



# **Rogue Wave SourcePro\* C++ and the Intel® C++ Compiler for Linux\*: A Winning Combination**

**Rogue Wave SourcePro C++ and the Intel C++ Compiler for Linux create a development synergy that addresses the major issues concerning software development today and tomorrow.**

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## The Need to Do More with Less

Massive technology spending for its own sake has fallen out of fashion. Current information technology (IT) budget spending is nearly stagnant, whereas it had been traditionally increasing at a compound rate between 10 and 20 percent<sup>1</sup> through the 1990s. Although technology spending has been significantly reduced, technology is still a crucial and costly tool. IT accounts for about 60 percent of all business equipment investment.

Gartner<sup>2</sup> surveyed more than 600 chief information officers (CIOs) worldwide and found that their top three goals, in order of importance, were:

- Cutting costs
- Upgrading information security
- Supporting innovation

The Harvard Business Review article, “IT Doesn’t Matter,” by Nicholas G. Carr, argued that as computer technology becomes more standardized, businesses will have a harder time gaining a competitive edge over their rivals through technology investments. The article posits that the current IT industry represents a technology maturation analogous to industrial technologies such as railroads and the telegraph.

The counter-argument is that railroads and the telegraph are single-use technologies; whereas computers are programmable, adaptable, and reconfigurable. In a dissenting view, Paul A. Strassmann, one-time CIO of General Foods, Kraft, Xerox and the Department of Defense, dismisses the article because of the “enormous unrealized potential of information technology.”

Strassman argues that this unrealized potential has been created by the technology-spending patterns of businesses through the 1980s and 1990s. The unrestrained spending,

likened to an “arms-race,” combined with exponentially increasing processing speeds and storage capacities, resulted in many companies having underutilized computing capacity.

The maturation of business technology has resulted in a call to base IT decisions on the traditional metrics of economics and productivity, using innovation to gain competitive advantage with IT. Instead of simply buying more software and hardware, business is taking an information-based strategy, where technology and business judiciousness are intermixed.

Current trends in IT development are illustrated by General Motors’ investments in software applications and systems to increase the use of the Internet to improve communications with suppliers, dealers, industry partners and customers. The banking and credit card firm Capital One uses data mining and information-analysis techniques to find and reach the most profitable components of the credit card market.

An irony of the argument that standardization of IT components makes it more difficult for technology spending to result in a competitive edge is that standardization of software components unleashes the potential to do just that. By standardizing on universal and open industry standards such as Linux, Intel architecture, and ISO- and ANSI-standard C++, a development team can build a development platform by acquiring tools that exploit the power of these resources and eliminate the massive problems inherent in trying to develop from scratch.

An even greater advantage is realized when these tools are designed specifically to work together, each maximizing the potential of the other. This synergistic relationship can be found in the combination of the Rogue Wave SourcePro C++ and the Intel C++ Compiler for Linux.

## SourcePro C++ Joins Forces with the Intel C++ Compiler for Linux

Leading firms are adopting information-based business IT strategies to gain competitive advantage. Key IT strategies include:

- Internet communications
- Data mining
- Information analysis to identify markets and opportunities

Software development by IS departments, consultants or application developers can address these current IT trends by using products that were developed in anticipation of these demands. The Intel C++ Compiler for Linux combined with Rogue Wave SourcePro C++ provides a world-class platform for Linux development teams to build mission-critical enterprise applications for a global market.

SourcePro C++ is an integrated set of cross-platform, object-oriented C++ components based on ISO and ANSI standards that work with multiple operating systems, compilers and databases. Having integrated components that are already built and tested reduces the planning, development, and testing workload of a project, thus accelerating deployment and reducing risks.

Maintenance is also reduced, because the software components are supported by an outside, dedicated staff and are used by many other companies: bugs have either already been eliminated or are relatively quickly addressed. And improvements are ongoing without effort on the part of the in-house development staff.

With developers not having to concern themselves with the low-level details of the software, they can focus their efforts on core project goals, rather than on the method of development. The highly integrated nature of SourcePro C++ means that applications can grow and evolve with changing business needs without the worry of incompatible components that would be more likely to occur if those components were developed in-house.

