Beam as a Risk Engine

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Presenter Profiles

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Peter K Coyle

Leading Engineering Excellence in Risk Technology with interest in Predictive Analytics in Finance, DevOps, High Performance Computing & Simulation

Raj Subramani

Financial professional with over twenty-five years experience across Capital Markets, including transformation in Risk execution, regulatory change and location strategy.

What is Credit Risk

A brief oversight into the build up of Credit Risk within Markets.

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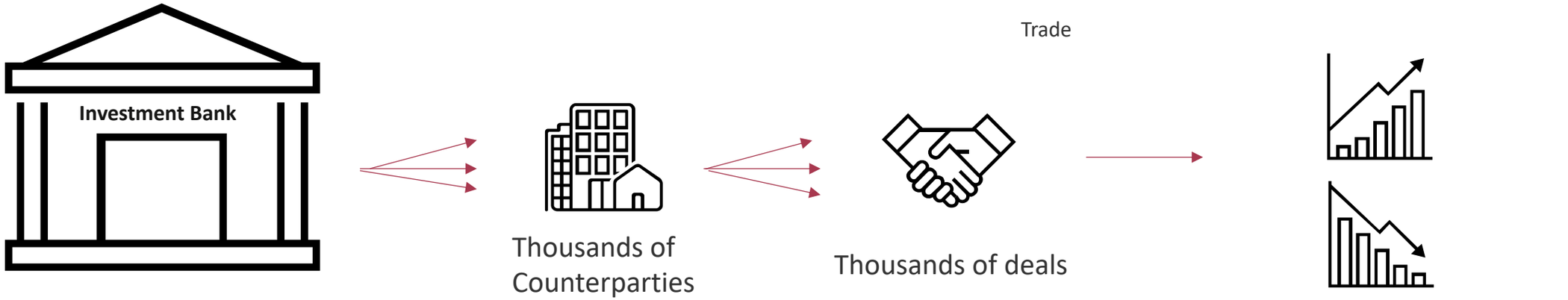
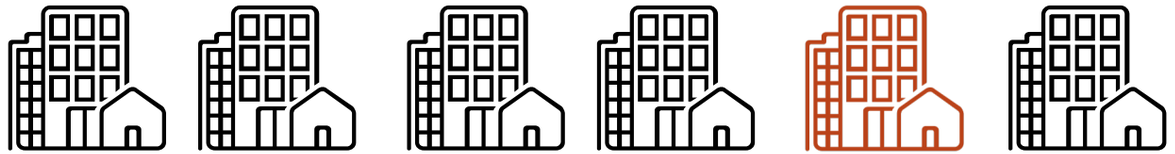
How does Credit Risk Arise
how does Credit Risk rise



Managing Credit Risk

What if a counterparty get's into difficulty?

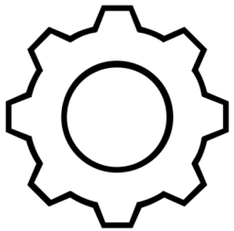


This is called **Credit Risk and needs to be managed.**

Managing Credit Risk

Exposure to each counterparty depends on how the financial markets move.

We can't predict the future.



There is structure in Financial Markets.
We can model this statistical structure.

Monte-Carlo Analysis allows us to estimate risks bases on plausible future scenarios. This leads to many billions of valuations to scan plausible future scenarios – reaching out 50+ years.

What are Risk Engines

An oversight of what a Risk Engine does and how they have evolved.

