



# OPC UA DEVELOPMENT TRAINING

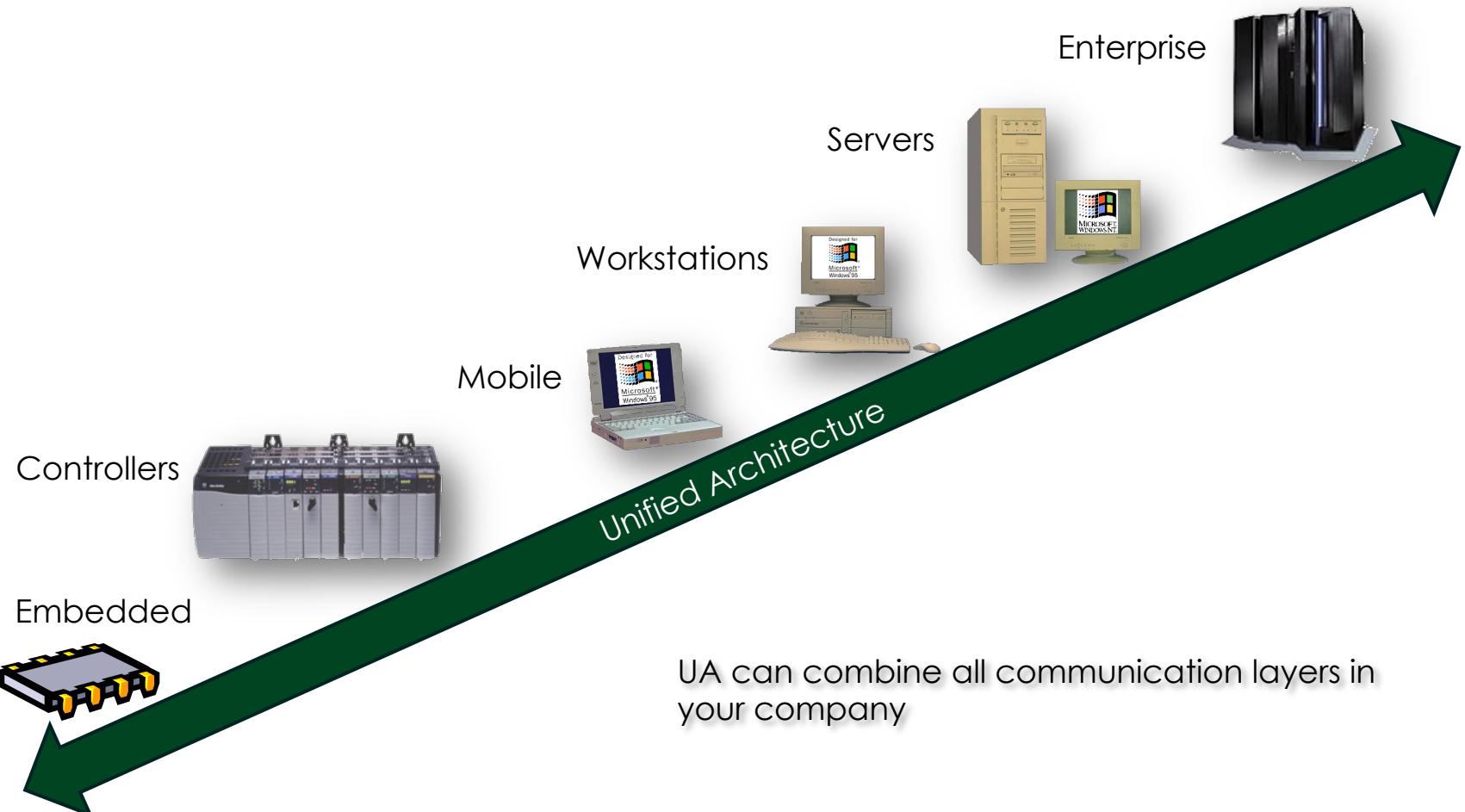
INTRODUCTION IN THE TECHNOLOGY AND HOW IT WORKS

# AGENDA

- THE OPC UA „VISION“
- 10 REASONS WHY TO CHOOSE OPC UA
- FEATURES OF OPC UA
- THE OPC UA SPECIFICATION
- How OPC UA WORKS



# THE OPC „UA VISION“



# 10 REASONS WHY TO CHOOSE OPC UA

- PLATFORM INDEPENDENT
- INCORPORATES ENHANCED INFORMATION SECURITY
- CREATE REAL INTEGRATION FROM PLANT-FLOOR TO EXECUTIVE-FLOOR
- BASES ON IEC STANDARD
- BUILDS ON A SIMPLIFIED ARCHITECTURE
- BASES ON A CLEAR, DEMANDING BUT NOT TECHNICALLY RESTRICTED SPECIFICATION
- COMPRISES OF A LARGE AMOUNT OF DOMAIN SPECIFIC ADD-ONS
- SCALABLE
- FUTURE-PROOF
- DEPLOYED EASILY

# FEATURES OF OPC UA

## Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

Compatibility

## ■ AUTHENTICATION OF CLIENTS AND SERVERS.

- CLIENT OR SERVER CAN ACCEPT/REJECT EACH OTHER BASED ON DIGITAL (X.509) CERTIFICATES

## ■ USER AUTHENTICATION

- ANONYMOUS, USERNAME AND X.509 CERTIFICATE USER AUTHENTICATION

## ■ AUDITING

- SUPPORT FOR SECURITY AUDIT TRAILS, AUDIT EVENT NOTIFICATIONS

# FEATURES OF OPC UA

## Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Plattform Independant

Scalable Architectur

Compatibility

### ■ TRANSPORT SECURITY

- SHA-2 SUPPORT (UP TO SHA512)
- INCLUDING SECURITY PROFILES
  - BASIC256SHA256
  - AES128SHA256RSAOAEP
  - AES256SHA256RSAPSS

### ■ INCORPORATED PROTECTION AGAINST “MESSAGE SPOOFING”, “INJECTION” AND “REPLAY”

### ■ INCORPORATED PROTECTION AGAINST LOSS OF MESSAGES

# FEATURES OF OPC UA

Integrated Security Model

## Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

Compatibility

- A SINGLE SERVER CAN INTEGRATE DATA ACCESS, ALARMS & EVENTS, HISTORY, METHODS, ...
  
- THE ADDRESSSPACE IS DEFINED BY NODES AND REFERENCES BETWEEN NODES
  
- THE CHARACTERISTICS OF NODES ARE DEFINED BY ATTRIBUTES
  
- NODES ARE TYPED BASED ON THEIR CONNECTED NODECLASSES

# FEATURES OF OPC UA

Integrated Security Model

## Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

Compatibility

- THE ADDRESSSPACE IS STRUCTURED HIERARCHICALLY BUT ALLOWS DIRECT REFERENCES BETWEEN NODES (MESH)
- SERVERS MAY CREATE SUBSETS OF THE ADDRESSSPACE INTO SO CALLED VIEWS

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

## Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

Compatibility

- THE OBJECT MODEL ALLOWS SERVERS TO PROVIDE TYPE DEFINITIONS FOR OBJECTS AND NODES
- CREATING AND USING OF STRUCTURED DATA
- DEFINE YOUR OWN OBJECT TYPES AND INSTANCES, FROM SIMPLE TO COMPLEX
- EACH OPC UA APPLICATION CAN USE ANY DATA TYPES DEFINED IN THE UA MODEL



# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

## Integrated Services

Platform Independent

Scalable Architecture

Compatibility

- INTERFACE BETWEEN CLIENTS AND SERVERS IS DEFINED AS A SET OF SERVICES
- LOGICALLY ORGANIZED IN SERVICE SETS AND PROVIDES TWO CAPABILITIES
  - REQUESTS (CLIENT SEND A REQUEST AND GETS A RESPONSE), E.G. READING OF A VALUE
  - SUBSCRIBE (CLIENT SUBSCRIBES FOR NOTIFICATIONS), E.G. GET ALARMS, DATA VALUE CHANGES OR EVENTS

