esri India
THE SCIENCE OF WHERE

Vol. 11, Issue 2

ArcIndia News

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CEPT University: Spearheading academic excellence in GIS

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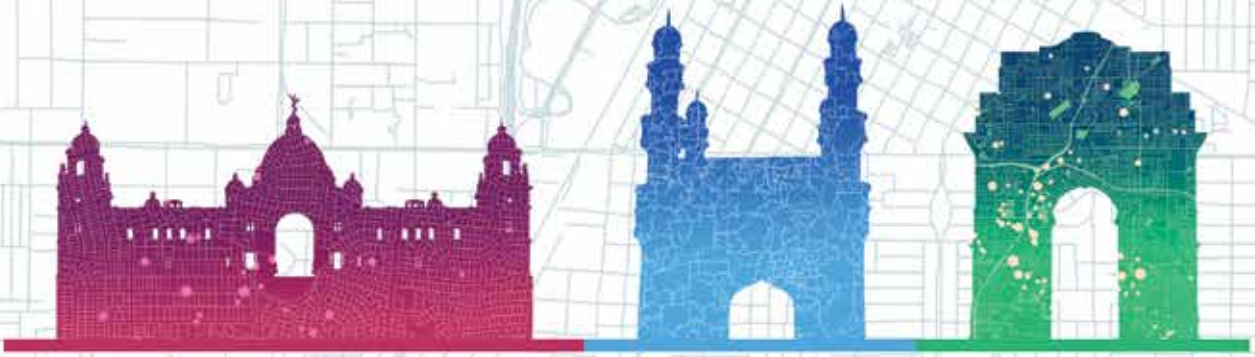
UC 2018

Esri India
User Conference

Three cities.
One GIS Conference.



Kolkata
Sept 4

Hyderabad
Sept 6

Delhi NCR
Sept 10-11

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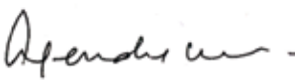
Agendra Kumar
President, Esri India

Technology industry is going through a major transformation often referred as the Fourth Industrial Revolution. Technologies such as Big Data, Artificial Intelligence, Machine Learning, Augmented Reality (AR)/ Virtual Reality (VR) and Internet of Things (IoT) are fast graduating from just being buzzwords to being applied in real use cases. These technologies have the potential to become key components of the solutions for addressing some of the major challenges the world is facing today. We are already seeing many practical applications of these technologies in areas such as traffic management, healthcare services, utility maintenance and of course connected cars.

IoT, for example, is being projected as the new IT. As per NASSCOM, the IoT market in India is poised to reach USD 15 billion by 2020, accounting for nearly 5 per cent of the total global market. The major programs such as Smart Cities, Safe Cities, National City Gas Distribution, National Smart Grid Mission and Digital India stand to benefit significantly from IoT and related technologies. The Start-ups and IT ecosystem in India is already gearing up to tap into this opportunity through innovative solutions leveraging these technologies. As per NASSCOM, nearly 120 organizations in India are already offering solutions in the IoT segment.

This presents a major opportunity for us, GIS professionals, to do more. With location as a common denominator, GIS provides an underlying platform that integrates these multiple technologies together for a meaningful decision making. Spatial analytics and analysis such as clustering, predictive modelling have been the core capabilities of GIS which are further getting enhanced. With ArcGIS 10.5 release onwards, the Geoevent Server capabilities have been enhanced significantly to manage the variety, volume and velocity of the real-time data. Machine learning capabilities are being integrated into desktop tools such as ArcGIS Pro. AuGeo, Esri's mobile app, can help you integrate your GIS data in an augmented reality environment.

With its leadership and vision, GIS industry is best positioned in applying these technologies for relevant solutions. As a community, we still need to learn more and build new capabilities. Our teams are working with you, our users, to create awareness about the new technologies by demonstrating various use cases, and through various workshops and digital events. During our past User Conferences, we have hosted specific technology sessions on Big Data, Real-time GIS and IoT for our users to explore the capabilities Esri GIS platform provides, and the ways to utilise them. The technology landscape today is more exciting than ever. We look forward to our users and partners leveraging these technologies with "The Science of Where" to help develop a better future for all.



Agendra Kumar

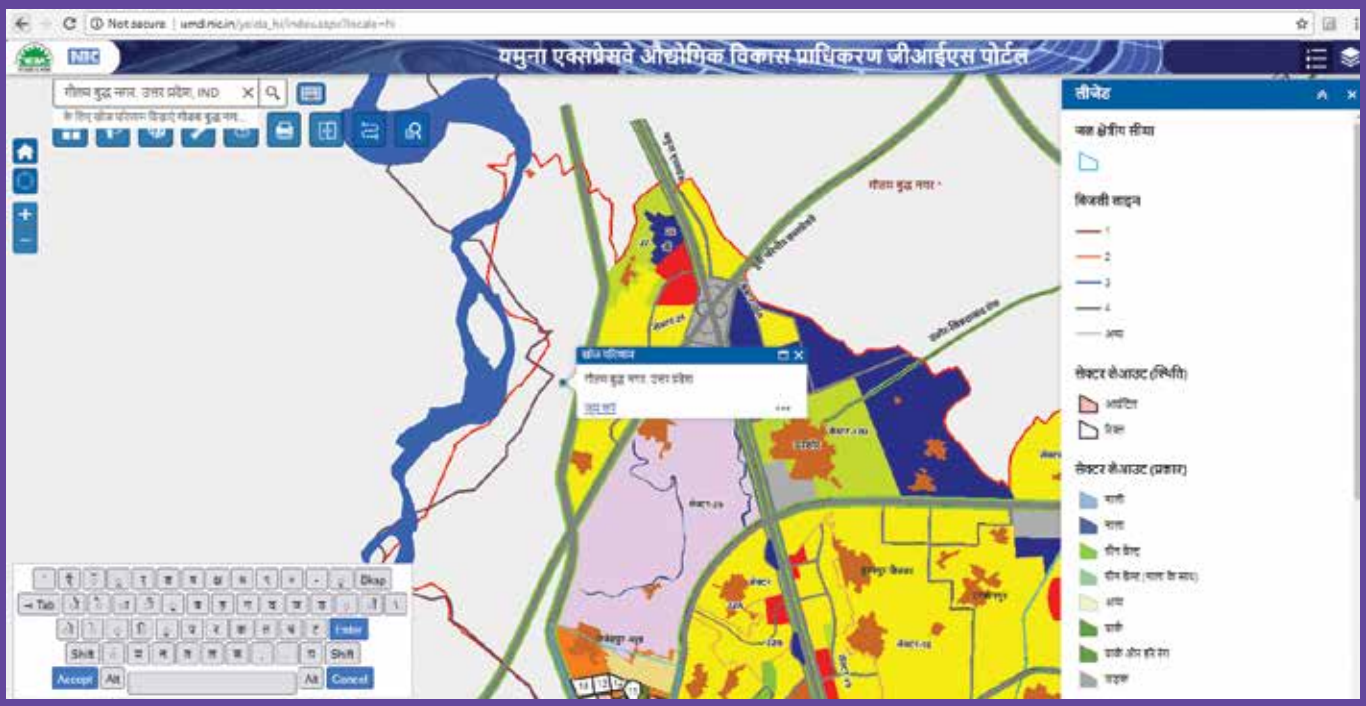
CONTENT

Esri India to enhance adoption of GIS technology with Hindi platform

Esri India has launched the Hindi version of Portal for ArcGIS. According to 2001 Census, 53.6% of Indian population have declared that they speak Hindi either as first or second language. This figure clearly show the need for tapping into this audience through their native language for enhancing the adoption of GIS and drive its growth in India.

On the launch of the Portal for ArcGIS in Hindi, Agendra Kumar, President, Esri India said, "The portal in Hindi will bring a revolutionary change in the adoption of GIS in India. It will be a game changer for the Indian organisations, specifically government departments which will be able to realise the vision of delivering citizen impact services by creating an end-to-end Hindi experience for their users while working on Esri GIS platform."

Esri's ArcGIS Online, which is a cloud offering of the popular GIS platform is also available in Hindi, and so are some of the common apps like Collector and Survey123. These apps are used for survey and collection of data. With this launch, users will be able to access all the features of the portal in Hindi.



Punjab Engineering College signs MoU for capacity building in geospatial technology

Punjab Engineering College (PEC) has signed an MoU with Esri India to disseminate information and awareness about GIS, remote sensing and digital mapping. The MoU was signed by Professor Manoj K. Arora, Director, PEC and Agendra Kumar, President, Esri India on 6.12.2017.

Agendra Kumar shared, "Esri is extensively working with colleges, universities and research institutes to build GIS capacity to address the changing skill requirements and resource shortage." The main aim of the MoU is to give support to various government programmes like Smart Cities, Digital India, Clean Ganga etc. Apart from working towards capacity building for geospatial technology, this collaboration supports the vision and mission of PEC to become a Centre of Excellence in technical education and research. "The future lies in the study of geospatial data and due to unavailability of the expertise in the relevant field, the need of such a centre becomes all the more significant," said Dr. Arora on the occasion.

Esri India receives prestigious awards for innovations in GIS

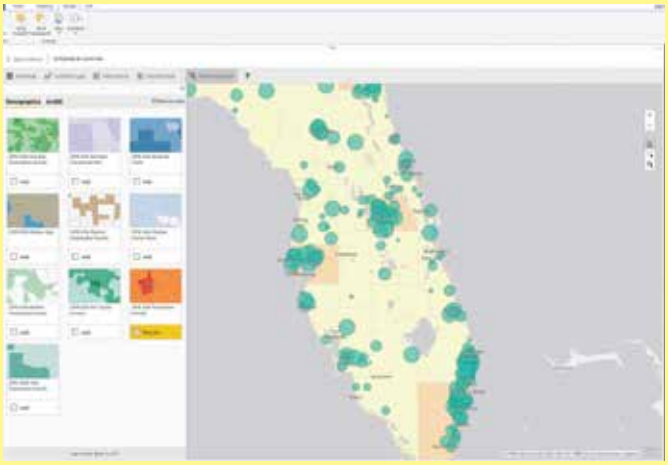
Esri India has been announced as the winner in "Innovative Enterprise Solution" category at the 8th edition of Aegis Graham Bell Award. It has been applauded for the best innovation in the ICT domain in India. Deloitte was the knowledge partner of this award.

Esri has been the pioneer in GIS solutions across the world and has been providing its ArcGIS platform to various organisations for managing their businesses efficiently and effectively. Esri's ArcGIS software has improved operational performance and decision-making throughout several organisations.

"We are glad and honoured to receive this very prestigious award for 'Innovative Enterprise Solution'. Today, Esri's ArcGIS platform enables people across an enterprise to collaborate and manage their business more efficiently. This award is testimony to the value GIS can deliver to organisations in India and help them deliver world class products and services while enhancing their customer experience," said Agendra Kumar, President, Esri India on the occasion.

On February 18, Esri India also received recognition as the 'Best Smart Cities Solution Provider in GIS' under the ET Now CSR Global Leadership Awards. These awards establish Esri India's position in the Telecom and Smart Cities segment strongly.

Esri and UberMedia partner to provide retailers with location specific data



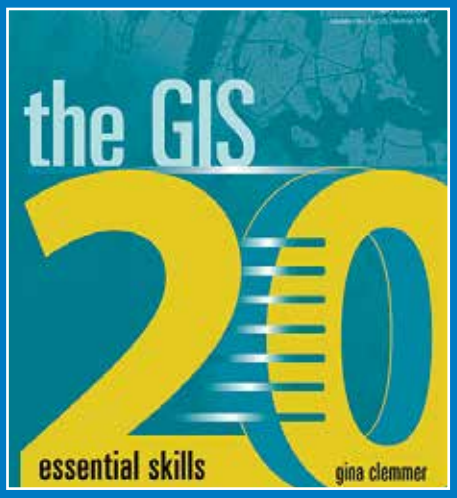
Esri and UberMedia announced a partnership to provide retailers with location-specific mobile data. This data enables retailers to better understand where their customers are coming from, and the behaviours and movements exhibited in the path to purchase. Mobile data, enriched with Esri's Tapestry, provides unique context to this data about customers that allows retailers to be more precise in the assortments, offers, and services they offer in their local stores and on customers' devices. Consumers can research, shop, purchase, and receive products from retailers anywhere at any time.

"The adoption of mobile technology is creating new data streams that can provide retailers with an unprecedented amount of information about who their shoppers are and how to bring them further into the fold," said Doug Shaddle, Director-Sales, UberMedia. "By partnering with Esri to provide the unique visualisations and insights needed, retail customers can quickly analyse and act on the information to deliver the right offer, at the right time, to the right customer."

"To compete in today's disruptive retail environment, retailers must not only understand who their customers are and what they buy, but where they live, work, and shop," said Gary Sankary, Head- Retail, Esri. "By layering mobile data onto the ArcGIS platform, we can provide a precise picture of the customer's behaviour to help retailers understand why things happen where they do, so they can adjust their strategies accordingly, particularly when armed with data about competitors."

By combining consumer data with spatial analytics and mobile capabilities, Esri can deliver the precision detail required to improve the overall customer experience and give consumers more reasons to shop.

Esri publishes workbook to teach top 20 GIS skills



Esri has published *The GIS 20: Essential Skills, Third Edition,* a book designed to quickly prepare those who need to use a geographic information system (GIS). *The GIS 20* is aimed at readers who are new to or unfamiliar with GIS. This quick-start guide provides clear, step-by-step instructions on how to do common GIS tasks. These include downloading shapefiles and using essential tools in the software, preparing data for a map, geocoding addresses, making thematic and other types of maps, mapping latitude and longitude points collected with a GPS, using aerial photography in maps, and publishing maps.

Author Gina Clemmer, President , New Urban Research, a social research and training company based in Portland, Oregon, US has spent her career teaching everyone from executives in New York City to residents of fishing villages in Alaska how to understand the core concepts and use the tools of GIS for decision-making. "This book is an extension of my passion to help everyday people quickly learn the fundamentals of ArcGIS," Clemmer wrote in *The GIS 20*. "Once you see the power of GIS and see that you yourself can create maps easily, you simply can't unsee it. GIS will change the way you think about presenting data and solving problems."

Esri releases world's first complete utility GIS platform

Esri has announced that it is releasing advanced network capabilities for utilities as part of the company's ArcGIS platform. The ArcGIS Utility Network Management extension, which delivers the new utility network, lets users create, manage, and share complete data about networks from source to demand, such as residential meters for electric, water, wastewater, gas, district heating and telecommunications companies.

These network management capabilities enhance Esri's current utility platform for handling billions of data elements while providing access to the utility network on any device, anytime, anywhere. For the first time, workers will be able to edit and trace the path of a network from a smart device while in the field and share information securely and more easily with those who need it. The utility network provides a holistic system for every component of the utility supply chain right down to the customer, as well as the ability to store unprecedented detail on each of these components, which will be very important as utilities evolve to provide higher-fidelity information to operational systems.

"We are very excited about the release of our next generation utility platform," said Jeff Rashid, Global Director, Utilities and Communications, Esri. "These advanced capabilities will help utilities and telecoms provide greater details about their networks across their organisation, at a rate of speed not seen in the past."