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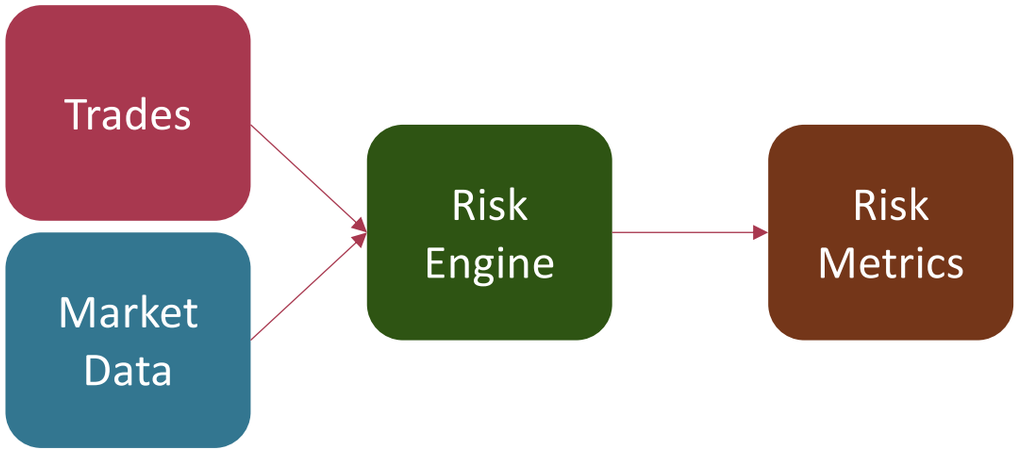
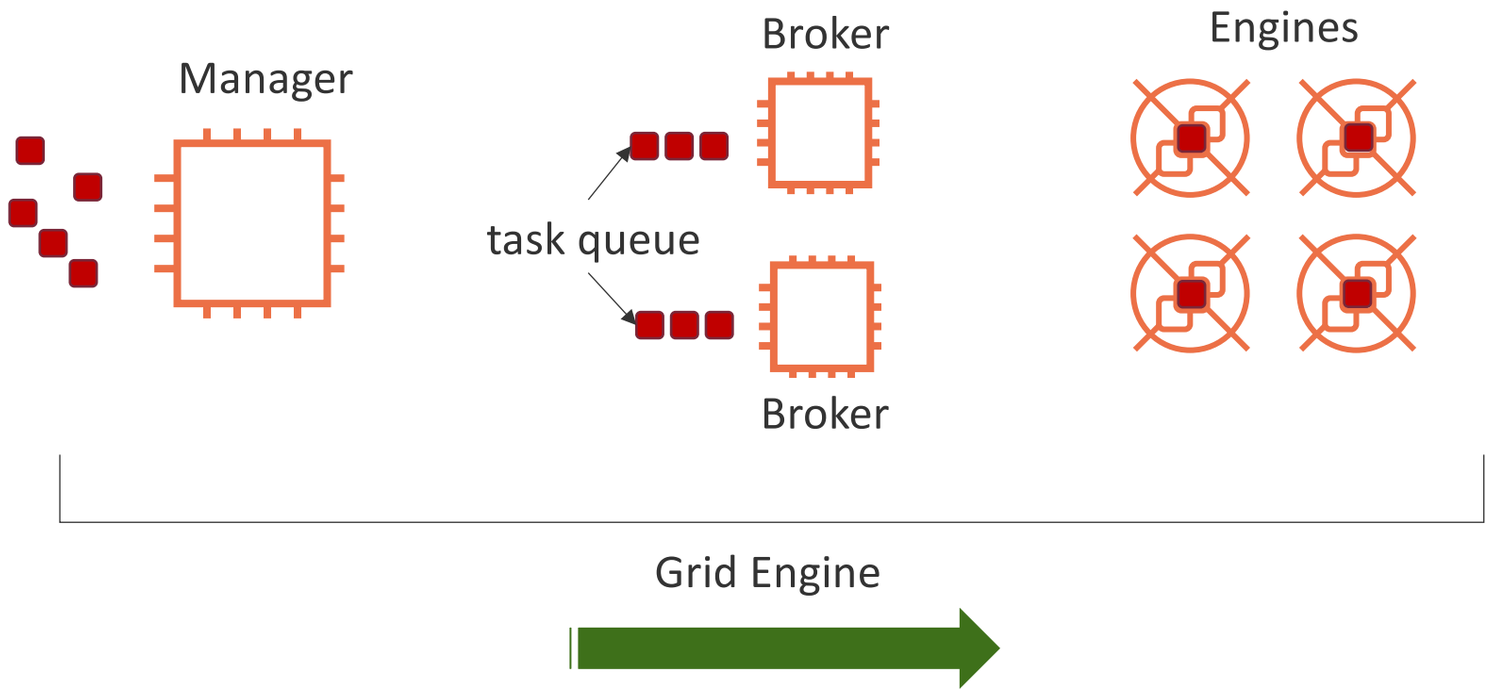
What is a Risk Engine
what does a Risk Engine do?

