
AWS
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NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

STG343

Deep dive on accelerating HPC and ML with Amazon FSx

Jordan Dolman

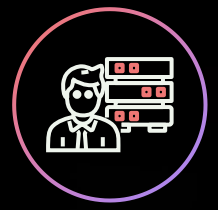
Senior Product Manager
Amazon FSx for Lustre
AWS

Shrinath Kurdekar

Principal Solutions Architect
Amazon File Services
AWS

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File workloads: broad spectrum



Storage and IT admins and app owners

Builders and data scientists





Enterprise IT applications



User shares



Line-of-business applications



Machine learning



SaaS applications



Software build environments



Backup and disaster recovery



Web serving and content management



Data science and analytics



DevOps platforms

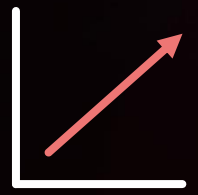
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Three usage patterns for file storage in the cloud



Network-attached storage



Virtually unlimited compute scale



Cloud-native apps and workflows

aws

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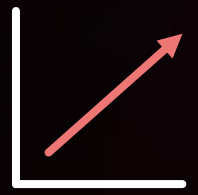
File solutions to serve the three usage patterns



Network-attached storage

FSx

Amazon FSx



Virtually unlimited compute scale

FSx

Amazon FSx



Cloud-native apps and workflows



Amazon EFS

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Virtually unlimited
compute scale

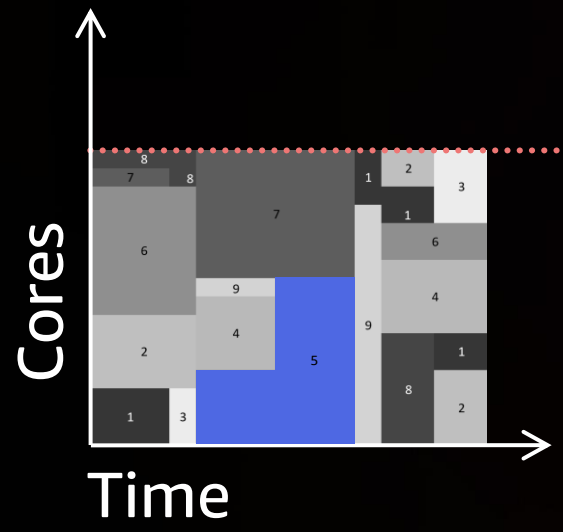
FSx

Amazon FSx

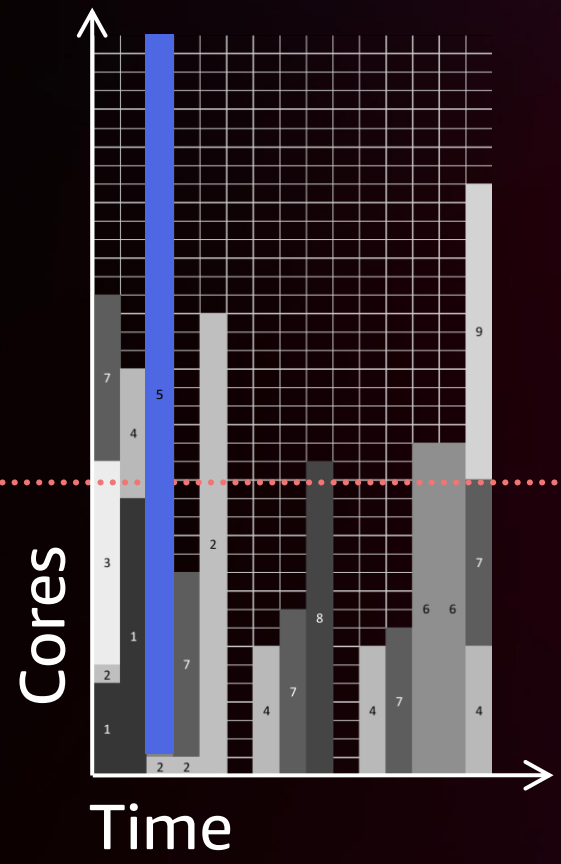
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Finite capacity on-premises



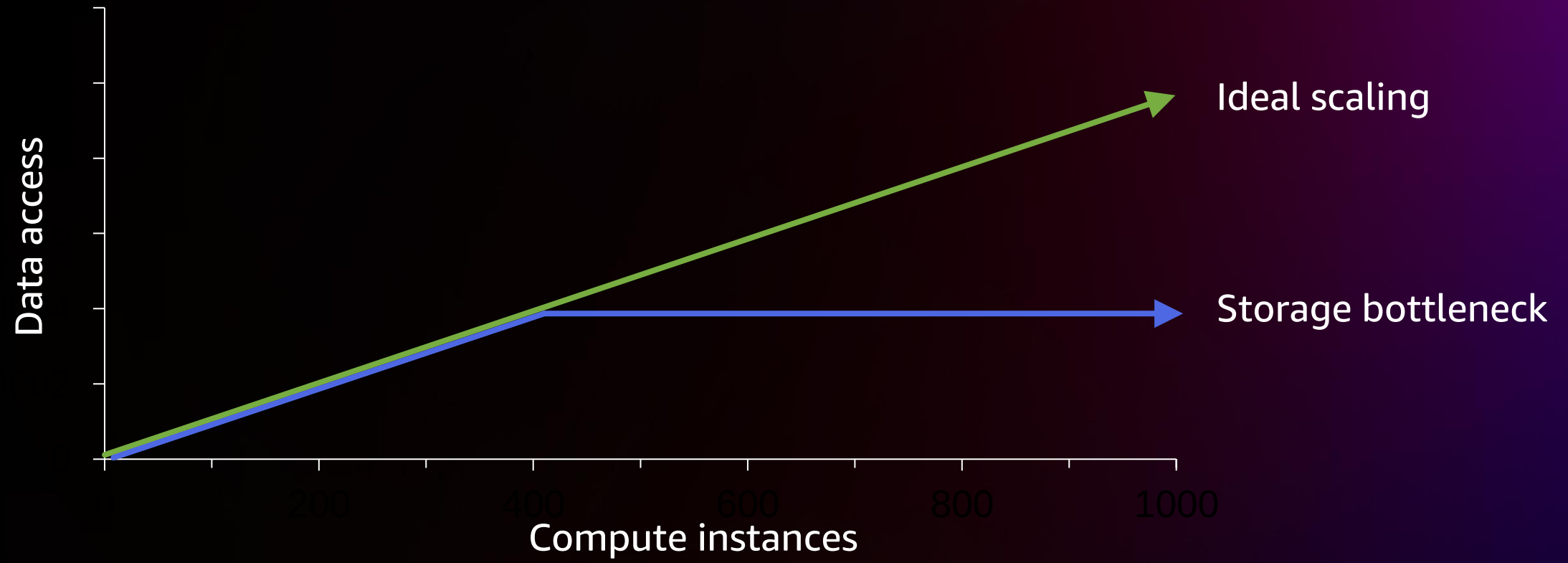
Virtually unlimited capacity on cloud



Fixed data center capacity limit

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Scalable compute requires scalable data access



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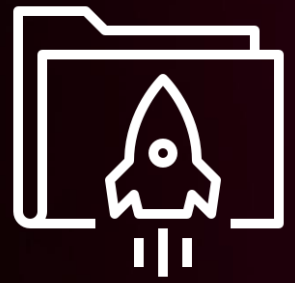
Amazon file storage portfolio for high performance applications

THE BEST WAY TO USE THE CLOUD'S PERFORMANCE SCALE

Focus of today's session



Amazon FSx for Lustre



Amazon File Cache

STG218

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lustre®

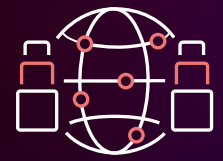
THE WORLD'S MOST POPULAR HIGH PERFORMANCE FILE SYSTEM



Highly scalable performance



Fully POSIX-compliant



Concurrent access for 100,000s of cores

aws

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The power of Lustre, fully-managed



