

Augmented Reality II
- User Interfaces for AR -

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User Interaction for Mobile AR Users

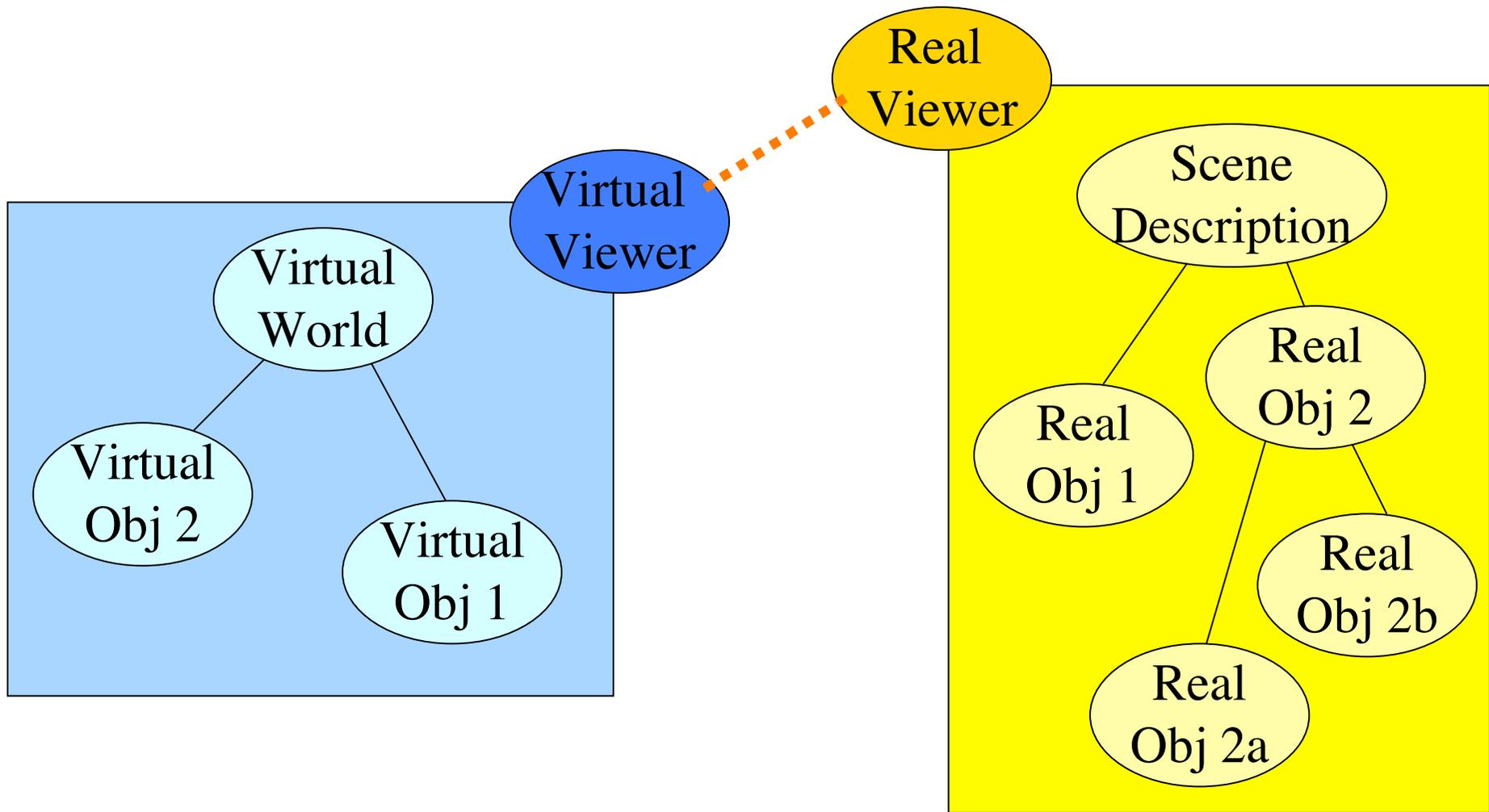
- Eye position and orientation
- 2D widgets inside the 3D world
- (Wearable devices)
- (Multimedia / multimodal input)
- Tangible interfaces

