











# SIMATIC OPC UA

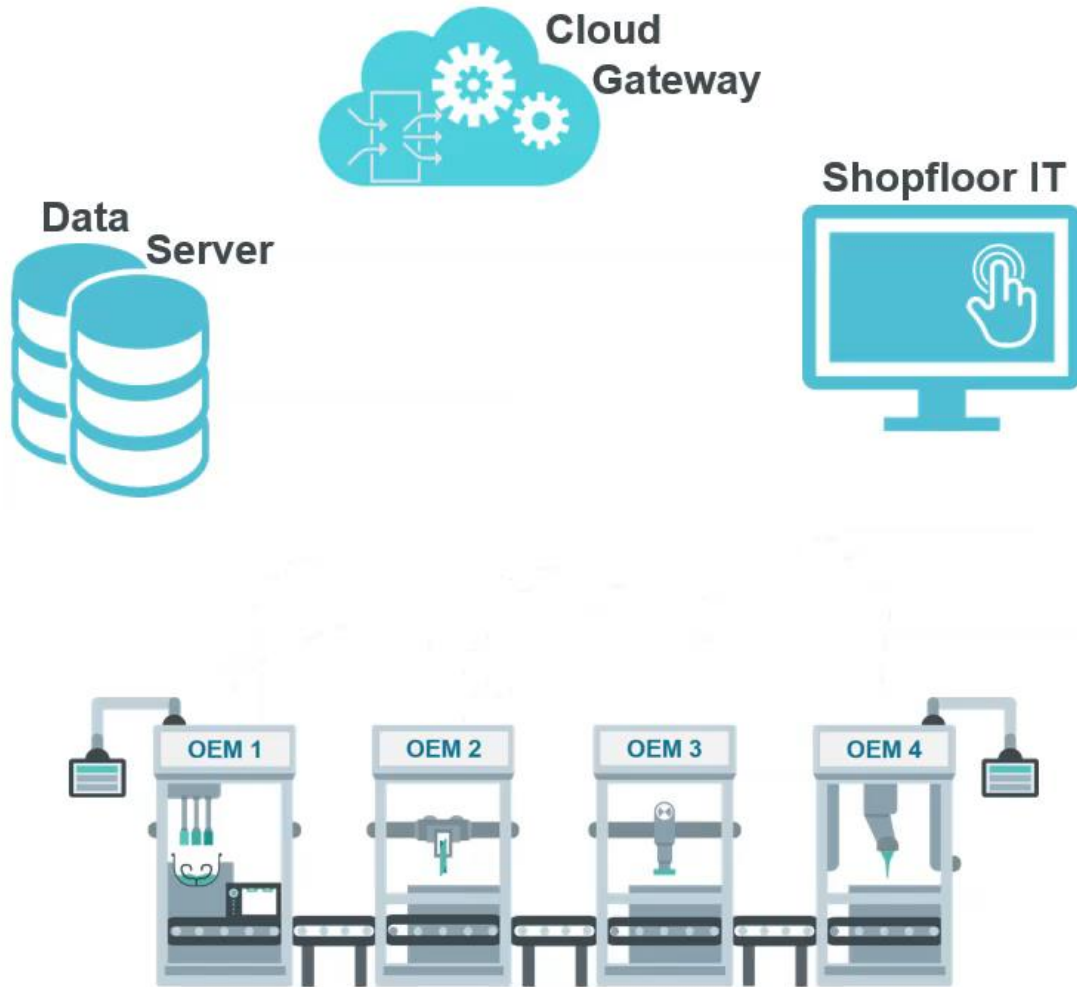
## Web based training

Part 1 → OPC UA specification overview

# Agenda

 <b>OPC UA</b> Part 1: OPC UA specification overview 	 <b>OPC UA SERVER</b> Part 2: SIMATIC data access server	 <b>OPC UA CLIENT</b> Part 3: SIMATIC data access client
 Part 4: Server information modelling	 Part 5: OPC UA Companion Specifications	 Part 6: Performance
 Part 7: Diagnostics	 Part 8: Security	 Part 9: Conclusion

# Communication requirements for digitalization



- Platform and system independent standards
- Standardized communication interfaces
- Standardized way of data access
- Semantics (self describing interfaces)
- Communication between machines (M2M)
- Communication to overlaying systems
- Cyclic and event driven communication
- Real time capability

 High dynamic  
on demand connectivity

# Open communication protocols for industry



Message Queuing Telemetry Transport



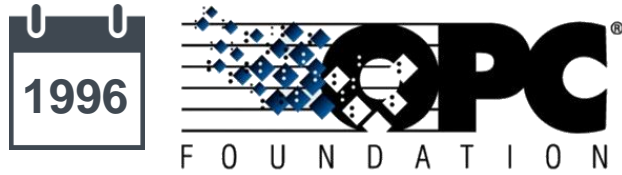
Data Distribution Service



**Open Platform Communications Unified Architecture**



# OPC UA History

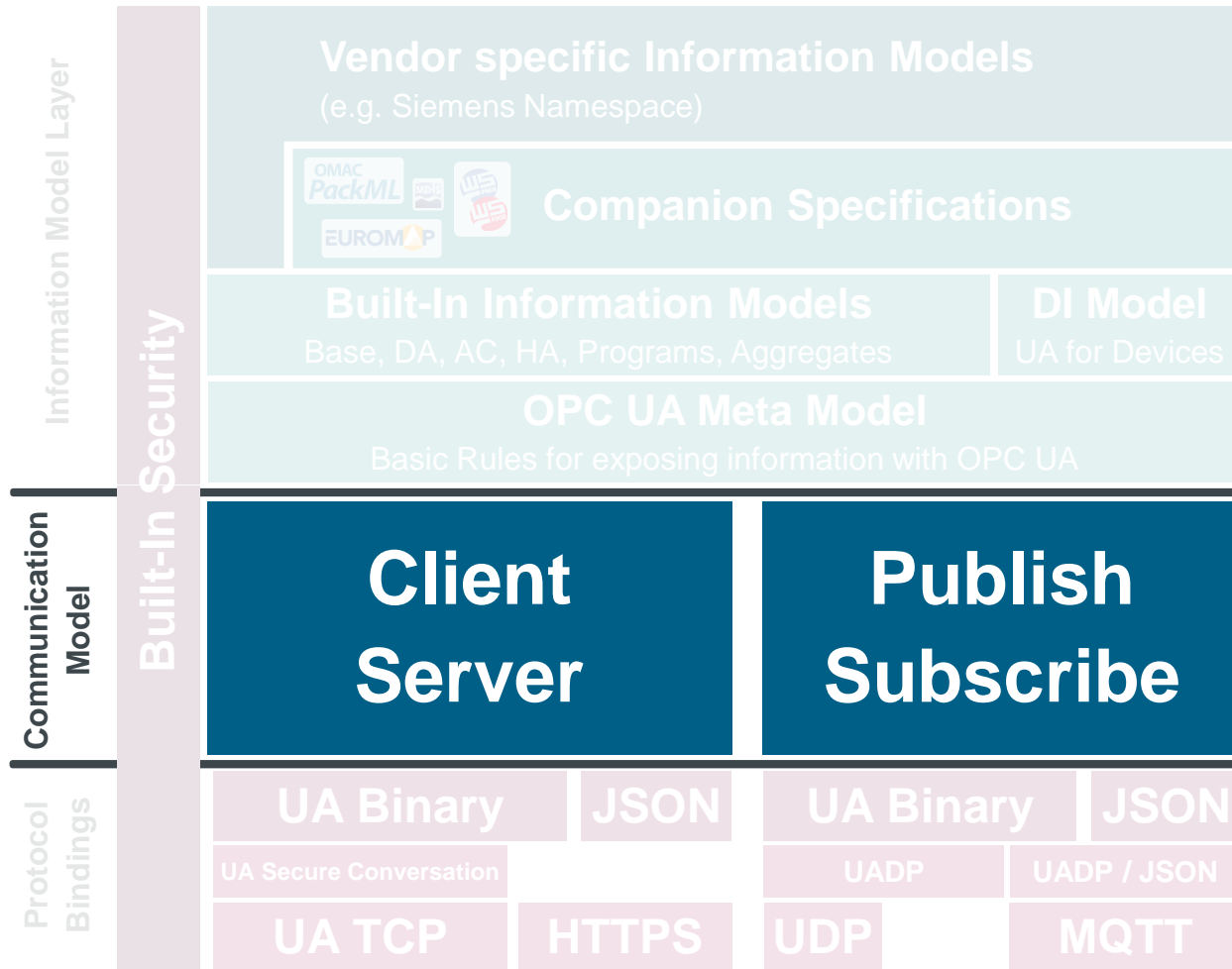


- Establishment of the OPC Foundation
- **O**LE for **P**rocess **C**ontrol
- Based on Microsoft Windows COM/DCOM
- Focus on Microsoft Windows Systems
- Standardized access to data, historical data, alarms and events



- **O**pen **P**latform **C**ommunications  
**U**nified **A**rchitecture
- Platform independence
- Expansions to the classic standard
- No native compatibility to OPC Classic  
→ Gateway Software available from different vendors

