NCTCOG Application Environment Criteria

This document is designed to describe technical specifications pertaining to database support, web content and applications, and GIS data and applications adhered to by the Research and Information Services (RIS) Department at the North Central Texas Council of Governments (NCTCOG) and any external contractors/vendors. When considering a particular technology, the project team should consider the level of support from the vendor and/or web community as well as how well the application will integrate with other technologies such as SQL Server, ASP.NET, etc. These practices and standards should be considered when the technology under consideration will reside on NCTCOG infrastructure and/or operational support will fall to NCTCOG staff at some point in the future. Although an application may run in the NCTCOG environment, RIS may not have the expertise or resources to maintain and/or enhance the application in-house. Technology choices and the decision to host and/or maintain an application in-house or externally should be carefully considered by the project team and consulted with RIS, as these can have a large impact on long-term maintenance costs and usability.

Application Development Practices

The following practices should be considered with any application.

- Exception handling should be used to catch any errors that may occur during the code execution. Any error messages should be user-friendly and not the default error messages used by developers to debug issues.

- Applications that produce programming code for NCTCOG to inherit must include comments in the source code to describe each significant function, subroutine, or event.

- Consultants will meet with NCTCOG Research and Information Department prior to beginning application development to review the functional as well as the technical design of the application.

- An agreed upon testing plan will be in place. All code should be unit tested prior to RIS/customer UAT. Vendor is required to perform UAT testing in the actual Dev/Prod environments PRIOR to RIS/customer testing.

- The final deployment of the application includes setup and testing on the NCTCOG systems. This also includes any knowledge transfer from technical documentation for the user to technical training. The time and cost of this knowledge transfer can be significant and can vary greatly depending on the complexity of the application and the level of in-house expertise.

- Unless it is agreed to up-front that RIS will take over maintenance and support after the application is developed, the developer is responsible for the maintenance of the application, including but not limited to user training, bug fixing and changes due to any system/software enhancement.

- For applications that use third party libraries and frameworks, documentation must be provided that covers their use and that provide instructions for upgrading them to newer versions in the future.
All code will have (at a minimum) daily commits to the NCTCOG Microsoft DevOps GIT repository.

Database Support

Applications will be built upon currently supported Microsoft SQL. (Currently MS SQL 2016/2019 of fully MS supported Azure SQL (no Azure Betas or RCs). ***Always verify current RIS supported version with RIS PRIOR to beginning development.) NCTCOG reserves the right to refuse any applications that demand Microsoft SQL resources beyond which capacity is available. Specific applications may use the current version of Microsoft Access supported by RIS, as long as they are not web-enabled or require simultaneous access for a significant number of users read and manipulate the data. NCTCOG only supports enterprise data access through its web site through Microsoft SQL.

The following methods of connectivity to databases are acceptable:

- Web interfaces (ASP.NET)
- Application software programmed to link directly to databases
- Microsoft Access links through file DSN. Storing named ODBC connections on users’ workstations is discouraged.

NCTCOG encourages all applications to provide their own automated means of self-cleaning and managing. Any customized procedures, triggers, or reports that are expected to be assumed by NCTCOG staff must be documented and described in detail. Expected time and risk expectations must be provided. Monitoring tools must follow the guidelines of development for software applications, and not be developed in languages or operating systems that NCTCOG does not support.

Database Specifications

- Current version of Microsoft SQL Server. (Currently MS SQL 2016/2019 of fully MS supported Azure SQL (no Azure Betas or RCs). ***Always verify current RIS supported version with RIS PRIOR to beginning development.) The use of a Microsoft Access database with a web application is not allowed.
- Field names must have no spaces and must start with a character. Hyphens are not allowed in field names, but underscores are acceptable.
- The following naming conventions are encouraged whenever possible (some exceptions may apply…contact RIS for proposed changes):
  - Views - vw_view_name
  - Stored Procedures – usp_stored_procedure_name
  - Functions – fn_function_name
  - Tables – tbl_table_name This is optional if the other non-table object types are appropriately prefixed.
- Application should utilize stored procedures for processor-intensive operations as much as possible to reduce Web server load. (Notify RIS prior to development of any proposed stored procedure usage to avoid negative impacts to the NCTCOG enterprise SQL environment.) Applications that query or process data from databases must specify how much data processing load is expected to impact the SQL server environment and how much is expected to impact the web server.
environment. RIS must approve all application impacts to both of these environments.

