



Semiconductor Design and Verification on AWS

Accelerating Innovation

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Amazon Web Services



Agenda

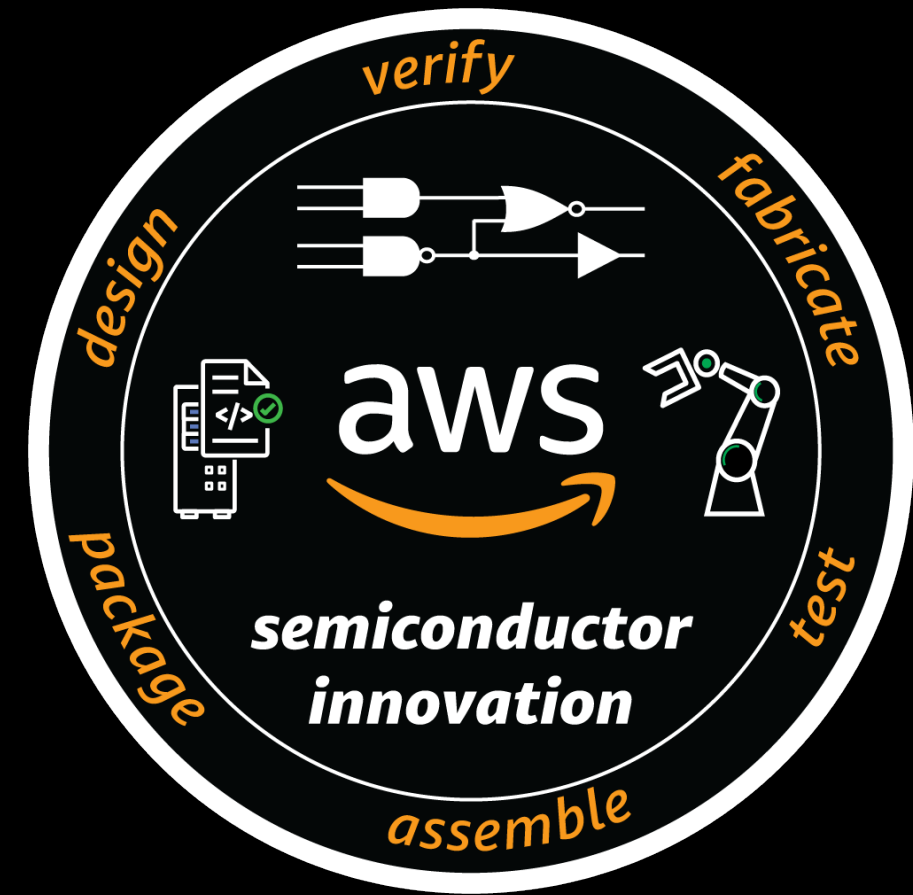
1 Compute

2 Storage

3 Orchestration

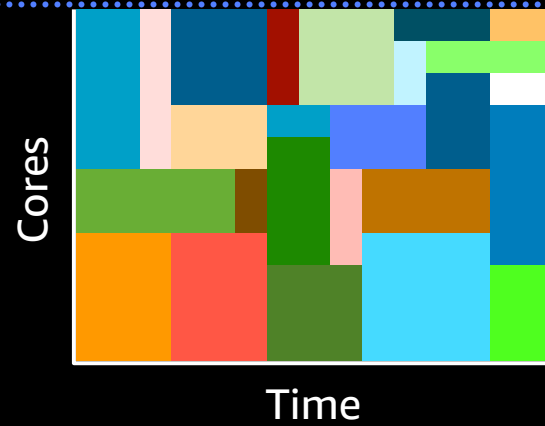
4 Secure Collab Chambers

5 Reference Architectures

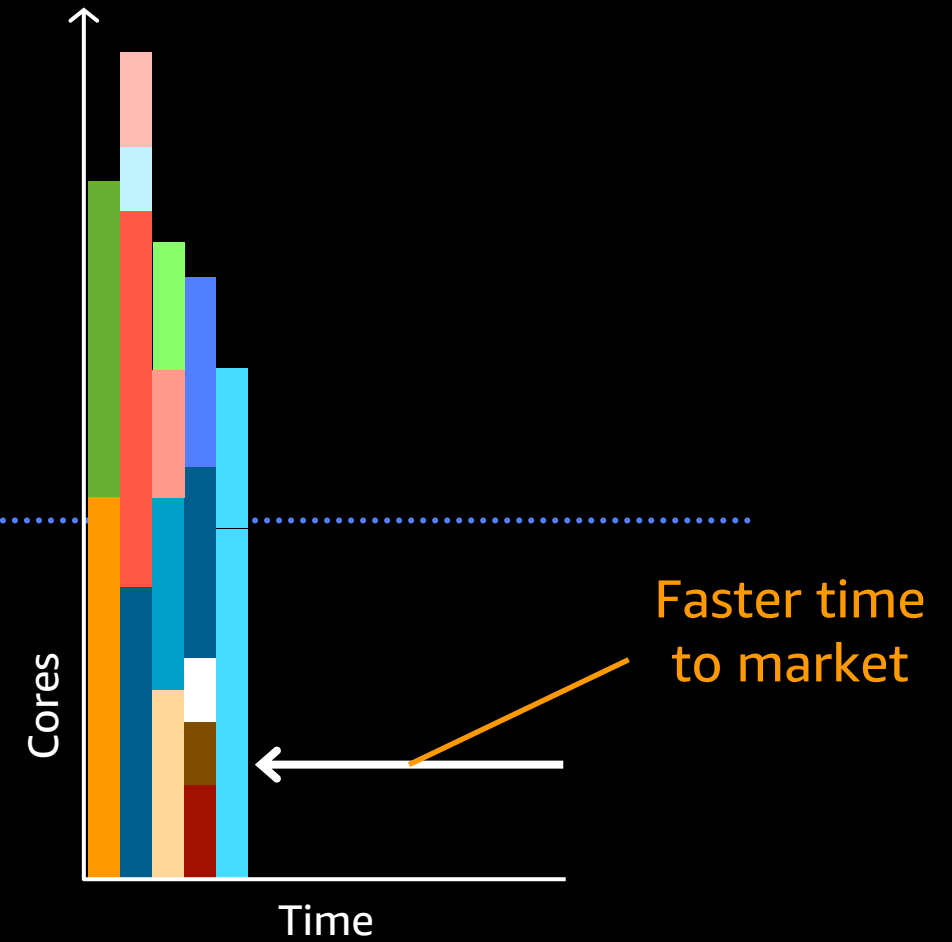


Cloud is a natural fit for semiconductor design

Fixed data center capacity limit



- Static capacity
- Long queue times
- Engineering bottlenecks



- Variable capacity
- No waiting for resources
- Jobs complete faster

Why Open Source EDA on AWS?

- **Innovate faster** – Prototype, design, and verify systems-on-chip, using scalable cloud resources for Open Source Electronic Design Automation (EDA). Leverage new computing paradigms to accelerate EDA jobs.

- **Collaborate better** – Work seamlessly and securely with third-party partners including Startups, Researchers, IP providers, and manufacturing service providers (foundries, OSATs, contract and original device manufacturers).

- **Reduce cost** – Stop wasting CAPEX on IT, and stop wasting valuable engineering time.

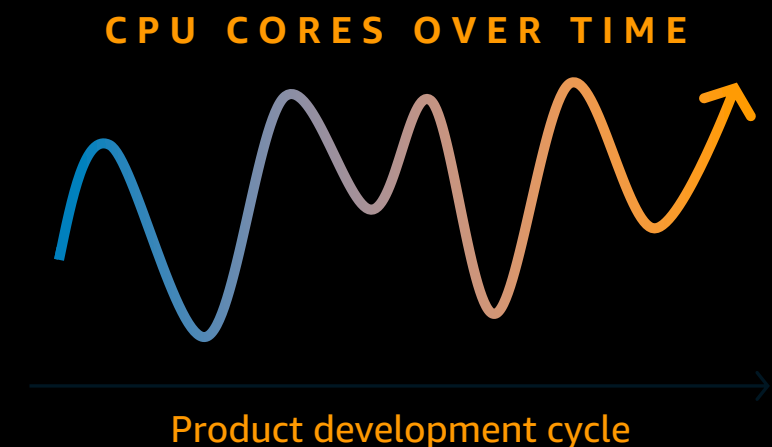
Faster design throughput with rapid, massive scaling

Scale up when needed, then scale down

- In a traditional EDA datacenter, **the only certainty is that you always have the wrong number of servers**—too few, or too many
- Every additional server launched in the cloud can improve speed of innovation—
if there are no other constraints to scaling
- Overnight or over-weekend workloads reduced to an hour or less

Think **BIG**

What if you could launch
1 million concurrent
verification jobs?



