## Revision History

<table>
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<tr>
<th>Revision</th>
<th>Revision History</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Initial release.</td>
<td>December 2012</td>
</tr>
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<td>1.1</td>
<td>Updated with information from Smart Connect Implementation Guide</td>
<td>February 2013</td>
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4 Setup and Configuration of Intel® Smart Connect Technology....24
4.1 Configuration for a Single System.................................................................24
4.2 Configuration for Remote Deployment........................................................24

5 Demonstrating and Verifying Intel® Smart Connect Technology.25
5.1 Steps for a Basic Test.........................................................................................25
  5.1.1 Configure the Client....................................................................................25
    5.1.1.1 Set up Intel Smart Connect Technology.................................................25
    5.1.1.2 Configure the Network...........................................................................25
    5.1.1.3 Configure the email Client....................................................................26
    5.1.1.4 Set up Intel Smart Connect Technology test logging tools.................26
  5.1.2 Configure the Remote PC.................................................................29
    5.1.2.1 Configure the email Client....................................................................29
    5.1.2.2 Configure the Test Logging Tools.........................................................29
  5.1.3 Run the Test / Demonstrate the Use Case..............................................29

5.2 Debug..............................................................................................................30
  5.2.1 General Logging.........................................................................................30
  5.2.2 Pings Never Respond.................................................................................32
    5.2.2.1 Verify the PC Woke Up.........................................................................32
    5.2.2.2 Verify the Network is Connected..........................................................35
  5.2.3 Email is Not Downloaded..........................................................................36
  5.2.4 Verify the PC Goes Back to Sleep............................................................37

A Appendix ..........................................................................................................40
  A.1 Observing a System Wake as It Happens....................................................40
    A.1.1 System LEDs............................................................................................40
    A.1.2 Local Monitor...........................................................................................40
    A.1.3 Second Monitor.........................................................................................41
    A.1.4 Audio Notification.................................................................................41
    A.1.5 Power Usage Meter...............................................................................41
  A.2 Running a Task Upon Wake........................................................................42

Figures
Figure 1: Typical Intel® Smart Connect Technology Activity...............................7
Figure 2: Basic Settings Screen...........................................................................11
Figure 3: Advanced Settings Screen .................................................................12
Figure 4: Cisco* AnyConnect Example...............................................................19
Figure 5: Edit Trigger Dialog................................................................................28
Figure 6: Intel Smart Connect Technology Event Log.........................................32
Figure 7: Intel Smart Connect Technology Debug Log........................................32
Figure 8: Windows Event Log.............................................................................33
Figure 9: Configured to Wake...............................................................................34
Figure 10: Time in Sleep......................................................................................34
Figure 11: Network Found...................................................................................35
Figure 12: No Network found..............................................................................36
Figure 13: Network Heuristics............................................................................36
Figure 14: Intel Smart Connect Event Log...........................................................37
Figure 15: Intel Smart Technology Debug Log....................................................38
Figure 16: Windows Event Log............................................................................39
Figure 17: Scheduled Task Trigger......................................................................43
Preface

Intel® Smart Connect Technology is designed to update programs by periodically waking your computer from sleep/standby mode for a short time. This function works with applications that automatically get their data from the Internet, such as Microsoft Outlook* and Microsoft Windows* Live Mail. This saves users time; when they wake their PC, new emails are already downloaded. It also ensures data is as fresh as possible; when in a location where there is no network, email is up to date from the last good network connection.

For business users on the go, this feature must work with the enterprise infrastructure including VPN connections. It may be desirable to work over a broad band network as well for enhanced connectivity.

This document provides information on how the technology works, integration considerations for enterprise IT and functionality test guidance prior to deployment.

1. Document Scope

This document contains background information on Intel Smart Connect Technology, how it works, insights for the best deployment and steps to test various facets of the technology within your environment to help successful integration. It is meant as an overview and aid in deploying Intel Smart Connect Technology. Following this guide will provide hands on experience, which will aid in deployment planning in a particular setup.

1.2 Intended Audience

This document is intended for Information Technology (IT) professionals who wish to learn more about with Intel Smart Connect Technology and get hands on experience.
2 Introduction

2.1 Intel® Smart Connect Technology Overview

The end goal of Intel® Smart Connect Technology is to be able to provide the latest data to the user when they resume their system from sleep – like a phone – to make the system more responsive and the user more productive. Users can now choose what device they pick up based on the best interface for their planned activity and not solely on how quickly they can get to the information.

Intel Smart Connect Technology is designed to update programs by periodically waking your computer from sleep/standby mode for a short time. When the system wakes, programs that are open will begin running again. The primary use case is to keep email refreshed. If the email client is open, it will download new messages. Intel Smart Connect Technology keeps the monitor off and the audio muted so the user does not know that the PC has woken up. After a short time, Intel Smart Connect Technology will place the computer back to sleep, setting the timer again for another wake. Although email is considered the primary Enterprise usage, any application that is open and refreshes content automatically can update during a wake cycle.

2.2 The User Experience

1. User opens applications such as Microsoft Outlook
2. User places the computer into S3 sleep (see Note below)
3. The Intel Smart Connect Technology sleep / wake cycles begins
   a. Intel Smart Connect Technology detects entry into S3 and sets the Real Time Clock (RTC) or Embedded Controller (EC) timer to wake the system.
   b. The timer or NetDetect wakes the system into a new ACPI mode known as S0isct. In this mode the monitor is blank, the audio is muted, and the CPU is running in a lower power state.
   c. The network connects and applications begin downloading data such as email.
   d. Intel Smart Connect Technology monitors the system and determines when to begin transition back to sleep. For example, if network activity has stopped.
   e. Intel Smart Connect Technology calculates when to wake next and sets the RTC or EC timer. If there is no network connection, Intel Smart Connect Technology will set NetDetect instead of the RTC timer.
   f. Intel Smart Connect Technology places the system into S3 and the cycle continues.
4. Eventually the user wakes the system. Thanks to Intel Smart Connect Technology, the user finds email is up to date.

