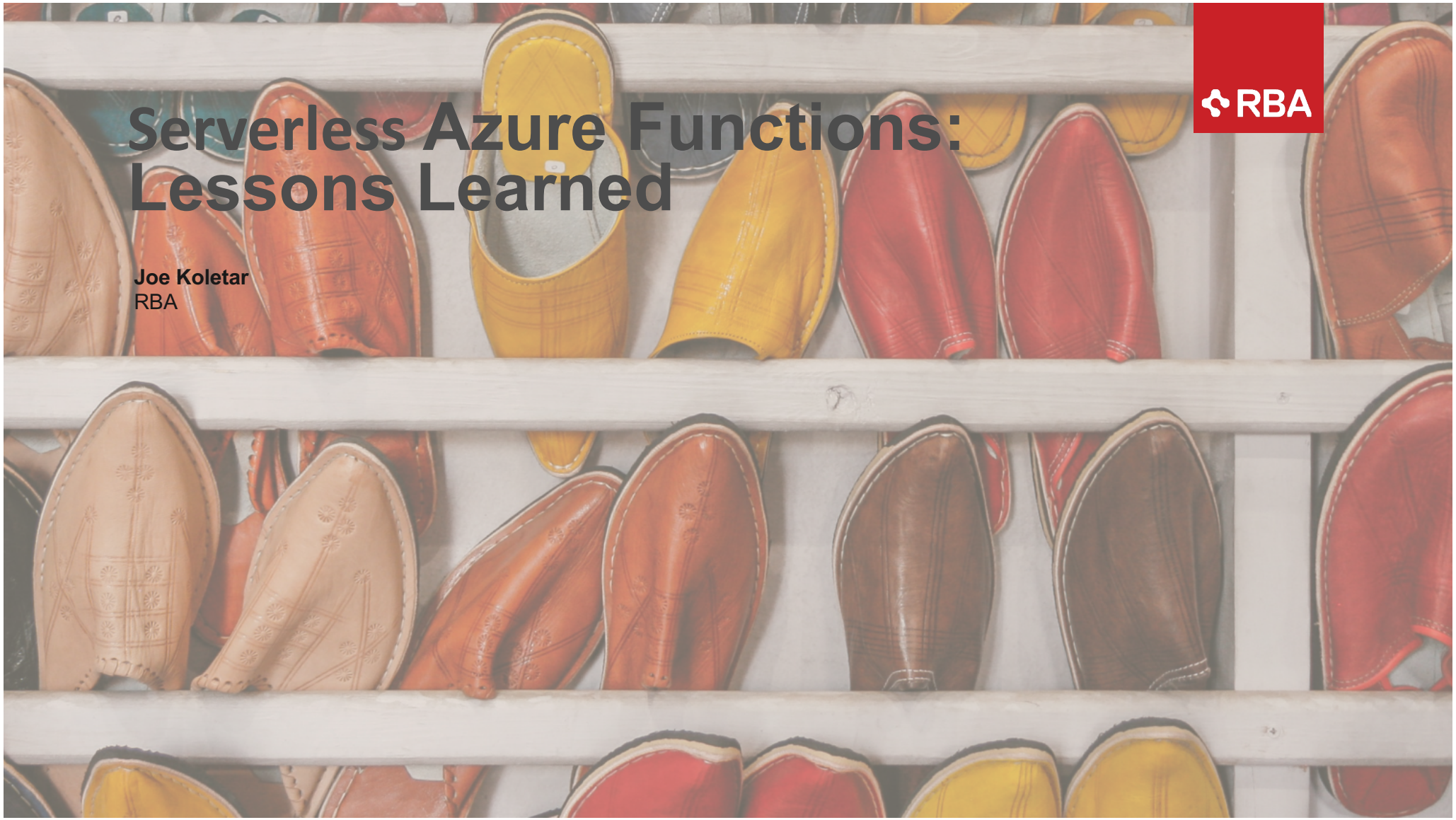

Serverless Azure Functions: Lessons Learned

Joe Koletar
RBA

INTRODUCTIONS

Joe Koletar
Managing Principal
Engineer

DESIGNED TO DELIVER

RBA is a digital and technology consultancy headquartered in Wayzata, MN with roots in strategy, design, and technology.

We have designed our services and engagement types to align to the unique needs of our clients. Whether that is adding capacity to a team, helping to deliver a solution on new technologies, or provide support after launch, we are designed to deliver.

What we do

- Custom & Cloud Applications
- Digital Experience
- Cloud Infrastructure
- Modern Workplace
- Data and Analytics
- B2C & B2B Commerce
- DevOps
- CRM

How we engage

- Project Services
- Co-Delivery & Staffing
- Managed Services

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BACKGROUND

What we are doing

Project Background

- Re-platform eCommerce for Caleres
- Supports 15 different brands
- Azure based project using Sitecore XP CMS and Sitecore Commerce
- Started on envisioning last summer with plan to launch first sites soon

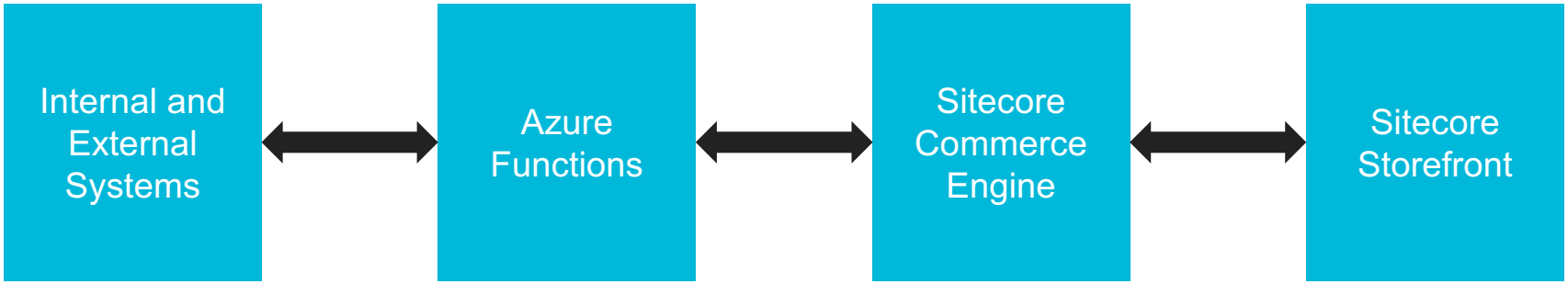
16
Unique brands

26%
Growth YoY for Cyber Monday

200M
Page views per month

Famous Footwear · VINCE. · Circus by Sam Edelman · NATURALIZER · VIA SPIGA · GEORGE BROWN BILT · Dr. Scholl's SHOES · Fergie · Bzees · Allen Edmonds AN AMERICAN ORIGINAL · Sam Edelman · FrancoSarto · CARLOS by Carlos Santana · Life Stride · SAM & LIBBY · DIANE VON FURSTENBERG · rykä