Our own journey, and our own digital transformation

AWS silicon optimizations

Formed 2014, Austin

Born in the cloud

Annapurna Startup

Formed 2011, Israel

Started with on-prem datacenter

AWS
"One Team"
Acquisition of
Annapurna



US expands deployment in AWS

Multi-site Development

Israel expands productivity via AWS

Hybrid Model

On-prem data center

US expands deployment in AWS

Multi-site Development

Multiple end-to-end silicon projects in AWS

Less infrastructure in on-prem data center

Full SoC Development in the cloud

Latest semiconductor fab 7nm process

Multi-site

Cloud-based secure collaboration

On-prem data center only for emulators

2011

2014

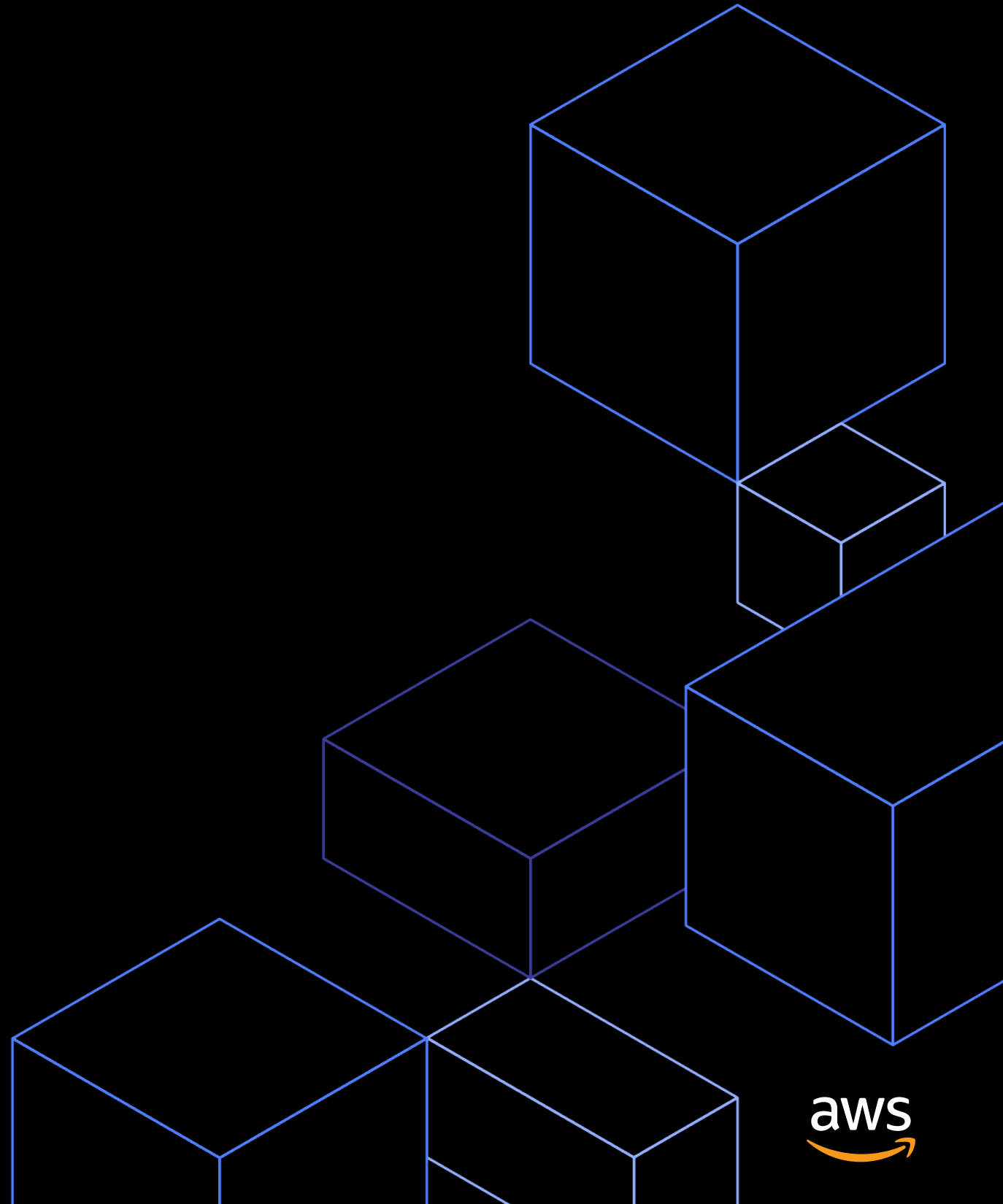
2015

2016

2017

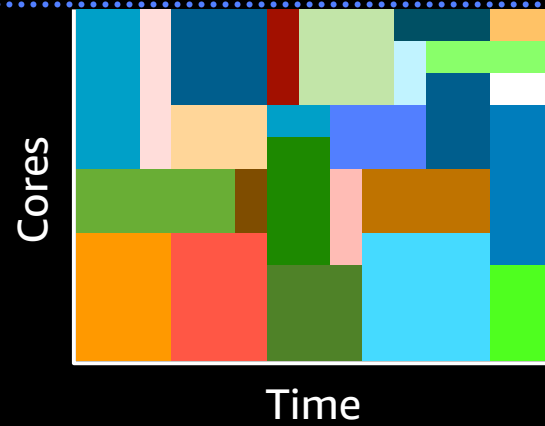
Today

Compute

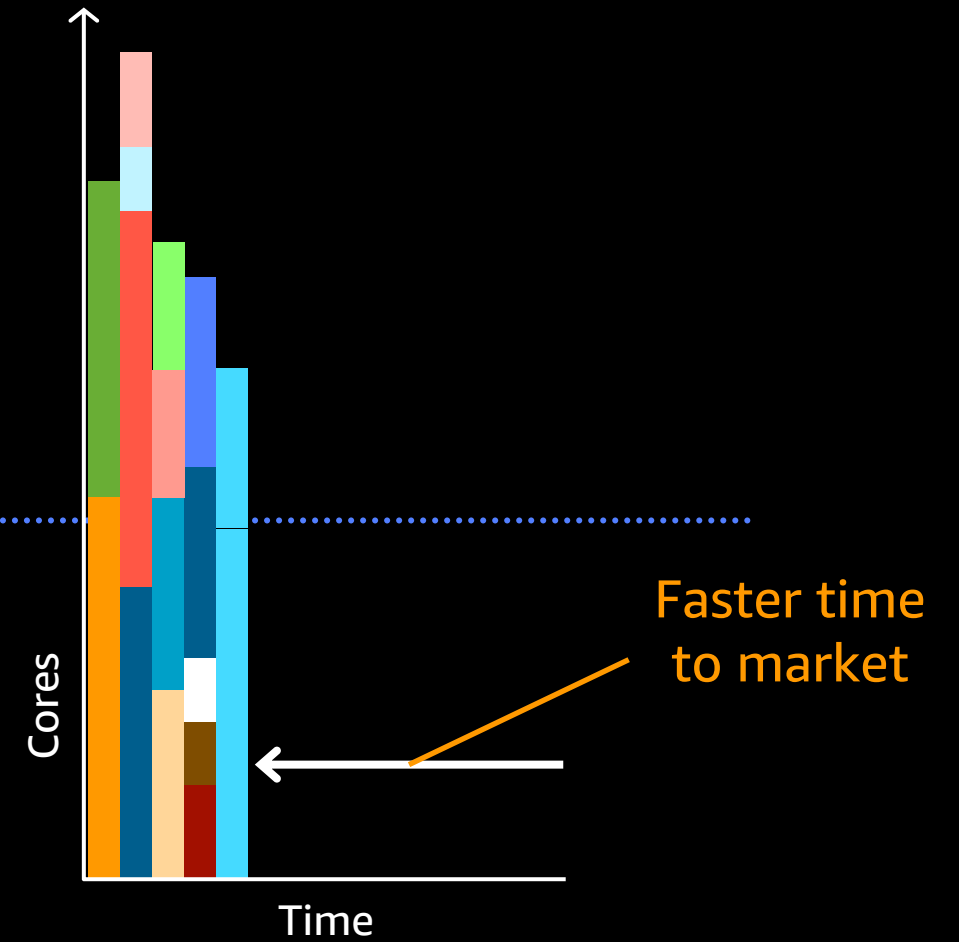


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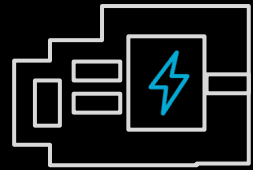


- Variable capacity
- No waiting for resources
- Jobs complete faster

AWS Nitro System

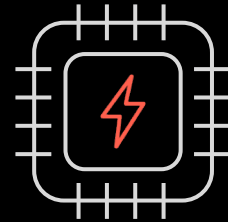


Nitro Card



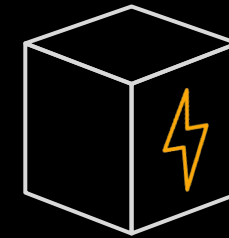
Local NVMe storage
Elastic Block Storage
Networking, monitoring,
and security

