Designing Interactive Systems II

Computer Science Graduate Programme SS 2010

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http://hci.rwth-aachen.de/dis2

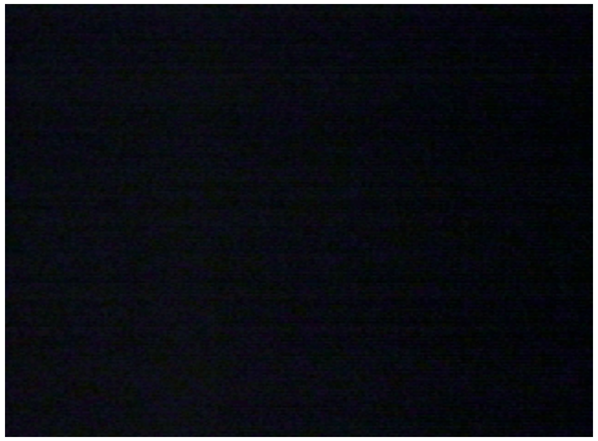
Review

- What is the difference between Smalltalk, Squeak, and Morphic?
- How did the original Smalltalk implement the window system layer architecture?
- What are the most particular qualities of Morphic as a UI toolkit?
- What are morphs, and what is special about them?
- How does Morphic implement widget layout?

The Apple Macintosh

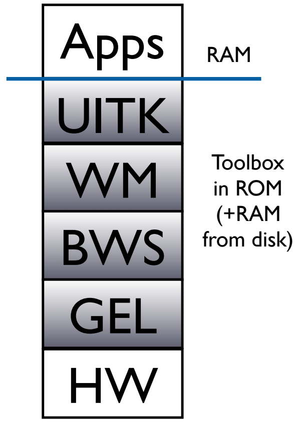
- Introduced in 1984
- Based on PARC Smalltalk, Star, Tajo
- Few technical innovations (QuickDraw)
  - Otherwise, rather steps back
- But landmark in UI design and consistency policies
  - First commercially successful GUI machine
  - Advertised with what is sometimes considered the best commercial in history: http://www.apple-history.com/movies/1984.mov

1984



20 Years Later...

Macintosh: Architecture



- One address space, communication with procedure calls
- “No” OS—app is in charge, everything else is a subroutine library (“Toolbox”)
  - Functional, not object-oriented (originally written in Pascal)
  - Organized into Managers
  - Mostly located in “the Mac ROM”

Event Manager

- Event loop core of any Mac app
- Processes events (from user or system) and responds
- Event Manager offers functions to deal with events
  - `extern pascal Boolean` **`GetNextEvent`**`(short eventMask, EventRecord *theEvent);`
- Cooperative Multitasking
  - External: App must allow user to switch to other apps
  - Internal: App must surrender processor to system regularly

```
struct EventRecord {
  short what;    // type of event
  long message;  // varies depending
                 // on type
  long when;     // Timestamp in
ticks
  Point where;   // mouse position
                 // in global coords
  short modifiers; // modifier keys
held down
};

Event types
enum {
  nullEvent    =  0,
  mouseDown    =  1,
  mouseUp      =  2,
  keyDown      =  3,
  keyUp        =  4,
  autoKey      =  5,
  updateEvt    =  6,
  diskEvt      =  7,
  activateEvt  =  8,
  osEvt        = 15,
};
```

Control Manager

- Controls: Buttons, checkboxes, radio buttons, pop-up menus, scroll bars,...
- Control Manager: Create, manipulate, redraw, track & respond to user actions

Dialog Manager

- Create and manage dialogs and alerts
- (System-) modal, movable (application-modal), or modeless dialog boxes—choice depends on task!

Window Manager(!)

- Not the Window Manager from our layer model
- Create, move, size, zoom, update windows
- App needs to ensure background windows look deactivated (blank scrollbars,...)

Menu Manager

- Offers menu bar, pull-down, hierarch. & pop-up menus
- Guidelines: any app must support Apple, File, Edit, Help, Keyboard, and Application menus

Finder Interface

- Defining icons for applications and documents
- Interacting with the Finder

Other Managers

- Scrap Manager for cut&paste among apps
- Standard File Package for file dialogs
- Help Manager for balloon help
- TextEdit for editing and displaying styled text
- Memory Manager for the heap
- List Manager, Sound Manager, Sound Input Manager,...

