c.def

(pronounced SEE-def)

Macromedia® Flash™
animation language

Inspiration

macromedia
FLASH™ MX

Macromedia® Flash™ weaknesses:

- Tedious navigation of complex paths
- GUI Cumbersome for non-trivial movies
- No batch object creation and placement

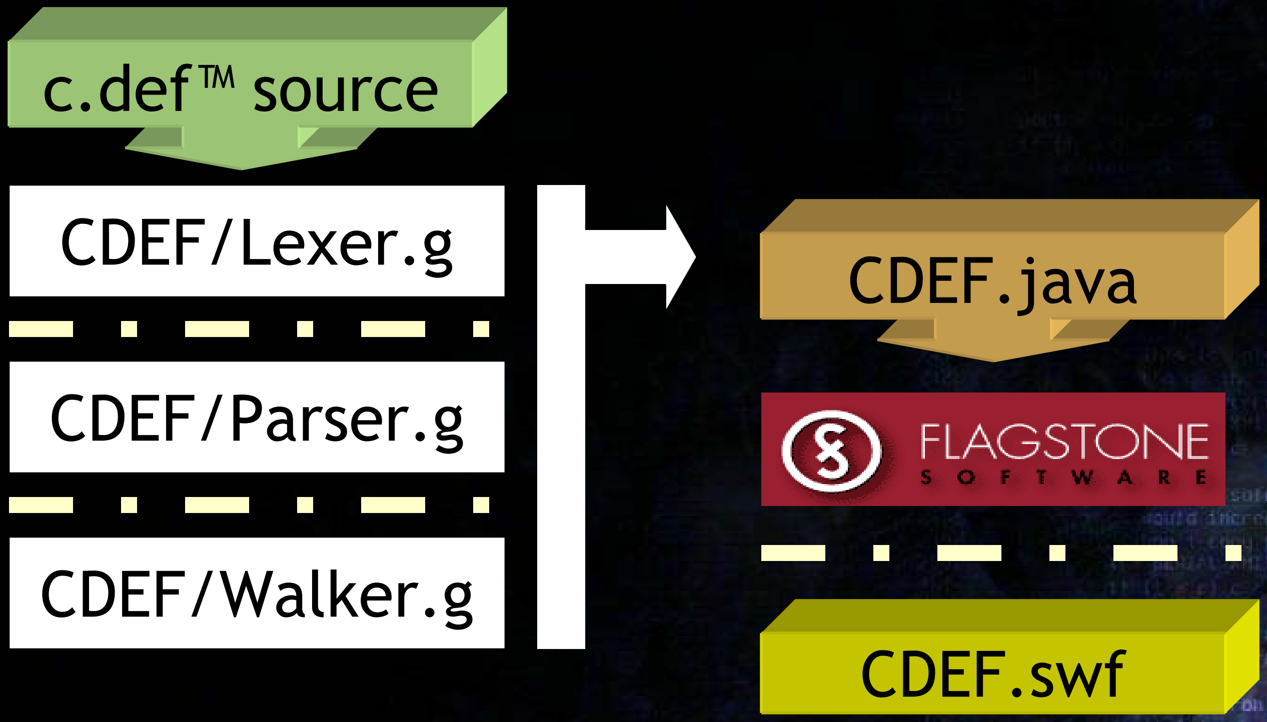
Solution:

- programmatically compose Flash movies with **c.def™**

The Process

- The Goals
  - Design a flexible language
  - … within time constraints
  - Create a Ferris wheel animation
- What Made Them Possible?
  - Working backwards
  - Working together
  - Regression testing, incremental testing

