

Project Workflow

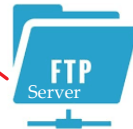
Wednesday, August 25, 2021 6:54 AM

K&L PC as OPC DA Client



Key & Label PC uses OPC DA Client
To read tags from Key & Label PLC

Python [OpenOPC](#) DA Server
to Convert to UA



Key & Label PC functioning as a Server

Data is hosted on OPC-UA Server
via the [Free OPC-UA Python Library](#)



Uses [Tesseract-OCR](#) to recognize
production data from BDE Image

OPC-UA Client and Web Server for
Real-time Data Display



Node-RED



MSTB 7873
MSTB 16370
MC 15822



Takes screenshot of PC every minute using [MSS](#)
(Multiple Screen Shot) Python Library and sends
them to server via FTP

Considerations

Wednesday, August 25, 2021 12:22 PM

The preferred way of getting data from the BDE HMI was using already present logs. The issue with this method is that BDE logs production data every 30 minutes, unfit for a real-time solution.

Potential Solution: Change configuration of BDE to log every 1-5 minutes in CSV this could then be sent via File Transfer Protocol to a Server similar to how images are sent currently

Hydra BDE logs production on a Hydra Server via json, for [example](#)

```
{ "CurrentOrder": { "Amount": 4100, "Article": "5603860", "ArticleDescription": "60WH PC CONNECTOR", "Material": "0087503", "MaterialDescription": "Plated Contact Otis CS8", "Hold": null, "Number": "0000050605290020", "Scrap": 16, "Updated": "2021-08-25 12:28:49.272", "Yield": 2000 }, "Description": "VAC OTIS 122", "Group": "122", "Id": 9, "Machine": "OTIS001", "PlcNext": null, "ProcessData": [], "ShortDescription": "OTIS001", "State": "Lack of Orders", "StateNumber": 60, "Updated": "08/23/2021 15:17:22" }
```

The issue with this method is that the logging rate is unclear and in this example for [MSTB7873](#) below, production data is missing

```
{ "CurrentOrder": null, "Description": "MSTB7873 2,5-2-24 St(F) R", "Group": "ASSEMBLY", "Id": 85, "Machine": "BM007873", "PlcNext": null, "ProcessData": [], "ShortDescription": "MSTB7873", "State": "Production", "StateNumber": 1, "Updated": "08/25/2021 12:17:51" }
```

Potential Solution: Inquire if Hydra-BDE is configurable to resolve discrepancies and pull production from HMI at a consistent to then host as json

Security

Wednesday, August 25, 2021 12:55 PM

The Website is only accessible to the same extent Phoenixlinx.com is, meaning unless you are connected to our production network you will not have access to website, thus is not openly available to the internet.

The Node-Red website has it's graphical editor disabled and does not receive any inputs from user. Thus a malicious actor with access to website is unable to harm anything

The Python OPC UA server's tags are programmed not to be writable by clients. Thus a bad actor with access to UA server is unable to affect anything, furthermore there isn't a direct connection to any machine's PLC.

An attacker would need to enter our Router's Firewall, production network and bypass ESET's Firewall to do anything to server. At that point the most harm could be done is to attempt to crash server. The server is hosted as a windows service that auto-restarts, mitigating any undesired results.

Node-RED settings.js



```
// By default, the Node-RED UI is available at http://localhost:1880/  
// The following property can be used to specify a different root path.  
// If set to false, this is disabled.  
//httpAdminRoot: '/admin',  
httpAdminRoot: false,
```

Only way to edit Node-Red is to re-enable online editor '/admin' path or replace flows.js

Future Use

Wednesday, August 25, 2021 1:57 PM

Besides providing a real-time display this project also standardizes DC Auto's Production Data to be hosted on a OPC UA Server

IT request must be made to allow inbound port 4840 traffic on K&L PC's ESET Security.

The Python OPC UA Server's endpoint is: `opc.tcp://10.209.18.188/freeopcua/server`

This lays the infrastructure for future Industrie 4.0 Projects. For example Elisa may utilize the OPC-UA Server to get production data from all of DC Auto.

Node-RED OPC UA Function Blocks (Nodes)

Node-Red is simply a OPC UA Client that displays production data on a website, any other interface with OPC UA Client could achieve similar results down the line.

