
National Capital Region Geospatial Data Exchange



Requirements Document

Prepared By:

KCI Technologies, Inc.

TechGlobal, Inc.

Touchstone Consulting Group

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1.0 Document Control

1.1 Document Information

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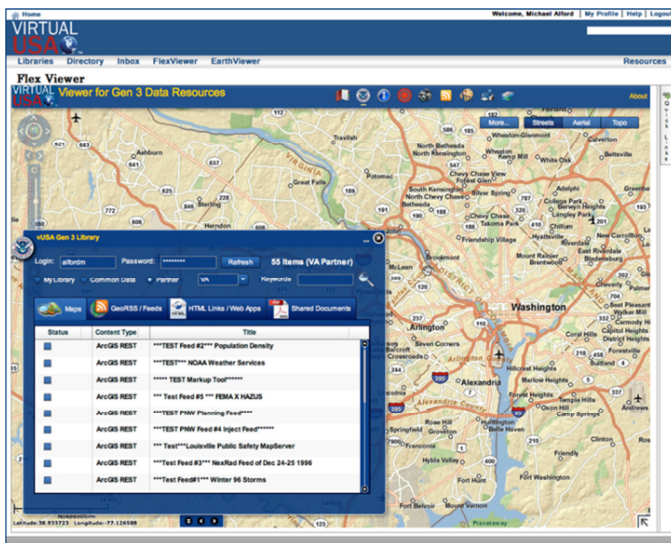
2.0 Introduction

The Metropolitan Washington Council of Government's CIO Committee's Subcommittee for GIS has received a grant from the United States Department of Homeland Security for establishing a **National Capital Region Geospatial Data Exchange (NCR GDE)**.

GIS, public safety and emergency response organizations in the NCR (National Capital Region: VA – DC – MD) have expressed the need to securely and easily share data across jurisdictional boundaries to effectively respond to various events that span the NCR, planned and/or emergency. Accordingly, regional Chief Information Officers and Geographic Information System Managers have agreed a system needs to be implemented that allows managers and responding agencies to collaborate, maintain and share common operating data across the Maryland-Virginia-DC region.

To this end, the purpose of this project is to build a system and procedures that facilitate the secure, flexible and standardized sharing of critical mapped information by all National Capital Region (NCR) partner jurisdictions and agencies. The primary goals of our project are to:

1. Provide access to viewer-independent geospatial information for the NCR;
2. Inventory available data and data gaps;
3. Create a user interface, indexing service and work processes for sharing so states, local jurisdictions, and other NCR partners will be able to submit their geospatial data and services and discover and or be notified what their neighbors have contributed;
4. Promote the use of live web services as a means to discover and consume geospatial data, while supporting more traditional file based data sharing;
5. Become a trusted source of data for existing situational awareness applications (Google DC, INDEX, ISAVE, VIPER, WebEOC, and others), so the jurisdictions can maximize use of existing investments in systems, processes, and training;
6. Develop tools within COTS GIS packages for GIS analysts to quickly publish their datasets to the region. To promote collaboration across jurisdictions and disciplines to share geospatial information;
7. Collaborate to develop a standard memorandum of understanding for sharing;
8. Allow all of the above to be done securely within parameters established by data providers.



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The GIS managers have selected the KCI Associates of DC / PhotoScience joint venture team along with Touchstone Consulting Group and TechGlobal, Inc. The Team brings to the project a working software product called “Virtual USA” that was created by the Department of Homeland Security’s Command, Control, and Interoperability Division. Virtual USA is an open source software platform used in several regions of the country to provide the cost-effective capability for securely and easily sharing user published geospatial data between jurisdictions of all levels of government.

This document provides detailed requirements on the features, modifications and enhancements needed in order to create a comprehensive NCR Geospatial Data Exchange.

2.1 Project Scope

The current scope of work is to design and develop a set of tools to publish and consume data feeds across multiple jurisdictions based on the vUSA platform. The primary task elements that will be performed to accomplish are as follows:

- Conduct 3 Initial Stakeholder Meetings to orient stakeholders to the project, demonstrate the vUSA product and collect feedback on issues, enhancements and new capabilities that are needed for vUSA to support the NCR region.
- Publish meeting notes and Summary Findings resulting from the 3 Initial Stakeholder Meetings.
- Inventory Stakeholder data sources and data needs associated with NCR data sharing
- Publish a Data Inventory Report documenting findings and recommendations
- Document System Requirements resulting from the Initial Stakeholder Meetings and supplement information gathering
- Prepare and document a System Design and design recommendations based on existing vUSA functionality
- Conduct 3 Stakeholder Review Meetings to collect comments and feedback on the System Design
- Develop a Test Plan
- Implement and test the NCR GDE Portal based on the reviewed and accepted System Design. The system components to be implemented are:
 - The NCR GDE software, enhanced and modified per the System Design
 - A Flex widget that enables native, Flex-based systems to access the NCR GDE Portal
 - An ArcGIS Toolbar that enables desktop users to publish data feeds to the NCR GDE Portal
- Conduct 3 Stakeholder Review Meetings to review the implemented system
- Prepare Training Materials and Conduct Training
- Conduct a Project Closeout Meeting and Publish a Project Closeout Document

2.3 Document References

This document should be utilized in conjunction with the following other project related documents:

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- Request for Task Order Proposal – dated December 13, 2010
- KCI Scope of Services – dated January 10, 2011
- Stakeholder Initiation Meeting Notes from May 12, 2011 - dated May 25, 2011
- Stakeholder Initiation Meeting Notes from May 16, 2011 - dated May 25, 2011
- Stakeholder Initiation Meeting Notes from May 19, 2011 – dated May 25, 2011
- Stakeholder Initiation Meeting Summary Findings – dated May 31, 2011

3.0 Existing National Capital Region Environment

Currently, there is no sanctioned system within the NCR environment for data sharing, rather the environment for data sharing is a collection of independent jurisdictions and entities acquiring and publishing data on an as needed basis and in a haphazard manner. The current process in which NCR jurisdictions exchange data involves a myriad of methods including email, FTP and CD/DVD transfer. The issues that surround these methods include:

- Data exchange typically happens in response to an individual's request;
- Emergency real-time data quickly becomes out of date;
- Time latency between a request and the delivery of data to the requestor impacts its usefulness;
- There is no way for the requestor to know if updates have been made to a shared dataset;
- Real-time updating of shared data is just not possible except in a few fringe cases wherein the service is publicly accessible;
- Methods are not available or in place to ensure the security and acknowledged receipt of sensitive data;
- Regional differences in vendor technology, data definition and data standardization compromise the ability to easily use and understand shared data;
- There is no way to know what data is available from other jurisdictions; and
- In current environments, executing data sharing requires technical assistance and is not easily performed by the non-technical individuals who are in need of the data.

