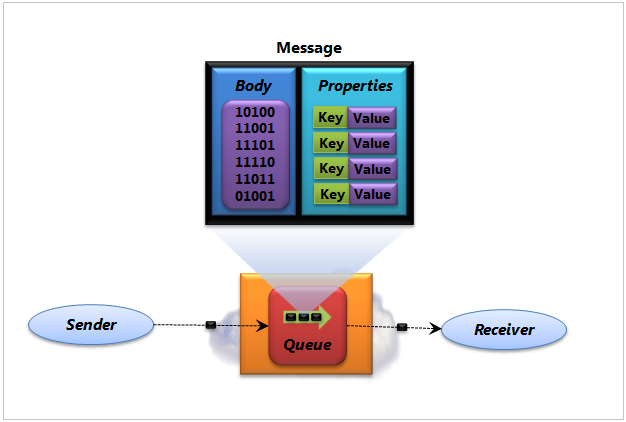
**Azure Service Bus**

* Service Bus Queues.
* Topics and Subscriptions.
* Handling Transactions.
* FIFO using Sessions

**Service Bus Queues**

Queues represent a persistent sequenced buffer into which **one or more senders** / **producer** send messages to **one or more receivers / consumer.** They are based on the first in first out (FIFO) model. They provide various methods to indicate for example time visibility of messages on the queue and the ability of messages to reappear on the queue, duplicate detection, deferred messaging etc.



***Load Balancing***: If the load in queue increases, more worker process can be added to read messages from queue. Each message will be processed by **only one** of the consumer. Consumer computer may differ in processing power, as they will pull messages from queue depending on their own capability/processing power, this pattern is often termed as “**competing consumer**” pattern.

Azure supports two types of queue mechanisms: **Storage queues and Service Bus queues**.

This table provides a summary.

|  |  |  |
| --- | --- | --- |
| **Comparison Criteria** | **Storage Queues** | **Service Bus Queues** |
| Ordering (FIFO) guarantee | No | Yes (Sessions) |
| Delivery guarantee | At-Least-Once | At-Least-Once (PeekLock)  At-Most-Once (ReceiveAndDelete) |
| Batch receive | Yes | Yes |
| Batch send | No | Yes |
| Scheduled delivery | Yes | Yes |
| Max TTL | 7 days | 1,06,75,199 days |
| Automatic dead lettering | No | Yes |
| Message auto-forwarding | No | Yes |
| Message groups | No | Yes |
| Duplicate detection | No | Yes |
| Transaction | No | Yes |
| Max Size of Message | 64 KB | 256 KB (Standard Pricing)  1024 KB (Premium Pricing) |
| Queue Size | 500TB | 80 GB (Premium Pricing)  5 GB (Standard Pricing), |

**Walkthrough:**

1. Create Service Bus namespace:
   1. Topics/subscriptions are not supported in the **Basic pricing** tier.
   2. The **Premium pricing tier** provides resource isolation at the CPU and memory level so that each workload runs in isolation. This resource container is called a messaging unit.

|  |  |
| --- | --- |
| **Premium** | **Standard** |
| High throughput | Variable throughput |
| Predictable performance | Variable latency |
| Fixed pricing | Pay as you go variable pricing |
| Ability to scale workload up and down | N/A |
| Queue Size: 80 GB | Queue Size: 5 GB |
| Message size up to 1 MB. | Message size up to 256 KB |

1. **Azure Portal 🡪 Service Bus 🡪 Select Namespace 🡪 Queue Tab 🡪 Create a New Queue 🡪 Quick Create**
2. **Queue Name = DemoQueue🡪. . . 🡪 OK**

* **Message time to live**. Determines how long a message will stay in the queue before it expires and is removed or dead lettered. This default will be used for all messages in the queue which do not specify a time to live for themselves.
* **Lock duration**. Sets the amount of time a message is locked from other receivers. After its lock expires, a message is pulled by one receiver before being available to be pulled by other receivers. The default is 30 seconds, with a maximum of 5 minutes.
* **Enable duplicate detection**. Configures your queue to keep a history of all messages sent to the queue during a configurable amount of time. During that interval, your queue will not accept any duplicate messages.
* **Enable dead lettering**. Enables holding messages that cannot be successfully delivered to any receiver. The messages are held in a separate queue after they expire. You can inspect this queue.
* **Enable sessions**. Allows ordered handling of unbound sequences of related messages. This guarantees first-in-first-out delivery of messages.
* **Enable Partitions**. Partitions a queue across multiple message brokers and message stores. Partitioning means that the overall throughput of a partitioned entity is no longer limited by the performance of a single message broker or messaging store. In addition, a temporary outage of a messaging store does not render a partitioned queue or topic unavailable.