Tested and operated at an unprecedented scale



Automatic infrastructure monitoring and replacement



Unified support experience



Designed and tuned to optimize AWS resources



Automatic and secure backups

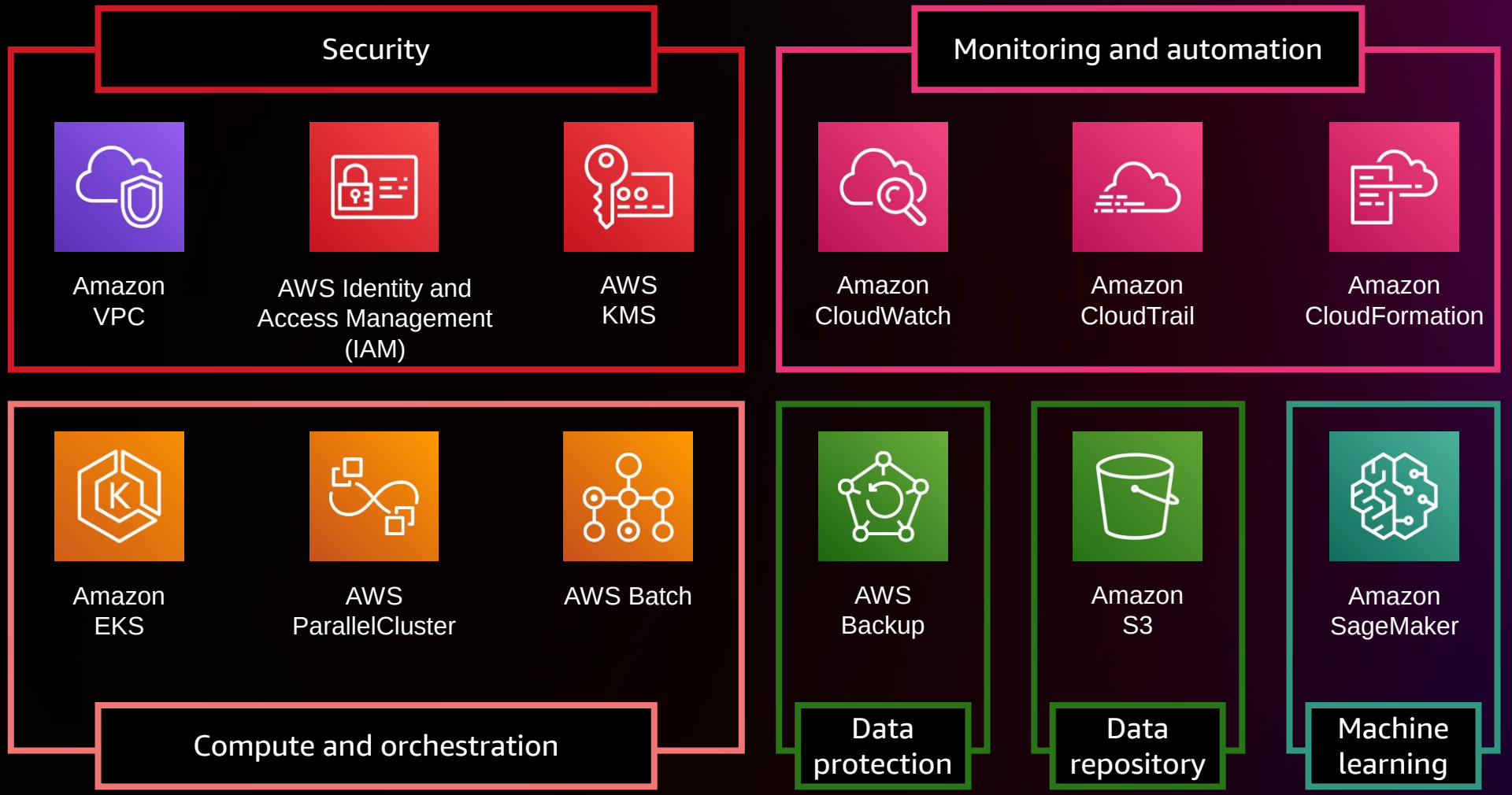


API for infrastructure as code

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. . . and natively integrated into AWS



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FSx for Lustre: Designed for the most compute-intensive workloads

By industry



Financial services



Life sciences



Media and entertainment



Automotive



Semiconductor



Oil and gas

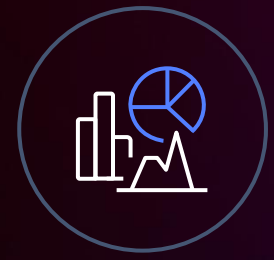
By application area



Big data analytics



Machine learning

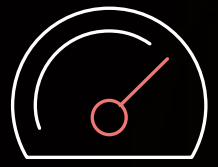


High-performance computing

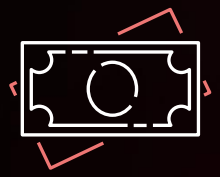
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What FSx for Lustre brings to your workloads



Highly scalable throughput capacity



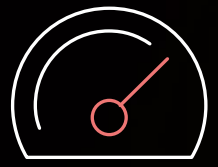
Storage options optimized for price-performance



Access to Amazon S3 data through a fast file interface

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What FSx for Lustre brings to your workloads



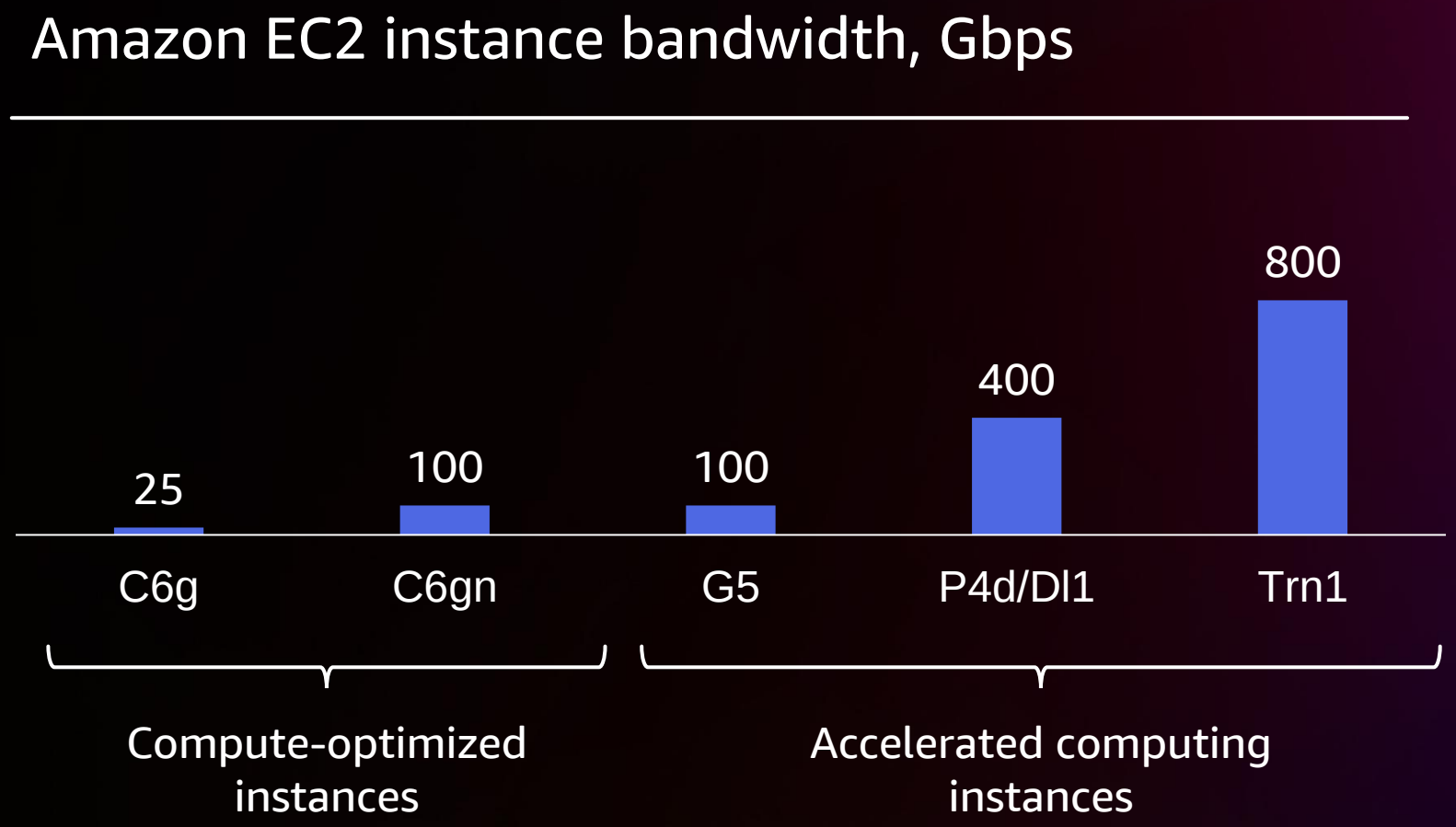
Highly scalable
throughput
capacity

100s of GB/s
of throughput

Millions
of IOPS

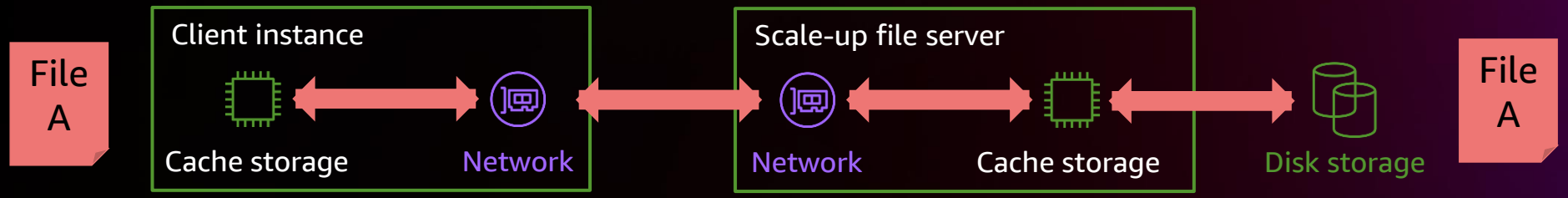
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Network bandwidth on Amazon EC2 instances is growing



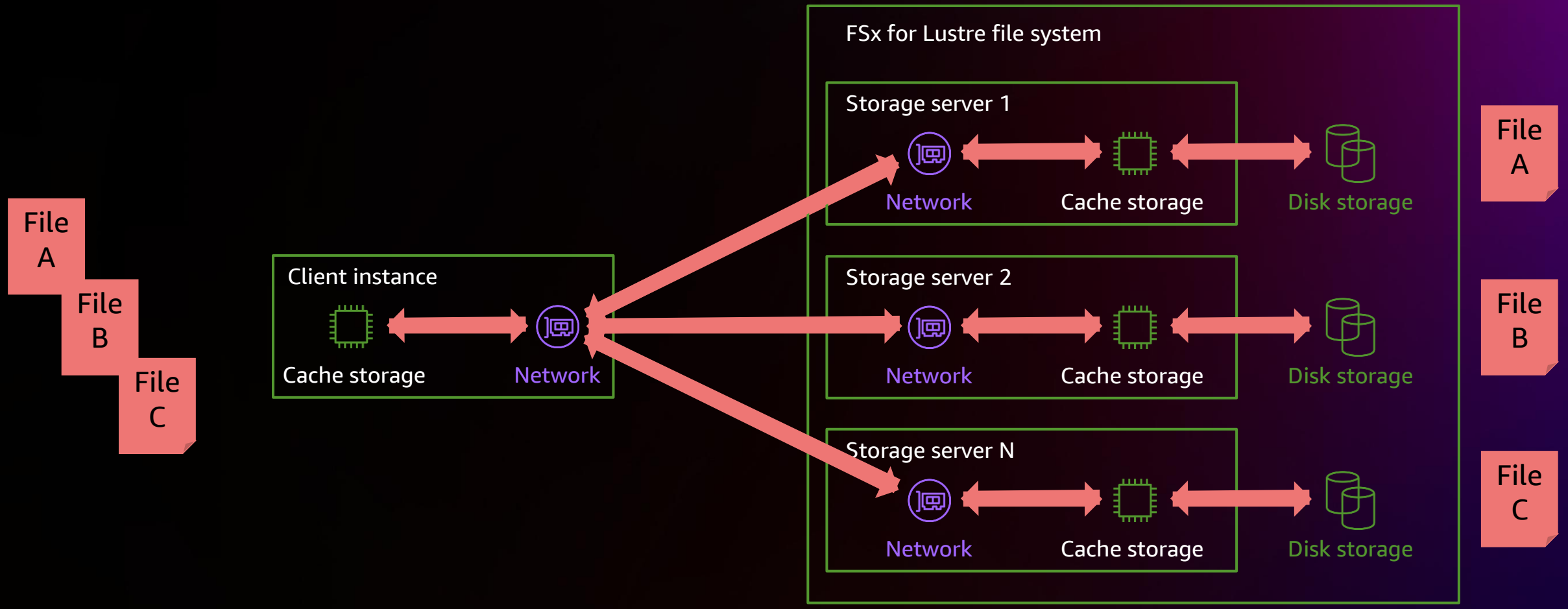
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How scale-up file systems work



