

Space-based Mediation

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Mediation

me·di·a·tion

Pronunciation: "mE-dE-'A-sh&n

Function: noun

Date: 14th century

: the act or process of mediating; especially

: intervention between conflicting parties to promote reconciliation, settlement, or compromise

Spaces and Mediation

- Communication: reads, writes and takes
- Coordination: blocking reads/takes
 - Predicate versions generally included
 - there are issues of semantic consistency

Othogonality

- **Decoupled**

- **Temporally**

- communicating processes need not run concurrently or even in prescribed order

- **Spatially**

- senders/receivers may remain anonymous

Case Studies--simple, scalable

- **Measure Me**

- Science Center Exhibit

- **Earth Echoes**

- Geospatial storytelling
 - Eatonville, Leu Gardens, Downtown Bus

- **MR MOUT**

- Mixed Reality
 - Variable number of Macrostimulators

Measure Me



Orlando Science Center

+



UCF

=



Measure Me



Our Customers



One Goal -- Uniqueness



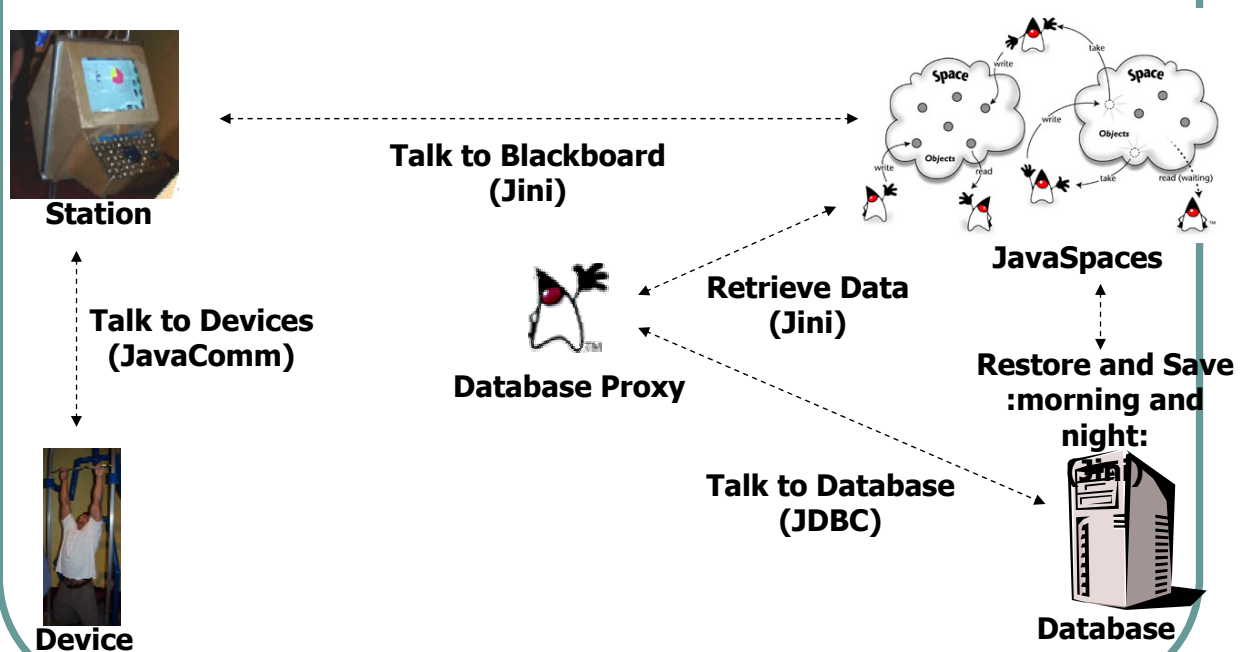
Visitor Procedure

- Pick up ruler
- Go to any station
- Place ruler in slot
 - code scanned and reported to station
- Code/date used to take your tuple
 - Failed predicate take if first station
- Provide demographics; do measurement
- Pick up ruler and go to another station
 - new tuple is written (take to write in transaction)

