

∞ dcbel

# Utility Partner Integration Brief



## As a company, dcbel sits at the nexus

of residential solar power, electric vehicle charging, smart home energy management and customer-centric utilities. Our products help customers rethink energy delivery as a decarbonized, distributed, and digital ecosystem that puts the consumer at the center of their own energy decisions.

**dcbel home energy stations** consist of both hardware and software that integrate many consumer functions into a single unit and software platform. Leveraging a purpose-built multi-layer Internet-of-Things (IoT) platform (dcbel Chorus), a native operating system (dcbel Orchestrate), and innovative inverter technology (dcbel PUC5, Packed U-Cell 5), dcbel products can be configured from the factory, at the time of installation, or remotely to enable (or disable) any of the following uses:

- Dual EV charger (AC Level 2 and DC fast charging)
- Rooftop solar inverter
- Stationary home battery inverter
- Smart charging capability
- Vehicle-to-home capability (backup power or rate arbitrage)
- Vehicle-to-grid capability (peak capacity reduction and balancing reserve)
- Smart home energy management and optimization

dcbel home energy station sits at the heart of a home's energy ecosystem.

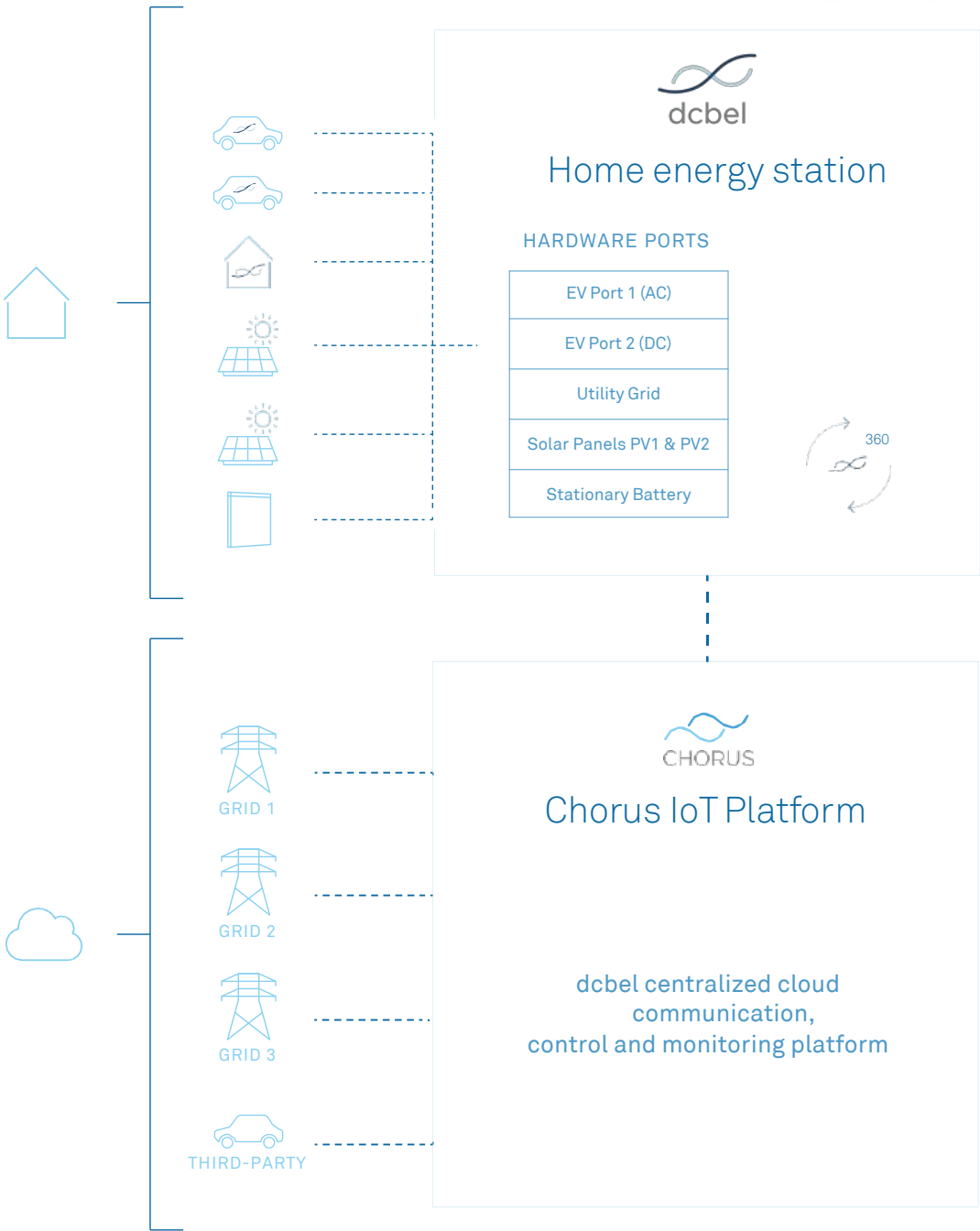


It uses machine learning to automatically predict energy requirements, lower bills, reduce carbon emissions and detect issues before they happen.

It also enables safe, straightforward grid interconnection, allowing consumers to be active participants in a variety of energy markets through virtual power plant aggregation, benefiting both utilities and consumers.

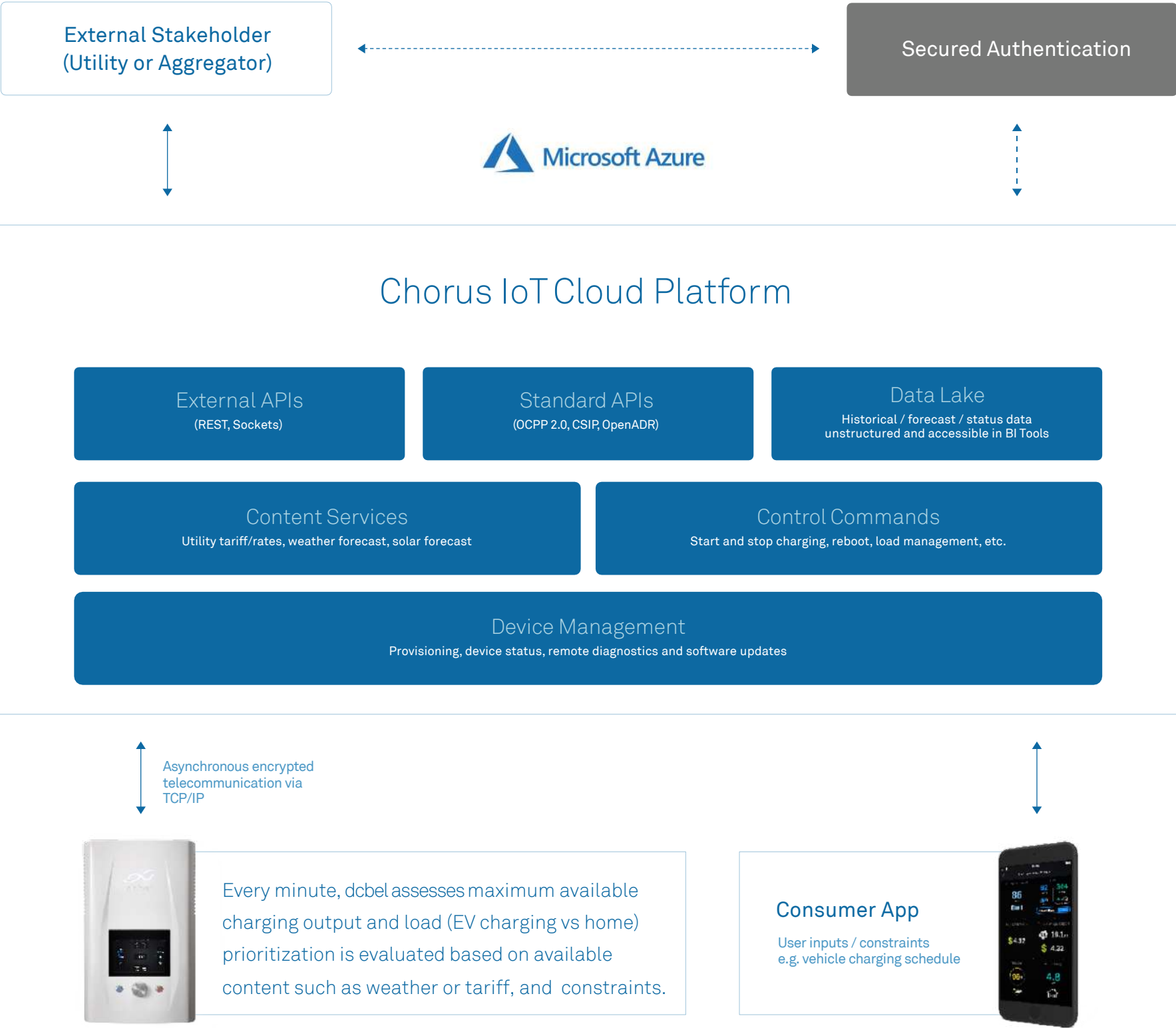
Grid interconnection of Distributed Energy Resources (DERs) such as EV batteries through aggregations, alongside traditional resources such as rooftop solar, will be key in valuing the benefits of Distributed Energy Resource in line with new policy changes (FERC 2222).

