OS-Climate

Technical Deep Dives

Heather Ackenhusen, Principal Technical Program Manager, OS-Climate

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OS-Climate Technical Deep Dives

- Building a platform to rapidly accelerate the shift of global investment
    - *Away* from GHG-intensive and climate-vulnerable companies, technologies, and infrastructure.
    - *Towards* sustainable solutions which drive mitigation, resilience, and adaptation.
- Today's Deep Dive Sessions *(will be recorded and shared)*
    - Data Commons
    - Extraction/Transformation of Corporate and other Data from structured & unstructured sources
    - Physical Risk & Vulnerability Modeling
    - Portfolio Alignment: ITR (Implied Temperature Rise) Tooling and Methodology
- Tomorrow's Deep Dive Session *(will be recorded and shared)*
    - Transition Risk & the tools being contributed to the OS-Climate platform by Airbus: SoSTrades platform and WITNESS

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Data Commons

OS-Climate - Technical Deep Dive

Vincent Caldeira, Chief Technologist (FSI), Red Hat

Erik Erlandson, Senior Principal Software Engineer, Red Hat

Michael Tiemann, Vice President of Open Source Affairs, Red Hat

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Data Commons Agenda

Platform Architecture Overview

- Data Commons platform overview: Overall data mesh architecture approach
- Data Availability: Enable collaboration through self-service data infrastructure
- Data Comparability: Manage data as a product leveraging a Data-as-Code approach
- Data Reliability: Manage data quality and transparency with automated and federated governance and compliance

Demo

Roadmap

Platform Architecture Overview

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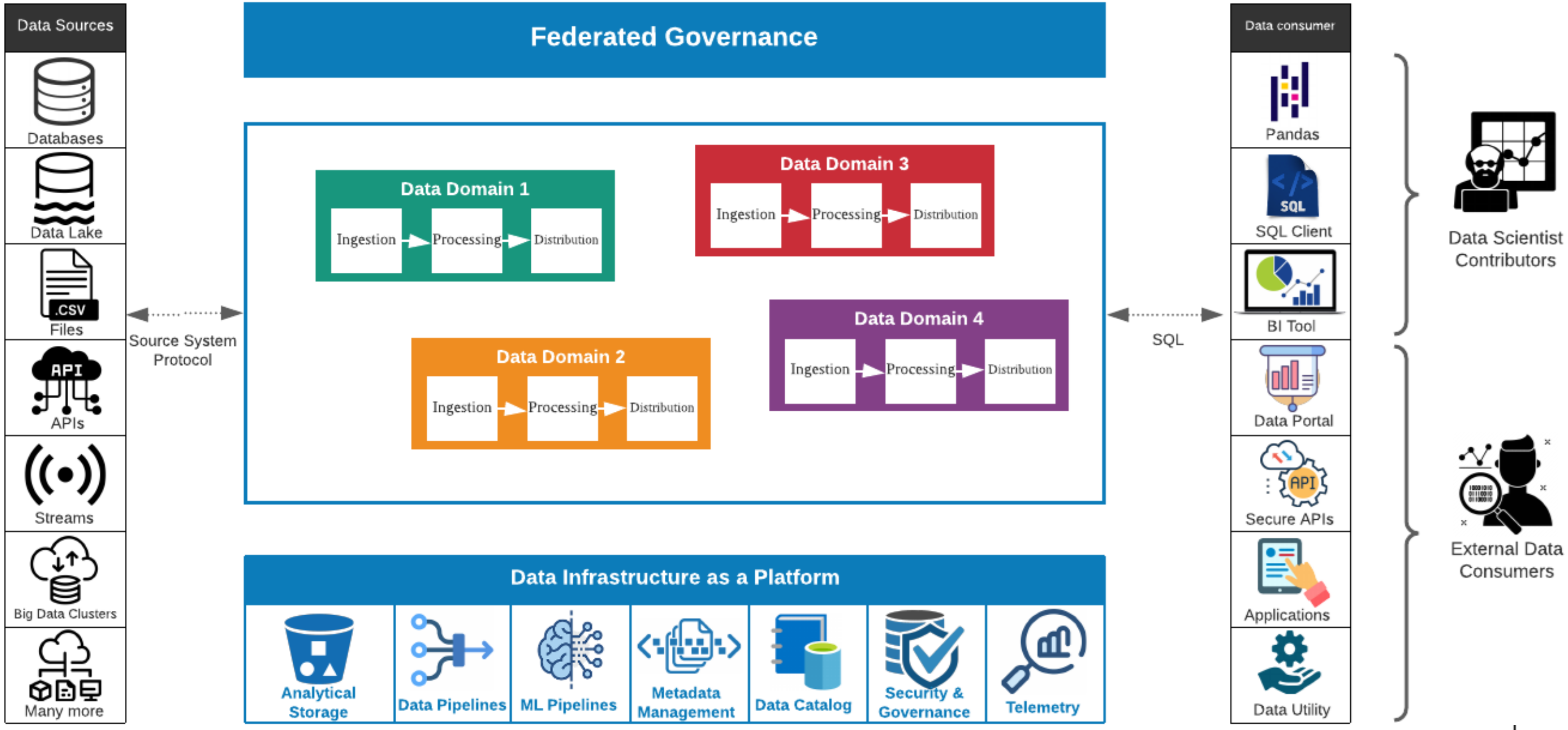
Turning a "data mess" into a "data mesh"



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Classification : Internal

Open Data Hub: 100% open source-based ML architecture blueprint with Red Hat® OpenShift® & broader portfolio as foundation

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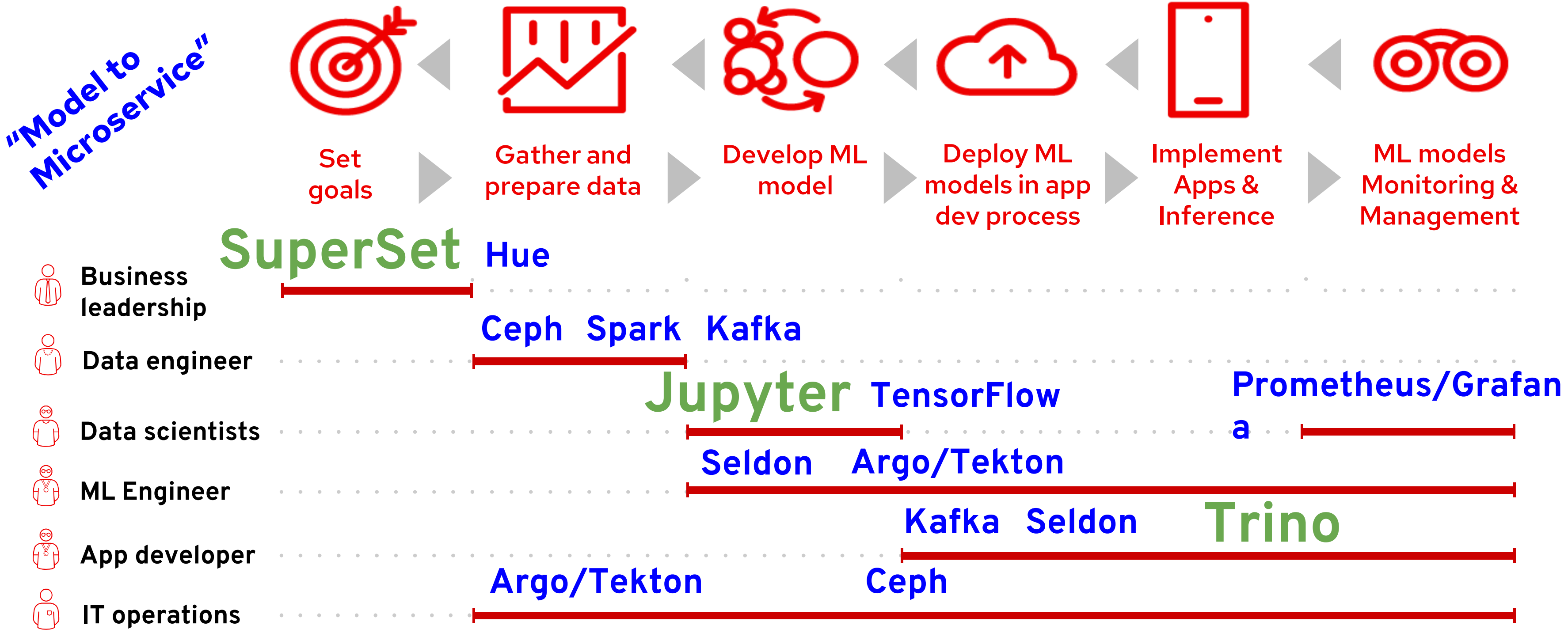
Classification : Internal

Data Science with ODH



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Based on Open Data Hub and Operate First

Upstream code enhanced with operational excellence

Open Data Hub

Community driven upstream meta-project demonstrating AI/ML platform on Red Hat OpenShift comprised of open source projects

Operate First (https://www.operate-first.cloud/)

Incorporate operational experience into Open Data Hub – operating software and services in the Open for our community members

OS-Climate Data Commons

Data science platform based on Open Data Hub and delivered as a cloud service on Red Hat OpenShift on any public or private cloud provider

Manage Data as a Product...

Data is managed as collections of related data aligned to business functions and goals, under a single owner stream that is responsible for governance of data created, provided, stored, transformed in and consumed

I want to contribute proprietary data but need guarding against infringement on protections of datasets.

—

Data Provider

I want to be able to integrate heterogeneous data sources quickly without having to stand my own infrastructure.

—

Data Engineer

I need tools for data preprocessing, feature engineering, and model training and validation but want to focus on solving problems.

