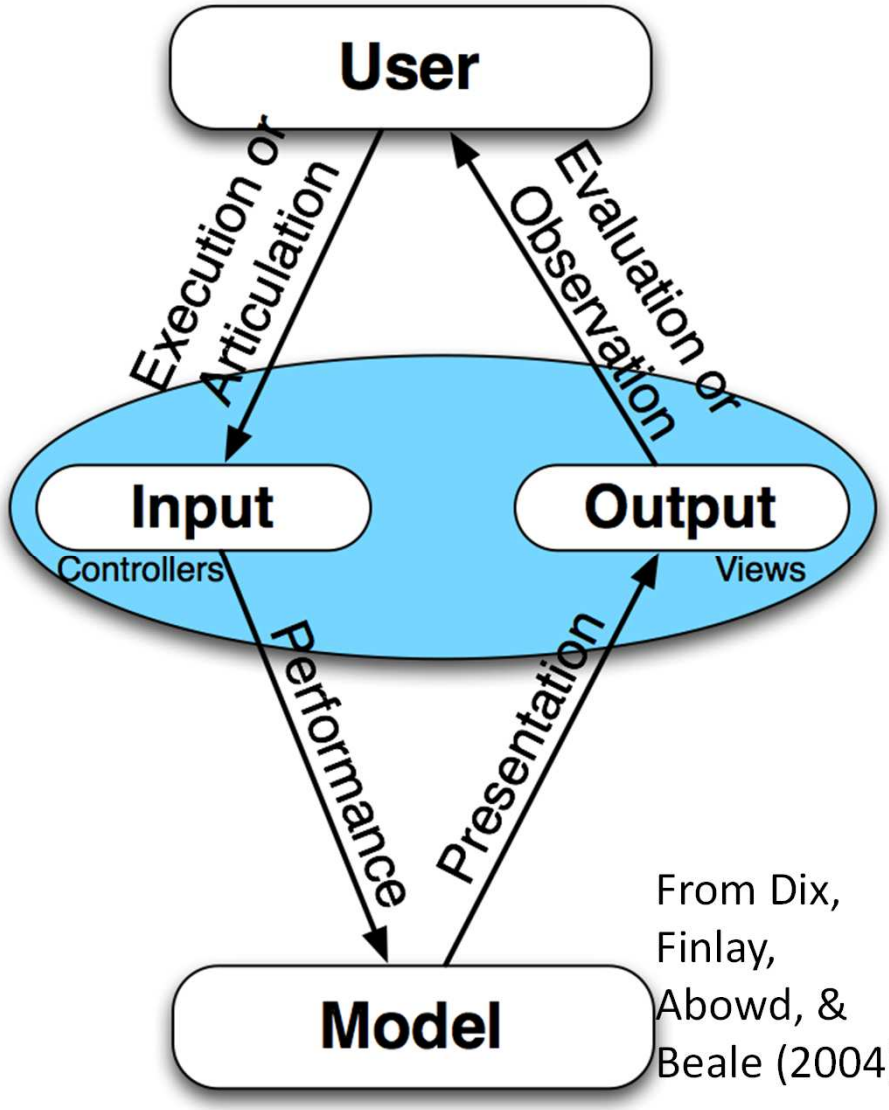
History

The History of Interaction…

- History of interaction is the history of making the input and output languages of the machine closer to the language of the user and their tasks
- Interaction has evolved from forms that favored the machine (when its time was more valuable) to those that favor the user

Interactive Cycle

- User formulates a goal & a plan to achieve it
  - Executes actions in the UI intended to achieve goal
  - Controllers tell model to change state
  - New state is presented in the UI
  - User evaluates results against goal
- Repeat

