



A Technical Guide to Revolutionizing WMS with Low Code and Composable Architecture

In today's fast-paced and constantly changing supply chain landscape, flexibility is no longer a luxury—it's a necessity. The ability to adapt rapidly to shifting customer demands, regulatory changes, and technological advancements can determine a warehouse's success. A modern WMS with maximum flexibility empowers businesses to scale operations, integrate seamlessly with new technologies, and customize workflows to meet unique operational needs. This ensures not only immediate adaptability but also long-term resilience, enabling your warehouse to stay competitive and efficient in a dynamic market.

Modern warehouse management systems are using composable architecture and low code application platforms (LCAPs) to provide the inherent flexibility needed by warehouse operators. Let's take a look at these technologies and why they are game changers.



How Low Code Application Platform-Based WMS Differ from Traditional WMS

Warehouses Need a WMS That They Can Adapt Themselves to Meet Their Needs

In contrast with traditional warehouse management software that is complex and rigid, WMS built on LCAPs do not require highly skilled IT resources or software developers to handle hand-coding or programming. Low-code application platforms are development environments that include a library of pre-built components for common functionalities including integrations, data visualizations, and authentication. This enables both non-software developers and professional developers and IT resources to build applications more efficiently by using an intuitive development approach.

Application designers select from pre-built components, including robust integration frameworks and connectors, and build applications or adapt the existing WMS to meet changing customer or business requirements. LCAPs include tools for defining businesslogic. Non-technical users can work alongside IT resources to automate workflows, create business rules, process flows and data models. To do this, visual tools are used to replace the need for writing complex code. Event-driven triggers and actions are leveraged to automate repetitive tasks and integrate with other systems.

Low-code application platforms include features to promote team collaboration. Multiple users can work on the same project simultaneously, and version control mechanisms help to ensure that changes can be tracked and managed efficiently. In case it becomes necessary, rollback can be used to return to previous versions.

Low-code application platforms include tools for deployment, hosting, and maintenance. Applications can be deployed by users to a variety of environments with only minimal configuration. Within the platform, maintenance and updates can be handled and automated testing and deployment pipelines are frequently used.

Using an LCAP-based WMS can help to empower even non-technical users to configure workflows for operational processes or create custom reports, without the need to write extensive code.



Great Reasons Why You Should Use a LCAP-based WMS for Your Warehouse

Flexibility: adaptability and ability to customize to meet the specific needs of customers and operations.

LCAPs provide significant value for WMS due to the speed and cost at which applications, features, and customizations can be adapted, developed and deployed. Using such innovative tools, a LCAP-based WMS has a significant competitive advantage when compared to a rigid traditional WMS.

Remediating integration challenges can be time consuming and costly. This problem is often common with traditional warehouse management systems. Often traditional WMS do not have the capability of integrating with cloud-based services, limiting the ability for them to take advantage of the cost benefits, flexibility and scalability of cloud computing. In addition, it is often challenging for traditional warehouse management systems to integrate with emerging technologies including robotics, flexible automation, autonomous guided vehicles (AGVs), conveyor systems and other technologies.

Because LCAPs leverage built-in connectors as well as APIs that facilitate integration with other systems, integration is seamless, ensuring a more efficient, cohesive ecosystem. This ease of integration can aid in unifying data across different systems to improve decision-making and information visibility.



Scalability: As a business grows can be problematic as warehouse operations typically become more complex. This complexity typically leads to the need to handle increased volumes of data more complicated workflows as well as expanded warehouse operations. This can present challenges for traditional warehouse management systems.

Low-code application platforms are better able to scale more easily to handle increased volumes of data, more operational complexity, and additional functionality without a complete overhaul of the WMS. It is faster and easier to make quick adjustments involving a WMS built on LCAP, scale up or down to handle new business requirements, changes in demand and much more.



Security is a major concern today for all warehouse operators. Older warehouse management systems may lack the advanced security features required to protect sensitive data from cyber-attacks. Robust security measures are needed to ensure that data is protected.