—

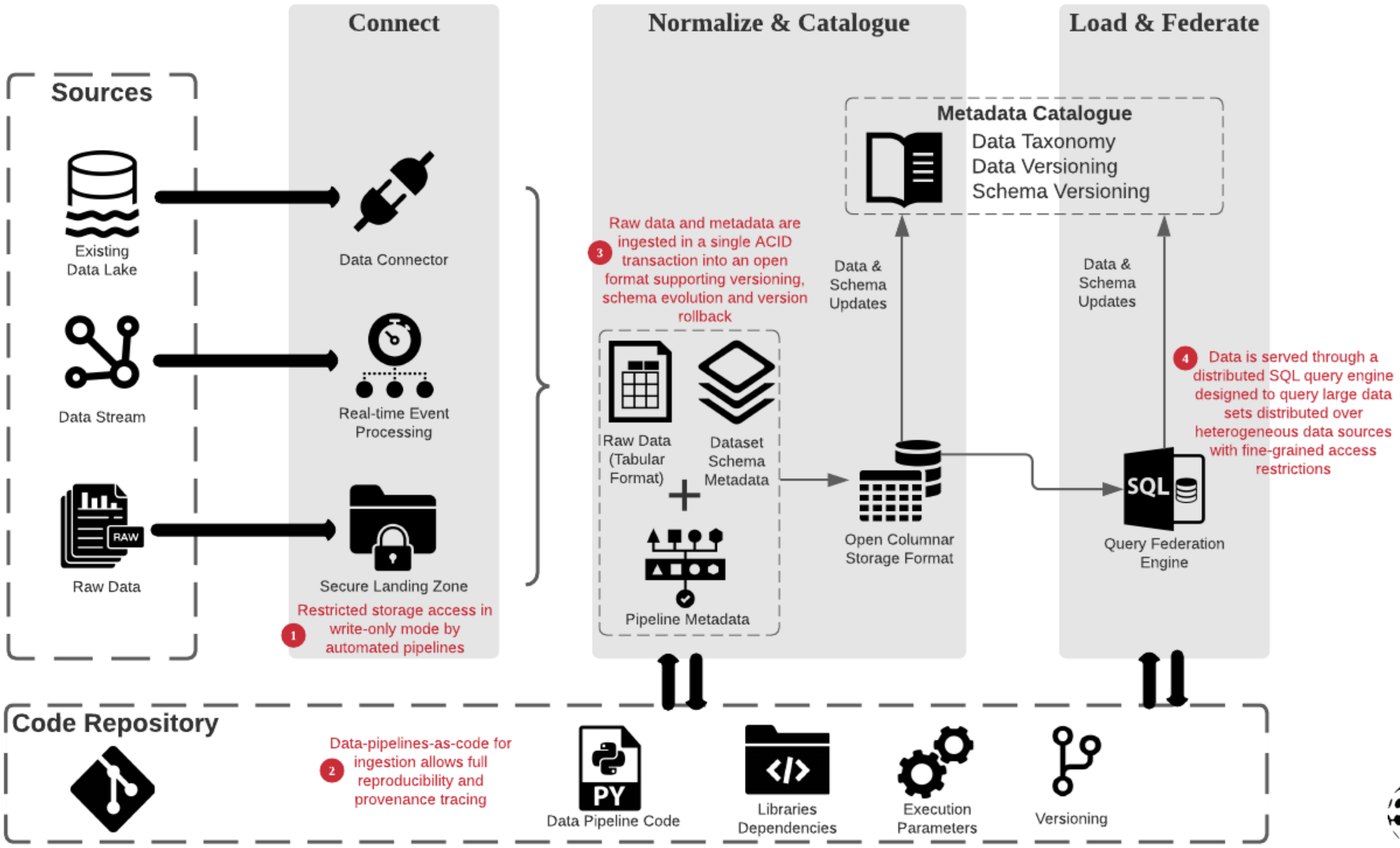
Data Scientist

To build trust, we need to have full auditability and transparency on the processes that are sourcing, processing and distributing the data.

—

Data Quality Engineer

… leveraging a Data-as-Code approach



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Classification : Internal

Leveraging Open Data Hub to stand up a Data Science platform

Data Pipeline → Train → Deploy → Manage → Serve

Data Pipeline	Train	Deploy	Manage	Serve
Data integration Data transformation Dataset management Data versioning Data automation	Experimentation Model training Model optimization Validation	CI/CD Pipelines Model versioning Data versioning Deployment monitoring	Model Registry Dataset catalogs Security / Compliance Reporting	Make trained model available for inference
jupyterhub Elyra AI Toolkit	TensorFlow PyTorch	Kubeflow Pipelines Pachyderm	DataHub	SELDON

Machine Learning Platform Kubeflow

Managing data quality and transparency…

“”

For me to to compare information reported across different sources, I need the data to be tied to common referential.

Data User

“”

I need consistency of authorization management across the data pipeline to manage security of the data as it is used and distributed.

Data Provider

“”

Managing data versioning and associated data schema and catalogues manually is time consuming and prone to error making data discovery difficult.

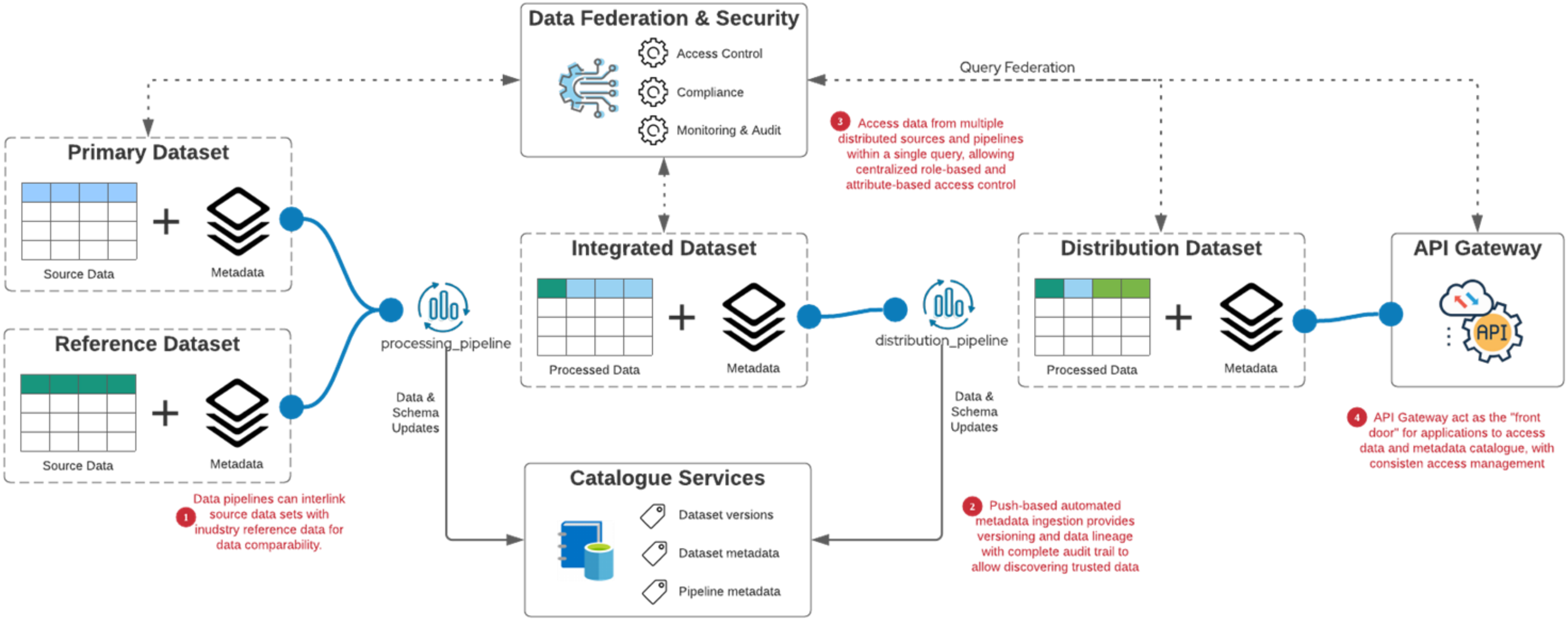
Data Engineer

“”

I need to be able to integrate data with various internal and external tools for development and also to support my users community.

Data Scientist

… with automated and federated governance and compliance



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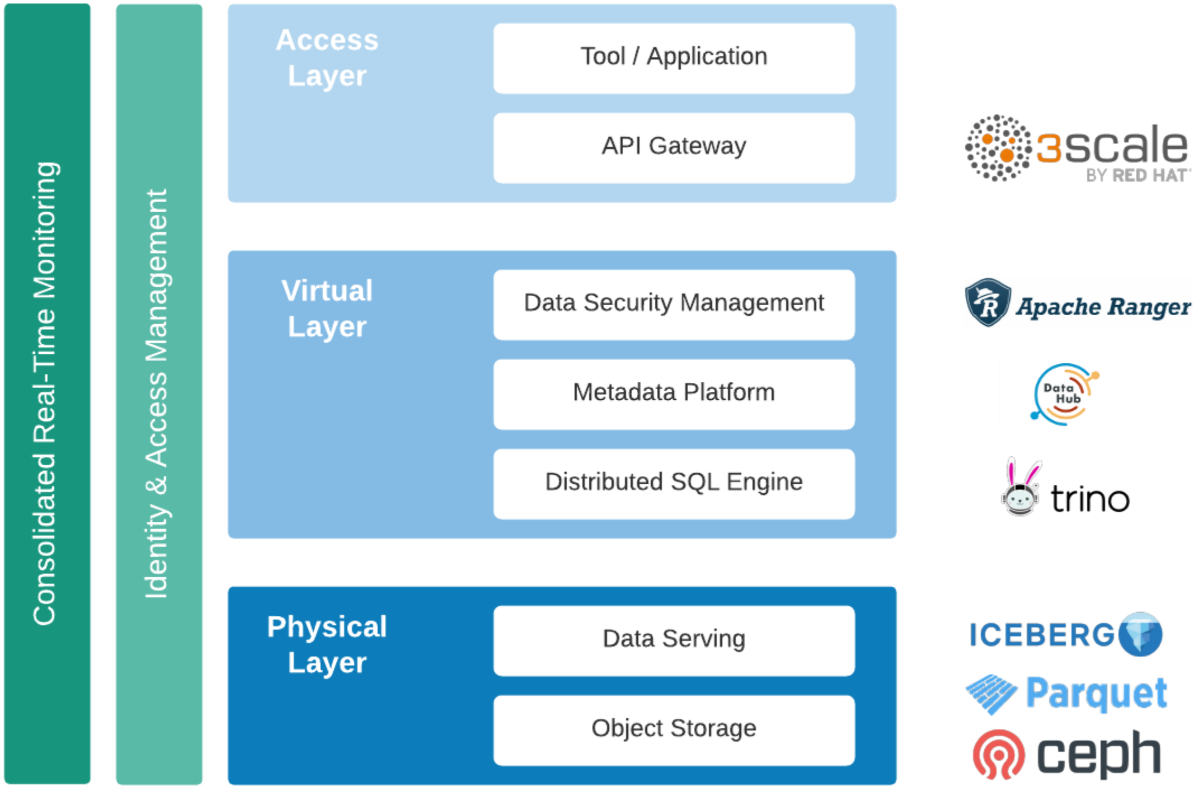
Classification : Internal