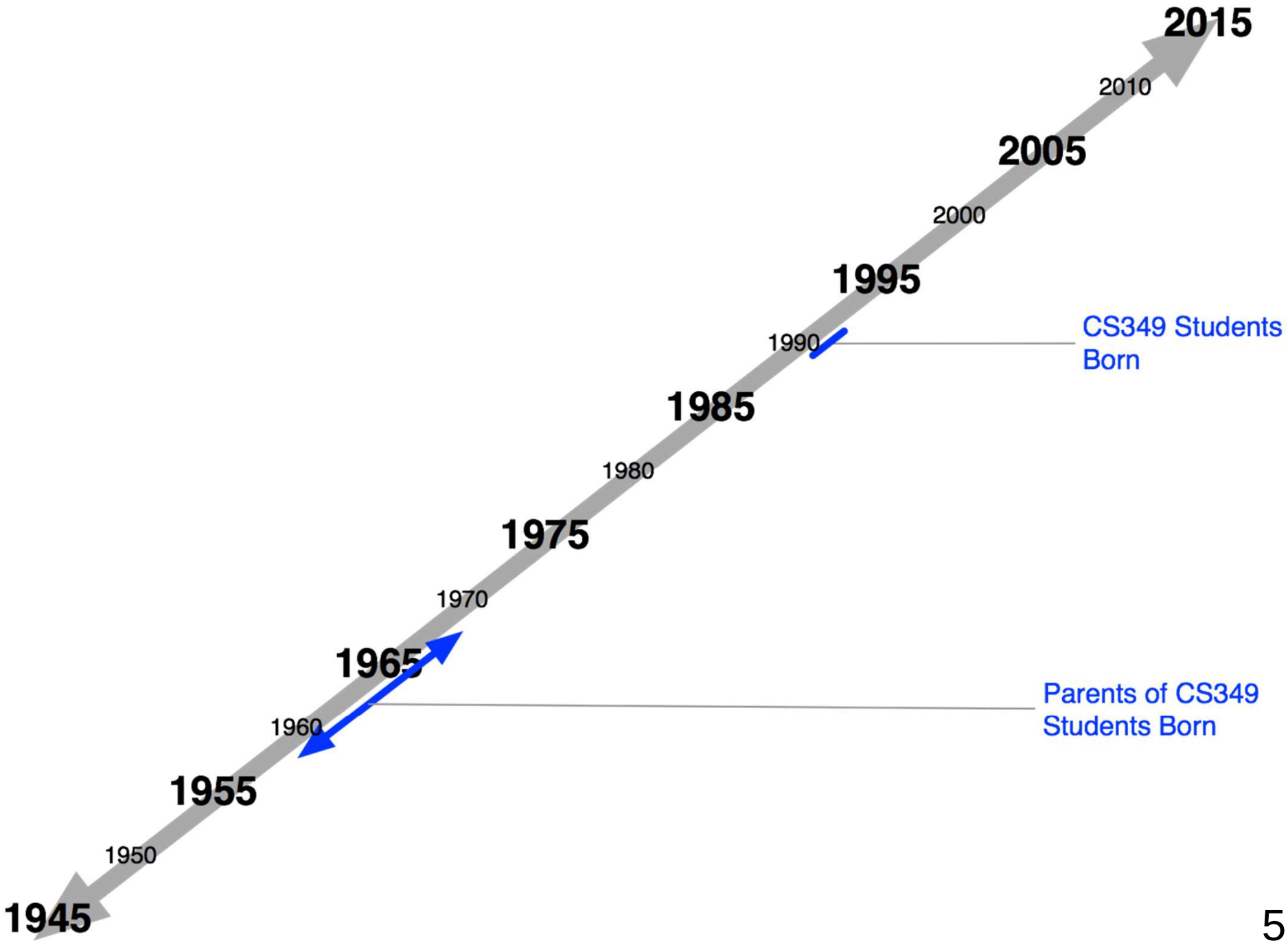


From Dix, Finlay, Abowd, & Beale (2004)

A (Brief) History of Interaction

- Major paradigms of interaction
  - Batch interfaces
  - Conversational interfaces
  - Graphical interfaces
  - “Ubicomp”

