Database Application Development

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Database Systems

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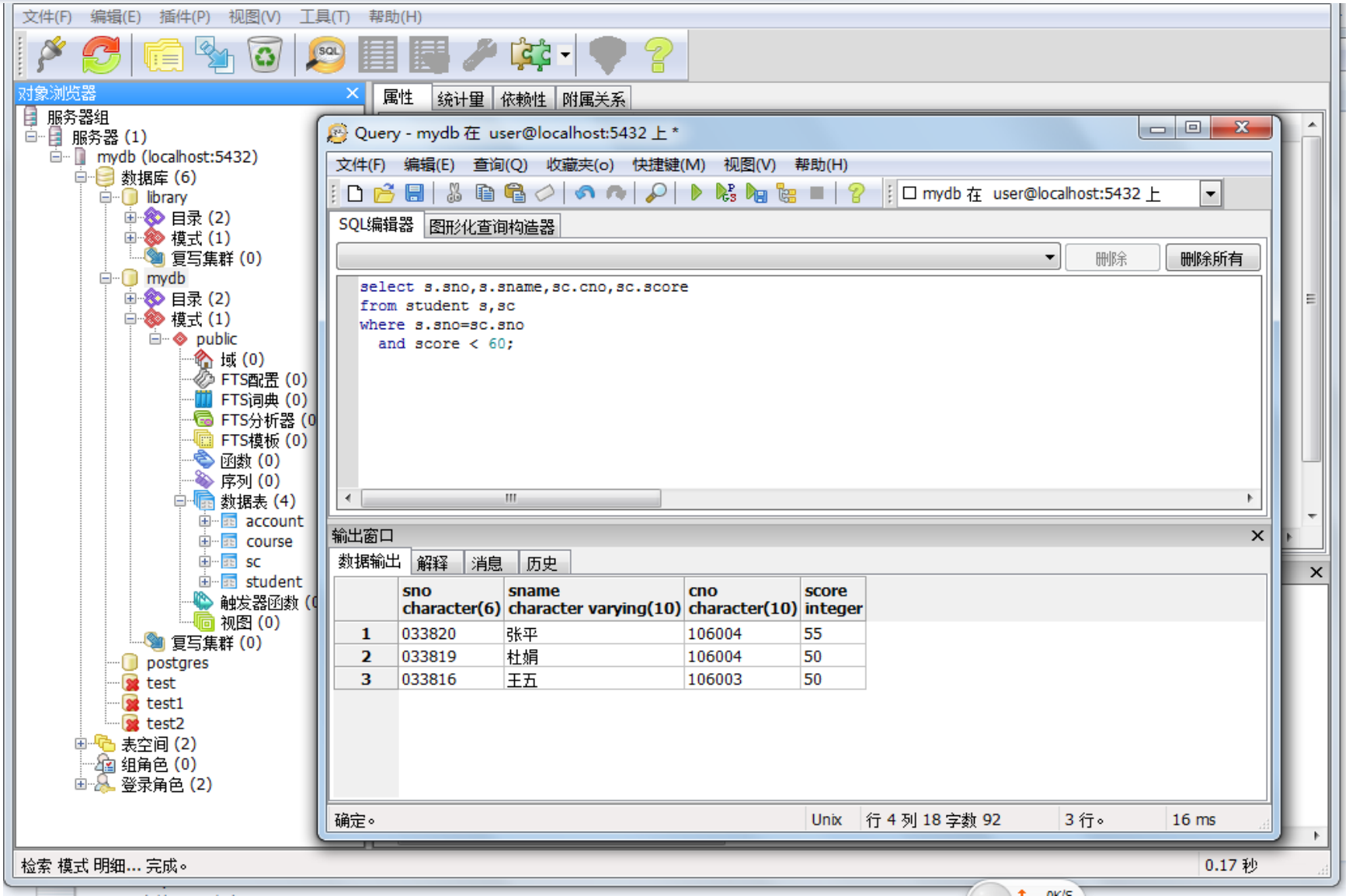
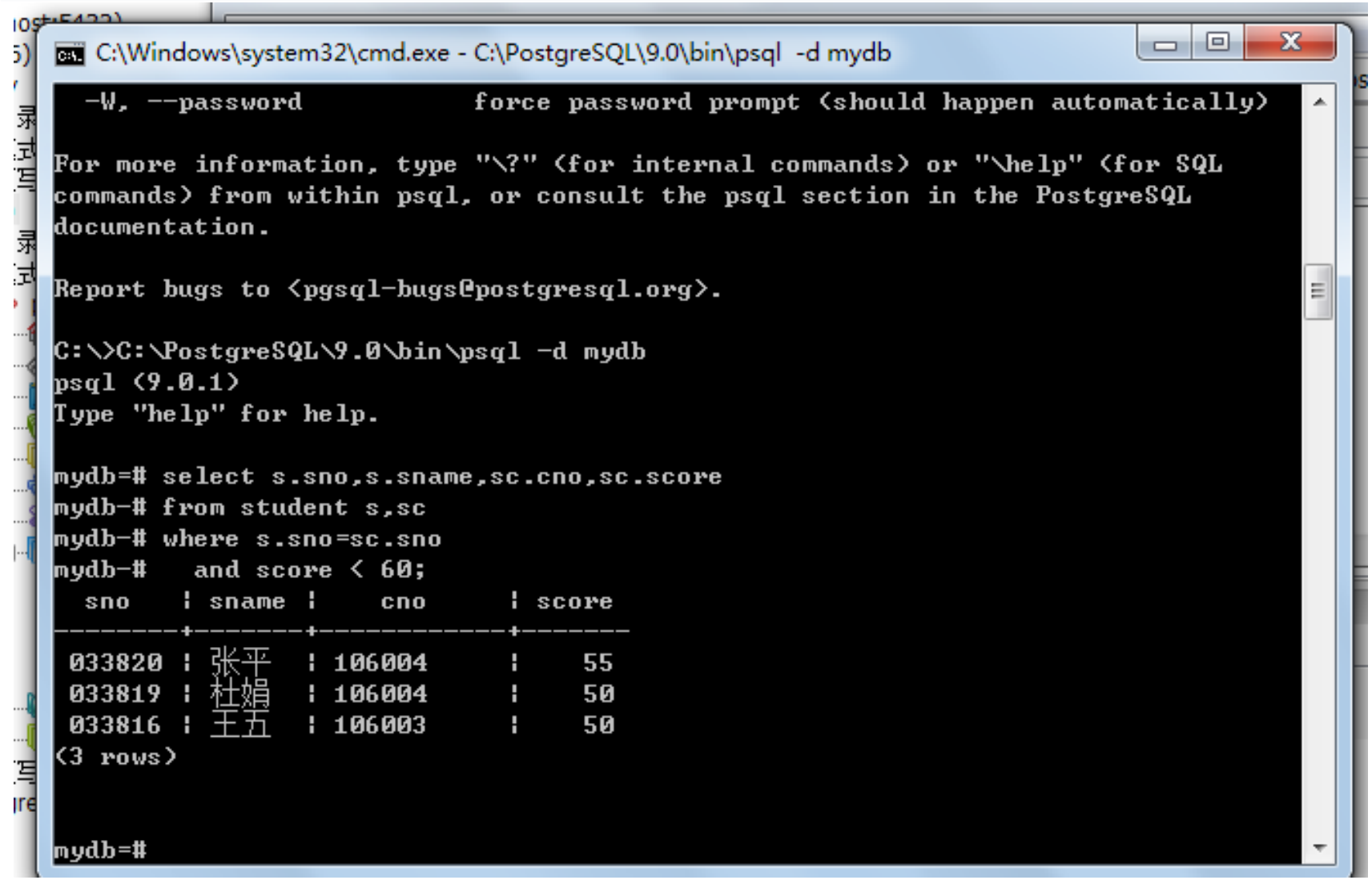
Outline

