Laerdal Network Requirement Document

How to setup a network for your Laerdal Equipment

This document describes the requirements for setting up a network on pre-existing infrastructure specifically for Laerdal simulation devices. To accurately create a true real time realistic medical simulation scenario, Laerdal's equipment needs its own dedicated network preferably a VLAN spanned to outlets to which its equipment can physically connect and/or an associated SSID to which it can connect wirelessly.
To allow for necessary future software, security updates and telemetry a secure connection to Laerdal's cloud-based services will also be required.

The next two pages contains the requirements while the appendixes may be used for reference.

Essential requirements:
- Communication between devices on VLAN restriction free, Appendix A page 4
- Wireless channels used must be 1-11 and/or 36 to 48, page 2
- Bonjour/mDNS services allowed according to list Appendix A, page 5
- Internet communication allowed, able to reach list specified in Appendix A, page 6
- SimView / SimCapture static IP support, Appendix A page 6
- SimCapture with AV equipment requirements, Appendix B

A wired infrastructure will always provide the most reliable network and is **Highly** recommended. However, while we understand you may need wireless connectivity to support insitu simulations, it is best practice to hardwire stationary devices and use wireless for mobile devices.

These devices can connect wirelessly if necessary, but we always recommend network drops as a backup:

- Simulator
- Instructor PC
- Patient monitor
- Simpad
- VitalBridge

These devices should always be hardwired:

- Axis cameras
- SimCapture nodes
- Axis audio module
- Symetrix DSP
- Stewart Amp
- JTECH
- Control/Debrief/Exam Workstations
- SimCapture UltraPortable
- ASL 5000

Bandwidth requirements

In a normal setting, one Laerdal devices will consume less than 1Mb/s and the number of packets exchanged between each device no more than 300/sec.

During startup and closure, equipment may consume momentary additional bandwidth. Transfer of large files between the devices may take place during the startup of a simulation system, anywhere between a few seconds up to a minute depending upon the scale and complexity of the simulation environment.

Simulation setups using SimCapture / SimView, specifically with video, will demand higher bandwidth. If the wireless network is unable to accommodate, the devices should be physically connected to the VLAN associated with the SSID.

Communication port requirements

Laerdal simulation devices need to reach all other Laerdal devices within the VLAN/SSID on a range of ports (please see appendix A) and certain traffic types, therefore data exchanges between the devices within the VLAN/SSID should be restriction free.

Traffic in and out of the VLAN/SSID will of course be governed by your own policies, however as Laerdal devices require a connection to the internet, specific flows originating from this VLAN/SSID will have to be provisioned (please refer to the section 'Internet Connection').

DHCP and Discovery Services

It is recommended Laerdal Simulation devices are assigned their IP address from a DHCP server. The IP address range for all simulators should exclude 192.168.168.*.

SimView and SimCapture cameras, audio modules and servers need static IPs. It is preferred that the DHCP server is set up to provide lease reservation instead of fixing IP addresses on individual equipment. See section in Appendix A for details.

For device discovery within the VLAN/SSID, Laerdal Simulation devices use multicast-DNS/DNS-SD (aka Bonjour) and therefore must be enabled and services added to the Wireless LAN controller. For further details on mDNS and its application, please see appendix A.

Wireless setup

- The preferred SSID: **"AnneSim"**
- All Laerdal simulators and VitalsBridge with wireless capabilities support 2.4GHz, channels 1-11.
- All Laerdal simulators except the ones based on SimPad/LinkBox Classic support 5GHz, channels 36, 40 ,44 and 48. Some simulators support more channels.
- Laerdal Simulation Devices supports:
    - WPA2-Personal Encryption.
    - WPA2-Enterprise Encryption with user authentication [1].