Data Management Architecture



Demo

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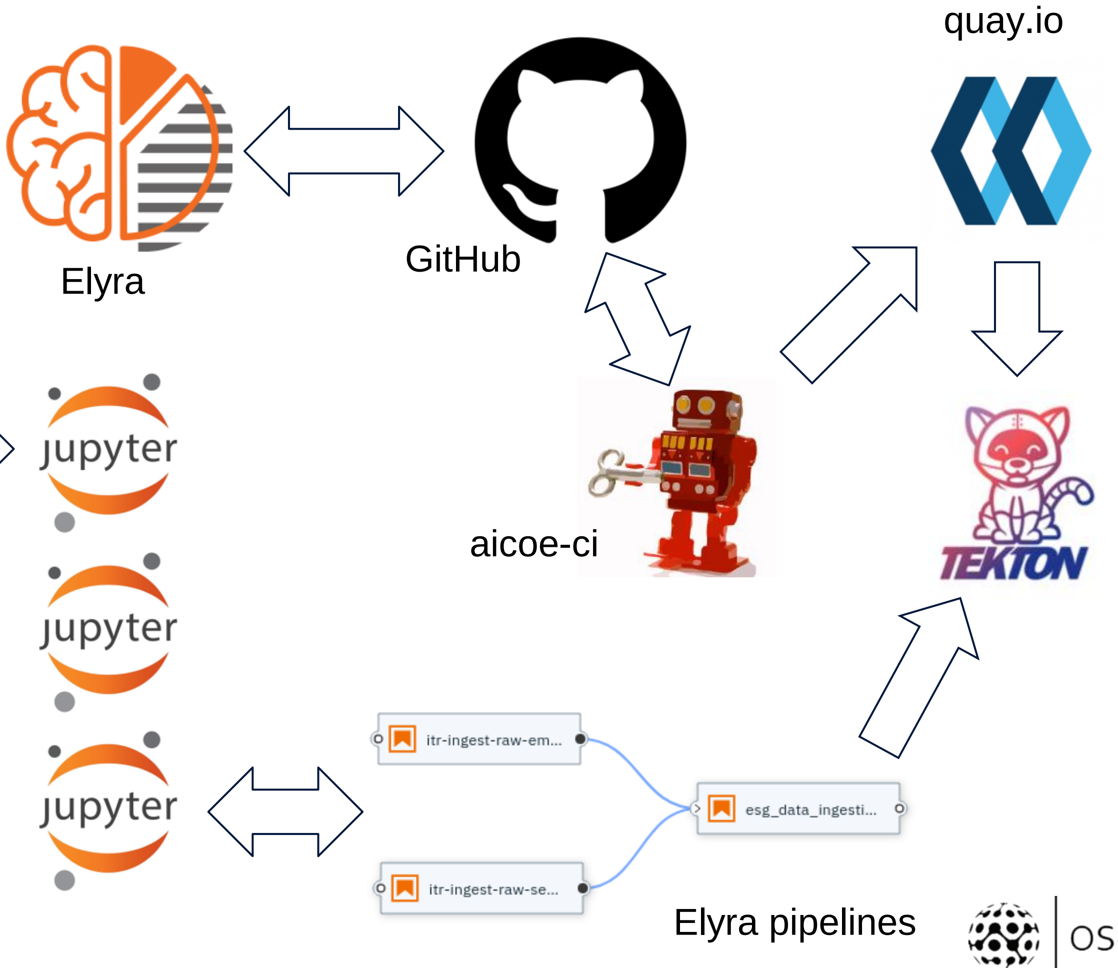
Enable collaboration through self-service data infrastructure

```
[10]: # a way to examine the structure of a pandas data frame
      df.info(verbose=True)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 35 entries, 0 to 34
Data columns (total 16 columns):
 #   Column                     Non-Null Count  Dtype
---  ------                     --------------  -----
 0   company_name               31 non-null     string
 1   company_id                 31 non-null     string
 2   isic                       0 non-null      Int64
 3   country                    31 non-null     string
 4   region                     31 non-null     string
 5   industry_level_1           0 non-null      Int64
 6   industry_level_2           0 non-null      Int64
 7   industry_level_3           0 non-null      Int64
 8   industry_level_4           0 non-null      Int64
 9   sector                     31 non-null     string
 10  company_revenue            30 non-null     Float64
 11  company_market_cap         30 non-null     Float64
 12  company_enterprise_value   30 non-null     Float64
 13  company_total_assets       30 non-null     Float64
 14  company_cash_equivalents   30 non-null     Float64
 15  target_probability         30 non-null     Float64
dtypes: Float64(6), Int64(5), string(5)
memory usage: 4.9 KB
```

Jupyter for
Iteration &
Development



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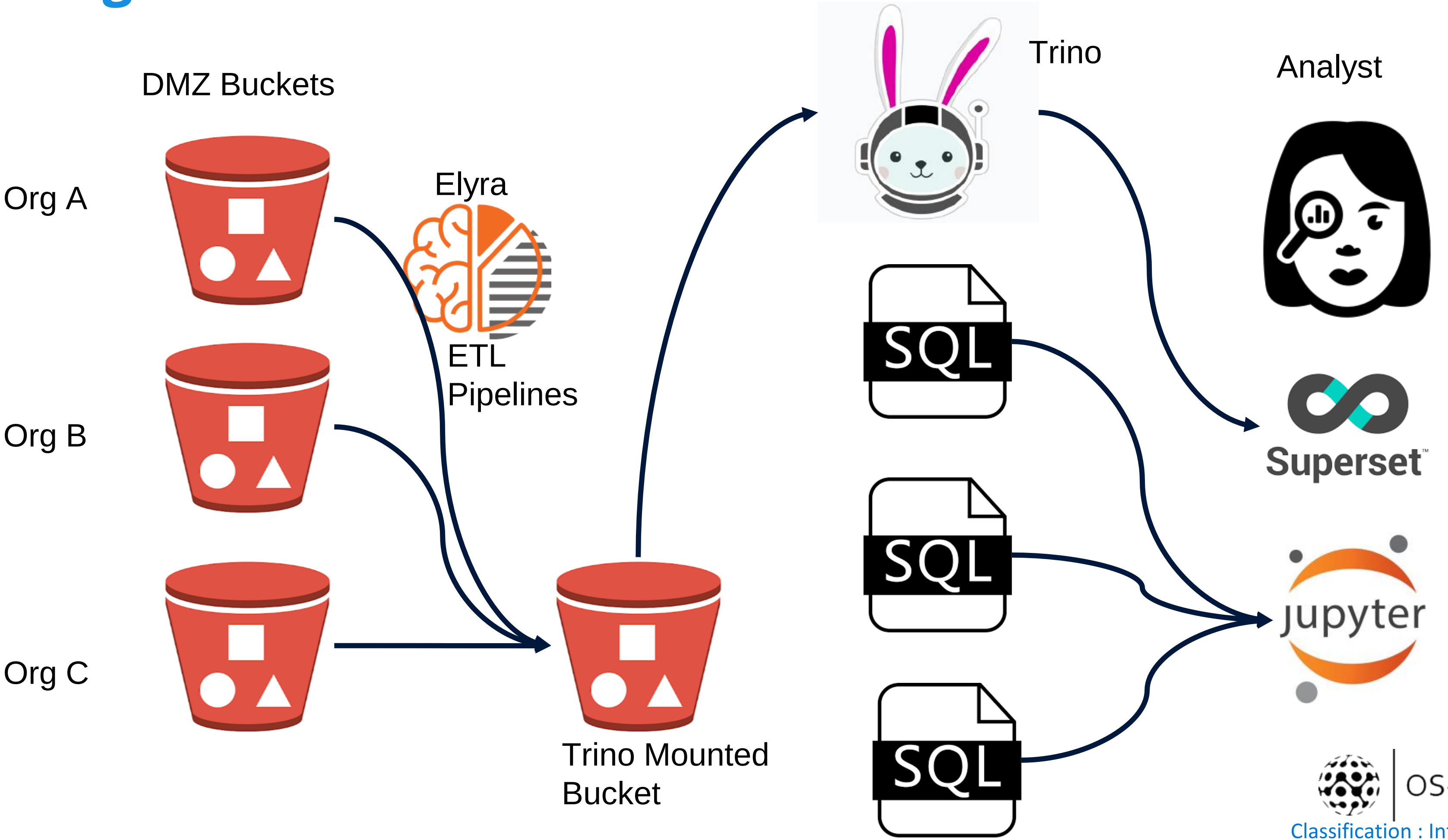
Data Ingest Model



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Classification : Internal

Bonus Demo Video:

A deep dive into insights from combining GLEIF with the EPA's GHG Reporting Program (GHGRP) data within Data Commons

from Michael Tiemann, OS-Climate Project Lead & VP of Open Source Affairs, Red Hat

Click Here for Bonus Video

password: osc-1201>>DeepDive

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Q & A

Please Use Raise Hand or Type Question in Chat
For any unanswered questions, we will respond.

Data Extraction: Climate Metrics & Natural Language Processing

OS-Climate – Technical Deep Dive

Lea Deleris, Head of RISK Artificial Intelligence Research, BNP Paribas

Ismail Demir, Data Scientist, Allianz IDS GmbH

Jeremy Goh, Data Scientist, BNP Paribas

Karan Chauhan, Data Scientist, Red Hat

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Data Extraction & Role of Natural Language Processing (NLP) in OS-C

Background

- From a climate perspective, **precious information such as emissions levels, transition targets or asset-level commissioning or decommissioning are peppered throughout company's CSR and Annual report**.
- In the NLP stream, our goal is to develop **algorithms that are effective at identifying this information** automatically, or at least well enough that it only requires human validation of the proposed information rather than tedious and costly human extraction.
- If we are able to develop such algorithms, ESG **data sourcing should be faster and easier** leading to a greater ability for banks and companies to measure and manage their transition and physical risk trajectories.

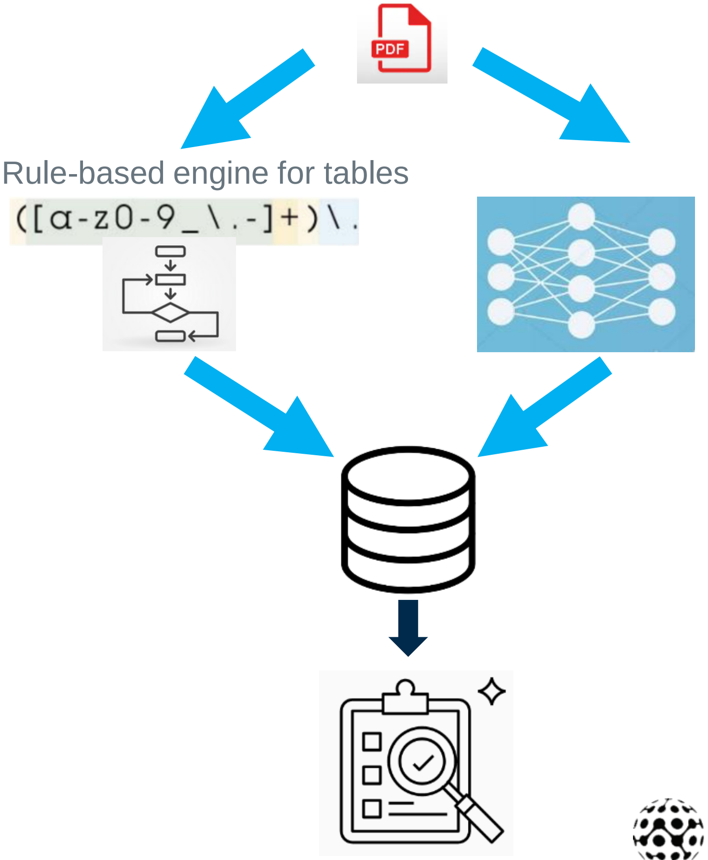
Vision for the NLP Tool

- Users can leverage OS-C's NLP toolkit to extract **key climate data/metrics** from CSR and annual reports of organizational entities.
- We are currently looking at **GHG emissions**, **emission reduction targets** and **production figures**.
- The NLP tool will scan and pull text/data from **OS-C's Data Commons** (e.g. SPGI pdf reports). It will also be able to process **user-provided documents**.
- The tool searches **text** and also parses data from **tables**.
- In future releases, the tool may also allow authorized users to **correct the data for** their organization. We may also look into crowdsourcing **the validation** of the information as feedback for the algorithms training.

