Second Life Gets Systems Engineering

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Agenda

- Web 2.0
- Virtual Reality Defined
- Virtual Reality Examples
- History: Second Life and Linden Lab
- Problems
- Solutions
- Live Demo

Web 2.0

- Changing trends in the use of the World Wide Web

- The internet is treated as a platform rather than a pipeline

- Enhances communications, information sharing, collaboration, social networking and creativity

- Facebook, Twitter, Flikr, Google Earth, Youtube

- Standardized browsers with plug-ins

- More of a business and software development approach, building on already extant protocols

What's Next?

Virtual Reality Definitions

- **Virtual Reality**: an artificial environment which is experienced through sensory stimuli (as sights and sounds) provided by a computer and in which one's actions partially determine what happens in the environment.
- **Virtual World**: A virtual world is a computer-based simulated environment intended for its users to inhabit and interact via avatars. These avatars are usually depicted as textual, two-dimensional, or three-dimensional graphical representations, although other forms are possible. Virtual worlds have persistence, boundaries, communications tools and social interaction.
- **Game**: A game is a structured activity, usually undertaken for enjoyment and sometimes used as an educational tool. Games are distinct from work, which is usually carried out for remuneration, and from art, which is more concerned with the expression of ideas. Key components of games are goals, rules, challenge, and interaction.
- **Massively multiplayer online role-playing game**: (MMORPG) is a genre of computer role-playing games (CRPGs) in which a large number of players interact with one another in a virtual world.

Virtual World Examples

- World of Warcraft
- America's Army
- Second Life
- Forterra OLIVE
- Activeworlds
- There
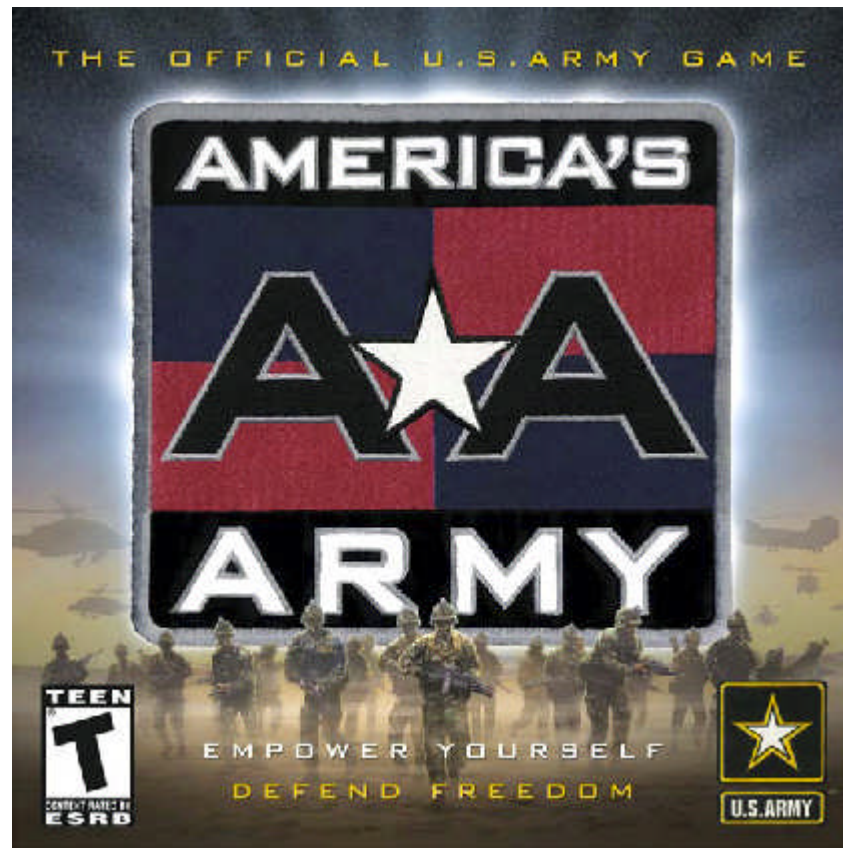- Entropia Universe

