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# Using MQTT and Eclipse Tools to Write an End-to-End M2M Application

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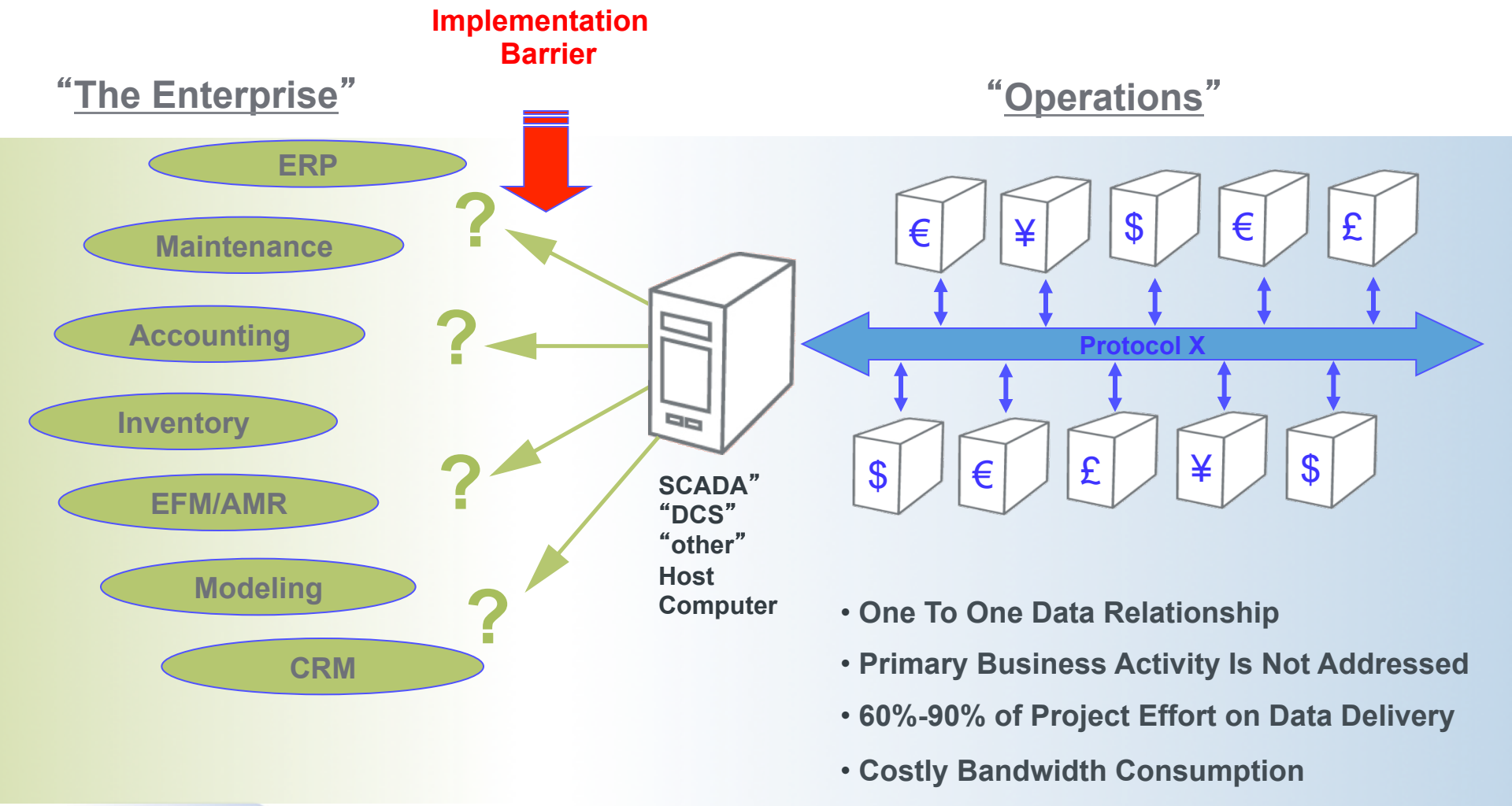
# The Internet of Things