# OPC UA Architecture



## Communication Model

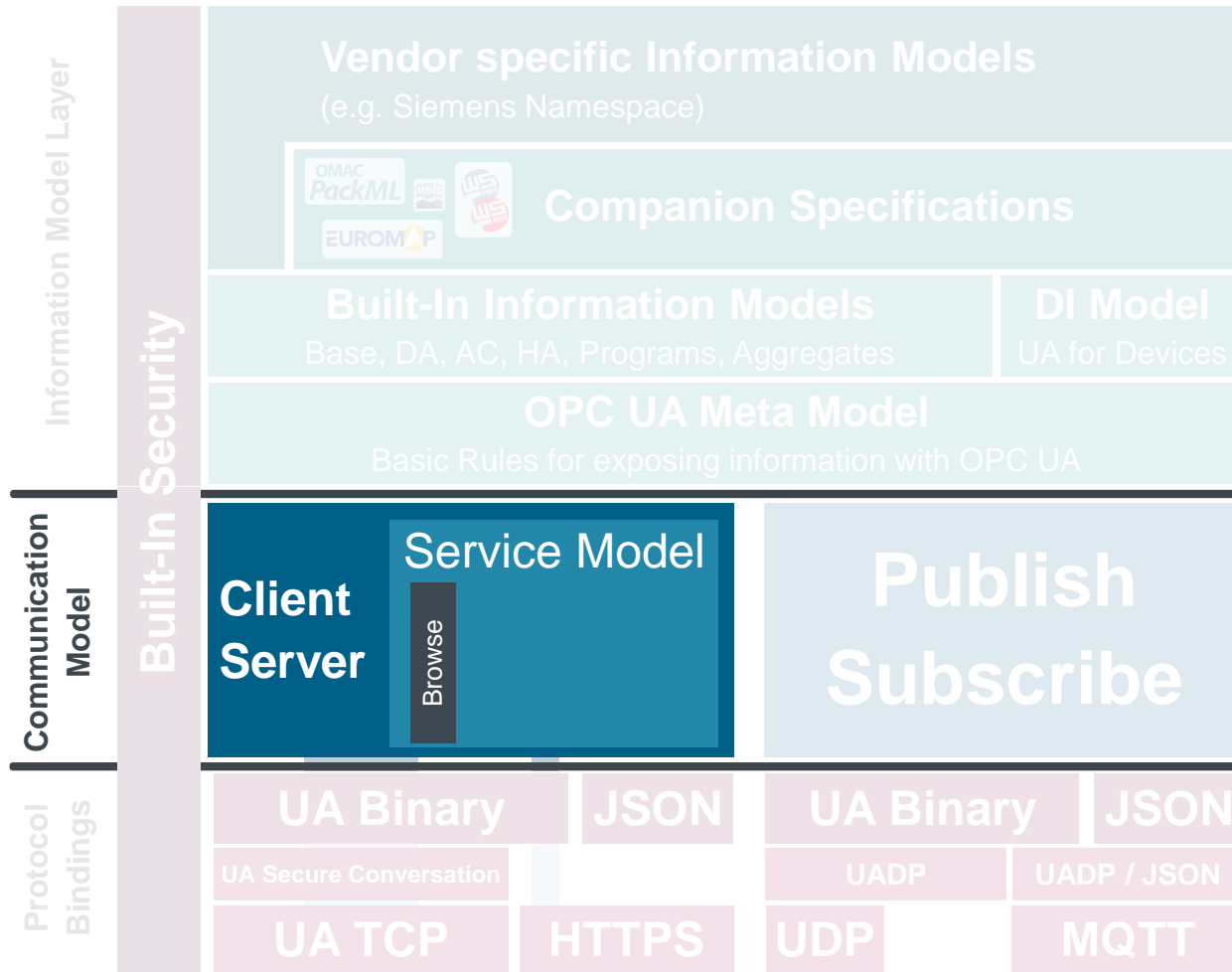
- **OPC UA Client Server**

**Service orientated approach for acyclic operations like read / write of data or function calls**

- **OPC UA Publish Subscribe**

**Message orientated approach for cyclic communication.**

# OPC UA Architecture



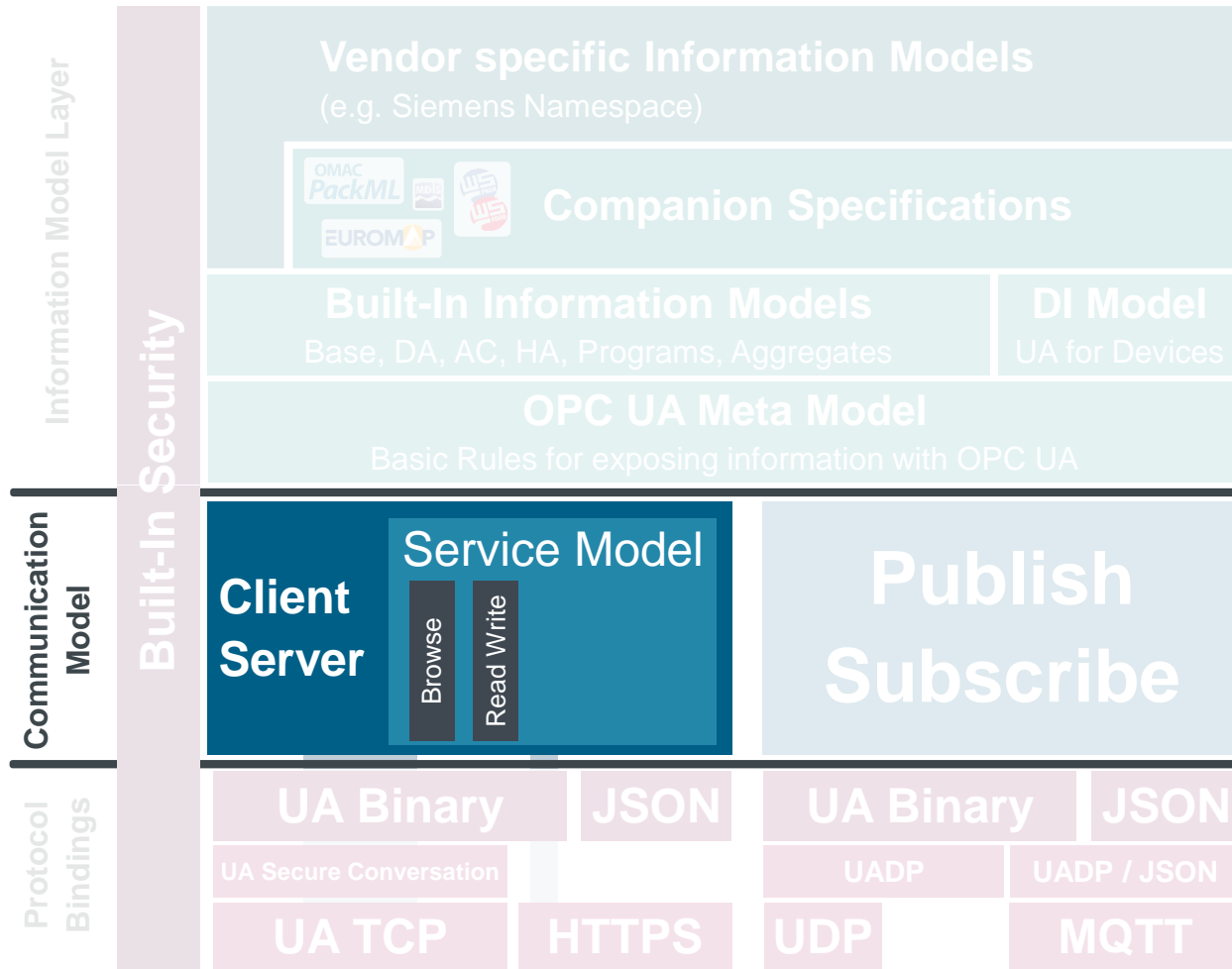
## Service Model - Browse

### Server



Browse

