

BattGenie.

BattDaas

The Foundation for Modern Battery
Research and Development

White Paper 2025

Welcome to,

A Comprehensive Open-Source Data Platform for the Battery Industry



Contents

1	Executive Summary	2
2	The Data Challenge in Battery Innovation	4
3	BattDaaS: Architecture for Innovation	6
3.1	BattETL	7
3.2	BattETL (Batch Processing)	8
3.3	BattETL-RT (Real-Time Insights)	9
3.4	BattDB	10
3.5	BattMon	11
4	Enterprise Capabilities Without Enterprise Complexity	12
4.1	Security and Compliance	13
4.2	Scalability by Design	14
4.3	Integration Ecosystem	15
5	The Open-Source Advantage	16
6	Implementation: Solutions Engineering at Scale	18
7	A Proven Foundation for Battery Innovation	20
8	Conclusion: Building the Future Together	22
9	About BattGenie	24
10	List of Figures	26

01

Executive Summary

The battery industry stands at a critical juncture. As global demand for advanced energy storage accelerates, research and development teams face an increasingly complex data management challenge.

BattDaaS

The battery industry stands at a critical juncture. As global demand for advanced energy storage accelerates, research and development teams face an increasingly complex data management challenge. Traditional approaches—whether manual spreadsheet management or rigid proprietary platforms—fail to scale with the velocity and volume of modern battery research.

BattDaaS (Battery Data and Decision as a Service) represents a fundamental rethinking of how battery data should be managed, analyzed, and shared across the scientific community.

Built on open-source principles and designed by battery scientists for battery scientists, BattDaaS provides a comprehensive data platform that adapts to existing research workflows while providing enterprise-grade capabilities for security, scalability, and collaboration. By combining specialized components for data ingestion, storage, analysis, and visualization with a commitment to open standards, BattDaaS enables organizations to accelerate their research while contributing to the broader advancement of battery science.



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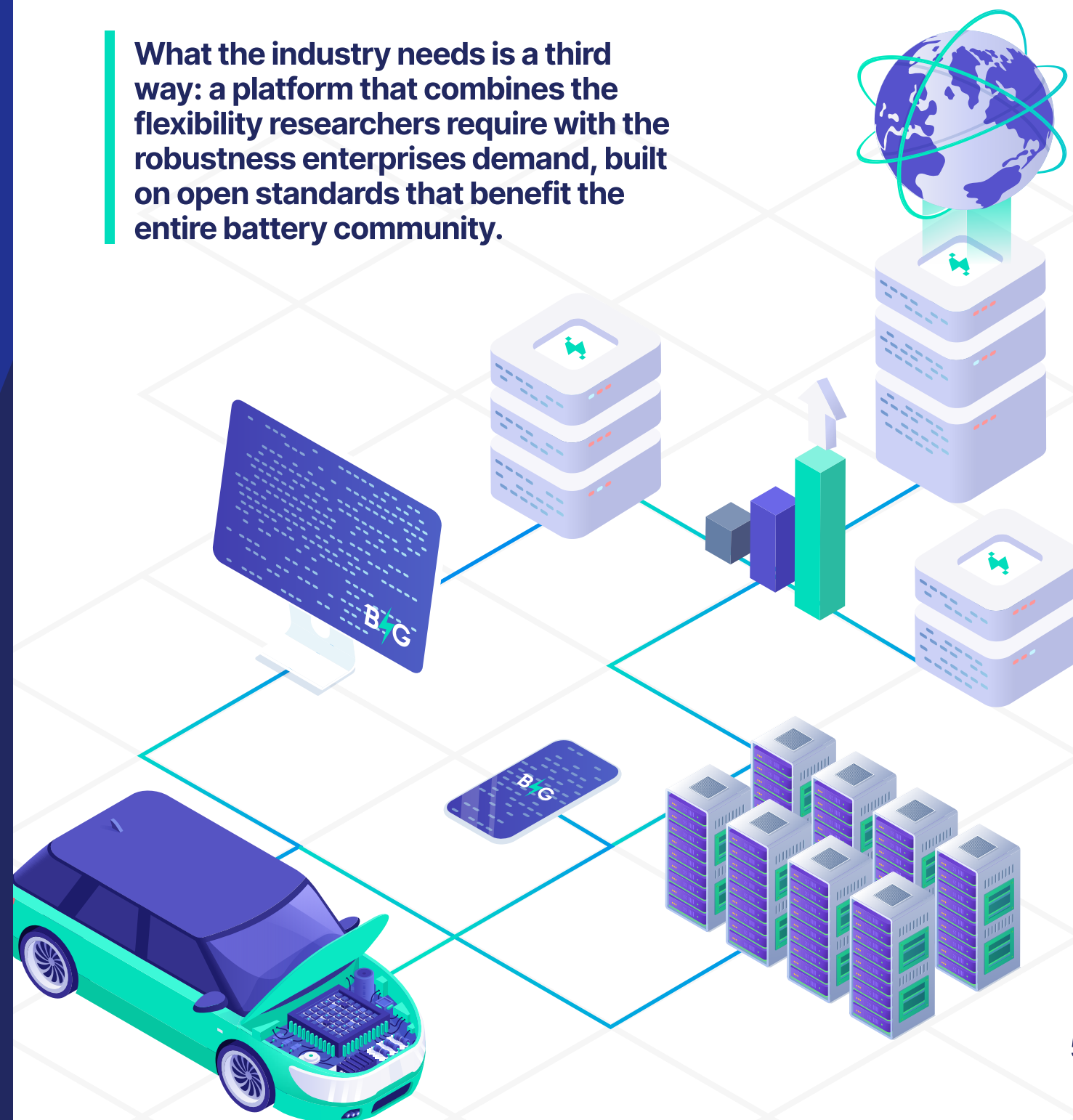
The Data Challenge in Battery Innovation