- Access to databases via programming languages
- SQL in Application Code
- Embedded SQL
- Application Programming Interface (API)
- JDBC

Justification for access to databases via programming languages



Justification for access to databases via programming languages



Justification for access to databases via programming languages

- SQL is a direct query language and it is very suit for data depositing and retrieving; as such, it has limitations.
  - Complex computational processing of the data.
  - Specialized user interfaces.
  - Access to more than one database at a time.

Justification for access to databases via programming languages

SQL

Lookup for all students which have failure records for any course.

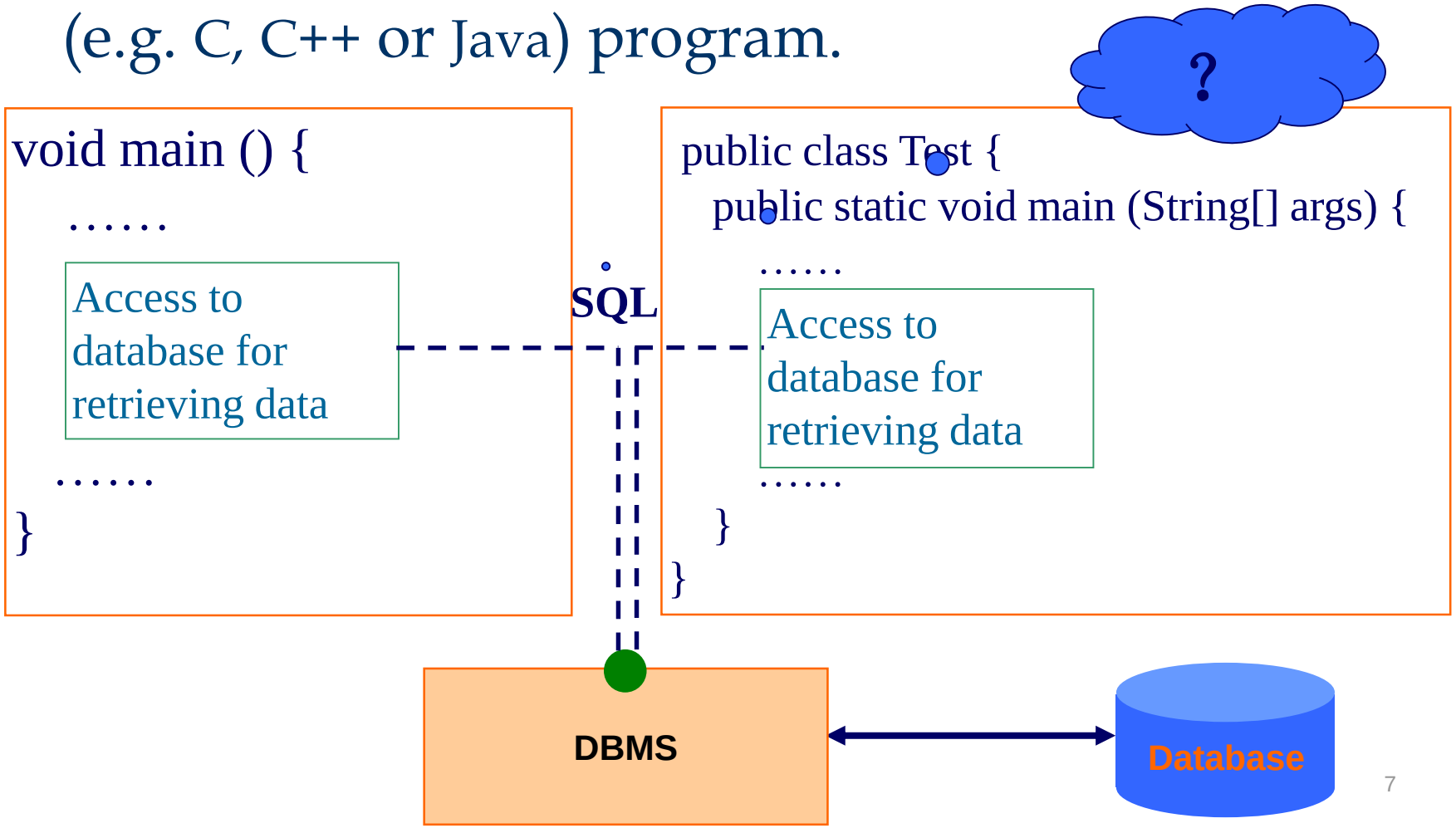
```
Select sNo
From sc
Where score < 60
```

For each student which score < 60
    send a message to him about makeup
print name list for all students need makeup

How to express this business

SQL in Application Code

- SQL can be called from within a host language (e.g. C, C++ or Java) program.



SQL in Application Code

- Questions
  - How to place SQL in high level languages to access database?
  - How to compile and run the high level languages including SQL?
- Example: summit your paper using other languages except for Chinese.

SQL in Application Code

2001年，IBM高级副总裁Paul Horn在哈佛大学的报告中提出“自主计算（Autonomic Computing[1]）”概念，以应对计算复杂性危机的问题。“自主计算”也译作“自治计算”，其基本思想是参照生物领域自主神经系统的自我调节机制，以现有的理论和技术为基础构建计算系统，使得计算系统具有自我感知与管理的能力。他在报告中指出“It’s time to design and build computing systems capable of running themselves, adjusting to varying circumstances, and preparing their resources to handle most effectively the workloads we put upon them. These autonomic systems must anticipate needs and allow users to concentrate on what they want to accomplish rather than figuring how to rig the computing systems to get them there.”

