White Paper

SpatialWorx Technology Overview

The solution for disconnected mobile data collection

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January, 2020

SpatialWorx Technology Overview

Abstract

The key problem with field data collection in both remote and urban locations is the availability of data networks to transmit and receive data updates from a single, authoritative, master data set. Most applications on the market are designed for "connected" data network availability to perform data collection, with "disconnected editing" a bolted-on afterthought. Alternatively, others are designed for "disconnected editing", with "connected editing" the bolted-on afterthought.

SpatialWorx is natively designed to work in both "disconnected" and "connected" scenarios with a simple administrative interface for single user or large workforce data collection efforts, and all sizes in between. As a hosted solution it avoids costly infrastructure acquisition and maintenance costs, allowing for rapid standup and operation for time sensitive data collection tasks. Since the app is designed for iOS, Android and Windows OS, it works for both BYOD (Bring Your Own Device) workforces as well as large-scale organization's managed device fleets. Taking advantage of message queue technology, all transactions are logged and queued for delivery to the master data set as well as to all individual worker's devices. This use of queued messages supports keeping individual devices synchronized as they move in and out of network.

SpatialWorx is built around four core components that make it a turn-key solution for your data collection needs.

1. ***SpatialWorx Console*** manages your data collection projects, users, access privileges, and data collection forms. It's easy to use, rapid design interface has a low learning curve and enables your projects to get in the hands of your workers rapidly.
2. ***SpatialWorx Portal*** is the gateway to your master data set via SpatialWorx Console, SpatialWorx Sync, SpatialWorx App, and OGC compliant data services for other authoritative business systems that need access to the data.
3. ***SpatialWorx Sync*** is a message queue based service framework that distributes and manages all network traffic between client devices and the master data store.
4. ***SpatialWorx App*** is the software work surface where the field data collection personnel do their day to day work with intuitive and easy to use forms and maps.

The SpatialWorx system is designed for your disconnected and connected field data collection projects in an easy to use, short lead time deployment scenario for locational accuracy and situational awareness. Our 3C workflows of Configure, Collect, and Collaborate will speed you to success. SpatialWorx is the right-sized and scalable turnkey solution for creating and increasing visibility for your collective operational landscape and objectives.

The Promises and Headaches of Field Data Collection

The Promises

Field data collection with mobile devices is rapidly becoming a necessity for all types of organizations. Paper and pen forms create significant time delays and transactional costs for organizations that are hanging on to outdated technology. Immediate feedback from the field, immediate feedback to the field, computerized dispatch, compressed project schedules, customer satisfaction, and branding are some of the reasons organizations are adopting field workforce automation. All of these are promised by products and platforms using slick presentations touting the next greatest technology. But what headaches are these really addressing for you without creating a myriad of additional challenges for your organization?

The Headaches

Jumping into field automation of your workforce takes a lot of expensive technology if you want to manage it in house. Servers, storage, networking, software development, software deployments, support and training, and the costliest, quality people to do it all. It is no small investment for an organization to implement their own home-baked solution.

To choose the best solution for your organization's needs you have to carefully consider and weigh the total cost of an in-house solution along with asking some hard questions about the nature of your data collection project and the operational area where it will occur.

Was the product designed for disconnected editing but my deployment scenarios are primarily connected cell data scenarios? Is the opposite true, and the solution designed for connected live data but the operational area for which the solution is needed has unreliable or no data networks available? How dependable is the cell data coverage in the operational areas is my organization inhabits? Are there urban canyons that block tower access or am I likely to be in the midst of carrier transceivers that are operating way beyond their capacity like Times Square on New Year's Eve, St. Patrick's Day in Savannah, or a championship game at a stadium?

It all makes the promises of field data collection begin to evaporate like a mirage, presenting an additional set of headaches.