During the Intel Smart Connect Technology wake cycle, the system will follow Windows* policy when connecting to wireless access points. In other words, the system will connect to access points that are configured to auto connect by the Windows Wireless Network Connection Manager.
NOTE

Intel Smart Connect Technology is designed to function in co-operation with Intel® Rapid Start Technology as well. In other words, the PC will continue to wake even from the deeper rapid start sleep state. For more information on Intel Rapid Start Technology:
http://download.intel.com/support/motherboards/desktop/sb/rapid_start_technology_user_guide.pdf

The graph below illustrates typical PC activity through this user experience.

Figure 1: Typical Intel® Smart Connect Technology Activity

2.3 Intel Smart Connect Technology Components

2.3.1 Intel Smart Connect Technology Agent

The agent is a software service and driver component that handles all Intel Smart Connect Technology operations. It determines if and when the PC should wake and return to sleep. It also tracks and manages system usage, battery levels, and temperatures. Intel recommends obtaining the agent from the PC OEM. A secondary option is to download it from downloadcenter.intel.com.
2.3.2 Intel Smart Connect Technology Firmware

In order for Intel Smart Connect Technology to function, PCs also need special firmware. This firmware works in tandem with the Intel Smart Connect Technology Agent. For example, it can set the RTC clock or EC timer so the PC will wake at the appropriate time. This will come preloaded from the PC OEM. Check with your OEM to determine if your PC supports Intel Smart Connect Technology.

2.3.3 Intel Wireless Adapter

In 2012, this component is optional for desktops but will be in all laptops and Ultrabooks™ that support Intel Smart Connect Technology. When used, the NetDetect feature will be available. See below for more details.

2.4 Feature List

2.4.1 Wake to S0isct

The most obvious feature of Intel Smart Connect Technology is its ability to periodically wake the PC. This state is known as S0isct. When in S0isct that PC will appear to the user to be asleep (S3); the screen will be blank, audio muted, and on some PCs LEDs will indicate S3, and in most cases the PC fans will not start. Also, the CPU is in a low power state, though it is executing instructions.

There are two triggers that wake the PC into an S0isct state. The first is based on a timer. The second is via NetDetect. The Intel Smart Connect Technology Agent will set one of these triggers before the PC goes to sleep.

2.4.2 Sleep

When in S0isct, the Intel Smart Connect Technology agent will automatically return the PC to its previous sleep state. This will happen based on which event comes first.

- There is no more network activity
- The maximum allowed time in S0isct has been reached.
- The battery is too low or the PC is too hot

2.4.3 NetDetect

If the platform supports NetDetect (a feature of Intel® Centrino® processor technology), the platform will only wake from S3 if a user specified Access Point is found. A user-specified Access Point is one that has been set up in the wireless network connection manager in the OS. This prevents unnecessary wakes from S3 if no network connection exists prior to the platform entering S3. The following steps illustrate a typical usage scenario.
1. The Intel Smart Connect Technology Agent determines no network connection exists prior to the platform entering S3.

2. If the user transitions the platform to S3 (manually or via OS unattended timer), the Agent will require one periodic wake cycle to successfully enable NetDetect due to OS limitation of time allowed for Agent to transition to S3.

3. Once the periodic wake occurs, Agent will configure NetDetect in the WLAN NIC and the request OS to transition platform to S3.

4. Platform remains in S3 until the WLAN card detects an AP with a SSID that is configured for 'Connect automatically'. Upon detection, the platform is awoken and application content update occurs.

5. Because a network connection is found, periodic wake is configured and NetDetect disabled. NetDetect is only set during a wake / sleep cycle, but not on the initial transition into a sleep state.

NetDetect is set only if RF is not connected but enabled. If user turns on the RF kill switch (disable RF), Intel Smart Connect Technology will not enable NetDetect and system will not wake up without user intervention.

2.4.4 Night Time

Since users are most likely to be away from their computer at night (or whenever it is they tend to sleep), the Intel Smart Connect Technology agent will wake the computer less often or not at all at night. Night time is determined based on user configuration (e.g., a User can set night to be between 11pm and 7am).

2.4.5 Thermal and Battery Usage

Waking periodically will consume some power. It will also cause heat generation. For laptops, this can mean decreased battery life and the potential to overheat when in an unventilated area like a laptop bag. Intel Smart Connect Technology is designed to mitigate these potential issues by using low power states and by staying in S0isct for very short periods of time. To further minimize impact, the Intel Smart Connect Technology agent and Intel Smart Connect Technology firmware will monitor laptop thermals and battery levels and react accordingly. To prolong battery life and reduce heat, PCs will stay asleep longer and longer. And though this is unlikely, the PC is immediately placed in a sleep state if a catastrophic circumstance arises.

One effect of this is that the configured time in sleep only represents a minimum. The Intel Smart Connect Technology agent will calculate the actual sleep duration during each wake cycle.

**NOTE**

Time in sleep is only calculated during a wake / sleep cycle, but not on the initial transition into a sleep state. Initial transitions use the configured time in sleep value.
2.4.6 **Network Heuristics**

Once a network connection is established in S0isct, the Intel Smart Connect Technology Agent will monitor network activity. When there is no network activity the agent will transition the PC back to a sleep state. This way the PC is not idling while in S0isct.

2.4.7 **Application White List**

To receive email, an email application must be open upon entering a sleep state. The Intel Smart Connect Technology Agent can monitor for applications listed in a “white list”. Intel Smart Connect Technology will only configure the PC to wake into S0isct if one of these applications is open and White list is configured. If White List is not configured, Intel Smart Connect Technology will ignore white list and run the wake/sleep cycle as if there is an open white list application.

2.4.8 **Operating System Support**

Currently Intel Smart Connect Technology only supports Microsoft® Windows 7 SP1 or higher and Windows 8 operating systems.
2.5 Intel Smart Connect Technology Settings

2.5.1 Basic Setup and Settings

The Intel Smart Connect Technology Agent provides a simple user interface to configure basic settings. Figure 2 and Figure 3 show the user interface screens, which are described in the table below:

<table>
<thead>
<tr>
<th>UI Element</th>
<th>Registry value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always Updated check box (Figure 2)</td>
<td>PeriodicWakeEnabled</td>
<td>When checked, Intel Smart Connect Technology will wake the system periodically to allow for email and other network based updates.</td>
</tr>
<tr>
<td>Slider (Figure 2)</td>
<td>S3SleepDurationSeconds</td>
<td>Minimum time to stay asleep. <strong>Note:</strong> Intel Smart Connect Technology may calculate a longer sleep time.</td>
</tr>
<tr>
<td>Extended Power Savings Start Time &amp; End Time (Figure 3)</td>
<td>NightTimeDuskMinutes &amp; NightTimeDawnMinutes</td>
<td>Between these times the system will wake less frequently and go into Intel Rapid Start power state if it is available.</td>
</tr>
</tbody>
</table>

**Figure 2: Basic Settings Screen**
2.5.2 Advanced Settings

Advance settings are configured by directly editing the registry for Intel Smart Connect Technology. Except for the White List which is discussed below, all values are type REG_DWORD and go in the following key:

[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Smart Connect Technology\Always Updated]

If registry values are invalid, the Intel Smart Connect Technology Agent will ignore them and use defaults instead. The table below represents the most commonly used advanced settings.

