



Develop & deploy accelerated applications at global scale on Amazon EC2 F1 Instances

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March 24, 2021

**AWS IS BUILT TO
SUPPORT VIRTUALLY
EVERY WORKLOAD**



World-class performance, security, and innovation



Broadest and deepest platform choice



Tools for managing cost and complexity



Enabling enterprise applications



Bringing the cloud closer to you

Amazon EC2: Broadest and deepest platform choice

CATEGORIES

General purpose
Burstable
Compute intensive
Memory intensive
Storage (High I/O)
Dense storage
GPU compute
Graphics intensive



CAPABILITIES

Choice of processor
(AWS, Intel, AMD)
Fast processors
(up to 4.0 GHz)
High memory footprint
(up to 12 TiB)
Instance storage
(HDD and SSD)
Accelerated computing
(GPUs and FPGA)
Networking
(up to 100 Gbps)
Bare Metal
Size
(Nano to 32xlarge)



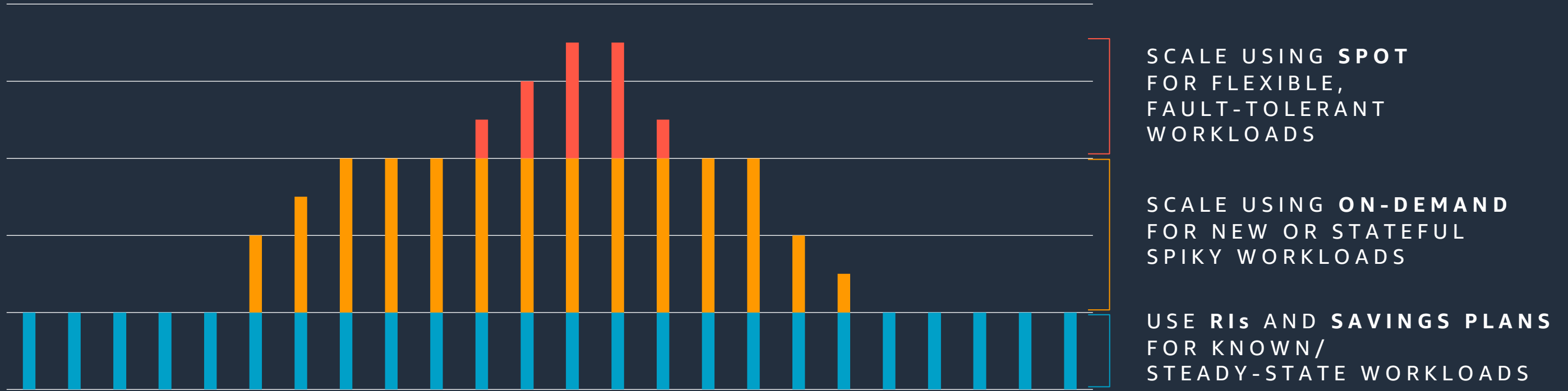
OPTIONS

Amazon EBS
Amazon Elastic Inference

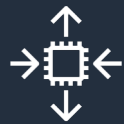


MORE THAN
300+
INSTANCE TYPES
for virtually every
workload and
business need

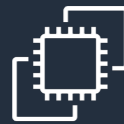
Simplifying capacity and cost optimization



AWS SERVICES MAKE THIS EASY AND EFFICIENT



Amazon EC2
Auto Scaling



EC2 Fleet



Amazon Elastic
Container Service
(Amazon ECS)



Amazon Elastic
Kubernetes Service
(Amazon EKS)



