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

FSI201

Goldman Sachs: Accelerating time to value in data analytics

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Goldman Sachs

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The rundown

1. Who, what, why
   Introduction to Goldman Sachs and Goldman Sachs Financial Cloud
2. Goldman Sachs Financial Cloud
   Bringing financial services to customers
3. Deep dive: data-driven analytics
   GS Financial Cloud + Legend + AWS services = Real-time insights!

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What does Goldman Sachs do?

- A leading global investment bank and financial services company
- Customers include institutions, corporations, consumers
- Increasingly tech-forward platforms and engineering-led businesses
- Data is the lifeblood of everything we do

$2T+
assets under supervision

12,000+
engineers

~100
locations

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The data-driven investment process . . .



Investment hypothesis



Set up

- Source data
- Clean and normalize
- Model



Build

- Create a strategy
- Optimize
- Backtest



Analyze

- Compare metrics
- Run scenarios



Productionize

- Execute trades
- Monitor risk

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. . . has many challenges!



Investment hypothesis



Set up



Build



Analyze



Productionize

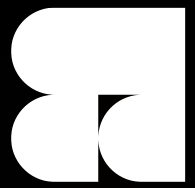
- Unrelated data sources with different stores and granularities
- Multiple distribution mechanisms with integration and scalability challenges
- Inconsistent semantics and data models
- Multiple programmatic interfaces to access data

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GS Financial Cloud for Data

A modular set of cloud-native services to help clients accelerate their technology strategy and deliver enhanced financial market analytics



Curated data

- GS proprietary data
- Third-party data products
- Consistent data model
- Normalized and curated reference data



Data management

- Fully managed time-series DB, specialized for financial data
- Integrated Security Master Service
- REST APIs



Data analytics

- GS Quant – Goldman Sachs open-source Python SDK
- PlotTool Pro – data visualization and analytic engine

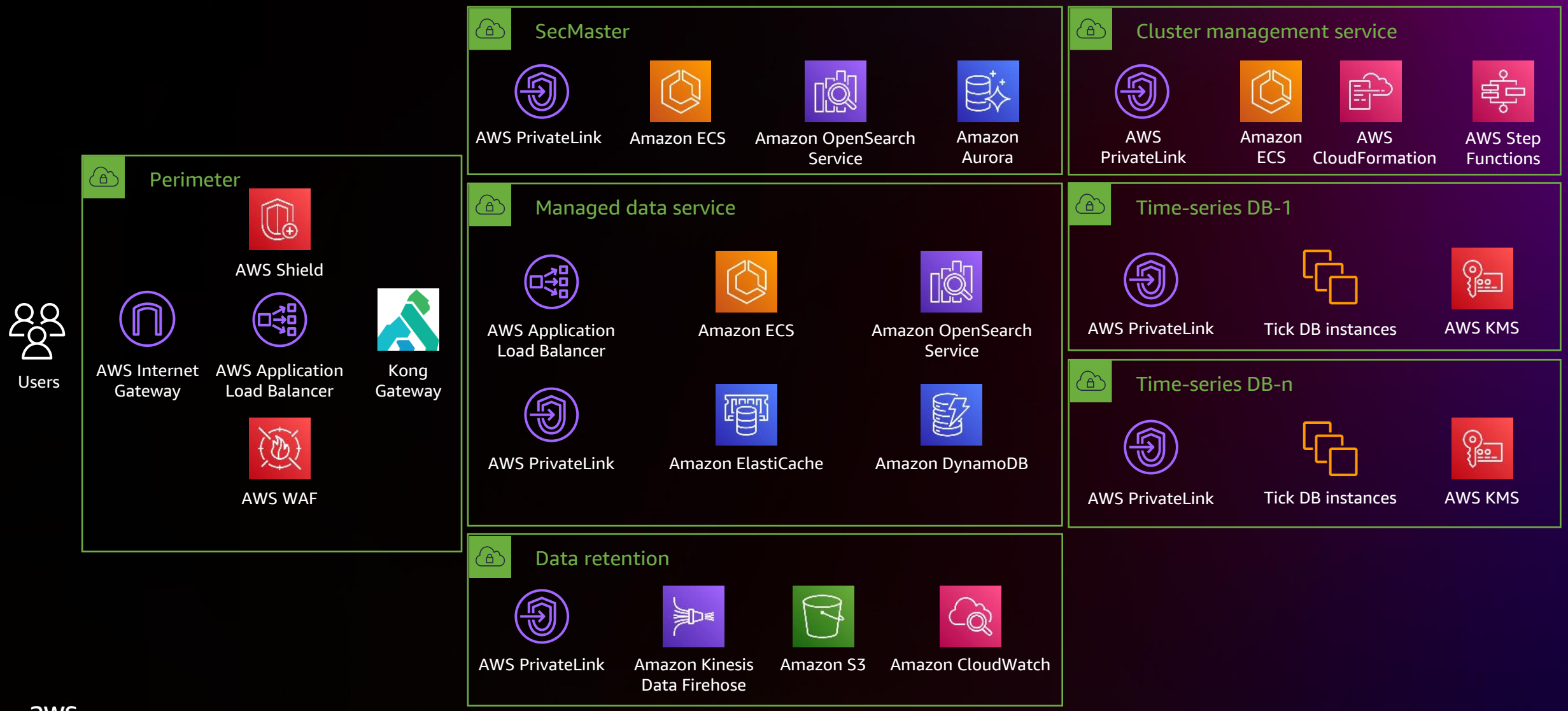
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Part 2: Goldman Sachs Financial Cloud

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GS Financial Cloud under the hood

