Massive Multi-Player - Advanced Technology and Integration Solutions

OpenSkies Network Fabric

Fusing diverse and disparate entities/events into one holistic and operational scenario, with scalability to

100,000s of entities

What is the problem?

- Integration of very many players/entities (>>10,000) from multiple sources in multiple object formats at differing degrees of reliability and at variable update rates into a common object model and framework is a hard problem.
- This problem is at the heart of solving:
  - Very large scale mixed Training Systems like LVC-IA
  - Large scale Test and Evaluation of Net-centric Systems
  - Ground and Air Battle Command and Control Systems

Large Live Virtual Constructive Stresses Present Distributed Simulation Networks

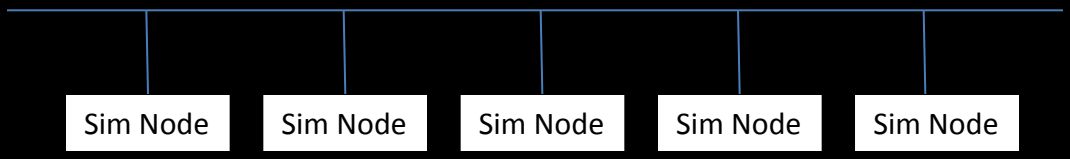
- DIS and HLA networks are made of NxN peer-to-peer network traffic
  - 42 byte packets once per second,
  - 100 entities 3.36 mb/sec,
  - 1000 entities 336 mb/sec,
  - 10,000 entities 33.6 gb/sec,
  - 100,000 entities 3360 gb/sec
- Massive multiplayer game sites handle much larger traffic (World of Warcraft holds up approximately 1.2 million players continuously on 486 servers – Ref: http://www.warcraftrealms.com/activity.php and http://www.wowwiki.com/Category:Servers)

How do they do that?

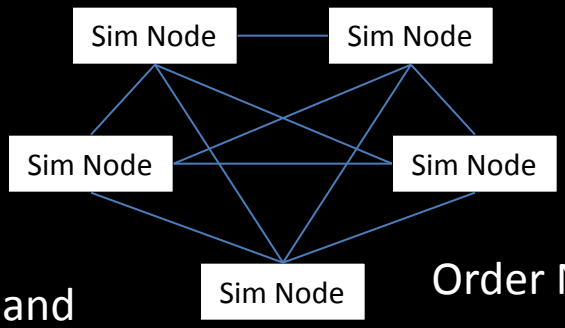
Gaming network vs. HLA network

- DIS/HLA Networks route all state change messages to all players

DIS/HLA Physical network

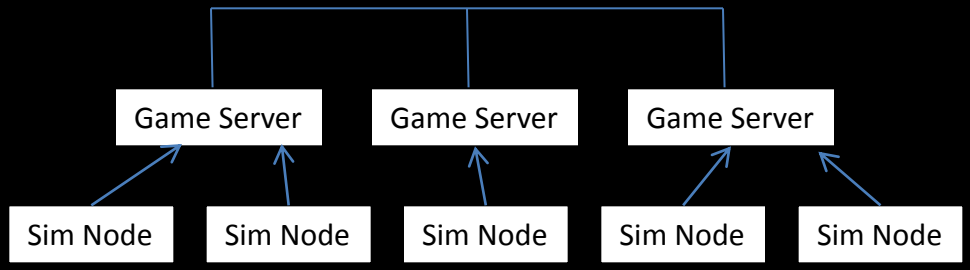


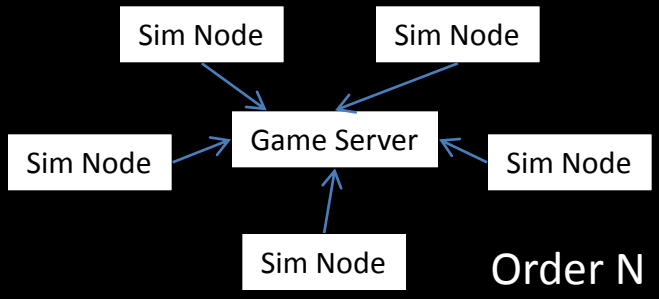
DIS/HLA Logical network



Order NxN

- Game Networks route all data to a central point and from there to each consumer