The Software Infrastructure

- Data stations “talk” to devices (e.g., Hang Time bar) through proxies
- Each station reads/writes messages from/to a JavaSpace that is shared with all data and analysis stations, and the database proxy
- Data captured during the day is stored in a persistent database at night and then written back to the space at the start of a new day

A Pictorial Overview



MeasureMe and JavaSpaces

- Start up clients with cumulative data
- Update clients' software and parameters
- Keep heartbeat
- Keep daily activities of all visitors
- Share info among all stations
- Query database backend
 - Lightweight agent – database proxy
- Collect into database at end of day

Associative Access

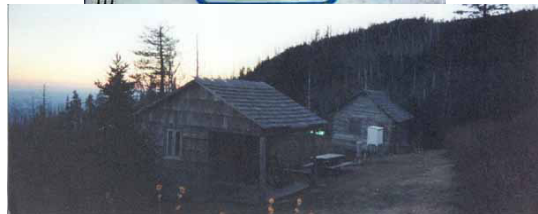
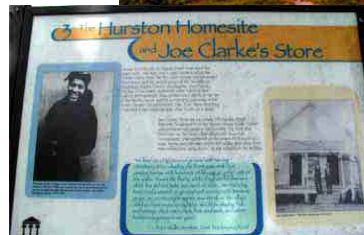
- Rulers are reused each day
 - mark sense code unique for a given day
- Need to support classroom teachers
 - analysis continues after Center visit
 - access via ruler's mark sense code & date

Earth Echoes

Interdisciplinary & Community-based

Earth Echoes: Motivation

- The history of Gettysburg has the most impact at the battle site
- The history and culture of Eatonville have the most impact in the town of Eatonville
- The stories of East Tennessee are best conveyed in the context of the Great Smoky Mountains



Earth Echoes: Concept

- The Concept
 - “drop” stories onto the earth
 - “echo” stories to people who pass by
 - echoes occur today, tomorrow, next week or even a hundred years from now
- Stories are preserved in relation to place
 - a picture of one’s grandparents might be associated with their family home
- Story genre and access rights are maintained
 - give me only what I want and what I have a right to

Content – Eatonville



Content – Mt. LeConte



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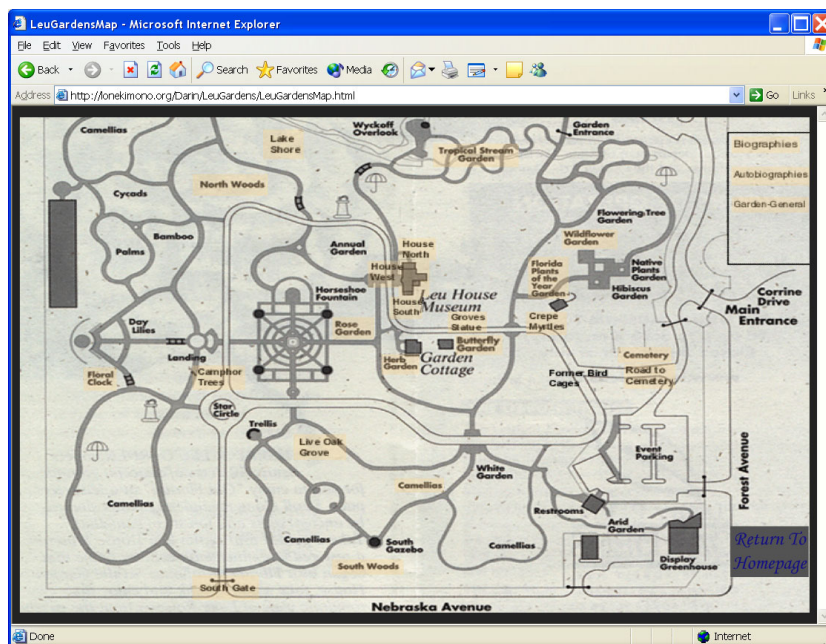
Space-based mediation ...

18

Content – Leu Gardens



A Map Interface to Gardens



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Space-based mediation ...