# OPC UA Architecture



## Service Model – Read / Write

### Server



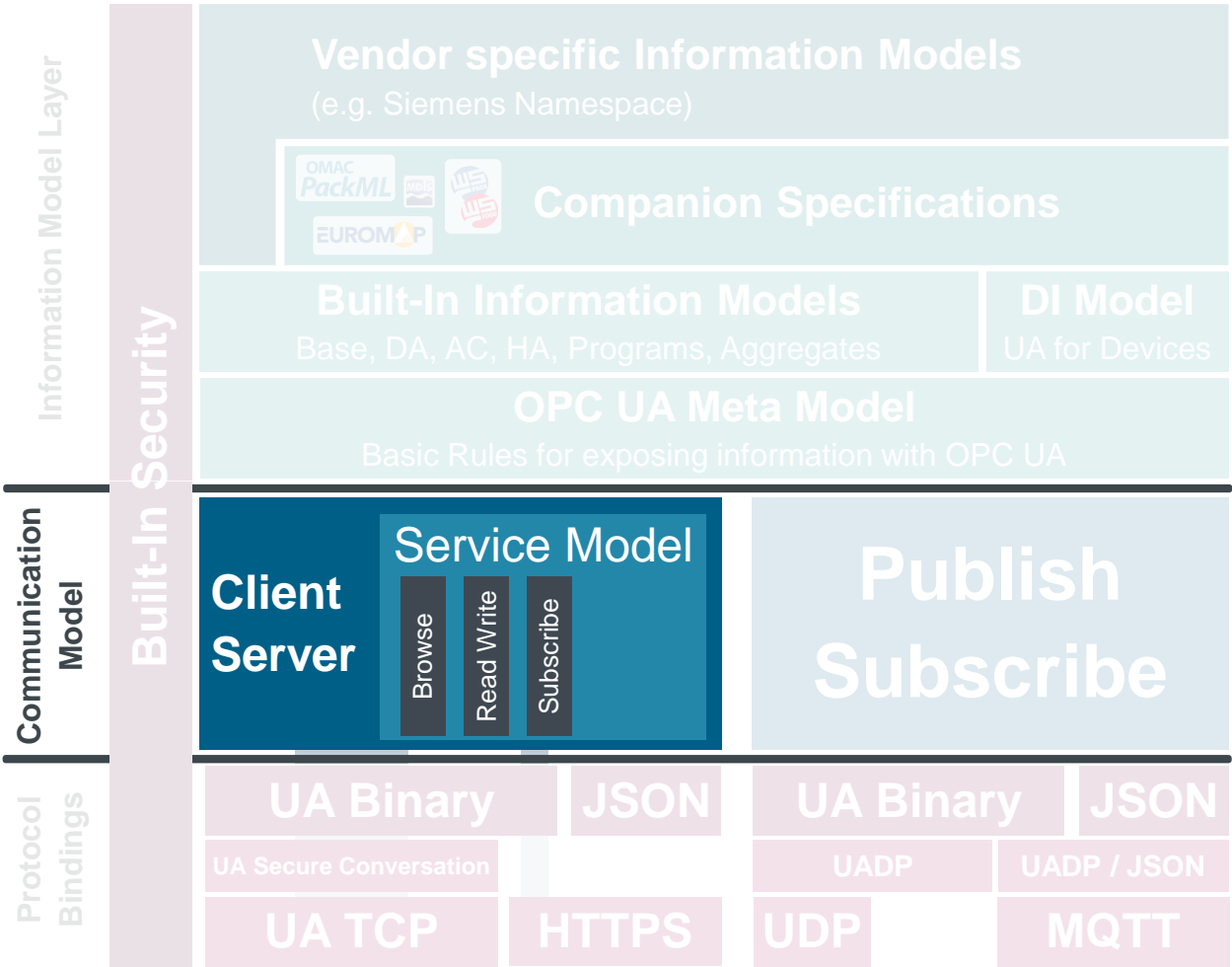
Read  
Write

### Client





# OPC UA Architecture



## Service Model – Subscribe

Server

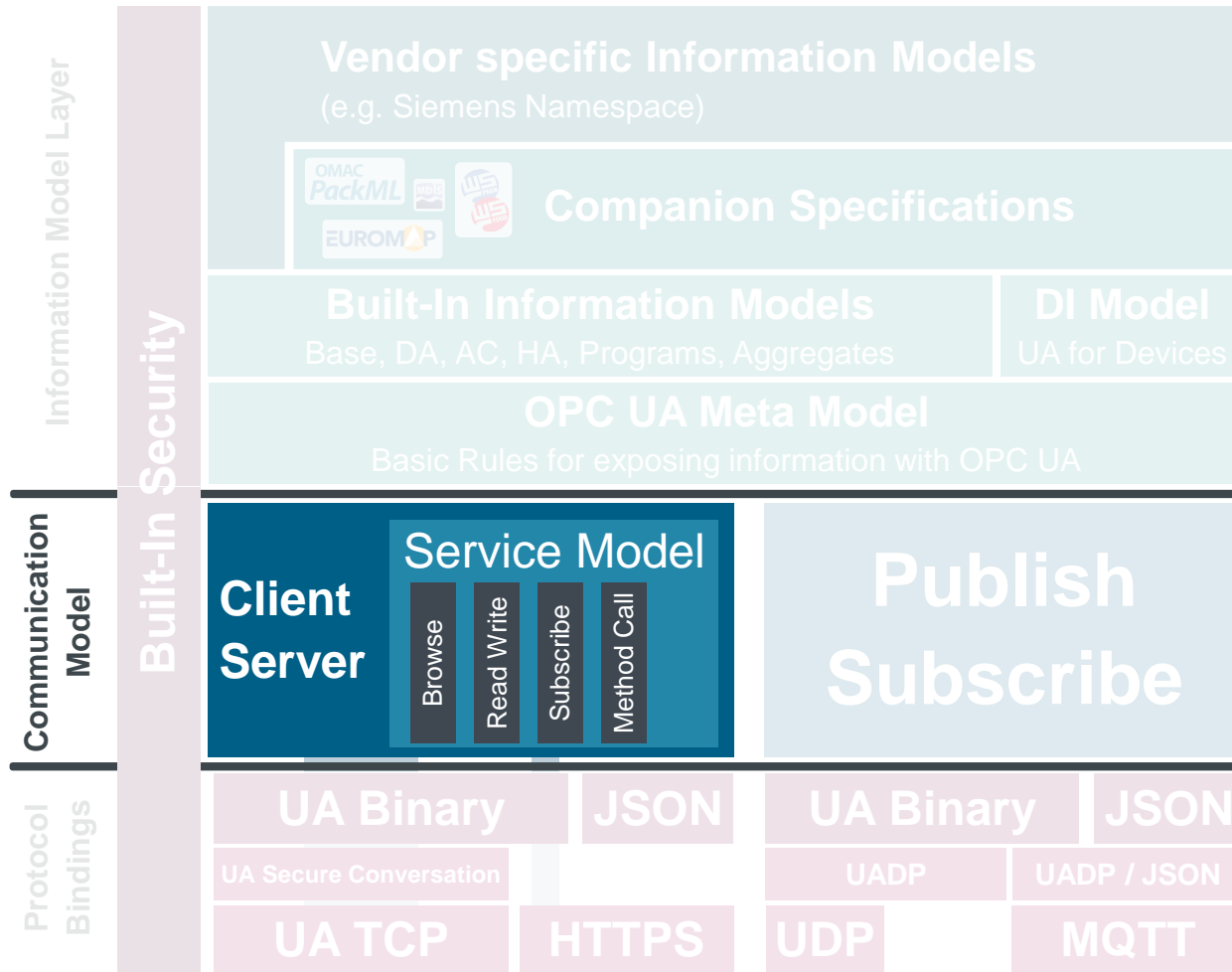


Subscribe

Client



# OPC UA Architecture



## Service Model – Method call

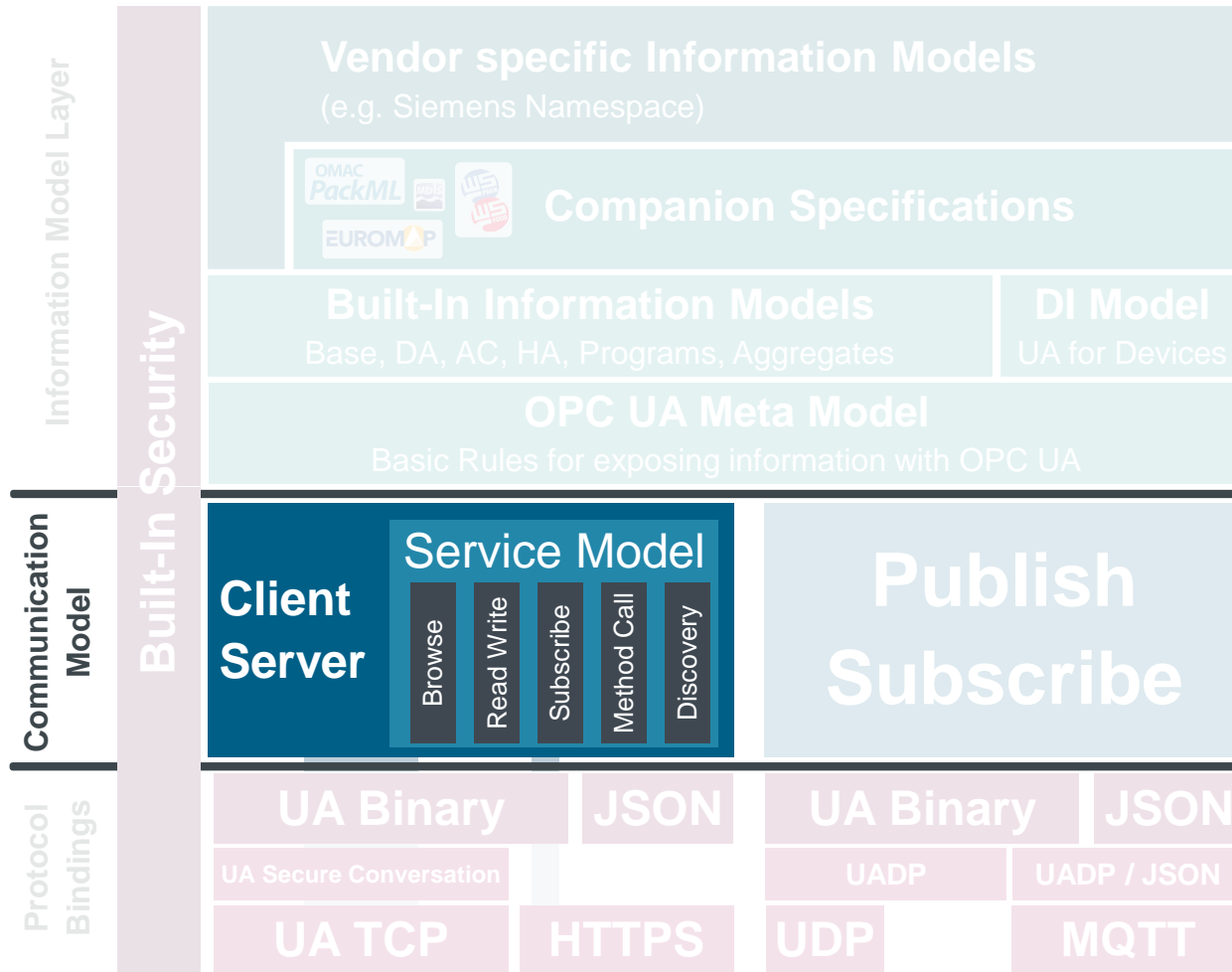
### Server



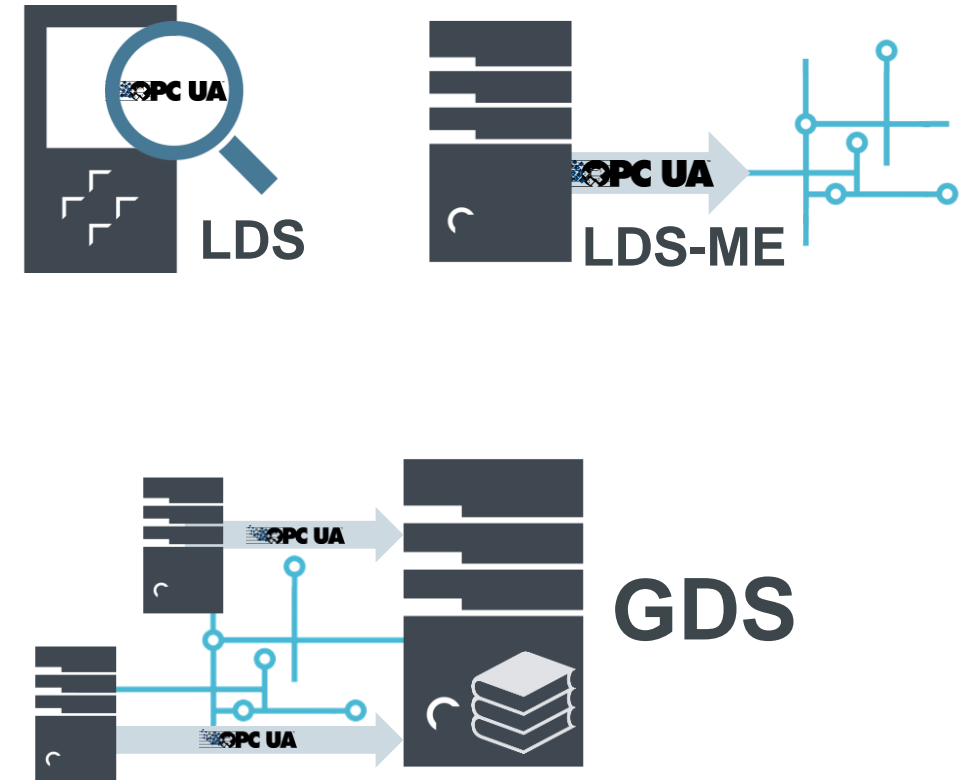
