

Digital Thread: Leveraging the power  
of API to connect your internal  
processes to **VOLTA**  
digital engineering platform

**um**  
**2023**

Matteo Francia  
Head of Professional Services





## The Digital Thread

risks and opportunities

## VOLTA Open Architecture

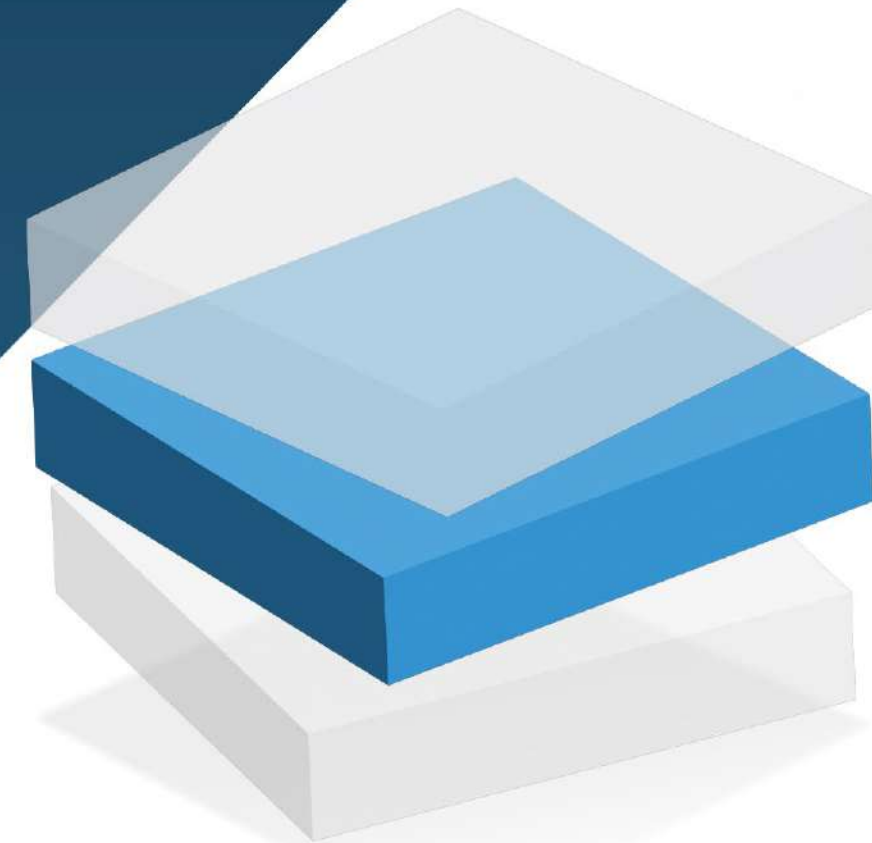
What's an API

## Runbox

How to leverage APIs

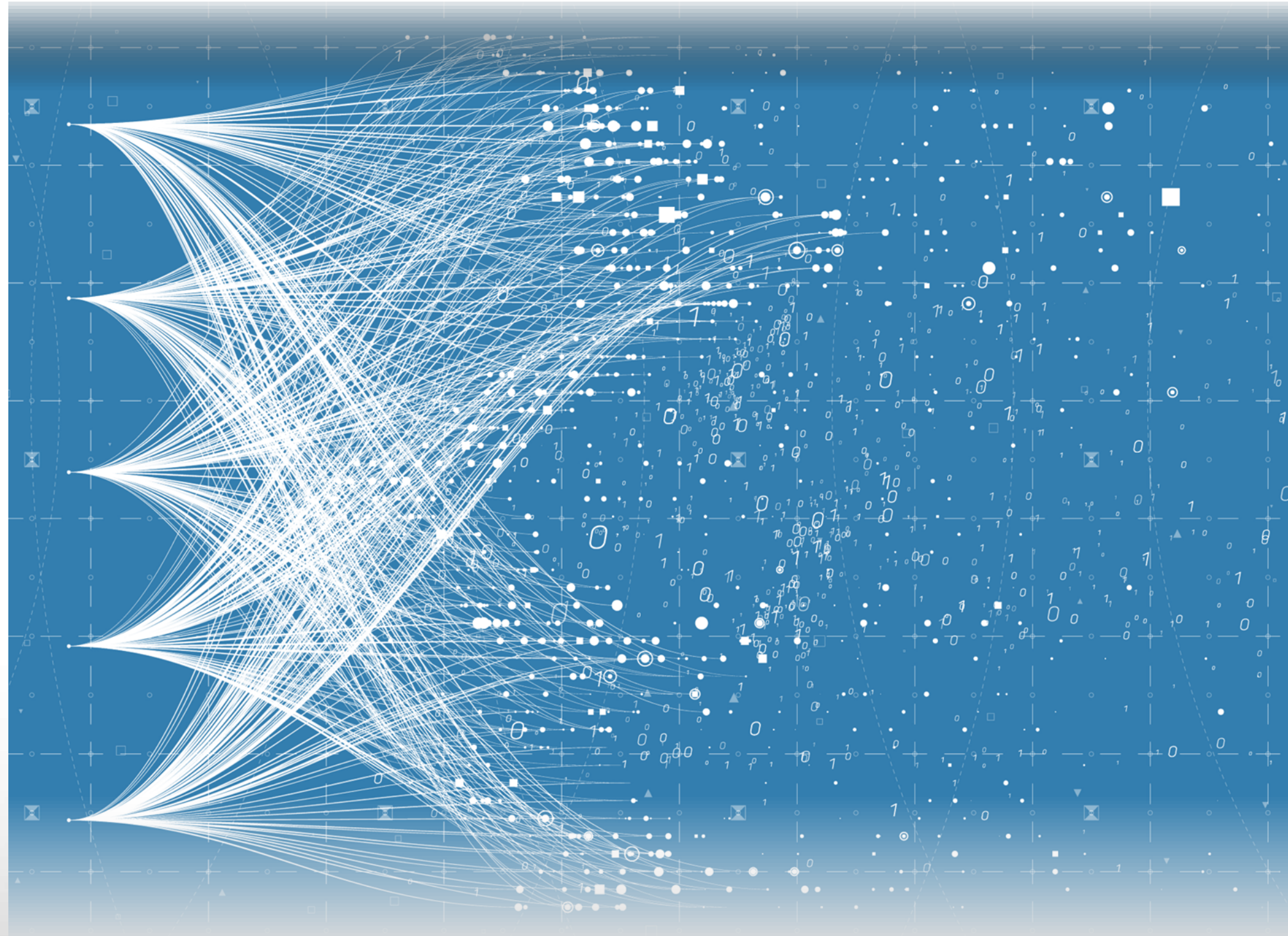
## Use Case

Cummins Emissions Solutions





# Digital Thread



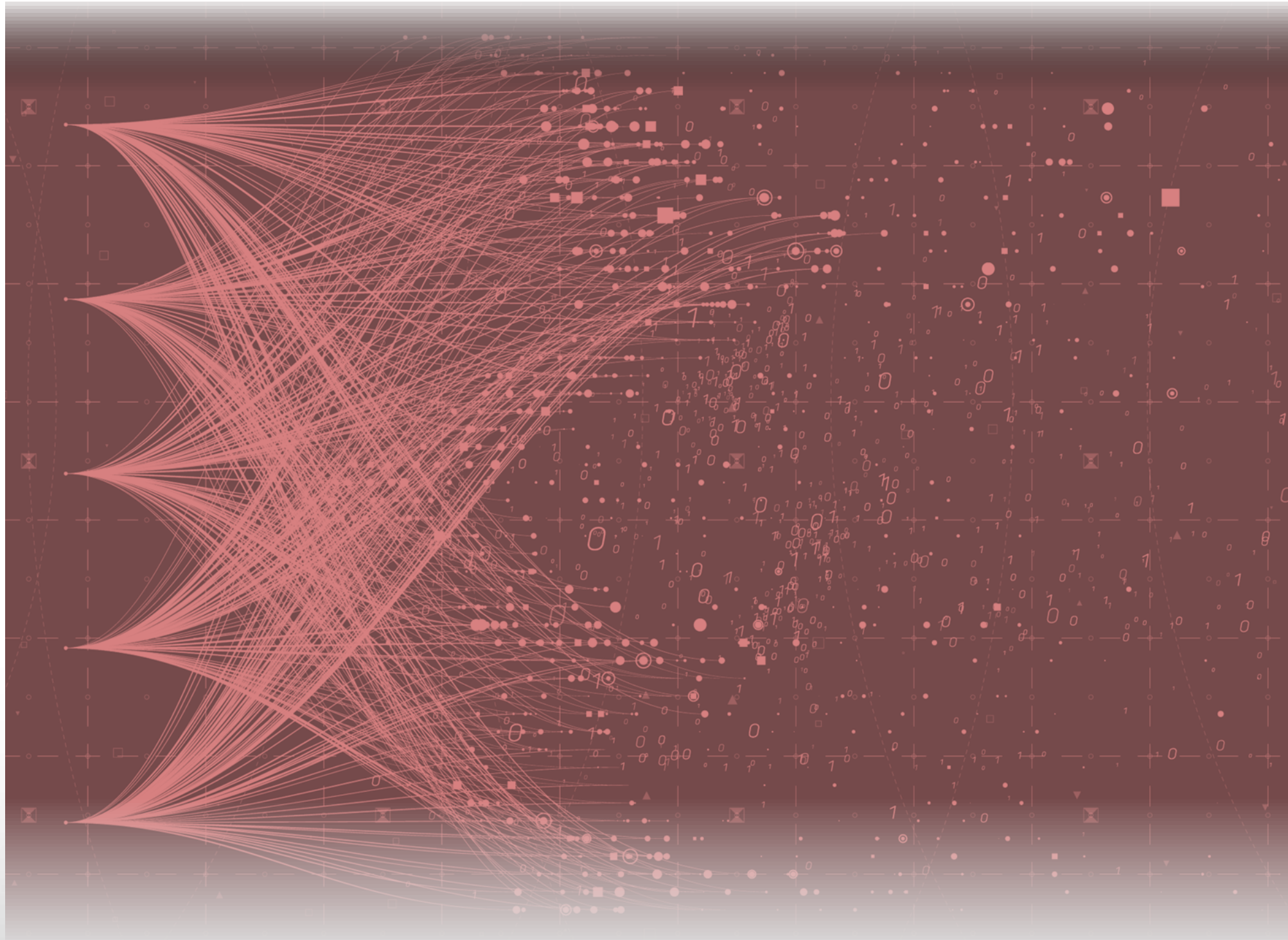
