Comparison of Open-source Microsoft.Net SCADA & HMI to Conventional Systems

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Definition of Open-Source

- A software application that can be upgraded for new feature addition, bug-fixing without having to be dependent on the software vendor, except Microsoft.
- Assumption: We are using Microsoft Windows Operating System.

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Overview

- History of HMI/SCADA development tools
- Introduction to Microsoft Development Environment for HMI/SCADA
- VB vs. VBA
- OPC vs. Microsoft object technologies (.NET components, ActiveX, dll)
- Example .NET applications
- Configuration of sample .NET applications
- System architecture comparison
- Objective comparisons

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HMI/SCADA Topics

- Definitions & assumptions – Open Source/Non-proprietary.
- Up to 80s HMI/SCADA systems – complicated to develop – C/C++ based
- Software development tools vendors- Microsoft & Borland
- Mainstream wholesale migration from non-Microsoft to Microsoft products for general office use since late 80s.
- Microsoft introduces VB in 1991 (SW Objects, components, VBX)
- Microsoft introduces VBA late 90s
- Conventional HMI/SCADA systems begin embracing VBA since early 2000.
- Typical Microsoft products – good candidates for HMI/SCADA….
  - Excel, Powerpoint, Visio etc. for small systems
  - VB.NET for mid to large/complicated Windows desktop apps
  - ASP.NET, Frontpage etc. for internet applications
  - VB.NET with compact framework for PocketPC/CE apps

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COMPARISON of VB/VB.NET vs. VBA

Visual Basic:

- Introduced in 1991
- Creates a true compiled application (uses the same compiler as C) – thus apps run at extremely fast speed
- Designed for building robust mission-critical applications
- Most popular software – world's about 70% Windows applications are developed with it.
- Created the basis for VBA & VBscript in 1995
- Buy from resellers openly
- Very powerful and extendible
- No run time fees owed to Microsoft for distribution.

VBA:

- Introduced in 1995
- It is interpreted at runtime and thus runs very slow.
- Designed primarily for non-critical office grade environment applications.
- It is a crippled sub set of the VB
- The VBA engine runs as a separate shell and thus become a 3rd party application running within the vendor's software application.
- The 3rd party vendor pays a very high price to Microsoft to allow them to embed VBA engine into their products.
- Special functions are added to VBA engine from Microsoft by the 3rd party vendor to make it proprietary for that product.

Several limitations, however it is a giant step ahead of the proprietary scripting languages of HMI products.

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COMPARISON of .NET or ACTIVE X controls vs. OPC

.NET or ACTIVE X:

- This concept was introduced in 1991 and the ActiveX name was coined in early 1996.• In-Process server integrated into one single application.
- Extremely light weight.
- A very solid foundation to begin with.
- Almost every Microsoft product supports it.
- Thousands of companies support it world-wide.
- Extremely fast and low resource consumer.
- Typically run-time licenses are free.
- Several options available to build client-server or n-tier applications.
- Only one application needed.

Additional issues for .NET

- Introduced early 2003.
- Native Support for COM & DCOM withdrawn. Use layers to support COM & DCOM.
- Basis for all long-term software technology infrastructure.

OPC:

- Introduced in 1997.
- Extremely heavy, needs a very souped up machine.
- The specification has been a moving target.
- No Microsoft product has native support for OPC except VC++. You must use automation layer as an interface.
- Slow and heavy on resources.
- Based on COM & DCOM (which is obsolete now).
- Setup is very complicated unless using on the same machine & from the same vendor.
- Must pay for each node.
- Must run multiple applications.

