

ATOMBEAM NEURPAC DATA SHEET FOR SMART METERING



Smart meters constantly record electricity, gas, and water usage from millions of devices, generating billions of data points. These readings must transmit reliably to central systems in real time to enable rapid outage response, grid monitoring, and detection of energy theft.

Optimizing Smart Meter Data Transport with Neurpac

There are several applications that require sending large amounts of continuous data:

- **Automated meter reading (AMR)** — Utilities remotely collect consumption data from electricity, gas, and water meters across vast service territories, with millions of devices transmitting readings multiple times per day.
- **Real-time Monitoring & Analytics** — Continuous tracking of energy usage patterns enables utilities to detect consumption trends, forecast demand, optimize grid operations, and deliver detailed usage insights to customers via web portals and mobile apps.
- **Outage Detection and Management** — Smart meters automatically report outages and restorations, helping utilities pinpoint affected areas instantly, dispatch repair crews efficiently, and provide accurate restoration updates to customers.
- **Predictive Maintenance** — Performance analytics identify equipment degradation, voltage fluctuations, and network irregularities early, allowing utilities to address potential failures before they result in service disruptions.

The Challenge

Smart meter deployments must transmit billions of data points each day from millions of distributed devices over bandwidth-constrained networks (cellular, RF mesh, LPWAN), leading to high ongoing costs and network congestion risks.

The Solution

To overcome these limitations, utilities need a data solution that reduces payload size while preserving all critical information, maximizing network efficiency and lowering costs across the meter fleet.



75% Message Size Reduction

Neurpac delivers real-time, lossless compaction that reduces message size by up to 75%, cutting cellular data costs for utilities with millions of meters and minimizing traffic over bandwidth-limited networks such as RF mesh, NB-IoT, and LTE-M.



4x Effective Bandwidth

Neurpac's ultra-fast encode/decode delivers 4x more effective bandwidth, compacting and transmitting messages as small as 4 bytes in real time, ideal for continuous smart meter data streams.



Real-Time Data Compaction

Neurpac enables real-time data compaction, allowing meters to send power quality and outage alerts instantly over constrained networks, ensuring critical data gets through for faster detection and response.



AI-Powered Codeword Technology

Neurpac uses AI to build and deploy edge codewords that replace raw data with compact, searchable formats optimized for repetitive smart meter patterns like interval readings, status codes, and event types.

Key Requirements:

- ✓ Provide compression with data integrity
- ✓ Provide edge-optimized processing
- ✓ Provide real-time data
- ✓ Enable scalability across thousands of devices

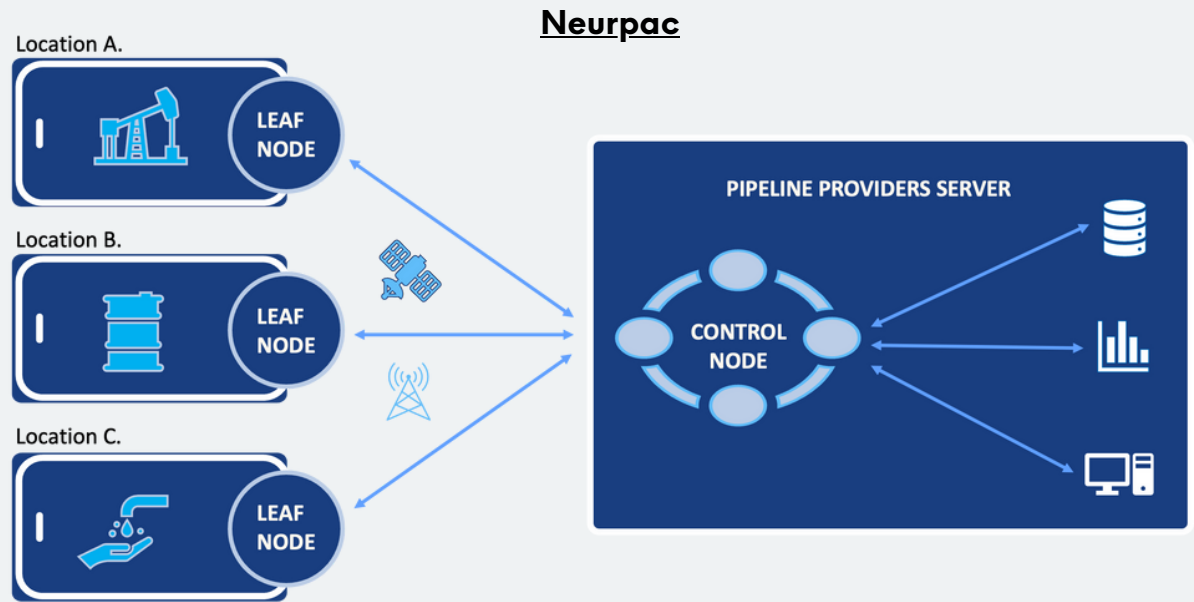
Neurpac

The Atombeam Neurpac solution introduces a more cost-effective, real-time method for smart meter provider applications by increasing throughput from diverse locations up to 4X.

