Fachhochschule
cole spécialisée bernoise
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bject-Oriented Programming 2

ernationalization – I18n

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omputer science

utline – I18n

- What is I18n?
- `java.lang.Locale`
- Culture Dependent Content
- Formatting
- Sorting

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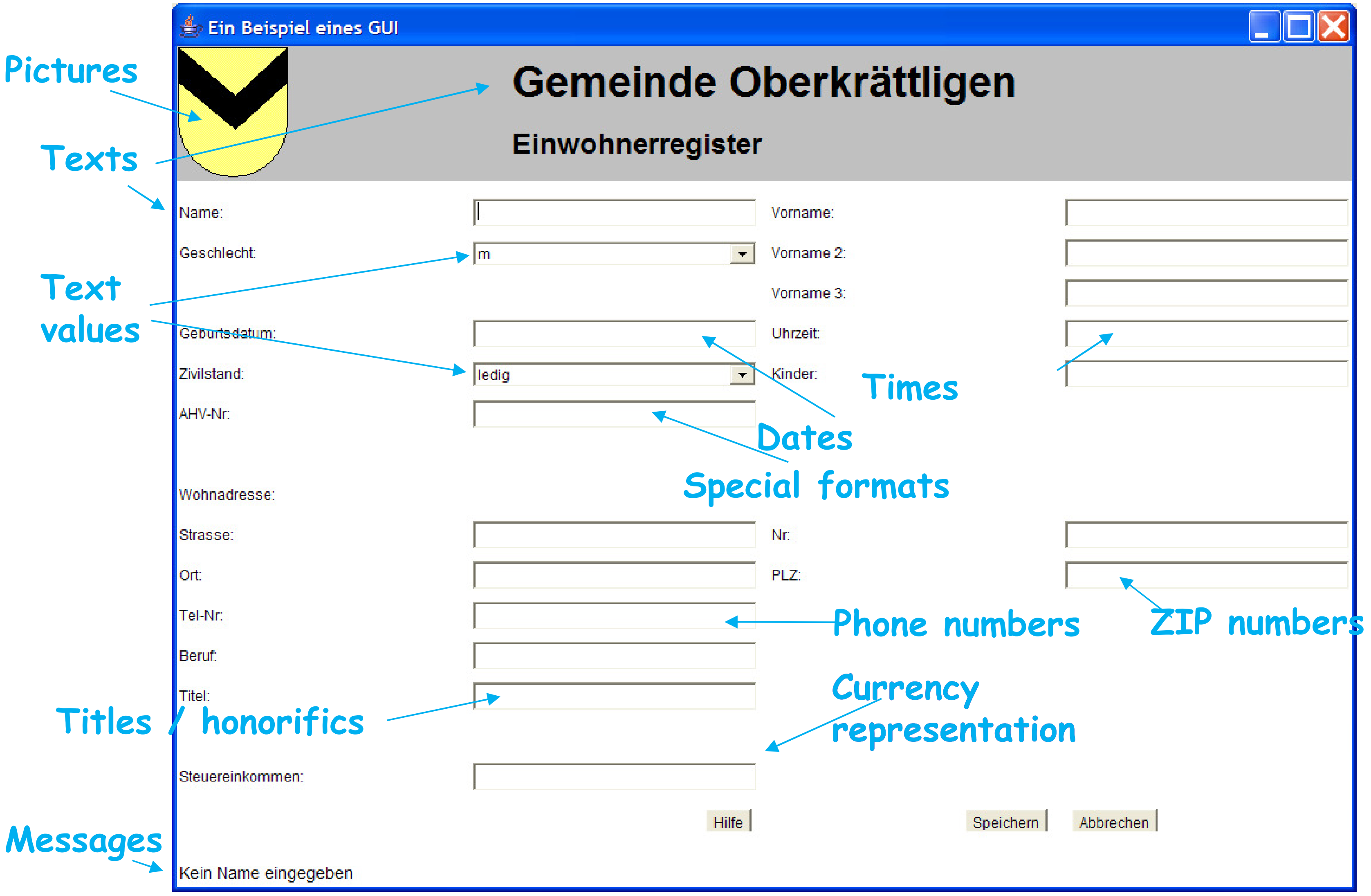
et‘s look at an example:


Ein Beispiel eines GUI

Gemeinde Oberkrättligen

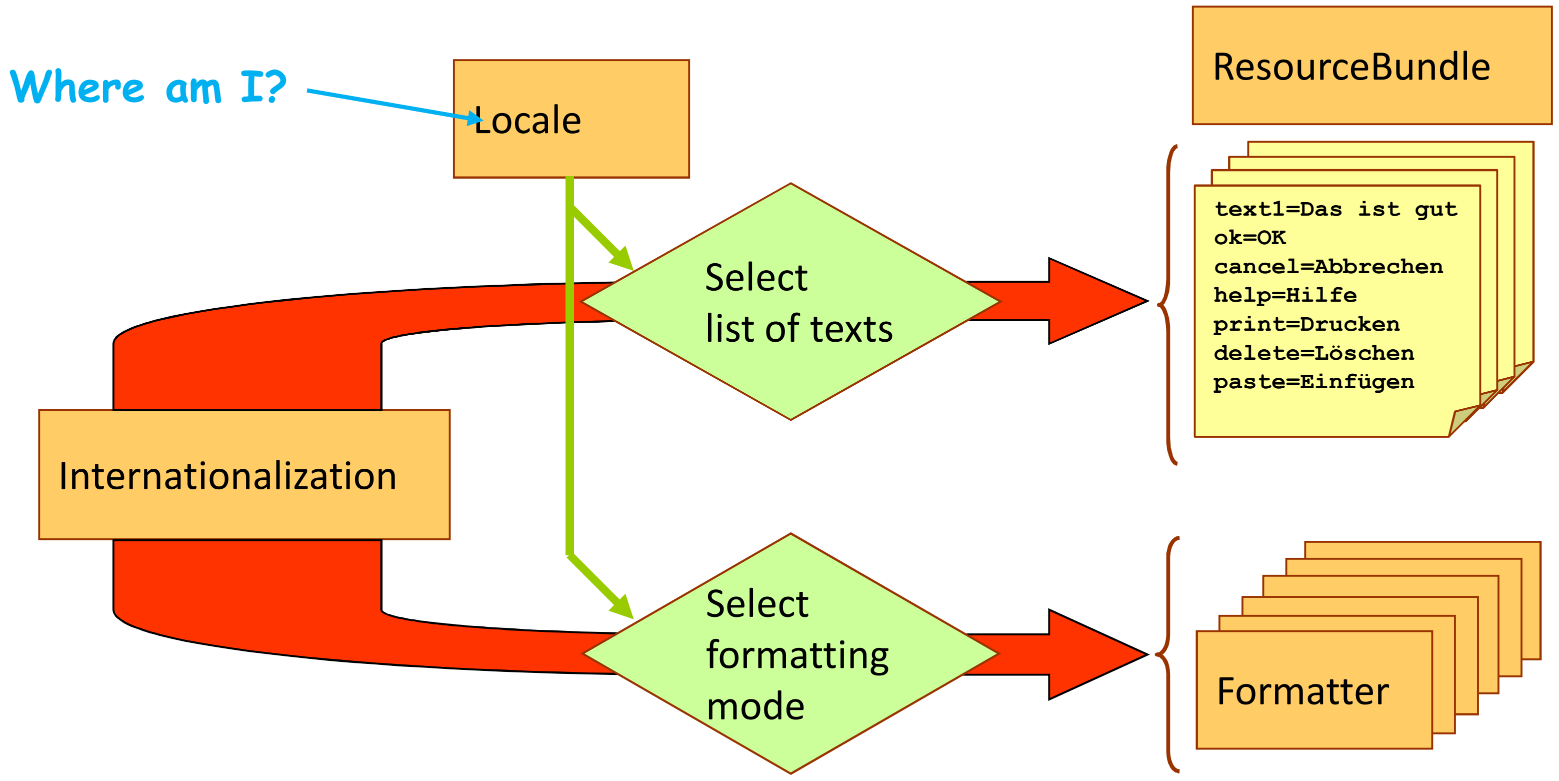
Einwohnerregister

Name:		Vorname:	
Geschlecht:	m	Vorname 2:	
		Vorname 3:	
Geburtsdatum:		Uhrzeit:	
Zivilstand:	ledig	Kinder:	
AHV-Nr:			
Wohnadresse:			
Strasse:		Nr:	
Ort:		PLZ:	
Tel-Nr:			
Beruf:			
Titel:			
Steuereinkommen:			

Kein Name eingegeben

ternationalization

e Principles of Internationalization



```
text1=Das ist gut
ok=OK
cancel=Abbrechen
help=Hilfe
print=Drucken
delete=Löschen
paste=Einfügen
```

ternationalization

Where can I get the information about in which country I am, which language I have to use etc ?