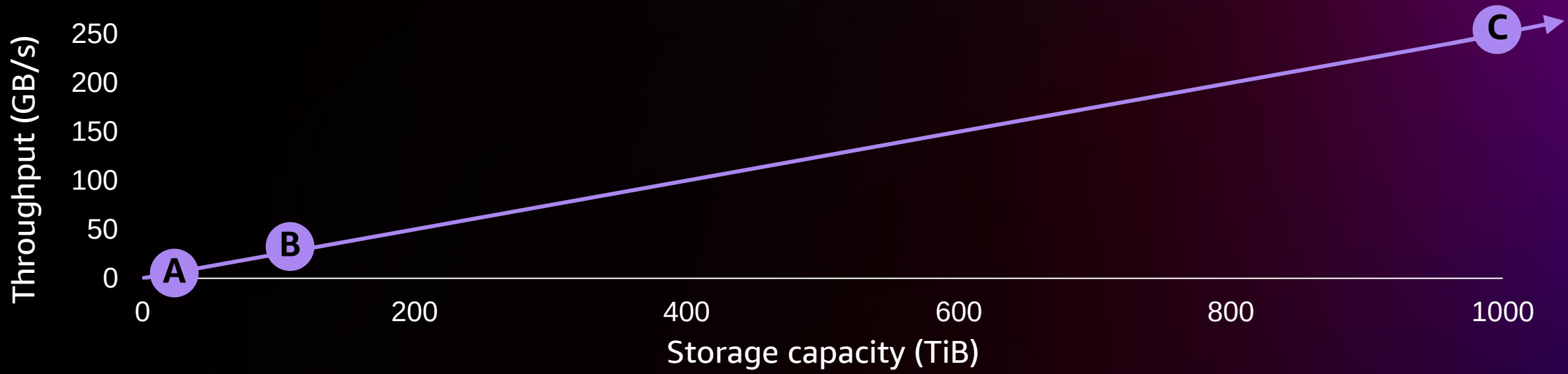
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How Lustre I/O works



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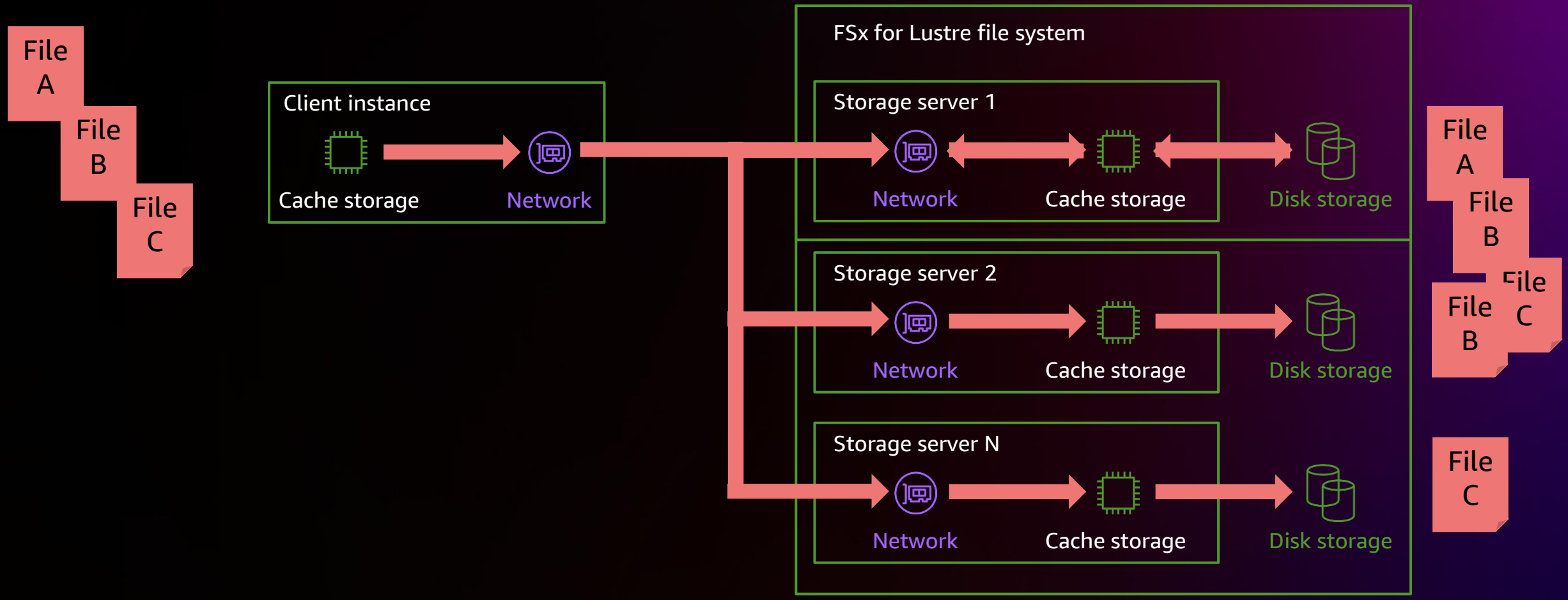
Lustre performance scales with storage capacity



	Storage capacity	Baseline throughput	IOPS	Latencies
A	10 TiB	2.5 GB/s	Tens of thousands	Sub-millisecond
B	100 TiB	25 GB/s	Hundreds of thousands	
C	1,000 TiB	250 GB/s	Millions	

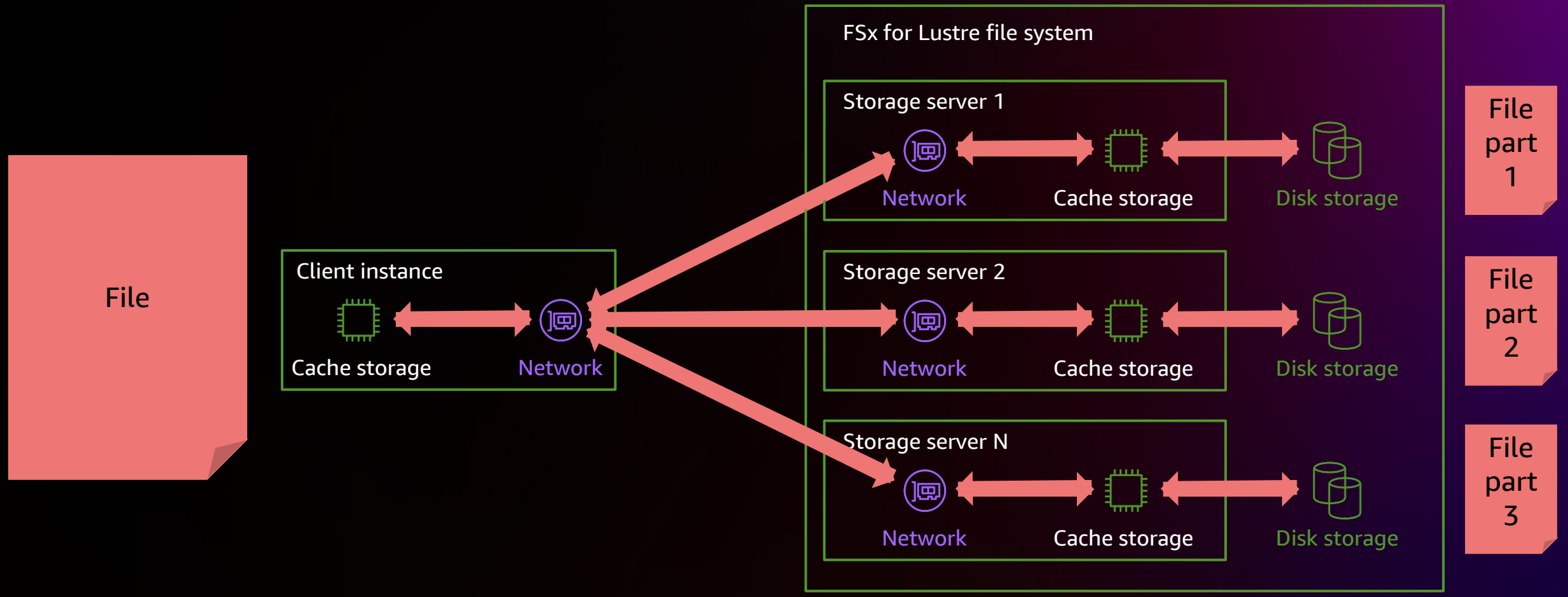
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FSx for Lustre storage scaling and rebalancing



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Lustre file I/O



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Lustre file I/O

1 GB file



>1 GB file



1 TB file



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RIVIAN

Rivian used Amazon FSx for Lustre and Amazon EC2 to support new concepts, crash and vibration testing, and simulations and achieved up to a 56% workload acceleration

“This is accelerating adoption across the board.”

