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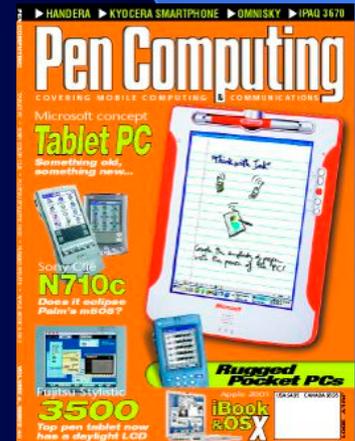
Conrad H. Blickenstorfer, Editor-in-Chief
Pen Computing Magazine

The Past and Future of Pen Computing

Conrad H. Blickenstorfer, Editor-in-Chief
Pen Computing Magazine

chb@pencomputing.com

<http://www.pencomputing.com>



Technology has become the international language of progress, of building things rather than destroying them

PC Market: Cloudy Future

- After 20 years of growth, demand leveling off
- IDC and Dataquest say shipments down first time ever, predict 6% down from 2000
- Still 30 million each in Q2 and Q3 2001, but....
 - Commodity components make it difficult to make profit
 - PC prices have come down:
 - 1981: 4.77MHz PC costs US\$4,000 (\$7,767 in 2001 money)
 - 2001: 1.8GHz PC costs US\$1,000
- Notebook market a bit better
- Estimate: 26 million units for 2001, same as for 2000

It is clear that PCs and notebooks as we know them represent the past and the present of computing, but not necessarily the future of computing.

Many people agree that PDAs and pen tablets or web tablets are a technology with a very promising future.

PDA Projections (1)

- IDC said that Asia Pacific (without Japan) PDA sales were about two million in 2000.
- Dataquest said there were 2.1 million PDAs sold in Europe in 2000, with Palm and Pocket PC each having a market share of about 40% in Q2/2001.
- The US PDA market is 7-8 million units this year, and represents 60-70% of worldwide PDA sales right now.
- Microsoft said in May 2001 that 1.25 million Pocket PCs have sold since the April 2000 introduction. At a August Microsoft conference in Seattle, Washington, Microsoft said that two million Pocket PCs have been sold worldwide.

PDA Projections (2)

- One report said there was a backlog of five million iPAQ Pocket PCs.
- Palm says that as of June 2001, over 16 million Palm devices have been sold.
- Dataquest says that global PDA sales will be about 14 million units this year and may reach 33 million in 2004.
- Aberdeen expects overall handheld sales to grow by 30 percent a year through 2005, bringing total sales to 39 million units.
- Strategic Analytics predicts 85 million units by 2006.

What about Tablet PCs and WebPADs?

- Tablet PC

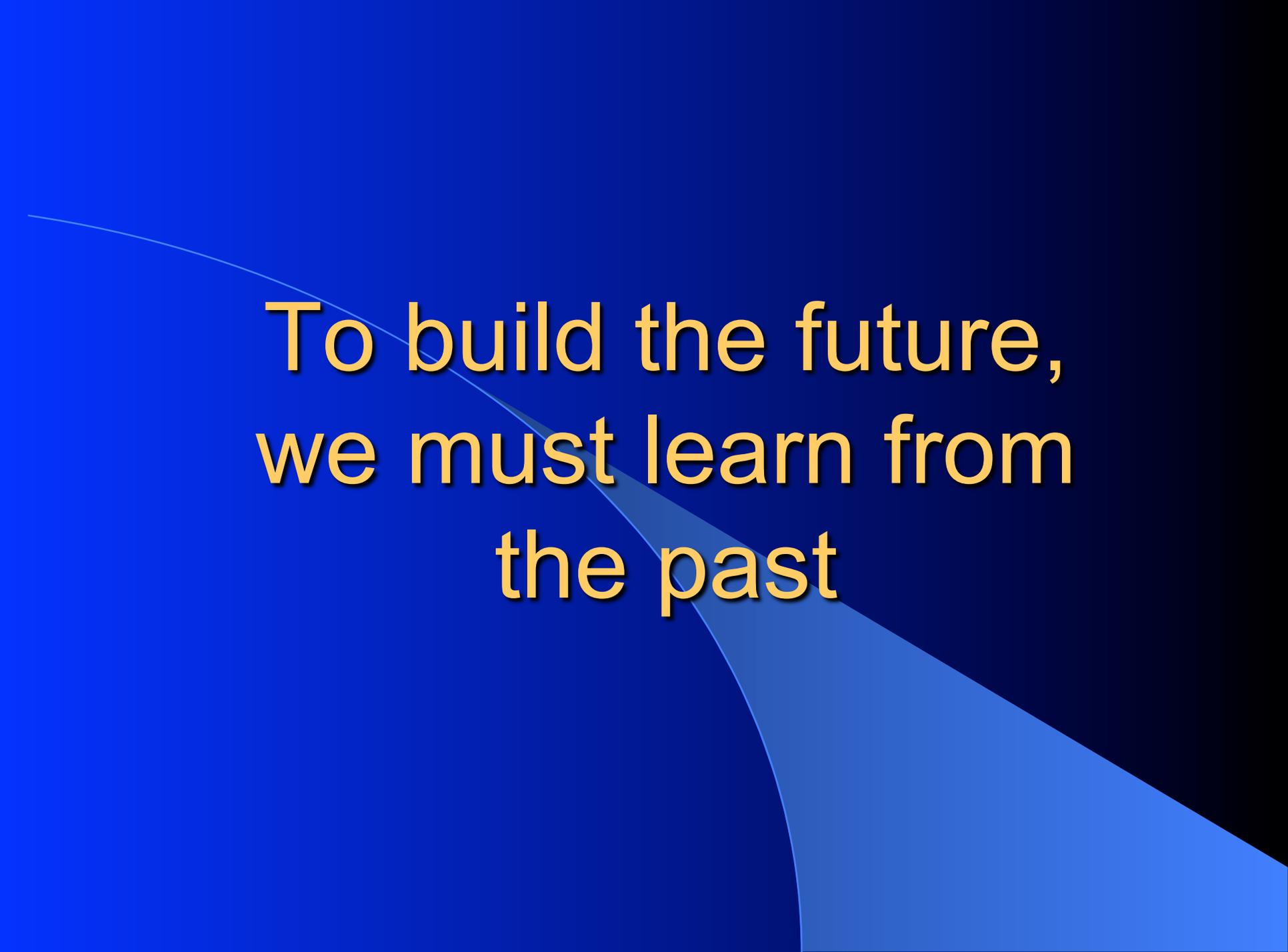
- Introduced Comdex 2000
- Demos Comdex 2001
- Full notebook functionality
- Windows XP + pen/voice overlay
- Compaq, FIC, Toshiba, Fujitsu, Acer/Wistron, etc.