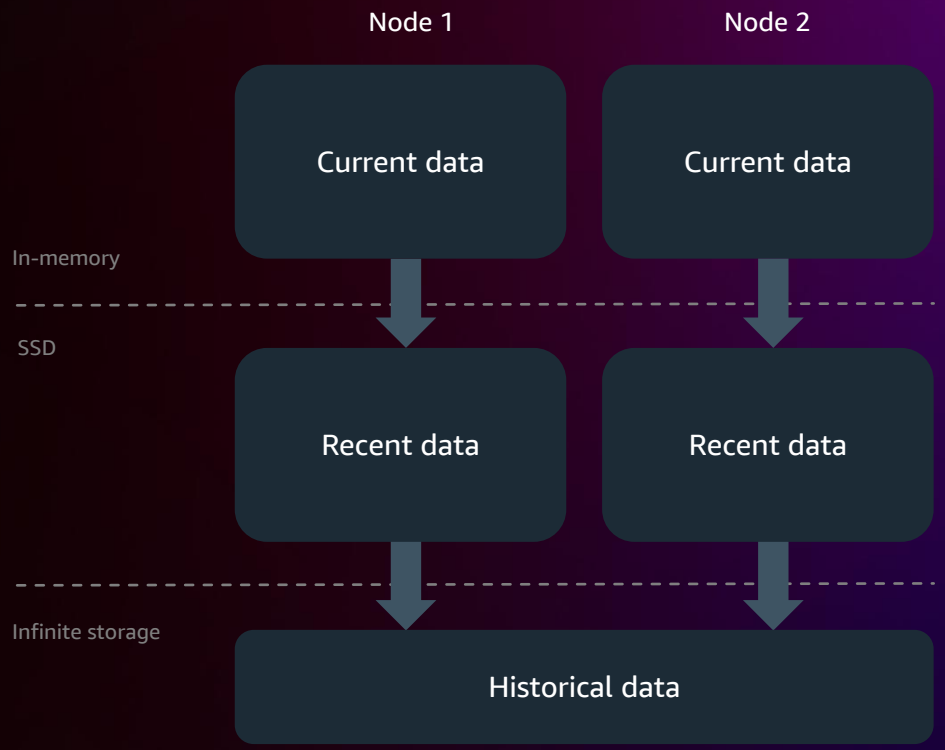


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Time-series database

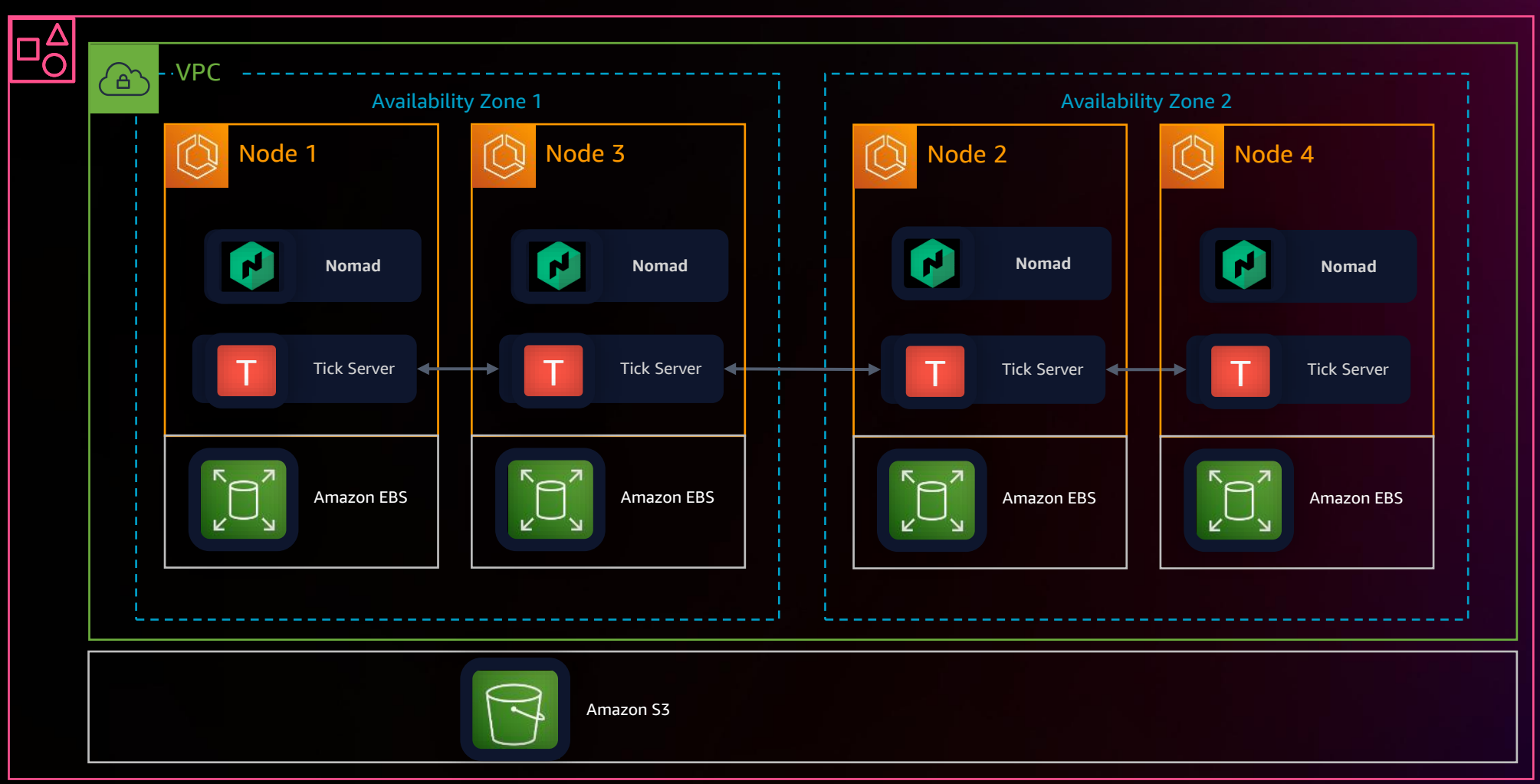
Tick Database \ˈtik-ˌdā-tə-ˌbās\
noun: A time-series store optimized for low-latency and real-time data access patterns commonly employed in financial markets

- Three-tier architecture for millisecond read times
- High-throughput writes (500K/sec/symbol)
- Horizontally scalable to handle petabytes of data
- Schema-less and fault-tolerant under live trading
- User-defined server-side computations
- ACID transactions for regulatory compliance



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Cloud-native architecture



Amazon Managed Service for Prometheus

AWS Secrets Manager

Amazon CloudWatch

AWS KMS

AWS Cloud Formation

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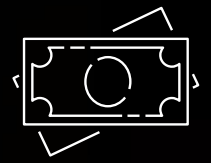
Part 3: Data-driven analytics

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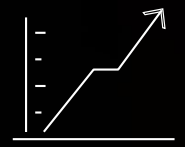
Questions



How are global climate policy developments impacting corporations and investors?



Are decarbonization commitments impacting fund flows?



What are the trends across the general market?



What theme do investors focus on most and where do we see potential investment opportunities?

