Data Storage for Remote Monitoring of Cat® Machines Using HDF

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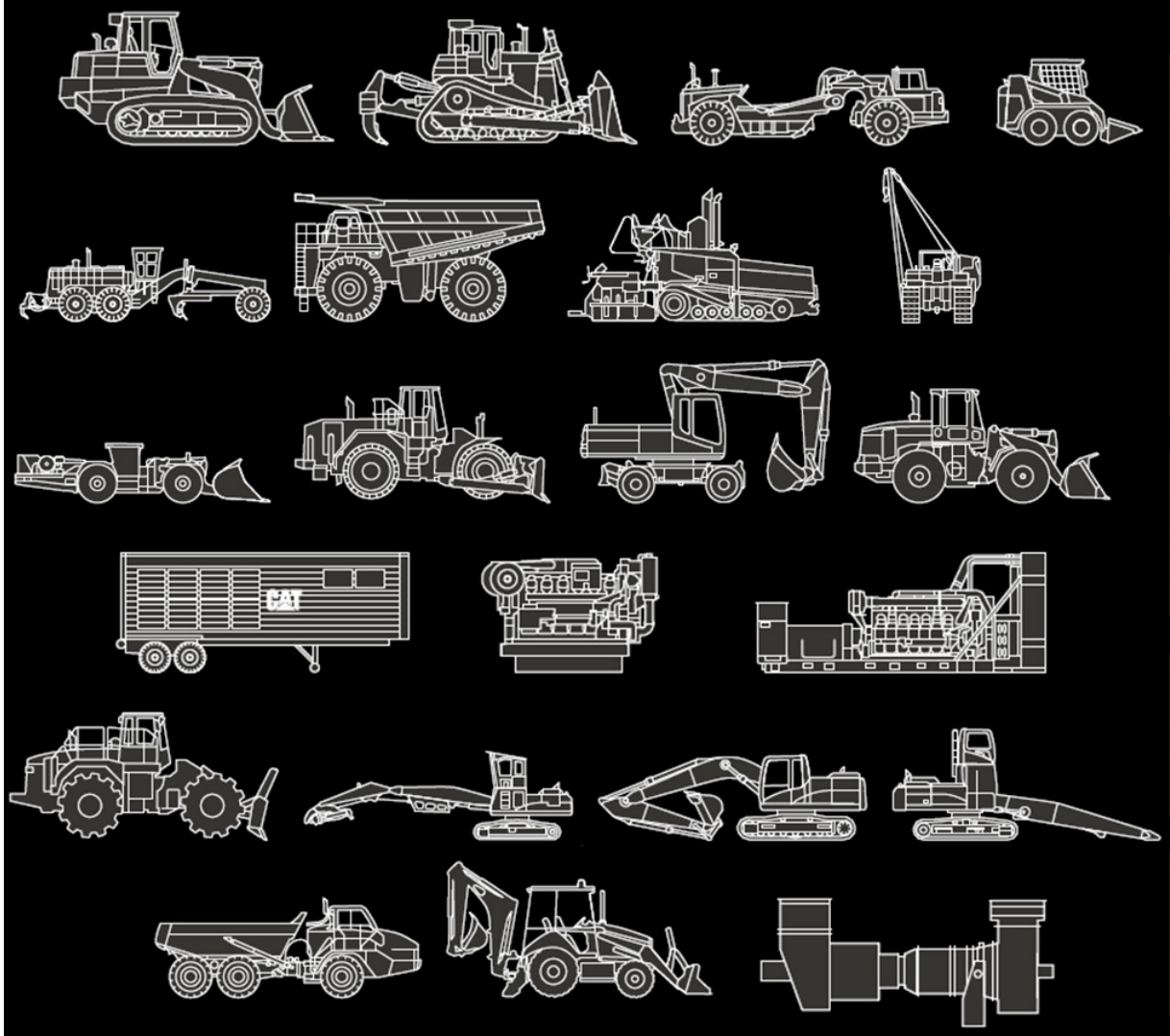
