The Digital Pl@net

industrialCAVE

a product of Fraunhofer IPA

IPA
Fraunhofer Institut Produktionstechnik und Automatisierung

DIGITAL FACTORY
HANNOVER MESSE

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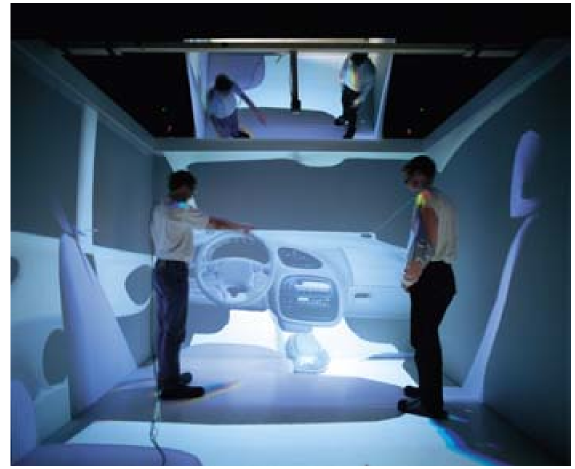
Why CAVE systems?



- 1:1 size projection, 180° view angle
- self explaining and realistic presentation
- real time navigation, real time rendering
- stereoscopic projection,
  mediating feeling of presence, space,
  distances, spatial orders
- Virtual Reality:
  involving user into virtual environment
- thereby improving the feeling of immersion
  into virtual environment: enhancing realism
- thereby intuitive navigation by simple movement
  in the CAVE and providing additional feeling of depth
- due to the size enabling cooperation
  according to a common object of inspection
- concluding: early detection of faults
  and avoidance by virtual prototypes
- further the multi wall projection can be used as a project room
  by simply showing several computers on the screens
  and discussion in a work group

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The CAVE system at Fraunhofer IPA

- 3 wall projection room (front, right and left screen)
- size: 2.7m x 2.7m x 2.0m
- passiv stereo system (polarization filters)
- 6 DLP projectors Hitachi
  Physical resolution 1365 x 1024 pixel
- 7 standard PCs with nVidia GeForce grafics cards,
  using their hardware antialiasing
- elektromagnetic tracking system Polhemus Fasttrak
- spacemouse und standard computer peripherals (e.g. mouse) applyable
- assembly with standard industrial metal profiles
  assembly of additional machinery easy
- renderer: bitmanagement contact stereo: 100% VRML 2.0
  ISO standard VRML: light-, sound- and sensor modell available
- surround sound system
- Space requirement of CAVE system: 7m x 7m x 3m.
- Power consumption: approx. 8 kW
- costs: approx. 120 T€. Time for built-up: approx. 3-4 months.

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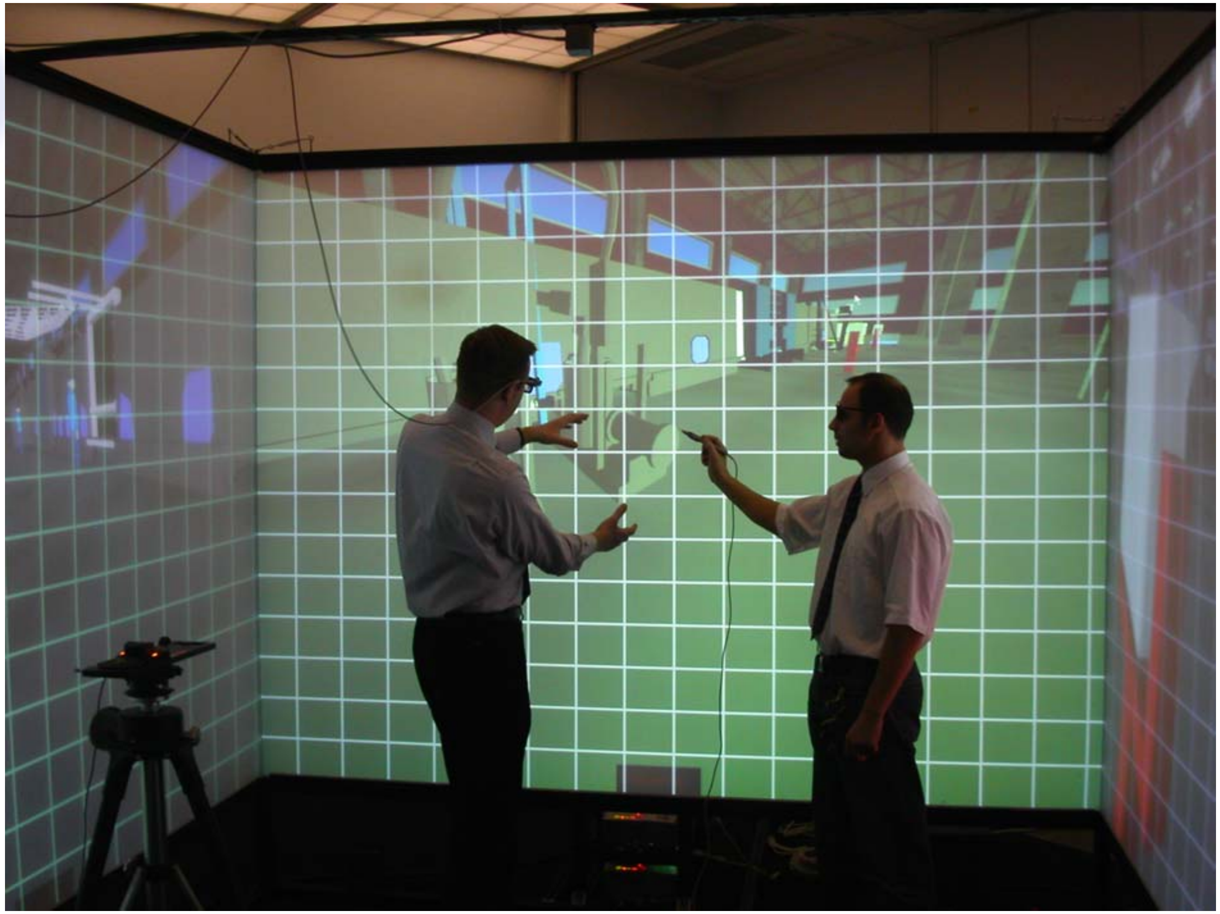
A view into the IPA-CAVE