World of Warcraft
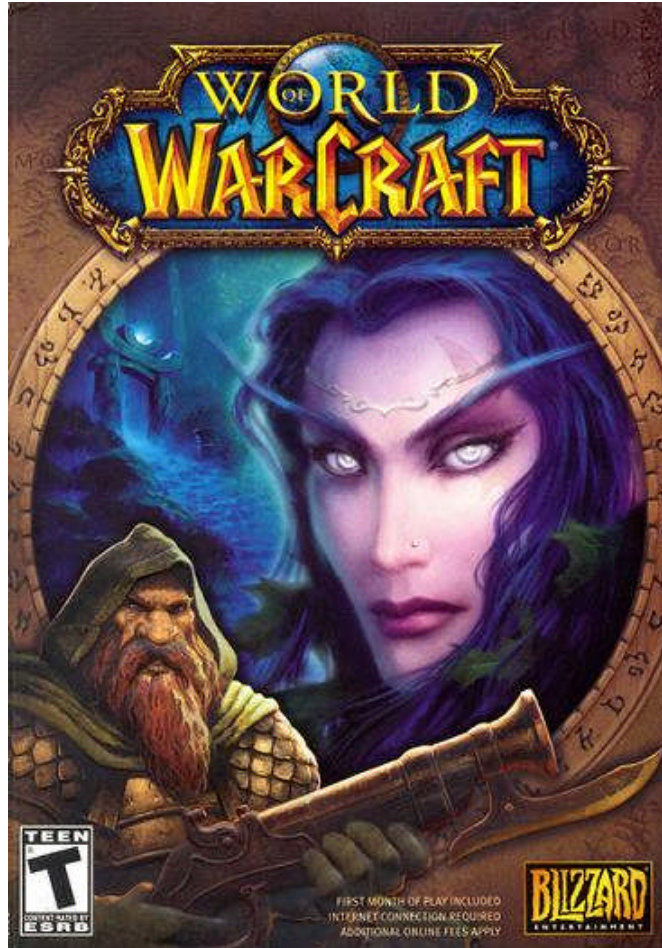
- MMORPG
- Blizzard Entertainment, Vivendi
- 11.5 m monthly subscribers
- Open environment
- 4 years to develop
- $200 m/quarter

WoW Screenshot

America's Army

- Massively Multiplayer Online (MMO) First Person Shooter (FPS)
- U.S. Army Office of Economic and Manpower Analysis (OEMA), Army Game Project, Naval Postgraduate School
- 9.5 m registered users
- Free to download
- Used for recruiting and training purposes
- Based on real world scenarios and ROE
- $100 m+ saved in training

America's Army

America's Army

America's Army

America's Army

Second Life (SL)

- Virtual world
- Linden Lab
- 15 m "Residents"
- 60-70 k concurrency
- Free to download
- Used for social networking, education, training, business, mucking about
- ~$40 m a year

Second Life (SL) Definition

- "Second Life is a free online virtual world imagined and created by its Residents. From the moment you enter Second Life, you'll discover a fast-growing digital world filled with people, entertainment, experiences and opportunity." – Linden Lab
- Is SL a game? Well, yes and no. There is no defined beginning, end, characters, rules, or criteria for success. It can, however, be entertaining.

Client and Server

- SL is written in C++, and based on open-source standards and SW when possible, e.g., linux, Apache, MySQL, Squid, Mono, UUID, UDP, HTTP and Havok 4. Core apps are still proprietary.

- SL has two major applications:

  - Client: an open-source rich internet application that is downloaded onto the user's PC as a "viewer" into the virtual world. "Viewer."

  - Server: runs on the LL "Grid." Each CPU hosts one 256x256 meter Region or "sim." The server controls almost every function performed within SL. "Simulator."

  - Glued together by UDP and HTTP.

Simulator Server

The simulator server handles storing object state, land parcel state, and terrain height-map state. It performs visibility calculations on objects and land and transmits the data to the client. It transmits image data in a prioritized queue. Physics simulation is handled with the Havok physics library. Chat and instant messages are processed here.

Running at full tilt, a simulator will run at 45 frames/sec. If it can't keep up, it will attempt time dilation without reducing frame rate.

Simulators communicate with one another using a circuit via UDP. A "circuit" is a UDP network connection. Circuits are maintained between adjacent simulators.

Simulator vs. Viewer

It helps to understand the division of labor between the simulator and the viewer, since the split in Second Life is very different than most other virtual environments:

Simulator's job:

Runs physics engine

Collision detection

keeps track of where everything is

Sends locations of stuff to viewer

Sends updates to viewers only when needed (only when collision occurs or other changes in direction, velocity etc.)

