Operational Risk Management
An Agile Enterprise and Systems Approach

Enterprise Risk World
Houston, TX - November 28, 2006

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Stevens Institute of Technology

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Abstract

Traditional operational risk management is fighting a loosing game as the business environment becomes more unpredictable and more complex.

Current procedures and frameworks can be effective when the environment behaves within its modeled profile.

Fundamentally they are reactionary.

Here we will look at operational risk management as a systems concept, and introduce agile systems and enterprise architectures that add proactive response capabilities to strategy, governance, compliance, and security.

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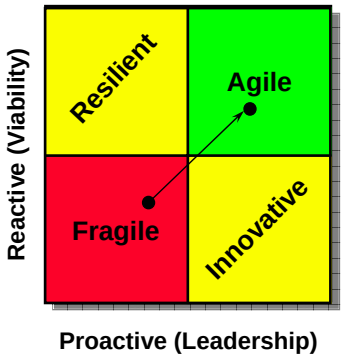
Agility is ...



The ability to respond effectively at *all* times, reactively *and* proactively

... the ability to survive and thrive in an unpredictable and uncertain environment

Manifested As ...

- An operating strategy
- An embedded culture
- An enterprise architecture
- A business-engineering discipline
- A broad competency across the enterprise

- **Agility is Risk Management: decreasing vulnerability and risk by increasing options and predictability**

What it Isn't – In the Energy Sector

- Outsourcing
- Alternative energy sources and hedges
- Technology of any kind...especially IT
- Diversified reg/dereg business models
- etc.....

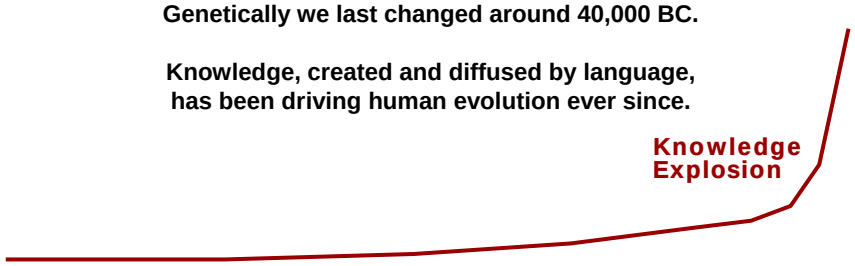
1. A business practice, no matter how agile, does not make an enterprise agile
2. A practice not designed to support agility won't, no matter what it's called

Why Now?

Years Ago	
2,500,000	Stone tools - humans live as apes
40,000	Great leap forward (Language-caused? art, houses, weapons, war)
4,000	Horse domesticated, plow invented, wheel invented
500	Water travel begins to homogenize humanity globally
0	Space exploration, nuclear physics, genetic engineering, global communications, networked humanity, ……

Genetically we last changed around 40,000 BC.

Knowledge, created and diffused by language, has been driving human evolution ever since.



From Jared Diamond's *The Third Chimpanzee* for general times and characteristics. The statement that we last genetically changed 40,000 years is my interpretation of his writings. His conjecture was that the voice box was responsible for the *great leap forward* in human development, which provided the uniquely human capability to then incorporate vowels into utterances, which led to a spoken language that could convey complexity and nuance, which led to thought, and to thoughts that could be passed on to others. The emergence of a new form of evolving stuff.

Why Now?

Knowledge builds on knowledge

The more you have the more you get

The knee of the curve is passed

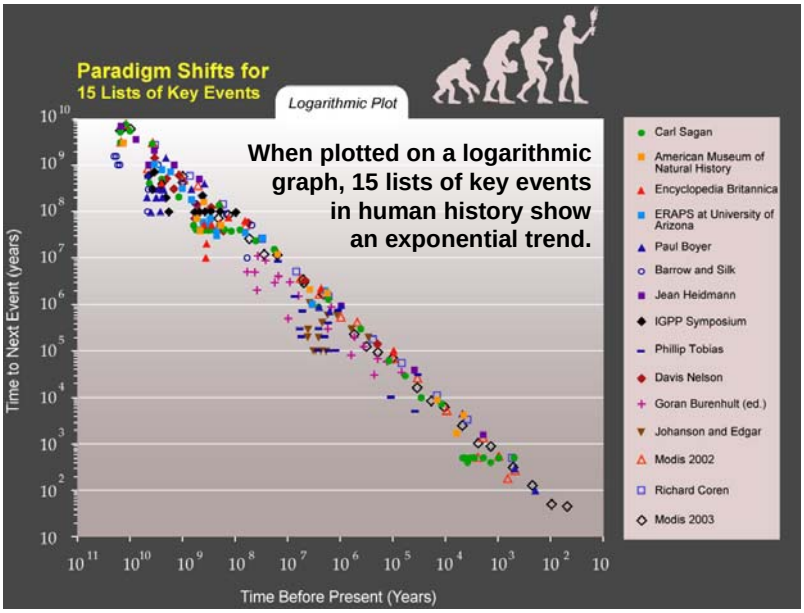
- Nuclear physics
- Personal computer
- Semiconductors in everything
- Space travel
- Internet
- Globalization
- Genetic engineering
- Cloning
- Nano-technology
- Hydrogen economy?
- Extended Lifespan?
- Quantum Computing?
- Cold fusion?
- Anti-gravity?

Decisions must be made faster…

…and implemented immediately

Knowledge Explosion

http://en.wikipedia.org/wiki/Technological_singularity
Courtesy of Ray Kurzweil and Kurzweil Technologies, Inc.
Attribution License v.1.0: http://creativecommons.org/licenses/by/1.0/



The Law of Accelerating Returns

"... technological change is exponential, contrary to the common-sense 'intuitive linear' view.

So we won't experience 100 years of progress in the 21st century -- it will be more like 20,000 years of progress (at today's rate).

The 'returns,' such as chip speed and cost-effectiveness, also increase exponentially.

