Re-engineering Engineering

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There's Change And Then There Is Change!

"…every strategic inflection point [is] characterized by a '10X' change …"

"There's wind and then there is a typhoon, there are waves and then there's a tsunami"

- Andy Grove

The Environment

The Environment

- **Hyper efficiency or Adam Smith II**
- **Hyper speed**
- **Winner take all economy**
- **Value add transparency**
- **Risk as a requirement?**
- **Change as a process**
- **Technology as a driver**
- **Diseconomy of Scale**
- **Technostructure & Infostructure**

Environment: "Change as a Process"

- **Business model evolution everyday!**
- **Infrastructure renovation**
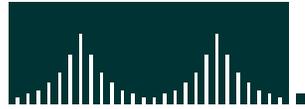- **Systems evolution**
- **Strategy evolution**

Environment : Technology as a Strategy Drivers

Environment : Diseconomies of Scale

- **Diseconomies of process / hierarchy**

- **Time for information disbursement**

- **Lack of "real time" – poor cost & poor partner experience**

- **The six month "learning curve" edge in a short product cycle world!**

Technostructure & Infostructure

- **Specialization & complexity of technology**
- **Decision-making: top down or bottom up?**
- **The role of the "fringe" employee**
- **Nuances as pitfalls**
- **Horizontal & vertical communication & cooperation - <u>not</u> top down**
- **Information based, dynamic decision making**

It's Not About a "Website"

- Brand building – pull vs. push vs. information
- Product marketing & research- a new paradigm?
- Cost of services and goods
- New variables– customer database, personalized product
- Logistics (Fed Ex), buying (FreeMarkets), admin.
- Operations: ordering, billing, service, returns, inventory...
- Transparency
- New models- eLance, eBay, Priceline, Amazon

New Networks, New Possibilities

- **Internet data centers**
- **High bandwidth last mile**
- **Total bandwidth exploding**
- **Connectivity - "evernet", "everyplace"**
- **Applications over IP-VPNs**
- **ASP's**

The CIO's Issues

CIO's Issues:

- **The problem of legacy - systems, people,...**
- **Skills shortage**
- **Re-engineering the enterprise for technology based competition/ strategy**
- **Intranets & extranets among islands of information/systems**
- **Dynamic information architecture vs. static databases ("enterprise models")**
- **Real time corporation & future of software**

CIO's Issues: Legacy Engineering

- **Optimization for what**
  - Cost
  - Performance
  - Reliability
- **Systems**
- **Business Process**

CIO's Issues: Skills Shortage

- **Complexity increasing exponentially**
  - More systems
  - More applications
  - More devices
- **Rapid change**
  - Faster versions
  - New requirements
- **Human capital**
  - Linear growth of supply
  - Outflow from MIS

CIO's Issues: Change Management
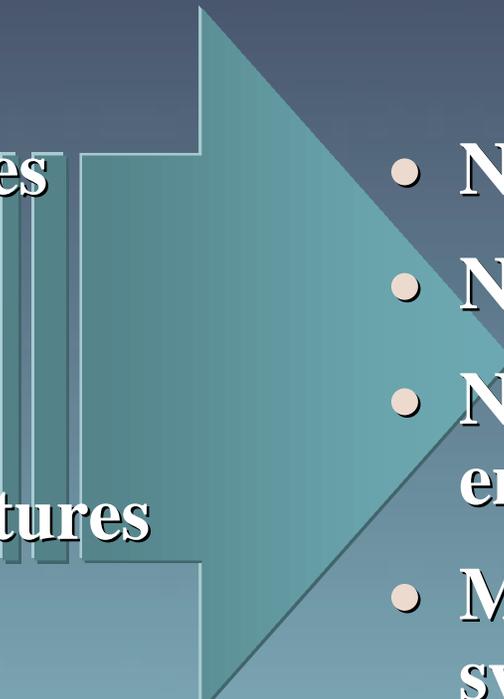
- **Old databases**
- **Old systems**
- **Legacy logic**
- **C/S architectures**

- **New applications**
- **New users**
- **New "internet" environment**
- **Multi-architecture systems**

CIO's Issues: Real-Time Corporation

- **Manual processes**

- **Batch processes**

- **Disconnected systems**

- **Limited "partner" connectivity (EDI)**

- **Increasing "real time" requirements**

CIO's Issues: Information Architecture

- **Intranets**
- **Extranets**
- **Multi-architecture environment**
- **Personalization**
- **Manageability**
- **Business strategy ready infrastructure**
  - Unified customer data (Epiphany)
  - Partner information integration (contract manufacturer)
  - Billing & more