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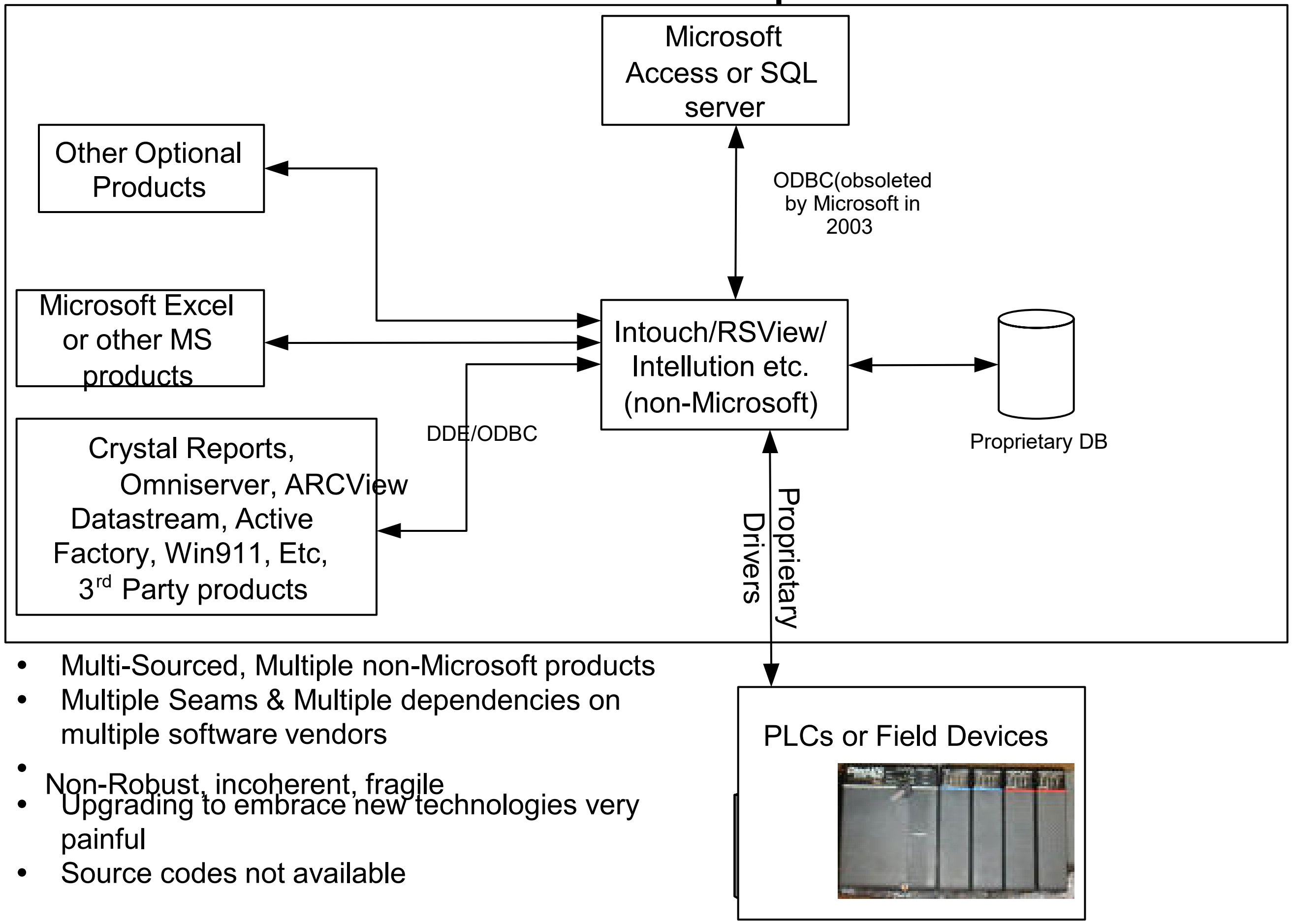
Typical Conventional HMI/SCADA Solution with non-Microsoft products


Microsoft Access or SQL server
ODBC(obsoleted by Microsoft in 2003
Other Optional Products
Microsoft Excel or other MS products
Intouch/RSView/ Intellution etc. (non-Microsoft)
Proprietary DB
DDE/ODBC
Crystal Reports, Omniserver, ARCView Datastream, Active Factory, Win911, Etc, 3rd Party products
Proprietary Drivers
PLCs or Field Devices

- Multi-Sourced, Multiple non-Microsoft products
- Multiple Seams & Multiple dependencies on multiple software vendors
- Non-Robust, incoherent, fragile
- Upgrading to embrace new technologies very painful
- Source codes not available

