

# PDU Provisioning - Tips and Tricks

“How to configure your intelligent PDUs and get them on the network faster and easier”

By Calvin Nicholson,  
Senior Director of Product Management and Software Development

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# ABSTRACT

One of the challenges with intelligent cabinet power distribution units has been the ability of users to get them configured and working on their network. Only on the network can they truly provide the valuable power and environmental monitoring and alerts that the user has paid for. This has been a challenge for many and there is no end to the number of reasons why some PDUs are not networked including:

- 1) The PDU's were installed well before the network was up as power was needed and we never got back to it.
- 2) The PDU's were not approved by the security team and now they must be installed and used without being connected to the network until we get approval.
- 3) We just haven't had the time or resources to get them all on the network yet.
- 4) Along with various other excuses all dealing with the traditional time and blame game.

This white paper will offer suggestions and solutions as to ways the user can get their PDU's up and going on the network quickly, with a reasonable amount of effort and configured in a way that provides real value to the facility personnel. In most data centers, co-location facilities, cloud providers, labs and other facilities about half of the power used is used in the data center cabinet. This fact along with the realization that the cabinet is often one of the best places to identify opportunities for power savings and increased efficiency makes it amazing that we find intelligent PDUs still not on the network.

# INTRODUCTION

Throughout this white paper, we will review a number of different ways that users can automate the configuration of their intelligent Server Technology PDUs. Acting as a guide to review different ways that a PDU can be provisioned for use on the network, it will give enough details to determine what methods are suitable or merit further review for your own applications. Users are welcome to explore the configuration options that are suitable for their environments with their local Server Technology Sales Engineer or Support person.

We will discuss and review the following configuration / provisioning methods:

- 1) Scripting
- 2) SPM (Sentry Power Manager) Spread sheet Tool (current and future SW releases)
- 3) Configuration via SNAP tool using SPM
- 4) StartUp Stick® (SUS) using USB based tools
- 5) STIC (editable ini file)
- 6) ZTP Zero Touch Provisioning

Each of these methods has its own advantages and disadvantages. Research might be required to make the best decision for your organization. Where it is applicable we will reference additional documents, like Technical Notes, or locations on our web site where further information is available. STI prides itself on superior support and our support team or local Sales Engineers are always available to answer any questions that you might have.

Note: The terms configuration and provisioning will be used interchangeably as in many cases configuration of the PDU and provisioning are done as a single step within the tools mentioned.

## SCRIPTING

STI PDUs offer a very well documented serial/terminal command line interface that is accessed via a serial cable, telnet or SSH. Just about any feature or function you can access, change or control via the GUI is also available to be configured via the CLI. As an alternative, STI Rack PDUs offer many features like outlet control via Simple Network Management Protocol v1, v2 or v3 (SNMP). The STI Sentry MIB and OID trees are available from [www.servertech.com](http://www.servertech.com).

There are advantages and disadvantages to creating custom scripts within your organization. Done properly they are a simple method for PDU configuration with a lot of flexibility as the user can carefully limit the items they configure. On the other hand, some organizations don't have employees with the skill-set or time to support these. There is also the concern that if the person who originally created the scripts leaves the organization, there may be nobody to maintain them as new equipment is introduced or for some reason those scripts mysteriously stop working.

Common scripting languages include; 1) Bash Shell Script, 2) Linux Shell Script, 3) Perl Script, 4) Procomm Script, 5) Python Script, 6) Ruby Script, 7) TeraTerm Script and 8) Visual Basic. Any script or macro that can automate the execution of tasks which could otherwise be executed one-by-one via a human operator can be used with STI PDUs.

Enclosed is a short snippet from a Perl script used by a customer to provision their PDUs using a DHCP server and their own security certificates. There are many different programs that can be used for generating scripts and most customers use tools that they have experience and are comfortable with.

```
sub configureServerTech {  
  
    my ($self,$pdu) = @_;  
    my $host = $pdu->{hostname};  
    eval {  
        my $waitFor = 10;  
  
        my $connectTries = 2;  
        my $dbh = $self->parent->{psadb};  
        $self->logMsg( "Attempt ServerTech Run" . Dumper($pdu);  
  
        my $connectString = $pdu->{address} || "$pdu->{hostname}.$pdu->{subnet}->{domain}";  
        my ($passwordDefaults, $adminPassword, $adminGroup, $opsGroup, $eventRules) = ( $self->config->{defaultAdminPassword},  
        $self->config->{adminPassword}, $self->config->{adminGroup}, $self->config->{opsGroup}, $self->config->{eventRules} );  
  
        my $socket = IO::Socket::INET->new(Proto=>'tcp',PeerAddr=>$connectString,PeerPort=>22,Timeout=>30);  
        if($@) {  
            $self->logMsg($self->{activeHost} . " Failed to connect to $connectString");  
            die 'Connection Error';  
        }  
  
        my $ssh = 0;  
        my $needsPassword;  
        my $foundWorkingPassword = 0;  
        my $passwordIndex = $pdu->{passwordIndex} || 0;  
  
        while ($passwordIndex) {  
            push @$passwordDefaults, shift @$passwordDefaults;  
            --$passwordIndex;  
        }  
    }  
}
```

Figure 1: Pearl Script Example

Note: STI does not provide or share scripts created by our customers.

# SENTRY POWER MANAGER (SPREAD SHEET TOOL):

**Via a Spread sheet and Your Local Sales Engineer:** If the user is using our Sentry Power Manager software tool (See Figure 2) then there is a great spread sheet tool that allows the user to configure every single PDU parameter down to minute items like the outlet name. This tool has a lot of advantages as in many cases the customer is already storing PDU configuration information via a spread sheet. It is available for all versions of SPM and you can configure as many or as few items as you would like using this tool.

