Locus multi-tenant architecture
(let's get technical!)

Locus Platform is the most modern multi-tenant cloud application development platform for EHS applications on the market today. Both government and commercial enterprises trust this platform to deliver robust, reliable, and highly scalable applications for managing EHS compliance and tracking environmental emissions.

To meet the demanding requirements of its customer base, Locus Platform is a metadata-driven software architecture that enables multi-tenant applications. This paper explains the technology that makes the Platform fast, scalable, easy to configure and maintain, low-cost, and secure for any application.

Cloud computing

Cloud computing has revolutionized the landscape of the IT world by providing enterprise-grade computing resources that are affordable and instantly available. Clouds provide straightforward access to IT resources, allowing you to access as many resources as you need when you need them. The complexities of managing the many underlying mechanisms providing those resources are not the responsibility of your IT department.

Multi-tenancy

Multi-tenant architecture is the optimal technology to share IT resources cost-efficiently and securely. The multi-tenant design of a cloud service has a dramatic impact on the application delivery, cost, and productivity of the organization.

Not all services in the cloud are same, and some vendors are content to disguise their services—claiming to deliver the advantages of multi-tenancy while leaving their customers shackled by same limitations as on-premises hosted solutions. Hence, it is important for CIOs, CTOs, system architects, and developers to "look under the hood" of the cloud service to determine if it will truly deliver the advantages claimed.

The only successful and sustainable multi-tenant SaaS implementations are those architected as multi-tenant from the ground up.

Locus Platform architecture overview

Locus Platform is the proven cloud multi-tenant application development platform that powers our EHS cloud applications (Sustainability, Waste Management, Task Management, etc.). It also supports custom applications that our customers build to satisfy their specific business requirements, like collecting and recording water samples, tracking daily environmental logs, GHG management, air emissions, and water quality management. Locus Platform allows you to build your business apps on a single, secure, and scalable platform that's easy to customize and upgrade, without having to worry about anything breaking.

The following sections provide an overview of key aspects of the Platform's design.

Multi-tenant instance

The Locus Platform is a modern SaaS platform built on cloud computing, with multi-tenancy inherent in its design from the ground up. A quick way to understand what makes Locus Platform unique is to consider the following figure that shows a traditional application development platform:
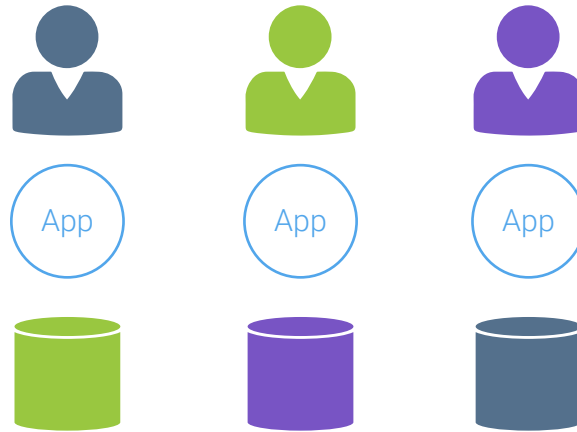
At the heart of all conventional applications is a relational database management system (RDBMS) used to support individual organizations' on-premises deployments.

Application servers and various services are built to support single-tenant applications. Without significant development efforts, using traditional applications to provide multi-tenant services is only possible with the help of hardware virtualization.