3.1 Existing System Environment

Three aspects of the existing environment of NCR participants are relevant to implementing an improved system for sharing data between organizations in the region:

1. The native system environments in use for viewing and managing GIS and emergency response information;
2. The network infrastructure that is in place for supporting regional data sharing;
3. The hardware infrastructure that is in place to support the functioning of a data exchange hub.

3.1.1 Native System Environments

The jurisdictions and organizations participating in the NCR GDE project operate in one to two primary native information system environments: 1) GIS or 2) Public Safety and Emergency Response.

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For participants utilizing GIS, three existing system environments predominate in the NCR region:

- **Web-based Server Systems using ESRI's ArcGIS Server Technology:** the majority of the participants in the project have implemented ESRI's ArcGIS Server software using 9.3+ or the most current 10.0+. ArcGIS Server is a GIS data management platform that leverages standard web technologies to allow GIS data sets to be published as live data feeds accessible as REST end points via the internet.
- **Desktop ESRI ArcGIS Technology:** quite a few of the project participants have not moved into the web-enabled ArcGIS Server environment and are using ESRI desktop software (ArcGIS Desktop), exclusively. In this environment, end-user access to GIS data is accomplished using ArcGIS desktop software that accesses data over a locally managed network or data that is resident on the desktop computer. In this environment, sharing data with an outside organization requires that the dataset be copied and transferred from entity to entity. Recipient's use their ArcGIS Desktop system to view the GIS information on a desktop computer.
- **Regional Data Sharing Systems:** several initiatives have occurred among sub-groups in the NCR region with implemented GIS environments which enable data sharing between some of the NCR participants. To date, these initiatives have been constrained to state jurisdiction borders and provide a partial response to the NCR's data sharing needs. A description of the primary regional GIS systems is provided in Section 3.3 below.

For the NCR participants who operate in the Public Safety and Emergency Response fields a variety of different information system environments are in use:

- **CAD (Computer-Aided-Dispatch) Systems:** most every City and County use CAD systems to manage dispatch and tracking of police, fire and ambulance vehicles. A variety of CAD vendor systems are in place and each uses its own proprietary data format. Some CAD system vendors provide the ability to deliver their CAD data in an open system compliant format (e.g., XML) and only some of these native CAD systems allow data feeds to be published from the system.
- **WebEOC Systems:** WebEOC systems are in use by emergency operations centers in Virginia, Washington D.C. and Maryland. WebEOC is a web-enabled information management center that brings key information together on one portal for decision making.
- **Regional Data Sharing Systems:** the Northern Virginia jurisdictions of Alexandria, Arlington, and Fairfax have implemented a CAD to CAD data exchange hub to enable the sharing of CAD data between participants. Maryland has also implemented a CAD to CAD data exchange which is currently in the acceptance testing phase. Both of these systems enable sharing of CAD data. Descriptions of the CAD to CAD systems are provided in Section 3.3 below.

3.1.2 NCR Network Infrastructure

The NCRnet fiber infrastructure provides dedicated secure bandwidth between the counties and jurisdictions within the NCR. It provides the pipeline in which to deliver the data. It is important to note that at this current time, NCRnet does not have secure access to the Internet so applications or data being deployed strictly on NCRnet would have limited participation. Many entities that are in the region are not on NCRnet, including federal and state agencies as well as partner entities in

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neighboring states. NCRnet does have quite a bit of capacity at this point with minimal use and in the event of the Internet going down; it would be an important failover for NCR members. Additionally, the NCRnet team is working on tasks to configure secure internet access to the network. In fact, the CAD to CAD project hosted by a subset of Virginia stakeholders is configured in this manner. The project team has requested documentation and meetings with the Virginia team to further assess the network configuration, security and integration features of this design.

3.1.3 NCR Hardware Infrastructure

The Maryland Data Exchange Hub INDEX project has invested considerable UASI grant monies in the establishment of robust development and production infrastructures for hosting the INDEX application as well as providing an ArcGIS Server spatial database to host data feeds. The production infrastructure currently resides at Prince George's County while the development environment continues to reside with Lockheed until project completion. The production environment is also on one of the NCRnet nodes. The current system is underutilized and should be further assessed as a possible co-location candidate with the Geospatial Data Exchange project.

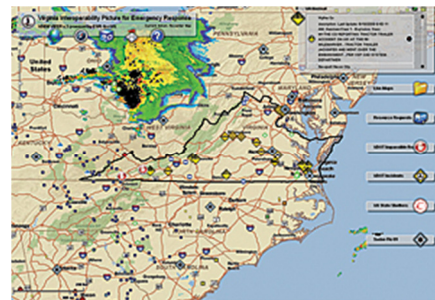
The Virginia CAD2CAD data exchange provides valuable data exchange services between independent CAD packages within the Northern Virginia community. Different from the Maryland implementation, the Virginia CAD2CAD does not have a user interface. The production environment is located at one of Verizon's Smart Centers as a hosted solution which has a secure connection to the NCRnet. Hardware is provided by Verizon from given specifications. The project is currently setting up their test environment at a facility in Manassas which, as previously stated, will consist of both a secure connection to NCRnet as well as to the Internet. This model should be considered for the Geospatial Data Exchange project as access to both NCRnet and the Internet will support the participant community best.

3.2 Regional Data Sharing Initiatives

There are a handful of regional data sharing initiatives already in place as well as common viewer applications being used by state and local emergency responders. The following are brief descriptions of each one with an identification of the technology to provide a basis for assessing interoperability with Virtual USA.

3.2.1 Virginia Interoperability Picture for Emergency Response (VIPER)

VIPER is a web-based mapping tool used by Virginia emergency responders to visually display and assess statewide emergency response operations in real time. VIPER provides access to a variety of GIS layers as well as incorporating live traffic camera feeds, social networking sites and geocoded photographs. It is accessible 24 hours a day, seven days a week in the Virginia Emergency Operations Center and is available to other emergency responders and public safety partners at the local, state and federal levels through authorized logins. The system was built using ArcGIS 9.3, including ArcGIS Server and ArcGIS Desktop software. Data is primarily uploaded to a central data warehouse rather than published as a federated system of independent data providers. ESRI's Flex Viewer was configured to additionally



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monitor environmental sensors and gather data from VDEM's crisis management system and other systems such as the National Weather Service.

3.2.2 NoVA CAD2CAD Exchange

The Virginia CAD2CAD data exchange provides valuable data exchange services between independent fire Computer Aided Dispatch systems within the Northern Virginia community. Different from the Maryland implementation, the exchanged data is available to the dispatcher in the existing CAD user interface. The production environment is located at one of Verizon's Smart Centers as a hosted solution which has a secure connection to the NCRnet. Hardware is provided by Verizon from given specifications. The project operates their test environment at a facility in Manassas which, as previously stated, will consist of both a secure connection to NCRnet as well as to the Internet. This model should be considered for the Geospatial Data Exchange project as access to both NCRnet and the Internet will support the participant community best.