## Decoupling Producer / Consumer




- One To One Data Relationship
- Primary Business Activity Is Not Addressed
- 60%-90% of Project Effort on Data Delivery
- Costly Bandwidth Consumption
- Protocol is the Transport – Can't break apart

# Introduction

## Additional considerations

- **Getting data to the Enterprise**
  - Applications need to be modular and extendable
  - Bandwidth is expensive
  - Networks are unreliable
  - Some components can be on private networks

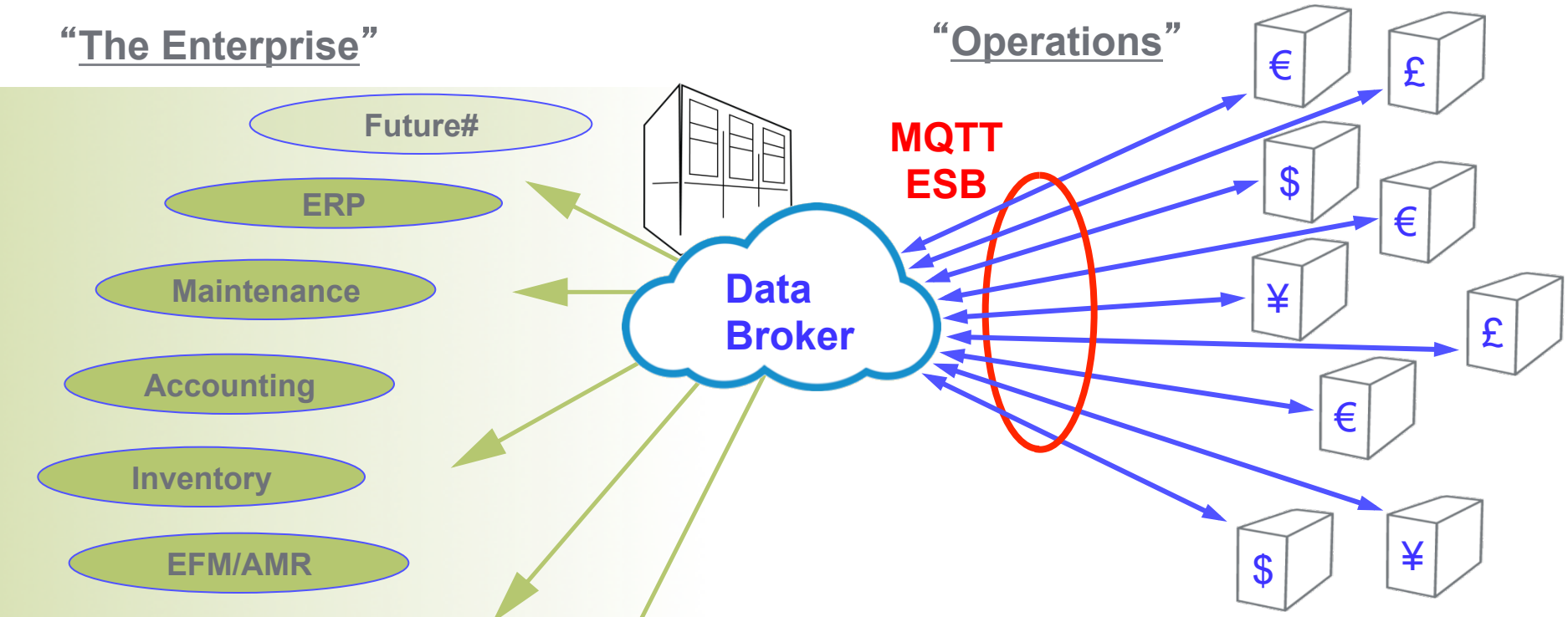
# MQTT

## The Solution

- **Publish/Subscribe Model – Broker and clients**
  - Decouple data producers from consumers to increase modularity and extensibility
- **Relies on TCP because it works**
- **Limits message overhead**
  - Uses less bandwidth
- **Doesn’t impose complex/restrictive requirements on data format**
  - Let the application control its data
- **Specifies Quality of Service to ensure delivery is a specific way**
  - 3 levels of QoS