*“A linked set of digital artifacts whose consistency is actively managed over the life cycle of a product, process, or system”*

- Data Integration
- Traceability
- Process Automation





# Digital Threat



- Leveraging collective knowledge
- Information reuse
- Management, not just information
- ~~Change Management~~

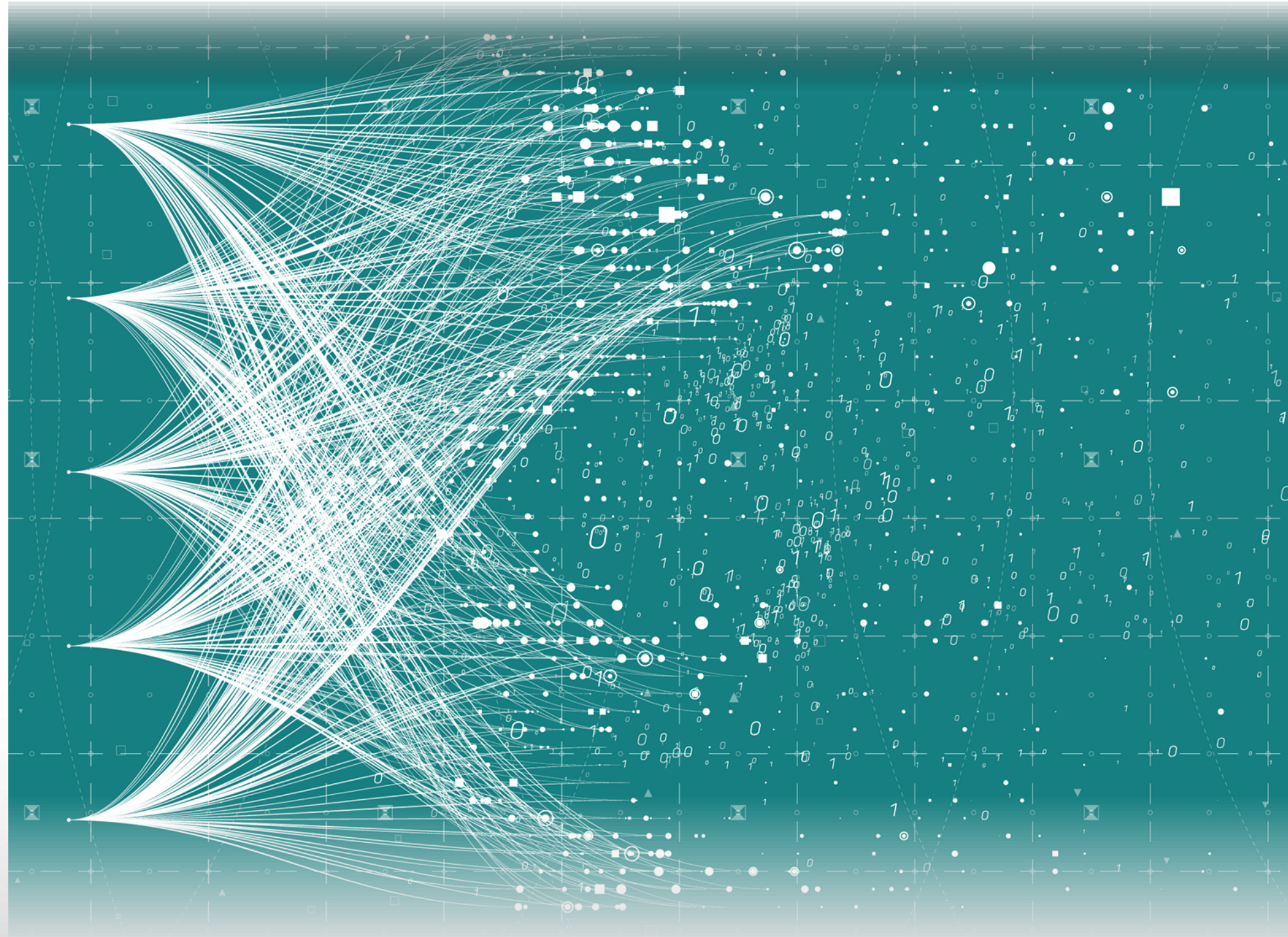
*“We’ve Always Done It This Way”*





# Digital Thread - opportunities

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- Data-Driven Decision-Making
- Digital Continuity
- Consistency Management



