Smalltalk Strengths Stand Out

An IDC White Paper

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Smalltalk in the Age of Java

Sometime soon, as Java percolates to popularity, Smalltalk will lose its status as the second most popular object-oriented language. Even its status as the most popular "pure object-oriented language" will become a thing of the past. So, will Java turn Smalltalk into toast? The answer may surprise you. No! Not in the foreseeable future. Not in the real world. Not in the everyday, bet-your-business world of major organizations. It will be quite awhile before Java is mature enough to deliver on its over-hyped promises. In the meantime, Smalltalk already delivers on most of these promises:

- Write once, run anywhere (including embedded systems)
- Efficient development, rapid prototyping, and reuse
- Distributed object processing
- Highly graphical event-driven user interfaces

This IDC Bulletin examines the current status and future of Smalltalk, including these questions:

- What types of applications are being developed and deployed using Smalltalk?
- How do Smalltalk developers feel about the language and the development environments?

IDC Opinion

Smalltalk has grown and prospered in the shadow of C++ for several years. As Java takes over the C++ market, we expect Smalltalk to continue this pattern of coexistence. The worldwide shift of development toward objects and components will continue for some time to come. Smalltalk plays well in this domain. Recognizing this situation — and especially the loyalty of the user base reflected in our survey — we predict a continued steady increase in the number of Smalltalk users. After all is said and done, the fate of Smalltalk probably resides with its two major vendors, ObjectShare (formerly ParcPlace-Digitalk) and IBM. Both vendors are now positioned to support both Smalltalk and Java.

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- How is Smalltalk expected to be used over the next two to four years, especially in the community of current Smalltalk users?
- What will be the expected use of Java in this community?
- Of what advantage is the relative simplicity and maturity of Smalltalk, especially compared with Java?

A Bet-Your-Country Application

JWARS is a bet-your-country application that pushes the envelope of the definition of the term mission critical.

JWARS stands for the Joint Warfare System. It is a bet-your-country application that pushes the envelope of the definition of the term mission critical. JWARS will be a state-of-the-art, closed-form, constructive simulation of multisided, joint warfare for analysis. It is the next-generation theater warfare model. Users of JWARS will include the Combatant Commanders, Joint Staff, Services, Office of the Secretary of Defense (OSD), and other U.S. Department of Defense (DoD) organizations. Applications will include the following:

- Evaluation of courses of action
- Analysis of force sufficiency
- Assessment of force structure alternatives
- Joint Warfare Capability Assessment, in particular development of joint capability issues and assessment of trade-offs
- Determination of requirements for new war-fighting capabilities
- Analysis of weapon system alternatives, in particular cost and operational effectiveness analysis
- Analysis of alternatives for program and budget reviews

JWARS will include representation of all joint warfare mission areas such as:

- Command, control, communications, and computers (C4)
- Intelligence, surveillance, and reconnaissance (ISR)
- Tactical and strategic mobility
- Logistics
- Protection
- Firepower
- Land operations, including ground maneuver, and direct and indirect fire combat
- Sea and amphibious operations
- Air and space operations

- Special operations
- Military operations other than war
- Information warfare

If this list brings to mind a vision of an extremely important, very complex application, it should.

For its implementation, JWARS required a mature, robust, fully object-oriented development environment that could support experimentation and rapid development — hence the selection of Smalltalk. Java was rejected because it was too immature.

For the implementation of JWARS, the DoD recently selected Smalltalk. JWARS will be object oriented throughout. Multiple object models will be constructed in its design. It will comprise roughly 2,500 classes containing 50,000 methods. For its implementation, it required a mature, robust, fully object-oriented development environment that could support experimentation and rapid development — hence the selection of Smalltalk. The alternatives to Smalltalk included C++, Ada95, and Java. Low-level languages were rejected because of their inability to support both rapid experimentation and development. Java was rejected because it was too immature.

Corporate developers especially find Smalltalk developer friendly and its development environment highly productive. Like the DoD, they too are writing complex bet-your-business applications with Smalltalk.

