Quick Guide

Sanako Study

Guide for wireless environments
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What will you find in this guide?

- Sanako recommendations and guidelines for implementing a wireless network
- General information on wireless networks
- Sample configuration for a wireless network environment
- Troubleshooting section for common issues in wireless network environments

General

- Wireless implementation requires Sanako Study version 6.0 or later. With earlier versions, LAN-environment is required.
- As wireless network performance is dependent on many factors, such as wireless hardware, radio interference, computers, network load etc. we cannot guarantee a satisfactory user experience with wireless learning environment unless certain criteria is met in terms of computers and wireless network.
- In case Sanako recommendations cannot be met, we encourage customers to evaluate the solution, apply the guidelines found in this guide and determine if a satisfactory user experience can be achieved in their wireless environment.
- If you need more information on implementing Sanako solutions in a wireless network, we are happy to help you at support@sanako.com

Disclaimer

Wi-Fi and other types of radio transmission are vulnerable to interference by their nature. Although certain best practices help to minimize this interference, Sanako, as well as other manufacturers cannot guarantee a 100% accurate and delay-free transmission of data. Transmission errors may cause packet loss. Sanako is not responsible for any damage caused by loss of data.
Requirements in brief

- For sufficient multicast performance, we recommend the hardware specified in the Sanako Study compatible Wi-Fi equipment -document. The documentation can be found in the Sanako Partner Zone.

- The hardware must be operated in 5GHz 802.11n mode. An interference-free 5GHz channel for 40MHz bandwidth must exist in network. Note: the most convenient setup for most applications is to reserve the 5GHz band entirely for Sanako language learning solutions and use existing 2.4GHz networks for other purposes.

- For performance reasons, the access point has to be dedicated for language learning use and must not be used to service other wireless clients.

- For best performance, we recommend connecting the teacher computer to the access point with a LAN cable.

- Computers must be equipped with Microsoft Windows® 7 operating system and have sufficient performance to run the operating system with adequate performance.

- The computers must have 802.11n 5GHz compatible wireless network adapters installed.

- We recommend that the multicast traffic be isolated inside the language learning environment. This can be done using NAT (network address translation – a standard feature in many access points) or VLAN (Virtual LAN) configuration.

- With Sanako Study 1200, we recommend using a separate NAS (Network Attached Storage) server connected to the network with a LAN cable.

- The functionality of Sanako Study has been tested for a maximum of 30 simultaneous wireless student computers. The student computers were located in the same physical classroom as the wireless access point in order to receive a strong signal. For higher numbers of students and complex multi-room installations, please contact support@sanako.com.

Related material

The documentation can be found in the Sanako Partner Zone.

- Technical document: Sanako Study compatible Wi-Fi equipment

- Technical document: Configuration example of Cisco Aironet 1250 -series WI-FI access point

- Technical document: Configuration example of Cisco Linksys E4200 Wi-Fi access point

- Technical document: Sanako Study - Guide for adjusting tutor registry settings
Glossary

LAN, Ethernet
LAN (Local Area Network) is an overall definition of devices that are connected to each other (wired or wireless). However, LAN is usually used to refer to a wired physical network which uses Ethernet technology. Ethernet is a family of computer networking technologies that is the current standard used in wired local area networks.

WLAN, Wi-Fi
WLAN (Wireless Local Area Network) means two or more devices which communicate with each other with wireless radios. Wireless LAN saves cabling costs and effort from the IT departments and offer mobility for users. The most modern WLAN techniques also offer very high speeds which allow streaming HD video and sound in the network. Most modern WLAN environments utilize the 802.11-standard. Most common devices utilizing 802.11 WLAN are computers, tablets and mobile phones. Note: Since WLAN may be easily confused with VLAN (Virtual LAN), the term “Wi-Fi” is often used instead. Originally “Wi-Fi” is a trademark of “Wi-Fi Alliance”.

Access Point
To build up a wireless network, you need to have a wireless access point which is a very central element in the network. Every wireless device connects to an access point which acts like a policeman standing on point duty controlling the traffic flow from different directions. The access point is usually connected to a LAN network with Ethernet cabling which provides e.g. internet access for the wireless devices.

802.11n
802.11n is the latest wireless standard in the IEEE 802.11–group. It offers better performance than the previous standards 802.11g and 802.11a and it can also operate on 5GHz frequency band although in some countries this band is reserved for other use.