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

## Integrated Services

Plattform Independant

Scalable Architectur

Compatibility

<b>Discovery</b> FindServers GetEndpoints RegisterServer	<b>SecureChannel</b> CreateSession ActivateSession CloseSession Cancel	<b>NodeManagement</b> AddNodes AddReferences DeleteNodes DeleteReferences
<b>View</b> Browse BrowseNext TranslateBrowse... RegisterNodes UnregisterNodes	<b>Query</b> QueryFirst QueryNext	<b>Attribute</b> Read HistoryRead Write HistoryUpdate
<b>Method</b> Call	<b>MonitoredItem</b> CreateMonitoredItems ModifyMonitoredItems SetMonitoringMode SetTriggering DeleteMonitoredItems	<b>Subscription</b> CreateSubscription ModifySubscription SetPublishingMode Publish Republish TransferSubscriptions DeleteSubscriptions

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

**Platform Independant**

Scalable Architectur

Compatibility

- NO LONGER ONLY SUPPORT OF WINDOWS!
- CAN BE PORTED TO ANY OPERATING SYSTEM
- CAN BE USED ON EMBEDDED DEVICES
- CONNECTS APPLICATIONS FOR DATA CAPTURE DIRECTLY TO A DEVICE

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Plattform Independant

**Scalable Architectur**

Compatibility

- ARCHITECTURE WITH MULTIPLE LAYERS
- "UPGRADE" A LAYER IS POSSIBLE WITHOUT INFLUENCING OTHER LAYERS
- NEW TECHNOLOGIES CAN BE ADDED TO OPC UA WITHOUT PROBLEMS

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

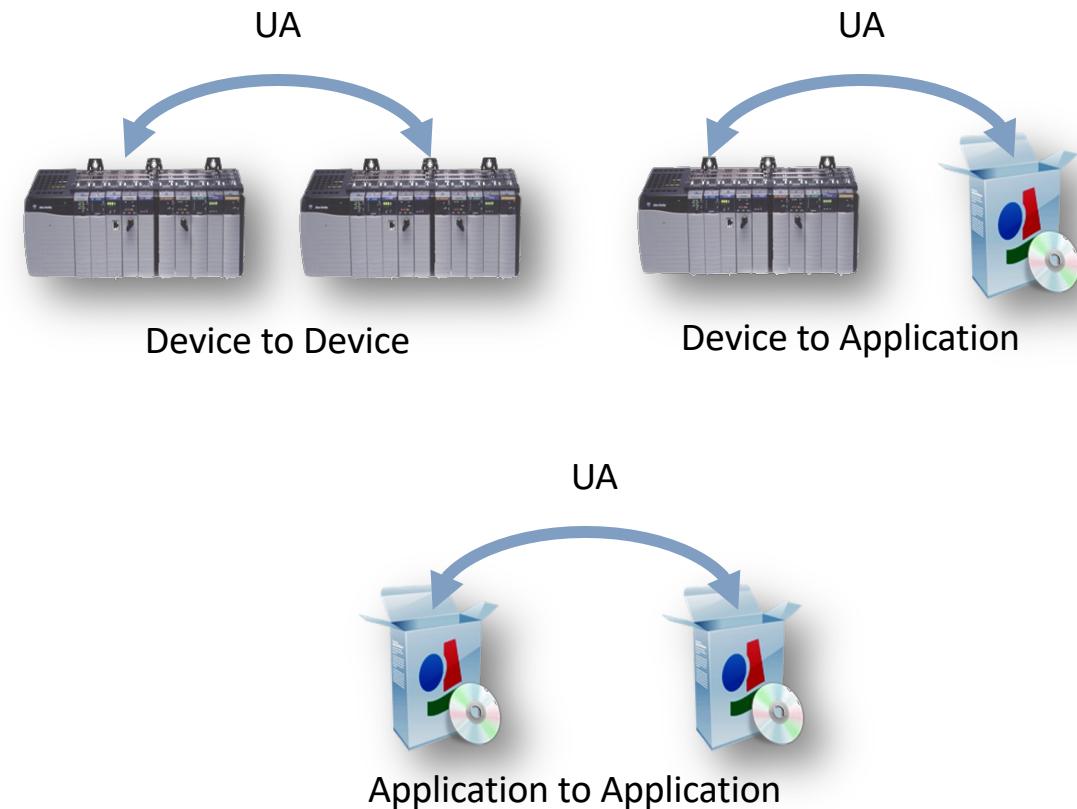
Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

**Compatibility**



# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Plattform Independant

Scalable Architectur

## Compatibility

### ■ SPECIFICATION

- AVAILABLE FOR REGISTERED USERS

### ■ REDISTRIBUTABLES

- LOCAL DISCOVERY SERVER (LDS) FOR WINDOWS ALLOWS DETECTION OF AVAILABLE OPC UA SERVERS ON A SYSTEM
- AVAILABLE FOR REGISTERED USERS

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Platform Independant

Scalable Architectur

**Compatibility**

## ■ OPC UA STACKS FOR DEVELOPERS

- ARE THE BASE FOR DEVELOPMENT OF OPC UA SERVER AND OPC UA CLIENT APPLICATIONS.  
AVAILABLE AS:
  - .NET STANDARD STACK  
[HTTPS://GITHUB.COM/OPCFoundation/UA-.NETSTANDARD](https://github.com/opcfoundation/ua-.netstandard)
  - ANSI C STACK (LEGACY)  
[HTTPS://GITHUB.COM/OPCFoundation/UA-ANSIC-LEGACY](https://github.com/opcfoundation/ua-ansic-legacy)
  - .NET STACK (LEGACY)  
[HTTPS://GITHUB.COM/OPCFoundation/UA-.NET-LEGACY](https://github.com/opcfoundation/ua-.net-legacy)
  - JAVA STACK (LEGACY)  
[HTTPS://GITHUB.COM/OPCFoundation/UA-JAVA-LEGACY](https://github.com/opcfoundation/ua-java-legacy)
- AVAILABLE VIA GITHUB
- SAMPLE CODE ONLY, NOT FULL SDKS

# FEATURES OF OPC UA

Integrated Security Model

Integrated AddressSpace Model

Integrated Object Model

Integrated Services

Platform Independent

Scalable Architecture

## Compatibility

- LOCAL DISCOVERY SERVER SOURCE CODE
  - CAN BE USED AS BASE FOR PORTING TO LINUX FOR EXAMPLE.
  - AVAILABLE VIA GITHUB  
[HTTPS://GITHUB.COM/OPCFoundation/UA-LDS](https://github.com/OPCFoundation/UA-LDS)
- GLOBAL DISCOVERY SERVER (GDS) SAMPLE
  - PROVIDES THE NECESSARY INFRASTRUCTURE TO PROVIDE ENTERPRISE-WIDE ADMINISTRATION OF OPC UA SERVERS.
  - SAMPLE CODE ONLY
  - AVAILABLE VIA GITHUB  
[HTTPS://GITHUB.COM/OPCFoundation/UA-.NETSTANDARD-SAMPLES/TREE/MASTER/SAMPLES/GDS](https://github.com/OPCFoundation/UA-.NETStandard-Samples/tree/master/Samples/GDS)