CIO's Issues: Engineering Methodology

- **Evolvability**
- **Specialization**
- **Experimentation**
- **Change isolation**
- **Diversity**
- **Connectivity oriented**
- **Best of breed oriented**
- **Standards**

*T*he Road Ahead
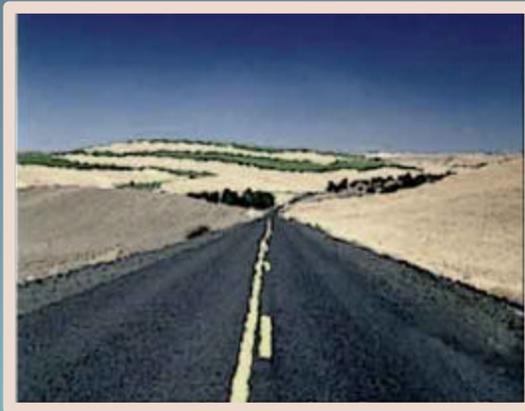
The Road Ahead ...

- **New goals**

- **Reliability**

- **Gene pool**

- **Process - organized chaos?**
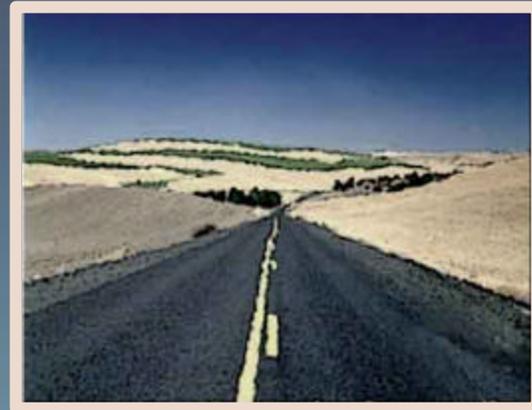
Road Ahead: "New" Goals

- **Complexity**
- **Adaptability**
- **Customizability**
- **Modularity - open systems model**
- **Personalization**
- **Application interoperability**

Road Ahead : A "new" Reliability

- **The shuttle Challenger: designed not to fail**

- **Biological systems: designed to fail gracefully**

- **Complex systems: "evolutionary approach"**

- **24/7 mission critical systems (Routers vs. phone network)**

Road Ahead: Diverse "Gene Pool"

- **Mix of skills**

- **Mix of areas**

- **Mix of personalities**

- **Mix of biases**

Road Ahead: Organized Chaos "process"

The Shepherd or the Sargent?

- **The flakes vs. architects vs. implementors**

- **Experimentation**

- **Execution**

- **Budgets, schedules, tasks vs. project stage**

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New Areas for Innovation

New Areas for Innovation

- **"Extranet information architecture"**

- **Virtual computer**

- **Network services** - **"decomposing" the computer**

New Area: "Ibase" for the "Extranet"

The Extranet Information Architecture

- Multi-architecture architectures
- Messaging paradigms
- Heterogeneous databases
- Metadata
- Entitlement: authentication, authorization...
- Inter-enterprise MIS, diverse environments
- Translation
- EAI
- Connectivity- speeds, modes, devices

Case Study: Asera "IBASE"

- **Architecture for multi-architecture integration**
- **Unification of the UI - "personal portal"**
- **Universal, application independent "entitlement system"**
- **Messaging, EAI, translation…**
- **Customizable and personalized**
- Not quite flexible "business object modeling"
- Not quite the work flow and rules engine

Architecture connecting architectures...

File   Edit   View   Go   Communicator   Help

Back   Forward   Reload   Home   Search   Netscape   Print   Security   Stop

Bookmarks   Location: http://mpalnts/wwwbcms/html/brandedportal.html   What's Related

Innovative Inc.

an **AserA** *service*

Home   myPortal   Search   Shopping Cart   Help

John, welcome to our commerce site. Please check your messages, status changed on 3 items. Remember, our spring promotion ends in 30 days!

