Using Windows XP Embedded Based Systems in a Control System

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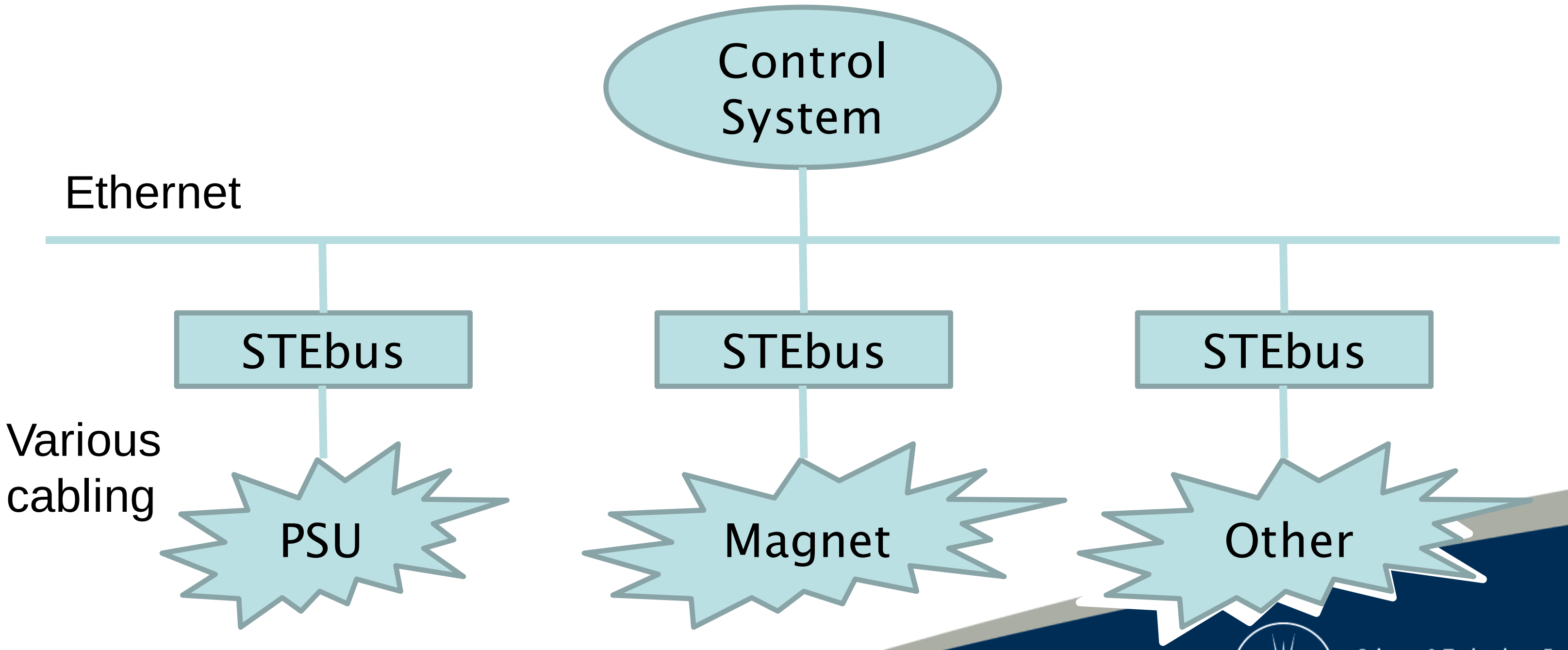
Presentation Outline

- Why did we do this?
- Platform choices.
- Building a Windows XP Embedded Image.
- The application program.

Why did we do this?

- Needed a platform to interface between VSystem software and various types of hardware: magnets, power supplies etc.



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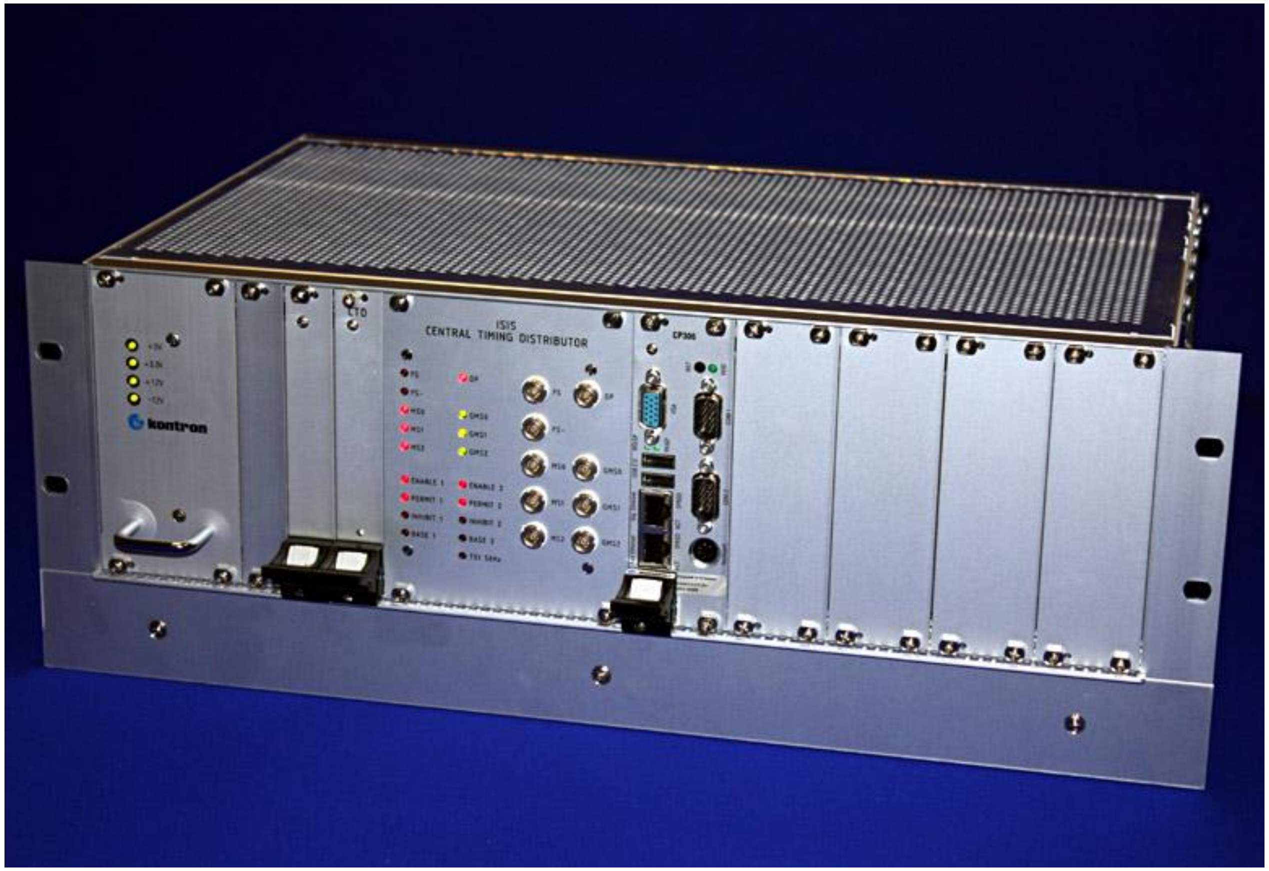
Platform Choices