AWS
Thinkbox



Amazon
EMR



AWS
CloudFormation

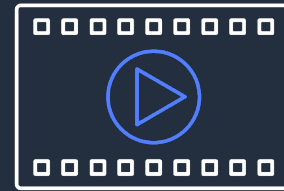


AWS Batch

AWS FPGA customer use cases



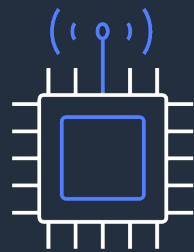
HPC



**Video and
Imaging**



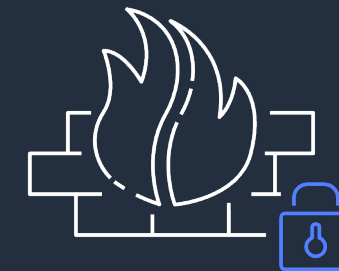
**Database and
Analytics**



**ASIC
Prototyping**



Fintech



Security

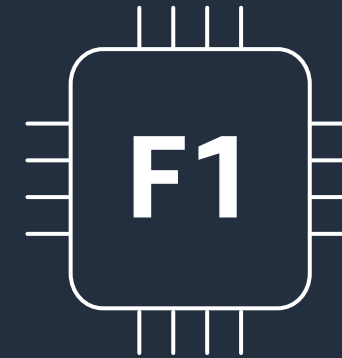
“We have been able to use the FPGA-based F1 instances to greatly speed up the process of whole genome sequencing. As a result, what used to take us 20 hours of compute time can now be achieved in only 3 hours.”

–Professor Dr. Torsten Haferlach, Chief Executive Officer, Munich Leukemia Lab

“Using Amazon EC2 F1 instances, Valtix can provide high performance and low latency SSL encryption/decryption and deep packet inspection (DPI) for threat detection.”

– Vijay Chander, CTO and Co-founder, Valtix

Amazon EC2 F1 Instances



- Xilinx 16nm UltraScale+ VU9P FPGA – Up to 8 FPGAs per instance
 - Each FPGA includes 64 GiB DDR4 + ECC, 512bit wide channel
 - Each FPGA with PCIe Gen3 x16 connectivity
 - 2.5 million logic elements and 6,800 Digital Signal Processing engines
- Three different instance sizes with up to 64 vCPUs per instance
- Up to 1 TB of RAM
- Local NVMe SSD storage, data automatically encrypted at-rest

Model	FPGA	vCPU	Memory (GiB)	Instance storage (GiB)	Networking performance	EBS bandwidth
f1.2xlarge	1	8	122	1 x 470 NVMe SSD	Up to 10,000 Mbps	1,700 Mbps
f1.4xlarge	2	16	244	1 x 940 NVMe SSD	Up to 10,000 Mbps	3,500 Mbps
f1.16xlarge	8	64	976	4 x 940 NVMe SSD	25,000 Mbps	14,000 Mbps

Amazon EC2 F1 Instance global footprint

F1 instances available around the World to meet data gravity & sovereignty needs

North America

US East (Northern Virginia)

US West (Oregon)

GovCloud (US-West)

US East (Ohio)

Canada (Central)

Europe/Middle East/Africa

Europe (Ireland)

Europe (Frankfurt)

Europe (London)

Asia Pacific

Asia Pacific (Sydney)

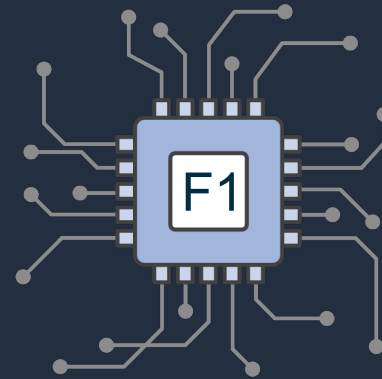
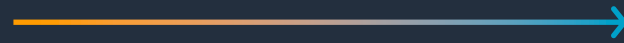
Asia Pacific (Singapore)

Mainland China (Beijing)

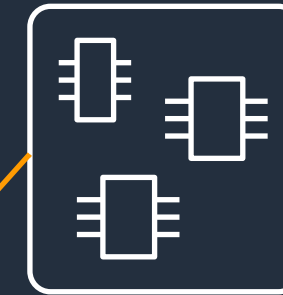
Orange denotes preview availability

Programming Amazon EC2 F1 Instances

Amazon Machine Image (AMI)



Amazon FPGA Image (AFI)



Launch F1 instance and load AFI

CPU Application



AMI

PCIe



DDR Controllers



DDR-4 Attached Memory

FPGA Developer Amazon Machine Image (AMI)

- Amazon Machine Image (AMI) launches virtual machine in minutes on any compute or FPGA instance
- New release supports Xilinx Toolset v2020.2 (Vivado and Vitis), and includes licenses
- Regularly updated with new developer resources
- Available for CentOS & Amazon Linux

The screenshot shows the AWS Marketplace page for the 'FPGA Developer AMI'. The page features the AWS logo, the product name 'FPGA Developer AMI', and the provider 'Amazon Web Services'. It includes a 'Continue to Subscribe' button, a 'Save to List' button, and a pricing box showing a typical total price of \$0.744/hr. The page is divided into sections: Overview, Pricing, Usage, Support, and Reviews. The 'Product Overview' section describes the AMI as a supported and maintained CentOS Linux image pre-built with FPGA development tools. A 'Highlights' box lists supported Xilinx Vitis versions and AWS integration. A metadata table at the bottom provides details on version, provider, categories, operating system, and delivery methods.

