



Wireless Technology Summit

Sun Microsystems, Inc.
March 15, 2001



Practical Guidelines for Mobile Computing



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Outline

- Wireless/Mobile Internet
- Evolution of Wireless
- Functionality Growth
- Software, Hardware and Network Curves
- Fractal S Curve
- Wireless Infrastructure
- Migration of Services
- 3G Value Added Services
- Why Java Fits
- Writing Wireless Apps
- J2EE/WAP Model
- J2ME
- Issues and Futures



Wireless/Mobile Internet

- It isn't just the Web on a Small Screen...
- Roots in Embedded World + Network Communications
 - Requirements: Battery and an IP Address
- Opportunity to Adjust:
 - Complexity of PC, and Free Content (U.S.)
- Asia and Europe ahead of U.S. in Infrastructure (good/bad)
- New Tech typically starts Lifestyle-based then B2B
 - POTS, Cell, Video Gaming, VoIP, PDA, P2P, IM, Mobile
- Wireless + Wired = Continuous Computing





Wireless and Java

Functional Evolution

2000-2001

- Now: Email, Screensavers, Gaming, Ringer Tunes, Stock Quotes, Simple Trading, Simple News



Wireless and Java

Functional Evolution

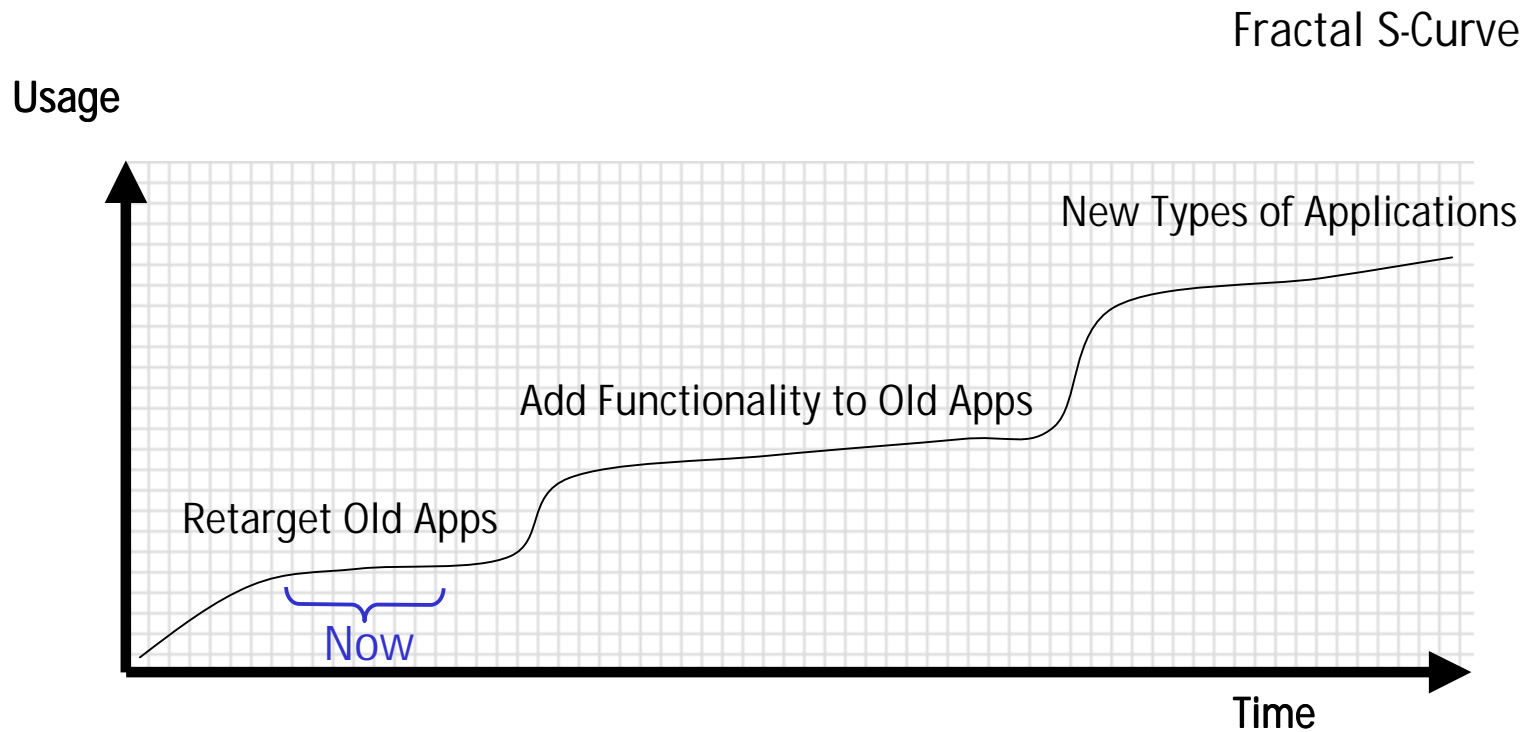
2001-2003?