- WebPADs

- Pioneered by National Semiconductor
- “Not a computer”
- Base, cradle, tablet
- E-Lab, FrontPath, View-Tech, AboCom Honeywell, Hitachi, Palmax, RSC, Philips, FIC, etc.

Tablet PC chance of success

- Informal estimates:
 - 2003: 2-4% of all notebooks might be Tablet PC
 - Microsoft: As many as a million Tablet PCs in 2003
 - 2005: 50% of 50 million notebooks will use Windows XP Tablet PC Edition
 - Even if only one in five is a tablet, that is 5 million pen tablets.
- Pen Computing Magazine estimate:
 - 50% chance that first generation succeeds (June 2001)
 - 20% chance that first generation succeeds (Sept. 2001)

The background is a solid blue color. A white curved line starts from the top left and curves downwards towards the center. A white triangular shape is positioned in the lower right quadrant, pointing towards the center. The text is centered in the upper half of the image.

To build the future,
we must learn from
the past

History of pen computing

- **1914:** Goldberg gets US patent for recognition of handwritten numbers to control machines
- **1938:** Hansel gets US patent for machine recognition of handwriting
- **1956:** RAND Corporation develops digitizing tablet for handwriting recognition
- **1957-62:** Handwriting recognition projects with accuracies of 97-99%
- **1963:** Bell Labs develops cursive recognizer
- **1966:** RAND creates GRAIL, similar to Graffiti

Pioneer: Alan Kay



Dr. Alan Kay:
Utah State University
Stanford University
Xerox PARC
Apple Computer
Disney

The Dynabook will be a “dynamic medium for creative thought, capable of synthesizing all media – pictures, animation, sound, and text – through the intimacy and responsiveness of the personal computer.”

(Alan Kay 1968 description of a notebook tablet computer, the “Dynabook”)

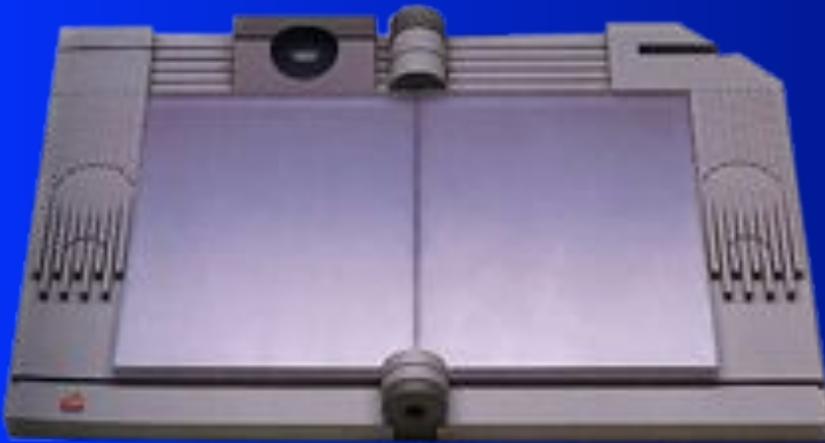
History of pen computing

- **1970s:** Commercial products, including kana/romanji billing machine
- **1980s:** Handwriting recognition companies
 - Nestor
 - Communication Intelligence Corporation
 - Lexicus
 - Several others

Pioneers: Apple



- 1987 Apple prototype
 - Speech recognition
 - Intelligent agents
 - Camera
 - Folding display
 - Video conferencing
 - Wireless communication
 - Personal Information Manager



“Knowledge Navigator”



In 1987, Apple Computer developed the Knowledge Navigator. It added speech recognition, audio, video, and intelligent information retrieval to the “Dynabook” concept.

