

# Web Services and Mobile Devices



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# About Me

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- Practicing Software Engineer for 16+ years
- Currently working on Web Services for mobile devices and high performance Web Services
- Specification lead for Real-time Java™ (JSR-000001)
- Author of *Practical Java™ Programming Language Guide*, Addison-Wesley, ISBN: 0-201-61646-7
- Please email me with any questions about this presentation



# Agenda

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- Mobile Devices and Web Services
  - Web Services Toolkit for Mobile Devices
- Device and Network Considerations
  - Usage
  - Now and Future
  - Application Development
- Firewalls, Security, and Performance



# Agenda (Continued)

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- Demo
- Web Services with Java Examples
- Web Services with C Examples
- References



# Mobile Devices and Web Services

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# Mobile Devices and Web Services

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- Extend the reach of the enterprise
- Enable access to corporate data and applications from a mobile device
  - Using industry standard protocols
    - XML, SOAP, WSDL, *etc.*
- More compelling use of device
  - Device can be used for more than PDA functionality, email, Web browsing

# Mobile Devices and Web Services

(Continued)

- Once Web services are deployed in the enterprise
  - They can be accessed by other
    - Servers
    - Thick clients
    - Why not thin clients (mobile devices)?
- Access *via*
  - HTML browser
  - Custom application



● *via* Web Services Toolkit for Mobile Devices

# Mobile Devices and Web Services

(Continued)

- Mobile device users can stay better connected with their enterprise
  - With each other
    - Everyone does not have to carry the same device
  - Web Services is the common communication glue

# Web Services Toolkit for Mobile Devices (WSTKMD)

- Released in November 2002 on IBM alphaWorks
  - Updates since then
- Supports Java on
  - BlackBerry
  - Palm
  - PocketPC
  - Sharp Zaurus 5500/5600 (Linux)
- Supports C on
  - Palm
  - Symbian



# WSTKMD

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- Java Web Services support
  - IBM JSR-172 implementation
    - Shipped as part of WSDD 5.5
  - kSOAP
- Java Application Development
  - IBM WebSphere Studio Device Developer
    - Supports Palm, PocketPC, and BlackBerry
- C Web Services support
  - gSOAP
- C Application Development (Palm)
  - Metrowerks CodeWarrior
  - GNU PRC-Tools



# WSTKMD (Continued)

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- C Application Development (Symbian)
  - Symbian tools
- Device support (Partial List)
  - Java enabled BlackBerry devices
  - PocketPC 2000 and PocketPC 2002 devices
  - Various Palm OS 3.5, 4.x and 5.x OS devices
    - Includes Tungsten W and Tungsten C
  - Symbian OS 6.x devices
  - Sharp Zaurus 5500/5600 with Linux

# Device and Network Considerations

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# Device and Network Considerations - Usage

- Plethora of devices
  - FFFF Factor
    - Tons of Features, Functions and Form Factors
- Need to consider each carefully before choosing a device
  - Will the device connect to an existing corporate network?
    - 802.11
  - Will the device double as a telephone?

# Device and Network Considerations - Usage (Continued)

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- Current devices only access one network each:
  - WAN (Wide Area Network)
    - Cellular service
      - ✓ AT&T Wireless
      - ✓ TMobile
    - Example device: Palm Tungsten W or RIM BlackBerry
  - LAN (Local Area Network)
    - 802.11b
    - Example device: Palm Tungsten C, Sharp Zaurus SL-5600

# Device and Network Considerations - Usage (Continued)

- PAN (Personal Area Network)
  - Bluetooth
  - Example Device: Palm Tungsten T, Sony Clie' TG50
- An 802.11 LAN device is also not a phone
  - Not yet anyway...
- A WAN device does not currently have the ability to also access an 802.11 hotspot
  - No roaming



# Future Handheld Devices

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- Device that can access WAN and LAN
  - Seamless roaming between networks
    - At work with 802.11 – connected
    - Leave building – connected (*via* Cellular coverage)
    - At airport with hotspot – connected
    - *etc...*
  - Issues:
    - Battery power
    - Cost

# Future Handheld Devices

(Continued)

- Device is a phone *via* WAN Cellular coverage
- Device can access internet
  - Via 802.11 when available
    - Inexpensive
    - Fast
  - Via WAN when 802.11 not available
    - More expensive
    - Slower
- Device chooses fastest/cheapest connection available

# Device Considerations – App. Development

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## ■ Blackberry

- Java only
- Excellent experience
- RIM has additional Java GUI classes not available in MIDP 1.0
  - Makes up for MIDP deficiencies
  - However, Java code no longer portable
    - ✓ Not much portability on these devices anyway
- Java is your only choice anyway for current BlackBerry devices

# Device Considerations – App. Development (Continued)

## ■ Palm

- Java or C
- Java on Palm – runs OK
  - JVM for OS5... coming soon
- MIDP 1.0 – weak
  - MIDP 2.0 will help once supported
- C is the choice for serious app. Dev.

## ■ PocketPC

- Java, C, C#
- Java runs well

# Device Considerations – App. Development (Continued)

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- Java on Sharp
  - Supports Personal Profile
    - Excellent app. Dev experience
  - Can develop using desktop Java tools
  - No experience with their C environment