- Visionaries who inspired advances
  - Vannevar Bush
  - Douglas Engelbart
  - Ivan Sutherland
  - Alan Kay
  - Mark Weiser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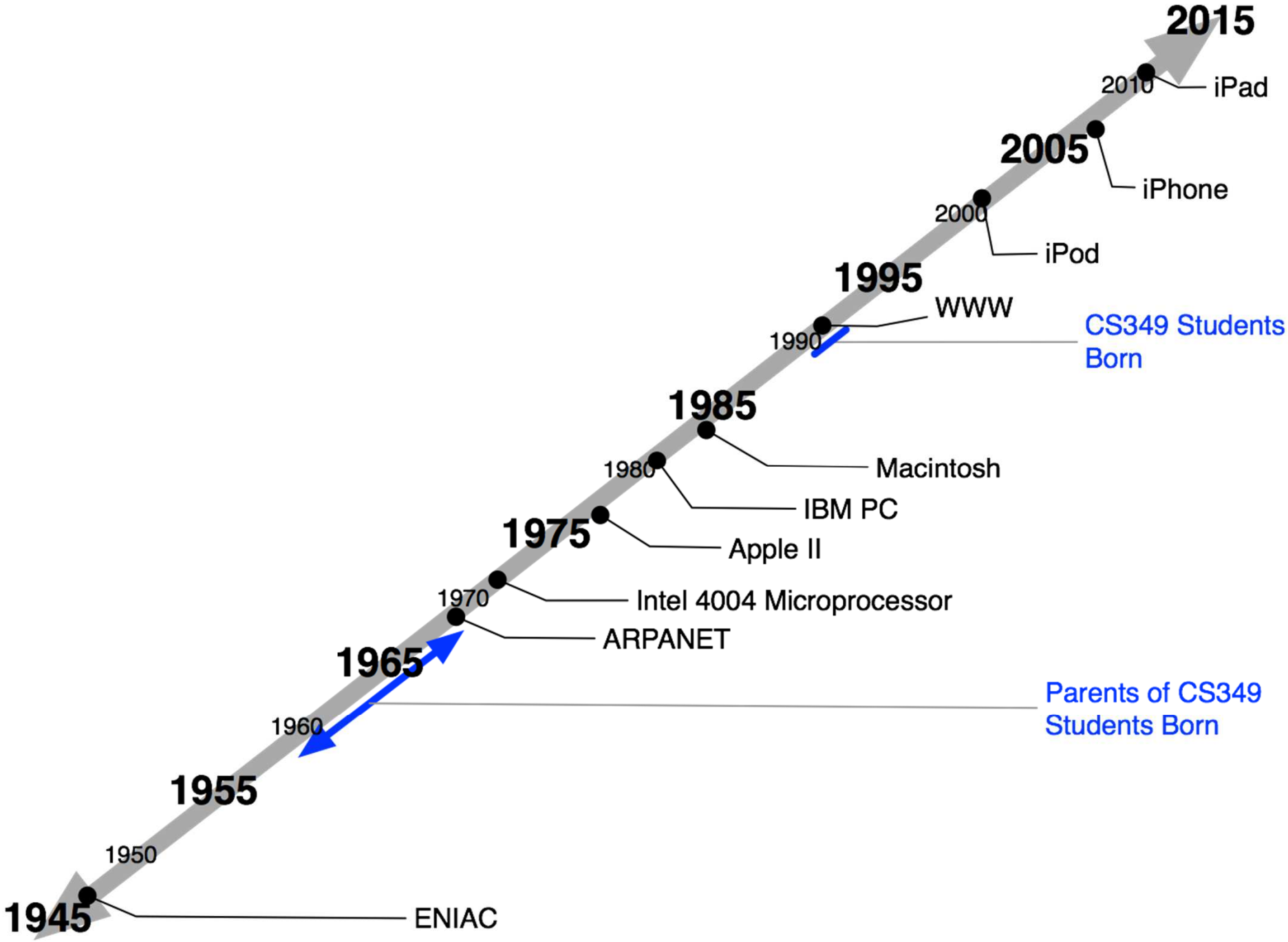
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Batch Interfaces

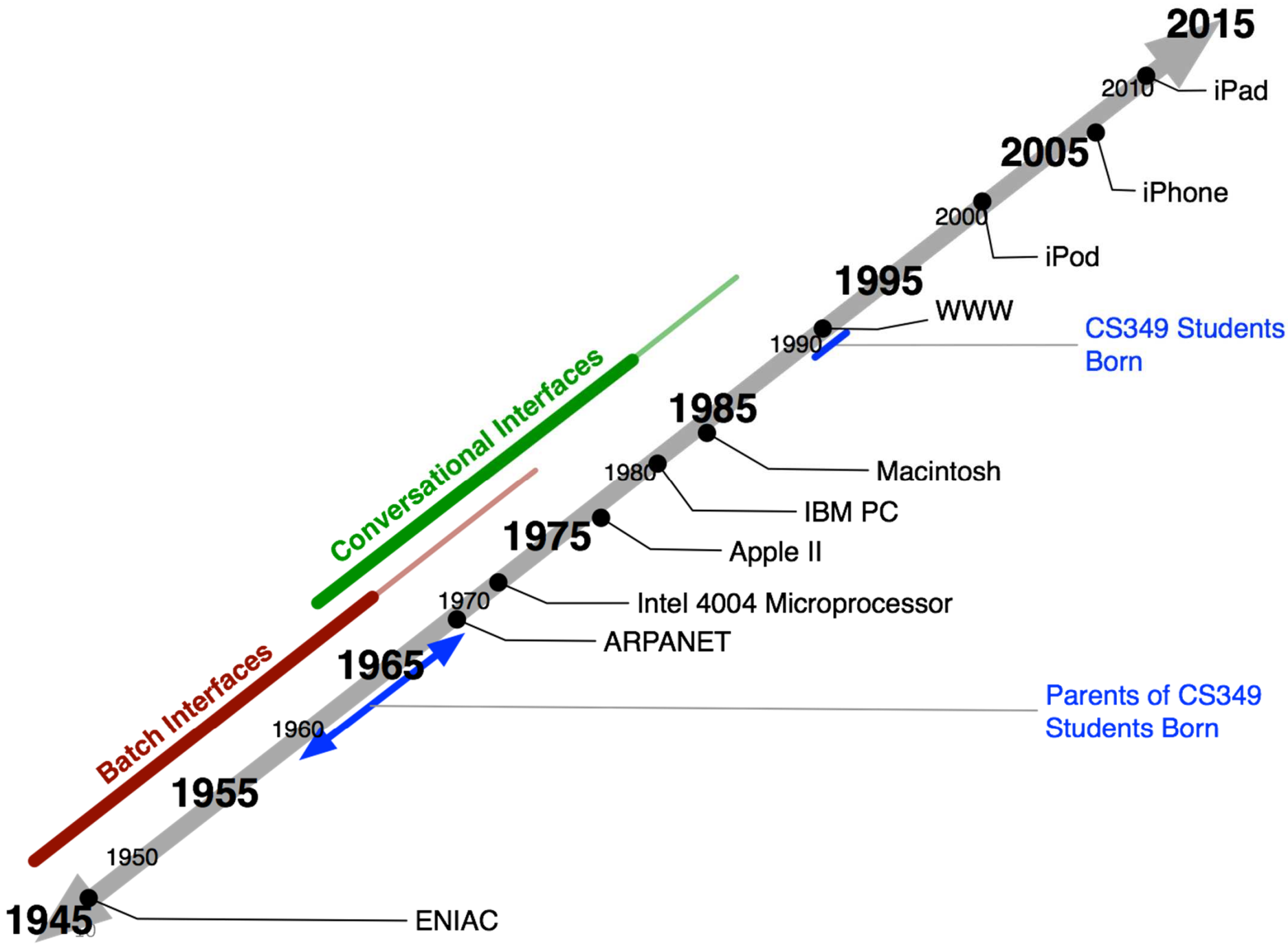
- Time period: ca. 1945-1965
- Interaction style
  - Set of instructions prepared a priori, fed to computer via punch cards, paper tape, magnetic tape
  - Response typically received via paper printout
  - No real interaction possible as system executes instructions
  - Responses received in hours, days
- Users
  - Only used by highly trained individuals
- System time costs more than human time
  - $100's/hr vs. $10-30/hr

