Microsoft

Service Fabric – Health, Monitoring and Operational Telemetry

Microsoft Services

Agenda

- Overview of Monitoring Services
- Health Reporting
- Event Trace Data

Monitoring scenarios for your services

Visibility into how your services are doing when running in production

Performance and stress response
- Built-in metrics for Actors and Services programming models
- Ability to add custom application performance metrics

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

Business telemetry
- Collect, analyze and drive insights from your customers' interaction with your application
- Allows data-driven decision making

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 code runs on OneBox 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 • Azure Diagnostics + Log Analytics • Easy to plug in your preferred tools: Kibana, Elasticsearch, NLog and more

Microsoft

Service Fabric – Health, Monitoring and Operational Telemetry

Health Reporting

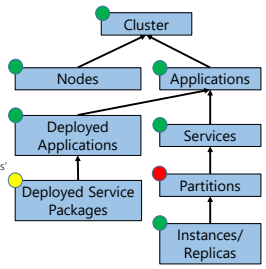
Microsoft Services

Health Architecture – Health Store

- The health store keeps health-related information about entities in the cluster for easy retrieval and evaluation
- It is implemented as a Service Fabric persisted stateful service to ensure high availability and scalability
- The health store is part of the **fabric:/System** application, and it is available as soon as the cluster is up and running

Health Entities, Events, and States

- Each entity has a set of health events
- Each event has a health state:
  - OK: No issues
  - Warning: An issue that may fix itself (ex: unexpected delay)
  - Error: Issue requiring action
  - Unknown: Entity not in health store
- When evaluating an entity
  - Service Fabric aggregates entities and descendants' events against policy



Health Policies

- Default: entity is healthy if it and children are healthy
  - In a world with regular failures, 20% errors might be considered warning – not to Service Fabric
- Health policies define what healthy means
  - Cluster policy can be in the cluster manifest
  - App policy can be in the application manifest
  - You can pass a custom policy when querying health

```
<FabricSettings>
  <Section Name="HealthManager/ClusterHealthPolicy">
    <Parameter Name="MaxPercentUnhealthyApplications" Value="0"/>
    <Parameter Name="MaxPercentUnhealthyNodes" Value="20"/>
  </Section>
</FabricSettings>

<Policies>
  <HealthPolicy MaxPercentUnhealthyDeployedApplications="20">
    <DefaultServiceTypeHealthPolicy
      MaxPercentUnhealthyServices="0"
      MaxPercentUnhealthyPartitionsPerService="10"
      MaxPercentUnhealthyReplicasPerPartition="0"/>
    <ServiceTypeHealthPolicy ServiceTypeName="FrontEndSvcType"
      MaxPercentUnhealthyServices="0"
      MaxPercentUnhealthyPartitionsPerService="20"
      MaxPercentUnhealthyReplicasPerPartition="0"/>
  </HealthPolicy>
</Policies>
```


Health Architecture

Demonstration

Health Reporting

Health Failure Examples

- Cluster: Nodes not responding to periodic heartbeat
  - Applications: Partition could not be placed
    - Service: Failed to place replica(s)
      - Partition: Below target instance count
        - Replica: Replica taking too long to open/close
  - Node: Node down, certificate expiration, load capacity violation
  - Deployed Applications: Failed to download code package
    - Deployed service packages: Service package activation, code package activation, service type registration, download, upgrade validation

Submitting Health Reports

- Have "watchdog" periodically check service instance
  - Watchdog code/process can be in or out of the cluster
  - Keep watchdog simple and "bug-free"
- Submit health reports via Azure PowerShell, REST, .NET API
  - .NET API batches reports and sends ~30 seconds (default)
- Submit helpful health reports that…
  - Prevent downtime, reduce issue investigation time, improve customer satisfaction
    - Ex: Diminishing disk space, bad performance, big queue size
    - Agents can poll health and take action (Ex: delete old files, send e-mails)
- Note: Reports are deleted when entity is deleted
  - To outlive entity, submit a report on the parent entity

Demonstration

Submitting a Health Report

What's in a Health *Report*

- For each entity, Service Fabric stores 1 health report per SourceId/Property

Mandatory Data	Description
Entity	Cluster, Node, App, Service, Partition, Replica, Deployed App, Deployed Service Package
SourceId	String uniquely identifies reporter
Property	Category (ex: "Storage" or "Connectivity")
HealthState	Ok, Warning, Error

Optional Data	Default	Description
Description	""	Human readable info
TimeToLive	Infinite	# seconds before report is expired
RemoveWhenExpired	False	Useful if TTL != Infinite. If false, report's entity is in Error; else report removed after expiration.
SequenceNumber	Auto-generated	Increasing integer. Use to replace old reports when reporting state transitions.

