

IO BOW GIS Architecture

Infrastructure Ontario

Version 1.1

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Revision History

#	Date	Author	Circulation List	Description of Change
1.0	Dec/2022	Esri	IO	Initial draft
1.1	Dec/2023	Esri	IO	Updates

1 Background

Infrastructure Ontario (IO) has commissioned Esri Canada for services related to supporting the Broadband One Window platform Team. This system named Broadband One Window (BOW) has been built by Planview and deployed with ArcGIS Online at its core, providing Software as a Service (SaaS) data management and map production, allowing integrations with 3rd party organizations data to support business operations. BOW is a unified system that leverage the modern out-of-the-box capabilities of the Esri ArcGIS Online platform. IO has requested support from Esri Canada to review BOW GIS current architecture state and provide guidance and recommendations toward a GIS road map which may include other deployment options.

1.1 Purpose

The purpose of this environment architecture design review and is to provide IO with an overall picture of BOW's current architecture and propose recommendations for a future state based on expected load and other technical aspects such as ease of deployment, development, and project life-cycle management.

1.2 Methodology

In November 2022, an Esri Canada Solution Architect worked with business, GIS, and IT resources to discuss BOW's development roadmap, current and target architectures. This discussion was to include the following topics:

- ▶ Review/confirm BOW's current deployment (SaaS deployments, AGOL, FME Server, web services, network, user distribution, etc.)
- ▶ Review IO's short-term and longer-term needs for BOW (growth, users, data, web apps, dashboards (if applicable), etc.)

The attendees for the calls/workshop sessions included:

Client (IO/Planview)	Esri Canada
Lisa Liang, Senior Advisor, IO	Parik Ranade, Project Manager
Eva Blackham, PM Consultant, IO	Juliano Kersting, Solution Architect
Rob Whitla, Consultant, IO/tantramar	Mark Lee, Senior GIS Consultant
Kris Philpott, Vice President, Planview	Andrew Timmins, GIS Developer
Tony Damico, Director GIS, Planview	Andrea Weston, Business Analyst
Michael Micallef, Manager GIS, Planview	
Scott Higgins, Project Coordinator, Planview	
Gustavo Grasser, Data Specialist, Planview	
Mack Khairi, Project Documentation, Planview	
Samuel, GIS Developer, Planview	
Wardah Rashid, Developer, Planview	

Table 1 - Workshop Attendees

2 System Architecture

This Section will contain the detail about components and architecture.

The diagram on Figure 1 shows BOW system, and main components and interfaces. Integration with 3rd party systems is currently limited to data synchronization processes which execute at the FME Cloud at various intervals including real-time notifications based on webhooks triggered by user activity.