Outdated user interface and poor user experience are common with older warehouse management systems and can hamper productivity and lead to errors. WMS users need to have a streamlined user interface, designed to focus their attention operations, without distractions.

Using a WMS built on an LCAP can improve the user experience and boost productivity. This is because LCAPs often feature intuitive, user-friendly interfaces that enhance the overall user experience. This makes it easier for warehouse workers to navigate the software, reducing errors and frustration.

Real time visibility into warehouse operations, inventory levels, and order status. Older traditional WMS may not be able to provide visibility in real time. This can reduce the responsiveness to customer and market demands and delay decision-making.

Another advantage of using a WMS built on an LCAP is that it can be integrated to IoT devices and sensors. This will enable the capture of real-time data on inventory levels, environmental conditions within the warehouse, equipment status, and more.

Data management issues, such as handling large volumes of data are common with traditional WMS. Today, with the popularity of online shopping, the volume of orders and need to engage with many individual items per order is required. Traditional WMS designed to handle goods by the case or pallet, rather than by the individual saleable unit, may have performance issues, such as data lock update retrieval.

Using a WMS built on an LCAP can facilitate the integration of multiple data sources into one unified platform, improving data accuracy and consistency. All data is available in one place. In addition, there are built-in tools for data validation, cleansing, and governance. This helps to ensure high data quality, essential for reliable real-time data visibility.

How Modern WMS Use LCAPs with Composable Architecture

What is Composable Architecture and How is It Different from LCAPs?

Composable architecture emphasizes scalability, interoperability, and reusability across broader systems and focuses on creating systems using modular, interchangeable, independent systems that work together seamlessly. Designed to enable businesses to adapt quickly to changes in technologies or requirements, composable architecture provides the ability to assemble or reconfigure systems on demand. It is primarily used by IT professionals to design and manage complex software ecosystems.

Although both composable architecture and LCAPs share a common goal of enabling adaptability and flexibility, they approach the matter from differing perspectives and are designed to solve different challenges. Low Code Application Platforms provide a development environment, enabling users to build and deploy applications with minimal coding. Extensive coding experience is not required. Users leverage drag-and-drop interfaces as well as pre-built templates. This empowers non-technical users to create applications quickly. By speeding up development cycles and reducing the reliance on IT professionals, applications can be adapted or generated more quickly and cost effectively.

LCAPs and composable architecture complement each other and are being used together in modern warehouse management systems, enabling greater flexibility and simplifying and speeding up application development.

Let's Take a Closer Look at the Technology Behind LCAP-Based WMS

Today a few software developers are leveraging composable architecture and low-code/no-code application platforms to design WMS, taking modular approach to system design. Applications such as WMS are being built using interchangeable, self-contained components such as microservices and APIs). This enables companies to be able to rapidly assemble and reassemble applications, tailored to their specific needs to make the systems readily adaptable to change and highly flexible.

An example of this is a WMS constructed with composable architecture designed to have separate modules for functions such as labor tracking and inventory control. These modules can be independently updated, replaced or deployed.

10 Ways That a WMS with Composable Architecture Helps Warehouses

Composable architecture provides flexibility, scalability, and adaptability to meet changing business requirements:

1. Specific WMS components can be added, removed, or modified independently without impacting the rest of the system.
2. Workflows can be tailored to meet unique requirements.
3. The WMS can be tailored to meet the need for changes without overhauling the entire system.
4. Fluctuating demand can be handled simply by scaling specific components to ensure the system is at a state of peak readiness.
5. Innovative new technologies can be easily integrated to the WMS without having to redesign the entire system.
6. With composable architecture, the WMS modules can be linked to ensure a consistent flow of data across systems. This helps to ensure operational visibility and improve the quality of decision-making.
7. Composable architecture facilitates faster deployment and decreases the downtime during rollouts and downtime.
8. In making changes to the WMS, teams can experiment with and make changes to individual processes at no risk to system stability.
9. Outdated components can be updated or replaced faster and with less disruption and maintenance can be streamlined.
10. Composable architecture facilitates an “easy grow” model, enabling warehouses to start with basic components, adding additional or advanced modules whenever ready. This keeps WMS cost affordable and facilitates continued investment in WMS technology that aligns with business growth.

