C++ Program Information Database for Analysis Tools

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C++ Program Information Database for Analysis Tools

1. Why employ program information database?

2. How program information database works?

3. Current status and future …

Why program information database?

Program source codes are

primary information source of software systems

Code analyzers

analyze source code for different requirements

Code analyzers: examples

- CSope *for* cross-reference of C programs
- OOTM *for* object-oriented testing
- GRASP *for* reverse engineering of structure diagrams
- COBOL/SRE *for* reengineering to recover reusable components
- ATM *for* analyzing the effect of changes to Ada code
- others, say, CIA and CIA++

Code analyzers(continue)

Various code analyzers

- need some common information
- share same program information

therefore

- store program information into database
- avoid duplicating extraction process

JBPAS

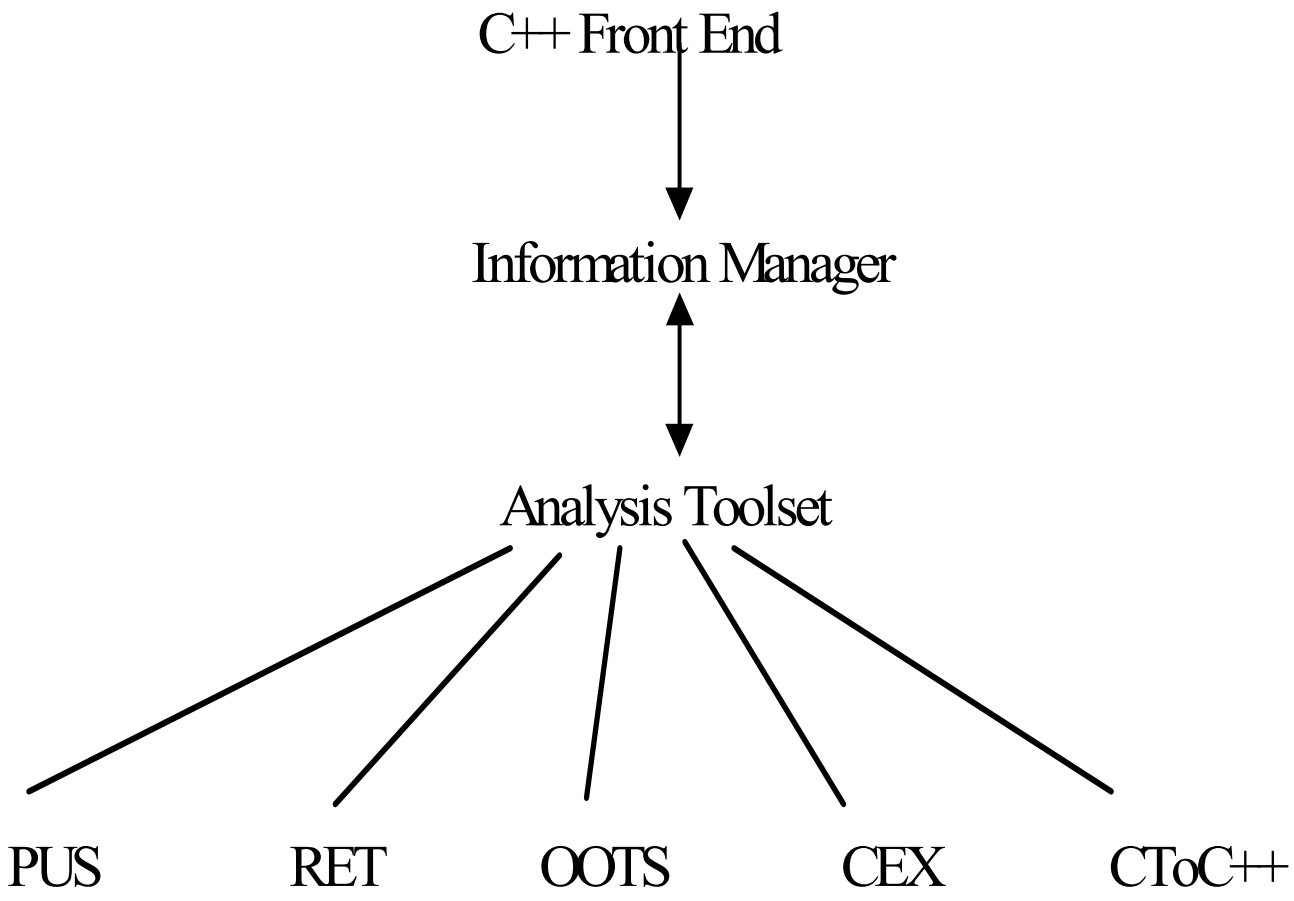
JBPAS: Jade Bird Program Analysis System