Early Pen Computers: Momenta

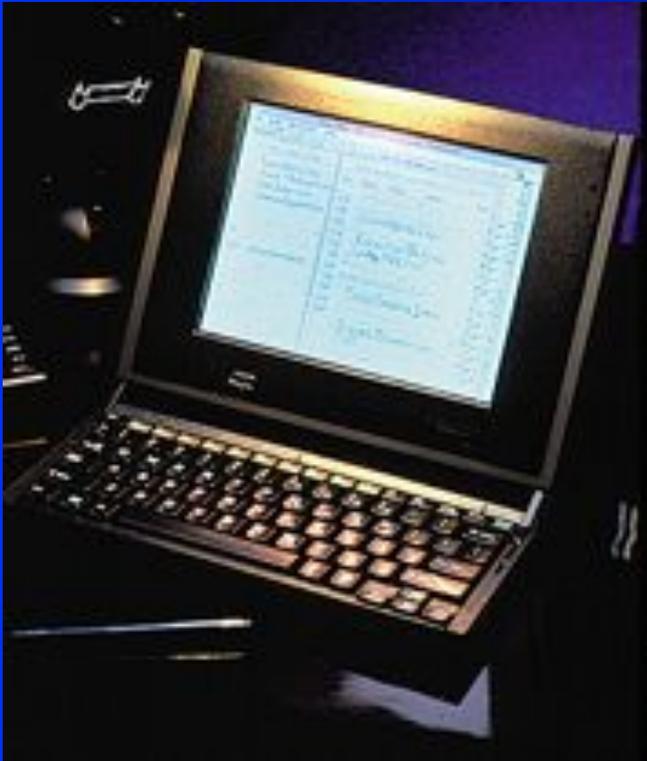
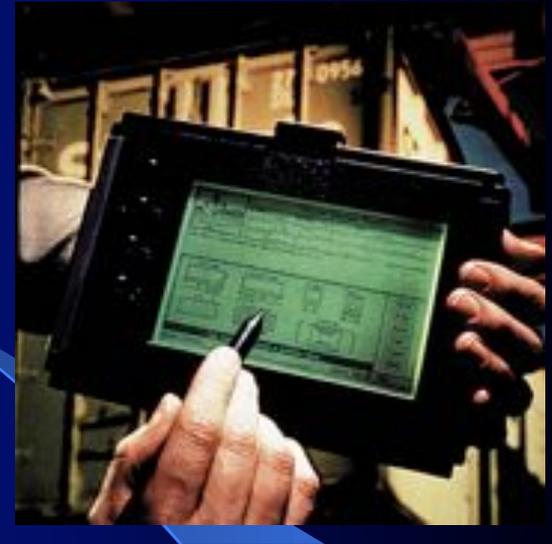


- Founded 1989 by Iranian Kamran Elahian
- Introduced October 1991
- 386/20, advanced design
- US\$40 million in VC capital
- Failed and closed in 1992

Early Pen Computers

GRiD

Jeff Hawkins designed the GRiD Convertible, GRiDPAD, GRiD PalmPad



Pen Computing Hype

- **1991:** Hype is building!
 - Pen as the next interface
 - Pen may replace keyboard
 - GRiD builds pen computer that runs PenDOS
 - GO Corporation finalizes PenPoint
 - EO founded to build PenPoint pen computers
 - But more power needed to run PenPoint and PenWindows

Pen Computing Hype

“The impact of pens on computing will be far greater than the mouse. The two key benefits—extreme portability and ease of use—will enable tiny, low-cost PCs that will appeal to a broader spectrum of users than ever before. Imagine “smart paper” that can do everything paper can as well as recognize objects, do calculations, neatly organize, duplicate and transmit itself.”

Greg Slyngstad, General Manager

Microsoft Pen Computing Group, November 1991

Pen Computing Hype

- **1992:** Products arrive
 - GO releases PenPoint in the spring of 92
 - Truly pen-centric
 - But steep learning curve
 - Lexicus Longhand handwriting recognition
 - Microsoft releases Windows for Pen Computing
 - Layer on top of Windows
 - But runs all existing Windows applications
 - Momenta creates its own Interface

1st Wave of Pen Tablets

- **1992-1994**
- 386 or 486 processor
- 4-8MB of RAM
- Windows for Pen Computing/PenPoint
- PC Card slots
- Clipboard format
- 3 to 4.5 pounds
- Active digitizer (Wacom or Kurta/Mutoh)
- 6 to 8-inch monochrome LCDs

Early Pen Computers

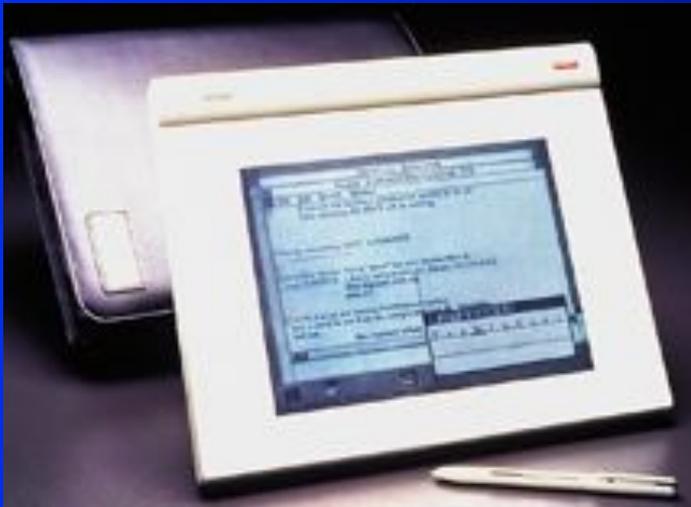
AT&T EO 440



- November 1992
- PenPoint OS
- Excellent product
- Larger 880 model had cellphone option
- Sold by Dell for a while
- AT&T stopped production and closed GO/EO in 94
- US\$70 million VC money lost

Early Pen Computers

NCR NotePad 3125



- Late 1992
- First pen tablet to run Pen Windows or PenPoint
- Weighed just over 4 pounds
- Four hour battery
- 3130 model adds backlight

Early Pen Computers

Samsung PenMaster



- Late 1992
- Also sold as GRiDPad SL
- Intel 386/16, backlight
- PenPoint or PenWindows
- Wacom digitizer, edged screen
- 2 PC Card slots
- Great design!

Early Pen Computers

Dauphin DTR-1



- 1992/93
- “Desk Top Replacement”
- Intel 486SLC/25
- PenWindows
- 2.5 pounds
- Sold in computer chains
- Later more powerful DTR-2 and Orasis
- Lost US\$50 million, bankrupt
(restructured now)

Early Pen Computers

Fujitsu 325Point



- 1993
- Am 386SXLV/25
- PenWindows/PenPoint
- 8.7 x 11.7 x 1.2 inches
- 3.0 pounds
- US\$1,695
- Predecessor of famous Stylistic models

Early Pen Computers

TelePAD SL



- 1993/94
- Intel 386SL/25
- 11 x 11 x 1.3 inches
- 4.5 pounds
- PenWindows/PenPoint
- Field force solution
- Later futuristic TelePad 3

Early Pen Computers

Compaq Concerto



- 1993/1994
- 486/25 and 486/33
- 250MB HD
- Active digitizer
- PenWindows
- Detachable keyboard
- Tablet PC....?

