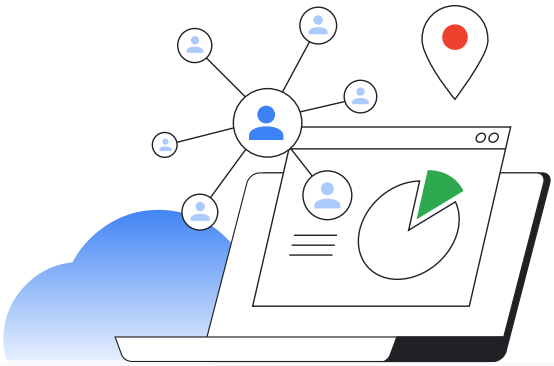
Google Cloud

High Performance Compute (HPC) for Value-at-Risk



Key trends driving the need for new approaches to market risk simulations

1. Changing regulatory expectations
2. Need for intraday visility
3. New products & risk drivers
4. Industry shift to cloud infrastructure

However, significant challenges remain

Cost

- Large capital expenditure
- Static resources
- Can't seamlessly scale up and down

Slow

- Queues & long wait times
- Legacy technology
- Disparate systems
- Difficult to procure hardware

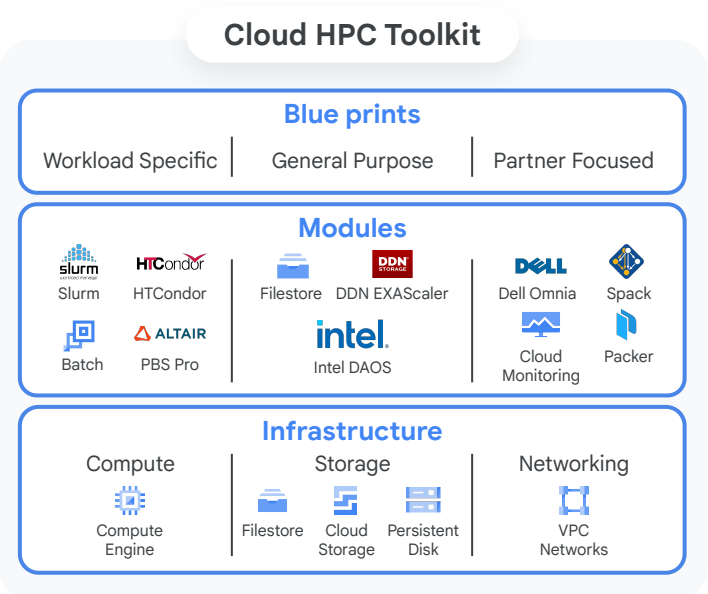
Complex

- Custom setup
- Many levers for optimal performance

Google Cloud's solution helps users easily create repeatable, turnkey HPC clusters based on proved best practices

Key components:

- **Blueprints** define an HPC environment. They reference individual modules which they use to compose the desired system.
- **Modules** are code to deploy specific components of an HPC system, such as a cluster's partition, a storage system, or the network. Either imported from public sources (Github), or hosted privately.
- **Infrastructure** hosts the HPC system that is built, and the Cloud HPC Toolkit supports the core Google Cloud services and features that are required for HPC.



Google Cloud

Google Cloud's HPC toolkit can help streamline the value at risk calculation

Security: Google's in-depth approach to security includes multiple layers of physical and logical protection. 100% of data at rest and in transit is encrypted by default.

Speed: Spin up multiple virtual machines quickly and calculate risk at the desk or portfolio level and aggregate it to the enterprise level in hours not days.

Scalability: Scale up complex risk calculation workloads as necessary. You only pay for the compute seconds you use.

Efficiency: Automated, templated configurations, and preemptible compute instances increase agility while saving money.

Customers are seeing results using HPC for risk calculations

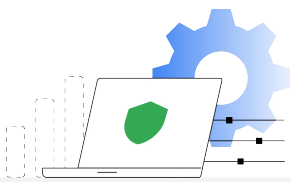
Cost-effective

HSBC migrated its equities risk processing workload using TIBCO GridServer onto Google Google Cloud. Their ongoing running costs are now around 60% of their equivalent for on-premise infrastructure with greater flexibility and direct ownership of their grids by the application owners.

Faster

"By simply migrating from on-premises to BigQuery, we've already noticed a 60% improvement in compute time for overnight batch processing of risk simulations and calculations."

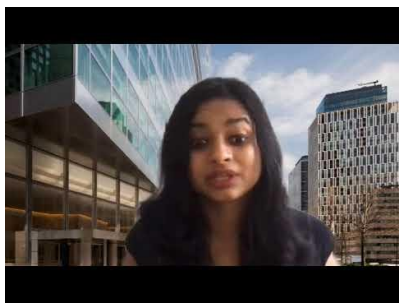
Chris Conway
Head of Risk and Finance Technology, NatWest Markets



More Reliable

Watch Google Cloud Webinar:

Goldman Sachs Customer Spotlight: Delivering Scale, Agility, and Trust



For a full list of example HPC blueprints, see the Cloud HPC Toolkit GitHub repository. You can read more about using the HPC Toolkit in the HPC Toolkit documentation, including our quickstart guides.