Conversational Interfaces

- Time period: ca. 1965 – 1985+
- Command line interface
  - First commonly used interactive style
- Interaction style:
  - User types command, waits for response
  - Programs usually run to completion before response, but...
    - Feedback can be given during execution
    - User can be prompted for information during execution
  - User is guided through heavily scripted / structured interaction

Conversational Interface

- Advantages
  - Highly flexible: Can combine commands to create sophisticated sets of operations
- Disadvantages
  - Need expert users
    - Users need to understand the computer
    - I/O is in system language, not task language
  - Requires recall rather than recognition
    - What does this mean and what are consequences?
  - System in control during execution: User cannot refine execution / make modifications during program execution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Conversational Interfaces
Batch Interfaces

Recognizing User Needs

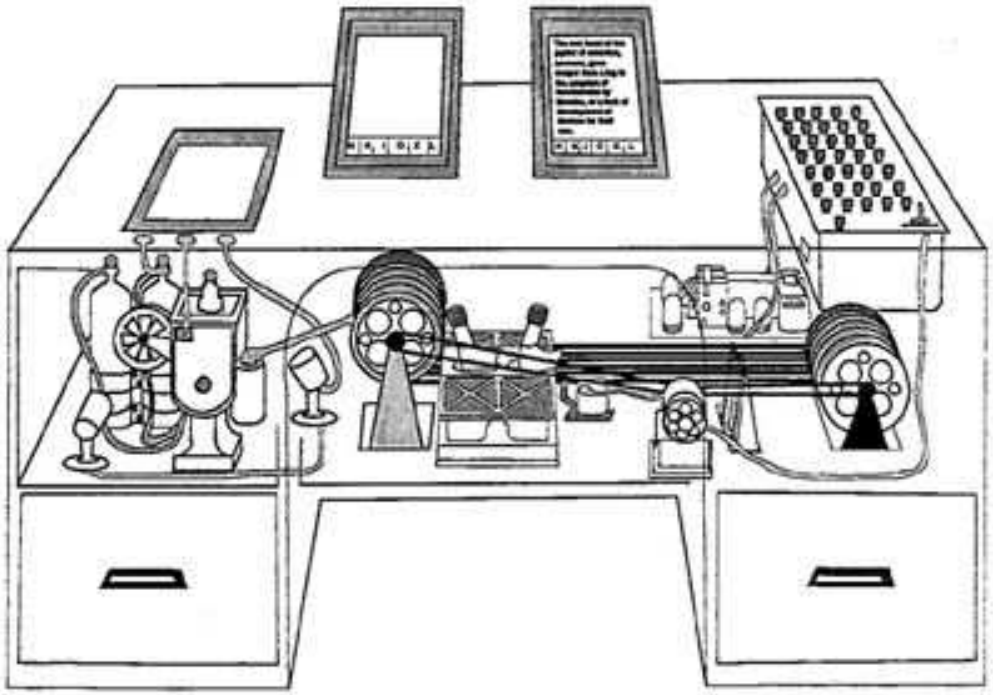
- Batch and Conversational interfaces offer interaction language closer to system language than task language
  - Onus on user to conform to system
- These interfaces were common at a time when computer's time was more expensive than a person's time
- Several visionaries imagined a different form of human-computer interaction

Vannevar Bush

- Headed Office of Scientific Research and Development
  - Manhattan project, other WWII science efforts
- 1945 article, As We May Think in The Atlantic inspires computer scientists to present day (http://www.theatlantic.com/doc/194507/bush)
- Goal was to augment human intellect