Modern battery research generates data at unprecedented scales. A single research facility may operate dozens of cyclers, impedance analyzers, and environmental chambers, each producing continuous streams of time-series data. Multiply this across global research teams, and the data management challenge becomes clear: organizations are drowning in information that could unlock breakthrough discoveries, if only it could be effectively harnessed.

The current landscape offers two unsatisfactory extremes. On one end, researchers rely on manual processes—exporting data to spreadsheets, creating ad-hoc analysis scripts, and maintaining fragmented databases. While flexible, this approach doesn't scale, leading to data silos, inconsistent analyses, and missed insights.

On the other end, proprietary battery data platforms promise comprehensive solutions but demand that researchers conform to predetermined workflows and data models. These rigid systems may work for routine testing but fail when researchers need to explore novel correlations or adapt to emerging experimental paradigms.

What the industry needs is a third way: a platform that combines the flexibility researchers require with the robustness enterprises demand, built on open standards that benefit the entire battery community.



03

BattDaaS: Architecture for Innovation

BattDaaS represents more than a data management platform—it's a comprehensive workflow engine specifically designed for battery data and analytics workflows.

At its core, BattDaaS orchestrates the entire lifecycle of battery research data, from initial capture through complex analytical pipelines to final insights. This workflow-centric architecture enables researchers to define, automate, and scale their data processes while maintaining the flexibility to adapt as research needs evolve.

The platform functions as an intelligent orchestration layer that understands the unique requirements of battery research workflows.

Whether running routine cycle life analyses, complex multi-parameter correlations, or exploratory data investigations, BattDaaS provides the framework to transform ad-hoc processes into repeatable, scalable workflows.

This approach fundamentally changes how battery research teams operate—from reactive data management to proactive insight generation.

BattDaaS achieves this through four integrated components that work together as a unified workflow engine:

BattETL: Seamless Data Ingestion

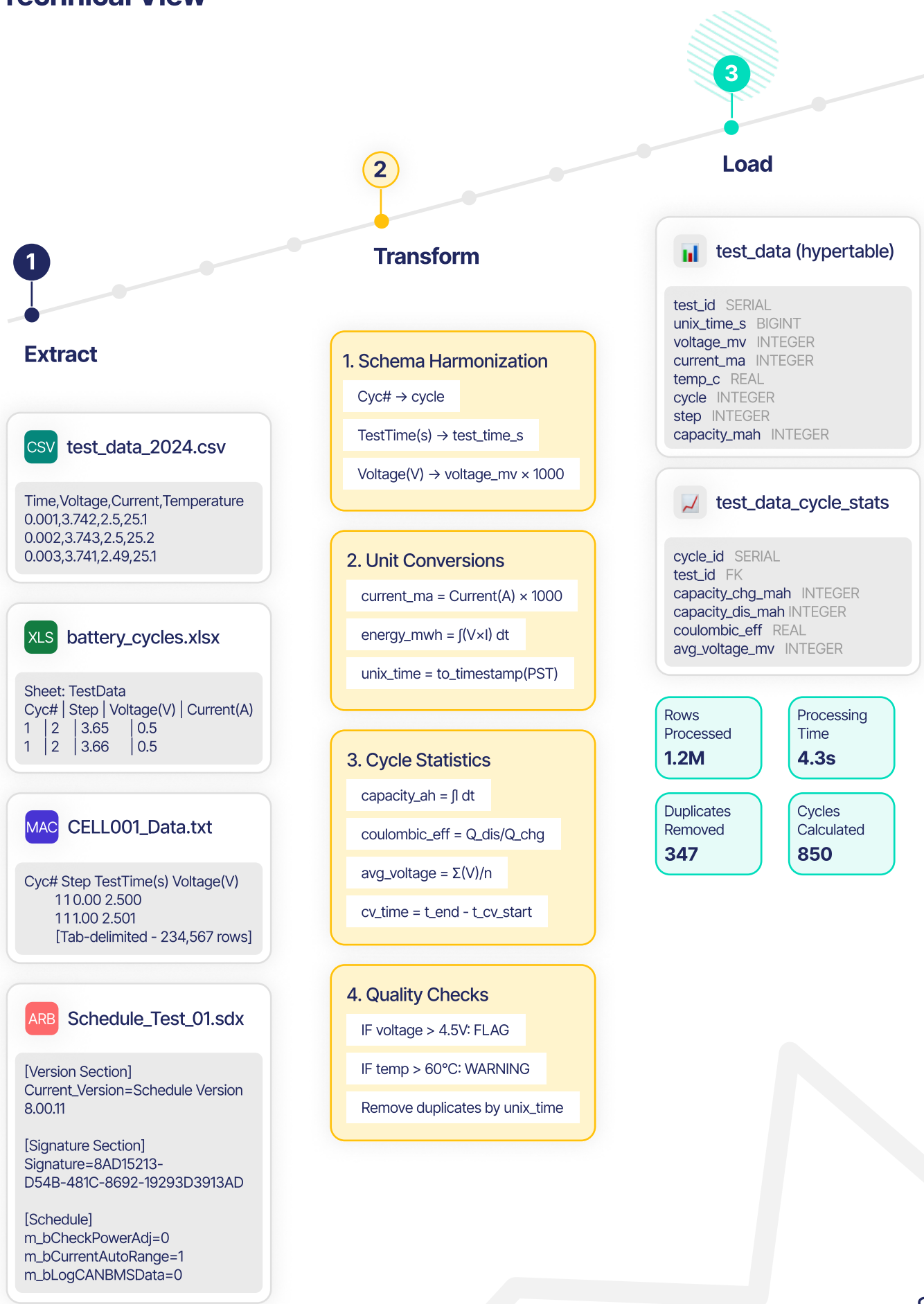
At the heart of any data platform lies the challenge of ingestion. Battery research facilities use equipment from dozens of manufacturers, each with proprietary data formats and export mechanisms.

BattETL (Extract, Transform, Load) solves this heterogeneity through intelligent adaptation.

Rather than forcing data into predetermined schemas, BattETL recognizes and processes native formats from leading cyclers manufacturers, impedance analyzers, and environmental chambers. The system handles batch imports of historical data while maintaining full fidelity to the original measurements, ensuring that no information is lost in translation.

BattETL (Batch Processing)

