OPC UA
DEVELOPMENT TRAINING

OPC UA DEVELOPMENT

AGENDA

- Profiles in General

- Data Access Profile

- Alarms & Conditions Profile

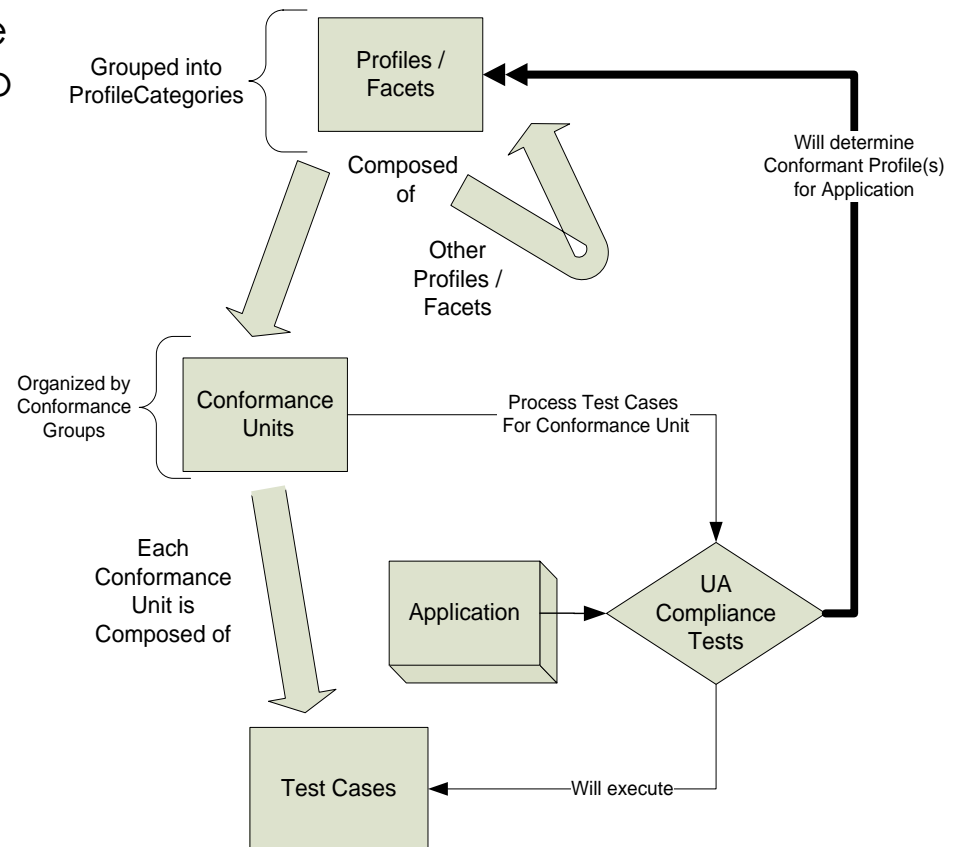- Historical Access Profile

PROFILES IN GENERAL
OVERVIEW

■ OPC UA describes a number of Services and a variety of information models.

■ Services and information models can be referred to as features of a Server or Client.

■ **Servers and Clients need to be able to describe which features they support.**

- A Grouping of these features is required.

- Individual features are grouped into ConformanceUnits

- ConformanceUnits are further grouped into Profiles.

- TestCases are related back to the appropriate ConformanceUnits defined in this specification.

- This relationship is also displayed by the OPC UA Compliance Test Tool.

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PROFILES IN GENERAL
PROFILES, CONFORMANCEUNITS AND *TESTCASES*

- The large arrows indicate the components that are used to construct the parent.