A tool kit of code analysis for C++ programs

Three major components:

- A C++ front end
- An information manager
- A set of program analysis tools

JBPAS Architecture



JBPAS Analysis Toolset

- Program Understanding System
  facilitate understanding of C++ programs
- Reverse Engineering Tool
  recover object-oriented design documents
- Object-Oriented Test Supporter
  determine test cases & support testing
- Component Extractor
  identify and extract reusable components
- C to C++ Translator
  restructure C program to equivalent C++ program

How program information database works?

- Conceptual Model

  define what program information to extract

- database link

  incremental parsing

Conceptual Model

Enhanced Entity Relationship (EER) model

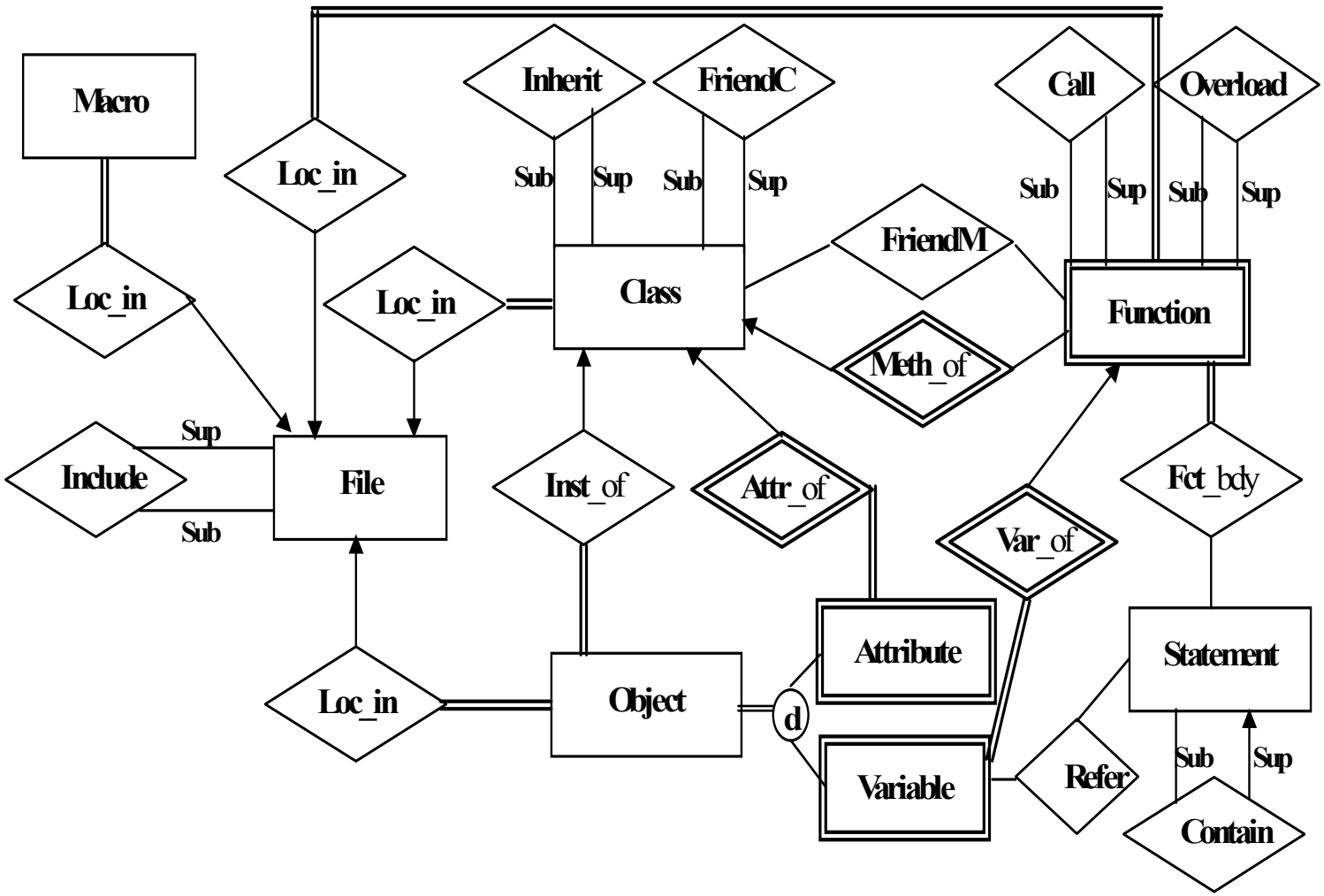
C++ programs *viewed as*

- entities (with attributes)
- relationships (with attributes, if any)

Conceptual model *should be*

- comprehensive
- well-defined

JBPAS Conceptual Model



JBPAS Conceptual Model: Entities

- Macro
- File
- Class
- Function
- Object (Attribute & Variable)
- Statement

JBPAS Conceptual Model: Relationship

- Relationship between classes
  - class A inherits class B
  - class A refer class B
  - class A is friend of class B
- Relationship between class & Object
  - object O is instance of class C
  - object O is attribute of class C
- Relationship between class & Function
  - function F is member of class C
  - function F is friend of class C

Relationship *(continue)*

- Relationship between Functions
  - function A call function B
  - function A overload function B
- Relationship between Function & Object
  - object O is local variable of function F
  - object O is refereed by function F
- Relationship between Object & Statement
  - object O is refereed by statement S
  - object O is modified by statement S

Database Link

Incremental parsing

parse only the modified portion

- Compilers

create a .OBJ file for each compiling unit

- JBPAS

create an incremental database for each .CPP file

Database Link *(continue)*

Difference btw compiler & code analyzer on declaration

- compiler

  analyze declarations and store their information in the symbol table ***temporarily***

- code analyzer

  extract declarations' information and store into database ***permanently***

Database Link *(continue)*

Difference btw compiler & code analyzer on declaration

- compiler linker

  resolve all external references

- database linker

  link all incremental databases to one information database

  keep only one copy of information on shared declaration

  update corresponding reference to the shared declaration

Database Link: example

```
// COURSE.H
class CCourse{
    char    m_sName[64];
    int     m_nCredit;
    ...
};
...
```

