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WAP vs. i-mode vs. J2ME Programming Paradigms and Limitations

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Lutris freedom to innovate

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Highlights

- **Leading Java technology**
  - Enhydra: quick-deploy Java/XML application server
  - EAS: next-generation Java/XML application server
  - Leading wireless solutions
- **Founded: July 1995**
- **Headquarters: Santa Cruz, CA**
  - European presence in London
  - Lutris KK currently being formed with Macnica
- **Employees: ~120**
- **Investors: JP Morgan Partners, Intel, Compaq, NEC, DB Alex Brown, JP Morgan H&Q, TransCosmos**

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Agenda

- Goals for this talk
- Introduction to each platform
- Quick comparison/contrast
- Suggested pros/cons
- Sample application that targets all

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Goals for this talk

- **Provide a clear introduction to the three dominant global wireless presentation technologies**
- **Provide an XML centric view of the world protocols to lessen the impact of these presentation technologies on your development**
- **Allow for the optimization of content by device/protocol, at your choice**
- **Approach the entire process in a manner which is platform neutral and standards based:**
  - XML and J2EE

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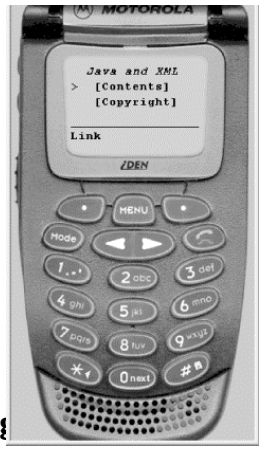
Wireless Internet WAN

USA	EC	Japan	
CDPD, Mobitex, DataTAC, WAP	WAP	i-mode (PDC-P)	any

PROTOCOL

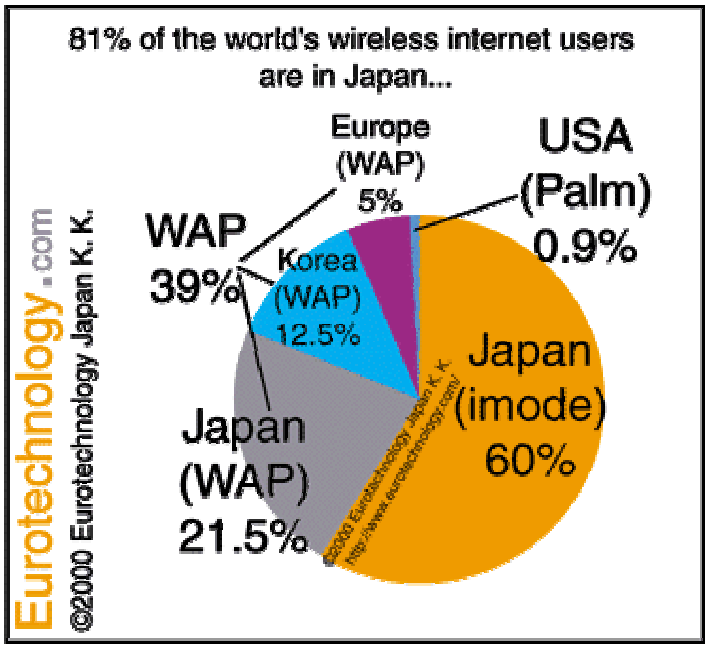
PRESENTATION

HDML & WML	WML	cHTML	J2ME
Handheld Dynamic Markup Language	*Wireless Markup Language*	*Compact Hypertext Markup Language*	*MIDlet GUI Components*



What Protocols are Used Where?

- **imode: 60% of the world's wireless internet users**
- **WAP: 39% of the world's wireless internet users**
- **PALM: 1% of the world's wireless internet users**



•November 2000 – Source: Eurotechnology Japan KK

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Introduction to WML/WAP

- **WAP Forum alliance of carriers & handset manufacturers, promising uniformity of deployment**
- **WML Derived from Phone.com's HDML**
  - HDML not XML nor HTML-based, but is entrenched in the USA
- **WML is an XML language, subsequent benefits**
  - Documents can be forced to be valid & well-formed
  - Can be dynamically generated according to DTD
- **WAP incorporates its own scripting language, security stack, etc.**
  - Optimized for network constraints [cards, decks, compiled]
  - Bearer independent [works on circuit & packet switched networks]
    - WAP in USA & Europe is far more limited than WAP in Japan

