Intel® Pro Wireless Display

Implementation Guide

November 2015

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1   Introduction

Welcome to the Intel® Pro Wireless Display (Pro WiDi) Implementation Guide. This guide is written for those looking to test and deploy Intel Pro WiDi in their environment.

The complete Intel Pro WiDi experience occurs when both the client and receiver devices are Intel Pro WiDi certified.   This guide is focused on that primary setup scenario.   This guide will also address interoperability with other Miracast capable devices that also benefit and can be integrated into an Intel Pro WiDi experience.

1.1   Why Wireless Display for Enterprise

Intel Wireless Display for Enterprise, commonly referred to as Intel Pro WiDi, enables a business professional to share full high definition content to a nearby display via a local wireless connection. With the diversity of video out options across a variety of mobile computing platforms business professionals are often challenged to perform this daily task.   Some screen sharing applications require network infrastructure connectivity or specialized applications enabled for wireless display, further impacting a simple daily task.
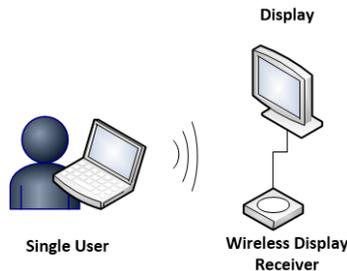
Built upon industry standard Miracast and enhanced beyond consumer Intel WiDi, Intel Pro WiDi includes additional business environment use case scenarios along with Enterprise IT requirements of security and manageability.

One example of the additional use case scenarios is that multiple users can be connected with an ability to manage who presents.   In the first example below, multiple users are connected with the ability to easily transition from one to the next.
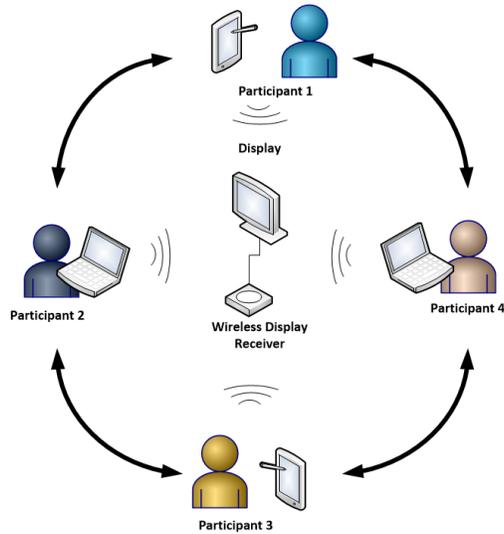
In the second example, multiple users are connected with the session controlled by the meeting leader.
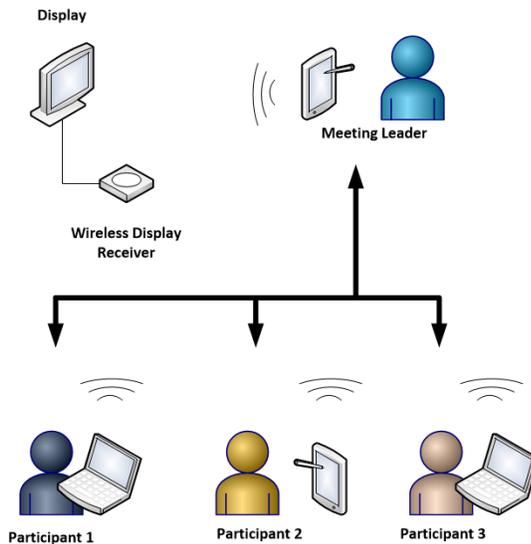
In both scenarios, meeting latencies are minimized by removing the cables and adapters associated to connecting and projecting to a conference room display.   These two examples highlight use case differences where Intel Pro WiDi is built for enterprise, enabling beyond a consumer solution.

NOTE: See the Intel Pro WiDi User Guide for more information on the user experience and session management.

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In addition to a business professional's desire to connect and project their screen, those responsible for Enterprise Information Technology (IT) in the business environment want to ensure the solution is secure and manageable.   A solution built for a home environment often lacks the security and management needed in an enterprise.

The security features include enhancements that are enabled by default and can be further customized specific to an environment.   Preventing bridging between an infrastructure and Wi-Fi direct session is often a native feature of the host operating systems, with additional options on Microsoft Windows 7 platforms.   Connection confirmation for the user to ensure they are connected to the correct display is defined on the client application.   Session pairing, content protection, whether a USB input device connected to the receiver can be used, and other settings specific to the wireless display receiver can be defined by IT administrators.

An important capability to an enterprise with multiple locations using wireless display is the ability to remotely manage the receivers.   Select Intel Pro WiDi receiver vendors enable this functionality.
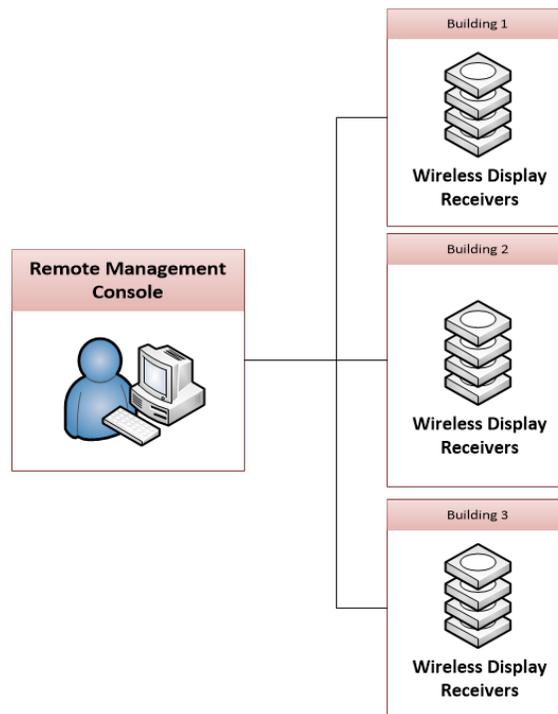
1.2 Purpose and Structure of this Document

The main sections of this document address specific roles related to Intel Pro WiDi deployment, identifying key responsibilities and decision points.   The target audience of this guide is dependent upon the role or job description.

- **PC Lifecycle:** This role focuses on those responsible for client computing environment. Those responsible for the PC Lifecycle will be intimately familiar with the client computing hardware inventory, imaging, update, and related events.   Specific to Intel Pro WiDi, knowledge of specific hardware, driver, and software is required to ensure a great experience.

- **Conference Room:** Often a part of the facilities team, this role focuses on those responsible for audio-visual setup and support for the conference room environment.   They will be intimately familiar with room build out such as ports and connections, conference room displays, whether video scalers are present, and so forth.   Specific to Intel Pro WiDi, the placement and connections to the receiver along with initial configuration to ensure a great experience apply to the conference room setup.

- **Network Infrastructure:** This role focuses on wireless network infrastructure and management of network devices.   The individuals involved are intimately familiar with the wireless channel spectrum utilization in the environment and how to fine tune the environment to ensure a great connectivity experience.   Specific to Intel Pro WiDi, this individual will define the initial configuration settings, may be involved with remote management of the wireless display receivers and helps ensure a great wireless display experience.

- **Client and Infrastructure Security:** This role focuses on the protection of corporate electronic assets. Specific items for Intel Pro WiDi include the client firewall settings, or intrusion prevention solutions, along with how to protect the wireless personal area network utilized for wireless display.

- **HelpDesk and User Support:** This role focuses on the troubleshooting of events that may impact user productivity.   This support technician interfaces across the others named above and is the end-user facing resource ready to address issues when and if needed.   Specific to Intel Pro WiDi, this individual helps to isolate and possibly resolve wireless display issues when needed to get the end-user back to a great experience.

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1.3　Components Overview

Intel Pro WiDi consists of three primary components: one of more transmitting devices, a single receiver device, and a single display.   All three components should be located in the same room for a successful experience.
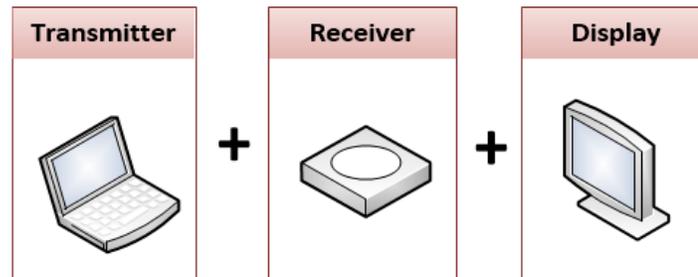
Specifics on Transmitters are referenced in Section 2.   The Receiver is certified and branded for Intel Pro WiDi.   For the purposes of this document, the Actiontec ScreenBeam Business Edition will be used.   The display is a monitor, projector, flat panel, or similar device that may be located in a conference room or collaboration area.   In some cases, the receiver and display may be the same device. Although Intel Pro WiDi can be used in a single user workspace area, other solutions such as Intel Wireless Docking may be more appropriate.

1.4　Architectural Overview

The foundation of the wireless display session is provided via the Wi-Fi Alliance Miracast™ standard. Miracast and Intel WiDi provide a consumer focused solution via 802.11n.   The wireless infrastructure channel used for an active client connection is also used to connect to the wireless display receiver.
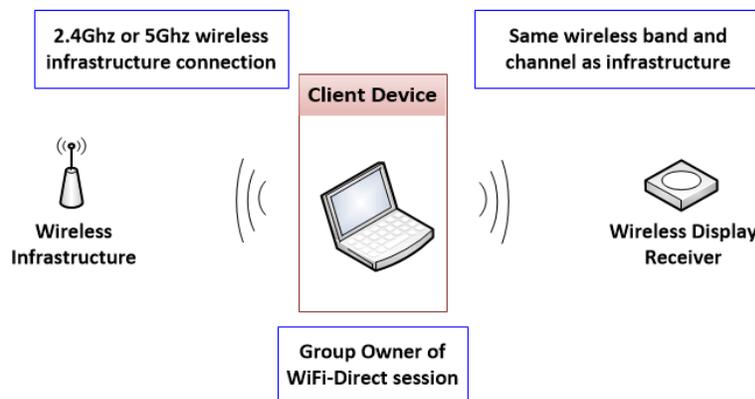
The above example is commonly referred to as Single Channel Mode, or SCM.   For a business enterprise environment a few adjustments are needed: Autonomous Group Owner for the session is transitioned to the receiver, Different Channel Mode (DCM) on the client to allow for two simultaneous wireless networking sessions on different channels, security on the client to isolate wireless LAN from wireless PAN, wireless channel selection on the wireless display receiver, and more.

For an enterprise business environment, multiple wireless infrastructure access points often exist across multiple wireless channels to provide a seemingly always connected experience for mobile systems. Unlike a consumer wireless environment, an enterprise wireless infrastructure has access to a larger number of wireless channels in the 5 GHz spectrum, including Dynamic Frequency Selection (DFS) channels which are prohibited in a Direct Wi-Fi usage model. The Intel Pro WiDi solution accommodates for these additional requirements.