SourcePro C++ components include powerful object-oriented abstractions for threading, secure communications, networking, internationalization, virtual streaming classes, higher-level containers, date/time processing, Unicode\* processing, object streaming and XML streaming. They also provide a C++ API for multiple databases, memory management, abstractions for DDL/DML (SQL) constructs, mathematical abstractions for FFT, histograms, linear algebra decomposition, statistical modeling, business currency handling, currency conversions and manipulations.

SourcePro C++ supports the industry standards of SQL92, ICU, POSIX 1003.1g, ISO 8601 date formats, Berkeley sockets, FTP, SMTP, POP3, MIME, HTTP, SSL/TLS, OpenSSL and HTTPS. The SourcePro components address many of the development needs of the current and future IT environment using C++ and Linux.

The Intel C++ Compiler for Linux has advanced optimization features to easily maximize application performance and is compatible with most Linux application-development tools. It also features substantial compatibility with GNU C/C++ and with widely used Linux software utilities. Each license for Intel software development products include one year of comprehensive support directly from Intel, which is usually a 'for-fee' add-on from providers of freeware products.

The advanced optimization features of the Intel C++ Compiler for Linux include excellent floating-point performance, inter-procedural and profile-guided optimization switches, data pre-fetching and full support for Streaming SIMD Extensions 3 (SSE3). Support for parallelism includes an automatic vectorizer, auto-parallelizer for automatic threading of loops and support for OpenMP\*. It also supports the ANSI C/C++ and ISO C/C++ standards and offers GNU inline ASM for the IA-32 architecture.

Rogue Wave SourcePro C++ and the Intel C++ Compiler for Linux create a development synergy that addresses the major issues concerning software development today and tomorrow.

## Maximizing Software-Development Potential

Chefs do not raise cattle or cultivate yeast, and painters do not manufacture paint and brushes. There is no technical reason that they could not do so, but specialization, economies of scale, and monetary and temporal resource constraints preclude those activities.

Professionals purchase tools and materials from specialized manufacturers to obtain the highest quality at the lowest resource costs. Oddly, many software-engineering teams continue to build low-level components for development projects and to rebuild them repeatedly for each new project.

Using pre-built software components helps development teams increase productivity, shorten time to market and reduce risk. Independent return on investment (ROI) experts at Alinean indicate that using pre-built components from a trusted and stable commercial vendor yields substantial benefits over using in-house developed or open-source components. The advantages include:

- Components have been field-tested by many developers and users
- Cross-platform support is built-in to appeal to the largest possible market
- Components are reusable and are typically scalable to appeal to the broadest possible market

An ROI study from Alinean showed that use of Rogue Wave C++ components proved significantly more efficient and effective than relying on in-house-developed components.<sup>3</sup> Component use reduced the planning, development and testing workload. Researchers found that component use increased application quality and reduced downtime, thereby reducing project risk. This study showed the resulting return on development investment in components to be between 300 and 500 percent.

## SourcePro C++ Architectural Overview

Rogue Wave Software, a QUOVADIX\* Division, has over 300,000 developers worldwide using SourcePro C++ software components in applications covering the spectrum of uses, including government, telecommunications, financial services, transportation, petroleum, chemical and electronics industries.

SourcePro C++ is an integrated set of cross-platform C++ development components complete with documentation, source code and support that are designed with one goal in mind: to facilitate the delivery of effective C++ applications that are on time, on budget and work exactly to specification.

By eliminating the need to build your own low-level C++ components, SourcePro C++ reduces the planning, development and testing workloads, accelerating project deployment. After deployment, SourcePro C++ reduces the ongoing maintenance burden. And because the components are highly integrated, they share a common, compatible interface. SourcePro C++ enables applications to grow and evolve with changing business needs.

### SourcePro C++ includes four primary components:

- **SourcePro Core** – Fundamental C++ components
- **SourcePro DB** – Components to provide relational database access in C++
- **SourcePro Net** – Components for network and Internet communication
- **SourcePro Analysis** – Components for business and scientific analysis

### SourcePro Core

The SourcePro Core product provides fundamental C++ components that offer a high-level, object-oriented interface to complex underlying APIs. Features include:

- Smalltalk\*-like collection classes with persistent storage
- Advanced classes like virtual page heap, cache manager, audit stream buffer and Btree on disk
- Complete, Unicode-based framework for internationalizing and localizing C++ applications
- Robust and complete implementation of the ANSI/ISO C++ standard library specification
- Complete set of string-processing classes, including string tokenizing, parsing and regular expressions

