SUPERSET ID - 6364957

Kafka Integration with C#:

Outline:

- Introduction to Kafka
- Kafka Architecture
- Topics
- Partitions
- Brokers
- Kafka plug in .NET
- Installation of Kafka
- Basics of Zookeeper
- Demo

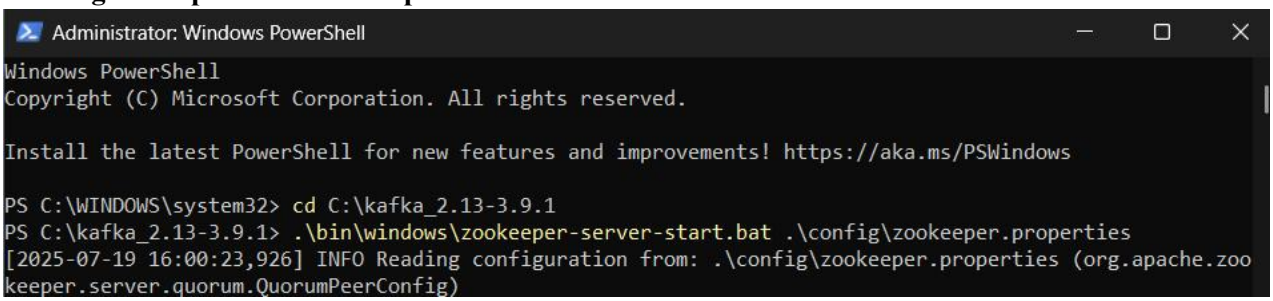
Hands On:

1. Create a Chat Application which uses Kafka as a streaming platform and consume the chat messages in the command prompt.

2. Create a Chat Application using C# Windows Application using Kafka and consume the message in different client applications.

Kafka Setup for Services after Installation and Changing Required Config Contents with correct Path :

- **Starting Zookeper in cmd Prompt:**



- Starting kafka Server in another cmd Prompt:

```
Administrator: Windows PowerShell
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\WINDOWS\system32> cd C:\kafka_2.13-3.9.1
PS C:\kafka_2.13-3.9.1> .\bin\windows\kafka-server-start.bat .\config\server.properties
[2025-07-19 16:01:13,039] INFO Registered kafka:type=kafka.Log4jController MBean (kafka.utils.Log4jContr
ollerRegistration$)
[2025-07-19 16:01:13,233] INFO Setting -D jdk.tls.rejectClientInitiatedRenegotiation=true to disable cli
ent-initiated TLS renegotiation (org.apache.zookeeper.common.X509Util)
[2025-07-19 16:01:13,317] INFO starting (kafka.server.KafkaServer)
[2025-07-19 16:01:13,318] INFO Connecting to zookeeper on localhost:2181 (kafka.server.KafkaServer)
[2025-07-19 16:01:13,339] INFO [ZooKeeperClient Kafka server] Initializing a new session to localhost:21
81. (kafka.zookeeper.ZooKeeperClient)
```

- **Creating a Topic in another cmd Prompt:**

```
Select Administrator: Windows PowerShell
PS C:\WINDOWS\system32> cd C:\kafka_2.13-3.9.1
PS C:\kafka_2.13-3.9.1> .\bin\windows\kafka-topics.bat --create --topic chat-topic --bootstrap-server lo
calhost:9092 --partitions 1 --replication-factor 1
```

- Kafka Topic Creation:

  kafka-topics.bat --create --topic chat-topic --bootstrap-server localhost:9092 --partitions 1 --replication-factor 1

HANDSON-1

Project Setup

1. Creating New Console Project

```
# Creating project directory
mkdir KafkaChatApp
cd KafkaChatApp

# Initializing new console application
dotnet new console

# Adding Kafka client package
dotnet add package Confluent.Kafka
```

Implementation Files

File 1: Producer.cs

- **Purpose:** Sends messages to a Kafka topic.
- **Key Concepts:** `ProducerConfig`, `ProduceAsync`, message serialization.

```
using Confluent.Kafka;
using System;
using System.Threading.Tasks;

namespace KafkaChatApp
{
    public class ChatProducer
    {
        private readonly string _bootstrapServers;
        private readonly string _topicName;

        public ChatProducer(string bootstrapServers, string topicName)
        {
            _bootstrapServers = bootstrapServers;
            _topicName = topicName;
        }

        public async Task StartProducing()
        {
            var config = new ProducerConfig
            {
                BootstrapServers = _bootstrapServers,
                ClientId = "chat-producer"
            };

            using var producer = new ProducerBuilder<string, string>(config).Build();

            Console.WriteLine("Chat Producer Started. Type messages (type 'exit' to quit):");
```

```
        Console.WriteLine("Format: username: message");


        string input;
        while ((input = Console.ReadLine()) != "exit")
        {
            if (string.IsNullOrWhiteSpace(input)) continue;


            try
            {
                var message = new Message<string, string>
                {
                    Key = DateTime.Now.ToString("yyyy-MM-dd HH:mm:ss"),
                    Value = input
                };


                var result = await producer.ProduceAsync(_topicName, message);
                Console.WriteLine($"✓ Message sent: {result.TopicPartitionOffset}");
            }
            catch (ProduceException<string, string> ex)
            {
                Console.WriteLine($"✗ Failed to send message: {ex.Error.Reason}");
            }
        }
    }
  }
}
```