Logout
Customize

Overview   Order Management   Promotions   Sales Support   Marketing   Service & Support   System Admin

Commerce Services
Order Management
  └ Catalogs
  └ Configuration
  └ Order Entry
  └ Order Status

Community Services
General Services
  └ Message Boards
  └ News & Research
  └ Usenet Newsgroups
  └ Meeting Rooms
Personal Services
  └ News & Research
Event Services
  └ Event Calendar
  └ Auditorium Event

Administration
Admin Services
  └ User Management
  └ Ad Management
  └ Preferences

Order Management
Browse Current Catalog
Product Configuration
Manage Quotes
Order Status Detail
Order History
Update Profile
Online Order Assistance

Sales Support
Sales Calendar
View Sales Leads - 6 unread
Sales Forecast Reports
Publish Sales Presentations
Price Configurator
ROI Calculator
How to Compete
Browse/Download Collateral

Marketing
Manage Lead Sources
Distribute Leads
Lead Analysis
MDF Reports and Analysis
Alliance Program
Partner Directory
Partner Registration

Service & Support
Technical Support Request
Ticket #52985 Closed 03-22-1999
Ticket #65689 Received 03-26-1999
Register Products
Warranty Claims

Product Information
Product Overviews
New Product Showcase
Quick Reference Guide
Product Bulletins, Technical Documentation
Product Release Schedules
Standards and Compliance Information

Current Promotions
Spring Promotion Registration (expires 04-30-1999)
Small Business Starter Kit
Order Online and Save!

Company News
Innovative, Inc. posts record Q1 financial results
Announcing the Innovative, Inc. Small Business Support Program
Senate ruling allows Innovative, Inc. to proceed with expansion plans
Innovative, Inc. announces strategic partnership with leading service providers
Corporate campus slated to open January, 2000
More News!

Training
Technical Certification Program
Browse Training Catalog
Register for Online Courses
Download Training Materials

Events
BroadBand 99 July 12-16, San Jose, CA, USA
Networkers Vancouver July 13-16, Vancouver, BC
Acuta July 18-22, Nashville, TN, USA
Fusion '99 July 22-25, San Francisco, CA, USA

Register Here
Virtual Event! Come meet David Houston, VP of Engineering, July 8
Virtual Event! Best Practices for E-Strategies, July 23

Your Messages
Order #234-1987 Shipped 03-12-1999
Order #574-8763 Backorder 03-04-1999
Claim #763-6542 Approved 03-15-1999
Part #C-87483 In Stock 03-23-1999
Spring Promotion Details Posted 02-01-1999
Reply to Inquiry #98622 Posted 03-29-1999
Reply to Inquiry #98625 Posted 03-29-1999

Meeting Rooms
04-01-1999 9:34am PST   3 rooms active
Today's Events   Register Here
Business Center Forum - 10 participants
Meet the Developers - 23 participants
R&D Lab - 12 participants

Message Boards
Tech Talk - 6 unread
Best Practice Forum - 15 unread
Ask the Experts - 1 unread
Small Business Solution Center - 8 unread
Usenet Newsgroups

Personal Links
Sales.com
EmPower Associates
Cisco Connection Online
JustSell.com

Industry News
Intel to unveil new networking chip
KPNQwest Drives Fiber Under the Thames
PMC-Sierra to Acquire Abrizio
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Single sign-on

Overview   Order Management   Promotions   Sales Support   Marketing   Service & Support   System Admin

Commerce Services

EAI

Order Management

Br___ ___atalog

Back Office ERP

Catalogs
Configuration
Order Entry
Order Status

Online Order Assistance

Community Services

General Services
Message Boards
News & Research
Usenet Newsgroups
Meeting Rooms

Personal Services
News & Research

Event Services
Event Calendar
Auditorium Event

Administration

Admin Services
User Management
Ad Management
Preferences

Sales Support

SFA

Sales Calendar
___ds - 6 unread
___ Reports
___ ___resentations
Price Configurator
ROI Calculator
How to Compete
Browse/Download Collateral

Marketing

Manage Lead Sources
Distribute Leads
Lead Analysis
MDF Reports and Anal___
Alliance Program
Partner Directory
Partner Registration

Profile

Service & Support

CRM

T___ ___ ___ Request
T___ ___sed 03-22-1999
T___ ___ceived 03-26-1999
Register Products
Warranty Claims

Product Information

Security

Product Overviews
Ne___
Qu___
Pro___ ___cal Documentation
Product Release Schedules
Standards and Compliance Information

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___motions
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User workflow

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News

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Best P___ ___ ___read
Ask th___
Small ___ ___ ___ter - 8 unread
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KPNQwest Drives Fiber Under the Thames
PMC-Sierra to Acquire Abrizio
Blaze Afterburner Evaluated by Corning
More News!