Nitro Security Chip



Integrated into motherboard
Protects hardware resources

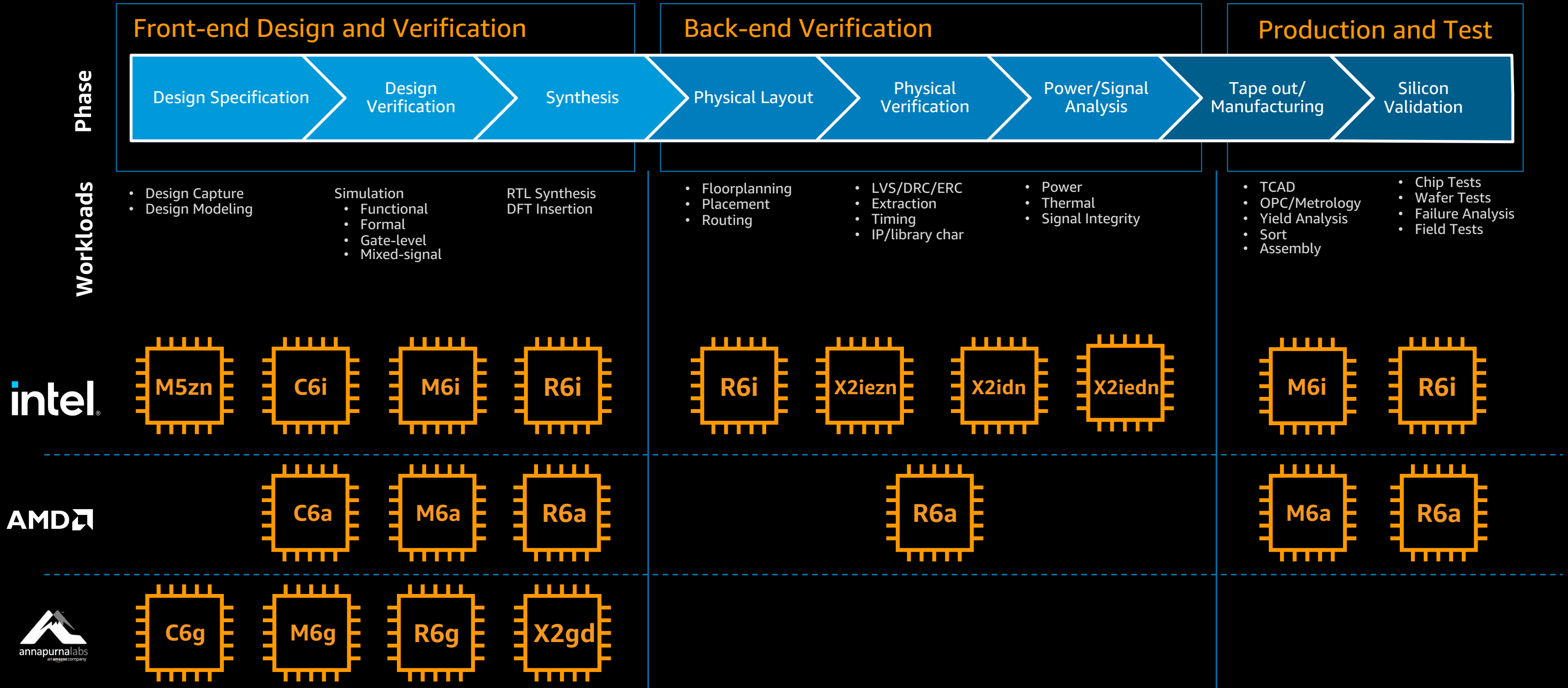
Nitro Hypervisor



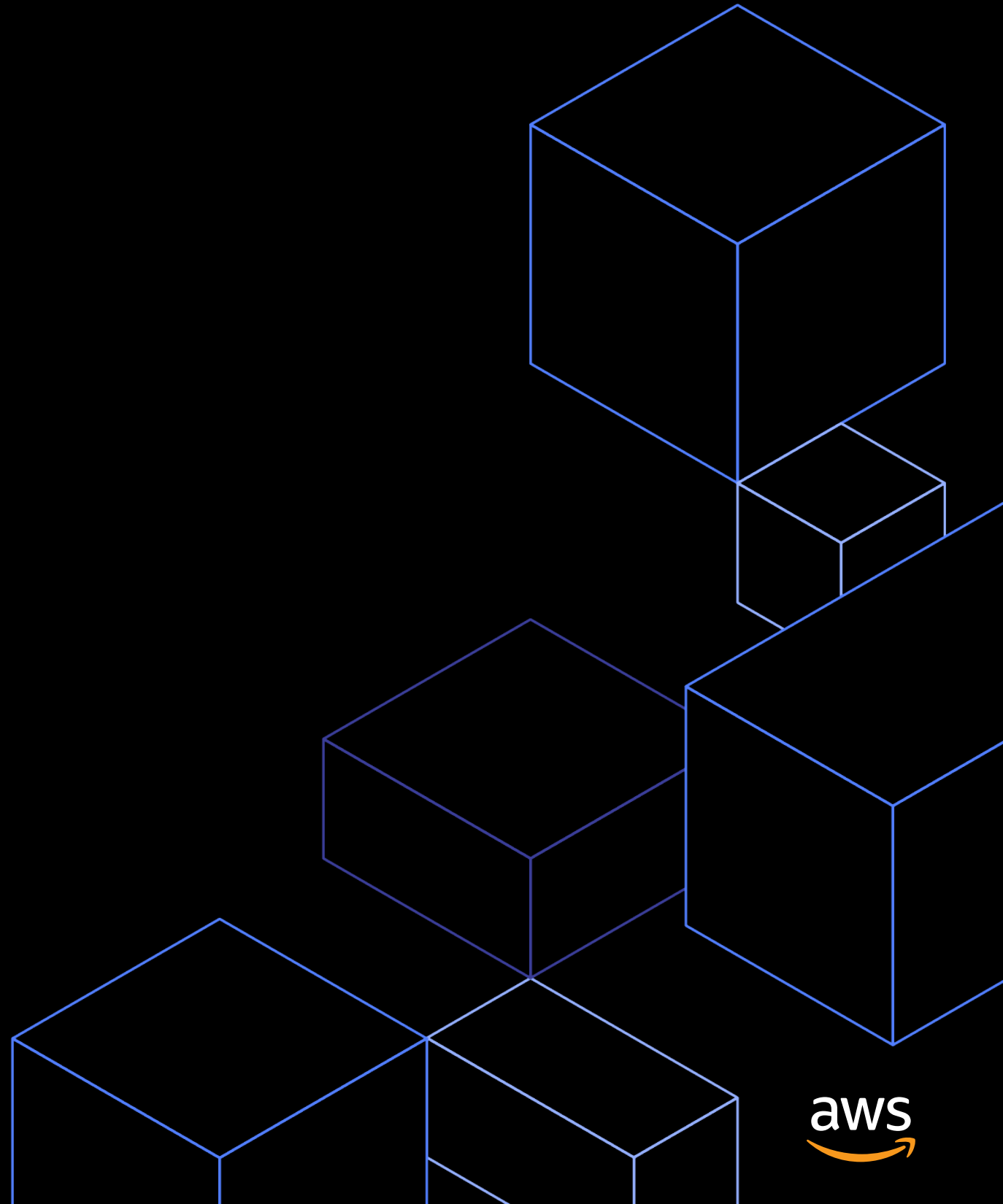
Lightweight hypervisor
Memory and CPU allocation
Bare metal-like performance