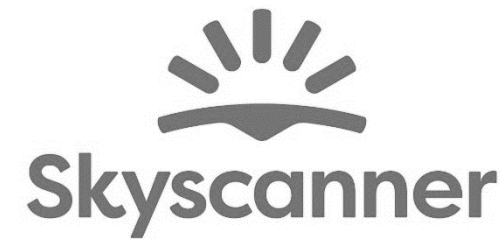


# What's an API

- ~~A definition~~ An example



# What happens when you book a flight?

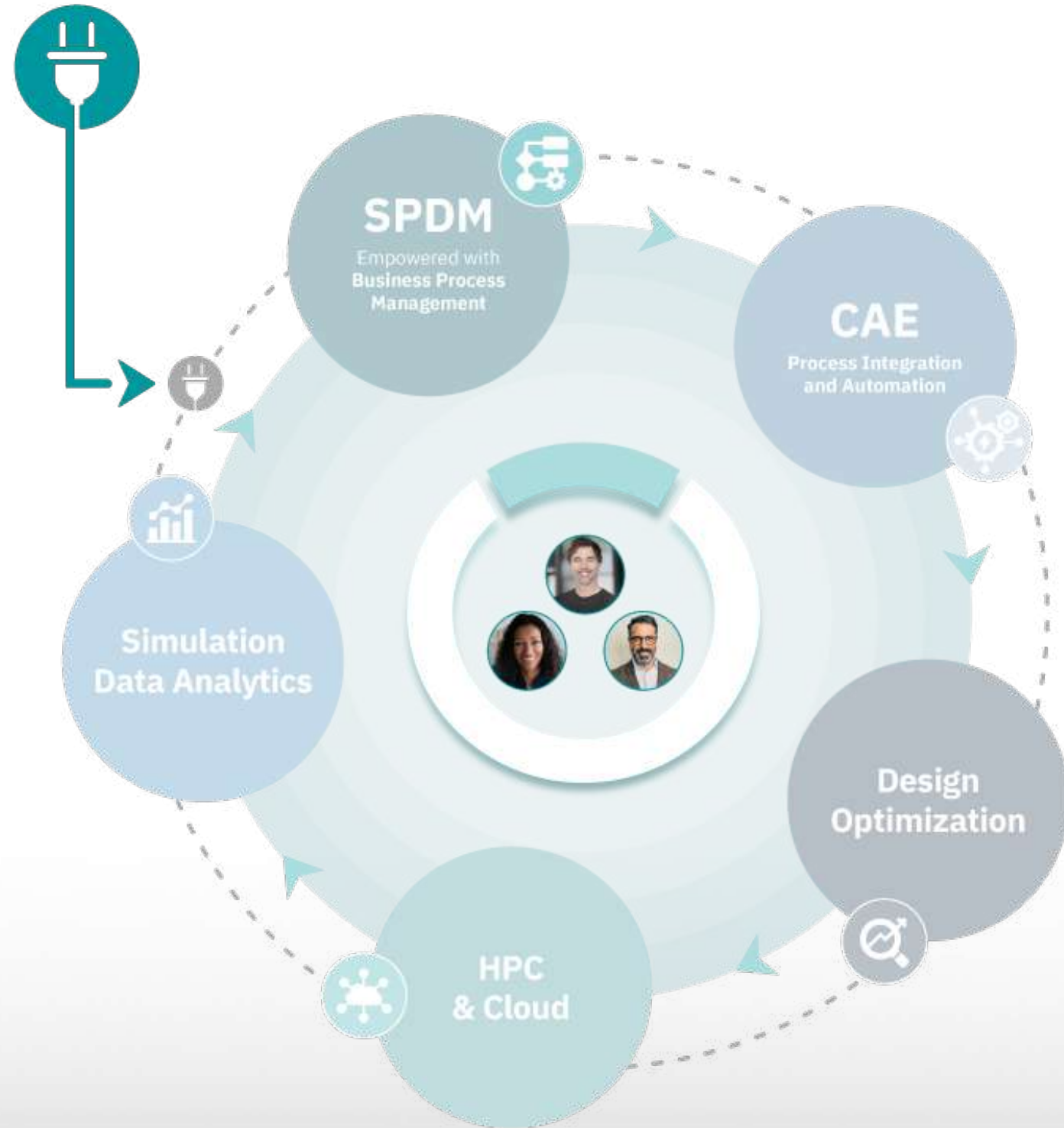


- API
- API
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- API
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- API





