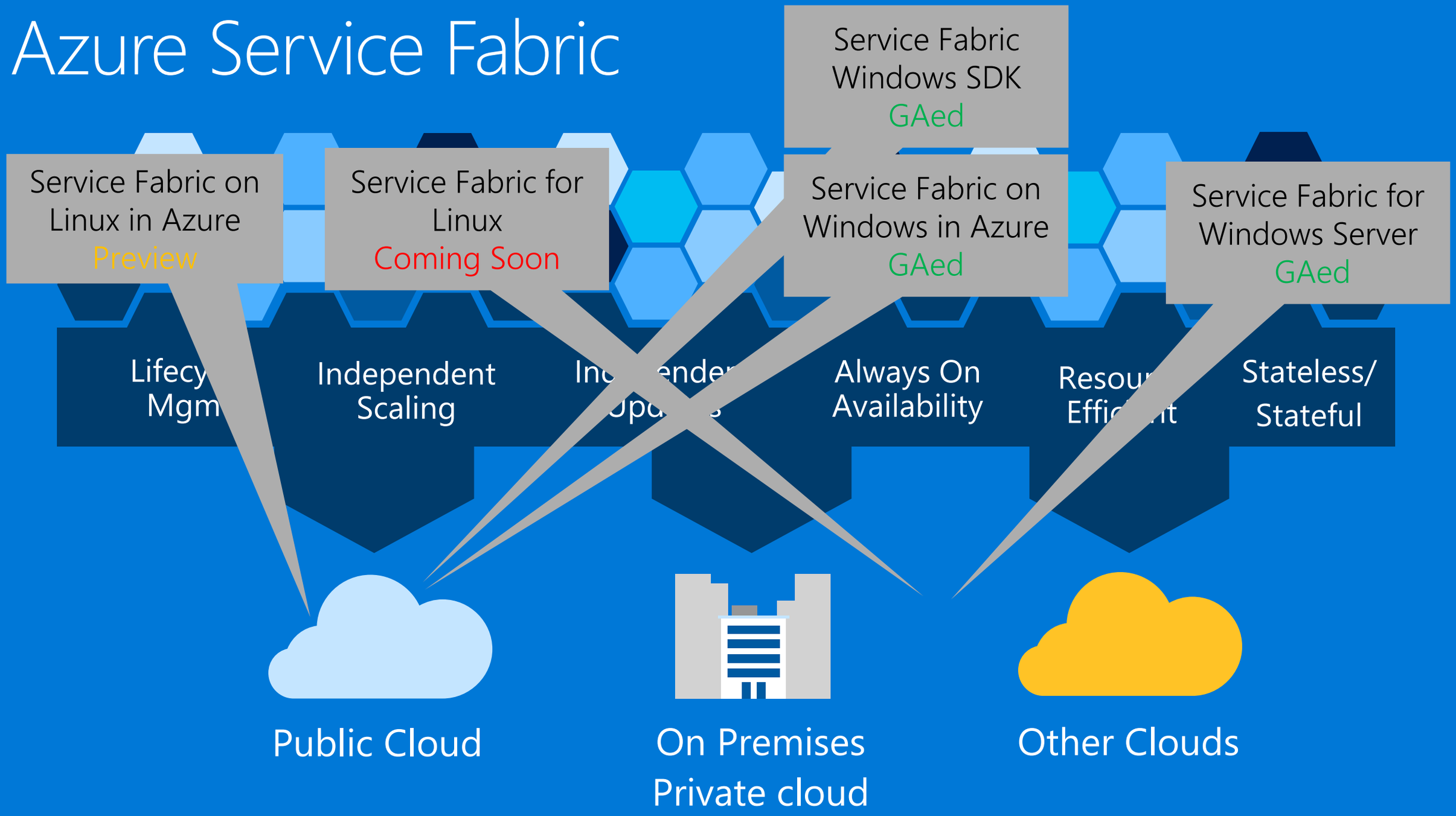
Azure Service Fabric

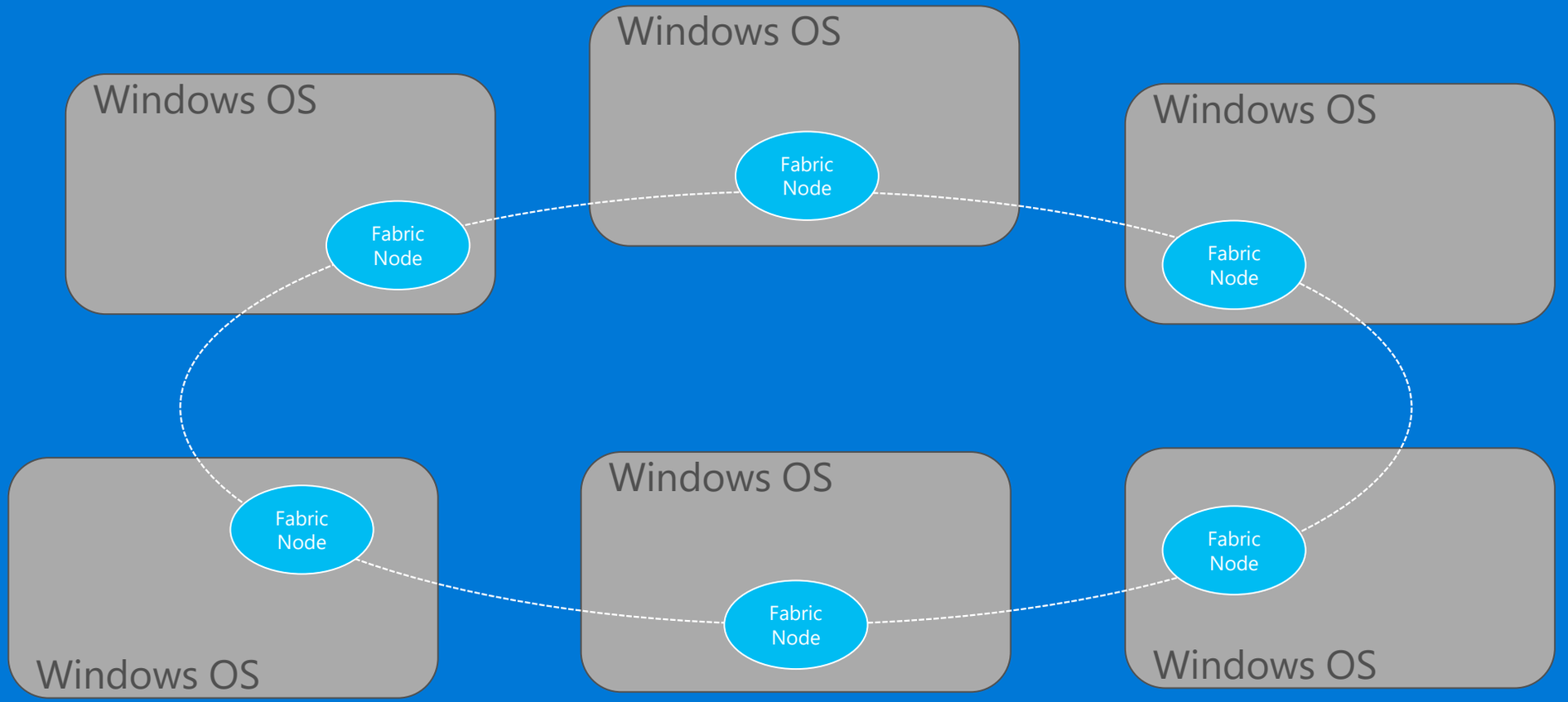
Evgeny Grigorenko

Azure Service Fabric

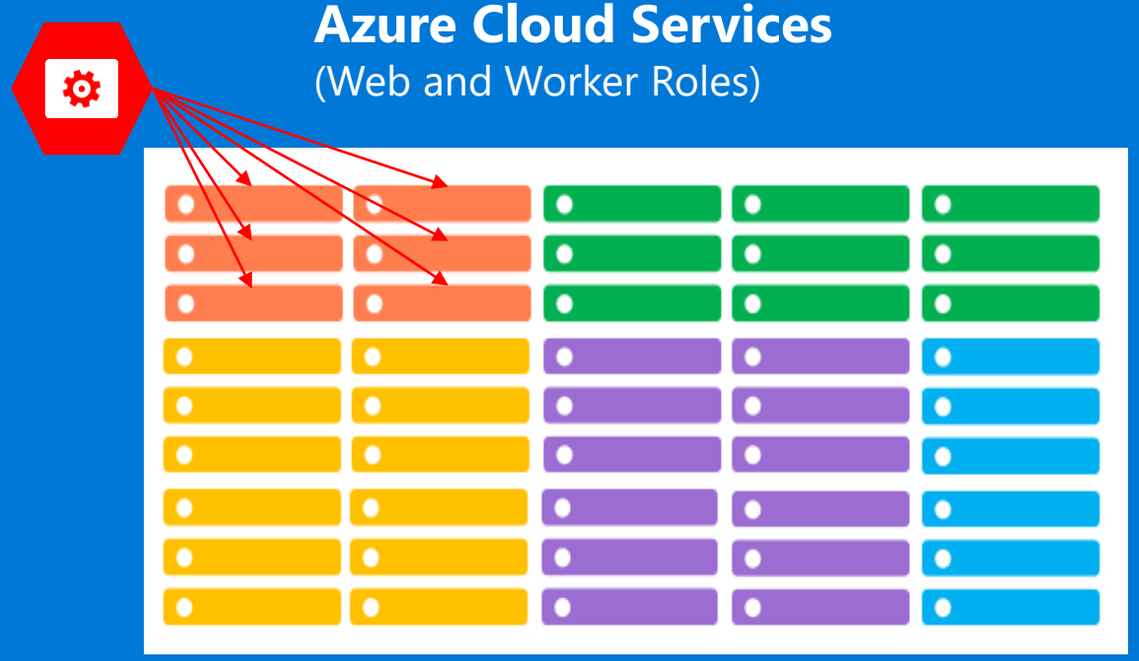


Cluster

- Set of OS instances (real or virtual) stitched together to form a pool of resources
- Cluster can scale to 1000s of machines, is self repairing, and scales-up or down
- Acts as environment-independent abstraction layer