For vendors claiming to offer multi-tenancy and employing hardware virtualization, these are still isolated applications that have to be individually maintained and scaled. This solution is what the majority of vendors provide when offering their applications in the cloud. Compare that to the Locus Platform's multi-tenant approach:
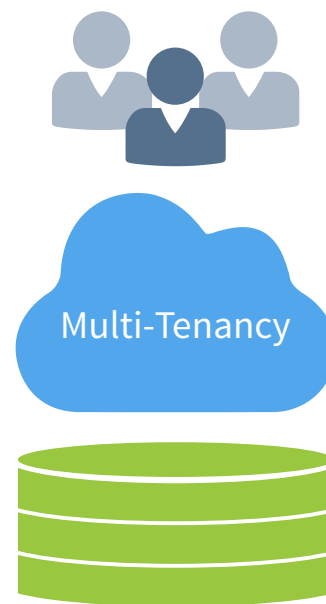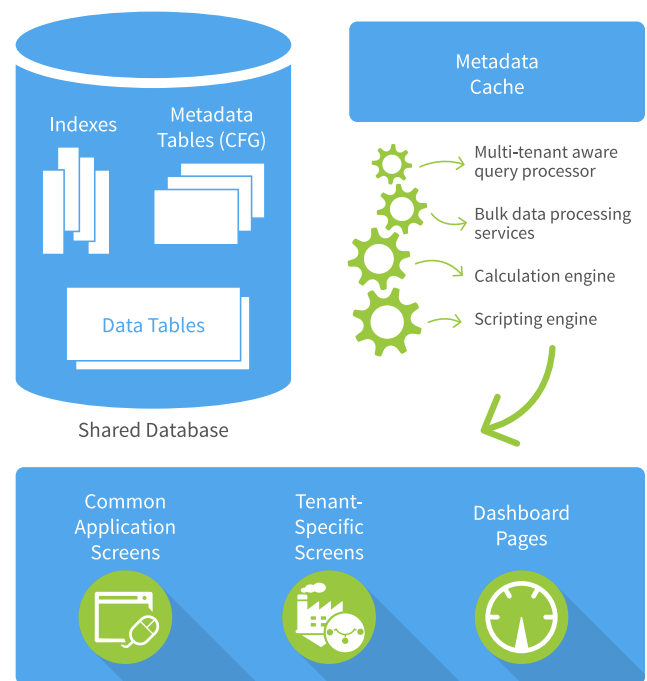
Locus Platform uses a custom-designed relational database schema, designed explicitly for clouds and multi-tenancy. Multi-tenancy is the architectural model that enables SaaS application vendors to serve multiple customers from a single, shared instance of the application. In other words, only one version of an application is deployed for all customers. These customers share a single, common infrastructure and base code that is centrally maintained. Importantly, customers never have access to each others' data, and each customer can configure their unique instance of the application to meet their specific needs.

The benefits of Locus Platform's unique architecture are extraordinary. Locus Platform is a proven, reliable, and secure cloud application development offering that serves thousands of users, all with exceptional performance and reliability.

Metadata-driven computing

The multi-tenant architecture provides a boundary between the platform and the applications that run on it, making it possible to create applications with logic that is independent of the data it controls.
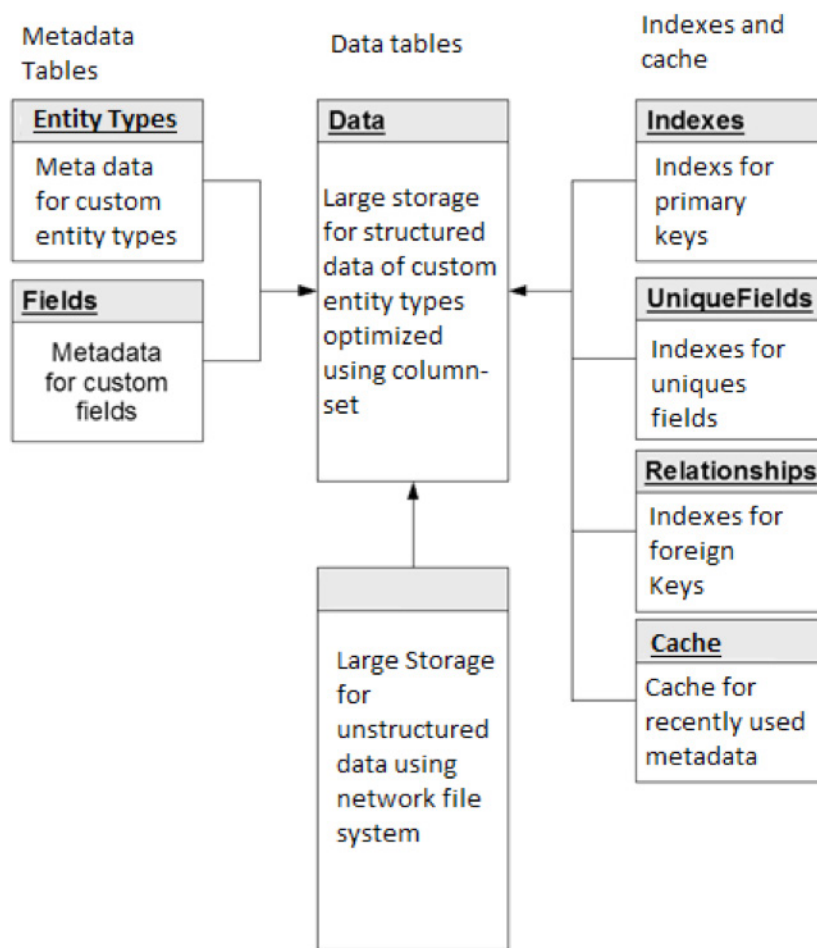
Instead of hard-coding data tables and page layouts, users define attributes and behaviors as metadata that functions as the application's logical blueprint. In contrast to conventional client/server applications, users in multi-tenant applications all share the same physical instance and version of an application. Individual deployments of these applications occupy part of the single infrastructure rather than separate physical stacks of hardware and software. It stores the metadata that defines each organization's business rules, fields used, custom forms, and interfaces to other systems. The application's metadata also includes any custom code for a given customer, ensuring that custom code for customers is separated and not shared with others - so customers are free to customize as needed to meet business needs without impacting other customers.