Audubon, Esri invite applications for Dangermond Fellowship

The Dangermond Fellowship is an exciting opportunity provided through the partnership between National Audubon Society & Esri. The Audubon Enterprise GIS team is hiring 5 Dangermond Fellows to assist in supporting Audubon's Enterprise GIS platform. This prestigious fellowship is designed with the aim to foster the next generation of leaders in the Enterprise GIS and nonprofit/ conservation sectors. Fellows will receive extensive and immersive training in the full ArcGIS platform at both the Esri campus in Redlands, CA and at the Audubon headquarters in New York City. The position is a one-year commitment and starts in June 2018 until June 2019.

Fellows will work full time over the summer to attend trainings, the Esri User Conference, and spend time on a GIS-related project at a unique Audubon field location (center or an office). In the fall and spring, Fellows will work part time and remotely from their college location. GIS Fellows will be mentored by experts in the GIS platform. The goal of the program is to provide Fellows with enterprise level exposure in a GIS department that is at the forefront of the GIS Enterprise landscape. Experience with GIS server technologies, cloud servers, database management systems, application development, and account management from an Esri President's Award winning team will be gained by hands-on application.

SAP and Esri geo-enable the intelligent enterprise

Esri now supports SAP HANA® platform as an enterprise geodatabase. The announcement was made at DistribuTECH Conference 2018, which took place from January 23–25.

The partnership between SAP and Esri brings powerful location intelligence to enterprise data and applications. It will allow businesses to thrive through spatial analytics and advanced visualizations, and by embedding geospatial data into core business processes.

This allows Esri to provide customers with greater insights, improved business decisions and a swifter ability to innovate. Esri and SAP customers will benefit from enhanced performance and scalability as well as full integration of both enterprise and spatial data.

Whether on premise or in the cloud, the Esri geodatabase powered by SAP HANA allows spatial data to be integrated and delivered across organisations and accessed from one place for true IT landscape consolidation. It also lowers total cost of ownership (TCO) and administration costs.

"We're extremely proud to announce SAP HANA as a supported enterprise geodatabase," said Jack Dangermond, Founder and President, Esri.

"The full unification of SAP HANA and Esri is a very big win for our expansive joint customer base," said Bernd Leukert, Member-Executive Board, SAP SE, Products & Innovation, SAP. "We have many customers running SAP, non-SAP and Esri solutions. They will now be able to streamline their IT architecture with one underlying platform powered by SAP HANA. This will not only support immediate return on investment by reducing redundancies and improving performance but also pave the way for further innovation by connecting GIS and enterprise systems and data."

Esri acquires ClearTerra Location Data Extraction Technology

Esri has acquired technology from ClearTerra, a leader in geospatial and activity-based intelligence tools. This acquisition will provide ArcGIS platform users the ability to easily discover and extract geographic coordinates from unstructured textual data like emails, briefings, and reports, instantly generating intelligent map-based information.

This capability will make mapping this elusive information easier across many industries. Defense, intelligence, and public safety organizations tend to have massive volumes of unstructured data, as do other fields such as petroleum, utilities, and maritime, where locating information on the earth is not as easy as searching for a street address. Esri's acquisition of ClearTerra technology brings workflow-enhancing software technologies into the ArcGIS platform.

"We have been close partners with Esri for a number of years," said Jeff Wilson, former vice president of sales for ClearTerra, now an executive for defense and intelligence with Esri. "Esri has the platform and resources to provide a solid path going forward for our technology, allowing us to expand this capability to the global market."

ClearTerra LocateXT technology allows analysts to rapidly scan through documents without having to

spend hours reading, copying, pasting, and running spreadsheet formulas, placing the results instantly into geospatial features. Additionally, ClearTerra FindFZ technology provides enhanced search capabilities for the ArcGIS platform, incorporating the powerful techniques found in internet search engines, including a tolerance for misspelled words, as well as wildcard and Boolean logic searches.

"We are excited to bring ClearTerra technology into the Esri family," said Jeff Peters, Esri director of national government. "The unstructured data tools are powerful not only for those who have made use of this technology for a number of years, such as in the military, but it also has useful applications for so many more Esri users."

NPMU LEVERAGING GIS FOR POWER DISTRIBUTION

India has one of the most diversified power sectors in the world comprising of conventional sources such as coal, hydro and nuclear power and viable non-conventional sources such as wind, solar, etc. Electricity is a prime driver for the economy as well. Over the years, India's electricity demand has increased rapidly. To meet this increased demand, the existence and development of adequate infrastructure is essential. India has moved up to rank 26th in the World Bank's list of electricity accessibility in 2017, still the per capita electricity consumption in our country is far below than the international average per capita consumption.

One of the main goals of the government has been to ensure adequate and quality power supply to customers and increase the reach of the electricity grid to reach all villages and households through the universal electricity supply policy. One of the important policy interventions has been to decrease the T&D losses and increase focus on revenue collection. Smart Grid initiative is one of the methods being adopted to meet the operational requirements of increasing the reliability of the utility networks to ensure reduced T&D losses.

Use of smart grids

A smart grid is the existing network with increased utilization of ICT technologies. Smart grids can help the discoms better manage power generation, transmission and distribution. Using those, they can know better what is happening at what point, which areas are under stress, which are the areas that are not performing, where and when the losses are higher, how it can reduce those losses, etc.

It is realized that power can be delivered in a better manner or understood in a better manner if the distribution companies start measuring what is happening at each node. Because the nodes are spread across the spatial level, it makes all the more sense that we have all the

information on real-time basis in the control center and then take corrective measures.

The problems faced by the traditional networks can be mitigated to a large extent using smart grids. Unlike traditional grids, where power flow is happening only one way, from generation to the load center, in smart grids, the power flow happens on both sides, which makes the grid more productive and intelligent.

Smart grids empower the consumers and ensure quality service to them. They help consumers in monitoring their consumption in real-time. Consumers can know when power-cuts are going to take place. If a customer doesn't want to use power as postpaid, by converting it into a prepaid meter, he can avoid paying when he is travelling. The bill payments are online, so that adds to the convenience. Then a consumer can know what his average consumption pattern is. With smart grids in place, the consumer can produce his own power using solar energy, and can use it at home or sell it. In other words, smart grids enable a consumer to have more control over his power consumption.

From the utility point of view, smart grids help in cutting losses and maximizing revenues by facilitating monitoring of sanction load.

National Smart Grid Mission

Formed in 2015, under the Ministry of Power, the National Smart Grid Mission (NSGM) was approved to develop a smart electrical grid based on state-of-the-art technology in the fields of automation, communication and IT systems that can monitor and control power flows from point of generation to point of consumption. The NSGM is a monitoring body, which not only funds it but also monitors the entire process from deployment to delivery of the smart grid project at ground level. The objective of the

> "With GIS integration, asset mapping has become easy, which allows network planning and better management of distributed generation integration. This means that we can figure out how we can reduce the stress off grid by promoting distributed generation in such areas.
>
> **Kumud Wadhwa, Deputy General Manager, NPMU**

smart grid is to provide affordable, reliable, uninterrupted power supply 24x7.

The mission is now in its second leg, where it is conceptualizing as to how it is going to roll out Smart Grid projects on the ground level. To ensure a smooth implementation of the NSGM, NSGM Project Management Unit (NPMU) was formed to operationalize the smart grid activities in the country.

GIS in smart grids

The role of GIS in the last few years has increased far too extensively. It has helped many industries in taking better decisions and the power sector is no exception. By integrating GIS with the traditional power distribution network, utility management firms are able to provide enhanced service quality to the customers, by not only enabling quicker detection of faulty lines and faster action, but also achieving better management of assets and outages. Esri ArcGIS platform enables this integration in many cases.

Reliance Energy Limited (REL) is India's leading integrated power utility company in the private sector, serving 25 million customers over 124,300 square kilometers. Along with its affiliates, it has a significant presence in power generation, transmission, and distribution, providing more than 16 billion units of power a year to Maharashtra, Delhi, Orissa, Goa, Andhra Pradesh and Kerala.

The company has a pioneering history of leadership and innovation spanning 75 years in Mumbai providing dependable electricity at competitive prices to its consumers. The company has 941 MW of power generation capacity at plants located in Maharashtra, Andhra Pradesh, Kerala, Karnataka and Goa.

To improve its services related to power generation, transmission, and distribution, REL decided to implement sophisticated applications and upgrade its operations through the use of GIS. After conducting a comprehensive evaluation of GIS software, it decided to implement a GIS-based system on the robust set of software and open information technology (IT) standards capable of integration with other enterprise systems. Esri India is working with REL to ensure that it is able to successfully leverage its geographic data and GIS knowledge across the organisation.

GIS is one of the core applications for the smart utilities. It is implemented in most of the utilities as part of R-APDRP (Revised Accelerated Power Development & Reform Programme) projects. Building on ArcGIS application, utilities have already mapped asset details and consumers. So with that information when smart meters are provided to consumers, the meter level information can be integrated and visualised faster with near real-time alerts and geospatial analysis. Another use of GIS is to support proper network planning. It can be used to figure out the stress assets, release the stress on the grid, when some of the transformers will be overloaded.

Satra Infrastructure & Esri India team up for enhanced road asset management

Business challenge

To maintain its leadership in the road asset management, Satra Infrastructure Management Services Private Limited, a subsidiary firm of New Zealand based HIMS Limited and Data Collection Limited, sought to gain more control over its marketing processes and more effectively leverage its business intelligence. The ultimate aim was to strengthen customer loyalty.

HIMS solution

Satra Infrastrucure collaborated with Esri India to develop a GIS-based road asset management system. The solution, which was built using Esri ArcGIS JavaScript API, is called HIMS Road Asset Management System.

HIMS, Commercial Off The Shelf (COTS) software is a powerful database and analytical system designed to meet the needs of asset owners, managers and consultants.

HIMS stores, manages and analyses asset data (spatial and non-spatial) on Roads & Highways, structures, railways, power distribution lines, and any other linearly referenced features. The embedded ArcGIS map server serves the spatial data operations in HIMS.

On asking why they chose Esri India, Raj Mallela, Managing Director of Satra Infrastructure said, "We chose Esri India for the solution because of its state-of-the art, sophisticated features and high functionality. Of all the available software in the market, whether open source or commercial, the features of Esri ArcGIS are simply the best."

HIMS has been implemented on networks ranging from 1,000 km to over 100,000 km comprising of national and state roads in several countries. HIMS is available in Client-Server, Web and SaaS models.

Key features

- Location Referencing System: HIMS makes use of advanced and best practice location referencing principles for linearly referenced assets. It can store data in multiple referencing systems and then can convert data from one referencing to another. HIMS defines a Location Referencing System that can utilise a Linear as well as a Spatial Referencing method to identify a same road feature.

- Network Editing and Auditing: The in-built network management module of HIMS allows users to track the historical changes in the road network through facilitating split and merge network operations by means of linear referencing notion. The supporting spatial operations like feature selection and rendering operations facilitates therein.

- Embedded GIS: Apart from reading and importing industry standard/ data exchange files, HIMS can read MS SQL tables to make dynamic data representation. HIMS can produce dynamic segments and thematic mapping in its GIS maps using attribute data, such as road condition data, pavement type, roughness index, traffic information, etc.

- User Definable Objects and Reports: The end-user can define and import various objects such as tables, queries, and forms to store and edit the data. The default templates available in the system

HIMS, Commercial Off The Shelf (COTS) software is a powerful database and analytical system designed to meet the needs of asset owners, managers and consultants.

facilitate rapid creation of databases and data entry facilities.

➔ **Project Controlled Access Based on Roles and Region:** HIMS allows varying user levels, each level having different functional accessibility and privileges. This routine can also be used to define a separate "access network" for each user based up on the region limits.

➔ **Homogeneous Sectioning:** Based on the user defined criteria, HIMS can automatically create "homogeneous sections" of road data that can be used for road analysis. Various methods are available for sectioning such as fixed length, value change, value range, cumulative deviation, etc.

➔ **Analysis Engine:** The in-built analysis engine offers a platform for various types of analysis including predictive modeling, lifecycle costing, optimisation, multi-criteria analysis, programming, scheduling, and asset valuation. This engine is very flexible, completely configurable and flexible to any infrastructure asset.

➔ **HDM-4 Interface:** The in-built HDM4 (a tool for the analysis, planning, management, and appraisal of road investments) interface can prepare network and traffic data for HDM4 analysis.

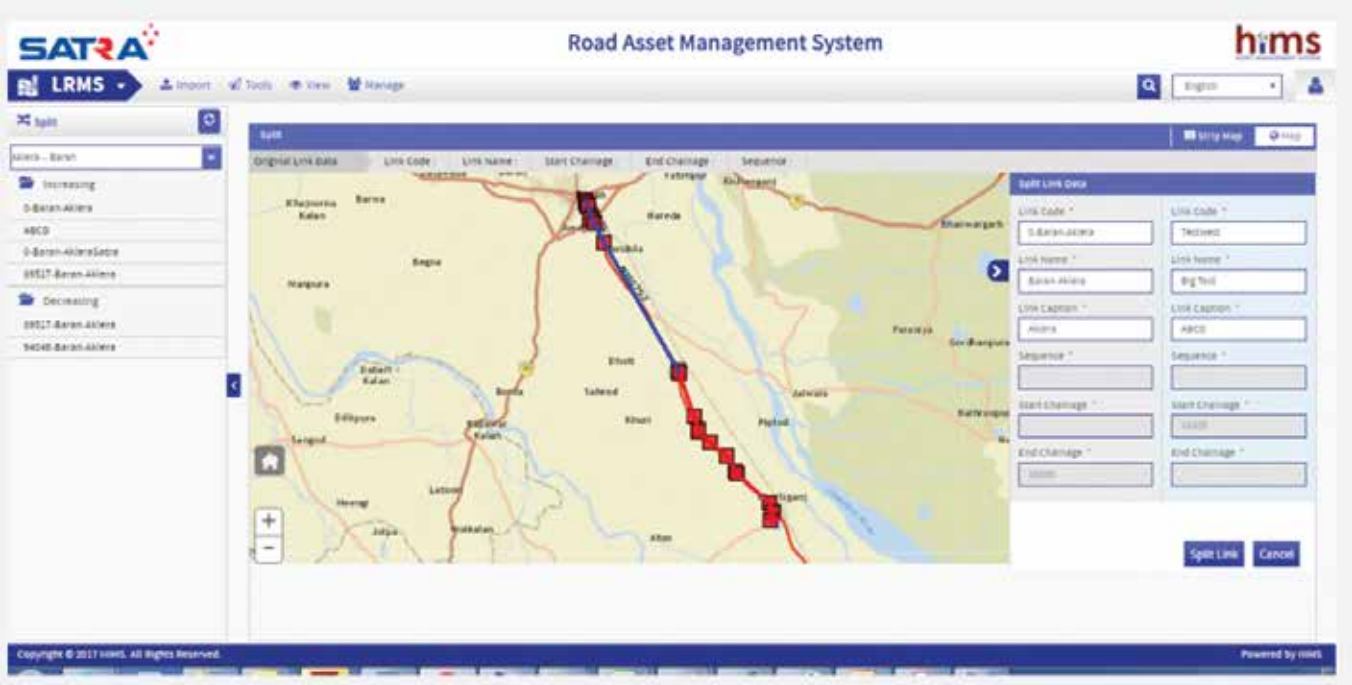
➔ **Mobile Interface:** HIMS Mobile is a single customised app that provides field staff with real-time connection to the powerful capabilities of HIMS for work management, inspections and data collection.

➔ **Multi-Language Support:** HIMS comprises multi-language support facilities to suit the global requirements.

Business benefits

➔ Improving the availability and performance of road assets while decreasing operating costs and without increasing liabilities.