- Next-Gen Trading, Notification/Ack Services, Location-based Services, New UI's, Dynamic/Mobile UI's, Collaborative Apps, Protocol "Standardization", Wireless Infrastructure, Bandwidth Detection/Rollover, Credit "card" devices, More Services, EJB + J2ME, Jini + EJB + Wireless?

2003-2010?

- Much Later: 3G, Dynamic Networking, Agents (et al), Wireless Broadband, Home Networking, Immersive Multimedia, P2P Wireless Exchanges? P2P Program Trading? Non-2D Net UI's? Autonomous Net Bots?

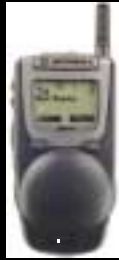
Innovation Evolution Functionality Growth of Wireless



*Over 95% of Wireless Services are Text-based.
In Europe, 3B SMS Messages/Month*

Wireless is More Natural than Wired!

Java Devices

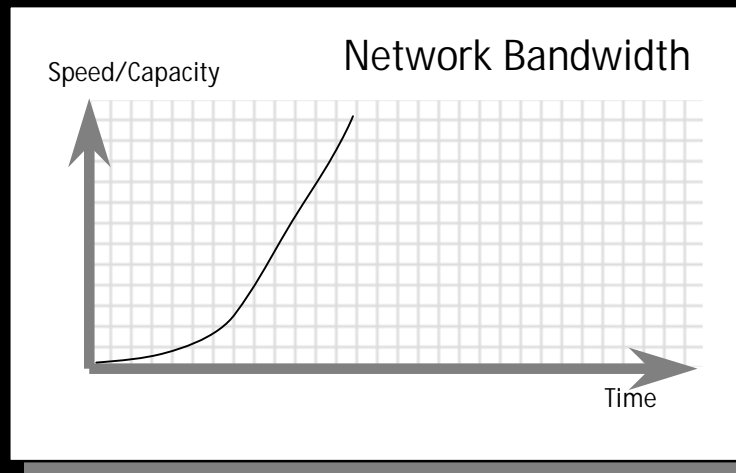
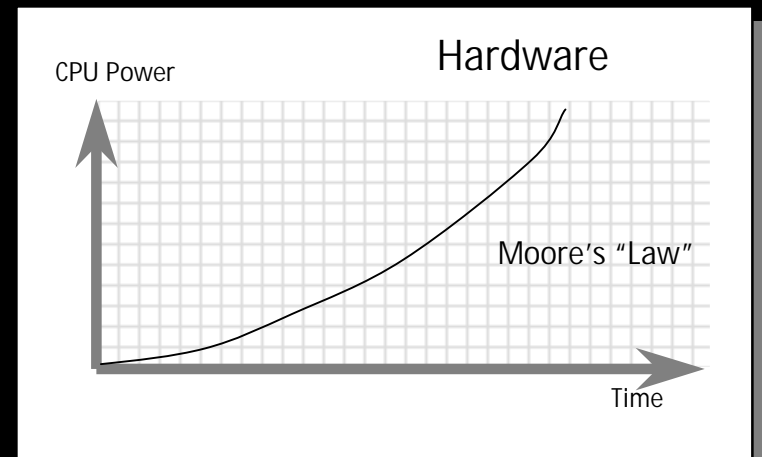
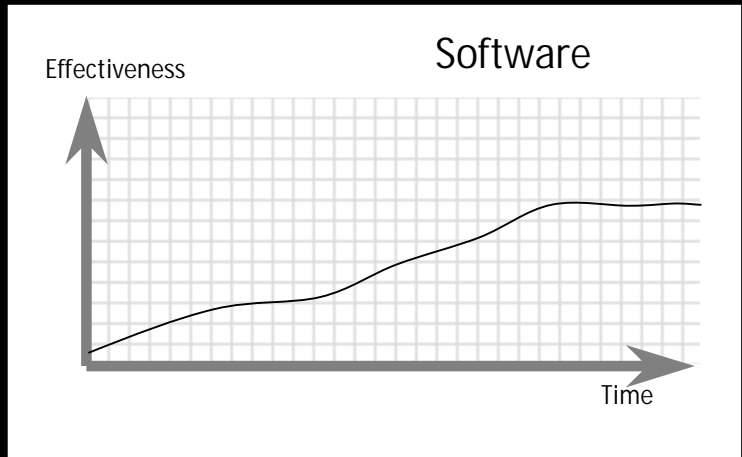