Early Pen Computers

Toshiba T200 “DynaPad”



- 1994
- Intel 486DX2/40
- 5 hour battery!
- 9.5” Color or b&w
- Wacom digitizer
- US\$ 2,449

Early Pen Computers

IBM ThinkPad 360P



- 1994
- Intel 486SX/33
- Convertible screen
- 2 PC Card slots
- 9.5-inch Color DSTN
- Pen Windows/PenDOS
- US\$2,899

Early Pen Computers

IBM ThinkPad 700/710/730



- 1993/94
- The original ThinkPad
- Wacom digitizer
- Paperlike surface
- Intel 486/33
- 2 PC Card slots
- Pen Windows/PenPoint
- 3.5 pounds

Crash 1993/94

- Momenta closes doors (1992)
- Samsung gives up after PenMaster
- NCR drops out
- GRiD sold to AST, liquidated
- Dauphin bankrupt
- AT&T buys GO/EO, EO bankrupt Aug 94
- Slate closes February 1994
- Compaq, IBM, NEC stop pen projects

Pens in Vertical Market

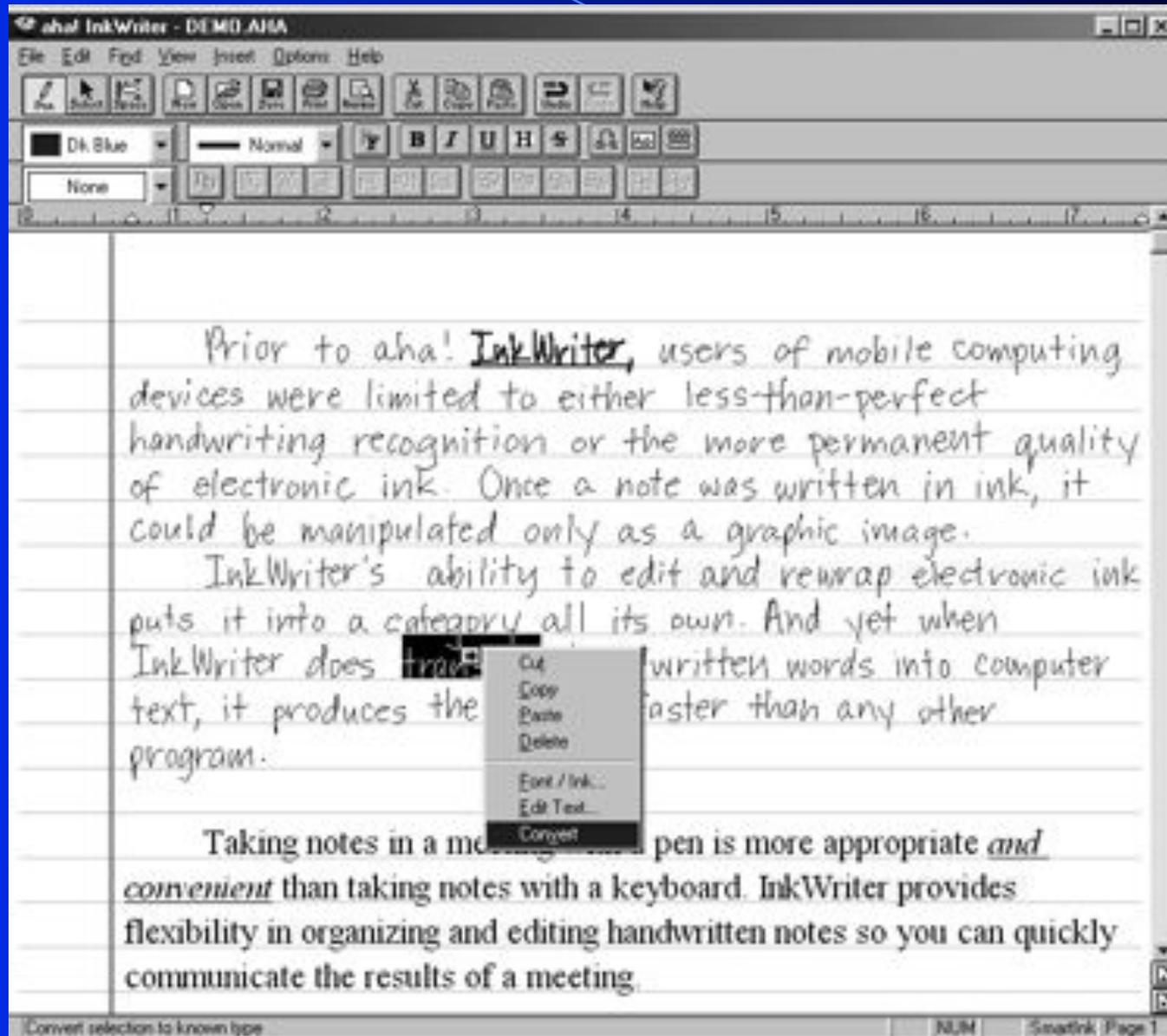
- After '94, pen computers in vertical/industrial markets
 - Symbol
 - Telxon
 - WalkAbout
 - Xplore
 - Intermec
 - Husky
 - Many others



Aha! InkWriter

- Ink processor for PenPoint and Pen Windows
- Introduced in June 1993 by aha! Software Corporation
- Smart ink, image processing, recognition
- Purchased by Microsoft
- Used in Windows CE Handheld PCs
- Technology returns in upcoming Tablet PC!