The Solution

Fortunately, SpatialWorx has been designed from the ground up to address these headaches. SpatialWorx is natively designed as easy to use and to work in both "disconnected" and "connected" edit mode with a simple interface for a single user or large workforce data collection efforts and all sizes in between. SpatialWorx is a hosted solution that integrates easily with your internal business systems via Open Geospatial Consortium (OGC) compliant secured data services. These services also allow you to pull your data "as you go" or you can pull a final data dump should you stop using SpatialWorx. Users and devices can come and go, even between devices, and are easily managed. SpatialWorx's message queue technology is designed to handle millions of transactions a second, which also opens it up to the

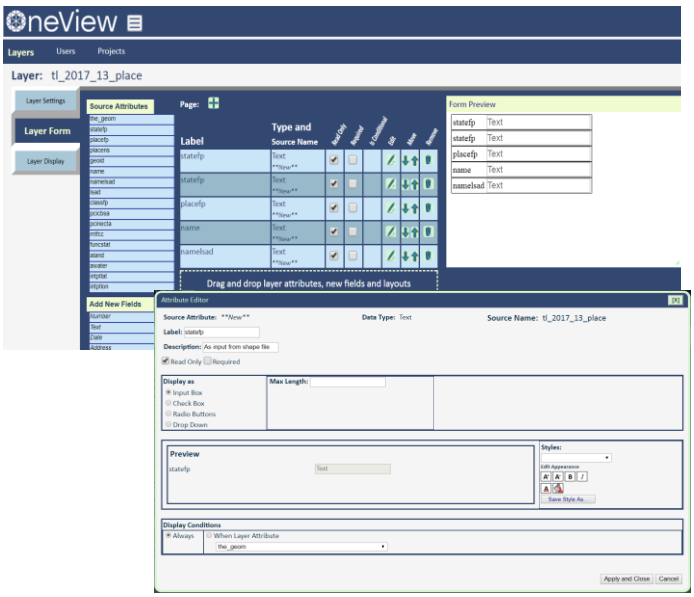
potential to manage the huge wealth of sensor data produced by Internet of Things (IoT) enabled devices.

SpatialWorx Components

Overview

As noted above, the SpatialWorx platform consists of four primary components that make it a turn-key solution for your data collection needs. These components work in concert to manage your projects, data, users, forms, maps, and the flow of information from/to external sources.

- ✓ SpatialWorx Console
- ✓ SpatialWorx Portal
- ✓ SpatialWorx Sync
- ✓ SpatialWorx App



SpatialWorx Console

The SpatialWorx Console is best thought of as the brain of the product. This brain tracks the three things necessary to have a web mapping product: Projects, Forms & Data Sources, and Users. Projects are groupings of field data collection tasks consisting of forms & data sources that are assigned to users according to their privileges, and as customized by you to meet your project needs. The robust form builder allows you to make sure you collect the data you need, while ignoring the data you don't. If you find that something was overlooked in your original project setup, not to worry! SpatialWorx's design allows you to easily update the forms and database to capture new data seamlessly with your field users. The SpatialWorx console allows for full map symbology editing and usage of your own custom icons that your user base is already familiar with so as to keep the training curve shallow and ensure the quickest user adoption. Picklists are easily created and updated to ensure the highest quality field collection and to lower the overall QA cost of the field collected data. Customized displays are fully configurable to allow executive dashboards to feed decision makers timely data all the way down to field supervisor data views for safety compliance. Consumable data sources allow you to import or connect to your own source data and include ESRI ArcGIS Server, WMS, WFS, WFS-T, geodatabase formats, Shapefile, KML, CSV, Excel, and most other vector formats supported by the Geospatial Data Abstraction Library (GDAL) toolset.

SpatialWorx Portal

The SpatialWorx Portal is the access gateway to connect to data from your office computers and internal expert systems that will use SpatialWorx Services, as well as the Sync that feeds the SpatialWorx app. By

using custom Data Adapters, the SpatialWorx Portal utilizes web services that act as a proxy to remote data sources such as relational tables, legacy system interfaces, and web services. The portal supports:

- Spatial RDMS statements: select, update, delete, create
- Provides support for the SpatialWorx API
- Monitors and submits messages to SpatialWorx Sync for distribution to affected devices