Next?




Devices 1.0

Anticipate Bandwidth Increases



Wireless Infrastructure - Bandwidth

- 
- **1G** - Analog, 9600 baud, voice applications
 - **2G** - Digital, circuit-switched, PCS, 19.2k++, slow
 - **2.5G** - Digital, *packet-switched*, 19.2k-384k, faster than 2G (*btw, Ricochet has 200K already!*)
 - **3G** - Digital, 384k-2Mbps, high-quality audio/video, expensive infrastructure, US (2003?), Europe (2001-2003?), Japan (2001?)
 - **4G** - Digital, software-controlled infrastructure ("software-defined radio"), 2010?

Migration of Mobile Applications

Today

- Current Applications re-targeted to Wireless
 - Finance: Simple trading, low-bandwidth news alerts, threshold alerts

Next

- *Extreme Personalization*
 - dynamic preferences, location, pattern, etc
 - context-sensitive computing, continuous computing
- Integration with Voice (VoIP)
- Devices can accept Complex Corporate Objects
 - research reports, webcasts, audio/video, charts/graphics, apps, etc
- Notification/Acknowledgement Services
- Return to Subscription Payment Model?
 - DoCoMo: \$76 per subscriber, 9% of all content-partner transactions

Who is Working on Mobile?

- Fidelity, Schwab, MSDW, Merrill, JPM, BoA, Discover Brokerage, Dreyfus, Clarity Bank, Crossroads, NetBank, TD Waterhouse Group, National Interbank, et al...
 - Speakers at recent wireless conferences
- Driven by Competitive Pressure
- At very least, Mobile Computing another way to communicate with Customers (similar to cell phones, pagers, etc)



Retail Banking

- Bill Payments
- Account Review
- Statement Details
- Pay Bills
- Transaction History Browsing
- Credit Card Balances
- Funds Transfer
- Alerts

Investment Banking

- Research
- *Real-Time* Market Info
- Position Tracking
- Order Entry
- Portfolio Tracking
- Institutional Client Sales
- Settlement Status
- Mobile Sales Staff

Brokerage

- Buy/Sell Financial Instruments
- Security Watch Lists
- Alerts
- Market Info - Quotes, News, Graphs
- Portfolio Viewing
- Browse/Delete Existing Orders
- Mobile Sales Staff