Within a few decades, machine intelligence will surpass human intelligence, leading to The Singularity -- technological change so rapid and profound it represents a rupture in the fabric of human history.

Ray Kurzweil, 2001

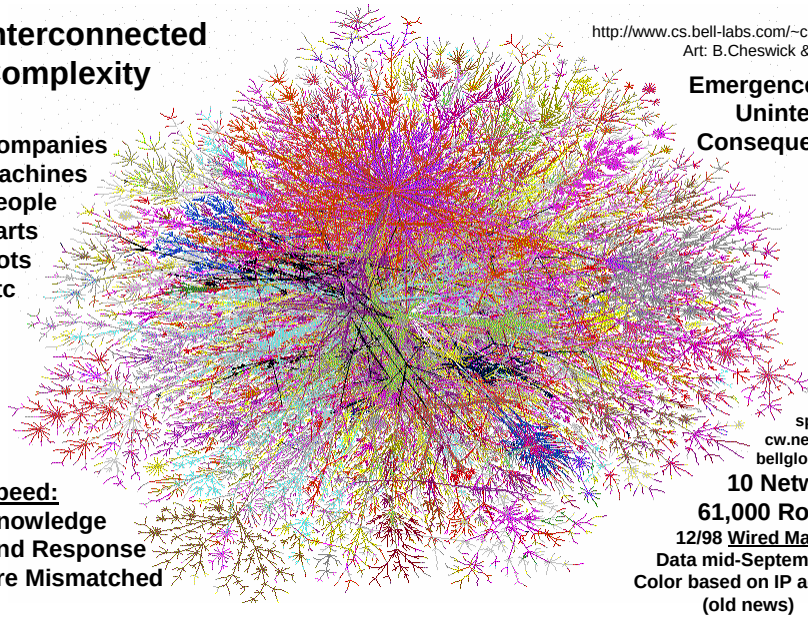
www.kurzweilai.net/meme/frame.html?main=/articles/art0134.html

A few of his many honors and awards... (not your ordinary kook)
2000 Lemelson-MIT Prize. This $500,000 award is largest in U.S. in invention and innovation
1999 National Medal of Technology, nation's highest honor in technology, President Clinton
1994 Dickson Prize, Carnegie Mellon University's top science prize
1993 ACM Fellow Award, Association for Computing Machinery
1982 Computer Science Award, President Reagan
1982 Admitted to the Computer Industry Hall of Fame

What Goes Around Comes Around...Fast

Interconnected Complexity

Companies
Machines
People
Parts
Bots
Etc



http://www.cs.bell-labs.com/~ches/map/
Art: B.Cheswick & H.Burch

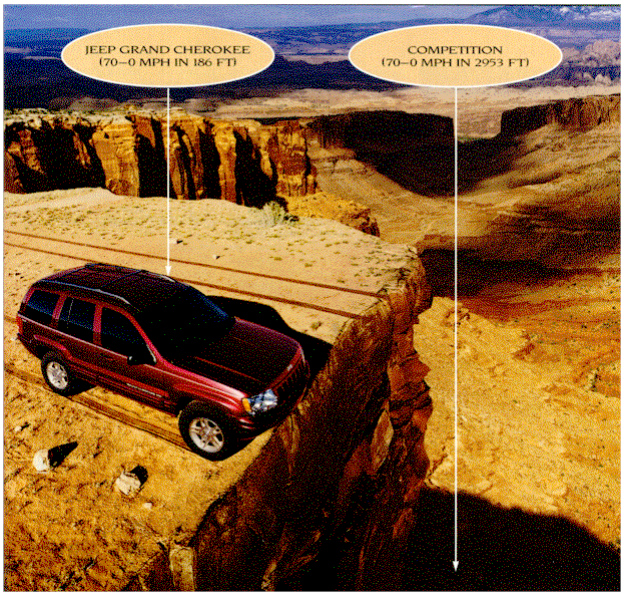
Emergence and Unintended Consequences

AOL
BBN
ac.jp
att.net
UUNet
dla.mil
Netcom
sprint.net
cw.net (+MCI)
bellglobal.com

10 Networks
61,000 Routers
12/98 Wired Magazine
Data mid-September '99
Color based on IP address
(old news)

Speed:
Knowledge And Response Are Mismatched

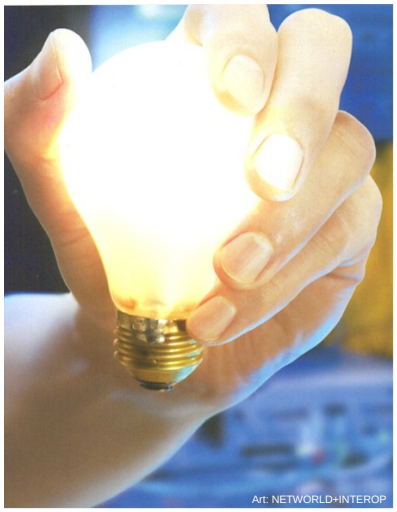
Inertia – The Bane of Agility



Ceasing prior activity quickly and cleanly is just as important as starting new activity.

Bane:
a cause of death, destruction, ruin
(Webster)

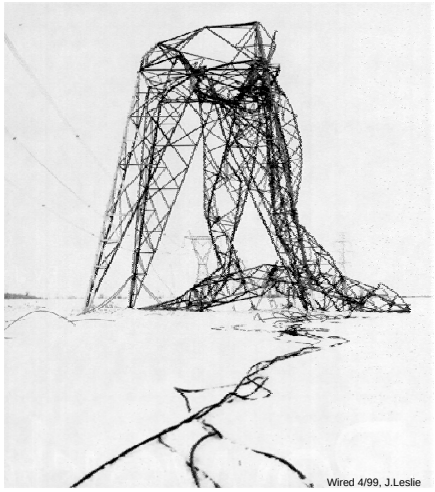
Energy: Proactive callings...at the moment



Hedge Funds, AMR, Demand Response, Distributed Generation, Outsourcing, Wireless, Info Integration, SOA, Business Proc. Mgmnt, BPL, SCADA TCP/IP, Fuel Cell, Wind, Nukes, M&A, dereg/rereg, ...