Hardware:

- CompactPCI based
- J2 Connector for rear IO



An example chassis

A picture of a fully configured chassis. This is the Central Timing Distributor (CTD) for ISIS, a fairly important piece of equipment!!

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Platform Choices

Operating System:

- Windows CE Embedded
- Windows XP Embedded
- Embedded Linux
- QNX

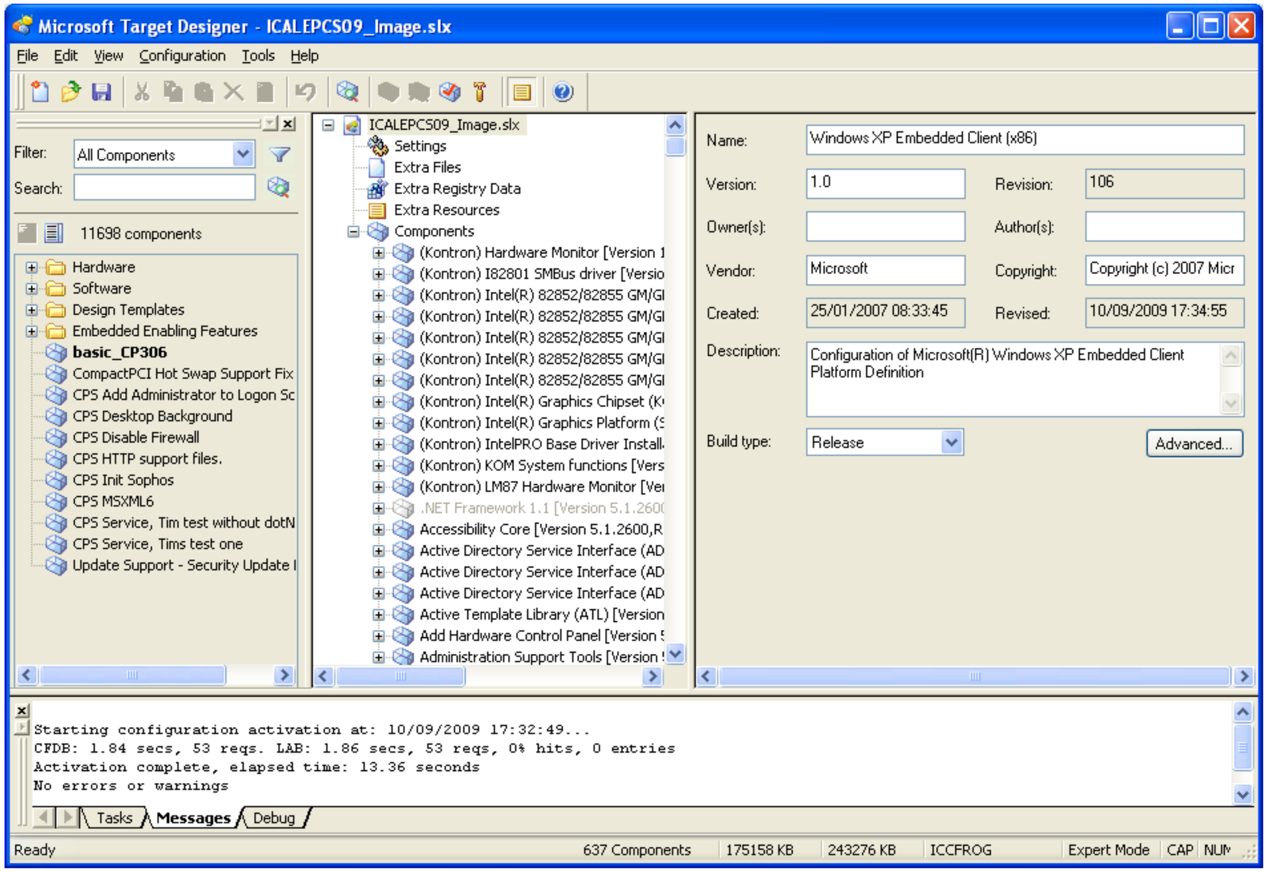
BUILDING A WINDOWS XP EMBEDDED IMAGE

Windows Embedded Studio

- Target Analyzer
- Component Database Manager
- Target Designer
- Component Designer
- SDI Loader & sdimgr.exe
- Remote Boot Manager

Beginning with XP Embedded

- Windows XP Embedded is component based.
- Using a Board Support Package (BSP)
- Analyze your target hardware.