**Dead Letter Queue Messages**

* Messages that expire before being received are called as Dead Letter Messages.
* Expiring a message can be useful in scenarios where the message has no meaning after certain period of time. For example Weather forecasting website may not be interested in updating yesterday’s weather forecast.
* Setting expiration on messages that are not relevant to consumer will reduce the size of queue and will prevent the application with additional burdon of receiving and discarding those messages. Thus overall improving the performance of the system.
* While creating a queue it is possible to specify **default message time to live**, also we can specify that the expired messages will be dead-lettered instead of getting ignored.

**Get Message Counters:**

Graphical user interface, text

Description automatically generated with medium confidence

|  |  |
| --- | --- |
| **Counter** | **Description** |
| ActiveMessageCount | Number of messages in the queue or subscription that are in the active state and ready for delivery. |
| ScheduledMessageCount | Number of messages in the scheduled state. |
| DeadLetterMessageCount | Number of messages in the dead-letter queue.  <queue path>/$deadletterqueue |
| TransferMessageCount | Number of messages pending transfer into another queue or topic. |
| TransferDeadLetterMessageCount | Number of messages that failed to transfer into another queue or topic and have been moved into the transfer dead-letter queue. |

**Programming in C#**

1. Create a two Console Application (Sender and Receiver)
2. Manage NuGet Package 🡪 Search **Azure.Messaging.ServiceBus**
3. Edit Program.cs (of Sender)

using System;

using System.Threading.Tasks;

using Azure.Messaging.ServiceBus;

class Program

{

static string connectionString = "<NAMESPACE CONNECTION STRING>";

static string queueName = "<QUEUE NAME>";

static async Task Main()

{

ServiceBusClient client = new ServiceBusClient(connectionString);

ServiceBusSender sender = client.CreateSender(queueName);

using ServiceBusMessageBatch messageBatch = await sender.CreateMessageBatchAsync();

while (true)

{

Console.WriteLine("Enter Message (exit to terminate): ");

string m = Console.ReadLine();

if (m == "exit")

break;

var msg = new ServiceBusMessage(m);

msg.ApplicationProperties.Add("Author", "sandeep");

msg.ApplicationProperties.Add("CreatedAt", DateTime.Now);

msg.ApplicationProperties.Add("Source", "DemoApp");

msg.TimeToLive = new TimeSpan(0, 0, 5);

msg.MessageId = msg.GetHashCode().ToString();

await sender.SendMessageAsync(msg);

Console.WriteLine("Sent...");

}

await sender.DisposeAsync();

await client.DisposeAsync();

}

}

//To send a group of messages, you can use the **sender.SendMessagesAsync** method with list of Message object

**Receiver Application:**

using System;

using System.Threading.Tasks;

using Azure.Messaging.ServiceBus;

namespace QueueReceiver

{

class Program

{

static string connectionString = "Endpoint=sb://dssdemo.servicebus.windows.net/;SharedAccessKeyName=RootManageSharedAccessKey;SharedAccessKey=51k0iCoL2iUpiDIFATNdhF0tKCNEcY1VkiGT0t3H6As=";

static string queueName = "demo-queue";

static ServiceBusClient client;

static ServiceBusProcessor processor;

static async Task **MessageHandler**(ProcessMessageEventArgs args)

{

string body = args.Message.Body.ToString();

Console.WriteLine($"Received: {body}, Count: {args.Message.DeliveryCount}");

await args.**CompleteMessageAsync**(args.Message);

}

static Task **ErrorHandler**(ProcessErrorEventArgs args)

{

Console.WriteLine(args.Exception.ToString());

return Task.CompletedTask;

}

static async Task Main()

