



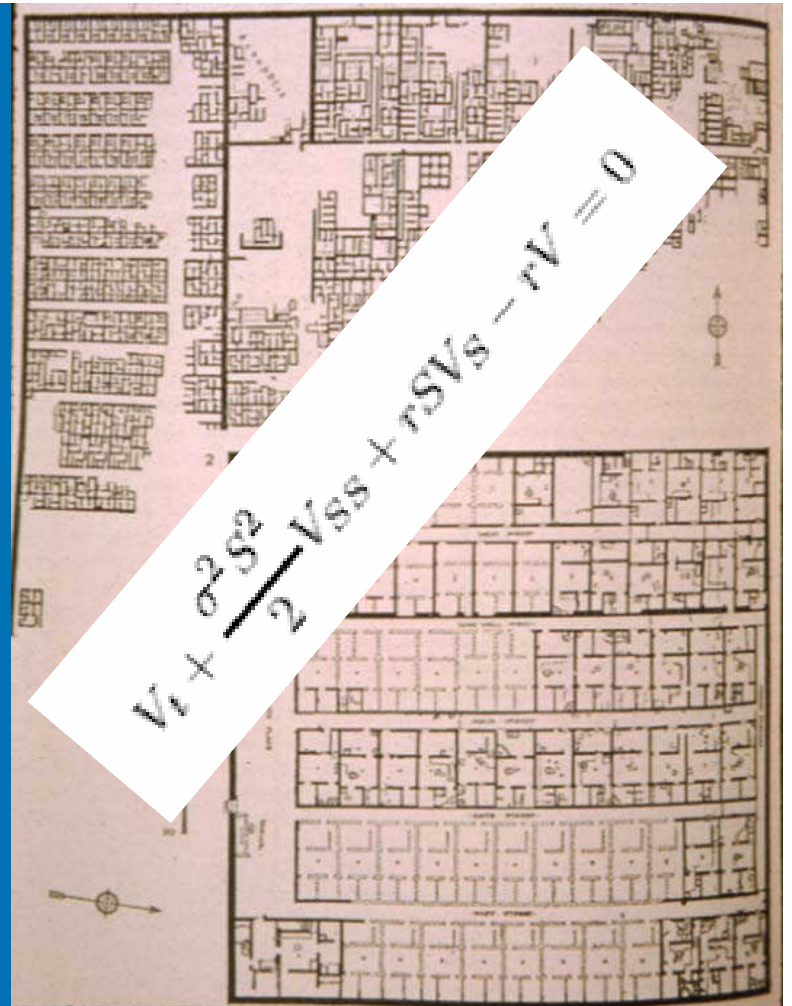
# Grid in Financial Services

EGR-RG Workshop

Sept 13, 2006

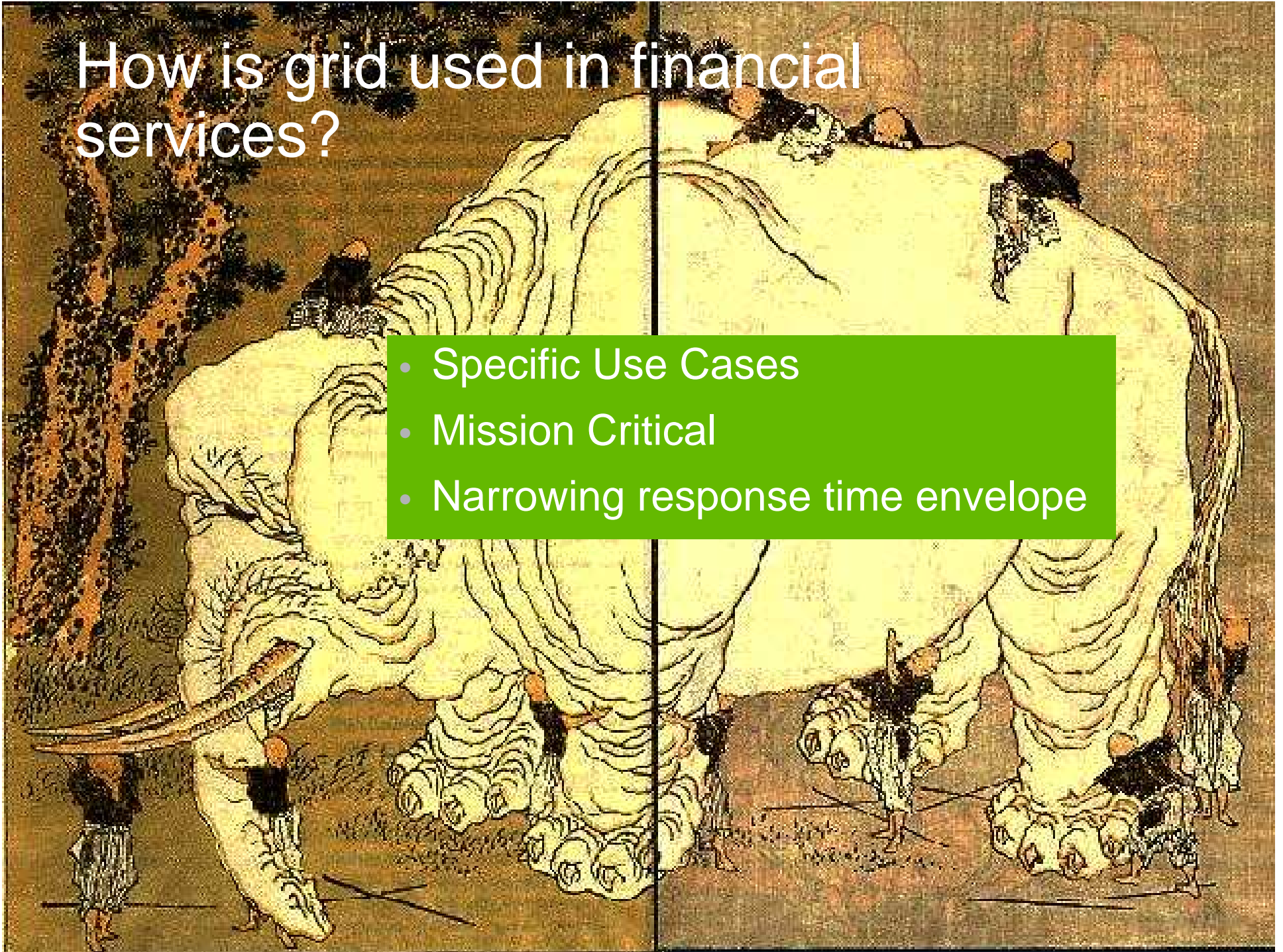
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