Viewer's job:

Handle locations of objects

Gets velocities and other physics information, and does simple physics to keep track of what is moving where

No collision detection

Other servers

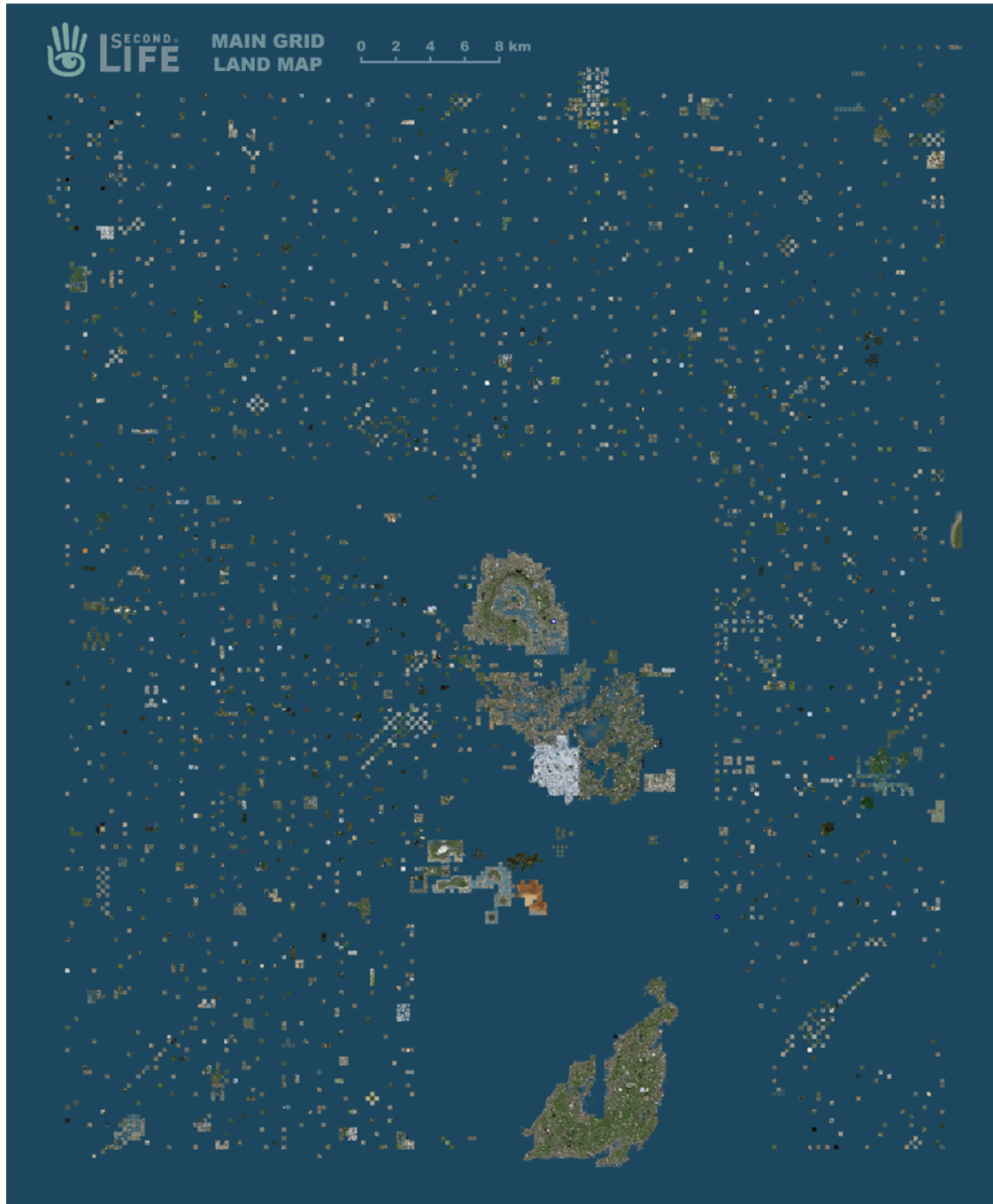Agent Database: keeps track of metadata<->item id (UUID) mapping

Central DB (CDB): a list of who owns what, used for billing, etc

Find DB (replica of Central DB used for search)

Map server - renders overall map with OpenGL

RPC server: API for developers to manupulate Second Life without using the viewer

Translates XMLRPC server into in-world requests

The flat, Earth-like world of Second Life is simulated on a large array of Debian servers, referred to as the Grid. Each dot here is a 256x256m area of land, a Region. Each Region is content rated, either PG or Mature. The large land masses are know as The Mainland; the smaller are called islands. Users can walk or fly to contiguous regions, or they can "teleport" to a distant region.