Another note is that Node-Red also host the Python OPC-UA tags on its own Node-RED OPC UA server. Thus, if someone was less comfortable with Python they could use Node-Red's Function Block to create their own OPC UA Server

Standard Method of using Node-RED's OPC UA Client

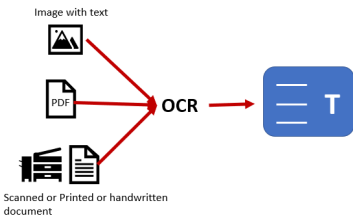
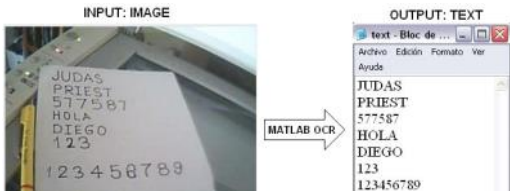


Technologies Involved

Thursday, August 26, 2021 7:07 AM



Used to take screenshots of BDE-HMI
Connecting to AX OPC Server and Tunneling it to OPC UA Server
Reading Images of BDE-HMI and reading production data from it
Hosting all data received from various sources as OPC UA Server Tags



- ~ Batch Scripts to routinely take screenshots of BDE-HMI and send to K&L PC
- ~ Visual Basic Script to hide the Command Line from view of operators
- ~ File Transfer Protocol utilized to send BDE images



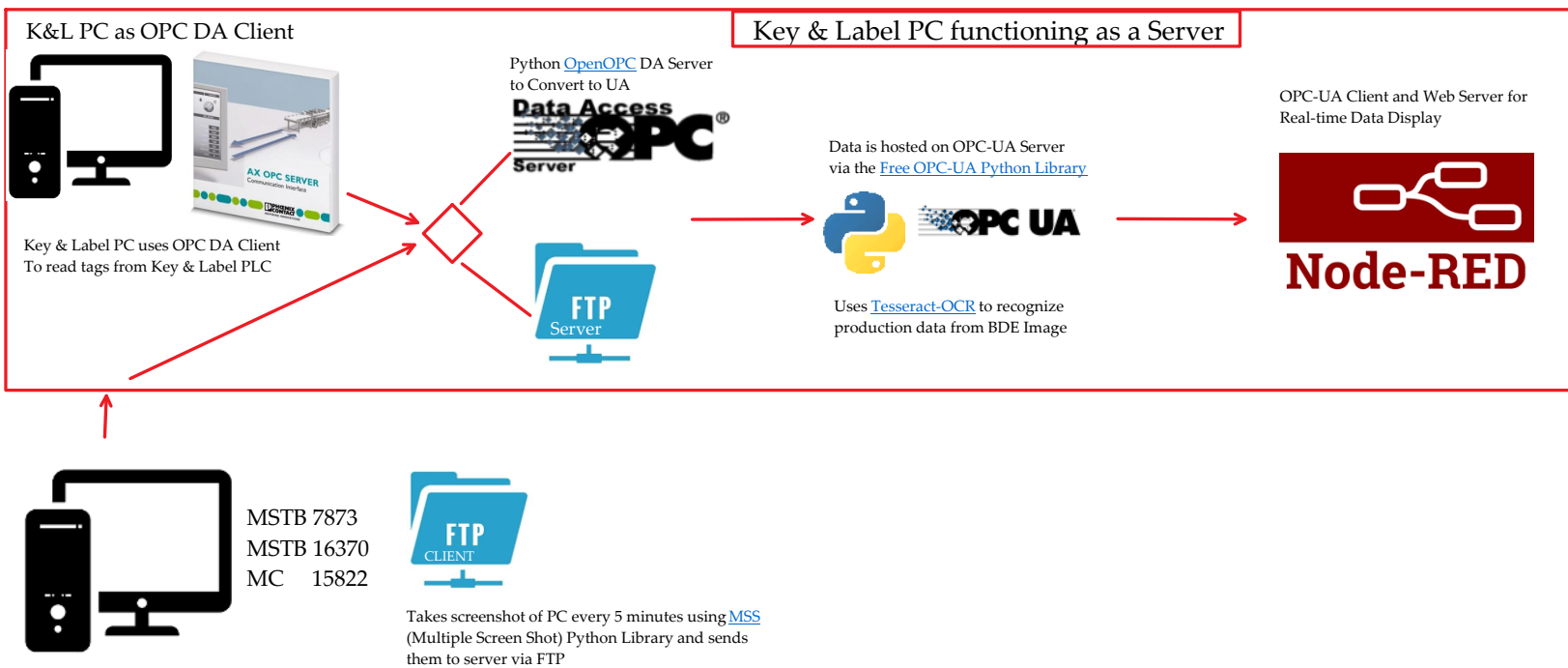
OPC UA Client to host Production Data on website
Displays BDE-Images on Website

Red around items Tesseract Optical Character Recognition is programmed to observe