Microsoft Target Designer - ICALEPCS09_Image.slx
File Edit View Configuration Tools Help
Filter: All Components
Search:
11698 components
Hardware
Software
Design Templates
Embedded Enabling Features
basic_CP306
CompactPCI Hot Swap Support Fix
CPS Add Administrator to Logon Sc
CPS Desktop Background
CPS Disable Firewall
CPS HTTP support files.
CPS Init Sophos
CPS MSXML6
CPS Service, Tim test without dotN
CPS Service, Tims test one
Update Support - Security Update I
ICALEPCS09_Image.slx
Settings
Extra Files
Extra Registry Data
Extra Resources
Components
(Kontron) Hardware Monitor [Version 1
(Kontron) I82801 SMBus driver [Versio
(Kontron) Intel(R) 82852/82855 GM/GI
(Kontron) Intel(R) 82852/82855 GM/GI
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(Kontron) Intel(R) Graphics Chipset (K
(Kontron) Intel(R) Graphics Platform (S
(Kontron) IntelPRO Base Driver Install.
(Kontron) KOM System functions [Vers
(Kontron) LM87 Hardware Monitor [Ver
.NET Framework 1.1 [Version 5.1.2600
Accessibility Core [Version 5.1.2600,R
Active Directory Service Interface (AD
Active Directory Service Interface (AD
Active Directory Service Interface (AD
Active Template Library (ATL) [Version
Add Hardware Control Panel [Version 5
Administration Support Tools [Version 5
Advanced...
Tasks
Messages
Debug
Ready
637 Components
175158 KB
243276 KB
ICCFROG
Expert Mode
CAP
NUM

Name:	Windows XP Embedded Client (x86)		
Version:	1.0	Revision:	106
Owner(s):		Author(s):	
Vendor:	Microsoft	Copyright:	Copyright (c) 2007 Micr
Created:	25/01/2007 08:33:45	Revised:	10/09/2009 17:34:55
Description:	Configuration of Microsoft(R) Windows XP Embedded Client Platform Definition		
Build type:	Release		

```
Starting configuration activation at: 10/09/2009 17:32:49...
CFDB: 1.84 secs, 53 reqs. LAB: 1.86 secs, 53 reqs, 0% hits, 0 entries
Activation complete, elapsed time: 13.36 seconds
No errors or warnings
```

Target Designer

Create your image by adding components, then perform a dependency check and build your image.

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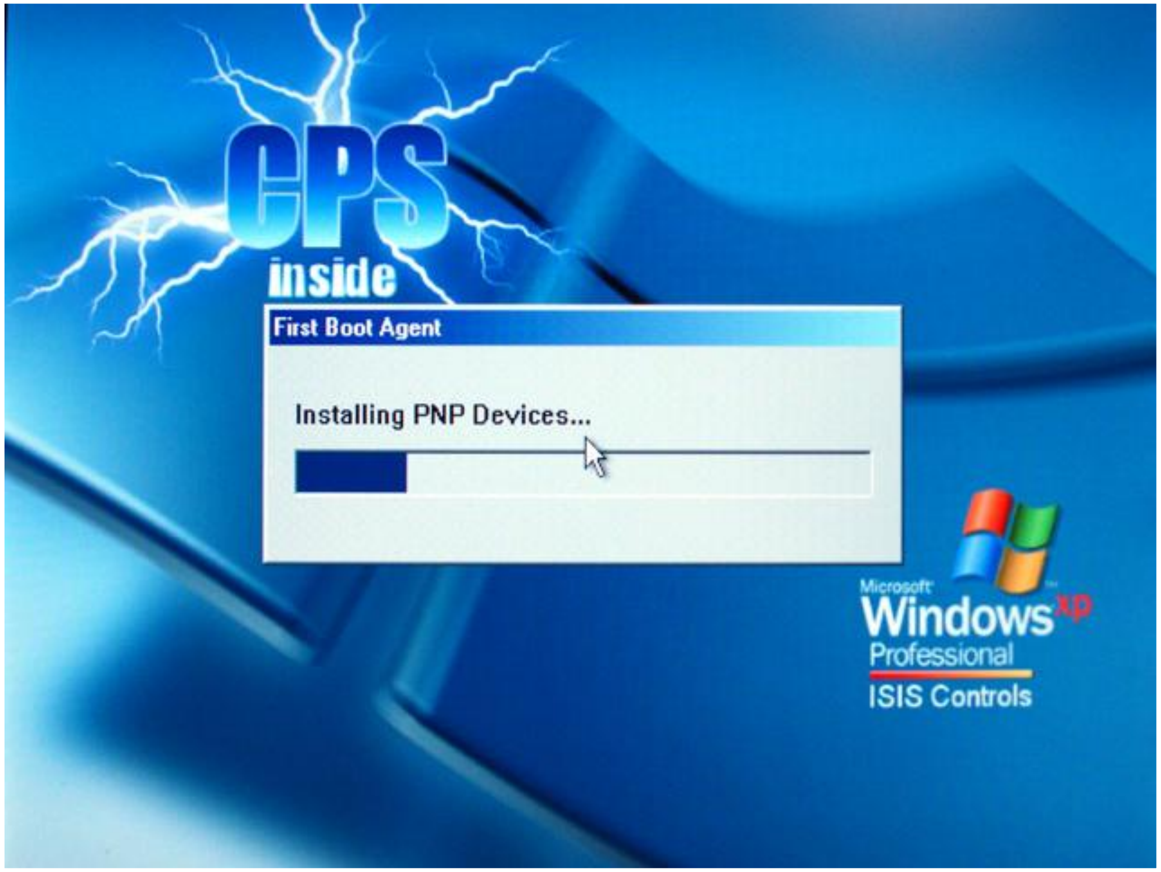
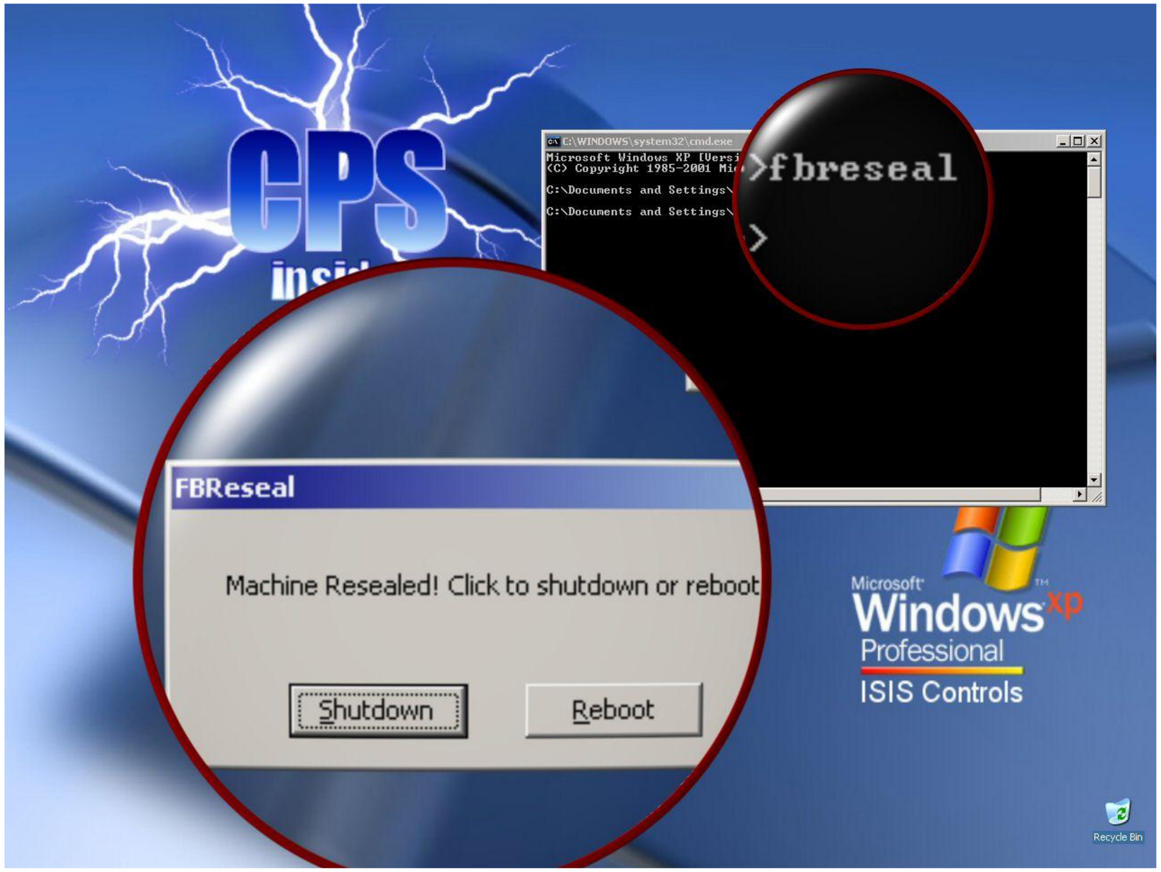