{

client = new ServiceBusClient(connectionString);

processor = client.**CreateProcessor**(queueName, new ServiceBusProcessorOptions() { ReceiveMode=ServiceBusReceiveMode.PeekLock, AutoCompleteMessages=false});

processor.ProcessMessageAsync += MessageHandler;

processor.ProcessErrorAsync += ErrorHandler;

await processor.StartProcessingAsync();

Console.WriteLine("Wait for a minute and then press any key to end the processing");

Console.ReadKey();

// stop processing

Console.WriteLine("\nStopping the receiver...");

await processor.StopProcessingAsync();

Console.WriteLine("Stopped receiving messages");

await processor.DisposeAsync();

await client.DisposeAsync();

}

}

}

**Note:** You will notice that we need to call the **CompleteMessageAsync** method of the queue client at the end of the message handler method. This ensures that the message is not received again. Alternatively, you can call **AbandonAsync** if you wish to stop handling the message and receive it again.

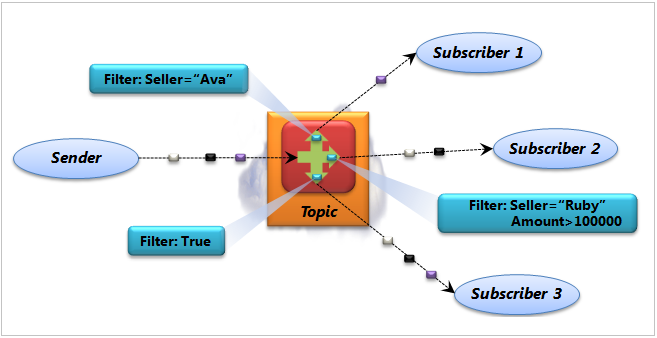
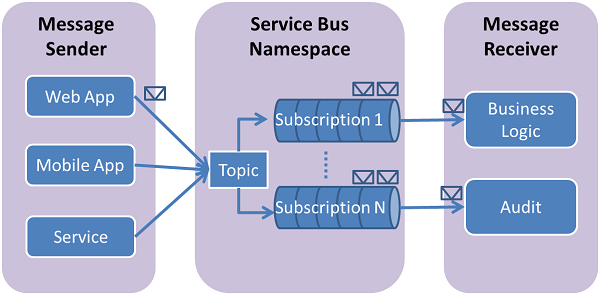
**Topics and Subscriptions**

Topics extend the messaging features provided by Queues with the addition of **Publish-Subscribe** Mechanism.

Senders submit messages to a topic in the same way that they submit messages to a queue, and those messages look the same as with queues.

**Based on the filter a subscribing application specifies, it can receive some or all of the messages sent to a Service Bus topic.**

Unlike queues, however, a single message sent to a topic can be received by multiple subscriptions. This approach, commonly called publish and subscribe (or pub/sub), is useful whenever multiple applications are interested in the same messages.

**Very Important**

A message is submitted from topic into all the **subscription queues** based on filter condition.

Receiver App will receive messages from Subscription and not directly from Topic.

From every subscription (**queue)**, the message will be received by only one application at any point of time (even if multiple application instances are running).

For message to be handled by multiple applications, create a separate subbsciber for each application.

**Sample to Create Queue, Topic and Subscriptions Programmatically:**

<https://github.com/Azure-Samples/service-bus-dotnet-management/blob/a55185bef30d1763c1a8182a3361dbb548bad436/src/service-bus-dotnet-management/ServiceBusManagementSample.cs>

**About Filters:**

<https://docs.microsoft.com/en-us/azure/service-bus-messaging/topic-filters>

**Publisher Console Application: (.NET Core Console Application)**

using System;

using System.Threading.Tasks;

using Azure.Messaging.ServiceBus;

class ProgramToSentInTopic

{

static string connectionString = "Endpoint=sb://dssdemo.servicebus.windows.net/;SharedAccessKeyName=RootManageSharedAccessKey;SharedAccessKey=t0P0CtA3PhEZLmzsEHSFijxFmXH4Uk8JYXhbMqoK+JM=";

static string topicName = "courses";

static ServiceBusClient client;

static ServiceBusSender sender;

static async Task Main()

{

client = new ServiceBusClient(connectionString);

sender = client.CreateSender(topicName);

while (true)

{

Console.WriteLine("Enter Message (exit to terminate): ");

string m = Console.ReadLine();

if (m == "exit")

break;

var msg = new ServiceBusMessage(m);

