Collaborative Visualization: Approaches and Techniques

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Presentation outline

- Introduction
- Models
- Evaluation Criteria
- MVE-based examples
- Non MVE-based examples
- Web-based Visualization
- Summary

Introduction

- Visualization is used in many scientific areas: Medicine, biology, chemistry, engineering, etc.
- In all these applications team work is important
- Collaboration in visualization is important as well
- Wood [1] claimed that **visualization is a collaborative activity**

[1] Wood, Wright, Brodlie, VIS'97

The importance of collaboration

- Work is usually performed by people organized in teams.
- Each participant brings his skills and expertise to the table.
- Multi-disciplinary teams.

The form of collaboration

- No limitations to the geographic positions of the collaborators.
- Different people should be able to drive the visualization.
- Each participant should work in his usual working environment.

Visualization categories

Bergeron [2] divided the goals of visualization in 3 categories:

- Descriptive
  - The subject is known.
  - Typical application: teaching and education.
- Analytical
  - Looking for something known.
- Exploratory
  - Looking for something unknown.

[2] Bergeron, Visualization Reference Models, Visualization '93

Collaborative Visualization Models

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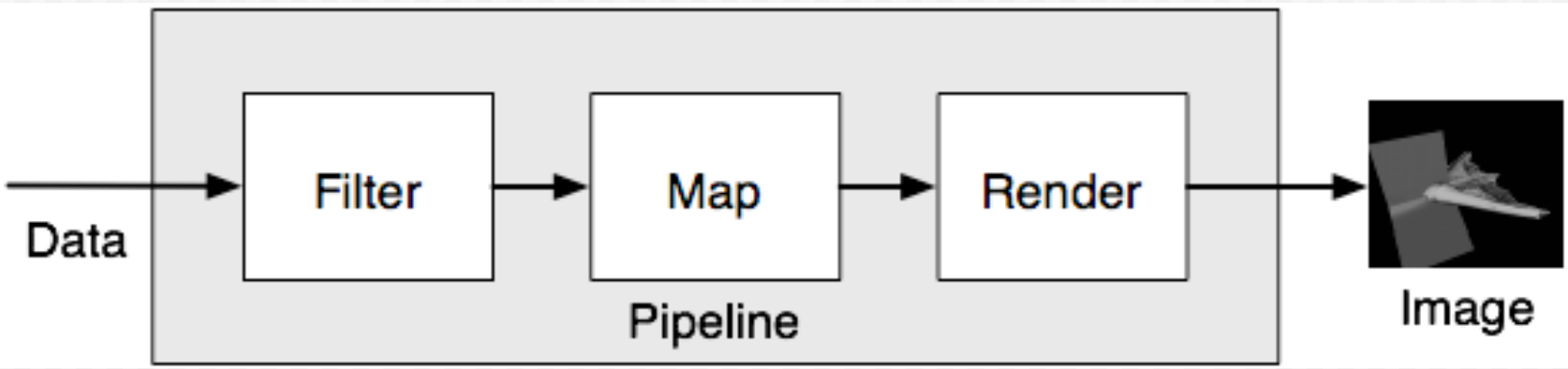
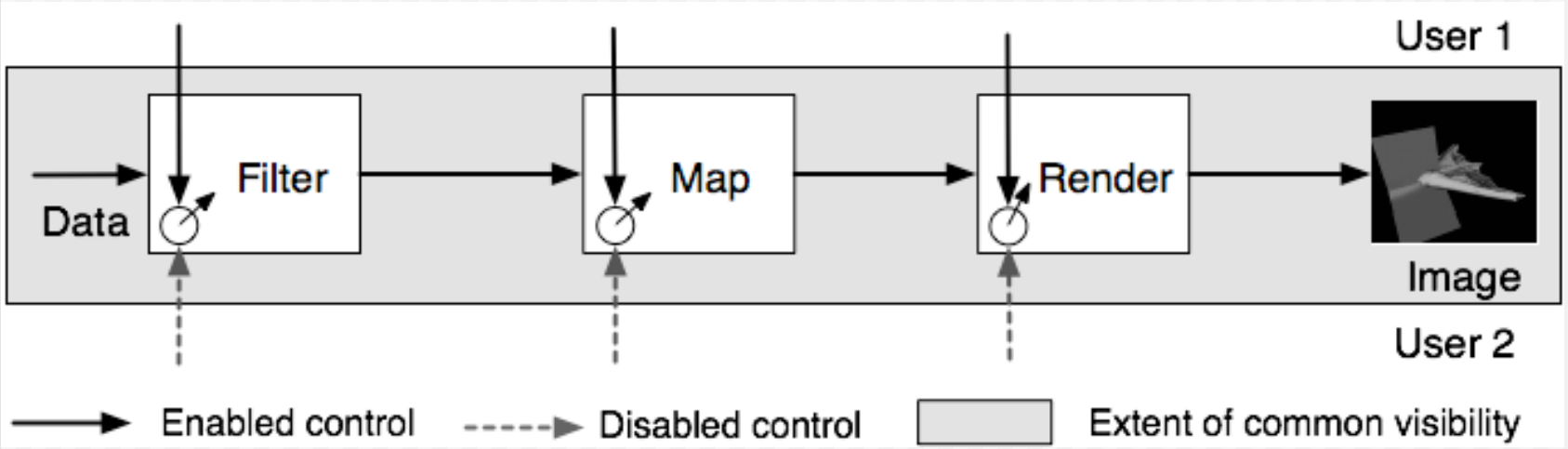
Haber and McNabb model