The figure depicted below provides a high-level overview of the 'AnneSim' SSID set up in a typical wireless LAN infrastructure.
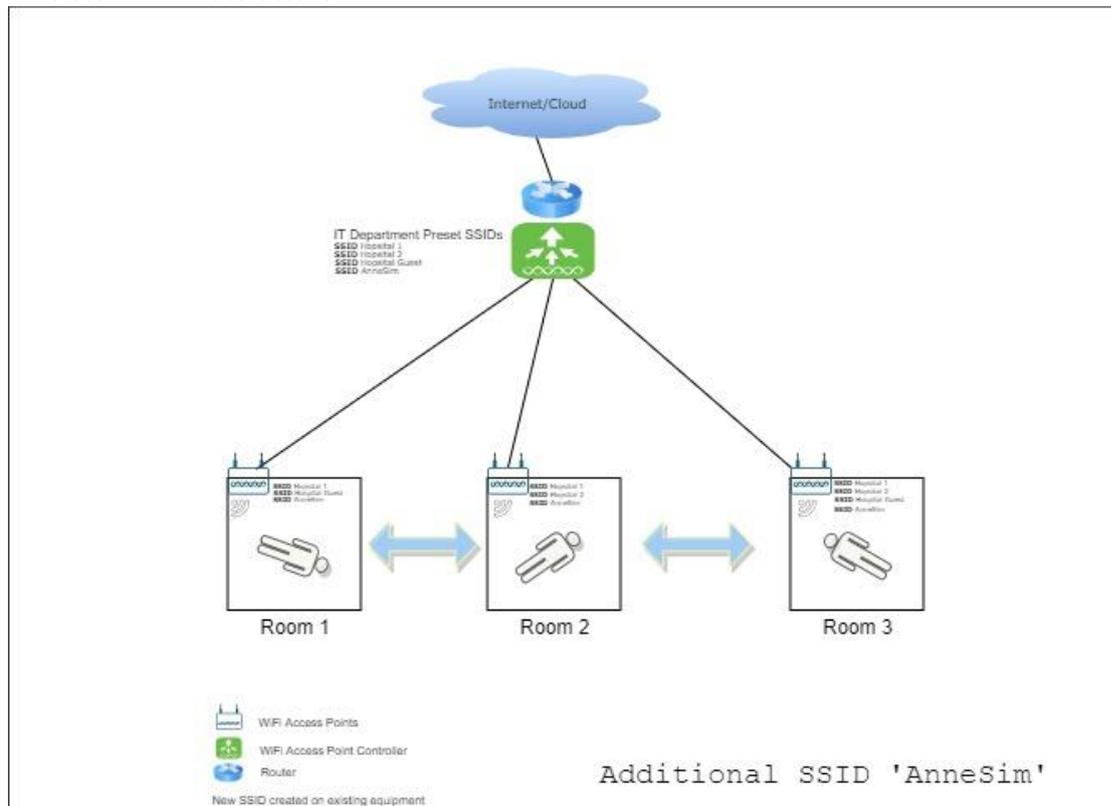
A more thorough setup is shown in appendix C.

Internet connection

Internet access may be restricted outbound, see section "Internet access" in appendix A. For a setup that includes SimCapture, VPN access must be provided for remote support.

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[1] Requires LLEAP or SimPad PLUS using software version 7.3.0 or newer.

Appendix A

Required TCP/UDP Ports

Laerdal equipment uses IPv4 for communication.

In addition to normal services such as IGMP, NBNS, DHCP and DNS, Laerdal equipment may set up servers on the following list of TCP and UDP ports that must be permitted within the VLAN/SSID:

Type	Ports	Devices	Description
http	80	SimMan3G-family SimView SimCapture	Configuration SimCapture RTMP camera streams
https	443	SimView SimCapture	Central server / SimCapture / Cloud instance
TCP (RTMP)	1935	SimCapture	WebRTC (obsolete from SimCapture ver. 6.0.4)
TCP	2000-2001	SimPad RA Plus	Data stream
TCP	2813	SimCapture	Exam System
TCP	3389	SimMan3G SimCapture	Remote Desktop
UDP	3478	SimCapture	Live view for outgoing internet access / between subnets
UDP	5353	All	Bonjour / mDNS / DNS-SD zeroconf discovery Udp://224.0.0.251:5353
TCP	5671	Client PC	Analytics
UDP	6681-6682	SimMan3G-family Client PC Debrief PC SimView SimCapture	Debrief system/SimView/SimCapture
UDP broadcast	6797-6798	SimMan3G-family ClientPC	Updates
UDP	7557-7558	Linkbox based	Vs params and unified params
UDP	8935	SimCapture/LiveCapture	webRTC
TCP	9897	SimMan3G-family	Configuration updates
TCP	9898	Simulator PC Client PC	Voice conferencing control
UDP (multicast)	11000-11006	Simulator PC Client PC SimPad, LinkBox	Voice conferencing
UPD broadcast	13000	Simulator PC Client PC	Legacy alive data
TCP	14997	Client PC VitalsBridge	VitalsBridge Communication
UDP	14998	Client PC VitalsBridge	VitalsBridge advertising
UDP (multicast)	15000-15007	Simulator PC ClientPC	Alive data
TCP	15020-15024	LinkBox, SimPad Simulator PC Client PC	Configuration and control, file transfer
TCP	15029	Simulator PC Client PC	
UDP	15030-150XX	Simulator PC Client PC	CTG server stream for SimMom
TCP/UDP	21935	SimCapture	SimCapture/Livecapture functionality
UDP	54915, 52734	Client PC ASL5000	ASL5000 device discovery
TCP	55195, 52719	Client PC ASL5000	ASL 5000 device control and data

Device discovery

LLEAP is using two parallel methods for discovery – Bonjour and 'Legacy'. Only Bonjour is supported for discovery of LinkBoxes whilst only Legacy is supported for updating SimMan3G simulators.

Bonjour - network service discovery

The LLEAP System uses an mDNS (multicast DNS system) and DNS-SD (DNS Service Discovery) for publishing and discovering network devices. This is described in RFC6762 and RFC6763 respectively. Please see http://en.wikipedia.org/wiki/MDNS, http://en.wikipedia.org/wiki/Zero_configuration_networking#Service_discovery. This service is often referred to as Apple Bonjour, zeroconf or Avahi.

It communicates with IP multicast message to 224.0.0.251 using UDP port 5353.

Below are the different services used by LLEAP and/or SimPad and Link Box

Service name	Device/Application	Description
_simbridge._tcp	SimPad Link Box	LLEAP uses this to connect to Link Box
_simmonitor._tcp	SimPad Link Box	Patient Monitors use this to connect to Link Box when running with a SimPad
_simlink._tcp	SimPad Link Box	SimPad will use this to connect to Link Box
_simse._tcp	LLEAP Simulation Engine	LLEAP and Patient Monitor use this to connect to a Simulation Engine (for 3G family simulators this is running inside the simulator, for other simulators the Simulation Engine is running on the LLEAP PC
_simvca._tcp	Voice Conference Application (VCA)	VCA use this to connect to another VCA, typically running inside a 3G family simulator, but also on a PC running with a LinkBox type simulator
_simventures._tcp	SimView/Session Viewer	Used by LLEAP and SimPad to connect to a SimView Server or Session Viewer
_http._tcp	Screen Capture	Used by SimView Server or Session Viewer to connect to a screen capture service
_workstation._tcp	SimPad update service	Used by LLEAP for updating software on the SimPad
_ssh._tcp	LLEAP/SimPad Link Box update	Used to update SimPad and Link Box
_lleaphost._tcp	LLEAP PC (IA, PM)	Used to configure PCs
_ctgserver._tcp	SimMom LLEAP PC (IA, PM)	Used to find the server for curves for Cardiotocography

These services will have to be added to the Wireless LAN Controller, should that be necessary. Different brands will demand different entries. Most controllers will have to have all services entered. Cisco equipment (pre-Cisco 9800 Wireless controllers) will have to add .local. at the end of the service string.