Madhavi Isanaka
Chief Information Officer, Rivian

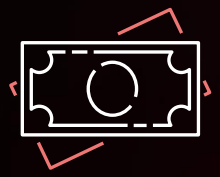
FSx

Learn More
Amazon FSx for Lustre

What FSx for Lustre brings to your workloads



Highly scalable throughput capacity



Storage options optimized for price-performance



Access to Amazon S3 data through a fast file interface

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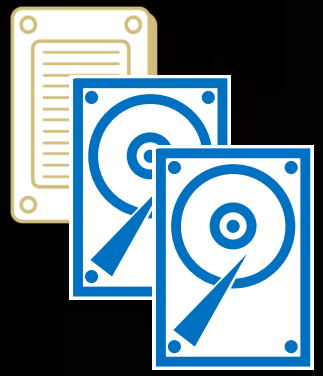
Storage optimized for price-performance



HDD-based persistent storage



SSD-based persistent storage



HDD-based persistent storage with an SSD cache



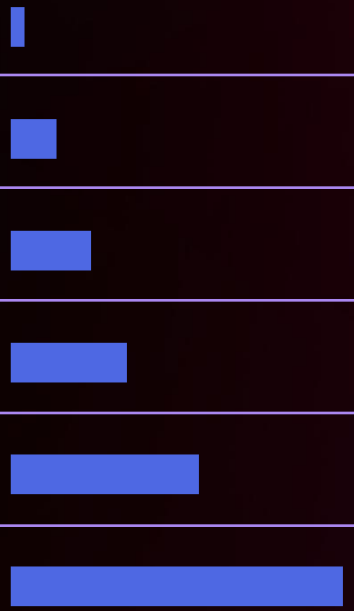
SSD-based scratch storage

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Storage optimized for price-performance

Storage type	Throughput per TiB	Price per unit of storage $ per GB-month
HDD persistent	12 MB/s	$0.025
	40 MB/s	$0.083
SSD persistent	125 MB/s	$0.145
	250 MB/s	$0.210
	500 MB/s	$0.340
	1000 MB/s	$0.600



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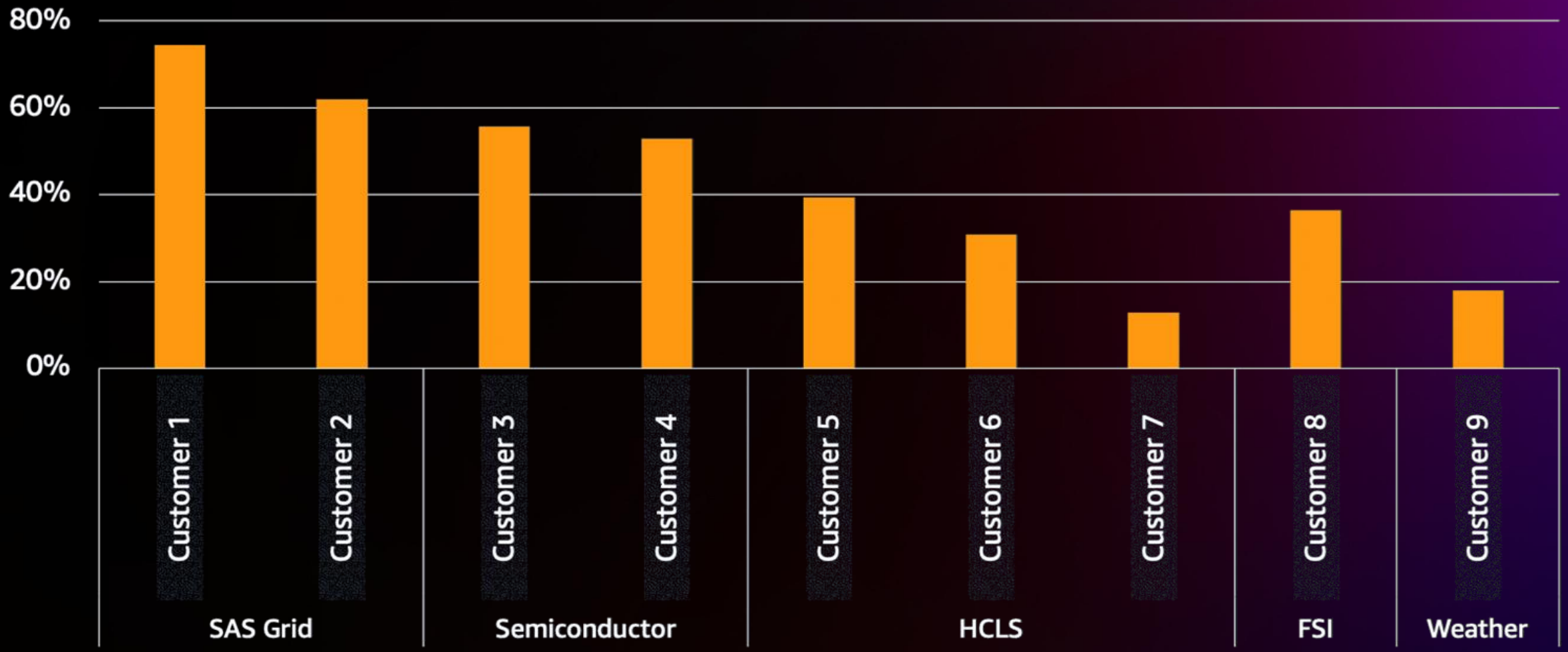
Storage optimized for price-performance

Storage type	Throughput per TiB	Price per unit of storage $ per GB-month	Price per unit of throughput, $ per MB/s-month
HDD persistent	12 MB/s	$0.025	$2.08
	40 MB/s	$0.083	$2.08
SSD persistent	125 MB/s	$0.145	$1.16
	250 MB/s	$0.210	$0.84
	500 MB/s	$0.340	$0.68
	1000 MB/s	$0.600	$0.60

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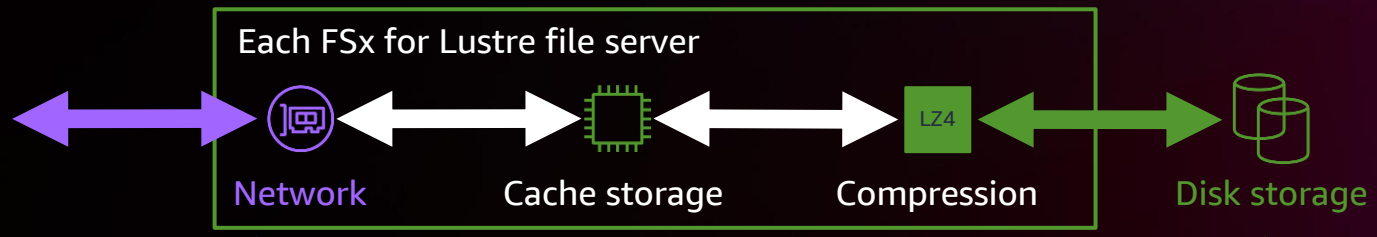
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Data compression: sample compression rates



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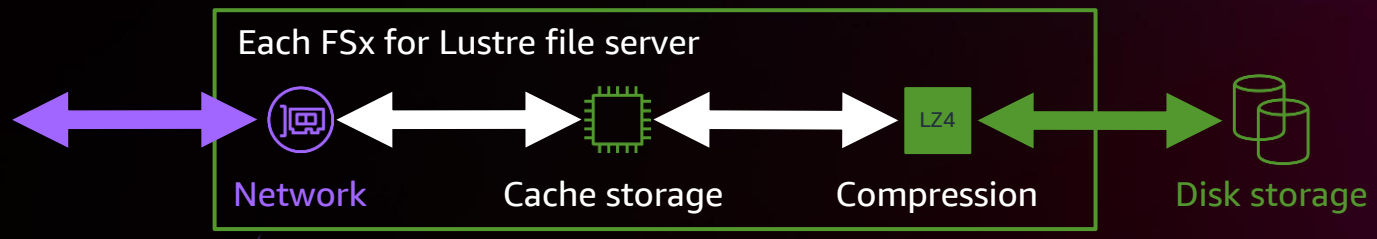
Data compression: How it works



Deployment type	Network throughput	Cache storage (RAM)	Disk throughput
PERSISTENT-250	640 MB/s	6.8 GB	250 MB/s

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Data compression: How it works

