



JavaOneSM

Sun's Worldwide Java Developer Conference



JavaOne™
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Java™ Appliances

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Java™ Is Appearing Everywhere

- Java™ will power a wide variety of devices
- Network Computers™ & Java™
- A new range of electronic appliances
- Intranet appliances
- “HomeNet” appliances
- “WirelessNet” appliances
- JavaOS™ is designed for Java™ appliances

Java Will Power a Wide Variety of Devices



- Java is scalable upward & downward
 - Server software
 - Desktop systems
 - Devices with limited memory
- Java can fit a variety of environments
 - Hosted on existing operating systems
 - Network computers
 - PDAs
 - Home entertainment components
 - Embedded controllers



Network Computers & Java

- Network Computer™ Reference Profile 1 announced
- Already endorsed by 70 companies
- Chip, HW, SW developers, telephone companies & Internet service providers
- Open, accepted Internet & software standards
- NC application environment is *Java*



Network Computer Reference Profile 1

- Specifies common properties of Network Computers
- Protocols: TCP/IP, NFS, HTTP, FTP, SNMP, DHCP
- E-mail: POP3, IMAP4, SMTP
- Content: HTML, JPEG, GIF, AU, WAV



Network Computer Reference Profile 1 (*cont.*)

- Application Programming Interface = Java Applet API
 - Applet API must be a complete *Application PI*
- Printing
 - Over the net
 - Directly attached printers are TBD
- Security: Crypto API, authentication, digital signing of data



Java Enables a New Range of Electronic Appliances

- Common Properties
 - Instant On
 - Completely simple installation & use
 - Appliance “applications” are all Java-based
 - Don’t require local disk storage
 - Securable

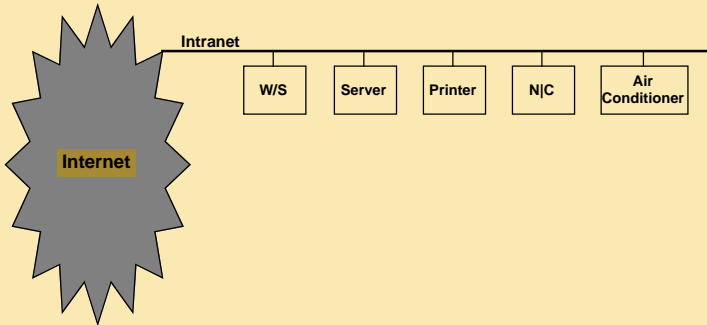


Examples of Internet Appliances

- Network Computers
- Network Printers
- Power management for buildings
 - Power management saves on electricity costs
 - Control & monitor down to air conditioners
 - Example: start A/C earlier on a hot day, but at lower power
 - Enterprises can manage multiple sites over the Internet



The Network Is Everywhere





“HomeNet” Devices

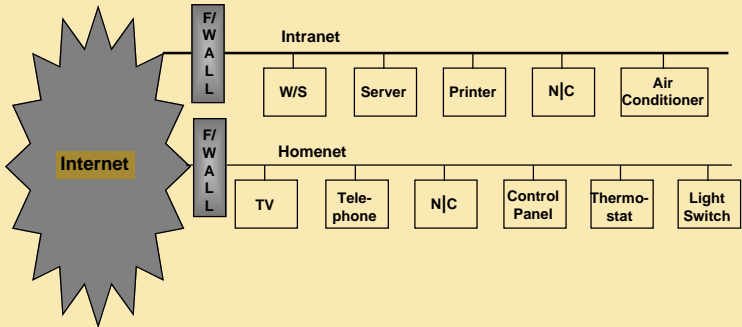
- Constant connectivity is coming
 - Telecommunications Act will bring it
 - Homes will be part of the Internet
- Network Computers
- Network Printers
- Telephones
- Home Data & Web Servers
 - Your home’s Web attachment,
safe storage