- from `java.util.Locale`

Do I have to write all specific adaptations for text, pictures etc. myself ?

- No, there are plenty of ready-made classes, mostly in `java.util.*` and `java.text.*`, such as
  - `ResourceBundle`, `PropertyResourceBundle`, `ListResourceBundle`
  - `Format`, `DateFormat`, `MessageFormat`, `NumberFormat`
  - `Calendar`, `GregorianCalendar`
  - `Collator` (for sorting/searching)
  - etc.

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- What is I18n?
- **`java.lang.Locale`**
- Culture Dependent Content
- Formatting
- Sorting

hat is a Locale ?

nere do I get the Locale from ?

A Locale object contains the country and the language of the host machine. It may specify other characteristics, too, such as a vendor or browser indication.

The JVM sets up a Locale containing these data which is then called Default Locale.

You may change the contents of the Locale or preset a new default Locale (for your JVM only!)

```
Locale locale = Locale.getDefault();
```

ternationalization

How do I use a Locale object?

By asking it explicitly its country or language

```
    Locale locale = Locale.getDefault();
    String country = locale.getCountry();
    String language = locale.getLanguage();
    String variant = locale.getVariant();

    // or lists of all known countries or languages
    String[] countries = locale.getISOCountries();
    String[] languages = locale.getISOLanguages();
```

By passing the Locale to locale-sensitive objects, e.g. to objects of ResourceBundle, Format, Collator etc.

xercise: My Locale

rite a small program that displays the Locale in your environment. Find out wha
the default Locale in your system.

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What is I18n?

`java.lang.Locale`

Culture Dependent Content

Formatting

Sorting

nternationalization for Texts/Messages

ResourceBundle is a specialized Collection to store locale-dependent information

It offers two relevant features for internationalization:

- ResourceBundle consists of a list of {key, value} pairs of items (values may be texts or any kind of objects)
- ResourceBundle allows retrieval of a Locale-specific list; if there is no list exactly matching the Locale, it provides the best-possible f
- May be backed by property files for different locales

```
# This is the UITexts_fr properties file
computer = ordinateur
disk = disque dur
monitor = écran
keyboard = clavier
```

ternationalization for Texts/Messages

sourceBundle = set of classes sharing the same base name:

```
Texts
Texts_de
Texts_en_GB
Texts_fr_CA_UNIX
```

owever you don’t need to implement classes. You just provide property files th the same name as the class and the file extension **.property**

lecting a ResourceBundle is done as follows:

```
cale current = new Locale("fr", "CA", "UNIX");
sourceBundle introLabels =
 ResourceBundle.getBundle("UITexts", current);
```

xercise: ResourceBundle

un the **`ResourceBundleDemo.java`** on your machine.
sert another language in the supported locals and provide a resource bundle fo

ok up the correct notation on http://www.localeplanet.com/java/.

ternationalization for Texts/Messages

Texts and objects are requested from a ResourceBundle using **`getString()`**

Thus, an application using localized items looks as follows:

```
Locale current = Locale.getDefault();
ResourceBundle uiTexts = ResourceBundle.getBundle("UITexts", current);
//...

// get a text from the resource bundle
statusLine.setText(uiTexts.getString("fileNotFound"));
```

Attention
MissingResourceExeption
could be thrown

ternationalization for Texts/Messages

To avoid **`MissingResourceExeption`** use a private method, e.g.

```
private String getI18nString(String key) {
   try {
     return bundle.getString(key);
   } catch (MissingResourceException e) {
     System.err.println("Missing key " + key + " in " +
            bundle.getBaseBundleName());
     return "! " + key + " !";
   }
 }
```

