New C++ Language Extends C Programming Capabilities

By Tony Griggs

AT&T Technologies recently announced that a new high-level programming language is available for licensing to universities. Called C++ (pronounced *C plus plus*), the new language is a major extension of the C programming language.

C++ was designed and implemented by Bjarne Stroustrup in the Computing Science Research Center at AT&T Bell Laboratories in Murray Hill. It facilitates powerful computer programming techniques such as "data abstraction," which enables a programmer to specify new data types with associated operations as needed for a particular application. Resulting programs are easier to understand and modify because of the way they are organized.

"Except for minor details, C++ is a superset of the C programming language," explained Stroustrup, who began developing the language in 1980. "It is fully implemented and tens of thousands of lines of code have been written and tested by dozens of programmers on significant projects."
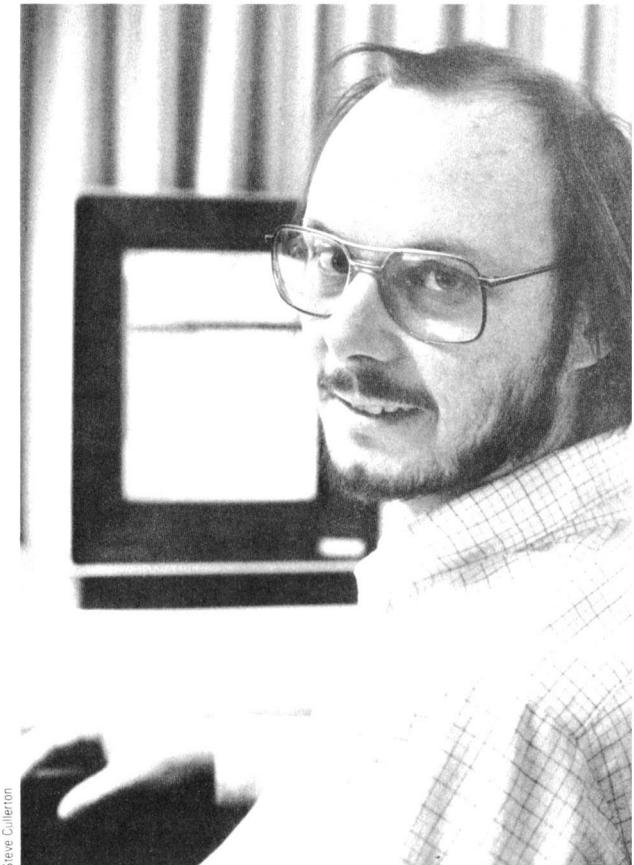
There are now more than 100 C++ installations within and beyond Bell Labs. For instance, Jim Coplien and colleagues in the Exploratory Software Systems Department at Indian Hill used the new language to write experimental switching software; and Tom Cargill of the Computing Science Research Center at Murray Hill, used it to write a C debugger called "pi". Some universities are already acquainted with C++; for example, the Digital Signal Processing Group in the Research Lab of Electronics at MIT has a C++ installation, and IRCAM (*Institut de Reserche et de Coordination Acoustique Musique*) in Paris uses C++ to write programs for producing computer music.

"Back in 1980, I wanted to write some simulations of distributed computer systems," Stroustrup recalled. "The Simula67 language had the key concept I needed, but it wouldn't have been efficient enough. On the other hand, C had the features I needed for efficiency, so I added Simula-like 'classes' to C. The result, known as 'C with Classes,' was and still is quite widely used. Two years ago I set about designing a new language and a new compiler based on that experience. The result is C++."

C++ also facilitates a technique called "object-oriented" programming. "From my perspective," said Tom Cargill, "this is the single most important feature of the new language. Most other languages are procedural, with active code manipulating passive data. Instead, with C++, the data or 'objects' themselves carry out actions requested by other parts of the

Bjarne Stroustrup said design for new programming language grew ou of experience in writing simulations of distributed computer systems.

