

# Virtualizing the World

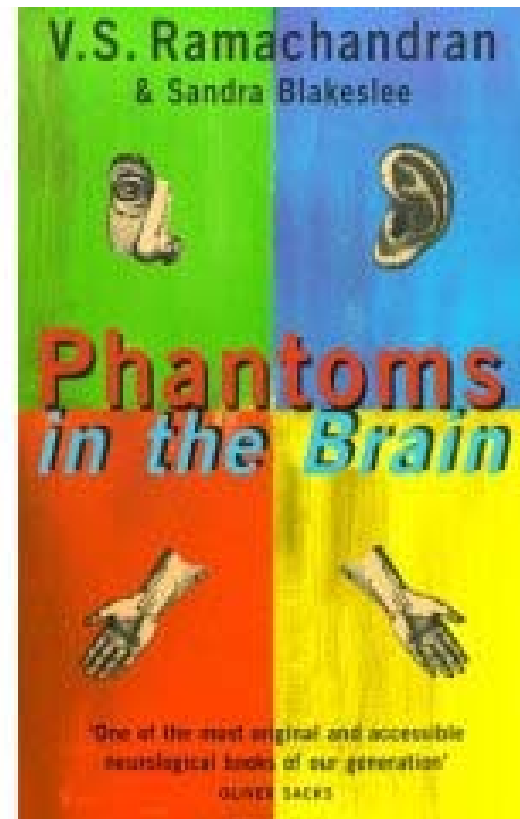
Michael Macedonia

Photo # USN 1162165 USS Spruance, combat information center, 1975



# Summary

- Sensors and “virtuality” are redefining our lives
- “Zillions” (sensor data, bots, and humans avatars) will aggregate at compute cores
- Virtual worlds are being created for more than entertainment and will become part of daily experience
- Virtual worlds are real-time converged media environments – video, VOIP, physical simulation, graphics – that demand high performance
- Performance is required at the edge as well as the core
  - Shifting more computing to core is more efficient but will concentrate energy requirements
- At the macro application layer, energy, latency, and bandwidth will pose major challenges

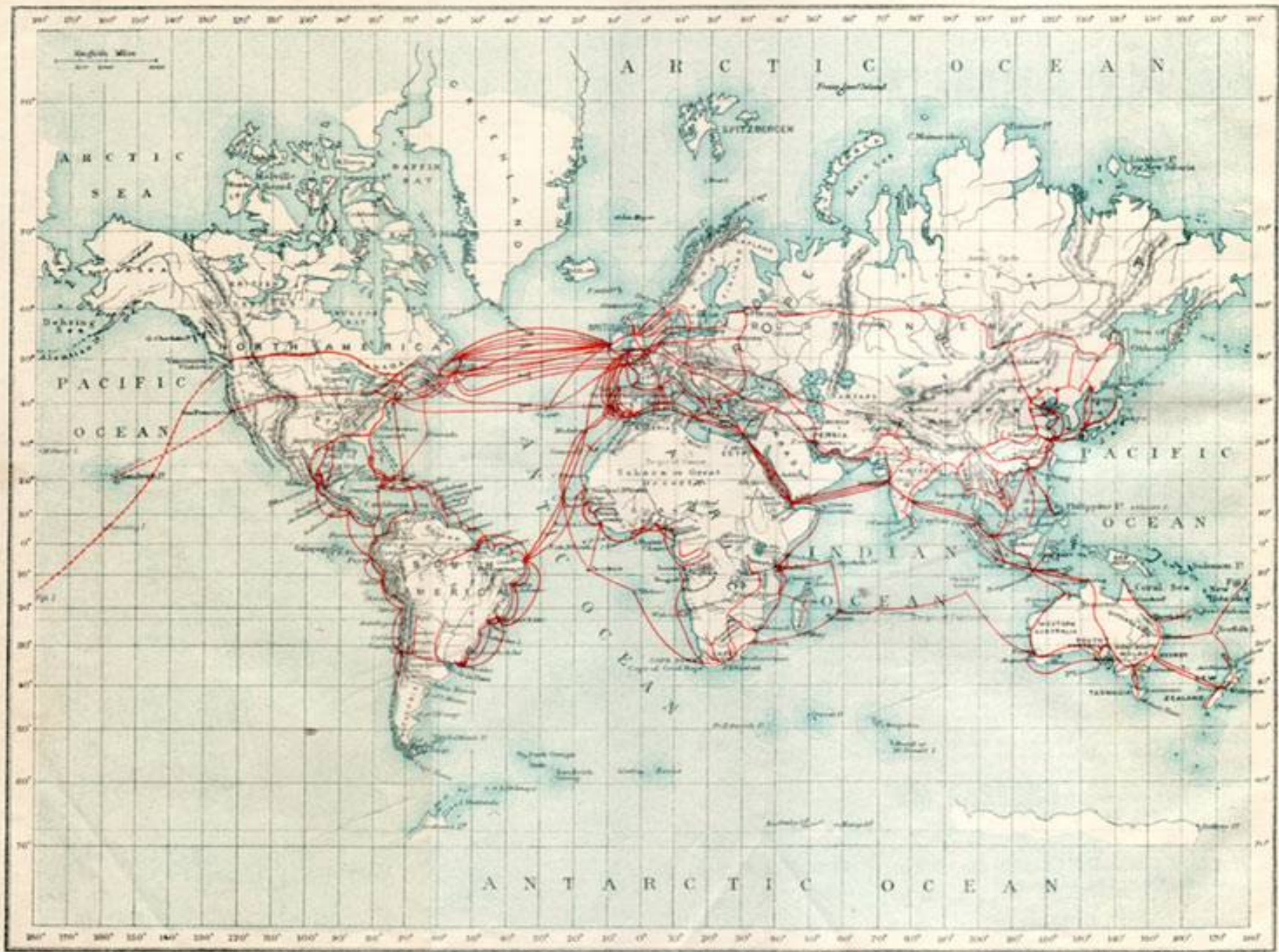


# Zillionics

- “Ubiquitous always-on sensors in bodies and environment will transform medical, environmental, and space sciences. **Unrelenting rivers of sensory data** will flow day and night from zillions of sources.”
- Zillionics requires **a new scientific perspective** in terms of permissible errors, numbers of unknowns, probable causes, repeatability, and significant signals.