5GHz, 2.4GHz frequency band
Due to global regulations, 802.11 Wi-Fi devices can operate in two frequency bands, 2.4GHz and 5GHz. Older Wi-Fi standards operate on 2.4GHz frequency band (except 802.11a). Due to the popularity of wireless networks, the 2.4GHz band is often much occupied with radio interference and in most situations it is hard to find a free wireless channel. Many other devices, such as car alarms, DECT phones and microwave ovens employ the same frequency band which makes the problem worse. The new 802.11n standard allows use of 5GHz frequency band which helps with the interference problem and naturally offers better performance as well.

Wireless Channel
Global regulations have allocated a certain number of wireless channels for private and corporate use to avoid the pollution of the precious frequency band. The 2.4GHz frequency band basically has three non-overlapping channels whereas the 5GHz frequency band supports eight (the list of available channels depends on the country’s regulations).
A channel is like a lane on a motorway. If you put too much traffic on one lane, it gets stuck. Therefore an effective use of channels is essential for good performance. Institutions have to always monitor that their access points are spread equally to all free channels.
NAS

NAS (Network attached storage) is a device which has storage space and is connected to a network. NAS-devices are usually used in Ethernet LAN networks but there are also Wi-Fi models available. The device allows corporate or home users to save, share and retrieve data from a central location instead of saving everything on their personal computers. Some NAS devices may have back up features or users may be able to access the data from anywhere through Internet.
General information on wireless networks

The purpose of this section is to provide general information regarding wireless networks. If you are only interested in our recommended settings, you may skip this section.

**Why do you recommend 802.11n-standard?**

802.11n is the latest standard for wireless networks. The maximum theoretical net data rate is 600 Mbit/s whereas the capacity of the previous standard 802.11g was 54 Mbit/s. The increase in data rate is achieved by using 5GHz frequency, 40MHz channel width and using transmissions with multiple antennas. A good quality 802.11n network is therefore a good choice for performance critical applications such as voice and video transfer.

*Note:* The practical data rate in 802.11n in our tests has been from 90 to 130 Mbit/s, which is still roughly twice as fast as the theoretical maximum speed of 802.11g.

**How does 5 GHz frequency band help compared to 2.4 GHz?**

802.11n allows using 5GHz frequency band as well as the 2.4GHz. The 5GHz band will have the following benefits compared to the traditional 2.4GHz network band:

- Better performance as 600 Mbit/s theoretical speed is only available in 5GHz
- Lower coverage and penetration of walls etc. which is often beneficial as this helps to prevent interference between Wi-Fi networks
- The 5GHz band is often unused so institutions can reserve the band for specialized applications such as language learning solutions. The existing 2.4GHz Wi-Fi networks can still be used for other purposes.

*Note:* Regulations in some countries will not allow the use of 5GHz band. Please check this with your local authorities. In this case, we recommend reserving a free 2.4GHz wireless band for 802.11n usage and evaluating whether satisfactory performance can be achieved.

**Any tips on using mobile laptop carts?**

Wireless networks are suitable with mobile laptop cart environments. However, here are some best practices to consider.

- Consider buying a cart which is equipped “intelligent electronics” to maintain the battery charge of laptops. Simply connecting laptops to extension cords may leave you vulnerable to issues with sparks, blown fuses, unclean power sockets etc.
- Make sure that cart has room for additional hardware, such as a teacher computer, NAS device, electronics, extension cords etc.
- Make sure that the access point can be mounted on the side of the cart. It should also be possible for the teacher to take the access point out of the cart and place it e.g. in the middle of the room.
- In order to have an Internet connection for the room, the cart must be used in places where the teacher can connect the laptop cart to a network with an Ethernet cable. If this is not possible, the
cart can be connected to an existing wireless network with a Wireless Ethernet bridge -device. However, this configuration is not in the scope of this guide.
Are there differences between access points?
Sanako solutions use multicast transmission for audio and video traffic. Multicast is especially difficult for wireless devices and there are very big differences in how manufacturers have implemented multicasting in their devices. There is usually no other way to find out whether some equipment is compatible with Sanako Study other than to test it. However, here are some parameters where low-budget consumer devices usually fail:

- 802.11n support
- 5GHz radio
- Good multicast implementation
- Handling of multiple clients (10+)
- Sufficient internal CPU
- Stability

What is the difference between a consumer and an enterprise level access point?
Consumer access points are easier to configure and may actually have more features than enterprise ones. This is due to the fact that enterprise access points are usually used in conjunction with a separate wireless controller. However, consumer access points may lack the internal processing speed, stability and robustness that enterprise-level access points offer.