3G Value-Added Services

- 3G: High-speed, packet-based (think: *fast, always-on, less-expensive*)
- Java is standard component of 3G Initiatives
 - Mobile Station App Exec Environment (MExE)
 - Open Multimedia App Platform (OMAP)
- News, events, sports, weather (opportunity for Bloomberg++?)
- Personalized Agents (P2P)
- Digital cash
- Travel services - schedules, bookings, route-assistance
- Network backup - PIM, document archival, image storage
- Delivery of information - Network Intelligence
 - terminal device and transmission speeds
 - type and quality of the data
 - profiles/preferences
- Content can be tailored for optimal presentation
- Financial Services companies should consider partnering with Telcos/Service Providers



Mobile Applications are Different!

Constraints



Small Display
Different Input Devices
Security Issues
Connect Speed Varies
Possible High Latency Connection
Network Coverage
Memory Constraints
Battery Constraints
Less Connection Stability
Less Predictable Behavior

Advantages

Highly Mobile
Localized Services
Always Connected
Reduced Cost

Is it Standalone vs. Desktop-Adjunct?

Wireless Needs Java Technology

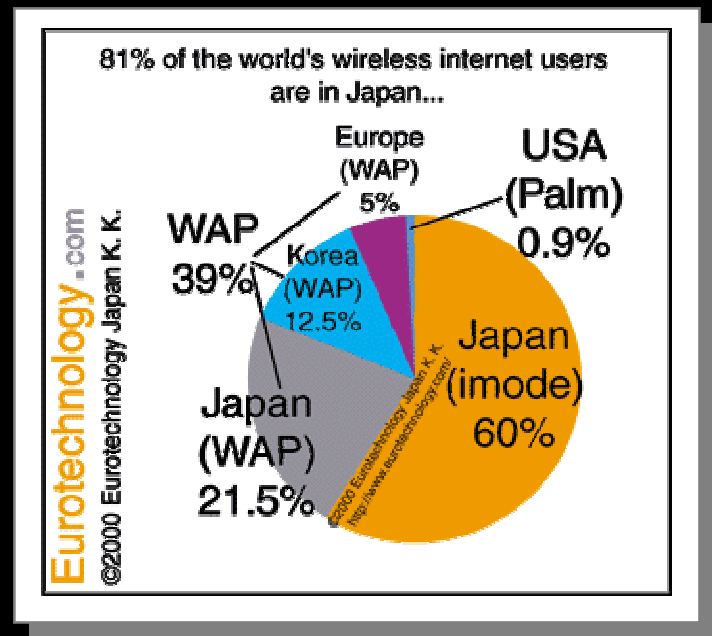
- Java Proven Technology, Used by IT for 5+ years
- Open Environment
- Develop Faster, Portable, Simple, Secure, Etc...
- Renders Heterogeneous Platforms Homogeneous
 - "implement heterogeneous designs homogeneously"
- Server-side model, Client-side model, or Both
- *Dynamic/Secure* Delivery of Financial Apps and Services
- Enhanced User Experience: Rich graphics, Multithreading
- Beyond the Constraints of Browsers; Work with Browsers
- Disconnected Access
- Mobile agents (P2P)
- >2.5M Java Programmers!

