Setting up SQL Server **AlwaysOn Availability Groups (AGs)** with two replicas requires careful planning, preparation, and meeting several prerequisites. Here’s a step-by-step list of pre-requisites and considerations for setting up AlwaysOn Availability Groups with two replicas:

### **1. SQL Server Version and Edition**

* **Supported SQL Server Version**: AlwaysOn Availability Groups are available in **SQL Server 2012** and higher.
* **Edition**:
  + **Enterprise Edition** is required for AlwaysOn Availability Groups.
  + **Standard Edition** supports Basic Availability Groups (which limits to one database and two replicas).

### **2. Windows Server and Active Directory Requirements**

* **Windows Server Version**: The Windows Server version should be **2012 R2** or higher.
* **Active Directory**:
  + Both SQL Server instances must be part of the same **Active Directory domain**.
  + Service accounts for SQL Server must have appropriate permissions in Active Directory (e.g., for creating endpoints, availability group configuration).

### **3. SQL Server Configuration Requirements**

* **SQL Server Configuration**:
  + Ensure that **SQL Server instances** are installed and running on all nodes (replicas).
  + Enable the **AlwaysOn Availability Groups feature** through SQL Server Configuration Manager on both replicas:
    - Go to SQL Server Configuration Manager → SQL Server Services → right-click on your SQL instance → Properties → Enable the **AlwaysOn Availability Groups** feature.
* **SQL Server Version**: Both instances must be running the same version and build of SQL Server.

### **4. Network Requirements**

* **DNS Resolution**: Ensure that all replicas can resolve each other’s fully qualified domain names (FQDNs).
* **Windows Firewall**: Open necessary ports for SQL Server and the AlwaysOn Availability Group:
  + Default SQL Server port: TCP 1433
  + SQL Server AlwaysOn communication: TCP port 5022 (can be customized, but port 5022 is default).
* **Reliable Network Connectivity**: AlwaysOn replicas require a reliable network connection between them.

### **5. Storage Requirements**

* **Shared Storage (Optional)**: In case you are using **Windows Server Failover Cluster (WSFC)**, ensure that shared storage (e.g., SAN or SMB share) is available. However, for Availability Groups, this is not strictly required because each replica has its own copy of the database files.
* **Data and Log Files**: Each replica needs a storage location for database and transaction log files, and they should be accessible and properly configured on each node.

### **6. Windows Server Failover Cluster (WSFC) Setup**

* **WSFC Cluster**:
  + Set up a **Windows Server Failover Cluster (WSFC)** that will manage the availability group.
  + Each replica (node) must be part of the same **WSFC cluster**.
  + Ensure that the cluster is healthy and all nodes can communicate with each other.
  + You can use the **Failover Cluster Manager** to configure and manage your WSFC.
  + At least **two nodes** are required for an Availability Group.

### **7. SQL Server Service Accounts**

* **Same Service Account**: It’s recommended to use the **same SQL Server service account** for all replicas in the Availability Group (or ensure that the accounts have equivalent permissions).
* The service account must have **sysadmin** privileges on all SQL Server instances involved.

### **8. Database and Log Configuration**

* **Full Recovery Model**: The database(s) involved in the AlwaysOn Availability Group must be set to **Full Recovery Model**.
  + This ensures that transaction logs are fully maintained for proper log shipping between replicas.
* **Backup of the Primary Database**: Take a **full backup** of the primary database, as this backup is required to join the secondary replica to the Availability Group.

### **9. Configure Endpoints**

* **Database Mirroring Endpoint**: An **endpoint** is required for communication between replicas. You will need to configure the AlwaysOn **database mirroring endpoint**:
  + On each replica, create an endpoint (usually on TCP port 5022).
  + The endpoint must be configured with appropriate permissions to allow communication between replicas.

### **10. Quorum and Availability Group Scripting/Tools**

* **Quorum Configuration**: Make sure that you understand the quorum model and configuration in the WSFC. Depending on the number of nodes, you may use **Node Majority** or **Disk Majority** quorum models.
* **SQL Server Management Studio (SSMS)**: Use SSMS to configure the AlwaysOn Availability Group once the prerequisites are in place.

### **11. Logins and User Synchronization**

* **Logins**: Ensure that logins are properly synchronized across replicas, especially if you're using contained databases or different security settings on each replica.
* **User Synchronization**: Users and logins must exist on all replicas, or you may need to use **contained databases** to avoid user mismatch issues when the secondary replica is brought online.

### **12. Additional Considerations**

* **Backup Strategy**: Plan a backup strategy that includes **both replicas** and ensures that backups are consistent with your availability requirements.
* **Failover Mode**: Decide between **Automatic Failover** or **Manual Failover** based on your environment.
* **Data Center Location**: Replicas should ideally be in different data centers for disaster recovery, but this adds complexity due to network latency.

### **13. Testing the Setup**

* **Test the Failover**: Once the AlwaysOn Availability Group is configured, perform manual and automatic failovers to ensure that both replicas are synchronized and failover works as expected.
* **Monitor the Availability Group**: Use the **AlwaysOn Dashboard** in SSMS to monitor the health and status of the availability group.

### **Summary of Key Pre-Requisites:**

1. **SQL Server** (Enterprise Edition) on compatible versions.
2. **Windows Server Failover Cluster** setup with at least 2 nodes.
3. **Full Recovery Model** on the databases involved.
4. **AlwaysOn Availability Groups feature enabled** on both SQL Server instances.
5. **Windows Server** and **Active Directory** in the same domain.
6. **Mirroring endpoints** configured for communication between replicas.
7. **Service accounts** with necessary permissions and synchronization.

Once all these prerequisites are met, you can begin setting up your AlwaysOn Availability Group with the two replicas. The setup will involve creating the availability group, adding the databases, configuring the listeners, and performing failover tests.