Technical View

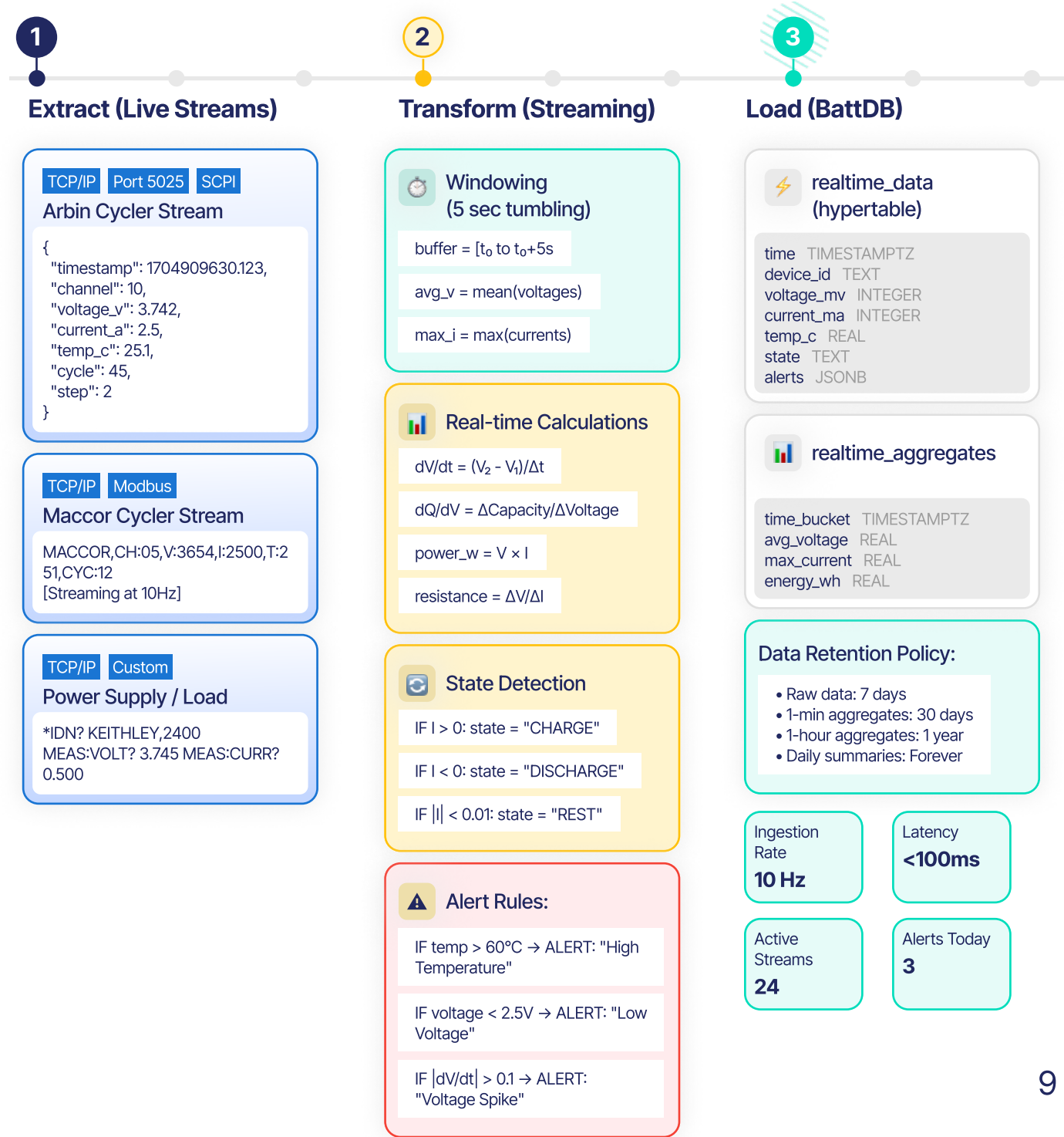


BattETL-RT: Real-Time Insights

While batch processing handles historical data, modern research demands real-time visibility into ongoing experiments.

BattETL-RT extends the ingestion capabilities to streaming data, enabling researchers to monitor experiments as they progress.

This real-time capability transforms how experiments are conducted—anomalies can be detected immediately, correlations can be explored while tests are running, and experimental parameters can be adjusted based on emerging results. The system maintains sub-second latency even while processing hundreds of concurrent data streams, ensuring that real-time truly means real-time.



BattDB: Purpose-Built Data Warehouse

Generic databases fail to capture the unique requirements of battery research organizations. BattDB represents years of refinement in storing not just electrochemical measurements, but the entire ecosystem of battery-related data. Built on PostgreSQL but extensively optimized for battery-specific patterns, BattDB serves as a comprehensive data warehouse that unifies experimental data, business process information, and rich metadata in a single source of truth.

The system seamlessly handles time-series measurements from cyclers and analyzers alongside project management data, supplier information, cost tracking, experimental protocols, and researcher annotations.