# The Internet of Things

## Decoupling Producer / Consumer




- Many To Many Relationship
- Primary Business Activity Is Addressed
- Data Delivery Using Common Protocol
- Efficient Bandwidth Utilization
- Utilizes TCP/IP Network Topology

# MQTT

## Players

- **Broker**
  - Responsible for accepting client connections and message routing
- **Client**
  - Establishes a persistent connection to the broker to provide and/or consume data
- **Message Components**
  - Topic
    - Hierarchical – usa/virginia/reston with wildcards # and +
    - Defined by the application
  - Payload
    - Byte array
  - Quality of Service
    - Fire and forget, At least once, Once and only once

# MQTT

## Important options not shown in the code examples

- **Client Keep Alive**
  - Maintains client session awareness
  - Enforced via client initiated ‘pings’
- **Last Will & Testament**
  - Published on behalf of a client
- **Message Retention**
  - Tells the broker to hang on to messages
- **Clean Start**
  - Tells the broker to forget about the previous client connection
- **MQTT Persistence**
  - Allows local persistence of data on the client side

# MQTT Broker

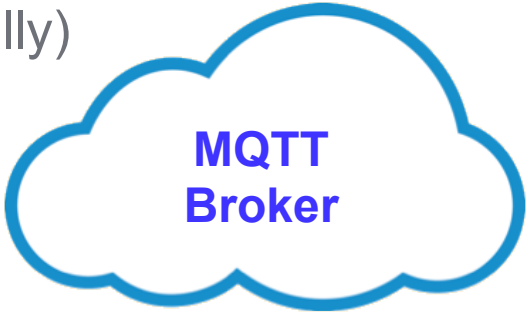
## Mosquitto – an open source implementation

- **MQTT v3.1**
- **Free BSD License**
- **$SYS support**
- **Access Control List support**
  - Allows only authenticated clients to connect
  - Supports limiting the topics clients can pub/sub on
  - Can be bound to an SQL database

# MQTT Broker

## Mosquitto

- **Starting the broker and configuration options**
  - Runs on Linux, Mac, Windows
  - Password setup (who has access)
  - ACL Setup (what clients can pub/sub on – plus support for pattern matching)
  - Basic scaling options (max clients, inflight messages, queued messges)
  - Timing parameters (retry for QOS resending)
  - Persistence options (how to store locally)
  - SQL options (how to authenticate)
- **Let's start the Broker!**



# MQTT Client

## Options

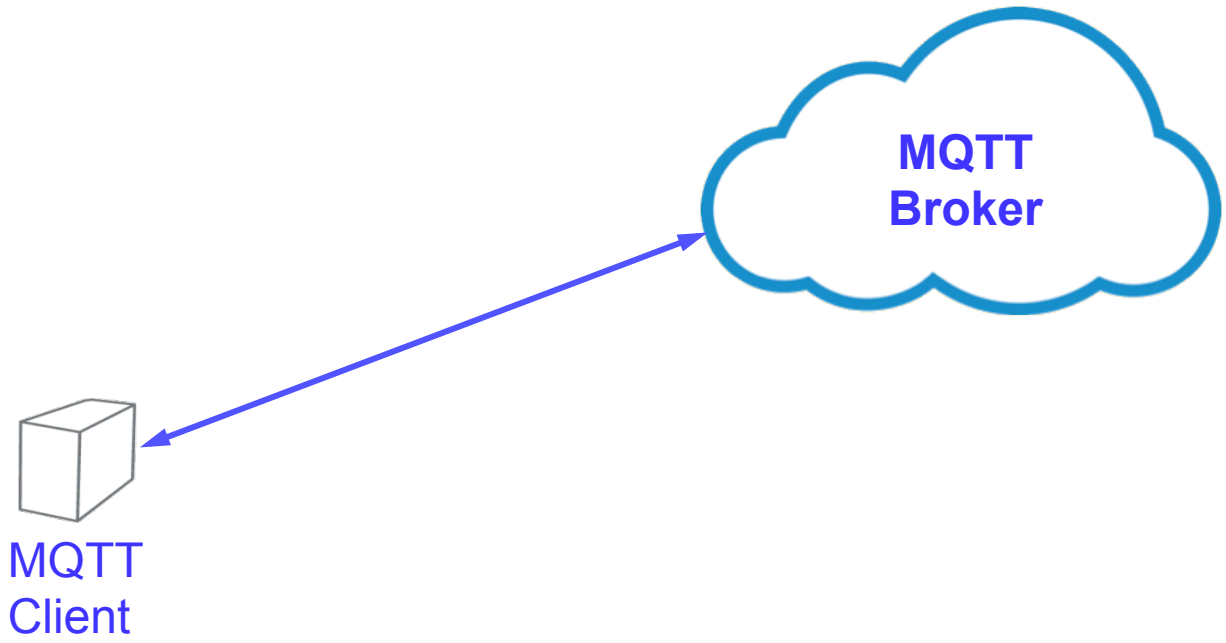
- **C client exists at Eclipse Paho now**
- **Java Client coming soon**
  - This example uses an older version of what will soon be released through Eclipse Paho
- **Eclipse MQTT client plugin coming soon via Eclipse Paho**
- **Lots of implementations at http://mqtt.org**
  - C/C++
  - Java
  - Perl
  - PHP
  - Python
  - .NET