Legacy discovery - broadcast and multicast

The LLEAP, Ingmar Lung and VitalsBridge systems use broadcast and multicast UDP for device discovery. Legacy discovery is required for updating SimMan3G simulators but since the recommended update procedure requires to use a direct cable it seldom requires changes in corporate network settings.

IP addresses

All simulators, SimPads, Instructor PCs and Patient Monitors underline support dynamic IP, however it may be useful to assign lease reservations to these devices through the DHCP server.
SimView and SimCapture cameras, audio modules and servers need static IPs. It is suggested that the DHCP server is set up to provide lease reservation instead of fixing IP addresses on individual equipment.

Power over Ethernet (PoE)

SimCapture AV equipment need PoE or PoE+. Please note that if Symetrix DSPs are installed, these devices can't use Cisco uPoE.

Internet connection

Internet access may be restricted to the following outbound flow:

Address	Ports or service	Function
*.laerdal.com	https	Online activations of licenses and Laerdal products
cdn.laerdal.com laerdalcdn.blob.core.windows.net	http https	Automatic update detection and update download
scenariocloud.laerdal.com	https	Online Laerdal Scenario Cloud sync
laerdalmedicalb2c.b2clogin.com	https	Laerdal AD B2C login
api.ipify.org	https	IOT external lookup
smtp.gmail.com	SMTP	Feedback forms, error reporting and log files for debugging
servicebus.windows.net	https	If user accepts that LLEAP reports usage data, data sent to Microsoft Application insights.
*.teamviewer.com	https	Remote desktop application.
*.simcapture.com	https	SimCapture cloud
update.blinemedical.com	https	SimCapture update server
*.SonoSim.com	http/https	SonoSim site
SonoSim.auth0.com	https	SonoSim authentication server
update.VitalsBridge.com	https	Updates to VitalsBridge
www.ingmarmed.com	https	Ingmar Lung downloads
*.gigya.com *.googleapis.com *.gstatic.com	https	Single-Sign-On for scenario cloud and other Laerdal services

VPN access (SimCapture)

VPN access must be provided to both networks for remote SimCapture/liveCapture and AV support. The client is responsible for configuring the "AnneSim" and Date VLAN per the specification provided in appendix B.
The VPN connection must provide an IP address within the same subnet as the Dante VLAN – if applicable.

Appendix B: Dante VLAN (SimCapture)

The Dante VLAN connects all Digital Signal Processors (DSP) and Dante amplifiers for real-time audio transmission without the need to run extra audio cabling. This is used in paging.

The workflow starts at the control station microphones: -> DSP -> in-room Dante amplifiers -> speaker. The DSP takes the analog microphone signal, processes it, and transmits it over UDP to the amplifiers, which then sends the amplified analog signal to the speakers.

This setup can also be used to transmit a copy of the audio (from the room microphones) to the control station headphones to provide low-latency monitoring audio.

The Dante VLAN is only required when SIMULATION CENTER control room(s) or headphone station package(s) are purchased.

AV Devices on Dante VLAN

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Device	IP Address	Network Type	Notes
In-Room Stewart Amplifier	Static IP	PoE+	no Cisco uPoE
In-Room Symetrix DSP Ethernet Port 1	Static IP	PoE+	no Cisco uPoE This is configured on the Dante VLAN if a control station or headphone package exists.
In-Room Symetrix DSP Dante Port 1	Static IP	Ethernet	
Control Room Symetrix DSP Ethernet Port 1	Static IP	PoE+	no Cisco uPoE
Control Room Symetrix DSP Dante Port 1	Static IP	Ethernet	

Dante VLAN Switch Requirements

Configuration Setting	Value	Notes
Energy Efficiency Ethernet	Disabled	This will cause the DSP and Amp devices to go offline.
IGMP Snooping	Disabled	Must be disabled on the Dante VLAN only. Dante uses Precision Time Protocol to sync clocks. We use unicast traffic, not multicast.
Packet filtering	Disabled	This will cause latency.
VPN	Dante VLAN	The IP assigned after a VPN connection is made must be on the Dante VLAN. This allows for Dante Controller to diagnose/update the Dante configuration.
We highly recommend all devices on the Dante VLAN be on the same physical switch.		