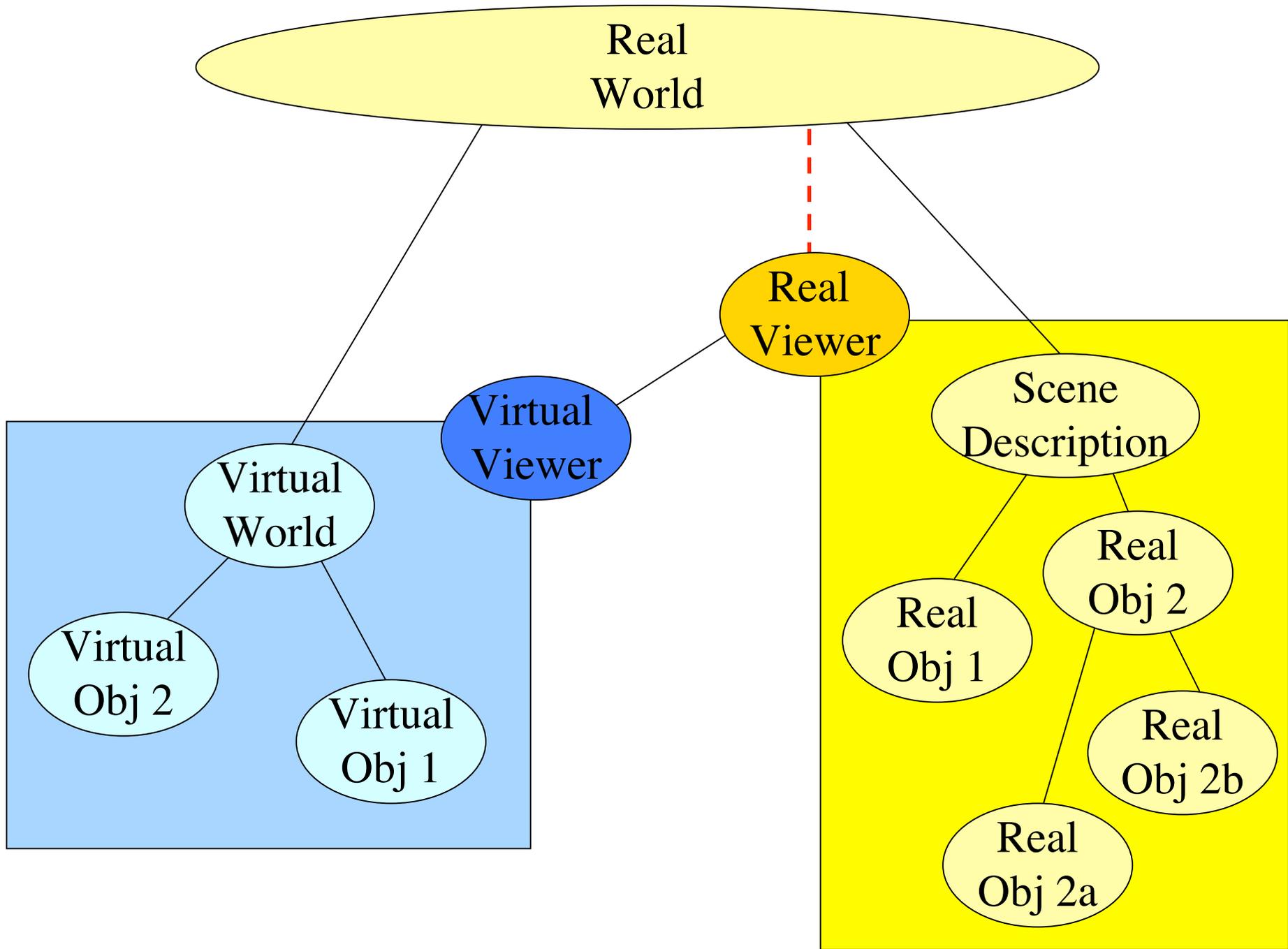
Literature

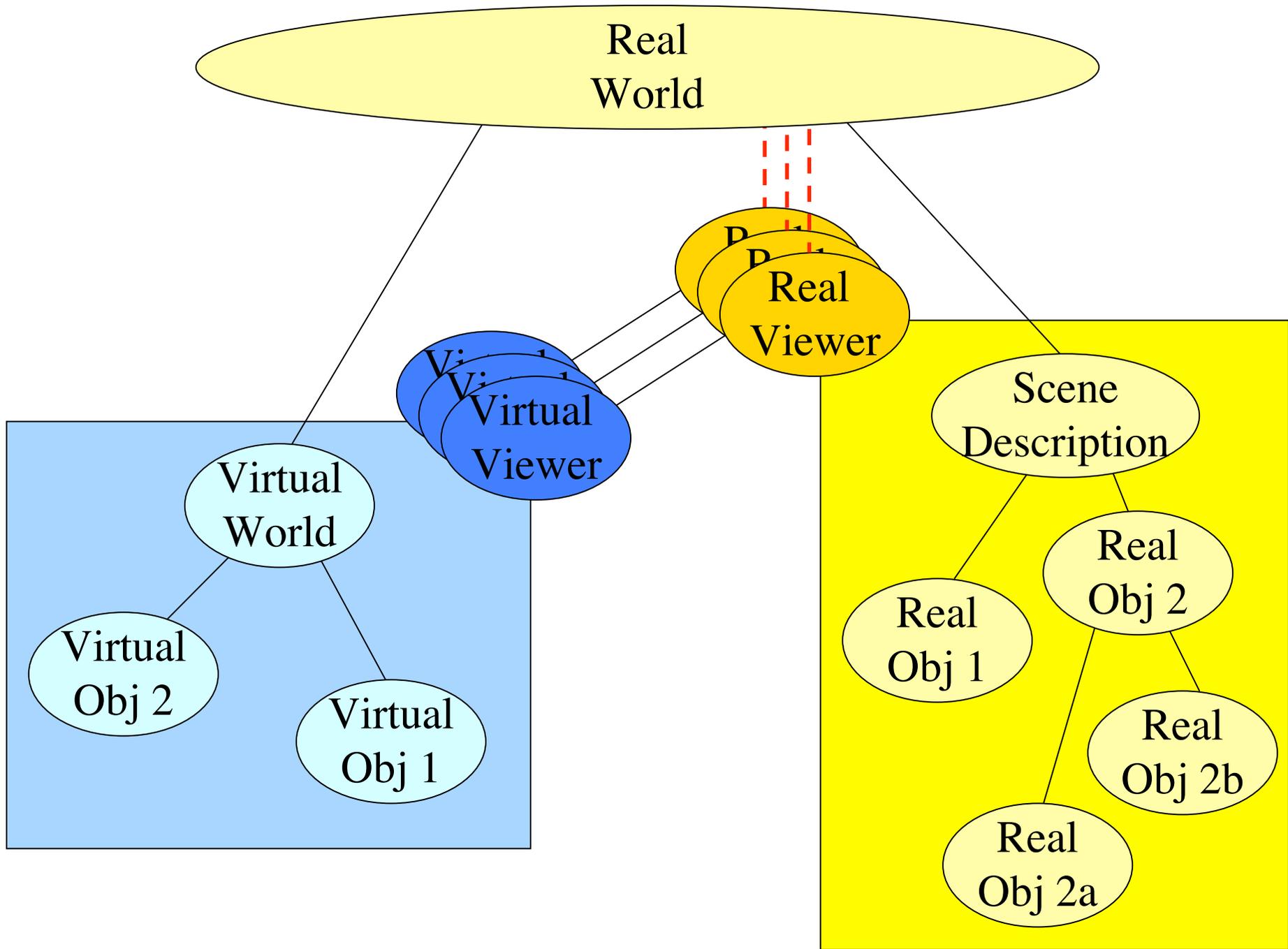
- S. Feiner, B. MacIntyre, M. Haupt, and E. Solomon, “Windows on the World: 2D Windows for a 3D Augmented Reality”, UIST’93
- Tangible Bits (Ishii et al, MIT Media Lab)
 - http://tangible.media.mit.edu/projects/Tangible_Bits/projects.htm
 - <http://www.acm.org/sigchi/chi97/proceedings/paper/hi.htm>

Eye Position and Orientation

- Primary level of immersion
- Apparently stationary objects within a real environment
- Isometric transformation:
real <--> virtual viewpoint







2D Widgets Inside The 3D World

Feiner et al: Windows on the World'93

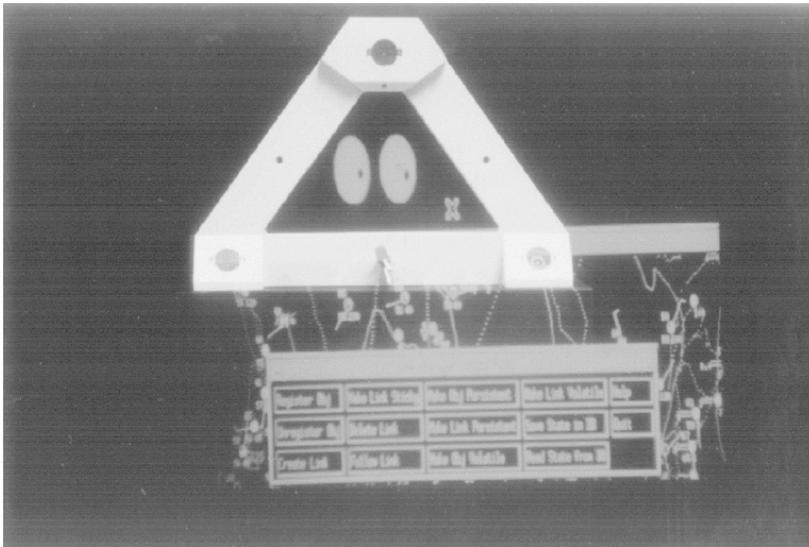
- Goal: Provide full X functionality on a head-tracked, see-through head-mounted display.
- HMD: Private Eye (720x280, red)
- Tracking: head, hand, body, objects
 - Ultrasound (Logitech: Red Baron)
 - Electro-magnetic (Ascension Technology: Flock of Birds)
- Hemispheric display space
 - X bitmap mapped onto a sphere about the user
 - right-left rotations (pitch)
 - up-down rotations (yaw)