# FEATURES OF OPC UA

Integrated Security Model

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**Compatibility**

## ■ COMPLIANCE TEST TOOL

- COMPLIANCE TEST TOOL WINDOWS AND LINUX FOR CORPORATE MEMBERS
- A SINGLE TEST TOOL FOR TESTING UA SERVER AND UA CLIENTS

## ■ INTEROPERABILITY WORKSHOP

- THERE ARE ALWAYS 3 INTEROPERABILITY WORKSHOPS (IOP-WORKSHOPS) PER YEAR:
  - USA
  - EUROPE
  - JAPAN
- TEST OF CLIENT- AND SERVER APPLICATIONS FROM DIFFERENT VENDORS TO CHECK COMPATIBILITY BETWEEN MEMBERS

# FEATURES OF OPC UA

Integrated Security Model

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Platform Independent

Scalable Architecture

**Compatibility**

## ■ OPC FOUNDATION CERTIFICATION TEST LAB

- THE OPC FOUNDATION'S CERTIFICATION AND COMPLIANCE PROGRAM EXISTS TO HELP MEMBERS DEVELOP AND PROVIDE HIGH QUALITY PRODUCTS THAT MEET MINIMUM OPERABILITY REQUIREMENTS.
- OPC CERTIFIED PRODUCTS ARE:
  - **COMPLIANT** WITH THE OPC SPECIFICATIONS
  - **INTEROPERABLE** WITH OTHER OPC PRODUCTS FROM OTHER VENDORS
  - **ROBUST**, RELIABLE AND ABLE TO RECOVER FROM LOST COMMUNICATIONS, ETC.
  - **USABLE**, BY FOLLOWING UNIVERSALLY ACCEPTED BEST-PRACTICES
  - **EFFICIENT** IN MANAGING RESOURCES (CPU, MEMORY, DISK SPACE ETC.)

# FEATURES OF OPC UA

Integrated Security Model

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Platform Independent

Scalable Architecture

## Compatibility

### ■ WHAT IS CERTIFIABLE?

- ANY OPC UA CLIENT OR SERVER CAN BE CERTIFIED BY A TEST LAB.
- SOFTWARE DEVELOPMENT KITS OR “TOOLKITS” CANNOT BE CERTIFIED DIRECTLY.
- REFERENCE IMPLEMENTATIONS (SAMPLE CLIENTS AND/OR SAMPLE SERVERS) SHIPPED WITH THE SDK ARE TESTED AND CERTIFIED IN A LAB.
- APPLICATIONS DEVELOPED WITH AN SDK THAT HAS A CERTIFIED REFERENCE IMPLEMENTATION STAND A MUCH HIGHER CHANCE OF CERTIFICATION, BUT REQUIRE THEIR OWN CERTIFICATION TESTING IN ORDER TO BECOME OFFICIALLY CERTIFIED PRODUCTS.





# Questions?

FEATURES OF OPC UA

# THE OPC UA SPECIFICATION

- SPECIFICATION CONSISTS OF 16 PARTS WITH OVER 1400 PAGES
- THE DIFFERENT PARTS OF THE SPECIFICATION ARE GROUPED IN THREE AREAS:
  - **CORE SPECIFICATION PARTS**  
THESE CORE CAPABILITIES DEFINE THE STRUCTURE OF THE OPC ADDRESSSPACE AND THE SERVICES THAT OPERATE ON IT.
  - **ACCESS TYPE SPECIFICATION PARTS**  
APPLY THE CORE CAPABILITIES TO SPECIFIC TYPES OF ACCESS PREVIOUSLY ADDRESSED BY SEPARATE OPC COM SPECIFICATIONS, SUCH AS DATA ACCESS (DA), ALARMS AND EVENTS (A&E) AND HISTORICAL DATA ACCESS (HDA).
  - **UTILITY SPECIFICATION PARTS**  
DESCRIBES THE DISCOVERY MECHANISMS FOR OPC UA AND WAYS OF AGGREGATING DATA.

# THE OPC UA SPECIFICATION

## OPC UA CORE SPECIFICATION

### ■ **PART 1: OVERVIEW AND CONCEPTS**

PRESENTS THE CONCEPTS AND OVERVIEW OF OPC UA.

### ■ **PART 2: SECURITY MODEL**

DESCRIBES THE MODEL FOR SECURING INTERACTIONS BETWEEN OPC UA CLIENTS AND OPC UA SERVERS.

### ■ **PART 3: ADDRESS SPACE MODEL**

DESCRIBES THE CONTENTS AND STRUCTURE OF THE SERVER'S ADDRESSSPACE.

### ■ **PART 4: SERVICES**

SPECIFIES THE SERVICES PROVIDED BY OPC UA SERVERS.

# THE OPC UA SPECIFICATION

## OPC UA CORE SPECIFICATION

### ■ PART 5: INFORMATION MODEL

SPECIFIES THE TYPES AND THEIR RELATIONSHIPS DEFINED FOR OPC UA SERVERS.

### ■ PART 6: MAPPINGS

SPECIFIES THE MAPPINGS TO TRANSPORT PROTOCOLS AND DATA ENCODINGS SUPPORTED BY OPC UA.

### ■ PART 7: PROFILES

SPECIFIES THE PROFILES THAT ARE AVAILABLE FOR OPC CLIENTS AND SERVERS. THESE PROFILES PROVIDE GROUPS OF SERVICES OR FUNCTIONALITY THAT CAN BE USED FOR CONFORMANCE LEVEL CERTIFICATION. SERVERS AND CLIENTS WILL BE TESTED AGAINST THE PROFILES.

# THE OPC UA SPECIFICATION

## OPC UA ACCESS TYPE SPECIFICATION

### ■ PART 8: DATA ACCESS

SPECIFIES THE USE OF OPC UA FOR DATA ACCESS.

### ■ PART 9: ALARMS AND CONDITIONS

SPECIFIES THE USE OF OPC UA FOR ACCESS TO ALARMS AND CONDITIONS. EXTENDS THE SIMPLE EVENTS TO INCLUDE SUPPORT FOR ALARMS AND CONDITIONS.

### ■ PART 10: PROGRAMS

SPECIFIES OPC UA SUPPORT FOR ACCESS TO PROGRAMS.

### ■ PART 11: HISTORICAL ACCESS

SPECIFIES USE OF OPC UA FOR HISTORICAL ACCESS. THIS ACCESS INCLUDES BOTH HISTORICAL DATA AND HISTORICAL EVENTS.

# THE OPC UA SPECIFICATION

## OPC UA ACCESS TYPE SPECIFICATION

- **PART 12: DISCOVERY AND GLOBAL SERVICES**

SPECIFIES THE INTERACTION WITH THE DISCOVERY SERVERS.

- **PART 13: AGGREGATES**

SPECIFIES THE INFORMATION MODEL ASSOCIATED WITH AGGREGATES.

- **PART 14: PUBSUB**

SPECIFIES THE OPC UA PUBLISH SUBSCRIBE PATTERN (PUBSUB)  
COMMUNICATION MODEL.

# THE OPC UA SPECIFICATION

## OPC UA ACCESS TYPE SPECIFICATION

- **PART 17: ALIASNAMES**

SPECIFIES A DEFINITION OF ALIASNAMES FUNCTIONALITY.

- **PART 19: DICTIONARY REFERENCE**

SPECIFIES THE BASIC INFRASTRUCTURE TO REFERENCE FROM AN OPC UA INFORMATION MODEL TO EXTERNAL DICTIONARIES LIKE IEC COMMON DATA DICTIONARY OR ECL@SS.