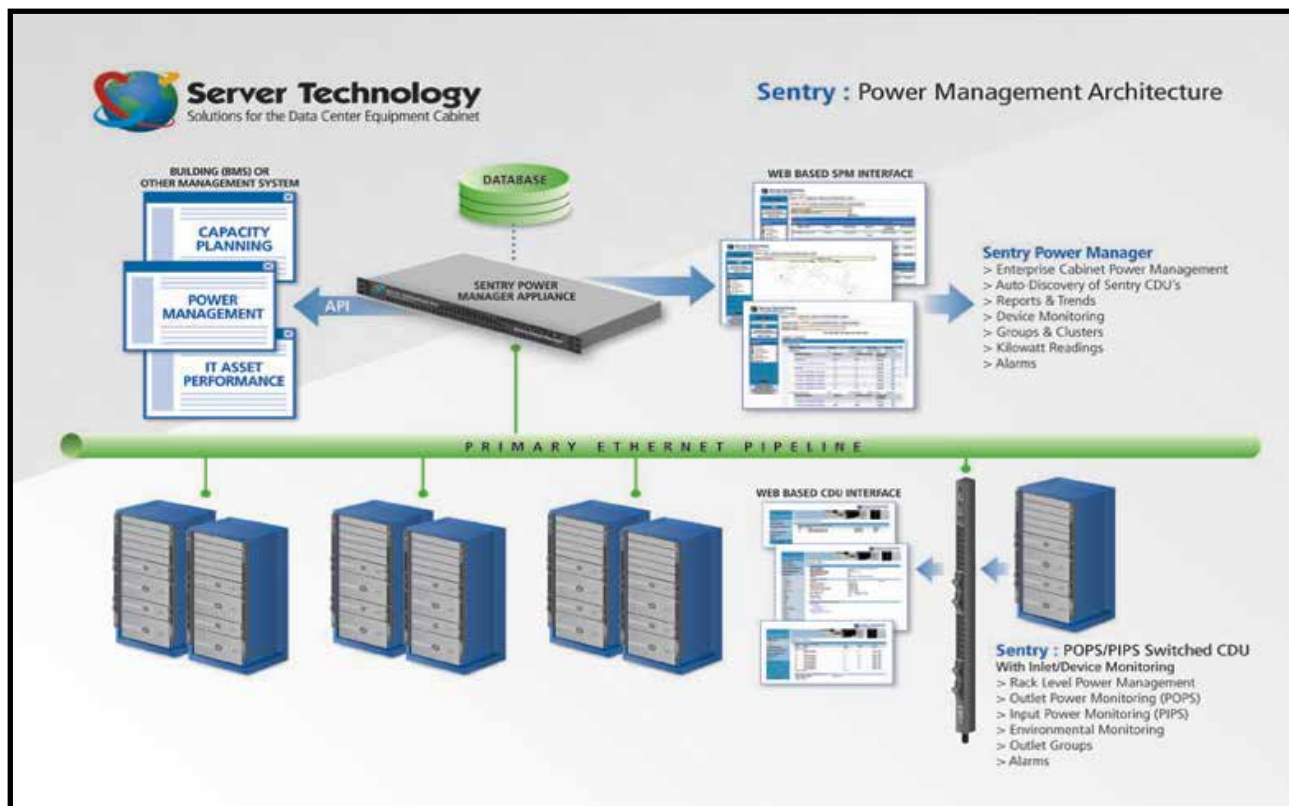


Figure 2: SPM Architecture

Note: Spread sheet tool and Bulk setup tool only work for discovered network devices (Server Technology PDUs) that are in normal operating status and communicating with SPM.

This spread sheet (see Figure 3) is managed by our Sales Engineers and is as simple as adding the information to the spread sheet, clicking on a button and then uploading the file to SPM. This information is then pushed down to the PDUs. It is offered as a free service as part of STI's superior product support when you purchase SPM. Be sure to ask for help on this from our Sales Engineers as they tend to only bring it up to customers that ask about it or customers that have paid for additional training or support.

This spread sheet allows the user to configure many items including:

Location Information, Cabinets, Device Templates, PDUs, Cords, Lines, Phases, OCPs, Branches, Infeeds, Outlets, EMCUs, Sensors, Contact Closures, Cabinet Devices, Zones, Outlet Clusters, Outlet Groups, Assign Groups to Clusters, Assign Outlets to Groups, User Groups, Users, Settings, Legends, Execute SQL Script Files

