Chapter 12

Khoros: An Integrated Development Environment for Scientific Computing and Visualization

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Abstract We describe a visual programming environment (Khoros) that allows researchers and scientists to solve problems in information processing, data exploitation, image and signal processing, and data visualization. Khoros is user extendable and can be used as an integrated environment for projects that will benefit from the advantages of visual programming.

1. INTRODUCTION

Khoros is an integrated development environment (IDE) that allows researchers and scientists to solve problems related to scientific computing and visualization. Khoros contains over 300 programs, or operators for information processing, data exploration, image and signal processing, and data visualization. Generalized to form a broad base-level technology, these operators facilitate problem solving in a wide variety of application domains used in research, science, government and industry. All Khoros operators may be run individually from the command line or executed from within the visual programming environment, Cantata. With Cantata, visual programmers can combine the scientific operators of Khoros in a graphically expressed, data flow visual language for experimentation, data exploration, and to rapidly prototype new solutions.

Designed to act as an integrated software development environment, Khoros is user extendable. New data processing operators and visualization applications written with Khoros will automatically be accessible in the Cantata visual programming environment. All the data processing and visualization routines provided with Khoros utilize the capabilities provided by the Program Services libraries that comprise the Khoros system infrastructure. The three major Pro-
gram Services [Khoral Research Inc, 1996] of Khoros are Foundation Services, Data Services, and GUI & Visualization Services, which deal with portability and operating system issues, data access and manipulation, and scientific visualization, respectively. Developers may choose whether or not to use Program Services when adding new operators to Khoros; therefore, Khoros is also frequently used as an integration environment for projects that will benefit from the advantages of visual programming.

2. SCIENTIFIC PROBLEM-SOLVING OPERATORS

For problem solving by researchers and scientists, Khoros provides a wide variety of operators for information processing, data exploration, and data visualization. Khoros operators are typically generalized to form a broad base-level technology rather addressing a specific scientific area. All Khoros programs provide automatic data format conversion, data type conversion, file format conversion, support of large data sets, and support for multidimensional data. Khoros operators for scientific problem solving fall into several categories:

- **Multidimensional (1D to ND) data manipulation operators**, including data import, data export, data generation, single & double operand arithmetic, trigonometric and nonlinear functions, bitwise and complex operators, comparison operators, linear transforms, histograms, size &