



BEA WebLogic RFID Edge Server™

Product Overview

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Introduction and Roadmap

The following sections describe the contents, audience for, and organization of this guide—*WebLogic RFID Edge Server Product Overview*.

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- [“Guide to This Document” on page 1-1](#)
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Document Scope and Audience

This document provides descriptive information about WebLogic RFID Edge Server, including:

- Use cases and key benefits
- Component architecture and functional overview
- RFID concepts and terminology
- Developer and RFID resources

The intended audience is developers, system administrators, operations staff, support engineers, and other personnel with an interest in WebLogic RFID Edge Server.

Guide to This Document

This document is organized as follows:

- This chapter, “[Introduction and Roadmap](#),” describes the scope of this guide and lists related documentation.
- “[Understanding WebLogic RFID Edge Server](#),” provides an overview of WebLogic RFID Edge Server.
- “[WebLogic RFID Edge Server Architecture](#),” provides a functional overview of the RFID Edge Server and describes its component architecture.
- “[RFID Terminology](#),” defines key terms and acronyms.

Related Documentation

This document is a part of the WebLogic RFID Edge Server documentation set. The other documents are:

- [*Installing WebLogic RFID Edge Server*](#) describes how to install and configure WebLogic RFID Edge Server.
- [*Using the RFID Edge Server Administration Console*](#) describes how to use the RFID Administration Console to configure ECSpecs, ECRports, RFID devices, filters, and workflows.
- [*Using the Reader Simulator*](#) describes how to use the reader simulator software included with RFID Edge Server. The Reader Simulator minimally simulates a ThingMagic Mercury4 RFID reader.
- [*Programming with the ALE and ALEPC APIs*](#) describes the Application Level Events (ALE) and Application Level Events Programming Cycle (ALEPC) programming interfaces (APIs) that you use to create applications that interact with WebLogic RFID Edge Server by reading and writing electronic product code (EPC) tags.
- [*RFID Reader Reference*](#) describes how to configure the RFID devices supported by the RFID Edge Server.
- [*Workflow Reference*](#) describes how to configure and use the workflow modules included with the WebLogic RFID Edge Server.
- [*ALE and ALEPC Javadoc*](#) provides reference documentation for the ALE and ALEPC Java packages that are provided with the WebLogic RFID Edge Server software.

Understanding WebLogic RFID Edge Server

The following sections provide an overview of WebLogic RFID Edge Server:

- [“Overview of WebLogic RFID Technology” on page 2-1](#)
- [“About the RFID Edge Server” on page 2-2](#)
- [“Standards Compliance” on page 2-4](#)

Overview of WebLogic RFID Technology

Radio frequency identification (RFID) is a generic term for technologies that use radio waves to identify objects. Typically, a unique identifier (such as an EPC code) that identifies objects, and perhaps other information, is stored on a microchip that is attached to an antenna (the chip and the antenna together constitute an RFID tag). The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that computers can receive and process on behalf of user applications.

BEA WebLogic RFID technology includes the following products:

- **WebLogic RFID Compliance Express**—An application that people at the warehouse or distribution center use to assign unique EPC codes, program them onto RFID tags, and verify the application of those tags to cartons and pallets.
- **WebLogic RFID Edge Server**—Software deployed at remote sites where there are RFID readers, such as warehouses, distribution centers, and retail stores, for recording incoming tag data and reporting that data to the Enterprise Server. The Edge Server can run

stand-alone on a computer or be embedded in a growing range of other devices, including routers.

- WebLogic RFID Enterprise Server—Runs at the data center; gathers information from Edge Servers and Compliance Express at the *edge* (remote sites); and processes, records, and presents the data.

About the RFID Edge Server

WebLogic RFID Edge Server performs a number of operations that help tailor the RFID solution to particular business requirements:

- Out of the box connectivity to various RFID devices including readers and printers.
- Support for filtering tag data and tag commissioning through the Application Level Events (ALE) API, a standard lead authored by BEA and ratified by EPCglobal.
- Support for monitoring and configuring RFID devices across the supply chain.
- Support for configurable local workflows for automating business processes relevant at the store, distribution center, or warehouse level.
- A lightweight, distributed architecture with minimal hardware and network requirements.