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Cloud-native event-driven pipeline

ESG data

REFINITIV
An LSEG Business

ESG scores

Transition Pathway Initiative

Carbon performance

Pricing data

REFINITIV
An LSEG Business

- Elektron Real-Time
- DataScope Plus

GS Financial Cloud

Curated data

Data management

Data analytics

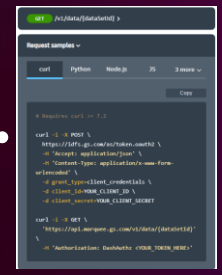
Set up

Build

Analyze

Productionize

REST APIs

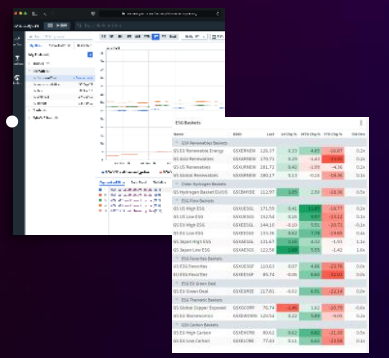


GS Quant

jupyter

PC

PlotTool Pro



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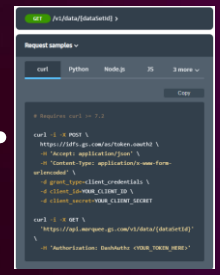
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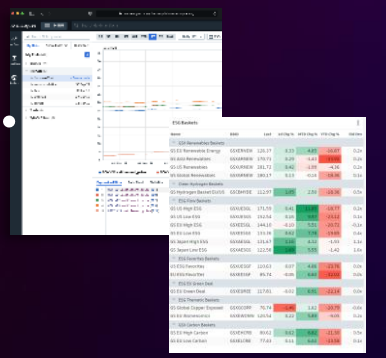


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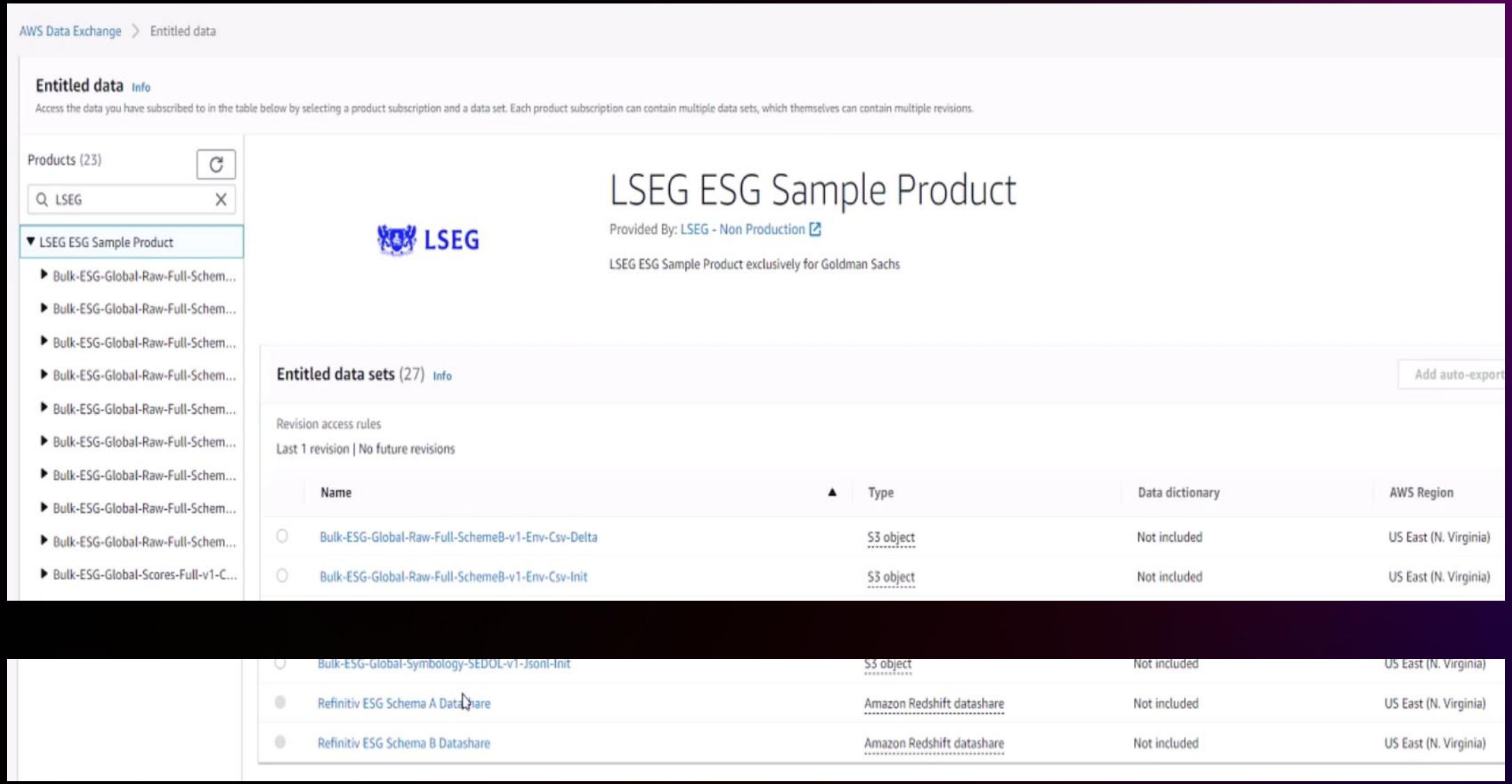
PlotTool Pro



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ESG reference data



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ESG raw data

Statementdetails Organizationid	Statementdetails Financialperiod fiscalyear	Communitydatapoints Anticompetition controversiescount Value	Communitydatapoints Businessethics controversies Value
[redacted]77	2016	2	5
[redacted]77	2017	5	9
[redacted]77	2019	30	21
[redacted]77	2020	33	6
[redacted]38	2021		0
[redacted]77	2021	7	5
[redacted]73	2019	21	4

Objectid	Organizationidentifiers Identifierdata Identifier	Organizationidentifiers Identifiertypeid V2
[redacted]63	904571	Cik
[redacted]77	[redacted]I80Z93	Legal Entity Identifier
[redacted]77	[redacted]801	Cik
[redacted]86	[redacted]IZWV18	Legal Entity Identifier
[redacted]86	[redacted]101	Cik

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ESG raw data … and preferred form