# Open Architecture



- Since 2018







# VOLTA API endpoints

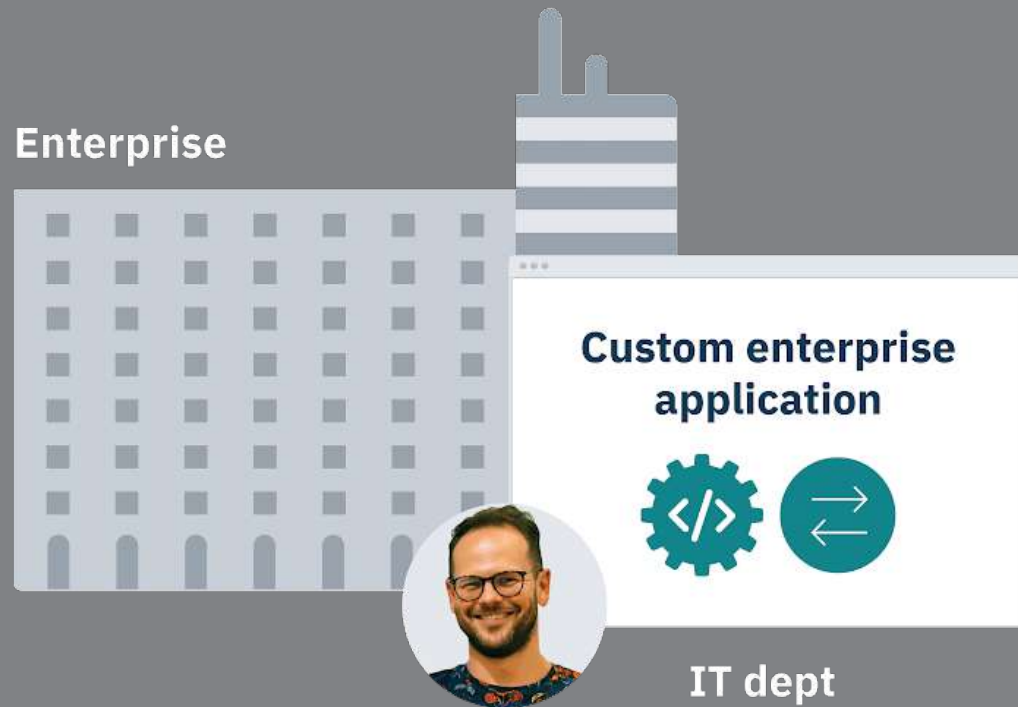
Digital Continuity





# VOLTA API endpoints

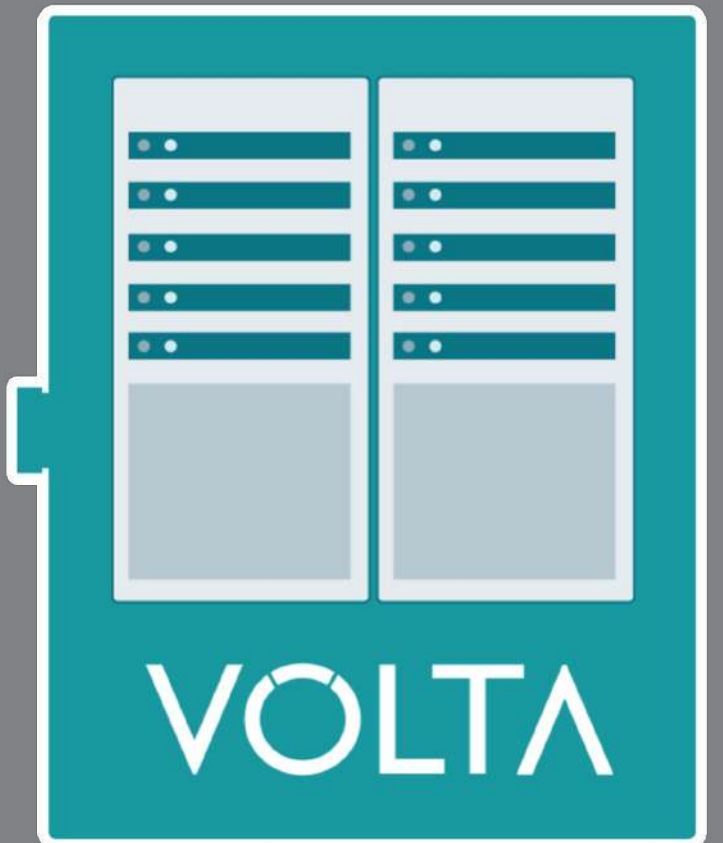
Enterprise



VOLTA API Documentation

## API Reference

- 1 Assign Metadata Options
- 2 Assign Tags
- 3 Create Binary
- 4 Create File
- 5 Create File Version
- 6 Create Folder
- 7 Create Project Plan
- 8 Create Release
- 9 Delete Item
- 10 Download File Version
- 11 Download Folder
- 12 Download Item
- 13 Download Release
- 14 Download Session
- 15 Edit Project Plan
- 16 Get Access Token
- 17 Get Folder Items
- 18 Get Groups
- 19 Get Item
- 20 Get Item Link
- 21 Get Item Path
- 22 Get Item Versions
- 23 Get Metadata
- 24 Get My Files Items
- 26 Get Project Models
- 27 Get Project Plan
- 28 Get Project Plans
- 29 Get Project Sessions
- 30 Get Queues
- 31 Get Release Names
- 32 Get Session Plan Configuration
- 33 Get Shared Items
- 34 Get Team Items
- 35 Get Teams
- 36 Get User Profile
- 37 Get Users
- 38 Move Item
- 39 Rename Item
- 40 Run Model as DOE
- 41 Run Model as Optimization
- 42 Run Model as Single Design
- 43 Run Model Version as DOE
- 44 Run Model Version as Optimization
- 45 Run Model Version as Single Design
- 46 Search
- 47 Share Item
- 48 Stop Session
- 49 Trash Item





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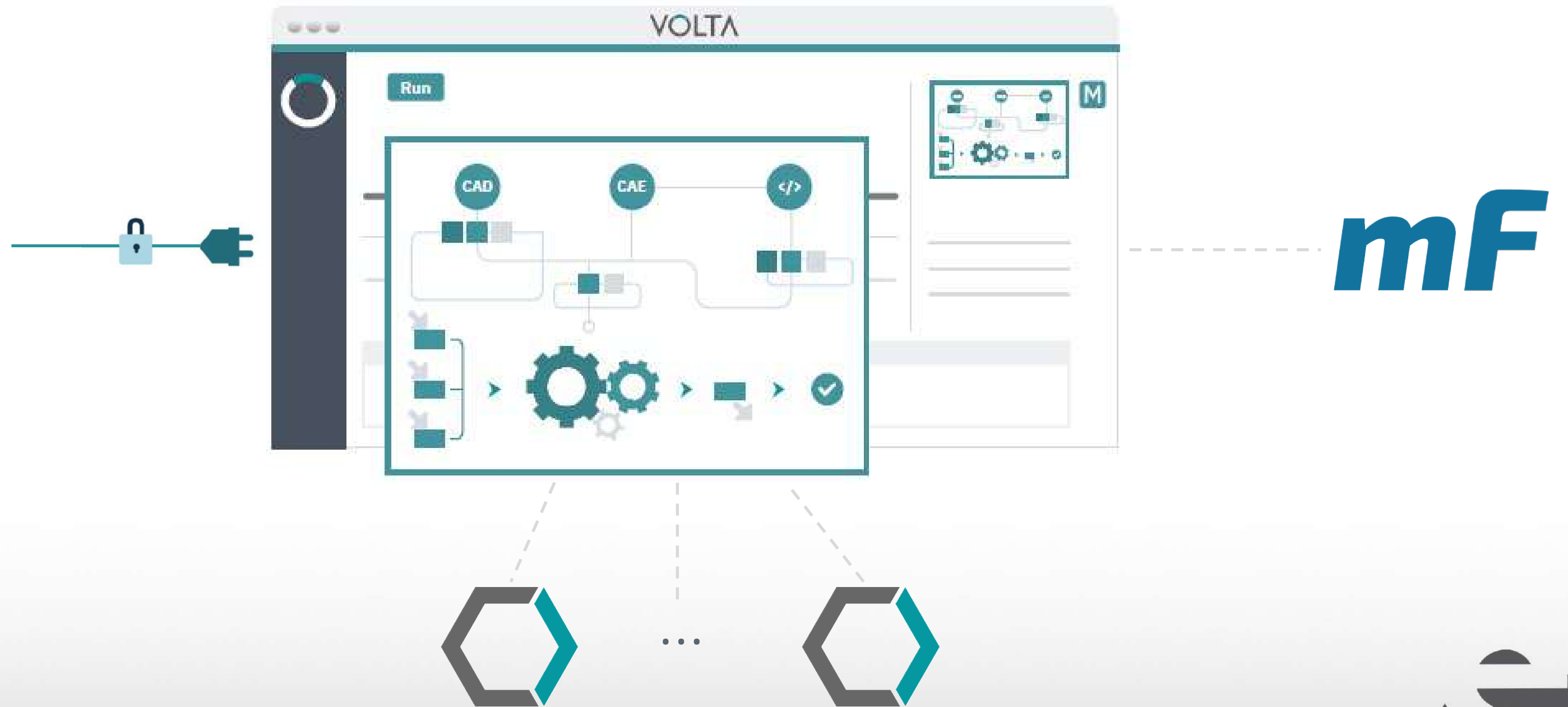
How to leverage VOLTA API





