



PRODUCTION
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ELEFLEX®

ELEFLEX VERSION 3 SOFTWARE DESIGN SPECIFICATION

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Abstract

This document is a software design specification for the PRODUCTION READY® ELEFLEX® Version 3 software platform. ELEFLEX® is an open source software platform for building modular, domain-driven, service-oriented applications and services. ELEFLEX® is intended to be used as a foundation to rapidly build and integrate multiple applications together using a services-based approach utilizing code generation, standards and governance to form a robust and scalable infrastructure.

Author

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<http://www.ProductionReady.com>

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Revision History

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Introduction

Abstract

This document is a software design specification for the PRODUCTION READY® ELEFLEX® Version 3 software platform. ELEFLEX® is an open source software platform for building modular, domain-driven, service-oriented applications and services. ELEFLEX® is intended to be used as a foundation to rapidly build and integrate multiple applications together using a services-based approach utilizing code generation, standards and governance to form a robust and scalable infrastructure.

Scope

This document provides an initial high-level overview of the ELEFLEX® platform and later delves into the low-level aspects. It is intended for business executives as well as software development professionals. This document is accurate as of the ELEFLEX v3.2.1 release.

What is ELEFLEX®?

The ELEFLEX® software platform was created by Danny R. Logsdon Jr. and officially released to the public June 14, 2013, from Production Ready, LLC located at <http://www.ProductionReady.com>. ELEFLEX® is the culmination of several years of work and research in large scale, enterprise software application design and is intended to be used as a foundation to rapidly build service oriented architecture (SOA) applications, with the ultimate goal of standardization to form a robust and scalable infrastructure. The ELEFLEX® software platform consists of an application software framework built using Microsoft® .NET C# that provides a standardized, reusable set of libraries, models and tools that enable software developers to rapidly develop applications.

The ELEFLEX® software platform was developed with the following guiding principle and is also how it received its name:

“Elegance in Simplicity, Flexibility in Design”

This implies easily comprehensible components, structure and usage that is flexible to evolve to changing technology and business needs over time gracefully. ELEFLEX®, as it has been developed, will be an ever-evolving refactor using the best of breed open source components to solve complex business problems in an elegant way.

Software Licensing

Visit <http://www.ProductionReady.com/About> to learn more about Production Ready and for licensing information.

Free and Open Source Software Licensing

ELEFLEX® is free open source software and is released under the [GNU General Public License](#), included in this document. The complete source code can be downloaded from GitHub located at <https://github.com/ProductionReady/Elfex>

References

This document makes references to the PRODUCTION READY® website located at <http://www.ProductionReady.com> as well as the following documents on the website or included as artifacts in the ELEFLEX® downloadable distribution.

Name	Location
Production Ready Website	http://www.ProductionReady.com/
GNU General Public License v3	http://www.ProductionReady.com/GPL

Requirements

Overview

The goal of this software platform is to provide a foundation to easily design, develop and deploy applications subscribing to a service oriented architecture (SOA). Building service-based applications promote reuse, can easily be modified for customized infrastructures and are scalable.

Services are loosely coupled applications that expose functionality for a domain area. Service commands provide single units of work via a formally defined, stateless operations through its

interface. Once a reusable set of services are instituted, orchestrations, workflows, composite services and ESB architectures can then be created to realize the full power of integrating and automating processes over multiple service boundaries.

The platform also utilizes code generation techniques to allow developers to quickly build applications. Software code generation reduces repetitive typing, eliminates common coding mistakes, misspellings and provides standardization to coding guidelines, policies and governance. Using this software platform as a foundation can provide the standardization and intrinsic interoperability needed when building large scale applications and services for an infrastructure.

The core concepts and design considerations for the software platform are programming language independent and each language that implements the foundation may utilize different constructs and methods to accomplish the same architecture goals.

The Requirements have been separated into four categories:

- Organization Requirements
 - These requirements are based upon organizational and strategic goals.
- Architecture Requirements
 - These requirements impact the overall design and implementation of the software platform and are shared throughout all applications.
- Module Requirements
 - These requirements represent a domain or section of an application built to solve a business problem.
- Feature Requirements
 - These requirements effect a Module and are areas of functionality or business logic that must be supported.

The following sections convey the design considerations and decisions needed to fulfil each of the software requirements as specified.

Organization Requirements

RO1 Free Software

Requirement

The software platform must be licensed as free, open source software.

Background

The philosophy of Production Ready resembles that of the [Free Software Foundation](http://www.FreeSoftwareFoundation.org). We hope to provide a software platform that will be useful to the community using software development best practices, patterns and tools to speed development implementing high quality solutions.

Solution

This software platform will be released under the GNU General Public License version 3.

Licensing information has been added to the project and the source code has been released, currently available on GitHub at <https://GitHub.com/ProductionReady/Eleflex>.

Architecture Requirements

RA1 Modern Application Architecture

Requirement

Design a modern application architecture with the latest software development principles, patterns and practices using the best of breed open source projects.

Background

Production Ready® is routinely asked to help develop, enhance or fix existing applications for our customers. Many of these applications are poorly written with no clear separation of concerns, have security issues, use older technology that is outdated, or not upgradeable.

Our goal is to produce a modern application architecture and framework template that can be used as a starting point to produce high quality software for the community. This software platform will additionally become the application infrastructure for the company and the basis for new applications developed in the future.

Solution

ELEFLEX® is an open source software platform for building modular, domain-driven, service-oriented applications and services. ELEFLEX® is intended to be used as a foundation to rapidly build and integrate multiple applications together using a services-based approach utilizing code generation, standards and governance to form a robust and scalable infrastructure.

To promote community collaboration, NuGet was selected to be used as the primary method to publish and integrate with the platform. NuGet allows installation of open source projects, source code, assemblies, files and custom logic to help configure with a project while the ELEFLEX® platform provides the framework code foundation to quickly develop modules.

Several open source components have been selected to provide structure to the application for dependency injection, inversion of control, object mapping, service location, auditing, user interface and more. These will be discussed in later sections.

RA2 Service Oriented Architecture

Requirement

Design a service oriented architecture with a standardized framework of services that can be easily expanded upon for new application modules.

Background

A service oriented architecture helps building large scale software easier. An application can be divided up into domains, with each domain exposing self-contained business activities. These stateless operations are easy to invoke over a network and are easily testable. The ELEFLEX® platform's governance has ensured that modules developed have a solid foundation to build from. Furthermore, these can be customized to realize other organizational requirements, processes and goals.

Solution

The ELEFLEX® software platform was developed utilizing Windows Communication Foundation (WCF) to provide the primary communication and security. Services exposed from the platform will operate on a request/response paradigm, with each method exposing a unique request object and a response object. The request object will be used to route to a configured service containing the business logic to process it. This allows new modules to be developed and integrated within the service pipeline.

RA3 Code Generation

Requirement

Design must incorporate code generation to quickly develop modules in the platform.

Background

The platform must be easy to integrate with and be able to quickly get new functionality up and running. Code generation is used to quickly create code files required by the platform's architectural layers. Using template-based techniques, templates can be customized and code re-generated to add or remove functionality. Templates can change to reflect coding guidelines and standards, reduce remediation, common coding mistakes and increases intrinsic interoperability.

Solution

Pre-processing of metadata to create individual code blocks, files or complete solutions will be required to reduce the burden of developing the number of code files needed to support the platform's architectural layers. The platform currently make use of T4 text templates to help produce code files required, although other tools are in development as well.

RA4 End to End Solution

Requirement

Design a templated solution that encompasses all layers of the platform to create a working application with minimal metadata.

Background

In order for the platform to be useful, developers must be able to build applications and application modules quickly. Code generation will be used to create a standardized, templated approach to building code files needed for the platform's architectural layers.

Solution

The ELEFLEX® platform has been developed to provide interfaces, objects and business logic functionality that are used in the various layers of the n-tiered application design. A complete, end-to-end solution is generated utilizing NuGet, as well as integrating other modules. T4 text templates are used to generate files needed to create a custom module.

RA5 Microsoft .NET C#

Requirement

Implementation of the design must be developed using Microsoft® .NET C#.

Background

The Microsoft® platform is one of the largest software development technologies available and aligns with organizational priorities and personnel.

Solution

The inherent design of the platform is language independent, however each language may use different constructs and techniques to accomplish the same task. Microsoft® .NET C# will be used as the default implementation of the software platform.

RA6 Microsoft SQL Server and Azure

Requirement

Design must support Microsoft SQL Server and Microsoft Azure database engine for data persistence, however it should provide the ability to incorporate other database engines.

Background

Hosting of the platform should be able to be deployed on an internal environment or one in the cloud with minimal changes.

Solution

We provide a clear separation of model and storage interfaces that give us the ability to target applications to differing backend storage databases as needed. By default, the platform supports Microsoft SQL Server as well as Microsoft Azure database engines out of the box.

RA7 Dynamic SOA Data Manipulation

Requirement

Design a standardized way to dynamically query and modify data within the SOA design.

Background

This requirement is to ensure the platform provides a standardized operations that allow for querying and manipulation of model data over service boundaries.

Solution

The ELEFLEX® software platform provides a canonical model that enables dynamic data manipulation over service boundaries. The *StorageQueryBuilder* object provides the implementation of the foundation data contract operations used for dynamic data manipulation and querying functionality. Additionally, Web API or other RESTful services can be added on top of the SOA model to expose information in their formats.

Module and Feature Requirements

RM1 Security

Requirement

Incorporate a security mechanism to authenticate and authorize users in the system.

Background

Applications developed on the platform should be secure, providing adequate protection for both users and for hosted services.

Solution

The ELEFLEX® platform utilizes Microsoft ASP .NET Identity and OWIN as the default security mechanism. This is integrated into the service command execution pipeline that allows authenticating and authorizing during the request lifetime.

RM1F1 Users, Roles and Permissions

Requirement

The security mechanism must allow for user, role and permission entities.

Background

Existing applications that will be upgrade to the ELEFLEX® platform currently use a notion of users, roles, and permissions. In some cases, a large effort was made to create security matrixes that allow an application to fully secure itself.

Solution

The ASP.NET Identity security mechanism has dropped support for permissions and created a new entity for claims. We have expanded the identity model to additionally keep track of permissions,

adding them along with roles in the new model. This allows transparent use with current security checking attributes that use roles, but can also be expanded with custom objects.

RM1F2 Effective Date Enforcement

Requirement

The security mechanism must allow for effective dates to determine when a user assigned role or permission is available.

Background

Existing applications that will be upgrade to the ELEFLEX® platform currently use this notion of effective dates on assignments.

Solution

The ASP.NET Identity security mechanism does not have support for effective date assignments. The platform has changed the underlying identity persistence stores to additionally keep track of effective dates and only return those items that are currently valid.

RM1F3 Dependent Role Hierarchy

Requirement

The security mechanism must allow for roles to be assigned to other roles, so that when one role is assigned to a user, any child roles of that role are automatically applied.

Background

Existing applications that will be upgrade to the ELEFLEX® platform currently use this notion of applying dependent roles based on an assigned role.

Solution

The ASP.NET Identity security mechanism does not have support for parent/child dependencies. The platform has changed the underlying identity persistence stores to additionally keep track of dependencies and return child roles of the user's assigned roles.

RM2 Logging

Requirement

Incorporate a logging mechanism into the design to store errors, audits and warning messages.

Background

Logging provides application health and monitoring. Storing this information provides developers the ability to help discover application defects, execution and processing debugging, warnings and other related information.

Solution

The platform exposes a logging service to store application messages during the execution of the application. A service contract is provided that allows sending and exposing message information while providing a centralized storage mechanism for all system services.

Developers access application logging by accessing the ***Eleflex.Logger*** object. Calling the Current property allows execution of error, debug, warning, info, and fatal methods with standard overloads.

RM2F1 Required Data

Requirement

The logging mechanism must allow storage of data:

- Create date (UTC)
- Application name
 - Multiple applications may be using centralized logging and this will allow narrowing search results for specific application messages.
- Server name
 - Multiple servers or clients may be sending messages and this will allow narrowing search results for a specific machine messages.
- IsError
 - Overall, determine if this message is an error and should be reviewed.
- Severity
 - This will be one of the methods that the developer will call on the logger, such as error, warning, info, etc.
- Message
 - Developer message describing current process execution or variables in question
- Exception
 - The exception message generated from the .NET runtime.

Background

Including the data mentioned above will provide greater monitoring and debugging of application health within the infrastructure.

Solution

The logging mechanism includes these data fields on the ***LogMessage*** object and messages can be sent to the application log using the ***Eleflex.Logger*** object.

RM3 Versioning

Requirement

Incorporate a versioning mechanism into the design to allow modules to self-upgrade after upgrading their NuGet package.

Background

Modules will often require data persistence, usually with a database engine. Often the schema or data may change between released versions of software. This versioning module will provide a path so the module can upgrade itself.

Solution

The platform exposes a versioning service to store an installed module's version information. On application startup, the system will dynamically load all the module's upgrade patches, determine the execution tree for patches and execute each in order.

Design

Development Standards and Naming Conventions

The software platform has been developed in conjunction with the *Production Ready Programming Standards* document to ensure standardized language syntax conventions, best practices and naming conventions.