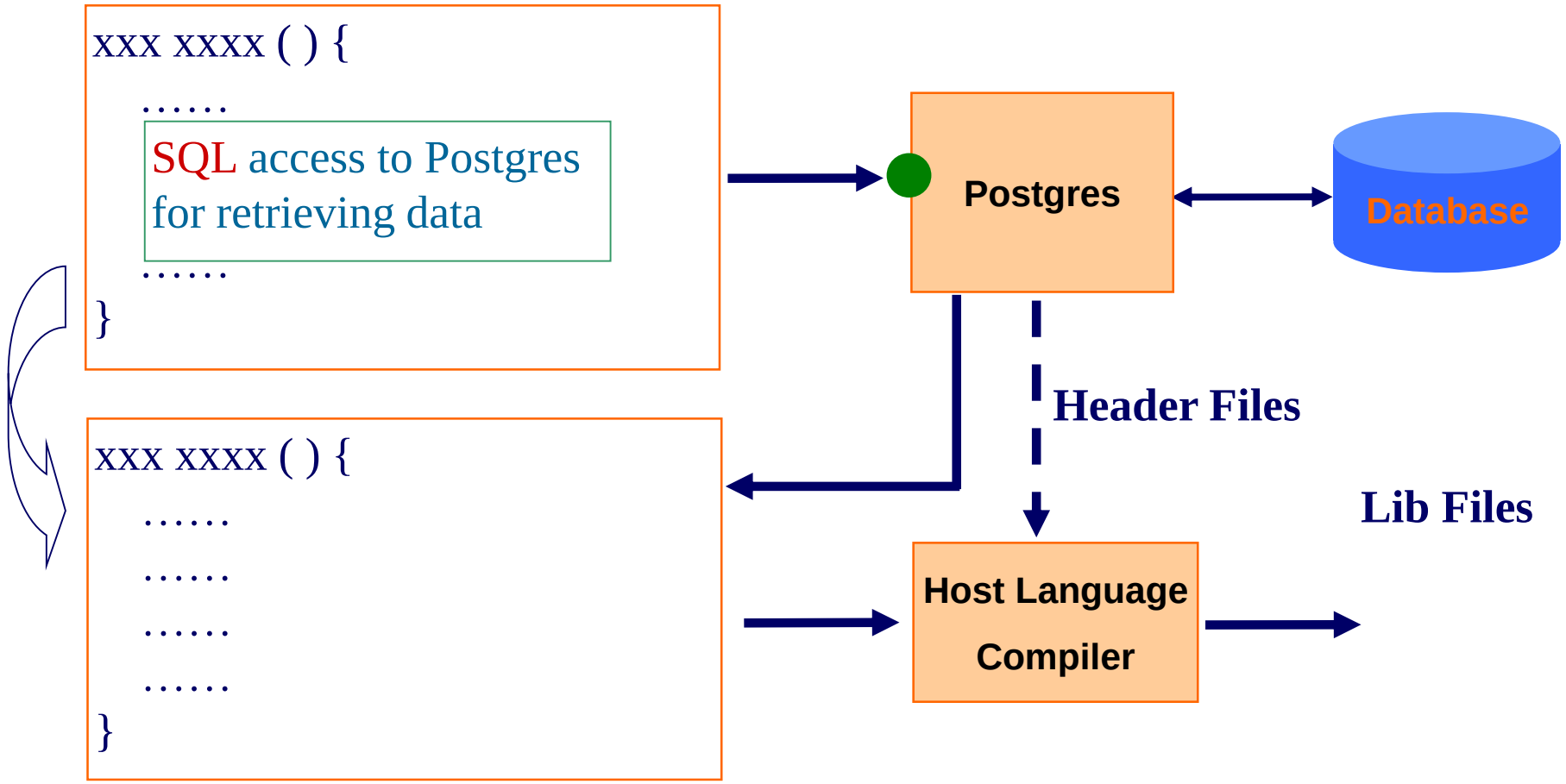
……

SQL in Application Code

- Two types of programmic SQL
  - Embedded SQL statements
    - SQL statements are embeded directly into the program source code and mixed with the host language statements.
    - Need to be precompiled.
  - Application Programming Interface (API)
    - Provide the programmer with a standard set of functions that can be invoked from the software.
    - Need not to be precompiled.
    - Open Database Connectivity (ODBC) standard.