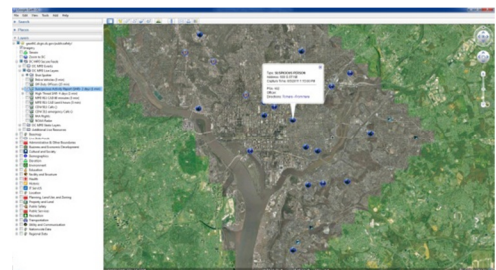
3.2.3 GISData.Virginia.Gov

GISData.Virginia.Gov is Virginia's online portal for discovering and sharing geospatial data and metadata for the Commonwealth. It is a service of the Virginia Geographic Information Network (VGIN), a part of the Virginia Information Technologies Agency (VITA). Data owners from federal, state and local government agencies publish metadata to the portal. Users can then access the publicly available website to search metadata for publicly accessible data. Registered users can view additional metadata that is restricted to specific user groups. A basic map viewer is available to preview datasets which is based on ESRI's ArcIMS technology. VGIN is currently in the process of considering newer technologies to replace the existing viewer.

3.2.4 Google Earth for DC

The District of Columbia has adopted Google Earth Enterprise to deploy to District employees for visualization of the over 400 live and static geospatial layers available from disparate local, state, federal, and utility data sources.

Google Earth Enterprise allows the District to quickly and efficiently display both raster and vector datasets within a 2D or 3D environment inside of the District's firewall on a secure server. There is no dependency on the public internet since it runs completely contained within the District's infrastructure. In addition, Google's 2D maps and Earth Plug-in is utilized for several custom mash-ups produced internally.



GoogleDC provides 5 globes of information strategically developed to meet needs of DC's 87 agencies and is also shared with several local, state and federal agencies such as FBI, USSS, DOJ, and Capitol Police. This system is deployed for routine user and major events in DC, such as the presidential inauguration, state of the union, snow disaster events and is used to support daily operations in several agencies.

The Situational Intelligence Globe is used by the Washington Regional Threat and Analysis Center (WRTAC) to support intelligence activities in the Nation's Capital. Using GoogleDC, WRTAC staff can seamlessly layer data from disparate sources such as the District's 911 Call Center and automated

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systems such as license plate readers and the ShotSpotter gunshot detection system. They can also view road closures during public events, promoting true situational awareness.

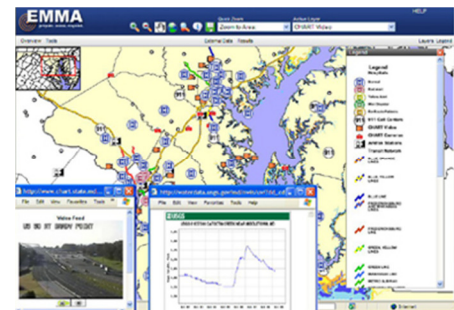
3.2.5 Maryland iMap Portal

Maryland's Internet Map (MD iMap) is an interactive mapping system that provides a variety of products and services to the citizens and government employees in Maryland. It is a centralized collection of the most commonly used map data such as roads, streams, place names, government boundaries, property information and detailed imagery. Much of the data in MD iMap is shared from Maryland state and local government agencies and represents the best data available. Datasets are submitted to the Towson University Center for GIS, site administrator, for inclusion. Datasets are provided in both REST and WMS formats and are cached. Data feeds that are available can be located here: http://www.imap.maryland.gov/portal/docs/MDiMap_Service_Inventory.pdf. MD iMap was built on ESRI's ArcGIS Server platform using ESRI's ArcGIS API for Flex.



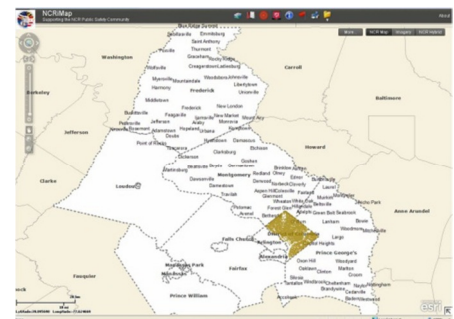
3.2.6 Emergency Management Mapping Application

The Emergency Management Mapping Application (EMMA) enables the Maryland emergency management community to access and display relevant and real-time information on a map before, during and after an incident occurs. EMMA is a secure, web-based GIS application that enables emergency responders to identify incident locations from the field, generate location-specific reports, visualize incident locations via a map, perform site-specific analysis, and coordinate response efforts. EMMA was originally built using ESRI's ArcIMS; however a new release is under development in ESRI's ArcGIS 10 Server environment using ESRI's ArcGIS API for Flex.



3.2.7 Maryland Data Exchange Hub

This initiative was funded under the Public Safety Interoperable Communications (PSIC) grant program with the goal of improving public safety data sharing by developing and delivering a geospatially referenced data exchange to support Frederick County, Montgomery County, Prince George's County, Maryland public safety agencies and their allied partners. The project produced a map viewer that was developed using ESRI's ArcGIS Server with the ArcGIS API for Flex. The data is provided through data feeds being published by the 3 counties. The application is currently going through testing and is expected to be in full production by fall.



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3.2.8 Integrated Situational Awareness Visualization Environment (ISAVE)

ISAVE was developed by the Federal Emergency Management Agency (FEMA) as a situational awareness tool to coordinate homeland security activities for the Office of National Capital Region Coordination. It uses a touch assisted visualization system environment that provides a dynamic User-Defined Operating Picture (UDOP) by combining best of breed GIS technology and the net-centric aggregation of a wide variety of disparate federal, state, local, regional, and private sector data sources. ISAVE consumes Open Geospatial Consortium (OGC) GIS data formats and combines them with real-time data to develop a comprehensive UDOP that includes Alerts and Notifications (20 regional voice and data feeds), Critical Information Management Systems (such as WebEOC and the Homeland Security Information Network), consequence analysis (modeling and simulation), real time data feeds (video, traffic sensors, etc.), collaborative communication, and asset tracking (GPS and RFID).



3.2.9 Multi-Agency Collaboration Environment (MACE)

MACE is an initiative from the Department of Defense's Chief Information Officer created to support information sharing partnerships across the government. MACE offers a range of services to partners confronted with designing, engineering, and deploying next generation technologies.

MACE exposes common technological solutions within and across communities of interest using the eCloud framework. The eCloud is a distributed hardware and software architecture of multiple cloud components communicating with each other over application programming interfaces or web services. For each partner organization and community of interest, the eCloud framework provides flexible and robust to support requirements associated with information, analytical functions, security, and other user-defined requirements. The eCloud framework provides:

- **eBackbone:** Enables secure interoperability of data, services, and applications within and across the enterprise.
- **eWarehouse:** A high-speed data warehousing capability that stores and aggregates data from multiple sources to enable rapid, efficient querying, data analysis and business intelligence.
- **eSearch:** An open source or third-party appliance that indexes structured and unstructured content to enable efficient and accurate search and discovery processes.
- **eViz:** The core front-end suite of tools and applications that enables the user to discover and analyze critical data within and across the enterprise.