# Runbox - The Architecture

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# Runbox - An alternative frontend

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The Runbox interface displays a list of available simulation configurations. The selected configuration, "Heat sink simulation", is shown in detail with the following parameters:

Parameter	Min	Max	Current Value
d1	1.8	2.2	1.923
h1	7.2	8.8	8.4188
h2	2.7	3.3	3.1072
t1	0.9	1.1	1.0557

Problem Outputs:

- Directional\_Heat\_Flux\_Average
- DirHeatFlux\_gif
- Temperature\_Maximum
- Temperature\_png
- Total\_Heat\_Flux\_Average
- Volume\_Total



The VOLTA interface displays a project overview for "Super Sonic Business Jet". The simulation studies table is as follows:

NAME	CREATED	CREATOR	SIZE
disciplines	Feb 6, 2023	Project Manager	-
libs	Feb 6, 2023	Project Manager	-
spare	Feb 6, 2023	Project Manager	-
Full Optimization Study	Feb 7, 2023	Simulation Expert	-
SSB1 Business Workflow	Feb 6, 2023	Project Manager	135.71 KB
SSB1_MDO_DEMO	Apr 11, 2023	Project Manager	-

Full Optimization Study Details:

- Shared with: 6 Groups - 4 Users
- Tags: discipline, range, SSB1, structure
- Description: Post-processing dashboard for the optimization of the supersonic business jet.
- Links: 0
- Metadata: Aircraft Configuration (Model: XZ86, Engine Type: Turbojet, Engine Model: PT390, Model Year: 2023)
- Creator: Simulation Expert
- Created: Feb 7, 2023, 10:25:42 AM





# Use case:

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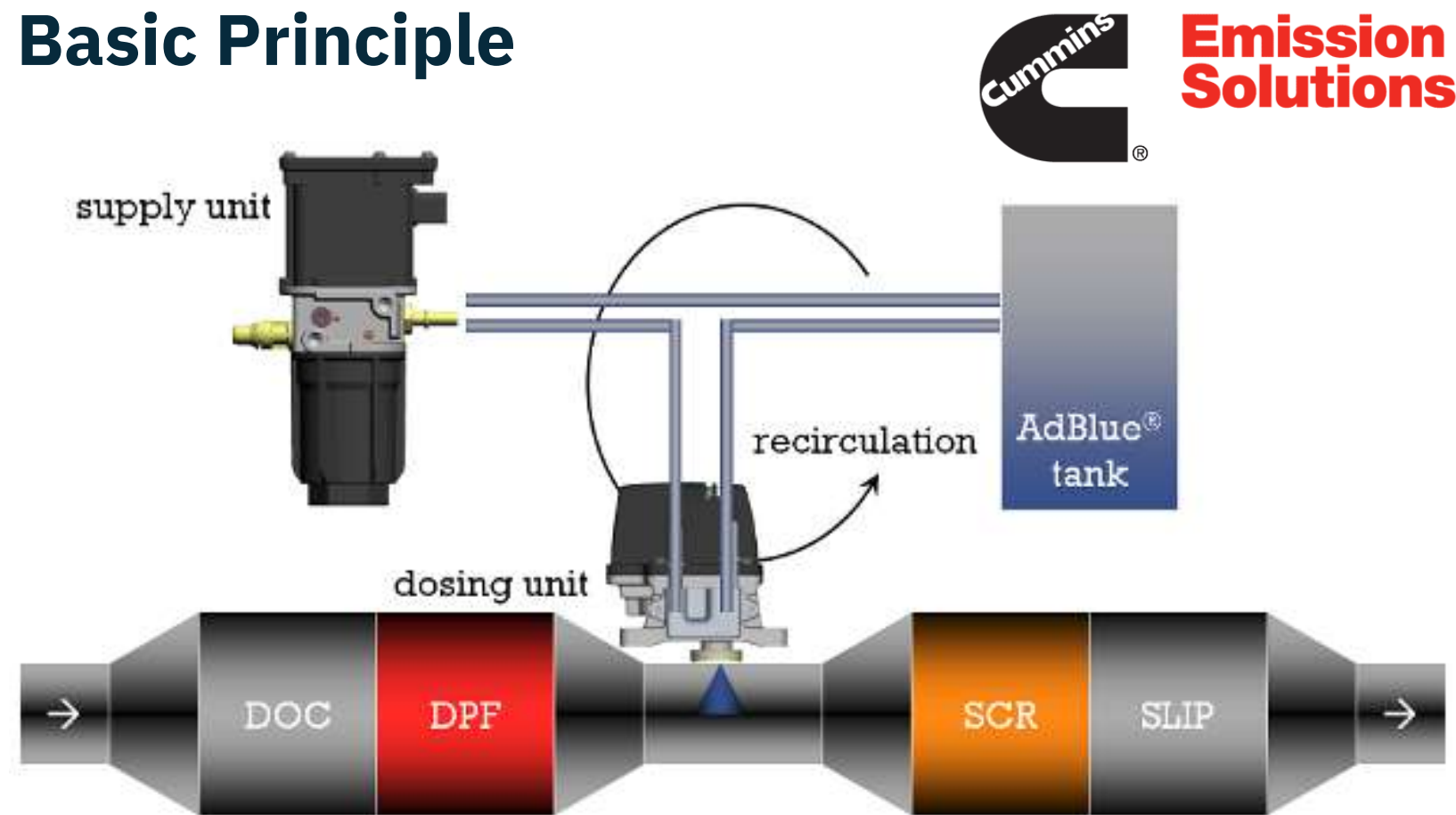


Democratization of Simulation-Based Swirl Atomizer Development Processes



# Cummins UL2.2 SCR-Dosing System

## Basic Principle



DEF: Diesel Exhaust Fluid  
 DOC: Diesel Oxidation Catalyst  
 DPF: Diesel Particle Filter

SCR: Selective Catalytic Reduction  
 SLIP: Ammonia Slip

## Dosing Unit

- Mounts to the Decomposition Reactor
- Cooled by urea recirculation (no additional coolant); heated by electricity
- Contains pressure-swirl atomizer
- Enhanced freeze-resistant components
- Contains injector, temperature and pressure sensors