Aha! InkWriter



Handwriting Recognition

- The “Holy Grail” of pen computing
- Much more difficult than anticipated
- Different writing styles
 - Printed vs. cursive
 - Neat vs. sloppy
- Different methodologies
 - Trainable vs. “walk-up”
 - Character-based vs. word-based

Handwriting Recognition

- Problems/challenges
 - Ambiguity in Western alphabets
 - Some character and number cannot be distinguished
 - Sloppy handwriting
 - “It’s the computer’s fault”
 - Poor digitizers
 - Poor editing tools
 - Computer cannot “fill in the blanks”

Handwriting Recognition

- Some of the major products:
 - CIC Handwriter (still available to VARs)
 - ParaGraph CalliGrapher (now Microsoft Transcriber)
 - NestorWriter (Nestor primarily into OCR)
 - Lexicus Longhand (first cursive recognizer)
 - ART smARTwriter (still available)
 - Microsoft MARS and GRECO (part of Windows pen extensions)
 - Apple “Rosetta” (not used since Newton)

Newton MessagePad



- Introduced Summer 1993
- ARM 610 processor
- 240 x 320 screen
- Newton OS
- 4MB ROM
- US\$599 and more

Apple Newton

- In 1993, cartoonist Gary Trudeau made fun of the Newton's handwriting recognition in several strips



Newton Evolution



- Feb 94: MP110
 - Better recognition
 - Screen lid
 - AA batteries
- Mid 95: MP120
 - Newton OS 2.0 (Nov. 95)
- Mid 96: MP130
 - Backlight!
- Apr 97: MP2000
 - 190MHz StrongARM
 - 2 PC Card slots

Early PDAs: Amstrad PenPad



- 1993
- Eden Group, UK
- First PDA in US, Europe
- 3 Zilog Z80 CPUs
- PC Card slot
- US\$399

Early PDAs: Zoomer



- Created by Jeff Hawkins
- Sold as:
 - Tandy Zoomer (“Consumer”)
 - GRiDPAD 2390
 - Casio Z-7000
- GEOS OS
- PC Card slot
- Lots of software
- Inspired by Sony PalmTop PTC-310

Early PDAs: Envoy/Marco



- Motorola's Wireless PDAs:
- Envoy
 - Magic Cap OS
 - Packet Radio
- Marco
 - Newton OS
 - Packet Radio
- Both too big, too expensive, and probably ahead of their time

Early PDAs: Sharp Zaurus

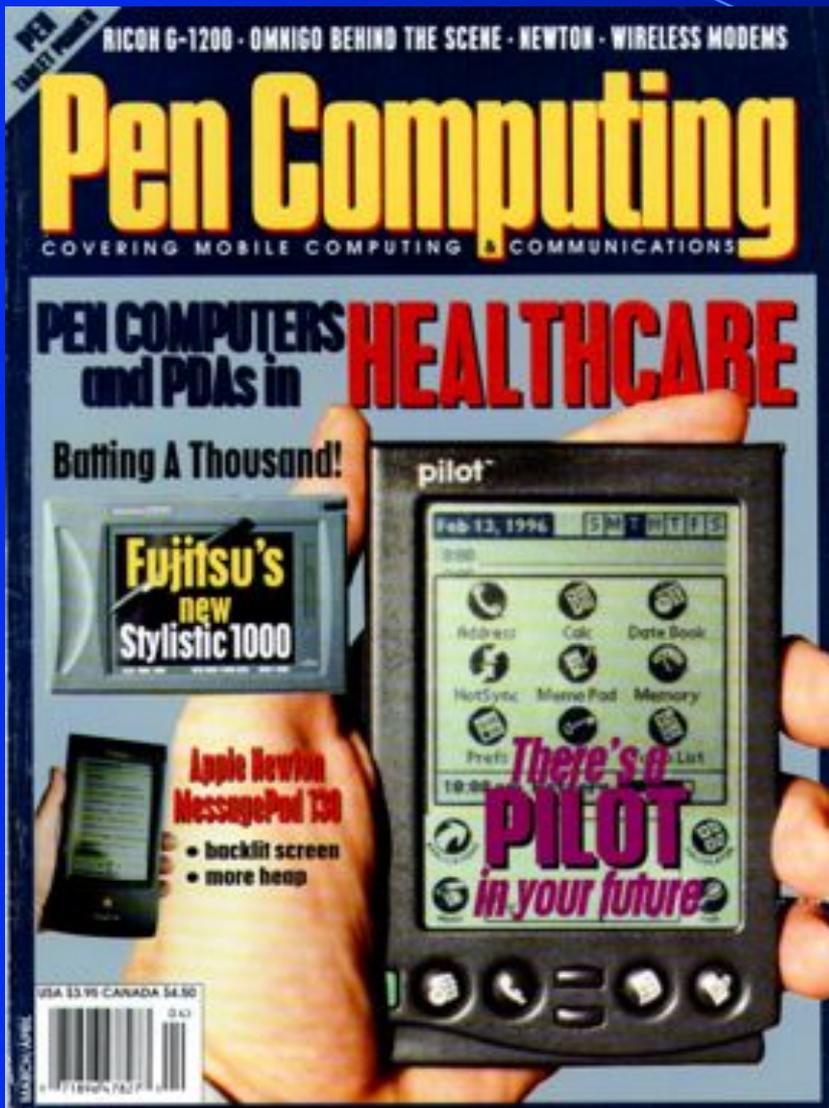
- 1995
- Unlike Japanese Zaurus line, US line had keyboard
- “K-PDA” (Keyboard PDA)
- Moderately successful
- Replaced by Windows CE devices in 1997