What are the recommendations when 2.4GHz is the only option?
A common problem with 2.4GHz access points is that the multicast rate drops very low with any disturbance. In our experience it helps if there is a possibility to set the multicast rate to certain fixed level. However many consumer level access point do not have this option. If 2.4GHz is the only possible option, please evaluate the product if possible and consult support@sanako.com. Some guidelines for evaluations are:

- Use 802.11n standard.
- Use 20MHz bandwidth
- Force a Multicast Rate of at least 5.5 Mbps, 36 Mbps if possible, in the access point
- Try to find a free channel by organizing the channels and transmission power of other access points in the area
- Enterprise level access points such as Cisco Aironet 1250 with adjustable multicast rate work better, especially in 2.4GHz

What about implementing an institution wide wireless solution?
In projects with hundreds of wireless clients, we encourage you to partner with enterprise level wireless solution providers such as Cisco, Xirrus, Juniper, Fortinet, Meru or HP. Also, please consult support@sanako.com as well for best practices of implementing Sanako solutions in large scale Wi-Fi environments. In general, the same principles apply. We recommend 5GHz band for specialized applications and 2.4GHz network for other use. If you are buying new computers, check that they have 5GHz 802.11n wireless adapters inside.
Recommendations

Free channel in 5GHz network band

An interference free 5GHz channel for 40MHz bandwidth must exist in the network. An easy option for an institution is to reserve the whole 5GHz band for language learning solutions whereas the existing 2.4GHz networks can be used for other purposes. An easy way to scan a site is to use the free Wi-Fi solution inSSIDer. In the following sample pictures, we can see that the 2.4GHz has numerous networks but 5GHz completely free for our purposes.

Picture 1 - Example situation with 2.4GHz
Picture 2 - Example situation with 5GHz

**Note:** If you cannot use 5GHz frequency band due to country restrictions, please evaluate Sanako solutions in the existing environment to determine whether a satisfactory user experience can be produced. If you have to use 2.4GHz frequency band, please see if the institution can arrange a free Wi-Fi channel for language learning usage.

**What if the 5GHz frequency band is full of other channels**

If your Wi-Fi analyzer software indicates that the 5GHz frequency band is full and there is no room to utilize an interference free channel with 40MHz bandwidth, the options are as follows:

- The best option is make the interfering networks utilize the 2.4GHz frequency area and leave the 5GHz for language learning solutions
- If this is not possible, you can change the other network to utilize different channels. The best logic is that the access point which is physically nearest to the language learning access point, should utilize a channel which is as far away as possible from the channel selected for language learning. The other possible interfering access points which are further away, can then utilize channels which are close to the channel of the access point dedicated to language learning.
It is also beneficial to try to lower the transmission power of the interfering access points if possible. However, not all access points have setting for emission levels.

Switch to 20MHz bandwidth. The performance drop is usually of an acceptable level.

Picture 3 - A Sample of channel selection at Linksys access points

Selecting an access point

To select an access point, please refer to the Sanako Study compatible Wi-Fi equipment –document available in the Sanako Partner Zone.

Access point placement and range

Sanako Study has been tested in a wireless environment with up to 30 students located in the same physical space (same room). The range of the wireless access point is dependent on many factors, such as walls, doors, windows etc. As a rough generalization, you usually get a good signal in the same room as well as in the room or corridor (to an adequate range up to 30 meters) next to the space if there are no further doors or walls blocking the signal. A more detailed use range can only be determined by a site survey.

The ideal placement of the access point is the ceiling in the middle of the room where the student computers are located. This allows the signal to spread equally to the area.

Recommendations for student computers

Make sure the laptops have 5GHz 802.11n adapters

Important! - When buying new laptops, ensure that they have a 802.11n 5GHz compatible wireless adapter inside. We have had the best experience using integrated Intel adapters but others can be used as well. Please note that not all 802.11n devices support 5GHz frequency band. You can find a list of tested adapters in the Sanako Study compatible Wi-Fi equipment document.

If an integrated wireless adapter does not exist external 802.11n 5GHz adapters can be used. We have tested D-Link DWA-160 and Cisco Linksys AE1000 and found both to have good performance parameters.

