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Nintex Assurance Digital Signature Integration - Complete Build Book

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Introduction & Architecture Overview

This build book provides two complete implementations for integrating Nintex Assurance digital signature capabilities with Microsoft Dataverse. Both approaches achieve the same core functionality but serve different architectural and business needs.

Core Functionality

Both implementations provide:

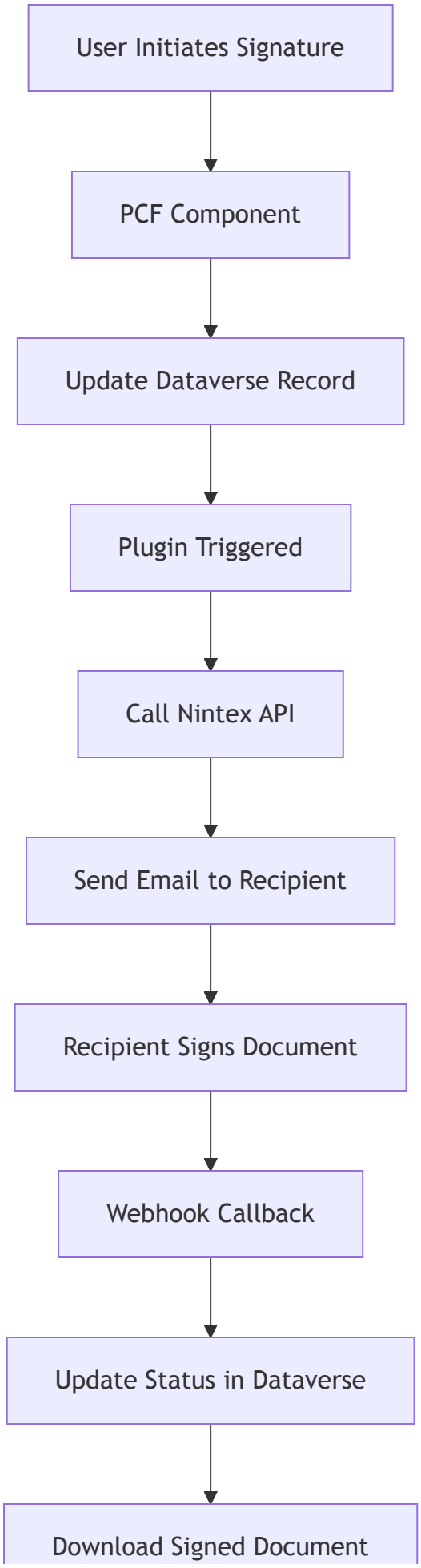
- **Digital signature request initiation** from Dataverse records
- **Nintex Assurance API integration** for signature processing
- **Real-time status tracking** of signature requests
- **Signed document storage** and retrieval

- **Modern PCF-based user interface**
- **Comprehensive error handling** and logging

Technical Architecture

```
Dataverse Environment
├── C# Plugin (Server-side logic)
│   ├── API Integration with Nintex
│   ├── Status Management
│   └── Document Processing
├── PCF Component (Client-side UI)
│   ├── React-based Interface
│   ├── Status Visualization
│   └── Document Management
└── Data Storage
    ├── Custom Table OR Activity Table
    ├── Signature Metadata
    └── Document Attachments
```

Integration Flow


User Initiates Signature
PCF Component
Update Dataverse Record
Plugin Triggered
Call Nintex API
Send Email to Recipient
Recipient Signs Document
Webhook Callback
Update Status in Dataverse
Download Signed Document

Approach Comparison & Decision Guide

When to Use Custom Table Approach

✅ **Best for:**

- **Specialized signature workflows** requiring custom business logic
- **Standalone signature management** separate from other activities
- **Complex approval processes** with multiple stages
- **Custom reporting requirements** specific to signatures
- **Integration with external systems** that need dedicated endpoints
- **Organizations with minimal activity usage**

✅ **Benefits:**

- **Complete control** over data structure and relationships
- **Custom business logic** without activity constraints
- **Specialized security models** for signature data
- **Dedicated forms and views** optimized for signatures
- **Independent lifecycle management**

⚠️ **Considerations:**

- **Additional development effort** for timeline integration
- **Manual relationship management** to parent records
- **Custom reporting and views** required
- **Separate security configuration** needed

When to Use Activity-Based Approach

✅ **Best for:**

- **Universal signature capability** across multiple entity types
- **Timeline-centric organizations** that rely heavily on activity tracking
- **Standard business processes** that align with activity lifecycles
- **Integrated workflows** where signatures are part of larger processes
- **Organizations wanting native Dataverse patterns**

✅ **Benefits:**

- **Automatic timeline integration** with all activity-enabled entities
- **Native Dataverse experience** familiar to users
- **Built-in activity management** capabilities
- **Standard security roles** and permissions
- **Universal applicability** across entity types
- **Centralized activity reporting**

⚠️ **Considerations:**

- **Activity model constraints** may limit some customizations
- **Inherited activity complexity** in some scenarios
- **Less flexibility** in status management
- **Standard activity behavior** may not fit all business needs

Decision Matrix

Requirement	Custom Table	Activity-Based
Multi-entity usage	⚠️ Manual setup needed	✅ Automatic
Timeline integration	❌ Custom development	✅ Native
Custom business logic	✅ Full flexibility	⚠️ Activity constraints
User familiarity	⚠️ New concepts	✅ Standard patterns
Development complexity	⚠️ Higher	✅ Lower
Maintenance overhead	⚠️ Higher	✅ Lower
Specialized workflows	✅ Optimal	⚠️ Limited
Reporting flexibility	✅ Full control	⚠️ Activity-based

Chapter 0: Testing Console Application

Overview

Before implementing plugins and PCF components, it's essential to validate your Dataverse connection, test basic operations, and prototype the Nintex API integration. This chapter provides a comprehensive .NET console application that allows you to test all aspects of the digital signature solution in a controlled environment.

Benefits of Console Testing

- **Rapid prototyping** without plugin complexity
- **Direct API testing** with immediate feedback
- **Connection validation** before deployment
- **Data model verification** and field testing
- **Error debugging** in a simple environment
- **Performance benchmarking** for operations

Prerequisites

- **.NET 8 SDK** installed
- **Visual Studio 2022** or **Visual Studio Code**
- **Access to Dataverse environment** with appropriate permissions
- **Basic understanding** of C# and .NET development

Step 1: Create the Console Application Project

1.1 Initialize the Project

```
# Create new directory
mkdir DataverseSignatureTest
cd DataverseSignatureTest

# Create console application
dotnet new console --framework net8.0

# Add required NuGet packages
dotnet add package Microsoft.PowerPlatform.Dataverse.Client
dotnet add package Microsoft.Extensions.Configuration
dotnet add package Microsoft.Extensions.Configuration.Json
dotnet add package Microsoft.Extensions.DependencyInjection
dotnet add package Microsoft.Extensions.Hosting
dotnet add package Microsoft.Extensions.Logging
dotnet add package Microsoft.Extensions.Logging.Console
dotnet add package Microsoft.Extensions.Options.ConfigurationExtensions
dotnet add package Newtonsoft.Json
```

1.2 Project Structure

```
DataverseSignatureTest/
├── Program.cs
├── Models/
│   ├── DigitalSignatureData.cs
│   ├── DataverseConfig.cs
│   └── NintexApiModels.cs
├── Services/
│   ├── IDataverseService.cs
│   ├── DataverseService.cs
│   ├── IDigitalSignatureService.cs
│   ├── DigitalSignatureService.cs
│   └── TestScenarioService.cs
├── appsettings.json
├── appsettings.local.json (gitignored)
└── DataverseSignatureTest.csproj
```

Step 2: Configuration and Models

2.1 Configuration Files

File: appsettings.json

```
{
  "Dataverse": {
    "ConnectionString": "",
    "EnvironmentUrl": "https://yourorg.crm.dynamics.com",
    "ClientId": "",
    "ClientSecret": "",
    "TenantId": "",
    "Username": "",
    "Password": ""
  },
  "Nintex": {
    "ApiKey": "",
    "BaseUrl": "https://api.nintex.com/assurance/v1",
    "WebhookSecret": ""
  },
  "Logging": {
    "LogLevel": {
      "Default": "Information",
      "Microsoft": "Warning",
      "Microsoft.Hosting.Lifetime": "Information"
    }
  }
}
```

File: appsettings.local.json (Create this file for your environment)

```
{
  "Dataverse": {
    "EnvironmentUrl": "https://yourorg.crm.dynamics.com",
    "ClientId": "your-app-registration-id",
    "ClientSecret": "your-client-secret",
    "TenantId": "your-tenant-id"
  },
  "Nintex": {
    "ApiKey": "your-nintex-api-key",
    "BaseUrl": "https://api.nintex.com/assurance/v1"
  }
}
```

2.2 Data Models

File: Models/DataverseConfig.cs

```
namespace DataverseSignatureTest.Models
{
    public class DataverseConfig
    {
        public string ConnectionString { get; set; } = string.Empty;
        public string EnvironmentUrl { get; set; } = string.Empty;
        public string ClientId { get; set; } = string.Empty;
        public string ClientSecret { get; set; } = string.Empty;
        public string TenantId { get; set; } = string.Empty;
        public string Username { get; set; } = string.Empty;
        public string Password { get; set; } = string.Empty;
    }

    public class NintexConfig
    {
        public string ApiKey { get; set; } = string.Empty;
        public string BaseUrl { get; set; } = string.Empty;
        public string WebhookSecret { get; set; } = string.Empty;
    }
}
```

File: Models/DigitalSignatureData.cs

```
namespace DataverseSignatureTest.Models
{
    public class DigitalSignatureData
    {
        public string Subject { get; set; } = string.Empty;
        public string RecipientName { get; set; } = string.Empty;
        public string RecipientEmail { get; set; } = string.Empty;
        public string DocumentName { get; set; } = string.Empty;
        public string DocumentContent { get; set; } = string.Empty;
        public string RequestNotes { get; set; } = string.Empty;
        public Guid? RelatedRecordId { get; set; }
        public string? RelatedRecordType { get; set; }
    }

    public class EntityReference
    {
        public string LogicalName { get; set; } = string.Empty;
        public Guid Id { get; set; }

        public EntityReference(string logicalName, Guid id)
        {
            LogicalName = logicalName;
            Id = id;
        }
    }

    public class EnvironmentInfo
    {
        public string EnvironmentName { get; set; } = string.Empty;
        public string EnvironmentUrl { get; set; } = string.Empty;
        public Guid OrganizationId { get; set; }
        public string Version { get; set; } = string.Empty;
        public string CurrentUser { get; set; } = string.Empty;
    }
}
```

File: Models/NintexApiModels.cs

```
using Newtonsoft.Json;

namespace DataverseSignatureTest.Models
{
    public class NintexSignatureRequest
    {
        [JsonProperty("recipientEmail")]
        public string RecipientEmail { get; set; } = string.Empty;

        [JsonProperty("recipientName")]
        public string RecipientName { get; set; } = string.Empty;

        [JsonProperty("documentName")]
        public string DocumentName { get; set; } = string.Empty;

        [JsonProperty("documentContent")]
        public string DocumentContent { get; set; } = string.Empty;

        [JsonProperty("callbackUrl")]
        public string CallbackUrl { get; set; } = string.Empty;

        [JsonProperty("expiryDays")]
        public int ExpiryDays { get; set; } = 7;

        [JsonProperty("contextInfo")]
        public SignatureContextInfo? ContextInfo { get; set; }
    }

    public class SignatureContextInfo
    {
        [JsonProperty("recordId")]
        public string RecordId { get; set; } = string.Empty;

        [JsonProperty("recordType")]
        public string RecordType { get; set; } = string.Empty;

        [JsonProperty("requestedBy")]
        public string RequestedBy { get; set; } = string.Empty;
    }

    public class NintexSignatureResponse
    {
        [JsonProperty("requestId")]
```

```
        public string RequestId { get; set; } = string.Empty;

        [JsonProperty("status")]
        public string Status { get; set; } = string.Empty;

        [JsonProperty("signatureUrl")]
        public string SignatureUrl { get; set; } = string.Empty;
    }

    public class NintexApiResponse
    {
        public bool Success { get; set; }
        public string RequestId { get; set; } = string.Empty;
        public string ErrorMessage { get; set; } = string.Empty;
    }
}
```

Step 3: Core Services Implementation

3.1 Dataverse Service Interface

Services/IDataverseService.cs**

```
using DataverseSignatureTest.Models;

namespace DataverseSignatureTest.Services
{
    public interface IDataverseService
    {
        Task<bool> TestConnectionAsync();
        Task<EnvironmentInfo> GetEnvironmentInfoAsync();
        Task<bool> TableExistsAsync(string tableName);
        Task<Guid> CreateRecordAsync(string tableName, object data);
        Task UpdateRecordAsync(string tableName, Guid recordId, object data);
        Task<dynamic?> GetRecordAsync(string tableName, Guid recordId, string? columns
        Task<IEnumerable<dynamic>> GetRecordsAsync(string tableName, string? filter = n
        Task DeleteRecordAsync(string tableName, Guid recordId);
    }
}
```

3.2 Dataverse Service Implementation

File: Services/DataverseService.cs

```
using Microsoft.Extensions.Logging;
using Microsoft.Extensions.Options;
using Microsoft.PowerPlatform.Dataverse.Client;
using Microsoft.Xrm.Sdk;
using Microsoft.Xrm.Sdk.Query;
using System.Dynamic;
using DataverseSignatureTest.Models;

namespace DataverseSignatureTest.Services
{
    public class DataverseService : IDataverseService, IDisposable
    {
        private readonly ILogger<DataverseService> _logger;
        private readonly DataverseConfig _config;
        private ServiceClient? _serviceClient;

        public DataverseService(ILogger<DataverseService> logger, IOptions<DataverseCon
        {
            _logger = logger;
            _config = config.Value;
        }

        private async Task<ServiceClient> GetServiceClientAsync()
        {
            if (_serviceClient == null || !_serviceClient.IsReady)
            {
                _logger.LogInformation("Establishing connection to Dataverse...");

                var connectionString = BuildConnectionString();
                _serviceClient = new ServiceClient(connectionString);

                if (!_serviceClient.IsReady)
                {
                    _logger.LogError("Failed to connect to Dataverse: {Error}", _servic
                    throw new InvalidOperationException($"Failed to connect to Datavers
                }

                _logger.LogInformation("Successfully connected to Dataverse");
            }

            return _serviceClient;
        }
```

```
private string BuildConnectionString()
{
    if (!string.IsNullOrEmpty(_config.ConnectionString))
    {
        return _config.ConnectionString;
    }

    var connectionString = $"Url={_config.EnvironmentUrl};";

    if (!string.IsNullOrEmpty(_config.ClientId) && !string.IsNullOrEmpty(_confi
    {
        connectionString += $"ClientId={_config.ClientId};ClientSecret={_config
        if (!string.IsNullOrEmpty(_config.TenantId))
        {
            connectionString += $"TenantId={_config.TenantId};";
        }
    }
    else if (!string.IsNullOrEmpty(_config.Username) && !string.IsNullOrEmpty(_
    {
        connectionString += $"Username={_config.Username};Password={_config.Pas
    }
    else
    {
        connectionString += "AuthType=OAuth;Username=;Password=;AppId=51f81489-
    }

    return connectionString;
}

public async Task<bool> TestConnectionAsync()
{
    try
    {
        var client = await GetServiceClientAsync();
        return client.IsReady;
    }
    catch (Exception ex)
    {
        _logger.LogError(ex, "Connection test failed");
        return false;
    }
}
```

```
public async Task<EnvironmentInfo> GetEnvironmentInfoAsync()
{
    var client = await GetServiceClientAsync();

    return new EnvironmentInfo
    {
        EnvironmentName = client.ConnectedOrgFriendlyName,
        EnvironmentUrl = client.ConnectedOrgUriActual?.ToString() ?? string.Emp
        OrganizationId = client.ConnectedOrgId,
        Version = client.ConnectedOrgVersion?.ToString() ?? string.Empty,
        CurrentUser = client.OAuthUserId
    };
}

public async Task<bool> TableExistsAsync(string tableName)
{
    try
    {
        var client = await GetServiceClientAsync();

        var request = new Microsoft.Xrm.Sdk.Messages.RetrieveEntityRequest
        {
            LogicalName = tableName,
            EntityFilters = Microsoft.Xrm.Sdk.Metadata.EntityFilters.Entity
        };

        client.Execute(request);
        return true;
    }
    catch (Exception ex)
    {
        _logger.LogDebug("Table {TableName} does not exist: {Error}", tableName
        return false;
    }
}

public async Task<Guid> CreateRecordAsync(string tableName, object data)
{
    var client = await GetServiceClientAsync();
    var entity = new Entity(tableName);

    foreach (var property in data.GetType().GetProperties())
    {
```

```
            var value = property.GetValue(data);
            if (value != null)
            {
                entity[property.Name] = value;
            }
        }

        var recordId = client.Create(entity);
        _logger.LogInformation("Created {TableName} record with ID: {RecordId}", ta

        return recordId;
    }

    public async Task UpdateRecordAsync(string tableName, Guid recordId, object dat
    {
        var client = await GetServiceClientAsync();
        var entity = new Entity(tableName, recordId);

        foreach (var property in data.GetType().GetProperties())
        {
            var value = property.GetValue(data);
            entity[property.Name] = value;
        }

        client.Update(entity);
        _logger.LogInformation("Updated {TableName} record with ID: {RecordId}", ta
    }

    public async Task<dynamic?> GetRecordAsync(string tableName, Guid recordId, str
    {
        var client = await GetServiceClientAsync();
        var columnSet = string.IsNullOrEmpty(columns) ? new ColumnSet(true) : new C

        var entity = client.Retrieve(tableName, recordId, columnSet);
        return EntityToDynamic(entity);
    }

    public async Task<IEnumerable<dynamic>> GetRecordsAsync(string tableName, strin
    {
        var client = await GetServiceClientAsync();
        var query = new QueryExpression(tableName);

        if (!string.IsNullOrEmpty(columns))
```

```
            {
                query.ColumnSet = new ColumnSet(columns.Split(','));
            }
            else
            {
                query.ColumnSet = new ColumnSet(true);
            }

            query.Orders.Add(new OrderExpression("createdon", OrderType.Descending));
            query.TopCount = 50;

            var results = client.RetrieveMultiple(query);
            return results.Entities.Select(EntityToDynamic);
        }

        public async Task DeleteRecordAsync(string tableName, Guid recordId)
        {
            var client = await GetServiceClientAsync();
            client.Delete(tableName, recordId);
            _logger.LogInformation("Deleted {TableName} record with ID: {RecordId}", ta
        }

        private static dynamic EntityToDynamic(Entity entity)
        {
            var expandoObject = new ExpandoObject();
            var dictionary = (IDictionary<string, object>)expandoObject;

            foreach (var attribute in entity.Attributes)
            {
                dictionary[attribute.Key] = attribute.Value;
            }

            return expandoObject;
        }

        public void Dispose()
        {
            _serviceClient?.Dispose();
        }
    }
}
```