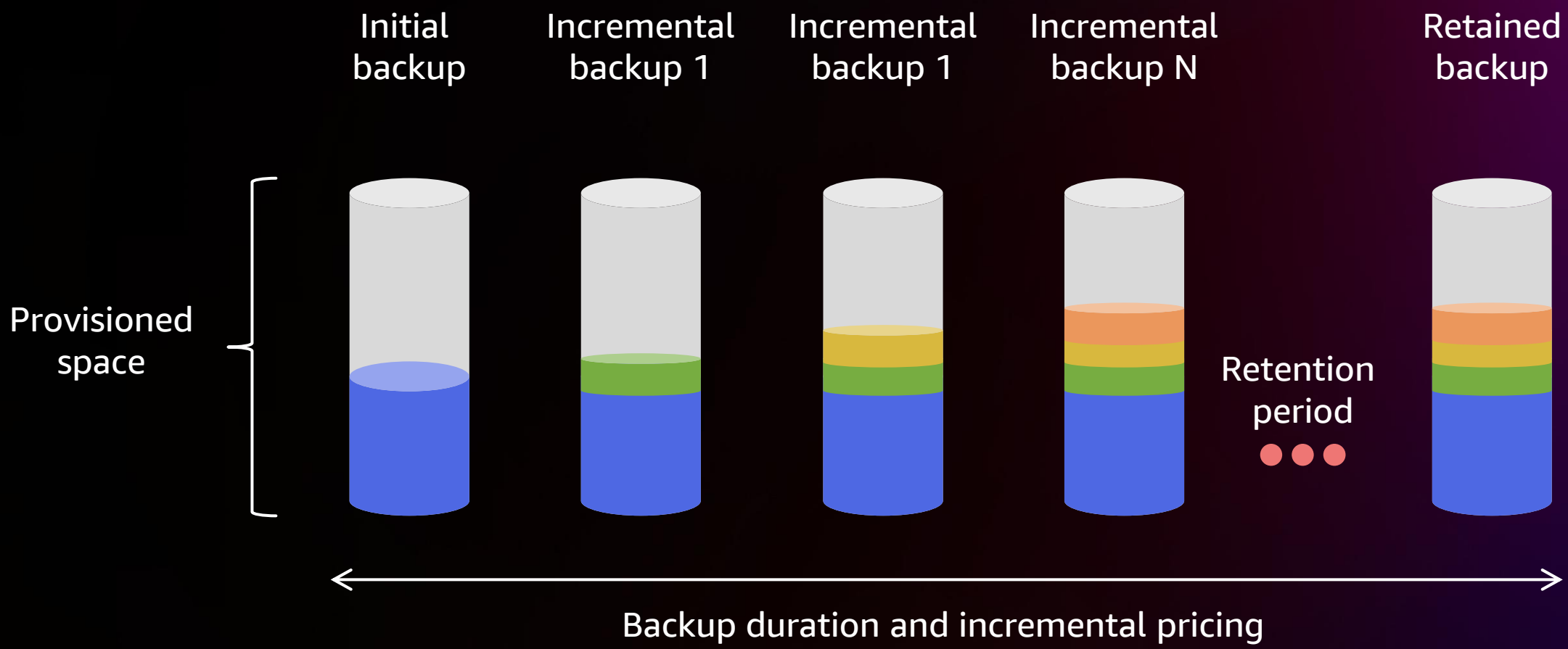


Deployment type	Network throughput	Cache storage (RAM)	Effective disk throughput	Disk throughput
PERSISTENT-250	640 MB/s	6.8 GB	500 MB/s	250 MB/s

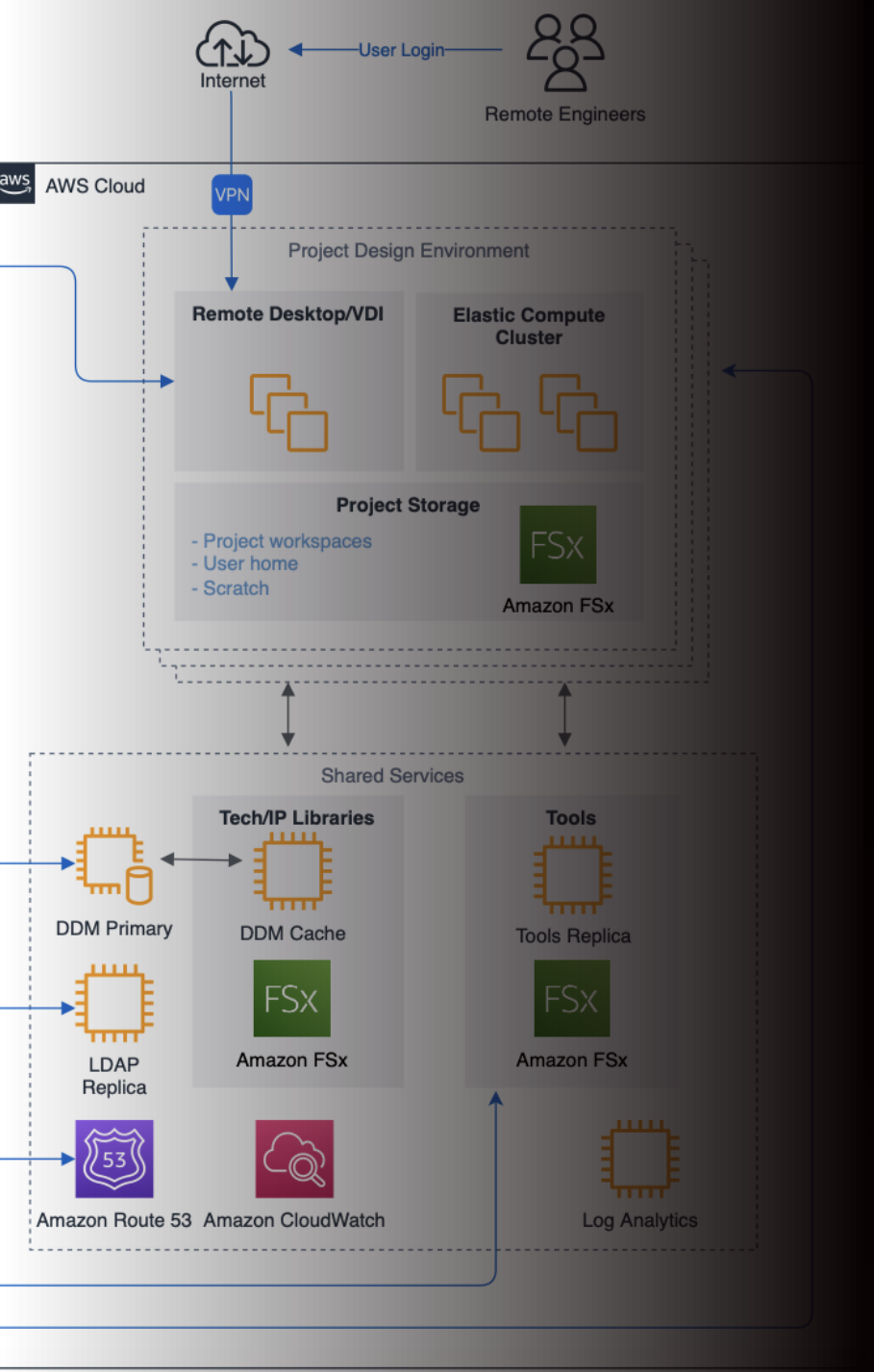
2:1 compression ratio = 2x throughput

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Efficient backup storage



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NXP

"We believe cloud-based EDA is critical to accelerating semiconductor innovation and **getting new designs to market faster** to power an increasingly digital world where more and more devices and infrastructure are connected."

Olli Hyyppa, CIO and Senior Vice-President
NXP Semiconductors N.V.

FSx

Learn More
Amazon FSx for Lustre

What FSx for Lustre brings to your workloads



Highly scalable throughput capacity



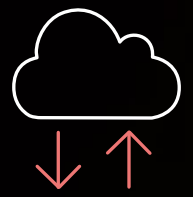
Storage options optimized for price-performance



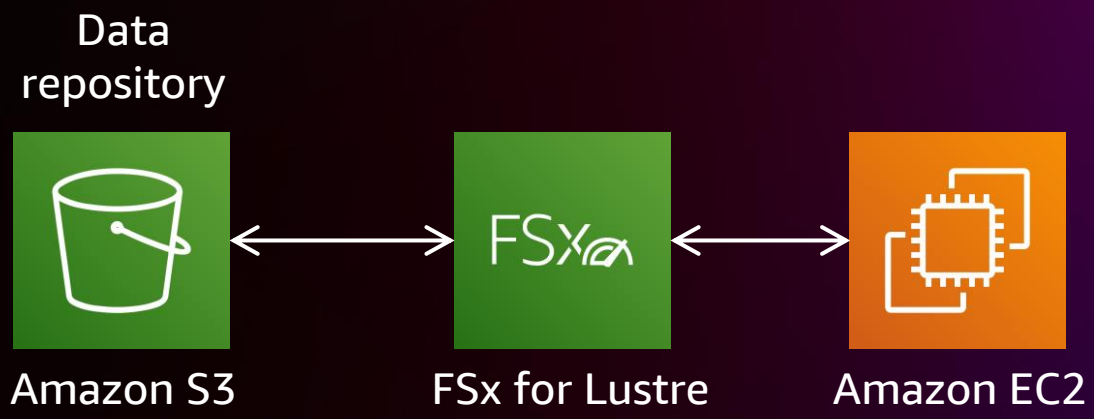
Access to Amazon S3 data through a fast file interface

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What FSx for Lustre brings to your workloads