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Introduction to i-mode

- **A presentation language, a protocol, and a carrier all in one**
- **NTT has a near monopoly [3x closest competitor, 29mm]**
- **Packet Network – 9.6kbs [64-384kbs begin 05/31], always on**
- **Accessibility to i-mode applications:**
  - Official providers - 'premium area' – right to charge - ~1,000 9/00
  - Unofficial providers –right to charge with 3rd party billing - ~36k as of 11/00
- **Devices are RIGIDLY enforced to i-mode specs**
  - NTT sets the standards, the handset manufacturers comply
  - Guaranteed 16 chars [8 double-byte chars] by 6 lines
  - GIF file format support [87, 87a, 89a formats; 94 x 72 dots]
  - i-mode compatible HTML 2.0 [502i series devices] support superset of HTML 1.0 of 501i devices (forward compatible).
- **Because there are no gateways, the phones have an IP stack, and most offer SSL / TLS support**

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Introduction to J2ME

- **The smallest of the Java continuum**
  - J2EE -> J2SE -> J2ME
- **Targeting mobile devices, runtime of equivalent size to WAP 2.0 / imode 3.0 browser stacks**
  - Devices need 1-2MB min RAM
  - 400kb stack, room for MIDlets
- **MIDlets installed via a Palm-like synchronization**
  - Over the air install in future releases
- **MIDlets offer persistence, offline use**
  - Cost benefits, Coverage benefits, etc.
- **Licensing of J2ME requires passing compatibility test suite**

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Pros/Cons of WAP and WML

- **Pros**
  - 2nd largest global penetration to end users, ubiquity in Europe, not USA
  - Carrier and handset independent – 500 members in WAPforum
  - Provides light-weight scripting language
  - Likely to be moving toward XHTML-basic in v. 2.0 [not yet committed]
- **Cons**
  - Geoworks Patent – all providers must currently pay royalties
  - Gateway required [transcoding occurs, unpredictably between vendors]
  - Difficult debugging [browser & server implementations vary]
  - No compatibility tests to ensure common deployment environment
  - Security hole between WAP and Web [fixed in WAP 2.0 in Q3/01]
  - 1k page size, nominal graphics, no color [except Japan!]
  - Language not scaleable [no easy path to HTML until v2.0]
  - Language not open [no W3C spec], no push [fixed in v 2.0]
  - Language not consistently implemented – especially USA
  - Existing HTML sites must be rewritten, code optimized per device

Pros/Cons of i-mode & cHTML

- **Pros**
  - Strongest WW penetration – 20.9 million subscribers, 30,000+ sites
  - Revenue sharing [monthly only, 300 yen/mo. max, 9% fee], per packet fees
  - Location-aware today [provided only to government agencies]
  - Language is scaleable: HTML and cHTML use existing web-based tools.
  - Packet Network means push and pull, today
  - Moving to XHTML-Basic in i-mode 3.0, Q2/01
  - Large 5k per page capability (<2K recommended)
    - Color support, animated GIF support on 502i color models
  - Gateway / Security / VPN– no gateway required, https supported
  - I-Appli, released 01/26/01, supports MIDlets & full https support, 1mm!!!!
- **Cons**
  - Led and directed by a dictatorship ☺
  - i-mode is only by NTT DoCoMo [roaming now in Africa/EC/ AT&T,etc.]
  - No scripting language like WMLScript, i-mode email limited to 500 bytes
  - cHTML a proposed W3C standard, but really controlled by i-mode

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Pros/Cons of J2ME

- **Pros**
  - Security [supports https protocol for e2e security]
  - No gateways [lower costs, simpler testing, etc.]
  - MIDlet GUI offers uniform behavior across devices
  - Adopted by handset manufacturers and carriers globally
  - MIDlet GUI components familiar to Swing developers
- **Cons**
  - Nominal penetration: 230k devices released since 02/01
  - Security: in this release, handset maker has option NOT to do SSL
  - Existing HTML sites/solutions must be re-written [same as WAP]
  - Extremely limited GUI components [2 GUIs, simple and gaming]
  - Installation overhead
    - MIDlet must be installed in device
    - Over the air in future, available in Japan today
  - Requires different UI designer, as HTML designers are of zero value in developing presentations

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Comparing and Contrasting the APIs

- One Sample app
- 4 presentations [HTML, cHTML, WAP, J2ME]
- Easily extensible to your own types of query based applications

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Why Open Source for the Sample?