Iran News 2.0

Second Life
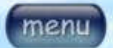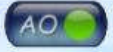
File   Edit   View   World   Tools   Help   Client   Server   Marmalade 82, 51, 40 (Mature) - Arabian Sunsets Club   10:02 PM PDT   L$680

Search

All   Classifieds   Events   Popular Places   Land Sales   Places   People   Groups

Find: Arabic TV   Search   ☑ Include Mature content

Profile

2nd Life   Web   Interests   Picks   Classified   1st Life   My Notes

Photo:

IRAN NEW

Info: oh! first life, woaaaa haaaaaa haaaaaaa
(250 chars)   1st life !!!!   haaaaaaaa haaaaaaaaaa woaaaaaa
that was long time ago dude
after being bounced and red and ban and block by you
thugs this is my million and billionth and trillionth life
get a life thug

General   Members & Roles   Notices   Proposals   Land & L$

IRAN NEWS 2.0
Founded by NETTY Oh

Group Charter

dar tamam donya cheh rl or sl ya paltalk
chon onja hastam va kamelan khabar daram
che oza vakhimi shodeh.
keywords: Persia Middle East Atomic Girls
Boys War Farsi Arabic, Turkish, Arab, Turk,
Kurd, Balouch, Oil, Islam, SecondLife,
Movie, Music, Dance, Newspaper Internet
Computer Magazine. Woman, Television,
freedom, democracy, King, Queen, Allah,
Monarchy, Love, Sex, Netty, Chat, Peace,
Shah, Art, Book Education News Reporter
Group Information Cosmic

Group information
Pulitzer Writer

Join (L$0)

Owners & Visible Members   (Owners are shown in bold)

Member Name	Title	Last Login
NETTY Oh	News reporter	

Group Preferences

☑ Show In Group List   ☐ Mature Group
☐ Publish on the web
☑ Open Enrollment
☐ Enrollment Fee: L$ 0.000

E   SE

NE   S

N   SW

NW   W

No AVs within 96m

Music

IM   Chat   Friends   Fly   Snapshot   Search   Build   Mini-Map   Map   Inventory

Start   Second Life   Inbox - Microsoft ...   1:03 AM   Friday

How does SL differ from Games?

- **Creativity:** SL provides almost unlimited freedom to its Residents. This world really is whatever you make it. If you just want to talk to other Residents, you can. If you want to go shopping or fight dragons, you can. If you want to start a business, create a game or build a skyscraper you can. It's up to you. SL provides a complete suite of tools to create 3-D animated objects "in world," along with user-configured streaming audio and video.
- **Virtual Real Estate**: Residents can buy virtual real estate for a purchase fee plus monthly maintenance costs.
- **Ownership:** Instead of paying a monthly subscription fee, Residents can start a Basic account for free. If you choose to get land to live, work and build on, you pay a monthly lease fee based on the amount of land you have. You also own anything you create—Residents retain intellectual property rights over their in-world creations.
- **Economy**: SL has it's own economy, based on the Linden Dollar (L$), which floats against the U.S. Dollar and is fully convertible.

SL History

- 1999-2001: Philip Rosedale opens Linden Lab to develop haptics HW. A SW simulator is developed to demonstrate these movements.

- 2001: HW effort is abandoned, and SW VR that can run on a home PC is pursued.

- 2002: "Linden World" is developed as prototype.

- 2003: Public beta testing of SL begins, land and avatars only. Eventually L$ are introduced. Local text and instant messaging.

- 2004: New textures, new terrain, new bitmapping, APIs.
    - New land and economic model allows users to buy or rent virtual real estate.
    - XML and RPC functions allow email exchange with outside world.
    - Custom animations.
    - Streaming audio enabled at landowner's discretion (HTTP streaming).