# Firewalls, Security, and Performance

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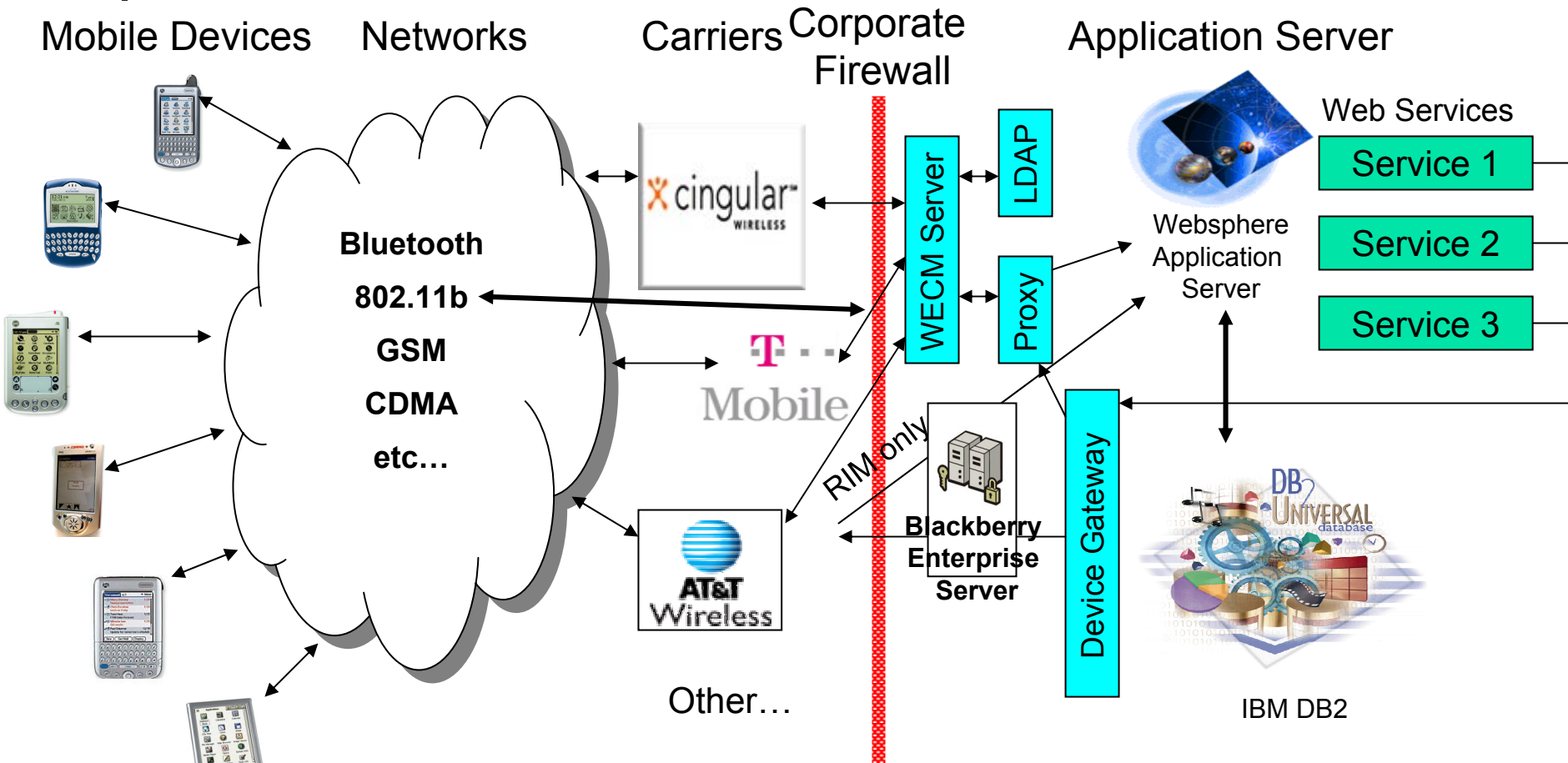


# Firewalls

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- When device is outside corporate firewall
  - It needs to tunnel
  - Not an issue with BlackBerry
    - Tunneled *via* BES server
  - Other devices can use WECM
    - WebSphere Everyplace Connection Manager
      - ✓ Provides tunneling and roaming
      - ✓ Runs on Palm, PocketPC, Linux
    - Other 3<sup>rd</sup> party tunneling software available as well

# Sample Architecture





# Security

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- RIM BlackBerry

- All communications between device and server are Triple DES encrypted

- Others

- WS-Security available in WSTKMD



# Performance

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- Work in progress:
  - Looking at compression and other technologies to aid performance
  - GZIP has shown promise on low bandwidth lines
    - However, processor intensive
    - Mobile device processors are not very powerful
      - ✓ How will GZIP fare?
  - Other proprietary technologies are being investigated