3.3 Digital Signature Service

File: Services/IDigitalSignatureService.cs

```
using DataverseSignatureTest.Models;

namespace DataverseSignatureTest.Services
{
    public interface IDigitalSignatureService
    {
        Task<Guid> CreateCustomTableSignatureAsync(DigitalSignatureData signatureData);
        Task<Guid> CreateActivitySignatureAsync(DigitalSignatureData signatureData, Ent
        Task<IEnumerable<dynamic>> GetCustomTableSignaturesAsync();
        Task<IEnumerable<dynamic>> GetActivitySignaturesAsync();
        Task UpdateSignatureStatusAsync(Guid signatureId, string entityName, int status
        Task<NintexApiResponse> TestNintexApiAsync(DigitalSignatureData signatureData);
    }
}
```

File: Services/DigitalSignatureService.cs

```
using DataverseSignatureTest.Models;
using Microsoft.Extensions.Logging;
using Microsoft.Extensions.Options;
using Newtonsoft.Json;
using System.Text;

namespace DataverseSignatureTest.Services
{
    public class DigitalSignatureService : IDigitalSignatureService
    {
        private readonly IDataverseService _dataverseService;
        private readonly ILogger<DigitalSignatureService> _logger;
        private readonly NintexConfig _nintexConfig;
        private readonly HttpClient _httpClient;

        public DigitalSignatureService(
            IDataverseService dataverseService,
            ILogger<DigitalSignatureService> logger,
            IOptions<NintexConfig> nintexConfig,
            HttpClient httpClient)
        {
            _dataverseService = dataverseService;
            _logger = logger;
            _nintexConfig = nintexConfig.Value;
            _httpClient = httpClient;
        }

        public async Task<Guid> CreateCustomTableSignatureAsync(DigitalSignatureData si
        {
            var recordData = new
            {
                new_name = signatureData.Subject,
                new_recipientname = signatureData.RecipientName,
                new_recipientemail = signatureData.RecipientEmail,
                new_documentname = signatureData.DocumentName,
                new_documentcontent = signatureData.DocumentContent,
                new_requestnotes = signatureData.RequestNotes,
                new_signaturestatus = 100000000, // Draft
                new_requestdate = DateTime.UtcNow
            };

            return await _dataverseService.CreateRecordAsync("new_digitalsignature", re
        }
```

```
public async Task<Guid> CreateActivitySignatureAsync(DigitalSignatureData signa
{
    var activityData = new
    {
        subject = signatureData.Subject,
        description = signatureData.RequestNotes,
        new_recipientname = signatureData.RecipientName,
        new_recipientemail = signatureData.RecipientEmail,
        new_documentname = signatureData.DocumentName,
        new_documentcontent = signatureData.DocumentContent,
        new_requestdate = DateTime.UtcNow,
        statecode = 0, // Open
        statuscode = 1, // Draft
        regardingobjectid = regardingRecord != null ? $"/{regardingRecord.Logic
        regardingobjecttypecode = regardingRecord?.LogicalName
    };

    return await _dataverseService.CreateRecordAsync("new_digitalsignatureactiv
}

public async Task<IEnumerable<dynamic>> GetCustomTableSignaturesAsync()
{
    return await _dataverseService.GetRecordsAsync(
        "new_digitalsignature",
        columns: "new_digitalsignatureid,new_name,new_signaturestatus,createdon
    );
}

public async Task<IEnumerable<dynamic>> GetActivitySignaturesAsync()
{
    return await _dataverseService.GetRecordsAsync(
        "new_digitalsignatureactivity",
        columns: "activityid,subject,statecode,statuscode,createdon,new_recipie
    );
}

public async Task UpdateSignatureStatusAsync(Guid signatureId, string entityNam
{
    var updateData = entityName switch
    {
        "new_digitalsignature" => new { new_signaturestatus = status },
        "new_digitalsignatureactivity" => new { statuscode = status },
```

```
            _ => throw new ArgumentException($"Unknown entity: {entityName}")
        };

        await _dataverseService.UpdateRecordAsync(entityName, signatureId, updateDa
    }

    public async Task<NintexApiResponse> TestNintexApiAsync(DigitalSignatureData si
    {
        try
        {
            var request = new NintexSignatureRequest
            {
                RecipientEmail = signatureData.RecipientEmail,
                RecipientName = signatureData.RecipientName,
                DocumentName = signatureData.DocumentName,
                DocumentContent = signatureData.DocumentContent,
                CallbackUrl = "https://test-callback.example.com/webhook",
                ExpiryDays = 7,
                ContextInfo = new SignatureContextInfo
                {
                    RecordId = Guid.NewGuid().ToString(),
                    RecordType = "test",
                    RequestedBy = Environment.UserName
                }
            };

            _httpClient.DefaultRequestHeaders.Clear();
            _httpClient.DefaultRequestHeaders.Add("Authorization", $"Bearer {_ninte
            _httpClient.DefaultRequestHeaders.Add("Accept", "application/json");

            var requestJson = JsonConvert.SerializeObject(request);
            var content = new StringContent(requestJson, Encoding.UTF8, "applicatio

            var response = await _httpClient.PostAsync($"{_nintexConfig.BaseUrl}/si
            var responseContent = await response.Content.ReadAsStringAsync();

            _logger.LogInformation("Nintex API Response: {StatusCode} - {Content}",

            if (response.IsSuccessStatusCode)
            {
                var apiResponse = JsonConvert.DeserializeObject<NintexSignatureResp
                return new NintexApiResponse
                {
```

```
                    Success = true,
                    RequestId = apiResponse?.RequestId ?? string.Empty
                };
            }
            else
            {
                return new NintexApiResponse
                {
                    Success = false,
                    ErrorMessage = $"API call failed with status {response.StatusCo
                };
            }
        }
        catch (Exception ex)
        {
            _logger.LogError(ex, "Exception in TestNintexApiAsync");
            return new NintexApiResponse
            {
                Success = false,
                ErrorMessage = ex.Message
            };
        }
    }
}
```