➔ Tracking work orders and failures to better schedule preventive road maintenance.



➔ Accessing state-of-the-art information technology for network analysis.

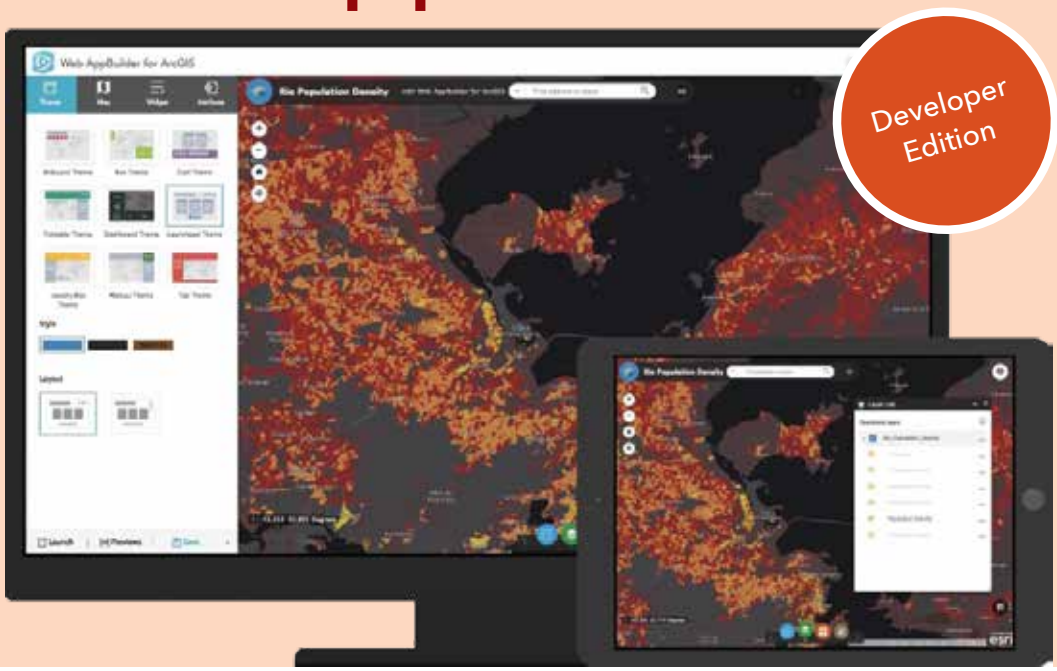
➔ Elevating a cost-effective IT solution for asset management through bundling the ArcGIS mapping software along with HIMS.

➔ Improving service quality and incident resolution time with accurate IT asset information.

➔ Providing accurate road budgeting and improving service delivery efficiency.

The technology used by HIMS can be divided into two categories-software and services. The software used by HIMS is ArcGIS Suite, Dot Net Framework, MS SQL Sever, and the service used is ArcGIS JavaScript API.

Web AppBuilder for ArcGIS



Key features

- Extensible framework for developers to create widgets and themes.
- Allows creation of HTML/ JavaScript apps that work on desktop browsers, tablets and smartphones.
- Integrated with ArcGIS Online and ArcGIS Enterprise platforms.
- Ready-to-use widgets, such as Query, Geoprocessing, and Print available for building apps.
- Custom app templates can be created.

Web AppBuilder for ArcGIS is a what-you-see-is-what-you-get (WYSIWYG) application that allows you to easily build web apps. It includes powerful tools to configure fully featured HTML apps. Web AppBuilder (Developer Edition) provides an extensible framework for developers to create custom widgets and themes.

Web AppBuilder allows you to create apps by accessing workflow tabs including Theme, Map, Widget, and Attribute.

Installing Web AppBuilder

To install Web AppBuilder for ArcGIS, complete the following steps:

1. Download the Web AppBuilder for ArcGIS (Developer Edition) ZIP file to your local drive and unzip it.

2. Because Web AppBuilder runs on top of Node.js, you must have Node.js installed on your computer. The Web AppBuilder for ArcGIS download package contains the Windows version of Node.js.

   - If you are on a Windows platform, proceed to the next section to start Web AppBuilder.
   - If you are on a platform other than Windows, such as Mac or Linux, you need to install Node.js independently on your platform first. If you already have Node.js installed, make sure its version is 4.2 or later.

Note: *The minimum version of Node.js supported by Web AppBuilder is 4.2. Version 4.2 is the first Node.js LTS (long term support) version.*

Starting Web AppBuilder

To start Web AppBuilder, complete the following steps:

1. Start Web AppBuilder based on your platform.

   - On Windows, double-click the startup.bat file in the unzipped folder. The batch file starts the Node.js server in the Command Prompt window and Web AppBuilder in your default browser with http://[yourmachinename]:3344/webappbuilder. If the browser is closed, you can reopen Web AppBuilder in the same or a different browser as long as Node.js is running in the Command Prompt window.

Tip: *If the machine is in domain, it is sometimes required to include the domain name along with the machine name to get started, for example,http://[yourmachinename].[yourdomain]:3344/webappbuilder.*

   - On platforms other than Windows, open the Command Prompt window, cd to the /server directory of the Web AppBuilder installation, and type node server.js. Once Node.js runs, start

Web AppBuilder in the browser with http://[yourmachinename]:3344/webappbuilder. If the browser is closed, you can reopen Web AppBuilder in the same browser, or a different one, as long as Node.js is running in the Command Prompt window.

2. Web AppBuilder runs on top of Node.js with the default port of 3344. To run Web AppBuilder with additional parameters, different ports, or as a Windows service, complete the following steps. Otherwise, see the Specify your portal URL section.

❍ Run with additional parameters and different ports.

a Open a command window and browse to the /server directory of the Web AppBuilder installation.

- On 64-bit Windows, type node_x64.exe server.js [-port=value] [-proxy=value].
- On 32-bit Windows, type node_x32.exe server.js [-port=value] [-proxy=value].
- On other platforms, type node server.js [-port=value] [-proxy=value].

Note: *port specifies the port you want Node.js to run on, and -proxy specifies the proxy URL if needed. Make sure your proxy URL starts with http or https.*

b Start Web AppBuilder in the browser with the port number specified above at http://[yourmachinename]:[yourport]/webappbuilder.

Tip: *If you have problems starting Web AppBuilder, see FAQs for more information.*

❍ Run as a Windows service.

Specifying portal URL

To use Web AppBuilder, you must have an ArcGIS Organisational account or an ArcGIS for Developers account.

1. Specify the URL for the ArcGIS Organisational account that you want Web AppBuilder to access.

Tip: *If you don't have an ArcGIS account, sign up for an ArcGIS free trial or the ArcGIS Developer Program.*

2. Click **Continue**

❍ If the portal you specified above uses web-tier authentication, skip the next section. After login, you can build your first app.

❍ If you're using ArcGIS Online or ArcGIS Enterprise with OAuth2 authentication, follow the steps in the next section to provide an app ID for Web AppBuilder.

Providing an app ID for Web AppBuilder

If this is the first time you've used Web AppBuilder with the portal specified above, you may be asked to provide an app ID for Web AppBuilder to support OAuth2 authentication. For a specified portal, this process is required once. When you subsequently start Web AppBuilder, you can log in to the portal directly.

Complete the following steps to retrieve an app ID:

1. Log in to the portal you specified above.

2. Add Web AppBuilder as an item.

❍ With ArcGIS Online or ArcGIS Enterprise, do the following:

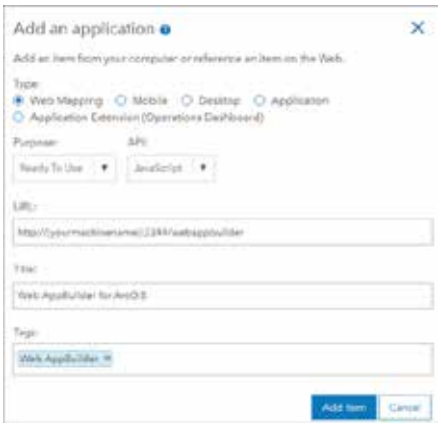
a Go to the **My Content** tab of the content page, click **Add Item**, and choose **An Application**.

b In the **Application** dialog box, enter the following parameters.

i. **Type**—Select the type of application.
ii. **Purpose**—Select Ready to Use.
iii. **API**—Select JavaScript.
iv. **URL**—Enter http://[yourmachinename]:3344/webappbuilder.

Tip: *If Web AppBuilder is started with the machine name along with the domain name, enter http://[yourmachinename].[yourdomain]:3344/webappbuilder.*

v. **Title**—Enter something that makes sense to you, such as Web AppBuilder for ArcGIS.
vi. **Tags**—Enter something that is easy to search, such as Web AppBuilder.



c Click **Add Item**.

❍ For Portal for ArcGIS 10.3.1 to 10.4.1, do the following:

a Go to **My Content**, click **+ Add Item** and select **An Application**.

b In the **Add Item** dialog box, in **The item** is drop-down box, **An application** is selected. Enter the following parameters:

i. **Type**—Select Web Mapping.
ii. **Purpose**—Select Ready to Use.
iii. **API**—Select JavaScript.

iv. **URL**–Enter http://[yourmachinename]:3344/webappbuilder.

Tip: *If Web AppBuilder is started with the machine name along with the domain name, enter http://[yourmachinename].[yourdomain]:3344/webappbuilder.*

v. **Title**–Enter something that makes sense to you, such as Web AppBuilder for ArcGIS.

vi. **Tags**–Enter something that is easy to search, such as Web AppBuilder.

c Click **Add Item.**

❍ For Portal for ArcGIS 10.3, do the following:

a Go to **My Content** and click **+ Add Item**.

b In the **Add Item** dialog box, in **The item** is drop-down box, choose **An application**. Enter the following parameters:

i. **Type**–Select Web Mapping.
ii. **Purpose**–Select Ready to Use.
iii. **API**–Select JavaScript.
iv. **URL**–Enter http://[yourmachinename]:3344/webappbuilder**.**

Tip: *If Web AppBuilder is started with the machine name along with the domain name, enter http://[yourmachinename].[yourdomain]:3344/webappbuilder.*

v. **Title**–Enter something that makes sense to you, such as Web AppBuilder for ArcGIS.
vi. **Tags**–Enter something that is easy to search, such as Web AppBuilder.

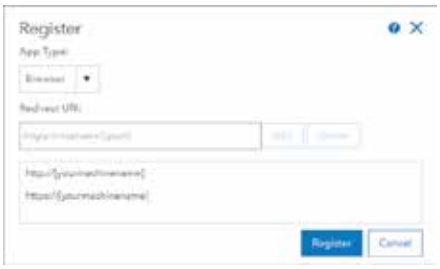
c Click **Add Item**.

3. On the item details page, do the following:

❍ For an ArcGIS Online Organisational or an ArcGIS for Developers account, click the **Settings** tab. Scroll down to the **App Registration** section and click **Register**.

❍ For Portal for ArcGIS, click **Register** in the **App Registration** section.

4. On the **Register** dialog box as shown below, for **App Type**, keep the default value. For **Redirect URI**, enter http://[yourmachinename] or https://[yourmachinename] and click **Add**. Be aware that URIs with HTTP and HTTPS protocols are distinguished as two different URIs. It is strongly recommended adding both of them to the URI list to avoid potential redirect issues.



Tip: *If Web AppBuilder is started with the machine name along with the domain name, enter http://[yourmachinename].[yourdomain] or https://[yourmachinename].[yourdomain].*

5. Click **Register**.

6. On the item details page, copy the app ID under **App Registration**.

7. In the browser, paste the app ID into the text box of Web AppBuilder, and click Continue.

If you get an Error 400 with **Invalid redirect_url**, complete the following steps:

a Go to the /server directory of the Web AppBuilder installation, and delete the signininfo.json file.

b Review step 4. Update the existing app ID with the correct redirect URIs. You can also create a new app ID from scratch.

c Refresh the browser running Web AppBuilder.

d Provide your app ID again, and click **Continue**.

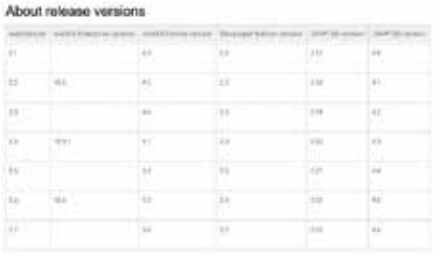
8. Provide your credentials if you're not already logged in, or click **Approve** on the **Request for Permission** dialog box.

An app ID is required by OAuth 2 authentication. See Authentication and OAuth2 for more information. If you have problems logging in, see FAQs and Add apps and register your app.

Tip: *Web AppBuilder uses a self-signed certificate in Node.js to support HTTPS by default. If you want to start Web AppBuilder in your full HTTPS site, you can use your own certificate. To do so, replace two files in the server directory: cakey.pem and cacert.pem. See this blog for details. Also visit nodejs and the OpenSSL FAQ page for more information.*

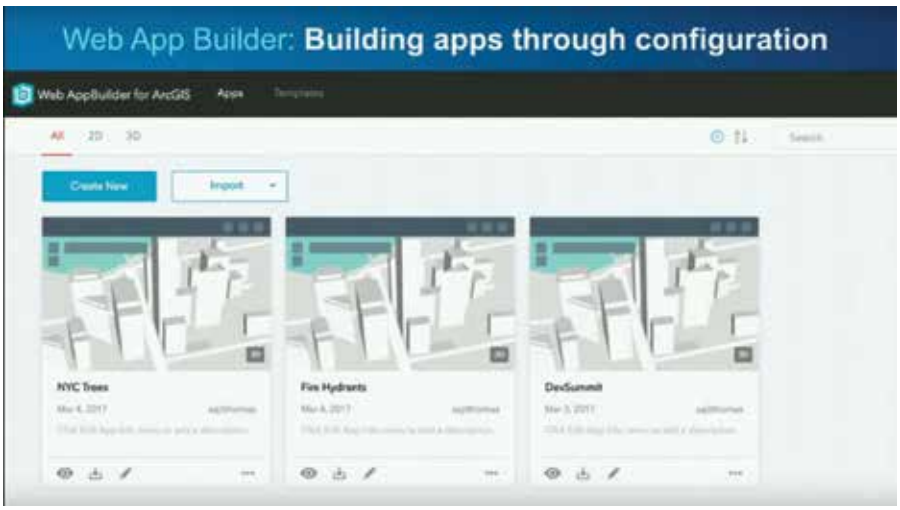
Release versions

Web AppBuilder for ArcGIS has three release formats–ArcGIS Online, ArcGIS Enterprise, and Developer Edition.



What's new in version 2.7

Web AppBuilder for ArcGIS (Developer Edition) 2.7 was released in January 2018. It includes the following



features and enhancements:

Widgets

- The new Public Notification widget enables you to identify a collection of properties and create mailing labels, or a structured text file, for owners and occupants.
- The new Cost Analysis widget (Beta) allows you to sketch a proposed design and get an estimated cost of the project.
- The Filter widget provides options to zoom to the features automatically when the filter is applied, to turn on filters when the widget is opened, and for end users to build their own filter expressions.
- Filter expressions now support relative dates such as today and in the last week. When Ask for value is checked, the default value can be blank.
- The Infographic widget adds eight new templates such as donuts and stacked bars and now supports custom colors per value field when applicable.
- The Add Data widget supports uploading local KML files.
- Info Summary becomes an in-panel widget for better display on devices and in the Dashboard theme.
- The Bookmark widget supports layers' visibility.
- The Edit widget adds a new option to save all edits to attributes with one commit.
- The Select widget adds new options to choose which layers to select and to make all layers selectable, de-selectable, or switch their select state.
- The Swipe widget adds options to automatically zoom to the swipe layer and choose which layers to swipe.
- The Geoprocessing widget supports using the current map extent as input and for turning off the visibility of the output layer on the map by default.
- The Directions widget can be opened from the Open route button in the pop-up, where a route on the map is generated by the Plan Routes tool from the Analysis widget. Make sure the Include route layers box is checked when running the Plan Routes tool.
- The output from the Print widget displays the local date and time of the user's location.
- The Environment widget in 3D has been renamed the Daylight widget.