File 2: Consumer.cs

- **Purpose:** Receives and processes messages from Kafka.
- **Key Concepts:** `ConsumerConfig`, `Subscribe`, `Consume`, offset management.

```
using Confluent.Kafka;
using System;
```

```
using System.Threading;


namespace KafkaChatApp
{
    public class ChatConsumer
    {
        private readonly string _bootstrapServers;
        private readonly string _topicName;
        private readonly string _groupId;

        public ChatConsumer(string bootstrapServers, string topicName, string groupId)
        {
            _bootstrapServers = bootstrapServers;
            _topicName = topicName;
            _groupId = groupId;
        }

        public void StartConsuming()
        {
            var config = new ConsumerConfig
            {
                BootstrapServers = _bootstrapServers,
                GroupId = _groupId,
                AutoOffsetReset = AutoOffsetReset.Earliest,
                EnableAutoCommit = true,
                ClientId = "chat-consumer"
            };

            using var consumer = new ConsumerBuilder<string, string>(config).Build();
            consumer.Subscribe(_topicName);

            Console.WriteLine($"Chat Consumer Started. Listening to topic: {_topicName}");
```

```
Console.WriteLine("Press Ctrl+C to stop...");


var cts = new CancellationTokenSource();
Console.CancelKeyPress += (_, e) =>
{
    e.Cancel = true;
    cts.Cancel();
};


try
{
    while (!cts.Token.IsCancellationRequested)
    {
        try
        {
            var result = consumer.Consume(cts.Token);
            if (result != null)
            {
                Console.WriteLine($"[{result.Message.Key}] {result.Message.Value}");
            }
        }
        catch (ConsumeException ex)
        {
            Console.WriteLine($"✗ Consume error: {ex.Error.Reason}");
        }
    }
}
catch (OperationCanceledException)
{
    Console.WriteLine("Shutting down consumer...");
}
finally
```

```
        {
            consumer.Close();
        }
    }
  }
}
}
```

Key Components Explained

- **ConsumerConfig:** Consumer settings
- **ConsumerBuilder:** Creates typed consumer
- **Subscribe:** Start listening for messages on topic
- **Consume:** Poll for messages

File 3: Program.cs

- **Purpose:** User interface and application entry point.
- **Key Concepts:** App flow, user input, dependency coordination.

```
using System;
using System.Threading.Tasks;

namespace KafkaChatApp
{
  class Program
  {
    private const string BootstrapServers = "localhost:9092";
    private const string TopicName = "chat-topic";

    static async Task Main(string[] args)
    {
      Console.WriteLine("Kafka Chat Application");
      Console.WriteLine("1. Producer (Send messages)");
```

```
        Console.WriteLine("2. Consumer (Receive messages)");
        Console.Write("Choose option (1 or 2): ");

        var choice = Console.ReadLine();

        switch (choice)
        {
            case "1":
                await RunProducer();
                break;
            case "2":
                RunConsumer();
                break;
            default:
                Console.WriteLine("Invalid choice. Exiting...");
                break;
        }
    }

    private static async Task RunProducer()
    {
        var producer = new ChatProducer(BootstrapServers, TopicName);
        await producer.StartProducing();
    }

    private static void RunConsumer()
    {
        var consumer = new ChatConsumer(BootstrapServers, TopicName, "chat-group");
        consumer.StartConsuming();
    }
  }
}
```

Key Components Explained

- **Main:** Entry point uses `async/await`
- **Switch:** User chooses producer/consumer mode
- **Method Separation:** Clear mode control

Build and Compile

```
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions
\Week 5 Solution\kafka> cd KafkaChatApp
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions
\Week 5 Solution\kafka\KafkaChatApp> dotnet build
Restore complete (0.8s)
  KafkaChatApp succeeded with 1 warning(s) (3.6s) → bin\Debug\net9.0\Ka
fkaChatApp.dll
    C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solution
s\Week 5 Solution\kafka\KafkaChatApp\Producer.cs(32,29): warning CS8600
: Converting null literal or possible null value to non-nullable type.

Build succeeded with 1 warning(s) in 4.8s
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions
\Week 5 Solution\kafka\KafkaChatApp>
```

Running the Application

- **Terminal 1: Starting Producer**

```
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions
\Week 5 Solution\kafka\KafkaChatApp> dotnet run
Kafka Chat Application
1. Producer (Send messages)
2. Consumer (Receive messages)
Choose option (1 or 2):
```

<u>Output</u>

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS        dotnet - KafkaChatApp

PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\
KafkaChatApp> dotnet run
Kafka Chat Application
1. Producer (Send messages)
2. Consumer (Receive messages)
Choose option (1 or 2): 1
Chat Producer Started. Type messages (type 'exit' to quit):
Format: username: message
Sachin: Hey, how you doing C# .NET FSE Handson
✓ Message sent: chat-topic [[0]] @3
Archi: I am doing by best to solve all Handson in time
✓ Message sent: chat-topic [[0]] @4
```

- **Terminal 2: Starting Consumer**

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS        dotnet - KafkaChatApp

PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka>
 cd KafkaChatApp
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\
KafkaChatApp> dotnet run
Kafka Chat Application
1. Producer (Send messages)
2. Consumer (Receive messages)
Choose option (1 or 2): 2
```