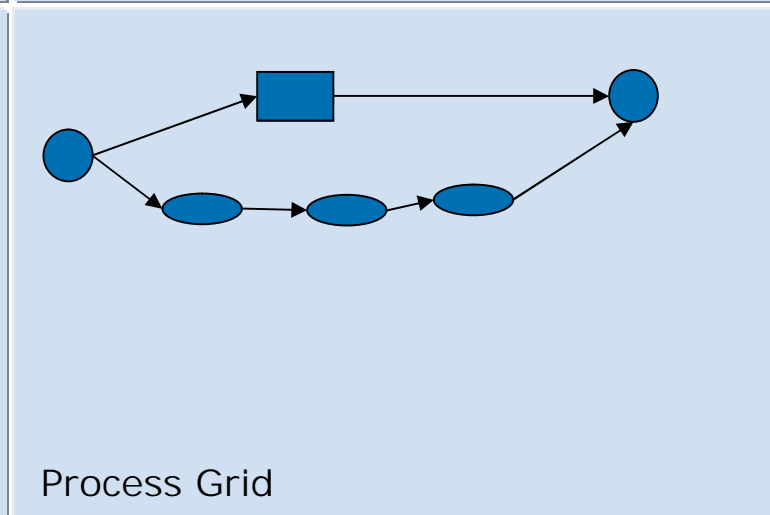
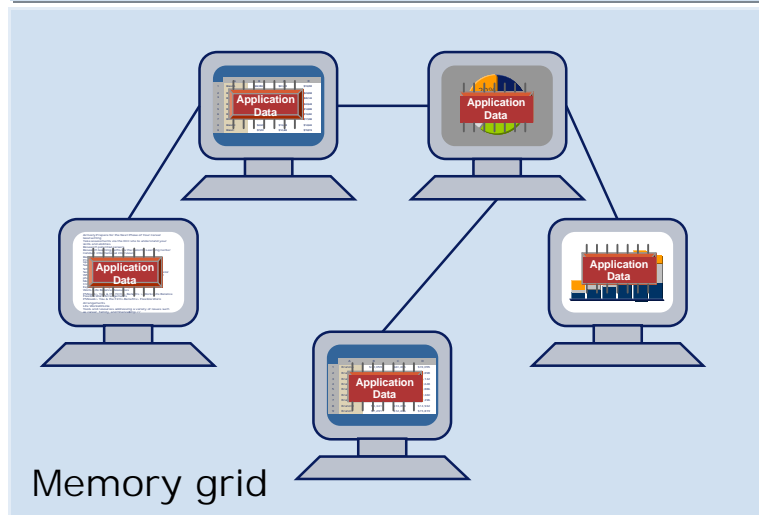
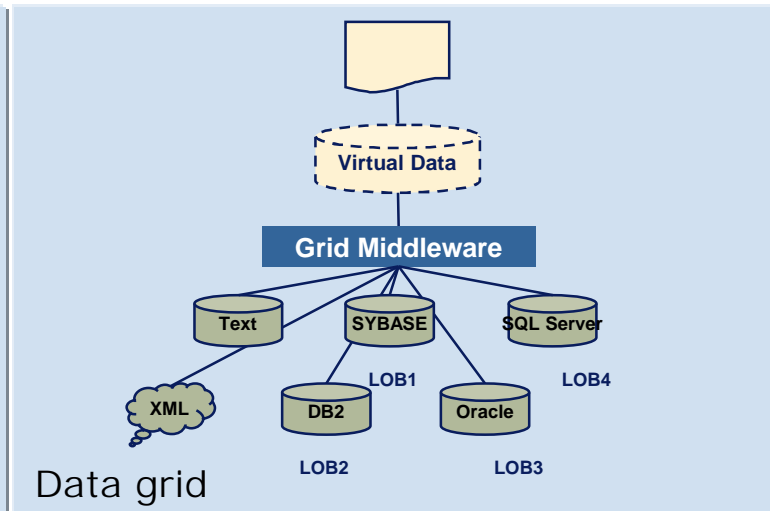
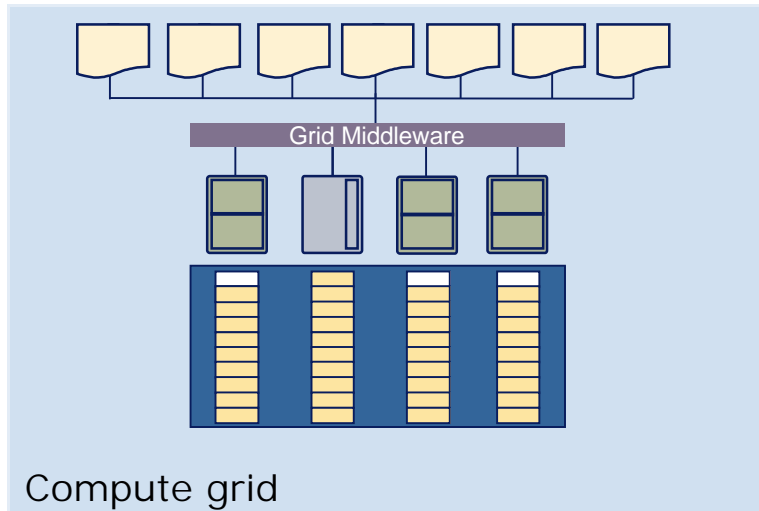