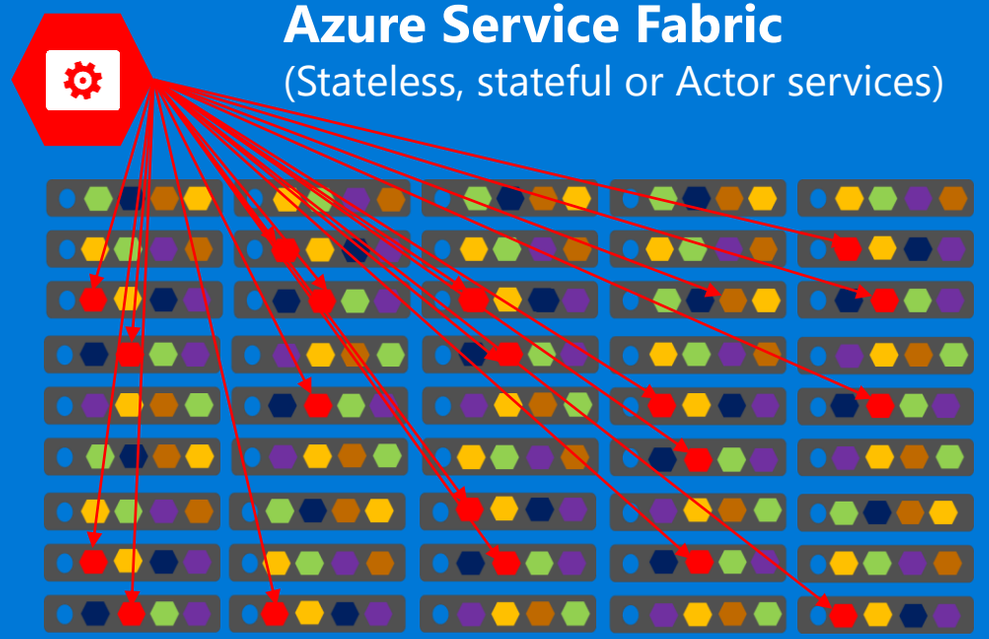


Comparing Azure Cloud Services vs. Azure Service Fabric



Azure Cloud Services
(Web and Worker Roles)

- 1 service instance per VM with uneven workloads
- Lower compute density
- Slow in deployment & upgrades
- Slower in scaling and disaster recovery



Azure Service Fabric
(Stateless, stateful or Actor services)

- Many microservices per VM
- High microservices density
- Fast deployment & upgrades
- Fast scaling microservices across the cluster

Why we need orchestration:

Rules

- Place workloads based on specific rules
- Update service requirements
- Place workloads based on resource consumption and node capacities

Optimizations

- Dynamically adjust resource consumption
- Balance and rebalance on the fly
  - Add/Remove workloads
  - Add/Remove nodes
  - Go over capacity

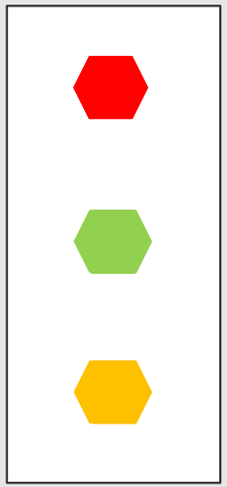
Processes

- Automated Monitored Rolling Upgrades (w/ Rollback)
  - While respecting rules & optimizations

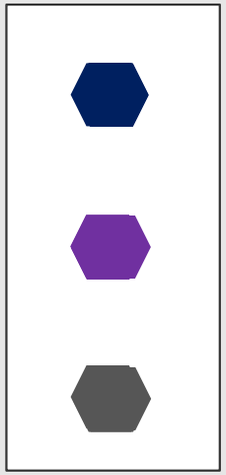
Service Fabric

- Service Fabric was there before orchestration was cool
- Platform agnostic – Windows/Linux, On-Prem/Cloud
- Offers much more…
  - Rich data-aware orchestration capabilities
  - Integrated operational health and safety checks
  - Rolling upgrades and health monitoring
  - A PaaS platform with APIs to build natively distributed apps
  - Service Fabric microservices can run inside/outside/SxS with containers
  - Integrated IDEs
  - Devbox debugging (on Windows/Linux/Mac)
  - About 1/3rd *of all cores in Azure* run on Service Fabric