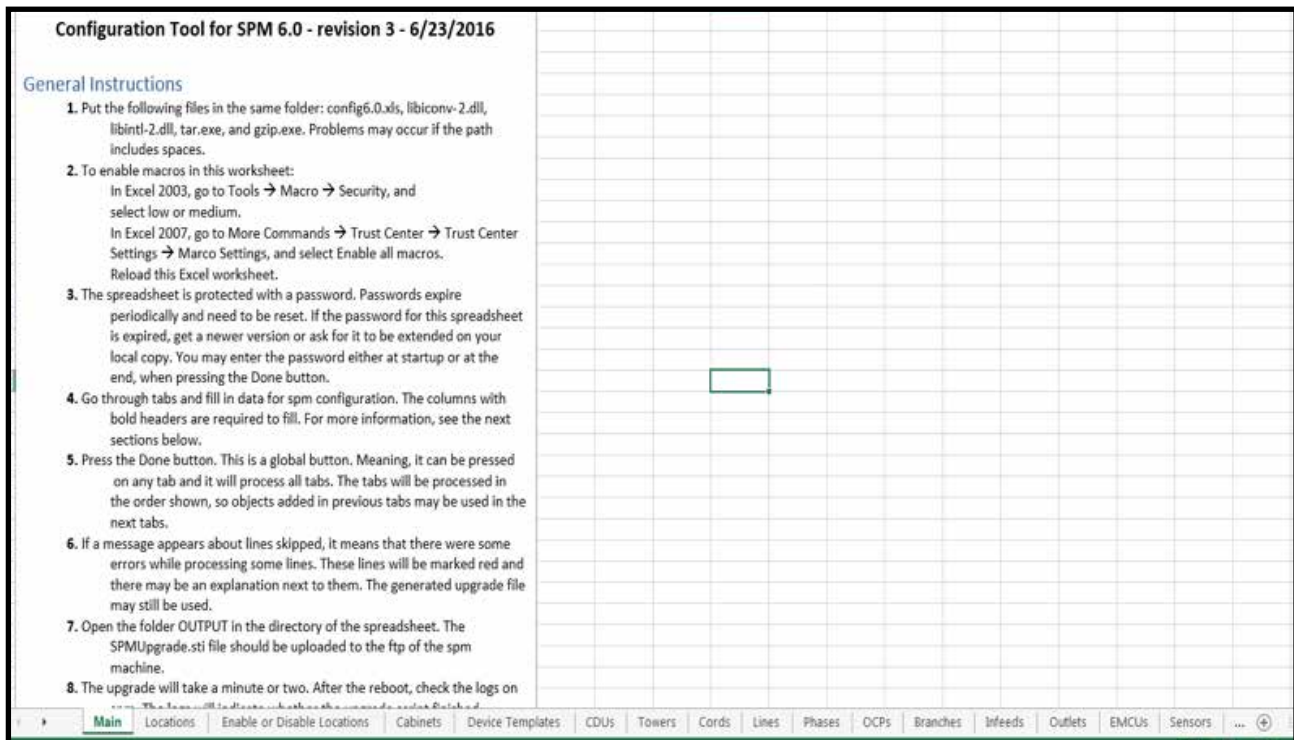


Figure 3: SPM Spread Sheet Tool

# SENTRY POWER MANAGER (BULK SETUP CONFIG TOOL):

**Bulk Setup Feature – Built Into SPM Version 6.1 or Later:** In SPM version 6.1 we have added the ability for the user to configure a subset of the key items that were originally in the spread sheet tool. This is called “Bulk Setup”. This was driven by customers wanting their own tools that they could access within SPM without having to get our Support people or Sales Engineers involved. Most of these features are documented via our Technical Notes posted on our website at: <https://www.servertech.com/support/technical-references/technical-notes>.

The “Bulk Setup Tool” (See Figure 4) allows the user to configure the following items including:

IP Address, Device Name, Enterprise Name, Cabinet Name, Location Name, Zone Name, Version, Get Community, Set Community, User Name, Authorization Protocol, Authorization Key, Privacy Protocol, Privacy Key

The tool also provides a status update of all configuration changes made.

Though the Bulk Setup Tool does not cover as many of the items that the original spread-sheet tool does, the user can make these changes on their own and it does cover most of the critical features required for PDU configuration and most requested by SPM users.

