Phase 3: CLI Improvements - Implementation Summary

Overview

Added command-line interface improvements including help, version flags, and intelligent config file search.

Features Implemented

1. Help Flag (`-h`, `--help`)

Shows comprehensive usage information:

- Command syntax
- Available options
- Config file search path
- Examples

```bash
$ dbus-mqtt-bridge --help
Usage: dbus-mqtt-bridge [OPTIONS] [CONFIG_FILE]

D-Bus to MQTT bridge service

Options:
  -h, --help      Show this help message
  -v, --version   Show version information

Arguments:
  CONFIG_FILE     Path to configuration file

If CONFIG_FILE is not specified, searches in order:
  - ~/.config/dbus-mqtt-bridge/config.yaml
  - /etc/dbus-mqtt-bridge/config.yaml
  - ./config.yaml

Examples:
  dbus-mqtt-bridge /etc/dbus-mqtt-bridge/config.yaml
  dbus-mqtt-bridge --help
  dbus-mqtt-bridge --version
```

2. Version Flag (`-v`, `--version`)

Shows version from CMakeLists.txt:

```bash
$ dbus-mqtt-bridge --version
dbus-mqtt-bridge 0.1.0
```

3. Config File Search Path

Searches multiple locations in priority order:

1. **Command-line argument** (if provided)
   - `dbus-mqtt-bridge /path/to/config.yaml`
2. **User config directory**
   - `~/.config/dbus-mqtt-bridge/config.yaml`
   - Works for session bus and user-specific configs
3. **System config directory**
   - `/etc/dbus-mqtt-bridge/config.yaml`
   - Standard location for system service
4. **Current directory**
   - `./config.yaml`
   - Convenient for development/testing

4. Error Handling

Unknown options:

```bash
$ dbus-mqtt-bridge --unknown
Error: Unknown option: --unknown
Try '--help' for more information.
[Shows full help text]
```

Config file not found:

```bash
$ dbus-mqtt-bridge /tmp/missing.yaml
Error: Config file not found: /tmp/missing.yaml
```

No config found in search path:

```bash
$ dbus-mqtt-bridge
Error: No configuration file found.

Searched locations:
  - ~/.config/dbus-mqtt-bridge/config.yaml
  - /etc/dbus-mqtt-bridge/config.yaml
  - ./config.yaml

Please specify a config file or create one in a default location.
See 'dbus-mqtt-bridge --help' for usage.
```

Files Created

New Source Files

1. **include/Version.h.in**

   - Template for version info
   - Populated by CMake from project version

2. **include/ConfigSearch.h**

   - Config file search logic
   - Path priority handling

3. **src/ConfigSearch.cpp**

   - Implementation of search algorithm
   - File existence checks

4. **include/CLI.h**

   - Command-line argument parsing
   - Help and version display

5. **src/CLI.cpp**

   - Implementation of CLI handlers
   - Error message formatting

Modified Files

6. **CMakeLists.txt**
   - Added version header generation
   - Added new source files to build
   - Added binary include directory

7. **src/main.cpp**
   - Integrated CLI parsing
   - Integrated config search
   - Better error messages

Test Files

8. **test-cli.sh**
   - Automated test script
   - Tests all CLI features
   - 10 test cases

Building

```bash
cd build
cmake ..
make
```

The version header is automatically generated at build time.

Testing

Automated Tests

```bash
chmod +x test-cli.sh
./test-cli.sh
```

Expected: 10 tests pass with green checkmarks

Manual Tests

1. Test help:

```bash
dbus-mqtt-bridge --help
dbus-mqtt-bridge -h
```

2. Test version:

```bash
dbus-mqtt-bridge --version
dbus-mqtt-bridge -v
```

3. Test config search (user config):

```bash
mkdir -p ~/.config/dbus-mqtt-bridge
cat > ~/.config/dbus-mqtt-bridge/config.yaml <<EOF
mqtt:
  broker: localhost
  port: 1883
bus_type: session
mappings:
  dbus_to_mqtt: []
  mqtt_to_dbus: []
EOF

# Run without arguments - should find user config
dbus-mqtt-bridge
```

4. Test config search (system config):

```bash
# With system config installed
sudo dbus-mqtt-bridge
```

5. Test explicit config:

```bash
dbus-mqtt-bridge /path/to/config.yaml
```

6. Test error handling:

```bash
dbus-mqtt-bridge --unknown       # Unknown option
dbus-mqtt-bridge /tmp/missing.yaml # File not found
dbus-mqtt-bridge                 # No config anywhere
```

Integration with Package

The systemd service file already specifies the config path explicitly, so it continues to work unchanged:

```ini
ExecStart=/usr/bin/dbus-mqtt-bridge /etc/dbus-mqtt-bridge/config.yaml
```

Benefits

1. **User-friendly**: Clear help and version information
2. **Flexible**: Works for system service, user sessions, and development
3. **Not distribution-specific**: Search path works anywhere with FHS
4. **Better errors**: Helpful messages guide users to solutions
5. **Scriptable**: Exit codes and output suitable for automation

Version Management

Version is managed in ONE place: `CMakeLists.txt`

```cmake
project(dbus-mqtt-bridge VERSION 0.1.0 LANGUAGES CXX)
```

To update version:

1. Edit `CMakeLists.txt`
2. Rebuild
3. Version automatically updates in `--version` output

Next Steps

Phase 3 complete! Ready for:

- **Phase 3.5**: Config builder script
- **Phase 4**: Man page

The CLI is now fully functional and user-friendly.