Java Technology is a GoodThing™

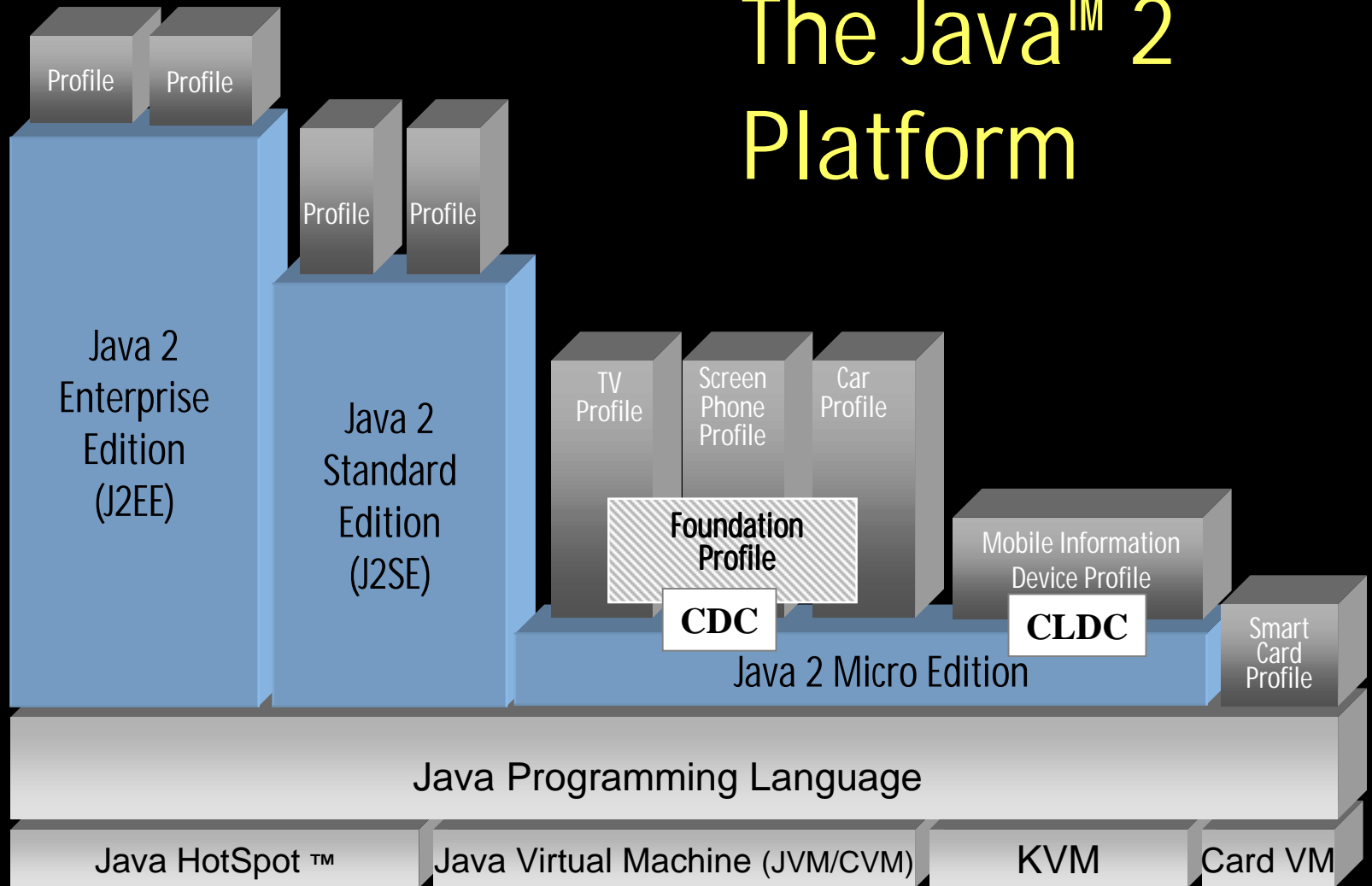
Development Technologies

- Java Technology
 - J2EE/WAP Strategy (WML/WMLScript/mBrowser)
 - + Similar for XHTML and XHTML BASIC
 - J2EE/Java 2 Micro Edition (J2ME)
 - J2ME Profiles/Configurations

- Proprietary Toolkits
 - C/C++ Vendor Toolkits
 - Other Languages
 - iMode (new SDK is Java-based)