2.1 System architecture Diagram

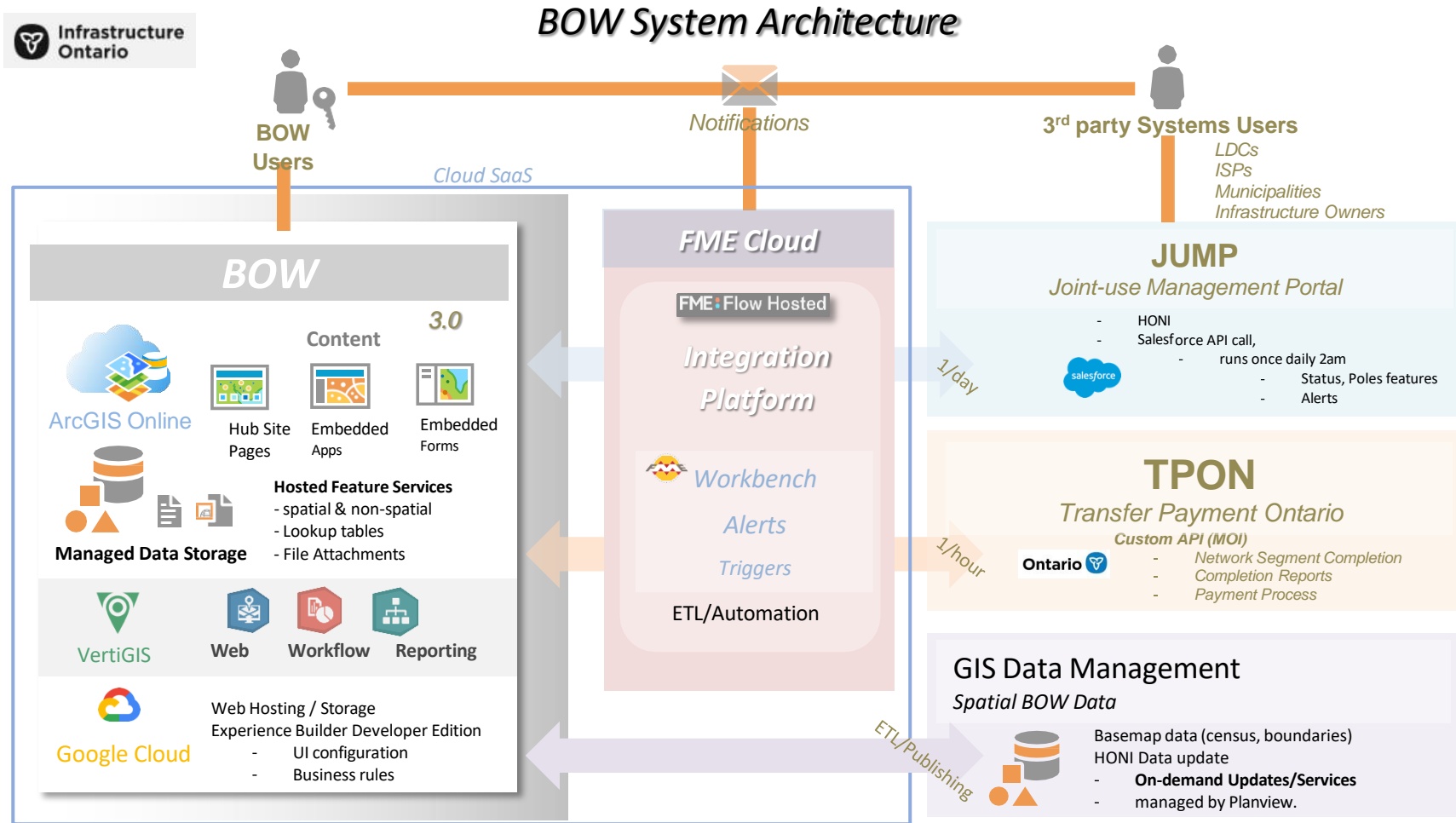


Figure 1 - System Architecture Diagram

2.2 GIS and GIS-Related Applications

The GIS and GIS-related applications supporting BOW are:

Application	Description	Users
ArcGIS Pro	Esri's 64-bit desktop GIS application for data editing, data management and analysis. Its usage is currently limited, but it is being leveraged by Planview for data management and publishing services to ArcGIS Online.	
ArcGIS Online	Esri's cloud-based solution for data visualization, data collection and collaboration. ArcGIS Online is heavily leveraged within BOW for its main interface and for a variety of business workflows. Currently there are no public facing workflows. It is set as the location which maintains and hosts: <ul style="list-style-type: none"> • All of Client's Esri mobile applications. • BOW's public-facing applications • Operation Dashboards for internal use 	
ArcGIS Survey123	Esri's field mobility, and web-based, solution for form-centric data collection. Survey123 needs to be hosted on either an ArcGIS Online or an ArcGIS Enterprise environment. It is configured against ArcGIS Online and used for various BOW's workflows. Traditional Survey123 forms are being replaced by VertiGIS workflows whenever possible to simplify security management.	
ArcGIS Hub	This is Esri's site building solution that enhances ArcGIS frontend experience. The Hub is currently configured for BOW and the public Landing Page, both of which are utilized as the front-end wrapper. Custom built web applications are embedded within hub pages to meet BOW's requirements.	
FME Cloud	Safe Soft's FME Cloud is a pay as you go option for FME that is used for BOW on many of its user-facing and data integration and administrative workflows.	
Web hosting	Web hosting for the web platform supporting BOW's custom web application requirements this includes ArcGIS Experience Builder Developer Edition applications built with embedded VertiGIS web viewers, reporting and workflows elements. Google is currently being used as production, while Azure web Application is being used in Esri Canada's development environment.	
VertiGIS Studio	VertiGIS Studio is heavily utilized within the BOW application, more specifically VertiGIS Studio Web, VertiGIS Studio Workflow and VertiGIS Studio Reporting which are used with ArcGIS Experience Builder to support custom workflows such as web mapping and reporting. The functionality provided by VertiGIS bridges the gap of out of the box ArcGIS online map viewers and apps.	