2D Widgets Inside The 3D World

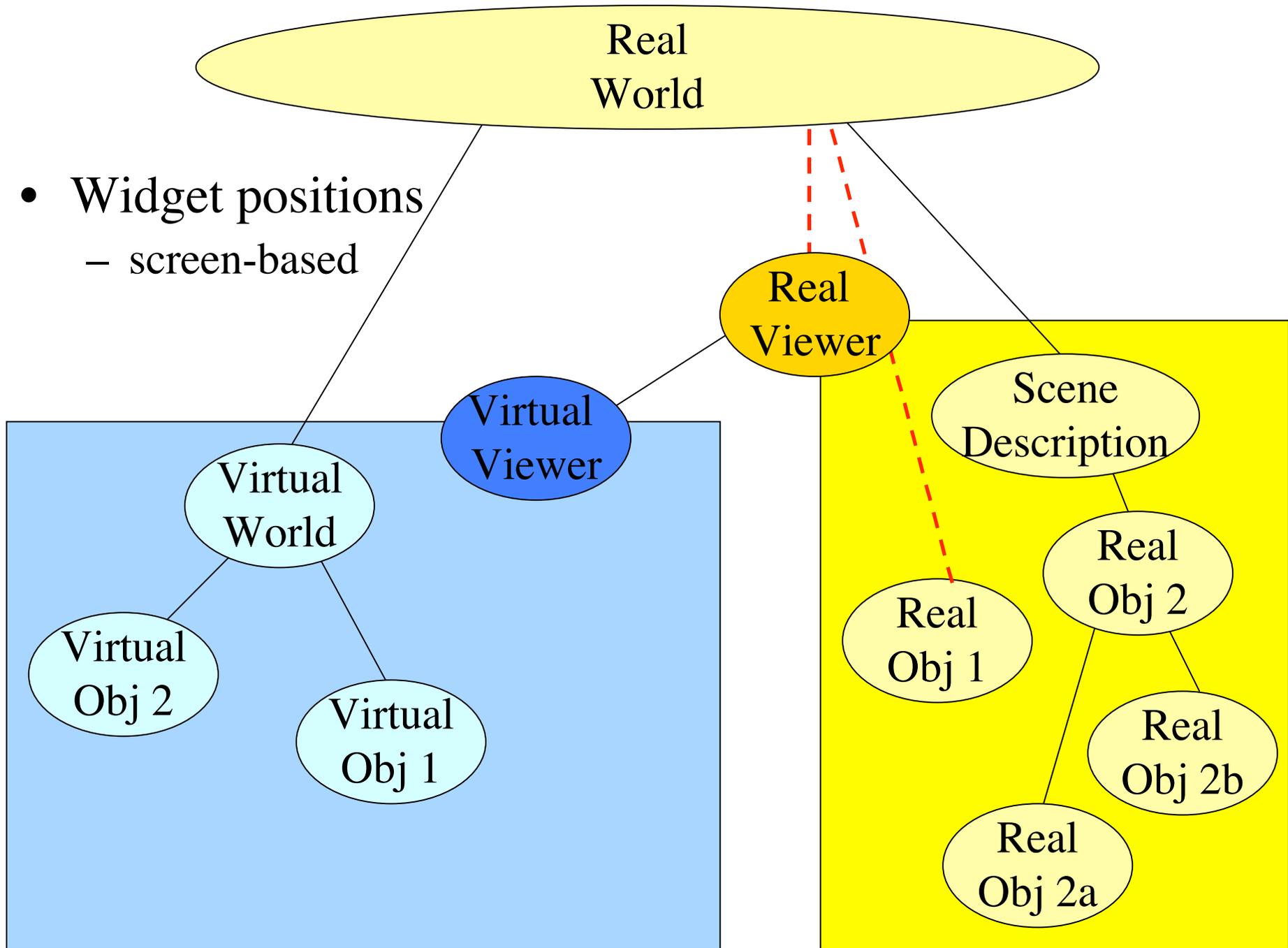
Feiner et al: Windows on the World'93

- Window positions
 - surround-fixed (constant position relative to the user body)
 - display-fixed (constant position on the screen)
 - world-fixed (constant position in the real world)
- Interaction devices
 - mouse, keyboard, 3D tracker at the user's hand
- Demo: hypermedia application
 - make links between arbitrary X windows
 - attach windows to object and locations
 - display-fixed control panel
 - various further windows (xeyes, weather map, xpositit, xload, ...)