# THE OPC UA SPECIFICATION

## OPC UA CORE SPECIFICATION

Part	Description	Version	Date	State
10000-1	Overview and Concepts	1.05.04	29-NOV-2024	Released
10000-2	Security Model	1.05.04	29-NOV-2024	Released
10000-3	Address Space Model	1.05.04	29-NOV-2024	Released
10000-4	Services	1.05.04	29-NOV-2024	Released
10000-5	Information Model	1.05.04	29-NOV-2024	Released
10000-6	Mappings	1.05.04	29-NOV-2024	Released
10000-7	Profiles	1.05.02	01-NOV-2022	Released
10000-8	Data Access	1.05.04	29-NOV-2024	Released
10000-9	Alarms and Conditions	1.05.03	13-DEC-2023	Released
0000-10	Programs	1.05.00	27-OCT-2021	Released
10000-11	Historical Access	1.05.04	29-NOV-2024	Released
10000-12	Discovery and Global Services	1.05.04	29-NOV-2024	Released
10000-13	Aggregates	1.05.02	01-NOV-2022	Released
10000-14	PubSub	1.05.04	29-NOV-2024	Released

# THE OPC UA SPECIFICATION

## OPC UA CORE SPECIFICATION

Part	Description	Version	Date	State
10000-15	Safety	1.05.04	29-NOV-2024	Released
10000-16	State Machines	1.05.04	29-NOV-2024	Released
10000-17	Alias Names	1.05.04	29-NOV-2024	Released
10000-18	Role-Based Security	1.05.04	29-NOV-2024	Released
10000-19	Dictionary References	1.05.03	13-DEC-2023	Released
10000-20	File Transfer	1.05.03	13-DEC-2023	Released
10000-21	Device Onboarding	1.05.04	29-NOV-2024	Released
10000-22	Base Network Model	1.05.04	29-NOV-2024	Released
10000-23	Common Reference Types	1.05.02	01-NOV-2022	Released
10000-24	Scheduler	1.05.02	01-NOV-2022	Released

# THE OPC UA SPECIFICATION

## OPC UA SPECIFICATION DOWNLOAD

- **OPCFoundation.org**

SPECIFICATIONS ARE NOW AVAILABLE FOR DOWNLOAD FOR EVERYONE (JUST REGISTER) AT

[HTTPS://OPCFoundation.org/developer-tools/specifications-unified-architecture](https://opcfoundation.org/developer-tools/specifications-unified-architecture)