Table 2 - Application Summary

2.3 BOW Users and Workflows

The current expected user and groups for BOW peak when in the production environment are:

Group / Department	Group Description	Count
Municipal	BOW, Municipal Consent permitting.	444
LDC	BOW, 3rd party attachments.	66-67
TAT/IO	BOW, support requests, ISP reporting, dashboards (future), mapping.	15
ISP	BOW, support requests, all modules.	24-29
Admin/Interface	BOW, Admin tasks such as python, service account UAT, dev account, heaviest workflows.	6

Table 3 – User Groups Summary

2.4 Databases and Data Sources

Data Source Type	Data Description
ArcGIS Online (REST API)	<p>ArcGIS Online is used as the storage location for BOW data and content including administrative and internal and public workflows:</p> <ul style="list-style-type: none"> • Data that is collected in BOW. • Integration Data originating from other sources such as JUMP data and other ancillary datasets that are maintained by Planview on premises and refreshed into BOW as needed. • Basemap Data that is provided by ArcGIS Online for reference (Esri's Living Atlas)
HONI JUMP (Salesforce)	<p>Web API-level integration with Hydro One Networks (HONI) Join Use Management Platform (JUMP) BOW, base on Salesforce:</p> <ul style="list-style-type: none"> • Business data around permitting and attachments. • GIS data related to assets that are maintained by HONI.
TPON (Custom web API)	<p>Web API-level data Integration with TPON based on custom web API built by MOI/IO for this purpose. The integration was delivered as part of BOW 3.x</p>

Table 4 - Database and Other Data Sources

2.5 Production Environment

Current production environment was established and is maintained by Planview. Before being promoted to production, all application changes are developed and tested on Development and Environments respectively. The following components make up the Production architecture for BOW:

Component Name + Role(s)	Environment	Contents	Licenses
bow2.maps.arcgis.com <ul style="list-style-type: none"> ArcGIS Online Organization 	Production	<ul style="list-style-type: none"> Production ArcGIS Online Organization, owned and maintained by Planview on behalf of Infrastructure Ontario Landing Page reachable from https://onewindow.ca redirects to a public accessible hub site: https://ahsip-landing-bow2.hub.arcgis.com/ Main BOW's interface link is available and reachable from the Landing Page Site https://bow-bow2.hub.arcgis.com/ All BOW production data and main artifacts including, Hub site, VertiGIS components, and documents reside in ArcGIS Online Custom Domain: https://www.onewindow.ca/ 	500+ User Types
storage.googleapis.com/onewindow-347720.appspot.com/prod2-0 <ul style="list-style-type: none"> Google Cloud Hosting 	Production	<ul style="list-style-type: none"> Google Cloud Hosting Experience Builder Developer Edition applications <ul style="list-style-type: none"> Performs, on-the-fly map and user authentication changes. Embedded VertiGIS Studio components (Workflows and Web Viewers) 	Google API storage
https://notify-testplanview.fmecloud.com/ <ul style="list-style-type: none"> FME Cloud 	Production	<ul style="list-style-type: none"> FME Flow Cloud <ul style="list-style-type: none"> Used for performing automation and ETL tasks, send alerts, handle webhooks, etc. 	

Table 5 - Production Environment components

Production Architecture Notes:

- ▶ Production architecture is currently based primarily on SaaS Components. To allow separation of environments a separate ArcGIS Online Organization was created for PreProd and for Development. The FME Cloud Environment is the same for Production and Preproduction.

2.6 Pre-Production Environment

Preproduction architecture is similar to production and currently managed by Planview who keeps the latest application updates within this environment and allow Esri Canada to access current and updated preproduction items through a Partnered Collaboration established between the Dev and Preprod organizations.