4.0 Current vUSA Product

The Virtual USA data exchange system, now at Generation III, was built by the Department of Homeland Security's Science and Technology Office to support state- and regional-level information sharing. Gen III is based on requirements developed under two 2010 pilot programs: the Southeast Regional Operations Platform Pilot (SE ROPP) and Pacific Northwest (PNW) Pilot. Gen IV, targeted for release in August 2011, will be tested in a third DHS pilot program in the summer of 2011 in New England.

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vUSA Gen IV will be the platform on which the NCR Geospatial Data Exchange is built and customized. While Gen IV is under construction, an instance of the existing Gen III platform is being made available to the NCR community for testing and evaluation.

4.1 Product Description

vUSA provides a Web-based, trusted environment and a common space for users to discover and share information in real time. It improves access to GIS and other emergency response information that exist as isolated, information “silos” by providing a secure, trusted space in which users can share actionable information with one another. This mainly occurs in the form of web-enabled data feeds, but vUSA also provides support to free-standing files of all sorts (imagery, office documents, or geospatial information).

vUSA functions as a series of dynamic libraries. Each participating organization—states, Federal agencies, and the private sector—decides what information they want to post in their own library and with whom they want to share it. Common information is shared among all users, but more sensitive information can be made available only to a subset of users (i.e., those with specific roles in specific partner organizations), at the discretion of the data owner. When users consult the various partner libraries, they see only the information the data owner has enabled them to see. Standard functionality of vUSA includes the following functional categories:

4.1.1 Administer Users

Users designated as administrators have access to an Administration page where they can add new users to the portal by designating the following information:

- Login name
- Password
- Name
- Jurisdiction
- Organization
- Email address
- Role(s)
- Indicator on whether user should be an administrator

Once the user has been added to the system, they can access the vUSA portal and additional information to their profile. Administrators are also able to post announcements to the vUSA portal page announcement section.

4.1.2 Manage User Profile

Each user has the ability to edit their own personal profile page which displays the user’s current assigned organization, jurisdiction and roles as well as allow the user to enter their own description, photo, email, phone / social networking contact information and elect whether to receive alerts by email. In addition, users can designate specific criteria under which they will receive notifications. Notification criteria include:

- Emergency Support Functional Areas
- Event Type or Name
- Counties/Cities
- Agencies

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- Keywords
- Roles

Once the user sets these criteria, they will receive a notification message any time a dataset is published that meets the stated criteria.

4.1.3 Browse Member Directory

The user directory provides a single location to view all current members along with their organization, jurisdiction, phone, cell phone and email information. Users can search for specific members using any of these fields as well as sort on these fields. This is useful to help the community of members become familiar with each other's expertise and technical specialties.

4.1.4 Member Chat

Once a member is logged into the Chat window, they will be able to chat with any other logged in chat members. This could be useful during an emergency in order to coordinate data exchange and communicate directly through the vUSA portal.

4.1.5 Explore Partner Libraries

The system provides a suite of partner libraries, one for each participating organization, plus a common library of general resources, to which authenticated members can post data links and upload data files of all types—geospatial data such as Shape files or KML / KMZ files, plus any other non-geofile type—PDFs, Word documents, Excel sheets, or HTML pages. The system shares these links and files using role, entity, and time-based security. All shared data can be targeted to specific staff roles, within specific entities, and for defined time periods. After the elapsed period, links are removed from libraries and downloadable files are erased from the common holding cache.

4.1.6 Publish/ Post Data

There are three methods in which to post data including posting a live data feed, uploading a stand-alone file and automatic data feed posting. All links or uploads are managed by the Virtual USA Content Broker at the core node. The core node is the centralized node of vUSA which manages all incoming requests from the portal user interface.

Manual Publishing

The system provides the capability of publishing data links of many supported types including ArcGIS REST Map Services, GEO RSS, XML, RSS, ATOM, HTML, PDF and all Microsoft Office document formats. Currently, KML/KMZ is partially supported with development efforts to make this fully supported very soon.

The system shares these links using role, entity, and time-based security. All shared data can be targeted to specific staff roles, within specific entities, and for defined time periods. After the elapsed period, links are removed from libraries and downloadable files are erased from the common holding cache.

During the posting process, users are asked to specify a minimum set of metadata including:

- Link address, data title, description and link type such as RSS, XML REST, WMS, etc.

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- Optionally, users can also provide data type categories, keywords, and technical processing methods.
- Date of last update and update frequency. Availability date range is another option available.
- Point of contact information. The contact person posted with each link is available to answer technical questions about the information.
- Technical methods (optional).

Once the metadata is entered, the user can specify whom to share the data link with including specifying role(s) and organization(s). Optionally the publisher can create an alert message to be sent to selected entities once the link is posted.

Manual Upload of Stand Alone Files

For data that is not available through a data feed, vUSA offers the ability to upload a static file into the cache for stand-alone file sharing. This could be useful for large files such as aerial images, or smaller, static documents and zipped files. Once the file is uploaded to the vUSA cache, access to the file is managed through the vUSA core node. The user is prompted to enter the same metadata and sharing preferences as for the live data links described above.

Automated Publishing Using GFE

GFE (GeoFusion for Enterprise) is an optional component that allows live data feeds to be published more easily and faster. GFE allows the user to establish a direct connection between the vUSA core and their home servers. GFE creates a separate interface on the vUSA Core that provides access to the entire collection of links on one or more connected servers. In contrast to vUSA's method for manually publishing data feeds, GFE expedites the process by:

- Automatically harvesting descriptive data about the link from the server (which with the manual publishing method must be enter by the user as a precursor to publishing)
- Allowing the user to pre-define different groupings of organizations to be given access to the published data so that "share groups" can be selected with a single click.
- Allowing multiple data publishing links and different share groups to be selected in seconds.

GFE connects to one or more servers behind the partner's firewall via a secured open port and interacts through the firewall with the vUSA core. All links available on the server(s) can be individually published through vUSA just as manually published links are, using role, entity, and time-based security. Automated sharing offers increased security, one-click publishing, and continuous metadata harvesting, meaning that links appearing in libraries always carry the most current metadata available from the home server.

vUSA is a true federated architecture by design which allows for complete business independence of its constituents in a decentralized manner. vUSA has effectively aligned the needs of the platform with needs to the data owners. As it should be, ownership, control and currency of the data is left in the hands of the owner.

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4.1.7 Send Alerts

vUSA provides the ability to send alert messages to members upon the publication of a data source that might be of interest to them because of their geographic footprint or role. Alerts give a publisher the option to “push” out information to selected participants. This is accomplished by giving the publisher the ability to send all or part of the recipient community an e-mail message telling them that data is being published and why they should be aware of it.