This type of analysis in the selection of an object-oriented programming language is often repeated in major corporations as they move to adopt object technology for their newer generations of applications. Corporate developers especially find Smalltalk developer friendly and its development environment highly productive. Like the DoD, they too are writing complex bet-your-business applications with Smalltalk. To get a clearer picture of the situation, the Smalltalk Industry Council commissioned International Data Corporation to conduct a survey of Smalltalk users. Figure 1 is a partial list of applications reported by end users in our survey, which is discussed below. The scope is broad. Not shown in Figure 1 are the many "tools" and other software products (intended for resale) that were also reported.

Smalltalk Users Speak Out

IDC Surveys Smalltalk Developers

In September 1997, IDC surveyed Smalltalk users to evaluate the following:

- How Smalltalk was currently used and how it would be used in the next two to four years
- How Smalltalk users perceived Smalltalk as a language, development environment, and platform
- What Smalltalk users felt would be the impact of Java on them personally and on their organizations' use of Smalltalk

The survey was accessible for one month. During that time, over 600 respondents took the survey.

The survey was administered as a Web-based questionnaire, accessible from an Internet browser. Notices were sent to the installed user base of both IBM and ParcPlace-Digitalk and posted in relevant chat forums. The survey was accessible for one month. During that time, over 600 respondents took the survey. The screening questions limited respondents to people who felt qualified to answer questions about application development requirements, activities and plans at their locations, and

Figure 1
Smalltalk Applications Reported by Users

Accounts receivable
Aircraft maintenance scheduling
Bank — front-end and back-end commercial banking
Bank — front-end teller
Bank — investigation of incorrect transactions
Bank call center, front end to mainframe
Bank-related query and analysis
Bill-of-material and supplier tracking
Bond portfolio configuration analysis
Border enforcement
Bug tracking
Call center interface
Car leasing
Case/account management
Caseload management
Claims and sales processing
Clinical information management for patients
Clinical trial data management
Commodity trading
Community college student information system
Complex data generation for data warehousing
Complex transportation scheduling
Computer-integrated manufacturing
Conference registration
Construction engineering and management
Construction equipment management
Contact management and workflow
Control of machines used in chip packaging
Courtroom presentation of exhibits
Custom office automation
Customer care
Customer information system
Database front end for decision support
DNA analysis and synthesis
Electric utility service order entry
Electric utility trouble analysis, reporting, dispatch
Electronic commerce
Electronic parts catalog
Encounter management
Engineering data analysis
Equipment execution system
Executive information system
Facilities management
Fleet maintenance
Front-end to mainframe order entry
Fuel inventory management
Genealogy maintenance
Governor's office phone and mail management
Graphics processing for thermal analysis
GUI for 900-number billing system
Higher education administration
Hospital management
Housing computer-aided design
Human resource data management
Image-based remittance processing
Insurance claim processing
Insurance endorsements
Internet catalog publishing
Investment banking trading support
Life insurance underwriting
Loan processing
Logistics, transportation query and reporting
Logistics reporting
Managing and reporting information
Manufacturing equipment control
Manufacturing resource planning
Medical school administration
Medical software
Medicare enrollment
Military intelligence computer-aided analysis
Modeling and simulation
Mortgage loan processing
Mortgage origination, international capital markets
Natural gas distribution management
Network switch management
Office automation
OLAP
OLTP and EDI
Options dealing
Order entry
Pension calculation
Police and public prosecuting administration
Policy administration
Policy processing
Policy rating
Price quotation
Printing labels for PC manufacturing
Process configuration
Process control
Procurement management
Product access server
Product configuration, selling support
Product life-cycle maintenance
Project execution control
Project labor tracking
Provisioning of video services over broadband
Quotation system for underwriters linked to external brokers
Real-time monitoring of processes
Records traffic accident data management
Reference in support of leisure travel sales
Remote monitoring of vital signs
Risk management analysis
Risk management for financial institution
Sales automation
Sales employee compensation
Sales forecasting
Sales tracking
Securities lending and borrowing
Securities trading
Semiconductor device characterization
Semiconductor manufacturing execution
Service and maintenance of products
Shop floor data collection
Simulation of aluminum rolling mills
Software configuration
Stock transfer administration
Strategic planning
Student academic records
Student recruitment
Student registration
Support of remote insurance agents
Telecom central office management
Telecom outside plant engineering
Telecom equipment administration
Telecom network management
Telecom sales
Test system executive
Total care (health) information system
Treasury and administrative
Validation processing for general ledger
Wafer fabrication factory administration
Waste tracking
Workload management

Source: 1997 Smalltalk Industry Council Survey

were familiar (25%) or very familiar (75%) with Smalltalk and associated development environments — hence our reference to this group as Smalltalk developers.