*-- Kevin Kelly*

# EASTERN TELEGRAPH CO'S SYSTEM AND ITS GENERAL CONNECTIONS.





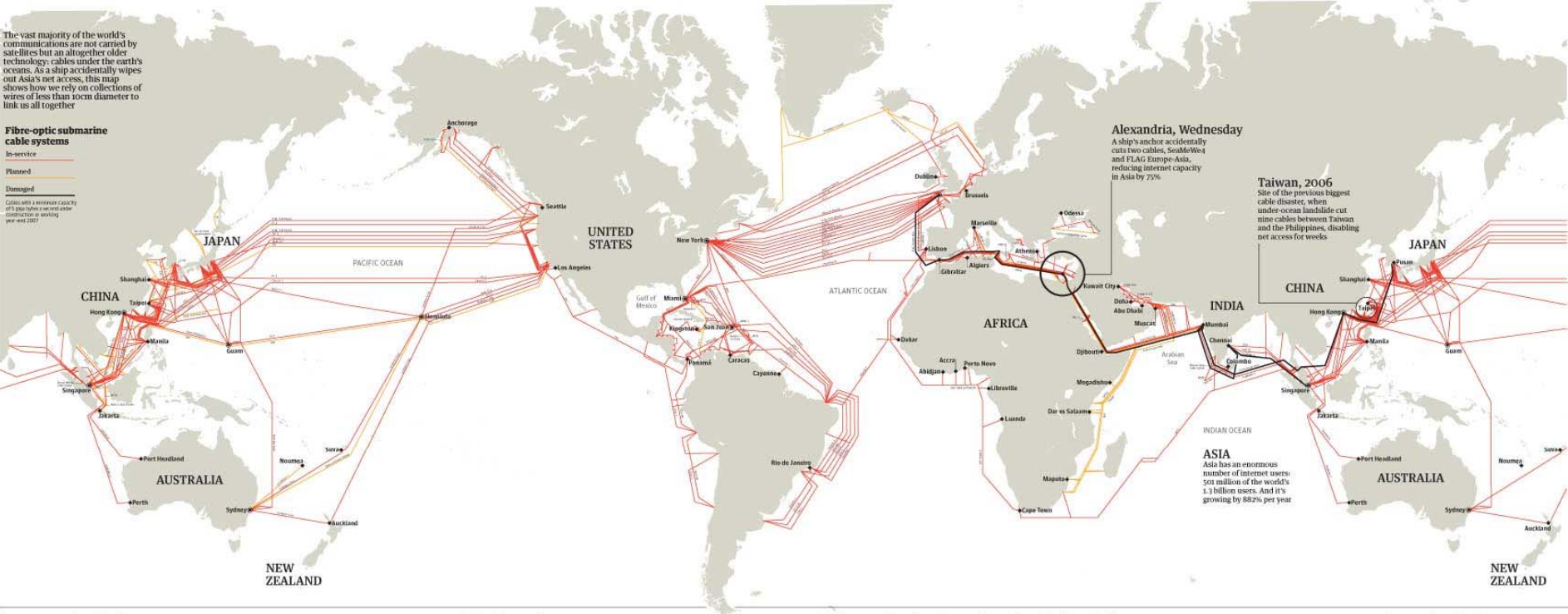
# The internet's undersea world

The vast majority of the world's communications are not carried by satellites but an altogether older technology: cables under the earth's oceans. As a ship accidentally wipes out Asia's net access, this map shows how we rely on collections of wires of less than 10cm diameter to link us all together

## Fibre-optic submarine cable systems

- In-service
- Planned
- Damaged

Cables with a minimum capacity of 1.500 Gbps received either construction or working permits until 2007



### Alexandria, Wednesday

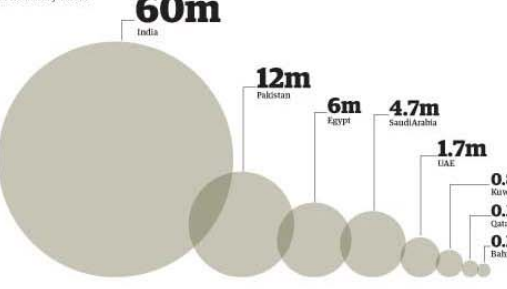
A ship's anchor accidentally cuts two cables, SeaMeWe4 and FLAG Europe-Asia, reducing internet capacity in Asia by 75%

### Taiwan, 2006

Site of the previous biggest cable disaster, when under-ocean landslide cut nine cables between Taiwan and the Philippines, disabling net access for weeks

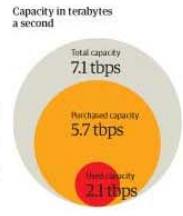
## Internet users affected by the Alexandria accident

The main countries affected in Wednesday's event

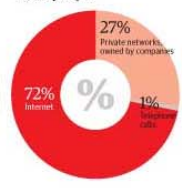


## World cable capacity

Submarine cable operators light (turn on) capacity on their systems to sell bandwidth to other carriers. Carriers buy extra capacity, mainly to hold in reserve. On the trans-Atlantic route 80% of the bandwidth is purchased, but only 29% is used



## What makes up "used capacity"?



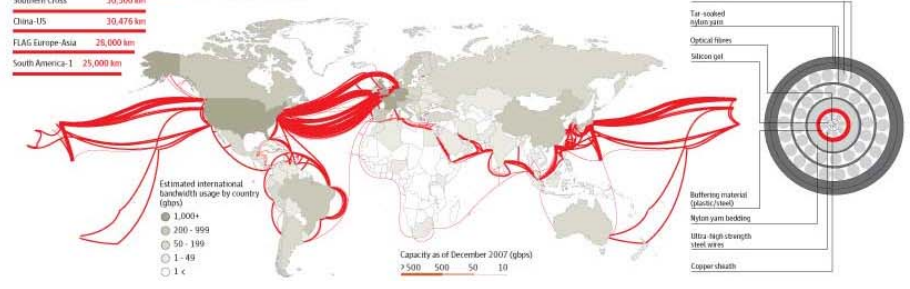
## The longest submarine cables

The SeaMeWe-3 system from Norden in Germany to Keeloo, South Korea connects 32 different countries with 39 landing points

SeaMeWe-3	39,000 km
Southern Cross	30,500 km
China-US	30,476 km
FLAG Europe-Asia	26,000 km
South America-1	25,000 km

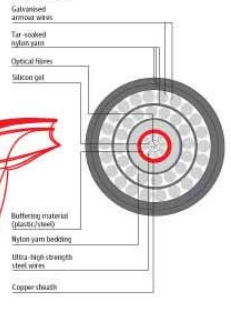
## The world's cables in bandwidth

The first intercontinental telephony submarine cable system, TAT-1, connected North America to Europe in 1958 and had an initial capacity of 640,000 bytes per second. Since then, total trans-Atlantic cable capacity has soared to over 7 trillion bps



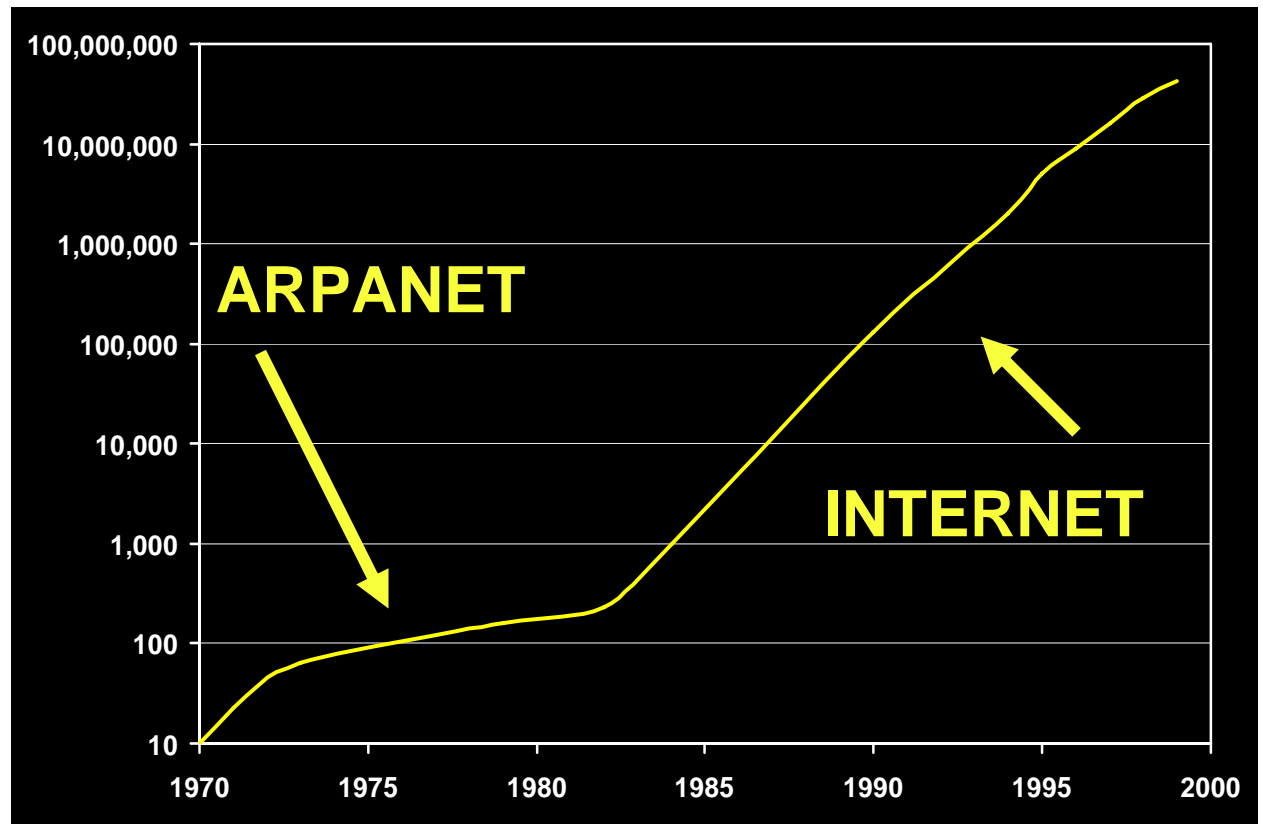
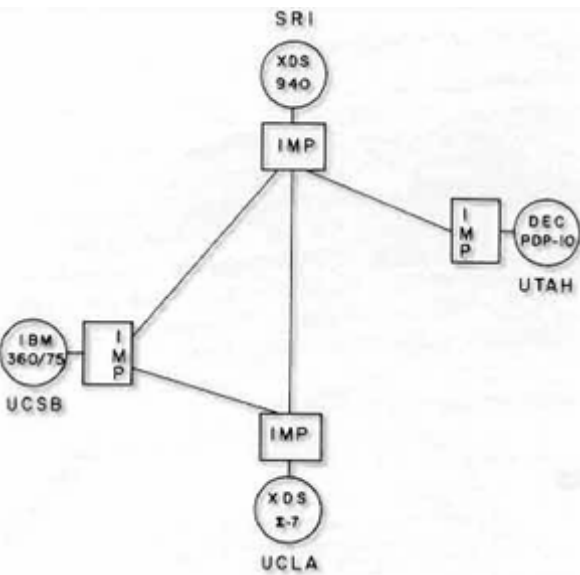
## Cross-section of a cable