A Risk Engine is typically a transformation engine.
It takes trades and market data as input and transforms it into Risk metrics.

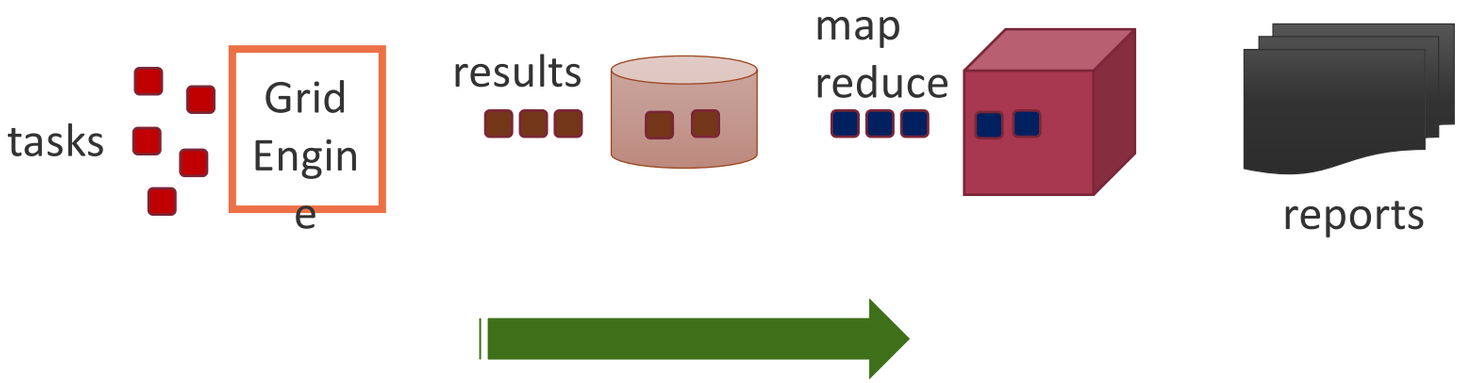


The transformation is usually an approved quantitative analytics process (typically in C++).
The risk metrics produced at trade level need to go through a map-reduction process to have them regrouped by netting sets on a Counterparty basis.

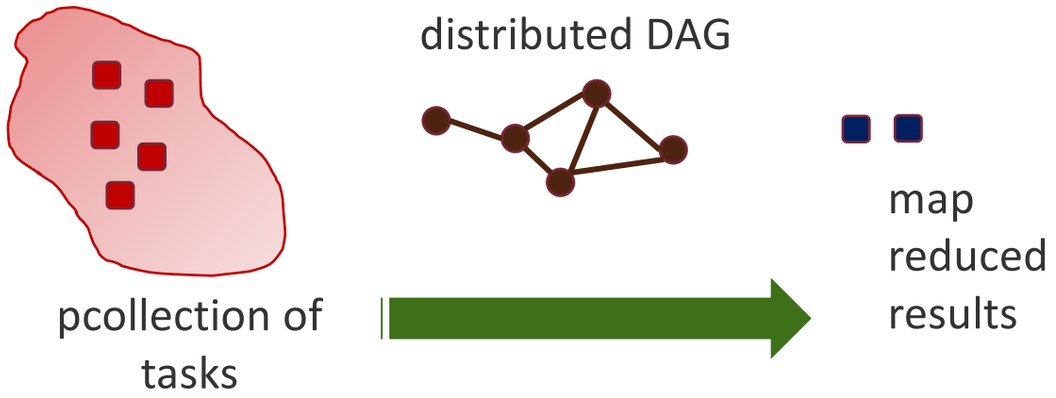
Traditional Risk Engines
task based engines - execution



