BEYOND THE ALGORITHM:

Standardized Manufacturing Data Models as the Foundation for Scalable Industrial AI

Engineers don't struggle to collect data anymore — they struggle to make it useful. The problem isn't volume. It's fragmentation and friction.

JOHN RINALDI – REAL TIME AUTOMATION

"AI Is Unrealistic For Many Manufacturers As There Is Absolute Chaos On Their Plant Floor."

- NO Asset Lists
- NO Segmentation
- NO Data Modeling
- NO Cybersecurity

- Author of six industrial automation books

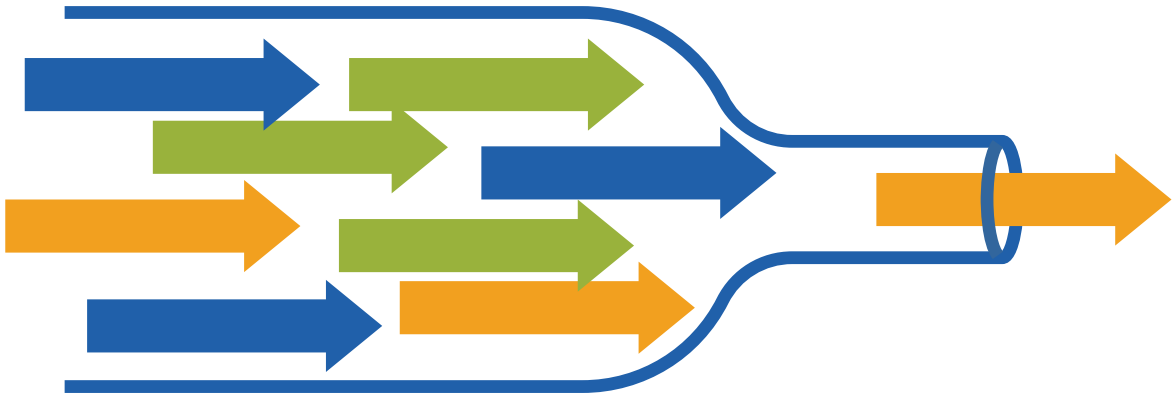
  Industrial Ethernet, OPC UA, Modbus, EtherNet/IP

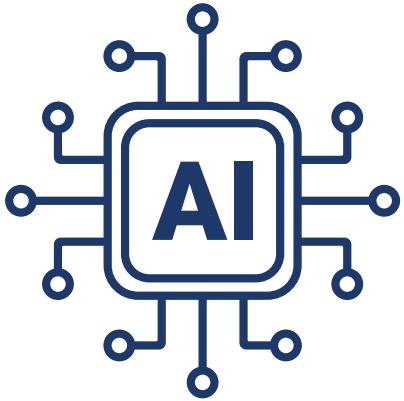
- Founder, Real Time Automation (RTA)

  Pewaukee, WI — serving plant engineers worldwide

- Recognized OT & cybersecurity expert

  Thousands of articles on industrial networking and automation strategy





BOTTLENECK #1

PLC Data is Raw, Unscaled, Context Free

No engineering units
No meta data
No business context

BOTTLENECK #2

Connectivity To All The Data You Need

Fragmented systems
Legacy protocols
Multiple data silos

BOTTLENECK #3

Inadequate Data Modeling

No standards
No versioning
No governance

73% of manufacturers report data quality prevents actionable insights (LNS Research)

60% of OT data collected is never analyzed (Gartner).

WHERE TO START

A MODERN HISTORIAN IS KEY TO DRIVING RESULTS WITH AI

Old historians simply archived records. Modern systems must do far more — and most fall short.

Old Historians

- Collect activity records
- Store everything
- Analyze later (Manually with great difficulty)