Starting Point

- NLP toolkit benefited at the onset from two solutions provided by Allianz and IDS: A machine learning and a rule-based approach that aim at extracting a set of climate related KPI from Oil and Gas and XXXX sectors.
- The NLP team is building on top of those two assets to expand in terms of KPIs and also in terms of sectors.
- A tool (interface) will also be built in a second phase once the algorithms have been thoroughly tested and standardised
- We will also work on the combination of the results from the two approaches (Waterfall logic)

Project and code management on GitHub



Current Approaches

ML SOLUTION

ML-based approach / Focus on Text

	Module / Status	Text	Table
Model Application	Extraction	✔	!
	Relevance Detection	✔	✔
	KPI Inference	✔	!
Model Training	Curation	✔	✔
	Relevance Detector Training	✔	✔
	KPI Inference Training	✔	!

✔ Works

! Works, but improvements needed

- Whole process can be executed at once
- Easily scalable to more KPIs
  - For each new KPI: Training data and testing needed

RB SOLUTION

Rule-based approach / Focus on Tables

	Module / Status	Text	Table
Model Application	Parsing PDFs / Conversion	✔	✔
	Detection of Text and Tables	✔	✔
	KPI Extraction	!	✔
Model evaluation (comparison)		✔	✔

✔ Works

! Works, but not tested yet

- Whole process can be executed at once
- Easily scalable to more KPIs
  - For each new KPI: Rule definition and testing needed

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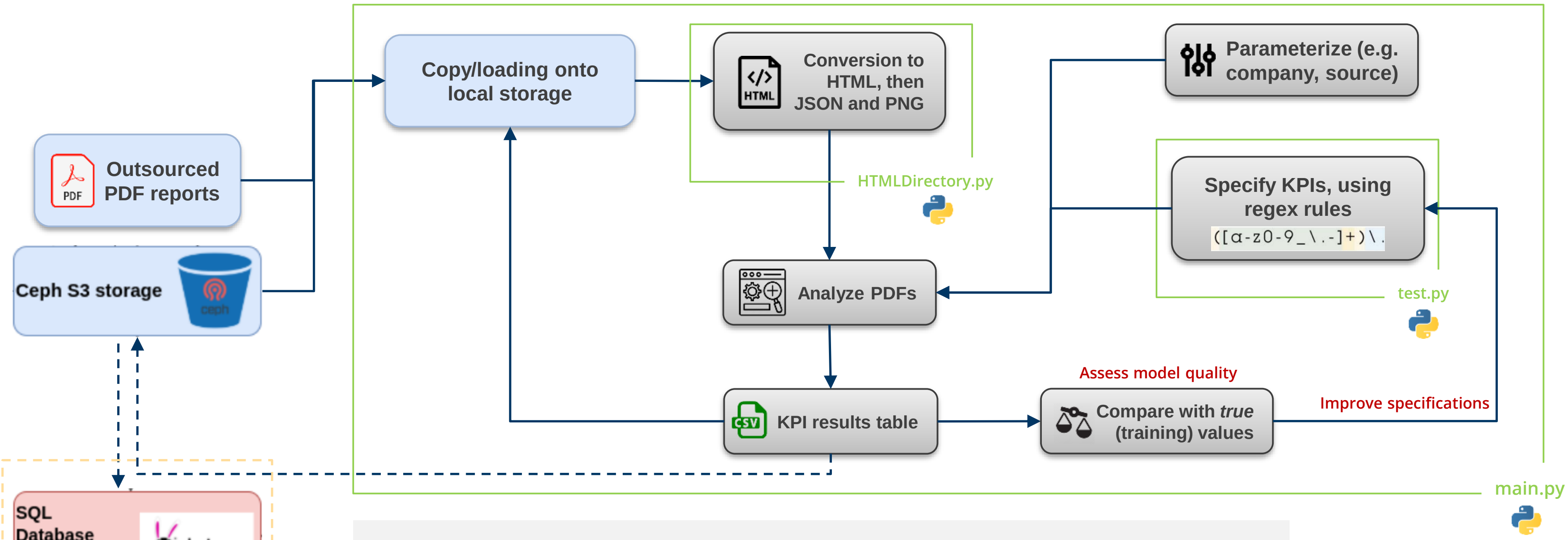
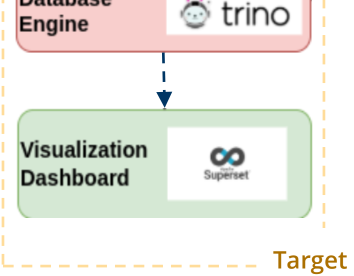
Rules-based Engine Architecture





Rule-based approach / Focus on Tables

- Can be run on PDFs manually sourced or accessible after connection to S3 bucket
- ✔ Works on the Red Hat OpenDataHub platform
- Parameters and KPIs are set directly in Python scripts
- Solution can be executed at once launching the *main.py* script
- ! Results are stored locally but could be stored on S3 to leverage Trino and Superset capabilities (Target box)

Red Hat OpenShift Data Science

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Classification : Internal

Rules Engine: Live Demo

ML tool environment, pipeline and output

Q & A

Please Use Raise Hand or Type Question in Chat

Physical Risk

OS Climate Technical Deep Dive

Matt Sandoe, Climate Risk Lead, BNP Paribas

Joe Moorhouse, Quantitative Analyst, BNP Paribas

Nikolaos Dimakis, Quantitative ESG Developer, Federated Hermes

December 1st 2021

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Physical risk

OS-CLIMATE VISION

Open source, plug & play physical risk tool and development ecosystem	A common language/framework—with transparency at its core

BENEFITS & GOALS

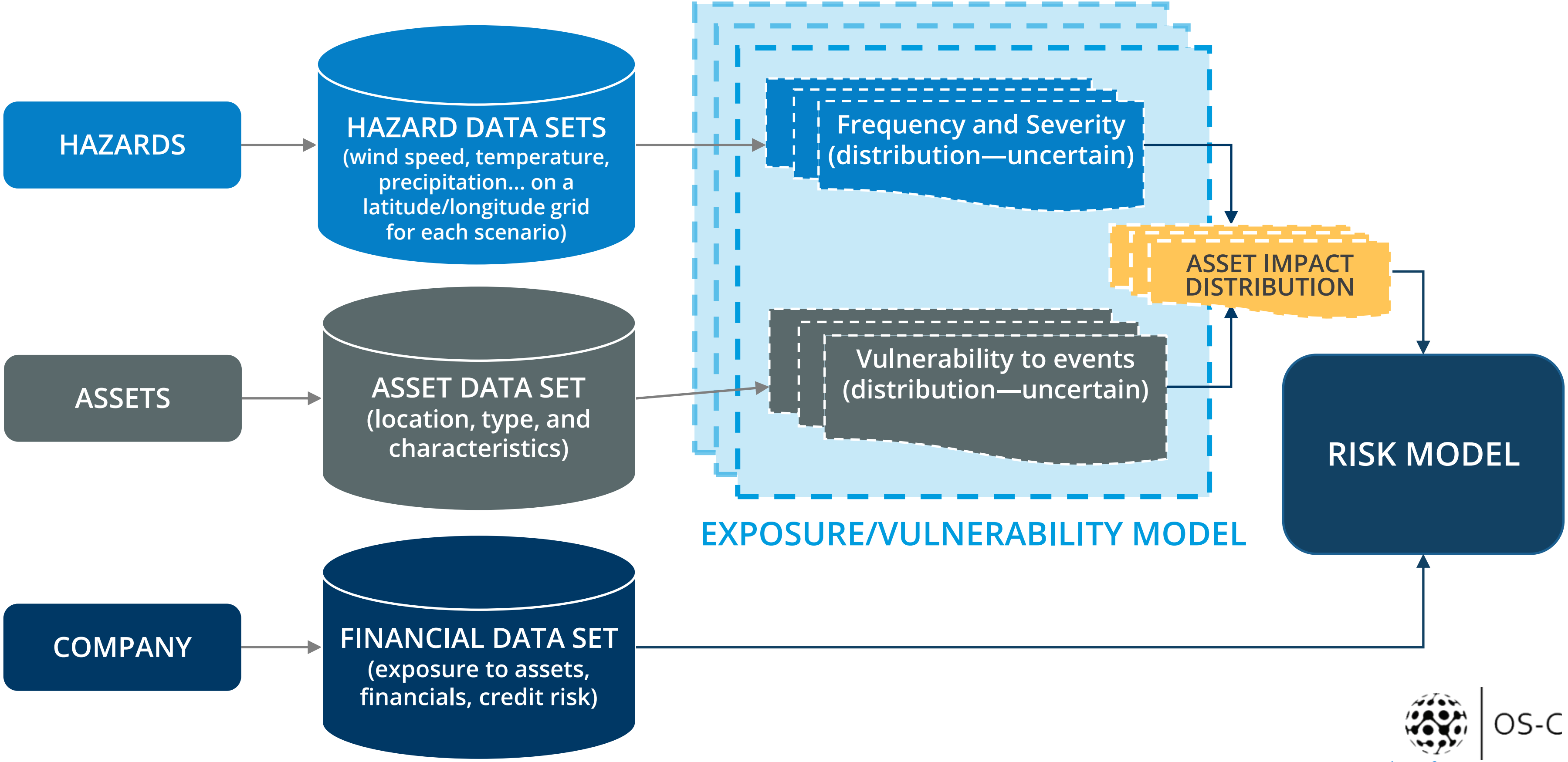
Helping industry to develop and apply modelling, data and disclosure standards for corporates and financial institutions

- Support the financial industry in its investment/lending decisions
- Provides a bridge between the research community, practitioners and decision makers in business and finance

Leveraging the customizable and widely-accessible physical risk toolkit

- Benefiting from the anticipated growth in open-source asset and company data availability
- Opportunity for data and analytics providers to participate in pre-competitive layers to accelerate commercial developments
- Continuous addition and improvement as community expands

Physical risk modelling framework



Classification : Internal

Physical risk methodology summary

- Core elements adopted from Oasis LMF (catastrophe model)
  1. Use of *primary* and *secondary* probability distributions
  2. Use of *non-parametric* distributions
  3. Explicit calculation of ‘effective damageability distributions’

- Why this is appropriate for Physical Risk use cases
  - *Common interface: facilitates sharing e.g. vulnerability information*
  - Flexibility to accommodate ecosystem of models
  - Computational performance
  - Ability to accommodate both simple and complex models
  - The above elements *enable* the construction of simple models bridging on-site / ‘light-touch’ bulk-assessment