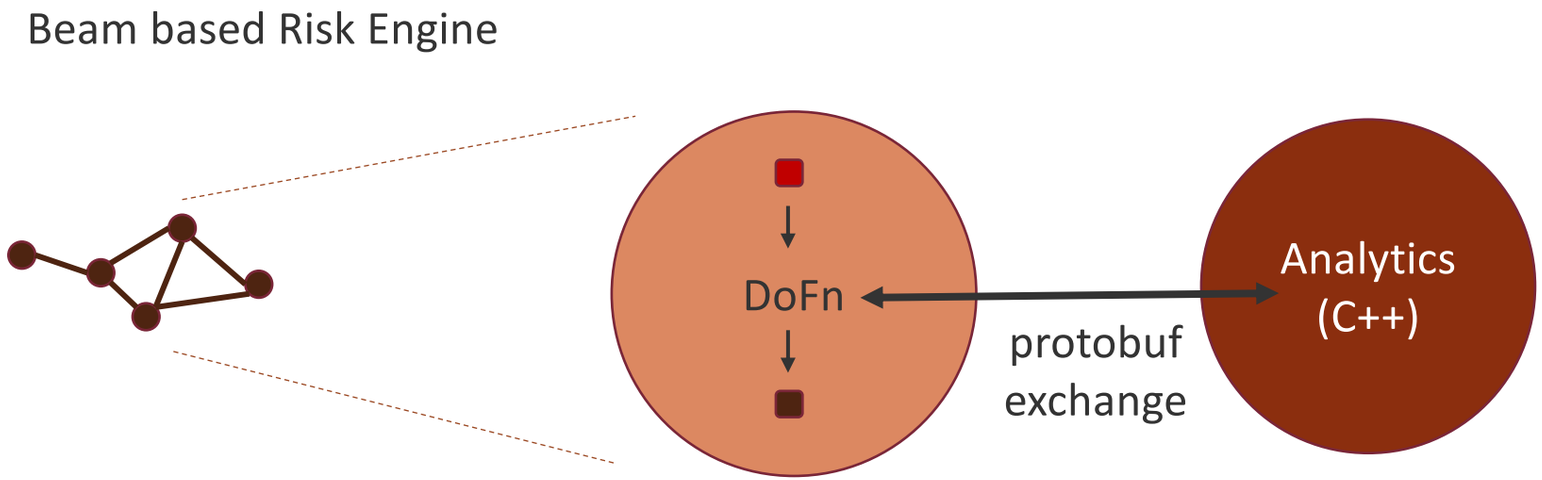
Traditional Risk Engines
task based engines – map-reduction



Beam based Risk Engines
transformation and map-reduce in one pass



Beam based Risk Engines inner workings



Beam for Counterparty Credit Risk

How HSBC uses Beam to drive the Counterparty Credit Risk metrics.

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Counterparty Credit Risk
global scope