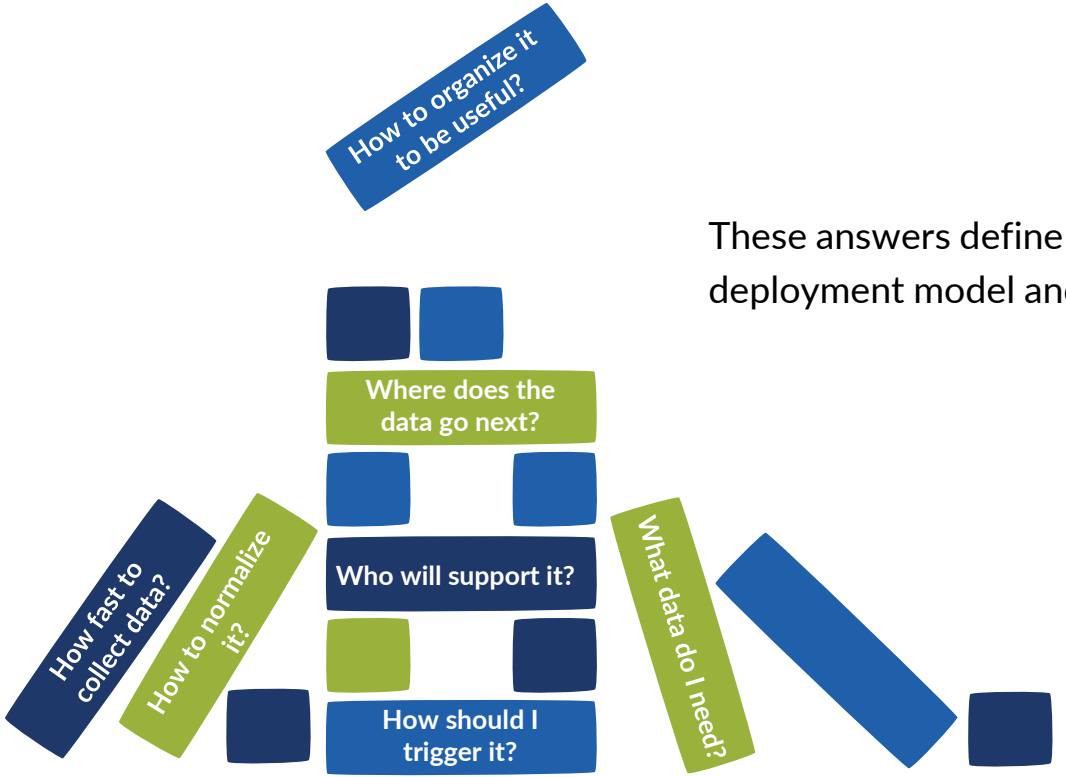
Modern Requirements

- Support multiple ingestion sources
- Normalization and Scaling
- Standardized Data Modeling
- Multiple Publishing Options
- Support AI decisions, diagnostics and real-time applications.
- Cybersecure

“The real test is whether your historian can quickly explain what happened!”

SELECTION STRATEGY

THE MOST COMMON MISTAKE: NOT SOLVING YOUR JENGA PROBLEM



These answers define the right type, deployment model and feature set.

DECISION FRAMEWORK

A HISTORIAN DECISION MATRIX

Use Case	Time-Series	Relational	Hardware	Software	Local	Enterprise
PLC Tag Monitoring	✓Best	-	✓Best	✓	✓Best	-
Machine Alarm & Fault History	✓Best	-	✓Best	✓	✓Best	-
Recipe/Batch Event Records	-	✓Best	✓	✓Best	✓	✓Best
Quality Inspection Audit Trail	-	✓Best	✓	✓Best	✓	✓Best
Multi-line Plant KPIs	✓	✓	-	✓Best	-	✓Best
Real-time Diagnostics/Root Cause Analysis	✓Best	-	✓Best	-	✓Best	-
Enterprise Data Lake/BI Analytics	✓	✓	-	✓Best	-	✓Best
Air-gapped/High-security Environment	✓Best	-	✓Best	-	✓Best	-

Best architecture uses both: Local historians serve the machine with low latency. Enterprise historians serve the business. Diagnostics need proximity — when a fault lasts 900 milliseconds, collection must happen close to the source.

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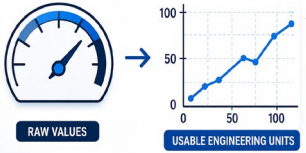
REQUIREMENTS & PITFALLS

7 INDISPENSABLE FEATURES OF HISTORIAN FOR AI INGESTION

1 Connectivity

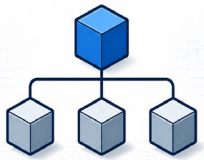
Ingest data from your actual PLCs & devices

2 Normalization / Scaling



Convert raw values into usable engineering units

3 Data Modeling



Group related tags into logical, portable structures

4 Flexible Triggering

Collect on schedule, event, or process upset

5 TRANSFER & PUBLISHING

6 Cybersecurity

- IEC 62443
- CISA
- CRA

IEC 62443, CISA, CRA — match your plant's policy

7 Time Synchronization

NTP/PTP timestamp at source — no timestamp drift

REQUIREMENTS & PITFALLS

THE PITFALLS TO WATCH OUT FOR

More Drivers ≠ Better Connectivity

20 well-tested drivers beat 400 poorly supported ones.