N-Tiered Architecture

The following diagram depicts the high-level view of the ELEFLEX® N-Tiered solution architecture separated into six layers that will constitute an end to end solution to support the architecture requirements. Each tier represents an assembly (or set of assemblies) that comprise the solution and arrows show the relationship where an assembly references another assembly or service communication occurs (loosely coupled via inter-process communication using WCF).

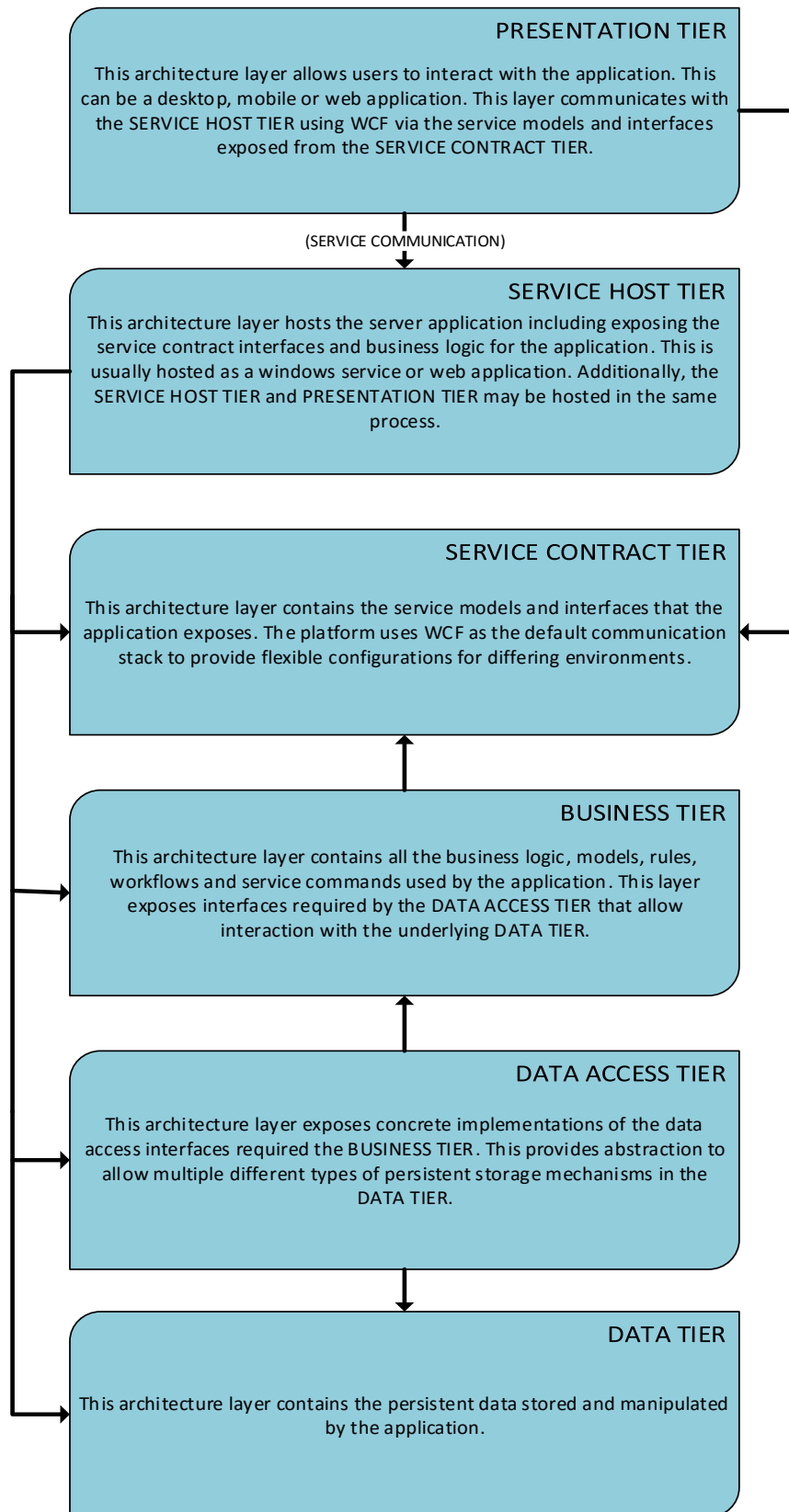


FIGURE 1- ELEFLEX N-TIERED HIGH LEVEL OVERVIEW

The following diagram depicts the component-level overview of the ELEFLEX® N-Tiered solution.

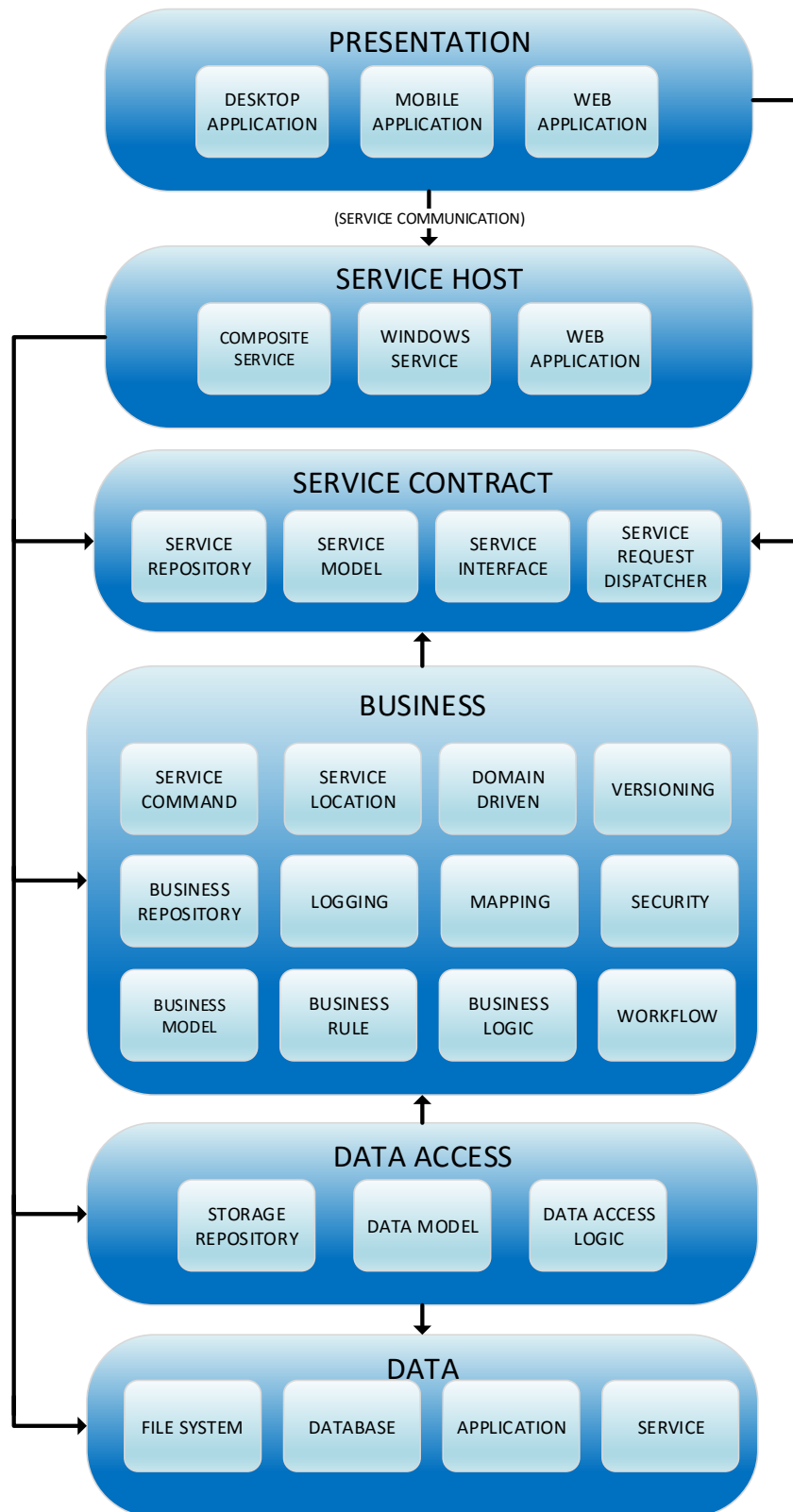


FIGURE 2- ELEFLEX N-TIERED COMPONENT OVERVIEW

System Startup, Startup Tasks and Registration Tasks

The platform provides an entry point for handling the complicated tasks of starting up, registering, configuring, updating and shutting down the system. Creating an instance of the **Eleflex.SystemStartupShutdown** object and calling the *Start()* or *Stop()* methods will perform system initialization or termination. These methods would be called in the *Application_Start()* or *Application_End()* methods of a web application's global.asax file or executed within the *Main()* method of a windows application or service. An example of calling the methods would be the following:

```
//Start the system
Eleflex.SystemStartupShutdown startup = new Eleflex.SystemStartupShutdown();
startup.Start(null);

//Shutdown the system
Eleflex.SystemStartupShutdown shutdown = new Eleflex.SystemStartupShutdown();
shutdown.Stop(null);
```

Using a convention over configuration approach similar to the open source project [Bootstrapper](#), the system defines an ordered approach to run various startup tasks, as executed by the **Eleflex.SystemStartupShutdown** object. The process will automatically find all objects inheriting from either **Eleflex.StartupTask** or **Eleflex.StartupTaskWithRegistration** and execute the tasks in order. The system contains the following pre-defined ordered tasks required by the system:

- Object Location – This startup task allows registering StructureMap configurations
- Mapping – This startup task allows registering AutoMapper configurations.
- Business Rules – This startup task allows registering business rules and events.
- Service Communication – This startup task allows registering WCF service commands.
- System Patching – This startup task dynamically loads all registered components and executes update logic for patching an installation.
- Logging – This startup task is used to register system logging.

The following example demonstrates how to create a custom startup task. Integrators creating a new startup task can order their task to execute before or after other tasks by setting the **Priority** property. See the **StartupConstants** object to get a list of predefined startup order values that can be used.


```
using Eleflex;

public partial class ExampleStartupTask : StartupTask
{
    public ExampleStartupTask() : base()
    {
        Description = @"Example startup task.";
        Priority = StartupConstants.PRIORITY_CUSTOM;
    }

    public override bool Start(ITaskOptions taskOptions)
    {
        //Execute custom logic here!

        return base.Start(taskOptions);
    }
}
```

Integrators using the ***Eleflex.StartupTaskWithRegistration*** object must also define a custom class attribute that registration tasks must decorate with so they can be dynamically discovered and executed when the corresponding startup task executes. The usage is demonstrated when registering object location and object mapping configurations in the next sections.

Inversion of Control, Dependency Injection and Service Location

The ELEFLEX® platform uses the open source component [StructureMap](#) for inversion of control and dependency injection. This system component helps to keep modular software designs maintainable by dynamically allowing configuration and resolution of objects and their dependencies. The system also incorporates the open source component [CommonServiceLocator](#) for service locator to resolve objects as other integrated open source components of the system rely on this.

The platform provides a static entry-point object, ***Eleflex.ObjectLocator***, which is consumed throughout the various layers of the application for dynamic object resolution. This object contains two properties:

- **Container** (object)
 - This property holds the core [StructureMap](#) container object for the application. This property should ideally only be accessed when registering configurations at startup.
- **Current** (IObjectLocatorService)
 - This property holds the object locator instance used for resolving objects at runtime. This object and property is used throughout the application to resolve object construction and dependencies. An internal startup task takes care of setting this property on system startup.

Object location registration takes place when the system is startup (discussed in the next sections). Integrators can register configurations for object location by inheriting from the **Eleflex.RegistrationTask** object and adding the [**ObjectLocationRegistrationTask**] class attribute. The following examples demonstrates how to create a class used to register any object location configurations you define.

```
using Eleflex;

[ObjectLocationRegistrationTask]
public partial class ExampleObjectLocationRegistrationTask : RegistrationTask
{
    public ExampleObjectLocationRegistrationTask()
    {
        Description = "This tasks registers MyApp object location configurations.";
    }
    public override bool Register(ITaskOptions taskOptions)
    {
        StructureMap.IContainer container = ObjectLocator.Container as StructureMap.IContainer;
        container.Configure(x =>
        {
            x.For<MyApp.Interfaces.IExampleService>().Use<MyApp.Model.ExampleService>()
        });

        return base.Register(taskOptions);
    }
}
```

The next example shows how to get an instance of the **IExampleService** configured in the above registration object example. The system uses the **Eleflex.ObjectLocator** object and **Current** property:

```
//Get Example Service
var exampleService = ObjectLocator.Current.GetInstance<MyApp.Interfaces.IExampleService>();
```

Object Mapping

The ELEFLEX® platform uses the open source component **AutoMapper** for object to object mapping. By default, the standard naming conventions of objects within the various layers will use the same property names as each other. This is done so that when properties are added later, they use the same name within the various layered models and are then subsequently automatically mapped.