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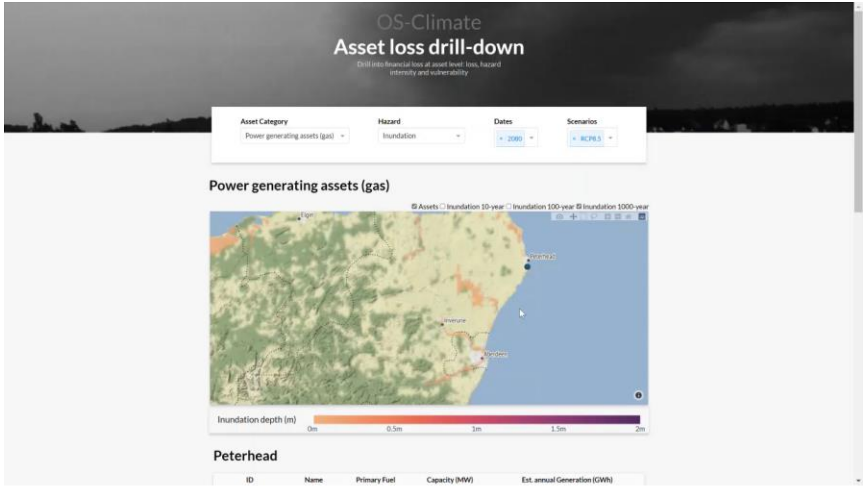
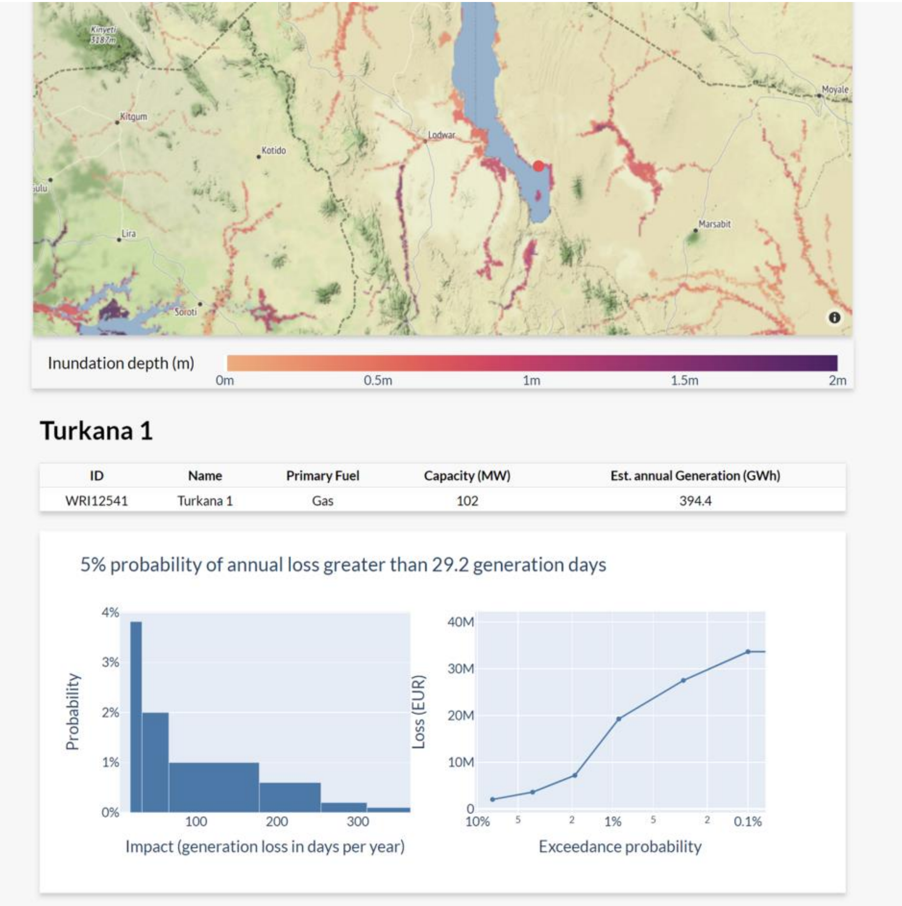
Requirements 1/2

- Build flexible and start simple; not too simple
  - **Need more than qualitative measures, e.g. scores**
  - **Need result in EUR (/USD etc) as common unit**
    - Otherwise we cannot aggregate and compare risks
      - How can we compare a 100 MEUR asset at low risk with a 1 MEUR asset at high risk?
      - How can we compare a business disruption from flood with a risk of damage from wildfire?
    - Does not necessarily imply sophisticated economic model
- In general, our results are probability distributions
  - Exceedance curves as well as mean loss
    - Small probabilities of large losses
    - Stranded assets

Requirements 2/2

- Exceedance probability curve
  - at asset level
  - aggregated to portfolio level
- Example for a WRI model developed for EBRD power-generating assets





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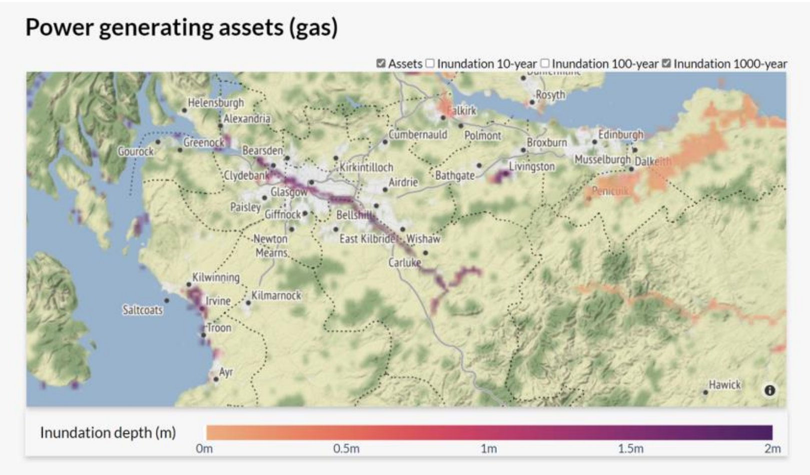
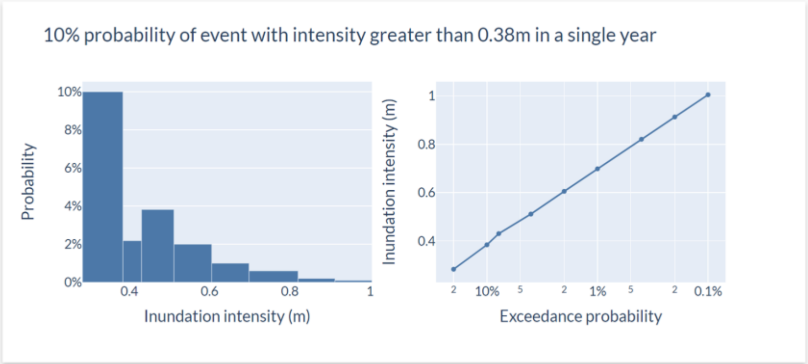
Primary uncertainty

- **Probability of experiencing a hazard event of certain intensity**
  - In a given time-frame
  - Driven by a specific scenario
  - Under a set of modelling assumptions
- **Already very useful!**
  - Ecosystem of hazard models in one place
  - Jupiter Intelligence hazard set
  - Accessible in ways optimized for Physical Risk (modelling and visualization)
  - Probability distributions in locale of asset

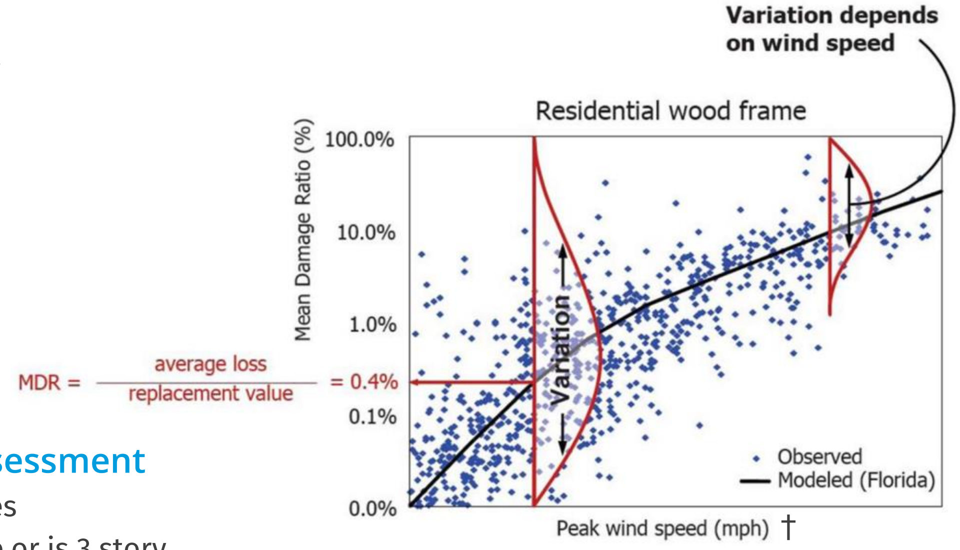


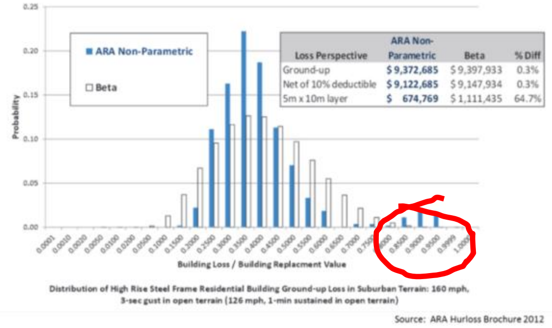


Secondary uncertainty

- **Vulnerability as a matrix**
  - May be multi-modal
- **Sources of uncertainty are a mixture**
  - Aleatory (‘truly random’)
  - Epistemic (could know, but don’t)
- **Epistemic important for physical risk bulk-assessment**

  e.g. flood risk for large portfolio of residential properties
  - We might not know if a property is a mobile home or is 3 story with pile foundations
  - *It might not matter* (i.e. not the *portfolio’s* main risk-driver)
  - *With vulnerability matrix we can include epistemic uncertainty to find out*





Loss Perspective	ARA Non-Parametric	Beta	% Diff
Ground-up	$ 9,372,685	$ 9,397,933	0.3%
Net of 10% deductible	$ 9,122,685	$ 9,147,934	0.3%
5m x 10m layer	$ 674,769	$ 1,111,435	64.7%

†Oasis LMF; reprod. Jean-Sébastien Lagacé, Catastrophe Modeling, 2008 – Université Laval

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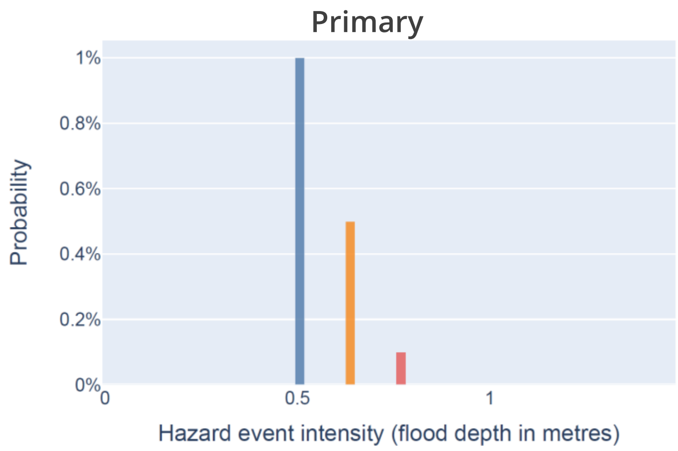
Effective damageability