dcbel's networked architecture also presents a simple yet flexible way for utilities and DER aggregators to integrate with other behind-the-meter energy resources via a single user interface.



# An Architecture Designed with Grid Integration in Mind

The energy grid, designed for unidirectional flow of power, has progressively been changing to support new sources energy in the form of DERs, and safely support bidirectional flow of power. Like all multi-stakeholder ecosystems, dynamic data exchanges is a key factor to success. In the context of the energy grid, communication means a live “conversation” among grid operators, consumer-owned DER devices, consumers (opt-in or out), Regional Operators, and many other actors. dcbel’s Chorus IoT platform ensures a secure and scalable approach to communication with the ecosystem.



## Chorus Cloud Platform

Chorus is an IoT management platform that monitors all installed dcbel units and provides subscribed users (e.g., dcbel owners and utilities) with real-time alerts as soon as it detects any operating abnormalities.

Chorus communicates with dcbel via Orchestrate OS and continuously balances and optimizes loads (home, EV charging) and source generation (utility grid, rooftop solar, battery storage).

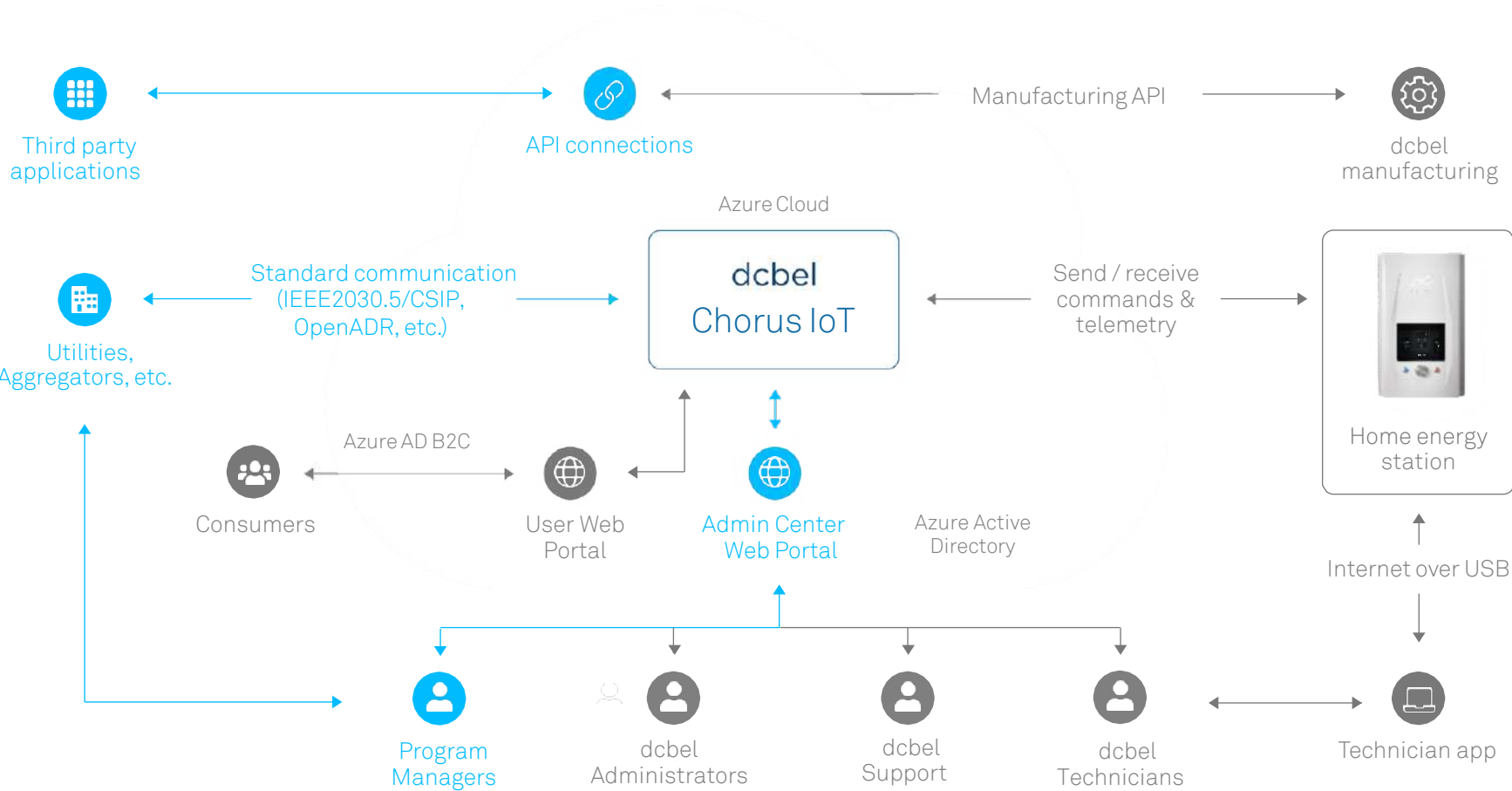
For utilities and DER aggregators, Chorus also provides scheduled or real-time control of dcbel units to support a broad range of use cases including peak load shifting, backup power, or vehicle-to-grid energy reserve.

### CHORUS IOT KEY FEATURES INCLUDE:

- Fully secure IoT platform
- Asynchronous communication
- Real-time geolocated monitoring
- Mobile applications
- Over-the-air updates
- Protocol framework & library



# Chorus Ecosystem



## CHORUS IOT PLATFORM

Cloud platform within a MS Azure environment, purpose-built by dcbel to handle data collection, processing, optimization, and communication across all ecosystem actors (dcbel, utilities, Aggregators, applications, etc.)

## TECHNICIAN APPS

Desktop application for secure wired dcbel installations by dcbel Technicians (Smart Home Integration Partners or SHIPs).

## ADMIN CENTER

- Operation center to monitor and control all installed dcbel home energy stations
- Device management from onboarding and support to sunsetting
- Role-based portal with permission management
- Analytics views and reports
- Utility program management and device registration

## CONSUMER APPS

Customer-facing applications will empower customers to have full visibility and control over the management of their home energy station.