# How is grid used in financial services?

- Specific Use Cases
- Mission Critical
- Narrowing response time envelope



# Grid Models



# Grid Computing for Financial Services

## Drivers for Grid

- Real-time calculations is a competitive advantage
  - Discover market opportunities
  - Faster calculations increase profit & reduce loss
- Financial engineering is computationally intensive
  - Modeling Financial Products
    - Derivative Pricing
    - Interest Rate Structures
  - Portfolio Analysis (fair value, rebalance, ...)
  - Evaluate risk (VaR, CVaR, monte carlo ...)
  - Historical Data Analysis
- Scale out is most effective strategy
  - Industry standard technology and open source development to enable use of latest technology
  - Grid to integrates the components

## Use Cases

- **Capital Adequacy** – Risk Analytics, Reporting, Compliance
- **Pricing Trades** – Structured Products, Fixed Income, Derivatives, MBO's, CDO's, etc...
- **Equities Trading** – Analysis, Automated Program Trading
- **Asset Management** – Composite Pricing & Exposure, sales expense reporting, etc...
- **Annuity Policy Administration** – account maintenance, reporting, tracking, workflow
- **New Business Processing** – Pricing, booking and processing of Term Life, Property & Casualty, Auto, etc...
- **Capital Risk** – Actuarial analysis & asset liability management
- **Document Generation & Conversion** – Customer statements, compliance documents, account activity, PDF conversions, Compression/De-compression of information
- **Fraud detection management** – Analytical software to minimize fraud