Step 4: Main Application Implementation

File: Program.cs

```
using Microsoft.Extensions.Configuration;
using Microsoft.Extensions.DependencyInjection;
using Microsoft.Extensions.Hosting;
using Microsoft.Extensions.Logging;
using DataverseSignatureTest.Services;
using DataverseSignatureTest.Models;

namespace DataverseSignatureTest
{
    class Program
    {
        static async Task Main(string[] args)
        {
            Console.WriteLine("=== Dataverse Digital Signature Test Application ===");
            Console.WriteLine();

            var configuration = new ConfigurationBuilder()
                .AddJsonFile("appsettings.json", optional: false, reloadOnChange: true)
                .AddJsonFile("appsettings.local.json", optional: true, reloadOnChange:
                .AddEnvironmentVariables()
                .Build();

            var serviceProvider = new ServiceCollection()
                .AddLogging(builder => builder.AddConsole())
                .AddSingleton<IConfiguration>(configuration)
                .Configure<DataverseConfig>(configuration.GetSection("Dataverse"))
                .Configure<NintexConfig>(configuration.GetSection("Nintex"))
                .AddTransient<IDataverseService, DataverseService>()
                .AddTransient<IDigitalSignatureService, DigitalSignatureService>()
                .AddHttpClient<DigitalSignatureService>()
                .Services
                .BuildServiceProvider();

            try
            {
                var app = new TestApplication(serviceProvider);
                await app.RunAsync();
            }
            catch (Exception ex)
            {
                Console.WriteLine($"Application error: {ex.Message}");
                Console.WriteLine("Press any key to exit...");
                Console.ReadKey();
```

```
        }
        finally
        {
            serviceProvider?.Dispose();
        }
    }
}

public class TestApplication
{
    private readonly IServiceProvider _serviceProvider;
    private readonly IDataverseService _dataverseService;
    private readonly IDigitalSignatureService _signatureService;
    private readonly ILogger<TestApplication> _logger;

    public TestApplication(IServiceProvider serviceProvider)
    {
        _serviceProvider = serviceProvider;
        _dataverseService = serviceProvider.GetRequiredService<IDataverseService>()
        _signatureService = serviceProvider.GetRequiredService<IDigitalSignatureSer
        _logger = serviceProvider.GetRequiredService<ILogger<TestApplication>>();
    }

    public async Task RunAsync()
    {
        if (!await _dataverseService.TestConnectionAsync())
        {
            Console.WriteLine("❌ Failed to connect to Dataverse. Please check your
            return;
        }

        Console.WriteLine("✅ Connected to Dataverse successfully!");
        Console.WriteLine();

        bool continueRunning = true;
        while (continueRunning)
        {
            DisplayMainMenu();
            var choice = Console.ReadLine();

            try
            {
                switch (choice?.ToLower())
```

```
        {
            case "1":
                await TestDataverseConnection();
                break;
            case "2":
                await TestCustomTableOperations();
                break;
            case "3":
                await TestActivityOperations();
                break;
            case "4":
                await TestNintexApiIntegration();
                break;
            case "5":
                await ListSignatureRecords();
                break;
            case "6":
                await SimulateWebhookUpdate();
                break;
            case "7":
                await RunComprehensiveTest();
                break;
            case "q":
            case "quit":
            case "exit":
                continueRunning = false;
                break;
            default:
                Console.WriteLine("Invalid choice. Please try again.");
                break;
        }
    }
    catch (Exception ex)
    {
        Console.WriteLine($"❌ Error: {ex.Message}");
        _logger.LogError(ex, "Error executing menu choice: {Choice}", choic
    }

    if (continueRunning)
    {
        Console.WriteLine("\nPress any key to continue...");
        Console.ReadKey();
        Console.Clear();
```

```
        }
    }

    Console.WriteLine("Thank you for using the Digital Signature Test Applicati
}

private void DisplayMainMenu()
{
    Console.WriteLine("=== MAIN MENU ===");
    Console.WriteLine("1. Test Dataverse Connection & Environment Info");
    Console.WriteLine("2. Test Custom Table Operations");
    Console.WriteLine("3. Test Activity Operations");
    Console.WriteLine("4. Test Nintex API Integration");
    Console.WriteLine("5. List Signature Records");
    Console.WriteLine("6. Simulate Webhook Status Update");
    Console.WriteLine("7. Run Comprehensive Test Suite");
    Console.WriteLine("Q. Quit");
    Console.WriteLine();
    Console.Write("Enter your choice: ");
}

private async Task TestDataverseConnection()
{
    Console.WriteLine("\n=== DATAVERSE CONNECTION TEST ===");

    try
    {
        var envInfo = await _dataverseService.GetEnvironmentInfoAsync();

        Console.WriteLine($"✅ Environment Name: {envInfo.EnvironmentName}");
        Console.WriteLine($"✅ Organization ID: {envInfo.OrganizationId}");
        Console.WriteLine($"✅ URL: {envInfo.EnvironmentUrl}");
        Console.WriteLine($"✅ Version: {envInfo.Version}");
        Console.WriteLine($"✅ User: {envInfo.CurrentUser}");
        Console.WriteLine();

        Console.WriteLine("Checking table existence:");
        var hasCustomTable = await _dataverseService.TableExistsAsync("new_digi
        var hasActivityTable = await _dataverseService.TableExistsAsync("new_di

        Console.WriteLine($"  Custom Signature Table: {(hasCustomTable ? "✅ Ex
        Console.WriteLine($"  Activity Signature Table: {(hasActivityTable ? "✅
```

```
            if (!hasCustomTable && !hasActivityTable)
            {
                Console.WriteLine("\n⚠️  Warning: No signature tables found. You'll
            }
        }
        catch (Exception ex)
        {
            Console.WriteLine($"❌ Failed to get environment info: {ex.Message}");
        }
    }

    private async Task TestCustomTableOperations()
    {
        Console.WriteLine("\n=== CUSTOM TABLE OPERATIONS TEST ===");

        if (!await _dataverseService.TableExistsAsync("new_digitalsignature"))
        {
            Console.WriteLine("❌ Custom table 'new_digitalsignature' does not exis
            return;
        }

        var signatureData = GetTestSignatureData("Custom Table Test");

        try
        {
            Console.WriteLine("📝 Creating custom table signature record...");
            var signatureId = await _signatureService.CreateCustomTableSignatureAsy
            Console.WriteLine($"✅ Created signature record: {signatureId}");

            Console.WriteLine("📖 Retrieving created record...");
            var record = await _dataverseService.GetRecordAsync("new_digitalsignatu
            Console.WriteLine($"✅ Retrieved record with name: {record?.new_name}")

            Console.WriteLine("📝 Updating signature status...");
            await _signatureService.UpdateSignatureStatusAsync(signatureId, "new_di
            Console.WriteLine("✅ Updated status to 'Pending Signature'");

            Console.WriteLine("🗑️ Cleaning up test record...");
            await _dataverseService.DeleteRecordAsync("new_digitalsignature", signa
            Console.WriteLine("✅ Test record deleted");
        }
        catch (Exception ex)
        {
```

```
            Console.WriteLine($"❌ Custom table test failed: {ex.Message}");
        }
    }

    private async Task TestActivityOperations()
    {
        Console.WriteLine("\n=== ACTIVITY OPERATIONS TEST ===");

        if (!await _dataverseService.TableExistsAsync("new_digitalsignatureactivity
        {
            Console.WriteLine("❌ Activity table 'new_digitalsignatureactivity' doe
            return;
        }

        var signatureData = GetTestSignatureData("Activity Test");

        try
        {
            Console.WriteLine("📝 Creating test account for regarding relationship.
            var accountId = await _dataverseService.CreateRecordAsync("account", ne
                name = $"Test Account {DateTime.Now:HHmmss}",
                description = "Test account for signature activity testing"
            });
            Console.WriteLine($"✅ Created test account: {accountId}");

            Console.WriteLine("📝 Creating activity signature record...");
            var regardingRecord = new EntityReference("account", accountId);
            var activityId = await _signatureService.CreateActivitySignatureAsync(s
            Console.WriteLine($"✅ Created activity record: {activityId}");

            Console.WriteLine("📖 Retrieving created activity...");
            var record = await _dataverseService.GetRecordAsync("new_digitalsignatu
            Console.WriteLine($"✅ Retrieved activity with subject: {record?.subjec

            Console.WriteLine("📝 Updating activity status...");
            await _signatureService.UpdateSignatureStatusAsync(activityId, "new_dig
            Console.WriteLine("✅ Updated status to 'Pending Signature'");

            Console.WriteLine("🗑️ Cleaning up test records...");
            await _dataverseService.DeleteRecordAsync("new_digitalsignatureactivity
            await _dataverseService.DeleteRecordAsync("account", accountId);
            Console.WriteLine("✅ Test records deleted");
        }
```

```
    catch (Exception ex)
    {
        Console.WriteLine($"❌ Activity test failed: {ex.Message}");
    }
}

private async Task TestNintexApiIntegration()
{
    Console.WriteLine("\n=== NINTEX API INTEGRATION TEST ===");

    var signatureData = GetTestSignatureData("Nintex API Test");
    signatureData.DocumentContent = Convert.ToBase64String(
        System.Text.Encoding.UTF8.GetBytes("This is a test document for Nintex 
    );

    Console.WriteLine("🔗 Testing Nintex API connection...");
    Console.WriteLine($"📧 Recipient: {signatureData.RecipientEmail}");
    Console.WriteLine($"📄 Document: {signatureData.DocumentName}");

    try
    {
        var result = await _signatureService.TestNintexApiAsync(signatureData);

        if (result.Success)
        {
            Console.WriteLine($"✅ Nintex API call successful!");
            Console.WriteLine($"📋 Request ID: {result.RequestId}");
            Console.WriteLine("📧 Signature request would be sent to recipient"
        }
        else
        {
            Console.WriteLine($"❌ Nintex API call failed: {result.ErrorMessage
        }
    }
    catch (Exception ex)
    {
        Console.WriteLine($"❌ Nintex API test failed: {ex.Message}");
    }
}

private async Task ListSignatureRecords()
{
    Console.WriteLine("\n=== SIGNATURE RECORDS ===");
```

```
        Console.WriteLine("1. List Custom Table Signatures");
        Console.WriteLine("2. List Activity Signatures");
        Console.Write("Choose option: ");

        var choice = Console.ReadLine();

        try
        {
            if (choice == "1")
            {
                if (await _dataverseService.TableExistsAsync("new_digitalsignature"
                {
                    var records = await _signatureService.GetCustomTableSignaturesA
                    DisplayCustomTableSignatures(records);
                }
                else
                {
                    Console.WriteLine("❌ Custom signature table does not exist.");
                }
            }
            else if (choice == "2")
            {
                if (await _dataverseService.TableExistsAsync("new_digitalsignaturea
                {
                    var records = await _signatureService.GetActivitySignaturesAsyn
                    DisplayActivitySignatures(records);
                }
                else
                {
                    Console.WriteLine("❌ Activity signature table does not exist."
                }
            }
            else
            {
                Console.WriteLine("Invalid choice.");
            }
        }
        catch (Exception ex)
        {
            Console.WriteLine($"❌ Failed to retrieve signatures: {ex.Message}");
        }
    }
```

```
private async Task SimulateWebhookUpdate()
{
    Console.WriteLine("\n=== SIMULATE WEBHOOK STATUS UPDATE ===");
    Console.WriteLine("This simulates a webhook callback from Nintex.");

    Console.Write("Enter signature record ID: ");
    var recordIdInput = Console.ReadLine();

    if (!Guid.TryParse(recordIdInput, out var recordId))
    {
        Console.WriteLine("❌ Invalid GUID format.");
        return;
    }

    Console.WriteLine("1. Mark as Signed");
    Console.WriteLine("2. Mark as Declined");
    Console.WriteLine("3. Mark as Expired");
    Console.Write("Choose status: ");

    var statusChoice = Console.ReadLine();

    Console.WriteLine("1. Custom Table");
    Console.WriteLine("2. Activity");
    Console.Write("Choose record type: ");

    var typeChoice = Console.ReadLine();

    try
    {
        int statusValue;
        string statusText;

        if (typeChoice == "1") // Custom Table
        {
            (statusValue, statusText) = statusChoice switch
            {
                "1" => (100000002, "Signed"),
                "2" => (100000003, "Declined"),
                "3" => (100000004, "Expired"),
                _ => throw new ArgumentException("Invalid status choice")
            };

            await _signatureService.UpdateSignatureStatusAsync(recordId, "new_d
```

```
        }
        else if (typeChoice == "2") // Activity
        {
            (statusValue, statusText) = statusChoice switch
            {
                "1" => (4, "Signed"),
                "2" => (5, "Declined"),
                "3" => (6, "Expired"),
                _ => throw new ArgumentException("Invalid status choice")
            };

            await _signatureService.UpdateSignatureStatusAsync(recordId, "new_d
        }
        else
        {
            Console.WriteLine("❌ Invalid choice.");
            return;
        }

        Console.WriteLine($"✅ Status updated to '{statusText}' successfully!")
    }
    catch (Exception ex)
    {
        Console.WriteLine($"❌ Failed to update status: {ex.Message}");
    }
}

private async Task RunComprehensiveTest()
{
    Console.WriteLine("\n=== COMPREHENSIVE TEST SUITE ===");

    var testResults = new Dictionary<string, bool>();

    Console.WriteLine("🧪 Running comprehensive test suite...");
    Console.WriteLine();

    // Test 1: Connection
    Console.WriteLine("1️⃣ Testing Dataverse connection...");
    try
    {
        await TestDataverseConnection();
        testResults["Connection"] = true;
        Console.WriteLine("✅ Connection test passed");
```

```
}
catch (Exception ex)
{
    testResults["Connection"] = false;
    Console.WriteLine($"❌ Connection test failed: {ex.Message}");
}

// Test 2: Custom Table (if exists)
Console.WriteLine("\n2️⃣ Testing custom table operations...");
try
{
    if (await _dataverseService.TableExistsAsync("new_digitalsignature"))
    {
        await TestCustomTableOperations();
        testResults["CustomTable"] = true;
        Console.WriteLine("✅ Custom table test passed");
    }
    else
    {
        testResults["CustomTable"] = false;
        Console.WriteLine("⚠️ Custom table not found - skipped");
    }
}
catch (Exception ex)
{
    testResults["CustomTable"] = false;
    Console.WriteLine($"❌ Custom table test failed: {ex.Message}");
}

// Test 3: Activity Table (if exists)
Console.WriteLine("\n3️⃣ Testing activity operations...");
try
{
    if (await _dataverseService.TableExistsAsync("new_digitalsignatureactiv
    {
        await TestActivityOperations();
        testResults["Activity"] = true;
        Console.WriteLine("✅ Activity test passed");
    }
    else
    {
        testResults["Activity"] = false;
        Console.WriteLine("⚠️ Activity table not found - skipped");
```

```
        }
    }
    catch (Exception ex)
    {
        testResults["Activity"] = false;
        Console.WriteLine($"❌ Activity test failed: {ex.Message}");
    }

    // Test 4: Nintex API
    Console.WriteLine("\n4️⃣ Testing Nintex API integration...");
    try
    {
        await TestNintexApiIntegration();
        testResults["NintexAPI"] = true;
        Console.WriteLine("✅ Nintex API test completed");
    }
    catch (Exception ex)
    {
        testResults["NintexAPI"] = false;
        Console.WriteLine($"❌ Nintex API test failed: {ex.Message}");
    }

    // Summary
    Console.WriteLine("\n📊 TEST SUMMARY");
    Console.WriteLine("".PadRight(50, '='));
    foreach (var result in testResults)
    {
        var status = result.Value ? "✅ PASS" : "❌ FAIL";
        Console.WriteLine($"{result.Key.PadRight(20)} : {status}");
    }

    var passedTests = testResults.Values.Count(x => x);
    var totalTests = testResults.Count;
    Console.WriteLine("".PadRight(50, '='));
    Console.WriteLine($"Overall: {passedTests}/{totalTests} tests passed");
}

private DigitalSignatureData GetTestSignatureData(string testName)
{
    return new DigitalSignatureData
    {
        Subject = $"{testName} - {DateTime.Now:yyyy-MM-dd HH:mm:ss}",
        RecipientName = "Test User",
```

```
            RecipientEmail = "test.user@example.com",
            DocumentName = $"Test Document - {testName}",
            DocumentContent = Convert.ToBase64String(System.Text.Encoding.UTF8.GetB
            RequestNotes = $"Test signature request created by console application
        };
    }

    private void DisplayCustomTableSignatures(IEnumerable<dynamic> records)
    {
        Console.WriteLine("\n📋 Custom Table Signatures:");
        Console.WriteLine("".PadRight(100, '-'));
        Console.WriteLine($"{"ID",-36} {"Name",-30} {"Status",-15} {"Created",-20}"
        Console.WriteLine("".PadRight(100, '-'));

        foreach (var record in records)
        {
            var id = record.new_digitalsignatureid?.ToString() ?? "N/A";
            var name = record.new_name?.ToString() ?? "N/A";
            var status = GetCustomTableStatusText(record.new_signaturestatus);
            var created = record.createdon?.ToString("yyyy-MM-dd HH:mm") ?? "N/A";

            Console.WriteLine($"{id,-36} {name,-30} {status,-15} {created,-20}");
        }
    }

    private void DisplayActivitySignatures(IEnumerable<dynamic> records)
    {
        Console.WriteLine("\n📋 Activity Signatures:");
        Console.WriteLine("".PadRight(100, '-'));
        Console.WriteLine($"{"ID",-36} {"Subject",-30} {"Status",-15} {"Created",-2
        Console.WriteLine("".PadRight(100, '-'));

        foreach (var record in records)
        {
            var id = record.activityid?.ToString() ?? "N/A";
            var subject = record.subject?.ToString() ?? "N/A";
            var status = GetActivityStatusText(record.statecode, record.statuscode)
            var created = record.createdon?.ToString("yyyy-MM-dd HH:mm") ?? "N/A";

            Console.WriteLine($"{id,-36} {subject,-30} {status,-15} {created,-20}")
        }
    }
```

```
        private string GetCustomTableStatusText(object? statusValue)
        {
            if (statusValue == null) return "Unknown";

            return statusValue.ToString() switch
            {
                "100000000" => "Draft",
                "100000001" => "Pending",
                "100000002" => "Signed",
                "100000003" => "Declined",
                "100000004" => "Expired",
                "100000005" => "Failed",
                _ => "Unknown"
            };
        }

        private string GetActivityStatusText(object? stateCode, object? statusCode)
        {
            var state = stateCode?.ToString();
            var status = statusCode?.ToString();

            return (state, status) switch
            {
                ("0", "1") => "Draft",
                ("0", "2") => "Pending",
                ("0", "3") => "Failed",
                ("1", "4") => "Signed",
                ("2", "5") => "Declined",
                ("2", "6") => "Expired",
                _ => "Unknown"
            };
        }
    }
}
```

Step 5: Running and Testing

5.1 Configuration Setup

1. **Copy `appsettings.json` to `appsettings.local.json`**

2. **Update `appsettings.local.json` with your environment details:**

```
{
  "Dataverse": {
    "EnvironmentUrl": "https://yourorg.crm.dynamics.com",
    "ClientId": "your-app-registration-id",
    "ClientSecret": "your-client-secret",
    "TenantId": "your-tenant-id"
  },
  "Nintex": {
    "ApiKey": "your-nintex-api-key",
    "BaseUrl": "https://api.nintex.com/assurance/v1"
  }
}
```

3. **Add `appsettings.local.json` to `.gitignore`**

5.2 Running the Application

```
# Build and run
dotnet build
dotnet run

# Or run directly
dotnet run --project DataverseSignatureTest.csproj
```

5.3 Test Workflow

1. **Start with connection testing** (Menu option 1)
2. **Test individual operations** (Menu options 2-4)
3. **Run comprehensive test** (Menu option 7)
4. **Use for ongoing validation** during development

Step 6: Testing Scenarios

6.1 Basic Validation Tests

- **Connection Test**: Verify Dataverse connectivity and permissions
- **Table Existence**: Check if signature tables are deployed

- **Record Operations**: Test CRUD operations on both table types
- **API Integration**: Validate Nintex API connectivity

6.2 Advanced Integration Tests

- **Webhook Simulation**: Test status update workflows
- **Multi-Entity Testing**: Validate activity relationships
- **Error Handling**: Test invalid data scenarios
- **Performance Testing**: Measure operation timings

6.3 Pre-Plugin Testing

Use the console app to:

- **Validate data models** before plugin development
- **Test API integration** patterns
- **Prototype business logic**
- **Verify security configurations**

Step 7: Benefits and Next Steps

7.1 Development Benefits

- **Rapid iteration** on business logic
- **Safe testing environment**
- **Easy debugging** with immediate feedback
- **API integration validation** before complex plugin development
- **Data model verification**

7.2 Transition to Production

Once validated with the console app:

1. **Extract tested logic** into plugin methods
2. **Reuse API integration patterns**
3. **Apply validated data models** to PCF components
4. **Implement proven error handling** strategies

7.3 Ongoing Usage

- **Development environment validation**
- **Integration testing** during deployments
- **Troubleshooting** production issues
- **Performance benchmarking**

Chapter 1: Custom Table Implementation

Overview

The custom table approach creates a dedicated `Digital Signature` entity with specialized fields and relationships. This provides maximum flexibility for signature-specific business logic while requiring manual integration points with other entities.

Architecture Benefits

- **Dedicated data model** optimized for signature workflows
- **Custom relationship management** to any entity type
- **Specialized business logic** without activity constraints
- **Full control over lifecycle** and status management
- **Custom security models** for signature data

Prerequisites

- Microsoft Dataverse environment with System Administrator privileges
- Visual Studio 2019/2022 with .NET Framework 4.6.2 or higher
- Power Platform CLI installed
- Node.js (version 12.x or higher)
- Nintex Assurance API credentials and access

Step 1: Custom Entity Creation

1.1 Create Digital Signature Table

1. **Navigate to Power Apps** (make.powerapps.com)
2. **Select your environment**
3. **Go to Tables** in the left navigation
4. **Click "+ New table"**
5. **Configure the table:**
   - **Display name:** Digital Signature
   - **Plural display name:** Digital Signatures
   - **Name:** new_digitalsignature
   - **Primary column:** Name (new_name)
   - **Table type:** Standard table

1.2 Add Custom Columns

Create the following columns for the Digital Signature table:

Display Name	Name	Data Type	Format	Description
Name	new_name	Single line of text	Text	Primary field - signature request name
Recipient Email	new_recipientemail	Single line of text	Email	Email address of signature recipient
Recipient Name	new_recipientname	Single line of text	Text	Full name of the signature recipient
Document Content	new_documentcontent	Multiple lines of text	Text	Base64 encoded document to be signed
Document Name	new_documentname	Single line of text	Text	Name/title of the document
Signature Status	new_signaturestatus	Choice	-	Current status of the signature request

Display Name	Name	Data Type	Format	Description
Nintex Request ID	new_nintexrequestid	Single line of text	Text	Unique identifier from Nintex Assurance
Signed Document	new_signaturedocument	Multiple lines of text	Text	Base64 encoded signed document
Signature Date	new_signaturedate	Date and time	Date and Time	When the document was signed
Request Date	new_requestdate	Date and time	Date and Time	When the signature request was sent
Expiry Date	new_expirydate	Date and time	Date and Time	When the signature request expires
Related Record	new_relatedrecord	Lookup	-	Polymorphic lookup to any entity
Request Notes	new_requestnotes	Multiple lines of text	Text	Additional notes about the request

1.3 Configure Signature Status Choice Values

For the **Signature Status** column, create these choices:

Label	Value	Color
Draft	100000000	Gray
Pending Signature	100000001	Blue
Signed	100000002	Green
Declined	100000003	Red
Expired	100000004	Orange
Failed	100000005	Dark Red

1.4 Create Custom Views

All Digital Signatures View:

- Name: All Digital Signatures
- Columns: Name, Recipient Name, Recipient Email, Signature Status, Request Date, Modified On
- Default sort: Modified On (descending)

My Pending Signatures View:

- Name: My Pending Signatures
- Columns: Name, Recipient Name, Signature Status, Request Date, Expiry Date
- Filter: Signature Status = Pending Signature AND Owner = Current User
- Default sort: Request Date (ascending)

Completed Signatures View:

- Name: Completed Signatures
- Columns: Name, Recipient Name, Signature Date, Signed Document
- Filter: Signature Status = Signed
- Default sort: Signature Date (descending)

1.5 Create Model-Driven App

1. **Go to Apps** in Power Apps
2. **Click "+ New app" > Model-driven**
3. **Configure app:**
    - **Name:** Digital Signature Management
    - **Description:** Manage digital signature requests and track their progress
4. **Add Digital Signature table** to the app
5. **Configure navigation:**
    - Add Views: All Digital Signatures, My Pending Signatures, Completed Signatures
    - Add Forms: Main form, Quick create form
6. **Save and publish** the app

Step 2: Custom Table Plugin Development

2.1 Create Visual Studio Project

1. **Open Visual Studio**
2. **Create new project:**
    - Template: Class Library (.NET Framework)

- Name: NintexDigitalSignaturePlugin
- Framework: .NET Framework 4.6.2

3. **Install required NuGet packages:**

```
<packages>
  <package id="Microsoft.CrmSdk.CoreAssemblies" version="9.0.2.46" />
  <package id="Newtonsoft.Json" version="13.0.1" />
</packages>
```