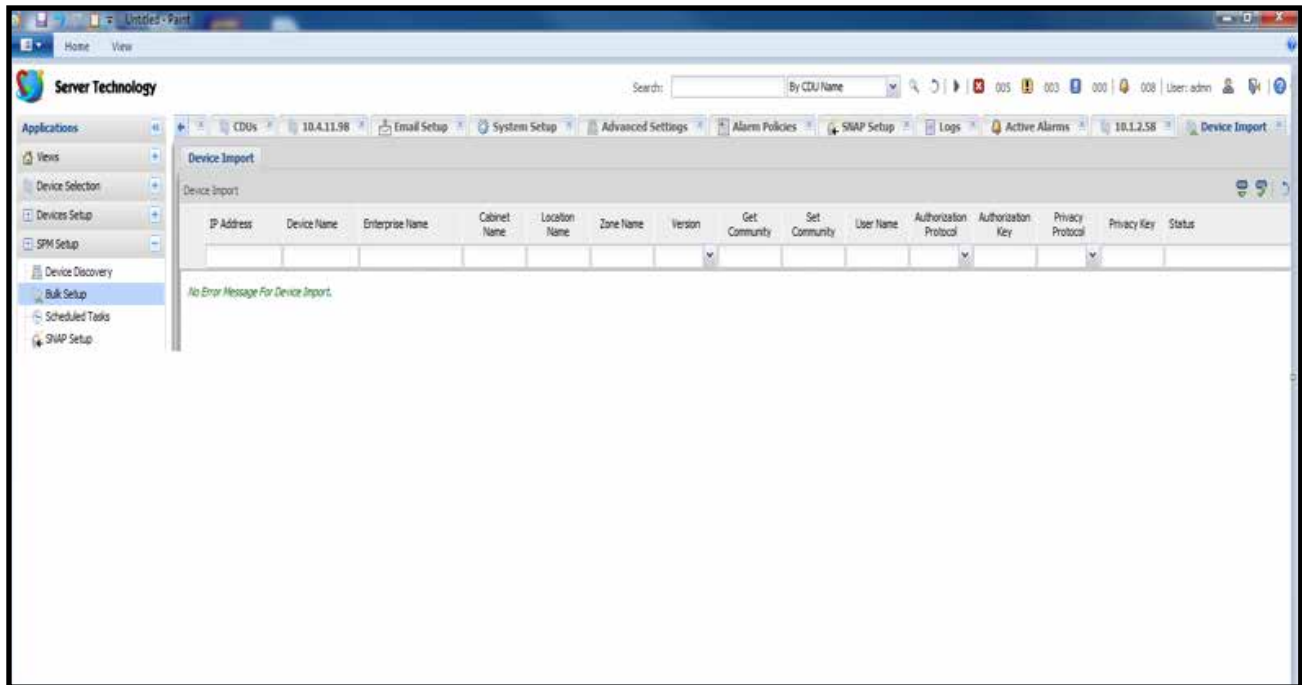


Figure 4: SPM Bulk Setup Tool

# SENTRY POWER MANAGER (SNAP) CONFIGURATION:

**Configuration via SPM and SNAP:** The SNAP configuration feature within SPM allows the administrator (and power user) to quickly push the latest values of CDU parameters to discovered network devices (Server Technology PDUs) that are in normal operating status and communicating with SPM. Numerous PDU parameters can be pushed to any or all PDUs, including the settings for:

System, IP, SNTP, Syslog, Web, Telnet, SSH, FTP, SMTP, SNMP, LDAP and LDAP Group

SNAP works directly from within the SPM user interface, allowing a SNAP template to be created with user-customized parameter values. These values can then be applied to a single PDU or multiple PDUs, or applied to all PDUs within a named SPM parent-level cabinet, location, or zone.

A SNAP template is SPM's mirror-image of PDU firmware parameters – the same parameters configured using the firmware's Web Interface or Command Line Interface (CLI) – available for editing directly in the SPM GUI.

All necessary PDU parameters are provided by default in SPM in the SNAP default template. When network PDUs are discovered by SPM, the SNAP tab on the PDU page shows the parameter values exactly as they have been set in the PDU itself. You can then edit parameters for that PDU and elsewhere assign the edited values to a different template name that can be reused on other PDUs for a customized and flexible PDU configuration within SPM.

You can also create and use a SNAP template based on one or more PDUs (See Figures 5 and 6) within an established parent-level hierarchy of cabinet, location, or zone. When SPM mass configuration updates are done at that parent-level, you have the option to protect your settings on designated PDUs from the mass update.

Cloning a template is a SNAP option that lets you create a new and customized template based on an existing template for quick configuration of a few parameter values.

For example, you have a SNAP template "A" already set up for all PDUs in Location 1. You can clone (copy) template "A" to template "B" for Location 2 in another time zone (so the cloned template "B" has most of the same settings as template "A"), and you just edit SNTP host, SMTP host, login banner, etc. in template "B" – the cloned template lets you quickly create a custom template by editing just those few parameters that pertain only to Location 2.

