist via FPGA Interchange Format



ISFPGA'24 Runtime-first FPGA Interchange Routing Contest

How fast can we route an FPGA if we pull out all the stops?



Built on:

CHIPS ALLIANCE

FPGA Interchange Format

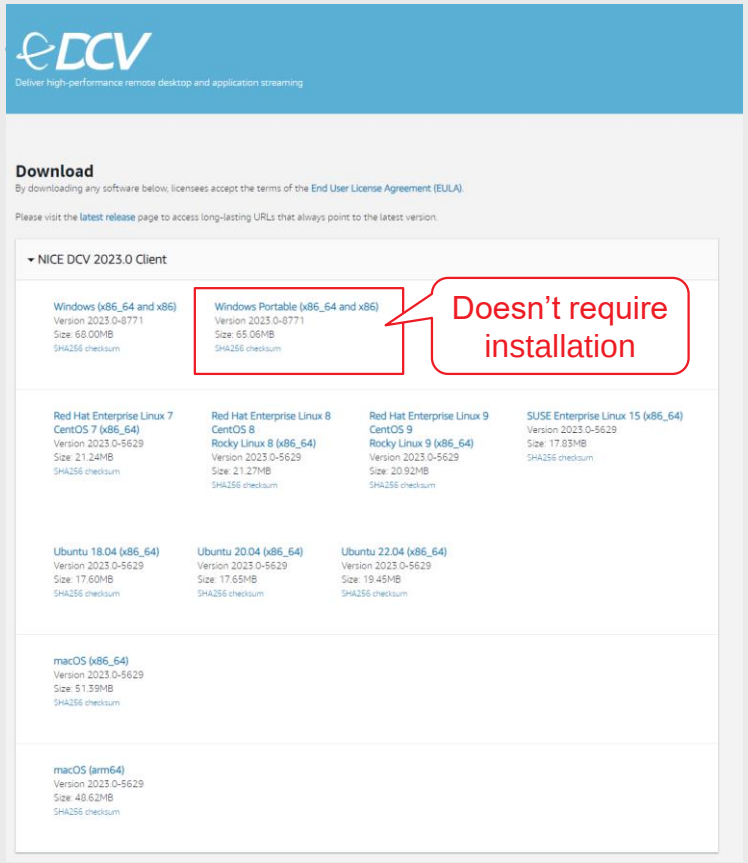
Rank	Prize (USD)
1st	$2500
2nd	$1500
3rd	$1000
4th & 5th	$500

Registration open until Nov 20:

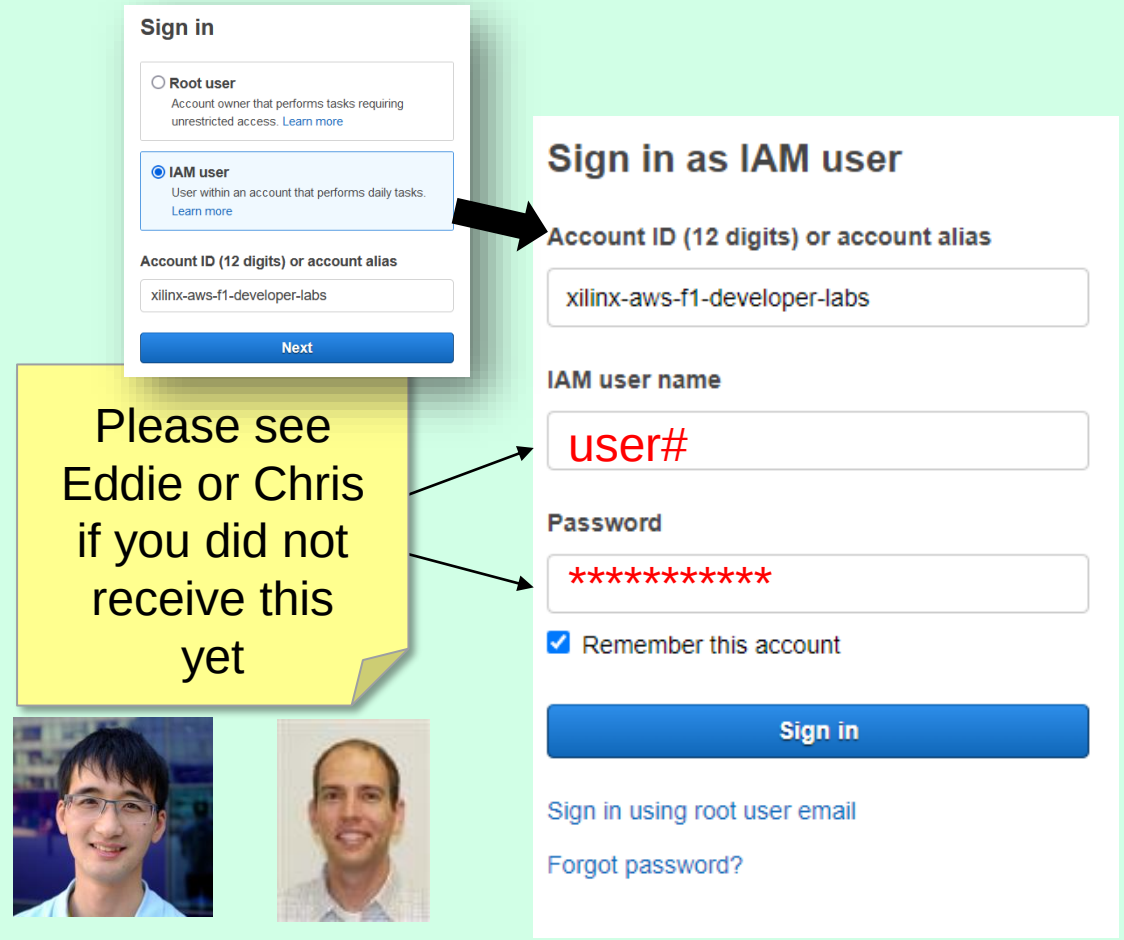
https://xilinx.github.io/fpga24_routing_contest

