

Java Adoption

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This white paper discusses Java's adoption.

First and foremost, Java is only 4 1/2 years old. All the Java products, services, tools, and technologies listed here have emerged in just the past 4 1/2 years, and this is by no means an exhaustive list, but a list of what was discovered during this Java adoption study. With this growth curve, the amount of "yet to be" announced products that are being developed, could easily dwarf these lists.

Great depth and breadth exists in Java products. The most obvious products are the consumer products that run Java- phones, set top boxes, DTVs, personal TVs, PCs, PDAs, game stations, etc. However, Java on these devices is only as interesting as the Java content available to these devices. Here, we also find significant amounts of Java content- e-commerce, ads, services, MP3, auctions, games, data warehousing, access to server data and email, software from ASPs, etc., all driving the need for Java on Internet appliances. Thirdly, to facilitate rapid development of even more Java based applications, there is a broad base of software technology available to rapidly develop Java content- multimedia and interactive development tools, software components, end-to-end e-commerce and service solution tools, application server tools, JVMs for various needs, etc. To summarize, not only do Java Internet appliances exist, but there is also a large Java content base, and the infrastructure to rapidly develop more Java applications and content.

Java performance is an issue- it could, and needs to be improved on Internet appliances. Today (1999) 76% of software developers surveyed (www.devx.com survey) said that Java performance problems would not be solved in 1999, or will never be solved. And this is based only on today's applications. In the future, e-commerce's use of multimedia and interactive Java applications will make this problem blatantly evident. Multimedia has high performance processing requirements even without Java. E-commerce is/will be widely used by everyone. Today, the first multimedia platforms for Internet appliances have just been announced, and they are Java based. Only a few e-commerce sites use them so far. But as this number grows, with e-commerce's widespread use, and with multimedia's high performance needs, the demand for high performance Java on Internet appliances will become glaring. Java processors with performance comparable to other high performance embedded processors used in multimedia applications, will be necessary. (Software JVMs will not be able to get anywhere close to this required Java performance.) To summarize, e-commerce's use of multimedia Java applications will necessitate (in high volumes) high performance Java microprocessors for Internet appliances.

Several trends are discussed at the end of this white paper.

- Multimedia and interactivity in Internet appliances
- Small memory footprint and faster JVMs for Internet appliances
- Real time Java
- Networked Internet appliances

These trends point to Java deployment in new markets, and increased Java usage in markets that already use Java.

Internet Appliance Products

This is a list of deployed and announced (may not be deployed yet) Internet appliances that can run Java.

Product	Company
Wireless phone	Ericsson
Wireless phone- ie TimePortP1088	Motorola
Wireless phone	Nokia
Wireless phone (at least some run NTT DoCoMo i-mode services)	Matsushita
Wireless phone	Philips
Wireless phone	Psion
Wireless phone (at least some run NTT DoCoMo i-mode services)	NEC
Wireless phone (at least some run NTT DoCoMo i-mode services)	Mitsubishi
Wireless phone (at least some run NTT DoCoMo i-mode services)	Fujitsu
Internet screen phone	Ericsson
Internet screen phone	Alcatel
Internet screen phone- ie Multimedia Phone (email, Web browser, fax)	Sharp
PDA- ie PalmV, PalmVII	3Com/Palm Computing
Pager (2-way, keyboard, screen, Web browser, email, fax)	Motorola
Set top box- M@gicBox	Philips
Set top box- ie Streammaster	Motorola
Set top box	TCI
Set top box	General Instruments
Set top box	Scientific Atlanta
PCs, laptops, handhelds, PDAs, etc.	HP
PCs, laptops, etc	Compaq

Content Providers

An abundance of Java content is driving the Java requirement in these and future Internet appliances. Java content over the Internet is springing up everywhere. Categories of content providers are:

- E-commerce- ie Food.com, drugstore.com, eToys.com, etc.
- Customer service
- Auctions
- MP3 (downloaded using Java)
- Advertisers
- Games- ie Sony (downloaded)
- Data warehousing
- Database management
- Server data access (provides ISP and corporate email and other files)
- Diverse content- ie NTT DoCoMo
- ASPs, ISPs, Web portals (provide applications from Web servers)

Software Technology and Tools Providers

Java software technology and tools are enabling Java content providers to create new Java based software systems at an astounding rate. Shown below are some examples of Java software technology and tools that are incorporated in software from Java content providers.

Java Software Technology or Tool	Use	Content Providers
Hot Media from IBM - multimedia (audio, image) sent to the client - interactivity at the client	presentations, slides, advertisements, etc.	e-commerce, customer service, auctions, ads, etc.
RichMail from Bluestreak.com - multimedia (audio, image) sent to the client in email - interactivity at the client from the email- ie purchases	in email	e-commerce, ads, etc.
Total-e-Business from Bluestone Software - software component based - end-to-end e-commerce solution	complete solution for e-commerce Web sites	e-commerce
An end-to-end service solution from Sony	service delivery over wireless networks	Credit Suisse
An end-to end enterprise solution from Bonita Software - Palm/server wireless communication	server business applications from a Palm	expense reporting from a Palm
Software components from ILOG - Java software components that are used in software systems and therefore cut development time	software applications	
Software components from Vision - Java software components that are used in software systems and therefore cut development time	Web based software applications	e-commerce, data warehousing, enterprise integration, etc.
Application Server tools from Cyrus Intersoft - tools to make applications that clients download - tools to make client initiated applications that run on the server	Web server applications development	ISPs, ASPs, Web Portals
Application Server from Oracle		
JDeveloper from Oracle		
Business Components from Oracle		
JVMs are available for most operating systems - WindowsCE, PalmOS, EPOC Internet appliance operating systems - all the server and desktop operating systems	Java system software needed to run all Java applications	all
JVMs with small memory footprints - KVM - J2ME	Java system software needed to run all Java applications, used when memory is limited	all that service Internet appliances (which have limited memory)