<u>Output</u>

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS        dotnet - KafkaChatApp

PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka>
 cd KafkaChatApp
PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\
KafkaChatApp> dotnet run
Kafka Chat Application
1. Producer (Send messages)
2. Consumer (Receive messages)
Choose option (1 or 2): 2
Chat Consumer Started. Listening to topic: chat-topic
Press Ctrl+C to stop...
[2025-07-19 17:55:00] Sachin: Hey, how you doing C# .NET FSE Handson
[2025-07-19 17:57:11] Archi: I am doing by best to solve all Handson in time
```

Note:
These commands must be running on in the separate Powershell Cmd Prompt

✓ **PS C:\kafka_2.13-3.9.1> .\bin\windows\zookeeper-server-start.bat config\zookeeper.properties**

✓ **PS C:\kafka_2.13-3.9.1> .\bin\windows\kafka-server-start.bat .\config\server.properties**

HANDSON-2:

Kafka Windows Forms Chat Application GUI Based

1. Creating a New Project

Opening a terminal and creating a new Windows Forms application separate from any Console apps:

```
# Navigating to development folder
C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\KafkaChatApp-GUI

# Creating project directory
mkdir KafkaWinFormsChatApp
cd KafkaWinFormsChatApp

# Initializing Windows Forms project
dotnet new winforms
```

```
afkaChatApp-GUI\KafkaWinFormsChatApp> dotnet new winforms
The template "Windows Forms App" was created successfully.

Processing post-creation actions...
Restoring C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\
kafka\KafkaChatApp-GUI\KafkaWinFormsChatApp\KafkaWinFormsChatApp.csproj:
Restore succeeded.
```

```
# Adding Kafka client library
dotnet add package Confluent.Kafka
```

```
PROBLEMS    OUTPUT    TERMINAL    ···        powershell - KafkaWinFormsChatApp

PS C:\Users\KIIT\OneDrive\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\K
afkaChatApp-GUI\KafkaWinFormsChatApp> dotnet add package Confluent.Kafka

Build succeeded in 1.0s
info : X.509 certificate chain validation will use the default trust store selected by .NET for
 code signing.
info : X.509 certificate chain validation will use the default trust store selected by .NET for
 timestamping.
info : Adding PackageReference for package 'Confluent.Kafka' into project 'C:\Users\KIIT\OneDri
ve\Desktop\Cognizant_DeepSkilling_.NET_solutions\Week 5 Solution\kafka\KafkaChatApp-GUI\KafkaWi
nFormsChatApp\KafkaWinFormsChatApp.csproj'.
info :   GET https://api.nuget.org/v3/registration5-gz-semver2/confluent.kafka/index.json
```

2. Replacing Program.cs

Updating `Program.cs` so the project launches the main chat form:

```
using System;
using System.Windows.Forms;

namespace KafkaWinFormsChatApp
{
    internal static class Program
    {
        [STAThread]
        static void Main()
        {
            Application.EnableVisualStyles();
            Application.SetCompatibleTextRenderingDefault(false);
            Application.Run(new MainForm());
        }
    }
}
```

3. Adding MainForm.cs

This file contains the chat interface, Kafka connection, and all messaging logic. Saving the following as `MainForm.cs`:

```
using System;

using System.Drawing;

using System.Threading;

using System.Threading.Tasks;

using System.Windows.Forms;

using Confluent.Kafka;


namespace KafkaWinFormsChatApp

{

    public partial class MainForm : Form

    {

        private const string BootstrapServers = "localhost:9092";

        private const string TopicName = "chat-topic";
```

```
// UI Controls
private TextBox txtUsername;
private TextBox txtMessage;
private RichTextBox rtbChatHistory;
private Button btnSend;
private Button btnConnect;
private Button btnDisconnect;
private Label lblStatus;
private Label lblUsername;
private Label lblInstructions;

// Kafka components
private IProducer<string, string> _producer;
private IConsumer<string, string> _consumer;
private CancellationTokenSource _cancellationTokenSource;
private Task _consumerTask;
private bool _isConnected = false;
private string _groupId;

public MainForm()
{
    InitializeComponent();
    _groupId = $"chat-group-{Environment.MachineName}-{DateTime.Now.Ticks}";
}

private void InitializeComponent()
{
    this.SuspendLayout();

    // Form properties
    this.Text = "Kafka Chat Application - Windows Forms";
```

```
this.Size = new Size(700, 550);
this.StartPosition = FormStartPosition.CenterScreen;
this.MinimumSize = new Size(600, 400);

// Instructions label
lblInstructions = new Label
{
    Text = "Enter your username and click Connect to join the chat",
    Location = new Point(10, 10),
    Size = new Size(400, 20),
    Font = new Font("Segoe UI", 9, FontStyle.Italic),
    ForeColor = Color.DarkBlue
};
this.Controls.Add(lblInstructions);

// Username label
lblUsername = new Label
{
    Text = "Username:",
    Location = new Point(10, 40),
    Size = new Size(80, 23),
    Font = new Font("Segoe UI", 9, FontStyle.Bold)
};
this.Controls.Add(lblUsername);