High performance virtualization enabled by the Nitro System

Shaping compute to workloads

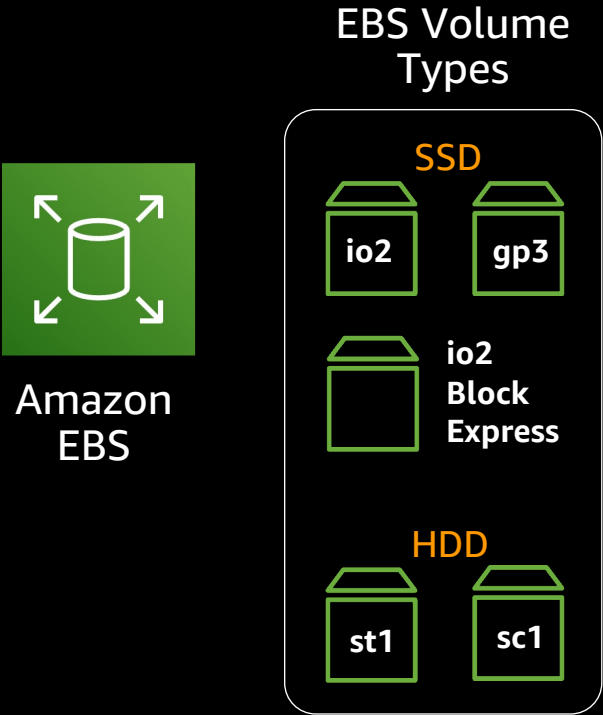


Storage



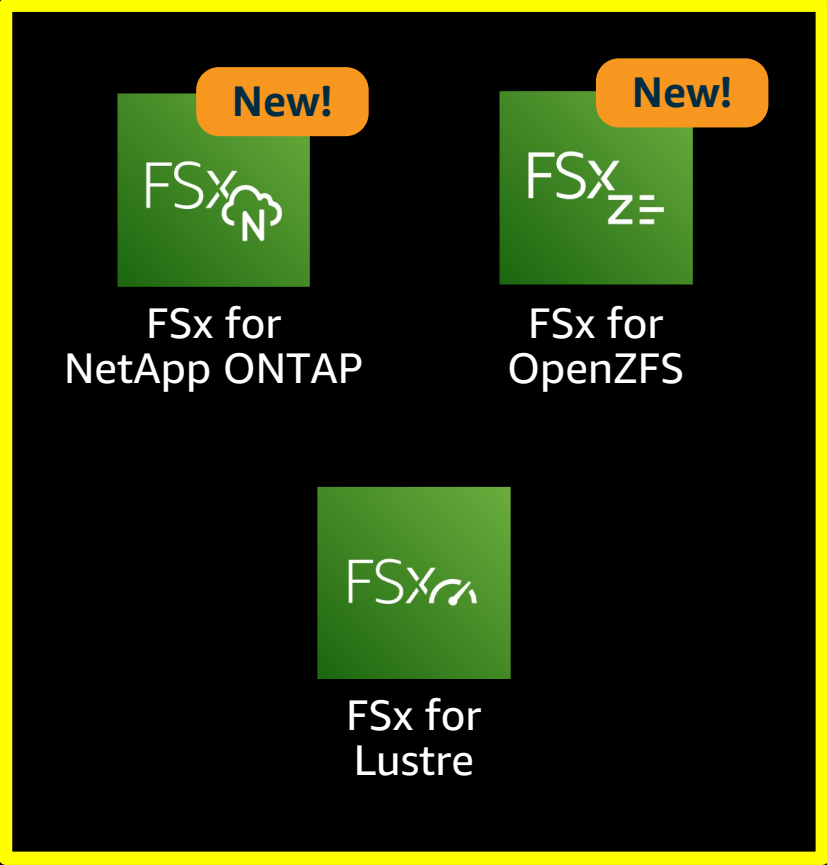
High performance storage options

Block Storage



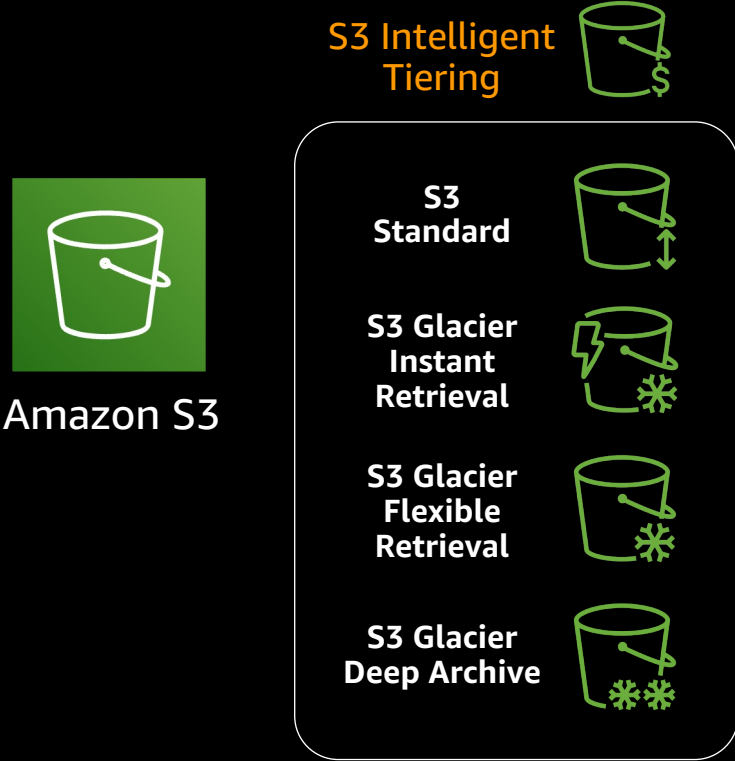
High performance, attached storage with 99.999% availability. Tune size and performance with elastic volumes.

File Storage



Fully managed file system options, providing enterprise NAS, scale-out storage, and petabyte-scale, elastic file storage accessible across applications, instances, and on-premises servers.

Object Storage



Low cost, highly scalable storage with 99.999999999% durability. Automatic data replication within regions.

Summary: File system options for semiconductor design



**Amazon FSx
for NetApp ONTAP**



**Amazon FSx
for OpenZFS**



**Amazon FSx
for Lustre**

On-premises
comparison

NetApp, commodity NAS

ZFS or other Linux
based file servers

Scale-out file storage
(Lustre, GPFS)

Deployment
Options

Multi-AZ

Single-AZ

Single-AZ

Unique
Features

Multi-protocol,
replication, cloning,
intelligent low-cost
tiering, file access
auditing, and anti-virus
integration

Sub milli-second latency,
up to 12.5 GB/sec
throughput, up to 1
million IOPS

Scale-out performance,
S3 data processing
capabilities

Use Cases

On-prem integration
with FlexCache and
Snapmirror

Front-end workloads,
small files, metadata
heavy, random access

Back-end workloads,
large files, sequential
access

Remote desktops with NICE DCV

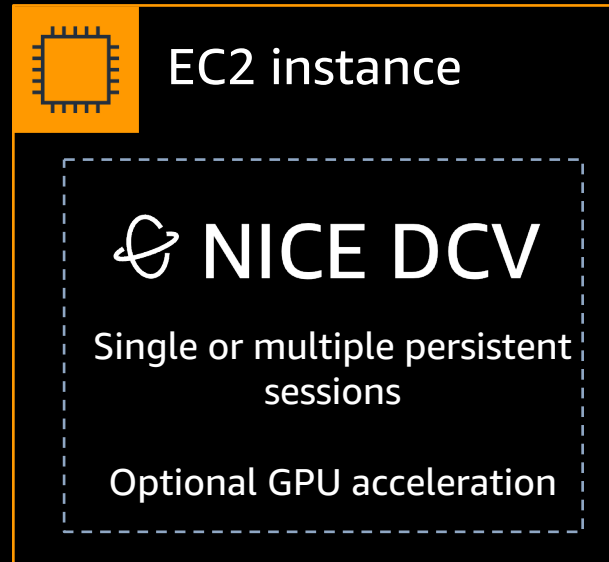
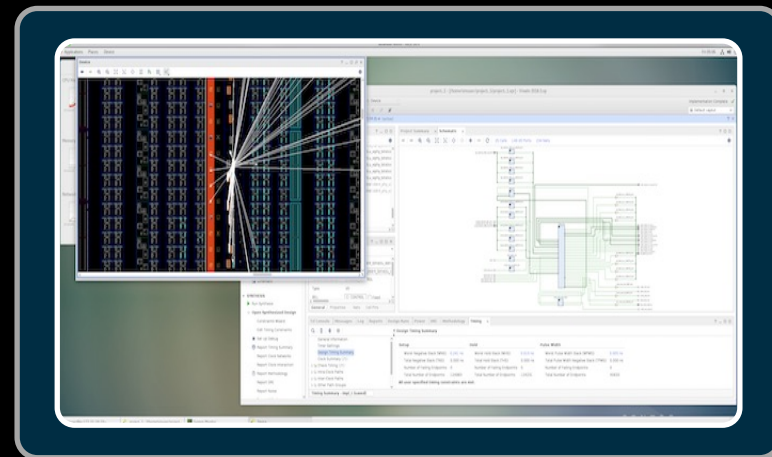
- Native clients for Linux, Mac, and Windows
- HTML5 for web clients
- Dynamic hardware compression
- Encrypted communication
- Multi-monitor support
- Extensive security options (restrict copy/paste, etc.)
- Support for peripherals (mice, sound, etc.)
- Optional GPU acceleration

