

# Architecture

The application provided is installed as a Windows Service on a Windows Server. The required prerequisite for this will be the .NET Framework 4.6.1 or higher.

Also need will be the B&R communication software v4.2.3.59 which can either be downloaded from their site or I can supply you a copy.

[https://www.br-automation.com/en-us/downloads/#categories=software/automation-netpvi](https://www.br-automation.com/en-us/downloads/%23categories=software/automation-netpvi%20)



You will also need the PVI License from B&R which installs as a USB key in the machine. However, for now we can run in trial mode, you don’t need the license until you are ready for production.

The diagram explains the concept of the total system. The CPU represents the controls panels running machines on the shop floor, each with an assigned IP Address. Each CPU contains a collection of Variables which are the data points we will want to capture.

The PVI Service is the communication service (provided by B&R Automation) running on the Windows Server which contains a collection of CPU connections.

The Windows Service hosts the REST API and hosts an internal business service that can communicate with the PVI Service.

## REST API

The REST API provides three basic functions:

* Return the current values of a Variables on a CPU
* Return status information about the system
* Allow for configuration of the system

You will notice that for my testing I am using Port 9001, but this is a configuration setting you can change.

The configuration settings for CPU’s and Variables are stored in XML files.

### Data

Retrieves the variables (see Variable configuration) from a machine named “Test3” (see CPU configuration)

**REQUEST**

**GET** <http://localhost:9001/api/Data/Test3> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 234

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 18:23:35 GMT

{

"Name": "Test3",

"Data": {

"test40": "datapoint\_1",

"test21": "datapoint\_2",

"v1": "datapoint\_3",

"master1": "datapoint\_4",

"master2": "datapoint\_5",

"master3": "datapoint\_6",

"master4": "datapoint\_7",

"master5": "datapoint\_8",

"master6": "datapoint\_9"

}

}

## CPU

Get the status of all the configured CPU’s.

**REQUEST**

**GET** [http://localhost:9001/api/cpu/](http://localhost:9001/api/cpu/%20) HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 927

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Thu, 27 Oct 2016 17:32:40 GMT

[{

"Name": "Test3",

"Description": "Description3",

"IpAddress": "123.45.67.33",

"IsConnected": false,

"HasError": true,

"Error": {

"ErrorCode": 4808,

"ErrorText": "No connection available to the PLC "

}

},

{

"Name": "Test1",

"Description": "Description1",

"IpAddress": "123.45.67.1",

"IsConnected": true,

"HasError": false

}]

Find a specific CPU by name

**REQUEST**

**GET** <http://localhost:9001/api/Cpu/FindByName/Test3> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 185

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 19:49:09 GMT

{

"Name": "Test3",

"Description": "Description3",

"IpAddress": "123.45.67.33",

"IsConnected": false,

"HasError": true,

"Error": {

"ErrorCode": 4808,

"ErrorText": "No connection available to the PLC "

}

Find a specific CPU by IP

**REQUEST**

**GET** [http://localhost:9001/api/Cpu/FindByIp/123.45.67.1](http://localhost:9001/api/Cpu/FindByIp/123.45.67.1%20) HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 184

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 19:52:49 GMT

{

"Name": "Test1",

"Description": "Description1",

"IpAddress": "123.45.67.1",

"IsConnected": true,

"HasError": false

}

Add a CPU

**REQUEST**

**POST** [http://localhost:9001/api/Cpu/Add](http://localhost:9001/api/Cpu/Add%20) HTTP/1.1

Host: localhost:9001

Connection: keep-alive

Content-Length: 90

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Content-Type: application/json

Accept: \*/\*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.8

{

"Name": "CPU\_25",

"Description": "CPU\_25",

"IpAddress": "123.45.67.25"

}

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 19:56:20 GMT

Update a CPU, such as change the IP

**REQUEST**

**PUT** <http://localhost:9001/api/Cpu/Update> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

Content-Length: 90

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Content-Type: application/json

Accept: \*/\*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.8

{

"Name": "CPU\_25",

"Description": "CPU\_25",

"IpAddress": "123.45.67.99"

}

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:00:08 GMT

Delete a CPU by Name

**REQUEST**

**DELETE** <http://localhost:9001/api/cpu/DeleteByName/Test4> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:08:57 GMT

Delete a CPU by IP

**REQUEST**

**DELETE** <http://localhost:9001/api/cpu/DeleteByIp/123.45.67.2> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:10:47 GMT

## PVI Service

Get current Status of the PVI Service

Name is just for internal use.

