SYNERGY
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Introducing the Harmony Core Open Source Project

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Harmony Core

Harmony Core is a framework that consists of libraries, CodeGen templates, and conventions that enable you to expose Synergy logic and data as a RESTful web service using OData and ASP.NET Core.

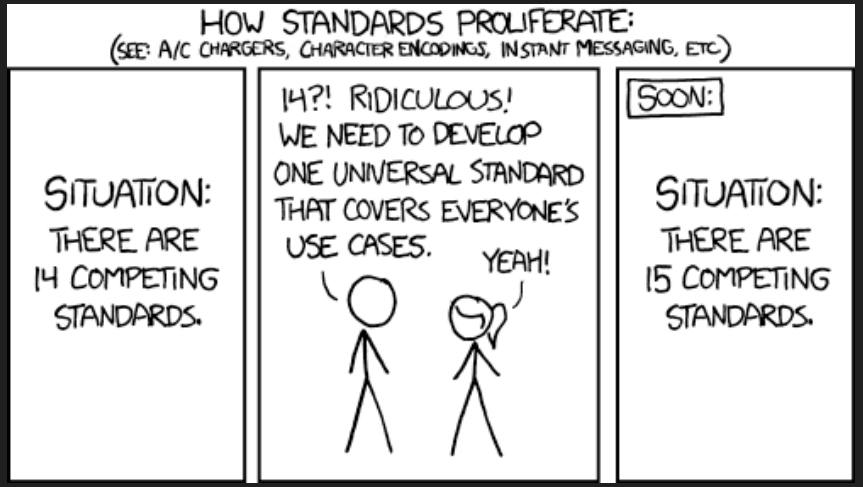
THE GOAL

Expose Synergy data over the network

Why did we make this?

We already have more than 6 different solutions to this problem:

- ***xf*ServerPlus**
- **Harmony/Bridge**
- **CodeGen'd WebAPI2 .NET code**
- **WCF services with App Domain isolation**
- **SQL replicate** *(It's someone else's problem now!)*
- **Bespoke WebAPI2/ASP.NET Core/WCF/ASMX**



NEW GOAL

Expose Synergy logic and data over the internet

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NEW GOAL

- Expose Synergy logic and data over the internet with tens of thousands of concurrent requests.
- Collect performance metrics and present configurable logging.
- Enable advanced queries, but with role-based security.
- Generated client libraries in the language of your choice.
- Oh, and while you're at it, what's this .NET Core thing I keep hearing about?

So we did all of those things for you and called it

Azure Web Service Demo

- https://harmonycoreapp.azurewebsites.net
- Not a VM!
- No Synergy install!
- Vnet'ed to a Synergy license server and configured with an environment variable

Elements of Harmony Core

ASP.NET Core

ASP.NET Core isn't just the new hotness, the 2.1 release has really been the inflection point, where it moved from a promising project to one that is ready to be used in production.

RESTful

REST stands for Representational State Transfer. We've been making the case for RESTful web services for a few years now, and we will keep making that case for the foreseeable future.

OData

OData is a set of standards that lays out how to interact with your web service.

Same standards utilized by:

- SharePoint
- SAP
- Microsoft Graph
- Salesforce
- Microsoft Dynamics
- And others

Harmony Core is currently on **Version 4** which is the most recent version

EF Core

Entity Framework has come a long way since 2008 when we initially offered a read-only EF 1.0 provider that was layered on top of *xf*ODBC.

- Created EF Core 2.1 provider
  - Code generation
  - Synergy Select class
  - Symphony FileIO class
  - Concepts and ideas from Symphony Harmony
  - General improvements to the design of EF that are new in EF Core 2.1

Harmony Core

- Works well as a whole
- Parts can be used independently as well
- Complexity hidden behind sane defaults
- .NET Standard 2.0
- Developed in the open!
- Integrates seamlessly with ASP.NET Core authorization and authentication

Concurrency

- Optimistic concurrency
  - GRFAs
  - ETags – HTTP headers that let the server know what version of the data you are working with
- Transaction isolation
  - Read un-committed
  - Read committed
  - Find me later if you think you need higher levels

