Dynamic Shared State

Class 10
Dr. Roger Smith

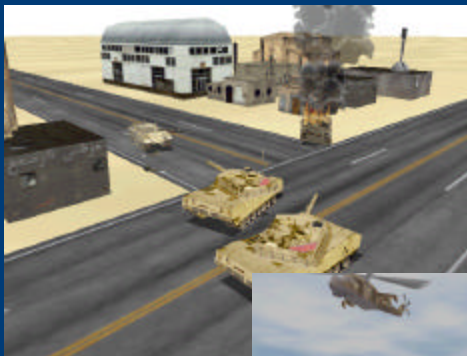http://www.simulationfirst.com/ein5255/
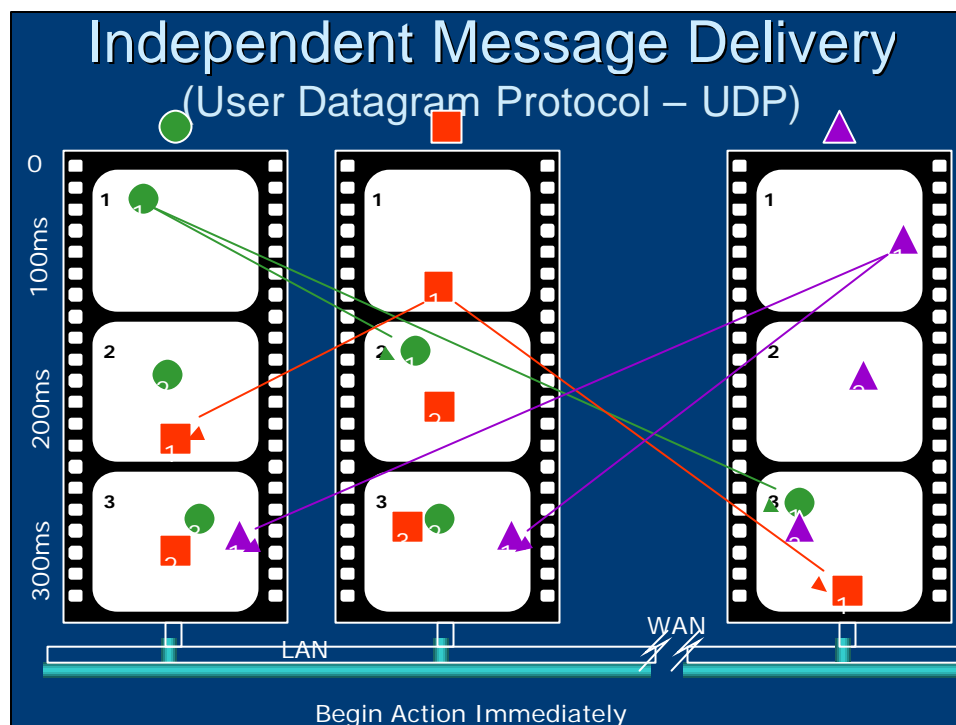
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Shared State Data