# Orchestrate Operating System (OS)

Orchestrate OS is a native operating system developed by dcbel that allows applications to run locally on home energy stations. For example, Orchestrate can learn a user’s energy patterns and adapt its decision-making to their lifestyle.

Orchestrate allows for incredible flexibility and everyday cost reduction on IT deployments while enhancing reliability over current hardware-only platforms. Further, running data transactions locally (as opposed to in the cloud) can reduce costs by more than 60% over traditional cloud or blockchain platforms. This approach unlocks scalable grid-edge computing, reducing cloud operating costs by more than \$300 per user, every year.

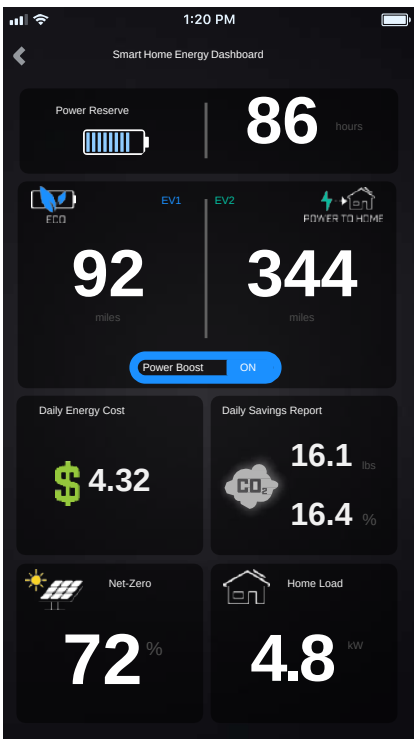


# Local vs Hosted Apps

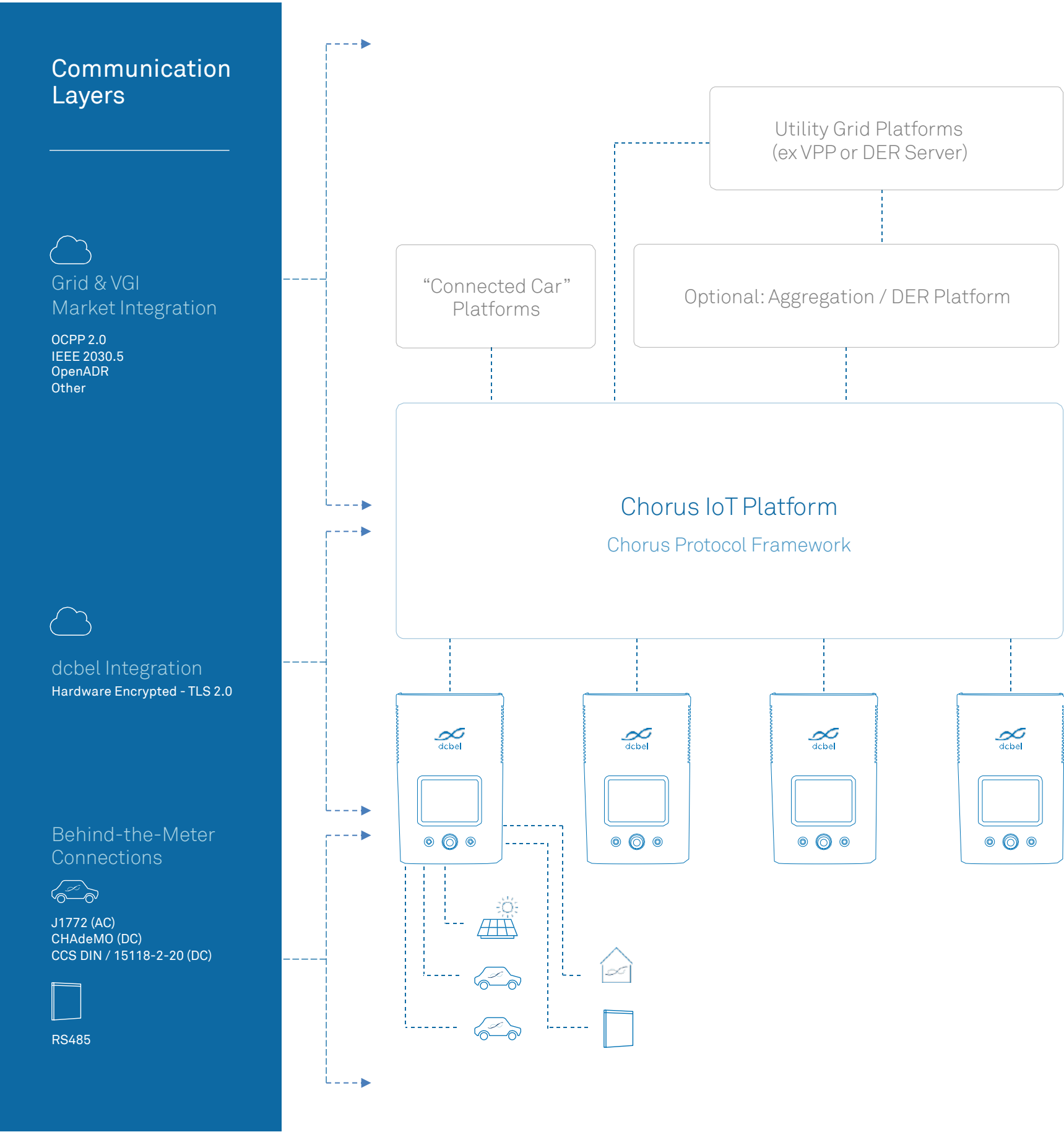
Analytics or services can be deployed locally or in the cloud, depending on the function it serves. The latter are defined as hosted applications. Local apps are typically time-critical applications or services that need to continue operating during a telecommunication blackout. Local apps reduce cloud computing costs and are well-suited for single thread CPU-intensive calculations that do not require immense amounts of data.