MethodCall



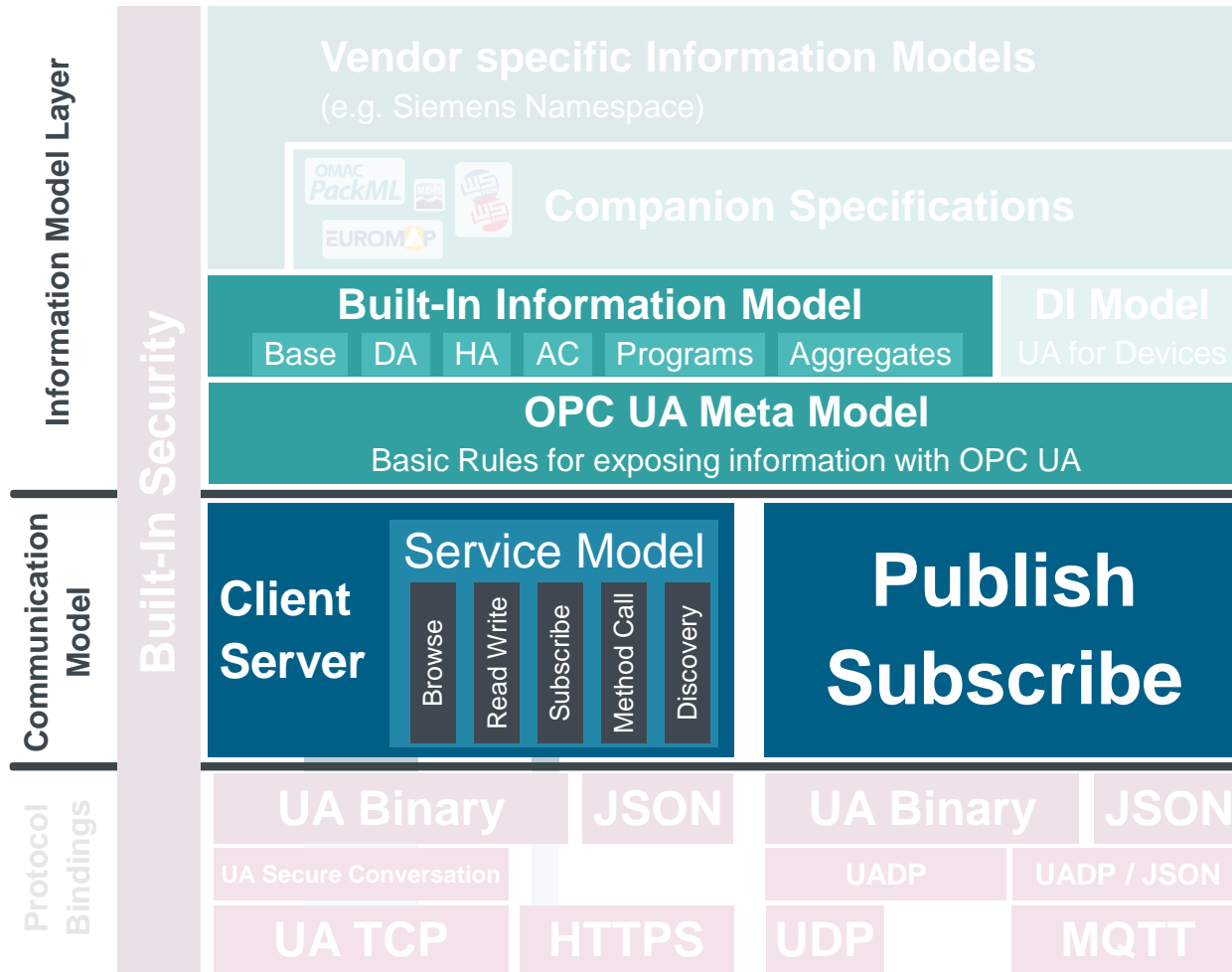
# OPC UA Architecture



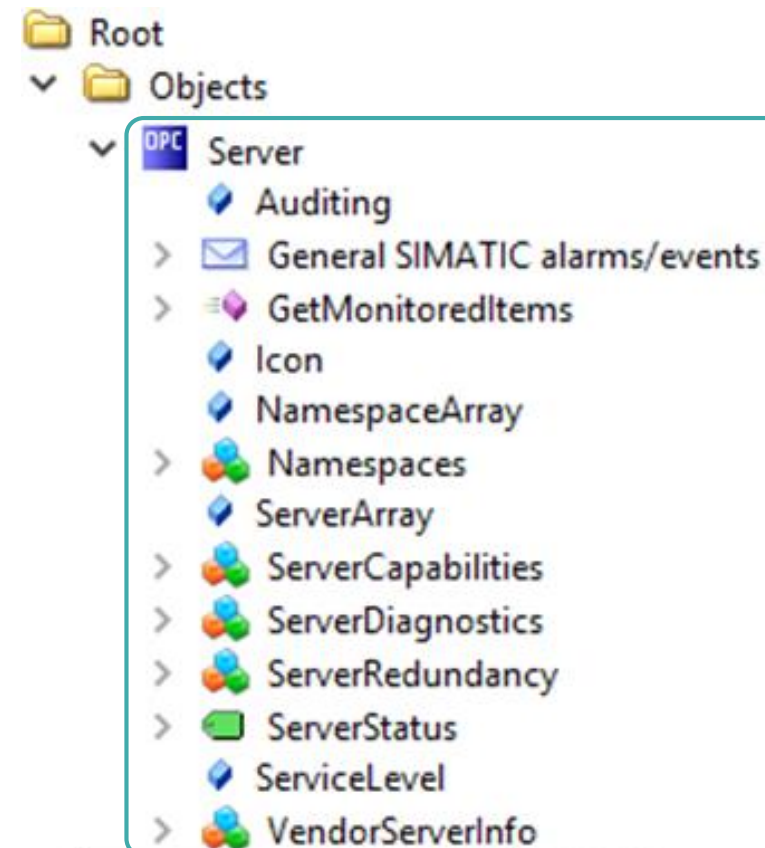
## Service Model – Discovery



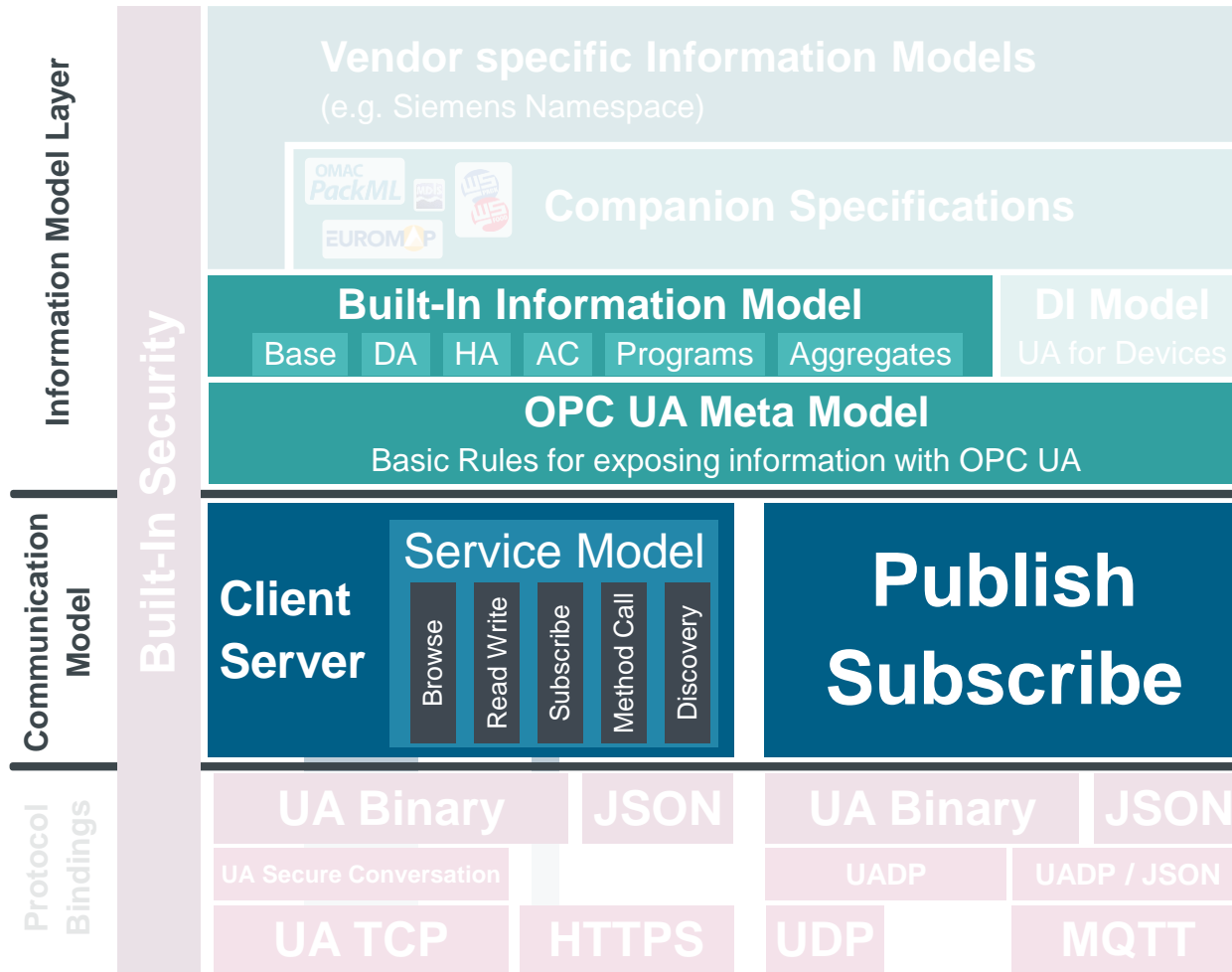
# OPC UA Architecture



## Built-In Information Model



# OPC UA Architecture



## OPC UA Information Model



**Data Access**



**Historical Data Access**



**Alarms and Conditions**

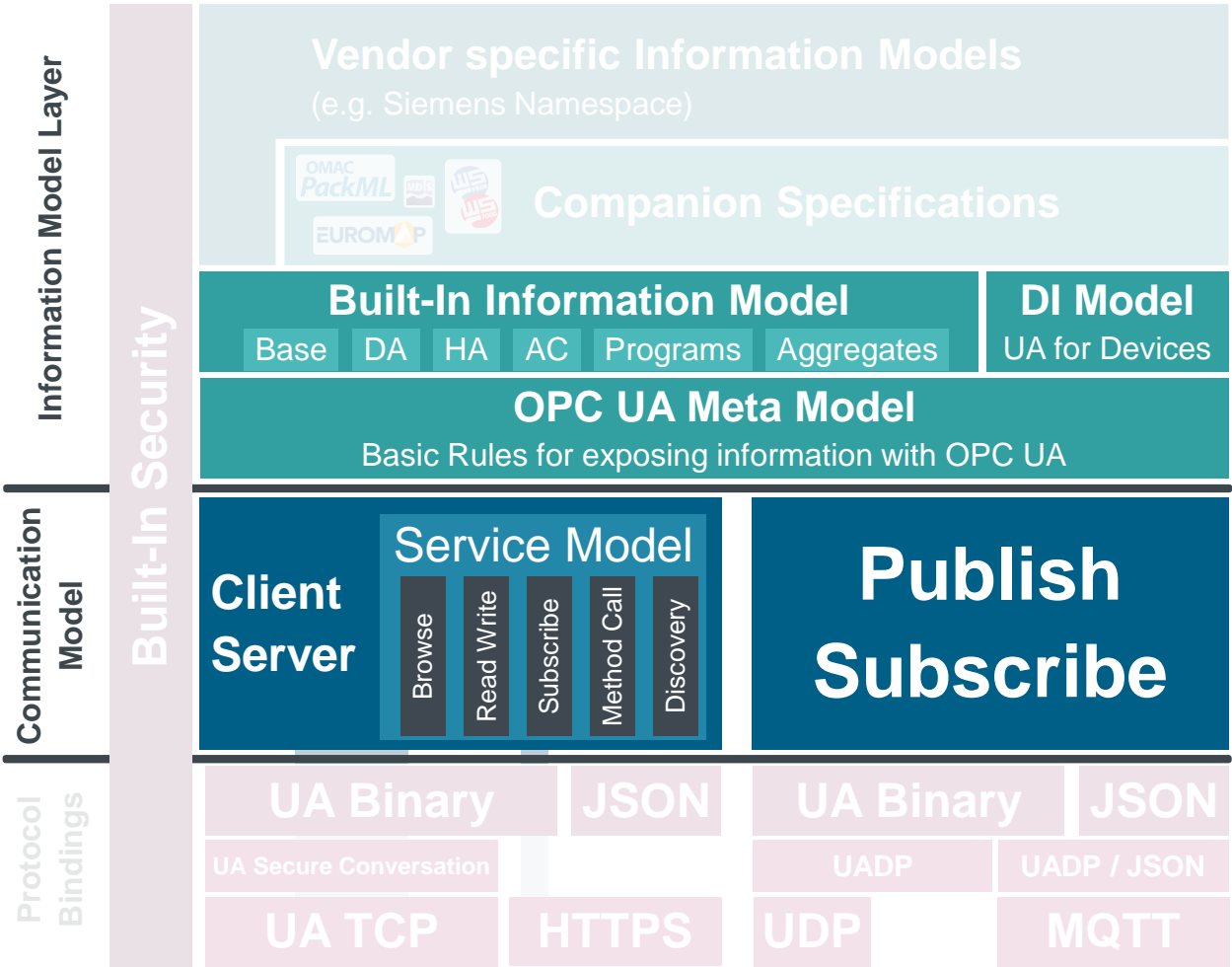