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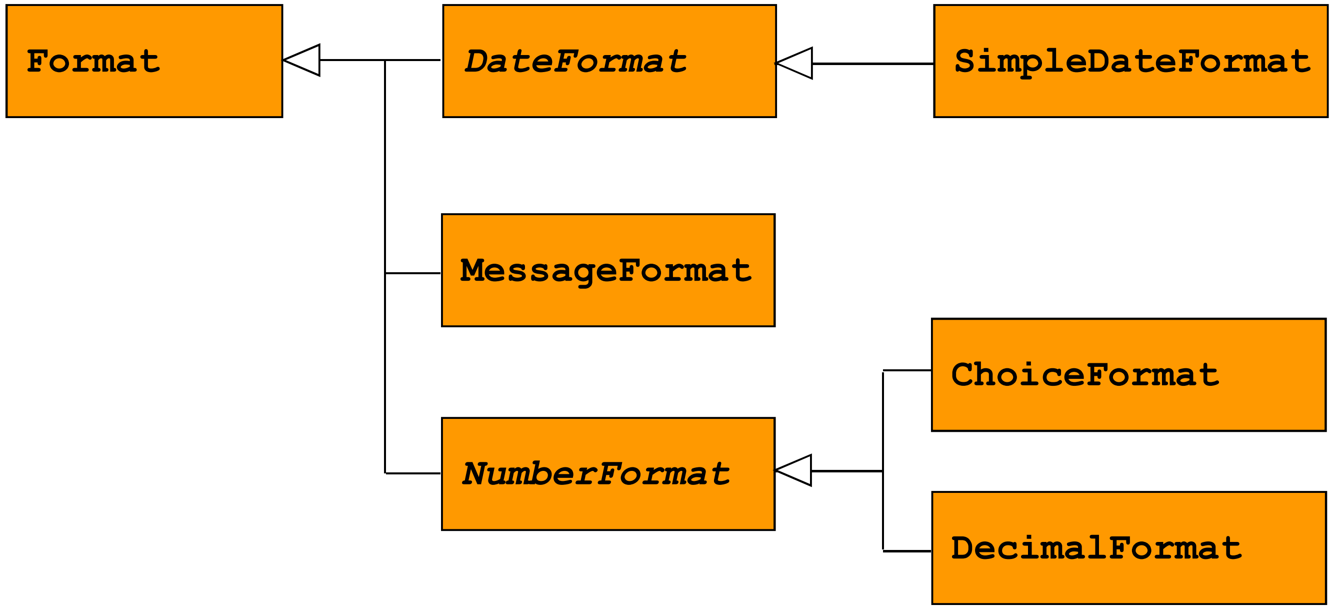
ternationalized Formatting

e **`Format`** class and its descendants is used to do locale-dependent formatting of texts tes/times and numbers/currencies

`rmat` offers the following subclasses for internationalization:



ternationalized Formatting

Use the static **`getXXXInstance()`** method of the **`Format`** subclasses to create an instance that can format objects in your program

- E.g to create a formatter for time.

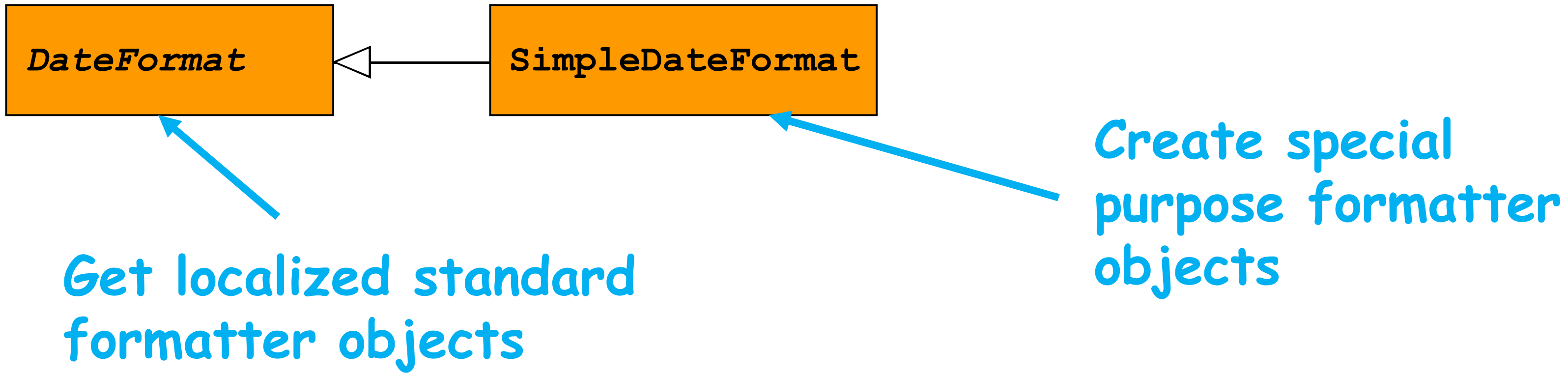
```
DateFormat timeFormatter =
    DateFormat.getTimeInstance(DateFormat.MEDIUM, Locale.GERMAN);
```

Almost all **`Format`** subclasses offer a

```
Locale[] getAvailableLocales()
```

method returning an array of those Locales which are supported by this class.

ternationalized Date/Time Formatting


DateFormat
SimpleDateFormat
Get localized standard formatter objects
Create special purpose formatter objects