# Benefits

- Competitive Advantage; increase revenue
  - Identify and respond to market opportunities
- Consolidating resources enables new business opportunities
- Free up risk reserve
- Effective utilization of capital investment
  - Enables use of utility services
- Scaleable application framework
- On ramp to agile enterprise

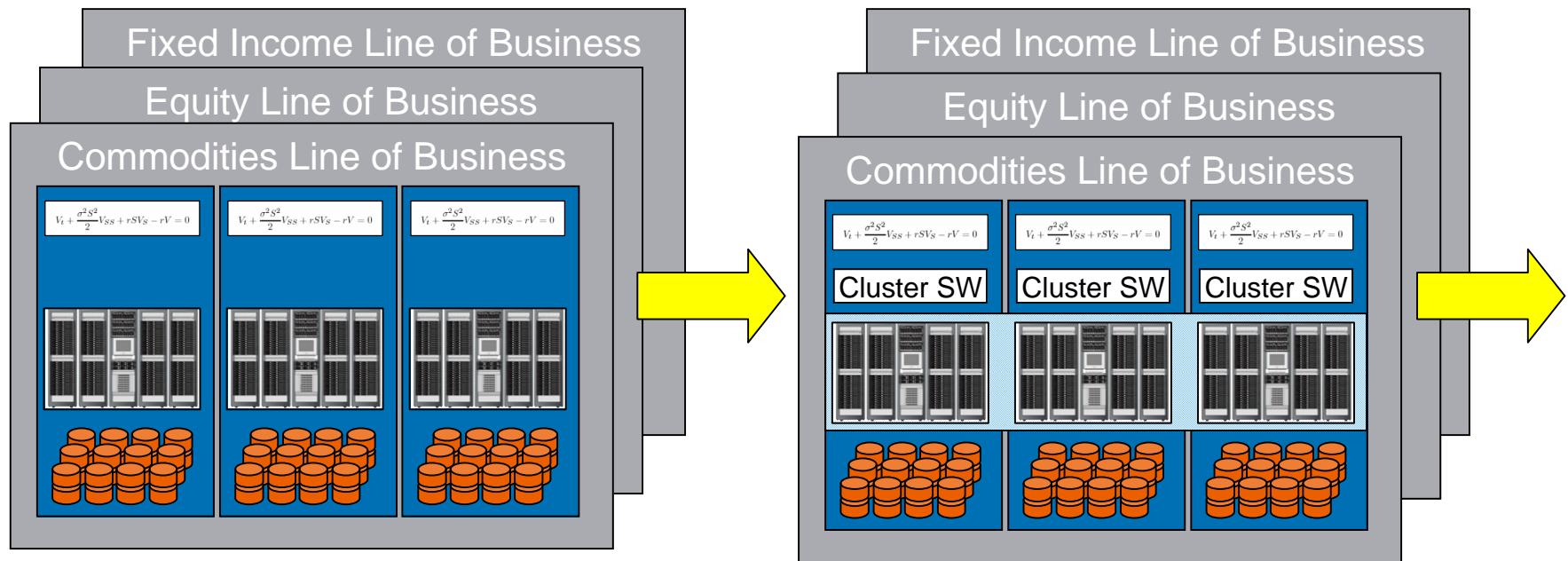


# Barriers to Adoption of Grid

- **Security**
  - Industrial Grids today typically do not cross firewalls or administrative domains
- **Standards maturity**
  - Recent direction of Grid & Web service convergence (WS-RF) improves this situation
- **Market development**
  - Software licensing schemes for service-oriented architectures & utility computing
- **Application design**
  - Ability to minimize application changes to take advantage of a Grid-based infrastructure
- **Non-technical**
  - Grids require a different way of thinking about how to deliver IT services
  - The normal resistance to changing behavior is always the toughest hurdle to overcome in technology adoption:
    - **Organizational politics** – adoption of shared resources
    - **Business issues** – chargeback, change of operational and business processes
    - **Expectation management** – time required to evolve technology and applications, realistic capabilities