2.2 Plugin Implementation

File: NintexDigitalSignaturePlugin.cs

```
using System;
using System.IO;
using System.Net.Http;
using System.Text;
using System.Threading.Tasks;
using Microsoft.Xrm.Sdk;
using Microsoft.Xrm.Sdk.Query;
using Newtonsoft.Json;
using System.ServiceModel;

namespace NintexDigitalSignaturePlugin
{
    public class NintexSignaturePlugin : IPlugin
    {
        private readonly string _secureConfig;
        private readonly string _unsecureConfig;

        public NintexSignaturePlugin(string unsecureConfig, string secureConfig)
        {
            _unsecureConfig = unsecureConfig;
            _secureConfig = secureConfig;
        }

        public void Execute(IServiceProvider serviceProvider)
        {
            IPluginExecutionContext context = (IPluginExecutionContext)serviceProvider.
            IOrganizationServiceFactory serviceFactory = (IOrganizationServiceFactory)s
            IOrganizationService service = serviceFactory.CreateOrganizationService(con
            ITracingService tracingService = (ITracingService)serviceProvider.GetServic

            try
            {
                tracingService.Trace("NintexSignaturePlugin: Execution started");

                if (context.InputParameters.Contains("Target") && context.InputParamete
                {
                    Entity targetEntity = (Entity)context.InputParameters["Target"];

                    if (targetEntity.LogicalName != "new_digitalsignature")
                        return;

                    tracingService.Trace($"Processing {context.MessageName} for digital
```

```
            Entity digitalSignatureRecord = GetCompleteRecord(service, targetEn

            if (context.MessageName.Equals("Create", StringComparison.OrdinalIg
            {
                ProcessCreateMessage(digitalSignatureRecord, service, tracingSe
            }
            else if (context.MessageName.Equals("Update", StringComparison.Ordi
            {
                ProcessUpdateMessage(digitalSignatureRecord, targetEntity, serv
            }
        }
    }
    catch (FaultException<OrganizationServiceFault> ex)
    {
        tracingService.Trace($"OrganizationServiceFault: {ex.Message}");
        throw new InvalidPluginExecutionException($"An error occurred in Nintex
    }
    catch (Exception ex)
    {
        tracingService.Trace($"General Exception: {ex.Message}");
        throw new InvalidPluginExecutionException($"An error occurred in Nintex
    }
}

private Entity GetCompleteRecord(IOrganizationService service, Entity targetEnt
{
    try
    {
        return service.Retrieve(targetEntity.LogicalName, targetEntity.Id,
            new ColumnSet("new_name", "new_recipientemail", "new_recipientname"
                        "new_signaturestatus", "new_nintexrequestid", "new_sign
                        "new_signaturedate", "new_requestdate", "new_expirydate
                        "new_relatedrecord", "new_requestnotes", "ownerid", "cr
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Error retrieving complete record: {ex.Message}")
        return targetEntity;
    }
}

private void ProcessCreateMessage(Entity digitalSignatureRecord, IOrganizationS
{
```

```
tracingService.Trace("Processing Create message");

// Get related record information for context
var relatedRecordInfo = GetRelatedRecordInfo(digitalSignatureRecord, servic

var signatureRequest = new NintexSignatureRequest
{
    RecipientEmail = digitalSignatureRecord.GetAttributeValue<string>("new_
    RecipientName = digitalSignatureRecord.GetAttributeValue<string>("new_r
    DocumentName = digitalSignatureRecord.GetAttributeValue<string>("new_do
                digitalSignatureRecord.GetAttributeValue<string>("new_name
    DocumentContent = digitalSignatureRecord.GetAttributeValue<string>("new
    CallbackUrl = GetCallbackUrl(),
    ExpiryDays = 7,
    ContextInfo = new SignatureContextInfo
    {
        SignatureRecordId = digitalSignatureRecord.Id.ToString(),
        RelatedRecordId = relatedRecordInfo?.Id,
        RelatedRecordType = relatedRecordInfo?.LogicalName,
        RelatedRecordName = relatedRecordInfo?.Name,
        RequestNotes = digitalSignatureRecord.GetAttributeValue<string>("ne
    }
};

var response = SendSignatureRequestAsync(signatureRequest, tracingService).

if (response.Success)
{
    Entity updateEntity = new Entity(digitalSignatureRecord.LogicalName, di
    updateEntity["new_nintexrequestid"] = response.RequestId;
    updateEntity["new_signaturestatus"] = new OptionSetValue(100000001); //
    updateEntity["new_requestdate"] = DateTime.UtcNow;

    service.Update(updateEntity);
    tracingService.Trace($"Signature request sent successfully. Request ID:
}
else
{
    Entity updateEntity = new Entity(digitalSignatureRecord.LogicalName, di
    updateEntity["new_signaturestatus"] = new OptionSetValue(100000005); //
    service.Update(updateEntity);

    tracingService.Trace($"Failed to send signature request: {response.Erro
```

```
            throw new InvalidPluginExecutionException($"Failed to send signature re
        }
    }

    private void ProcessUpdateMessage(Entity digitalSignatureRecord, Entity targetE
    {
        tracingService.Trace("Processing Update message");

        if (targetEntity.Contains("new_nintexrequestid") &&
            targetEntity.Contains("new_signaturestatus"))
        {
            var status = targetEntity.GetAttributeValue<OptionSetValue>("new_signat
            if (status != null && status.Value == 100000002) // Signed
            {
                tracingService.Trace("Processing signed document callback");
                ProcessSignedDocument(digitalSignatureRecord, service, tracingServi
            }
            else if (status != null && status.Value == 100000003) // Declined
            {
                tracingService.Trace("Processing declined signature");
                ProcessDeclinedSignature(digitalSignatureRecord, service, tracingSe
            }
        }
    }

    private void ProcessSignedDocument(Entity digitalSignatureRecord, IOrganization
    {
        try
        {
            string requestId = digitalSignatureRecord.GetAttributeValue<string>("ne
            if (string.IsNullOrEmpty(requestId))
            {
                tracingService.Trace("No Nintex request ID found");
                return;
            }

            var signedDocumentResponse = GetSignedDocumentAsync(requestId, tracingS

            if (signedDocumentResponse.Success)
            {
                Entity updateEntity = new Entity(digitalSignatureRecord.LogicalName
                updateEntity["new_signaturedocument"] = Convert.ToBase64String(sign
                updateEntity["new_signaturedate"] = DateTime.UtcNow;
```

```
                updateEntity["new_signaturestatus"] = new OptionSetValue(100000002)

                service.Update(updateEntity);
                tracingService.Trace("Signed document retrieved and saved successfu

                // Create note on related record if it exists
                CreateRelatedRecordNote(digitalSignatureRecord, service, tracingSer
            }
            else
            {
                tracingService.Trace($"Failed to retrieve signed document: {signedD
            }
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error processing signed document: {ex.Message}")
        }
    }

    private void ProcessDeclinedSignature(Entity digitalSignatureRecord, IOrganizat
    {
        try
        {
            // Additional logic for handling declined signatures
            tracingService.Trace("Signature declined - additional processing comple
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error processing declined signature: {ex.Message
        }
    }

    private RelatedRecordInfo GetRelatedRecordInfo(Entity digitalSignatureRecord, I
    {
        try
        {
            var relatedRecordRef = digitalSignatureRecord.GetAttributeValue<EntityR
            if (relatedRecordRef != null)
            {
                var relatedRecord = service.Retrieve(relatedRecordRef.LogicalName,

                return new RelatedRecordInfo
                {
```

```
                Id = relatedRecordRef.Id.ToString(),
                LogicalName = relatedRecordRef.LogicalName,
                Name = relatedRecordRef.Name ?? GetPrimaryNameValue(relatedReco
            };
        }
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Error getting related record info: {ex.Message}"
    }

    return null;
}

private string GetPrimaryNameValue(Entity entity)
{
    string[] primaryNameFields = { "name", "fullname", "subject", "title", "acc

    foreach (string field in primaryNameFields)
    {
        if (entity.Contains(field))
        {
            return entity.GetAttributeValue<string>(field);
        }
    }

    return entity.LogicalName + " Record";
}

private void CreateRelatedRecordNote(Entity digitalSignatureRecord, IOrganizati
{
    try
    {
        var relatedRecordRef = digitalSignatureRecord.GetAttributeValue<EntityR
        if (relatedRecordRef == null) return;

        Entity note = new Entity("annotation");
        note["objectid"] = relatedRecordRef;
        note["objecttypecode"] = relatedRecordRef.LogicalName;
        note["subject"] = "Digital Signature Completed";
        note["notetext"] = $"Digital signature request '{digitalSignatureRecord
                           $"Signed by: {digitalSignatureRecord.GetAttributeValue
                           $"on {DateTime.UtcNow:yyyy-MM-dd HH:mm:ss} UTC.";
```

```
            service.Create(note);
            tracingService.Trace("Related record note created");
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error creating related record note: {ex.Message}
        }
    }

    // API Communication Methods
    private async Task<NintexApiResponse> SendSignatureRequestAsync(NintexSignature
    {
        try
        {
            using (var httpClient = new HttpClient())
            {
                httpClient.DefaultRequestHeaders.Add("Authorization", $"Bearer {Get
                httpClient.DefaultRequestHeaders.Add("Accept", "application/json");

                var requestJson = JsonConvert.SerializeObject(request);
                var content = new StringContent(requestJson, Encoding.UTF8, "applic

                var response = await httpClient.PostAsync(GetNintexSignatureEndpoin
                var responseContent = await response.Content.ReadAsStringAsync();

                tracingService.Trace($"Nintex API Response: {response.StatusCode} -

                if (response.IsSuccessStatusCode)
                {
                    var apiResponse = JsonConvert.DeserializeObject<NintexSignature
                    return new NintexApiResponse
                    {
                        Success = true,
                        RequestId = apiResponse.RequestId
                    };
                }
                else
                {
                    return new NintexApiResponse
                    {
                        Success = false,
                        ErrorMessage = $"API call failed with status {response.Stat
```

```
                };
            }
        }
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Exception in SendSignatureRequestAsync: {ex.Mess
        return new NintexApiResponse
        {
            Success = false,
            ErrorMessage = ex.Message
        };
    }
}

private async Task<SignedDocumentResponse> GetSignedDocumentAsync(string reques
{
    try
    {
        using (var httpClient = new HttpClient())
        {
            httpClient.DefaultRequestHeaders.Add("Authorization", $"Bearer {Get

            var response = await httpClient.GetAsync($"{GetNintexDocumentEndpoi

            if (response.IsSuccessStatusCode)
            {
                var documentContent = await response.Content.ReadAsByteArrayAsy
                return new SignedDocumentResponse
                {
                    Success = true,
                    DocumentContent = documentContent
                };
            }
            else
            {
                var errorContent = await response.Content.ReadAsStringAsync();
                return new SignedDocumentResponse
                {
                    Success = false,
                    ErrorMessage = $"Failed to retrieve document: {response.Sta
                };
            }
```

```
            }
        }
        catch (Exception ex)
        {
            return new SignedDocumentResponse
            {
                Success = false,
                ErrorMessage = ex.Message
            };
        }
    }

    // Configuration Methods
    private string GetNintexApiKey()
    {
        return Environment.GetEnvironmentVariable("NINTEX_API_KEY") ?? _secureConfi
    }

    private string GetNintexSignatureEndpoint()
    {
        return "https://api.nintex.com/assurance/v1/signature-requests";
    }

    private string GetNintexDocumentEndpoint()
    {
        return "https://api.nintex.com/assurance/v1/signed-documents";
    }

    private string GetCallbackUrl()
    {
        return "https://yourorg.crm.dynamics.com/api/nintex/webhook";
    }
}

// Data Transfer Objects
public class NintexSignatureRequest
{
    [JsonProperty("recipientEmail")]
    public string RecipientEmail { get; set; }

    [JsonProperty("recipientName")]
    public string RecipientName { get; set; }
```

```
    [JsonProperty("documentName")]
    public string DocumentName { get; set; }

    [JsonProperty("documentContent")]
    public string DocumentContent { get; set; }

    [JsonProperty("callbackUrl")]
    public string CallbackUrl { get; set; }

    [JsonProperty("expiryDays")]
    public int ExpiryDays { get; set; }

    [JsonProperty("contextInfo")]
    public SignatureContextInfo ContextInfo { get; set; }
}

public class SignatureContextInfo
{
    [JsonProperty("signatureRecordId")]
    public string SignatureRecordId { get; set; }

    [JsonProperty("relatedRecordId")]
    public string RelatedRecordId { get; set; }

    [JsonProperty("relatedRecordType")]
    public string RelatedRecordType { get; set; }

    [JsonProperty("relatedRecordName")]
    public string RelatedRecordName { get; set; }

    [JsonProperty("requestNotes")]
    public string RequestNotes { get; set; }
}

public class RelatedRecordInfo
{
    public string Id { get; set; }
    public string LogicalName { get; set; }
    public string Name { get; set; }
}

public class NintexSignatureResponse
{
```

```
        [JsonProperty("requestId")]
        public string RequestId { get; set; }

        [JsonProperty("status")]
        public string Status { get; set; }

        [JsonProperty("signatureUrl")]
        public string SignatureUrl { get; set; }
    }

    public class NintexApiResponse
    {
        public bool Success { get; set; }
        public string RequestId { get; set; }
        public string ErrorMessage { get; set; }
    }

    public class SignedDocumentResponse
    {
        public bool Success { get; set; }
        public byte[] DocumentContent { get; set; }
        public string ErrorMessage { get; set; }
    }
}
```

2.3 Build and Deploy Plugin

1. **Build the solution** in Release mode
2. **Sign the assembly** (recommended for production):
   - Right-click project > Properties > Signing
   - Check "Sign the assembly"
   - Create new strong name key file
3. **Register the plugin** using Plugin Registration Tool:

   Download Plugin Registration Tool:

   ```
   Install-Package Microsoft.CrmSdk.XrmTooling.PluginRegistrationTool
   ```

   Register Assembly:
   - Connect to Dataverse environment
   - Register > Register New Assembly
   - Browse to compiled DLL

- Isolation Mode: Sandbox
- Location: Database

Register Plugin Steps:

Create Step:

- Message: Create
- Primary Entity: new_digitalsignature
- Event Pipeline Stage: Post-operation
- Execution Mode: Synchronous

Update Step:

- Message: Update
- Primary Entity: new_digitalsignature
- Event Pipeline Stage: Post-operation
- Execution Mode: Synchronous
- Filtering Attributes: new_signaturestatus,new_nintexrequestid

2.4 Configure Secure Configuration

In Plugin Registration Tool, add secure configuration:

```
{
  "nintexApiKey": "your-nintex-api-key-here",
  "apiBaseUrl": "https://api.nintex.com/assurance/v1",
  "webhookSecret": "your-webhook-secret-key"
}
```

Step 3: Custom Table PCF Component Development

3.1 Initialize PCF Project

```
# Create project directory
mkdir NintexDigitalSignatureControl
cd NintexDigitalSignatureControl

# Initialize PCF project
pac pcf init --namespace NintexControls --name NintexDigitalSignatureControl --template

# Install React dependencies
npm install @types/react@^16.9.0 @types/react-dom@^16.9.0 react@^16.8.0 react-dom@^16.8
```

3.2 Component Implementation

File: index.ts

```
import { IInputs, IOutputs } from "./generated/ManifestTypes";
import * as React from "react";
import * as ReactDOM from "react-dom";
import { DigitalSignatureControl, IDigitalSignatureProps } from "./DigitalSignatureCont

export class NintexDigitalSignatureControl implements ComponentFramework.StandardContro
    private _container: HTMLDivElement;
    private _context: ComponentFramework.Context<IInputs>;
    private _notifyOutputChanged: () => void;
    private _recordId: string;

    public init(
        context: ComponentFramework.Context<IInputs>,
        notifyOutputChanged: () => void,
        state: ComponentFramework.Dictionary,
        container: HTMLDivElement
    ): void {
        this._container = container;
        this._context = context;
        this._notifyOutputChanged = notifyOutputChanged;
        this._recordId = (context as any).page?.entityId || "";

        this.renderControl();
    }

    public updateView(context: ComponentFramework.Context<IInputs>): ComponentFramework
        this._context = context;
        this.renderControl();
        return {} as ComponentFramework.ReactControl.UpdatedControls;
    }

    private renderControl(): void {
        const props: IDigitalSignatureProps = {
            context: this._context,
            recordId: this._recordId,
            recipientEmail: this._context.parameters.recipientEmail?.raw || "",
            recipientName: this._context.parameters.recipientName?.raw || "",
            signatureStatus: this._context.parameters.signatureStatus?.raw || 0,
            nintexRequestId: this._context.parameters.nintexRequestId?.raw || "",
            signedDocument: this._context.parameters.signedDocument?.raw || "",
            documentName: this._context.parameters.documentName?.raw || "",
            onSignatureRequest: this.handleSignatureRequest.bind(this),
            onRefreshStatus: this.handleRefreshStatus.bind(this),
```

```
        onDownloadDocument: this.handleDownloadDocument.bind(this)
    };

    ReactDOM.render(React.createElement(DigitalSignatureControl, props), this._cont
}

private async handleSignatureRequest(recipientEmail: string, recipientName: string,
    try {
        const updateRecord = {
            new_recipientemail: recipientEmail,
            new_recipientname: recipientName,
            new_documentname: documentName,
            new_signaturestatus: 100000001 // Pending
        };

        await this._context.webAPI.updateRecord("new_digitalsignature", this._recor

        (this._context as any).page?.data?.refresh();

        this._context.navigation.openAlertDialog({
            title: "Success",
            text: "Signature request has been sent successfully!"
        });
    } catch (error) {
        this._context.navigation.openAlertDialog({
            title: "Error",
            text: `Failed to send signature request: ${error}`
        });
    }
}

private async handleRefreshStatus(): Promise<void> {
    try {
        (this._context as any).page?.data?.refresh();
    } catch (error) {
        console.error("Error refreshing status:", error);
    }
}

private handleDownloadDocument(): void {
    const signedDocument = this._context.parameters.signedDocument?.raw;
    if (signedDocument) {
        const byteCharacters = atob(signedDocument);
```

```
            const byteNumbers = new Array(byteCharacters.length);
            for (let i = 0; i < byteCharacters.length; i++) {
                byteNumbers[i] = byteCharacters.charCodeAt(i);
            }
            const byteArray = new Uint8Array(byteNumbers);
            const blob = new Blob([byteArray], { type: 'application/pdf' });

            const url = window.URL.createObjectURL(blob);
            const a = document.createElement('a');
            a.href = url;
            a.download = `signed-document-${this._recordId}.pdf`;
            document.body.appendChild(a);
            a.click();
            document.body.removeChild(a);
            window.URL.revokeObjectURL(url);
        }
    }

    public getOutputs(): IOutputs {
        return {};
    }

    public destroy(): void {
        ReactDOM.unmountComponentAtNode(this._container);
    }
}
```