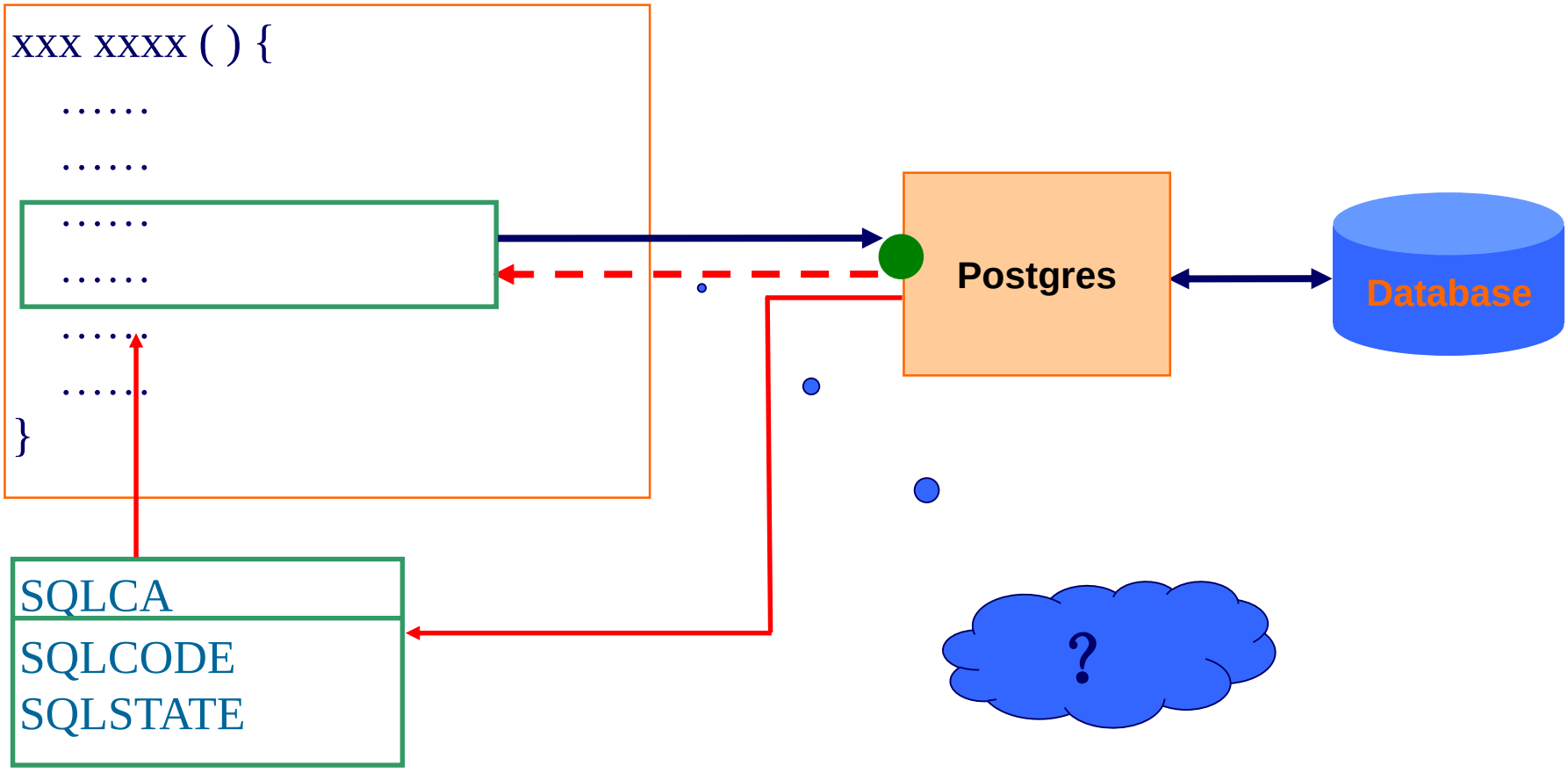
Embedded SQL

- Precompile



Embedded SQL

- Result Return (Communication Area)



Embedding SQL in C: An Example

- Example1

Static SQL Statements

- In static embedded SQL statement, the pattern of database access is fixed and can be 'hard-coded' into the program.
- Static SQL does not allow host variables to be used in place of table names or column names.

Static SQL Statements

- In static Embedded SQL, the follow elements must be fixed:
  - Reserved words (SELECT,UPDATE,DELETE…)
  - The number of host variables