**Aggregates**

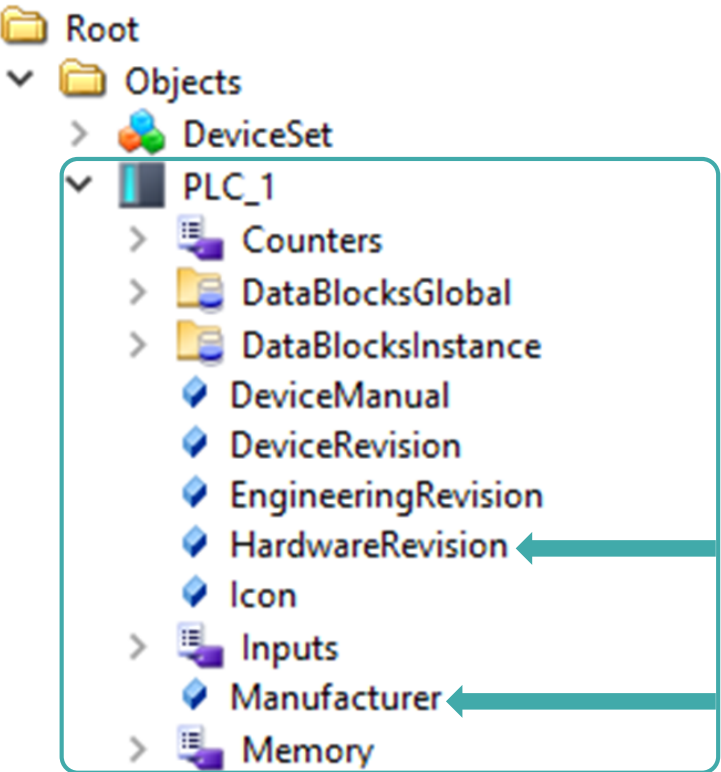


**Programs**

# OPC UA Architecture

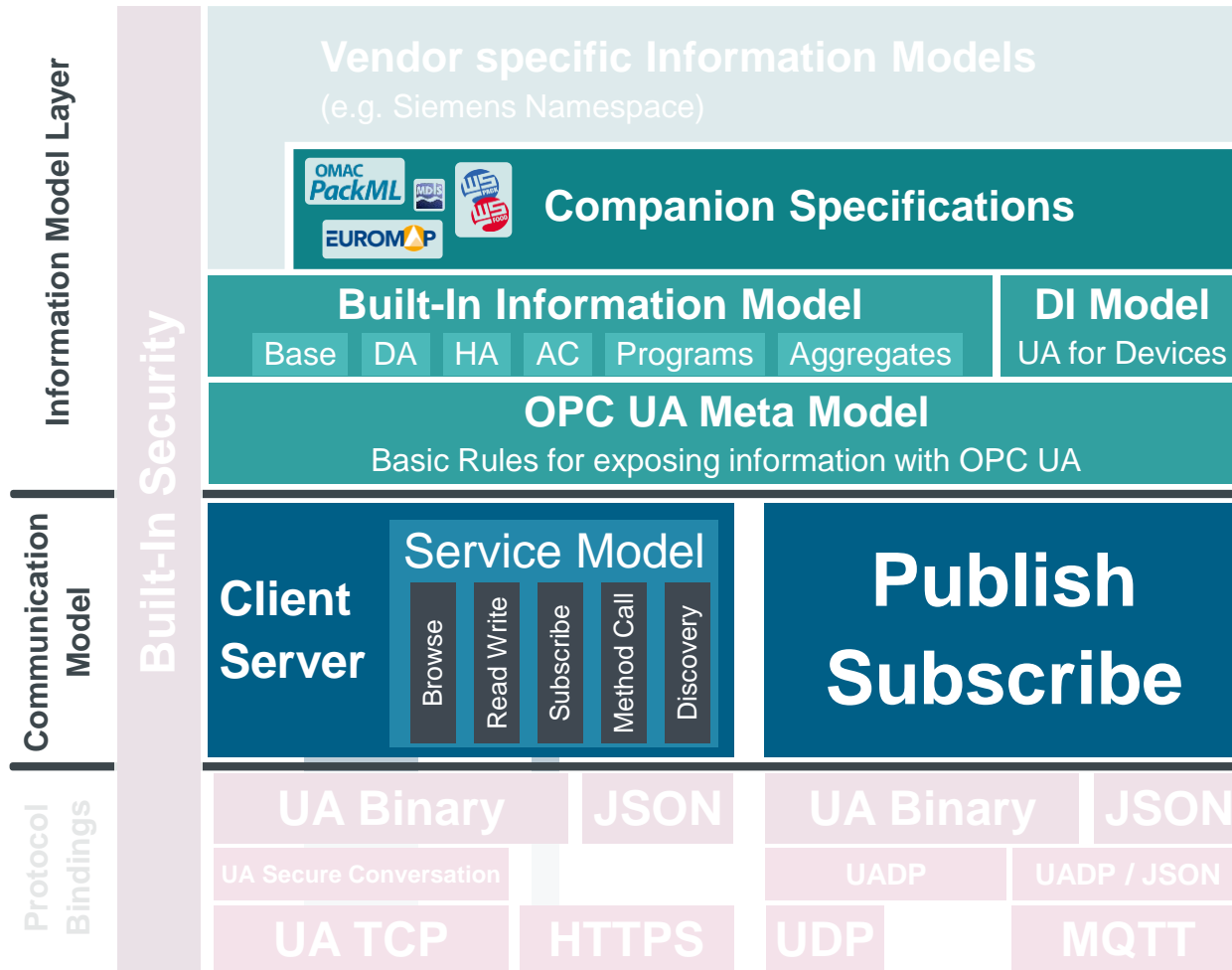


## DI Information Model

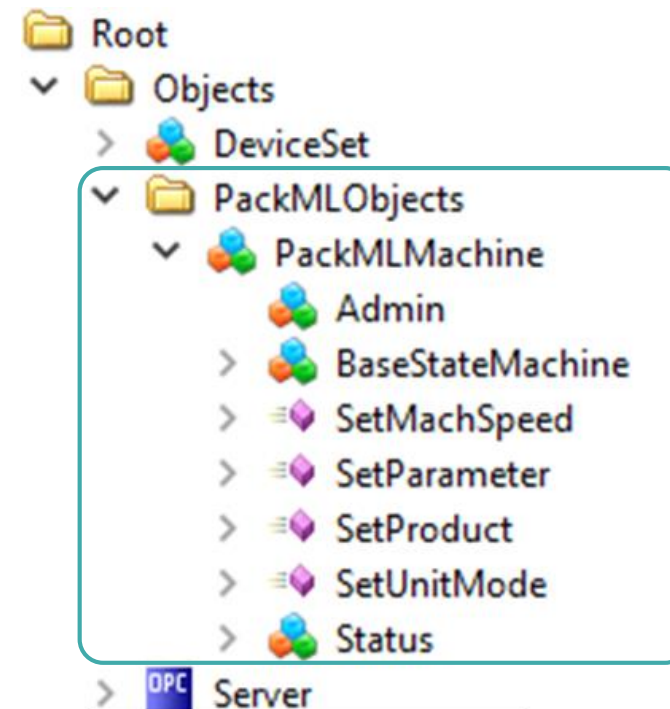




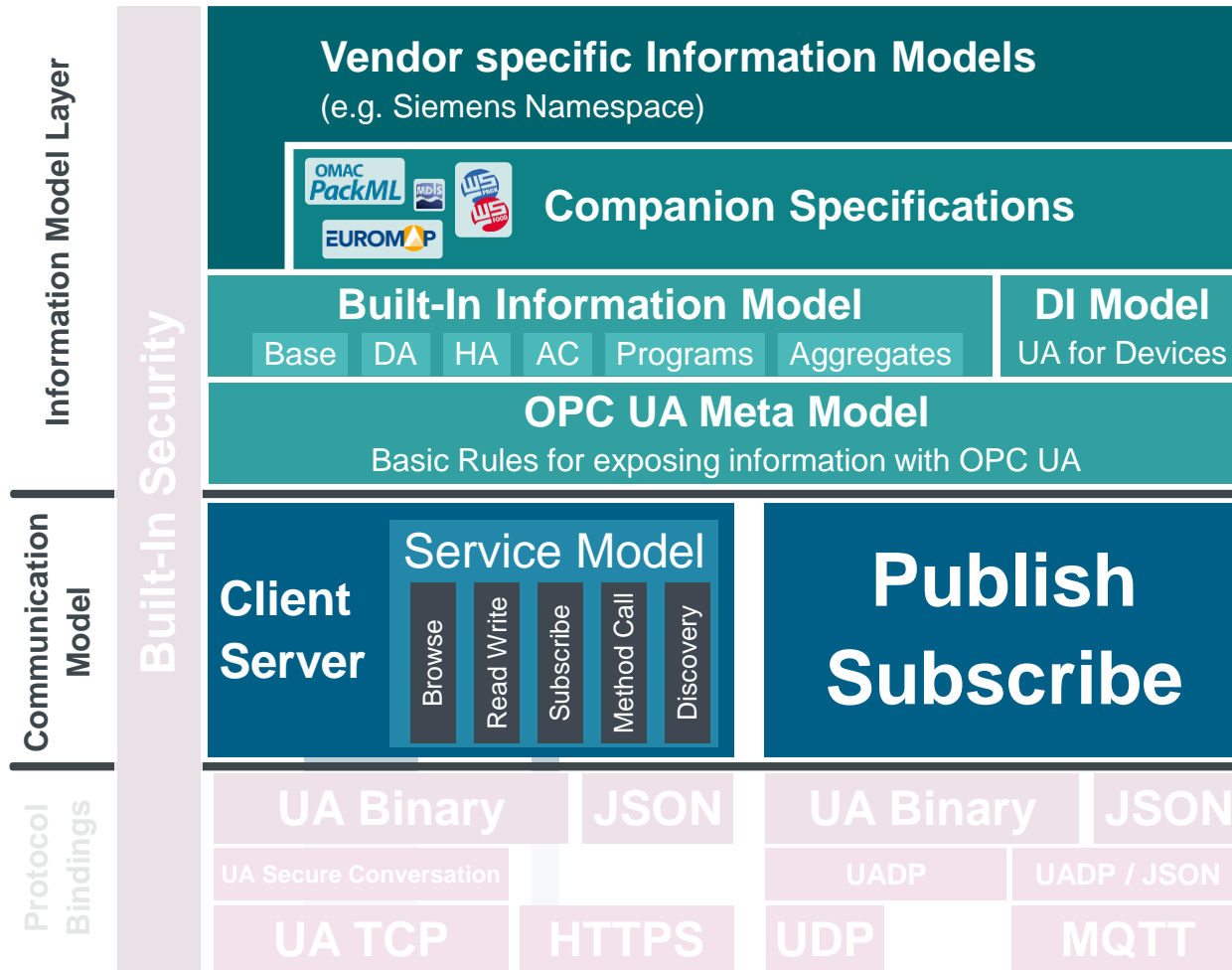
# OPC UA Architecture



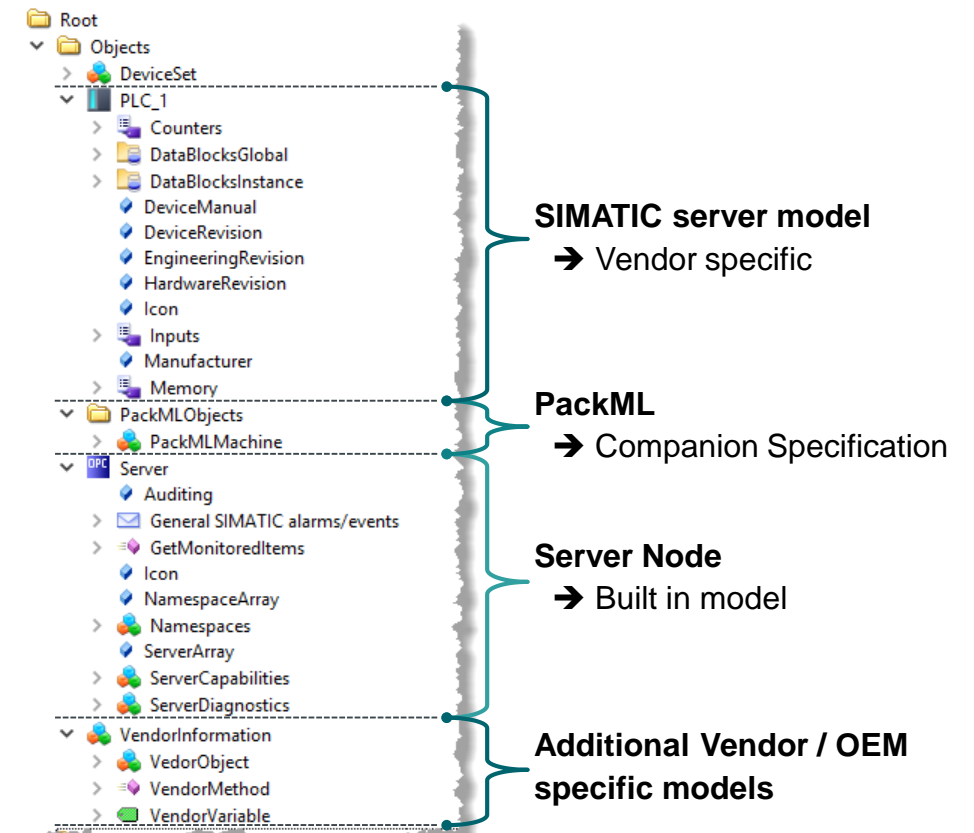
## Companion Specifications



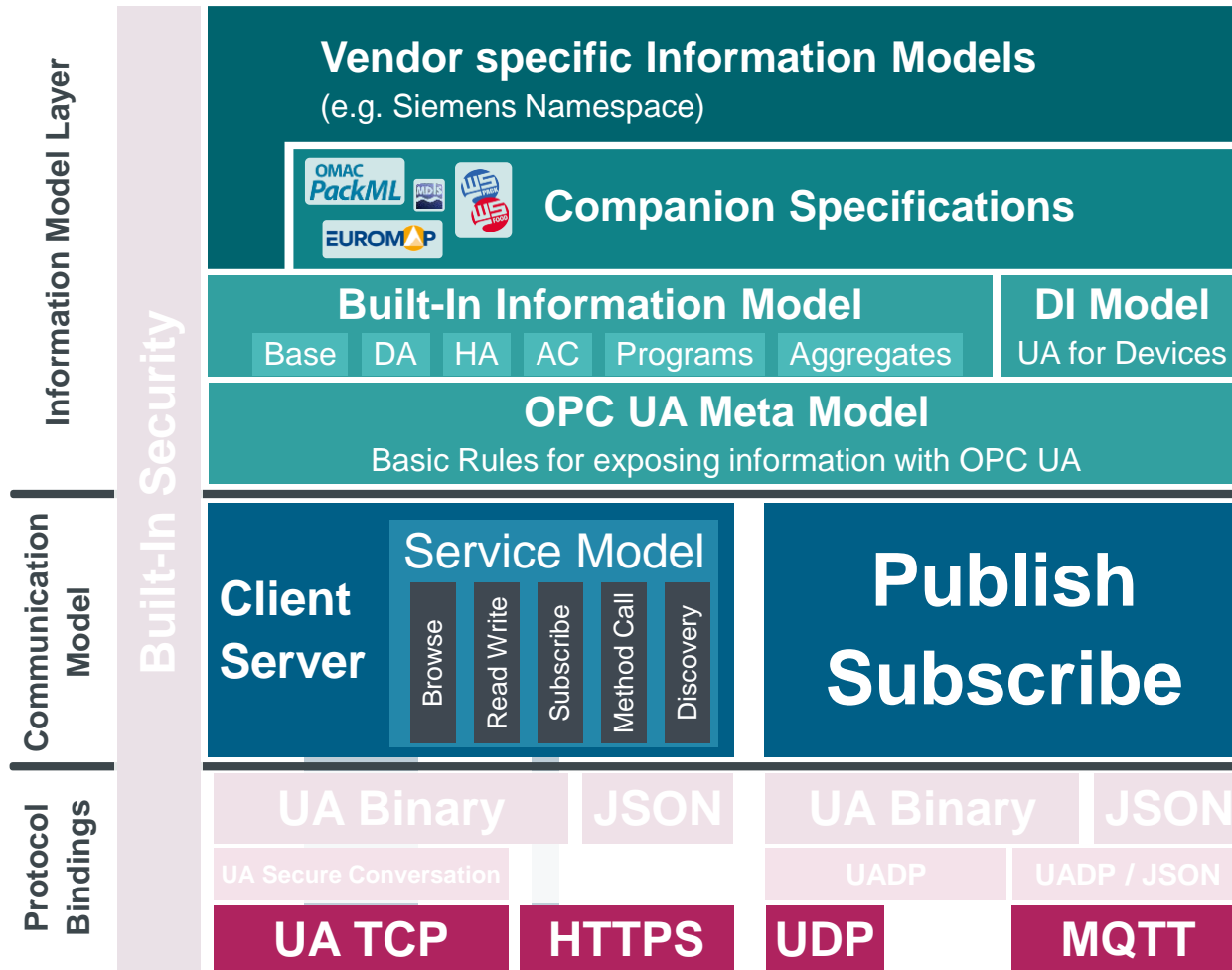