- **Community, Control, Cost & Quality**
  - Forte for Java IDE – 675K downloads in 1 year
  - Enhydra, #1 Java/XML Open Source Application Server
    - 120,000+ Downloads
    - 100s of thousands of copies distributed by SCO, HP, SUN, RedHat
  - InstantDB – all Java RDBMS with JDBC 2
    - 10s of thousands of downloads
    - Used by IBM, Nortel, Allaire and others
  - kXML – all Java XML parser for the KVM
- **You can remove any element and use your own tools, appserver, database, etc.,**
- **All emulators are closed source [Motorola/Sun/Yospace/Pixo]**

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Simple Tutorial – An Address Book

- **Open Source, so share it!**
  - Original Contributors Victor, Keith, Joe, & Robert
- **Easily extensible for other needs**
  - Local restaurants [query by city & type]
  - Local movies [query by city & time]
  - Your UPS package [query by name & ID]
- **Sample Application**
  - Phone Book Servlet – retrieve contact information
  - Supports 4 client types
    - HTML – web browser
    - WML – WAP phone browser
    - XML – J2ME client application
    - cHTML – imode browser
  - Demonstrates how device independence is implemented
  - Demonstrates adding a J2ME client to an existing application

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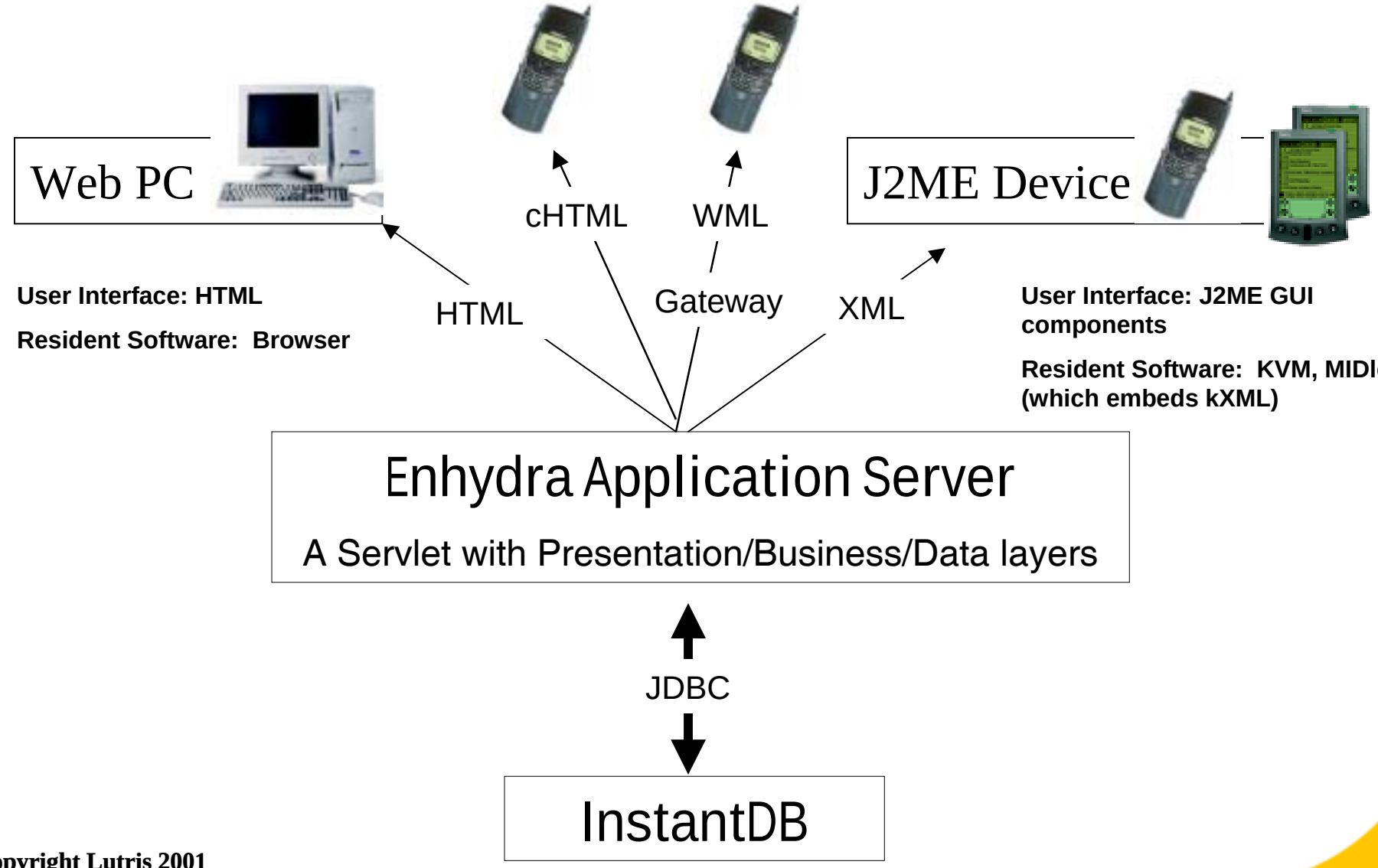
High Level Address Book Architecture