File: DigitalSignatureControl.tsx

```
import * as React from "react";

export interface IDigitalSignatureProps {
    context: ComponentFramework.Context<any>;
    recordId: string;
    recipientEmail: string;
    recipientName: string;
    signatureStatus: number;
    nintexRequestId: string;
    signedDocument: string;
    documentName: string;
    onSignatureRequest: (email: string, name: string, documentName: string) => Promise<
    onRefreshStatus: () => Promise<void>;
    onDownloadDocument: () => void;
}

export const DigitalSignatureControl: React.FC<IDigitalSignatureProps> = (props) => {
    const [recipientEmail, setRecipientEmail] = React.useState(props.recipientEmail ||
    const [recipientName, setRecipientName] = React.useState(props.recipientName || "")
    const [documentName, setDocumentName] = React.useState(props.documentName || "");
    const [isLoading, setIsLoading] = React.useState(false);

    React.useEffect(() => {
        setRecipientEmail(props.recipientEmail || "");
        setRecipientName(props.recipientName || "");
        setDocumentName(props.documentName || "");
    }, [props.recipientEmail, props.recipientName, props.documentName]);

    const getStatusText = (status: number): string => {
        switch (status) {
            case 100000000: return "Draft";
            case 100000001: return "Pending Signature";
            case 100000002: return "Signed";
            case 100000003: return "Declined";
            case 100000004: return "Expired";
            case 100000005: return "Failed";
            default: return "Unknown";
        }
    };

    const getStatusColor = (status: number): string => {
        switch (status) {
            case 100000000: return "#666666";
```

```
        case 100000001: return "#0078d4";
        case 100000002: return "#107c10";
        case 100000003: return "#d13438";
        case 100000004: return "#f7630c";
        case 100000005: return "#a80000";
        default: return "#666666";
    }
};

const handleSendSignatureRequest = async (): Promise<void> => {
    if (!recipientEmail || !recipientName || !documentName) {
        alert("Please enter recipient email, name, and document name.");
        return;
    }

    setIsLoading(true);
    try {
        await props.onSignatureRequest(recipientEmail, recipientName, documentName)
    } catch (error) {
        console.error("Error sending signature request:", error);
    } finally {
        setIsLoading(false);
    }
};

const containerStyle: React.CSSProperties = {
    fontFamily: "'Segoe UI', Tahoma, Geneva, Verdana, sans-serif",
    padding: "20px",
    border: "1px solid #e1e5e9",
    borderRadius: "8px",
    backgroundColor: "#ffffff",
    maxWidth: "600px",
    boxShadow: "0 2px 4px rgba(0,0,0,0.1)"
};

const headerStyle: React.CSSProperties = {
    fontSize: "20px",
    fontWeight: "600",
    marginBottom: "20px",
    color: "#323130",
    borderBottom: "2px solid #0078d4",
    paddingBottom: "8px"
};
```

```
const fieldGroupStyle: React.CSSProperties = {
    marginBottom: "16px"
};

const labelStyle: React.CSSProperties = {
    display: "block",
    fontSize: "14px",
    fontWeight: "600",
    marginBottom: "6px",
    color: "#323130"
};

const inputStyle: React.CSSProperties = {
    width: "100%",
    padding: "10px 12px",
    fontSize: "14px",
    border: "1px solid #d1d5da",
    borderRadius: "4px",
    boxSizing: "border-box",
    transition: "border-color 0.2s"
};

const buttonStyle: React.CSSProperties = {
    padding: "10px 20px",
    fontSize: "14px",
    fontWeight: "600",
    border: "none",
    borderRadius: "4px",
    cursor: "pointer",
    marginRight: "10px",
    marginBottom: "10px",
    transition: "background-color 0.2s"
};

const primaryButtonStyle: React.CSSProperties = {
    ...buttonStyle,
    backgroundColor: "#0078d4",
    color: "white"
};

const secondaryButtonStyle: React.CSSProperties = {
    ...buttonStyle,
```

```
    backgroundColor: "#f3f2f1",
    color: "#323130",
    border: "1px solid #d1d5da"
};

const statusStyle: React.CSSProperties = {
    display: "inline-block",
    padding: "6px 16px",
    borderRadius: "20px",
    fontSize: "12px",
    fontWeight: "600",
    color: "white",
    backgroundColor: getStatusColor(props.signatureStatus)
};

const infoStyle: React.CSSProperties = {
    padding: "16px",
    backgroundColor: "#f8f9fa",
    border: "1px solid #e1e5e9",
    borderRadius: "6px",
    marginBottom: "20px"
};

return (
    <div style={containerStyle}>
        <h3 style={headerStyle}>Digital Signature Request</h3>

        <div style={infoStyle}>
            <div style={{ marginBottom: "10px" }}>
                <strong>Status: </strong>
                <span style={statusStyle}>{getStatusText(props.signatureStatus)}</s
            </div>
            {props.nintexRequestId && (
                <div>
                    <strong>Request ID: </strong>
                    <span style={{ fontFamily: "monospace", fontSize: "12px", backg
                        {props.nintexRequestId}
                    </span>
                </div>
            )}
        </div>

        {(props.signatureStatus === 0 || props.signatureStatus === 100000000) ? (
```

```
        <div>
            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Document Name *</label>
                <input
                    type="text"
                    value={documentName}
                    onChange={(e) => setDocumentName(e.target.value)}
                    style={inputStyle}
                    placeholder="Enter document name for signature"
                />
            </div>

            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Recipient Email *</label>
                <input
                    type="email"
                    value={recipientEmail}
                    onChange={(e) => setRecipientEmail(e.target.value)}
                    style={inputStyle}
                    placeholder="Enter recipient's email address"
                />
            </div>

            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Recipient Name *</label>
                <input
                    type="text"
                    value={recipientName}
                    onChange={(e) => setRecipientName(e.target.value)}
                    style={inputStyle}
                    placeholder="Enter recipient's full name"
                />
            </div>

            <button
                onClick={handleSendSignatureRequest}
                disabled={isLoading || !recipientEmail || !recipientName || !do
                style={primaryButtonStyle}
            >
                {isLoading ? "Sending..." : "Send Signature Request"}
            </button>
        </div>
    ) : (
```

```
                <div>
                    <div style={fieldGroupStyle}>
                        <label style={labelStyle}>Document Name</label>
                        <div style={{ padding: "8px 0", fontSize: "14px", fontWeight: "
                            {props.documentName || "Not specified"}
                        </div>
                    </div>

                    <div style={fieldGroupStyle}>
                        <label style={labelStyle}>Recipient Email</label>
                        <div style={{ padding: "8px 0", fontSize: "14px" }}>{props.reci
                    </div>

                    <div style={fieldGroupStyle}>
                        <label style={labelStyle}>Recipient Name</label>
                        <div style={{ padding: "8px 0", fontSize: "14px" }}>{props.reci
                    </div>

                    <div style={{ display: "flex", gap: "10px", flexWrap: "wrap" }}>
                        <button
                            onClick={props.onRefreshStatus}
                            style={secondaryButtonStyle}
                        >
                            Refresh Status
                        </button>

                        {props.signatureStatus === 100000002 && props.signedDocument &&
                            <button
                                onClick={props.onDownloadDocument}
                                style={primaryButtonStyle}
                            >
                                Download Signed Document
                            </button>
                        )}
                    </div>
                </div>
            )}
        </div>
    );
};
```

3.3 Component Manifest

File: ControlManifest.Input.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest>
  <control namespace="NintexControls" constructor="NintexDigitalSignatureControl" versi
    <type-group name="strings">
      <type>SingleLine.Text</type>
      <type>SingleLine.Email</type>
    </type-group>
    <type-group name="numbers">
      <type>Whole.None</type>
      <type>OptionSet</type>
    </type-group>
    <property name="recipientEmail" display-name-key="Recipient Email" description-key=
    <property name="recipientName" display-name-key="Recipient Name" description-key="F
    <property name="signatureStatus" display-name-key="Signature Status" description-ke
    <property name="nintexRequestId" display-name-key="Nintex Request ID" description-k
    <property name="signedDocument" display-name-key="Signed Document" description-key=
    <property name="documentName" display-name-key="Document Name" description-key="Nam
    <resources>
      <code path="index.ts" order="1"/>
      <resx path="strings/NintexDigitalSignatureControl.1033.resx" version="1.0.0" />
    </resources>
    <feature-usage>
      <uses-feature name="WebAPI" required="true" />
    </feature-usage>
  </control>
</manifest>
```

3.4 Build and Deploy PCF Component

```
# Build the PCF component
npm run build

# Create solution for deployment
mkdir Solutions
cd Solutions

# Initialize solution
pac solution init --publisher-name "YourCompany" --publisher-prefix "yourprefix"

# Add PCF component reference
pac solution add-reference --path "../"

# Build solution
msbuild /p:configuration=Release

# The deployable solution will be in bin/Release folder
```

Step 4: Custom Table Form Configuration

4.1 Configure Main Form

1. **Open Digital Signature table**
2. **Go to Forms tab**
3. **Edit the main form**
4. **Add form sections:**

   Header Section:
   - Name (primary field)
   - Owner
   - Signature Status

   General Tab:
   - Related Record (lookup)
   - Document Name
   - PCF Component section with all property bindings

   Recipient Details Tab:
   - Recipient Email

- Recipient Name
- Request Notes

Signature Details Tab:

- Nintex Request ID
- Request Date
- Signature Date
- Expiry Date

4.2 Add PCF Component to Form

1. **Create new section** in General tab
2. **Section name:** "Signature Management"
3. **Add PCF control:**
   - Insert > Control > Add Control
   - Select "Nintex Digital Signature Control"
   - Configure property bindings:
     - recipientEmail → new_recipientemail
     - recipientName → new_recipientname
     - signatureStatus → new_signaturestatus
     - nintexRequestId → new_nintexrequestid
     - signedDocument → new_signaturedocument
     - documentName → new_documentname

4.3 Configure Quick Create Form

1. **Create Quick Create form**
2. **Add essential fields:**
   - Name (required)
   - Related Record (lookup)
   - Document Name
   - Recipient Email
   - Recipient Name
   - Request Notes

Step 5: Custom Table Testing and Usage

5.1 Test Basic Functionality

1. **Create new Digital Signature record**
2. **Fill in required fields:**
   - Name: "Contract Signature Request"
   - Related Record: Link to Account/Contact
   - Document Name: "Service Agreement"
   - Recipient Email: test@example.com
   - Recipient Name: "John Doe"
3. **Save record** - Plugin should trigger automatically
4. **Verify status** changes to "Pending Signature"
5. **Check Nintex Request ID** is populated

5.2 Test PCF Component

1. **Open saved Digital Signature record**
2. **Verify PCF component** displays correctly
3. **Test status refresh** functionality
4. **Simulate signed document** and test download

5.3 Test Integration Points

1. **Related Record Notes:** Verify notes are created on parent records when signatures complete
2. **Status Tracking:** Test all status transitions (Draft → Pending → Signed/Declined)
3. **Error Handling:** Test with invalid data to verify error messages

Chapter 2: Activity-Based Implementation

Overview

The activity-based approach leverages Dataverse's native activity framework to create a digital signature solution that automatically integrates with timeline controls across all activity-enabled entities. This provides universal applicability and familiar user experience.

Architecture Benefits

- **Universal application** across any activity-enabled entity
- **Native timeline integration** without custom development
- **Standard activity lifecycle** management
- **Built-in activity security** and permissions
- **Familiar user patterns** and interfaces

Key Differences from Custom Table

Aspect	Custom Table	Activity-Based
Entity Type	Standard table	Activity table
Primary Key	Custom (new_name)	Subject (inherited)
Status Management	Custom choice field	StateCode/StatusCode
Relationships	Manual lookup fields	Native regarding relationships
Timeline Integration	Custom development needed	Automatic
Multi-entity Usage	Manual configuration	Automatic

Step 1: Activity Entity Creation

1.1 Create Digital Signature Activity

1. **Navigate to Power Apps** (make.powerapps.com)
2. **Select your environment**
3. **Go to Tables** in the left navigation
4. **Click "+ New table"**
5. **Configure the activity:**
    - **Display name:** Digital Signature Activity
    - **Plural display name:** Digital Signature Activities
    - **Name:** new_digitalsignatureactivity
    - **Table type:** Activity table ⚠️ **CRITICAL: Must select Activity table**
    - **Primary column:** Subject (automatically inherited from ActivityPointer)

1.2 Add Activity-Specific Columns

Create the following columns for the activity:

Display Name	Name	Data Type	Format	Description
Recipient Email	new_recipientemail	Single line of text	Email	Email address of signature recipient
Recipient Name	new_recipientname	Single line of text	Text	Full name of the signature recipient
Document Content	new_documentcontent	Multiple lines of text	Text	Base64 encoded document to be signed
Document Name	new_documentname	Single line of text	Text	Name/title of the document
Nintex Request ID	new_nintexrequestid	Single line of text	Text	Unique identifier from Nintex Assurance
Signed Document	new_signaturedocument	Multiple lines of text	Text	Base64 encoded signed document
Signature Date	new_signaturedate	Date and time	Date and Time	When the document was signed
Request Date	new_requestdate	Date and time	Date and Time	When the signature request was sent
Expiry Date	new_expirydate	Date and time	Date and Time	When the signature request expires
Callback URL	new_callbackurl	Single line of text	URL	Webhook URL for status updates

1.3 Configure Activity Status Reasons

Activities use built-in StateCode (Open/Completed/Cancelled) and StatusCode (Status Reason). Configure custom Status Reason values:

State: Open (0)

Label	Value	Default
Draft	1	Yes
Pending Signature	2	No
Failed to Send	3	No

State: Completed (1)

Label	Value	Default
Signed	4	Yes

State: Cancelled (2)

Label	Value	Default
Declined	5	Yes
Expired	6	No

1.4 Enable Activities on Target Entities

For each entity where you want digital signature capability:

1. **Navigate to target table** (Account, Contact, Case, etc.)
2. **Go to table properties**
3. **Communication & Collaboration section**
4. **Enable "Activities"** if not already enabled
5. **Save and publish**

Recommended entities to enable:

- Account (for business agreements)
- Contact (for personal documents)
- Opportunity (for sales contracts)
- Case (for resolution confirmations)
- Lead (for qualification documents)
- Custom business entities

1.5 Activity Views Configuration

Create custom activity views:

All Digital Signature Activities:

- Columns: Subject, Regarding, Status Reason, Request Date, Owner
- Sort: Modified On (descending)
- Filter: Activity Type = Digital Signature Activity

My Pending Signature Requests:

- Columns: Subject, Recipient Name, Status Reason, Request Date, Expiry Date
- Sort: Request Date (ascending)
- Filter: Owner = Current User AND State = Open AND Status Reason = Pending Signature

Completed Signatures This Month:

- Columns: Subject, Regarding, Recipient Name, Signature Date
- Sort: Signature Date (descending)
- Filter: State = Completed AND Signature Date = This Month

Step 2: Activity Plugin Development

2.1 Activity Plugin Key Concepts

Important differences for activity plugins:

```
// Activity-specific considerations
- Entity Name: "new_digitalsignatureactivity" (activity table)
- Primary Field: "subject" (not custom name field)
- Status Management: "statecode" and "statuscode" (not custom choice)
- Relationships: "regardingobjectid" (automatic activity relationship)
- Lifecycle: Open (0) → Completed (1) or Cancelled (2)
```

2.2 Enhanced Activity Plugin Implementation

File: NintexDigitalSignatureActivityPlugin.cs

```
using System;
using System.IO;
using System.Net.Http;
using System.Text;
using System.Threading.Tasks;
using Microsoft.Xrm.Sdk;
using Microsoft.Xrm.Sdk.Query;
using Newtonsoft.Json;
using System.ServiceModel;

namespace NintexDigitalSignatureActivityPlugin
{
    public class NintexSignatureActivityPlugin : IPlugin
    {
        private readonly string _secureConfig;
        private readonly string _unsecureConfig;

        public NintexSignatureActivityPlugin(string unsecureConfig, string secureConfig
        {
            _unsecureConfig = unsecureConfig;
            _secureConfig = secureConfig;
        }

        public void Execute(IServiceProvider serviceProvider)
        {
            IPluginExecutionContext context = (IPluginExecutionContext)serviceProvider.
            IOrganizationServiceFactory serviceFactory = (IOrganizationServiceFactory)s
            IOrganizationService service = serviceFactory.CreateOrganizationService(con
            ITracingService tracingService = (ITracingService)serviceProvider.GetServic

            try
            {
                tracingService.Trace("NintexSignatureActivityPlugin: Execution started"

                if (context.InputParameters.Contains("Target") && context.InputParamete
                {
                    Entity targetEntity = (Entity)context.InputParameters["Target"];