# OPC UA Architecture



## Vendor specific models



# OPC UA Architecture



## Transport Protocols



**TCP**



**HTTPS**

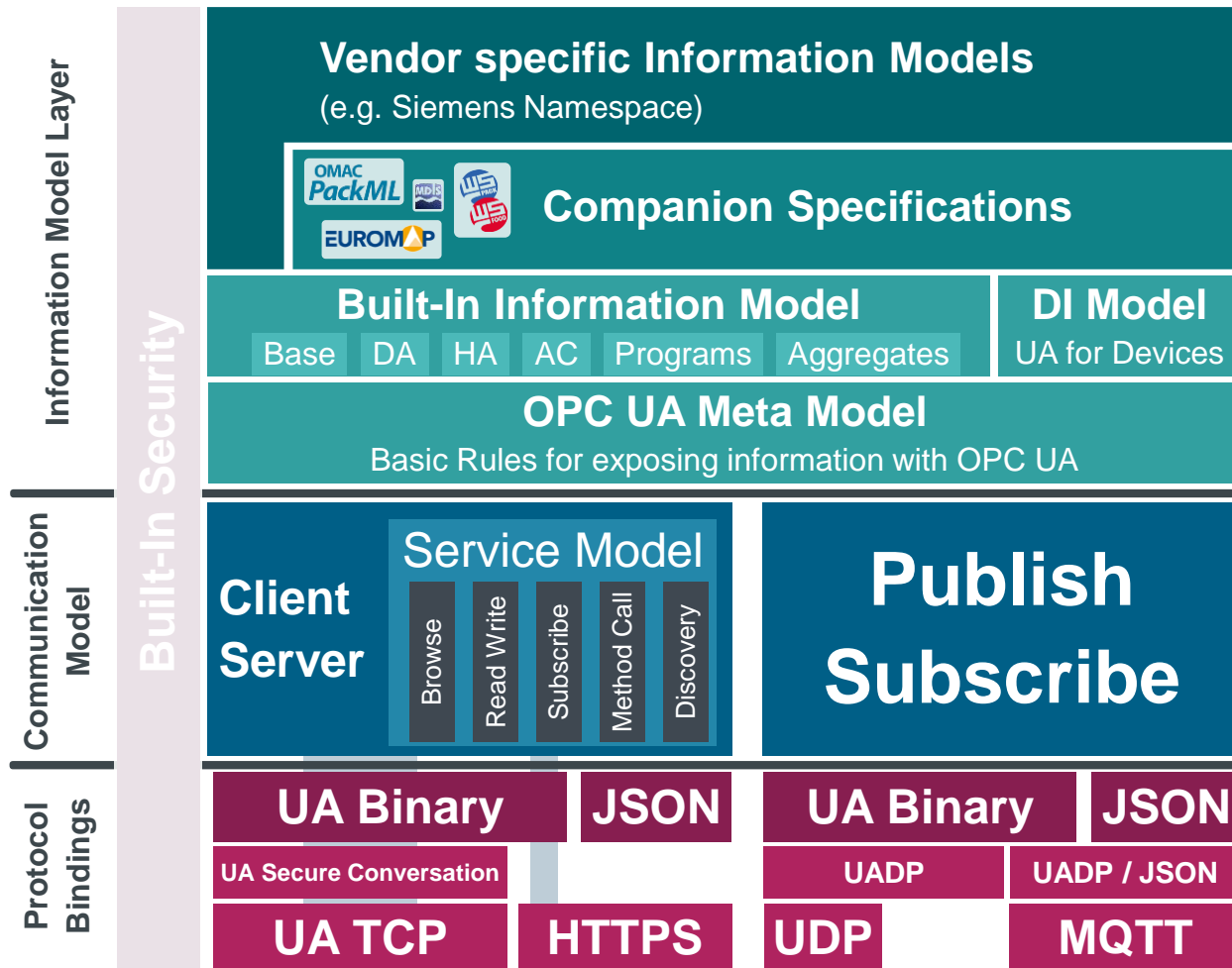


**UDP**



**MQTT**

# OPC UA Architecture

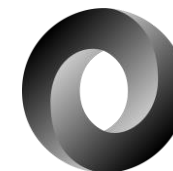


## Encodings

- Mapping OPC UA services, data structures and security model to transport protocols
- Specifies the data format of the transport protocol (e.g. TCP package encoding)