Energy: Reactive demands...at the moment

Serious security, active impatient PUC, expectant customer, governance upgrade, SOX, environmental, IT mess, reliability, cost reduction, aged workforce, SCADA TCP/IP, dereg/rereg ...



Wired 4/99, J.Leslie

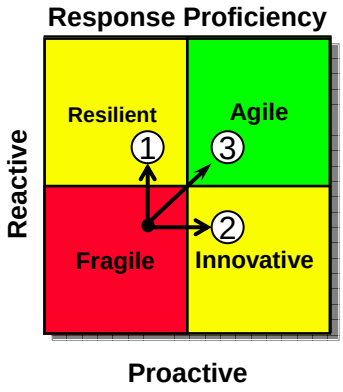
Sailing in uncharted waters

The World Is Flat, Thomas L. Friedman
First edition cover art
2005, Farrar, Straus and Giroux

- **We don't control the pace of new knowledge**
- **Unpredictable, Uncertain, Continuous...**
  - **New rules**
  - **New decisions**
  - **New values**
  - **New strategies**
  - **New priorities**
  - **New projects**

You do have some choices

- Learn how to react very well (or get run over)
- Set the agenda and pace that others must react to (but don't stumble)
- Develop effective response competency and regain control



Cats are the icon of agility

We agree that cats are agile. Why?

Aware, Nimble, Focused on value.

But on a hot tin roof they're spastic. Why?

- Info overload.
- Lost awareness.
- Inability to create options.

Up a tree they're catatonic. Why?

- Paralyzed with fear.
- Lost awareness.
- Inability to create options.

Forces impeding progress

- Regulation
- Entrenched culture
- Below-par IT infrastructure
- Perceived risk of IT migration

(IT is the business critical infrastructure, as such, it enables or cripples)

Forces supporting progress (Energy)

- The pace of demands and expectations: governance, environmental, reliability, cost, satisfaction...
- The pace of compelling technologies: AMR, DG, Fuel cells, Wind, Nukes, Wireless...
- The pace of compelling services: BPL, DR, time-of-day pricing, efficient appliances...
- IT industry is enabling/promoting agility: EAI, EII, SOA, BAM, BI, web services, virtualization...
- Pathfinders are at work: PNM, Xcel, NSTAR ...
- Executive churn sorts for agile management naturally
- Security will not be effective until it is agile

Where to find some models (sometimes)

- On Demand JIT load response!
- Disaster recovery
- Energy sourcing risk management
- Business process outsourcing
- Collaboration (Xcel)
- Outage response (NSTAR)
- Substation Design (PNM)

Enabling Initiative

How Fast

Can You Design and Deploy

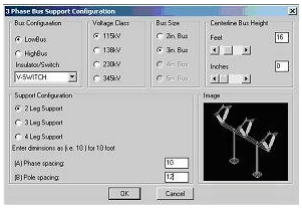
a New Source of

Revenue Generation

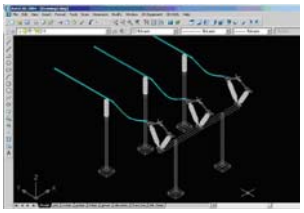
Fast Enough

To Seize The Moment?

Substation designs in 6 hours
(normally 6 months)

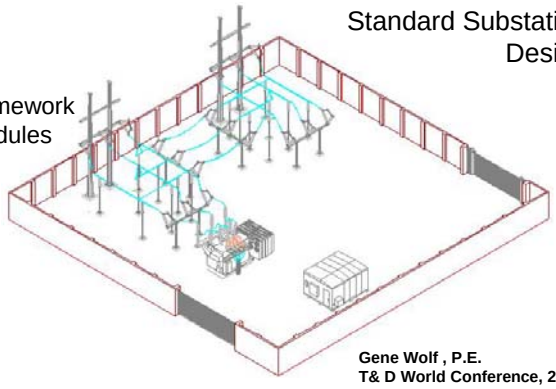


DASL provides common framework and common equipment modules



PNM = Public Service New Mexico

PNM's Second Standard Substation Design



Gene Wolf , P.E.
T& D World Conference, 2004

Details: www.tdworld.com/mag/power_pointandclick_substation_matures/index.html

1- Proposed Site

58 Days
from Signing of Contract
to Energization
of El Cerro Substation

Usually 12-18 months

Gene Wolf , P.E., PNM, T& D World Conference, 2004

2- Superimposed Computer Graphic

3- Completed Project

Lesson

Drag and drop

response to opportunity

Plug and play

construction of initiative

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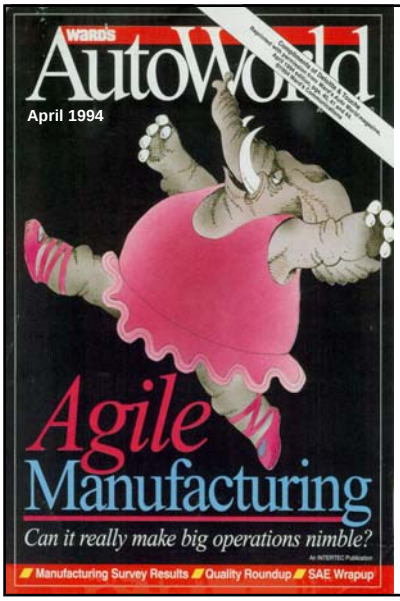

Manufacturing
Enterprise Systems
and
Production Systems

Were the First Focus
of the 1991 study
and the
Agility Forum 92-96
Industry-Led Discovery

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Adaptable Wafer-Processing Machine

Depiction of *Precision 5000* Family from Applied Materials Inc.