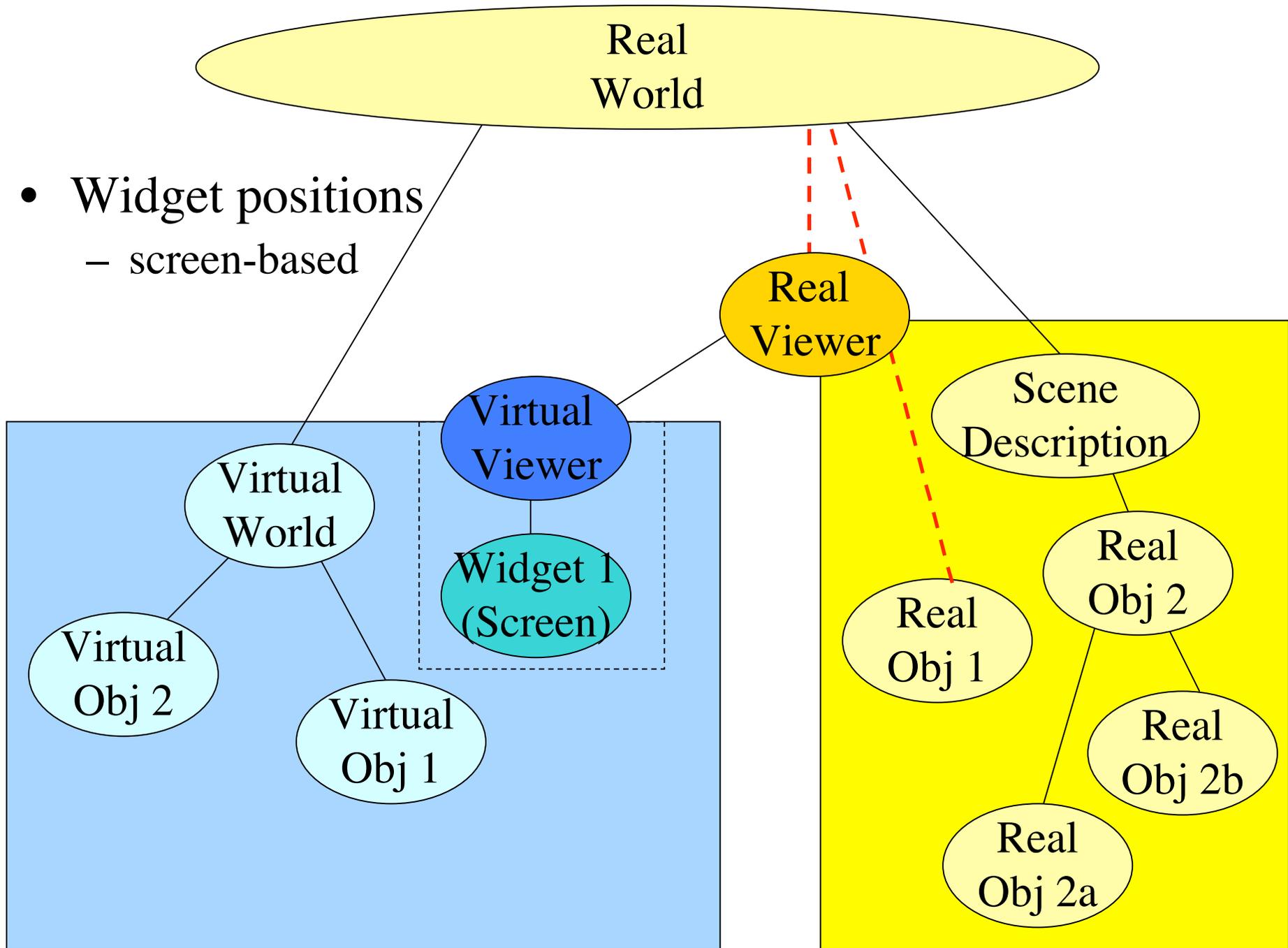


2D Widgets Inside The 3D World

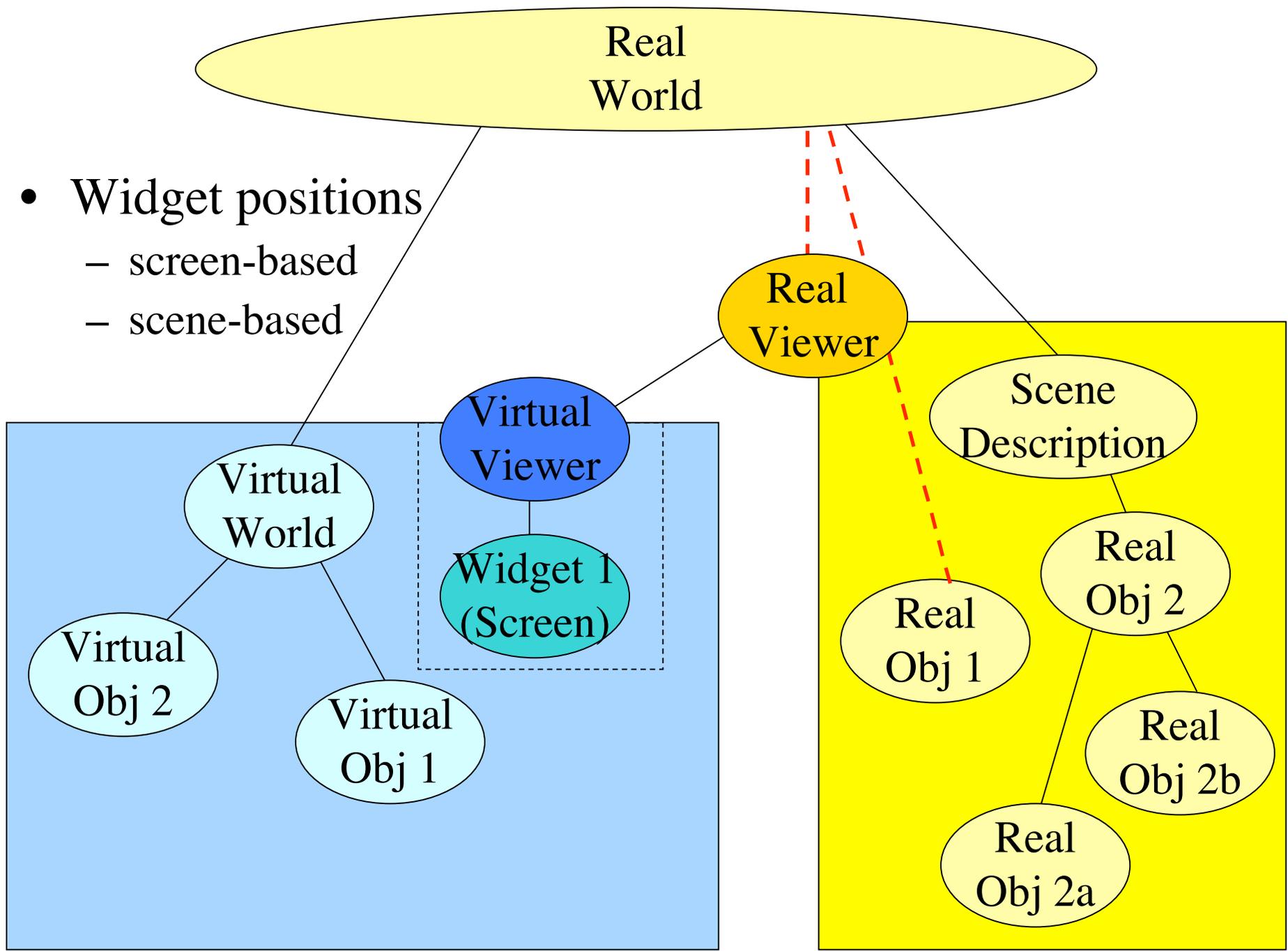
- Widget positions
 - screen-based
 - scene-based
 - object-based