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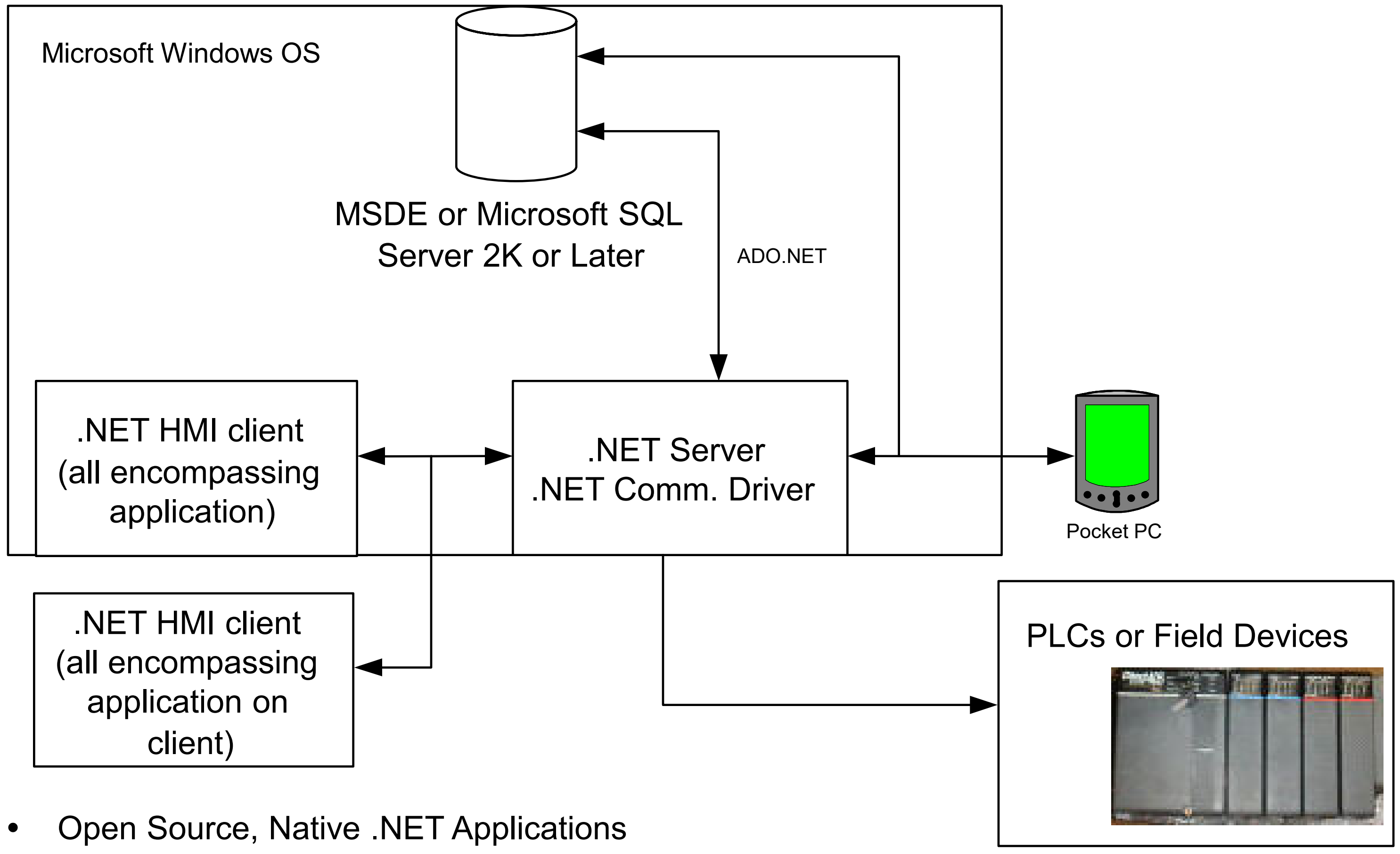
Typical Parijat Solution with Microsoft


Microsoft Windows OS
MSDE or Microsoft SQL Server 2K or Later
ADO.NET
.NET HMI client (all encompassing application)
.NET Server
.NET Comm. Driver
Pocket PC
.NET HMI client (all encompassing application on client)
PLCs or Field Devices

- Open Source, Native .NET Applications
- All development tools are available from Microsoft
- Create custom .NET controls to make quick & automated system configurations
- Create add-ins to make self-configuring HMI/SCADA systems
- Develop your own drivers for communication with foreign devices
  The .NET server may run on dual redundant/clustered machines

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	Conventional	MS.NET
•Comm Drivers for RTU/PLCs	Vendor’s proprietary	None from MS. 3rd party .Net, ActiveX, Dll. Source Code Avalbl
OPC Servers as drivers	Vendor’s native products	No native support. Via OPC automation layer & COM layer
Basic Product Development License cost	raises exponentially as tag count (2-15K)	100/1k/5k
Runtime License cost	Per seat charge (40-60% of development)	Nill
Comm drivers (dev License) cost	750	750
Runtime cost for driver	750	Nill
Optional products	Depends 1k-~undefined upper limit	Nill

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	Conventional	MS.NET
Database	MS SQL Server or other	>2 Gig pay, else MSDE free
Configuration effort	Both comparable	
Time to setup	Both comparable	
Co-ordination with 3rd party SW products(GIS, Leak Detect, batch, scheduling…..)if needed	Difficult, in a round about way	Relatively Smooth
Compatibility problems	Several	Few within MS family
Graphical tools for GUI development	Reasonable	Excellent
Graphical file formats supported	Generally only BMP	Over 10 formats supported

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	Conventional	MS.NET
Linking with RTU/PLC points for Animation	Well Integrated	User defined
Add-on Tools/Wizards (user built) Tanks, valves etc. or automate mundane or repetitive tasks	None or very poor	Excellent
Self configuration tools to suit your specific project	None	Create your own anytime
Tools to create above tools/wizards	None or buy options	Built in
Troubleshooting tools	Poor	Excellent
Extensibility	Reasonable	Excellent
Support of Web services, XML, SOAP	Not supported	Natively built-in

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	Conventional	MS.NET
Simple systems (annunciation, alarming, trending)	Excellent	Excellent
Advanced systems, complicated data manipulation, data transfers, non-core HMI functions	Difficult, some items you may not be able to do	Excellent
Handling repetitive functions	Average	Superior
Version Control	None	Excellent built-in tools
Group development	Not possible	Excellent built-in tools
Training	Only good for vendor's product	Good to be an all-rounder

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