New Area: "Virtual Computer"

A Computer Distributed Over the Internet

- **Scalability of hardware - add & delete**

- **Self management**

- **Geographic distribution**

- **Load balancing, caching, COS, … services**

- **"Network operating system" for the IBASE**

Case Study: Router Networks

- **Behave as "one" machine**

- **System self-adjusts to "node" failures**

- **Capacity can be added/deleted - "self organizing"**

- **Geographically disbursed**

New Areas: Network Services

The "decomposed" Computer Architecture

- **Storage services**
- **Database services**
- **Web servers/HTTP servers**
- **TCP/IP session servers**
- **Application servers**
- **Composite services**
  - Replication
  - Load balancing
  - Distribution

Case Study: Zambeel

…distributed data <u>services</u>

Re-engineering Databases

Databases Changing Needs

- **Data vs. "other"**
- **Metadata**
- **QOS, reliability vs cost vs. access time**
- **Distribution**
- **Scalability: size, concurrent users ...**
- **Security**

Re-engineering Databases

Databases Changing Needs

- **Entitlement system, security**
- **Changing hardware – routers as a model of HW/SW interaction & evolution**
- **Changing application environments**
- **"Need" diversity: traditional databases, content, portal data, evolution, "free web" vs. corporate**
- **Database use: tables, relations, emergent behavior, analysis types, browsing, version control, logic vs. data**

Re-engineering Databases

Database Needs Asilomar Report on Database (12/98)

- Large enterprises have hundreds, sometimes thousands, of large-scale, complex packaged and custom applications. Interoperation between these applications is essential for the flexibility needed by enterprises to introduce new web-based applications services, meet regulator requirements, reduce time to market, reduce costs, and execute business mergers.

- Because of gizmos, we foresee an explosion in the size and scale of data clients and servers -- trillions of gizmos will need billions of servers. The number, mobility, and intermittent connectivity of gizmos render current client-server and three-tier software architectures unsuitable for supporting such devices. Most gizmos will not have a user interface and cannot have a database administrator -- they must be self-managing, very secure, and very reliable.

Re-engineering Databases

"Plug & Play Database Management Systems Report
Asilomar Report on Database (12/98)

- No knobs operation; a no-knobs system must adapt as conditions change

- Have the database system automatically discover and interact with the other database systems accessible on the network. This information discovery process will require that database systems provide substantially more metadata that describes the meaning of the objects they manage.

- Billions of web clients will be accessing millions of databases. Enterprises will set up large-scale federated database systems.

- Imprecise information will not only appear as the output of queries; it already appears in data sources as well

- Most organizations need continuous system operation. Designing a software system that never fails requires remote replicas and dynamic reconfiguration. Made to not fail or fail gracefully?

- Changing needs at the app level and changing hardware environment – no assumptions

- The information utility: make it easy for everyone to store, organize, access, and analyze the majority of human information online

Case Studies - "Issues"

- **Oracle**
  - **"Poor" implementations**
  - **Is Oracle or the implementation the problem?**
  - **People or technology the invariant problem?**

- **Windows/NT**
  - **Slow innovation**
  - **One size fits all**
  - **Not very flexible**

Case Study: "Solutions"- Linux

- **Modularity**

- **High customizability**

- **Higher reliability**

- **Short "version cycle"**

Linux

…engineering from the bottom up

…powerful testimony to the power of evolution

…the invisible hand of Adam smith

Linux: Cathedral and the Bazaar

Eric Raymond:

- **Ideas are many…..the trick is to recognize the good ones.**

- **Be Modular**

- **Be flexible: Change your mind and approach.**

- **Release early and often**

- **Peer review is essential**

- **Feedback is key to rapid and effective code development and debugging.**

- **Beta testers are your most valuable resource**

Evolvable Systems (Sharky)

- Only solutions that produce partial results

when partially implemented are evolvable

- What is, is wrong

- Evolution is cleverer than you are

Centrally designed protocols start out strong and
improve logarithmically….evolvable protocols start
up weak and improve exponentially

Linux: A Bazaar at the Edge of Chaos

Linux has dazzled engineers, users, and critics alike with its immense complexity and dazzling performance. Its existence owes as much to accidental luck as to ingenious hack. It is a story of something out of nothing, a powerful testimony to the power of evolution.

Given the essential ingredients of evolution … any system, natural or artificial, can evolve into a complex design through incremental changes explored in parallel.

Analytically, Linux is twice improbably - once for its technical complexity, and twice for its social complexity.

Linux: A Bazaar at the Edge of Chaos

The Linux project has neither top-down planning nor a central body vested with binding and enforcing authorities. Its power, the source of its bubbling creativity, is instead in the ceaseless interactivity among its developers.