Although **`DateFormat`** is an abstract class, it has static factory methods to create formatter objects for date, time, date&time and time zone

The **`SimpleDateFormat`** class is used when you have to create a specific forma which doesn‘t correspond to any of the standard representations

ate/Time Formatting Using Standard Formatters

standard formatter is created by:

```
teFormat timeFormatter =  DateFormat.getTimeInstance(int style, Locale aLocale)
```

The specific item to be formatted;
may be time, date or both

The formatting style to be used
→ next slide

The Locale to be used

.. and used:

```
DateFormat timeFormatter =
   DateFormat.getTimeInstance(DateFormat.MEDIUM, Locale.GERMAN);
String myText = timeFormatter.format(myDate); // or
StringBuffer myTextBuffer =  timeFormatter.format(myDate, buffer,
fieldPosition);
```

ate/Time Formatting Using Standard Formatters

amples (DateTimeFormatter):

tyle	Locale	Format
HORT	France	18/10/04 13:30
	Germany	18.10.04 13:30
	England	18/10/04 13:30
EDIUM	France	18 oct. 2004 13:30:00
	Germany	18.01.2004 13:30:00
	England	18-Oct-2004 13:30:00
ONG	France	18 octobre 2004 13:30:00 CET
	Germany	18. Oktober 2004 13:30:00 MEZ
	England	18 October 2004 13:30:00 CET
ULL	France	lundi 18 octobre 2004 13 h 30 CET
	Germany	Montag, 18. Oktober 2004 13.30 Uhr MEZ
	England	Monday, 18 October 2004 13:30:00 o'clock CET

xercise: Date and Time Formatter

rite a program that creates the different date and time formats (SHORT, MEDIU
NG, FULL) for at least 3 languages.

ate/Time Formatting Using Standard Formatters

A standard formatter can also be used for input parsing:

```
DateFormat dateFormatterFull =
    DateFormat.getDateInstance(DateFormat.FULL, Locale.GERMAN);

myDate = dateFormatterFull.parse("Mittwoch, 4. April 2018");
```

Can throw a ParseException

By default, the formatter also accepts date or time values not adhering to the Locale‘s representation (*lenient*); this feature may be turned off if required

```
    dateFormatterMed.setLenient(false);
```

See: **ParseDemo.java**

ate/Time Formatting Using SimpleDateFormat

he **SimpleDateFormat** class is a parameterizable formatter for special purposes. It is created by pecifying a format string when calling its constructor. In the most simple form this is:

```
impleDateFormat simpleFormat =
 new SimpleDateFormat(pattern);
```

here the **pattern** specifies the format to be applied, e.g.

ate and Time Pattern	Result
yyyy.MM.dd G 'at' HH:mm:ss z"	2001.07.04 AD at 12:08:56 PDT
EEE, MMM d, ''yy"	Wed, Jul 4, '01
h:mm a"	12:08 PM
hh 'o''clock' a, zzzz"	12 o'clock PM, Pacific Daylight Time
K:mm a, z"	0:08 PM, PDT

ate/Time Formatting Using SimpleDateFormat

Sb	Meaning	Pres.	Ex.	Sb	Meaning	Pres.	Ex.
G	Era designator	Text	AD	k	Hour in day (1-24)	Num.	24
y	Year	Year	1996	K	Hour in AM/PM (0-11)	Num.	0
M	Month in year	Month	July	h	Hour in AM/PM (1-12)	Num.	12
w	Week in year	Num.	27	m	Minute in hour	Num.	30
W	Week in month	Num.	2	s	Second in minute	Num.	55
D	Day in year	Num.	189	S	Millisecond	Num.	978
d	Day in month	Num.	10	z	Time zone	General time zone	GMT
F	Day of week in month	Num.	2	Z	Time zone	RFC 822 time zone	-0800
E	Day in week	Text	Friday	'	Escape for text	Delim.	'at'
a	AM/PM marker	Text	PM	''	Single quote	Literal	o''clock
H	Hour in day (0-23)	Num.	0				

oing Arithmetics with Date/Time

metimes you have to do arithmetics with dates or times.
r this you may use the Calendar classes. Java provides the **`GregorianCalendar`** only,
t there are many others available as Open Source.

```
Calendar rightNow = Calendar.getInstance();
rightNow.setDate(now);

rightNow.add(Calendar.DAY_OF_MONTH, -5);
```

