

## GIS Professional Development

### 1. How can I quickly expand my ArcGIS skills?

Learn ArcGIS offers guided tutorials and workflows based on real-world problems that new and experienced users can use to evaluate, apply, and understand the value of ArcGIS products and key workflows. On this site, you can explore hundreds of resources and interesting paths that you can follow to get started using ArcGIS right away.

Most paths can be performed in a few hours or an afternoon. Here are some useful, hands-on learn paths that enable you to get started with various aspects of ArcGIS:

Brand new to GIS? Start on this New User page dedicated to your on-boarding experience to ArcGIS.

No time? Check out this quick-lesson series: Make a map in a minute.

Try the new Map Viewer in this set of scenarios; you will become familiar with and comfortable using the next evolution of ArcGIS Online.

Are you an Analyst or Data Scientist interested in incorporating spatial data, tools, and algorithms using Python and R into your workflows? Visit this curated page for current and future spatial Data Scientists.

To get started using ArcGIS Pro now, see Try ArcGIS Pro to get going right away.

(By the way, you may want to check out this recent book about moving to ArcGIS Pro by the award-winning author Marybeth Price.)

Health professionals and academics can follow the exercises here to develop expertise in innovative technology; connect maps, apps, data and people; and make more informed health decisions.

Check out this Introduction to Imagery and Remote Sensing curriculum for your classroom, help your students learn to prepare and render imagery, work with lidar and drone data, analyze multidimensional and temporal data, extract information from remote sensed data, and more.

### 2. How can I grow my career as a GIS professional?

GIS offers many potential paths you can follow to further your career. We recommend a solid education embracing science, the arts, or a professional degree along with technology training. There are many colleges and universities worldwide that offer professional and advanced degrees in GIS.

If you want to evaluate, try, or apply a new product to an interesting workflow, try some free, hands-on, self-paced learning opportunities at Learn ArcGIS.

To grow your skills more deeply, track your training, and engage in certified professional development, take advantage of all the resources available at Esri Academy, including instructor-led classes, MOOCs, web courses, videos, white papers, and more. Esri Academy also offers learning plans, which are a great tool to continually grow your knowledge on topics that interest you.

We also highly recommend that you pursue technical certification with our software. Certification validates that individuals have the technical knowledge required to become strong GIS practitioners and offers a competitive advantage to organizations using ArcGIS. Read the Q&A on certification to learn more.

To keep up with new developments in GIS and the geospatial industry, find out about the latest developments in Esri technology and where it is headed, and learn about the innovative work of your professional peers, subscribe to ArcNews and ArcUser magazines. Both are available to you in print and online at no charge.

Finally, get connected to other users via user groups. These meetings include the annual Esri User Conference, our developer summits, as well as numerous regional and community events throughout the year. The online Esri Community also provides an effective and fun way to connect digitally with many users.

### 3. How can I keep up with developments in GIS, in Esri technology, and learn about what other GIS professionals are doing?

Esri offers four publications that you can subscribe to free of charge. These publications will help you keep current on developments in the rapidly changing GIS industry.

ArcNews celebrates the achievements of users through stories supplied by them. It is the source for news on the latest developments in Esri technology. It also highlights educational resources and employment opportunities at Esri. It is available in print and online editions.

ArcUser is for people who use Esri software whether they are GIS professionals, GIS managers, GIS developers, students and professors in GIS programs, or researchers who use GIS. It features articles that demonstrate examples of outstanding implementations of GIS, innovative applications of geospatial technology, and best practices. For developers, the magazine highlights the newest capabilities of Esri's developer tools and developer programs. ArcUser also supports the work of GIS managers and educators. It is available in print and online editions.

ArcWatch is a monthly publication targeted at new or casual users of GIS. Each issue contains the most recent news on developments in Esri technology, examples of outstanding or innovative implementations of GIS, and links to educational and other resources from Esri. It is available as an email newsletter and website.

Esri Globe is a weekly email newsletter that provides a curated collection of links to articles, blogs, podcasts, and videos on geospatial technologies presented in a simple text format that is easily read on a smartphone. The target audience is tech-savvy executives, CxOs, managers, GIS professionals, and others who want to keep up with the constantly evolving world of all things geospatial. Visit Esri Globe to read the latest issue and subscribe.

#### 4. How does Esri support professional standing through certification?

Esri's [Technical Certification Program](#) supports GIS practitioners, students, and other professionals using ArcGIS by validating their knowledge and skills applying GIS concepts, ArcGIS Pro, ArcGIS Online, ArcGIS Enterprise, and focused technology products related to ArcGIS.

For first-time job seekers, established professionals, and those forging a new path after years in the workforce, the process to achieve an Esri technical certification hones time management, analytic, and problem-solving skills. Together with proven technical expertise, these skills build credibility with decision-makers and hiring managers.

For organizations that rely on Esri technology, certification simplifies the hiring process by helping hiring managers quickly identify qualified candidates for key technical positions. Supporting professional development with certification is a valuable tool to motivate and retain talented team members.

#### 5. As a GIS professional how can I volunteer my skills to help make a difference in the world?

There is a variety of organizations that help facilitate applying your GIS expertise as a volunteer. They include

[GISCorps](#) is a program of the Urban and Regional Information Systems Association (URISA). GISCorps coordinates short term, volunteer GIS services to underprivileged communities and in support of conservation programs worldwide. Their services support conservation, humanitarian relief, community development, local capacity building, health, and education. Through the GIS Service Pledge, GISCorps—supported by Esri volunteers— can identify, design, and manage their own project supporting an organization, community, or cause that matters to them.

[The Society for Conservation GIS \(SCGIS\)](#) is a nonprofit organization that assists conservationists worldwide in using GIS through communication, networking, scholarships, and training.

[Map Action](#) is a UK-based humanitarian mapping charity that works through skilled volunteers to provide support after disasters around the world.

Esri provides software and technical support to these and other organizations to support volunteers. Learn more by visiting the [Esri Special Programs website](#).

#### 6. Can you describe the relationship between the GIS professional and the data science community?

While many data scientists view GIS as a parallel field, we increasingly see these fields growing together and evolving more closely over time. In many ways, GIS professionals are leading the world in the emerging field of spatial data science. GIS analysts apply the same analytical patterns of data analysis as traditional data scientists, yet, they also have the capacity and insight to amplify their analytical expertise and data science using GIS as a catalyst.

GIS is well known for its ability to integrate and analyze many types of data and the ability to more creatively explore and represent vast amounts of information using maps to discover patterns and insights, affecting our capability to understand, interpret, and draw meaningful conclusions.

Scientists everywhere are becoming more aware of the interpretive power and intuitions that are communicated through the spatial analytics and maps generated in GIS. At Esri, we are continuously investing in world-class, spatial machine learning and AI, building new tools and technologies based on the latest trends in algorithms and computational approaches.

GIS has always been about spatial modeling and analysis. For over 10 years, ArcGIS analysts have been using Python, a key data science language, to perform analysis and to more deeply understand the world's most complex problems. ArcPy was built to allow for modeling and scripting of these complex workflows, and so that GIS analysts could extend their GIS with their own analytical capabilities. Building on the importance of Python, ArcGIS has been extended to include ArcGIS Notebooks and the ArcGIS API for Python. These capabilities provide powerful opportunities for increasing collaboration between the data science community and GIS professionals.

We think that many GIS practitioners seek to grow professionally as spatial data scientists, extending the disciplines of data science, statistics, and machine learning, with advanced GIS modeling and interpretation. We see a number of key aspects in this discipline of spatial data science that are supported by ArcGIS, including:

**Data Engineering:** Use out-of-the-box tools and data science libraries to read, transform, clean, and enrich your data, preparing information for advanced spatial modeling.

**Visualization and Exploration:** Create beautiful interactive maps and dynamic charts to visually explore and interpret your data.

**Spatial Analysis:** Bring location into your analysis. Tap into over 1,500 analytical tools within ArcGIS and integrate packages from the broad data science ecosystem such as the R statistical computing package.

**Machine Learning and AI:** Easily integrate location into machine learning models to solve complex spatial problems. Apply spatial analysis based on machine learning tools within ArcGIS.

**Big Data Analytics:** Turns massive spatial data into manageable information. Analyze and display large volumes of data as it streams into your ArcGIS modeling environments.

**Modeling and Scripting:** Automate processes and extend functionality using ArcGIS, Python, and other data science packages.

**Collaboration:** Effectively communicate and share complex analysis results through beautiful maps and apps.

**Integration with game engines** such as Unity and Unreal for interacting with real worlds and virtual worlds built from ArcGIS.

Visualize and explore analytic results in ArcGIS. Use 2D and 3D maps (as well as time-enabled displays) to explore and interpret spatial modeling results. Use smart mapping methods to discover patterns and insights from your analysis results.

ArcGIS supports broad user needs with a critical focus and guidance on solving complex spatial problems. We expect that our users will continue to evolve their knowledge and skills with the ArcGIS collection of cutting-edge analytic methods, algorithms, computing architectures, and modeling paradigms. Esri's intention is to share these with professional colleagues throughout the data science world.

## 7. As a GIS professional what scripting language should I invest in (Python, JavaScript?)

Python is the core scripting language for ArcGIS. People use Python to build models, script workflows, and automate various aspects of their job. At the engineering level, Esri is increasingly exposing our technology to this scripting environment and enabling ArcGIS to support open scripting through the ArcGIS API for Python and Jupyter-based ArcGIS Notebooks.

JavaScript is the primary scripting language for building web applications. If you have a requirement to build applications for the web, the ArcGIS API for JavaScript is our premier API for building powerful, custom GIS apps that run in the browser. It offers capabilities for building compelling apps that let users visualize your data in 2D and 3D and gain insights with location intelligence.

Another language to consider is ArcGIS Arcade, a portable, lightweight, and secure expression language written for use with ArcGIS. Like other expression languages, it can perform mathematical calculations, manipulate text, and evaluate logical statements. It also supports multi-statement expressions, variables, formatting, and flow control statements. Arcade was designed specifically for creating custom visualizations and labeling expressions in ArcGIS. It allows users to write, share, and execute custom expressions in ArcGIS Pro, ArcGIS Runtime, ArcGIS Online, and ArcGIS API for JavaScript. See the ArcGIS Arcade website for more information.

## 8. What is a good way to start learning about using Python with ArcGIS?

The following Python books by ArcGIS author Paul Zandbergen are a good place to start:

- Python Scripting for ArcGIS Pro
- Advanced Python Scripting for ArcGIS Pro

You can read this [Blog article](#) to learn more about these books.

For a quick and easy introduction to Notebooks in ArcGIS Pro, try this 30-minute Learn tutorial:

- [Get started with notebooks in ArcGIS Pro](#)

## 9. As a GIS professional, how can I use ArcGIS to extend the reach of my GIS?

Every GIS manager needs a geospatial strategy that considers how people, process, and technology can best be leveraged to extend the reach of your GIS in their organization. That strategy should consider the key needs and priorities of the organization, and GIS managers should work to execute on that strategy for their stakeholders. There are now more tools, solutions, apps, and ways to solve problems with GIS than ever before, and a geospatial strategy can help you figure out where to start.

Tools like ArcGIS StoryMaps, Dashboards, and simple web maps are dramatically expanding our field and who accesses GIS daily. The open and comprehensive nature of ArcGIS makes it easier than ever to create and share your work as useful, interactive GIS maps, data layers, and analytics. The Web GIS pattern means that all of the advanced geographic intelligence that you create as data, maps, and analytical models can be mashed up and delivered as online maps and apps and shared with others who can put them to work—both within your organization and beyond. The

people who need your information can work with easily configured apps on their computers, tablets, and smartphones to leverage your geographic information in their work.

In other words, GIS professionals who understand the needs of their organizations can provide key information to the right audience. Knowledge workers, executives, citizens, developers, and other GIS users can build upon and leverage your work, extending the reach of GIS in a meaningful and impactful way.

10. As a GIS Manager, how can I educate leaders at my organization about the value of our geospatial applications and expanding their use?

We suggest you start by sharing specific business impacts of your GIS applications (while avoiding the use of technical terms and details unless they are asked for). Impacts could be reduced labor costs, faster turnaround on maintenance crew work orders, and so on. “Speaking their language” is a good strategy to gain the attention and support of leaders.

For an in-depth discussion on how to get and sustain leader support for your initiatives and deploy collaborative ways to gain interest from multiple departments within your organization, attend the Adoption Strategies: Preparing Your Organization for GIS session (Tuesday, July 12 at 2:30pm SDCC Room 15 B).

Esri also offers [people-focused change management solutions](#), including workshops, coaching, and consulting, to help organizations proactively plan and deploy an effective adoption strategy when implementing new ArcGIS capabilities.

11. Can I learn more about how to create a geospatial strategy at UC?

Yes. There are many resources at UC that can help you review your existing strategy or learn more about developing and executing one. Here are some user sessions to explore:

- Expo Spotlight Talk: Geospatial Strategy: A Brief Introduction
- Defining and Implementing Your Geospatial Strategy
- GIS Managers Special Interest Group (SIG)

You can also meet 1:1 with a strategy consultant to discuss how to get started or review an existing strategy. Follow this link to [sign up](#).

## ArcGIS

### 1. What are the latest trends and innovations in ArcGIS technology?

Esri continues to advance GIS and ArcGIS technology by expanding core capabilities, modernizing deployment patterns, and improving workflows to support GIS users and enhance the impact they are having on their organizations and the communities they serve.

Here we highlight the trends and innovations we are seeing.

**Increasingly Interconnected:** The ArcGIS system provides an ecosystem of technology that's increasingly embedded across organizations, whether it's through millions of desktop users or hundreds of thousands of servers or the cloud environment that serves millions of users. ArcGIS is designed as one system, which allows it to connect as a system of systems to provide the geospatial infrastructure that allow agencies and companies to work together through collaborative workflows.

GIS extends beyond the ArcGIS system through open standards and open architecture to connect to many more systems, such as CRM, ERP, BIM, and many more. The cloud has strengthened the interconnectedness of geospatial infrastructure, within and between organizations.

**Portals Organize Shared Geospatial Services:** Services delivered via portals are the next generation of enterprise GIS. Portals bring together different departments and agencies, organizing data around common challenges. Portals allow information that is created and maintained by a trusted authoritative source to be brought together, organized for a specific purpose, and repurposed through apps that combine data from many services.

**Integrating All Types of Data:** All kinds of data, such as vector, tabular, business, raster, real-time from IoT sensors, 2D, 3D, big data, and graph databases can be integrated and consumed from internal or external data sources through web services. ArcGIS allows a wide mix of heterogeneous data to be viewed on shared maps and to be analyzed to enhance understanding.

**Ready-to-Use Content:** Geographic data is becoming more ready to use. ArcGIS Online contains petabytes of basemaps and imagery in the Living Atlas giving users the ability to build authoritative maps with data from many sources including our users. Esri partners are also making their data more accessible to extend the possibilities for users and organizations to tap the most authoritative sources of data to guide decisions.

**ArcGIS Apps Are Pervasive:** Users are increasingly packaging their data and analysis in interactive web-based apps that address specific questions or are tuned to specific workflows.

In many cases, interactive maps are the app. They allow users to explore and answer questions, they tell a story to inform the public, and the end-users of the app don't require any software beyond a web browser to view and interact with map-based apps. This technology is changing the way we understand and work with maps.

Then there are the ArcGIS apps that help users collect data and display their own interactive maps. For example, ArcGIS Field Maps, ArcGIS Survey123, ArcGIS Dashboards, and ArcGIS StoryMaps.

In addition, users can build their own apps using a low-code approach using app builders like ArcGIS Experience Builder and AppStudio.

Advances in Spatial Analytics: ArcGIS is a comprehensive spatial analytics system, because spatial analytics is at the core of the system and there's a growing demand for spatial data science. We have been advancing predictive modeling, spatiotemporal modeling, advanced visual analytics, and other types of analysis tools. For example:

Business intelligence tools, such as Business Analyst.

ArcGIS Insights provides the means for interactive visual analysis in an environment that's easy to learn and use.

Esri has also embraced Notebooks for scripting, and there are new tools for data engineering, visualization, and modeling.

GeoAI brings the ability to automatically classify imagery using computer learning.

ArcGIS Knowledge, launched this year, is for modeling and analyzing relationships and networks. It's a new field that looks at interconnections.

Last year, we introduced ArcGIS Velocity, where you can use a fully managed software-as-a-service to connect IoT measurements, or any kind of measurements, with your GIS for alerting, analytics, and data management of real-time data.

Big Data Integration: The integration of big data has opened a new frontier by connecting GIS to data lakes and data warehouses where organizations are accumulating data from transactional systems at scale to deal with massive problems and processing large volumes of data in the cloud.

ArcGIS GeoAnalytics Engine is a new library of software tools that we can send to a Spark cloud environment, with about a hundred functions that can be performed right next to the data, greatly speeding the processing time. It's a spatial analysis library that big data analytics people can use.

Advances in Imagery and Remote Sensing: ArcGIS provides a comprehensive and integrated imagery system with four main parts that include the management and dissemination of imagery data with server technologies; drone mapping tools that connect these collection tools with cloud resources; a rich set of tools for analytics, including pulling data from imagery to create new features; and many tools for imagery visualization and exploration.

This year, we launched ArcGIS Image for ArcGIS Online, which adds the capability to upload imagery into ArcGIS Online and host it and manipulate it there. And the capability works in any cloud to do image processing where the data lives.

This spans from simple image basemaps to now full motion video to massive point clouds visualization to the world of GeoAI and machine learning. This year, we're spending a lot of time on the ability to take massive reality capture technology and integrate it directly into ArcGIS.

3D Systems of Record: ArcGIS has always implemented 2D systems of record, which means linking updates and transactions to the database. This is now also true for 3D, which involves turning GIS into a tool for creating a living digital twin, with transactions that allow the twin to be updated more or less in real time. To enable this, we added new visualization capabilities, like voxel visualization, game engine immersive experiences, and the integration of BIM models and spatial analytics into the same frame.



**Immersive Experiences:** Using ArcGIS Maps SDK, users can plug into the leading game engines (Unreal Engine and Unity) to build new applications that opens the mixed reality, virtual reality, and augmented reality experiences for our users. It's going to mesh the visualization and simulation crowd with the GIS crowd.

**Feeding this are new technologies for creating reality capture at the city scale.** SURE for ArcGIS is a surface reconstruction software that allows users to create photo-realistic models from imagery as well as lidar. This automated technology takes massive amounts of flight information, whether from drones or aircraft, and produces detailed textured meshes. This brings detailed 3D textured pictures inside GIS, meshing it with the attributes to query and display detailed vector information, bringing raster and vector together.

**Embedded Geospatial Capabilities:** Working with partners, GIS capabilities are becoming more embedded in other systems from Amazon, Microsoft, SAP, Autodesk, and others. With Microsoft, GIS maps and capabilities are now accessible in Microsoft 365 Office environments to give non-GIS professionals tools across the enterprise.

**Last year, we introduced GeoBIM that links features in ArcGIS Pro, ArcGIS Online, or ArcGIS Enterprise with Autodesk and their cloud.** You can do things like bring up a Revit diagram or CAD drawing alongside a road network in ArcGIS. This enables new kinds of collaborative connections that empowers dynamic engineering and construction work, allowing our joint customers to geoenable their engineering and design work.

**Hubs Are Enabling Community Collaboration:** ArcGIS Hub is increasingly being implemented across many communities as a way to connect and interconnect organizations with volunteers and citizens. It organizes people, data, and tools to accomplish initiatives and goals. Cities, regions, and large federal agencies are using this tool to share information and create integrated plans.

2. Is there an affordable way for me to get ArcGIS for my school work, volunteer work, or personal use?

Yes. Esri offers ArcGIS for Personal Use and ArcGIS for Student Use licenses to give you access to the latest version of ArcGIS at a very low cost (\$100 for a 12-month license in the United States). You can take advantage of these licenses for volunteer work, to improve your personal GIS skills, or even to study for your ArcGIS certification. In addition to the wealth of software included with these licenses, you get installation support, software updates, and unlimited access to self-paced e-learning through the Esri Training website.

For all the details on the software included with these licenses, please visit [ArcGIS for Personal Use](#) or [ArcGIS for Student Use](#).

3. What are some of the deployment patterns of ArcGIS?

Modern implementations of ArcGIS take advantage of ArcGIS Pro, ArcGIS Enterprise, and ArcGIS Online to power both traditional GIS data management tasks and the many ArcGIS apps available today through the services-based architecture that ArcGIS is built on.

The most common deployment patterns we see consist of one of the following combinations:

- ArcGIS Pro + ArcGIS Enterprise
- ArcGIS Pro + ArcGIS Online
- ArcGIS Pro + ArcGIS Enterprise + ArcGIS Online

There are many ways of deploying ArcGIS Pro and ArcGIS Enterprise in your own infrastructure. Both support deploying in the cloud using public cloud infrastructure as well as private cloud and traditional on-premises infrastructure.

Choosing the pattern that is right for you depends on several factors such as desired functionality, where your data lives, need for integration with other systems, etc. You can reach out to the Esri consulting services team for help determining the best pattern for your needs. Customers in the Advantage Program have a Technical Advisor who can provide assistance with these kinds of long-term planning decisions.

#### 4. How can I make use of the cloud with ArcGIS?

All aspects of ArcGIS software can run on cloud infrastructure including public cloud, private cloud, and hybrid cloud configurations. This includes

- ArcGIS Pro Desktop-as-a-Service (DaaS) options from several cloud providers give great graphics performance and the ability to run your modern desktop GIS in the cloud. One example of this is seen in the Microsoft Azure cloud where the NV-series VMs provide dedicated graphics hardware in order to deliver amazing frame rates that will make it hard to believe you're not running on a high-end desktop PC sitting right beside your desk.
- ArcGIS Online is inherently cloud native. It runs in Esri's cloud infrastructure and is made available through a Software-as-a-Service (SaaS) model that doesn't require you to install or manage any server-side software. Go to [arcgis.com](https://arcgis.com) and start using ArcGIS Online today.
- ArcGIS Enterprise can be deployed and self-hosted on all modern public and private clouds using an Infrastructure-as-a-Service (IaaS) model. Thousands of organizations have been using ArcGIS software in Amazon Web Services (AWS) and Microsoft Azure for many years.

With the latest release of ArcGIS Enterprise, you have the ability to run a fully cloud native option on Kubernetes using Azure Kubernetes Service (AKS), Amazon Elastic Kubernetes Service (Amazon EKS), Google Kubernetes Engine (GKE), or on-premises using IBM RedHat OpenShift. Also available for the AWS and Microsoft Azure cloud providers, is specialized cloud tooling if you want to deploy on traditional Windows and Linux VMs. This tooling includes the Cloud Builder command line interface and CloudFormation templates for Amazon Web Services, as well as the Cloud Builder for Microsoft Azure. These tools make it easy to deploy and run ArcGIS Enterprise in the cloud, allowing you to fully leverage the benefits of cloud-based deployments.

ArcGIS Enterprise running in cloud environments can also make use of several cloud Platform-as-a-Service (PaaS) features such as Database-as-a-service (DBaaS) options including AWS RDS for SQL Server, PostgreSQL, and Oracle; Azure SQL Database; and more. Other PaaS features that can be used with ArcGIS Enterprise include cloud storage options like AWS S3 and Azure Storage for storing content for the system and large volumes of data like imagery and map caches. Most

recently we've added support for connecting to cloud data warehouses like Google BigQuery, AWS Redshift, and Snowflake. No matter what cloud or what type of data store you are using, odds are good that ArcGIS can help you use that data and help you make better decisions.

Want to run in a different cloud? We have general purpose tooling based on automation technologies like Chef and PowerShell DSC that you can use to install and configure ArcGIS Enterprise anywhere you want. Visit our [Chef landing page](#), which includes video demos, links to Chef cookbooks.

Interested in making use of the cloud, but want to go one step further and avoid installing and maintaining the software yourself? Take a look at Esri Managed Cloud Services. For additional information, visit [ArcGIS Enterprise in the cloud help documentation](#), and attend the related sessions during the UC.

#### 5. Can Esri help me move my GIS to the cloud?

Yes. There are several ways Esri can help you move your GIS to the cloud.

If you are in the planning phase of your move, here are resources from Esri that provide general guidance:

- [Enterprise and Cloud Migration](#)
- [ArcGIS Enterprise in the cloud](#)
- [Migrate to a new machine in ArcGIS Enterprise](#)
- [Migrate to a new machine in ArcGIS Enterprise using the WebGIS DR tool](#)
- [Configure a Replicated ArcGIS Enterprise Deployment in AWS using the WebGIS DR Tool](#)
- [Implementing ArcGIS - Esri Community](#)

Esri also provides easy-to-use tools like Cloud Builder to help you move to the cloud. If you have an issue when trying to employ these tools, our support team can help you resolve it.

In addition, Esri Professional Services can provide design, implementation, and migration services for those looking for help from subject matter experts to apply cloud best practices for GIS and IT.

If you want to move your GIS into the cloud and want to have it managed for you, Esri offers managed cloud services for end-to-end support.

#### 6. Does Esri provide managed services?

Yes. Increasingly user organizations are looking to have their data, applications, and even entire GIS operations managed in cloud computing environments. Esri and its partners provide a range of cloud-based capabilities and services. For more information, check out the [Esri Managed Cloud Services](#) website.

## 7. What is the difference between Esri Managed Cloud Services and ArcGIS Online?

ShapeEsri Managed Cloud Services and ArcGIS Online are deployment patterns of ArcGIS. As such, each provides organization-wide mapping, analysis, data management, sharing, and collaboration capabilities. Both support these workflows in secure, scalable, and flexible ways that can be customized to meet your organizational and business needs. Both ArcGIS Online and Managed Cloud Services provide these capabilities on cloud infrastructure but with some key differences:

- ArcGIS Online enables users to make and share maps using a scalable software-as-a-service (SaaS) provided by Esri. As a SaaS product, ArcGIS Online is managed by Esri on shared cloud infrastructure removing the overhead of managing and administering an Enterprise GIS solution while providing the same user experience. Because ArcGIS Online is managed by Esri for a large number of users, the customer cost for ArcGIS Online is reduced compared to other Web GIS patterns.
- Esri Managed Cloud Services host and manage an organization's ArcGIS Enterprise solution in the cloud on dedicated infrastructure. Each environment is designed based on customer requirements. These requirements include business drivers, security, user workflows, data inventory, uptime expectations, and required support. The service includes a team of resources to help organizations prepare for the cloud, onboard, and maintain the solution over time.

To determine the appropriate pattern for your organization, we recommend that you review your needs around security, customization, IT capacity, and capability-based server roles, or contact your Esri representative to discuss your options.

## 8. Will Esri continue to provide both installable software and SaaS offerings?

Yes, because you very likely have needs for both. While our SaaS offerings continue to grow rapidly, Esri will continue to advance both our software-as-a-service and self-hosted software offerings long into the future.

## 9. Is Esri moving to subscription licensing?

Yes, but not exclusively. To provide our customers with complete flexibility when licensing Esri products, we offer a variety of licensing options to align with customer requirements and expectations. In addition to the classic perpetual license plus maintenance model, Esri has offered subscription licensing for our software products for many years. We will continue to provide our customers with multiple licensing options that best align with how they want to utilize our technology.

## 10. What's the next big security change from Esri that could affect my operations?

Esri is actively advancing ArcGIS Online's security posture from FedRAMP Tailored Low to FedRAMP Moderate this year. This is an immense change as the number of security controls assessed increases almost 10-fold, such as adding annual pentesting by a certified Third-Party Assessor Organization (3PAO).

Cloud-based SaaS offerings are increasingly an integral component of customer enterprise operations that require storing sensitive data or personal information beyond the assurance level provided by FedRAMP Tailored Low. Today, many ArcGIS customers utilize a hybrid deployment of ArcGIS Enterprise in-house for storing sensitive information separately from ArcGIS Online to help bridge this gap. Once the FedRAMP Moderate authorization is in place (early next year), most customers will find the security assurance equivalent or better than their own on-premises deployments.

FedRAMP moderate will allow you to confidently expand your use-cases of ArcGIS Online to include more critical information and operations. To stay on top of the latest security & privacy trends and patches, please subscribe to the [ArcGIS Trust Center](#) announcement RSS feed.

11. Does Esri have any tools that help me quickly check the security of my ArcGIS deployment?

Yes. [The ArcGIS Security Advisor](#) supports both ArcGIS Enterprise and ArcGIS Online and is found on the ArcGIS Trust Center home page. This tool requires no install and runs in seconds by an administrator of your organization to provide Red/Yellow/Green awareness of settings you have in place. It also provides a basic visualization interface of the application logs available.

ArcGIS Enterprise includes script tools for both the ArcGIS Enterprise portal and ArcGIS Server components that scan for common security configuration issues. We recommend configuring these scripts to automatically run at least once per month to minimize and correct 'misconfiguration creep.'

You can find additional guidance on secure implementation for cloud, enterprise, desktop, and mobile products within the [ArcGIS Trust Center](#), which is also the location where new tools are announced.

12. What security and privacy standards do Esri products comply with today?

Esri is continuously improving our coverage of security and privacy standards as they evolve, so the best place to confirm what is in place today is the [ArcGIS Trust Center compliance tab](#).

- ArcGIS Online (multi-tenant) is FedRAMP Tailored Low authorized by the US government and is expected to be FedRAMP Moderate in early 2023. Customers interested in alignment with ISO 27001 & 15408 security controls can [download a mapping](#) to the FedRAMP controls implemented.
- Esri Managed Cloud Services Advanced Plus (single-tenant) is FedRAMP Moderate. Esri's desktop products are self-certified for USGCB compliance to ensure they are fully operational in security hardened deployments.
- ArcGIS Enterprise is now validated against the [OWASP Web Application Firewall Core Ruleset](#) and guidance provided within the ArcGIS Trust Center.

For privacy, we align our company and products with the California Consumer Privacy Act (CCPA) and the European Union-based General Data Protection Regulation (GDPR).

- We are able to meet EU privacy adequacy requirements in our Data Processing Addendum (DPA) as we include Standard Contractual Clauses (SCCs) as well as Supplementary Measures as recommended by the EU.

- Our ArcGIS Online Geocoding services meet the rigorous requirements of HIPAA which can be [backed by a Business Associated Agreement \(BAA\)](#).

Lastly, Esri products are designed to be implemented as part of overall solutions that incorporate 3rd-party security components to align with requirements such as CJIS for law enforcement, STIGs for defense, and even PCI DSS.

13. What is the best way to report an ArcGIS product security vulnerability or privacy concern?

Use the [ArcGIS Trust Center](#). You can report any security or privacy concerns by going to the ArcGIS Trust Center website and clicking Report a Security or Privacy Concern.

Note that before submitting a concern, we strongly recommend customers check out the [Customer Accessible Documents section of the ArcGIS Trust Center](#) first, for requirements to submit vulnerability scans as well as known 3rd-party component CVE details.

Users may submit automated security scan reports, vulnerability proofs of concept, and privacy concerns to the PSIRT (Incident Response) arm of Esri's Software Security and Privacy Team via the website. Your concerns are routed directly to security and privacy experts to accelerate the turnaround time of potentially critical concerns. These experts also facilitate the issues from cradle to grave. If you would like to learn more about PSIRT, check out PSIRT Services Framework on First.org.

14. What steps is Esri taking towards meeting accessibility requirements (including WCAG and 508 compliance)?

Esri is committed to creating accessible technology inclusive to all customers and continues to place a priority on accessibility for our products. Our development teams work closely with our UX/UI experts and our accessibility team to ensure alignment of our products with various accessibility standards including WCAG 2.1 AA, US Section 508, and EN 301 549.

Many of our software applications are used to create maps, apps, and other information products for the public to consume, and Esri continues to work closely with our customers to help them meet their accessibility needs. Our goal is to be an innovator in the field of accessible mapping, and we believe there should be no barriers to what our users can achieve with our software.

More information and resources are available on [Esri Accessibility](#) and [Esri Legal Accessibility](#).

15. Why should I contact Esri Technical Support?

Esri Technical Support's mission is to ensure your success with Esri technology. Our staff members are knowledgeable about the entire spectrum of Esri products, solutions, and technologies and can handle an array of issues from documentation questions to mission-critical support. Our Technical Support professionals go beyond addressing problems; they work to understand causes behind challenges and, while remedying issues, offer guidance on how to best leverage Esri products. We invest in real-time support availability to ensure that you always reach a Support Analyst quickly, whenever you need help.

Technical Support staff view every interaction with you as an opportunity to provide a positive customer experience and build trust. These interactions are also opportunities to collect your feedback, which we relay to our Product teams, helping to improve Esri's product offerings. Your input helps to strengthen the quality of our products and our support. We are here to help you; whether you're just getting started or you're a long-time Esri customer, please don't hesitate to [contact us](#).

#### 16. What is Esri doing to advance Technical Support?

Providing technical support for cutting-edge technologies and innovative users requires a culture of continuous improvement. We use feedback from thousands of support interactions to determine how to consistently provide excellent experiences. In addition to cases, we view support as a holistic experience which includes My Esri support dashboards, self-help web resources such as knowledge articles on support.esri.com, a mobile app, Premium Support programs, and much more.

We are currently evaluating, implementing, and/or improving numerous aspects of Technical Support, including

##### **Support staff and service delivery**

We place significant emphasis on recruiting, onboarding, and professional development of all Technical Support staff members. In doing so, we closely evaluate industry trends to ensure we hire staff and develop their skillsets to foster experience in emerging technologies while building on our GIS foundation.

Immediate availability of Technical Support Analysts is paramount to our organization. We continue to evaluate our response times and make adjustments so that staff are available and prepared to help you. We recognize that your time and requests are important; balancing availability, efficiency, and thoroughness in our support will always be of the utmost importance. We also work with our distributors to ensure consistent customer support experiences worldwide.

##### **Technologies, systems, and offerings**

We understand the trust you place in Esri when you choose ArcGIS Online to host your GIS systems. Performant and reliable SaaS offerings are critical to building that trust. To make sure we can effectively assist you, we are strengthening our connections with the ArcGIS Online Operations team to improve our awareness of system issues and troubleshoot infrastructure-related problems at a deeper level.

Traditionally, when you needed help, you reached out to Esri Technical Support. Now, we are beginning to explore and test proactive outreach support models that would allow us to initiate communication with you, thanks to monitoring capabilities built into our products. Under this model, if you submitted an ArcGIS Pro error report, we would contact you to collect additional information or to offer you a solution. We are also testing proactive outreach related to events and behaviors we observe in ArcGIS Online. Be sure to keep your most up-to-date contact information in My Esri and/or your ArcGIS Online organization's administrator contacts so we can reach out to you in the future.

We constantly upgrade and improve key components of our contact center infrastructure to identify gaps in our service coverage and provide new paths for customer engagement; for example, we are exploring functionality which allows customers to schedule calls with the Support Analyst working their case. We're also looking at new tools, such as AI and bots, to enhance our support experience by helping our customers find the information they need and routing cases to Support Analysts who can help customers as quickly as possible. In 2021 we released a Beta version of "in-app" support functionality in ArcGIS Pro to a small group of customers. We are implementing user feedback for a potential rollout later this year. In-app support will allow authorized callers to connect with an Esri Technical Support Analyst through chat, inside ArcGIS Pro, at the click of a button.

#### 17. What is Esri doing to standardize Technical Support globally?

Esri provides support to customers outside the United States through its distributors. Together, we have implemented several initiatives to standardize Technical Support globally. First, we've added all distributors to our Global Customer Relationship Management tool for managing cases, collaborating, and measuring performance.

Likewise, we have implemented a technical support strategy, wherein all distributors and Esri agree to a set of key performance indicators to ensure consistent, world-class technical support around the globe. To achieve this, we provide a benchmark review of our distributors' workflows, hiring, and training processes. For distributors with limited resources, we have the option of sending customer cases to Esri's regional support centers.

Finally, we share resources, such as the mobile support app, that distributors implement in their country and language. These efforts have resulted in reduced time to resolve cases, increased transparency between organizations, and sharing of best practices. Most importantly, these investments provide customers with standardized service, a self-service portal with their local distributor, and opportunities to provide feedback.

#### 18. What is Premium Support?

Premium Support is a subscription-based service designed to provide Esri's highest level of support and meet the needs of customers who are developing, implementing, or supporting complex, mission-critical GIS. It provides all the benefits of Standard Support plus a designated Technical Account Manager, prioritized case management, 24-hour support 365 days a year, work with a Premium Analyst, and a 1-hour response SLA so you can get to work on your issue right away – day or night. Premium Support is available to purchase as a stand-alone service, an element of the [Advantage Program](#), or as part of an Enterprise Agreement.

The two types of Premium Support annual subscriptions allow for up to ten cases or unlimited cases. Special Event Premium Support offers the same benefits for one, three, or six months at a time in a term subscription.

Esri's distributors provide Premium Support to customers outside the United States. Customers outside of the United States who require direct support from Esri should consider Direct Premium Support.



#### 19. Why should I share my ArcGIS Pro crash reports with Esri?

Sometimes our software crashes. Many variables can impact software stability, and it is frustrating when instability occurs. As part of the Esri User Experience Improvement (EUEI) Program, when a severe application error occurs, users can report it. We encourage customers to share these reports because it helps us identify, track, and repair critical issues.

If you do choose to submit these error reports, please include a valid email address. If a recent release of Esri software or an available software update includes a resolution to the issue you've reported, a Support Analyst may contact you directly to make you aware of updates which will improve your experience with the software. In other cases, someone from our Technical Support team may contact you to collect more information.

The error report we receive includes essential, detailed information that often enables us to diagnose and repair problems that we have no other means of reproducing. These types of errors typically occur in situations where complex configurations involving third-party software components are functioning in concert with ArcGIS in very specialized data formats. The content of the error report that you send to [ArcGISErrorReport@esri.com](mailto:ArcGISErrorReport@esri.com) provides the Esri Development team with direct failure points and technical information. By referencing this data, the team can research, analyze, and fix software instability issues in the next release and improve the overall quality of the software.

#### 20. Does Esri provide a solution for enterprise workflow management?

Yes. Organizations can now automate and simplify aspects of repeatable GIS and non-GIS processes using ArcGIS Workflow Manager. This solution supports any combination of web, desktop, and mobile processes to allow organizations to scale and create seamless end-to-end enterprise workflows across ArcGIS. It also provides tools to manage, in real-time, the people, processes, and products required to complete work.

Workflow Manager has a new service-driven architecture focused on web-based workflows, such as digital data submissions, and web-based data editing and QC. This deployment is in addition to the pre-existing geodatabase version which continues to assist organizations with multiuser data editing and management challenges.

For more information, visit the Workflow Manager [resources page](#) or attend the [ArcGIS Workflow Manager: An Introduction](#) technical workshop at the User Conference. If you are interested in brainstorming building your digital data submission (such as permitting) or branch versioned (editing in the Utility Network, Parcel Fabric, or Linear Referencing) workflows, you can sign up for a 1:1 appointment with an Esri expert. Keep an eye out for details on how to sign up via the Esri UC 2022 page.

#### 21. What are ArcGIS Solutions?

ArcGIS Solutions are a collection of focused maps and apps that help address business needs in your organization. They leverage your authoritative data and are designed to improve operations, provide new insight, and enhance services in government, utility, defense, public safety, telecommunications, and commercial business.

## 22. How are organizations leveraging ArcGIS Solutions?

ArcGIS Solutions align with your business needs, transform your use of ArcGIS, and help maximize your investment in location-based data and technology. They leverage the power of ArcGIS and your authoritative data to help you improve operations, gain new insight, and enhance services. Each solution generally includes one or more applications, surveys, maps, feature layers, and ArcGIS Pro projects that can be configured to meet your needs.

Many organizations deploy ArcGIS Solutions that align with their business needs and use them as-is. Other organizations may deploy ArcGIS Solutions and configure them to meet specific needs they have. When ArcGIS Solutions don't fit your organization's needs, they can still be used as inspiration for your specific project and the ArcGIS configurations you might create.

## 23. How much do ArcGIS Solutions cost?

ArcGIS Solutions are included with your ArcGIS Online subscription and ArcGIS Enterprise software licensing. There is no additional cost for ArcGIS Solutions.

## 24. How do I deploy an ArcGIS Solution?

There are several deployment options that can reduce the time it takes to deploy location-enabled solutions in your organization and increase the business impact they make. Quickly deploy fully supported ArcGIS Solutions in your ArcGIS Online organization or ArcGIS Enterprise portal on infrastructure you manage.

The ArcGIS Solutions app is used to deploy a solution in your ArcGIS Online organization and Enterprise, starting with the 10.9 release. The app is accessible in the app launcher when you sign into your organization or portal. If you are using ArcGIS Enterprise 10.5 through 10.8.1, you can use ArcGIS Pro and the ArcGIS Solutions Deployment Tool to deploy an ArcGIS Solution.

To deploy an ArcGIS Solution, you must have a Creator or GIS Professional user type. A level 2 member is required for ArcGIS Enterprise 10.7 and earlier.

## 25. Which ArcGIS Solutions are most popular?

Here are a few of the most frequently deployed ArcGIS Solutions over the last year:

- **3D Basemaps** – can be used to author and maintain a 3D basemap for your organization.
- **Address Data Management** – can be used to maintain an authoritative address repository and continuously improve the quality of address data.
- **Capital Project Tracking** – can be used to manage an active project portfolio, communicate project status, and share project updates with internal and external stakeholders.
- **Citizen Problem Reporter** – can be used to solicit non-emergency problem reports (for example, blight, graffiti, trash, potholes, clogged drains, and flooding) from the public.
- **Crime Analysis** – can be used to enhance public safety, identify emerging trends, organize law enforcement operations, and plan crime-prevention strategies.

- **Damage Assessment** – can be used to conduct initial damage assessments after a natural disaster or catastrophic incident.
- **Electric Utility Network Foundation** – can be used to accelerate electric utility network implementations.
- **Emergency Management Operations** – can be used to manage incident operations and maintain situational awareness during emergency response and recovery phases.
- **Lead Service Line Inventory** – can be used to develop a lead service line inventory and monitor the replacement of service lines required to comply with the Environmental Protection Agency (EPA) Lead and Copper Rule Revisions.
- **Water Distribution Data Management** – can be used to map water distribution assets, edit data, view system maps in the field and office, view asset reports, and collaborate with map notes.

26. What are Learn ArcGIS tutorials, and who are they designed for?

[Learn ArcGIS](#) is a collection of free, hands-on guided tutorials for independent learning. Learn ArcGIS offers guided tutorials and exercises based on real-world problems to people new to GIS as well as professionals wanting to explore all of the latest capabilities within ArcGIS.

We design Learn ArcGIS tutorials with the following groups in mind:

- **Educators and students** (higher education and K-12) who would like to provide their students with interesting labs for hands-on learning that complements conceptual lectures. The resources available provide students of all ages, from K-12 and CTE programs to higher ed and graduate level programs, with the most current GIS knowledge and skills relevant to the classroom.
- **New ArcGIS users** who want to nurture their love and appreciation of geography, maps, and exploration. [Learn ArcGIS](#) provides guided tutorials that connect users with the latest software to apply ArcGIS to real-world scenarios. These exercises help users evaluate and understand how to apply GIS to a wide range of issues.
- **Trial users** seeking convenient online self-guided lessons to evaluate and apply the latest ArcGIS technology to a variety of scenarios.

27. How can Learn ArcGIS help me cultivate a passion for STEAM learning in my students?

The [Teach with GIS](#) website is a gentle on-ramp for K-12 teachers, school administrators, and school district administrators who want to enhance their STEAM curriculum through mapmaking and discipline-focused applications and exercises in the classroom. Teach with GIS is primarily targeted at high school and undergraduate classrooms.

[Learn ArcGIS](#) supports higher education with a wide range of tutorials and other educational content. Search the complete [Tutorial Gallery](#) and search through a variety of STEAM disciplines. They are freely available to TAs and students and updated regularly to save you time and effort to maintain resources with product releases. Learn Tutorials are engaging and thought provoking and help improve students' critical thinking skills in key subject matter areas.

28. Does Learn ArcGIS offer the option to try the latest Esri technology?

The Learn ArcGIS Education Trial is for educators and students seeking to practice analyses workflows, tools, and applications before introducing them to the classroom and who do not already have access to ArcGIS.

This account works much like a sandbox so you can build and play for 21-days, but you can't take the work with you or convert to a permanent account. For this reason, we do not recommend students use this account for longer term school projects.

Educators who are ready to permanently bring ArcGIS into the classroom should visit the Esri [Higher Education](#) or [K-12 Education](#) websites for how to access an ArcGIS organization with student licenses. GIS Professionals and new users who intend to purchase should use the [ArcGIS Online Trial](#).

29. What type of content does Learn ArcGIS provide?

Learn ArcGIS provides tutorials and collections of onboarding resources focused on solving real-world problems using GIS to help evaluate and understand ArcGIS products and workflows. These tutorials cover emerging technical and scientific areas of GIS, including breakthrough content in the areas of Notebooks, data science, machine learning, business intelligence, and 3D. An in-house team of subject matter experts regularly tests and maintains content to verify quality standards, currency, and authenticity of the workflow.

New content is added to the [Learn Gallery](#) regularly. The lessons allow for active participation - "learn-by-doing"- so you can relate each workflow to your own data or context. The scenarios are authentic and cover a range of topics suitable for new and ArcGIS Trial users, as well as educators and students. You can learn at your own pace based on your individual needs and interests.

30. I am an educator, and I would like to connect with my peers to learn, share ideas, and grow as a community. How can I do that?

We strongly encourage sharing educational resources and invite you to contribute back to the community. You can share your lessons and any other educational resources with us through our Learn ArcGIS Contributor program. [Contact us](#) with your ideas. We will send you a proposal template for submitting and sharing educational resources with your peers and academic community.

We would also encourage you to explore the work of some amazing educators who have gone above and beyond to share their own work and experiences and help train other educators in the [Peer-to-Peer Learning Hub](#). Follow your favorite teachers to grow your skills, find exercises on current events, share your own work, and join a community eager to share knowledge and skills and engage with their peers.

### 31. What is ArcGIS StoryMaps?

ArcGIS StoryMaps transforms your geographic information system (GIS) work into interactive content that informs and inspires. It makes it easy to explain complex topics related to your professional knowledge and experience. Bring your existing web maps, surveys, dashboards, and more into a memorable digital experience that will engage internal and external stakeholders. Publish and share your story with your organization or everyone around the world. Visit the [ArcGIS StoryMaps website](#) to learn more.

### 32. What is new with ArcGIS StoryMaps?

It is now easier than ever to create remarkable stories with custom maps that inform and inspire. Here are a few exciting enhancements in ArcGIS StoryMaps:

- Enjoy authoring with a flexible [text editor](#) with shortcuts, superscripts/subscripts, [text alignment](#), [drag-and-drop](#), and more
- Ensure everyone notices your legend by [automatically pinning the legend open](#)
- Experience [map tours in 3D](#) and add another dimension with [audio and buttons](#)
- Explore different layouts and storytelling options with the ease and freedom that comes with an undo/redo option
- [Share and collaborate on themes](#) with your organization
- Clone, create, and update stories with the [ArcGIS API for Python](#)
- Add images, videos, stories, apps, and PDFs to your [collections](#)
- Create [map actions](#) with express maps
- Get inspired with a new [ArcGIS StoryMaps Gallery](#)
- And so much more!

ArcGIS StoryMaps releases exciting updates every two weeks. To learn about what's new, we recommend reading the monthly [What's New in ArcGIS StoryMaps](#) blog articles.

### 33. What if I only want to create stories?

Anyone in an organization wanting to leverage maps made in ArcGIS can do so with the [Storyteller user type](#). With the Storyteller user type, users can add maps and apps (created by others in their ArcGIS organization) to compelling stories using ArcGIS StoryMaps.

Storytellers can create express maps, view all the ArcGIS essential apps and Living Atlas content, embed links/videos/images, view access to all content shared via organizations or groups. This user type can also choose to share the stories and collections publicly or just to organizations and groups. It is ideal for people who work in marketing, communication, and public relations, and for executives and other non-GIS business users.

#### 34. How do I get started with ArcGIS StoryMaps?

Esri has many resources available to help you get started with ArcGIS StoryMaps:

- The [Esri Academy](#) site has a range of courses from tutorials to full-day seminars
- The [Learn ArcGIS](#) site provides a path of ArcGIS StoryMaps lessons
- [ArcGIS Blog](#) and the [Esri Community](#) both have a wide array of content and an active community around ArcGIS StoryMaps
- [Videos](#) available on YouTube created by Esri staff and by our users
- For further information, please review the [online documentation](#) for ArcGIS StoryMaps.

#### 35. What is the difference between ArcGIS StoryMaps and StoryMaps?

In July 2019, Esri launched [ArcGIS StoryMaps](#)—a professional storytelling tool used to share GIS-related stories as presentations, reports, training, etc. It is integrated into the ArcGIS system so you can easily provide meaningful context to your GIS work (web maps, insights, dashboards, surveys, etc.).

In April 2022, Esri launched [StoryMaps](#)—a new product that is not part of the ArcGIS system. It's designed for anyone who wants to share stories about topics they are passionate about like their favorite food, sports, music, places, friends, and family.

ArcGIS StoryMaps is the professional storytelling tool used for work while StoryMaps is the personal storytelling tool used outside of work. View the [Storytelling Solutions](#) page to learn more about the difference between ArcGIS StoryMaps and StoryMaps.

You can create and edit stories with Esri's classic storytelling templates until 2024. After that time, they will only be available for viewing. Read this story to learn more about [how to move to ArcGIS StoryMaps](#).

## Products and Capabilities

### ArcGIS Pro

1. What is new in ArcGIS Pro since the last Esri User Conference?

There have been two releases of ArcGIS Pro in the last year. Below are highlights from each of these releases, starting with the most recent.

#### June 2022

The ArcGIS Pro release in June 2022 was driven by the change to .NET 6 (formerly known as .NET Core). .NET 6 is Microsoft's latest framework which positions Esri and other ArcGIS Pro developers well for future development and enhancements. In addition, new capabilities in this release include the following:

- An option to upgrade existing cloned Python environments to be compatible with the Pro update has been added
- Credit estimation is added to geocoding tools when using the World Geocoding Service
- Maps can be added to Reports
- Export Presets bring pre-configured settings for both maps and layouts, and also make it easy to store and re-use your own settings quickly
- A Color Vision Deficiency Simulator has been added to simulate how a map, layout, or report appears to someone who has a color vision deficiency, sometimes referred to as color blindness.
- A number of productivity and usability improvements
- For more details on this release, read the [What's New in ArcGIS Pro 3.0](#) blog post.

#### November 2021

The November 2021 release of ArcGIS Pro delivered many new functionality updates such as cloud data warehouse support, knowledge graphs, dynamic feature clustering, animated symbols, and a linear referencing user interface. Other highlights include the following:

- Legends, legend items, table frames, and table frame fields can be saved as [style items](#) to reuse in various layouts and projects
- Graphic elements such as points, lines, polygons, and text can be [converted to features](#) with the [Graphics To Features](#) geoprocessing tool. Likewise, features can be converted to graphics with the [Features To Graphics](#) tool.
- The [PDF To TIFF](#) geoprocessing tool was added.
- For more details on this release, read the [What's New in ArcGIS Pro 2.9](#) blog post.

2. Why did ArcGIS Pro versions change from 2.x to 3.0 with the latest release?

ArcGIS Pro follows the semantic versioning specification as described in the [Releases and patches](#) help, which means when the first number changes, it is a Major release. The ArcGIS Pro 3.0 release in June 2022 is a Major release driven by the change to .NET 6 (formerly known as .NET Core). .NET 6 is Microsoft's latest framework which positions Esri and other ArcGIS Pro developers well for future development and enhancements.

Major releases often require backward-breaking changes to be made, and we have taken the opportunity with this release to make important changes not possible in minor updates. An example is changing the project file (.aprx) format from xml to json, making it smaller and faster.

For more details, read the [Get Ready for ArcGIS Pro 3.0](#) blog post.

### 3. How do I get ArcGIS Pro?

You can get access to ArcGIS Pro in three different ways:

- ArcGIS Pro can be obtained as part of a [GIS Professional user type](#). The GIS Professional user type provides all the app bundles of the Creator user type plus access to ArcGIS Pro (Basic, Standard, or Advanced).
- If you already have a [Creator user type](#), you can get ArcGIS Pro (Basic, Standard, or Advanced) as an add-on to this user type.
- If you are an ArcGIS Desktop user, you already have access to ArcGIS Pro as it is included with ArcGIS Desktop. If you haven't yet, you or your administrator can download ArcGIS Pro from My Esri.

### 4. What resources are available to help me get started with ArcGIS Pro?

Esri provides many resources to help you get started with ArcGIS Pro. Explore the following:

- The [Esri Training](#) site has more than 600 items related to ArcGIS Pro including seminars, web courses, instructor-led training, and tutorials.
- The [Learn ArcGIS](#) site also has many lessons using ArcGIS Pro including a great [Getting Started lesson](#).
- [Videos](#) available on YouTube created by Esri staff and by our users.
- The [ArcGIS Blog](#) and [Esri Community](#) both have a wide array of content and an active community around ArcGIS Pro.
- [Esri Press](#) has multiple titles including: Switching to ArcGIS Pro from ArcMap, Getting to Know ArcGIS Pro, and Understanding GIS: An ArcGIS Pro Project Workbook.
- The ArcGIS Pro [Help](#) system is comprehensive and available to everyone.

If you are looking into migrating your custom tools from ArcMap to ArcGIS Pro, there is also a great set of [developer resources](#).