- Any aliases should be indicated with a comment near the top of the stored procedure.
- Database normalization is recommended unless query performance is significantly degraded (i.e., relational databases must be utilized wherever possible).
- SQL Server add-ons and services can be installed but must be approved by NCTCOG RIS Department. Recommendations, including costs, of any additional software components should be included in the initial proposal.
- NCTCOG will create or import initial databases requested and apply appropriate security.
- NCTCOG maintains the functionality of Microsoft SQL Database Server. Applications that require Analysis Services, Integration Services, or Reporting Services must be addressed on a case by case basis. NCTCOG must determine resource availability of those services, and determine if the needs can be met, before an application is approved to use them.
- Applications that require their own dedicated database instance or dedicated database server should clearly defined and justify the resource requirements and expectations for this. The availability of these resources will be addressed on a case by case basis.
- For any application hosted in Azure using the Platform as a service model (PaaS), only features that have been released for general availability should be used in production environments. Any feature that is in preview mode or other unsupported pre-production phase can be used in lower environments at your own risk, but the project must not be released to production without fully supported features.
- Data housed or managed by NCTCOG servers are subject to NCTCOG data security guidelines.

**Data Exchange Formats (for database exchange)**

Any data exchanged between NCTCOG and a third-party group developing an NCTCOG application should be in one of the following formats:

- Microsoft SQL backup (.BAK) files
- Microsoft SQL database (.mdf,.ldf)
- Microsoft Access database
- Microsoft Excel spreadsheet
- Delimited Text File (well formatted with text field values in quotes)
- Fixed-Width Text File (specifications must be provided)

The formats provided for data exchange must be in software versions that can be imported into the current environment maintained by NCTCOG.

NCTCOG reserves the right to refuse an application where the data format deviates from the above list, originates from a software version that cannot be imported into the nctcog environment, or is not manageable or appropriate for the staff resources available. These instances will be evaluated on a case by case basis.
**Testing Environment**

Vendors should develop their own test environment which is representative of the actual UAT/Prod environment (whether cloud based and/or on-prem) and confirm that all functionality is working before shipping/deploying the software tools to NCTCOG for testing. If direct access is required to the NCTCOG network to perform work on a system already existing at NCTCOG, it will be evaluated on a case by case basis and ultimately approved by NCTCOG’s security officer.

**Database Documentation**

An accurate ER Diagram should accompany all databases being created. Documentation should also be provided on any database specific code as part of the application and any special tasks or services that should run as part of the ongoing operation of the software.

**Web Site Content and Applications**

New pages or applications should be editable in Kentico, Visual Studio, or other software which does not require separate purchase and installation. Visual Studio 2019 projects are currently supported.

All web applications will reside on NCTCOG servers (on-prem and/or Azure). Current NCTCOG server and software specifications are listed below. FTP access can be given to upload and test applications. Additional hardware/software components will require approval and should be identified with the initial proposal.

The acquisition of new domains, SSL certificates or other certificates should be documented, and time should be scheduled to load them onto the NCTCOG system. All support requirements that are to be performed by NCTCOG must be documented. Meeting(s) with NCTCOG’s Research and Information Services Department prior to beginning application development will be required to review general application design and needs.