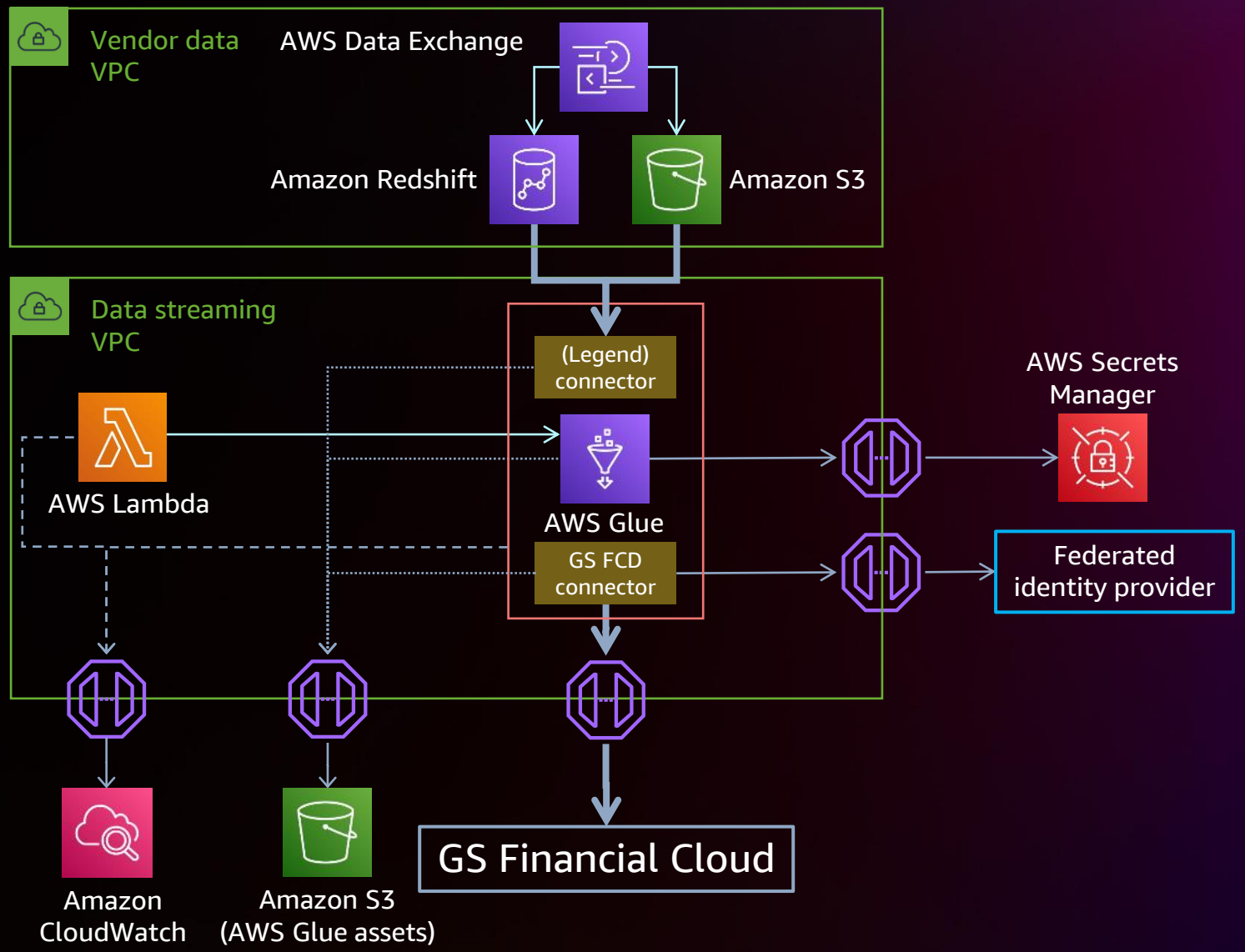
Statementdetails Organizationid	Statementdetails Financialperiod fiscalyear	Communitydatapoints Anticompetition controversiescount Value	Communitydatapoints Businessethics controversies Value
[redacted]77	2016	2	5
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[redacted]77	2019	30	21
[redacted]77	2020	33	6
[redacted]38	2021		0
[redacted]77	2021	7	5
[redacted]73	2019	21	4

Objectid	Organizationidentifiers Identifierdata Identifier	Organizationidentifiers Identifiertypeid V2
[redacted]63	904571	Cik
[redacted]77	[redacted]I80Z93	Legal Entity Identifier
[redacted]77	[redacted]801	Cik
[redacted]86	[redacted]ZWV18	Legal Entity Identifier
[redacted]86	[redacted]101	Cik

Organization Id	Organization Name	Legal Entity Identifier	Anticompetition	Businessethics	Shareholder Rights
[redacted]93	[redacted]	[redacted]H955	2	4	1
[redacted]33	[redacted]	[redacted]3VL35	1	5	
[redacted]02	[redacted]	[redacted]ZIB256	1	1	
[redacted]45	[redacted]	[redacted]36697	1	2	