Neurpac Overview

Neurpac is a data compaction software solution with a small device footprint requiring very little power and very little memory. It runs transparently in line in a network data path where it transparently compacts the data transmission, making it extremely beneficial in the case of WAN transmission within contended networks.

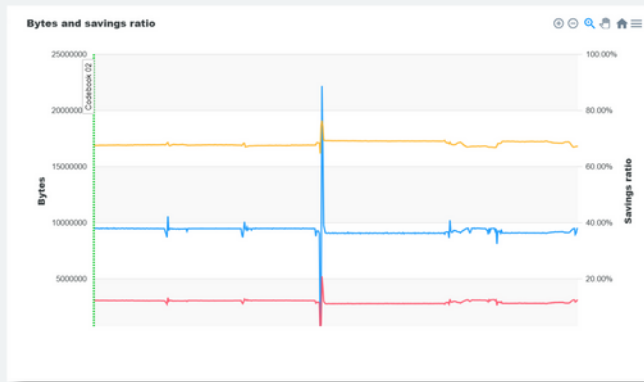
Software Components	Decoder	Encoder	Configurator	Trainer
Leaf Node	✓	✓		
Control Node	✓	✓	✓	✓



Control Nodes manage and coordinate the operation of connected **Leaf Nodes**. Each Leaf Node is deployed as a software-defined VPN on a server or virtual machine. They contain an **encoder**, a **decoder**, a **trainer**, and a **configurator**.

Leaf Nodes contain an encoder, decoder, and optionally a trainer and configurator. They automatically adjust the local machine's networking configuration and operate under the supervision of their associated Control Node.

- The **trainer** analyzes telemetry data to generate codewords, which form the basis for data efficiency.
- The **encoder** converts raw data into codewords for compact transmission.
- The **decoder** reconstructs the original data from codewords with no loss of fidelity.



- Original Data Bytes
- Compaction Ratio
- Encoded Bytes

Neurpac for Smart Meters Key Benefits:

Dramatic Cost Reduction

- Neurpac transforms the economics of smart meter data transmission, allowing utilities to collect granular real-time data they need for modern grid management at a fraction of the traditional bandwidth cost.

Lossless Data Integrity

- Neurpac enables lossless data compaction, ensuring consumption values, timestamps, and critical metering data maintain perfect accuracy for billing and regulatory compliance.

New services expansion

- With a 75% bandwidth reduction, utilities can offer new services like advanced grid analytics, distributed energy resource management, and advanced demand response programs.

[Get in touch!](#)

Schedule your proof-of-concept today and discover how Atombeam can cut your data and costs by up to 75%.

System Requirements: Neupac Point to Point VPN - Overview

Hardware Requirements

Leaf Node	Control Node
Minimum Requirements • CPU: 1 core, 1 GHz • RAM: 100 MB • Storage: 100 MB free space • Network: 1 Mbps bandwidth	Minimum Requirements • CPU: 2 core, 2 GHz • RAM: 1 GB • Storage: 1 GB free space • Network: 10 Mbps bandwidth
Recommended Requirements • CPU: 1 core, 2 GHz • Ram: 1 GB • Storage: 1 GB free space • Network: 1 Mbps Bandwidth	Recommended Requirements • CPU: 4 core, 2 GHz • RAM: 16 GB • Storage: 5 GB free space • Network: 100 Mbps Bandwidth

Operating System Support

Linux (Primary Support)

- Ubuntu: 22.04 LTS, 24.04 LTS

Architecture Support

- x86_64 (AMD64)
- ARM64 (aarch64)

Network Requirements

Ports

- Server: TCP 443 (configurable)
- Client Metrics: TCP 9090 (optional, configurable)

Protocols

- WebSocket over TLS (WSS)
- Mutual TLS authentication
- TUN interface (Layer 3 tunneling)

Memory Usage

- Base: ~50 MB per process
- Compaction: +20-100 MB (depends on codebook size)
- Per Session: +10-50 MB (server only)

Privilege Requirements

Linux Capabilities

- CAP_NET_ADMIN: TUN interface creation/configuration
- Root privileges: Required for network operations

Memory Usage

- Base: ~50 MB per process
- Compaction: +20-100 MB (depends on codebook size)
- Per Session: +10-50 MB (server only)

CPU Usage

- Idle: <1% CPU
- Active Compression: 5-15% CPU per 100 Mbps
- Training: Up to 50% CPU during codebook generation

Storage Requirements

- Binaries: ~20 MB (statically linked)
- Codebooks: 1-2 MB per codebook set
- Logs: Variable (configurable retention)
- Temporary Files: Up to 1 GB during training