Respondent Demographics

Smalltalk Usage

The sites represented by the survey respondents were intended to be Smalltalk users.

The sites represented by the survey respondents were intended to be Smalltalk users. That they were indeed users was verified by two statistics: on average, the percentage of the development staff at a site using Smalltalk was 41%, and the percentage of the installed base of applications written in Smalltalk was also 41%. Smalltalk is the primary development alternative at these sites.

Job Title

By job title, respondents were predominantly (80%) technical professionals. The rest were executives (7%), managers (11%), and other business professionals (2%). Most of the management respondents were software development managers.

Types of Projects

Table 1 shows the roles respondents played in the development of six types of projects. The table reads across each row. For example, 8% had no role in the development of corporate/custom projects; 50% had a role as in-house developers. Corporate/custom projects seem to dominate, followed by the development of commercial/shrink-wrapped business applications. Consumer product development, and especially game development, ranked low.

Table 1
Roles of Respondents in Different Types of Development Projects (%)

Type of Project	Consultant	In-House	Integrator	VAR	No Role	N =
Corporate/custom projects	37	50	4	1	8	571
Commercial/shrink-wrap bus apps	15	33	6	2	44	508
Government/public projects	18	12	2	1	67	473
Consumer-based products	10	12	3	1	74	465
Games/entertainment	2	3	0	0	95	444
Other	13	9	3	1	74	386

Source: 1977 Smalltalk Industry Council Survey

Experience

The medians (midpoint of distributions) for years of experience are represented in the following ranges. The percentage of respondents with no experience are in parenthesis.

Total application development	10 or more years (0% none)
Total OO programming	5 to < 10 years (0% none)
Smalltalk	2 to < 5 years (0% none)
Relational databases	2 to < 5 years (9% none)
Analysis and design tools	2 to < 5 years (14% none)
C	2 to < 5 years (20% none)
Java	Less than 1 year (37% none)
4GLs and RAD tools	Less than 1 year (37% none)
HTML/CGI/Perl	Less than 1 year (38% none)
C++	Less than 1 year (38% none)
Object databases	Less than 1 year (43% none)
COBOL/PL1/RPG	Less than one year (49% none)
Other databases (e.g., IMS)	None (63% none)

Scope of Responsibility and Size

Thirty-five percent had responsibility for a majority of the company's business units.

The scope of the development responsibilities for a respondent's site indicates a significant amount of responsibility. Only 23% were limited to serving only their own site, and 35% had responsibility for a majority of the company's business units. The median organization size in terms of annual revenue was between $250 million and $500 million. Thirty percent had annual revenue under $10 million; 11% had revenue in excess of $25 billion.

Industry

Roughly three-quarters of the respondents were end-user industries (73%); the rest were providers of computer products or services.

Roughly three-quarters of the respondents were end-user industries (73%); the rest were providers of computer products or services. The larger end-user industry categories represented were business services/consulting (14%), communications (10%), banking/finance (10%), manufacturing (9%), and "other" (12%). The following were between 1% and 5%: retail/wholesale, insurance/real estate/legal, health care/medical), education, and government. Providers of computer products and services were split among software publishers/ISVs (10%), technical consultants (9%), system integrators (5%), and computer equipment manufacturers (3%).

Primary Platforms for Development and Deployment

For development, Windows NT topped the list (74% of sites), followed by Windows 95 (54% of sites), Solaris (27% of sites), and OS/2 (26% of sites).