WebLogic RFID Edge Server provides a comprehensive software infrastructure for developing and deploying reliable RFID applications. Edge Server technology enables developers to write applications at a suitably high level, while the RFID Edge Server handles all low-level interactions with many types of readers and ensures that the network of readers and software functions at peak efficiency.

The RFID Edge Server provides support for processes that are crucial to any enterprise-scale deployment of RFID technology:

- [Data Filtering and Integration](#)
- [Management of RFID Infrastructure](#)
- [Local Workflows](#)

Data Filtering and Integration

RFID readers generate a flood of very fine-grained information. For example, an RFID reader deployed in a typical warehouse shelf environment reports the presence of a particular tag as frequently as five times per second. Most business applications cannot deal effectively with such

fine-grained information; they are geared to receive high-level reports such as “in the last 60 seconds, the following case-level tags were added to the shelf.”

WebLogic RFID Edge Server provides a simple yet powerful application programming interface (API) through which applications can define such high-level events, and receive them in a variety of formats designed for easy integration with enterprise software. Applications define what application-level events they are interested in, and the RFID Edge Server fulfills those requests by interacting with RFID readers and performing filtering, counting, and grouping data operations.

In addition, WebLogic RFID Edge Server insulates applications from the details of how many readers are in use at a given location, their make or model, and how they are configured.

Management of RFID Infrastructure

Enterprise-scale RFID applications typically involve hundreds to hundreds of thousands of RFID readers, deployed at dozens to thousands of remote sites. Most readers are deployed at sites having limited or no IT support staff. Moreover, RFID readers operate autonomously, generating data into enterprise business processes without human intervention or control. In order for business processes to rely on this data, there must be confidence that the infrastructure is sound. For example, it makes a difference whether no RFID tags are read at Loading Dock #5 because no shipments are received, or because an errant forklift damaged the reader's antenna.

WebLogic RFID Edge Server provides a comprehensive remote monitoring and management facility for the RFID infrastructure. Through the RFID Edge Server's monitoring and management facilities, operations staff can centrally monitor the health and functioning of remote RFID readers and associated computer hardware. The RFID Edge Server can also connect this monitoring information into existing enterprise infrastructure management and service applications.

WebLogic RFID Edge Server also provides a central location for defining and administering RFID device configuration, including setting model-specific parameters that you use to tune for optimal operation.

Local Workflows

Enriching technical events with business related information is done at the workflow module level. A workflow is a series of actions triggered by an external event, such as the observation of an RFID tag. For example, the observation of an RFID tag on a piece of luggage traveling down a conveyor belt could increment an LED counter, change a stack light to green, send an EPC Information Service (EPCIS) event, or send a notification to another system. Any or all of these

workflow related events could be triggered by the tag observation. In more complex cases, multiple actions of the same type could be triggered (for example, events or notifications could be sent to multiple destinations).

Workflows are constructed from *workflow modules*, which take input messages (event cycle reports or output from other modules), and emit workflow messages according to embedded business logic. There are two types of workflow modules: business logic modules (such as, Directional Portal or Observe Portal) that represent business processes, and helper modules (such as, Stack Light) that the business logic modules call to control hardware at the edge or send messages to other systems.

Standards Compliance

WebLogic RFID Edge Server is compliant with all relevant standards of EPCglobal, ISO, and other standards bodies. BEA is committed to revising RFID Edge Server so that it is always in compliance with these standards.

WebLogic RFID Edge Server conforms to EPCglobal and ISO standards as follows:

- RFID Edge Server works with RFID readers that implement the following protocols:
 - EPCglobal Class 0, Class 0+, Class 1, and Class 1 RF Protocols
 - EPCglobal UHF Class 1 Gen 2 Tag Protocol (ISO 18000-6C)
 - ISO 15693 RF Interface protocol
 - ISO 18000-6B RF Interface protocol
- RFID Edge Server supports the EPCglobal [EPC Generation 1 Tag Data Standards Version 1.27](#). This standard governs the bit-level encoding of object identity and other information onto RFID tags. It also specifies a URI-based syntax for exchange of tag data between software application components, and a second URI-based syntax for the description of filtering patterns.
- RFID Edge Server includes components that fulfill the collecting and filtering role, as defined by EPCglobal. RFID Edge Server has been certified for conformance with the [The EPCglobal Application Level Events \(ALE\) Specification Version 1.0](#), which is the standard interface to filtering and collection as defined by EPCglobal (replacing earlier “Savant” specifications). RFID Edge Server also provides extensions in the areas of reader management, application integration, and tag writing.