Grouped into ProfileCategories

Profiles / Facets

Will determine Conformant Profile(s) for Application

Composed of

Other Profiles / Facets

Organized by Conformance Groups

Conformance Units

Process Test Cases For Conformance Unit

Each Conformance Unit is Composed of

Application

UA Compliance Tests

Test Cases

Will execute

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PROFILES IN GENERAL
CONFORMANCEUNITS

- EACH CONFORMANCEUNIT REPRESENTS A SPECIFIC SET OF FEATURES (E.G. A GROUP OF SERVICES, PORTIONS OF SERVICES OR INFORMATION MODELS) THAT CAN BE TESTED AS A SINGLE ENTITY.

- CONFORMANCEUNITS ARE THE BUILDING BLOCKS OF A PROFILE.

- EACH CONFORMANCEUNIT CAN ALSO BE USED AS A TEST CATEGORY.

- FOR EACH CONFORMANCEUNIT, THERE WOULD BE A NUMBER OF TESTCASES THAT TEST THE FUNCTIONALITY DESCRIBED BY THE CONFORMANCEUNIT.

- THE SAME FEATURES DO NOT APPEAR IN MORE THAN ONE CONFORMANCEUNIT.

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PROFILES IN GENERAL
PROFILES

- Profiles are named groupings of ConformanceUnits.

- The Servers and Clients in an OPC UA application will provide the names of Profiles that they support.

- The definition of Profiles is a dynamic activity, in that it is expected that new Profiles will be added in the future.

- A Profile can be defined to inherit from an existing Profile.

- An OPC UA Application will typically support multiple Profiles.

- Multiple Profiles may include the same ConformanceUnit.

- Testing of a Profile consists of testing the individual ConformanceUnits that comprise the Profile.

- Profiles are named based on naming conventions

PROFILES IN GENERAL
PROFILE CATEGORIES

Category	Description
Client	Profiles of this category specify functions of an OPC UA Client.
Global Directory Service	Profiles of this category specify functions for global discovery and certificate management.
Security	Profiles of this category specify security related functions. Security policies are part of this category. The URI of security policies has to be part of an Endpoint Description returned from the GetEndpoints service. Profiles of this category apply to Clients and Servers.
Server	Profiles of this category specify functions of an OPC UA Server. The URI of such Profiles can be exposed in the Server capabilities.
Transport	Profiles of this category specify specific protocol mappings. The URI of such Profiles has to be part of an Endpoint Description. These Profiles apply to Clients and Servers.

DATA ACCESS PROFILE

- DATA ACCESS DEALS WITH THE REPRESENTATION AND USE OF AUTOMATION DATA IN OPC UA SERVERS.

- AUTOMATION DATA CAN BE LOCATED INSIDE THE OPC UA SERVER OR ON I/O CARDS DIRECTLY CONNECTED TO THE OPC UA SERVER. OPC UA DATA ACCESS SERVERS PROVIDE ONE OR MORE OPC UA DATA ACCESS CLIENTS WITH TRANSPARENT ACCESS TO THEIR AUTOMATION DATA.

- THE LINKS TO AUTOMATION DATA INSTANCES ARE CALLED DATAITEMS. WHICH CATEGORIES OF AUTOMATION DATA ARE PROVIDED IS COMPLETELY VENDOR-SPECIFIC.