Cables of this strength are typically 60 mm in diameter and weigh over 10,000 kilograms a kilometer. In deeper waters, lighter and less insulated cables are used

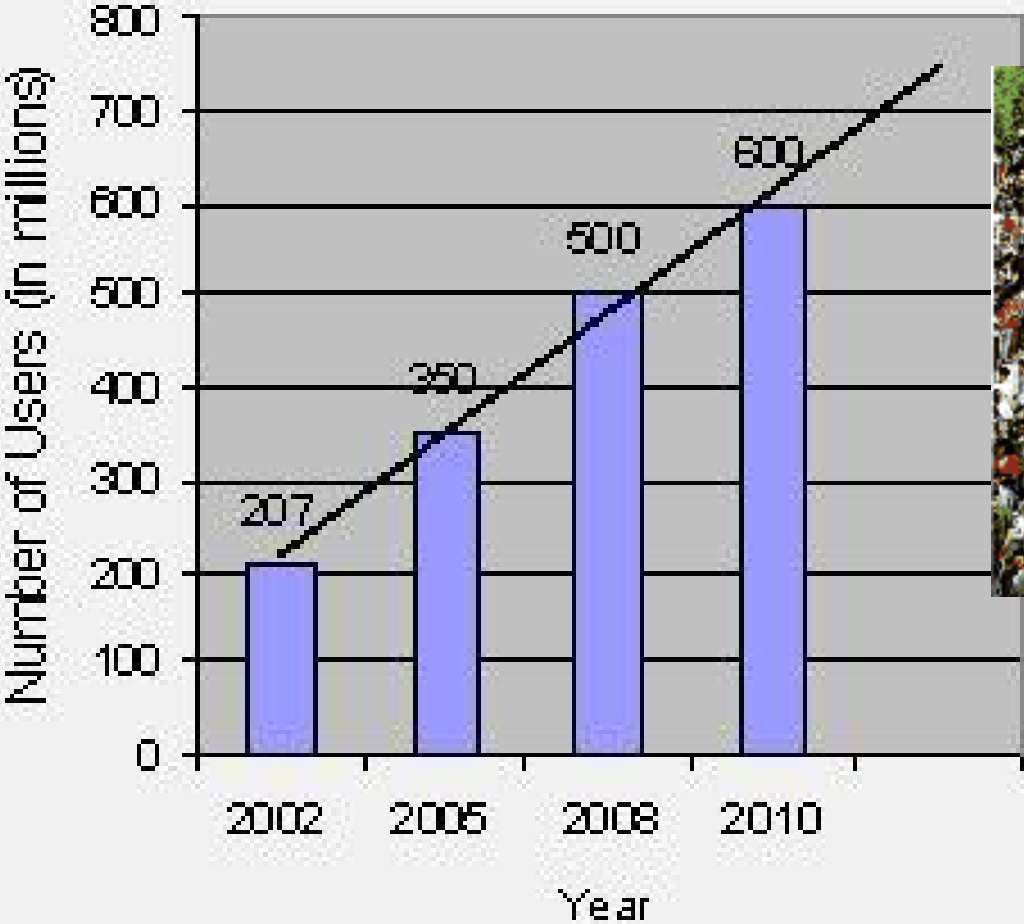


SOURCE: THE GEOGRAPHY CHANNEL/BRITAIN CABLES MAP 2004. INTERNET STATISTICS FROM INTERNETMEASUREMENTS.COM

# Internet Growth (Hosts) in Millions



# Number of Mobile Phone Users in China





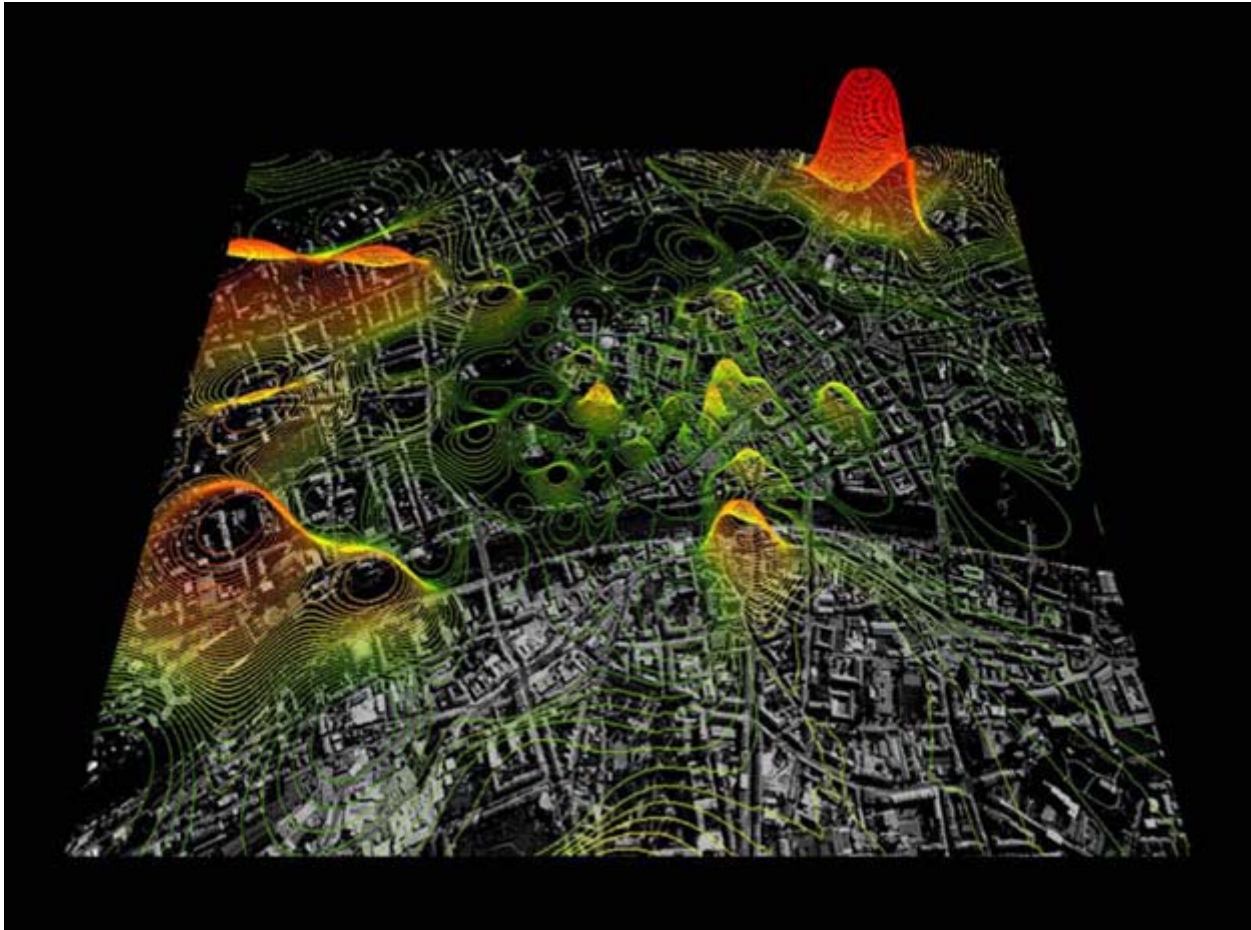
# Sensors Everywhere – How Many?