This organization named PvPreprod (<https://pvpreprod.maps.arcgis.com>)

For the

Component Name + Role(s)	Environment	Contents	Licenses
ArcGIS Online Organization pvpreprod.maps.arcgis.com	Pre-Production	<ul style="list-style-type: none"> ArcGIS Online Organization was created to serve as a development environment on which changes will be made and once tested and approved, moved to the production organization/ environment. There is a Partnered Collaboration between this organization to Esri Canada allowing access to shared items. Preprod landing page hub site https://ahsip-landing-PVPreProd.hub.arcgis.com/ Prorprod Bow url: https://bow-esri-ui-pvpreprod.hub.arcgis.com/ Custom Domain configured: https://bow-preprod.onewindow.ca/ 	5 user types
Web Hosting https://storage.googleapis.com/pvpreprod_21/	Pre-Production	<ul style="list-style-type: none"> Google Cloud Hosting Experience Builder Developer Edition <ul style="list-style-type: none"> Performs, on-the-fly map and user authentication changes. Embedded VertiGIS Studio components 	
https://notify-testplanview.fmecloud.com/ FME Cloud	Pre-Production	<ul style="list-style-type: none"> FME Cloud hosts the preproduction and is shared with the production host Used for performing automation and ETL tasks, send alerts, handle webhooks, etc. 	

Table 6 – Pre-Production Environment components

2.7 Development Environment

Esri Canada has a current Development environment which is synchronized to Preproduction made available by Planview through partnered collaboration in ArcGIS Online. This developer organization Organizations that serve different purposes.

Component Name + Role(s)	Environment	Contents	Licenses
ArcGIS Online Organization esricao.maps.arcgis.com	Development	<ul style="list-style-type: none"> This ArcGIS Online Organization was created by Esri Canada to serve as a development environment on which changes will be made and once tested and approved, moved to the pre-production organization/ environment. 	10 User Types for development
Web Hosting https://storage.googleapis.com/pvppreprod_21/	Development	<ul style="list-style-type: none"> Google Cloud Hosting Experience Builder Developer Edition <ul style="list-style-type: none"> Performs, on-the-fly map and user authentication changes. Embedded VertiGIS Studio components 	
https://esrica-io-integration-dev.fmecloud.com/fmeserver/ FME Flow (FME Server) instance	This is the server endpoint that hosts the Integration workflows (workbenches) published from FME Form	<ul style="list-style-type: none"> Esri Canada Development 	1 pay as you go server

Table 7 - Development Environment components.

2.7.1 Release Management

Currently in BOW release management is controlled by Planview. Changes first are deployed in Preproduction and then tested and promoted to Production environment.

Change log for each version can be found on a change log managed by Planview on the following Smartsheets link:
<https://app.smartsheet.com/sheets/wGpfQvp3PW4hp7cXQVvhFFH363VGpJ8qf36F7fp1?view=grid>

2.7.2 Integrations

There are currently two major system integration within BOW.

1. BOW - HONI JUMP
 - a. Involves a daily data synchronization between BOW and HONI Jump which is executed at FME Cloud level. This synchronization is one way, from JUMP to BOW and is dependent on users entering a BOW identifier in JUMP. This is also known as HONI MVP+ integration.
 - i. This integration is currently being expanded to accommodate new requirements and allowing a much more robust two-way integration with real-time data updates and supporting cloning for JUMP initiated workflows. This integration also allows for real-time data access and alerts based on activities from the Jump system.
2. BOW - TPON
 - a. Transfer Payment Ontario (TPON) integration with BOW enables the two applications to communicate on deliverables related to Network Segment completion and payment, project completion and payment, and monthly availability payment. The TPON system will issue payments to the ISP based on MOIs approval of the information sent by BOW.
3. Power BI – one way integration point.

2.7.3 Security

Currently security is based on ArcGIS Online portal model which relies on built in accounts and groups created within the ArcGIS system. Feature service views are shared with the groups and user membership to groups is what makes data available to specific users.

Integration security is based on OAUTH, which handles API access.

See [BOW -TPON Integration Security Assessment - 1.0.docx](#) for more detailed information around security

Data Level Security

2.7.4 Customizations

ArcGIS Experience Builder Developer Edition is currently used within BOW to provide customized interfaces that allow the BOW application to adapt services and maps according to signed in user, which allows for a more streamline application architecture.

The Experience builder apps contain also embedded (iframe) VertiGIS Studio Web applications, which are used to host VertiGIS Studio Workflows that a help meet user business requirements and allow for custom map-centric workflows such as selection, search, spatial components etc. VertiGIS Reporting is also used to provide printable reports and data exports, which are business requirements.

2.7.5 Network and Sites

Currently most BOW architecture is based on Internet Accessible SaaS components. The non-SaaS components would be the web applications hosted on Cloud hosts and FME Cloud which although the name suggest is not a fully SaaS software as a dedicated instance is created for each project, which requires system updates to be applied by the team much like an IaaS model. The diagram below illustrates the network connection points.