# Evolution towards grid

## 1 of 2

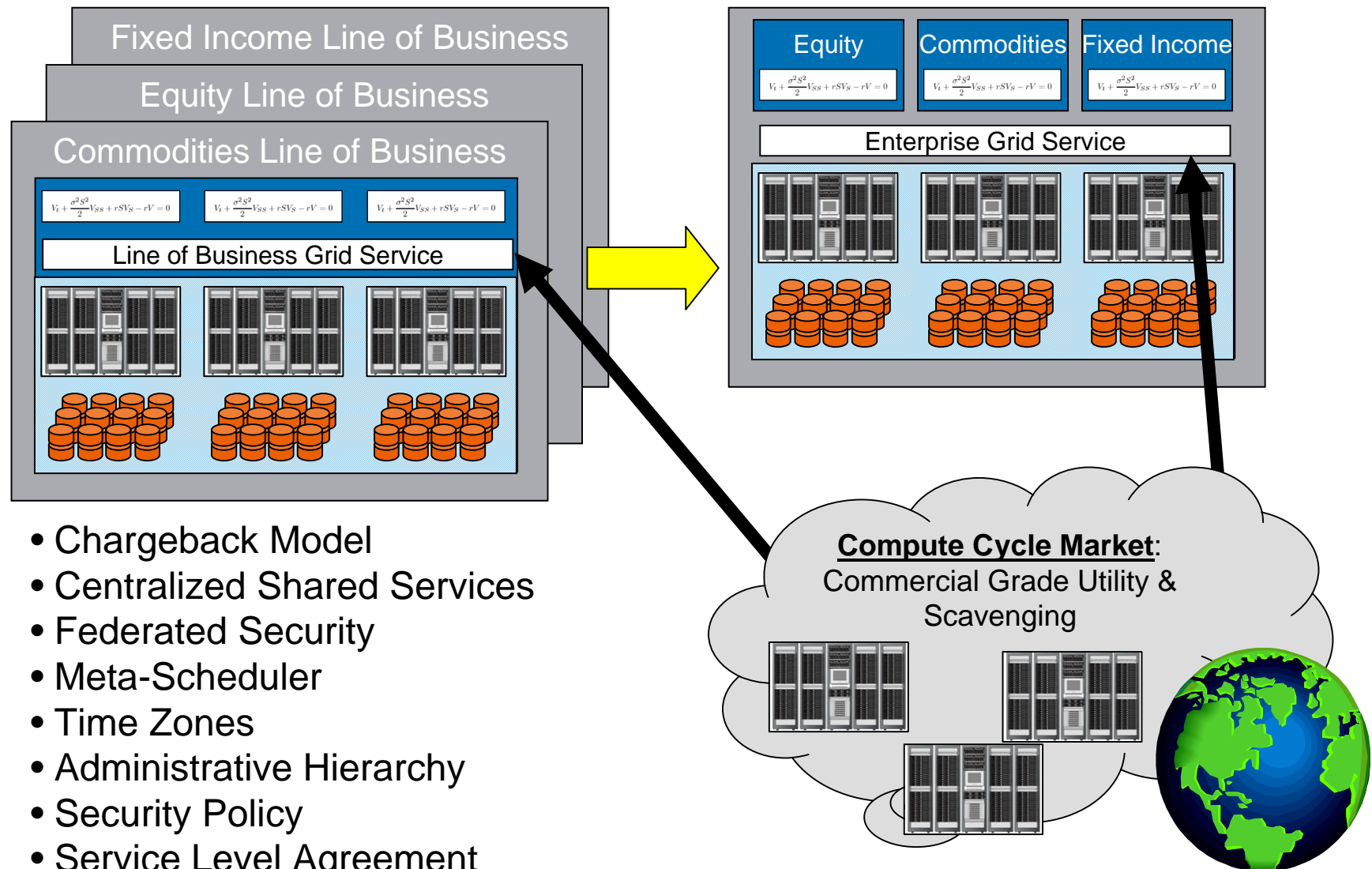


- Standalone Clusters
- Load Balancing in cluster
- Admin Domain / cluster
- Security domain / cluster
- Fault Tolerance
- Disaster Recovery

- Linked Clusters
- Some Resource Sharing
- Single Admin Domain
- Multiple security domains

# Evolution towards grid

## 2 of 2



- Chargeback Model
- Centralized Shared Services
- Federated Security
- Meta-Scheduler
- Time Zones
- Administrative Hierarchy
- Security Policy
- Service Level Agreement



# On-ramp to agile enterprise

- Expand usage to non-computational applications
- Improve system utilization & enable scalability
- Mitigate management challenge
- Establish standards to virtualize applications
- Data access key issue
- Foundation for SOA

# Financial Industry Needs

- Leverage grid architecture for resiliency
- Grid interoperability standards
- End user experience
  - Simplified job submission & monitoring
- Management standards
  - Graphical management console
- Tight reliable Security Model
  - SOX, ...
- Chargeback models
- Transition / evolution models
- Capacity on demand



i n v e n t



# Grid Computing @ The Hartford

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September 25, 2006

12



# The Hartford

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- Almost 200 years old (founded in 1810)
- \$27.5 billion 2005 revenues
- \$285.5 billion 2005 assets
- 30,000 employees worldwide
- Diverse products
  - n Property & Casualty Insurance
  - n Individual and Group Life Insurance
  - n Group Benefits
  - n Individual Annuities
- Not a technology company!