Instead of sharing the same wireless band and channel as the wireless infrastructure, the Intel Pro WiDi experience for a business enterprise environment enables the wireless display receiver to be the Wi-Fi-Direct group owner, commonly referred to as Autonomous Group Owner (AGO). In this model, the client system must support Different Channel Mode (DCM) to allow two discussions on separate wireless channels.
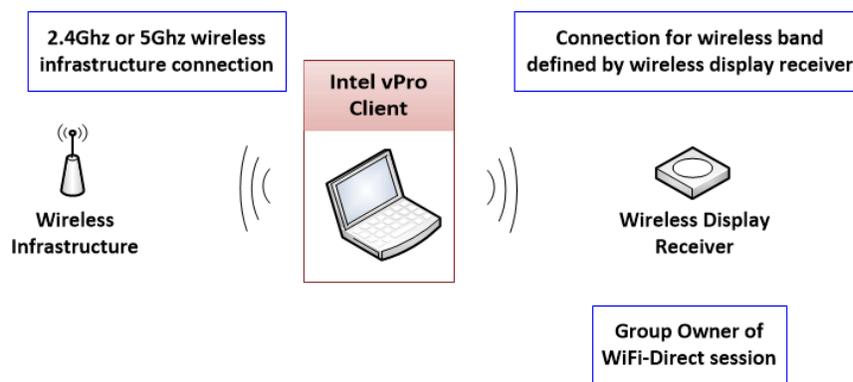
Separately from the wireless connectivity changes, Intel Pro WiDi provides improved security and manageability for Enterprise IT environments. The security enhancements include isolation between infrastructure (i.e. Wireless LAN) and Wi-Fi-Direct (i.e. Wireless PAN) connections and ensuring only wireless display communications are occurring on the Wi-Fi-Direct session. Manageability enhancements include access to settings within the wireless display receiver to customize options

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specific to the target environment.One benefit of the Intel Pro WiDi architectural changes is the enabling of an important functional use case: Managed Meetings.   With Intel Pro WiDi, up to 16 client devices can be connected to the wireless display receiver device with presenter controls to determine which device is shown on the external display.   In this scenario, each of the participating clients may be on a different wireless infrastructure connection, but all are connected to the same Wi-Fi channel as defined by the Intel Pro WiDi receiver depicted in the following diagram.
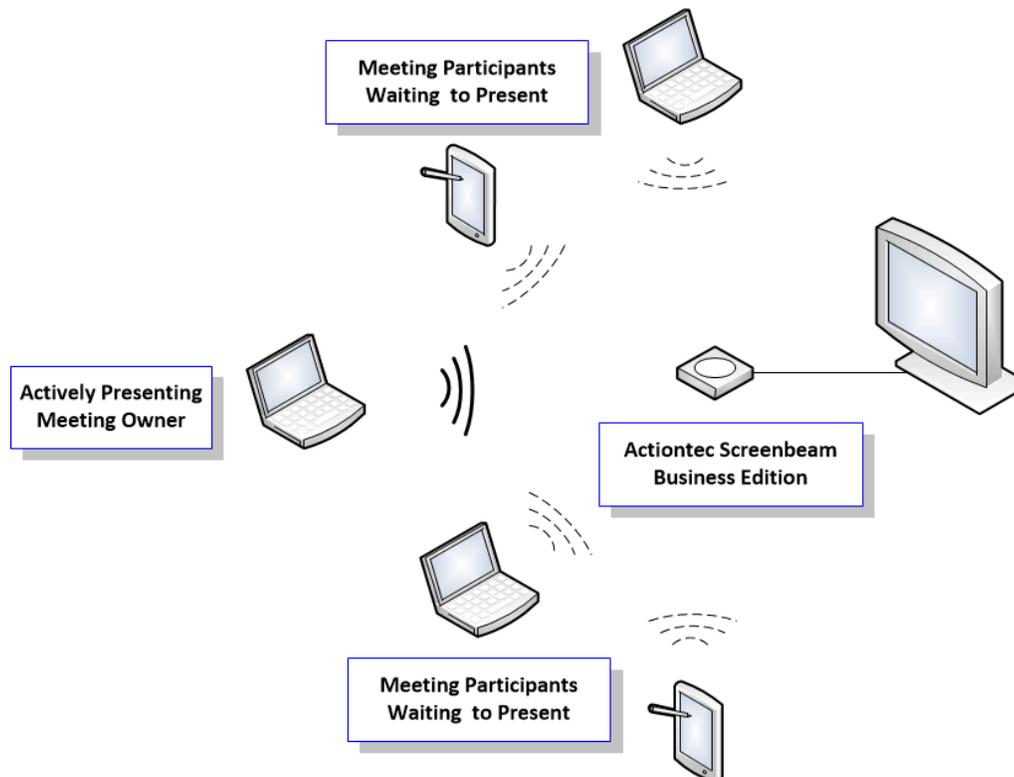
1.5   Before you Begin

If new to Intel Pro WiDi, please review the quick start guides or Intel Pro WiDi user guide for more details on basic setup and use of the solution.

The prior sections provide a foundational understanding on the capabilities of Intel Pro WiDi.   In preparation to deploying Intel Pro WiDi, start with a simple test environment based on the three main components of Intel Pro WiDi:

- **Client Device** – More information is provided in Section 2 of this guide.
- **Receiver Device** – For the purposes of this guide, the Actiontec ScreenBeam Business Edition adapter with firmware 2.11.11 is used.   Please refer to your preferred Intel Pro WiDi receiver vendor for additional guidance as needed.
- **Environment** – Once the initial connection between client and receiver has been attempted, review sections 3 through 5 for additional details pertaining to deployment of the solution.

2   PC Lifecycle

2.1   Area of Responsibility

This section of the deployment guide focuses on the individual or team assigned to PC Lifecycle, commonly responsible for inventory, imaging and deployment, and updates of enterprise mobile computing devices.

2.2   Specific items to know about Intel Pro WiDi

Intel Pro WiDi has minimum hardware, driver, and software requirements for client devices   Current Intel Core-M vPro and 5th Gen Intel Core vPro platforms ship with drivers that meet or exceed the default driver requirements and 6th Gen Intel Core vPro will also ship with drivers that exceed the minimum requirements for Intel Pro WiDi.   The first generation to support Intel Pro WiDi was 4th Gen Intel Core vPro.

Other platforms that are Miracast or Intel WiDi capable may be able to connect to an Intel Pro WiDi receiver when specific requirements are met.   To help in determining whether a specific client platform support wireless display, whether Miracast or Intel WiDi or Intel Pro WiDi, tools are available online.   The capability assessment utilities may also help identify if a specific driver or software update is recommended.

2.3   Required Intel® Hardware

Intel Pro WiDi requires specific client platforms components to realize the full features and benefits. Client platforms with all components will be Intel vPro brand certified, specifically 4th through 6th Generation Intel Core vPro Technology platforms with Intel HD or Iris Pro graphics.

Required Platform Components	
Intel Processor with Intel HD or Iris Pro Graphics	6th Gen Intel Core Processor 5th Gen Intel Core Processor 4th Gen Intel Core Processor Intel Core M Processor
Intel Wi-Fi Products	Intel Dual Band Wireless-AC 8260 Intel Dual Band Wireless-AC 7265 Intel Dual Band Wireless-N 7265 Intel Dual Band Wireless-AC 7260 Intel Dual Band Wireless-N 7260
Platform Technologies	Intel vPro Technology Intel Wireless Display

Compatible platforms will also include the appropriate Intel Management Engine (ME) used in conjunction with Intel Pro WiDi. To assist in identifying compatible platforms, use Intel ARK website.[1]

Note: When assessing a hardware inventory query, two key data points to query are for Intel Dual Band wireless 72xx/82xx and Intel HD graphics.

Note: Mobile computing platforms that support dual graphics controllers, where one of the graphics controllers is the Intel HD, will support Intel Wireless Display.

2.4   Driver and Software Versions

The following subsections indicate the minimum and recommended versions of drivers and software for Intel Pro WiDi clients.   The minimum versions indicate a known good version at the launch of Intel Pro WiDi at the start of 2015.   The recommended version indicates the latest publicly available version at the time of this document.

Current Intel Core-M vPro and 5th Gen Intel Core vPro platforms often are delivered with drivers that meet or exceed the default driver requirements.   6th Gen Intel Core vPro will also be delivered with drivers that exceed the minimum requirements for Intel Pro WiDi.   The first generation to support Intel Pro WiDi was 4th Gen Intel Core vPro.   Intel recommends updating the graphics and wireless LAN drivers for these systems with the latest supported on OEM support sites.   Please contact your OEM if provided downloads for 4th Gen Intel Core vPro platforms that do not meet the minimum requirements listed below.

In the tables below, two versions of the Intel HD graphics are listed.   The first refers to the specific graphics driver version.   The second refers to the complete Intel HD Graphics package, which includes important components related to Intel Wireless Display such as the virtual audio driver.   Often the two version numbers are used interchangeably.

When comparing versions, focus on the **final four digits**. For example:

 Version 15.36.x.**4080** is older than version 10.18.x.**4279** (4080 < 4279)

Enterprise customers are encouraged to utilize existing client imaging, PC update or software distribution resources in their environment to apply driver and application updates, if and when needed.

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[1] As of November 2015, compatible processors listed via http://ark.intel.com/Search/Advanced?s=t&FilterCurrentProducts=true&WiDi=true&VProTechnology=true. Compatible Intel Wi-Fi products listed at http://ark.intel.com/compare/83635,84177,75439,75440,86068.   As additional platform components supporting Intel Pro WiDi are introduced, the queries will need to be adjusted.

2.4.1 Microsoft Windows 7

Microsoft Windows 7		
Component	Minimum Version	Recommended Version
Intel® HD Graphics Driver & Package	10.18.x.4080, as part of the 15.36.x.4080 Intel HD Graphics Package.	10.36.x.4264 or later, as part of the associated Intel HD graphics package. (i.e. Intel HD graphics package 15.36.x.4264 or higher)
Intel® PROSet/Wireless Software and Drivers	17.14.0 or later software package 17.13.11.5 Intel Wireless LAN driver	18.20.0 or later
Intel® Wireless Display Software	5.1.28.0 or later	6.0.44 or higher
Microsoft .NET Framework	Version 4.5 client	
Intel Management Engine Interface (MEI) firmware[2]	10.0.30.1072 or later 9.5.20.1742 or later 9.0.30.1482 or later	

NOTE: The driver downloads from an OEM website may only list the Intel HD Graphics driver version, such as 10.18.14.4080.   Download and install the complete graphics package.

NOTE: Intel PROset with wireless software extensions is required for Microsoft Windows 7 platforms.   Microsoft Window 8.1 and 10 do not require Intel PROset for wireless display.

2.4.2 Microsoft Windows 8.1

Microsoft Windows 8.1		
Component	Minimum Version	Recommended Version
Intel® HD Graphics Driver & Package	10.18.x.4080, as part of the 15.36.x.4080 Intel HD Graphics Package.	10.18.x.4279 or later, as part of the associated Intel HD graphics package. (i.e. Intel HD graphics package 15.40.x.4279 or higher)
Intel® Wireless LAN Driver	17.13.11.5	18.20.0.9 or higher
Intel® Wireless Display Software	5.1.28	6.0.44 or higher
Microsoft .NET Framework	Version 4.5 client	
Intel Management Engine Interface (MEI) firmware	10.0.30.1072 or later 9.5.20.1742 or later 9.0.30.1482 or later	

NOTE: For Microsoft Windows 8.1 platforms, ensure Update 1 (KB2919355) has been applied. Microsoft Windows 8.0 platforms are not supported.

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[2] Intel MEI firmware and drivers are platform generation specific. Refer to the platform OEM for the correct version.

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2.4.3 Microsoft Windows 10

Microsoft Windows 10		
Component	Minimum Version	Recommended Version
Intel® HD Graphics Driver & Package	10.18.x.4248, as part of the 15.40.x.4248 Intel HD Graphics Package.	10.18.x.4279 or later, as part of the associated Intel HD graphics package. (i.e. Intel HD graphics package 15.40.x.4279 or higher)
Intel® Wireless LAN Driver	18.11.x.x	18.20.x.x or higher
Intel® Wireless Display Software	6.0.40	6.0.44 or higher
Microsoft .NET Framework	Version 4.5 client	
Intel Management Engine Interface (MEI) firmware[3]	10.0.30.1072 or later 9.5.20.1742 or later 9.0.30.1482 or later	

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[3] Intel MEI firmware and drivers are platform generation specific. Refer to the platform OEM for the correct version.