- CLIENTS MAY READ OR WRITE DATAITEMS, OR MONITOR THEM FOR VALUE CHANGES. CHANGES ARE DEFINED AS A CHANGE IN STATUS (QUALITY) OR A CHANGE IN VALUE THAT EXCEEDS A CLIENT-DEFINED RANGE CALLED A DEADBAND.
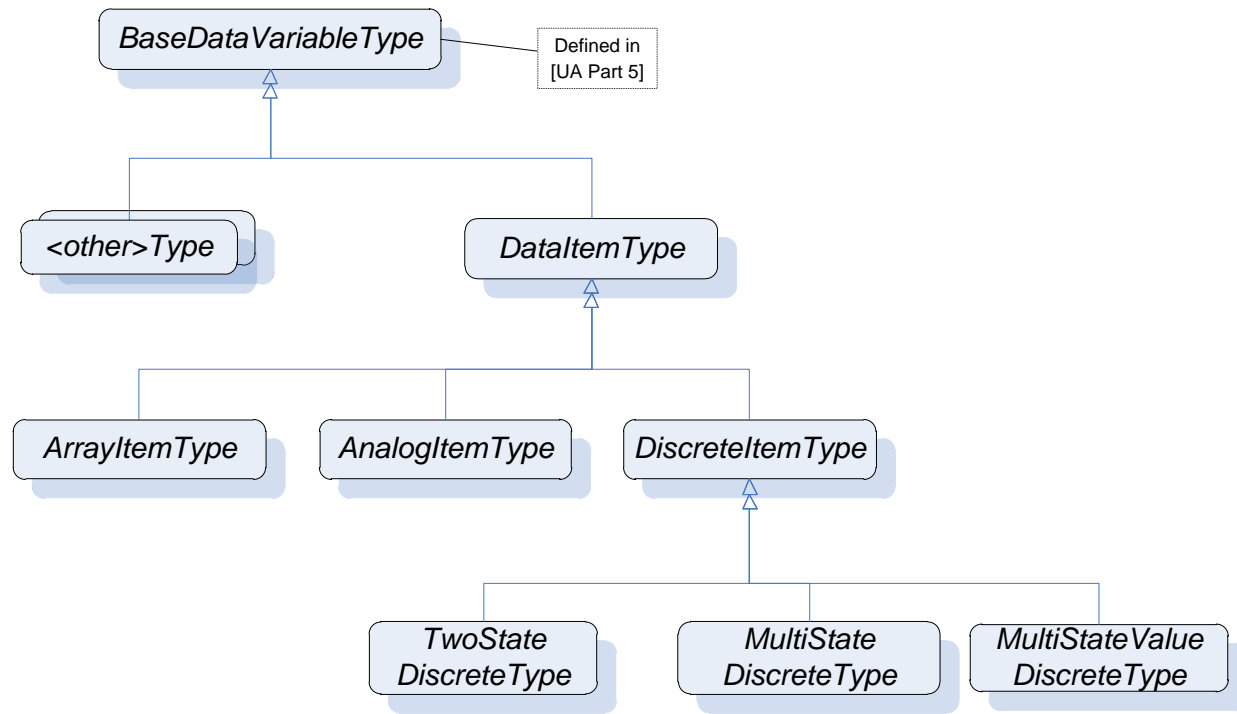
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DATA ACCESS PROFILE
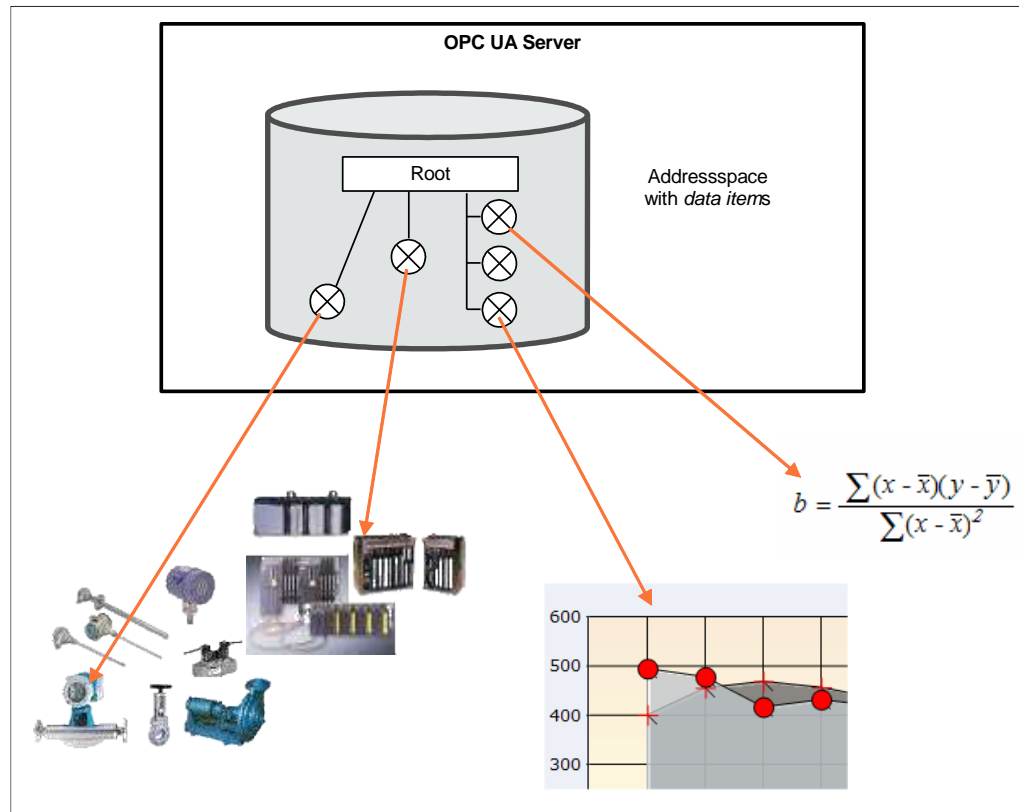
Sample OPC UA Server with Data Access Profile