This holistic approach ensures that every piece of information—from raw voltage readings to procurement records, from test conditions to quality control metrics—is captured, indexed, and made queryable. BattDB achieves remarkable performance across this diverse data landscape: 3:1 compression ratios without information loss, query responses in milliseconds even across terabytes of heterogeneous data, and specialized indexing that understands relationships not just between electrical/electrochemical parameters, but between experiments, projects, teams, and business outcomes. The schema design reflects a deep understanding of how battery organizations actually operate, supporting everything from simple cycle counting to complex multi-dimensional analyses that correlate technical performance with economic factors.



BattMon: Visualization and Intelligence

Data without insight is merely storage. BattMon transforms raw measurements into actionable intelligence through purpose-built visualizations and alerting capabilities.

Built with battery-specific requirements in mind, BattMon provides researchers with intuitive dashboards that surface critical metrics, reveal hidden patterns, and alert to anomalous conditions. Unlike generic visualization tools, BattMon understands battery science—it knows that a voltage spike during charging might indicate lithium plating, that impedance growth correlates with aging, and that temperature excursions can permanently damage cells. BattMon also features a configurable alerting layer that provides alerts when the cell voltages or temperatures are abnormal, swelling measurements are due for a reading or if the test has encountered an anomalous condition.



04

Enterprise Capabilities Without Enterprise Complexity

Security and Compliance

While BattDaaS emerged from research laboratories, it was engineered for enterprise deployment from the ground up. This dual focus ensures that organizations can deploy with confidence while researchers can work without constraints.

Modern research facilities must protect intellectual property while enabling collaboration. BattDaaS implements comprehensive security measures including role-based access control (RBAC), encryption at rest and in transit using AES-256 and TLS 1.3 protocols, and detailed audit logging with tamper-proof trail mechanisms. The platform maintains a zero-vulnerability posture through continuous security scanning, automated dependency updates, and proactive patch management.

Regular penetration testing and security audits ensure that potential vulnerabilities are identified and remediated before they can be exploited.

The system integrates seamlessly with enterprise identity providers, supporting single sign-on through SAML, OAuth, and OpenID Connect, while implementing multi-factor authentication (MFA) for enhanced access security. For organizations with specific compliance requirements, BattDaaS supports SOC 2 framework, with the open-source nature enabling complete security audits and custom extensions to meet any regulatory standard.

