

Advantage Risk Management

Evolution to a Global Grid

Michael Oltman

Risk Management Technology
Global Corporate Investment Banking



Agenda

- Warm Up
- Project Overview
- Motivation & Strategy
- Success Criteria
- Architecture
- Success
- The Problems of Success
- Global Grid Defined
- Challenges of a Global Grid
- More Success

Warm Up

- CPUs are not part of a union, they work 24/7.
- The common question: how can we increase utilization with existing applications.
- A more interesting question: what new applications can we develop to take advantage of available cycles.
- Is a grid itself a solution to anything? Maturity of grid technology requires supporting applications, better integration with enterprise, more mature administration.
- Anyone got a cheap rack of CPUs?

Motivation & Strategy

- Importance of a coordinated Business and Technology strategy based on business motivation.
- Business Motivation
 - Replace legacy compute cluster with distributed Grid
 - Enable horizontal business organization
 - Converge silo technology services (multiple risk systems)
 - Improve overall resource utilization and prioritization
 - Contingency utilization
 - Globalization of technology services and resources

Motivation & Strategy continued

- Technology Motivation
 - Heterogeneous hardware and OS deployment
 - Java and J2EE with C++ calc layer
 - n-tier, n-grid Architecture, Simplify Scalability
 - Improve monitoring and feedback loops
 - Focus on business logic, not scale
- Cross Over Strategy
 - Start local and specific, think global and generic
 - Consolidation
 - Provide a recipe for scalability
 - Provide more services long-term

Architecture

- ***Its All About the Architecture***
- Application Components
 - Feeder Services
 - Configuration
 - Initialization
 - Farm Manager Service
 - Grid Monitoring and Status Publishing
 - Task distribution
 - Task aggregation
 - Grid drivers
 - Resource Providers
 - Data caching
 - Data globalization
 - Grid (Calc Farm)

Architecture continued

- Application Components
 - Result Publishing
 - Translation
 - Distribution of Results
 - RDBMS Integration
 - Progress Monitor
 - Progress
 - Status
 - Re-Execution Interaction

