CSE 403
Lecture 22

Localization

Reading: *Core Java, Volume II: Advanced Features, 8ed*
by Cay Horstmann, Ch. 5

Agile Web Development with Rails, 3ed
by Ruby/Thomas/Hansson, Ch. 13

slides created by Marty Stepp
http://www.cs.washington.edu/403/

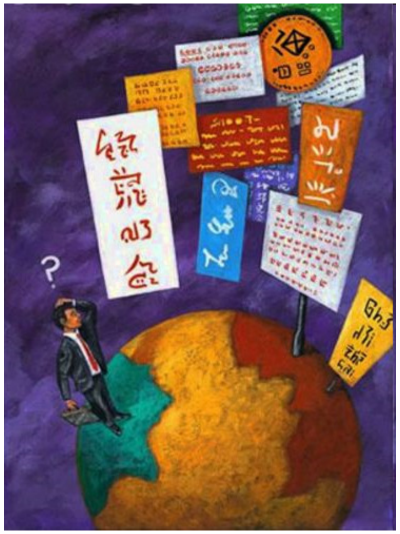
i18n and L10n

- **internationalization ("i18n")**: Process of designing software so that it can be adapted to various languages and regions.
  - done once per product (ideally); updated as code is added
- **localization ("L10n")**: Process of adapting/translating internationalized software for a specific region or language.
  - done once per locale; each locale is updated as text is added
- **globalization ("g11n")**: i18n + L10n
  - Less commonly used term,
    but many companies use it.

Who cares?

- Why should a team want to internationalize / localize its app?
  - reach a wider audience
  - make more $$$

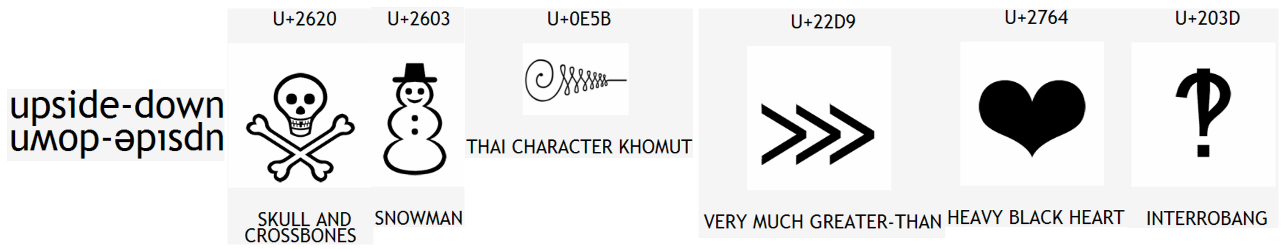
- Is it worth it to localize?
  - May need to evaluate cost/benefit:
    - What fraction of our users speak that language?
    - Are they also fluent in English?
    - Are they already able to use the site now?



- open-source software is often translated for free by community
  - Maybe you can post your code and let them do it ...

Unicode

- **Unicode**: Standard for storing, encoding, numbering over 107,000 chars from > 90 languages.
  - created in 1991 by non-profit Unicode Consortium
  - standard character ⇔ integer mappings
  - Translation Formats (UTF-*) to store chars as bytes
  - supported by languages (Java,.NET,Python), browsers
  - important for localization because it defines int'l chars and encodings we will use to present localized text



Character encodings

- **ISO-8859-1**: ANSI, 8-bit (extended ASCII)
  - backward-compatible; simple; mostly English-only

- **UTF-8**: 1 byte for all ANSI chars, which have the same code values as in standard ASCII; up to 4 bytes for other chars

- **UTF-16**: uses 2 bytes for almost all characters, and 4 bytes to encode certain special characters

- Code files, web pages may specify or be saved with encoding:

```
<html>
    <head>
        <title>CSE 403, Winter 2048</title>
        <meta charset="utf-8" />
```

Locales

- **locale**: A geographic/cultural location targeted for localization.

  A locale consists of:
  - a language (e.g. English)
    - often expressed as an ISO-639-1 code: `de`, `en`, `fr`, `ja`
  - a location or variant (e.g. United States, UK)
    - often expressed as an ISO-3166-1 code: `CA`, `US`, `GB`, `DE`, `ES`, `JP`

- Why isn't it enough to specify just the language?
  - different locations may use different conventions, spelling, etc.
    - "color" (US) vs. "colour" (UK)
    - "localize" (US) vs. "localise" (UK)
  - some locations use dialects of a given language
  - other differences (dates, currency, numbers, time zone, etc.)