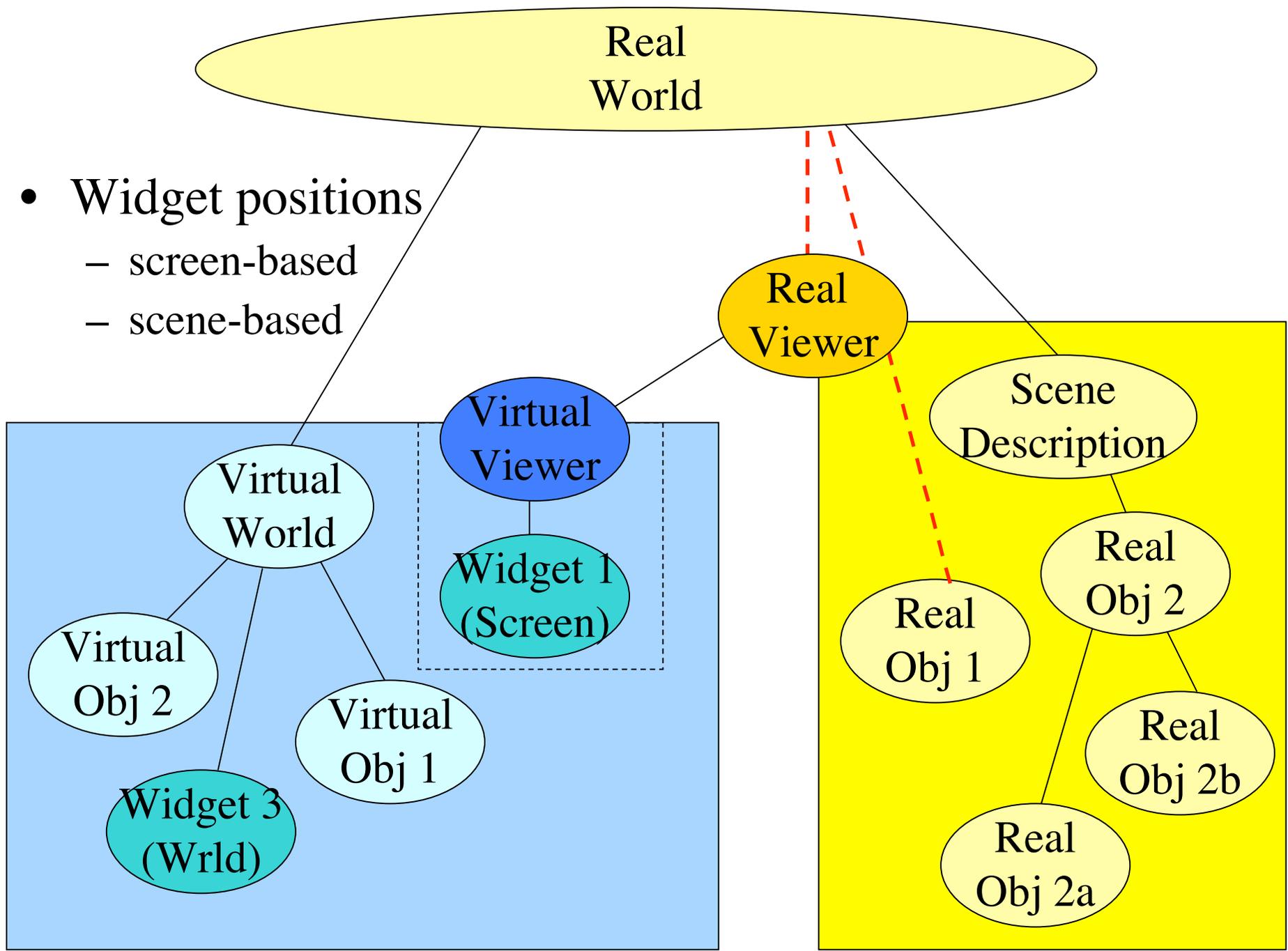
- **Widget positions**
 - screen-based



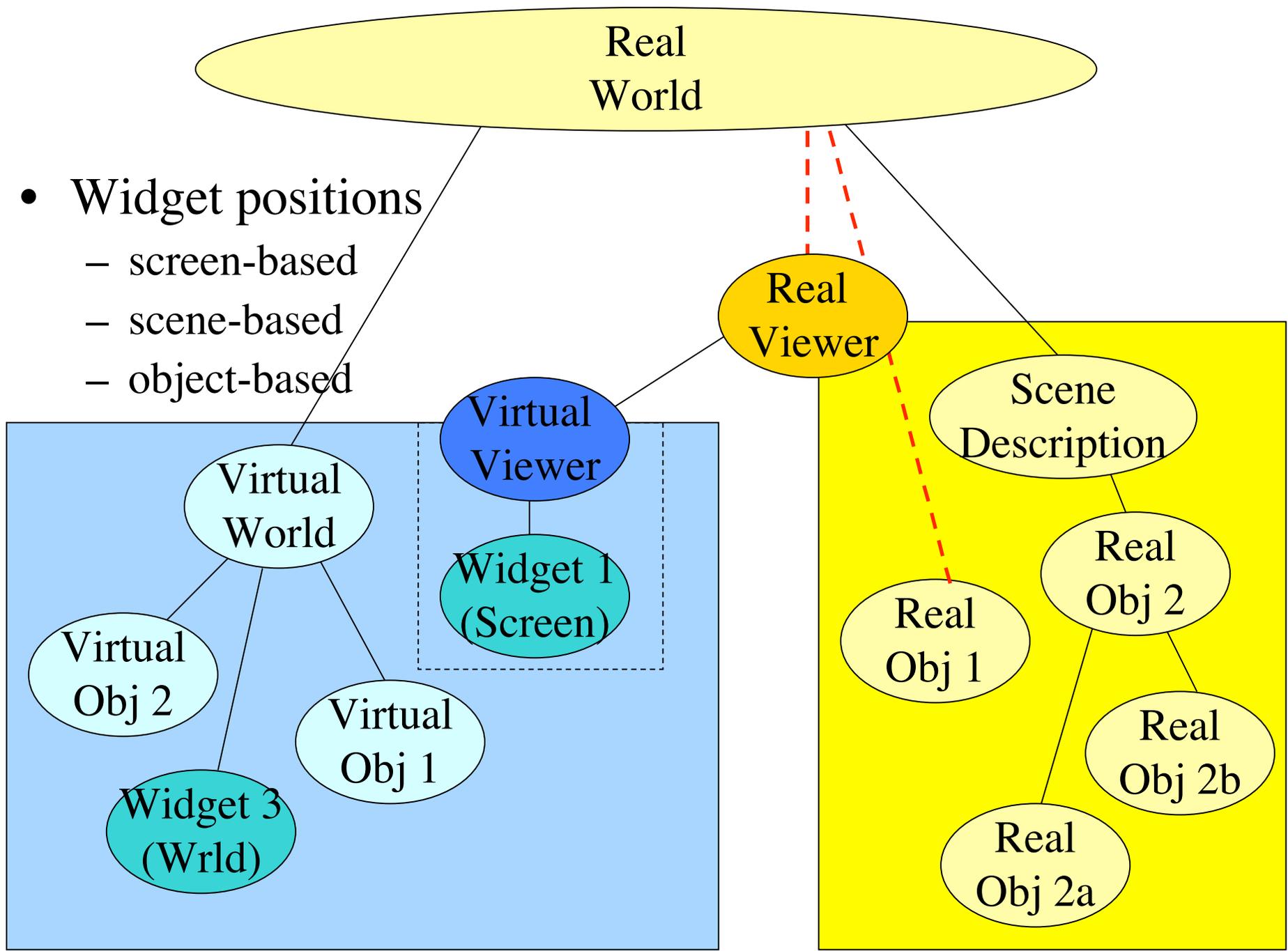
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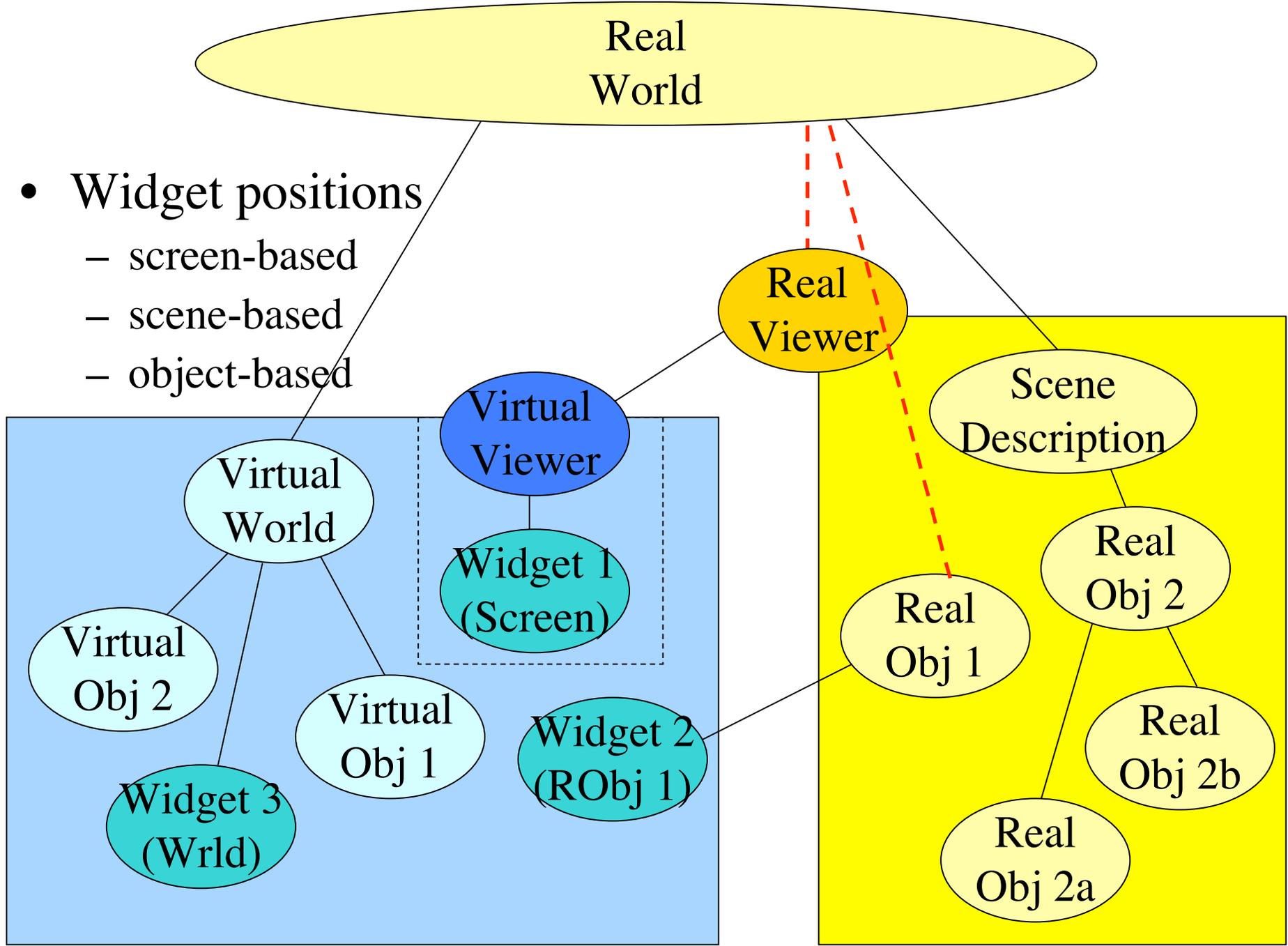
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 - screen-based
 - scene-based
 - object-based