Order N

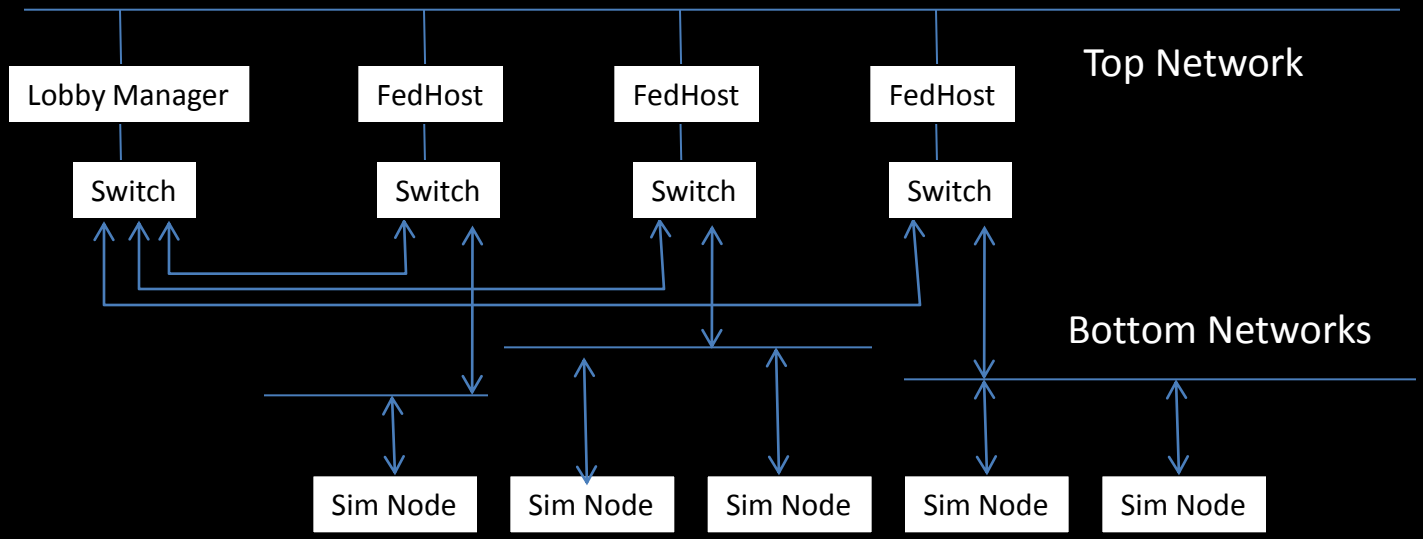
- Network traffic in Game Networks is reduced by Order N over HLA

Traffic grows linearly with the network attached clients not by NxN

Cybernet OpenSkies HLA

Lessons learned from Gaming applied to OpenSkies HLA RTI Architecture:

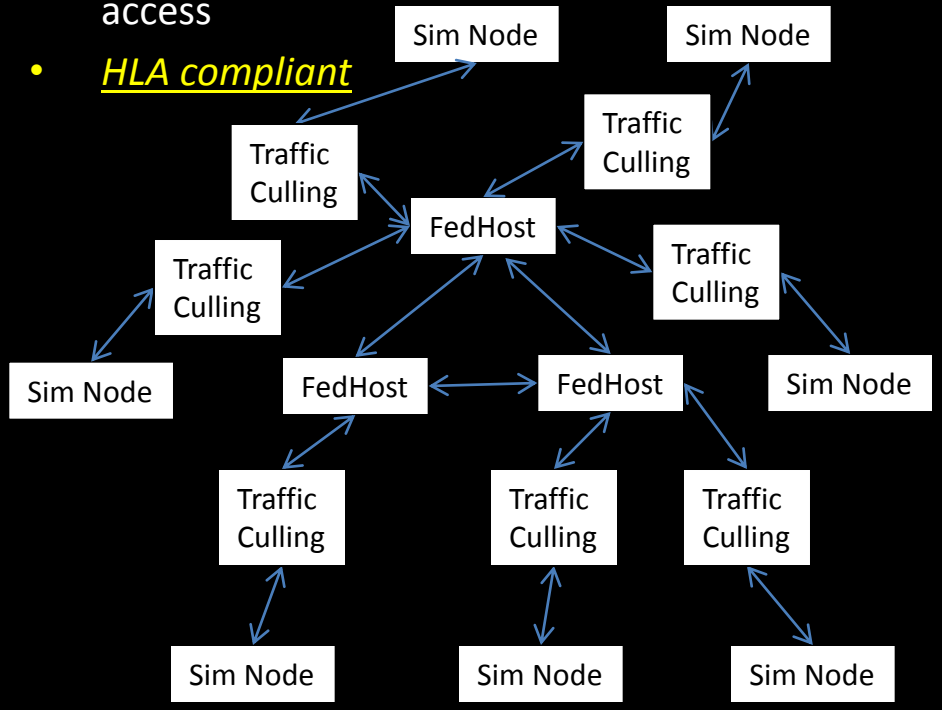
- Centralize federation management & forwarding functions in FedHost "game servers"
  - FedHost cloud controls the federation and implements smart multicast
  - FedHost Traffic Culling Modules assigned to each client filter/conduit message traffic to implement data access, multilevel security, quality of service (latency/update rate)
- Less than full NxN redundancy in communications with load balancing
  - Lobby Manager provides authentication, monitors status, and load balances
  - Sim Nodes use a single physical connection to a FedHost *not NxN to all federates*
- Partition network connections and network performance to match traffic pattern



Logical Topology

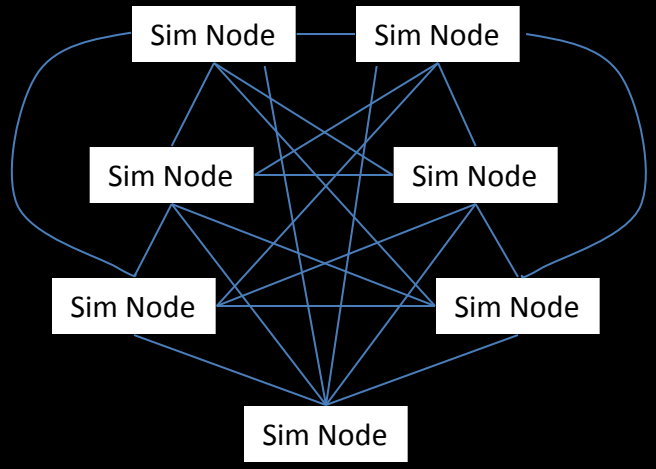
How it looks to Message Traffic:

- Hierarchical centralized flow avoids the NxN problem
- Culling modules control data access, quality of service, and multilevel security access
- *HLA compliant*



How it looks to Sim Nodes :

- Nodes still post entity changes without need to know the destination
- The network takes care of distributing changes to all federates according to command priority, security level, and quality of service specification



What is Traffic Culling? See next page.