**Visit our booth #1841 for
NICE DCV Demo**

SEMICON® WEST

July 11-13, 2023

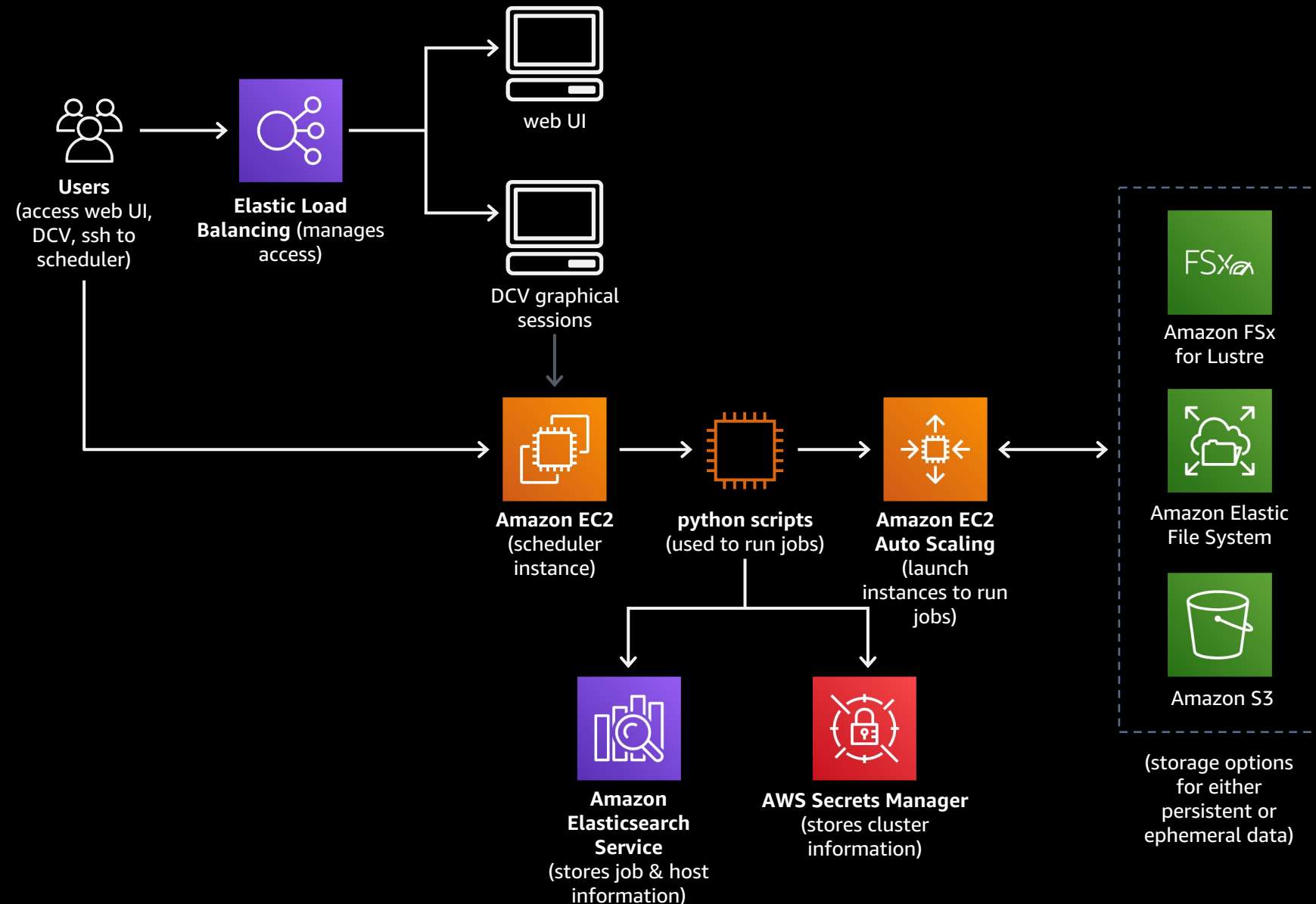
**No added cost when
running on
Amazon EC2
Instances!**



Scale-out computing on AWS

aws.amazon.com/solutions/scale-out-computing-on-aws

- AWS Solution
- EDA/HPC environment on AWS
- Easy installation in your AWS account
- Amazon EC2 Integration
- Simple job submission
- OS agnostic and AMI support
- Desktop cloud visualization
- Automatic errors handling
- Web UI
- 100% customizable
- Persistent and unlimited storage
- Centralized user-management
- Support for network licenses
- EFA support
- Simple cost/budget management
- Detailed cluster analytics
- Used in production

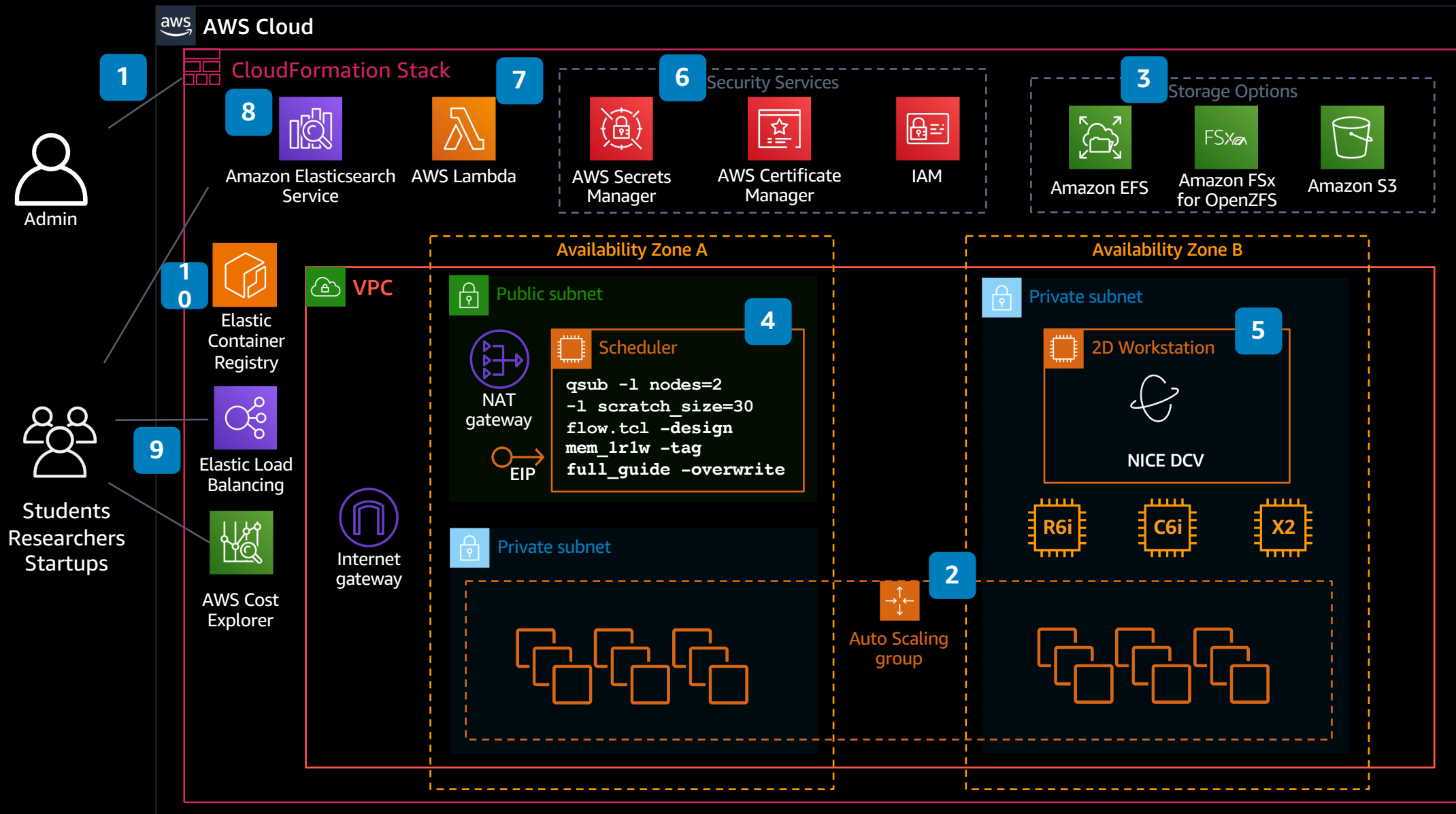


Open Source Chip Design on AWS

Launch a turnkey scale-out open source EDA environment in minutes

Solution location: <https://aws.amazon.com/solutions/scale-out-computing-on-aws/>

Source Code: <https://github.com/aws-labs/scale-out-computing-on-aws>



- 1 Specify required parameters (VPC, Subnet, storage, etc.) and launch the **AWS CloudFormation** stack, which launches several nested stacks.
- 2 Choose to run in **multiple Availability Zones**, or use auto-reallocation in the case an instance isn't available in the Availability Zone.
- 3 Choose from several storage options: **Amazon EFS, Amazon FSx for Lustre, Amazon S3, Amazon EBS, and Instance Store** to open source tools, design data, PDKs
- 4 Log in, submit, and monitor EDA jobs from the Scheduler Instance.
- 5 Launch a 2D or 3D Workstation that uses **NICE DCV**, that can be used to submit batch jobs and run GUI tools such as OpenROAD.
- 6 Security services and resources that are used include **AWS Secrets Manager, AWS Certificate Manager, Security Groups, and AWS Identity and Access Management (IAM)**.
- 7 **AWS Lambda** is used throughout the entire deployment and architecture.
- 8 **Amazon Elasticsearch Service** is used to launch an analytics dashboard.
- 9 **Elastic Load Balancing** is used to ensure accessibility across Availability Zones, and **Cost Allocation Tags** are used with **AWS Cost Explorer**.
- 10 **Elastic Container Registry** used to store images of open source EDA tools



MediaTek

“NXP Semiconductors Selects AWS as Its Preferred Cloud Provider to Power Electronic Design Automation in the Cloud”

“Using AWS, our EDA workload characterization turnaround time was reduced from a few months to a few weeks.”