# The Catalysts...

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- Hedging – Rapid growth in sales of our variable annuity products necessitated the creation of a hedging program to limit our exposure to adverse market conditions.
- Stochastic Modeling - In order to effectively construct our hedge, we needed to understand the behavior of our book of business over a wide range of market scenarios.
- Convergence – Model accuracy increases with more data points (scenarios, cells). More data points require more compute power.
- We needed more power - quickly.



# Stop-gap Solutions

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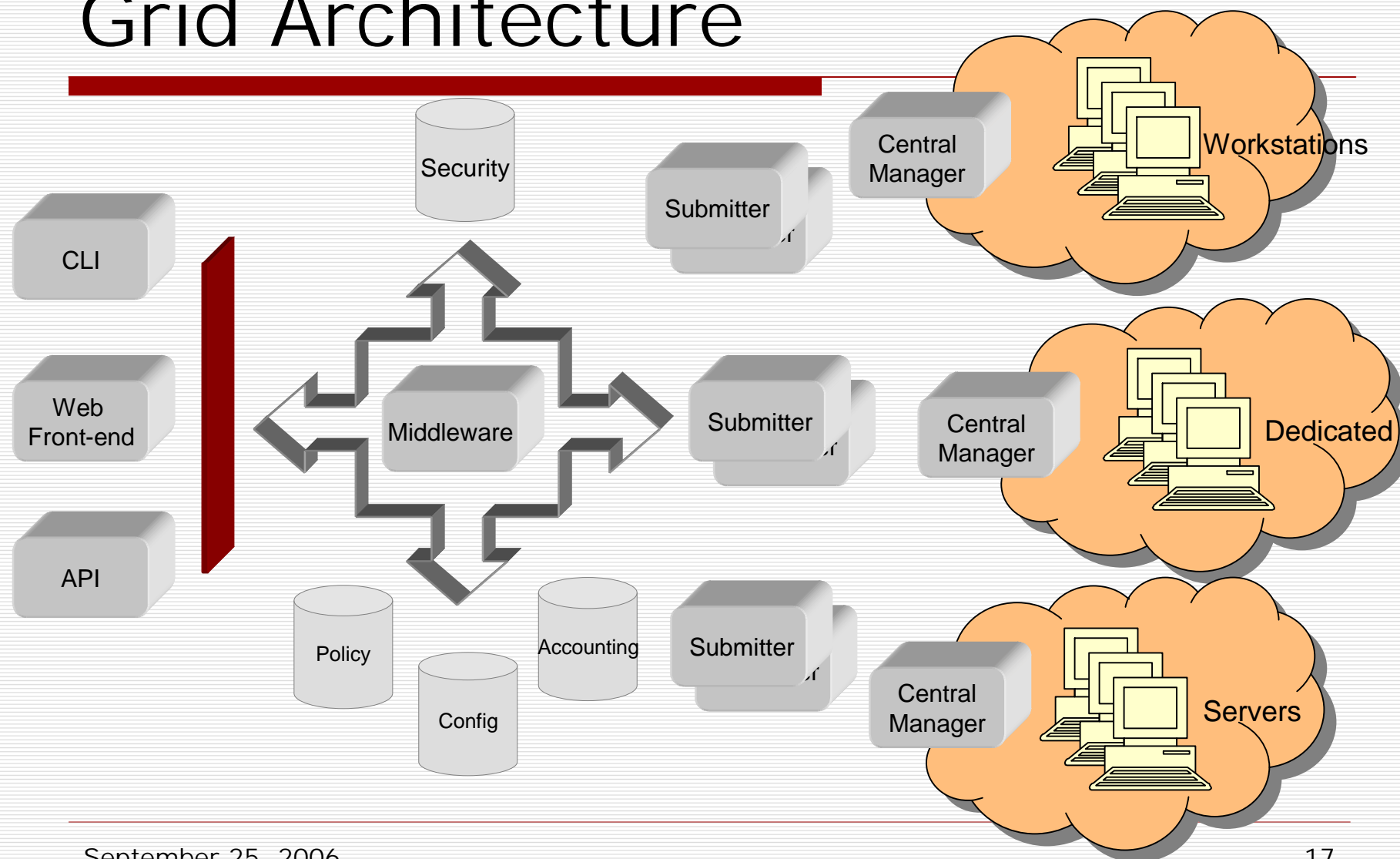
- Extend the distributed capabilities of our off-the-shelf modeling tool.
  - n Buy dedicated server-class hardware
  - n Improve networking
  - n Create policies and procedures to improve reliability
- Results...
  - n Largest distributed implementation of modeling tool in the world
  - n Tested to 68 workers
- Still not good enough.
  - n Reliability concerns
  - n Breaking new ground for scalability
  - n Manually intensive operation