2.5 Utilities to Assess Existing Microsoft Windows Client Devices

To help in assessing a Microsoft Windows Client for Intel Pro WiDi compatibility two utilities are available: Intel WiDi Compatibility Checker Tool and Intel Platform Discovery Tool.

2.5.1 Intel WiDi Compatibility Checker Tool

The Intel WiDi Compatibility Tool[4], analyzes a client system and provides a summary answer.   This utility requires an internet connection when assessing the client device to query an online database.
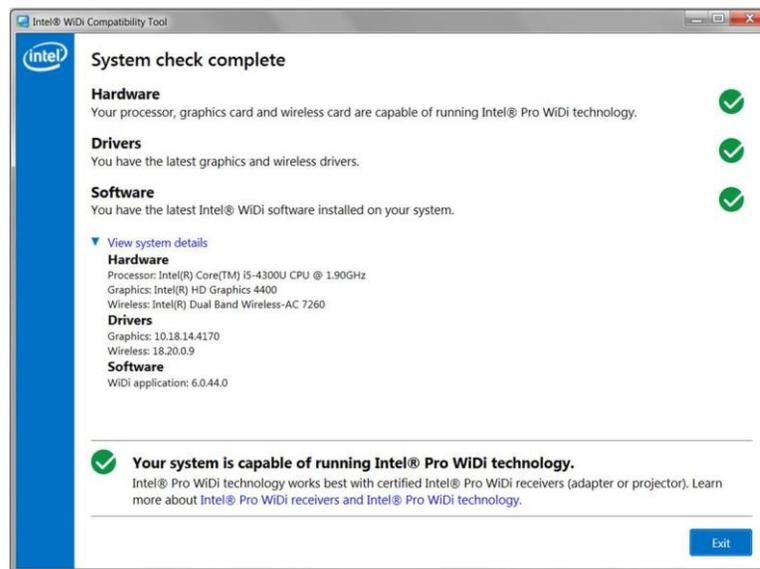
2.5.2 Intel Platform Discovery Tool

Intel Platform Discovery tool[5], generates an XML file output that can be imported into reviewed by a client management solution to determine next steps.   This utility queries for several Intel hardware features specifically enabled for enterprise client devices, including Intel Pro WiDi.   This utility runs independently of a network or internet connection.

To use the utility:

1. Download the tool and extract to a c:\Temp on the client
2. Open a command prompt using **Run as Administrator** for the required elevated rights
3. Run the command: **PlatformDiscovery.exe > file.xml**

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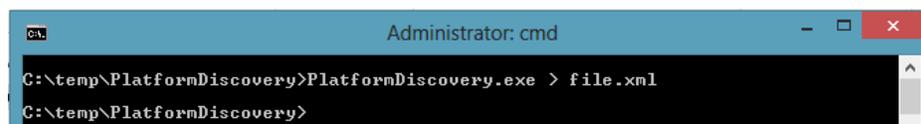
[4] Intel WiDi Compatibility Tool available at http://downloadmirror.intel.com/25025/eng/CompatibilityChecker.exe
[5] Intel Platform Discovery tool available at https://downloadcenter.intel.com/download/24667

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4. Open the resulting file.xml and scroll to the final section of the output.

In the example output shown below, the platform meets the minimum requirements per the following

```
<Hardware version="Intel(R) Core(TM) i5-4300U CPU @ 1.90GHz - 00040651"/>
<Hardware version="Intel(R) Management Engine - 9.5.15.1730"/>
<Hardware version="Intel(R) HD Graphics Family - 10.18.14.4264"/>
<Hardware version="Intel(R) Dual Band Wireless-N 7260 -
    PCI\VEN_8086&DEV_08B1&SUBSYS_C0608086&REV_6B\5C514FFFFFD82D2C00"/>
<Software version="6.3.9600" available="true" name="Microsoft Windows 8.1 Pro 64-bit" required="true"/>
<Software version="6.0.621.0" available="true" name="WiDiApp.exe" required="true"/>
<Software version="18.20.0.9" available="true" name="Intel(R) Dual Band Wireless-N 7260" required="true"/>
```

data points.

   o Intel WiDi application (i.e. WiDiapp.exe) installed is version 6.0.621
NOTE: The application installation checks platform requirements.   If the application with appropriate version number is already present, the platform is known to be Intel Pro WiDi compliant
   o Intel Dual Band Wireless 7260 with driver 18.20.0.9
   o Intel HD Graphics with driver 10.18.14.4264
   o Microsoft Windows 8.1 64-bit

The collected information identifies the current state of the client device.   Comparing the data to the minimum and recommended versions will help identify if and where updates are needed.

2.6   Updating Drivers and Software

If a driver or application update is needed, choose one of the following sources for downloads:

1. OEM platform downloads meet or exceed the suggested minimums.
2. Intel generic drivers and software packages via Intel Download Center

The recommended option is to obtain and install drivers provided by the OEM which meet the minimum requirements for Intel Pro WiDi.

If the OEM drivers do not meet the minimum requirements, Intel generic drivers and software can be obtained from the Intel Download Center.

The Intel WiDi Update Utility[6] is often not preferred for business environments.   It is intended for a consumer user with permissions to install software and drivers on their system. Enterprise policies often prevent end users ability to accomplish this. In addition, most PC manufacturers have a customized graphics driver. Intel recommends IT managers refer to OEM drivers first.   If an IT managers chooses to use the latest graphics drivers found on Intel.com, the existing OEM customized drivers must be removed.

More information on silent installation of the drivers and application is available via Appendix A.

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[6] This tool cannot update platforms with customized OEM drivers. https://downloadcenter.intel.com/download/23239/Intel-WiDi-Update-Tool

2.7 Interoperability with other Wireless Display Capable Devices

The complete Intel Pro WiDi experience occurs when both the client and receiver devices are Intel Pro WiDi certified.   Other wireless display capable devices can connect to an Intel Pro WiDi receiver as explained in the following table with associated notes:

	Intel Pro WiDi Client	Intel WiDi Client	Miracast Client [1]
Hardware Specifications	Intel Dual-Band Wireless 72xx/82xx [2] 4th/5th/6th Gen Intel Core vPro Processor with Intel HD graphics	Intel Wireless support for Intel WiDi [3] Intel Processor with Intel HD graphics	Various platforms. See operating system requirements below
Operating System	Microsoft Windows 7, 8.1, 10	Microsoft Windows 7, 8.1, 10	Microsoft Windows 8.1 or 10, supporting WDDM 1.3 [4] Google Android 4.2.2 or higher with enabled BSP [5]
Dual-Channel Wireless and Different Channel Mode (DCM) [6]	Yes	Varies [8]	Varies [8]
Intel WiDi application versions [7]	5.x, 6.x (recommended)	3.x, 4.x, 5.x, 6.x	Not applicable
Confirmation Before Presenting	Yes	No	No
Manage Wireless Display Session	Yes	No	No
Participate in Wireless Display Session	Yes	Yes [8]	Yes [8]

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NOTES:

1. Miracast is an industry standard defined by WiFi Alliance.   Google Chrome OS, Apple iOS, and Apple Mac OS X platforms do not support as of October 2015

2. Please refer to ark.intel.com for a list of Intel Wi-Fi modules supporting Intel WiDi and intended for an Intel vPro platform.
   http://ark.intel.com/compare/83635,84177,75439,75440,86068

3. Please refer to ark.intel.com for a list of Intel Wi-Fi modules support Intel WiDi.
   http://ark.intel.com/compare/84178,75174,75442,66888,66889,59481,59480,59474,59470,59471,59472,66890

4. WDDM refers to Windows Display Driver Model.   Intel HD graphics driver version 10.x natively supports WDDM 1.3. Please refer to the device OEM video graphics specification and associated drivers to determine whether WDDM 1.3 is supported.

5. BSP refers to Android Build Support Package.   Please refer to the device OEM or reseller documentation.   Miracast support may be referred to as "wireless display", "screen mirroring", or "screen sharing"

6. Dual-Channel wireless indicates both 2.4Ghz and 5Ghz capabilities, which must match the settings of the Intel Pro WiDi receiver.   Different Channel Mode enables two simultaneous network associations on different wireless channels.

7. Please refer to the Read Me document associated to the Intel WiDi application download and installation for additional details

8. Caveats of connectivity to an Intel Pro WiDi receiver and participation in the wireless display session are commonly due to support of Dual-Channel Wireless and Different Channel Mode.

3 Conference Room

3.1 Area of Responsibility

Those responsible for the conference room environment will be intimately familiar with the room build out such as ports and connections, conference room displays, whether video scalers are present, and so forth.

3.2 Specific items to know about Intel Pro WiDi

Intel Pro WiDi requires a receiver, either an adapter connected or capability integrated into the conference room display device.   If the adapter supports remote management, either a network or wireless infrastructure connection is required along with a centralized remote management console. The power, network, and video connections, along with placement of the adapter, in the room are the focuses of this role.

Some Intel Pro WiDi receivers include a USB port.   The advanced USB-over-IP (UoIP) or User Input Back Channel (UIBC) capabilities of the adapter are used for touch screen displays or other compatible USB Hardware input devices.

These factors will need to be considered by those responsible for conference room environments. Please refer to your preferred Intel Pro WiDi receiver vendor for additional details on USB connected devices for the adapter.

3.3 Basic Physical Connections

Please refer to the receiver vendor documentation.   Common points of consideration include:

- Power source and connector
- Location and mounting of the receiver
- Network connectivity, if remote management is applicable

If the receiver is an external adapter connected to the display device, additional considerations:

- Video-out connection, whether HDMI or VGA
- Display device is set to the correct video input setting
- Audio connection, if display device supports audio and video is connected via VGA
- USB connectivity, if supported by adapter

NOTE: Refer to receiver vendor documentation whether DVI or other video connections possible.

NOTE: Displays that support HDMI-CEC for autosensing video input may specific receiver device settings to power-off the HDMI interface when the unit is idle and no active wireless display sessions are occurring.   Please refer to the receiver vendor documentation.

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3.4   Settings for Extended Display Identification Data (EDID)

Conference rooms that do not have direct connection between the Intel Pro WiDi adapter (i.e. the video source) and the conference room display (i.e. the video display) will likely have an EDID device commonly associated with video display splitters, extenders, scalers, or similar video control units. The EDID capable solution may have support for HDCP (High Definition Content Protection), specific display output resolutions, video capable extensions, and so forth.   When connecting the Intel Pro WiDi adapter via an EDID device, the conference room video display may show a distorted or blank screen due to settings not compatible with the source Intel Pro WiDi adapter.