The Java™ 2 Platform



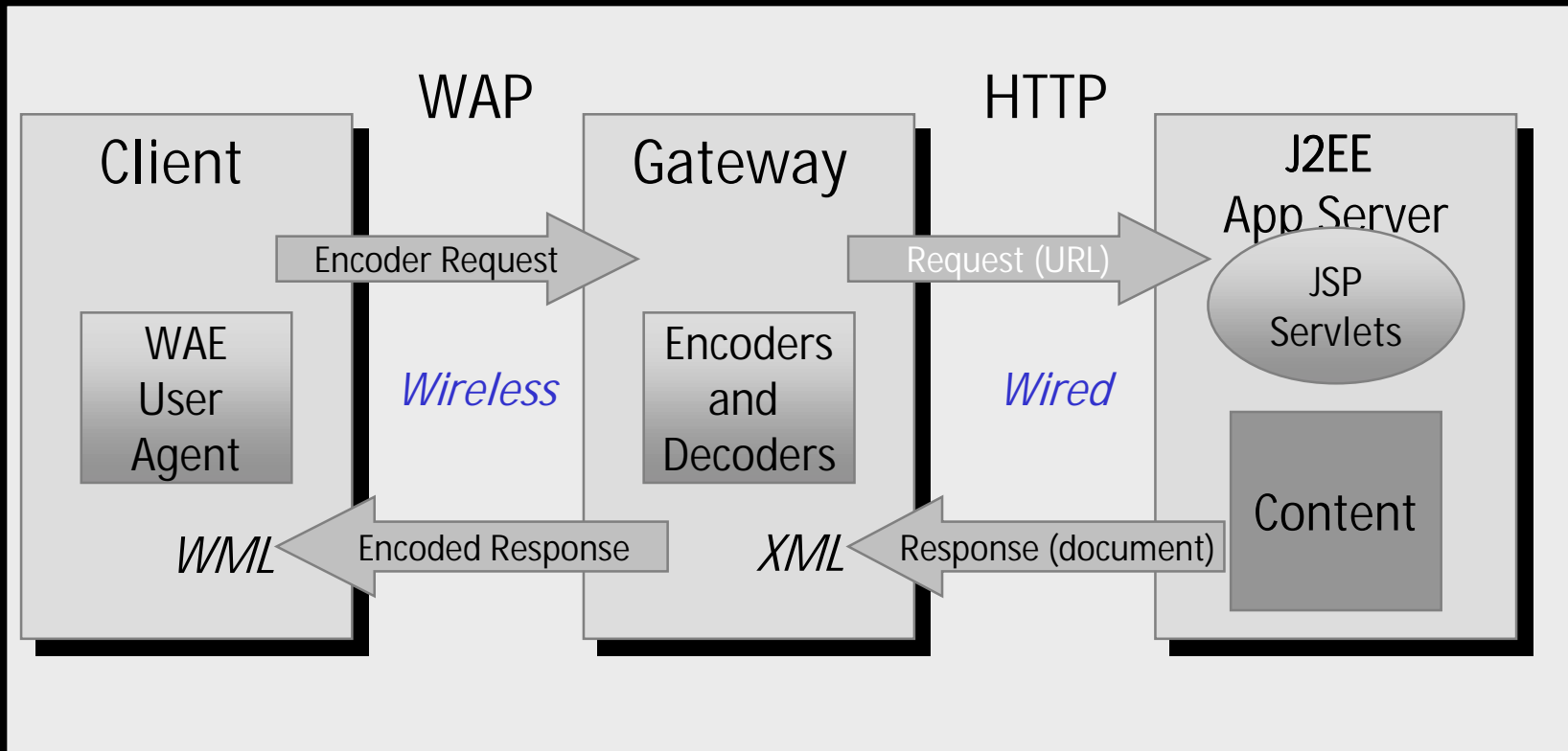
J2EE/EJB and Wireless

Java on the Server

- WAP-enabled application server over J2EE platform
- Wireless Java applications can use reusable session and transactional management features
- EJB application server can provide scalability management to wireless Java applications (J2ME or WAP)
- EJB's can create XML for WAP Proxies (WML)