- It is the model of single user **M**odular **V**isualization **E**nvironment (**MVE**)

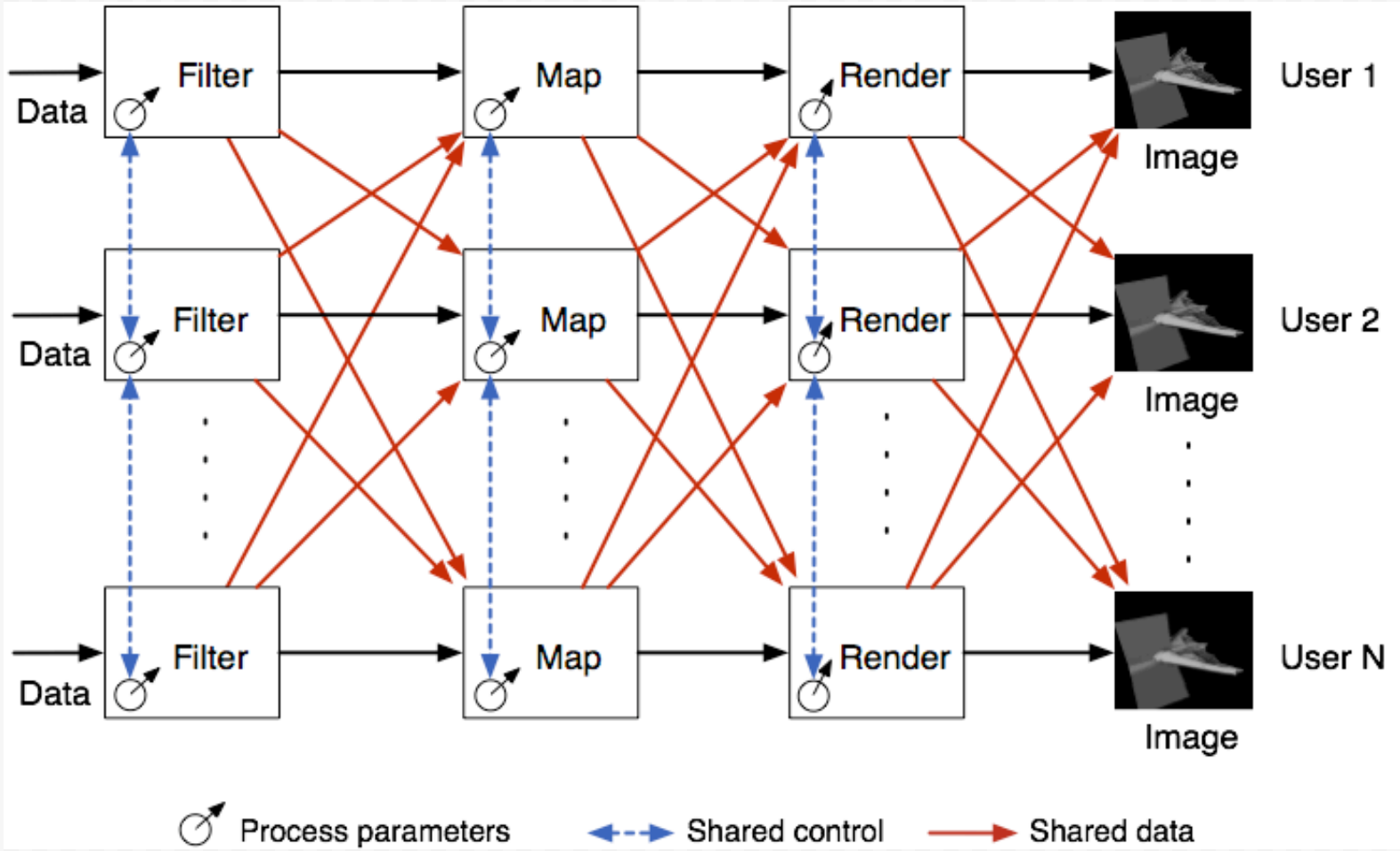