1 & 2: Install Client & Log in to AWS Console

1. Download & extract/install NICE Desktop Cloud Visualization Client (to access AWS instance) https://download.nice-dcv.com/

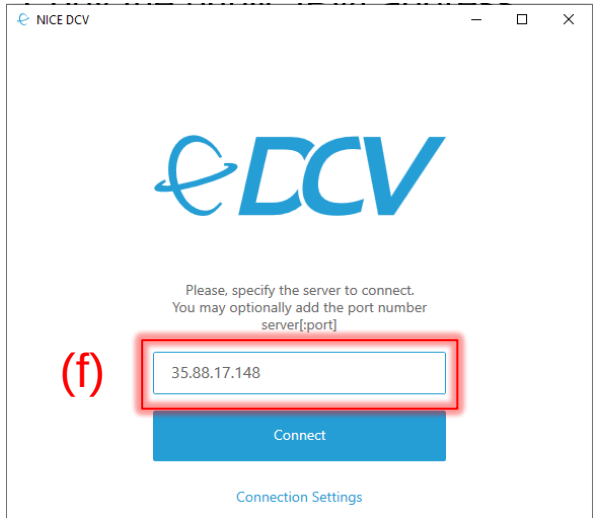


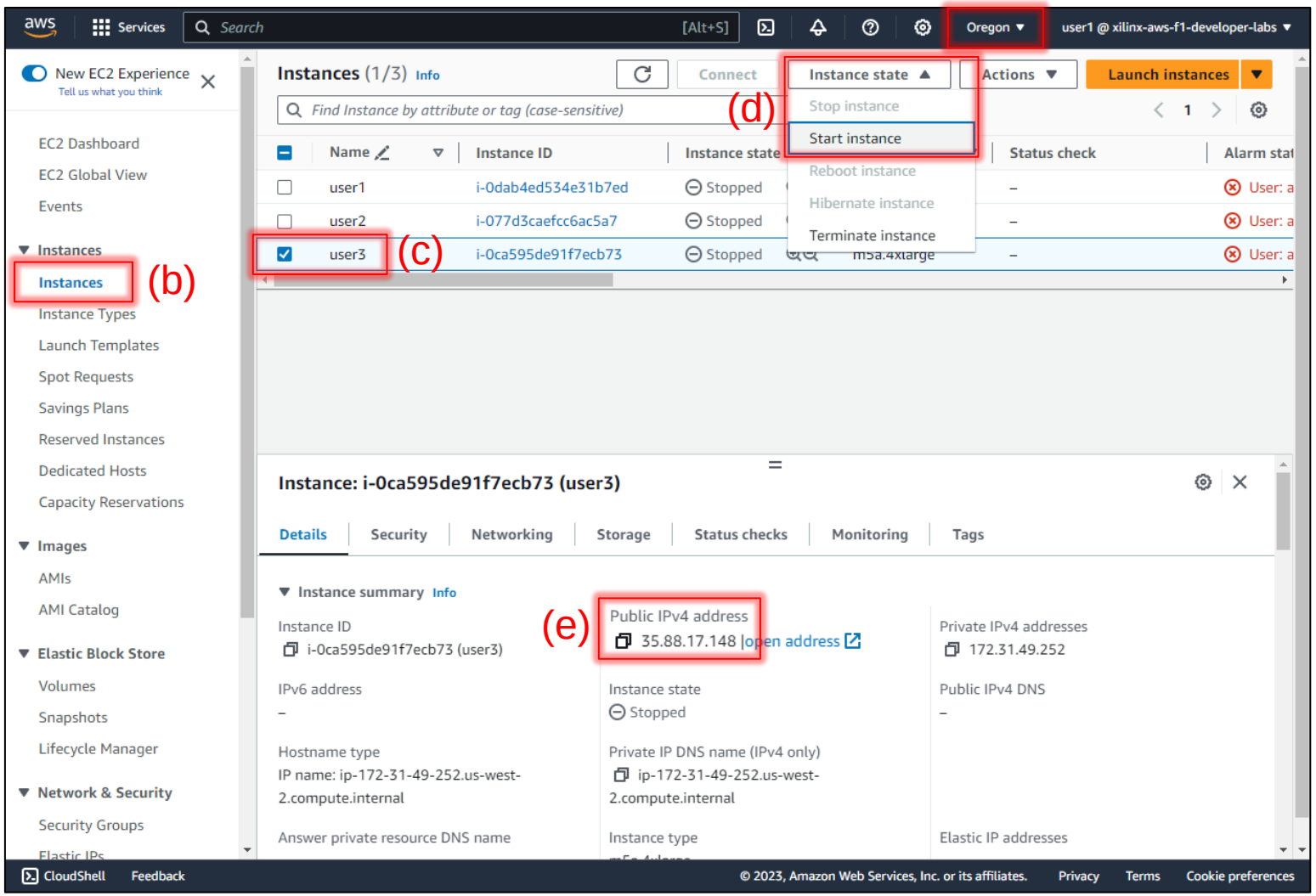
2. Log in to the AWS EC2 Console https://console.aws.amazon.com/ec2/