A widget is a set of text files that you can share, move, and deploy to a Web AppBuilder application.

Builder

- The hyperlinks added from the Attribute tab can be any protocol supported by the browser such as HTTP, HTTPS, MAILTO, and FTP.

- The included Node.js has been upgraded to the latest LTS V8.9.3, and dependent modules are up to date.

SDK

The following documentation has been added:

- About release versions– Web AppBuilder has three release formats: ArcGIS Online, ArcGIS Enterprise, and Developer Edition. The table shows the relationship among these formats and associated ArcGIS API for JavaScript in terms of versions.

- What's new archive–A list of What's new from previous releases of the Developer Edition.

More strength to ArcGIS Solutions

30 new Solution Products have been added, 27 Solution Products have been updated and 12 Solution Products have changed lifecycle phase.

Prominent new products include:

An Agriculture collection with three new configurations:

- **Invasive Pest Surveys** - Enables organisations to monitor locations for invasive agricultural pests.
- **Invasive Pest Status** - Manages invasive pest monitoring activities and progress towards program goals.
- **Invasive Pest Viewer** - Helps organisations to respond to invasive pest infestations.

Capital Improvement Configurations collection with nine new configurations:

- **Capital Improvement Plan** - Helps the public to explore and understand projects included in a capital improvement plan.
- **Capital Project Dashboard** - Assists public works executives to monitor status of active capital projects.
- **Capital Project Journals** - Organizes a collection of apps to document communication, notes, and decisions during construction of capital projects.
- **Capital Project Locator** - Informs the public about the status of capital projects underway.
- **Capital Project Plans** - Organizes new and revised capital project plans during the planning process.
- **Capital Project Reports** - Captures the status of project schedule, cost and quality.
- **Capital Project Review** - Helps staff review individual capital projects, organize capital project portfolios and assemble a capital improvement plan.
- **Construction Activity Tracker** - Informs the public about building permits and construction activity.
- **External Agency Projects** - Facilitates private utilities and other external agencies sharing capital project plans with a municipality.

Cycling Infrastructure Inventory - Enables public works field staff to inventory bikeways, bike parking and bike share locations.

Emergency Response Guide (ERG) Widget - Assesses potential hazards from spills, finds materials and responses from the 2016 Emergency Response Guidebook, and generates Initial Isolation and Protective Action Zones.

Events Calendar - Enables the public to discover festivals, shows, concerts and other events.

Fatal and Serious Injury Dashboard - Enables the public to better understand fatal and serious crash locations.

High Injury Network Locator - Informs the public about streets and intersections with concentrations of serious and fatal crashes.

Lead Service Management - Communicates the location of potential and known lead water services in a water distribution network and helps water utilities manage information about service materials.

Neighborhood Crime Reports - Informs community leaders about past crime activity.

Park and Recreation Locator - Helps the public discover recreational activities.

Pavement Moratoriums - Simplifies inventorying moratoriums that preclude or restrict work in recently paved streets.

Public Crime Map - Informs the public about recent crime activity at or near a location.

Shelter Locator - Helps people displaced by natural and man-made incidents find emergency shelters.

Street Intersection Inventory - Supports inventory of street intersections and approach characteristics.

Traffic Calming Inventory - Supports inventory of devices designed to reduce traffic flow or encourage safe driving.

Warming and Cooling Center Locator - Helps the public locate warming and cooling centers.

Warming and Cooling Center Reporter - Enables community members to record locations of warming and cooling centers.

Water Access Locator - Enables the public to discover water access sites.

Wildlife Management Area Locator - Helps the public discover wildlife management areas and recreational activities.

Prominent updated products include:

- Crash Analysis
- Crowdsource Manager affecting Citizen Science Manager, Health and Safety Reports and Property Listing Reviewer
- Crowdsource Polling affecting Environmental Impact Public Comment and Events Permit Review
- Crowdsource Reporter affecting Citizen Science Reporter and Health and Safety Reports
- Environmental Screening
- Logistics Planning
- Maps and Apps Gallery affecting Common Operating Picture and Events Map Gallery
- Operations Response
- Parcel Drafter
- Photo Survey
- Property Lister
- Road Closures
- Situational Awareness Viewer
- Tactical Operations Dashboard
- Tactical Operation Planner
- Tactical Operation Surveillance
- Transportation 511
- Wildlife Photo Survey

Prominent product lifecycle changes include:

- Capital Project Planning has been moved to mature support; replaced with a collection of public works configurations.
- Capital Project Tracking has been moved to mature support; replaced with a collection of public works configurations.
- Events Calendar (JavaScript) has been moved to mature support; replaced by Events Calendar (Web AppBuilder for ArcGIS).
- Event Locator has been moved to mature lifecycle phase; replaced by Events Calendar.
- GeoEvent Server Components has been moved to mature lifecycle phase; code is available in Proofs of Concept repository.
- Park Locator has been moved to mature lifecycle phase; replaced by Park and Recreation Locator.
- Photo Survey (Version 1) has been moved to mature lifecycle phase; replaced by Photo Survey (Version 2).
- Shelter Locator (JavaScript) has been moved to mature lifecycle phase; replaced by Shelter Locator (Web AppBuilder for ArcGIS).
- Water Access Locator (JavaScript) has been moved the mature lifecycle phase; replaced by Water Access Locator (Web AppBuilder for ArcGIS).
- Wildlife Management Area has been moved to mature lifecycle phase; replaced by Wildlife Management Area Locator.
- Wildlife Photo Survey (Version 1) has been moved to Mature Support; replaced by Wildlife Photo Survey (Version 2).

Do more with ArcGIS Runtime SDK 100.2.0

ArcGIS Runtime SDK 100 has got loaded with new functionalities with Update 2.

New layers

A new **WMS layer** is now available that can display content from OGC-compliant WMS 1.3 services in maps and scenes. The user can now identify features that are displayed, and generate a legend for them. The version also includes a new **ENC layer** that can display content from ENC (Electronic Navigational Charts) data in the S-57 format. The Runtime implementation follows the S-52 Presentation Library 4.0 specification for rendering. The user can now identify features that are displayed, select features, and change various display settings for view groups, text, and other elements such as isolated dangers, contours, color scheme, etc.

New data formats

ArcGIS SDK 100.2.0 supports direct read of **Shapefile** datasets. Shapefiles can be added as a feature layer for display in maps and scenes. The user can also add and edit features in the dataset through the shapefile feature table.100.2.0 also supports the **OGC GeoPackage** format. The user can add vector and raster datasets in a GeoPackage to the maps and scenes as feature layers and raster layers, respectively. It is also now possible to add and edit features in an existing GeoPackage feature table.

Dynamic rendering

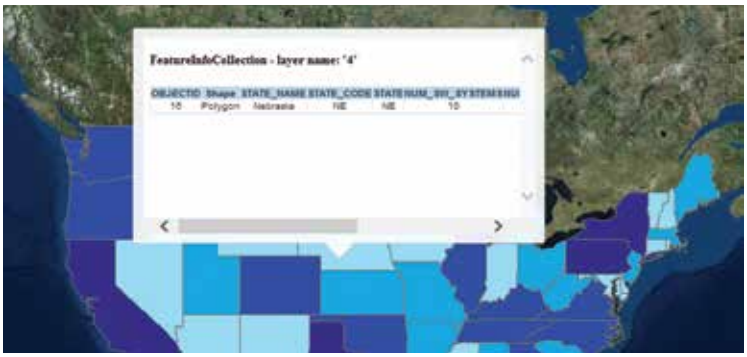
With ArcGIS SDK 100.2.0, feature layers can now be rendered **dynamically** as well. The user can set the rendering mode at the map or scene level via load settings, or on a by-layer basis at the feature layer level. Feature layers containing point geometries are rendered dynamically by default and their symbols remain screen-aligned in map views, and get 'billboarded' in scene views. Feature layers containing polygon or polyline geometries are still rendered statically by default, but the user can choose to render them dynamically to allow for 3D behaviour. The new release also allows enhanced display performance of graphics overlays.

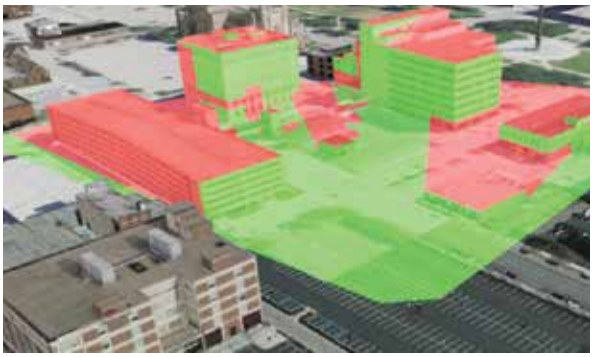
New multi-layer symbol types

New **multi-layer symbol** types have been introduced in 100.2.0. These symbol types can be authored in ArcGIS Pro and deployed through feature services, Mobile Map Packages, and Mobile Style files for use in the runtime.

New tools for advanced analysis

ArcGIS SDK 100.2.0 comes with the new **Scene Analysis API, which allows the user to** define a variety of analyses to be performed





using data displayed in the current 3D scene view, then render results that are updated dynamically. This release includes two types of scene visibility analyses: **viewshed** and **line of sight**. While viewshed highlights areas in the user's 3D scene that are visible from a given observer, line of sight shows which segments are visible along a line drawn between an observer and a target location. For either type of analysis, the observer and/or target may be moving or stationary.

The new **statistics query** API allows the user to get any of the following statistics for a specified field in a feature table: Sum, Average, Count, Minimum, Maximum, Standard Deviation, or Variance.

Coordinate systems and transformations

With ArcGIS SDK 100.2.0, it is possible to discover and define Geographic transformations or datum transformations. They can now be used in the project function of the geometry engine class, and chosen to be used by default. A new transformation catalog class enables the user to look up a list of the best transformations to use. Defining a transformation, creating a **custom transformation** and changing the default transformation are also possible. Both equation-based and grid-based transformations are supported in the new release.

Offline maps

ArcGIS SDK 100.2.0 supports **exporting and downloading vector tile packages** from vector tile map services hosted by ArcGIS Online or ArcGIS Enterprise. Vector tile packages contain a default style and Vector tile layers can also reference custom styles as resources in a portal item. These styles can be downloaded and applied as resources to vector tile layers on the client. With the new **preplanned workflow,** users can take maps offline.

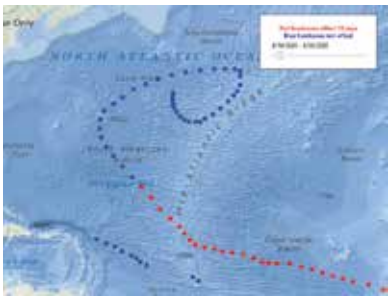
New language support

Directions returned by Route task and Closest Facility task are now available in **10 additional languages** – Danish, Finnish, Hindi, Croatian, Indonesian, Norwegian Bokmål, Romanian, Serbian, Vietnamese, and Chinese (Taiwan). If the requested language isn't available, directions fall back to a default language instead of failing. Furthermore, error messages returned by Route, Service Area, and Closest Facility tasks are consistent and translated into all supported languages.

Editing transactions

ArcGIS SDK 100.2.0 supports transactional editing in the geodatabase and geodatabase feature tables.

Time support



It is now possible to apply a time extent to map views and scene views to filter the display of content from time-aware layers. Time-aware layers include feature layers, map image layers, and raster layers. The user can apply time offsets to time-aware layers, which can be used to compare data over time. He can also specify temporal parameters when querying a feature table.

ACHIEVING EXCELLENCE WITH REAL-TIME GIS AND IoT

With every passing day, Internet of Things (IoT) is gaining popularity across industries such as smart cities, public safety, agriculture, healthcare, utilities and transportation. With increase in IoT applications, numerous devices are getting connected together, generating huge volume of data in real-time. To make sense of such a large volume of data, seamless integration of location capabilities of the devices is required, and this is where GIS plays an indispensable role in enabling the IoT ecosystem. It is only through integration of GIS and IoT that businesses can utilize real-time data for most effective business outcomes.

IoT can be best defined as "The network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment." When businesses analyse the data captured by IoT, location plays an important role in the process. It is vital for the businesses to be able to tie all the information to 'where' things are happening and this makes 'The Science of Where', a major component of the entire process. The data that can be collected through GIS analysis can yield automatic reports, and those can greatly assist businesses in performing the aforementioned assessments and making relevant decisions. GIS could also be used to enhance existing IoT practices. GIS integration with the IoT may also lead to entirely new practices, leading to more efficient business outcomes.

As Jack Dangermond, Founder & President, Esri, says, "Sensor data collected in the Internet of Things ecosystem requires context to understand and make valuable. Geolocation provides that context, by transforming the raw data into useful information and ultimately actionable intelligence."

The application of GIS to IoT can bring exemplary results in almost every field. To understand how, let's consider a few examples.

Smarter solutions with real-time GIS and IoT

We are moving into a 'smart' world and it can become a reality only through effective integration of GIS and IoT. Each and every smart solution has IoT as a component. Sensors are providing us real-time information, for instance environmental sensors are telling us the level of pollution in a city, but that real-time value of 440 or 230 on its own does not have much relevance to a common man. However, if that value is combined with a GIS-based app and it gives an alert that a particular route is showing high level of pollution and thus should be avoided, then it brings in value to a common traveller. This is the power of integrating IoT and GIS, this integration can give us the best of both the worlds.

By bringing in IoT and GIS on a common platform, we can have smarter solutions for solving common problems. In smart cities, a network of sensors, cameras, wireless devices, data centres form the key infrastructure, which allows civic authorities to provide essential services in a faster and more efficient manner. Real-time streaming data capture infrastructural conditions, human movements, market transactions and many other activities that flow and interact in the cities. These real-time GIS data take the pulse of the smart cities, offering new insights on how the cities are functioning in time. They become invaluable resources to support informed and intelligent city planning, economic modelling, real-time traffic predictions and decision making.

Like smart cities, smart office campuses are also using IoT-based data streams, real-time processing and location intelligence to run the facilities most efficiently. On these smart campuses, facility managers can see in 3D not only the location of fixed and mobile assets, but also their status. GIS technology brings these 3D dashboards to life, allowing managers to see things in real time and decide by precise location which asset where needs immediate attention.

Better transportation through Real-time GIS and IoT

Digital wave has changed the way IT is supporting organisations and individuals. IoT is a component of the entire digital ecosystem. GIS has embraced each of these technological developments and has identified the touch-points where it can significantly contribute.

Getting the location of a moving object is one thing but tracking entire fleets of vehicles in real time allows moment-by-moment decision-making for improved operational awareness. By integrating advanced driver-assistance systems software with mapping, analysis, and visualisation, cities are able to visualise and analyse real-time location data. This helps in improving safety for all road users in urban environments.