Failure to complete the above could manifest as clicks, pops, and dropouts of audio transmissions.

Appendix C: Network diagram example
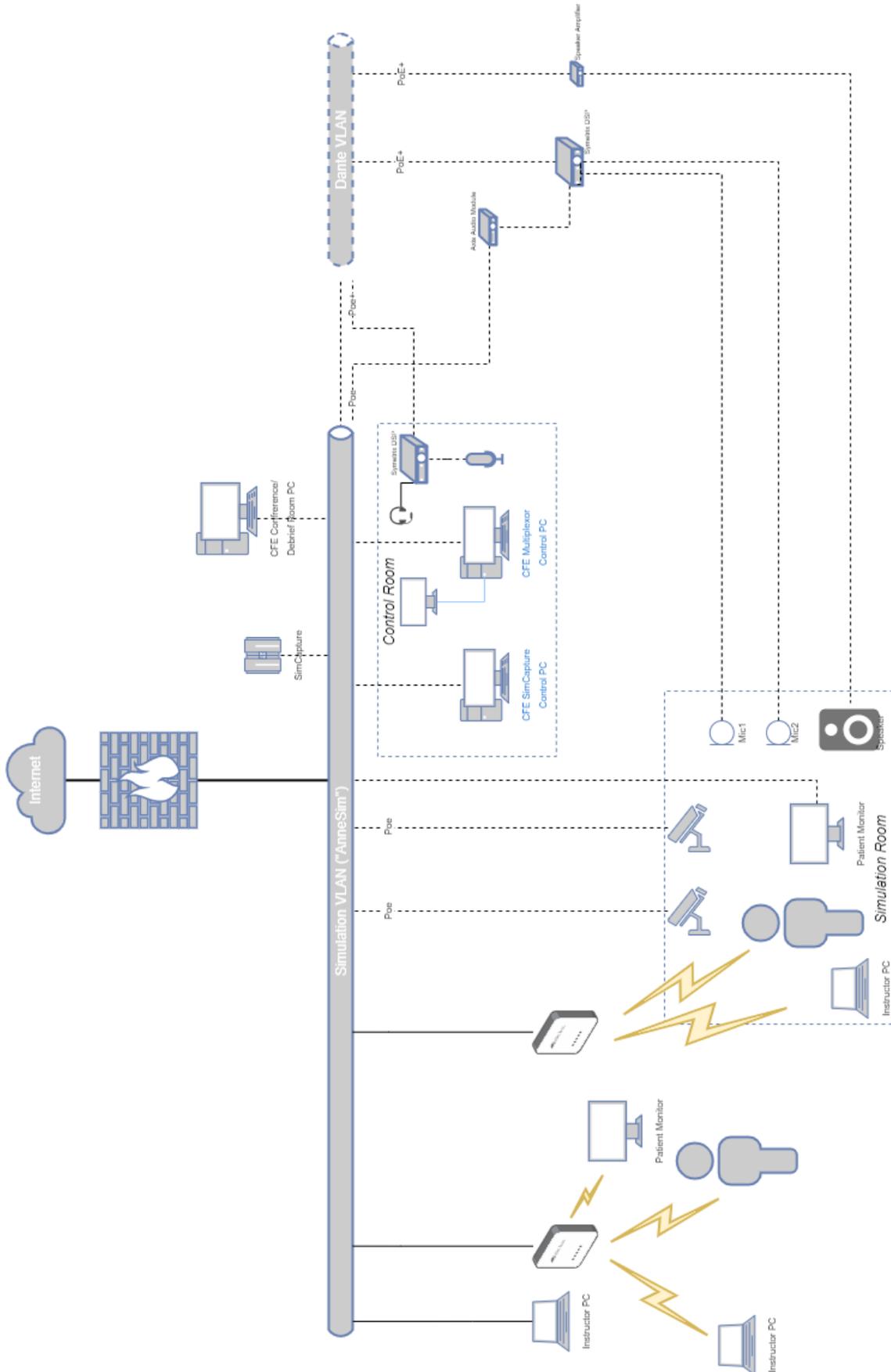
Appendix D: Elevated privileges