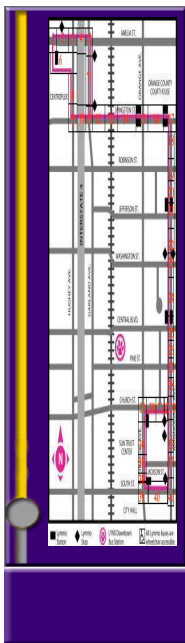
20

Content Seen from Map View



Content – Orlando Lymmo

The Current Time is 6:05 AM



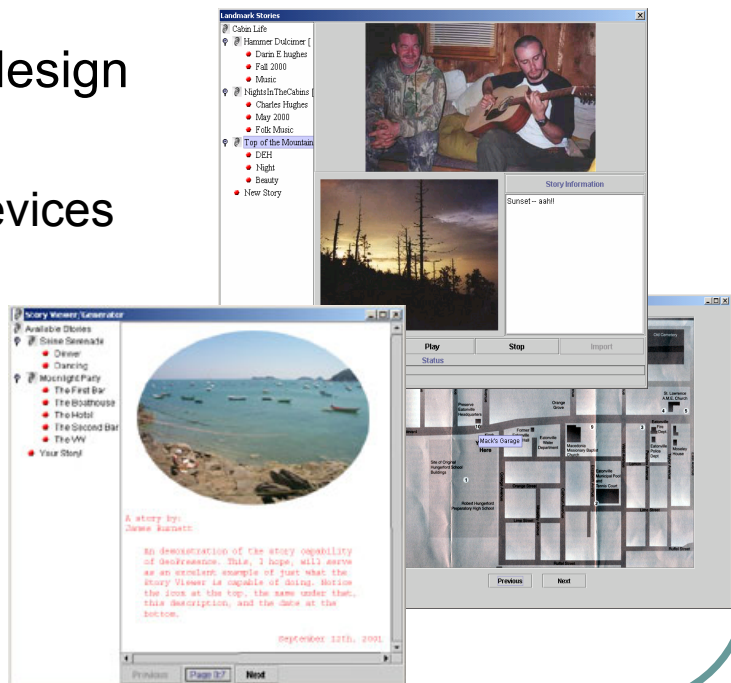
QuickTime™ and a Cinepak decompressor are needed to see this picture.

Associative Access

- Keys are place, genre, identity, ...
- Current implementation is in TSpaces
 - Uses XQL queries
 - Uses URLs for large media objects
- Last TSpaces update on June 14, 2001
 - Change to what?

Issues

- User interface design
 - web-based
 - on portable devices
- Network design
 - scalable
 - extensible
 - anonymous
 - legal?