FPGA Developer AMI
By: [Amazon Web Services](#) Latest Version: 1.9.1

The FPGA (field programmable gate array) AMI is a supported and maintained CentOS Linux image provided by Amazon Web Services. The AMI is pre-built with FPGA development tools
[Show more](#)

Linux/Unix ★★★★☆ [6 AWS reviews](#)
Free Tier

[Continue to Subscribe](#)
[Save to List](#)

Typical Total Price
\$0.744/hr
Total pricing per instance for services hosted on z1d.2xlarge in US East (N. Virginia). [View Details](#)

[Overview](#) [Pricing](#) [Usage](#) [Support](#) [Reviews](#)

Product Overview

The FPGA (field programmable gate array) AMI is a supported and maintained CentOS Linux image provided by Amazon Web Services. The AMI is pre-built with FPGA development tools and run time tools required to develop and use custom FPGAs for hardware acceleration. The FPGA Developer AMI along with the FPGA Developer Kit(<https://github.com/aws/aws-fpga>) constitutes a development environment which includes scripts and tools for simulating your FPGA design, compiling code, building and registering your AFI (Amazon FPGA Image). Developers can deploy the FPGA developer AMI on an Amazon EC2 instance and quickly provision the resources they need to write and debug FPGA designs in the cloud. The AMI is designed to provide a stable, secure, and high performance development environment. The FPGA AMI is provided at no additional charge to Amazon EC2 users.

Highlights

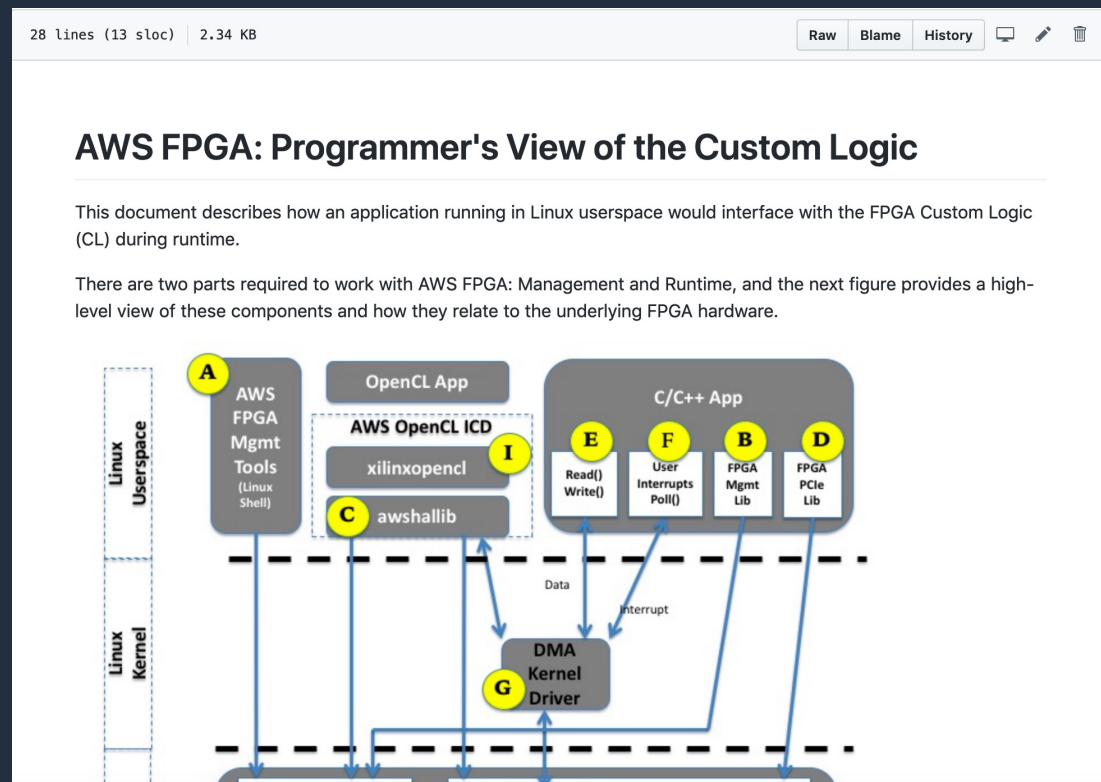
- Xilinx Vitis 2020.1(v1.9.x), 2019.2(v1.8.x), SDx 2019.1(v1.7.x), 2018.3(v1.6.x), 2018.2(v1.5.x) or 2017.4 (v1.4.X) and Free license for F1 FPGA development
- AWS Integration - includes packages and configurations that provide tight integration with Amazon Web Services

