Real-time processing e-VLBI with the EVN and the SKA

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Very Long Baseline Interferometry (VLBI) is a technique which combines data received by distant radio telescopes in order to form images of celestial objects at (sub-)milliarcsecond resolution. In the past this could only be done by recording the data at the telescopes and process them later, which in turn required very high precision time and frequency standards at each site. Data recording and independent clocks have been trademarks of VLBI for a long time. With the development of high-bandwidth Internet across the globe, streaming the data to the central processor (the correlator) has become a viable alternative to recording and data shipping in the past 10 years. Real-time correlation is now a well-established procedure routinely used during e-VLBI sessions at the European VLBI Network (EVN, or e-EVN), and at other astronomical VLBI networks. It has been used for geodetic VLBI and space tracking applications as well. The other trademark of VLBI, independent time and frequency standards might be obsolete in the near future as well, to be replaced with a central clock signal distributed across the network. While these defining features may be vanishing, the term VLBI will be still used in the future for the technique that allows us to produce radio astronomical images at unprecedented resolution.

The next step is to realize the Square Kilometre Array (SKA), with VLBI operations in mind. Initially the mid-frequency components of the SKA may be added as ultra-sensitive elements to existing VLBI networks. These will be capable of forming a number of phased-array beams. The full SKA will have a very large number of elements distributed over 1000s of km and will act as a standalone VLBI array.

The possibility of real-time data processing (while it has a number of advantages and some disadvantages as well) has changed the culture of VLBI. The e-EVN – a recognized SKA-pathfinder – has made a significant contribution to this field. I will briefly describe the e-EVN and its science, and show how VLBI research will be carried out in the SKA-era.