Nos of batches processed per day by region

Region	Batches/day
ASIA	21
EUROPE	10
NORTH AMERICA	5

Trade counts per day by region across all batches

Region	Trades/day
ASIA	1.4m
EUROPE	3.4m
NORTH AMERICA	0.6m
Grand Total	5.4m

Average trade count per batch by region

Region	Trades/day
ASIA	67,000
EUROPE	340,000
NORTH AMERICA	129,000

Counterparty Credit Risk volumes

Total trade value by notional processed per region (in billions of USD) per day

Region	Batches/day
ASIA	8,000
EUROPE	21,000
NORTH AMERICA	4,500

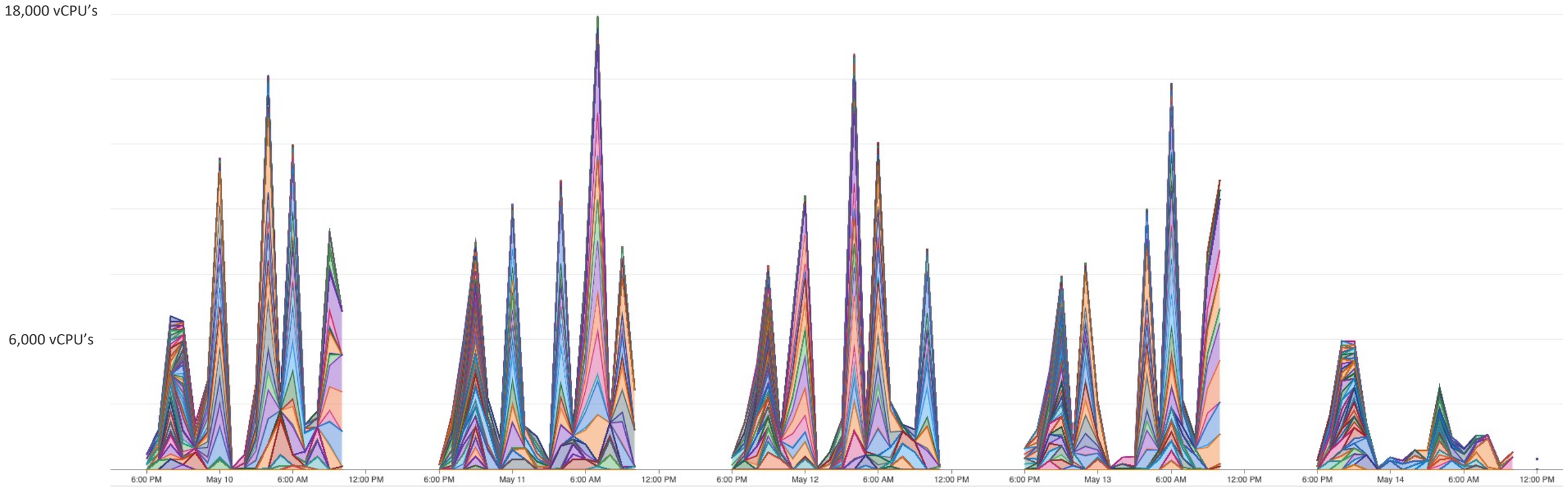
Number of computations executed per day in the beam batches (in billions)