Shared pipeline for collaboration

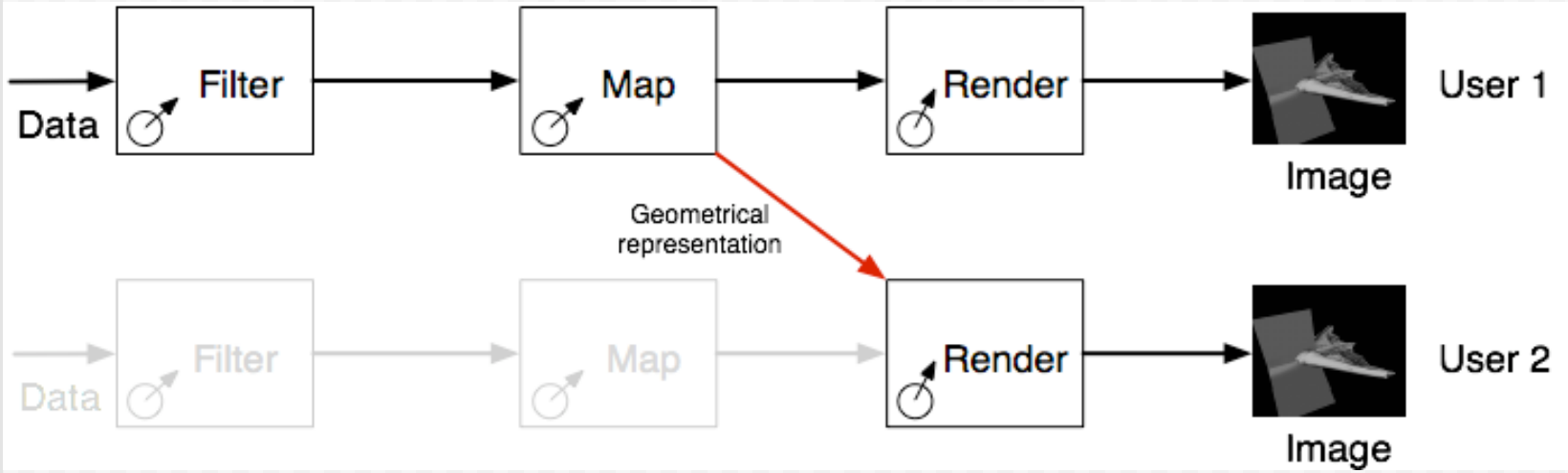


- Shortcomings:
  - Limited control.
  - Shared parameters are statically defined.