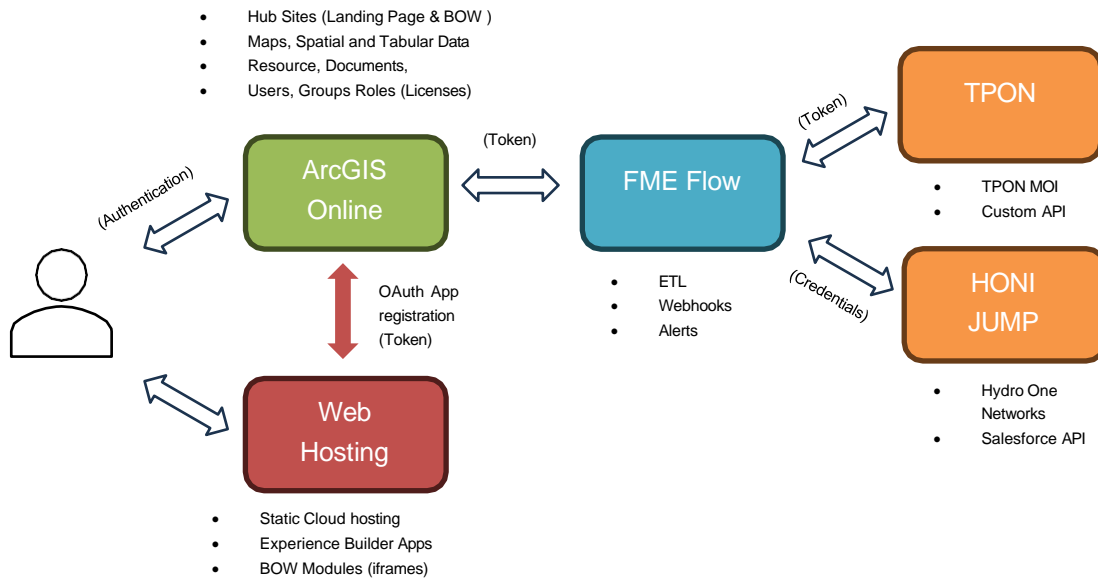


Figure 2 - Network and SaaS sites

2.7.6 Licensing

Planview controls all production licenses on behalf of IO. Esri Canada has replicated the complete environment to allow development on its own environment.

2.7.7 Service Levels

The BOW solution uses a combination of SaaS IaaS and Cloud hosting. Each stack from different vendor has its own service levels. ArcGIS Service Online is the main system of record and hosts all maps and data for BOW¹. Service levels can be found on <https://trust.arcgis.com/en/documents/G-632%20Svc%20Lv%20Agmt.pdf>

2.7.8 Backups and Recovery

Planview controls all production activities regarding taking active backups of bow data, more details of this procedure can be found in the document: Information on BOW Backups.docx.

¹ There are no single points of failure in the solution due to inherently resiliency of SaaS and cloud webhosting.

2.8 Notes

Issues reported during initial testing and after production deployment of versions 1, and 2 of BOW relate to:


1. ArcGIS Online
 - a. Poor performance on some services (was evaluated and improved upon)
 - b. Difficult or cumbersome administration (this is due to may SaaS mixed model)
 - c. Complicated environment separation (DEV/TEST/PROD)
2. BOW
 - a. User interface with basic UI/UX for the main production applications
 - b. Inefficient user workflows requiring too many click to perform simple BOW tasks.
 - c. Long waiting times for certain seemingly simple tasks
 - d. Some modules are embedded iframes and some require opening within a new window which affects user experience and seems disconnected from main application pages.

Appendices



Appendix – Documents

Appendix – Related Documents

- ▶ [ArcGIS Online Cloud Security Alliance Answers](#)
- ▶ [ArcGIS Secure Mobile Implementation Patterns Whitepaper](#)
- ▶ [Data in ArcGIS: User Managed and ArcGIS Managed](#)
- ▶ [Architecting the ArcGIS System: Best Practices](#)
- ▶  [Information on BOW Backups.docx](#)
- ▶ <https://trust.arcgis.com/en/documents/G-632%20Svc%20Lv%20Agmt.pdf>
- ▶ [BOW -TPON Integration Security Assessment - 1.0.docx](#)