Further explanations on the Java API documentation

ew Date and Time API

Human Time
- local date/time: **`LocalDate`**
- Zoned time: **`ZonedDateTime`**

Package **`java.time.*`**

Examples **`LocalDate`**

```
LocalDate today = LocalDate.now();

LocalDate einsteinBirthday = LocalDate.of(1879, Month.MARCH, 14);

LocalDate lastDayinFebruar = einsteinBirthday.minusMonths(1)
     .with(TemporalAdjusters.lastDayOfMonth());

LocalDate programmersDay =  LocalDate.of(2015,1,1).plusDays(256);
```

ew Date and Time API

Examples **`LocalTime`**

```
LocalTime atTen = LocalTime.of(10, 00);

LocalTime tenFifteen = atTen.plusMinutes(15);

LocalTime breakfestTime = tenFifteen.minusHours(2);
```

`LocalDateTime` combines **`LocalDate`** and `LocalTime`

```
LocalDateTime jdk8Release = LocalDateTime.of(2014,3,18,8,30);
```

ormatting new Date and Time

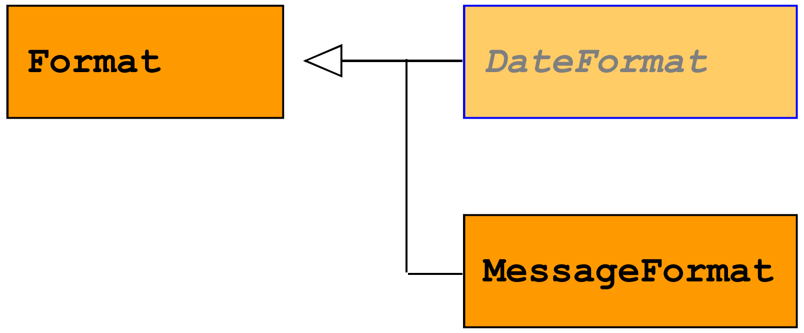
```
ocale currentLocale = new Locale("en","us");
ocalDate date = LocalDate.now();

ateTimeFormatter  formatter =
   DateTimeFormatter.ofLocalizedDate(FormatStyle.FULL).withLocale(currentLocale);
ystem.out.println(formatter.format(date));
/ or alternatively
ystem.out.println(date.format(formatter));

ocalTime time = LocalTime.now();
ormatter =
ateTimeFormatter.ofLocalizedTime(FormatStyle.MEDIUM).withLocale(currentLocale);
ystem.out.println(formatter.format(time));

ocalDateTime dateTime = LocalDateTime.now();
ormatter = DateTimeFormatter.ofLocalizedDateTime(FormatStyle.LONG,FormatStyle.SHORT)
             .withLocale(currentLocale);
ystem.out.println(formatter.format(dateTime));
```

essage Formatting



essageFormat helps you to format complex messages such as

```
t 12:30 PM on Jul 3, 2053, there was a gravitation anomaly on planet 7.
```

essageFormat is not an abstract class, and it doesn't have static factory methods to create formatter objects. Insteac
is parameterized at creation time by the constructor.

`essageFormat` cannot be given a Locale, i.e. you have to create a class per Locale yourself.

essage Formatting

is message

```
t 12:30 PM on Jul 3, 2053, there was a gravitation anomaly on planet 7.
```

as obtained by

```
tring pattern =
 "At {1,time} on {1,date}, there was {2} on planet {0,number,integer}."

bject[] arguments = {
 new Integer(7), new Date(System.currentTimeMillis()), "a gravitation anomaly"
;

tring result = MessageFormat.format(pattern, arguments);
```

Also possible to pass as optional parameters

Further explanations on the Java API documentation

essage Formatting

essageFormat uses patterns of the following form:

ssageFormatPattern:

String

MessageFormatPattern FormatElement String

rmatElement:

{ *ArgumentIndex* }

{ *ArgumentIndex* , *FormatType* }

{ *ArgumentIndex* , *FormatType* , *FormatStyle* }

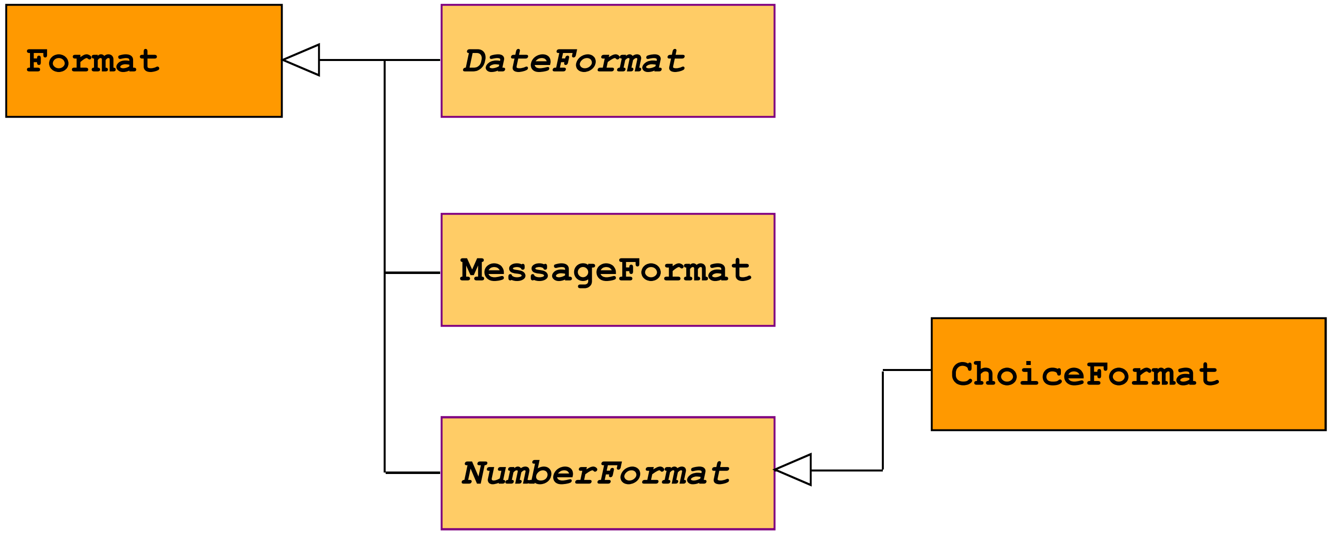
rmatType: one of

number date time choice

rmatStyle:

short medium long full integer currency percent *SubformatPattern*

dvanced Message Formatting using ChoiceFormat



noiceFormat helps you to reflect different grammatical forms such as

```
he directory ABCD contains no files.
he directory ABCD contains one file.
he directory ABCD contains 128 files.
```

essage Formatting

essageFormat and ChoiceFormat have proven to be very „tricky“ classes!!!
ead the API doc carefully and do in-depth unit testing!

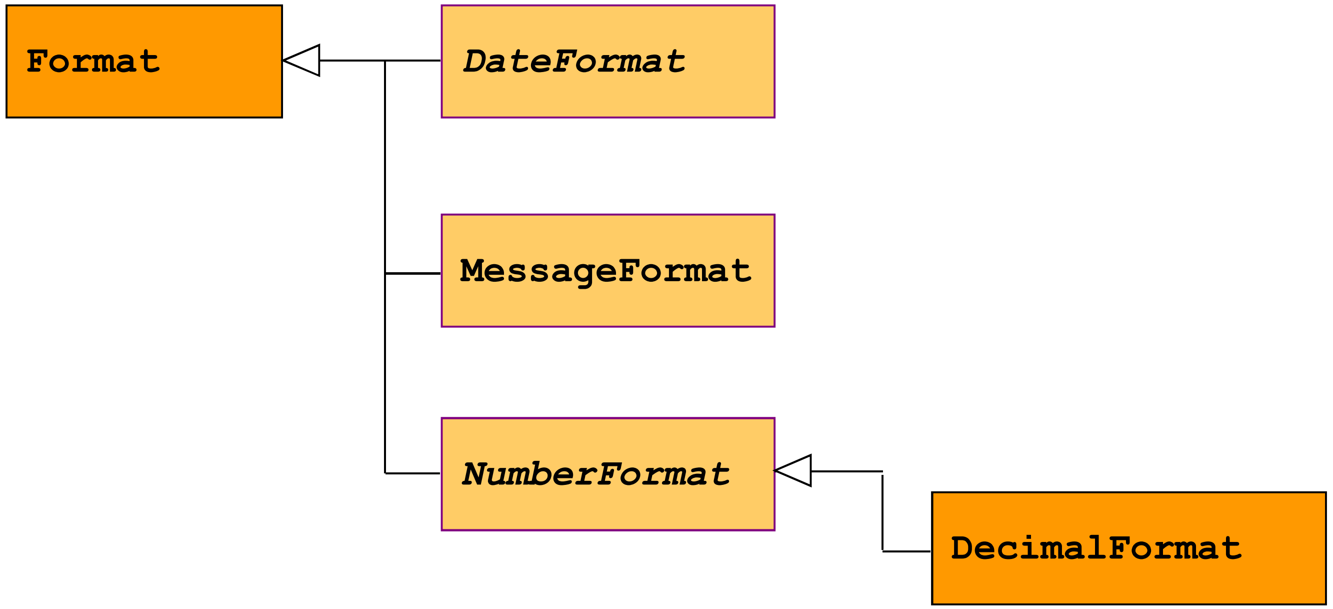
essageFormat and ChoiceFormat are not thread-safe!
you intend to use these objects from different threads, protect them by ynchronization!