Posted alerts are visible on the user’s home page each time she logs-in. From the lists, the user can then transfer newly published data links to their “My Library” as needed, without having to go to the library of the participant who posted the alert.

4.1.8 Notifications

Notifications, in contrast to alerts, allow a user to “pull” information from other users. By setting personal preferences, the user can define what types and sources of information she is interested in (e.g., data of certain types, data with specific keywords or categories, specific organizations, and/or specific roles).

Each time the user logs-in, notifications responding to the user’s defined notification preferences are posted to that user’s home page. From the lists, the user can then transfer newly published data links to their “My Library” as needed, without having to go, one-by-one, to the libraries of the participants who posted data of interest.

4.1.9 Flex Widget

Presently, vUSA’s libraries can be accessed in two ways: directly accessing the vUSA portal or via a custom Flex Widget from within native state and local information systems that enable map visualization using the Adobe Flex Library Widget. This Widget is distributed by vUSA and can be incorporated into any existing ESRI/Flex application. Once incorporated, the Flex Widget provides access to the various vUSA libraries and allows the vUSA data links to be visualized from within the user’s native system. Additional widgets will be available in the near future for Silverlight, JavaScript, and Google-based visualization systems.

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4.2 System Architecture

Figure 4.1 presents a diagram of the vUSA system architecture, showing the components associated with the application layer, the data layer and the presentation layer of the vUSA framework.

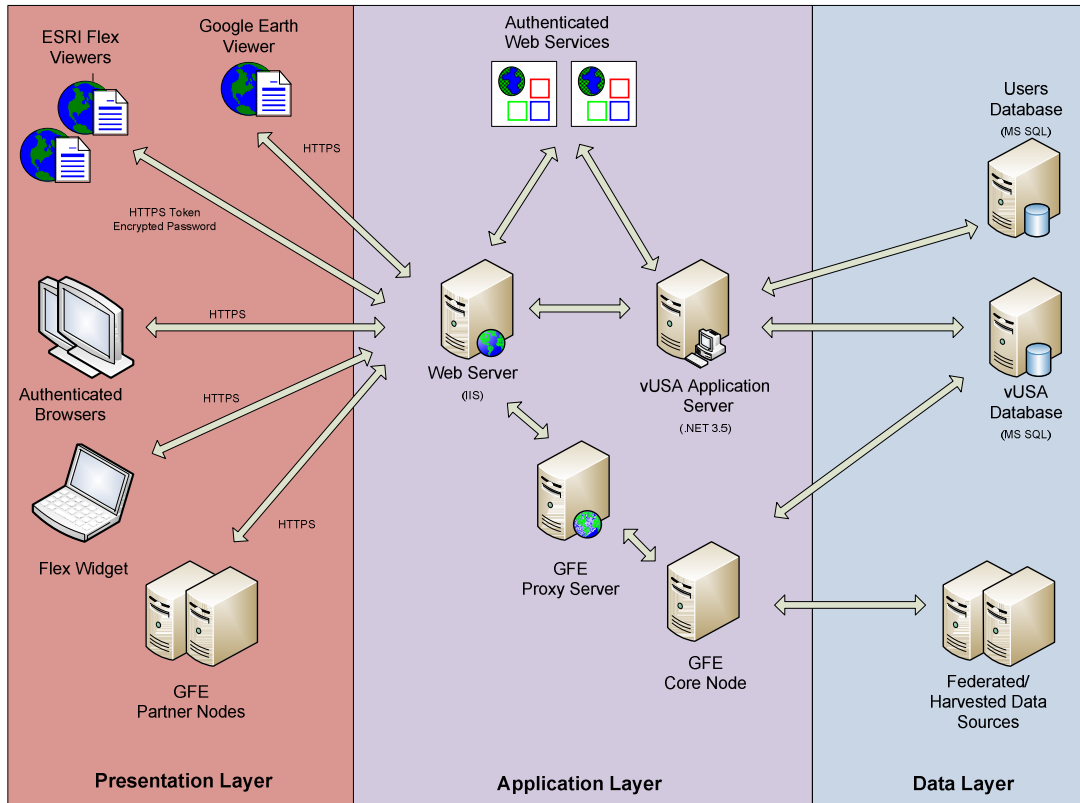


Figure 4.1: vUSA Generalized Architecture

vUSA's architecture delivers data security by assigning URL proxies to each participant's posted data feed (GFE Proxy Server). Manually-posted links are encrypted using an `https://vusa.us` domain mask, thereby requiring that all access to the data feed be routed through the vUSA server which in turn must find valid user credentials to publish the data feed. Automated postings via the GFE package add a second level of proxy at the participant's firewall. This ensures that all access to the partner servers must originate from the vUSA domain, and that no contributing server is directly exposed to the open internet. All traffic is routed through the vUSA servers and client GFE Proxy Server over a secured channel.

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The following table shows the specific technologies that vUSA is built upon:

Component	Software	Version
Web Application	Adobe Flex	4.0
	ArcGIS API for Flex	2.2
Web Services Layer	J2EE	
Database	MS SQL Server	
Environment	Microsoft .NET Framework	4.0
Server	Server 2008 Operating System, 64-Bit	2008
	IIS	7.0

Table 1 - vUSA Software Components

4.3 Planned Enhancements

Based on feedback from current vUSA users, vUSA Generation IV will include the following enhancements to the existing system described above.

- Partner entity types will expand from state/federal agency/private corporation to include Tribes and Special Purpose Entities (to enable support for organization types that do not fit into the four defined organization types).
- Partner entities will become hierarchical, allowing optional sub-entities such as counties and cities under states, regions under Federal Agencies, and so forth. Under this “open configuration,” entities will be free to design their internal structures to suit themselves.
- Any number of agencies, departments, or other sub-groups can be optionally added to any entity or its sub-entities.
- Roles will change from the current Executive, Security, Emergency Management and Contractor roles to:
 - Executive (agency heads, incident commanders)
 - General Operations
 - IT/GIS (technical staff)
 - Law Enforcement
 - Read-only (a low-access general category that cannot post data)
- Sharing will become fully “granular,” allowing organization-to-organization sharing at any level.
- Data can be optionally tagged as “law enforcement sensitive,” and to access this information users will have to be assigned to the “law enforcement” role.
- Frequently-used sharing combinations can be saved as pre-sets to speed up future postings for both manual and GFE automated shares.
- vUSA Administration will be expanded so that each organization can assign an administrator to set and manage the organization’s vUSA users and user privileges.

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- Users will be able to see (but not use) data in libraries to which they do not have access. They will be able to request access by sending the publisher an email. The data publisher will have the additional ability to turn on or off whether their published data can be seen by other participants.
- Data can be optionally metered so the provider can see how often it is used, and who is using it.
- The higher security offered by GFE automated sharing of links can be selectively relaxed on request to permit freer access to contributing servers to allow more extensive analysis of the shared data.