### 5. Can I migrate and use documents from ArcMap in ArcGIS Pro?

Yes. Map documents (.mxd), scenes (.sxd), and globes (.3DD) can be imported into ArcGIS Pro. Once in ArcGIS Pro, the map and layout become part of an ArcGIS Pro project (.aprx). This is a great starting point for working with ArcGIS Pro, and it allows you to transition the work that you've done in ArcMap.



6. How can I migrate my ArcMap customizations, built with the ArcObjects SDK, over to ArcGIS Pro?

ArcMap customizations built with the ArcObjects SDK can be migrated to new and modern ArcGIS Pro tools and workflows using the ArcGIS Pro SDK for Microsoft .NET. The ArcGIS Pro SDK provides extensive capabilities for organizations to customize ArcGIS Pro with add-ins using the four available patterns:

- **Add-Ins** – Develop new tools and functionality, and customize the Pro UI
- **Managed Configurations** – Provides all the capabilities of add-ins, plus allows for additional customization of the Pro UI/UX
- **Plugin Datasources** – Build custom data source integration with Pro
- **CoreHost Applications** – Build standalone apps with 64-bit Geodatabase and Geometry access

There are many resources online for learning and developing with the Pro SDK, available directly from the product [landing page](#). A helpful document for getting started with the SDK and migrating customizations is [Migrating to ArcGIS Pro](#), which has many links to documentation, code snippets and samples, tutorials, and videos.

Developers can also collaborate, ask technical questions and search the knowledge base of existing question threads in the [ArcGIS Pro SDK Group](#) on Esri Community.

7. How can I customize and extend ArcGIS Pro?

There are several ways to configure, automate, and extend ArcGIS Pro depending on your needs. The following are the main approaches, listed from easier to more advanced options.

- [Customize the Pro ribbon](#) to organize the tools and buttons that appear on tabs in Pro. You can import and export files containing your ribbon customizations. You can also configure Pro's [quick access toolbar](#).
- Create and share [Tasks](#). Tasks allow you to create a custom workflow complete with steps and instructions that you can share with others who perform the same type of work. Tasks ensure everyone using them will perform a consistent workflow and get work done faster.
- Use [ArcPy](#), a Python site package, to automate analysis and mapping. For example, you can use ArcPy to create script tools that perform complex analysis or create an automated map layout that updates based on map content. Automation with ArcPy can greatly reduce redundant workflows and processing.

Develop add-ins with the [ArcGIS Pro SDK for Microsoft .NET](#) to create a custom Pro UI and user experience for your organization. With the Pro SDK, you can build your own custom tools and workflows within Microsoft Visual Studio using the SDK templates and Pro APIs.

#### 8. What are the changes to ArcGIS Pro SDK development at 3.0?

ArcGIS Pro 3.0 is built on Microsoft .NET 6, formerly known as .NET Core. For Pro SDK developers, this is a significant change as Pro 2.x add-in code will need to be migrated for use with Pro 3.0.

Many of the considerations for the upgrade migration will include handling differences between the earlier .NET Framework 4.8 and .NET 6. The new [ProConcepts 3.0 Migration Guide](#) provides extensive information and resources for developers.

Another change is new support for Microsoft Visual Studio 2022 for Pro 3.0 development. Visual Studio 2017 and 2019 are still supported for Pro 2.x development, although they are not supported for Pro 3.0 development with .NET 6. For further information on SDK updates at 3.0, see [this reference document](#).

#### 9. Can I modify keyboard shortcuts (accelerators) in ArcGIS Pro?

Yes. In ArcGIS Pro, we have chosen [keyboard shortcuts](#), also referred to as keyboard accelerators, that closely match the keys used throughout ArcGIS. For example, the navigation experience in Pro more closely matches the experience of working with an online web map viewer, and we've chosen keyboard shortcuts that align with that experience. We also provide a way to assign and modify Pro's existing [keyboard shortcuts](#).

Almost all of Pro's commands can be assigned shortcuts using a keystroke combination or a function key. These can be used to both improve your productivity and to customize your keyboard to match the shortcuts you may be more familiar with.

#### 10. What are the licensing options for ArcGIS Pro?

**License level:** There are three license levels—Basic, Standard, and Advanced. The license levels can be applied using any of the license types.

**License type:** The three license types are Named User, Single Use, and Concurrent Use.

A Named User license allows ArcGIS Pro to be used by a person with credentials who signs in to the application on any machine where it is installed.

A Concurrent Use license allows ArcGIS Pro to be installed on any computer. Use of the application by multiple users is managed through a license manager on a network computer.

A Single Use license authorizes one person to use ArcGIS Pro on two machines, such as a desktop and laptop computer. However, the application may not be used on both machines at the same time.

#### 11. Do I need to be connected to use ArcGIS Pro?

No. You do not need to be connected to your network or the internet to use ArcGIS Pro. Users with Named User licensing can take their license offline at any time and work in a disconnected environment. The [Authorize ArcGIS Pro to work offline](#) help topic shows you how to take your Named User license offline.

Concurrent Use licenses can be checked out to work offline as well, and Single Use licenses are enabled for working offline by default because they are authorized on each machine individually.

ArcGIS Pro also allows you to work with both services and local data sources such as shapefiles and file and mobile geodatabases. See a complete list of the wide variety of [data sources](#) you can work with in ArcGIS Pro. The majority of these can be used in a disconnected environment.

#### 12. Can I take my ArcGIS Pro license offline?

Yes. Here is how:

- To take a Named User license offline, see Authorize ArcGIS Pro to work offline in the help topic [Start ArcGIS Pro with a Named user license](#).
- To take a Concurrent Use license offline, see Authorize ArcGIS Pro to work offline in the help topic [Start ArcGIS Pro with a Concurrent Use license](#).
- Single Use licenses are enabled for working offline by default, because they are authorized on each machine individually.

#### 13. How do I manage my ArcGIS Pro license with ArcGIS Online?

ArcGIS Desktop and the GIS Professional user type include ArcGIS Pro. By default, your ArcGIS Pro licenses use the Named User license type managed through your ArcGIS Online organization. To set up your ArcGIS Online organization, follow these steps:

- Activate your ArcGIS Online organization.
- Add members to your organization.
- Enable ArcGIS Pro access for the members who will use ArcGIS Pro.
- Manage Named User licenses for your members.

Optionally, you can convert some or all of your ArcGIS Pro licenses to Concurrent Use or Single Use licenses based on the ArcGIS Desktop license types your organization purchased.

Please review the [ArcGIS Pro documentation](#) for additional information.

#### 14. How do I manage ArcGIS Pro licenses with ArcGIS Enterprise?

To manage Named User licenses using ArcGIS Enterprise, follow the steps outlined in [Named User licensing in ArcGIS Enterprise](#).

Optionally, you can convert some or all of your licenses to Concurrent Use or Single Use licenses based on the ArcGIS Desktop license types your organization purchased.

#### 15. What is the future of ArcMap?

ArcGIS 10.8.2 is the current release of ArcMap and will continue to be supported until March 01, 2026 as established in the [ArcGIS Desktop Product Life Cycle](#). We do not have plans to release an ArcMap 10.9. This means the 10.8.x series will be the final release series of ArcMap and will be supported until March 01, 2026.

We understand there may be questions as to what's next for ArcMap inside ArcGIS Desktop. We have created the [ArcMap Continued Support](#) page where you can find answers to many of your questions as well as resources to help you transition your work moving forward into ArcGIS Pro.

#### 16. What can I do to ensure that ArcGIS Pro performs optimally on my desktop computer?

ArcGIS Pro is a 64-bit, multi-threaded desktop application and runs optimally on a machine that meets our recommended hardware requirements including:

- A 4 core CPU
- X64
- 16 GB of Memory/RAM
- 32 GB of free space on a solid-state drive (SSD)
- Video/Graphics adapter that supports DirectX 11, feature level 11.0, Shader Model 5.0 with 4 GB or more of dedicated graphics memory. If you're using a notebook computer with an integrated GPU, consider increasing the system RAM to compensate for the usage of shared memory.

For the complete ArcGIS Pro system requirements, which are different than those for ArcMap, please see the [ArcGIS Pro system requirements and recommendations](#) for optimum performance.

To test your computer's ability to run key ArcGIS Pro workflows, use the ArcGIS Pro Performance Assessment Tool (PAT). Read more about the tool, where to download it, and how to use it [here](#).

With each release, we focus on improving the performance of all our software including ArcGIS Pro. As we continue to make improvements, staying up to date with the latest version of the software will ensure you are getting the best performance.

If you experience performance issues, we recommend running PAT to first ensure that the machine meets the published benchmarks when working with standard data, and continuing to work through [Troubleshooting Performance Issues in ArcGIS Pro](#) if necessary. This resource has many suggestions that can help improve performance.

#### 17. How does Esri ensure the quality and stability of ArcGIS Pro?

We are dedicated to improving the quality of not only ArcGIS Pro, but all our software products. Software quality is a core focus of every ArcGIS Pro release, and we will continue to maintain quality as a pillar in evaluating each release.

We use the latest software development methodologies and perform automated and holistic tests throughout the development cycle. With every install we require unit tests, automated regression tests, and manual checklist tests. We have 20 different regression test harnesses and run more than 150,000 automated tests daily. We also run performance, workflow, and usability tests. In addition to our own internal quality team, we host a large number of customer holistic testing sessions each year where users work with their own data and workflows before the software is released.

With all of this testing we still do not catch every issue. The thousands of users we have sometimes do things with the software we didn't anticipate, and sometimes things go wrong. If ArcGIS Pro closes unexpectedly, a dialog box will open that provides a way for you to give us feedback in the form of an [error report](#). All error reports that you submit are reviewed and analyzed.

As part of our commitment to improving ArcGIS Pro, Esri routinely performs customer outreach, so if you ever get the 'ArcGIS Pro has stopped working' dialog, we encourage you to take a couple seconds to enter your email address and write a few notes about what you were doing at the time of the shutdown. This will help us evaluate what went wrong, and if we have follow-up questions, our outreach team will have a way to contact you. Though you normally will not be contacted, providing your email allows us to get in touch if we need more information in order to fix an issue. Also, if we already have a high-confidence fix for the issue being reported, we will email you and let you know which patch or update fixes the problem.

The systems discussed above are in place as continuous improvement processes. However, we understand the frustration that can result when an application stops unexpectedly, and that providing details or receiving an email does not address that immediate frustration. ArcGIS Pro includes a [Project Recovery](#) option which allows you to create a backup of your project at a specified interval so that in the event of the software stopping unexpectedly, loss of work is minimized.

Of course, if you are experiencing any problems with our software, please contact [Esri Technical Support](#), and we will do everything we can to help you resolve them.

#### 18. Does ArcGIS Pro include an Export to Adobe Illustrator?

ArcGIS Pro includes the ability to export to .AIX format that can be opened in Adobe Illustrator using the [ArcGIS Maps for Adobe Creative Cloud](#) Illustrator plugin. This workflow more closely follows the Illustrator pattern for bringing in content and provides a good starting point for working with your map. With the plugin, vector and raster map content from an AIX file is converted into editable, layered artwork for an improved editing experience in Adobe Illustrator. Once opened in Illustrator, the file can be used for high-end graphic design or map finishing workflows and migrated across the other Adobe Creative Cloud applications.

#### 19. Can ArcGIS Pro be virtualized?

Yes. ArcGIS Pro is widely used in virtualized environments, including all the major on-premises virtualization and cloud environments. There is a continuous effort to test ArcGIS Pro in many of both the current and newest virtualization offerings in on-premises virtualization technology from Microsoft, VMWare, and Citrix. The same effort is put into testing ArcGIS Pro in a wide range of instance types and application streaming platforms from AWS, Microsoft Azure, Google Cloud, and Oracle Cloud.

This effort continues to grow as the number of on-premises and cloud technologies expands. To help with this effort, we work closely with key technology partners such as NVIDIA, AWS, Microsoft Azure, and Dell.

All this testing is to provide our users information on what technologies are suitable for hosting ArcGIS Pro.

We make this information available through blogs, white papers, and the [ArcGIS Pro System Requirements](#) page. Here are a few resources:

- [Leveraging Multi-session VMs to support ArcGIS Pro using Azure Virtual Desktop](#)
- [Dell VDI Reference Architecture featuring ArcGIS Pro](#)
- [NVIDIA Application Sizing Guide for ArcGIS Pro](#)
- [Virtualization of ArcGIS from the Cloud and On-Premises platforms to support Higher Education](#)
- [ArcGIS Pro leveraging NVIDIA vGPU](#)
- [ArcGIS Pro Virtualization, an Esri White Paper](#)

Esri has recently updated our [ArcGIS Pro Virtualization Appliance](#), which is configured to deliver virtualized ArcGIS Pro in a rack mounted server with very good VM/Server density. This is now configured with Dell PowerEdge R750s and NVIDIA A40s.

## 20. How do I let Esri know what new/improved features I want to see in ArcGIS Pro?

The best way to provide feedback about new functionality you'd like to see, or enhancements you'd like us to add is through [ArcGIS Ideas](#) in Esri Community. We actively monitor and update the ideas and track what's trending and what's popular.

We also use the site to keep you informed of when an idea is Under Consideration, moved into our Product Plan, and Implemented. With each release of ArcGIS Pro, we have been implementing anywhere from 25 to 50 new ideas directly from your feedback on the site.

## 21. How do I stay up to date with what's going on with ArcGIS Pro?

There are many ways to stay up to date with what's going on with ArcGIS Pro. We would recommend that you start by following us on [Twitter](#) @ArcGISPro or by joining our [LinkedIn group](#), and visit the [ArcGIS Pro resources page](#) to find a compilation of helpful resources.

Here is a detailed list of some of the resources available:

- Read the latest [ArcGIS Pro articles on the ArcGIS Blog](#) to learn about new software developments and best practices and to see examples of outstanding cartography.
- Sign up for the [ArcGIS Pro Newsletter](#) to have the latest news delivered straight to your inbox.
- Connect with other users and ask questions in the [ArcGIS Pro place on Esri Community](#).
- Share, discuss, and vote on what you would like to see come to ArcGIS Pro on [ArcGIS Ideas](#).
- Get a sneak peek at what we're focusing on for the future of ArcGIS Pro on the [ArcGIS Pro Roadmap](#).

22. Are cloud storage services, such as Microsoft OneDrive and Google Drive supported with ArcGIS Pro?

No. ArcGIS Pro does not support storing projects and data in Microsoft OneDrive or Google Drive at this time. Providing support for the mentioned file-synching services is on our roadmap. Please review the following [knowledge base article](#) for more information on this topic.

## ArcGIS Online

1. When will Map Viewer Classic go away?

Map Viewer Classic will remain available at least until Map Viewer includes heavily used Map Viewer Classic features and functionality such as Analysis Tools and support for related records. Map Viewer and Map Viewer Classic will be available side-by-side throughout 2022 and into 2023.

2. What is the difference between Map Viewer and Map Viewer Classic, and how do I know which to use?

Map Viewer is a modern ArcGIS Online mapmaking tool driven by the speed and visualization capabilities of the most current ArcGIS API for JavaScript version. Map Viewer brings a variety of powerful tools together in an interface designed to inspire creativity and experimentation to find your data's best representation.

Map Viewer Classic is its predecessor, built on an older ArcGIS API for JavaScript version.

ArcGIS Online apps which are built with the older ArcGIS for JavaScript version, such as Web AppBuilder, will “flatten” any features, for example a Bloom layer effect, which are exclusive to the current technology. For this reason, you may choose to author maps intended for Web AppBuilder using Map Viewer Classic.

3. What is partnered collaboration? How will it make it easier to work with other organizations?

Partnered collaboration allows you to establish a formal relationship between two or more ArcGIS Online organizations. Once the partnership is set up, organizations can work closely and securely in groups. Key capabilities include

- **Group management:** Organizations can identify key people in their organization—collaboration coordinators—to facilitate partnered collaborations and directly add members from their organization to the group without an invite.
- **Collaborative item editing:** Members from different organizations can build maps or apps together through a shared update group.
- **Share content:** Adding content to a group can be limited to group owners and managers in different organizations who can ensure that the right content is curated and shared.

[Learn more about using partnered collaborations.](#)

#### 4. Can I manage and analyze Imagery and Rasters in ArcGIS Online?

Yes, with ArcGIS Image for ArcGIS Online, you can eliminate the time and money it takes to build and manage infrastructure. Conveniently host, stream, and analyze your imagery collections through this software-as-a-service solution.

[Explore ArcGIS Image for ArcGIS Online.](#)

#### 5. What accessibility improvements have been made to ArcGIS Online?

ArcGIS Online accessibility (a11y) can be looked at from two perspectives: first, users authoring accessible maps and apps for their audiences, and second, the ArcGIS Online application being accessible to users with disabilities or those using assistive technologies. Accessibility improvements have been made in both categories.

From an authoring perspective, ArcGIS Online encourages users to build apps and maps that are accessible to many different users. Specific examples include

- Color ramps that are optimized for people who are colorblind
- Support for alternate text (ArcGIS StoryMaps, Instant Apps)
- Home page color options including eight curated color themes that maintain sufficient color contrast so that text is legible by default and the option to create custom themes. To ensure text legibility for custom themes, the editor checks the contrast ratio of the colors you select and informs you if they pass accessibility standards.

We've also done work to improve how ArcGIS Online supports keyboard navigation and screen readers, particularly in the following areas: the ArcGIS Online organization and settings tab, home page, content page, as well as the new Map Viewer, ArcGIS Instant Apps, ArcGIS Web AppBuilder, ArcGIS Experience Builder, and ArcGIS Hub. You can find our existing accessibility conformance reports, learn about new a11y features, and find a11y resources at [Esri Accessibility](#) page. We will also be hosting several sessions related to accessibility at the User Conference this year, so we invite you to join us there as well.

#### 6. Can my content in ArcGIS Online be backed up?

It is each organization's responsibility to back up their content that is hosted in ArcGIS Online. There are a few ways to accomplish this, such as

- You can save local copies of data files you've added to your organization.
- If your hosted feature layer is updated frequently, you may want to periodically export the data—as a shapefile or CSV file, for example.
- Distributed collaboration provides the ability to copy content between ArcGIS Enterprise 10.8.1 base installations and ArcGIS Online organizations. This workflow can be used to create scheduled backups of your data and web maps and may require additional steps to copy data to other locations depending on your back up strategy.

Note: ArcGIS Online as a system maintains backups as outlined in this [document](#), but these backups are not available to individual organizations.

[Learn how in the documentation.](#)



7. What is new with ArcGIS Experience Builder?

To find out more about ArcGIS Experience Builder, please go to the [App Builders section of the Q&A](#).

8. What new capabilities have been added to ArcGIS Online? And how can I learn about what's coming?

Below are some highlights from ArcGIS Online releases in the last year:

### Map Viewer

- Effects were added to Map Viewer, letting you create expressive maps using creative visualizations that can be applied to basemaps and operational layers
- Filters can be used to apply effects to specific features in a layer for additional cartographic control
- Charts came out of beta, letting you add bar charts, histograms, scatter plots, and line charts to your map to discover patterns, trends, and relationships
- Pop-ups have been enhanced with support for new Arcade elements and HTML editing
- You can now add GeoJSON layers from a URL
- The [Flow smart mapping style](#) in Map Viewer allows you to display vector field data in imagery layers using animated streamlines and wavefronts to represent direction and magnitude
- You can [duplicate](#) or [group](#) layers for better layer management
- An improved [editing experience for feature layers](#) in Map Viewer includes an enhanced Editor pane and new snapping options
- Keyboard shortcuts are now available to help you complete common workflows. To view the full list of keyboard shortcuts in Map Viewer, press Alt+?/ on Windows or Option+?/ on Mac.

### General ArcGIS Online

- Legacy home pages were automatically switched over to the new home page editor.
- A new, more intuitive experience for creating feature layers was introduced.
- Organization members can transfer content directly to other members (with [the right permissions](#)).
- Groups now include the ability to configure a [featured content gallery](#) that lets you highlight important group content. ArcGIS Online organizations can set up [hierarchical categories for organizing members](#) according to characteristics such as department, location, and expertise.
- Administrators can now [schedule administrative reports](#).

### More information

- You can find detailed info about Instant Apps, Dashboard, Experience Builder, and other ArcGIS Online features by reading the What's New blogs for each of the releases in the past year:
- [March 2022](#)
- [December 2021](#)
- [September 2021](#)

- [June 2021](#)

There are many ways to stay informed about what's new and coming in ArcGIS Online, including the following:

- The [ArcGIS Online blog](#)
- [What's New documentation](#)
- The @ArcGISOnline Twitter account
- Blog posts in the [Esri Community](#)
- Email announcements with information about what's coming in each release are sent three weeks prior to each update. These announcements are sent to ArcGIS Online administrators in the United States and anyone else who has signed up for updates (any user can [opt-in to those emails here](#)).

You can also influence what's coming in ArcGIS Online by submitting and voting up [ArcGIS Ideas](#).

#### 9. What is the maximum number of features that I can display in ArcGIS Online?

There isn't a maximum number of features that can be displayed in a web map or web application in ArcGIS Online. The use of WebGL enables maps to request millions of features using feature tiles, and utilizes GPU to quickly render large amounts of data. As ArcGIS Online draws data based on feature information returned from the service, large complex datasets can result in large amounts of data being drawn by a web browser. For large datasets with complex geometry with more than 50,000 vertices, [drawing optimization](#) is enabled to speed up the drawing time of many features when needed. Additionally, tile layers can be used for high performing, static layers.

With Scene Viewer there are no longer limitations on the number of features from a feature layer that can be shown in Scene Viewer, and it is possible to bring millions of features into a scene. We recommend creating scene layers for datasets larger than 60,000 features to more efficiently display features in 3D. [Scene Layers](#) are cached 3D features designed to show a large volume of 3D data in a variety of types.

#### 10. If I am experiencing performance issues with ArcGIS Online, what should I do?

If you suspect an issue with the ArcGIS Online infrastructure, you can always check our [ArcGIS Online Health Dashboard](#). This dashboard is how we notify the public and customers about the status of ArcGIS Online services. Issues, maintenance, and informational notifications are posted on this site.

If you believe you might be experiencing performance issues that aren't the result of app or data configuration, but there are no notices on the ArcGIS Online Health Dashboard, please contact [Esri Technical Support](#).

11. What are the benefits of a Premium Feature Data Store? Does it help features on my map draw faster than with a Standard Feature Data Store?

Premium Feature Data Store does not make individual workflows faster, but rather performs more work without slowing down. Imagine a powerful truck with a heavy load traveling at highway speeds—a smaller car might be able to carry the same load, but will do so much more slowly. You can monitor your Premium Feature Data Store's capacity with the usage chart described here: [Tracking your Premium Feature Data Store Key Health Indicators](#).

A Premium Feature Data Store is not the first consideration for optimizing drawing speed. First consider best practices such as scale visibility and multiscale rendering, filters, data aggregation, and smart mapping styles. For public maps, follow best practices for viral traffic, including cache control, feature tile queries, and restricting editing to authenticated users. For more information, see [Essential configurations for highly scalable apps](#).

Consider a Premium Feature Data Store if your organization requires more storage space or greater computational resources to support complex analytical queries or high volumes of sync workflows or asynchronous processing.

12. Can I set up data so some users can edit the data and others can view the data?

Yes. Hosted feature layer views allow users to create new views of a single dataset with different privileges enabled for each of the views. One view can be created with the editing disabled in the service settings and shared publicly. This way the public will see updated data but won't be able to add or update the authoritative data. If the data of a public layer needs to be updated frequently, create a view of the source layer and enable editing on the layer settings. Share the layer privately with members who are responsible for updating the data. Both the public layer and the private layer point to the same data source, so viewers of the public layer will be able to immediately see updated data without having the risk of the public editing your data.

Read this [blog](#) to learn more about hosted feature layer views.

13. Is there a way for me to script or automate or schedule the work I do in ArcGIS Online?

Yes. ArcGIS Online has a rich set of tools that users can explore through the [developers site](#). Many users automate workflows such as publishing, user management, and data updating using the ArcGIS API for Python or making direct [Rest API](#) requests with other APIs or SDKs.

ArcGIS Notebooks in ArcGIS Online includes the ability to create hosted Python notebooks using a built-in Jupyter notebook environment, enabling spatial data science and automation of Web GIS administration. This is an out-of-the-box way to access the ArcGIS Python libraries: the ArcGIS API for Python and ArcPy, as well as open-source Python. ArcGIS Online users can now perform spatial analysis and run automated scripts without having to leave ArcGIS Online.

Automate routine tasks, run large or lengthy processes outside work hours, or update datasets frequently by scheduling ArcGIS Notebooks in ArcGIS Online at a set time or recurring basis. You can also pass parameters into a notebook on a schedule to account for different analytical scenarios or for security purposes.

In addition, organization administrators reports offer efficient and effective ways to manage members, content, credits, and activities in your ArcGIS Online organization. Those reports can be created by organization administrators, and also be scheduled to run automatically at a particular time or cadence. For more details, refer to this [blog](#) and this included short [video](#).

#### 14. How can I share my ideas for improving ArcGIS Online with Esri?

Submitting an idea for improving ArcGIS Online or any Esri product is quick and easy using [ArcGIS Ideas on Esri Community](#). Submissions are reviewed by the product team. As an idea contributor, you can submit new ideas, vote, and add comments and example workflows to existing ideas. This is a great way to communicate your software needs directly to the team and facilitate discussion about common ideas with the user community, so please contribute and vote.

#### 15. How can I try upcoming features and test their compatibility with my existing workflows?

The ArcGIS Online Early Adopter Community (EAC) allows you to test new features and provide feedback directly to the product team. The EAC is available a few weeks prior to each ArcGIS Online release and is open to users from organizations with an existing subscription. To learn more about how to sign up, take a look at [this blog](#).

#### 16. Is there a service level agreement (SLA) for ArcGIS Online?

Yes. ArcGIS Online provides a service level agreement as our commitment to the availability of our SaaS mapping platform. In short, Esri will use commercially reasonable efforts to make the Covered ArcGIS Online Services available with a Quarterly Uptime Percentage of 99.9%. The ArcGIS Online system is monitored 24x7x365 with alerts for performance and reliability by a dedicated operations team. Read the details of the [Service Level Agreement for ArcGIS Online](#).

The use of SaaS, including ArcGIS Online, needs your trust at its core – and to that end, we provide two other related sites that will be helpful to you about the status of the system as well as security, privacy, and compliance:

- A [web page](#) showing the status of the services included in the SLA. On this web page, you can find not only the current service status, but also a table of any service interruptions in the previous 28 days and an associated detailed incident report.
- Our [overall security site](#) that is a resource for security, privacy, and compliance information. Note that this site includes information for all Esri products and services, not just ArcGIS Online.

#### 17. How can I monitor and manage credit usage?

Most capabilities in ArcGIS Online do not require credits for use. There is no charge for viewing maps, even when they experience high amounts of web traffic. The primary transactions that require credits include analysis tools including geocoding, routing, and geoenrichment, and premium data including demographics and lifestyle. Credits are also used to pay for the actual feature and file storage that are stored in an ArcGIS Online Organization.

Many tools are available to monitor and manage credit usage. With credit budgeting, administrators can allocate a specific quantity of credits to each member. Administrators can also monitor their members' credit usage through dashboards, charts, and detailed reports.

A new credit report was introduced in the September 2020 update and shows a holistic view of transactional credit consumption by each member in the organization. Administrators can now generate a report showing the number of credits used by each member, by month or by week. The report includes all members in the organization and breaks down credit usage by the transactional tools used in ArcGIS Online. The names of transactional tools listed in the report correlate with the [Credits by Capability](#) table, so it's easy to match and track down credit consumption if any ambiguity exists. For more details of the credit report, read this recent [blog](#).

We recommend using organization item report as a quick way to access the credit consumption based on the amount of storage space in your organization. There are two columns in the item report, one is called "Feature storage size" and the other is called "File storage size." Feature storage is specific to feature layers hosted in ArcGIS Online, and the amount is measured in bytes. File storage includes other types of layers and files, including attachments in your hosted feature layers and imagery files in your imagery layers, and the amount is measured in bytes.

Before running an analysis tool, all ArcGIS Online users can use the credit estimator to calculate the expected number of credits used for the transaction. See [ways to manage credits](#).

18. My ArcGIS Online organization is getting larger with more items. What tools are available to help me manage these resources?

The number of members and items that exist in ArcGIS Online is growing. Many members and content administrators are being asked to manage and govern larger organizations. Over the past few years, we have implemented some tools to help manage these large resources, and we continue to develop new strategies and tools to match the growth. Here are a few tools and tips to manage content and users:

- The [Premium Feature Data Store usage chart](#) allows organization administrators to maintain awareness of computation and storage resource consumption over time. This knowledge supports a variety of management analyses, from forecasting next year's storage requirements to assessing the rate of GIS adoption across the organization and beyond.
- Administrative reports, which allows administrators to generate a csv file including the organization's member accounts, items, credits, and activity. These reports run asynchronously and can be created for organizations of any size. The reports, saved conveniently to the Organization page, will help administrators understand members' actions and provide an overall picture of content in the organization.
- A modern take on subfolders, [content categories](#) provide a taxonomy to aid in content categorization and discovery. Unlike subfolders, one item can be associated with multiple content categories, reflecting the inter-connectedness of your information products. Content categories are a key best practice promoting order and clarity as part of a strong data governance strategy.

- The [ArcGIS API for Python](#) and the [REST API](#) provide intuitive mechanisms to automate and execute repetitive tasks and extend out-of-the-box functionality to meet your organization's specific needs.
- Events related to the organization and its items and users can be monitored through the [History API](#) and activity log csv file. This historical information provides insight into tracked events, like sharing items, logging into apps, and adding and removing users. These tools can be helpful to maintain awareness of specific actions in your organization. Check out this [article](#) for more information.

#### 19. What is the difference between a user type and a role?

All members of an ArcGIS Online organization have both a user type and a role. Organizations assign user types to members based on the capabilities and apps they need to complete their work. The user type determines the privileges that can be granted to the member through a default or custom role.

Let's take the GIS Professional Advanced user type as an example. This user type is designed for users who will be working with ArcGIS Pro, so it includes an ArcGIS Pro Advanced license. It is also compatible with all roles. However, a Field Worker user type doesn't come with an ArcGIS Pro license and can only be granted a Viewer, Data Editor, or custom role with compatible privileges.

Default roles include a predefined set of privileges, and custom roles are created from individual privileges. For instance, Administrator and Publisher are default roles that contain the privileges necessary to administer an organization and publish content, respectively. A custom role might have most of the same privileges as a default Publisher role but could include a couple of administrative privileges such as designing the organization home page and inviting members to the organization. Administrators are free to use default roles if they have the capabilities you need for your users, or you can create custom roles to meet the unique needs of your workforce.

#### 20. Does ArcGIS Online support related records, for example to document multiple inspections of a single asset?

To use related records in ArcGIS Online, consider using hosted feature layer templates such as Manhole Inspection and Backflow Inspection. These layer templates include a hosted feature layer and related table whose fields you can add, drop, or modify to suit your data collection requirements. Using this model, the feature being inspected is stored once in the hosted feature layer while many subsequent inspection results are stored in the related table.

[This blog](#) describes in more depth the workflow for getting started with related record inspections in ArcGIS Online.

To understand which editing capabilities are supported in different ArcGIS web and field apps, refer to this [related table editing capabilities](#) guide.

## 21. Can I customize HTML in pop-ups?

You can use HTML in ArcGIS Online anywhere you find a rich text editor, including within pop-up configuration. Using HTML in popups allows you to add tables, images, and more customized layouts from simple to sophisticated depending on your needs.

Learn more about how to create rich, informative pop-ups with HTML and how to use your pre-existing HTML in [this blog](#), or [jump here to review supported HTML](#). To take this one step further, partner HTML with Arcade to [Bring Colors From Your Map Into Your Pop-up](#).

## 22. Where can I learn more about ArcGIS Online security?

Security is embedded into the DNA of ArcGIS, including ArcGIS Online. Compliance and privacy information is documented in the [ArcGIS Trust Center](#) where you will find:

- Links to security alerts and announcements
- Security best practices
- ArcGIS compliance, certifications, and accreditations

The ArcGIS Trust Center also includes the ArcGIS Online Cloud Security Alliance (CSA) Consensus Assessments Initiative Questionnaire (CAIQ), which details ArcGIS Online security controls. This document answers questions such as:

- What backup or redundancy mechanisms has ArcGIS Online implemented?
- Where is data stored?
- What infrastructure providers does ArcGIS Online use?
- How do you enforce tenant data retention policies?

Website configuration and management of member, content, and collaborations can be found in the [ArcGIS Online administrative documentation](#).

## 23. Where can I learn more about how to use ArcGIS Arcade?

ArcGIS Arcade is the cross-platform scripting language that transforms your data on the fly and can be used to build pop-ups and customize symbology. Below are some excellent resources for getting started and growing your skills in Arcade. Especially with Arcade, there are lots of answered questions on Esri Community, with sample code that can be repurposed for your work.

- ArcGIS Learn lesson: [Get started with ArcGIS Arcade Learn Lesson](#)
- Web course: [Introduction to ArcGIS Arcade](#)
- ArcGIS Arcade Reference: [Getting Started](#)
- [ArcGIS Blog Articles on ArcGIS Arcade](#)
- [Esri Community Reference Documents on ArcGIS Arcade](#)
- [Answered ArcGIS Arcade questions on Esri Community](#)

#### 24. What regions are available for hosting content in ArcGIS Online?

We recognize that in some cases organizations have legal or policy requirements for hosting data outside the United States. To accommodate this requirement, new organizations can now elect to store their geospatial data (features, tiles, data files, and web maps) in Europe or the Asia-Pacific region (in addition to the option of hosting it in the United States) upon organization activation.

Note that outside of features, tiles, data files, and web maps, a limited amount of content and user information remains in the United States including subscription information, item metadata, groups, and sharing information. We also continue to host our credit accounting and location services such as geocoding, routing, and geoenrichment in the United States.

#### 25. Can I use maps created in the new Map Viewer with web applications?

Older ArcGIS Online apps were created using the ArcGIS API for JavaScript version 3.x. This includes Map Viewer Classic, Dashboards Classic, and ArcGIS Web AppBuilder.

These apps cannot use the advancements which the ArcGIS API for JavaScript version 4.x brings to the online mapping ecosystem.

For this reason, maps authored in Map Viewer which use the more modern features and functionality such as feature effects and group layers, will be “flattened” when rendered within an older app.

If you’re authoring a map for use with an older app such as Web AppBuilder, you may choose to use Map Viewer Classic, to ensure the features and functionality of that map are within Web AppBuilder’s capabilities.

#### 26. What materials and resources are available to help me learn ArcGIS Online?

Esri offers a wide variety of learning and educational resources to learn ArcGIS Online, including

- [Try ArcGIS Online](#) path
- [Get Started with ArcGIS Online](#) lesson
- ArcGIS Online [documentation](#)
- ArcGIS Online – [Make a map in a minute](#) activities
- ArcGIS Online – [Complete gallery of lessons for new users](#)
- ArcGIS Online [blog](#)
- ArcGIS Online [on Esri Community](#)
- ArcGIS Online [training courses](#)
- ArcGIS [books](#)



27. What tools are available to help me manage members in my organization?

- [Member categories](#) are new addition to ArcGIS Online. They are hierarchical categories for organizing members according to characteristics such as department, location, and expertise. Both administrators and members with the “View Members” privilege can use these member categories to filter the list of members on the organization page’s Members tab. Refer to this [blog](#) for more details.
- [Administrative reports](#), which allows administrators to generate a csv file including the organization’s member accounts, items, credits, and activity. These reports run asynchronously and can be created for organizations of any size. The reports, saved conveniently to the Organization page, will help administrators understand members' actions and provide an overall picture of content in the organization. Refer to [this blog](#) for more details.
- Administrators can now simplify the member invitation process by [configuring new member defaults](#). New member defaults allow administrators to define a role, user type, groups, credit budget, and add-on licenses that will be automatically assigned to new members when they join the organization.
- New filters and a consolidated search on the Members tab of the organization page make it easier for administrators to perform [bulk member management](#) tasks such as updating user types and [assigning add-on licenses](#).

28. What are the new apps and capabilities have been added to ArcGIS Instant Apps?

A total of 7 apps were added to ArcGIS Instant Apps in the last year.

To showcase a map and scene, [Sidebar](#) (with recent [update](#)) explores a map with a side panel for info and tools, such as editing. [Basic](#) explores a map or scene with basic tools. [Exhibit](#) plays a slide show that presents a story using specific map extents and info.

To display a collection of related content, [Portfolio](#) (with recent [update](#)) explores a curated set of related maps, scenes, apps, and sites in one app.

To explore different capabilities on your maps, [Chart Viewer](#) explores map charts, histograms, and scatter plots on your map. [Countdown](#) explores ranked features and [Slider](#) explores animate temporal or numeric data on your map.

For the additional capabilities to the existing apps, please refer to this blog series “What’s New in Instant Apps”

- June 2021 [update](#)
- September 2021 [update](#)
- December 2021 [update](#)
- March 2022 [update](#)

## 29. Does Esri support no code solution to deploy native apps?

Yes. You can configure a web app using ArcGIS Instant Apps, build a cross-platform native mobile app from a web app with ArcGIS AppStudio, and deploy these apps on the web and mobile app stores. Currently there are 3 app templates from Instant Apps that support this no-code solution to deploy native apps: Nearby, Zone lookup, and Attachment Viewer. Refer to this [video](#) to see the details.

## ArcGIS Enterprise

### 1. What is ArcGIS Enterprise?

[ArcGIS Enterprise](#) is a full-featured Geographic Information System (GIS) for data management, mapping, and analytics that runs on infrastructure you control. With ArcGIS Enterprise, you and your organization can create stunning maps and applications, share them with others, and act upon your location-based data.

ArcGIS Enterprise can be installed in public cloud, private cloud, and traditional on-premises infrastructure using physical hardware or virtual machines. It can also be hosted by Esri Managed Cloud Services for customers who want more assistance installing and maintaining the underlying infrastructure. Regardless of where and how ArcGIS Enterprise is deployed, it can be scaled and customized to meet your organization's growing needs. Rich with data management capabilities, ArcGIS Enterprise lets you connect your existing folders and databases to publish map and feature services and integrate with cloud stores to store raster data and map and image caches.

ArcGIS Enterprise includes a website called the ArcGIS Enterprise portal where administrators can customize their organization, and users can create content, share data, and explore resources.

With ArcGIS Enterprise, you have access to all of Esri's configurable web applications such as ArcGIS StoryMaps, ArcGIS Experience Builder, ArcGIS Dashboards, ArcGIS Field Maps, and much more to fuel your organization's data collection workflows and visualization needs.

If you require powerful analytics, you can extend the capabilities of ArcGIS Enterprise to do deep image and raster analytics, big data analysis and processing, real-time data tracking, and data science using Python notebooks.

ArcGIS Enterprise also powers ArcGIS Mission, ArcGIS Utility Network, ArcGIS Indoors, and many other focused solutions and capabilities.

### 2. What can I do with ArcGIS Enterprise?

One of the fundamental capabilities of ArcGIS Enterprise is the ability to manage your data and expose it as web services. This is powered by ArcGIS Server technology and its ability to work with data from many sources, including your own databases and the built-in data stores that are included with ArcGIS Enterprise. You can incorporate these services into web maps and applications to tell a story, solve a problem, educate and inspire others, and much more. And you don't have to start from scratch. ArcGIS Enterprise comes with many different kinds of configurable templates, from layers to applications, giving you a launching point to develop your own information products. In addition, Esri-curated [Living Atlas](#) content is included with ArcGIS

Enterprise, and you can use this amazing collection of geospatial information as standalone datasets or integrate it with your own data.

With ArcGIS Enterprise, your organization can better understand your data, whether it is imagery and raster data, big data, tabular and vector data, real-time data, or 3D data. ArcGIS Enterprise provides a suite of analytical tools so you can generate actionable insights from all kinds of data. When you are ready to share your data and information with others, you can build tailored websites using [ArcGIS Enterprise Sites](#) to display your maps, apps, and information your way. If you are working with other departments or organizations, you can seamlessly share maps and layers with other ArcGIS Enterprise deployments and ArcGIS Online using [distributed collaboration](#).

ArcGIS Enterprise supports your patterns of use such as mapping and visualization, organizational data management, field operations, monitoring, analytics, site selection, decision support, and constituent engagement. ArcGIS Enterprise is also the engine for many focused solutions, like ArcGIS Indoors and ArcGIS Mission. Though you may not realize you are working with ArcGIS Enterprise while using these focused systems, it is still powering your workflows behind the scenes.

For hands-on examples of how to use ArcGIS Enterprise, visit [Esri's discovery paths](#).

### 3. What are the benefits of integrating the ArcGIS Enterprise portal?

ArcGIS Server and the ArcGIS Enterprise portal are perfect companions, and both are components of an ArcGIS Enterprise deployment. ArcGIS Server powers your web services, while the ArcGIS Enterprise portal is a customizable interface to browse, search, and discover those services and information.

The Enterprise portal is also the foundation on which you can build a wealth of custom applications using both no-coding options and extremely flexible fully custom options. The Enterprise portal allows you to make use of your great content and the services you have published without a need to build and maintain costly custom-built applications.

With an ArcGIS Enterprise portal (via an ArcGIS Enterprise deployment) you can:

- Organize and structure your data and make it accessible to anyone in your organization on any device.
- Share your maps quickly and easily with the rest of your organization without requiring a custom application.
- Bring browser-based mapping (2D and 3D) and analysis to your organization.
- Perform advanced imagery, raster, vector, and tabular analytics.
- Create, share, and execute code using Python notebooks.
- Leverage [ArcGIS Dashboards](#) to display real-time status and operational views of people, services, assets, and events.
- Use your data in [ArcGIS Insights](#) for powerful location analytics.

- Set up a distributed collaboration with other ArcGIS Enterprise deployments or with ArcGIS Online to share geospatial content across systems.
- Use ArcGIS Enterprise Sites to create pages tailored for finding data and information.
- Integrate your data collection and management workflows using ArcGIS Field Maps, ArcGIS Workforce, ArcGIS Survey123, and ArcGIS QuickCapture.
- Use ArcGIS Experience Builder, ArcGIS Web AppBuilder, ArcGIS AppStudio, and customized templates to build focused applications for your audience.

More information is available in the [What is the ArcGIS Enterprise portal help topic](#).

#### 4. How are ArcGIS Enterprise and ArcGIS Online similar? How are they different?

ArcGIS Online and ArcGIS Enterprise are complementary products that share many common capabilities and present a very similar user experience. Both products provide core GIS functionality like mapping, visualization, and spatial analysis as well as advanced capabilities like big data, real-time analytics, data science, and imagery workflows. Both include Esri applications like ArcGIS StoryMaps, ArcGIS Dashboards, ArcGIS Experience Builder, ArcGIS Web AppBuilder and more.

Examples of products included in either ArcGIS Enterprise or ArcGIS Online include:

- ArcGIS Mission is currently only available with ArcGIS Enterprise.
- The ArcGIS Utility Network and ArcGIS Parcel Fabric capabilities are currently only available with ArcGIS Enterprise.
- ArcGIS Enterprise Sites is an application specific to ArcGIS Enterprise.
- ArcGIS Hub is only available in ArcGIS Online.
- ArcGIS Urban is only available for ArcGIS Online at this time.

As ArcGIS Online is a SaaS product, Esri manages the infrastructure for you and controls the service level agreement. Updates happen automatically every quarter with ArcGIS Online, therefore everyone using the product is always using the same update. With ArcGIS Enterprise, you have full control over where you want to install the software, what infrastructure you will use, and the scale and size of your system. You choose when you want to upgrade and to which version you upgrade.

With ArcGIS Enterprise, a key feature is the ability for you to register and connect many different types of data stores that you maintain and control, including enterprise geodatabases, cloud stores, file shares, or more. This enables you to publish data to ArcGIS Enterprise that references live data residing in your own data stores, without having to copy a snapshot of the data over to ArcGIS Enterprise (though you can do that too). This data can be published as several different kinds of web services including several dynamic map services that are only available with ArcGIS Enterprise.

ArcGIS Online provides many content and services (such as geocoding and routing) that do not come out of the box with ArcGIS Enterprise.

It is very common for organizations to use ArcGIS Enterprise and ArcGIS Online together. This has been made even easier over the last few years with the release of distributed collaboration for sharing data across systems. For deployments of ArcGIS Enterprise that can connect to ArcGIS Online via the open internet, it is very easy and very common to make use of ArcGIS Online content and services like basemaps, geocoding, routing, and more.

The ArcGIS Enterprise documentation has a deeper dive in the [Understand the relationship between ArcGIS Enterprise and ArcGIS Online](#) topic.

## 5. What's new in ArcGIS Enterprise?

ArcGIS Enterprise 10.9.1, available as part of the ArcGIS 2021 Q4 release, includes exciting updates and enhancements throughout the product in many areas—applications, managing data, and administrative options, ArcGIS Enterprise sites, and more.

This latest release includes key updates such as:

- New Map Viewer, formerly available as Map Viewer Beta, now comes installed with ArcGIS Enterprise.
- Cloud data warehouse support – this includes Amazon Redshift, Google BigQuery, and Snowflake.
- Faster installation times for the Portal for ArcGIS component.
- Optional ArcMap Runtime Support feature.
- Email notifications for low disk space in ArcGIS Server and the ArcGIS Data Store.
- Ability to set up distributed collaboration between ArcGIS Enterprise on Windows or Linux and ArcGIS Enterprise on Kubernetes.
- Support for ArcGIS Enterprise on Kubernetes on Google Kubernetes Engine (GKE).

For the full overview of what's new, see the [What's new in ArcGIS Enterprise documentation topic](#) and the [what's new blog](#). You can also attend the User Conference session: What's New in ArcGIS Enterprise for more on what's new in ArcGIS Enterprise 10.9.1, as well as what you can expect in ArcGIS Enterprise 11.0.

## 6. Where can I get more information on new releases of ArcGIS Enterprise?

The [ArcGIS Enterprise page of the ArcGIS Blog site](#) is where the latest blogs on ArcGIS Enterprise and other Esri products are available. With every release, we provide a new blog covering key highlights as well as individual blogs about specific new features in the release.

Here is where you can find all the details about the latest ArcGIS Enterprise release in particular:

- [What's new in ArcGIS Enterprise 10.9.1 blog](#)
- At the User Conference, we will be offering a What's New in ArcGIS Enterprise session with a Q&A afterwards.

A comprehensive view of what is new in ArcGIS Enterprise, is available in the [what's new topics in the documentation](#). If you have additional questions, you're always welcome and encouraged to reach out to your Esri account manager.

7. How have recent releases of ArcGIS Enterprise improved my workflows as an administrator?

Since the 2021 Esri UC, we have introduced a number of new features and enhancements to better your experience as an ArcGIS Enterprise administrator, including:

- Ability to add members through a template: instead of adding members through a CSV file you have to properly format, you can now download a CSV file within the Enterprise portal to serve as a template when adding members.
- Faster installation times for Portal for ArcGIS: enhancements have been made to the Portal for ArcGIS installer on Windows and Linux – meaning you can expect faster installation and upgrade performance.
- Optional ArcMap Runtime Support feature: the ArcMap Service runtime feature is now optional. Consider this option if you are looking to remove Python 2.x from your environment or if you are ready to fully migrate to the ArcGIS Pro-based runtime.
- Email notifications for low disk space: if your ArcGIS Enterprise is configured for email notifications from the Enterprise portal, email notifications can be sent to Enterprise administrators when the ArcGIS Server and ArcGIS Data Store machines reach critical disk space thresholds.

8. What are the benefits of upgrading ArcGIS Enterprise?

Upgrading to the latest release of ArcGIS Enterprise by moving from one version of the software to a higher version is the mechanism by which you can take advantage of new features and functionality, to work with newly released and updated products and applications, and to benefit from performance improvements and bug fixes.

It is also important to upgrade to remain covered by Esri's support lifecycle (see the [version table](#) for a full list of supported versions). Being on a supported version means that your organization can receive technical support when needed, as well as software support in the form of patches and security updates.

Esri releases blogs, videos, and what's new documentation at each release to help you explore the latest in each version. When you are ready to upgrade, [follow the upgrading documentation topic](#) for information on how to move to the next version.

We highly encourage all users to upgrade to ArcGIS Enterprise 10.9.1. This is the last release to include both the ArcMap-based and ArcGIS Pro-based runtimes, and it includes migration tooling to help prepare for breaking changes in ArcGIS Enterprise 11.0. It is also the last release to include classic Esri Story Map templates, ArcGIS Dashboards Classic, Presentation for Map Viewer Classic, and .NET Framework for .NET-based SOEs and SOIs. Upgrading to ArcGIS Enterprise 10.9.1 will ensure that you can take advantage of the long-term support release, providing plenty of time for necessary migration work before upgrading to ArcGIS Enterprise 11.0 and beyond.

If you are interested in learning more at this year's User Conference, attend the ArcGIS Enterprise: Best Practices for Upgrading session, which will include a wealth of information around how to upgrade your system.

#### 9. How can I move content between development, staging, and production environments?

At ArcGIS Enterprise 10.8.1, we released REST and Python API functionality to export the contents of one group and import it into another. Supported item types include applications, maps, and hosted layers. For more information on this functionality, please see the blog [Moving content across tiered ArcGIS Enterprise deployments](#) and the video [Content Deployment Automation](#). With each release, new item types are supported for export and coming up in ArcGIS Enterprise 11.0 is support for exporting ArcGIS StoryMaps.

We encourage you to consider the specific needs you have for content migration between environments. Often the traditional approach of entirely separate environments for development, staging, and production introduces unnecessary overhead. If your needs to create and validate content can be met by creating the content directly in the target environment and not sharing it to a broader audience until validated, this can be a much simpler and lower cost approach than having to move between entirely separate systems.

#### 10. What are some of the deployment patterns of ArcGIS Enterprise?

You can scale and customize ArcGIS Enterprise to meet your organization's needs, which means that you can allocate additional server resources to specific functionality like geocoding, analysis, or hosting services as needed. It also means that you can go beyond the ArcGIS Enterprise base deployment and leverage real-time, big data, imagery and raster analysis, and data science by dedicating server infrastructure to these specific workflows.

In recent releases, we have expanded the documentation to include detailed diagrams for [different deployment patterns](#), including ones that are using capability-based server roles like GeoAnalytics Server, Image Server, GeoEvent Server, and Notebook Server. Patterns aren't exclusive to the ones outlined in the documentation, but they can help give you an idea of different options. As with any IT project, it is always a good practice to develop a sense of your system architecture before deploying and adjust it based on growing needs.

For more guidance, take a look at the [ArcGIS Enterprise: Architecting Your Deployment slide doc](#) which discusses both single machine vs. multi-machine patterns and how to expand for capacity and functional reasons. If you are interested in high-availability deployments, the [Minimize data loss and downtime documentation topic](#) has an excellent section on the considerations that go into planning and architecting such a setup. The documentation also has an entire section on [ArcGIS Enterprise in the cloud](#) which covers the tooling Esri provides for AWS and Microsoft Azure in particular.

For organizations with requirements for modern cloud native deployment patterns, we encourage you to consider ArcGIS Enterprise on Kubernetes. This is a newer way of deploying and managing ArcGIS Enterprise that is built from the ground up to take full advantage of public and private cloud infrastructure. Kubernetes makes scaling and managing your ArcGIS Enterprise deployment easier. It does require you to be familiar with the technology and with running

containerized software. Talk with your Esri representative to learn more. There are several sessions scheduled at the 2022 User Conference that focus on Kubernetes.

#### 11. Can I automate the installation of ArcGIS Enterprise in the cloud and on-premises?

Deployment options for ArcGIS Enterprise on Windows and Linux are flexible – you can deploy on your own physical or virtual machines, or you can deploy in the cloud. You can install all of the software components on one machine if that meets your needs, or you can scale out to multiple machines. For information on architecture strategies, please reference the [ArcGIS Enterprise: Architecting Your Deployment](#) slide doc and the [Architecting Your Deployment video](#).

Esri has developed a range of automation tools for the installation and upgrade stages of your deployment to make ArcGIS Enterprise as easy as possible to deploy.

#### Single-machine deployments

The ArcGIS Enterprise Builder is an easy installation and configuration wizard that will set up an ArcGIS Enterprise base deployment on one machine in less than an hour. You can also upgrade deployments originally set up with the ArcGIS Enterprise Builder for the easiest possible upgrade experience. There is also a command line utility for the times when you want to automate the use of the Builder. For single-machine base deployments that are ready out of the box, look to the Enterprise Builder.

#### Cloud deployments

An alternative to hosting your deployment on-premises is to use the cloud. When you're installing and upgrading in the cloud, there are automation opportunities available to you as well. For deployments in Amazon Web Services (AWS), Esri provides ArcGIS Enterprise Amazon Machine Images (AMIs) to launch several different architectures. In addition, Esri provides the ArcGIS Enterprise Cloud Builder for Amazon Web Services web app and command line interface and sample AWS CloudFormation templates. For Microsoft Azure, Esri provides the ArcGIS Enterprise Cloud Builder to easily stand up your deployment in the cloud. Note that you can run ArcGIS Enterprise on any cloud that meets system requirements - it's just for Azure and AWS that Esri provides specific tooling. For more information on cloud support, read through the [ArcGIS Enterprise in the cloud blog](#) as well as [documentation for cloud support](#).