# HOW OPC UA WORKS

## UA Stack

Connections

Nodes, Browse, Views

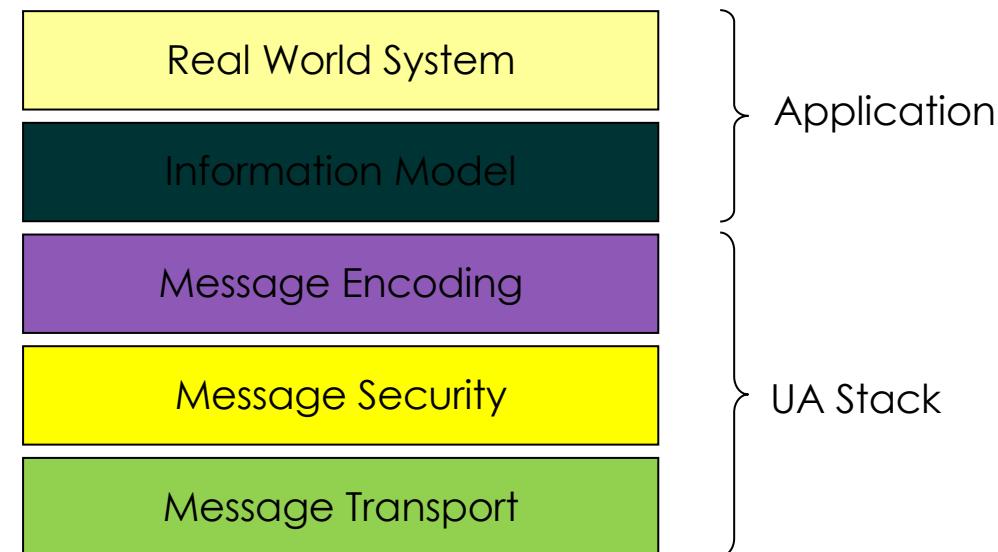
Data Types

Subscriptions

Services

Profiles

- THE STACK PROVIDES THE BASE NODE CLASSES
- THE STACK INCLUDES THE UA SERVICES
- THE STACK HANDLES THE CONNECTIONS



# HOW OPC UA WORKS

## UA Stack

Connections

Nodes, Browse, Views

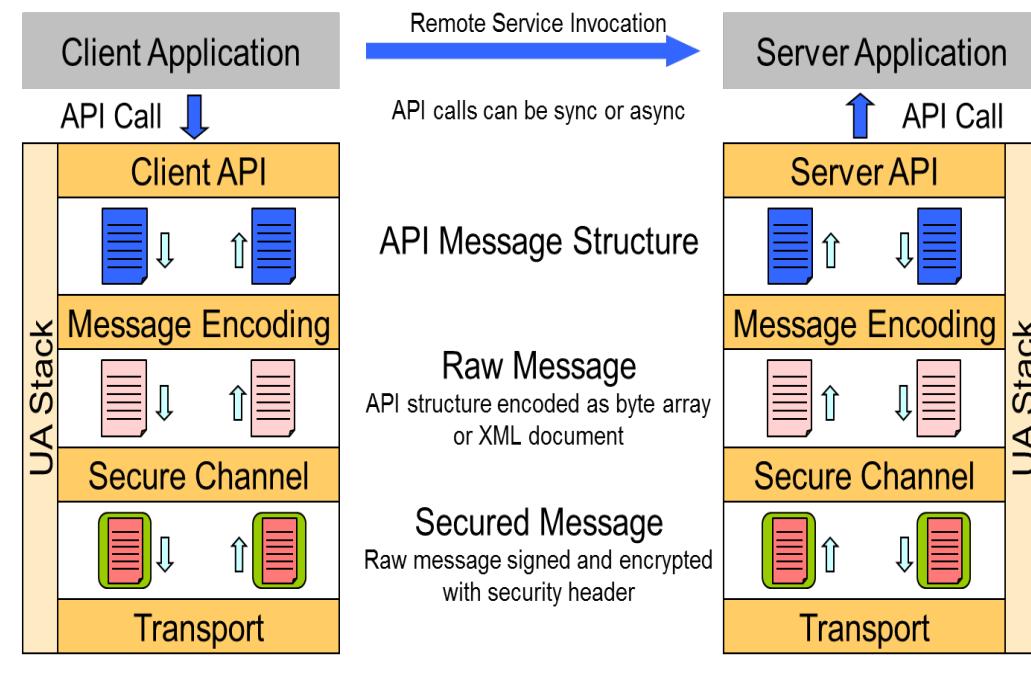
Data Types

Subscriptions

Services

Profiles

## ■ HANDLING OF THE MESSAGE ENCODING & TRANSPORT



# HOW OPC UA WORKS

UA Stack

**Connections**

Nodes, Browse, Views

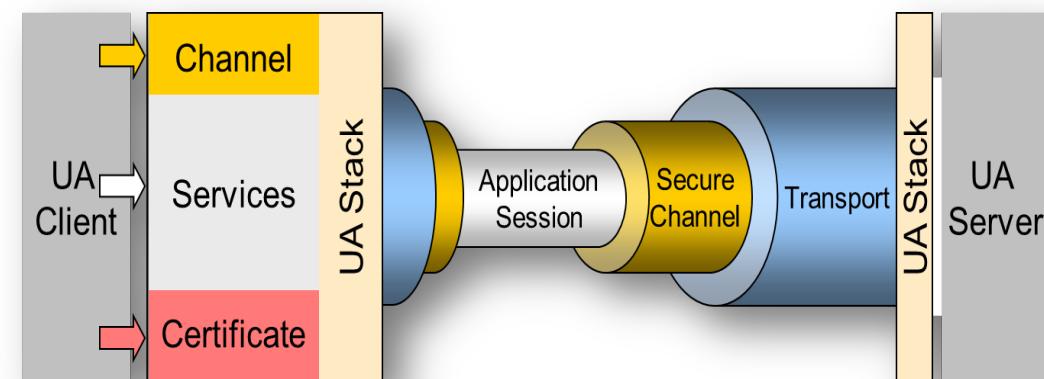
Data Types

Subscriptions

Services

Profiles

- OPEN A “CHANNEL” TO THE SERVER:
  - PROTOCOL: SOAP/HTTP OR UA BINARY
  - SECURITY: ENCODING, OPTIONS
  
- OPEN A “SESSION” TO THE CHANNEL:
  - USER AUTHENTICATION AND SETTINGS
  - ALL SERVICE-CALLS ARE DONE VIA A SESSION



# HOW OPC UA WORKS

UA Stack

**Connections**

Nodes, Browse, Views

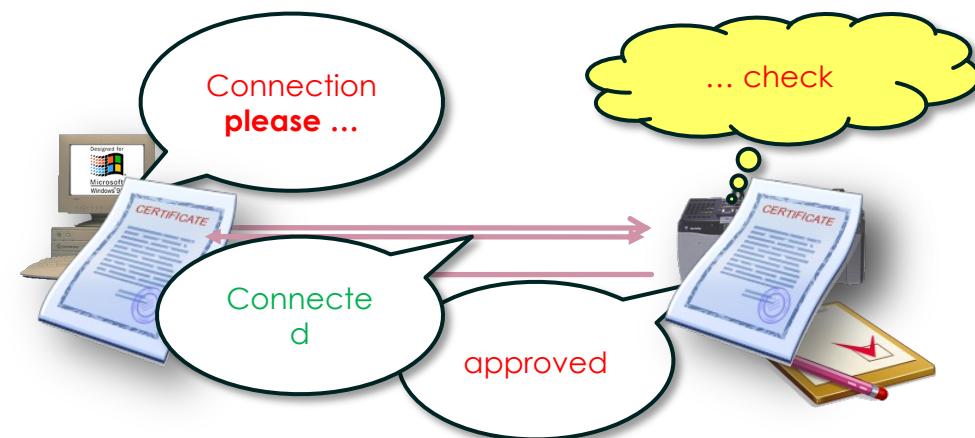
Data Types

Subscriptions

Services

Profiles

- CLIENT PROVIDES A SOFTWARE CERTIFICATE WHICH THE SERVER CAN CHECK
- SERVER PROVIDES A SOFTWARE CERTIFICATE WHICH THE CLIENT CAN CHECK
- CLIENT AND SERVER CAN RESTRICT ACCESS OF APPLICATIONS WITH THESE CERTIFICATE FOR TRUSTABLE APPLICATIONS ONLY.



# HOW OPC UA WORKS

UA Stack

Connections

## Nodes, Browse, Views

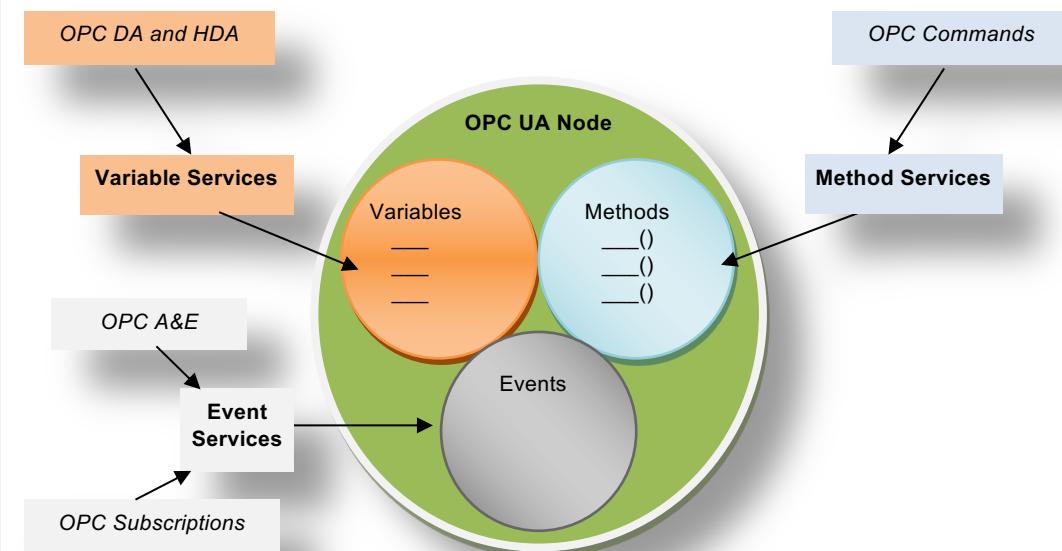
Data Types

Subscriptions

Services

Profiles

- ONE NODE FOR DATA, HISTORY, EVENTS AND METHODS ETC.
- THE FUNCTIONALITY OF NODES CAN BE EXTENDED!