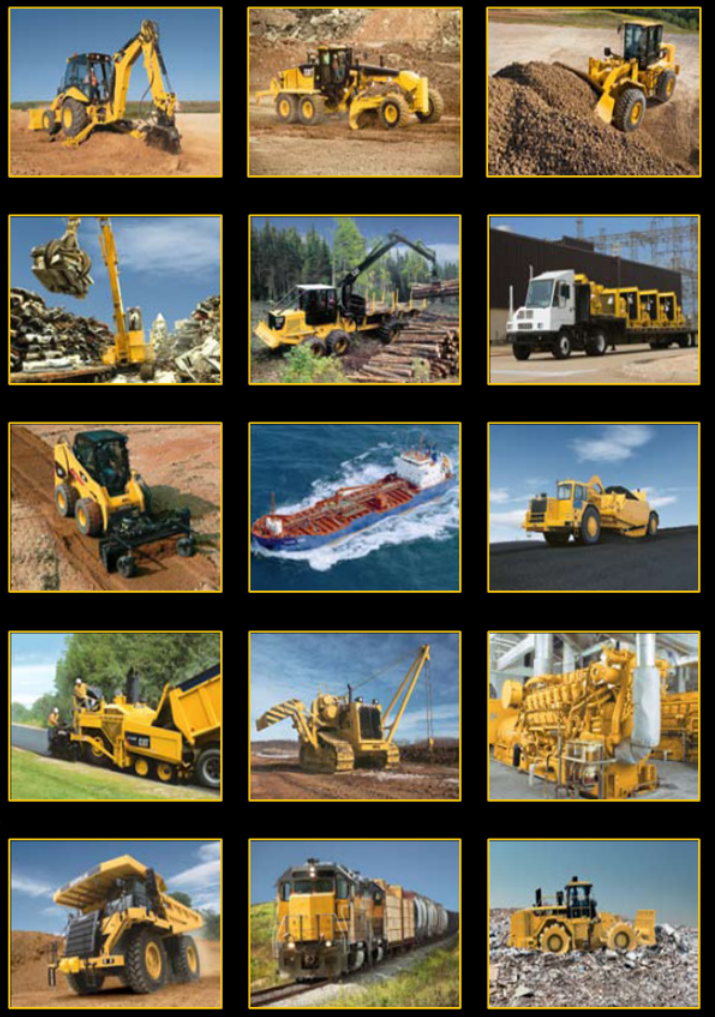
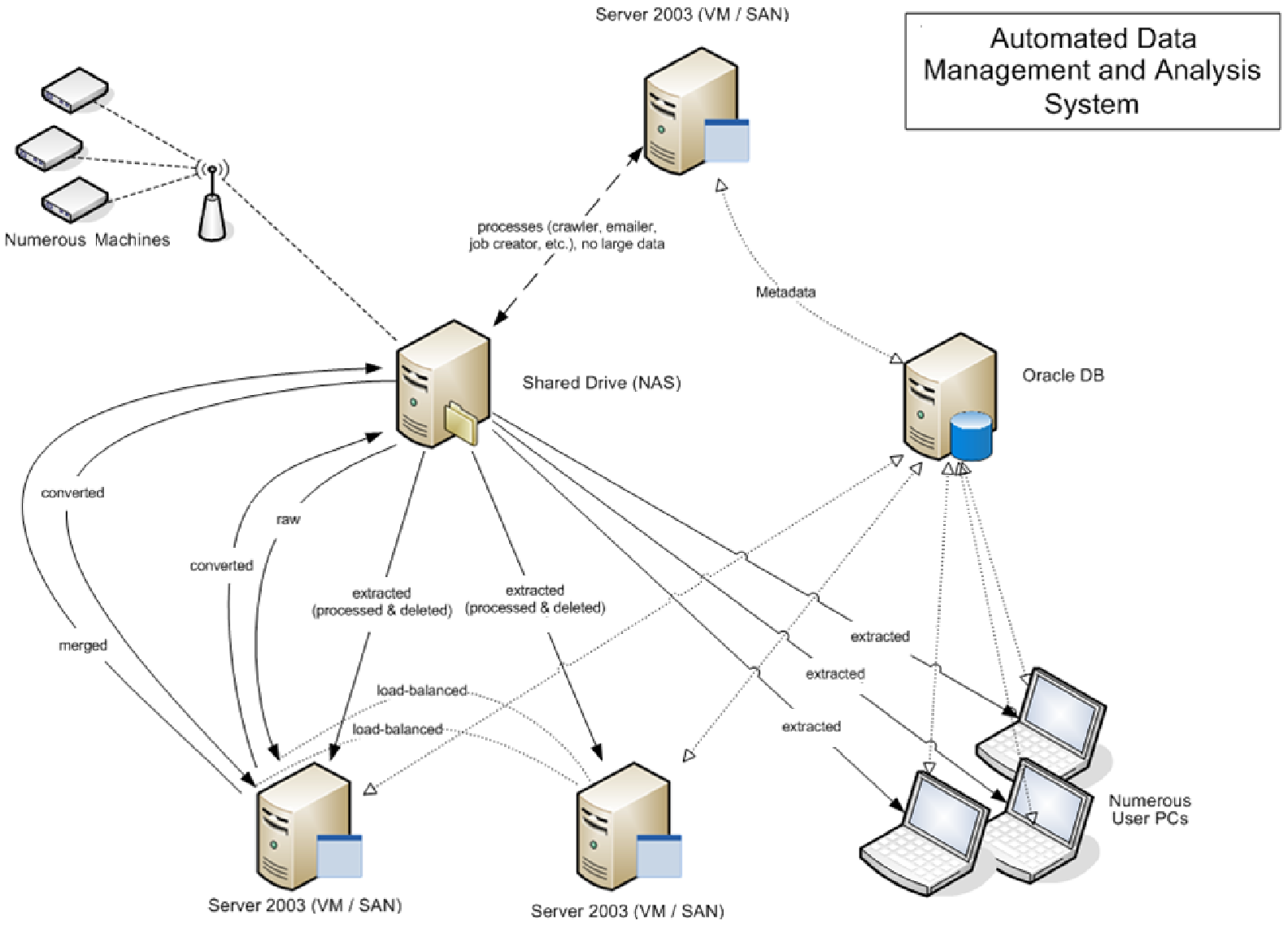