#### Multi-machine deployments

- For multi-machine deployments outside of cloud environments, we have resources for the Chef IT automation toolbox. Chef uses a server-client model to automate installation and configuration tasks, and our team publishes cookbooks and guides that give you all you need to deploy ArcGIS Enterprise across multiple machines, in high-availability configurations, and/or for repeatable deployments. We have a [website all about Chef](#) to help you get started as well as video guides in the [Chef blog](#). Chef is great for both Linux and Windows deployments.
- Esri also offers tools to automate your ArcGIS Enterprise deployment using PowerShell Desired State Configuration (DSC). You can use the PowerShell DSC for ArcGIS module to automate the installation, uninstallation, and upgrade of an ArcGIS Enterprise deployment, as well as incremental software additions to a deployment already installed using the module. PowerShell DSC for ArcGIS contains sample JSON files,



to which you add your specific information and parameters before running in the PowerShell console. Learn more and get started at the [PowerShell DSC for ArcGIS repository on GitHub](#). If you're a Microsoft shop, PowerShell DSC is a great option that integrates really well with your existing Windows-based workflows.

- When you want to upgrade Enterprise components one by one, we have command line utilities available as well. Using the `upgradeserver` and `upgradeportal` tools makes it easy to perform component upgrades from your console or in custom scripts.

See the [ArcGIS Enterprise functionality matrix](#) for a breakdown of automation tools.

If you do not wish to manage and host the software yourself, there are many managed services offerings available including Esri's own [Esri Managed Cloud Services \(EMCS\)](#) that will install and maintain the software for you using dedicated infrastructure.

Additionally, for customers who are looking for a modern cloud native deployment option, ArcGIS Enterprise on Kubernetes is available. This deployment method optimizes scalability, resilience, and maintainability and is for organizations with large or complex deployments and a modern cloud native strategy. Please see [What is ArcGIS Enterprise on Kubernetes](#) for more **information**.

## 12. How can I make use of the cloud with ArcGIS Enterprise?

Many organizations are using cloud infrastructure to host and run their ArcGIS Enterprise deployments. The cloud is highly scalable and provides easy access to server resources without having to acquire and maintain your own physical hardware.

Below is an outline of the level of support ArcGIS Enterprise has for cloud environments:

**ArcGIS Enterprise can be deployed in any cloud environment that meets the ArcGIS Enterprise system requirements.** Though we do not provide specialty tooling outside of Amazon Web Services and Microsoft Azure, you can use deployment tooling such as Chef automation cookbooks and recipes and PowerShell DSC for deployment in other cloud environments so long as they meet system requirements. In practice, this means any public or private cloud environment that provides compute infrastructure (VMs) that can run supported versions of Linux or Windows.

**For Amazon Web Services (AWS) and Azure, Esri provides specialty tooling to help you deploy the software in those environments.** For AWS, this includes Amazon Machine Images (AMIs), the ArcGIS Enterprise Cloud Builder command line interface, and web apps. There are also sample AWS CloudFormation templates for the ArcGIS Enterprise base deployment and additional server roles like Image Server, GeoAnalytics Server, and more. For Azure, Esri provides the ArcGIS Enterprise Cloud Builder for Microsoft Azure, which supports setting up the ArcGIS Enterprise base deployment as well as additional server roles.

**For some cloud environments, we support cloud native functionality such as native cloud storage, native managed cloud databases, and more.** For many releases, we have had support for various cloud native functionality across AWS, Microsoft Azure, and Alibaba Cloud. Support for cloud native functionality is independent of whether we have deployment tooling for a cloud platform. For example, we have support for Alibaba cloud storage, but dedicated deployment tooling does not exist for that cloud environment.

For customers familiar with Kubernetes, ArcGIS Enterprise on Kubernetes is a newer deployment option for ArcGIS Enterprise that takes full advantage of cloud native software, following the patterns of microservices and containerization. ArcGIS Enterprise on Kubernetes is supported on AWS Elastic Kubernetes Service (EKS), Azure Kubernetes Service (AKS), Google Kubernetes Engine (GKE), and on-premises with Red Hat OpenShift. You can read more about this deployment option in the blog [What is ArcGIS Enterprise on Kubernetes](#).

**Note:** Running ArcGIS Enterprise in the cloud is different than using ArcGIS Online. When you run ArcGIS Enterprise in the cloud, you are still installing and running software as well as provisioning and managing your own servers to run that software (unless you are using [Esri Managed Cloud Services](#) to help with this). In contrast, ArcGIS Online is software-as-a-service where Esri manages all of the software and backend cloud infrastructure for you in what's called a multi-tenant environment where many other customers are also sharing that same infrastructure under the hood. There are also functional differences between ArcGIS Online and ArcGIS Enterprise even if there are many similarities in terms of the web applications and main user experiences.

### 13. Can Esri help me move my ArcGIS Enterprise deployment to the cloud?

Yes. Esri's Professional Services team can assist you with migrating your ArcGIS Enterprise deployment to the cloud with a three-step process to understand, plan, and act. Learn more about the migration pattern that best fits your organization as well as the steps to take for success by reviewing the information available on the [Enterprise and Cloud Migration](#) website.

### 14. Can I create tailored websites and pages that showcase my data, maps, and apps?

Yes. Many organizations want to go beyond having users simply search content in the Enterprise portal to provide tailored experiences to find and explore data, apps, and information. Two common ways of doing this are using ArcGIS Enterprise Sites and customizing your ArcGIS Enterprise home page.

With ArcGIS Enterprise Sites, you can create numerous sites and pages tailored to different audiences. Websites and pages created using Enterprise Sites are designed to be usable by non-GIS users but are powerful enough to let users interact with your data in dynamic ways. Sites features a built-in web page designer that integrates a drag-and-drop experience with HTML markup, giving you absolute control over the design of the web pages you create.

When you need to have many sites and pages for different audiences, use ArcGIS Enterprise Sites. For example, say your ArcGIS Enterprise organization serves many different departments. You can create sites for each department so that they can access maps, apps, and layers from the site that is customized in a way that is friendly and approachable to them.

The home page editor in the latest releases allows you to provide a customized, branded landing page displaying the most relevant content to your organization. The home page editor is optimized for desktop, tablet, and mobile, and includes a flexible set of components and options that allow you to create a unique entry point to your organization.

Take a look at the [ArcGIS Enterprise Sites documentation](#). For more information on the new home page, visit the [Configure home page](#) documentation.

## 15. Does ArcGIS Enterprise come with access to data?

Yes. With ArcGIS Enterprise, you have access to data to help jumpstart and enhance your GIS. This includes the following:

**Living Atlas:** ArcGIS Enterprise gives you access to the world's foremost and largest collection of geospatial data from the [Living Atlas of the World](#), including rich imagery, such as NAIP and Landsat; demographic information on consumer and population data; and environmental data, such as wildfires, oceans, weather, and much more.

When your ArcGIS Enterprise deployment is connected to the internet, you can use this data in your maps, apps, and even use the optimized data for analysis. Using credentials to an ArcGIS Online organization, your administrator can set up access to an even broader amount of content—subscriber and premium data—directly within ArcGIS Enterprise as well. This gives ArcGIS Enterprise users access to a subset of Living Atlas items based on Esri-maintained and curated content. Even more content is available and updated regularly in ArcGIS Online. This content can be searched and discovered by following the steps outlined in this [Esri Community post](#).

**Boundary layers:** Whether connected or disconnected from the internet, you can also download boundary layers from My Esri and host them within ArcGIS Enterprise. These layers—such as state, province, census area, and ZIP Code boundaries—contain demographic information for use in maps, scenes, apps, feature analysis tools, and [ArcGIS Insights](#).

**Data Appliance:** If your deployment is disconnected, you can purchase the [ArcGIS Data Appliance](#) to host and use basemaps and reference layers.

**Distributed collaboration:** You can also use distributed collaboration to send data to other organizations using ArcGIS Enterprise and ArcGIS Online and receive data from those organizations as well. This is a good way to expand the layers, maps, and items available to your Enterprise users and to collaborate on projects with other organizations.

## 16. How can I share my GIS content with other ArcGIS Enterprise or ArcGIS Online organizations?

Distributed collaboration is a way to share content (layers, maps, and apps) across organizations to achieve a common operational picture. Common patterns of collaboration include sharing from ArcGIS Enterprise to ArcGIS Online and between multiple ArcGIS Enterprise deployments. Collaboration can be used across all industries, from government to utilities to retail and oil and gas, to reach common goals and universal understanding of data.

Distributed collaboration is a capability that is included with ArcGIS Enterprise and ArcGIS Online. As an administrator, simply set up your collaboration with other participants, link a group or groups to the collaboration, and share your data. The system will synchronize your data with other participants so that they are able to access your information in their environment (and vice versa). With the latest releases, edits to feature layers can be synchronized across organizations, improving, and advancing data collection and data maintenance workflows.

For more information about the patterns that collaboration supports and how you can implement it in your own organization, check out the [Five ways to use distributed collaboration to share data](#)

[with others](#) blog. See how it works in our [technical documentation: About distributed collaboration](#).

17. Is the new Map Viewer available with ArcGIS Enterprise?

Previously available as a beta for ArcGIS Enterprise 10.8.1 and 10.9, the new Map Viewer comes installed with ArcGIS Enterprise 10.9.1.

Map Viewer comes with enhancements in its interface, the ability to create apps directly from the app, and additional layer support. You will still have access to Map Viewer Classic and can set either Map Viewer or Map Viewer Classic as the default for your organization.

18. I've heard of ArcGIS Data Store. Is it meant to replace my enterprise geodatabase?

No, ArcGIS Data Store is not intended to replace your enterprise geodatabases. Enterprise geodatabases continue to be an essential aspect of data management in ArcGIS and part of many organizations' data strategies. The ArcGIS Data Store is intended to work alongside your own data stores, including enterprise geodatabases.

ArcGIS Data Store, which is included with ArcGIS Enterprise, functions as a simple-to-manage embedded database that hosts data copied to ArcGIS Enterprise and data that is generated by Enterprise as part of workflows like analysis in your Enterprise portal, copying data in distributed collaboration, and more. It doesn't require a lot of the back-end administration otherwise associated with general-purpose databases. Instead of thinking of it as a database per se, think of it as a software component that powers access to certain data in ArcGIS Enterprise.

Many organizations leverage hosted services powered by ArcGIS Data Store for self-service mapping and analysis workflows and as a place to store data that doesn't have advanced spatial and attribute quality/validation needs as those provided in an enterprise geodatabase.

For additional information on data storage options in ArcGIS, read the related [Data in ArcGIS technical paper](#) as well as the technical paper on [Content Management Techniques for your ArcGIS Enterprise portal](#).

19. What skills do I need to work with ArcGIS Enterprise? Can you recommend Esri training to attend?

Every deployment of ArcGIS Enterprise is different. What might be needed, personnel-wise, to support a large-scale deployment with thousands of users may not be necessary for a smaller deployment.

What we have seen is that both IT and GIS teams (or the teams driving the need for ArcGIS Enterprise) often need to work together on installing and upgrading an ArcGIS Enterprise deployment. Having these teams on the same page makes for a much smoother process.

Once you are up and running, it is generally very helpful to have one or more administrators who can manage users and roles, licenses, groups, and content as well as administrators who can manage the backend system, such as monitoring services and servers. Some organizations

separate the two, where some administrators are responsible for the former, more Enterprise portal-centric work, and others focus more on the ArcGIS Server side of things.

Some power users will perform double duty and act as both administrators and users of ArcGIS Enterprise. It is up to your organization to determine the scope of your deployment and what level of support you will need from an administrative perspective. Remember to keep your IT group involved as your organization's needs grow and evolve. It is important to plan not just for the initial architecture and installation but also the ongoing IT maintenance tasks as well as having a plan for content management and ongoing governance.

Here are some helpful resources as you get started:

- This technical paper, [Architecting the ArcGIS System: Best Practices](#), covers best practices for designing your GIS, from both a business and architectural perspective.
- Instructor-led courses such as [ArcGIS Enterprise: Configuring a Base Deployment](#) and [ArcGIS Enterprise: Administration Workflows](#) help you get ramped up on the product.
- The [ArcGIS Enterprise resources page](#) contains great learning paths so you can explore hands-on activities as you work with the software.
- Esri's technical paper, [Content Management Techniques for your ArcGIS Enterprise Portal](#), provides governance techniques for maintaining quality content in ArcGIS Enterprise.

20. Does Esri have an application to monitor and report on the status of my ArcGIS Enterprise implementation?

Yes. [ArcGIS Monitor](#) allows you to monitor the enterprise, infrastructure, and resources that support your GIS deployment. ArcGIS Monitor complements ArcGIS Enterprise to provide the ability to monitor your entire ArcGIS system and acts as an early warning system if or when your resources start to exceed user-defined thresholds. By identifying bottlenecks and system overloads in real time, you can eliminate problems in your deployment before they become an issue. If you encounter an unexpected outage, ArcGIS Monitor will help you pinpoint the source of the problem, allowing you to solve the problem quickly saving you money and reducing down time.

In addition to system monitoring, ArcGIS Monitor helps you plan when and where you will need to scale or modify your deployment. ArcGIS Monitor has built-in mapping capabilities that can show you where your system has high and low utilization. By tracking your system's performance over time, you can identify where resources may need to be scaled up or down and where system maintenance or additional resources should be prioritized. ArcGIS Monitor can be used with current or past releases of ArcGIS Enterprise. A next generation release of ArcGIS Monitor will be released at the end of 2022. Visit the team at the ArcGIS Enterprise area in the showcase to learn more.

## 21. What is the product lifecycle for ArcGIS Enterprise?

A product lifecycle is the number of years that technical and software support such as patches and other security updates are made available for a given version. The product lifecycle for ArcGIS Enterprise was updated at 10.7 and includes short-term support (STS) and long-term support (LTS) releases. Product lifecycles of other software and previous versions of ArcGIS Enterprise are not affected.

STS releases include 3 years of support. LTS releases include 6 years of support, which mirrors the product lifecycle that has been around since ArcGIS 10.2.

As of this Q&A, the latest STS release is ArcGIS Enterprise 10.9 and the latest LTS release is ArcGIS Enterprise 10.9.1. ArcGIS Enterprise 11.0 will be a short-term support release.

For customers who are comfortable upgrading on a regular cadence, at least every 6-12 months, we encourage you to adopt the latest available release when upgrading. This gives you the latest features and fixes twice a year.

We provide LTS releases for those customers who may not be looking for the latest features twice a year, prefer more stability in their environments, and desire a longer period of support. For this kind of environment, we encourage adopting the latest LTS release when planning your next upgrade.

For more information, please read this blog: [Learn about the update to ArcGIS Enterprise Product Lifecycle](#) and see the [product lifecycle table](#) on the Esri Support website. When you are looking to deploy a specific version or upgrade to one, we highly recommend familiarizing yourself with which support lifecycle that version is using (LTS or STS) to be sure it meets your business needs.

The new ArcGIS Enterprise on Kubernetes deployment option follows a separate, faster, product lifecycle than ArcGIS Enterprise on Windows and Linux. If you are interested in the Kubernetes deployment option, please review the [product lifecycle details](#) on the Esri Support site and speak to your Esri account manager about whether it is a good fit for your organization.

## 22. Why is Esri increasing the major version number of ArcGIS Enterprise to 11?

The next major version of ArcGIS Enterprise, planned to be available in late July 2022, will be ArcGIS Enterprise 11.0. This is the first time we have increased the major version number of ArcGIS Server, now ArcGIS Enterprise, since ArcGIS 10.0 was released in 2010.

We are moving to ArcGIS Enterprise 11.0 because of the significant under-the-hood changes in technology. We are moving from supporting both ArcMap and ArcGIS Pro for publishing and administrative workflows to only supporting ArcGIS Pro. As part of ArcGIS Enterprise 11.0 we are also retiring several first-generation web applications built with ArcGIS API for JavaScript 3.x that have been part of ArcGIS Enterprise for many years. In their place are even better and modern web applications built on ArcGIS API for JavaScript 4.x.

We know that technology changes of this nature can require careful planning as you prepare your workflows and your organization. The major version number change reflects this shift in technology and a signal to plan for your upgrade to 11.0 with the care that is appropriate for you and your organization.

Stay tuned for more content on how you can prepare to upgrade to 11.0 closer to the release date.

### 23. How should I prepare to upgrade to ArcGIS Enterprise 11.0?

ArcGIS Enterprise 11.0 contains many changes compared to previous releases. It will be the first release of ArcGIS Enterprise to only contain the ArcGIS Pro-based runtime meaning it will no longer be possible to run services published from ArcMap. It is also the last release to include classic Esri Story Map templates, ArcGIS Dashboards Classic, Presentation for Map Viewer Classic, and .NET Framework for .NET-based SOEs and SOIs.

To prepare for these changes, we encourage you to first consider upgrading to ArcGIS Enterprise 10.9.1. This release not only contains both the ArcMap and ArcGIS Pro-based runtimes, but also includes migration tooling to help migrate your existing services. It also contains both classic and new versions of the web applications that will be retired in Enterprise 11.0. Upgrading to ArcGIS Enterprise 10.9.1 will ensure that you can take advantage of the long-term support release, providing plenty of time for necessary migration work before upgrading to ArcGIS Enterprise 11.0 and beyond.

### 24. Is it a requirement to upgrade to ArcGIS Enterprise 10.9.1 before upgrading to 11.x?

While upgrades from ArcGIS Enterprise 10.7.x to 11.0 are supported, keep in mind that there are many changes between older versions of ArcGIS Enterprise and 11.0.

To prepare for these changes, we strongly encourage you to first consider upgrading to ArcGIS Enterprise 10.9.1. Upgrading to ArcGIS Enterprise 10.9.1 will ensure that you can take advantage of the long-term support release, providing plenty of time for necessary migration work before upgrading to ArcGIS Enterprise 11.0 and beyond.

### 25. I've been hearing about the ArcMap-based runtime removal. What is that and how can I migrate my services to the ArcGIS Pro-based runtime?

The ArcGIS Server component in ArcGIS Enterprise currently includes two internal runtimes: an ArcMap-based runtime for services published from ArcMap and an ArcGIS Pro-based runtime for services published from ArcGIS Pro. Starting with the ArcGIS 2022 Q2 release, with ArcGIS Enterprise 11.0, the ArcMap-based runtime will be removed from the software, meaning it will no longer be possible to publish new services from ArcMap to ArcGIS Server sites. Additionally, existing services previously published from ArcMap will need to be migrated to the ArcGIS Pro-based runtime. The ideal time to migrate these services is before upgrading to an ArcGIS Enterprise release that only contains the ArcGIS Pro-based runtime. For more on this, see the [Removal of ArcMap-based runtime from ArcGIS Enterprise blog](#).

To help you prepare for this change, the ArcGIS Enterprise 2021 releases – versions 10.9 and 10.9.1 – included migration tooling that can help you migrate all compatible ArcMap-based services to the ArcGIS Pro-based runtime. This migration tooling comes in two forms: the Edit Runtime operation, accessible through ArcGIS Server Manager, and the UpdateArcMapServices utility, accessible as a command line utility included with ArcGIS Server. For more on the



migration tooling included in the latest release, see the [Migrating services to the ArcGIS Pro-based runtime in ArcGIS Enterprise 10.9 blog](#).

ArcGIS Enterprise 10.9.1 also included the ability to disable the ArcMap Runtime Support feature. This should be considered if you are looking to remove Python 2.x from your system or if you are ready to fully migrate to the ArcGIS Pro-based runtime. For more on this, see the [ArcMap Runtime Support: to disable or not to disable?](#) blog.

Even with the migration tooling introduced at 10.9, some services will need to be migrated manually, meaning that they will need to be republished from ArcGIS Pro. For those running a version of ArcGIS Enterprise without the migration tooling, 10.8.1 or earlier services will need to be manually migrated to the ArcGIS Pro-based runtime before upgrading directly to a release of ArcGIS Enterprise with only the ArcGIS Pro-based runtime. For more information on how to migrate ArcGIS Enterprise services manually, see the [Manually migrating services from the ArcMap-based to the ArcGIS Pro-based runtime technical paper](#).

## 26. How can I incorporate capabilities like big data, real-time tracking, image and raster analysis, and data science into ArcGIS Enterprise?

ArcGIS Enterprise can be extended to support many different types of advanced analytics and workflows. If you are interested in big data analytics, check out ArcGIS GeoAnalytics Server. For real-time analysis and IoT tracking, look to ArcGIS GeoEvent Server. To work with image services and raster analytics, ArcGIS Image Server is key. And for data science and Python scripting, ArcGIS Notebook Server is available.

Each of these products are included in this Q&A, so visit the related sections, such as Spatial Analysis and Data Science, to learn more.

## 27. Where can I submit questions and ideas around ArcGIS Enterprise?

We encourage you to engage with us on [Esri Community](#) whether you have questions about specific functionality, a new idea for an enhancement, or general feedback on Esri products.

Specifically, posting in the [ArcGIS Enterprise Ideas forum](#) is a great way to get the conversation going about new product ideas and engage with both the Esri product team and the user community.

If you are running into issues in your ArcGIS Enterprise deployment, please reach out to [Esri Technical Support](#) to work with an analyst to troubleshoot and diagnose any issues. It is also possible to submit enhancement requests when engaging with Esri Technical Support.

## 28. What is ArcGIS Enterprise on Kubernetes?

ArcGIS Enterprise on Kubernetes, launched in 2021, is a cloud native deployment option for ArcGIS Enterprise based on the principles of microservices and delivered through containerization. [Kubernetes](#) automates deployment, scaling, and management of containerized applications. Esri has completely re-architected ArcGIS Enterprise helping you deliver GIS into your cloud or on-premises environment. This is a strategic investment by Esri into our technology



and helps us address the increased demand for GIS services that we are all seeing in the world today.

#### 29. How will ArcGIS Enterprise on Kubernetes benefit me?

For our users who have a modern cloud native strategy, the Kubernetes deployment option for ArcGIS Enterprise provides several benefits.

Administrators can enjoy streamlined deployment and upgrade experiences, which are both simplified and relatively fast since they remove the need to manage individual servers and virtual machines. Administrators also receive increased visibility into the health of the system, thanks to granular logging at the level of microservices.

Architects and IT teams will appreciate that the system provides high availability out of the box because of the resilience features provided by Kubernetes orchestration. Scalability is also an important benefit of the new architecture, helping you adjust infrastructure capacity in response to unpredictable swings in demand.

End users will have a similar ArcGIS Enterprise experience no matter what technology is being used behind the scenes (Windows, Linux, Kubernetes). However, they may notice indirect benefits such as more consistent performance and system responsiveness that does not fluctuate even in times of high demand. This stability is another benefit of the resource management provided by Kubernetes orchestration.

Kubernetes may help reduce infrastructure costs, helping you fine-tune compute and memory resources and can match your capacity for GIS services more closely to demand. See [Determine whether Kubernetes is right for you](#) for more information.

#### 30. How is ArcGIS Enterprise on Kubernetes different from other deployment options?

This is still the same ArcGIS Enterprise product. Users, analysts, and GIS administrators will interact with the portal or via ArcGIS Pro in the same way as on Windows or Linux deployments. However, some activities such as deploying, upgrading, monitoring, and tuning the system will feel very different for administrators. A new administrative interface, ArcGIS Enterprise Manager, empowers administrators to manage their deployment on Kubernetes. Usage metrics are also available to help administrators build dashboards, such as on Grafana, to help them further extend their ability to manage the environment.

See [ArcGIS Enterprise on Kubernetes - Operating and Scaling](#) for a demonstration of the new administrative experience.

Architecturally, there are no longer separate software components such as ArcGIS Server, Portal for ArcGIS, and the ArcGIS Data Store. Instead, these components are broken down into smaller microservices and installed and configured during deployment via a script or wizard-like interface. There are no longer servers or virtual machines to manage individually. This means that certain constructs like an ArcGIS Server site are replaced by computing resources managed entirely at the service level.

Within the infrastructure, there are also many differences. A Kubernetes cluster is made up of interchangeable [nodes](#) where work can be scheduled as appropriate to deliver resources to

microservices that need them. Nodes are logically similar to virtual machines and used by Kubernetes to provide services automatically in response to dynamically changing demand. Administrators no longer manage distinct servers or virtual machines, but rather direct Kubernetes as it manages workloads delivered by [pods](#), and ultimately delivers the GIS services your users need.

31. Will customers install ArcGIS Enterprise on Kubernetes themselves?

Yes, you will set up the underlying Kubernetes environment and control the deployment process by executing a script provided by Esri. The script deploys the containerized software into your environment from a repository managed by Esri. You control the configuration of your ArcGIS Enterprise environment based on parameters you specify. You will need to have a Kubernetes cluster environment available that meets certain [system requirements](#). This can run on your own infrastructure on-premises or in the cloud. The deployment can be run silently if configuration properties are set in advance and can be integrated into your DevOps pipeline.

32. How will updates work with ArcGIS Enterprise on Kubernetes?

Upgrades to major new releases of ArcGIS Enterprise on Kubernetes will be on the same release cadence as Windows and Linux. The choice of when to upgrade to new versions will be up to each individual customer and administrator. The ArcGIS Enterprise release cycle remains unified so that customers can expect to see releases for the Windows, Linux, and Kubernetes deployment options at around the same times.

However, the product lifecycle for the Kubernetes deployment option is shorter than for Windows and Linux. After a release, Esri provides one year of technical support and updates and patches for six months. We encourage customers to stay up to date on ArcGIS Enterprise to maintain technical support. We believe the streamlined upgrade process facilitates this pace. The product life cycle is described on our [Product Support page](#).

In addition to upgrades, we plan to offer interim updates that will focus on administrative functionality, improving performance, or resolving issues. Updates and release upgrades will benefit from the speed and simplification that come with containerized software.

33. Will customers of ArcGIS Enterprise on Kubernetes be able to download whatever containers they want?

No. ArcGIS Enterprise on Kubernetes is delivered as a unified system that consists of multiple interdependent containers that will be run and orchestrated on top of the Kubernetes platform but are not meant to be run as a set of individual containers that administrators download and deploy individually.

Esri will provide a deployment script that customers run against a container registry to obtain the container images needed for the installation or upgrade. An administrator would not necessarily know which containers are needed for each of these events. Therefore, they need to have secure access to the container images, but they will not be picking and choosing which containers (or

services) they want to update. The installation and upgrade processes themselves are highly automated.

See [ArcGIS Enterprise on Kubernetes - Overview](#) for a demonstration of the deployment experience.

34. Is ArcGIS Enterprise on Kubernetes replacing the Windows and Linux deployment options?

No. While we have this new option for ArcGIS Enterprise, this will not replace the current Enterprise deployment methods of Windows and Linux, nor are there any plans to deprecate or remove those supported operating systems. All three deployment options will be available, fully supported, and will benefit from product updates in the future. The Kubernetes deployment option provides similar GIS functionality – not more – to what is available via the Windows or Linux options. Read [What's new in ArcGIS Enterprise 10.9.1 on Kubernetes](#) for more information about capabilities supported on Kubernetes.

We believe organizations using ArcGIS Enterprise on larger deployments can benefit greatly from running on Kubernetes, but it will be left up to you to decide whether and when your organization adopts it. If you have a demand for a modern, fully cloud native deployment option we very much encourage you to look at ArcGIS Enterprise on Kubernetes.

35. What will be required to use ArcGIS Enterprise on Kubernetes?

Starting with the 11.0 release, ArcGIS Enterprise on Kubernetes will be available via an annual subscription. Customers must also have an established Kubernetes cluster running on one of the supported environments: AWS Elastic Kubernetes Service (EKS), Microsoft Azure Kubernetes Service (AKS), Google Cloud (GKE), or Red Hat OpenShift. The environment must meet these [system requirements](#). Just like Windows or Linux, the ability to administer and manage the environment is also necessary. To ensure your success with ArcGIS Enterprise on Kubernetes, we want to have an individual conversation with ArcGIS Enterprise customers who are interested in exploring or adopting the Kubernetes deployment option. Please talk to your Esri account manager if you are interested.

36. What has been containerized within the initial release of ArcGIS Enterprise on Kubernetes, and what will be coming with future iterations?

We include most of the GIS functionality and administrative workflows you are familiar with after deploying ArcGIS Enterprise. This is not beta software; it is fully tested and ready for use in production. Certain capabilities we have not completed testing are deferred to be supported in a future release. These are described at [What's New in ArcGIS Enterprise 10.9.1 on Kubernetes](#) and in our [product documentation](#).

Examples of deferred functionality include federating GeoEvent Server or GeoAnalytics Server; several user types or apps such as Insights, Tracker, or Mission Manager; and several user type extensions such as ArcGIS Utility Network or ArcGIS Parcel Fabric. With each release, we move

closer to full parity to support the same capabilities of the Windows and Linux deployment options.

### 37. How can my team prepare for ArcGIS Enterprise on Kubernetes?

The major providers of managed Kubernetes offerings have training resources available; some are free, and some require membership in their partner networks. The [kubernetes.io](https://kubernetes.io) website and many third-party training providers also offer training. Please get in touch with your Esri representative for further ideas on how to help your team become familiar with Kubernetes. Our ArcGIS Enterprise [resource page](#) and [blog site](#) also link to recordings, demonstrations, and documentation for the software, and [product documentation](#) is also available.

### 38. How can I work with ArcGIS Enterprise as a developer?

As a developer there are many ways you can work with ArcGIS Enterprise. This includes building applications on top of ArcGIS Enterprise as well as extending existing functionality with your own custom business logic.

Our ArcGIS Enterprise SDK allows you to extend the functionality of map and image services published via ArcGIS Pro by creating server object extensions (SOEs) and server object interceptors (SOIs). SOEs enable you to expose new operations, and SOIs let you modify the behavior of existing operations in ArcGIS Server through pre-processing or post-processing of requests. For more on this, look at the [ArcGIS Enterprise SDK section of the help documentation](#).

In addition to the ArcGIS Enterprise SDK, you can also integrate higher level APIs with ArcGIS Enterprise. These APIs include the ArcGIS API for JavaScript, where you can build your own custom web applications, the ArcGIS Runtime SDK to build powerful desktop and mobile apps that incorporate capabilities such as mapping, geocoding, routing, and geoprocessing, and the ArcGIS API for Python, which provides a powerful python wrapper for administrative, data management, and analytical workflows. There is also the ArcGIS REST API for programmatic access to services, users, groups, and administering ArcGIS Enterprise.

Lastly, ArcGIS Enterprise can integrate and work with ArcGIS Platform, Esri's platform-as-a-service (PaaS) offering that contains location services, including ready-to-use content, data hosting, and content management services for developers.

### 39. What does it mean when ArcGIS Enterprise includes beta functionality?

Beta features are released within fully supported versions of ArcGIS Enterprise but are different from general availability functionality.

Beta features are intended for testing and providing early feedback to Esri to help guide future development efforts. They are not designed for, nor supported in, production environments. We recommend that you carefully evaluate how to take advantage of beta functionality.

Beta features are limited to short-term support releases and are not supported through typical support channels. All feedback and support for beta features must be submitted through the Early

Adopter Community, and product documentation will provide instructions for how to submit this feedback.

It will not be possible to have bugs escalated or receive fixes for beta features prior to their general availability in a future release. Beta features also may not be present in future releases of ArcGIS Enterprise, or may change significantly, so please plan accordingly.

#### 40. Does ArcGIS Enterprise have a beta program?

Beta programs provide an early version of the software before a final release. There are regularly beta programs for ArcGIS Enterprise although not every release of ArcGIS Enterprise has beta releases. These beta programs are typically by invitation only and are intended for a specific audience in order for Esri to get feedback on particular topics or features.

If you are interested in participating in ArcGIS Enterprise beta programs, please keep an eye out for communication through channels such as our product newsletter for updates. These communications will explain the process for signing up for future beta programs.

#### 41. What is the difference between a beta program and a beta feature?

Beta programs provide an early version of the software prior to a final release. Beta programs are typically by invitation only and are intended for specific ArcGIS Enterprise users.

Beta features are released within a final release of ArcGIS Enterprise and are available to all users for testing and feedback.

For both beta programs and beta features within final releases, users will submit feedback through the Early Adopter Community. Beta program releases and beta features in final releases are also both intended exclusively for testing and providing feedback and are not designed for, nor supported in, production environments.

#### 42. When will ArcGIS Enterprise support adding Experience Builder custom widgets?

Starting with ArcGIS Enterprise 11.0, you will be able to add Experience Builder custom widgets, meaning you will be able to extend the builder in ArcGIS Enterprise similar to how you did with Web AppBuilder. For more information about ArcGIS Experience Builder, see the App Builders section.

## ArcGIS for Developers

### 1. What developer activities will take place at the UC this year?

For the first time ever at Esri UC we are hosting a "Developer Day." It will take place on Wednesday, July 13. Developer Day will begin with an overview presentation for everyone to highlight the ArcGIS system through a developer lens, covering the spectrum of developer tools from no-code/low-code builders and templates all the way to the latest APIs you may not have seen yet, along with expanded and evolved capabilities of APIs that have been helping you build great apps for years.

During Developer Day, and elsewhere throughout the UC week, there are 19 technical workshops for developers scheduled at the UC this year. Whether you are a GIS analyst looking to start developing or a seasoned developer, you will find the topics and technologies covered of interest to you.

There are technical sessions throughout the conference dedicated to all ArcGIS developer products including

- Our new product designed specifically for developers, ArcGIS Platform
- Web development using the ArcGIS API for JavaScript and popular open-source APIs
- Native and mobile app development using the ArcGIS Runtime SDK
- Data science and system administration with the ArcGIS API for Python
- Customizing ArcGIS Pro with its .NET SDK
- An introduction to our ArcGIS Maps SDK
- No-code solutions with AppStudio, Web AppBuilder, and Experience Builder
- ArcGIS StoryMaps

In addition, there will be sessions on developer-focused products that provide new or improved capabilities in mapping, visualization, analysis, and productivity, including the use of ArcGIS location services with 3rd-party and open-source technologies.

### 2. How is Esri supporting the developer community?

We support the developer community in multiple ways. Our main hub of information is the [ArcGIS Developer](#) website. Here you'll find all documentation related to our developer offerings including APIs, SDKs, including in-depth guide topics, sample code, supplementary toolkits, and detailed API reference.

If you are getting started, try the [ArcGIS Tutorials](#), which are short and focused tutorials designed to help you build apps. In addition, [Open-Source Apps](#) are complete applications that illustrate best practices and walk you through the implementation of our core features. If you want to be inspired by what our customers are building with our developer technology, be sure to check out [Success Stories](#).

To connect and network with other developers building on ArcGIS, we encourage you to participate in Esri's active online developer communities on [Esri Community](#) (formerly GeoNet). This is an interactive experience where you can find all the latest information regarding Esri technology that is relevant to you by following groups and topics of interest. Esri Community contains a variety of online content including blogs, videos, and forums shared by the global ArcGIS developer community to help you solve problems and become more productive.

In addition, Esri sponsors many hackathons throughout the year where you can bring your creativity and technical skills to solve problems in your community by participating in a hackathon event.

The DevSummit conferences, Esri's "For Developers, By Developers" events are increasing in popularity. Over the past several years, Esri has hosted DevSummit conferences in [Palm Springs, California](#); [Washington, D.C.](#); Dubai, UAE; and [Berlin, Germany](#). These conferences allow developers to learn firsthand about the latest ArcGIS developer technology and meet and speak with the developers and engineers who build it.

### 3. As a developer, how can I work with ArcGIS?

You can work with ArcGIS in many ways, from building apps to extending ArcGIS. Here are some examples:

- Use app builders to select from common templates and configure and extend your solution without writing code.
- Use APIs to build web, mobile, desktop, and game engine apps for just about any platform.
- Extend ArcGIS by customizing the user experience in ArcGIS Pro, implementing custom workflows using the ArcGIS Pro SDK, automating using the ArcGIS API for Python, and extending services with ArcGIS Enterprise.
- More information can be found on the [ArcGIS Developer](#) website.

If you are a member of an ArcGIS organization, you already have access to all of the developer tools and APIs within ArcGIS for which your organization is licensed. If not, you can take advantage of the ArcGIS Developer Subscription, which provides the flexibility of 5 levels of subscription access to ArcGIS, from the free "Essentials" plan, which gives you the ability to build with web and native developer tools leveraging ArcGIS Platform, all the way up to the "Enterprise" plan, which gives you access to all of the software and services at the highest levels, along with a complimentary registration to an annual Esri Developer Summit of your choice.

### 4. What are my options if I want to extend ArcGIS?

As a developer, you have many options to extend ArcGIS:

- Build add-ins and extensions for ArcGIS Pro with the [ArcGIS Pro SDK for .NET](#).

- Automate your processes using Python (this includes ArcPy and the ArcGIS API for Python).
- Extend ArcGIS Enterprise by building Server Object Extensions (SOEs) and Server Object Interceptors (SOIs) using the ArcGIS Enterprise SDK.
- Develop apps using our web and native APIs and SDKs that improve the efficiency of your operations and give your users a focused workflow.

There are many sessions at the UC that cover these topics. The best way to find the appropriate session for you is to search the detailed agenda for key words such as: JavaScript, ArcGIS Pro SDK, Web AppBuilder, Runtime, Python, etc.

#### 5. What is Esri doing to support the open-source community?

For many years, Esri has developed software, solutions, utilities, and other projects on GitHub. There are hundreds of open-source projects on [github.com/esri](https://github.com/esri), and we continue to encourage our user community to download and use them, but also to contribute code and participate in issue thread discussions for improving them. In addition, Esri staff continue to be active contributors to a wide variety of open-source projects across the global developer community.

A relatively new offering for developers is a platform-as-a-service approach to accessing ArcGIS and including it in apps you build. One of the key benefits of this product, called ArcGIS Platform, is a simpler, more seamless, and industry-standard way to access a set of comprehensive, on-demand services. This makes ArcGIS easier than ever to use with 3rd-party and open-source mapping technologies, such as Leaflet, GL JS, and OpenLayers, not to mention extensive documentation and dozens of runnable code samples for each.

#### 6. I want to develop a native app and deploy to many platforms. What are my options?

As a developer building a solution for multiple platforms, you may want to avoid having to write your app multiple times. This can be costly, time consuming, and can require learning multiple developer technologies. The ArcGIS Runtime SDK team has worked to include cross-platform tools in the family of ArcGIS Runtime SDKs to make it easier to develop applications for multiple platforms. Several options are available:

- The ArcGIS Runtime SDK for .NET includes support for Xamarin.iOS and Xamarin.Android, allowing you to write cross-platform apps that target Android, iOS, and Windows platforms.
- With the ArcGIS Runtime SDK for Qt, you can write apps in either C++ or QML that target five platforms: Android, iOS, macOS, Windows, and Linux. Web developers will find an easy transition to QML since it is a scripting language similar to JavaScript.
- The current version of the ArcGIS Runtime SDK for Java allows for apps to be developed once and run on Windows, macOS, and Linux platforms.
- ArcGIS AppStudio is built on top of the ArcGIS Runtime SDK for Qt and includes several productivity tools you can leverage like streamlined setup, the AppStudio Player that makes enterprise deployments easy, ready-to-use templates, and productivity libraries.



You can extend applications built with ArcGIS AppStudio using QML and the ArcGIS Runtime SDK for Qt.

- While Esri does not officially support JavaScript frameworks to build native applications (such as React Native or Ionic) at this time, developers can choose to build and maintain bindings or wrappers for the ArcGIS Runtime SDK targeting the platforms of choice. The primary reason for using this approach is to enable JavaScript developers to build native apps and leverage native capabilities. That said, any issues reported to Esri will need to be reproduced outside of a JavaScript framework.

In addition to native development, the ArcGIS API for JavaScript can be used to develop browser-based apps that can be used cross-platform. Apps can be implemented with a responsive design so they can have a high-quality experience that adapts well to any screen size.

## 7. How can I use ArcGIS with game engines?

In general, we have two options: developer tools and data export.

- **Developer Tools:** The ArcGIS Maps SDKs are available as developer products that integrate with the two market-leading game engines, Unity and Epic's Unreal Engine. The ArcGIS Maps SDK for Unity and ArcGIS Maps SDK for Unreal Engine are distributed as plugins, support local and global 3D experiences, and provide components and APIs to access ArcGIS services and local data. Game engine developers can then use this content within the game engine using techniques and patterns they are familiar with.
- **Data Export:** ArcGIS CityEngine can be used to export geospatial data as static models/formats which can be accessed directly in Unity (FBX) or Unreal Engine (Datasmith). The main purpose of this functionality is to support architectural and design visualization.

Following a successful [public beta program](#), we recently launched the first production release of the ArcGIS Maps SDK for Unity, and the ArcGIS Maps SDK for Unreal Engine is due for release at the end of June.

## 8. What data types do the ArcGIS Maps SDKs support?

The initial release of the ArcGIS Maps SDKs will support 3D Object layers and Integrated Mesh layers as defined by the I3S standard, as well as raster tile layers and elevation layers. These can read data from services or from local files such as scene layer packages and TPK/TPKX files. The ArcGIS Maps SDKs Support for additional layer types will be added in future releases.

## 9. Do the ArcGIS Maps SDKs support feature layers?

Feature layer support is not available in the initial release of the ArcGIS Maps SDKs but is on the roadmap. However, thanks to the collaboration between Esri and both Unity and Epic Games, developers can now use real world coordinates to create game engine representations of geometries obtained from REST requests to feature services.

10. Are the ArcGIS Maps SDKs free to use?

Yes. The ArcGIS Maps SDKs are free to download. You can also develop, test, and deploy your applications for free.

11. Does Esri provide any resources to help me build apps?

Absolutely. We have a number of resources, which are available via the [Developers Site](#).

- Feature Pages can be found on the front page of the [Developers Site](#). They introduce ArcGIS functionality and allow you to drill down into specific details and SDK documentation. For example, here's one for [Data Visualization](#).
- [Success Stories](#) describe how your peers have created applications using ArcGIS SDKs and APIs, linking you directly to relevant SDK documentation.
- [ArcGIS open-source apps](#) are robust example projects which use ArcGIS SDKs and APIs to build location-based apps. They demonstrate best practices for integrating with typical application frameworks and building good user experiences. Distinct from samples, they show multiple pieces of ArcGIS functionality working together in real-world use cases. You can use these apps as the starting point for your own apps, pick and choose individual components from them, or you can simply lean on them for inspiration. While originally designed and written by Esri, they are open-source projects, so the evolution of each is to a large degree entrusted to the open-source community, not specifically maintained by Esri like SDK code samples are.
- [ArcGIS Tutorials](#) are self-guided, hands-on exercises that take you through working with a specific component of an API and can be explored in any order. Each tutorial takes no more than about 15 minutes and includes a full solution for reference.
- Each SDK includes [Guide Documentation](#) covering key concepts and capabilities.
- [Reference Documentation](#) provides comprehensive details on all our APIs.
- Widgets and toolkits—commonly used, open-source app components—allow you to rapidly implement common capabilities in your app. Examples include a basemap switcher, measure tool, north arrow, and scale bar.

12. What developer tools are available for situational awareness workflows?

Esri continues to build and improve solution applications for managing and acting on high volumes of time-critical data, to provide situational awareness in a wide variety of contexts, from the management of emergency events, as well as continuous operations of public safety services, such as fire, rescue, and emergency medical response. These tools are designed to help you quickly analyze incident impact; assess damage; deploy needed resources; and educate, inform, and warn the public with maps built to scale. When incidents occur, you can keep yourself prepared with a solution to empower the kind of critical decision-making that can help you save lives.

[Check out this website](#) for more information on how this works, and real-life case studies that describe how ArcGIS, and specifically designed solution products, can help you provide effective public safety services.

Developers can build situational awareness applications leveraging the latest advancements in real-time visualization and analysis available in the ArcGIS APIs. These applications can be built to run in connected and disconnected environments, ensuring continuity of operations and allowing operators to have the information they need to make more informed decisions.

The [Dynamic Situational Awareness Open Source App](#), built with the ArcGIS Runtime SDK for Qt, is a reference implementation showcasing best practices for developing situational awareness applications in disconnected environments. It includes tools for visualizing local (on-device) data formats, real-time feeds of friendly forces and observations, dynamic visibility analysis, geofences, and collaboration.

### 13. How has performance in the ArcGIS API for JavaScript changed recently?

With every release, we look for ways in which we can further optimize performance. In terms of 2D improvements, we introduced some high-impact performance enhancements for feature layers over the last couple of years. Performance improvements can be seen in most applications, although apps that will see the most drastic performance gains due to these recent improvements are those that contain:

- Layers that have polygons with many vertices
- Maps with many layers
- Layers with many polygons
- Point feature layers
- Layers with simple polygons (performance boost is particularly impactful on resource-constrained devices.)
- Imagery layers

**Faster draw time for layers with complex, high-vertex count polygons:** Behind the scenes we've added a new simplification algorithm to preprocess complex geometries and optimize memory management.

**Faster draw time for layers with many polygons:** Because of the optimizations mentioned above and the switch to web assembly, you should also see performance improvements for layers with many polygon features.

**Faster draw time for maps with many layers:** We've also added some optimizations for the way we handle maps with a large number of feature collections. These optimizations have resulted in an improved start time and an improved frame rate for smoother map panning.

**Faster load time of data-heavy apps:** We've overhauled the feature processing pipeline, which significantly improves the load time of data-heavy apps.

**Progressive loading of feature tiles:** We also improved the experience when loading feature-dense datasets. As you might already know, features are requested in feature tiles which are built for high-performance caching. The API draws features incrementally as they are loaded, which results in a visual progression of the loading tile.

**Better data processing and memory management:** Improvements to enable more efficient processing of data, and reduced memory pressure. One example is that we've reduced memory usage by 50% for apps with feature layers using simple polygons by streamlining how vertex data is encoded.

**Load point data upfront:** Because of the above performance improvements, we were able to optimize how the feature requests data. It will fetch all its features at once from the server as opposed to requesting features on demand. Once loaded, the features won't need to be re-requested from the server, which will make future redraws after panning and zooming much faster. This now applies to both ArcGIS Online- and Enterprise-hosted feature layers.

**Faster raster layers:** Performance improvements when working with large image services with multiple bands (this was possible because we switched to Web Assembly for the LERC decoder for client-side rendering) – it is very noticeable on mobile devices. There are also huge performance gains for vector field rendering for dynamic imagery layers – drawing is on par with performance with tiled imagery layers.

14. Now that Esri has support and documentation for open-source mapping libraries like Leaflet and GL JS in addition to the ArcGIS API for JavaScript, how do I pick an API to use?

ArcGIS comes with a fully featured web mapping library - the ArcGIS API for JavaScript. If you are beginning a new project, we recommend you consider using Esri's JavaScript API for building mapping applications. However, if you have an existing app that uses open-source or if you have a desire to work with open-source mapping libraries and technologies, you can leverage your existing investment and even make your apps better by integrating ArcGIS location services – you have access to Esri's documentation and technical support to help you with your implementation. Developers should be aware that there are limitations in capabilities (and often performance) when using one of the open-source libraries.

15. Do popups work with vector tile layers in the ArcGIS API for JavaScript?

No. If you would like to enable interaction with your data within your app, the best option is to use a feature layer.

Modern browser technology coupled with optimized querying and other underlying ArcGIS API for JavaScript logic enables you to achieve performance comparable to vector tile layers in many scenarios. For example, the API is optimized to only download the attribute data when needed – in initially only the attributes needed for display, while those needed for the popup are requested from the server on demand.

With feature layers, you get the performance, full-scale interactivity, and access to the geometry and attributes. This means you can build workflows that leverage client-side queries, statistics, filtering, and geometry operations (such as creating a buffer or testing for feature intersection)

with almost instantaneous performance. Vector tile layers don't contain complete geometries – they can be split at tile boundaries so they aren't meant for geometry operations/analysis. They also are not dynamic – anytime the data changes or if you were to change the attributes in tiles, the tile set would have to be recreated. In the case of feature layers, you are working against your source data and dynamically decide which attributes you want to use in your workflows and across applications.

#### 16. How can I use vector symbology in the ArcGIS API for JavaScript?

The ArcGIS API for JavaScript now has extensive support for vector symbology. It consists of

- **Out-of-box vector symbols:** Hundreds of scalable vector symbols that are easily used in apps by referencing the symbol name. The out-of-the-box vector symbols are available for [2D](#) or [3D](#) and come as basic shapes, icons, POIs and even realistic symbols for 3D such as trees and signs.
- **Custom vector symbols:** Developers can also create their own custom vector symbols that are based on CIM, the cartographic information model of ArcGIS. CIM symbols are used to display multi-layer vector symbols for features and graphics in 2D maps. Symbol layers can be dynamically updated using an ArcGIS Arcade expression (including using attribute values and scale), like in this [sample](#). In the last year, we added more comprehensive support for complex multi-layer polyline and polygon symbols.

Vector symbology is a new addition to the web map specification and the new ArcGIS Online map viewer. To see some of the beautiful vector symbology in action, check out these demos on [smart mapping](#) and [web app design](#).

#### 17. What recent enhancements have been added to the ArcGIS API for JavaScript?

Here's a list of 10 important improvements to the ArcGIS API for JavaScript since the last User Conference, in no particular order (note that this is only a subset of the key updates):

**Performance increases:** There have been on-going performance enhancements introduced in the API over the last year, having a significant impact on a variety of scenarios. See the Q&A “How has performance in the ArcGIS API for JavaScript changed recently?” for more information.

**Better sketching and editing experience:** The Editor and Sketch widgets have more advanced snapping behavior in them, along with a new simple user interface to the SnappingControls widget. In addition to the snapping improvements, the editing experience was overhauled. The updated UI streamlines the process for creating and updating features which includes support for batch (continuous) feature creation. Sketching was also improved with customizable active drawing symbology, better highlight, and easier graphic selection.

**Control feature drawing order:** Vector-type feature layers like FeatureLayer, CSVLayer, GeoJSONLayer, and OGCFeatureLayer have a new orderBy property that you can use to control the draw order of features within a layer based on and attribute column or Arcade expression.

**3D mapping Updates:** Like support for heatmaps, programmatic access to analysis tools, ability to display weather conditions into your scenes, a virtual light option (particularly useful at the poles),

a new layer for displaying voxels, SceneLayer support in the FeatureTable widget, more line and label patterns, and local scene support for WGS84.

**Utility Network support:** These capabilities are being introduced in phases over the next several releases, for example the introduction of the SubTypeGroupLayer for fast display of UN data, a new network tracing widget, contingent attribute value support, and more.

**Visualize flow:** We introduced the flow renderer which is an effective way for your users to experience flow behavior on your map, using flow direction and magnitude information stored in your image layers to create animated flow lines.

**Basemaps with different spatial references:** Switch the spatial reference of the MapView by changing the SpatialReference property or by changing the basemap using the BasemapGallery or BasemapToggle widgets.

**Better experience for routing & directions:** The new RouteLayer provides routing visualization and turn-by-turn directions in both 2D MapViews and 3D SceneViews, and a RouteLayer can be saved to and retrieved from ArcGIS Online or Enterprise. The Directions widget now uses RouteLayer to handle persistence, customization, and modification of routes.

**Enhanced feature table:** The feature table now supports CSVLayer, GeoJSONLayer, ImageryLayer, WFSLayer, FeatureLayers and SceneLayers. You can also sort by multiple fields and zoom to selection.

**Enhanced feature selection:** hitTest() now returns all hit features from all layers, as opposed to just the top-most feature in each layer.

If you would like to follow our progress with the next version of the API and try out new features, check out the early access [/next GitHub](#) repo. You can share feedback with the team via GitHub issues.

#### 18. Can I consume ArcGIS API for JavaScript as standard JavaScript modules?

Yes. In April 2020 (version 4.19), we introduced the production release of the API's ESM build. ES modules are an official, standardized module system for working with modern JavaScript that has been adopted by all the major browsers. If you use the ArcGIS API for JavaScript with a third-party framework such as Angular or React or create custom builds of the API, using ES modules makes the process much easier.

To get started, you'll install a new NPM package [@arcgis/core](#) and then you can use native imports like this:

- import WebMap from '@arcgis/core/WebMap'
- import MapView from '@arcgis/core/views/MapView'

Review the [ES modules](#) guide topic for the complete steps necessary for using ES modules. For examples using the ES modules with frameworks and build tools, visit the [jsapi-resources](#) GitHub repository. To see the modules in action, check out this demo on [Web developer tooling](#).

## 19. What is Calcite Design System?

Calcite is Esri's design system, a collection of design and development resources for creating beautiful, easy-to-use, cohesive experiences across apps with minimal effort. It includes design best practices, icons, color schemes, and an accessible web component library with UI elements such as buttons, panels, accordions, alerts, and many more. To get started, go to the [Calcite Design System site](#). All you need is an ArcGIS Developer account. To see what Calcite is all about, watch the 2022 Esri Developer Summit Plenary demo called [Build Beautiful Web Apps Faster Using Calcite](#).

## 20. What is the ArcGIS API for Python, and what can I do with it?

ArcGIS API for Python is a powerful Python library for working with maps and geospatial data, powered by Web GIS. It provides simple and efficient tools for sophisticated vector and raster analysis, geocoding, map making, routing and directions, as well as for organizing and managing a GIS with users, groups, and information items. In addition to working with your own data, the library enables access to ready-to-use maps and curated geographic data from Esri and other authoritative sources. It also integrates well with the scientific Python ecosystem and includes rich support for Pandas and Jupyter notebooks.

Analysts and data scientists can use the ArcGIS API for Python for geocoding, spatial analysis, and big data analysis tools on their raster and vector datasets. The Python API can also integrate with machine learning libraries and enhance their research. Administrators and content publishers can manage groups, users, and their content. They can clone content, users, and groups from staging to production, publish new content, or keep existing web layers and maps up to date, etc. To experience the full functionality of the ArcGIS API for Python, you will need to have either ArcGIS Online or ArcGIS Enterprise. You can learn more and check out the [sample notebooks](#) on Python section of the ArcGIS Developers page. Additionally, you can try out the API quickly [in your browser](#) without any installation.