DATA ACCESS PROFILE
MODEL

■ The DataAccess model extends the variable model by defining VariableTypes.
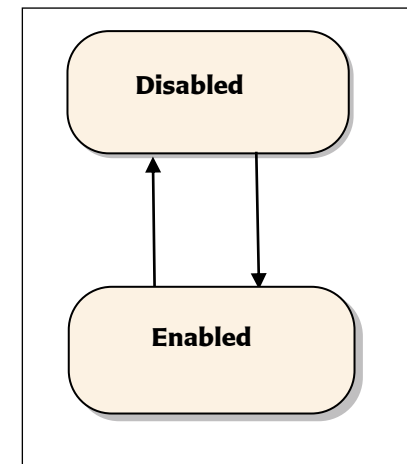
ALARMS AND CONDITIONS PROFILE

- THIS STANDARD DEFINES AN INFORMATION MODEL FOR CONDITIONS, DIALOG CONDITIONS, AND ALARMS INCLUDING ACKNOWLEDGEMENT CAPABILITIES.

- IT IS BUILT UPON AND EXTENDS BASE EVENT HANDLING WHICH IS DEFINED IN [UA PART 3], [UA PART 4] AND [UA PART 5].

- THIS INFORMATION MODEL CAN ALSO BE EXTENDED TO SUPPORT THE ADDITIONAL NEEDS OF SPECIFIC DOMAINS.

- THE DETAILS OF WHAT ASPECTS OF THE INFORMATION MODEL ARE SUPPORTED ARE DEFINED VIA PROFILES (SEE [UA PART 7] FOR PROFILE DEFINITIONS).

- SOME SYSTEMS MAY EXPOSE HISTORICAL EVENTS AND CONDITIONS VIA THE STANDARD HISTORICAL ACCESS FRAMEWORK (SEE [UA PART 11] FOR HISTORICAL EVENT DEFINITIONS).

ALARMS AND CONDITIONS PROFILE
CONDITIONS

- CONDITIONS ARE USED TO REPRESENT THE STATE OF A SYSTEM OR ONE OF ITS COMPONENTS.

- SOME COMMON EXAMPLES ARE:

  - A TEMPERATURE EXCEEDING A CONFIGURED LIMIT

  - A DEVICE NEEDING MAINTENANCE

  - A BATCH PROCESS THAT REQUIRES A USER TO CONFIRM SOME STEP IN THE PROCESS BEFORE PROCEEDING
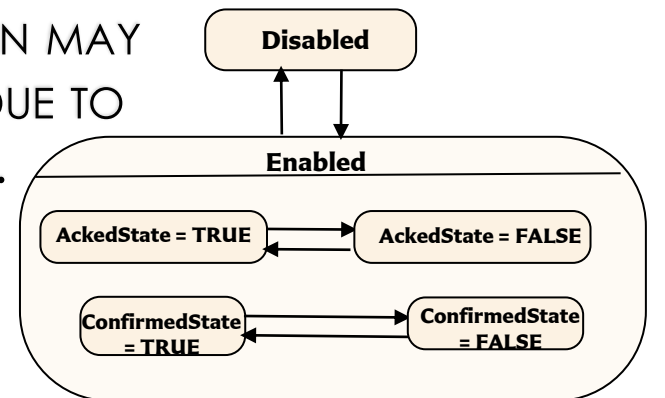

Base Condition State Model

ALARMS AND CONDITIONS PROFILE
ACKNOWLEDGEABLE CONDITIONS

■ AcknowledgeableConditions are sub-types of the base ConditionType.

■ AcknowledgeableConditions expose states to indicate whether a Condition has to be acknowledged or confirmed.

■ Acknowledgment of the transition may come from the Client or may be due to some logic internal to the Server.

AcknowledgeableConditions State Model

ALARMS AND CONDITIONS PROFILE
SEVERITY, QUALITY, AND COMMENT

- COMMENT, SEVERITY AND QUALITY ARE IMPORTANT ELEMENTS OF CONDITIONS AND ANY CHANGE TO THEM WILL CAUSE EVENT NOTIFICATIONS.

- THE SEVERITY INDICATES THE URGENCY OF THE CONDITION AND IS ALSO COMMONLY CALLED 'PRIORITY', ESPECIALLY IN RELATION TO ALARMS IN THE PROCESSCONDITIONCLASS.

- A COMMENT IS A USER GENERATED STRING THAT IS TO BE ASSOCIATED WITH A CERTAIN STATE OF A CONDITION.

- QUALITY REFERS TO THE QUALITY OF THE DATA VALUE(S) UPON WHICH THIS CONDITION IS BASED. SINCE A CONDITION IS USUALLY BASED ON ONE OR MORE VARIABLES, THE CONDITION INHERITS THE QUALITY OF THESE VARIABLES. E.G., IF THE PROCESS VALUE IS "UNCERTAIN", THE "LEVELALARM" CONDITION IS ALSO QUESTIONABLE.

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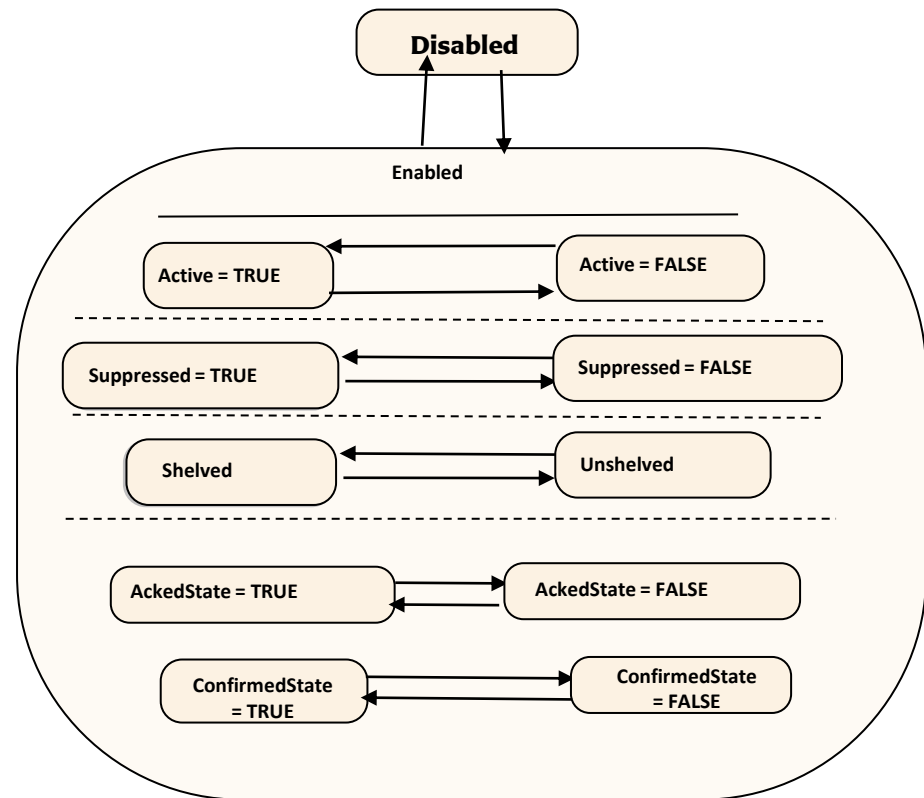# ALARMS AND CONDITIONS PROFILE
DIALOGS