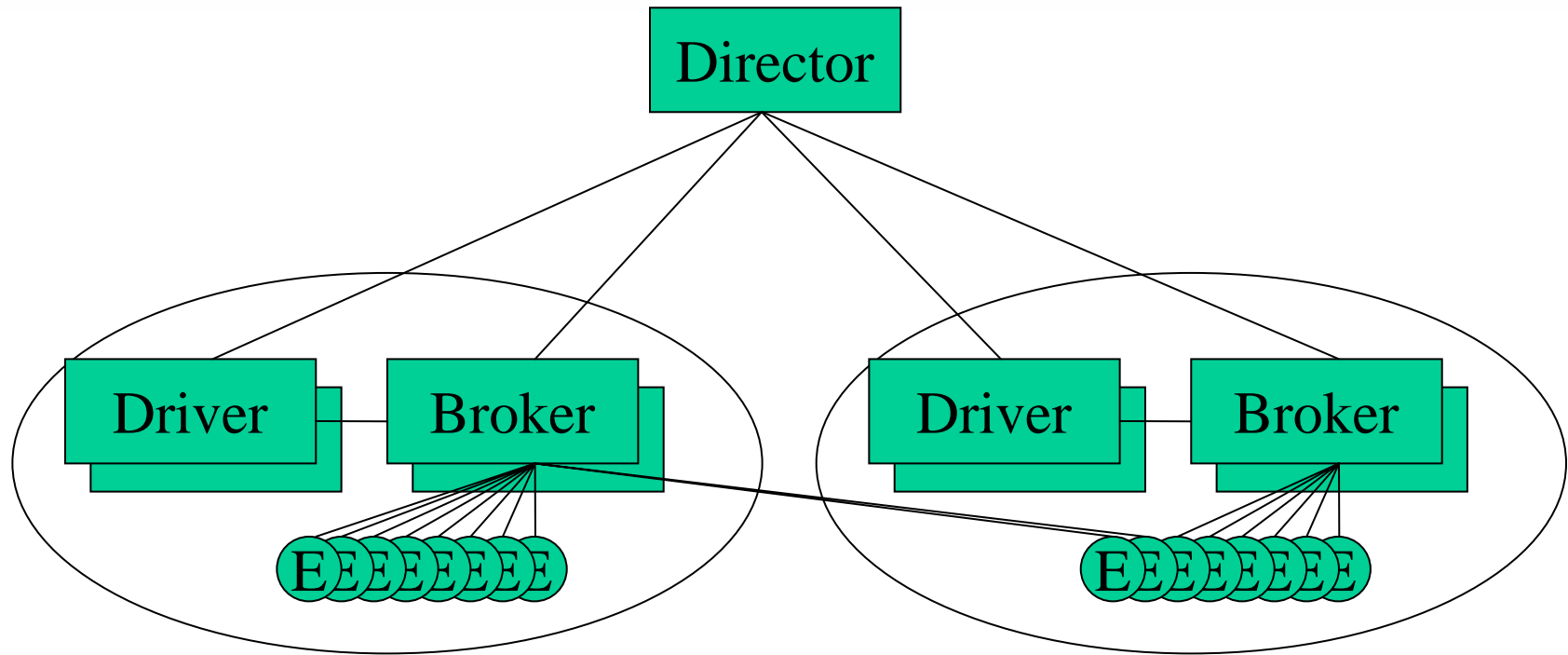
Architecture continued

- Enterprise Services
 - Java Message Service
 - Enterprise Java Application Server
 - Sybase and MSSQL Databases via JDBC
 - Actuate
- DataSynapse GridServer
 - Application distribution
 - DS Driver integration with Farm Manager
 - Federated grids
 - guaranteed execution
 - grid sharing when available
 - GridCache
 - Serial vs. Parallel execution

GridServer Terminology

- Director
 - Authentication and Load Balancing of engines between Brokers
- Engine Daemon
 - Interacts with Director to monitor and invoke engines
- Broker
 - Task scheduling and resource deployment
- Engine
 - Runs application code
- Driver
 - Embedded in client code – the entry point to the Grid

GridServer Architecture



Success

- Early Successes
 - Created first architecture to grid enable Advantage Risk
 - Running 80 engine grid
 - Reduced 90 minute jobs to 20 minutes
 - Reduced single trade valuation from 4 hours to 40 minutes
 - Able to complete 200,000 trade valuations - about 1 million calculations in a few hours.
- Early successes lead to business confidence
- Early successes lead to technology confidence and improved strategy

Success continued

- Evolving Successes
 - Easy grid scalability scaled to 150, 225 and now 600 Chicago CPUs through subsequent software releases
 - Reduced original 90 minute job to 4 minutes
 - Reduced 4 hour single trade to 20 minutes
 - Now computing over 1 billion calculations per 24-hour period creating millions of records of data for business units delivered well ahead of SLA.
 - Evolving recipe for increasing capacity
 - Continuous expansion of customers of risk data

Success continued

- Success to the Business
 - More work done in less time allows for more scenarios to be run and therefore less overall risk for the business
 - Increasing available cycles enables new intraday processes instead of just overnight batches.
 - More business units getting onboard, standardizing IT and business processes enabling more horizontal business strategy
 - Increased stability
 - Reduced support and maintenance costs (and distribution). Heterogeneous infrastructure, homogeneous application

The Problems of Success

- “What have you done, Ray?”
 - The Grid scales easier than other services
 - Downstream data consumers can’t keep up
 - Customer expectations only get higher
 - Grid Fiefdoms
 - QA team can’t keep up
- Need for scalable services that surround the Grid
 - Caching services on all resource providers
 - Messaging clusters
 - Auto-reconciliation tools
 - Real-time data analytics
 - Smart task distribution strategy

Ongoing Strategies

- The scalability recipe
- Task distribution strategy
- Relative scheduling
- Grid-to-grid workflow
- Grid enable more components