Another excellent example of achieving better outcomes with integration of real-time data and GIS is the Remote Monitoring and Management of Locomotives and Trains (REMMLOT) system incorporated by the Indian Railways.

As part of this project, Indian Railways has put sensors in about 1700 of its diesel locomotives. Through this system, every 10 minutes real-time information is sent to a central control room, from where they can monitor the health of a locomotive in real-time, and thereby decide what action to be taken for its maintenance. As per usual maintenance schedule a locomotive goes for preventive maintenance every 90 days, however, with real-time data, they could be sent for maintenance if a need is identified earlier. One of the parameters that Indian Railways observes is location. That's where GIS comes into picture. They can locate where a locomotive is and which is the nearest workshop where it can be sent for maintenance. This helps in faster, more informed decisions and results.

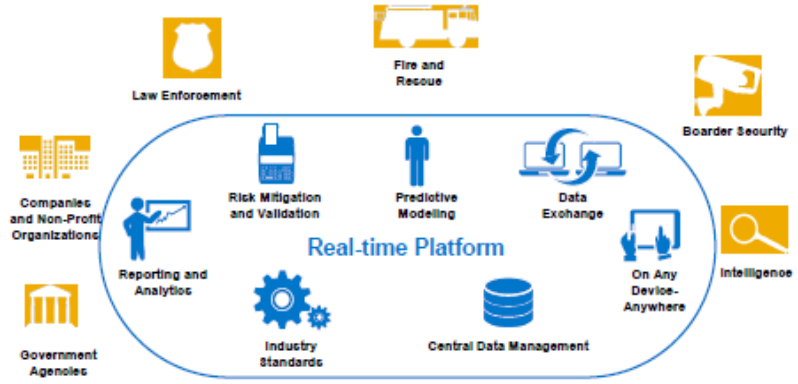
GIS data take the pulse of the smart cities, offering new insights on how the cities are functioning in time.

Connected cars – another example

Connected cars have become a reality today. Equipped with sensors that create a 360 degree awareness field, a connected vehicle gathers road hazard data. GIS processes the real-time data and transforms it into useful information. Using live weather data and historical incident data, for instance, GIS can predict the risk of an accident occurring on a specific section of road when it is raining or when fog will make the road hard to see.

GIS also plays an important role in vehicle and infrastructure sensor systems that share real-time data with each other. While drivers are traveling down the road, their vehicles are "talking" with various roadside structures. A geofence around a school and elderly housing can alert a car's system to tell the driver to slow down inside the zone. Car sensors can detect potholes and report the locations to other drivers and the city. Roadside sensor systems can capture real-time data about highway traffic conditions in the lane ahead and automatically relay it to the car's dashboard to forewarn the driver.

While IoT is enabling the driver to stay connected with a central control room through a dashboard all the time, GIS is facilitating quicker solutions in case of a crisis. Imagine your connected car getting stuck in a ditch. You are frantically trying to get out, but without any luck. At this moment, you receive a call, promising



Real time situational awareness

help to reach your exact location within a few minutes. This is not a miracle, but the power of IoT and GIS integration.

So, what enabled this excellent service?

To start with, the sensors empowered the person sitting in the control room to judge something is wrong as he could see on the dashboard that the wheels of your car are moving but the car itself is stationary. Sensing something is wrong, he calls you and as you confirm your problem, using GIS, he is able to identify your precise location and send help to you quickly. While IoT made him aware of a problem, GIS allowed him to resolve it most efficiently.

GIS enriches navigation systems with additional information during the daily commute to help the driver avoid traffic delays and complete the day's errands most efficiently. By accessing real-time and historical data about the places and times of traffic congestion, GIS helps in determining traffic pattern trends. It can forecast what traffic conditions to expect on a given day, month, or year. This smart routing system help drivers use less fuel and reach places on time.

It won't be long before connected cars will help commuters plan their day. GIS would record the driver's habitual routes by day and week, such as dropping off the dry cleaning, taking the kids to soccer practice, and doing the grocery shopping. Based on this data, GIS predictive modelling would create routes tailored to the driver's routine on a given day.

The more vehicles that connect to a community's data sharing platform, the more efficient the urban transportation system becomes.

A safer world with real-time GIS and IoT

Disaster monitoring can be greatly facilitated by real time sensor based data, and response can be faster through GIS integration. When disasters strike, every second counts. Real-time situational awareness saves lives and helps protect people, property, and critical resources.

For instance, Karnataka that has been experiencing weather related natural hazards consecutively every year since 2001. To mitigate the risks and have better control over the situation, the Karnataka State Natural Disaster Monitoring Centre (KSNDMC) thought of establishing Master Control Facilities, which provide alerts/early warnings/forecast/advisories to the farmers, fishermen, governance and others in the State along with information dissemination for real time data towards providing near real time alerts/ early warning/advisories to the community.

The centre collects the information through state of the art natural hazards monitoring sensors, information and communication system, and uses the ArcGIS platform for locating which areas are going to be affected the most and makes its evacuation plans accordingly. While GPRS enabled and solar powered telemetric rain gauges have been established and made operational at 1638 stations, automatic weather monitoring stations have been installed and made operational at 135 stations. VSAT enabled and solar powered permanent seismic monitoring stations have also been installed and made operational in the State. These initiatives now enable the centre to manage disasters in a much more efficient way, leading to better prevention, response and recovery.

What lies in future?

The world of citizens and consumers is already interconnected digitally—people are connected with each other and with their governments and businesses. Leveraging this vast network of devices and sensors is perhaps the latest trend and the number one priority for organisations that want to remain ahead in terms of having a comprehensive enterprise GIS for the future. Everything from smartphones to crowdsourced social media feeds is being used to integrate real-time data from the IoT directly into a GIS

layer stack, where the data is analysed, visualised, and reintegrated into online applications for use by either professionals within the enterprise or by consumers and citizens.

There remains not an iota of doubt that amalgamation of real-time GIS and IoT is bringing in fantastic results across all sectors. Trucking and logistics companies are using IoT & location intelligence to track packages and make sure deliveries reach customers on time. They're also using tracking data to make their operations more efficient: to save gas, reduce mileage, ensure that their drivers don't exceed their allotted hours for the day, and more. That helps improve the bottom line.

Retail companies are also analysing patterns of life through data that's collected from the apps people opt in to download on their mobile devices. Retailers are now able to understand not just buying behaviours but travel patterns and where people shop. Location analysis helps them decide where to place their stores, where to advertise, and how to market to potential customers more effectively. That, in turn, increases in-store traffic and improves sales.

Real-time health monitoring can be life-saving. Location-based intelligence is critical in healthcare. Insight into 'where' makes all the difference in access to care, quality of care delivered, and the opportunity to achieve a positive healthcare outcome. There are many examples, from simple calculations of travel time to get to a clinic, to more unique uses such as setting up a geo-fence to keep individuals suffering from Alzheimer's disease safe. Newer technologies even make it possible for smart drones to deliver emergency resuscitation equipment to heart attack patients using spatial intelligence technology.

As the IoT and its applications mature, the future will become increasingly intelligent and automated. Machine to-machine communication and machine learning, as well as predictive (what will happen?) and prescriptive (what should be done?) analytics, are already changing the landscape across retail, manufacturing, utilities and government entities. The power of location and IoT has the ability to identify where disruptions are likely to occur and empower organisations to act in advance. In times to come, these technologies will be used to build more powerful, personalised and safer experiences.

The next leap in GIS technology and computing is connecting to the vast network of devices providing data in real time. The more accessible data is, the more important it will be to understand it. And maps are the visual language for understanding the context of data.

In IoT, everything has a place. When external context like weather, traffic and demographics are added to that, we land on a rich source of real time insight. The common factor is location and this makes GIS the essential means to make sense of it all, focus on what matters and take the right action. The combination of data from IoT and spatial analytics from GIS enables taking a prescriptive step toward saving lives and money, rather than simply predicting outcomes. A geospatial ecosystem of shared data makes it easier for utility companies, emergency providers, and anyone else providing community services to understand data, act in real time, and ultimately improve the lives of citizens.

Next-Generation Automobiles by Mobileye

It is estimated that a motorist makes 400 observations, 40 decisions, and one mistake for every two miles driven. The US-based National Safety Council puts this in perspective with its own statistics that says motor vehicle accidents resulted in more than 4.6 million injuries and 40,000 deaths in the US last year. While this can be traced to a variety of factors including distraction, fatigue, aggression and impairment, the fact remains–far too many vehicular accidents occur on the roadways.

With recent advances in sensor technology that have been implemented both roadside and in vehicles there is a belief that real-time alert systems will mitigate traffic collisions by giving drivers a greater awareness of accident potential and sufficient time to take action.

Mobileye's sensor technology uses visual sensors that repeatedly scan and identify common highway features, obstacles, and conditions including lane markings, speed limits, road conditions, weather, pedestrians, accidents, obstructions, and other roadway related information. Distances to these traffic constraints are continually recalculated in real time and potential dangers are conveyed to the driver with visual and audio alerts.

The system employs computer vision, an application of artificial intelligence that extracts cognitive information from digital images and videos that emulates the manner in which humans process and respond to visual information.

The technology deployed includes a number of traffic monitoring capabilities and the resultant safety features including autonomous emergency braking, blind spot monitoring, lane centering, forward collision warning, intelligent speed adaptation, night vision, pedestrian detection, road sign recognition, and other functions. The extensive amount of data collected to support these features is processed on-the-fly using onboard technology that is capable of computing trillions of mathematical calculations per second.

Location plays an important role in the scenario and this is where Esri's ArcGIS plays an important role. The spatial analysis capabilities of Esri's software is being used on the data collected by Mobileye's Shield+ to expand

its functionality and provide cutting edge location intelligence, refined visualisation, and enhanced mapping capabilities. By synthesizing this network of sensors into a common unified map, cities can now have a type of situational awareness that was previously unavailable.

Mobileye's Shield+ streams road safety data retrieved from city fleets into Esri's ArcGIS platform, where information such as pedestrian and cyclist detection in blind spots can be viewed on the Mobileye Smart Mobility Dashboard. Shield+ alerts are updated to the dashboard in real time, providing a city-wide view of pedestrian and cyclist safety.

Amongst other things, this allows users such as municipal bus drivers to receive alerts about imminent hazards seconds before a potential collision, and to have a better, safer awareness of the roads they travel. Integration of Mobileye's sensor technology with ArcGIS provides cities with the ability to visualise and analyse real-time location data from Mobileye's Shield+, improving safety for all road users in urban environments.

In the future, Mobileye is planning to make greater use of artificial intelligence in the autonomous car system it is developing so that the cars using the system can respond more quickly and intelligently in emergency situations and during times of heavy traffic. The technology is intended to go beyond rule-based decision making by analysing and learning from the data it collects and the decisions it makes based on that data, which will allow it to develop more human-like response skills. "Currently, we are developing connected Advance Driver Assistance System (ADAS) systems," says Nisso Moyal, Director of Business Development & Big Data at Mobileye. "What this means is that we will be able to alert drivers not only to a potential collision that has been detected by the onboard camera itself, but also to dangerous conditions that are on the roadway ahead, such as a sharp curve or an accident 500 meters up the road that has been identified by another vehicle equipped with our technology."

Esri India User Conference 2017

An engaging platform to understand how GIS is empowering India

We are now living in a technological age where there is abundance of data available everywhere. To make best use of this data, the industry needs to collaborate with different sectors, and Esri India is playing an important role in facilitating this collaboration through its various initiatives.

The Esri India User Conference, which was organised from **December 13-14, 2017** in Delhi, India, provided the entire geospatial ecosystem an engaging platform for exchanging ideas as to how to make India more GIS empowered. With presence of more than **1500 delegates** and more than **50 speakers**, the User Conference (UC) played an excellent role in raising awareness about the importance of GIS in solving real-life problems.

The theme of Esri India UC was **'GIS: The Science of Where.'** The three-day conference included intriguing pre-conference seminars that set the right mood for exciting technology and industry sessions during the main conference. Along with facilitating collaboration, the UC enabled the audience to gain useful insight into the latest innovations, applications and best practices in GIS. It was evident from the speaker sessions, presentations and panel discussions that Esri India is making humongous efforts in helping the community achieve more with GIS.

Pre-conference Seminars

The pre-conference seminars, which took place on December 12, focused on bringing out the necessity of collaborating GIS and academia and exploring the role of imagery and mapping in solving organisational challenges. It included the GIS Educators Summit and the Imagery & Mapping Summit.

GIS Educators Summit

The aim of this Summit was to help the academia understand what it takes to develop and imple-

ment a successful and sustainable geospatial programme across disciplines as per the requirements of the industry. Industry-academia collaboration came out as an important requirement to achieve the desired outcomes.

Rajesh Mathur, Esri India highlighted, "Industry-academia collaboration is essential for capacity building. The industry needs to partner with the leadership, serve the government agencies that use GIS and build technical competencies by providing solution architects, database analysts, web designers, project managers or team leaders."

Imagery & Mapping Summit

The Imagery & Mapping Summit helped in exploring how imagery and mapping technologies like LiDAR, 3D, multidimensional analysis and modelling can play a vital role in solving organisational challenges. The Summit helped the industry get a close look at innovations driving capture and mapping technologies, their impact, and how agencies need to adapt to the new paradigm. It circled around mapping, imagery, surveying, cadastre and land administration, astronomy, agriculture, forestry, defence and intelligence, mining and geology, climate change/environment management, urban planning and so on.

Eminent speakers like Dr. A. Senthil Kumar, (Director, IIRS), Dr. S.K. Singh, (Director, ICAR). Dr. Sandeep Goyal, (Senior Principal Scientist, MPCST Bhopal), Krishna Rao, (Technical Architect, Esri India), Dr. Giulia Tessari, (Earth Observation Specialist) and Simon Warwick, (Director of Business Development, Aeroptic LLC) provided important insights around LiDAR imagery, 3D data and ArcGIS. Also, important points were raised surrounding drone data collection, visualising large surface and point cloud data sets, and data fusion from various data collections.

Esri India UC 2017 – Day 1

The main conference kicked off on December 13 with an encouraging note from Agendra Kumar, President, Esri India. He said, "GIS is the science

Amid all the discussions on current developments and emerging trends, Esri India also remembered the Father of GIS, Roger Tomlinson by giving him a tribute and having a lecture in his memory. The lecture was delivered by Dr. B. K. Gairola, Ex-Mission Director (e-governance), Department of Electronics and IT (DeitY) Government of India.

of geography, but that's not the technology of GIS. The technology of GIS is what is behind the science of geography." He added, "It [GIS] helps us in finding answers to the challenges that industry and society are facing today. Whether it is a weather-related challenge or a climate-related challenge… GIS plays an important role in all these programmes."

Dean Angelides, Corporate Director-International/ Alliances/ Partners, Esri, reinforced that 'The Science of Where' is actually a fundamental digital language for helping us understand and manage our world. Recognising the need for collaboration between GIS and academia, Angelides said, "We are also focused on education and this is about building the next generation of spatial thinkers to help us advance and continue solving the problems that we have at hand."

Focusing on the role of GIS in the Indian context, a plenary talk was also delivered by Major General Girish Kumar, Surveyor General of India. As the head of the agency, Major General Kumar, talked about the current challenges lying before the Survey of India (SoI). The day also saw a Technology Exposition. Hosted by Krishna Rao TVB, Technology Architect, Esri India, the session allowed the participants to learn about some of the latest innovations in the field of geospatial by established names in the industry such as Esri, Harris Corporation, Sarmap and Trimble.