It is not individual efficacy that propels collective action, but group efficacy that motivates individual contribution.

Coordination is a crucial element sustaining collective efforts, giving the Linux project its integrity that unfolds the seemingly chaotic yet infinitely creative process of evolution.

Linux: A Bazaar at the Edge of Chaos

Providing a public good is not simply a matter of pooling efforts, but also of coordinating efforts.

Given the essential ingredients of evolution … any system, natural or artificial, can evolve into a complex design through incremental changes explored in parallel.

Linux: Personal Views

- **Powerful Development Mechanisms**

- **Methodology : Ultimate "open system"**

- **Maybe evolutionary "biological" systems approach works?**

Personal Views : Development Mechanisms

- **Modular development**

- **Successive refinement**

- **Aggressive peer review**

- **Forced "Architecture, Architecture, Architecture"**

Personal Views : Methodology
Ultimate "Open System"

- **Origin of "open systems" circa 1982**

- **Methodologically forced openness**

- **Methodologically forced modularity**

- **Methodologically forced adaptability**

Personal Views : Biological System?

- **"Emergent"?**

- **Biological resiliency?**

- **Biological, incremental evolution?**

- **Defects cause variation/experimentation?**

- **Complexity theory proof?**

Reading:

- **The Cathedral and the Bazaar (Eric Raymond)**

- **In Praise of Evolvable Systems (Clay Shirky)**

- **The Circus Midget and the Fossilized Dinosaur Turd (Martin Hock)**

- **Linux: A Bazaar at the Edge of Chaos (Ko Kusabara)**

Economics

- **The relative cost of computing and human attention has changed**

- **This new economics requires that computer systems be autoeverything: autoinstalling automanaging, autohealing, and autoprogramming**

- **Computers can augment human intelligence by analyzing and summarizing data, by organizing it, by intelligently answering direct questions and by informing people when interesting things happen**

- **The cost of "failure" is increasing exponentially**

The Weather Forecast …

- **Rate of change will accelerate - life will be more complex, busier . . .**
- **Adaptability, agility & momentum will be the key to success!**
- **Innovation, opportunities & entrepreneurship will thrive**
- **Disruption will be the order of the day**
- **Fun, fortunes & failure will be in abundance**

Comments?
Resumes?
Business Plans?

vkhosla@kpcb.com
www.kpcb.com/team/vinod.html

Impact on Software Architecture

- **New tradeoffs for the new, diverse networked environment**
- **Architecture for integration -- plug and play application architecture**
- **Customizable and personalized**
- **Rapid deployment**
- **Ease of change management**
- **Continuous availability**