Differences between locales

• **language**	English vs. German
• **spelling**	"color" vs. "colour"
• **slang**	"line" vs. "queue"
• **number** formatting	
– telephone number format	(206) 949-0504 vs. +1.206.949.0504
– decimal separator, digit groups	
• **currency** units/formatting	$123.45 vs. 123,45€
• **date** formatting	3/14/10 vs. 2010/Mar/14
• keyboard **shortcuts**	
• text **direction**	hello vs. שָׁלוֹם

– left-to-right ("LTR") vs. right-to-left ("RTL"), AKA "bidi" issues

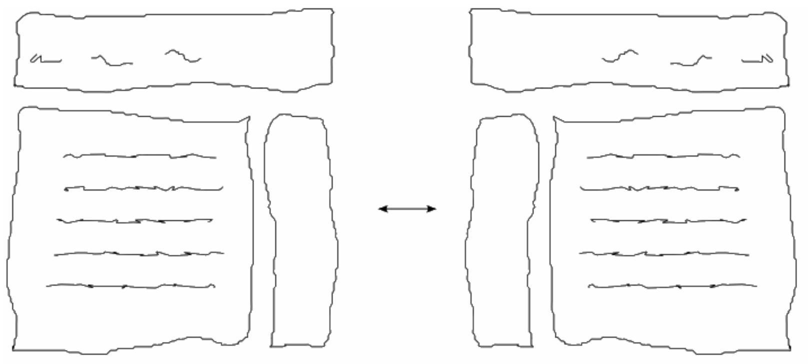
- **multimedia**: spoken audio; video subtitles

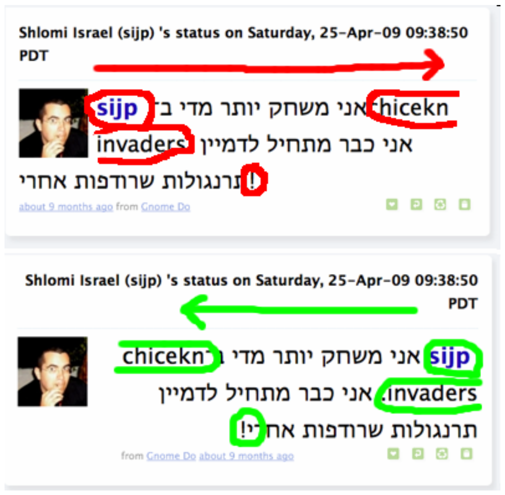
Right-to-Left (RTL)

- some languages begin lines on the right side and go left
  - Arabic, Farsi/Persian, Hebrew, Kurdish, Punjabi, Somali, ...
  - hello vs. שָׁלוֹם

- often handled by supplying separate .css files for RTL locales

- can lead to lots of subtle UI bugs based on coders' LTR assumptions





Shlomi Israel (sijp) 's status on Saturday, 25-Apr-09 09:38:50 PDT

sijp ב מדי יותר משחק אני chicekn
invaders אני כבר מתחיל לדמיין
תרגולות שרודפות אחרי!

about 9 months ago from Gnome Do

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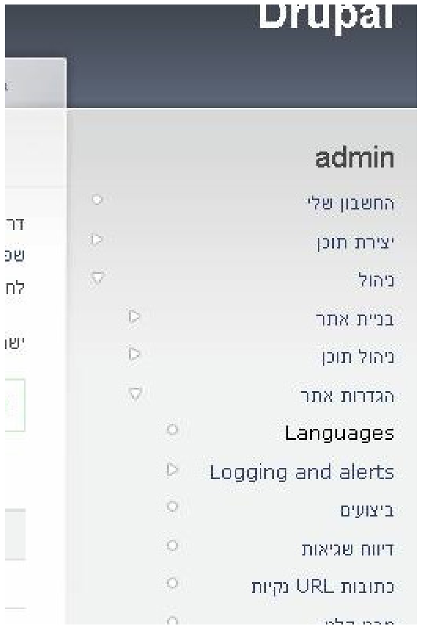
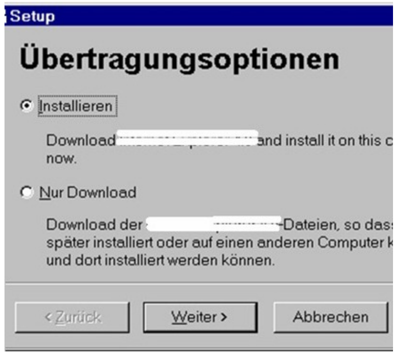


Drupal

admin

החשבון שלי
יצירת תוכן
ניהול
בניית אתר
ניהול תוכן
הגדרות אתר
Languages
Logging and alerts
ביצועים
דיווח שגיאות
כתובות URL נקיות

Localization gotchas



Übertragungsoptionen

(•) Installieren

Download [redacted] and install it on this c
now.