According to him, "India has technology and knowledge, but we need a stronger plan to have a robust geospatial ecosystem. This is where organisations like Esri India are playing a crucial role, and the User Conference surely shines as an excellent platform for exchange of ideas and facilitating collaborations."

Esri India UC 2017 – Day 2

The second day of the conference, provided exciting avenues for engagement in the form of Real-time GIS and IoT Summit, Future Utilities Summit and WhereNext Summit. The Summit allowed different industries and users to discover latest trends and best practices in GIS.

Future Utilities

The Future Utilities Summit focused on the role of GIS in the power sector. According to the speakers, the role of GIS in the power sector has increased in the last few years far too extensively. A technology with multi-faceted applications, GIS plays a significant role in developing smart electric utility grids in India that are used for power generation, transmission and distribution.

As a speaker at the session, Kumud Wadhwa, Deputy General Manager, NPMU provided valuable insights on the benefits of having smart grids in the country. The other speakers in the session:

Pradeep N of Esri India, Atul Pratap Singh of UP Power Corporation Limited and Phillip Dodds of Schneider Electric reinforced the points made by Kumud, highlighting the effectiveness of implementing GIS in utility.

WhereNext

When it comes to GIS, the areas of application and the resultant outcomes are almost limitless. This is what the WhereNext Summit at the Esri India User Conference focused on. At the Summit, as industry leaders shared their thoughts and strategies for adoption of future technologies (AI, IoT, Cloud, Big Data) and integrating them with GIS to perform better, it was fascinating to discover how spatial analysis combined with the right enterprise tools and strategy can enable innovation and competitive differentiation. The Summit answered

questions on how Business Intelligence and GIS integration can provide powerful visualisation and analysis of business data through smart maps etc.

Real-time GIS and IoT

IoT is already being used across industries such as smart cities, public safety, agriculture, healthcare, utilities and transportation. With increase in IoT applications, multitude of devices are connected together generating huge volume of data in real-time. Making sense of such a large volume and velocity of data requires a seamless integration of location capabilities of these devices. This is where GIS plays an indispensable role in enabling the IoT ecosystem.

The relevant sessions at the User Conference, comprising intriguing presentations from technical experts from the Esri family and other industry experts enabled the audience gain valuable insights into how to make IoT work for businesses, and how integration of GIS and IoT can bring excellent results. It provided an innovative platform for different industries to network and discover new opportunities for growth.

Panel Discussion: Age of Geographic Enlightenment – An Opportunity for Indian Start-ups

Esri is strongly inclined to provide the start-up community the much needed support as it is evident from its GeoInnovation initiative. To bring out more ideas on how to strengthen the start-up community, a panel discussion on opportunities for Indian start-ups was organized at the UC.

The session was moderated by Harpreet Singh, (Vice President – Marketing & Partner Ecosystem, Esri India) and the Speakers were; Dean Angelides, (Corporate Director-International/ Alliances/ Partners, Esri), Dr. Debapriya Dutta, (Advisor/Scientist, DST), Srikant Sastri, (Co-founder, Crayon Data), Bipin Chandra, (Founder & CEO, Esyasoft Technologies Pvt. Ltd.) and Taranjeet Singh, (Managing Director, Agnext).

GIS offers immense opportunities for start-up entrepreneurs. But as everyone in the panel agreed, a stronger support system is required, and India is working towards providing the same. According to Debapriya Dutta, Advisor/Scientist, DST "We are trying to develop a national geospatial programme in order to catalyse the geospatial science, geospatial technology and geospatial solutions. We have enough applications that need to be integrated with the workflow process of the organisations. We are also looking at capacity

AWARDS

Making The Difference Award

The conference ended by acknowledging the efforts made in the field of GIS by some of the best minds in the country.

In Pic (L to R): Mr. Amit Bhargav, Mr. Uday Kumar, Mr. Vishnu Chandra & Mr. Arvind Thakur

Special Achievement in GIS Award

Reliance Energy Limited

In Pic (L to R):
Mr. Arvind Thakur, Mr. Anand Kumar, Mr. Govind Samant Mr. Sumit Dey

Department of Science and Technology, Government of Madhya Pradesh

In Pic (L to R):
Mr. Rohit Garg, Dr. Sandeep Goyal & Mr. Arvind Thakur

Jharkhand Space Application Center

In Pic (L to R):
Shri Sarvesh Singhal & Mr. Arvind Thakur

building across the entire geospatial ventures."

Dean Angelides said, "We need a great convergence of ideas and need to put them into practice. Data availability and technology availability, those are the things that governments should focus on and make them available not only to experts, but more broadly.

Open Data movement, I would say, is very significant and it is beginning to help. Software availability - that is something we are doing, just that nobody knows about it. We need active promotion, advertising and evangelising. The next big thing is governments can set aside some procurement for smaller businesses. It is not just about promoting start-ups and entrepreneurship, but also establishing connections in the market. It is people helping people that create value in the industry."

Highlighting how Esri India can help the start-ups more, Srikant Sastri said, "For a start-up, it is next to impossible to get access to large enterprises and be taken seriously, therefore the biggest help Esri can deliver given its global customer base is making available access to that customer base. And that is the best practice you can look at." That surely is an encouraging idea to help the start-ups.

Taranjeet supported the Open Data movement by saying, "We should enable data and we should enable individuals or companies who have the solutions to access that data; how can it be done fast is the thing. If we want to make India the hub of GIS, this is the approach that has to be followed."

The crux of the panel discussion was that start-ups can contribute significantly in making India have a strong presence in the geospatial industry, and established companies must extend the much needed support. Esri India leads by example.

Esri India facilitating innovation through unique initiatives

Esri India is profoundly enabling the community to do more with GIS. Its GeoInnovation Challenge initiative received immense recognition from the community as a unique concept to encourage the young generation to come up with exceptional ideas to make GIS work for the greater good.

With growing GIS capabilities, the time is ripe to geo-innovate and develop solutions that promote effortless adoption of geospatial technologies across diverse domains.

While almost every organisation today is using geospatial technologies for better outcomes, numerous start-ups are coming up with innovative geospatial solutions that can help businesses to perform better. Start-ups are playing an important role in making geospatial technologies more usable.

However, there is no denying that they need the initial thrust to make worthwhile contribution, and this is where established names like Esri can make a difference. Esri India is known for its commitment towards encouraging innovation and providing a more enabling environment for start-ups.

GeoInnovation Challenge

The Challenge provided the start-ups a platform for bringing in their GIS based business ideas to market and build a strong network with industry experts, investors and peer group. It was GIS industry's first of its kind Public Private Partnership (PPP) initiative in India.

During a special session on 'Best of GeoInnovation Challenge' at the Esri India User Conference, Brett Dixon, General Manager – Asia Pacific, Esri applauded Esri India's efforts by saying, "Esri has a long long history of innovation. Innovation for us is a key driver, but we recognize that we need to go beyond our company to look for new ideas. Our start-up programme has been the strongest at Esri India. They ideated the concept of the GeoInnovation Challenge. First time something like this has been offered in the domain of geospatial in India. The Challenge has been highly successful. Congrats!"

The jury comprised of:

- Dr. Debapriya Dutta, Advisor/ Scientist, DST
- Jay Krishnan, CEO, T-Hub
- Girish Shivani, Co-founder, YourNest
- Digvijay Singh, COO, Indian Angel Networks
- Ajay Ramasubramaniam, Director, Zone Startups
- Rajesh C. Mathur; Advisor, Esri India
- Dean Angelides, Corporate Director-International/ Alliances/ Partners, Esri

The proud winners of the Challenge are:

Attentive AI Pvt. Ltd: It is a big data analytics company providing AI based geospatial solutions to governments, commercial and humanitarian institutions.

Gray Routes Technology Pvt. Ltd: It is a leading provider of location analytics and field automation software.

Saartha Labs Pvt. Ltd: 'Serving the customers' IT Purpose' – This sums the mission and vision of Saartha. This is what fuels their passion, focus, dedication and approach to help customers achieve the best business outcomes.

mApp Your Way

In its quest to build capacity and provide the student community opportunities to gain competence in GIS, Esri India has been organising an initiative called mApp Your Way. It is an application (mobile or web) development challenge. The challenge is open to all students (UG/PG/Research scholars) associated with the institutions that are users of Geospatial/ArcGIS technology.

The objective of this challenge is to provide a platform to the institutes and students to showcase their skills and capabilities in geospatial technology. The challenge offers an exclusive opportunity for institutes and students to implement new ideas via meaningful GIS enabled applications and in process, gain enriching experience. At the Esri India User Conference, held from December 13-14 2017, Esri India announced the results of the third edition of mApp Your Way. This year's winners are University of Petroleum and Energy Studies (UPES), followed by CEPT University and Andhra University.

Winners: University of Petroleum and Energy Studies, CEPT University and Andhra University

The **winner** of the award is University of Petroleum and Energy Studies (UPES). The University received the award for their app named 'Parv-Kumbh'. This app facilitates user convenience in a mega event. It is equipped with features that make technology more accessible to the masses.

The **1st Runner up** position has been bagged by CEPT University for the CEPTSmart application developed by the students of its M. Tech (Geomatics) course. CEPTSmart is a customized platform for improving the life of students, faculties, administration and visitors by incorporating various geospatial solutions such as complaint redressal system, query based classroom allocation, indoor navigation etc. within the University campus.

Andhra University gained recognition at the contest as the **2nd Runner up**. They presented an app called 'DigiSuraksha'. DigiSuraksha sends the user's location who is in need of emergency services to the nearest emergency service provider. Upon user's request his/her location can be sent to the nearest ambulance in case of medical emergency and to the nearest fire station in case of fire outbreak and upon user's request his/her location can be tracked by the nearest police officer.

The awards have been an excellent way of acknowledging the efforts of the intelligent student community that has great potential for solving the problems of the society using geospatial solutions. Esri India is glad to be able to make a worthwhile contribution towards boosting the confidence of the young minds.

Commenting on the initiatives, Agendra Kumar, President, Esri India said, "Our constant endeavour is to enhance the adoption of GIS in India by providing services and forums to the users which help them realize the benefits of the technology. mApp Your Way and GeoInnovation contests provide unique platform for developing innovative GIS based solutions targeted at addressing real-life challenges. I congratulate all the winners on their achievement."

RESEARCH PAPER

Intelligence of 3D City Models for Smart Cities and Use Cases

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Solution Architect, Cyient Limited

Dr Hanuman Prasad
DGM, Cyient Limited

Research is fundamental to innovation. Keen to make the community more empowered in Real-time GIS, Esri India at the User Conference provided a platform to the researchers in the field to share their innovative ideas for a smarter world. Out of the many papers presented, Esri India chose to publish the following on 'Intelligence of 3D city models for smart cities', in its current edition of ArcIndia News to enable the readers get an insight on urban landscape visualisation and 3D virtual development for smart cities.

Abstract

Recent advents and developments in the widely available applications of computer and communication technologies such as CAD, computer graphics (CG), virtual and Augmented Reality, AR/VR photogrammetry, satellite images, web-based technologies, geographic information system (GIS) and global positioning system (GPS) have opened up opportunities for large-scale urban landscape visualisation and 3D virtual development for cities.

3D City experience is a key to any city's development concerning the current growth of urabnisation and infrastructure. 3D virtual modeling, visualisation, dissemination, and management of urban infra is one of the disruptive opportunities in the geospatial arena across the world that has innovations and challenges as well. Intelligent 3D models are the most discussed opportunities in Geospatial space which has its own significance, benefits and complexities.

Experiencing visualisation is not the only requirement in the 3D space. 3D experience needs to be enabled with real-time use cases for justifying its existence for the people who can be benefitted out of this. The latest technical trends towards Smart environment, Smart mobility, Smart governance and Smart communications conjoint with 3D models provide a realistic outlook of any city.

Intelligent 3D models not only acts for visual perspective but their consortium with IoT and traffic information provides a real perspective of the city. Power of IoT adds the live data feeds from the devices/sensors placed in the city. 3D model helps designing the plan for CCTV camera placements, device location planning, correlation with adjacent features. Few of the environmental parameters mapped with IoT power are Noise pollution, rainfall, emissions of gases etc. whereas it has scalability to add other parameters as well. The seamless geospatial 3D platform enables a user to map the IoT devices on the field, connect with cloud, record the

live feeds, set the rules for alerts & alarms and provides a useful insight through dashboards.

Introduction

Data is an important part of any enterprise implementation. The system, processes and workflows are totally dependent on quality of data and its richness. 2D GIS data is something which is being used for a long time now and people across the globe look forward to 3D or 4D experience with the data.

This paper explains how 3D GIS data conjoined with other technologies give intelligence to city authorities and users for better planning and decision making.

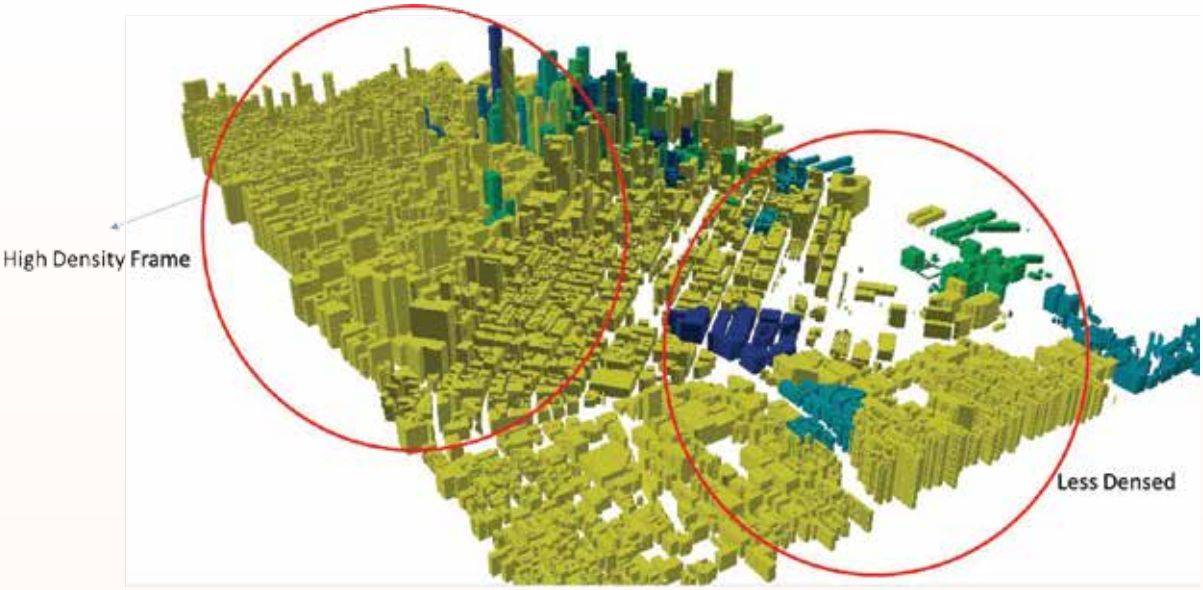
One of the important use case is the consortium of IoT with 3D City models. In the previous advents, IoT can work with 2D data as well however 3D model gives a perspective in below manner:

- ➔ Actual location where device needs to be placed. (looking at the Z)
- ➔ Settlement Cluster/Density
- ➔ Network reachability

3D models enable planners and implementers to actually see (and not visualize virtually) and plan the things.