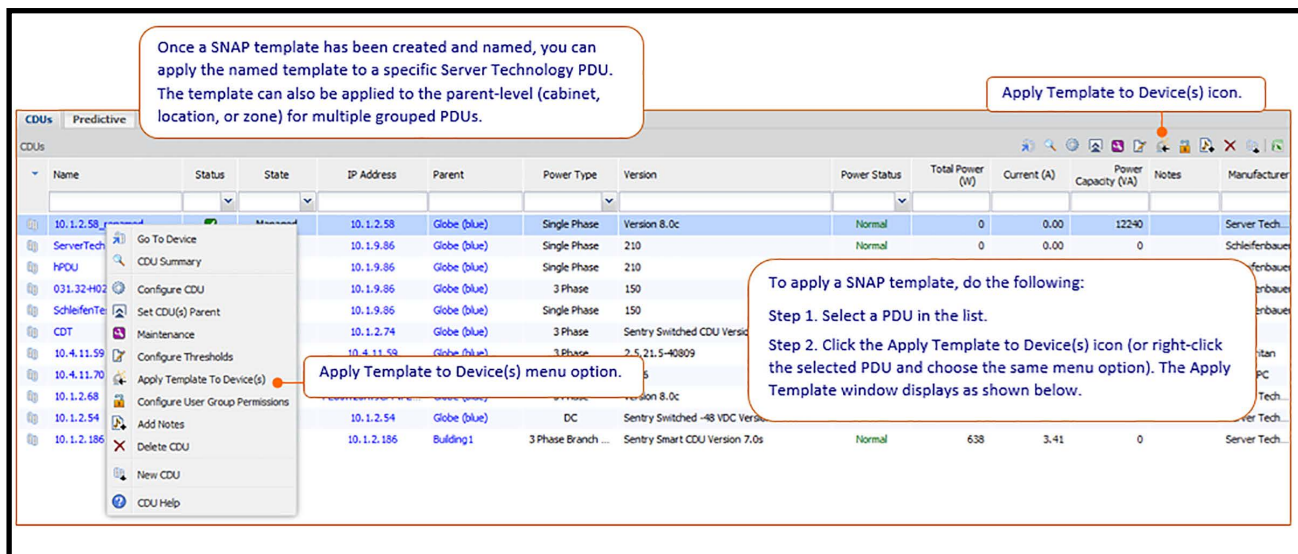


Figure 5: How to Apply a SNAP Template to Multiple PDUs



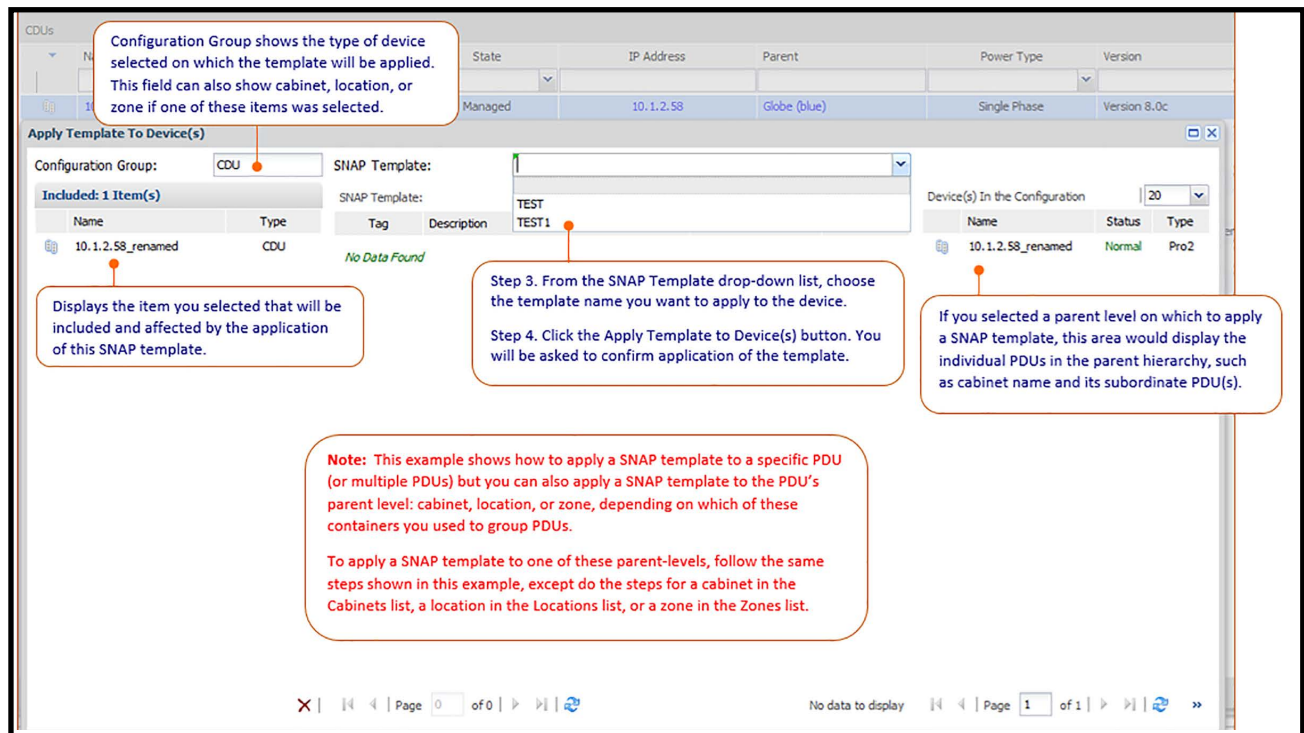


Figure 6: How to Apply a SNAP Template to a Single PDU

# START UP STICK CONFIGURATION TOOL:

The StartUp Stick (See Figure 7) allows you to define parameter values on your PC, laptop, or other device, and then save time by quickly distributing those values via a special flash drive (the "Stick") to multiple PDUs throughout the data center. The only disadvantage is that the user needs physical access to the PDUs. As long as the PDUs are powered the StartUp Stick is an excellent way to configure a PDU either on site, at the integrator or in a lab without having to connect the PDUs to a network first or your laptop computer. Setup options include custom PDU parameters as well as global only options that allow you to mass configure PDUs without the need to specify NIC serial numbers.

Numerous PDU parameters can be sent to specified PDUs, including all settings for:

System Settings, Network Settings, Telnet, SSH, HTTP/SSL, FTP, SMTP, SNMP, SNTP/DST, SysLog

Custom parameter values are entered in the StartUp Stick's user interface, an Excel spreadsheet already loaded and available on the Stick. You have the option to apply a value to a specific PDU or to apply that value globally to all PDUs throughout your enterprise. Using the StartUp Stick results in fast and accurate mass configuration of multiple PDUs with the same hardware Stick, all with a single load of custom parameter values.

When you purchase StartUp Stick, the user interface on the Stick (Excel spreadsheet) includes step-by-step instructions in a separate Instructions tab for how to work with the spreadsheet to provide configuration values and export them to a PDU. After you receive your kit, if a reload of the StartUp Stick is ever needed, you will be able to download the tool directly from the Server Technology website at <https://www.servertech.com/products/accessories>.