The platform provides a default mapping service, **Eleflex.IMappingService**, which is used to provide dynamic object-to-object mapping and is used through the various application layers. Calling one of the various **Map()** methods and supplying a source object and optionally a destination object, will move data between the two. An internal startup task takes care of registering the default mapping provider during system startup (discussed in the next sections).

Integrators can register configurations for mapping by inheriting from the ***Eleflex.RegistrationTask*** object and adding the ***[MappingRegistrationTask]*** class attribute. The following examples demonstrates how to create a class used to register any object mapping configurations you define.

```
using Eleflex;

[MappingRegistrationTask]
public partial class ExampleMappingRegistrationTask : RegistrationTask
{
    public ExampleMappingRegistrationTask()
    {
        Description = "This tasks registers MyApp object mapping configurations.";
    }
    public override bool Register(ITaskOptions taskOptions)
    {
        AutoMapper.Mapper.CreateMap<MyApp.Model.EditPerson, MyApp.Model.Person>();
        AutoMapper.Mapper.CreateMap<MyApp.Model.Person, MyApp.Model.EditPerson>();

        return base.Register(taskOptions);
    }
}
```

The next example shows how to map data between two objects using the ***Eleflex.IMappingService*** object.

```
//Use object locator to get mapping service
var mappingService = ObjectLocator.Current.GetInstance<Eleflex.IMappingService>();
MyApp.Model.EditPerson objA = new MyApp.Model.EditPerson();
objA.Name = "test";

//Map Data Between Two Objects
MyApp.Model.Person objB = mappingService.Map<MyApp.Model.EditPerson, MyApp.Model.Person>(objA);
```

Logging

The platform provides a static entry-point object, ***Eleflex.Logger***, which is consumed throughout the various layers of the application for storing system logging information. By using logging throughout your module, you can detect system health or error conditions that require further debugging. The ***Eleflex.Logger*** class contains the following property:

- ***Current*** (*ILoggingService*)
 - This property holds the logging service instance used to store log messages. This property is set by an internal startup task.

The application integrates with the open source project ***Common.Logging*** as it is used by other open source projects used in the system. The ***ILoggingService*** service contains multiple overloads of the following logging methods:

- Debug
- Error
- Fatal
- Info
- Warn
- Trace

The following examples show the various overloads to call on a method for the **Logger** object:

```
Logger.Current.Debug<MyClass>("Something happened");  
Logger.Current.Debug<MyClass>(exception);  
Logger.Current.Debug<MyClass>("Something happened with an exception", exception);  
Logger.Current.Debug("MyClass", "Something happened");  
Logger.Current.Debug("MyClass", "Something happened with an exception", exception);
```

While processing a request, we don't want log messages to be tied to the current Unit of Work as it may be rolled back instead of committed. The underlying mechanism for the **ILoggingService** uses a background thread to process log messages, ensuring that they are operated on a separate thread outside the scope of the calling process that created the log message. This additionally provides the benefit to the calling process not having to wait for log messages to be stored and can continue on with its own processing.

Messages stored with the **ILoggingService** using the **Eleflex.LogMessage** object, which are stored in with database in the table **EleflexV3.LogMessage**. To manipulate the LogMessage objects in storage, you would use with the ILogMessageServiceRepository, the ILogMessageBusinessRepository, or the ILogStorageRepository.

Security

The platform uses [Microsoft ASP .NET Identity](#) and [OWIN](#) to provide security for the system. The ASP.NET identity model required for implementation is done with the following classes:

- Eleflex.Security.ASPNetIdentity.IdentityUser
 - This is the base class that implements identity model requirements for a User.
- Eleflex.Security.ASPNetIdentity.IdentityRole
 - This is the base class that implements identity model requirements for a Role.
- Eleflex.Security.ASPNetIdentity.IdentityUserManager
 - The IdentityUserManager class is used to manipulate a User object.
- Eleflex.Security.ASPNetIdentity.IdentityRoleManager
 - The IdentityRoleManager class is used to manipulate a Role object.
- Eleflex.Services.WCF.OWIN.IdentitySignInManager
 - The IdentitySignInManager class is used to log a user in and subsequently store an OWIN cookie for authentication on the client.

To support the ASP.NET Identity model, several database tables were created to store the required information. The model was expanded from feature requirements to support effective date availability and permissions. The tables created for security include:

- EleflexV3.SecurityPermission
 - This table stores permission information. This is the same concept as a role and permissions are loaded into the user identity as Roles as well. This allows a migration path from older application designs with defined security matrixes incorporating permissions.
 - Mapped to Eleflex.SecurityPermission object and repositories.
- EleflexV3.SecurityRole
 - This table stores role information along with effective dates.
 - Mapped to Eleflex.SecurityRole object and repositories.
- EleflexV3.SecurityRolePermission
 - This table stores role to permission membership along with effective dates.
 - Mapped to Eleflex.SecurityRolePermission object and repositories.
- EleflexV3.SecurityRoleRole
 - This table stores role to role membership along with effective dates.
 - Mapped to Eleflex.SecurityRoleRole object and repositories.
- EleflexV3.SecurityUser
 - This table stores user information.
 - Mapped to Eleflex.SecurityUser object and repositories.
- EleflexV3.SecurityUserClaim
 - This table stores user claims.
 - Mapped to Eleflex.SecurityUserClaim object and repositories.
- EleflexV3.SecurityUserLogin
 - This table stores user external login tokens for other services.
 - Mapped to Eleflex.SecurityUserLogin object and repositories.
- EleflexV3.SecurityUserPermission
 - This table stores user to permission membership along with effective dates.
 - Mapped to Eleflex.SecurityUserPermission object and repositories.
- EleflexV3.SecurityUserRole
 - This table stores user to role membership along with effective dates.
 - Mapped to Eleflex.SecurityUserRole object and repositories.

The ASP.NET Identity store classes are used to manipulate security objects. There is a ***IUserStoreBusinessRepository*** and an ***IUserStoreServiceRepository*** used to access security in the application. If you are a server application, you would use the BusinessRepository. If you are a client application, then you would use the ServiceRepository. The same is true for the ***IRoleBusinessRepository*** and ***IRoleServiceRepository***. They are configured with the application

using structuremap in your application's object location registration task. These repositories are configured and obtained in code through the following interfaces:

- ***IUserStore<IdentityUser>***
 - This allows creating new users, adding/removing roles to users, set password, etc.
- ***IRoleStore<IdentityRole>***
 - This allows creating new roles, updating, searching and deleting.

These interfaces should be used for most security routines such as creating a user, getting a user by email, getting a user's roles/claims, etc. However you can operate on the underlying table data by using the `Eleflex.Security*` objects noted above.

Service-Oriented Architecture and Exposing Services

A core design premise of the ELEFLEX® platform is to expose all service commands for all system processing events and to provide a completely service-based user interface so that multiple platforms can be targeted as technologies evolve. The design also includes the ability to support each service hosted on a shared or independent hosted processes using request dispatchers.

The ***Eleflex.Services.WCF.IWCFCommand*** interface provides the core means to exposing a service method within the platform. The command interface uses a simple Request/Response paradigm for sending and receiving information, allowing for other communication method abstractions as needed. This method signature utilizes the ***ServiceKnownType()*** attribute that allows us to dynamically get a list of service commands exposed in the system for integrating all modules. Module service commands will be automatically registered with the ***WCFCommandRegistry*** object and then dynamically accessed depending on the request object sent to the system.

```
[ServiceContract]
public partial interface IWCFCommand
{
    [OperationContract]
    [ServiceKnownType("GetKnownTypes", typeof(WCFCommandRegistry))]
    Response ExecuteServiceCommand(Request request);
}
```

Exposing a service in the platform requires the following objects:

- Request object
 - This is the object that is sent to the system. All service commands in the system are inherited from an ***Eleflex.Request*** object and only one request object can be linked to a service command, so they cannot be reused for multiple service commands.
- Response object
 - This is the object that is returned from the system. All service commands must return a response object that contains information such as call success, error messages, etc. You

can use the default ***Eleflex.Response*** object for your service response or create an inherited class to return any additional information that needs to be returned to a caller.

- Service Interface
 - This is an interface that exposes the method signature with a request and response object that the command and service objects will implement. This provides the contract of information being passed and returned.
- Request Dispatcher object
 - This is the object is used by the client service object and allows use of different endpoints for different services in the platform. This allows services to be hosted all together or each service independently using different configurations. Typically a module only has one request dispatcher, however multiple can be created depending on requirements. This is inherited from ***Eleflex.Services.WCF.WCFCommandRequestDispatcher***
- Client Service object
 - This is the object implements the Service Interface that sends the request from the client to the hosted service using the Request Dispatcher object.
- Service Command object
 - This is the object that performs the business logic on the service host against the request object sent to the system from a client. Service commands inherit from ***Eleflex.Services.WCF.WCFCommand*** to expose their functionality.

Calling a service requires a service endpoint to be defined. By default, all service calls in a module are made through a request dispatcher that is configured to the “EleflexDefault” endpoint in the application’s config file. This allows all modules to expose service commands on the same endpoint as other modules. Client Service objects in each of the modules call their respective request dispatcher to get the configuration to send the request out on. Integrators can then change the endpoint for a particular service to point to a new server address or using a different security configuration. This is done by changing the object location configuration for each service. For the logging service, it is ***ILoggingRequestDispatcher***, for security it is ***ISecurityRequestDispatcher*** and so on.

The following example displays the classes needed to expose a service command in the system. By using the ***WCFCommandRegistration()*** class attribute, the system will automatically register the command, request and response objects dynamically on system startup with an internal startup task. For client-calling applications not in the main hosted process, a separate configuration class is generated in the Messages assembly to register request and response objects on the client side for service communication.


```
//REQUEST OBJECT
public partial class ExampleRequest : Request
{
    public string Input { get; set; }
}

//RESPONSE OBJECT
public partial class ExampleResponse : Response
{
    public string Output { get; set; }
}

//SERVICE INTERFACE OBJECT
public partial interface IExampleService
{
    ExampleResponse ExampleMethod (ExampleRequest request);
}

//CLIENT SERVICE OBJECT
public partial class ExampleService : IExampleService
{
    public ExampleResponse ExampleMethod (ExampleRequest request)
    {
        using (IExampleRequestDispatcher dispatcher =
ObjectLocator.Current.GetInstance<IExampleRequestDispatcher>())
        {
            return dispatcher.ExecuteServiceCommand<ExampleResponse>(request); //SERVICE CALL
        }
    }
}

//REQUEST DISPATCHER OBJECT
public partial interface IExampleRequestDispatcher : IWCFCommandRequestDispatcher
{
}

public class ExampleRequestDispatcher : WCFCommandRequestDispatcher, IExampleRequestDispatcher
{
    public ExampleRequestDispatcher()
        : base(WCFConstants.SERVICE_ENDPOINT_NAME_DEFAULT)
    { }
    public ExampleRequestDispatcher(string endpoint)
        : base(endpoint)
    { }
}

//SERVICE COMMAND OBJECT
[WCFCommandRegistration(typeof(ExampleRequest), typeof(ExampleResponse))]
public partial class ExampleCommand : WCFCommand<ExampleRequest, ExampleResponse>
{
    public override void Execute(ExampleRequest request, ExampleResponse response)
    {
        response.Output = "Hello " + request.Input;
    }
}
```


Securing service command methods can be done with the ***PrincipalPermission()*** class attribute or with a custom implementation. The next example shows adding the ***PrincipalPermission()*** attribute on the *Execute()* method to require only user's that have the "Admin" role are allowed to call the method.

```
[PrincipalPermission(SecurityAction.Demand, Role = "Admin")]  
public override void Execute(ExampleRequest request, ExampleResponse response)  
{  
    response.Output = "Hello " + request.Input;  
}
```

By default, OWIN is configured in the WCF pipeline with the current requestor's user principal information for all requests. There may come times when an anonymous user or user without sufficient privileges is making a request, however the system needs to make a call that requires elevated privileges. In these cases, you can impersonate a specific user or the system admin account with the following objects:

- ***Eleflex.Services.WCF.OWIN.ImpersonateUser***
 - This allows impersonating an individual user using a specified username and password.
- ***Eleflex.Services.WCF.OWIN.ImpersonateSystem***
 - This allows impersonating the system admin account using the configured shared secret token located in the application's config file using the key ***EleflexImpersonateSystemToken***. This is a secret key used by managed ELEFLEX client hosts connecting to your ELEFLEX service host and should be changed for your site before deploying your application!

Impersonation is handled by the system through a server WCF behavior, ***Eleflex.Services.WCF.OWIN.CookieSecurityServerBehaviorExtension*** that is responsible for receiving and processing the request and from the client using the ***ELEFLEX.Services.WCF.OWIN.CookieSecurityClientBehaviorExtension***. As the name implies, the OWIN cookie is passed from client to server allowing authentication and authorization with OWIN since it has been injected into the WCP pipeline during a service call.