Architecture



c.def™ source

CDEF/Lexer.g

CDEF/Parser.g

CDEF/Walker.g

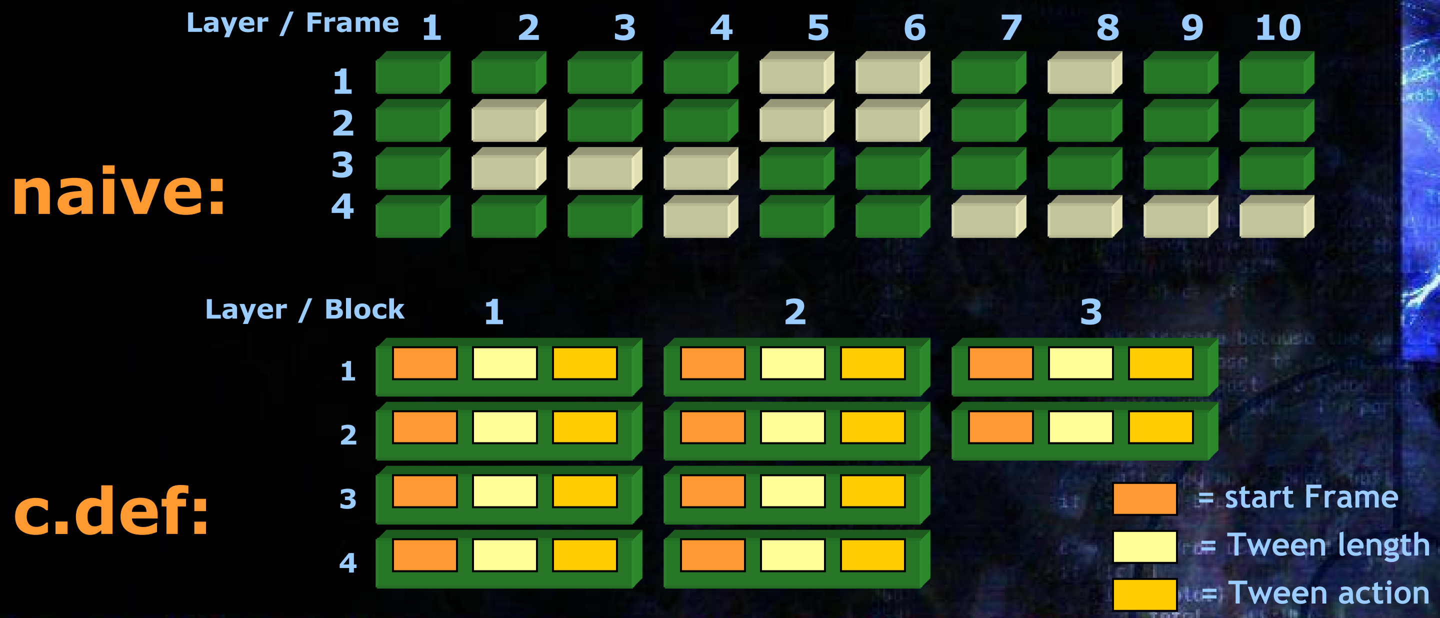
CDEF.java

FLAGSTONE SOFTWARE

CDEF.swf

Features I

- Non-linear 2D array (keyframes)



naive:

Layer / Frame	1	2	3	4	5	6	7	8	9	10
1	🟩	🟩	🟩	🟩	⬜	⬜	🟩	⬜	🟩	🟩
2	🟩	⬜	🟩	🟩	⬜	⬜	🟩	🟩	🟩	🟩
3	🟩	⬜	⬜	⬜	🟩	🟩	🟩	🟩	🟩	🟩
4	🟩	🟩	🟩	⬜	🟩	🟩	⬜	⬜	⬜	⬜

c.def:

Layer / Block	1	2	3
1	🟧🟨🟡	🟧🟨🟡	🟧🟨🟡
2	🟧🟨🟡	🟧🟨🟡	🟧🟨🟡
3	🟧🟨🟡	🟧🟨🟡	
4	🟧🟨🟡	🟧🟨🟡	

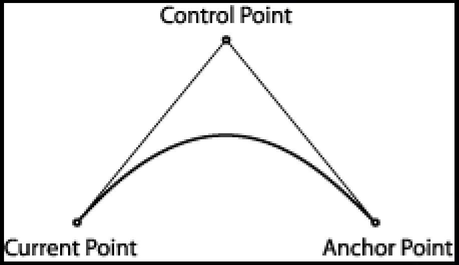
🟧 = start Frame

🟨 = Tween length

🟡 = Tween action

Features II

- Circles drawn utilizing Bezier curves



Curved lines are constructed using a Quadratic Bezier curve. The curve is specified using three points - the current drawing position, an off-curve control point and an on-curve anchor point which defines the end-point of the curve.