The below image shows an area settlement:

Within IoT framework, the illustration here is to measure Noise limits in the entire area.



3D Conjoins IoT

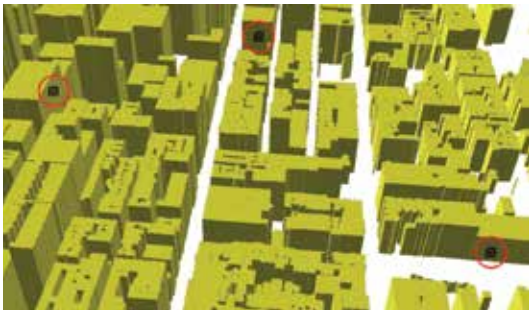
Cyient has been developing 3D models for the last decade, and a half of it's been an age-old story that 3D models are developed and used for specific department or a definite use, but now it is a trend and Governance is looking for Smart 3D platform which is web-enabled and quick to market for informed decisions. Smart data empowers various Technogyms & platform to easily access, analyze and take quick decisions on the city requirements.

The virtual 3D city model is equipped with many other use case applications which can derive required information important for city operations.

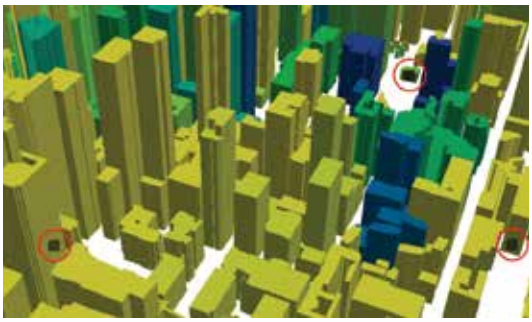
High dense area will have more level of Noise whereas less densed area will have less. Less densed areas will propagate the noise emission easily. However, looking at the noise metrics recorded from various sensors, it would be a decision framework for city authorities to regularise vehicle movements, crowd management etc so that these do not cause social challenges.

On the planning side as well, devices can be planned looking at the cellular coverage in the area, height of the building, area density etc. Some of the examples below:

The above red circled are the sensors placed on the buildings to record noise level. These are stationed at multi levels



Sensor Placement Perspective- 1



Sensor Placement Perspective-2

to understand the impact at various altitudes.

The recorded value can be further classified as below and accordingly planning can be done. The 3D data can further be classified based on the below metrics.

Noise Zone	dBA
Extreme Noise Zone	>100
High Noise	70-100
Intermediate Noise Zone	40-70
Silent Zone	0-40

Custom Thresholds

The overall status can be viewed using below dashboard:

Based on the above dashboard, city authorities can develop plans to mitigate noise pollution issue from the area which is impacted with this. This will also help maintaining the equilibrium of the noise across the city with respect to urban settlement.

Dashboard Representation - Not Actual

Noise is just a use case and the same can be replicated for other environmental monitoring domains and in utility asset management as well.

3D Conjoins Live Traffic Feed

There are lot of organisations which provide online live traffic feeds. However, when it comes to use this traffic data with the customer specific maps, it is a big challenge as most of the traffic feeds work with their native map services. In this case, the traffic feed need to be decoded from the native map/service provider and encode in the customer specific map data. This is necessary to map the data models of source and target map data in order to get the traffic feeds on the customer specific data.

In order to map the source and target data model, linear referencing tool is used to decode the traffic feed from their native map service. It is executed by writing a script which runs in the back end and decodes. Similar way, script has to be re-engineered to encode into customer specific data.

Traffic Segment Representation in 3D-Not Actual

Conclusion

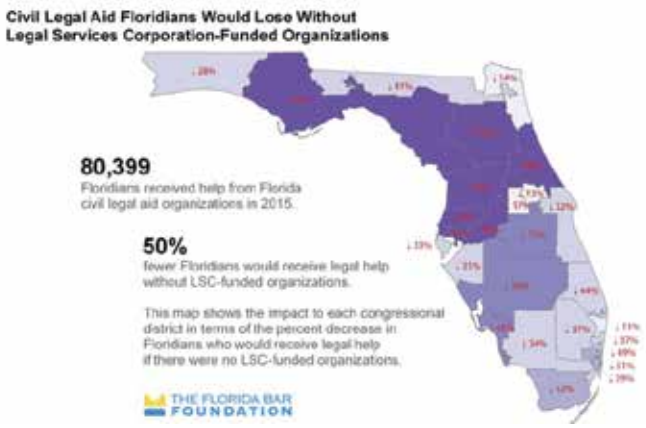
World is now moving into different dimension of visualization. We have already seen and explored 2D maps and now it's the time to incorporate 3D and 4D elements to the map. Above examples of conjoining IoT and Traffic is just a representation of 3D data capabilities and this can be extended for any defined use case. Data and communication network are the main pillar of such implementation which can move the entire concept to 7D in future.

Location technology helps the legally vulnerable after disasters

When the clouds parted following Hurricane Irma's sweep across the Florida Keys, residents found both their beautiful islands and their lives in ruins. They desperately needed food, water, and shelter, but as time went on, the disaster victims also realized they needed legal assistance.

An RV Park on Big Pine Key was one of the few places where island hospitality workers, such as kitchen servers and housekeeping staff, could afford to live. Following the hurricane, residents returned to the park and found notices tacked to their doors. The notices stated they had to leave because crews would be sweeping out debris and removing damaged trailers.

Residents were given just a few days to pack up and move. Fortunately, at a clinic organized by two Miami-based civil legal aid organizations, a Key West attorney heard about their plight and offered pro bono legal help. He wrote a letter to the park's owner explaining the tenants' rights. Next, Legal Services of Greater Miami stepped in to represent each tenant, one-by-one, in negotiations with the owner to buy them more time to relocate.



The Florida Bar Foundation provided maps that revealed, by congressional district, those that would be left on their own without assistance from Legal Services Corporation funding.

Lawyers are among the wave of second responders when disasters happen, and many take up the needs of the legally vulnerable. The Florida Bar Foundation aggregates data about marginalized communities likely to be overlooked in recovery efforts. Then it uses location-based insights to raise awareness and raise funds, building the case about the effectiveness of legal services to help lobbyists seeking greater federal assistance.

Seeing Problems

Sadly, low-income families and individuals are the most vulnerable to the many traumas that come with disasters. They are the least likely to receive compensation from employers for time lost and the most likely to lose their jobs. The poor don't have enough savings to pay rent or hire an attorney, so they are often quickly evicted. Other common factors that put the poor at risk of losing homes and going hungry are immigration status and language barriers. People living at and below the poverty level desperately need legal assistance in their efforts to recover.

Certainly, Federal Emergency Management Agency (FEMA) funding is available to victims living in disaster areas but navigating FEMA paperwork can be complex. Even if people successfully submit the necessary forms, FEMA relief may not arrive in time to prevent homelessness. Some victims may have their applications rejected while others, such as undocumented residents, are not eligible to apply. Many are on their own during these most difficult of circumstances.

Congress designates federal funding for legal aid (about $385 million nationwide in 2016), which the Legal Services Corporation (LSC) administers. However, one of Presi-

dent Donald Trump's initial ideas to scale back government was to eliminate the LSC altogether. As Congress continues to wrangle over the Fiscal Year 2018 budget, the current House budget cuts LSC funding by 22 percent. Chief Justice Jorge Labarga of the Florida Supreme Court as well as leaders from The Florida Bar Foundation, The Florida Bar, and the American Bar Association have jointly lobbied Congress to protect this funding.

Key takeaways

- GIS helps quantify the needs of the most-vulnerable populations.
- Location data presents relatable details to help guide those that help the legally vulnerable.
- Looking at needs geographically provides a scientific approach to prioritize limited funds.

The Legal Vulnerability Index (LVI) shows the level of community need for civil legal help after a disaster based on at-risk indicators.

Quantifying Assistance

The Florida Bar Foundation, a group whose mission is to provide greater access to justice, has long compiled location-driven evidence about the civil legal aid provided by its grantees in an effort to measure impact and advocate for funding. At one time, they distributed several pages of narrative to each member of Congress with summaries and statistics. They have since realized that raw numbers coupled with lengthy explanations overwhelm representatives and require too much time to understand.

In 2017, The Florida Bar Foundation provided the Florida delegation to ABA Days in Washington with one-page fact sheets. These featured GIS-derived counts to convey to each of Florida's congressional representatives the impact of civil legal aid on his or her constituents. The data revealed, by congressional district, the groups and numbers of people (veterans, elderly, abuse survivors, etc.) who would have been left on their own without assistance from Legal Services Corporation-funded organizations. The delegation was also armed with statewide maps showing the percentage decrease, by congressional district, in the legal services that would have been provided to each representative's constituents without those organizations.

Representatives could easily see exactly how dependent their constituents were on LSC funding. Seeing the geographic context of the data customized to their congressional districts opened their eyes to the situation and improved their understanding of the need. One representative said that the geographic information made more sense than many of the presentations he had seen from other organizations that lobby for congressional support.

Meeting Needs

When Hurricane Irma hit Florida, The Florida Bar Foundation had dedicated $881,000, including more than $300,000 that it raised in just two months, to hurricane-related civil legal aid. It distributed these funds via grants that went to 16 legal aid organizations. To help grantees prioritize these funds where they would have the greatest impact, the foundation provided maps that showed the extent of the damage.

"We wanted to take a scientific approach to awarding grants," Nancy Kinnally, The Florida Bar Foundation director of communications, said. "We also thought that having geographic data would provide useful information for our grantees as they strategized to deliver civil legal aid."

The Self-Represented Litigation Network (SRLN) is a non-profit that provides mapping services to the civil legal aid community. The foundation retained SRLN to use maps and geospatial data to tell its story. The team devised a Legal Vulnerability Index (LVI) as a yardstick for measuring an area's likelihood of needing legal aid. The LVI indicators include poverty, housing costs, native language barriers, rent, and health insurance. Combining the LVI with open-source data on ArcGIS Online about impacts, disaster declaration areas, baseline conditions, and federal assistance, the team quickly created a Story Map depicting the need for legal services by county.

"We know these maps help people quickly grasp concepts and formulate plans that match the solutions to the need," Katherine Alteneder, executive director of Self-Represented Litigation Network, said. "Access to justice maps can help people understand a local issue—to visualize and see patterns."

As Florida's second responders continue to fight for the state's most vulnerable populations, location data provides critical evidence of the need, and proof that these funds make a difference.

Chicago adds real-time awareness to manage the marathon

Feeds from Runners Convey Up-to-date Details About the Course

by Ryan Lanclos

Runners love the Chicago Marathon for its mix of raucous urban canyons filled with cheering fans, and quiet and colorful leafy side streets. Chicagoans are always into an event, with a lot of fun-loving people turning out to encourage the runners and keep them smiling through the pain. The course also runs flat and fast, which brings many new runners who are reaching for their personal record. It's one of six World Marathon Majors, and world records have been broken there four times.

The 40th Bank of America Chicago Marathon took place this year on Sunday, October 8. The race is capped at 45,000 runners, and this year, according to the race website, 44,508 finished the race, with 1.7 million spectators. The elite runners add to the spectacle, with $500,000 in prize money on the line.

This year's event took place just seven days after the mass shooting in Las Vegas. In addition, the bombing at the 2013 Boston Marathon is always in the back of every

several situations where runner awareness would have proven helpful on race day. Last year, a hostage/barricade incident unfolded a block off the course. An incident on a bridge several years ago caused the race to be re-routed. Both scenarios were handled quickly and effectively, but knowing where the runners were on the course would have helped spread awareness and assurances to all, and a more coordinated response.

Projecting the location of runners, along with details about the location of personnel and assets, on a map that was available on computers and devices as well as projected on a large screen in the OEMC gave all the first responders a common and current understanding of the race status.

"My leadership [Executive Director Alicia Tate-Nadeau] has an expectation," Thomas Sivak, deputy director of the OEMC, said. "She wants to come into the room informed and not have to ask a single question to know what's going on."

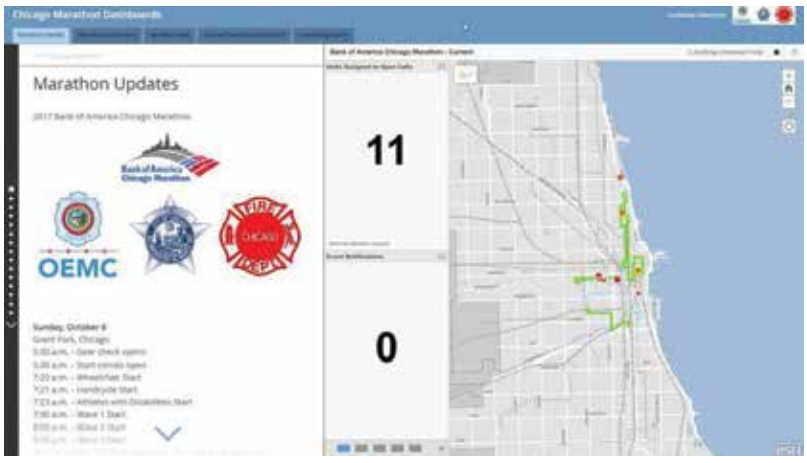
Key takeaways

- Real-time awareness of the course helps inform and guide public safety response and resources.
- GIS helps paint the picture decision makers need for improved community safety.
- The city of Chicago continues to increase its use of GIS to manage major special events.

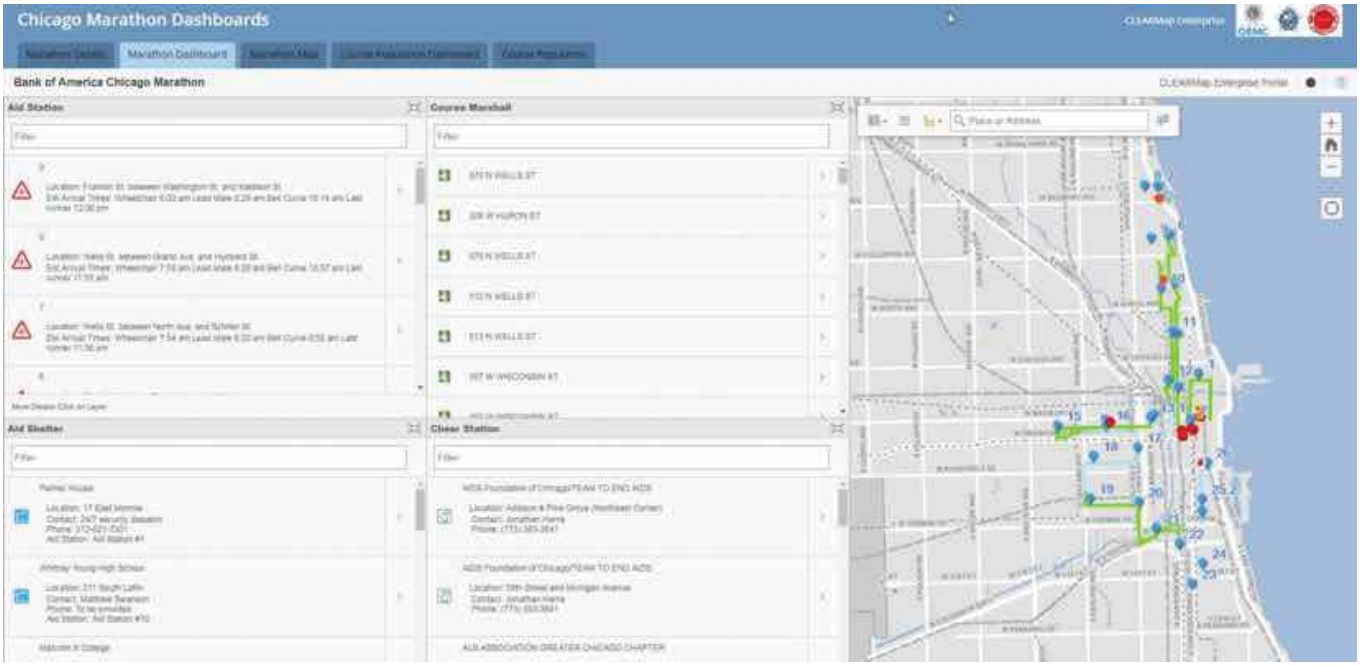
marathoner's mind. As the first World Marathon Major after Boston, Chicago had already substantially augmented its security plan for the 2013 Bank of America Chicago Marathon, and continues to make adjustments to it from year-to-year. Given this backdrop, community safety and security efforts were increased this year, with the City of Chicago adding real-time sensor feeds to their event awareness.