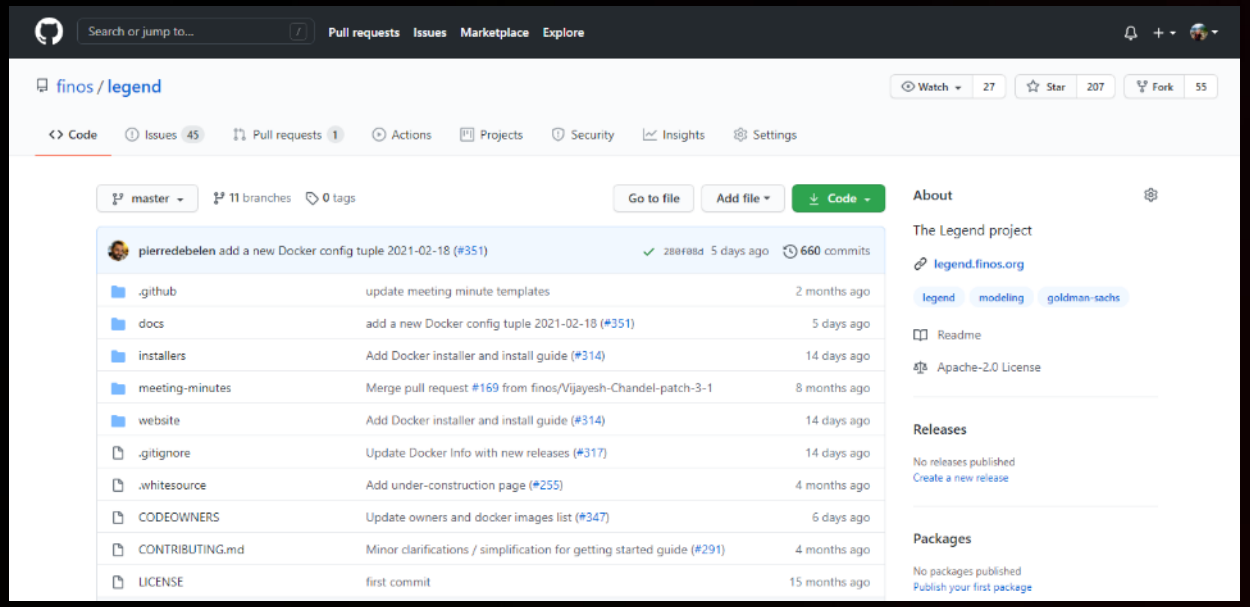
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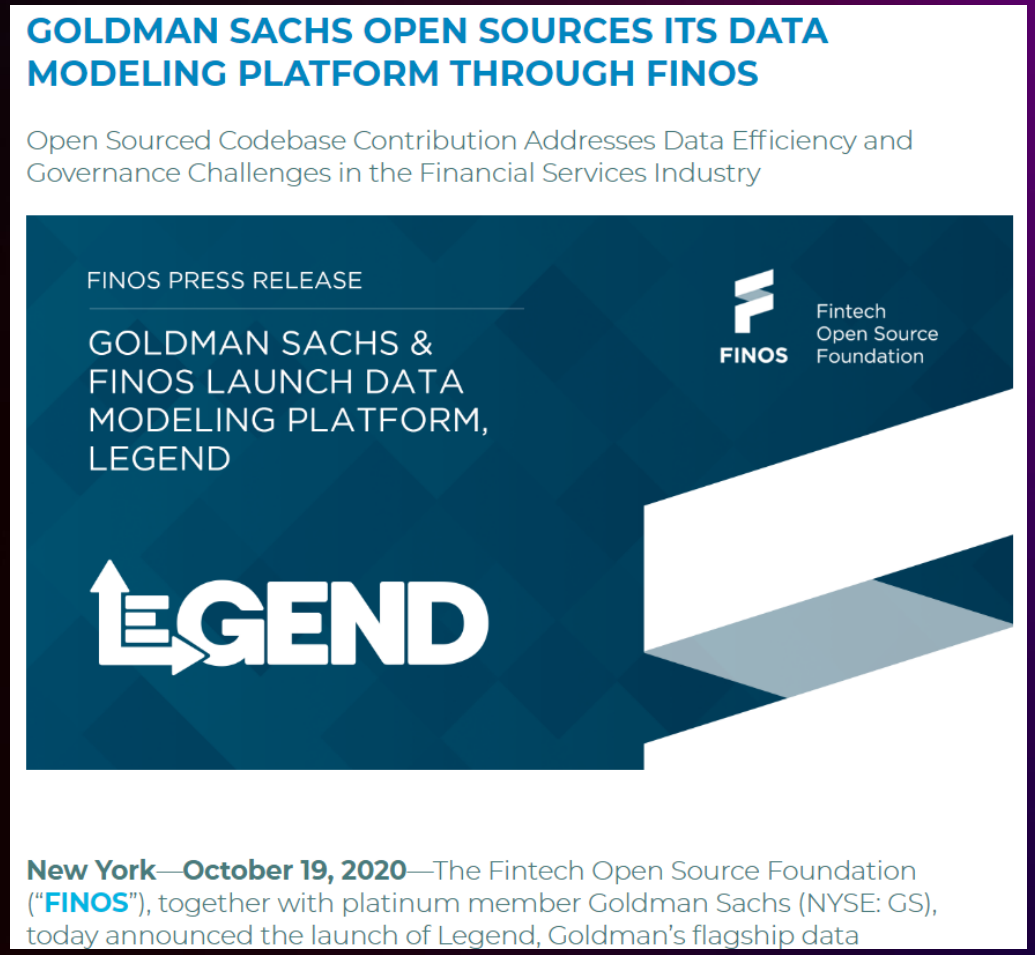
Reference data integration



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Legend: Open-source data management





Learn more at https://github.com/finos/legend and https://legend.finos.org

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What is Legend?

DATA DISCOVERY
Discover important metadata and begin tackling business needs

DATA EXPLORATION
Explore and manipulate data, subject to entitlements, to understand and evaluate further investment

BUSINESS UNDERSTANDING
Create data models to enhance business understanding and codify imprecise concepts

SOURCING & PUBLICATION
Publish data to other sources using APIs or conduct further processing for real-time sharing, all appropriately entitled

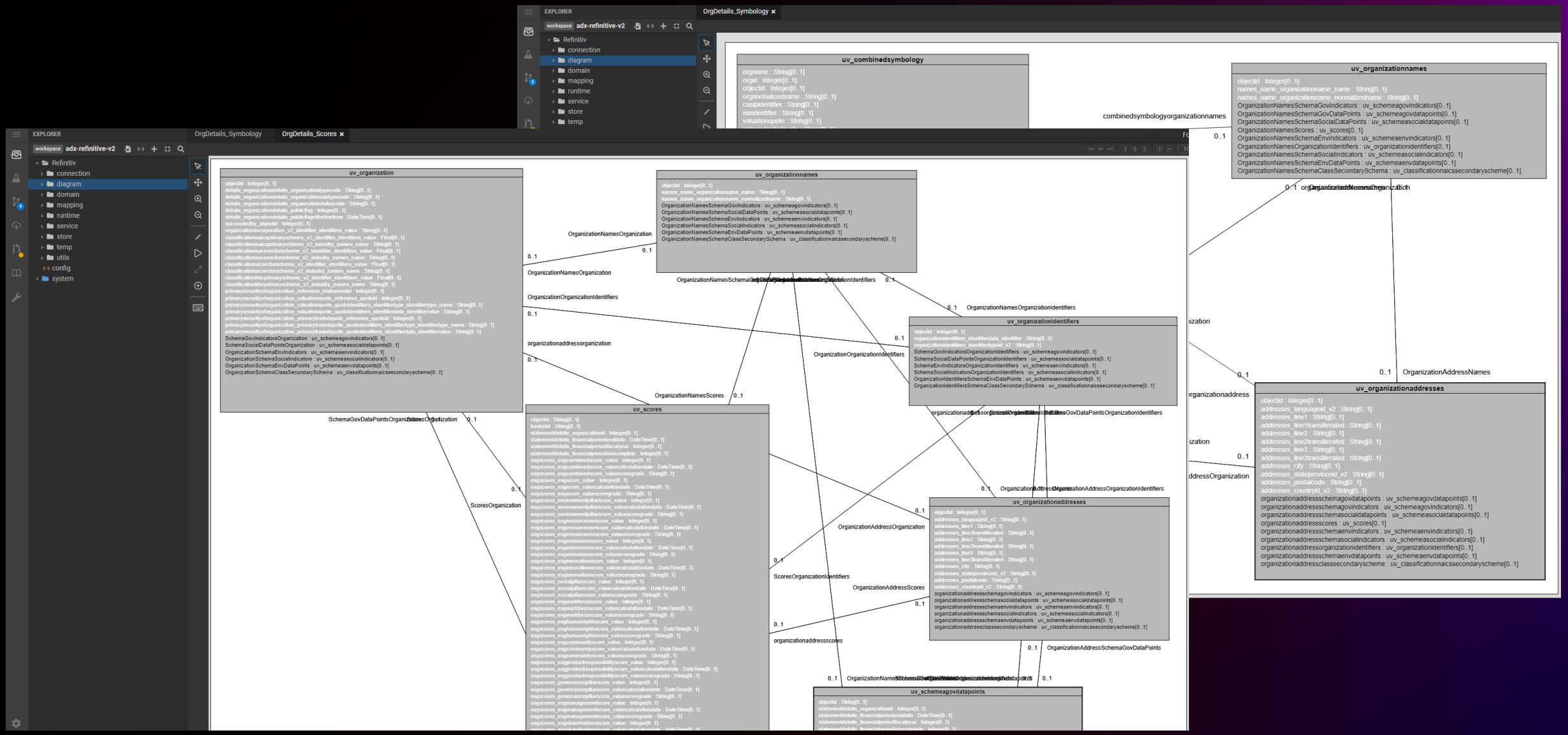
GOVERNANCE
Ensure data contracts and ownership are in place for shared governance with in-line constraints for safety and quality