WebLogic RFID Edge Server Architecture

The following sections describe WebLogic RFID Edge Server architecture:

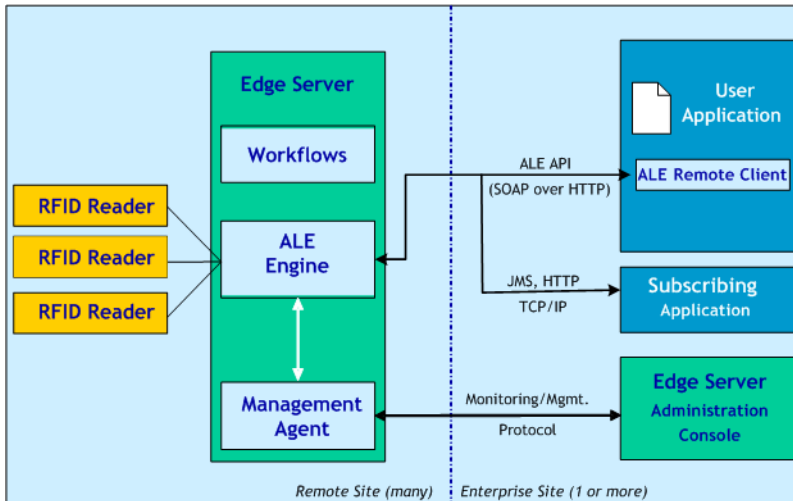
- [“Component Architecture” on page 3-1](#)
- [“Functional Overview” on page 3-3](#)
- [“Developer Resources” on page 3-6](#)
- [“RFID Resources” on page 3-7](#)

Component Architecture

The WebLogic RFID Edge Server has the following components:

- [“RFID Edge Server” on page 3-2](#)
- [“Administration Console” on page 3-3](#)

Figure 3-1 RFID Edge Server Architecture



RFID Edge Server

The main subcomponents within the RFID Edge Server are:

- **ALE data processing engine**—Receives, processes, writes, and filters RFID tag data according to Event Cycle Specifications (ECSpecs), as defined by the EPCglobal ALE specification.

An ECSpec describes a particular combination of readers, filters, and reporting options, defined by an application. ECSpecs may be defined programmatically using the ALE API (via the SOAP listener), or using command-line tools provided with WebLogic RFID Edge Server.

- **Monitoring and management agent**—Monitors and manages the health and functioning of readers and Edge Server software remotely through the RFID Edge Server Administration Console.

The management agent also provides real-time telemetry, including the number of tags read, the read cycle time, and when the read cycles occurred. Real-time telemetry is useful in diagnosing the overall health of the RF environment in which readers operate.

- **Local workflows**—Out of the box workflows for observing case and pallet count, associating cases with pallets, and determining the direction of product movement, that are configurable through the RFID Edge Server Administration Console.

Administration Console

The Administration Console is software typically deployed at a centralized enterprise site, where operations staff can use it to:

- Configure and monitor the activities of multiple Edge Servers and readers
- Add, remove, and configure readers and composite readers
- View and manage ECSpec data objects and their subscribers
- Configure and deploy workflows
- View real-time Edge Server and RFID device telemetry data
- Export and import RFID Edge Server configuration objects

For detailed information about the Administration Console, see [Using the RFID Edge Server Administration Console](#).

RFID Readers

You need one or more RFID readers to use RFID Edge Server. RFID Edge Server supports the most widely used RFID readers, which are listed in the [RFID Readers Reference](#).

You configure RFID readers through the RFID Administration Console. See [Configuring and Monitoring Readers](#). For readers that require more specific configuration prior to use with RFID Edge Server, also see the [RFID Readers Reference](#).

If you do not have a reader, you can use the reader simulator software provided with WebLogic RFID Edge Server. Out of the box, it runs on any workstation and simulates a ThingMagic Mercury4 reader; with minor editing it can simulate a Printronix reader. The reader simulator is useful for software evaluation, application development, and debugging. See [Using the Reader Simulator](#).