Console.WriteLine("Enter Author of message: ");

string author = Console.ReadLine();

msg.ApplicationProperties.Add("Author", author);

msg.ApplicationProperties.Add("CreatedAt", DateTime.Now);

msg.ApplicationProperties.Add("Source", "DemoApp");

msg.TimeToLive = new TimeSpan(0, 0, 5);

msg.MessageId = msg.GetHashCode().ToString();

await sender.SendMessageAsync(msg);

Console.WriteLine("Sent...");

}

await sender.DisposeAsync();

await client.DisposeAsync();

}

}

**All Author Subscriber Console Application (.NET Core)**

using System;

using System.Threading.Tasks;

using Azure.Messaging.ServiceBus;

class Program

{

static string connectionString = "<NAMESPACE CONNECTION STRING>";

static string topicName = "<SERVICE BUS TOPIC NAME>";

static string subscriptionName = "<SERVICE BUS - TOPIC SUBSCRIPTION NAME>"; //AllSubscription or SandeepSubscription

static ServiceBusClient client;

static ServiceBusProcessor processor;

static async Task **MessageHandler**(ProcessMessageEventArgs args)

{

string body = args.Message.Body.ToString();

Console.WriteLine($"Received: {body} from subscription: {subscriptionName}");

await args.CompleteMessageAsync(args.Message);

}

static Task **ErrorHandler**(ProcessErrorEventArgs args)

{

Console.WriteLine(args.Exception.ToString());

return Task.CompletedTask;

}

static async Task Main()

{

client = new **ServiceBusClient**(connectionString);

var options = new ServiceBusProcessorOptions();

options.ReceiveMode = ServiceBusReceiveMode.PeekLock;

processor = client.**CreateProcessor**(topicName, subscriptionName, options);

try

{

processor.ProcessMessageAsync += MessageHandler;

processor.ProcessErrorAsync += ErrorHandler;

await processor.StartProcessingAsync();

Console.WriteLine("Wait for a minute and then press any key to end the processing");

Console.ReadKey();

Console.WriteLine("\nStopping the receiver...");

await processor.StopProcessingAsync();

Console.WriteLine("Stopped receiving messages");

}

finally

{

await processor.DisposeAsync();

await client.DisposeAsync();

}

}

}

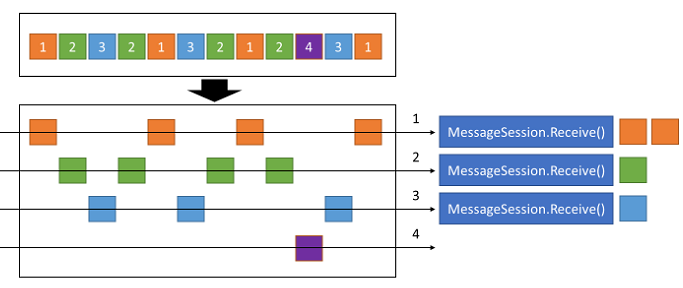
**AuthorSandeep** Subscription (Author = Sandeep)

Graphical user interface, application

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**Session Service Bus**

Service Bus sessions enable joint and ordered handling of unbounded sequences of related messages. To realize a **FIFO guarantee** in Service Bus you need to use **Sessions**. Any sender can create a session when submitting messages into a topic or queue by setting the [SessionId](https://docs.microsoft.com/en-us/dotnet/api/microsoft.azure.servicebus.message.sessionid#Microsoft_Azure_ServiceBus_Message_SessionId) broker property to some application-defined identifier that is unique to the session.



**To send messages in a session.**

**message.SessionId = "abcd";**

Note: For every message object, same session id should be used for them to in in FIFO

**To Receive Messages:**

using System;

using System.Threading.Tasks;

using Azure.Messaging.ServiceBus;

class Program

{

static string connectionString = "<NAMESPACE CONNECTION STRING>";

static string queueName = "<QUEUE NAME>";

static ServiceBusClient client;

static ServiceBusSessionProcessor processor;

static async Task **MessageHandler**(**ProcessSessionMessageEventArgs** args)

{

string body = args.Message.Body.ToString();

Console.WriteLine($"Received: {body}");

await args.CompleteMessageAsync(args.Message);

}

static Task ErrorHandler(ProcessErrorEventArgs args)