- Date/time-processing classes with ISO 8601 date-format support
- C++ encapsulations of key multithreading concepts such as thread creation, control and synchronization
- Advanced threading abstractions like IOUs, server pools, inter-thread communication and producer/consumer queues
- Thread-safe and exception-safe smart pointer classes
- Thread-compatible exceptions classes
- Efficient and flexible execution-tracing facility
- Functor classes for retrofitting existing single-threaded applications
- Non-intrusive streaming mechanism to stream any C++ class with minimal code changes, including XML streams

## SourcePro DB

The SourcePro DB product supports relational database access in C++ through an intuitive and easy-to-use API that is consistent across supported databases. Features include:

- High-performance C++ classes that encapsulate SQL 92 Data Manipulation Language (DML) and Data Definition Language (DDL) constructs
- “Native” access to Oracle, Sybase, Microsoft\* SQL Server\*, IBM\* DB2\*, IBM Informix\*, MySQL Server, PostgreSQL\* Server, and ODBC 3.x databases
- Open SQL interface for added flexibility
- High-performance bulk insertion and reading support
- Internal memory management of data buffers
- Large C++ data type support
- Support for cursors, join expressions, transactions and isolation levels
- Support for internationalization for various databases
- Automatic runtime SQL generation from high-level C++ constructs
- Dynamic data-binding support and complex SQL generation
- Support for distributed transaction processors like Tuxedo\* and Encina\*
- Optional schema caching for high performance
- Connection pooling for user-controlled connection management
- Asynchronous-processing support
- Flexible SQL tracing

## SourcePro Net

The SourcePro Net product includes components for network and Internet communication.

- Flexible, layered architecture
- C++ encapsulation of the MIME message format
- Clean, intuitive API for developing secure or non-secure networking and Internet-enabled applications
- Support for both encryption and authentication (X509 certificates)
- Intuitive API for secure communication using HTTPS
- Intuitive C++ interface to the Berkeley socket API
- Flexible C++ encapsulations of key Internet protocols including FTP, HTTP, SMTP and POP3
- Based on proven, respected SSL/TLS implementations

## SourcePro Analysis

The SourcePro Analysis product provides components for business and scientific analysis.

- Intuitive C++ interfaces to essential mathematical algorithms
- Optimized math collection classes, including vectors, matrices and arrays
- Classes for complex numbers, persistent streams, FFTs, linear algebra decompositions, histograms, random distributions and linear regressions
- Support for high performance libraries like the Intel Math Kernel Library
- Linear algebra module for object-oriented C++ interface to FORTRAN LAPACK subroutines
- Classes for specialized and sparse matrix, factorization, symmetric and non-symmetric eigen-value decomposition
- Powerful classes for statistical prediction
- Classes for representing currencies, money, money calculator and conversion policies
- Currency-conversion capabilities for both bilateral and triangulated conversion methods within the eurozone countries
- Decimal classes for representing and manipulating decimal fractions exactly
- Formatted I/O and runtime localization

SourcePro C++ components are source code. SourcePro C++ comes with the Rogue Wave Component Builder (RCB), a graphical user interface (GUI) wizard that facilitates the compilation of the components to meet development-platform and target requirements. The RCB allows the creation of multiple “build spaces,” each a component library using the compiler, linker and options of your choice. The RCB can also build only the make files required, allowing command-line builds with make and allowing further customization.

Building applications with SourcePro C++ is done using standard methods. The exception is when building the libraries that are required for the exact build configuration decided upon and declaring RWCONFIG= to internally define the build used.

SourcePro C++ for Linux can be used either with the standard GNU C/C++ Linux compiler or with the Intel C++ compiler. The Intel compiler is a better match to SourcePro C++, in that the optimization advantages of Intel C++ provide a definite increase in performance, especially in floating-point mathematical algorithms.

## Intel C++ Compiler for Linux

Intel employs more than 6,000 software engineers and spends millions of dollars annually on software research and development.<sup>4</sup> Hence, software innovation and development is one of the highest priorities.

