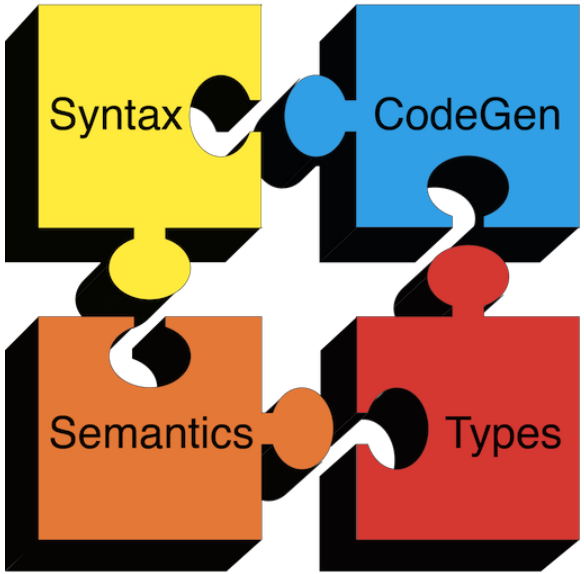


Compilers

Activation Records

Activation Records

- The information needed to manage one procedure activation is called an *activation record (AR)* or *frame*

- If procedure F calls G, then G's activation record contains a mix of info about F and G.

Activation Records

- F is "suspended" until G completes, at which point F resumes

- G's AR contains information needed to
  - Complete execution of G
  - Resume execution of F

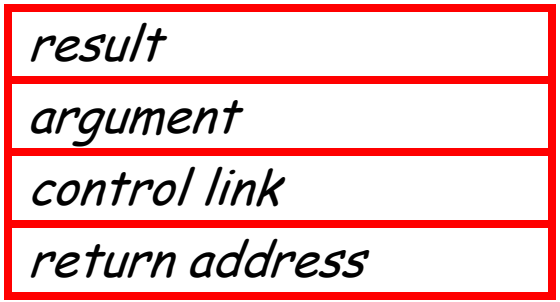
Activation Records

- Space for G's return value
- Actual parameters
- Pointer to the previous activation record
  - The *control link;* points to AR of caller of G
- Machine status prior to calling G
  - Contents of registers & program counter
  - Local variables
- Other temporary values

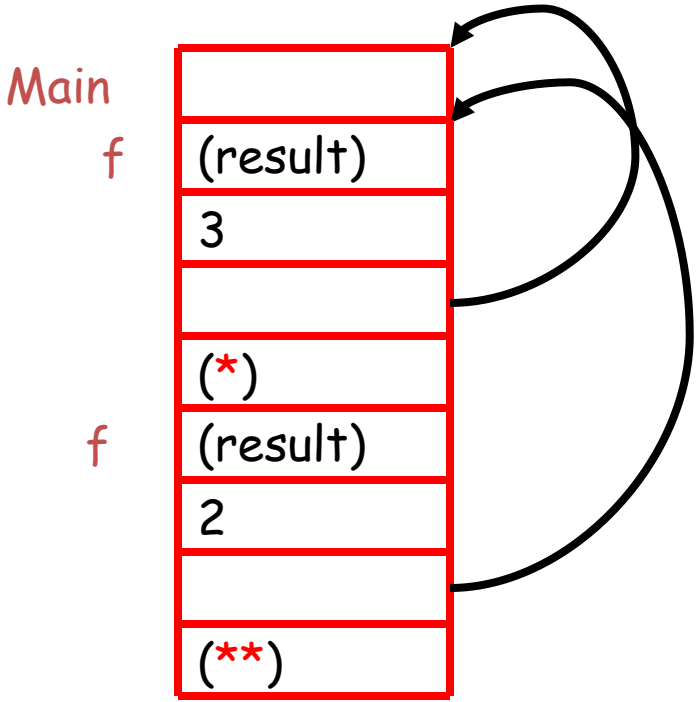
Activation Records

```
Class Main {
    g() : Int { 1 };
    f(x:Int):Int {if x=0 then g() else f(x - 1)(**)fi};
    main(): Int {{f(3); (*)
}};}
```

AR for f:



Activation Records



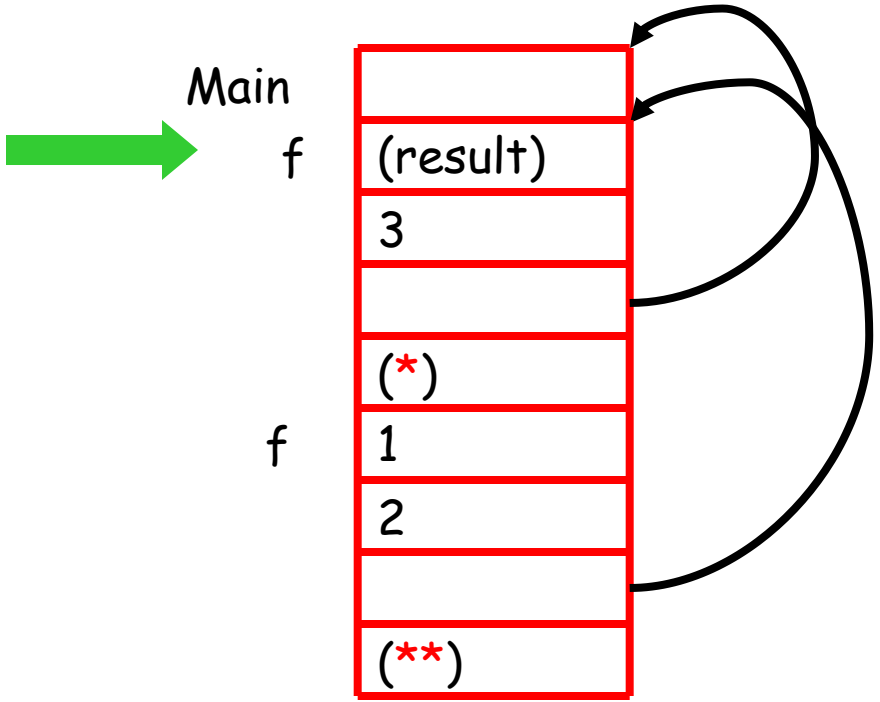
Activation Records

- Main has no argument or local variables and its result is never used; its AR is uninteresting
- (*) and (**) are return addresses of the invocations of f
  - The return address is where execution resumes after a procedure call finishes

- This is only one of many possible AR designs
  - Would also work for C, Pascal, FORTRAN, etc.

Activation Records

The picture shows the state after the call to the 2nd invocation of f returns



Activation Records

- The advantage of placing the return value 1st in a frame is that the caller can find it at a fixed offset from its own frame

- There is nothing magic about this organization
  - Can rearrange order of frame elements
  - Can divide caller/callee responsibilities differently
  - An organization is better if it improves execution speed or simplifies code generation

Activation Records

- Real compilers hold as much of the frame as possible in registers
  - Especially the method result and arguments

Activation Records

The compiler must determine, at compile-time, the layout of activation records and generate code that correctly accesses locations in the activation record

Thus, the AR layout and the code generator must be designed together!