Note: The platform must be rebooted or the Agent restarted anytime registry settings are changed.

<table>
<thead>
<tr>
<th>Registry Key</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3SleepDurationSeconds</td>
<td>Minimum time to stay asleep during the day time. Listed in seconds.</td>
<td>5 min</td>
<td>60 min</td>
<td>15 min</td>
</tr>
<tr>
<td>NightTimeDuskMinutes</td>
<td>The start of night time. Listed in seconds since midnight. E.G. 3c (60) = 1:00am</td>
<td>0h 00min</td>
<td>24h 00min</td>
<td>19h 00min</td>
</tr>
<tr>
<td>Parameter</td>
<td>Description</td>
<td>Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NightTimeDawnMinutes</td>
<td>The end of night time. Listed in seconds since midnight (e.g., 3c (60) = 1:00am)</td>
<td>0h 00min, 24h 00min, 7h 00min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3SleepDurationNightSeconds</td>
<td>Minimum time to stay asleep during the night time Listed in seconds.</td>
<td>10 min, 1380 min (23 hours), 120 min (2 hours)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCBatteryThresholdHalt</td>
<td>If the battery charge reaches this percentage, the system will stop waking. Listed in %. E.G. f (15) = 15%</td>
<td>Current OS Suspend setting, 95%, 15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S0WakeDurationLimitSeconds</td>
<td>Maximum time to stay in S0isct Listed in seconds.</td>
<td>10 sec, 165 sec, 45 sec</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WhiteList</td>
<td>Only wake to S0isct when these apps are open. Listed as a ; delimited string (e.g., outlook.exe; thunderbird.exe) See section 2.5.2.10 below.</td>
<td>10 entries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PeriodicWakeEnabled</td>
<td>Enable Intel Smart Connect Technology 0 = disabled, 1 = enabled</td>
<td>0, 1, 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LoggingEnabled</td>
<td>Enable logging 8 = log to standard out, 4 = log to debug port, 2 = log to text file and event log, 1 = log to event log, 0 = disabled</td>
<td>0, 8, 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LoggingLevel</td>
<td>Logging detail 16 = maximum detail</td>
<td>0, 16, 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WakeOnNetworkDetectEnabled</td>
<td>Use NetDetect if available 0 = don’t use NetDetect, 1 = use NetDetect if available</td>
<td>0, 1, 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPConnectDurationSeconds</td>
<td>Number of seconds to wait for an IP address. If none is available, go back to sleep.</td>
<td>4, 60, 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.5.2.1 **Application White List**

Intel Smart Connect Technology provides the ability to control the periodic wake of the platform by checking prior to entering S3 if an application is running from a defined list of applications ("White List"). The Intel Smart Connect Technology Agent will suspend the S0isct/S3 cycle if none of the applications defined in the white list are running prior going into S3 mode. A non-existent or empty list will indicate that the Intel Smart Connect Technology Agent will always do the S0isct/S3 cycle irrespective of running applications.

The White List is stored in the OS Registry under the key of:

[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Smart Connect Technology\Always Update\]

in the "WhiteList" multistring. The list supports a maximum of 10 applications. The list is read at the start of the Intel Smart Connect Technology Agent execution.
3 General Implementation Considerations

This section provides considerations for IT technicians to keep in mind when implementing Intel Smart Connect Technology – battery life impact, VPN policy, encryption software co-existence.

Note that no new hardware or software is required (such as additional silicon, secondary network connection, etc.). If you have purchased a PC client with Intel Smart Connect Technology, then the PC has all the necessary components. Setup will be discussed in Section 4.

3.1 Trade-offs: Update Frequency vs. Battery Life

Updates can occur as frequently as every 15 minutes or as infrequently as every 60 minutes. The more frequently your PC updates, the more battery power will be used. That said, it is important to note that Intel Smart Connect Technology will not drain your system’s battery completely. Once the battery level reaches 15%, Intel Smart Connect Technology will disable itself until battery power rises above that threshold.

There are a couple of features that help to preserve battery:

1. Laptops with Intel Wireless Networking have a feature called NetDetect which will prevent wakes when the laptop is not in proximity to a known access point. The system will stay in Sleep (S3) until it recognizes the SSID of an access point on the managed wireless network list.
2. Additionally, you can specify a block of time during the day or night as “Extended Power Savings” (for example, from 7:00 pm to 7:00 am) that will update less frequently during the Extended Power Savings time period. Setup of this feature is discussed in Section 2.

**NOTE**

If the system has Intel Rapid Start Technology, Intel Smart Connect Technology will use Intel Rapid Start Technology during the Extended Power Savings time to minimize energy consumption.

3.2 Re-imaging

If you need to reimage a client system, be sure to download the latest BIOS image that supports Intel Smart Connect Technology and Intel Smart Connect Technology software from your OEM’s website. If you do not want to enable Intel Smart Connect Technology on your systems, we recommend that you turn off Intel Smart Connect Technology in the BIOS and do not include the Intel Smart Connect Technology software in the gold image for reimagining your systems. The Intel Smart Connect Technology software cannot be installed if it detects that the BIOS does not support Intel Smart Connect Technology or that the feature has been disabled in the BIOS.
3.3 Applications

Intel Smart Connect Technology will update applications that are open while systems are in a sleep state as long as an Internet connection is available. Many applications can take advantage of Intel Smart Connect Technology. Look for the following characteristics in applications to get the best user experience with Intel Smart Connect Technology:

- The application looks for updates automatically or in a short time period (e.g., every 10 minutes) when connected to a network
- The application stores content from the Internet locally on the hard drive
- If applicable, the application caches user account credentials so that updates can be retrieved in sleep state without user interaction

A list of applications can be found at www.intel.com/smartconnect but some examples of applications that will automatically update are: Microsoft Outlook, Mozilla* Thunderbird and Microsoft LiveMail which synchronize your email. Applications like Sobees can store your Facebook*, Twitter*, LinkedIn* and RSS feed data to your hard drive. Cloud storage solutions like Skydrive, Dropbox and iCloud* will also keep content from the cloud synchronized on the local drive.