SL History

- 2005: Several major upgrades and additions:
  - Simulator (server) performance improved;
  - Compression and streaming of data to client improved;
  - Inventory added and modified;
  - Full "satellite view" map added and enhanced;
  - Search improved;
  - www.secondlife.com integrated with in-world applications.
- 2006: SL registered users increase from 30,000 to one million. Multiple crashes and slowdowns occur…often.
- 2007: SL adds voice, improves graphics. Crashes and slowdowns continue. LL decides they actually have to have an architecture.

So, what's the problem(s)?

- LL and SL started with six smart engineers and a simple design, a dozen servers, and a couple of hundred users.

- Over the course of 7 years they added dozens of new features and upgrades, 10,000+ servers, and 15 million users. 100+ terabytes of storage.

- Each user is simultaneously accessing multiple servers:

  - the sim, inventory, map, search, account, and asset servers, which are accessed through the sim;

  - and web, email, IM, and voice servers, which are accessed separately.

- **Scalability** is the problem, a result of building the SL grid first, then adding to it, without an architecture.

So what are the solutions?

- Systems Engineering and an Architecture are the answers.

- The plan is over the next 10 years to add up to several million servers and a billion people—the current Grid will grind to a halt long before that.

- LL would also like to see this emergent technology propagate. They will continue to run the SL Grid, but the goal is to allow others…like IBM or NASA…to run their own Grids behind their own firewalls, to satisfy security and privacy concerns, while still maintaining a connection to the SL Grid.