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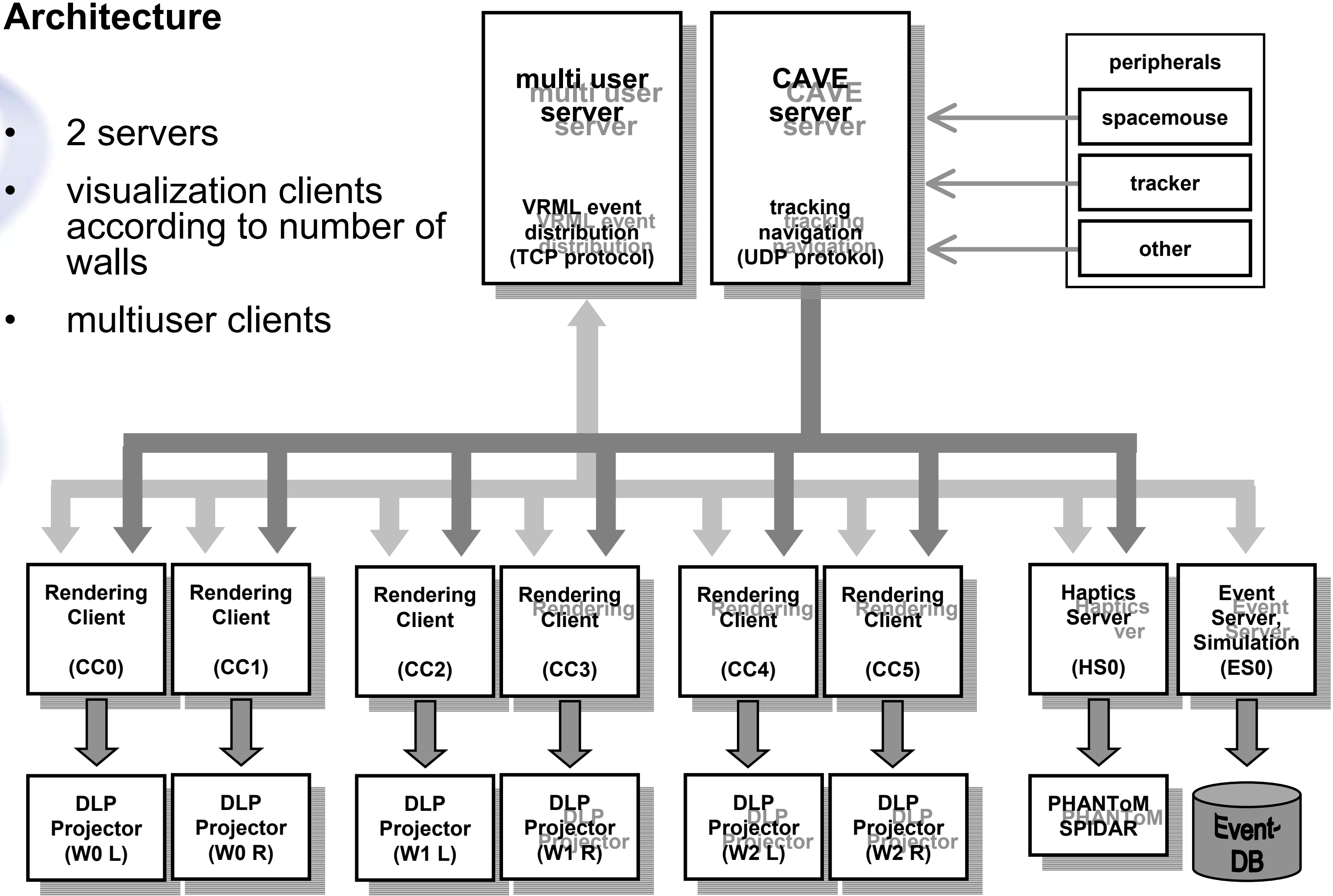
Architecture