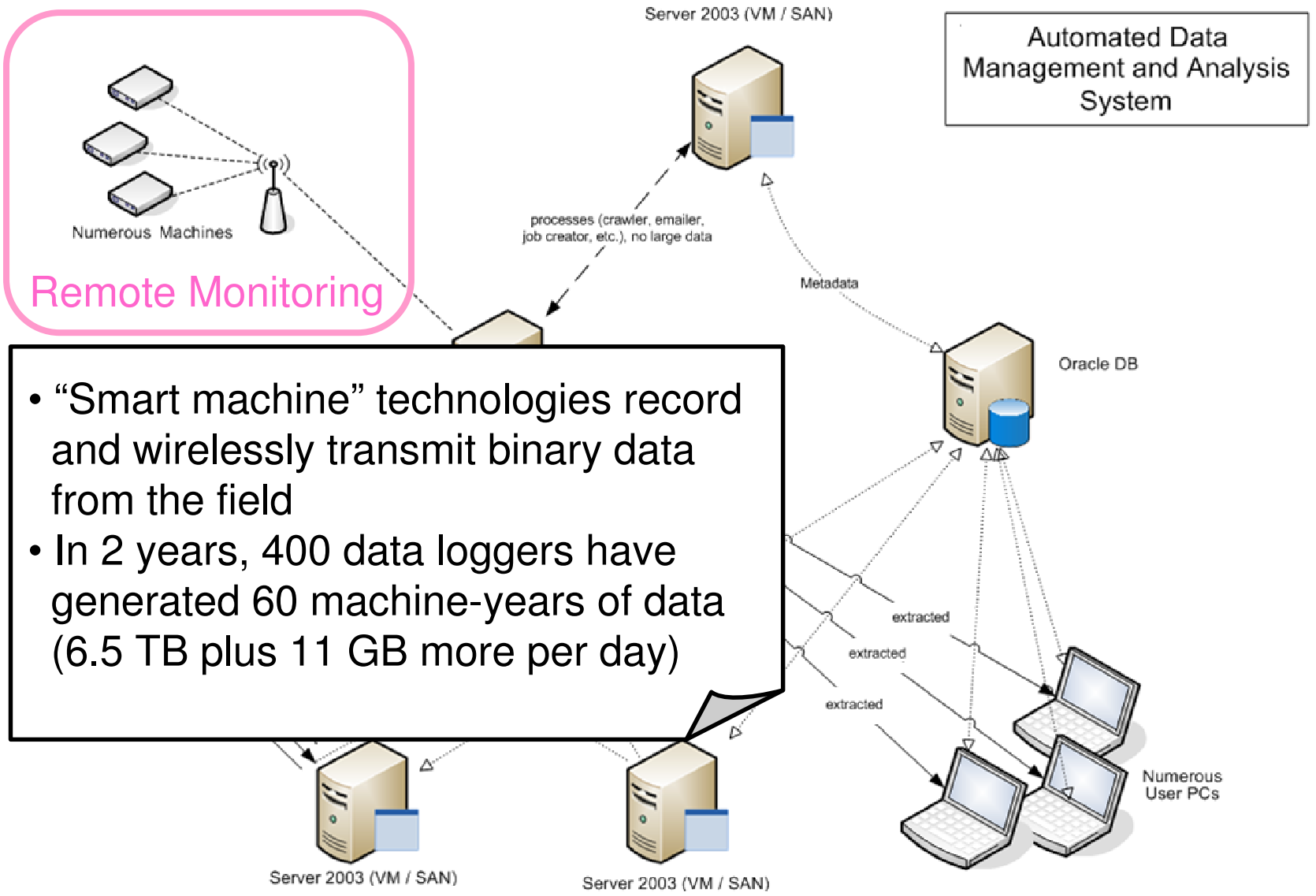
CATERPILLAR®