Project Diagram



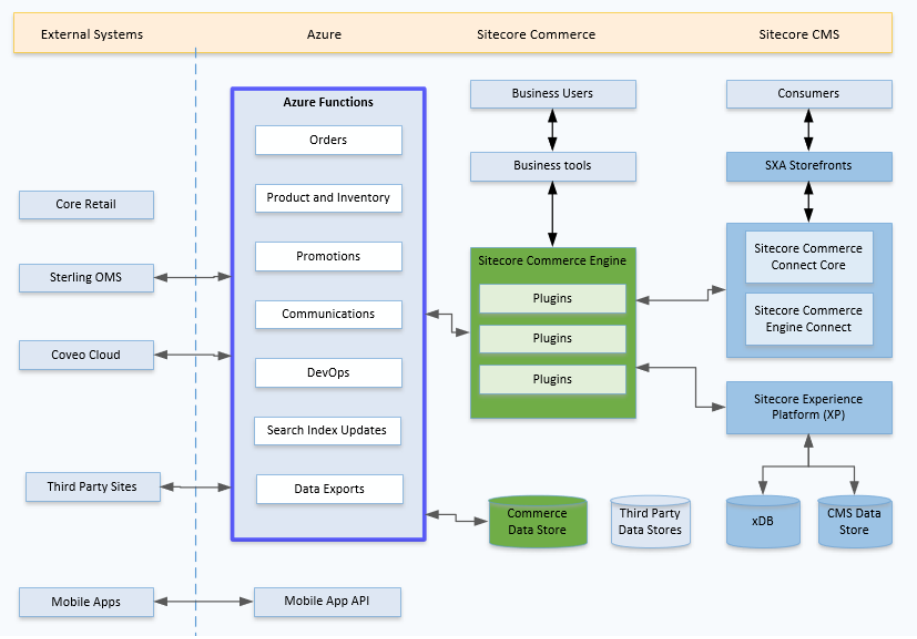
PIM
DAM
Fulfillment
Partners

Customers
Products
Carts
Orders

MVC Pages

Project Intent

- Functions are replacing a set of Windows services
- Intent was to create highly scalable microservices



Azure Functions

- Functions support small pieces of code in the cloud
- Can be developed in JavaScript, C#, F#, Python, and others
- Can be developed in the portal or IDE
- Capable of being serverless

Serverless

- Abstraction of servers
- Event-driven scalability
- Pay per use

Azure Function Triggers

Triggers define how a function is invoked

- Available Triggers
  - HTTP
  - Timer
  - GitHub
  - Generic webhook
  - CosmosDB
  - Blob Storage
  - Azure Storage Queue
  - EventHub
  - ServiceBus Queue
  - ServiceBus Topic

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SETUP OPTIONS

Configuration options for your Azure Functions

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Hosting Options

Consumption

Serverless

Scales automatically

Pay for what you use

App Service

Runs on dedicated VM

Pay for the App Service

Can scale with App Service

Premium

Serverless

Min/Max scaling

Instance sizing

Perpetually warm instances

Vnet Connectivity

Function App vs Function

Function App

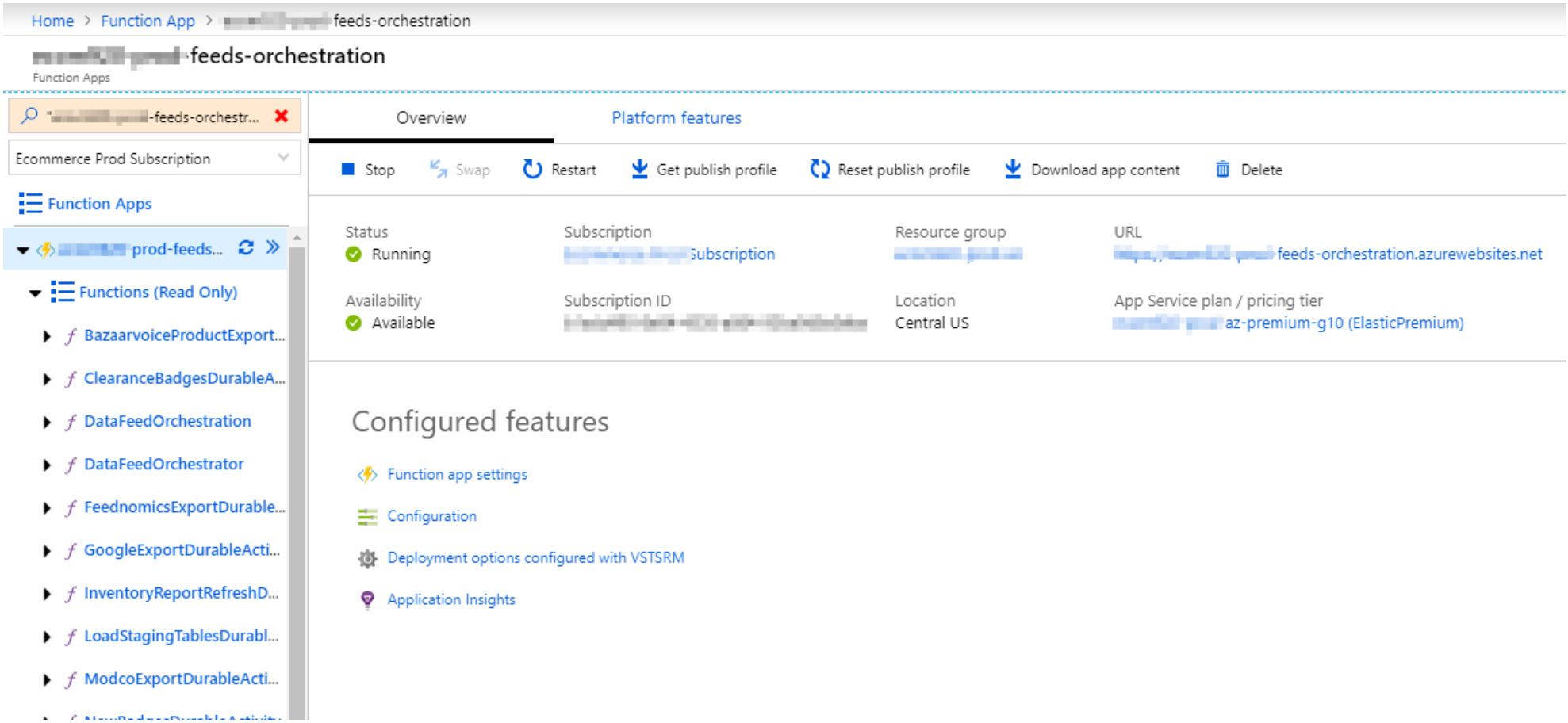
Can contain more than one function

Deployable/scalable unit

Function

Is uniquely addressable

Performs specific action



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Versions

Version 1.x

Uses .NET Framework

Only supports Azure and Windows

Version 2.x

Runs on .NET Core 2

Support macOS and Linux

All Functions in Function App must share same language

More bindings

Support for dependency injection

SECURITY

Locked up tight

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Connectivity

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- Project need to support PCI compliance
- Required ability to communicate over Vnet and Hybrid connection
- Azure Functions talking to internal systems
- Use of Vnet required premium plan support
- Use of Hybrid connection required app service plan

App Service Plan	Premium Plan
Vnet – **No**	Vnet – **Yes**
Hybrid Connection – **Yes**	Hybrid Connection – **No**