Indexes
Metadata Tables (CFG)
Data Tables
Shared Database

Metadata Cache
Multi-tenant aware query processor
Bulk data processing services
Calculation engine
Scripting engine

Common Application Screens
Tenant-Specific Screens
Dashboard Pages

Multi-tenant metadata tables

Locus Platform manages all metadata in tables prefixed by "CFG". Metadata tables are partitioned by tenant ID (TID); each tenant metadata is separate, and changes to one tenant do not impact the application of another tenant. Metadata defines application behavior like the UI layout, the fields on the form, the rules to render and validate data and the workflow, and security around processing data.

The figure below shows the relation of metadata tables with other objects in the database schema:

Metadata Tables

Entity Types
Meta data for custom entity types

Fields
Metadata for custom fields

Data tables

Data
Large storage for structured data of custom entity types optimized using column-set

Large Storage for unstructured data using network file system

Indexes and cache

Indexes
Indexs for primary keys

UniqueFields
Indexes for uniques fields

Relationships
Indexes for foreign Keys

Cache
Cache for recently used metadata

Multi-tenant data tables

Locus Platform stores all application-accessible data in tables prefixed by "DAT". This data maps to the entities and fields defined by the metadata in CFG tables. Each row in data tables includes a column identifying the tenant (TID) and the context for the data. The data tables have generic storage columns (e.g., string1, string2, etc.) that store various types of data that originate from different forms. The metadata provides meaning to the data stored in storage columns.

The figure below shows the relation between data and the metadata that defines the data:
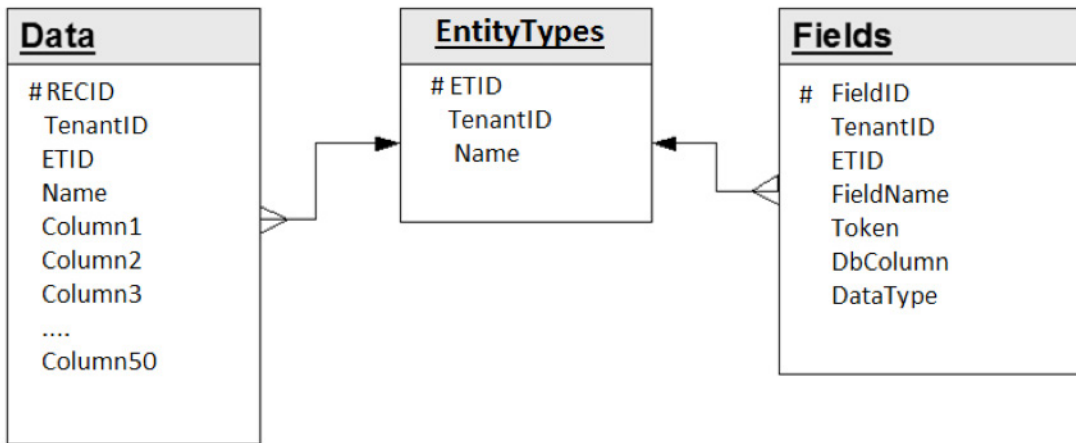
Metadata-driven data means no schema change is needed to customize or extend forms to hold customer-specific fields. For example, when you want to add a custom field to a form, only requiring a record added to the Fields metadata table specifying the storage column for that data.