A Broad Range of Products and Industries

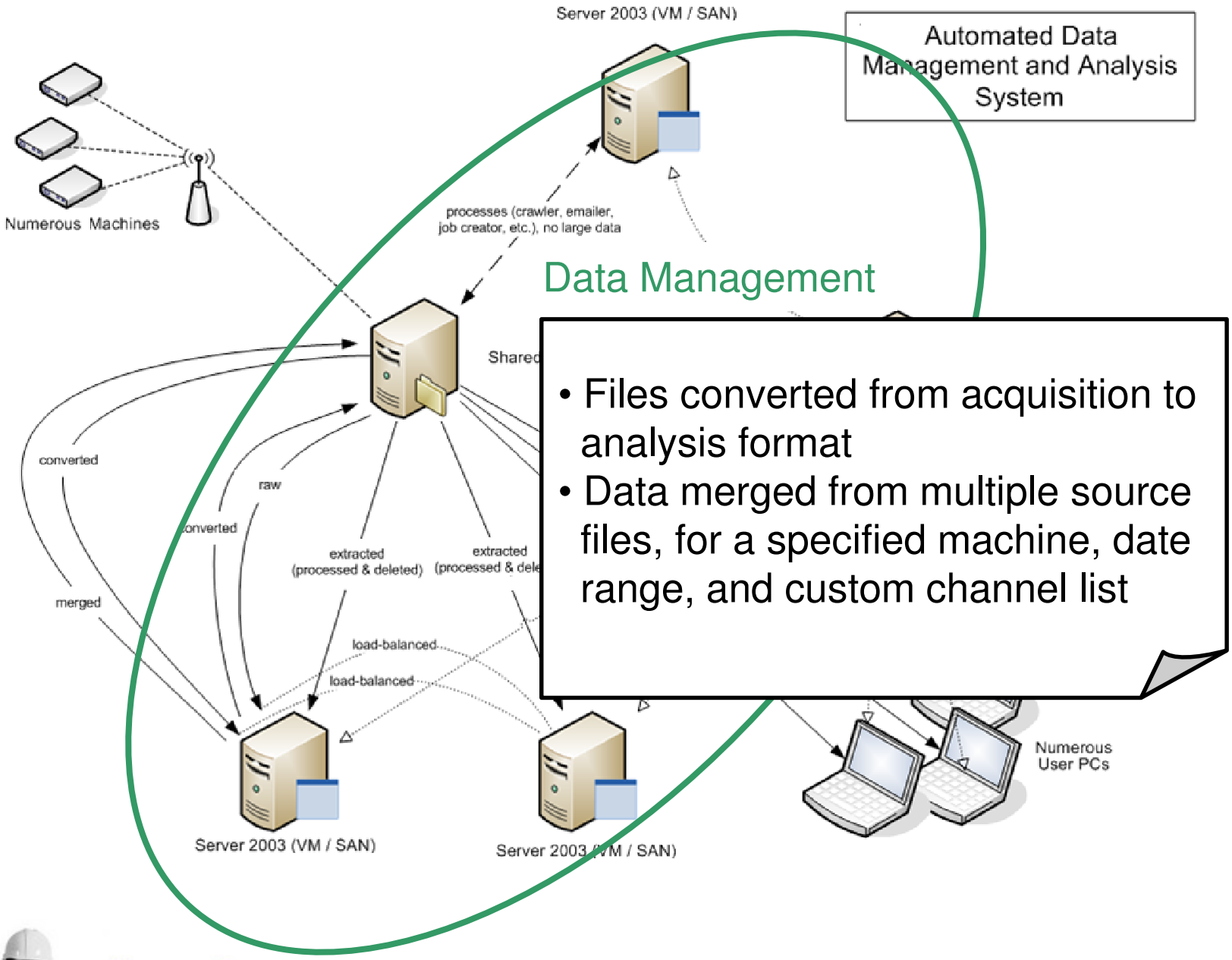




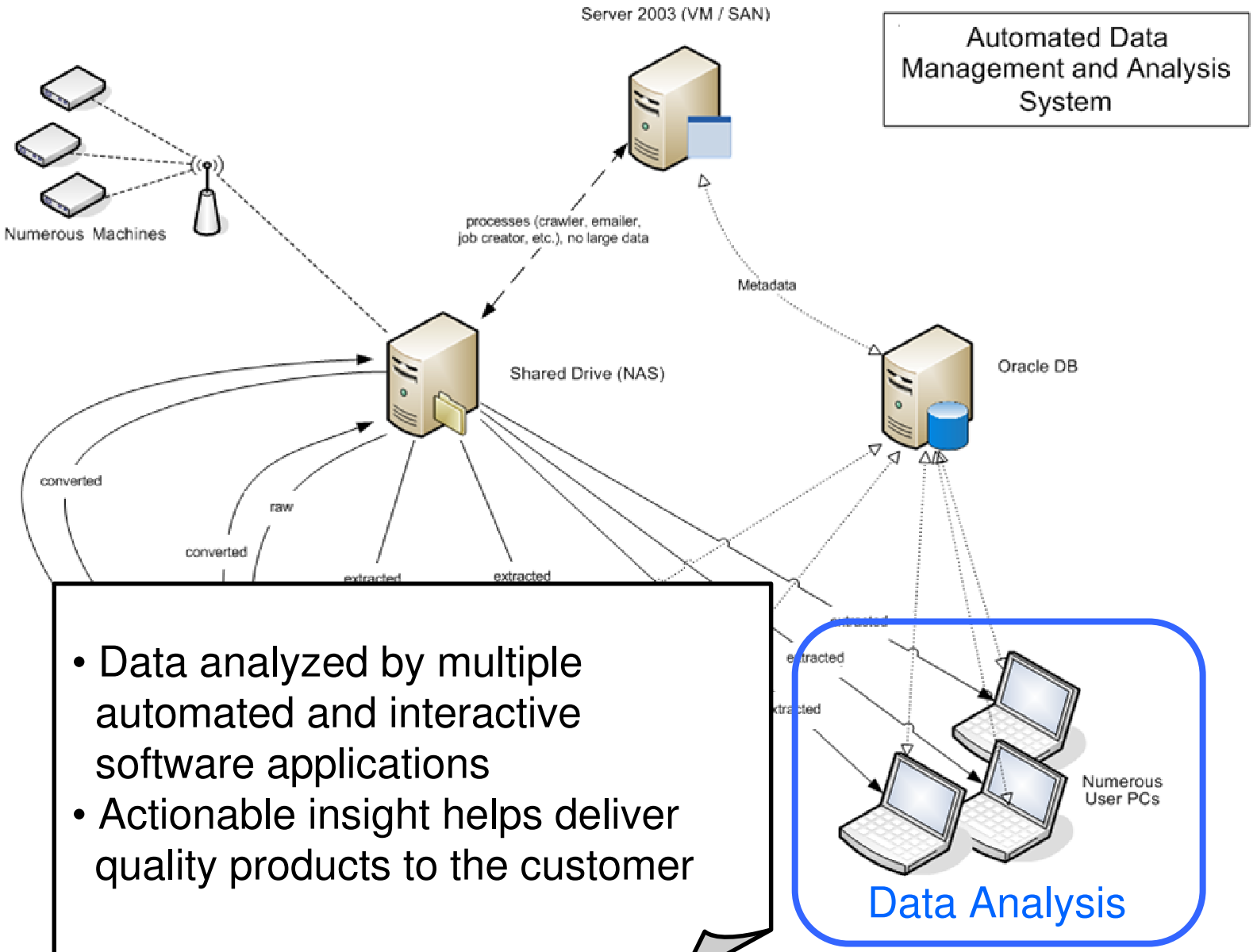




- "Smart machine" technologies record and wirelessly transmit binary data from the field
- In 2 years, 400 data loggers have generated 60 machine-years of data (6.5 TB plus 11 GB more per day)