## 21. How can I use the ArcGIS API for Python in data science workflows?

The ArcGIS API for Python helps accomplish all stages of a data science workflow, from data preparation to model development and evaluation, deployment, and automation.

- Data preparation - Within a data science workflow, data preparation typically comprises the following three areas: data collection, data cleaning, and managing data from different input sources and formats. Using the ArcGIS API for Python's integration with Web GIS means you can bring Esri curated content from the Living Atlas into your data science workflows, as well as use your own data or data shared with you through your organization or groups that you belong to. Additionally, you can use maps, layers, and datasets shared by users worldwide through ArcGIS Online or the open web.
- Analysis - The ArcGIS API for Python enables you to perform sophisticated vector and raster analysis on small, as well as large datasets, and has support for the full gamut of analytical capabilities in ArcGIS, including network analysis, geocoding, routing, and directions.



You can perform learning and inference at scale on big datasets by distributing the computation using GeoAnalytics and distributed raster analysis servers. The ArcGIS API for Python enables easy integration of ArcGIS with the rich collection of libraries in the Python data science ecosystem.

You can perform data wrangling with Pandas and NumPy, machine learning with scikit-learn or TensorFlow, or leverage specialized spatial analysis using PySAL or GDAL, and integrate this analysis with ArcGIS. One of the most powerful aspects of the ArcGIS API for Python is that it allows you to seamlessly carry your in-memory values from native ArcGIS tools to the external scripting libraries that have been added to your Python environment so that you can create richer analytical models.

- Dissemination of results - Whatever work you do using the ArcGIS API for Python can persist as items within your Web GIS allowing you to share the results of your data science workflows as information products like web maps, scenes and layers, and notebooks. The ability to share your data science workflows as notebooks is especially helpful in documenting workflows and facilitating reproducible research. Using the Jupyter dashboard widget, you can display the key maps, tables, and charts from your notebooks in an executive dashboard style view allowing your users to discover the key points and findings of your analysis without having to sift through the underlying code.
- Deep Learning and AI - The `arcgis.learn` module of the ArcGIS API for Python is designed to simplify data prep and model training for deep learning workflows. Once your model is created you can deploy it for inferencing new data, and you can disseminate the results of your model by creating or updating data layers, maps, and apps such as ArcGIS Dashboards.

The `arcgis.learn` module includes ready-to-use models for solving computer vision problems such as object detection and feature extraction. It can also be used for pixel classification and creating super-resolution imagery. The API can work with a wide variety of data types including multispectral imagery, feature and tabular data, lidar point clouds, full-motion video, and scanned maps.

Also, through its support for natural language processing, it can work with unstructured data in text files. Using the ArcGIS API for Python, you can easily go from model prototype to an operationalized workflow.

## 22. Does the ArcGIS API for Python work with my Integrated Development Environment (IDE)?

The ArcGIS API for Python works with any Python IDE. When using an IDE of choice, make sure to connect it to the appropriate conda environment from which you installed the API. When using the [ArcGIS Notebooks](#), you get rich HTML representation for some of the API objects such as Items, Groups, Users, etc. You also get to experience the map and scene widgets. Many analysts and data scientists use Notebooks to learn and experiment with the API because of the rich ecosystem of Python libraries, which integrate well with Jupyter Notebooks, such as Pandas, SciPy, Matplotlib, Seaborn, etc. Thus, notebooks become a place to document not only executable code, but also share your analysis using narrative text, images, interactive charts, and



maps. Additionally, the SDK material, such as the samples and guide, are distributed as Jupyter Notebooks making it a natural place for many users to get started.

23. What license do I need to work with the ArcGIS API for Python?

The ArcGIS API for Python is free for download and use. It comes pre-installed with ArcGIS Notebooks and ArcGIS Pro. While you can use it as an anonymous user, your functionality is limited to what an anonymous user can do on ArcGIS Online or ArcGIS Enterprise. To experience the full functionality of the API, you would need to log in with an ArcGIS named user account on ArcGIS Online or Enterprise or an ArcGIS Developer account. The extent of the operations you can perform with this Python API simply align with the capabilities, roles, and privileges of the user type assigned to you by your organization's portal administrators. If you have a developer license, then the ArcGIS API for Python is simply available to you, and its capabilities conform to the level of developer subscription you have.

Go [here](#) to learn more.

24. Does the ArcGIS Runtime SDK for .NET support WinUI 3?

Yes. WinUI 3 is Microsoft's next-generation user interface platform for Windows. It offers a consistent UI framework for all Windows apps across both Win32 and UWP, which enables .NET developers to modernize apps written in WinForms and WPF. ArcGIS Runtime SDK for .NET 100.13, released in December 2021, introduced support for WinUI 3.

25. Does the ArcGIS Runtime SDK for .NET support .NET 6?

Yes. .NET 6 completes the unification process of .NET on one platform to target Windows, Android, iOS, and more. ArcGIS Runtime SDK for .NET 100.13, released in December 2021, added support for .NET 6.

26. Will the ArcGIS Runtime SDK for .NET support .NET MAUI?

Yes. See *What is the upcoming 200.0 release of the ArcGIS Runtime SDKs?*

A preview release of the ArcGIS Runtime SDK for .NET with .NET MAUI support was made available through the [early adopter site](#) in April 2022.

27. Will the ArcGIS Runtime SDK for Qt support Qt 6?

Yes. See *What is the upcoming 200.0 release of the ArcGIS Runtime SDKs?*

28. Will the ArcGIS Runtime SDK for Android include a Kotlin API?

We are working on a new ArcGIS Runtime SDK for Kotlin. See *What is the upcoming 200.0 release of the ArcGIS Runtime SDKs?*

29. Will the ArcGIS Runtime SDK for iOS include a Swift API or Swift UI components?

We are working on a new ArcGIS Runtime SDK for Swift. See *What is the upcoming 200.0 release of the ArcGIS Runtime SDKs?*

30. What is the upcoming 200.0 release of the ArcGIS Runtime SDKs?

Developer languages, tools, and platforms have evolved and advanced in the nearly 6 years since we first released version 100.0 of the ArcGIS Runtime SDKs. To take full advantage of these developments, we will release version 200.0 of the ArcGIS Runtime SDKs at the end of 2022.

The 200.0 ArcGIS Runtime SDKs will be a continuation of the existing 100.x releases, using the same tried-and-tested underlying shared C++ Runtime Core: they will provide the same functionality, usage patterns, and licensing as the 100.x releases (even continuing to use existing license strings), but will be updated to integrate with the latest in developer tooling.

The 200.0 ArcGIS Runtime SDKs will support NET MAUI, .NET 6 for Android, .NET 6 for iOS, Qt 6, Swift, Swift UI, and Kotlin. For more details, please read the [ArcGIS Runtime in 2022 and beyond](#) blog post.

31. Will updating from 100.x to 200.0 of the ArcGIS Runtime SDKs be like updating from 10.x to 100.x?

No. The 200.0 SDKs will be a continuation of the existing 100.x releases, using the same underlying shared C++ Runtime Core: they will provide the same functionality, usage patterns, and licensing as the 100.x releases, updated to integrate with the latest in developer tooling.

Applications built with the 100.x ArcGIS Runtime SDKs for .NET, Java, and Qt will likely require very little work to update to 200.0.

Applications built with the 100.x ArcGIS Runtime SDKs for iOS and Android will need some development effort to adopt the new 200.0 ArcGIS Runtime SDK for Swift and ArcGIS Runtime SDK for Kotlin.

To support developers while they assess the 200.0 SDKs, the 100.15 release of the ArcGIS Runtime SDKs (due August 2022) will be a Long-Term Support release, offering 2 years of General Availability support in place of the typical 1 year, for a total of 5 years of support instead of 4.

For more details on the Runtime roadmap, including the 100.15 and 200.0 releases, please read the [ArcGIS Runtime in 2022 and beyond](#) blog post.

32. Will the ArcGIS Runtime SDKs support Virtual Reality (VR), Augmented Reality (AR), or Mixed Reality (MR) solutions?

Yes and no. We have two options for developers:

- ArcGIS Runtime SDKs support AR on mobile devices for use in production as of version 100.6, which was released in August 2019. In general, support for AR in ArcGIS Runtime means overlay of 3D content (in a SceneView) on a camera feed from an iOS or Android device. With 100.6, AR functionality is supported with components/capabilities delivered

in Runtime toolkits. These toolkit components are built on ARCore and ARKit (Android and iOS, respectively) to optimize support for positional accuracy.

- Support for all XR experiences (AR/MR/VR) is provided with a new set of developer products that integrate with game engines. The ArcGIS Maps SDK for Unity and ArcGIS Maps SDK for Unreal Engine are available as plug-ins that provide a simplified API to access ArcGIS services and local data. They support direct access to raster tiles for display/elevation and scene layers such as 3D objects and integrated mesh. Use of GIS data in a game engine means leveraging animation, physics, analytics, and other immersive/holographic 3D experiences that target a wide range of devices, from mobile phones to VR and AR headsets such as Oculus Quest and HoloLens devices.

Following a popular [public beta program](#), we recently launched the first production release of the ArcGIS Maps SDK for Unity, and the ArcGIS Maps SDK for Unreal Engine is due for release at the end of June.

### 33. Can I migrate from ArcGIS Engine (ArcObjects SDK) to ArcGIS Runtime?

Yes. However, you will need to rewrite your code and consider different workflows for preparing and accessing data, operations, and analytics. Fortunately, both ArcGIS Engine and ArcGIS Runtime support .NET and Java development environments and can be used in native apps on Windows and Linux operating systems.

Ideally, you can take advantage of native capabilities in ArcGIS Runtime. This includes access to a variety of service types and capabilities and local data formats and packages. However, to access some data formats and tooling available to ArcGIS Engine, you may need to take advantage of ArcGIS Runtime Local Server.

Local Server is an optional component for the ArcGIS Runtime SDKs for .NET, Java, and Qt and is designed to help developers consume local map data or execute local geoprocessing tasks delivered in packages authored in ArcGIS Pro and ArcMap. It is built on the same ArcObjects technology as ArcGIS Server and is only supported on Windows and Linux operation systems.

If you need to use Local Server, it is important to understand how developer patterns differ from ArcGIS Engine. ArcGIS Engine has direct access to local data and geoprocessing tools. Local Server, through ArcGIS Runtime APIs, enables access to local data and geoprocessing tools through packages published as local service endpoints. ArcGIS Runtime acts as a client to local map and geoprocessing services hosted in a separate process by Local Server.

Over time, much of the functionality available in Local Server will be implemented natively through ArcGIS Runtime and available for Windows, iOS, Android, Linux, and Mac platforms. In some cases, as this functionality is implemented natively in ArcGIS Runtime, it will be removed from Local Server. That said, geoprocessing capabilities of Local Server are very extensive. So while native support for some common geoprocessing operations will be available in ArcGIS Runtime, Local Server will remain necessary for ArcGIS Runtime to take full advantage of the geoprocessing tools and options available in ArcGIS Pro.

It is important to note that ArcGIS Runtime supports 64-bit architectures (natively), is more flexible (more licensing options), and more cost effective when compared to ArcGIS Engine. For more information, see this technical session on [migrating from ArcGIS Engine to ArcGIS Runtime](#).

If ArcGIS Runtime Local Server is needed, these documentation links for [.NET](#), [Java](#), and [Qt](#) developers will provide a great start.

#### 34. Do the ArcGIS Runtime SDKs support 3D offline?

Yes. In general, the same local data formats and packages supported for use in a map (2D) are supported in a scene (3D). Raster tile packages (.tpk) and raster files can be used for display and elevation in a scene. Vector tile packages (.vtpk) can be used for display. You can display features from a feature layer in a mobile geodatabase, from a shapefile, or a GeoPackage. 2D and 3D content in a KML data source can be visualized in a scene. In some cases, a data source is 3D specific, such as a scene layer. Scene layers are based on a public spec (I3S) to optimize for storage and display of 3D objects (e.g., buildings), point clouds, integrated mesh, and point/line/polygon features. They can be delivered and accessed in a local scene layer package (.slpk). In addition, locators and network datasets can be used offline and results displayed in a scene.

ArcGIS Pro 2.3 and ArcGIS Runtime 100.5 introduced support for mobile scene packages. Similar to a mobile map package and a map, a mobile scene package (MSPK) provides a mechanism for delivering a scene and its data in a single file. The scene contained in the mobile scene package is a geodocument (like a map) which describes how to display and use the contents of the package. Currently, a mobile scene package contains one or more scene documents and can contain many scene layer packages, raster tile packages for display or elevation, a mobile geodatabase with feature data, network datasets for routing, and locators for geocoding.

As of ArcGIS Pro 2.6 and ArcGIS Runtime 100.8, mobile scene packages support online layers. This means scene documents will contain a reference to service layers and can load and render if accessible (i.e., connected). This also means that MSPKs may no longer be completely encapsulated as basemap and operational layers may reference external data sources. With the latest release of ArcGIS Runtime, ENC layers and building scene layers are not supported for use in a 3D scene.

#### 35. Does the ArcGIS Runtime SDK for iOS support Apple silicon?

Apple silicon is the name given to the hardware architecture used in recent Macs powered by Apple's own M1 chip. There are two aspects to consider about Apple silicon:

1. **Developing and simulating iOS apps on an Apple silicon Mac:** This is supported with ArcGIS Runtime SDK for iOS 100.11 and later.
2. **Deploying and running iOS apps on an Apple silicon Mac:** ArcGIS Runtime based iOS apps will run unmodified on Macs equipped with Apple silicon. However, Mac Catalyst is not supported for customizing your iOS apps for the Mac nor for running your apps on Intel-based computers. You can learn more about iOS apps on the Mac [here](#).

#### 36. Do the ArcGIS Runtime SDKs support Metal?

Yes. The ArcGIS Runtime SDKs for iOS and for .NET (Xamarin.iOS) have already added support for Metal and removed support for OpenGL ES, which was deprecated by Apple with the iOS 12 release.

The ArcGIS Runtime SDKs Qt and Java intend to support Metal on iOS (Qt) and macOS (Qt, Java) in the future

### 37. What is ArcGIS Marketplace? How can the Marketplace help me?

ArcGIS Marketplace is a destination that allows ArcGIS users to search, discover, and access apps, data, ArcGIS Pro add-ins, Web AppBuilder Widgets, and partner solutions, or browse Esri's trusted professional services partners.

The Marketplace features products and services that extend the capabilities of ArcGIS to include industry and workflow-specific solutions built by Esri's global partner and distributor community. With ArcGIS Marketplace, you can find a provider with the right expertise/solution in your industry, try before you buy, access useful free items, and become productive from day one. Our vision is to make ArcGIS Marketplace the most convenient way for our users to connect with Esri partners and distributors. For Esri Partners or Startups, the Marketplace is a global business channel that offers a great opportunity to grow your business by expanding your reach to ArcGIS users all over the world and go to market in Esri's digital ecosystem.

## ArcGIS Platform

1. I've been hearing a lot about the new product called "ArcGIS Platform." What is it and what do I need to know about it?

ArcGIS Platform is a platform-as-a-Service (PaaS) for developers who need to integrate location capabilities into their apps, business systems, and products. ArcGIS Platform lets developers access Esri's powerful ArcGIS location services using their APIs of choice—including open-source APIs. It also allows developers to create apps and extend ArcGIS products using ArcGIS APIs, SDKs, and app builders.

ArcGIS location services power Esri's industry-leading mapping and spatial analytics products, which are used by thousands of organizations worldwide. With ArcGIS Platform, developers can build innovative solutions using the most comprehensive, high-quality set of location services, data, and mapping tools available.

2. What value does the ArcGIS Platform bring to Esri's developer offering?

ArcGIS Platform brings significant improvements that developers can leverage, whether they are new to Esri or have been using Esri technology previously. They include:

- Support for 3rd-party open-source mapping libraries, such as OpenLayers, Leaflet, and Maplibre GL JS
- Feature Services now deliver industry standard vector tiles. This will help developers more easily use their authoritative content in 3rd-party mapping libraries.
- Additional Authentication method. In addition to OAuth authentication, ArcGIS Platform also supports API keys.

- The developer dashboard shows detailed service transaction usage allowing the developer to gauge the health of their application.
- A new consumption-based business model that is transparent, easy to understand, and allows you to estimate usage before you buy. With this business model, you only pay for what you use.
- A new Developer Guide that is the authoritative source for working with all the location services included with ArcGIS Platform regardless of the mapping library you choose
- A generous free tier for services allows developers to get started with no cost.

### 3. Does Esri provide technical support for open-source clients?

Yes. Esri today provides technical support for the most popular open-source mapping libraries (Mapbox GL JS V1, MapLibre GL JS, OpenLayers, and Leaflet). In the future, additional open-source libraries will be supported based on demand.

In terms of support for other open-source clients, developers have the following options:

- Access to excellent documentation with tailored guides that explain how to use ArcGIS Platform services with their open-source client
- Peer-to-peer support in the Esri Community forums
- A developer support option that provides access to Esri's world-class support team

### 4. What is the relationship between ArcGIS Platform and the ArcGIS Developer subscription?

The ArcGIS Developer subscription is the way developers access ArcGIS Platform. ArcGIS Developer subscriptions are offered through multiple subscription plans that are tailored to what developers want to do with ArcGIS. The first plan is the free Essentials plan. This is all that is required for developers to access ArcGIS Platform and our location services. The rest of the plans—the paid Builder, Professional, Premium, and Enterprise plans—are for developers who want to extend the ArcGIS system. They might be building apps on top of ArcGIS Online with ArcGIS AppStudio, extending ArcGIS Pro with custom add-ons, or extending ArcGIS Enterprise using SOIs and SOEs.

ArcGIS Platform does not replace the existing developer subscription model, nor are we introducing a new kind of developer account for ArcGIS Platform.

### 5. How is ArcGIS Platform (PaaS) different from ArcGIS Online (SaaS)?

ArcGIS Platform (PaaS) exposes a set of location services for developers to incorporate into their apps, products, and solutions. ArcGIS Online (SaaS) provides a user experience that includes web and mobile apps that support users in their GIS workflows.

The business models are also different. ArcGIS Platform is fully consumption based, and ArcGIS Online is a combination of subscription and consumption.

6. Does the ArcGIS Developer subscription provide anything that ArcGIS Online does not?

Yes. While ArcGIS Online provides access to all the technology components of ArcGIS Platform—the developer experience, APIs, SDKs, and location services—developers need an ArcGIS Developer subscription to

- Access the new business model, which lets them pay for service transactions directly in US dollars. ArcGIS Online accounts will continue to pay for service transactions by consuming service credits.
- Deploy commercial apps, which are apps that generate revenue to the developer (e.g., sales, advertisement, subscriptions, etc.). ArcGIS Online accounts are not permitted to deploy commercial apps.

The ArcGIS Developer Subscription (no cost Essentials plan) is all that's required to access the new business model and deploy commercial apps. However, developers interested in building solutions that leverage/extend our software and SaaS can also access additional ArcGIS software for development and testing purposes through the paid ArcGIS Developer subscription plans.

7. Do customers still need to have a paid developer subscription to deploy revenue-generating apps?

No. Customers can now deploy revenue-generating apps with any developer subscription plan, including a free developer account. However, customers are required to use the ArcGIS Platform service endpoints.

8. Will developers need to change their existing apps to work with ArcGIS Platform?

Developers building applications for use with ArcGIS Online do not need to make any changes. Developers building commercial applications or applications that are consuming pay-as-you-go services available with developer subscriptions must update their applications to use the ArcGIS Platform service endpoints.

- For developers using JavaScript API 4.x or Runtime 100.x APIs, this is a simple process of upgrading to the latest release of the APIs and making a small number of changes.
- For developers using earlier technology, the changes are more involved. More detailed information will be available soon.

9. Are developers required to use API keys to use ArcGIS Platform?

Authentication is required to use ArcGIS Platform. However, API keys are just one of the options developers have. Developers can use any supported authentication method with ArcGIS Platform that include OAuth app login and API key authentication. Each of these authentication methods allows developers to generate an access token. An API key is a permanent access token, which makes it simple to use and manage—but also makes it less secure.

When using API keys, developers need to monitor usage to ensure no unauthorized access has occurred. App logins use the OAuth standard to generate a temporary access token. These tokens

are more secure since they are temporary, and the credential data used to generate the access token can be kept secure.

10. Are ArcGIS customers required to migrate to the new business model to use API keys?

Not necessarily. Customers who access our services in their applications through their ArcGIS software/SaaS licensing will continue to use the service credit business model to pay for services, even if they use API keys.

11. Does the release of ArcGIS Platform impact ArcGIS Enterprise developers?

No. ArcGIS Enterprise developers are not required to change the way they are developing and deploying apps. They can continue to access Esri's developer capabilities through their ArcGIS Enterprise licensing. They are not required to change their method of authentication.

## App Builders

1. What is ArcGIS Experience Builder?

ArcGIS Experience Builder enables you to transform your data into web apps and web pages with low or no code. You can explore design decisions with templates that are easily customized, access ready to use widgets that are integrated with 2D and 3D, and, when needed, build custom tools, to deliver modern web experiences you envision.

To learn more, visit the [ArcGIS Experience Builder website](#).

2. What are the key features of ArcGIS Experience Builder?

With ArcGIS Experience Builder, you can

- Optimize mobile experiences by configuring unique experiences on mobile, tablet, and desktop separately with one URL
- Design your own experience from scratch or with templates
- Build custom workflows
- Interact with 2D and 3D content in one app
- Integrate with ArcGIS Survey123 and other apps to streamline processes
- Customize widgets and templates with an extensible framework for developers



3. Is there any functionality difference between the online, enterprise, and developer edition of ArcGIS Experience Builder?

ArcGIS Experience Builder is available in three editions: online, enterprise, and developer. The latest features are available first in the online edition, then picked up by the developer edition 3-4 weeks later. Both editions are released quarterly. The enterprise edition has two releases each year and will pick up features from the online edition. The enterprise edition, however, does not include any beta features.

4. What widgets will be available in the upcoming releases of ArcGIS Experience Builder?

In the Q3 and Q4 2022 releases, ArcGIS Experience Builder is planning to include the Swipe widget, the Basemap Gallery widget, the Coordinate widget, the Threat Analysis widget, and the Emergency Response Guide widget.

5. What is the functionality difference between ArcGIS Experience Builder and ArcGIS Web AppBuilder?

A mobile-optimized design, flexible layouts to build web apps and pages, integrated 2D and 3D, and actions to connect widgets for workflows are key features in Experience Builder that are not available in Web AppBuilder.

Currently, ArcGIS Web AppBuilder has more widgets than ArcGIS Experience Builder. However, we are working on functional parity between the two offerings.

6. Will ArcGIS Experience Builder reach functional parity with ArcGIS Web AppBuilder?

Yes. Experience Builder will reach most of the functional parity of Web AppBuilder through incremental releases. For more information, see the [Functionality Matrix for Web AppBuilder and Experience Builder](#) documentation we share and update in Esri Community.

7. Will ArcGIS Experience Builder replace Web AppBuilder in ArcGIS Online?

No. Esri currently has no plans to replace ArcGIS Web AppBuilder in ArcGIS Online. Both builders will be running and maintained in parallel for the foreseeable future.

8. What is the support plan for Web AppBuilder in ArcGIS Enterprise?

For ArcGIS Enterprise, support for Web AppBuilder follows the [ArcGIS Enterprise product life cycle](#).

9. What is the support plan for Web AppBuilder developer edition?

Support for Web AppBuilder developer edition follows the version of the [ArcGIS API 3.x for JavaScript product life cycle](#).

10. I have created Web AppBuilder apps in ArcGIS Online and ArcGIS Enterprise. Can I migrate them to Experience Builder?

No. You will need to reconfigure apps created with Web AppBuilder if you choose to move them to Experience Builder.

11. Can I use the new Map Viewer generated maps in Experience Builder and Web AppBuilder?

Yes. You can add the new Map Viewer generated maps to Experience Builder and Web AppBuilder. Features such as group layer, clustering, map rotation, that are only available in the new Map Viewer generated maps are supported in Experience Builder but not in Web AppBuilder.

12. I have custom widgets built on ArcGIS Web AppBuilder; will I be able to use them with ArcGIS Experience Builder?

No. While ArcGIS Experience Builder maintains a very similar programming pattern for building custom widgets, all widgets will need to be rewritten to work within the new framework. This is because ArcGIS Experience Builder is built on ArcGIS API 4.x for JavaScript, whereas Web AppBuilder is built on version 3.x.

Additionally, ArcGIS Experience Builder takes advantage of modern web development technologies, including React and TypeScript, which are part of the new widget development platform.

13. When will ArcGIS Enterprise support adding Experience Builder custom widgets?

Starting with ArcGIS Enterprise 11, you will be able to add Experience Builder custom widgets, meaning you will be able to extend the Experience Builder in ArcGIS Enterprise similar to how you did with Web AppBuilder.

14. Is Esri planning on migrating ArcGIS Web AppBuilder Developer Edition from version 3.x to 4.x of the ArcGIS API for JavaScript?

No. We have no plans to upgrade the version of the ArcGIS API for JavaScript that the Web AppBuilder uses. While Web AppBuilder continues to be a supported product still being developed and improved, the versions of the ArcGIS API for JavaScript that developers will use for building custom widgets will continue to be 3.x for 2D mapping applications and 4.x for 3D mapping applications. If you want to build custom widgets for a Web AppBuilder application, we encourage you to consider ArcGIS Experience Builder.

15. What is ArcGIS AppStudio?

ArcGIS AppStudio is a low-code/no-code toolset for creating native apps that run on mobile devices and desktops/laptops. AppStudio is built to work with the maps, layers, and data from

your ArcGIS organization (ArcGIS Online, ArcGIS Platform, or ArcGIS Enterprise). With the productivity tools included in AppStudio you can quickly build apps for distribution in your organization or publish to app stores (Apple App Store or Google Play).

#### 16. Do I have to be a developer to build native apps with ArcGIS AppStudio?

No. ArcGIS AppStudio makes it easy for both non-developers and developers to create custom native apps.

- Using the included app templates, anyone can use AppStudio to create an app by configuring app settings such as images, colors, and text.
- Users with some development skills can customize the feature functionality and design of their AppStudio apps.
- Developers can take advantage of many development productivity features in AppStudio for quickly building, testing, and deploying apps across multiple platforms.

#### 17. What kind of apps can I build with ArcGIS AppStudio?

With ArcGIS AppStudio, you can build native apps that run on smartphones, tablets, and even desktops/laptops. AppStudio is an ideal tool for building apps to display maps while disconnected (offline), edit data in the field, or connect to external sensors (Bluetooth, GNSS/GPS). AppStudio comes with configurable app templates to get you started with some common uses such as general map viewing (online/offline), simplified data capture, and asset inspection. Some of the AppStudio templates work with web apps created using ArcGIS Instant Apps; these include the Attachment Viewer, Nearby, and Zone Lookup templates. Using this no-code workflow, you can simply convert a configurable web app to a native mobile app that works offline and can be published to an app store.

#### 18. How do I deploy my ArcGIS AppStudio apps to members in my ArcGIS organization?

ArcGIS AppStudio gives you great flexibility with how you deliver apps to members in your ArcGIS organization without the need for publishing to an app store. The apps you create can be uploaded to ArcGIS Online or Enterprise, and then shared with any ArcGIS user in your organization. Using the free ArcGIS AppStudio Player app, the ArcGIS user can then download the app and run it on their own device.

AppStudio also includes tools to create a build of your app suitable for publishing in public app stores (Apple App Store, Google Play Store) or deploying to devices using an enterprise mobile device management system (MDM).

#### 19. When do I use ArcGIS AppStudio versus the ArcGIS Runtime SDK for Qt?

The answer depends on your skillset and your objectives. If you're an aspiring or novice developer who needs to build native apps for the app stores quickly, ArcGIS AppStudio is a great option for

you. It's also a great option for developers looking to extend ArcGIS and deliver custom mobile and desktop apps to the public or throughout an enterprise.

ArcGIS Runtime SDK for Qt is perfect for someone who already has experience working with C++, frameworks and SDKs and understands the particulars of integrating SDK libraries into their existing environment.

## Data and Location Services

1. What are the benefits of using vector basemaps, and which ArcGIS apps currently use them?

Esri has a set of 'vector tile' basemaps that provide several benefits, including

- **Frequent updates:** We update the global vector basemaps every three weeks.
- **Worldwide coverage:** All of the vector basemaps are available worldwide at all levels of detail and all styles utilize the same vector tile set.
- **Styles:** The basemaps are available in many traditional styles such as Streets, Streets at Night, Navigation, Topographic, Dark and Light Gray Canvas, as well as many other creative styles. New styles are being introduced to provide more ready-to-use options.
- **Smaller sizes:** The smaller size of vector tiles makes it easier to take areas of interest offline for use in ArcGIS mobile and desktop apps.
- **Localization:** Vector basemap labels support many different languages (39 and counting) and world views (e.g., boundary treatments).
- **Style editing:** If you want to modify an existing basemap or make something completely new, you can create your own styles with the [ArcGIS Vector Tile Style Editor](#). Things like changing the cartography and symbols and dropping unwanted layers can be done quickly. The Vector Tile Style Editor is integrated into the ArcGIS Online Map Viewer, as well as via the ArcGIS Developer [site](#).
- **Resolution:** Vector basemaps look great on high-res displays (e.g., Retina devices) because they are rendered client side.
- **Easy to take offline:** Vector basemaps are much smaller in storage size, making it easier to download selected areas and store offline.

ArcGIS Online organizations can easily enable vector basemaps to be the default styles in the basemap gallery. ArcGIS Online users see vector basemaps in their basemap gallery. If you don't already have access to the vector basemaps in the basemaps galleries of ArcGIS Online or ArcGIS Pro, you can still access them from the [Vector Basemaps group](#) in ArcGIS Online. Vector basemaps are supported across ArcGIS through the ArcGIS Online Map Viewer (JavaScript API), Style Editor, Configurable Maps & Apps, StoryMaps, ArcGIS Enterprise, ArcGIS Pro, ArcGIS Field Maps, and Mobile apps built on Runtime such as Workforce, Navigator, and Indoors. Developers can learn more about vector basemaps by referring to the [basemap layer service](#) in the developer documentation.

## 2. What is Esri doing to update the World Imagery map?

Esri has a very active program to update the World Imagery map with detailed and current imagery. Our goal for the World Imagery map is to provide a multi-scale imagery basemap that includes high-resolution imagery for most of the world at 1m or better resolution and has been collected within the last three to five years. The imagery is updated every three weeks and compiled from a variety of best-available sources, including commercially-licensed and community-contributed imagery.

Keep track of the latest updates on the [Living Atlas blog](#).

## 3. When World Imagery is updated, can I still access the imagery that was previously available?

Yes, by using the World Imagery (Wayback) service. Wayback is a digital archive of the World Imagery map, enabling users to access different versions of the map archived over the years. Each time World Imagery is updated, a new layer is created and added to the Wayback service. Learn more about Wayback in the [ArcGIS Blog](#), or check out the [Wayback app](#).

## 4. How can I determine the collection date of the imagery?

The World Imagery map includes a metadata layer so you can get information on the data source, acquisition date, resolution, and accuracy of the high-resolution imagery for any given location. You can access this information by adding the [World Imagery tile layer](#) to your web map as a layer (not a basemap), or by using the Esri maintained [Imagery with Metadata](#) web map. Zoom to your area of interest and click on the map for the source metadata about each map tile. The [Wayback](#) app also includes metadata. You can point and click anywhere on the map to get additional information about the imagery for the selected layer and location.

## 5. What live feeds are available in Living Atlas and who can use them?

Esri hosts weather, disaster, and earth observation feeds for you to use in your maps and applications. Examples include weather watches, active hurricanes, wildfire activity, and stream gauge levels, along with many others. These layers have been instrumental in disaster preparedness, public information maps, and climate analysis as examples. We've been working on making the more popular feeds more reliable and scalable by migrating them to ArcGIS Online feature layers so they can support heavier traffic during major events. You can keep track of the latest updates on the [Living Atlas blog](#).

## 6. What are the different ways I can access Esri's demographic data?

Esri hosts a global data portfolio of over 20,000 data attributes including demographics, Tapestry segmentation, business and consumer data, and more. Content is updated regularly from trusted data sources and is accessible through Esri's products and focused solutions as well as ready-to-use maps, direct-to-download datasets, and consumer-ready reports.

- [ArcGIS Living Atlas of the World contains a comprehensive set of demographic maps](#) covering more than 150 countries. A set of web maps provide a color-coded thematic representation at the national level down to neighborhood level worldwide.
  - [ArcGIS Business Analyst web and mobile apps](#) offer a comprehensive SaaS solution for market analytics, site selection, demographic analysis, and more. It includes data coverage options for more than 150 countries.
  - [Esri Tapestry Segmentation](#) – Tapestry segmentation provides an accurate, detailed description of America's neighborhoods—U.S. residential areas are divided into 67 distinctive segments based on their socioeconomic and demographic composition—then further classifies the segments into LifeMode and Urbanization Groups. Tapestry data is also available through the GeoEnrichment Service, Esri Reports, and ArcGIS Business Analyst.
  - [Esri Reports](#) – Obtain timely, data-driven, and presentation-quality reports describing people, businesses, and other characteristics of your study areas and sites around the world.
  - Esri Demographics can also be queried via GeoEnrichment through multiple tools and capabilities built into Esri's software and solutions, and through discrete location services. Options include the Enrich Layer analysis tools in [ArcGIS Online](#) and [ArcGIS Pro](#), the enrich method in the [ArcGIS API for Python](#), and the GeoEnrichment service endpoints through [ArcGIS Platform](#).
  - The [American Community Survey maps and apps group](#) in Living Atlas provides examples and inspiration on using demographics to solve real-world problems.
7. Where can I find out more information about location services such as Geocoding, Routing, and GeoEnrichment?

The location services are built into many ArcGIS clients such as ArcGIS Online, ArcGIS Pro, and other web and mobile apps. Developers can also tap into these services for their own applications.

- Developers interested in making use of these location services in their applications can find more information [here](#).
- [Geocoding](#). Esri's World Geocoding technology delivers comprehensive street and addressing coverage for over 150 countries. In addition, your organization can enhance the geocoding experience by contributing the most recent, accurate, and comprehensive address data through the [Community Maps Program](#). You can find addresses, get suggestions, batch geocode, and reverse geocode all from the same service.
- [Network Analysis and Routing](#). Esri's network service allows you to do point-to-point routing, calculate optimized routes, find closest facilities, build service areas, solve multi-vehicle routing problems, perform location allocation, and construct origin destination matrices.
- [GeoEnrichment](#). GeoEnrichment gives you the ability to enhance your data with additional location-based context. The additional context can drive better understanding, analysis, and decisions beyond what your original data alone may support.

GeoEnrichment provides access to global demographic and lifestyle data, summarized business data, flexible output options, and the ability to analyze your study areas and sites around the world through advanced spatial analytics. One of the key benefits of GeoEnrichment is the ability to obtain demographic estimates which consider the non-uniform distribution of populations within your analysis areas. This can become very important if you are analyzing areas that differ in shape and size compared to the existing boundaries of the source data (e.g., you're querying consumer spending summarized by county for a ring-based analysis area that only covers part of a county).

#### 8. How can I use Esri's content within my organization's infrastructure?

Esri has several options for deploying content from Esri for use in [your infrastructure](#) and for use behind firewalls. Here they are:

- ArcGIS Enterprise can be [configured](#) with utility services to make an organization's GIS connect to Esri's content via web services.
- [ArcGIS Data Appliance](#) includes basemaps and elevation data, including the new vector basemap, which are much smaller in size to host.
- [ArcGIS Business Analyst Pro](#) (extension to ArcGIS Pro) offers ArcGIS Pro users access to market analytics, site selection, demographic analysis, and more with on-premises data coverage options for the U.S. and Canada from Esri, and for Japan, France, Australia, and New Zealand from Esri's distributors.
- [ArcGIS Business Analyst Enterprise](#) is a comprehensive ArcGIS Enterprise-based solution for market analytics, site selection, demographic analysis, and more. It includes on-premises data coverage options for more than 150 countries.
- [ArcGIS StreetMap Premium](#) offers access to country-specific geocoding and routing that can directly be used with ArcGIS Desktop or published as a geocoding service using ArcGIS Enterprise.
- [ArcGIS World Geocoder](#) offers users a robust, global geocoding capability.

#### 9. How is Esri delivering Geocoding capabilities today, and how do I choose which option is right for me?

Esri's World Geocoding capability is both the market leader and technology leader in the general field of geocoding. This capability is delivered using four principal technologies:

- ArcGIS World Geocoding Service (cloud-based service with global coverage)
- ArcGIS World Geocoder (deployment in your own infrastructure with global coverage)
- ArcGIS StreetMap Premium for (geocoding datasets with countrywide coverage, along with ready-to-use street map display, and a network dataset, for use with ArcGIS Pro and ArcGIS Enterprise)

- Custom Geocoders (built and managed by organizations that require searching against their own assets and address data).

Here are some use cases to help you decide the best option for you:

- If you are deploying ArcGIS in the cloud or looking for a ready-to-use geocoding service, you can access Esri's ArcGIS World Geocoding service. The service is scalable and ready to use in ArcGIS, and its API is available for developers to implement geocoding into their applications.
- If you are deploying ArcGIS behind your organization's firewall, we offer two options:
  - ArcGIS World Geocoder: For organizations that require a global geocoding capability hosted on their own premises, the ArcGIS World Geocoder product lets users geocode large global datasets securely in their own infrastructure at a fixed fee.
  - ArcGIS StreetMap Premium: For organizations that require geocoding limited to a specific geography, ArcGIS StreetMap Premium delivers geocoding, ready-to-use map display, and routing for the geography of interest. These capabilities can be used behind the firewall with ArcGIS Desktop or hosted using ArcGIS Enterprise.
- If you are maintaining your own address data or asset data that you need to search against, you have the ability to build your own geocoding capability with ArcGIS to search against your data. For example, utilities may be interested in searching against their own assets, and local governments may want to search against their own authoritative addresses. ArcGIS includes the tools necessary to build your own geocoding solution that you can use with ArcGIS or deploy as a geocoding service for use across the organization.

## ArcGIS Hub

1. What is ArcGIS Hub?

ArcGIS Hub is an online engagement platform that lets organizations work more effectively with their communities. There are two subscription levels available:

- **ArcGIS Hub Basic** is included with ArcGIS Online and enables users to share data--as open data or privately--and create websites for sharing information on specific topics.
- **ArcGIS Hub Premium** extends engagement capabilities by providing additional feedback tools, and a framework for organizing work with collaborators.

Key capabilities of ArcGIS Hub include the following:

- **Sites for Information Sharing.** ArcGIS Hub provides a site builder that requires no programming or HTML/CSS skills. Sites are used to create a designated place where community members can learn about important topics and find authoritative content. Sites are a great way to unite apps and data into a comprehensive destination or "hub" for the community.



- **Data & Content Sharing.** A configurable content search feature is built into ArcGIS Hub sites to facilitate data and content discovery. ArcGIS Hub provides a consistent out-of-the box interface for exploring and downloading data regardless of the source, creating a seamless data catalog. Data and content can be either spatial or non-spatial, and can be searched, filtered, and downloaded or accessed via APIs. Data and content can be shared publicly as "open data" for the community to consume, as well as privately with staff and trusted collaborators.
- **Community Feedback and Data Contribution.** ArcGIS Hub (Premium) includes identities for community members so they can provide feedback and gather data with identity. Community identities are also useful when there is a need to share apps and data with external collaborators without making that content publicly visible. ArcGIS Hub also provides integrated Survey123 workflows, email notifications, and an Events system to increase two-way engagement.
- **Initiative Framework for Collaboration.** ArcGIS Hub (Premium) provides a framework for organizing people, data, apps, events, analysis, and activities associated with initiatives or projects. Users can organize staff and community members into teams and control the flow of data and apps shared to those teams. Because they have identities, community members can create website content, schedule events, contribute data, or perform analysis to help the initiative's objectives. Organizations can create and manage an unlimited number of initiatives. To help customers get up and running quickly, ArcGIS Hub provides ready-to-use initiative templates (sites and apps) that address common community-based initiatives. Customers can also create their own initiative templates to reuse and share with others.

## 2. What is the difference between an ArcGIS Hub Initiative and Site?

An initiative requires a subscription to ArcGIS Hub Premium and allows members to bundle content around a project, topic, or goal. Every initiative includes a site, a core team, and the ability to send emails and content to specific audiences, including the public. Core team members can also create a template of the initiative (including its site, apps, and pages) so that others within the organization or community can configure standardized content as their own. A site, in comparison, is one element of an initiative that provides internal and public audiences with a place to sign in, search for and download content, and find events and surveys. Each site can include multiple pages, so you can build out a comprehensive, branded experience for the initiative.

## 3. How does ArcGIS Hub help me work with the community?

ArcGIS Hub Basic makes it easy to create sites that convey information on important topics and to share data and content with the community that can be explored, downloaded, or accessed via API.

ArcGIS Hub Premium makes it possible for community members to have identity within the ArcGIS system so they can collaborate more deeply on initiatives that improve the community. With Hub Premium, customers can form teams of community volunteers, stakeholders, and

working groups who wish to lend their support, time, expertise, and resources to projects and initiatives.

Community members are given a Creator User Type and are added to a separate ArcGIS Online organization. While they are able to add content and create apps as Creators, they will not impact your ArcGIS Online organization's credit usage and they cannot edit any of the content in your organization.

Community members with identity in the ArcGIS system can "follow" initiatives to stay informed, meaning they will receive updates sent by the core team. Community members can also crowdsource data using field apps, sign up for events, submit feedback, and access and/or upload privately shared data, content, and apps. A new Discussions capability, available this summer, will enable community members to participate in discussions with initiative organizers and each other. Community members can even be added to the "core" team that manages initiatives in ArcGIS Hub, giving them the power to edit and maintain sites, events, and content as co-creators and partners in tackling important issues.

#### 4. Is ArcGIS Hub available with ArcGIS Enterprise?

ArcGIS Hub is currently only available with ArcGIS Online. However, ArcGIS Enterprise Sites is essentially equivalent to the website authoring and data sharing capabilities found in ArcGIS Hub Basic. We continue to evaluate the need for ArcGIS Hub Premium capabilities for ArcGIS Enterprise based on customer feedback.

#### 5. How do I stay up to date with what's going on with ArcGIS Hub?

ArcGIS Hub releases weekly. Changes to the product may be small, or they may be exciting enhancements we are eager to bring to our customers. Here are some ways to stay up to date with what's new:

- Read the latest [ArcGIS Hub articles on the ArcGIS Blog](#) to learn about new developments and best practices, and to see examples of outstanding hub sites. Significant changes to the product are almost always relayed in blogs.
- Sign up for the [ArcGIS Hub e-newsletter](#) to stay current on what's coming, what's new, and to get the latest news delivered straight to your inbox.
- The [Hub Changelog](#) is updated with each release and lists all new capabilities (big or small), fixes, and changes to existing features.
- Connect with other users and ask questions in the [ArcGIS Hub Community](#).
- Connect with us and follow us on [Twitter](#).
- Visit the [ArcGIS Hub Resources page](#) to see the latest resources to help you learn more.

6. How does ArcGIS Hub compare to and work with ArcGIS Experience Builder and ArcGIS StoryMaps?

ArcGIS Hub, ArcGIS StoryMaps, and ArcGIS Experience Builder all enable engaging, full-page experiences for presenting content, but each offers unique strengths. ArcGIS Hub makes it easy for novice users with no programming experience to create sites quickly. Hub sites uniquely provide the option to have a custom domain (URL) for sites, and handle common website needs, including making it easy to comply with GDPR tracking consent guidelines, providing auto-translation tools, and providing ways to embed and share to social media platforms.

Users frequently combine Hub sites with both stories and experiences. It is common to see Hub sites with elegant Experience Builder-built applications embedded. And stories crafted in ArcGIS StoryMaps add compelling narratives to Hub sites that help to encourage community engagement and action in support of important initiatives. Hub sites can be configured to embed stories and experiences within a page, open them in a separate page while maintaining the Hub site navigation, or open stories and experiences in separate browser tabs.

The [ArcGIS Hub Gallery](#) showcases exemplary Hub sites and initiatives across a wide range of topics. The Focus Area filters show the breadth of topics Hub can be used to support, while the ArcGIS Integrations filters show examples of Esri's suite of tools being featured in within Hubs. [Esri's App Builders page](#) is a great resource for exploring options for showcasing your maps and data, including how ArcGIS Hub helps to unify this content and engage community members around it.

7. What is the difference between ArcGIS Hub and ArcGIS Open Data?

ArcGIS Hub, formerly known as ArcGIS Open Data, is Esri's solution for organizations to share their authoritative data with the community. If you have a former ArcGIS Open Data site, that has been automatically converted to a Hub site. Customers can select between two URLs for their Hub site, either [hub.arcgis.com](https://hub.arcgis.com) or [opendata.arcgis.com](https://opendata.arcgis.com).

## ArcGIS Business Analyst

1. What is ArcGIS Business Analyst and how I can use it in my industry?

ArcGIS Business Analyst helps you understand your local community and markets better. Businesses use it for smarter market analysis and site selection, while governments and many other industries improve lives for customers and constituents through improved decision making. Available on desktop, web, mobile, and the enterprise, Business Analyst combines demographic, lifestyle, and spending data with map-based analytics to help identify opportunity and need. Real-time analysis, dynamic presentations, and interactive infographic reports enable you to share information with everyone and work anywhere. To find out more, please visit the [ArcGIS Business Analyst](#) product page.

## 2. What's new and on the roadmap for ArcGIS Business Analyst?

Since the last User Conference, many workflows and geoprocessing tools have been updated and improved.

- Sharing your work with stakeholders and decision makers is now easier and faster using new modernized and interactive reports.
- Significant improvements to data enrichment performance, enhanced territory design, and threshold analysis enable you to work smarter in Pro and on the Web.
- New connectable datasets and Generate Grids and Hexagons tools allow users to work more flexibly with data and all scales and geographic representations.
- Business Analyst Web App now supports Infographic [integration with ArcGIS Dashboards](#) and Experience Builder.
- The first release of the [Interesting Facts infographic panel](#) reveals differentiating information about your study area. Specify a set of variables to search, and Interesting Facts will apply statistical analysis to those variables to reveal key insights about an area with interactive tables and word clouds
- The [Void Analysis](#) workflow has been updated and streamlined for faster analysis results and an improved results table.

Going forward, we will integrate more machine learning and artificial intelligence tools to improve information discovery, recommended variables, and processing speed to accommodate the needs of data scientists and market analysts.

## 3. What new data has been added to ArcGIS Business Analyst?

- The June 2022 release includes updated Esri Demographics for the United States based on 2020 Census geographies and new forecasts for 2022 and 2027. Census data from 2000 and 2010 have been migrated to the new geographic boundaries, providing consistent analysis for users who want to work across Census vintages.
- More than 2,000 new variables have been added to the market potential, behavioral, and spending data.
- Esri Demographics for 2021 and 2022 will be available as switchable data collections in the Web App and Business Analyst Pro.
- Business Analyst Web App is now FedRAMP compliant, making it easier to work with US Federal environments and data.
- All European countries were updated with 2022 data as part of the annual update. Nearly 50 countries in Africa, Oceania, and Asia were added, bringing the total to over 175 countries and territories.
- New Places of Interest (POI) data from SafeGraph and INEGI has been added in Mexico, Puerto Rico, and Canada. A global dataset for all countries with demographics will be added in July.

#### 4. Can I use ArcGIS Business Analyst Infographics in other ArcGIS products?

[Infographics](#) is a key tool to combine proprietary data on locations with data about prospective customers, clients, or patients then share your analysis as beautiful, interactive, and [customizable infographic](#) reports – all within ArcGIS Business Analyst. You can also create infographics through the [Business Analyst Widget](#) inside ArcGIS Web AppBuilder and ArcGIS Experience Builder, as well as through the [ArcGIS API for JavaScript](#).

Once your infographic is complete, you can easily export it as a dynamic HTML, a PDF, an image, or to Classic Story Maps. You can find more information and demos at the User Conference session titled, "Building Custom Infographics for Your Organization."

#### 5. Is there a way to try ArcGIS Business Analyst before buying?

Yes. Those interested in trying ArcGIS Business Analyst Web and Mobile Apps can sign up for a 21-day [free trial](#). To try ArcGIS Business Analyst Pro, or to request a demo, please reach out to the [ArcGIS Business Analyst product team](#).

#### 6. How do I purchase ArcGIS Business Analyst?

New and current Esri customers can review pricing and purchase ArcGIS Business Analyst Web App on the [Business Analyst pricing page](#).

ArcGIS Business Analyst Web App includes two tiers: Standard and Advanced.

- The ArcGIS Business Analyst Standard bundle includes everything new and current Esri customers need to be successful. Included in the bundle is ArcGIS Business Analyst Web App, ArcGIS Business Analyst Mobile App, a Creator user type (a prerequisite for running Business Analyst), and 6,000 credits — these credits allow customers to create stunning reports and beautiful infographics and run demographic analysis (average Business Analyst credit usage is approximately 4,000-5,000 per user/per year).
- Customers interested in accessing both the Web App and the extension to ArcGIS Pro can purchase the newly available ArcGIS Business Analyst Advanced Bundle, which includes ArcGIS Business Analyst Web App, ArcGIS Business Analyst Mobile App, a Creator user type (a prerequisite for running Business Analyst), 6,000 credits, and access to ArcGIS Pro and ArcGIS Business Analyst Pro with a subscription to Online data.

Customers interested in purchasing ArcGIS Business Analyst Pro (which comes with on-premises data) or ArcGIS Business Analyst Enterprise can fill out the form on the [pricing page](#) or reach out to the [ArcGIS Business Analyst product team](#) directly.

#### 7. Where can I learn more about the June 2022 release of ArcGIS Business Analyst?

You can learn about the latest product updates by reading the [What's New blog](#), or by attending one of the ArcGIS Business Analyst: What's New sessions at the 2022 User Conference. At the User Conference, you will also have the opportunity to learn valuable tips and tricks, more about the data available in Business Analyst, and how to use your own data within the product. See the [this blog](#) for helpful Business Analyst session information.

## ArcGIS IPS

### 1. What is ArcGIS IPS?

ArcGIS IPS is an indoor positioning system that enables you to locate yourself and others inside a building or facility in real time. Similar to GPS, it puts a blue dot on indoor maps and uses location services to help you navigate to any point of interest or destination.

Through the ArcGIS Indoors mobile app and custom-built apps based on ArcGIS Runtime, you can empower customers, visitors, and contractors with real-time indoor navigation, location sharing and location tracking. Indoor location data collection and analytics help businesses increase efficiency and improve customer service.

### 2. What is needed to set up ArcGIS IPS?

To set up ArcGIS IPS, you need

- **ArcGIS Online or ArcGIS Enterprise (10.9.1 or later).** ArcGIS IPS is an organizational capability that requires ArcGIS Online or ArcGIS Enterprise 10.9.1 (or later).
- **ArcGIS Pro Standard or Advanced (2.9 or later).** ArcGIS IPS uses geoprocessing tools in ArcGIS Pro to load data from ArcGIS IPS Setup into the customer's indoor maps. These tools require ArcGIS Pro Standard or Advanced, and they're only available in ArcGIS Pro 2.9 (or later). We recommend that customers use ArcGIS Pro 2.9.1 or later.
- **Indoor maps.** The information model used by ArcGIS IPS depends on indoor maps. These maps are typically created with ArcGIS Indoors Pro or ArcGIS Indoors Maps, though they don't have to be. We recommend that customers use ArcGIS Indoors because we designed ArcGIS IPS to work best with maps created in ArcGIS Indoors.
- **Hardware infrastructure that can be used for indoor positioning.** To use indoor positioning, customers need a network of signal-emitting hardware that can be used to determine the indoor location of a mobile device. Customers may already have this hardware in place, or they may need to purchase and set up new hardware. The current release of ArcGIS IPS supports a beacon-based and Wi-Fi-based indoor positioning system. Please note that for a Wi-Fi-based indoor positioning system, Apple IPS on iOS is required. On Android, Wi-Fi scan limitations can potentially apply.
- **An ArcGIS Runtime app that supports indoor positioning.** To use ArcGIS IPS capabilities, an app that leverages indoor positioning through ArcGIS Runtime 100.13 or later is needed. This can be an Esri-developed app, or a custom app built by developers. At the current release of ArcGIS IPS, Esri apps that support indoor positioning are ArcGIS Field Maps and ArcGIS Indoors mobile app.

### 3. Which positioning technology can be used in the current version of ArcGIS IPS?

In the current release (June 2022) we support beacon-based positioning on the iOS and Android platform.

Additionally, ArcGIS IPS supports Wi-Fi-based indoor positioning. Please note that for Wi-Fi-based IPS, Apple IPS on iOS is required. On Android, Wi-Fi scan limitations can potentially apply.

4. Does ArcGIS IPS support indoor and outdoor positioning?

Yes. ArcGIS IPS can switch between IPS (indoors) and GPS (outdoors). However, if the use case is purely based outdoors (i.e., GPS positioning only), we do not recommend using ArcGIS IPS, and we recommend using standard GPS instead.

5. Can I use ArcGIS IPS for location sharing and tracking?

Yes. In combination with using the ArcGIS Indoors mobile app, you can track building occupants (who are using the Indoors mobile app) indoors and outdoors. To allow this, users need to opt in to share their real-time location.

6. Can I add indoor positioning to a custom mobile app?

Yes. You can add indoor positioning to a custom-built mobile app using the ArcGIS Runtime SDKs.