Vannevar Bush

- “A memex is a device in which an individual stores all his books, records, and communications… It is an enlarged intimate supplement to his memory.”
- Proposes associative links between content (hyperlinks)
- Dual display setup!
- Direct annotation of stored content
- Proposes direct connection to nervous system
- But hardware a long way off



Douglas Engelbart

- “By ‘augmenting human intellect’ we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems…

  [We seek] more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble…”

Augmenting Human Intellect, 1962 SRI Report

Douglas Engelbart

- Known for…
  - Creating the mouse, chording keyboard
  - Black on white display
  - Implementing hypertext
  - Demonstrates concepts such as copy/paste, computer-supported collaborative work in a 1968 live demo

Video: 9:19 - 18:15 (skip parts)

Beyond the Knowledge Worker

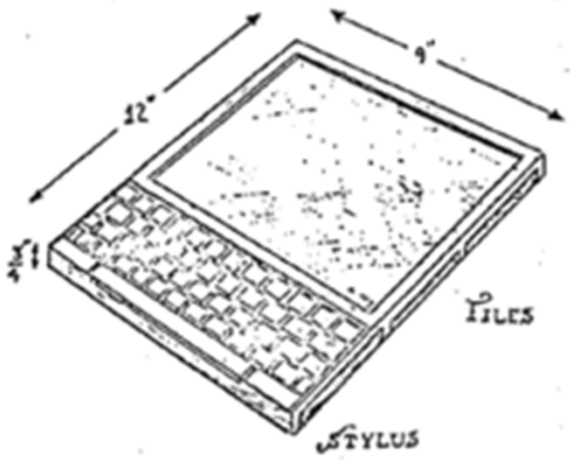
- Ivan Sutherland's Sketchpad (1963)
  - Light pen
  - Direct manipulation
  - Early "WYSIWYG"
- Expands computer domain to include artists, draftsmen, and more
- Language of interface moves substantially closer to task domains

Video: 4:04 - 9:17

Alan Kay

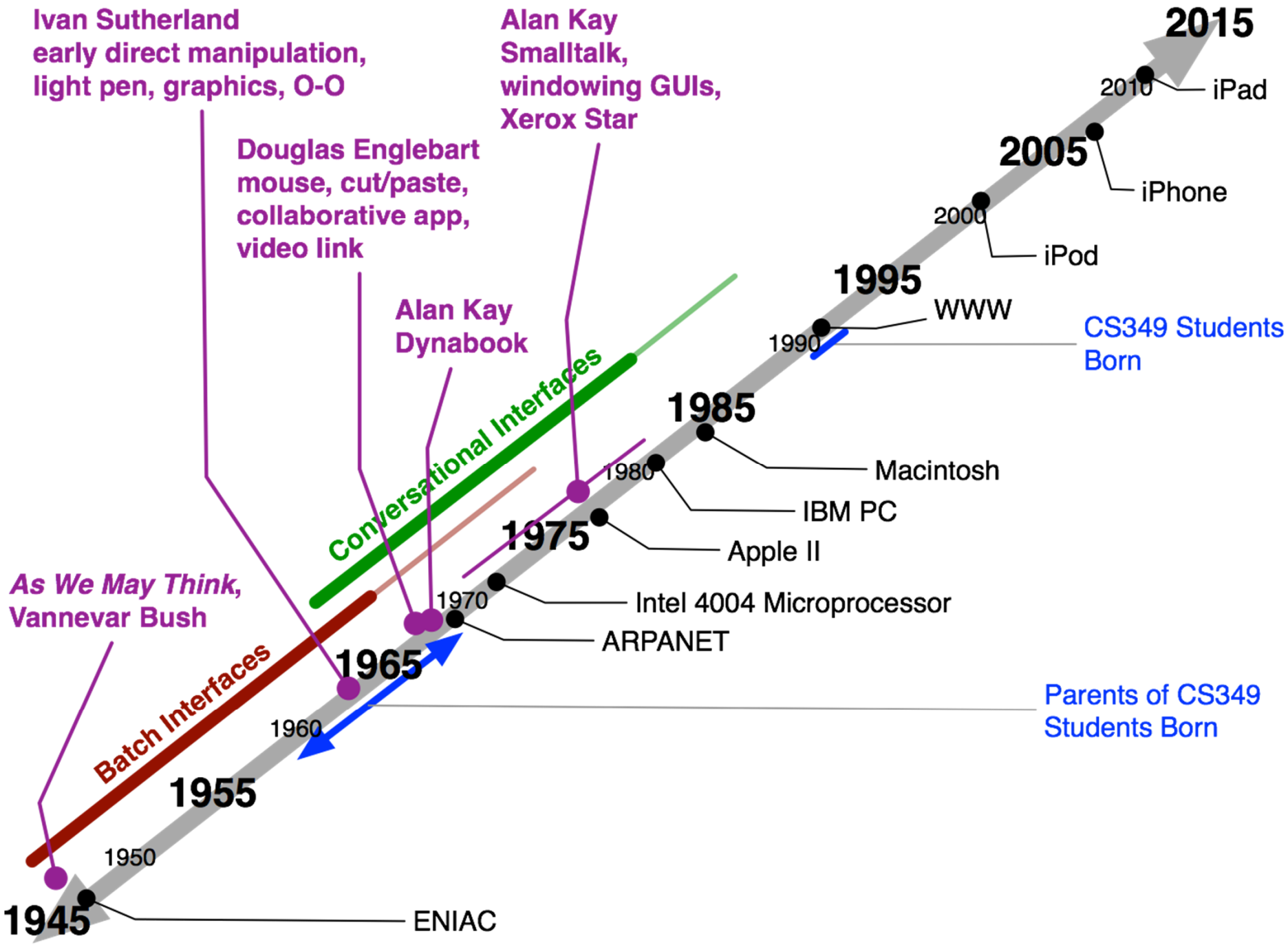
- Worked with Ivan Sutherland
- Pioneering work on
  - object-oriented programming (Smalltalk)
  - architecture for modern overlapping windowing GUIs
  - computers in education
  - Dynabook: conceptual basis for laptops and tablet computers
- Quote: "The best way to predict the future is to invent it."