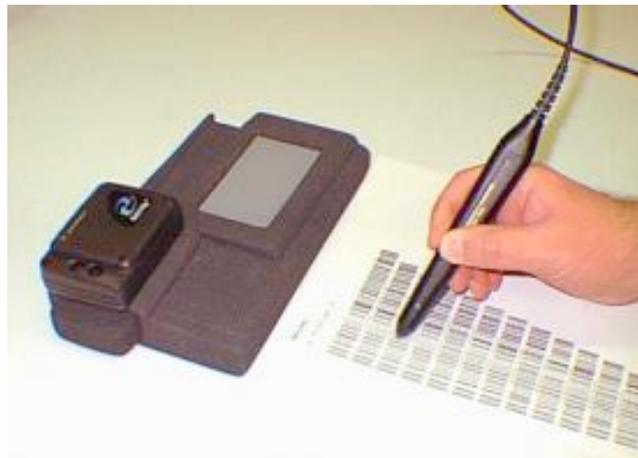
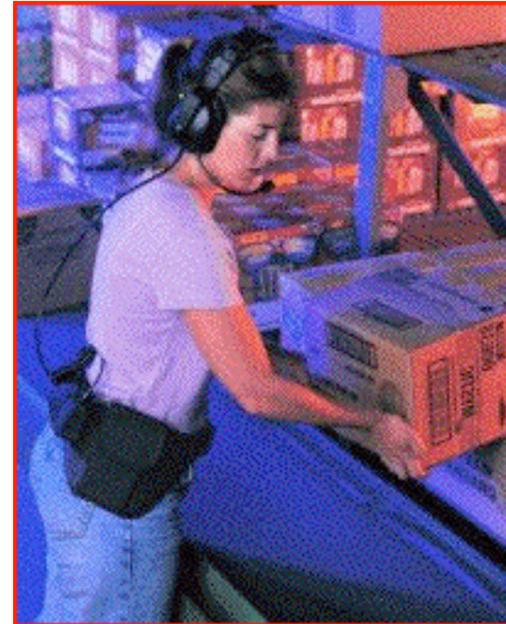
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Wearable Devices

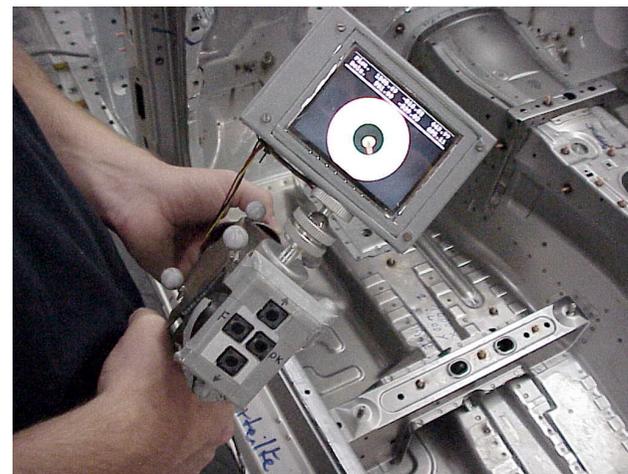


- wireless mouse
- space mouse
- wearable keyboard
- tablet PC (touch pad)
- microphone
- special dial
- optical reader
- RF-ID-Tag



Intelligent Devices

- Surveying tools
- Intelligent welding gun



Tangible User Interfaces

Literature

- Tangible Bits (Ishii et al, MIT Media Lab)
 - http://tangible.media.mit.edu/projects/Tangible_Bits/projects.htm
 - <http://www.acm.org/sigchi/chi97/proceedings/paper/hi.htm>
- Magic Book (Billinghurst et al, HIT-Lab)
 - <http://www.hitl.washington.edu/magicbook/>
- KidsRoom ()
 - <http://www-white.media.mit.edu/vismod/demos/kidsroom/kidsroom.html>

Tangible Interfaces

(Ishii, Ullmer, Underkoffler et al.)

- Tangible Bits
 - grasp & manipulate bits
 - bits vs. atoms: coupling bits with everyday physical objects
 - background vs. foreground information: ambient display media (light, sound, airflow, water movement, ...)
- Motivation:
 - variety of specialized physical artifacts in museums to
 - measure passage of time
 - predict movement of planets
 - draw geometric shapes
 - compute

Tangible Interfaces

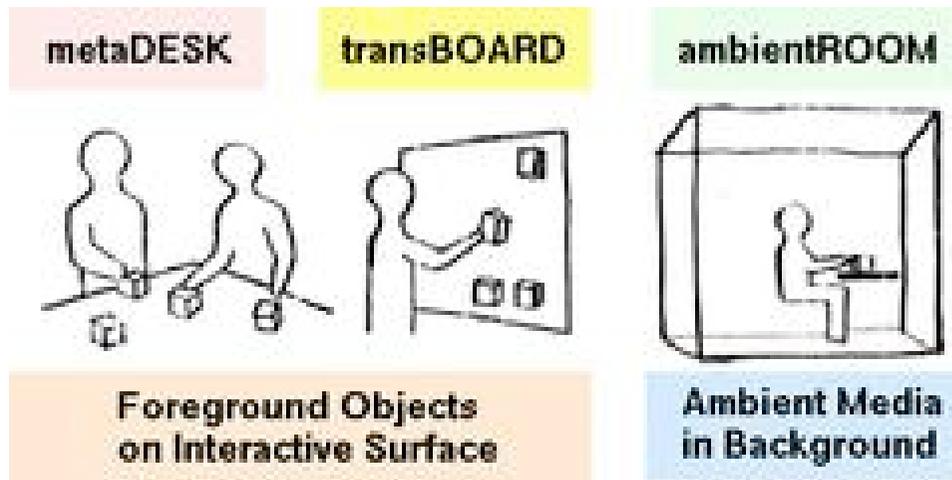
- Key concepts / goals
 - Interactive surfaces:
Transformation of each real surface into an active interface between the physical and virtual worlds.
 - Coupling of bits with graspable physical objects:
Seamless coupling of everyday graspable objects with digital information.
 - Ambient media for background awareness:
Use of ambient media with cyberspace at the periphery of human perception.

Bits and Atoms

- Combination between physical environment and cyberspace
 - 1981: Xerox Star Workstation
first generation of GUI, desktop metaphor, bit-mapped screen, mouse, windows, icons, ...
 - 1991: Ubiquitous Computing (Weiser)
 - Tangible User Interfaces
a means to truly make computing ubiquitous and invisible