The next example shows how to make a service call impersonating the system account. In this case, we request the ***ISecurityUserServiceRepository*** interface that will allow us to make a service call to get users in the platform, which requires the requesting user to have "Admin" access. By making service calls while the ***ImpersonateSystem()*** object is alive, the request will resolve to the system admin account, rather than the user the call originated from and the call will succeed.

```
var service = ObjectLocator.Current.GetInstance<ISecurityUserServiceRepository>();  
using (var adminAccess = new ImpersonateSystem())  
{  
    var resp = service.Get(new RequestItem<Guid>() { Item = userKey });  
}
```

Layered Repository Design

The platform exposes data from database tables in a layered repository design. The layers consist of the following:

- Storage Repository
 - This repository is located in the Data Access Tier and contains data access logic for accessing data from a specific data storage mechanism such as SQL Server, Oracle, MySQL, etc. This repository is only available in the server process and should rarely be used, and only when needing to bypass business rules and event logic.
 - Default naming convention: I[object name]StorageRepository
- Business Repository
 - This repository is located in the Business Tier and contains business rule and event processing while relaying commands to the Storage Repository for actual work to be performed. This repository is only available in the server process and should be the most commonly used object to access data.
 - Default naming convention: I[object name]BusinessRepository
- Service Repository
 - This repository is located in the Service Contract Tier and is responsible for sending client service requests to the server process. The server process when receiving the request, then calls the Business Repository to perform the work. This repository is only available in client processes that contain only the service contract.
 - Default naming convention: I[object name]ServiceRepository
 - The T4 text templates that generate the service commands for these objects require the "Admin" role in order to call them over the service boundary.

All repository classes derive from the ***IRepository<>*** interface. It follows the standard Request/Response design paradigm so that requests through all layers are handled the same way. It contains the following methods:

- Insert
 - Insert an object
- Get
 - Get an object by its primary key value

- Update
 - Update an object
- Delete
 - Delete an object
- Query
 - Query for objects, including paging (See next section on dynamic querying)
- Query Aggregate
 - Return an aggregate count of records based on a query

```
public partial interface IRepository<TObject, TPkDataType>
    where TObject : class
{
    IResponseItem<TObject> Insert(IRequestItem<TObject> request);

    IResponseItem<TObject> Get(IRequestItem<TPkDataType> request);

    IResponseItem<TObject> Update(IRequestItem<TObject> request);

    IResponse Delete(IRequestItem<TPkDataType> request);

    IStorageQueryResponseItems<TObject> Query(IRequestItem<IStorageQuery> request);

    IResponseItem<double> QueryAggregate(IRequestItem<IStorageQuery> request);
}
```

The following code demonstrates use of each of the Repository methods above on the ***SecurityUser*** class, which define users in the system.

```
var service = ObjectLocator.Current.GetInstance<ISecurityUserBusinessRepository>();
var newUser = new SecurityUser();
newUser.FirstName = "test";

//INSERT
var respInsert = service.Insert(new RequestItem<SecurityUser>(){Item = newUser});

//UPDATE
var updateUser = respInsert.Item;
var respUpdate = service.Update(new RequestItem<SecurityUser>(){Item = updateUser});

//GET
var respGet = service.Get(new RequestItem<Guid>(){Item = updateUser.UserKey});

//QUERY
var builder = new StorageQueryBuilder();
builder.IsEqual("UserKey", updateUser.UserKey.ToString());
var respQuery = service.Query(new RequestItem<IStorageQuery>(){Item = builder.GetStorageQuery()});

//QUERY AGGREGATE
var respQA = service.Query(new RequestItem<IStorageQuery>(){Item = builder.GetStorageQuery()});

//DELETE
var respDelete = service.Delete(new RequestItem<Guid>(){Item = updateUser.UserKey});
```

The ***IMappingRepository***<> interface defines an object that allows mapping an object to a designation object before calling a repository method. This allows creating repositories for classes that do not have an underlying data store, but that map to a base case that can. This provides a shorthand way to collapse several lines of code into just a couple. The following example shows an **IdentityUser** object (ASP.NET Identity User implementation) that maps to the internal ***SecurityUser*** class that is mapped to storage. The following shows the usage with a ***MappingRepository***:

```
//Starting object
IdentityUser identityUser = new IdentityUser();
identityUser.FirstName = "test";

//Update an IdentityUser method #1
var repoM1 = ObjectLocator.Current.GetInstance<ISecurityUserServiceRepository>();
var mapM1 = ObjectLocator.Current.GetInstance<IMappingService>();

SecurityUser securityUser = map.Map<IdentityUser, SecurityUser>(identityUser);

var respM1 = repoM1.update(new ResponseItem<SecurityUser>(){Item=securityUser}); //SAVE USER

//Update an IdentityUser method #2
var repoM2 = ObjectLocator.Current.GetInstance<IMappingRepository<IdentityUser, Guid,
ServiceModel.SecurityUser, ISecurityUserServiceRepository>>();

var respM2 = repoM2.update(new ResponseItem<IdentityUser>(){Item=identityUser}); //SAVE USER

//Update an IdentityUser method #3 - this uses a pre-defined interface, same as #2
public interface IIdentityUserServiceRepository : IMappingRepository<IdentityUser, Guid,
SecurityUser, ISecurityUserServiceRepository
{
}

var repoM3 = ObjectLocator.Current.GetInstance<IIdentityUserServiceRepository >();
var respM3 = repoM3.update(new ResponseItem<IdentityUser>(){Item=identityUser}); //SAVE USER
```

Dynamic Querying Over Service Boundaries

The ELEFLEX® platform needed a way of dynamic querying of information that crosses application boundaries and could also be leveraged against varying back-end storage mechanisms to support the **RF3 Dynamic SOA Data Manipulation** requirement. The solution was to build a simple model that could contain queryable expressions that would then be translated to dynamic Linq statements using the open source project [LinqKit](#).

Creating query expressions is done with the **Eleflex.StorageQueryBuilder** object. It contains standard methods and expressions to develop complex queries that can be transferred and translated easily. Because the information may pass application boundaries, the property name and data associated with the filter are stored as string values. The translation engine will parse the values to their native datatypes as needed. Specifying an invalid filter or a property name not defined on an object will return a response with a storage error code.

Name	Description
Aggregate	Perform an aggregate operation against a property including Average, BinaryChecksum, Checksum, Count, Minimum, Maximum, and Sum

Between	Perform a comparison between a high and low value
Compare	This includes IsEqual, NotEqual, GreaterThan, GreaterThanOrEqual, LessThan, and LessThanOrEqual.
Distinct	Get a distinct item set
Expression	Filter comparers including And, Or, BeginExpression and EndExpression. It is important to note that if an expression combiner (as in "And()") as well as "Or()") is not defined between two where clause filters, the engine will automatically use an "And()" filter when combining the filter tree.
Like	Comparison filter for StartsWith, EndsWith, Contains() and notcontains() operations using wild cards
Null	Determine if the property value is null or not null
PropertyComparison	Allows comparisons between properties
Select	Filter defines which properties are to be returned from a response. By default, all properties are selected for queries.
Set	Filter for InSet, NotInSet, defines a set of values that a property must value or not have
Sort	Determines the sort direction for a specific property
Paging	Filter that defines the number per page and page number of items that should be returned

The following example demonstrates how to create a simple query to find all users with the name equal to "TestUser" and have an EffectiveStartDate of null or an EffectiveStartDate in the past.

```
//CREATE REPOSITORY SERVICE
var service = ObjectLocator.Current.GetInstance<ISecurityRoleBusinessRepository>();

//CREATE BUILDER
StorageQueryBuilder builder = new StorageQueryBuilder();

//WHERE Name = "TestUser" AND have an effective start date of null or a date in the past
builder
    .IsEqual("Name", "TestUser")
    .And()
    .BeginExpression()
    .IsNull("EffectiveStartDate")
    .Or()
    .IsLessThanOrEqual("EffectiveStartDate", DateTimeOffset.UtcNow.ToString())
    .EndExpression();

//CALL SERVICE
var respRoles = service.Query(new ResponseItem<IStorageQuery>(){Item = builder.GetStorageQuery()});
```

Transaction Usage and Unit of Work

All storage transactions are handled using the ***Eleflex.IStorageContextUnitOfWork*** object. This object holds a list of all transactions that occur during processing of the current thread/request and allow *Commit()* or *RollBack()* of individual or all transactions created during the lifetime. Storage Repositories automatically register themselves with the Unit of Work object on creation. It is up to the programmer to *Commit()* or *Rollback()* the unit of work when all processing has been completed.

The ***Eleflex.IStorageContextUnitOfWork*** is configured with ***StructureMap*** by default to only create one instance per thread. This allows the same object instance to be shared by all objects on the same thread when using the object locator.

An example of managing transaction usage on a thread would be the following:

```
ISStorageContextUnitOfWork uow = ObjectLocator.Current.GetInstance<ISStorageContextUnitOfWork>();
try
{
    //DO WORK HERE WITH MULTIPLE REPOSITORIES

    uow.Commit();
}
catch (Exception ex)
{
    uow.Rollback();
    Logger.Current.Error("My transaction", ex);
}
```

Business Rules and Events

The platform provides business rules and events to execute customized business logic. These class provide an easy way to separate logic for a cleaner and more maintainable project. Additionally, they expose a mechanism to allow for cross-module integration of components and customization.

Business events are raised objects that inform other modules in the system of an application event. Business events are registered in the system by creating a new class that inherits from ***Eleflex.BusinessRuleEvent***. To fire the event, an extension method was created so that you simply create the object, set any properties and call the *RaiseEvent()* method. This causes all business rules subscribed to this object to be executed against the object. If any business rule being processed returns with a *ResponseSuccess* equals false, a managed exception will be thrown that will contain a user error message from the business rule that caused the error.

Business rules are classes that contain validation or business logic that subscribe to business events. Business rules are registered in the system by creating a new class that inherits from ***Eleflex.BusinessRule*** and it must have the ***[Eleflex.BusinessRuleProcess]*** class attribute applied with the object you plan on validating. Rather than registering each business rule individually, you can use

the ***Eleflex.BusinessRuleSet*** object instead with a reference to all linked business rules. This also must have the ***[Eleflex.BusinessRuleProcess]*** class attribute applied in order for the system to dynamic register it.

The Business Repository layer will raise an event with the object being operated on when the insert or the update method is called. This provides a general event that will be called before an object is saved. Assuming this succeeds, the Business Repository will call the Storage Repository next, along with its more granular events.

- (Object)
 - This event is fired just before an object is inserted or updated in the Business Repository. This provides a way to integrate generic extensions with other data access mechanisms when not using the Repository.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(object))`

The Storage Repository layer will raise an event with the object for the following methods during processing:

- `RepositoryInsertEvent<object>`
 - This event is fired just before the object is sent to storage.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryInsertEvent<object>))`
- `RepositoryDeleteEvent<object, datatype>`
 - This event is fired just before the object is deleted from storage.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryDeleteEvent<object, datatype>))`
- `RepositoryGetEvent<object, datatype>`
 - This event is fired just before the object is retrieved from storage.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryGetEvent<object, datatype>))`
- `RepositoryUpdateEvent<object>`
 - This event is fired just before the object is updated in storage.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryUpdateEvent<object>))`
- `RepositoryQueryEvent<object>`
 - This event is fired just before a query is performed.
 - Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryQueryEvent<object>))`
- `RepositoryQueryAggregateEvent<object>`
 - This event is fired just before a query aggregate is performed.

- Register a business rule against this event by creating a business rule with the attribute:
 - `BusinessRuleProcessAttribute(typeof(RepositoryQueryAggregateEvent<object>))`

The following example shows how to create a new business event and how to raise it to let other areas of the system know it has been fired. Note that using the *RaiseEvent()* extension method will throw a managed exception if any rules fail that it processes.

```
public partial class ExampleBusinessRuleEvent : BusinessRuleEvent
{
    public virtual string Data { get; set; }
}

ExampleBusinessRuleEvent myEvent = new ExampleBusinessRuleEvent ();
myEvent.Data = "test";
myEvent.RaiseEvent();
```

The following example demonstrates how to create a class that subscribes to *ExampleBusinessRuleEvent* being fired, from the above example.

```
[BusinessRuleProcessAttribute(typeof(ExampleBusinessRuleEvent))]
public partial class ExampleBusinessRule : BusinessRule
{
    public ExampleBusinessRule()
    {
        ErrorMessage = "Data cannot be null";
    }
    public override IResponse Execute(IRequestItem<IContext> request)
    {
        IResponse response = base.Execute(request);
        ExampleBusinessRuleEvent exampleEvent = (ExampleBusinessRuleEvent) request.Item.Item;
        If(exampleEvent.Data == null)
            Response.AddMessage(true, this.ErrorMessage);
        return response;
    }
}
```

This example demonstrates how to create a class that subscribes to the Business Repository raising an event on the SecurityUser object. This event will only be called from the Business Repository when the *Insert()* or *Update()* method is called.

```
[BusinessRuleProcessAttribute(typeof(SecurityUser))]  
public partial class SecurityUserBusinessRule : BusinessRule  
{  
  
    public SecurityUserBusinessRule()  
    {  
        ErrorMessage = "FirstName cannot be null";  
    }  
    public override IResponse Execute(IRequestItem<IContext> request)  
    {  
        IResponse response = base.Execute(request);  
        SecurityUser user = (SecurityUser) request.Item.Item;  
        If(user.FirstName == null)  
            Response.AddMessage(true, this.ErrorMessage);  
        return response;  
    }  
}
```

The next example shows how to create a business rule that will subscribe to the Storage Repository Insert business event.

```
[BusinessRuleProcessAttribute(typeof(RepositoryInsertEvent<SecurityUser>>))]  
public partial class ExampleUserBusinessRule : BusinessRule  
{  
  
    public ExampleUserBusinessRule()  
    {  
        ErrorMessage = "First name cannot be system";  
    }  
    public override IResponse Execute(IRequestItem<IContext> request)  
    {  
        IResponse response = base.Execute(request);  
        RepositoryInsertEvent<SecurityUser> insertEvent =  
(RepositoryInsertEvent<SecurityUser>)request.Item.Item;  
  
        If(insertEvent.FirstName == "system")  
            Response.AddMessage(true, this.ErrorMessage);  
        return response;  
    }  
}
```

MVC Page Routing and Embedded Web Applications

One of the platform's design requirements was to support a modular framework that allowed for web applications to be dynamically embedded. This requirement was achieved with an open source project called **MVC Code Routing**. This component allows a web application to add a reference to another web application and bind those pages to an MVC path in the server application. There are some rules to follow when building web applications, such as:

- It is recommended to create your module web controllers, models and view in the main website for debugging purposes first, then move all related files to the embedded web application once completed.
- Views in the web application module must have the Build Action property set to be "Embedded Resource" so that the View is compiled as an assembly resource.
- 3rd party user interface components are not required in the embeddable web application if they are installed in the server web application.
- Dots (.) are used as path separators. For example, accessing a website path of "/Products/Software" is defined as the path "Products.Software" and will call the SoftwareController object.
- Don't use dots (.) in the view file name except for the extension. When attempting to map a virtual path to an assembly resource, dots are interpreted as path separators (/).
- Use the "~" prior to a controller name to start in the application root. Use the "+" prior to a controller path to denote it is a child of the current path.