// Username textbox
txtUsername = new TextBox
{
    Location = new Point(100, 37),
    Size = new Size(150, 23),
    Text = Environment.UserName,
    Font = new Font("Segoe UI", 9)
```

```
};
this.Controls.Add(txtUsername);

// Connect button
btnConnect = new Button
{
    Text = "Connect",
    Location = new Point(260, 36),
    Size = new Size(80, 25),
    Font = new Font("Segoe UI", 9),
    BackColor = Color.LightGreen
};
btnConnect.Click += BtnConnect_Click;
this.Controls.Add(btnConnect);

// Disconnect button
btnDisconnect = new Button
{
    Text = "Disconnect",
    Location = new Point(350, 36),
    Size = new Size(80, 25),
    Enabled = false,
    Font = new Font("Segoe UI", 9),
    BackColor = Color.LightCoral
};
btnDisconnect.Click += BtnDisconnect_Click;
this.Controls.Add(btnDisconnect);

// Status label
lblStatus = new Label
{
    Text = "Status: Disconnected",
```

```
        Location = new Point(440, 40),
        Size = new Size(200, 23),
        ForeColor = Color.Red,
        Font = new Font("Segoe UI", 9, FontStyle.Bold)
    };
    this.Controls.Add(lblStatus);

    // Chat history
    rtbChatHistory = new RichTextBox
    {
        Location = new Point(10, 70),
        Size = new Size(660, 350),
        ReadOnly = true,
        BackColor = Color.White,
        ScrollBars = RichTextBoxScrollBars.Vertical,
        Font = new Font("Consolas", 9),
        BorderStyle = BorderStyle.Fixed3D
    };
    this.Controls.Add(rtbChatHistory);

    // Message input label
    var lblMessage = new Label
    {
        Text = "Message:",
        Location = new Point(10, 435),
        Size = new Size(60, 23),
        Font = new Font("Segoe UI", 9, FontStyle.Bold)
    };
    this.Controls.Add(lblMessage);

    // Message input textbox
    txtMessage = new TextBox
```

```
        {
            Location = new Point(80, 432),
            Size = new Size(500, 23),
            Enabled = false,
            Font = new Font("Segoe UI", 9)
        };
        txtMessage.KeyPress += TxtMessage_KeyPress;
        this.Controls.Add(txtMessage);

        // Send button
        btnSend = new Button
        {
            Text = "Send",
            Location = new Point(590, 431),
            Size = new Size(80, 25),
            Enabled = false,
            Font = new Font("Segoe UI", 9),
            BackColor = Color.LightBlue
        };
        btnSend.Click += BtnSend_Click;
        this.Controls.Add(btnSend);

        // Form event handlers
        this.FormClosing += MainForm_FormClosing;
        this.Load += MainForm_Load;

        this.ResumeLayout();
    }

    private void MainForm_Load(object sender, EventArgs e)
    {
        AppendToChatHistory("System", "Welcome to Kafka Chat! Enter your username and click Connect.", Color.Blue);
```

```
        txtUsername.Focus();
    }

    private async void BtnConnect_Click(object sender, EventArgs e)
    {
        if (string.IsNullOrWhiteSpace(txtUsername.Text))
        {
            MessageBox.Show("Please enter a username", "Error", MessageBoxButtons.OK, MessageBoxIcon.Warning);
            txtUsername.Focus();
            return;
        }

        try
        {
            btnConnect.Enabled = false;
            btnConnect.Text = "Connecting...";

            await ConnectToKafka();
            UpdateUIConnectionState(true);
            AppendToChatHistory("System", $"Connected to chat as '{txtUsername.Text}'", Color.Green);
            txtMessage.Focus();
        }
        catch (Exception ex)
        {
            MessageBox.Show($"Failed to connect to Kafka:\n{ex.Message}", "Connection Error", MessageBoxButtons.OK,
MessageBoxIcon.Error);
            btnConnect.Enabled = true;
            btnConnect.Text = "Connect";
        }
    }

    private async void BtnDisconnect_Click(object sender, EventArgs e)
```

```
{
    btnDisconnect.Enabled = false;
    btnDisconnect.Text = "Disconnecting...";

    await DisconnectFromKafka();
    UpdateUIConnectionState(false);
    AppendToChatHistory("System", "Disconnected from chat", Color.Red);

    btnDisconnect.Text = "Disconnect";
}

private async Task ConnectToKafka()
{
    // Initialize producer
    var producerConfig = new ProducerConfig
    {
        BootstrapServers = BootstrapServers,
        ClientId = $"chat-producer-{txtUsername.Text}",
        MessageTimeoutMs = 10000
    };
    _producer = new ProducerBuilder<string, string>(producerConfig).Build();

    // Initialize consumer
    var consumerConfig = new ConsumerConfig
    {
        BootstrapServers = BootstrapServers,
        GroupId = _groupId,
        AutoOffsetReset = AutoOffsetReset.Latest,
        EnableAutoCommit = true,
        ClientId = $"chat-consumer-{txtUsername.Text}",
        SessionTimeoutMs = 10000
    };
```

```
    _consumer = new ConsumerBuilder<string, string>(consumerConfig).Build();
    _consumer.Subscribe(TopicName);