Apps that are data-intensive or are not time- critical for the local operation of the home energy station, are deployed in Chorus as hosted apps.

This decentralized and networked architecture also allows any third parties (like utilities and Aggregators) to build and integrate home energy applications across multiple use cases. dcbel users will soon have access to an app store that will allow them to develop and host their own home energy service applications as part of the dcbel Cloud Platform. These applications will be hosted in Chorus marketplace and will be available to dcbel consumers.



# dcbel Communication Architecture





## Physical Communication Protocols

Depending on the use case, dcbel installation may also require additional dcbel components, such as an Automatic Transfer Switch (ATS), Home Current Sensor (Tempo) and Stationary Battery. All of these devices communicate with dcbel home energy station via the RS485 port.

dcbel communicates with electric vehicles via either J1772 (in AC mode), CHAdeMO, or CCS (ISO 15118 or DIN SPEC 70121) (in DC mode) depending on the EV connector selected and installed.

The station draws from a library of EV charging communication protocols to automatically detect the bidirectional capability of the EV.

All communication protocols can be updated remotely over the air. This ensures that dcbel maintains compatibility with new stationary battery and EV models released in the future.

Every dcbel unit is communication-ready with a RJ45 port that can be connected to an Ethernet cable (preferred for optimal reliability). Alternatively, dcbel can use external hardware to connect to the home's Wi-Fi network.



## Operation During a Communication or Power Outage

In the event of a communication failure between a home energy station and Chorus Cloud, dcbel remains fully operational. It houses all of Orchestrate's computing power locally, allowing it to continue to store data during a communication or power outage. Data will be synchronized with Chorus Cloud once communication is restored.

During a power outage, dcbel will be powered by the home's stationary battery. In the absence of this component, dcbel will enter standby mode and be powered by the dcbel UPS until a compatible bidirectional EV is connected to power the home.