DATA FLOW

Getting from here to there

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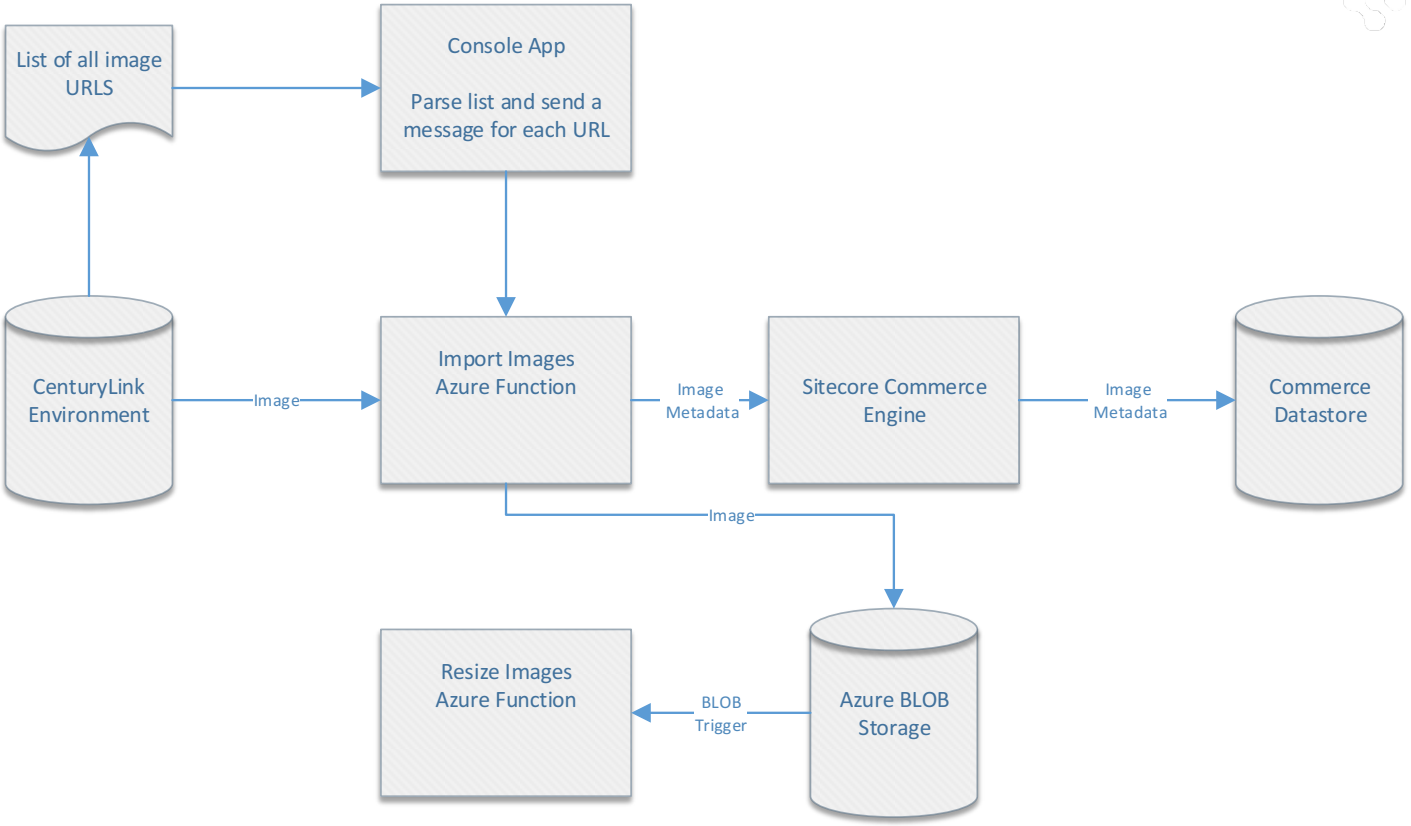
Azure Service Bus

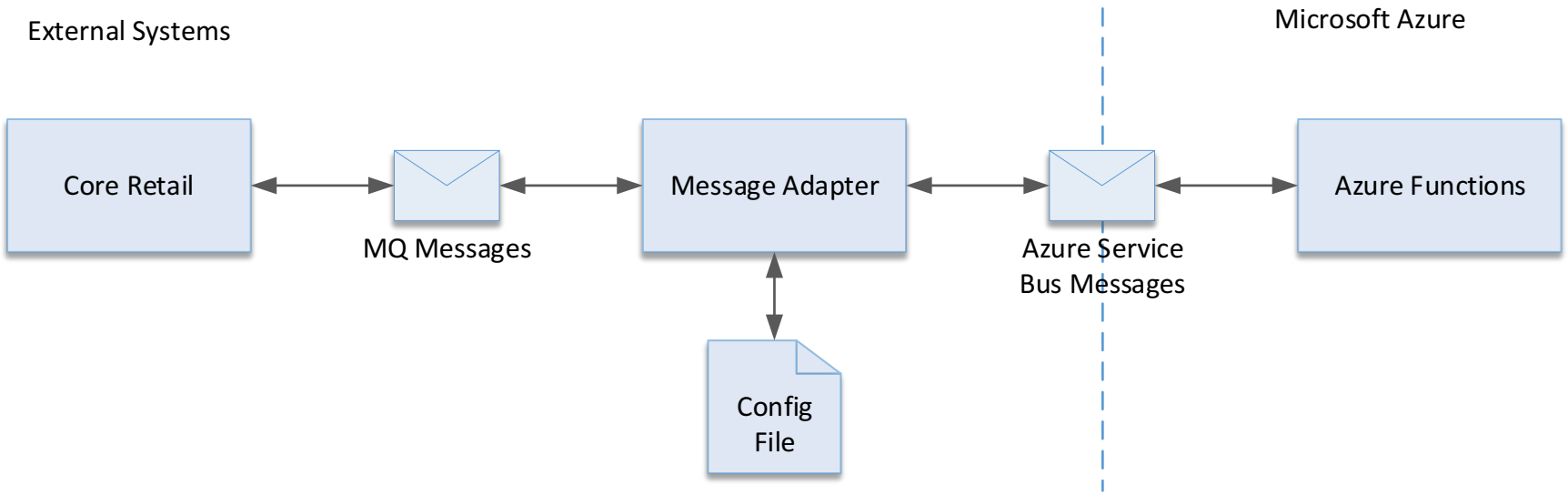
- Using Azure Service Bus Messages as trigger on most functions

- Advantages of Messages
  - Guaranteed delivery
  - Automatic retries
  - Dead letter queue for failures
  - Ability to delay delivery
  - Automatic scaling of functions

Messages For Flow



Connecting to Internal Systems



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SCALABILITY

Handling the load

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Service Bus Scalability

- Each function processes one message
- Need to handle thousands of messages arriving within seconds
- Weekly catalog refreshes send hundreds of thousands of messages in under an hour
- Treating functions as a microservice

Function Scalability

- Functions in a function app share resources
- Functions are inherently instance based
- Scalability requires shared resources
  - Database connections
  - HTTP connections
  - Azure storage connections