The following example shows feature specific settings for the Actiontec ScreenBeam Business Edition receiver. Settings that may need adjustment when an EDID device is involved include:

- Force EDID at RTSP M3
- HDCP Encryption
- VGA Compatibility Mode
- TV Screen Size (Overscan settings)
- Aspect Ratio
- HDMI-CEC
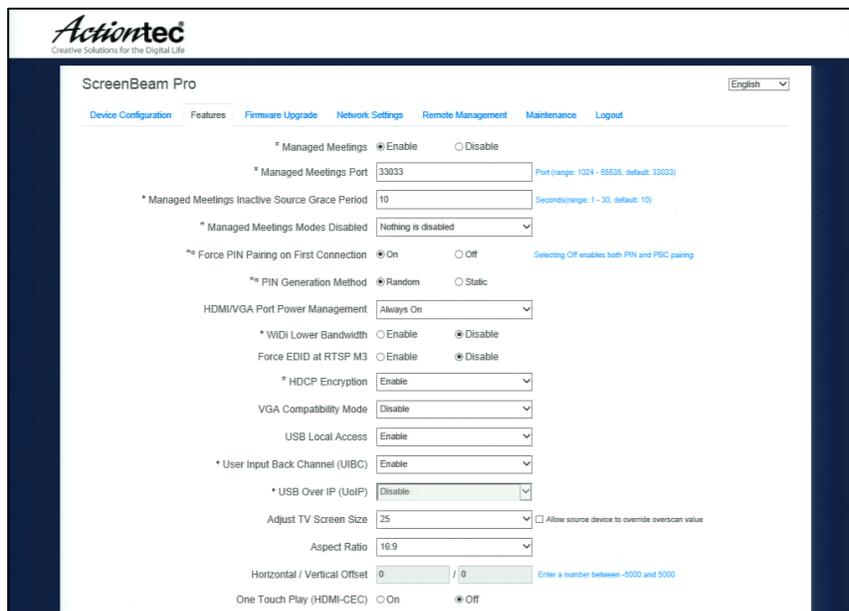
Please refer to Actiontec or other certified vendor documentation for additional details.

3.5   Settings for Remote Management

Please contact your Intel Pro WiDi receiver vendor regarding their ability to support remote management of the adapter and the associated settings.

3.6   Connections and Settings for USB Input or Touchscreen

USB Human Interface Devices (HID) such as keyboard, mouse, or touch screen can be attached to the wireless display adapter.   This configuration is common in education environments or when touch screens are used to collaborate with meeting attendees.
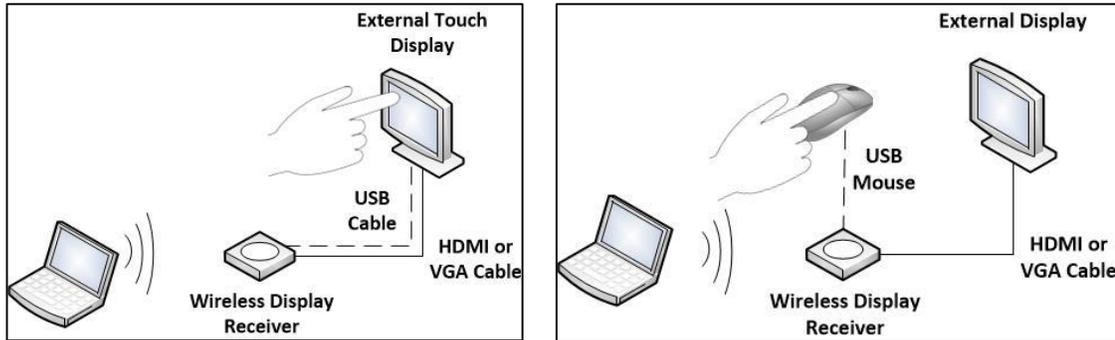
When a USB input device is connected, the wireless display configuration settings must be adjusted to enable the USB interface.   USB-over-IP (UoIP) is recommended for Microsoft Windows 7 and 8.1 client devices.   User Input Back Channel (UIBC) is recommended for Microsoft Windows 10 client devices.

Please refer to Actiontec or other certified vendor documentation for additional details for more information how to enable this feature.

NOTE: Customers using Actiontec ScreenBeam Central Management System (CMS) will have a USB-to-Ethernet or USB-to-Wireless adapter connected to the USB port of the Actiontec ScreenBeam Business Edition. Please contact Actiontec to discuss supported options in this scenario.

4 Network Infrastructure

4.1 Area of Responsibility

This role focuses on wireless network infrastructure and management of network devices. The individuals involved are intimately familiar with the wireless channel spectrum utilization in the environment and how to fine tune the environment to ensure a great connectivity experience.

4.2 Specific items to know about Intel Pro WiDi

Specific to Intel Pro WiDi, this individual will define the initial configuration settings, handle remote management of the wireless display receivers and help to ensure a great wireless display experience.

As mentioned in Section 1.3, Intel Pro WiDi is built upon the Miracast standard. Communications occur via 802.11n between the transmitting client device and the wireless display adapter. The wireless display adapter is the Autonomous Group Owner (AGO) and include the ability of wireless channel selection. The transmitting client device supports Different Channel Mode (DCM), enabling two separate wireless network associations on different wireless channels whether in the 2.4 GHz or 5 GHz band.

Reference the receiver vendor documentation for details how to access and adjust network related setting.

As a reference for wireless infrastructure best practices, please reference the associated IT@Intel White Paper[7]

4.3 Remote Management of the Intel Pro WiDi Adapter

Please contact your wireless display adapter vendor regarding their ability to support remote management and the associated network infrastructure requirements.

4.4 Wireless Infrastructure Assessment

When planning the placement and configuration of the Intel Pro WiDi adapter for the environment, consider the infrastructure wireless utilization. The wireless display receiver can be set to any non-DFS[8] channel in the 2.4 GHz or 5 GHz band.

A variety of wireless infrastructure assessment tools are available for 802.11 a/b/g/n/ac networks. This document references inSSIDer by MetaGeek, a simple tool that shows wireless network beacons. For a complete assessment of wireless network saturation or full spectrum analysis, additional tools may be available to you.

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[7] See http://www.intel.com/content/www/us/en/it-management/intel-it-best-practices/wireless-infrastructure-implementation-best-practices-paper.html
[8] Dynamic Frequency Selection

An example enterprise wireless environment with an Intel Pro WiDi receiver is shown below. The assessment should occur near the location of the Intel Pro WiDi adapter.
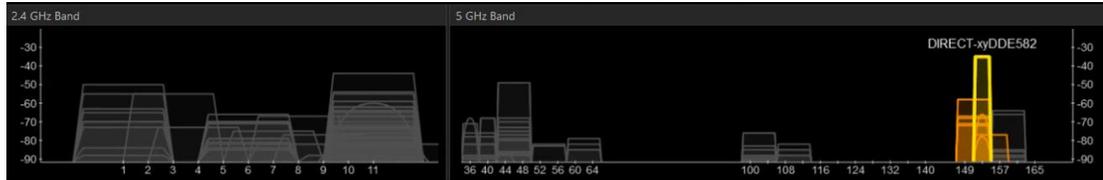
The receiver SSID is labeled **DIRECT-xyDDE582** in this example. Actiontec ScreenBeam Business Edition adapters will commonly be shown via wireless beacons with DIRECT-xyXXXXXX, where the last 6 characters are unique per adapter. This wireless beacon label is not reflective of the wireless display receiver names seen by the users when scanning for devices via the Intel Pro WiDi application.

When a specific SSID is selected in the inSSIDer tool, additional information is shown:

The following guidance is provided based on these example screens in regards to Intel Pro WiDi:

- The wireless display receiver operates on 802.11n with WPA2-Personal security which includes CCMP-AES encryption
- Link score, as defined by inSSIDer, is a grade for each network calculated by its signal strength, channel power, and number of networks competing for airtime. With a range of 0-100, the higher the value the better.
- Co-Channel, as defined by inSSIDer, indicates other access points on the same wireless channel. Each access point will negotiate when to transmit signal. The more access points on the same channel, the slower the overall performance for every connected device. For Intel Pro WiDi, a value of 10 or less is recommended. The actual value will vary based on the number of client devices connected to co-channel networks and their respective level network activity, which is beyond the capabilities of the inSSIDer utility to determine.
- Overlapping channels should be avoided. As defined by inSSIDer, this refers to stations or access points on overlapping channels or frequencies. This causes transmission corruption and slows performance for connected devices. Overlapping channels have a more severe impact on performance than co-channel networks. Overlapping channels are common in the 2.4GHz band when access points are set to channels beyond 1, 6, and 11. This is also a reason to set the Intel Pro WiDi adapter to a channel in the 5 GHz band.
- Signal refers to the RSSI (Received Signal Strength Indication) of the wireless access point. For quality wireless communications, a signal strength of -67 dBm or better is recommended. In this example, a value of -35dBm indicates a strong signal.

Additional observations from the inSSIDer tool in regards to Intel Pro WiDi:

- Dynamic Frequency Selection (DFS) channels exist only in enterprise wireless infrastructure and cannot be used for wireless display.   The list of DFS channels will vary by country.[9]
- Intel Pro WiDi uses standard 20 MHz range within a channel, commonly referred to as standard.   Wide channels are common in the 5 GHz spectrum, using a 40 MHz range and shown as two channels together such as 149+151.

4.5 Select an Appropriate Wireless Channel for Intel Pro WiDi

The following screenshot shows the Actiontec Configuration Settings page via a web browser, which can be accessed via an active wireless display session if the appropriate address and credentials are used.
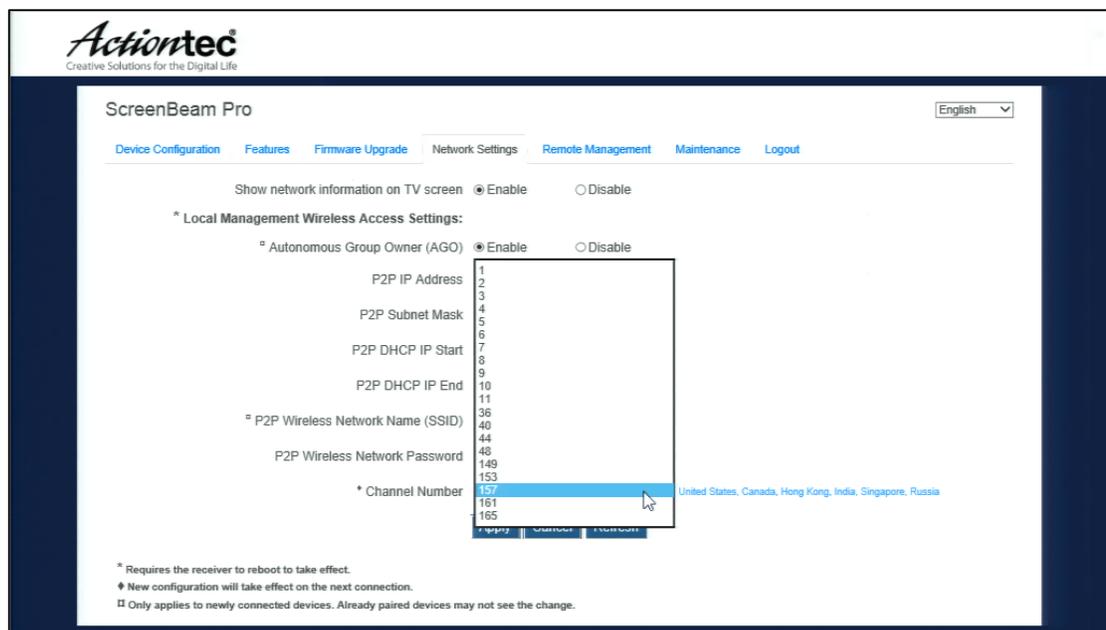
NOTE: The wireless channels shown apply primarily to North America.   The available wireless channels may differ in other countries and regions.

Please check with your preferred Intel Pro WiDi receiver vendor for a similar setting capability.