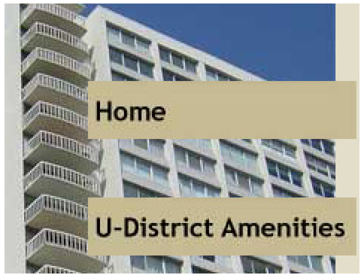
( ) Nur Download

Download der [redacted] Dateien, so das
später installiert oder auf einen anderen Computer k
und dort installiert werden können.

- Some languages (e.g. German) use long words
  - buttons/labels get too wide for space provided
- Some Unicode characters look like ASCII ones
  - U+00A0 "non-breaking space" character
  - "-" vs. U+2014 "em-dash" —, U+2013 "en-dash" –
- some fonts don't have all characters
  - but a smart OS can use *font substitution*
- regular expressions / text searches may not match i18n input
  - ex. `\w` "word boundary" doesn't match Unicode word delimiters
- web server might return text that has not been localized (Ajax)

Things to avoid for i18n

- Don't hard-code widths/heights in CSS or GUI



- Avoid images that look like text.

- Avoid using symbols that have no meaning in other locales.
  - USA "STOP sign"
  - Hand up for "Wait"

- (if localizing to RTL locales) Avoid hard-coding the notion that "left" means "start" and "right" means "end".
  - example: Left for "Back", right for "Forward"
  - example: Left for "less", right for "more"

How are i18n/L10n done?

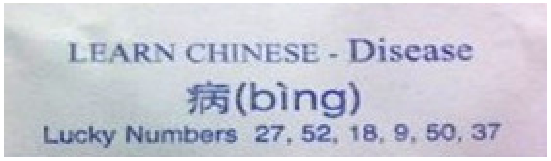
- **developers** *internationalize* the app's code
  - pull all strings out of code and into separate resource files
  - call methods that localize/format strings, numbers before printing
  - use libraries (e.g. `gettext`) to help localize messages

- **localizers** (maybe not programmers) *localize* the app's text
  - often hired to localize an app for a particular locale at a time
  - *desktop apps:* possibly compile a different binary for each locale
  - *web app:* look up localized strings when generating each page

- *model-view separation* is very important for i18n/L10n

Perils of poor localization

- word "Okay" could be translated as "so-so" or "mediocre"
- << and >> , when used as "arrows", can confuse some users whose languages use << and >> as quotation marks
- product's name or ad could translate poorly
  - Microsoft's "Bing" can translate to "disease" in Chinese
  - McDonald's pictures-only billboard in Saudi Arabia
- product could offend users from other countries
  - an online dating site that allows users under 16 to register?
  - an online auction site that has bidding end on a holy day?


LEARN CHINESE - Disease
病(bìng)
Lucky Numbers 27, 52, 18, 9, 50, 37

Poorly localized messages

- *"Drop your pants here for best results."* - dry cleaning, Tokyo
- *"We take your bags and send them in all directions."* - Scandinavian airport
- *"Ladies may have a fit upstairs."* - dry cleaning, Bangkok
- *"Teeth extracted by latest methodists."* - dentist, Hong Kong
- *"Please leave your values at the front desk."* - hotel, Paris
- *"No smoothen the lion."* - zoo, Czech
- *"If you consider our help impolite, you should see the manager."* - hotel, Athens
- *"Our wines leave you nothing to hope for."* - Swiss restaurant
- *"It is forbidden to enter a woman, even if dressed as a man."* - Bangkok temple
- *"Fur coats made for ladies from their own skin."* - Swedish furrier
- *"Specialist in women and other diseases."* - doctor, Rome
- *"Ladies, leave clothes here and spend afternoon having good time."* - laundry, Rome
- *"We regret that you will be unbearable."* - hotel, Bucharest
- *"When passenger of foot heave in sight, tootle the horn. Trumpet him melodiously at first, but if he still obstacles you then tootle him with vigor."* - car rental, Tokyo

Automated translation

- Why hire localizers when automated translators exist, such as Google Translate and BabelFish?
  - From course syslabus:

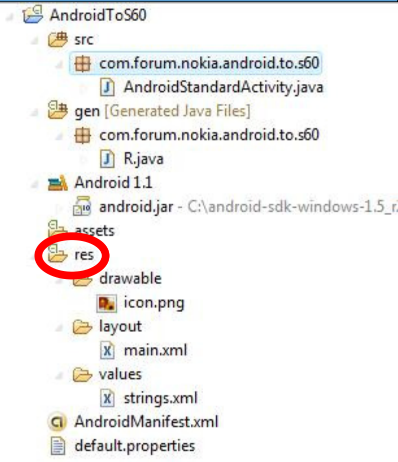
    "There is no textbook, but there will be reading assignments throughout the quarter that will be posted to the course web site to print or read online. For many of the reading assignments, we will assign questions posted online for you to answer about the reading. You will submit your answers to these questions online. These will be part of your course grade and will not be accepted late."

  - Translated to Chinese by BabelFish, then back to English:

    "Without the textbook, but will have will be posted to the route website, in on-line printing or reads in quarter reading assignment. For many reading assignments, we the assignment problem on-line will post, for you can reply that about studies. You on-line will submit your answer to give these questions. These will be a your route rank part, and after them, will not be accepted."

Android localization

- Android apps store resources in `res/` folder
  - text strings go in `strings.xml` files:
    - `res/values/strings.xml` (defaults)
    - `res/values`**`-en`**`/strings.xml` (English)
    - `res/values`**`-fr`**`/strings.xml` (French)



```
AndroidToS60
  src
    com.forum.nokia.android.to.s60
      AndroidStandardActivity.java
  gen [Generated Java Files]
    com.forum.nokia.android.to.s60
      R.java
  Android 1.1
    android.jar - C:\android-sdk-windows-1.5_r
  assets
  res
    drawable
      icon.png
    layout
      main.xml
    values
      strings.xml
  AndroidManifest.xml
  default.properties
```

  - testing locales:
    - *(on a real Android device)*
      Home → Menu → Settings → Locale & text → Select locale
    - *(on the emulator using adb)*
      adb -e shell
      # setprop persist.sys.language [language code];setprop
        persist.sys.country [country code];stop;sleep 5;start

strings.xml example

```
<!-- res/values/strings.xml -->
<?xml version="1.0" encoding="utf-8"?>
<resources>
  <string name="greeting">Hello!</string>
  <string name="login">User %1 logged in.</string>
</resources>

<!-- layout XML file that uses string in View -->
<TextView
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:text="@string/greeting" />

// in-app Java code that grabs a resource string
Resources res = getResources();
String greet = res.getString(R.string.greeting);
String msg = String.format(
  res.getString(R.string.login), userName);
```

Other resources

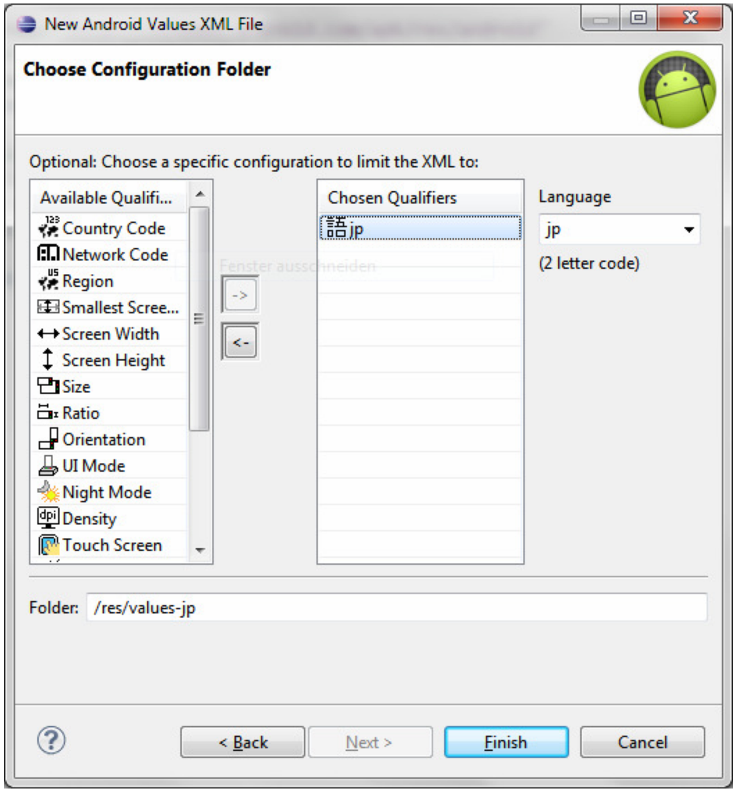
- Images are in res/drawable
  - res/drawable/company-logo.png (English)
  - res/drawable-fr/company-logo.png (French)

```
<!-- layout XML file that uses image in View -->
<ImageView
  android:layout_height="wrap_content"
  android:layout_width="wrap_content"
  android:src="@drawable/company-logo" />
```