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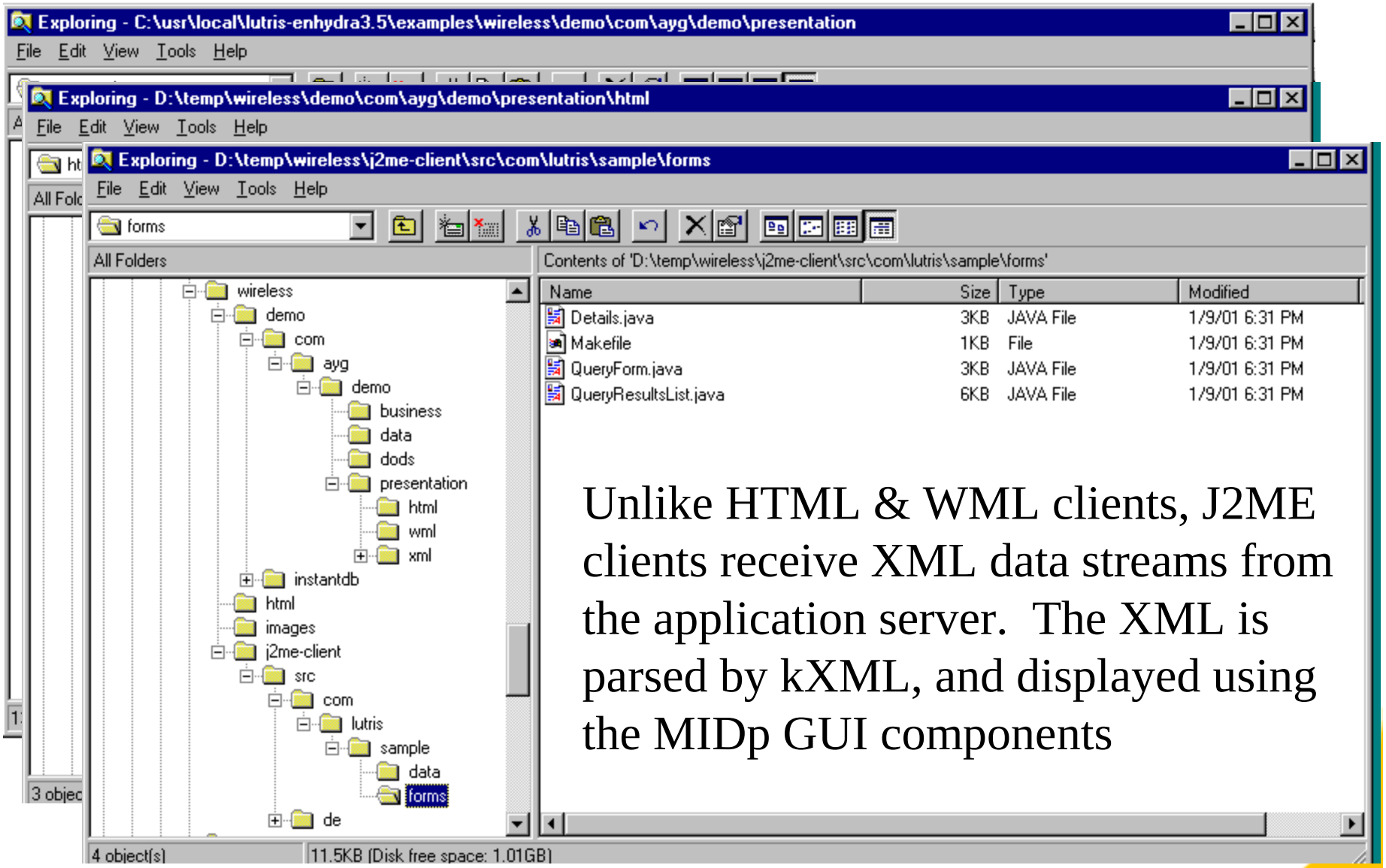
Sample Application Structure



Unlike HTML & WML clients, J2ME clients receive XML data streams from the application server. The XML is parsed by kXML, and displayed using the MIDp GUI components

The Presentation Layer

- **Detects incoming client type**
- **Requires the developer to create unique presentations for each presentation technology**
  - WML
  - cHTML
  - HTML
  - J2ME/MIDp