Static clients

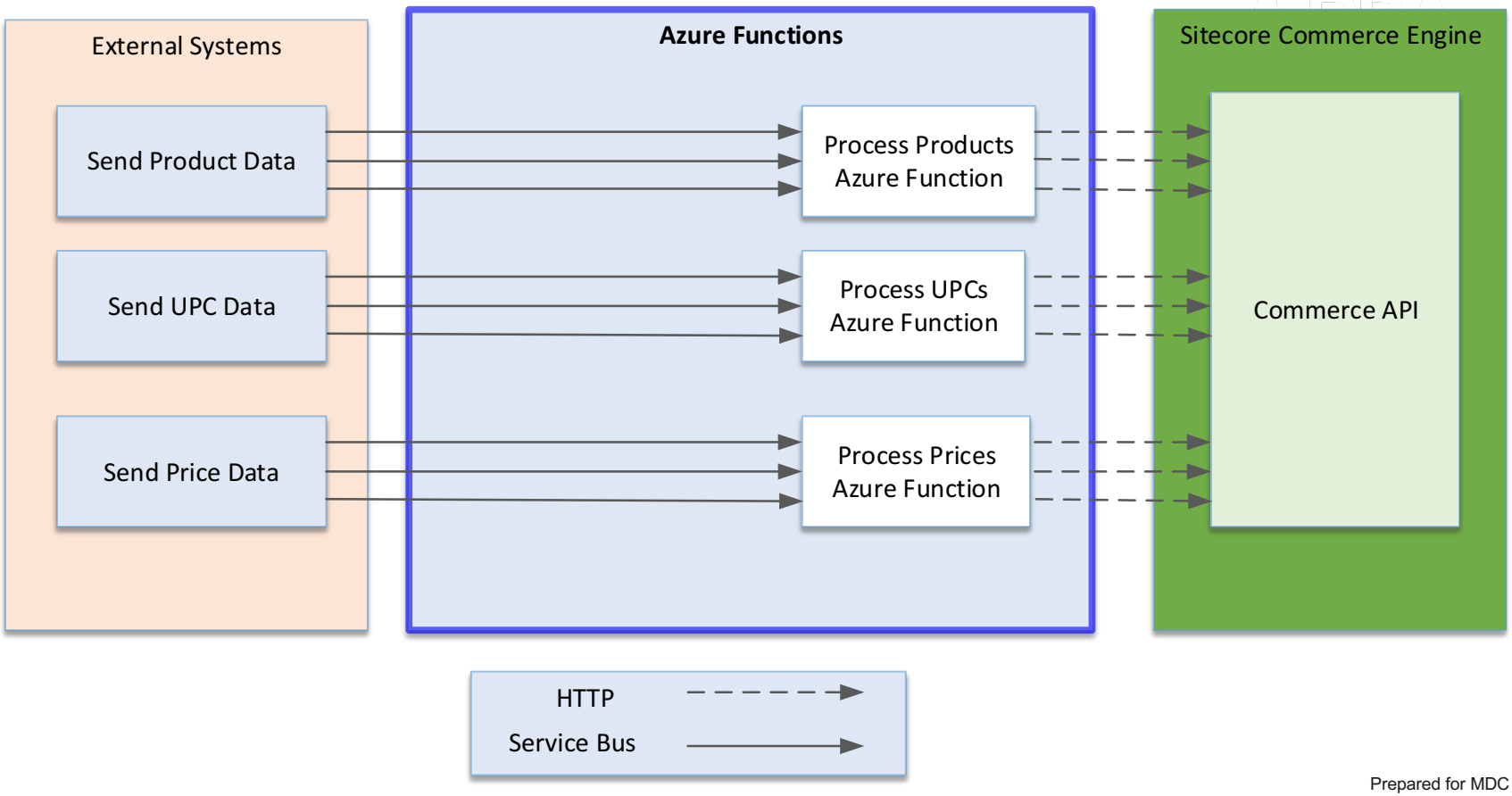
- Do not create a new client with every function invocation.
- Do create a single, static client that every function invocation can use.
- Consider creating a single, static client in a shared helper class if different functions use the same service.

```
// Create a single, static HttpClient
private static HttpClient httpClient = new HttpClient();

public static async Task Run(string input)
{
    var response = await httpClient.GetAsync("https://example.com");
    // Rest of function
}
```

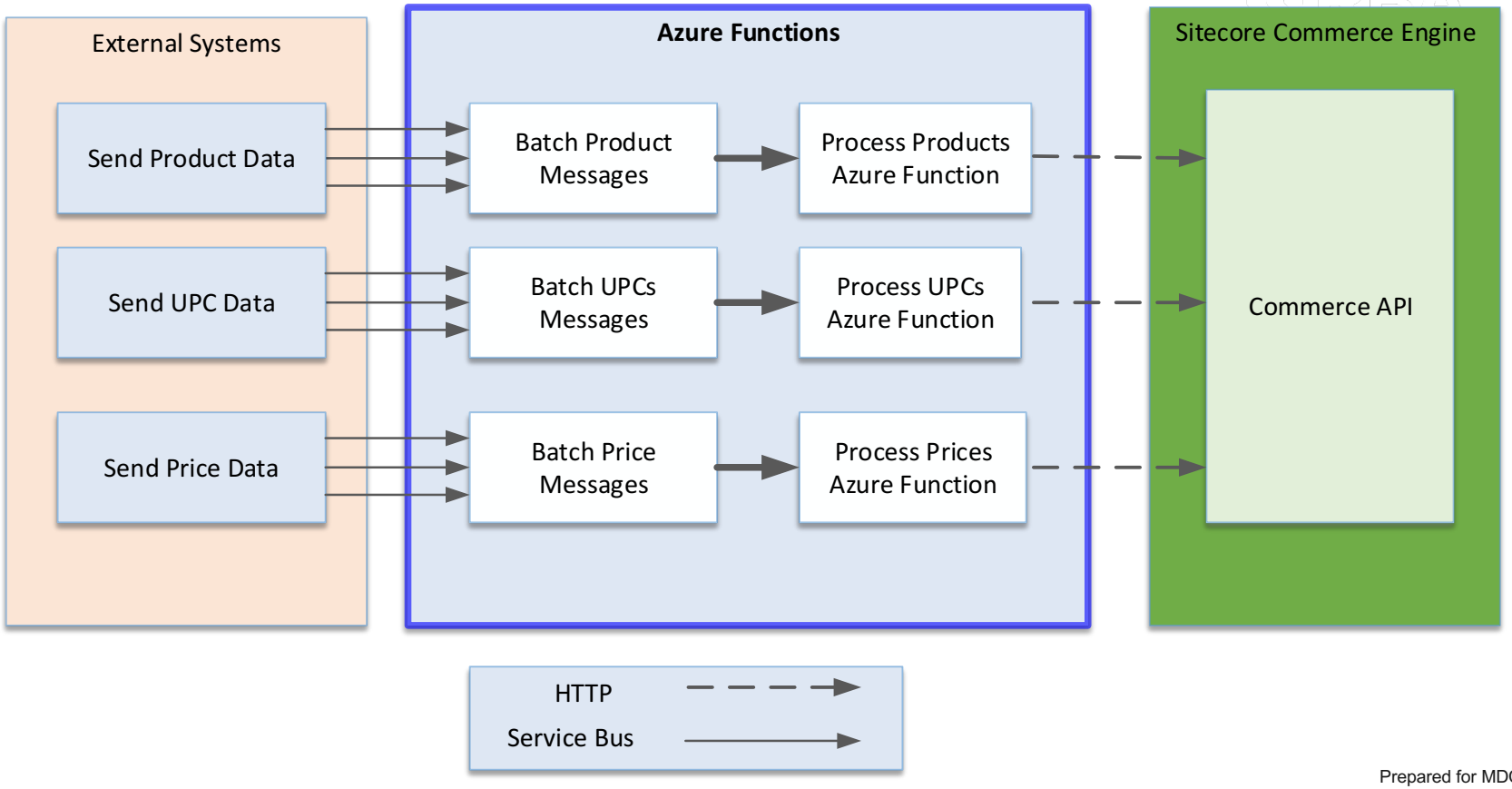
Dependency Injection


```
public class HttpTrigger
{
    private readonly IMyService _service;
    private readonly HttpClient _client;

    public HttpTrigger(IMyService service, IHttpClientFactory httpClientFactory)
    {
        _service = service;
        _client = httpClientFactory.CreateClient();
    }

    [FunctionName("GetPosts")]
    public async Task<IActionResult> Get(
        [HttpTrigger(AuthorizationLevel.Function, "get", Route = "posts")] HttpRequest req,
        ILogger log)
    {
        log.LogInformation("C# HTTP trigger function processed a request.");
        var res = await _client.GetAsync("https://microsoft.com");
        await _service.AddResponse(res);

        return new OkResult();
    }
}
```