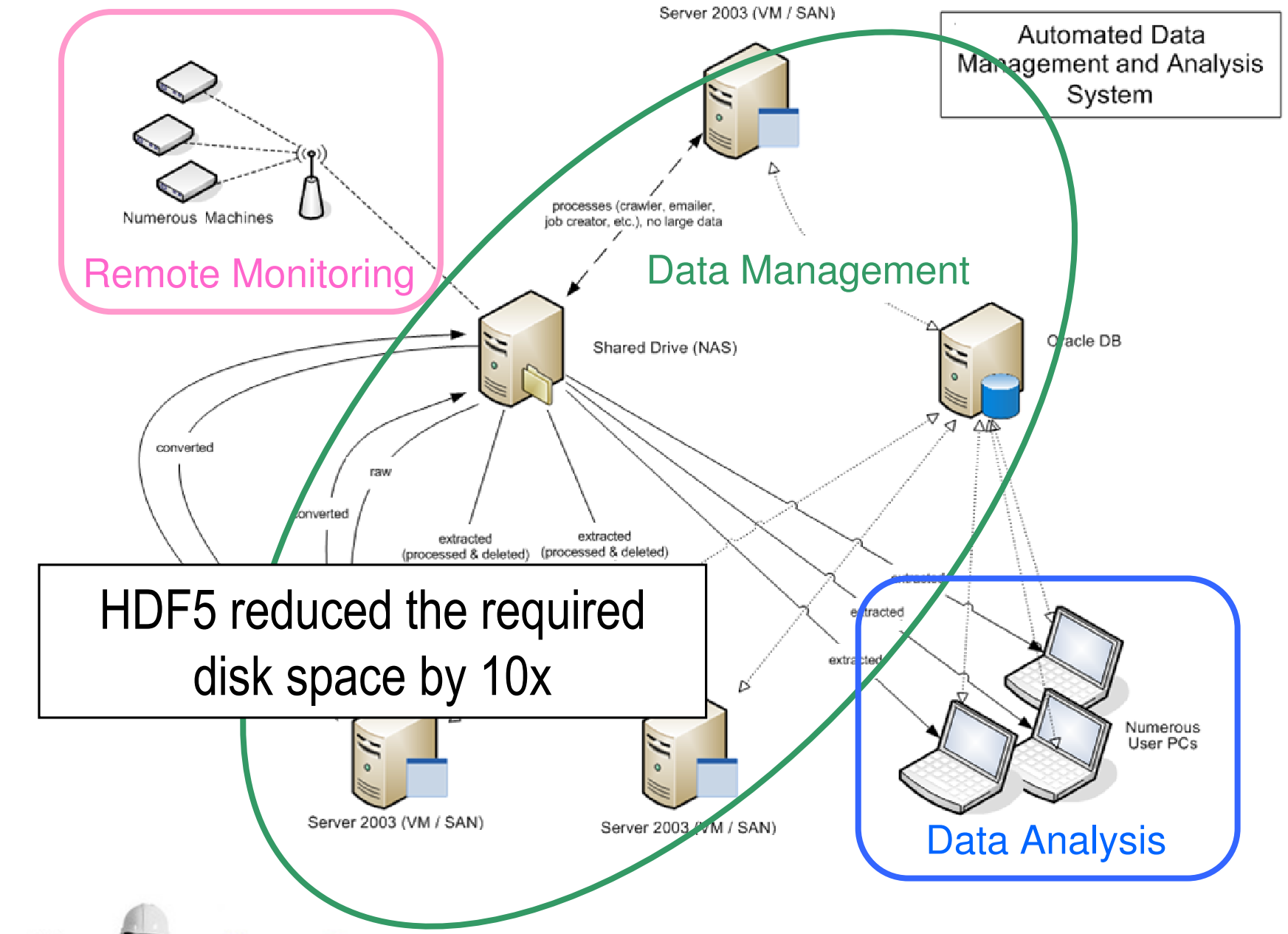
- Files converted from acquisition to analysis format
- Data merged from multiple source files, for a specified machine, date range, and custom channel list



- Data analyzed by multiple automated and interactive software applications
- Actionable insight helps deliver quality products to the customer