    // Start consuming messages
    _cancellationTokenSource = new CancellationTokenSource();
    _consumerTask = Task.Run(() => ConsumeMessages(_cancellationTokenSource.Token));

    _isConnected = true;
}

private async Task DisconnectFromKafka()
{
    _isConnected = false;

    if (_cancellationTokenSource != null)
    {
        _cancellationTokenSource.Cancel();
        if (_consumerTask != null)
        {
            try
            {
                await _consumerTask;
            }
            catch (OperationCanceledException)
            {
                // Expected
            }
        }
    }

    _consumer?.Close();
    _consumer?.Dispose();
```

```
    _producer?.Dispose();
}

private void ConsumeMessages(CancellationToken cancellationToken)
{
    try
    {
        while (!cancellationToken.IsCancellationRequested)
        {
            try
            {
                var result = _consumer.Consume(TimeSpan.FromMilliseconds(1000));
                if (result != null && !result.IsPartitionEOF)
                {
                    var parts = result.Message.Value.Split(new[] { ": " }, 2, StringSplitOptions.None);
                    if (parts.Length == 2)
                    {
                        var username = parts[0];
                        var message = parts[1];

                        // Don't display our own messages (they're already shown when sent)
                        if (username != txtUsername.Text)
                        {
                            this.Invoke(new Action(() =>
                            {
                                AppendToChatHistory(username, message, Color.Blue);
                            }));
                        }
                    }
                }
            }
            catch (ConsumeException ex)
```

```
            {
                if (!cancellationToken.IsCancellationRequested)
                {
                    this.Invoke(new Action(() =>
                    {
                        AppendToChatHistory("System", $"Error receiving message: {ex.Error.Reason}", Color.Red);
                    }));
                }
            }
        }
    }
    catch (OperationCanceledException)
    {
        // Expected when cancellation is requested
    }
}

private async void BtnSend_Click(object sender, EventArgs e)
{
    await SendMessage();
}

private void TxtMessage_KeyPress(object sender, KeyPressEventArgs e)
{
    if (e.KeyChar == (char)Keys.Enter)
    {
        e.Handled = true;
        Task.Run(async () => await SendMessage());
    }
}

private async Task SendMessage()
```

```
{
    if (string.IsNullOrWhiteSpace(txtMessage.Text) || !_isConnected)
        return;

    var messageText = txtMessage.Text;

    try
    {
        var kafkaMessage = new Message<string, string>
        {
            Key = DateTime.Now.ToString("yyyy-MM-dd HH:mm:ss"),
            Value = $"{txtUsername.Text}: {messageText}"
        };

        await _producer.ProduceAsync(TopicName, kafkaMessage);

        // Display our own message immediately
        this.Invoke(new Action(() =>
        {
            AppendToChatHistory(txtUsername.Text, messageText, Color.DarkGreen);
            txtMessage.Clear();
        }));
    }
    catch (ProduceException<string, string> ex)
    {
        this.Invoke(new Action(() =>
        {
            AppendToChatHistory("System", $"Failed to send message: {ex.Error.Reason}", Color.Red);
        }));
    }
}
```

```
private void AppendToChatHistory(string username, string message, Color color)
{
    var timestamp = DateTime.Now.ToString("HH:mm:ss");

    // Move to end
    rtbChatHistory.SelectionStart = rtbChatHistory.TextLength;
    rtbChatHistory.SelectionLength = 0;

    // Add timestamp
    rtbChatHistory.SelectionColor = Color.Gray;
    rtbChatHistory.AppendText($"[{timestamp}] ");

    // Add username
    rtbChatHistory.SelectionColor = color;
    rtbChatHistory.SelectionFont = new Font(rtbChatHistory.Font, FontStyle.Bold);
    rtbChatHistory.AppendText($"{username}: ");

    // Add message
    rtbChatHistory.SelectionColor = Color.Black;
    rtbChatHistory.SelectionFont = new Font(rtbChatHistory.Font, FontStyle.Regular);
    rtbChatHistory.AppendText($"{message}\n");

    // Reset formatting
    rtbChatHistory.SelectionColor = rtbChatHistory.ForeColor;
    rtbChatHistory.SelectionFont = rtbChatHistory.Font;

    // Auto-scroll
    rtbChatHistory.ScrollToCaret();
}

private void UpdateUIConnectionState(bool connected)
{
```

```
        _isConnected = connected;
        btnConnect.Enabled = !connected;
        btnConnect.Text = "Connect";
        btnDisconnect.Enabled = connected;
        txtMessage.Enabled = connected;
        btnSend.Enabled = connected;
        txtUsername.Enabled = !connected;

        lblStatus.Text = connected ? "Status: Connected" : "Status: Disconnected";
        lblStatus.ForeColor = connected ? Color.Green : Color.Red;

        if (connected)
        {
            lblInstructions.Text = $"Connected as '{txtUsername.Text}' - Type messages below";
            lblInstructions.ForeColor = Color.DarkGreen;
        }
        else
        {
            lblInstructions.Text = "Enter your username and click Connect to join the chat";
            lblInstructions.ForeColor = Color.DarkBlue;
        }
    }