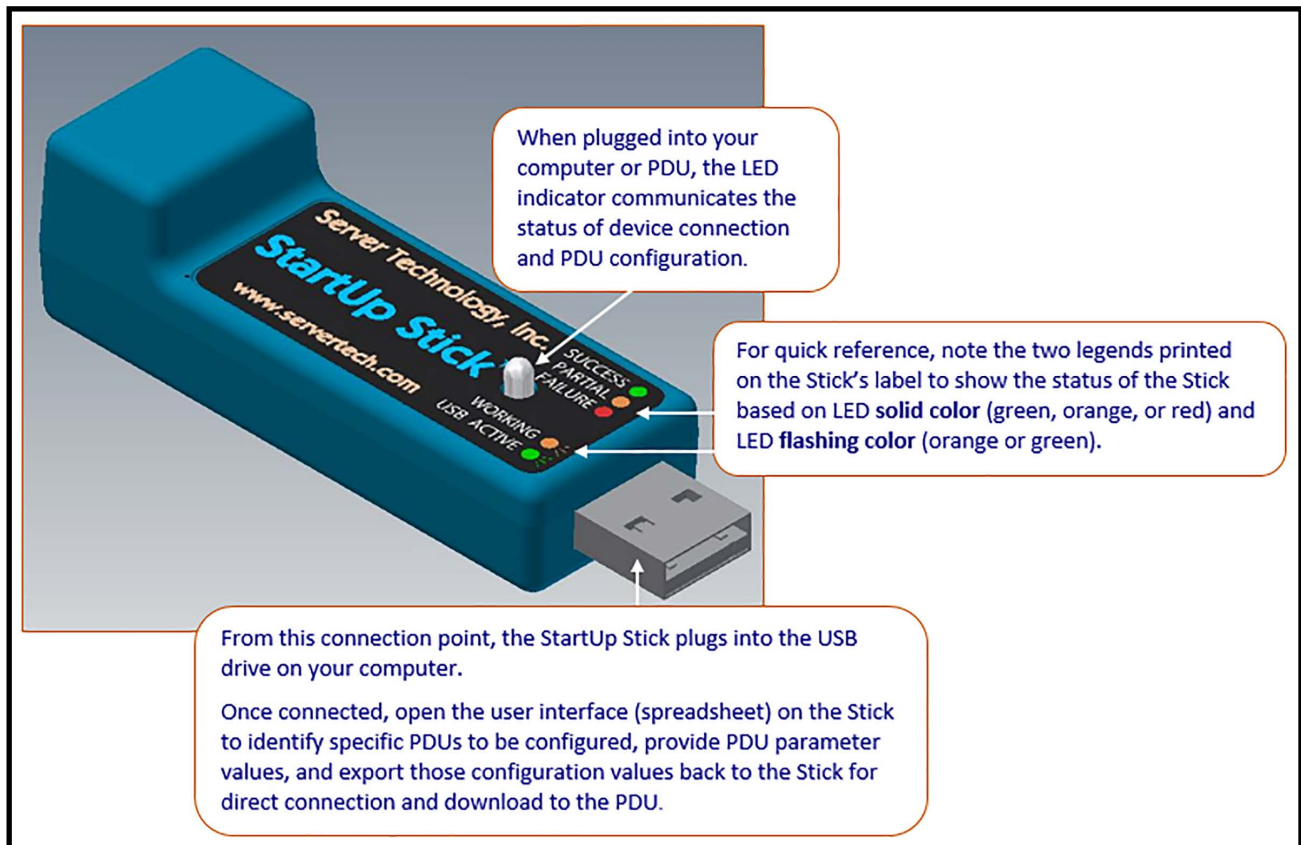


Figure 7: StartUp Stick

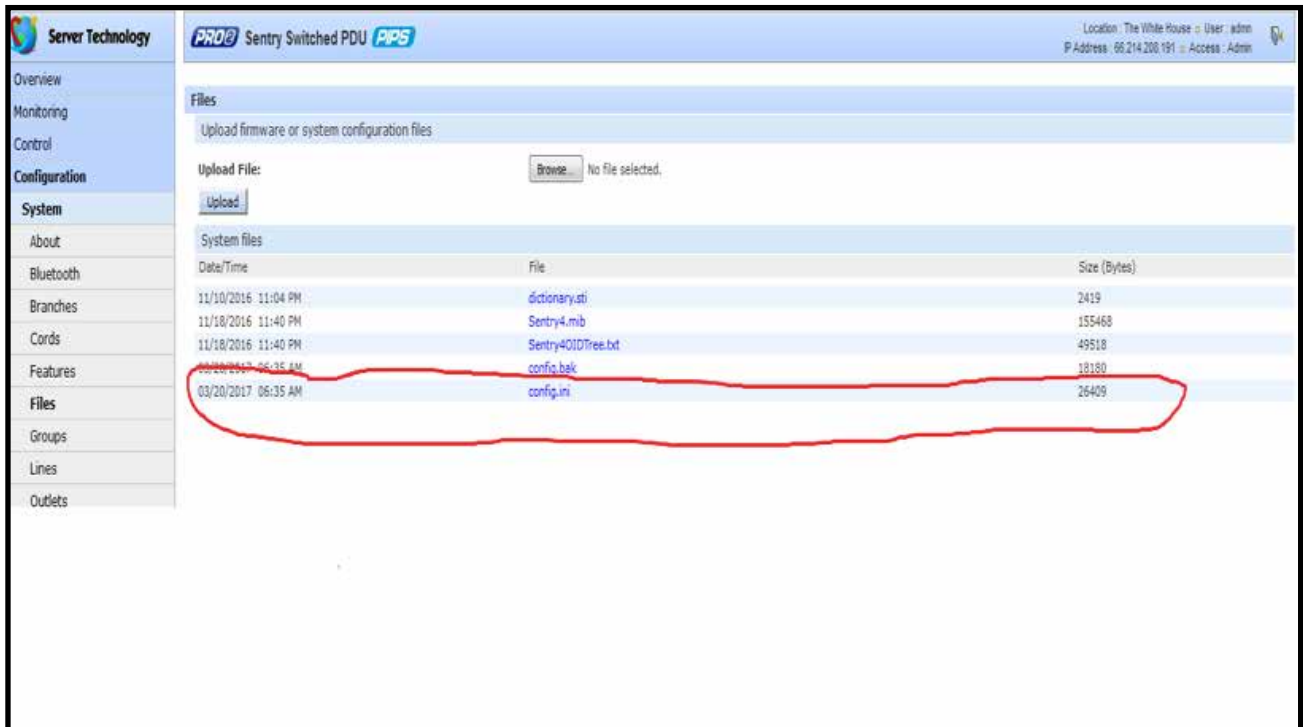
# STIC PROTOCOL:

Server Technology INI Configuration (STIC) file format is a text based configuration format utilized by STI's PDUs. It is specifically designed to work with Server Technology's StartUp Stick, as well as other PDU network interfaces such as HTTP/HTTPS web uploads or SFTP/FTP pushes. The format is simple, yet flexible enough to expand into every aspect of STI's current and future configuration needs. You can find more details on our web site at: <https://www.servertech.com/support/rack-pdu-firmware-downloads/switched-rack-pdu-firmware-downloads> under STIC Documentation.