Service Fabric - Deployment



App1

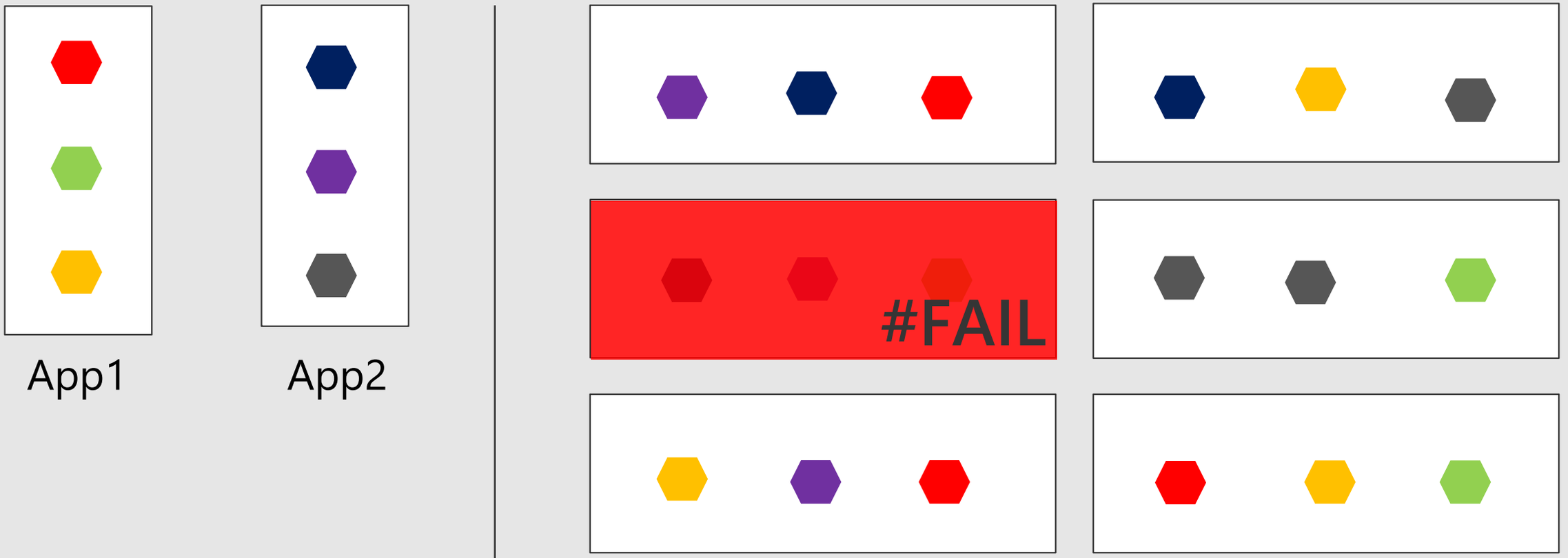


App2

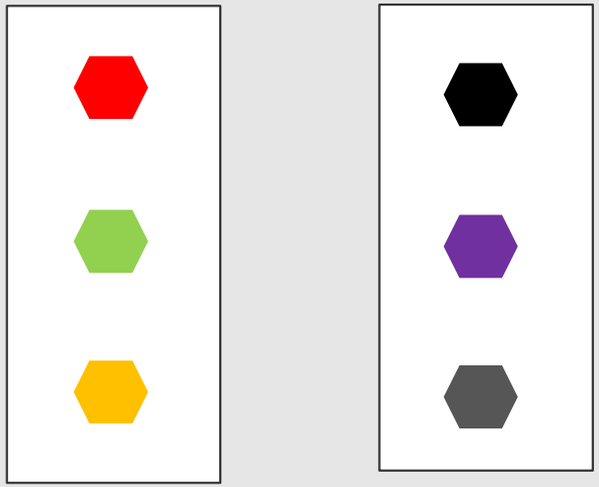
App Type Packages

Service Fabric Cluster VMs

Handling machine failures



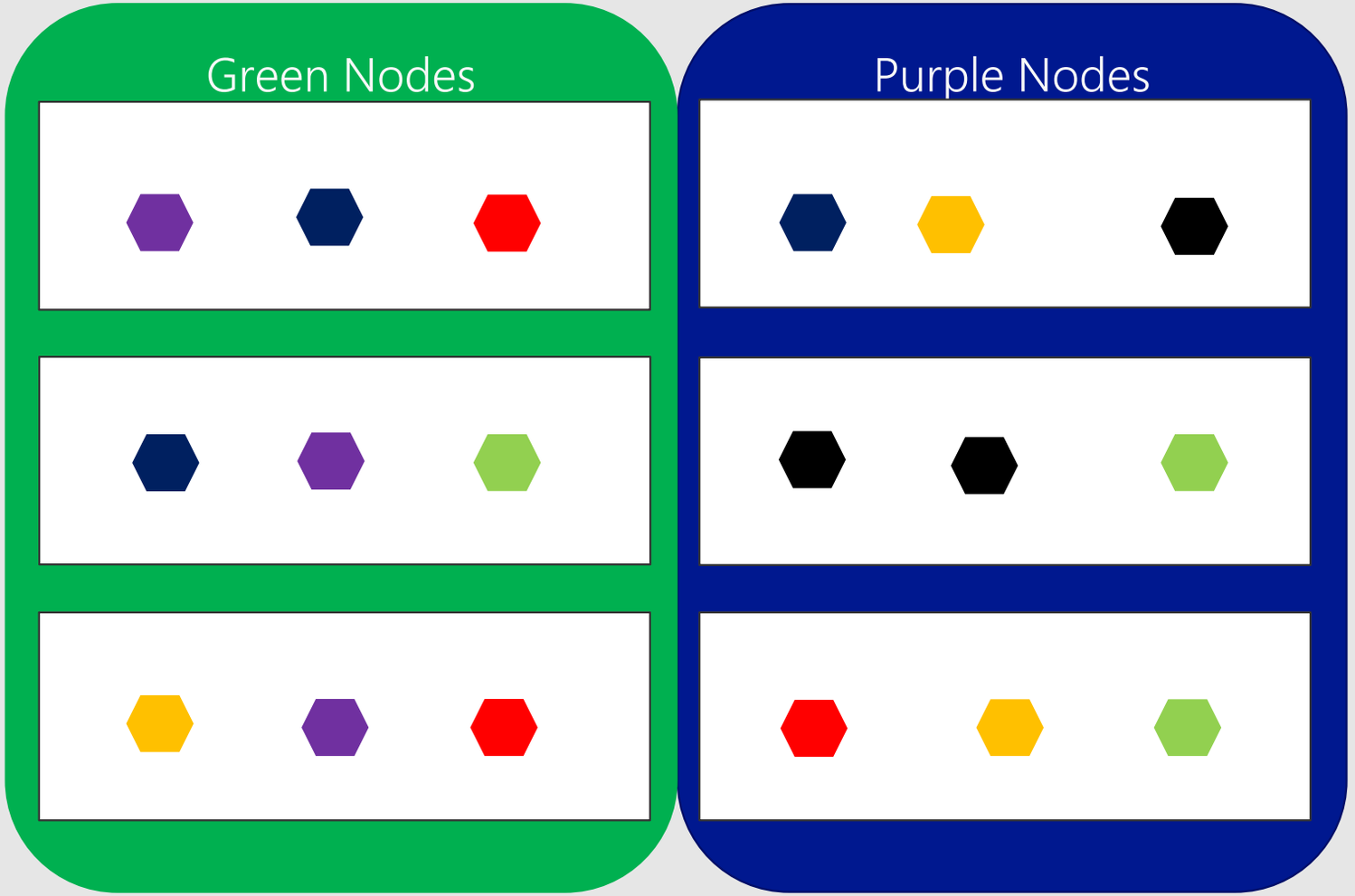
Orchestration basics - Constraints



App1

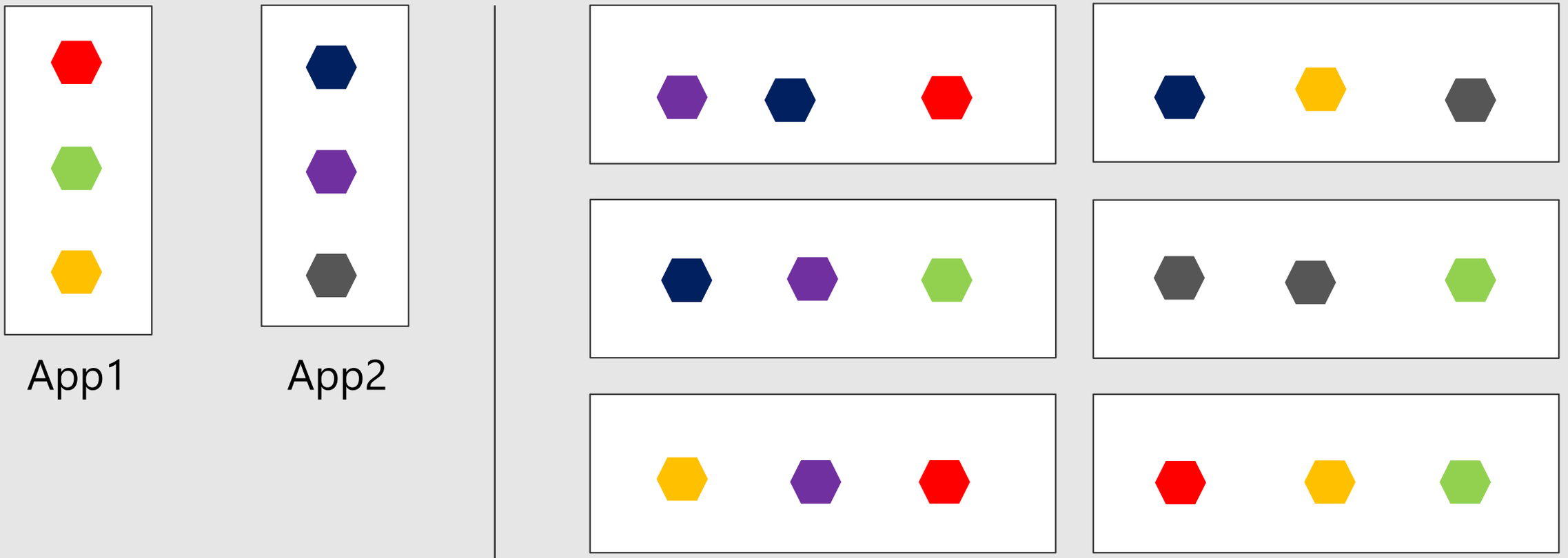
App2

App Type Packages

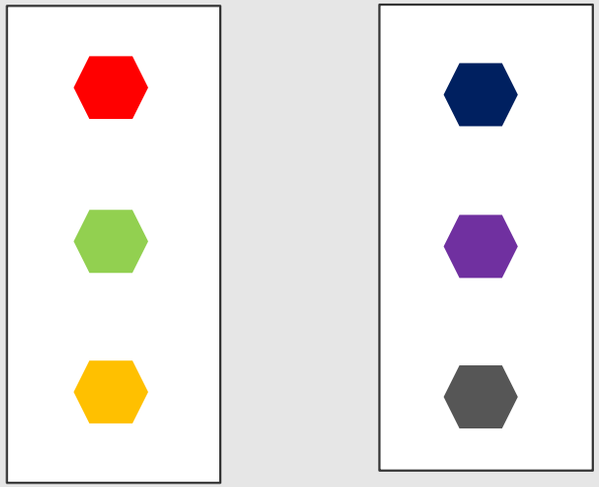


Service Fabric Cluster VMs

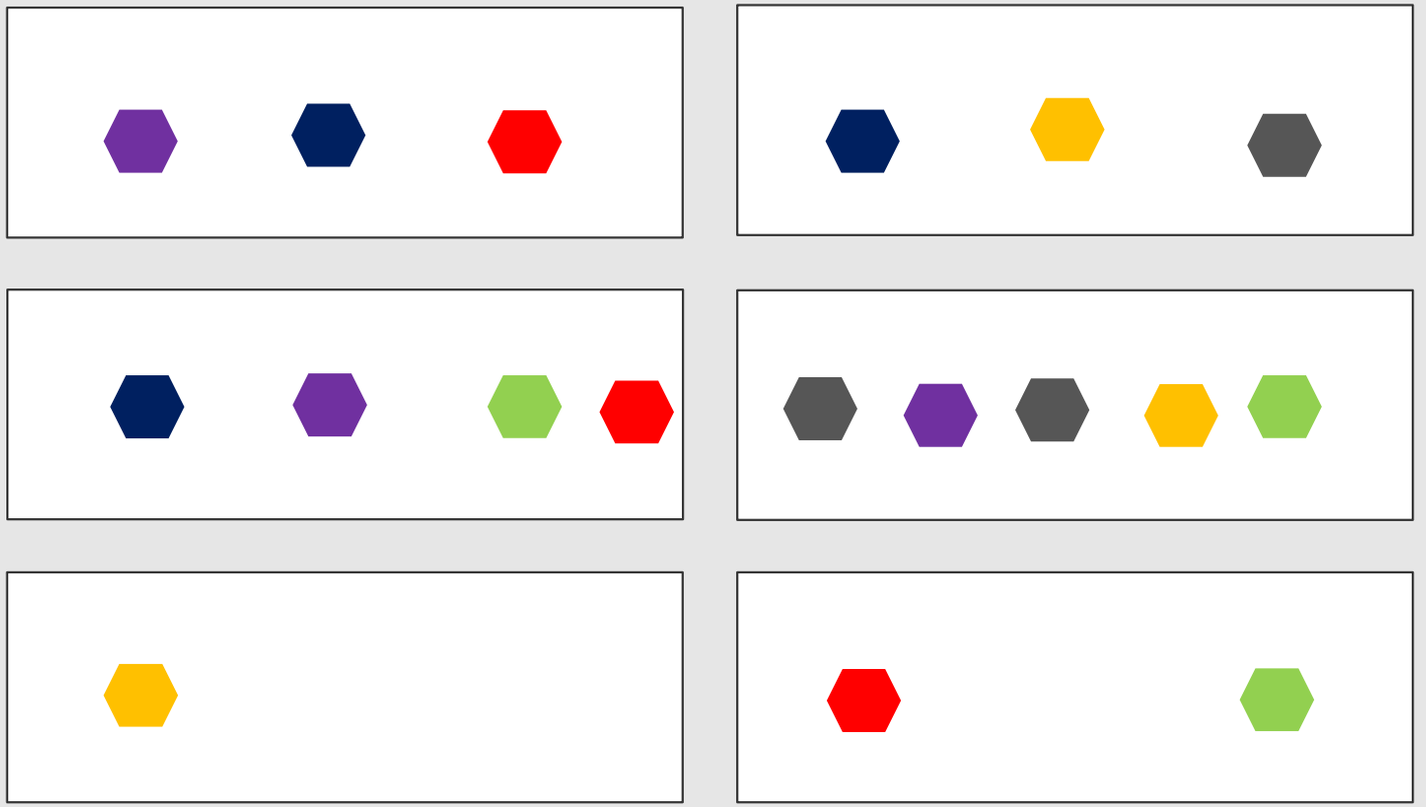
Orchestration basics - Capacity



Orchestration basics - Balancing

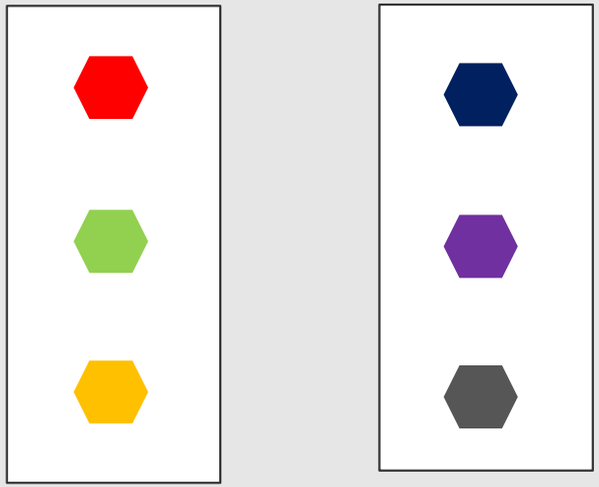


App Type Packages

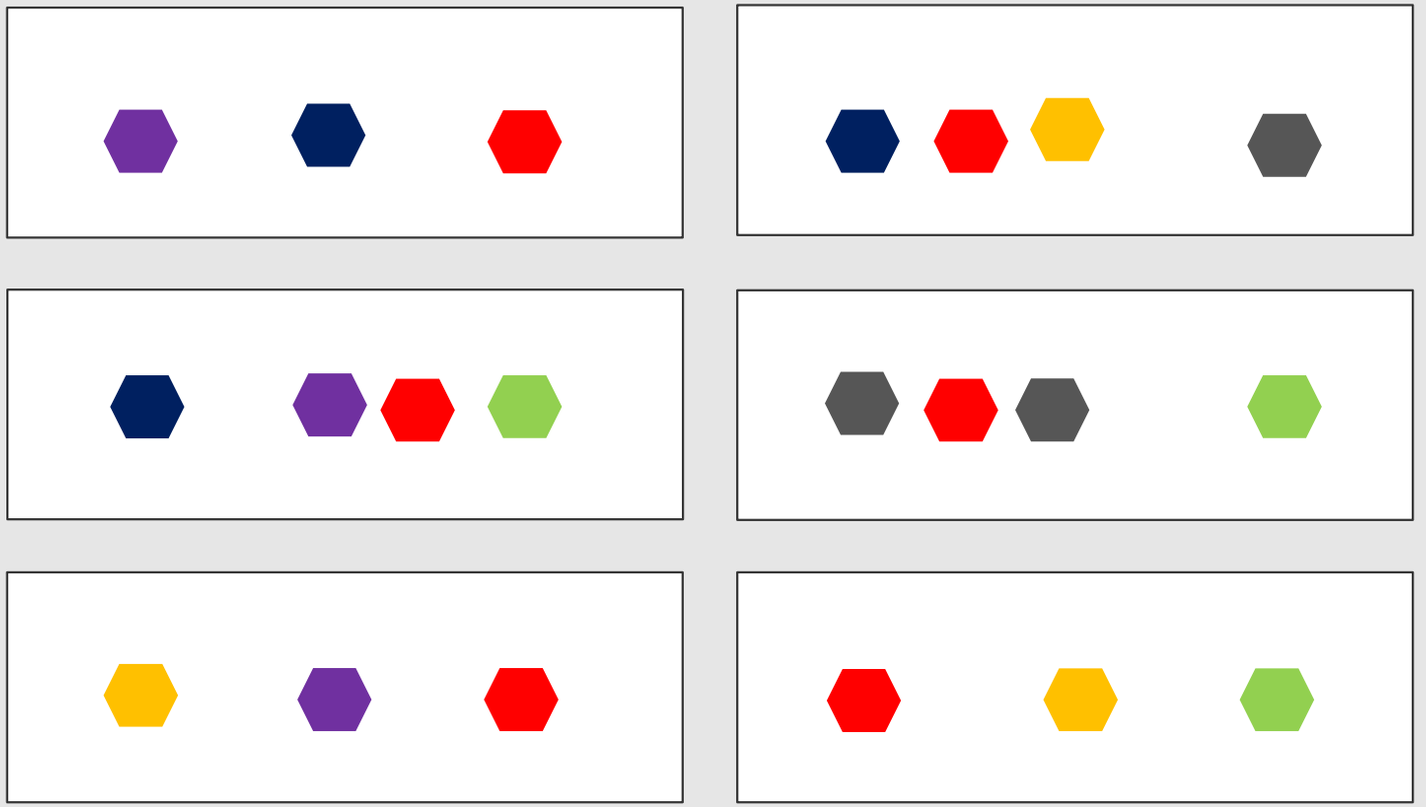


Service Fabric Cluster VMs

Orchestration basics – Scaleout services

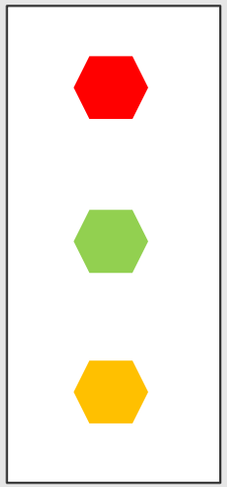


App Type Packages

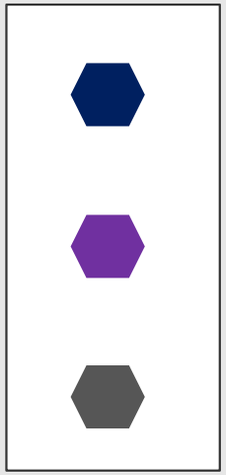


Service Fabric Cluster VMs

Orchestration basics – Scaleout cluster



App1