To achieve the maximum potential of the SourcePro C++ components requires a compiler capable of producing highly optimized code. The Intel C++ Compiler for Linux offers extremely high performance.<sup>5</sup> Many customers report performance improvements of 30 percent or more when they switch to Intel Compilers for Linux.<sup>6</sup>

Among the optimizations available in the Intel C++ compiler is inter-procedural optimization. By using the -ip compiler switch, performance is improved in programs that frequently call small or medium-sized functions by “inlining” the function’s code. This eliminates pushing and popping parameters on and off the stack and the branch call itself. Significant performance improvements can be exploited with the -axW switch to employ advanced Streaming SIMD extensions (SSE3) for Intel Pentium® 4 and Intel Xeon™ processors.

The Intel C++ compiler is OpenMP-compliant and takes advantage of the architectural features of all generations of Intel processors. The Intel C++ compiler has logged the best

performance of any IA-32 Linux C++ compiler in standard benchmarks.<sup>7</sup> Key features of the Intel C++ Compiler include:

- Advanced optimization features provide an easy and fast way to get optimal performance from applications
- Compatible with development tools most programmers already use for Linux application development
- Comprehensive support directly from Intel keeps programmers current with the latest compiler releases

### Compatibility features include:

- Binary compatibility with gcc and glibc
- Substantial GNU C/C++ compatibility features
- Compatible with widely used Linux software utilities

### Advanced optimization features include:

- Excellent floating-point instruction throughput
- Inter-procedural optimization (IPO)
- Profile-guided optimization
- Data prefetching
- Full support for streaming SIMD extensions 2 (IA-32 and EM64T)
- Automatic vectorizer (IA-32 and EM64T)
- Runtime support for IA-32 based processor generations: processor dispatch
- Predication (Intel® Itanium® architecture only)
- Improved branch prediction (Intel Itanium architecture only)
- Speculation (Intel Itanium architecture only)
- Software pipelining (Intel Itanium architecture only)

### Multi-threading application support includes:

- OpenMP support
- Auto-parallelization

### Standards and inline style support includes:

- IA-32 architecture support for the C++ ABI object model
- ANSI C/C++ standard
- ISO C/C++ standard
- GNU inline ASM for IA-32 architecture

### Debugger support includes:

- gdb
- Etnus\* TotalView\*
- Intel Debugger (ldb)

## Conclusion

By providing a stable and supported set of infrastructure components, SourcePro C++ reduces the time to market of development projects and saves on development costs by leveraging existing C++ investment and lowering maintenance costs over time. Application evolution is easier with SourcePro C++ as platforms and databases change, due to the high degree of integration, scalability and uniform interface for multiple platforms and database systems provided by SourcePro C++.

By compiling SourcePro C++ components with the Intel C++ Compiler, the libraries created can be custom built to specifically target the architecture and applications desired and to maximize performance for both 32-bit and Intel Itanium processors.

SourcePro C++ is currently available through Rogue Wave Software's standard sales channels ([www.roguewave.com/purchase](http://www.roguewave.com/purchase)) and through Developer Dispatch in the Intel Early Access Program.

Evaluation versions of Intel® Software Development Products are available for free download and include free support during the evaluation period ([www.intel.com/software/products/global/eval.htm](http://www.intel.com/software/products/global/eval.htm)).

## Additional Resources

- The Intel C++ Compiler for Linux
- Rogue Wave SourcePro C++

Intel, the world's largest chipmaker, also provides an array of value-added products and information to software developers:

- **The Early Access Program** provides software vendors with the latest Intel technologies, helping member companies to improve product lines and grow market share. Sign up for the Early Access Program at [www.intel.com/ids/eap](http://www.intel.com/ids/eap).
- **Intel Developer Services** offers free articles and training to help software developers maximize code performance and minimize time and effort. For more information, visit [www.intel.com/ids](http://www.intel.com/ids).
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- **IT@Intel**, through a series of white papers, case studies and other materials, describes the lessons it has learned in identifying, evaluating and deploying new technologies. Discover how Intel does IT at [www.intel.com/it/index.htm](http://www.intel.com/it/index.htm).
- **The Intel Software College** provides a one-stop shop at Intel for training developers on leading-edge software-development technologies. Training consists of online and instructor-led courses covering all Intel architectures, platforms, tools and technologies. For a current course listing, visit <https://shale.intel.com/softwarecollege/>.

For more information about Rogue Wave SourcePro C++, including white papers, datasheets, case studies and a free 30-day evaluation version, visit [www.roguewave.com/intel2004](http://www.roguewave.com/intel2004).

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