STIC is based on the informal but well-known initialization (INI) file format. Enhanced flexibility has been added to the format to be more cross-platform friendly. The concept of text editable INI files being used for configuration of devices is not a new one but is a tried and true method for configuration.

There is a long list of items that can be configured via the STIC protocol and it is best to reference the STIC documentation for a complete list of configuration items. One caveat is that the STIC protocol is only available with our PROx series of products.

A STIC configuration file (See Figure 8) can easily be copied from an existing configured PDU. The user can then make changes and using the PRO series file system and "browse" button, the new file can be easily added to existing PDUs. Though admittedly these units already have to be on the network for this to work.



The screenshot shows the Server Technology web interface for a Sentry Switched PDU. The interface includes a navigation menu on the left with options like Overview, Monitoring, Control, Configuration, System, About, Bluetooth, Branches, Cords, Features, Files, Groups, Lines, and Outlets. The main content area is titled 'Files' and contains an 'Upload File' section with a 'Browse' button and an 'Upload' button. Below this is a table of system files:

Date/Time	File	Size (Bytes)
11/10/2016 11:04 PM	dictionary.sti	2419
11/18/2016 11:40 PM	Sentry4.mib	155468
11/18/2016 11:40 PM	Sentry4OIDTree.txt	49518
03/20/2017 06:35 AM	config.bak	18180
03/20/2017 06:35 AM	config.ini	26409

The 'config.ini' file is highlighted with a red circle.

Figure 8: STIC File Access

# ZERO TOUCH PROVISIONING (ZTP):

ZTP is a feature available only on Server Technology PROx (PRO1 and PRO2 PDUs). ZTP is implemented via specific DHCP server options and Server Technology's Configuration (STIC) protocol in conjunction with a simple TFTP server configuration pull. This process allows PDUs to be provisioned and configured during the initial boot up, or whenever needed, to automate network setup, user permission updates, or other changes to the PDU as needed.

Fast, simple, and easy deployment is key to getting your networked PDUs up and running quickly so they can provide critical power and control information, as well as environmental monitoring within your data center. ZTP can be adapted to many device deployment scenarios, and reducing the risk of human error is a significant benefit.

The Server Technology ZTP (See Figure 9) feature uses the following two DHCP options, 43 and 60, which must be configured on the DHCP server for ZTP actions to work. The PDU uses these options to determine where the STIC configuration file is located and then pulls the file down via TFTP for PDU configuration:

- DHCP option 43: "Vendor Specific Information", requested in the DHCP DISCOVER message and its reply data is expected in subsequent responses.
- DHCP option 60: "Vendor Class Identifier", sent in the DISCOVER message, identifies Server Technology to the DHCP server using the text data "ServerTech".

## HOW ZTP WORKS

The Server Technology PDU, with firmware version 8.0g or later, is required for ZTP to function. The PDU is shipped DHCP-enabled and ZTP-capable out of the box.

Communication between the PDU and the DHCP server work as follows:

- When a ZTP-enabled PDU is powered up and physically connected to your network, the PDU will look for a DHCP server to obtain both an IP address and, based on either its MAC address or Vendor Class Identifier (option 60), ZTP information.
- The PDU will then boot up with its default factory configuration. Shortly afterwards, the ZTP information obtained during bootup will be used to locate and pull the STIC file needed to complete the PDUs ZTP configuration.
- Upon seeing the MAC address or option 60 in a DHCP DISCOVER packet (along with a DHCP option 43 request, described above), the DHCP server will respond with a DHCP OFFER that includes a URL pointing to where the STIC configuration file is located on the network.
- As long as the DHCP server is active, ZTP will be attempted on each lease renewal until ZTP succeeds.
- Note that with physical access to the PDU, disconnecting and reconnecting the PDU's Ethernet cable will restart DHCP service on the PDU.

# ACCESS TO THE STIC FILE AND DESCRIPTIONS:

When you click the STIC Documentation button on the website, the downloaded zipped file provides the following three resources to support the ZTP process:

- Server Technology INI Configuration (STIC), v2.12.pdf A PDF file that defines the general rules for working with the STIC configuration file format.
- Reference.ini This file has all STIC properties for each possible section, including those not supported by all PDUs, along with either lists of possible property values (for example, “enabled | disabled”) or the rule for forming a compliant property value (must be a valid ASCII string from 0 to 30 characters). It also includes notes on which version of STIC a section or property first appeared.
- Template.ini This file can be used to create a configuration file applicable to multiple PDUs. All properties in this file are commented out (“;”) and, when processed, will be ignored until those comment characters are removed.

A typical programming editor will highlight the “section” entries of this INI file but will “gray-out” all the commented properties, however, when editing copies of this file, it should be straight-forward to uncomment and change desired properties as well as remove unneeded ones.

Note: See Figure 8 for information on how to copy a STIC file from an existing PDU.