Scalability Issues



Scalability Improved



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DURABLE FUNCTIONS

It’s getting complicated

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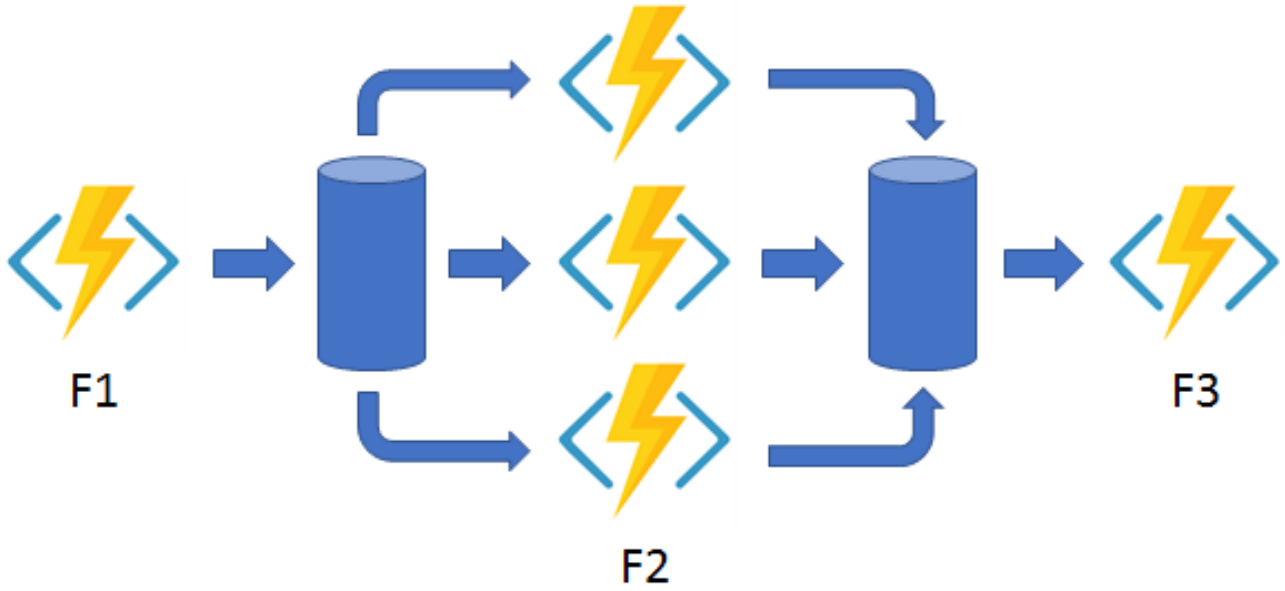
Durable Functions

- Support stateful functions using an orchestrator
- Allows coordination between serverless applications
- The orchestrator manages state, checkpoints, and restarts for you.

Fan Out / Fan In



Reporting Use Case

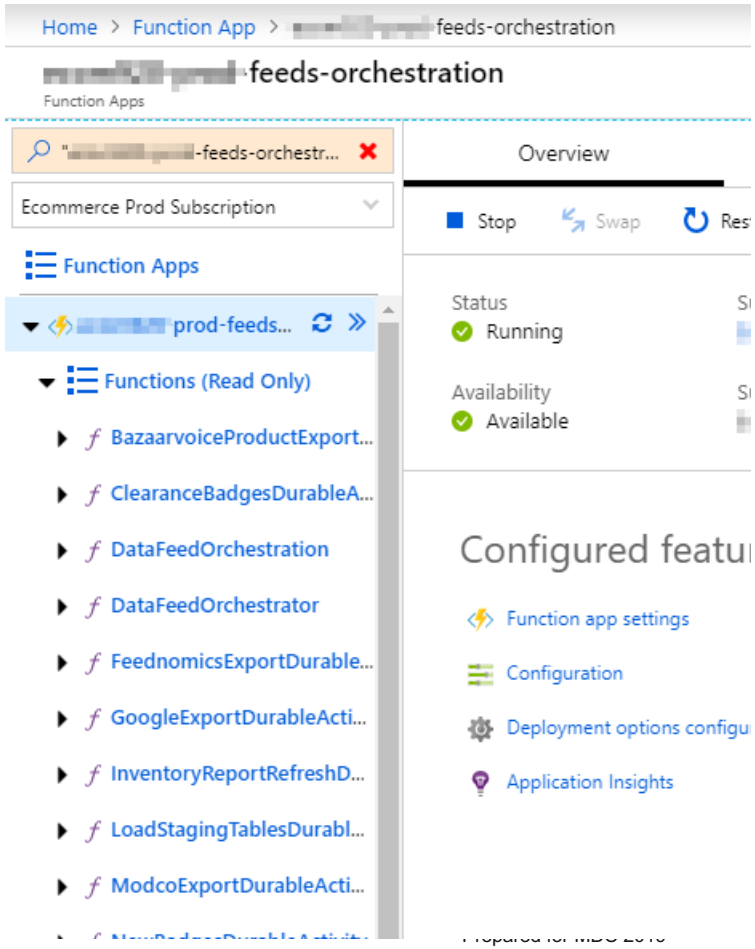
- Reporting database periodically built to support multiple activities
  - External exports
  - Product activation checks
  - Product classification operations

- Activities are run on different schedules
  - Every 30 minutes
  - Once an hour
  - Twice a day
  - Once a day

- Needed to coordinate the refreshing of the reporting database with tolerance for stale data

Reporting Implementation

- Bundled Functions and orchestrator in a single Function App
- Orchestration fires every 10 minutes and kicks off other activities
- Each function determines if it needs to be executed and if it needs updated data



DEPLOYMENT & CONFIGURATION

Putting things in their place

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Deployment and Configuration

- Using Azure DevOps for Build and Release
- Using Git for source control
- All functions are housed in a single Integration VS solution