- Layouts are in res/layout
- Menus are in res/menu
- Colors are in res/values/colors.xml

IDE resource support

- Many IDEs (Eclipse) help you graphically create/edit resources



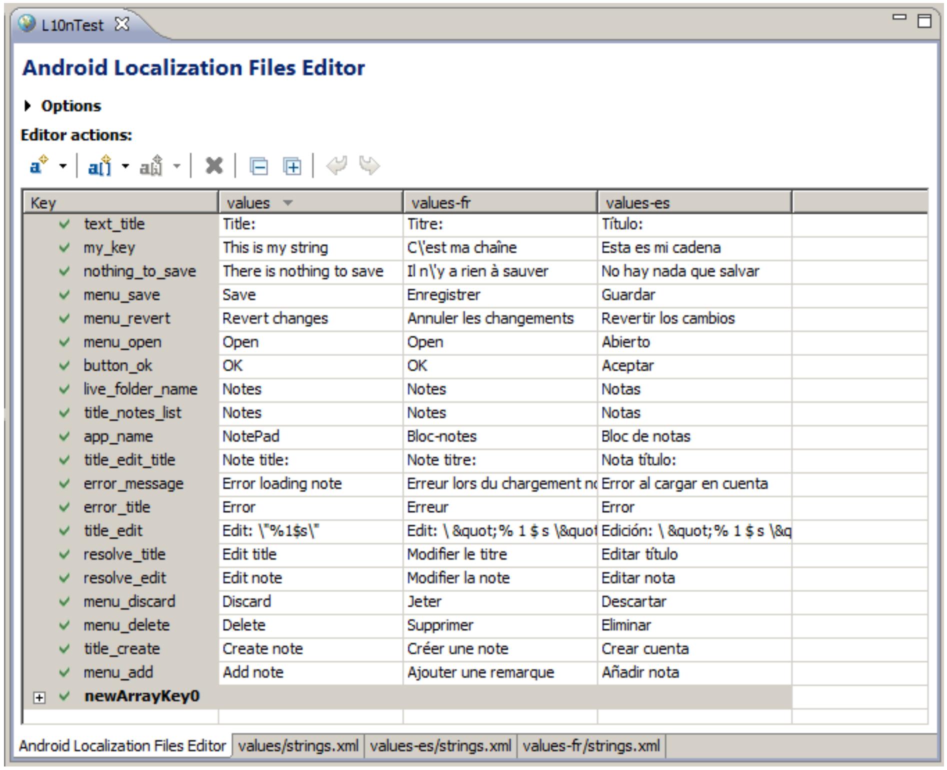
New Android Values XML File

Choose Configuration Folder

Optional: Choose a specific configuration to limit the XML to:

Available Qualifi...	Chosen Qualifiers	Language
Country Code	jp	jp
Network Code		(2 letter code)
Region		
Smallest Scree...		
Screen Width		
Screen Height		
Size		
Ratio		
Orientation		
UI Mode		
Night Mode		
Density		
Touch Screen		

Folder: /res/values-jp



L10nTest

Android Localization Files Editor

Options

Editor actions:

Key	values	values-fr	values-es
text_title	Title:	Titre:	Título:
my_key	This is my string	C\'est ma chaîne	Esta es mi cadena
nothing_to_save	There is nothing to save	Il n\'y a rien à sauver	No hay nada que salvar
menu_save	Save	Enregistrer	Guardar
menu_revert	Revert changes	Annuler les changements	Revertir los cambios
menu_open	Open	Open	Abierto
button_ok	OK	OK	Aceptar
live_folder_name	Notes	Notes	Notas
title_notes_list	Notes	Notes	Notas
app_name	NotePad	Bloc-notes	Bloc de notas
title_edit_title	Note title:	Note titre:	Nota título:
error_message	Error loading note	Erreur lors du chargement no	Error al cargar en cuenta
error_title	Error	Erreur	Error
title_edit	Edit: \"%1$s\"	Edit: \ &quot;% 1 $ s \&quot	Edición: \ &quot;% 1 $ s \&q
resolve_title	Edit title	Modifier le titre	Editar título
resolve_edit	Edit note	Modifier la note	Editar nota
menu_discard	Discard	Jeter	Descartar
menu_delete	Delete	Supprimer	Eliminar
title_create	Create note	Créer une note	Crear cuenta
menu_add	Add note	Ajouter une remarque	Añadir nota
newArrayKey0			

