II.4. Erweiterungen von Klassen und fortgeschrittene Konzepte

- 1. Unterklassen und Vererbung
- 2. Abstrakte Klassen und Interfaces
- 3. Modularität und Pakete
- 4. Ausnahmen (Exceptions)
- 5. Generische Datentypen
- **6. Collections**

Collection Framework

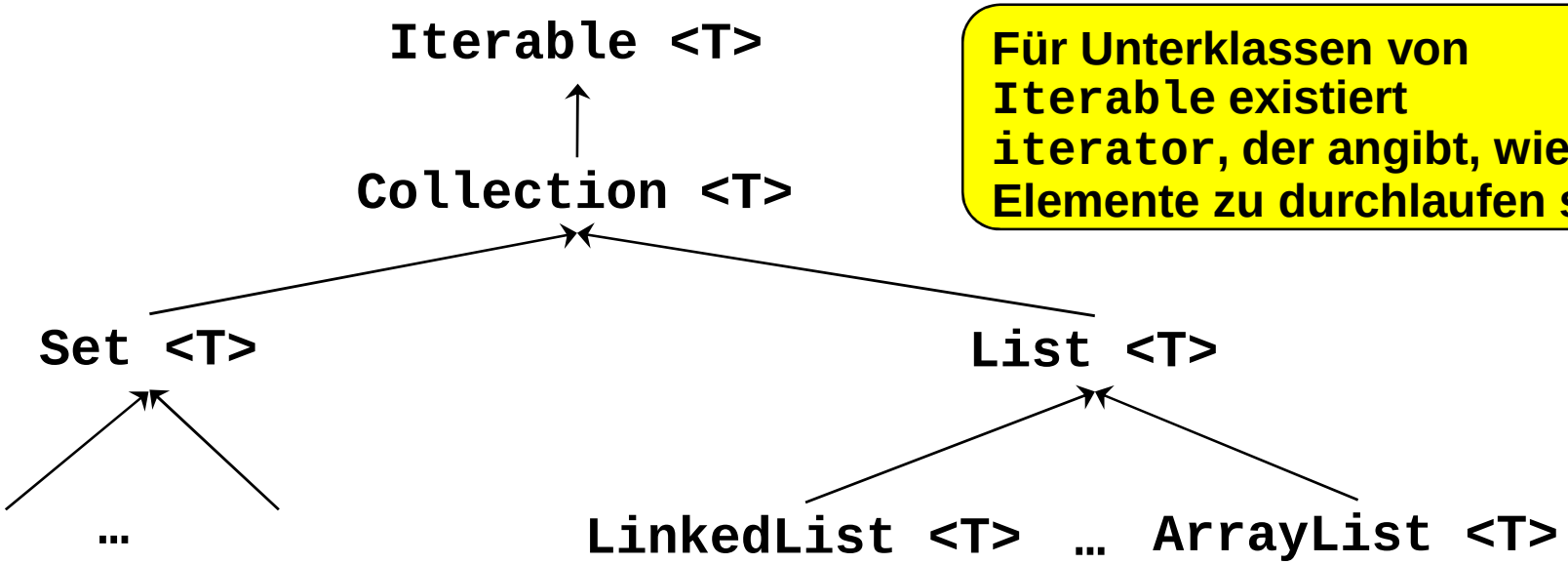
Typische Datenstrukturen im Paket `java.util` vordefiniert

`Liste <T>`

- `Liste ()`
- `String toString ()`
- `void fuegeVorneEin (T wert)`

`LinkedList <T>`

- `LinkedList ()`
- `String toString ()`
- `void addFirst (T wert)`



Für Unterklassen von `Iterable` existiert `iterator`, der angibt, wie Elemente zu durchlaufen sind