The Business Layer

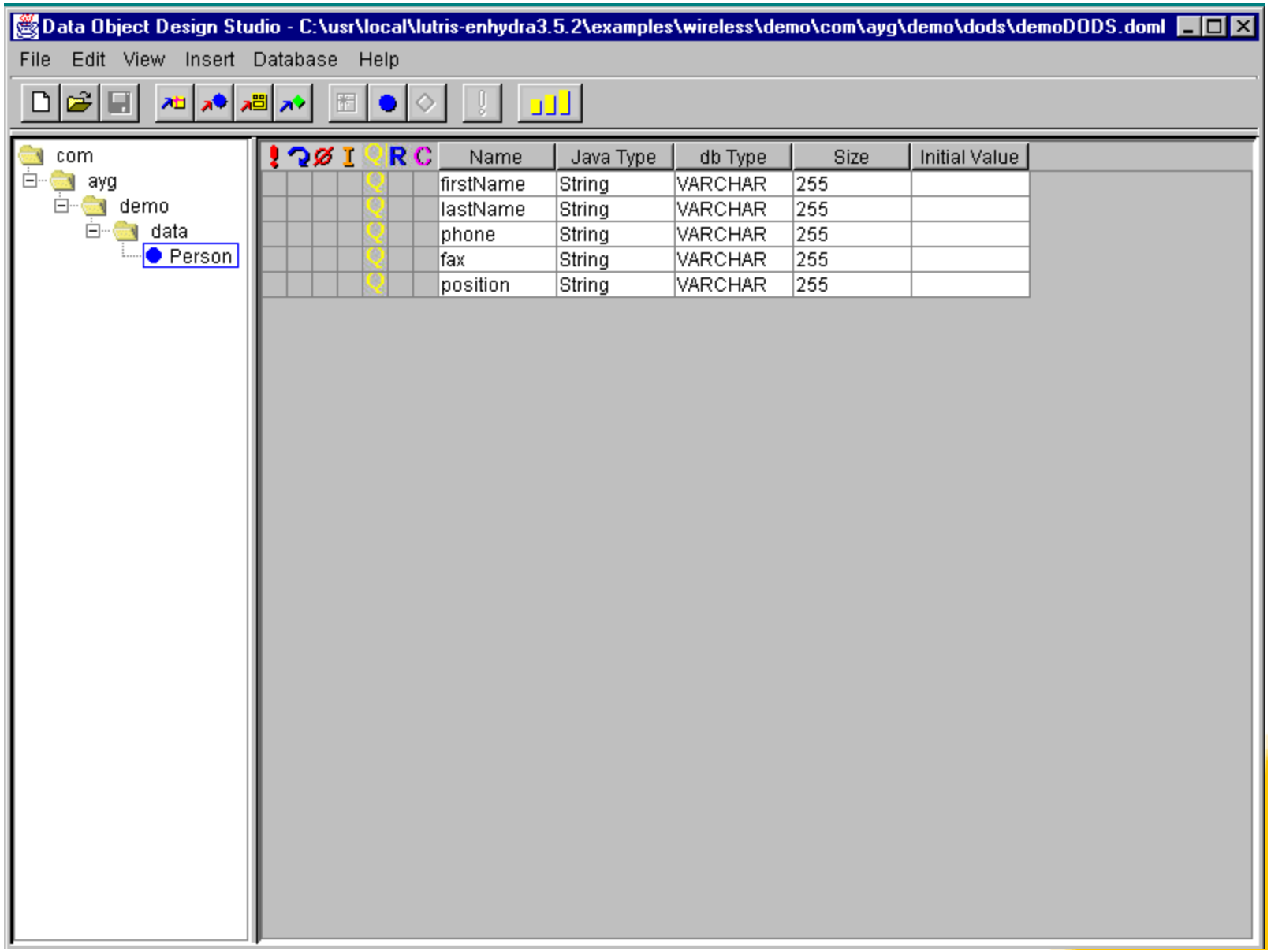
- **Focus on business logic at this level**
  - Decision making processes happen here.
  - Main workflow is clear in this layer.
  - The ‘meat’ of the application
- **Resist temptation to put any presentation or data specific code into this layer.**

The Data Layer

- **DODS (Data Object Design Studio) is an open source GUI tool for Object to Relational mapping.**
  - http://dods.enhydra.org
- **Use DODS to create data objects (DOs) to encapsulate access to the database**
- **The value of DODS is in removing specific database dependencies from your core app, makes porting easier.**
- **DOs access the data base (in the sample, InstantDB)**
- **Focus on persistence and storage at this layer**

Great introduction to DODS at:
http://www.enhydra.org/software/documentation/index.html

Data Layer is Created Automatically



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4 Principles For Device Independence

- Compiling XML to reduce device dependence
- Device specific templates.
- Common XMLC API.
- Template selection mechanism.
- Generic DOM template manipulation.

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Enhydra XMLC™ - What is it?