- Dialogs are ConditionTypes used by a Server to request user input.

- They are typically used when a Server has entered some state that requires intervention by a Client.

- Example:

  - A Server monitoring a paper machine indicates that a roll of paper has been wound and is ready for inspection. The Server would activate a Dialog Condition indicating to the user that an inspection is required. Once the inspection has taken place the user responds by informing the Server of an accepted or unaccepted inspection allowing the process to continue.
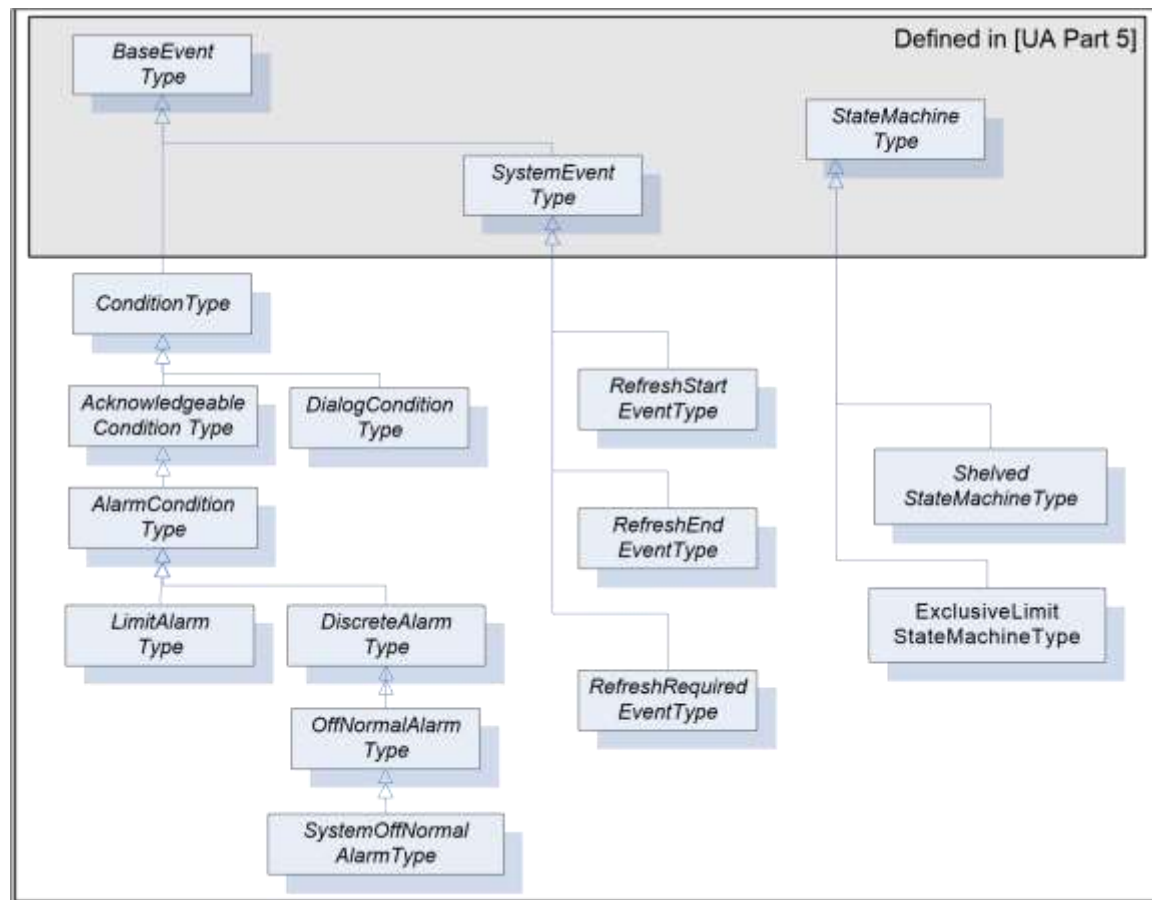
ALARMS AND CONDITIONS PROFILE
ALARMS