                    // Check if this is our digital signature activity
                    if (targetEntity.LogicalName != "new_digitalsignatureactivity")
                        return;

                    tracingService.Trace($"Processing {context.MessageName} for digital
```

```
            Entity signatureActivity = GetCompleteActivityRecord(service, targe

            if (context.MessageName.Equals("Create", StringComparison.OrdinalIg
            {
                ProcessCreateMessage(signatureActivity, service, tracingService
            }
            else if (context.MessageName.Equals("Update", StringComparison.Ordi
            {
                ProcessUpdateMessage(signatureActivity, targetEntity, service,
            }
        }
    }
    catch (FaultException<OrganizationServiceFault> ex)
    {
        tracingService.Trace($"OrganizationServiceFault: {ex.Message}");
        throw new InvalidPluginExecutionException($"An error occurred in Nintex
    }
    catch (Exception ex)
    {
        tracingService.Trace($"General Exception: {ex.Message}");
        throw new InvalidPluginExecutionException($"An error occurred in Nintex
    }
}

private Entity GetCompleteActivityRecord(IOrganizationService service, Entity t
{
    try
    {
        return service.Retrieve(targetEntity.LogicalName, targetEntity.Id,
            new ColumnSet("subject", "description", "regardingobjectid", "regar
                        "new_recipientemail", "new_recipientname", "new_documen
                        "new_nintexrequestid", "new_signaturedocument", "new_si
                        "new_requestdate", "new_expirydate", "new_documentname"
                        "statecode", "statuscode", "activitytypecode", "ownerid
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Error retrieving complete activity record: {ex.M
        return targetEntity;
    }
}
```

```
private void ProcessCreateMessage(Entity signatureActivity, IOrganizationServic
{
    tracingService.Trace("Processing Create message for signature activity");

    // Get regarding object details for enhanced context
    var regardingInfo = GetRegardingObjectInfo(signatureActivity, service, trac

    var signatureRequest = new NintexSignatureRequest
    {
        RecipientEmail = signatureActivity.GetAttributeValue<string>("new_recip
        RecipientName = signatureActivity.GetAttributeValue<string>("new_recipi
        DocumentName = signatureActivity.GetAttributeValue<string>("new_documen
                    signatureActivity.GetAttributeValue<string>("subject") ??
        DocumentContent = signatureActivity.GetAttributeValue<string>("new_docu
        CallbackUrl = GetCallbackUrl(),
        ExpiryDays = 7,
        ContextInfo = new SignatureContextInfo
        {
            ActivityId = signatureActivity.Id.ToString(),
            RegardingObjectId = regardingInfo?.Id,
            RegardingObjectType = regardingInfo?.LogicalName,
            RegardingObjectName = regardingInfo?.Name,
            RequestedBy = GetUserInfo(signatureActivity.GetAttributeValue<Entit
            ActivitySubject = signatureActivity.GetAttributeValue<string>("subj
        }
    };

    var response = SendSignatureRequestAsync(signatureRequest, tracingService).

    if (response.Success)
    {
        // Update activity with Nintex request details
        Entity updateActivity = new Entity(signatureActivity.LogicalName, signa
        updateActivity["new_nintexrequestid"] = response.RequestId;
        updateActivity["statuscode"] = new OptionSetValue(2); // Pending Signat
        updateActivity["new_requestdate"] = DateTime.UtcNow;
        updateActivity["description"] = $"Digital signature request sent to {si

        service.Update(updateActivity);
        tracingService.Trace($"Signature request sent successfully. Request ID:
    }
    else
    {
```

```
            // Update activity to failed status
            Entity updateActivity = new Entity(signatureActivity.LogicalName, signa
            updateActivity["statuscode"] = new OptionSetValue(3); // Failed to Send
            updateActivity["description"] = $"Failed to send signature request: {re
            service.Update(updateActivity);

            tracingService.Trace($"Failed to send signature request: {response.Erro
            throw new InvalidPluginExecutionException($"Failed to send signature re
        }
    }

    private void ProcessUpdateMessage(Entity signatureActivity, Entity targetEntity
    {
        tracingService.Trace("Processing Update message for signature activity");

        // Check for status changes indicating signature completion or decline
        if (targetEntity.Contains("statuscode"))
        {
            var statusCode = targetEntity.GetAttributeValue<OptionSetValue>("status
            if (statusCode != null)
            {
                switch (statusCode.Value)
                {
                    case 4: // Signed (Completed state)
                        tracingService.Trace("Processing signed document callback")
                        ProcessSignedDocument(signatureActivity, service, tracingSe
                        break;
                    case 5: // Declined (Cancelled state)
                        tracingService.Trace("Processing declined signature");
                        ProcessDeclinedSignature(signatureActivity, service, tracin
                        break;
                    case 6: // Expired (Cancelled state)
                        tracingService.Trace("Processing expired signature");
                        ProcessExpiredSignature(signatureActivity, service, tracing
                        break;
                }
            }
        }
    }

    private void ProcessSignedDocument(Entity signatureActivity, IOrganizationServi
    {
        try
```

```
    {
        string requestId = signatureActivity.GetAttributeValue<string>("new_nin
        if (string.IsNullOrEmpty(requestId))
        {
            tracingService.Trace("No Nintex request ID found");
            return;
        }

        // Retrieve signed document from Nintex
        var signedDocumentResponse = GetSignedDocumentAsync(requestId, tracingS

        if (signedDocumentResponse.Success)
        {
            Entity updateActivity = new Entity(signatureActivity.LogicalName, s
            updateActivity["new_signaturedocument"] = Convert.ToBase64String(si
            updateActivity["new_signaturedate"] = DateTime.UtcNow;
            updateActivity["statuscode"] = new OptionSetValue(4); // Signed
            updateActivity["statecode"] = new OptionSetValue(1); // Completed
            updateActivity["description"] = "Document has been successfully sig

            service.Update(updateActivity);
            tracingService.Trace("Signed document retrieved and saved successfu

            // Create completion note on regarding object
            CreateSignatureCompletionNote(signatureActivity, service, tracingSe
        }
        else
        {
            tracingService.Trace($"Failed to retrieve signed document: {signedD
        }
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Error processing signed document: {ex.Message}")
    }
}

private void ProcessDeclinedSignature(Entity signatureActivity, IOrganizationSe
{
    try
    {
        Entity updateActivity = new Entity(signatureActivity.LogicalName, signa
        updateActivity["statuscode"] = new OptionSetValue(5); // Declined
```

```
            updateActivity["statecode"] = new OptionSetValue(2); // Cancelled
            updateActivity["description"] = "Digital signature request was declined

            service.Update(updateActivity);
            tracingService.Trace("Signature decline processed successfully");

            // Create decline note on regarding object
            CreateSignatureDeclineNote(signatureActivity, service, tracingService);
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error processing declined signature: {ex.Message
        }
    }

    private void ProcessExpiredSignature(Entity signatureActivity, IOrganizationSer
    {
        try
        {
            Entity updateActivity = new Entity(signatureActivity.LogicalName, signa
            updateActivity["statuscode"] = new OptionSetValue(6); // Expired
            updateActivity["statecode"] = new OptionSetValue(2); // Cancelled
            updateActivity["description"] = "Digital signature request has expired

            service.Update(updateActivity);
            tracingService.Trace("Signature expiration processed successfully");
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error processing expired signature: {ex.Message}
        }
    }

    private void CreateSignatureCompletionNote(Entity signatureActivity, IOrganizat
    {
        try
        {
            var regardingObject = signatureActivity.GetAttributeValue<EntityReferen
            if (regardingObject == null) return;

            Entity note = new Entity("annotation");
            note["objectid"] = regardingObject;
            note["objecttypecode"] = regardingObject.LogicalName;
```

```
            note["subject"] = "Digital Signature Completed";
            note["notetext"] = $"Digital signature activity '{signatureActivity.Get
                               $"Signed by: {signatureActivity.GetAttributeValue<stri
                               $"Signed on: {DateTime.UtcNow:yyyy-MM-dd HH:mm:ss} UTC
                               $"Document: {signatureActivity.GetAttributeValue<strin
                               $"The signed document is available for download from t

            service.Create(note);
            tracingService.Trace("Signature completion note created on regarding ob
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error creating completion note: {ex.Message}");
        }
    }

    private void CreateSignatureDeclineNote(Entity signatureActivity, IOrganization
    {
        try
        {
            var regardingObject = signatureActivity.GetAttributeValue<EntityReferen
            if (regardingObject == null) return;

            Entity note = new Entity("annotation");
            note["objectid"] = regardingObject;
            note["objecttypecode"] = regardingObject.LogicalName;
            note["subject"] = "Digital Signature Declined";
            note["notetext"] = $"Digital signature activity '{signatureActivity.Get
                               $"Recipient: {signatureActivity.GetAttributeValue<stri
                               $"Declined on: {DateTime.UtcNow:yyyy-MM-dd HH:mm:ss} U
                               $"Document: {signatureActivity.GetAttributeValue<strin
                               $"You may need to follow up or create a new signature

            service.Create(note);
            tracingService.Trace("Signature decline note created on regarding objec
        }
        catch (Exception ex)
        {
            tracingService.Trace($"Error creating decline note: {ex.Message}");
        }
    }

    private RegardingObjectInfo GetRegardingObjectInfo(Entity signatureActivity, IO
```

```
{
    try
    {
        var regardingObjectRef = signatureActivity.GetAttributeValue<EntityRefe
        if (regardingObjectRef != null)
        {
            var regardingObject = service.Retrieve(regardingObjectRef.LogicalNa

            return new RegardingObjectInfo
            {
                Id = regardingObjectRef.Id.ToString(),
                LogicalName = regardingObjectRef.LogicalName,
                Name = regardingObjectRef.Name ?? GetPrimaryNameValue(regarding
            };
        }
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Error getting regarding object info: {ex.Message
    }

    return new RegardingObjectInfo();
}

private string GetPrimaryNameValue(Entity entity)
{
    // Common primary name attributes across different entity types
    string[] primaryNameFields = { "name", "fullname", "subject", "title", "acc

    foreach (string field in primaryNameFields)
    {
        if (entity.Contains(field) && !string.IsNullOrEmpty(entity.GetAttribute
        {
            return entity.GetAttributeValue<string>(field);
        }
    }

    return $"{entity.LogicalName} Record";
}

private string GetUserInfo(EntityReference userRef, IOrganizationService servic
{
    try
```

```
    {
        if (userRef != null)
        {
            var user = service.Retrieve(userRef.LogicalName, userRef.Id, new Co
            return user.GetAttributeValue<string>("fullname") ?? user.GetAttrib
        }
    }
    catch
    {
        // Return default if can't retrieve user info
    }

    return "System User";
}

// API Communication Methods (same as custom table implementation)
private async Task<NintexApiResponse> SendSignatureRequestAsync(NintexSignature
{
    try
    {
        using (var httpClient = new HttpClient())
        {
            httpClient.DefaultRequestHeaders.Add("Authorization", $"Bearer {Get
            httpClient.DefaultRequestHeaders.Add("Accept", "application/json");

            var requestJson = JsonConvert.SerializeObject(request);
            var content = new StringContent(requestJson, Encoding.UTF8, "applic

            var response = await httpClient.PostAsync(GetNintexSignatureEndpoin
            var responseContent = await response.Content.ReadAsStringAsync();

            tracingService.Trace($"Nintex API Response: {response.StatusCode} -

            if (response.IsSuccessStatusCode)
            {
                var apiResponse = JsonConvert.DeserializeObject<NintexSignature
                return new NintexApiResponse
                {
                    Success = true,
                    RequestId = apiResponse.RequestId
                };
            }
            else
```

```
            {
                return new NintexApiResponse
                {
                    Success = false,
                    ErrorMessage = $"API call failed with status {response.Stat
                };
            }
        }
    }
    catch (Exception ex)
    {
        tracingService.Trace($"Exception in SendSignatureRequestAsync: {ex.Mess
        return new NintexApiResponse
        {
            Success = false,
            ErrorMessage = ex.Message
        };
    }
}

private async Task<SignedDocumentResponse> GetSignedDocumentAsync(string reques
{
    try
    {
        using (var httpClient = new HttpClient())
        {
            httpClient.DefaultRequestHeaders.Add("Authorization", $"Bearer {Get

            var response = await httpClient.GetAsync($"{GetNintexDocumentEndpoi

            if (response.IsSuccessStatusCode)
            {
                var documentContent = await response.Content.ReadAsByteArrayAsy
                return new SignedDocumentResponse
                {
                    Success = true,
                    DocumentContent = documentContent
                };
            }
            else
            {
                var errorContent = await response.Content.ReadAsStringAsync();
                return new SignedDocumentResponse
```

```
                    {
                        Success = false,
                        ErrorMessage = $"Failed to retrieve document: {response.Sta
                    };
                }
            }
        }
        catch (Exception ex)
        {
            return new SignedDocumentResponse
            {
                Success = false,
                ErrorMessage = ex.Message
            };
        }
    }

    // Configuration methods
    private string GetNintexApiKey()
    {
        return Environment.GetEnvironmentVariable("NINTEX_API_KEY") ?? _secureConfi
    }

    private string GetNintexSignatureEndpoint()
    {
        return "https://api.nintex.com/assurance/v1/signature-requests";
    }

    private string GetNintexDocumentEndpoint()
    {
        return "https://api.nintex.com/assurance/v1/signed-documents";
    }

    private string GetCallbackUrl()
    {
        return "https://yourorg.crm.dynamics.com/api/nintex/webhook";
    }
}

// Enhanced data transfer objects for activity context
public class NintexSignatureRequest
{
    [JsonProperty("recipientEmail")]
```

```
    public string RecipientEmail { get; set; }

    [JsonProperty("recipientName")]
    public string RecipientName { get; set; }

    [JsonProperty("documentName")]
    public string DocumentName { get; set; }

    [JsonProperty("documentContent")]
    public string DocumentContent { get; set; }

    [JsonProperty("callbackUrl")]
    public string CallbackUrl { get; set; }

    [JsonProperty("expiryDays")]
    public int ExpiryDays { get; set; }

    [JsonProperty("contextInfo")]
    public SignatureContextInfo ContextInfo { get; set; }
}

public class SignatureContextInfo
{
    [JsonProperty("activityId")]
    public string ActivityId { get; set; }

    [JsonProperty("regardingObjectId")]
    public string RegardingObjectId { get; set; }

    [JsonProperty("regardingObjectType")]
    public string RegardingObjectType { get; set; }

    [JsonProperty("regardingObjectName")]
    public string RegardingObjectName { get; set; }

    [JsonProperty("requestedBy")]
    public string RequestedBy { get; set; }

    [JsonProperty("activitySubject")]
    public string ActivitySubject { get; set; }
}

public class RegardingObjectInfo
```

```
    {
        public string Id { get; set; }
        public string LogicalName { get; set; }
        public string Name { get; set; }
    }

    // Response objects (same as custom table implementation)
    public class NintexSignatureResponse
    {
        [JsonProperty("requestId")]
        public string RequestId { get; set; }

        [JsonProperty("status")]
        public string Status { get; set; }

        [JsonProperty("signatureUrl")]
        public string SignatureUrl { get; set; }
    }

    public class NintexApiResponse
    {
        public bool Success { get; set; }
        public string RequestId { get; set; }
        public string ErrorMessage { get; set; }
    }

    public class SignedDocumentResponse
    {
        public bool Success { get; set; }
        public byte[] DocumentContent { get; set; }
        public string ErrorMessage { get; set; }
    }
}
```

2.3 Activity Plugin Registration

Register plugin steps for activity:

Create Step:

- Message: Create
- Primary Entity: `new_digitalsignatureactivity`
- Event Pipeline Stage: Post-operation

- Execution Mode: Synchronous

Update Step:

- Message: Update
- Primary Entity: `new_digitalsignatureactivity`
- Event Pipeline Stage: Post-operation
- Execution Mode: Synchronous
- Filtering Attributes: `statuscode,new_nintexrequestid`

Step 3: Activity PCF Component Development

3.1 Activity-Aware PCF Implementation

Key differences for activity PCF component:

```
// Activity-specific property bindings
- subject: Activity subject (primary field)
- statuscode: Activity status code (not custom choice)
- statecode: Activity state code (Open/Completed/Cancelled)
- regardingobjectid: Regarding object reference
- regardingobjecttypecode: Type of regarding object
```

3.2 Enhanced Activity Component

File: index.ts (Activity version)