Indexes

The database schema also includes indexes that optimize query performance for the data partitioned by tenant ID. The architecture further leverages RDBMS feature (where applicable) for efficiently accessing and processing data in the data model.

Application development

Developers can declaratively build server-side application components using the browser-based development environment, called the Locus Platform Configuration Workbench.

This point-and-click UI supports all facets of the application-building process. This includes the creation of an application's data model (entities and their fields, relationships), security and access model, user interface (data entry forms, dashboards, reports), process logic (workflows), and validation logic (business rules).

The following figure shows an example of a screen used to define the entity type:
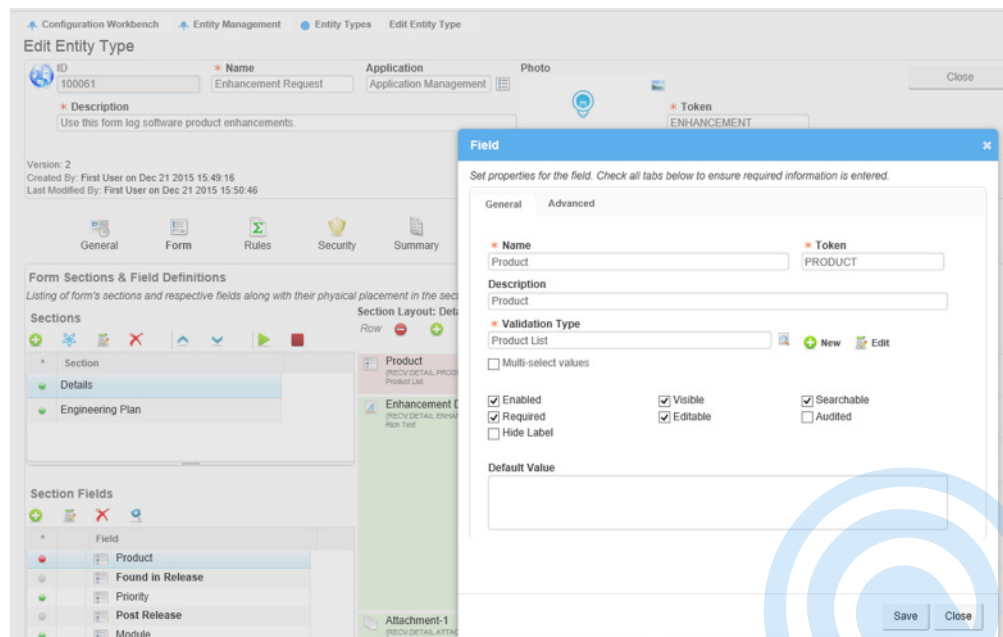
Application developers define workflows using a drag-and-drop process flow—no coding is necessary. Workflows define the actions that application users can take to transition the records through different states. Security rules on the workflow can define who can take a particular action on the record, and execution steps can be configured to trigger automation (such as sending messages or sending or receiving data from other applications through integration). This handy feature enables Locus' customers to build their own apps in a safe and controlled manner, enhancing the utility of the platform, without the need for trained software engineers.
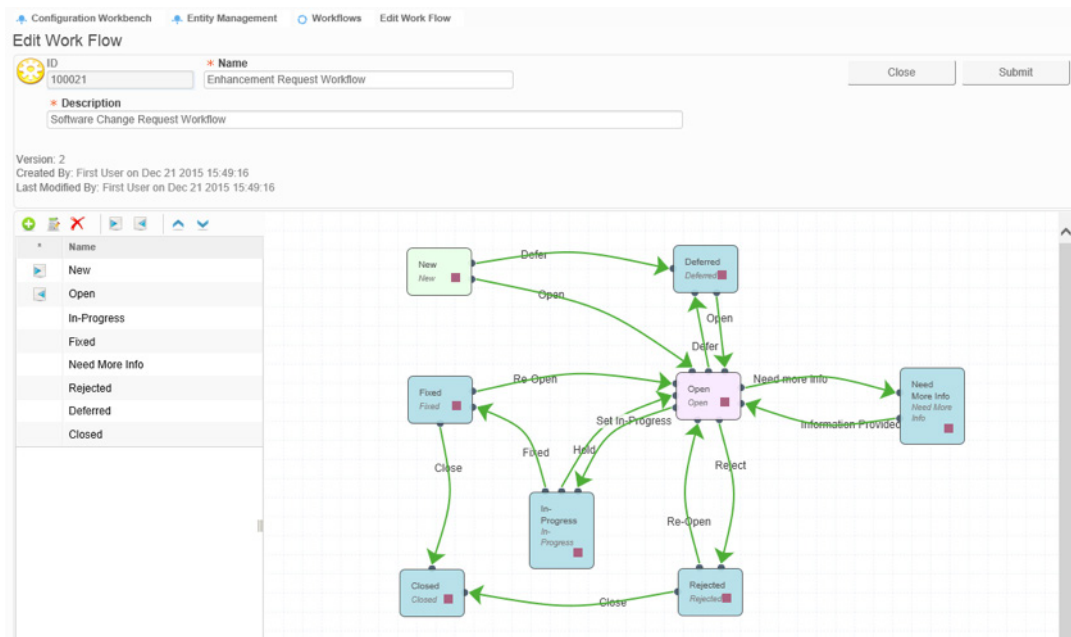
JavaScript code for business logic