Once the power outage is detected via the dcbel current sensor (TEMPO), dcbel will first confirm whether the ATS has properly islanded the home from the grid before initiating blackout power mode.



# Grid Interconnection

Many of the protocols in use today were developed within industry silos and were not designed to support a full ecosystem of grid-edge connected devices. As the electric vehicle, residential solar and smart home industries begin to converge and interconnect with legacy electrical distribution networks, it becomes increasingly urgent to find a way to standardize and support the multitude of protocols.

## DER AGGREGATION SERVERS (OR VIRTUAL POWER PLANT) MANAGEMENT

- Operation center to monitor and dispatch events to registered home energy stations
- Device management from provisioning and support to sunsetting

## DER PROGRAM MANAGERS

- Demand response event: curtail one of many loads or send power back to the grid
- Active Feeder Curtailment

## CHARGE POINT OPERATOR COMMUNICATIONS

- OCPP 2.0

## SOLAR & HOME STORAGE INVERTER MANAGEMENT

- UL 1741 SA (Rule 21 for California) & IEC61850 Protocols



## External Communications Services

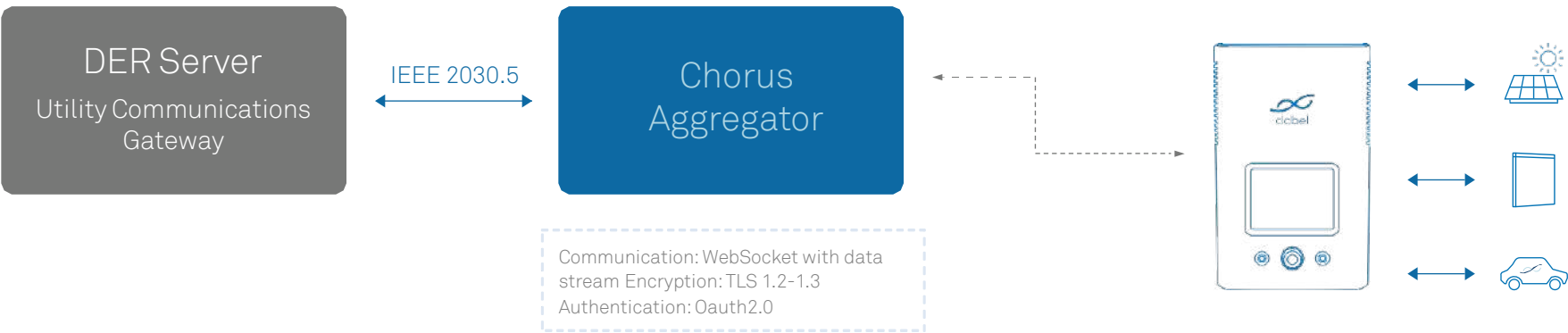
Communication between Chorus and third parties can be done via three different secured services:

- **Internal integrations:** dcbel operations integrations through manufacturing (MRP), product life management (PLM) and user onboarding (CRM) applications
- **External open APIs:** Request-based connection to third parties (available on demand)
- **Standard APIs:** IEEE 2030.5 CSIP
- **Data Lake:** Unstructured historical/forecast/status data accessible by an authenticated user's BI tools

## Common Smart Inverter Profile (CSIP)

With the increased use of DERs, it is critical to ensure reliable and secure communications, as well as manage voltage and power quality issues that could result from distributed-generation resources. While there have been many methods, the two approaches that best fit these requirements are OpenADR, for a decentralized and demand response-focused approach, and IEEE 2030.5 for direct smart inverter control and adjustments. The IEEE 2030.5 CSIP protocol supports a wide range of DER control applications, with inverter control representing a subset of that functionality.

dcbel favors IEEE 2030.5 CSIP for DER dispatch of its home energy stations, providing smart inverter capabilities to all connected devices (solar, ESS, EV). With support for both generation and storage, IEEE 2030.5 CSIP enables higher compatibility with grid-tied PV systems and new behind-the-meter energy resources such as home stationary batteries and EV batteries. In addition to remote monitoring and control, it also allows increased customer engagement (opt-in or opt-out) and information (dynamic pricing based on load profiles).