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[9] For a list of DFS and related wireless network channels, see http://en.wikipedia.org/wiki/List_of_WLAN_channels

As a reference in selecting a channel, the following example inSSIDer snapshot is provided:
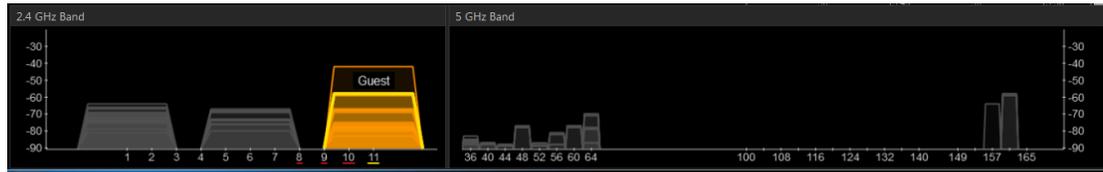
In this example, wireless channels 149, 151, or 165 would be good candidates for the following reasons:

- Use a 5 GHz channel for the Intel Pro WiDi receiver.   The 5 GHz spectrum, especially the higher channels, is often not used for corporate wireless due to signal penetration.   An Intel Pro WiDi session will commonly occur within a conference room with the client system less than 20 meters away and minimal obstructions.   This will require connecting client devices to support dual-band wireless, which is standard on Intel Core vPro platforms.
- Use a wireless channel that is non-overlapping.   Often the wireless display receiver is set to default channel 11.   Changing to an available 5 GHz band channel is recommended.
- DFS channels cannot be selected.   For North America, the DFS channels are 52-140[10].
- If co-channel networks exist, ensure other access points are separated by at least 20 dBm

The lower 5 GHz band, channels 36-48, would also be good candidates in this example.

With the enterprise wireless network dynamically adjusting based on users and devices, a re-assessment of the environment at different times or weekdays may be needed to determine the appropriate channel per Intel Pro WiDi adapter.

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[10] See list of WLAN channels at http://en.wikipedia.org/wiki/List_of_WLAN_channels

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4.6 Conference Room and Quality of Service Considerations

In a dense conference room environment where multiple Intel Pro WiDi receivers will be in range of each other, additional considerations may apply. In the example below, 6 conference room are shown with an Intel Pro WiDi receiver in each room connected to either a flat panel display or projector. In this example, a client PC in Conference A may see the wireless display receivers in Conference Rooms A through F. Similarly, the Intel Pro WiDi receivers are set as Autonomous Group Owners for the Wi-Fi direct sessions and by default will have overlapping wireless signals.
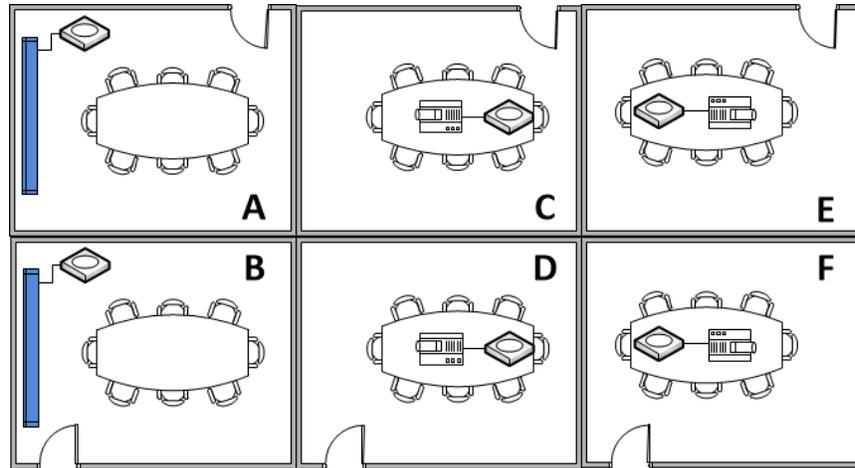
Intel Pro WiDi supports 802.11e QoS (Quality of Service). The video and audio packets are marked as AC_VI (video) which enables the transmitter to have priority over other non-QoS packets. QoS only applies to devices on the same wireless channel.

If infrastructure wireless solutions, such as such as VoIP (Voice over IP) which utilizes 802.11e QoS setting AC_VO (Voice), are present they will have a higher priority than the wireless display. With a Wi-Fi over the air PHY data rate above 100Mbps and a wireless display throughput maximum of 10Mbps, approximately 10% of the available wireless network communication on a specific channel is used by wireless display QoS packets.

Early deployment testing of Intel Pro WiDi indicated that up to 6 wireless display adapters can be in range of each other on the same wireless channel without causing conflict to the enterprise wireless infrastructure. If adjustments are needed, a simple solution is to set the wireless display receivers to separate channels based on channel availability.

5 Client and Infrastructure Security

5.1 Area of Responsibility

This role focuses on the protection of corporate electronic assets, especially when transmitted by a device via wireless to a display while connected to the corporate infrastructure. Ensuring the data being transmitted and the source of that data is protected from intrusion while allowing the intended functionality is the focus of this section.

5.2 Specific items to know about Intel Pro WiDi

The foundation of Intel Pro WiDi is industry standard Miracast as defined by the Wi-Fi Alliance. Once established, the Wi-Fi direct session is protected via the WPA2-Personal standard. Transmitted content can be further protected via High Definition Content Protection (HDCP) version 2.x.

The Wi-Fi-Direct session of Miracast utilizes a wireless personal area network (WPAN). The Miracast architecture is native to Microsoft Windows 8.1 and 10, when the installed graphics driver supports Windows Display Driver Model (WDDM) version 1.3[11]. Miracast was also adopted via select Android based devices. The Microsoft Windows 7 operating system does not natively support Miracast, requiring an extension to the operating system that is provided via Intel My Wi-Fi Technology in the Intel PROset Wireless Software.

The WPAN session is established similar to a wireless infrastructure session. The Intel Pro WiDi receiver is the Autonomous Group Owner (AGO) to define the wireless session parameters including wireless channel and session security. The Intel Pro WiDi receiver also includes a DHCP server with a defined TCP\IP address scope. The sequence in establishing a session is summarized below:

1. Scan for available wireless display receivers.
2. User selects the target receiver.
3. Peer to peer session occurs via Wi-Fi Direct.
4. DHCP lease reply\request occurs via UDP ports 67/68. The IP address of the receiver and the DCHP scope are customizable.
5. An IP address is assigned to the wireless personal area network of the client system, a Miracast RTSP (Real Time Streaming Protocol) determines the systems capabilities between the transmitting client and receiving wireless display adapter.
6. Simple Service Discovery Protocol (SSDP) on multicast port 1900 occurs to determine the USB-over-IP capabilities of transmitting client and receiving wireless display adapter.
7. Intel Pro WiDi session is established using the Miracast protocol on TCP port 7236.

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[11] See https://msdn.microsoft.com/en-us/library/windows/hardware/dn265513%28v=vs.85%29.aspx

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5.3 Common Enterprise Security Settings to allow Intel Pro WiDi

A comprehensive list of all enterprise security solutions that may need adjustment to allow Intel Pro WiDi is beyond the scope and purpose of this document.   Three common areas of focus include:

1. The pairing method between transmitting and receiving devices.
2. Enterprise security policies to allow hosted networks for the WPAN.
3. Client security or wireless supplicant settings to allow only wireless display via the WPAN

Using the foundation guidance of the previous sections on how wireless display operates, the following sections focus on specific focus points.   If additional guidance is needed, please contact the receiver vendor.

5.4 Select an appropriate pairing sequence

The initial pairing between the transmitter and receiver devices is via Wi-Fi Protected Setup (WPS) with a preference for PIN entry by the user. The default setting is a dynamic PIN shown on the conference display that must be entered by the user.   An alternative option is a static PIN that is not shown on the display but must be known and entered by the user.   Pairing between the client transmitter and the wireless display receiver can also occur via an automated push button configuration (PBC) to simplify the initial connection experience, if enabled by transmitting client and receiver devices.

The Intel Pro WiDi pairing process will create a display device on a Microsoft Windows client.   The pairing process occurs only once.   Once pairing has completed, subsequent connections utilize the device setting for future wireless display sessions.   If the security settings of the wireless display receiver are changed, the device must be removed from the Microsoft Windows client and the pairing process restarted.

5.4.1 Dynamic PIN

The default and preferred approach is a dynamic PIN that is shown via the Intel Pro WiDi receiver at the top of the external display.

5.4.2 Static PIN

If displaying the PIN is not preferred, use a static PIN.   A static PIN is defined via the configuration settings of the wireless display receiver and must be known by those wanting to pair to the receiver.

In the following example, the static is 12345670.   The PIN can be changed by the administrator.
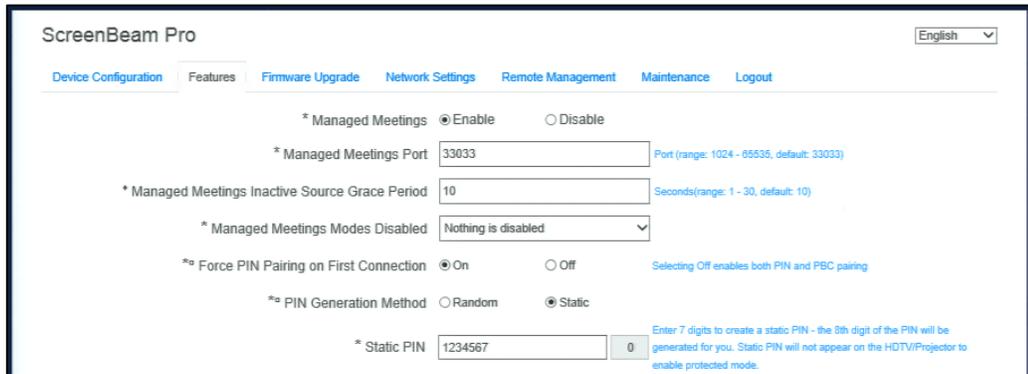
NOTE: If the PIN Generation Method is changed from Random to Static, all client devices previously paired to the adapter will need to remove the virtual display device and restart the pairing process due to the security setting change of the receiver.

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When a client PC initiates a pairing session with the device, the following message will appear and the user will need to know the static PIN.

5.4.3   Push Button Configuration (PBC)

For simplicity and device interoperability, use push button configuration (PBC). This is the default option for Microsoft Windows 8.1 systems supporting wireless display and will allow for specific Android devices that support Miracast to connect. If Microsoft Windows devices have already paired to the receiver before changing this setting, the display device on the client must be removed and repaired after the change.

Reference the wireless display receiver user manual for more information on how to enable this feature.

5.5 Microsoft Active Directory Group Policy Setting for Wireless Display

Microsoft Active Directory Group Policy settings must allow for Wi-Fi direct communications. Microsoft Windows 7 systems are impacted if Hosted Networks are not allowed. Microsoft Windows 8.1 and 10 systems are impacted if Wi-Fi Direct Groups are not allowed.