Statistics

Quantifiable statistics:

Statistic	Source
44% of software developers use Java	Evans Marketing Service
75% of software developers projected to use Java in 2000	Evans Marketing Service
500,000 programmers using purchased Java programming tools in 1998	IDC
42% CAGR for Java developer seats (62% projected in 2000)	IDC
40% of US workplace sites conducting internal web development are using Java	ZDNet's CI technology database
48% of Fortune 1000 companies have deployed Java in their organizations	ZDNet's CI technology database
60% of enterprises projected to adopt Java by 2004; of these 30% are financial services 19% are higher education 11% are retail, distribution 4-7% for each of manufacturing, healthcare, transportation, research, publishing, utilities	Gartner Group
67% of Java systems include self service applications (client runs Java to communicate with server, server runs Java to service client)	
90% of world smartcard manufacturers have licensed Java	
98% of Japan (23 million subscribers) covered by NTT DoCoMo wireless digital network (not necessarily Java users) 1.7 million NTT DoCoMo i-mode subscribers (Java users) 4.0 million projected NTT DoCoMo I-mode subscribers in 2000	Kei-ichi Enoki, Managing Director, Gateway Business Development, NTT DoCoMo
76% of software developers surveyed in 1999 said that Java performance problems would not be solved by the end of 1999, or would never be solved	www.devx.com survey

Qualitative facts:

Fact	Source
Web development (heavily based on Java) tools are the fastest growing segment of the software market	IDC
Software components (typically written in Java) are the fastest growing segment of the software development tools market, with a projected 45.6% annual growth rate by 2003	IDC
"I was experiencing fivefold productivity improvement compared to my C++ development. And I was an expert in C++" referring to Java development	Rich Kadel, CTO, Dtai, Inc., San Diego

Trends

Trend 1:

E-commerce, services, and games to non-PC devices- Palm Pilots, Web phones (including cell phones), and set top boxes.

This was mentioned repeatedly in the articles that were read for this study. This includes all the Web based e-commerce, on-line banking, trading, games, personalized news, financial services, and entertainment. Java based multimedia and interactivity will be in this Web content (see above- IBM's Hot Media, Bluestreak.com's RichMail). Multimedia inherently requires high performance processors. Therefore, this trend will drive high performance Java requirements into these Internet appliances.

Trend 2:

Java is gaining ground in clients due to JVMs with smaller memory footprints, and improved performance.

Java has been slower to catch on in clients (such as Internet appliances) than in servers. There were two reasons for this:

1. Clients, having limited memory, need a JVM that fits in a small memory footprint. This small memory footprint JVM has not been available until recently. Recently available are two new small footprint JVMs that solve this problem. The KVM is the smallest and fits in clients (ie wireless and handheld Internet appliances) with less than 512KBytes of memory. The J2ME is slightly larger and is targeted at clients (ie TVs, set top boxes, game stations, cars) with more than 512KBytes of memory.
2. Clients tend to have less processing power than servers, and therefore the Java performance was too slow on them. This problem is helped by Sun's new Hot Spot technology. However, this is still a software solution, and therefore performance is still lower than with a hardware Java solution. It is also processor dependent.

It is expected that Java will be at least as popular in clients as it is in servers (where it is very popular) due to these solutions to these two problems. The client performance problem will be completely solved with the availability of a hardware Java solution, therefore boosting Java's popularity to even greater heights on clients.

Trend 3:

The real time Java specification is happening and will open up real time application to Java solutions.

A number of potential applications for Java have real time requirements such as well defined and prompt interrupt response times, increased reliability and safety. Test and measurement equipment, navigation equipment, medical devices, telephony infrastructure and equipment, network routers and switches all have real time requirements. Currently, Java does not satisfy real time requirements and therefore these applications do not use Java. However, a real time Java specification is under development and has been released for review. When this specification is finalized, Java can be adopted by real time applications.

Trend 4:**Home gateways and networks will be increasingly based on Java and Jini.**

There are a number of initiatives, projects, and standards under development that propose Internet gateways to the home, and gateways within the home to connect the different home networks (ie wireless, powerline, IEEE1394, telephone line, etc).

1. The Open Service Gateway Initiative (OSGI) defines an Internet gateway to Internet appliances in the home and small businesses. Several companies are involved in this initiative- Alcatel, Cable and Wireless Electricite de France, Enron Communications, Ericsson, IBM, Lucent, Motorola, Network Computer, Inc., Nortel Networks, Oracle, Philips, Sun, Sybase, and Toshiba.
2. The Home Audio Visual Initiative (HAVi) defines an audio/visual IEEE1394 network within the home. Companies involved in this are Grundig, Hitachi, Matsushita, Philips, Phoenix, Sharp, Sony, Sun, Thompson, and Toshiba.

These networks are based on Java and Jini. Jini is a network communication protocol built on top of Java. Thus, as networking becomes a requirement for all Internet appliances, they must all run Java to participate in the network.

Jini is less than a year old. Thirty (30) companies are signed up to work with Jini. Most of these thirty companies have Jini development efforts in progress. It is expected that in the next 12 to 18 months there will be several Jini based product announcements.