Graffiti

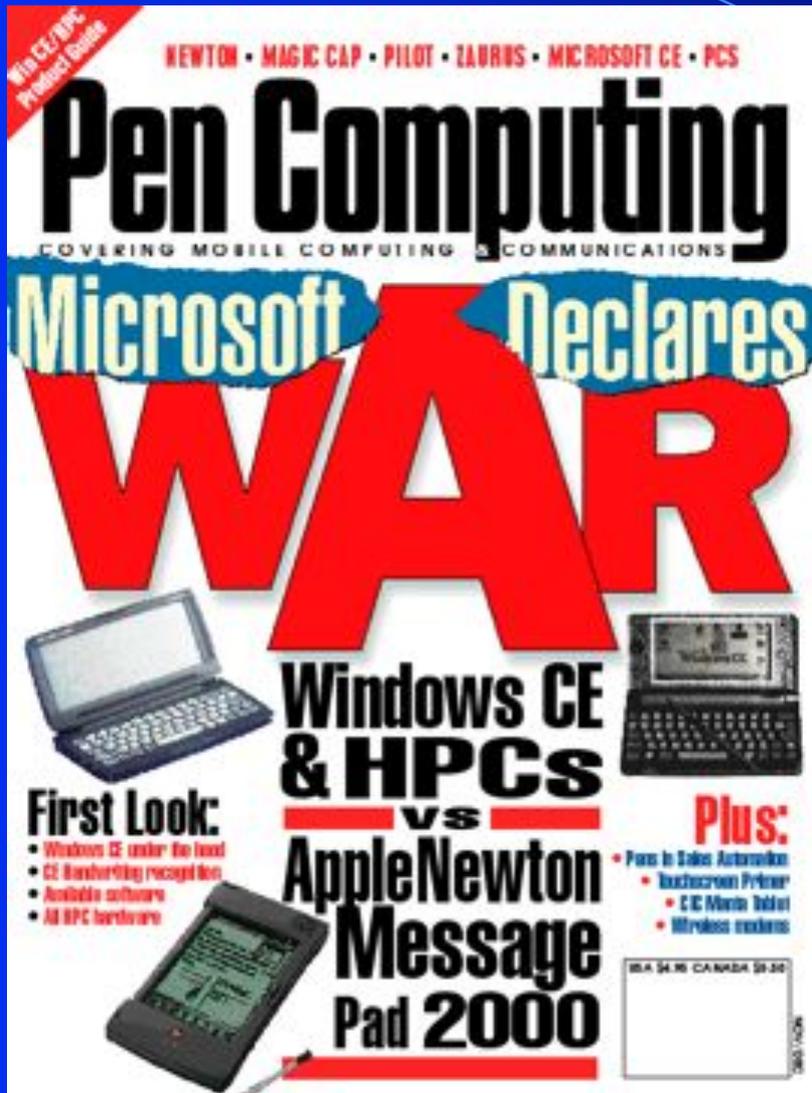


- Unistroke characters eliminate ambiguity
- Mnemonic shapes remind of alphabet
- Very fast, very small memory requirement
- Recognition accuracy near 100%
- Only problem: punctuation (.,:;”!?”- _~)



