Notification based Inter-process communication using OPC and WCF Technology for windows system

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ABSTRACT:

Development of notification based Inter-process communication Software. This software provides notifications to subscribers as soon as an event occurs. Notifications also have information needed by clients.

This Notification based Inter-process communication software is used to get information from OPC Server and sent to application software for further processing of data.

The OPC server is a software program that converts the hardware communication protocol used by a Programmable Logic Controller (PLC) into the OPC protocol. The OPC client uses the OPC server to get data from or send commands to the hardware. But it’s a headache to bring the data from OPC Server to client. It required DCOM (Distributed Component Object Model) settings; it may even be common practice to disable firewalls and also expose the computer to unauthorized or anonymous users. Even if a firewall is in place, DCOM requires that port 135 be added to the exception list by default. This port is used for Microsoft’s Remote Procedure Call and has been the target of many malicious attacks.

How can a safe and secure remote OPC connection be established?
We develop this software using Microsoft visual studio 2012 and gave its name OPCNotification. It doesn’t require DCOM for remote connections. One needs to install it on OPC server machine and configures it with OPC server information. On Data change of subscribed tags of OPC server, OPCNotification software sends data to the clients. The clients could be HMI and Application program executing business logic.

Keywords- Avoid DCOM settings, Handle many OPC connection, easy notification based communication between OPC client and server, Real time data display on HMI, Log the data into database, Auto reconnect OPC server in case of failure.

[1] INTRODUCTION

Notification based Inter-process communication software developed with WCF (Windows Communication Foundation) technology as the central point to broadcast events to all other connected clients. All clients will get a real time notification whenever an event occurs on any of the clients and server. It saves a lot of server request traffic. It’s implemented with OPC communication.

Open Platform Communications (OPC) is a series of standards and specifications for industrial telecommunication. An industrial automation industry task force developed the original standard in 1996 under the name OLE for Process Control (Object Linking and Embedding for Process Control). OPC specifies the communication of real-time plant data between control devices from different manufacturers.
The OPC server is a software program that converts the hardware communication protocol used by a PLC into the OPC protocol. The OPC client software is any program that needs to connect OPC Server. The OPC client uses the OPC server to get data from or send commands to the hardware. The hardware vendors of PLC like Honeywell, Motorola, Siemens, Rockwell etc. provide OPC Servers.

OPC is widely used in industrial communication that enables the exchange of data between multi-vendor devices and control applications. But communication between OPC server and client need highly configure DCOM setting and also disable the firewall.

**[2] BENEFIT OF PROPOSED OPC CONNECTION**

- Easy and Eliminates DCOM configurations
- Firewall-friendly (Firewall ON)
- Provides easy Client management
- Provides enhanced security by Net.Tcp protocol
- Real Time Performance.
- Maintain Alive and Watch features to ensure reliable connectivity.
- Easy to integrate into pre-existing IT networks.
- Communicate through any standard HTTP or TCP port.
- Data encryption for security.
- Communication with multiple OPC servers and clients based on notification.
Subscribe and Receive Conditional Alarms and Events.
Automatic refresh method to update the state of condition events.
Give alarm to Connection status and provided for OPC real-time data items monitoring
Notification based transfer real-time data and alarms field data to multiple clients at a time.

[3] TECHNOLOGY USED

- Microsoft Visual Studio 2012 (WCF, Discovery Service, Entity Framework, Silverlight with C#)
- OPC Server software Tool.
- Oracle Database.

WCF (Windows Communication Foundation) - Windows Communication Foundation (WCF) is a framework for building service-oriented applications. Using WCF, you can send data as asynchronous messages from one service endpoint to another. A service endpoint can be part of a continuously available service hosted by IIS, or it can be a service hosted in an application. An endpoint can be a client of a service that requests data from a service endpoint. The messages can be as simple as a single character or word sent as XML, or as complex as a stream of binary data.

It contain ABC-

Address - Address signifies “Where the service is?”
Binding - Binding specifies, “How do I talk to the service? how a service is accessible?”
Contract In WCF, all services expose contracts. The contract is a platform-neutral and standard way of describing what the service does.

WCF defines four types of contracts.
- **Service contracts**: Describe which operations the client can perform on the service.
- **Data contracts**: Define which data types are passed to and from the service. WCF defines implicit contracts for built-in types such as int and string, but you can easily define explicit opt-in data contracts for custom types.
- **Fault contracts**: Define which errors are raised by the service, and how the service handles and propagates errors to its clients.
- **Message contracts**: Allow the service to interact directly with messages.

Discovery Service - Windows Communication Foundation (WCF) provides support to enable services to be discoverable at runtime in an interoperable way using the WS-Discovery protocol. WCF services can announce their availability to the network using a multicast message or to a discovery proxy server. Client applications can search the network or a discovery proxy server to find services that meet a set of criteria.

It contain two property Announcement and Probe
An announcement message contains information about the service such as its fully-qualified contract name, any scopes that the service is operating in as well as any custom metadata the service wants to send. Probe the client calls the System.ServiceModel.Discovery.DiscoveryClient.Find method, which sends a Probe request. Services listening for discovery messages receive this Probe request. If the service matches the criteria specified in the Probe, it sends a Probe Match message back to the client.

Entity Framework (EF) - is an object-relational mapper that enables .NET developers to work with relational data using domain-specific objects. It eliminates the need for most of the data-access code that developers usually need to write.

Silverlight - is a cross-browser, cross-platform plug-in for delivering media and rich interactive applications for the Web. The Silverlight browser plug-in is freely available for all major browsers including Internet Explorer, Mozilla Firefox,

OPC Server software Tool- OPC Server is software which installed on OPC server for receives the data from PLC. It configure different PLC signal with tag.
**Oracle Database** is an object-relational database management system produced and marketed by Oracle Corporation.

### [4] HOW IT WORKS

- Install(WCF) Discovery service on centralized server. This is windows service when we install it generate an announcement and probe URL.
- Install OPC Notification on OPC server and configure it according to OPC Server, bind with discovery announcement URL and define OPC ID. This id should be unique with all OPC notification.
- Define Configure OPC Information in Database with OPC ID.
- Install WCF(Application Program) Windows service on any centralized server where all client send and receive notification to/from OPC server.
- WCF is a backbone of this tool. It contain all proxy of OPC Notification service.
A Proxy in Windows Communication Foundation is a class that enables client applications to communicate with a service by sending and receiving messages. It actually encapsulates a number of service details like service path, service implementation technology, platform being used, communication protocol etc. as well as all the methods (signature only) of the Service Contract.

When we run this service it probes the URL to discovery service and brings all the OPC notification URL and fetch OPC id wise data and tag from database and connect OPC id wise all notification URL.

After connect OPC Notification it receive the any notification when event occur in OPC server

- Client which is develop in Silverlight it contain proxy of WCF (Application Program) for communication. When Client opens HMI it registers with WCF for send and receives the notification and unregisters with Application Program after close or log out the application

When Event Occur On OPC server or client

![Diagram]

[5] CONCLUSION

OPC is widely used many industrial but connectivity between OPC Client and server required much challenge of effort. But Notification based Inter-process communication with OPC

Improving upon security and migrating to a platform-independent implementation based on standard web technologies. It overcomes many of the challenges with OPC connectivity. Provide open, and secure real time communication based on notification.

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