Reusable

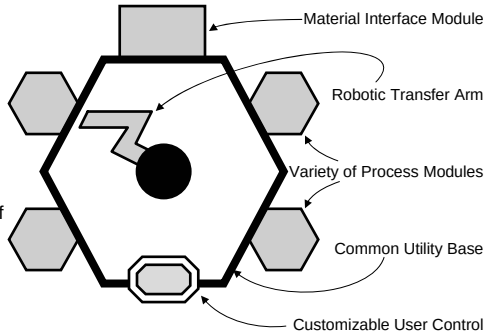
- Material interfaces, transfer robots, process modules, utility bases, docking modules, and user controls are independent units.
- Common human, mechanical, electrical, gas, and hydraulic framework.
- A growing variety of processing modules may be mixed or matched within a cluster.

Reconfigurable

- Wafer path determined in real-time by availability of appropriate process modules.
- New process modules may be added when new capability is required, and not before.
- Clusters may begin as 4 sequential processes and evolve to a single 4-unit process as product demand grows.
- Process-specific control is contained within the process module, traveling with it when redeployed.
- User control modules are custom configurable for proprietary processing.

Scalable

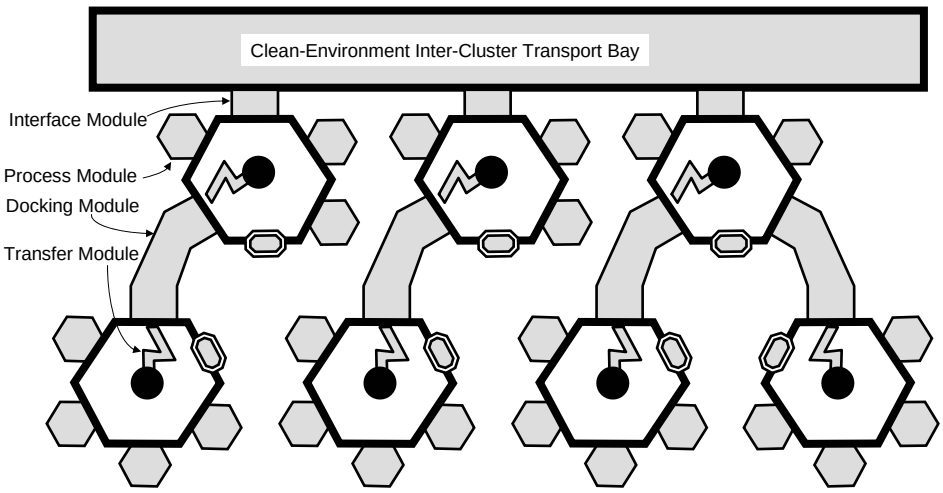
- Within a cluster 1 to 4 process modules may be installed.
- Clusters may be interconnected into larger super-clusters using docking modules in place of process modules.
- Clusters and super-clusters can be interconnected without limit.



Response Ability

- Test & Introduce new process modules incrementally.
- Custom process individual wafers and prototype runs.
- Repair/replace faulty module while cluster operates.
- Add modules and machine clusters as/when needed.
- Reconfigure clusters and redeploy process modules as product-line demand cycle changes.
- Create super-clusters as contaminant sensitivity requires.

Scalable Machine Clusters



Adaptable Machining Cell

Reusable

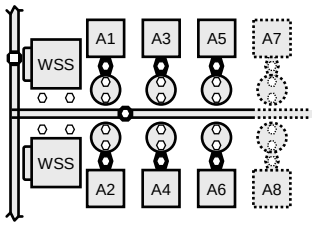
- Machines, work setting stations, pallet changers, fixtures are all standard, independent units.
- Common human, mechanical, electrical, and coolant framework.
- Machines do not require excavated pits or special foundations, and are relatively light and easy to move from one cell to another.

Reconfigurable

- Cell control dynamically changes work routing as machines are removed or added, on the fly.
- Autonomous part machining, non-sequential.
- Machines and material scheduled by cell control software in real time per current cell status.
- Part programs downloaded when needed.
- Machine's history stays with its controller.
- Machines ask for appropriate work when ready.

Scalable

- Cell may have any number of machines and up to four work setting stations.
- Cells may have multiple unit instances in operation.
- Machines capable of duplicate work functionality.
- Utility services and vehicle tracks can be extended without restrictions imposed by the cell or its units.

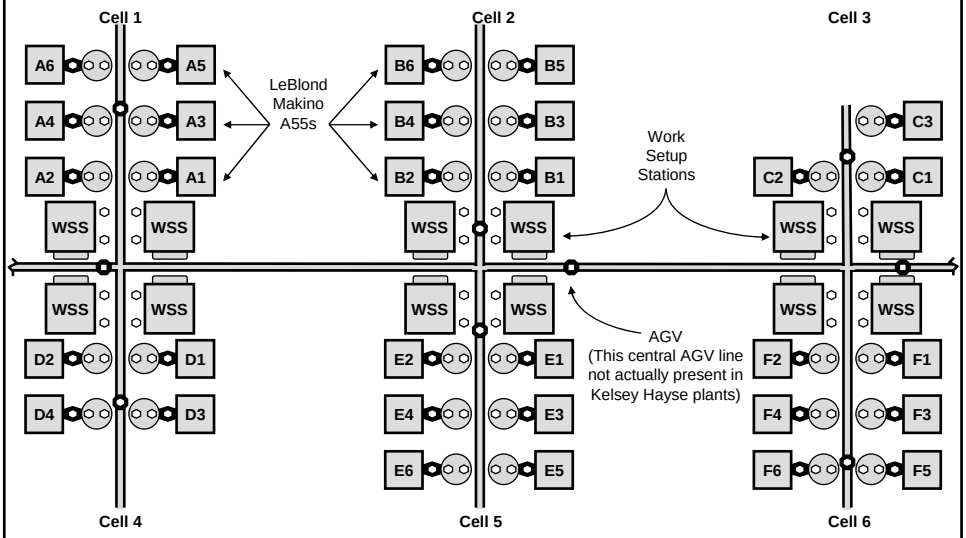


Concept Based on LeBlond Makino A55 Cells at Kelsey-Hayes

Response Ability

- Install and set up a new cell in 4-8 weeks.
- Reconfigure a cell for entirely new part in 1-4 weeks.
- Duplicate cell functionality in another cell in 1-2 days.
- Add/calibrate machine in 1-2 days while cell operates.
- Remove or service machine without cell disruption.
- JIT part program download.
- Insert prototypes seamlessly.