Subscription Pricing Trap

10–15 years on subscription can cost 3–5× perpetual licensing.

Triggering Misses Events

Faults happen between polling intervals — rigid schedulers miss root causes.

MOVING BEYOND VENDOR-CENTRIC THINKING

Standardized Data Models as the Foundation for Scalable Industrial AI

An Expert Integrator's Perspective

DAVID SCHULTZ – AMARACH STACKWORKS

Principal Consultant & Solutions Architect

30 years of hands-on experience spanning every layer of the automation stack — from field instrumentation at ISA-95 Level 1 through SCADA, historian and MES applications.

Level 1 – Device Layer
Instrumentation, control valves, pumps and process equipment

Level 2 – Control & Management
SCADA systems and historian applications supporting plant operations

Level 3 – MES & Enterprise
Standards-based manufacturing operations management on a modern technology stack

Industry Voice

Dozens of published LinkedIn Articles on industrial automation and MES

Standards Practitioner

ISA-95, ISA-88, ISA-101, ISA-99/IEC-62443, PackML, BPMN

HISTORIAN ARCHITECTURE: EXPERT RECOMMENDATIONS

High-Fidelity Data on the Edge

Full-resolution process data belongs locally — enabling plant floor analysts to work with the precision they require without cloud latency or cost.

Aggregate as Data Moves Up

Aggregate and downsample data as it travels up the ISA-95 stack. Most enterprise applications can operate effectively on lower-fidelity data.

ML Models Run at the Edge

Machine learning applications for anomaly detection require full-resolution data. Edge deployment is both a performance and architectural necessity.

ON-PREM VS CLOUD: IT DEPENDS

Keep On-Premises (Edge)

- High-fidelity, full-resolution time-series data
- Machine learning inference models
- Plant floor analytics and real-time monitoring
- Sensitive or air-gapped process data

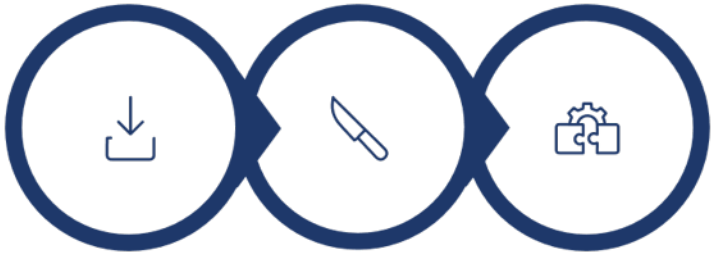
Move to Cloud

- Aggregated, downsampled historian data
- Cross-site enterprise analytics
- Long-term trend storage and reporting
- Executive dashboards and KPI visibility

A hybrid approach minimizes cloud ingress, storage, and egress costs while preserving analytical capability and security posture.

ARCHITECTURE PRINCIPLE

MODEL AT THE EDGE



Capture Model at Edge Consume

When data is modeled at the edge, every consuming system — regardless of whether it natively supports modeled data — benefits from the applied context.

DATA MODELING DO'S AND DON'TS

Do: Model on the Edge

Apply context and structure at the data source. All upstream systems inherit a clean, consistent model.

Do: Govern from Enterprise

Edge models should be governed from a master data management system at the enterprise level to ensure consistency.

Do: Develop Common Models

Participate in emerging industry-specific common data model initiatives to reduce integration complexity.

Don't: Model in Silos

Avoid letting each system define its own model independently — this creates reconciliation debt and integration friction.

KEY TAKEAWAYS

High-Fidelity Data Belongs on the Edge

Aggregate as data moves up the stack. ML models need full resolution — run them locally.

Model at the Source

Data modeled close to origin is easier for all systems to consume — modeled or not.

Govern Enterprise-Wide

Master data management ensures edge models remain consistent, auditable and scalable across sites.

Standards Reduce Integration Debt

Common data models and industry standards lower long-term complexity and total cost of ownership.

SEE IT IN ACTION IN BOOTH 3723

Live demo of a modern factory floor historian addressing all seven indispensable features. No sales pitch, just real PLC data and real answers.

Live Demo + Q&A

John Rinaldi & Dave Schultz — bring your toughest historian and connectivity questions.

Real Time Automation | Booth 3723

rtautomation.com · sales@rtautomation.com · 262-436-9299

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