Developers (or knowledgeable customers with Configuration Workbench access) can write custom rules and validation logic using JavaScript. There is no need to learn any proprietary language. JavaScript is a widely-used language that makes it very easy to modify application behavior to match the business requirements. Developers declare program variables and constants, execute traditional flow control statements (if-else, loops, etc.), perform data manipulation operations (insert, update, delete) and access special commands made available in the Platform to access data.

The code is stored as metadata and is loaded and interpreted at runtime.
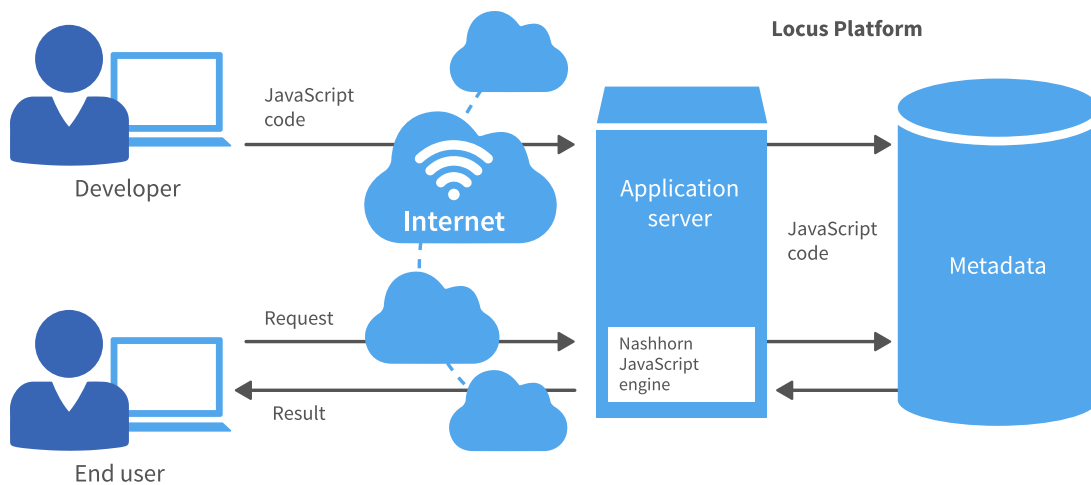
REST APIs

Locus provides open, standards-based REST APIs that developers can use to build apps. Using these various APIs, an application can do many things such as:

◇ *Create, read, update, and delete (CRUD) business data*

◇ *Manipulate metadata that describes an application schema*

# Transitioning to true multi-tenant SaaS

It should be apparent to most people that building a true multi-tenant SaaS platform from ground up is a huge effort. Locus has been delivering SaaS products since its inception and released its multi-tenant version of Locus Platform back in 2012. Legacy on-premises EHS software vendors are now realizing this inevitable trend and are attempting to jumpstart such development efforts through costly acquisitions and promoting hybrid connectors to integrate with their legacy on-premises systems. Such an approach will only increase the complexity and maintenance costs of the solution, while customers have to wait for years to realize the benefits of a true cloud platform—i.e., after a complete migration to the new applications in the cloud. It is also unlikely most vendors with an eye to the future will want to enhance their on-premises codebase going forward.

These software users do not have to wait another five years or more—they can switch today by choosing Locus to move their processes to the cloud. Hybrid cloud systems will only be a stepping-stone, and interim fixes will just add more overheads in an attempt to continue to deliver the product.