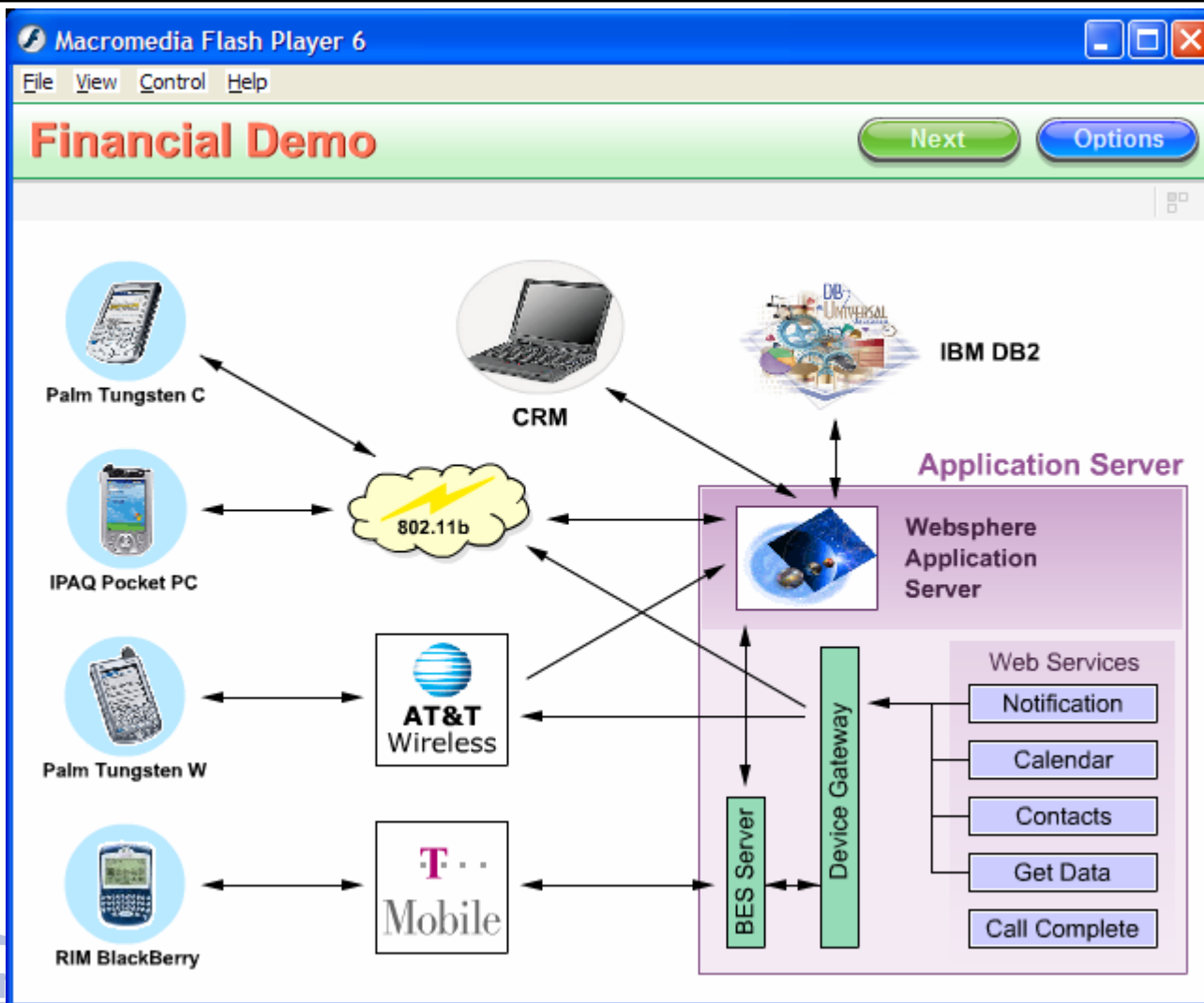


# Demo

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- Flash Demo

# Demo



# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 1

Palm Tungsten C

IPAQ Pocket PC

Palm Tungsten W

RIM BlackBerry

802.11b

AT&T Wireless

Mobile

CRM

IBM DB2

Application Server

WebSphere Application Server

BES Server

Device Gateway

Web Services

- Notification
- Calendar
- Contacts
- Get Data
- Call Complete

# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 2

Palm Tungsten C

IPAQ Pocket PC

Palm Tungsten W

RIM BlackBerry

802.11b

AT&T Wireless

T-Mobile

CRM

IBM DB2

Data

Application Server

Websphere Application Server

BES Server

Device Gateway

Web Services

Notification

Calendar

Contacts

Get Data

Call Complete

# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 3