Locales in standard Java

- `java.util.Locale` class represents a locale on the system

```
Locale here = Locale.getDefault();
Locale swiss = new Locale("de", "CH");
System.out.println(swiss.getDisplayName());
System.out.println(swiss.getDisplayName(Locale.GERMAN));
Locale.setDefault(Locale.ITALIAN);
```

- many other classes have methods to get supported `Locale`s

```
Locale[] locs = DateFormat.getAvailableLocales();
```

- many other classes have methods that accept a `Locale`

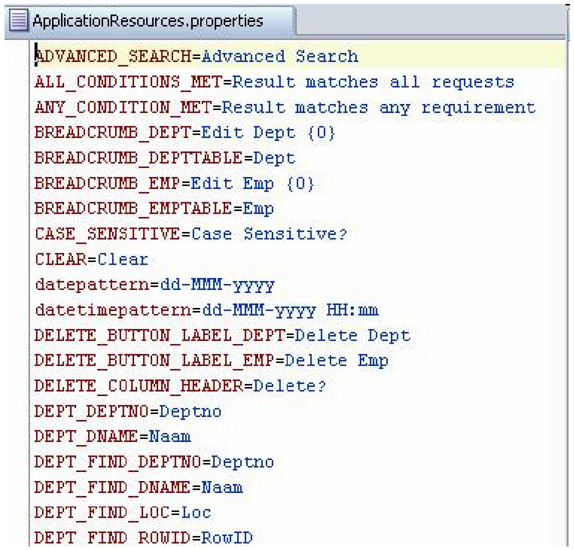
```
NumberFormat euro =
        NumberFormat.getCurrencyInstance(Locale.US);
```

Resource files

- **resource**: An external file (not code) containing a list of text messages localized for a particular locale.

  benefits:
  - putting messages together makes sure you don't forget any
  - easier to add another language later
  - no locale-based logic in program code
  - non-programmers can work on localization

- given file names that contain locale info
  - e.g. `PracticeIt_de_DE.properties`


ApplicationResources.properties

```
ADVANCED_SEARCH=Advanced Search
ALL_CONDITIONS_MET=Result matches all requests
ANY_CONDITION_MET=Result matches any requirement
BREADCRUMB_DEPT=Edit Dept {0}
BREADCRUMB_DEPTTABLE=Dept
BREADCRUMB_EMP=Edit Emp {0}
BREADCRUMB_EMPTABLE=Emp
CASE_SENSITIVE=Case Sensitive?
CLEAR=Clear
datepattern=dd-MMM-yyyy
datetimepattern=dd-MMM-yyyy HH:mm
DELETE_BUTTON_LABEL_DEPT=Delete Dept
DELETE_BUTTON_LABEL_EMP=Delete Emp
DELETE_COLUMN_HEADER=Delete?
DEPT_DEPTNO=Deptno
DEPT_DNAME=Naam
DEPT_FIND_DEPTNO=Deptno
DEPT_FIND_DNAME=Naam
DEPT_FIND_LOC=Loc
DEPT_FIND_ROWID=RowID
```

Resource bundles in Java

- standard (non-Android) Java's resource file format:
  - a "properties file", full of *name = value* pairs named something like `MyProgram_de_CH.properties`

```
computeButton=Rechnen
colorName=black
defaultPaperSize=210x297
```