Contexts

- Neatly bundle up your functionality
- Dependency injection provides it
  - Standard web API controllers
  - OData controllers
  - Attributed Synergy class with methods
- ContextPools
  - Ensure isolation
  - Session state
  - Performance

CRUD

- Basic repository
  - Structures and fields are up to date with ISAM
  - At least primary key defined
  - Works best if you define your files in repository
- CodeGen templates make everything for you
  - Partial classes and partial methods allow you to customize

CRUD with Queries

- Advanced repository
  - Relations
  - All of your keys
  - All of your foreign keys
- CodeGenerated templates now support $expand
  - $filter, $expand, $select, $orderby all nest and work together
  - $expand results in a Synergy Select Join operation

Directly Exposing Logic

- Custom controller code
  - Choose your endpoint and convention
  - Write whatever logic you want
  - Get called by ASP.NET Core/OData directly
  - Use DI to request functionality from the rest of the framework
- Harmony Sproc Routing Convention
  - Attribute and register a class at a particular endpoint
  - Exposed as OData functions/actions on a named singleton
  - Optional: inherit from IContextBase
    - Pooling
    - Session state management
    - Isolation level

Local and Remote Process Isolation

- How does it work?
  - Target programs communicate using JSON across stdin/stdout
  - Local processes use the streams directly
  - Remote processes use SSH to log in and launch the target

Local and Remote Process Isolation

- Why did we make it?
  - IT Admins like protocols they know (SSH)
  - Traditional Synergy running on the same server
  - Traditional Synergy running on a remote OpenVMS/Unix/Linux/Windows server
  - .NET code that must be process-isolated
  - Any other code that can follow our communication protocol

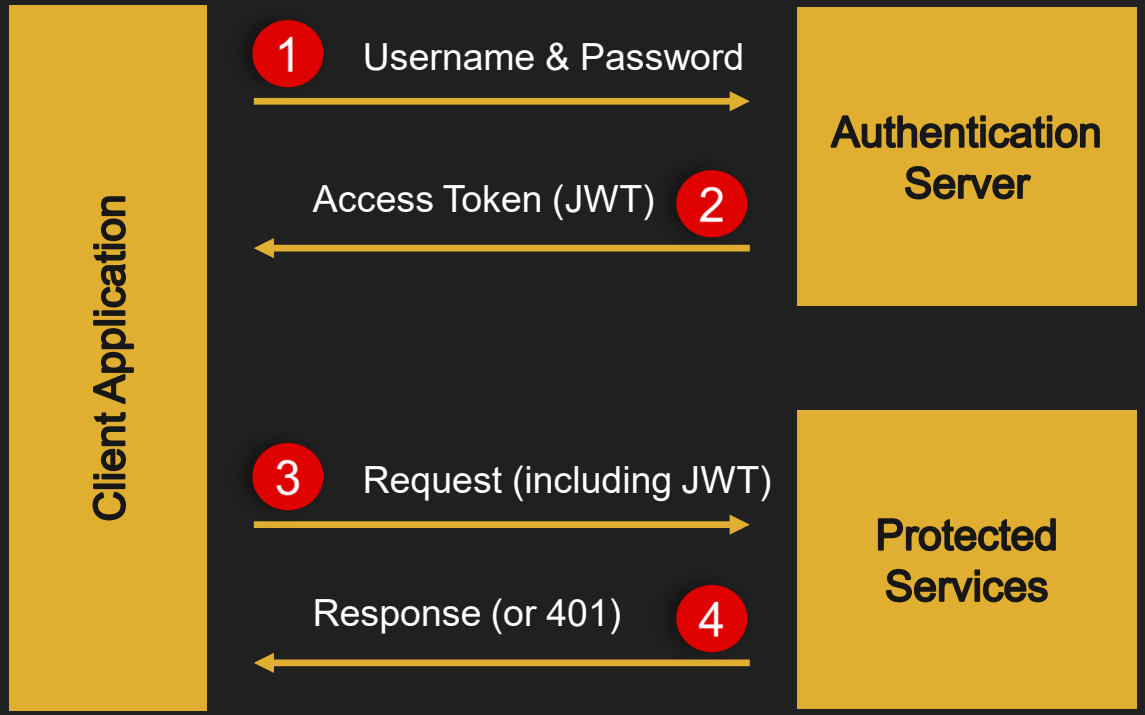
Authentication & Authorization

- ASP.NET Identity
  - Highly customizable
  - Supports multiple persistence mechanisms
    - ADFS, Azure AD, OData, etc.
  - Role provider supports custom access control
  - Claims-based authentication
  - Unit testable
- Consumer authenticates and obtains a “bearer token”
  - JSON Web Tokens (JWT)
- Bearer token presented back via Authorization header
- Capabilities for protecting APIs
  - Authentication at the controller or operation level
  - Role-based authorization at the endpoint level
  - Role-based authorization at the field level