  - The data type of each host variable
  - The database object will be accessed in SQL(table,column,view,index,…)

Dynamic SQL

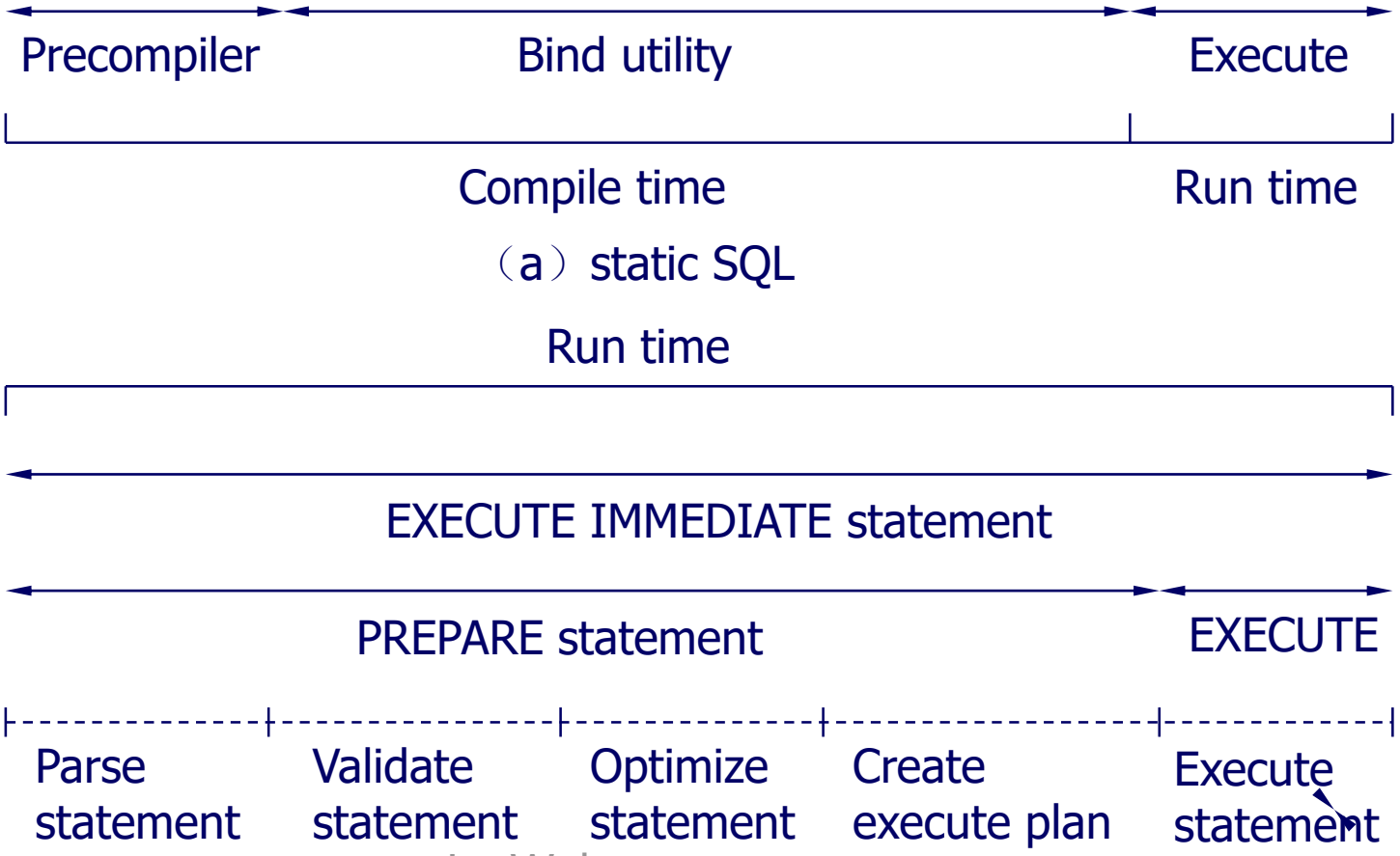
- In many situations where the pattern of database access is not fixed and is known only at runtime. This requires more flexibility than static SQL.
- Dynamic embedded SQL can be used to resolve this problem.
- The basic idea of dynamic SQL is to place the complete SQL statement to be executed in a host variable. The host variable is then passed to the DBMS to be executed.