Palm Tungsten C

IPAQ Pocket PC

Palm Tungsten W

RIM BlackBerry

CRM

802.11b

AT&T Wireless

T-Mobile

IBM DB2

Data

Application Server

Websphere Application Server

BES Server

Device Gateway

Web Services

Notification

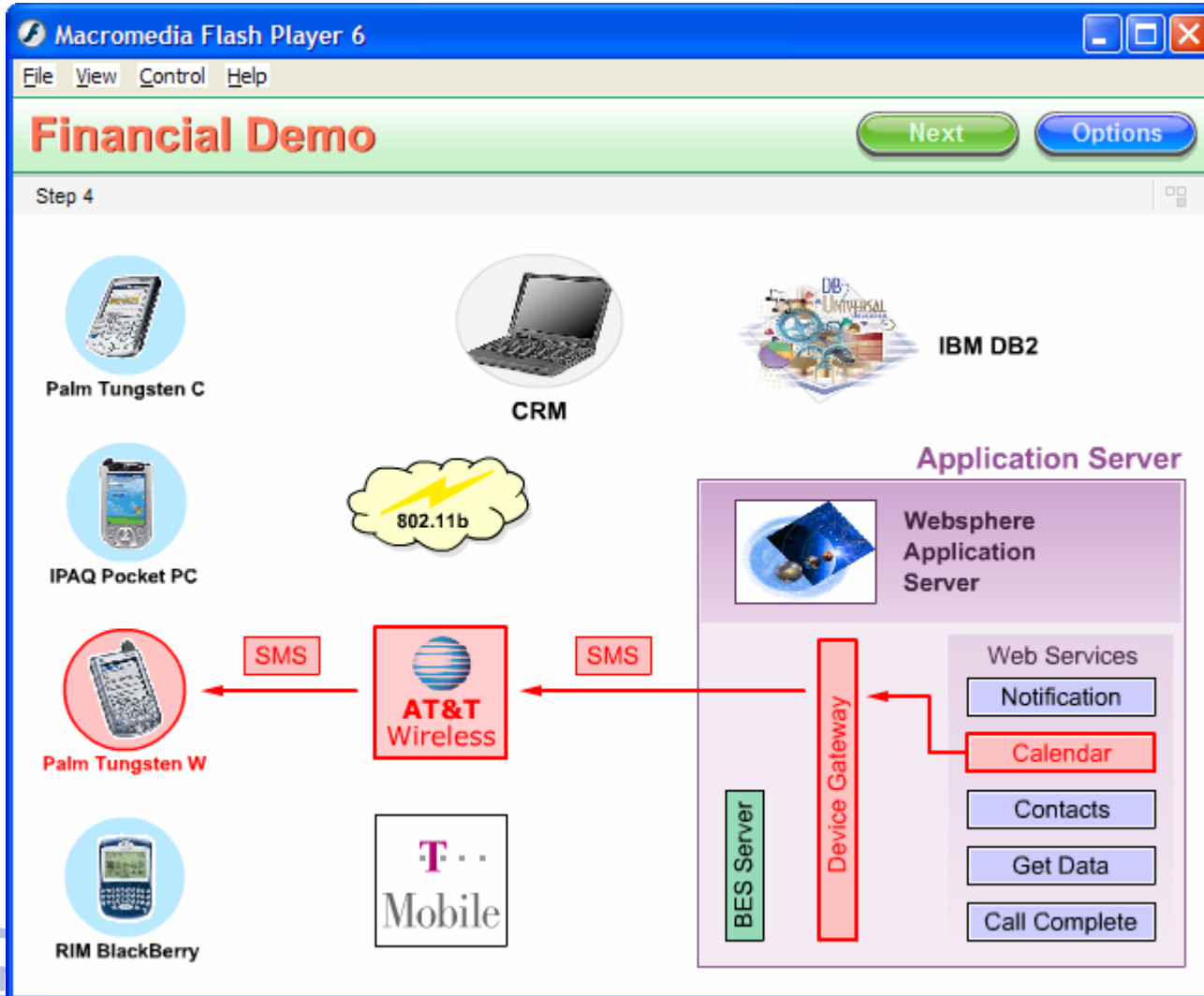
Calendar

Contacts

Get Data

Call Complete

# Demo



# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 5

Palm Tungsten C

CRM

IBM DB2

802.11b

Application Server

Websphere Application Server

WSREQ

AT&T Wireless

Web Services

Notification

Calendar

Contacts

Get Data

Call Complete

BES Server

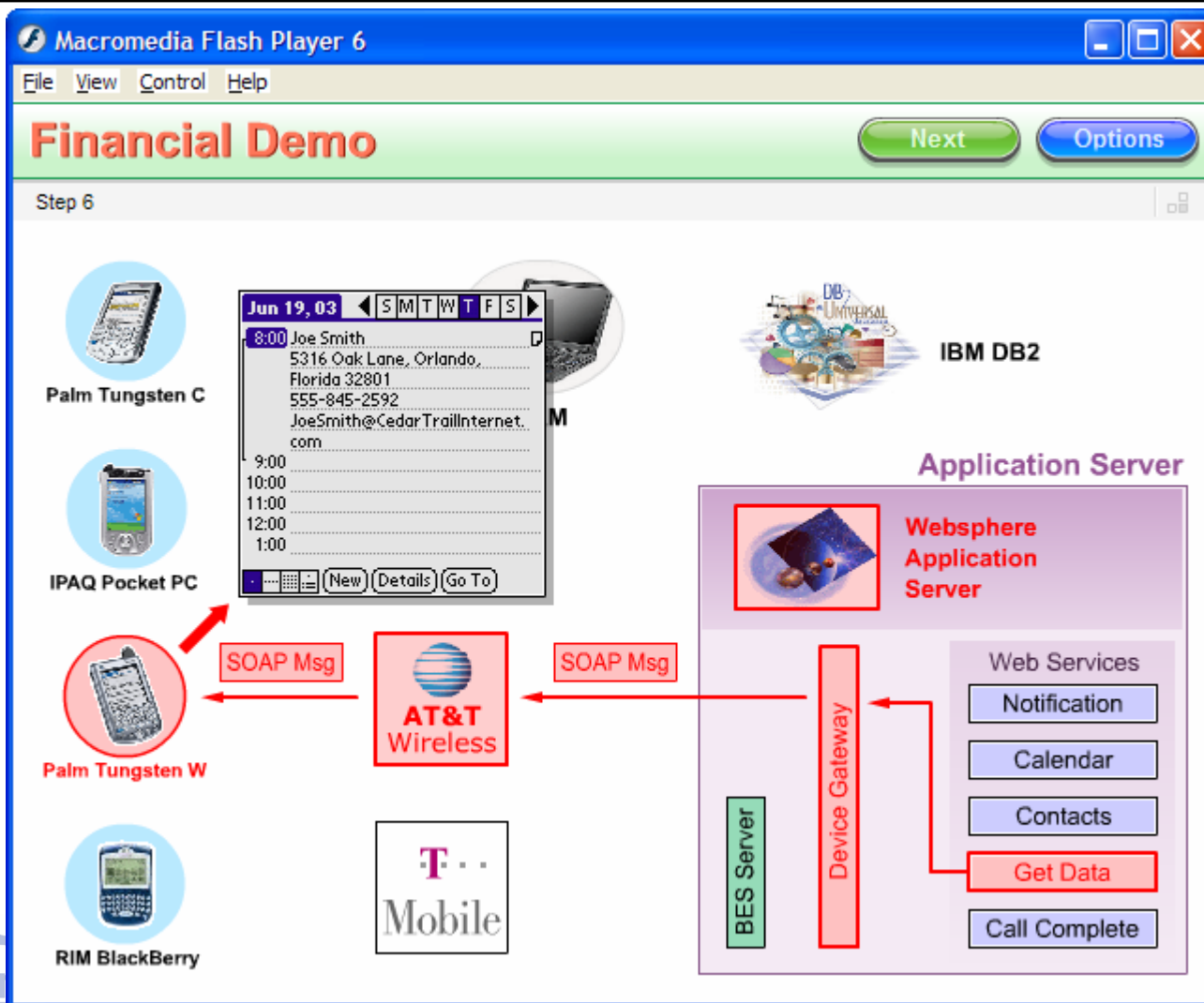
Device Gateway

Palm Tungsten W

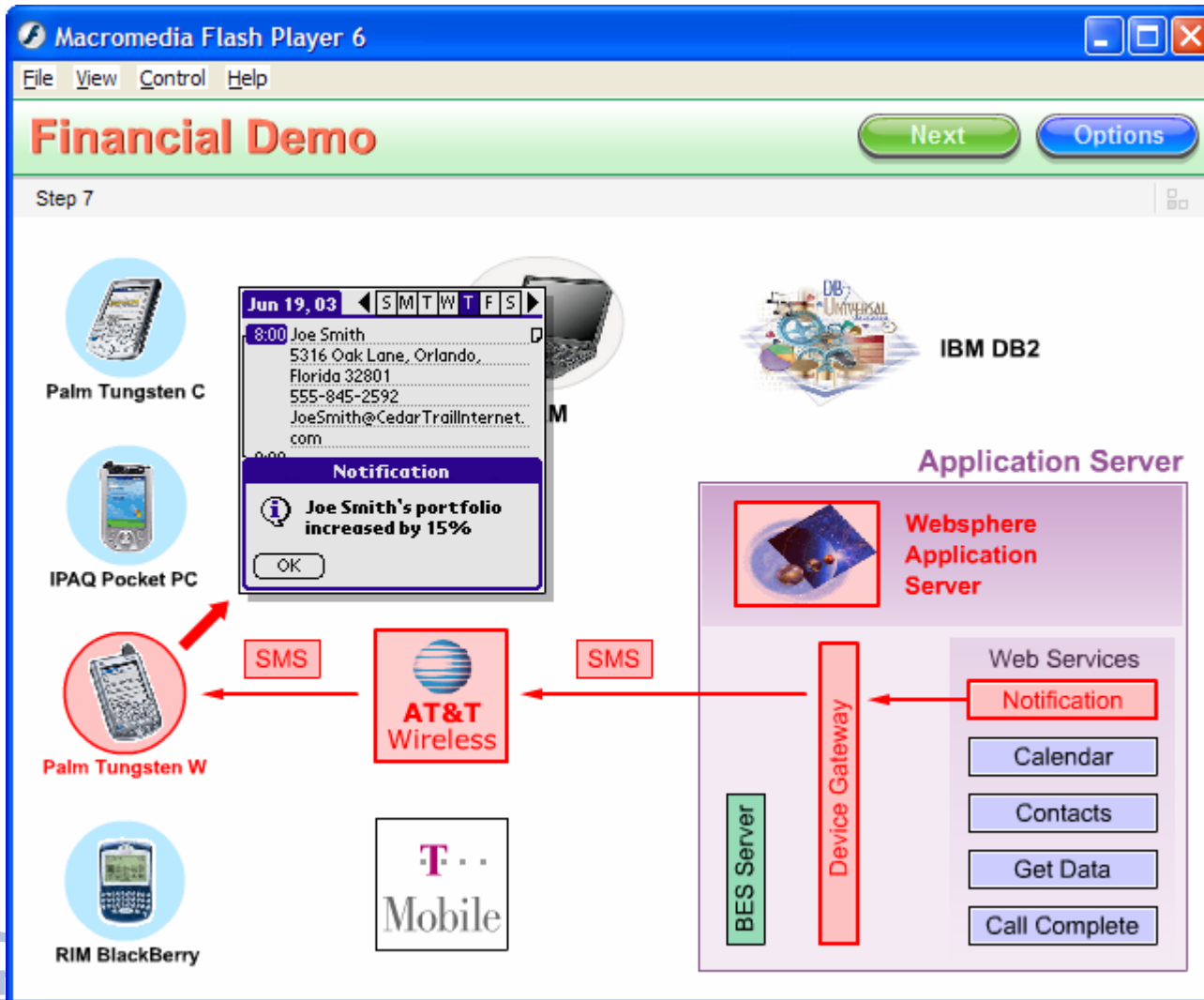
T-Mobile

RIM BlackBerry

# Demo



# Demo



# Demo

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File View Control Help

## Financial Demo

Next Options

Step 8

**Record Edit Options**

- New Event ✓N
- Delete Event... ✓D
- Attach Note ✓A
- Delete Note... ✓O
- Purge... ✓E
- Call Complete...
- Send Event

10:00  
11:00  
12:00  
1:00

(New) (Details) (Go To)

**Palm Tungsten C**

**IPAQ Pocket PC**

**Palm Tungsten W**

**RIM BlackBerry**

**AT&T Wireless**

**Mobile**

**IBM DB2**

**Application Server**

**Websphere Application Server**

**Web Services**

- Notification
- Calendar
- Contacts
- Get Data
- Call Complete

**BES Server**

**Device Gateway**

# Demo

**Macromedia Flash Player 6**

File View Control Help

## Financial Demo

Next Options

Step 9

**Call Complete**

Broker Appointment  
 Customer: Joe Smith  
 Date: 6/19/2003 8:00 - 9:00  
 Call notes:  
 Joe wants to buy 500 shares IBM

