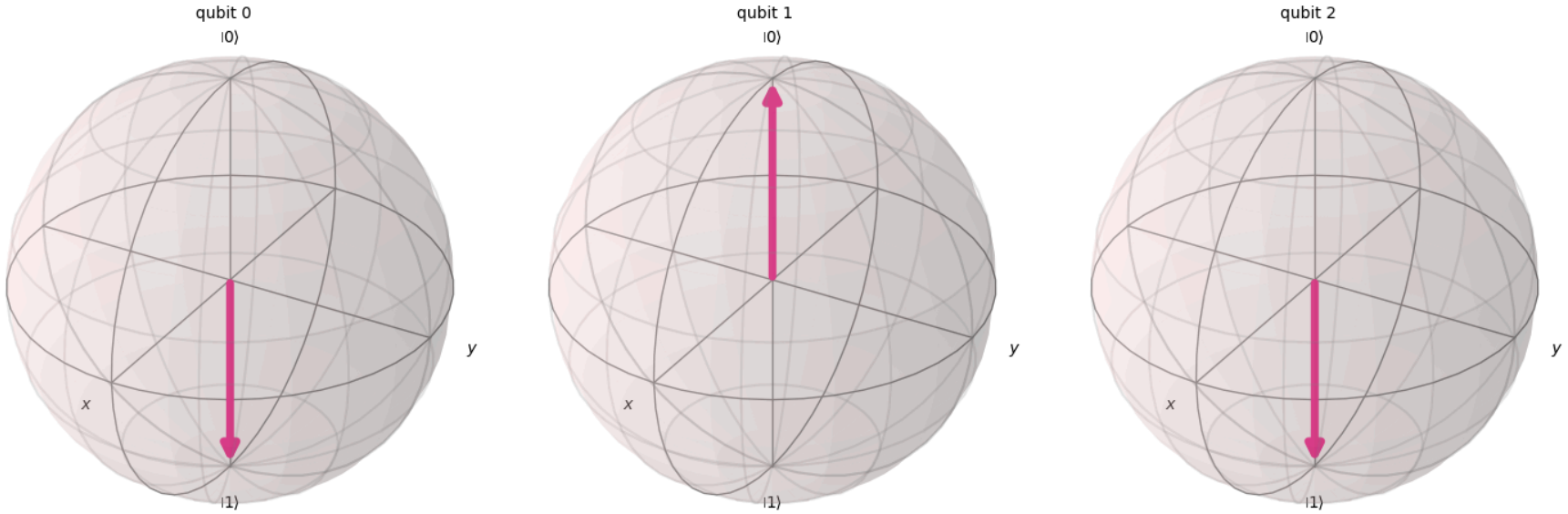
```
#Demo Friedkin Gate using three qubits

# Install Qiskit if not already installed
!pip install qiskit matplotlib qiskit_aer

from qiskit import QuantumCircuit, transpile
from qiskit_aer import Aer
from qiskit.visualization import plot_histogram
from qiskit.visualization import plot_bloch_multivector
import matplotlib.pyplot as plt

# 1. Initialize a 3-qubit circuit with 3 classical bits for measurement
qc = QuantumCircuit(3, 3)

# 2. Setup initial state: Set control qubit (q0) and one target (q2) to |1>
# Input state: |q2 q1 q0> = |1 0 1>
qc.x(0) # Control qubit
qc.x(2) # One of the target qubits

fig_0 = plot_bloch_multivector(qc, title="Initial States", reverse_bits=False)
display(fig_0)

# 3. Apply the Fredkin (Controlled-SWAP) gate
# Parameters: (control, target1, target2)
qc.cswap(0, 1, 2)
fig_1 = plot_bloch_multivector(qc, title="Final States after Fredkin Gate", reverse_bits=False)
display(fig_1)

# 4. Measure the qubits
qc.measure([0, 1, 2], [0, 1, 2])

# 5. Simulate the circuit
backend = Aer.get_backend('qasm_simulator')
job = backend.run(transpile(qc, backend), shots=1024)
result = job.result()

# 6. Output the results
counts = result.get_counts()
print("Measurement Results (Little Endian):", counts)
# Expected result: '011' because q1 and q2 swapped states
```

```
Requirement already satisfied: qiskit in /usr/local/lib/python3.12/dist-packages (2.3.1)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.12/dist-packages (3.10.0)
Requirement already satisfied: qiskit_aer in /usr/local/lib/python3.12/dist-packages (0.17.2)
Requirement already satisfied: rustworkx>=0.15.0 in /usr/local/lib/python3.12/dist-packages (from qiskit) (0.17.1)
Requirement already satisfied: numpy<3,>=1.21 in /usr/local/lib/python3.12/dist-packages (from qiskit) (2.0.2)
Requirement already satisfied: scipy>=1.5 in /usr/local/lib/python3.12/dist-packages (from qiskit) (1.16.3)
Requirement already satisfied: dill>=0.3 in /usr/local/lib/python3.12/dist-packages (from qiskit) (0.3.8)
Requirement already satisfied: stevedore>=3.0.0 in /usr/local/lib/python3.12/dist-packages (from qiskit) (5.7.0)
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.12/dist-packages (from qiskit) (4.15.0)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (1.3.3)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (4.62.1)
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (1.5.0)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (26.0)
Requirement already satisfied: pillow>=8 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (11.3.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (3.3.2)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.12/dist-packages (from matplotlib) (2.9.0.post0)
Requirement already satisfied: psutil>=5 in /usr/local/lib/python3.12/dist-packages (from qiskit_aer) (5.9.5)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.12/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)
```

Initial States



Final States after Fredkin Gate