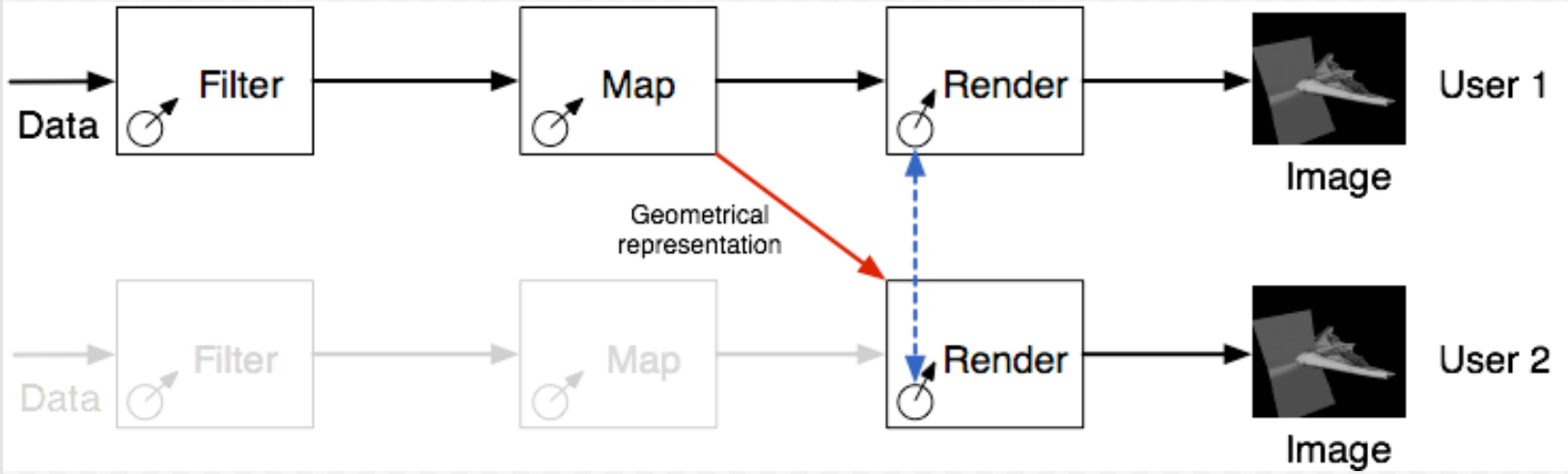
A general model



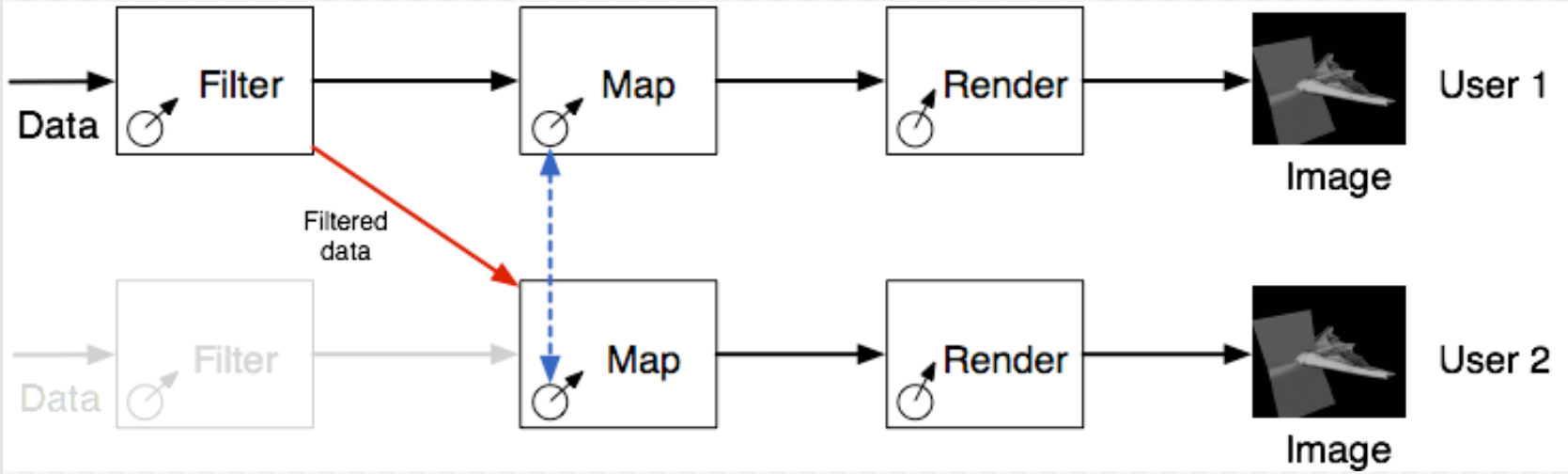
Example 1: Independent rendering



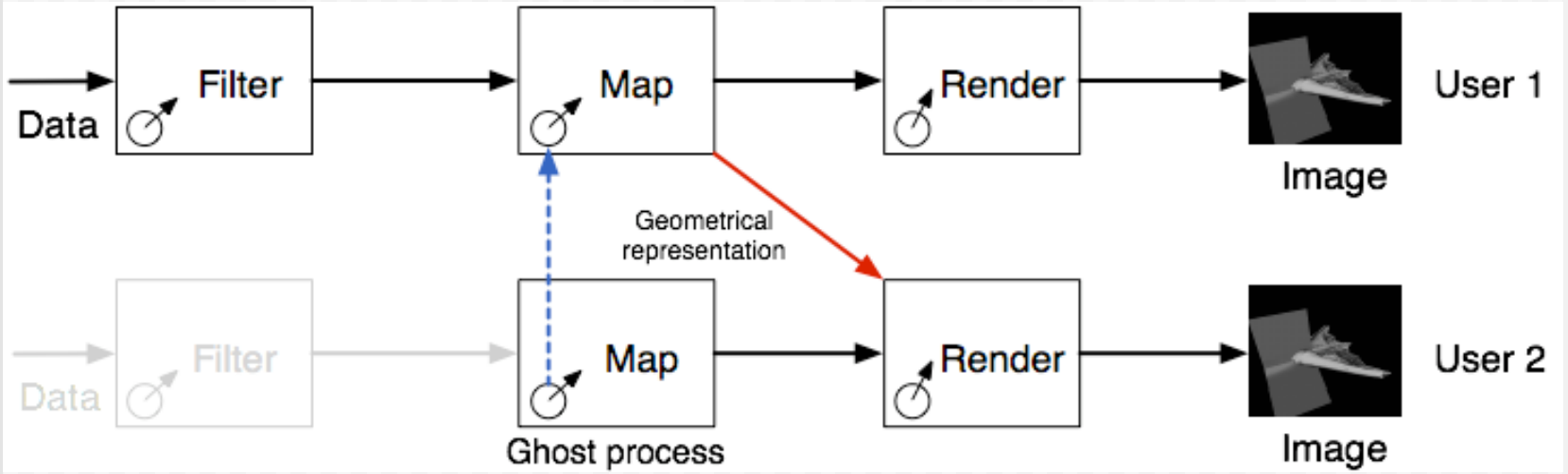
Example 2: Synchronized rendering



Example 3: Synchronized mapping - Public filtered data



Example 4: Synchronized mapping - Private filtered data



Evaluation Criteria