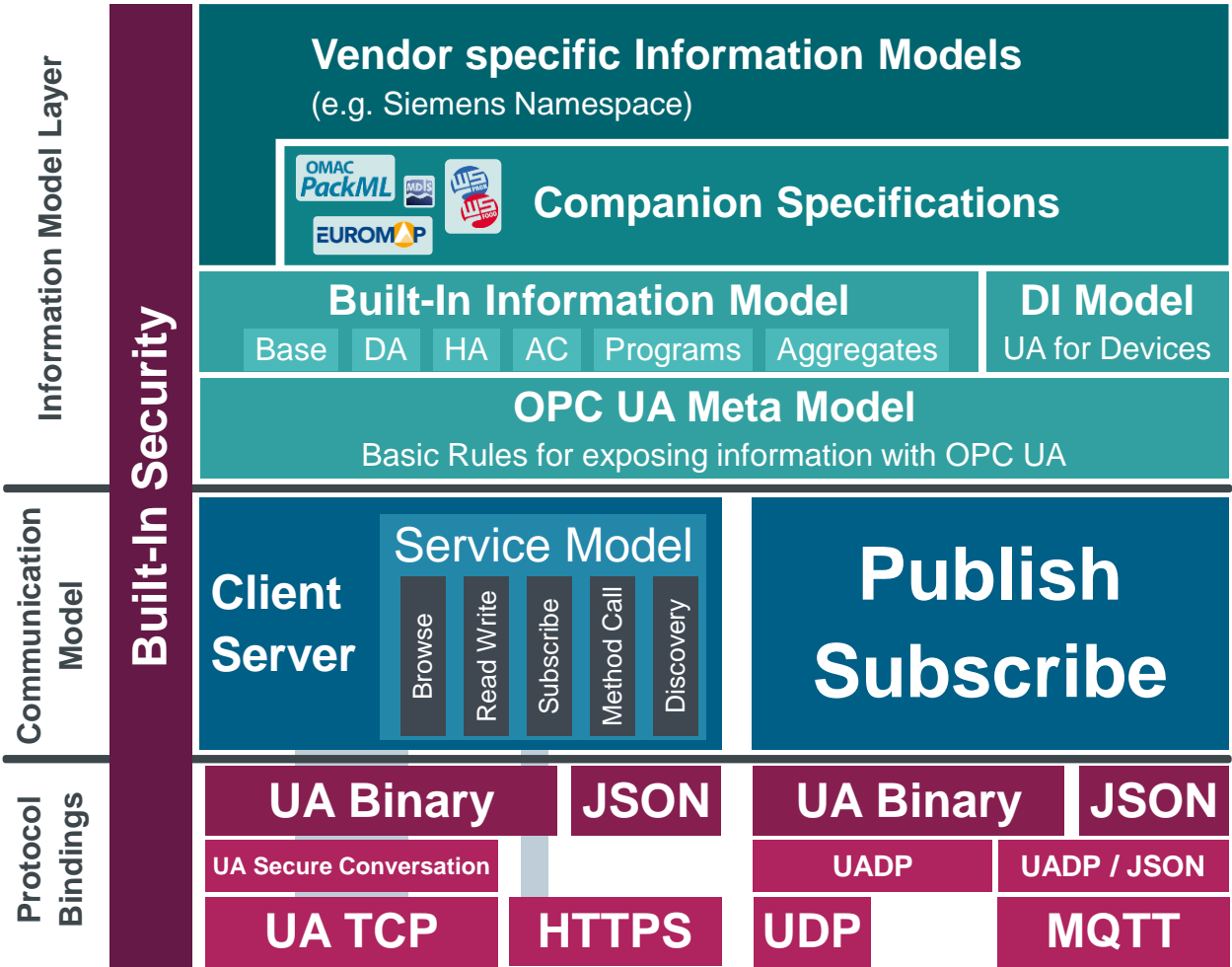
1100100  
00001111  
11111111  
001110011  
11111000

**Binary**



**JSON**

# OPC UA Architecture



## Security



**X.509  
Device/User  
certificates**



**User  
accounts**



**None**



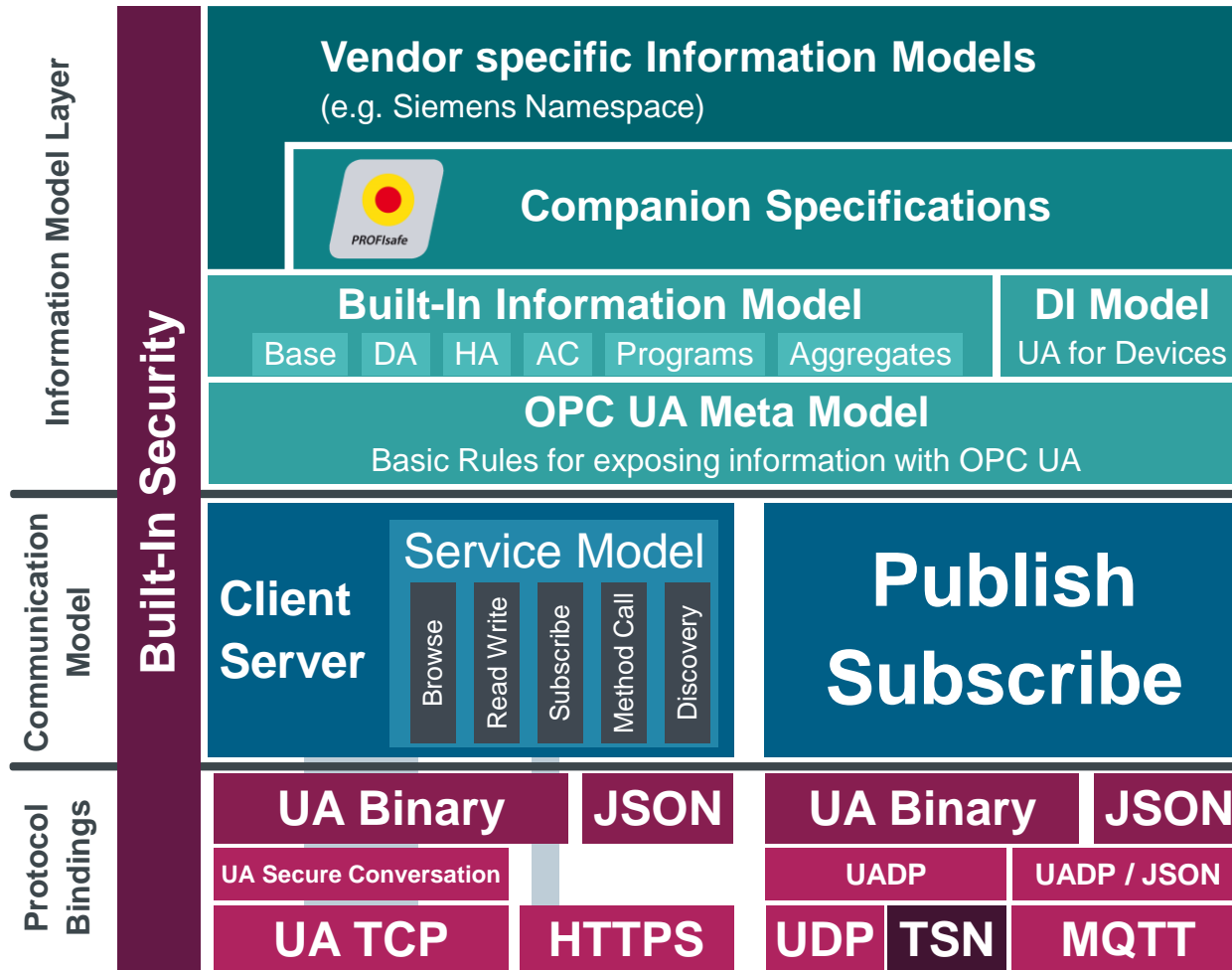
**128bit**



**256bit**

# OPC UA

## Further developments



## Safety over OPC UA (based on PROFISAFE)

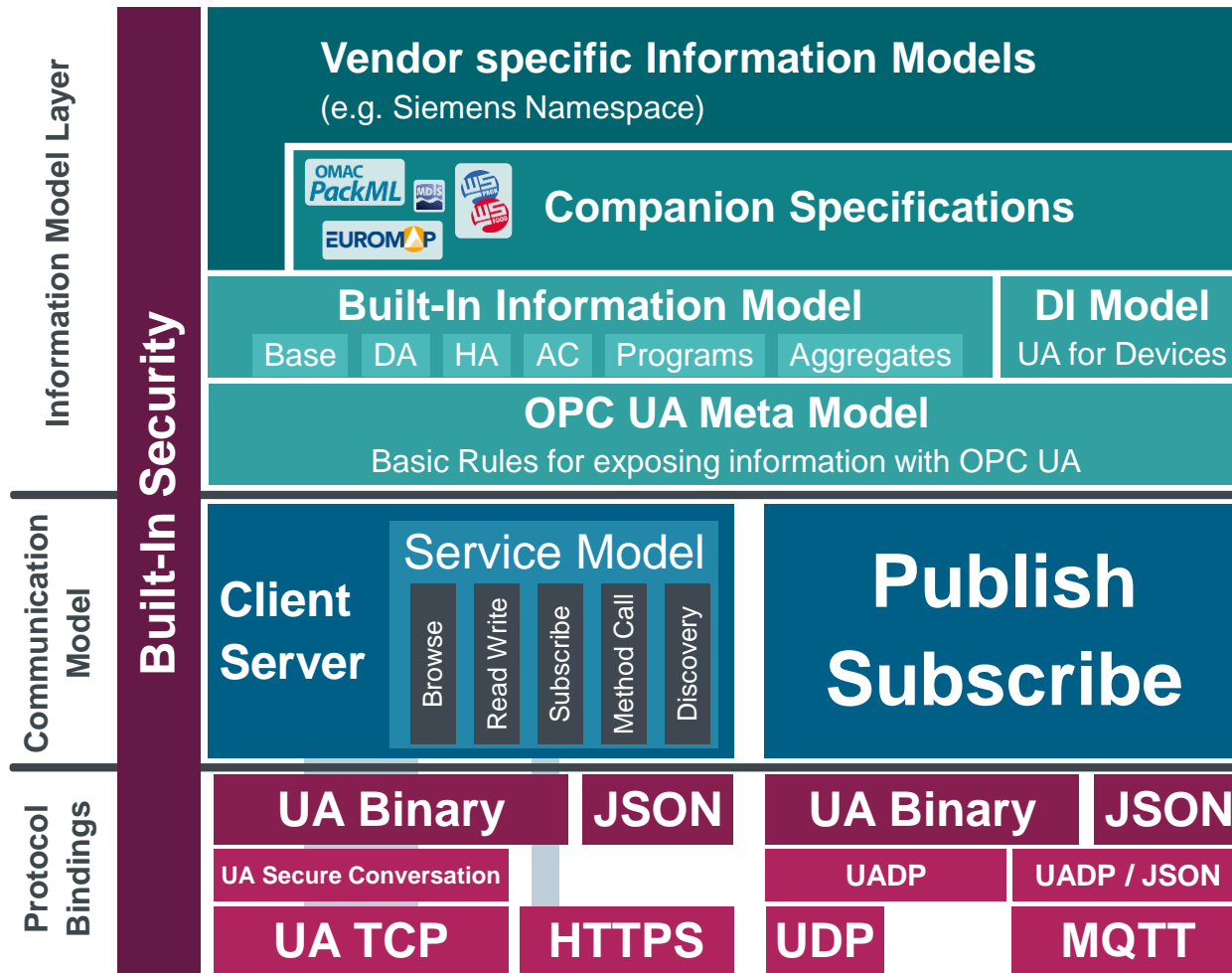
- Failsafe communication between controllers
- Combines PROFINET safety mechanisms with openness of OPC UA
- First prototypes for C2C communication shown on HMI and SPS (based on OPC UA Methods)