- And of course the Global Grid

Global Grid Defined

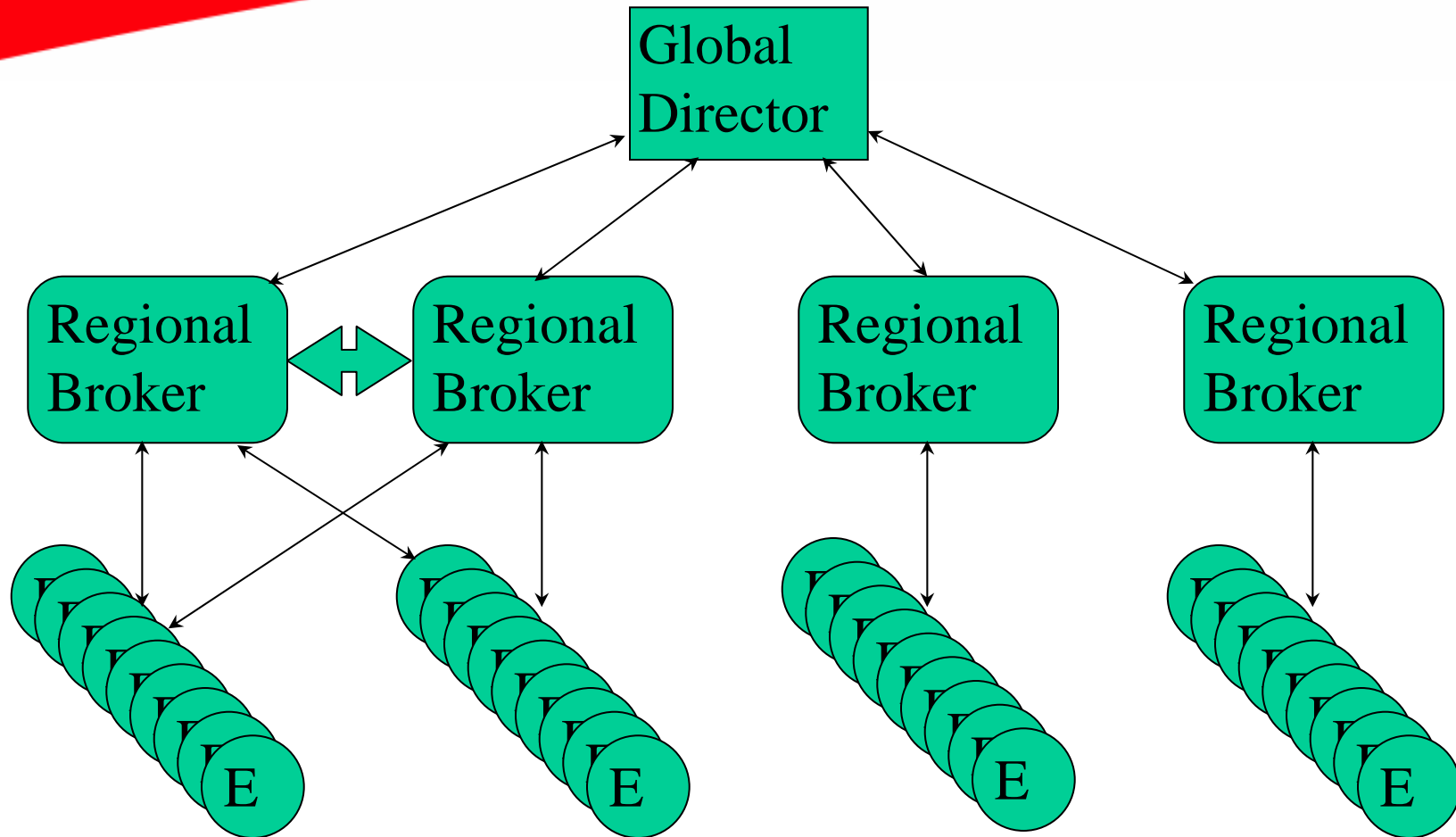
- Comprised of multiple local regional and business unit grids.
 - Chicago
 - New York
 - London
 - Charlotte
- Each grid is connected via a global director and can share engines from local to local grid when engines are idle.
 - Guaranteed availability to each region to meet SLAs
 - Automatic contingency
- Engines include desktops and citrix client machines.
 - Utilization of more corporate resources



Challenges of the Global Grid

- Convergence on request and publishing APIs
- Task Distribution
 - When does network cost outweigh engine usage
- Global Grid requires Global Data Cache
- Timezone issues
 - Application design issue, not grid issue
- Application distribution
 - Idle distribution
 - On-demand distribution
- Customer expectations
- Outsourcing Cycles

Global Grid Architecture



Global Grid now

- Global Grid is in production
- Hardware shared between Exotics RiskEngine, ScenarioTool, Advantage and PDT (legacy non-DataSynapse application)
- Over 2000 engines – mix of Windows, Linux and desktop
- Global Primary Director runs on two Solaris machines behind a virtual IP address. Not directly supported by DataSynapse – a homegrown cluster solution
- Brokers on Linux machines. At least two per application for failover and load-balancing
- Each application also has a secondary director

Success Measures of Global Grid

- Dollar savings due to reduced hardware needs – orders of millions of dollars
 - \$15m saving on hardware over 3 years
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- Better use of resources allows businesses opportunities otherwise denied to them
 - 3D Time-Dependent model for rates exotics freed up \$10m of risk reserves
 - Recent events in Credit Market required extra scenarios. Grid simply rebalanced demand
- Increased system reliability, uptime etc
- Application convergence saves on development cost

The End

- Questions?