Stop Position Notification  
 Schedule Follow Up

Follow Up Details

Save Cancel

**Palm Tungsten C**

**IPAQ Pocket PC**

**Palm Tungsten W**

**RIM BlackBerry**

**AT&T Wireless**

**Mobile**

**IBM DB2**

**Application Server**

**Websphere Application Server**

**BES Server**

**Device Gateway**

**Web Services**

Notification

Calendar

Contacts

Get Data

Call Complete

# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 10

Palm Tungsten C

CRM

IBM DB2

802.11b

Application Server

Websphere Application Server

WSREQ

AT&T Wireless

WSREQ

BES Server

Device Gateway

Web Services

- Notification
- Calendar
- Contacts
- Get Data
- Call Complete

Palm Tungsten W

T-Mobile

RIM BlackBerry

# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 11

Palm Tungsten C

CRM

IBM DB2

802.11b

Application Server

IPAQ Pocket PC

AT&T Wireless

Websphere Application Server

Palm Tungsten W

Mobile

BES Server

Device Gateway

Web Services

Notification

Calendar

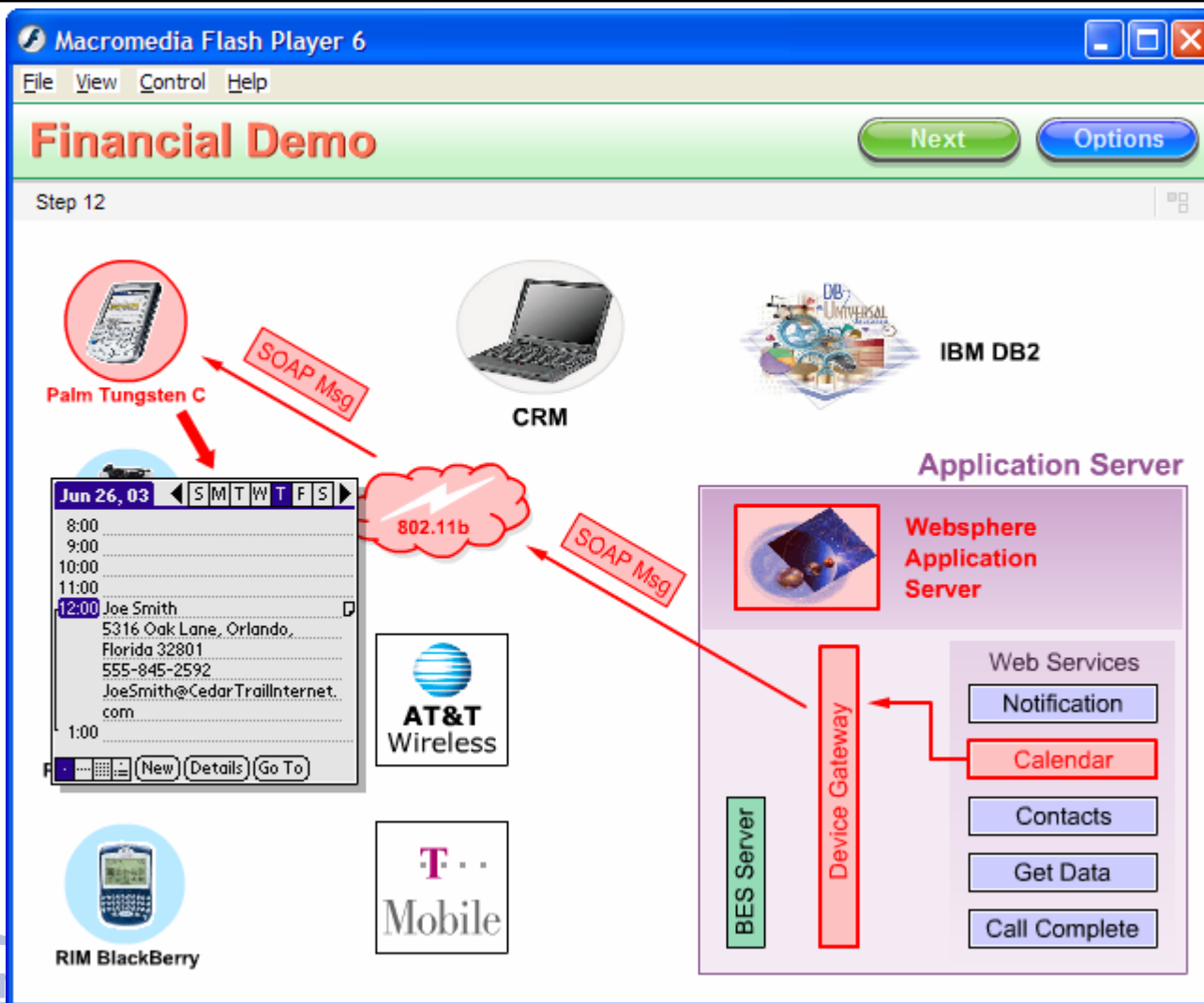
Contacts

Get Data

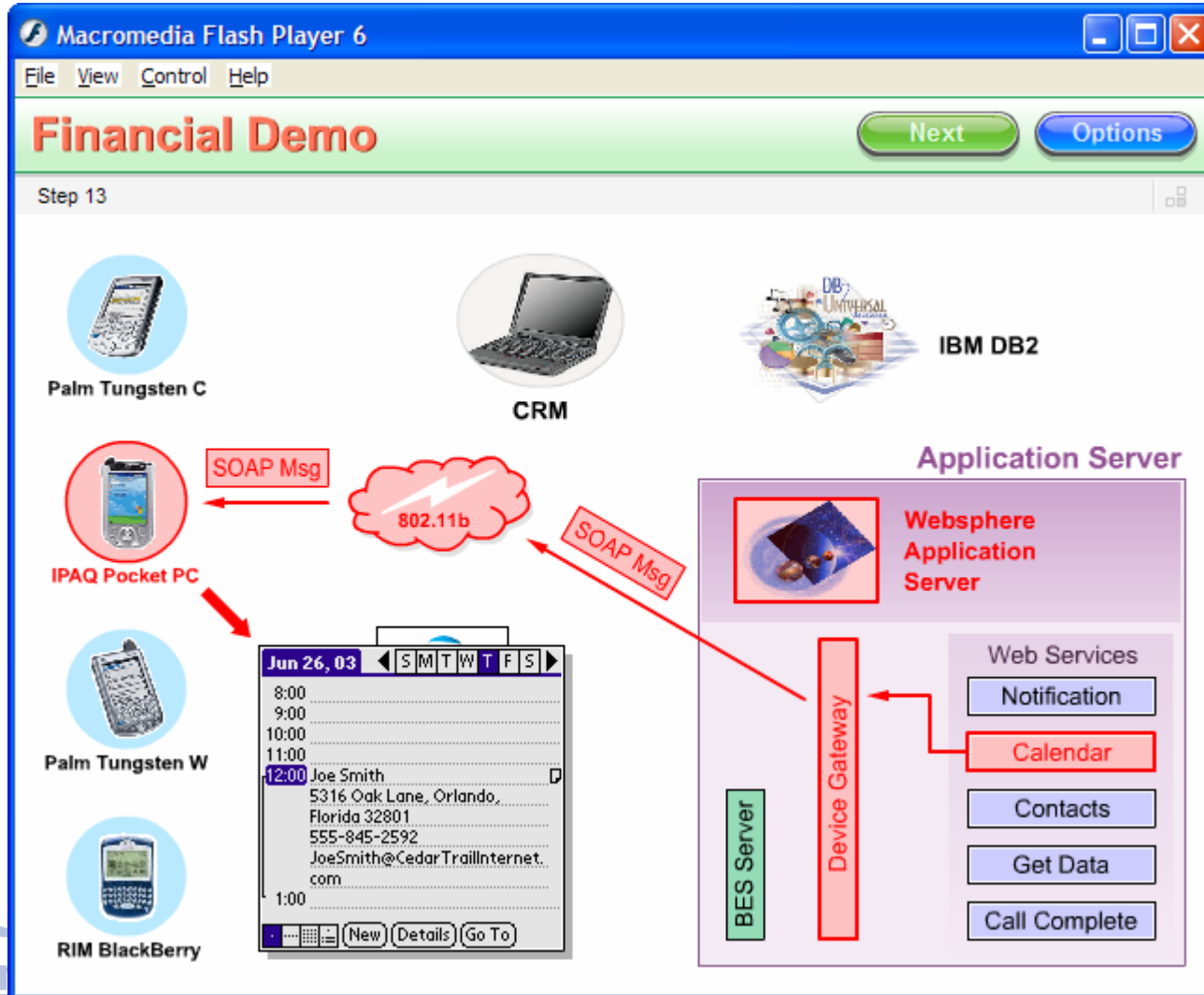
Call Complete

RIM BlackBerry

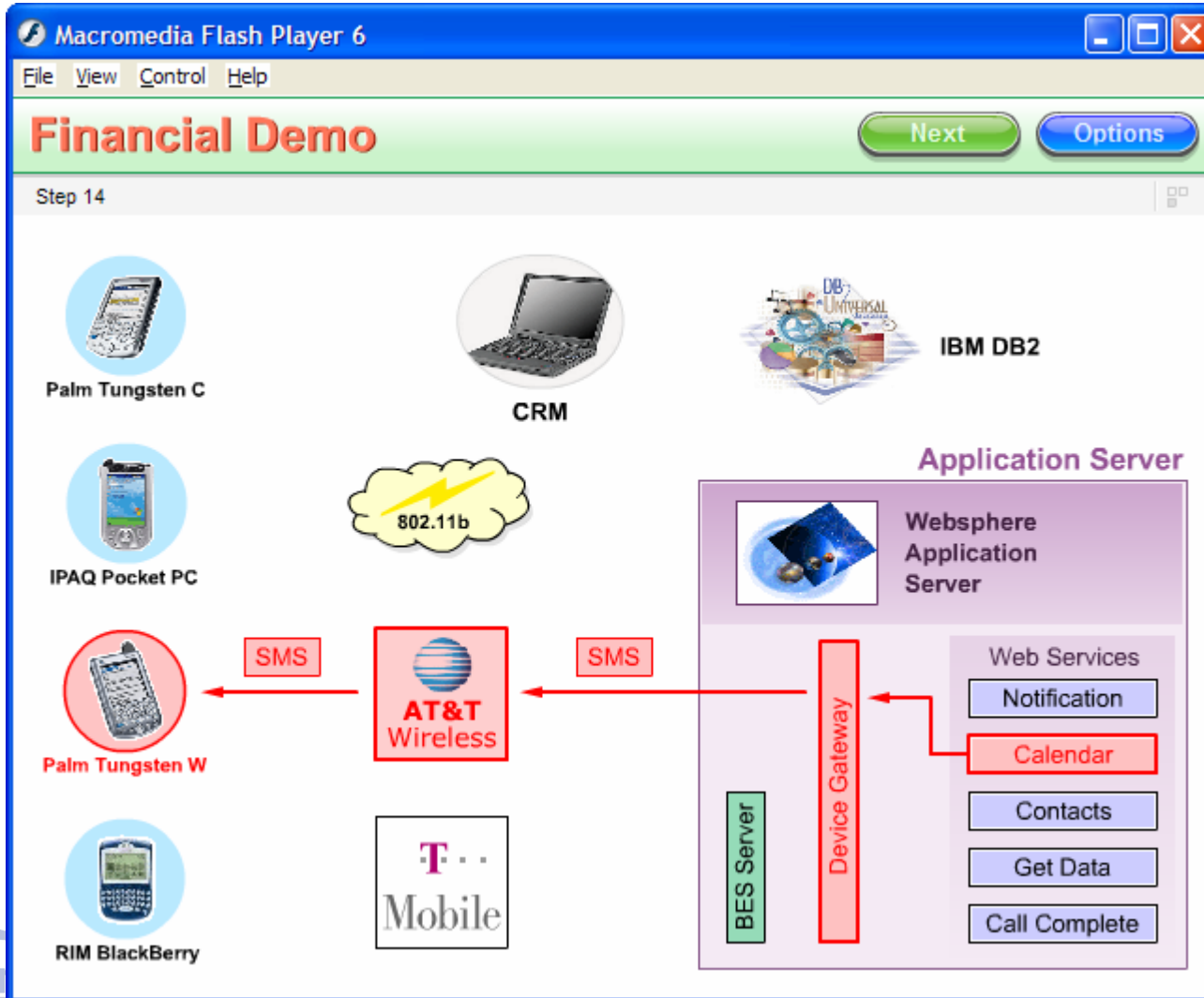