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Evaluation criteria for user

- Nature of the collaboration.
- Collaboration level
  - Data.
  - Parameters.
  - Modules.
- Participation.
- Ease of learning.
- Other features (audio/video conferences, chat, etc.)

Evaluation criteria for developers

- Multiple platforms.
- Performance.
- Reliability.
- Robustness.

Four levels of collaboration

- Local control.
- Local control with shared data.
- Limited shared control.
- Fully shared control.

MVE-Based examples

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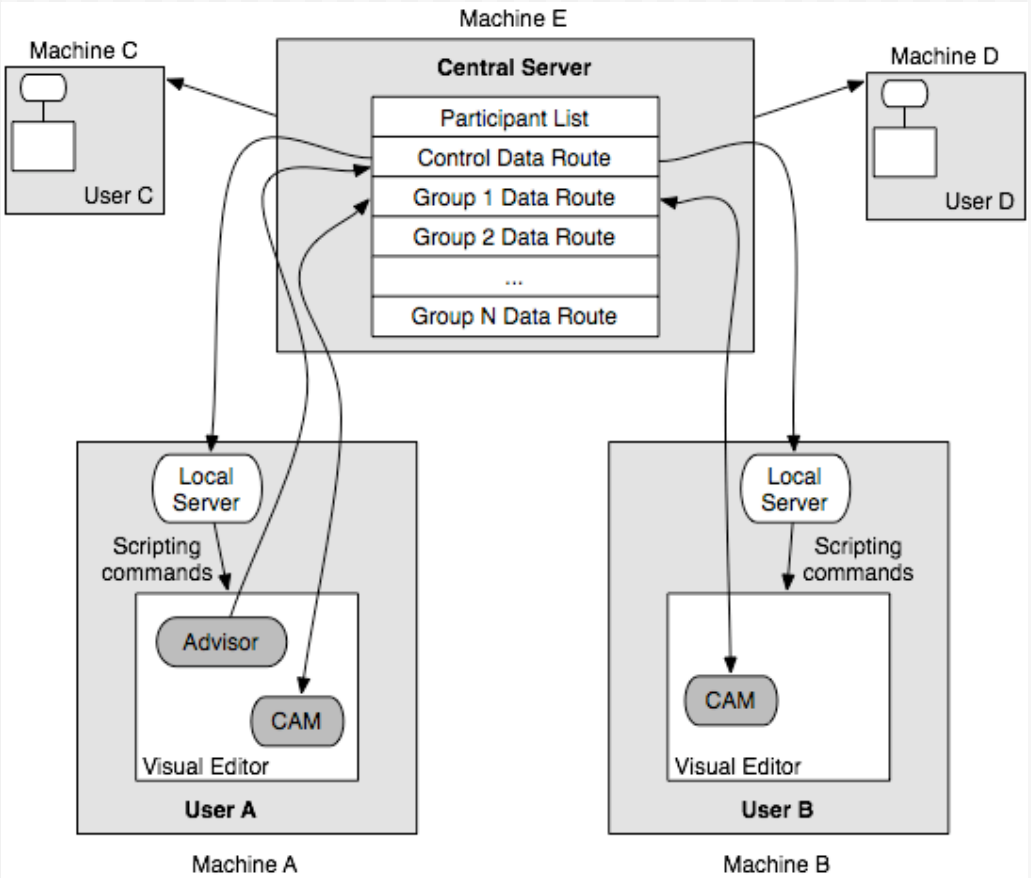
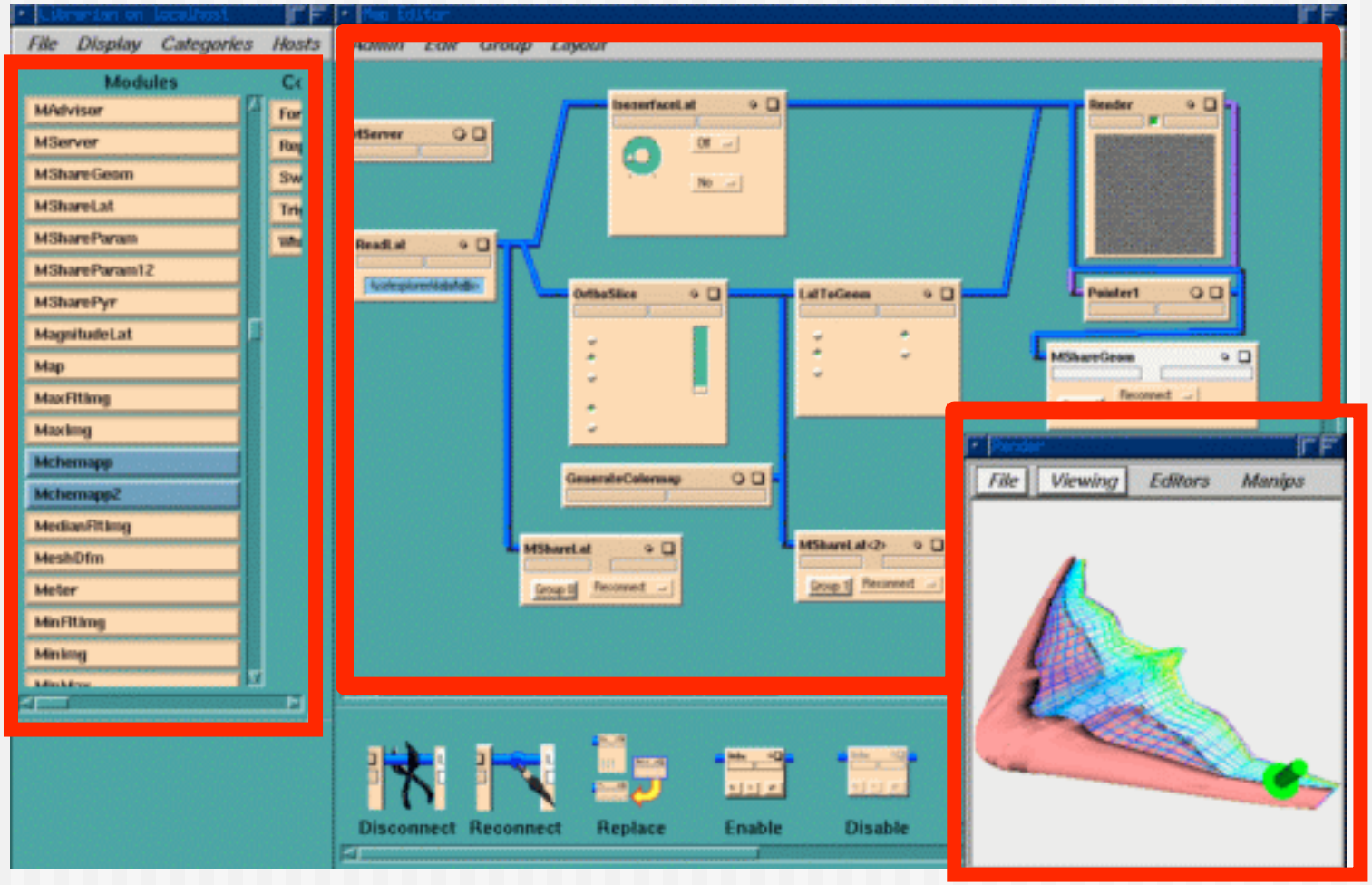
MVE-Based systems