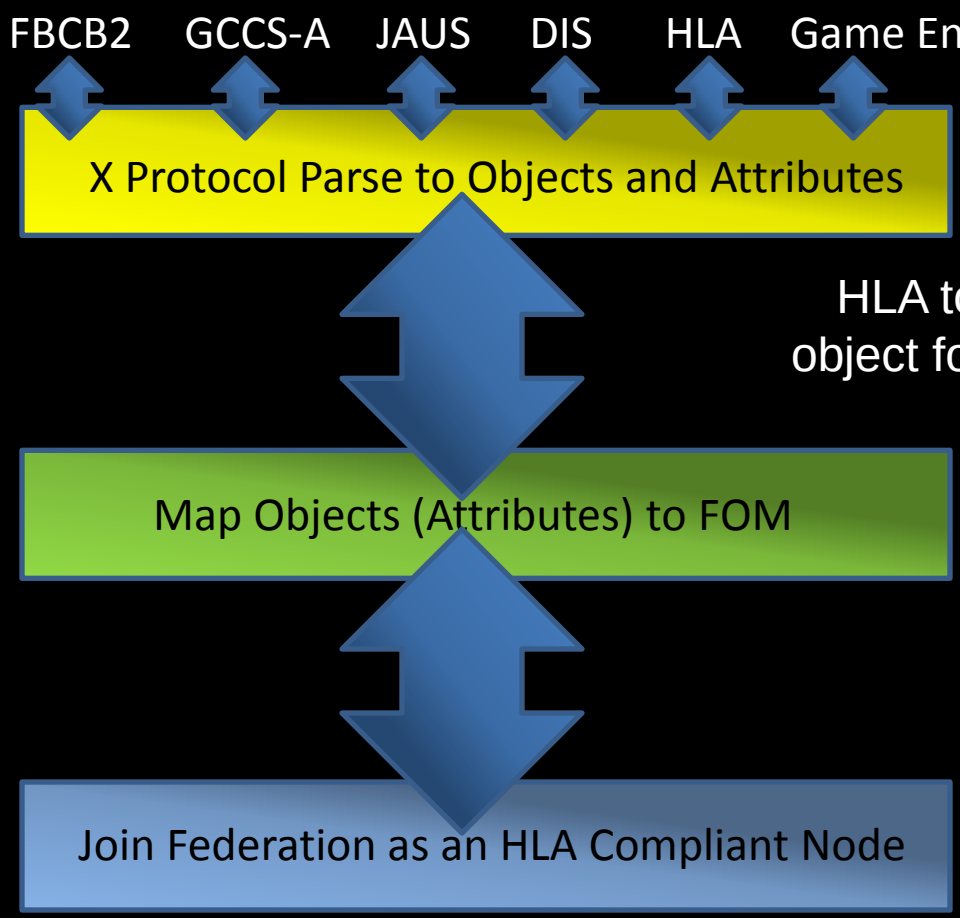
What is Traffic Culling?

Each client attaches to/from a FedHost through a culling module which is customized to the federation. It controls:

- Access and data hiding (based on Security or Chain-of-Command rules) in and out of the client into the federation
- Data rewrite (i.e. veiling of certain data or attributes, perhaps associated with security access)
- Update rate to other objects based on type, absolute location, location difference between send and receive objects
- Region membership of the client and other update recipents

- *Culling implements reconfigurable Security, Access, Bandwidth Allocation*

How do we connect to Non-HLA data sources/destinations?