## INITIATING THE ZTP PROCESS STEP-BY-STEP INSTRUCTIONS

The following steps initiate ZTP on ZTP-enabled PRO1 and PRO2 PDUs:

1. Decide on the configuration for your PDUs and create the STIC configuration file with your required configuration changes.
2. Disperse the STIC configuration file to a TFTP server reachable by all ZTP PDUs.

Notes:

- The STIC configuration file can either be tailored to individual PDUs, or you can create one (or more) generic STIC files.
  - In the example configuration file URLs below, it is assumed the config files will be in a public “sti” subdirectory.
- However, where the .ini files are placed is completely your choice.

3. Configure the DHCP server used by the PDUs. In the examples below, an ISC DHCP server is assumed and only the `dhcpd.conf` file used for its configuration is considered. Note that the Server Technology ZTP actions do not depend on any particular DHCP server type.

4. Power the PDUs and connect them to the serviced network. In about five minutes [exact time to be determined], verify all your expected ZTP changes have been made. If so, the PDUs are now configured.

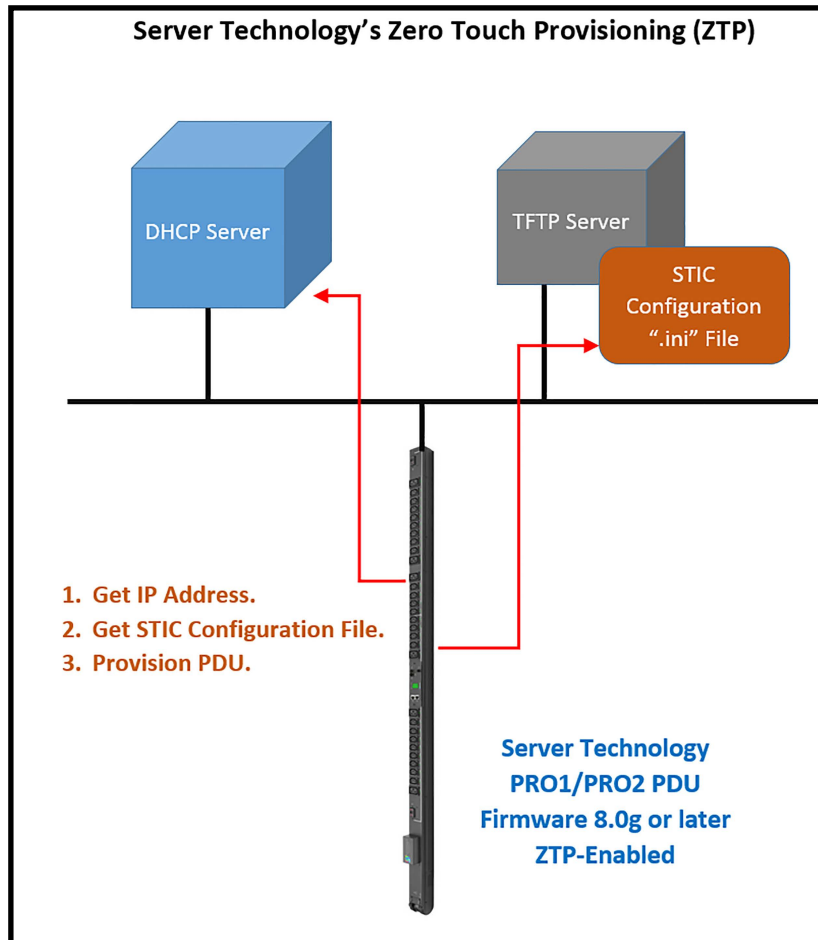


Figure 9: Zero Touch Provisioning

ZTP ultimately provides a true "plug and play" configuration and provisioning tool for intelligent PDUs. We expect other advancements in the area including file pull being done from `http/https` as well as from `SFTP`.

# SUMMARY:

The ultimate reward for utilizing intelligent PDUs is the ability to monitor and or control power as you cannot improve something that you are not monitoring. This also transfers into proactive alarms that let the users avoid problems before they happen like detecting a hot spot before there is damaged equipment. This white paper gives the users some options for intelligent PDU configuration and provisioning that ultimately leads to uptime and lower cost operation.

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#### North America Headquarters

1040 Sandhill Road  
Reno, Nevada 89521  
1-775-284-2000 Tel  
1-800-835-1515 Toll Free  
1-775-284-2065 Fax  
sales@servertech.com  
www.servertech.com  
www.servertechblog.com

#### U.K. Western Europe, Israel & Africa

Fountain Court  
2 Victoria Square  
Victoria Street  
St. Albans  
AL1 3TF  
United Kingdom  
+44 (0) 1727 884676 Tel  
+44 (0) 1727 220815 Fax  
salesint@servertech.com

#### Germany Central Europe, Eastern Europe & Russia

10th + 11th Floor  
Westhafen Tower  
Westhafenplatz 1  
60327 Frankfurt  
Germany  
+49 697 1045 6205 Tel  
+49 697 1045 6450 Fax  
salesint@servertech.com

#### Hong Kong APAC

Level 43, AIA Tower  
183 Electric Road, North  
Point, Hong Kong  
+852 3975 1828 Tel  
+852 3975 1800 Fax  
salesint@servertech.com

#### India & Middle-East

Regus Municipal No. 3, Old  
Madras Road, Benniganahalli  
village,  
Krishnarajpuram Hobli, RMZ  
Infinity, 1st floor,  
Tower D, Bengaluru,  
Karnataka 560016  
India  
+91 99022 44534 Tel  
salesint@servertech.com



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