First Boot Agent

Installing PNP Devices...

First Boot Agent (FBA)

Runs the first time you boot your image on your target device and performs such things as Plug and Play device detection, network configuration etc.


CPS inside
Microsoft Windows XP Professional
ISIS Controls
Recycle Bin
C:\WINDOWS\system32\cmd.exe
FBReseal
Shutdown
Reboot

```
Microsoft Windows XP [Versi
(C) Copyright 1985-2001 Mic

C:\Documents and Settings\

C:\Documents and Settings\
```

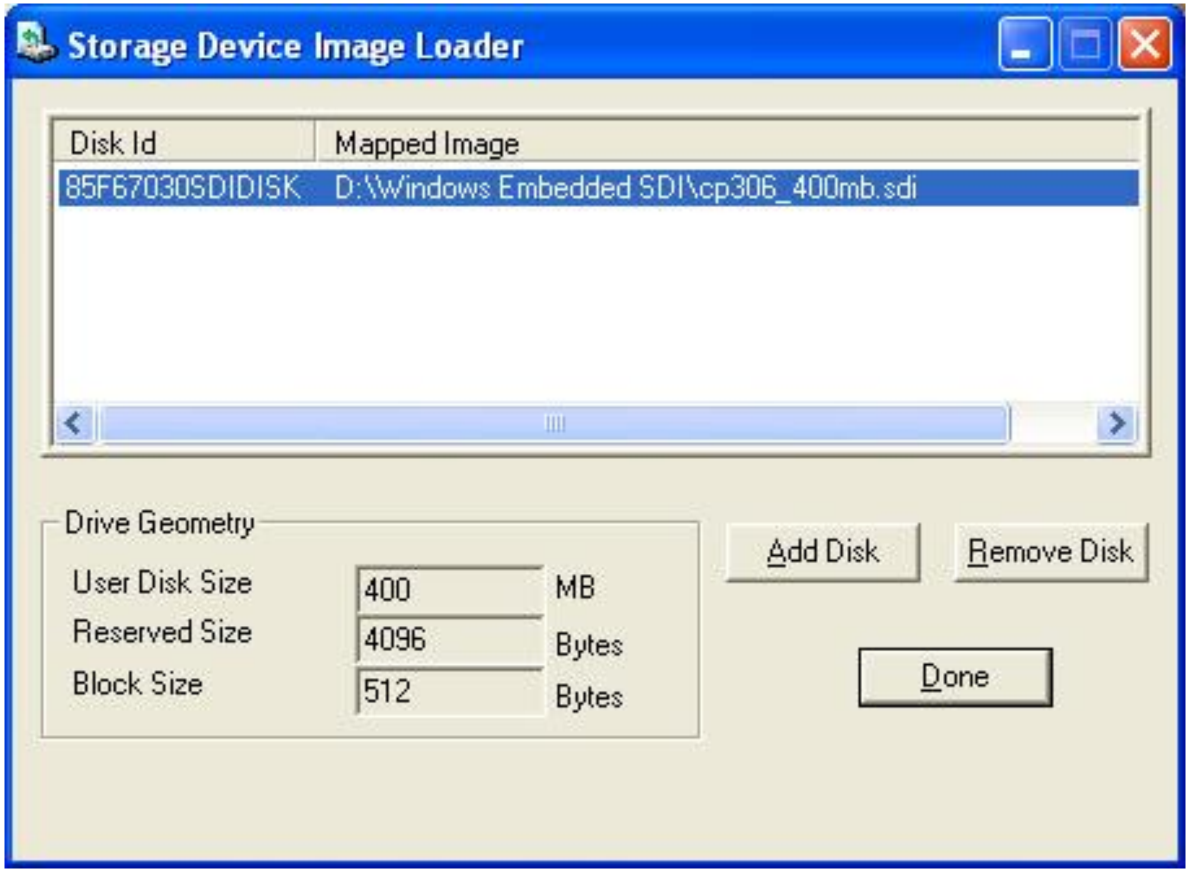
```
>fbreseal

>
```

Machine Resealed! Click to shutdown or reboot

FBReseal

This basically clones your image, ready to distribute to multiple target devices.



Disk Id	Mapped Image
85F67030SDIDISK	D:\Windows Embedded SDI\cp306_400mb.sdi

Drive Geometry

User Disk Size	400	MB
Reserved Size	4096	Bytes
Block Size	512	Bytes

SDI Loader.