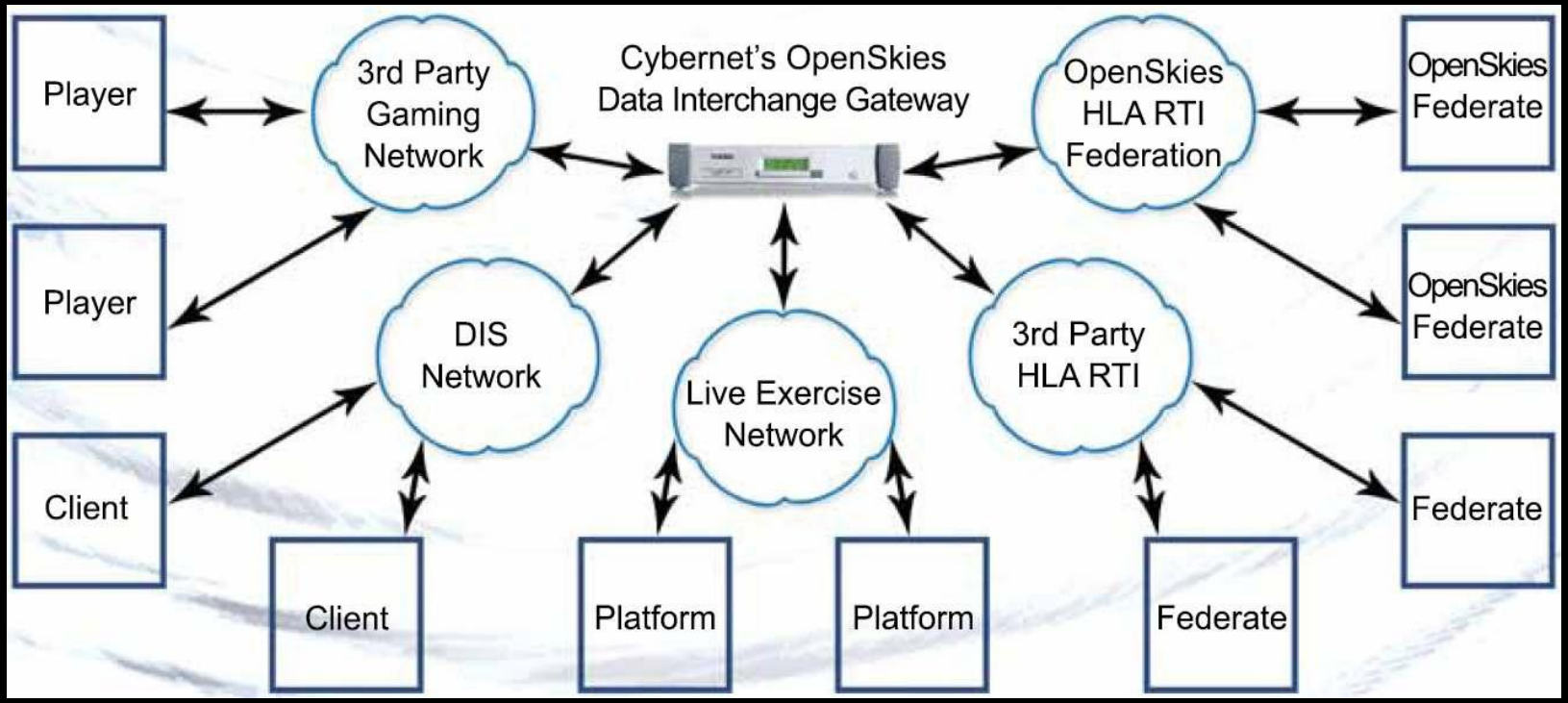
HLA to X Gateways translate from native object formats to HLA Object Models (FOMs)

An OpenSkies Gateway:

- Parses native protocol
- Provides object (attribute) mapping
- Looks like a Sim Node to the HLA network it connects to/through

OpenSkies Gateways Already Support:

- Multivendor HLA to HLA (Constructive)
- DIS to HLA (Virtual)
- Physical to HLA (Live position & Orientation)
- Game platform to HLA (Game)
- JVMF to HLA (C2)
- JAUS to HLA (Robot)



HLA and DIS interface support leveraging OneSAF, SE Core, LT2, CTIA, TENA Components

Demonstration Format

- Demonstration scale – comparable to LVC-IA Phase I Specification
- Integrates synthetic virtual, constructive, and C2 scale of object traffic
- Shows aggregate performance
- Shows typical performance of a constructive simulation generated COP on an independent COP viewer over a traffic stressed network