Adaptable Cells - Reconfigurable Factory



Adaptable Organization

Reusable

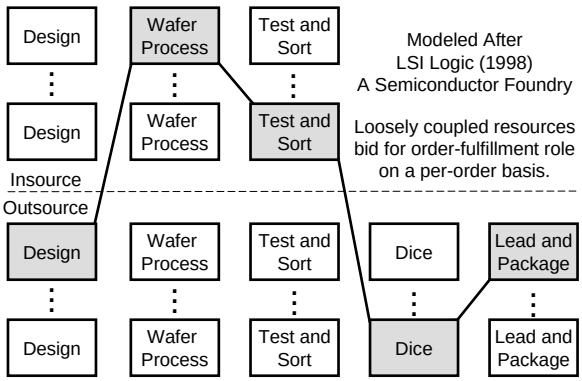
- Individual in/outsource resources are configured on a bid-per-order basis.
- Order fulfillment configurations are bid and assembled by Hong Kong group.
- Common network interface at each resource provides enterprise integration and real-time management. Can be relocated as resources come and go.
- Network-accessible production data can be downloaded to multiple locations

Reconfigurable

- Common resource interface and real-time order process status enables mid-order reconfiguration of prod. chain.
- Insource and outsource resources are interchangeable for equivalent processing technology.

Scalable

- No limits on the number or mix of insource and outsource resources.
- Hong Kong management group qualifies new and existing resources as needed to maintain sufficient resource pool.



Modeled After
LSI Logic (1998)
A Semiconductor Foundry

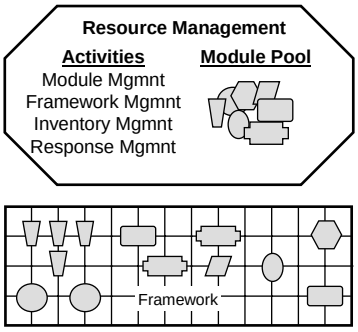
Loosely coupled resources bid for order-fulfillment role on a per-order basis.

Response Ability

- Production chain assembled, scheduled, working within 24 hours.
- Resources added any time for extra capacity or quicker fulfillment.
- Real-time status & issue-resolution for quick problem correction.
- Net-wide data enables coordinated system-wide order changes.

Reusable Modules Reconfigurable within a Scalable Framework

Applied's Machines	Kelsey-Hayes' Cells	LSI's Production Chains
Components Physics Units Robotic Transfer User Controls	Components Machines Setup Stations Pallet Changers	Components In-side Resources Out-side Resources Partner Interfaces
Framework Standardized Utility Base	Framework AGV Network Grid Cell Layout Standards Common Machines	Framework Enterprise Network Qualification Standards



High Concept:
Agility is Deployed as an Assembly-Line Process

www.parshift.com/Essays/essay005.htm

Agile-systems research

Problem:

- Technology and markets changing faster than ability to employ and accommodate
- Requirements are uncertain and unpredictable
- Flexible approaches are inadequate
- Systems life is too short

Objective:

- Discover design principles for agility

Publications available at www.parshift.com/library.htm
and www.parshift.com/publications.htm

Agile-systems research

Solution Search:

- Examined 100s of systems of various types (products, processes, procedures, peopled)
- Looked for systems that responded *effectively*
- Looked for metrics that defined *effectively*
- Looked for categories of response types
- Looked for principles that enabled response

(Facilitated by the Agility Forum, Lehigh University, 1991 – 1997
Over 1,000 participants from over 250 organizations)

What analysis found (requirements)

Proactive response in 4 categories:

Creation - Improvement - Migration - Modification

Reactive response in 4 categories:

Correction - Variation - Expansion - Reconfiguration

Response effectiveness with 4 metrics:

Time - Cost - Quality - Scope

What analysis found (design)

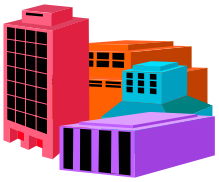
One general strategy:

- **R**eusable modules **R**econfigurable in a **S**calable framework

Ten general design principles:

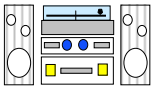
1. Evolving Framework Standards
2. Encapsulated Modules
3. Facilitated Plug Compatibility
4. Facilitated Module Reuse
5. Module Redundancy / Diversity
6. Elastic Capacity
7. Distributed Control / Info
8. Facilitated Deferred Commitment
9. Flat Interaction
10. Self Organization

Basic Definitions



Company of Divisions

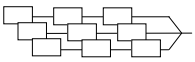
An enterprise is a system



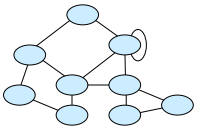
Stereo System of Components

System

A group of modules
sharing a common interaction framework
and serving a common purpose.



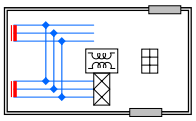
Portfolio of Energy Options



Practice of Procedures

Framework

A set of standards
constraining and enabling the interactions
of compatible system modules.