IsConnected means that the PVI Service is running correctly

ConnectTime is the last time the service was started

License indicates if the B&R License is active

**REQUEST**

**GET** <http://localhost:9001/api/Pvi> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Authorization: Basic QVBJXzE0NjA2MzkxMjE1NDU2MjQyNDI1NDQ6VzNsY29tZTEh

Content-Type: application/xml

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 158

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:16:28 GMT

{

"Name": "8b4b9f78-9fef-40b9-b019-365e64264444",

"IsConnected": true,

"Cpus": 5,

"ConnectTime": "2016-10-28T13:22:50.3547652-05:00",

"License": "Undefined;NO LICENCE"

}

## Variables

Get the Variables assigned to each CPU

VARIABLE\_MASTER are variables assigned to all CPU’s. This example shows that cpu1 is using all the master variables plus three variables unique to the cpu. These are the variables that will return values when you do a GET on the “Data” API.

**REQUEST**

**GET** <http://localhost:9001/api/variables/> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 1280

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:31:53 GMT

[{

"CpuName": "VARIABLE\_MASTER",

"VariableNames": ["master1",

"master2",

"master3",

"master4",

"master5",

"master6"]

},

{

"CpuName": "cpu1",

"VariableNames": ["test40",

"test21",

"v1",

"master1",

"master2",

"master3",

"master4",

"master5",

"master6"]

}]

Add Variables to a CPU

By default a CPU will add the MASTER variables and it is not necarry to add them. This call will add a custom variable to this CPU only

**REQUEST**

**POST** <http://localhost:9001/api/variables/Add> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

Content-Length: 49

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Content-Type: application/json

Accept: \*/\*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.8

{

"CpuName": "cpu50",

"Variables": ["test55"]

}

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:45:57 GMT

Get CPU Variables

This builds on the previous example, showing that even though only one variable was added, the CPU is also picking up the master variables.

**REQUEST**

**GET** <http://localhost:9001/api/variables/cpu50> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 106

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:51:28 GMT

{

"CpuName": "cpu50",

"VariableNames": ["test55",

"master1",

"master2",

"master3",

"master4",

"master5",

"master6"]

}

Copy the Variable settings of a CPU to a new CPU setting

In this example a new setting is created for a CPU named “copy51”

**REQUEST**

**POST** <http://localhost:9001/api/variables/Copy> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

Content-Length: 48

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Content-Type: application/json

Accept: \*/\*

Accept-Encoding: gzip, deflate, br

Accept-Language: en-US,en;q=0.8

{

"Source": "cpu50",

"Destination": "copy51"

}

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 107

Content-Type: application/json; charset=utf-8

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 20:55:09 GMT

{

"CpuName": "copy51",

"VariableNames": ["test55",

"master1",

"master2",

"master3",

"master4",

"master5",

"master6"]

}

Delete a CPU variable setting

**REQUEST**

**DELETE** <http://localhost:9001/api/Variables/DeleteCpu> HTTP/1.1

Host: localhost:9001

Connection: keep-alive

Content-Length: 20

User-Agent: Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/54.0.2840.71 Safari/537.36

Origin: chrome-extension://fhbjgbiflinjbdggehcddcbncdddomop

Content-Type: application/json

Accept: \*/\*

Accept-Encoding: gzip, deflate, sdch, br

Accept-Language: en-US,en;q=0.8

["cpu50", "copy51"]

**RESPONSE**

HTTP/1.1 200 OK

Content-Length: 0

Server: Microsoft-HTTPAPI/2.0

Date: Fri, 28 Oct 2016 21:01:49 GMT