How Low-Code Application Platforms Work: Core Components of LCAP

Let's look at the core components of low code platforms to better understand how the elements work together to create a more flexible, adaptable WMS.

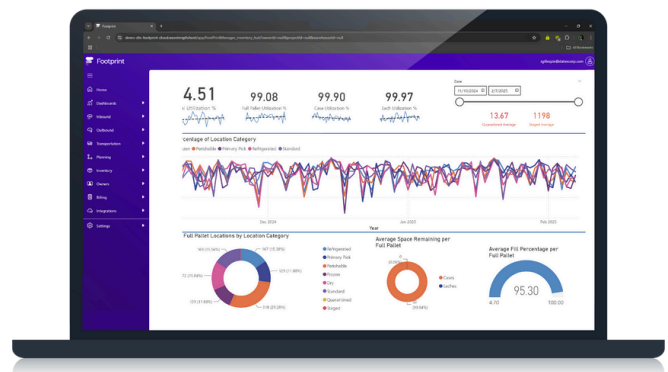
Visual Development Environment

The visual development environment of low code application platform-based WMS is fundamentally different from that of traditional WMS software. Companies using traditional warehouse management systems must rely on the software vendor or IT resources with coding expertise to customize the software to meet their needs. Experienced coders make changes to the WMS by editing backend code, editing scripts, and configuration files. These efforts are more time-consuming, expensive and prone to error.

Contrarily, when a WMS has a visual development environment, customization is accomplished visually, using a drag-and-drop interface. This interface is used to design workflows, configure modules and develop dashboards and can even be accomplished by non-technical users.

Here are the elements of the Visual Development Environment:

- **Drag-and-Drop Interfaces:** facilitates the placement and configuration of UI components, workflows and data models
- **Model-Driven Development:** leverages visual depictions of workflows, business logic and application structures
- **Real-Time Previews:** enables developers to immediately see how the changes they make to appear and function within the application



Pre-Built Modules and Templates

To reduce dependence on software developers and IT resources, LCAP-based WMS incorporates reusable components and industry-specific templates that have been developed specifically for industries. This typically includes reusable components such as login pages, integrations, and dashboards.

Integration Framework

Although most low-code application platform-based WMS provide connectors, the availability and capabilities of these features vary depending upon the design of the platform, target audience and integration capabilities.

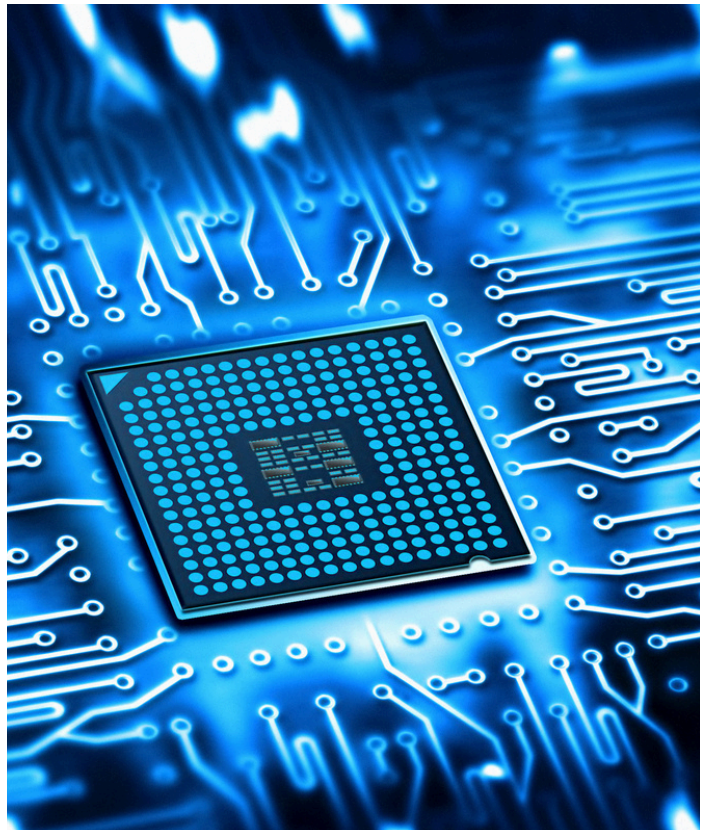
Here's a closer look at the components of the integration framework:

APIs and Connectors: Nearly all LCAP-based WMS offer GraphQL or REST APIs to facilitate seamless interaction with external systems including ERP or TMS. Some platforms provide tools to create custom APIs. Other LCAPs limit users to predefined API endpoints.

Usually, prebuilt connectors for integrating popular systems can be found. Leveraging these connectors reduces the time and effort spent on integration and enables non-technical users to configure them more easily. Platforms that target broader industries tend to have an extensive library of pre-built connectors.

Middleware Layer: Most LCAP-based WMS include a middleware layer which acts as an abstraction layer to handle data transformation, protocol bridging and integration logic. Often LCAP-based WMS natively include middleware.

Event Listeners: Advanced platforms often include real-time event triggers which facilitate the response of the platform to changes, such as updates to inventory or new orders. The event listener triggers an automatic workflow in the WMS in response to the trigger. Event-triggered architecture is also frequently present in advanced LCAP-based WMS. This provides support to asynchronous communications and facilitates real-time updates across systems. Some advanced platforms enable users to define and customize their own responses and events, while other platforms may only support a limited set of predefined events.



Workflow Automation

Another core component of LCAP-based WMS is workflow automation. Business Process Automation (BPA) tools are provided to enable users to visually design and automate workflows including notifications such as status changes as well as items such as an approval process.

The event-driven architecture responds to triggers to execute tasks or workflows. Rules engines are necessary and provide encoded conditional logic which enables users to define “if-then” rules to automate decision-making.



Data Modeling and Management: In LCAP-based WMS, data binding links the user interface components directly to the underlying data sources. Visual tools, known as Entity Relationship Modeling (ERM) are provided to enable users to define data relationships as well as fields and constraints. To hide the complexity of SQL or NoSQL database operations, a database abstraction layer is used. This enables users to define data models visually.

Extensibility: LCAP-based WMS includes Custom Code Integrations to enable the addition of custom scripts in JavaScript, Python, or other supported languages for unique requirements.

Plugins and Extensions are provided in the platform to support external libraries or proprietary add-ons to improve functionality.

LCAP-based WMS commonly have microservices compatibility to enable the platform to call or embed microservices for specialized tasks.



Technical Underpinnings of LCAP-based WMS

A Look at the Backend Infrastructure

Microservices Architecture: LCAP-based WMS includes microservices architecture. To enable more scalability and modularity, the microservices architecture divides functionality into smaller, independent services.

Cloud-Native Hosting: LCAPs are typically hosted on cloud providers such as Azure, GCP or Azure due to needs for high availability and scalability.

State Management: The application's state is being managed across user sessions by using frameworks or built-in mechanisms.

Frontend Frameworks

Dynamic UI Rendering: Modern web frameworks including React, Angular, Vue.js are used to render the application interfaces.

Responsive Design: To ensure that applications work seamlessly across desktop, mobile and tablet devices, responsive design is incorporated into LCAPs.



Security Features

Role-Based Access Control (RBAC) is used by LCAPs to manage user permissions at a granular level.

Encryption: Secure data transmission and storage using security protocols such as TLS and AES is ensured by using encryption.

Auditing and Logging: To track system changes and user actions involving compliance and troubleshooting, auditing and logging are used in the LCAP-based WMS.

Deployment and DevOps

One-Click Deployment: To minimize effort, LCAPs typically include one click deployment capabilities to enable quick deployment to staging or production environments.

Continuous Integration/Continuous Deployment (CI/CD): Automated testing and deployment pipelines are supported by continuous integration/continuous deployment capabilities within the LCAP.