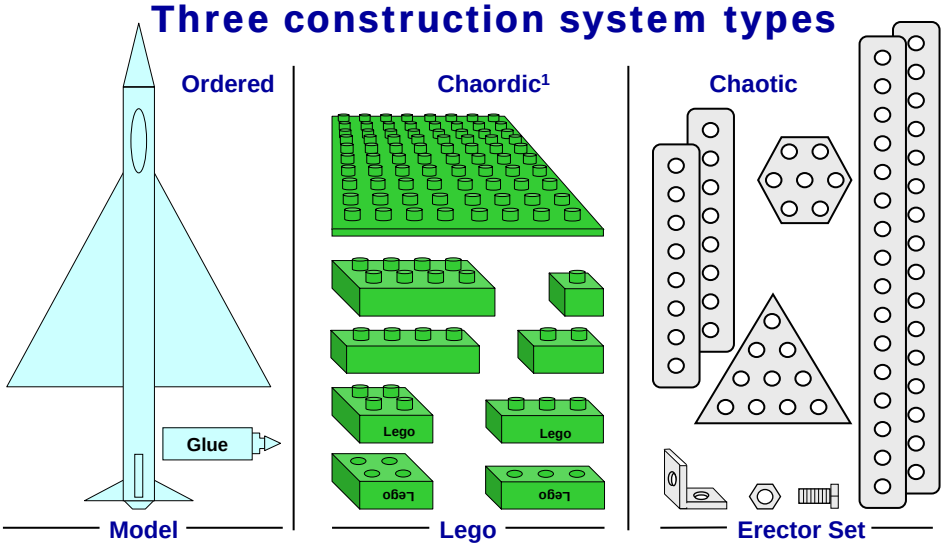
Substation of Equipment

Team of People

Module

A separable system sub-unit
with a self-contained capability/purpose/identity,
and capable of interaction with other modules.

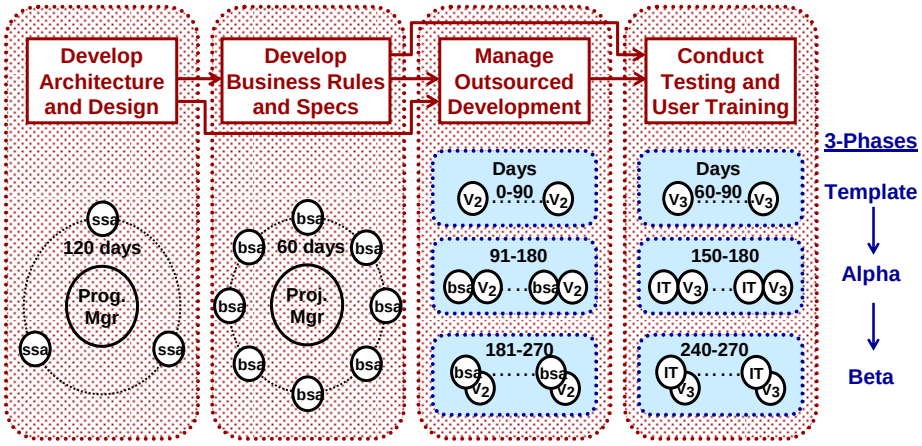
Frameworks: Three construction system types



[1] Dee Hock (Visa Corp) coined the word *chaord* for organisms, organizations, and systems which harmoniously exhibit characteristics of both order and chaos.

$1.5 billion company
ERP: $9mil, 12 mos + HRM in 5

Under budget, on spec, on time = Predictable



Encapsulated ERP Implementation Process
- Designed to Accommodate Requirement Evolution -

Details: www.parshift.com/Files/PsiDocs/Rkd050324CserPaper.pdf

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Agile projects are predictable

Consider all agile principles: better design-for-agility

Values: increases scope of response options, reduces future cost and time

Define clear framework: integration rules don't change

Values: increases predictability of project, reduces current cost and time

Encapsulate work modules: requirements don't change

Values: increased predictability of project, increased options for alternatives, reduces current cost and time

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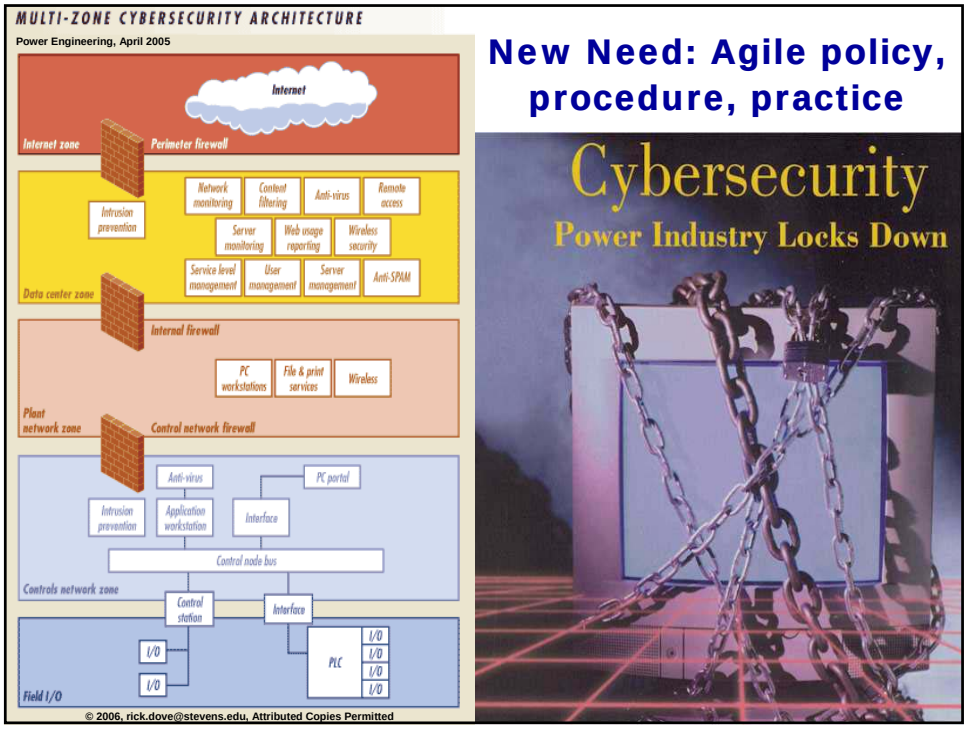


New Need: Agile policy, procedure, practice

In 2002 ... What is it Now?