Order	5059118 / 0010	start	Fr, 08/20/2021 08:04:02 AM
Article number	1803617-00	Charge	
Article name	MC 1.5/ 6-ST-3.81		
Article part	MC 1.5/ 6-ST-3.81		
Work cycles	4080	100.00 %	Total time 39.02 100.00 %
Good poles	4061	99.53 %	Operation time 36.12 92.56 %
Reject poles	13	0.32 %	Stop time 2.49 6.39 %
Empty cycles	6	0.15 %	Failure time 0.00 0.00 %
Good parts quantity	665	97.79 %	Standby time 0.41 1.05 %
Reject quantity	15	2.21 %	Service time 0.00 0.00 %
Rejected blocks	2	0.00 %	
Efficiency	82.81 %		Number of errors 4
Use	92.56 %		Number of checking faults 15
Quantity	0 Pieces		Number of warnings 16
			Current cycle number 114.03
			Average cycle number 112.96
			Technical cycle number 127.00

Project Workflow

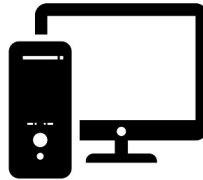
Wednesday, August 25, 2021 6:54 AM



BDE PC's

Wednesday, August 25, 2021 9:32 AM

Takes screenshot of PC every minute using [MSS](#) (Multiple Screen Shot) Python Library and sends them to server via FTP



MSTB 7873
MSTB 16370
MC 15822



For Windows XP Compatibility purposes,
Python version 3.4.3 is used along with
MSS version 3.1.2

Located in RED Folder:

python-3.4.3.msi
python-mss-3.1.2.zip ~ use 'pip install python-mss-3.1.2.zip' to install the package offline
You may have to add python modules to PATH so that mss can be executed from CMD

mini.vbs is the VBScript that launches bdeftp.bat program in the background

```
Dim WShell
Set WShell = WScript.CreateObject ("WScript.shell")
WShell.run "cmd /C bdeftp.bat", 0
Set WShell = Nothing
```

Upon running the installation script "BDE-Installation.bat" a shortcut called BDE-FTP is created and set to run automatically. It launches mini.vbs

BDE - Installation Script

```
net session >nul 2>nul&if errorlevel 1 Batch_Admin "%~0" %
cd "%~dp0"
```

```
set LOGFILE=BDE-Installation-Log.log
call :LOG > %LOGFILE%
exit /B
:LOG
```

```
SETLOCAL ENABLEDELAYEDEXPANSION
SET LinkName=BDE-FTP
SET StartDir=%cd%
SET Esc_LinkDest=%cd%\!LinkName!.lnk
SET Esc_LinkTarget=%cd%\mini.vbs
SET cSctVBS=CreateShortcut.vbs
SET LOG=".\%~N0_runtime.log"
((
    echo Set oWS = WScript.CreateObject("WScript.Shell")
    echo sLinkFile = oWS.ExpandEnvironmentStrings("!Esc_LinkDest!")
    echo Set oLink = oWS.CreateShortcut(sLinkFile)
    echo oLink.TargetPath = oWS.ExpandEnvironmentStrings("!Esc_LinkTarget!")
    echo oLink.WorkingDirectory = "!StartDir!"
    echo oLink.Save
)1>!cSctVBS!
cscript //nologo .\!cSctVBS!
DEL !cSctVBS! /f /q
)1>>!LOG! 2>>&1
REG ADD "HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Run" /V BDE-FTP /t REG_SZ /F /D "%cd%/BDE-FTP.lnk"
REG QUERY "HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Run"
rapidee -A -M PATH "C:\Python34\Scripts"
rapidee -A -M PATH "C:\Python34\"
python-3.4.3.msi /quiet InstallAllUsers=1 PrependPath=1 Include_test=0
set PATH=%PATH%;C:\Python34\Scripts";C:\Python34\
py -3.4-32 -m pip install python-mss-3.1.2.zip
BDE-FTP.lnk
```

Edit bdeftp.bat to change the filename of the screenshot and alter FTP IP address endpoint