```
import { IInputs, IOutputs } from "./generated/ManifestTypes";
import * as React from "react";
import * as ReactDOM from "react-dom";
import { DigitalSignatureActivityControl, IDigitalSignatureActivityProps } from "./Digi

export class NintexDigitalSignatureActivityControl implements ComponentFramework.Standa
    private _container: HTMLDivElement;
    private _context: ComponentFramework.Context<IInputs>;
    private _notifyOutputChanged: () => void;
    private _activityId: string;

    public init(
        context: ComponentFramework.Context<IInputs>,
        notifyOutputChanged: () => void,
        state: ComponentFramework.Dictionary,
        container: HTMLDivElement
    ): void {
        this._container = container;
        this._context = context;
        this._notifyOutputChanged = notifyOutputChanged;
        this._activityId = (context as any).page?.entityId || "";

        this.renderControl();
    }

    public updateView(context: ComponentFramework.Context<IInputs>): ComponentFramework
        this._context = context;
        this.renderControl();
        return {} as ComponentFramework.ReactControl.UpdatedControls;
    }

    private renderControl(): void {
        const props: IDigitalSignatureActivityProps = {
            context: this._context,
            activityId: this._activityId,
            subject: this._context.parameters.subject?.raw || "",
            recipientEmail: this._context.parameters.recipientEmail?.raw || "",
            recipientName: this._context.parameters.recipientName?.raw || "",
            statusCode: this._context.parameters.statusCode?.raw || 1,
            stateCode: this._context.parameters.stateCode?.raw || 0,
            nintexRequestId: this._context.parameters.nintexRequestId?.raw || "",
            signedDocument: this._context.parameters.signedDocument?.raw || "",
            documentName: this._context.parameters.documentName?.raw || "",
```

```
        regardingObjectId: this._context.parameters.regardingObjectId?.raw || "",
        regardingObjectType: this._context.parameters.regardingObjectType?.raw || "
        onSignatureRequest: this.handleSignatureRequest.bind(this),
        onRefreshStatus: this.handleRefreshStatus.bind(this),
        onDownloadDocument: this.handleDownloadDocument.bind(this),
        onViewRegardingRecord: this.handleViewRegardingRecord.bind(this)
    };

    ReactDOM.render(React.createElement(DigitalSignatureActivityControl, props), th
}

private async handleSignatureRequest(recipientEmail: string, recipientName: string,
    try {
        const updateActivity = {
            new_recipientemail: recipientEmail,
            new_recipientname: recipientName,
            new_documentname: documentName,
            statuscode: 2, // Pending Signature
            subject: `Digital Signature Request - ${documentName || 'Document'}`
        };

        await this._context.webAPI.updateRecord("new_digitalsignatureactivity", thi

        (this._context as any).page?.data?.refresh();

        this._context.navigation.openAlertDialog({
            title: "Success",
            text: "Digital signature request has been sent successfully!"
        });
    } catch (error) {
        this._context.navigation.openAlertDialog({
            title: "Error",
            text: `Failed to send signature request: ${error}`
        });
    }
}

private async handleRefreshStatus(): Promise<void> {
    try {
        (this._context as any).page?.data?.refresh();
    } catch (error) {
        console.error("Error refreshing status:", error);
    }
```

```
}

private async handleViewRegardingRecord(): Promise<void> {
    const regardingObjectId = this._context.parameters.regardingObjectId?.raw;
    const regardingObjectType = this._context.parameters.regardingObjectType?.raw;

    if (regardingObjectId && regardingObjectType) {
        try {
            await this._context.navigation.openForm({
                entityName: regardingObjectType,
                entityId: regardingObjectId
            });
        } catch (error) {
            console.error("Error opening regarding record:", error);
        }
    }
}

private handleDownloadDocument(): void {
    const signedDocument = this._context.parameters.signedDocument?.raw;
    if (signedDocument) {
        const byteCharacters = atob(signedDocument);
        const byteNumbers = new Array(byteCharacters.length);
        for (let i = 0; i < byteCharacters.length; i++) {
            byteNumbers[i] = byteCharacters.charCodeAt(i);
        }
        const byteArray = new Uint8Array(byteNumbers);
        const blob = new Blob([byteArray], { type: 'application/pdf' });

        const url = window.URL.createObjectURL(blob);
        const a = document.createElement('a');
        a.href = url;
        a.download = `signed-document-${this._activityId}.pdf`;
        document.body.appendChild(a);
        a.click();
        document.body.removeChild(a);
        window.URL.revokeObjectURL(url);
    }
}

public getOutputs(): IOutputs {
    return {};
}
```

```
    public destroy(): void {
        ReactDOM.unmountComponentAtNode(this._container);
    }
}
```

File: DigitalSignatureActivityControl.tsx

```tsx
import * as React from "react";

export interface IDigitalSignatureActivityProps {
    context: ComponentFramework.Context<any>;
    activityId: string;
    subject: string;
    recipientEmail: string;
    recipientName: string;
    statusCode: number;
    stateCode: number;
    nintexRequestId: string;
    signedDocument: string;
    documentName: string;
    regardingObjectId: string;
    regardingObjectType: string;
    onSignatureRequest: (email: string, name: string, documentName: string) => Promise<
    onRefreshStatus: () => Promise<void>;
    onDownloadDocument: () => void;
    onViewRegardingRecord: () => Promise<void>;
}

export const DigitalSignatureActivityControl: React.FC<IDigitalSignatureActivityProps>
    const [recipientEmail, setRecipientEmail] = React.useState(props.recipientEmail ||
    const [recipientName, setRecipientName] = React.useState(props.recipientName || "")
    const [documentName, setDocumentName] = React.useState(props.documentName || "");
    const [isLoading, setIsLoading] = React.useState(false);
    const [regardingInfo, setRegardingInfo] = React.useState<any>(null);

    React.useEffect(() => {
        setRecipientEmail(props.recipientEmail || "");
        setRecipientName(props.recipientName || "");
        setDocumentName(props.documentName || "");
        loadRegardingObjectInfo();
    }, [props.recipientEmail, props.recipientName, props.documentName, props.regardingO

    const loadRegardingObjectInfo = async () => {
        if (props.regardingObjectId && props.regardingObjectType) {
            try {
                const regardingRecord = await props.context.webAPI.retrieveRecord(
                    props.regardingObjectType,
                    props.regardingObjectId,
                    "?$select=name,accountname,fullname,subject,title,lastname,firstnam
                );
```

```
            setRegardingInfo(regardingRecord);
        } catch (error) {
            console.error("Error loading regarding object:", error);
        }
    }
};

const getRegardingDisplayName = (): string => {
    if (!regardingInfo) return "Unknown Record";

    // Try common name fields for different entity types
    return regardingInfo.name ||
           regardingInfo.accountname ||
           regardingInfo.fullname ||
           regardingInfo.subject ||
           regardingInfo.title ||
           `${regardingInfo.firstname || ''} ${regardingInfo.lastname || ''}`.trim(
           "Record";
};

const getStatusText = (statusCode: number, stateCode: number): string => {
    if (stateCode === 0) { // Open
        switch (statusCode) {
            case 1: return "Draft";
            case 2: return "Pending Signature";
            case 3: return "Failed to Send";
            default: return "Open";
        }
    } else if (stateCode === 1) { // Completed
        return "Signed";
    } else if (stateCode === 2) { // Cancelled
        switch (statusCode) {
            case 5: return "Declined";
            case 6: return "Expired";
            default: return "Cancelled";
        }
    }
    return "Unknown";
};

const getStatusColor = (statusCode: number, stateCode: number): string => {
    if (stateCode === 0) { // Open
        switch (statusCode) {
```

```
            case 1: return "#666666"; // Draft - Gray
            case 2: return "#0078d4"; // Pending - Blue
            case 3: return "#d13438"; // Failed - Red
            default: return "#666666";
        }
    } else if (stateCode === 1) { // Completed
        return "#107c10"; // Signed - Green
    } else if (stateCode === 2) { // Cancelled
        return "#d13438"; // Declined/Expired - Red
    }
    return "#666666";
};

const canInitiateSignature = (): boolean => {
    return props.stateCode === 0 && props.statusCode === 1; // Open and Draft
};

const handleSendSignatureRequest = async (): Promise<void> => {
    if (!recipientEmail || !recipientName || !documentName) {
        alert("Please enter recipient email, name, and document name.");
        return;
    }

    setIsLoading(true);
    try {
        await props.onSignatureRequest(recipientEmail, recipientName, documentName)
    } catch (error) {
        console.error("Error sending signature request:", error);
    } finally {
        setIsLoading(false);
    }
};

// Styling (enhanced for activity context)
const containerStyle: React.CSSProperties = {
    fontFamily: "'Segoe UI', Tahoma, Geneva, Verdana, sans-serif",
    padding: "20px",
    border: "1px solid #e1e5e9",
    borderRadius: "8px",
    backgroundColor: "#ffffff",
    maxWidth: "700px",
    boxShadow: "0 2px 8px rgba(0,0,0,0.1)"
};
```

```
const headerStyle: React.CSSProperties = {
    fontSize: "20px",
    fontWeight: "600",
    marginBottom: "20px",
    color: "#323130",
    display: "flex",
    alignItems: "center",
    gap: "12px",
    borderBottom: "2px solid #0078d4",
    paddingBottom: "10px"
};

const activityIconStyle: React.CSSProperties = {
    width: "24px",
    height: "24px",
    fill: "#0078d4"
};

const contextStyle: React.CSSProperties = {
    padding: "16px",
    backgroundColor: "#fff4ce",
    border: "1px solid #fed100",
    borderRadius: "6px",
    marginBottom: "20px",
    display: "flex",
    justifyContent: "space-between",
    alignItems: "center"
};

const statusContainerStyle: React.CSSProperties = {
    padding: "16px",
    backgroundColor: "#f8f9fa",
    border: "1px solid #e1e5e9",
    borderRadius: "6px",
    marginBottom: "20px"
};

const statusBadgeStyle: React.CSSProperties = {
    display: "inline-block",
    padding: "6px 16px",
    borderRadius: "20px",
    fontSize: "12px",
```

```
    fontWeight: "600",
    color: "white",
    backgroundColor: getStatusColor(props.statusCode, props.stateCode),
    marginRight: "12px"
};

const fieldGroupStyle: React.CSSProperties = {
    marginBottom: "16px"
};

const labelStyle: React.CSSProperties = {
    display: "block",
    fontSize: "14px",
    fontWeight: "600",
    marginBottom: "6px",
    color: "#323130"
};

const inputStyle: React.CSSProperties = {
    width: "100%",
    padding: "10px 12px",
    fontSize: "14px",
    border: "1px solid #d1d5da",
    borderRadius: "4px",
    boxSizing: "border-box",
    transition: "border-color 0.2s"
};

const buttonStyle: React.CSSProperties = {
    padding: "10px 20px",
    fontSize: "14px",
    fontWeight: "600",
    border: "none",
    borderRadius: "4px",
    cursor: "pointer",
    marginRight: "10px",
    marginBottom: "10px",
    transition: "all 0.2s"
};

const primaryButtonStyle: React.CSSProperties = {
    ...buttonStyle,
    backgroundColor: "#0078d4",
```

```
    color: "white"
};

const secondaryButtonStyle: React.CSSProperties = {
    ...buttonStyle,
    backgroundColor: "#f3f2f1",
    color: "#323130",
    border: "1px solid #d1d5da"
};

const linkButtonStyle: React.CSSProperties = {
    ...buttonStyle,
    backgroundColor: "transparent",
    color: "#0078d4",
    border: "1px solid #0078d4",
    textDecoration: "none"
};

return (
    <div style={containerStyle}>
        <h3 style={headerStyle}>
            <svg style={activityIconStyle} viewBox="0 0 24 24">
                <path d="M14,2H6A2,2 0 0,0 4,4V20A2,2 0 0,0 6,22H18A2,2 0 0,0 20,20
            </svg>
            Digital Signature Activity
        </h3>

        {props.regardingObjectId && (
            <div style={contextStyle}>
                <div>
                    <strong>Related to: </strong>
                    <span style={{ fontSize: "16px" }}>{getRegardingDisplayName()}<
                    <span style={{ color: "#666", fontSize: "12px", marginLeft: "8p
                        ({props.regardingObjectType})
                    </span>
                </div>
                <button
                    onClick={props.onViewRegardingRecord}
                    style={linkButtonStyle}
                >
                    View Record
                </button>
            </div>
```

```
        )}

        <div style={statusContainerStyle}>
            <div style={{ marginBottom: "12px" }}>
                <span style={statusBadgeStyle}>
                    {getStatusText(props.statusCode, props.stateCode)}
                </span>
                {props.nintexRequestId && (
                    <span style={{ fontSize: "12px", color: "#666" }}>
                        Request ID: <code>{props.nintexRequestId}</code>
                    </span>
                )}
            </div>
            {props.subject && (
                <div style={{ fontSize: "14px", fontWeight: "500" }}>
                    <strong>Subject:</strong> {props.subject}
                </div>
            )}
        </div>

        {canInitiateSignature() ? (
            <div>
                <div style={fieldGroupStyle}>
                    <label style={labelStyle}>Document Name *</label>
                    <input
                        type="text"
                        value={documentName}
                        onChange={(e) => setDocumentName(e.target.value)}
                        style={inputStyle}
                        placeholder="Enter document name for signature"
                    />
                </div>

                <div style={fieldGroupStyle}>
                    <label style={labelStyle}>Recipient Email *</label>
                    <input
                        type="email"
                        value={recipientEmail}
                        onChange={(e) => setRecipientEmail(e.target.value)}
                        style={inputStyle}
                        placeholder="Enter recipient's email address"
                    />
                </div>
```

```
            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Recipient Name *</label>
                <input
                    type="text"
                    value={recipientName}
                    onChange={(e) => setRecipientName(e.target.value)}
                    style={inputStyle}
                    placeholder="Enter recipient's full name"
                />
            </div>

            <button
                onClick={handleSendSignatureRequest}
                disabled={isLoading || !recipientEmail || !recipientName || !do
                style={primaryButtonStyle}
            >
                {isLoading ? "Sending..." : "Send Signature Request"}
            </button>
        </div>
    ) : (
        <div>
            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Document Name</label>
                <div style={{ padding: "8px 0", fontSize: "14px", fontWeight: "
                    {props.documentName || "Not specified"}
                </div>
            </div>

            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Recipient Email</label>
                <div style={{ padding: "8px 0", fontSize: "14px" }}>{props.reci
            </div>

            <div style={fieldGroupStyle}>
                <label style={labelStyle}>Recipient Name</label>
                <div style={{ padding: "8px 0", fontSize: "14px" }}>{props.reci
            </div>

            <div style={{ display: "flex", gap: "10px", flexWrap: "wrap" }}>
                <button
                    onClick={props.onRefreshStatus}
                    style={secondaryButtonStyle}
```

```
            >
                Refresh Status
            </button>

            {props.stateCode === 1 && props.signedDocument && (
                <button
                    onClick={props.onDownloadDocument}
                    style={primaryButtonStyle}
                >
                    Download Signed Document
                </button>
            )}

            {props.stateCode === 2 && props.statusCode === 5 && (
                <div style={{
                    padding: "8px 12px",
                    backgroundColor: "#fde7e9",
                    border: "1px solid #d13438",
                    borderRadius: "4px",
                    fontSize: "14px",
                    color: "#721c24",
                    width: "100%"
                }}>
                    <strong>Signature Declined:</strong> The recipient decl
                    You may need to follow up or create a new signature req
                </div>
            )}

            {props.stateCode === 2 && props.statusCode === 6 && (
                <div style={{
                    padding: "8px 12px",
                    backgroundColor: "#fff4ce",
                    border: "1px solid #f7630c",
                    borderRadius: "4px",
                    fontSize: "14px",
                    color: "#8a4100",
                    width: "100%"
                }}>
                    <strong>Signature Expired:</strong> This signature requ
                    Please create a new signature request if still needed.
                </div>
            )}
        </div>
```

```
                </div>
            )}
        </div>
    );
};
```

3.3 Activity Component Manifest

File: ControlManifest.Input.xml (Activity version)