Scalability by Design

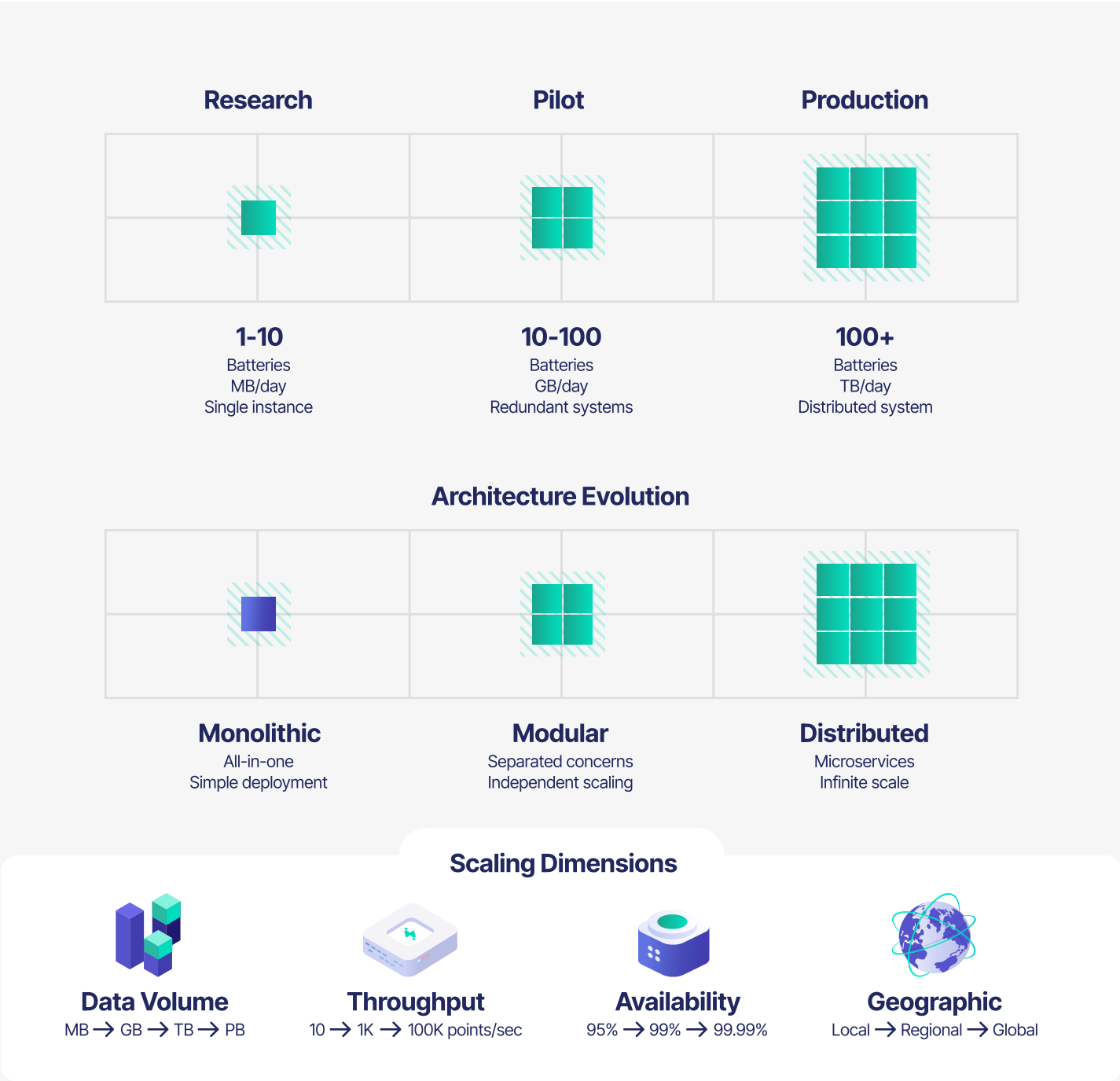
Battery research doesn't follow predictable patterns. A facility might process gigabytes daily during routine testing, then suddenly need to handle terabytes when a new experimental campaign begins.

BattDaaS scales elastically to meet these demands, leveraging containerized microservices that can be deployed on everything from a single server to a distributed cloud infrastructure. The architecture supports horizontal scaling at every layer, ensuring that performance remains consistent whether serving ten researchers or ten thousand.

Integration Ecosystem

No platform exists in isolation. BattDaaS provides comprehensive RESTful APIs enabling seamless integration with existing laboratory information management systems, electronic lab notebooks, and analysis tools.

The system can consume data from any source that can export files or stream measurements, and can push insights to any downstream system. This integration capability transforms BattDaaS from a standalone platform into the connecting tissue of a modern research infrastructure.



05

The Open-Source Advantage

The decision to open-source BattDaaS reflects a fundamental belief: the challenge of battery data management is too important and too complex for any single organization to solve alone.

The decision to open-source BattDaaS reflects a fundamental belief: the challenge of battery data management is too important and too complex for any single organization to solve alone. Open source provides complete transparency and trust—research organizations can inspect, understand, and modify every line of code handling their data, eliminating black boxes, vendor lock-in, and concerns about proprietary algorithms. This transparency enables community-driven innovation where researchers contribute novel analysis methods, organizations share specialized extensions, and the platform evolves with user needs rather than vendor priorities. As adoption grows, BattDaaS naturally promotes standardization across the industry—not through mandate but through utility—making data more portable, analyses more reproducible, and insights more shareable.

The result is a collaborative ecosystem where the collective expertise of the battery research community drives continuous improvement, creating a rising tide that accelerates innovation for all participants.