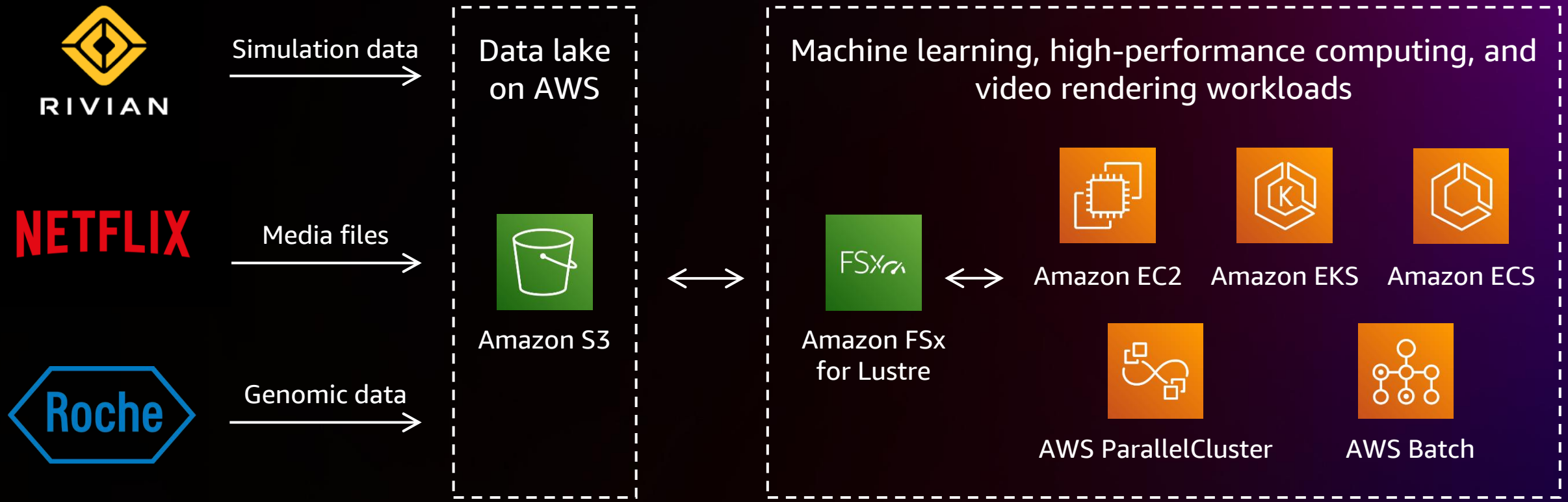


Access to Amazon S3 data through a fast file interface



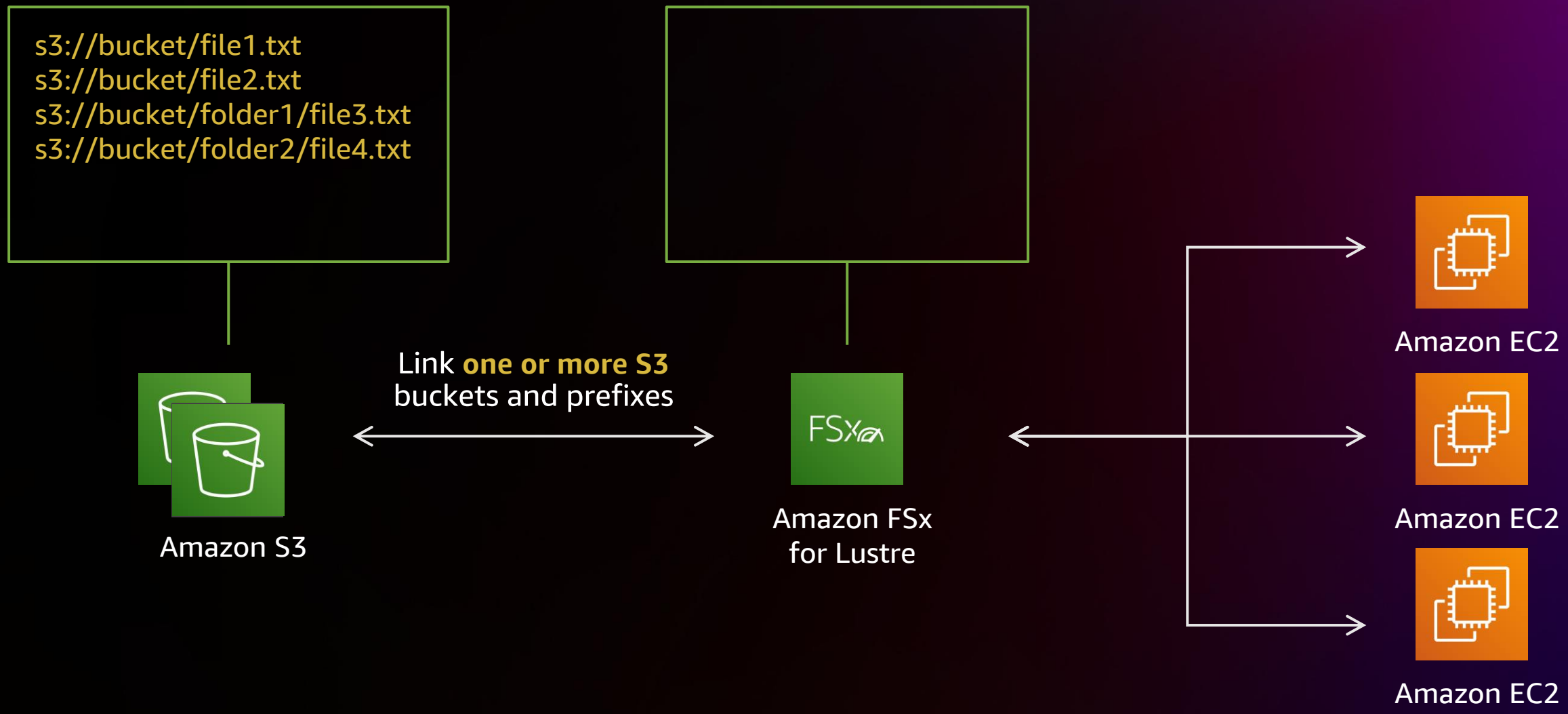
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Use cases: Process Amazon S3 data on FSx for Lustre



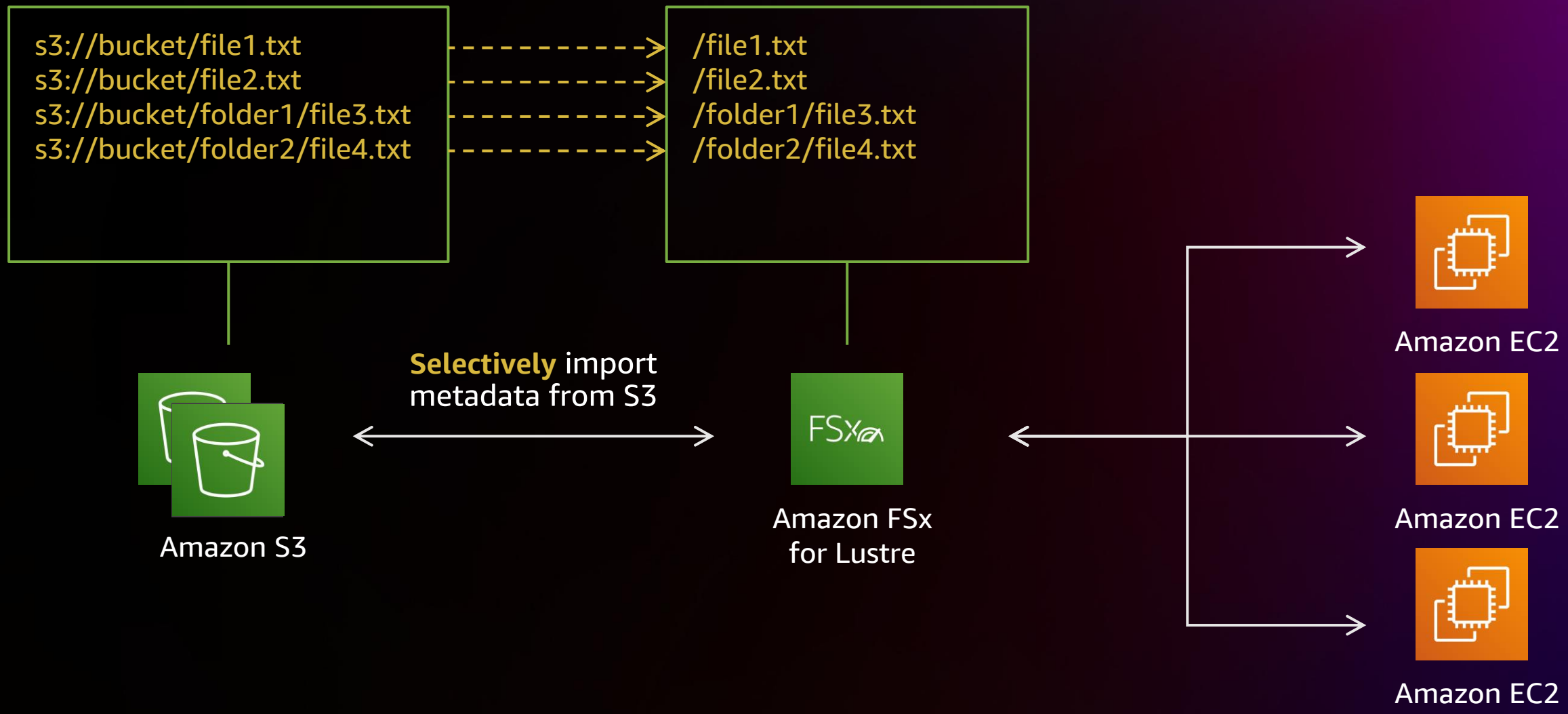
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Fast file interface for data on S3: How it works



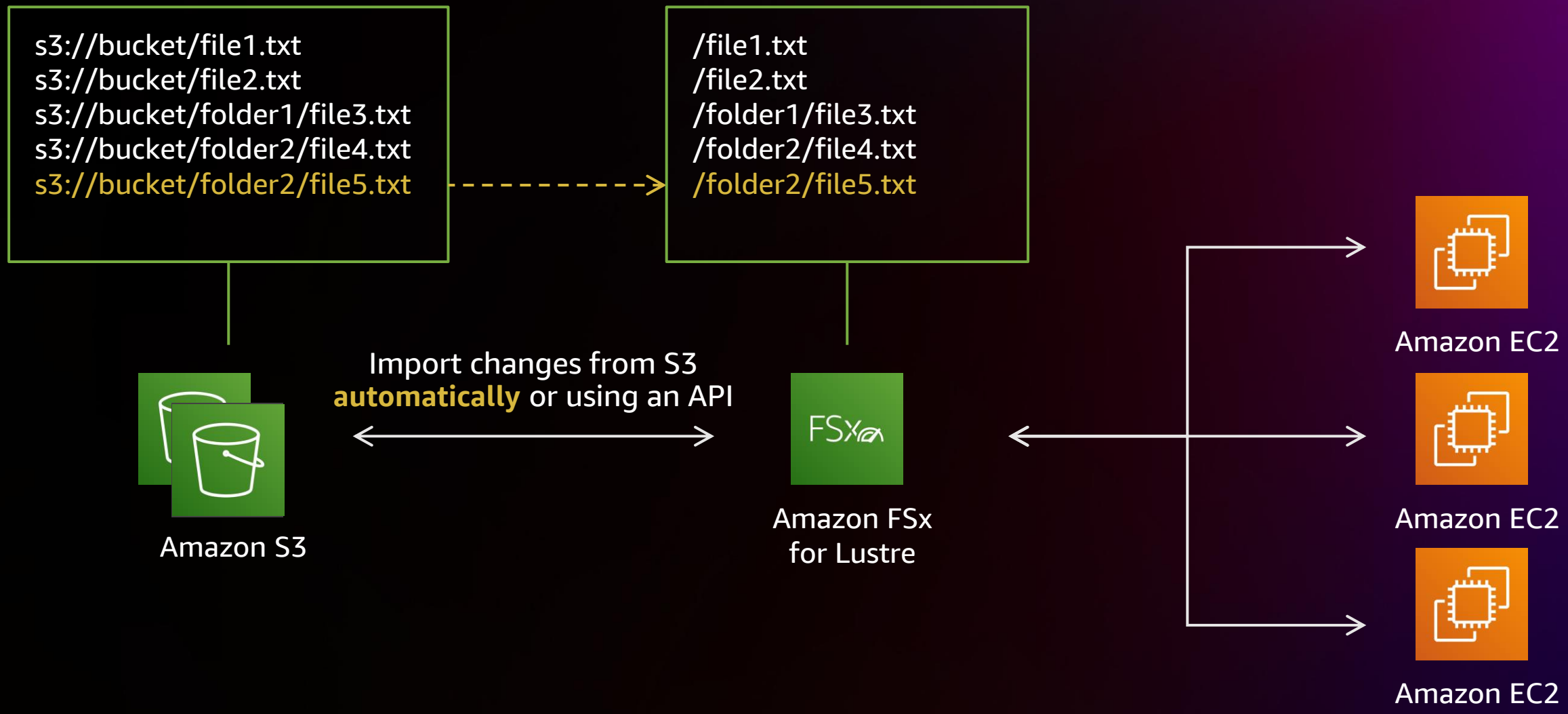
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S3 objects appear on FSx for Lustre