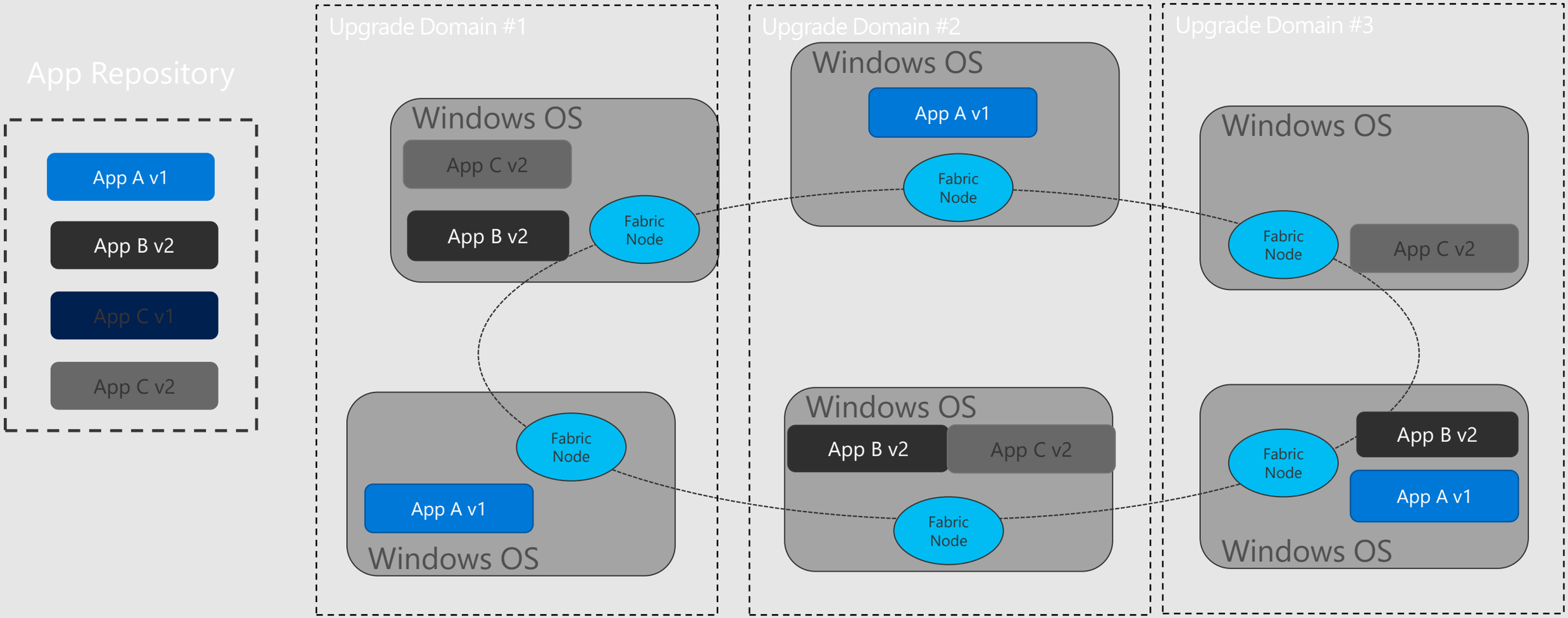


App2

App Type Packages

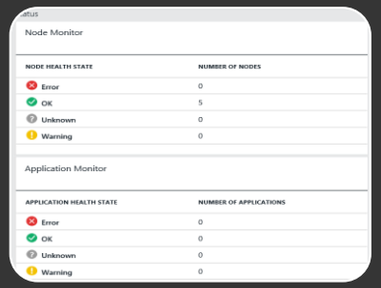
Service Fabric Cluster VMs

Application Upgrade



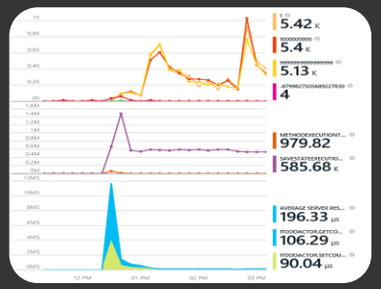
Monitoring your Services

Visibility into how your services are doing when running in production



Health status monitoring

- Built-in health status for cluster and services
- Flexible and extensible health store for custom app health reporting
- Allows continuous monitoring for real-time alerting on problems in production



Performance and stress response

- Rich built-in metrics for Actors and Services programming models
- Easy to add custom application performance metrics

Diagnostics and Troubleshooting

Detailed System Optics

- Repair suggestions. Examples: Slow RunAsync cancellations, RunAsync failures
- All important events logged. Examples: App creation, deploy and upgrade records. All Actor method calls.