- In late 2007 LL formed an Architecture Working Group (SL AWG) and invited users to join.
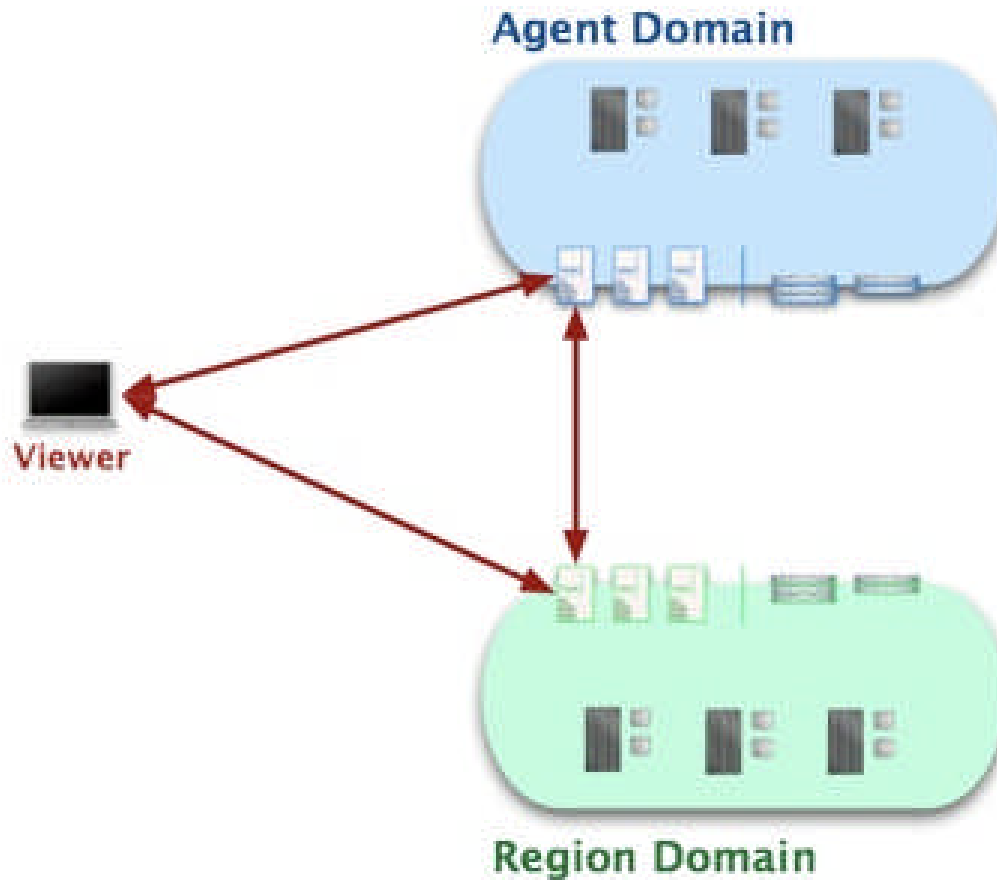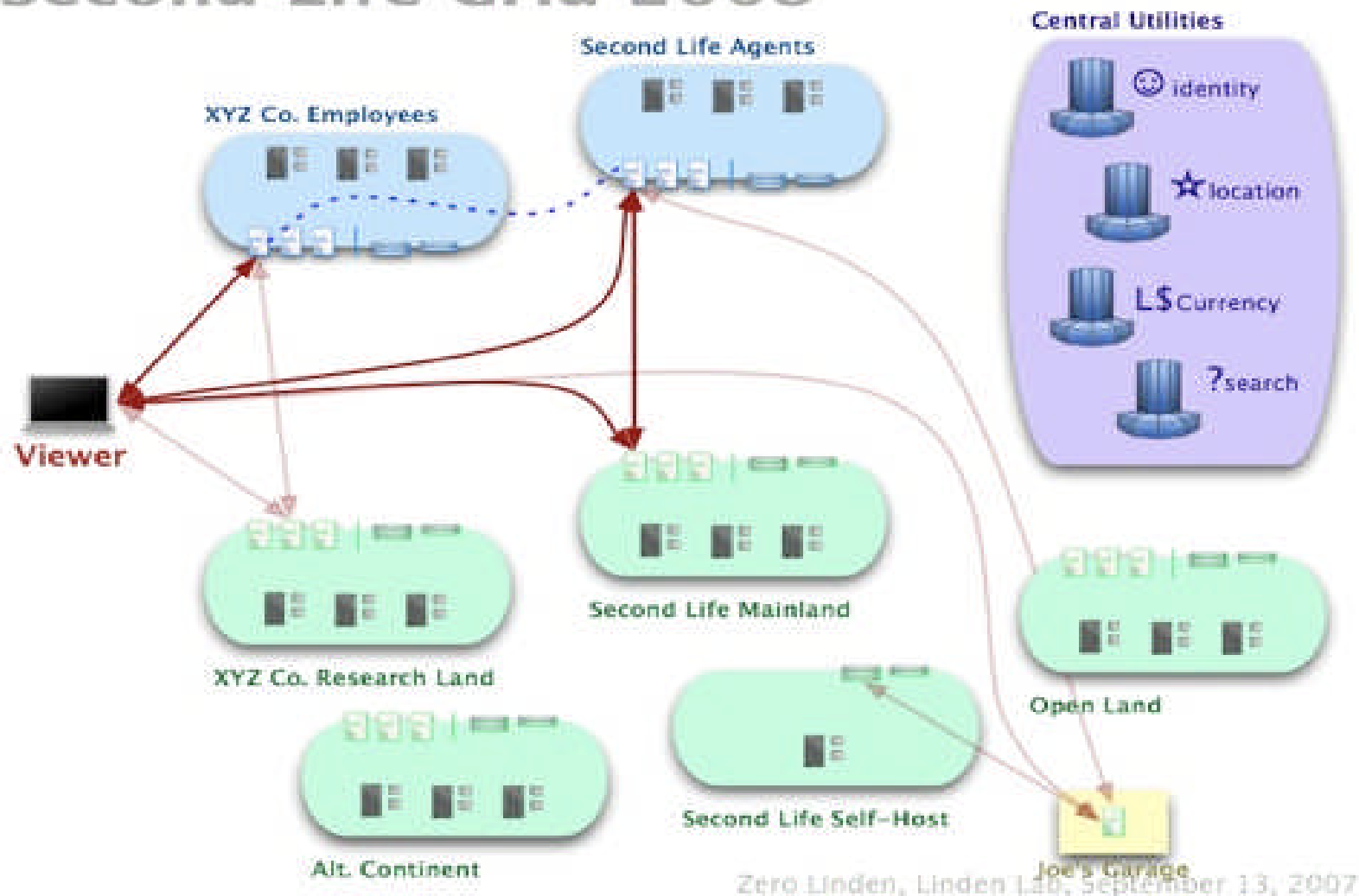
Original Architecture