- Terrain
- Buildings
- Trees
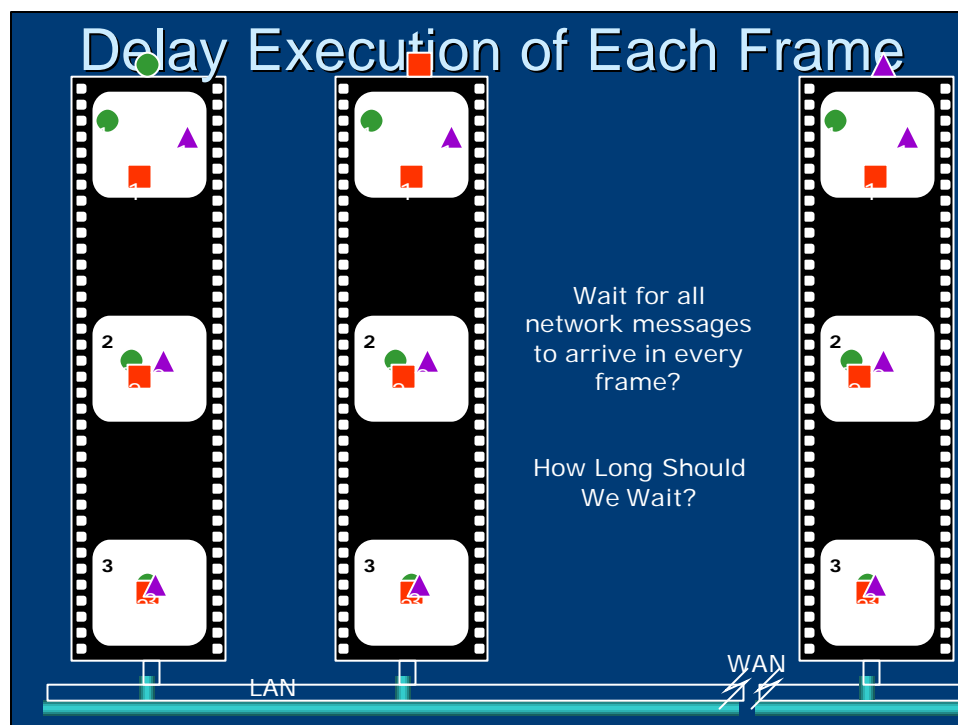- Vehicles
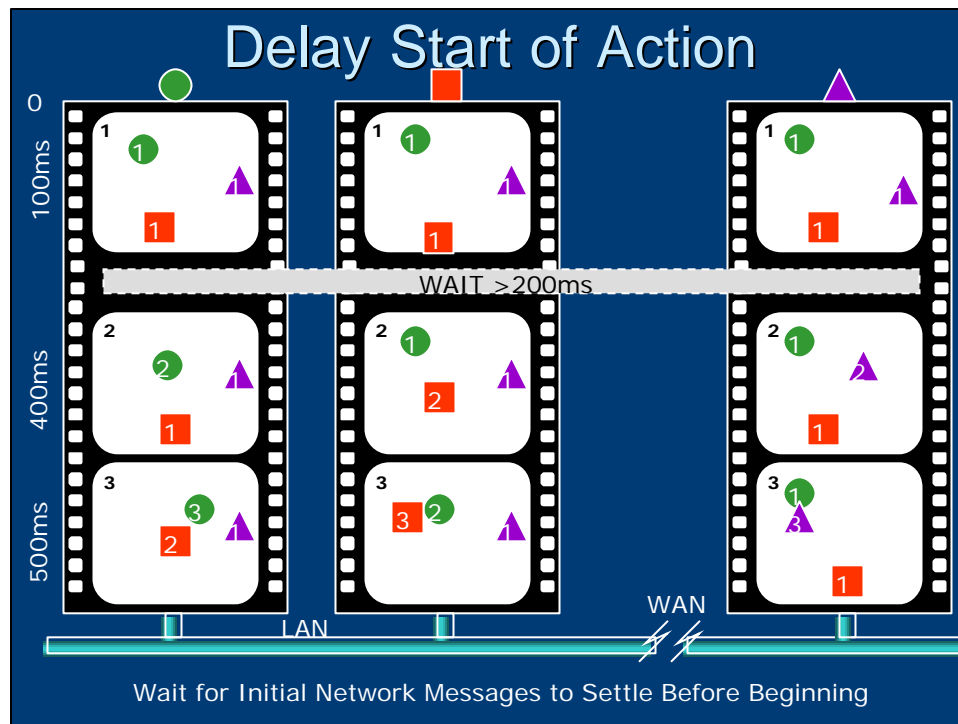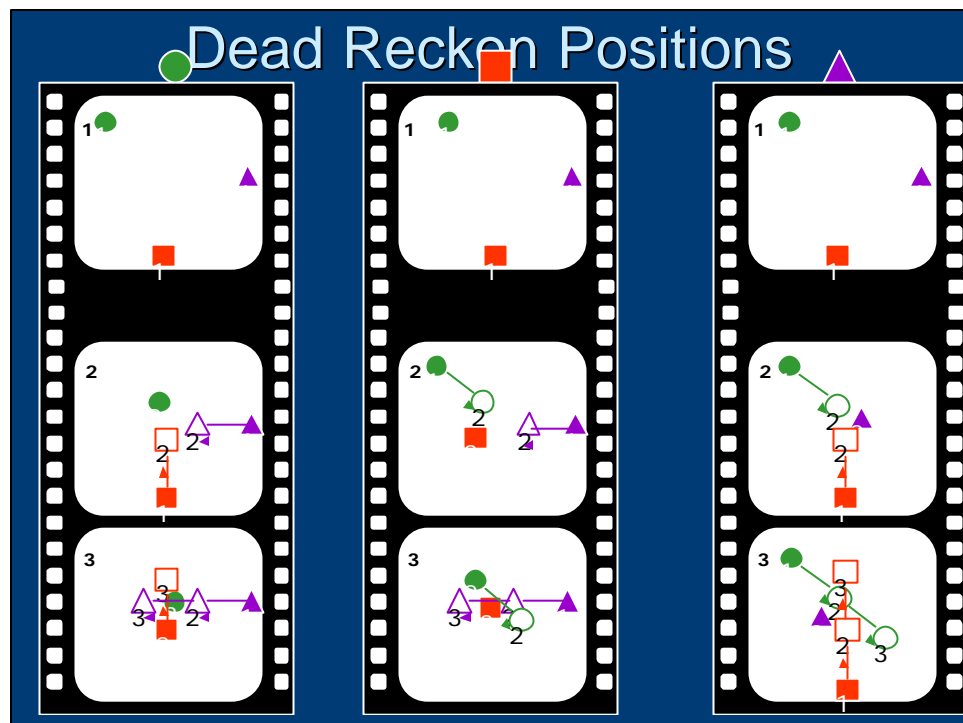- Smoke
- Cows
- Rain
- ...