    private async void MainForm_FormClosing(object sender, FormClosingEventArgs e)
    {
        if (_isConnected)
        {
            await DisconnectFromKafka();
        }
    }
  }
}
```

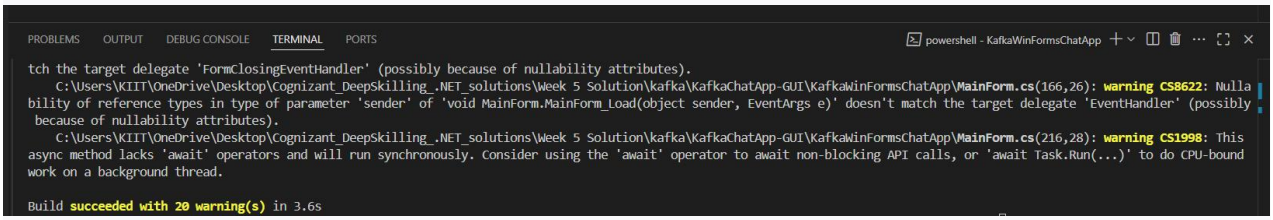
4. Updating Project File

Replacing `KafkaWinFormsChatApp.csproj` with:

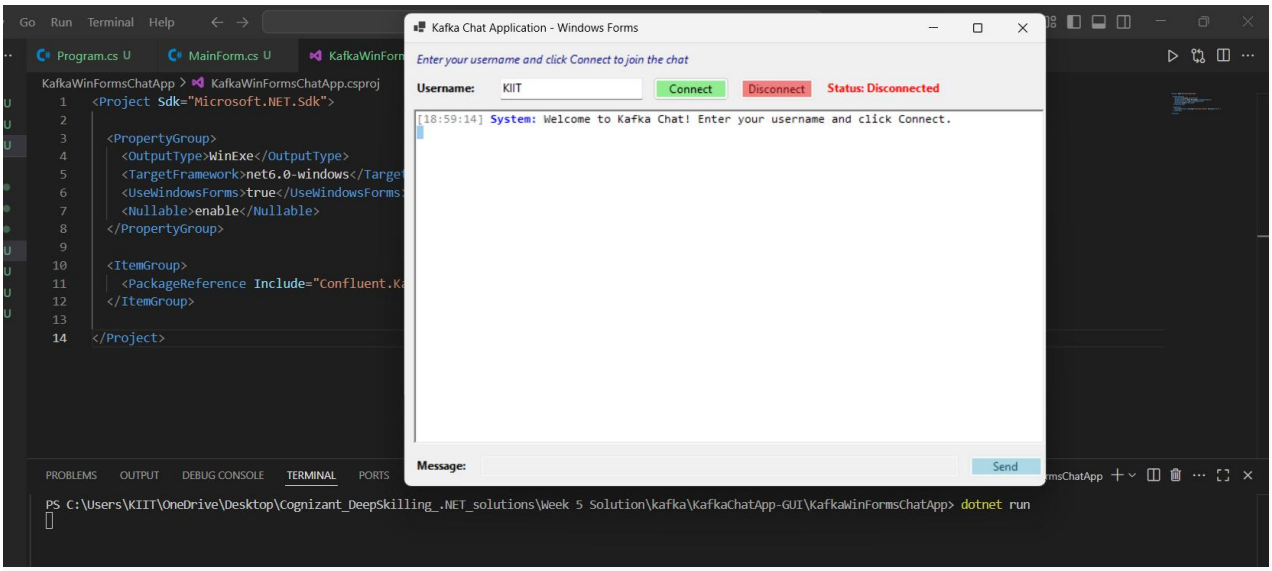
```
<Project Sdk="Microsoft.NET.Sdk">
  <PropertyGroup>
    <OutputType>WinExe</OutputType>
    <TargetFramework>net6.0-windows</TargetFramework>
    <UseWindowsForms>true</UseWindowsForms>
    <Nullable>enable</Nullable>
  </PropertyGroup>