Alan Kay



Dynabook

Xerox Star


Ivan Sutherland
early direct manipulation,
light pen, graphics, O-O
Douglas Englebart
mouse, cut/paste,
collaborative app,
video link
Alan Kay
Smalltalk,
windowing GUIs,
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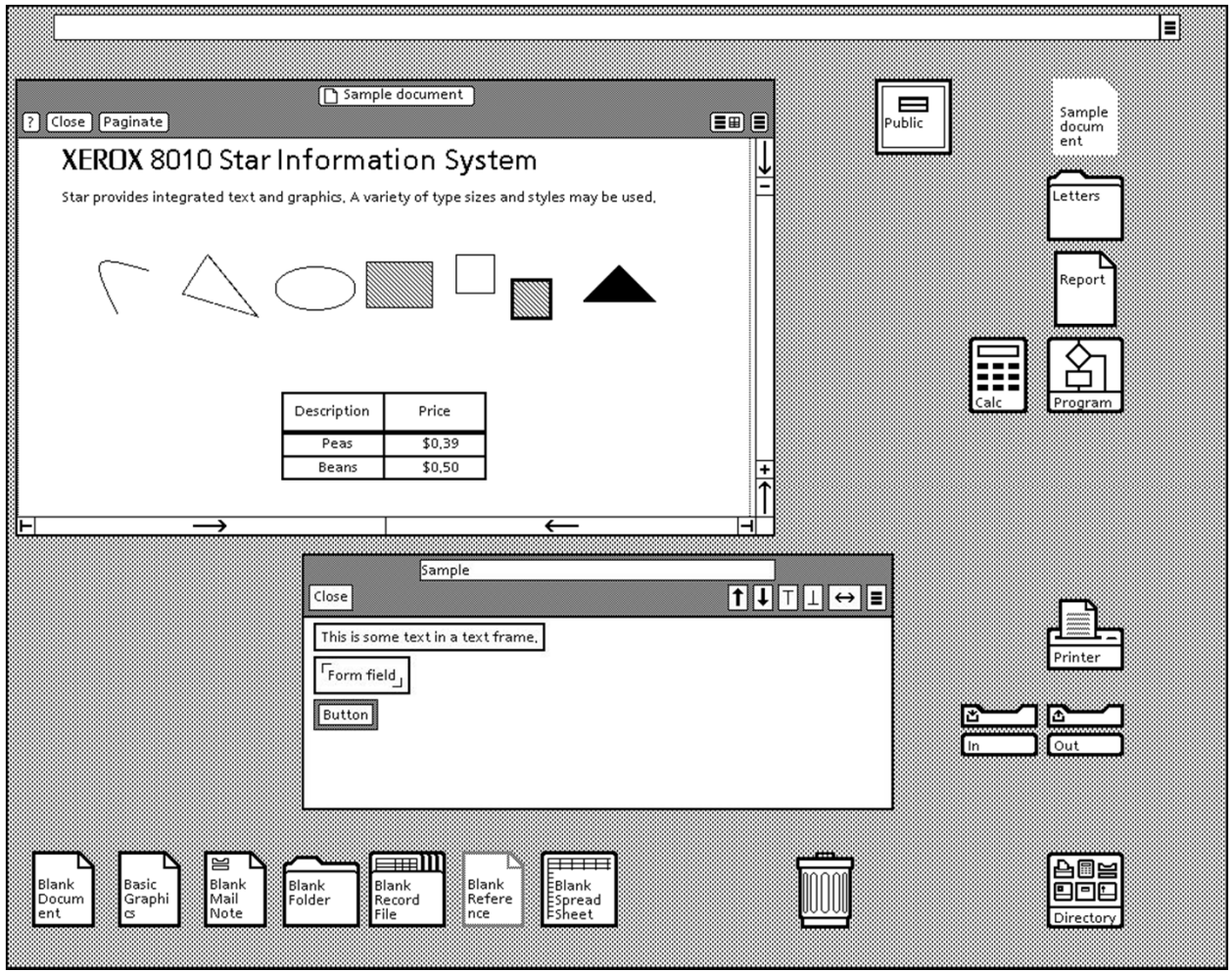
Graphical User Interface