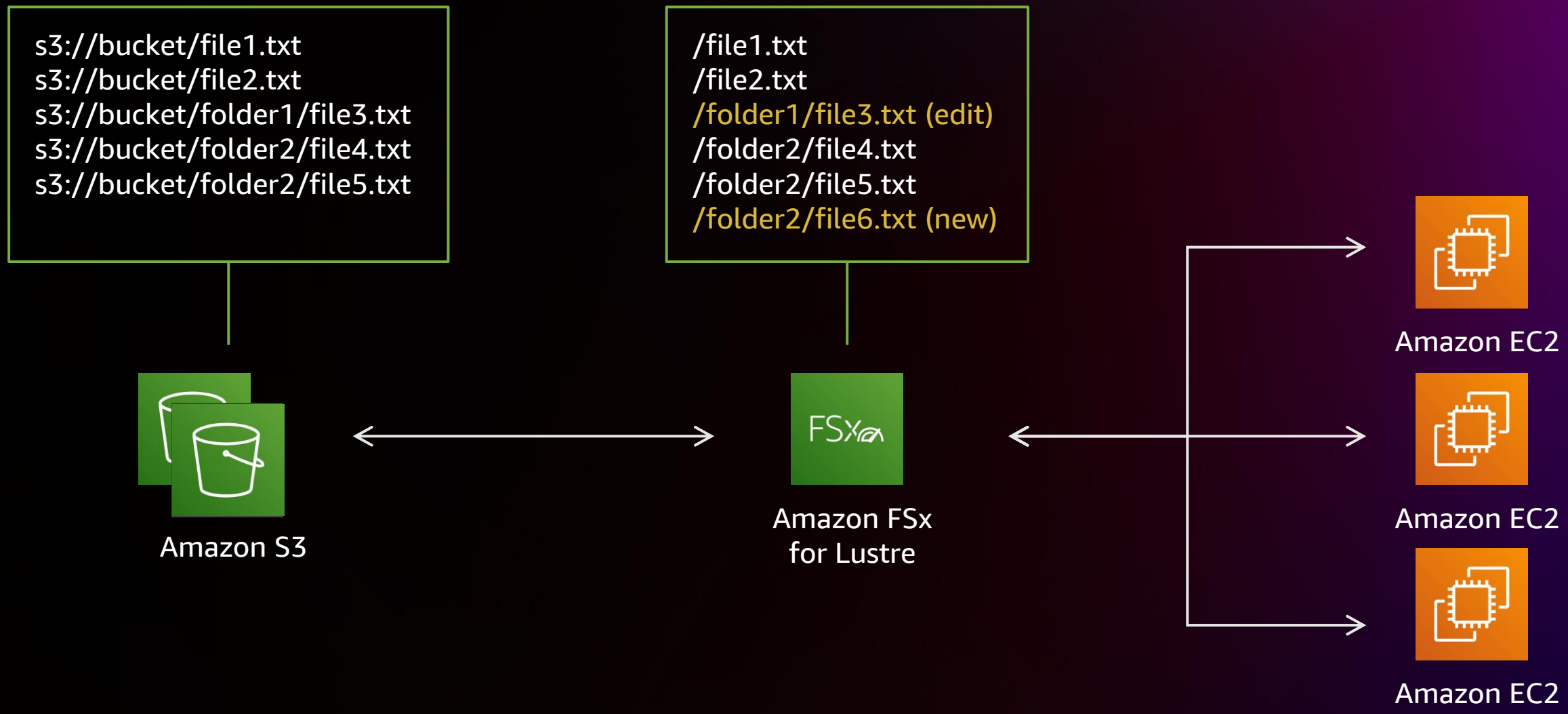
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Updates on S3 are imported to FSx for Lustre



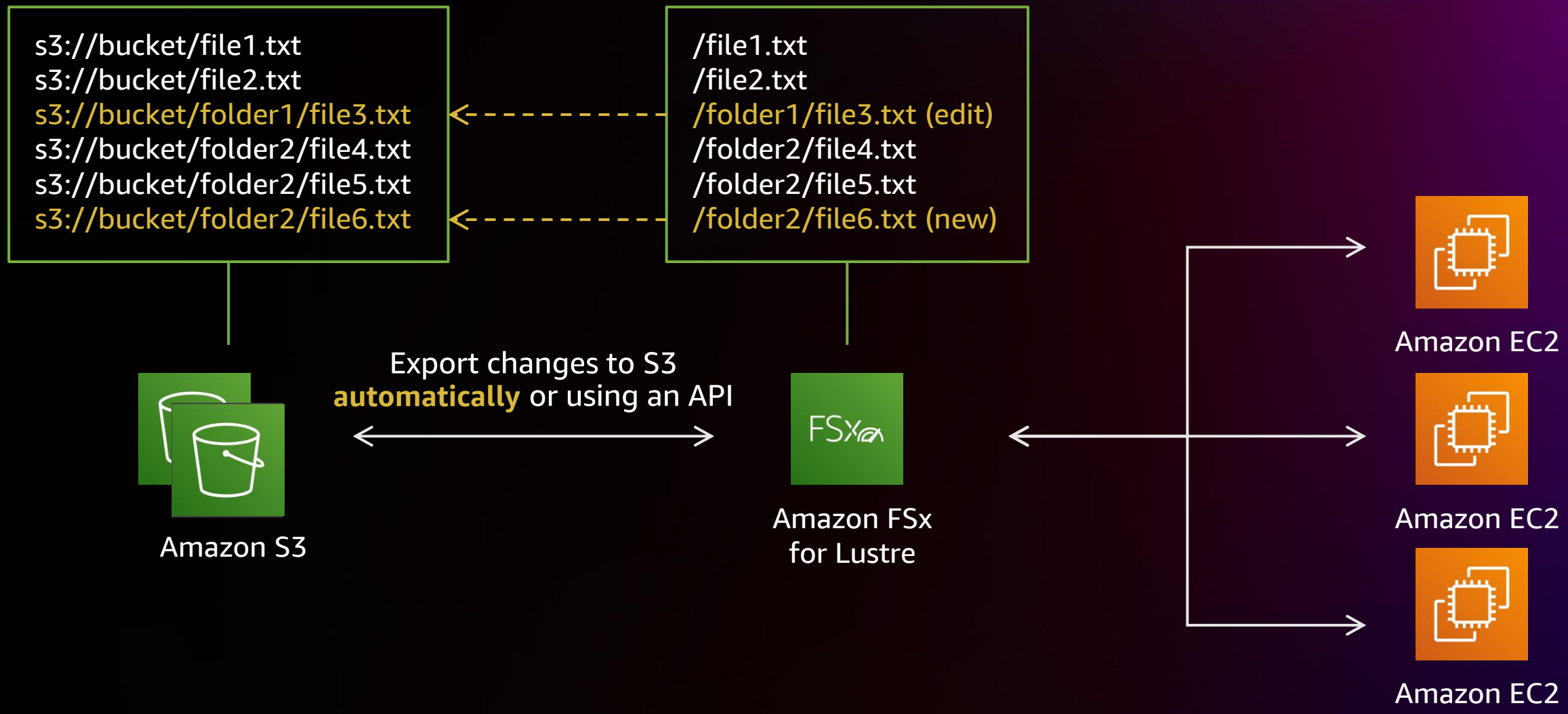
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Updates on FSx for Lustre are exported to S3



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Updates on FSx for Lustre are exported to S3



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Spin up/spin down storage with compute resources

s3://bucket/file1.txt
s3://bucket/file2.txt
s3://bucket/folder1/file3.txt
s3://bucket/folder2/file4.txt
s3://bucket/folder2/file5.txt
s3://bucket/folder2/file6.txt



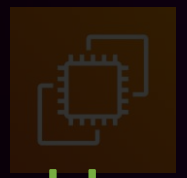
Amazon S3

/file1.txt
/file2.txt
/folder1/file3.txt (edit)
/folder2/file4.txt
/folder2/file5.txt
/folder2/file6.txt (new)