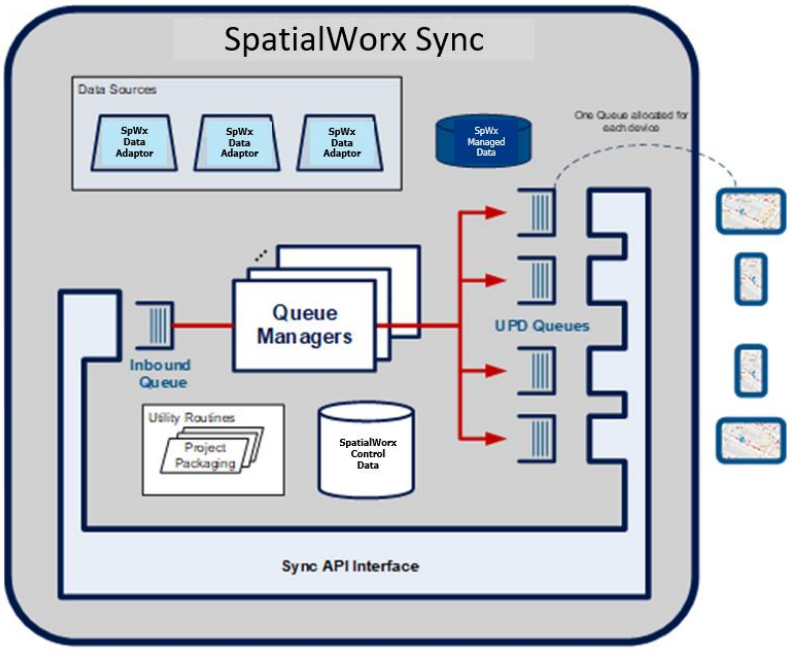


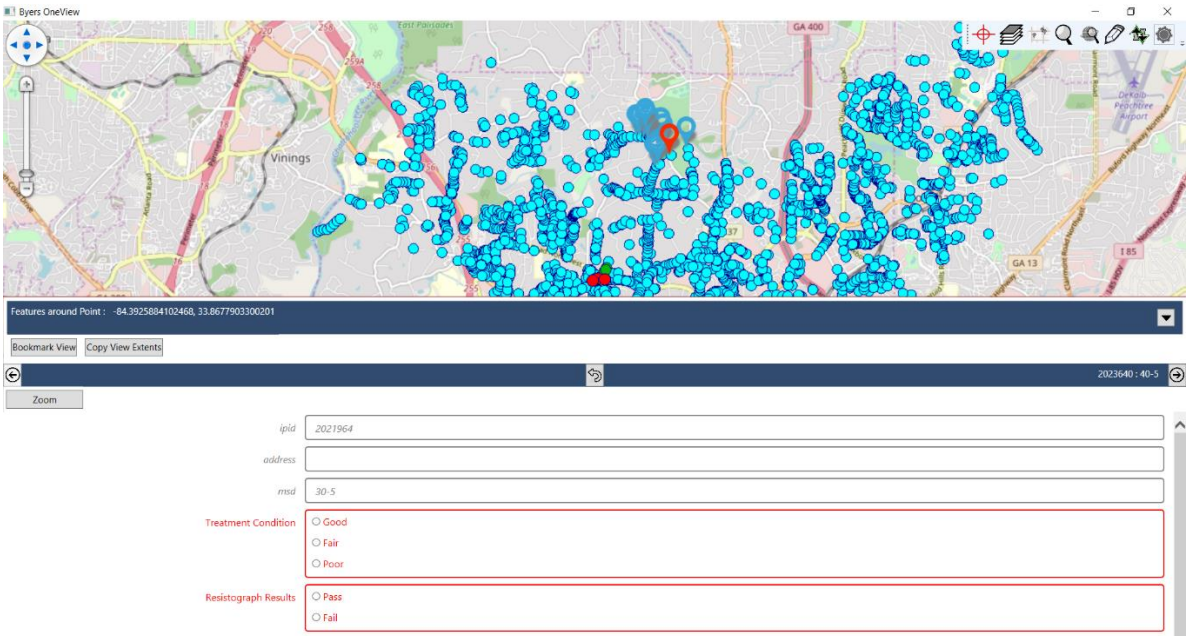
FIGURE 1

SpatialWorx Sync

The SpatialWorx Sync Service manages the swarm of messages and message queues that is the fundamental basis for SpatialWorx. SpatialWorx uses a queue based architecture (Figure 1) in a First In/First Out (FIFO) methodology. Each organization has a single inbound queue into the SpatialWorx Portal. Within each organization of SpatialWorx each unique combination of User/Device/Project has its own outbound queue which allows for device sharing among users.

