Customer Case Study: CGI & Volt Active Data: Powering the UK's National Smart Metering Infrastructure

Executive Overview

CGI Inc., a £14B global IT and business process services leader, serves as the Data Services Provider (DSP) for the UK's national smart metering programme, the most complex civil and technological upgrade to the British energy sector in a generation.

Orchestrated by the Data Communications Company (DCC), the programme connects 53 million smart gas and electricity meters across 30 million domestic and small business premises, serving a population of 70 million people. CGI operates the central clearing house that securely routes and authenticates every command between energy suppliers, network operators, and millions of devices.

To meet the performance, availability, and security demands of Critical National Infrastructure (CNI), CGI integrated Volt Active Data as the high-performance real-time decisioning layer, replacing slow, disk-bound legacy systems with an in-memory transaction engine capable of processing 145GB of live state at <10ms latency.

The outcome:

- **53 million smart meters** managed through a single, authoritative real-time decisioning platform
- **<10ms** message authentication and anti-replay fraud checks, per device, per command
- **16 million peak messages** shaped across a 3-hour overnight window without breaching telco capacity
- **Four-nines availability** (≤4 minutes downtime/month) achieved via Active-Active Cross-Data Centre Replication (XDCR)
- **Zero maintenance windows**: in-service upgrades eliminate previous 4–6 hour outages
- National infrastructure **future-proofed** for the UK's Clean Power 2030 goals

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National infrastructure decisioning became a real-time system property, not a batch reconciliation exercise.

Key Performance Results

Validated under peak operational load across the national metering estate:

METRIC	BEFORE VOLT	AFTER VOLT ACTIVE DATA
Meter messages processed daily	~53 million commands	Zero processing gaps
Message authentication latency	Minutes (Oracle-bound)	<10ms (Volt in-memory)
Peak throughput (midnight window)	~16M msgs in 3 hrs, system strain	Smoothly shaped across window
System availability	Three-nines (~8 hrs downtime/year)	Four-nines (<4 mins downtime/month)
Maintenance windows	4–6 hours per upgrade	Zero downtime (XDCR + ISSU)
Anti-replay / fraud checks	Batch or delayed	Real-time, per-message
Data centre architecture	Active/DR (failover)	Active-Active XDCR

Zero duplicate message submissions. Zero fraud replay events. Continuous operation across Critical National Infrastructure.

Business Challenge: Real-Time State at National Scale

The UK Smart Metering programme is not a data storage problem; it is a real-time state management challenge. CGI's DSP role required a platform that could simultaneously address:

- **The "Midnight Thundering Herd":** Millions of meter reading requests from energy suppliers arrive simultaneously at midnight, threatening to overwhelm the telco infrastructure with uncontrolled burst traffic.
- **Architectural drag:** Legacy RDBMS systems (Oracle) were too slow for the ingestion, queuing, and routing logic required to authenticate and process 50 million messages within a three-hour overnight window.
- **High-stakes security:** Every message requires complex authentication and anti-replay checks to prevent fraud, such as adding credit twice to a first-generation meter. A late or missed check has direct financial and safety consequences for UK households.
- **Critical National Infrastructure SLAs:** The programme operates under CNI obligations. Downtime is measured in minutes per year, not hours.

Legacy architectures could see the problems forming. They could not prevent them. What CGI required was not faster reporting, it was authoritative decisioning at the moment of execution.

The Volt Solution: Unified Real-Time Decisioning Engine

CGI integrated Volt Active Data as the centralised, deterministic decisioning layer within the DSP architecture, replacing fragmented queue management, batch authentication, and manual reconciliation with a single in-memory execution engine.

The architectural principle: keep all active request state in Volt. Make every decision; authenticate, route, queue, shape, validate where the data lives, not after it has moved.

Three-Tier Deployment Architecture

1. **Request Management (RM) Tier: Southbound Decisioning**
   A 3-to-7 node Volt cluster manages all device identities and authority certificates. Every Southbound command to a meter is authenticated and authorised through Volt before it enters the network. No unauthenticated message passes. No replay attack succeeds.

2. **Communications Service Provider (CSP) Tier: Queue Management & Transformation**
   A dedicated Volt tier manages queue state and message transformation. It correlates all incoming Northbound meter responses with their originating requests, ensuring energy suppliers receive correct data in the mandated GBCS format at scale, without reconciliation.

3. **Smart Queue Management: Traffic Shaping**
   Volt's real-time state management allows CGI to actively shape traffic, controlling a massive queue of messages (including future-dated commands) to ensure network capacity is never breached during peak periods. The midnight surge is absorbed, not endured.