# In Casinos ...



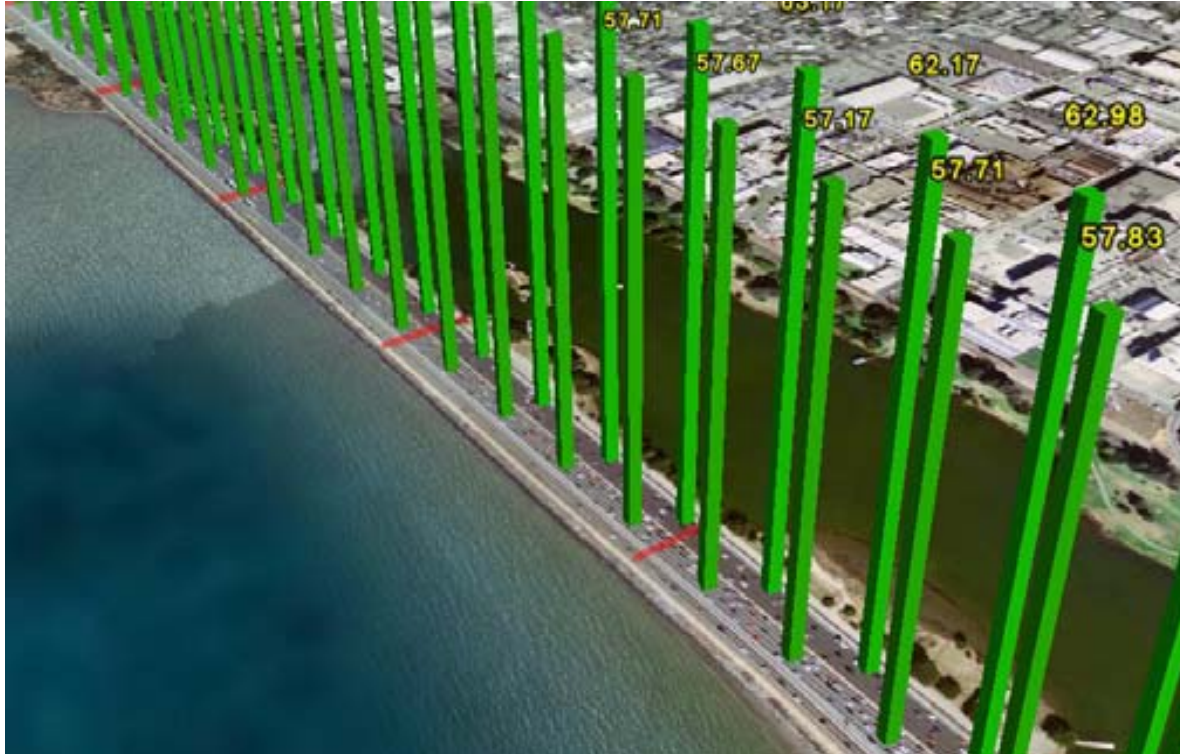
# Real Time Cell Phone Tracking



MIT Mobile Landscape Project Graz, Austria



# Tracking Cell Phones on Highways



A Google Earth rendering of collected cell phone GPS data California. Virtual trip lines measuring speed upon crossing of the vehicles are shown in red.



# Sensors Overhead Watched by Billions -- Image of Sub In Google Earth



# Webcams

Bucuti Beach Resort Aruba, Sun Jan 20 2008 2:25:33 pm



<http://www.1plus1.tv/> 20 Jan 2008 20:29:00



**LIVE**

**BREAKING NEWS**

6:31 71°

**Explosion Near 41st St  
Between Third & Lexington**





bbc.co.uk

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16 September 2007

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Sun 16 Sep 01:12  
341 A2 Westmount Road  
Transport for London

**FAULT: Camera Communications Failure**

A2 Westmount Road

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**A2 Rochester Way Relief Road by Riefield Road**

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**A2 Rochester Way Relief Road**



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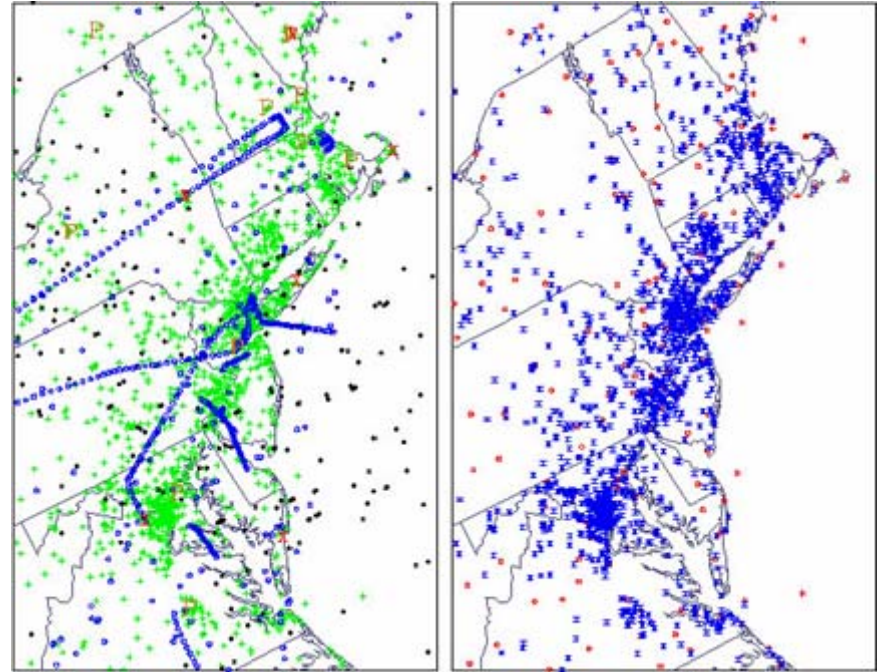
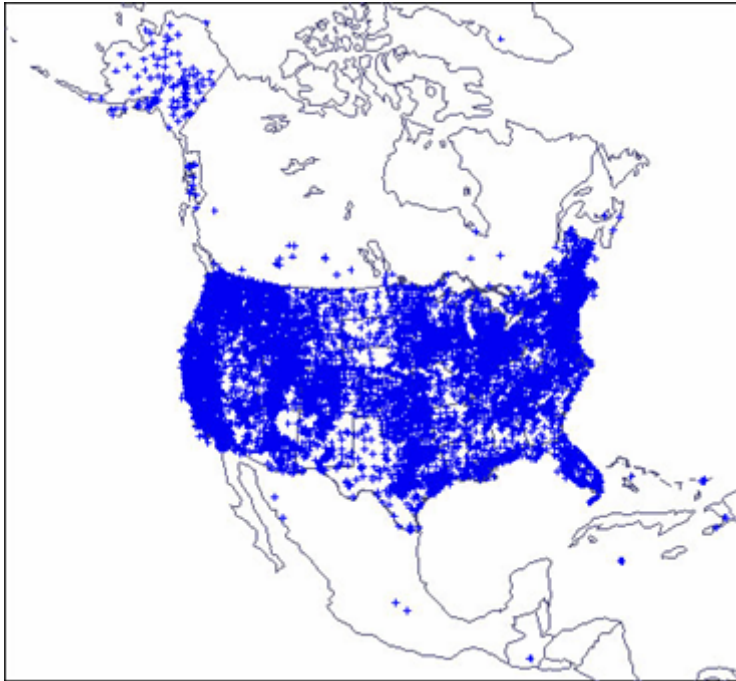


# Intelligent Transportation Systems



# *Meteorological Assimilation Data Ingest System (MADIS)*

MADIS mesonet stations in the North-American domain on May 26, 2004.