- Authentication
  - Who are you

- Authorization
  - What can you do?

Client Interaction with a Protected Service



- Client gets access token from authentication server
  - ADFS, Azure AD, or other OAuth server
  - Token contains “claims” based on user, e.g., roles
- Client presents access token with each request
  - Server permits or denies access based on token
  - Token reused until it expires

JSON Web Token Example

JSON Web Token

eyJhbGciOiJSUzI1NiIsImtpZCI6Ijg2NGMxNDU5Y2U1
ODVhMDhkZDU1MWMwYzFkYTMzNWY
ldUIn0.eyJuYmYiOjE1MzY0Mz
NjQ0MjI1MSwiaXNzIjoiaH
MDAwIiwiYXVkIjpbImh0
AwMC9yZXNvdXJjZXM
ZCI6InJvLmNsaWVud
OWQtNGNiMC1iMjQ
GhfdGltZSI6MTUzNj
iLCJyb2xlIjpbIkVtcG
9wZSI6WyJhcGkxIl0s
tLgZho6Bwp5nhcMA
9XTNjuWrkgZzaL3zwYr
XoTnTii17g3D7yzfH_1KjE
Kv12WHRwTLmzFDQ6TtW4
V79zc2Szs5K72VVu4RPlD8VZ7I
AHpZGr5MEuPdN0owU62cBBf4-
4_ugkb2CfUVDECwXcxxXhIB-OcRZxqnR8-H9Q--
_JPbshTDpr9u4eDgqjeoNGiiqEL0ZfKKtour7xlYZ8IM
26G8hN9eFIwjF3nA


```
"role": [
    "Employee",
    "Manager"
],
    "scope": [
    "api1"
],
```

Decoded & Validated


```
[
    {
        "alg": "RS256",
        "kid": "864c1459ce585a08dd551c0c1da335f3",
        "typ": "JWT"
    },
    {
        "nbf": 1536438651,
        "exp": 1536442251,
        "iss": "http://localhost:5000",
        "aud": [
            "http://localhost:5000/resources",
            "api1"
        ],
        "client_id": "ro.client",
        "sub": "159cd4bb-029d-4cb0-b244-99d1413dd4a6",
        "auth_time": 1536438651,
        "idp": "local",
        "role": [
            "Employee",
            "Manager"
        ],
        "scope": [
            "api1"
        ],
        "amr": [
            "pwd"
        ]
    }
]
```

Licensing

- Harmony Core is BSD – 2 Clause
  - You're free to use it however you want
- Regular Synergy Runtime licenses will be consumed by running Synergy .NET or traditional Synergy processes
- We're looking into ways to make runtime license compliance easier but we're not looking to use this for enforcement

WHY DOES THIS MATTER TO YOU?

- **Makes your life easier**
- **Security**
- **Open standards**
- **Performance best practices**
- **Fewer change requests**
- **Happier integrators**
- **Flexibility**

WHAT'S NEXT?

- More optimization / logging / metrics / samples / docs
- Joining data from runtime-determined files based on field value
- Any,All,Apply support in OData queries
- Improved CodeGen template distribution
- Make handling concurrency conflicts easier and faster
- Remote and local process isolation
- Investigate System.Transactions
- Async methods in HarmonySprocRoutingConvention
- Versioned API's

Additional Links of Interest

https://github.com/aspnet/EntityFrameworkCore
https://github.com/aspnet/Mvc
https://github.com/OData/WebApi
https://github.com/dotnet/coreclr
https://github.com/Synergex/PartsDataServices
https://github.com/Synergex/HarmonyCore

Questions?