■ ALARMS ARE SPECIALIZATIONS OF ACKNOWLEDGEABLE CONDITIONS THAT ADD THE CONCEPTS OF AN ACTIVE STATE, A SHELVING STATE AND A SUPPRESSED STATE TO A CONDITION.
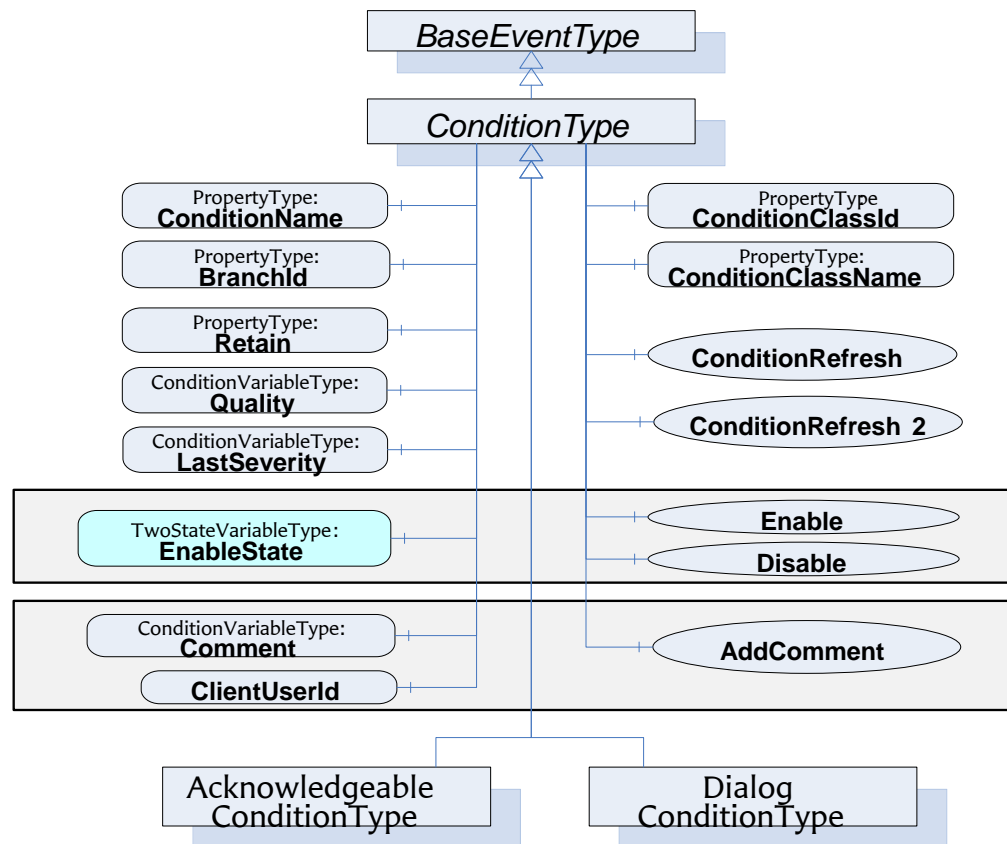