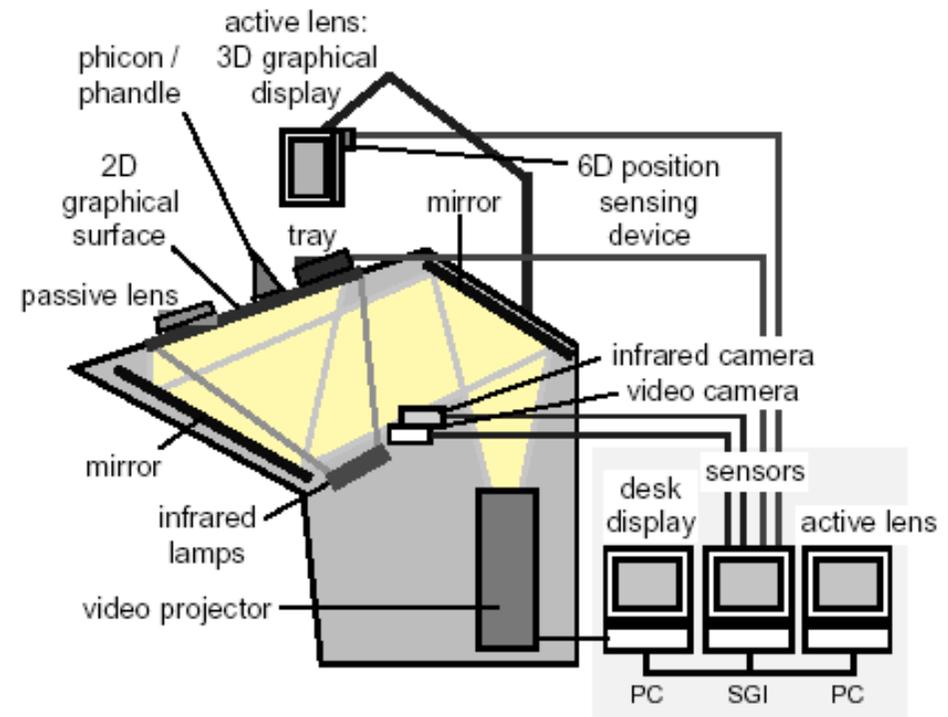
Research Platforms

- metaDesk
- transBoard
- ambientRoom



metaDESK (Ishii and Ullmer)

- nearly horizontal back-projected graphical surface
- trackers:
 - magnetic (FOB)
 - optical (infrared)
 - electrical register tags (LEGO Dacta)
- arm mount of jeweler's magnifying glass
- Intel Pentium Pro, SGI Indigo



passiveLENS

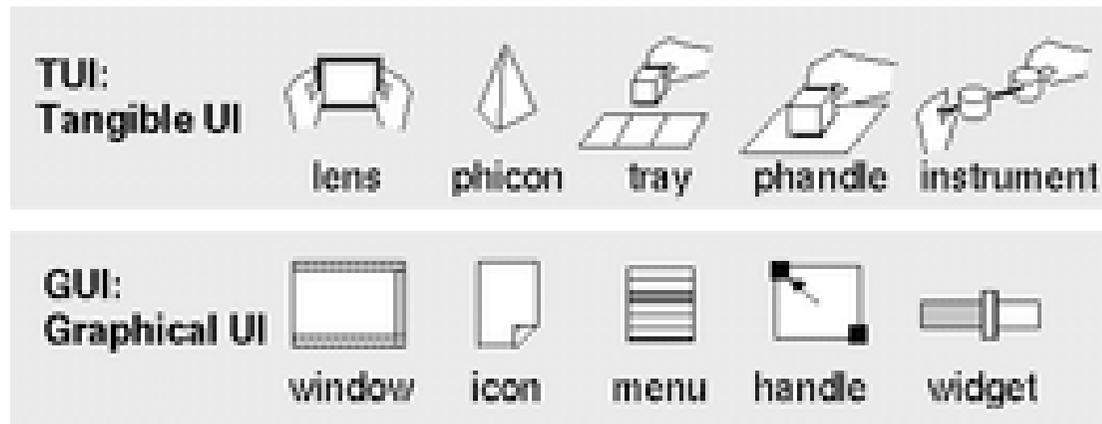
activeLENS



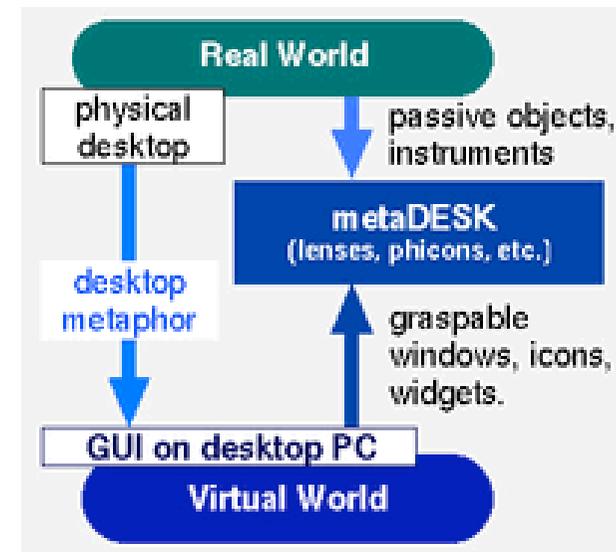
instrument

phicons

metaDesk



- Tangible User Interfaces
 - activeLENS
 - passiveLENS
 - phicons
 - instruments



Tangible Geospace on metaDESK



passiveLENS

activeLENS



instrument

phicons

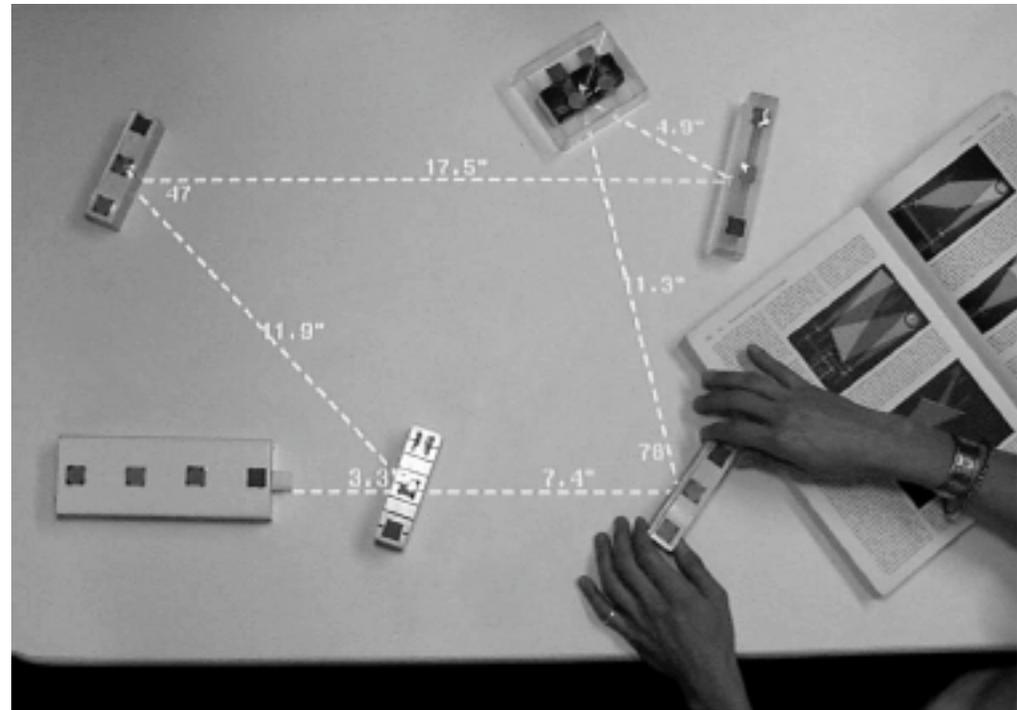
Luminous Room

(Ishii and Underkoffler)

- Interior architectural space whose surfaces have been made capable both of displaying visual information and of performing visual capture
- Pairing of optical input and output