Region	Trades/day
ASIA	193
EUROPE	466
NORTH AMERICA	87
Grand Total	746

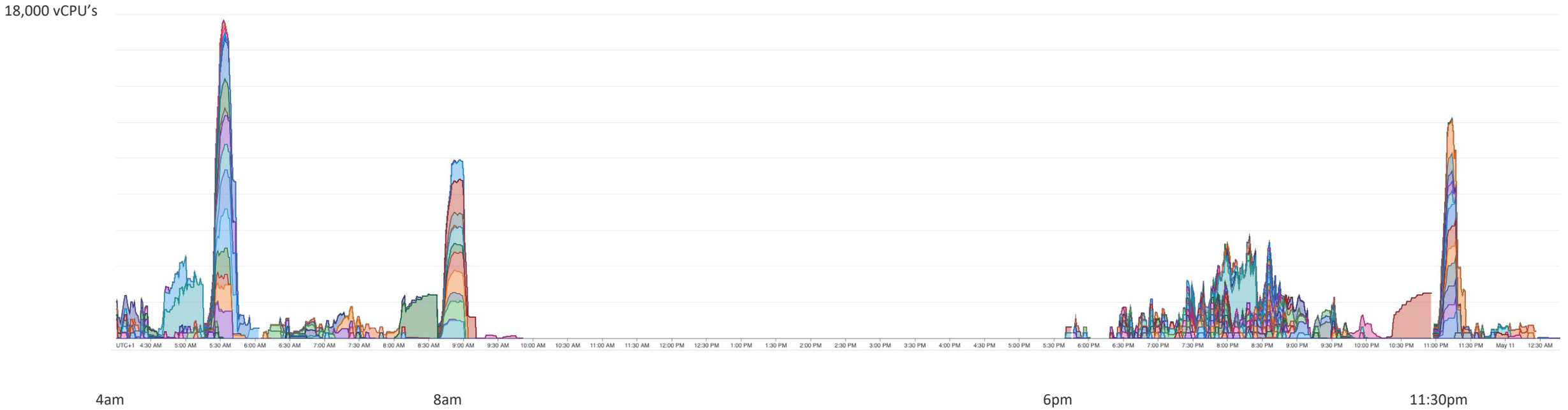
Data volume handled (in MB) per day

Region	Trades/day
ASIA	61,244
EUROPE	69,723
NORTH AMERICA	18,749
Grand Total	149,716

Counterparty Credit Risk
weekly usage patterns – vCPU’s

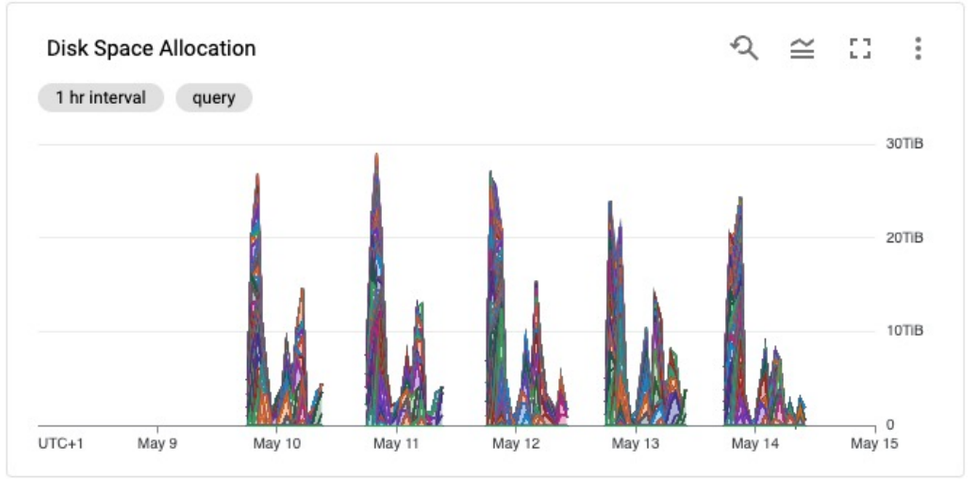


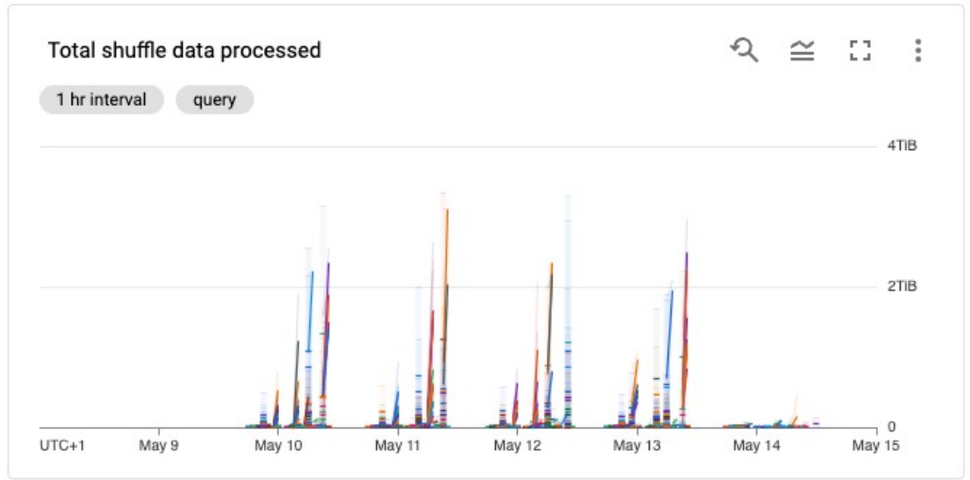
Counterparty Credit Risk
daily usage patterns – vCPU’s