What's in a Health *Event*

- Service Fabric wraps a health event around a health report

Property	Description
HealthInformation	The original health report
SourceUtcTimetamp	The time the health report was originally submitted
LastModifiedUtcTimestamp	The last time the report was modified
IsExpired	True if TTL expired and RemoveWhenExpired=false
LastOkTransitionAt LastWarningTransitionAt LastErrorTransitionAt	These give a history of the event's health states. Ex: Alert if !Ok > 5 minutes

Health report aggregation

Health Report Submission Guidance

- Never submit a report not related to health
  - Health is not a generic reporting mechanism
- Avoid reporting on state transitions because you'll have to synchronize state across failures
- Always clean up reports when no longer valid
  - Ex: Errors affect upgrades
  - So, have watchdog report periodically with TTL and RemoveWhenExpired=false
  - If the watchdog fails, set the Event's IsExpired=true and Entity's health to Error
  - To have the report self-expire, send the report with TTL and RemoveWhenExpired=true

Event Tracing for Windows

Recommended technology for tracing messages in Service Fabric

- **ETW is fast -** It was built as a tracing technology that has minimal impact on code execution times
- **ETW tracing works across local development environments and also real-world cluster setups -** This means you don't have to rewrite your tracing code when you are ready to deploy your code to a real cluster
- **Service Fabric system code also uses ETW for internal tracing -** This allows you to view your application traces interleaved with Service Fabric system traces. It also helps you to more easily understand the sequences and inter-relationships between your application code and events in the underlying system
- There is built-in support in Service Fabric Visual Studio tools to view ETW events

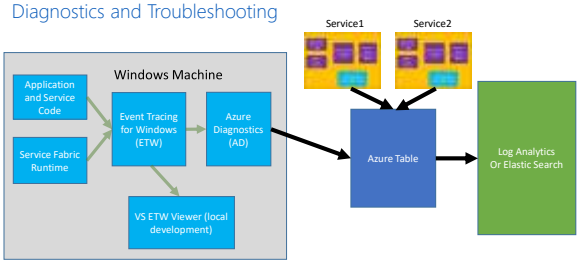
ETW Events in Service Fabric

- Built in ETW events
  - Reliable Actors diagnostics -https://azure.microsoft.com/en-us/documentation/articles/service-fabric-reliable-actors-diagnostics/
  - Reliable Services diagnostics - https://azure.microsoft.com/en-us/documentation/articles/service-fabric-reliable-services-diagnostics/
- Custom ETW events
  - The RunAsync methods in the Visual Studio templates have examples of custom events built in
  - The EventSource classes contain events that are built into the templates, including an implementation designed for high frequency events.

```
// Stateless...
ServiceEventSource.Current.ServiceMessage(this, "Working-{0}", ++iterations);

// Stateful...
ServiceEventSource.Current.ServiceMessage(this, "Current Counter Value: {0}",
result.HasValue ? result.Value.ToString() : "Value does not exist.");
```


Diagnostics and Troubleshooting



Diagnostics Extension

- Deployed to each VM in the cluster
- Collects logs and uploads them to a storage account
- Can configure the extension through the portal or ARM, at create time or on existing cluster

ARM Sample - https://github.com/Azure/azure-quickstart-templates/tree/master/service-fabric-cluster-5-node-1-nodetype-wad
Azure Diagnostics - https://azure.microsoft.com/en-us/documentation/articles/service-fabric-diagnostics-how-to-setup-wad-operational-insights/

Demonstration

Viewing ETW Events in Visual Studio

Decide what to collect

- **Service Fabric logs:** Emitted by the platform to standard ETW and EventSource channels. Logs can be one of several types:
  - Operational events
  - Actor Programming Model events
  - Reliable Services Programming Model events
- **Application events:** Events emitted from your services code and written out by using the EventSource helper class provided in the Visual Studio templates

SQL Database Elastic Search

- You can also use Elastic Search to query and make sense of the logging
- Complete step-by-step for setting this up is available here:
- https://azure.microsoft.com/en-us/documentation/articles/service-fabric-diagnostic-how-to-use-elasticsearch/
- Can configure apps to send directly, or use the diagnostics extension or other aggregator

Recap

- Diagnostics
  - Service Fabric uses ETW + Azure Diagnostics
  - Services get EventSource class for ETW tracing
  - View VS.NET's Diagnostics Events Window or Use *Logman* to copy and view logs after the fact
- Health Reporting
  - Default health reports are provided by Service Fabric
  - Health Reports can be volatile with TTL
  - Apps', Services', Partitions', Replicas' health state are controlled by health policies
  - Report custom health events to Service Fabric via API or PowerShell