How do you share with consistency?

- Frequent Updates
  - Talk a lot (Network Messages)
- State Prediction
  - Guess at future state (Dead Reckoning)
- Shared Repositories
  - All from the same well (Data Server)
- Combination of All Three

Independent Message Delivery
(User Datagram Protocol – UDP)

Delay Start of Action

WAIT >200ms

Wait for Initial Network Messages to Settle Before Beginning

Delay Execution of Each Frame

Wait for all network messages to arrive in every frame?

How Long Should We Wait?

Coordinate Execution Times

(Transmission Control Protocol – TCP)

Send ①

Send ⚊

Acknowledge Receive ①

Acknowledge Receive ⚊

(... Repeat for Each Frame ...)

Dead Recken Positions
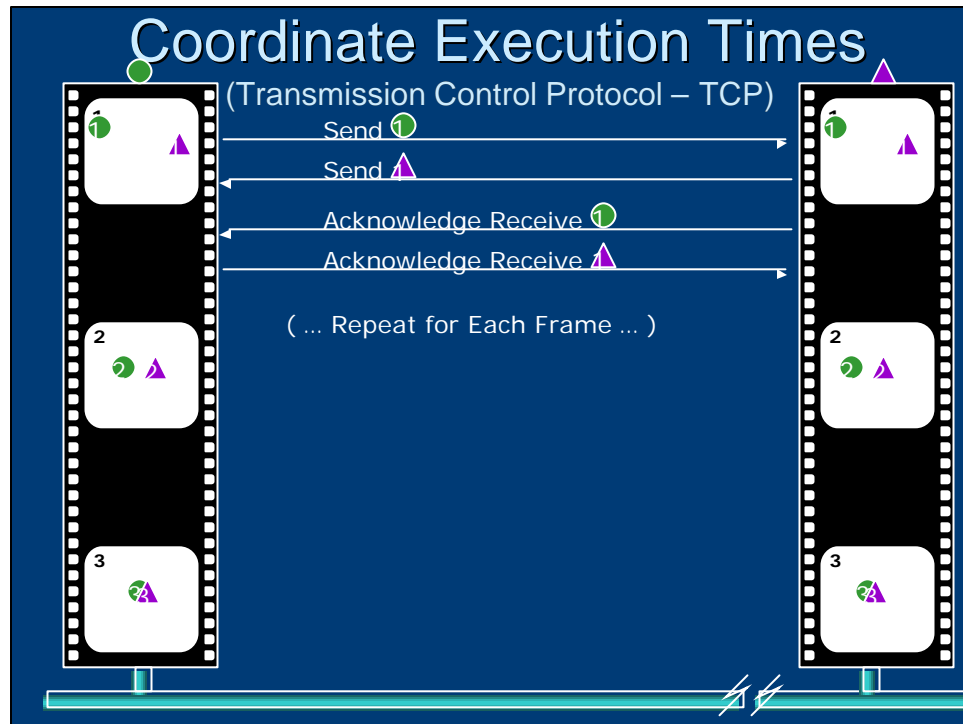
Network Cheating: Hit Catcher
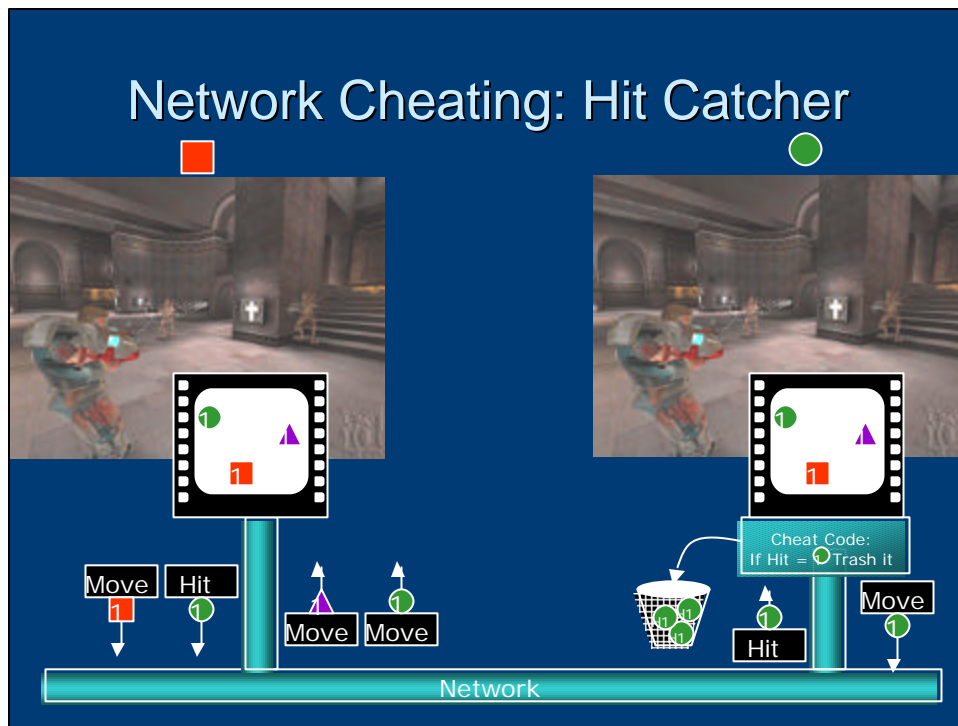
Network Cheating: Auto Shooter
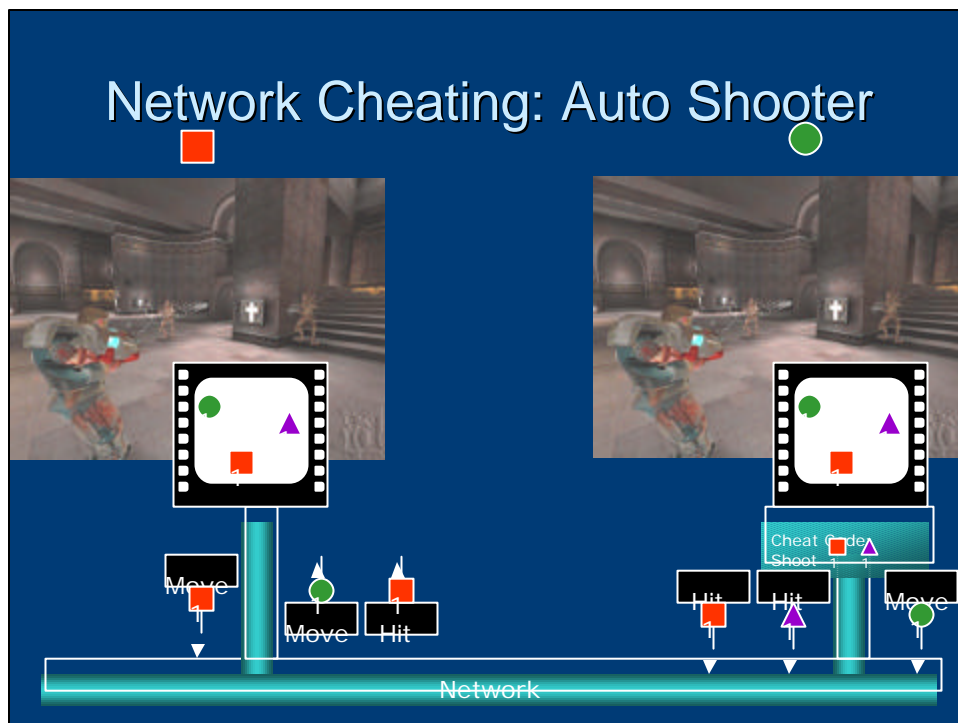
Computer Games are Always Client/Server