3. Start AWS EC2 Instance and Connect

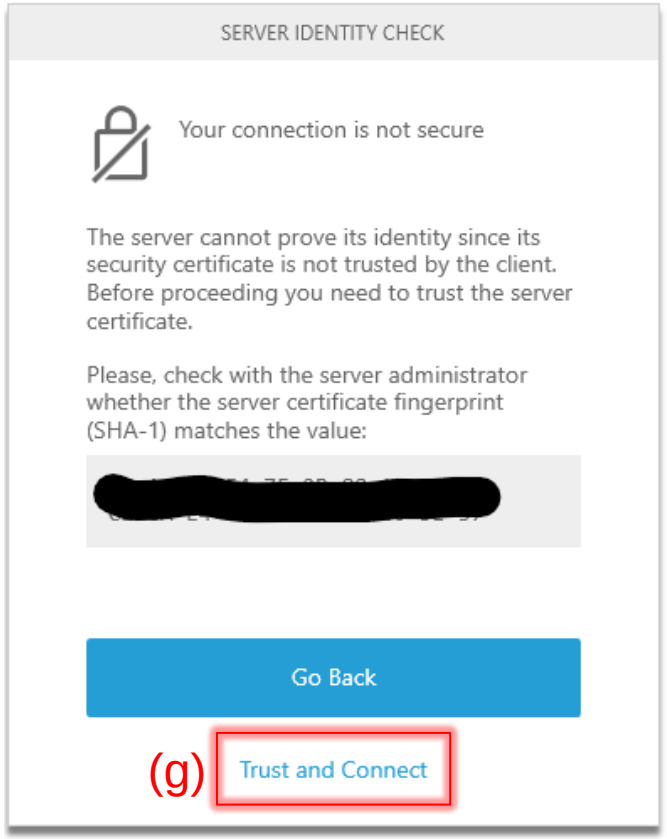
a) Ensure “Oregon” region
b) Click on “Instances”
c) Select your named user instance (e.g., ‘user3’)
d) Select “Start instance” from the “Instance state” menu
e) Copy the public IPv4 address (click the ⧉ icon)
f) Open NICE DCV Client, Paste IP address in window, click Connect