Functional Overview

By gathering unique identification data at many detection locations, the RFID Edge Server provides item-level detection for literally billions of items. To handle this process effectively, the RFID Edge Server must:

- Minimize the amount of data communicated
- Make communications as efficient as possible

- Make the system robust to communications outages and configuration changes

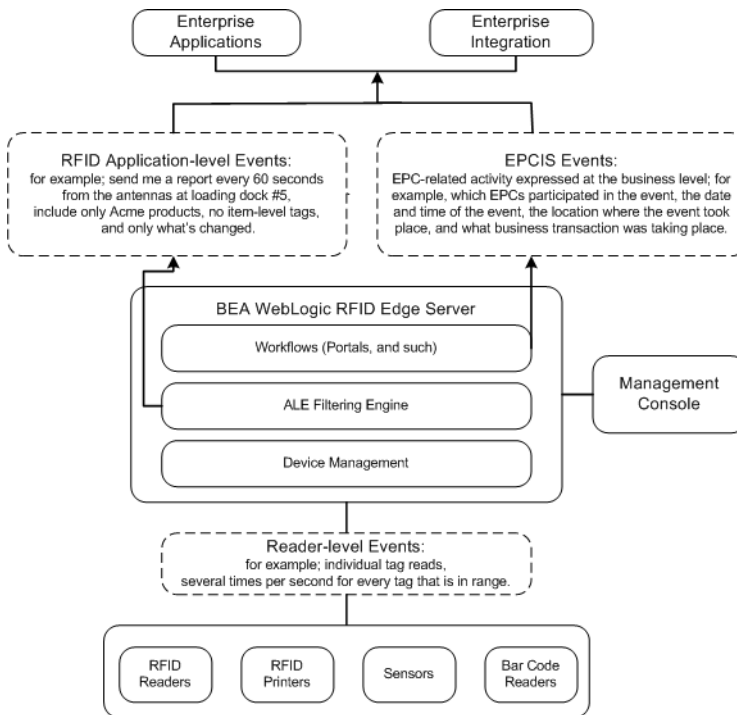
Data Processing

All access to data from RFID readers is made using the ALE engine of the WebLogic RFID Edge server. The RFID Edge Server uses single-layer filtering at a low level in the architecture. The filtering is generic enough to support different readers and different application needs, and it returns information in a standardized format. The standardized interface for client applications is the ALE API. The ALE API allows applications to specify exactly the type of information required from a raw stream of RFID data, such as:

- Locations for reading tag data (where a location maps to one or more RFID readers or antennas)
- Time interval for accumulating data (absolute time or a time interval triggered by external events, such as motion detectors)
- How to filter the data
- How to group the results
- Whether to report all the currently visible tags or only the additions and deletions
- Whether to report actual tag values or just a count of the tags that were read

Applications all send requests to the filtering layer and the filtering layer subsequently provides reports back to the applications.

The following figure shows a functional overview of WebLogic RFID Edge Server.

Figure 3-2 WebLogic RFID Edge Server Functional Overview

WebLogic RFID Edge Server provides the following key functions and features:

- Reader-level events filtering through the ALE processing engine
 - Reduces the volume of data to applications
 - Elevates the level of abstraction for application writers
 - Insulates applications from device details
 - Shares data among multiple applications
- Device management through the RFID Edge Server Administration Console
 - Manages reader configuration such as setup, reboot, and individual requirements of each reader model
 - Monitors reader health, for example, determines whether no tag reads means that no goods are received or that the reader is broken

- Provides real-time monitoring of radio (RF) environment health, that is, helps determine whether data is useful
- Local workflows turn low-level technical events into meaningful business events
 - Provides integration of readers and user feedback devices (stack lights, LEDs, and such)
 - Workflow modules subscribe to ECSpec reports and add the required business-oriented information, such as business location ID and business process step ID
 - The result of a workflow process could be an EPCIS document, or some other XML payload, that will then be transported to upstream enterprise IT subsystems using JMS (topic or queue) or HTTP

Connectivity

Key functionality of WebLogic RFID Edge Server includes establishing and maintaining network connections to RFID devices, insuring that they are properly configured, retrying connections in the event of failure, and exchanging device read and write events with the ALE engine. For devices with built-in Ethernet capability, WebLogic RFID Edge Server interfaces with the network using the device's own proprietary protocol (every device manufacturer defines its own protocol, sometimes a different protocol for different models within the same product family). For devices having only a serial connection (such as, RS-232, RS-485), a serial-to-Ethernet converter is used.