J2EE/WAP Programming Model



Current Limitations of WAP

- Microbrowser Only Interface to Internet
- Must Use Slow WAP Gateway
- Device Display is Limited
- Input Mechanisms are Limited
- Only Simple UI
- Not Good Enough Security Model
- Currently, Must Be Connected
- Currently, Only a "Pull" Model
- Currently, No Multimedia
- Limited or Non-existent Graphics
- Limited Manipulation of Corporate Objects
- Minimal Colors

Or... Use **J2ME** on Client

J2ME Architecture

Java on the Client

vertical

horizontal

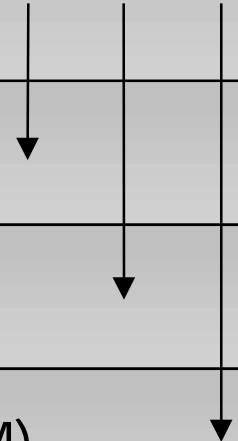
Applications

Profiles (MIDP, PDAP, etc)

Configurations (CDC, CLDC)

Java Virtual Machines (JVM, CVM, KVM)

Host Operating Systems





J2EE, J2SE and J2ME Functionality



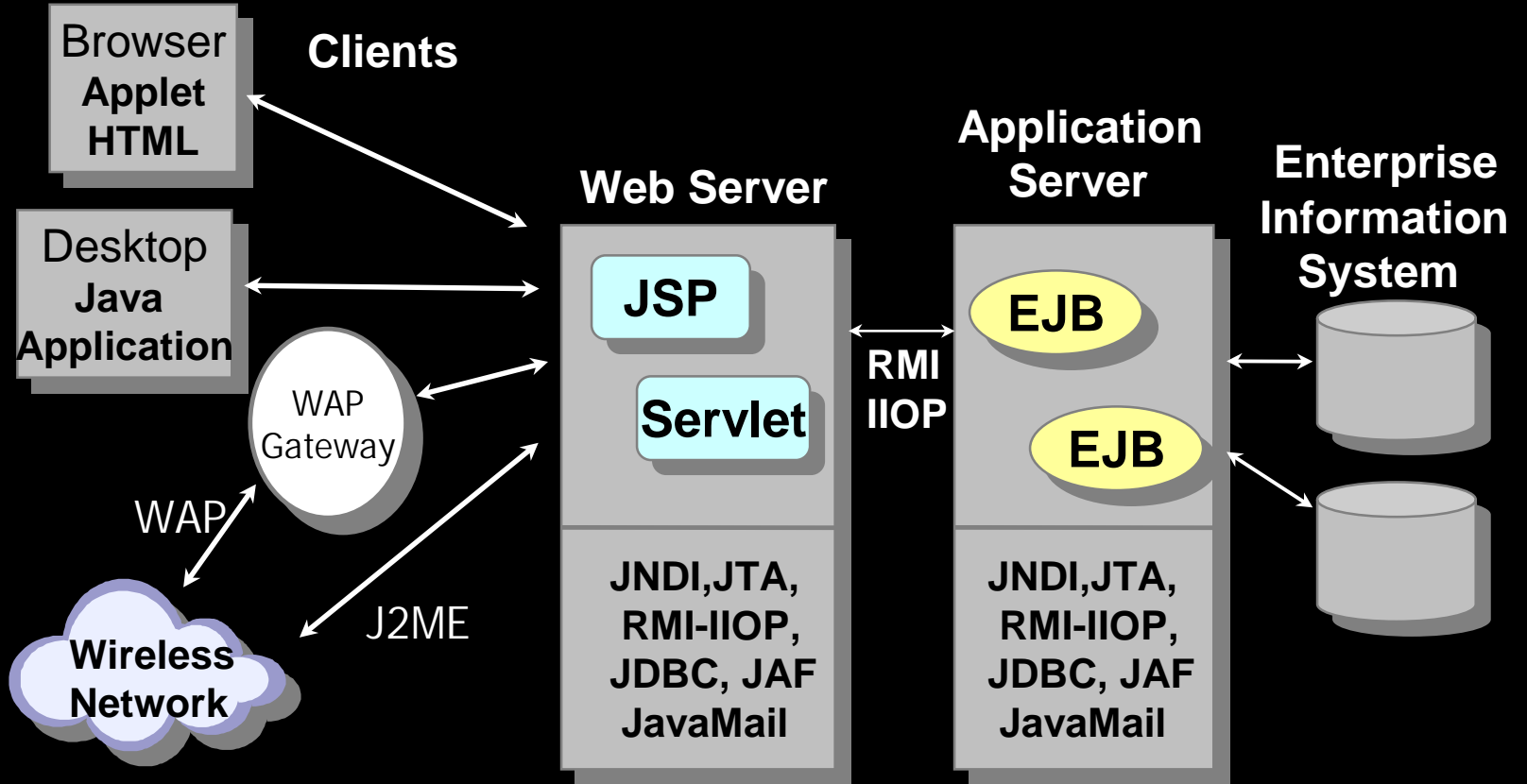
J2EE

J2SE

J2ME/CDC

J2ME/CLDC

Wireless Server Architecture



Who Supports Java Devices?

- Motorola iDEN
 - mid-2002, All Motorola devices Java-enabled
- NTT DoCoMo I-mode (as of 12/00, Java-enabled)
- LG Telecom (ez-java)
- Symbian – Java is Core Component in EPOC
- RIM Going 100% Java
- Handspring – MExE member
- Palm – Palm Profile for J2ME?
- TI – OMAP/DSP – Java for 3G clients
- Zucotto – Xpresso, Java native processor for devices
- Etc...etc...etc...

Developing with J2ME

Its Not J2EE or Even J2SE!

Differences:

- Long, Float/Double may not be available
- Multi-dimensional arrays may not be available
- Java.lang.* is a subset (as are many other packages)
- No On-device Class Verification
- No Thread Groups
- No JNI
- Possibly No Full or User-Defined Class Loaders
- Possibly No Finalization
- Internal JVM Data Structures may be smaller



