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How to create a very-low cost, very-low-power, credit-card-sized and real-time ready datalogger

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In some cases a field instrumentalist could have to add some extra sensors in a remote station. Additional ADCs (Analogic Digital Converters) are not always implemented on commercial dataloggers, or may already be used. Adding more ADCs often implies an expensive development, or buy a new datalogger. We present here a very simple way to deploy an embedded ARM computer, use its features and embedded ADCs to create datas in a seismological standard format and integrating it within the real-time data stream from the station.

In the past few years, because of the market growth of telephony and mobile applications, the ARM processor from ARM Ltd has become very common and available at a reasonable price. This processor has the particularity to be an excellent compromise between its frequency and its power consumption. That's why most of smartphones and tablets feature nowadays that kind of processor. It is also available on the market as Soc (System on Chip) or complete embedded computer. The most known is probably the Raspberry Pi, but many ohers exist like the BeagleBone or BeagleBoard. This kind of computer can be bought between 35€ for Raspberry Pi and several hundred Euro for more industrial products. Each model often embed some ADCs on its chip or some special buses, allowing additional ADCs to be easily used. Our experiment has been made on a BeagleBone platform, available at 78€Ẇe chose it because its a more mature product than Raspberry Pi, it has all connectors and options needed: seven ADCs, an USB port for local backup, an Ethernet port for real-time streams, and some useful things like GPIO and I2C buses. Our goal was to plug temperature and humidity sensors on the ADCs, read datas, record them in mini-SEED format (Standard for the Exchange of the Earthquake Data), and transmit those datas to a central server as a secondary source for a remote station, by using Seedlink, which is a standard for seismology. Seedlink is a real-time data acquisition protocol and a client-server software that implements this protocol. We first discuss on how install a linux Os, and a Seedlink server on this platform. We then explain how we developed a very simple plugin for the Seedlink server, for reading, preparing, sending and recording datas in mini-Seed format, and how we implemented it in the whole data stream. We later evaluate the quality of this low-cost datalogger, with methods we normally use with our commercial seismological dataloggers. We finally talk about how deploy several platform with the same disk image as quickly as possible.