```
<?xml version="1.0" encoding="utf-8"?>
<manifest>
  <control namespace="NintexActivityControls" constructor="NintexDigitalSignatureActivi
    <type-group name="strings">
      <type>SingleLine.Text</type>
      <type>SingleLine.Email</type>
    </type-group>
    <type-group name="numbers">
      <type>Whole.None</type>
      <type>OptionSet</type>
    </type-group>
    <property name="subject" display-name-key="Subject" description-key="Activity subje
    <property name="recipientEmail" display-name-key="Recipient Email" description-key=
    <property name="recipientName" display-name-key="Recipient Name" description-key="F
    <property name="statusCode" display-name-key="Status Code" description-key="Activit
    <property name="stateCode" display-name-key="State Code" description-key="Activity
    <property name="nintexRequestId" display-name-key="Nintex Request ID" description-k
    <property name="signedDocument" display-name-key="Signed Document" description-key=
    <property name="documentName" display-name-key="Document Name" description-key="Nam
    <property name="regardingObjectId" display-name-key="Regarding Object ID" descripti
    <property name="regardingObjectType" display-name-key="Regarding Object Type" descr
    <resources>
      <code path="index.ts" order="1"/>
      <resx path="strings/NintexDigitalSignatureActivityControl.1033.resx" version="1.0
    </resources>
    <feature-usage>
      <uses-feature name="WebAPI" required="true" />
    </feature-usage>
  </control>
</manifest>
```

Step 4: Activity Form Configuration

4.1 Configure Activity Quick Create Form

1. **Open Digital Signature Activity table**
2. **Go to Forms tab**
3. **Create new Quick Create form:**
   - **Name:** Digital Signature Activity Quick Create
   - **Add sections:**

   General Section:
   - Subject (required)
   - Regarding (lookup to any entity)
   - Owner

   Signature Details Section:
   - Document Name
   - Recipient Email
   - Recipient Name
   - Description
4. **Set as default Quick Create form**

4.2 Configure Main Activity Form

1. **Edit the main activity form**
2. **Configure form layout:**

   Header Section:
   - Subject
   - Owner
   - Status Reason
   - Regarding

   General Tab:
   - PCF Component section
   - Activity-specific fields

   Details Tab:
   - Standard activity fields (Description, Due Date, etc.)
   - Custom signature fields

4.3 Add PCF Component to Activity Form

1. **Create new section:** "Signature Management"

2. **Add PCF control with activity property bindings:**
    - subject → subject
    - recipientEmail → new_recipientemail
    - recipientName → new_recipientname
    - statusCode → statuscode
    - stateCode → statecode
    - nintexRequestId → new_nintexrequestid
    - signedDocument → new_signaturedocument
    - documentName → new_documentname
    - regardingObjectId → regardingobjectid
    - regardingObjectType → regardingobjecttypecode

Step 5: Timeline Integration and Testing

5.1 Automatic Timeline Integration

Activities automatically appear in timeline when:

- Entity has activities enabled
- User has appropriate permissions
- Activity table is published and active

No additional configuration required for:

- Timeline appearance
- Activity icons
- Status visualization
- Contextual menus

5.2 Timeline Workflow Testing

Test complete activity lifecycle:

1. **Open any activity-enabled record** (Account, Contact, Case)
2. **Go to Timeline**
3. **Click "+ New Activity"**
4. **Select "Digital Signature Activity"**
5. **Fill Quick Create form:**
    - Subject: "Contract Signature Required"

- Document Name: "Service Agreement"
- Recipient Email: test@example.com
- Recipient Name: "John Doe"

6. **Save** - Activity created and plugin triggers
7. **Verify timeline updates** showing "Pending Signature"
8. **Test status progression** through completion

5.3 Multi-Entity Testing

Test across different entity types:

Account Timeline:

```
Contoso Corporation
├── Timeline
    ├── Phone Call: "Initial Discussion"
    ├── Digital Signature Activity: "Service Agreement" (Pending)
    ├── Email: "Contract Sent"
    └── Digital Signature Activity: "NDA" (Signed)
```

Contact Timeline:

```
John Doe
├── Timeline
    ├── Appointment: "Meeting Scheduled"
    ├── Digital Signature Activity: "Employment Contract" (Signed)
    └── Task: "Complete Onboarding"
```

Case Timeline:

```
Support Case #12345
├── Timeline
    ├── Phone Call: "Issue Reported"
    ├── Task: "Investigation Complete"
    └── Digital Signature Activity: "Resolution Confirmation" (Pending)
```

Migration Guide

Migrating from Custom Table to Activity-Based

If you initially implemented the custom table approach and want to migrate to the activity-based approach:

1. Data Migration Strategy

Export existing signature data:

```
-- Export existing digital signature records
SELECT
    new_name,
    new_recipientemail,
    new_recipientname,
    new_documentname,
    new_signaturestatus,
    new_nintexrequestid,
    new_relatedrecord,
    createdon,
    modifiedon
FROM new_digitalsignature
```

Create migration mapping:

```
// Custom Table → Activity mapping
new_name → subject
new_signaturestatus → statuscode (with value conversion)
new_relatedrecord → regardingobjectid
// Additional fields map directly
```

2. Migration Process

1. **Deploy activity solution** alongside existing custom table
2. **Run parallel operations** for testing period
3. **Migrate historical data** using custom migration tool
4. **Update integrations** to use activity endpoints
5. **Deprecate custom table** after validation period

3. Migration Tool Example

```
public class SignatureMigrationTool
{
    public async Task MigrateCustomTableToActivity(IOrganizationService service)
    {
        // Retrieve all custom table records
        var query = new QueryExpression("new_digitalsignature")
        {
            ColumnSet = new ColumnSet(true)
        };

        var results = service.RetrieveMultiple(query);

        foreach (var record in results.Entities)
        {
            // Create equivalent activity
            var activity = new Entity("new_digitalsignatureactivity");

            // Map fields
            activity["subject"] = record.GetAttributeValue<string>("new_name");
            activity["new_recipientemail"] = record.GetAttributeValue<string>("new_reci
            activity["new_recipientname"] = record.GetAttributeValue<string>("new_recip

            // Convert status values
            var oldStatus = record.GetAttributeValue<OptionSetValue>("new_signaturestat
            activity["statuscode"] = ConvertStatus(oldStatus);

            // Map regarding object
            var relatedRecord = record.GetAttributeValue<EntityReference>("new_relatedr
            if (relatedRecord != null)
            {
                activity["regardingobjectid"] = relatedRecord;
            }

            // Preserve dates
            activity["createdon"] = record.GetAttributeValue<DateTime>("createdon");

            service.Create(activity);
        }
    }

    private OptionSetValue ConvertStatus(int? oldStatus)
```

```
    {
        // Map custom table status to activity status codes
        switch (oldStatus)
        {
            case 100000000: return new OptionSetValue(1); // Draft
            case 100000001: return new OptionSetValue(2); // Pending
            case 100000002: return new OptionSetValue(4); // Signed
            case 100000003: return new OptionSetValue(5); // Declined
            case 100000004: return new OptionSetValue(6); // Expired
            default: return new OptionSetValue(1); // Default to Draft
        }
    }
}
```

Production Considerations

Performance Optimization

1. Plugin Performance

Optimize API calls:

```
// Use async patterns for API calls
private async Task<NintexApiResponse> SendSignatureRequestAsync(...)
{
    using (var httpClient = new HttpClient())
    {
        // Configure timeout
        httpClient.Timeout = TimeSpan.FromSeconds(30);

        // Implement retry logic
        var retryPolicy = new RetryPolicy();
        return await retryPolicy.ExecuteAsync(async () =>
        {
            // API call implementation
        });
    }
}
```

Implement caching:

```
// Cache API configuration
private static readonly Dictionary<string, string> ConfigCache =
    new Dictionary<string, string>();

private string GetCachedConfig(string key)
{
    if (!ConfigCache.ContainsKey(key))
    {
        ConfigCache[key] = RetrieveConfigFromEnvironment(key);
    }
    return ConfigCache[key];
}
```

2. Timeline Performance

Optimize activity queries:

- Use selective column sets in plugins
- Implement proper indexing on custom fields
- Consider pagination for large activity sets

Timeline loading optimization:

- Enable timeline caching
- Configure appropriate page sizes
- Use filtered views where possible

Security Considerations

1. API Security

Secure API key management:

```
{
  "secureConfig": {
    "nintexApiKey": "encrypted-api-key",
    "webhookSecret": "webhook-verification-secret",
    "apiBaseUrl": "https://api.nintex.com/assurance/v1"
  }
}
```

Implement API key rotation:

```
public class ApiKeyRotationService
{
    public async Task RotateApiKey()
    {
        // Retrieve new key from secure store
        var newApiKey = await GetNewApiKeyFromVault();

        // Update environment variable
        await UpdateEnvironmentVariable("NINTEX_API_KEY", newApiKey);

        // Validate new key works
        await ValidateApiKey(newApiKey);
    }
}
```

2. Document Security

Encrypt document content:

```
public class DocumentEncryption
{
    public string EncryptDocument(string documentContent)
    {
        using (var aes = Aes.Create())
        {
            // Encrypt document before storing
            var encrypted = EncryptStringToBytes(documentContent, aes.Key, aes.IV);
            return Convert.ToBase64String(encrypted);
        }
    }

    public string DecryptDocument(string encryptedContent)
    {
        var encryptedBytes = Convert.FromBase64String(encryptedContent);
        // Decrypt and return original content
        return DecryptBytesToString(encryptedBytes);
    }
}
```

Monitoring and Logging

1. Plugin Monitoring

Implement comprehensive logging:

```
public class PluginLogger
{
    public void LogSignatureRequest(string requestId, string recipientEmail, string sta
    {
        var logEntry = new
        {
            RequestId = requestId,
            RecipientEmail = recipientEmail,
            Status = status,
            Timestamp = DateTime.UtcNow,
            Environment = GetEnvironmentName()
        };

        // Log to Application Insights or similar
        TelemetryClient.TrackEvent("SignatureRequest", logEntry);
    }
}
```

Set up alerts:

- Failed signature requests exceeding threshold
- API response time degradation
- Unusual signature request volumes

2. Business Intelligence

Create signature analytics:

```
-- Signature completion rates by entity type
SELECT
    regardingobjecttypecode as EntityType,
    COUNT(*) as TotalRequests,
    SUM(CASE WHEN statuscode = 4 THEN 1 ELSE 0 END) as Completed,
    (SUM(CASE WHEN statuscode = 4 THEN 1 ELSE 0 END) * 100.0 / COUNT(*)) as CompletionR
FROM new_digitalsignatureactivity
WHERE createdon >= DATEADD(month, -3, GETDATE())
GROUP BY regardingobjecttypecode
```

Backup and Recovery

1. Data Backup Strategy

Regular exports of signature data:

```
# PowerShell script for regular backup
$connection = Get-CrmConnection -ConnectionString $connectionString
$signatures = Get-CrmRecords -conn $connection -EntityLogicalName "new_digitalsignature

# Export to secure storage
$backupData = $signatures | ConvertTo-Json -Depth 10
$backupData | Out-File "signatures_backup_$(Get-Date -Format 'yyyyMMdd_HHmmss').json"
```

2. Disaster Recovery

Recovery procedures:

1. **Plugin Recovery:** Redeploy plugin assemblies from source control
2. **Data Recovery:** Restore from regular backups
3. **API Recovery:** Validate API connectivity and credentials
4. **Form Recovery:** Redeploy PCF components and form configurations

Appendices

Appendix A: Nintex Assurance API Reference

Common API Endpoints

Authentication:

```
POST https://api.nintex.com/assurance/v1/auth
Authorization: Bearer {api-key}
Content-Type: application/json
```

Create Signature Request:

```
POST https://api.nintex.com/assurance/v1/signature-requests
Authorization: Bearer {api-key}
Content-Type: application/json

{
  "recipientEmail": "recipient@example.com",
  "recipientName": "John Doe",
  "documentName": "Service Agreement",
  "documentContent": "base64-encoded-pdf",
  "callbackUrl": "https://yourorg.crm.dynamics.com/api/nintex/webhook",
  "expiryDays": 7
}
```

Retrieve Signed Document:

```
GET https://api.nintex.com/assurance/v1/signed-documents/{requestId}
Authorization: Bearer {api-key}
Accept: application/pdf
```

Appendix B: Error Handling Reference

Common Error Scenarios

Plugin Errors:

```
// Handle API timeouts
catch (TaskCanceledException ex) when (ex.InnerException is TimeoutException)
{
    tracingService.Trace("API call timed out");
    // Implement retry logic or mark for later processing
}

// Handle API rate limiting
catch (HttpRequestException ex) when (ex.Message.Contains("429"))
{
    tracingService.Trace("API rate limit exceeded");
    // Implement exponential backoff
}

// Handle invalid document format
catch (FormatException ex)
{
    tracingService.Trace($"Invalid document format: {ex.Message}");
    throw new InvalidPluginExecutionException("Document format is invalid");
}
```

PCF Component Errors:

```
// Handle API failures gracefully
try {
    await this.handleSignatureRequest(email, name, documentName);
} catch (error) {
    const errorMessage = error instanceof Error ? error.message : 'Unknown error occurr

    this._context.navigation.openAlertDialog({
        title: "Error",
        text: `Failed to send signature request: ${errorMessage}`
    });

    // Log error for debugging
    console.error("Signature request failed:", error);
}
```

Appendix C: Testing Scenarios

Unit Testing Examples

Plugin Unit Tests:

```
[TestMethod]
public void TestSignatureRequestCreation()
{
    // Arrange
    var context = CreateMockContext();
    var service = CreateMockService();
    var plugin = new NintexSignaturePlugin("", "test-api-key");

    // Act
    plugin.Execute(context);

    // Assert
    // Verify API call was made
    // Verify record was updated with request ID
    // Verify status was set to pending
}
```

PCF Component Tests:

```
// Jest test example
describe('DigitalSignatureControl', () => {
    test('should handle signature request correctly', async () => {
        const mockProps = {
            onSignatureRequest: jest.fn().mockResolvedValue(undefined),
            // ... other props
        };

        const component = render(<DigitalSignatureControl {...mockProps} />);

        // Simulate user input
        fireEvent.change(component.getByPlaceholderText('Enter recipient email'), {
            target: { value: 'test@example.com' }
        });

        // Trigger signature request
        fireEvent.click(component.getByText('Send Signature Request'));

        // Verify mock was called
        expect(mockProps.onSignatureRequest).toHaveBeenCalledWith(
            'test@example.com',
            expect.any(String),
            expect.any(String)
        );
    });
});
```

Integration Testing Checklist

Custom Table Approach:

- [ ] Record creation triggers plugin
- [ ] API integration works correctly
- [ ] Status updates reflect in UI
- [ ] Document download functions properly
- [ ] Related record notes are created
- [ ] Error handling works as expected

Activity-Based Approach:

- [ ] Activity creation from timeline
- [ ] Timeline updates reflect status changes

- [ ] Multi-entity support works across all enabled entities
- [ ] Activity lifecycle management
- [ ] Regarding object relationships maintained
- [ ] Activity views and filtering

Appendix D: Deployment Checklists

Pre-Deployment Checklist

Environment Preparation:

- [ ] Dataverse environment accessible
- [ ] System Administrator privileges confirmed
- [ ] Development tools installed and configured
- [ ] Nintex Assurance API credentials obtained
- [ ] Network connectivity to Nintex services verified

Code Quality:

- [ ] Unit tests pass
- [ ] Integration tests pass
- [ ] Code review completed
- [ ] Security review completed
- [ ] Performance testing completed

Deployment Checklist

Custom Table Deployment:

- [ ] Digital Signature table created and published
- [ ] Custom columns added and configured
- [ ] Views created and shared
- [ ] Forms configured and published
- [ ] Plugin assembly deployed and registered
- [ ] PCF component solution imported
- [ ] Security roles assigned
- [ ] Test records created and validated

Activity-Based Deployment:

- [ ] Digital Signature Activity table created

- [ ] Activity status reasons configured
- [ ] Target entities have activities enabled
- [ ] Activity plugin deployed and registered
- [ ] Activity PCF component imported
- [ ] Activity forms configured
- [ ] Timeline integration verified
- [ ] Multi-entity testing completed

Post-Deployment Checklist

Validation:

- [ ] End-to-end workflow testing completed
- [ ] User acceptance testing passed
- [ ] Performance benchmarks met
- [ ] Error handling verified
- [ ] Documentation updated
- [ ] Training materials prepared

Monitoring Setup:

- [ ] Plugin execution monitoring enabled
- [ ] API usage tracking configured
- [ ] Error alerts configured
- [ ] Performance dashboards created
- [ ] Backup procedures implemented

Appendix E: Troubleshooting Guide

Common Issues and Solutions

Plugin Not Executing:

```
Issue: Plugin doesn't trigger on record creation
Solution:
1. Verify plugin registration steps
2. Check filtering attributes
3. Confirm entity logical name
4. Review user permissions
```

API Authentication Failures:

```
Issue: Nintex API returns 401 Unauthorized
Solution:
1. Verify API key is correct
2. Check API key expiration
3. Confirm API endpoint URLs
4. Test API key with Postman
```

Timeline Not Showing Activities:

```
Issue: Digital signature activities don't appear in timeline
Solution:
1. Verify activities are enabled on target entity
2. Check activity table type (must be Activity table)
3. Confirm user has read permissions on activity
4. Refresh timeline or reload page
```

PCF Component Not Loading:

```
Issue: PCF component shows error or doesn't load
Solution:
1. Check solution import was successful
2. Verify property bindings are correct
3. Review browser console for JavaScript errors
4. Confirm control is added to form correctly
```

Conclusion

This comprehensive build book provides three complete approaches for implementing Nintex Assurance digital signature integration with Microsoft Dataverse:

- **Chapter 0: Testing Console Application**: Validate connections and test functionality before plugin development
- **Chapter 1: Custom Table Approach**: Maximum flexibility and control for specialized signature workflows
- **Chapter 2: Activity-Based Approach**: Universal applicability with native Dataverse integration patterns

All implementations provide robust, production-ready solutions with comprehensive error handling, security considerations, and monitoring capabilities. The console application enables safe testing and validation, while the migration guide ensures you can transition between approaches as your requirements evolve.

Key Success Factors:

1. **Start with console testing** to validate connectivity and functionality
2. **Choose the right approach** based on your specific needs and constraints
3. **Follow security best practices** for API key management and document handling
4. **Implement comprehensive testing** across all supported scenarios
5. **Monitor performance** and user adoption post-deployment
6. **Maintain documentation** and provide adequate user training

The console application provides an excellent starting point for validation and testing, while the activity-based approach is generally recommended for most organizations due to its universal applicability and native integration with Dataverse patterns. The custom table approach serves specialized use cases requiring maximum flexibility.