Met aggressive tapeout schedule to release world’s first 5G integrated system-on-chip.

Philippe Moyer, Vice President of Design Enablement, Arm

re:Invent 2019 session:
MFG206-L



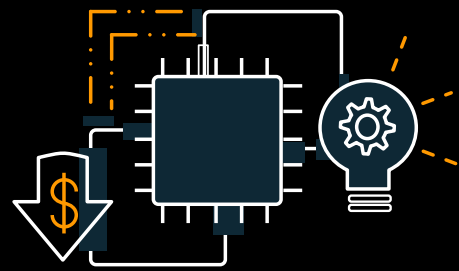
Astera Labs Develops Complex SoC
100% on AWS



Higher likelihood of catching defects early, saving potentially millions of dollars each year.

re:Invent 2019 session:
MFG404

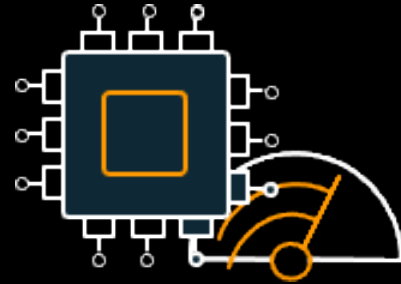
Semiconductor Industry Trends



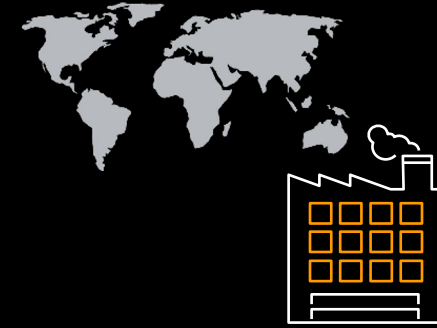
Supply Chain
Constraints and
Shortages



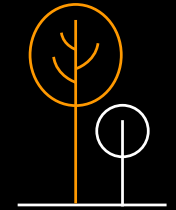
Increased Multi-
Party ASIC/SoC
Development



Balancing Power,
Performance, Area,
Cost (PPAC)



Engineering
Staffing
Shortages

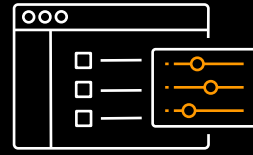


Sustainability
and ESH/ESG

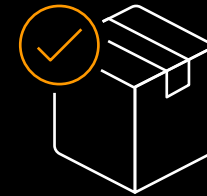
How Does Secure Collaboration Help?



Protecting and
securing IP and supply
chains



Enabling data analytics
based decision making for
business and engineering



Increases supply chain
resilience and visibility



Improves yields and
shortens ramp to high
volume production



Cost
reduction

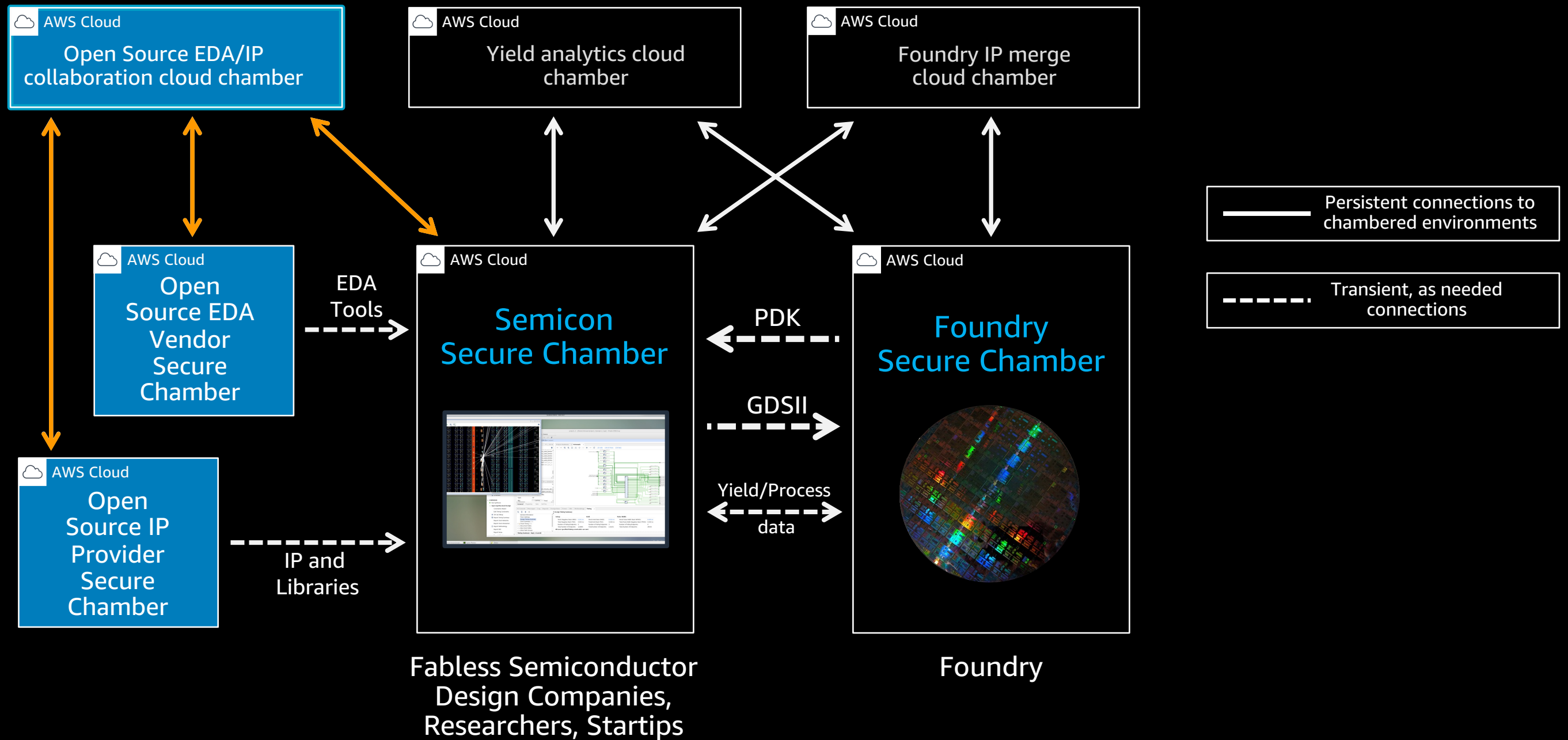


Create new
revenue sources



Worker attrition
and training

Secure collaboration enabled on AWS



AWS resources for semiconductor design

<https://aws.com/semiconductor>



Under "Resources" link:

- White papers
- Blogs and articles
- Reference architectures
- Videos & webinars
- Technical tools & training

The screenshot shows the AWS website's "Semiconductor and Electronics Resources" page. It features a navigation bar with "Manufacturing" selected. The main content area includes a "PAGE CONTENT" sidebar with links to Documentation, Blogs & articles, Reference architectures, Videos & webinars, and Technical tools & training. The main content area is titled "Documentation" and contains several resource cards:

- Run Semiconductor Design Workflows on AWS**: This implementation guide provides you with information and guidance to run production semiconductor workflows on AWS, from customer specification, to front-end design and verification, back-end fabrication, packaging, and assembly. [Read documentation >](#)
- Semiconductor Design on AWS**: This whitepaper presents an overview of the semiconductor design flow, a migration path for moving design and verification workflows to AWS, and the AWS architectural components needed to optimize semiconductor design workloads on AWS. [Read documentation >](#)
- Best practices for deploying ClioSoft SOS7 on AWS**: This paper outlines the advantages of and best practices for deploying the ClioSoft SOS design data management software on the AWS Cloud platform. [Read documentation >](#)
- Using Ellexus Breeze for EDA workload migration to AWS**: This whitepaper outlines the best practices for migrating Electronic Design Automation (EDA) workloads to AWS using the I/O profiling and dependency analysis tool suite Breeze from Ellexus. Profiling the EDA tool on premises and in the cloud.

