

# c-treeEDGE

## IoT DATABASE

## c-treeEDGE V2 Feature List

### NoSQL NAV API

- NAV API is the fastest way to build the fastest running applications
  - + NAV is an object-oriented, NoSQL API
  - + It achieves extreme data processing speeds by giving the application complete control over every aspect of data processing:
    - Finding records
    - Record traversal: forward and backward
    - Index traversal: forward and backward
    - Transactions
      - Automatic and manual transactions
      - Nested transactions
      - Manual control over whether a record belongs to a transaction or not
    - Positions
      - Saving current positions: record or index
      - Jumping directly to previously saved index positions without index lookup
      - Opening records directly using saved record positions without index lookup or record traversal
    - Server-side batch operations
      - Retrieve multiple filtered records with one server request
      - Insert, update, and delete multiple records with one server request
    - Locks
      - Automatic and manual locks
      - Read and write locks
      - Exclusive and commit intent locks
      - Strict and non-strict serializer locks

### ANSI SQL

- ANSI SQL is the easiest way to query data for application development and troubleshooting
- Use SQL and NAV together (both with full read and write support) for the maximum benefits of each one: SQL for easy queries and NAV for maximum performance
- ODBC
- JDBC, Java Hibernate ORM
- ADO.NET, .NET Entity Framework, and LINQ
- Python SQLAlchemy ORM
- PHP

### Massively Parallel Data Replication

- Configure and manage replication using a drag-and-drop user interface
- Synchronize data between any number of FairCom databases
  - + Replicate data to and from devices, gateways, edge, fog, cloud, etc.
- Synchronize filtered data between individual tables in any direction
  - + Replicate only the data you want by filtering which data gets replicated to each server
- Synchronize data reliably when connections and bandwidth fluctuate
- Automatically detect data conflicts and easily reconcile them
- Modify replicated data in real time
  - + Transform data into different data types
  - + Turn real data into fake data for non-production environments
- Implement any cluster architecture using c-treeEDGE replication technologies
  - + ACID-compliant, synchronous replication between a few servers
  - + Eventually consistent, asynchronous replication between many servers
  - + Central database replicating persisted data to many other databases as in-memory data
  - + And any other topology you can imagine

### Automatic Data Aggregation

- Automatic data aggregation
  - + Automatically aggregate any numeric data using configuration
    - Set the aggregation period, such as hourly
    - Set the data retention period, such as monthly
    - Automatically add a timestamp to data being collected
- Replicate automatically aggregated data to other databases

### Automatic Integrations

- OPC UA
  - + Certified OPC UA client

- + Plug-in and SDK for building OPC integration solutions
- + Automatically collect data from a wide variety of IIoT devices
- ThingWorx
  - + Visually map data in the c-treeEDGE Database to ThingWorx objects and properties
  - + Automatically create ThingWorx models of data in the c-treeEDGE Database
  - + Automatically update ThingWorx when new data is inserted into c-treeEDGE
    - Update ThingWorx in real time or on a schedule
    - Use ThingWorx AlwaysOn protocol
    - Use MQTT to integrate with ThingWorx
- MQTT
  - + Connect to queues receiving data from devices for data processing and automatic data persistence
  - + Process messages from queues
  - + Send messages to devices listening on queues
- REST API
  - + Load data into the database through JSON over HTTP
  - + Query data over HTTP
  - + Configure the database over HTTP
- Node-RED
  - + Create workflows
  - + Create user interfaces and dashboards with gauges

## Supported Platforms

- Run c-treeEDGE on all major operating systems, CPU architectures, and major compilers
  - + Linux - ARM, x86 (All Linux-based OSs)
  - + Android and Android Things - ARM
  - + Windows - x86
  - + Windows IoT - ARM, x86
  - + Raspbian - ARM (Raspberry Pi)
- Additional platforms are available on request

## Embedded Capabilities

- Process data quickly on slower hardware
- Very small footprint on disk and in RAM
- Compile or link database into an application
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- Connect application to separate database process through shared memory or TCP/IP

## Software Development Kit (SDK)

- c-treeEDGE's software development kit (SDK) builds edge and IIoT applications at lower cost
- Modify sample code to quickly build applications

- Plug-in modules to easily add new features to the database
- Client libraries and SDKs optimized for the following software development languages
  - + C
  - + C++
  - + Java
  - + C#
  - + Python
  - + Node.js
  - + PHP

## Browser-based Database Administration

- Visual data explorer to create, view, and query tables of data
- Database monitor to graphically detect and fix database issues
- FairCom Ops Manager to manage database operations and configure replication scenarios

## Security

- Data encryption
  - + In transit (TLS)
  - + At rest (AES)
  - + Password protected files
- Authentication and Authorization
  - + LDAP
  - + Unix Shadow Authentication
  - + Internal hashed database passwords
  - + Automatic lockout after a user-defined number of attempts with enforced increasing delays between attempts
  - + Each OEM database version can connect only to corresponding OEM clients
- Permissions
  - + Accounts
    - Optional start and end effectivity dates
    - Limit times for valid logins
  - + Roles (groups)
  - + Privileges
    - Table access
    - Row-level Security for reads and writes
- Transaction history auditing

## Reliability

- ACID transactions
- Self-healing and self-tuning data files
- Automatic backup and recovery
- No need for DBAs

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