Client 1　Client 2　Client 3　　　Client 4　Client 5　Client 6

C

Virtual World Server 1 — Virtual World Server 2
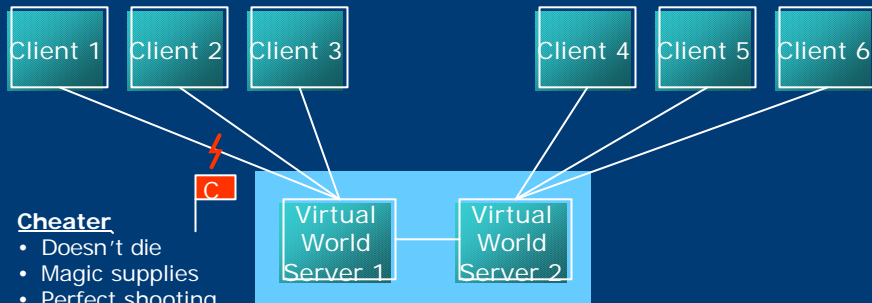
Cheater
- Doesn't die
- Magic supplies
- Perfect shooting
- Shooting too fast

- Server contains the official version of the world
- Server adjudicates all interactions
- Server watches for inconsistencies that indicate cheating
- Cheaters are disconnected
- Cheaters accounts are deleted
- Cheaters charge card numbers are tracked
- Constant escalating arms race

Shared Environment

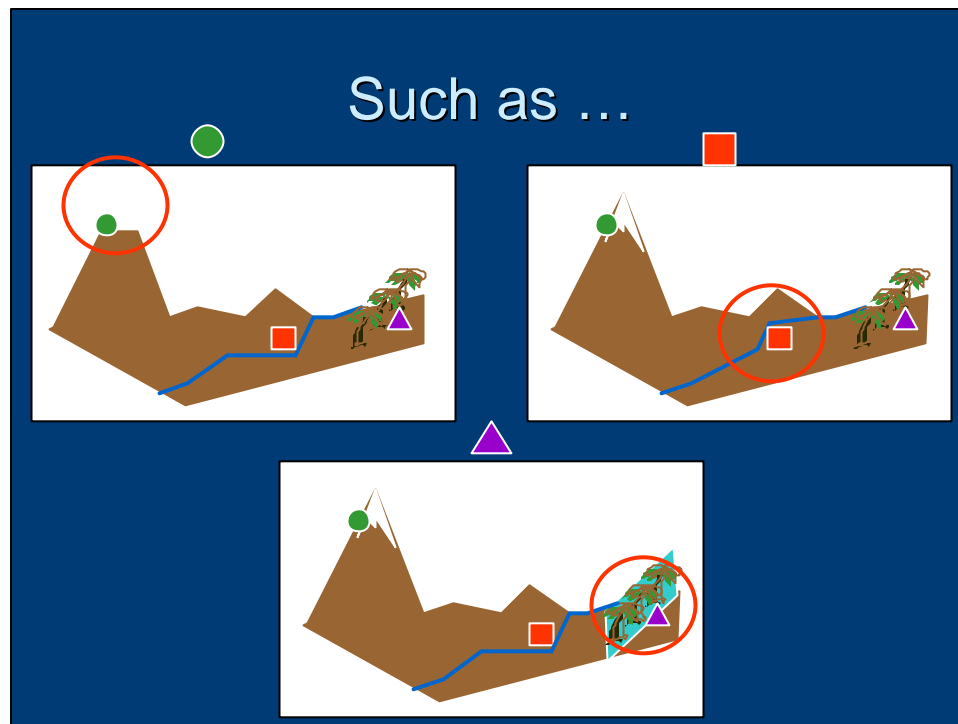"One of these things is not like the others ..."