Cisco Linksys AE1000 USB Adapter

Note: Integrated wireless adapters usually have better performance than external USB ones as laptop manufacturers can mount the Wi-Fi antennas on the sides of the laptop screen.

Selecting the operating system
We recommend Windows 7 operating system as in our experience it has better wireless network handling and performance than Windows XP.

**Set power saving features to ‘Maximum performance’**

Power saving features can have a severe impact on performance. In some environments, even a single computer in power saving mode can affect the performance of the whole access point. We recommend setting power saving features to ‘best performance’ in both battery and charging mode.

To disable power saving features in Windows 7, go to Control Panel / Power Options / Edit Plan Settings / Change advanced power settings. Then, select Wireless Adapters Settings / Power Saving mode and select Maximum performance when using battery and when plugged in.

In Windows XP environments power saving features can be adjusted directly from the card settings at Control Panel / System / Hardware / Device Manager / Network Adapters.

**Note:** Laptop manufacturers may also have their own configuration programs for power saving features which may potentially override the settings described here. In this case, refer to your laptop user guide.

**Recommendations for teacher computer**

For maximum performance, we recommend connecting the teacher computer to the access point with LAN cabling.
In case the teacher computer is used in a wireless network, the same Wi-Fi recommendations apply as with student computers.

**Selecting sufficient hardware**

Screen and video transfer operations demand processing power from the tutor computer. For the performance we recommend a teacher computer with Intel i5, i7 or equivalent processor and at least 4GB memory.

**Selecting the operating system**

We recommend Windows 7 operating system as in our experience it has better wireless network handling and performance than Windows XP.

**Tips to increasing performance on slow PCs**

**Disable hardware acceleration (XP only)**

We recommend using Windows 7 operating system for the tutor PC. However, if you need to use a Windows XP teacher computer, you get the best screen transfer performance by disabling display adapter hardware acceleration in the tutor PC. To do this, go to Control Panel / Display Properties / Settings / Advanced / Troubleshoot.

![Picture 4 - Disabling HW acceleration](image)
Adjust PC for best performance

If the Tutor PC is slow, you can optimize Windows for best performance at Control Panel / System / Advanced / Settings.

**Picture 5 - Adjust PC for best performance**

**Disable Aero theme (only in Windows Vista and Windows 7)**

You can speed up a computer by selecting a basic display theme at Control Panel / Personalization. Disabling the Aero theme (in Windows Vista and Windows 7 operating systems) on the teacher PC is particularly helpful with screen transfer functions.
Sanako Study software

Choosing the right network settings

For optimal performance, select ‘Fast WLAN’ as the network connection type in Sanako Study Tutor at Tools / Preferences / Settings / Operating environment. The Fast WLAN settings are optimized for Cisco Linksys E4200 access point in 5GHz network. For slower network environments, you can choose ‘Slow WLAN’.
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Note: If you are an advanced user and want to experiment with different video and audio parameters, please refer to the Study screen and audio setting guide.

Setting sounds

Correctly adjusted sound settings are essential for proper audio functionality. To adjust sound in either the Tutor or Student application, select Tools / Sound Settings and adjust the sound settings as appropriate.
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In order to equalize sound settings for a classroom first adjust the sound settings in Study Tutor and then restart program to apply the settings. After Tutor settings have been completed, adjust the sound settings on one Student computer and then copy the settings to the rest of the class.

For detailed instructions, please refer to the Sanako Study Technical Guide and the Setup section of the Sanako Study video site [http://download.sanako.com/study-videos/](http://download.sanako.com/study-videos/).

**Note:** Copying student sound settings requires that the student computers have identical hardware.

**Headsets**

To avoid distortion and interference in discussion activities (Discussion activity is available in Sanako Study 700 and 1200), each student computer must be equipped with headsets. For best performance we recommend Sanako SLH-07 insulating USB headsets.
## Troubleshooting

### General Wi-Fi

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable cause and recommendations</th>
<th>Possible other causes</th>
</tr>
</thead>
</table>
| **Student computers unable to connect to the wireless access point** | - Student computer adapters not capable of 5GHz 802.11n connection  
- Wrong password settings in Windows profile (delete the profile and connect again) | - Change wireless channel in access point to lower band. (Some adapters are not compatible with channels above 5.7GHz/140)  
- Old driver firmware in Wi-Fi adapters  
- Old firmware in Wi-Fi access point.  
- Check that SSID is not hidden in the access point or MAC filter is not enabled |
| **Student laptops keep connecting to other wireless networks** | - Check that the preferred network is the only option in the Windows wireless network list | - Lower the Wi-Fi adapter "roaming aggressiveness" setting |
| **Inappropriate wireless clients keep connecting to the access point.** | - Hide SSID broadcast on the access point. Refer to page Error! Bookmark not defined.  
- Implement a MAC filter to the access point.  
- Change the WPA2 passphrase to a more secure | |
one.
### Screen and audio transfer operations