Version	1.9.1 Show other versions
By	Amazon Web Services
Categories	High Performance Computing
Operating System	Linux/Unix, CentOS 7.5
Delivery Methods	Amazon Machine Image

AWS FPGA developer resources

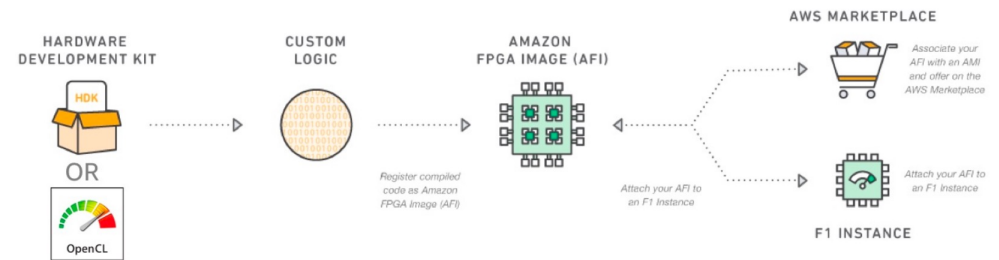
<https://github.com/aws/aws-fpga/>

AWS FPGA Github contains all the drivers, code, examples and tutorials needed to develop a hardware acceleration for the AWS FPGAs



Overview of AWS EC2 FPGA Development Kit

The AWS EC2 FPGA Development Kit is provided by AWS to support development and runtime on [AWS FPGA instances](#). Amazon EC2 FPGA instances are high-performance compute instances with field programmable gate arrays (FPGAs) that are programmed to create custom hardware accelerations in EC2. F1 instances are easy to program and AWS provides everything needed to develop, simulate, debug, compile and run hardware accelerated applications. Using the [FPGA Developer AMI](#), developers create an FPGA design. Once the FPGA design (also called CL - Custom logic) is complete, developers create the Amazon FPGA Image (AFI), and easily deploy it to the F1 instance. AFIs are reusable, shareable and can be deployed in a scalable and secure way.



Overview of Development Environments

Development Environment	Description	Accelerator Language	Development Tool	Debug Options	Typical Developer / FPGA