WebLogic RFID Edge Server also allows you to receive information about other RFID devices and control them by communicating with a programmable logic controller (PLC), a specialized industrial computer used for automation of real-world processes.

Developer Resources

Applications interact with the Edge Server through the ALE API. The ALE interface provides a high-level, declarative way for applications to obtain RFID data, without requiring application programmers to interact directly with RFID readers or perform any low-level real-time processing or scheduling operations. For detailed information about the ALE interface, see [*Programming with the ALE and ALEPC APIs*](#) and the [*ALE and ALEPC Javadoc*](#).

RFID Resources

- EPCglobal—A non-profit organization set up by the Uniform Code Council and EAN International, the two organizations that maintain bar code standards, to commercialize EPC technology. EPCglobal has chapters in various countries and regions. It is commercializing the technology originally developed by the Auto-ID Center.

EPCglobal Tag Data Standards—This document is available on the EPCglobal Web site at <http://www.epcglobalinc.org>.

- [International Organization for Standardization \(ISO\)](#)—A non-governmental organization of national standards institutes in 146 countries. Each member country has one representative, and the organization maintains a Central Secretariat in Geneva, Switzerland, that coordinates the system.
- ISO Standards—ISO has developed RFID standards for automatic identification and item management. For a comprehensive overview of all ISO standards related to RFID, see [Radio Frequency Identification \(RFID\) Identification \(RFID\) - ISO & ISO/IEC Standards](#).

WebLogic RFID Edge Server Architecture

RFID Terminology

Key terms and acronyms that you will encounter throughout the RFID documentation include the following:

action

Classifies an EPCIS event as one that creates a new entity (ADD), removes a previous entity (DELETE), or merely observes the state of existing entities without changing them.

Application Level Events (ALE)

Application programming interface (API) through which clients may obtain filtered, consolidated EPC data from a variety of sources. The ALE API is defined by an EPCglobal standard.

Application Level Events Programming Cycle (ALEPC)

Main interface for programming tags. See also [tag programming](#).

asynchronous notification mechanism

Method by which the RFID Edge Server pushes data to an application based on a prior subscription. Asynchronous notification mechanisms include HTTP, JMS, and File I/O. Applications may define events of interest (through specifications such as ECSpec, PCSpec, and EPCCacheSpec) and later subscribe to asynchronous delivery of corresponding reports (ECReports, PCWriteReport, EPCCacheReport). All notification delivery mechanisms encode reports.

check operation

A read carried out to verify that exactly one tag is in the field. A check operation is part of a pattern within a programming cycle whereby one or more check operations is followed by one or more verification cycles. See also [verification cycle](#).

composite reader

Logical reader that combines a set of other logical readers as one group. A composite reader is used within an ECSpec to identify a group of readers based on a composite name, thereby providing the flexibility of adding physical readers to the group without having to change the ECSpec itself. See also [logical reader](#).

ECSpec

See [Event Cycle Specification \(ECSpec\)](#).

ECSpec Report or ECRReport

Set of reports for an ECSpec.

Electronic Product Code (EPC)

Next generation method of product identification that uniquely identifies objects (items, cases, pallets, locations, and so on) in the supply chain and can be used to track them. EPCs are often written to RFID labels.

EPC

See [Electronic Product Code \(EPC\)](#).

EPC Information Service (EPCIS)

Refers to both a standard definition of business-level EPC data and a standard set of services and interfaces for capturing and querying that data. EPCIS is defined by an EPCglobal standard.

In WebLogic RFID Enterprise Server, the EPCIS is a component responsible for capturing EPCIS event information, storing it, and providing access to the stored data. See also [EPCIS event](#).

EPC cache

Ordered list of EPC values used in sequence to program tags. An EPC cache allows a series of tags to be programmed without tag-by-tag application intervention to supply new EPC codes. See also [EPC pattern](#).