COP – Common Operating Picture C2 – Traffic into/from tactical systems

Demonstration Size

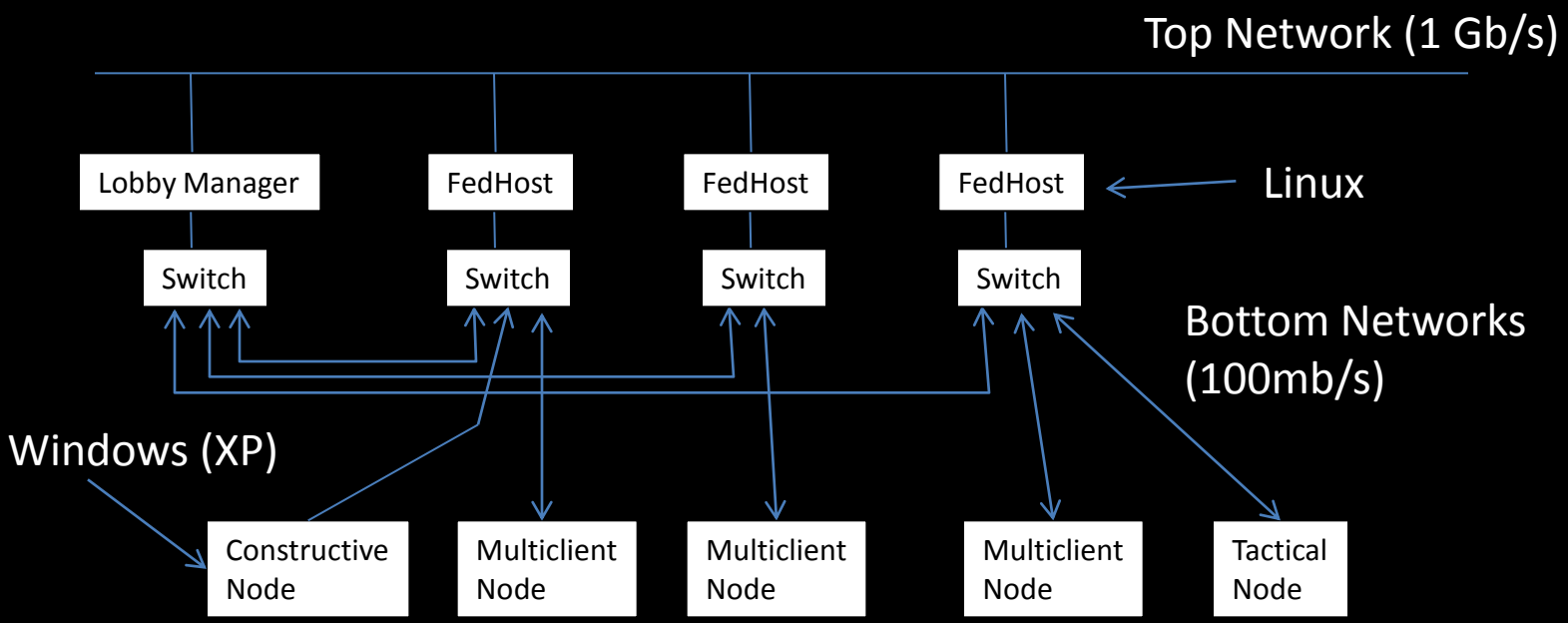
- 5 client stations running 773 virtual clients and >30,700 changing entities
  - 773 distinct virtual clients
  - >30,700 varying entities
  - 3 Federation Hosts, 1 lobby manager for load balance

LVC-IA Big

- A constructive simulation feeding a tactical viewer overlays the synthetic traffic