April 1996:
Palm/US Robotics
introduces
Palm Pilot

- small
- simple
- inexpensive
- no expansion
- no communication



Fall 1996:
Microsoft introduces
Windows CE at Fall
Comdex, Las Vegas

- Hewlett Packard
- NEC
- Philips
- LG Electronics
- Casio



January 1998:
Microsoft introduces
Palm PC

- Everex
- Palmax
- Casio
- Compaq
- Philips



June 1999: Multimedia Palm-size PCs

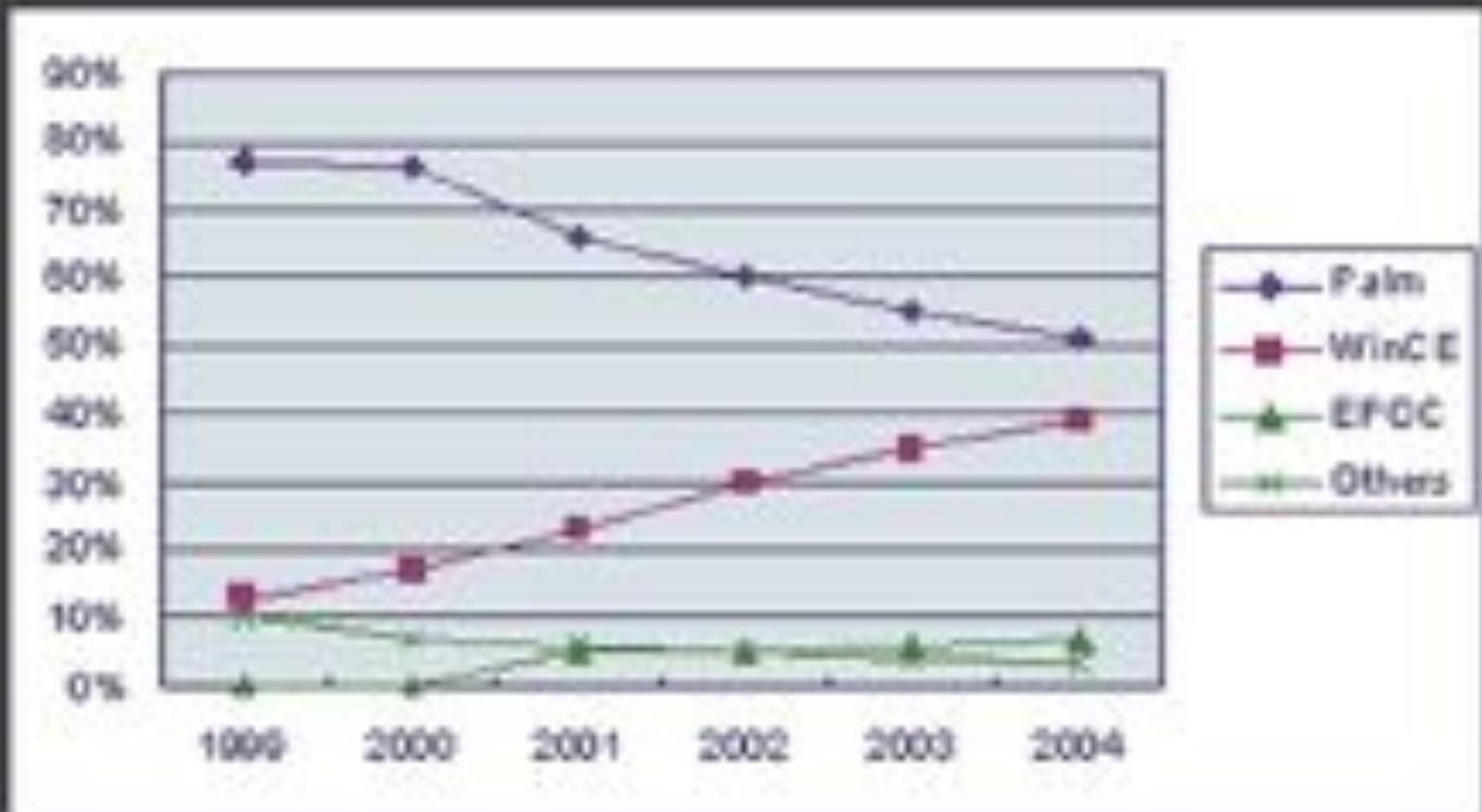
- HP
- Casio
- Compaq
- Philips



April 2000:
Microsoft introduces
Pocket PC

- HP
- Casio
- Compaq
- Symbol

Palm vs. Microsoft



OS Market Share, compiled by Digitimes

Palm vs. Microsoft

- Palm

- 75% global marketshare
- Fast and simple
- Aging OS
- Pushed to the limit
- 16 million sold
- Small company
- Very focused
- Low margin products
- Strong in wireless

- Pocket PC

- Gaining marketshare
- Complex
- Part of .NET
- Very powerful
- 2 million sold
- Huge companies
- No united front
- High margin products
- Wireless just beginning

► CHOOSING A MOBILE PLATFORM ► TOSHIBA'S NEW POCKET PC

Pen Computing

COVERING MOBILE COMPUTING COMMUNICATIONS

Pocket PC 2002

Featuring a vastly improved user interface, real networking, 200MHz+ CPUs, 64MB+ memory, MS Messenger, & digital media.

Look out, Palm.

UP to 100MB RAM
starting Pocket PC 2002

IS THIS THE FIRST TABLET PC?

Viewsonic's radical new
ViewPad

Sony CL5166115
starting \$499 (US \$600)

USA \$699 CANADA \$815

Handhelds
in Education

The image shows the cover of 'Pen Computing' magazine. At the top, it says 'CHOOSING A MOBILE PLATFORM' and 'TOSHIBA'S NEW POCKET PC'. The main title is 'Pen Computing' in a large, stylized font. Below it, the subtitle is 'COVERING MOBILE COMPUTING COMMUNICATIONS'. The central focus is 'Pocket PC 2002', with a sub-headline: 'Featuring a vastly improved user interface, real networking, 200MHz+ CPUs, 64MB+ memory, MS Messenger, & digital media.' Below this, it says 'Look out, Palm.' There are two images of mobile devices: a Sony PDA on the left and a Toshiba Pocket PC on the right. At the bottom, there's an advertisement for 'Viewsonic's radical new ViewPad' with the text 'IS THIS THE FIRST TABLET PC?'. There are also some smaller text elements like 'UP to 100MB RAM starting Pocket PC 2002' and 'Handhelds in Education'.

Fall 2001: Release of Pocket PC 2002

- “Windows XP look”
- More polished
- More reliable
- ARM only
- Flash ROM
- Better security
- Corporate focus
- Reflective LCDs

Recipe for PDA success:

- Battery life is essential
 - 6-10 hours is not enough. Go for 20 hours.
 - Offer snap-on extended batteries
- Screen quality
 - Only the best TFT is good enough
- Color is important
 - Black and white only for very low cost PDAs
 - 16-bit color or better mandatory

Recipe for PDA success:

- Reflective/transmissive display?
 - New Pocket PCs all use reflective
 - Offer both standard and reflective
- Flash memory!
 - Data loss on dead battery is unacceptable
 - Move to Flash storage of user data
- Expansion card problem
 - Too many standards!
 - Agree on one or two

Recipe for PDA success:

- **Wireless connectivity important**
 - Offer internal 802.11b, perhaps Bluetooth
 - Offer internal “always-on” packet radio
- **Industrial design**
 - Know US consumer taste
 - Learn from Palm V and iPAQ
- **Color and materials**
 - Business tool versus “toy”
- **Packaging**
 - Lots of shelf space → eye-catching packaging

Recipe for PDA success:

- Marketing/advertising
 - Consumers still must be educated to PDAs
 - Some US firms do a good job, others do not
 - Example: Microsoft: “We will not be advertising in any mobile magazines as we have a different focus.”
- Screen lid to prevent scratching
- Power supply
 - Small, don't hog the power strip
 - Clearly marked
- Improve quality of voice recorder

Future of Tablets and Pads?

- We KNOW that PDAs work because tens of millions have been sold
- We don't know if tablet computers work as they have failed in the past
- Let's see why they failed and what has changed

Pens: 1992 vs. 2001

- 1992: Hardware not advanced enough
 - Same hardware worked fine with notebooks
 - Hardware was never the primary problem
- 1992: Handwriting recognition didn't work
 - True, and not much progress has been made
 - However, faster hardware helps!
- 1992: Pen computers too expensive
 - Cost of digitizer added US\$500-1000
 - Pen computers must not be more expensive!