- Polygons created with a sequence of Cartesian translations

Actions

```
: #("Document" name=id a=param b=param doc_body:.)
| #("Glyph" name=id a=param glyph_body:. )
| #("Path" name=id c=numericexp path_body:. )
| #(INSERT name=id a=param)
| #("Render" name=id (a=param | c=numericexp)
   (name2=id | b=param))
| #("Rotate" name=id c=numericexp a=param )
| #("SetColor" name=id a=param)
| #("for" name=id a=param for_body:. )
| #("if" c=numericexp if_body:. ( else_body:.)?
| #(BODY (expr [parent] )* );
```

Convenient Notation

- Makes code easier to read – no comma-separated lists of numbers
- Colors
  - #*Name* ← 16 pre-defined colors
  - #(*red*, *green*, *blue*)
- Ranges
  - ->(*from*, *to*)
  - ->(*from*, *to*, *step*)
- Coordinates
  - &(*x*, *y*)

Drawing Statements

```
: "point”^ … coords …
| "line"^ … coords … coords …
| "circle"^ … coords … expr …
| "rect"^ … coords … coords …
| "ellipse"^ … coords … expr … expr …
| "polygon"^ … coords (COMMA! coords)* …
| "color"^ … color …
| "fillcolor"^ … color …
| ID^ … coords …
```

Nitty Gritty

- Static Scoping

```
if(parent instanceof CDEFDocument) {
  CDEFDocument doc = (CDEFDocument)parent;
  doc.setParams((CDEFXY)a, (CDEFColor)b);
  ipt.setDocument(doc);
  ipt.enterScope();
  expr( doc_body, doc );
  ipt.exitScope();
}
```

Demo

- (A quick and working one!)

Sample Program

```
Document d[&(400, 400), #White]
{
    /* Ferris wheel base */
    Glyph base[&(100, 0)]
    {
         fillcolor[#(215, 155, 251)];
         polygon[&(100, 0), &(-100,170), &(0, 10),
             &(200, 0), &(0, -10), &(-100, -170)];
        fillcolor[#None];

        polygon[&(-60, -170), &(20, 0), &(-10, 0),
             &(0, 20)];
        circle[&(-35, -155), 5];
        . . .

    }
}
```

Nesting Glyphs, Rotation

```
/* A wheel's spike */
Glyph spike[&(0, 0)]
{
   line [&(20, 0), &(120, 0)];
   line [&(120, 0), &(58, 105)];
}

/* Define the wheel */
Glyph wheel[&(150, 150)]
{
   for[ i: ->( 1, 6 ) ]
   {
      Rotate [spike, 60, &(0, 0)];

       /* Place it onto the wheel */
      spike [&(150, 150)];
   }
```

Translation Over Paths

```
for[ i : ->(1, 6) ]
{
   Path circularPath[i * (100/6)]
   {
      circle[&(200, 200), 120];
      point[&(0, 120)];
   }


   if[ i % 2 == 0 ]
   {
       Render [ferrisCar, ->(1, 180), circularPath];
   }
   else
   {
       Render [ferrisCar2, ->(1, 180), circularPath];
   }

}
```

Lessons Learned

- Got OOP? We do.
- Work backwards: maintain your sanity.
- Start early, spend Rogaine $$ on beer.
- Set expectations early.

Group Members

- Dennis Rakhamimov, Group Leader

  FrontEnd, Backend
- Eric Poirier

  Documentation, Presentation, and Testing
- Charles Catanach

  Backend, and Testing
- Tecuan Flores

  Documentation, Presentation, and Testing