- **An Open Source development tool**
- **A Lutris innovation**
- **A member of the Enhydra Open Source family of technologies**
- **A methodology for…**
  - generating content (e.g., HTML, WML, J2ME) dynamically from Java
  - leveraging XML to build easy to maintain Web application presentations.
  - building device-independent application presentations
  - Building presentations that can be reworked without modifications to Java code
- **A portable presentation technology (e.g., Enhydra, BEA)**

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Enhydra XMLC Key Elements

- **XML – more than just data transport**
  - Defined by W3C
  - Foundation for evolving standards, e.g. VoiceXML, WML, XHTML, CML)
- **DOM – Document Object Model**
  - Defined by W3C
  - How a program represents an XML/HTML document in memory
  - A hierarchical representation of an XML/HTML document as represented in a software programming language, e.g. Java
  - Library for traversing, pruning, accessing portions of the DOM “tree”
- **XML Parser (from Apache Xerces Project)**
  - Parses an XML text file, turning the results into a Java DOM tree in memory.
- **Net Result**
  - presentation templates with id tags for dynamic elements are compiled to Java and become a resource to the application server

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Creating a Presentation with XMLC

- **Designer and Developer agree on common IDs.**
  - IDs represent areas of dynamic content
  - E.g., `<TABLE id=Customers>`, `<TR id=CustomerInfo>`, `<SPAN id=CustomerName>John Doe</SPAN>`
  - Designer & Developer only re-group if ID changes are required.
- **Designer and Developer part ways.**
- **Developer passes preliminary document through Enhydra XMLC compiler**
  - Generates accessor methods, e.g. `SetTextCustomers()`, `SetRowElement()`to begin development
- **Designer evolves document design/layout**
  - Review, rework according to customer requirements/feedback
- **Auto-recompile detects changes**

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4 Principles For Device Independence

- Compiling XML to reduce device dependence
- **Device specific templates.**
- Common XMLC API.
- Template selection mechanism.
- Generic DOM template manipulation.

Device Specific Templates

HTML – Details.html

```
...
<p id="person">
<b><em id="name">Johh Doe</em></b><br />
<b>Position: </b><em
    id="position">President</em><br />
<b>Phone: </b><em id="phone">111.2222</em><br />
<b>Fax: </b><em id="fax">222.3333</em><br />
</p>
...
```

WML – Details.wml

```
...
<card id="indexTemplate" title="Details">
  <p id="person">
   <b><em id="name">John Doe</em></b><br />
   <b>Position: </b><em
    id="position">President</em><br />
   <b>Phone: </b><em id="phone">111.2222</em><br
    />
   <b>Fax: </b><em id="fax">222.3333</em><br />
  </p>
 </card>
...
```

XML - Details.xml

```
...
<Person id="person">
  <Name id='name'>John Doe</Name>
  <Phone id='phone'>111.2222</Phone>
  <Position
    id='position'>President</Position>
  <Fax id='fax'>222.3333</Fax>
</Person>
```

cHTML – Details.chtml

```
...
<p id="person">
<b><em id="name">John Doe</em></b><br />
<b>Position: </b><em id="position">President</em><br />
<b>Phone: </b><em id="phone">111.2222</em><br />
<b>Fax: </b><em id="fax">222.3333</em><br />
</p>
...
```

Continued...

Device Specific Templates (Cont.)

XML - Details.xml

```
...
<Person id="person">
  <Name id='name'>Hal</Name>
  <Phone id='phone'>2222222</Phone>
  <Position
   id='position'>President</Position>
  <Fax id='fax'>1111111</Fax>
</Person>
```

sample.dtd

```
...
<!ELEMENT Person (Name, Phone,
   Position, Fax)>
<!ATTLIST Person id ID #IMPLIED>

<!ELEMENT Name (#PCDATA)>
<!ATTLIST Name id ID #IMPLIED>

<!ELEMENT Phone (#PCDATA)>
<!ATTLIST Phone id ID #IMPLIED>

<!ELEMENT Position (#PCDATA)>
<!ATTLIST Position id ID #IMPLIED>

<!ELEMENT Fax (#PCDATA)>
<!ATTLIST Fax id ID #IMPLIED>
```

J2ME HTTPConnection

```
/**
    * Retrieves the contact information for a particular person
*/
   public Person getDetails(String oid)
         throws IOException
   {
      HttpConnection con = null;
      InputStream in = null;
      Document document = null;

      try {
         StringBuffer detailsURL = new StringBuffer(DETAILS_SERVICE);
         detailsURL.append("?id=");
         detailsURL.append(oid);

         con = (HttpConnection) Connector.open(detailsURL.toString(),
               Connector.READ, true);
         con.setRequestMethod(HttpConnection.GET);
         con.setRequestProperty("Accept", "text/xml");
         con.setRequestProperty("Content-Language", "en-US");
         in = con.openInputStream();
```

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HTTP Connection, Cont'd

```
      Parser parser = new DefaultParser(new InputStreamReader(in));
      document = new Document();
      document.parse(parser);

      Person p =
XMLServices.getInstance().deserializePerson(document);
      return p;
   } finally {
      if (in != null) {
         in.close();
      }
      if (con != null) {
          con.close();
      }
   }
```