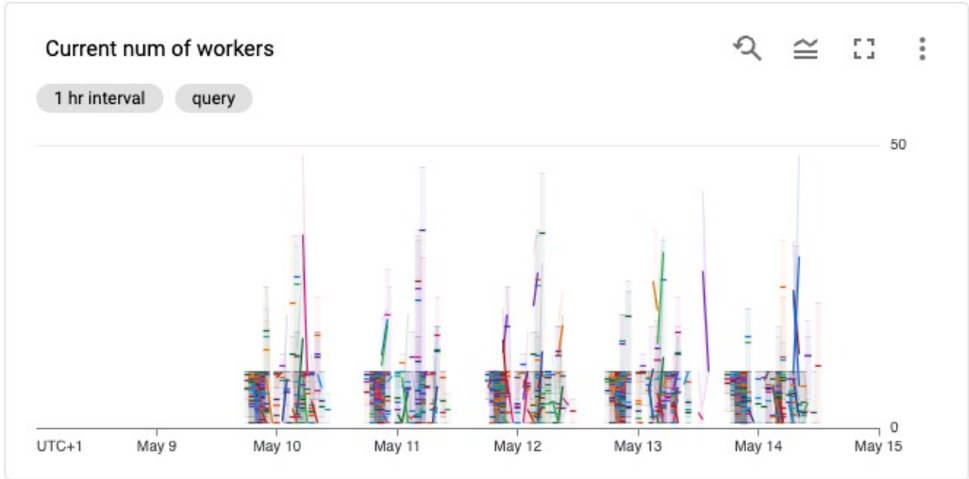
Counterparty Credit Risk resource usage metrics

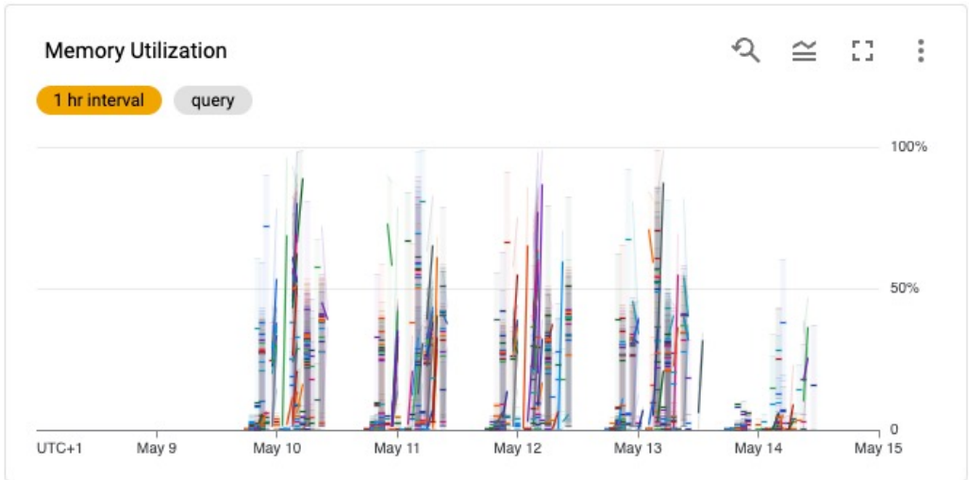
Shuffle Data (TB) / Disk space (TB)