Custom Application Tracing

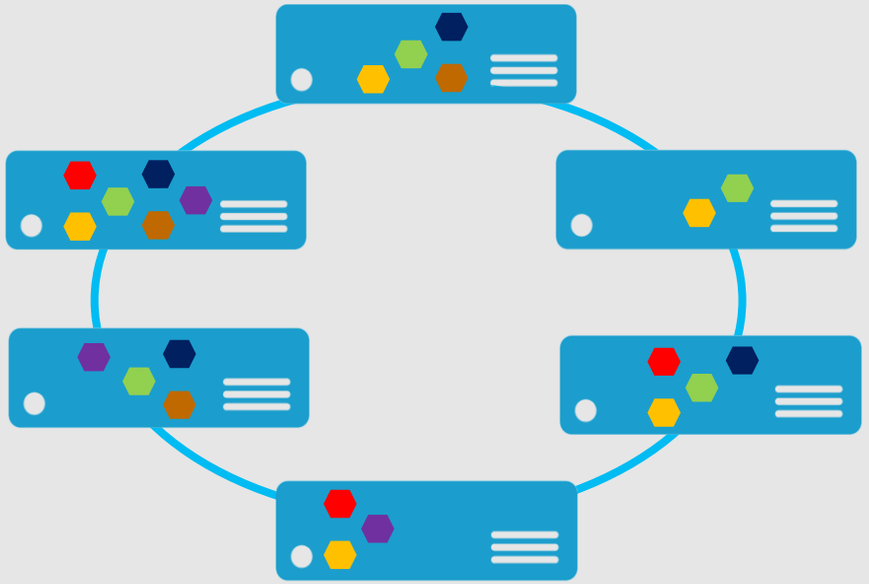
- ETW == Fast Industry Standard Logging Technology
- Works across environments. Same tracing code runs on devbox and also on production clusters on Azure.
- Easy to add and system appends all the needed metadata such as node, app, service, and partition.

Choice of Tools

- Visual Studio Diagnostics Events Viewer
- Windows Event Viewer
- Windows Azure Diagnostics + Operational Insights
- Easy to plug in your preferred tools: Kibana, Elasticsearch and more

Important topics in Service Fabric

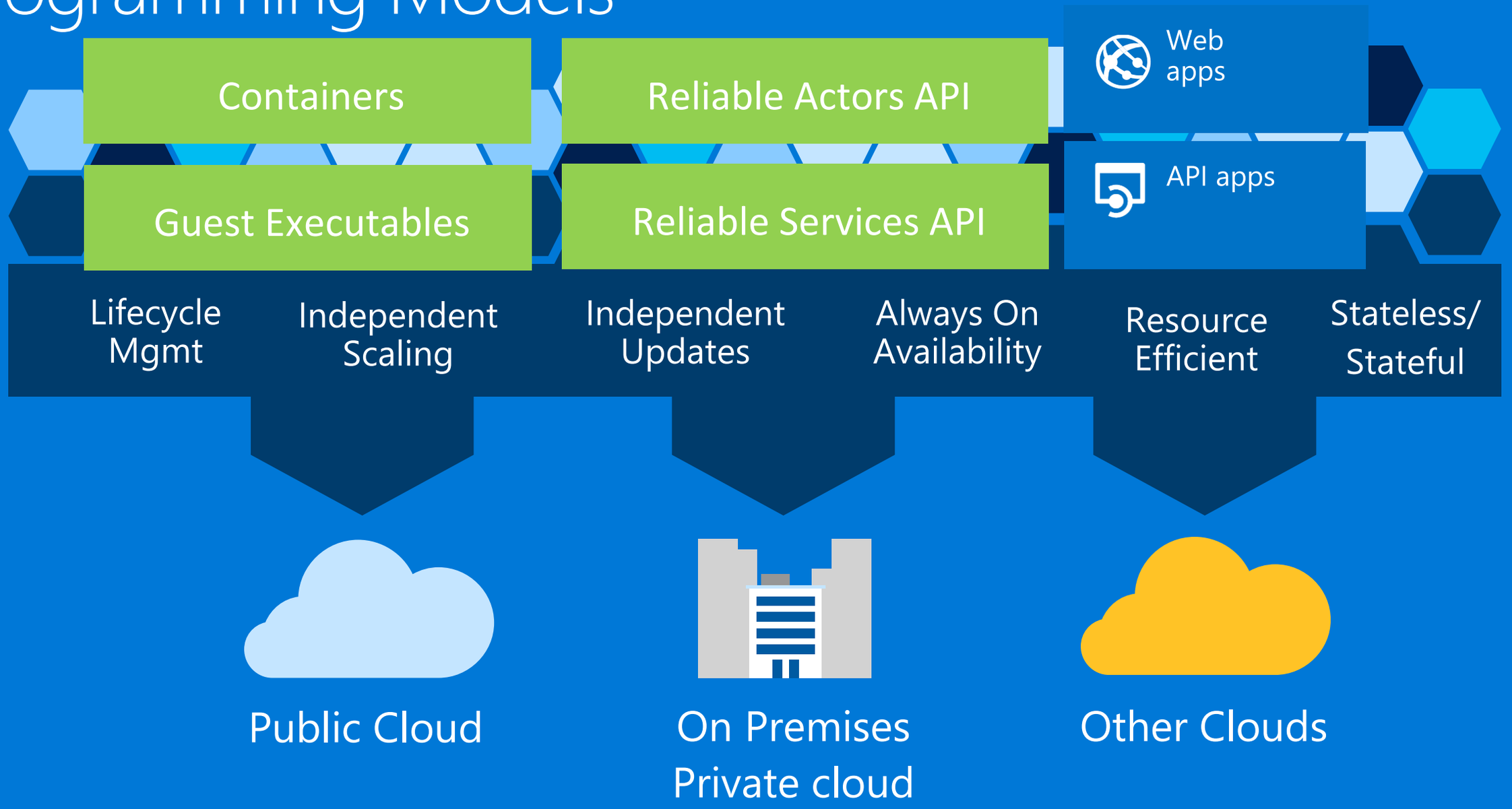
- Cluster scale-up and down and different VM sizes
- Cluster placement constraints
- Application rolling upgrades and rollback
- Application health monitoring and reporting
- Application operational insights
- Advance application resource balancing and scheduling
- Chaos and scenario testing in production



Building and managing microservice applications

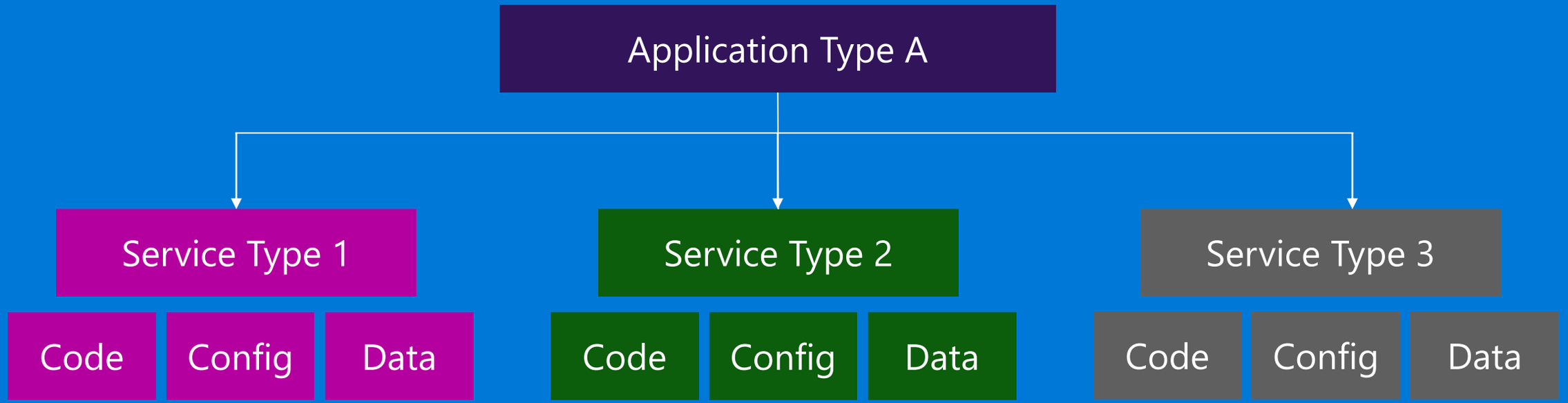
Microsoft

Service Fabric Programming Models



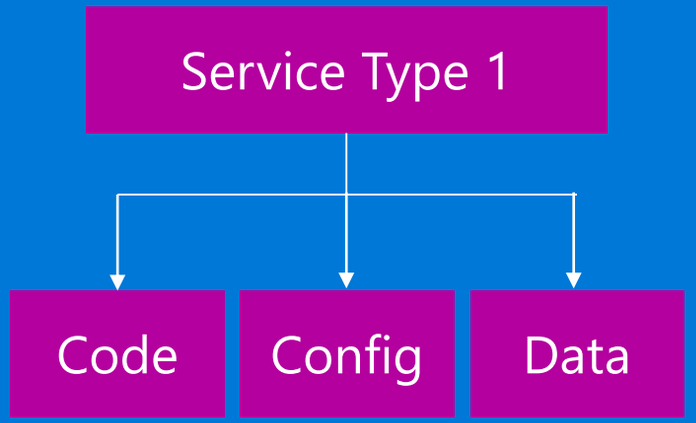
Application type

- Declarative template for creating an application
- Based on a set of service types
- Used for packaging, deployment, and versioning