MQTT
Client

# MQTT Client

## A data producer example

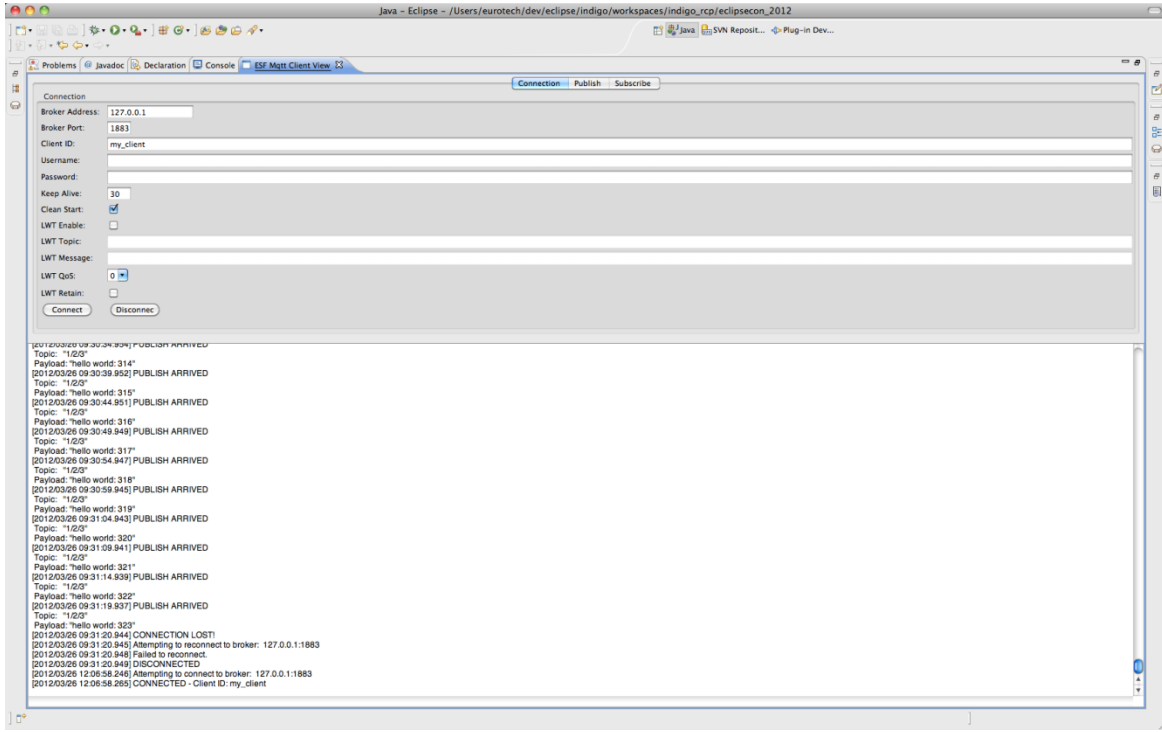
- **Basic Flow**
  - Create the MQTT client
  - Connect
  - Start publishing data
- **Let's see the code and start the client!**