7. I want to use indoor positioning in ArcGIS Indoors and in a custom-built app; do I need to pay more or have multiple licenses of ArcGIS IPS?

No, you do not. ArcGIS IPS is licensed on an organizational level. Whether you're using ArcGIS IPS in a single product or within multiple products does not affect the licensing cost.

8. Are there venue types where ArcGIS IPS works better than others?

How well any IPS works depends on the building layout and how either beacons or Wi-Fi are available and placed. For example, for a beacon-based positioning, beacons should be placed in strategically good positions – ideally about 9-10 feet above ground. In general, spaces with separate rooms and structured spaces (e.g., office environments, hospitals, corporate campuses, airports) work better than huge open spaces (e.g., big conference halls with an open layout).

## ArcGIS Indoors

1. What is ArcGIS Indoors?

ArcGIS Indoors is an indoor mapping system that allows you to assemble, manage, and share building and campus information. It is the foundation for an indoor GIS for asset, space, and building management. ArcGIS Indoors

- Provides a web and mobile occupant experience for workspace reservation, location sharing, and wayfinding, and can interface with other systems for facility incident reporting
- Supports facility operations through problem reporting, asset management, and mapping for safety and security

- Includes an out-of-the-box app for space management that supports office assignments, space allocation, and office hoteling
- Provides data management tools to aggregate CAD and BIM floor plans into a geodatabase to build indoor maps
- Offers device tracking to support finding and tracking people indoors

The indoor maps and apps created through ArcGIS Indoors can support a number of operational workflows.

You can deploy ArcGIS Indoors as an on-premises solution that is built around ArcGIS Enterprise or purchase and use ArcGIS Indoors from ArcGIS Online as a SaaS solution.

## 2. Is ArcGIS Indoors a solution for Facility Management?

ArcGIS Indoors supports capabilities that can support space management and planning, asset management and maintenance, as well as safety and security. Though ArcGIS Indoors is not a complete solution for Facility Management, it does support workflows that are a part of facility management and provides an indoor mapping platform for partners to build Facility Management offerings.

## 3. How does ArcGIS Indoors support Asset Management?

With ArcGIS Indoors, you can understand and manage the location and inventory of assets. ArcGIS Indoors provides web and mobile apps to visualize floor plan maps and asset locations. Using floor aware maps created with ArcGIS Indoors, you can leverage other parts of ArcGIS (e.g., ArcGIS Pro, Field Maps, Map Viewer, custom Experience Builder app) to edit the locations and attributes of those assets.

ArcGIS Indoors can support real-time asset tracking through integration with Bluetooth, Ultra-wide band, and RFID tracking solutions with the use of GeoEvent Server or Velocity. Through this capability, you can, not only track the real-time location of assets and visualize the locations on an indoor and outdoor map, but also create geofences to be alerted when assets cross a threshold. If an asset leaves an area or enters an area, GeoEvent Server can be configured to send alerts or actuate other systems or devices to respond. Note that GeoEvent and Velocity are sold separately from ArcGIS Indoors.

Through prescribed patterns of integration, ArcGIS Indoors can interface with third-party asset management systems to bring indoor mapping, navigation, and incident reporting to your existing asset or maintenance management systems.

## 4. How is ArcGIS Indoors used for safety and security?

ArcGIS Indoors supports the ability to secure and protect people, property, and assets through the creation and publication of indoor and outdoor maps of sites and campuses. Safety and security staff can do operations planning on these workspace maps. These maps can support evacuation planning, security personnel deployment, and informing first responders of building



layouts. They can also be used to plan the placement of equipment such as fire extinguishers, first aid kits, and defibrillators, and more.

ArcGIS Indoors also supports device tracking both indoors and outdoors. This capability can support monitoring the real-time location of staff such as security personnel for the purpose of dispatch to incidents or to ensure appropriate security levels in risk areas.

#### 5. How is ArcGIS Indoors used for Space Management?

ArcGIS Indoors offers a template application, called Space Planner, intended for this very purpose. Space Planner supports staffing office assignments, office hoteling management, hot desk area management, office moves, what-if scenario planning, space allocations, the ability to export modifications for external systems, and more.

In addition, you can get geospatial insight into the usage of your indoor spaces through thematic indoor mapping, in a manner that lets you visualize spaces by type, usage, occupancy, department assignment, capacity, and utilization.

Because ArcGIS Indoors models indoor data in the geodatabase, GIS analysts can support facilities management by performing and publishing analytics against indoor floorplans, asset, and people locations through the use of the ArcGIS Pro tools for spatial analytics.

ArcGIS Indoors can support space planning by empowering facilities workers with indoor maps to perform scenario-based planning.

By configuring ArcGIS Dashboards with the ArcGIS Indoors Information Model, you can support drilldown charting and reporting with space and asset information, and in a manner that integrates with an interactive map.

#### 6. How can ArcGIS Indoors be used to help my organization bring my workforce back to the workplace?

Space planning and office hoteling are foundational needs to support organizations in bringing staff back to the workplace or support staff that work from home with their workplace needs when they need to visit the office.

ArcGIS Indoors can help in a few different ways. Here are a few examples:

- Use Space Planner to
  - Define office hotels for work from home staff to service more staff per workspace
  - Consolidate unused space due to employees working from home, reallocating the space to other initiatives, selling it, stop leasing it, or stop operating it (facility cleaning, electricity, HVAC). This will help reduce operating costs
  - Space out seat assignments to honor social distancing

In addition, you can use ArcGIS Pro, with an indoor map, to do analytics about where people sit and see visualizations of where social distancing is violated.

7. Does ArcGIS Indoors offer special pricing for universities and the Education market?

Yes. ArcGIS Indoors offer significant price reductions for the University and Education markets. Please contact your Esri account manager for details.

8. How is ArcGIS Indoors licensed?

ArcGIS Indoors has a new licensing model, with 3 licensing options:

- ArcGIS Indoors Pro (an extension to ArcGIS Pro)
- ArcGIS Indoors Maps
- ArcGIS Indoors Spaces

When you purchase **ArcGIS Indoors Pro**, you get a single user license to use the ArcGIS Indoors extension to ArcGIS Pro. This extension supports floor aware indoor mapping, indoor data curation, and indoor routable network generation.

When you purchase **ArcGIS Indoors Maps**, you get

- Access to ArcGIS Indoors Pro for all ArcGIS Pro users in the organization
- Access to use the following apps in your organization, available to anyone with an ArcGIS user type:
  - Indoors Viewer – web application for indoor maps, wayfinding, and routing
  - Indoors Kiosk – touch screen web application for indoor maps, wayfinding, and routing
  - Indoors Mobile – iOS and Android application for indoor maps, wayfinding, and routing
- An unlimited number of Indoors user types that provide access to Indoors Viewer, Indoors Kiosk, and Indoors Mobile for users in your organization that don't have a Viewer user type or higher. Indoors Viewer and Indoors Mobile also support workspace reservation, but these capabilities are only enabled by ArcGIS Indoors Spaces licensing.

**ArcGIS Indoors Spaces** is an optional purchase add-on to ArcGIS Indoors Maps. It includes Indoors Space Planner, a web application that supports space assignment and workspace reservation configuration and management. Indoors Spaces licensing also unlocks the use of workspace reservation (office hoteling and meeting room booking) capabilities in Indoors Viewer and Indoors Mobile.

ArcGIS Pro, ArcGIS Enterprise, and other ArcGIS components that are not mentioned above are sold separately.

#### 9. What APIs or SDKs are available for building indoor mapping apps?

The ArcGIS Runtime SDKs (iOS and Android) and JavaScript API for ArcGIS offer indoor mapping API support.

ArcGIS Indoors Pro supports the creation and publication of floor aware maps. A floor aware map works like any other map in ArcGIS, but it also supports the view being filtered to a floor of a specific building. These maps can be consumed and programmed against using the ArcGIS API for JavaScript and the ArcGIS Runtime SDKs (iOS and Android) through the same constructs used for other maps. In addition, these APIs offer a user experience widget for filtering a map view to a specific floor of a specific building.

In addition, ArcGIS IPS exposes APIs in Runtime for ArcGIS for indoor positioning.

#### 10. What floor plan formats of data can I load into ArcGIS Indoors?

ArcGIS Indoors has out-of-the-box tools to load CAD formats such as DGN and DWG and BIM formats such as REVIT and IFC.

A variety of other formats can be loaded using the ArcGIS Pro Data Interoperability extension. This does require an understanding of the ArcGIS Indoors [Information Model](#) which is documented, with a data dictionary, in the user help.

#### 11. Are there any prerequisites for my CAD data to load into ArcGIS Indoors?

The most optimal case for CAD data to be loaded into ArcGIS Indoors is when indoor spaces, called Units in the ArcGIS Indoors Information Model, have line work that closes the polygons of the Unit features.

Another optimal situation is when Units are attributed in the CAD data by their name and use type, as annotation in the CAD data. Use type is useful for data curation workflows such as identifying the location of stairways and elevators to connect floors for the indoor routing network. It's also useful to help classify hallways and pathways and other open areas that aren't offices as primary pathways to avoid routing through these areas (unless they are an origin or destination).

It's also optimal if Unit entities, Unit name annotation, and Unit use type annotation are separated in the CAD into separate layers that contain only these elements. This makes it easier to load the Units and attributes without also loading undesired entities.

If these conditions in your CAD are not met, you can still load the CAD data into ArcGIS Indoors, there is just more work that needs to be done to clean up data post loading it into the Indoors Information Model in the geodatabase.

## 12. What does it take to get started with ArcGIS Indoors?

Adopting ArcGIS Indoors has 2 components to getting up and running.

First is loading data into the [ArcGIS Indoors Information Model](#). If you have clean CAD or BIM data, then getting started is a matter of running data conversion [geoprocessing tools](#) in ArcGIS Pro to load the data. In some cases, CAD and BIM data cleanup may be required.

Second is deploying the system. This is a matter of deploying an ArcGIS Enterprise portal. If you are using ArcGIS Indoors from ArcGIS Online, this step can be omitted.

The third step is to build indoor maps from your data, deploy the Indoor Viewer and Space Planner template applications, and deploy a mobile map package for Indoors Mobile.

Esri Professional Services and our Indoors Specialty Partners can help get data loaded and deploy the system. Some of our partners can perform scans of your buildings and create the digital outputs needed for the ArcGIS Indoors Information Model if you don't have CAD or BIM source floor plans.

## 13. Does ArcGIS Indoors support the Apple IMDF (Indoor Mapping Data Format)?

Yes. Using the ArcGIS Pro Data Interoperability extension, you can export the ArcGIS Indoors Information Model to the IMDF format using a [workbench](#) provided by Safe Software. You can use the Data Interoperability extension to also import IMDF. The ArcGIS Pro Data Interoperability extension is a separate purchase from ArcGIS Indoors.

## 14. What indoor positioning systems does ArcGIS Indoors support?

At the current release, ArcGIS Indoors supports ArcGIS IPS and the Apple indoor positioning systems (IPS).

ArcGIS IPS uses Bluetooth beacons deployed throughout your facility for indoor positioning. ArcGIS IPS also supports Wi-Fi-based positioning on Android, which Indoors Mobile will support in the Summer 2022 release.

Apple's IPS uses Wi-Fi access points deployed through your facility for indoor positioning.

## 15. Do I need a separate portal or Online Organization to use ArcGIS Indoors?

No. With the new licensing model for ArcGIS Indoors, you no longer need a separate portal or Online Organization to deploy and license ArcGIS Indoors.

## ArcGIS Urban

### 1. What is ArcGIS Urban?

ArcGIS Urban is a 3D web-based product that applies GIS technology to urban planning by streamlining plan creation, analyzing the impact of plans, visualizing current projects, and facilitating public engagement. In addition to helping analyze, design, manage, and measure urban developments, ArcGIS Urban allows you to visualize citywide plans and projects in one place for collaboration among stakeholders.

### 2. Is ArcGIS Urban available for ArcGIS Enterprise?

No. ArcGIS Urban is currently only available for use with ArcGIS Online. Support for ArcGIS Enterprise on Kubernetes will be available in 2023.

### 3. What can I do with ArcGIS Urban?

With ArcGIS Urban, you can

- View a digital representation of your city in which all urban developments are visualized in one place for collaboration among stakeholder groups.
- Create and compare design scenarios at project and plan level.
- Create zoning or land use plans to support specific and comprehensive plans.
- Visualize zoning rules in 3D. Convert legal text into a visual representation that you can use for detailed scenario planning down to the parcel level.
- Generate plausible buildings according to zoning regulations and draw custom buildings.
- Perform suitability analysis at the parcel level to identify development sites.
- Analyze the impact of plans with predefined or custom metrics.
- Discuss and review plan and project scenarios within user groups.
- Gather feedback from the public on plans and projects.
- Export and share scenarios as web scenes.

### 4. What is a Plan in ArcGIS Urban?

Plans in ArcGIS Urban are long-term (10–50 years) urban planning initiatives on a large scale. Plans are designed to meet a city's estimated targets, such as population growth and density, and consist of a local zoning or land-use code formatted as a common data model. This generates a 3D representation of the zoning parameters in the form of a maximum envelope and building form. You can use the geometries to support scenario planning down to the parcel level.

ArcGIS Urban supports two types of plans: land-use and zoning. You can use a land-use plan to broadly plan for the type of activity a parcel of land will be used for in the future. Zoning plans are more detailed than land-use plans. You can validate a zoning plan against a land-use plan.

Users with the appropriate licensing and permissions can configure and edit plans.

#### 5. What is a Project in ArcGIS Urban?

Projects in ArcGIS Urban refer to short-term (1–5 years) urban planning at the parcel level. A project has a proposed building, which can have various levels of detail, from a simple point representation to an architectural proposal. A project is a 3D model in the context of its surrounding city environment, allowing for scenario comparison and project status management.

#### 6. What is an Indicator in ArcGIS Urban?

Indicators are pre-configured web scenes that provide insights related to the initiatives and objectives of your plans and projects. ArcGIS Urban provides out-of-the-box indicators from ArcGIS Living Atlas or allows you to create your own custom indicators.

ArcGIS Living Atlas indicators are available when you create an urban model based on the USA Default Urban template. They are only available for cities in the United States. ArcGIS Living Atlas indicators include data regarding general topics of interest such as population, housing, and education.

Custom indicators can be pre-published web scenes and dashboards that you create from data synthesis or spatial analysis and reference in ArcGIS Urban. This means that any GIS data that you can display on a map or in a scene can be used as a custom indicator.

#### 7. How can I use metrics in ArcGIS Urban?

Metrics are used to quantify and analyze the impact of development in your scenarios and compare them with each other. The plan and project dashboard allow you to visualize and explore metrics over the whole study area or by parcel selection in a meaningful way using different types of charts.

Each metric consists of at least one metric source or an existing metric value. Metric sources are aggregated as a weighted sum to a metrics dashboard value. The metrics dashboard values are calculated based on the net area of building and surface spaces. Constant or space-use dependent weights can be configured using parameters. ArcGIS Urban models can be created with or without default metrics and parameters, that can be carried over to the plans and projects.

#### 8. What is the Urban API?

The ArcGIS Urban API is a public GraphQL-based web service that allows you to read aggregated data from the Urban data model. You can also use it to create and update data directly in the Urban database without using the ArcGIS Urban app. ArcGIS Urban has a clear data model that is relatively complex with many relationships between sublayers. Using the Urban API, incoming or outgoing data can be validated and corrected to match the data model. Additionally, the Urban API can be used by other products (internal and external) to integrate with and extend the functionality of ArcGIS Urban.

## 9. Can I edit Plans and Projects from ArcGIS Urban in other Esri products?

Yes. Plans and Projects are based on a collection of feature and scene services in ArcGIS Online. Thus, they can be edited and/or updated by the majority of Esri's products. ArcGIS CityEngine, however, is directly integrated with ArcGIS Urban, allowing you to view, open, and edit Urban Plans directly.

Scenarios in Plans in ArcGIS Urban are honored in CityEngine. The rules used in Urban to generate zoning envelopes and plausible building forms are provided as part of the Esri rule library in CityEngine. Editing tools and rules can be used to provide enhanced realism and architectural detail, and the results can be shared back to Urban as a new scenario. CityEngine also provides a bridge from ArcGIS Urban to game engines for use in generation of high-end visualization and virtual reality experiences.

The ArcGIS Urban Connector makes it very easy for the ArcGIS Pro user to push layers to Urban and receive scenario layers from ArcGIS Urban. The connector uses the Urban API and can be downloaded from [ArcGIS Online](#).

## ArcGIS Mission

### 1. What is ArcGIS Mission?

ArcGIS Mission is an all-inclusive command and control software that streamlines operations while providing teams tactical situational awareness of an operating environment.

With ArcGIS Mission, users can

- Define the area of interest, map tactical resource assignments, and share information with teams
- Get real-time updates, make changes, and quickly update team members as the situation evolves
- Establish command and control via peer-to-peer communication between the field and the command center in disconnected, intermittent, or limited-bandwidth environments

All mission data is documented and stored for after-action review and playback. Teams can better understand operations, make informed decisions in real time, and acquire new insights from completed missions.

### 2. What components make up ArcGIS Mission?

ArcGIS Mission is composed of a web app, a mobile app, and a server component.

- [ArcGIS Mission Manager](#) is a premium web app used to plan, prepare, and manage an organization's missions including assigning mission members and provisioning mission content.
- [ArcGIS Mission Responder](#) is Mission's mobile app used for communication and collaboration in the field. It is available for free on both iOS and Android devices.

- [ArcGIS Mission Server](#) is the server role that allows Manager and Responder to communicate.

3. What skills are needed to use ArcGIS Mission?

Organizations who use ArcGIS Mission typically have staff who perform the following roles:

- Mission owners who create and configure the mission for organizational use
- Mission analysts in the Command Center who participate and collaborate in a mission through messaging, tasking, and reporting
- Mission members in the field who engage in mission activities by sharing location information and communicating information from the field back to the command center
- Mission observers who are typically in a supervisor role to oversee real-time mission communications
- GIS professionals who can enhance the mission experience by creating web maps containing key context layers for situational awareness

4. Is ArcGIS Mission available for ArcGIS Online?

Not yet. ArcGIS Mission is currently only available in ArcGIS Enterprise 10.8 and higher.

5. Can ArcGIS Mission work in a disconnected environment?

Yes. ArcGIS Mission supports native peer-to-peer (P2P) communication between the field and command center in disconnected, intermittent, or limited-bandwidth environments. Tracks, messages, tasks, and reports can be stored on the device until connection is restored.

6. Can ArcGIS Mission be connected to 3rd-party devices (body camera, microphone, smart watch, etc.)?

Yes. ArcGIS Mission supports 3rd-party sensors for alert and notifications. Connecting to additional 3rd-party devices is under research and development.

7. Does ArcGIS Mission support video?

Video support is coming in the next major release of ArcGIS Mission.



## ArcGIS Insights

### 1. What's new with ArcGIS Insights?

Since the summer of 2021, ArcGIS Insights had three releases: [July 2021](#), [September 2021](#), and [March 2022](#). Some of the key features recently added include:

- Spatial data support within Snowflake and Google BigQuery data connections
- JDBC database connections will be out of preview and into final. This includes support for spatial data.
- Support data connections to SAP HANA Cloud
- A new table card for displaying and understanding record-level detailed information
- Scatterplot binning for a simplified and quick interpretation of scatterplots with many data points
- Many enhancements with interactive reports (e.g., banner and logo customization, page settings, viewer map selection)
- Temporal decomposition with cross-filters, which can be used to compare spatial differences
- Export of data and images at a card level
- New temporal filter widget
- Support for geopandas, koalas, and pySpark
- Schedule updates for reports extended to ArcGIS Online Insights
- Weighted centrality option and table view of centralities added to Link analysis capabilities

A more detailed and comprehensive description of new features is available within the [help documentation](#).

### 2. What does visual analytics mean in the context of ArcGIS Insights?

As more workflows encompass data coming from a variety of data sources, visual analytics user applications aim at making it easier for an analyst to work with data regardless of the persistence solution or its deployment. ArcGIS Insights allows a user to visually construct an analysis experience that results in SQL statements sent to an established connection. If the user is working with multiple databases or data warehouses, the application will construct appropriate SQL statements to each source based on the choices made in the visual environment. The statements are executed in the database where the data resides, with ArcGIS Insights as the visual interaction with the results. Additionally, the user interface of the application is informed by the data, so the analytic choices available to the user are tailored to the type of data they are working with.

### 3. What is the roadmap for ArcGIS Insights?

The next release of ArcGIS Insights is planned for July 2022, and some enhancements planned for this release include

- Support for Data Engineering Experience
- Many quality and performance improvements

We are currently planning two more releases for ArcGIS Insights in 2022: an October and December update. To share features and enhancements you would like to see in future releases, please let the ArcGIS Insights team via the [ArcGIS Ideas web page](#).

### 4. When should I use ArcGIS Insights, as opposed to ArcGIS Dashboards or ArcGIS for Power BI?

Business analysts and GIS analysts sometimes ask about the difference between ArcGIS Insights and ArcGIS Dashboards, or the difference between ArcGIS Insights and ArcGIS for Power BI. This confusion is likely caused by the fact that all 3 products can create interactive reports with maps and charts. The similarities generally end there, however.

- When evaluating to use either ArcGIS Dashboards or ArcGIS Insights, you should consider three primary aspects.
  - First is access to data. ArcGIS Dashboards requires connections be a feature layer, while Insights supports other types of data connections.
  - Second is the real-time data. ArcGIS Dashboards is fantastic at consuming and presenting real-time information (monitoring dashboards), while Insights does not consume stream layers, and produces interactive analytic dashboards.
  - Third is analytics. Insights provides an exploratory analysis and iterative analysis environment, and analysis operations can create new information and datasets. Conversely, Dashboards does not create new datasets nor run analytical operations.
- When evaluating to use either ArcGIS for Power BI or ArcGIS Insights two main ideas should be understood.
  - First, if you are looking to embed and spatial enable existing Power BI workflows, ArcGIS for Power BI is for you. While delivering GIS features directly within Power BI is a huge convenience, it also inherently presents limitations on what can technically be delivered within the Power BI “box.”
  - ArcGIS for Power BI has some limitations that ArcGIS Insights as a GIS-first application does not have. These limits are constantly moving, but some examples include mapping more than 30,000 records, working with polygon and line data, updating refreshed data, and overall providing the greatest number of core mapping and spatial analysis tools possible. In general, if your report is primarily driven by spatial, Insights is the better option.

It is also common for analysts to use a combination of products together, within integrated workflows.

## 5. Where can I learn more about ArcGIS Insights at the User Conference?

During the 2022 User Conference, you can learn more about ArcGIS Insights by attending these three 1-hour technical workshops:

- ArcGIS Insights: Data Analysis, Visualization, and Science
- ArcGIS Insights: An Introduction
- ArcGIS Insights: Tips and Tricks

## ArcGIS for Office

### 1. What is ArcGIS for Microsoft 365?

In 2022, we will be consolidating the ArcGIS for Office, ArcGIS for SharePoint, ArcGIS for Power BI, and ArcGIS for Teams products into a single offering called ArcGIS for Microsoft 365. This product will contain components that enable you to create maps in Excel, SharePoint, Power BI, Teams, and leverage Power Automate to bring location into your business logic. The products are available in App Source for Microsoft 365 Administrators to quickly be deployed across the organization. Updates will be seamlessly delivered now that the applications are now a SaaS offering.

### 2. What will happen with the legacy Microsoft integration products?

These products will start to sunset this summer, with an end of life planned for 2023.

### 3. Where can I learn more about ArcGIS for Microsoft 365 at the User Conference?

There are a few technical sessions as well as demo theaters that will discuss the overall products, as well as deeper dives on Power BI and Power Automate. Our development team will be available all week in the Esri Showcase to answer any questions you may have.

## ArcGIS Excalibur

### 1. What is ArcGIS Excalibur?

ArcGIS Excalibur is a premium web application that provides users with tools and capabilities to easily discover, analyze, collect, report, and share information derived from imagery analysis and focused workflows.

ArcGIS Excalibur unifies traditional, separate geospatial, and imagery-based views into a single view. This new experience allows you to work with imagery of all types in the collected view for maximum analytic value, while allowing full integration with authoritative geospatial reference layers available across ArcGIS.

With ArcGIS Excalibur, you can

- Use a focused, web-based imagery application that is integrated with ArcGIS Enterprise
- Streamline your search, discovery, and use experiences
- Work with fully integrated, side-by-side visualizations of imagery in map space and image space
- Use image annotation, measurements, and sketching capabilities with automatic, accurate transformation to geographic features
- Create and use imagery project workflows for efficient image analytics

2. Is ArcGIS Excalibur designed for a specific persona?

No. Anyone who wants to discover, analyze, report, and efficiently disseminate imagery-derived information to consumers can use ArcGIS Excalibur. Users include analysts and managers of all types in industries such as national security, disaster response, local and federal government, humanitarian relief, insurance, transportation, and public works.

3. How is ArcGIS Excalibur licensed?

ArcGIS Excalibur is a premium application and requires a separate ArcGIS Enterprise portal license file. You must have a Creator or GIS Professional user type with the appropriate roles before an ArcGIS Excalibur license can be assigned to you.

4. Is ArcGIS Excalibur available in ArcGIS Online?

Not yet. ArcGIS Excalibur is currently only available in ArcGIS Enterprise 10.7 and later.

5. Can I use content created in ArcGIS Excalibur in other ArcGIS applications?

Yes. Excalibur uses ArcGIS and its information model to consume and create content that can be applied to other ArcGIS applications. In particular, content created in an observation-type imagery project is written to a hosted feature service and can be used in other applications such as Map Viewer and ArcGIS Pro, and web applications such as ArcGIS Dashboards and ArcGIS Insights. You can also use exported views from the imagery exploitation canvas in ArcGIS StoryMaps templates.

## Standards

1. What are the different facets of Esri's Open Platform approach?

Esri's geospatial platform, ArcGIS, is designed to be open, interoperable, and secure. Esri continues to be committed to enabling our users to work more easily with geospatial data inside and outside of the ArcGIS system, share and use location-enabled data from virtually any source, and participate in the open science community. As such, ArcGIS includes support for the following foundational capabilities and aspires to the goals within:

- **APIs & SDKs** – To provide developers with a variety of well documented, easy-to-use APIs that allow them to use geospatial data or embed modular geospatial processing functions at different levels of their own software stacks, as well as extend ArcGIS in a variety of ways to meet their organization’s needs.
- **Open Architecture** – To enable IT professionals to deploy geospatial infrastructure across all major cloud implementation patterns, including virtualization, container orchestration, and deployment automation across public, private, and hybrid clouds.
- **FAIR & Open Data** – To align ArcGIS capabilities with the [FAIR principles](#) (FAIR stands for Findable, Accessible, Interoperable, Reusable) as well as the Open Data principles primarily to expand accessibility to quality, high-demand, and authoritative geospatial data to a variety of users. This is achieved by
  - enabling customers to ingest and egress data from any source
  - sharing FAIR and open geospatial data services
  - providing free, public access to insight-ready mapping services
  - amplifying the reach of open data to many types of users through search engine optimization (SEO) and accessible web apps
- **Open Standards** – To release core technologies as open specifications to help foster interoperability, innovation, and cooperation; to use and support open standard formats and service specifications within our software; and to participate actively in geospatial standards development.
- **Open Source** – To contribute many tools as open-source software available on GitHub under open licenses, ranging from foundational compression libraries to easy-to-use application templates.
- **Open Science** – To enable scientific users and data producers to integrate with scientific and data analysis community tools and models, and to support the reproducibility and replicability of scientific analyses.

We believe that improvements on these fronts happen primarily through the strength and direction of our community. As such, Esri provides community support tools on GitHub and the Esri Community. Specifically, check out topics such as [Data Interoperability](#), [Standards/Compliance](#), and [Open and Interoperable](#).

## 2. What is Esri’s approach to enterprise integration?

Esri understands the challenges users face in connecting together different systems and is committed to streamlining integration workflows. As a result, ArcGIS natively supports data and systems integrations at multiple levels of the enterprise technology stack, connecting

- Identity management appliances supporting user authentication via LDAP, SAML, and OAuth protocols (GitHub, Google, Facebook)
- Connectivity to major on-premises, hosted, and cloud native database management systems

- To hundreds of local and cloud data source types through the ODBC, OLE DB, and JDBC connections and the ArcGIS Data Interoperability extension
- To real-time data feeds and services using open protocols like WebSockets, Kafka messaging, RSS, and HTML Polling
- To third-party business applications (Excel, SharePoint, Power BI, Adobe Illustrator, Autodesk Revit, InfraWorks, and Civil Works) through app plugins and data export tools
- To third-party platforms and applications using ETL patterns and near real-time syncing webhooks. Webhooks are triggered by actions in ArcGIS, such as a user logging in, an edit to a feature layer, a survey submitted using ArcGIS Survey123, and more. You can integrate webhooks with Microsoft Power Automate and other citizen integration platforms to chain a sequence of events and automate repetitive tasks.

For many years, Esri has also provided developer-focused solutions for ArcGIS integration. Esri provides the Runtime SDKs and ArcGIS API for JavaScript for embedding ArcGIS capabilities in third-party systems and solutions. Many ArcGIS products have SDKs to allow developers to extend them to leverage third-party tools or custom data formats. In addition, Esri provides an open-source Koop.js server implementation for developers wanting a scalable, microservices path to read from unstructured or tabular data sources and enrich geospatial services on demand. This Node.js Server provides an API bridge into the ArcGIS application ecosystem, translating APIs to the Esri Feature Service specification, and it has been deployed in production by many partners and customers. Esri can support implementations through professional services engagements and the Enterprise Advantage Program.

Today, a new integration pattern is emerging across SaaS platforms and web-enabled apps where both developers and ‘citizen integrators’ are looking for “no-code” or “low-code” approaches, and more event-triggered workflow options. You can see this embodied in how easy it is to connect business intelligence frameworks (for example) to many tabular data sources. While integrating geospatial data is more complex than tabular data, Esri is working to expand the options and ease of use of these API-based integration methods.

To provide data replication integration patterns, Esri has partnered with the recognized leader in spatially-enabled, no-code enterprise integration – Safe Software – and provides their Feature Manipulation Engine (FME) technology within ArcGIS in the Data Interoperability extension. Data Interoperability inherits the FME visual programming paradigm that supplies connections to hundreds of data sources and transformations that users configure to make an integration. Once configured, an integration exists within the ArcGIS geoprocessing environment for deployment on desktops or enterprise servers, enabling ArcGIS users to interact with a variety of data sources and types.

### 3. How does Esri support FAIR and Open Data?

Esri supports the key principles embedded in the FAIR and Open Data community movements. Primarily among them, Esri strives to increase accessibility to quality, high-demand, and authoritative geospatial data to a variety of users in three key ways:

- **Enable:** ArcGIS Online and ArcGIS Hub make it easy for customers to host and share authoritative FAIR and open data services.

- **Provide:** The ArcGIS Living Atlas of the World directly provides many insight-ready FAIR and public geospatial data services for anonymous, public reuse.
- **Amplify:** ArcGIS Hub, ArcGIS Online configurable applications and Developer Support for Esri Services in open-source clients, amplifies the reach of open data to many types of users inside and outside of our applications, services, and ecosystem.

Esri values accessibility at a premium among the [FAIR](#) and open data principles. While not all of our publicly shared data is under the most permissive open licensing, due to customer government constraints, much of it is still highly accessible - free reuse and insight-ready within ArcGIS applications as well as accessible in third-party mapping apps.

Here's a [blog](#) article that helps you implement FAIR principles into your data strategy.

#### 4. How does Esri support open standards and specifications?

Esri remains committed to an open design architecture that enables our users to work more easily within a heterogeneous IT environment, across many types of data sources and applications, supported by open standards.

Esri supports geospatial open standards in two ways:

1. We participate in the creation and development of open standards via Standards Development Organizations like the Open Geospatial Consortium (OGC), ISO Technical Committee 211 Geographic information/Geomatics (ISO/TC 211) through ANSI/INCITS-L1, and the International Hydrographic Organization (IHO).
  - Esri is a Principal Member of the Open Geospatial Consortium, Inc. (OGC), and is active in the OGC Standards Program, the Innovation Program, and OGC Outreach activities. Esri has served on various OGC committees such as the Planning Committee, OGC Architecture Board, Joint Advisory Group between OGC and ISO/TC 211, and OGC Technical Committee. Esri's is also represented on the OGC Board of Directors. Esri continues to be an active participant in various technical committee activities.
  - Esri is an active member of the National Standards Body, INCITS L1, that represents the United States in ISO/TC 211. We have also hosted ISO/TC 211 meetings.
  - Esri is actively supporting the charting and mapping standards work of the IHO.
2. We adopt and support open international standards, open specifications, standards profiles, and de facto standards into the ArcGIS, for example:
  - As of Spring 2021, Esri has supported more than 926 OGC standards over multiple releases and within various products. Additionally, ArcGIS products have received over 338 OGC Compliance Certificates\* through the years.
  - Support of the latest ISO geospatial metadata standards continues to be rolled out.

- ArcGIS supports multiple metadata profiles, such as ISO 19115/19139, ISO 19115-1/19115-3, INSPIRE, and FGDC CSDGM.
- Esri historically has supported many widely-used de facto standards, including Shapefiles and GeoServices, released as open specifications.

Many geospatial standards are in the process of revision and modernization, and Esri will support these as they become stabilized. Examples of newer standards adopted by Esri include: OGC GeoPackage, OGC API-Features and the OGC I3S Community Standard. For details about Next Generation OGC APIs, see the question “What are Esri’s plans for supporting the new OGC API family of specifications?”

For more information, visit [Esri's Open Vision website](#).

5. Where can I get more information about ArcGIS compliancy with geospatial and IT standards?

You can learn about ArcGIS-supported standards on the [Esri Standards and Specifications](#) page.

6. What are Esri’s plans for supporting the new OGC API family of specifications?

OGC is currently working towards modernization of existing OGC web services standards, such as the [Web Feature Service](#) (WFS) and [Web Map Service](#) (WMS). The newer standards are being built using the Open API pattern for documentation to ensure easier uptake for non-spatial experts and web developers. As a Principal Member of OGC, Esri is an active participant and supporter of the new OGC generation of web services for geospatial information. Esri continues to use its resources to test and validate the new approach.

The first activity from this new initiative, called the OGC API-Features (OAF), has been voted by OGC and ISO communities as a global standard. The OAF and similar APIs in development within OGC have adopted a core and extension pattern of rollout. Standardization of some of the extensions for OAF is still underway.

Esri product support for OGC API-Features:

- ArcGIS clients consuming OAF
  - Released: JavaScript API (4.16), ArcGIS Online Map Viewer, ArcGIS Runtime (100.9), ArcGIS Pro 2.8
- ArcGIS products publishing OAF
  - ArcGIS Online (Hosted Servers) – Q2 2021
  - Planned Release ArcGIS Enterprise 11.0 (2022)



7. What is Esri's view of Spatial Data Infrastructures (SDI)? What is the Esri product view for this market?

Our world is more complex and interconnected than ever before. This presents challenges and new opportunities to how we manage our natural environment, resources, infrastructure, and societal issues for our collective well-being today, and for future generations. Today's shared challenges and "wicked" problems require new patterns for collaboration and sharing to increase understanding and make more informed decisions, for example:

- Coronavirus response and recovery
- Infrastructure for our future
- Regional planning (transit, economic development, water distribution, etc.)
- Disaster management
- Planning for sustainable development
- Biodiversity
- Climate change

As a company, we are both impacted by these problems and have the capacity to help drive positive change.

Today, integrated geospatial infrastructure enables new patterns for modern SDI and federated Web GIS. Contemporary SDI can be mission-focused with their collaborating partners. It shifts the SDI paradigm from hierarchical towards an interconnected web of nodes on a network. To achieve their objectives, collaborating organizations rely on open data, open standards, APIs, interoperability, collaboration, and new methods of community engagement that focus on putting data to use in decision-ready information products. It expands SDI beyond the geospatial domain and into the mainstream IT domain, positioned for a geospatial knowledge infrastructure of the future.

Esri helps our users take a holistic approach to SDI implementation, supporting the four main components of a modern SDI: organization, data & technology, engagement, and capacity building. This integrated approach aligns with the UN GGIM Integrated Geospatial Information Framework (IGIF) implementation framework for emerging NSDI. Additional resources, like Esri's regional geoportals, provide data, tools, and learning resources to help build geospatial capacity and community around the world.

From a product perspective, ArcGIS software provide the foundation for modern SDI. Here are a few examples:

- ArcGIS Pro pairs with ArcGIS Solutions like Address Management, Parcel Fabric, and 3D Basemaps, and extensions like ArcGIS Data Interoperability, to serve your system of record.
- ArcGIS Enterprise and ArcGIS Online help you serve and share standards-based web services and APIs. They also are a system of collaboration for you and your partners.
- ArcGIS Living Atlas of the World and Community Maps program supplement your work.

- ArcGIS Hub provides essential engagement and delivery system for your FAIR and open data.

These components are available to meet on-premises requirements with ArcGIS Enterprise and Sites and are complemented by open-source tools such as Esri's Geoportal Server.

Are you building or modernizing your SDI? Do you need to make your data more findable, accessible, interoperable, and reusable (FAIR)? Integrated geospatial infrastructure helps deliver actionable data that people can use many times in decision-ready products. Join us at the Esri UC 2022 SDI showcase to learn more about using ArcGIS technology for your SDIs.

#### 8. What plans do you have for improved support for metadata and search across ArcGIS?

For **search**, ArcGIS Online recently deployed the ability to search and return matches from so-called 'sublayers' or layers with a Feature Layer item. This is the first of several phases of incorporating more Item metadata into search to improve discoverability. ArcGIS Enterprise has a Beta Smart Search feature with an architecture that surfaces better search results for items with relatively few tags or descriptors or more domain-specific vocabulary. This architecture has also paved the way for additional search enrichments in future releases.

Next on the roadmap is indexing more formal Item metadata within Search and surfacing metadata for administrator-configurable search filters. These new filters would be exposed wherever the default filter options are currently available across core ArcGIS Enterprise and Online.

For **metadata management**, standards-compliant metadata is already supported for items throughout the ArcGIS system, allowing authoring, viewing, and editing in ArcMap, ArcGIS Pro, ArcGIS Online, and ArcGIS Enterprise. The phased support for the latest ISO 19115 standard (-1/3) for geospatial metadata is continuing. Full implementation in ArcGIS Pro is complete, and support in the web in ArcGIS Enterprise and Online is under development. Upgraded support for the latest INSPIRE metadata profile v2 was released in ArcGIS Online and as an Add-In in ArcGIS Pro.

Currently, ArcGIS allows users to

- Create a full metadata profile for projects, maps, layers (in Desktop) and for any other item type in Enterprise or Online
- Import and export Metadata from any supported standard in Desktop (ISO 19139, NAP, FGDC, ISO 19115-3, INSPIRE v2)
- Reference the live layer-level metadata directly from the authoritative source as stored in the user-hosted databases when served through feature services via ArcGIS Server and ArcGIS Enterprise
- View layer-level metadata for hosted feature layers in XML or HTML in any supported metadata standard and edit that metadata the layer's item page in Enterprise or Online (except ISO 19115-3)

- Export item metadata from Hosted Feature Layers with downloads file geodatabase or to shapefiles from Online, Enterprise or Hub

For advanced enterprise data governance and management, enterprise developers can create workflows to automate metadata validation and management with the `arcpy.metadata` module and ArcGIS API for Python. They can also extend Pro to support editing and display of custom metadata profiles within Pro using the [ArcGIS Pro Metadata Toolkit](#) and ArcGIS Pro SDK.

Esri is working on a new Unified Metadata Editing experience and architecture that leverages JSON Schema for validation and rendering. To learn more about this, please reach out to us at this year's User Conference.

## Ready-to-Use Content

### 1. What is ArcGIS Living Atlas?

ArcGIS Living Atlas of the World is the foremost collection of worldwide geographic information, containing basemaps, maps, apps, and more from Esri and the global GIS community. The content is curated, authoritative, and continually updated. The goals of ArcGIS Living Atlas are to provide content that

- Saves you time by offering ready-to-use maps, layers, and live feeds that are deeply integrated into ArcGIS
- Is authoritative and reliable, originating from the best available sources
- Is updated regularly
- Is available online and also within your own infrastructure

### 2. What is the role of ArcGIS Living Atlas?

The primary role of ArcGIS Living Atlas is in delivering immediate value and high-quality content across ArcGIS. It is deeply integrated and integral to ArcGIS Pro, ArcGIS Enterprise, and ArcGIS Online. It is also used in field apps, business apps, and more. ArcGIS Living Atlas is the foundation upon which you can build maps and apps, perform analysis, and communicate and share your work.

### 3. Where can I find ArcGIS Living Atlas content?

ArcGIS Living Atlas content can be discovered in ArcGIS Online or ArcGIS Enterprise via general search, or by filtering for Living Atlas when authoring maps using Map Viewer or ArcGIS Pro. Default Living Atlas basemaps are configured in your organization by your organization administrator and appear in both Map Viewer and ArcGIS Pro.

Another very good place to discover and begin working with Living Atlas content is the [ArcGIS Living Atlas website](#). You can sign in on the [Browse tab](#) and begin searching for and using Living Atlas content.

#### 4. How do I get started with ArcGIS Living Atlas?

[Get started with ArcGIS Living Atlas of the World](#) is a Learn ArcGIS lesson that helps you understand Living Atlas and how to get started. [Other Learn ArcGIS lessons and tutorials](#) provide specifics and how-to articles that leverage Living Atlas content and help you get the most out of it.

#### 5. How can I learn about what's new in ArcGIS Living Atlas and stay up to date with news and announcements?

There are several ways to learn about what's new, recent announcements, and how to get the most out of ArcGIS Living Atlas:

- [ArcGIS Living Atlas News](#) is published regularly and summarizes what's new and recently published in ArcGIS Living Atlas.
- The [ArcGIS Living Atlas website home page](#) is regularly updated with the latest Living Atlas news.
- The [ArcGIS Living Atlas blog](#) summarizes updates, new content, and techniques and best practices.
- The [ArcGIS Living Atlas Esri Community](#) includes blogs with product news and announcements, as well as Q/A, ideas, and more.

#### 6. Are there any apps where I can see and use ArcGIS Living Atlas layers?

The [Apps tab at the ArcGIS Living Atlas website](#) highlights a variety of applications that are designed to help you use and understand Living Atlas content. Some of the apps are designed to help you explore content to create your own web maps, such as World Imagery Wayback, Esri Maps for Public Policy, USGS Historical Topographic Map Explorer, Landsat Explorer, and others.

#### 7. How can I contribute to ArcGIS Living Atlas?

You can contribute to ArcGIS Living Atlas in several ways.

Anyone can submit content to be included in ArcGIS Living Atlas. You can nominate your maps, apps, and data to become part of Living Atlas. Nominated items will be reviewed by curators, and you will be contacted if there are any questions or suggestions. Once ready, your items will become part of Living Atlas. See [Share your content to ArcGIS Living Atlas of the World](#) for more info about the steps and process.

The [Community Maps Program](#) enables community contributions of authoritative data to help build the ArcGIS Living Atlas. You can provide feedback, create detailed features, and share data layers and services, contributing to Esri basemaps that anyone can use.

If you don't have a collection of data layers to provide, but still want to contribute, consider adding content through the [Community Maps Editor app](#). Edit parts of the Esri Community Maps basemap to add detailed features for universities, schools, parks, landmarks, and other special

areas of interest. Recent contributions and releases include over 100 new and updated communities in basemaps and World Imagery.

8. How can I provide feedback or report issues with ArcGIS Living Atlas basemaps? How often do the basemaps get updated?

You can provide feedback about basemaps via maps found in the [Basemap and Geocoding Feedback group](#). Once feedback has been reviewed, the suggested changes are incorporated into the vector basemaps typically within a month.

Esri is committed to keeping the basemaps as up to date as possible with the latest data from our commercial and [community map](#) sources along with your feedback. Esri releases targeted updates to the basemaps every three weeks.

9. Can ArcGIS Living Atlas content be used by anyone? Does it cost credits?

ArcGIS Living Atlas content is intended for use across ArcGIS by ArcGIS users. Most ArcGIS Living Atlas content is public and does not require an account or authentication to view or use in maps and apps.

Some Living Atlas content is *subscriber* content, meaning that you need to have an ArcGIS account to use these layers to author a map. However, you can include the maps containing subscriber content in apps and stories that you can deliver publicly to anyone.

A small subset of Living Atlas content is *premium subscriber* content, meaning that use incurs credits, though typically a very negligible amount. Even premium subscriber content can be included in public apps and stories if you choose to use them for public consumption.

## Mapping

1. What are the benefits of using smart mapping?

Smart mapping evaluates your data and suggests which visualizations are available to showcase its meaning and importance.

From these suggestions, even with little to no experience with cartography, you can quickly discover and implement beautiful and powerful layers that showcase a single variable or the relationship between multiple fields in your data.

In seconds, any map author can try many different visualization techniques, from simple unique values to more complex styles such as predominance and dot density. Try them all on and find which best suits your audience.

Learn how to [get started with Smart Mapping here](#), and check out our [Smart Mapping Styles Collection](#) for inspiration.

## 2. What new visualization tools have become available in recent releases?

In recent releases, we've added the following visualization tools:

- The beautiful and informative Flow style offers intuitive visualization of magnitude and direction in imagery layers. [Learn more](#).
- Feature and layer [effects](#) work alongside [blend modes](#) to support nuanced visualizations, strategically drawing focus to details and inter-relationships hidden in your data.
- [Feature display order](#) allows you to control the order in which overlapping features are drawn on the map, ensuring none of your data is obscured from view.
- The ability to [duplicate layers](#) allows you to create multiple layers using the same data and then filter and style those layers individually, highlighting the relationships between them. When visualizing multiple attributes of a layer, also check out predominance, [dot density](#), and [above-and-below](#).

## 3. How does rapidly evolving web technology influence mapping?

Map Viewer partners with ArcGIS API for JavaScript to advance web cartography with new innovations in both data visualization and performance. The mapping experience now includes real-time, interactive communication between keystroke and map—as you type Arcade statements, click through the Smart Mapping options, or shift label positions—the map updates in real time. This responsiveness is possible through the engineering breakthroughs driven by the Map Viewer team's commitment to supporting creativity and experimentation for both new and experienced mapmakers.

Read more about performance innovation [in this blog](#).

## 4. What are Group Layers and when should I use them?

Grouping layers which share common traits allows map authors to communicate information about their data at a glance.

Users may toggle group visibility on and off, which simultaneously shows or hides each of the layers within the group.

In addition to toggling visibility, map authors may also apply some visualizations to the group layer, which influences the appearance of each layer in the group. For example, you can set transparency on a group layer, and each of the layers within the group will render with that same transparency setting. This can save time and help keep your visualization consistent.

Map Viewer now supports adding a group layer to another group layer—lending support to more sophisticated layer taxonomies.

Have a look at this blog post for a [deeper dive](#).

5. How do Feature Layers compare with Vector Tile Layers in terms of performance and flexibility?

The conceptual waterfront of mapping is vast and encompasses many kinds of data, real-world entities and phenomena, spatial dimensions, scales and so on. As a result, there is no one-size-fits-all approach for storing and displaying all geographic reality in a browser. Instead, Esri has created a set of related layer types, each optimized for a different mapping task. Two of the most important are Feature Layers and Vector Tile Layers.

In simple terms, Vector Tiles are great for storing and depicting the basemap “canvas,” while Feature Layers are great for displaying the geographic features that sit on top of the basemap. The content in Feature Layers is what is turned into thematic maps and visualizations through mapping and analysis. For many of us, the basemap Vector Tiles are the fast-drawing backdrop of pre-styled content (i.e., an Esri basemap) against which we visualize our Feature Layer data. We can also query Feature Layers, click to see pop-ups, and so on. There are different [kinds](#) of Feature Layers, but conceptually they fit this role.

Digging deeper, Feature Layers deliver the performance of Vector Tiles without having to create separate visualization layers of your data. Feature Layers work directly with your data through dynamic feature tiles, which gives them their speed and flexibility. These tiles are built dynamically as you use your data, and they are updated as data changes. For example, a Feature Layer can visualize unemployment data as a choropleth map, a proportional symbol map, or as a dot density map. And it can draw these on-demand the moment you want to see them. The Esri clients automatically pull down just the data that is needed for display, so they are efficient. When working with your layers in the Map Viewer, data is retrieved as you use it. The benefit to you is that you don't need to maintain a separate Vector Tile visualization layer with the exact data you need every time you explore your data; the data stored in a Feature Layer can morph into multiple data visualizations as needed.

6. How can my graphics department using Adobe products use the maps I create with ArcGIS?

[ArcGIS Maps for Adobe Creative Cloud](#), a plugin for Adobe Illustrator and Photoshop empowers graphics professionals and enables collaboration with map makers. By allowing direct access to ArcGIS maps for creating visual content, it allows creatives to

- directly consume map content from an ArcGIS organization as artwork and,
- convert Adobe Illustrator Exchange (AIX) export from ArcGIS Pro to Illustrator files.

Maps and layouts brought into Adobe this way can be further used for high-end design or migrated across to other Adobe apps. The plugin software is separately installed alongside Adobe apps. Individuals and enterprises using ArcGIS can use the plugin with their existing Viewer, Editor, Creator or GIS Professional named user subscriptions, without the need for an additional license.

## 7. Can I create publication quality maps and prepress ready files using ArcGIS Pro?

Yes. [ArcGIS Pro](#) includes a comprehensive set of advanced mapping capabilities such as advanced symbology, spatial data processing, page layouts, and automated label placement. ArcGIS Pro also supports color management and symbology that includes the ability to specify a color profile for display and output. Color profiles are files that correspond to how a device captures, renders, and understands color values and puts them into context for that device. Along with color management we include support for offset printing requirements such as spot colors, color blending, overprinting, and knockouts. Resulting export files maintain standard print formatting and can be sent through a RIP (Raster Image Processor) and support industry standard prepress operations.

## 8. What's New in Mapping and Cartography in ArcGIS Pro since the last User Conference?

Since the last User Conference, we've released ArcGIS Pro 2.9, and the new ArcGIS Pro 3.0 release. In these releases we've continued to extend and enhance the mapping and cartography capabilities of the software. With the high-end graphics and visualization tools in ArcGIS Pro, you can make the most advanced and highest quality maps for publication and sharing either as printed or Web maps. Highlights include the following:

### ArcGIS Pro 2.9

- [Dynamic Feature Clustering](#) – Dynamically aggregate large numbers of point features into proportional symbols with feature counts.
- [Animated Symbols](#) – Add symbols to your maps and visualizations that move, pulse, or dance. Use them to draw attention to a detail, visualize direction, or realistically display moving features.
- [Generalize Hydrographic Features](#) – Collapse river, lake, and other hydrographic polygon features into connected linear stream networks.
- [Graphics to Features](#), [Features to Graphics](#) – Convert your map graphics into features, and your features into map graphics.
- [PDF to Tiff](#) – Convert your georeferenced PDF files to Tiff files for viewing in your maps.

### ArcGIS Pro 3.0

- Export Presets – Save and share your export settings with others in your organization for repeatable export scenarios.
- Color Vision Deficiency Simulation – Simulate how your map or layout will look with the three different color vision deficiency simulation modes.
- JPEG 2000 Compression – Now supported for images in PDF exports resulting in smaller file sizes.
- glTF Marker Symbols with emissive textures – GL Transmission Format (.glTF) files can be used to create more photo-realistic marker symbols.



9. Does Esri provide industry-specific data and cartographic production tools in ArcGIS Pro?

Yes. Esri provides industry-specific data and map production solutions that extend ArcGIS Pro. ArcGIS Production Mapping and ArcGIS Defense Mapping support civilian and defense organizations and include data models, templates, configuration rules, production workflows, and generalization tools to efficiently produce and maintain authoritative content.

ArcGIS Maritime allows a wide variety of organizations including hydrographic offices, data scientists, and port authorities to support information products and standards, like ENC, Inland ENC, AML, S-58, S-4, S-63, and DNC, in compliance with VPF, S-57 and S-100 specifications. ArcGIS Maritime provides two deployments - automate chart production in desktop and publish electronic charts as web services in the web.

ArcGIS Aviation consists of two extensions that support data management and analysis workflows for the aeronautical community:

- ArcGIS Aviation Airports provides tools to create obstruction identification surfaces, perform analysis, and create and manage signs and markings. These tools enable airport planning and design activities and ensure safe operations of airfield infrastructure.
- ArcGIS Aviation Charting provides data management, modeling, and cartography tools to generate navigational products that are compliant with International Civil Aviation Organization (ICAO) Annex 4 and Federal Aviation Administration (FAA) standards. It simplifies aeronautical charting and ensures charts are kept up-to-date according to the Aeronautical Information Regulation and Control (AIRAC) cycle.

## Spatial Analysis and Data Science

1. What are some key improvements in spatial analysis and geoprocessing in ArcGIS Pro?

ArcGIS Pro 2.9 was released in 2021 and includes many improvements in spatial analysis and geoprocessing. Here are some examples:

- In the Geoprocessing pane, you can add your favorite tools to the My Favorites section of the Favorites tab. Your favorite tools appear in all projects.
- You can create toolboxes in a new ArcGIS toolbox format that are stored with the .atbx file extension. This format represents the next generation of geoprocessing toolbox, tool, script, and model storage, and will be the default format at the next major release of ArcGIS Pro.
- Several geoprocessing tools that consume credits have a credit estimator that appears on a banner when the tool is opened in the Geoprocessing pane.
- Hosted geoprocessing sample and code sample items from ArcGIS Online or your portal can be discovered, downloaded, and added to a project.
- When you run geoprocessing tools using ArcPy in a notebook, the tool result is displayed as a rich representation with messages that may contain formatted elements such as tables, images, bullet lists, and hyperlinks.