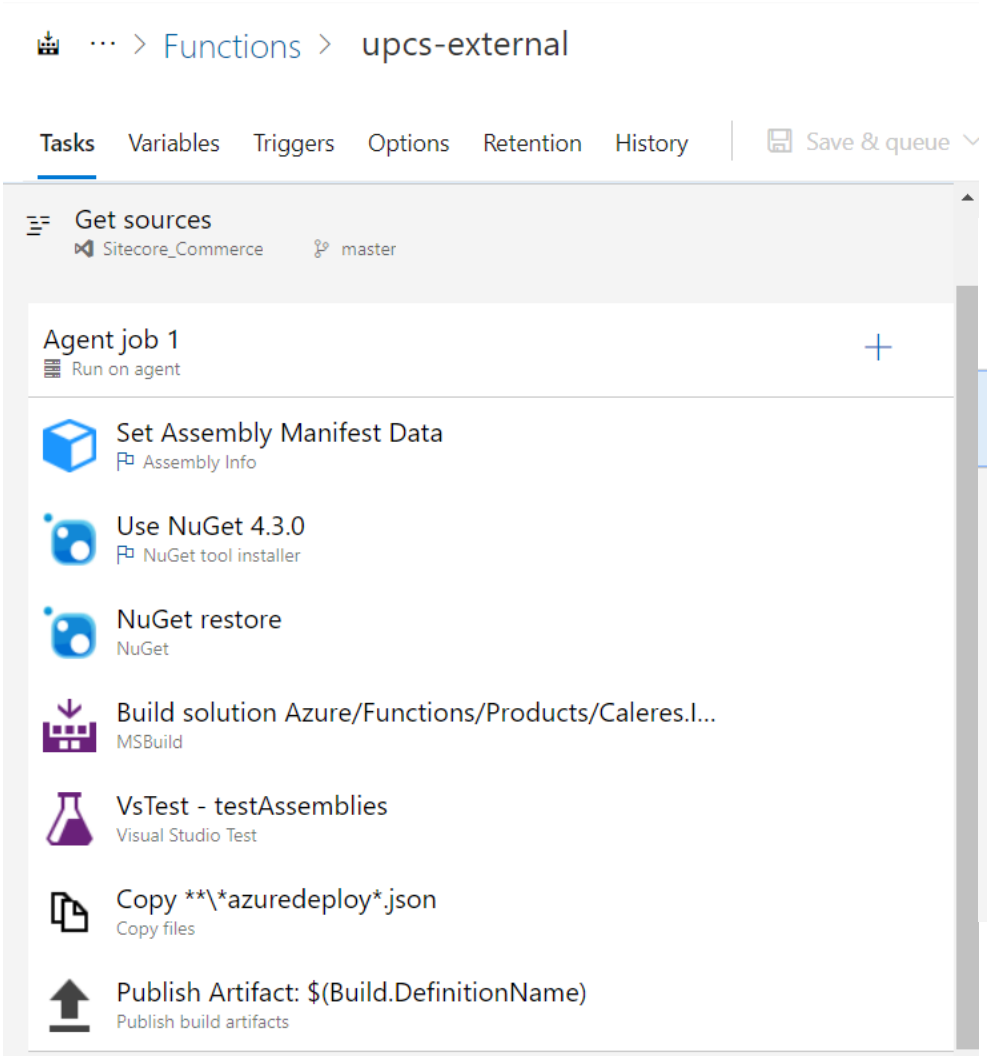
Deployment – Initial Approach

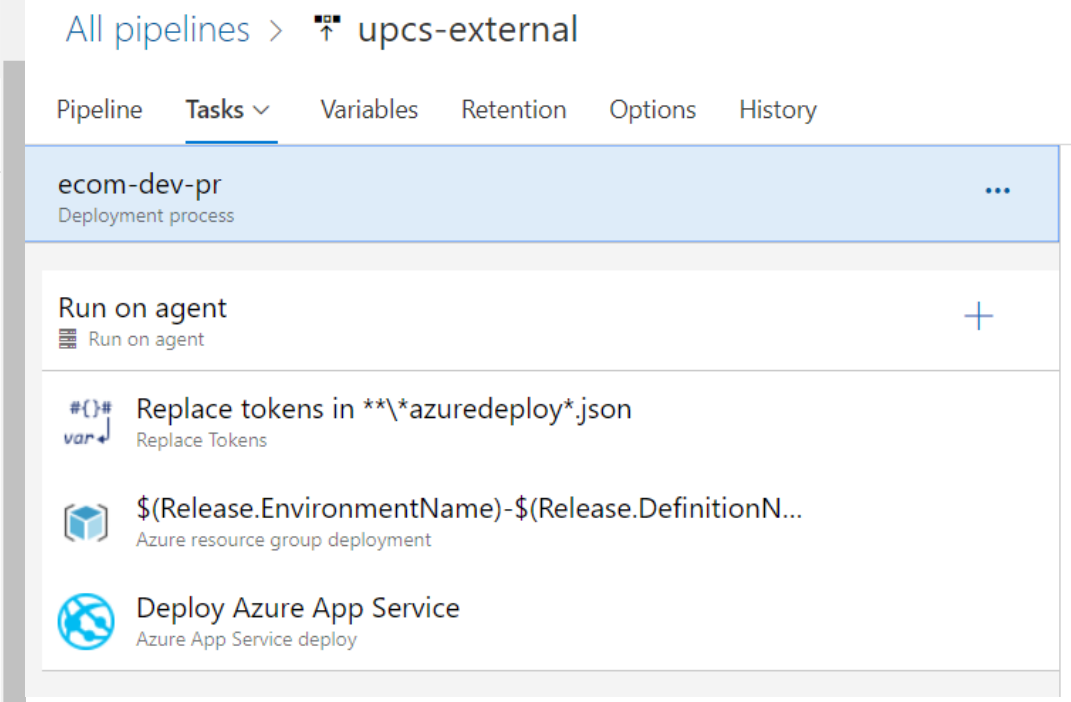
- Single build for the whole VS Integration solution
- Release had a step per function
  - Eventually 20+ steps

- Issues identified:
  - Required replicating the build per environment
  - Each time a new function was developed, it had to be added to the build in each environment
    - It was a lot to keep up with
  - Hard to track status of release as functions soon number more than 20

Deployment – Refined Approach

- Every function has its own build and release
- Tokenized replacement per environment in release
- Creation of ARM templates are part of development process
- Allows devs to update app settings via PR/code check in
- Functions deploy very fast





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Configuration

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- Each function has a variety of configuration parameters
  - Trigger settings
  - Database connections
  - Service Bus connection strings
  - Service Bus Queue names
  - Certificates thumbprints

- Many of the parameters vary per environment
- Often need to store arrays of settings per store
- Considerable volume of settings to manage

Configuration Initial Approach

- Stored parameters in Azure App Settings

- Awkward to manage
- No good way to handle nested/arrays of settings
- Could not be easily checked into source control
- Required coordination between developers and DevOps
- Multiple environments required different settings