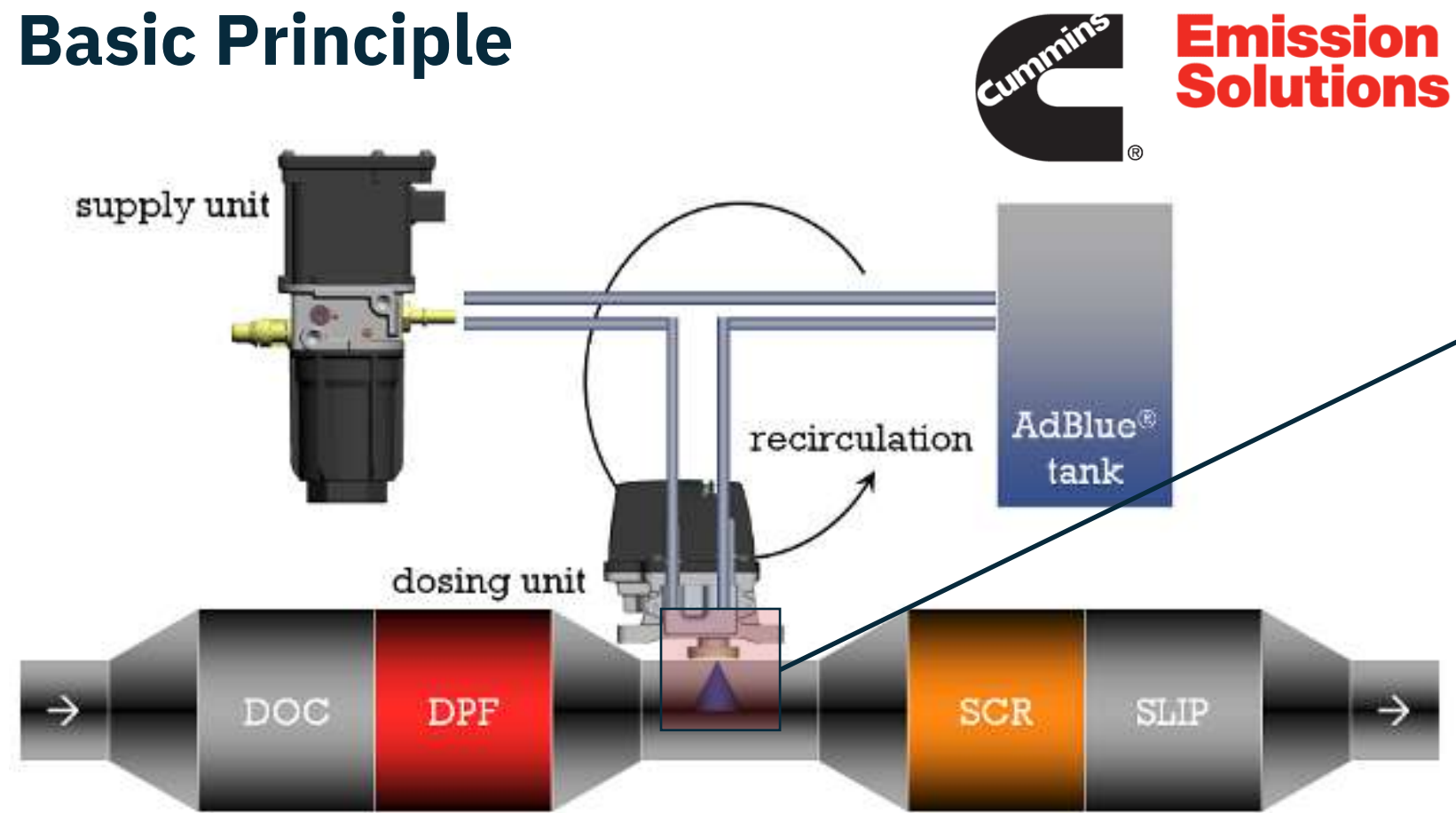
## Supply Unit

- Mounts to the chassis
- Heated by engine coolant
- Enhanced freeze-resistant components
- Contains optional integrated dosing controls to monitor injector, temperature and pressure sensors



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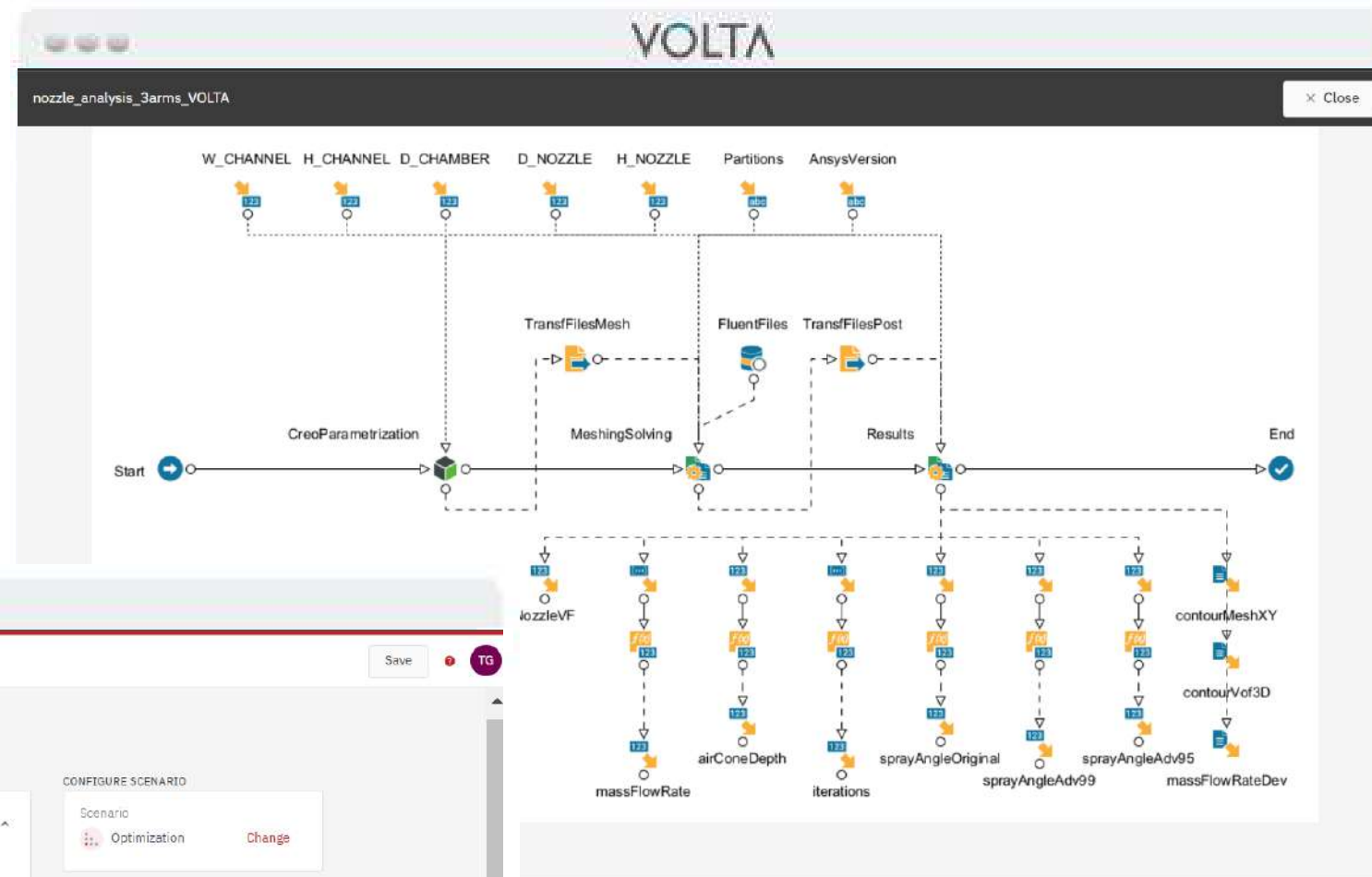
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# SPDM ...