# HOW OPC UA WORKS

UA Stack

Connections

**Nodes, Browse, Views**

Data Types

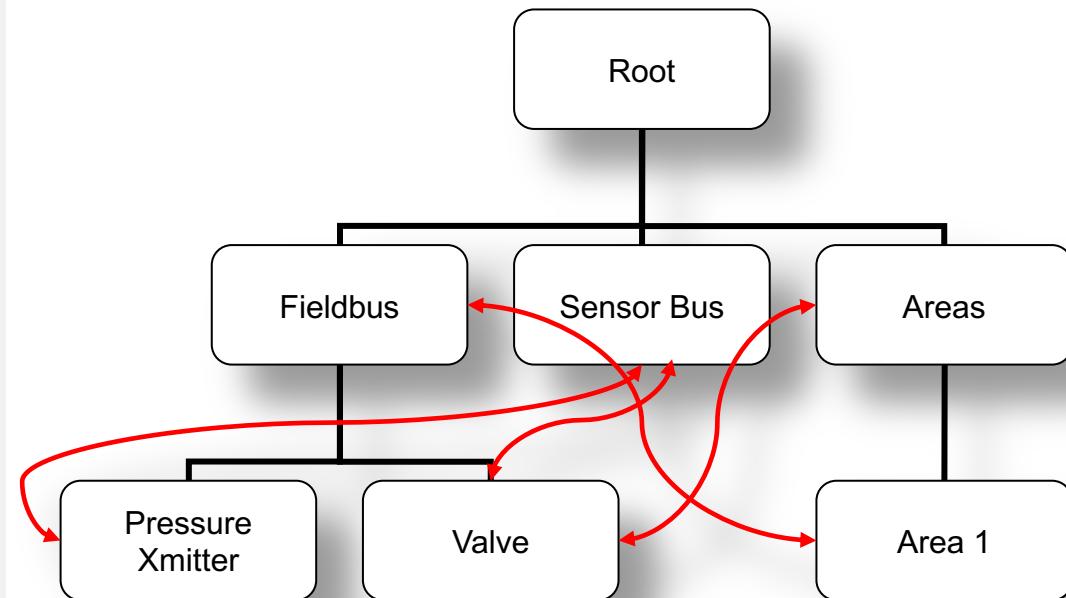
Subscriptions

Services

Profiles

- NODES ARE ORGANIZED HIERARCHICALLY

- NODES CAN POINT TO OTHER NODES



# HOW OPC UA WORKS

UA Stack

Connections

**Nodes, Browse, Views**

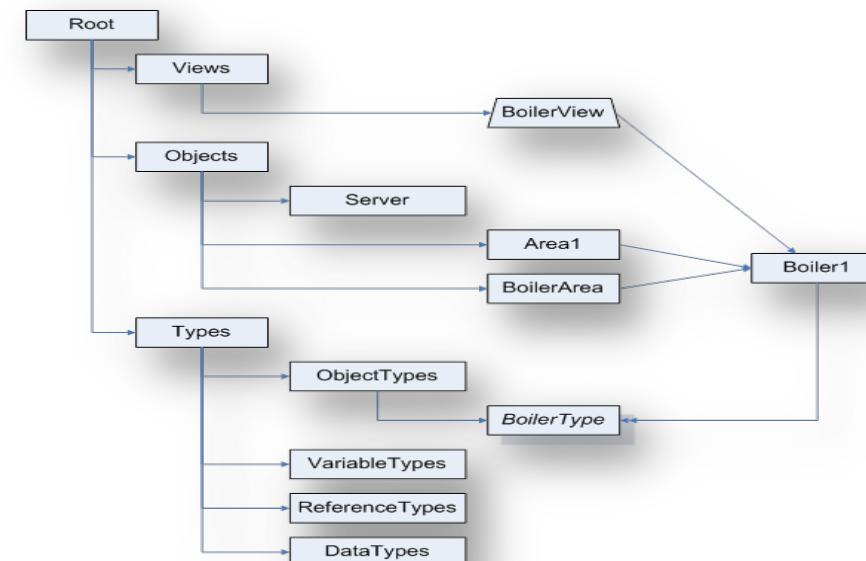
Data Types

Subscriptions

Services

Profiles

- ORGANIZATION OF THE ADDRESS SPACE
- VIEWS (LIKE DATABASE VIEWS)
- OBJECTS (THE NODES TO WORK WITH)
- TYPES (FROM THE SERVER SUPPORTED TYPES)



# HOW OPC UA WORKS

UA Stack

Connections

**Nodes, Browse, Views**

Data Types

Subscriptions

Services

Profiles

- A *VIEW* IS A SUBSET OF THE ADDRESSSPACE.
- *VIEWS* ARE USED TO RESTRICT THE *NODES* THAT THE *SERVER* MAKES VISIBLE TO THE *CLIENT*
  - RESTRICTING THE SIZE OF THE ADDRESSSPACE FOR THE SERVICE REQUESTS SUBMITTED BY THE *CLIENT*.
- THE DEFAULT *VIEW* IS THE ENTIRE ADDRESSSPACE.

# HOW OPC UA WORKS

UA Stack

Connections

## Nodes, Browse, Views

Data Types

Subscriptions

Services

Profiles

- SERVERS MAY OPTIONALLY DEFINE OTHER VIEWS.
- VIEWS HIDE SOME OF THE NODES OR REFERENCES IN THE ADDRESSSPACE.
- VIEWS ARE VISIBLE VIA THE ADDRESSSPACE AND CLIENTS ARE ABLE TO BROWSE VIEWS TO DETERMINE THEIR STRUCTURE.
- VIEWS ARE OFTEN HIERARCHIES, WHICH ARE EASIER FOR CLIENTS TO NAVIGATE AND REPRESENT IN A TREE.

# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

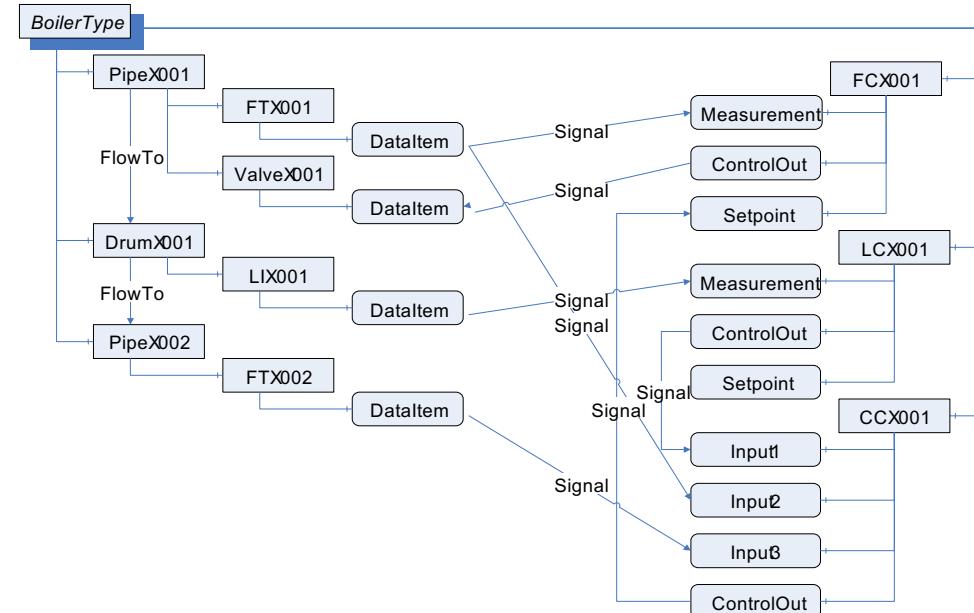
## Data Types

Subscriptions

Services

Profiles

- STANDARD “SCALAR” DATA TYPES
- COMPLEX DATA TYPES ARE POSSIBLE
- DEFINITION OF OBJECT TYPES AND INSTANCES
- DEFINITION OF OWN DATA TYPES!



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

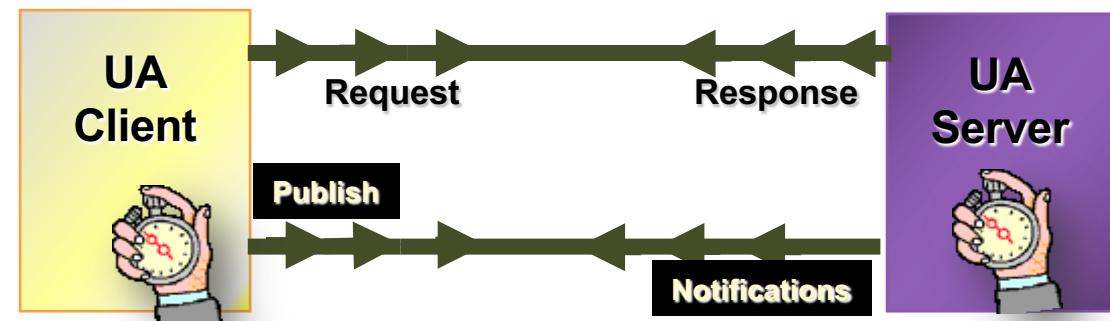
Data Types

**Subscriptions**

Services

Profiles

- CLIENT DEFINES MONITORED ITEMS WHICH THE SERVER SHOULD PROVIDE, BY USING SETTINGS LIKE:
  - TIME INTERVAL, FILTER
  - MODE (DISABLED, REPORTING, SAMPLING)
  - BUFFER SIZE
- SERVER BUFFERS THE “NOTIFICATIONS”
- CLIENT REQUESTS SERVER TO SEND THE BUFFERED NOTIFICATIONS



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

## Subscriptions

Services

Profiles

- ALL ANSWERS TO A PUBLISH REQUEST ARE IDENTIFIED BY A SEQUENTIAL ID.
- CLIENTS CONFIRMS THE ID WITH THE NEXT PUBLISH REQUEST
- CLIENTS USE THE ID TO DETECT A MESSAGE LOSS.
- CLIENTS CAN REQUEST LOST NOTIFICATIONS WITH A REPUBLISH REQUEST.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

Subscriptions

## Services

Profiles

- THE OPC UA SERVICES ARE THE COLLECTION OF ABSTRACT REMOTE PROCEDURE CALLS (RPC) THAT ARE IMPLEMENTED BY OPC UA SERVERS AND CALLED BY OPC UA CLIENTS.
- ALL INTERACTIONS BETWEEN OPC UA CLIENTS AND SERVERS OCCUR VIA THESE SERVICES.
- THE DEFINED SERVICES ARE CONSIDERED ABSTRACT BECAUSE NO PARTICULAR RPC MECHANISM FOR IMPLEMENTATION IS DEFINED IN THIS PART.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

Subscriptions

## Services

Profiles

- PART 6 SPECIFIES ONE OR MORE CONCRETE MAPPINGS SUPPORTED FOR IMPLEMENTATION. FOR EXAMPLE, ONE MAPPING IN PART 6 IS TO XML WEB SERVICES. IN THAT CASE THE SERVICES DESCRIBED IN THIS PART APPEAR AS THE WEB SERVICE METHODS IN THE WSDL CONTRACT.
  