AWS FPGA support forum

Built in to your AWS Console

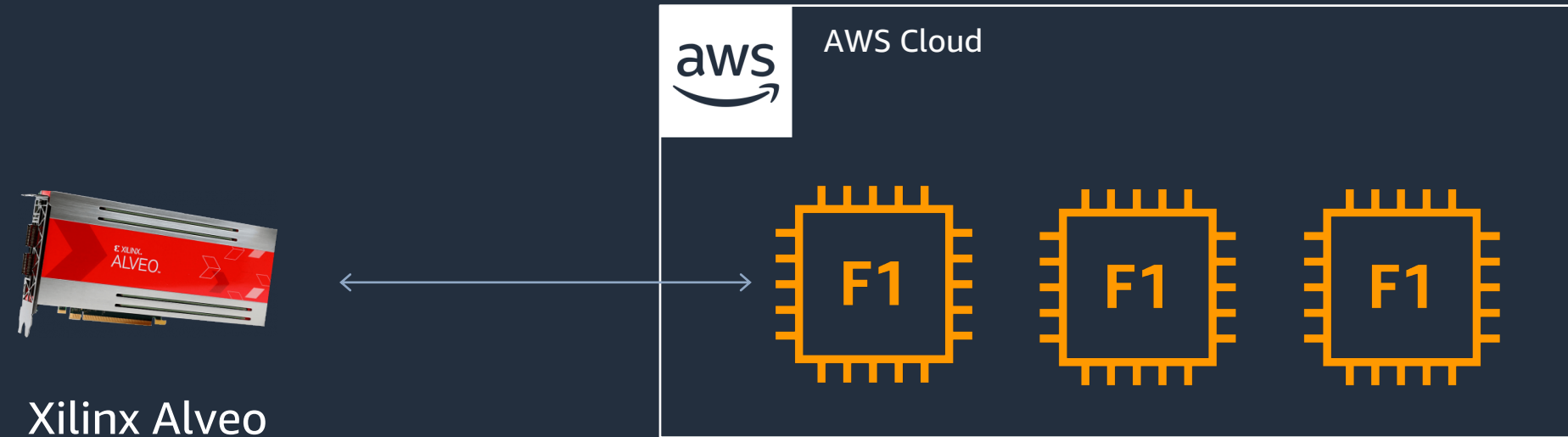
Deep knowledge repository

Hundreds of questions and answers related to the AWS FPGA compute platforms

Monitored by the community, AWS and Xilinx

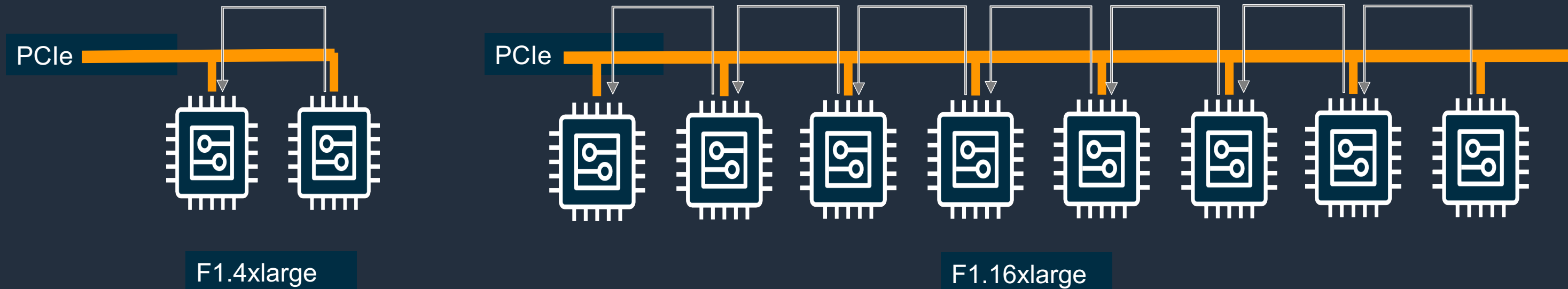
The screenshot shows the AWS support forum interface. At the top, there is the AWS logo and navigation links for 'My Account / Console' and 'English'. Below this is a search bar with 'AWS Product Information' and a search icon, along with 'Developers' and 'Support' dropdown menus. The main heading is 'Discussion Forums' with a welcome message and links for 'Login' and 'Forums Help'. The breadcrumb trail is 'Discussion Forums > Category: Compute > Forum: FPGA Development'. The main content area contains a paragraph about the Amazon FPGA development environment. Below this is a search bar with a 'GO' button and a link to 'Advanced search options'. The 'Forum Announcements' section lists four items, each with a star icon, a title, and a post date: 'AWS F1 FPGA Developer Kit (v1.4.16) now supports Xilinx 2020.1 tools' (Sep 17, 2020), 'Future developer kit releases - Xilinx tool version support announcement' (Sep 14, 2020), 'Xilinx Design Advisory for UltraScale/UltraScale+ DDR4/DDR3 IP - Memory IP Timing Exceptions (AR# 73068)' (Jul 10, 2020), and 'Amazon EC2 F1 Instance Expands to More Regions, Adds New Features, and Improves Development Tools'. On the right side, there are two sections: 'Available Actions' with a 'Post New Thread' button, and 'Popular Tags' with a grid of tags including 'afi', 'ami', 'aws', 'centos', 'ec2', 'error', 'f1', 'fpga', 'hdk', 'openc1', 'problem', 'sdaccel', 'vitis', 'vivado', and 'xilinx'. A 'View all tags' link is at the bottom of the tags section.