SDI Loader is used to create a network boot file to use in conjunction with the PXE protocol in a compatible BIOS.

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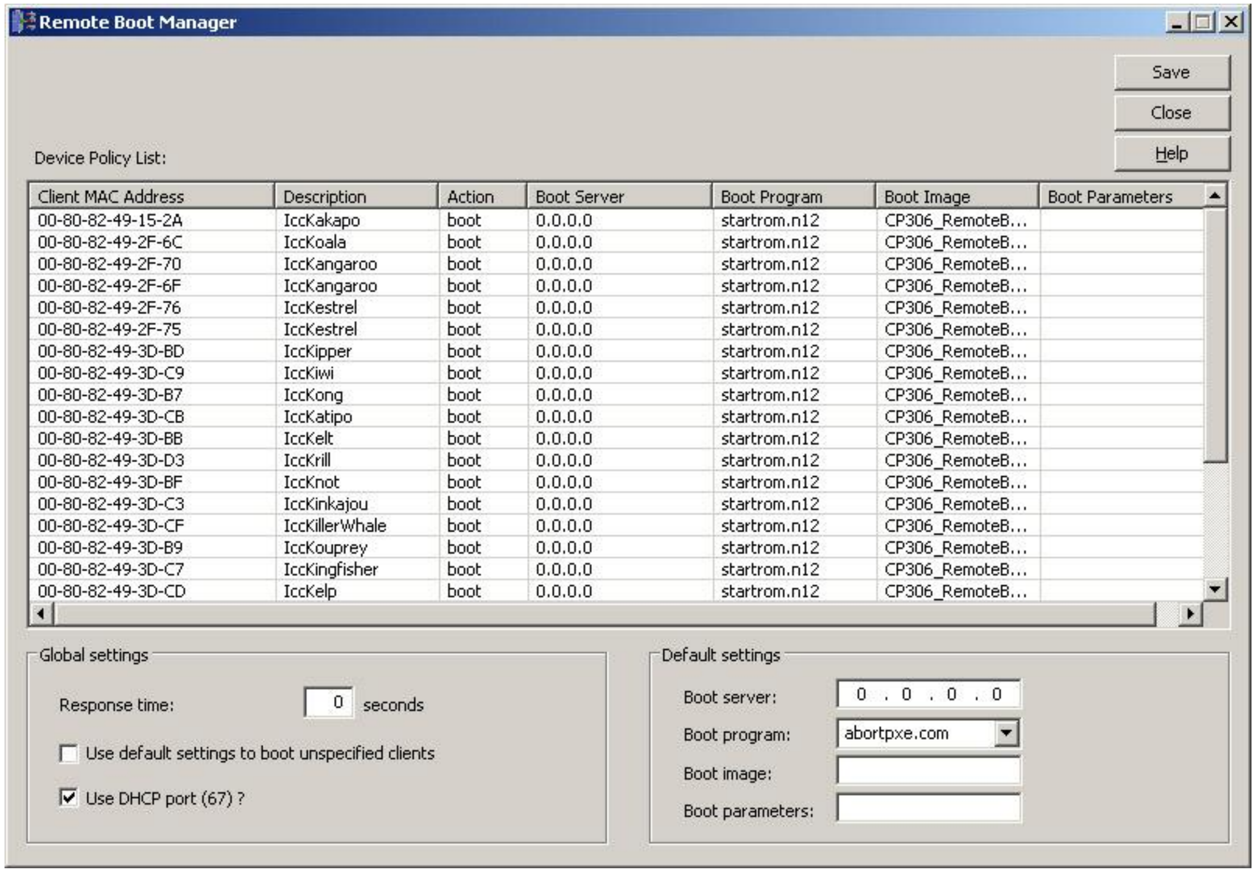


Remote Boot Manager

Device Policy List:

Client MAC Address	Description	Action	Boot Server	Boot Program	Boot Image	Boot Parameters
00-80-82-49-15-2A	IccKakapo	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-2F-6C	IccKoala	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-2F-70	IccKangaroo	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-2F-6F	IccKangaroo	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-2F-76	IccKestrel	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-2F-75	IccKestrel	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-BD	IccKipper	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-C9	IccKiwi	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-B7	IccKong	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-CB	IccKatipo	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-BB	IccKelt	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-D3	IccKrill	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-BF	IccKnot	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-C3	IccKinkajou	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-CF	IccKillerWhale	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-B9	IccKouprey	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-C7	IccKingfisher	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	
00-80-82-49-3D-CD	IccKelp	boot	0.0.0.0	startrom.n12	CP306_RemoteB...	

Global settings

Response time: 0 seconds

☐ Use default settings to boot unspecified clients

☑ Use DHCP port (67) ?

Default settings

Boot server: 0 . 0 . 0 . 0

Boot program: abortpxe.com

Boot image:

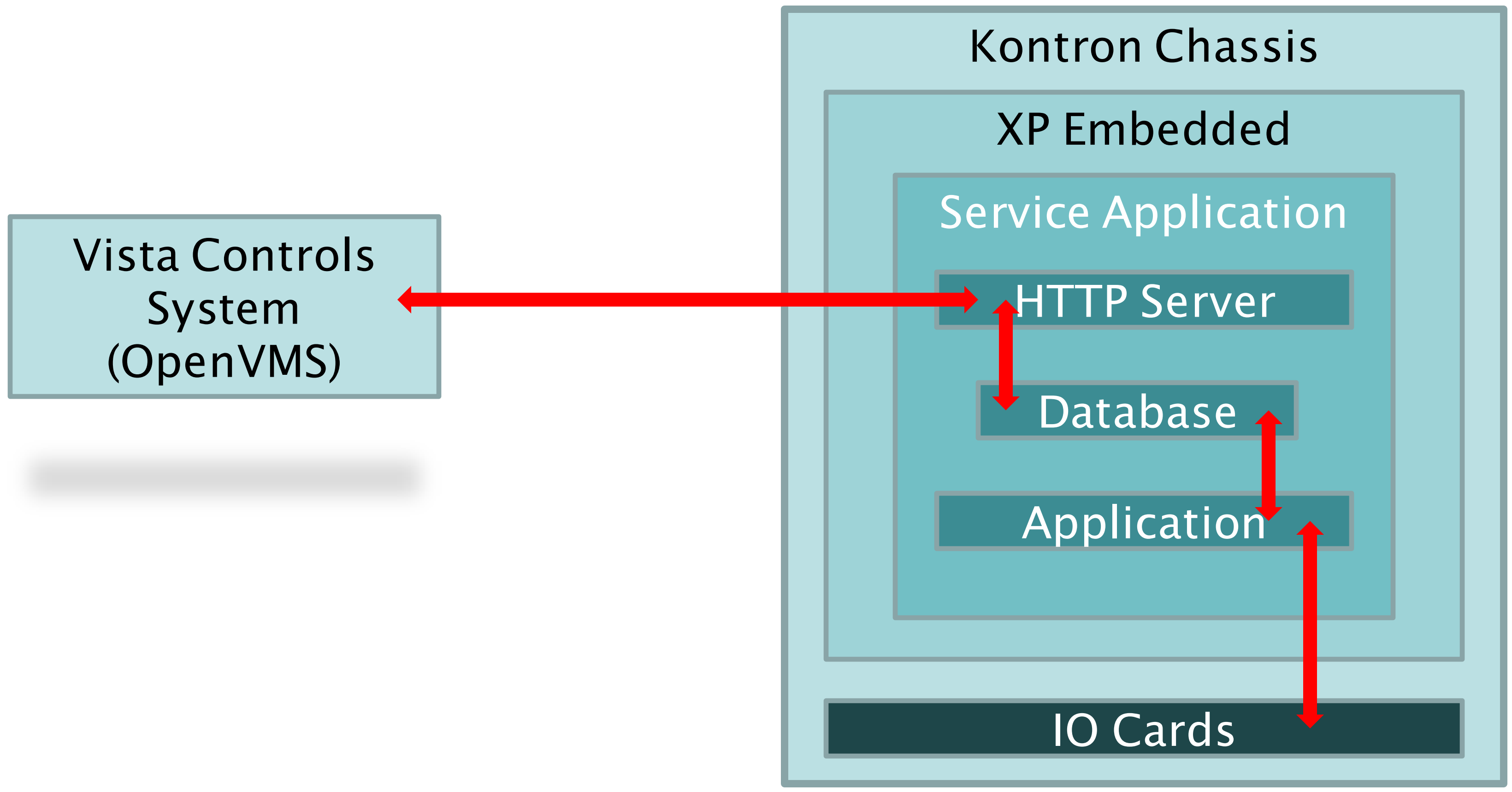
Boot parameters:

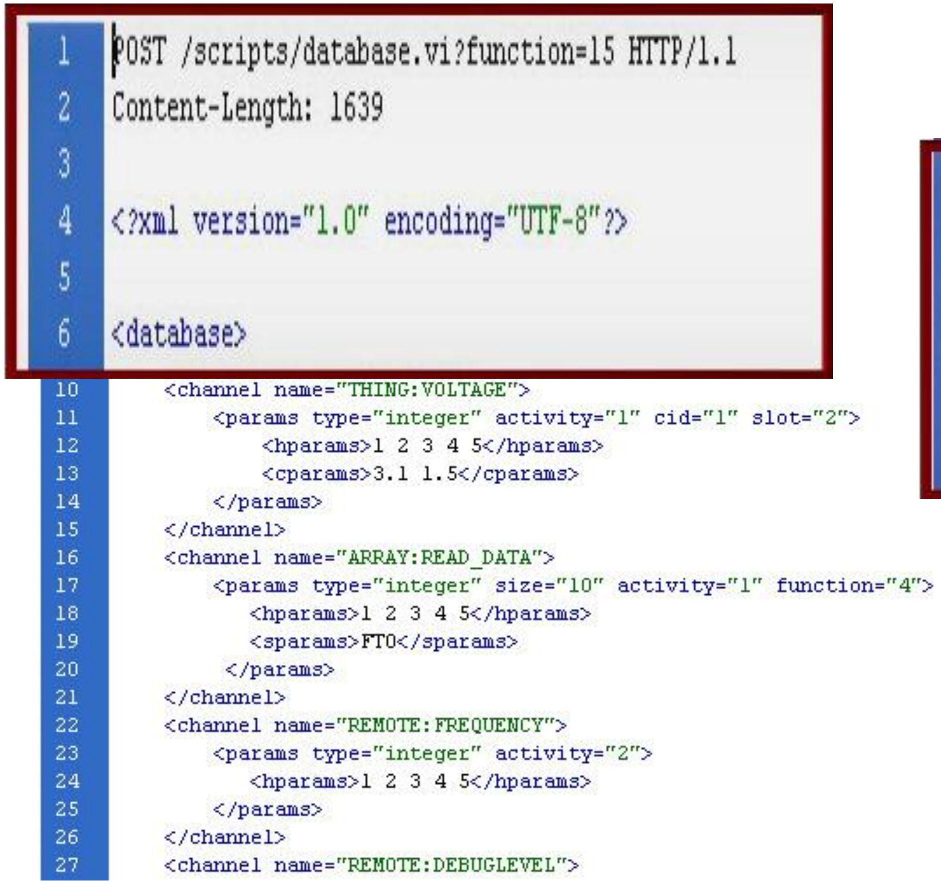
Remote Boot Manager

Use this to determine which target devices load which Windows XP Image over the network. This process requires PXE support in the target device BIOS.