*MADIS observations available over the east coast of the U.S. on April 29, 2004.*



Google Earth

File Edit View Add Tools Help

Local Search Directions

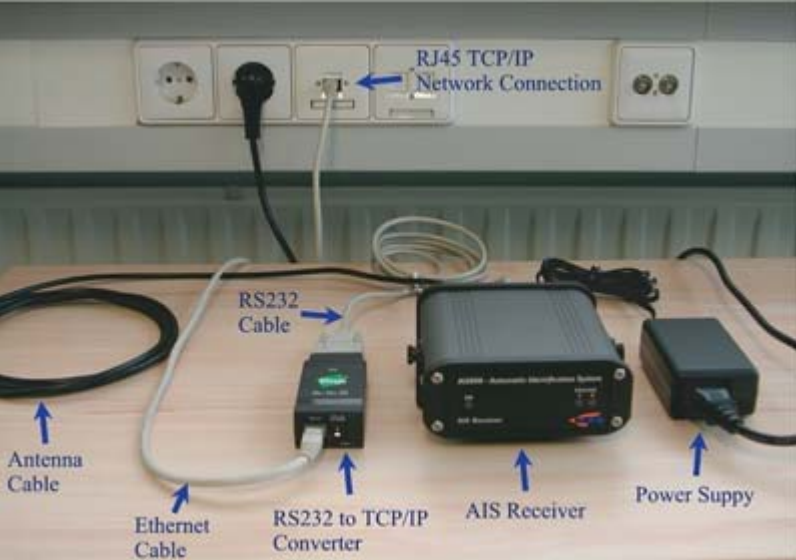
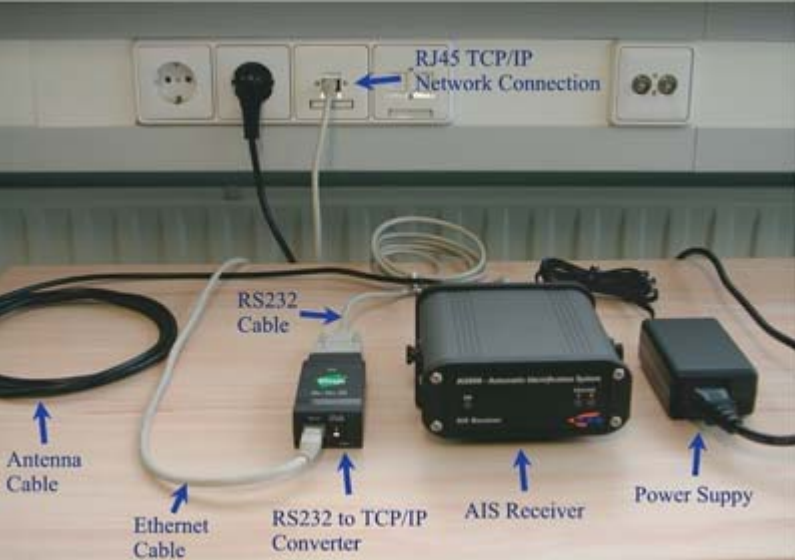
4. 27 25.81° N, 122 05.26° W

Places

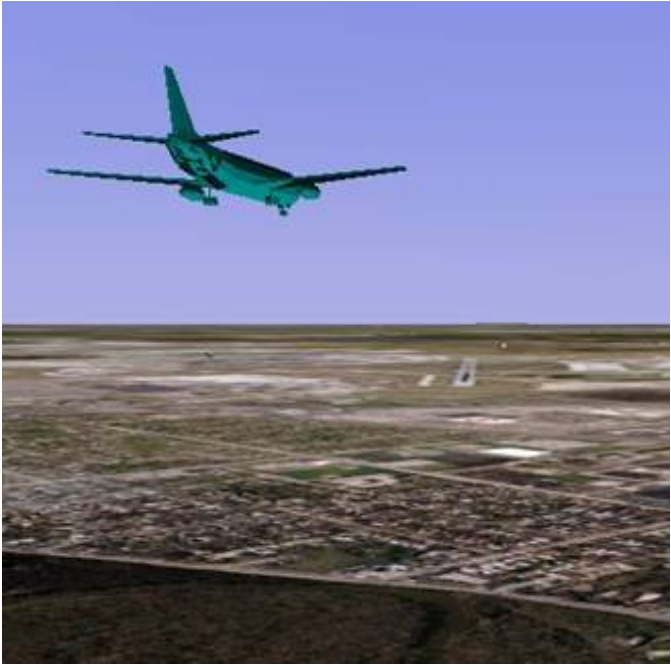
- AZUL FRONTIER Moored
- BALTIC NEWS Moored
- BBC ARGENTINA Moored
- BIANCO ID Moored
- BOBELLY Under way using engine
- CELESTINE Under way using engine
- EAST SUS Moored
- EGK Moored
- GLEST MERCHANT Under way using engine
- GULDHEP Moored
- GRENID Moored

Layers

- Terrain
- National Geographic Magast
- Google Earth Community
- Community Showcase
- Google Earth Community (Unsked)
- Dining
- Lodging
- Banks/ATMs
- Bars/Clubs
- Coffee Shops
- Shopping Malls
- Major Retail
- Movie/DVD Rentals
- Grocery Stores