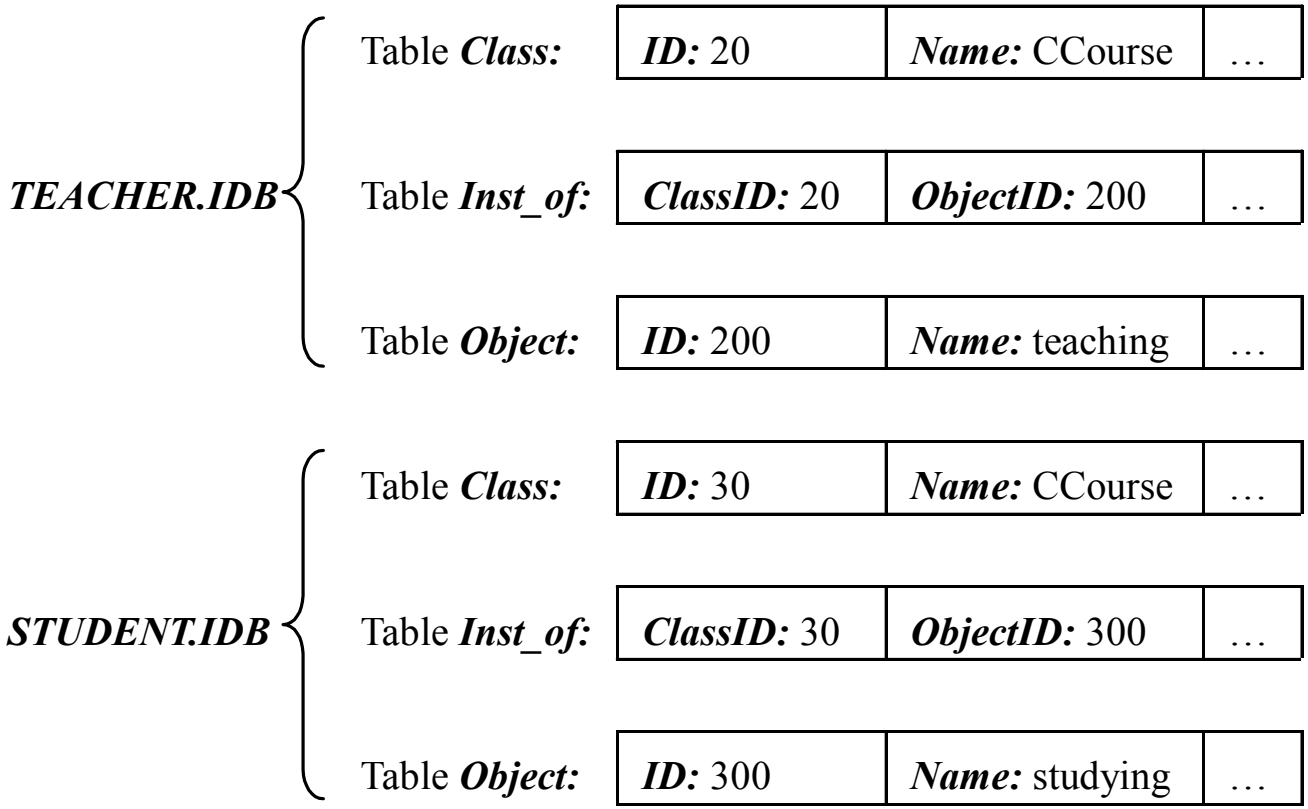
File ***COURSE.H***

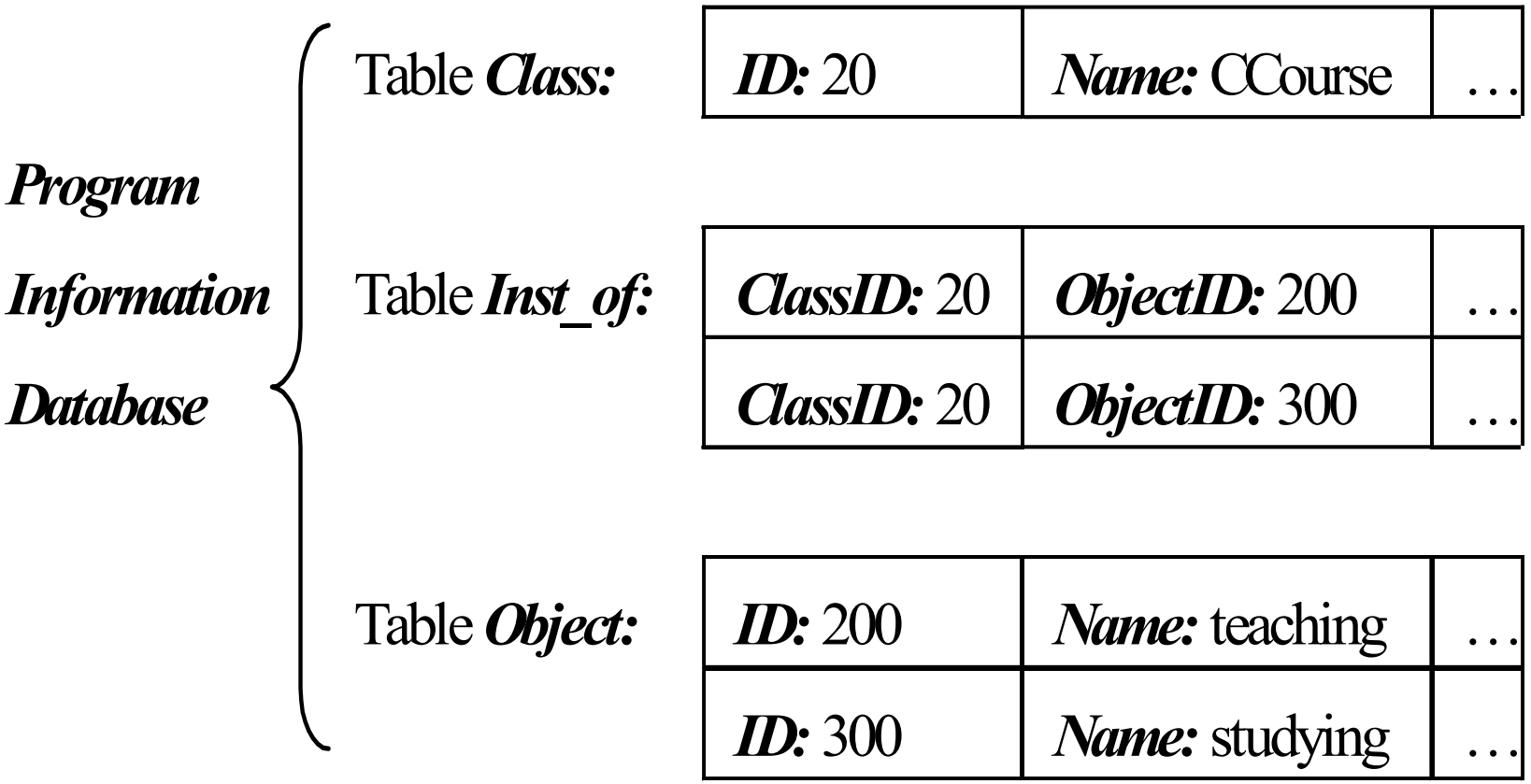
```
// TEACHER.CPP
#include "COURSE.H"
CCourse teaching;
...
```

File ***TEACHER.CPP***

```
// STUDENT.CPP
#include "COURSE.H"
CCourse studying;
...
```

File ***STUDENT.CPP***


TEACHER.IDB
Table Class:
ID: 20
Name: CCourse
…
Table Inst_of:
ClassID: 20
ObjectID: 200
…
Table Object:
ID: 200
Name: teaching
…
STUDENT.IDB
Table Class:
ID: 30
Name: CCourse
…
Table Inst_of:
ClassID: 30
ObjectID: 300
…
Table Object:
ID: 300
Name: studying
…


Program Information Database
Table Class:
ID: 20
Name: CCourse
...
Table Inst_of:
ClassID: 20
ObjectID: 200
...
ClassID: 20
ObjectID: 300
...
Table Object:
ID: 200
Name: teaching
...
ID: 300
Name: studying
...

Current status

- the C++ front end
- the information manager
- prototype versions of program understanding system
- product version of reverse engineering tool to be released by Jade Bird Co.

Future . . .

- Form a more concise EER model
- Implement other analysis tools and integrate them in an integrated environment
- Construct similar systems for other object-oriented language

Thank you!