# Demo



# Demo



# Demo



# Demo

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File View Control Help

## Financial Demo

Next Options

Step 15

Palm Tungsten C

CRM

IBM DB2

802.11b

Application Server

IPAQ Pocket PC

WSREQ

AT&T Wireless

Websphere Application Server

Palm Tungsten W

Device Gateway

BES Server

T-Mobile

Web Services

Notification

Calendar

Contacts

Get Data

Call Complete

RIM BlackBerry

# Demo

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File View Control Help

## Financial Demo

Next Options

Step 16

**Calendar:** Jun 26, 03

- 8:00
- 9:00
- 10:00
- 11:00
- 12:00 **Joe Smith**
  - 5316 Oak Lane, Orlando, Florida 32801
  - 555-845-2592
  - JoeSmith@CedarTrailInternet.com
- 1:00

**Mobile Devices:** Palm Tungsten C, IPAQ Pocket PC, Palm Tungsten W, RIM BlackBerry

**Service Providers:** AT&T Wireless, T-Mobile

**Application Server:** Websphere Application Server

**Web Services:** Notification, Calendar, Contacts, **Get Data**, Call Complete

**Architecture:** BES Server, Device Gateway

**Message Flow:** SOAP Msg (Application Server to Device Gateway, Device Gateway to AT&T Wireless, AT&T Wireless to Palm Tungsten W)