With regard to operating systems, Intel Smart Connect Technology works with the Microsoft Windows 7 SP1 or higher and Windows 8 operating systems.

3.3.1 Email Client Optimal Settings

For best results, the desired email client must be configured to periodically download email more frequently than Intel Smart Connect Technology’s minimum configured wake cycle time. This way the email client’s timer will have passed and it will be ready to check for email automatically when the system wakes.

Steps for various clients are outlined at the links below:

- Microsoft Outlook: http://www.intel.com/support/services/smartconnect/sb/CS-033411.htm?wapkw=intel+smart+connect+technology
- Microsoft Live Mail: http://www.intel.com/support/services/smartconnect/sb/CS-033414.htm?wapkw=intel+smart+connect+technology

Another potentially important aspect is that the email client waits for a valid network connection before downloading. Otherwise it may attempt the download before the network is ready and then not attempt again before Intel Smart Connect Technology puts the PC back to sleep (S3). Note that in most cases, Ethernet and Wi-Fi will reconnect fast enough that this will not be an issue. However, with other connections like 3G connect time takes longer and this may become a factor.

Smart Connect versions 4.x and higher have optimizations built in to improve download success when Microsoft Outlook is being used.
3.4  Security

Recently, information security has bubbled up to the top of most users’ and IT managers’ concerns when it comes to their data. In this section, we look at the considerations for implementing Intel Smart Connect Technology with the most common information security technologies in your IT environment.

3.4.1  Windows* Password

If the Windows password is used, applications will still update with Smart Connect. Even with the system on the lock screen applications are given system resources, network connectivity is re-established and applications can update. Intel Smart Connect does not cache passwords.

3.4.2  Encryption

Intel Smart Connect Technology works with software-based encryption solutions (for example, McAfee, PGP* and BitLocker*). It will not work with encryption solutions that require authentication when resuming from Sleep (S3).

Keep in mind that Intel Smart Connect Technology only works in Sleep (S3) state. Intel Smart Connect Technology is disabled when the system moves into Hibernate state or Shut Down.

Note: If a timer is used to transition the platform to Hibernate after a period of time in Sleep, Smart Connect may change this behavior since every Smart Connect wake will reset the Hibernate entry timer.

3.4.3  Virtual Private Networks (VPNs)

Most enterprise-class VPNs offer IT departments the ability to cache the user’s credentials in order to automatically reconnect upon returning from a sleep state, provided the user has previously authenticated prior to entering the sleep state. For example, a VPN may specify a time period (such as 24 hours) wherein if the user has authenticated and then entered a sleep state (say, by closing the laptop lid), the PC can automatically reconnect to the VPN when it wakes (i.e., the lid is opened) without the user having to re-authenticate.

This is important for Intel Smart Connect Technology so that it can reconnect to the corporate network and update a user’s corporate application data (for example, Microsoft Outlook) without requiring user interaction to authenticate to the VPN.

When taking advantage of this re-authentication feature in a VPN, Intel recommends that you test the amount of time it takes for your VPN to automatically reconnect. The longer it takes for your VPN to reconnect, the more battery power is used for each periodic data update. The recommended goal is to have your VPN reconnect to the corporate network in under 5 seconds.
Cisco* AnyConnect v2.5 or later and Check Point* Remote Access E75.30 or later are good examples of VPNs with sub-5-second reconnect times. If your VPN does not reconnect quickly, Intel recommends you work with your VPN provider to improve their reconnect time.

If your reconnect time is greater, IT has the option increase the length of time Smart Connect will wait for a connection. This is discussed in section 2.5.2. It is recommended that you test the battery life impact once you find minimum time interval that allows the VPN to reconnect.

See the following sections for specific implementations with Cisco* and Microsoft VPN and other challenges.

3.4.4 Cisco* AnyConnect Example

Cisco* AnyConnect v2.5 or later is a good example of a VPN with sub-5-second reconnect times. Here is one example of the configuration needed for auto-reconnect and credential caching. In the AnyConnect VPN Profile editor for AnyConnect 3.0.5080, check the box for auto reconnect and select Reconnect after Resume as shown below. All other VPN profile settings may be left at default. When using this profile, AnyConnect will automatically reconnect the VPN when the computer wakes up so long as the user has made a successful connection prior to going to sleep.
3.4.5 Microsoft VPN Client Example

By default, the Microsoft VPN client does not auto connect. However, using the Windows task scheduler and the command line tool RasDial, it is possible to automate VPN connect upon PC resume. Note, however, that this method means storing the user’s password in clear text. As such, be sure the security implications are understood and acceptable before implementing.

1. Create a batch file with the following command:
   
   rasdial.exe <yourvpnconnectionname> <username> <password>

2. Follow steps in section A.2 to create a task that runs when the PC wakes up. Set it to run the batch file created above.

Now, every time the PC wakes it will connect the VPN. This includes waking to S0isct.
3.4.6 Other VPNs

Check Point* Remote Access E75.30 is also known to support cached credentials and reconnect in 5 seconds or less.

3.4.7 Other Challenges

The Network Heuristics used by Intel Smart Connect Technology is not able to monitor some VPN connections. When connected over a wired or wireless network this is not an issue because Intel Smart Connect Technology will instead monitor one of these connections. However, if connecting over broadband or some other connection that cannot be monitored Intel Smart Connect Technology will place the system back to sleep because it does not sense network traffic. Future versions of Intel Smart Connect Technology are planned to address this limitation.

To check if your VPN can be monitored:
3. Connect the VPN.
4. Open a command prompt as administrator and change directory to windump’s location.
5. Type `wmic nic get name,guid`
6. Find the VPN adapter and remember its GUID.
8. If windump lists the VPN’s GUID, Intel Smart Connect Technology will be able to monitor it.