Why Volt Active Data

CGI evaluated traditional RDBMS platforms and streaming alternatives before selecting Volt. Neither alternative could meet all requirements simultaneously.

1. **ACID Compliance for Security**
   Anti-replay checks and command authentication require atomic, isolated, consistent processing per message. Volt's full ACID compliance ensures that no fraudulent duplicate command can succeed, even under extreme concurrent load.

2. **In-Memory Throughput at National Scale**
   Volt manages 145GB of active state entirely in memory. Oracle RDBMS systems could not sustain the ingestion, queuing, and authentication rates required to process 50M messages in a 3-hour overnight window. Volt does so with headroom.

3. **Active-Active XDCR for CNI Availability**
   Both data centres operate simultaneously. Site A handles Southbound commands, Site B processes Northbound responses. Deterministic conflict resolution (Last Write Wins) maintains a single global source of truth without human intervention. Regional failure becomes a capacity event, not a downtime event.

4 **Smart Traffic Shaping**

Volt's real-time queue state allows CGI to dynamically throttle message dispatch, absorbing the midnight surge and future-dating commands across the available window. This is not post-hoc reconciliation; it is authoritative operational control in real time.

Architecture & Implementation Highlights

Four architectural moves define the Volt deployment within CGI's DSP:

- **Centralised request authority:** All Southbound device commands authenticated through Volt's RM tier before network entry. Oracle serves as system of record downstream, not in the decision path.
- **In-transaction fraud prevention:** Anti-replay and authority certificate checks execute inside the Volt transaction boundary, atomically, per message, at <10ms latency.
- **Single queue state store:** The CSP tier maintains all active message queues in Volt, eliminating distributed state drift between systems and enabling instant Northbound/Southbound correlation.
- **Deterministic Active-Active replication:** XDCR upgrades the system from DR failover to concurrent dual-site operation, with automatic conflict resolution and zero-downtime platform upgrades via ISSU.

LEGACY DSP ARCHITECTURE	WITH VOLT ACTIVE DATA
Oracle RDBMS as processing layer	In-memory decisioning engine
Batch authentication and queuing	Per-message real-time auth & anti-replay
Active / Disaster Recovery model (three-nines)	Active-Active XDCR (four-nines)
4–6 hour maintenance windows	Zero downtime, in-service upgrades
Manual traffic management	Automated smart queue shaping

The key shift: decision authority moved into the data layer. Volt became the source of truth for what happens next, not a downstream system that explains what happened.

Business Outcomes and Benefits

The results of the Volt Active Data deployment are immediate, measurable, and material to the UK's national energy infrastructure:

Outcomes across the national metering estate

Critical National Infrastructure availability
Four-nines SLA met via Active-Active XDCR, under 4 minutes downtime per month across the estate.

Fraud prevention at device scale
Real-time anti-replay and authentication per command across 53 million meters, zero tolerance for duplicate credits or unauthorised access.

Midnight surge eliminated
Smart queue management absorbs 16M peak messages without breaching telco network capacity.

Operational continuity
Zero planned downtime. ISSU upgrades run node-by-node while both data centres keep serving the national network.

Programme scale ready
Linear scalability to the full 53 million device endpoint, with <10ms decisioning throughout the growth curve.

Clean Power 2030 foundation
Real-time decisioning underpins future grid capabilities, from micro-generation metering to real-time demand response.

Conclusion: A Resilient Foundation for the Greener Grid

National smart metering is not a data storage programme. It is a test of real-time decisioning architecture, whether a system can make authoritative decisions at the moment of execution, at national scale, without degrading correctness under load.

With Volt Active Data, CGI has transformed a high-risk national mandate into a functioning reality serving millions of UK households. By replacing disk-bound, batch-heavy processing with an automated in-memory decisioning engine, CGI has effectively future-proofed the UK's energy infrastructure for the next decade of innovation.

Volt's unique combination of ACID transactions, real-time queue management, Active-Active replication, and zero-downtime operations makes it the decisioning engine of choice for the UK's most critical national infrastructure programme.

Infrastructure-scale compliance is no longer a function of batch reconciliation. It is a function of architecture.

Ready to make real-time decisioning a reality?

Volt Active Data is purpose-built for the latency, throughput, and availability demands of Critical National Infrastructure and mission-critical operational systems. Whether you face national-scale IIoT, regulatory compliance, or real-time fraud prevention, Volt gives you the platform to be correct: provably, at scale, in real time.

Talk to a Volt Solutions Architect today.

Visit www.voltactivedata.com, email info@voltactivedata.com, or contact your Volt account team to arrange a briefing and proof-of-concept scoping session.