Service type

- Services types are composed of code/config/data packages
  - Code packages define an entry point (dll or exe)
  - Config packages define service specific config information
  - Data packages define static resources (eg. images)
- Packages can be independently versioned




```
<ServiceManifest Name="QueueService" Version="1.0">
 <ServiceTypes>
    <StatefulServiceType ServiceTypeName="QueueServiceType" HasPersistedState="true" />
  </ServiceTypes>
  <CodePackage Name="Code" Version="1.0">
    <EntryPoint>
      <ExeHost>
        <Program>ServiceHost.exe</Program>
      </ExeHost>
    </EntryPoint>
  </CodePackage>
  <ConfigPackage Name="Config" Version="1.0" />
  <DataPackage Name="Data" Version="1.0" />
</ServiceManifest>
```

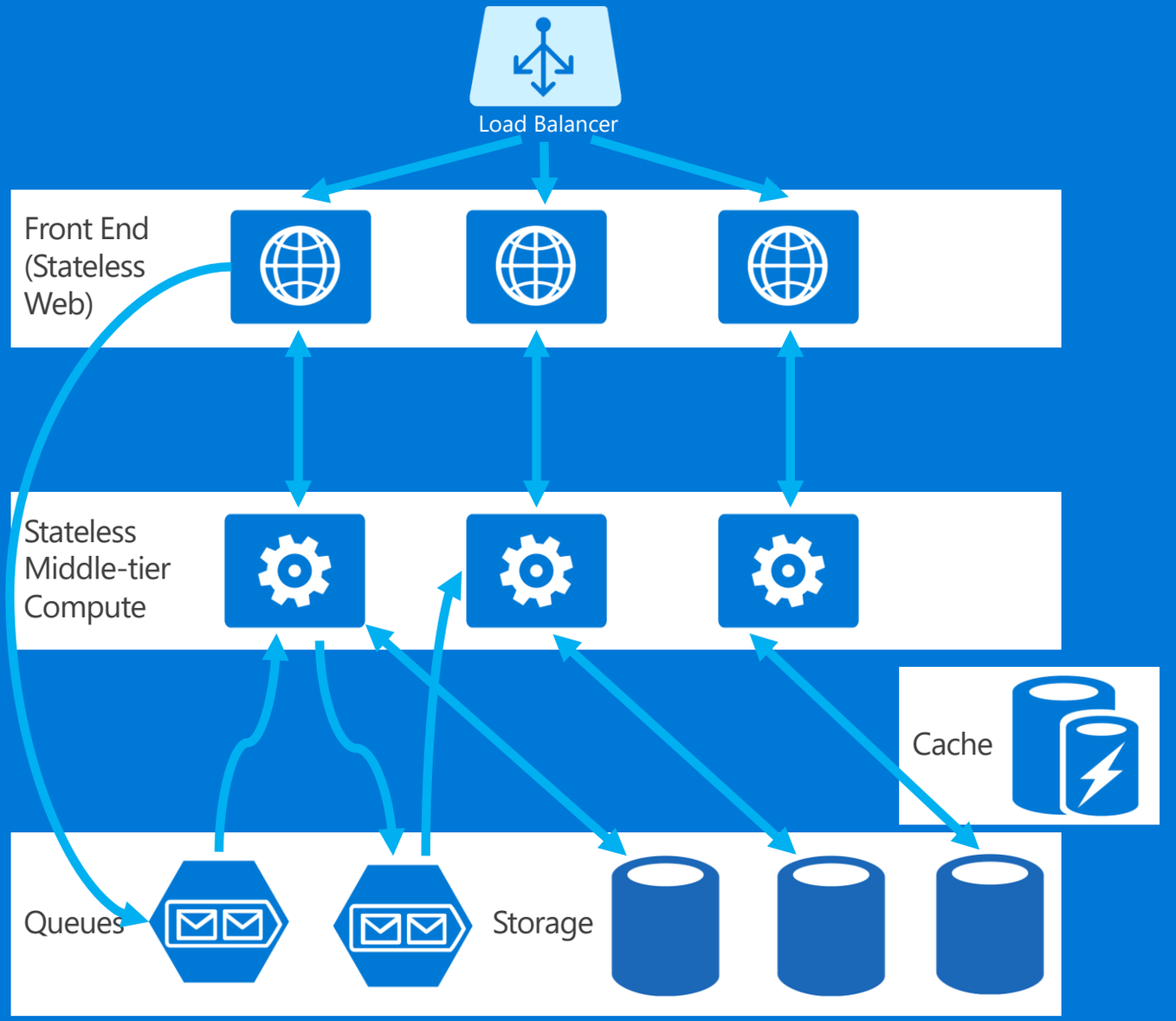
Types of microservices
from a Service Fabric perspective

- Stateless microservice
  - Has either no state or it can be retrieved from an external store
  - There can be N instances
  - e.g. web frontends, protocol gateways, Azure Cloud Services etc.

- Stateful microservice
  - Maintain hard, authoritative state
  - N consistent copies achieved through replication and local persistence
  - e.g. database, documents, workflow, user profile, shopping cart etc.

Stateless Services Pattern

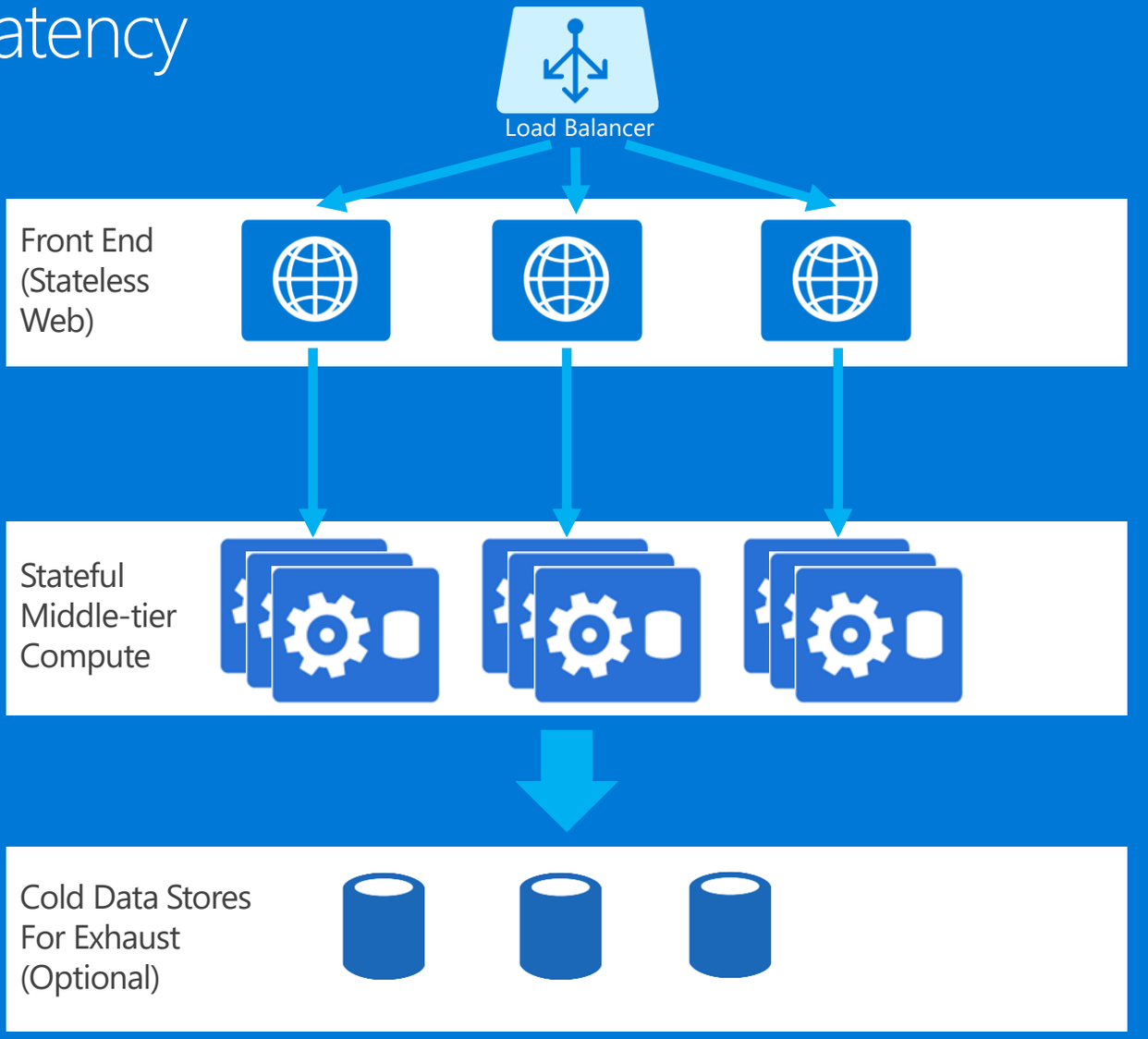
- Scale stateless services backed by partitioned storage
- Increase reliability and ordering with queues
- Reduce read latency with caches
- Manage your own transactions for state consistency
- More moving parts each managed differently