AT&T Team a Winner on Autoplex™ System 10
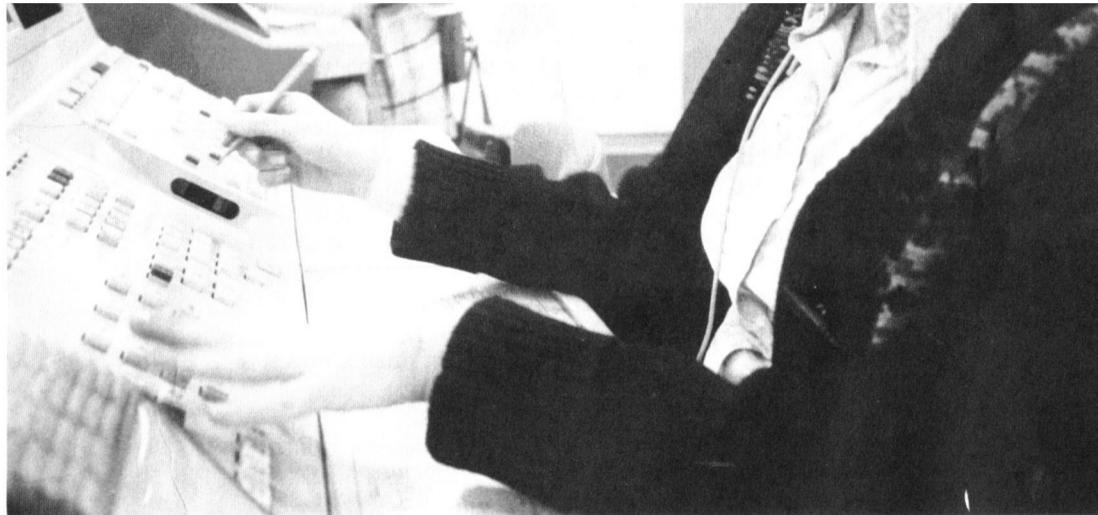
By Ellen Sweets

With the increasing need to get products out the door quickly, closely-coupled efforts across company lines are more important than ever to AT&T. Getting the job done with these added requirements can be

NewVector Communications, Inc., was signed.

The new Autoplex System 10 took advantage of existing AT&T Technology. It uses the Dimension® System 85 to switch calls, the AT&T 3B20D computer as the executive cellular processor (ECP), and can use

Charleston to explain why his company was staying with AT&T.

As part of the company's community relations program, AT&T this year supplied a 20-foot by 30-foot screen to be used at the concert site of Charleston's annual river festival. The screen allowed more people to see the concert performers. In addition, AT&T supplied T-shirts for officials of the road race.

Lauding AT&T's involvement in the community, the company president wrote, "You may count on us to support AT&T so that you may continue to support such events. ... We look forward to working with you in the future." ☐

dinating administration of the survey can answer questions about it. Call (201) 870-7319 or CORNET 8-266-7319. Her electronic mail address is hou2b!3049kej.

Gary Fiederowicz, member of the Education Administration Department, formatted the survey and will do programming for statistical analysis of the results.

The results will be sorted by families of job classifications and locations. ☐

C++ continued

program."

C++ supports both programming techniques—'data abstraction' and 'object-oriented'—without forcing a programmer to use either, Stroustrup said. "This allows programmers to use techniques suitable to particular applications. Many of the best applications of C++ use hybrid approaches so that part of the program is written as it would have been in C, other parts use 'data abstraction' and yet other parts are 'object-oriented.' C++'s particular merit compared to other languages is the efficiency with which 'high-level' data types can be implemented in terms of simpler types, the completeness of the abstraction mechanisms, and the compactness of the written code."

He added that C++ can be used to produce higher quality software products faster because the C++ compiler can catch many more "bugs" than a C compiler can, and because the structuring facilities of C++ can be used so as to guarantee the absence of whole classes of errors. He emphasized, however, that C++ does not impose any particular style or set of restrictions on a programmer.

Bjarne Stroustrup is now busy writing a C++ textbook, for which there seems to be quite a demand. ☐

Autoplex continued

members of the Cellular Telecommunications Laboratory in Whippany.

In spite of difficulties in getting laboratory equipment and enough people to do the job in the early phases of the project, the Indian Hill contingent continued the most ambitious product delivery schedule anyone on the team could recall.

By January of this year, the awesome task of pulling the huge software development project together in such short time—with limited staff and laboratory facilities—became increasingly apparent to all involved.

In March, during a major project review, it also became apparent that additional new lab facilities as well as a new testing laboratory were needed if the schedule was to be met.

At this point, a monumental teamwork effort was launched.

A number of executives from AT&T Technologies, AT&T Information Systems and Bell Labs cleared the roadblocks to delivering a second laboratory. Project team members at Indian Hill, West Long Branch, Whippany and Denver revised their work plans and began to meet weekly to review status reports and undertake whatever reorganization was needed to handle contingencies.

By July 1, a fully-equipped Autoplex System 10 laboratory was in place, complete with a 3B20 computer, a cell site and the Dimension System 85. At the same time the first system was being installed in Salt Lake City.

By Sept. 13, the developers delivered an installation software package to the field implementation team in Salt Lake City. It ran without a glitch. Several scheduled updates have been delivered since then, leading to the turnover load now in place. The team that decided to go for the gold won. NewVector Communications, Inc., got its first Autoplex System 10 on time. ☐