300 Companies Studied:

- 79% avg increase in attacks per company (not virus/worms)
- 43% of companies had at least one potentially crippling attack
- 39% of attacks were targeted at specific entities

Most-targeted industries were:

- high tech (961 attacks)
- power and energy (725)
- financial services (895)
- media/entertainment (706)

Biggest losses from insiders:

- $2.7 million average insider attack cost
- $57,000 average outsider attack cost

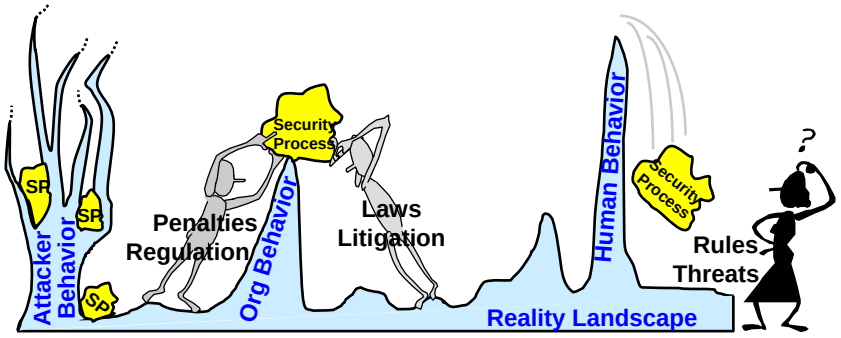
"Internet Threat Serious and Growing," E. DeJesus, *Security Wire Digest*, 31 Jan 2002, www.infosecuritymag.com

Seven ignored reality factors

1. Human Behavior: Human error, whimsy, expediency, arrogance...
2. Organizational Behavior: Survival rules rule, nobody's in control...
3. Technology Pace: Accelerating vulnerability-introductions...
4. System Complexity: Incomprehensible, unintended consequences..
5. Globalization: Different partner ethics, values, infrastructures...
6. Agile Enterprise: Outsourcing, webservices, transparency...
7. Agile Attackers: Distributed, collaborative, self organizing...

For 50 years of IT-progress,
management policy/procedure/practice
has followed behind ... patching potholes.

Maintaining Systems in Unstable States Takes Constant Energy Input



Expecting or enforcing ideal and repetitive behavior ignores reality...
not a substitute for effective strategy

Security Strategy requires understanding

A rational view of the problem:

- Reality bites – what is its nature?
- The problem is bigger than technology – what is its nature?
- The situation is in constant flux – what is its nature?

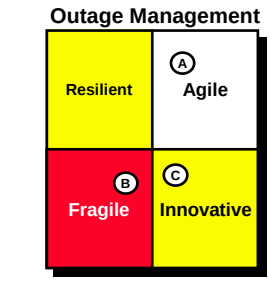
A rational view of the solution:

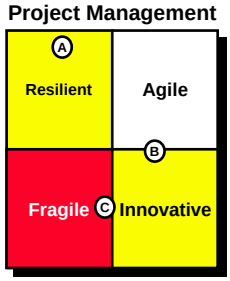
- You <u>are</u> compromised – now what?
- Situation in flux – what is proactive response-ability?
- eXcellence – what is its nature?

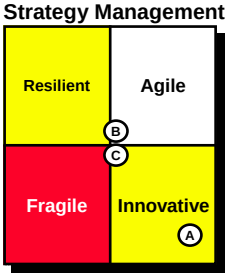
FYI: Stevens Institute will facilitate a major collaborative study in 2007 with an industry-led Agile Security Forum

How to recognize Agility

- At the systems level:
  With evidence of the principles
- At the enterprise level:
  With characteristics of the
  Response Proficiency Maturity Model

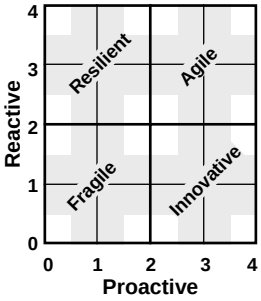






Comparing Companies A, B, C.

Assessment and Competitive Evaluation

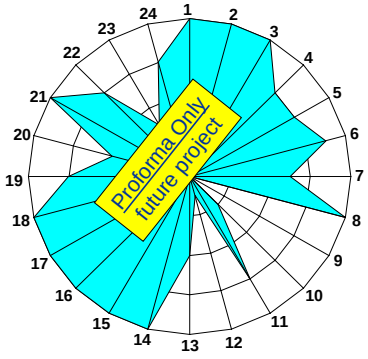


Response Proficiency Maturity Model

	Stages	Metric Focus	Working Knowledge	Competitive Development Proactive	Reactive
0	Accidental	Pass/Fail	Examples	Lucky	None
1	Repeatable	Time	Concepts	Creation	Correction
2	Defined	Cost	Metrics	Improvement	Variation
3	Managed	Quality	Rules	Migration	Expansion
4	Mastered	Scope	Principles	Modification	Reconfig'tion

Benchmarking response proficiency

...across the industry



maturity model metrics

Critical Business Practice???

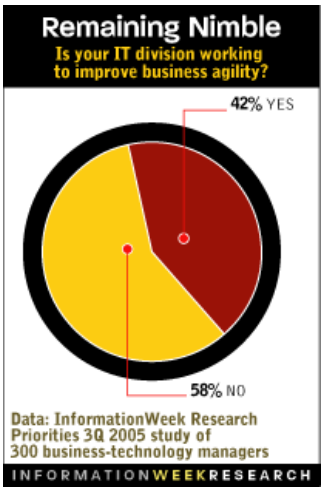
4.0	1	Regulatory compliance
4.0	2	SOX compliance, controls
4.0	3	Governance
3.0	4	Management development
3.0	5	Creativity and innovation
3.5	6	Asset management
2.5	7	Outage manage
4.0	8	Service reliab
0.0	9	Cyber security
1.0	10	Physical security
3.0	11	Customer care
0.5	12	Outsource management
2.0	13	Business process manage
4.0	14	Regulatory relationship mgmnt
4.0	15	Business intelligence
4.0	16	Risk management, energy
4.0	17	Risk management, operations
4.0	18	Plant technology migration
3.0	19	Staffing and skill development
2.0	20	Cost management
4.0	21	Disaster management
3.0	22	Business process IT support
1.5	23	Information technology migration
3.0	24	Field operations

How Would Your Company Score?