Resource Manager

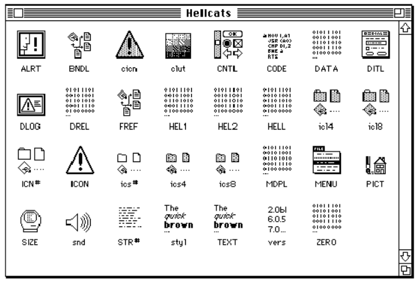
- Resources are basic elements of any Mac app: Descriptions of menus, dialog boxes, controls, sounds, fonts, icons,...
    - Makes it easier to update, translate apps
- Stored in resource fork of each file
    - Each Mac file has data & resource fork
    - Data fork keeps application-specific data (File Manager)
    - Resource fork keeps resources in structured format (Resource Manager)
        - For documents: Preferences, icon, window position
        - For apps: Menus, windows, controls, icons, code(!)

Resource Manager

- Identified by type (4 chars) and ID (integer)
    - Standard resource types (WIND, ALRT, ICON,...)
    - Custom resource types (defined by app)
- Read and cached by Resource Manager upon request
    - Priorities through search order when looking for resource
        - Last opened document, other open docs, app, system
- Can write resources to app or document resource fork
    - E.g., last window position

ResEdit

- Graphical Resource Editor (Apple)
- Overview of resources in resource fork of any file (app or doc), sorted by resource type
- Opening a type shows resources of that type sorted by their ID
- Editors for basic resource types built in (ICON,DLOG,...)
- Big productivity improvement over loading resources as byte streams



Macintosh: Evaluation

- Availability: high (apps from 1984 still ran on machines from 2005)
- Productivity: originally low (few tools except ResEdit; Mac was designed for users, not programmers)
- Parallelism: originally none, later external+internal
  - External: Desk accessories, Switcher, MultiFinder
  - Internal: Multi-processor support in mid-90's

Macintosh: Evaluation

- Performance: high (first Mac was 68000@1MHz, 128K RAM) – improvement over Smalltalk
- Graphic model: QuickDraw (RasterOp+fonts, curves...)
- Style: most consistent to this day (HI Guidelines, Toolbox)
- Extensibility: low (Toolbox in ROM, later extended via System file)

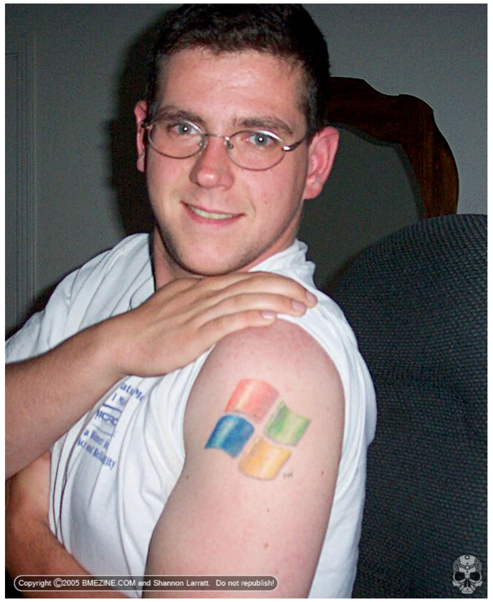
Macintosh: Evaluation

- Adaptability: medium (System/app/doc preferences in resources, but limited ways to change look&feel)
- Resource sharing: medium (fonts, menu bar shared by apps,...)
- Distribution: none
- API structure: procedural (originally Pascal)
- API comfort: high (complete set of widgets)
- Independency: Medium (most UI code in Toolbox)
- Communication: originally limited to cut&paste

