Using PowerShell to Call Web Services

Eric Kool-Brown, Software Engineer (kool@uw.edu)
UW-IT Infrastructure

INFORMATION TECHNOLOGY
UNIVERSITY of WASHINGTON

Agenda

- > What is a Web Service
- > REST Details
- > Example Web Services
- > PowerShell Web Service Commandlets
- > Web Service AuthN/AuthZ
- > Reading the Data – JSON or XML
- > Demos

What is a Web Service?

DCE, RPC, DCOM, CORBA, CRUD, oh my!

- **In the beginning, non-standard and proprietary formats/protocols**
  - **open a socket and send binary packets**
- **Remote Procedure Calls – making function calls over the network.**
  - **E.g. connecting to SQL Server over a named pipe**
  - **Not firewall-friendly!**
- **SOAP (simple object access protocol) – transport-independent, can use SMTP, HTTP, UDP, etc.**
  - **XML as the payload encoding, POST as the HTTP verb**

What is a Web Service Part 2

One HTTP Protocol to Rule Them All!

- **Representational State Transfer (REST)**
  - **leveraging, rather than abusing, the features of HTTP**
  - **Roy Fielding dissertation published in 2000**
- **REST architecture**
  - **Resources uniquely named using a URL**
  - **CRUD translates directly to the HTTP verbs PUT, GET, POST, and DELETE**
  - **Stateless – facilitates Internet-scale services**
    - **HTTP GETs have no side-effects, allows for caching**
    - **PUTs and DELETEs are idempotent**
  - **Payload encoding uses HTTP media types (JSON, XML, etc)**

REST Details

- **Multiple API description languages**
  - **OData**
    - **$metadata = service data description in XML**
  - **OpenAPI (was: Swagger)**
- **HTTP URL Components**
  - **Each resource has a unique, hierarchical URL path**
    - **https://service.org/stuff/thingys/thingy22**
  - **Searching rooted in container paths using URL parameters to specify query filters, paging, etc.**
    - **https://service.org/stuff/thingys?$filter=thingnum lt 22**
  - **Some function-like URL paths**
    - **https://service.org/foobar(2)/allfoo**

Examples of Web Services

- **UW Groups Web Service (GWS)**
  - Manage your UW groups programmatically
  - Uses the ‘text/plain’ media type – its actually XHTML
  - Requires UWCA certificate auth
- **Azure Active Directory Graph API**
  - Apply CRUD operations to AAD objects
  - Traverse links to follow relationships
  - Uses OAuth authentication/authorization, must have an AAD application object with appropriate permissions
  - Superceded by Microsoft Graph API?
- **AWS, Facebook, Google, etc.**
  - UW Enterprise Integration Platform (EIP)

PowerShell Web Service Commandlets

- **Invoke-WebRequest – parses response into HtmlWebResponseObject with the following elements**
  - StatusCode – Http response status
  - Content – the response body
  - RawContent – the entire, unparsed response
  - Forms, Headers, Images, Links, ParsedHtml
- **Invoke-RestMethod – Can parse JSON, XML, and HTML forms**
  - Returns corresponding object types
  - Gets thoroughly confused by GWS XHTML
- **Both throw WebException for failure**

Web Service Authentication and Authorization

- **SSL/TLS almost always used for confidentiality**
- **Certificate-based auth – passed as part of SSL setup to validate the client**
- **OAuth – obtain an authorization token, attach it to the web service request**
  - **OAuth tokens on Azure are obtained via an Azure AD Application object**
    - **Confusingly named, it is actually an application identity**
    - **Permissions are assigned to the app object that determine what the token can be used for; e.g. read all Azure AD user objects**
    - **Perms: direct vs. delegated, user vs. admin**

Processing the Returned Data

- **XML – PowerShell's XML parsing is complicated**
  - **XPath: PS cmdlet Select-XML, does not return an XML node object, must extract it from the SelectXmlInfo object**
  - **Can use dotted notation if all of the elements exist**
- **JSON – PS "deserializes" JSON into custom objects**
  - **Returned JSON can be a single long line, machine readable but not easily human readable**
  - **Use ConvertFrom-Json to convert a JSON string into a PSCustomObject**
    - **A "NoteProperty" will be created or each JSON element**
  - **Trick: to format the JSON string with indented multiple lines:**

```
$Json = $groupInfo.Content | ConvertFrom-Json | ConvertTo-Json
```

Demos

- **Example PS scripts:**
  - **New-UwGsGroup.ps1**
  - **Get-UwGsGroup.ps1**
  - **Get-AzureADGraphInfo.ps1**
  - **Get-AADGraphRestMethod.ps1**

Resources

- **Example PS scripts: https://github.com/erickool/ws-powershell**
- **Blog post: https://blogs.uw.edu/kool**
- **Groups Web Service: https://wiki.cac.washington.edu/display/infra/Groups+Web+Service+REST+API**