The Grid Today

Second Life Simulators

Viewer

All Hail the Central Databases
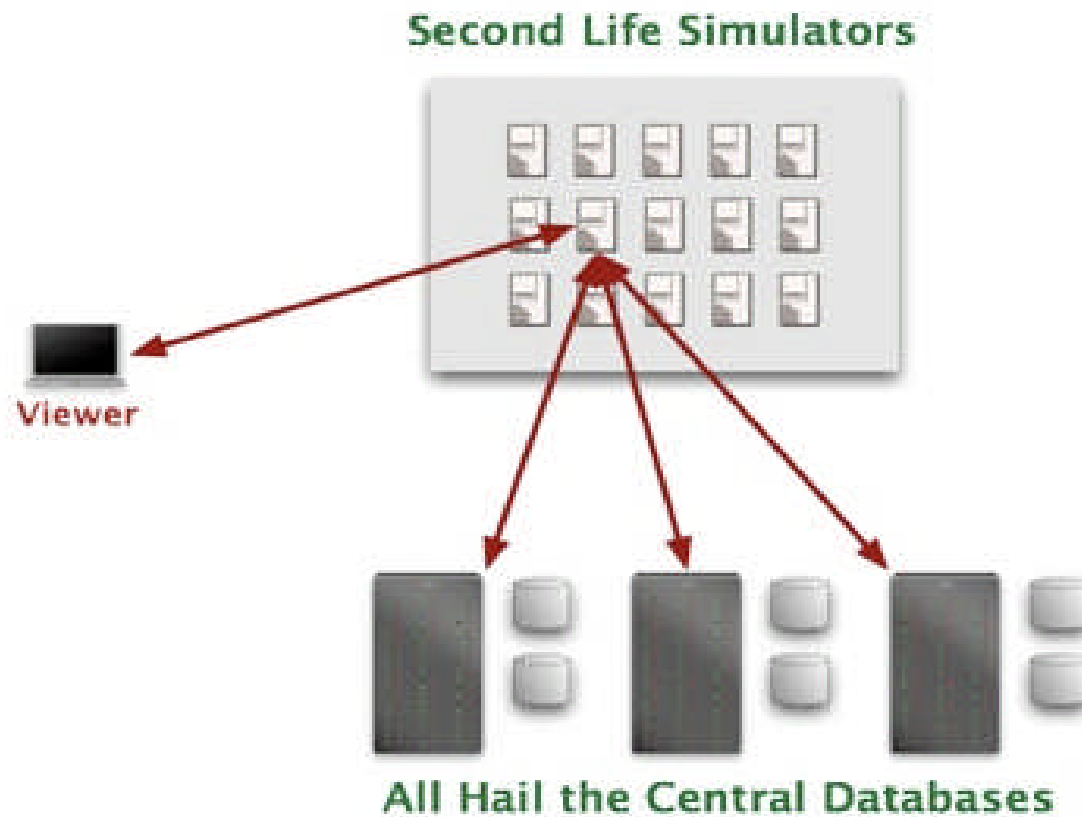
Revised Architecture

Two Domains

Agent Domain

Viewer

Region Domain

Extended Architecture

GET A FIRST LIFE

Your World. Sorry About That.

WHAT IS LIFE? | **SHOWCASE** | **BUSINESS PARTNERS** | **DEVELOPERS** | **COMMUNITY** | **BLOG** | **SUPPORT**

GO OUTSIDE
MEMBERSHIP IS FREE

FIRST LIFE IS A 3D ANALOG WORLD WHERE SERVER LAG DOES NOT EXIST

- ▸ WORK
- ▸ REPRODUCE
- ▸ PERISH

FIND OUT WHERE YOU ACTUALLY LIVE

FORNICATE USING YOUR ACTUAL GENITALS

ACCESS YOUR CLOSET TO BUILD YOUR FIRST LIFE LOOK

Total Residents:	6,553,628,382
Born Today:	364,936
Died Today:	152,029
Pants Purchased:	27,021
TV Hours Watched:	82,124,102,305

Upgrade Your FL Wardrobe

Work.
...roduce.

Under 18? Get a Teen First Life

"I like totally tried to get into First Life and those dudes were like, sorry man, you're totally not old enough. I was like, WTF! Then I found out about Teen FL, and everything's cool

Got First Life Questions? We've Got Answers

Are five senses enough?

What's this body thing, and what do I do with the dangly bits?

Ads from a First Life "Search Engine"

Ads by Google
Second Life