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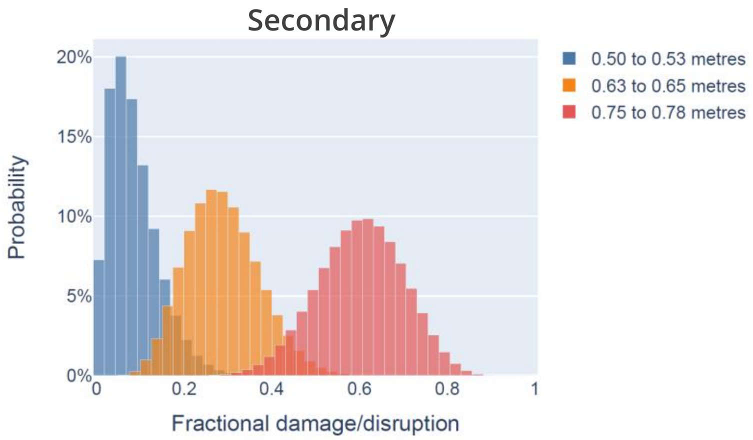

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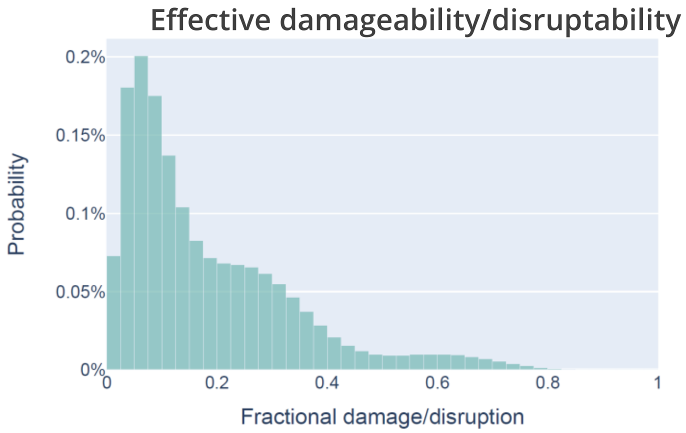

Can described as:

- a *convolution* or
- a matrix multiplication with the vulnerability matrix

Option of *Monte Carlo sampling* from effective damageability distribution

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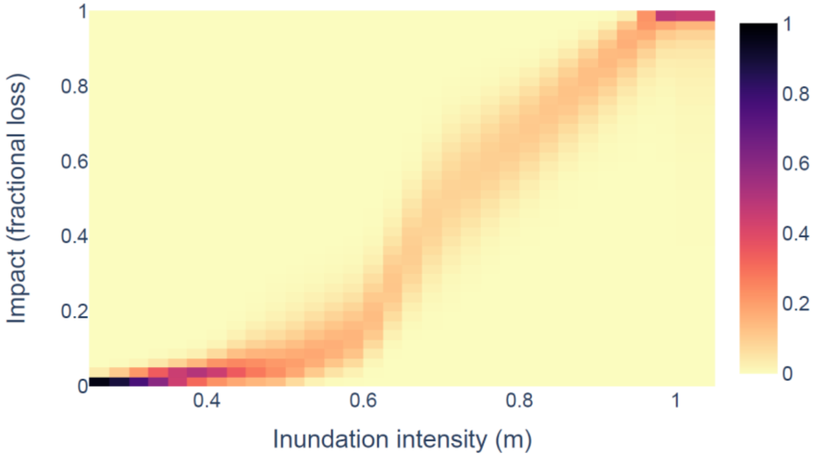
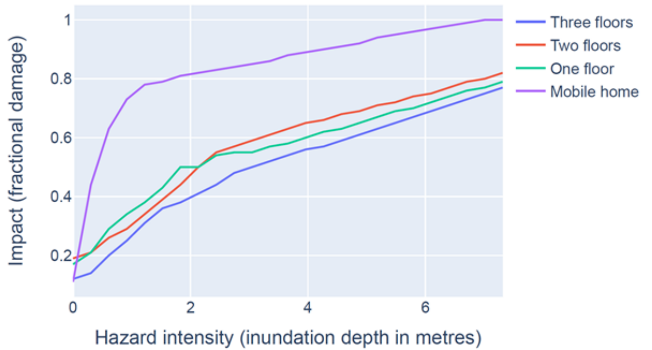
Simple modelling approaches

Examples:

1. **WRI power generating assets**
   - Aims to bridge gap between on-site assessment and 'light-touch' bulk assessment
2. **FEMA FAST**
   - Provides detailed content/inventory/structure impacts for different categories
   - Can handle the case where there is (epistemic) uncertainty as to category by assuming a *prior distribution*

Vulnerability from damage curve or with uncertainty





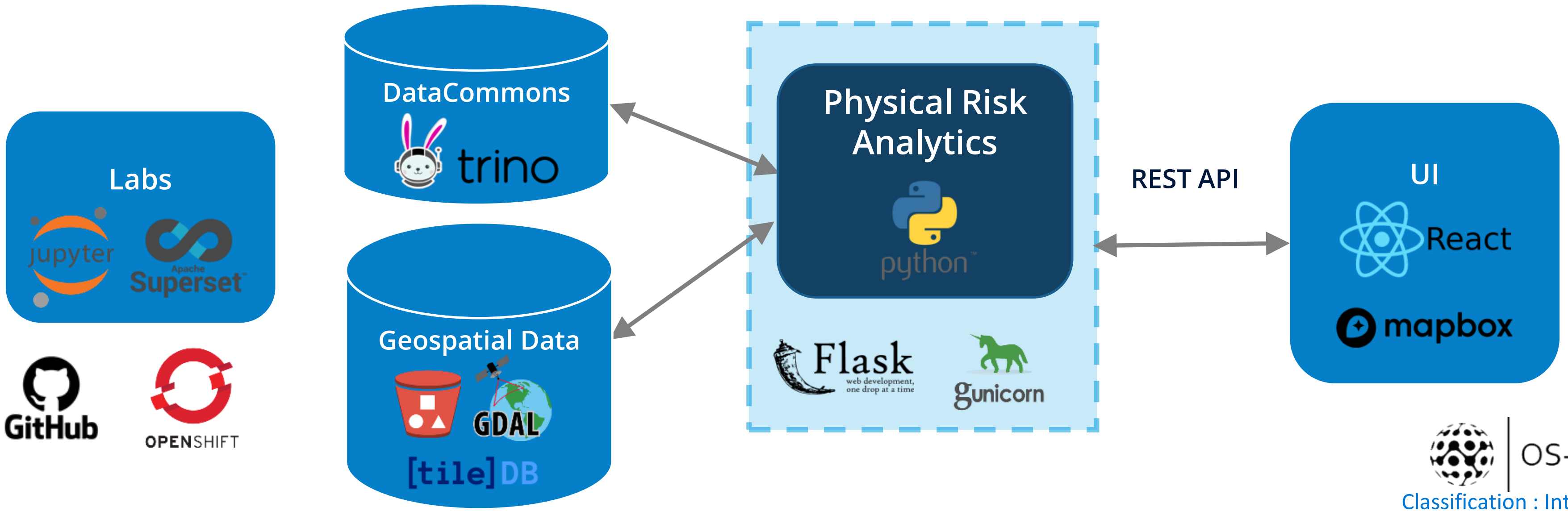
Not a system in isolation

- Climate change alerts can be integrated and assets affected, highlighted
- Example data sources:
  - Flooding: GDACS, DFO
  - Drought: Drought monitor (NOAA)
  - Fire: FIRMS
  - Etc.

Note: Calculated probabilities of the models should not be interpreted as 'live' impacts

Choice of technologies

- Overview of stack (see DataCommons Deep Dive for more details)
  - Transfer to institutions' internal systems
  - Accessible choices
- A number of PoCs in flight; not set in stone!



Q & A

Please Use Raise Hand or Type Question in Chat

Implied Temperature Rise Model (ITR)

OS-Climate – Technical Deep Dive

Jared Westheim (Goldman)
Leyla Javadova (Allianz)
Ruben Haalebos (LSEG)
Joris Cramwinckel (Ortec Finance)

December 1st 2021

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ITR OBJECTIVE

COP 26 Portfolio Alignment recommendations can be advanced by an open source tool to help drive convergence and transparency in portfolio alignment methodologies

"OS-C is establishing an Open Source collaboration community to build a software platform that will dramatically boost global capital flows into climate change mitigation and resilience."

In collaboration with Academia, NGOs, Investors, and Commercial data providers, the aim is to aggregate the best available data, modelling, and data science to enable powerful applications for climate-integrated investing.

ITR Workstream Participants

LSEG, Allianz, IDS, Goldman Sachs, Red Hat, URGENTEM, ORTEC FINANCE, metafinanz

Mission

- Build an open source ITR tool based on the recommendations set out by Portfolio Alignment Team
- The tool shall be transparent, dynamic and science-based
- Incorporate and cross compare multiple benchmarks
- Incorporate backward-forward looking data
- Be sector specific
- Ultimately cover all sectors within a portfolio

- Climate crisis requires not only emission reduction to net-zero, but also keeping cumulative emissions within a defined carbon budget.
- ITR is a forward-looking management tool that facilitates the evaluation of how individual investment decisions can contribute to long-term climate goals.
- A variety of inconsistent methods have emerged that produce incompatible results. A transparent and open source model will facilitate the wider application of the tool and methodology improvement over time.

Tool Setup

Leyla Javadova (Allianz)
Ruben Haalebos (LSEG)

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TOOL ARCHITECTURE

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Six modules developed in parallel to provide an end to end demonstration tool

Linked to Data Commons | ITR Modules

Modules

Data collection	Data loading	Climate Scenario selection	Emissions projection	Temperature score	Portfolio reporting
Secure and host company data to drive assessment of company performance; define precisely input data needed	Transform and match data to portfolio securities at the appropriate entity level (company hierarchy)	Climate Scenarios from one or more sources are selected	Historic emission trajectory and target projections	Company score assigned based on cumulative benchmark divergence & aggregated to	Results are reported to investors and visualized
✔ Sector Coverage: Electric Utilities, Oil & Gas, Automobiles, and Steel ✔ Data input: RMI ❑ Consolidation of Urgentem and LSEG data ❑ Incorporation of granular target data ❑ Expansion of further forward-looking data e.g. capex, avoided emissions	✔ Open source company hierarchy based on LEIs ❑ Treatment of conglomerates	✔ OECM 1.5 degree aligned benchmark scenario (region specific for EU & North America) ✔ TPI 2 degree and below 2 degree scenarios ❑ More sector and region specific scenarios required	✔ Extrapolation of historic emission intensity trajectories based on company level Scope 1 + 2 emissions and production values ✔ Linear projection of company target data ❑ Automatization of projections in process	✔ Calculation of trajectory and target overshoot ratio ✔ Measurement of alignment/misalignmen t to a selected climate scenario ✔ Final ITR score comprised of trajectory and target ITR scores (50/50 weighted)	✔ Different calculation methods provided such as WATS and ECOTS ✔ Preliminary GUI set-up with basic reporting functionalities ❑ Enhance portfolio upload functionality ❑ Add flexible calculations required for portfolio analyses

Module focus

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Classification : Internal

DATA INPUT AND COVERAGE

The ITR can be enhanced further to include further forward-looking data such as capex relevant data on green and brown activities.