  <ItemGroup>
    <PackageReference Include="Confluent.Kafka" Version="2.3.0" />
  </ItemGroup>
</Project>
```

5. Building and Running the Application

dotnet build

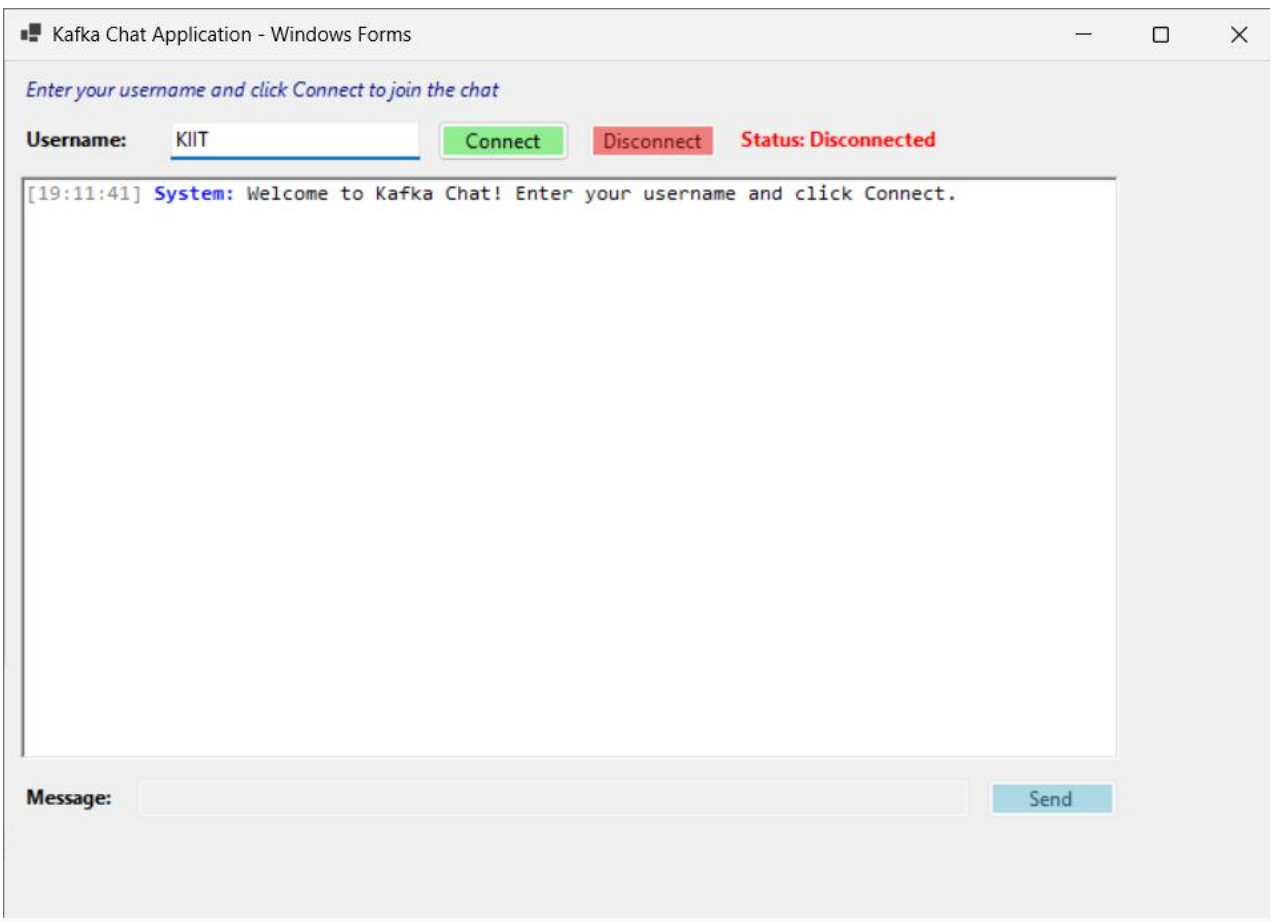


dotnet run