5.0 Proposed Environment

The proposed environment for the NCR Geospatial Data Exchange system will utilize:

- The **NCR GDE Portal**: the NCR GDE Portal will be created using the vUSA Generation 4 software platform with enhancements that respond to NCR-specific requirements.
- A **Flex Widget**: the Flex Widget will allow participants using Flex-based technology (for native ESRI GIS or other systems) to access the NCR-vUSA portal.
- An **ArcGIS Desktop Toolbar**: an ArcGIS Desktop Toolbar will be created for use by participants who rely on ESRI GIS desktop software (as opposed to ArcGIS Server web technology). The toolbar will enable access from the ESRI Desktop software environment to the NCR GDE portal for the publishing of data.

Stakeholder requirements for the proposed environment were gathered from Stakeholder feedback recorded during three Initial Stakeholder Meetings conducted on May 12th, 16th and 19th. This section documents the requirements associated with each component of the proposed environment. The KCI Team has defined the following requirement “Types” and type codes to organize and track the requirements associated with each component:

- User Interface
 - UI
- System Integration
 - SI-Integration
 - SI-Access
 - SI-Hosting
- Data Publishing
 - DP-Content
 - DP-Metadata
 - DP-Base
- Security
 - Security
- Data Consumption
 - DC-Search
 - DC-Notify
- Use/Access Monitoring

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- Monitoring
- Sustainability / Fail-over
 - Fail-over

5.1 NCR GDE Portal Requirements

5.1.1 Requirements

Req. ID	Type	Req. Description
5.1.1	UI	Must be easy to use and provide the user with the ability to publish and consume data without executing a complicated, multi-step data sharing setup for exchange of information.
5.1.2	UI	Provide a unified log-in procedure that avoids a cumbersome process for logging in or requires multiple logins to access or publish information.
5.1.3	Integration	Must be accessible from within native, primary-use systems (e.g., VIPER, WebEOC, EMMA, etc.)
5.1.4	Integration	Native systems that serve as a data source to the NCR GDE Portal must be able to publish a web-accessible data feed provided as a URL link and the data must be provided in an open systems data format (i.e., not in a native vendor format).
5.1.5	Integration	NCR Participants who do not possess the ability to publish web-accessible data feeds need to be provided an ability to make their data accessible through services provided by the NCR GDE portal or a service provided through a third-party.
5.1.6	SI-Access	NCRnet will serve as one of the delivery backbones for vUSA users.
5.1.7	SI-Access	The NCR GDE portal will also be accessible over the public Internet for members not having access to NCRnet.
5.1.8	SI-Hosting	<p>The minimum server requirements for hosting NCR GDE are:</p> <ul style="list-style-type: none"> ▪ CPU: Intel® Xeon® E5503, 2.0Ghz, 4M Cache, 800MHz Max Mem ▪ RAM: 8GB Memory (8x1GB), 1333MHz Single Ranked UDIMMs for 2 Processors, Optimized ▪ DISK SPACE and RAID: 146GB 15K RPM Serial-Attach SCSI 3Gbps 3.5in Hotplug Hard Drive, RAID 5 for PERC6i/H700 Controllers ▪ OPERATING SYSTEM SW: .NET3.5/IIS ▪ RDBMS SW: MS SQL Server ▪ Other SW: GFE package (custom)

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Req. ID	Type	Req. Description
5.1.9	DP-Content	<p>Portal needs to support an ability to publish and consume information from multiple information systems: GIS, CAD2CAD, WebEOC, real-time sensors, static documents and potentially video and voice.</p> <p>For publishing: information systems will need to support the ability to web-publish data and to publish the data in a supported, generic data format.</p> <p>For consuming: information systems will need to support access using plug-in access widgets developed in Flex, Google or Silverlight.</p>
5.1.10	DP-Content	Need a standardized method and ability to label, classify, assign key words and possibly assign an incident label or name to data that is being published.
5.1.11	DP-Content	The NCR GDE needs to provide the ability to name an event and allow data feeds to be exclusively associated with the event.
5.1.12	DP-Content Security	The CAD (computer aided dispatch) data that cannot be shared and the data of interest to NCR participants needs to be defined and a system for filtering the provision of CAD data needs to be established
5.1.13	DP-Content Metadata	A method or strategy needs to be implemented for de-conflicting data redundancy and identifying/determining authoritative authorship to assist with minimizing redundant data
5.1.14	DP-Metadata	The NCR GDE needs to support the documentation of any data feed's coordinate referencing information (geoid, projection, coordinate system).
5.1.15	DP-Base	The information and data source(s) for a common NCR basemap needs to be defined.
5.1.16	DP-Base	A geo-referencing standard needs to be defined for the NCR basemap and then the basemap needs to be conformed to the standard.
5.1.17	Security	Must provide an effective, reliable security control for the publication of sensitive information that limits access to only properly authorized recipients.
5.1.18	Security	The NCR GDE portal needs to provide and support the classification and labeling of data to be published in a manner that adequately defines the sensitivity of the information.
5.1.19	Security	The NCR GDE portal needs to provide and support the definition and administration of user-access privilege categories consistent with the levels of defined information sensitivity.
5.1.20	Security	The NCR GDE portal needs to provide and support the ability to administer and assign access privilege categories to individual users or to roles that are then assigned to users.
5.1.21	Security	The NCR GDE portal needs to use the HTTP/S protocol.

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Req. ID	Type	Req. Description
5.1.22	Security	For certain named events (“special events”), the NCR GDE needs to provide tools that allow an Administrator to be assigned to the event and that allow the Administrator to restrict access to data feeds published for the special event to a list of authorized users.
5.1.23	Security	The NCR GDE needs to either directly use the Virginia CIO’s security level definitions or fully support and defend how the VA security levels are accommodated in the NCR GDE role model.
5.1.24	Security	The portal will be “LDAP Ready” in terms of being able to integrate LDAP security at a later date. A separate identity management initiative is starting in the NCR region to formulate this goal.
5.1.25	DC-Search	Need to provide an ability to search for data that is or might be available from NCR participants.
5.1.26	DC-Search	Users should have the ability to see, search and sort currently published data feeds by information category or key words.
5.1.27	DC-Search	Users should have the ability to retrieve information related to a published data feed that allows the user to evaluate the information content of the feed and to see the ‘owners’ contact information so the user can contact the owner, request access, or get additional information about the published data.
5.1.28	DC-Search	Users should have the ability to search by information category or key word for information that was historically published with the ability to learn more about the previously published data and to retrieve ‘owner’ contact information.
5.1.29	DC-Notify	Users should have an ability to post (open broadcast) a search request that can be seen and responded to by other participants.
5.1.30	DC-Notify	The system should support an ability to broadcast an alert to all participants.
5.1.31	DC-Notify	The NCR GDE needs to provide a default time limit for published data sets (e.g., 30 days) if it has not been specified by the user and an automatically generated email notice sent to the publisher with a button to renew the link for another 30 days or cancel the link.
5.1.32	Monitoring	Need to provide an ability to monitor and report participant access to an entity’s published data.
5.1.33	Monitoring	Monitoring and reporting should allow the identification of who accessed the published data and how long the data was accessed.
5.1.34	Fail-over	The system needs to provide for fail-over support in the event that electrical or network outage occurs and compromises the portal’s ability to support data publishing and consumption.