## OPC UA over TSN

- Combines openness of OPC UA with real time capability of TSN
- Communication between controllers and connectivity to field devices
- First prototypes for C2C communication shown on HMI and SPS



# OPC UA Architecture



**!** Every system supports only a subset of the specified features

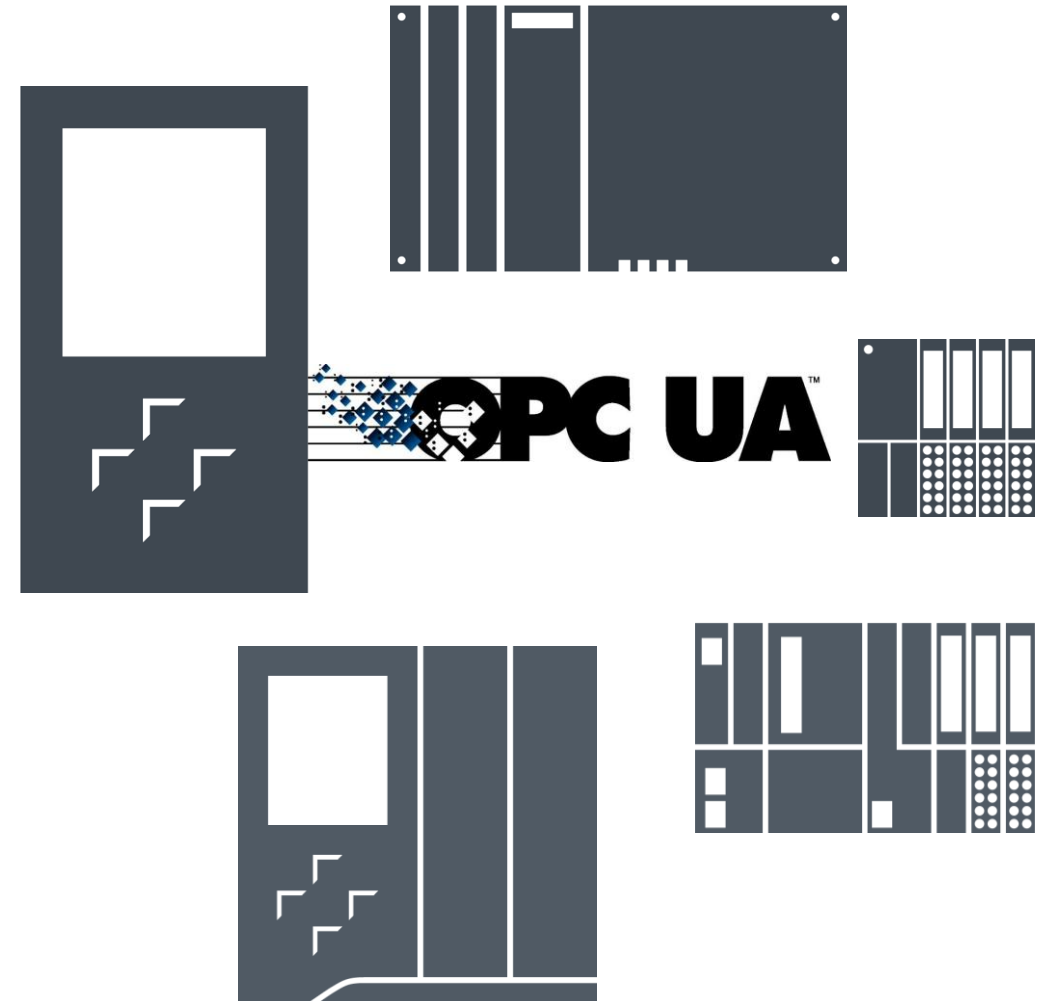
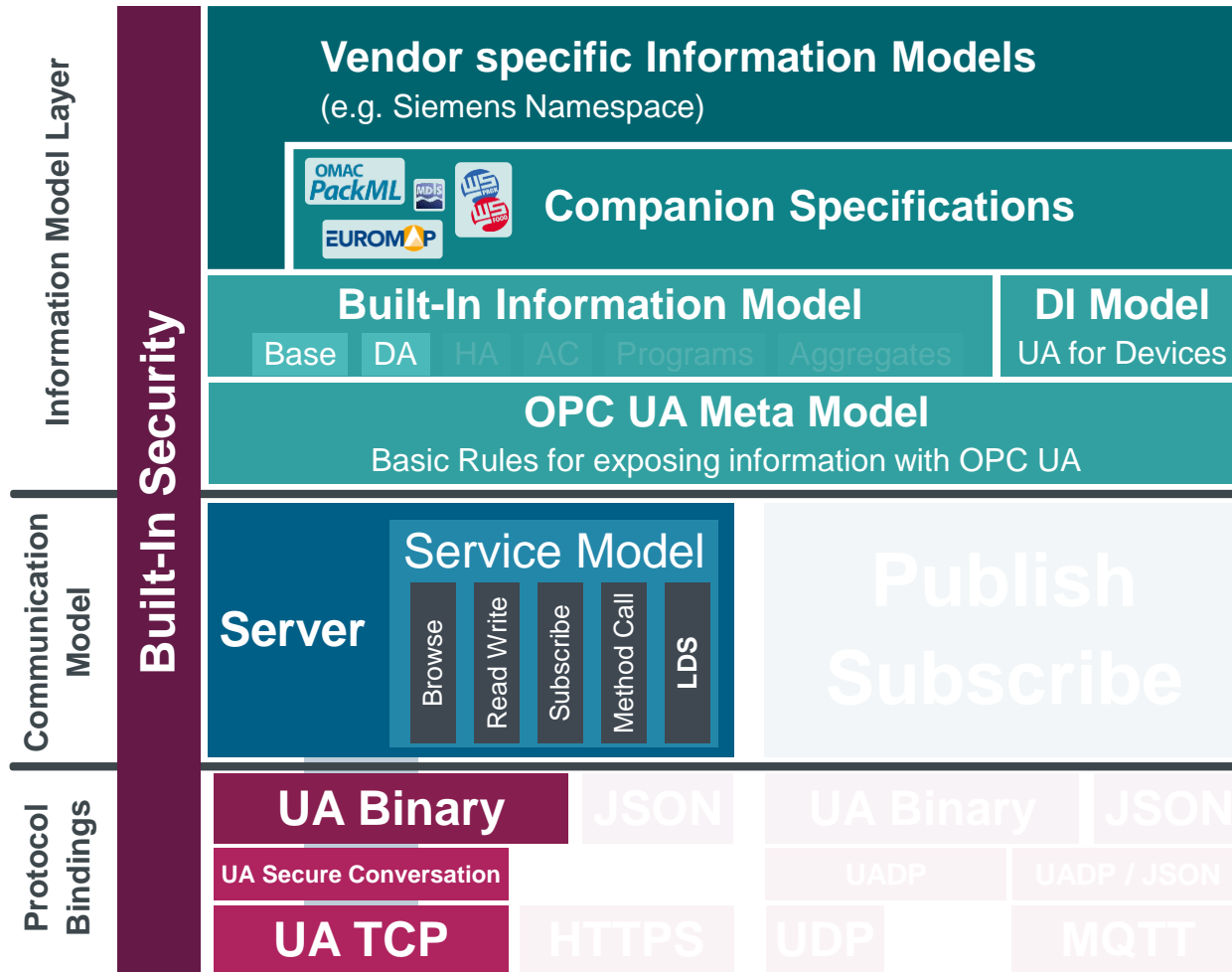
**Feature comparison** between the involved systems is **essential** during development of new communication concepts

Specification part 7 defines **profiles** to classify OPC UA capable devices

# S7-1500 OPC UA functional scope

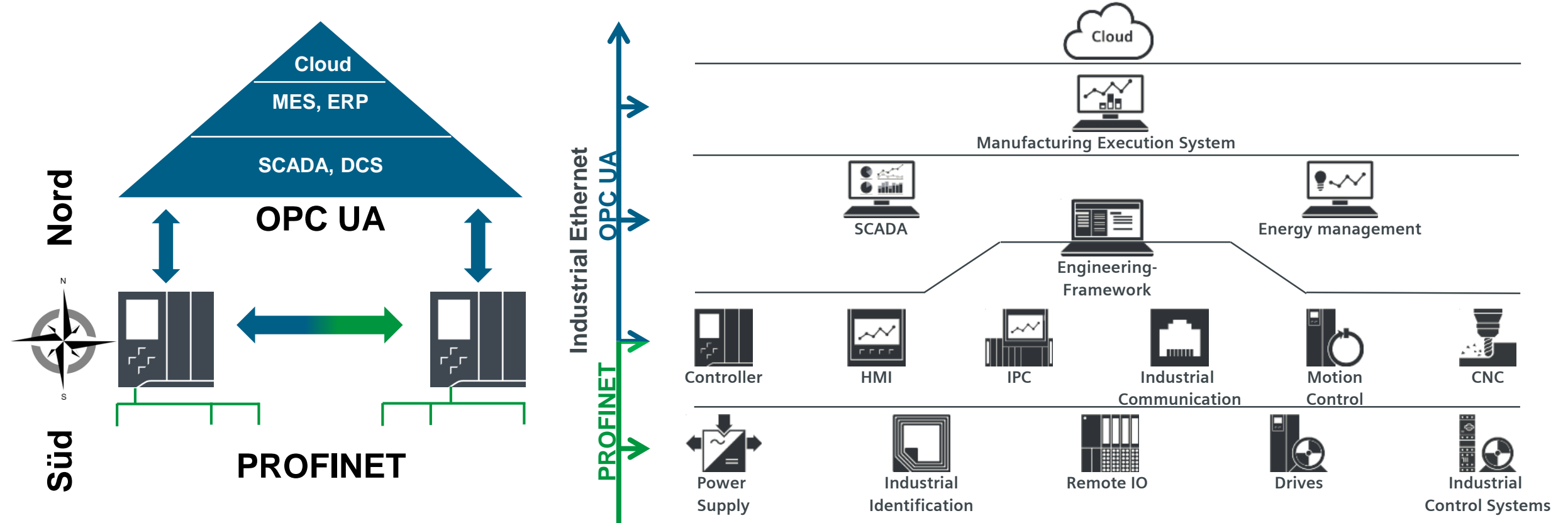
# S7-1500

## Functional scope



# S7-1500 OPC UA

## North- south alignment with PROFINET




# Agenda




**Part 1:**  
OPC UA specification overview




The slide features a teal background with a white Siemens logo in the top right corner. The main content area includes a large, stylized 'i' icon on the left, followed by a horizontal line of blue dots, and then the text 'OPC UA' in large, bold, black letters. Below this, the text 'Part 1: OPC UA specification overview' is displayed in white. A black square with a white checkmark is located in the bottom right corner.



**Part 2:**  
SIMATIC data access server



**OPC UA  
SERVER**



The slide features a teal background with a white Siemens logo in the top right corner. The main content area includes a SIMATIC icon on the left, followed by a horizontal line of blue dots, and then the text 'OPC UA SERVER' in large, bold, black letters. Below this, the text 'Part 2: SIMATIC data access server' is displayed in white. A black square with a white left-pointing arrow is located in the bottom right corner.