BDE - FTP

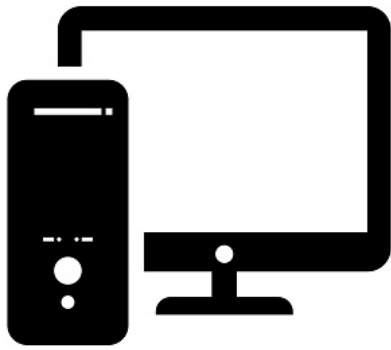
```
@echo off
set PATH=%PATH%;C:\Python34\Scripts;C:\Python34;%SystemRoot%\System32;
REM Change location to .bat file directory and screenshot
:loop
cd "%~dp0"
mss -o BDEscreen.png
```

```
REM Generate the script. Will overwrite any existing temp.txt
echo open 10.209.18.188> temp.txt
REM Username
echo manufact>> temp.txt
REM Password
echo manufact>> temp.txt
echo put BDEscreen.png>> temp.txt
echo quit>> temp.txt
REM Launch FTP and pass it the script
ftp -s:temp.txt
REM Clean up.
del temp.txt
REM Ping takes 1 second each, thus wait 60 seconds and restart loop
ping 127.0.0.1 -n 61 >nul
goto loop
```

K&L PC as OPC DA Client

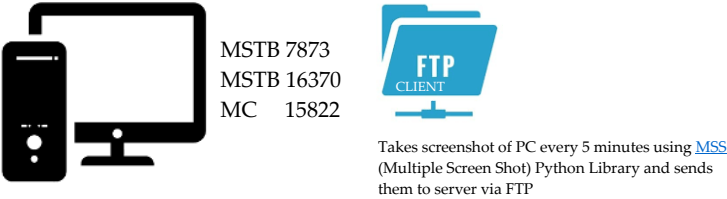
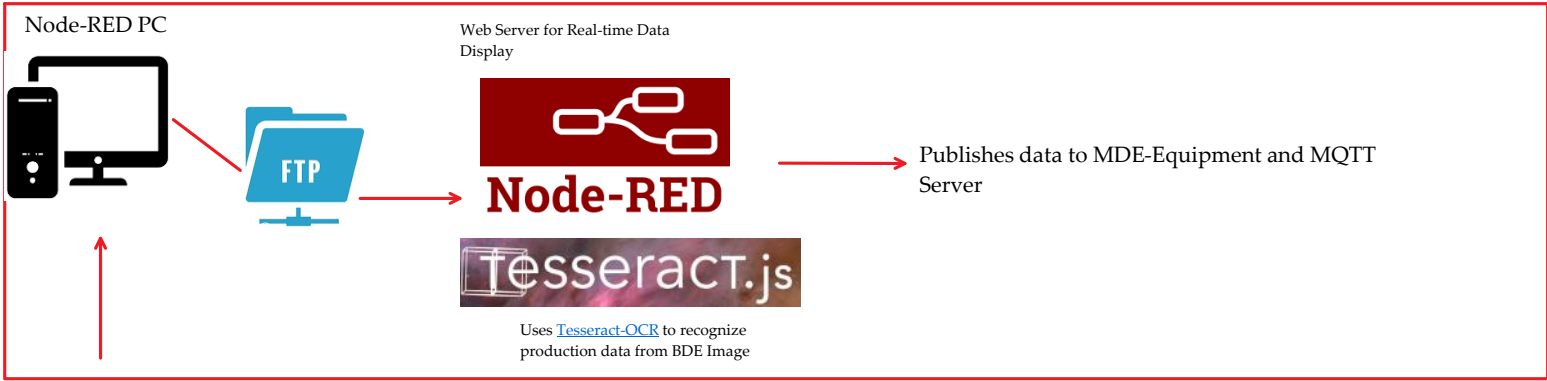
Wednesday, September 1, 2021

7:55 AM



Key & Label PC uses OPC DA Client
To read tags from Key & Label PLC

How it works



K&L PC OPC UA Server

End of September, last 2 days.

Felix

opc.tcp://10.209.18.188:4798/opcua

Tuesday, August 30, 2022 9:25 AM

MPDV OPC-UA

MDE - in Start Menu->Master Data -> Workplace Configuration

DNC ->Parameters for Molding Machine,(CNC)

MNR- Machine Number

MDE configuration -> Posting during prod. Lock: posting as yield

Workplace tab, Counter Configuration:

One counter for good parts

One counter for scrap

C ~ Counter

D ~ Digital Input

Z ~ Cycle time recording

P ~ Process Data Collection

System Administrator under Start Menu

Hydra Terminal: Program Files x86/mpdv/AIP2 .ini files

Ctaip.ini:PCC.exe connection to hydra server | [DLL] BusDLL=PCC.exe

BUSSTARTMODE=SYNCHRONIZE

Pccdll.ini

Two Drivers, one opc and another opcua. Can use both in one terminal:

OPCMPDV.DLL/OPCUA_MPDV.DLL

Opcua_mpdv.ini

[OPCUA]

Url=opc.tcp://10.2018.18.188:4798/opcua

Time is in milliseconds

P:P007 is process data. Node ID Events=OFF

P is Order, Article Number

T: T300 is Trigger. Boolean or Counter

C:C001=UA.NODEID=ns-1;s="goodparts"|EVENTS=OFF

C:C002=UA.NODEID

Z:Z001=ILC150.MPDV.iZ

Polling is not done, it uses triggering event to get values.