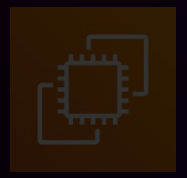
Spin down resources between workloads



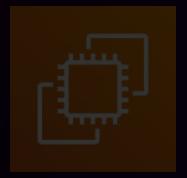
Amazon FSx
for Lustre



Amazon EC2



Amazon EC2



Amazon EC2

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Optimize for simplicity

Lazy-load file data

Export all file system updates to Amazon S3 during workload execution

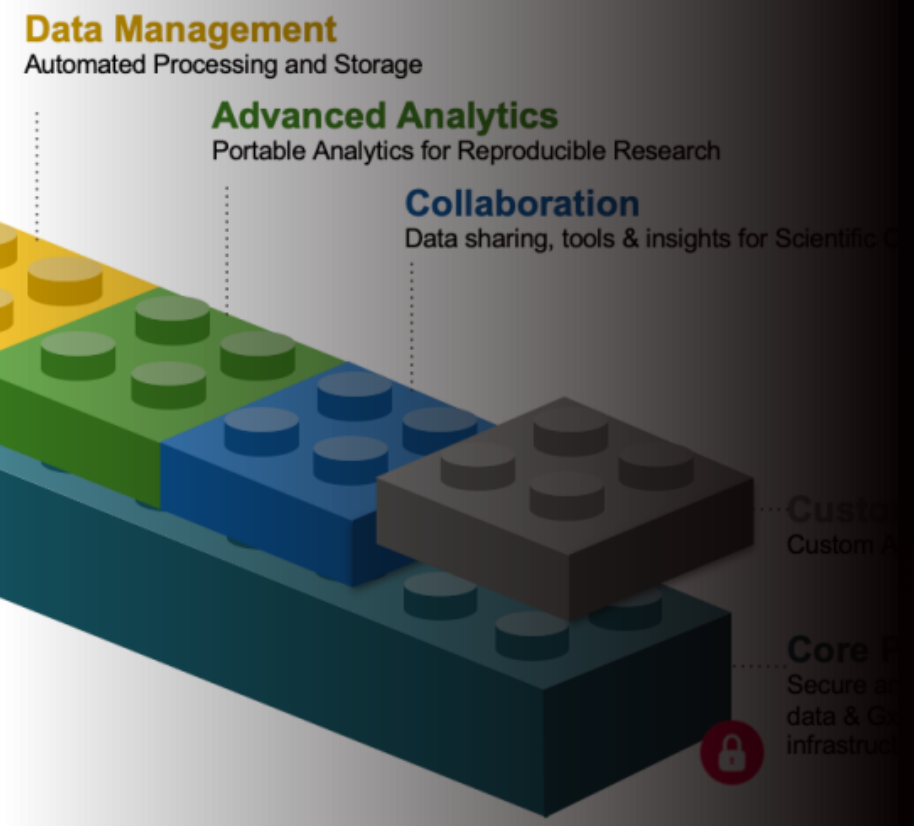


Optimize for performance

Pre-load file data

Selectively export results after workload completes

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Roche

Image files that previously took 2–3 days for processing are now ready in hours, and modular electronic health record datasets get processed within minutes.

“Roche is taking steps closer towards its mission to **provide every patient with the best treatment possible in the fastest time.**”

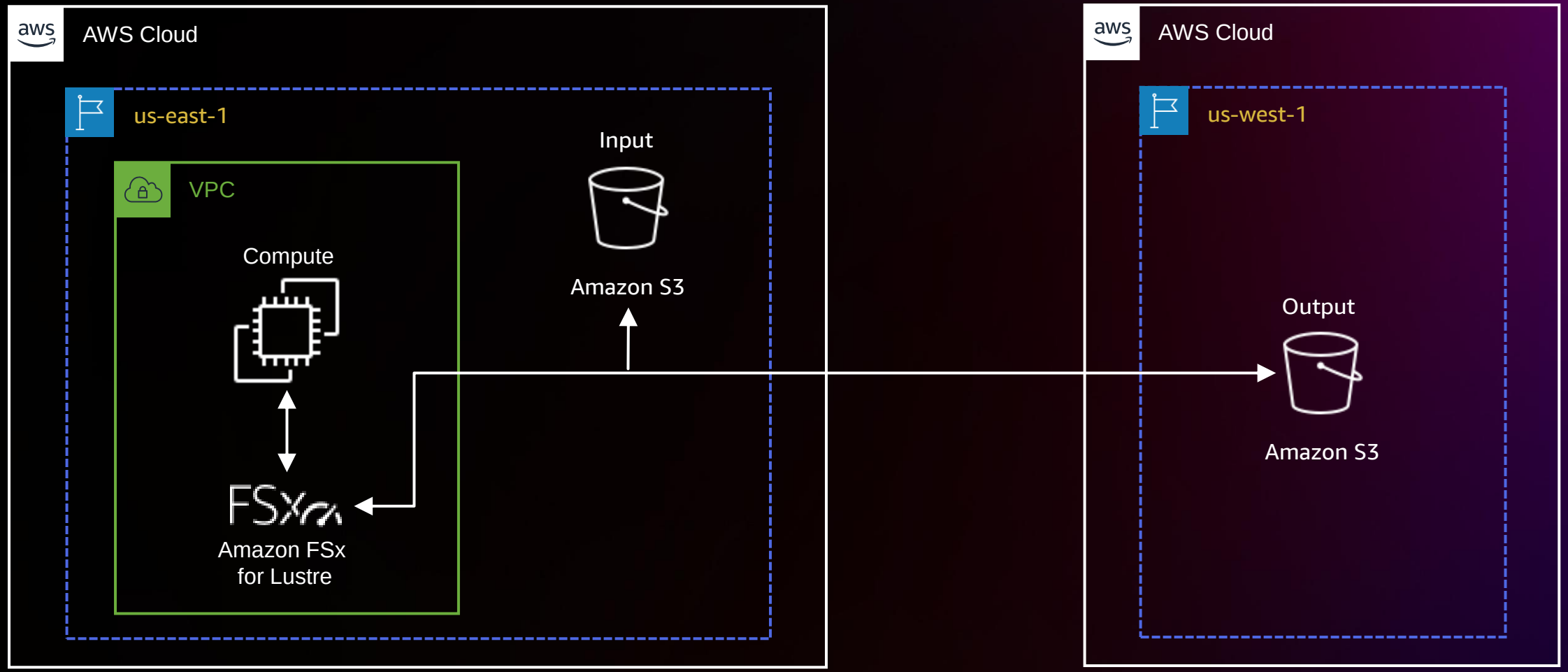
Mustaqhusain Kazi, Head of Personalized Healthcare, Pharma Informatics at Roche

FSx

Learn More
Amazon FSx for Lustre

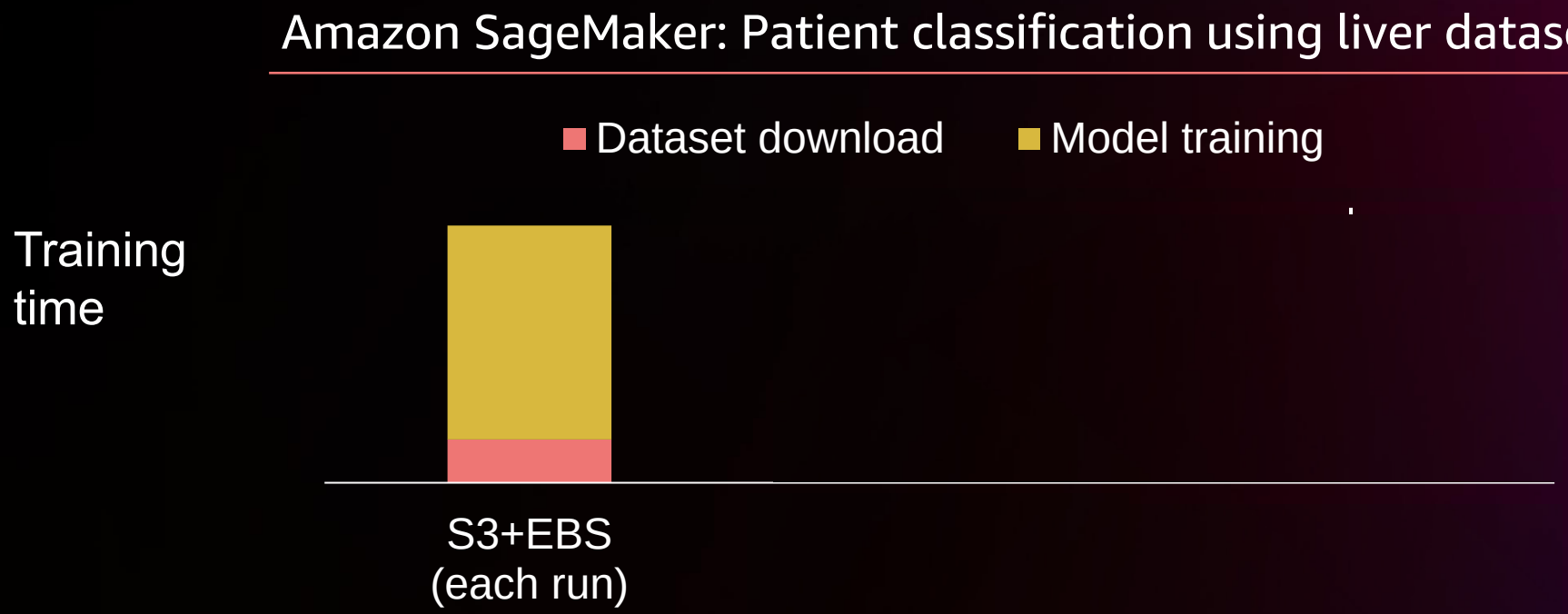
Demo: FSx for Lustre with Amazon S3 integration

Demo environment



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Case study: Reduce ML model training cost



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amazon

Search M5, a team within Amazon Search builds large models with tens of billions of parameters to support machine learning (ML) applications at Amazon

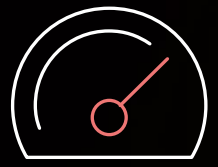
“By extensively using a combination of AWS FSx, Amazon EC2, and AWS Batch, we have increased our experimental velocity”

Roshan Makhijani
Engineering manager at Amazon Search

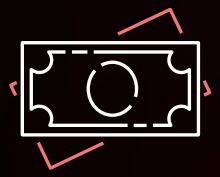
FSx

Learn More
Amazon FSx for Lustre

What FSx for Lustre brings to your workloads



Highly scalable throughput capacity



Storage options optimized for price-performance



Access to Amazon S3 data through a fast file interface

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