5.5.1 Domain Group Policy Settings

On a Microsoft Windows Server 2008 R2 or higher, the domain group policy for wireless network security must allow for Hosted Network and Wi-Fi Direct Groups. The options for **Don't Allow Hosted Networks** and **Don't Allow Wi-Fi Direct Groups** must be unselected

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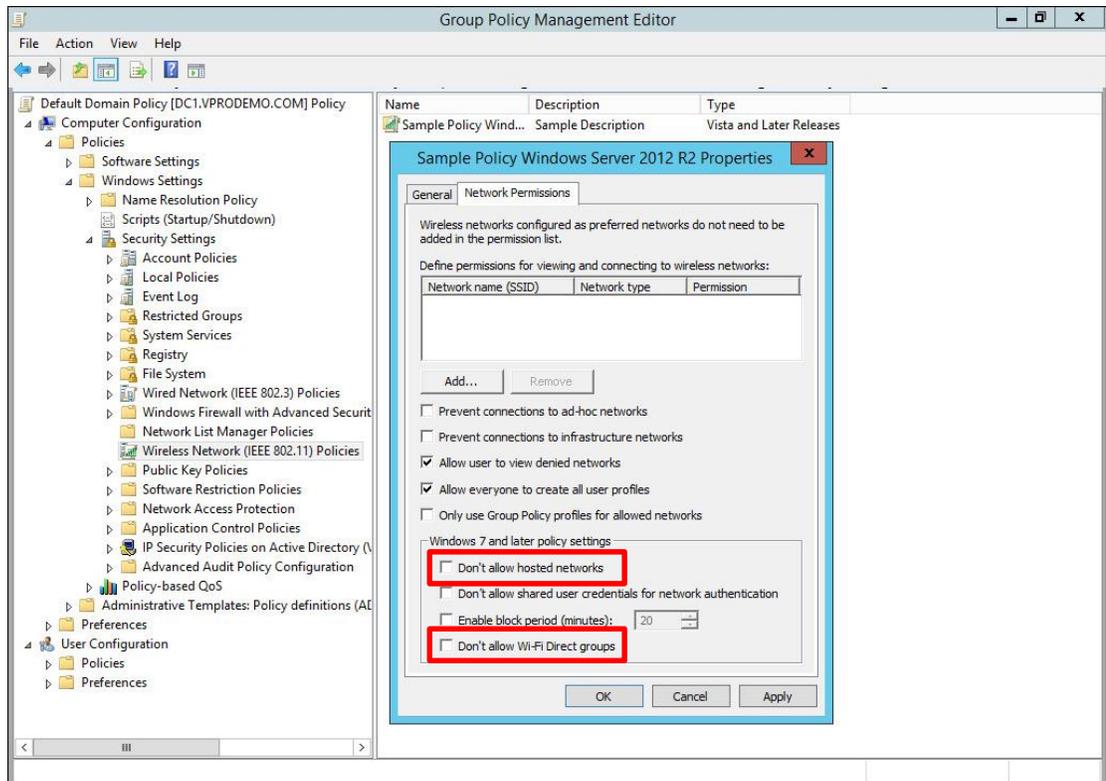
5.5.2 Validate Resultant Domain Group Policies on the Client

To ensure the latest domain group policies have been applied to the client system, run **gpupdate.msc**

To validate the resultant set of policies applied to the client, run **rsop.msc**
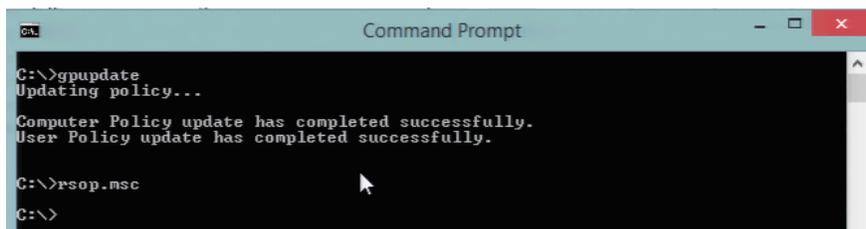
The client system will check all domain enforced policies and show a screen similar to the Group Policy Editor shown previously.   The difference is that resultant policies are read only on the client. Navigate to the Wireless security settings to validate that Host Networks and Wi-Fi Direct groups are allowed.
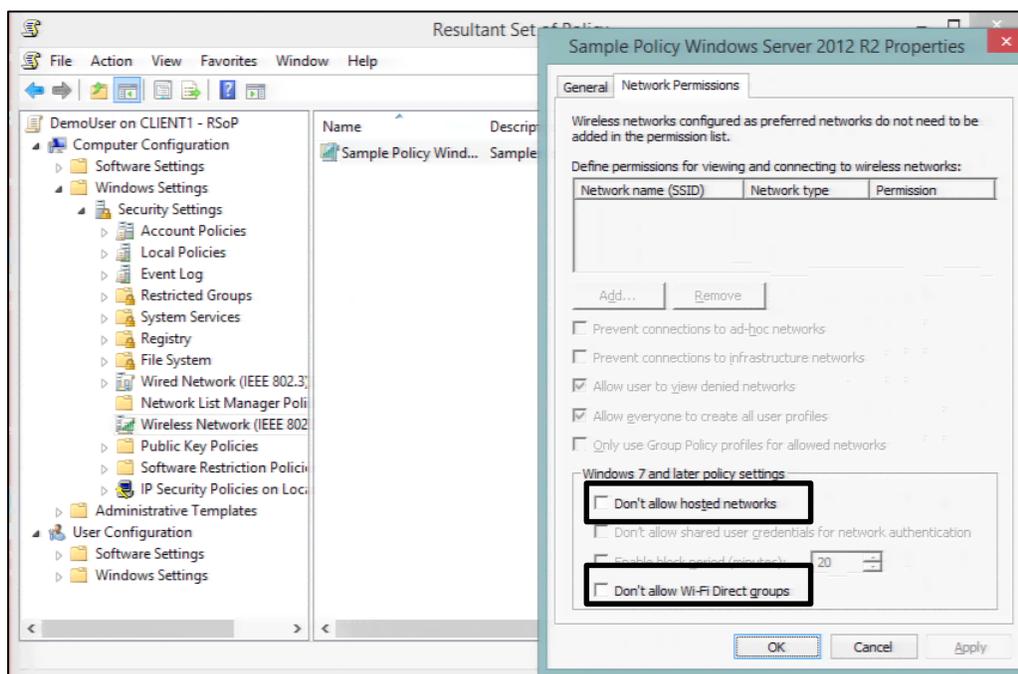
5.5.3 Addressing Common Concerns to Allowing Hosted Networks

Hosted networks must be allowed for Microsoft Windows 7 client to participate in a wireless display session.   Foundational information on Hosted Networks is available via Microsoft MSDN[12].   Enabling

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[12] See https://msdn.microsoft.com/en-us/library/windows/desktop/dd815243(v=vs.85).aspx

or disabling of hosted networks does not impact wireless display on Microsoft Windows 8.1 or 10 clients.

Security tools outside the scope of this implementation guide can help to identify and remediate client systems of concern, and still allow for hosted networks to be enabled.

There are two main components to a wireless hosted network within the Microsoft Windows 7 operating system:

- Virtualization of a physical wireless adapter
- Software-based access point ("Soft AP") that is disabled by default

A common, and valid, concern is that the hosted network will be started and the specific wireless connection settings will be known to others.   As a reminder, adjusting the settings and starting the "Soft AP" requires local administrator.   If the hosted network is started and active, it will appear as an independent access point in the enterprise environment.   If the system is rebooted or resumes from sleep, the hosted network status will reset to "not started".

In consideration of the timeframe and environment when wireless hosted networks was introduced, a few environmental items have changed.   Users have mobile hotspots, often via a smartphone which may be connected via USB to a client system and effectively bypass the intended reason of disabling hosted network.   Wireless is more pervasive and sharing via wireless hosted networks may be less of a requirement.   An independent wireless access point in a corporate environment with wireless network monitoring tools will often be seen as a rogue access point with associated measures to isolate.   Plus, as a reminder, starting the hosted network requires local administrative access which changes the security perspective of allowed user access or other potential attack surfaces.

5.6 Client Firewall and Intrusion Prevention Settings

This subsection identifies the client firewall and intrusion prevention settings to allow for Intel Pro WiDi session.   These settings commonly occur via an administrative console of the client security solution for the enterprise

5.6.1 Allow Applications and Services for the WPAN interface

The following applications and services must be allowed for Intel Pro WiDi to function correctly:

- WiDiapp.exe – Specific to Microsoft Windows 7 clients, this is the Intel WiDi application as found at c:\Program Files\Intel Corporation\Intel WiDi\WiDiapp.exe.
- WUDFhost.exe – Specific to Microsoft Windows 8.1 clients, this is the Microsoft Windows User Device Frame Driver located at c:\Windows\Systems32\WUDFhost.exe.
- UoIPServer.exe – This service is optional for Intel Pro WiDi but must allowed if USB Hardware Input Devices such as keyboard, mouse, or touch display will be connected to the wireless display receiver.   The application is located at c:\Program Files\Intel Corporation\USB over IP\UoIPserver.exe.

5.6.2 Ports, Protocols, and Direction of Communication

The following table provides additional details specific to the WPAN interface for the Intel Pro WiDi session.   Items in **BOLD** indicate minimum requirements for a single wireless display session.

Service	TCP\UDP	Port	Direction	Specification	Notes
Miracast	TCP	7236	Bi-Directional	Miracast	
Simple Discovery Protocol (SSDP)	UDP	1900	Bi-Directional	IETF	Required for USB-over-IP Discovery and functionality
USB over IP (UoIP)	TCP	Above 52000	Bi-Directional	Intel Proprietary	Preferred over UIBC. Uses Dynamic Upper ports. Not commonly restricted by firewalls
Managed Meeting session	TCP	see notes	Bi-Directional	Intel Proprietary	Configurable. Actiontec default is port 33033
HDCP AKE	TCP	See notes	Bi-Directional	Miracast	Applicable if HDCP is enabled. Actiontec uses port 25030
Real-Time Transport (RTP) A/V Stream	UDP	See notes	Client to Receiver	Miracast	Actiontec uses 24030
Intel Fast Cursor	UDP	See notes	Client to Receiver	Intel	Actiontec uses 1232
Microsoft HW Cursor	UDP	See notes	Client to Receiver	Microsoft	Actiontec uses 19134
User Input Back Channel (UIBC)	TCP	Above 49152	Receiver to Client	Miracast	Uses Dynamic Upper ports. Not commonly restricted by firewalls

6 HelpDesk and User Support

6.1 Area of Responsibility

This role focuses on the troubleshooting of events that may impact user productivity.   Specific to Intel Pro WiDi, this individual helps to isolate and possibly resolve wireless display issues when needed.   When needed, this individual will engage peer teams for PC lifecycle, Conference Room and Facilities, Network Infrastructure, or Security to assist in resolving a situation.   In addition the guidance of this implementation guide, this individual may contact a specific component vendor of the Intel Pro WiDi solution for further assistance.

6.2 Specific items to know about Intel Pro WiDi

There are three main components associated to Intel Pro WiDi: client system (transmitter), wireless display adapter (receiver), and the conference room display.   The Intel Pro WiDi experience is impacted when one or more components is not configured correctly or the target environment is disrupting the Wi-Fi direct communication.

A common approach to troubleshooting Intel Pro WiDi is to isolate what solution component or environment scenario may be impacting the overall solution.   Review of the prior sections will assist in this process.   When needed, contact the specific vendor of the transmitter or receiver device. When needed, assess changes to the environment to allow for wireless display.

6.3 Troubleshooting Intel Pro WiDi

6.3.1 Transmitter Device Assessment

Refer to section 2 for the minimum hardware and driver requirements of an Intel Pro WiDi client device, in addition to other devices that support Intel WiDi and Miracast.   The Intel WiDi Compatibility Tool can be used on Microsoft Windows client devices to further assess a specific platform.

Common consideration points when assessing the client transmitter include:

- Determine whether the issue impacts a specific device model or all
- Validate the device is Intel Pro WiDi capable (see Sections 2.5 and 2.7)
- Restart the pairing process on the client
- Apply the most recent OEM and\or operating system updates
- Test connectivity with a consumer Miracast or Intel WiDi receiver (see Section 6.3.1 below)
- Assessing whether Hosted Networks is allowed (see section 5.5)
- Temporarily disable or adjust VPN settings
- Temporarily disabling or removing client security solutions

NOTE: VPN solutions often create a virtual network interface and redirect all network communications resulting in disruption to wireless personal area network (WPAN).   If disabling or removing the VPN client restores wireless display, contact the VPN vendor for additional guidance.

NOTE: If wireless display is successful after disabling, refer to section 5.6 to determine security adjustments that allow wireless display and maintain security.