Dynamic SQL

```
EXEC SQL BEGIN DECLARE SECTION;
   float increment;
EXEC SQL END DECLARE SECTION;
EXEC SQL UPDATE Staff SET
    salary=salary+:increment WHERE
    staffNo='SL21';
EXEC SQL BEGIN DECLARE SECTION;
 char buffer[100];
EXEC SQL END DECLARE SECTION;
 sprintf(buffer,"UPDATE Staff SET salary=salary+%f
   WHERE staffNo='SL21'",increment;);
EXEC SQL EXECUTE IMMEDIATE :buffer;
```

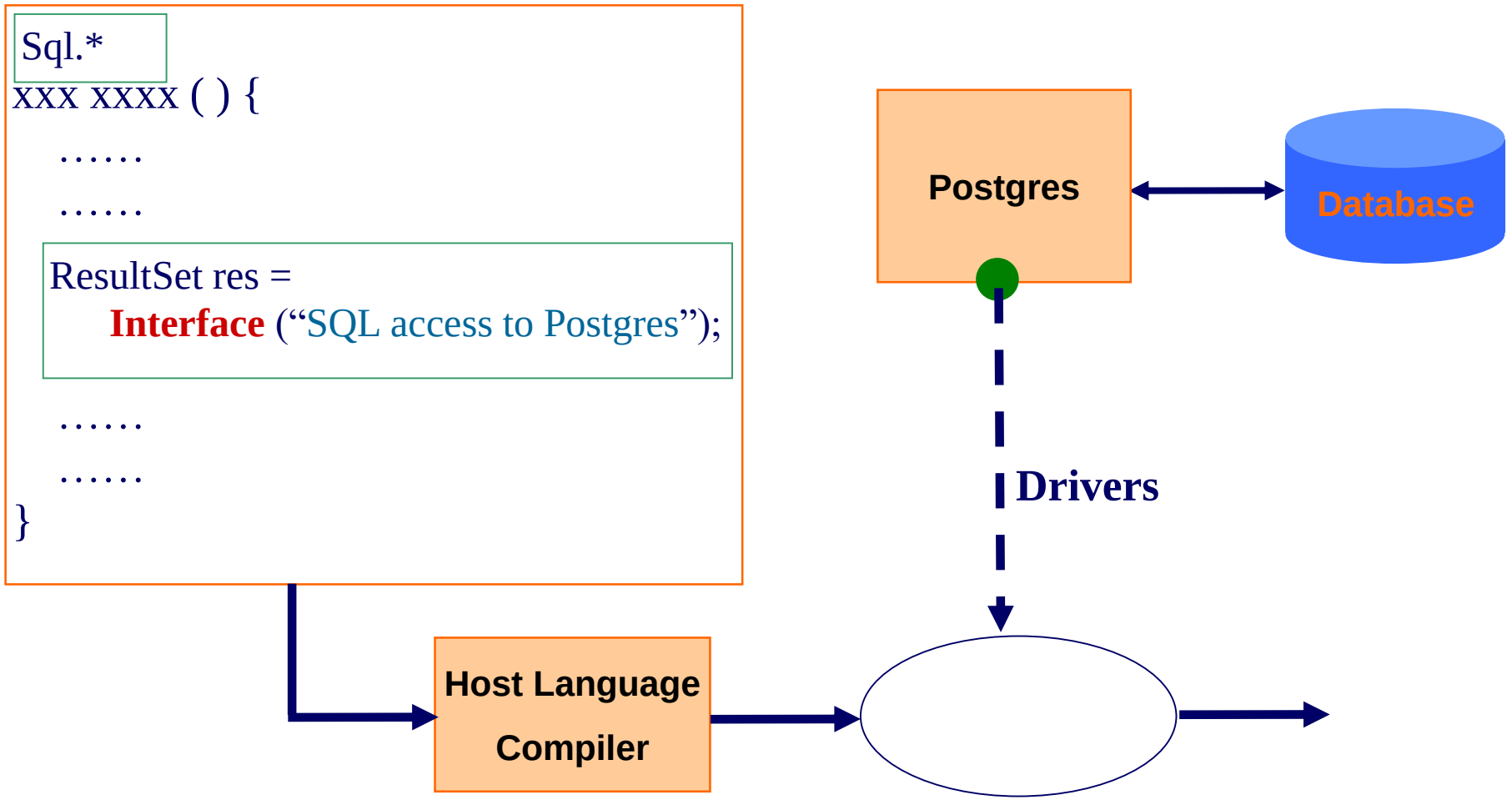
Dynamic SQL

- The PREPARE and EXECUTE Statements



（b）Dynamic SQL

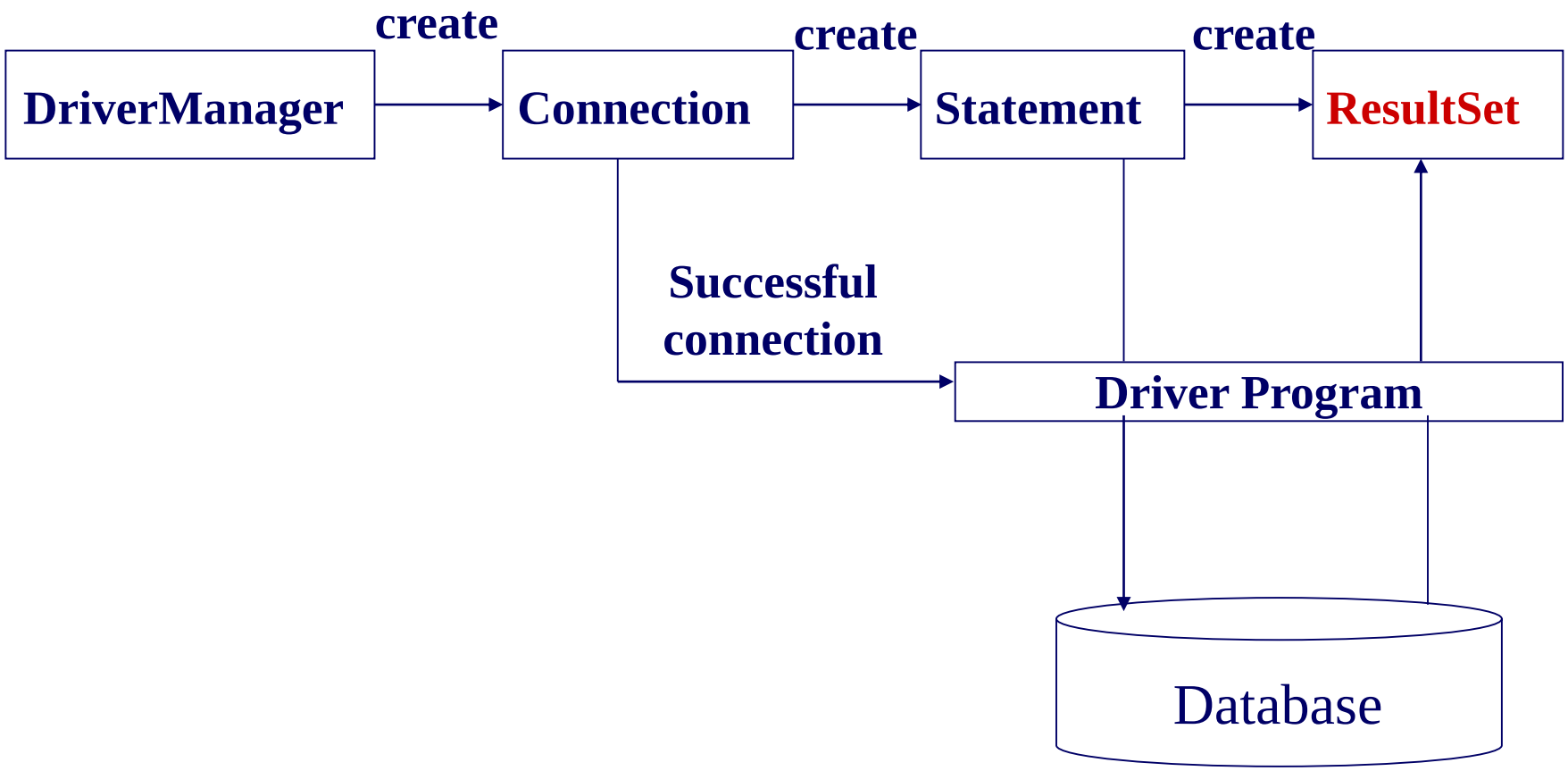
Application Programming Interface (API)



