

Open Video Chat for OLPC/Sugar: a Free and Open Source Deaf Education Initiative

Stephen Jacobs, JeRemy R. DeCausemaker, Justin T. Lewis, Taylor J. Rose, Fran Rogers
Rochester Institute of Technology, Lab for Technological Literacy

Abstract – Sponsored by the RIT Postsecondary Education Network International (PEN-International), a team of RIT faculty and students from the B. Thomas Golisano College of Computing and Information Science (GCCIS), undertook a project to develop a video chat program capable of delivering and receiving video streams of sufficient quality to support sign language communication on the One Laptop Per Child XO laptop and any other computer running the Sugar Learning Platform. Research on the problem was initiated in December, 2009 and active development on Open Video Chat (OVC) began in March of 2010. A fully functioning prototype was released in May of 2010. This paper discusses the evolution of OVC, its current status and plans for future work.

Index Terms – Deaf Education, Free and Open Source Software, One Laptop Per Child, Video Chat

Background

First produced in June of 2007¹, the One Laptop Per Child XO is a durable, sustainable, child-centric laptop designed to be distributed to children in the emerging world as a platform upon which school systems could provide a first class education by overcoming the lack of resources available to them. The XO has a built-in Video Camera and is capable of networking to other XO's with or without an external Internet connection.

The XO uses a Python-based GUI called Sugar that sits on top of the Fedora Linux operating system. All of the software is Open Source and much of the library of software applications (called Activities) that run in Sugar have been created by volunteers. In May of 2008², Sugar Labs was formed to promote the use of Sugar on other computing platforms as well and the first version of the software capable of auto booting from a USB Flash Drive, "Sugar on a Stick," was released in June of 2009³.

A video chat activity was first released for Sugar on the XO in October first of 2008 and updated a year later. ⁴ This activity was primarily a proof of concept designed for hearing children. As such it delivered video at only 7.5 frames per second and was only borderline useable for sign language.

In October of 2009, RIT's Lab for Technological Literacy (LTL) demonstrated the video chat capabilities to members of NTID's Center for Access Technology and PEN-International. Both groups were interested in seeing if the technology could be improved to bring it up to the performance quality required to make it functional for signed communication and PEN-International provided the funds to support development of a prototype.

This paper was presented at the *Technology and Deaf Education Symposium: Exploring Instructional and Access Technologies*, held at the National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, NY, June 21-23, 2010.

Evaluation of the original video chat activity proved that the underlying code was dated enough that it made sense to build a new Activity from scratch rather than attempt to modify and upgrade the existing program.

What OVC Does and How It Works

As of this writing, OVC is a chat application for the OLPC XO 1.5 /Sugar platform that provides video and text chat capabilities. The program is constrained by The XO 1.5 hardware uses a Via C7-M (1 GHz) ULV CPU, a Via VX855 northbridge / southbridge companion chip for peripheral I/O and 1 Gigabyte DDR2 SDRAM system memory, running at 400MHz. The on-board video camera is capable of 640 x 480 resolution video at 30fps. The base performance of the camera hardware is, of course, impacted by OVC's need to stream video live between computers. ⁵

As the display system on the XO supports only one hardware accelerated and many software accelerated video streams, OVC currently provides the user with 2 windows. A preview window, on the right hand side of the screen, allows the signer to ensure they are within the camera frame while they are signing to the "caller" at the other end. As this function does not require high-fidelity resolution or frame rate, this video stream is software accelerated and generally runs at less than 15fps in practical use. The "message" window, on the left side of the screen is hardware accelerated and as a result provides higher resolution video and a frame rate of 15-25fps depending on network conditions for the stream. (see Fig 1 at end of paper)

The software architecture of the application is as follows. Open Video Chat is written in the Python⁶ programming language. Its main class (OVC in Fig 2 at the end of the paper) is responsible for connecting to the Graphical User Interface (GUI), the GStreamer Stack⁷, (GST) and the Network Stack. (NET)

GStreamer is a pipeline-based multimedia framework It handles different forms of media and is responsible for the audio and video handling of the OVC application. Telepathy⁸ is a framework for real-time conversations, including instant messaging, IRC, voice calls and video calls. It is responsible for making the connection between the laptops across the Internet that the Network Stack uses to pass the XO's ip address as well as the chat session. In a future implementation, we hope to get video to travel through this connection.. Dbus enables Telepathy's ability to make those connections. All are existing Open Source standards that OVC makes use of.

When a participant joins the activity, they start by listening for incoming video in the GST Stack. At the same time, they announce their IP address in the Network Stack to the other participant. When a participant receives the other's IP address, they start streaming their video to that address. It is important to know that Open Video Chat only uses open and freely available video codecs, which on the XO is Theora.

Current Status and Future Work

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OVC is currently available for download as a prototype release (as opposed to a finished product) at <http://activities.sugarlabs.org/en-US/sugar/addon/4305>. As of this writing it has been downloaded over 1300 times and the development team has been collecting feedback sent from downloads and collected from informal user tests at NTID. It has also been distributed, along with Sugar on a Stick, to registered attendees of the 2010 NTID Technology and Deaf Education Symposium.

During RIT's summer quarter the development team has received funding from Pen-International and the Golisano College of Computing and Information Sciences to refine the prototype to a widely distributable version and to explore porting a non-Sugar version of the software, tentatively entitled Open Access Video Chat, to other computing platforms. The team will explore adding additional features such as control of font size, audio, video contrast and window sizing to make the package more flexible for those with needs for greater visual accessibility as well.