6.3.2 Receiver Device Assessment

A complete Intel Pro WiDi experience requires an Intel Pro WiDi certified receiver.   Common differences between a consumer and business wireless display receiver include:

- Branding and certification that the receiver is Intel Pro WiDi.
- An Intel Pro WiDi receiver is seen via Wi-Fi beacon scanners.   (See section 4.4)
- Either local or remote management options exist to adjust receiver settings.

Ensure the receiver device is updated to the current firmware release.

For additional assistance, please contact the receiver vendor.

6.3.3 Environment Assessment

If the considerations for transmitter and receiver have been completed, use the same devices in a different environment.   For example, if issues are occurring in a meeting room, re-test the equipment in a different building or location.   Review sections 4.4 through 4.6.   If needed, contact your receiver vendor regarding remote management options.

If the pairing sequence or security settings of the wireless display receiver(s) changed, the associated virtual display device on the client systems will need to be removed and the pairing process restarted.

6.4 Capturing Intel WiDi Logs

The Intel WiDi application provides both an installation log and a runtime log.   Both logs are helpful when working with Intel Customer Support to understand the main issue.

6.4.1 Intel WiDi Application Installation Logs

During installation of the Intel WiDi application, an MSI log and WDL log are created as follows:

- C:\users\<UserID>\AppData\Local\Temp\MSI<number>.log
- C:\temp\WiDiSetupLog.<timestamp>.log

6.4.2 Intel WiDi Application RunTime Logs

To enable runtime logging of the Intel WiDi application:

1. Exit the Intel WiDi application
2. Ensure c:\Temp directory exists on the client
3. Open the Microsoft Windows Registry using Regedit.exe
4. Enable logging via the following Windows Registry Keys
   - HKEY_CURRENT_USER\Software\Intel Corporation\Intel WiDi\LogEnable=1
5. Exit Regedit.exe

Start the Intel WiDi application and repeat the sequence of events leading to the error experienced.

Location of Intel WiDi Application RunTime log files:

- C:\Temp

Intel WiDi Application RunTime log file naming format:

- WiDiLog.<date>.<time>.wdl

Share the collected logs files with your vendor support representative.

NOTE: At this time, full review of the WDL format log file requires a tool available only to authorized Intel support representatives.

6.5   Contact Intel Support

For assistance specific to Intel WiDi software and associated utilities referenced in this document, please contact Intel Customer Support (ICS).

Multiple options exist for contacting ICS. Start at:
http://www.intel.com/p/en_US/support/contactsupport

The following is a quick example

Select your region and product. Intel WiDi and Intel Pro WiDi are part of the Intel® Wireless Networking product family.

At the next prompt, select Intel Wireless Display Technology.

The next prompt provides communications options.


```
Guest: Intel® Wireless Display Technology
Intel:  If you purchased a complete system please
        contact the system manufacturer for updates
        and support.

        To provide support we need the Intel® Wireless
        Display software version, graphics driver and
        wireless networking driver version.

        When you have this information click:
        📨 Live Chat
        📧 Email
        ☎ Phone
        💬 Community
        📧 Email Pre-Sales
```

An Intel representative will respond to the request via the selected preferred method.

7 Appendix A – Silent Installation

7.1 Introduction

When a driver or application is needed for an Intel Pro WiDi client system, the OEM provided package is commonly a self-extracting installation wizard with no apparent silent or scripted options applicable to software delivery solutions. Most OEM packages can be extracted to expose the underlying folder\file structure for the Intel HD graphics and Intel PROset\WLAN driver packages. If the driver updates are obtained via Intel Download Center, a similar folder\file structure will occur. The Intel WiDi application is a single executable.

The preferred source for updates is from the OEM.

This section of the document provides guidance how to use the silent installation commands associated to the driver and application. A complete explanation how to re-package the installer for distribution across several clients systems is beyond the scope of this document.

7.2 Silent Installation of the Intel Generic Graphics Driver

Using the extracted files, run **setup.exe -?** to see the command-line options of the Intel Graphics package installation.
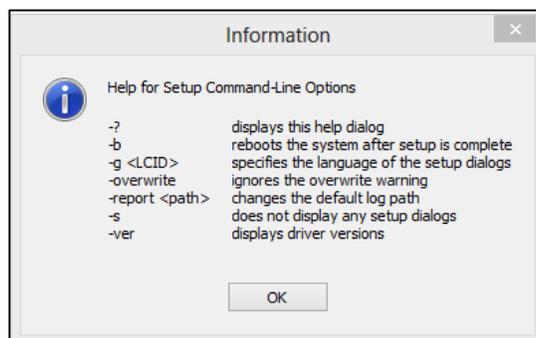
Running the command **setup.exe –s –overwrite** will silently install the driver, overwriting existing Intel graphics drivers and suppressing the system reboot. A reboot is recommended once all driver and software updates have completed.

7.2.1 Overwriting OEM driver via silent installation

NOTE: An OEM driver update is preferred. If the OEM provided graphics driver does meet recommend minimum versions, testing with an Intel generic driver will require removal of the OEM platform optimized driver.

If an OEM customized driver is present, the driver from Intel Download Center will fail to install with reference to incompatible platform. An additional step is required. Using the downloaded and extracted Intel graphics package, first run **setup.exe –uninstall –s**. Once that completes, then run

setup –s –overwrite.   This sequence will remove the OEM driver, install the Intel driver, and allow for the network driver package installation to occur before rebooting the client system.

7.3   Silent Installation of Intel PROset package and driver

To create a silent installation package, the Intel PROset/Wireless Software and Drivers for IT Administrators is required, available at http://www.intel.com/support/wireless/wtech/proset-ws/sb/CS-034038.htm.   The file downloads will be in ZIP format instead of single installation EXE format. The recommended package version for Intel Pro WiDi support is 17.14 or higher.

7.3.1   Intel Wireless driver for Microsoft Windows 8.1 and 10 platforms

Microsoft Windows 8.1 and 10 platforms only require the appropriate Intel Wireless LAN Driver as Wi-Fi-Direct and wireless display is native to the operating system.   The Intel PROset software extensions are not required.

Access the Intel PROset/Wireless Software and Drivers for IT Administrator webpage as indicated above, specifically for version 18.20 or higher.   In the file download area, the specific file for 32-bit platforms will be Wireless_ (Version) _De132.zip.   The specific file for 64-bit platforms will be Wireless_ (Version) _De164.zip.   The extract file downloads will include only the wireless drivers.

7.3.2   Intel PROset and Wireless driver for Microsoft Windows 7 platforms

Intel PROset/Wireless software package is required for Microsoft Windows 7 platforms, specifically the Intel PROset Package Wireless Software Extensions to enable Wi-Fi direct along with the Intel Wireless LAN driver.

Access the Intel PROset/Wireless Software and Drivers for IT Administrator webpage as mentioned earlier, specifically for version 18.20 or higher.   In the file download area, the specific file for 32-bit platforms will be Wireless_ (Version) _Win32.zip.   The specific file for 64-bit platforms will be Wireless_ (Version) _Win64.zip.   These downloads include the complete Intel PROset installation.

Extract the downloaded ZIP file specific to the target operating system.   Advanced configuration options as referenced in Appendix B require the Intel PROset Administrator Tools on one client system and can be selected by manually executing **setup.exe.**

To see the available silent installation options, run **setup.exe -?**

For silent installation of Intel PROset and wireless drivers on a Microsoft Windows 7 client use:

> **setup.exe –s -norestart**

7.4 Silent Installation of the Intel WiDi application

Version 6.x or higher of the Intel WiDi application is recommended for Intel Pro WiDi.

The downloaded file is **setup.exe** and be used on either 32-bit or 64-bit platforms.

To see available silent installation options, run **setup.exe -?**
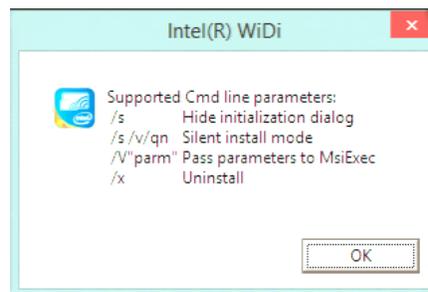
An example silent installation of the Intel WiDi application with option to disable Windows desktop shortcut icons is shown below:

> **Setup.exe /s /v/qn /V"WIDIAPP_DESKTOP_SHORTCUT=0"**

NOTE: The Windows desktop icon may be preferred for Windows 7, as the wireless display connection occurs via the Intel WiDi application. In Microsoft Windows 8.1 or 10 environments, clicking the connect option in the Intel WiDi application initiates a shortcut key to complete the connection via the operating system.

8 Appendix B – Intel PROset Administrator Control

8.1 Introduction

Intel PROset Software Extensions are required for Microsoft Windows 7 clients. In addition to the software extension, an administrator profile can be defined to restrict usage Wi-Fi Direct communications.

A single PROSet package will be defined using Intel PROSet administrator tool to apply wireless display session security options. Once defined on the administrator or reference system, the resulting package can be applied to other client systems by running the saved executable file on each client.

Wireless display security settings that can be defined by Intel PROset administrator and applied to Microsoft Windows 7 clients include:

- Restrict the Wi-Fi direct session to only Intel WiDi connections
- Isolate the personal area network (PAN) from infrastructure wireless LAN (WLAN)
- Allow USB over WiDi functionality
- Enable the Intel WiDi session connection indicator
- Enable the Intel WiDi connection confirmation

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8.2 Creating an Intel PROset Administrator Profile

Creating a Wi-Fi policy script for the client PC requires the Intel Wi-Fi driver and Intel PROSet Administrators Toolkit to be installed[13].   When installing Intel PROset, select the customize option and choose Administrator Toolbox.

The following steps are completed via the Intel PROset administrator tool.

1. Open **Control Panel** and select **Intel® PROSet-Wireless Tools.**

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[13] See http://www.intel.com/support/wireless/wlan/sb/CS-031762.htm

Select "**Administer the Wireless computers in your network**". The "Create a Password" (first time) or the "Enter Password" dialog is displayed
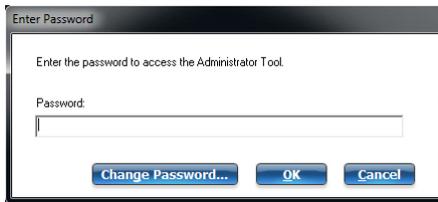
Create a password to protect the administrator profiles from non-Administrator users and click **OK**.

In the Open Administrator Package dialog, select **Create a new package**, and click **OK**. On the Profiles tab, uncheck "**Include Profiles in this Package**".
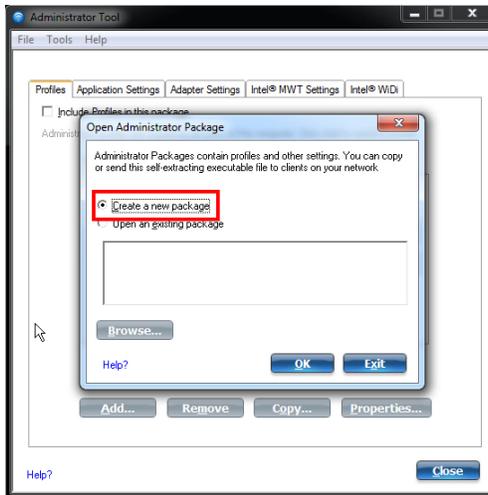
5. In the Administrator Tool – New Package window, select the **Intel® MWT Setting** tab to define your Intel MWT policy options.

