Connecting IGT Device with OpenIGTLink

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Slicer in Operating Room

3D Slicer’s data I/O in OR
- Import images from MRI/CT/Ultrasound
- Import tool tracking data
- Send commands to robotic devices
- ...
OpenIGTLink

- TCP/IP network communication
  - NDI 3D tracking systems
  - Research software
    - CISST library (JHU), PLUS (Queen’s), IGSTK (Kitware), Matlab/Octave, etc

- Why TCP-based network?
  - Available in modern operating rooms
  - Affordable devices (interfaces, switchers and cables)
  - Flexible network topologies
  - Wireless capability (IEEE 802.11a/b/g/n)
  - Reasonable performance (i.e. bandwidth, latency)
3D Slicer OpenIGTLink IF

- Import data from remote host MRML scene
- Export data from MRML scene to remote host
TCP Connection Basics (1)

Remote host is specified by

- IP address (i.e. 192.168.0.1) or network address (i.e. watson.bwh.harvard.edu)
- Port number (i.e. 18944)
TCP Connection Basics (2)

“Server” and “Client”
- The server waits for the client at a given port.
- The client requests a connection to the server.
- Server (client) is not necessarily a sender (receiver).
- Slicer can be either server or client

Connection request:
- Host A
  - Software A1 (server)
- Host B
  - Software B1 (client)

Data transfer:
- Host A
  - Software A1
- Host B
  - Software B1

Network connection diagram:
- Host A
- Software A1
- Network
- Software B1
- Host B
This course requires the following installation:

- 3DSlicer version 4.1 Software (Slicer 4.1.0 r19886), which can be installed from:
  
  http://download.slicer.org/

- Tracker Simulator:
  
  http://wiki.slicer.org/slicerWiki/index.php/Modules:OpenIGTLinkIF-3.6-Simulators

**Disclaimer**

It is the responsibility of the user of 3DSlicer to comply with both the terms of the license and with the applicable laws, regulations and rules.
Following this tutorial, you’ll be able to import tracking data from external devices (e.g. tracking system) through the network.
Overview

• Configuring OpenIGTLink IF module
• Setting up Test Server
• Visualizing Tracking Data
Part 1: Configuring OpenIGTLinkIF module
The Graphical User Interface (GUI) of Slicer3 integrates five components:

• the Menu Toolbar
• the Module GUI Panel
• the 3D Viewer
• the Slice Viewer
• the Slice and 3D View Controller
Starting OpenIGTLinkIF

Select OpenIGTLinkIF
Adding Connector

To connect 3D Slicer to external device/software using OpenIGTLink IF, a “connector” has to be created for each connection.

Connectors can be configured in “Connectors” Tab in OpenIGTLink IF module.
Adding Connector

Click “+” button

“vtkMRMLIGTLConnectorNode1” shows up on the list
Changing Connector Name

You may change the name of the connector by typing in a new name and hit Return key.

This is an optional step. It is a good idea to name connectors, especially if you have multiple connections.
Setting Connector Type

Check “Client”

Type and hostname appears on the list
Part 2: Setting up TrackerServer
Uncompress the archived simulator files downloaded from the simulator page. Find TrackerServer binary file.
Open Terminal

Open a terminal window.

Windows: Open the start menu, type “cmd” in the search box area and then press Enter key.

Mac: Open “Utilities” in “Application” folder and double-click the “Terminal.app” icon.

Linux: Open terminal window.
Start TrackerServer (1)

Windows/Mac: Drag “TrackerServer” icon from Explorer (Win) or Finder (Mac) and drop into the command window.

Linux: Type the path to the binary file of “TrackerServer”.

1. Drag
2. Drop
Specify port number (18944) and frame rate (10 frames/second) in the terminal window. Once the return key is pressed, the TrackerServer starts waiting for a client.
Connect to Test Server

1. Click “Active” to connect

2. Status becomes “ON”

3. Simulator starts printing random transform matrix values in the terminal window.
Checking Transform

- Open "Transforms"
- Choose "Tracker"

Transform is being updated while Tracker Simulator is sending data.
Part 3: Visualizing Tracking Data
Loading Sample MRI Data

Open “Welcome to Slicer”

Click “Download Sample Data”
Loading Sample MRI Data

Click “Download MRHead”

Status window shows the progress

Sample image appears in the slice viewer
Choosing Locator Source

1. Click “+” at “IGTLConnector” in the I/O configuration to expand the IO tree

2. Click “+” at “IN”
Enable Locator

Click the eye icon in the I/O configuration tree.

The icon changes to

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Visualizing Locator

Locator model appears in 3D Viewer

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Showing Resliced Images

Click [Link button] and then [Eye button]

Resliced images are shown in 3D Viewer
References

• 3D Slicer OpenIGTLinkIF Documentation Page

  http://www.slicer.org/slicerWiki/index.php/Modules:OpenIGTLinkIF-Documentation-4.1

• OpenIGTLink Protocol Web Page:

  http://www.na-mic.org/Wiki/index.php/OpenIGTLink

• Paper

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