Identifying and quantifying risk is vital in modern pursuits. Choice of risk model and selection of appropriate parameters, and the computational tractability of such analyses, depends on factors such as data availability (symmetric or asymmetric) and data quantity and quality. Increasing quantities of information lead to considerations of increasingly complex models and/or numbers of simulations and computations. We consider two aspects here: (i) Grid services for finance, requiring greater understanding of risk and its analysis within increasingly complex financial products and markets; (ii) the potential application of these techniques to the challenge of developing Grid commodity markets, including the trading and hedging of risk, options, futures and structured products.

Companies such as HP, Amazon, SUN and IBM already offer commoditized servers and pricing models for their Grids, Clouds, and Compute Utilities. Providers of services using these systems pass on the cost to their customers. Such a commoditized approach does not necessarily ensure that the service provider or consumer obtains the best price or margin, nor any assurances regarding resource failure. The AssessGrid project, partly grounded in auction-based approaches from as early as 1968, attempts to integrate risk assessment and management through negotiated Service Level Agreements (SLA) among 3 Grid actors (End-user, broker and resource provider) [2], [3], [6]. The authors identify that risk-aware SLAs are only possible in planning-based systems: insufficient estimations are available for queuing-based systems such as Condor & SGE.

In this paper, we will outline how financial portfolio analysis could be applied to creating a Grid economy that can encompass queuing-based systems. Many financial Grid applications are claimed, though few are reported on in the literature: notable exceptions include RiskGrid [4], ImpliedVolatilityGrid [7], derivatives pricing [8] and Monte Carlo pricing [5]. Such analyses place significant demands on available resources, and it is typical to assume availability; these applications also provide substantial opportunities for collecting, and additionally simulating, data relating to their execution. Our aim, essentially, is to predict availability and capability for financial prediction, providing both Grids for financial risk analysis and financial risk analysis for Grids. We will report on computational challenges with regard to Grid-based services for computing portfolio Value at Risk (VaR), demonstrating how commonality in approaches, characterized by Best [1], provide for beneficial decomposition of the Monte Carlo simulation, with reuse of Historical and Covariance analysis improving resource requirement capture. We discuss implementations using Condor (Figure 1) and efforts to make use of the UK’s National Grid Service. We consider how values for convergence between the Monte Carlo and Covariance approach, in portfolios of option-free equities (Table 1), enable us to evaluate our implementation and establish and mitigate performance issues relating to balancing computational speed with calculation accuracy. We subsequently consider extension of financial models to Grid economics and how, for example, structured products such as collateralized debt obligations (CDOs) might provide useful pointers for such work.
Table 1 VC and MC VaR approaches testing results

<table>
<thead>
<tr>
<th></th>
<th>1 node</th>
<th>2 nodes</th>
<th>4 nodes</th>
<th>8 nodes</th>
<th>Monte Carlo Simulation</th>
<th>16 nodes</th>
<th>32 nodes</th>
<th>64 nodes</th>
<th>128 nodes</th>
<th>256 nodes</th>
<th>512 nodes</th>
<th>1024 nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Away from VC VaR (5%)</strong></td>
<td>0.07%</td>
<td>0.10%</td>
<td>0.06%</td>
<td>0.05%</td>
<td>0.13%</td>
<td>0.09%</td>
<td>0.06%</td>
<td>0.13%</td>
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<td>0.06%</td>
<td>0.13%</td>
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<tr>
<td><strong>SD of VaR</strong></td>
<td>0.00%</td>
<td>0.00%</td>
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<tr>
<td><strong>Tolerance Level (1%)</strong></td>
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<tr>
<td><strong>Away from VC VaR (1%)</strong></td>
<td>0.00%</td>
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<tr>
<td><strong>Existing Time (Seconds)</strong></td>
<td>1.76</td>
<td>3.72</td>
<td>6.77</td>
<td>11.21</td>
<td>19.92</td>
<td>34.00</td>
<td>59.10</td>
<td>92.13</td>
<td>130.67</td>
<td>211.04</td>
<td>336.05</td>
<td>546.83</td>
</tr>
<tr>
<td><strong>Speedup</strong></td>
<td>1.76</td>
<td>3.72</td>
<td>6.77</td>
<td>11.21</td>
<td>19.92</td>
<td>34.00</td>
<td>59.10</td>
<td>92.13</td>
<td>130.67</td>
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