- COVISA
- Shastra (environment) and Poly (visualization)
- COVISE
- MANICORAL
  - Based on AVS/Express
- ONERA
  - Based on AVS5 and IRIS Explorer

COVISA


Machine E
Machine C
Central Server
Machine D
Participant List
Control Data Route
Group 1 Data Route
Group 2 Data Route
...
Group N Data Route
User C
User D
Local Server
Scripting commands
Advisor
CAM
Visual Editor
User A
Local Server
Scripting commands
CAM
Visual Editor
User B
Machine A
Machine B

COVISA Screenshot



COVISA evaluation

- Benefits:
  - Collaboration nature.
  - Collaboration level.
  - Participation.
  - Ease of learning.
- Shortcomings:
  - Multiple platforms.
  - Performance.
  - Other features.

Shastra

- Collaborative multimedia scientific environment
- Infrastructure for running tools in a collaborative way
- A tool to work in Shastra needs to specify:
  - Services offered (Directory)
  - Where to be contacted (Location)

Shastra and Poly

- Poly is a 3D visualization tool for Shastra
- Collaborative visualization is provided by running several instances of Poly
- All activities regulated by a centralized session manager
- Collaborative Session
  - Started by the group leader
  - Users can join only if invited by him
  - Access or modify permission

Shastra and Poly evaluation

- Benefits
  - Collaboration Nature
  - Collaboration Level
  - Participation
  - Other features
  - Multiple Platforms
- Shortcomings
  - Performance
  - Robustness

Poly screenshot

Non MVE-Based Collaborative Visualization systems

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Non MVE-Based systems

- CSPray
- Tempus Fugit and Interview
- Sieve
- NPAC SciVis

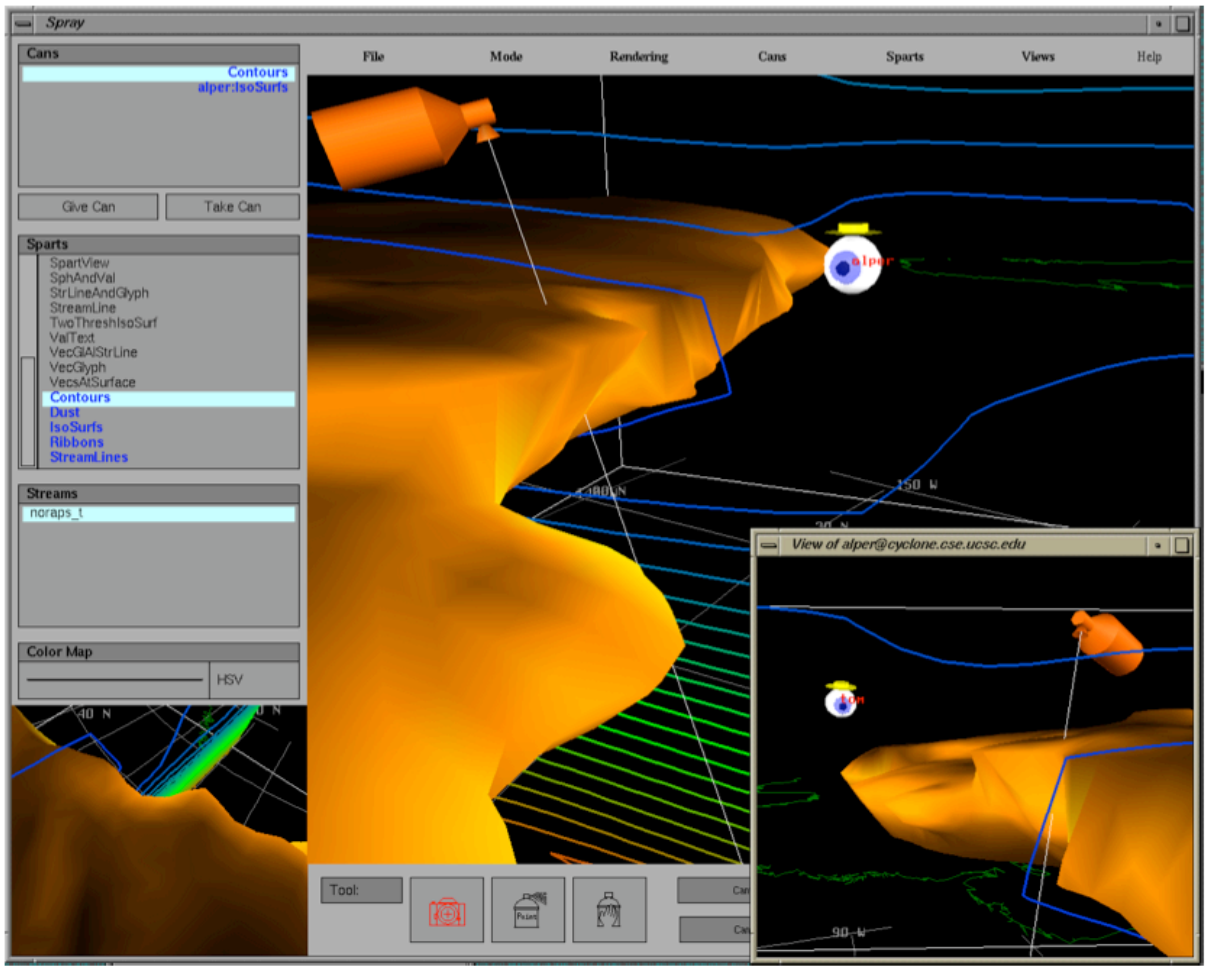
CSpray: Principle

- Based on the Spray rendering system
- Users can modify the visualization by means of spraycan
- Smart particles (sparts) are fired in the data creating geometrical primitives
- MVE is reversed: Modules flows through the data

CSpray: Collaboration

- Shared visualization space
  - Participants are displayed as eyecon
  - They can move the eyecon to get a different location point on the view
  - Each user can apply his spraycan
  - Private and public spraycan