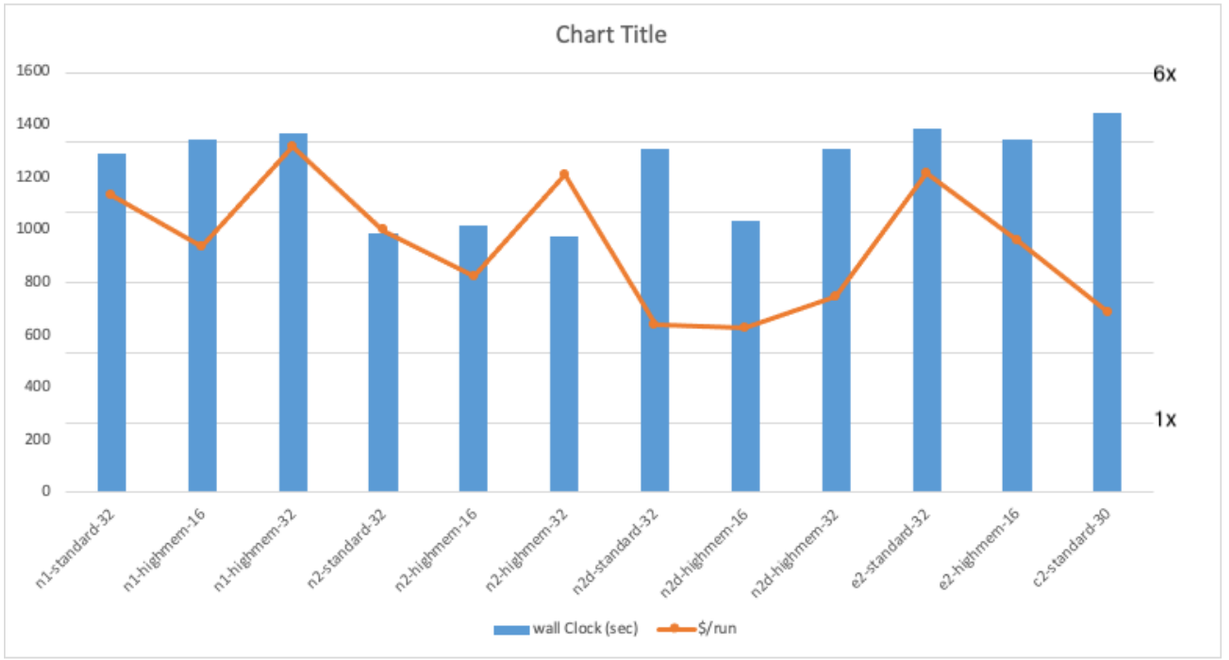
Memory utilization / Number of workers in operation





Counterparty Credit Risk
devops considerations

- Advance planning with your Cloud provider (Google, in this case) on primary and secondary locations for high volume.
- Take in account additional resources such as shuffle slots if using Cloud Dataflow in Google. Its availability in the regions also needs to be in sync with the location of the primary and secondary location of the managed service.
- A particular worker type might suit you beam run better.
- Consider best machine type to suit your batch dynamics.



Counterparty Credit Risk resilience planning

- Workout likelihood of stock out events occurring (Black Friday, Cyber Monday)
- Review your reservation strategy
- Define a fallback strategy (outside of reservation periods)

For example:

Fallback machines should suit the profile of the job and must have abundance of availability for the chosen region & zone in which you will operate.

Conclusions

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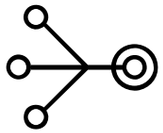
Beam as a Risk Engine conclusions

- Generation of risk metrics is transformation process usually involving a directed acyclic graphing (DAG) process.



- Monte-Carlo simulation-based risk generations involves evaluating billions of points and is generally (not always) and embarrassingly parallel problem.

- Post processing of risk metrics generally involves large amounts of regrouping based on the desired dimension on which to group by.

- Beam offers a natural language to cater for all of these requirements.
- When the transformative analytics is available in Python (or any Beam native language), the case to use Beam for generating risk metrics becomes compelling.

Thank you

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