- The tool properties dialog box has an improved design. New functionality allows you to embed and password protect script and model tools, edit script tool execution code, and more.
- A new geoprocessing option allows you to open the messages window automatically after running a tool.

ArcGIS Pro continues to add spatial analysis and geoprocessing tools. For example, the PDF To TIFF geoprocessing tool in ArcGIS Pro 2.9 exports a PDF file to Tagged Image File Format (TIFF) including GeoTIFF. A GeoTIFF file can be viewed in ArcGIS Pro and used to digitize features. The Presence-only Prediction (MaxEnt) geoprocessing tool estimates the presence of a phenomenon in a study area using previously known presence locations and explanatory factors. There are also several new and improved raster functions to support multidimensional raster analysis.

Other key improvements in spatial analysis and geoprocessing in ArcGIS Pro 2.9 include:

- Usability and productivity improvements in the Data Engineering view, which was first introduced in ArcGIS Pro 2.8.
- ModelBuilder saves model edits automatically.
- ModelBuilder report views support find and replace for model element names and values.
- Bar charts, line charts, and scatter plots can display multiple series as a grid of mini-charts to facilitate comparison of trends and patterns.
- You can now overwrite geoprocessing services shared on a stand-alone ArcGIS server.

In addition to these advancements in ArcGIS Pro 2.9, ArcGIS Pro 3.0 continues to enhance spatial analysis and geoprocessing in the areas of general framework, data engineering, spatial analytics and machine learning, ModelBuilder, Python, charts, sharing analysis, and much more.

## 2. Is ArcGIS Pro equivalent to ArcMap when it comes to analytical capabilities?

Yes, and much more. ArcGIS Pro has far exceeded the spatial analysis capabilities of ArcMap, with hundreds of new vector and imagery analysis tools, including tools that leverage machine learning and deep learning to perform clustering, regression, classification, and prediction. There is a small set of geoprocessing tools that are only available in ArcMap and not in ArcGIS Pro which relate to the management or processing of data formats or data models that are not supported in ArcGIS Pro. For a comprehensive list, visit the [Tools that are not included in ArcGIS Pro](#) documentation topic.

## 3. What research and development work is Esri doing in the field of Machine Learning and Artificial Intelligence (AI)?

Esri is constantly working to bring edge spatial machine learning to the ArcGIS community, focusing on the methods and approaches that are most appropriate for spatial data, and finding ways to extend existing methods to more appropriately handle the unique nature of spatial data and spatial problems.

Here is what's new in spatial machine learning:

- The Change Point Detection tool can detect changes in the mean, standard deviation, slope, or count values in a time series for each location.
- The Forest-based Forecast tool also added the ability to incorporate explanatory variables, estimate lagged effects between them, and change the model scale providing more flexibility to find a better prediction model.
- Presence-only Prediction uses the MaxEnt algorithm to estimate the presence of a phenomenon by using previously known presence locations and explanatory factors without the need for any absence data.
- The Multiscale Geographically Weighted Regression (MGWR) tool performs local linear regression that models spatially varying relationships and allows these relationships to occur at different spatial scales.

In the areas of deep learning, we continue to increase and optimize the modeling options and experiences available. Over the last year, we have worked to introduce:

- A new GeoAI toolbox in ArcGIS Pro 3.0. It contains tools for performing automated machine learning (AutoML) on feature/tabular data, and text analysis tools for natural language processing on unstructured text.
- Several new pretrained models have been added for extracting features and performing land cover classification on imagery. New pretrained models for natural language processing are being added to complement the text analysis tools in the GeoAI toolbox.
- Test time augmentation in all object detection and pixel classification models.
- Smooth blending of output across adjacent tiles when performing pixel classification.
- Few shot detection model (DETR) has been added to enable training object detection models on limited amounts of training data.
- Support for training and using panoptic segmentation model (MaX-DeepLab) has been added to jointly perform pixel classification and object detection.
- Integration with the open source MMDetection and MMSegmentation libraries, which allow you to train and use 23 additional object detection models and 22 pixel classification models, respectively.
- Integration with PyTorch Image Models (timm) library adds over 300 model backbones for object classification, object detection, and pixel classification models.
- Support for 'click to track' and automatic detection and tracking in full motion video.
- Support for multiple object tracking using DeepSORT model.

In the `arcgis.learn` module of the ArcGIS API for Python, model explainability using SHAP and GradCAM has been added to tabular analysis models and object classification models, respectively. We've also added support for gradient boosting models for feature/tabular analysis in the `MLModel` class, as well as several new sample notebooks showcasing the functionality of newly added deep learning models, including the use of deep learning to map assets from oriented imagery.

#### 4. How does ArcGIS support the analysis of spatiotemporal data?

By adding the power of space (where) and time (when), we can strengthen our understanding (why) of the things and phenomena we experience. We continue to build new tools and capabilities that can analyze spatiotemporal data to find patterns and make predictions leveraging powerful machine learning and statistical algorithms. One such example is the new Change Point Detection tool that can detect changes in the statistical property (mean, standard deviation, slope, or count) of a time series at each location in a space time cube. Enhancements to the existing tools such as Forest-based Forecast have expanded the ability to incorporate multiple explanatory variables, estimate lagged effects between them, and change the model scale to cater to the dynamic needs in the realm of predictive analytics.

New Utility tools such as Describe Space Time Cube and Subset Space Time Cube can respectively unwrap what's inside a space time cube (e.g., spatial and temporal extent, variables in the cube, etc.) and give you the ability to slice and dice the cube to fit your needs.

#### 5. What are the new capabilities in spatial statistics in ArcGIS Pro?

The Spatial Statistics team has introduced many new tools and capabilities for your analysis workflows. These include a new way to streamline data exploration and preparation, new statistical, geostatistical, space time pattern mining, and prediction tools leveraging various machine learning algorithms and techniques.

For the data preparation and exploration work, a new Data Engineering view has been added that brings existing functionality in ArcGIS Pro together with new capabilities to help you explore, clean, and prepare your data for analysis.

For spatial pattern analysis, new tools leveraging machine learning have been added, including Presence-only Prediction and Multiscale Geographically Weighted Regression (MGWR). Presence-only Prediction uses the MaxEnt algorithm to estimate the presence of a phenomenon by using previously known presence locations and explanatory factors without the need for any absence data. MGWR performs multiscale geographically weighted regression, which is a local form of linear regression that models spatially varying relationships and allows these relationships to occur at different spatial scales.

In the realm of spatiotemporal analysis, the new Change Point Detection tool can detect changes in the mean, standard deviation, slope, or count values in a time series for each location. The new space time utility tool Describe Space Time Cube has been added to better understand the contents and characteristics of a space time cube. Similarly, the Subset Space Time Cube tool can spatially and temporally subset a space time cube to work with your area of interest. The Forest-based Forecast tool also added the ability to incorporate explanatory variables, estimate lagged effects between them, and change the model scale providing more flexibility to find a better prediction model.

Finally, for geostatistical analysis, Exploratory Interpolation has been introduced which generates various interpolation results from input point features and a field and compares them based on various customizable criteria. Another tool called Compare Geostatistical Layers also compares and ranks geostatistical layers using customizable criteria based on cross-validation statistics.

## 6. What does ArcGIS offer in terms of data engineering (preparing data for analysis)?

With the release of ArcGIS Pro 2.8, we introduced a brand-new user experience for efficient, interactive data engineering. It allows you to visualize and explore your data in a fields-based view, quickly calculate summary statistics, and use a set of focused tools to address issues that are found in the data.

At ArcGIS Pro 2.9, we included a number of new features to improve performance and to help users be even more productive with data engineering. These include: showing the number of fields in a table, the percentage of null values for each field, a new spatial group in the Data Engineering ribbon, and the ability to export statistics from the Data Engineering view as a standalone table.

At ArcGIS Pro 3.0, we've continued to add new functionality and enhance the user experience with Data Engineering in Pro by adding new statistics for date fields, the ability to generate statistics for all fields in one-click, new tools for cleaning data, and an indicator of whether your table is participating in a join.

In addition to the Data Engineering view in ArcGIS Pro, ArcGIS users can also perform data engineering programmatically using the ArcGIS API for Python. In the past year, we've added several new guides containing code snippets and workflows for engineering data using Pandas, NumPy, and the Spatially Enabled DataFrame.

ArcGIS Insights users also have a new experience for data engineering. Data engineering in ArcGIS Insights allows you to clean, filter, reformat, and sample your datasets before beginning analysis. Additional engineering tools will be added to Insights in future releases. ArcGIS Insights data engineering will turbo-charge the speed and efficiency of your analysis and will speed up interactive visualizations shared with your audience.

Whether your goal is simply getting to know your data or moving into statistical- or machine learning-based modeling, Esri offers several data engineering experiences that will help you understand your data and prepare it for analysis.

## 7. What is Esri's vision regarding the use of Python with GIS?

GIS and Python go hand in hand, and our goal is to deliver a "best of both worlds" experience that is accurate, approachable, and easy to use.

Python is an extremely powerful programming language that can be used to help you automate workflows, perform analysis, and build machine and deep learning models. Combined with GIS, Python can add efficiency to workflows, increase reproducibility, and allow you to tap into the open-source data science community. It is our vision that every ArcGIS user be able to use the power of Python within the Esri ecosystem and bring ArcGIS to their Python environment of choice.

In the past year, we've added support for Python 3.9 across ArcGIS to ensure that the bug fixes and performance improvements of core Python trickles down to the ArcGIS Python libraries, ArcPy, and the ArcGIS API for Python.

## 8. What is the difference between ArcPy and ArcGIS API for Python, and what's new in both?

ArcPy and the ArcGIS API for Python are the Python packages that make up the ArcGIS Python libraries.

Using the ArcGIS Python libraries, you can convert and manage geographic data, automate spatial workflows, perform advanced spatial analytics, and build models for spatial machine learning and deep learning. Whether you are building prototypes of an analytical model or developing a large-scale application, you can solve complex problems quickly, with seamless integration with your favorite open-source packages and frameworks.

ArcPy is a comprehensive and powerful library for spatial analysis, data management, and conversion. With it, you can access industry-leading spatial analysis and spatial machine learning algorithms and create and automate simple or complex workflows easily. ArcPy makes for a rich Python experience across ArcGIS, offering code completion and reference documentation for each function, module, and class.

In the past year, we've made many "quality of life" improvements related to ArcPy, such as better navigation and rich representations in ArcGIS Pro Notebooks, as well as a new and improved Python Package Manager in the Pro backstage which will make Conda package management easier and more intuitive for our users.

ArcGIS API for Python is a simple and lightweight library for analyzing spatial data, managing your Web GIS, and performing spatial data science. It provides simple and efficient tools for sophisticated location-based analytics and integrates well with the larger Python ecosystem. In addition to your own data, the library enables access to ready-to-use maps and curated geographic data from Esri and other sources. It can also help you save time and improve efficiency by automating the administration and management of your ArcGIS Online organization or ArcGIS Enterprise portal.

The bulk of the work on the ArcGIS API for Python in the past year culminated with a major release to version 2.0 in February 2022. This release focused on user experience improvements including: ability to administer ArcGIS Enterprise on Kubernetes, support for more authentication protocols, expanded content management functionality, and documentation improvements (e.g., new guides and snippets, etc.).

There is continued development work to make it easy to use both of the ArcGIS Python libraries together seamlessly, providing you the most robust spatial Python offerings available.

## 9. What is new in ArcGIS Notebooks?

ArcGIS Notebooks provide a Jupyter Notebook experience built directly into ArcGIS Enterprise, Online, and Pro. They allow users to create, share, and execute Python scripts for data science and analysis, content management, and administrative workflows.

In both Enterprise and Online (hosted notebooks), you have access to the ArcGIS Python libraries, as well as hundreds of open-source Python libraries via the notebook runtimes, which are the ready-to-use Python package sets that accompany hosted notebooks. You can choose to execute hosted notebooks interactively (e.g., manually cell-by-cell), or on a schedule without any human interaction.

ArcGIS Notebooks continue to grow and evolve. In the last year, we introduced many improvements and enhancements to notebooks across ArcGIS Enterprise, Online, and Pro.

At ArcGIS Enterprise 10.9.1, we added the ability to publish notebooks as web tools and to trigger notebooks from webhooks. Notebook web tools extend the reach of analysis within organizations by providing non-developers with a way to execute Python code from a UI.

Notebook webhooks can help you save time and resources by automating notebook execution based on events, such as an update to a portal item.

ArcGIS Online Notebooks now have a progress indicator when a notebook is opened. This allows you to track the progress as a notebook container is opening, which has resulted in a much better user experience. There has also been a significant backend architectural change which will improve performance and lay the foundation for additional functionality in future releases.

Within ArcGIS Pro, the team has added several quality of life improvements to Pro notebooks, including rich representations from geoprocessing tools, as well as zoom and search capabilities within the notebook.

#### 10. Does ArcGIS integrate with Apache Spark?

Yes. ArcGIS utilizes Apache Spark in a number of products that offer customers a choice in deployment.

Both ArcGIS Pro and ArcGIS Enterprise utilize Apache Spark to power the distributive capabilities of GeoAnalytics Desktop Tools and GeoAnalytics Server. In both these cases, Spark is built-in, meaning that when you distribute your analysis or data processing tasks, you are distributing across the resources you have allocated for GeoAnalytics. In the case of ArcGIS Pro, this will be cores on your machine. For ArcGIS Enterprise, this will be the nodes of your GeoAnalytics Server site.

ArcGIS Velocity makes use of Apache Spark as part of its big data processing capabilities offering a combination of big data and real-time solutions through ArcGIS Online.

This summer, Esri will release a new product, ArcGIS GeoAnalytics Engine. GeoAnalytics Engine is an extension for Apache Spark that provides the ability to run GeoAnalytics tools and spatial functions in hosted Spark environments like Databricks, Amazon EMR, and Google Dataproc, providing a fully-scalable and cloud native approach to spatial big data analytics.

#### 11. What is ArcGIS GeoAnalytics Engine?

ArcGIS GeoAnalytics Engine is an extension for Apache Spark that provides the ability to structure data as a spatial type, transform data to a desired projection, and execute standard spatial functions through SQL. It also contains a set of operators which group functions into toolchains for most common workflows. GeoAnalytics Engine can be run in hosted Spark environments like Databricks, Amazon EMR, and Google Dataproc, or in Spark environments on private clouds, providing a fully-scalable and cloud native approach to spatial big data analytics.

## 12. What improvements have been made in the ArcGIS Spatial Analyst extension?

The ArcGIS Spatial Analyst extension provides powerful spatial modeling and analysis tools. It is designed to solve complex problems such as finding suitable locations, discovering spatial patterns, modeling terrains, performing hydrologic analysis, modeling distance and cost, and statistical analysis for raster data.

Spatial Analyst users may scale up their workflows using the distributed processing and storage capabilities in Image Server especially when processing large areas or large data collections. To provide better performance, we've added the ability to execute more and more Spatial Analyst tools in parallel. The most commonly used tools were prioritized, and we have implemented new algorithms over the past several releases for many tools. Nearly all new implementations can run in parallel in ArcGIS Pro and distribute when run in ArcGIS Enterprise Image Server. Some also leverage GPU capabilities when available.

With the ArcGIS Pro 2.5 release, Spatial Analyst was updated with significant improvements in the areas of distance analysis, multidimensional raster analysis, and zonal analysis. Also, in ArcPy and ArcGIS API for Python, many new functions are available for analyzing, visualizing, and managing raster data using Python. For example, the Raster Cell Iterator makes it easy to query and modify cell values at each cell location and at neighboring cell locations in Python, so you can write custom raster analysis scripts and combine them with the existing suite of Spatial Analyst geoprocessing tools.

The biggest new feature for Spatial Analyst with the ArcGIS Pro 2.6 release was the interactive Suitability Modeler user interface, which provides an interactive dashboard experience for building a suitability model, with dynamic feedback in the maps and graphs when adjusting weights.

Two new geoprocessing tools were added in Spatial Analyst extension with the ArcGIS Pro 2.7 release. The new Storage Capacity tool calculates the surface area and total volume of the underlying region at a series of elevation increments, which is useful for determining the volume of a reservoir at different levels. The new Surface Parameters tool provides a new implementation of slope, aspect, and curvature that is more suitable for modern high resolution and noisy DEMs by providing a new window size parameter and adaptive window option. Surface Parameters computes in geodesic space to ensure proper calculation regardless of map projection. It is our recommended workflow for calculating slope, aspect, and curvatures.

In addition to improved user experience and performance, several new pieces of functionality are added in ArcGIS Pro 3.0 including:

- Support for sub-models in Suitability Modeler. For example, each suitability criteria can be in its own sub-model. The sub-models can be run locally or on the server. We also support a new suitability model portal item which is another step closer to bringing Suitability Modeler to ArcGIS Online.
- New hydrology tools for finding flow directions, calculating flow accumulations, and deriving streams from a DEM. The new tools will eliminate the previously required filling sinks, which is a big productivity improvement.
- Support to calculate circular statistics in Zonal tools for data representing cyclic quantities like aspect (compass direction of 0° to 360° in degrees) or hours of a day (0 to 24 hours).



- New tools to read multidimensional scientific features (DSG) in ArcGIS. These tools were used to build the ocean database product by Esri.
- New Calculate Kernel Density Ratio tool that uses two input datasets to calculate a spatial relative risk surface.

13. What improvements have been made in the ArcGIS Geostatistical Analyst extension at ArcGIS Pro?

ArcGIS Geostatistical Analyst extension includes statistical models and tools for spatial interpolation, which is a common GIS workflow. The extension includes many geostatistical interpolation methods such as Empirical Bayesian Kriging (EBK), EBK Regression Prediction, Areal Interpolation, and the Empirical Bayesian Kriging 3D method.

Starting at ArcGIS Pro 2.5, users were able to export a 3D geostatistical layer created using the Empirical Bayesian Kriging 3D tool to a multidimensional Cloud Raster Format (\*.crf file) raster dataset using the GA Layer 3D To Multidimensional Raster tool.

In ArcGIS Pro 2.6, a brand-new layer type called Voxel layers was introduced for creating 3D volumetric visualizations from NetCDF data. This is an ideal way for the Geostatistical Analyst users to visualize and interactively explore the details of the 3D geostatistical layers created by the EBK 3D tool. To prepare 3D geostatistical layers as a voxel layer in ArcGIS Pro, users can use the Geostatistical Analyst Layer 3D To NetCDF tool in ArcGIS Pro 2.6. In ArcGIS Pro 2.7, a new parameter was added to Geostatistical Analyst Layer 3D to NetCDF tool. The Input study area polygons parameter allows you to define a study area for the analysis. You can create voxel layers that conform to the study area, rather than creating a cube of the full 3D extent.

In ArcGIS Pro 3.0, two new tools are added in the Geostatistical Analyst extension: Compare Geostatistical Layers and Exploratory Interpolation:

- Compare Geostatistical Layers compares and ranks prediction results from various interpolation models using customizable criteria based on cross-validation statistics. It helps GIS analysts (particularly those new to geostatistics) to better interpret geostatistical model results and to automate the selection process to find the most suitable prediction model.
- The Exploratory Interpolation tool takes an input of sample points and the prediction field, and generates various interpolation results based on different models. The interpolation results are then compared and ranked using customizable criteria based on cross-validation statistics. This helps to ease the difficulty that many users often have in choosing the best geostatistical model.

14. How can I use network analysis in my organization?

Businesses, public service, and other organizations benefit from the ArcGIS Network Analyst extension because it helps them run their operations more efficiently and improve strategic decision making. For example, organizations can

- Better understand dynamic markets, both current and potential, once they know who can access their goods or services

- Reduce transportation costs by optimally sequencing stops and finding the shortest paths between stops while considering several constraints such as time windows, vehicle capacities, and maximum travel times
- Improve customer service through quicker response times or more convenient facility locations

Researchers and analysts commonly benefit from the ability of ArcGIS Network Analyst to determine the least-cost network paths between several origins and destinations. The origin-destination cost matrices created often become input for larger analyses. For instance, predicting travel behavior frequently incorporates the distances people would need to travel to reach certain attractions. These network distances are applied in mathematical expressions to help make trip forecasts.

Similarly, some analyses in spatial statistics provide more accurate results when network distances are used in place of straight-line distances. Consider as an example traffic-incident analysis, which has the aim of locating clusters of traffic accidents, pinpointing their causes, and taking action to reduce the number of accidents. Since cars travel on roads, determining clusters of car accidents with network distances is far more effective than using straight-line distances.

To perform network analyses and reap the benefits of knowing the answers to questions like those listed above, you need a network dataset, which models a transportation network. You can create your own network dataset, purchase one, or use network analysis services, such as the ones in ArcGIS Online, because they include their own network datasets.

#### 15. What's new and next in network analysis?

Here is what's new in network analysis in ArcGIS:

- The Explore Network tool can be used to identify network elements in the map display and inspect their attributes and connectivity.
- Network dataset symbology can be customized via the symbology pane.
- OD Cost Matrix result objects support output to Arrow table, making it more scalable and easier to consume in third party apps.
- You can use ArcGIS Pro to easily configure live traffic data services for use with SMP on Enterprise.
- ArcGIS Pro can now easily configure location settings for loading locations into solvers.
- Improved performance of solvers when using networks in mobile geodatabases.
- Improved performance and quality of Runtime solvers and 10.x equivalency.

Coming soon

- Support of OpenLR traffic standards
- Improved VRP solution quality for medium density orders
- Ability to parallelize large problems to use multiple cores where possible in desktop

#### 16. Where can I learn more about network analysis?

Watch the online network analysis tech and demo sessions from the 2021 Esri User Conference. You can learn more about the new Network Analyst capabilities from these online resources:

- [What is Network Analyst?](#)
- [How to Create a Usable Network Dataset](#)
- [Service a Set of Orders with a Fleet of Vehicles](#)

#### 17. How does Esri integrate with R and SAS?

The R-ArcGIS Bridge is an R package that creates a connection between ArcGIS Pro and R allowing easy transfer of spatial data between the two platforms. With the R-ArcGIS Bridge, you can enrich your GIS workflows by accessing thousands of open-source statistical packages in R, and you can extend your R analyses by accessing the authoritative datasets, mapping and visualization capabilities, and advanced spatial analytics of ArcGIS.

We also have a strong integration with SAS. Esri and SAS work together via the Esri Partner Network, in which [SAS is a Global Alliance Partner](#). Through this partnership, Esri and SAS can combine resources, technology, and expertise to develop specialized solutions and services that are beneficial to shared clients. A current example of this partnership is the SAS-ArcGIS Bridge, a joint effort to tightly integrate ArcGIS and SAS and make it easier to get both data and analytics across the two platforms.

With the [SAS-ArcGIS Bridge](#), users can leverage the advanced, industry-standard statistical and machine learning analysis tools of SAS, and combine these with the authoritative datasets, mapping and visualization capabilities, and advanced spatial analytics of ArcGIS to tackle complex data science and spatial business problems.

#### 18. What are Esri's plans for an interactive Coordinate Conversion tool?

An interactive Coordinate Conversion button and pane were added at ArcGIS Pro 2.6. To convert coordinates, click a point on the map and enter coordinates into the input text box. You can then copy the converted coordinates and use them elsewhere. A coordinate matching your input coordinate format is added to the list, and the location is displayed in the formats you set in the output table.

To learn more, visit the [Work with Coordinates](#) topics in the ArcGIS Pro help documentation.

#### 19. Will Esri support the new US datum and coordinate systems?

Yes, we will. The National Geodetic Survey (NGS) plans to update the geodetic datums (geographic coordinate systems) for the US and its possessions. Originally, they were going to be released in 2022, but are now planned for 2025 at the earliest. The new datum for the contiguous US and Alaska will be NATRF2022. There will also be PATRF2022 (eastern Pacific), MATRF2022 (Mariana), and CATRF2022 (Caribbean). NGS in connection with individual states is defining a new

set of state plane zones, statewide zones (a first for many states!), and larger-scale LDP (low-distortion projections) zones much like Wisconsin's county coordinate systems.

The vertical coordinate system, NAD88, will be replaced with NAPGD2022 and a connected GEOID2022 model.

As soon as NGS releases beta versions of the coordinate systems or transformation files, we will begin testing them with Esri software.

NGS has been conducting industry engagement summits and monthly webinars for several years. We have been attending both. For more information, NGS has a main landing page [here](#).

20. I'm an educator who would like to add a spatial data science component to my class. What books and resources should I consider?

The following [Esri Press](#) books offer a number of options that focus on analysis, scripting, and data science:

- GIS for Science (Volumes 1 and 2)
- The Esri Guide to GIS Analysis (Volumes 1-3)
- Scripting with Python in ArcGIS Pro
- Advanced Scripting with Python in ArcGIS Pro

Please note that Esri Press e-books can be requested free of charge for educators through the [VitalSource platform](#).

In addition, we recommend you visit [Learn ArcGIS](#) and [Teach with GIS](#) (K-12) for free lessons, learning paths, and access to trial software. Learn ArcGIS has dozens of lessons which apply spatial analysis and data science techniques to solve real-world problems. Topics covered include: basic GIS analysis, spatial statistics, geostatistics, raster analysis, machine learning, deep learning, spatiotemporal analysis, suitability modeling, data engineering, and working with Python and R. Most of these lessons range from 30-60 minutes, so they can be easily added to any classroom, no matter the subject.

Last, you can sign up for the Spatial Data Science: The New Frontier in Analytics MOOC. This is a free, 6-week MOOC hosted by Esri experts and covers the latest and greatest in spatial analysis and data science. Over 70,000 people from around the world have registered for this MOOC in the three times Esri has hosted it, and it earned a spot on Class Central's Best Online Courses of the Year list (2021 edition). The next offering of the MOOC is October 5-November 16, 2022, and registration can be completed [here](#).

## Imagery and Remote Sensing

1. What is Esri's strategic direction with respect to supporting imagery?

Imagery and raster data are foundational to most geospatial workflows across every industry. With both image management and analytics as core components, ArcGIS provides the only

system that truly allows you to work with vector and imagery data together to derive richer business insights by seamlessly combining these sources.

The imagery and rasters capabilities in ArcGIS make it easier than ever to bring this rich data source into your GIS workflows. As users already working with imagery and rasters know, the image capabilities of ArcGIS are constantly expanding and helping users learn the latest about how they can gain control of their growing imagery holdings, make their data accessible to all of the stakeholders who need access, help them derive richer business insights with advanced analysis, as well as communicate insights across the organization with a rich array of apps and dashboards.

ArcGIS as a comprehensive system provides the five key imagery capabilities enabling complete workflows to gaining insights from imagery:

- Availability of **Content** from many sources
- **Management** of the content to make it accessible
- **Reality Mapping** to turn source content into GIS-ready products
- **Analysis** to extract information from the imagery
- **Visualization and Exploitation** tools for human interpretation of the imagery and insights gained

These capabilities are implemented as ArcGIS Image, a suite of products that can be deployed on desktop, enterprise, Software as a Service (SaaS), or as a managed SaaS. This provides the flexibility to implement the extensive imagery capabilities, whether you want to just use powerful workstations, integrate the technology into extensive enterprise information systems, or remove the requirements to manage infrastructure by using SaaS.

Massive volumes of raw imagery are collected by satellite, airborne, drone, and mobile sensors, and by scanning maps and aerial film photography. Additionally, there are massive collections of processed raster data, including orthoimages, digital terrain models, categorical rasters, suitability maps, and multidimensional datasets.

Your organization may already have archives of imagery content. These can be supplemented by the massive volumes of imagery and raster content available from the Living Atlas, including a global, high-resolution imagery basemap, global digital terrain models, Landsat and Sentinel data, and hundreds of other imagery and raster sources. Additionally, Esri works closely with imagery partners that can provide access to a wide range of imagery sources.

All this content can be managed within ArcGIS to make it accessible, either directly or as web services, to a wide range of applications. Most image management is achieved using mosaic datasets in ArcGIS Pro, which can then be served as both tiled and dynamic imagery through ArcGIS Image Server. Your organizations may have many users that want to host imagery and upload it directly from their desktops, such that it becomes quickly yet securely available to others. Such image hosting was available through ArcGIS Image Server and is now also available through ArcGIS Image for ArcGIS Online that extends the imagery capabilities of ArcGIS Online.

Similar to ArcGIS Image Server, the imagery can be served as dynamic imagery that includes dynamic mosaicking and on-the-fly processing or as tiled imagery that is streamed to client

applications for rendering and analysis. ArcGIS Image for ArcGIS Online also has the advantage of enabling analysis of the imagery without the limits of desktop infrastructure.

For raw imagery direct from sensors, the reality mapping capabilities enable the creation of imagery-derived products such as orthomosaics, digital terrain models, point clouds, and 3D textured meshes. This is done by processing drone imagery using ArcGIS Drone2Map; leveraging the ortho mapping capabilities in ArcGIS Pro and the scaling capabilities of ArcGIS Image Server; or using Site Scan for ArcGIS to generate imagery products from drones in the cloud. Esri is integrating the nFrames SURE technology into ArcGIS Drone2Map and Site Scan for ArcGIS to enable the production of very high quality true orthos and 3D Mesh.

From collections of imagery and rasters, the analysis tools available in ArcGIS Image Analyst enable the extraction of features, classification, and deep learning. The range of processing and analysis functionality is extensive. These can also be scaled up within an enterprise using ArcGIS Image Server to run raster analytics using distributed processing and storage. Alternatively, for organizations using ArcGIS Image for ArcGIS Online, similar analysis can be performed without setting up infrastructure. These server capabilities can be accessed through various interfaces, including ArcGIS Notebooks.

The visualization and exploitation capabilities of ArcGIS Pro and ArcGIS Image Analyst enable you to efficiently interpret many different types of imagery integrated with all your other spatial data. Interactive web applications for imagery can also be quickly created and shared. Alternatively, ArcGIS Excalibur offers a web-based application focusing on image exploitation and observation management.

ArcGIS provides a comprehensive set of tools to handle all your imagery and remote sensing needs and ensure maximum value is obtained from all your imagery and rasters.

## 2. Does ArcGIS support all imagery and raster formats?

Yes. ArcGIS has the industry's most comprehensive support for all forms of imagery and rasters. Not only does ArcGIS read nearly all standard formats of imagery, it also supports a very large range of imagery products from all the major imagery providers. This ensures that all the associated metadata about the imagery is read by ArcGIS and exploited to enable simpler and more accurate usage. Many of these raster types are also available with ArcGIS Image for ArcGIS Online. There are many different structures for imagery data and associated metadata—for those that we don't directly support, a Python raster type can be created to enable support.

In addition to formats such as TIF, COG, NITF, MRF, IMG, and MrSID, we also support multidimensional formats such as ZARR, NetCDF, GRIB, as well as HDF conforming to CF conventions. From an image management perspective, collections of multidimensional data can be combined as multidimensional mosaic datasets and then exported as multidimensional CRFs that can be streamed efficiently from cloud storage. Multidimensional mosaic datasets or CRFs can now also be exported as CF conformant NetCDFs enabling them to be used as voxel layers. Through the use of Oriented Imagery, we also support a wide range of non-mapping or non-nadir images that may not intersect with the ground, such as oblique imagery captured by drones, mobile cameras, 360 imagery, or imagery used for inspection workflows.

Traditionally, images were stored on hard disks connected directly or via network file shares. ArcGIS also supports imagery and rasters stored in cloud storage, including Amazon Web Services

S3 and Microsoft Azure Blob Storage. Imagery in cloud storage can also be directly accessed from ArcGIS Pro and published through ArcGIS Image Server, making massive image stored in the cloud accessible. To enabling image hosting from cloud storage, images referenced in cloud storage can now also be served to ArcGIS Image for ArcGIS Online. If you have large collections of imagery stored in cloud storage, we encourage you to look into ArcGIS Image Dedicated, which provides a managed SaaS to enable simple sharing, processing, and analysis of such data without the need to set up infrastructure.

### 3. What image processing and analysis options does ArcGIS provide?

Most ArcGIS users don't realize the extensive image processing capability that is available in ArcGIS Pro Basic, which includes over fifty image processing functions, such as image enhancement, spectral indices, math operators, and surface generators. These are further extended with ArcGIS Image Analyst, which provides over 70 built-in functions including segmentation, classification, and statistical functions in addition to advanced tools ranging from feature extraction, change detection, time series analysis, and more. This image processing and analysis can be applied on a variety of data types including overhead imagery, street view imagery, multidimensional imagery, motion imagery, point cloud data, radar and more. With ArcGIS Spatial Analyst, more than 25 additional functions are added that include advanced raster analysis such as hydrology, cost path, viewshed, and multidimensional analysis functions. The functions include not only local functions, which process small extents around each pixel, but also highly optimized global functions, which require access to large extents of imagery. The combination of all these processing functions enables all forms of image and raster processing.

These functions can be chained together to accomplish virtually any processing workflow. This processing can be applied on the fly as rasters are accessed or persisted when a raster is exported. The raster function chains can be stored as part of a layer or saved separately to be applied to other datasets. Raster functions can be extended by incorporating Python libraries such as NumPy and SciPy. Not only can they be applied to individual rasters, but they are incorporated into mosaic datasets to define how to process very large collections.

While ArcGIS Pro visualizes and exports datasets by processing the data locally, the functions can also be applied in web services. When imagery is served as dynamic imagery using ArcGIS Image Server or ArcGIS Image for ArcGIS Online, raster function chains can be applied on the fly, or distributed processing and storage can be used to process and persist very large datasets. Processes that were previously too large to compute or reserved for super computers can now be run using ArcGIS Image Server running on elastic cloud infrastructure or using ArcGIS Image for ArcGIS Online.

With ArcGIS Image for ArcGIS Online, these advanced image processing and analysis capabilities are accessible online. Access to 26 tools (including deep learning and multidimensional analysis) and over 150 raster functions enable on-the-fly processing or the scaling to persisted products using distributed raster analytics.

The ArcGIS web applications (including JavaScript API 3.x and 4.x) can access imagery processed and rendered dynamically on server, but also stream and render tiled imagery from ArcGIS Image Server or ArcGIS Online. This instantaneous client-side rendering includes reproject, enhancement, classifiers, and hill shading. This online functionality is also accessible through the REST and Python APIs.



ArcGIS also includes machine and deep learning workflows. Please see the machine learning and deep learning UC Q&A.

#### 4. What's new in image management?

Image management and dissemination has been a key imagery capability of ArcGIS for many years. Mosaic datasets created in ArcGIS Pro are the optimum data model for managing all forms of satellite, aerial, and drone imagery and raster data, as well as orthoimages, terrain models, and categorical data. ArcGIS Image Server is used not only to provide access to imagery and rasters, but to also process the imagery either on the fly or persist the output as new image layers.

There are typically two different image management workflows that organizations employ. 'Curator Managed' workflows by which one person or a department within an organization is mandated to collect together the organization's imagery, that they manage typically as mosaic datasets and then serve to others. The second workflow is the 'user managed' or 'hosted imagery' workflow where many individuals in the organization upload their image content from the desktop or web browsers so that others can access or perform analysis on the data. Both of these workflows are supported using ArcGIS Image Server and ArcGIS Image for ArcGIS Online.

ArcGIS also supports various image data cubes and Analysis Ready Data products. It is quick to create mosaic datasets from a wide range of scene and tile products along with their associated metadata. The increasing existence of such image data cubes has also been a driver for extending support for multidimensional rasters with the CRF format and the ability to access 'transposed' versions that ensures near instantaneous access to multidimensional data through any axis.

The imagery can be streamed as dynamic imagery with on-the-fly processing and dynamic mosaicking being performed on the servers. Alternatively the imagery can be streamed as tiled imagery to different web and desktop clients, with processing performed on the client side. Each has its advantages.

#### 5. Can ArcGIS handle scientific and multidimensional datasets?

Yes. ArcGIS includes direct access to multidimensional data formats such as ZARR, NetCDF, HDF, and GRIB. Additionally, users can add collections of these files to a mosaic dataset to form large virtual multidimensional rasters. These can then be directly accessed through ArcGIS Pro, ArcPy, and a range of applications including notebooks using image services. To provide very fast access, such multidimensional rasters can also be persisted as image cubes using CR, which is optimized for efficient cloud storage.

ArcGIS also provides an extensive set of raster functions that can process a single slice or NumPy arrays created from multidimensional rasters. These functions are accessible using ArcPy for raster analysis; they enable a wide range of processing, and also integrate with other Python libraries, such as SciPy. ArcPy and the ArcGIS API for Python also enable multidimensional raster analysis. You can apply raster functions across any dimension of a multidimensional raster dataset with a single command.

Additionally, tools to perform anomaly detection, model trends, and perform predictive analysis are available. Tools for aggregating multidimensional rasters and generating multidimensional anomalies make it easy to analyze and subset such datasets. The majority of the tools and



functions which were historically designed for two-dimensional rasters have been modified to support multidimensional datasets. This includes custom user experiences like the classification wizard (enabling time-series classification on an image cube). Additionally, many new tools have been added to enable processing of temporal imagery such as Continuous Change Detection and Classification (CCDC) and LandTrendr that enable stacks of imagery or rasters to be analyzed to detect when, where, and the extent of changes that have occurred over a given geography across multiple slices of time.

## 6. What is raster analytics?

Raster analytics is a capability of ArcGIS Image Server, available on ArcGIS Enterprise and ArcGIS Online. It uses distributed processing and storage to speed up large or complex raster processing tasks like multidimensional analysis, terrain modelling, machine learning/deep learning tasks and more. Large processes that may have taken days before raster analytics can now be completed in minutes.

Raster analytics can be accessed using standard workflows within ArcGIS Pro, using Map Viewer, ArcGIS Notebooks, or APIs. When a task is run, the process is split into many smaller subtasks that are submitted concurrently to the available processors and the results recombined. This enables the processing to be performed in parallel, significantly reducing processing time. Additionally, many of the more advanced global functions, such as those for hydrological modeling and distance functions, have been rewritten to utilize the parallel compute and significantly speed up processing.

For organizations not wanting to set up their own infrastructure to perform such extensive processing and analysis, such services can be set up using Esri Professional Services or using ArcGIS Image Dedicated, where compute infrastructure can be spun up on demand next to your own cloud storage.

## 7. Does ArcGIS include machine learning and deep learning?

ArcGIS Image Analyst and ArcGIS Spatial Analyst include comprehensive tools and wizards for doing image classification, segmentation, and machine learning. These tools perform pixel- and segment-based classification. They also incorporate traditional classifiers such as nearest neighbor and Iso cluster, as well as machine learning classifiers such as random forest and support vector machine. The new Train Random Trees Regression tool derives a random tree regression model that best maps the input into the target datasets. This trained regression model can then be used to perform predictive analysis across geographies with similar characteristics.

Of rapidly increasing interest to many users is the extensive deep learning capabilities that are built into ArcGIS Image Analyst and ArcGIS 3D Analyst, but also available as part of ArcGIS Image for ArcGIS Online. ArcGIS provides more than 30 deep learning models out of the box, which enable a very wide range of deep learning tasks. These include pixel classification, object detection, instance segmentation, image classification, object classification, image enhancement, change detection, object detection/tracking (in video) and image translation. These models have been extended to work on many different modalities of imagery, such as elevation and point clouds. Support for Auto deep learning (AutoDL), will be especially valuable

for users, reducing the barrier to entry to AI, simultaneously enabling advanced users to easily pick the right model and backbone for the deep learning task at hand. With the introduction of pre-trained deep learning models, we have made deep learning more approachable and significantly lowered the bar of entry to deep learning for our users. Esri now provides more than 30 pre-trained models to perform tasks like land cover classification, building footprint extraction, human settlement detection, and more.

ArcGIS Image Analyst and ArcGIS 3D Analyst include the tools required to create training datasets from collections of features and associated imagery. The `arcgis.learn` module in the ArcGIS API for Python and ArcGIS Pro provides the tools to quickly train and refine the models. These models created in ArcGIS as well as external models can be packaged as deep learning packages (DLPKs) that can be shared with others. These models can be directly applied on imagery in ArcGIS Pro, or on massive datasets by using the raster analytics capability of ArcGIS Image Server, or ArcGIS Image for ArcGIS Online. With these additional features, ArcGIS has become the premier tool for performing deep learning workflows such as change detection, object identification, feature extraction and classification, on desktop, enterprise, and online.

The Image Server Deep Learning Studio web app is the newest addition to the deep learning suite of tools. It's an end-to-end deep learning project-based collaborative web experience to capture training data, QA the training data, train a deep learning model and run inferencing. The app is currently designed to run on ArcGIS Enterprise and requires an ArcGIS Image Server license with raster analytics configured.

8. What is the difference between Site Scan for ArcGIS, ArcGIS Drone2Map, and ortho mapping?

ArcGIS provides several capabilities for processing raw sensor data to generate GIS-ready products. These capabilities have a lot of common features, and some important differences based on the input data source (drone, aerial mapping camera, satellite) and processing environment (desktop vs. cloud).

**Site Scan for ArcGIS** is a complete end-to-end drone management and processing capability that provides professional organizations with a cloud-based (SaaS) workflow for integrating drones into their operations.

Site Scan Flight for ArcGIS is an iPad application that enables users to complete drone flight planning in 2D and 3D and perform automated drone flights, then upload the imagery to the Site Scan Manager for ArcGIS cloud where it is processed automatically. The outputs include a range of 2D and 3D products including true orthos and 3D meshes that can be shared through ArcGIS Online or ArcGIS Enterprise for deeper analysis, or brought into ArcGIS Pro and Autodesk products.

The Site Scan Manager web application also provides tools for immediate analysis of the data products, generation of professional reports, and the management and maintenance of fleets of drone hardware and pilots.

**ArcGIS Drone2Map** is a focused desktop application for individual GIS users seeking a complete and simplified workflow to process drone imagery. Drone2Map users can use the Site Scan LE (Limited Edition) iPad application for automated drone data captures. Outputs include orthomosaics, digital surface models (such as for measuring stockpile volumes), point clouds, true

ortho and 3D textured meshes. 2D data products and 3D web scenes can be easily published on ArcGIS Online or ArcGIS Enterprise.

Drone2Map runs as a standalone application. In June 2022, we released ArcGIS Drone2Map 2022.1, which includes the creation of significantly higher quality data products, and reduced processing time. This has been a long-time request from users to enable the use of 3D mesh at higher resolution and extent enabling more detailed 3D inspection and review. Multispectral data processing has also been enhanced with new calibration tools.

Drone2Map is now available in two versions:

- Drone2Map Standard is focused on the rapid creation of 2D data products such as orthomosaics and DTMs typically used in agriculture, surface mining and rapid response type applications.
- Drone2Map Advanced includes the creation 3D data products such as true orthos, point clouds, and 3D meshes used in site inspection, utility and AEC type applications. All Drone2Map users can use the Site Scan LE (Limited Edition) iPad application for automated drone data captures.

The **ortho mapping** workflows available in ArcGIS Pro Advanced enable GIS professionals to create 2D products including digital elevation models and orthomosaics from multiple sources (satellite, aerial, drone, and scanned aerial imagery) as local data products. These can then be published to ArcGIS Image Server or ArcGIS Online.

Workflows in ArcGIS Pro can be automated by calling the geoprocessing tools using Python or ModelBuilder. Ortho mapping creates orthomosaics based on the DTM to minimize any ghosting, but these may include layover effects. The dynamic ortho mosaics can be very rapidly generated for applications where time is of the essence or where multiple views of objects is advantageous. These dynamic image services can be shared as image services or persisted as base maps or tiled imagery.

Ortho mapping capabilities are also included in ArcGIS Image Server, enabling organizations to scale up processing of large collections of imagery, with the resulting products (orthorectified imagery and digital elevation models) published directly as dynamic image services. These ortho mapping services can be managed using ArcGIS Pro, the ArcGIS API for Python, or Ortho Maker.

Ortho Maker provides an easy-to-use, web-based user interface for uploading drone imagery and controlling the ortho mapping workflow. It is included with ArcGIS Image Server on ArcGIS Enterprise (no additional licensing is required). It is primarily for organizations with multiple users wanting simple web-based workflows to create orthomosaics or DTMs from drone imagery for applications like agriculture or emergency response.

## 9. What is Esri's plan for enhancing the imagery capabilities in ArcGIS Pro?

ArcGIS Pro has become the premier desktop application for image processing, analysis, and visualization. The current capabilities are extensive. Perhaps most importantly, ArcGIS Pro offers the deep integration of imagery with all other forms of spatial data. ArcGIS Pro also includes raster functions that can be chained together for all forms of image processing, fast visualization, and

interpretation of imagery. A recent enhancement includes improvement in how 16-bit and 32-bit imagery is handled using dynamic range adjustment that further improve visualization.

The ArcGIS Image Analyst extension for ArcGIS Pro further extends these capabilities by adding more image processing functions, support of stereo display, image space display and mensuration, support for full motion imagery, and image classification tools. An enhancement to the wizard-driven change detection tools and functions enables change detection using multispectral imagery, thereby further simplifying this important workflow. Also included is pixel editor to perform redaction, reclassification of categorical data, and DEM editing directly on a raster dataset. With the latest release of ArcGIS Pro, we have further extended the deep learning tools to support additional modalities of imagery and additional tools for working with and analyzing multidimensional data.

We continue to enhance the imagery capabilities of ArcGIS Image Analyst. An enhancement coming in Pro 3.0 is for the processing of radar data. The tools include the processing of Sentinel 1 GRD data to generate RTC Analysis ready products that can then be used with the extensive analysis tools. In future versions additional radar sensors, processing and analysis will be added.

## 10. What is Oriented Imagery?

Oriented Imagery refers to images collected with cameras that include both the camera location and orientation. Such images include oblique, non-nadir, street side, 360-degree, panorama, and video. They include oblique images from above the earth, images taken at ground level, or images taken underground such as in pipes or tunnels. Nearly all images collected by drones and planes as well as images collected by mobile mapping systems are oriented.

With the consumerization of digital cameras and GPS, the volumes of Oriented Imagery collected has exploded in recent years and is used extensively in a range of industries such as local government, utilities, oil & gas, and emergency response. Oriented Imagery is also a capability of ArcGIS to efficiently manage, visualize, exploit, and analyze such imagery. Imagery collected from a wide range of sources including professional and consumer grade cameras is supported. An easy-to-use user interface provide for quickly viewing the best available image for any location while indicating the image coverage on the map. The ability to take location, distance, area, and height measurements from the imagery (if sufficient metadata exists, such as depth image) is included. Other capabilities include annotating and recording features in both image and map space, superimposing vector data into images, extracting feature locations using deep learning and many more. A recent addition is the ability to superimpose such imagery into web scenes, providing intuitive interfaces for fusing 3D features including point clouds and 3D mesh with such imagery.

Oriented imagery supports a wide range of applications, including 2D maps, 3D scenes, web apps, mobile apps, and desktop applications such as ArcGIS Pro. Oriented Imagery can also be added to custom web applications developed using ArcGIS Experience Builder or ArcGIS Web AppBuilder.

## 11. What is Esri's strategy for integrating lidar into ArcGIS?

Lidar has been supported in ArcGIS for many years. To work effectively with lidar, users need ArcGIS Pro with either ArcGIS Spatial Analyst or ArcGIS 3D Analyst, both of which allow large collections of LAS or zLAS files to be managed and accessed as a project using the LAS dataset. Many different renderings are possible (RGB values, intensity, height, class code, etc.) with on-the-fly filtering of multiple attributes.

Lidar can be displayed in both 2D and 3D views, as well as using interactive profiles that also allow the user to edit class codes. Numerous geoprocessing tools are provided for classifying and processing lidar data to create derived products, such as DTM and DSM raster elevation models, and for the extraction of features.

In ArcGIS Pro, the 3D point rendering performance is enhanced by inclusion of pyramids (fast, reduced-resolution view) in the LAS Dataset. For users performing manual/interactive class code editing within LAS files, the LAS dataset pyramid is updated on the fly.

LAS, zLAS, and LAZ files can also be efficiently converted to point cloud scene layer packages (SLPKs) that conform to the OGC I3S community standard. Such SLPKs can be hosted and shared from ArcGIS Online or ArcGIS Enterprise and displayed in a web browser, providing users in web or desktop environments the ability to quickly view lidar data integrated with all their other spatial data. It is now also possible to extract subsets of such point cloud layers back as LAS files for local editing or analysis. Point cloud and lidar are now datasets that can be integrated into nearly any application.

## 12. What is ArcGIS Image for ArcGIS Online?

ArcGIS Image for ArcGIS Online is an extension to ArcGIS Online that enables you to host, analyze, and stream imagery, such that it can be easily integrated into all spatial applications. ArcGIS Image for ArcGIS Online requires a user type extension to be added to your ArcGIS Online subscription, and then you can upload single image or collections of images to ArcGIS Online to be published as tiled imagery or dynamic imagery layers.

For tiled imagery layers, multiple images are mosaicked together to create a single imagery layer that can then be streamed to web applications and ArcGIS Pro for efficient viewing and analysis. The client applications project and render the imagery as required, enabling efficient usage of the imagery. Applications can dynamically change the rendering and obtain the pixel values to be used in charts for example.

Alternatively, collections of images can be published as dynamic imagery layers that provide server-side dynamic mosaicking and on-the-fly processing.

Client applications can make request for the imagery, and the servers process and transform the imagery as required. This opens the extensive image visualization and exploitation capabilities that were previously only available in ArcGIS Enterprise with ArcGIS Image Server.

In addition to hosting and streaming imagery, ArcGIS Image for ArcGIS Online also provides extensive image analysis. Users with the Image user type extension can bring up the raster function editor to author, edit, and save raster function templates. For dynamic imagery, these can be applied on the fly. For both dynamic and tiled imagery the results can also be persisted to create new datasets. Such analysis could be performed for a small area of interest or over large

areas and include a wide range of tools such as deep learning and terrain analysis. ArcGIS Image for ArcGIS Online can be accessed using the Map Viewer Classic, ArcGIS Pro, or via REST APIs that enable further integration and automation.

ArcGIS Image for ArcGIS Online is providing extensive imagery capabilities as a SaaS, so no infrastructure needs to be set up. The data sources for analysis can be those that you directly host, and we will be adding the ability for extensive analysis against data in the Living Atlas. For organizations that already have large collections of imagery loaded into cloud storage or those mandated to store imagery in defined (AWS or Azure) cloud storage, we provide ArcGIS Image Dedicated for serving tiled imagery and dynamic imagery as well as processing and analysis capabilities against this cloud storage.

Esri will stand up servers and compute infrastructure next to these cloud storages, enabling efficient serving and elastic compute without the need to set up infrastructure.

### 13. What resources are available from Esri to help me get started with imagery in ArcGIS?

Esri provides many resources to help you get started with imagery in ArcGIS. Here is a list:

- At the Esri User Conference (July 11–14, 2022), attend some or all of the [sessions devoted to imagery](#), then stick around to ask your questions during the live Q&As following each session.
- Attend the [Imagery Summit](#) (July 10th) the Sunday before UC. This will be another great opportunity to learn about the many imagery capabilities in ArcGIS.
- The [ArcGIS Imagery Workflows](#) website provides resources, best practices, tutorials, and downloadable tools to simplify common workflows for managing, analyzing, and using a wide range of imagery and raster data in ArcGIS. New content this year includes expanded support for ortho mapping in ArcGIS Pro, management and analysis of multidimensional data, and best practices for working with imagery in the cloud.
- Visit the Imagery & Remote Sensing boards in [Esri Community](#) to ask questions, participate in discussions, and read blogs about managing, sharing, processing, and analyzing your imagery.
- For remote sensing instructors, visit [Introduction to Imagery & Remote Sensing](#) for resources to aid the development of university-level curricula, including a series of hands-on activities covering a wide variety of topics, interactive web apps, labs based on real-world problems, and slide decks presenting fundamental imagery and remote sensing concepts.
- Sign up for the [Imagery in Action MOOC](#) to learn more about imagery in ArcGIS. Explore cutting-edge imagery applications and advanced tools to extract information from imagery and remotely sensed data. Course exercises guide you through the steps to tackle essential imagery workflows using the latest ArcGIS Pro and cloud-based apps.
- Find hands-on lessons from [Learn ArcGIS](#) that use imagery in ArcGIS to address interesting, real-world problems. This provides an excellent introduction to imagery and a way for existing image professionals to learn more about how these capabilities come to life in ArcGIS.

- Learn more about the [Imagery & Remote Sensing capability](#) across ArcGIS, including management, map production, analysis, visualization & exploitation, and content.
- The [Getting to Know ArcGIS Image Analyst](#) guide offers essential workflows and hands-on tutorials for getting started with ArcGIS Image Analyst, including extracting features from imagery, processing with advanced functions, working with stereo and full motion video, and using image space.
- [ArcGIS Pro Help documentation](#) provides a comprehensive guide to the imagery and raster tools and functionality in ArcGIS Pro, including how to manage, analyze, and share imagery and raster data.
- [Esri Training](#) offers a variety of instructor-led and online courses, videos, and training seminars covering different aspects of using imagery with ArcGIS.
- [Imagery and GIS: Best Practices for Extracting Information from Imagery](#), a book by Kass Green, Russell G. Congalton, and Mark Tukman, explains how imagery can be integrated successfully into mapping and GIS projects, including practical considerations and real-world applications.

