Cost aware resource management of distributed cloud data centers

Outline

Data Analysis

* Day ahead and real time energy prices
* Characteristics of energy markets
* Energy price case study
  + Present scenario of 3 years of day ahead and real time energy prices
  + Discuss differences / structure

Forecasting

* Methodologies
  + Box Jenkins
  + Box Cox
  + periodogram
* Model generation
  + Walk through a manual fc model generation method (ARIMA)
    - standard 95% confidence level
  + Show ACF / PACF plots
  + Show in-sample / out-of-sample fc errors in relation to real data
* Model selection algorithm
  + Describe algorithm
    - find frequencies (periodogram)
    - generate models
    - weighted (utility) function of AICc and Ljung box test values
    - choose best model based on weighted function
* R / Java simulation framework
  + Briefly describe structure of implementation
  + List methods used for (batch) model and forecast generation in Java
  + Describe basic methodology of applied forecasting (fc horizon, concatenate)
* Forecast model evaluation
  + Compare forecast model error measures over a wider range of energy price time series
  + Simulation
    - Provide trainings and test sets via defined trainings period, interval and test period
      * e.g. take steps of one week, with training sets of 2,3,4 weeks, 1 week of out-of-sample test data
    - Connection to Application server -> fetch energy price data via rest service interfaces
      * get arbitrary time ranges for stored electricity prices (DA and RT)
    - Iterate over 3 years of energy price data
    - Evaluate each model with out-of-sample accuracy of different fc horizons
      * 1,3,6,12,18,24,36,48,96,168
    - Show results
      * Show aggregated results of fc error measures
      * Show results for each model aggregated for 2,3 and 4 weeks of trainings data periods
      * Show results for different DA and RT locations (1,2,4,6,8)
      * Show result table for RMSE error measures?

Simulation framework

* Definition of simulation scenarios
  + Define scenarios for DA and RT simulations
    - define all parameters (bandwidth, dprs, sla)
    - define types of workloads (HPC with different dprs)
  + Explain necessity of both simulations (DA time difference, RT realistic..)
* Modeling migration energy
  + define all formulas related to migration energy and costs
  + refer to differences of DPRs and Bandwidth combinations
* Cost optimization based on utility function (Scheduler and utility function)
  + Utility function
    - Formalise utility function
  + Introduce scheduler functionality
    - show when and how forecasts are applied (different schedulers)
  + Explain utility function and application
    - explain about how to calculate cost differences (mean distance)

Evaluation and Results

* Definition of simulation scenarios
* Utility function optimization
* Simulation Results

Conclusion and Future Work

* Future Work