**Code Specifications**

- Application will be developed in either ASP.NET Web Forms (C#) or ASP.NET MVC. (Java and Flash are not currently supported.)
- Entity Framework should be utilized as the ORM, unless specifically approved by RIS to negate performance degradations. (NHibernate is not currently supported.)
- Cascading stylesheets should be utilized for design. Bootstrap is a supported framework. Any other proposed frameworks will be reviewed on a case-by-case basis.
- The use of templates or starter pages is required for new web applications. The use of include files is recommended.
- AJAX and iFrames are supported for dynamic content. (AJAX is preferred.)
- The use of header and footer controls is encouraged.
- The use of Master pages (ASP.NET) or shared partial Views (ASP.NET MVC) is recommended.
- ASP.NET framework 4.5.2 and later are supported. (RIS can provide the current revision number at the onset of a project if requested.)
Any DB account used by the application must be able to function without requiring DB Owner privileges.

All web pages should ensure against Cross Site Forgery Request (XSFR) and Cross Site Scripting (XSS) attacks.

If the application requires authentication by UserId/Password which are stored in an application database, those passwords should be stored as hashed strings. Salting the passwords is recommended.

All applications will be subject to vulnerability scanning using the Qualys Web Security Application scanning tool. Any critical security items identified in the scan must be resolved before the application can be published to a production environment.

A data design/programming flowchart should be provided.

Code should be fully commented.

Code checked into a source repository should include comments describing the change.

Release notes should be provided detailing changes from a previous version of the code.

Documentation describing the contents of all applicable website directories should be included.

Server side includes are allowed.

Source Code for any compiled Dynamic Link Libraries (DLLs) must be provided along with Microsoft Visual Studio project information required to build them.

User input should be programmatically sanitized to minimize SQL injection.

Code should be verified to work in the lastest two browser versions of the following: Microsoft Edge, Mozilla Firefox, Apple Safari, and Google Chrome

All sites should be thoroughly tested outside the NCTCOG firewall before being implemented.

The .config file for .NET applications should contain at least the following:

- Supported versions of common language runtime
- Custom errors set to ‘On’
  - A custom error page should be employed with a default redirect
- Email server settings (to be provided by NCTCOG)
- Debug mode should be set to “false” in the production environment to avoid performance issues.

Server Specifications

- Windows 2016/2019 Server
- Internet Information Server 10 or later
- The use of the native .NET email component is allowed. Also, for hosted applications there is an Amazon Simple Email Service (SES) available.
- Nightly/monthly tasks can be run through Windows Task Scheduler
- Additional software or DLLs can be installed but must be approved by NCTCOG Research & Information Services Department. Recommendations, including costs, of any additional software components should be included in the initial proposal.

Data Exchange Formats (for automated application data transfer)

Any data exchanged between NCTCOG and a third-party group developing an NCTCOG application should be in one of the following formats:
- JSON
- eXtensible Markup Language (XML) (schema must be provided)

NCTCOG reserves the right to refuse an application where the data format deviates from the above list or is not manageable or appropriate for the staff resources available. These instances will be evaluated on a case by case basis.

**Testing Environment**

Vendors should develop their own test environment which is representative of the actual UAT/Prod environment (whether cloud based and/or on-prem) and confirm that all functionality is working before shipping/deploying the software tools to NCTCOG for testing. If direct access is required to the NCTCOG network to perform work on a system already existing at NCTCOG, it will be evaluated on a case by case basis and ultimately approved by NCTCOG’s security officer.

**GIS Data and Applications**

**Spatial Data**

Spatial data should be projected in NAD 1983 State Plane Texas North Central FIPS 4202 (Feet) unless there is a valid reason to do otherwise, such as on-the-fly re-projection performance issues or data with an extent that goes far beyond the NCTCOG region.

Spatial data should be accompanied by adequate metadata that explains, at a minimum, what it is, how/when it was created, source(s), accuracy/quality controls, use constraints, contacts, and field descriptions.

Storing spatial data in a relational database is recommended. Refer to the Database Support section for supported databases. Data that will be edited and/or consumed in ESRI’s ArcGIS should reside in ESRI geodatabase format, but the use of personal geodatabases is not recommended.

Adhere to naming conventions listed in Database Specifications, with the additional guidance below. If the extent of the data covers an area larger or smaller than the NCTCOG 16-county region, include the extent at the end of the name. Example: “CityLimits” would imply a NCTCOG-regional dataset, whereas “CityLimits_Texas” would note that the data represents the entire state.