## 3D Visualization and Analytics

1. What are the typical industries and systems in which users are applying 3D?

Users apply 3D GIS to many classic patterns of GIS and to some new patterns as well. Major areas that we're seeing 3D applied include:

- **Complete Systems of Record, Insight, and Engagement for organizations who manage land, assets, or property** – Many organizations around the world are realizing that new types of 3D content or new regulations are requiring them to have a strategy and systems to support the storage, maintenance, distribution, and usage of 3D GIS data both above and below ground. This includes
  - organizations who may have established subsurface property ownership rules and must now manage 3D underground parcels
  - organizations who are setting regulations or boundaries for drone flights aboveground
  - organizations who are increasingly concerned about large amounts of GIS and Building Information Modeling (BIM) information that will be required to be used together in 3D to inform and manage the organization's assets throughout their lifecycle
- **Enterprise Globe Systems** – Large users who support global operations
- **Reality Capture** – Capture snapshots of the real world that can be used as a 3D basemap for high-accuracy planning, visualization, and analysis workflows
- **City Design and Urban Planning System** – 3D planning and visualization for cities and urban areas reaching scales beyond buildings or campus



- **3D Smart City and IoT Dashboard** – 3D provides a visual medium for bringing together rich 2D and 3D content about the as-built world and environment onto which status, statistics, and positional information about sensors and IoT devices can be overlaid in real time.
- **3D Project Delivery tools** – AEC users are asking for web interfaces that bring together 3D GIS and BIM information along with IoT sensor feeds, project documentation, and schedule information.
- **Indoor Mapping and GIS** – 3D capability in ArcGIS is part of the solution set for users who are starting to look at 3D campuses and navigation workflows into and around buildings.
- **New Experiences Enabled by 3D and Game Engines** – Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) have developed into more widely available experiences through which GIS users are now starting to see potential value. Connecting to Game Engines generates fully interactive 3D experiences based upon real-world content.

ArcGIS users are applying 3D across all industries. Users are quickly realizing that 3D location information is a key component of modern GIS and that the availability of 3D content is making it possible to apply 3D GIS to many different problems. Some examples of where we see usage of 3D in GIS include

- **State and Local Government** to use reality capture and other 3D contents as foundation of a spatial digital twin platform to visualize and integrate information from departments
- **Architecture, Engineering, and Construction** to bring together lifecycle GIS data with 3D building information models (BIM) to inform design and construction
- **Site Security** to visualize assets with the context of 3D in order to mitigate risks
- **Urban Planning** to provide views of 3D zoning information, shadow and sun analysis, and to visualize plans that don't yet exist in the real world
- **Utilities and Telecommunications** to view and analyze more accurate representations of real-world assets and for planning and asset location
- **Defense and Intelligence** to provide a common operational picture of where events are happening on the globe
- **Science and Education** to view information about the real world as it actually exists
- **Geology and Natural Resources** to bring together information about the natural world and real-world assets for construction, resource management, and responsible resource extraction

## 2. Is ArcGIS a 3D system of record?

Yes. Our users' workflows require ArcGIS to support the same capabilities in 3D that we support in 2D for maintaining and updating system of record data for land, property, and assets. We have been systematically evolving ArcGIS to support the full lifecycle of GIS data in 3D.



A significant amount of effort has gone into expanding the GIS information model in ArcGIS to support new capabilities and data types with 3D. For example

- The vector GIS model has been expanded to add 3D to classic 2D vector GIS features including expanding tools and interfaces for working with these features in 3D
- Support for 3D services including specifications for scene layers that represent 3D objects, building models, 3D points, 3D point clouds, and 3D meshes (I3S)
- Reality capture capability that recreates 3D models and meshes from scan data such as photogrammetry and point clouds
- Creation of high-performance raster elevation models (LERC)
- Support for vector tiles working in 3D
- Support for voxels derived from NetCDF and raster information, and on the web
- 3D symbology for vector points including a 3D symbol library that can be used in ArcGIS Pro, Scene Viewer, and the ArcGIS API for JavaScript
- Support for vertical coordinate systems allowing the integration of drone imagery, lidar data, and satellite information
- The capability to store and serve massive 3D datasets on premises with ArcGIS Enterprise or in the cloud with ArcGIS Online
- Support for updating 3D content shared to the web
- Support of Open Street Map 3D buildings and trees across the system
- Increasing support for materials and other 3D graphic properties

We introduced open specifications for large 3D datasets over five years ago, and we have seen partners able to produce massive reality capture datasets including photogrammetric or textured meshes with tens of gigabytes of content. We are also seeing partners who produce point clouds able to add value to existing datasets by converting them to new streaming formats and serving datasets that have billions of points/hundreds of gigabytes of data to web and desktop clients.

To support data in the 3D system of record, we are also improving the capability to create, edit, and update 3D data across a wide range of applications for different users including ArcGIS Pro, ArcGIS Drone2Map, ArcGIS CityEngine, and ArcGIS Earth. Some users may find that they are now able to work completely within a web browser to discover, organize, and share web scenes, StoryMaps, and Web AppBuilder projects using a combination of 2D and 3D content that is already available for them within their organization.

3. Will the capability to publish 3D data to ArcGIS Online be equivalent to the capability for ArcGIS Enterprise?

Yes. While there are minor version differences due to the schedule of releases for ArcGIS Enterprise and ArcGIS Online, publishing of 3D content to ArcGIS Enterprise and ArcGIS Online is substantially equivalent today.

#### 4. Can I host 3D content in ArcGIS Online?

Yes. ArcGIS Online can host I3S scene layers, 3D raster content, and web scenes, including layers containing 3D objects, such as buildings, raster elevation, point clouds, 3D points, Voxel, and integrated mesh data. With ArcGIS Pro, you can publish 3D layers as packages that can be uploaded to ArcGIS Online or ArcGIS Enterprise.

#### 5. Where is Esri headed with 3D editing? Will I be able to edit complex 3D objects with Esri tools?

ArcGIS Pro includes the capability to interactively edit 3D models on the desktop and has the ability to split, extrude, explode, and merge 3D models. This capability will continue to improve over time. ArcGIS Pro enables interactive editing of 3D feature services, such as services that may be stored in an ArcGIS Utility Network model. ArcGIS Pro users can import popularly available OBJ content that can then be manipulated and edited.

In recent releases, ArcGIS Pro has begun introducing the 3D Object Feature Layer, a new layer type that enables imported 3D models to retain industry-standard materials and other graphic features. The 3D Object Feature Layer will be developed further to offer an alternative to multipatch feature layers for using 3D content in ArcGIS, including for publishing 3D Object Scene Layers over the web.

With ArcGIS CityEngine, you can edit complex 3D objects using the built-in shape editing tools. These tools allow you to combine or separate parts of a 3D object by splitting or grouping faces. The position, rotation, and scale of faces, edges, and points can be modified as separate features, or as features shared by multiple faces. Faces can be split, merged, extruded, or pushed in using interactive creation tools. In addition, CityEngine now supports a new enhancement to procedural modeling called local edits. Local edits allow you to make changes to portions of a procedurally-generated 3D model, enabling the more precise creation of 3D content.

SURE for ArcGIS enables users to edit mesh and point clouds during a reality capture processing workflow.

Web products, such as ArcGIS Urban, will support 3D sketching and editing in lightweight user experiences for web users.

ArcGIS Earth also supports the creation of 3D KML content from 3D objects to interactive georeferencing of images as ground overlays.

#### 6. Does ArcGIS support advanced 3D visualization?

Absolutely. ArcGIS with its 3D services, 3D authoring clients (ArcGIS Pro, ArcGIS CityEngine, and the ArcGIS API for JavaScript ), and 3D viewers (web scenes, ArcGIS Earth, and device apps) represents a complete system for 3D GIS.

Esri has expanded the GIS information model to include items such as web scenes that allow users to define the layers, environment settings, and symbology that define a '3D map.' Web scenes can be shared across ArcGIS as a basic building block for other desktop, web, and mobile 3D GIS experiences.

The Scene Viewer in ArcGIS Online and ArcGIS Enterprise includes extensive capability to display and symbolize 3D content. The Scene Viewer, based on the ArcGIS API for JavaScript, uses WebGL to natively render 3D in browsers on the desktop and on mobile devices.

The new ArcGIS Maps SDK for Unity and Unreal Engine, currently in prerelease, enables GIS content to be streamed into game engines for high-end visual experiences with game-like interactivity.

Some of the types of visualization tools available in the Scene Viewer include

- Smart mapping for assisted symbolization of 3D Object, Point Cloud, and 3D Point scene layers along with 2D vector point, line, and polygon layers in 3D
- New Voxel layers that allow the interactive visualization of billions of volumetric data points in ArcGIS Pro
- Persist analysis results in slides
- Ability to mash up 3D content with 2D content including map services, feature layers, and WMS
- Interactive tools including sun shadow, 3D measurement, and interactive slicing
- Extensive symbolization capability including using 3D model web styles and applying edge rendering to 3D object features

With all of these capabilities in ArcGIS Enterprise, Pro, Runtime, and Scene Viewer, users—both at the development and end-user levels—can treat ArcGIS Online and ArcGIS Enterprise as a complete 3D system for Web GIS.

## 7. What is I3S?

Indexed 3D Scene Layers (I3S), an [OGC Community Standard](#), is a delivery format for a single Scene Layer dataset that may be streamed over the web or used locally on disk.

A Scene Layer is a container for arbitrarily large amounts of heterogeneously distributed 3D geographic data. I3S is cloud, web, and mobile friendly. I3S is based on JSON, REST, and modern web standards and is easy to handle, efficiently parse, and render by web and mobile Clients. I3S can stream large 3D datasets and is designed for performance and scalability. I3S supports 3D geospatial content and the requisite coordinate systems and height models in conjunction with a rich set of layer types.

A Scene Layer is characterized by a combination of a layer type and a profile that fully describes both the behavior of the layer and the manner in which it is realized within the specification. The persistence model for a Scene Layer is a Scene Layer Package (SLPK).

Both I3S streams and SLPKs are specified in detail in this [OGC Community Standard](#). Both formats are encoded using JSON and binary ArrayBuffers (ECMAScript 2015). Updates to the I3S Community Standard have been proposed to include

- Point Cloud Scene Layer type
- The addition of Oriented Bounding Boxes, Attribute Domain Rules, Service Update Timestamp, and Index hash table for improved performance

- Esri improvements to I3S that will be recommended in future OGC proposals including the Building Scene Layer for encoding the geometry, attributes, and semantic organization of large numbers of BIM building files
- A new voxel I3S layer is introduced in the recent release

To learn more, visit the [open community GitHub version of this standard](#).

#### 8. Why is the I3S standard important for 3D?

3D content can be very large. Picture for example, the difference between building footprints for a city in 2D compared with complex model content required to realistically represent buildings in 3D. Indexed 3D Scene Layers (I3S) was developed by Esri to stream optimized 3D content for such huge datasets. Using I3S, a single web scene could include, for example, all the 3D buildings, trees, and street furniture in an entire city.

I3S layers are served from within Esri's Web GIS to share 3D features across large organizations or on the public internet. I3S layers can be used to share Point Cloud datasets with billions of points and Integrated Mesh data, which can depict large areas on the globe with details such as buildings and vegetation as single continuous surface.

I3S has also enabled us to deliver entirely new capability that is bringing GIS to new users. The Building Scene Layer is a first-of-its-kind capability to directly store semantically correct buildings in a GIS and then to stream them over the web for mobile and browser-based users.

Many partners and data providers have started to use I3S to share 3D content within the GIS community.

#### 9. How is 3D changing the GIS user experience for analysis?

At Esri, we have been transforming the experience for analysis by introducing interactive tools for 3D analysis across ArcGIS. These interactive tools allow users to achieve just-in-time understanding of their data by manipulating tools right in the 3D scene in multiple products. Typically, these tools work on the visible data in the scene and may also provide some numerical output, though this may depend on the product and on the data.

We continue integrating a wide range of interactive analytical tools across ArcGIS. Some of the tools that have been introduced so far include

- ArcGIS Pro: Exploratory Analysis Tools including Line of Sight, Viewshed, View Dome, Slice, Cut & Fill Measurement, and Profile Viewing
- ArcGIS CityEngine: Interactive tools including Viewshed, View Dome and Line of Sight
- Scene Viewer: Interactive 3D measurement tools, interactive sun shadow tools, interactive slicing, and an interactive elevation profile tool
- ArcGIS Runtime: Capability to build native apps with interactive line of sight, measure, and viewshed
- ArcGIS Earth: ArcGIS Earth has interactive vertical exaggeration, line of sight, terrain profile, daylight, and viewshed, including on the mobile versions of ArcGIS Earth.

#### 10. How is 3D enabling systems of engagement with stakeholders and end users?

Perhaps the biggest advance in 3D is on the web environment with new capabilities for both 3D thematic cartography through 3D data streaming and client-side representation. This is an exciting capability in the sense that the 2D Web GIS foundation has now been extended with 3D capabilities through web scenes and web apps that can use GIS attributes with any kind of 3D-streamed content to enable query, filter, and symbolization rapidly in a web browser.

Users now have access to Smart 3D Mapping in Scene Viewer, in which the user is assisted with smart defaults and preconfigured palettes that allow the user to start out with visually pleasing cartographic settings for GIS data in 3D web scenes. Web scenes created with Smart 3D Mapping are then reusable in configurable web apps, including ArcGIS StoryMaps, Web AppBuilder, Experience Builder, and Instant Apps to help users rapidly share visually compelling 3D scenes for communication to stakeholders who may not understand 2D maps.

We are also adding a new capability to support engagement with stakeholders in desktop apps, including ArcGIS Pro and ArcGIS Earth.

- ArcGIS Pro has an innovative experience that allows a GIS author to quickly create animations that can then be exported to movie file formats and directly uploaded to popular sharing services to easily allow the technical GIS user to communicate with anyone without requiring them to touch a GIS application.
- ArcGIS Earth can be installed across large organizations to provide a consistent experience for exploring basemaps and content in ArcGIS Online or ArcGIS Enterprise, and for creating markup that can easily be shared as KMZ through both desktop and mobile platforms.

#### 11. How can I use 3D in my browser?

Esri supports 3D in the browser in several ways.

- ArcGIS web 3D experiences based on the Scene Viewer and the ArcGIS API for JavaScript work in desktop and mobile browsers.
- The Scene Viewer in ArcGIS Online and ArcGIS Enterprise is an out-of-the-box experience for viewing 3D and 2D content.
- The ArcGIS API for JavaScript allows users to embed Esri 3D experiences in web pages and to build sophisticated 3D web applications that can do client-side processing on streamed services.
- Experience Builder, Web AppBuilder, Instant Apps, and ArcGIS StoryMaps allow users to build 3D experiences for browser-based workflows and narrative storytelling.

ArcGIS web 3D experiences based on the Scene Viewer and the ArcGIS API for JavaScript work in desktop and mobile browsers.

## 12. When will ArcGIS Runtime SDKs support web scenes?

Web scenes are containers for 2D and 3D layers, bookmarks, and environment settings that are a core item type in ArcGIS Enterprise and ArcGIS Online for sharing 3D experiences across ArcGIS. ArcGIS Runtime SDKs currently support web scenes, and this capability has been added to Runtime 3D apps such as ArcGIS Earth.

ArcGIS Runtime web scene support includes support for Mobile Scene Packages so that users can package and transport web scenes for 3D offline applications.

## 13. Does 3D work on mobile devices?

Yes. ArcGIS contains several technologies for using 3D on mobile devices.

- The Scene Viewer and the ArcGIS API for JavaScript allow users to build web experiences for 3D that will work on desktop and mobile browsers.
- The ArcGIS Runtime SDKs allow users to build native mobile apps for Android and iOS.
- [ArcGIS 360 VR](#) allows users to explore 360-degree panoramic VR experiences on major VR devices, desktop, and mobile platforms.
- ArcGIS Earth has both an iOS and an Android version, which supports opening web scenes, interactive analysis, and collect GPS tracks in 3D environments.

## 14. How can I get started with 3D if I only have 2D data in my GIS?

Soon a 3D base layer will be introduced using Open Street Map contents including both buildings and trees. Organizations who have no experience with 3D data can create and explore 2D contents within 3D scenes.

There are multiple tools to help you add existing 2D data to 3D visualizations and analyses. You can use ArcGIS 3D Analyst and procedural rules built with ArcGIS CityEngine to extrude 3D shapes and create 3D objects from 2D data in ArcGIS Pro or in CityEngine. Advanced users can create multiple scenarios of proposed buildings and other urban assets with CityEngine. Scene Viewer users and developers can even use smart mapping styles to extrude shapes in 3D from 2D feature services.

The ArcGIS 3D Basemaps solution provides workflows for the creation and maintenance of a 3D basemap that supports diverse information needs. The solution allows organizations to use existing data, such as lidar, building footprints, and utilities, to generate authoritative 3D content for visualization and analysis.

To help you get started in 3D, we provide curated world terrain and basemap services that allow you to create 3D scenes. Our hosted 3D content is usable in ArcGIS Pro, web experiences, and Runtime applications, such as ArcGIS Earth. Users can even add 2D data directly as local files into ArcGIS Earth or upload them to ArcGIS Online and view them in 3D, draped onto the Esri World Elevation Surface.

#### 15. What is ArcGIS Earth and can I use it to replace Google Earth in my enterprise?

Users are already using ArcGIS Earth extensively to replace the Google Earth Enterprise Client in their workflows. ArcGIS Earth allows you to work with a variety of 3D and 2D map data formats including KML, shapefiles, services, and open-source data. ArcGIS Earth is able to display data, sketch placemarks, measure, add annotations, perform interactive analysis, and connect to ArcGIS.

ArcGIS Earth is free and may be downloaded for Windows desktop from [the Esri website](#). ArcGIS Earth mobile is available for Android and iOS.

Features of ArcGIS Earth include

- KML editing
- Android and iOS versions
- Ability to connect to WMS/WMTS
- Ability to connect to a wide variety of Esri services
- Ability to connect to privately shared data in ArcGIS Online and Enterprise
- Imagery capability including identify and brightness/contrast/gamma correction
- Interactive Analysis – Vertical exaggeration, Elevation Profile, Line of Sight, View Shed
- 3D model import
- PKI and additional enterprise authentication support
- Earth Automation API
- Ability to use ArcGIS Earth in offline mode with Mobile Scene Packages
- GPS recording, analysis and ability to share as KML to ArcGIS Online and ArcGIS Enterprise

ArcGIS Earth has similar performance to Google's visualization technology and supports many analytic and mapping capabilities not available in Google, such as the ability to easily change basemaps, quickly change contrast and brightness in imagery services, and use interactive analytical tools such as line of sight and viewshed with more on the way.

We will continue to add functionality including support for very large packages for offline workflows, more 3D analysis, and sharing between ArcGIS Earth and other Esri apps.

#### 16. How is KML being supported in Esri apps?

ArcGIS Earth and ArcGIS Pro share the same KML engine and natively support KML with substantial OGC KML 2.2 compliance and even some KML 2.3 support, including time sliders and KML tours.

ArcGIS Earth can directly save and edit KML. KML support currently includes network links, ground overlays, and many of the popular tools that the Google Earth community came to love. We will be continuing to update and improve our KML support into the future.

ArcGIS CityEngine can also import KML as a source of 3D models for building 3D scenes and allows for the export of procedurally generated models to KML.

#### 17. What is ArcGIS CityEngine?

ArcGIS CityEngine is an advanced urban design software used to build urban environments from existing GIS data. CityEngine is focused on rapid interactive creation of content, with multiple iterations managed as scenarios, and real-time feedback through reports and dashboards. It is also able to consume 3D data in a large variety of formats.

CityEngine is the authoring environment for creating and publishing procedural rules to be consumed in ArcGIS Pro as 3D symbology, or to be used by the "Feature from CityEngine Rule" geoprocessing tool to create 3D content in a geodatabase. The 3D environments that you build in CityEngine can be brought into ArcGIS Pro for deeper analysis or published to ArcGIS Enterprise or ArcGIS Online as services. ArcGIS CityEngine scenes can also easily be imported to Game Engines to create high-quality visualizations and XR experiences.

#### 18. What is new in ArcGIS CityEngine?

ArcGIS CityEngine continues to evolve, both as a product, and as a tool for Urban Design. The editing experience has been refocused on site planning and design. This means extensive improvements to the editing and creation tools, including

- A Tool Options window allows for precise control over feature creation.
- Precise lengths, angles, curves, and other constraints can be specified when creating or editing shapes.
- Snapping controls constrain what type of features the drawing tools snap to including street graph centerlines.
- Interactive guidelines, temporary lines created in reference to existing shapes guide the creation of new features through snapping and inference.

CityEngine supports Physically Based Rendering (PBR) for materials, meaning high-quality visuals are displayed live in the viewport, and report ready images can be generated directly in the applications. These materials add realism to features by supporting a variety of visual properties such as opacity, specularity, surface roughness, and light emission.

The new export to Twinmotion, Epic's real-time architectural visualization tool allows you to quickly and easily bring your CityEngine neighborhood to life.

It is easier than ever to share and publish designs from CityEngine. It can now export Mobile Scene Layer Packages (MSPKs), allowing you to deliver terrain, imagery, and 3D models in a single file. Many enhancements have been added to the Procedural Run Time (PRT) to improve its ability to generate zoning volumes and plausible building forms in support of ArcGIS Urban that can be utilized by CityEngine rule authors. This includes support for arrays directly inside of Computer Generated Architecture (CGA). The Procedural Run Time (PRT) is now available for use in Python through PyPRT or through the CityEngine SDK available on GitHub.



#### 19. Is ArcGIS CityEngine really used in the production of Hollywood blockbusters?

Yes. One of the original motivations for [ArcGIS CityEngine](#) was to create digital urban environments for movies in a more efficient way than modeling everything manually. While the main application of CityEngine has shifted to urban design since it joined the Esri product family, we still have a strong user base in the visual effects industry (VFX).

Recent examples of movies that used CityEngine include Game of Thrones, The Witcher, [Blade Runner 2049](#) and [Pixar's Incredibles 2](#). CityEngine is used by several major animation studios and visual effects houses for the creation of digital sets of urban environments. CityEngine can generate Alembic geometry caches of unlimited size on disk. Alembic allows for the hassle-free management and rendering of massive 3D models in DCC tools such as Houdini or Maya and is typically used in the production of feature films.

The ArcGIS CityEngine team has released several tools for integrating with Epic Games' Unreal Engine to enable users to take advantage of award winning procedural generation capability in gaming workflows.

Additionally, we are collaborating with partners to help build integration between our procedural technology and other software packages commonly used in the industry, such as [Palladio](#), an open-source procedural modeling plugin for Houdini, Serlio for Autodesk Maya, Puma for Rhino/Grasshopper and Vitruvio for Unreal Engine.

#### 20. How is Esri supporting Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) experiences?

The emergence of AR, VR, and MR has been a huge boost to the 3D GIS industry by driving demand for GIS data in new 3D experiences. Esri has several strategies for supplying content and technology for users to experiment with these new experiences.

ArcGIS CityEngine can be used to provide data in FBX, USD, and other formats that can easily be brought into Unity, Unreal Engine, or other game engines to produce AR, VR, and MR apps. Notably, CityEngine supports exporting to Unreal Datasmith which allows content from CityEngine to be instantly usable in Unreal Engine gamified experiences.

The CityEngine VR Experience is a solution for creating a premium VR application to explore 3D city models and urban planning scenarios. It builds on data integration and modeling in CityEngine, combined with Unreal Engine which renders 3D data in real-time, controls a VR headset, and allows for collaborative studies. The VR Experience is available as a ready-to-use and extensible Unreal Engine project template from which CityEngine scenes can be imported, configured, and viewed. For more information, see this [blog post](#).

AuGeo is an [Esri Labs](#) initiative that allows users to explore the possibilities of using ArcGIS data in an augmented reality experience on a mobile phone. Available to ArcGIS users for free in the [iTunes](#) and [Google Play](#) stores, the AuGeo mobile app allows you to easily bring data from your existing ArcGIS point feature layers into an augmented reality mobile app. The AuGeo app is experimental and not designed for use in production; however, the source code for AuGeo is available to ArcGIS AppStudio users.

ArcGIS 360 VR is Esri's lightweight, all-in-one solution for creating and viewing 360-degree panoramic VR experiences. It allows urban planners, architects, and GIS professionals using

CityEngine to author VR experiences consisting of computer-generated panoramic images, multiple viewpoints and design scenarios. The experiences are made available to users in ArcGIS Online. With the release of CityEngine 2021.0, ArcGIS 360 VR is now production-ready and available as a web app, based on the latest WebXR technology. Using the web app, users can view 360 VR experiences on all major VR devices, desktop, and mobile platforms using the built-in browser. Other improvements in the 2021.0 update include higher panorama resolution and local preview of experiences in CityEngine to speed up the authoring workflow. To try it out, go to the [ArcGIS 360 VR website](#), where you can find three featured experiences: the updated Redlands redevelopment plan, a new Pasadena redevelopment project, and a detailed architectural project with a number of outdoor/indoor viewpoints. Previously exported experiences will continue to work in the web application without any changes required.

Developers can use ArcGIS Runtime SDKs to build production-ready AR experiences for iOS and Android devices today. The ArcGIS Runtime toolkits for the Android, iOS, .NET, and Qt SDKs include an AR view component built on 3D capabilities in ArcGIS Runtime. The AR view works with device sensors such as a compass and camera to power tabletop and world-scale AR experiences. For more information, read this [blog post](#).

A set of new developer products, the ArcGIS Maps SDK for Unity and ArcGIS Maps SDK for Unreal Engine, enable game engine developers to access and use geospatial data and analytics from ArcGIS. This includes support for imagery tiles for display, raster tiles for elevation, 3D objects (e.g., buildings) and integrated mesh (e.g., surface), as well as features. These SDKs, combined with the high-performance, photorealistic visualization, and broad platform support of a game engine, will power the full spectrum of XR experiences (AR, VR, MR).

Following a successful [public beta program](#), we recently launched the first production release of the ArcGIS Maps SDK for Unity, and the ArcGIS Maps SDK for Unreal Engine is due for release at the end of June.

## Real-Time Visualization and Analytics

### 1. What is Real-Time Visualization and Analytics?

Fundamentally, there are two definitions for [Real-Time Visualization and Analytics](#). First, it means the integration and application of real-time data in a system (including sensor data, GPS locations, social media, and more). This can mean bringing in feeds of information from sensors or moving objects at rates of 1,000s per second, or it may mean hourly updates.

The second definition refers to the real-time coordination of work across an organization. Using [ArcGIS Enterprise](#) and [ArcGIS Online](#), people in the field can be collecting data while at the same time others are visualizing, analyzing, and even disseminating the very same data as web maps or reports. An example of this is in public health where immunization activity and health surveys can be carried out using an application like [ArcGIS Field Maps](#) or [ArcGIS Survey123](#), and simultaneously the results can be visualized in [ArcGIS Dashboards](#) or analyzed using [ArcGIS Insights](#). This means connecting the field to the whole world of real-time insights and decision making, all at the same time. ArcGIS Enterprise and ArcGIS Online will increasingly support these kinds of collaborations and workflows.

2. What are the key takeaways for the Real-Time Visualization and Analytics capability of ArcGIS?

Here are some highlights of the Real-Time Visualization and Analytics capability of ArcGIS:

- The [Real-Time Visualization and Analytics](#) capability allows organizations to know what is happening as it happens, providing the insights necessary to make better and more informed decisions at the right place and the right time. This capability is expanding throughout ArcGIS.
- ArcGIS provides options for ingesting almost any kind of streaming data, performing continuous real-time and big data analytics on that data, and storing and visualizing massive amounts of observational data as raw features or as aggregations.
- Esri continues to improve the Real-Time Visualization and Analytics capabilities in 2022 with enhancements to existing products as well as strategic initiatives across the organization.
  - **ArcGIS Velocity** brings real-time and big data capabilities to ArcGIS Online. Over the past few releases, Velocity has been enhanced with easier capabilities for capturing real-time data over time, broadened authentication options for connecting to data from third-party systems, dynamic geofencing and joins, additional GeoAnalytics Server machine learning tools, and improved user experiences for analytic model-building. Additionally, the Standard and Advanced subscription levels have been expanded to allow organizations to run more feeds and analytics simultaneously. Learn more about [ArcGIS Velocity](#).
  - **ArcGIS GeoEvent Server**, the real-time capability in ArcGIS Enterprise, has many quality and stability improvements in the 10.9.1 and 11 releases, including enhancements to usability and manager performance, and for the first time will allow users to connect to shared services and layers. Additionally, data store connections to ArcGIS Enterprise and Online will have a new user experience for browsing to layers for ingestion, dissemination, enrichment, and spatial filtering. Learn more about [ArcGIS GeoEvent Server](#).

3. What is new with the Real-Time Visualization and Analytics capability of ArcGIS?

The Real-Time Visualization and Analytics capabilities of ArcGIS are enabled with [ArcGIS Velocity](#) (SaaS), [ArcGIS GeoEvent Server](#) (in your own environment), and across multiple ArcGIS applications.

### ArcGIS Velocity

Recent releases of ArcGIS Velocity include many new capabilities and key enhancements highlighted below.

#### General:

- The maximum number of running items for Standard and Advanced subscription [licenses](#) was increased. Standard subscriptions can run up to 10 feeds and analytics (previously 5). Advanced subscriptions can run up to 15 feeds and analytics (previously 10).

- The [model view](#) analytic editing experience has been rebuilt for improved performance and includes new enhancements such as easier node resizing, node renaming, and smart snapping during manual model arrangement.
- The feed and analytic pages include the last modified date to easily work with recent items.
- Autoscaling enhancements for lower velocity [feeds](#) and [real-time analysis](#).
- Enhancements to subscription notifications when storage reaches 75 percent and 100 percent of the subscription limit.
- Notification when your Velocity subscription is within 30 days of expiration.
- Notifications were enhanced in several areas of the Velocity app.
- Significant enhancements were made to the Velocity cloud architecture which enable more efficient feature storage and the ability to upgrade with minimal downtime.

#### Feeds, data sources, and outputs:

- The new [gRPC](#) feed type enables a client server paradigm in which real-time data can be pushed into ArcGIS Velocity either transactionally or in a streaming approach.
- The [Feature Layer \(new\)](#) output has been enhanced to support writing output data to ArcGIS Online hosted feature layers from big data analytics.
- The [Kafka](#) feed type's authentication options have been enhanced to support SASL PLAINTEXT (non SSL) in addition to SASL PLAIN.
- The [Geotab](#) feed type was enhanced to allow the user to specify additional attributes from the Geotab database for ingestion such as driver data.
- When authoring [feeds](#), users can choose to immediately store incoming data over time to a feature layer as it is received on the feed, to more easily ingest data for historical visualization and analysis.

#### Analytics:

- Dynamic geofencing and dynamic joins in real-time analytics enable you to find relationships between two sets of data that are changing in real-time, and can be configured by using two feeds together in tools such as [Filter by Geometry](#), [Join Features](#), and [Detect Incidents](#). See [Geofencing analysis](#) for more information.
- A new tool, [Forest-based Classification and Regression](#) was added for big data analytics.
- The [Calculate Journeys](#) tool was enhanced with new optional parameters to improve handling of minor dwell locations.
- The analytic editor was enhanced for real-time analytics to display detailed metrics for each processing step, and additional information on input feeds such as the recurrence setting for feeds that poll regularly for data.

- [Big data analytics](#) were enhanced so you can see the status of recent runs, especially useful when big data analytics are scheduled to run on a regular basis.
- Real-time and big data analytics can now be shared publicly.

#### Data management and visualization:

- New user experience for setting default symbology for [visualizing feeds and stream layers](#) including simple, unique value, and class break rendering.
- Storage metrics for administrators displays the size of each layer in addition to number of features and percent of storage consumption, improving the transparency when managing available subscription storage.
- Enhancements to improve the creation of [views on spatiotemporal feature layers](#).
- [Data retention](#) is supported when storing output data and keeping the latest observation for any given Track ID.

For a complete list of what's new at the current release of ArcGIS Velocity, see [What's new](#).

#### ArcGIS

#### GeoEvent

#### Server

The 10.9.1 and 11.0 releases of ArcGIS GeoEvent Server provide new capabilities and key enhancements, including:

- When importing geofences, a query can now be defined to import specific geofences (data) from the feature layer, instead of importing all data in the feature layer.
- Improvements and optimizations with dynamic geofencing.
- Map and feature services support republishing in place, retaining Portal for ArcGIS user configurations.
- Map services now support relative date queries.
- Additional query support for map and feature services.
- Improved service layer support for faster loading of layer details.
- More responsive administrative interface with reduced load time.
- Access to shared service layers across application in addition to existing owner-based paradigm.
- Improved disaster recovery with introduction of human readable file-based configurations.
- Performance improvement with loading the inventory of spatiotemporal data sources and layers.
- Important updates to backend libraries and dependencies.

For a complete list of what's new in the recent releases of GeoEvent Server, see what's new at [10.9.1](#) and 11.0.

**NOTE:** Users upgrading from any previous release of ArcGIS GeoEvent Server to ArcGIS GeoEvent Server 11.0 will need to export their current configuration and manually import the configuration after successfully completing installation.

4. What is coming next with the Real-Time Visualization and Analytics capability?

[ArcGIS Velocity](#) will be enhanced with support for additional IoT and AVL feed types, real-time analytics for movement analysis, and more interactive analytic configuration experiences. Esri is continuing to keep a strong focus on further advancing the capabilities of [ArcGIS GeoEvent Server](#). This includes key new functionality and enhancements for improved usability, performance, underlying technologies, and documentation.

5. Tell me more about ArcGIS Velocity and what can it do for me?

ArcGIS Velocity is the real-time and big data analysis capability of ArcGIS Online. It enables users to ingest, visualize, and analyze spatial real-time and big data to gain new insights and make informed decisions. You can explore your streaming Internet of Things (IoT) data on maps and dashboards, identify temporal patterns, and extract location-based intelligence—all while working at scale in Esri's geospatial cloud.

ArcGIS Velocity meets the needs of customers who prefer not to host their own infrastructure or have velocities and volumes of data that go beyond what on-premises Real-Time Visualization and Analytics can handle.

At the Esri UC, learn more and talk to Esri experts about ArcGIS Velocity in the ArcGIS Online area. In the meantime, explore available resources below to get acquainted with its capabilities.

- [ArcGIS Velocity](#) on Esri.com
- [ArcGIS Velocity](#) documentation
- [Get started with ArcGIS Velocity](#) discovery path on Learn ArcGIS

6. What is the difference between ArcGIS Velocity and ArcGIS GeoEvent Server?

[ArcGIS Velocity](#) and [ArcGIS GeoEvent Server](#) both drive the Real-Time Visualization and Analytics capability in ArcGIS. ArcGIS Velocity is a capability of ArcGIS Online and is cloud native. ArcGIS GeoEvent Server is a server role of ArcGIS Enterprise on-premises. Both platforms process data live and perform real-time event processing. The difference is whether you want a solution that is hosted in ArcGIS Online, or you prefer to bring a solution on-premises and administer it yourself.

7. Are there differences in the analytic event processing capabilities between ArcGIS Velocity and ArcGIS GeoEvent Server?

There are some differences in the analytic tools between ArcGIS Velocity and ArcGIS GeoEvent Server. Essential use cases namely, geofencing, detecting incidents based on attributes or other criteria, and enriching data based on spatial relationships, are supported across both products. The tools are expressed in different ways. In Velocity, the tools are arranged and designed to align

with ArcGIS Online and portal spatial analysis tools, are named accordingly, and run in real-time or in batch. Every analytic is a tool in Velocity, versus being classified separately as a filter or a processor in GeoEvent Server.

#### 8. Does ArcGIS Velocity replace ArcGIS GeoEvent Server?

No. ArcGIS Velocity is not a replacement for ArcGIS GeoEvent Server. GeoEvent Server is the real-time and big data aggregation capability for ArcGIS Enterprise, and it remains a key server role of ArcGIS Enterprise that lets customers do flexible, configurable, real-time analytics in their own infrastructure or private clouds.

ArcGIS Velocity is a Kubernetes-based system and leverages different underlying technology. It does not replace GeoEvent Server as many organizations require a server-based software model. Both products have dedicated roadmaps going forward.

#### 9. What are some common use cases for Real-Time Visualization and Analytics?

Real-Time Visualization and Analytics provides new insight into your daily operations, allowing you to track and monitor assets in the field including vehicles, personnel, environmental sensors, and more. For example,

- A police department may want a real-time map of where all the police patrols are and their current status: in service, out-of-service, busy, or available.
- A utility company may want to visually represent the status of the network with real-time information captured by sensors in the field and map the location of field crews with their current status.
- A government entity can publish a map that accurately shows the last known pollution levels or weather across a region or country.
- An airport can monitor not only flights but also ground vehicles to better coordinate operations and detect incidents before they happen.
- A city may want to stream traffic and alert data from Waze to better manage traffic signals based on real-time incidents.
- A department of transportation may want to track and monitor snowplows and optimize the amount of salt that is spread on the streets using sensors.
- A large sporting event may want to track athletes and monitor incidents and emergency crews during an event to improve operations and better support attendees and the athletes.

The Real-Time Visualization and Analytics capability can help you make more informed decisions and respond faster by not only visualizing the real-time data, but also performing real-time analytics on the streaming data. Additionally, it allows you to notify and alert key stakeholders when an event of interest occurs. For example,

- A transportation company can monitor the temperature of goods in its delivery trucks and warn the driver and the supplier via SMS or email when a particular temperature threshold is crossed.
- End customers can also be notified when the delivery truck is within a given distance from a delivery location.
- Crews at a construction company can be alerted when expensive equipment leaves a project area.
- Emergency responders can use the current location of field crews to determine which member is closest to an incident to provide improved response.
- A logistics company can lock down access to a computer or vehicle when its owner is more than 60 feet away from it.
- A public works organization can keep track of the route followed by its vehicles during a storm. The tracked route can be logged for further analysis, indicating if a particular vehicle stopped for a period of time or deviated from its initial assignment.

Big data analytics can be used to process and analyze large volumes of stored observation data allowing you to gain insights into patterns, trends, and anomalies. For example,

- As an environmental scientist, you can identify times and locations of high-ozone levels across the country in a dataset of millions of static sensor records.
- As a GIS analyst, you can run a scheduled big data analytic that checks a data source for new data every five minutes and sends a notification if certain attribute or spatial conditions are met.

#### 10. What are some more advanced use cases for Real-Time Visualization and Analytics?

Real-Time Visualization and Analytics enables spatiotemporal patterns of interest to be detected both continuously in the stream of data as it is received as well as historically over time. For example,

- Receive public safety updates on inclement weather warning areas, buffer them by a distance, and alert critical infrastructure that is in proximity to be impacted by the weather.
- Detect when various entities that are moving around come in proximity of one another.
- Detect when entities of interest meet up, notify those interested as it is happening while providing additional context such as duration of meetup and proximity to other locations.
- Proactively monitor that a convoy of entities that are moving together stays together, and if they separate alert those interested.
- As a retail analyst, process millions of anonymous cell phone locations within a designated time range to determine the number of potential consumers within a certain distance of store locations.



## 11. What should I not miss at the Esri UC regarding Real-Time Visualization and Analytics?

For this year's Esri UC, attend sessions, talk to Esri experts, and learn how to get started with the Real-Time Visualization and Analytics capabilities of ArcGIS. You can choose from several technical workshops including:

### Tuesday:

- ArcGIS Velocity: An Introduction - 1:00 p.m. — 2:00 p.m.
- ArcGIS GeoEvent Server: An Introduction - 2:30 p.m. — 3:30 p.m.

### Wednesday:

- ArcGIS GeoEvent Server: An Introduction - 8:30 a.m. — 9:30 a.m.
- ArcGIS Velocity: Applying Real-Time and Big Data Analytics - 10:00 a.m. — 11:00 a.m.
- ArcGIS GeoEvent Server: Applying Real-Time Analytics - 1:00 p.m. — 2:00 p.m.
- ArcGIS Velocity: Custom Data Ingestion with gRPC - 2:30 p.m. — 3:15 p.m.
- ArcGIS Velocity: An Introduction - 4:00 p.m. — 5:00 p.m.

### Thursday:

- ArcGIS Velocity: Applying Real-Time and Big Data Analytics - 8:30 a.m. — 9:30 a.m.
- ArcGIS Velocity: Automation with Python - 10:00 a.m. — 10:45 a.m.
- Real-Time Visualization and Analytics: The Road Ahead - 10:00 a.m. — 11:00 a.m.
- ArcGIS GeoEvent Server: Best Practices - 1:00 p.m. — 2:00 p.m.
- ArcGIS: Real-Time Use Cases - 2:30 p.m. — 3:30 p.m.

### Friday:

- ArcGIS GeoEvent Server: Applying Real-Time Analytics - 9:00 a.m. — 10:00 a.m.

For more information on these sessions and others, visit the [Detailed Agenda](#) for UC 2022.

## 12. What connectors and processors are available with ArcGIS GeoEvent Server?

ArcGIS GeoEvent Server provides many out-of-the-box input connectors, output connectors, and processors that allow you to receive event data from virtually any source, analyze that data in real-time, as well as send that event data to almost any destination. Refer to the [GeoEvent Server documentation](#) for a complete listing of the out-of-the-box [input connectors](#), [output connectors](#), and [processors](#).

Additional connectors and processors are available on the [ArcGIS GeoEvent Server Gallery](#) and the [ArcGIS GeoEvent Server Partner Gallery](#). The connectors and processors available on the galleries enable GeoEvent Server to handle additional types of sensors or feeds and perform additional real-time analytics. Many of those connectors and processors on the galleries have associated source code available on [Esri's GitHub](#), providing you the opportunity to extend their capabilities.

13. If I cannot find a connector or processor in ArcGIS GeoEvent Server that meets my specific requirements, can I develop my own?

Yes. New connectors and processors can be created using the ArcGIS GeoEvent Server SDK. In addition to developing your own connectors using the SDK, new connectors can also be configured in GeoEvent Manager using the out-of-the-box adapters and transports, which are the underlying components of a connector. To learn more about extending GeoEvent Server, refer to [Extend GeoEvent Server](#).

14. How is the spatiotemporal big data store used in ArcGIS?

The spatiotemporal big data store, part of ArcGIS Enterprise, is used to store high volumes of data generated by ArcGIS GeoEvent Server, ArcGIS GeoAnalytics Server, and ArcGIS Field Maps. For customers using ArcGIS Mission, the spatiotemporal big data store is required to store missions and locations.

The spatiotemporal big data store sustains high velocity write throughput and can run across multiple machines (nodes). It is also scalable—adding more machines increases capacity, enabling you to store more data, implement longer retention policies of your data, and support higher data write throughput.

For more information, see the help topic [What is ArcGIS Data Store?](#)

15. Why are spatiotemporal analytics so important, and what is Esri doing to integrate this type of analysis?

The challenges we face increasingly require us to make decisions based on real-time data. The data organizations are confronted with is frequently big data that happens to have both temporal and spatial components. Visualizing and analyzing this kind of data introduces new challenges and requires us to think about our problems not just in terms of location, or time, or attribute space separately, but in a truly multidimensional manner that brings all these aspects of information together.

The ability to simultaneously explore this multidimensional data to profile, summarize, cluster, and connect information based on spatial, temporal, and attribute characteristics allows us to solve the problems that bridge the domains of spatial science and dynamic/real-time analysis. Having the flexibility to model time as both linear and cyclical is critical, as is the ability to visualize all the spatial, temporal, and attribute dimensions of our data at varying scales.

Spatiotemporal analytics is an integral part of ArcGIS; from the way real-time and time-aware big data is stored, to the methods we use to aggregate and visualize this data, to the analytics that uncover underlying patterns, trends, and anomalies. These innovations allow our science to evolve, gaining new perceptions of our world from the massive amounts of spatiotemporal data at our fingertips.

## 16. How is temporal data supported in ArcGIS?

Time is supported throughout ArcGIS, including support for:

- Historical data in the geodatabase data model (time stamps and historical data logging).
- Ingestion and storage of real-time data that contains time information (for example, sensor time and received time).
- Temporal visualization of historic (playback, time window) and real-time data (live).
- Temporal analysis of historic (for example, duration, course, speed, distance covered, time slicing, temporal relationships, drive times) and real-time data (for example, geofencing).
- Statistical analysis and visualization of spatiotemporal trends and patterns (for example, time series, hot spots, and outliers).
- Temporal imagery and raster datasets that extend to multidimensional scientific datasets.

There are several resources available to get more information, including:

- For ArcGIS Online, start with [View time maps \(Map Viewer\)](#) and [Configure time setting \(Map Viewer\)](#).
- For ArcGIS Pro, start with [Temporal data](#).
- For ArcGIS Velocity, start with [Define data and time parameters](#).
- For statistical analysis, start with [An Overview of the Space Time Pattern Mining toolbox](#).
- For ArcGIS Enterprise, start with [Stream services](#).
- For developers, start with [TimeSlider widget](#), [Filter features with TimeSlider](#), [TimeSlider with timeOffset and actions](#), and [Time-based layer](#).
- For temporal raster and scientific data, start with [Improve your scientific analysis with one simple trick!](#)

## 17. How is location intelligence related to the Internet of Things (IoT)?

Location provides context and depth to the billions of real-time inputs from the Internet of Things (IoT). Fed by real-time data, the applications of location intelligence are broad, ranging from supply chain digitization to market and customer analysis, to logistics and fulfillment, to site analysis and territory planning. Real-time data is also being used to inform risk management, monitor performance, track and analyze assets, and to monitor events for increased public safety.

Increasingly, location provides the key to unlocking hidden, and potentially valuable, insights within data of any size. Unless organizations can see relationships between data points, and translate those relationships into actionable information, data pouring in from the IoT will be rendered exponentially less beneficial.

Location intelligence is a method of analyzing and synthesizing big data—whether real-time or data-at-rest—to derive true insight.

## Data Management

1. What kind of data does ArcGIS work with?

ArcGIS supports several data formats and storage options serving many purposes from visualizing simple features to analyzing data in real time. Please review the following [knowledge base article](#) on the kinds of data supported in ArcGIS.

2. What are the significant advancements being developed in ArcGIS related to database management?

Esri continues to make significant advancements to geodatabase management. Here are some recent highlights:

- Mobile Geodatabase: Introduced at the ArcGIS Pro 2.7 release, mobile geodatabases are a newer geodatabase type based on a SQLite database.
  - Mobile geodatabases support most geodatabase behaviors such as contingent values, attribute rules, and relationship classes.
  - Support for [utility \(trace\) networks](#), [parcel fabrics](#), and nonversioned archiving was added with the ArcGIS Pro 2.9 release.
  - Publishing data from a mobile geodatabase to either ArcGIS Online or ArcGIS Enterprise is added with the ArcGIS Pro 3.0 release.
  - The mobile geodatabase can also be used in third-party applications for query purposes and report generation.

For more information on mobile geodatabases, please review the [ArcGIS Pro help documentation](#).

- Starting with the ArcGIS Pro 3.0 release, newly created or upgraded enterprise geodatabases in SQL Server can be restored into the same database instance in a new name. Read this [blog post](#) for more information.
- We continue to expand support to include more database-as-a-service offerings to support cloud adoption. Starting with the ArcGIS Pro 2.9 and ArcGIS Enterprise 10.9.1 releases, we've added support for Google's Cloud SQL for PostgreSQL and Cloud SQL for SQL Server. We will continue to evaluate other database-as-a-service offerings in future ArcGIS releases.
- In the ArcGIS Pro 2.9 and ArcGIS Enterprise 10.9.1 releases, [we introduced the ability to access data from cloud data warehouses](#). Supported cloud data warehouses include Amazon Redshift, Google BigQuery, and Snowflake. Through ArcGIS Pro, you can connect to, explore, and visualize your cloud data warehouse data. This includes the ability to create query layers and to enable feature

binning on point datasets. From ArcGIS Pro, [you can then share your data to ArcGIS Enterprise as a map image layer](#).

- Sharing your data as a read-only feature layer is available starting with the ArcGIS Pro 3.0 and ArcGIS Enterprise 11.0 release when working with Google BigQuery. Read-only feature layer support will be extended to Snowflake and Amazon Redshift in subsequent ArcGIS releases.
- In addition, Esri continues to extend data management capabilities in ArcGIS Pro, such as adding the Check Geometry and Repair Geometry geoprocessing tools for third-party spatial data stored in an enterprise geodatabase and the Trim Archive History geoprocessing tool for cleaning up unused geodatabase archive history for nonversioned, archive-enabled feature classes at the ArcGIS Pro 2.7 release.

3. I have my own relational database management system; how can I use it in ArcGIS?

The database platforms where we support geodatabases are: Microsoft SQL Server, Oracle, PostgreSQL, IBM Db2 and Informix, and SAP HANA. We also support database access (query layers) with Dameng (China) and Teradata Vantage.

4. When using databases with ArcGIS, I have heard the terms “user managed data” and “ArcGIS managed data.” What is the difference?

User managed and ArcGIS managed refer to the level of access that an organization has to the underlying database storage.

**User managed data storage** is managed solely by an organization, usually database administrators who are responsible for provisioning, tuning, scaling, and otherwise managing the database directly.

**ArcGIS managed storage** is managed by ArcGIS software. Administrators install the software, but they are not responsible for provisioning the underlying database or working with it directly. Users interact with ArcGIS managed data via layers and services, not via direct connections to a database.

Examples of each of the storage types are enterprise database management systems/geodatabases (user managed) and the ArcGIS Data Store (ArcGIS managed).

Often, organizations use both options based on their workflows and needs. The two are not in competition with each other, and both provide their own set of functionalities. For example, storing data in your enterprise geodatabase gives you control over spatial and attribute quality and supports large scale multi-user implementations, while leveraging hosted layers (in the ArcGIS Data Store) supports self-service workflows without requiring direct integration with a back-end database.

Please review the [Data in ArcGIS: User Managed and ArcGIS Managed](#) technical paper for more information on this topic. At the User Conference, check out the 'ArcGIS Enterprise: Data Storage Strategies' session for more information.

## 5. What improvements is Esri making for exploration and visualization of large datasets?

Esri implemented feature binning to help you visualize large amounts of point data. Feature binning is a process that aggregates point features into dynamic polygons called bins. A single bin represents all features within its boundaries and appears wherever at least one feature lies within it. As a method of feature reduction, feature binning vastly improves the drawing performance of layers that contain millions of point features.

Bin-enabled feature layers are aggregated visualizations of point features. When a point feature class includes so many features that it is difficult to interpret meaning from drawing each feature individually at smaller scales, you can aggregate them into equally-sized polygonal bins. Each bin can be symbolized to represent the number of features contained within (the feature count) or another summary statistic. Drawing the point feature information as bins at smaller scales makes the data easy to understand and fast to draw. As you zoom in, the individual points are drawn in place of the bins at a defined threshold, revealing the full complexity of the data at larger scales. The changes in bin size as you zoom in or out are referred to as levels of detail, or LODs.

The ArcGIS Enterprise 10.9 release provided the ability for sharing bin-enabled feature layers as a feature service to be consumed in ArcGIS Pro. The symbology and other properties of the bin can then be modified as desired.

For more information on working with binned feature layers, please review the [ArcGIS Pro help documentation](#).

## 6. What are attribute rules?

Attribute rules enhance the editing experience and improve data integrity for geodatabase datasets. Available in ArcGIS Pro and ArcGIS Data Reviewer, attribute rules are user-defined rules that automatically populate attributes, restrict invalid edits during edit operations, and perform quality assurance checks on existing features. In ArcGIS Pro, attribute rules are created using ArcGIS Arcade expressions, and in ArcGIS Data Reviewer, they are created using configurable checks.

## 7. What enhancements to attribute rules have been made in ArcGIS Pro?

The following enhancements were made to attribute rules over the last two ArcGIS releases:

- Inclusion of attribute rules when generating a schema-only layer package
- Support for batch calculation and validation rules on mobile geodatabase data
- Ability to modify imported rules prior to saving rules on a table or feature class
- Ability to request for specific fields using the [Expects function](#)

Please read the following blogs for more information on:

- How [newly created or updated features can auto-snap to nearby features](#) using attribute rules
- How to use the [Exclude from Application Evaluation property](#)

- Tips for using [ArcGIS Arcade in attribute rules](#) when authoring an attribute rule involving a set of lookup values

For more information on attribute rules, please review the [ArcGIS Pro help documentation](#).

8. What enhancements to branch versioning have been made in ArcGIS Pro and ArcGIS Enterprise?

Branch versioning is a type of versioning for multi-user editing via a services-based architecture. It was initially introduced with the ArcGIS Pro 2.1 and ArcGIS Enterprise 10.6.1 releases. The industry models, such as utility network, parcel fabric, and ArcGIS Roads and Highways, utilize this versioning type.

The following enhancements were made to branch versioning over the last two ArcGIS releases:

- A [default versioning type](#) can be set for new database connections starting with the ArcGIS Pro 3.0 release.
- A new '[Change to Default](#)' context menu was added starting with the ArcGIS Pro 3.0 release to enhance editing workflows when working in a named version.
- The reconcile and post operations support asynchronous processing starting with the ArcGIS Enterprise 10.9.1 release.

For more information on branch versioning, please review the [ArcGIS Pro help documentation](#).

9. Is geodatabase archiving supported with branch versioned data?

Yes. A branch versioned dataset has the archiving functionality already built into its framework. Hence, archiving is automatically enabled when registering a dataset as branch versioned. This temporal aspect of branch versioning is used to track edits on the dataset.

10. Can traditional versioned and branch versioned data exist in a single enterprise geodatabase?

Yes, traditional versioned and branch versioned data can exist in the same enterprise geodatabase. However, a feature dataset can only contain feature classes with one of the registration types. Hence, an organization can set up a Parcels feature dataset with branch versioning and a Planning feature dataset with traditional versioning for different use cases.