Chicago's Office of Emergency Management and Communications (OEMC) added runner locations to their shared map by linking to live data from the timing mats on the course that collect data from the RFID chips each runner wears. This was made possible via a partnership with Bank of America that provided key course details and helped the city coordinate with a chip time vendor and Esri Professional Services to make this happen.

Runner awareness provides great insight into what's happening where, as the race progresses. In the past, there have been



A shared dashboard provides public safety stakeholders with a real-time understanding of the Chicago Marathon.



An additional dashboard view allows public safety agencies to drill into the details.

Coordinated force

In light of the recent mass shooting, the Chicago Police Department increased its presence, alongside a heightened presence from the Federal Bureau of Investigation (FBI), the Federal Emergency Management Agency (FEMA), the Department of Homeland Security (DHS), the Illinois State Police (ISP), and other agencies and nonprofits. That's a lot of activity for OEMC to coordinate.

A geographic information system (GIS) is central to this effort, with Web-based forms for each department to input details about personnel, their posts, and the assets each agency deploys.

"Chicago is a special event-driven city, and this is one of our biggest events of the year," Sivak said. "We have worked hard to establish a common operating picture to support our decision-making processes. Adding a real-time awareness of runners helps us know the size and complexity of any incident, and helps us manage the consequences."

Given the 26.2-mile length of a marathon, most marathons take place across many jurisdictions. In Chicago, the entire course is contained within the city. This makes it easier to get every city department on the same page regarding all the details of the event. A geographic information system (GIS) is central to this effort, with Web-based forms for each department to input details about personnel, their posts, and the assets each agency deploys.

"Data accuracy and availability continue to increase, because people see the benefit when it's all displayed at the mapping endpoint," said Joe Kezon, GIS manager at the OEMC. "Rather than going to a paper document to understand where officers are deployed, they can query and see it all on a map to gain a visual perspective."

The OEMC is where the city's police, fire, and emergency medical service are all integrated in one dispatch system, and where all aspects of Chicago's emergency services are coordinated. The OEMC also contains the Traffic Management Authority, which deploys traffic control aides to work with CPD to ensure participant, spectator and motorist safety along the route. In addition, the OEMC's Public Safety Information Technology Section, along with the City's Operations Center, monitors thousands of CCTV cameras throughout the city. The GIS acts as a central integration point to provide overall situational awareness.

"We have to remember that GIS is not mapping," Sivak said. "That's just a piece of it. It's the data inputs and the outputs, and the coordination that takes place on the backend that paints the picture and helps us with our decision process."

The shared view that GIS provides, combined with rehearsed scenarios, means that everyone knows what to do, with the added assurance that everyone knows where you are and what you're dealing with.

"It's always beneficial to think about how I would use it," Kezon said. "I think it would be a great thing for bike paramedic teams to see where they're being dispatched, and the information associated."

Real-time understanding

The City of Chicago has prior experience displaying real-time data in their GIS for a high-level security event. In May 2012, the city hosted the NATO Summit. For that event, the federal agencies saw Chicago's system and decided to rely on it, and integrate with it, rather than send all their GIS data and people to the event.

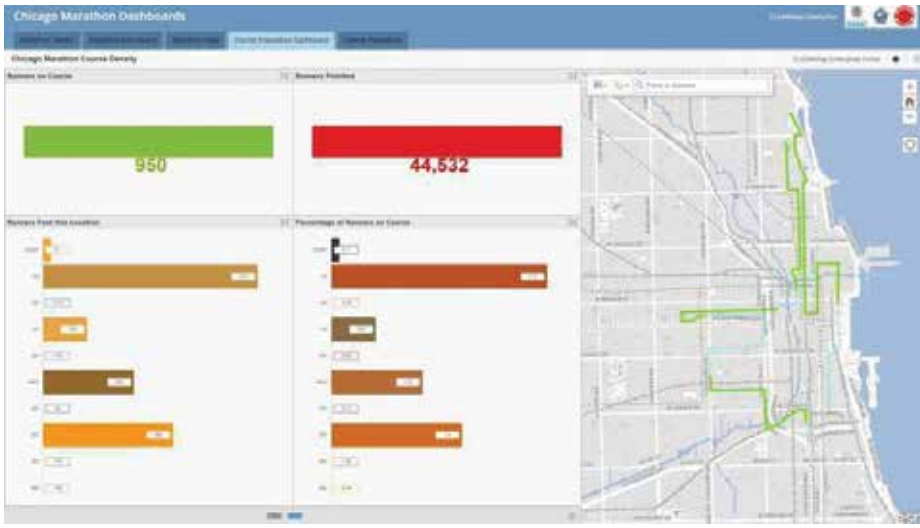
"We were able to display the GPS location for each of our Chicago Police Department officers, and we integrated the FBI's Blue Force Tracker system to see where everyone was deployed," Kezon noted.

This real-time component was a first for the city. Since then, the city has increasingly relied on GIS for major special events. They have added a link to all the city's cameras to see live video feeds. They've also been eager to add to their real-time awareness.

In preparation for every event, the city gathers data from the event organizer as well as plans and personnel from each department. GIS data is displayed, along with geofences that trigger when things enter or exit the event area. The geofences are also used to display and send to the OEMC only the 911 calls within the event area.

Always evolving

At the OEMC officials are thinking about a quick response as much as they're thinking about the recovery and aftermath of each incident.



With a quick glance, public safety stakeholders can see how many runners have completed the race and where the remaining runners are on the course.

"I knew fully that if I looked at Joe and asked him to turn on a layer of data, that he would find it and bring it over so that we wouldn't lose any ground," Sivak said.

If an incident involved the need for shelters, a data layer could quickly be added to show the location and capacity of each of the city's emergency shelters. If an incident required a strong local response, a data layer of staging areas could be added and shared with nearby personnel who would then concentrate the needed equipment closer to the incident.

Having a record of what happened where and when proves useful after the event to examine any incidents for future improvement. It's also a crucial piece if an incident reaches the level where briefings to executive leadership and chief elected officials become necessary. The OEMC used a story map to capture this detail on a regular basis. The Story Map records information in a way that can be scrolled and clicked to uncover details, and to understand the response as an incident evolved.

"Our top-end site is for the marathon, but we have events that happen every single weekend," Sivak said. "We want to do more. We have to adapt on the fly, track things appropriately, and capture information to mold our response to every situation."

ArcGIS Online and ArcGIS Enterprise collaboration workflow – How to take maximum advantage

While hosting in ArcGIS Enterprise and ArcGIS Online, it is now possible to maintain a synchronized copy of feature layers and web maps between an ArcGIS Online Organization and an ArcGIS Enterprise Deployment through a trusted relationship.

This brand-new functionality spans across two separate Web GIS environments. For easier understanding, let us consider a scenario.

Scenario: The Geocloud County Parks and Recreation department manages 17 feature layers of parks data. The layers are used to create web mapping products for the website, as well as to manage maintenance and infrastructure data. Of the 17 layers, 8 layers are used to create public apps that the community uses for navigation and information about Geocloud County Parks and Recreation. The rest of the layers are used by internal staff to determine maintenance areas and track light inspections and lawn mowing schedules. The Parks and Recreation department maintains all of their data with the rest of the county in their ArcGIS Enterprise Deployment, Geocloud Deployment. They want to use their ArcGIS Online Showcase Organisation for their public maps so they don't have to manage the infrastructure or scalability for their public data. They want to maintain the data in a single location for both environments. Geocloud County is using distributed collaboration to meet the needs of their data environments.

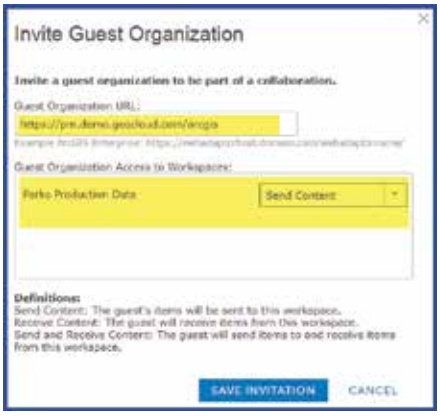
In the screenshots below, the ArcGIS Enterprise Deployment is referred to as the Geocloud Deployment and the ArcGIS Online Organization is referred to as the Showcase Organization.

The following seven steps must be followed for setting up a distributed collaboration between the ArcGIS Enterprise Deployment and the ArcGIS Online Organization.

Steps to follow

1. Create the collaboration and workspace in the host environment by following the prompts to create a name, description, and workspace. Currently, ArcGIS Online must be the host of collaborations.
2. Invite the guest and establish the workspace access mode

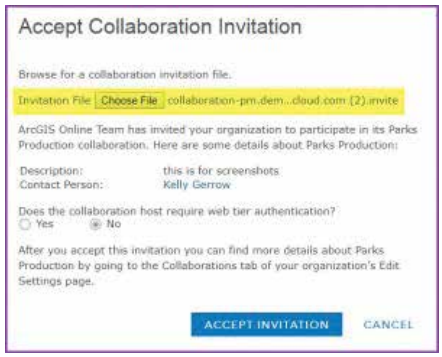
of the collaboration. The host must indicate the portal URL of



The Parks and Recreation department maintains all of their data with the rest of the county in their ArcGIS Enterprise deployment, Geocloud Deployment.

the guest to create an invitation. The host must also define the workspace access mode of the collaboration in the invitation. For this collaboration, the web maps and layers will be sent from the Geocloud Deployment (guest) to the Showcase Organization (host) so the Send Content option should be selected.

3. Establish a trusted relationship by having the guest accept the invitation and the host accept the invitation response from the guest.
4. Have the Geocloud Deployment join the workspace from



the Collaboration settings page. When joining the workspace, indicate the group that will participate in the workspace and specify that feature layers will be sent as Copies. The guest controls the synchronisation interval for the collaboration. The parks data edits should be synchronised overnight, every night; for that reason, the Geocloud Deployment will set a scheduled synchronisation interval to occur at 10:00 pm once a day (24 hours).

5. Now that the collaboration is set up, users in the Geocloud

Deployment can share content with the group participating in the workspace and have it copied to the Showcase Organization through the synchronisation process. For this example, the GIS manager in the Parks and Recreation department will ensure that all layers that need to become public layers meet all of the prerequisites to share feature layers as copies, including enabling Sync. Once the pre-requisites are met, the GIS manager can share the desired public content with the group participating in the workspace.

6. When the data and web maps are initially shared with the work-

space, the data will automatically be synchronised to the host (Showcase Organization). Ensure that all of the layers in the web map are also shared with the workspace group so they will all be copied. Members of the Showcase Organization who are members of the workspace group can now access the layers and web map and create applications from the copied content as needed.

7. Internal members of the Geocloud Parks and Recreation department

can also access an internal version of the data and edit the data as needed. Once a day, edits to this

data will be updated to the Showcase Organization. To demonstrate this, navigate to this editing application (pretend it's internal) and add a new trail using the editor widget. You can monitor the requests to see that the data is being added to a service hosted in the Geocloud Deployment.

Benefits of the collaboration workflow

Three main benefits of this workflow are as follows:

- ➔ You maintain the data in one location, ArcGIS Enterprise, but view the updated data in both ArcGIS Enterprise and ArcGIS Online.
- ➔ ArcGIS Online will display on the Data tab of the collaborated

data item page when your data was last updated, so you can verify how recently the data was updated.

- ➔ You can use ArcGIS Online functionality, like feature layer views

and automatic tiles, with the collaborated content.

CEPT UNIVERSITY

Spearheading academic excellence in GIS

GIS is one of the most exciting and growing technology today. In the last few years, GIS has evolved to become a mainstream technology for businesses, governments and communities, enabling them to acquire valuable insights through spatial analytics.

With advancement in adoption of GIS across sectors, the demand for skilled workforce has increased manifold and this is where academic institutions are playing a vital role. To bridge the gap, they are not only skilling the students with latest GIS technologies, but also promoting its adoption in India. Industry-academia collaboration is essential for capacity building, and Esri India is committed to supporting the academia in teaching and research with best practices and resources. It is helping numerous universities and colleges in India to adopt and teach GIS technology with the intent to equip the next generation with the GIS skills required for the modern workplace.

CEPT University or Centre for Environmental Planning and Technology, Ahmedabad, India is renowned for its commitment towards capacity building in GIS and its association with Esri India, enables it to be much ahead in encouraging innovation in GIS.

The Faculty of Technology offers a Master's course in Geomatics. Other than Geomatics, the University also offers 11 electives based on GIS. Students from any course are free to take up these electives. The students learn the best under the guidance of eminent faculty members and get the best training at the world-class facilities. Popular courses include Urban and Regional Planning, GIS in Remote Sensing, Geomatics and Smart City, GIS for Landscape Architecture and GIS for managers.

Going beyond the routine in GIS training

What makes CEPT stand out is its commitment to keep the students' knowledge updated on the latest innovations in the field. Along with exposure to traditional subjects like remote sensing, GIS, data management and programming languages, the students are taught advanced technologies like Big Data analytics, machine learning, LiDAR etc.

The students are also provided a lot of international exposure. The Centre for Advanced Geomatics conducts a lot of short term training programs, national level symposium and international level seminars. Majority of the students go to the western world for their dissertation or else in ISRO and DRDO.

CEPT and mApp your Way

Esri India's mApp your Way contest is largely enabling students to build their capabilities in GIS technology, and CEPT students enthusiastically participate in the same. At the 2017 User Conference, a group of students of M.Tech (Geomatics), Faculty of Technology won the 1st Runners-Up award in Geospatial Applications Development competition for their application 'CEPTSmart'. This app was developed to support students and administration with solutions related to classroom allocation and complaint system for non-working fixtures within the CEPT campus.

Celebrating GIS Day

To make GIS more popular, the University also celebrates GIS Day every year in the second week of November. GIS, per se, is a subject which people still understand only as mapping. CEPT tries to break that idea through various events on the GIS Day. During the weeklong celebration, industry experts are invited to give lectures on current developments in the field.

Dr. Anjana elaborates, "The day begins at 9 am and ends at late night. Almost 150 students from different universities get together and we first have an introductory lecture on GIS just to increase awareness of students in a very colloquial manner. Various competitions are held. Every year one theme is selected and based on that various competitions are organised. The University also conducts treasure hunt using GPS."

It is evident that through its varied initiatives and association with Esri India, CEPT University is setting the perfect roadmap for other academic institutions as to how to make India more GIS capable.

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