Shared Environment
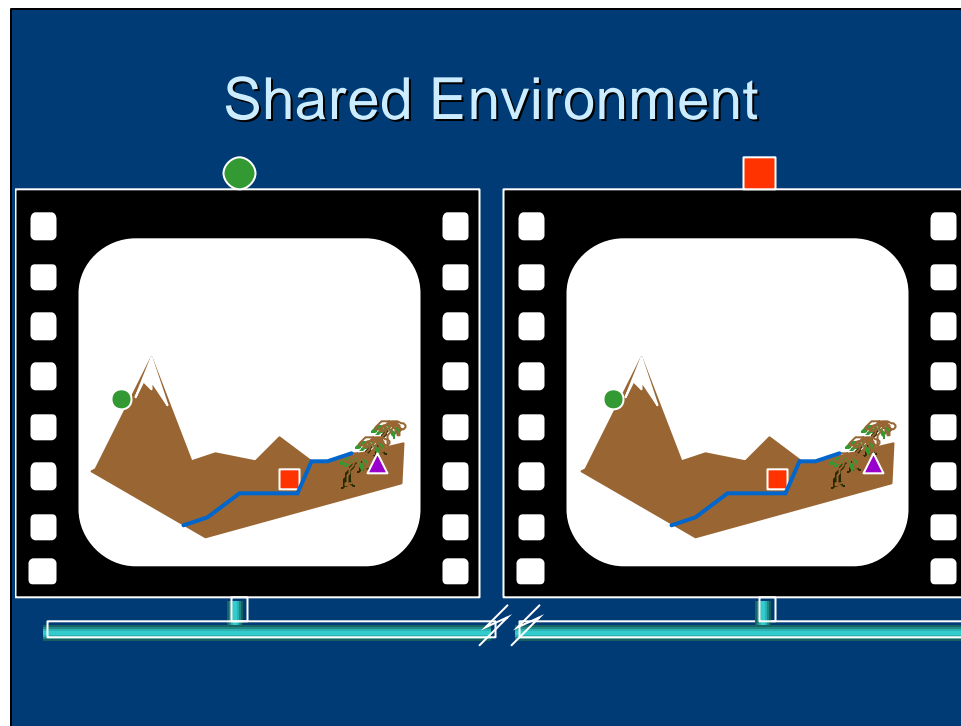
Environmental Data Variance

- Data Compression
- Data Thinning
- Format for Target Computers
- Fix Errors in Original Source
- Add Fidelity
- Data Representation
- etc. etc. etc.

Such as …

Solution 1: Master Data Format

| Field Name	Units	Data Type
X-Coordinate	Meters	Integer
Y-Coordinate	Meters	Integer
Z-Coordinate	Meters	Integer
Soil Type	Enumerated	Road, Dirt, Sand, Marsh
Vegetation Type	Enumerated	Pine, Oak, None, …
Wetness	Enumerated	Dry, Damp, Soaked …
Radar Reflectivity	…	…
IR Absorption	…	…
…		
…		

- Project 2851
- Standard Database Interchange Format (SIF)
- SIF++ (from CCTT Project)