# Demo

Macromedia Flash Player 6

File View Control Help

## Financial Demo

Next Options

Step 17

Palm Tungsten C

CRM

IBM DB2

IPAQ Pocket PC

Palm Tungsten W

RIM BlackBerry

Application Server

Websphere Application Server

Web Services

- Notification
- Calendar
- Contacts
- Get Data
- Call Complete

Device Gateway

BES Server

SOAP Msg

SOAP Msg

May 27, 2003 2:19p <MTWTFSS>

7:00a	
8:00a	Broker Meeting Joe Smith (5316 Oak Lane, Orlando, Florida 32801)
9:00a	
10:00a	
11:00a	
12:00p	
1:00p	
2:00p	
3:00p	
4:00p	
5:00p	



# Web Services with Java Examples

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# Web Services with Java

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- BlackBerry

- Makes Web Service Request
  - Using kSOAP
- Receive a SOAP Envelope
- Update Calendar



# Web Service Request with Java

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- Step 1
  - Install the WSTKMD for Java
- Step 2
  - Invoke your web service
    - Must be on secondary thread on BlackBerry
- See `\rim\CallCompleteProxy.java`
- See `\rim\WebServiceProxy.java`



# Receiving SOAP on device

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- Listen for SOAP envelopes with small server
  - See `\rim\SOAPServer.java`
- Need to write custom deserializer for your object
  - See `\rim\SOAPProcessor.java`
  - See `\rim\WebService.java`



# Web Services with C Examples

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# Web Services with C

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## ■ Palm

- Much more complicated than Java
  - What else is new?
- Use command line tools to generate code from .wsdl files
- Make Web Service Request
  - Using gSOAP
- Receive and process a SOAP Envelope



# Web Service Request with C

---

- Step 1

- Install the WSTKMD for C

- Step 2

- `wsdlcpp -c xxx.wsdl`

- Generates

- .h file

- ✓ Web Service call prototypes

- .c file

- ✓ Web Service call stub functions

- The `-c` option is for C code. Leave it off for C++

# Web Service Request with C

## ■ Step 3

- `soapcpp2 -c xxx.h` (the .h file generated in Step 2)
- Generates
  - `soapC.c`
    - ✓ Guts of SOAP processor
  - `soapClient.c`
    - ✓ Generated Web Service calls
  - `soapServer.c`
    - ✓ For Hosting Web Services on device

■ The `-c` option is for C code. Leave it off for C++



# Web Service Request with C

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➤ Generated files continued...

- soapH.h
- soapStub.h
- Request and response xml files
- \*.nsmmap file
  - ✓ Contains namespace information



# Web Service Request with C

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- If you are only calling a Web service from your device
  - Include all files except soapServer.c in your project.
- If you are calling a Web service AND receiving a SOAP envelope
  - You will need to include soapServer.c as well after hacking it some
    - More later



# Web Service Request with C

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- soapStub.h is generated with empty structures
  - Metrowerks compiler will give error message
    - Add void\* dummy; to empty structures
- Step 4
  - Add the namespace information from \*.nsmap to your code
- Step 5
  - Make your Web service call in your code



# Web Service Request with C

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- See `\palm\wsdl\*`
  - WSDL files
- See `\palm\generated\*`
  - Generated files using `wsdlcpp` and `soapcpp2` tools
- See `\palm\callWS\*`
  - Code to call a Web service



# Receiving SOAP on Device

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- Hand-modify the generated soapServer.c
  - Remove calls to server Web Services
  - Add function for Web service call to do work
  - Add file to your project
    - See `\palm\receiveSOAP\soapServer.c`



# Receiving SOAP on Device

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- Change your code to invoke the `soap_serve()` function that is in `soapServer.c`
  - Add receive and send functions
  - Fiddle with function pointers
    - See `\palm\receiveSOAP\application.java`



# Gotchas

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- Don't call `soap_end()` twice
  - Will unload the shared libraries on Palm
    - Not reference counted
    - Bug to be fixed in next release of WSTKMD
  - Call `soap_free()` instead
    - See `\palm\callWS\wsclient.c`
- Use two soap objects
  - One for Web services request
  - One to pass to `soap_serve(soap);`
    - See `\palm\receiveSOAP\application.c`



# Gotchas (Continued)

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- Apache SOAP uses ns1 as a namespace name
  - You must change the call in soapServer.c to use ns1 instead of the prefix in your wsdl
    - See \palm\receiveSOAP\soapServer.c
      - ✓ Line 39
  - You must add
    - {"ns1", "http://XXX"}
  - to the namespace table
    - See line 8 \palm\receiveSOAP\application.c
      - ✓ Where XXX is the class name that contains the Web services you are calling



# Notes

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- HTTP requests must be made on a secondary thread on BlackBerry devices
- Do not expect a lot of code portability with your Java code between devices
  - User interfaces are quite different
  - Bugs in MIDP implementations
  - Different UI characteristics on devices...



# UI Characteristics

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- There is no button class in MIDP
  - You use Command objects
- Some devices show the command object as
  - Button
    - PocketPC
      - ✓ However when there are too many to fit, the extras are displayed in a menu
  - Menu Item
    - BlackBerry
    - Palm



# UI Characteristics

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- List control does not behave consistently across device's MIDP implementations
  - Prefer ChoiceGroup



# References

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- Web Services Toolkit for Mobile Devices
    - <http://www.alphaworks.ibm.com/tech/wstkmd>
  - Article on writing cross-platform device programming by Peter Hagggar
    - <http://www-106.ibm.com/developerworks/webservices/library/ws-mobprg.html>
  - More articles coming on developerWorks...
    - Web Services programming on Palm, PocketPC and RIM BlackBerry
    - IBM developerWorks
      - <http://www.ibm.com/developerworks>
- ✓ Web Services Zone and Wireless Zone