Requests require a certain training and validation sets in the Kalman models for system performance analysis. Statistical techniques enable the estimation of resource demands, helping performance engineers to find a suitable estimation approach.

**Offline Analysis**
- Ready-to-use implementations of most common estimation approaches
- Framework for implementing new estimation approaches
- Checking of pre-conditions of estimation approaches
- Automatic cross-validation of estimated resource demands

**Online Analysis (as Java library)**
- EMF-based configuration model
- Supported by graphical Eclipse editor
- Selection and initialization of estimation approaches
- Check of pre-conditions
- Obtain current monitoring data from system
- Partitioning of monitoring data into k subsamples
- Generate k training and validation sets
- Run selected estimation approaches
- Repeated for each training set
- Run k-fold cross-validation
- Validate predicted utilization and response times
- Estimated resource demands
- Mean relative utilization/response time error

**Supported Estimation Approaches**
- Least-squares regression
- Kalman filter (2 variants)
- Non-linear optimization (2 variants)
- Service Demand Law

**Example: Auto-Scaling of VMs**

**LibReDE – A Library for Resource Demand Estimation**

**Motivation**

- Requests require a certain **processing time at each resource** in the system.
- This time is called resource demand (or service demand).
- Different request types have different resource demands.
- Key parameter of stochastic models for system performance analysis.
- **Problem:** Direct measurement of resource demands can be difficult.
- Limited instrumentation capabilities of many systems.
- Inacceptable instrumentation overhead.
- Heterogeneous infrastructures.
- **More than 25 approaches** to resource demand estimation are proposed in the literature with varying pre-conditions, robustness, and complexity.

**LibReDE**

- **Create estimation model**
- **Setup estimation approaches**
- **Load monitoring data**
- **Run estimation approach(es)**
- **Cross-Validation**
- **Output results**

**Estimation Process**

- Eclipse update site
- Binary archives for Windows/Linux (EPL 1.0)
- Sources + User Guide + Example

Get it at [http://descartes.tools/librede](http://descartes.tools/librede)