Data Abstraction and APIs

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Todays Lecture

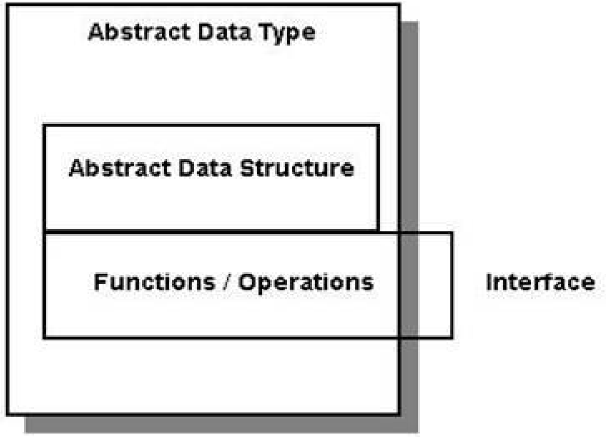
- Abstract Data Types
- Application Program Interface(API)
- Implementing an API
- Consuming an API (writing an API client)
- Useful APIs for this module

Data Abstraction

- A data type is a set of values and a set of operations on those values
  - primitives(e.g. int)
    - value (2^{31} and 2^{31}- 1)
    - operations (+,-,*...)
  - reference types(e.g. Name Java class)
    - values (firstName, lastName …)
    - operations (getFirstName(), toString())
- Lots of predefined data types and **you can build your own…**

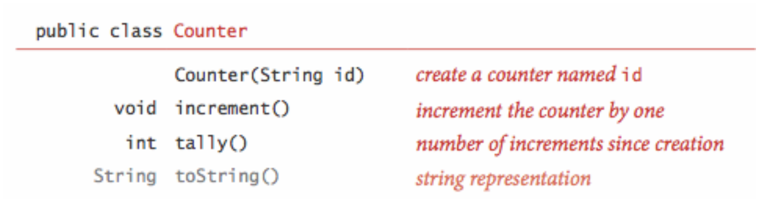
Abstract Data Type (ADT)

- Implementation hidden from client.
- Hide data from client and focus on operations.
- This is Good for algorithms
  - we can substitute one algorithm for another to improve performance.
  - no need to change any client



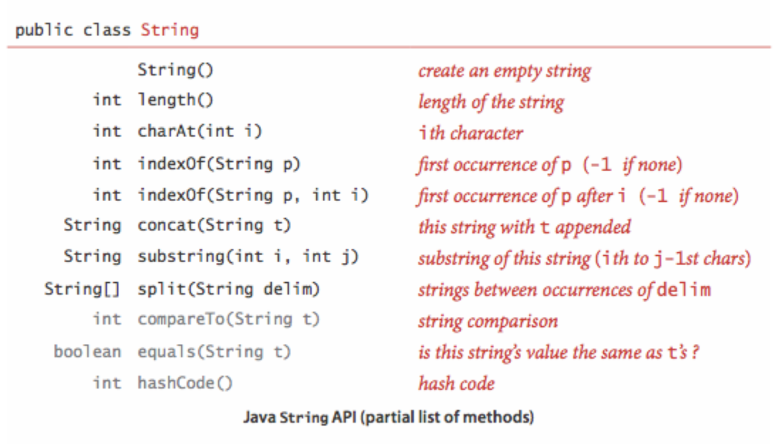
Application Program Interface(API)

- Specifies behaviour of Abstract Data Type
- API provides a list of Constructors and Instance Methods
- Often including short description of methods



public class Counter

	Counter(String id)	*create a counter named* id
void	increment()	*increment the counter by one*
int	tally()	*number of increments since creation*
String	toString()	*string representation*



public class String

	String()	*create an empty string*
int	length()	*length of the string*
int	charAt(int i)	i*th character*
int	indexOf(String p)	*first occurrence of* p (-1 *if none*)
int	indexOf(String p, int i)	*first occurrence of* p *after* i (-1 *if none*)
String	concat(String t)	*this string with* t *appended*
String	substring(int i, int j)	*substring of this string (*i*th to* j-1*st chars)*
String[]	split(String delim)	*strings between occurrences of* delim
int	compareTo(String t)	*string comparison*
boolean	equals(String t)	*is this string's value the same as* t*'s ?*
int	hashCode()	*hash code*

Java String API (partial list of methods)

Implementing an ADT

- Use a Java Class
- See implementation of counter API here: http://algs4.cs.princeton.edu/12oop/Counter.java.html

Client Code

- Declare variable of the type
- Use to refer to object

```
Counter c1 = new Counter("ones");
c1.increment();
Counter c2 = c1;
c2.increment();
StdOut.println(c1);
```

Useful ADT Libraries

- Stdlib_package.jar
  - http://introcs.cs.princeton.edu/java/stdlib/stdlib-package.jar
- Other useful APIs
  - http://algs4.cs.princeton.edu/10fundamentals/

Other APIs

- Java has thousands of ADTs
  - Standard system ADTs in java.lang.*
  - Collection ADTs to facilitate manipulation collections of data of the same(e.g. ArrayList, Stack….)