



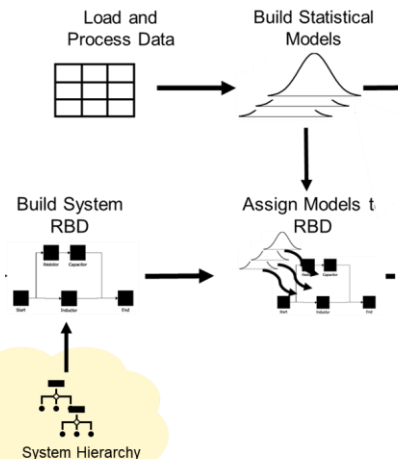
HBK Technology Days – Virtual Seminar Series

Tuesday, November 22, 2022

W Weibull++
Reliability life data analysis
& accelerated testing

B BlockSim
System modeling
and RAM analysis

F XFMEA
FMEA & related
analyses



Using automation to scale advanced reliability analysis and digital twins

Presented by Adi Dhora and Eric Fritts,
Reliability Solutions Consultants,
HBK Engineering Solutions

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Abstract

This presentation describes a practical approach to use automation for creating reliability models, simulations, and insights for a large number of assets. Most industries are looking to pursue more data-driven reliability practices. Most reliability practitioners highly value the insights they gain from fault tree analysis and reliability block diagrams. However, often a limiting factor is data access, quality, and personnel time to process large quantities of data. This is where automation can help to enable reliability practitioners to focus majority of their time on analysis and decisions. This presentation will showcase how best to merge automation with reliability-know-how to scale in-depth analysis like reliability predictions and event probability for tens of thousands of assets in a short timeframe.

About the presenter, Adi Dhora and Eric Fritts, Reliability Solutions Consultants, HBK Engineering Solutions

As a Reliability Solutions Consultant, Adi Dhora specializes in implementing data-driven methodologies to improve the reliability of critical assets for various industries. He has a background in mechanical engineering and has assisted many leading industrial companies in implementing reliability programs.

Eric Fritts is a Project Engineer at HBK and regularly tackles industry problems with his know-how in reliability analysis, failure propagation and mitigation and the ancillary/logistical impacts of component failure. He has experience across private sector heavy industry and military. He has a background in Automation Engineering and Software Engineering.

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Session 6: Reliability Fault Tree Analysis

Adi Dhora | HBK Engineering Solutions
Eric Fritts | HBK Engineering Solutions

Introduction/Bios



Adi has a background in Mechanical Engineering. For the past 10 years, he has primarily focused on assisting various organizations adopt a more data-driven physical asset management approach.



Eric has a background as an Automation Engineer with the steel industry, Oil & Gas upstream operations, plus many years with the military and private sector heavy industry. He also holds a Software Engineering degree.

The Vision

- Want to spend more time using insights for decisions rather than reporting
- Transition business to be more data-driven
- Recognize trends or problem areas sooner
- One central reliability data repository for the organization, globally

The Problem

- Collecting asset failure information (warranty claims, service calls, maintenance tickets) but it is not in an analysis ready format
- Spreadsheet-as-a-database, analysis with manual data handling, time-consuming
- Large number of assets, personnel are geographically spread out
- Decisions are blend of expert estimations and/or past performance not data-driven or tested against alternatives

The Solution

- Identify applicable data sources and map its content to a Failure Recording Corrective Action System data structure. Business rules are defined (for example - ignore repeated items, threshold on early life failures).
- Result: You get a structured, repeatable, scalable solution to handle the data
- Automate the data pre-processing required for different RAM metrics (example – get failure data by mileage and calendar time for system, sub-system, lowest repairable unit)
- Result: No spreadsheets required, analysis ready data, get user-specific data queries with a few clicks from a shared repository