As an alternative to any standard communication, third parties and partners can leverage dcbel proprietary external APIs to communicate events or event information such as pricing.

## External Open APIs

Chorus provides APIs that may be used by authenticated users, such as third-party partners and businesses.

Functionalities available to these users can vary according to their role and the privileges granted by Chorus. Capabilities provided by the APIs can be particularly useful from a provisioning and utilities perspective, as they permit “at-scale” or batch execution of the functions normally manually accomplished by internal or external resources.

**Functionalities that will be available via dcbel APIs include:**

### USER MANAGEMENT

- Create a new user
- Assign a role to user or group of users
- Set privileges to a role or group of roles
- Disable users

### HOME ENERGY STATION MANAGEMENT

- Assign a site where a dcbel will be installed
- Update home energy station information such as equipment and model, utility rate schedule, micro-weather data, and more
- Send commands to a station (enable/disable, reboot, control load etc.)

### HOME ENERGY STATION MONITORING AND ALERTING

- Access station data stored in the cloud

### DEVICE CONTROL

- Send commands to dcbel

Chorus Cloud will provide real-time visibility into the home energy station’s health and overall performance.

**Data measurements communicated to Chorus include but are not limited to:**

- |  |   |
|--|---|
| ● EV AC - (V, A, W, State, Direction)                        | ● Fans - (RPM)  |
| ● EV DC - (V, A, W, SoC, State, Direction)                   | ● dcbel interaction - (Button pressed, screens consulted) |
| ● PV - (V, A, W, Curtail, State, Direction)                  | ● ATS - (V, A, Hz, Relay position)                        |
| ● ESS - (V, A, W, SoC, State, Direction)                     | ● Tempo home current sensor - (A, Hz, import or export)   |
| ● PUC5 - (V, A, W, Hz, °C, Fan speed, Operation mode, State) | ● Alarms & notifications                                  |
| ● Operating temperature - (°C / °F)                          | ● Errors  |

Various APIs, based on the DER Program requirements, will be made available via secured authentication and authorization.

# Chorus Security

IoT poses unique security, privacy, and compliance challenges. Unlike traditional cyber technology where issues revolve around software and how it is implemented, IoT involves both the cyber and the physical worlds.

dcbel is the only EV charger / PV inverter with an embedded Trusted Platform Module (TPM) 2.0 chip for superior hardware security encryption, futureproofing its adherence to possible future grid compliant requirements as more and more grid edge devices are connected.

For this reason, it is not possible to directly access a dcbel unit. All communication is done via the Chorus IoT platform, which oversees the encryption and transfer of information to dcbel. This provides easier integration, the ability to support new and legacy protocols, and assurance that physical assets already deployed will be compatible with protocol evolution.

## A secure approach to role management

Chorus is a unique IoT platform thanks to its ability to provide access and control to different users over the same dcbel unit while respecting customer privacy and regulations.

Subscribed users will get event notifications based on monitored performance on a dcbel or a group of dcbel units through user applications, administration portals or operational requirements for administrators and utilities.

## Certificate management

Chorus is a multi-tenant Software-as-a-Service (SaaS) solution. This means that there is only one instance of Chorus that is distributed across the cloud (with exceptions for testing, staging and development).

When a device is added to Chorus, it will provide a certificate that is signed by one of the tenants' certifying authorities. Chorus will validate the chain of certificates, apply associated limitation/permissions (scopes), and store the device's certificate for later use.

For components that reside under different tenants, the administrator of tenant must agree to allow the other to communicate with elements under their respective tenants.





To learn more, contact us at  
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[Review dcbel r16 specifications here](#)

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