End-to-end data modeling and management platform

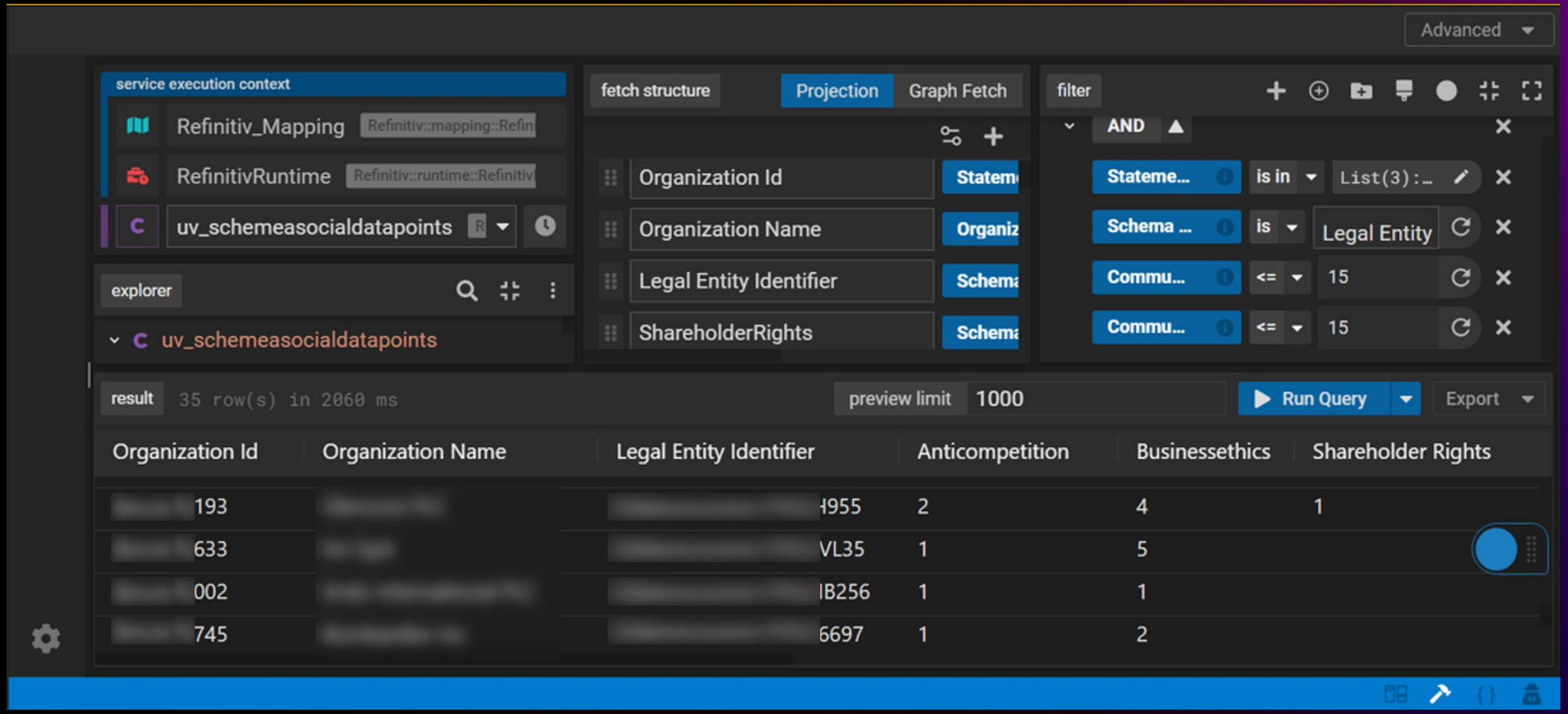
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Modeling reference data



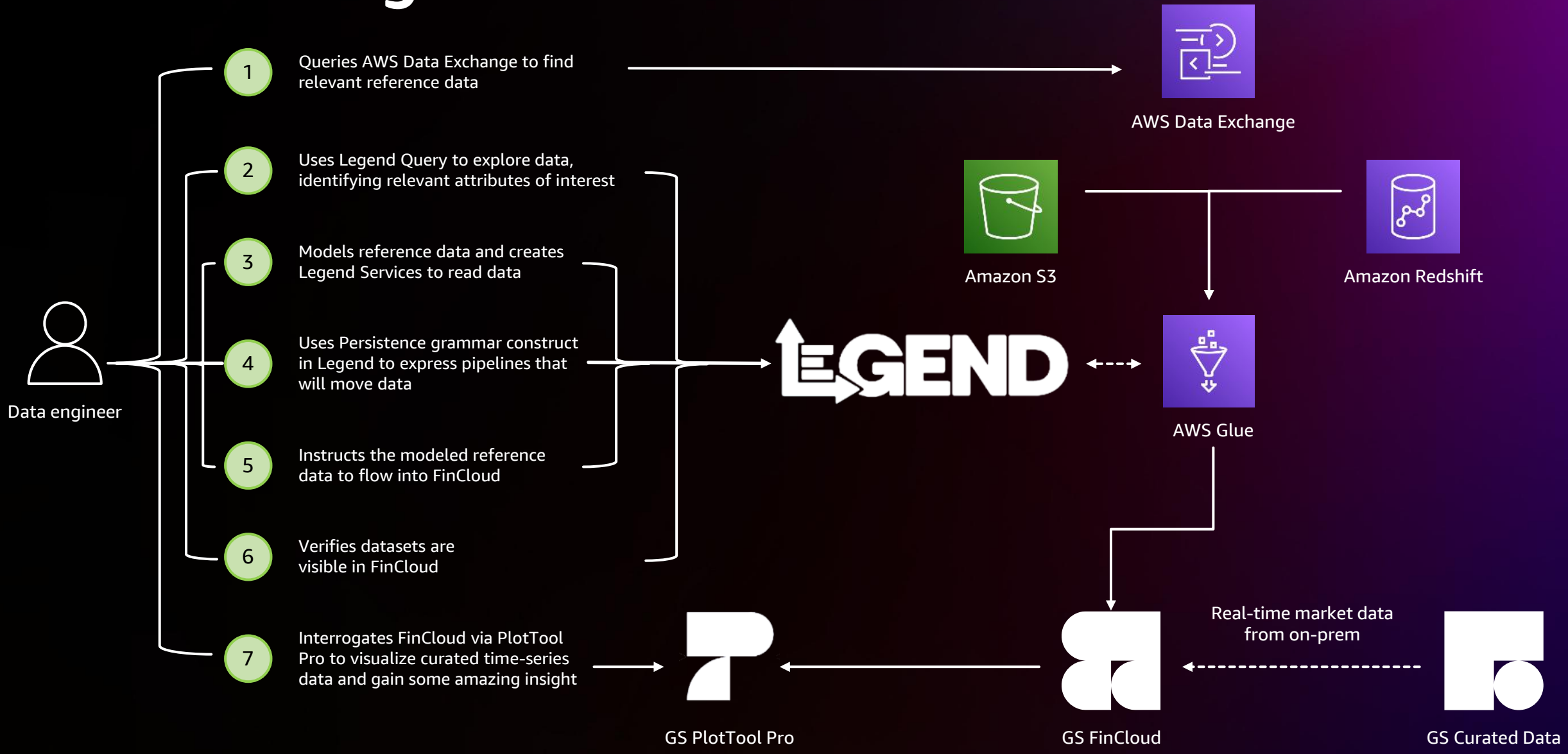
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Legend Query – Self-service for all!