THE APPLICATION PROGRAM

Application Layout



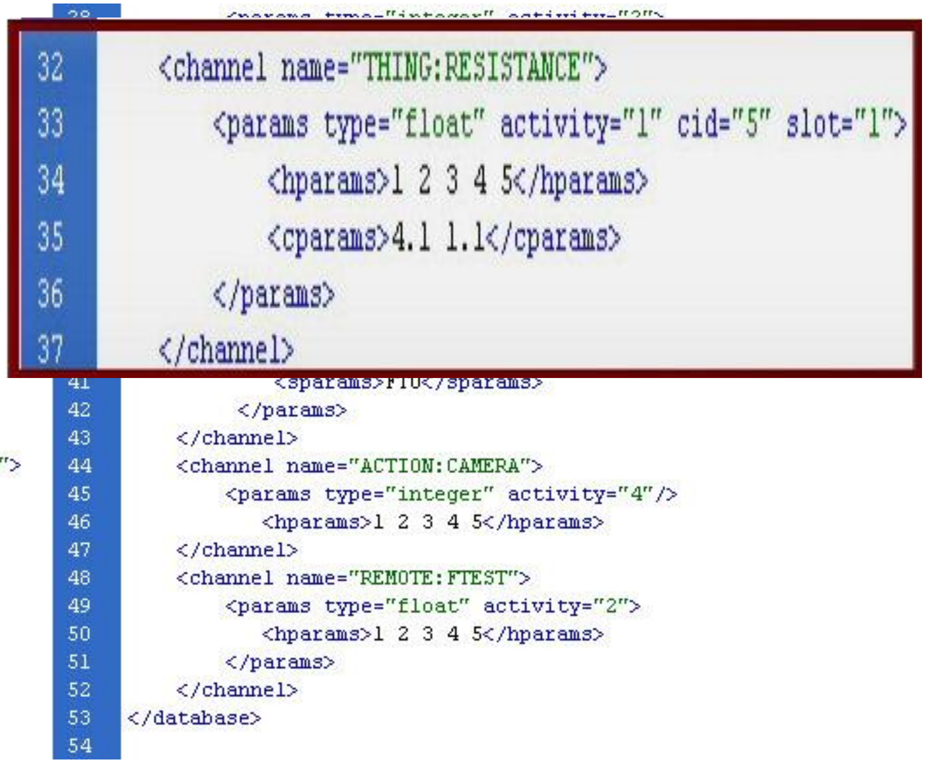


```
POST /scripts/database.vi?function=15 HTTP/1.1
Content-Length: 1639

<?xml version="1.0" encoding="UTF-8"?>

<database>
```

```
    <channel name="THING:VOLTAGE">
        <params type="integer" activity="1" cid="1" slot="2">
            <hparams>1 2 3 4 5</hparams>
            <cparams>3.1 1.5</cparams>
        </params>
    </channel>
    <channel name="ARRAY:READ_DATA">
        <params type="integer" size="10" activity="1" function="4">
           <hparams>1 2 3 4 5</hparams>
           <sparams>FT0</sparams>
         </params>
    </channel>
    <channel name="REMOTE:FREQUENCY">
        <params type="integer" activity="2">
           <hparams>1 2 3 4 5</hparams>
        </params>
    </channel>
    <channel name="REMOTE:DEBUGLEVEL">
```



```
    <channel name="THING:RESISTANCE">
        <params type="float" activity="1" cid="5" slot="1">
            <hparams>1 2 3 4 5</hparams>
            <cparams>4.1 1.1</cparams>
        </params>
    </channel>
```

```
            <sparams>FT0</sparams>
        </params>
    </channel>
    <channel name="ACTION:CAMERA">
        <params type="integer" activity="4"/>
           <hparams>1 2 3 4 5</hparams>
    </channel>
    <channel name="REMOTE:FTEST">
        <params type="float" activity="2">
           <hparams>1 2 3 4 5</hparams>
        </params>
    </channel>
</database>
```

Database download XML format

This is an example of the XML with the HTTP POST header that is sent from the controls system to the Windows XP Embedded chassis where it will be processed into a Database object.

