MQTT & IoT Messaging – 5 Days (40 Hours)

Day 1 – MQTT Foundations & Architecture (8 Hours)

Module 1: Introduction to IoT Messaging (2 Hrs)

- IoT communication models (Request/Response vs Pub/Sub)
- Messaging protocols comparison (HTTP, CoAP, AMQP, MQTT)
- Why MQTT for IoT?
- Lightweight communication principles

Module 2: MQTT Core Concepts (3 Hrs)

- Publish/Subscribe model
- Broker architecture & role
- Client lifecycle
- Topics & message flow
- MQTT packet structure overview

Module 3: MQTT Setup & Hands-on (3 Hrs)

- Installing Mosquitto Broker
- MQTT client tools (MQTTX / CLI)
- Connecting publisher & subscriber
- Basic message publishing & subscribing lab

Hands-on Lab: Build a simple Pub/Sub demo

Day 2 – Topics, QoS & Session Management (8 Hours)

Module 4: Topics & Messaging (3 Hrs)

- Topic hierarchy design
- Wildcards (+ and #)
- Topic naming best practices
- Message routing strategies

Module 5: Quality of Service (QoS) (2 Hrs)

- QoS 0, 1, 2 deep dive
- Reliability trade-offs
- Use-case mapping

Module 6: Session & State Management (3 Hrs)

- Clean session vs persistent session
- Session continuity
- Retained messages
- Last Will & Testament (LWT)

Hands-on Lab: Implement QoS comparison and retained messages

Day 3 – Data Exchange & Reliability (8 Hours)

Module 7: Data Exchange & Payload Design (3 Hrs)

- JSON structure for IoT
- Lightweight payload optimization
- Binary vs JSON payloads
- Sensor data modeling

Module 8: Message Reliability & Delivery Assurance (3 Hrs)

- Acknowledgment flow
- Duplicate message handling
- Message ordering
- Offline message buffering

Module 9: Metadata Handling (2 Hrs)

- Device ID design
- Timestamps & time synchronization
- Message context tagging

Hands-on Lab: Design structured payload for multi-sensor system

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Day 4 – Security & Industrial Use Cases (8 Hours)

Module 10: MQTT Security Fundamentals (4 Hrs)

- TLS/SSL concepts
- Authentication mechanisms (Username/Password, Certificates)
- Topic-level authorization
- Secure broker configuration
- Security best practices

Module 11: Operational & Industrial Use Cases (4 Hrs)

- Smart manufacturing telemetry
- Marine communication systems
- Defense telemetry architecture
- Fleet tracking systems
- Smart city deployment patterns

Case Study Discussion: Secure IoT architecture for industrial monitoring

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Day 5 – Advanced Features & Mini Project (8 Hours)

Module 12: MQTT Advanced & Scalability (3 Hrs)

- Broker clustering
- High availability setup
- Load balancing strategies
- Cloud MQTT services (AWS IoT Core, Azure IoT Hub overview)

Module 13: End-to-End Mini Project (5 Hrs)

Project: Industrial IoT Monitoring System

- Design topic hierarchy
- Implement publisher (sensor simulator)
- Configure broker security
- Implement subscriber dashboard

- Apply QoS & reliability features
- Testing & validation

Deliverables:

- Working MQTT architecture
- Secure message flow
- Structured payload design
- Deployment documentation