Data Contributors

LSEG URGENTEM! RMI Self-extracted Data

- We have identified the minimum data required to run the ITR tool for four highest emitting sectors: Utilities, Steel, Oil and Gas and Automobiles
- Long-term we recommend creating an open source database with the minimum data required enabling full transparency on raw data
- The NLP Workstream set out by OS-Climate aims to extract the required data from Annual and Sustainability reports of companies with the objective to build such an open source database
- Going forward scope 3 emissions of companies should be included as well

Minimum data input required

Fundamental Data	Company Name
	LEI
	ISIN
	Country
	Region
	Industry ISIC
	EVIC
Target Data	Source of the Target Data
	Target Type (Absolute/Intensity)
	Base year of the target
	End year of the target
	Target reduction from base year in %
	Target Scope (Scope 1, 2 Emissions)
	Target Units (e.g. CO2e per tons of steel produced)
Emission Data	Scope 1 Emissions in tons of CO2e
	Scope 2 Emissions in tones of CO2e
	Scope 1 Emissions in tons of CO2e (timeseries for the past 5 years)
	Scope 2 Emissions in tones of CO2e (timeseries for the past 5 years)
Production Data Annnual total production values required	Steel Production in total (tons of steel producred in metric tons)
	Steel Production in total (timeseries for the past 5 years)
	Electricity Produced (electricity produced in gigajoules) / or in MWh
	Electricity Produced (timeseries for the past 5 years)
	Automobiles (in passenger km)
	Automobiles (timeseries for the past 5 years)
	Oil & Gas in total (in barrel of oil & gas produced) / or in PJ/MJ
	Oil & Gas in total (timeseries for the past 5 years)

CLIMATE SCENARIO SELECTION

OECM 1.5 degree aligned Benchmark

The OECM is a 1.5°C model developed by members of the UN Net-Zero Asset Owner Alliance in collaboration with academics and experts from various sectors. The output of the OECM model can be translated to granular sector pathways with precise carbon emissions and carbon/energy intensity reduction needs to reach net zero by 2050.

Cumulative energy-related CO_2 emissions [$GtCO_2$]

Note (A): Energy Statistics and Financial Sectorial breakdowns differ - emissions therefore will **not** add up.

	World			OECD North America			Share global emissions	OECD Europe			Share global emissions
	2017-2030	2017-2050	Sector [%]	2017-2030	2017-2050	Sector [%]	[%]	2017-2030	2017-2050	Sector [%]	[%]
Industry	71,7	94,2	24%	6,7	8,0	13%	8,5%	5,5	7,5	19%	8%
- Cement	8,3	11,5	3%	0,3	0,4	1%	3%	0,6	0,9	2%	8%
- Steel	23,4	30,3	8%	1,1	1,4	2%	5%	1,6	2,1	5%	7%
Transport	78,0	90,7	23%	21,5	23,6	37%	26%	9,1	9,8	24%	11%
- Aviation	4,1	4,9	1%	1,9	2,2	3%	44%	0,3	0,3	1%	6%
- Navigation	2,0	2,6	1%	0,3	0,4	1%	14%	0,2	0,2	1%	8%
- Road	67,6	77,7	20%	17,8	19,3	31%	25%	7,9	8,5	21%	11%
Power	113,2	137,5	35%	17,5	18,7	30%	14%	9,2	11,6	29%	8%
- Utility	192,7	261,4	66%	38,9	45,3	72%	17%	21,6	30,1	74%	12%
- Energy Sector	345,0	421,3	106%	60,8	68,1	108%	16%	34,0	41,1	102%	10%
Buildings/other sectors	36,6	46,5	12%	7,0	7,7	12%	17%	6,9	8,5	21%	18%
other conversions	20,3	27,2	7%	4,4	5,1	8%	19%	2,4	3,1	8%	11%
Total actual CO_2 emissions	320,0	396,0	100%	57,0	63,1	100%	See (A)	33,1	40,5	100%	See (A)

Transition Pathway Initiative

TPI 2 degrees and below 2 degrees benchmark

The Transition Pathway Initiative (TPI) is a global initiative led by asset owners and supported by asset managers with the aim to assess company preparedness for the transition to a low-carbon economy. The benchmark information provided by TPI are based on the Sectoral Decarbonization Approach (SDA). Sectoral emissions are normalized by a relevant sectoral activity which results in benchmark path for emissions intensity in each sector.

	2°C benchmark								below 2°C benchmark							
sectors	2014	2020	2025	2030	2035	2040	2045	2050	2014	2020	2025	2030	2035	2040	2045	2050
Oil and Gas	65,57	60,29	55,9	48,21	40,08	33,43	27,27	21,7	65,57	58,74	53,04	43,45	33,95	24,41	15,98	9,98
Steel	1,669	1,498	1,37	1,13	0,954	0,813	0,677	0,62	1,669	1,325	1,046	0,815	0,597	0,477	0,375	0,263
Electric utilities	0,586	0,457	0,36	0,245	0,151	0,097	0,056	0,04	0,586	0,44	0,33	0,229	0,141	0,072	0,02	-0,008
Auto	147	113	94	77	64	56	50	43	147	113	68	40	24	15	10	6

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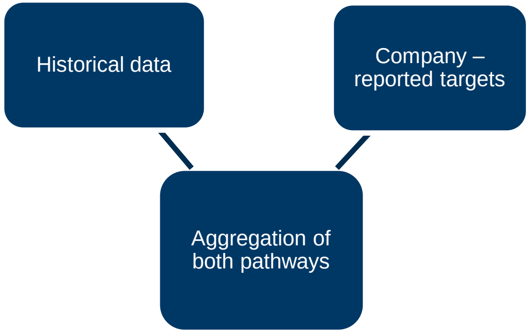
FORWARD-LOOKING PROJECTIONS

Methodology



- Each projection is weighted according to the sector's historical probability of achieving its targets
- If the company has no reported target, only the historical evolution of intensity is used

TCFD Recommendation:

- Use company disclosed targets and historical emissions (or near-term Capex plans)
- Projections should incorporate multiple data sources
- Weighting between different data sources should be based on credibility

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

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DATA AND CONSTRAINTS

Projections are based on carbon intensities:

$$CI = \frac{Emissions}{Production}$$

Data cleaning and processing steps:

- Matching data using a single company identifier
- Harmonization of target database
- Correcting extreme or abnormal values
- Interpolation where necessary

Data name	Data description	Data Source
Company emissions	Scope 1 and Scope 2 historical emissions	Urgentem
Company production	Company-level production, unit dependant on the company's sector	Refinitiv
Company targets	Company reported emissions targets	FTSE Russell

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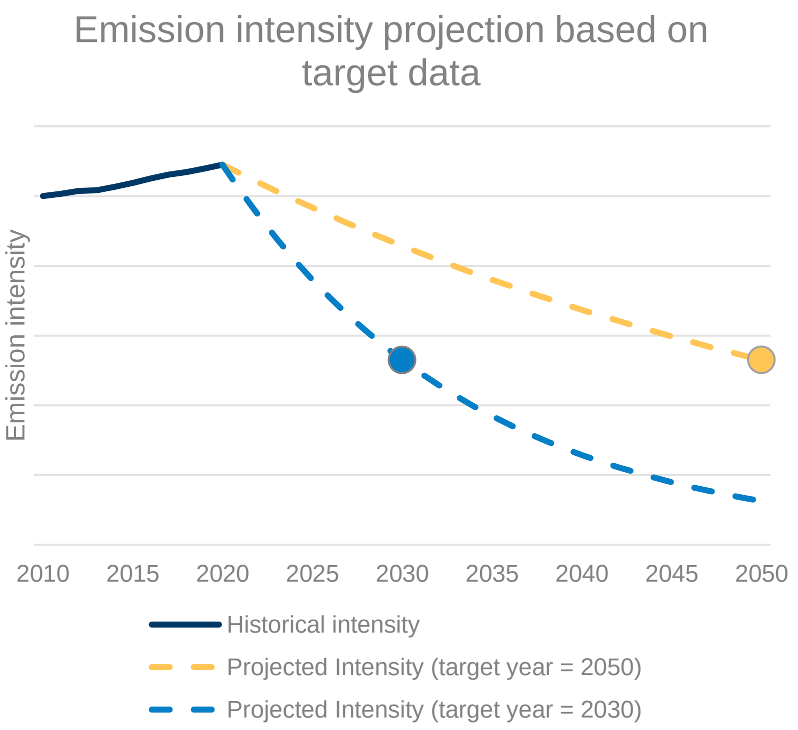
PROJECTION USING TARGETS

What constitutes a target?

- Base year
- Target year
- Planned reduction

If the target year is not 2050:

- Data is projected until the target
- Data is projected forward to 2050 using the observed rate of reduction



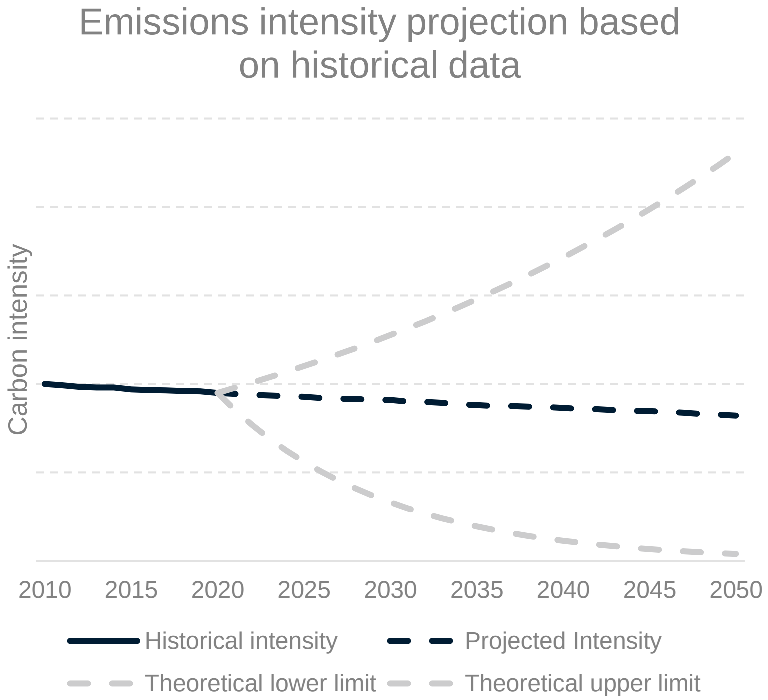
Limitation: companies are not always compliant with their announced target text

PROJECTION USING HISTORICAL DATA

The intensity is projected forwards using its historical variation:

$$I\_(t+1)=I\_t*(1+\Delta I\_hist)$$

ΔI_hist is the YoY variation of intensity, it is limited between [-10%, 3%] annual change to prevent extreme variations



Limitation: past behavior is the predictor of future evolution

ITR CALCULATION

ITR model translates an assessment of alignment/misalignment with a benchmark in the form of a temperature score

1. For the ITR calculation, company emissions must be compared to scenario pathways on a cumulative basis (emissions are summed up from the base year to 2050 for trajectory-based and target-based pathways).
2. Next cumulative emission benchmark overshoot ratio is calculated by dividing the cumulative emissions of trajectory or target-based pathways by cumulative emissions of the selected climate scenario.
3. Subsequently, TCRE is applied for the final calculation.
4. Two final ITR scores are generated, the trajectory ITR score and the target ITR score. Both equally weighted and combined generate the final ITR score.