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J2ME GUI for Details.java

```
/**
    * Builds the screen with the information of a particular
   Person.
    */
   private void buildPersonInfo(Object person) {
      if (size() != 0) {
         clearScreen();
      }

      Person p = (Person) person;
      setTitle(p.getName());
      append("Phone: " + p.getPhone(), null);
      append("Position: " + p.getPosition(), null);
      append("Fax: " + p.getFax(), null);
   }
```

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4 Principles For Device Independence

- Compiling XML to reduce device dependence
- Device specific templates
- Common XMLC API
- **Template selection mechanism**
- Generic DOM template manipulation

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Define a Common XMLC API

DetailsPage.java

```
public interface DetailsPage extends XMLObject {
    public Element getTagPerson();
    public Element getTagName();
    public Element getTagPosition();
    public Element getTagPhone();
    public Element getTagFax();

    public void setTextName(String name);
    public void setTextPosition(String position);
    public void setTextPhone(String phone);
    public void setTextFax(String fax);
}
```

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Template Selection Mechanism

BasePO.java – all other POs extend BasePO

```
public String getPageName(HttpPresentationComms comms, String poName) {
   ...
   try {
      if ((header = comms.request.getHeader("Accept")) == null) {
         return null;
      } else if (header.indexOf("text/xml") != -1) {
         return poName + "XML";
      } else if (header.indexOf("text/vnd.wap.wml") != -1) {
         return poName + "WML";
      } else if (userAgent != null && userAgent.indexOf("Pixo") != -1) {
         return poName + "CHTML";  // For development purposes...
      } else if (header.indexOf("text/chtml") != -1) {
         return poName + "CHTML";
      } else {
         return poName + "HTML";
      }
   } catch (Exception e) {
   ...
```

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Generic DOM Manipulation

Details.java

```
public class Details extends BasePO {
    public void run(HttpPresentationComms comms)
            throws HttpPresentationException
    {
        DetailsPage details = (DetailsPage)
                create(comms, "com.ayg.demo.presentation.Details");
        // RETRIEVE PERSON'S INFORMATION FROM DATABASE
        // IF PERSON NOT IN DATABASE
            Element personElement = details.getTagPerson();
            Node personContainer = personElement.getParentNode();
            Node errMsg = details.createElement("em");
            errMsg.appendChild(details
                    .createTextNode("Error retreiving database info."));
            personContainer.replaceChild(errMsg, personElement);
            comms.response.writeDOM(details);
            return;
```

Continued...

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Generic DOM Manipulation (Cont.)

Details.java - continued...

```
try {
    String name = person.getFirstName() + " " +
person.getLastName();
    String phone = person.getPhone();
    String position = person.getPosition();
    String fax = person.getFax();

    details.setTextName(name);
    details.setTextPhone(phone);
    details.setTextPosition(position);
    details.setTextFax(fax);
} catch (Exception e) {
    ...
}
comms.response.writeDOM(details);
```