Respondents indicated their top three platforms. For development, Windows NT topped the list (74% of sites), followed by Windows 95 (54% of sites), Solaris (27% of sites), and OS/2 (26% of sites). Given that these are Smalltalk users and that IBM and ParcPlace-Digitalk are the only Smalltalk vendors of any significant size, the OS/2 number is no surprise. Deployment follows a similar pattern: Windows NT (70%), Windows 95 (63%), Solaris (29%), and OS/2 (27%). There were 14 other platforms in the list. The Java VM was mentioned for both development

and deployment (i.e., one of the top three platforms at the site) at roughly 10% of sites. That number is generally consistent with other IDC surveys on Java adoption.

The information above is what we call demographics. It describes the respondents who answered our survey. With this data in mind, we will see what these developers had to say about Smalltalk.

Survey Results

The survey results clearly demonstrate the following:

- Smalltalk developers are very loyal
- Smalltalk developers have a high opinion of Smalltalk
- Smalltalk is used for serious application development
- Smalltalk developers perceive Java as immature
- Smalltalk will continue to be used for application development
- Smalltalk is and will be used for both client-side and server-side deployment

Note: The size of the sample for the results that follow varies between 618 and 393, depending on the question. Most of the time the number of respondents is around 500.

Smalltalk Developers Are Very Loyal

Respondents were asked to characterize the importance of Smalltalk in their future as a developer. They were given seven statements to choose from (see Table 2). The vast majority (78%) said that Smalltalk would continue to be the most important (36%) language for them personally or an important language (42%). Not a single respondent said Smalltalk had no future importance for that user personally. Twenty-one percent said Smalltalk would be less significant over time for them personally, with more than half citing a move to Java as the primary reason.

Table 2
The Importance of Smalltalk Personally to Respondents

Statement Selected	% of Respondents
It will continue to be the most important language for me personally	36
It will continue to be an important language for me personally	42
It will be less significant over time because I am moving to higher-level languages and tools	3
It will be less significant over time because I plan to direct my attention to Java	13
It will be less significant over time but for other reasons	5
It has no future importance for me personally	0
This is not an appropriate question for me to answer	1

N = 612
Source: 1977 Smalltalk Industry Council Survey

IDC believes that this level of loyalty, at a time when Java is so heavily promoted, is a very, very significant testimony to Smalltalk.

This very strong commitment to Smalltalk is reflected in many of the responses made to questions that allowed respondents to type in comments in their own words. IDC believes that this level of loyalty, at a time when Java is so heavily promoted, is a very, very significant testimony to Smalltalk.

Smalltalk Developers Have a High Opinion of Smalltalk

The following data illustrates how Smalltalk developers rate Smalltalk relative to other alternatives for application development. A 5-point rating scale was used, based on 1 = much worse to 5 = much better and 3 = about the same.

Smalltalk is the clear choice for the development of object-oriented applications. Eighty-two percent of them gave Smalltalk the top rating, 5 = much better. Only 1% rated Smalltalk a less competitive alternative!

Without a doubt, these respondents are absolutely convinced that Smalltalk is the clear choice for the development of object-oriented applications. Eighty-two percent of them gave Smalltalk the top rating, 5 = much better. Only 1% rated Smalltalk a less competitive alternative! Overall, we used 17 measures for comparison. The mean rating was above average for 13 of the 17 measures. A majority of respondents (>50%) gave Smalltalk the top rating on 8 of these measures. Characteristics with a rating of 4 or more, where the maximum could be 5, were:

1. Support for object-oriented application development (4.8)
2. Rapid application development (4.6)
3. Cost-effective development (developer productivity) (4.5)
4. Ease of code maintenance (4.4)
5. Portability to many operating environments (4.4)
6. Integration of overall development environment (4.3)
7. Maturity of the language and of the available development tools (4.2)
8. Support for multiple developer teams
9. Requirement to use Englishlike syntax in development (4.0)

IDC expects Java to take the growth out of the C++ marketplace. Not so for Smalltalk, which will continue to grow, at least for the foreseeable future.

It is not surprising that Smalltalk users who answered our survey would have a high opinion of the language, development environment, and platform. As we shall see later, Smalltalk is being used very effectively for serious application development. But so is C++. However, as we have seen from previous surveys, C++ developers are not that happy with C++ or associated development environments. Frankly, the primary reason for the rapid rise in Java's status is that C++ developers are migrating to Java. As a result, IDC expects Java to take the growth out of the C++ marketplace. Not so for Smalltalk, which will continue to grow, at least for the foreseeable future.