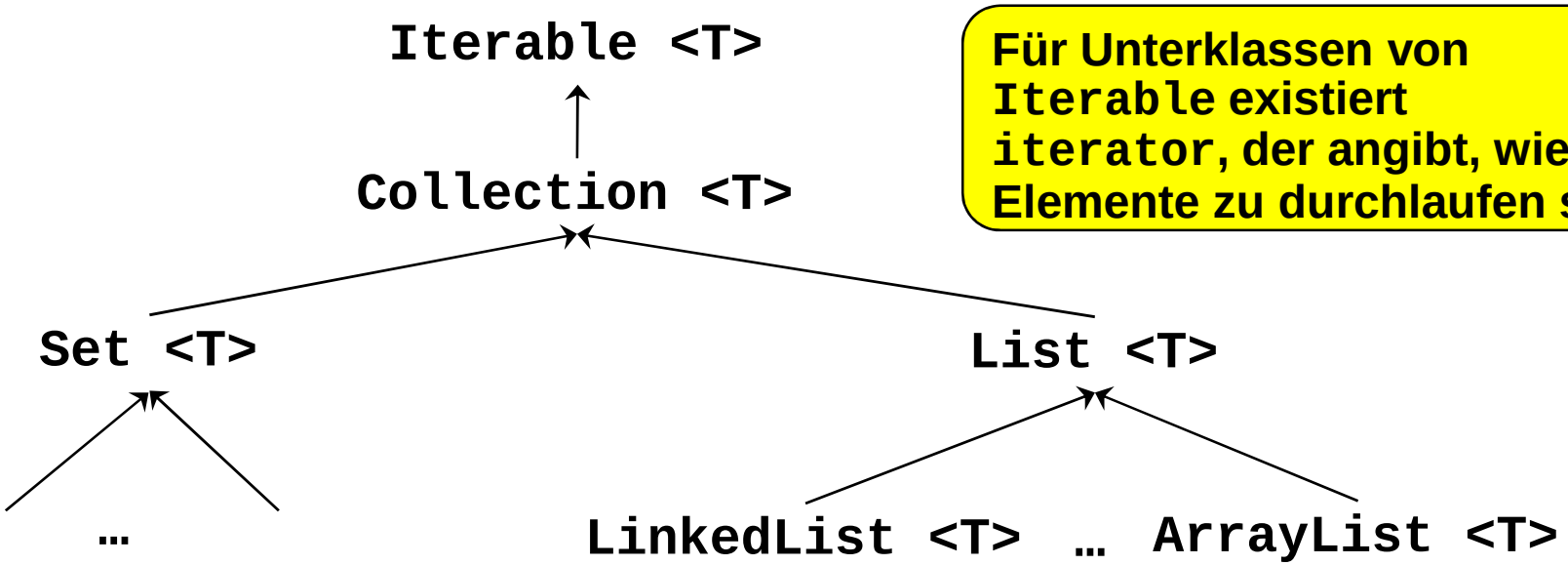
Collection Framework

```
interface Iterable <T> {

 Iterator <T> iterator();

}
```

```
interface Iterator <T> {
 boolean hasNext();
 T       next();
 void    remove();
}
```



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Collection Framework


```
interface Iterator <T> {
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LinkedList <String> sl = new LinkedList < > ();

sl.addFirst("drei");  sl.addFirst("zwei");  sl.addFirst("eins");
```

Collection Framework


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interface Iterator <T> {
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LinkedList <String> sl = new LinkedList <> ();

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Iterator <String> it = sl.iterator();
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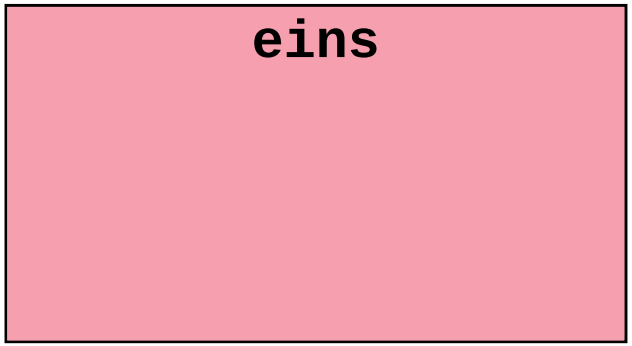
Iterator <String> it = sl.iterator();