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable cause</th>
<th>Possible other causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Screen transfer or talk functions do not work (black screen to students)</strong></td>
<td>• Multicast disabled in access point.</td>
<td>• Other network interfaces in teacher computer. Change binding order or disable excess adapters in Tutor PC. See <em>Microsoft Knowledge Base article</em>.</td>
</tr>
<tr>
<td></td>
<td>• Other network interfaces in teacher computer. Change binding order or disable excess adapters in Tutor PC. See <em>Microsoft Knowledge Base article</em>.</td>
<td>• Wrong network settings in Sanako software. See page 17.</td>
</tr>
</tbody>
</table>

| **Poor screen transfer performance**                         | • Incorrect access point settings (5GHz, 802.11n must be selected)              | • Interference from other 5GHz networks in area. See page 11.                          |
|                                                              | • Wrong network setting in Sanako software. See page 17.                        | • Wi-Fi Power saving settings not set to “maximum performance”. See page 14.         |
|                                                              | • Adjust Tutor PC for best performance. See page 15                            | • Tutor computer not connected to access point with LAN cable.                       |
|                                                              | • In Windows XP Tutor: Disable hardware acceleration. See page 15              | • High internet traffic                                                             |
|                                                              | • In Vista / Windows 7 Tutor: Disable Aero display theme. See page 15          |                                                                                      |

| **Student CPU usage over 70% during screen transfer**        | • See *Tips to increasing performance on slow PCs* on page 6.                   | • Adjust “Parity” and “MaxFPS” -setting in Study Tutor Registry. Refer to separate *Study screen and audio setting guide* |
|                                                              |                                                                                   |                                                                                      |
| **Strong loopback noise during discussion**                 | • Check that each student has a headset.                                         |                                                                                      |
|                                                              | • Check that sound settings are correct. See page 18.                            |                                                                                      |
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Cuts and interference in sound

- Wrong network setting in Sanako software. See page 17.
- Incorrect sound settings.
- See symptoms at “Poor Screen transfer performance”
### Discussion

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable cause</th>
<th>Possible other causes</th>
</tr>
</thead>
</table>
| Discussion activity does not work (no sound)| - Multicast disabled in access point                                          | - Change binding order or disable excess adapters at student PC:s. See [http://support.microsoft.com/kb/894564](http://support.microsoft.com/kb/894564)  
|                                              |                                                                               | - Check that sound settings are correct. See page 18 in this guide for instructions. |
| Cuts and interference in sound              | - Wrong network setting in Sanako software. See page 17.                      | - See the Poor screen transfer performance item in this troubleshooting section       |
|                                              | - Check that sound settings are correct. See page 18.                         |                                                                                       |
| Strong loopback noise during discussion      | - Check that each student has a headset.                                     |                                                                                       |
|                                              | - Check that sound settings are correct. See page 18.                         |                                                                                       |
| Student CPU usage over 70% during discussion | - See Tips to increasing performance on slow PCs at page 6.                  | - Limit the number of students in discussion                                          |

### Language activities

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Probable cause</th>
<th>Possible other causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collection very unstable or slow</td>
<td>- Wrong network setting in Sanako software. See page 17.</td>
<td>- Study collection folder not correctly defined to NAS</td>
</tr>
<tr>
<td></td>
<td>- No NAS device in use for collection.</td>
<td></td>
</tr>
</tbody>
</table>
### Audio transfer cuts when using Audio CD, Tutor Player or Tutor PC as media source

- Wrong network setting in Sanako software. See page 17.
  
  See the *Poor screen transfer performance* item in this troubleshooting section.

- Check that sound settings are correct. See page 18.

### No audio when using Audio CD, Tutor Player or Tutor PC as media source

- Check that sound settings are correct. See page 18.

- In Windows XP, a sound card with a “Stereo Mix” line is needed for Tutor. E.g. Sanako USB headsets include “Stereo Mix” -line.