Smalltalk Is Used for Serious Application Development

Three-quarters had used Smalltalk for more than one deployed application; 34% were in organizations where Smalltalk was used regularly by most people/projects.

These respondents were not just evaluating Smalltalk or developing small prototypes. Rather, almost 100% were using Smalltalk for application development and had deployed applications. Three-quarters had used Smalltalk for more than one deployed application; 34% were in organizations where Smalltalk was used regularly by most people/projects.

Perhaps most telling was the description of the largest Smalltalk application at each respondent's organization (see Table 3). Six characteristics were evaluated. The number in parenthesis is the percentage of the roughly 500 respondents who answered these questions by choosing the phrase indicated.

Criticality	Mission critical (63%)
Proprietary use	Custom/exclusively for internal use (56%)
Frequency of use	Daily (91%)
Level of use	Strategic (49%)
Locality	Enterprise WAN (49%)
Development effort	Median fell between 5 and 10 person/years

Table 3
Characterization of Largest Smalltalk Application

Category	Measure Statements	% of Respondents
Criticality	Not at all critical	2
	Plays minor role	5
	Important, routinely used	30
	Mission critical	63
Proprietariness	Custom	56
	Product for sale	25
	Both	15
	Other	3
Frequency of Use	Occasionally	3
	Quarterly	0
	Monthly	1
	Weekly	4
	Daily	91
Level of Use	Casual/trivial	2
	Routine	27
	Tactical	21
	Strategic	49
Locality	Standalone desktop	15
	Departmental LAN	36
	Enterprise WAN	49
Scope of development	Less than 5	32
(person years)	5–10	26
	11–20	17
	21–100	17
	More than 100	9

N = 495
Source: 1977 Smalltalk Industry Council Survey

Smalltalk is used primarily to develop strategic, mission-critical, custom applications that are used daily across the enterprise.

A simple concatenation of these characteristics says Smalltalk is used primarily to develop strategic, mission-critical, custom applications that are used daily across the enterprise — the bet-your-business application development to which we referred earlier.

Smalltalk Developers Perceive Java as Immature

This perception is no surprise because Java is indeed immature. We address this issue elsewhere. Respondents rated the maturity of both Java and Smalltalk, using a 5-point scale, where 1 = very immature to 5 = very mature. A clear differentiation could be found here in favor of Smalltalk.

Smalltalk	4.4 (mature to very mature)
Java	1.9 (immature)

One can assume that, to the extent that the existing staff at these sites has some say in how new application development will be performed, any use of Java will be isolated and tentative for the near term. The next section sheds more light on this assumption.

Smalltalk Will Continue to Be Used for Application Development

We used several measures to "triangulate" on this issue. The bottom line is that Smalltalk will not only continue to be used for application development at these sites for the next several years but also will continue to be the primary development alternative.

We used two measures to get some sense of the relative use of Smalltalk:

- The percentage of the development staff at the respondent's site using Smalltalk
- The percentage of the installed base of applications that was written in Smalltalk

The same questions were asked in three time frames: currently (September 1997), two years from now, and four years from now. The latter two are each respondent's estimates or expectations. The question was asked for eight languages or categories of development tools. Table 4 shows the trends indicated in the respondents' estimates.

Smalltalk is now and will continue to be the primary development alternative at these sites. There is an insignificant decrease in the percentage of staff using Smalltalk over the four-year period, and the percentage of installed base of applications written in Smalltalk is virtually unchanged.