- Time period: ca. 1984 – present
- Hardware interface
  - High resolution, high refresh graphics display
  - Keyboard
  - Pointing device (e.g., mouse)
- Typical instantiation: WIMP interface
  - Windows, Icons, Menus, and Pointer
- First instantiation of WIMP interface?

Xerox Star



Source: http://www.guidebookgallery.org/site/about

Graphical User Interfaces

- Xerox's 8010 Star Information System (1981) first commercial WIMP offering
  - Xerox's Alto the experimental precursor
  - Many ideas from Engelbart's earlier work
- Apple's Macintosh (Jan 1984), brings the GUI to the masses
- Microsoft Windows
  - v1: tiled windows (Nov 1985)
  - v2: overlapping windows (Oct 1987)

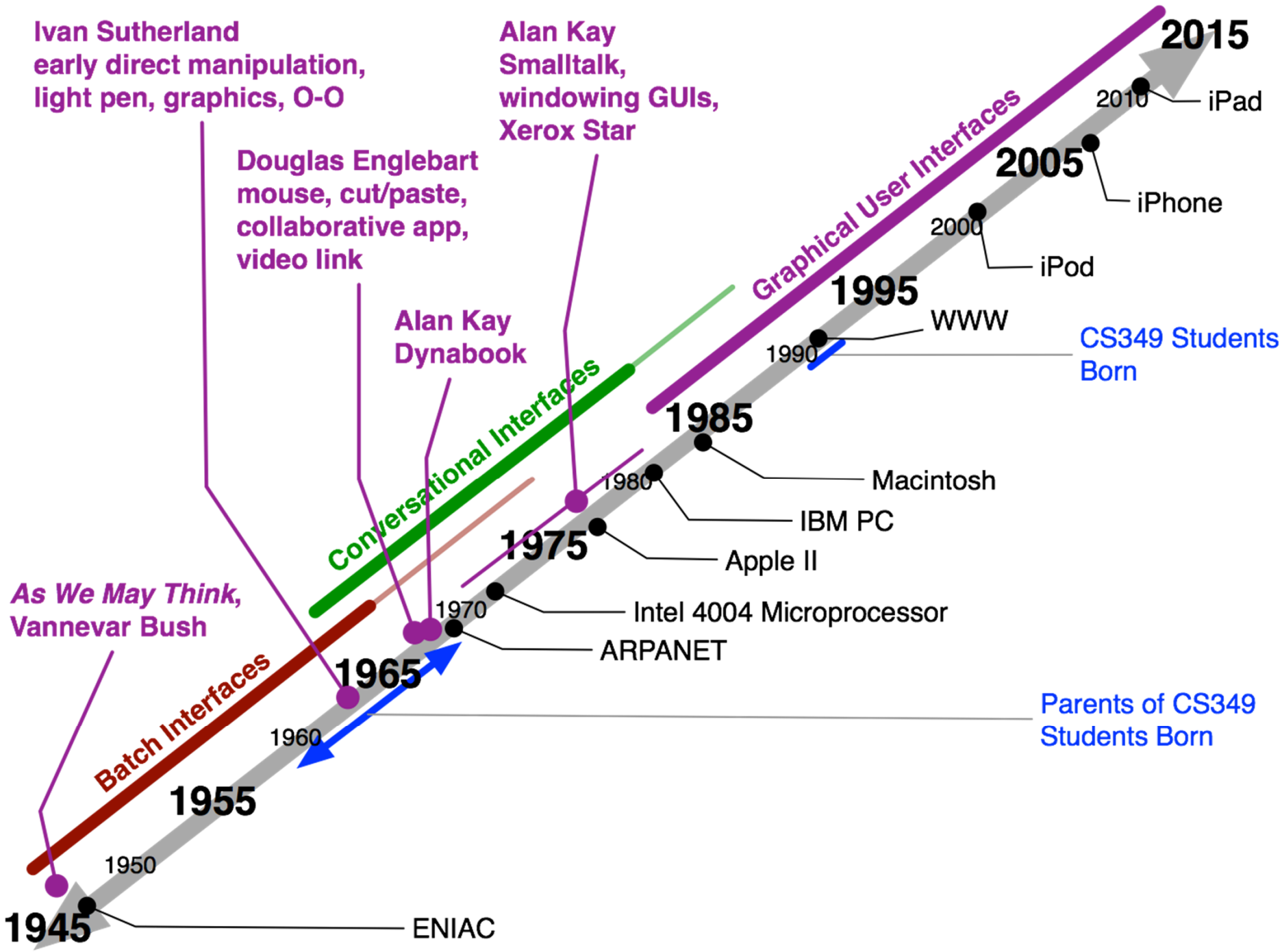
(See http://www.digibarn.com/stories/finalstardemo for videos of these early systems)

Graphical User Interfaces

- Interaction style
  - User in control: System waits for input, responds
  - Recognition over recall enables discovery of options, experimentation
  - Simulated world metaphor employed
    - What does this mean and what are its consequences for interaction?