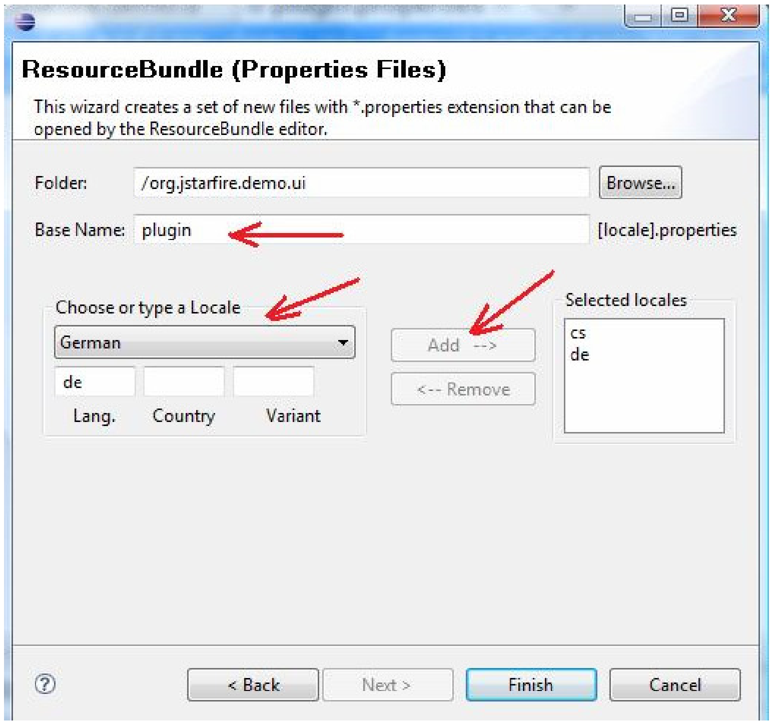
- `java.util.ResourceBundle` class reads resource files

```
ResourceBundle bundle =
  ResourceBundle.getBundle(bundleName, locale);
String buttonText = bundle.getString("computeButton");
```

  - can bundle objects by extending `ResourceBundle`, but don't

IDE resource support

- Many IDEs (Eclipse) help you graphically create/edit resources



ResourceBundle (Properties Files)

This wizard creates a set of new files with *.properties extension that can be opened by the ResourceBundle editor.

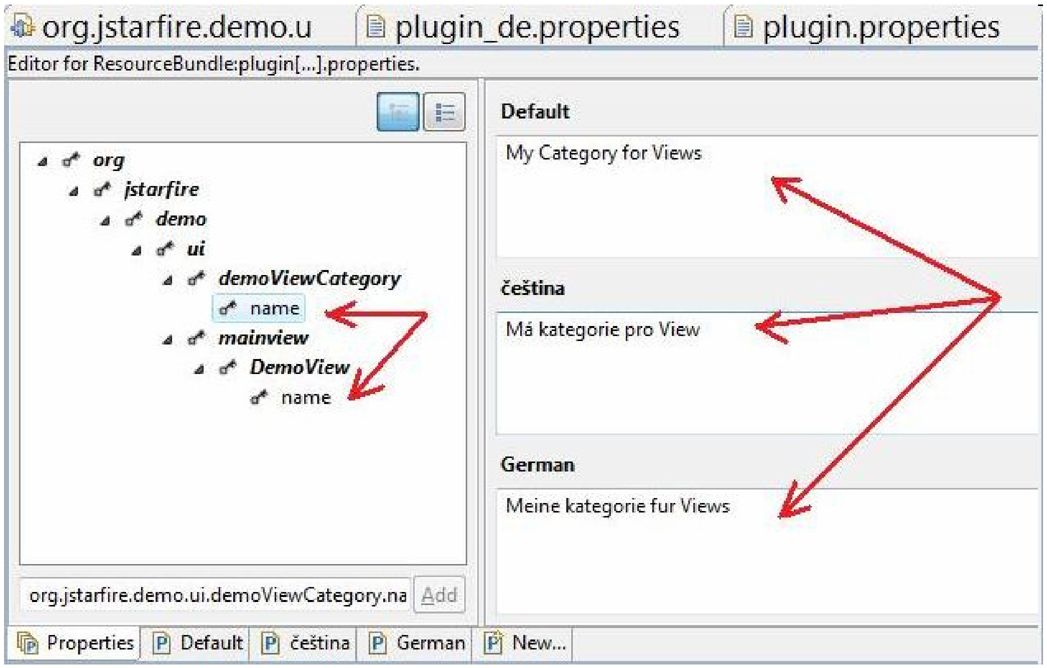
Folder: /org.jstarfire.demo.ui

Base Name: plugin [locale].properties

Choose or type a Locale: German

Lang.: de | Country: | Variant:

Selected locales: cs, de



Editor for ResourceBundle:plugin[...].properties.

```
org
  jstarfire
    demo
      ui
        demoViewCategory
          name
        mainview
          DemoView
            name
```

org.jstarfire.demo.ui.demoViewCategory.na

Default: My Category for Views

čeština: Má kategorie pro View

German: Meine kategorie fur Views

Formatting numbers

- `java.text.NumberFormat` formats numbers for a locale

```
Locale loc = Locale.getDefault();
NumberFormat currFmt =
        NumberFormat.getCurrencyInstance(loc);
String result = currFmt.format(1234.56);  // 1.234,56€

// don't use Double.parseDouble, etc.
String line = scanner.nextLine();         // user input
Number input = fmt.parse(line.trim());
```