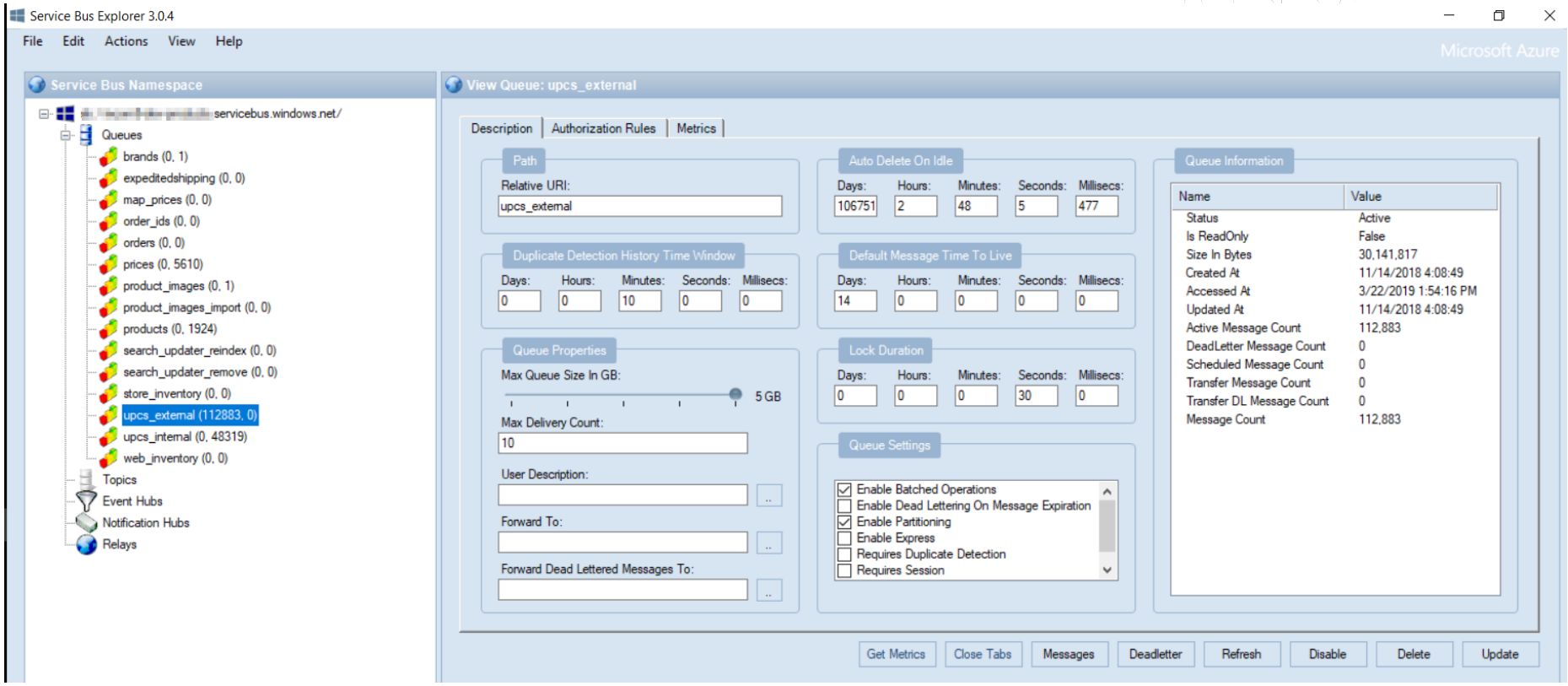
Configuration – Revised Approach

- Use ARM templates for trigger settings
- Store settings in a centralized file
  - JSON format supports complex settings
  - File is copied to every function in the deployment
  - Environment based settings are transformed between environments

- Easier to manage
- Good balance between source control access and configurability

Tools

Service Bus Explorer



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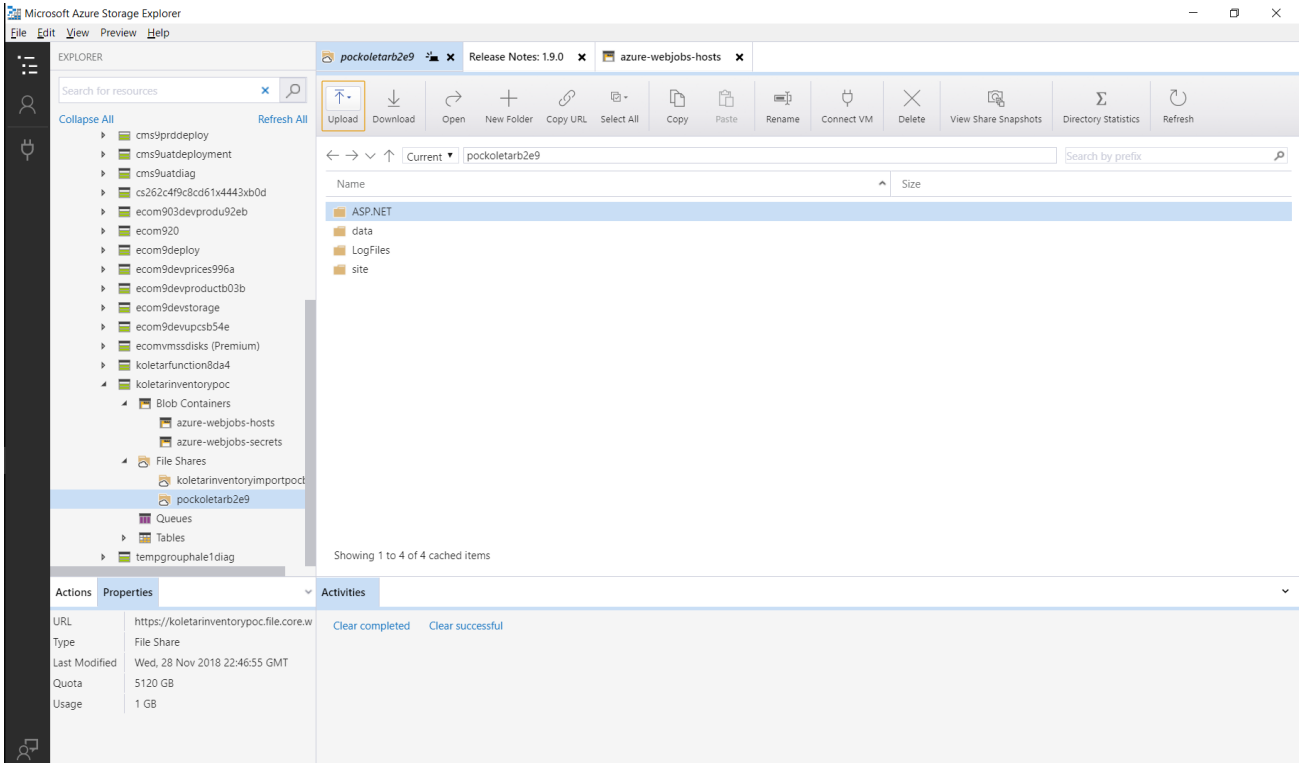
Service Bus Explorer

- Available at https://github.com/paolosalvatori/ServiceBusExplorer

Tip:

- Edit the ServiceBusExplorer.vshost.exe.config and add your connection string to the `<serviceBusNamespaces>` nodes

Microsoft Azure Storage Explorer



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Microsoft Azure Storage Explorer

