

## Total Open Station: freeing your hardware

Luca BIANCONI / Stefano COSTA

Research Group, International Institute of Ligurian Studies

**Abstract:** "Total Open Station", a new software providing a unique platform for managing total stations. Problems and necessities of developing an Open Hardware for scientific purposes. Importance, worries and future evolution of this example of Open Source project in archaeology.

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The contact between Archaeology and Open Source Software is increasing since several years. During each year it produces more interesting and useful results for archaeological practice in each one of its activities. If you think, just for the most common uses, to Spatial Analysis', to office's and Database management's applications, our everyday instruments are heavily changed and improved in the past years and probably they are going to change much more in the following ones. Nobody could deny the feedbacks have been just positive, even if there is still so much to think about again and again. This situation can be considered more than encouraging and the people, related to archaeology, involved and using open source software is increasing sensibly. Actually one of the main reason seems to be that the production of software and IT solutions for Archaeology looks like having found a practical way out of the constant lacks of interest in developing good software just for archaeological aims by software houses and the commercial companies: our tools are improving thanks to the benefits of the approach related to the Open Source movement, that is the so-called "Collaborative method", and the sharing of information and skills between people interested in renewing IT application in sciences.

As a unique research and work group, we have moved our first paces in Open Source for archaeology when Stefano Costa conceived what is probably one of the first Italian websites dedicated to Archaeology and Free/Open Source instruments, presenting that in Vienna's Conference in 2006. In all these years we have seen the development of the need and appreciation of Open Source software in our scientific field and the rise of an increasing demand for not only open software and open content, but even for open hardware.

This in particular is indeed the natural evolution of open source software, because its most important and distinctive feature is not the fact of being free, but of being highly adaptable and that anyone could modify it according to their needs. That is why archaeologists are looking forward having the possibility even to adapt their devices and modify their tools, according to their very particular necessities. That is because we also need open hardware and because we have decided to take this way for trying to solve some of our very particular problems.

After the trowel, the most common archaeological tool is the total station. In everyday practice the total station is a reliable friend for archaeologists, in the technical sense of the measuring action, but it

brings with its usage also some troubles, speaking about using the data you have saved with it on the fieldworks.

The main problems about total station aren't necessarily related to proprietary downloading software but the potential to be locked into a single operating system. You shouldn't be obliged to use any of them in particular, but you should be free to work just on the one you need and you commonly use for all the other applications.

Thus we could roughly divide these kind of difficulties in two main categories: you have lots of total stations but not a unique interface to manage them all, you have plenty of software but not a multi-platform framework to interact with data and total stations. Firstly it is necessary spending some words for explaining which are the sources of these problems and see how they come.

The first problem comes because you could have more than one total station and you could be obliged to use a different operative chain for handling and get your data out of each device (this usually means also using different software provided by vendors, if you still have it of course).

The second trouble is in a certain sense caused by the first one: you have no independent, from a particular device, framework to handle data from total stations (that often means there's no software at all to manage your total station under some Operating Systems).

So the needs of having just one software for working with several total stations and taking data from total station under different Operating Systems have been the strongest push for implementing a software aiming to solve all these problems.

To fulfill this wish we have developed a new application, called Total Open Station (TOPS). Thanks to TOPS you can manage many models of total station and work under plenty of operating systems. It tries to be really multi-platform.

TOPS is an open source software, of course. It is written in Python, according to the 2.6 release, and it is released under GNU GPL 3 license (it means you can use it for free, you can get it for free, you can modify it for free, according to a basic copyright of course). We have expressively tried to design it to be a multi-platform (Unix-Mac-Win) software, at least as long as the Python's interpreter allows.

Anyway we have tested it booting the application passing through the Python interpreter with Windows Xp and Windows Vista, with Ubuntu, Kubuntu, Debian and Openmoko Linux and it already works generally alright.

The application is designed following the logical chains of data flow from total stations to specific software, so it is thought as passing through three consecutive steps: import, process, export.

The import phase it is the one used for transferring the raw data from the total station (plugged via the serial port to your pc or mobile device). It's the basic data retrieving part of the whole work flow.

The second part of TOPS' work chain is the one that processes, parsing them to see if they make sense, and transform the data, providing a preview, making them to be ready for being stored within a file. It implies that TOPS parses the raw data and save temporarily just the points and the notes you are interested in, that is the core of information you have recorded on field-excavation.

The last phase, that we can call export, is conceived for saving the data, already processed and

transformed in a general format, in a particular file format accessible and usable from a specific software.

TOPS allows you to load raw data from a number of already supported total stations (some Leica, Nikon and Zeiss) and to export the data in several formats (txt, csv, dxf, dat, etc.), according to the program you need to use. Extra station models can be catered for by coding a simple parser using provided instructions.

Hardware support goes even further and beyond total stations; TOPS has been tested to run on a variety of hardware platforms, most noticeably the Openmoko mobile telephone. Archaeologists then are not bound to traditional computing hardware, but can use their Open Total Station with a variety of hardware; freeing both geospatial data and themselves.

We should also let you take a quick note about the formats for storing the data and for exporting them into a standard interface: apparently there are no standards about data formats: not for storing into total station while you are on the field and neither for the raw data output from the total station when you want to download them into total station. This is one of the points causing more troubles for implementing a unique and handy general framework. It is not so straightforward having a common parser for data coming from devices for whom there is no already written parser. Thus at this very moment it needs having a raw data sample of any data output for having a proper parser to analyze our source data. Anyway we are making encouraging improvements, studying the logical process of parsing these data and we seem to be on the right road to provide a unique abstract and general parsing system, suitable for the most of the total stations.

There are some other aspects we have kept in mind developing TOPS, that is the care to make it even more portable to resources limited systems, like mobile devices, maintaining it a very light weight application. We have tried to use just the Python standard distribution (TKinter library for the rough GUI) and the of course needed pySerial library for the transferring of data from the total station to TOPS.

It needs to say that TOPS is at the beginning of its development and still a work in progress. We have still plenty of things to do and some bugs to fix, even in this very essential first release.

The first thing we have in mind, it will be providing a stable installer for the actual release of the software, avoiding the users the worries of using the Python interpreter. At the moment we have just one semi-stable and working for MS Windows XP

(<http://sharesource.org/project/totalopenstation/files/180/297/> ) *Not available anymore.*

The next step will be firstly the redesign of the whole application according to a much more planned and rational project plan and then the adding of some essential features, like a "custom parser" creator and the implementation of a release, fully compatible, for the Openmoko system.

We should thank Oxford Archaeology Ltd and in particular Joseph Reeves for having tested the application, for having provided us some samples of raw data from their total stations and eventually for working together to the implementation of a TOPS version for the Openmoko.

Even if we already have some very important feedback (like University of Siena and Oxford Archaeology Ltd), we would welcome any other one with enthusiasm. We would like to know much more opinions about TOPS and what could be improved and enhanced. So any e-mail sent us to this address would be welcome : [tops\\_dev@lists.berlios.de](mailto:tops_dev@lists.berlios.de). If you like downloading TOPS, you can find it at <http://tops.berlios.de/>. *Not available anymore.*

This is the way we have tried to provide archaeologists with what they often need: an “open hardware” total station.

## References

S. Costa, IOSA.IT : an online resource for archaeology and free software at the XI International Congress “Cultural Heritage and New Technologies”, Vienna, 18-20 October 2006