Outbound queues are used by Sync to distribute the messages to the unique User/Device/Project combination.

SpatialWorx App



The SpatialWorx App is the field workhorse that has your custom projects, forms, and data on each user's mobile device. Updates are automatically delivered to the appropriate User, Device, and Project combination necessary for the field worker to perform optimally. MANHOLE is designed to be versatile and works on iOS, Android, and Windows devices. SpatialWorx forms are Html 5 / Javascript based and designed/built in the web console. The SpatialWorx App accommodates all the following connected and disconnected workflows:

1. Basic Map Functions
    a. Basemap switching
    b. Zoom, Pan, GPS orientation
    c. Feature Select, Query, Search, Annotation
    d. Measure
    e. Layer hiding, transparency, labeling
2. Permission based Feature and Attribute editing
    a. Collect, edit, move, and delete features and attributes based on permissions
    b. Console generated pick lists make field edits simpler and remove free type errors
    c. Free type fields are available as the project requires
    d. Rich media support for capturing photos, video, audio, and sketches

The Sum of the Parts – The Workflow

It is great to describe what's under the hood but what really happens when I get SpatialWorx? The most important thing we can convey is our 3 C workflow.

The 3 C Workflow: Configure, Collect, Collaborate

Configure

- Sign up for a new account (free trial or a paid subscription)
- SignIn to the SpatialWorx Console and create a project (or projects) by following these simple steps:
    - If you have your own data to make available to field users, select it as a linked source (via Data Adapters) or import it directly into SpatialWorx's cloud storage
    - If you don't have data to begin with, the Form Builder interface allows you to build forms from scratch for any data you want to collect – if you *do* have your own data, the drag/drop interface in Form Builder allows you to add any attribute data field to a form
    - Create a Project by defining any metadata pertinent to it (name, due date, geographic bounding area, etc)
    - Choose which data sources and forms to attach to the Project
    - Select the basemap(s) you want field users to see in the app
    - Define or refine symbology for each data source – these data sources now become distinct Map Layers in the App
    - Create users, specify their Roles (permissions, such as read-only, read/update/delete, create), and add them to your Project
- Save all Project configurations to make it Live
- Users who are added to a Project receive an email with instructions to download/install the App from the appropriate App Store (Apple, Google, Windows)
- Each user installs the App (if not already installed), signs in, and automatically has access to all the data & maps in any Project they have been assigned to

Collect

- Users open the SpatialWorx App and begin work to review or collect field data; additionally, if track logging is enabled the App also records the GPS points of the device location and transmits that information back to the master data set along with any feature updates

- As users are connected all data updates are passed between their device and the SpatialWorx Portal via SpatialWorx Sync – this includes data updates from all other users which are automatically distributed to every other user assigned to the same Project(s). When not connected, the SpatialWorx App patiently waits to get new messages and deliver its messages to the SpatialWorx Portal.

Collaborate

- SpatialWorx provides a collaborative environment where all system users are connected and share the same data sets and updates, additional data can be pulled in from multiple sources to facilitate a more productive exchange of ideas and information, and all system data can be readily exported or shared with other interested parties or affiliates.
- Additionally, rarely does a field data collection app nail the project requirements on its first iteration and project requirements are frequently subject to change. The beauty of SpatialWorx is that as organic collaboration happens and changes need to be made to accommodate new project needs, the configuration can be revisited at any time.

Bringing It All Together

Of course, there is much more to SpatialWorx than what we've described in this whitepaper. Subsequent topics will delve more deeply into various aspects of the product ecosystem and how they can address any issues you might have, from typical scenarios to others that are much more complex. The key take away is that SpatialWorx, above all else, is designed to be a versatile platform for effectively managing any location based data. And as a true SaaS (Software as a Service) solution its affordable subscription model ensures you only pay for what you need, for as long as you need it. And with a generous, no-cost trial period you can kick the tires with no obligation and see how SpatialWorx's best-in-class data collection and management platform can work for you.