# MQTT Client

## As an Eclipse Plugin

- **Three basic controls**
  - Connect/Disconnect
  - Publish
  - Subscribe
- **Connection Parameters**
  - Username/password
  - Keep alive
  - Clean start
  - LW&T




- **Will soon be released through the Eclipse Paho project**
- **Let's take a look and connect to the broker!**

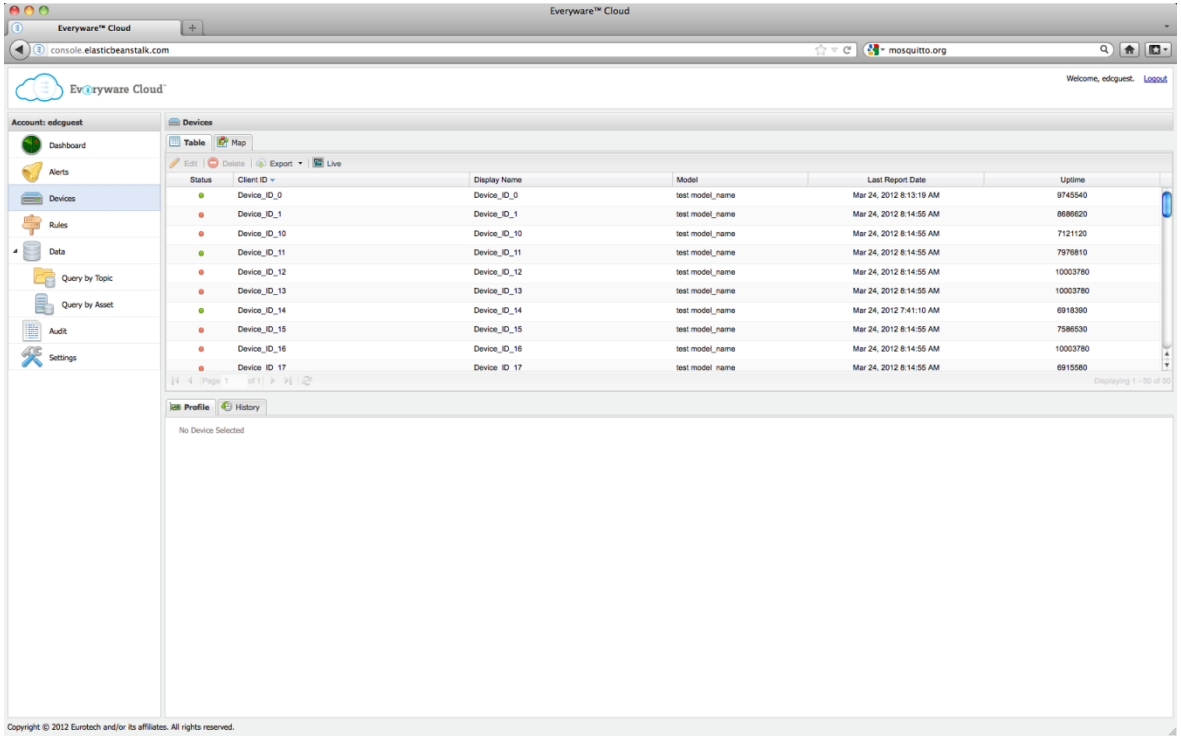
# MQTT Client

## A data consumer example

- **Basic Flow**
  - Create the MQTT client
  - Connect
  - Subscribe
  - Handle publish notifications as needed
- **Let’s see the code and start the client!**

# MQTT in a more complex example

- Broker in the cloud
- MQTT clients on devices publish to the broker
- Store data in the cloud
- Web console provides view of devices, query support, different views of data.



# Resources

- **http://www.eclipse.org/paho/**
- **http://mqtt.org**
- **http://mosquitto.org**

- **For further questions, you can reach me at**

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# Thank You

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