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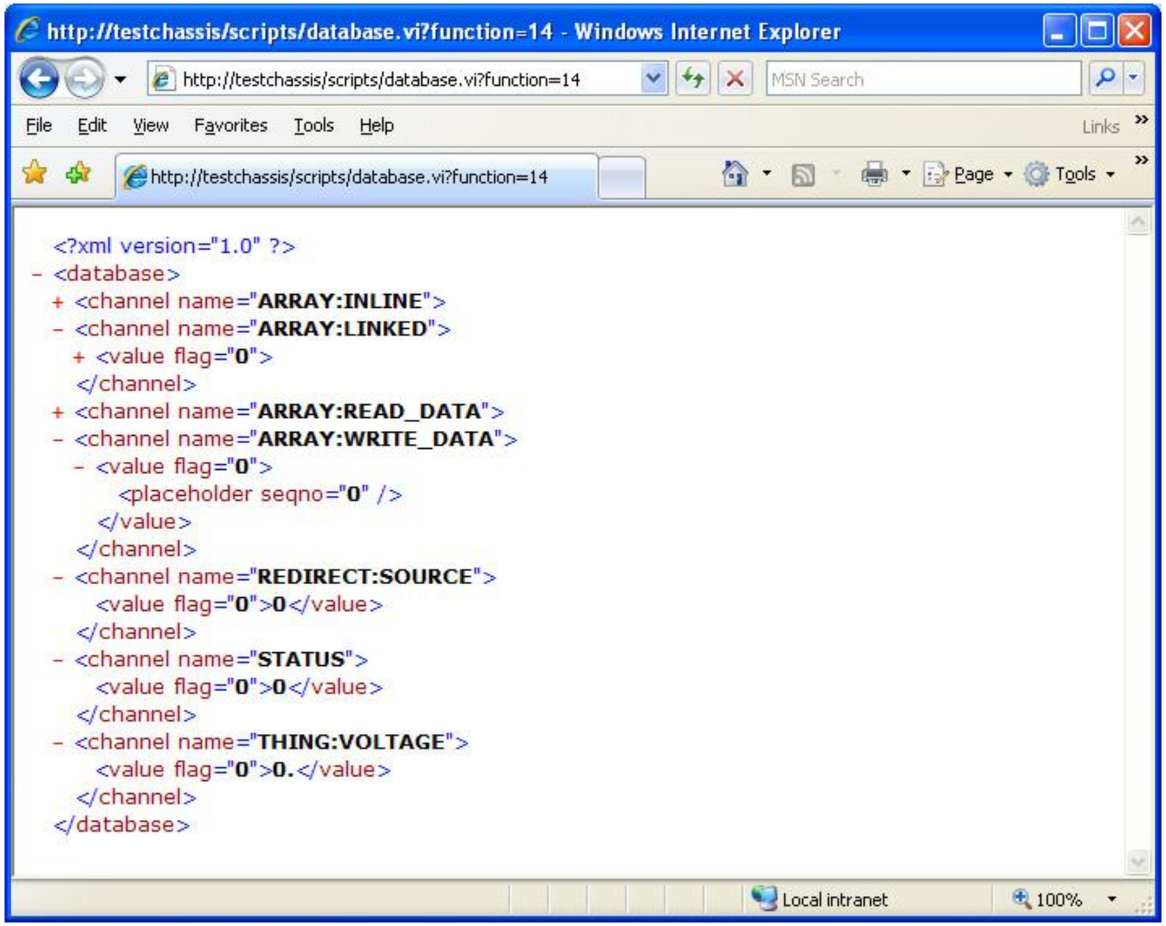
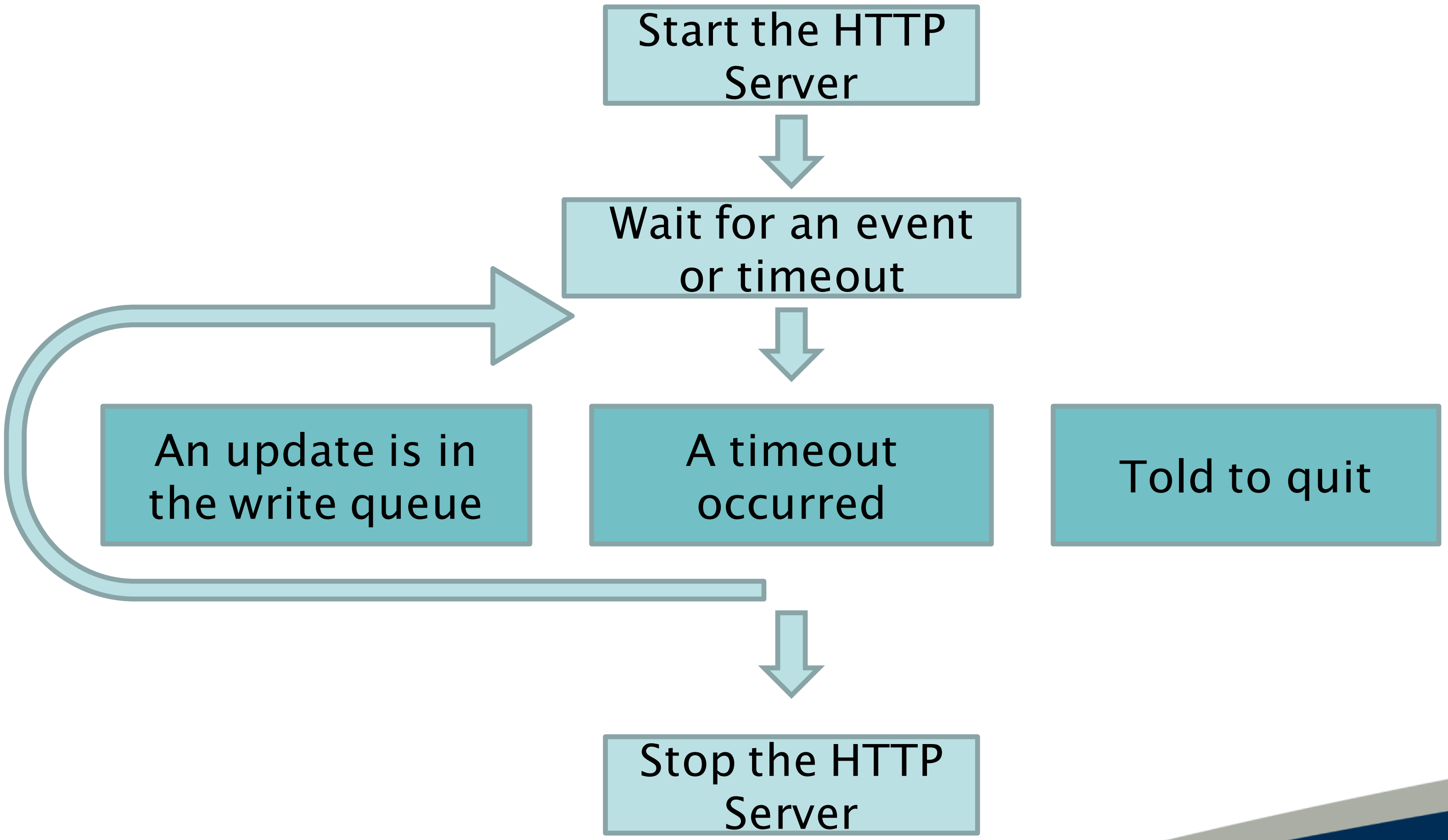

http://testchassis/scripts/database.vi?function=14 - Windows Internet Explorer
File Edit View Favorites Tools Help
Local intranet
100%

```
  <?xml version="1.0" ?>
- <database>
  + <channel name="ARRAY:INLINE">
  - <channel name="ARRAY:LINKED">
    + <value flag="0">
    </channel>
  + <channel name="ARRAY:READ_DATA">
  - <channel name="ARRAY:WRITE_DATA">
    - <value flag="0">
        <placeholder seqno="0" />
      </value>
    </channel>
  - <channel name="REDIRECT:SOURCE">
      <value flag="0">0</value>
    </channel>
  - <channel name="STATUS">
      <value flag="0">0</value>
    </channel>
  - <channel name="THING:VOLTAGE">
      <value flag="0">0.</value>
    </channel>
  </database>
```

Database through a browser.

You can view the current Database object via a browser, this is the same information that the reader process on the controls system periodically retrieves.

Application Service



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Common Use

- Database Class
  - Create it before use, contents sent via XML once HTTP Server starts.
  - Exposes an event that signals when it has been updated from the Control System (Vsystem).
  - Contains Channel objects, application works with these.
  - IsItNew() – Has a new database been downloaded.
  - IterateChannels() – Step through each channel in the database.
  - UpdateChannel() – Update a channel in the database.
  - Lock() & Unlock() – Multi channel operations mainly.
- HttpServer Class
  - Handles database/channel writes from VMS, all exchanged via HTTP/XML.
  - Supply a database as a parameter using Start() method.

Common Use

- Channel Class
  - GetType(), retrieves the data type of channel e.g. CPS_FLOAT, CPS_FLOAT_ARRAY
  - GetValue() / SetValue() , to modify channel data.
  - GetActivity()
  - GetCardId()

Conclusion

- It works!
- It has freed the hardware guys from writing networking software.
- Pretty easy to deploy a new image.
- Slower booting, but this is mitigated because it doesn’t happen often.
- Changing the image for regular updates is a necessary evil, as is anti-virus & a firewall. But you can mitigate the exposure by limiting the components.
- Useful to view from a browser.