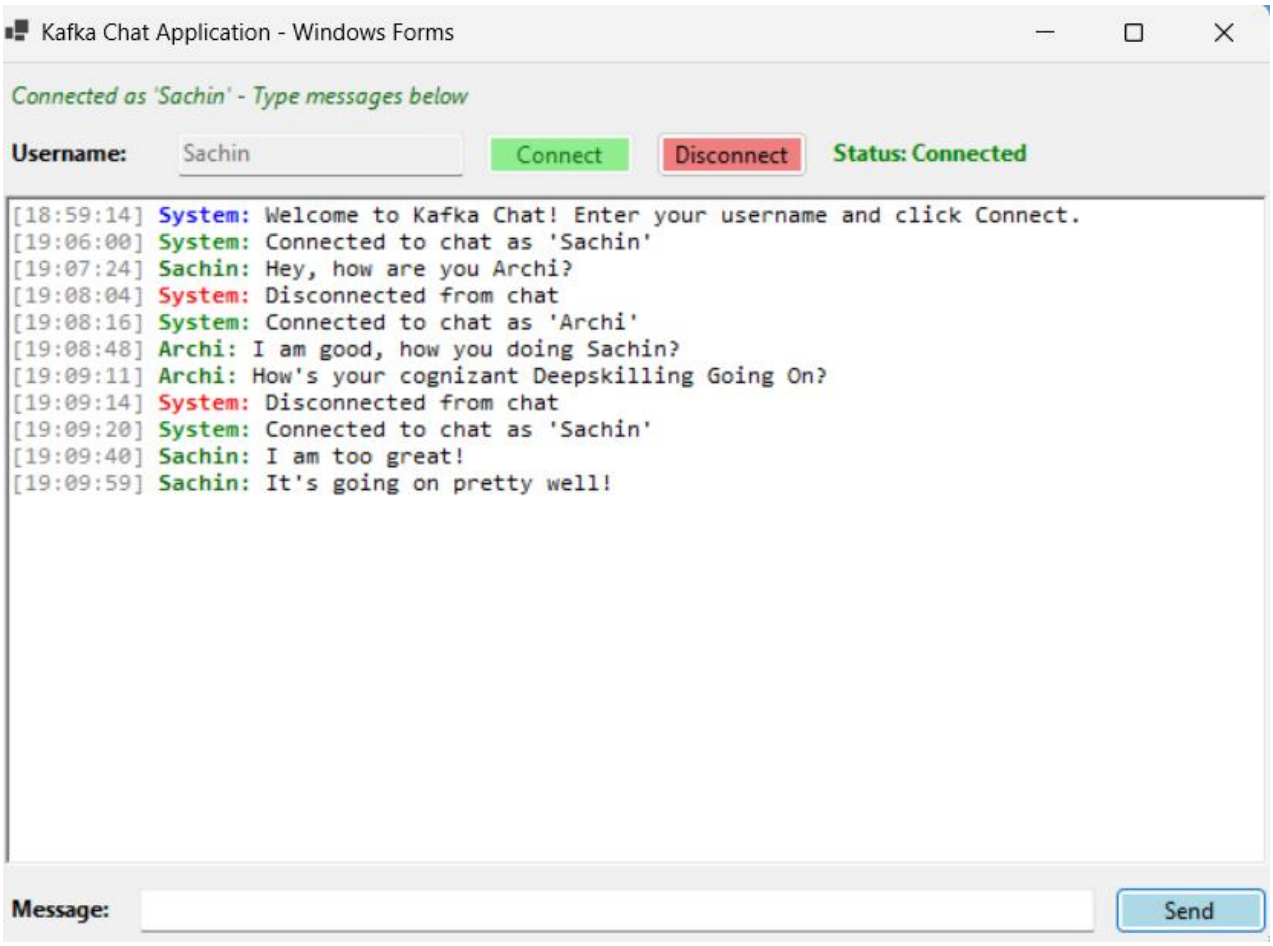


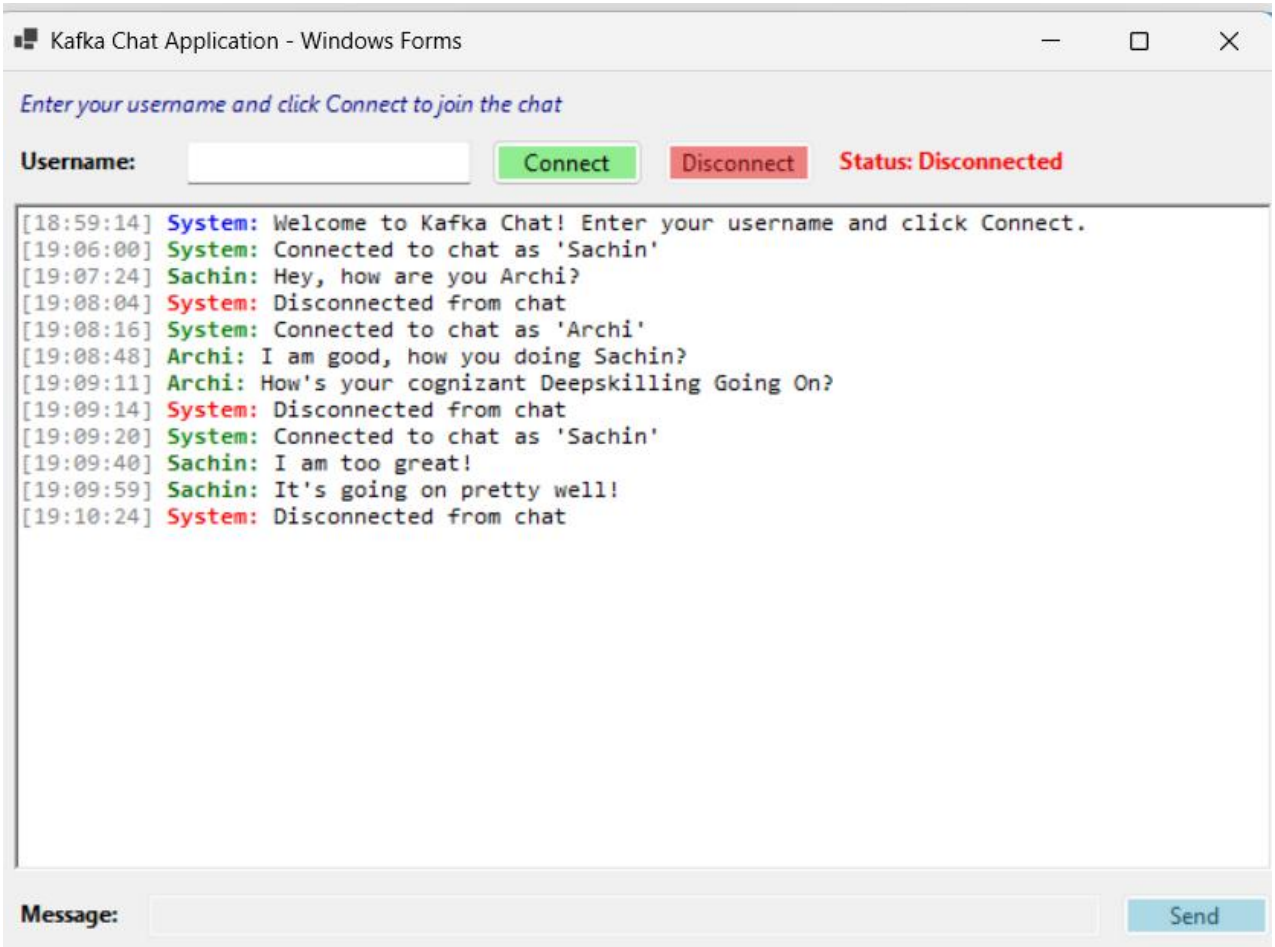
Output:

Application Starting:



When Connected and Chatting:





Chatting using two different Terminal (**Multi-Client Real-Time Chat**):