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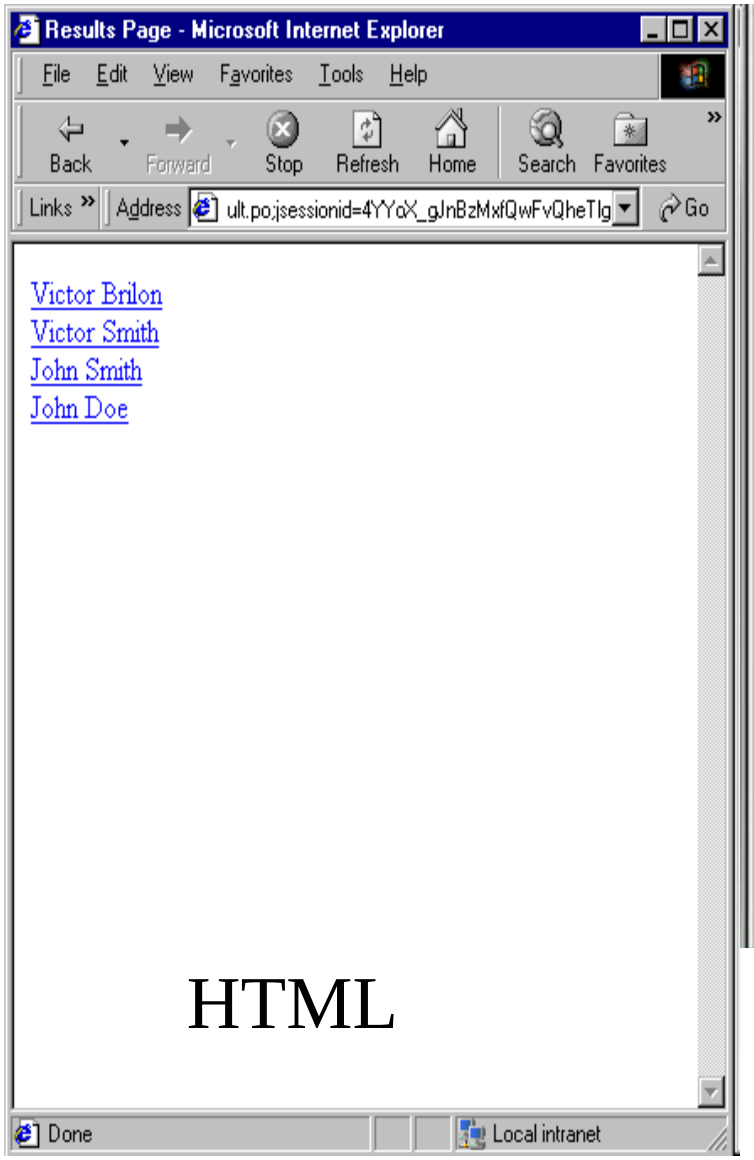
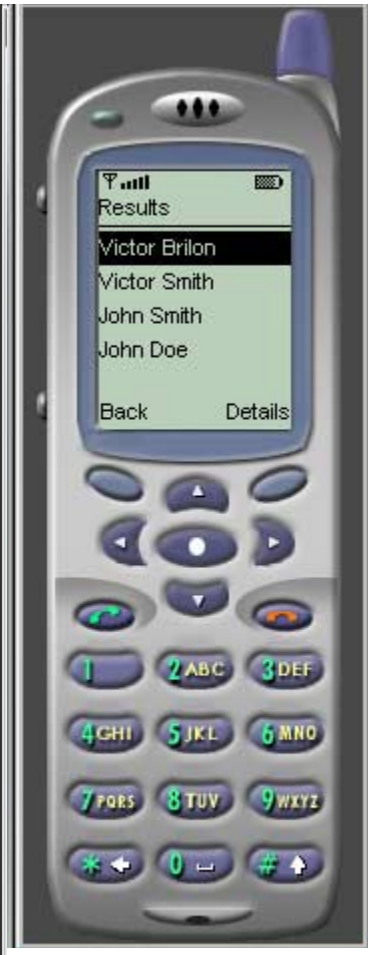
Our Sample, Everywhere

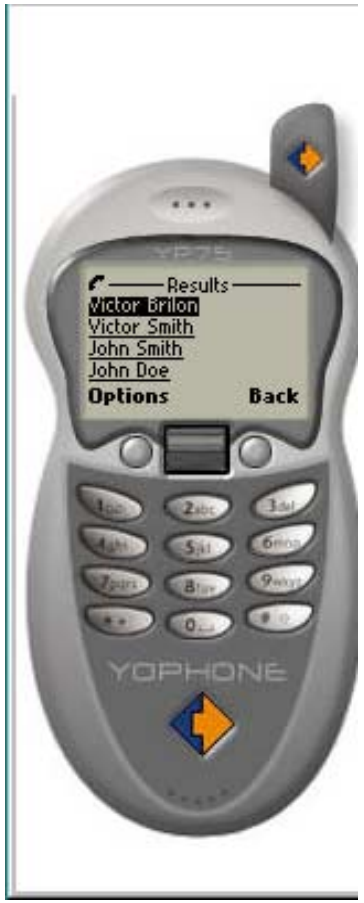


HTML



J2ME

CHTML



WAP

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Installing / Configuring

1. **Download the tutorial at**
   - http://www.lutris.com/marketing/addressbookdl/index.html
2. **Install Enhydra**
   1. Corporate developers: http://www.lutris.com/products
   2. Open source developers: http://www.enhydra.org
3. **Install an IDE, or use the command-line tools**
   - www.sun.com, www.borland.com
4. **Install phone emulators**
   - Motorola J2ME Emulator (www.motorola.com/idendev)
   - Consider installing WAP emulator for comparison (www.yospace.com)
5. **Install the sample tutorial – webinar.zip from Step 1**
6. **Follow the "QuickStart" guide to run the application!**

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Resources

- **The tutorial!**
- **Become an Enhydra/J2ME/kXML developer:**
  - enhydra@enhydra.org
  - kXML@enhydra.org
- **Emulators**
  - i-mode: www.pixo.com
  - WAP: Nokia.com, Phone.com, Yospace.com
  - J2ME: java.sun.com/j2me, www.idendev.com
- **Language references**
  - cHTML - http://www.nttdocomo.com/i/tag/lineup.html
    http://www.w3.org/Submission/1998/04/
  - WML – http://www.wapforum.org/
  - J2ME – java.sun.com/j2me
- **Keith.Bigelow@lutris.com**

QUESTIONS?