{

Console.WriteLine(args.Exception.ToString());

return Task.CompletedTask;

}

static async Task Main()

{

client = new ServiceBusClient(connectionString);

var options = new **ServiceBusSessionProcessorOptions**()

{

**SessionIds** = { "abcd" }

};

processor = client.**CreateSessionProcessor**(queueName, options);

processor.ProcessMessageAsync += MessageHandler;

processor.ProcessErrorAsync += ErrorHandler;

await processor.StartProcessingAsync();

Console.WriteLine("Wait for a minute and then press any key to end the processing");

Console.ReadKey();

// stop processing

Console.WriteLine("\nStopping the receiver...");

await processor.StopProcessingAsync();

Console.WriteLine("Stopped receiving messages");

await processor.DisposeAsync();

await client.DisposeAsync();

}

}

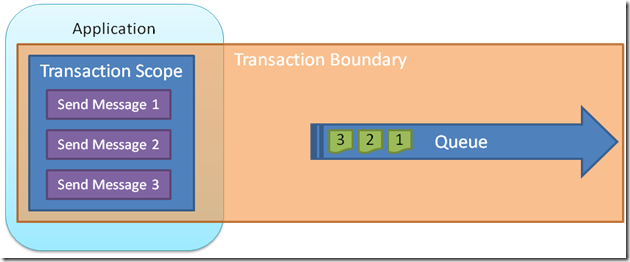
**Transactions in Brokered Messaging**

Transaction support in Service Bus Brokered Messaging allows message operations to be performed within a transactional scope; however there are some limitations around what operations can be performed within the transaction.

In the current release, only one top level messaging entity, such as a **only one queue** or or **only one topic** can participate in a transaction, and the transaction cannot include any other transaction resource managers, **making transactions spanning a messaging entity (multiple queues or topic) and a database not possible.**

**Sending Transactional Messages:**

When sending messages, the send operations can participate in a transaction allowing multiple messages to be sent within a transactional scope. This allows for “**all or nothing**” delivery of a series of messages to a single queue or topic.



An example of the code used to send 10 messages to a queue as a single transaction from a console application is shown below.

Messages that are sent as part of a transaction must specify **a partition key**. The key can be one of the following properties: session ID, partition key, or message ID.  **All messages in a given transaction must be in same partition key.**

**Note: Partition Key in order of Priority**

1. SessionId
2. PartitionKey
3. MessageId

**To the project add reference to System.Transactions.**

using Microsoft.Azure.ServiceBus;

using Microsoft.Azure.ServiceBus.Management;

using System;

using System.Linq;

using System.Threading.Tasks;

**using System.Transactions;**

class Program

{

    static void Main(string[] args)

    {

        var queueName = "tranqueue";

        var connectionString = "Endpoint=sb://dssdemo.servicebus.windows.net/;SharedAccessKeyName=RootManageSharedAccessKey;SharedAccessKey=fXbUbJTu7hhrQO93ZslGSgV+L0l9PA3bxBV4ZOtbIpg=";

        var queueClient = new QueueClient(connectionString, queueName);

        using (**TransactionScope scope = new TransactionScope())**

        {

            for (int i = 0; i < 10; i++)

            {

                // Send a message

                Message msg = new Message(System.Text.Encoding.UTF8.GetBytes("Message" + i));

                msg.**PartitionKey** = "demopartition";

                queueClient.SendAsync(msg).Wait();

                Console.Write(".");

            }

            Console.WriteLine("Done!");

            Console.WriteLine();

            // Should we commit the transaction?

            Console.WriteLine("Commit sent 10 messages? (yes or no)");

            string reply = Console.ReadLine();

            if (reply.ToLower().Equals("yes"))

                scope.**Complete**();

        }

        Console.WriteLine();

    }

}

Receive is not part of transaction. Only operations which actually do something with the message on the broker are part of the transaction.

These are: Send, Complete, Deadletter, Defer. Receive itself already utilizes the peeklock concept on the broker.

**Note: Partitioned queues and topics aren't supported in the Premium messaging tier. Sessions are supported in the premier tier by using SessionId.**

Service Bus client libraries that are used for operations like send and receive messages can also be used to manage queues, topics, subscriptions, and rules in an existing Service Bus namespace.

Use **ServiceBusAdministrationClient** class.