Deployment Considerations

In the simplest of deployment configurations, all presentation, services and logic can be housed within one application. In the most complex scenario, each service and presentation tier can be deployed to its process, machine or multiple machines for scalability and fault tolerance, as may be required by the customized infrastructure. WCF configuration bindings additionally provide more control of security and process handling of requests as customization may require.

Code Generation and Customization Considerations

One of the design considerations for the ELEFLEX® enterprise application framework has to do with the eventual customization of models and logic within the framework. All classes in the framework have been marked *partial* as well as all methods and properties marked *virtual* for overriding. Additionally, all variables should either be public or protected. Customizers should create new partial class files where ever possible to avoid conflicts with framework updates.

Application NuGet Packages

NuGet is the package manager for the Microsoft development platform including .NET. The NuGet client tools provide the ability to produce and consume packages. The NuGet Gallery is the central package repository used by all package authors and consumers.

The ELEFLEX® platform has been separated into several NuGet packages to allow module developers to reference certain portions of the platform that are required for a particular assembly or layer in the n-tiered architecture without needing to reference unused components. The following sections describe each package and their contents that are used to install the ELEFLEX® platform.

The following diagram displays which NuGet packages are installed on an ELEFLEX® web server and web client installation.

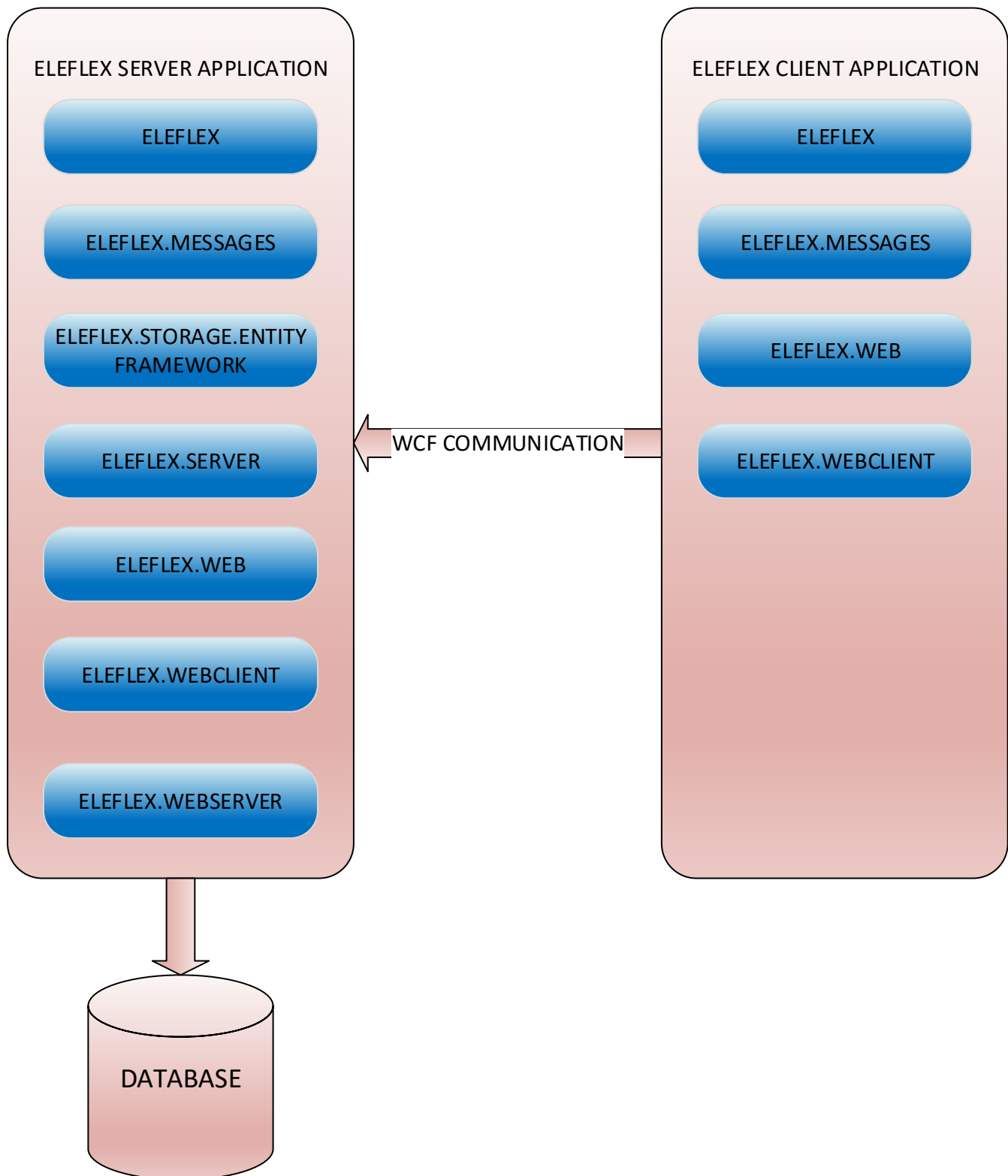


FIGURE 3- ELEFLEX NuGET PACKAGE INSTALLATION OVERVIEW

NuGet Open Source Project References

The ELEFLEX® platform utilizes several open source projects in its design to fulfill architectural needs, design characteristics, system requirements or needed functionality. The table below lists all components, a general overview of the project and how and where they are used in the platform.

NuGet Project	Version	Description	ELEFLEX Usage
Antlr	3.5.0.2	ANother Tool for Language Recognition, is a language tool that provides a framework for constructing recognizers, interpreters, compilers, and translators from grammatical descriptions containing actions in a variety of target languages.	Required by web compilers.
AutoMapper	4.1.1	A convention-based object-object mapper. AutoMapper uses a fluent configuration API to define an object-object mapping strategy. AutoMapper uses a convention-based matching algorithm to match up source to destination values. Currently, AutoMapper is geared towards model projection scenarios to flatten complex object models to DTOs and other simple objects, whose design is better suited for serialization, communication, messaging, or simply an anti-corruption layer between the domain and application layer.	Used for object to object mapping. See Eleflex.IMappingService
bootstrap	3.3.6	The most popular front-end framework for developing responsive, mobile first projects on the web.	Used for web page styling.
bootstrap.chosen	1.0.0	An alternate stylesheet for Chosen 1.0. This one is supposed to integrate better with Bootstrap 3.0.	Used for web drop down pickers.
chosen	1.2.0	Chosen is a JavaScript plugin that makes long, unwieldy select boxes much more user-friendly. It is currently available in both jQuery and Prototype flavors.	Used for web drop down pickers.
chosen.jquery	1.2.0	Chosen is a JavaScript plugin that makes long, unwieldy select boxes much more user-friendly. It is currently available in both jQuery and Prototype flavors.	Used for web drop down pickers.
Common.Logging	3.3.1	Common.Logging library introduces a simple abstraction to allow you to select a specific logging implementation at runtime.	Used for application logging.
Common.Logging.Core	3.3.1	Common.Logging.Core contains the portable (PCL) implementation of the Common.Logging low-level abstractions common to all other Common.Logging packages.	Used for application logging.

CommonServiceLocator	1.3	The Common Service Locator library contains a shared interface for service location which application and framework developers can reference. The library provides an abstraction over IoC containers and service locators. Using the library allows an application to indirectly access the capabilities without relying on hard references. The hope is that using this library, third-party applications and frameworks can begin to leverage IoC/Service Location without tying themselves down to a specific implementation. This library contains a portable class library that targets .NET Framework 4, Windows 8, Windows Phone Silverlight 8, Windows Phone 8.1, and Silverlight 5.	Used for object location.
CommonServiceLocator.StructureMapAdapter.Unofficial	3.0.4.125	An unofficial StructureMap Adapter for the Common Service Locator	Used for object location tying CommonServiceLocator and Structuremap together.
EntityFramework	6.1.3	Entity Framework is Microsoft's recommended data access technology for new applications.	Used for Microsoft SQL Server and Microsoft Azure database access. See Eleflex.Storage.EF.EntityStorageService
FontAwesome	4.4.0	Iconic font designed for use with Twitter Bootstrap. Package Issues? Post them to https://github.com/JustLikecarus/Font-Awesome-NuGet/issues	Used for web page icons.
jQuery	2.1.4	jQuery is a new kind of JavaScript Library. jQuery is a fast and concise JavaScript Library that simplifies HTML document traversing, event handling, animating, and Ajax interactions for rapid web development. jQuery is designed to change the way that you write JavaScript.	Used for web scripting.
jquery.datatables	1.10.9	DataTables is a plug-in for the jQuery Javascript library. It is a highly flexible tool, based upon the foundations of progressive enhancement, which will add advanced interaction controls to any HTML table.	Used for web table display.
jQuery.UI.Combined	1.11.4	jQuery UI is an open source library of interface components — interactions, full-featured widgets, and animation effects — based on the stellar jQuery javascript library . Each component is built according	Used for web display elements.

		to jQuery's event-driven architecture (find something, manipulate it) and is themeable, making it easy for developers of any skill level to integrate and extend into their own code.	
jQuery.Validation	1.14.0	This jQuery plugin makes simple clientside form validation trivial, while offering lots of option for customization. That makes a good choice if you're building something new from scratch, but also when you're trying to integrate it into an existing application with lots of existing markup. The plugin comes bundled with a useful set of validation methods, including URL and email validation, while providing an API to write your own methods. All bundled methods come with default error messages in english and translations into 32 languages.	Used for web scripting validations.
LINQKit	1.1.3.1	LINQKit is a free set of extensions for LINQ to SQL and Entity Framework power users.	Used to translate dynamic SOA queries into Linq commands. See Eleflex.Storage.EF.EntityQueryBuilder
Microsoft.AspNet.Identity.Core	2.2.1	Core interfaces for ASP.NET Identity.	Used for security.
Microsoft.AspNet.Identity.Owin	2.2.1	Owin implementation for ASP.NET Identity.	Used for security.
Microsoft.AspNet.Mvc	5.2.3	ASP.NET MVC is a web framework that gives you a powerful, patterns-based way to build dynamic websites and Web APIs. ASP.NET MVC enables a clean separation of concerns and gives you full control over markup.	Used for web page display.
Microsoft.AspNet.Razor	3.2.3	Razor is a markup syntax for adding server-side logic to web pages. This package contains the Razor parser and code generation infrastructure.	Used for web page display.
Microsoft.AspNet.Web.Optimization	1.1.3	ASP.NET Optimization introduces a way to bundle and optimize CSS and JavaScript files.	Used for web script and styles bundling.
Microsoft.AspNet.WebPages	3.2.3	This package contains core runtime assemblies shared between ASP.NET MVC and ASP.NET Web Pages	Used for web page display.
Microsoft.CodeDom.Providers.DotNetCompilerPlatform	1.0.1	Replacement CodeDOM providers that use the new .NET Compiler Platform ("Roslyn") compiler as a service APIs. This provides support for new language features in systems using CodeDOM (e.g. ASP.NET runtime compilation) as well as improving	Used for web page compilation.

		the compilation performance of these systems.	
Microsoft.jQuery.Unobtrusive.Validation	3.2.3	jQuery plugin that unobtrusively sets up jQuery.Validation.	Used be web scripting validations.
Microsoft.Net.Compilers	1.1.0	.Net Compilers package. Referencing this package will cause the project to be built using the specific version of the C# and Visual Basic compilers contained in the package, as opposed to any system installed version.	Required for web applications.
Microsoft.Owin	3.0.1	Provides a set of helper types and abstractions for simplifying the creation of OWIN components.	Used for security.
Microsoft.Owin.Host.SystemWeb	3.0.1	OWIN server that enables OWIN-based applications to run on IIS using the ASP.NET request pipeline.	Used for security.
Microsoft.Owin.Security	3.0.1	Common types which are shared by the various authentication middleware components.	Used for security.
Microsoft.Owin.Security.Cookies	3.0.1	Middleware that enables an application to use cookie based authentication, similar to ASP.NET's forms authentication.	Used for security.
Microsoft.Owin.Security.OAuth	3.0.1	Middleware that enables an application to support any standard OAuth 2.0 authentication workflow.	Used for security.
Microsoft.Web.Infrastructure	1.0.0.0	This package contains the Microsoft.Web.Infrastructure assembly that lets you dynamically register HTTP modules at run time.	Used for startup (custom).
Modernizr	2.8.3	Modernizr adds classes to the <html> element which allow you to target specific browser functionality in your stylesheet. You don't actually need to write any Javascript to use it. Modernizr is a small and simple JavaScript library that helps you take advantage of emerging web technologies (CSS3, HTML5) while still maintaining a fine level of control over older browsers that may not yet support these new technologies.	Used for web page styling.
Moment.js	2.10.6	A lightweight javascript date library for parsing, manipulating, and formatting dates.	Used for web scripting.
MvcCodeRouting	1.3.0	Namespace-based Modularity for ASP.NET MVC and Web API. Convention over configuration Automatic Routing.	Used for MVC page routing and Module embedded web applications.
Newtonsoft.Json	7.0.1	Json.NET is a popular high-performance JSON framework for .NET	Used for web page display.
Owin	1.0	OWIN IAppBuilder startup interface	Used for security.