- Versioning
- Traceability
- Model Management

The screenshot shows the 'Edit Plan' interface in VOLTA. It is titled 'Optimization Example' and has a 'Save' button and a 'TG' icon. The interface is divided into several sections:

- CONFIGURE MODULES:**
  - Input Domain:** 5 (5 scalars, 0 vectors) variables, 2 (2 strings) parameters.
  - Objectives:** Define at least one objective. Minimize 0, Maximize 0.
  - Constraints:** Define at least one constraint. Constraints: 0.
  - Optimization Algorithm:** This algorithm requires at least one objective. Autonomous p1OPT.
  - Run Options:** Run Mode: All in one; Concurrent Designs: 1; Delete policy: never; Un-feasible designs: Run.
  - Queues:** No queue selected.
- CONFIGURE SCENARIO:** Scenario: Optimization. Change button.
- ADD MODULES:** With this scenario you can add these modules: + DOE Table, + DOE Algorithm, + Source Data.
- EDIT PLAN DESCRIPTION:** Description: No description. Edit button.

- Collaboration
- Access and permission management
- Ease computing resources use





# SPDM ...

- Track all future, past, and present designs
- Capture and builds know how

The screenshot displays the VOLTA software interface for a project named "1255\_Mesh\_Study". The interface includes a sidebar with navigation options like Search, Data, Starred, Teams, Simulation, Process Manager, and Help. The main content area is divided into several sections:

- Sessions:** A table showing simulation status. A "View all" button is present.
- Details:** A panel showing tags (cfd, swirl, Fluent, nozzle, CMHF, 1255, atomizer) and a description of the workflow.
- Users:** A list of users and their permissions.

total	completed	stopped	running	queued	quarantined
3	2	0	1	0	0

Session ID	Status
DOE 1255_Mesh_Study 2023-08-11 2:21:29 PM	running
DOE 1255_Mesh_Study 2023-08-11 2:16:49 PM	completed
DOE 1255_Mesh_Study 2023-08-11 2:10:40 PM	completed

User	Permission
TG Tobias Gloesslein (sd176)	Full Control
KS Kay Schmidt (sq965)	Full Control
SS Saurabh Sharma (s1571)	Contribute
CS CMHF Simulation	View
CH Christian Hintner (sd445)	Contribute

**Cummins Emission Solutions**





# SPDM ...

- Track all future, past, and present designs
- Capture and builds know how

The screenshot shows the VOLTA dashboard for a project named 'CMHF Nozzle Development / Simulation / 1255\_Mesh\_Study / 1255\_Mesh\_Study'. The 'Sessions' table shows 3 total sessions, with 2 completed and 1 running. The 'Details' panel for the running session includes tags like 'atomizer', 'cfd', 'swirl', 'Fluent', 'nozzle', 'CMHF', and '1255'. A description explains the workflow for running 3D CFD pseudo-transient nozzle simulations.

total	completed	stopped	running	queued	quarantined
3	2	0	1	0	0

ID	Delta_Excel	delta_O_Excel	SMD_Excel	lamAngle_CFD	lamAngle_Excel	m_dot_CFD	m_dot_Excel	nozzleVolFrac_CFD	airConeDepth_CFD
0									



The screenshot shows the VOLTA dashboard with three image widgets: a mass flow rate graph, a 3D nozzle model, and a contour plot. A data table below shows simulation parameters and results. A red double-headed arrow labeled 'Results' spans across the data table. A note section provides a summary of the findings.

ID	Delta_Excel	delta_O_Excel	SMD_Excel	lamAngle_CFD	lamAngle_Excel	m_dot_CFD	m_dot_Excel	nozzleVolFrac_CFD	airConeDepth_CFD
0									

Note:

- Mass flow rate prediction of analytical Excel tool compared to 3D CFD approach within about 3%
- Air cone clearly visible from CFD contour plots
  - Drawn into swirl chamber
  - Nozzle volume fraction of urea and air cone depth prediction indicate the same
- Discrepancy of the lamella angle between the two approaches

- Post-process result
- Share results analysis





# runbox - Leveraging VOLTA API ...

- Custom API-based web application
- Exploits existing processes and infrastructure