- NOT ALL OPC UA SERVERS WILL NEED TO IMPLEMENT ALL OF THE DEFINED SERVICES.
  
- PROFILES DICTATE WHICH SERVICES NEED TO BE IMPLEMENTED IN ORDER TO BE COMPLIANT WITH A PARTICULAR PROFILE.

# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

Subscriptions

## Services

Profiles

- SERVICES ARE ORGANIZED INTO SERVICE SETS.
- EACH SERVICE SET DEFINES A SET OF RELATED SERVICES.
- THE ORGANIZATION IN SERVICE SETS IS A LOGICAL GROUPING USED IN THIS STANDARD AND IS NOT USED IN THE IMPLEMENTATION.

# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

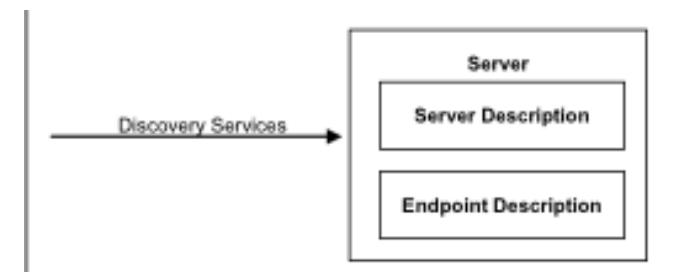
Subscriptions

## Services

Profiles

### ■ DISCOVERY SERVICE SET

- DEFINES SERVICES THAT ALLOW A *CLIENT* TO DISCOVER THE *ENDPOINTS* IMPLEMENTED BY A *SERVER* AND TO READ THE SECURITY CONFIGURATION FOR EACH OF THOSE *ENDPOINTS*.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

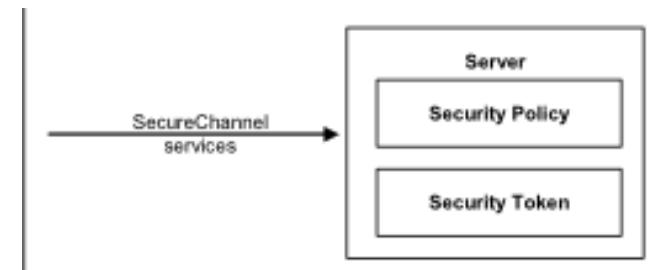
Subscriptions

## Services

Profiles

### ■ SECURE CHANNEL SERVICE SET

- DEFINES SERVICES THAT ALLOW A CLIENT TO ESTABLISH A COMMUNICATION CHANNEL TO ENSURE THE CONFIDENTIALITY AND INTEGRITY OF MESSAGES EXCHANGED WITH THE SERVER.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

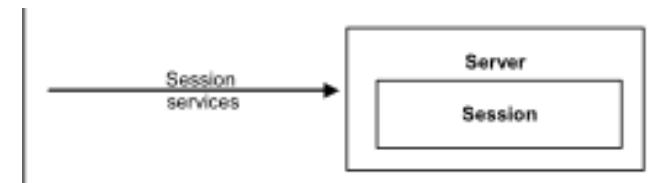
Subscriptions

## Services

Profiles

### ■ SESSION SERVICE SET

- DEFINES SERVICES THAT ALLOW THE CLIENT TO AUTHENTICATE THE USER ON WHOSE BEHALF IT IS ACTING AND TO MANAGE SESSIONS.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

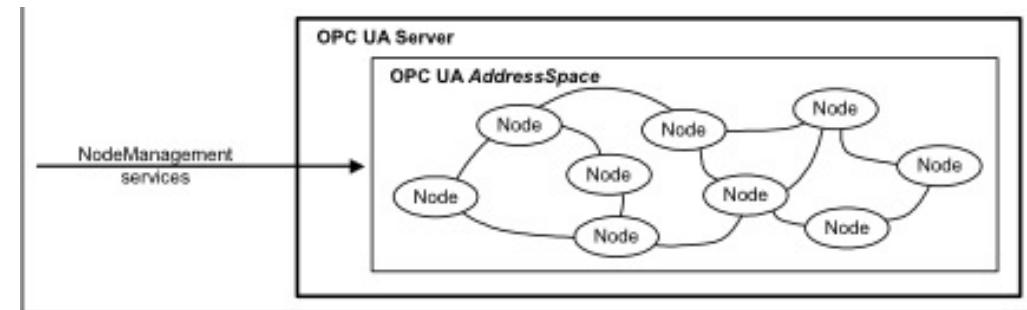
Subscriptions

## Services

Profiles

### ■ NODE MANAGEMENT SERVICE SET

- DEFINES SERVICES THAT ALLOW THE CLIENT TO ADD, MODIFY AND DELETE NODES IN THE ADDRESSSPACE.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

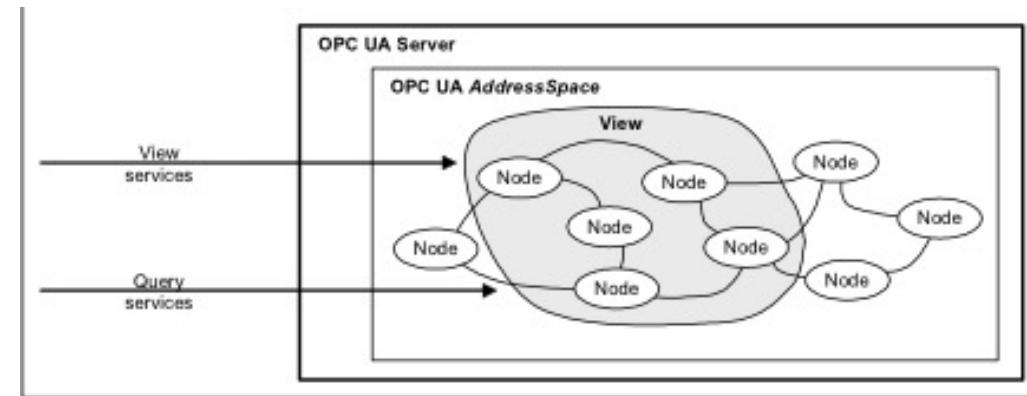
Subscriptions

## Services

Profiles

### ■ *VIEW SERVICE SET*

- DEFINES SERVICES THAT ALLOW CLIENTS TO BROWSE THROUGH THE ADDRESSSPACE OR SUBSETS OF THE ADDRESSSPACE CALLED VIEWS. THE QUERY SERVICE SET ALLOWS CLIENTS TO GET A SUBSET OF DATA FROM THE ADDRESSSPACE OR THE VIEW.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