- 2 servers
- visualization clients according to number of walls
- multiuser clients



The CAVE server

- administrates the input devices like tracking system, space mouse and mouse. Input signals are forwarded to the visualization clients
- can emulate mouse activity on the visualization clients
- coordinates the visualization clients and controls their virtual camera parameters
- adjusts eye distance and amplification of (real) movement in the CAVE compared to movement in the virtual environment

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The multi user server

- administrates the elements of the 3D environment
- loads and erases 3D models in the view/in the scenario
- administrates the users and their access to the virtual environment
- distributes VRML events, generated on one of the visualization clients (e.g. by touching an object) to the other clients
- distributes VRML events, generated by any type of client (haptics, simulation, views on desktop PCs of a holobench, factory planning table) to all other clients. This property also enables the users to share a distributed virtual environment between them.

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The CAVE client (BS Contact Stereo)

- gets the 3D environment from the multi user server
- gets the identification of its virtual camera from the CAVE server. Like this, easy adaption to other visualization systems (holo bench, factory planning table) is possible
- gets the position of the user inside the CAVE and inside the virtual environment from the CAVE server
- gets the eye distance from the CAVE server
- gets mouse events from CAVE server. A local mouse is emulated. VRML events, triggered by mouse signal can be adressed.
- gets further VRML control events from other clients passing the multi user server

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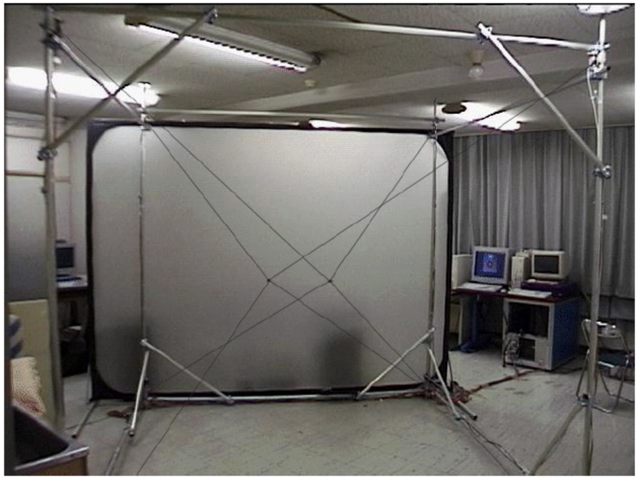
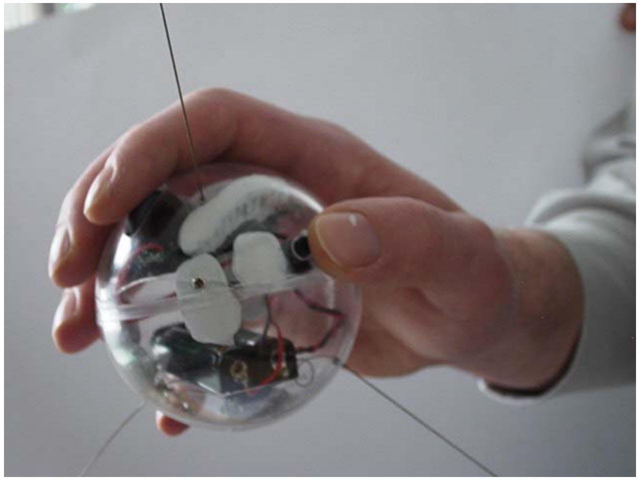
Actual developments

- Force feedback device for large virtual environments (Space Interface Device for Artificial Reality – SPIDAR)





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Actual developments

- Use of software architecture also for holo bench, KoKoBel and factory planning table.
- Both use for stand-alone operation and for coupled operation (simultaneous engineering).

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Actual developments

- incorporating tele conferencing techniques. Use of video streams as dynamic textures on 3D objects
- further use as project room

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Actual developments

- enhancing tracking with compensation of field distorsion (due to metal assembly profiles)
- Implementation of interfaces to simulators from UGS-Tecnomatix and Delmia
- integration of collision detection SOLID 2.0

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