In-Class Exercise: Simple Mac Application

- Write a simple Macintosh application that opens a window and exits upon mouseclick

```
void main (void)
{
    WindowPtr window;
    Rect rect;

    InitGraf (&qd.thePort); // must be called before any other TB Manager (IM IX 2-36)
    InitFonts (); // after ig, call just to be sure (IM IX 4-51)
    FlushEvents(everyEvent,0); // ignore left-over (finder) events during startup
    InitWindows (); // must call ig & if before (IM Toolbox Essentials 4-75; IM I 280)

    InitCursor (); // show arrow cursor to indicate that we are ready

    SetRect (&rect, 100, 100, 400, 300);

    window = NewCWindow (NULL, &rect, "\pMy Test", true, documentProc,
        (WindowPtr) -1, FALSE, 0);

    do {
    }
    while (!Button());

    DisposeWindow (window);
}
```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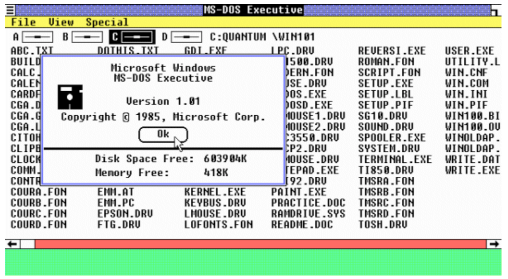
Windows: History

- 1985: Windows 1.0
  - no virtual memory, shared memory space
  - tiled windows only, no composite widgets
  - dev tools: DOS only



```
A      B      C      D      C:QUANTUM \WIN101
ABC.TXT      DOTHIS.TXT   GDI.EXE      LPC.DRV      REVERSI.EXE  USER.EXE
BUILD                                  1500.DRV     ROMAN.FON    UTILITY.L
CALC.                                  DERN.FON     SCRIPT.FON   WIN.CNF
CALEN                                  USE.DRV      SETUP.EXE    WIN.COM
CARDF                                  DOS.EXE      SETUP.LBL    WIN.INI
CGA.D                                  DOSD.EXE     SETUP.PIF    WIN.PIF
CGA.G                                  MOUSE1.DRV   SG10.DRV     WIN100.BI
CGA.L                                  MOUSE2.DRV   SOUND.DRV    WIN100.OV
CITOH                                  C3550.DRV    SPOOLER.EXE  WINOLDAP.
CLIPB                                  CP2.DRV      SYSTEM.DRV   WINOLDAP.
CLOCK                                  MOUSE.DRV    TERMINAL.EXE WRITE.DAT
COMM.                                  TEPAD.EXE    TI850.DRV    WRITE.EXE
CONTR                                  I92.DRV      TMSRA.FON
COURA.FON    EMM.AT       KERNEL.EXE   PAINT.EXE    TMSRB.FON
COURB.FON    EMM.PC       KEYBUS.DRV   PRACTICE.DOC TMSRC.FON
COURC.FON    EPSON.DRV    LMOUSE.DRV   RAMDRIVE.SYS TMSRD.FON
COURD.FON    FTG.DRV      LOFONTS.FON  README.DOC   TOSH.DRV
```

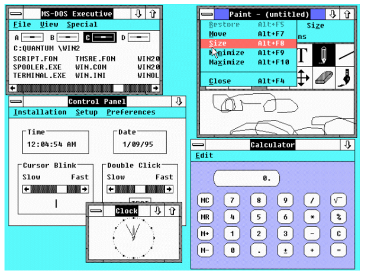
```
Microsoft Windows
MS-DOS Executive

Version 1.01
Copyright © 1985, Microsoft Corp.
Ok

Disk Space Free:  603904K
Memory Free:      418K
```

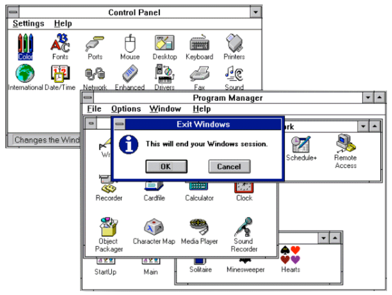
Windows: History

- 1987: Windows 2.0 - windows can overlap
  - composite widgets (dialog boxes)
  - Windows 2.04: address memory >1MB
  - SDK w/ MS C 5.0, can develop within Windows



Windows: History

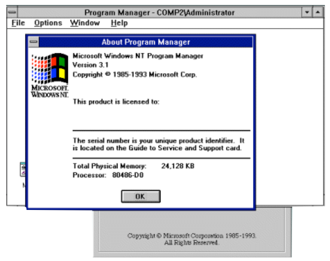
- 1990: Windows 3.0
  - virtual memory
  - BMP format adopted



This will end your Windows session.