This collage features several key AWS resources for semiconductor design:

- Semiconductor Design on AWS Whitepaper**: A whitepaper with the AWS logo, providing an overview of the semiconductor design flow.
- Run Semiconductor Design Workflows on AWS Technical Guide**: A technical guide detailing the implementation of production semiconductor workflows on AWS.
- Transfer GDSII file to foundry**: A technical guide explaining how to transfer GDSII files to a foundry using AWS services.
- Testing of Synopsis IC Validator on AWS**: A technical guide showing performance improvements when using Synopsis IC Validator on AWS X2i instances.
- Table 1: Comparison of X2i and R5d instances**: A table comparing the performance of X2i and R5d instances for IC Validator testing.
- Graph 1: 320 Cores (vCPU)**: A bar chart showing CPU utilization for X2i and R5d instances.
- The semiconductor supply chain**: A circular diagram illustrating the semiconductor supply chain, including Customer specification, Design and verification, Semiconductor Foundry, Assembly, packaging, and test, Contract manufacturing, and OEM and products.
- AWS Architecture Monthly**: A magazine cover for March 2021, featuring "Semiconductor Design" as the main topic.

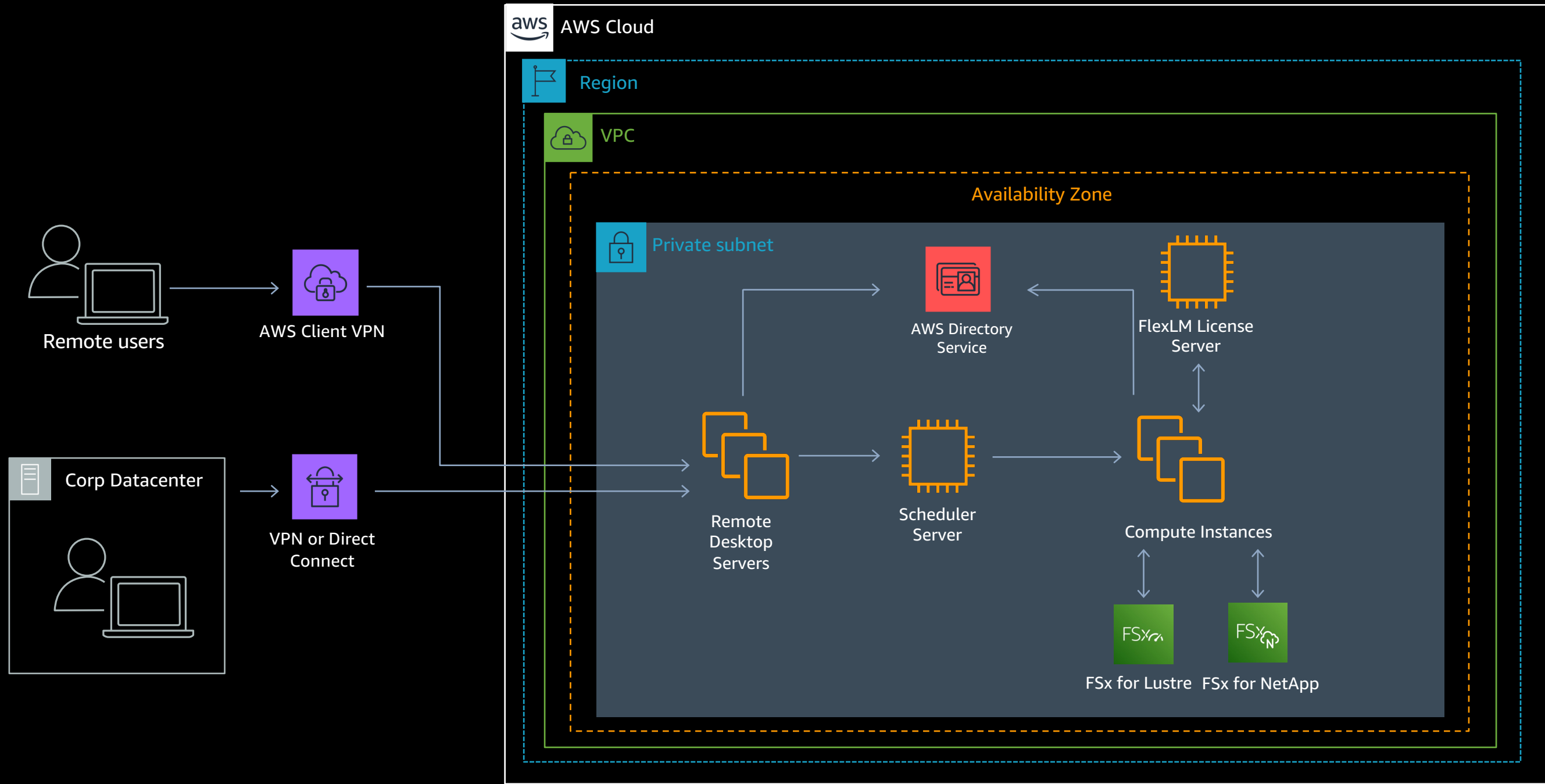
Thank you!