Graphical User Interfaces

- Interaction style continued…
  - Simulated world metaphor uses real-world metaphors to represent data, enable interaction
  - Interaction language closer to users' own language, closer to task domain
  - Examples:
    - Files, folders, trashcan
    - How to "refile" a file?
- Users
  - Language of interaction opens interface up to broader audience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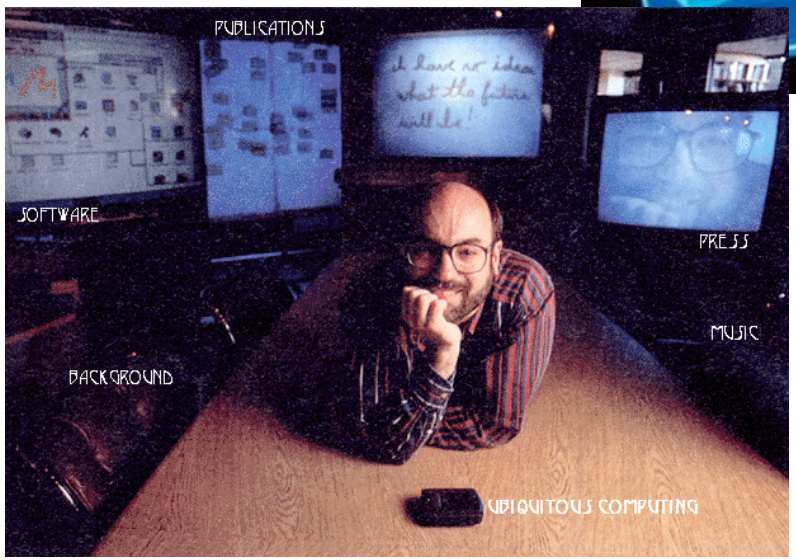
Interaction: Now What?

- Where can we go from here?
- What other paradigms are possible?

1990's: Get off the Desktop

- Two visions of the future digital age
  - Virtual reality
  - Ubiquitous computing



Mark Weiser

Mark Weiser

- "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." (Scientific American, 1991)
- Envisions computing on three scales: inches, feet, yards
- Computing as "natural" as writing, fading into the environment

http://web.media.mit.edu/~amanda/mas834web/papers/weiser-sciam91-ubicomp.pdf

Ubicomp

- Ubiquitous computing (ubicomp) highly active research area now
- Goal is to create language of interaction so close to task domain that the computer and its interface essentially become invisible
  - Not conscious of the fact that we are interacting with a computer
- How can this be achieved?

Some Ubicomp Approaches

- Make use of greater context in interaction
  - What is context?
- Context is the current physical, social, and psychological situation
  - Emotional, psychological state of user
  - Nature of task, where user is within a larger task
  - Who is present, what they are doing
  - Other examples?

Ubicomp and Context

- How can context change nature of interaction?
- System can potentially do more for you, act more “intelligently” if it knows more about your goals

Some Ubicomp Approaches

- Increase range of input, output devices
  - Sensors (heat, light, sound, etc.) throughout the environment
  - Artifacts at appropriate scales, in appropriate form factors (handheld devices, wall-sized devices…)
  - Computation embedded in situationally appropriate places
- Fold in machine learning to aid in interpreting new inputs
  - Not necessarily interfaces that work for you
  - Rather, system may offer assistance by being able to interpret, manage your data at a higher semantic level
  - Example: Determine whether you are interruptable, help you find interesting features of a large data set

Pushing the Boundaries of Interaction

- Interfaces should rise to meet us and our task domain
  - We shouldn't need to expend effort translating our intentions, actions into a language far removed from task for the convenience of the system
- Some inspirations…

Pushing the Interface

- Proxemic Interaction (Greenberg et al, 2010)
  - http://grouplab.cpsc.ucalgary.ca/Publications/2010-ProxemicInteractions.ITS
- Prefab: Modifying existing interfaces (Dixon, Fogarty, 2010)
  - http://www.youtube.com/watch?v=lju6IIteg9Q&feature=related
- Sikuli: script existing GUIs (Yeh, Chang, Miller, 2010)
  - http://groups.csail.mit.edu/uid/sikuli/demo.shtml
- Ubiquitous Computing: Google for various "visions"
  - eg: http://www.youtube.com/watch?v=H_gLVlYOl0w