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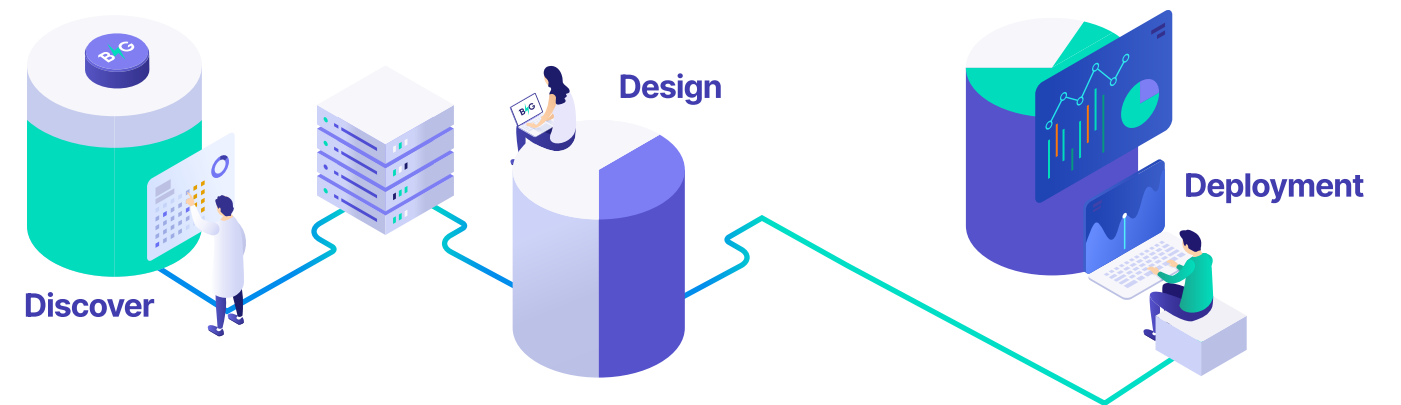
Implementation: Solutions Engineering at Scale

Deploying BattDaaS follows a proven methodology that prioritizes understanding over installation.

Rather than a one-size-fits-all deployment, each implementation begins with deep discovery—understanding existing workflows, identifying pain points, and mapping data flows.

This solutions engineering approach ensures that BattDaaS enhances rather than disrupts research productivity.

The typical implementation progresses through three phases. Discovery involves embedding with research teams to understand their unique challenges and workflows. Design translates these insights into a customized deployment architecture that preserves what works while addressing what doesn't. Deployment proceeds iteratively, with researchers validating each component before proceeding to the next, ensuring zero disruption to ongoing research.



This approach has proven successful across diverse organizations, from academic laboratories to industrial research facilities.

The flexibility of the open-source platform combined with the expertise of solutions engineering creates implementations that feel custom-built while leveraging the robustness of a mature platform.



07

A Proven Foundation for Battery Innovation

The impact of BattDaaS extends far beyond operational efficiency.

Organizations deploying the platform report fundamental transformations in their research capabilities. Data that was previously siloed becomes accessible across teams. Analyses that required days of manual effort complete in minutes. Correlations that might have remained hidden for years emerge through systematic exploration. One such case in point is when BattGenie was able to manage data for large scale industrial customers such as Microsoft that generates GBs of batch as well as real time testing data from thousands of battery cycler channels.

We are excited by BattDaaS's capabilities for managing our battery data. The open-source nature of BattDaaS was crucial for us and it was a no-brainer to switch our platform from another battery intelligence platform to BattDaaS. We can inspect every aspect of how our data is handled, contribute improvements that benefit our research, and know that we're part of advancing the entire field. It's not just about managing our data better—it's about accelerating battery innovation globally. BattStudio hasn't just improved our research efficiency; it's changed what we believe is possible with our data.

Jeff Bruce, Director of Battery Technologies, Microsoft

08

Conclusion: Building the Future Together

BattDaaS represents more than a technical solution to data management challenges. It embodies a vision for how the battery research community can collaborate to accelerate innovation. By providing an open, flexible, and powerful platform for managing battery data, BattDaaS enables organizations to focus on what matters most: developing the next generation of energy storage technologies that will power our sustainable future.

The platform continues to evolve through community contribution and ongoing development. As more organizations adopt BattDaaS, the collective intelligence of the battery research community is captured and shared, creating a rising tide that lifts all participants.

In an industry where breakthroughs require both individual brilliance and collective effort, BattDaaS provides the foundation for both.



09

BattGenie.

About BattGenie Inc.

Founded by battery scientists and software engineers, BattGenie Inc. specializes in engineering solutions that accelerate battery innovation. With deep expertise in electrochemistry, data science, and enterprise software, BattGenie creates platforms and algorithms that enhance battery performance and enable breakthrough discoveries.

BattDaaS represents our commitment to advancing the entire battery industry through open collaboration and technical excellence.