# Flight Tracking



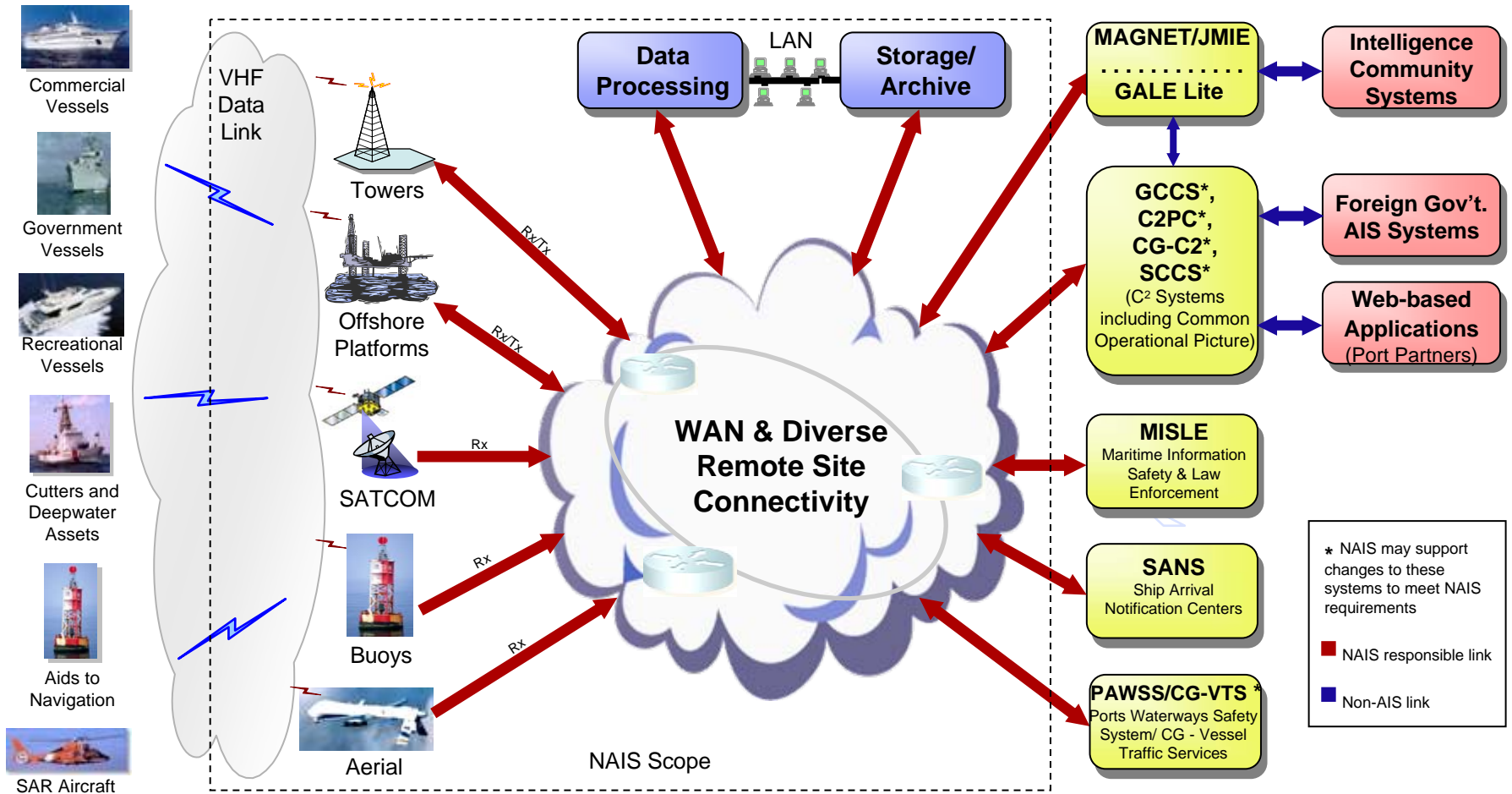


# CIC on Ship

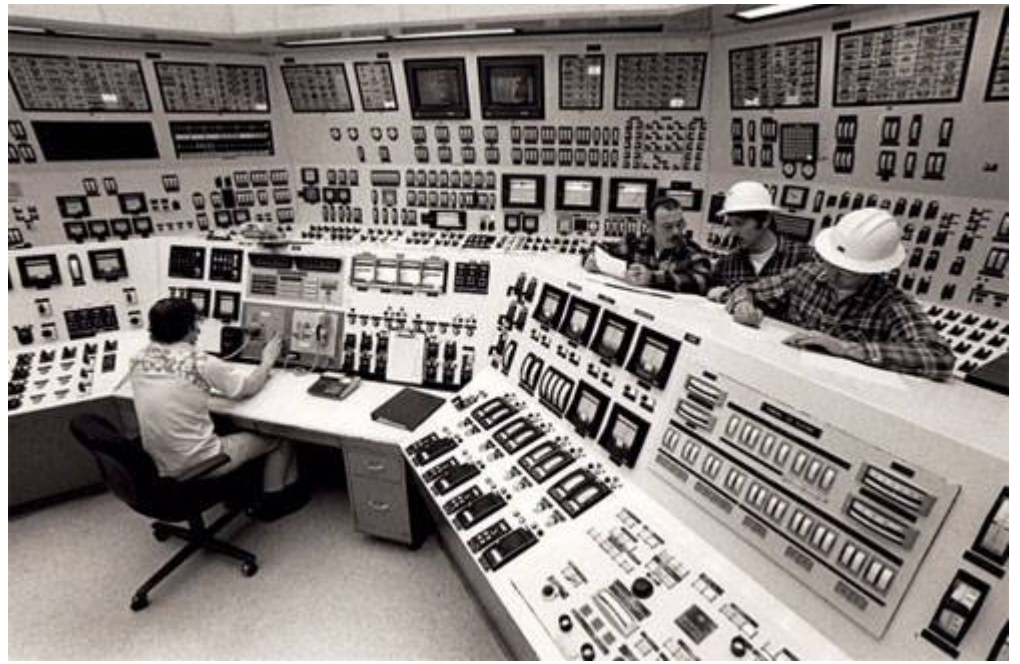
Photo # USN 1162165 USS Spruance, combat information center, 1975



# Nationwide AIS System Context Diagram









# The Dawn of Social Networks

**LinkedIn** Welcome, Jim [Sign Out] Account & Settings | Inbox | Expand Your Network

Home | People | Jobs & Hiring | Services | Answers | My Profile | My Contacts

Profile | Public Profile | Email Signatures

Search People [Enter keyword, name, company or title] Go Advanced Search

Forward this profile | Flag this photo | Go back to Home Page

**Jim Glass** you  
Senior Site Manager at Microsoft  
Greater Seattle Area

Send InMail | Get introduced through a connection | Add Jim to your network

Profile | Recommendations | Connections

**Current**

- CRM Sr. Site Manager at Microsoft
- Musician, sax and clarinet at Second Story Repertory Theater
- Manager at the Dissonance, a jazz xTet (Sole Proprietorship) see all...

**Past**

- User Education Manager at Microsoft
- Soldier at U.S. Army
- Tech Writer, Build Engineer at Rho Tech (Contractor)

**Jim Recommends**

People (28)

**Ayaz Ahmad [MVP - MSCRM]**  
CRM MVP, Microsoft Dynamics  
Ayaz is one of the more active Microsoft CRM MVPs...

**Brad Severtson**

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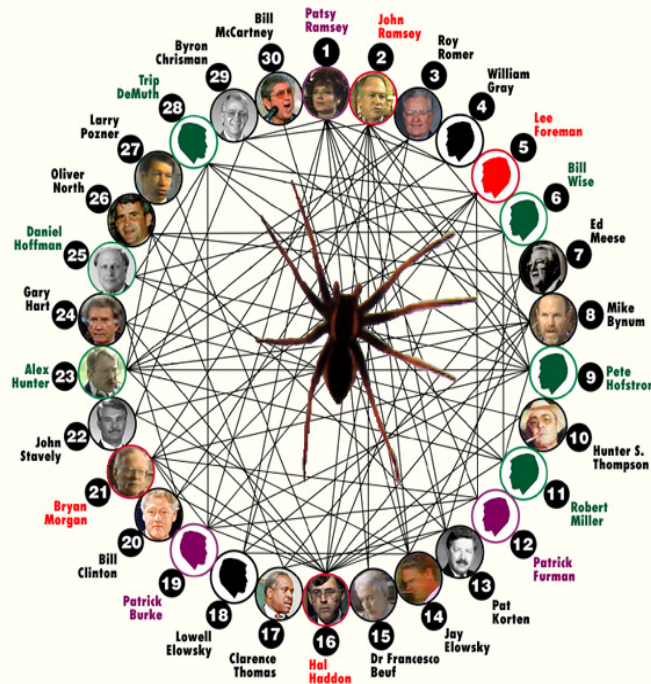
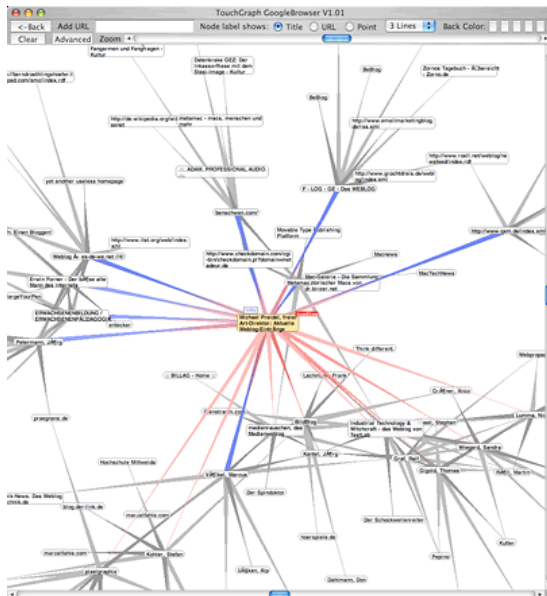
Send Bill a Gift | Send Bill a Message | Poke Bill

**Bill Gates**  
is glad he finally joined facebook and hopes you will too!! :)  
Updated 6 minutes ago

**Mini-Feed**  
Displaying 15 stories See All

Update: Bill has posted a note:  
Friends, I have finally caved and joined facebook, America's fastest-growing social-networking web site! At first I didn't join because you needed a college alumni address, and I never quite got one... Then when the place started opening up to high schools and corporations, with everyone and his grand-mother joining, I wanted in. But by then I was mad I didn't have any shares in this \$15 billion baby... So just now I decided to plunk down \$240 million to buy 1.6% of the company from cool kid CEO Mark Zuckerberg. Sure I saw the potential for ad revenue right away -- but this is wild. I've never had my own Facebook page before!