specially, MessageFormat can be nicely used with Resource Bundles .

xercise: ChoiceFormat

nalyse the program FormatDemo.java.

ormatting Numbers and Currencies



ecimalFormat provides you with conversion functions for numbers and currencies as well as a special epresentation for percentages.

s with DateFormat, actual DecimalFormat instances are created using the appropriate factory method of umberFormat, such as getCurrencyInstance(), getNumberInstance() etc.

umber/Currency Formatting Using NumberFormat

standard localized formatter is created by:

```
mberFormat someFormatter = NumberFormat.getNumberInstance(Locale aLocale);
```

The specific item to be formatted; may be
```
getCurrencyInstance(...)
getIntegerInstance(...)
getNumberInstance(...)
getPercentInstance(...)
```

The Locale to be used (or no parameter → using the default Locale

umber representation is done according to the specific rules of the applicable Locale.
 you need a specific format, use DecimalFormat with an explicit setup!

umber/Currency Formatting Using NumberFormat

standard formatter can also be used for input parsing:

```
mberFormat numberFormatter = NumberFormat.getNumberInstance();
mber number = format.parse("1234.5678", new ParsePosition(2));
```

ll return Number(34.5678)

y default, the formatter also accepts numbers not adhering to the Locale‘s epresentation.

e careful with too large numbers:

If possible these are returned as `Long` objects – if too large, as a `Double` truncated at the low end.

If you explicitly use `setParseBigDecimal()`, values will be returned as `BigDecimal` objects.

xercise: NumberFormat

nalyse the program NumberFormatDemo.java.

umber Formatting Using DecimalFormat

s with **SimpleDateFormat**, **DecimalFormat** is used when special formatting is required.

formatting pattern is described by the following characters:

char	Meaning	char	Meaning
0	Digit; will pad if necessary	;	Pos./Neg. pattern separator
#	Digit; zero shows as space	%	*100, shows as percentage
.	Decimal separator	‰	*1000, shows as per mille (\u2030)
-	Negative prefix (minus)	¤	Currency sign (\u00A4 or local)
,	Grouping separator	‘	To quote special char. in
E	Mantissa-Exponent separator		prefix or suffix (see API descr.)

utline

What is I18n?

`java.lang.Locale`

Culture Dependent Content

Formatting

Sorting

orting

orting is done using a comparator telling which of two elements is first / second in a iven ordering scheme.

orting of text must take into account the pecularities of the alphabetic sorting for each nguage.

his is done by a class named **`Collator`**.

standard localized collator is created by e.g.:

```
ollator fr_FR_Collator = Collator.getInstance(new Locale("fr", "FR"));

ollator defaultCollator = Collator.getInstance();  // to use the default Locale
```

orting

`stract class java.text.Collator mplements Comparator<Object>, Cloneabl`

ethods:

`static Collator getInstance()` Collator for current Locale

`static Collator getInstance(Locale desiredLocale)` Collator for given Locale

`abstract int compare(String source, String target)`
Compares 2 strings. Return value is <0, 0 or >0.

`int compare( Object o1, Object o2 )`
Compares 2 objects. Calls `compare((String)o1, (String)o2)`.

orting

orting an array of Strings is then done as follows (using a plain BubbleSort
gorithm):

```
llator defaultCollator = Collator.getInstance();
ring tmp;
r (int i = 0; i < words.length; i++) {
for (int j = i + 1; j < words.length; j++) {
  if (defaultCollator.compare(words[i], words[j]) > 0) {
     tmp = words[i];
     words[i] = words[j];
     words[j] = tmp;
  }
}
```

xercise: Collater

nalyse the program CollatorDemo.java.

orting

course, you may also use the same comparator as an ordering criterion for an ordered t, such as :

```
mparator myCollator =
(Comparator) Collator.getInstance();

eeSet orderedSet = new TreeSet<String>(myCollator);
```

which allows you to insert, remove or search your Strings (words/phrases) according to e Locale's ordering.