Solution 2: Identical Clients

Client 1 Client 2 Client 3 Client 4 Client 5 Client 6
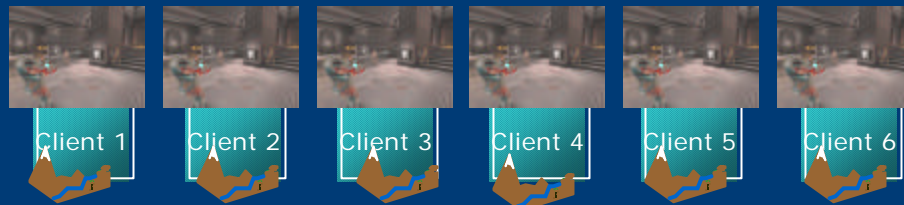
- Computer game solution
- Single source of software
- Uniform hardware
- Centralized control of changes to client

Solution 3: Common Source

Client 1 Client 2 Client 3 Client 4 Client 5 Client 6
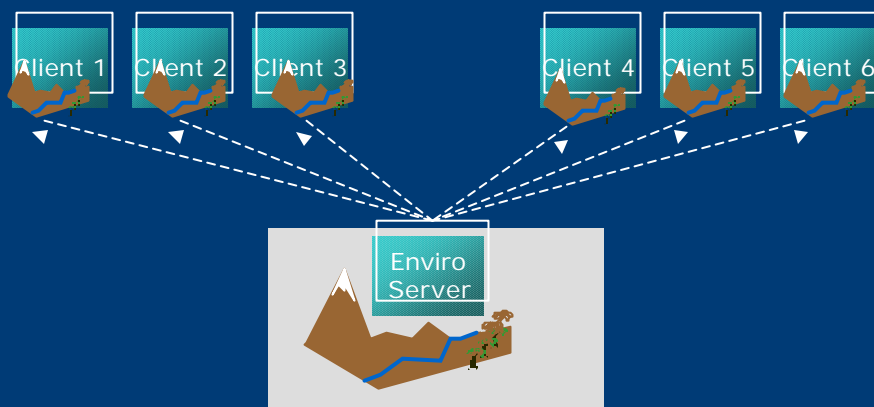
Enviro Server

- Load from a single source long before execution
- All clients do not have same formats
- Requires translation => variance
- SEDRIS

Solution 4: Environment Server

Client 1   Client 2   Client 3   Client 4   Client 5   Client 6
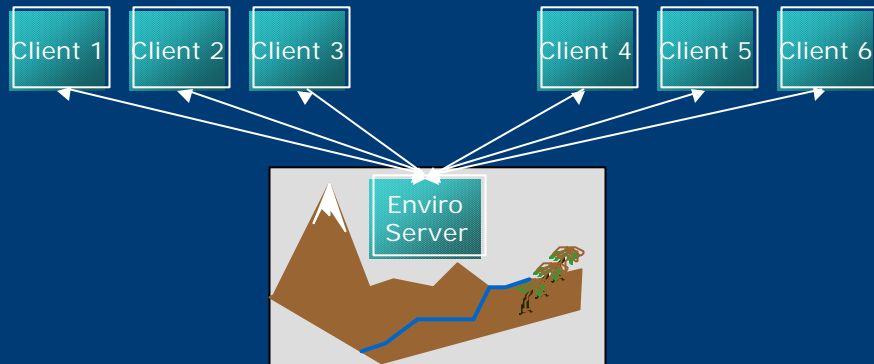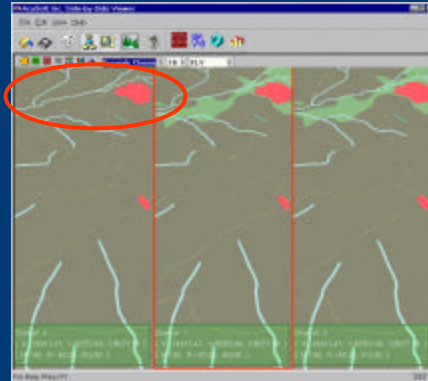
Enviro Server

- Single consistent source
- Slow performance
- Additional network traffic
- Enviro Server is bottleneck for entire system
- TIREM, TAOS, HPAC, etc.