while (it.hasNext()) {
    String s = it.next();
    System.out.println(s);
}
```

setzt Iterator weiter und liefert "überlaufenes" Element als Ergebnis

Collection Framework

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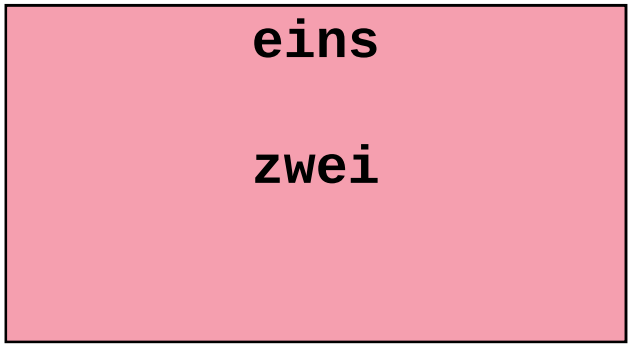


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Collection Framework


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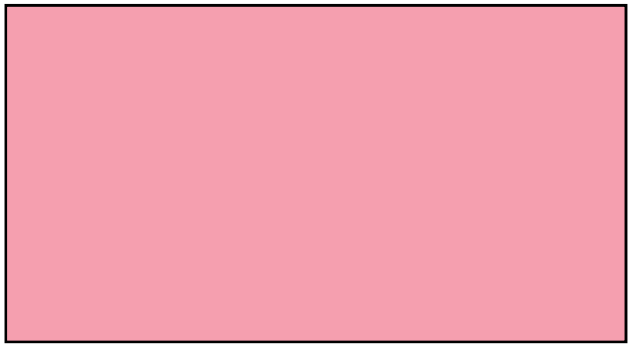
Iterator <String> it = sl.iterator();

while (it.hasNext()) {
    String s = it.next();
    System.out.println(s);
}
```

```
for (String s : sl) {
    System.out.println(s);
}
```

Collection Framework



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Iterator <String> it = sl.iterator();
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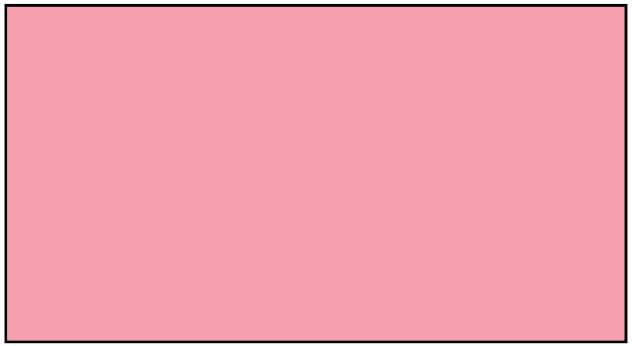
Collection Framework



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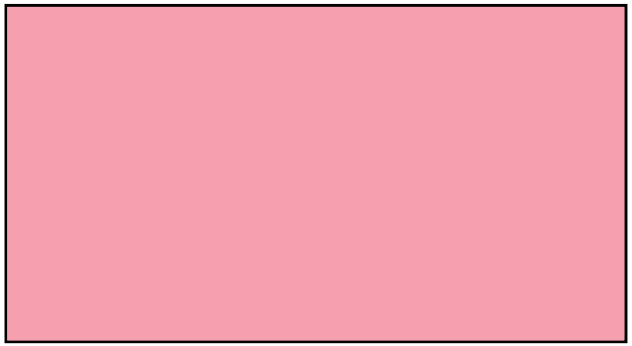
sl.addFirst("drei");  sl.addFirst("zwei");  sl.addFirst("eins");

Iterator <String> it = sl.iterator();

it.next();
```

Collection Framework



```
LinkedList <String> sl = new LinkedList <> ();

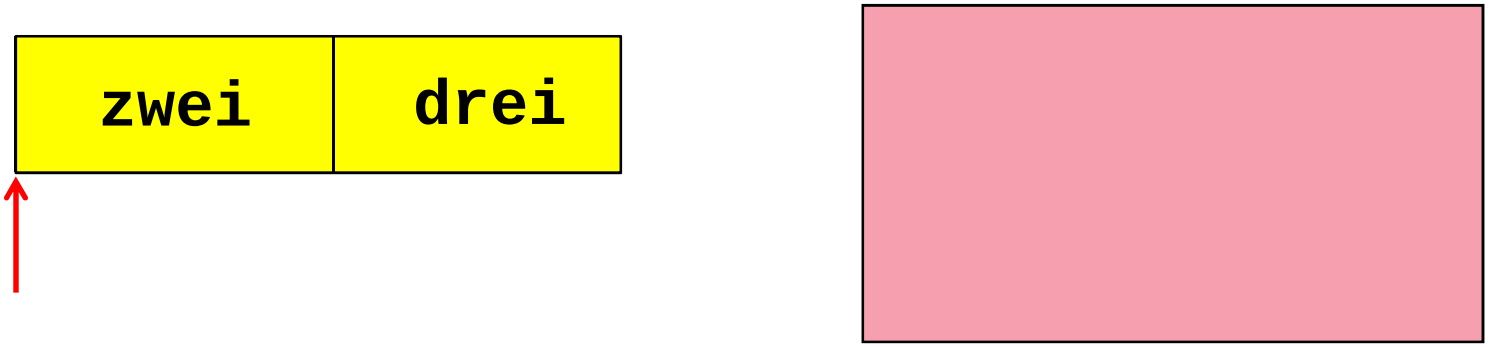
sl.addFirst("drei");  sl.addFirst("zwei");  sl.addFirst("eins");