3.5 Broadband

To facilitate access while on the go, many users use broadband connections like 3G or LTE. This can present specific challenges to email update with Intel Smart Connect Technology. Each of these challenges can be addressed, but require special consideration.

3.5.1 Connection Time

For email to download over broadband, the broadband interface must be configured to automatically connect. Further, broadband connections usually take longer to connect than wired or Wi-Fi. This presents a challenge for Intel Smart Connect Technology and for some email clients. By default, Intel Smart Connect Technology will wait 10 seconds for a connection and then put the system to sleep if no connection is established. Also, some email clients will not wait for the network to connect before they check for email.
The first goal is to configure broadband to connect automatically and as quickly as possible. To set automatic connection using the Windows 7 built-in broadband profile manager:

1. In the system tray click the wireless icon. A list of wireless networks is presented including the broadband connection.
2. Right-click the broadband connection and choose properties.
3. In the Profile tab set Autoconnect to “Always connect automatically” or “Connect Automatically except when roaming”. **Note:** you can check the box for “Autoconnect only if no alternate internet connection is available.” However, this may slow the connection times slightly.

**NOTE**

Some 3rd party connection managers do not support auto connection over broadband. With these, it is impossible to update email with Intel Smart Connect Technology.

To speed up connection times, first ensure the latest driver for the broadband device is installed. Then, adjust the power options for the device as follows:

1. Right-click **Computer** and select **Properties**.
2. Click Device Manager.
3. Expand **Network Adapters** and select your device.
4. Right-click the device and choose **Properties**.
5. Under the Power Management tab, uncheck Allow the computer to turn off this device to save power.
6. Click **OK** and close device manager.

If connection times are still not fast enough, the time Intel Smart Connect Technology waits for a connection can be extended by advanced setting in the Windows registry. In the following key, add a DWORD value named IPConnectDurationSeconds and give it a value long enough for the broadband network to connect.

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel® Smart Connect Technology\Always Updated]
```

It is recommended that you test the broadband adapter in use so that this value can be set as low as possible but still allow for successful connections. It is also highly recommended that you test the battery life impact of these settings to ensure this provides a good user experience.

### 3.5.2 Network Heuristics

The network heuristics used by Intel Smart Connect Technology are not able to monitor some broadband connections. In this case, Intel Smart Connect Technology will place the system back to sleep because it does not sense network traffic.
Currently, the only work around for this is to use a VPN over the broadband connection. Then network heuristics will monitor the VPN. Future versions of Intel Smart Connect Technology are planned to address this limitation.

If a network adapter cannot be monitored the Intel Smart Connect Technology debug log will show an IP address, but then will not identify a network adapter to log.

To test if Intel Smart Connect Technology can monitor your broadband connection:

1. Download and install winpcap: http://www.winpcap.org/
2. Download windump: http://www.winpcap.org/windump/
3. Connect to broadband.
4. Open a command prompt as administrator and change directory to windump’s location.
5. Type wmic nic get name,guid
6. Find the broadband adapter and remember its GUID.
8. If windump lists the broadband’s GUID, Intel Smart Connect Technology will be able to monitor it.

If the broadband’s GUID cannot be monitored, check your VPN as outlined above. If the VPN is working properly, Intel Smart Connect Technology will still be able to update email over broadband when using the VPN. If neither can be monitored, it is unlikely Intel Smart Connect Technology will work. However, future versions are planned to address this limitation so check for new versions of the Intel Smart Connect Technology Agent and of this document. In either case, it is recommended that you perform end-to-end testing to verify functionality prior to large scale deployment.

3.5.3 NetDetect

Broadband NICs do not support NetDetect. Thus, if the PC wakes into S0isct when out of broadband signal range and no other network connection is available, the PC will not wake again until either a wireless network connection is available (via NetDetect) or the user wakes the system. However, it is desirable for the PC to wake again if it goes back into range of a broadband network.

To work around this issue, the use of NetDetect can be disabled. In the following key add a dword value named WakeOnNetworkDetectEnabled and give it a value of 0

[HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel® Smart Connect Technology\Always Updated]

Note that this will cause Intel Smart Connect Technology to always wake periodically, even when no network is available.
3.6  NetDetect

3.6.1   SSID Broadcasting

For NetDetect to detect an SSID the Wireless Access Point must be broadcasting the SSID. If it is not, the NetDetect will not detect it and will not wake up the system.
4  Setup and Configuration of Intel® Smart Connect Technology

4.1  Configuration for a Single System

Before Intel Smart Connect Technology will wake the system it must be enabled. This takes place as follows:

1. Install the Intel Smart Connect Technology software component. This can be obtained from the PC manufacturer. Or, it is available on downloadcenter.intel.com. **Note:** Some systems allow Intel Smart Connect Technology to be disabled in the BIOS. If it is disabled, the Intel Smart Connect Technology software component will not install.
2. Use the software component configuration wizard to turn on Intel Smart Connect Technology and make basic settings.
3. If desired, adjust the registry to apply advanced settings. Then, restart the iSCTAgent service.
4. Set the email client to auto download email on a regular interval. See section 3.3.1 for more information.

4.2  Configuration for Remote Deployment

1. On a gold system, install and configure Intel Smart Connect Technology manually as outlined in section 4.1.
2. When desired settings are chosen, export the following key from the registry: [HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Smart Connect Technology]
3. Create a remote software install package that performs a silent install as follows:
   a. Apply the exported registry key
   b. Run Intel Smart Connect Technology setup silently (Setup –s)

The install process will use the current registry settings; Intel Smart Connect Technology is configured and ready to use.
5 Demonstrating and Verifying Intel® Smart Connect Technology

Demonstrating and verifying Intel Smart Connect Technology is an important step to understanding it and to fine tune settings for a given corporate network environment. This section provides a step-by-step guide to demonstrate and verify Intel Smart Connect Technology operation. This section concludes with troubleshooting tips.

5.1 Steps for a Basic Test

For this test you will need two PCs; one is the client with Intel Smart Connect Technology installed and configured, the other is used to monitor the Intel Smart Connect Technology enabled system. Also, you will need a timer (for example, many smart phones have timer features). Since testing requires a bit of waiting for the system to wake up, the timer is used to alert the operator when they should be paying attention.

It is recommended to keep the PC plugged into AC power and 100% charged during tests. Older versions of Intel Smart Connect Technology have a built-in back off scheduler that retards wakes for every 10% of battery degradation. This will help to eliminate inconsistencies in tests.

5.1.1 Configure the Client

5.1.1.1 Set up Intel Smart Connect Technology

If not already done, set up Intel Smart Connect Technology on the client as follows:

1. Be sure Intel Smart Connect Technology is enabled in the BIOS. Check your OEM documentation for details. **Note:** some OEMs do not expose this option in the BIOS; in that case it is always enabled.
2. Download Intel Smart Connect Technology from your OEM or from downloadcenter.intel.com. This document uses version 3.0.30.1526.
3. Install Intel Smart Connect Technology with the default options.
4. Open Intel Smart Connect Technology from the system tray and follow the wizard to enable Intel Smart Connect Technology. Set the wake time for 15 minutes†.

† **Note:** Though a setting of 5 minutes is possible, Outlook sometimes is unable to receive email on a 5 minute cycle. If you try 5 minutes and everything works except Outlook, try again at 15 minutes.

5.1.1.2 Configure the Network

Configure any desired wireless or broadband connections. Be sure to set them to autoconnect. If a VPN is desired install and configure it as well. It is recommended to perform initial testing on a wired or wireless network before trying broadband and/or VPNs.
5.1.1.3 Configure the email Client

Install a desired email client. This document uses Outlook 2010.

Configure the email client for desired email services. This document connects to Microsoft Exchange* 2012.

Configure the email client to auto download content. Here are some examples:


Verify that the email client can connect to the service, send and receive emails, and auto downloads new messages.

For more information on email client optimal configuration see section 3.3.1.

5.1.1.4 Set up Intel Smart Connect Technology test logging tools

Now you will set up remote monitor viewing to aide in observing Intel Smart Connect Technology behavior. For logs, the default event logs created by Windows and Intel Smart Connect Technology will suffice. **Note:** these steps are not needed for Intel Smart Connect Technology use. Rather they aid in testing and debugging.

On the client:

1. Create c:\isct.
2. Create c:\isct\wake_task.bat as follows. Change **192.168.1.10** to match the IP address of your remote PC:

```bash
@echo off
set CONN=192.168.1.10
:net_wait
:: Wait for an IP address
set count=1
set MAXCOUNT=100
set IP=
:loop_IP
for /f "delims=: tokens=2" %%A in (\ipconfig^| find /i "IPv4 Address") do (set IP=%%A
)
if not "%IP%"=="" goto check_apipa
goto continue_loop_ip
:check_apipa
if "%IP:-1,7%"="169.254" goto continue_loop_ip
goto loop_exit_IP
:continue_loop_ip
```
if %count%==%MAXCOUNT% goto :EOF
ping 127.0.0.1 -n 2 > NUL
set /a count=%count%+1
goto loop_IP
:loop_exit_IP
:Connect
"C:\Program Files\RealVNC\VNC Server\vncserver.exe" -service -connect %CONN%

4. Select Task Scheduler Library.
5. Click Create Task...
6. On the General tab give the task a name. The example in this document uses “wake log for iSCT”. Under Security Options, set to Run whether user is logged on or not. If prompted, enter credentials for currently logged on user. Leave the remaining items as default values.
7. On the Triggers tab click New...
8. Set as follows:
   - Begin the Task: On an event
   - Basic vs. Custom: Basic
   - Log: System
   - Source: Power-Troubleshooter
   - Event ID: 1
   - Delay task for: unchecked
   - Repeat Task Every: unchecked
   - Stop is task runs longer than: unchecked
   - Active: unchecked
   - Expire: unchecked
   - Enabled: Checked
9. Click OK.
10. On the Action tab click **New...**
11. Fill in as follows:
   - **Action:** Start a program
   - **Program/script:** c:\\isct\\wake_task.bat
   - Click **OK**.
12. On the Conditions tab uncheck all boxes.
13. Leave the Settings tab as at defaults.
14. Click **OK**.
15. Download RealVNC’s VNC for Windows 5.x:
    - [http://www.realvnc.com/download/vnc/](http://www.realvnc.com/download/vnc/) The version used in this document is 5.0.0. Also, obtain a license from RealVNC for the “Free license only, without premium features” version: [http://www.realvnc.com/purchase/activate/](http://www.realvnc.com/purchase/activate/)
16. Perform the default installation. Be sure to set a VNC password and set the VNC Server Service to **autostart**.
17. Disable the Windows Firewall as follows
   - Click Start -> Control Panel -> Windows Firewall
   - Click Turn on or off Windows Firewall
   - Set all zones to Turn off Windows Firewall
18. Disable the login on wake feature as follows:

- Click **OK**

- Click **Start** -> **Control Panel** -> **Power Options**
- Click **Change Plan Settings**
- Click **Change Advanced Plan Settings**
- Expand (plan name) -> **Require a password on wakeup**
- Set both **On Battery** and **Plugged in** to **No**

5.1.2 Configure the Remote PC

5.1.2.1 Configure the email Client

Install an email client and configure it to work with the desired email service. This will be used later to send test email messages to the client.

5.1.2.2 Configure the Test Logging Tools

1. Install RealVNC’s VNC* Viewer using the custom install option. Only install the viewer.
2. On the remote PC, start a listening VNC Viewer as follows: **Start** -> **Programs** -> **Real VNC** -> **Advanced** -> **Start Listening Real VNC Viewer**. Be sure the Windows firewall will allow connections to this service.
3. Open a command prompt as administrator and run the following command to start an endless ping test to the client.
4. Type `ping –t <IP address of client>`
5. Verify pings are responding.

5.1.3 Run the Test / Demonstrate the Use Case

1. On the client, open the email client and keep it maximized.
2. Place the client into S3 sleep (**Start** -> **Shutdown** -> **Sleep**)
3. Set the timer for 15 minutes, then wait 15 minutes. The timer will alert you when it is time to pay attention again.
4. From the remote system, send an email to the client system. Also note that pings are no longer responding (see NOTE below).
5. When the timer goes off, observe pings on the remote PC. When pings begin to respond, the client’s network has connected. *This is a key verification step that verifies that the client PC has woken up and obtained a network connection.*
6. Shortly after pings begin, a VNC Viewer window will appear on the remote system. At this point the email client can be seen through the viewer window.
7. Watch the email client to see if it obtains the email sent at step 4. *This is a key verification step to ensure email has been downloaded during S0isct.*
8. When the client goes back to sleep, the VNC Viewer window will close with a warning message. Also, pings will stop responding (see NOTE below). *This is a key verification step to ensure the PC goes back to sleep.*

The next steps are optional for further verification and/or demonstration purposes. They also may be used instead of using RealVNC’s VNC Viewer to remotely view the client screen.

9. If possible, disable the network connection on the client by unplugging it, by turning off the wireless hardware disable switch, or by turning off any wireless access points the client may use. This is done to ensure the client does not download email after you wake it up.

10. Wake the client by pressing the power button.

11. If step 9 was successful, verify that the email sent at step 4 is in the client’s inbox. *This is a key verification step to ensure email has been downloaded during S0isct.*

**NOTE**

*If Intel AMT is configured and the connection is wired or wireless, pings may continue to respond. However, the TTL will increase by a value of 127 (e.g. TTL when in S0 is 128 (Windows is responding), TTL when in S3 is 255 (Intel AMT is responding)).*

### 5.2 Debug

This section provides some tips on what to check if you experience problems in the above procedure.

#### 5.2.1 General Logging

Intel Smart Connect Technology version 3.0 provides detailed logging to aid in debugging. In normal settings, Intel Smart Connect Technology keeps a log in the Windows event log. The easiest way to view these is to create a custom filter.

1. Right-click **My Computer** and choose **Manage**.
3. Right-click Event Viewer and click Create Custom View...
   - Select “By log”
   - Set **Event Logs** to **Windows Logs -> Application**.
   - Set **Event Sources** to **iSCTAgent**.
   - Click **OK**
4. Name the view and click **OK**.
5. Expand the tree to the new view.
By default, only error, warning, and critical information that is useful for troubleshooting are logged. Additional, verbose logging can be enabled by adding two registry entries: (Location: [HKEY_LOCAL_MACHINE\SOFTWARE\Intel\Intel Smart Connect Technology\Always Updated])

- “LoggingLevel” with a DWORD value of 0x10
- “LoggingEnabled” with a DWORD value of 0x2

Once changes are made to the registry, restart the ISCTAgent service as it only reads registry configuration items upon its startup cycle.

The debug log is stored at C:\ProgramData\Intel\iSCT\ISCTLog.txt. Note that the “C:\ProgramData” directory is hidden.

Windows has built in logs that track system suspend and resume as well. Resume is tracked in the Windows Logs -> System Logs by the Power-Troubleshooter source. Suspend is tracked in the Windows Logs -> System Logs by the Kernel-Power source.

Another helpful debug log is that of the email client. This differs by client. Below are links to a few.


5.2.2 Pings Never Respond

If the client never responds to pings as listed on step 6 in section 5.1.3 above, one of two things has gone wrong: either the client did not wake up or the client woke but never connected to the network.

5.2.2.1 Verify the PC Woke Up

Use the Intel Smart Connect Technology and Windows event logs to view this event after it has happened. Figure 6, Figure 7, and Figure 8 show what to look for:

```
Figure 6: Intel Smart Connect Technology Event Log

Intel Smart Connect Technology logs most of its action in the Windows event log under Application from the ISCTAgent source.

Figure 7: Intel Smart Connect Technology Debug Log
```
1. Note the time difference. Intel Smart Connect Technology was set to a 5 minute sleep time.
2. *iSCT Resuming* will appear anytime the platform wake up.
3. *Wake up by EC timer* shows the reason why the platform woke up. This is key to verify that the platform woke due to Intel Smart Connect Technology and not a user action.
4. *Changing E_STATE to [STATE_S0_ISCT]* shows the new power state is S0isct, not the standard S0.

5. Windows event log has built in tracking of system wakes. This happens in the System logs from the Power-Troubleshooter.
6. Scroll down in the detail area to view the wake up source.

**5.2.2.1.1 If the PC Did Not Wake Up**

The most likely cause is that Intel Smart Connect Technology is not configured as expected. For example,

- it is not configured to wake periodically (not enabled)
- it is set for a longer time in sleep than expected

The Intel Smart Connect Technology debug log will show if it scheduled a wake up and when. See the figures below.

Other causes may be:

- The Application White list is configured and a desired application is not open. This will show in the log.
• NetDetect was enabled by Intel Smart Connect Technology (this will not happen on the first cycle). This will show in the log.
• The firmware detected a thermal or battery event and decided to keep the PC asleep. This will not show in the log since it happens at the firmware level.

![Figure 9: Configured to Wake](image)

7. This shows that Intel Smart Connect Technology is enabled for periodic wake.

![Figure 10: Time in Sleep](image)

8. PeriodicWakeEnabled shows periodic wake is enabled.
9. Will be woken by timer shows Intel Smart Connect Technology will set the system to wake by a timer.
10. ISCTNextSleepDuration shows how long the system will remain asleep.
5.2.2.2 Verify the Network is Connected

Once the PC enters S0isct, network connections behave the same as a normal S0. That is to say, Windows will automatically attempt to connect to a network. For a wired network, a network cable must be plugged in. For wireless and broadband networks, Windows will scan for connections and connect to the highest priority available network that is set to auto connect. Finally, if VPN software is open and configured for autoconnect it will attempt a connection.

The Intel Smart Connect Technology debug log will show when it detects an IP address. It will also show how long it waits and if it timed out.

**Figure 11: Network Found**

1. The first circled item is how long it will wait for an IP address
2. *IP Connection Changed* shows that Intel Smart Connect Technology detected an IP address and how long it took
3. The IP address is shown as well. It was found on the Intel® Centrino® Ultimate-N.
Figure 12 shows the log entry is no IP address is found before the timer expires.

If the timer is expiring and the network is definitely working, try extending the timeout period. See advanced settings in Section 2.5.2 for more details.

5.2.3 Email is Not Downloaded

If email is not being downloaded, use the email client logs. This will tell you if the email client tried to download email. If it did not, check the email client settings to verify it is set to automatically download email.

If it did try to download, compare the time stamps to see if it tried before or after the client got an IP address. If it was before, see if the email client can be adjusted to wait for a network connection. Or, work with the email client vendor to adjust it so it waits for a connection.

For more information on Email Client optimal configuration see section 3.3.1.

You can also check to see how much time Intel Smart Connect Technology is allowing time for email to download by checking the Intel Smart Connect Technology debug log.

Figure 13: Network Heuristics

- The first red circle in Figure 13 shows which NIC is being monitored for email traffic. To find NIC GUIDs use WMIC NIC get NAME,GUID from a command prompt.
- The second red circle shows that monitoring started
• The third red circle shows that the monitor exited. Here you can see that at least 10 seconds was available to check for email.

Note that Intel Smart Connect Technology can monitor wired and wireless network adapters but cannot monitor all VPNs or Broadband adapters. In this case Intel Smart Connect Technology may place the system back to sleep before the email client can check for email. See section 3.4.5 for more information.

5.2.4 Verify the PC Goes Back to Sleep

The logs will show if the PC went back to sleep at the end of the S0isct cycle.

![Intel Smart Connect Event Log](image)

Figure 14: Intel Smart Connect Event Log

1. Intel Smart Connect Technology logs most of its action in the Windows event log under Application from the ISCTAgent source.
2. \textit{ISCTNextSleepDuration} denotes how long until the next wake-up. This time is computed and so may change on every wake.

3. \textit{Intel Smart Connect Technology initiated suspend with one or more network connections...}: If there was no network connection and NetDetect was supported and enabled, Intel Smart Connect Technology would not set a timer. Rather, it would set NetDetect. It would then be up to NetDetect to wake the platform.

4. The last two items show the platform going to sleep. The next entry in the log will be from the system’s next wake up.