Summary

Locus Platform is a multi-tenant application platform built from the ground up to leverage cloud computing. This modern multi-tenant architecture makes upgrades very easy to deploy. It also addresses the scalability issues typically found in isolated applications. "Building from the ground up" does not happen overnight. It's a major development process, and any vendor claiming to have become magically "multi-tenant" overnight should be viewed with skepticism.

Only software offering true multi-tenant SaaS architecture will deliver the full benefits of the cloud technology revolution. Vendors often attempt to mislead customers by putting single-tenant applications in the cloud and then claiming they are a "SaaS-based solution". At best, these are the lower levels of multi-tenancy—but they are not true SaaS solutions. If an application is running in the cloud but does not meet the criteria of multi-tenancy, it will not deliver all of the celebrated benefits that make SaaS the revolutionary technology that it was meant to be.
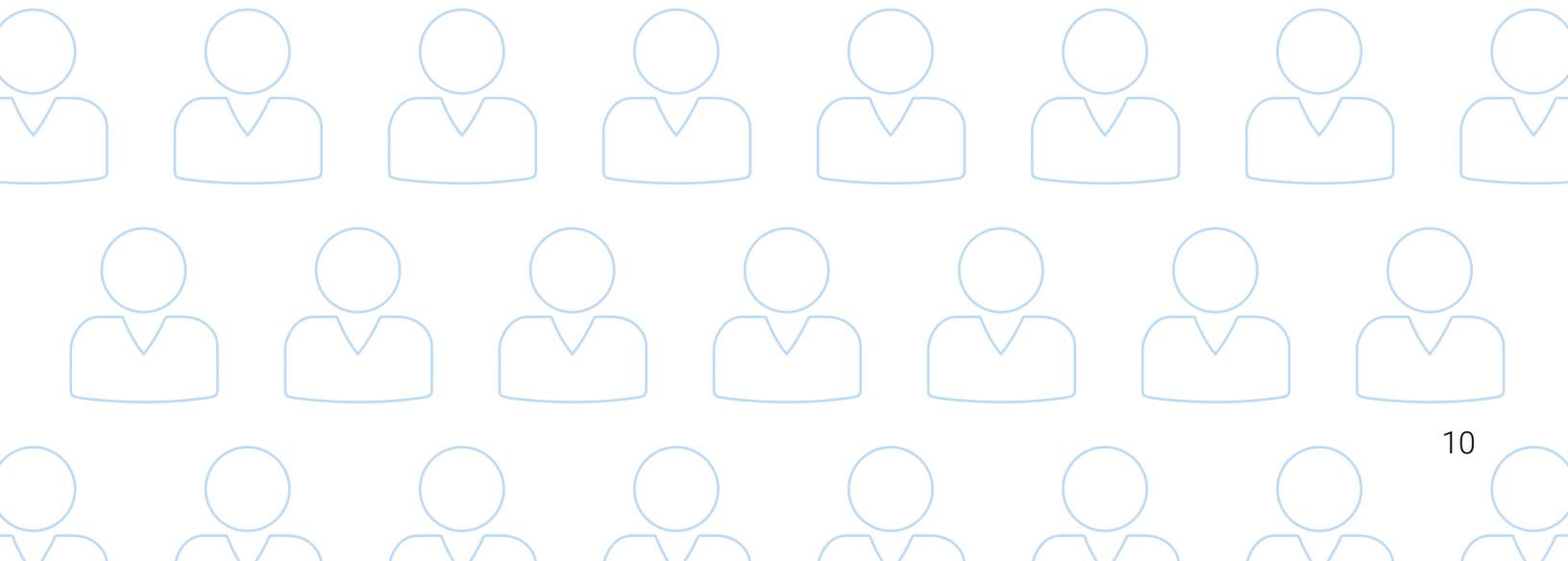
How can we help?

If you're looking for an all-in-one EHS solution you can count on, make sure to put Locus Technologies on your shortlist! Our fully configurable solutions for environmental, health & safety, incident reporting, air quality, waste management, sustainability tracking, and other compliance-related data are built to adapt to your business processes, down to the most specific state regulation or corporate metric.

Find out more about Locus, our service-oriented staff of engineers and domain experts, and why our EHS software is the solution you've been looking for:

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