Dynamically Reconfigurable Data Architectures for Aircraft Data Analysis and Anomaly Detection

ONR Program Code 35

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At a Glance

What is it?

- Dynamically Reconfigurable Data Architectures Small Business Innovative Research (SBIR) program enables rapid large scale engineering analysis of aircraft parametric and other sensor data. It is a high performance time series database with an intuitive graphical user interface and open architecture programming interfaces.

How does it work?

- Dynamically Reconfigurable Data Architectures provides an effective way to organize and compress time series data, allowing storage of terabytes of data while improving data load and query speeds. Test results have demonstrated a 20 times database size reduction and 200 times increase in query speed when compared with the leading databases.

What will it accomplish?

- Data collection and management of operational aircraft data is a critical enabler of effective condition based maintenance (CBM+). This effort enables the aerospace user community to rapidly analyze flight data resulting in improved condition based maintenance, operational availability and asset life. Accessibility of fleet wide parametric data is a critical enabler for effective engineering analysis.

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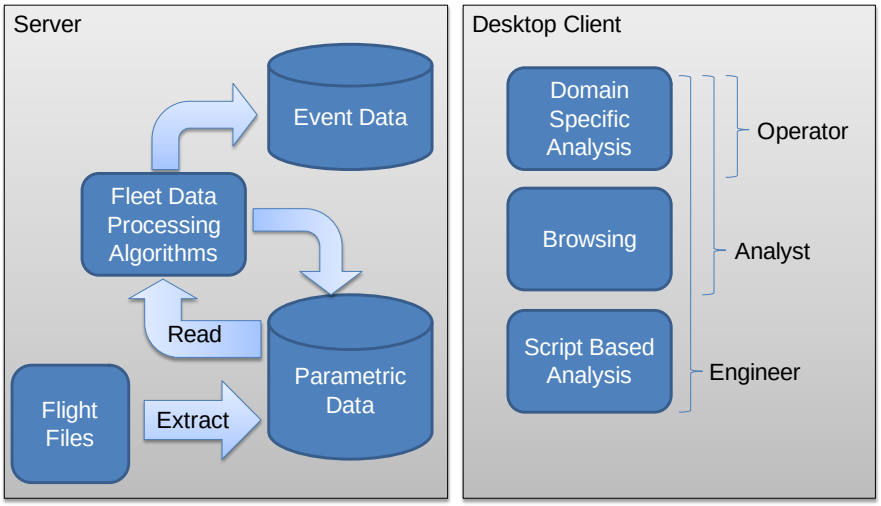

Department of Defense (DoD) Instruction 4151.22 directs the application of CBM+ to optimize material availability and costs, maintain mission capability and improve asset health management. Effective application of CBM+ requires:

- Engineering analysis of fleet scale parametric data
- Continuous validation and improvement of engineering algorithms

Dynamically Reconfigurable Data Architectures moves beyond the state of the art to meet these requirements. As condition based algorithms are developed, historical data is needed to validate their performance. Performing comparative analyses across flights, aircraft, and squadrons can help to identify indicators that can form the basis of new predictive algorithms.

Existing relational database solutions have significant performance limitations when working with condition monitoring data. The differences in performance between the relational databases and the capability to dynamically reconfigure data architectures is the difference between an operator waiting hours or days for results to them waiting seconds or minutes for many common tasks. Performance and data size are issues with a relational database. The characteristics of many of the condition monitoring signals lend themselves well to compression but relational databases don't lend themselves well to being able to be compressed and queried simultaneously.

Research Challenges and Opportunities:

- The challenge and opportunity is to be able to conduct rapid fleet wide engineering analysis of flight data