Reference Architectures

Secure collaboration

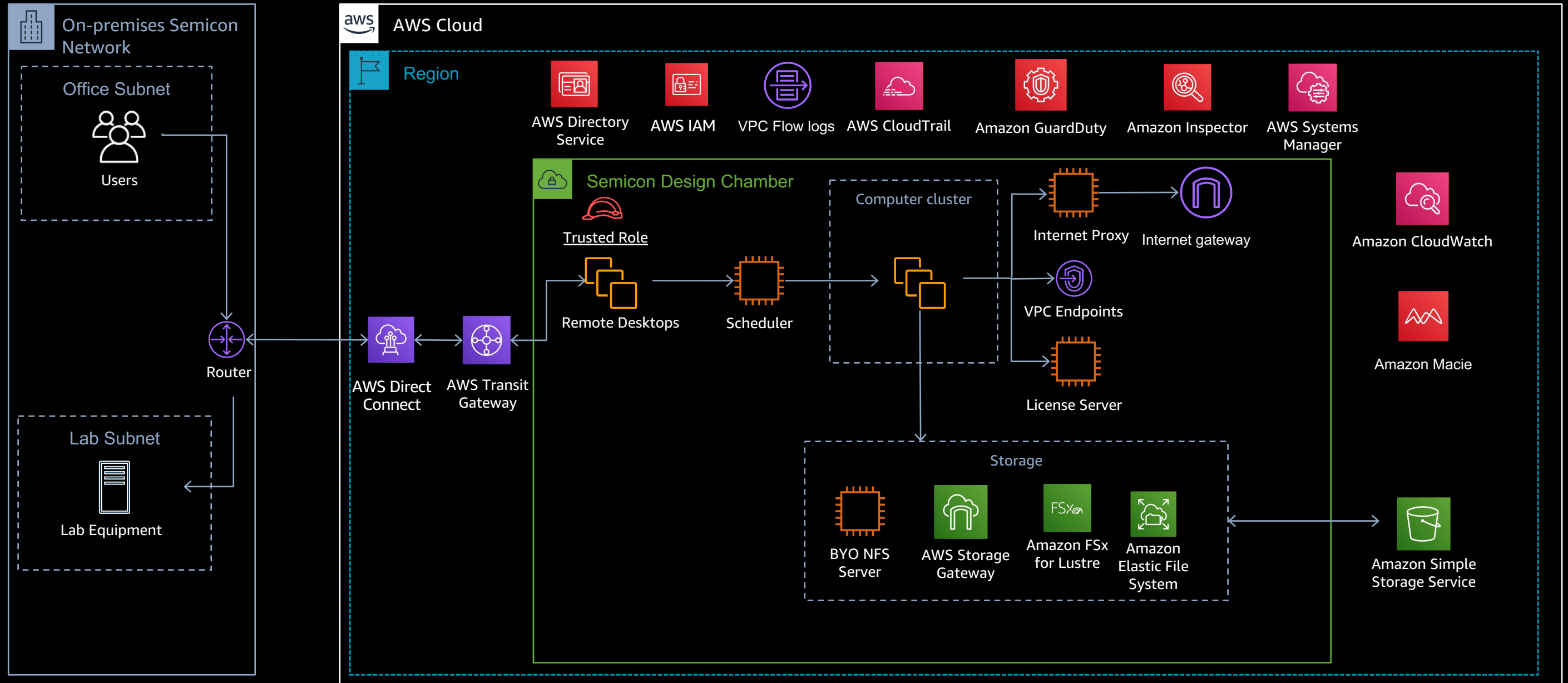


Cloud IC design collaboration chamber

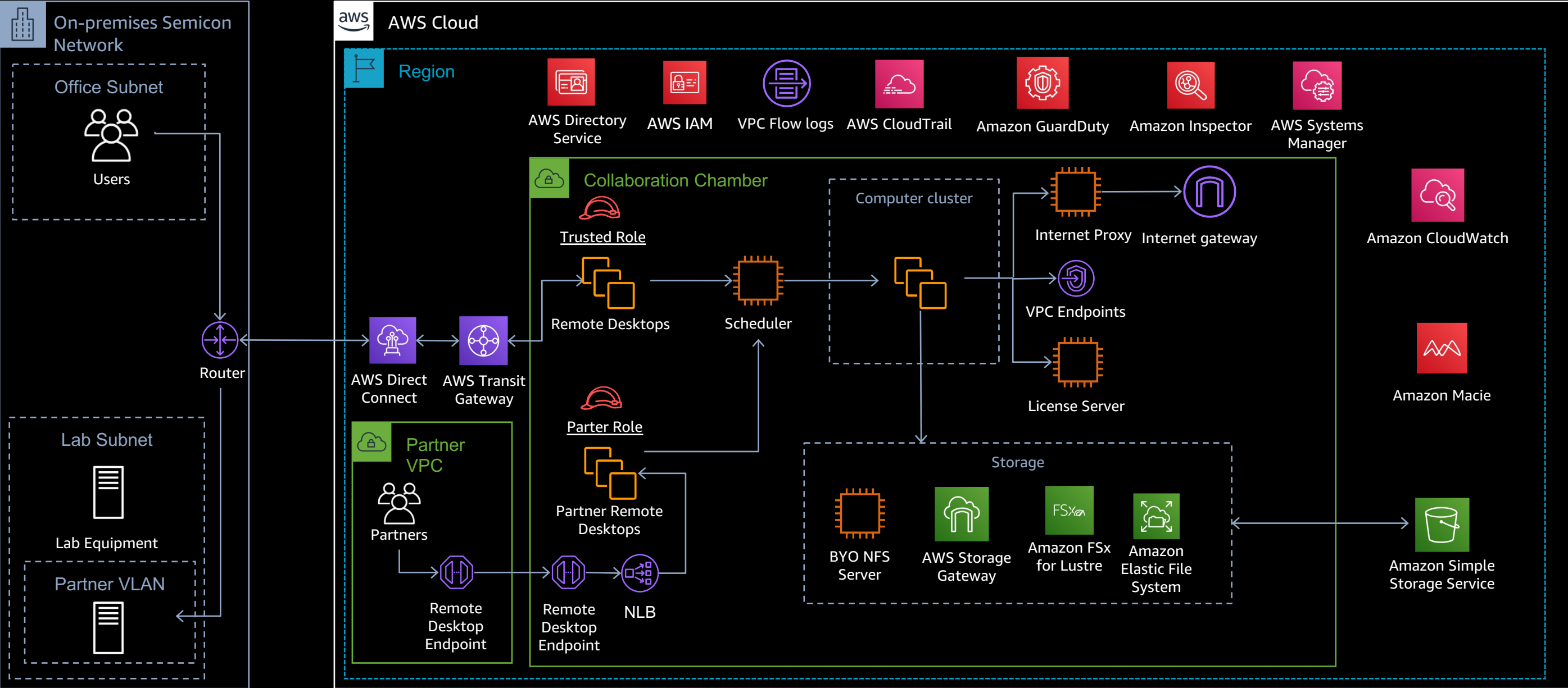


Secure silicon design environment

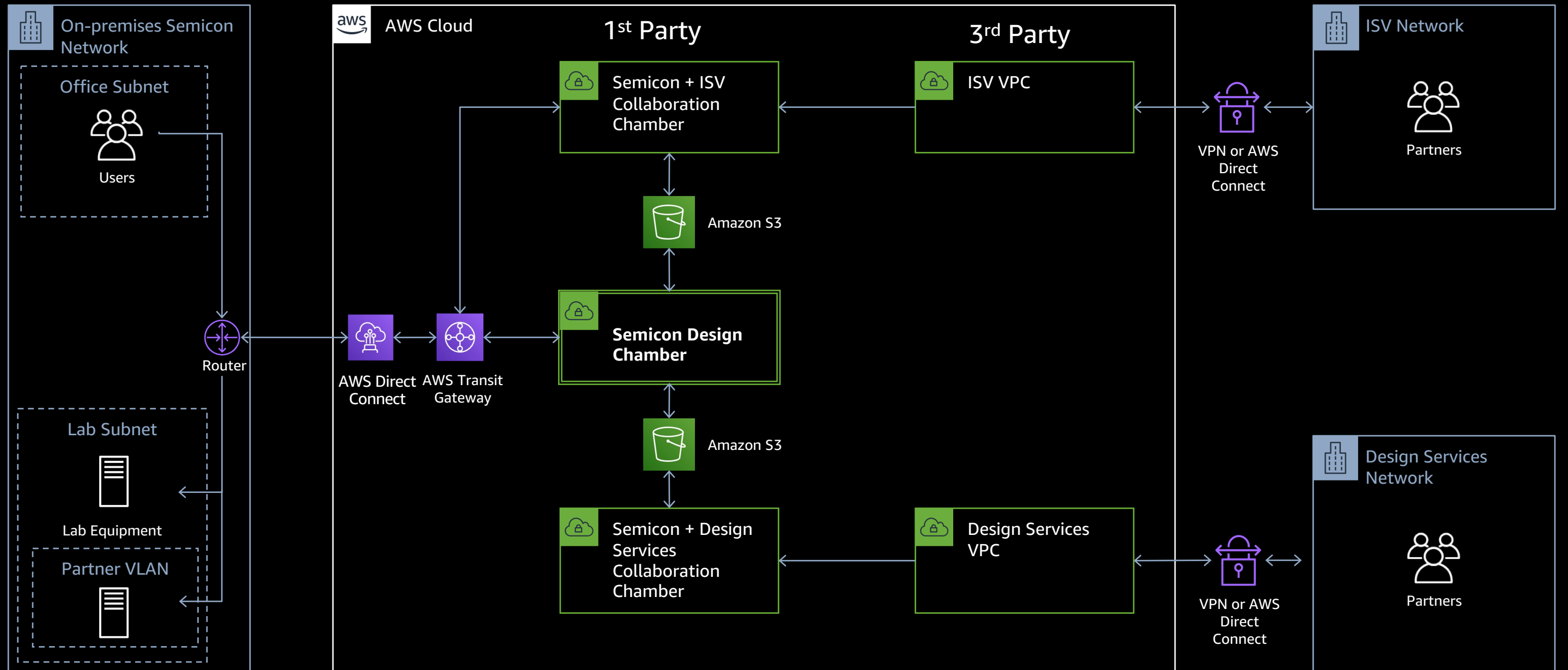
1st Party



Collaboration chamber



Secure collaboration



Scale-out computing on AWS

aws.amazon.com/solutions/scale-out-computing-on-aws

Framework behind Amazon Devices
Lab126 HPC environment

Enables engineers/scientists with
minimal cloud and/or Linux
experience

Official AWS Solution:

“Vetted, technical reference
implementations designed to help
you solve common problems and
build faster”

admin's dashboard

Scale-Out Computing on AWS

Source Code Help and Support Documentation Logout

Welcome to your Scale-Out Computing on AWS HPC cluster

This website is designed to simplify user on-boarding process as well as interactions with our remote AWS cluster. Refer to the links below for more documentation

Access the Cluster

SSH access
Easily download your private key in pem/ppk format and access the cluster directly.

Remote Desktop
DCV is a remote visualization technology that enables users to securely connect to graphic-intensive applications hosted on AWS.

Job Management

Launch your job
Scale-Out Computing on AWS leverages AWS flexibility and scalability. To learn how to take advantage of AWS ecosystem to run your job, refer to [this page](#).

Check your queue
Stay up-to-date with your job process using our web-based [queue viewer](#)

Create a new queue
You can customize the scheduler [based on your requirements](#)

Analytics and Budget

Budget Management
Control your HPC spend using [AWS Cost Explorer](#) and [AWS Budget](#)

Cluster Analytics
Access your job analytics and cluster information in real time using your [ElasticSearch domain](#)

ACCESS CLUSTER

- SSH access
- Graphical Access
- Transfer Files (SFTP)

JOB MANAGEMENT

- Submit my first job
- My Job Queue
- Create my queue

ANALYTICS

- Dashboard

BUDGET

- Cost Management

ADMIN SECTION

- User Management