5. Windows event log has built in logging of sleep events. This happens in the System logs from the Kernel-Power source.
Appendix

A.1 Observing a System Wake as It Happens

There are methods to observe the system wake real time as well. However, they differ from system to system. These are useful in that you can verify success immediately. However, care must be taken to ensure a method works on your test system. Compare the logs with observation to determine if a method works.

A.1.1 System LEDs

For PCs with Power LEDs, the LED will slowly flash when the system is sleeping (S3). Some of these PCs will change the power LED to solid or vary the LED flash speed when in S0isct. However, not all PCs do this. Instead, some OEMs prefer to flash the LED as if the system were in S3 so as to not confuse the user.

If the power LED is not an option, other LEDs may flash during system activity. For example the hard drive LED or wireless network LED. However, these also vary from system to system based on OEM choices.

**NOTE**

Some systems do not have any LEDs.

A.1.2 Local Monitor

In testing situations it would be useful if the local monitor turned on for testing only. This way, when the monitor turns on, you know the system woke up. On some systems, it is possible to force the monitor to wake up. Note that this does not work on all systems because some OEMs choose to disable the monitor at the firmware level during S0isct.

If you followed the steps to section 5.1, a VNC server is already running on the client. When this server connects to a viewer, it will trigger the local monitor to wake up. As such, you may have already seen this happen. If this is working, set the viewer on the client to listen for connections and adjust the script to connect to 127.0.0.1. Also, the script may be adjusted so it does not wait for a network connection. Finally, adapt the VNC viewer so that it launches in a very small window so it does not impede the view of the desktop.

One tip here is to disable the need to login upon system wakeup. Otherwise, all you will see is a login screen.
A.1.3  Second Monitor

Some OEMs have chosen not to blank a second monitor. For these, just attach a second monitor and mirror it with the primary monitor. Then, when the system wakes, the second monitor will wake and show everything that is shown on the primary monitor.

One tip here is to disable the need to login upon system wakeup. Otherwise, all you will see is a login screen.

A.1.4  Audio Notification

Intel Smart Connect Technology mutes the audio during S0isct. On some systems it is possible to programmatically unmute the audio and then play a sound as a notification that the system is awake. Note that this does not work on all systems because some OEMs choose to disable audio at the firmware level during S0isct.

To implement audio notification use the windows task scheduler method outlined below. For the task, setup a batch file with a loop that will unmute and then beep. The loop is required because Intel Smart Connect Technology may mute the speakers more than once. To unmute the speakers, nircmd works well: http://www.nirsoft.net/utils/nircmd.html. To beep the speakers, check out this trick: http://forums.whirlpool.net.au/archive/564510

From a command line, do the following:
1. Type copy con beep.txt.
2. Press the following key combinations: <Ctrl-g> <ctrl-z> <Enter> (output will show 1 file(s) copied.)
3. Type beep.txt.

A.1.5  Power Usage Meter

Since a PC in the S0isct state uses more power than when in the S3 state, a power usage meter may be used to determine if the PC is awake. However, for PCs with batteries, battery charging also uses power. This may make it impossible to tell the difference between S3 and S0isct. Therefore, remove the battery when using this method. Note, however, that many Ultrabooks™ and tablets have non-removable batteries. For such a device, a power usage meter will not be helpful.
A.2 Running a Task Upon Wake

Using Windows task scheduler, it is possible to run a task every time the PC wakes up. This includes wakes for Intel Smart Connect Technology. This can be useful for custom logging during a test run. For example, a script may collect network adapter state and IP address information throughout the cycle. It may also unmute the speakers and play a short .wav file to alert the tester that the system has woken. Or it can connect to a listening VNC viewer so that the screen may be observed without the need for a second monitor. Note, this task will run on all wake ups, not just Intel Smart Connect Technology. As such, it’s good for testing, but it not useful to cause tasks to run during S0isct.

To run a custom task, do the following:

2. Select Task Scheduler Library.
3. Click Create Task…
4. On the General tab give the task a name. This document uses “wake log for iSCT”.
   Leave the remaining items at default values.
5. On the Triggers tab click New…
6. Set as follows:
   • Begin the Task: On an event
   • Basic vs. Custom: Basic
   • Log: System
   • Source: Power-Troubleshooter
   • Event ID: 1
   • Delay task for: unchecked
   • Repeat Task Every: unchecked
   • Stop if task runs longer than: unchecked
   • Active: unchecked
   • Expire: unchecked
   • Enabled: Checked
   • Click OK
7. On the Action tab click **New**...
8. Fill in as follows:
   - Action: Start a program
   - Program/script: `<path to your script>`
   - Click **OK**
9. On the Conditions tab uncheck all boxes.
10. Leave the Settings tab as at defaults.
11. Click **OK**.