Developing with J2ME - Strategies

- Move CPU Load to Server
- Do Not Over-Architect or Over-Engineer
- Think SMALL
- Be Aware of Different Types of RAM
- Try to Use Primitive Datatypes
- Be Aware of Object Creation and Reclamation Performance Issues
- Avoid Exceptions if you can
- Be Aware of Standard Java Optimization Techniques



Futures

- 3G is Coming! Packet-Switched (*Faster, Always On, Cheaper*)
- Wireless Asset Management will be a Necessity
- Multi-Protocol Connectivity HW – Modem/NIC on 1 card
- Credit Card Companies vs. Wireless Providers+Content Partners
- Migration of Document-centric Web to Services-centric Web
- Wireless Broadband, Wireless Video
- New Non-2.5D User Interfaces on Wireless Devices
- Peer to Peer (dynamic, collaborative networks)
- Jini/UDDI and Agent-based Computing
- Digital Currency?
- MCommerce or Focused Applications?
- Wireless Connectivity will be Pervasive
- “4.2M Wireless Traders/Content Users in 2005” - TowerGroup



Issues

- Standardization of Network Protocols for Finance and Telecom
- International Standards a Real Possibility?
- Viability of Generic MCommerce?
- Adoption of Expensive 3G Infrastructure
- Migration of >2.5M Desktop Java Developers to Constrained Environment
- Battery, Low-Power and Display Technology Advancements
 - Transmeta, Future ARM, DTV technology, OEL Displays, et al
- Adoption of XHTML and XHTML BASIC
- J2ME Profile Architecture v.s. WORA?
- Good CHI (UI) Skills Critical for Typically Small Displays
- Economic Environment - Long/Short term Impact?





Questions?

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