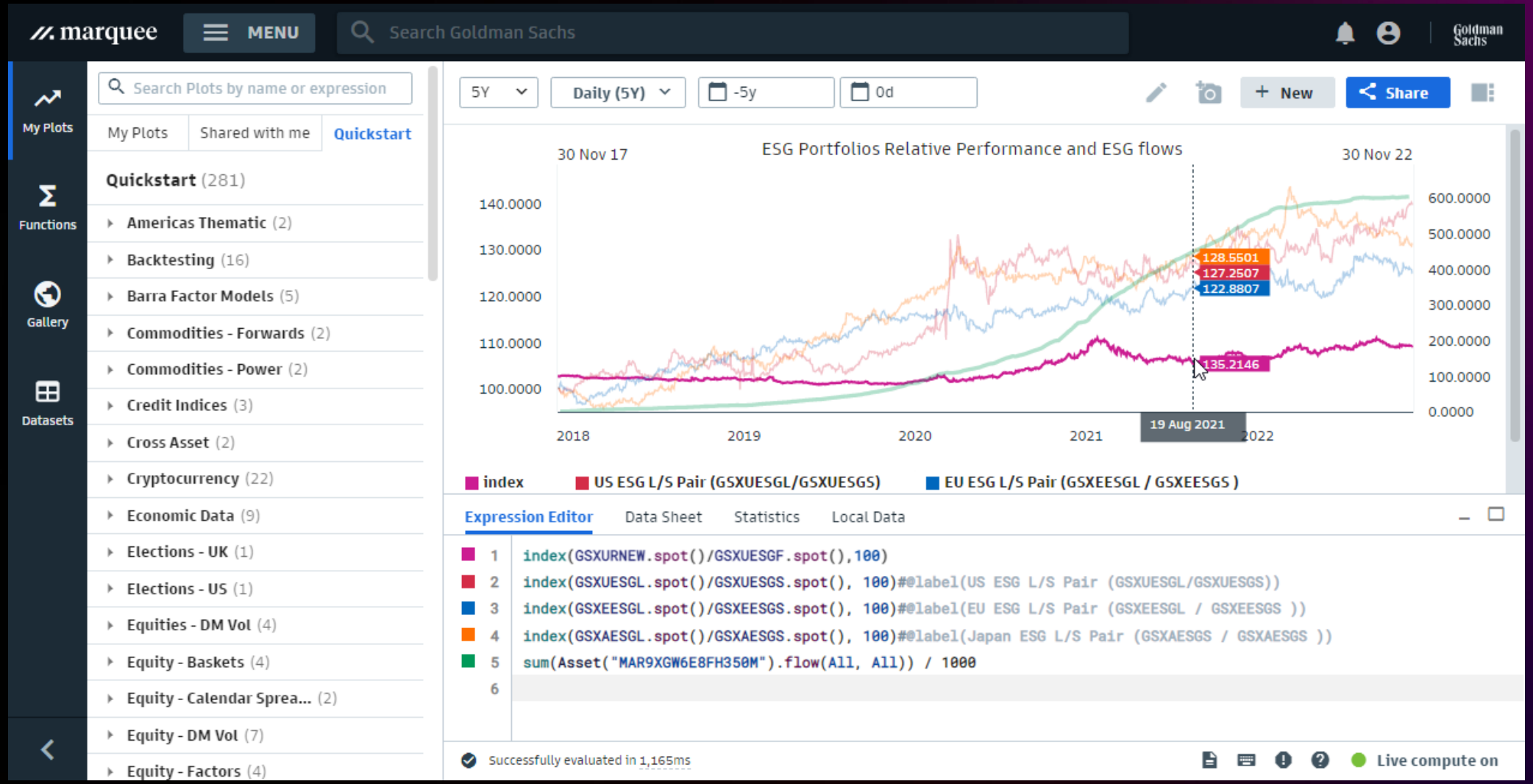
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Walk-through



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Accelerate research with instant feedback



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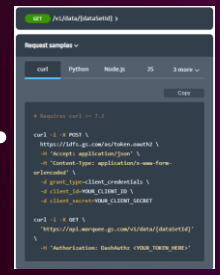
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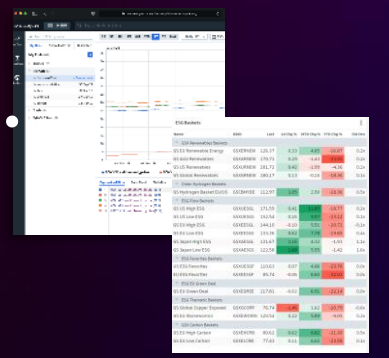