File Format

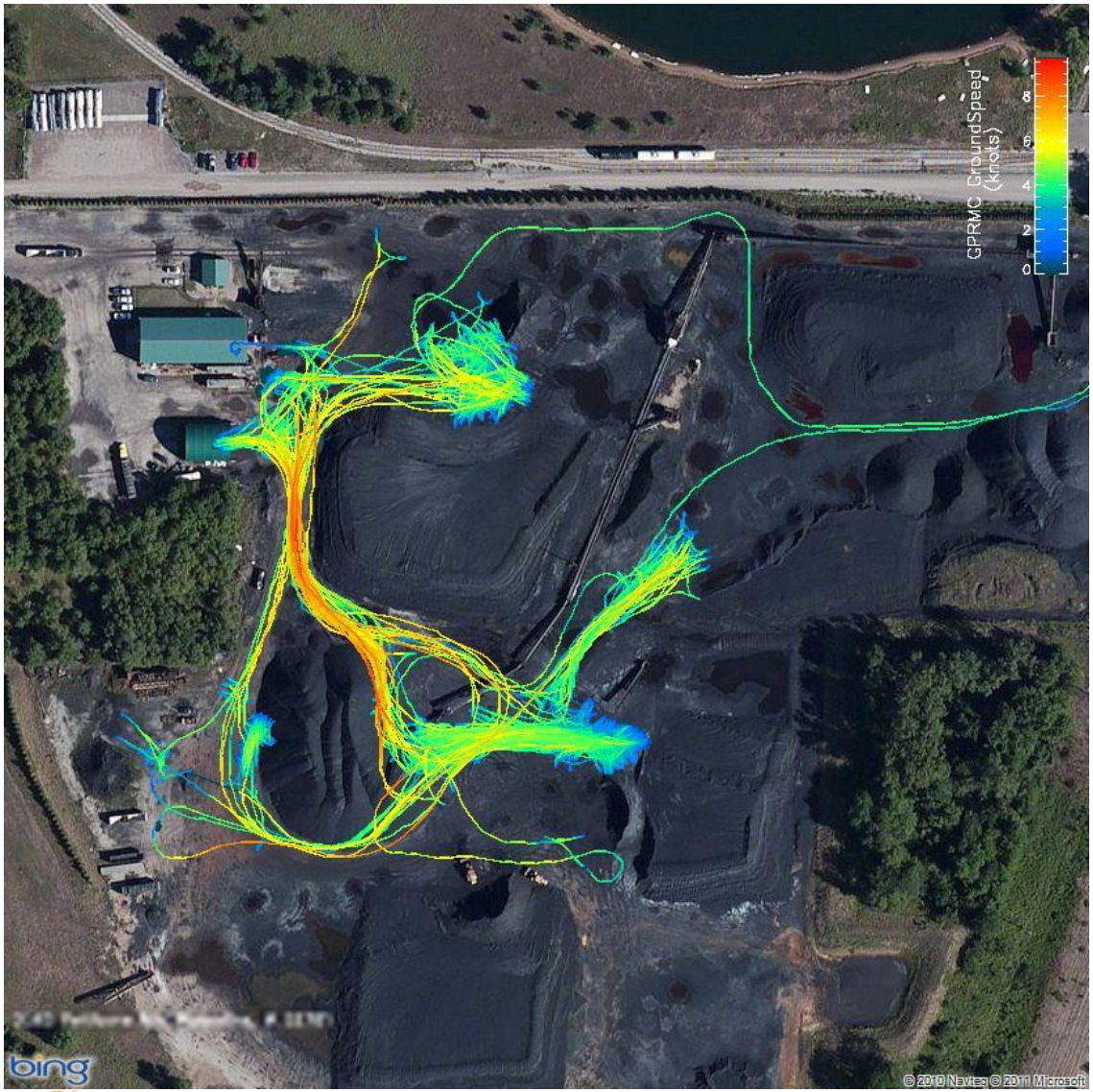
- GDF
  - Caterpillar proprietary format
  - Developed in 1990 based on HDF
  - 2 GB limit, no compression
- GH5
  - Introduced in 2010 for intermediate storage
  - Developed using HDF5 framework
  - No limit, **90% compression**
  - Analysis runs **28% faster**
  - Support for PV-WAVE, MATLAB, Python, Java


Server 2003 (VM / SAN)
Automated Data Management and Analysis System
Numerous Machines
Remote Monitoring
processes (crawler, emailer, job creator, etc.), no large data
Data Management
Shared Drive (NAS)
Oracle DB
converted
raw
converted
extracted (processed & deleted)
extracted (processed & deleted)
HDF5 reduced the required disk space by 10x
Server 2003 (VM / SAN)
Server 2003 (VM / SAN)
Numerous User PCs
Data Analysis

Data Uses: Analysis

- Cat Electronics
  - Fault code resolution, ECM troubleshooting
- Validation
  - New system validation
  - Other software features, control strategies, components, systems, etc.
- R&D
  - Customer insight and usage, engine / machine load cases
  - Composite work-cycle segmentation
- Future considerations
  - Integrate HDF5 into Caterpillar's standard data analysis tool
  - Use HDF5 to mediate other formats into databases

Data Uses: GPS Mapping



Questions?

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