Windows: History

- 1993: Windows NT 3.1
  - rewritten from scratch, 32-bit (Win32)
  - pre-emptive multitasking, processes
  - ran on x86, MIPS, Alpha, PowerPC



Microsoft Windows NT Program Manager
Version 3.1
Copyright © 1985-1993 Microsoft Corp.

This product is licensed to:

The serial number is your unique product identifier. It is located on the Guide to Service and Support card.

Total Physical Memory: 24,128 KB
Processor: 80486-D0

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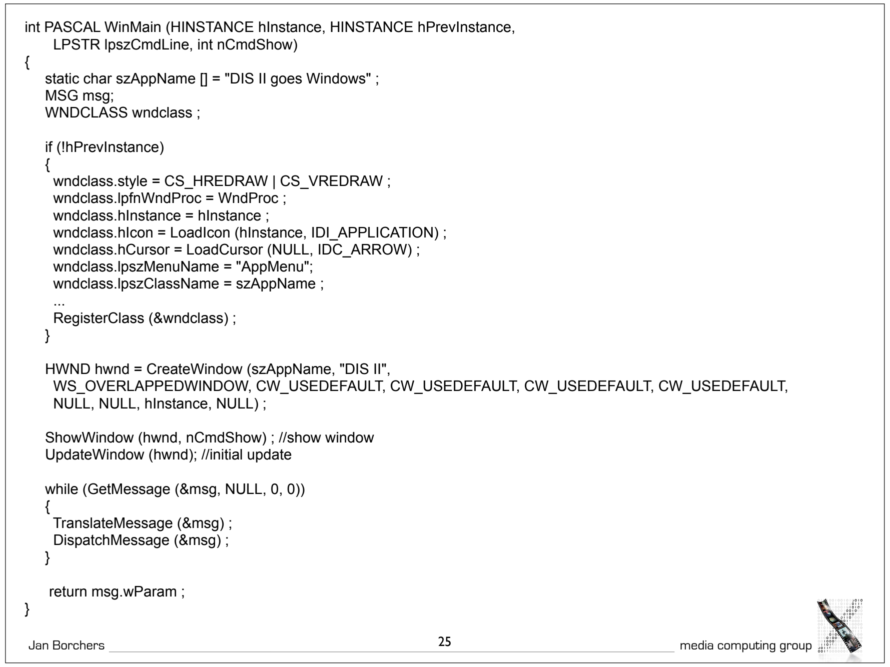

```
int PASCAL WinMain (HINSTANCE hInstance, HINSTANCE hPrevInstance,
      LPSTR lpszCmdLine, int nCmdShow)
{
     static char szAppName [] = "DIS II goes Windows" ;
     MSG msg;
     WNDCLASS wndclass ;

     if (!hPrevInstance)
     {
       wndclass.style = CS_HREDRAW | CS_VREDRAW ;
       wndclass.lpfnWndProc = WndProc ;
       wndclass.hInstance = hInstance ;
       wndclass.hIcon = LoadIcon (hInstance, IDI_APPLICATION) ;
       wndclass.hCursor = LoadCursor (NULL, IDC_ARROW) ;
       wndclass.lpszMenuName = "AppMenu";
       wndclass.lpszClassName = szAppName ;
       ...
       RegisterClass (&wndclass) ;
     }

     HWND hwnd = CreateWindow (szAppName, "DIS II",
       WS_OVERLAPPEDWINDOW, CW_USEDEFAULT, CW_USEDEFAULT, CW_USEDEFAULT, CW_USEDEFAULT,
       NULL, NULL, hInstance, NULL) ;

     ShowWindow (hwnd, nCmdShow) ; //show window
     UpdateWindow (hwnd); //initial update

     while (GetMessage (&msg, NULL, 0, 0))
     {
       TranslateMessage (&msg) ;
       DispatchMessage (&msg) ;
     }

      return msg.wParam ;
}
```