Scale on-prem applications to Amazon EC2 F1 Instances



- Re-use on-prem investment to scale to AWS cloud
- Same Vitis design with no/minimal changes
- https://github.com/aws/aws-fpga/blob/master/Vitis/docs/Alveo_to_AWS_F1_Migration.md

Improving latency with FPGA peer-to-peer (P2P)



P2P enables data transfers between FPGAs (F1.4xlarge and F1.16xlarge)

- Bypass host memory: improving latency and scalability
- Using F1 XDMA – directly write data to/from FPGA memory

Best use cases are:

- AFI Pipeline (as shown above)
- Other topologies: Producer/Consumer

<https://github.com/aws-labs/aws-fpga-app-notes/blob/master/Using-PCIe-Peer2Peer/README.md>

Simplified networking interface

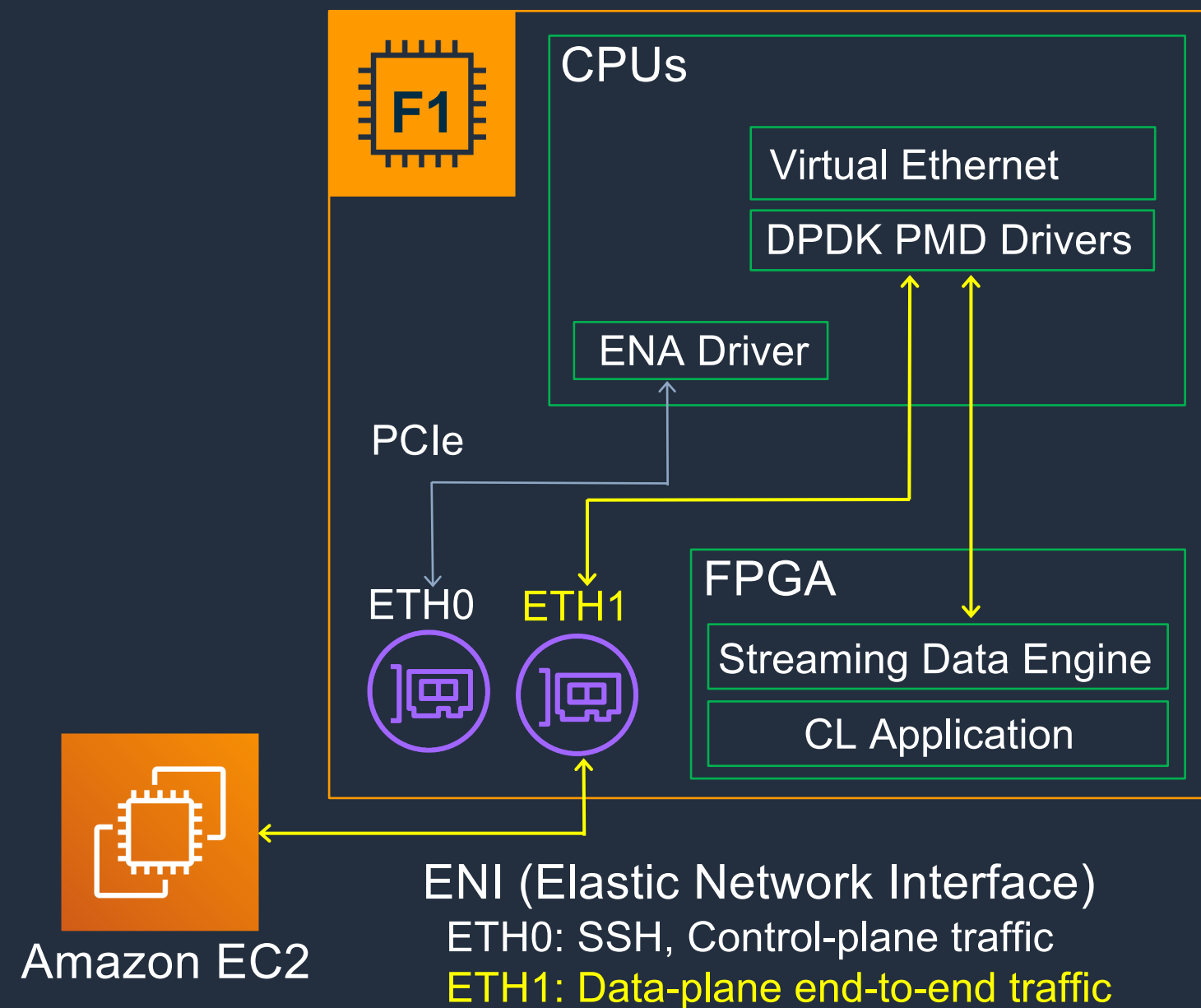
Integrated virtual Ethernet interface

Open source example design

Leveraging **DPDK** for high performance

Use cases:

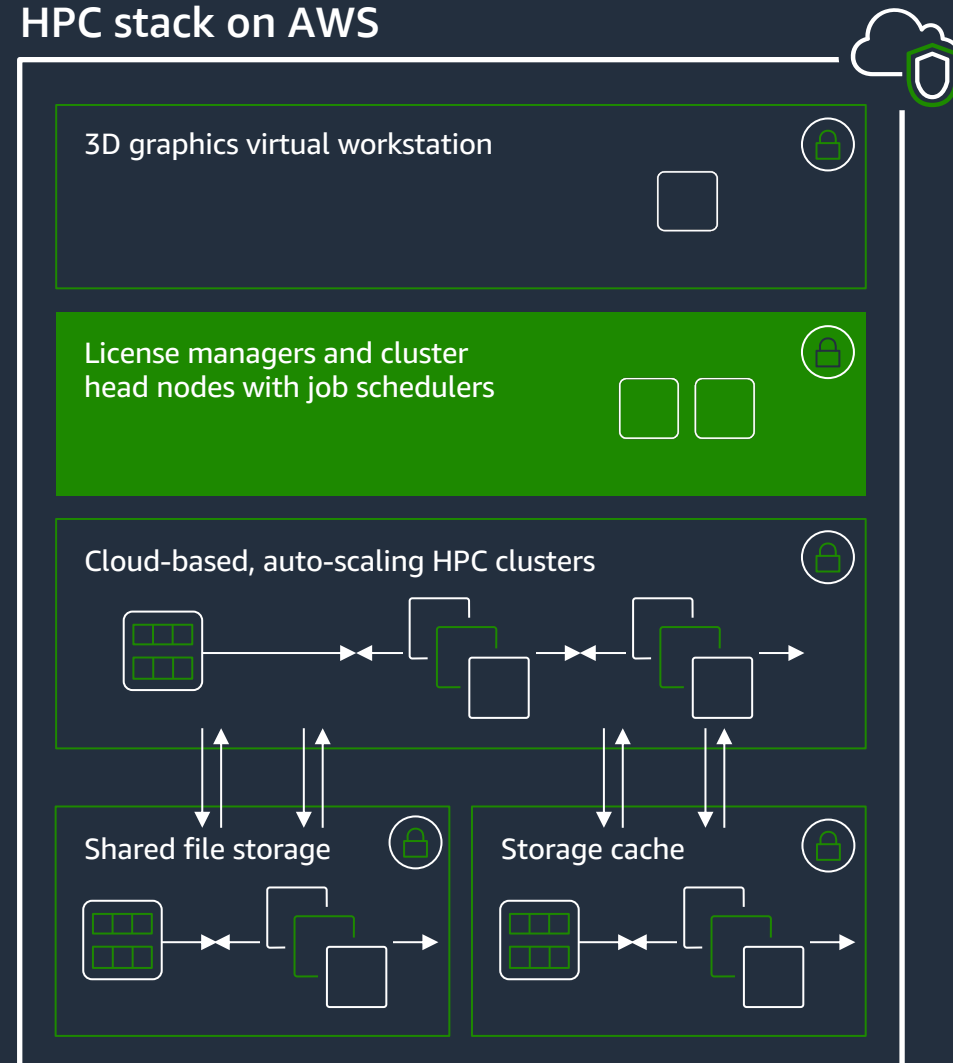
- Routing, Switching
- Packet processing
- SDN (Software Defined Networking)
- DPI (Deep Packet Inspection)
- Stream encryption or compression



<https://github.com/aws/aws-fpga/tree/master/sdk/apps/virtual-ethernet>

Simplified workload scaling with AWS ParallelCluster

HPC stack on AWS



Enables customers to quickly build an HPC compute environment in AWS and run large-scale workloads

Offers a variety of batch schedulers such as AWS Batch, SGE, Torque, and Slurm

Customers can build higher level workflows, such as a Genomics portal that automates the entire DNA sequencing workflow

F1 Instances available in AWS Educate Classrooms

aws  educate

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<https://aws.amazon.com/education/awseducate/>

F1Educator@amazon.com

Get started today!

Amazon EC2 F1 Instances

<https://aws.amazon.com/ec2/instance-types/f1/>

Github Repository with Design Guidance & Examples

<https://github.com/aws/aws-fpga>

Leverage our partners' solutions via the AWS Marketplace

<https://aws.amazon.com/marketplace/>

Thank you