Provides a good feel for nominal performance

Demonstration Network Topology

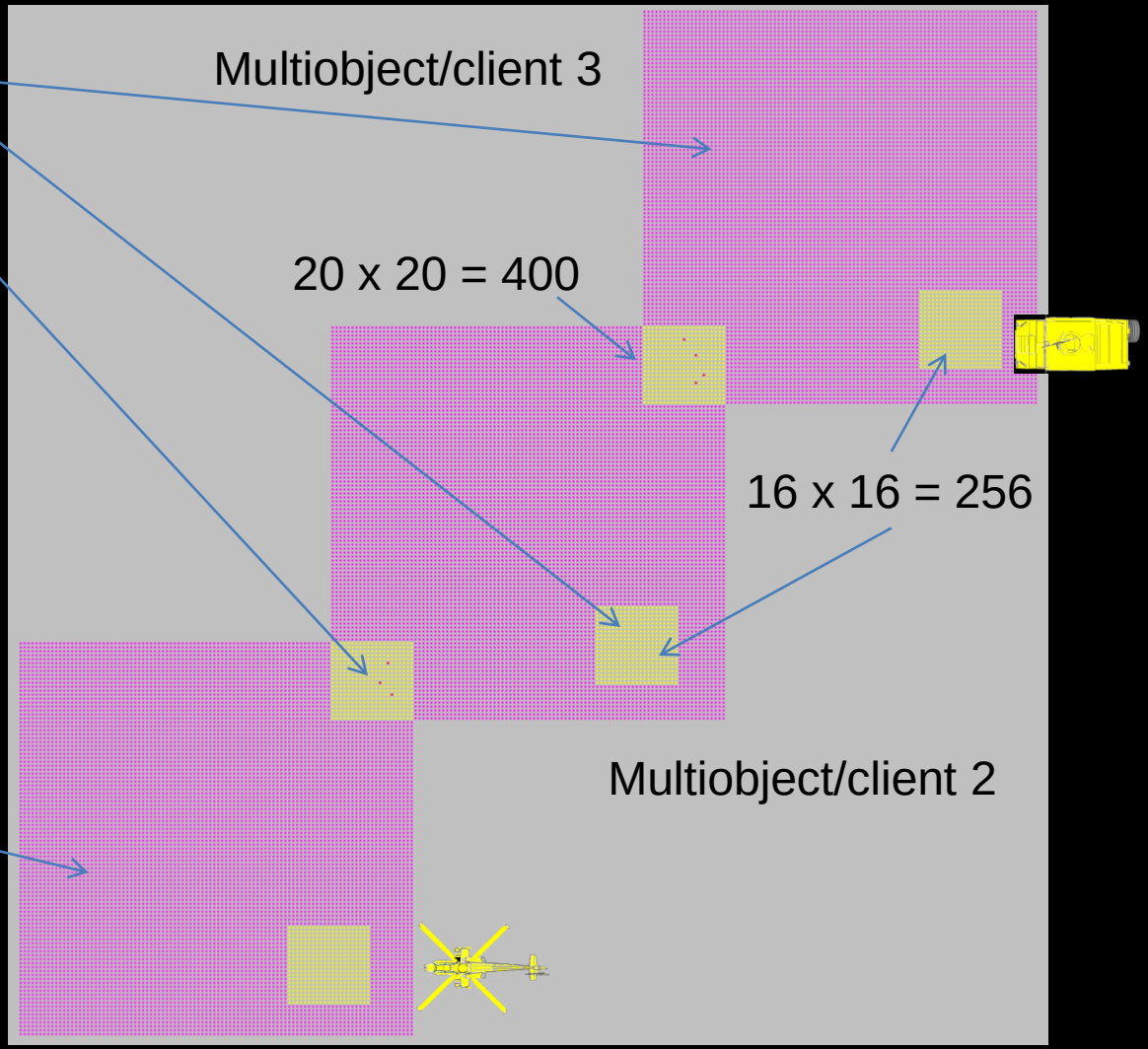


Traffic Generators

- Multiclient
  - 256 independent simulation clients per instance
  - 16 x 16 array of rotating vehicles/rotorcraft
  - 3 instances for 768 distinct virtual clients
- Multiobject
  - 10,000 entities per Multiobject instance
  - 100 x 100 array of rotating dismounts
  - 3 instances for 30,000 distinct entities