Alarm State Machine Model

ALARMS AND CONDITIONS PROFILE
CONDITIONTYPE HIERARCHY

ALARMS AND CONDITIONS PROFILE
CONDITIONTYPE MODEL

HISTORICAL ACCESS PROFILE

- THIS STANDARD DEFINES THE HANDLING OF HISTORICAL TIME SERIES DATA AND HISTORICAL EVENT DATA IN THE OPC UNIFIED ARCHITECTURE. INCLUDED IS THE SPECIFICATION OF THE REPRESENTATION OF HISTORICAL DATA AND EVENTS IN THE ADDRESSSPACE.

- A SERVER SUPPORTING HISTORICAL ACCESS PROVIDES CLIENTS WITH TRANSPARENT ACCESS TO DIFFERENT HISTORICAL DATA AND/OR HISTORICAL EVENT SOURCES (E.G. PROCESS HISTORIANS, EVENT HISTORIANS, ETC.).

- THE HISTORICAL DATA OR EVENTS MAY BE LOCATED IN A PROPRIETARY DATA COLLECTION, DATABASE OR A SHORT TERM BUFFER WITHIN THE MEMORY. A SERVER SUPPORTING HISTORICAL ACCESS WILL PROVIDE HISTORICAL DATA AND EVENTS FOR ALL OR A SUBSET OF THE AVAILABLE VARIABLES, OBJECTS, PROPERTIES OR VIEWS WITHIN THE SERVER ADDRESSSPACE.

HISTORICAL ACCESS PROFILE
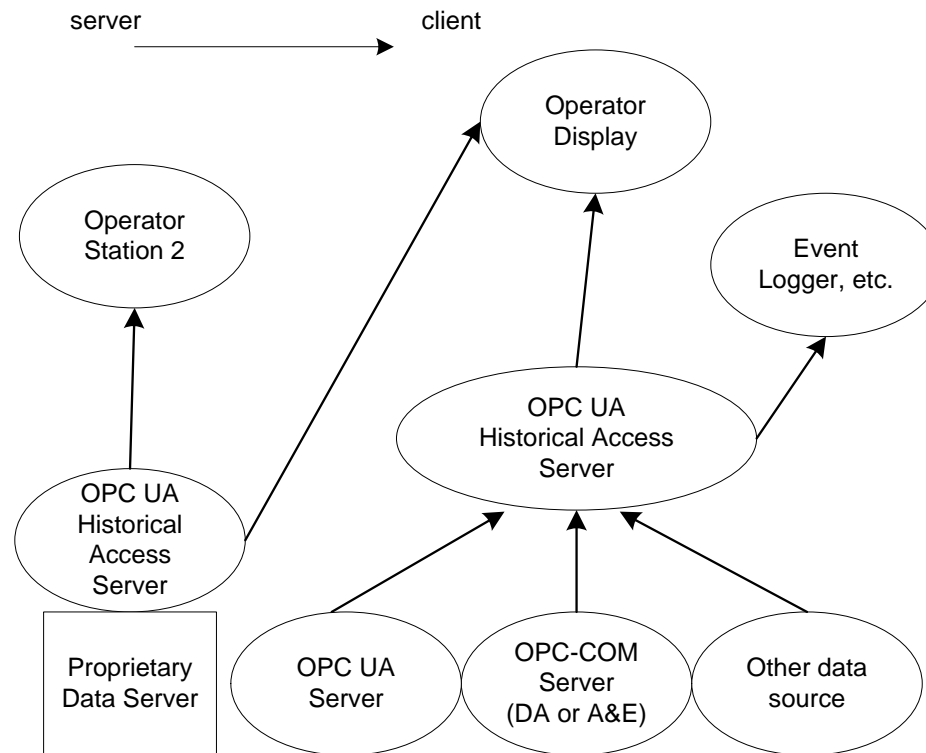
Possible OPC UA Server supporting Historical Access