EPCIS event

Observation of EPC-related activity, expressed at the business level. EPCIS events typically have four informational aspects: what (which EPCs or other entities participated in the event), when (the date and time of the event), where (the location where the event took place and where the entities are expected to be afterward), and why (what business transaction was taking place and what is the business condition of the entities afterward).

EPC pattern

URI-formatted string that denotes a single EPC or a set of similar EPCs.

event cycle

An interval of time over which data is accumulated for reporting through the ALE API. Filtered, aggregated data collected during an event cycle is delivered to an application in an ECRpt. See also [ECSpec](#), [ECSpec Report](#) or [ECRpt](#).

Event Cycle Specification (ECSpec)

A data object in the ALE API that specifies the time boundaries for a series of event cycles, the readers from which data is to be collected, and the filtering and reporting options for delivering the data.

logical reader

Abstract name that an application uses to refer to one or more physical readers or antennas that have a single logical purpose; for example, readers positioned around a door might be called DockDoor42. Logical readers can be considered equivalent to “locations.”

physical reader

See [reader](#).

portal

Doorway or other physical structure equipped with one or more RFID readers to read EPC information from tagged objects that pass through it.

portal workflow

Software used to capture data generated when an RFID tagged object goes from one place to another. The software is capable of detecting tags, providing user feedback, and sending messages to enterprise applications (including location, directionality, and tag data).

programming cycle

Interval during which a single tag is written and verified.

Programming Cycle Specification (PCSpec)

A data object in the ALEPC API that specifies the time boundaries for a series of programming cycles, the readers or printers through which the tags are to be written, an optional EPC Cache to provide unique EPC codes, and reporting options for delivering the results.

Radio frequency identification (RFID)

Method of identifying unique items by using radio waves. Typically, a reader communicates with a tag, which holds digital information in a microchip.

read cycle

Single complete scan of all tags in a single reader antenna's field. A read cycle typically occurs several times a second.

reader

Generic term for a hardware device, also referred to as a physical reader, which reads EPC values from or writes EPC values to RFID labels. The reader has one or more antennas, which emit radio waves and receive signals back from the tag. Occasionally used to refer to devices with no RFID capabilities, such as bar code readers.

reader simulator

Software that simulates a reader.

RFID

See [Radio frequency identification \(RFID\)](#).

RFID device

Generic term for an RFID reader or an RFID-enabled printer.

RFID Edge Server

Software deployed at remote sites where there are RFID readers, such as warehouses, distribution centers, and retail stores, for monitoring and filtering incoming tag data, for device management (such as configuring and monitoring RFID readers and printers), and enabling local workflows.

subscriber

Destination for ECSpec report information.

stack light

Set of lights used to signal the status of a process or hardware device. Stack lights usually appear in one or more of the following colors: white, blue, green, amber, or red.

tag programming

Associating an EPC value with a physical entity, such as an RFID tag or a printed label. The process of writing a serial number to a tag for the first time is sometimes called *commissioning a tag*.

telemetry

Transmission of data captured by instrumentation and measuring devices to a remote station where it is recorded and analyzed.

trigger

External event that signals the beginning or end of an event or programming cycle. See [event cycle](#) and [programming cycle](#).

Uniform Resource Identifier (URI)

Unique name that represents the address or location of a resource, typically on the Internet. URIs are also used by the RFID Edge Server to specify the destinations for asynchronous notifications.

verification cycle

A write attempt followed by one or more read attempts. A verification cycle is part of a pattern within a programming cycle whereby one or more check operations are followed by one or more verification cycles. See also [check operation](#).

workflow

Series of actions triggered by an external event. The actions a workflow performs may include sending information about the observation to another system or changing the display on hardware such as LEDs or stack lights.

workflow module

User-configurable building blocks used to create workflows in the WebLogic RFID Edge Server. A module takes input messages (event cycle reports or output from other modules), and emits workflow messages according to embedded business logic.

Extensible Markup Language (XML)

Markup language used to describe and transmit data across many different systems. See the description available at <http://www.w3.org/TR/REC-xml>.

Extensible Stylesheet Language (XSL) Transformations (XSLT)

A language used to transform XML documents using stylesheets. See the description available at <http://www.w3.org/TR/xslt>.

RFID Terminology

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