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5.1.2 Assumptions / Constraints

1. GIS participants will have ArcGIS Server 9.3 or above to publish data feeds.
2. WebEOC participants will publish data feeds in an XML or other open systems data format supported by vUSA.
3. CAD2CAD participants will publish data feeds in an XML or other open systems data format supported by vUSA.
4. CAD2CAD systems will publish data feeds ‘filtered’ to publish only non-sensitive and relevant data to vUSA participants.
5. Participants will individually abide by the general data sharing rules laid out in the national memorandum of agreement laid out by vUSA. The current draft, to be accepted individually by new users on first log-in, defines these as:

“As a user of the vUSA information-sharing capability, I agree to:

1. Share only data for which my entity, [auto populate user entity], is the authoritative source or for which I can attest to the authority of the source, to the extent possible;
2. Maintain the security of the data by not sharing data with third parties, except for incident response and/or planning;
3. Share web-enabled feeds rather than static files, to the extent possible; and
4. Abide by all other terms and conditions of the vUSA National Agreement.”

5.2 Flex Widget Requirements

Widgets provide interoperability between the vUSA data sharing platform and Flex viewers such as VIPER, INDEX and MDiMap. They are for the management of web feeds only; they do not access or display static files in the vUSA cache, although they can display documents such as PDFs that are available online. There is currently one such widget available: the vUSA Library widget, which at present provides access to all libraries (My Library, the Partner Library, and the Common library) but does not currently allow transfer of links into or out of My Library, does not include Alerts and Notifications or the Directory, and does not manage links using GFE. In addition, the current widget displays only GeoRSS and ArcGIS REST links.

vUSA is upgrading the widget to provide for the display of KML and WMS links.

5.2.1 Requirements

Req. ID	Req. Description
5.2.1	Add the ability to access WebEOC feeds to the Library widget.
5.2.2	Add existing Planning (live white boarding) widget and emerging WebEOC widget to the Resources pages.
5.2.3	Add Alerts and Notifications.
5.2.4	Add Member Directory.
5.2.5	Add the ability to add/remove data links in My Library
5.2.6	Add KML and WMS link formats.

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5.2.2 Assumptions / Constraints

1. Users accessing the NCR GDE through the Flex Widget are authorized vUSA users.
2. Users installing widgets in home viewers also install (if they have not done so already) the required ESRI proxy server, or connect to a proxy server provided by NCR.

5.3 Google Earth Enterprise API Requirements

The District of Columbia uses Google Earth Enterprise primarily for viewing and data mapping. A component similar to the functionality of the Flex widget could be developed for use by DC to access the vUSA portal.

The vUSA team has developed a Google Earth Enterprise plug-in based client for use in standard browsers. This would be the logical route for expanding functionality for Google-based viewers, since the GFE client cannot be extended. This interface is owned by EPA but can be made available to NCR users. Since the vUSA core provides web services for use by any remote applet such as the Flex Library widget, the same services could connect to the Google browser plug-in.

5.3.1 Requirements

Req. ID	Req. Description
5.3.1	Provide a working version of the existing EPA Google browser plug-in for review to the project steering committee to evaluate.

5.3.2 Assumptions / Constraints

1. The members have adequate Google Earth Enterprise licensing in place.
2. The use case for this solution requires discussion: the plug-in solution could be used by selected in addition to the GFE client or it could be more widely deployed as a standard option.

5.4 ArcGIS Desktop Toolbar

Two separate tools will be designed and developed for the ArcGIS Desktop environment which will allow the user to publish a dataset to the NCR GDE and remove a data link from NCR GDE publication.

The tool to publish to the NCR GDE portal will package and ship a MXD/MXT with associated data files to the NCR GDE portal environment and create an ArcGIS Server data feed inside a jurisdictional file geodatabase. The user will then use the vUSA portal to publish the link through the standard work flow. See Use Case 2.0 for a more detailed workflow.

The tool to remove an existing data link will provide quick access to the user's published data links in order to remove them from publication. See Use Case 3.0 for a more detailed workflow.

The specific requirements as understood from the original RFTOP are listed in the next section.

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5.4.1 Requirements

Req. ID	UC ID	Req. Description
5.4.1	2.0	Capability to publish an existing shapefile, file geodatabase or personal geodatabase from a local system to the NCR GDE server for publication.
5.4.2	2.0	During the publish process, capture all of the same metadata required during a typical NCR GDE posting process.
5.4.3	2.0	Retain metadata captured in user's form for the next publication in order to minimize the information the user needs to enter.
5.4.4	2.0	Ensure that appropriate alerts/notifications happen according to user preferences.
5.4.5	3.0	Capability to remove a published data source from further access on the NCR GDE.
5.4.6		The functionality needs to work within both ArcGIS 9.3.1 and 10.1 desktop environments.

5.4.2 Assumptions / Constraints

1. Users will have adequate ESRI ArcGIS Desktop licensing.
2. Users will have Internet or NCRnet access.
3. Users will have a valid NCR GDE user profile.

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6.0 Approval

The signatures below indicate review and acceptance of the NCR Geospatial Data Exchange Requirements document, and will initiate the development and implementation of the solution by the KCI team. Any additional requirements identified that are outside of the defined scope as detailed in the Requirements document will be managed and using a change management process to ensure proper analysis and design steps are executed.



Mr. Robert Horne
Project Manager / NCR Geospatial Data Exchange
District of Columbia Office of Chief Technology Officer

2 August 2011

Date

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Appendix A

Use cases are used to describe the expected system behavior from a user point of view including expected input and outputs of the system. Use cases are used by the system architect to understand the expected user interaction through detailed scenario-driven threads through the functional requirements. Individual use cases are identified using the functional requirements. In addition to the expected user work flow, the use case identifies pre-conditions, expected users of the function, post conditions, functional requirement(s) that are being fulfilled, primary workflow and alternate workflows that are possible.