Don't have a lot of friends yet but I've been running into people... Seeing their status updates... Wow, it's a great place to check up on my employees and my kids! They keep saying what their weekend plans are in their status bars. And of course I love how you can add all these little software applications to the



Six degrees of Wikipedia - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://tools.wikimedia.de/sixdeg/index.jsp?from=einstein&to=F-22

Google | six degrees of wiki

**six degrees of Wikipedia**  
a *shortest path query solver for the English Wikipedia...*  
six degrees finds the shortest path between any two Wikipedia articles in the main namespace using wiki links

find path... from:  to:  go  
 ignore date and year articles

4 degrees of separation

[Einstein](#)  
[Albert Einstein](#)  
1946  
[M61 Vulcan](#)  
[F-22](#)

[View the return path?](#)

Internet

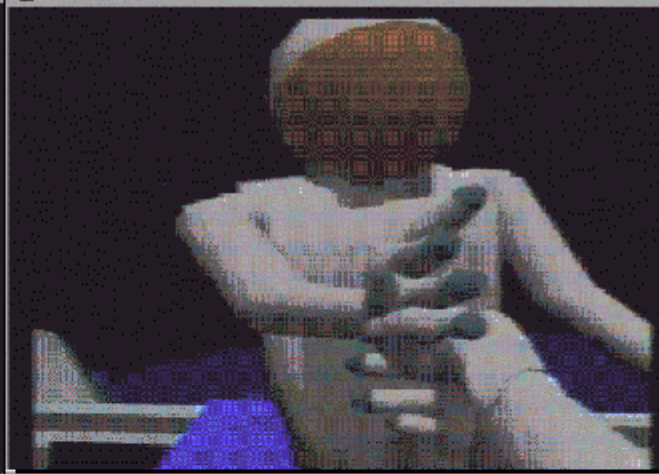


# Massive Multiplayer Virtual Worlds





Jobel



Jobel



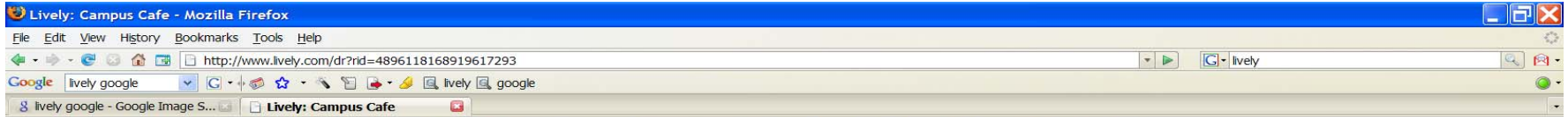
1995







# Google Lively



[Visit Popular Rooms](#)

Use this HTML to embed this room into your webpage:

```
<iframe src='http://embed.lively.com/iframe?rid=4896118168919617293' width='460'  
height='400' marginwidth='0' marginheight='0' frameborder='0'  
scrolling='no'></iframe>
```

http://www.lively.com/dr?rid=4896118168919617293





# NOAA Real Time Weather in Second Life



# University of Maryland I-95 Project



Forterra OLIVE

# Stanford University Medical Center



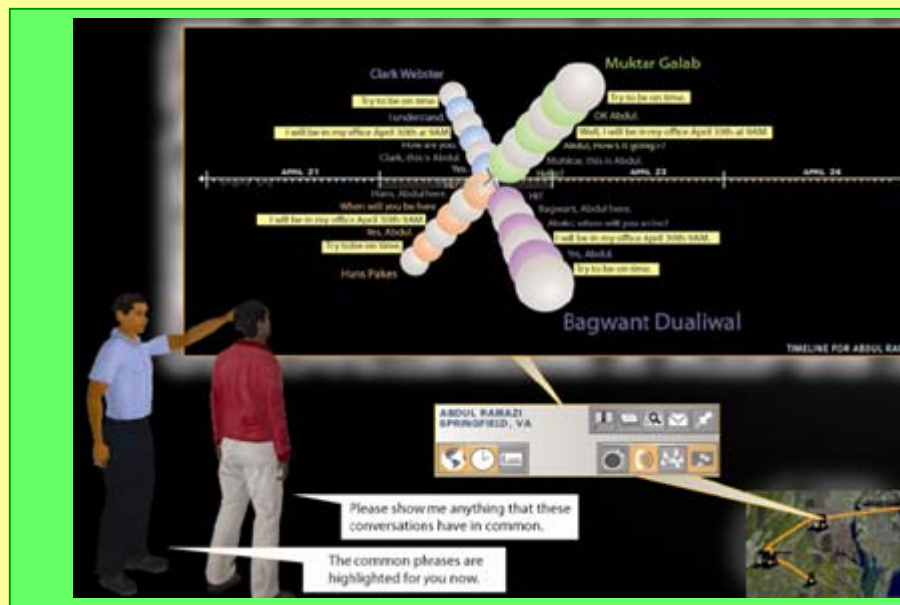


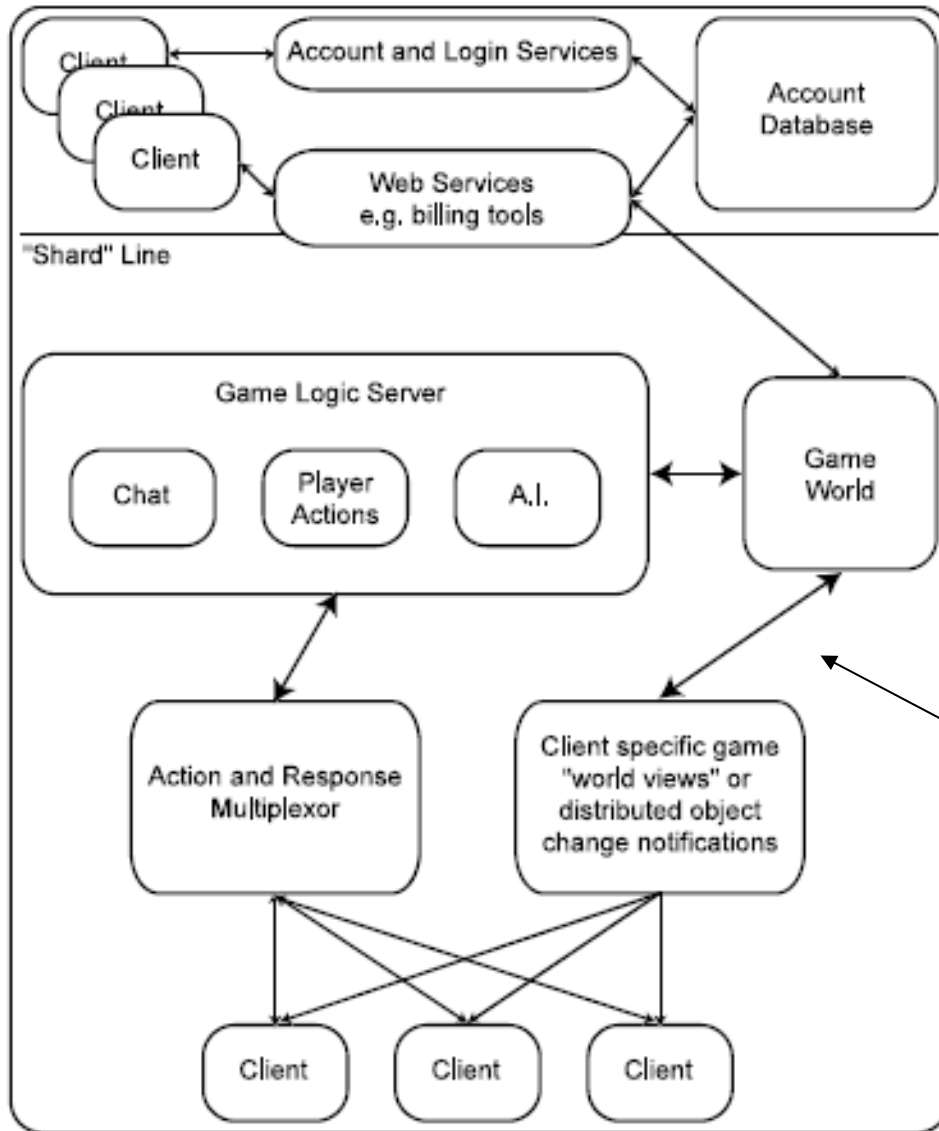
# Virtual Worlds Will Become our Workspace