  – throws `ParseException` if text is in invalid format (need to trim)

Formatting dates

- Differences in how to display dates across locales:

– names of the months/days	(Monday vs. Lundi)
– ordering of days	(what day does a week start/end)
– relative order of y/m/d	(3/14/2010 vs. 2010/Mar/14)
– time zone	(usually offset from UTC/GMT)
– 12 vs. 24 hour time	(5:00 PM vs. 17:00)

- `java.text.DateFormat` formats dates
  - styles: `DateFormat.DEFAULT`, `FULL`, `LONG`, `MEDIUM`, `SHORT`

```
DateFormat fmt = DateFormat.getDateTimeInstance(
        DateFormat.LONG, DateFormat.SHORT, locale);
String s = fmt.format(new Date());
Date d = fmt.parse(dateText.trim());  // parse a date
```

Formatting currencies

- currencies are represented by ISO-4217 currency identifiers
  - examples: `USD`, `GBP`, `EUR`, `JPY`, `CNY`, `INR`, `RUB`
  - programming languages don't know exchange rates between currencies (can't tell you how many Euros equals $100.00)
  - but facilities exist for displaying a variable as a currency amount

- `java.text.NumberFormat` has currency objects (instances)

```
NumberFormat dollar =
 NumberFormat.getCurrencyInstance(Locale.US);
NumberFormat euro =
 NumberFormat.getCurrencyInstance(Locale.GERMANY);
euro.setCurrency(Currency.getInstance("EUR"));
String s = euro.format(123456.78);
```

String collation

- **collation**: Locale-dependent relative ordering of strings.
  - `String`'s `compareTo` method just goes by ASCII/Unicode value
  - doesn't work well for special characters: é, Å, æ, ß, ™
    - one locale might want Å to come between A and B
    - another might want Å to come after Z...
  - normalization/decomposition: turning ™ into `"TM"`, é into `"e´"`
- `java.text.Collator` class collates strings for a given locale
  - implements `Comparator` interface
  - collation strengths: `PRIMARY`, `SECONDARY`, `TERTIARY`

```
Collator coll = Collator.getInstance(locale);
coll.setStrength(Collator.TERTIARY);
if (coll.compare(a, b) < 0) { ... // a comes before b
```

String/text formatting

- When dealing with strings that insert variables' values, it is best practice to make them use `printf` / `String.format` / etc.
  - This gives one complete sentence/string for the localizers.
  - Easier to understand context and translate properly.

- [`java.text.MessageFormat`] formats localized strings

```
String format = "On {2}, a {0} caused {1} damage."
String msg = MessageFormat.format(message,
    "hurricane",  10.0E8,
    new GregorianCalendar(1999, 0, 1).getTime());
// On 1/1/99 12:00 AM, a hurricane caused 100,000,000 damage.

format = "On {2,date,medium}, a {0} caused
             {1,number,currency} damage.";
// On Jan 1 1999, a hurricane caused $100,000,000 damage.
// can specify placeholder format: number, time, date, ...
```

Localization in Ruby/Rails

- `I18n` module has `transate` (`t`) and `localize` (`l`) methods

```
t 'store.title'    # translate the given string id
l Time.now         # localize the current time
```

  – you can also get/set the following `I18n` properties as necessary:
    - `load_path`, `locale`, `default_locale`, `exception_handler`, ...

  – setting locale based on URL subdomain:

```
# de.myapp.com -> set I18n.locale to "de"
I18n.locale = request.subdomains.first
```

  – setting locale based on HTTP request

```
# request is "de" -> set I18n.locale to "de"
I18n.locale = request.env['HTTP_ACCEPT_LANGUAGE']
                     .scan(/^[a-z]{2}/).first
```

Localization resource files

- each language gets a `.yml` file of hierarchical key/value pairs:

```
en:
    hello: "Hello, world!"
    store:
        title: "Jim's Meat Market"
es:
    hello: "Hola, mundo!"
    store:
        title: "Mercado carne de Jim"
```

- views can refer to a key from the resource file:

```
# app/views/home/index.html.erb
<h1><%= t :hello %></h1>
<p><%= flash[:store.title] %></p>
<h2><%= l Time.now %></h2>
```