Smalltalk is now and will continue to be the primary development alternative at these sites. There is an insignificant decrease in the percentage of staff using Smalltalk over the four-year period, and the percentage of installed base of applications written in Smalltalk is virtually unchanged. This clearly indicates that Smalltalk will continue to be used at the majority of these roughly 600 sites. At the same time, other interesting trends are indicated. Bear in mind that these trends are specific to Smalltalk sites, and not necessarily the general population. Nevertheless, they are interesting. C++ usage remains level. Java usage rises dramatically to almost the same level as Smalltalk. But there does not appear to be a significant trade-off with Smalltalk. It is possible that, for the near term at least, Java will be used for a different class of application than Smalltalk — one where there is minimal competition. The data

Table 4
Language Usage over Time

	Mean % of Staff Using			Mean % of App Base Written In		
	Sept 1997	Sept 1999	Sept 2001	Sept 1997	Sept 1999	Sept 2001
Smalltalk	41	40	39	41	42	41
Analysis and design tools	26	35	40	16	21	23
COBOL/PL1/RPG	22	17	15	27	20	17
C	17	14	12	17	12	10
C++	15	15	14	12	12	13
4GLs/RAD	13	13	15	14	11	11
HTML/CGI/Perl	13	18	20	9	12	13
Java	13	30	37	5	21	30

N varies between 506 and 376
Source: 1977 Smalltalk Industry Council Survey

also shows that the use of analysis and design tools rises, as does the use of HTML, for example. COBOL/PL1/RPG and C usage declines steadily.

At 41% of sites, management had issued no directives in this regard. Another 33% would allow Smalltalk use on new application development, 17% would require it.

- **Management policy**. Another indication of future use of Smalltalk is whether IT management has issued any policy statement about its use at the site. At 41% of sites, management had issued no directives in this regard. Another 33% would allow Smalltalk use on new application development, 17% would require it, and 10% would not allow it. The 10% is significant, but we did not determine the motivation for such a directive.

- **Respondents' estimate**. We also asked respondents for their estimate of whether the site's Smalltalk usage would increase, decrease, or remain the same in the near future (the next one to three years). Thirty-five percent said it would increase, 40% remain the same, and 26% decrease. Those indicating a decrease were asked to split the decrease across alternatives for development — namely Java, another OO programming language, or neither. Of the 26%, 65% said Java. That's 17% of the overall sample.

Smalltalk Is and Will Be Used for Both Client-Side and Server-Side Deployment

Smalltalk is not being used only to create highly graphic, interactive graphical user interfaces. Twenty-one percent of the average installed base of Smalltalk applications at these sites were deployed on a server, and another 14% were deployed on both clients and servers.

Client-only deployment accounted for the majority (61%) of the average installed base of Smalltalk applications at these sites. However, Smalltalk is not being used only to create highly graphic, interactive graphical user interfaces. Twenty-one percent of the average installed base of Smalltalk applications at these sites were deployed on a server, and another 14% were deployed on both clients and servers.

In another set of questions, respondents were asked to indicate their degree of agreement or disagreement with a series of questions. The 5-point scale ranged from 1 = strongly disagree to 5 = strongly agree and 3 = neutral. The ratings do not vary far from the neural point.

- 3.7 (slightly agree). Smalltalk will still be a serious choice for server-side applications.
- 3.4 (slightly agree). Smalltalk will still be a serious choice for client-side applications.
- 3.3 (slightly agree). Java will dominate client-side applications.
- 2.4 (slightly disagree). Java will dominate server-side applications.

Respondents indicated that 74% of their Smalltalk applications were application/domain specific.

Respondents indicated that 74% of their Smalltalk applications were application/domain specific; 26% were utilities/infrastructure /plumbing/tools.

One cannot draw strong conclusions from this data. Client-side deployment is obviously an important use of Smalltalk and one that will be challenged by Java in the coming years, especially for application deployment on the Web. However, the percentage of all development worldwide that is just for the World Wide Web is far less than the attention it is being given in the press implies. The evidence favoring one language over another is not significant. So stay tuned. (Author's note: It would be interesting to repeat this survey among C++ users.)

Smalltalk Is Much More Mature

Today, Java is as much promise as it is reality. Most industry observers agree that Java is relatively immature when compared with other alternatives for serious application development such as Smalltalk.

Today, Java is as much promise as it is reality. Most industry observers agree that Java is relatively immature when compared with other alternatives for serious application development such as Smalltalk. We like to characterize Java as a teenager and Smalltalk as an adult. Carrying the analogy one step further, Java is more like a teenager on steroids. Although Java is immature, it will not go away, and the massive amount of R&D dollars being spent by such major vendors as Sun, IBM, and Microsoft will hasten its maturity. For example, most of the compiler talent on the planet is focused on Java, on attempting to improve the performance of the compilers, and on virtual machines — especially on servers. That the teenager will eventually make it through puberty is not the question so much as how long it will take.