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Select **Include Intel® My Wi-Fi Technology settings in this package**, and select the **Enable Intel® My Wi-Fi Technology**. The lower right Intel MWT policy options window becomes active. You can allow or disallow Wireless LAN and Wireless PAN bridging on client PCs as required for your IT security to prevent data traffic between Intel MWT and other network interfaces. (For example, no internet sharing will be possible.)
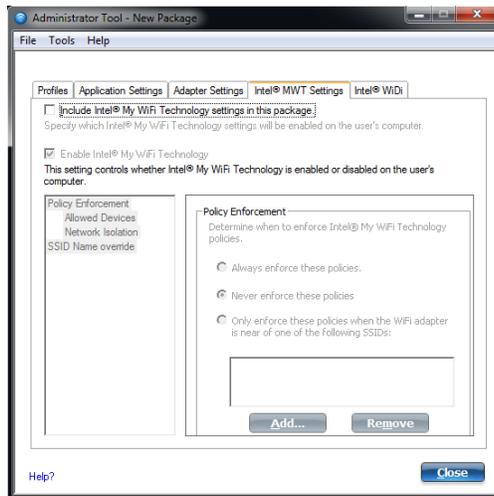
In the left pane, select **Policy Enforcement**. In the right pane, select **Always enforce these policies**.
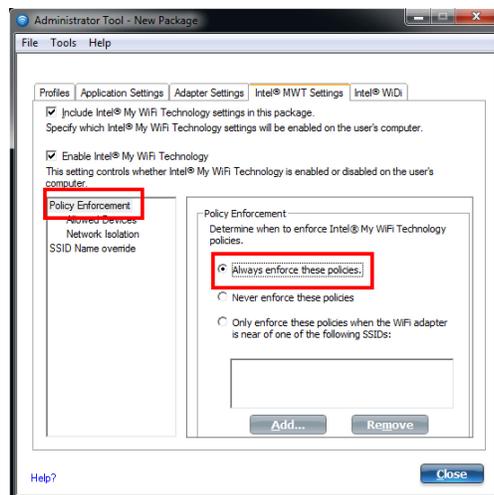
Click **Add**. The Add device type dialog is displayed.

In the top drop-down selector, select **Intel® WiDi receiver – Enterprise**. This allows PC clients to connect to only enterprise class wireless displays. Leave the other settings unchanged. Click **OK**.
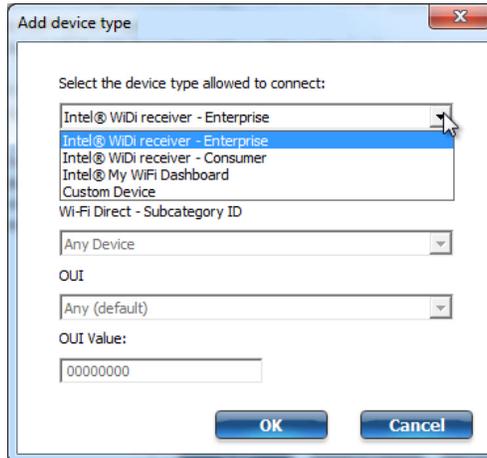
Click **Add** again. Another Add device type dialog is displayed. In the top drop-down selector, select **Intel® WiDi receiver – Consumer**. Leave the other settings unchanged. Click **OK**.

Click **Add** a third time. Another Add device type dialog is displayed. In the top drop-down selector, select **Intel® My Wi-Fi dashboard**. Leave the other settings unchanged. Click **OK**.

There should be three entries under **Devices allowed to connect**.
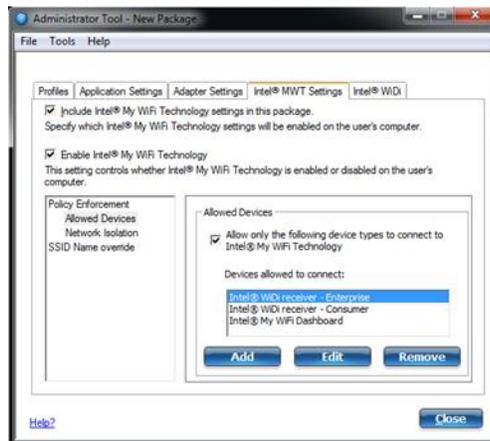
In the left-hand pane, select **Network Isolation**. In the right-hand pane, select **Isolate the Intel® network…**. This prohibits network bridging between the Intel® My Wi-Fi personal area network and other network interfaces. Selecting this option prevents Internet Connection Sharing (ICS).

Do not make any changes to options under **SSID Name override**.
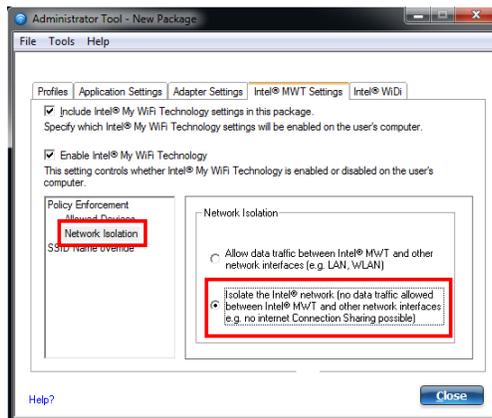
Select the **Intel® WiDi** tab. Select Include **Intel WiDi settings** in this package.

In the left-hand pane, select **USB over WiDi**. In the right pane, select **Allow USB over WiDi functionality**.
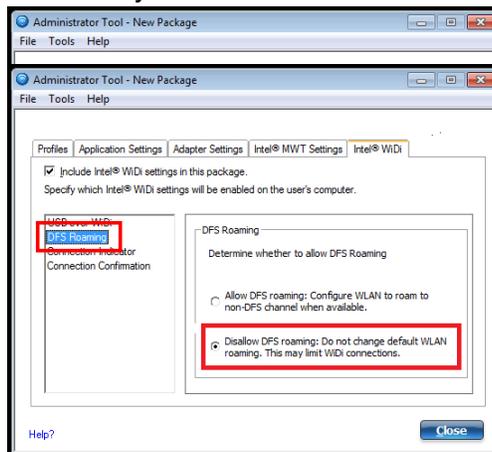
In the left pane, select **DFS Roaming**. In the right pane, select **Disallow DFS** roaming.

In the left-hand pane, select **Connection Indicator**. In the right pane, select both options **Show indicator when …** and **Enforce the setting….** This ensures that the connection indicator in the taskbar is green and that the user cannot change it, i.e., turn off the indicator.
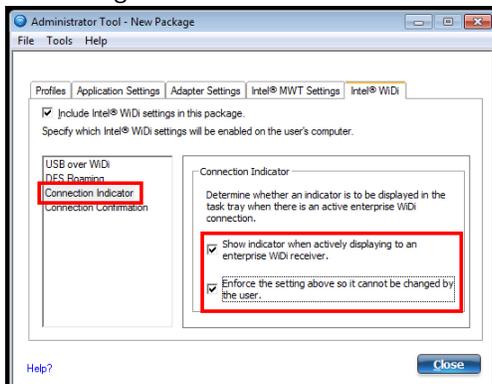
In the left-hand pane, select **Connection Confirmation**. In the right pane, select both options **Confirm connection to...** and **Enforce the setting....**This ensures that the connection must be confirmed before the user's desktop is displayed in the WiDi display and that the user cannot change it.

Click **Close**.
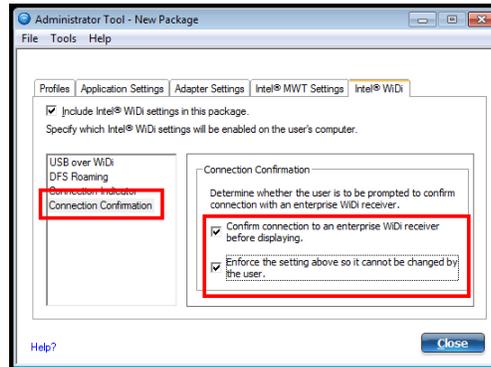
You are prompted to save the changes. Click **Yes** to save the changes to a new file.
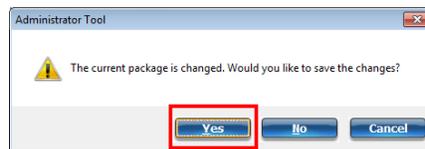
In the Save As dialog, enter a name for the new Profile. Do not change the default location. Click **Save**. This creates an executable profile. When the package is written, click **Finished**.

In the Package Saved window, a summary of the settings you specified is displayed.
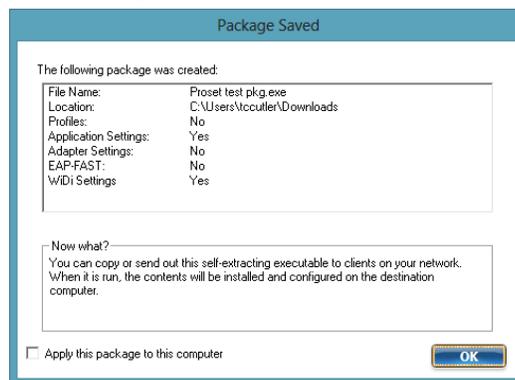
NOTE: If you are creating the PROSet package from an admin station do not select **Apply this package to this computer**. If you intend to apply the settings to the current computer then select **Apply this package to this computer.**

Click **OK**.

A self-extracting executable file is created and can be executed on desired client computers.

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9 Appendix C. Reference Links

The following is a compilation of the useful links mentioned in this guide for Intel® Pro Wireless Display (Pro WiDi).

9.1 Overview materials

- **No Wires Workspace Improves Business Productivity reference:** http://www.intel.com/content/www/us/en/collaboration/intel-dell-no-wires-workspace-video.html
- **Intel® vPro Technology:** http://www.intel.com/content/www/us/en/architecture-and-technology/vpro/vpro-technology-general.html

9.2 Intel Utilities, Software, and Compatibility Components

- **Intel® WiDi Compatibility Tool:** http://supportkb.intel.com/wireless/wireless-display/templates/selfservice/intelwidi/#portal/1026/article/700100000023944/Intel-WiDi-Compatibility-Tool
- **Intel® Pro WiDi Software for Windows:** https://downloadcenter.intel.com/download/25153/Intel-Pro-WiDi-Software-for-Windows
- **Compatible Intel Wi-Fi products:** http://ark.intel.com/compare/83635,84177,75439,75440,86068
- **Compatible Intel processor with Intel HD Graphics:** http://ark.intel.com/Search/Advanced?s=t&FilterCurrentProducts=true&WiDi=true&VProTechnology=true
- **Intel Platform Discovery tool:** https://downloadcenter.intel.com/download/24667

9.3 Certified Intel Pro WiDi Receivers and Projectors

As November 2015, the following Intel Pro WiDi certified receivers and projectors are available for purchase

- **Actiontec ScreenBeam* Pro Business Edition:** http://www.screenbeam.global/screenbeam-business-edition/
- **Actiontec ScreenBeam* Enterprise 950p:** http://www.screenbeam.global/screenbeam-enterprise-950p/
- **Panasonic PT-VW350 Series:** https://www.panasonic.com/sg/corporate/news/article/pt-vw350series.html
- **Lenovo Pro WiDi Adapter:** https://support.lenovo.com/ca/en/documents/acc100248

9.4 Support Resources

- **Intel Support:** http://www.intel.com/p/en_US/support/contactsupport

- **Actiontec Support, Documentation, and Downloads:** https://actiontec.zendesk.com/hc/en-us

9.5 Additional Reference Material

- **IT@Intel Whitepaper on Enterprise Wireless Best Practices:** http://www.intel.com/content/www/us/en/it-management/intel-it-best-practices/wireless-infrastructure-implementation-best-practices-paper.html
- **List of DFS and related wireless network channels:** http://en.wikipedia.org/wiki/List_of_WLAN_channels
- **Microsoft WDDM 1.3 Capable Graphics Drivers for Microsoft Windows 8.1 or newer operating system:** https://msdn.microsoft.com/en-us/library/windows/hardware/dn265513%28v=vs.85%29.aspx

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