Respond	1.4.2	The goal of this script is to provide a fast and lightweight (3kb minified / 1kb gzipped) script to enable responsive web designs in browsers that don't support CSS3 Media Queries - in particular, Internet Explorer 8 and under. It's written in such a way that it will probably patch support for other non-supporting browsers as well (more information on that soon).	Used for web page styling.
smalot.bootstrap-datetimepicker	1.0.4	This library is developed by Smalot, this package is just copy the library to nuget.	Used for web date/time pickers.
structuremap	4.0.0.315	StructureMap is a Dependency Injection / Inversion of Control tool for .Net	Used for object location.
structuremap.web	4.0.0.315	ASP.Net specific functionality for use with the StructureMap IoC container	Used for object location.
WebGrease	1.6.0	Web Grease is a suite of tools for optimizing javascript, css files and images.	Used for web scripting and styling.

ELEFLEX NuGet Packages

Eleflex Package

This package contains the platform's core object model. This package should be added to all assemblies in the application. This consists of the following core interfaces and models:

- BusinessRules
 - This contains BusinessRules, BusinessEvents and the BusinessRuleService used for processing events.
- Context
 - This contains a model used to store the context of a call, including user information
- Core
 - This contains constants and base interfaces used in the platform.
- Exceptions
 - This contains managed exceptions used by the platform.
- Logging
 - This contains interfaces and objects for logging application messages
- Mapping
 - This contains interfaces used for mapping an object to another object.
- Messages
 - This contains the object model used for service messages.
- ObjectLocation
 - This contains the interfaces and model for the ObjectLocator object used for creating objects and their dependencies.
- RequestResponse

- This contains the objects used for service request and response objects.
- Security
 - This contains the object used for security, including SecurityUser, SecurityRole, SecurityPermission and more.
- Services
 - This contains the interfaces for sending data over services.
- Startup
 - This contains objects used for application startup, registrations and shutdown.
- Storage
 - This contains the main repository interfaces for exposing persistent data in the platform.
- Versioning
 - This contains the object model used for versioning modules in the platform.

Eleflex.Messages Package

This package contains the WCF service components used for defining service contracts and communicating with the server application from a client application. This package should be added to assemblies that expose service contracts. This consists of the following namespaces:

- Eleflex.Services.WCF
 - This contains the core interfaces and objects for service commands and service request dispatchers.
- Eleflex.Logging.Services.WCF
 - This contains the core interfaces and objects for exposing logging information.
- Eleflex.Security.Services.WCF
 - This contains the core interfaces and objects for exposing security information.
- Eleflex.Versioning.Services.WCF
 - This contains the core interfaces and objects for exposing versioning information.

Eleflex.Server Package

This package contains the server commands and data access components required to host services in the platform for the platform's core object model. This contains the core classes for logging, security and versioning. This package should only be added to the server application that exposes service commands and data access for the core application components. This consists of the following namespaces:

- Eleflex.Logging.Services.WCF.Server
 - This contains service commands for the logging module.
- Eleflex.Logging.Storage.EF
 - This contains the entity framework data access layer for the logging module.
- Eleflex.Logging.Storage.EF.AutoMapper
 - This contains the business model to storage model AutoMapper mappings.

- Eleflex.Logging.Storage.EF.Azure
 - This contains the data access components for use with Microsoft Azure.
- Eleflex.Logging.Storage.EF.SqlServer
 - This contains the data access components for use with Microsoft SQL Server.
- Eleflex.Security.Services.WCF.Server
 - This contains service commands for the Security module.
- Eleflex.Security.Storage.EF
 - This contains the entity framework data access layer for the Security module.
- Eleflex.Security.Storage.EF.AutoMapper
 - This contains the business model to storage model AutoMapper mappings.
- Eleflex.Security.Storage.EF.Azure
 - This contains the data access components for use with Microsoft Azure.
- Eleflex.Security.Storage.EF.SqlServer
 - This contains the data access components for use with Microsoft SQL Server.
- Eleflex.Versioning.Services.WCF.Server
 - This contains service commands for the Versioning module.
- Eleflex.Versioning.Storage.EF
 - This contains the entity framework data access layer for the Versioning module.
- Eleflex.Versioning.Storage.EF.AutoMapper
 - This contains the business model to storage model AutoMapper mappings.
- Eleflex.Versioning.Storage.EF.Azure
 - This contains the data access components for use with Microsoft Azure.
- Eleflex.Versioning.Storage.EF.SqlServer
 - This contains the data access components for use with Microsoft SQL Server.

Eleflex.Storage.EntityFramework Package

This package contains the data access layer components used to expose data from Microsoft SQL Server and Microsoft Azure database platforms. This package should be added to Module server packages that contain data access components. This consists of the following namespaces:

- Eleflex.Storage.EF
 - This contains the core Entity Framework service repository and storage service objects used to connect to SQL Server and Azure database engines.

Eleflex.Web Package

This package contains the startup components for integrating logging with common logging, object location with Structuremap, object mapping for AutoMapper and ASP.NET Identity and OWIN security classes. This package should be added to Module embedded web application packages. This consists of the following namespaces:

- Eleflex.Logging.CommonLogging

- This contains Common.Logging components that expose logging in the application using the Business Repository. This should be used for server applications.
- Eleflex.Logging.CommonLogging.WCF
 - This contains Common.Logging components that expose logging in the application using the Service Repository. This should be used for client applications.
- Eleflex.Mapping.AutoMapper
 - This contains the Automapper service and registration tasks.
- Eleflex.ObjectLocation.CSL
 - This contains the core CommonServiceLocator service.
- Eleflex.ObjectLocation.CSL.StructureMap
 - This contains the ObjectLocation and Business Rule startup tasks.
- Eleflex.ObjectLocation.CSL.StructureMap.Web
 - This contains web components for MVC dependency injection, ModelState extensions, and Unit of Work registration tasks.
- Eleflex.Security.ASPNetIdentity
 - This contains the core ASP .NET Identity model to expose security in the application. It exposes the IdentityUser, IdentityRole and Business Repositories to interact with data.
- Eleflex.Security.ASPNetIdentity.AutoMapper
 - This contains an Automapper registration task to register Security to Identity object mappings.
- Eleflex.Services.WCF.OWIN
 - This contains the WCF server and client behaviors for system impersonation and Service Repository objects for security services.
- Eleflex.Web
 - This contains web componenets such as web background processes, AjaxResponse and other web objects.

Eleflex.WebClient Package

This package contains web startup and registration tasks that configure a web application to communicate with an ELEFLEX® server application. It also contains dependencies to the web-based open source packages that are used in the platform, such as jquery, bootstrap, etc. This package should be added to an ELEFLEX® client application. This package should not be added to a Module's embedded web application.

Eleflex.WebServer Package

This package contains web startup and registration tasks that configure a web application to become an ELEFLEX® server application. This package relies on startup and registration tasks used in the Eleflex.WebClient package, and additionally overwrites other files that are specific to the server application. It contains the Eleflex.Server package to exposes the WCF commands and connect to the

data access providers. This package should be added to an ELEFLEX® server application. This package should not be added to a Module's embedded web application.

ELEFLEX Module Design

This section outlines an ELEFLEX Module that integrates with the platform.

Using Eleflex.Email Module as an Example

For the next sections, we are going to examine the Eleflex.Email Module. The source code for the Eleflex.Email module is included in the same release as the ELEFLEX complete source code. Download the [complete source code online](#). The Eleflex.Email module project files are located in the solution folder under Release/NuGet.

The Email Module provides distributed storage and sending of emails. By default in the ELEFLEX platform, emails are sent directly to an SMTP server. If the SMTP server is offline, the email trying to be sent could be lost, or an application workflow could not proceed unless the email is sent. To alleviate this, the Email module provides the following functionality:

- It creates database tables used to store email messages temporarily.
- It creates an object location configuration that maps the ASP.NET Identity email store to use its service, which stores the email in the database table instead of trying to send it immediately.
- It creates a web process that runs every minute to see if any email messages need to be sent. It will then pull messages out in a queue fashion and attempts to send the email. If it succeeds, it marks the email as being sent. If a send error happens, the email stays in the queue and will be attempted later.
- It creates a web process that runs once every 8 hours to purge emails from the system that are older than a configured number of days. By default, emails are deleted after being 30 days old.

Module Assemblies

Assembly namespaces are laid out with the first tuple comprising the company name, the module name, and the remainder following the ELEFLEX project template name.

- Eleflex.Email
 - This assembly contains the core interfaces, business model, rules, events and workflow needed for the module.
- Eleflex.Email.Messages
 - This assembly contains the service contract interfaces, models and client services needed to call a hosted service that exposes this information.
- Eleflex.Email.Server
 - This assembly contains the WCF service commands exposed from the Messages assembly as well as the data access components needed to access the data directly.
- Eleflex.Email.WebClient

- This assembly is optional, however it can be used to hold logic, as well as provide versioning information to be displayed in the platform.
- The module uses this assembly to store an ASP.NET Identity Email Service using a Service Repository and also provide versioning information.
- Eleflex.Email.WebServer
 - This assembly is optional, however it can be used to hold logic, as well as provide versioning information to be displayed in the platform.
 - The module uses this assembly to store an ASP.NET Identity Email Service using a Business Repository and also provide versioning information.
- Eleflex.Email.Web.Admin
 - This assembly is a web application that will be embedded in the host application to displays views made for the Email module.

Database Tables and Entity Model

The Email Module creates the following tables to store email messages temporarily:

- EmailProcess
 - This contains the main email components such as from, to subject, body, etc., as well as columns for processing emails.
- EmailProcessAttachment
 - This contains any attachments to the email.

In order to manipulate these tables, we rely on an object relational mapping tool (ORM) from Microsoft called Entity Framework. The Eleflex.Storage.EntityFramework NuGet package contains framework classes that perform the work using this technology.

The Eleflex.Email.Server project contains the ADO .NET Entity Data Model for the database tables called "EmailDB.edmx". This allows developers access to the database table programmatically. This file is important because the T4 text templates will generate all the default classes needed in the module using this, discussed in the next section.

T4 Text Templates Generate Needed Files

The platform utilizes T4 text templates to generate nearly all needed files for a Module. The templates require an Entity Data Model to be created first, to use as a data source. At the top of the template will be a configuration section where you will modify the input parameters to work with your project. By default, the Entity Data Model should be created in the Eleflex.Email.Server project.

The text templates will create partial interfaces and classes, as well as make sure methods are marked virtual to allow developers to create derived classes with the most overloading possibilities. Running the template will cause all files to be regenerated, so do not make changes in generated files. Whenever possible, create a new partial file to add functionality, otherwise modifying the template may be required.

The text templates for each of the assemblies is listed along with the files produced for each template.

