Advantage Risk Management

Evolution to a Global Grid

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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

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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?

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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

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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

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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)

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Architecture continued

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

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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

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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

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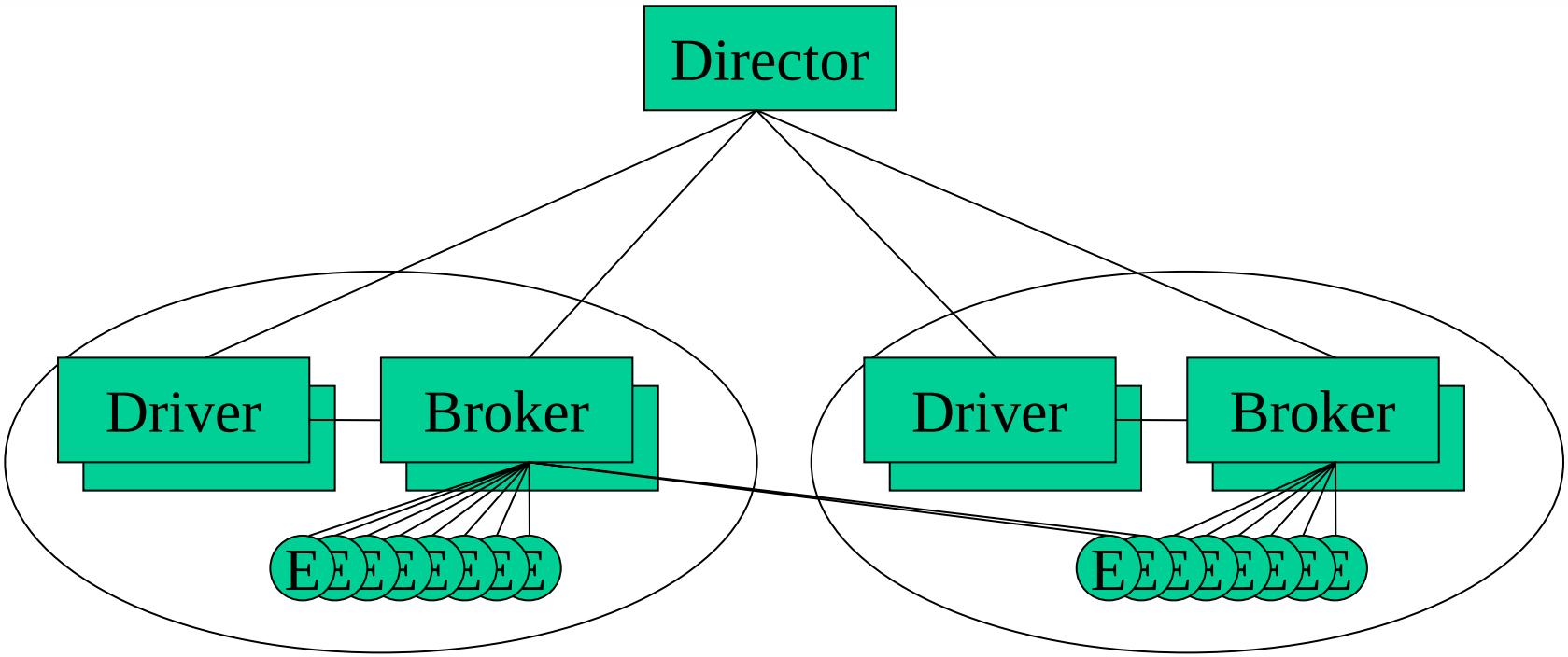
GridServer Architecture



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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

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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

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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

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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

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Ongoing Strategies

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

- And of course the Global Grid

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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

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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

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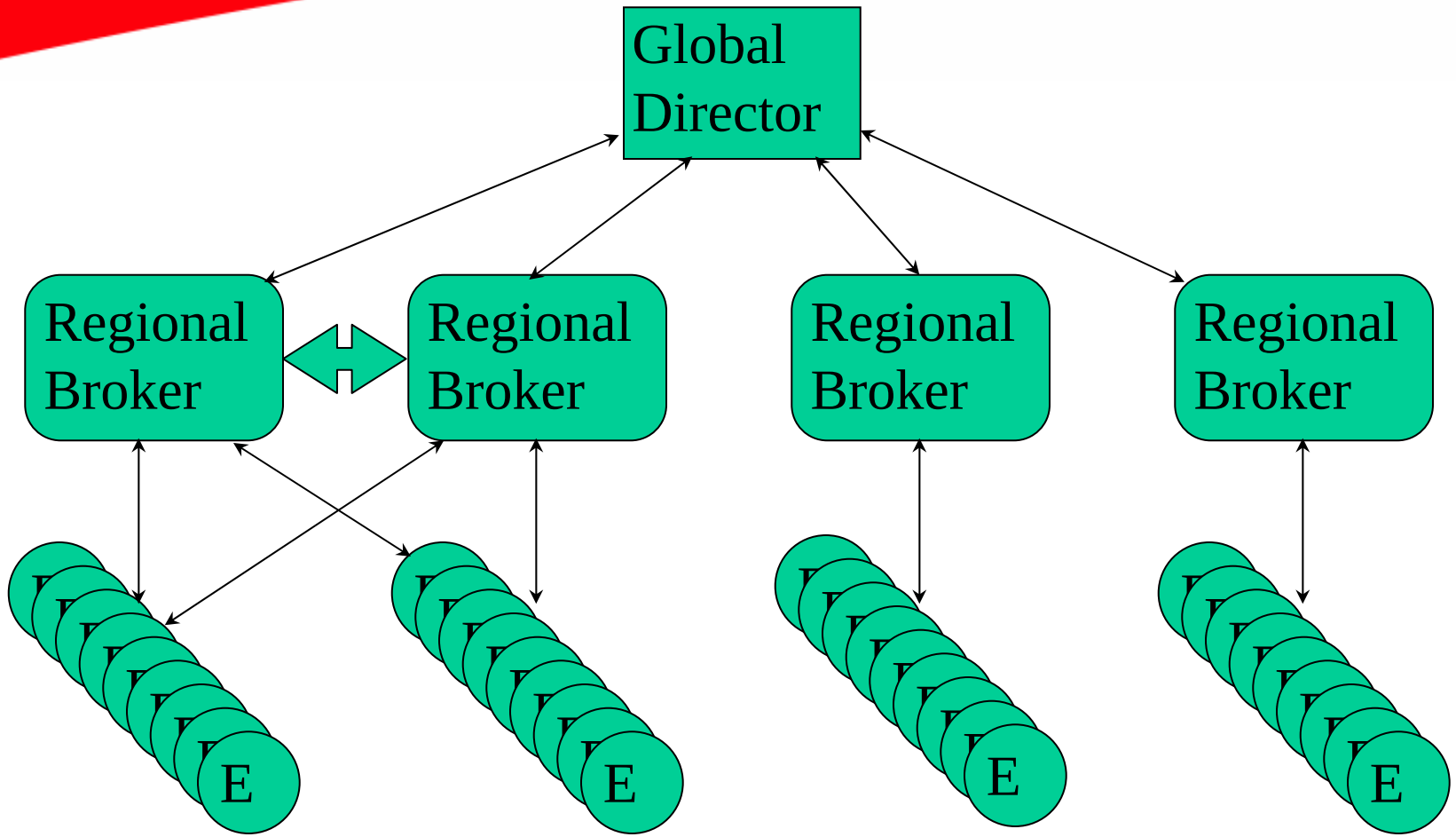
Global Grid Architecture



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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

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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

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The End

- Questions?

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