For more information on versioning in ArcGIS Pro, please review the [ArcGIS Pro help documentation](#).

11. Does registering a dataset as branch versioned prevent the enterprise geodatabase from being accessed with ArcMap?

Yes. Registering a dataset as branch versioned prevents you from accessing it in ArcMap. However, data that is not registered as branch versioned or related to a table that is branch versioned can be accessed from ArcMap.

12. Does branch versioning support a QA/QC version for edit verification prior to reconciling and posting edits to the default version?

No. Branch versioning only supports one version level from the default version. To perform edit verification tasks, [change the owner of the named \(editor\) version](#) to a version administrator. The version administrator can subsequently reconcile and post the named version to default version after verifying the edits.

13. Where can I learn more about branch versioning at this year's UC?

Please check the UC agenda schedule for the "Enterprise Geodatabase: Get to know Branch Versioning" technical session to learn more about using this versioning model with ArcGIS Enterprise and ArcGIS Pro.

14. What are Esri's plans for distributed data workflows in ArcGIS Pro?

Starting with the ArcGIS Pro 2.5 release, geodatabase replication was added to support data distribution using traditional versioning. We implemented the 'Create Replica' and 'Synchronize Changes' geoprocessing tools along with a user interface to manage replicas.

- The [Replica Manager](#) was enhanced at the ArcGIS Pro 2.6 release to provide more information about the replicas, and the '[Unregister Replica](#)' geoprocessing tool was added to help manage unused replicas including service-based replicas.
- The '[Create Replica](#)' geoprocessing tool was also improved to support the creation of replicas using the 'register existing data only' option at the ArcGIS Pro 2.7 release.
- Tools to support disconnected replication and the creation of replicas from geodata services have been added in the ArcGIS Pro 2.9 and 3.0 releases respectively.

Additionally, you can enable offline editing workflows using ArcGIS Pro when working with a sync-enabled feature service. This allows maps to be taken offline and synchronized multiple times in both directions. Datasets participating in sync-enabled feature services can be either non-versioned with archiving enabled or registered as versioned (traditional or branch).

On a broader level, many organizations are synchronizing maps, apps, and layers across ArcGIS Enterprise deployments and between ArcGIS Enterprise and ArcGIS Online using distributed collaboration. This helps facilitate better data visibility and data management workflows for use cases where more than one organization needs access to content. There are many patterns of collaboration, and one of the newest is data collection workflows where organizations edit the same feature layers that are shared using collaboration and sync changes both ways.



For more information on sharing feature layers, please review the [ArcGIS Enterprise help documentation](#).

15. Can geodatabase replication be enabled on branch versioned data?

No. Branch versioning is not supported with geodatabase replication, as branch versioned data is edited and synced via feature services. The geodatabase replication capability is only supported with traditional versioning. Creating a replica between traditional and branch versioned data is not supported.

The feature service's sync capability has supported branch versioned data on the default version since ArcGIS 10.7. Starting with ArcGIS Enterprise 10.7, you can use distributed collaboration with branch versioned layers to keep data in sync from one organization to another. When you share a branch versioned layer, a hosted layer is created for your collaboration recipient either in ArcGIS Enterprise or ArcGIS Online.

Starting at the ArcGIS Enterprise 10.9 release, you can share edits to and receive edits from organizations that you are collaborating with.

Supported feature layers include hosted feature layers or feature layers published by reference from an enterprise geodatabase. When you publish a feature layer that references an enterprise geodatabase, the underlying data can be versioned, or non-versioned with archiving enabled.

For more information on sharing feature layers from an enterprise geodatabase, please review the [ArcGIS Enterprise help documentation](#).

16. Can a feature service using branch versioned data be taken offline with ArcGIS Field Maps?

Yes, feature services using branch versioned data can be taken offline. You can take data offline from the default version or use the option of [generating a version for each map that is downloaded](#). Creating a version for each downloaded map will allow edits on the replica version to be reviewed prior to reconciling and posting the field edits to the default version.

For more information on working with offline maps and branch versioned data, please review the [ArcGIS Enterprise help documentation](#).

17. My organization has archive-enabled feature classes in our enterprise geodatabase that we use with ArcGIS Field Maps. The size of the feature classes grows to a point where taking database backups take a long time. How can we manage the archived data?

Geodatabase archiving can be enabled on data for several reasons. Notable among them are record keeping for compliance purposes and supporting offline editing workflows. The size of such tables grows with increasing edits, which can result in storage and backup concerns over time. The ArcGIS Pro 2.6 release introduced the ability to trim archive history from nonversioned archive tables.

For more information on trimming the archive history of nonversioned datasets, please review the [ArcGIS Pro help documentation](#).

18. Can branch versioned data be compressed if the historic data is no longer required?

The Compress operation on an enterprise geodatabase workspace is only applicable to traditional versioned data. There are plans to provide the functionality of trimming historic records from branch versioned datasets, similar to the [current capability of trimming archive history from nonversioned archive tables](#).

19. Does ArcGIS Online support feature services with branch versioning?

No. Branch versioning is only supported with feature services that are published by reference. It is not supported with hosted feature services.

20. Are versioned views supported with branch versioned data?

No. Versioned views are not supported with branch versioned data. We are reviewing cases for the versioned view requirement to determine an optimal way of addressing it in a later ArcGIS release.

21. With the release of branch versioning in ArcGIS Pro, is traditional versioning being deprecated?

There are no plans to deprecate traditional versioning. Both [traditional and branch versioning are supported in ArcGIS Pro](#). However, newer datasets such as utility networks and parcel fabrics utilize the branch versioning architecture.

Versioning is used by many organizations to support various multi-user editing workflows. Traditional versioning supports long transactions by directly accessing an enterprise geodatabase. Editing branch versioned data is supported solely via feature services.

22. How does control over data access change once I begin using a services-based architecture?

ArcGIS supports many deployment patterns from desktop, to SaaS, to enterprise software, to web and mobile implementations. Organizations implement various patterns to meet their business needs, often combining many of these patterns together for a complete system.

When you publish data as services and layers, it provides access to the data through ArcGIS Online and/or ArcGIS Enterprise. For many, this method is scalable and streamlined, as administrators don't have to work within the database to grant all users access to each dataset, but rather access is controlled by sharing layer items and by users' roles in the organization.

Esri has published a "[Content Management Techniques for your ArcGIS Enterprise Portal](#)" technical paper that is related to this topic and provides tips and governance techniques to make the best use of your content in ArcGIS Enterprise. The topics in the paper apply widely to ArcGIS Online as well.

### 23. Is the SDEBINARY type supported?

There are no current plans to stop supporting the SDEBINARY type, and we continue to support it as a legacy format. We encourage customers to move to SQL spatial types as further development work is focused on those. Functionality such as [non-versioned archiving](#), branch versioning, utility networks, and parcel fabric created using ArcGIS Pro, is only supported on SQL spatial types. SQL spatial types, which store spatial data directly in the shape column, have been the default for Oracle (ST\_Geometry) since ArcGIS 9.2 and SQL Server (Geometry) since ArcGIS 10.1.

### 24. What is ArcGIS LocateXT?

ArcGIS LocateXT is an extension to ArcGIS Pro, ArcMap, and ArcGIS Enterprise. ArcGIS LocateXT discovers and extracts geocoordinates, place names, and other critical information from almost any unstructured data, including messages, reports, briefings, and even social media, and places them instantly on a map.

### 25. What unstructured data challenges does ArcGIS LocateXT solve?

There are large amounts of location-based information that are not in traditional structured spatial formats but trapped in unstructured and semi-structured text-based formats where it cannot be captured, visualized, or analyzed. Examples include emails, presentations, reports, websites, etc.

These workflows are time consuming and highly subject to human error. As a result, important spatial patterns are missed or ignored due to the tedious nature and quantity of work involved with finding, identifying, and mapping geospatial references in textual data.

ArcGIS LocateXT provides the ability to easily discover and extract geographic coordinates (and other custom locations) from their unstructured data holdings such as emails, briefings, and reports, allowing them to instantly generate and analyze intelligent map-based information and share it across the enterprise.

ArcGIS LocateXT shows the connections between your data and the world.

### 26. What are some of the key features of ArcGIS LocateXT?

With ArcGIS LocateXT, you can

- Discover & extract geocoordinates, user-defined place names, image geotags, dates, and other critical information from unstructured data
- Identify and extract thousands of variations of geocoordinate formats: DD, DM, DMS, UTM, and MGRS
- Configure place name extraction using geospatial layers or gazetteer files
- Relate textual content about an extracted location that is provided as attributes in the output feature class

- Create custom extracted attributes by configuring keyword search and extraction controls
- Support the input of several custom attributes at once and share the results as user defined schema
- Use configurable Solutions templates curated and focused for specific industry workflows

27. Can I perform data validation with Attribute Rules without having to write ArcGIS Arcade?

Yes. ArcGIS Data Reviewer provides a library of pre-defined checks to simplify the implementation of [constraint](#) and [validation](#) attribute rules. These checks are configurable and do not require the creation of custom ArcGIS Arcade scripts.

Data Reviewer's checks detect common errors found in geospatial data that affect different aspects of a feature's quality, such as its integrity, properties such as attribution, and spatial relationship with other features. Some of the most frequently used checks are:

- [Domain](#) - Finds attribute values that do not comply with coded value or range domains that are associated with an attribute field.
- [Feature on Feature](#) - Finds features that have a specific relationship, either from two feature layers or within the same feature layer.
- [Query Attributes](#) - Finds features based on a WHERE clause run against a feature's attributes.
- [Check Geometry](#) - Finds features whose geometry is empty, nothing, or not simple, as well as features with empty envelopes.
- [Table to Table Attribute](#) - Finds features or rows that contain attribute values that meet a relationship you define to values in another feature class or stand-alone table.

For more information, please see the [ArcGIS Pro help documentation](#).

28. Have any ArcGIS Data Reviewer capabilities been deprecated?

Some of Data Reviewer's capabilities previously provided have been replaced by new capabilities in ArcGIS Pro and ArcGIS Enterprise.

In Data Reviewer for ArcGIS Pro, the extension's map-based data validation workflows and associated tools have been removed in the upcoming ArcGIS Pro 3.0 release. Customers are encouraged to consider migrating their automated review workflows to Reviewer-enabled attribute rules. For more information, please see the technical support [article](#).

In Data Reviewer for ArcGIS Enterprise, the extension's ArcMap runtime-based server object extension and associated geoprocessing service have been removed in the ArcGIS Enterprise 11.0 release. Customers are encouraged to consider migrating their quality control workflows to Reviewer-enabled attribute rules and the [Validation](#) server. For more information, please see the technical support [article](#).

## AEC and Asset Management

### 1. How long will the geometric network be supported?

ArcGIS Desktop 10.8.x was the last release for ArcMap and the geometric network; support will continue until 2026.

### 2. What is the trace network, and who is it for?

The trace network was designed for wetlands, hydrologic networks, and other simple networks; it is provided as a solution for non-utility customers within ArcGIS Pro (file geodatabase support) and through feature services.

Introduced with the ArcGIS Pro 2.6 release, the trace network is designed to be a path forward for geometric network customers who are not utilities or telecoms (utility and telecom users should move to the Utility Network). The new network type uses a simple approach to network modeling with the benefits of the updated environment and implementation you find with ArcGIS Pro. The target audiences for the trace network are hydrology (streams), rail, and other disciplines.

The trace network with ArcGIS Pro includes

- Tools to migrate directly from a geometric network, or to start from scratch with a new network
- Full editing capabilities against the network features including rubberbanding of connected edges
- Ability to set flow direction based on the digitized direction of the lines
- Tracing capabilities based on flow direction for connected, upstream, downstream, and shortest path traces using network attributes (weights)
- Ability to create network diagrams (schematics) from selected features in the network
- File geodatabase support

ArcGIS Enterprise 10.9.1 provides support for the trace network in a multi-user environment with a Trace Network user type extension for licensing.

### 3. What is the Utility Network?

Utility Network is an advanced topologic model for all utilities. It provides an optimized schema, network diagrams, and advanced flow analysis to supporting business drivers such as network operations, asset management, customer support, and load forecast planning.

You can learn more on the [ArcGIS Utility Network](#) page.

#### 4. How is Utility Network licensed?

The utility and trace networks both leverage user type license extensions for enterprise deployments. Single users on file geodatabase can use utility and trace networks with ArcGIS Pro.

The add-on license extension can be applied to most user type licenses to access industry-focused data models and network tools to support utility operations, asset management, and customer service.

If working solely with a file geodatabase version of the Utility Network, then standard or advanced licensing of ArcGIS Pro is required.

#### 5. What are the target industries for ArcGIS Utility Network?

ArcGIS Utility Network is designed for all utilities. Esri has released ArcGIS Solutions for a range of Electric, Gas, Water, Sewer, and Communications implementations, with additional models such as Steam Networks being worked on. Users and partners have the ability to create their own Utility Network schemas for the utility and telecom types listed above, as well as for those not listed.

Utility Network can also be applied to other industries such as district heating or rail, but we do not have sample data models for them yet. For these industries and all others requiring network capabilities, end users and partners continue to have the ability to create their own data models for the utility network.

#### 6. Will Esri provide tools to help migrate data to Utility Network?

Yes. Esri has already provided resources to help users migrate data to the Utility Network, including resources for data migration on the various industry web pages found on the [ArcGIS Solutions website](#).

In addition, Esri partners are providing resources, such as this one: [Migrating to the Esri Utility Network](#) from Safe Software.

For advanced migration solutions, users are encouraged to work with Esri partners who are in our [Utility Network Management Specialty](#) program.

#### 7. Can I use Utility Network in web and mobile applications?

Yes. Enterprise-based Utility Network configurations are designed to expose most capabilities through REST services for web and mobile solutions. Esri currently provides SDK components to assist with solution building, and more will be available with upcoming releases to improve the user experience for ArcGIS API for JavaScript and ArcGIS Experience Builder and mobile applications.

Applications like ArcGIS Field Maps and ArcGIS Explorer can currently take Utility Network features offline as simple features, with designs in place to expand these capabilities going forward to include things such as tracing.

Web access is currently through the REST endpoints, with Esri core plans for support directly through the ArcGIS API for JavaScript and available widgets. Some partners have already written web applications for Utility Network by making direct calls to the REST endpoints. Other partner applications including editing capabilities will be available soon.

#### 8. What is the role of partner solutions with Utility Network?

Esri partners are a great resource for user-focused solutions specific to your industry. We have many partners with strong engineering experience to augment the core Utility Network technology from migration through implementation, and including advanced analysis.

Our partners have a number of resources to assist you in the migration and implementation of Utility Network. [Partners in the ArcGIS Utility Network Specialty](#) have been recognized for their understanding of the utility market and providing services to support Utility Network. Other partners can provide other aspects of implementation or enterprise-based solutions.

#### 9. How can I find out more about Utility Network and the ArcGIS Utility Network extension during the UC?

There are a number of Utility Network sessions that will be provided during the UC; [we recommend that you explore the agenda](#) to select the sessions that work best for you. Additionally, Esri subject matter experts from Development, Solutions, and Professional Services will be on hand to answer your questions. Partners will also be available to showcase their capabilities and solutions at the conference and help answer specific questions as needed.

#### 10. What's new in ArcGIS Parcel Fabric?

The latest version of the parcel fabric provides the following new functionality:

- [Configured data quality layers](#) are available for parcel fabric feature layers. These layers have been specifically configured to show potential data quality issues in the parcel fabric.
- Easier [import of optional attribute rules](#) is now supported for parcel fabric feature classes.
- The [SHAPE IS FIXED attribute rule](#) is now a default attribute rule on the Points feature class.
- The Highlight command can be used to [find and highlight gaps and overlaps](#) between parcels in the current map extent.
- Improved labeling of lines is available using the Label Position field on the parcel Lines and Connection Lines feature classes.
- Parcel fabrics are now supported on mobile geodatabases (SQL Server Lite) in a single-use deployment.
- History parcel shapes are now included in the record polygon shape. A Retired Count field stores the number of historic parcels that are part of the record.

#### 11. What workflows are supported in ArcGIS Parcel Fabric?

The workflows supported by the parcel fabric can be categorized as “Record Driven” and “Quality Driven” workflows.

The parcel fabric is a records-driven system that organizes parcel data based on the form in which the data was originally recorded. Parcel data is recorded on legal records such as plans, plats, deeds, and records of survey. These workflows include the most typical edits such as merges(combinations), Splits, Split from Parent, and import CAD data.

Quality workflows can include correcting data errors as a result of legacy formats like shape files and coverages and analyzing data for blunders utilizing Least Squares Adjustments.

#### 12. How do I deploy ArcGIS Parcel Fabric?

The parcel fabric has two deployment options, a single editor or multi-editor deployment. In a single editor deployment, the ArcGIS parcel fabric resides in a File Geodatabase. In a multi-editor deployment, the ArcGIS Parcel Fabric is published to an ArcGIS Enterprise instance. Editors connect to the Enterprise portal and add the ArcGIS Parcel Fabric to their map. In both cases, you must have ArcGIS Pro standard or advanced licenses. In a multi-editor environment, the editors must also have a parcel fabric user type extension assigned to them by their portal administrator.

#### 13. Will I need to migrate my Parcel Fabric for ArcMap again to the new Parcel Fabric?

If you are currently using an ArcMap Parcel Fabric, you will need to upgrade your ArcMap Parcel Fabric to the ArcGIS Parcel Fabric. Use the “[Upgrade Parcel Fabric](#)” geoprocessing tool to upgrade to the ArcGIS Parcel Fabric. The upgrade tool will look at your ArcMap parcel types and create an ArcGIS Parcel Fabric with those same parcel types.

#### 14. How can I keep up to date with information about the editing parcels in ArcGIS Pro?

The Parcel Fabric team hosts one to two meet-ups a month on different topics. Some topics are “How-To” focused going over a particular task. Others are more broad and may include what’s coming in the next release. We also try to include user stories, where ArcGIS Parcel Fabric users describe their workflows. These sessions are recorded and can be found on the [Esri community Parcel Fabric place](#).

#### 15. Which editing tools can be used in ArcGIS Pro to edit parcels?

The ArcGIS Parcel Fabric has been designed to behave like any other standard feature class. Tasks for merging, splitting, or dividing use standard tools on the Modify Features Pane. When there is an active record in the Parcel Fabric’s Heads-Up-Display (HUD), some tools become “Parcel Aware” and will generate the appropriate parcel history and lineage.



This is known as [Record Driven Workflows](#) and organizes parcel data based upon the form in which it was originally recorded.

The ArcGIS Parcel Fabric also supports [Quality Driven Workflows](#) that use standard geodatabase topology and tools to perform data quality edits like “Align Features,” “Extend or Trim,” and “Planarize.”

16. Will the new Parcel Fabric support 3D parcels?

The ArcGIS Parcel Fabric has been designed to support 2D, 3D, and 4D. Much of the information managed by the ArcGIS Parcel Fabric is represented as a two-dimensional polygon and boundary line measurements. However, by using an elevation attribute or an attribute to record the floor number, parcels can be extruded and viewed in a three-dimensional scene, using the elevation or floor number to extrude parcels into vertical space. Since the ArcGIS Parcel Fabric utilizes branch versioning, archiving, or 4D capability is also supported.

17. What types of clients can access Parcel Fabric features for editing?

In a multi-editor deployment, the ArcGIS Parcel Fabric utilizes branch versioning and is accessed as a feature service. Therefore, any client that can access the feature service and interact with the Parcel Fabric Service through the REST API can perform edits. Today, the off-the-shelf client is ArcGIS Pro.

18. Is ArcGIS Parcel Fabric REST API supported?

Yes, the [ArcGIS Parcel Fabric service](#) is responsible for exposing the editing and management capabilities of the Parcel Fabric.

19. Does the Parcel Fabric work outside of the United States?

Yes, the ArcGIS Parcel Fabric has been designed with a flexible data model to support multiple land description types. Parcels are added to the Parcel Fabric as parcel types. A Parcel Type is composed of a polygon and line feature class defined by your organization. You can add as many parcel types as necessary for your organization.

Regardless of whether your parcel data is coordinate based or entered from observed measurements (Bearings and Distances), the Parcel Fabric supports standard land domain models such as the Land Administration Domain Model (LADM), Social Tenure Domain Model (STDm), Canadian Parcel Data Model (CPDM) and others.

20. How does the release of ArcGIS Parcel Fabric impact Esri’s Land Records solution?

The ArcGIS Parcel Fabric provides the ability to integrate survey information with the parcel boundary and with the land registry. This provides the unique capability for a complete solution from the recording or registration of the deed, to the mapping of the boundaries, to analyzing its land use and assessment value. Since the ArcGIS Parcel Fabric is services based, it feeds the Land

Records Solutions from Esri such as the [Equitable Property Value Hub](#), the [Tax Parcel Viewer](#), [My Tax Distribution](#), [Floodplain Inquiry](#), and [Residential Comp Finder](#).

21. What efficiency gains can I expect when I use the new Parcel Fabric in ArcGIS Pro?

The ArcGIS Parcel Fabric is the system of record for organizations that maintain land information. As such, data quality is important. The ArcGIS Parcel Fabric provides more efficient management of parcel data with the ability to configure tasks to standardize editing workflows, attribute rules that can automatically calculate and update attribute values, editing constraints to minimize errors, and topological checks.

22. Is ArcGIS Parcel Fabric LADM compliant?

Yes, the ArcGIS Parcel Fabric has been designed with a flexible data model to support multiple land description types. Regardless of whether your parcel data is coordinate based or entered from observed measurements (Bearings and Distances), the Parcel Fabric supports standard land domain models such as the Land Administration Domain Model (LADM), Social Tenure Domain Model (STDM), and others.

23. What is new in ArcGIS for AutoCAD?

ArcGIS for AutoCAD is a free extension to AutoCAD. It continues to improve the connections between CAD and GIS. This includes the ability to connect Autodesk AutoCAD to ArcGIS Online and Enterprise for location, context, and constraints. ArcGIS for AutoCAD gives you the ability to view ArcGIS Online public data and any content that you have access to for ArcGIS Online or Enterprise. Organization data, group data, and your personal content can all be leveraged from within AutoCAD. AutoCAD users can now publish content to ArcGIS Online and Enterprise. These workflows allow for designers and other groups, such as field crews, to better collaborate, and gives the CAD user a direct role in GIS data creation.

The latest release of ArcGIS for AutoCAD improves the way AutoCAD users access and discover content available in ArcGIS Online and ArcGIS Enterprise. It also lets users with appropriate permissions publish and edit ArcGIS feature layers. Critical information, such as maps, feature layers, and imagery that has been difficult to add to AutoCAD, is now easy to browse for, search, and add from ArcGIS Online and ArcGIS Enterprise. New industry specific document feature templates make it simple to publish data with pre-designed schema and attributes.

The latest release of ArcGIS for AutoCAD supports 64-bit AutoCAD versions 2018-2022.

Visit [ArcGIS for AutoCAD](#) to learn more.

24. What is BIM and why is it relevant to the GIS user?

For many users, real-world 3D means buildings, bridges, roads, and other infrastructure. Building Information Modeling (BIM) is widely recognized as the process for collaboratively creating and using detailed information about built assets throughout their lifecycle. This information can

include bridge design, civil design, buildings, piping, HVAC, electric, structural, and many other required systems and disciplines. ArcGIS has the ability to bring together BIM content in context with GIS data to assist with Project Delivery tasks like Design Evaluation, Construction Monitoring, Safety, and Environmental Compliance.

Numerous government and commercial entities around the world are adopting BIM as the process for the delivery of assets during construction and design. In many of these cases, we are seeing increasing demand for BIM projects to incorporate GIS information during Design and Construction, and then to use BIM information to inform the GIS. The integration of GIS and BIM has even been specified into some national standards, such as in the UK.

When we look at what people are really interested in, we see that they are using BIM to capture detailed information about assets, with GIS providing information about how those assets operate and are used in spatial context. Clearly, BIM and GIS should be able to work together to provide information about the entire lifecycle of urban systems.

At Esri, we are focused on the essential ingredients that will make BIM useful to the GIS user:

- Correctly geolocate their BIM data
- View BIM models in GIS context
- Inspect, query, and symbolize BIM model content in GIS as if it were GIS data
- View many BIM models at once across a campus or city
- Connect GIS and BIM cloud systems to enable collaboration and portfolio overviews

We are also focused on bringing geospatial content into the BIM world to better support GIS and BIM interoperability.

ArcGIS Pro supports Revit and IFC formats of BIM models for buildings and expanded infrastructure.

## 25. What versions of CAD and BIM data are supported in ArcGIS?

CAD and BIM data can be added directly as feature layers in ArcGIS Pro. ArcGIS Pro supports CAD files from both Autodesk's AutoCAD and Civil 3D as DWG, DXF and Bentley's MicroStation as DGN files. BIM content in RVT and IFC formats are directly supported. ArcGIS gives you the ability to export feature class or feature layer data to DWG, DXF, and DGN formats or convert CAD and BIM feature datasets to a geodatabase or hosted content in ArcGIS Online or Enterprise.

The current version of ArcGIS Pro supports direct read from:

- Autodesk AutoCAD DWG and DXF releases: AutoCAD Release12 to AutoCAD 2022
- Autodesk Civil 3D DWG and DXF releases: Autodesk Civil 3D 2013 to Autodesk Civil 3D 2022
- Bentley MicroStation DGN releases: 95, SE, J, V8, V8i, MicroStation Connect Edition V10
- Autodesk Revit releases: ArcGIS Pro 2.9 supports Revit 2017 to 2022
- IFC Support: ArcGIS Pro 2.9 supports Building IFC 2x3 and 4x

26. How is Esri working to help users integrate BIM with ArcGIS, and is the alliance with Autodesk contributing to this effort?

Esri and Autodesk have combined efforts to bring together Autodesk Revit data, DWG files, and other documents stored in BIM360 and Autodesk Construction Cloud (ACC) within ArcGIS Pro and next with the new ArcGIS GeoBIM product.

The BIM Cloud Connection functionality in ArcGIS Pro allows users to leverage a direct connection to BIM360 or ACC and leverage the content within the Autodesk environment to support integration with ArcGIS. Later this year, Esri's ArcGIS GeoBIM product will allow you to create a Web Mapping application that brings together your 2D and 3D GIS along with the Revit data and tie elements and documents directly to the Forge viewer. There are also Autodesk Connectors for ArcGIS that ship with Civil 3D and InfraWorks and Esri's ArcGIS for AutoCAD plugin that support integrating ArcGIS Online and Enterprise content directly within Autodesk Civil3D, InfraWorks, Map3D, and AutoCAD environment.

The Esri community has shown significant interest in better integration of Building Information Modeling (BIM) workflows and GIS. In 2017, Esri announced [an alliance with Autodesk](#) to help transform the asset lifecycle by providing better technologies for using GIS to inform Design and Construction and for continuing the utility of BIM data into the Operations and Management phases of the asset lifecycle. In 2020, Esri announced membership in buildingSMART International for the first time to add the geospatial community's voice into standards and data discussions that will impact critical buildings and infrastructure for the future.

We are rolling out capabilities to enable GIS users to easily import and use some kinds of BIM data. With ArcGIS Pro, users are able to directly read Autodesk Revit (.RVT) and Autodesk Civil 3D (.DWG) files to view and inspect the geometries and attributes in those files. Building Scene Layers can be published from ArcGIS Pro to ArcGIS Online and ArcGIS Enterprise and then streamed over the web. The ArcGIS Pro workflow includes improved ability to georeference a BIM file, and at the 2.9 release, improves direct read from Revit and IFC 4x3 formats to support various infrastructure disciplines.

ArcGIS also works with BIM data through data interoperability tools that allow you to transform building and infrastructure objects into Esri-supported 3D model formats and to read the attributes into a database. Today, you can add BIM models from IFC and various graphic formats such as KML, SketchUp, and DAE. The ArcGIS Data Interoperability extension can convert IFC sources to GIS content as attributed 3D feature content. ArcGIS Pro has also added the ability to directly download files from Autodesk BIM 360 for better collaboration between GIS and Design staff.

Autodesk also is contributing to the alliance through product development activities. Autodesk InfraWorks, Autodesk Civil 3D, and Autodesk Map 3D allow engineers to directly access ArcGIS Online and ArcGIS Enterprise content and to even edit feature services. Engineers will ultimately be able to have access to all of the content in ArcGIS as services. We believe that this integration will further enhance the connections and interoperability between the whole GIS world and that of engineering, architecture, and planning environments.

Future efforts will be devoted to enabling users to work more natively with BIM information, including support for more types of BIM data such as open formats and expanding support for infrastructure data like airports, rail, transportation, and utilities.

27. What does the Autodesk alliance with Esri mean for users in the AEC industry?

The Esri Autodesk Alliance helps solidify the amalgamation of CAD, BIM, and GIS data to better serve the full asset lifecycle for engineers, designers, drafters, and GIS professionals within the AEC industry and for Asset Owners. The alliance expands the capabilities of multiple disciplines to improve the management, planning, design, construction, and operation of an asset. The result is a successful project that can be turned over and deliver the foundation for your Digital Twin and support the move toward Smart Cities.

Because of user demand for better interoperability of GIS with BIM, Esri entered into an alliance with Autodesk to investigate and begin to develop workflows to improve the daily lives of our combined user communities. The focus for our relationship is built around streamlining the flow of information between BIM and GIS to increase efficiency in the project lifecycle and to achieve better long-term outcomes from more informed asset operation.

The focus areas for our partnership include

- Transforming the project lifecycle
- Connecting cloud workflows to facilitate collaboration
- Providing continuous context of the site and the environment
- Sensing site change
- Designing and visualizing the real world in 3D
- Optimizing infrastructure operation
- Open platforms for innovation and sharing

28. Is Esri working with other organizations in the industry to improve BIM-GIS interoperability?

Yes. In addition to the Esri Autodesk partnership that is helping to push Revit and Civil 3D integration across ArcGIS, Esri has added buildingSMART International's IFC (Industry Foundation Classes) BIM standard as a direct read in ArcGIS Pro. The initial rollout in ArcGIS Pro 2.8 included support for the Building IFC type, and the Pro 3.0 release, additional approved IFC 4x3 specifications expand support for civil infrastructure models. This means that any BIM format supporting IFC export could be read directly by ArcGIS Pro and converted to scene layers and other content that can be hosted in ArcGIS Online and ArcGIS Enterprise.

Esri is committed to an open, thriving market in which customers have the option to find the right solution that best meets their needs. The BIM ecosystem is a complex and highly developed community of software and hardware vendors, asset owners, standards bodies, and service providers. Esri is exploring a variety of collaborations, standards, and relationships with entities across the BIM market.

Examples of Esri's commitment to encourage openness in the BIM marketplace are

- Membership in buildingSMART International: Esri joined buildingSMART International and is exploring how to contribute to the community through that membership.

- IFC: Esri will provide direct read workflows in ArcGIS Pro for users to import industry standard IFC 4x3 information into ArcGIS for use in 2D and 3D workflows.
- Open Geospatial Consortium (OGC): Esri's ongoing membership and contributions to OGC now include I3S. We plan to propose the addition of the Building Scene Layer as one of the foundational layers in the I3S Community Standard for better integration of BIM information into open GIS experiences.
- Bentley Systems ContextCapture: ArcGIS developers have worked with Bentley Systems to encourage support for OGC I3S to enable the interchange of reality capture mesh data between Bentley software and ArcGIS.

#### 29. What is IFC and how does it help BIM integration?

buildingSMART International's Industry Foundation Classes (IFC) is a standard for the open exchange of BIM data. This widely used schema helps designers share BIM content from any source that supports the standard. Esri has added direct read of IFC content to ArcGIS Pro 2.8, and at 3.0 will expand support to IFC 4x3 that includes civil infrastructure data. This will allow GIS users to add IFC content directly to ArcGIS Pro and host the data out to ArcGIS Online and Enterprise. IFC data typically was exported as a copy or iteration of the original BIM content for sharing or archive. This offers a powerful method to share data between many BIM software applications and ArcGIS. These IFC files can be stored on Autodesk BIM360 or the Autodesk Construction Cloud and be refreshed in the GIS as IFC files are updated.

#### 30. What is ArcGIS GeoBIM and when is it released in ArcGIS Online and Enterprise?

ArcGIS GeoBIM delivers an innovative, easy-to-use web-based experience for teams to collaborate on building information modeling (BIM) projects and issues in a geospatial context. Architecture, engineering, construction (AEC) and operations teams can easily work with linked data and documentation from multiple systems in configurable web apps to simplify communication and collaboration.

With ArcGIS GeoBIM, teams spend less time on costly and time-consuming file conversion, thus increasing access to reliable up-to-date project and asset data. ArcGIS GeoBIM enables secure access to project and asset information, including BIM content, reality capture, documentation, and issues, so that teams can see active information for better decision making and collaboration.

ArcGIS GeoBIM is currently available in ArcGIS Online following its quarterly release schedule. ArcGIS GeoBIM is currently in development for ArcGIS Enterprise with a tentatively scheduled release in early 2023. Learn more about the new connected capabilities and web experiences in ArcGIS GeoBIM by [visiting the product page](#).

#### 31. Does ArcGIS GeoBIM require licensing and data storage in Autodesk Construction Cloud or BIM 360?

The value of easily connecting project and asset data in ArcGIS GeoBIM requires users to have [subscriptions](#) with the ability to link their GIS in ArcGIS services with BIM process documentation in either Autodesk Construction Cloud or Autodesk BIM 360. If organizations have

subscriptions to the Autodesk AEC Collection for desktop applications, they also receive licensing to Autodesk Docs within Autodesk Construction Cloud.

For more information on Autodesk Construction Cloud subscriptions, see [this Autodesk site](#).

### 32. Does ArcGIS GeoBIM replace ArcGIS and Autodesk desktop application workflows?

ArcGIS GeoBIM provides web-based GIS and BIM integration tools that automate the creation of hosted polygon and point features linked to their digital models and issues stored within Autodesk. While these new processes reduce the need for desktop workflows for project and asset stakeholders, these tools do not replace workflows in ArcGIS Pro and Autodesk desktop applications that create detailed datasets stored in each system.

Whether you're a geospatial professional, designer, engineer, or construction professional, using your desktop of choice will be needed to author robust systems, files, layers, and assets that can then be easily shared through connected web apps in ArcGIS GeoBIM.

Learn more information about these related workflows, and the value of GIS & BIM integration, by [visiting our StoryMaps collection](#).

## Field Operations

### 1. What is Esri's Field Operations strategy?

Organizations around the globe transform their field operations workflows using ArcGIS technology. Esri's Field Operations strategy is focused on delivering capabilities for both field and office to help improve coordination, increase operational efficiency, and make smart decisions throughout the workday.

ArcGIS enables better operations in key phases of field workflows:

- **Coordination.** Leverage the power of location to understand where work needs to be done and effectively coordinate and dispatch resources. Your GIS data is the backbone of your field activity planning.
- **Navigation.** Consistently meet deadlines by using turn-by-turn voice-guided directions along optimized routes to your assets. Optimized routes work on mobile devices completely offline and even consider the type of vehicle being driven and road restrictions along the route.
- **Awareness.** Field teams while on site need to have the information of what's around them to help support their task. Teams can take your organization's most current and accurate digital maps to find detailed information while on the go.
- **Data Capture.** Location-aware apps enable field workers to easily perform accurate data collection and asset inspections. The apps have been designed to be intuitive, meaning any experience level can use them. Data captured in the field can immediately feed into your ArcGIS system, allowing back-office team members to have near-real-time visibility into ongoing field work.

- **Evaluation.** Field work can be communicated by displaying real-time data feeds, which can include the data captured or the location of mobile teams. For data captured in the field, capabilities in the apps such as Smart Forms help reduce the quality assurance processes, meaning data is actionable immediately for further analysis, reporting, and decision making. By knowing where mobile teams are and what activities they have completed, resources can be focused, compliance can be met, and worker safety protected.

## 2. Which apps can help me plan my field work?

Our premier solution for this capability is the [ArcGIS Workforce](#) app. It was built to support and empower the constant stream of activities performed throughout the entire field operations life cycle, performed in the office and the field.

ArcGIS Workforce supports activities from the first stages of planning, defining, prioritizing, and assigning work to enabling the mobile workers to report back on the status of the work from the field, keeping the office and the field in sync and able to respond effectively as things change. [ArcGIS Survey123](#), our premier form-centric data collection app, also provides workforce coordination capabilities. Those in the office can set up and assign specific surveys to individual workers and track the work that has been done. Mobile workers can access their inbox in Survey123 mobile app to see which surveys have been assigned to them to complete.

Keep an eye on this space as we grow and evolve this capability within our mobile applications and build out integrations with broader work management systems.

## 3. Which app can help me navigate to my field locations using hands-free turn-by-turn voice guided directions?

[ArcGIS Navigator](#) is a mobile navigation app that works online or offline for Android and iOS, and it uses GIS to route your field workforce.

You can use the hundreds of global maps included with ArcGIS Navigator, or you can add your own custom maps and road networks. You can define travel modes, route along your own roads, and search your assets. ArcGIS Navigator works alongside other ArcGIS field apps to enable a complete field operations solution.

## 4. Which app will help me view my asset information on my mobile device while in the field?

[ArcGIS Field Maps](#) enables mobile teams to take your organization's GIS with them into the field on iOS or Android smartphones or tablets. Field Maps can be used simply for viewing a map and querying features. Mobile teams can also create a mark-up and share it with peers in the field or send notes back to the office for further review. With robust offline capabilities workers can stay productive in remote locations by downloading the maps needed before they go.



5. Which apps can help me capture data while in the field?

There are several apps that can help you collect data from the field. All are built on top of ArcGIS, leveraging its security (ArcGIS users and groups), identity, and feature layer storage models. They are focused on providing intuitive user experiences through distinct data capture workflows:

- [ArcGIS Field Maps](#) is a map centric mobile app designed to help you capture and edit both spatial and form-based data. With Field Maps, you can take your GIS data to the field and perform asset inspections, update information about existing features, see existing inspection records, or capture new features to improve the accuracy of existing maps.
- [ArcGIS Survey123](#) is a form-centric mobile app. Survey123 is built around the forms you create. These smart forms drive the user experience in Survey123, making it ideal for data collection workflows that traditionally have involved forms.
- [ArcGIS QuickCapture](#) is a simple-to-use mobile app that allows rapid data collection with minimal user involvement. A 'big button' interface allows users to easily tap a button to collect new data while traveling at-speed in a vehicle or while otherwise unable to use more interactive interfaces.

6. How can I share my maps and data with mobile users who are not a part of my ArcGIS organization (contractors, seasonal workers, and other third parties)?

There are a few methods to share maps with others who are not part of your ArcGIS organization:

- Using ArcGIS Publisher:
  - ArcGIS Publisher is an extension to ArcGIS Pro that provides a way to publish beautiful offline maps that can be used through the ArcGIS Field Maps app without needing an ArcGIS account.
  - Field Maps can be downloaded on Android or iOS phones and tablets, and can open maps made with Publisher completely for free without signing in.
- Maps can also be shared publicly with people such as mutual assistance crews helping get the power back on, firefighters who need fire perimeters, or contractors who need mobile access to your maps.

7. How can I track and analyze where my mobile workers have been?

Many organizations want to gain a better understanding of their field workforce. From wanting to see the locations of their mobile workers to ensure worker safety especially for lone workers, understanding the coverage of their mobile work to see if there are areas which need to be examined, or be able to prove regulatory compliance, there are many reasons for organizations to see and analyze the location of mobile workers.

Enabling location sharing within your organization is a two-step process:

1. The first step is to enable the location sharing service for your organization. The location sharing service is a secure, robust backend built to handle the volume and velocity of data coming from a mobile workforce that is reporting last-known locations minute by minute.

2. The second step of enabling location sharing is getting your mobile workers set up with the right apps and licenses that work with the location sharing service. The easiest path to accomplishing this is by assigning your mobile workers a Field Worker user type. The Field Worker user type comes with location sharing by default, but a standalone location sharing license can be added to any user type to location-enable the account as well.

[ArcGIS Field Maps](#) is a mobile app for iOS and Android devices that allows mobile workers to share their current and previous location data (in addition to its other capabilities such as map viewing and data collection), whether the app is in the foreground or background. [ArcGIS QuickCapture](#) too supports location sharing, and both applications have been optimized for minimal battery use and both support offline use, where they send location data about the mobile worker to ArcGIS once they have a data connection.

The last-known-locations and location history are shared to ArcGIS where they are recorded within your location sharing service. Using securely shared views, others within the ArcGIS organization can visualize and analyze track data by timeline, mode of travel, accuracy, and more. Recorded locations can be used within mapping apps, dashboards, and for analytics.

8. Which apps can help me monitor the progress of field work or the locations of field workers while in the field?

**Workforce Coordination:** [ArcGIS Workforce](#) allows organizations to assign field work to mobile workers and monitor the progress of assigned work. As field workers use the Workforce mobile app to mark assigned work as 'complete,' the Workforce web app updates to show dispatchers and other staff the real-time status of work assignments. Workers can also communicate their working status to the office, letting dispatchers know whether they are working, on a break, or done for the day.

**Location Sharing:** A capability found in [ArcGIS Field Maps](#) and [ArcGIS QuickCapture](#) which enables mobile workers to share their last known location, location tracks, and their location history with their organization.

**Back office synchronicity:** [ArcGIS Dashboards](#) provides the ability to use charts, gauges, maps, and other visual elements to reflect the status of people, services, assets, and events in near real time. From a dynamic dashboard, view the activities and key performance indicators most vital to mobile work objectives.

For a focused view of mobile teams locations, decision makers within the organization can utilize [Track Viewer](#) web app which allows them to view and analyze the near real-time location of their mobile operations.

9. What should I not miss about the apps at Esri UC 2022?

To hear the latest and greatest from the teams who build the apps you love, join our live Q&A tech workshop sessions. To call out a few specifically, there is a lot of excitement around ArcGIS Field Maps, ArcGIS Survey123, and ArcGIS QuickCapture - search the agenda for any sessions about those apps. We also highly recommend two sessions where you can ask your questions to the app teams and hear what's coming next:

- ArcGIS Field Apps: Q&A with the Product Teams
- ArcGIS Field Apps: the Road Ahead

#### 10. What is ArcGIS Workforce?

[ArcGIS Workforce](#) enables organizations to improve their planning and coordination between the office and the field.

In the Workforce web app, office coordinators can set up field projects, define the work that needs to be done, prioritize it, and assign it to individual mobile workers. The mobile workers receive those assignments, along with instructions, asset information, and supporting attachments, in their To-Do list in the Workforce mobile app. Being location aware, Workforce can evaluate which assignments are nearby and optimize the To-Do List.

Mobile workers can report back to the office with the details of how the work is progressing and who is actively working or on a break, keeping both teams in sync and able to respond quickly to shifting priorities or changing conditions in the field.

Built for efficiency, the Workforce app supports ongoing work even with there is limited or no connectivity. Workforce integrates with Navigator, Field Maps, and Survey123, so that field workers can get turn-by-turn directions to the location of their work assignments and complete any data collection or inspections at the site. Dispatchers can monitor ongoing status of field activity in the Workforce web app or build their own monitoring solutions in Dashboards.

#### 11. What is new in ArcGIS Workforce?

[ArcGIS Workforce](#) was recently enhanced to enable syncing even when the Workforce app is not actively in use. The ArcGIS Workforce team is preparing to integrate Workforce into the ArcGIS Field Maps app. As such, new development work in this area will go into ArcGIS Field Maps.

#### 12. How can I use ArcGIS Workforce in my organization?

Leverage ArcGIS Workforce to improve coordination and planning between back office and mobile workers - digitally transforming manual processes managed on paper or using spreadsheets. Workforce can be combined with ArcGIS Field Maps or ArcGIS Survey123 to empower situational awareness and data collection workflows. Workforce can also integrate with existing work management systems to feed field operations data through to the whole organizational ecosystem.

#### 13. What is ArcGIS Navigator?

ArcGIS Navigator is a mobile app that gets your field workforce where it needs to be, unlocking efficiency and improving reliability.

Navigator provides voice-guided turn-by-turn directions – even while offline – giving mobile workers the peace of mind knowing they won't get lost, no matter how remote they may be.

Navigator also allows mobile workers to access route layers that have been created for them with ArcGIS – things like snowplow routes, package delivery routes, or a daily work assignment route.

For advanced organizations, you can even build your own custom maps and road networks to navigate your users along private roads that aren't typically on commercial navigation apps.

Users can install ArcGIS Navigator from [Google Play](#), or from the [App Store](#) (for iPad, iPhone, and iPod Touch devices).

#### 14. What are the key things that differentiate Navigator from other mobile turn-by-turn directions apps?

ArcGIS Navigator has a number of capabilities which aren't found in other turn-by-turn direction applications today. The ability to use one's own proprietary data in navigation, take data offline, and rerouting completely disconnected are all capabilities which can be utilized and offer differentiation from other mobile direction apps.

#### 15. How can I use ArcGIS Navigator in my organization?

If you have staff driving in the field, ArcGIS Navigator can save you mileage, gas, and time – by giving optimized route guidance to work locations. Data is stored on the device (iOS or Android), so it works in remote areas without cellular coverage.

Navigator works with your authoritative GIS map, which means you route on your own roads, search your own assets, and view your own content. It supports connecting to and using pre-planned routes that were created in ArcGIS Pro, Enterprise, and Online. Navigator also plugs right into other ArcGIS field apps like Collector and Workforce, and even integrates as a companion to your custom app.

Hundreds of organizations in local government, natural resources, utilities, public safety, and the commercial space are using Navigator today. Examples include Pima County, AZ and Atlantic County, NJ.

#### 16. What is ArcGIS Field Maps?

ArcGIS Field Maps combines into one app the ability to view maps and data, share worker location, and perform asset inspection and data collection activities, thereby reducing the number of apps your mobile workforce needs to learn and use to get the job done. It is the must-have app if your organization uses ArcGIS to complete field-based workflows that are map centric.

With the planned inclusion of work management capabilities from ArcGIS Workforce and the turn-by-turn navigation capabilities of ArcGIS Navigator, ArcGIS Field Maps will only get even more essential for your mobile workforce.

## 17. What is new in ArcGIS Field Maps?

In 2022, the ArcGIS Field Maps releases have focused on driving three key benefits for our user community: efficiency, empowerment, and integration.

**Efficiency:** we've released more [Smart Form elements](#) like choice as well as [Calculated Expressions](#). Here Arcade can be used to define the field value which can utilize geometry, attributes, additional layers, and portal connection as part of the expression. These calculations automatically run on every create and edit, meaning the data is always valid. Check out the commonly used expressions [here](#). As of May 2022, we also support [Contingent values](#) authored using ArcGIS Pro.

**Empowerment:** We are really excited to have added **Geofences** powered by geotriggers which work when connected and offline. You can define areas to automate where location sharing should be enabled as well as provide messages to field users when they enter and/or exit a geofence, giving them enhanced situational awareness. We have just released support for **Utility Network** and further support for **ArcGIS Indoors**, to empower field teams needing to utilize these capabilities. Earlier this year, we also released support for [linear referencing](#) to help support pipeline and transport communities.

**Integration** comes in many forms, and for field work, it's typically integration as part of wider business systems and integration with 3rd-party devices, most notably high-accuracy devices and sensors. Released recently was an update to the [Power Automate connector](#) which means data collected in Field Maps, could send a trigger to notify someone in Teams, or update a record in Salesforce or Dynamics 365. In terms of integration with 3rd-Party devices, we now have the ability to [search using RFIDs](#) through our partnership with InfraMarker by Berntsen.

Check out what else we've been working on by reviewing our [blogs](#) and [YouTube videos](#).

## 18. How can I use ArcGIS Field Maps in my organization?

Organizations are using ArcGIS Field Maps to digitally transform their field workflows, improve the accuracy and currency of their GIS data, modernize asset inspection workflows, capture observations, and share and monitor mobile worker locations.

Leveraging smartphone or tablet devices, you can quickly map your data or take your existing, mapped data to the field to inspect and update it through an intuitive and easy-to-use interface. Field Maps builds upon your investment in ArcGIS so the web and offline maps that you create and edit in the office can simply be used in the field as well.

There are a number of ArcGIS Solutions that leverage Field Maps to help you jumpstart your field workflows. See our [Learn lesson](#) and [videos](#) to get started.

## 19. What is ArcGIS QuickCapture?

ArcGIS QuickCapture enables rapid field observations collection. With this simple app, you can quickly record field observations with the single tap of a button. Send data such as images, comments, and precise locations, back to the office for analysis in real time and eliminate time spent manually processing handwritten notes. ArcGIS QuickCapture is integrated with ArcGIS, so new data from the field can be used instantly for better decision making.

To learn more about ArcGIS QuickCapture, [watch this video](#).

## 20. What's new in ArcGIS QuickCapture?

The latest version of ArcGIS QuickCapture includes some exciting developments to improve data collection and location tracking.

**Oriented Imagery:** QuickCapture generates Oriented Imagery-ready photos, magnifying their informational value and improving overall usability. Oriented Imagery improves map interactivity by providing different viewpoints of specific locations, such as different viewing angles of an object. It assists with a wide range of applications including asset inventory, property damage, and close-range inspections.

**Location Sharing:** QuickCapture combines the power of rapid data collection and location sharing within a single app. Use location sharing in QuickCapture to monitor the last known location of field workers in real time, or to analyze where field work has been performed. This is hugely important to organizations in an emergency (like a wildfire) to determine the last known location of employees.

## 21. How can I use ArcGIS QuickCapture in my organization?

Thousands of organizations worldwide rely on ArcGIS QuickCapture to capture field observations in real time without interrupting their task at hand. It is easy to set up, intuitive for users, and provides high accuracy – even from a moving vehicle.

We recently published a few case studies illustrating the use of ArcGIS QuickCapture:

- [GIS Improves Aerial Surveys for Better Wildlife Management](#)
- [Mobile GIS Apps Help Citizen Scientists Guide Oil Spill Cleanup](#)
- [City Uses ArcGIS Solutions to Replace Lead Water Pipes](#)

Common ways organizations use ArcGIS QuickCapture include:

- Aerial surveys
- Vegetation encroachment
- Asset inventories
- Road inspections
- Windshield surveys
- Citizen science and crowdsourcing

## 22. How can I get started with ArcGIS QuickCapture?

Get started with this [step-by-step tutorial](#). Learn more through our [resources page](#) and connect with the [ArcGIS QuickCapture community](#).

### 23. What is ArcGIS Survey123?

ArcGIS Survey123 is a complete form-centric data collection system. With Survey123, you can build location-aware smart forms for the web, desktop, and mobile devices. Organizations use Survey123 to modernize data collection workflows using digital forms and workflow automation.

### 24. What is new in ArcGIS Survey123?

Over the past few months, we have added great new capabilities and enhancements to ArcGIS Survey123. Here are the highlights:

- **Smart form design:** We are expanding our capabilities in the Survey123 web designer and Survey123 Connect so you can build more powerful smart forms. In designer, you can now configure calculations, hide questions, and set input masks. In Connect, we added new options to help you configure the Inbox, Overview Map, media folder, and more.
- **Markup tools:** Markup photos, diagrams, and maps using built-in annotation tools, or you own.
- **New Address question type:** Allows you to easily capture standardized addresses and their location leveraging your own locators of the Esri World Geocoding service.
- **Choice randomization:** If you feel like the display order of choices in a list could bias responses from users, you can now choose to sort your lists randomly.
- **Photo question enhancements:** As the author of a form, you can now decide how many photos a user should submit through your form: How many? Just one? As many as they like? Four? Something between 1 and 3? You decide. You can also configure your photo questions to force the user to take a new photo with the camera, or optionally enable browsing of existing photos.
- **Expanded XLSForm support:** We have added support for many new XLSForm properties and functions including max-pixels, indexed-repeat, compact-n, and many others. We also now allow you to calculate the filename of photos and signatures.
- **Better reports:** Expanded syntax to help you format numbers, aggregate data, create better maps, and more.

### 25. How can I use ArcGIS Survey123 in my organization?

Organizations use ArcGIS Survey123 to modernize business workflows. For what this means in practice, [listen to this example directly from PG&E](#).

There are many uses for ArcGIS Survey123. As many as forms you already have in your organization. You can use Survey123 forms to gather data from the general public, such as:

- To report issues in your jurisdiction
- To gather opinions
- To document damage to property

- etc.

Survey123 forms are often used to model complex asset inspection workflows, to support large population census efforts, and more.

#### 26. How can I get started with ArcGIS Survey123?

The Esri [Survey123 resources](#) page includes everything you need to get started: Step-by-step tutorials, videos, forums, blogs, and more.

#### 27. What is Location Sharing?

Worker safety, regulations, and office synchronicity are primary reasons organizations ask their mobile workforce to share their location. Location Sharing is the capability in the ArcGIS system which supports these requirements. See how to enable this capability in both [ArcGIS Online](#) and [ArcGIS Enterprise](#).

Once the capability is enabled, mobile teams utilizing [ArcGIS Field Maps](#) and/or [ArcGIS QuickCapture](#) are able to share their locations back with the office team. This capability was previously known as Location Tracking.

#### 28. What license do I need to use Location Sharing?

For users to be able to share their location, they will need to have a Location Sharing user type extension. This is included in the Mobile Worker user type. No license is required to enable Location Sharing within an ArcGIS organization.

#### 29. What is the difference between Field Worker and Mobile Worker user type?

Mobile Worker is the new name for the Field Worker user type. There is no functional difference between the two, and you do not need to do anything to change the name. This name change will automatically happen in the June release of ArcGIS Online and version 11.0 of ArcGIS Enterprise.