- Eleflex.Email
 - Eleflex_Email_CodeGen.tt
 - (table name).cs
 - Business model object
 - I(table name).cs
 - Interface for business model object
 - I(table name)BusinessRepository.cs
 - Interface for a Business Repository for managed data access.
 - I(table name)StorageRepository.cs
 - Interface for a Storage Repository for managed data access.
 - (table name)BusinessRepository.cs
 - Business Repository class for managed data access.
 - I(table name)StorageServer.cs
 - Interface for a Storage Service. (Such as SQL Server access via Entity Framework)
 - (module name)Constants.cs
 - A class containing constants used by the various layers
- Eleflex.Email.Messages
 - Eleflex_Email_Services_WCF_Message_CodeGen.tt
 - (table name).cs
 - Service model object
 - (table name>DeleteRequest.cs
 - Request object for the delete service command.
 - (table name>DeleteResponse.cs
 - Response object for the delete service command.
 - (table name)GetRequest.cs
 - Request object for the get service command.
 - (table name)GetResponse.cs
 - Response object for the get service command.
 - (table name)InsertRequest.cs
 - Request object for the insert service command.
 - (table name)InsertResponse.cs
 - Response object for the insert service command.
 - (table name)QueryAggregateRequest.cs
 - Request object for the query aggregate service command.
 - (table name)QueryAggregateResponse.cs
 - Response object for the query aggregate service command.

- (table name)QueryRequest.cs
 - Request object for the query service command.
- (table name)QueryResponse.cs
 - Response object for the query service command.
- (table name)UpdateRequest.cs
 - Request object for the update service command.
- (table name)UpdateResponse.cs
 - Response object for the update service command.
- I(table name)ServiceRepository
 - Interface for the Service Repository for service-based data access.
- I(table name)ServiceRepository
 - Service Repository class for service-based data access.
- I(table name)ServicesRegistrationTask
 - Registration task to configure WCF access for client applications.
- I(module name)RequestDispatcher
 - Interface for a Request Dispatcher used to send WCF messages for the module.
- (module name)RequestDispatcher
 - Request Dispatcher class used to send WCF messages for the module.
- Eleflex.Email.Server
 - Eleflex_Email_Services_WCF_AutoMapper_CodeGen.tt
 - (table name)ServicesAutomapperRegistrationTask.cs
 - Registers Automapper mapping between the business and service models
 - Eleflex_Email_Services_WCF_Server_CodeGen.tt
 - (table name)Delete.cs
 - WCF service command for repository delete.
 - (table name)Get.cs
 - WCF service command for repository get.
 - (table name)Insert.cs
 - WCF service command for repository insert.
 - (table name)Query.cs
 - WCF service command for repository query.
 - (table name)Update.cs
 - WCF service command for repository update.
 - (table name)QueryAggregate.cs
 - WCF service command for repository query aggregate
 -
 - Eleflex_Email_Storage_EF_CodeGen.tt
 - (table name)StorageRepository.cs

- Entity Framework storage repository class.
- (module name)StorageService.cs
 - Module data storage service so all storage repository use the same database connection
- (entity data model name)Custom.cs
 - Adds a partial class with a constructor taking in a connection string
- Eleflex_Email_Storage_EF_AutoMapper_CodeGen.tt
 - (table name)StorageAutomapperRegistrationTask.cs
 - Automapper configuration for business to storage model mapping

Embedded Web Application

An embedded web application allows deploying a web application as an assembly reference and mapping its root controller an MVC route in the host application. This is accomplished by using the [MVC Code Routing](#) open source component. Using namespace-based routing, instead of conventional MVC routing, routes don't need to be configured and are dynamically found by using the root controller namespace. This reduces NuGet upgrade issues with deploying individual files web application files in a host process as the whole module application can be deployed as a project reference.

Creating an embedded web application is the same as creating any other web application. One key difference is that you must set the property for all views in the application for "Build Action" to "Embedded Resource". This is found in the Visual Studio property window for the view. This will embed the view in the assembly so that it can be found by the dynamic routing engine in the host application. It is recommended for debugging purposes to create the controllers/models/views in the host application first, then once working, move then to the embedded web application.

Examining the Eleflex.Email.Web.Admin project, it contains controllers, models and views as any other web application would. In order to register this embedded web application in a host application, we need to add an MVC route configuration. For the default system components, this is found in web server and web client applications in the App_Start/Eleflex_Start/WebRoutesStartupTask.

When installing new ELEFLEX® Modules, developers should try not to modify any existing files in an ELEFLEX® installation. Instead, create new files specific to your module and use the startup conventions to configure and register your module.

The next example shows how the Eleflex.Email module configures its embedded admin web application route into the host process. This is found in the App_Start/Eleflex_Start/EleflexEmail/WebClientRoutesStartupTask.cs file. This will set the host web application route for "/Admin/Email" to point to the Eleflex.Email.Web.Admin project's AdminController and all web requests will be funneled to this application.

```
using System.Web.Routing;
using Eleflex;
using MvcCodeRouting;

namespace WebServer.App_Start.Eleflex_Start.EleflexEmail
{
    /// <summary>
    /// Represents a startup task for configuring routes in the web application.
    /// </summary>
    public partial class WebClientRoutesStartupTask : StartupTask
    {
        /// <summary>
        /// Constructor.
        /// </summary>
        public WebClientRoutesStartupTask() : base()
        {
            Description = @"This task registers mvc routes used for the ELEFLEX Email Module.";
            Priority = StartupConstants.PRIORITY_CUSTOM;
        }

        /// <summary>
        /// Start processing logic.
        /// </summary>
        /// <param name="taskOptions"></param>
        /// <returns></returns>
        public override bool Start(ITaskOptions taskOptions)
        {
            //CONFIGURE ROUTE FOR ADMIN/Email
            RouteTable.Routes.MapCodeRoutes(
                baseRoute: "Admin/Email",
                rootController: typeof(Eleflex.Email.Web.Admin.Controllers.AdminController),
                settings: new CodeRoutingSettings
                {
                    EnableEmbeddedViews = true,
                }
            );

            return base.Start(taskOptions);
        }
    }
}
```

Configure Startup and Registration Tasks

The Email Module needs to register object location and registration tasks. It creates these files in the server and client applications in the App_Start/Eleflex_Start/EleflexEmail folder. It creates the following:

- WebClientObjectLocationRegistrationTask.cs

- This task registers the EmailRequestDispatcher for service-based access and registers a new email service for the ASP.NET Identity mail service used to store emails rather than sending them.
- WebClientRoutesStartupTask.cs
 - This task registers the embedded web application in the host process.
- WebServerObjectLocationRegistrationTask.cs (WebServer only)
 - This task registers the Email StorageService for database access.
- WebServerProcessStartupTask.cs
 - This task starts background processes for sending emails and purging emails.

Patches for Integration and System Updates

The Email module needs to create versioning patch files so that it can be packaged and deployed on other ELEFLEX® platforms. This is very important to keep database DDL changes in sync with the code. Current Patch version numbers are stored in the versioning table and displayed in the admin section of the web application.

ELEFLEX® web server applications have a startup task added to their application called SystemPatchStartupTask.cs. This startup task loads the patch manager and starts the upgrade processes for all installed modules. This following lists the Email assemblies and the patches created for each.

- Eleflex.Email.Messages
 - ModulePatch Folder
 - The patches in this module are created strictly for cosmetic reasons so that the Eleflex.Email.Messages package is registered in the versioning table for completeness.
- Eleflex.Email.Server
 - ModulePatch Folder
 - The patches in this module are created strictly for cosmetic reasons so that the Eleflex.Email.Server package is registered in the versioning table for completeness.
 - Eleflex.Email.Storage.EF.Azure Folder
 - The patches in this module are created to keep Microsoft Azure database DDL/schema changes in sync with the code.
 - Eleflex.Email.Storage.EF.SqlServer Folder
 - The patches in this module are created to keep Microsoft SQL Server database DDL/schema changes in sync with the code.
- Eleflex.Email.WebClient
 - ModulePatch Folder

- The patches in this module are created strictly for cosmetic reasons so that the Eleflex.Email.WebClient package is registered in the versioning table for completeness.
- Eleflex.Email.WebServer
 - ModulePatch Folder
 - The patches in this module are created strictly for cosmetic reasons so that the Eleflex.Email.Webserver package is registered in the versioning table for completeness.

NuGet Packaging

Each NuGet package has an *.nuspec file that contains information about the package. This contains metadata such as the project id, name, summary, project references, etc. Additionally, NuGet includes a folder structure on adding assemblies, content and project references to a package. These are stored in version number folders found in each solution's NuGet folder using file explorer.

The Email module is broken up into the following NuGet packages:

- Eleflex.Email.Messages
 - This contains the service contracts for calling email services.
 - Contains Eleflex.Email.Messages assembly.
- Eleflex.Email.Server
 - This contains the service commands and data access logic
 - Contains Eleflex.Email and Eleflex.Email.Server assemblies.
- Eleflex.Email.WebClient
 - This contains web client-based logic, service calls, embedded web application, patches and startup tasks.
 - Contains the Eleflex.Email.WebClient and Eleflex.Email.Web.Admin assemblies.
- Eleflex.Email.WebServer
 - This contains web server-based logic, patches and startup tasks.
 - Contains the Eleflex.Email.WebServer assembly.

The following diagram displays an ELEFLEX Module package installation requirements for a web server and web client application.

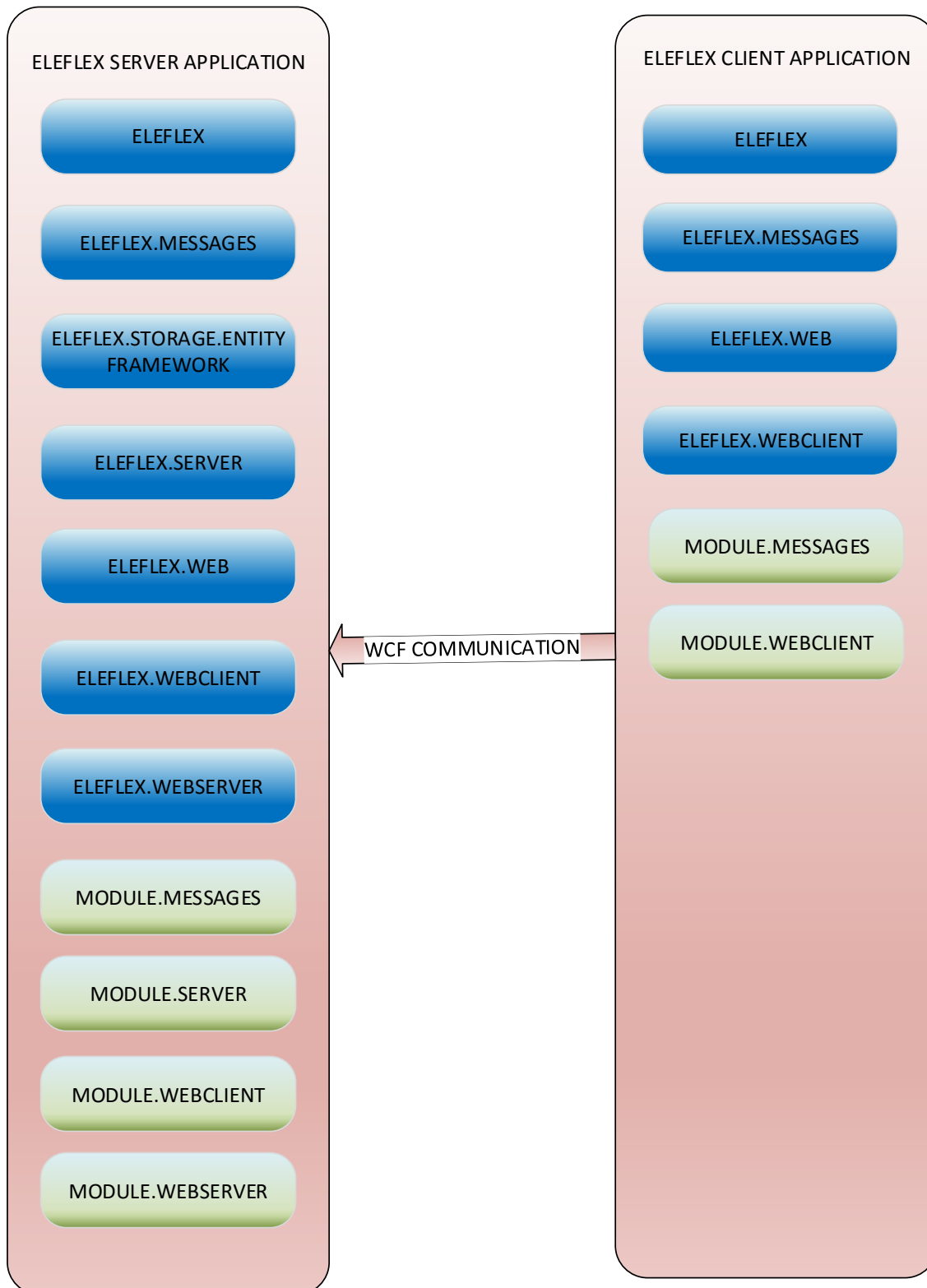


FIGURE 4- MODULE NuGET PACKAGE INSTALLATION OVERVIEW

The next diagram shows the package dependencies of an ELEFLEX Module with the platform released packages.