Conventions specific to Microsoft SQL Server:

- Prefix spatial tables with “Spatial_” (not necessary for databases managed by ArcSDE).
- Fields containing geography data types should be named “geog”.
- Field containing geometry data types should be named “geom”.

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**ArcGIS Server**

NCTCOG utilizes ESRI ArcGIS Server 10.4 which supports map, geocode, geodata, geometry, geoprocessing, globe, and image services. If the service will be consumed in web mapping APIs such as Google or Bing Maps, the coordinate system of the MXD data frame used to create the service must be set to WGS 1984 Web Mercator. Setting minimum and maximum scale dependencies for each layer is encouraged. The use of field name aliases is encouraged. Fields that are unnecessary for the application should be hidden (i.e. “SHAPE”).

Storage, performance, and application requirements will dictate whether the map service should be cached or dynamic. Refer to ESRI’s web site for guidance and best practices. Dynamic or tile-on-demand map services should be optimized to achieve a high level of performance. Refer to ESRI’s web site for guidance and best practices on issues such as whether to use an MXD or MSD, projection on-the-fly, simple or complex symbology, labeling or annotation, etc.

NCTCOG Research & Information Services Department must be notified of the types of services that will be created early in the process to determine if existing capacity must be expanded to meet the needs of the application.

**Web GIS Applications**

NCTCOG does have an ArcGIS online account. Its availability is not to be assumed but can be proposed for use in a project. NCTCOG reserves to the right to accept or reject use of this resource based on load and potential cost. Any proposal that includes this as a resource should provide a detailed estimate of usage and credit utilization.

When choosing a web mapping API, consider the following:

- In-house expertise. NCTCOG has experience and an existing codebase for ESRI JavaScript. The use of other mapping APIs is discouraged.
- Vendor terms of service.
  - Example considerations:
    - Can you use the API behind an Intranet?
    - Do they allow your intended functionality?
    - Are you giving them rights to your data?
    - Can they include advertising?
    - Is the API to be accessible on remote devices?
- If a system is chosen that carries a license or transaction fee license levels and ongoing cost estimates should be provided as part of the initial proposal.

**Desktop GIS**

The application shall be created in C#. ESRI currently supports up to .NET version 4.5. The method of deployment of custom ArcGIS Desktop applications should be carefully considered. Example considerations:

- Will users be required to install the application?
- Will they have enough access privileges to do so?
- Can it be automatically deployed to all users?
Additional DLLs can be installed but must be approved by NCTCOG RIS Department. NCTCOG also reserves the right to approve/disapprove installation procedures that impact its staff and time resources. Any software components that require administrative access to function or install must be identified and agreed upon early in the project scoping process.

Code should be verified to work in ArcGIS Desktop 10 unless otherwise specified and agreed upon by both NCTCOG and the application builder.

General Information

Load Testing Process
Where applicable, vendors should load test any software being developed and provide result reporting back to NCTCOG RIS Staff for review. For software that involves multiple development tiers testing should be conducted at all levels to ensure optimal application performance. NCTCOG preference in this testing is that the test environment be set up to emulate the NCTCOG infrastructure the application will be deployed on; however, should that not be an option, hardware configuration should be provided as part of the results report.

Process Documentation
A list of all scheduled/automated tasks and batch process should be provided with a description of the application process being performed.

System Requirements
All server requirements for the application should be provided in writing and accompanied with a recommended network design diagram that includes any infrastructure limitations that an application may require.
All end-user system requirements for the application should be documented and provided in an electronic format.

Undefined Criteria
NCTCOG Staff is available to assist on any project as needed to help ensure that project goals are reached.

NCTCOG staff will consider any technology that is not covered in this document or requires exception to this document on an as requested basis. Requests for review should be made prior to any contracts or agreements being signed. NCTCOG staff will also review on an as requested basis any contract terms related to technology, services, and support to assist in vendor selection and/or negotiation.