# Enter the Grid.

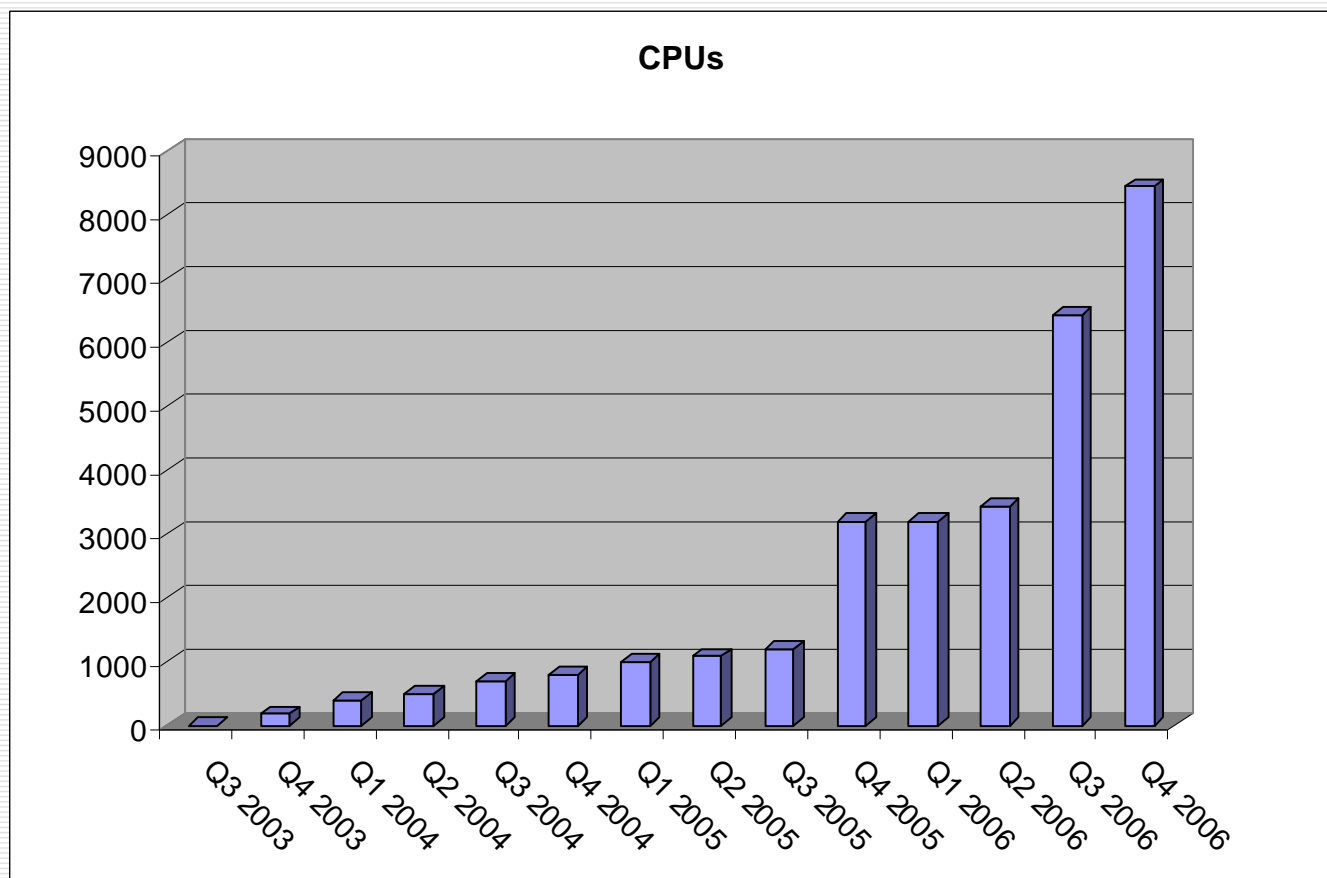
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- In Q2 of 2003, a commercial grid vendor approached us with a turnkey grid solution for our modeling tool.
  - n Scalable
  - n Recoverable
  - n Integrated
  - n Not a production release
  - n Very expensive
- At the same time, we hedged our technology bet with an in-house solution using Condor.
  - n Scalable
  - n Mature
  - n Flexible
  - n Free