Stateful Services Pattern

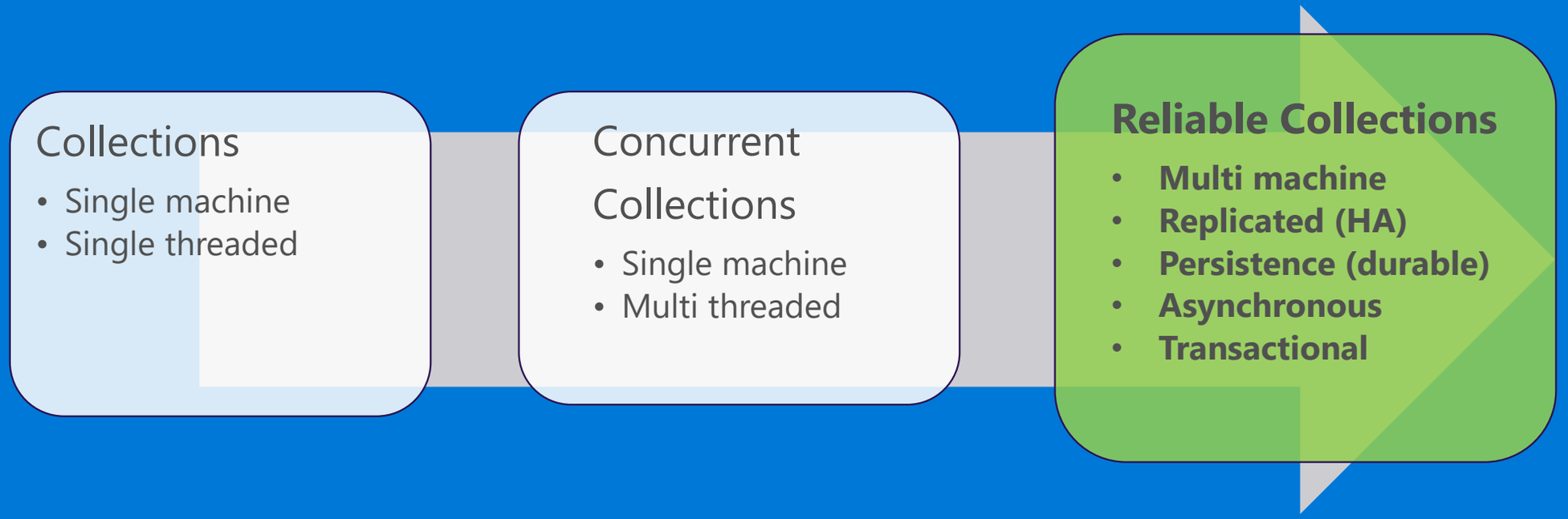
Simplify design, reduce latency

- Application state lives in the compute tier
- Low Latency reads and writes
- Partitions are first class at the service layer for scale-out
- Built in transactions
- Fewer moving parts
- External stores for exhaust and offline analytics



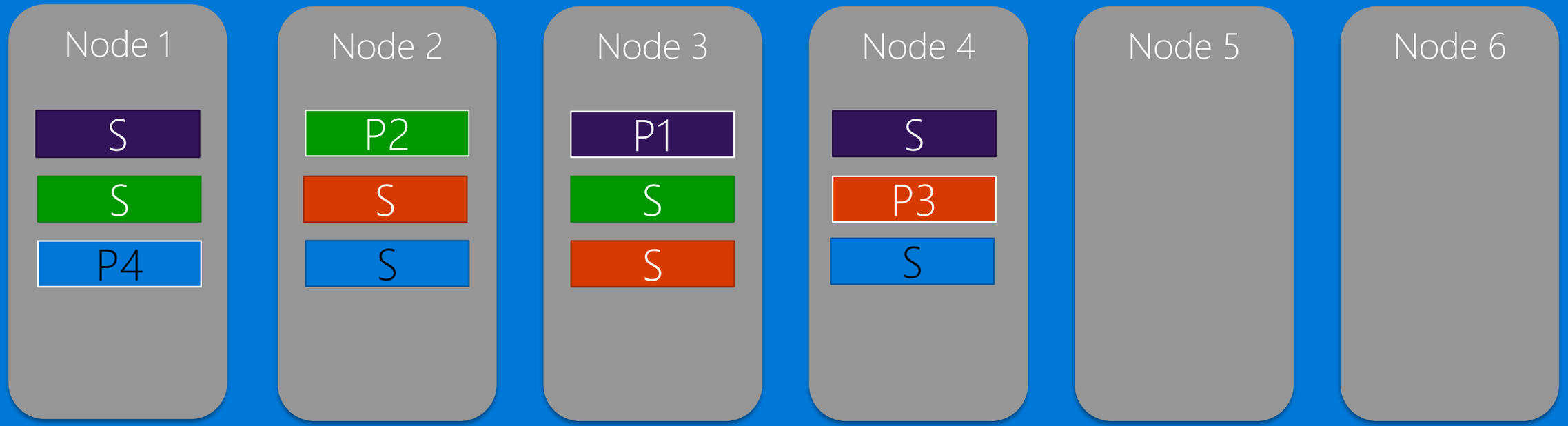
Reliable Collections

- Reliable collections make it easy to build stateful services.
- An evolution of .NET collections for the cloud.
- ReliableDictionary<T1,T2> and ReliableQueue<T>



Service partitioning

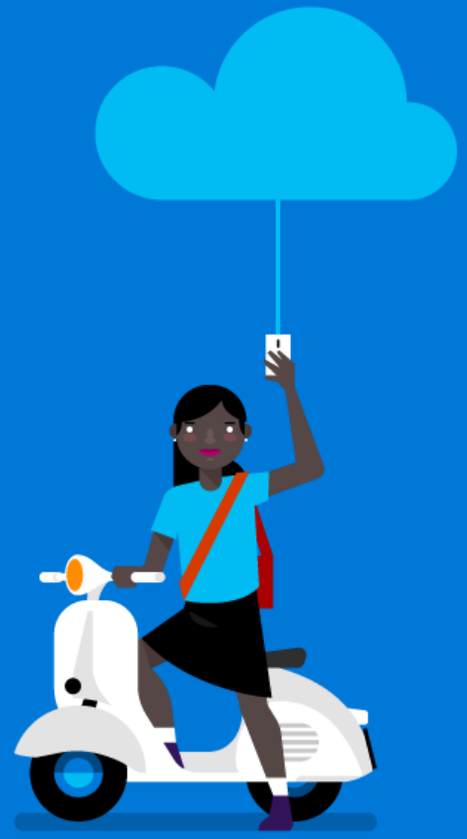
- Services can be partitioned for scale-out.
- You can choose your own partitioning scheme.
- Service partitions are striped across machines in the cluster.
- Replicas automatically scale out & in on cluster changes



What is an Actor?

- An independent unit of compute and state with large number of them executing in parallel
- Communicates with other actors using asynchronous messaging
- Has single threaded execution (turn based concurrency)

Running Containers at Scale



Microsoft

Service Fabric Container Integration - Guest Container

Container Images

FE

image: contoso/fr

Order Service

image: contoso/o

Side car

image: contoso/c

Data base

image: contoso/d

Datacenter (Azure, On-Premises)

```
<ServiceManifest Name="ContosoServiceTypePkg"
                 Version="1.0">
  <ServiceTypes>
    <StatelessServiceType
      ServiceTypeName="ContosoServiceType" ... >
    </StatelessServiceType>
  </ServiceTypes>
  <CodePackage Name="CodePkg" Version="1.0">
    <EntryPoint>
      <ContainerHost>
        <ImageName>contoso/frontend</ImageName>
      </ContainerHost>
    </EntryPoint>
  </CodePackage>
  . . .
</ServiceManifest>
```

Service Fabric

Service Fabric

Service Fabric Container Integration – SF Service

Container Images

Datacenter (Azure, On-Premises)

FE

Service Fabric

image: conto

Orde

Servic

Service Fabric

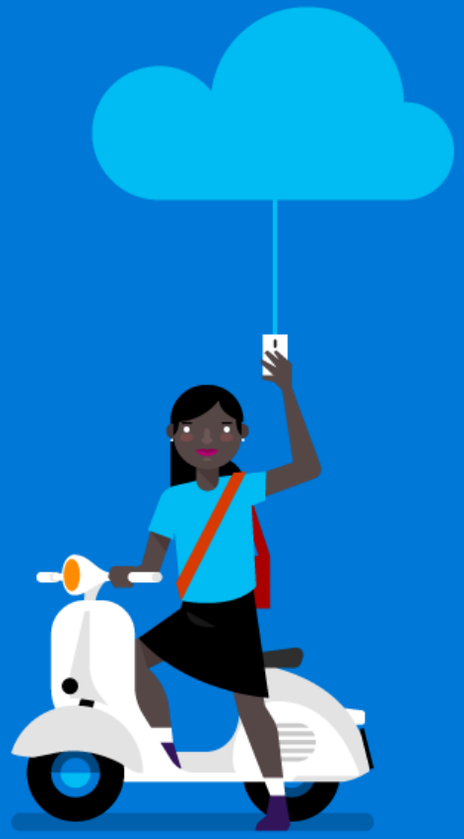
image: conto

```
<ServiceManifest Name="ContosoServiceTypePkg"
                 Version="1.0">
  <ServiceTypes>
    <StatelessServiceType
      ServiceTypeName="ContosoServiceType" ... >
    </StatelessServiceType>
  </ServiceTypes>
  <CodePackage Name="CodePkg" Version="1.0">
    <EntryPoint>
      <ContainerHost>
        <ImageName>contoso/frontend</ImageName>
      </ContainerHost>
    </EntryPoint>
  </CodePackage>
  . . .
</ServiceManifest>
```

Service Fabric

Service Fabric

Example Customer Solutions



Microsoft

Services built with Service Fabric

Azure Core Infrastructure

thousands of machines

Azure Document DB

billions transactions /week

Intune

800k devices

Skype for Business

Hybrid Ops

Event Hubs

20bn events/day

Bing Cortana

500m evals/sec

Azure SQL Database

1.4 million databases

Power BI

IoT Suite

Service Fabric Customers

TalkTalk, a UK video-on-demand service delivering TV and movie content across multiple-devices

Benefits

Microservices workflow for content encoding and resolution

Agility - Ability to upgrade microservices independently and without downtime. No need to coordinate DB schema with app upgrades

Programming API - Using actors and reliable collections to easily orchestrate the encoding and resolution of the on-demand content