Pens: 1992 vs. 2001

- 1992: People lost expensive pens
 - Still a problem with active digitizer
 - Use backup (pointing device, touch screen)
- 1992: No communication
 - Include wireless radio (802.11, BlueTooth, etc.)
- 1992: OS not optimized for pen!
 - May still be true
 - Let's hope Microsoft gets it right

Tablet PC: Gates Comdex Keynote



1/3 of Bill Gates' keynote at 2001 Comdex was on Tablet PC

“...an entirely new breakthrough generation of the PC.”

“I'm already using a Tablet as my everyday computer.”

Demonstrates prototypes of Tablet PCs from various vendors

“...within five years I predict it will be the most popular form of PC sold in America.”



Tablet PC: Fall 2001

Acer TravelMate

(shown at Comdex Tablet PC press event)



Ultraportable convertible notebook with 10.4-inch TFT

Tablet PC: Fall 2001

Compaq

(shown at Comdex Tablet PC press event)



Concept only;
actual product
will be different.
Different size,
same style as
popular iPAQ

Tablet PC: Fall 2001

FIC Crystal/Thunder

(shown at Comdex Tablet PC press event)



Tablet PC
concepts with
10.4-inch XGA
TFT; Crystal uses
Transmeta 5800.
Thunder Mobile
Pentium III

Tablet PC: Fall 2001

Fujitsu PC

(shown at Comdex Tablet PC press event)



Tablet PC
concept based
on Stylistic
3500 pen tablet,
but uses
WACOM active
digitizer

Tablet PC: Fall 2001

Tatung

(shown at Comdex Tablet PC press event)



Very polished
“book-style”
concept using
700MHz Mobile
Pentium III,
10.4” XGA TFT

Tablet PC: Fall 2001

Toshiba

(shown at Comdex Tablet PC press event)



Small form
factor Tablet PC
concept with
VGA display

Tablet PC: Fall 2001

VIA

(shown at Comdex Tablet PC press event)



Elegant
reference
design with
VIA
motherboard,
processor,
and chipsets

Tablet PC: Fall 2001

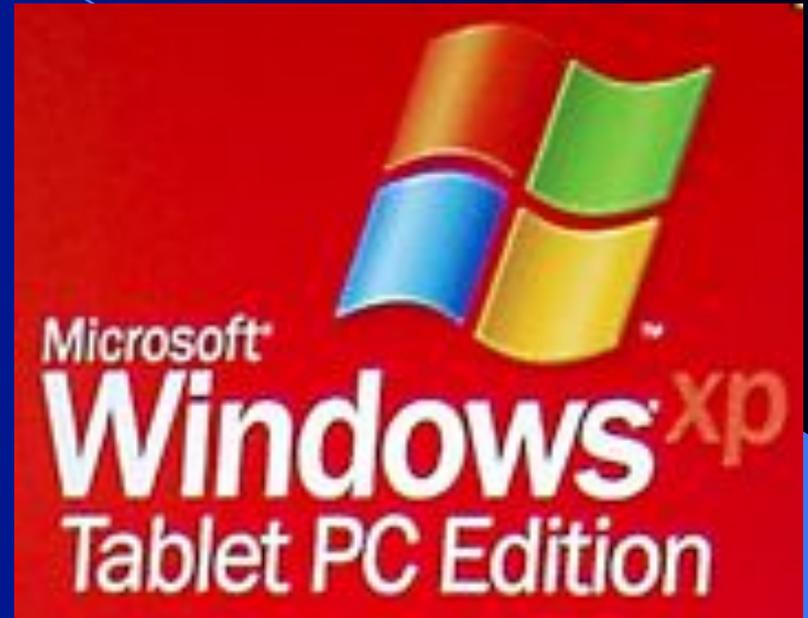
Wistron

(shown at Comdex Tablet PC press event)



Slim, elegant
“book-style”
Tablet PC

Tablet PC: Comdex Demos



Tablet PC demos
and prototypes all
over Fall Comdex
in Las Vegas

More Webpads and Tablets

DT Research WebDT



Comdex 2001:
dozens of pen-based
tablets running
Windows, Windows
CE, or Linux

Innolabs Evita



PaceBlade PaceBook



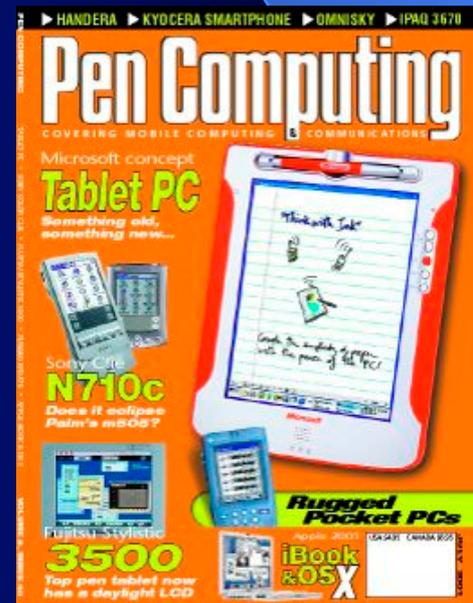
AirSpeak FLAIR



VOIX IP-Station



Webpads and Tablet PCs may become an important new category in addition to notebooks and desktops



Recipe for Tablet PC success:

- Microsoft!!!
 - If Microsoft doesn't get it right, the Tablet PC will fail
- Marketing
 - Emphasize ink and convenience, NOT recognition
 - Pen must be seen as value added
- Pricing
 - Must be affordable; no price premium for pen
- Design
 - New, exciting designs
 - Different form factors
 - Include wireless

Recipe for Tablet PC success:

- Design

- No annoying fan
- Reliable, fast instant-on, instant-off
- Must not get hot even after hours of use
- Backup for active digitizer (touch screen/touch pad, etc.)
- ClearType must work in portrait mode!

- Software

- Not just standard software that also works with pen
- Reliable screen rotation
- Reliable, convenient on-screen keyboard

Thank you and
good luck!