Opcmpdv.ini

C is counterC:C001=ILC150.MPDV.iAusschuss

Workplace Configuration-Master Data- MDE Configuration

Cyclic Monitoring

Hydra waits for "ping"

So Trigger event is how it knows run time/

Trigger may be counter variable itself.

BAT-SFI

Tuesday, September 27, 2022 9:59 AM

Make sure Terminal is Active

AIP --> CTAIP.ini

PCC started by PCC.ini refers to PCCDLL.DLL (PCCDLL.ini) ~Refers(OPCMPDV.DLL) |OPCMPDV.ini|

Project-PLCNext Deployments

Wednesday, September 28, 2022 8:53 AM

PMIOBox | SQL, PROFICLOUD
Mpro needs edge device
IoT Gateway

Throughbeam PLCNext Shop Floor Data

Data Collection Boxes for Machines disconnected from any connectivity.

Three pillars: ~Shopfloor Management, Data Collection, Analytics & Visualization

0 Gemba Walks, 5s, Lean

- Current - Data Collection
- PLC Next Deployments - connect stranded machines.
 - ? Publish to MDM Equipment and/or MQTT HBG Broker
 - Rad-900-IFS \$300 Creation Cost | 2,450 on Order all through March in 300 Batches | June -1500
 - Mark Brown, Mike Cherewka | Reports to Davis Matthews
 - Machine Status: On/Off
 - OEE
 - Production Information JSON
 - 224 Machines not connected. Q1 2023
 - MQTT Broker is already present | 10.207.130.198 port 1883
 - DC/7873/Status
 - ICC/WMS/Status
AXCF 1152 | \$600
 - BPC? Industrial fan-less Box PC
 - MQTT HBG Broker 1883/inbound/outbund
 - ESP32 (enclosed) MQTT Pub Client | Industries Certification | Mach over Mach ☒
 - PLCNext | VM pulls MQTT Sub Client to HBG Broker and then sends that data to Hydra via OPC UA
 - Price out options for thin edge device clients
- Injection Mold Center PLC based data collection. 5 Inputs and will be connected to Hydra | Simulation
 - IT needs a simulator. Data collection. Need counter for parts, machine status.
 - Simulator inputs din rail sample. Machine Run State(Making Parts), no. of parts, no. of rejects,
 - Machine State, Good Part Pulse, Bad Part Pulse, Error State:
 - 4 Dry Contacts | Run State NO, Good Cycle Pulse, Bad Cycle Pulse(Scrap), Error State Boolean
 - Run State and Error may be true???
 - Bad/Good Interlocked
 - 5 Digital Inputs
 - Paul Northrop
 - Sooner than February.
 - They are stranded from Hydra
 - Machine Solutions made a box that is mounted to machine to get info
 - Hydra gets served info from box
 - You are simulating this box.
 - Simulate the conditions of those inputs.
 - PLCNext Tags have the info. OPCUA/MQTT. HMI that lets you manipulate values
 - Lauren Barns | Paul Northrop
 - IT wants to test BAAN HYDRA vs SAP HYDRA
 - BAAN Hydra Terminal
 - ILC 2985330 | Eric Lechrone, Jim Gehenio ILC 150 ETH
 - Modbus
 - Hydra OPC DA
 - OEE - Operational Equipment Effectiveness: Parts produced, Reject, Runtime
 - Jay Hostetter (DB Admin), Mike Lewis (Micro Services), David Vavra

MQTT Server

- Machine || PLCnext Box MQTT for Sensor Data
 - Influx DB > Elisa
 - Event Service of MQTT Broker> Elisa
- Quality of Service

PC MQTT Broker
AXCF 1050next

Automation Worx

Hydra Terminal(BAAN)->Test PLC ILC 150 ETH
PCC: Hydra gets plc info via OPC-DA

~	ILC 150 Ethernet connected to network
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Webvisit allows you to manipulate counters.

OPCUA potentially

MQTT Client to 10.207.130.198:1883

Thursday, September 29, 2022 11:59 AM

BAAN HYDRA TERMINAL - ILC 150

Connected via OPC DA

OPC Client (Simulator) on Hydra Terminal

Remote into hydra terminal to manipulate PLC values via OPC Simulator for Testing