If we were to create a report card today, Table 5 shows how the languages and associated development and run-time environments would compare.

Currently a number of problems limit the portability of Java applications and applets. There are differences in Java virtual machine implementations, especially those in the two leading Internet browsers (Microsoft and Netscape).

Like Smalltalk, the write-once, run-anywhere benefit of Java can be obtained by using only one vendorís development environments. Applications developed on multiple vendorsí tools are another story. Currently a number of problems limit the portability of Java applications and applets. There are differences in Java virtual machine implementations, especially those in the two leading Internet browsers (Microsoft and Netscape). Definite differences are apparent in the performance of the virtual machines. Users are reporting problems with the Mac and with Windows 3.1 — they cannot get their applets to run on these platforms, for example.

One trade journal earlier this year tried different combinations of Java applications (64 of them), Java virtual machines, and platforms (OSs). Only 37 of the 64 combinations actually worked. These problems will eventually be overcome; however, they are evidence of the immaturity of Java in general.

Table 5
Language Usage over Time

Factor	Smalltalk	C++	Java
Availability	Very good	Excellent	Good
Stability	Excellent	Excellent	Emerging, better since JDK 1.1
Platform support	Excellent	Excellent	Very good
OO language type	Pure	Hybrid	Pure
Inheritance support	Single, by choice in most major products on market	Multiple	Single
Polymorphism	Pure	Limited	Limited
Type checking	Dynamic	Static, strongly typed	Static, strongly typed
Class libraries	Extensive – 1,000 classes; 25,000 methods; but not compatible between vendors	Standard definition limited, varies with vendor	Sun controls the JDK and is suing Microsoft over variations
Memory management	Automatic	None	Automatic, but no standard garbage collection
Classes represented as objects at runtime	Yes, fully supported	No	Yes
Programming environment	Extensive and generally well integrated. No edit-compile-debug cycle	Not inherent, good to excellent support available through tool vendors	Not inherent, varies with vendor, currently OK but not great
Binding	Dynamic	Static	Dynamic
Interpreted/compiled	Interpreted (or incrementally compiled) during development. Compiled into bytecode, which is then interpreted or compiled and cached as used at runtime (not all products)	Compiled, sometimes incrementally.	Interpreted (or incrementally compiled) during development. Compiled into bytecode, which is then interpreted or compiled and cached as used at runtime (not all products)
Prototyping support	Excellent	Good	Good
Syntax	Unlike other languages, but very simple	Complex, similar to C	Better than C++, but nowhere as simple as Smalltalk
Visibility to public/ private variables	Private to object	Public to class	Five cagtegories: public, default, protected, private-protected, private
Name space	One global. Some vendors are working on multiple name spaces.	C-like, nested to any level	Well specified, but varies with classes, packages, and use of inheritance
Work orientation	Work space	File space	Vendors support both views

Source: 1977 Smalltalk Industry Council Survey

Currently, Java is being criticized for the following:

- Performance. Poor to good, but improving constantly. Compilers that bring performance up to the level of C++ are available if one is willing to sacrifice portability.
- Tools. We are now beyond the initial spate of tools that were rushed to the market in the latter part of 1996. But many tools are still version 1.0. Many others are just now coming to market, and most are generally limited in functionality in some way.
- Difficulty. The assertion is that Smalltalk is much simpler than Java, and thus Java is harder to learn and use. This is a somewhat bogus criticism. The reality seems to be that most organizations using Java have been using C++, and their developers are finding the move over to Java easy. Further, these developers are very motivated to move to Java.
- Incomplete implementation. This criticism is warranted. Some specifications are just now being published, and it will be some time before robust implementations are available.
- Experience with large, mission-critical application development. We are still in the early adopter stages here despite the hype. IDC surveys show that 10% to 15% of organizations in the United States are using Java. But for what? Very few large code bases exist. Sun has described some on its JavaSoft Web site. The largest end-user application seems to be one written by CSX, a U.S. railroad that has written 300K to 400K lines of Java code. The number of these reference accounts is still relatively small.
- Lack of an international standard. Sun is working this issue. Microsoft is a fly in the ointment. But to be fair, there is no Smalltalk standard either. However, an ANSI standard for Smalltalk is in final ANSI submittal form, and it does have representatives from several companies. At this point Sun is still attempting to own the standard for Java instead of allowing participation by third parties. To date, Sun's proposal to proceed in this fashion has been rejected by ANSI and ISO.