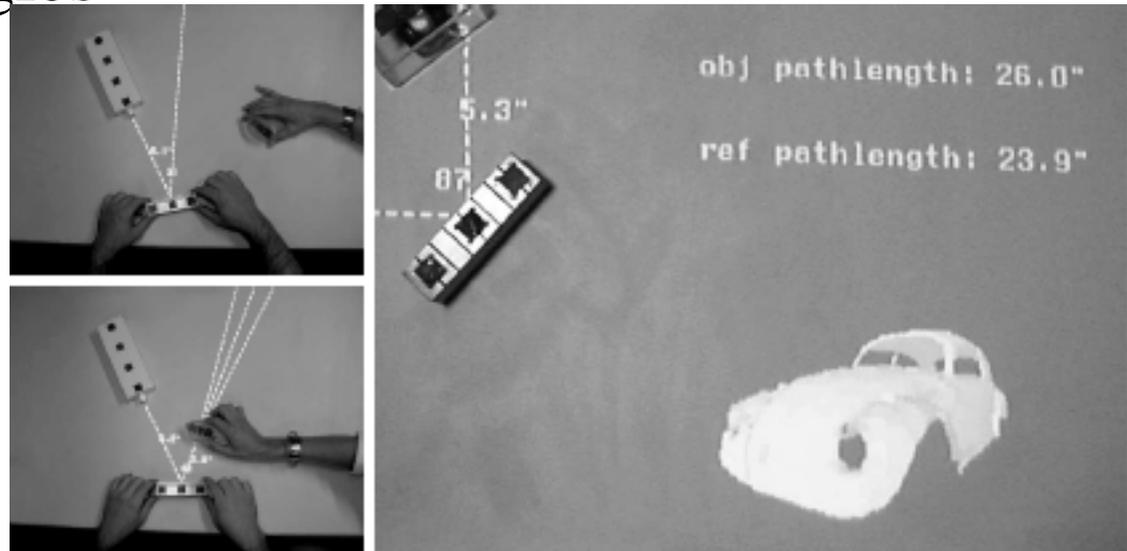
Illuminating Light

- Phicons:
 - Laser
 - Mirror
 - Lens
 - Beamsplitter
 - Recording film



Illuminating Light

- Domain knowledge concerning holography
- Ancillary information:
 - Length of optical paths
 - Reflection angles



Chess & Bottle

- Phicon: chessboard w. animated pieces
- Digital artifacts: images, numbers, text, regions of live video
- Physical container: vase, bottle



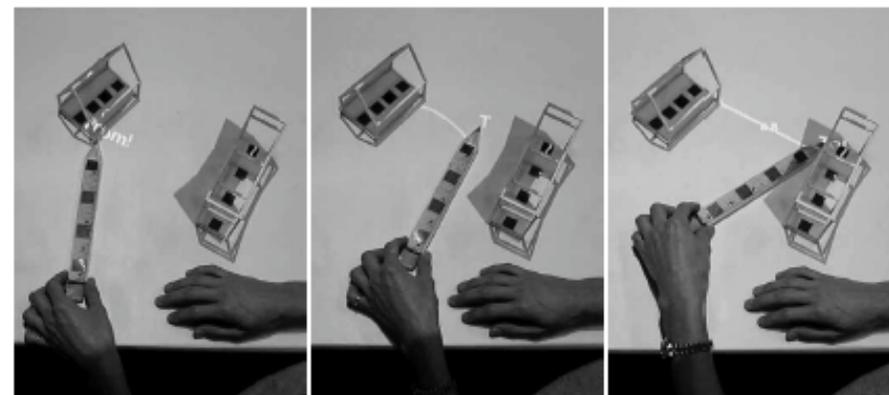
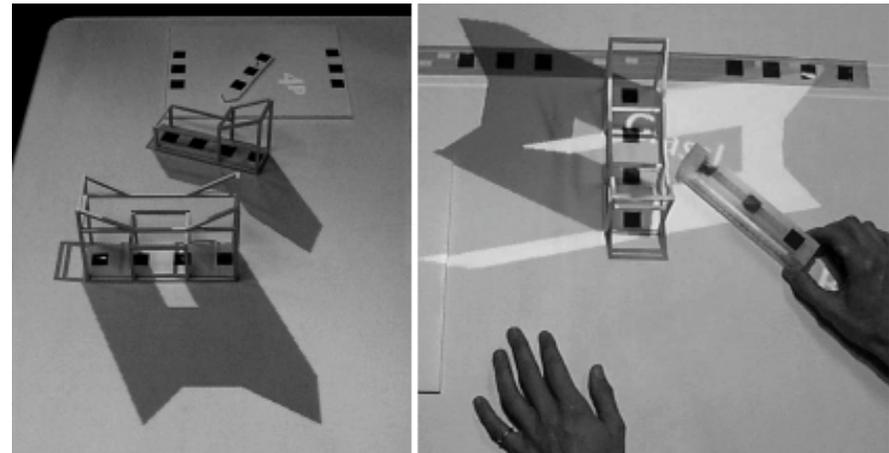
Seep

- Physical objects as obstacles in a computational simulation of fluid flow.



Urp

- Direct manipulation of basic objects
- Phicons: buildings
- Tools:
 - Hour hand
 - Measuring tool
 - Material tool
 - Wind tool





Distributed Illuminating Light

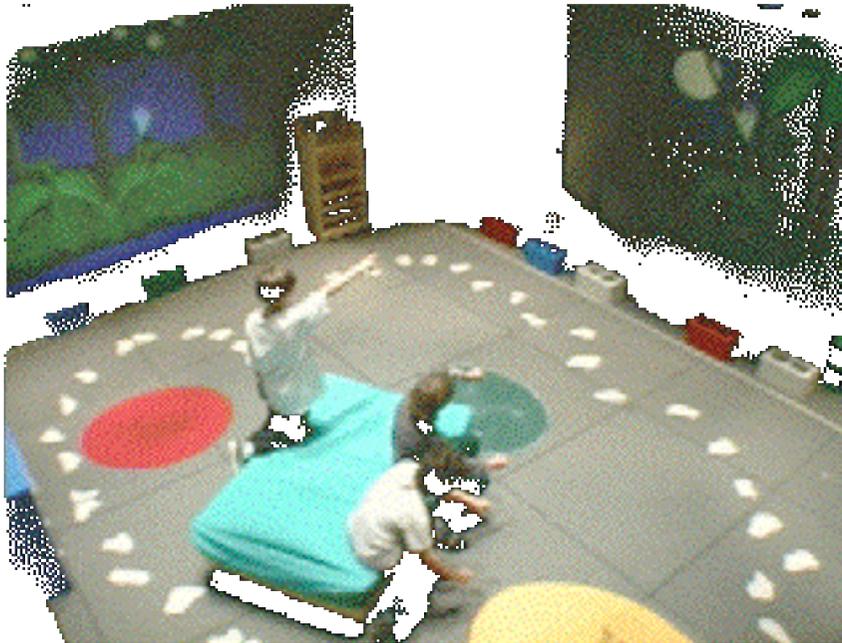
- Two tables with one contiguous space
- Two tables with replicated spaces



Magic Book (Billinghurst et al)



The KidsRoom (MIT Media Lab)



<http://www-white.media.mit.edu/vismod/demos/kidsroom/kidsroom.html>

Multimedia / Multimodal Input

- Goal 1: No more WIMPS (windows-icons-menus-pointing)
- Multiple input modalities:
 - Speech
 - Pen
 - Lip movements
 - Gaze
 - Gesture (hands, body)
- Different Environments
 - Noisy
 - Quiet
- Goal 2: Reduce recognition uncertainty by fusing two or more information sources
- “Put that there” [R. Bolt, 1980]

Multimedia / Multimodal Input

- Current strategies / research activities:
 - Increase the number of input modes interpreted within the multimodal system.
 - Combine input modes that represent semantically-rich information sources.
 - Increase the heterogeneity of the input modes combined within the multimodal system.
 - Integrate maximally complementary input modes.
 - Develop multimodal processing techniques that retain information.
 - Apply multimodal system design to brief information segments for which robust recognition is known to be unreliable.
 - Apply multimodal system design to challenging user groups and usage environments for which robust recognition is known to be unreliable.