Application Challenges

- **Flexible business object modeling**
- **Business workflow engines**
  - **Rapid business process modeling**
  - **Rapid business process change**
  - **Intranet/Extranet enabled**
- **Business rule engines**
  - **Complex business processing rules**
  - **Customization/profiling rules**
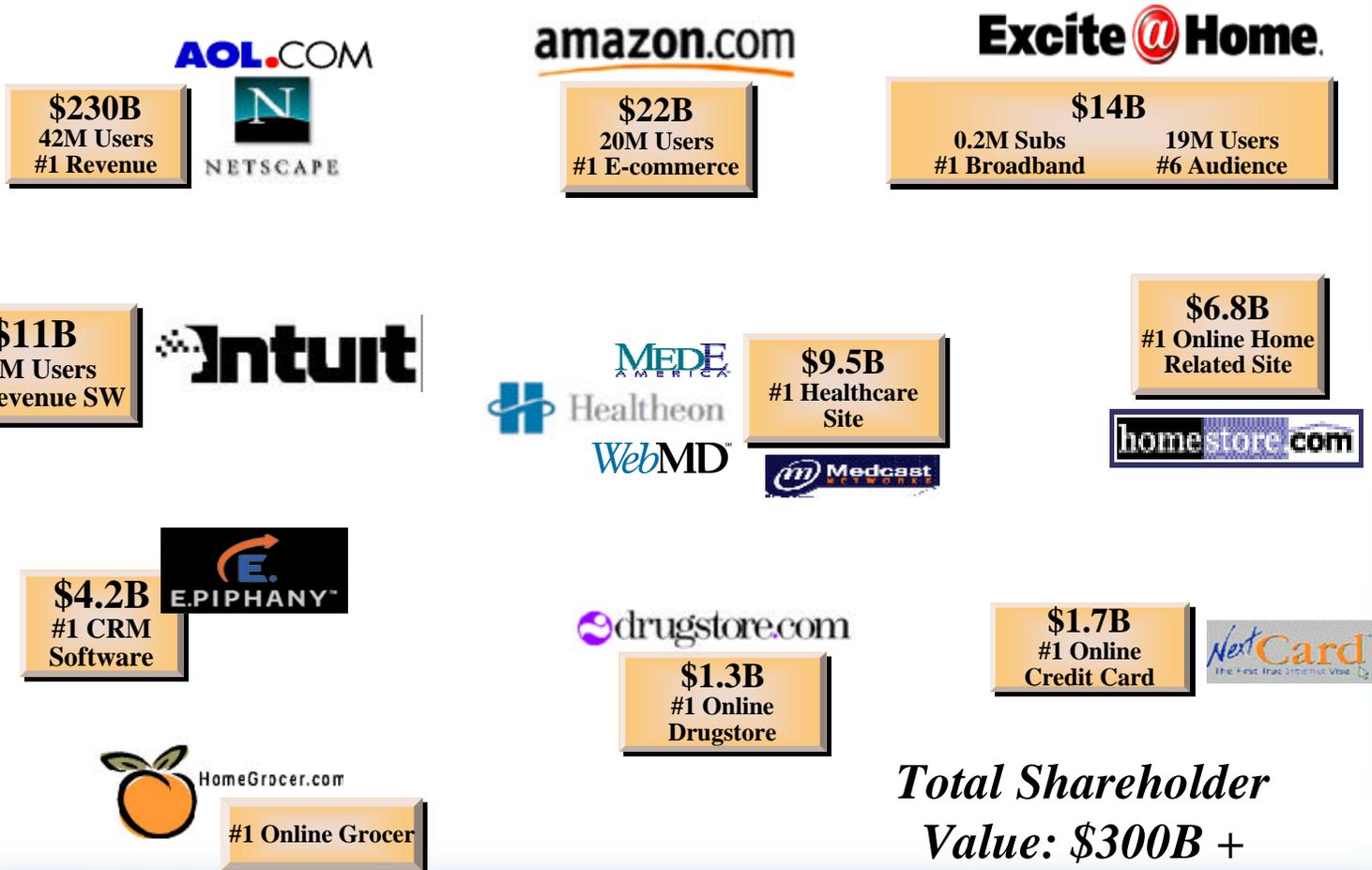- **Doing all these right!**

KPCB

- **Founding investors in 11 of Forbes 500:**
  - Sun, Compaq, Genentech, AOL, LSI Logic, Ascend, Juniper, Cerent, Netscape, Amazon, Excite, @HOME ...

- **Not financiers: technologists, operating execs**

1999 Annual Report on KPCB 350	
	99 Stats
Total Revenue	$80+ billion
Employment	195,000
Market Value	$658 billion

KP Net Services Leadership

AOL.COM
N NETSCAPE

$230B
42M Users
#1 Revenue

amazon.com

$22B
20M Users
#1 E-commerce

Excite @ Home.

$14B
0.2M Subs · 19M Users
#1 Broadband · #6 Audience

$11B
12M Users
#1 Revenue SW

Intuit

MED**E**
AMERICA
Healtheon
Web**MD**
Medcast

$9.5B
#1 Healthcare
Site

$6.8B
#1 Online Home
Related Site

homestore.com

E. E.PIPHANY™

$4.2B
#1 CRM
Software

drugstore.com

$1.3B
#1 Online
Drugstore

$1.7B
#1 Online
Credit Card

NextCard
The First True Internet Visa

HomeGrocer.com

#1 Online Grocer

*Total Shareholder
Value: $300B +*

Share Price on 1/31/00

Kleiner Perkins B2B Leadership

Vertically focused

60

KP's Long History of Building Big, Relevant Companies

Excite @ Home

amazon.com

Genentech, Inc.

Electronic Arts

Sun microsystems
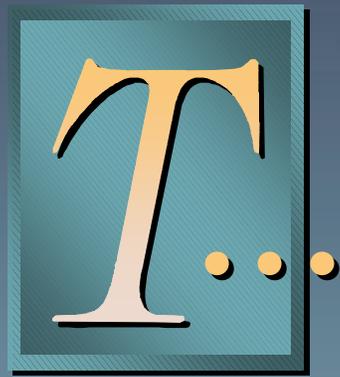
COMPAQ

AOL.COM

N Netscape

concentric network

VLSI Technology

Juniper NETWORKS

Adobe
Inspiration becomes reality.

Intuit

SYMANTEC.

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