The simple truth is that, despite Sun's cadre of Java reference accounts, Java has a way to go before large organizations start to choose it as their primary development language.

The simple truth is that, despite Sun's cadre of Java reference accounts, Java has a way to go before large organizations start to choose it as their primary development language. It would be too risky now and will be so for a year or two. Nevertheless, Java has two important market drivers:

- Java has a "killer application" in the Internet. It is a language designed for the efficient development of secure, Internet applications. Since Internet usage is growing exponentially, we can expect Java to continue to receive the development investments needed to grow it into maturity.
- Vendors that have a clear stake in reducing the competitiveness of Microsoft have seized on Java as the "virtual platform" that they hope will break the Wintel monopoly. Time will tell. The battle for control of Java certainly introduces its own set of risks.

For a discussion of the strengths and weaknesses of Smalltalk, see Smalltalk Market Accelerates (IDC #9818, March 1995). It can be found at the Smalltalk Industry Council's Web site at **www.stic.org.**

IDC's Prognosis for Smalltalk

While Java evaluation may be going on, more pragmatic development managers will be selecting more mature development alternatives.

Smalltalk usage has grown steadily over the past few years. Two years ago IDC reported a spurt of growth. Worldwide revenue for Smalltalk had increased more than 50% annually. Apparently, the increase was just that — a spurt. We estimate that in 1996 the same revenue grew, but at a more modest rate, approximately 20%, and that will be the growth rate going forward. Because the Java tools market is growing at a much higher rate, it will probably surpass Smalltalk in the next year or two. Hence our assertion in the opening paragraph that Java will move into second place. This growth will come more at the expense of C++ tools than Smalltalk, something that should be clear from the responses of the Smalltalk users documented in the IDC survey. In another survey from earlier this year, only 2% of sites involved with object-oriented development listed Java as their primary object-oriented programming language. For 70% of sites, C++ was primary, and for 7% of sites, Smalltalk was primary. So, although evaluation may be going on, more pragmatic development managers will be selecting more mature development alternatives.

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We do not expect Smalltalk to retreat into a niche (e.g., server-side application development only) although we do expect the client-side versus server-side mix to gradually shift to the server side as browsers subsume a larger proportion of the total clients.

After all is said and done, the fate of Smalltalk probably resides with its two major vendors, ObjectShare (formerly ParcPlace-Digitalk) and IBM. Both vendors are now positioned to support both Smalltalk and Java.

After all is said and done, the fate of Smalltalk probably resides with its two major vendors, ObjectShare (formerly ParcPlace-Digitalk) and IBM. Both vendors are now positioned to support both Smalltalk and Java. IBM especially seems interested in fielding development tools to support multilanguage development, and the company is working on a "universal virtual machine" (an unfortunate choice of terms) with which it hopes to integrate Java and Smalltalk environments within VisualAge. As long as IBM continues on this path, the Smalltalk tools market will continue to grow. Neither ObjectShare nor IBM plans to abandon Smalltalk. At the same time, both are investing in Java.

IBM's wholly owned subsidiary, Object Technology Inc., is strongly committed to Smalltalk and is busy taking the Smalltalk virtual machine into the embedded applications market ahead of Java. OTI has a long history of deploying Smalltalk in real-time applications. Thus, Smalltalk is more mature than Java in this area as well.

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Smalltalk has grown and prospered in the shadow of C++ for several years. As Java takes over the C++ market, we expect Smalltalk to continue this pattern of coexistence. The worldwide shift of development toward objects and components will continue for some time to come. Smalltalk plays well in this domain. Recognizing this situation — especially the loyalty of the user base reflected in our survey — we predict a continued steady increase in the number of Smalltalk users.

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