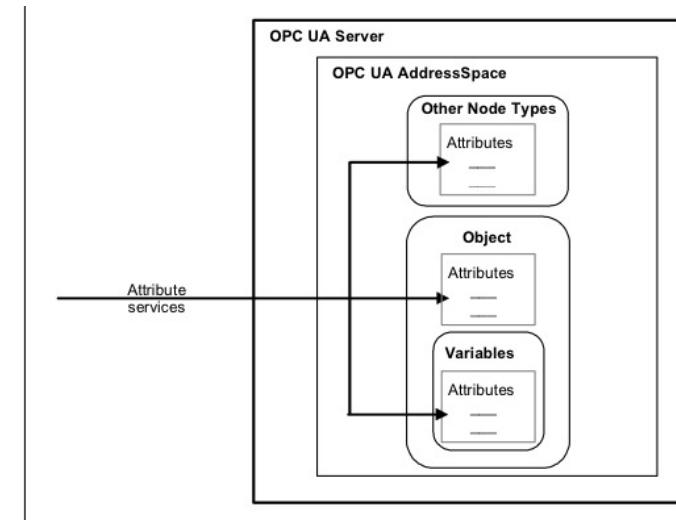
Subscriptions

## Services

Profiles

### ■ ATTRIBUTE SERVICE SET

- DEFINES SERVICES THAT ALLOW CLIENTS TO READ AND WRITE ATTRIBUTES OF NODES, INCLUDING THEIR HISTORICAL VALUES.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

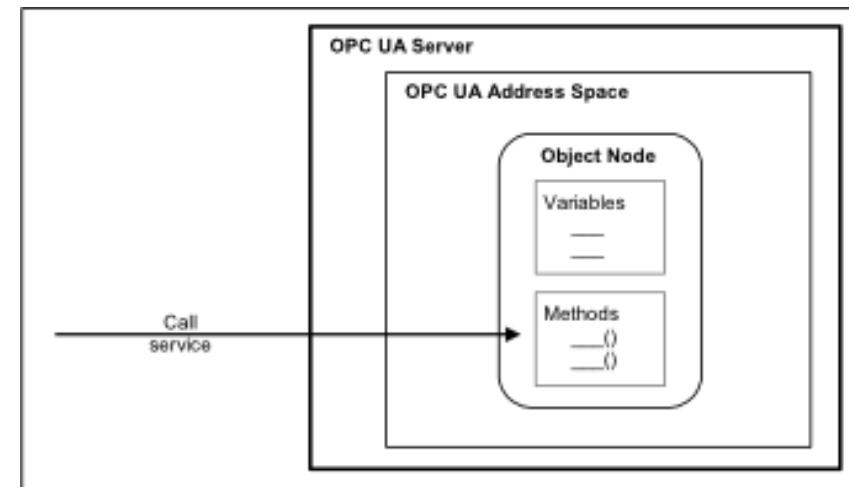
Subscriptions

## Services

Profiles

### ■ *METHOD SERVICE SET*

- DEFINES SERVICES THAT ALLOW CLIENTS TO CALL METHODS. METHODS RUN TO COMPLETION WHEN CALLED. THEY MAY BE CALLED WITH METHOD-SPECIFIC INPUT PARAMETERS AND MAY RETURN METHOD-SPECIFIC OUTPUT PARAMETERS.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

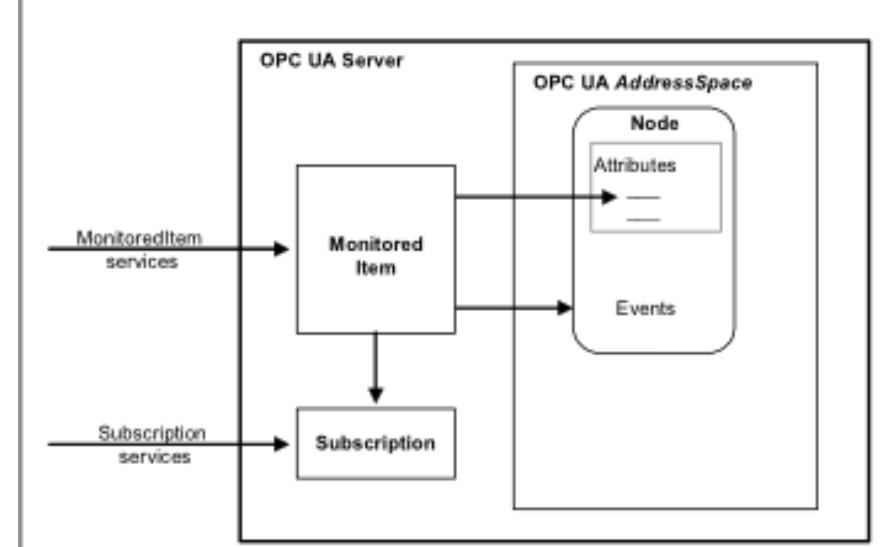
Data Types

Subscriptions

**Services**

Profiles

- **MONITOREDITEM SERVICE SET AND SUBSCRIPTION SERVICE SET**
  - USED TOGETHER TO SUBSCRIBE TO NODES IN THE OPC UA ADDRESSSPACE.



# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

Data Types

Subscriptions

## Services

Profiles

### ■ MONITOREDITEM SERVICE SET

- DEFINES SERVICES THAT ALLOW CLIENTS TO CREATE, MODIFY, AND DELETE MONITOREDITEMS USED TO MONITOR ATTRIBUTES FOR VALUE CHANGES AND OBJECTS FOR EVENTS.
- THESE NOTIFICATIONS ARE QUEUED FOR TRANSFER TO THE CLIENT BY SUBSCRIPTIONS.

### ■ SUBSCRIPTION SERVICE SET

- DEFINES SERVICES THAT ALLOW CLIENTS TO CREATE, MODIFY AND DELETE SUBSCRIPTIONS. SUBSCRIPTIONS SEND NOTIFICATIONS GENERATED BY MONITOREDITEMS TO THE CLIENT. SUBSCRIPTION SERVICES ALSO PROVIDE FOR CLIENT RECOVERY FROM MISSED MESSAGES AND COMMUNICATION FAILURES.

# HOW OPC UA WORKS

UA Stack

Connections

Nodes, Browse, Views

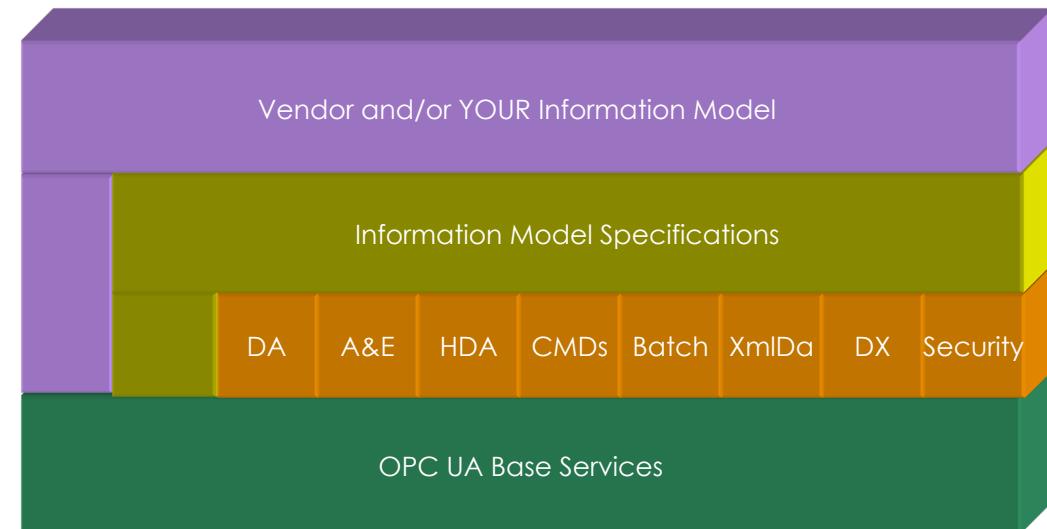
Data Types

Subscriptions

Services

**Profiles**

- “PROFILES” ARE LOGICAL GROUPED SERVICE CALLS AND DATA TYPES
- NEW “PROFILES” CAN BE ADDED, OR EXISTING ONES CAN BE USED





# Questions?

How OPC UA Works