June 2005 Survey – Across Sectors

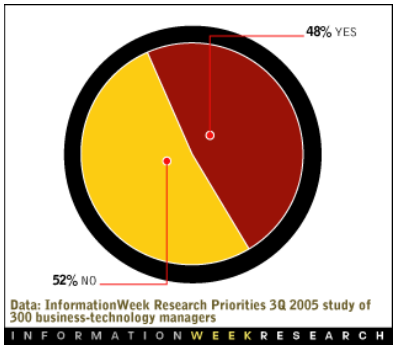
"*InformationWeek* asked 300 business-technology managers about their business-technology initiatives."

"Two in five managers cite improving business agility as a key IT objective."

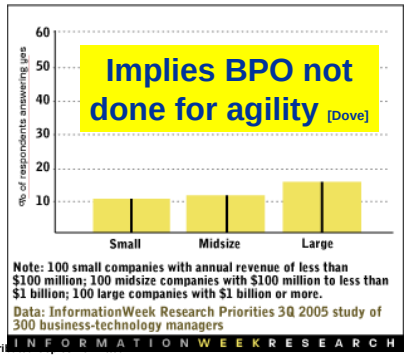


Reported in InformationWeek 7/25/05

"Is keeping up with the pace of change among your company's business priorities?"



"Is your IT division supporting business-process outsourcing?"



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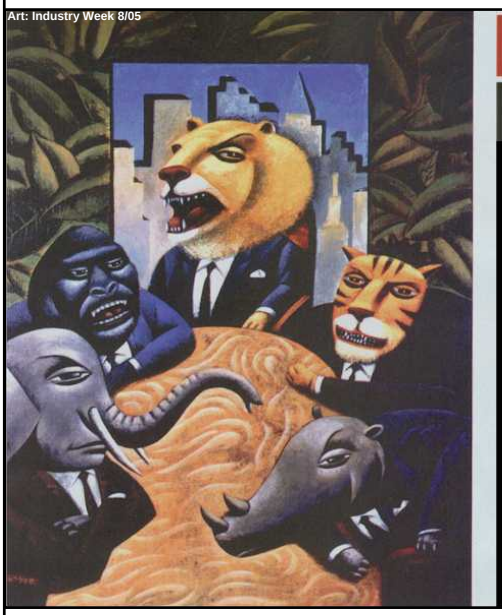


BEEFED UP BOARDS

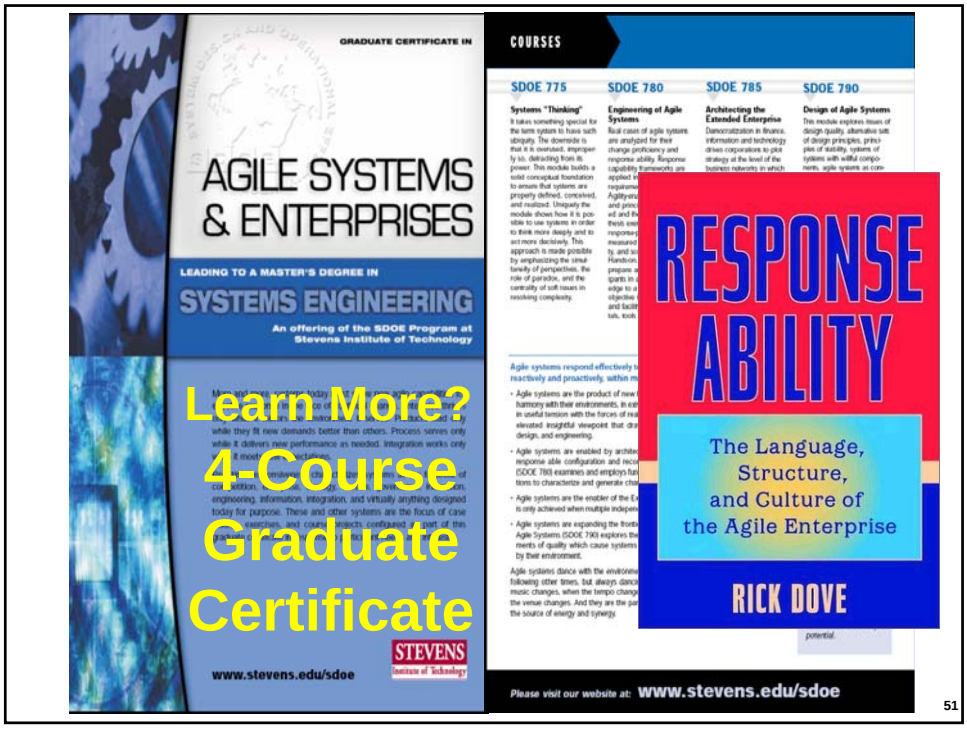
MEET YOUR FIRM'S NEW BOARD.

More independent of the company it serves. More accountable for the accuracy of financial statements. Better informed about how the company is run. And, maybe, less a pal to the company's chief executive officer and more representative of shareholder's interests.

August 1, 2005, Jill Jusko, Industry Week

Different sectors, different motivations

- **Manufacturing sector threatened with both industry extinction and company extinction**
- **For the energy / utility sector:**
  - **No industry extinction risk**
  - **Little company extinction risk**
  - **But, management is at real personal risk**
- **Boards, commissions, and customers want *response able* best practices**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What's on your horizon?
2003 - Edge of the Hurricane