Synthetic Environment Data Representation and Interchange Specification (SEDRIS)

- **COMPLETE:** Capture complete set of data elements and relationships
- **LOSSLESS:** Provide standard, lossless data interchange mechanism and format
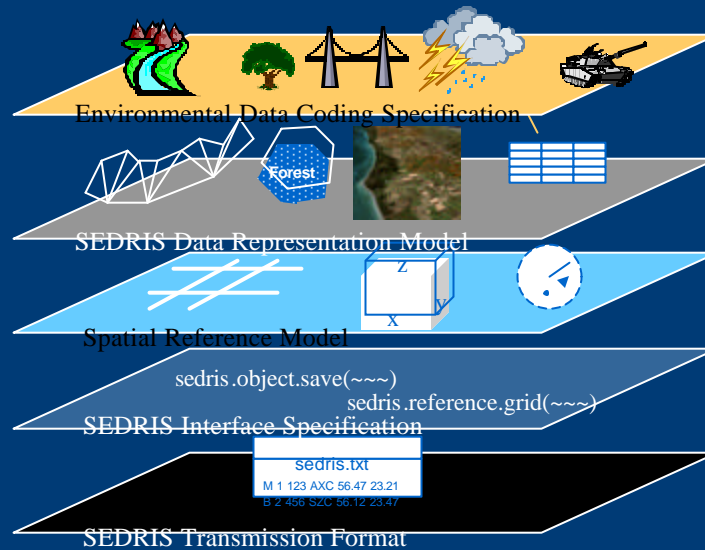- **UNAMBIGUOUS:** Provide self explanatory databases

SEDRIS Data Interchange

Producers NIMA etc.

Native Format n

API

Common Model

Resource Repository

Native Format3

Native Format1

Native Format2
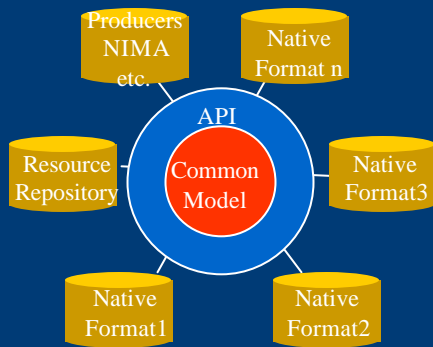
- Unambiguous representation
- Lossless and consistent interchange
- 100X reduction in conversion costs
- More disciplined process of interchange

SEDRIS Technology Components

Environmental Data Coding Specification

Forest

SEDRIS Data Representation Model

Z
X Y

Spatial Reference Model

sedris.object.save(~~~)
sedris.reference.grid(~~~)

SEDRIS Interface Specification

sedris.txt
M 1 123 AXC 56.47 23.21
B 2 456 SZC 56.12 23.47

SEDRIS Transmission Format

Dynamic Terrain

- Obstacles on Surface
  - Concertina Wire
  - Dragon's Teeth
  - Minefields
- Terrain Surface Changes
  - Anti-Tank Ditches
  - Infantry Trenches
 - Berms
  - Craters

Dynamic Environment

- Independent
  - Weather Movement - Clouds, Rain, Wind
  - Sea State - Storms, Daily Tide
  - Daylight - Sunrise, Sunset, Dusk
  - Smoke & Dust - Clouds, Raising, Dispersing
- Interaction
  - Holes - Artillery craters, Engineering Artifacts
  - Tank Treads - Tracks, Destruction
  - Terrain Morphing - Engineering, Construction
  - Feature Modification - Building Damage, Trees Burned

Dynamic Weather

Weather Feature Object

Weather Data Matrix
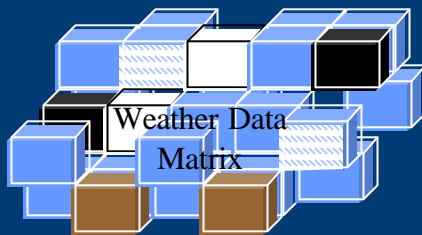
- Weather Features as Objects rather than data tables
- Feature Attributes
  - Location, Size, Speed,
  - Duration
  - Movement Path
  - etc.
- Very similar to an aircraft on a mission