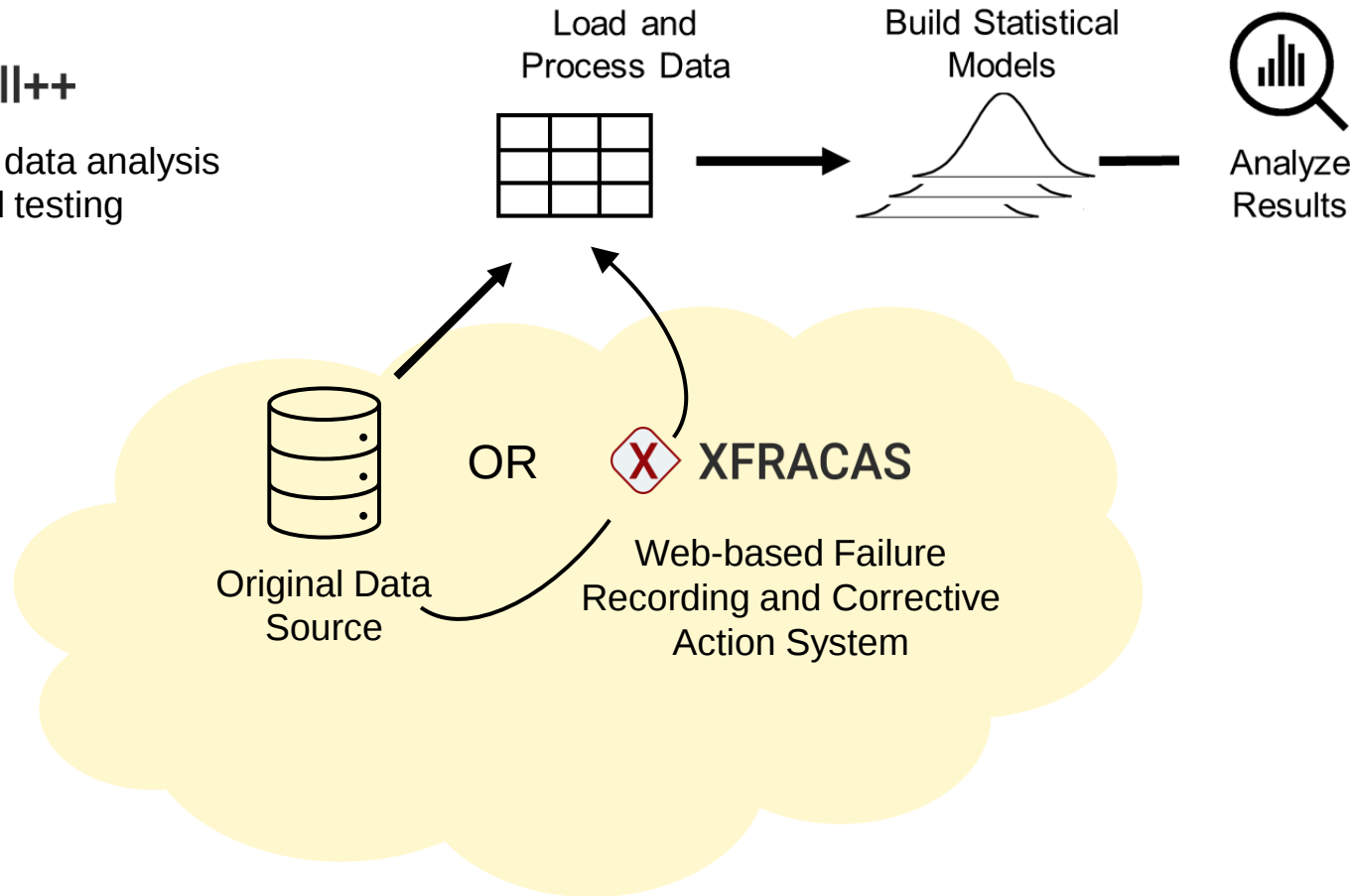
The Solution

*Step 1: Process data automatically to generate statistical models
(reliability, cost, time to repair etc.)*



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The Solution

Step 2: Build a reliability block diagram (RBD) to represent the physical system and the relationships between its repairable components

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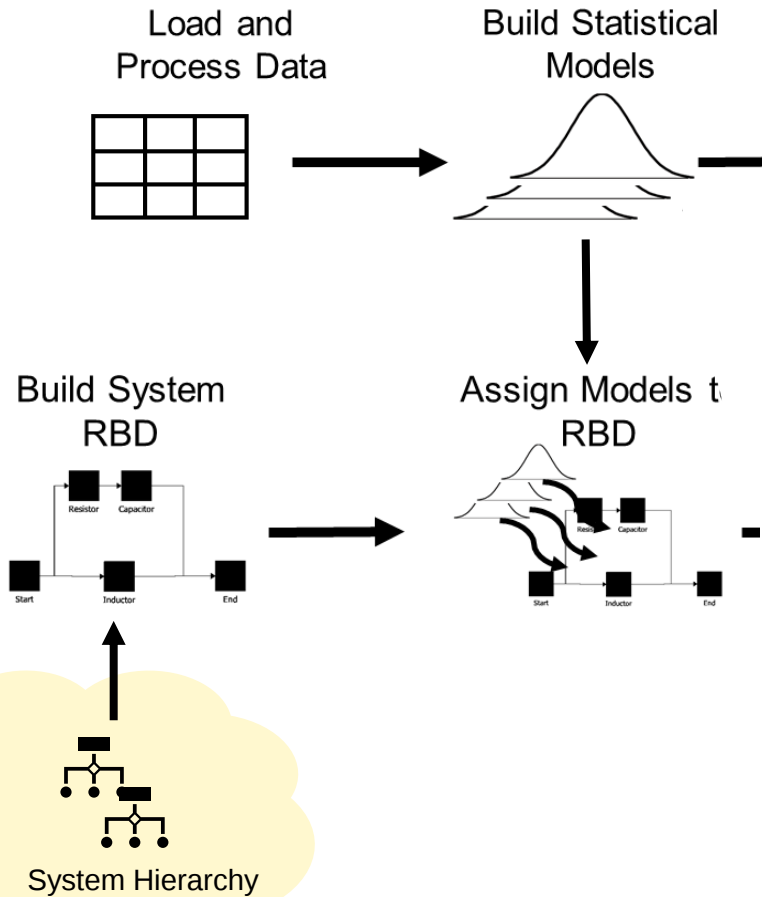
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The Solution