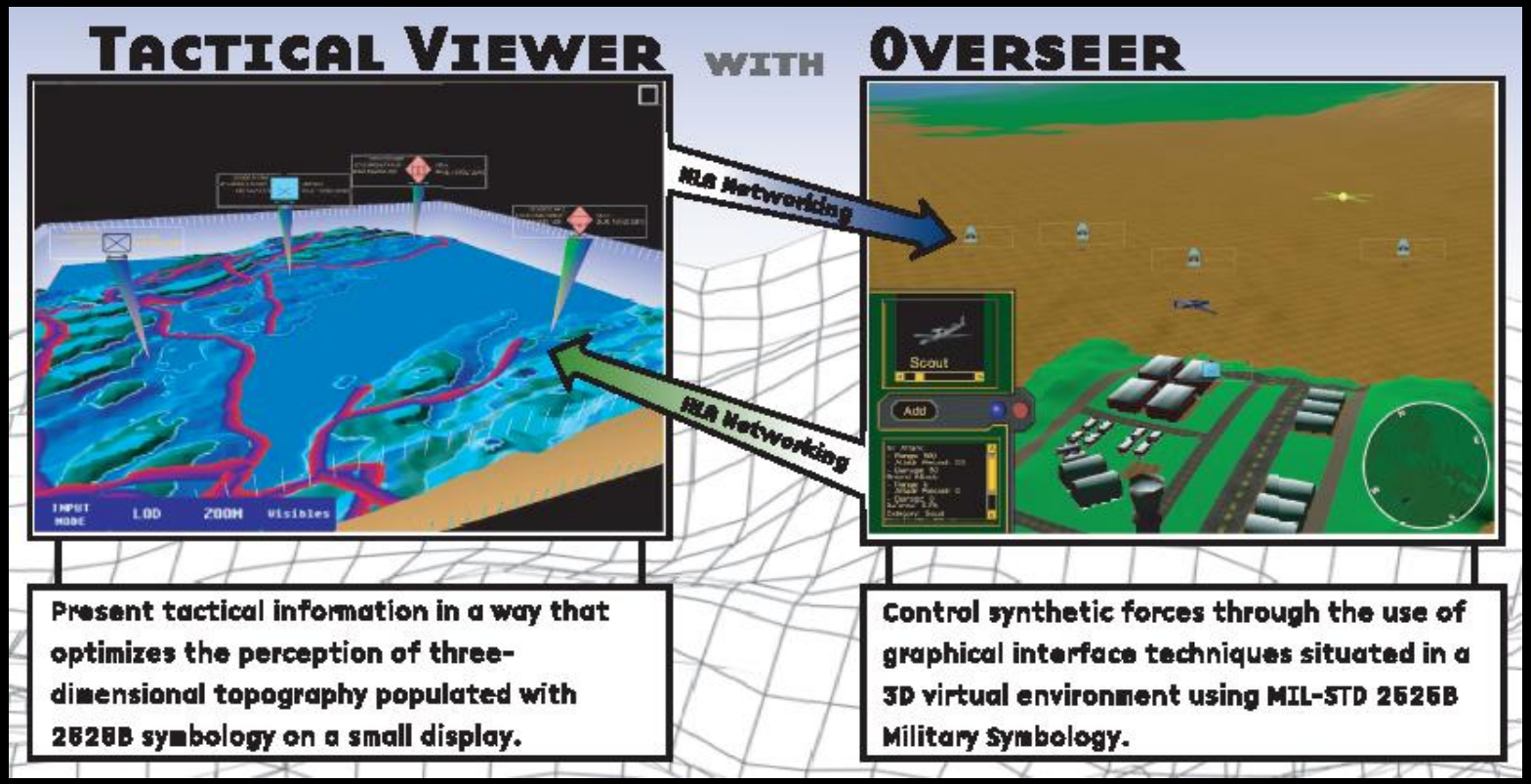
Organized in an overlapping battlespace

- Violet – own objects
- Yellow – other objects
- Red – other objects with degraded update rate
- 1 Hz update rate per object
- 30,000+768=30,768 objects
- 3+768=771 clients



Example Constructive Sim and Viewer

- Simulate Red/Blue Engagement
- Runs in a Loop for Demo
- *Shows demo performance under stress*
- Air and Ground Simulation
- Swarm scripted
- 3D Mil 2525B Symbology



- *Can carry test and measurement data along side simulation & training data*
- *Supports after action review*

Conclusion

- Cybernet's Massive Multi-Player Technology is:
  - Infinitely scalable
  - Simultaneous federations over the same infrastructure
  - HLA Compliant
  - Integrates Gateways for protocol conversion
  - Is compatible with OneSAF, SE Core, etc.
  - Makes very big network simulations/live-virtual-battlespace/test&measurement mixes possible

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