

# Distributed Haptic Environments

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## Research Goal

Design an architecture that will support collaborative touch in a virtual environment called *virtual haptic world*.

- Collaboration over a non-dedicated channel (such as an Internet connection), which can adapt to current communication bandwidths and delays.

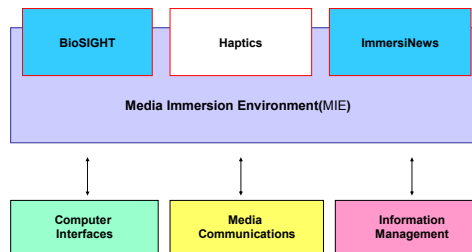


- Collaboration in multi-user environments with heterogeneous haptic devices (e.g. the PHANTOM, the CyberGrasp, the iFeelmouse)

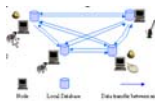
- The psychophysics of haptic collaboration

## Role in IMSC

Distributed haptic environments is one of the projects that addresses haptic issues to make the MIE a reality.

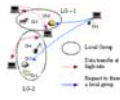


## Research Approach



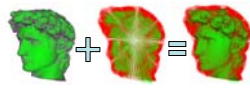
- Each node has a local database which contains information about nodes and objects in the haptic world
- Haptic data are exchanged between nodes.

- Local groups are formed according to communication delays.
- Objects in a local group interact to each other by simulating Newton's laws.
- Prediction and interpolation can be used to reduce network traffic and network delay.



### Haptic Rendering Algorithm

- Based on a hybrid surface representation
- Fast & stable, no force discontinuities
- Novel haptic texturing and painting
- Volume-based haptic sculpting



## Accomplishments

- A new architecture has been developed for the real time collection and simultaneous broadcast of haptic information.
  - Adding and removing remote nodes and objects dynamically.
  - Forming local group by communication delays between nodes
- A new mutual touch demo has been developed based on the new architecture.
- A mutual touch experiment on touch recognition and discrimination in multi-user, heterogeneous haptic environments
- Implicit haptic rendering techniques



## Uniqueness & Related Work

### Uniqueness

- A distributed architecture for real-time collection and simultaneous broadcast of haptic information to multiple haptic session participants
- Users can use disparate haptic devices.
- The interaction between two hosts is decided dynamically based on the measured network latency between them.
- Haptic rendering based on a hybrid representation
- New haptic editing and sculpting techniques

### Related Work

- Comparison of cooperative tasks of moving a ring back and forth along a wire in the dual modality (haptic plus graphic) and the single modality (graphic only) conditions

## 5-Year Plan

### 2003-2005

- Development of basic haptic collaboration architecture to share a virtual environment between PHANTOMs and CyberGrasps
- 3D visualization of haptic environments using the Immersadesk

### 2005-2007

- Integration of haptics with other modalities, such as simulated contact sounds (3D), voice.
- Integration of haptic collaboration with other IMSC projects (e.g. the Haptics Museum and BioSIGHT)

### 2007-2009

- Full integration of haptics within the MIE