Acknowledgements

This work has been sponsored, in part, Pen-International and the Golisano College of Computing and Information Sciences. It has also been supported by donations of XO computers from the Fedora Project and One Laptop Per Child

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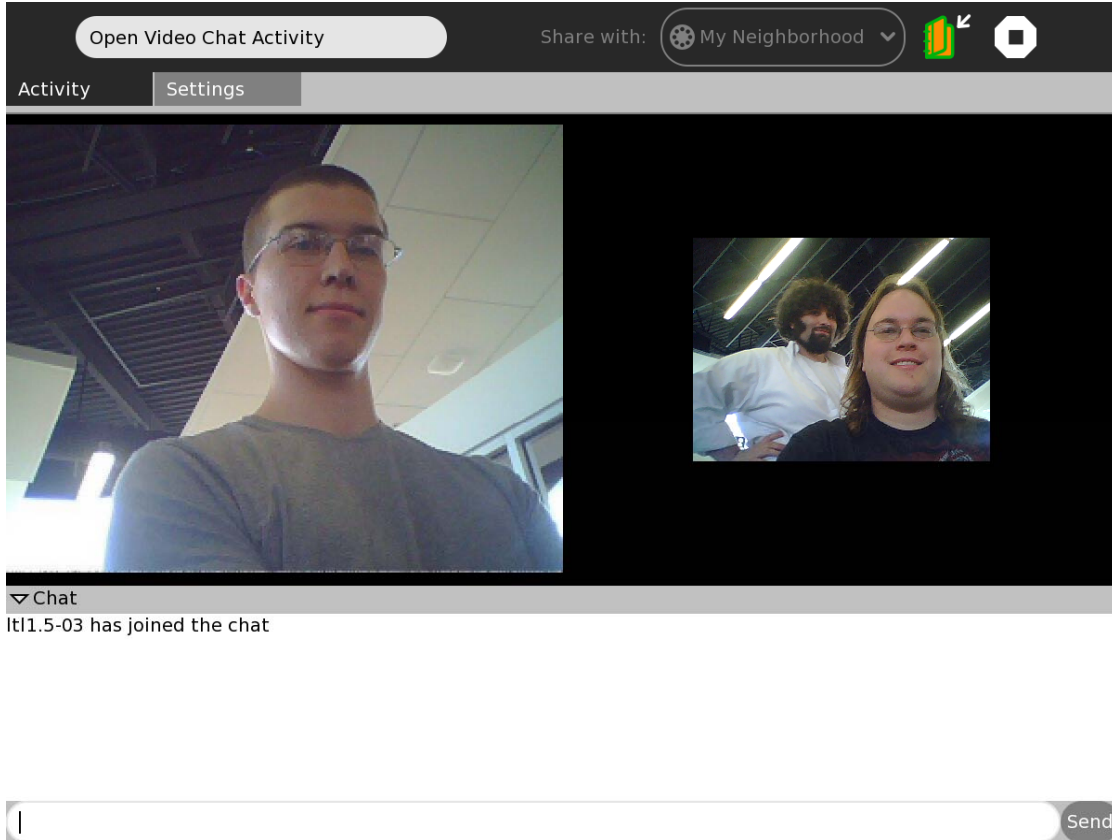


Figure 1
Screen Shot of OVC.

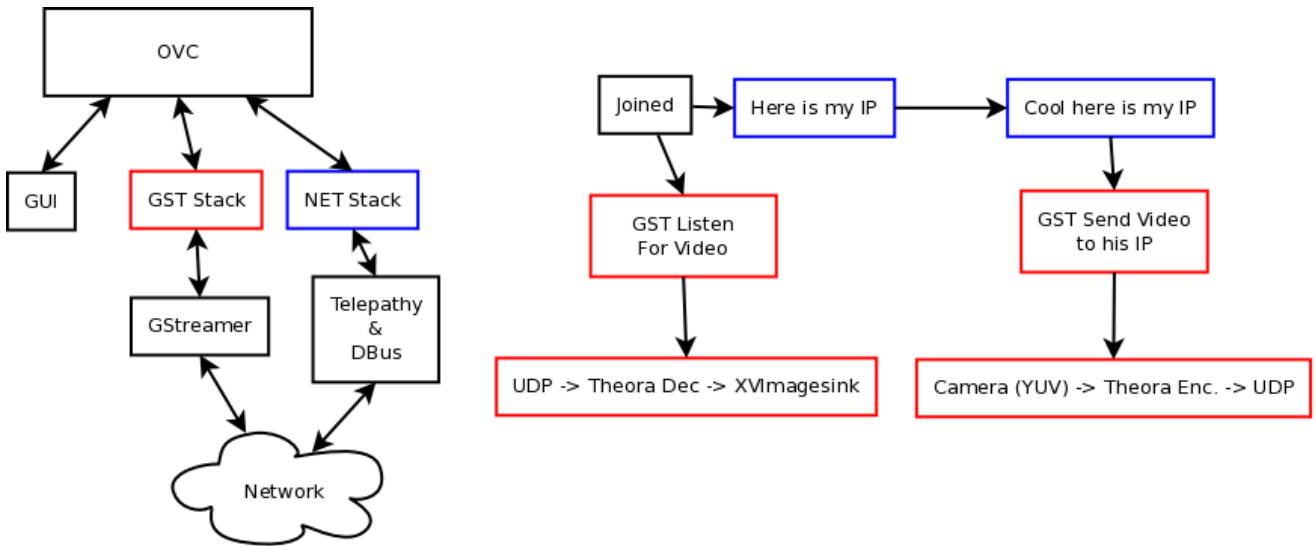


Figure 2 – Stack Diagram

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