(Ultimately) Everything Can Be on HomeNet



- Media Viewers
 - Includes TV, Audio Systems, Home Theatre
- Light switches, thermostats, alarm systems
- Multipurpose touch displays
 - For HomeWeb & Worldwide Web access
- Your home can be accessed from anywhere
 - Homes need firewalls, too

The Network Will Reach Further

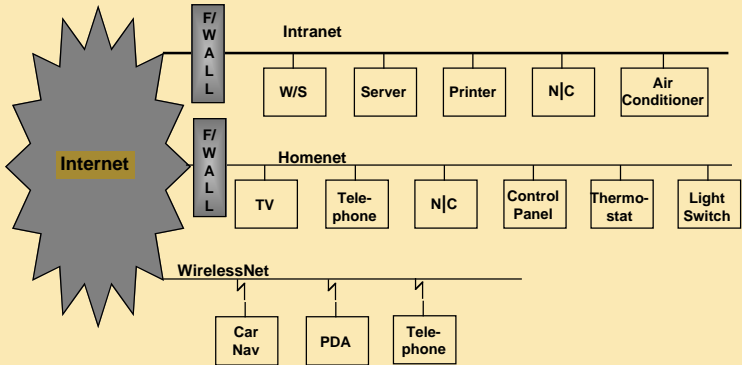


The Wireless Internet Is Coming



- Wireless telephones
- Wireless Network Computers
- Networked, wireless PDAs
- Car navigation systems

The Network Will Reach Beyond Wires





JavaOS™ For Java Appliances

- JavaOS™ implements Java directly on hardware
- JavaOS™ implements just enough OS of just the right kind to implement Java
 - Windowing system, network protocols & device drivers
 - All implemented in Java
 - C code for threads, interrupts, booting etc.



JavaOS™ Performance

- Small amount of code plus multi-threading make JavaOS™ fast & responsive
- JavaOS™ uses Just-in-time (JIT) compilation to make “hot spots” faster
 - Less than 20% of Java code needs to be compiled to get enough speedup



JavaOS™ Is Designed for Java Appliances

- ROMable Java code
- Small footprint
 - JavaOS™ + HotJava + Applets & Web pages
 - in 4MB ROM + 4 MB RAM
 - or 8MB RAM (net booting)
- Instant on
- “Zero” network installation/admin
- Easy upgrading of applications via the Web



Embedded JavaOS™

- Implements Embedded Java API
 - Anything less and you couldn't run Java code
- Embedded JavaOS™ footprint
 - 0.128MB RAM + 0.5MB (Flash) ROM =
- Retains ability to load classes dynamically



Examples of Embedded JavaOS™ Appliances

- Set top boxes
- Digital televisions
- Copiers, fax machines
- Cellular telephones
- Network printers & scanners
- Vehicle navigation systems
- Air conditioning monitoring & control



Sub-minimal Java Appliances

- Thermostats, light switches, sockets, ovens
- Java can still be used
 - Single chip processor with ROM in the device
 - ROM holds Java code + native code to control the device
 - Load Java code into a Java environment
 - Devices can coexist for many years with newer units



Challenges for Java

- Improve the Java execution model
 - JIT compilers & beyond
 - Exact, incremental garbage collection
 - Chip/hardware accelerators
- Reduce the size of Java implementations
- Make Java suitable for real-time systems



Challenges for System and Application Developers

- Make Java appliances
 - As simple as possible to use
 - Available as soon as possible
 - Secure
- Simplify management of appliances
 - In the enterprise
 - In the home
 - In the car



Opportunities from Java Appliances

- For suppliers
 - Chip manufacturers
 - Hardware manufacturers
 - Software developers
 - Internet service providers
- For customers
 - Businesses
 - Consumers



Summary

- Java is the lingua franca of Network Computers
- Java enables very small devices to be network attachable
- Java can even be used for devices too small to support a Java VM
- Java appliances will expand the Internet by an additional factor of 10