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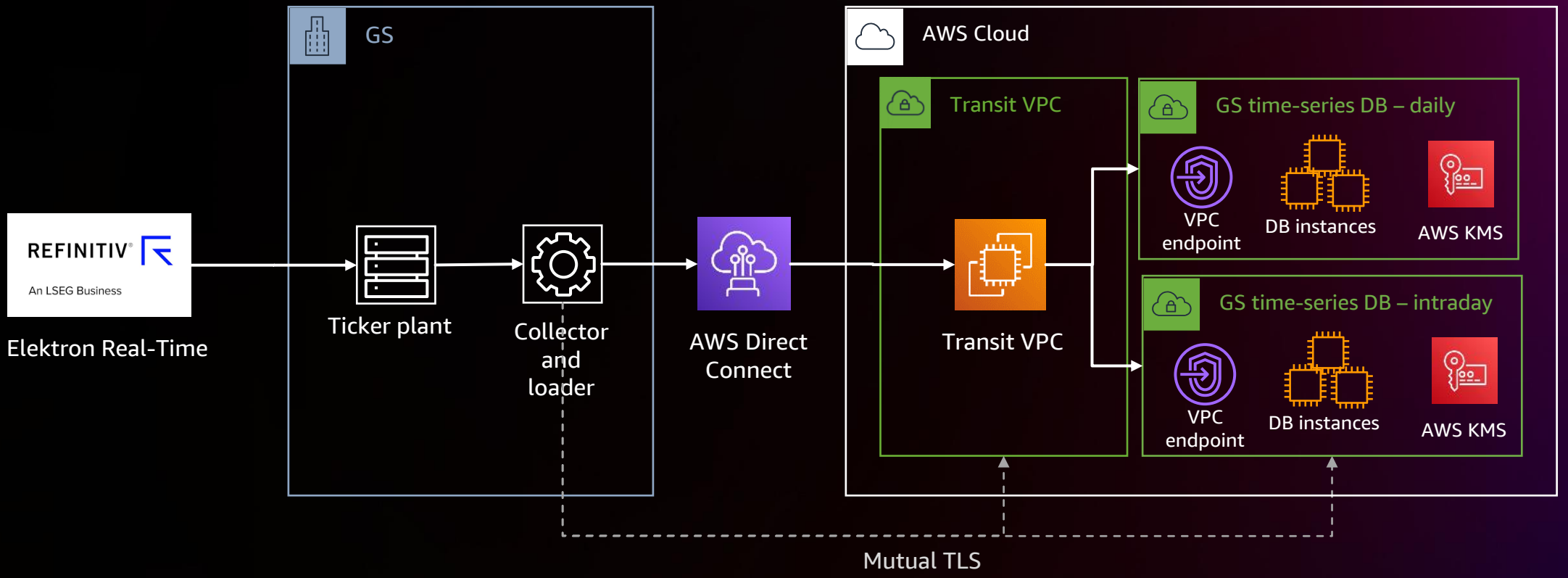
PlotTool Pro



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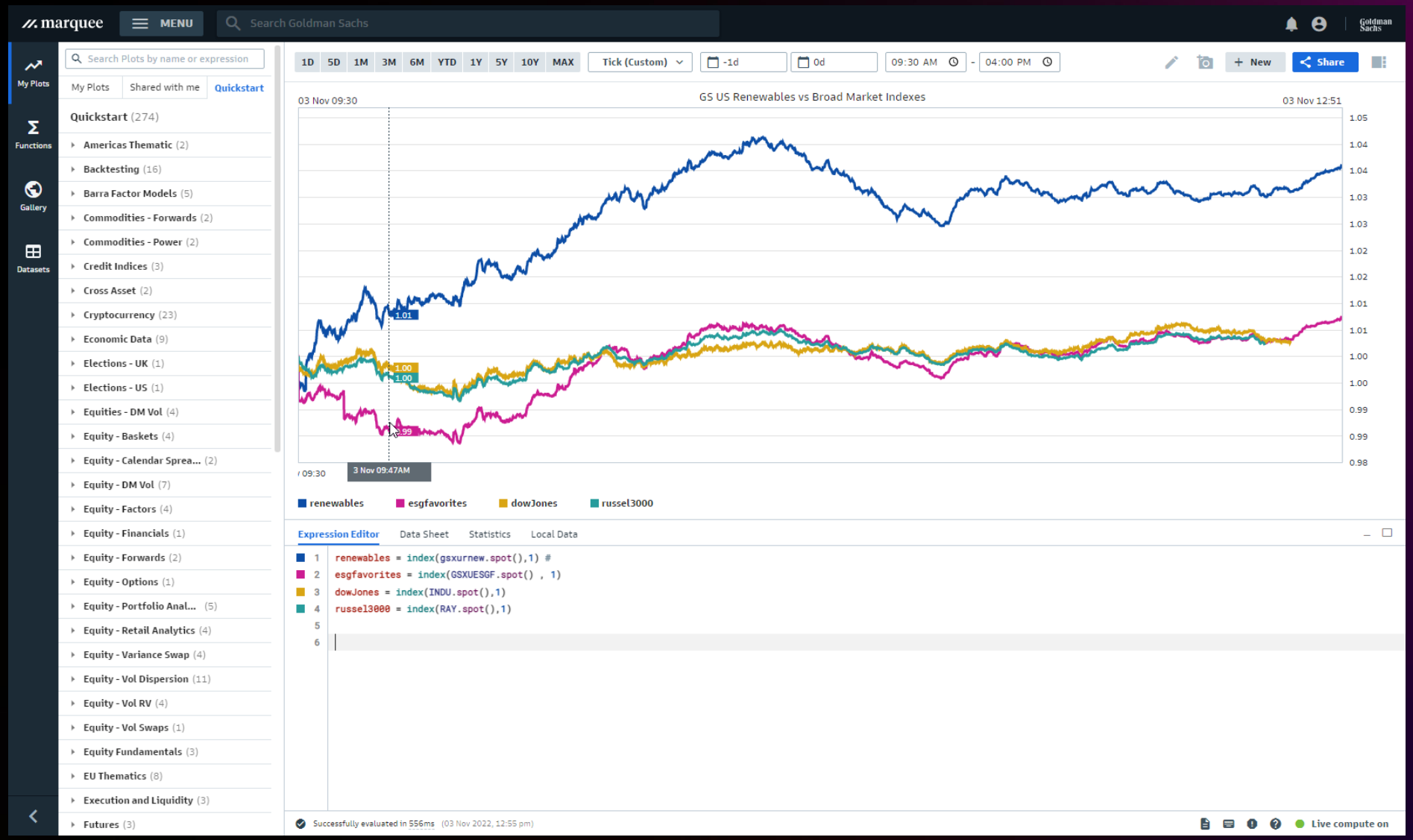
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Real-time market data ticker plant



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Intraday monitoring



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Lessons learned

Demand for new, broad, deep data

- Digital assets
- ESG
- Unstructured data
- Highly complex relational data

Real-time analytics enabled by streaming data

On-premise and cloud systems must work together

AWS

- Petabyte-scale relational analytics
- Live third-party data sharing
- Serverless extract, transform, load

Goldman Sachs Financial Cloud for Data

- Extensive curated financial data
- Optimized time-series analytics
- Scalable compute and storage

Plan and prepare

- Serverless and managed for the win
- Data lineage and ontology from Day 1
- Engage early with security team

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Visit the Goldman Sachs booth
#3446

Visit the Financial Services Lounge
Caesars Forum Main Hall @ 2:30 - 4:00pm

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Thank you!

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Francesco Pontrandolfo
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Further reading



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