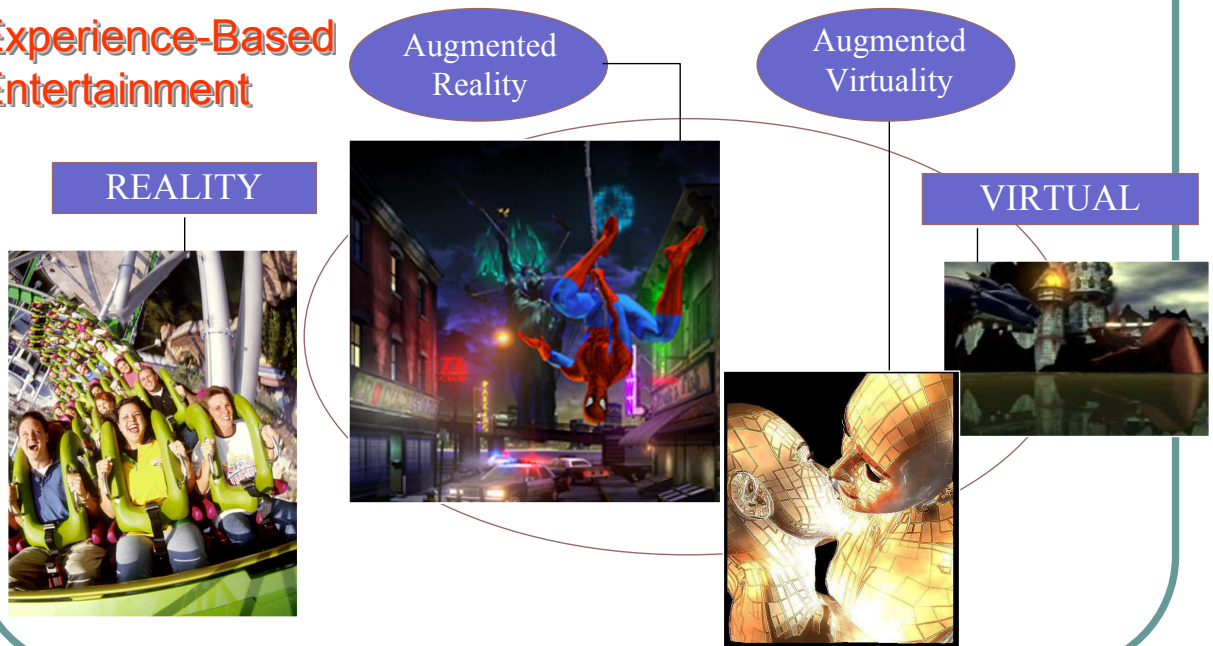


Mixed Reality

Learning from Theme Parks

Mixing Realities

Experience-Based Entertainment

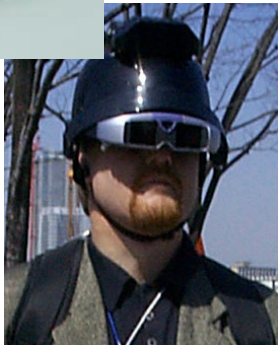


Mixed Reality from Canon

Indoor Unit



Outdoor Mobile Unit



Canon's CoaStar Mixed Reality HMD includes lightweight video cameras to support video see-through. Software mixes synthetic imagery with live video from cameras.

Issues

- Tracking
- Scene analysis
- Registration
- Rendering (illumination)
- Audio immersion
- Macrostimulators
- Scripting
- Scalability
- The great outdoors

Macrostimulators

- Show effects
 - Audio
 - Pyrotechnics
 - Smoke
 - Moving objects
- Spaces allow absence of recipients, absence of senders, dynamic add-ins, default providers when more desirable ones are not available

View-Centric Reasoning (VCR)

- Reasoning in presence of uncertainty

Joint work with

Marc L. Smith
Colby College

Rebecca Parsons
ThoughtWorks

Communication

*The greatest problem with communication
is the illusion it has been accomplished.*

- George Bernard Shaw

VCR in a Nutshell

- Observation-based model
 - reasoning via observation
- In Modern Systems
 - sub-processes represent the *observers* of a computation
 - communications represent the events of a computation
 - observers may each see a different *view*
 - observers might not be perfect (or even want to be so)
- In VCR, represent
 - what might happen (nondeterminism)
 - what did happen (history)
 - what appeared to happen (views)

VCR Inspired by CSP

- Communicating Sequential Processes (CSP)
 - seminal work by [Hoare 1985], reasoning about computation via trace
 - process described by its observable events
 - observer records history of a computation
 - what about event simultaneity?
 - synchronization? (record one event in trace)
 - otherwise record arbitrary interleaving of events
 - history is a *sequentialized* trace of events

VCR Abstractions

- Events and un-events
- Two new event aggregates
 - parallel event (unordered)
 - ROPE (Randomly Ordered Parallel Event)
- Event aggregates
 - serve as trace primitives
 - provide context for event simultaneity
- Two new types of traces
 - history (sequence of parallel events)
 - view (sequence of ROPEs)

VCR Implications

- One history may have many views!
- History and views permit us to reason about properties we can't with sequentialized traces
 - we can generate all possible views from a history
 - the reverse is not true
- Consider sequentialized trace: A, A, A, A
 - assume perfect observation, and that this trace represents all possible interleavings
 - possible histories: $\langle \{A, A, A\}, \{A\} \rangle$ or $\langle \{A, A\}, \{A, A\} \rangle$ or other parallel event traces?

JavaSpaces and Ordering

- Provides predicate versions of rd() and in()
 - Removed from Linda due to ambiguity
- JavaSpaces Service Specification
 - “Operations on a space are unordered ...”
- Loose semantics for inp and rdp is a way around ambiguity (see paper on GLOBE)
- VCR supports extensive reasoning, even in light of strong semantics

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