# Find & Process Information





← **1 CPU/10 Clients**

← **Big Pipes**

← **1-100K concurrent**

# Simple Math

- China World of Warcraft
  - 1,000,000 concurrent users
    - Avg 500 Watts
    - 500 MW
  - Server CPU's aprox 100,000
    - Avg 200 Watts
    - 20 MW
  - Total 520 MW
  - 500 MW per power plant
- There are three VW's in China that have over 1 million concurrent users
- 3 coal-fired power plants in the last 3 years!







*Actual*



*Virtual*



*Actual*



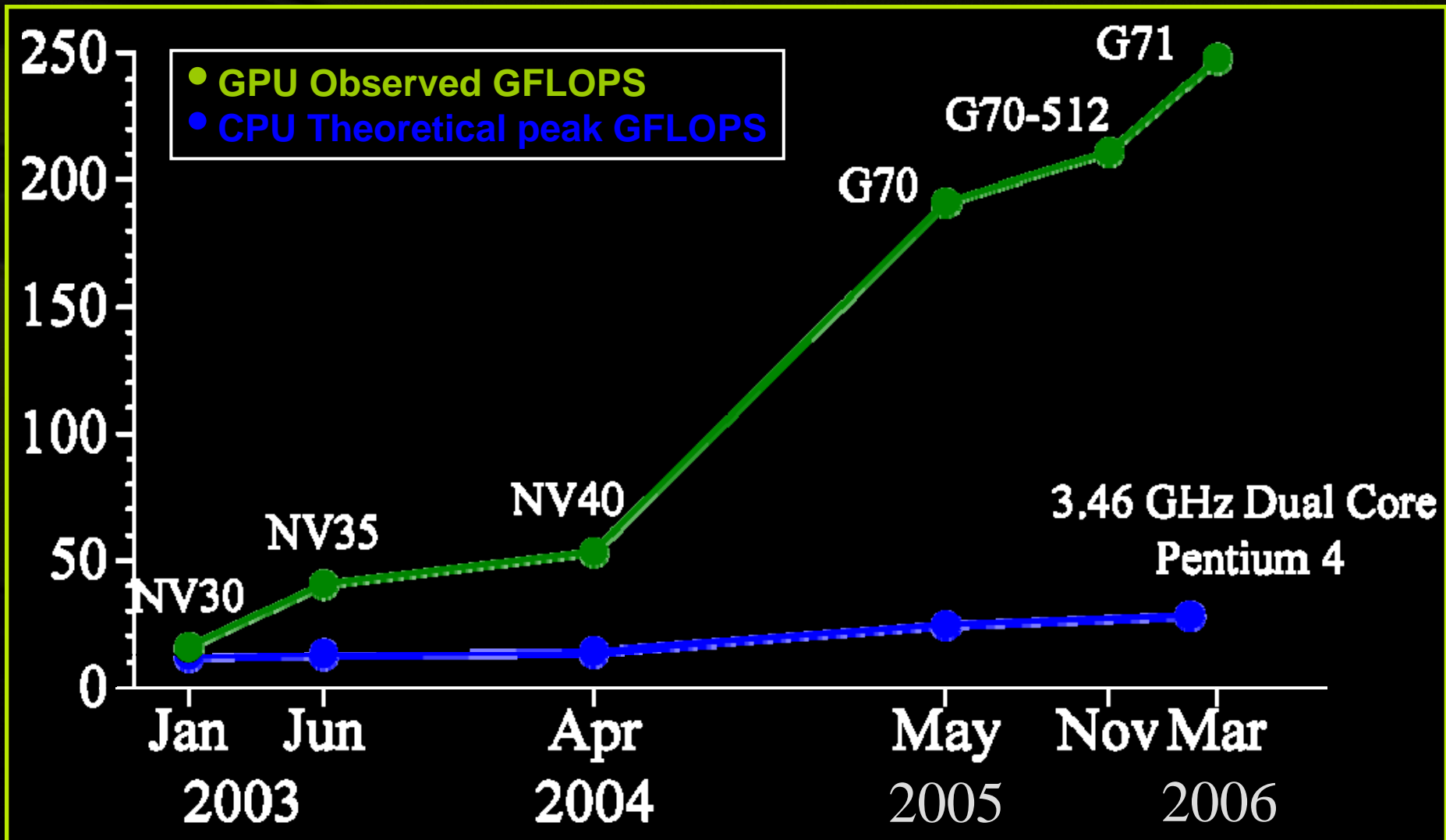
*Virtual*



# Raw Data Promises High Perf, Too



## NVIDIA GPU Pixel Shader GFLOPS



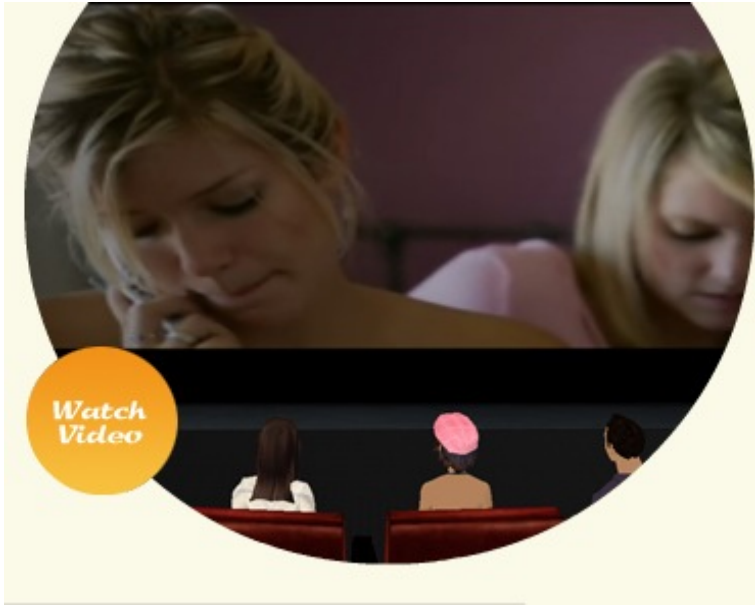


# **Nvidia GeForce GTX 200 Graphics Cards Makes Your Gaming Rig Officially Outdated**



- **“The GTX 280 rocks 240 processing cores and 1GB of RAM, while the 260 comes with 192 cores and 896MB of memory, making them equally adept at generating eye-popping graphics or serious parallel computing and physics crunching.**
- **“Of course, there is a cost to being maybe the best performing GPU on the planet: besides running US\$650 and US\$399, respectively (making three-way SLI nearly two grand with the GTX 280), they both require two PCI-E power connections to run and a massive power supply (like 1000w) if you're even thinking about SLI.”**

# Video in the Virtual World





AT&T

9:42 AM



Text



Calendar



Photos



Camera



YouTube



Stocks



Maps



Weather



Clock



Calculator



Notes



Settings



Phone



Mail



Safari



iPod