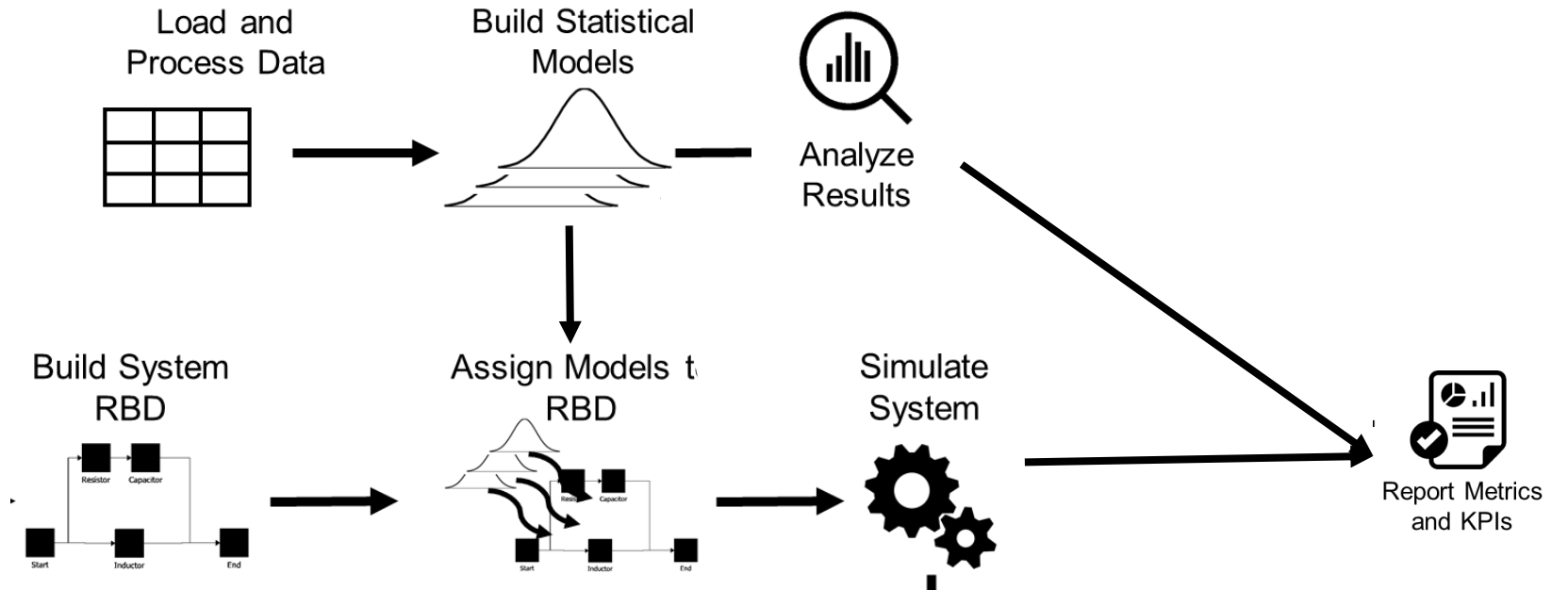
Step 3: Visualize Monte-Carlo simulation results periodically within a dashboard



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Demo

The Result

- Automation of commonly used analysis techniques like life data analysis, MTBF, warranty analysis
- Result: Analysis typically only done sparingly due to time requirements can now be widely applied to whole fleet of assets, all LRUs or all equipment within the plant.
- Publish metrics from models created to a central database for reporting with minimal manual intervention
- Result: Greatly reduce the time taken using manual analysis vs. automated. Problem areas identified quickly with ability to drill-down further into a system down to the LRU. Simulate resources required to achieve certain reliability and plan accordingly.



What's Next?

- Possibilities with dynamic RBD or RAM models
 - Compare previous predictions based on life data with actual system performance
 - Close the loop between design and field operations
 - Data driven maintenance budgeting, contract guarantees, warranty analysis, product reliability assurance
 - Investigate failure points with time-series data to identify failure patterns [prognostics or predictive monitoring]

You can explore the ReliaWiki for documentation regarding ReliaSoft APIs used in the demonstration here: https://reliawiki.org/index.php/ReliaSoft_API_Reference

Thank you for your attention.

Q&A

Hottinger Bruel & Kjaer
Engineering Solutions



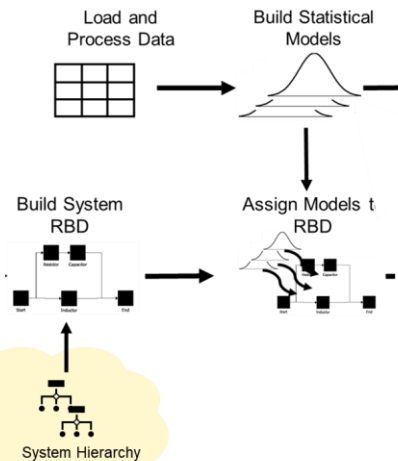
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