CSpray screenshot



Web-based Collaborative Visualization Systems

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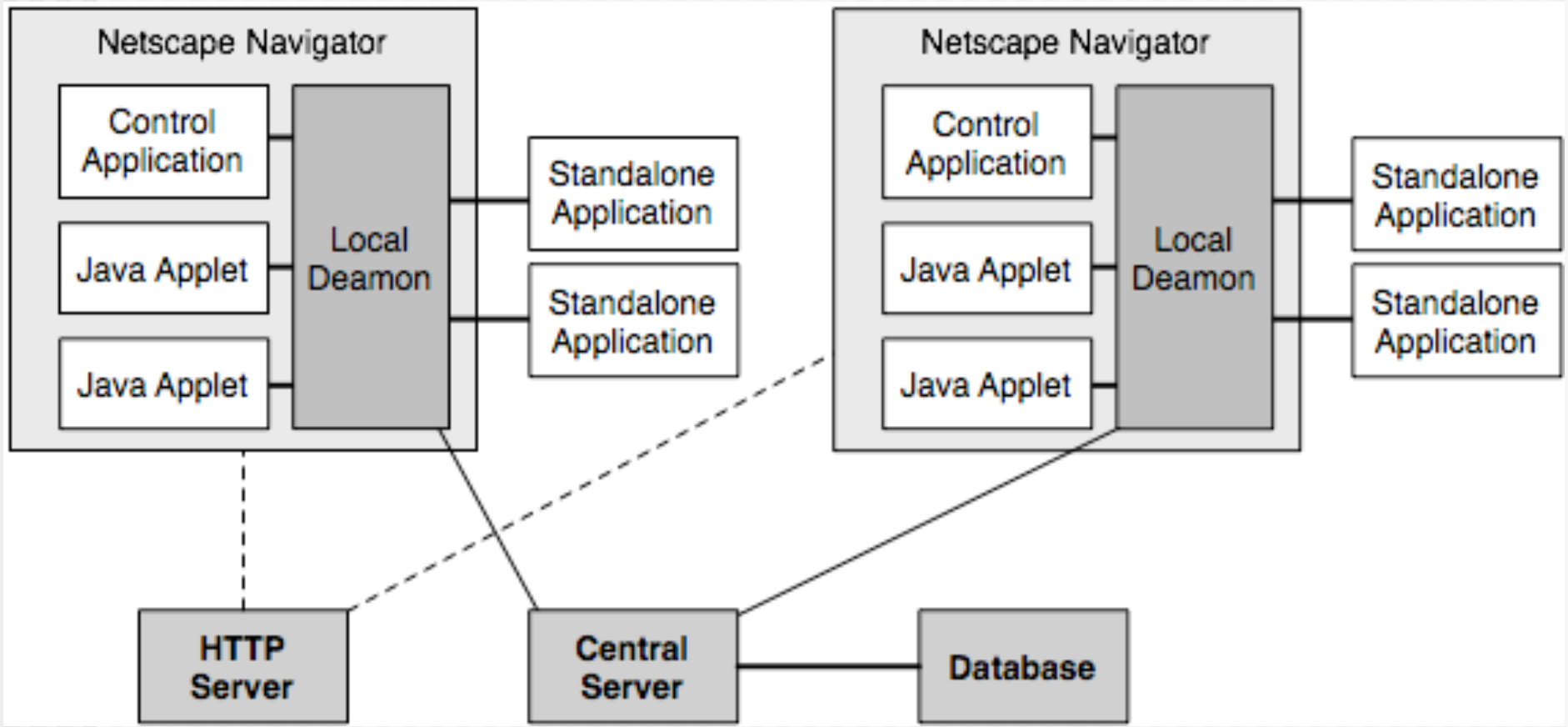
Motivations

- World Wide Web
  - At the beginning it was an information repository
    - Publisher-reader interaction only
    - Descriptive visualization only
  - Today it is a distributed computing environment
    - Reader-reader interaction
    - Analytical and exploratory visualization

TANGOsim

- Integrate web-based and standalone application written in any language
- The visualization is rendered and controlled in a web-browser
- Based on the concept of session
  - Every application belongs to a session
  - Every session has a master (floor control)
  - Collaboration among applications belonging to the same session
- Event logging for asynchronous collaboration

TANGOsim architecture



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Summary

- We have seen models and applications for collaborative visualization
- Common shortcoming: scalability
- The potentiality of collaboration in visualization is very important

My own view

- Collaborative visualization for software visualization
  - Analyzing a system with developers
  - Detecting low quality components with the maintainer of the module
  - Repository (CVS) visualization: See the impact of changes