ITR calculation for the trajectory and targets:

$$ITR(c, trajectory) = BMtemp + (Overshootratio(c, trajectory) - 1) * TCRE * Carbonbudget/3664$$

$$ITR(c, target) = BMtemp + (Overshootratio(c, target) - 1) * TCRE * Carbonbudget/3664$$

The two ITR's can be combined using a company-specific probability measure for the estimated likelihood that the target will be reached:

$$ITR(c) = p(c) * ITR(c, target) + (1 - p(c)) * ITR(c, trajectory)$$

TCRE application

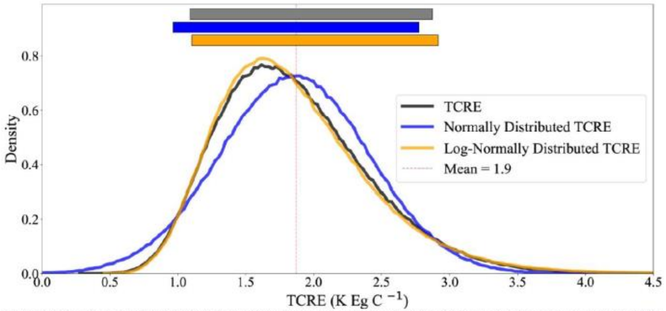


Figure 4. Probability density function (PDF) of calculated TCRE values, a normally distributed TCRE PDF, and a log-normally distributed TCRE PDF, the latter two based upon the mean and standard deviation of calculated TCRE values. Each bar designates a 5%–95% confidence interval, the grey bar corresponding to the calculated TCRE, the blue bar corresponding to a normally distributed TCRE and the orange bar corresponding to a log-normally distributed TCRE. Source: Spafford & MacDougall (2020).

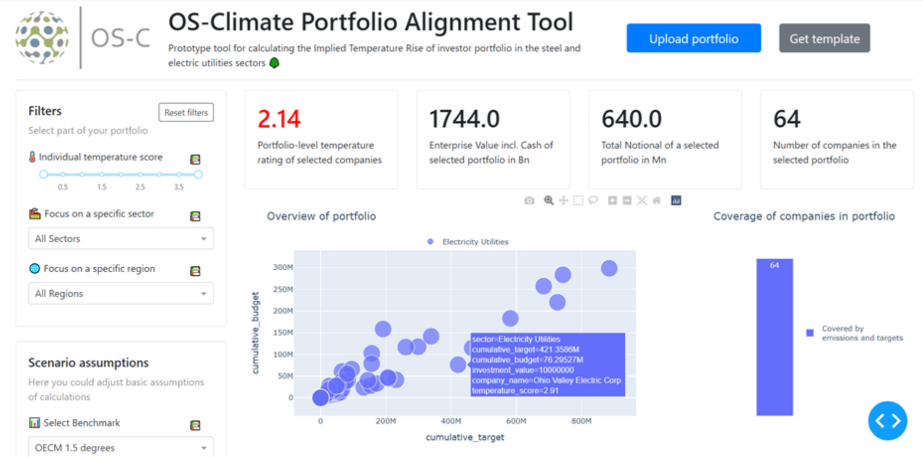
TCRE stand for transient climate response to cumulative carbon emissions. It represents the proportionality between global temperature change and cumulative CO2 emissions. The OECM benchmarks assume a remaining energy-related carbon budget with 66% likelihood of staying below 1.5 degrees. Thus, the TCRE value is set at 2.2.

REPORTING

ITR report can be generated via the user interface and/or via the ITR tool code, which will be open source

The tool generates:

- Issuer level ITR scores
- Multiple calculation options
- Sector heat maps
- Best and worst contributors
- Going forward, the aim is to build a functionality where the user can upload proprietary input data and run the tool accordingly via the online user interface



Tool Design

Joris Cramwinckel (Ortec Finance)

OS-C

OS-C

TOOL DESIGN

Persona's

Portfolio Manager
Quant
Consultant

User story #1

As a portfolio manager, I want to assess my asset and lending portfolio with the ITR methodology such that I can report its climate impact to stakeholders

User story #2

As a Quant, I want to research the ITR methodology such that it can be used in our models

User story #3

As a consultant, I want to run analysis with the ITR methodology such that I can advise my clients

ITR TOOL WORKFLOW

1

	mpany_name	company_id	company_isin	investment_value
0	Company AG	US0079031078	US0079031078	35000000
1	Company AH	US00724F1012	US00724F1012	10000000
2	Company AI	FR0000125338	FR0000125338	10000000
3	Company AJ	US17275R1023	US17275R1023	10000000
4	Company AK	CH0198251305	CH0198251305	10000000

3

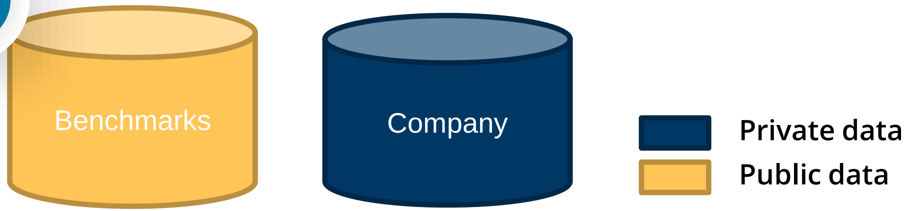
REST API
Base image:
registry.access.redhat.com/ubi8/python-36
(Openshift compatible)
Middleware: FastAPI

pip install ITR
Relies on pydantic models
96% unit test coverage
https://github.com/os-c/ITR/tree/develop

4

	ompany_name	time_frame	scope	temperature_score
0	Company AG	LONG	S1S2	2.05
1	Company AH	LONG	S1S2	2.22
2	Company AI	LONG	S1S2	2.06
3	Company AJ	LONG	S1S2	2.01
4	Company AK	LONG	S1S2	1.93
5	Company AL	LONG	S1S2	1.78
6	Company AM	LONG	S1S2	1.71
7	Company AN	LONG	S1S2	1.34
8	Company AO	LONG	S1S2	2.21

2



1. Input Portfolio
2. Required data to run
3. Run (stateless) – split second
4. Slice and Dice result object

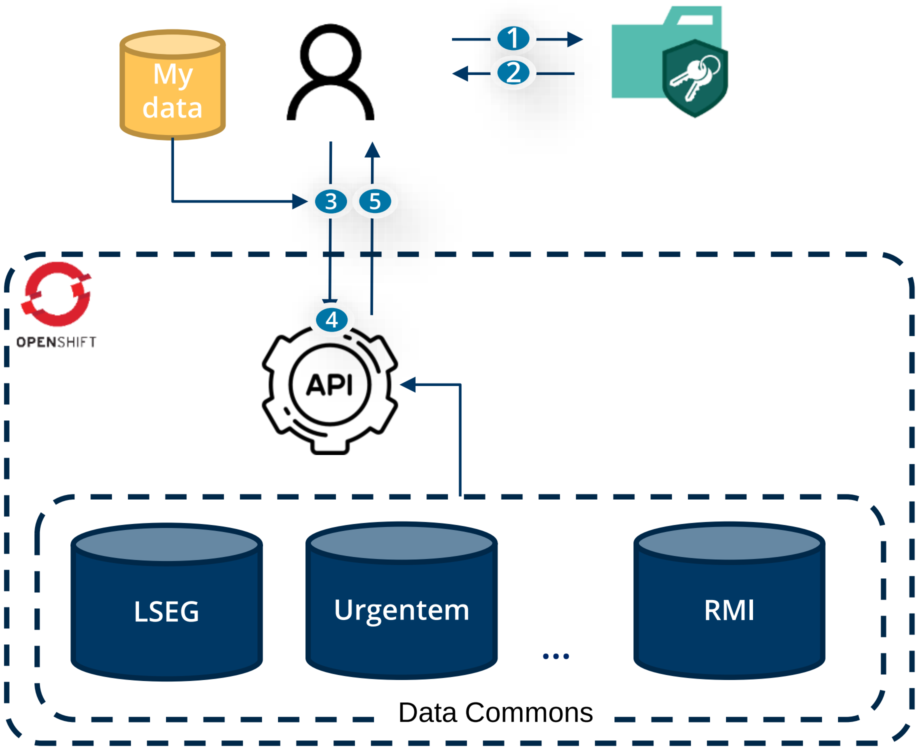
DEPLOYMENT OPTIONS

- Run Python code locally
  - pip install ITR
- Run in Jupyter Notebook – possibly with Dash (e.g. local or Google Colab, Sagemaker, AzureML, etc)
- Run API – catering third party apps or Front-ends
  - local or in any kubernetes platform

REST API
Base image:
registry.access.redhat.com/ubi8/python-36
(Openshift compatible)
Middleware: FastAPI

pip install ITR
Relies on pydantic models
96% unit test coverage
https://github.com/os-c/ITR/tree/develop

WHAT IF: I DON'T HAVE ACCESS TO COMPANY DATA?



1. Provide credentials
2. Get JWT
3. Post Request (portfolio, and optionally own data)
4. Amend my data with data commons and process
5. Response based on JWT authorization:
    - Temp scores (black box)
    - Temp scores + intermediate results (grey box)
    - Full data dump (crystal box)

Optional user provided climate data

Climate data with federated access

2022 Portfolio Alignment Outlook

Leyla Javadova (Allianz)

OS-C

Portfolio Alignment Outlook for 2022

Tool Testing
- Portfolio level testing (AZ, GS, OF, GFANZ, AOA)
- Perform UAT

Business Requirements
- Adapt sector mappings (ISIC, NACE)
- Update climate pathways
- Enhance target projections
- Inclusion of Scope 3 emissions
- Missing data treatment
- Incorporation of further forward-looking data

Go-live
- Methodology Handbook
- Code finalization
- GUI go-live

Tool Development
- Automatized projections
- Enhance data upload template
- Open source GUI set-up

Q & A

Please Use Raise Hand or Type Question in Chat

Thank You!

Join us on Thursday, December 2nd, 11:00 AM – 12:00 PM EST

Learn more about Transition Risk and the tools being contributed to the OS-Climate platform by Airbus. The event will feature demos on:

- SoSTrades platform
- WITNESS

Interested in Learning More: **https://os-climate.org/contact-us/**

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