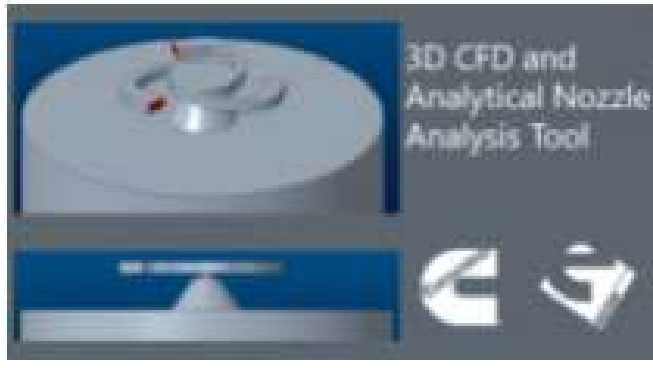
**Cummins** ▶ RUNBOXES RESULTS

## Runboxes

View and Access all the RUNBOXES you have access to



Excel Nozzle Dev. Tool  
CMHF/MPLAN Excel Nozzle Development Tool



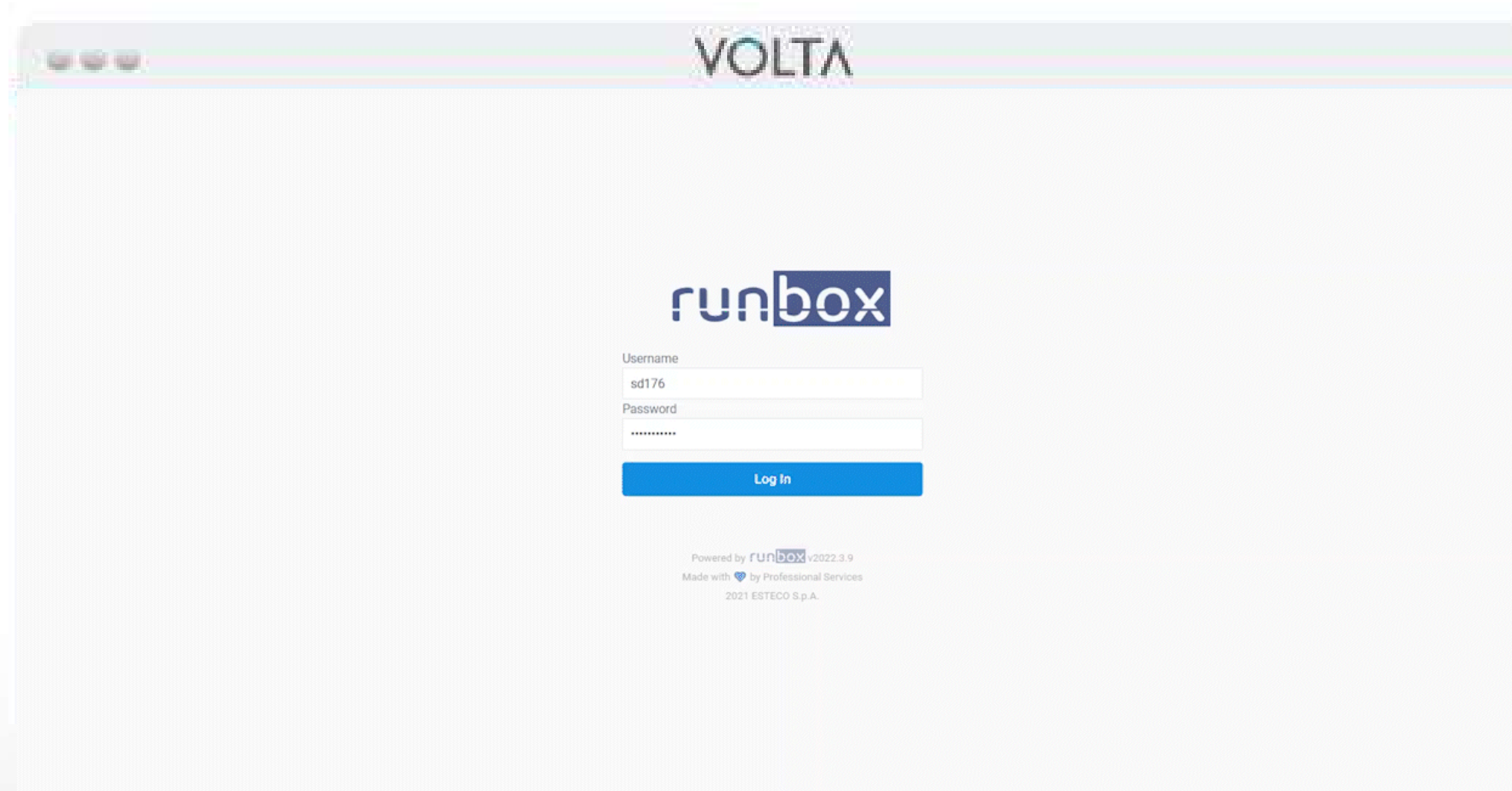
Combined Nozzle Dev. Tool  
Combination of the analytical and CFD workflows.





# runbox - Democratization

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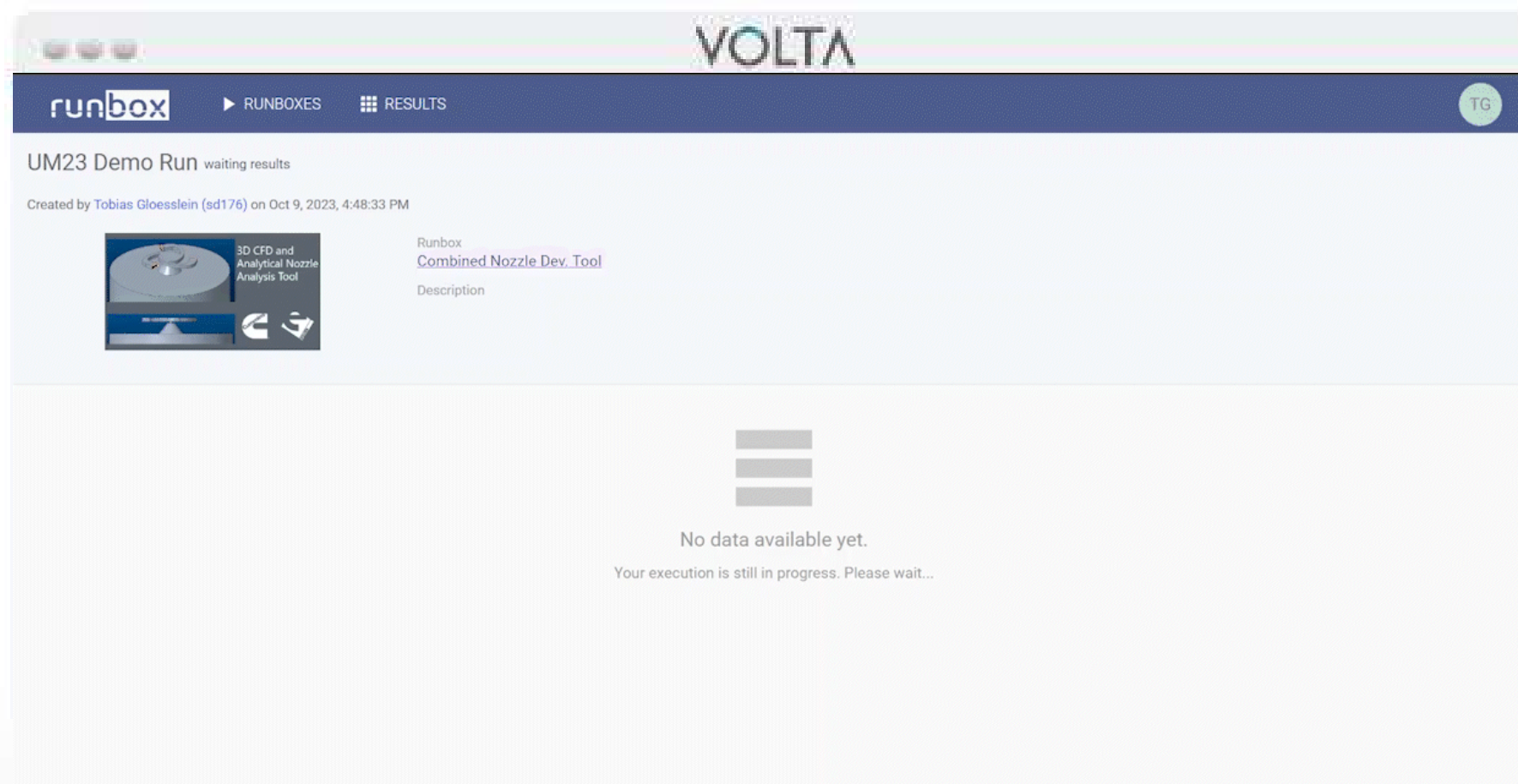


- Process Democratization
- Lowers the entry barrier for swirl atomizer model use
- Involve non-expert users





# runbox - A safe playground



- Spreading and developing methodologies across the company
- Control over how models are used
- More independence for non-expert users





# Take Away

- tool for user-tailored verticalization
- base for more advanced capabilities
- technical enabler for workflow automation
- turn processes and automations into VOLTA pluggable applications





# VOLTA hands-on training - Business Process Modeling and no-code democratization



Don't miss tomorrow's workshops and hands-on sessions!







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# Thank you!

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