Application Programming Interface (API)-JDBC

- Sun's JDBC: Java API (Part of the java.sql package)
- Steps to submit a database query:
  - Load the JDBC driver
  - Connect to the data source
  - Execute SQL statements

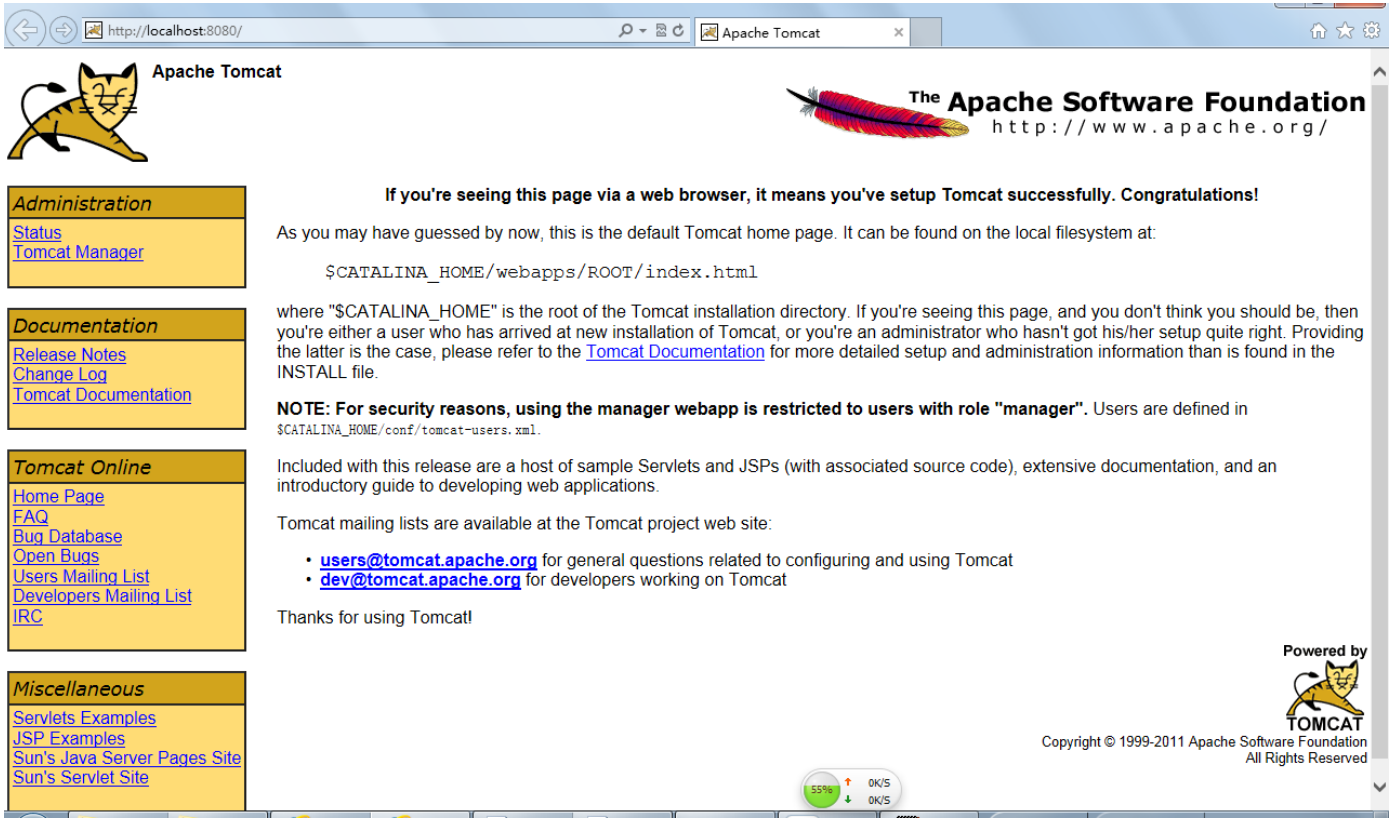
Principle of JDBC



JDBC- An Example

- Example2

Database Application



Database Application-An Example

- Create Library Database
- Library System presentation

MVC Architecture

- The Model View Controller (MVC) architecture describes a way to organize and separate the tasks of an application into three distinct parts: Model, View, and Controller.
- The View manages the output of a user interface.
- The Controller processes the user's input.
- The Model represents the data and logic of the subset of the external world used in the program

MVC Architecture

- In Java-based Web applications using the MVC architecture
  - JavaBeans (hereafter called *beans*) serve as the Model.
  - JSP pages are primarily used to implement the View component
  - Servlets are used to implement the Controller component of the MVC architecture.

Questions

Thanks