Scalability - Real time résolution for 30K titles, designed to scale for growth of users, devices and content

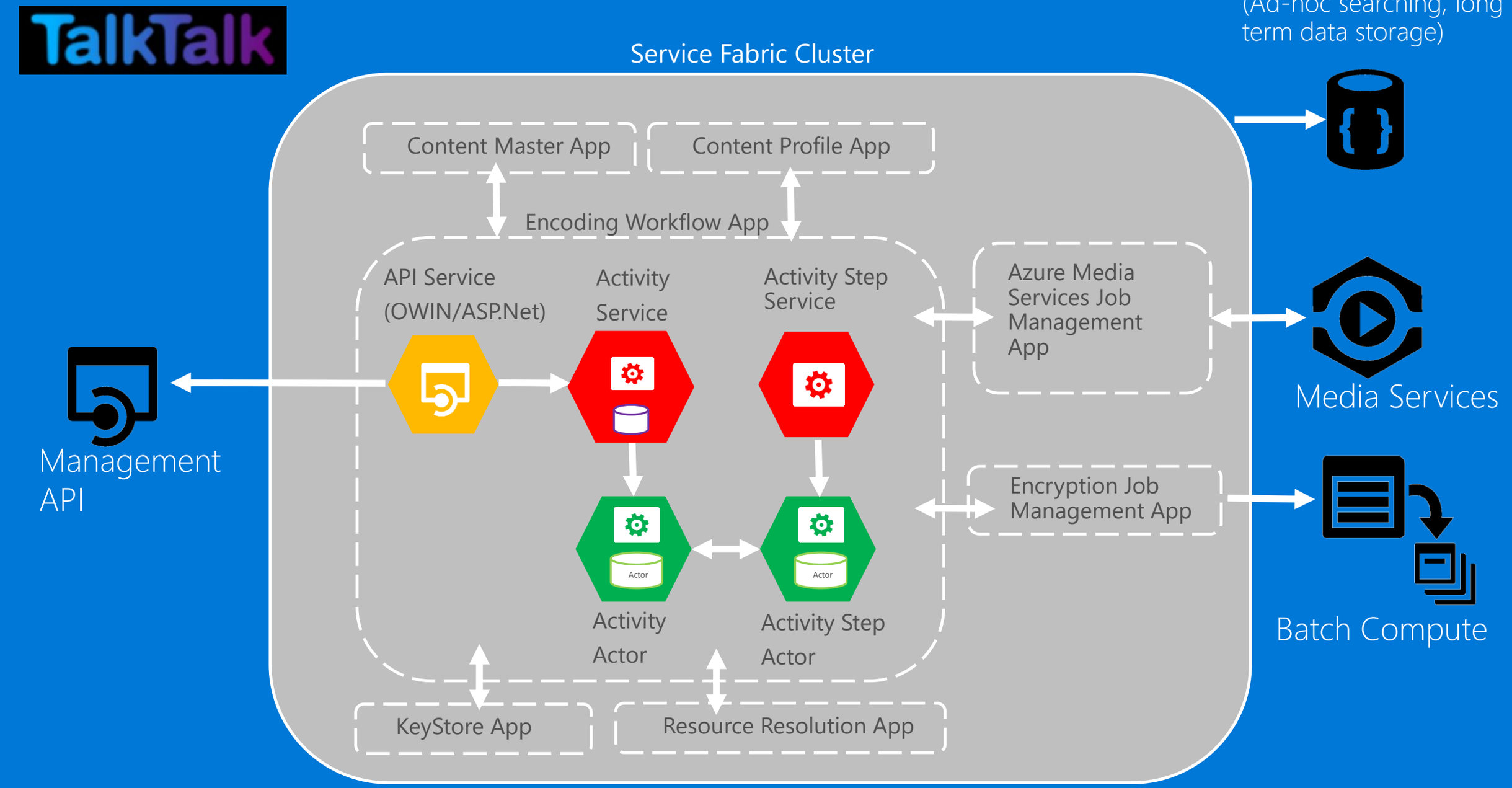
- Replacing existing IaaS/DB backed system with microservices solution
- 1.5 PB of for streaming content delivered to millions of customers using Azure Media Services
- Read the blog post on Service Fabric team blog
- https://blogs.msdn.microsoft.com/azureservicefabric/2016/03/15/service-fabric-customer-profile-talktalk-tv/

TalkTalk

Microservices workflow for content encoding

TalkTalk

DocumentDB
(Ad-hoc searching, long term data storage)



Call to Action

- Download the Service Fabric developer SDK
  - http://aka.ms/ServiceFabricSDK
- Download the standalone Service Fabric preview for Windows Server
  - http://aka.ms/ServiceFabricWS2012R2
- Learn from samples, complete solutions and FREE clusters
  - http://aka.ms/ServiceFabricSamples and http://aka.ms/tryservicefabric
- Signup for Service Fabric on Linux
  - http://aka.ms/SFlinuxpreview
- Provide feedback
  - http://aka.ms/ServiceFabricForum
- Twitter HashTag

#AzureServiceFabric

Resources

Microsoft Azure Service Fabric
https://azure.microsoft.com/en-us/services/service-fabric/

Learning Path for Service Fabric
https://azure.microsoft.com/en-us/documentation/learning-paths/service-fabric/

Book: Programming Microsoft Azure Service Fabric
https://www.microsoftpressstore.com/store/programming-microsoft-azure-service-fabric-9781509301881

Book: Microservices, IoT and Azure: Leveraging DevOps and Microservice Architecture to deliver SaaS Solutions
http://www.amazon.com/Microservices-IoT-Azure-Microservice-Architecture/dp/1484212762

Azure Service Fabric Team Blog
https://blogs.msdn.microsoft.com/azureservicefabric/

Microsoft Virtual Academy
https://mva.microsoft.com/en-US/training-courses/build-always-on-hyper-scalable-microservice-based-cloud-services-13992?l=fqheWt4rB_1705368485

MSDN Service Fabric Forum
https://social.msdn.microsoft.com/Forums/azure/en-US/home?forum=AzureServiceFabric

Many Videos on YouTube
https://www.youtube.com/results?search_query=Azure+Service+Fabric

Various Service Fabric Videos
https://azure.microsoft.com/en-us/documentation/videos/index/?services=service-fabric

Overview of the Azure Service Fabric
https://azure.microsoft.com/en-us/documentation/videos/azurecon-2015-overview-of-the-azure-service-fabric/

Migrating your Application to Azure Service Fabric
https://azure.microsoft.com/en-us/documentation/videos/azurecon-2015-migrating-your-application-to-azure-service-fabric/

More Resources

Microsoft Azure Service Fabric Architecture
https://channel9.msdn.com/Events/Ignite/2015/BRK3717
https://channel9.msdn.com/Events/Build/2015/2-640

Building Resilient, Scalable Services with Microsoft Azure Service Fabric
https://channel9.msdn.com/Events/Ignite/2015/BRK3730

Service Orchestration with Microsoft Azure Service Fabric
https://channel9.msdn.com/Events/Ignite/2015/BRK3478

Deploying and Managing Services with Microsoft Azure Service Fabric
https://channel9.msdn.com/Events/Build/2015/2-717

Deep Dive into Microsoft Azure Service Fabric Reliable Actors
https://channel9.msdn.com/Events/Build/2015/2-66

Azure Service Fabric for Developers
https://channel9.msdn.com/Events/Build/2016/B874

Azure Service Fabric
https://channel9.msdn.com/Events/ASPNET-Events/ASPNET-Fall-Sessions/Azure-Service-Fabric

Azure PaaS v2 – Microservices, Microsoft (Azure) Service Fabric, *.Apps and of course – some "containers" - Tomasz Kopacz
https://channel9.msdn.com/Series/NET-DeveloperDays-2015-on-demand/Azure-PaaS-v2--Microservices-Microsoft-Azure-Service-Fabric-Apps-and-of-course--some-containers-Toma

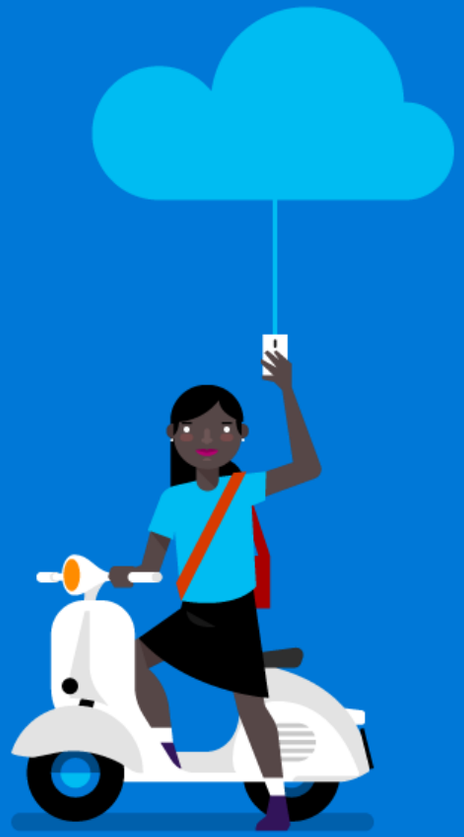
Podcast: Episode 108 – Service Fabric Deep Dive
http://azpodcast.azurewebsites.net/post/Episode-108-Service-Fabric-Deep-Dive

Azure Service Fabric Code Samples
https://azure.microsoft.com/en-us/documentation/samples/?service=service-fabric

Powershell Service Fabric Cmdlets
https://msdn.microsoft.com/en-us/library/mt125965.aspx

MSDN Article
https://msdn.microsoft.com/en-us/magazine/mt595752.aspx
MSDN Magazine Article Sample App
https://msdn.microsoft.com/en-us/magazine/mt632274.aspx
Blog Post by Mark Russinovich
https://azure.microsoft.com/en-us/blog/microservices-an-application-revolution-powered-by-the-cloud/

Thank you!



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