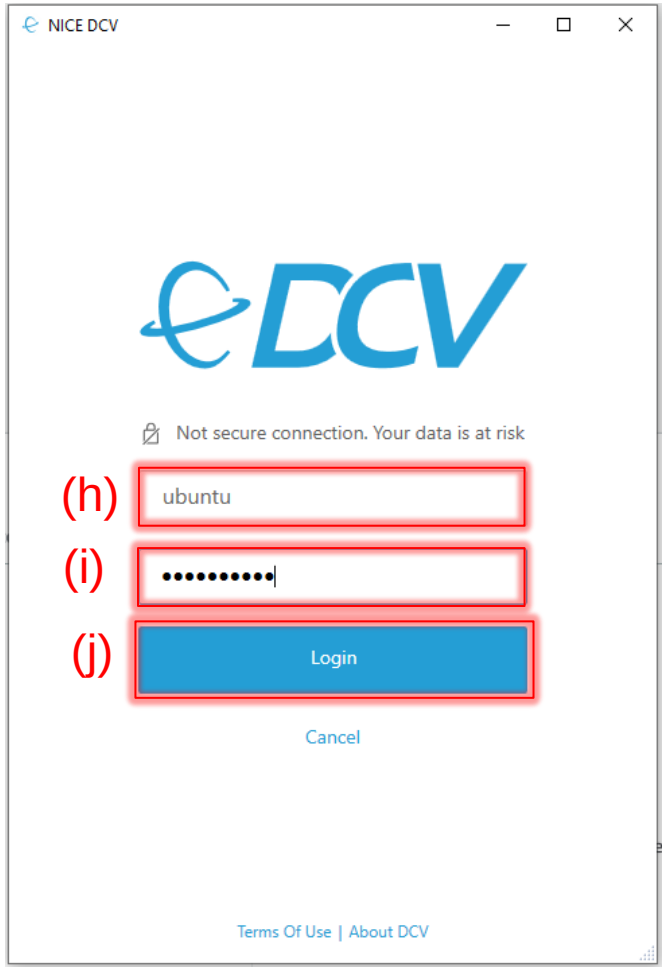




3. Log Into NICE DCV (cont.)

g) Choose “Trust and Connect”
h) Enter username: “ubuntu”
i) Enter Password: <same as AWS Console>
j) Click “Login”
k) Click on to launch the Tutorial Page





RapidWright ICCAD 2023 Hands-on Tutorial

Title: RapidWright: Unleashing the Full Power of FPGA Technology with Domain-Specific Tooling
Organizers: Chris Lavin and Eddie Hung
Where: Artisan Room, Hyatt Regency San Francisco Downtown SOMA, ICCAD 2023
When: Wednesday, November 1st, 2023, 11:00am PDT

- 11:00am - 11:05am : Machine Allocation
- 11:05am - 11:15am : Introduction and Overview
- 11:15am - 1:00pm : Hands-on, self-guided tutorials

Featured Tutorial Segments	Time	Description
Reuse Timing-closed Logic As A Shell	30 mins	Create a pre-implemented shell from an existing design without pblocks
Using DREAMPlaceFPGA to Place	25 mins	Use a 3rd party placer with the FPGA Interchange Format
Polynomial Generator	15 mins	Create placed and routed circuits from scratch in seconds
ECO Debug Core Insertion	35 mins	Add debug logic without changing existing placement and routing

Additional Tutorial Segments	Time	Description
Hello, World	5 mins	Intro to RapidWright in Jupyter Notebooks
Create Netlist from Scratch	10 mins	How to build a netlist from scratch
Pre-implemented Modules: Part I	15 mins	How to create a pre-implemented module
Pre-implemented Modules: Part II	15 mins	Use & relocate pre-implemented modules
SAT Router	15 mins	Use SAT to solve hard routing congestion
Create and Use an SLR Bridge	20 mins	Combine Vivado & RapidWright circuits
Basic Routing	20 mins	How to build a basic router in RapidWright

= Jupyter Notebook Tutorial

URL:
rapidwright.io/docs/ICCAD23_Tutorial.html

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