Iterator <String> it = sl.iterator();

it.next();
it.remove();
```

löscht zuletzt "überlaufenes" Element

Collection Framework

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sl.addFirst("drei");  sl.addFirst("zwei");  sl.addFirst("eins");

Iterator <String> it = sl.iterator();

it.next();
it.remove();
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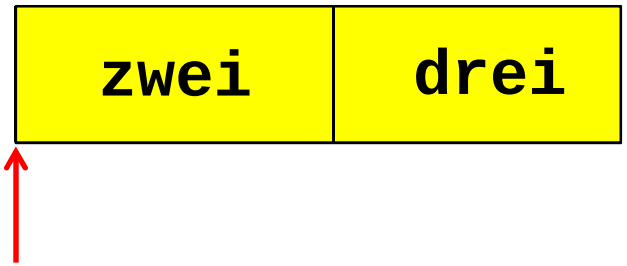
löscht zuletzt "überlaufenes" Element

Collection Framework




```
LinkedList <String> sl = new LinkedList <> ();

sl.addFirst("drei");  sl.addFirst("zwei");  sl.addFirst("eins");

Iterator <String> it = sl.iterator();

it.next();
it.remove();

for (String s : sl) System.out.println(s);
```

löscht zuletzt "überlaufenes" Element

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();


il.addFirst(3); il.addFirst(2); il.addFirst(1);
```

Autoboxing (konvertiert **int** in **Integer**)

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();

il.addFirst(3); il.addFirst(2); il.addFirst(1);

Iterator <Integer> it = il.iterator();

while (it.hasNext()) {
    Integer i = it.next();
    System.out.println(i);
}
```

Autoboxing (konvertiert **int** in **Integer**)

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();

il.addFirst(3); il.addFirst(2); il.addFirst(1);

Iterator <Integer> it = il.iterator();

while (it.hasNext()) {
    int     i = it.next();
    System.out.println(i);
}
```

Autoboxing (konvertiert **int** in **Integer**)

Unboxing (konvertiert **Integer** in **int**)

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();

il.addFirst(3); il.addFirst(2); il.addFirst(1);

Iterator <Integer> it = il.iterator();

while (it.hasNext()) {
    int     i = it.next();
    System.out.println(i);
}

for (Integer i : il) System.out.println(i);
```

Autoboxing (konvertiert **int** in **Integer**)

Unboxing (konvertiert **Integer** in **int**)

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();

il.addFirst(3); il.addFirst(2); il.addFirst(1);

Iterator <Integer> it = il.iterator();

while (it.hasNext()) {
    int     i = it.next();
    System.out.println(i);
}

for (Integer i : il) System.out.println(i);

for (int i : il)   System.out.println(i);
```

Autoboxing (konvertiert **int** in **Integer**)

Unboxing (konvertiert **Integer** in **int**)

Collection Framework

```
LinkedList <Integer> il = new LinkedList <> ();

il.addFirst(3); il.addFirst(2); il.addFirst(1);

Iterator <Integer> it = il.iterator();

while (it.hasNext()) {
    int     i = it.next();
    System.out.println(i);
}

for (Integer i : il) System.out.println(i);

for (int i : il) { System.out.println(i); il.addFirst(0); }
```

Autoboxing (konvertiert **int** in **Integer**)

Unboxing (konvertiert **Integer** in **int**)

compiliert, aber Fehler zur Laufzeit