Administrator privileges are required for a few selected functions:
- Installation of the SW, upgrades and patches.
- If firewall settings have been removed, they will be re-written on start of LLEAP and this requires elevation.
- When changing settings for Windows auto logon from Laerdal Simulation Home.
- When connecting to a SimLink Ad-hoc network the Network Selector application will ask for elevation to set a static IP on the WiFi adapter. Also, when disconnecting for SimLink and connecting to a normal network it will ask for elevation to remove the static IP. Refer to the section 'Special IP addresses' above.
- Voice Conference Application may ask for elevation to change a sound setting in the Playback Sound device properties under 'Enhancements' where it needs to activate the setting "Disable all sound effects".
- When using Simulator Firmware & Network Wizard (SFNW). In some situations, SFNW will require administrator privileges in order to discover remote simulator devices on the network (change routing tables).
- SimDesigner is using Silverlight and running this in Out-of-Browser mode with elevated trust. For SimDesigner to function elevated trust must be allowed. Make sure this registry key is not set to 0 (or remove it if there):
  `HKLM\Software\Wow6432Node\Microsoft\Silverlight\AllowLaunchOfElevatedTrustApps`

Appendix E: Required access

LLEAP requires access to certain files and folders.
It also requires access to certain areas in the registry.
Some Policy restrictions may interfere with these requirements when running logged into a domain.
The below list is not exhaustive, but lists the most important locations that LLEAP needs access to.

Access	Application	Location	Purpose
Read/Write	LanguageSelector Laerdal Simulation Home	HKLM\SOFTWARE\Laerdal Medical	Configuration
Read/Write	LLEAP	HKCU\SOFTWARE\Laerdal Medical HKCU\SOFTWARE\Laerdal Sophus HKCU\SOFTWARE\Laerdal	Configuration
Read/Write	LLEAP, SimDesigner	%programdata%\Laerdal Medical	Licensing, folder locations, Custom events definitions
Read/Write	Laerdal Simulation Home, SDK	%tmp%\Laerdal Medical	Automatic updates and SDK cache
Write	Laerdal Simulation Home	%tmp%\Laerdal Simulation Setup Assistant	Logging
Write	LLEAP	%tmp%\Laerdal Simulation	Logging
Write	LLEAP	%tmp%\SimSW	Logging
Write	Laerdal Manikin Update	%appdata%\Laerdal Manikin Update	Logging
Write	Laerdal Network Configuration	%appdata%\Laerdal Network Configuration	Logging
Write	Laerdal Simulation Home	%appdata%\ Laerdal Simulation Setup Assistant	Logging
Write	3G Manikin Update	%appdata%\ SimMan 3G Configuration Tool	Logging
Write	SessionViewer	%programdata%\SimVentures	Logging
Read/Write	SessionViewer	HKCU\SOFTWARE\SimVentures HKLM\SOFTWARE\WOW6432Node\SimVentures	Configuration
Read/Write	SimDesigner	%appdata%\SimDesigner	File launching
Read/Write	LLEAP, SimDesigner	{Personal}\Laerdal Simulation	Local resources
Read/Write	Laerdal Scenario Cloud	%tmp%\LaerdalScenarioCloud	Logging and temporary files