Each Use Case will be described in a table formatted according to the following:

Item	Detail
UC Name	Name of the Use Case
UC Identifier	Unique identifier of the Use Case
Requirement ID	Unique identifier of the requirements that this Use Case will fulfill
Description	Description of the Use Case
Pre-Conditions	Conditions that must exist prior to executing the Use Case
Post-Conditions	Conditions that will exist subsequent to executing the Use Case
Trigger / Actors	Triggers: The action that initiates the Use Case Actors: Users or systems that will participate in the Use Case
Primary Workflow	The primary business process for the Use Case
Secondary Workflow	The secondary business process for the Use Case

Use Cases Index

Use Case ID	Use Case Description
UC 1.0	Login to NCR GDE
UC 2.0	Upload Spatial File to NCR GDE
UC 3.0	Remove Data Link from NCR GDE

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Use Case 1.0 – Login to NCR GDE

Item	Detail
UC Name	<i>Login to NCR GDE</i>
UC Identifier	<i>UC 1.0</i>
Requirement ID	
Description	<i>The user logs into the NCR GDE portal in order to access additional publication tools.</i>
Pre-Conditions	<ul style="list-style-type: none"> • <i>The user must be in ArcGIS Desktop with the NCR Toolbar accessible.</i> • <i>The user must also already have an existing NCR GDE user profile.</i> • <i>The user must have Internet or NCRnet access.</i>
Post-Conditions	<i>The user is successfully logged into NCR GDE and the PUBLISH and REMOVE tools become active.</i>
Actors	<ul style="list-style-type: none"> • <i>Data Creator</i>
Primary Workflow	<p><i>The primary business process for the Use Case is as follows:</i></p> <ol style="list-style-type: none"> <i>1. The User selects the “Login” tool from the NCR Toolbar.</i> <i>2. The System displays a form to input user name, password and domain (option for LDAP users).</i> <i>3. The User enters the information and submits to the System.</i> <i>4. The System passes the login information to the NCR GDE portal for authentication. [Alternate Scenario A]</i> <i>5. The NCR GDE Portal performs authentication.</i> <i>6. The System notifies the user of successful authentication. [Alternate Scenario B]</i> <i>7. The System activates the PUBLISH and REMOVE tools on the toolbar.</i>
Alternate Scenario(s)	<p><i>Alternate Scenario A – User enters a LDAP domain.</i></p> <ol style="list-style-type: none"> <i>1. If a domain is entered, the System passes the login information to the user’s specified LDAP for authentication.</i> <i>2. The user is authenticated. [Alternate Scenario B]</i> <i>3. The process returns to Step 5 to authenticate active vUSA user profile.</i> <p><i>Alternate Scenario B – System does not authenticate user.</i></p> <ol style="list-style-type: none"> <i>1. The System notifies the user that they were not able to be authenticated.</i> <i>2. The process ends.</i>

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Use Case 2.0 – Publish Data Feed on NCR GDE ArcGIS Cloud

Item	Detail
UC Name	<i>Publish Data Feed on NCR GDE ArcGIS Cloud</i>
UC Identifier	<i>UC 2.0</i>
Requirement ID	<i>5.4.1, 5.4.2, 5.4.3, 5.4.4, 5.4.6</i>
Description	<i>The user is able to publish a data feed to the NCR GDE Cloud either because they don't have the capability to publish data feeds or just need to publish expeditiously.</i>
Pre-Conditions	<ul style="list-style-type: none"> • <i>The User must be in ArcGIS Desktop with the NCR Toolbar accessible.</i> • <i>The User must have successfully logged into the NCR GDE system using the LOGIN tool on the NCR Toolbar.</i> • <i>The User must have Internet or NCRnet access.</i> • <i>The spatial data to be published must be a vector feature class(es), which can include standard labeling/annotations.</i> • <i>A named MXD/MXT file must exist that contains the spatial data to be published.</i> • <i>All feature class layers in the MXD will be published.</i>
Post-Conditions	<i>The user is able to verify the dataset is being published by viewing it in the "My Uploads" library on the vUSA portal.</i>
Actors	<ul style="list-style-type: none"> • <i>Data Creator</i>
Primary Workflow	<p><i>The primary business process for the Use Case is as follows:</i></p> <ol style="list-style-type: none"> 1. <i>The User selects the "Publish" tool from the NCR interface.</i> 2. <i>The System displays a form to input the following:</i> <ol style="list-style-type: none"> a. <i>Data layers to include</i> b. <i>Map service name</i> c. <i>Map extent of data</i> 3. <i>The User submits the information to the System.</i> 4. <i>The System performs validation checks on the MXD/MXT and referenced feature layers.</i> 5. <i>Upon successful validation, the System packages the MXD/MXT and data files into a ZIP or RAR file. [Alternate Scenario A]</i> 6. <i>The System uploads the ZIP or RAR file to a file server location within the NCR GDE portal environment.</i> 7. <i>The NCR GDE portal environment unpacks the ZIP or RAR file and creates a data feed using the NCR GDE ArcGIS Cloud environment. [Alternate Scenario B]</i> 8. <i>The System reports to the User that the data has been successfully published.</i> 9. <i>The System opens a browser window to the NCR GDE portal.</i> 10. <i>The User logs in to the NCR GDE portal.</i> 11. <i>The User navigates to the GFE Catalog Viewer section.</i> 12. <i>The GFE Catalog Viewer section displays existing data feeds from the NCR GDE ArcGIS Cloud environment that are published for the User's jurisdiction.</i>

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Alternate Scenario(s)	<ol style="list-style-type: none">13. <i>The User selects the data feed to post in NCR GDE.</i>14. <i>Optionally, the User edits the default link information and sharing preferences.</i>15. <i>Once posted, the System issues the appropriate alerts and notifications.</i>16. <i>The process ends.</i> <p><i>Alternate Scenario A – The validation checks fail.</i></p> <ol style="list-style-type: none">1. <i>The System notifies the user that the MXD/MXT and/or data files did not pass the validation checks.</i>2. <i>The process ends.</i> <p><i>Alternate Scenario B – The creation of a data feed fails.</i></p> <ol style="list-style-type: none">1. <i>The System notifies the user that the data feed was not successfully created.</i>2. <i>The process ends.</i>
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Use Case 3.0 – Remove Data Link from NCR GDE

Item	Detail
UC Name	<i>Remove Data Link from NCR GDE</i>
UC Identifier	<i>UC 3.0</i>
Requirement ID	<i>5.4.5, 5.4.6</i>
Description	<i>The user is able to remove a dataset from publication on NCR GDE.</i>
Pre-Conditions	<ul style="list-style-type: none"> • <i>The User must be in ArcGIS Desktop with the NCR interface accessible.</i> • <i>The User must have successfully logged into the NCR GDE portal using the LOGIN tool on the NCR Toolbar.</i> • <i>The User must have Internet or NCRnet capability.</i>
Post-Conditions	<i>The user is able to verify the dataset is no longer being published and can verify that it no longer exists in the “My Uploads” library on the NCR GDE portal.</i>
Actors	<ul style="list-style-type: none"> • <i>Data Creator</i>
Primary Workflow	<p><i>The primary business process for the Use Case is as follows:</i></p> <ol style="list-style-type: none"> <i>1. The User selects the “Remove” tool from the NCR Toolbar.</i> <i>2. The System opens a browser window to the NCR GDE portal.</i> <i>3. The User logs in to the NCR GDE portal.</i> <i>4. The User navigates to the “My Uploads” section.</i> <i>5. The User selects the data feed to remove from publication.</i> <i>6. The process ends.</i>
Alternate Scenario(s)	