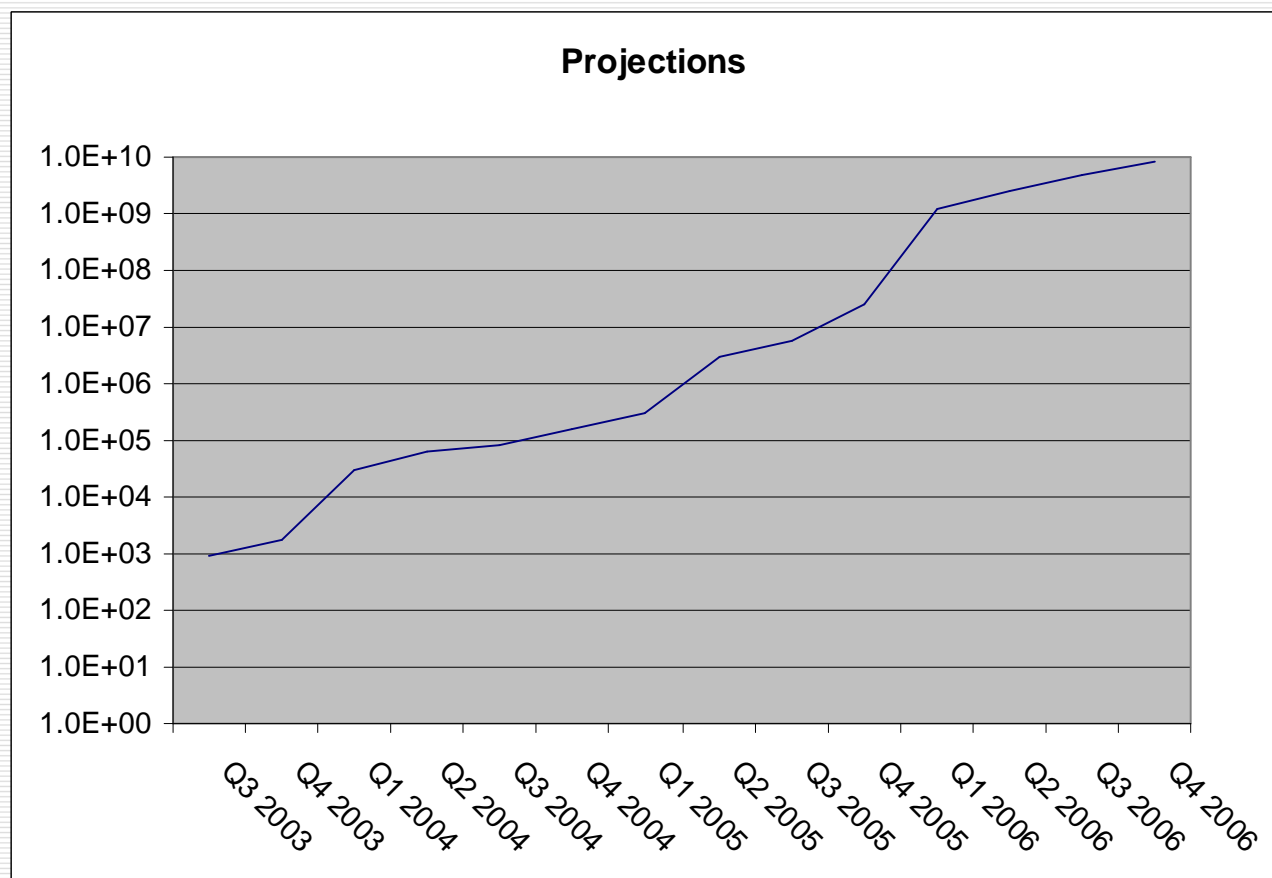
# Grid Architecture



# Grid Capacity



# Grid Utilization



# Our Strategy

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- Enhanced Operating Environment
  - n End-user automation
  - n Compute pool confederation
  - n Improved security
  - n Comprehensive fair-use policies
  - n Accounting and reporting
- Expand use to shared resources.
  - n 1,000+ file servers unused or underutilized after business hours
  - n 800+ application and database servers
  - n 25,000+ desktops
- Grid-optimized Application Development
- Evangelize