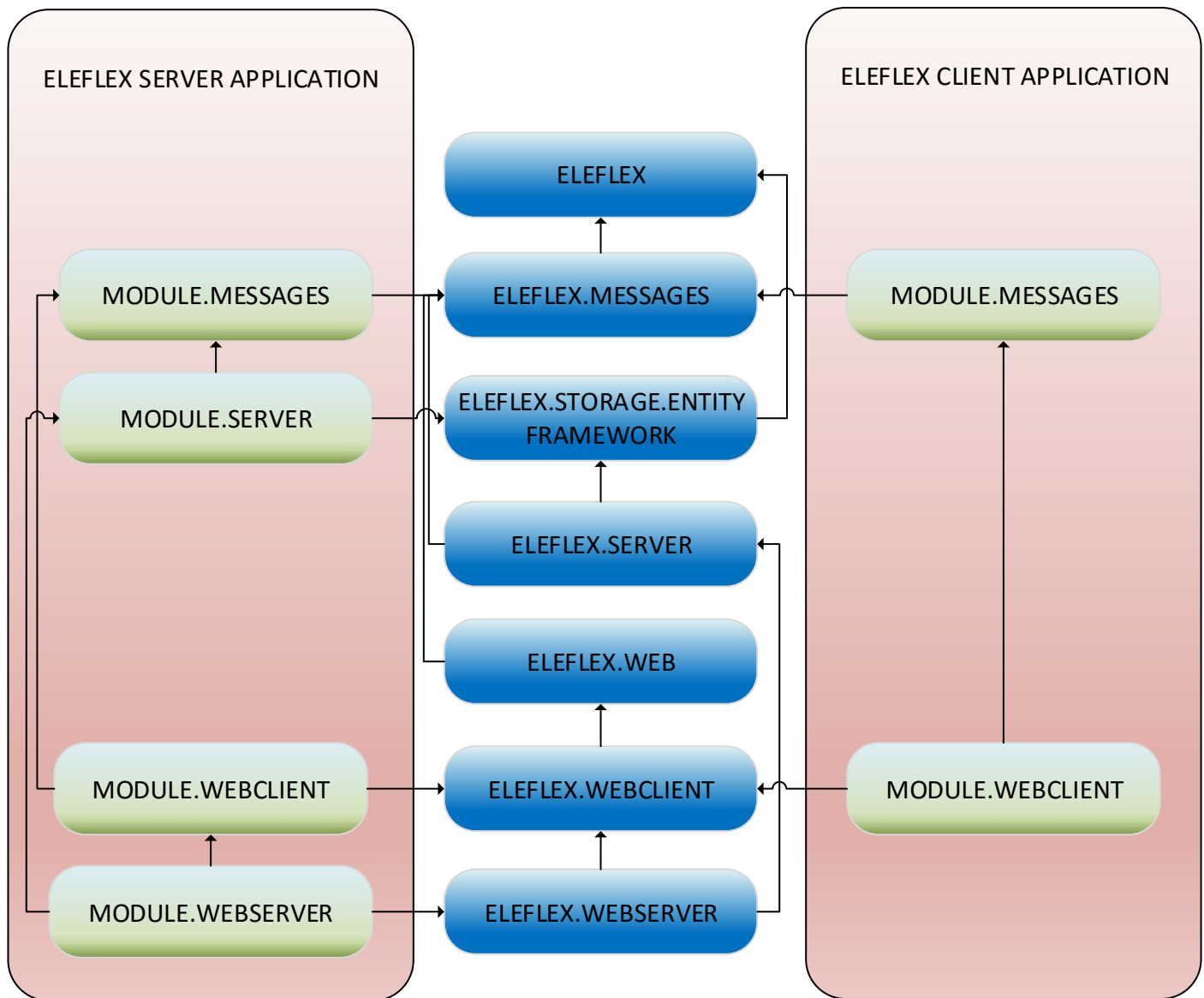


FIGURE 5- ELEFLEX MODULE RELATIONSHIPS

Implementation Details

This section outlines implementation details of the NuGet packaged applications.

Create an Eleflex.WebServer Application

Follow the steps below to create a new Eleflex.WebServer application.

- 1) Open Microsoft Visual Studio 2015 and create a new ASP.NET Web Application (Empty Template)
- 2) Right click your web application in the solution explorer and select "Manage NuGet Packages for Solution", search for "Eleflex.WebServer" and install the package.

- a. When prompted to overwrite any files, select "Yes to All"
- 3) Right click your web application in the solution explorer, select "Properties" and go to the "Web" tab on the left. Copy the port number of your web application.
 - a. Update the web.config file for the system.servicemodel/client/endpoint address. Change the "localhost:16185" to be your web application's port number.
- 4) Open Microsoft SQL Management Studio and create a new database. Update the web.config file to change the connection string to connect to the database you just created.
- 5) Change the web.config file for the appSettings key of "EleflexImpersonateSystemToken" to be any new value.
 - a. This allows system admin impersonation over services. This key should be changed before publishing your application.
- 6) Rebuild your web application and run it. The first user to register with the system receives the Admin role to administer the system.
 - a. Go to the Login page and click the "Register New User" link. Enter your information and you will be logged in as an Admin of the system.

Create an Eleflex.WebClient Application

Follow the steps below to create a new Eleflex.WebClient application.

- 1) Open Microsoft Visual Studio 2015 and create a new ASP.NET Web Application (Empty Template)
- 2) Right click your web application in the solution explorer and select "Manage NuGet Packages for Solution", search for "Eleflex.WebClient" and install the package.
 - a. When prompted to overwrite any files, select "Yes to All"
- 3) Update the web.config file for the system.servicemodel/client/endpoint address. Change the "localhost:16185" to be your Eleflex.WebServer's port number.
- 4) Make sure that the web.config appSettings key for "EleflexImpersonateSystemToken" is the same as your Eleflex.WebServer's app setting for the same key.
 - a. This allows system admin impersonation over services. This key should be changed before publishing your application.
- 5) Rebuild your web application and run it. This web client application will run the same as the web server application, except that all calls for data will be sent to the web server application using WCF services.

Package Installed Files

Installing the Eleflex.WebClient or Eleflex.WebServer NuGet packages will modify the Global.asax and web.config files, as well as create several files in your web application. These files are used to configure the application to work with the platform and to start and stop it.

Global.asax

Both packages will update the Global.asax.cs file to add platform specific logic.

- **Application_Start()**
 - This method first load all assemblies into the application domain and create an instance of the Eleflex.SystemStartupShutdown object to call it's *Start()* method to start the platform.
- **Application_End()**
 - This method will create an instance of the Eleflex.SystemStartupShutdown object to call it's *Stop()* method to stop the platform.
- **Application_Error()**
 - This method will log an application error message calling the Eleflex.Logger object along with the HTTP server error that occurred.
- **Application_EndRequest()**
 - This method will commit and dispose the IStorageContextUnitofWork to release all transactions created during the course of the client web request. Since the client application only uses service's to communicate, this is only useful for the server application where storage methods may have been called during the request.

App_Start/Eleflex_Start Folder

The main differences between the Eleflex.WebClient and Eleflex.WebServer startup tasks is usually object location configurations. WebClient applications will register services that use ServiceRepository objects for service communication, whereas WebServer applications will register services that use BusinessRepository objects for direct access to data.

- **OWINStartup (both)**
 - This task configures OWIN and ASP .NET Identity security for the application.
- **SystemLoggingStartupTask (both)**
 - This task configures Logging for the application.
- **SystemObjectLocationRegistrationTask (both)**
 - This task configures object location configurations for the core system components of Logging, Security and Versioning.
 - This registers ServiceRequestDispatchers for service-based access
 - For Eleflex.WebServer, this additionally registers StorageServices to connect to underlying data persistence engines.
- **SystemPatchStartupTask (Eleflex.WebServer only)**
 - This task is used to patch the system for versioning.
- **SystemShutdownTask**
 - This task shuts down the system
- **WebBundlesStartupTask**
 - This task is used to create script and style bundles for the web application

- WebFiltersStartupTask
 - This task is used to create filters for the web application.
- WebRoutesStartupTask
 - This task registers MVC page routes for embedded web applications to be hosted in the main web application.

Web.config

- appSettings
 - Adds "webpages.Version" for MVC 5 configuration
 - Adds "enableSimpleMembership" to disable default ASP.NET Identity
 - Adds "EleflexImpersonateSystemToken" which allows impersonating the system account for service calls. This should be changed before deploying your web application!
- connectionStrings (Eleflex.WebServer only)
 - Adds the "EleflexDefault" database connection string used by all modules by default.
- system.net/mailSettings (Eleflex.WebServer only)
 - Adds default settings for sending email
- System.servicemodel/extensions and behaviors
 - EleflexCookieSecurityClientBehavior (Eleflex.WebClient only)
 - Adds behavior for sending impersonation token in service command header
 - EleflexCookieSecurityServerBehavior (Eleflex.WebServer only)
 - Adds behavior for receiving impersonation token or credentials to impersonate the system admin or a user during the service command request.
- System.servicemodel/bindings (Eleflex.WebClient only)
 - Adds bindings for the call to the web server application
- System.servicemodel/clients (Eleflex.WebClient only)
 - Adds the address to call the web server application
- System.servicemodel/services (Eleflex.WebServer only)
 - Adds the exposed service used by all service commands in the platform.

EleflexService.svc

This WCF service file is added to the root of the Eleflex.WebServer application and exposes the platform's WCF service commands for all modules.

Content Folder

- Eleflex.css
 - Specific themes for the default installed website.
- EleflexTheme.css
 - Bootstrap theme for the default installed website.

Controllers Folder

- EleflexHomeController.cs
 - Default controller for the web application. This can be changed by modifying the WebRoutesStartupTask.
- ErrorController.cs
 - Default controller for handling errors in the web application.
- Admin\AdminController.cs
 - Controller requiring the user to have the “Admin” role assigned to view.

Images/ProductionReady Folder

This contains Production Ready® images used for the default web application.

Scripts Folder

- Eleflex.js
 - This contains custom functions used in the website.
 - Load()
 - This will automatically configure datatables, select pickers, and date/datetime pickers and validators by using defined classes
 - eleflexClearInput()
 - This will clear input controls within a form.
 - eleflexGetRequestVerificationToken()
 - This will get the antiforgery token for use with ajax posts to the server.
 - eleflexHandleAjaxResponse()
 - This will handle an AjaxResponse from an ajax call and call success, warning, info or error messages as required.
 - eleflexShowSuccessMessage()
 - Display a success message.
 - eleflexShowErrorMessage()
 - Display an error message.
 - eleflexShowInfoMessage()
 - Display an info message.
 - eleflexShowWarnMessage()
 - Display a warning message.
 - eleflexDeleteMessages()
 - Remove all displayed messages.

Views Folder

- _ViewStart.cshtml
 - This configures all pages to use the EleflexDefaultLayout for the default application
- Admin Folder

- Default views for the web application.
- EleflexHome Folder
 - Default views for the web application.
- Error Folder
 - Default views for the web application.
- Shared Folder
 - Default views for the web application.

Configuring an Eleflex.WebServer for Azure

Changing the web server application to use Microsoft Azure is simple. You will need to change the object location configurations for the storage services to use Azure instead of the default SQL Server configurations. Update the App_Start/Eleflex_Start/SystemObjectLocationRegistrationTask.cs class. For each storage service, change the constructor parameter for `ISTORAGESEVICE_CONSUCTORPARAM_VERSIONINGSTORAGECONFIG` to use the Azure config for each library instead of `SqlServer`.

```
Eleflex.Logging.Storage.EF.SqlServer.LoggingSqlServerConstants.VERSIONING_STORAGE_CONFIG
```

```
Eleflex.Versioning.Storage.EF.SqlServer.VersioningSqlServerConstants.VERSIONING_STORAGE_CONFIG)
```

```
Eleflex.Security.Storage.EF.SqlServer.SecuritySqlServerConstants.VERSIONING_STORAGE_CONFIG
```

Should be changed to:

```
Eleflex.Logging.Storage.EF.Azure.LoggingAzureConstants.VERSIONING_STORAGE_CONFIG
```

```
Eleflex.Versioning.Storage.EF.Azure.VersioningAzureConstants.VERSIONING_STORAGE_CONFIG
```

```
Eleflex.Security.Storage.EF.Azure.SecurityAzureConstants.VERSIONING_STORAGE_CONFIG
```

Web Processes

As of the time of writing this document, Microsoft Azure does not support .NET 4.5.2 and the `QueueBackgroundWorkItem` object. The ***Eleflex.EleflexWebProcess*** object uses a simple timer object to routinely run a background process until the Microsoft Azure platform supports an upgraded framework.

This example shows how to create a startup task that creates a background web process.

```
public class ExampleProcessStartupTask : StartupTask
{
    protected EleflexWebProcess _exampleProcess = null;

    public ExampleProcessStartupTask() : base()
    {
        Description = @"This task starts the example background process.";
        Priority = StartupConstants.PRIORITY_CUSTOM;
    }

    public override bool Start(ITaskOptions taskOptions)
    {
        if (_exampleProcess == null)
        {
            _exampleProcess = new EleflexWebProcess(60000, //Run every minute (high priority)
                () =>
                {
                    try
                    {
                        //Do work here
                    }
                    catch { }
                }
            );
        }
    }
}
```

Create a new ELEFLEX Module

This section will outline how to build and publish an ELEFLEX Module.

We are currently developing a new module that will generate all the required assemblies and files needed for you to develop a module. COMING SOON!

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