Version Control: LCAPs utilize version control capabilities to track changes in the application so that the system can be rolled back to previous states, if it becomes necessary to do so.



What Are the Critical Features that Enable Low-Code Development?

How Metadata-Driven Architecture Works

Rather than hard-coded logic, low-code application platforms are defined through metadata. The LCAP interprets this metadata to produce application components dynamically. By leveraging metadata-driven architecture, application updates can be simplified to ensure consistent behavior across the components.



Declarative Logic

LCAPs enable users to define “what” the application should do rather than “how” it should be done. Declarative logic provides the ability for non-technical users to define workflows without requiring the users to write code.

Artificial Intelligence Assistance

Not all LCAP-based WMS leverage artificial intelligence. Those that do may leverage AI to automate repetitive coding tasks or recommend actions. In addition, artificial intelligence automatically can identify potential issues as well as suggest test cases based on application flows.

How Low-Code Application Platforms Benefit IT Teams and Developers

LCAPs provide the opportunity to relieve pressure from IT teams and software developers and enable these teams to work on other mission-critical tasks. In addition, using an LCAP-based WMS provides the tools and framework for the collaboration with non-technical users.

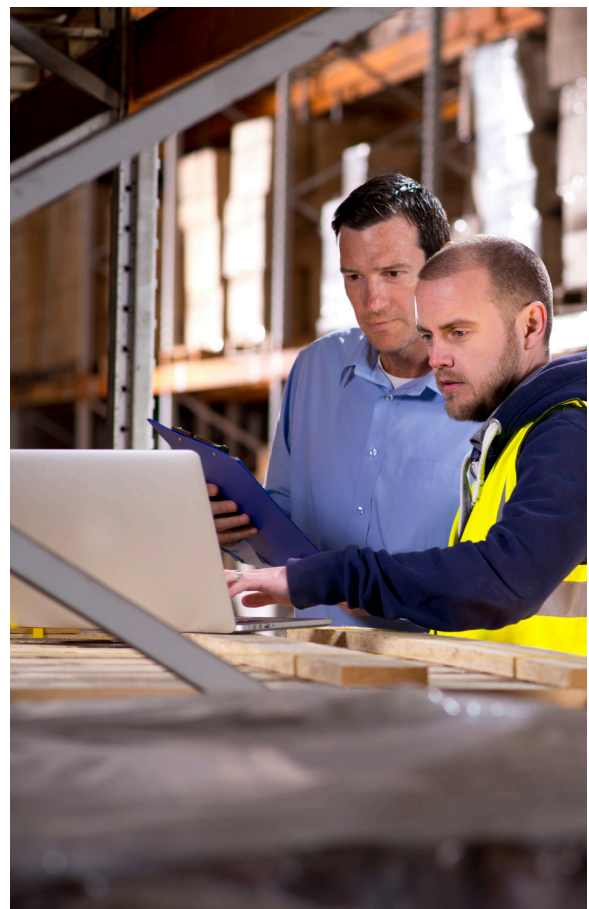
In addition, LCAP-based WMS:

- **Ease the Burden of Maintenance** as the reusable components are easier to navigate, understand, debug and update.
- **Rapidly Scale** as standardized components can be extended or integrated without the necessity of rewriting large volumes of code.
- **Future-Proofing:** Your WMS Investment: Using a flexible, readily configurable LCAP-based WMS ensures that code is well-structured and can be reused. This minimizes the likelihood that expensive overhauls to code will be needed as needs change. For example, reusable modules include shipping label generation; ability to manage inventory at multiple warehouses or locations.

Conclusion:

Technology continues to advance. As software development methodologies continue to evolve, supply chain industry professionals can take advantage of the innovative capabilities provided by low-code application platforms: development environments designed to simplify the software development process.

LCAP-based WMS enable rapid development, adaptation, customization, and deployment of software applications, enabling businesses to respond rapidly to changing market conditions and technological changes. The result is notable cost and time savings, increased efficiency, and more effective operations. Using LCAPs, companies can take advantage of increased flexibility, scalability, and adaptability to be more competitive, drive operational excellence, and support growth.



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