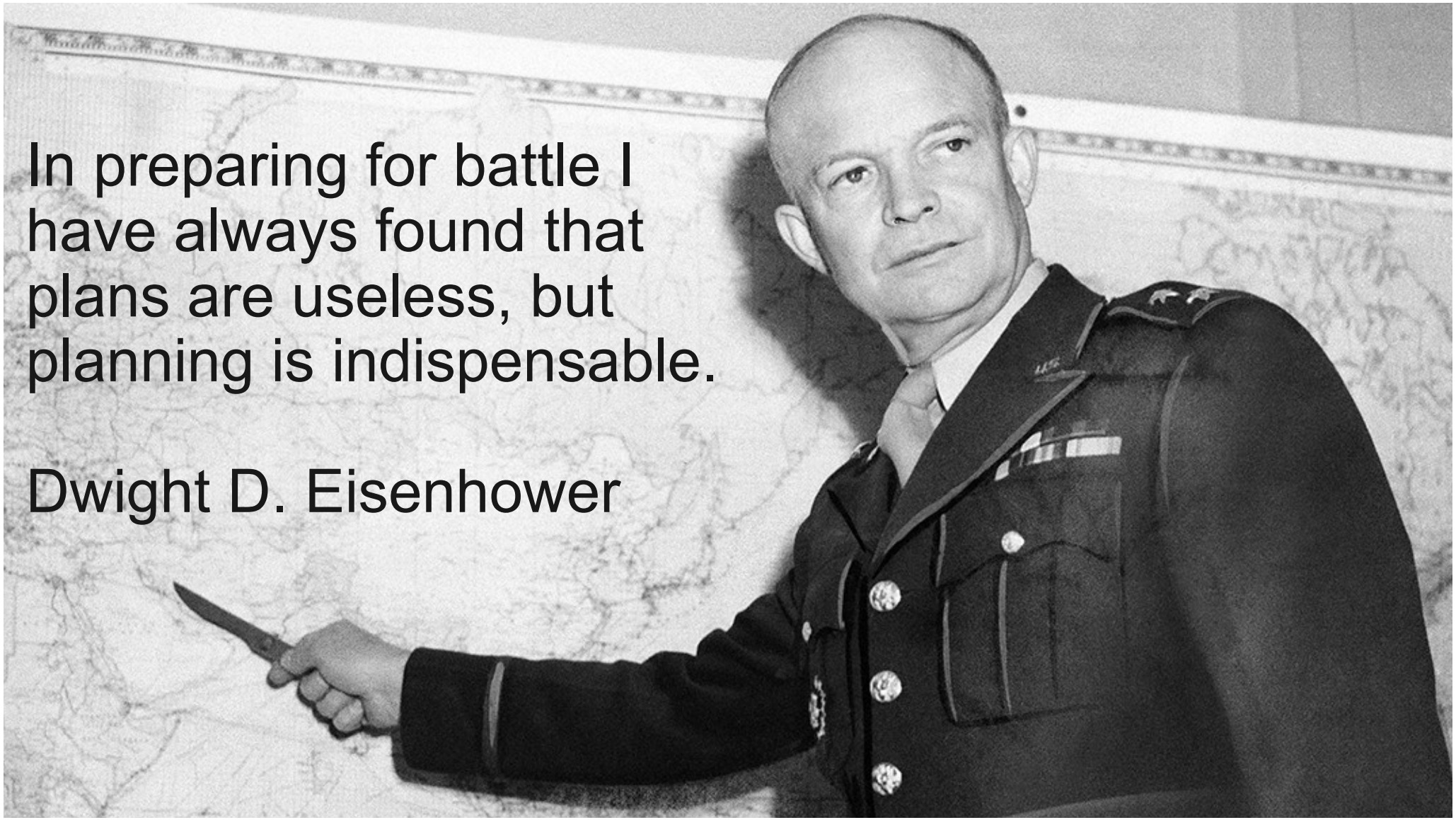
- Uses your Azure accounts
- Available at https://azure.microsoft.com/en-us/features/storage-explorer/

Build Azure Functions to be scalable

Microsoft Guidance

- https://docs.microsoft.com/en-us/azure/azure-functions/functions-dotnet-dependency-injection
- https://docs.microsoft.com/en-gb/azure/azure-functions/manage-connections

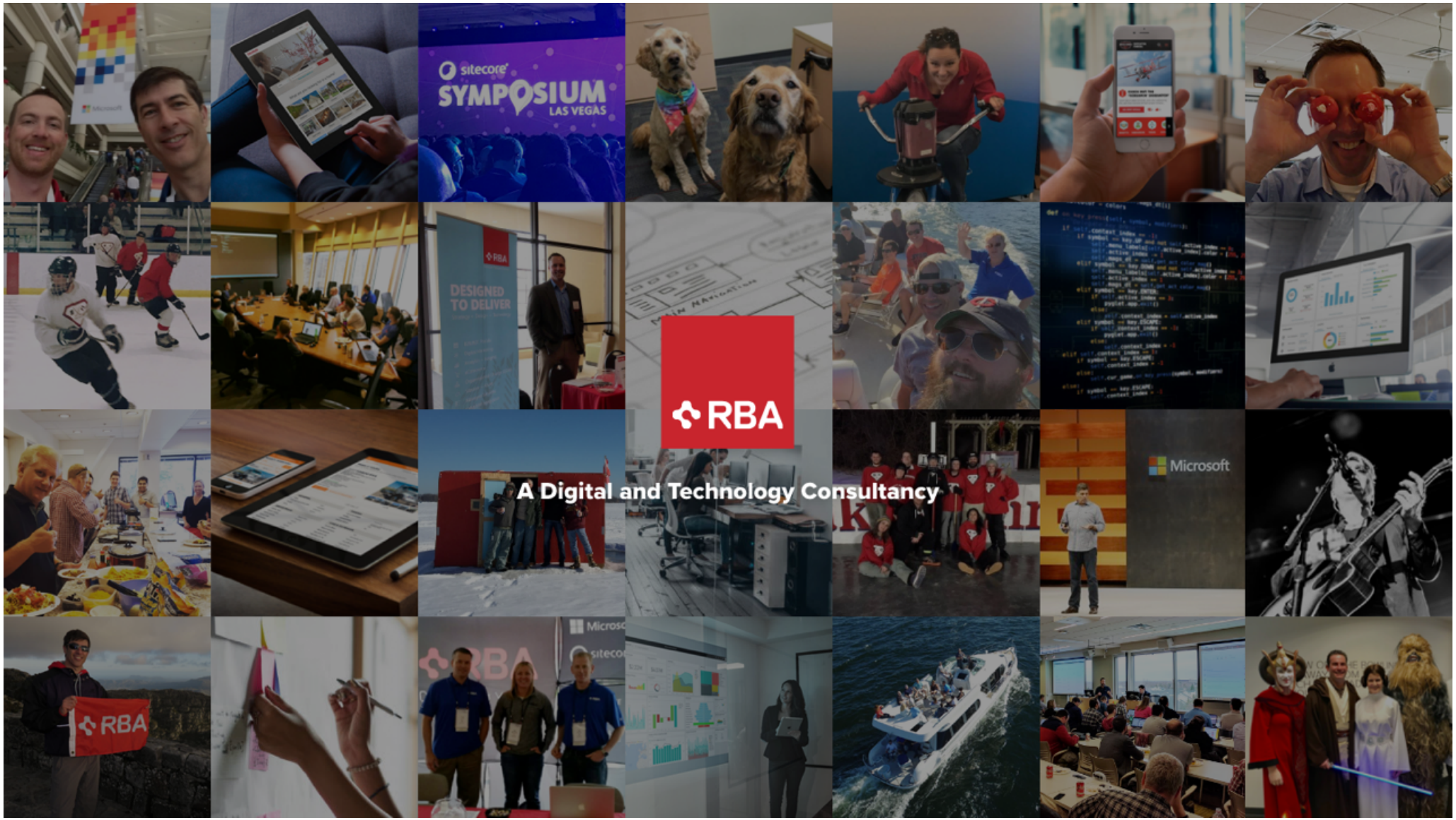
TAKEWAYS


In preparing for battle I have always found that plans are useless, but planning is indispensable.
Dwight D. Eisenhower

Lessons Learned

- Plan your approach, know your choices, but be flexible
- Know your trigger options and make sure your choices support how you plan to scale
- Functions scale rapidly, but you still need to consider being chunky over chatty to achieve scalability
- Durable functions support complex processing, but should be approached carefully as they are tricky to develop and debug
- Deploy Function Apps individually. Atomic DevOps processes are easier to manage.
- Configuration parameters can grow rapidly. Centralize what you can with plans to transform per environment.
- Determine your approach to monitoring the functions

QUESTIONS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