Power OVER INFORMATION™

$I = MC^2$™

The Embedded Real Time Database

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User-Friendly Presentation of BUFR data

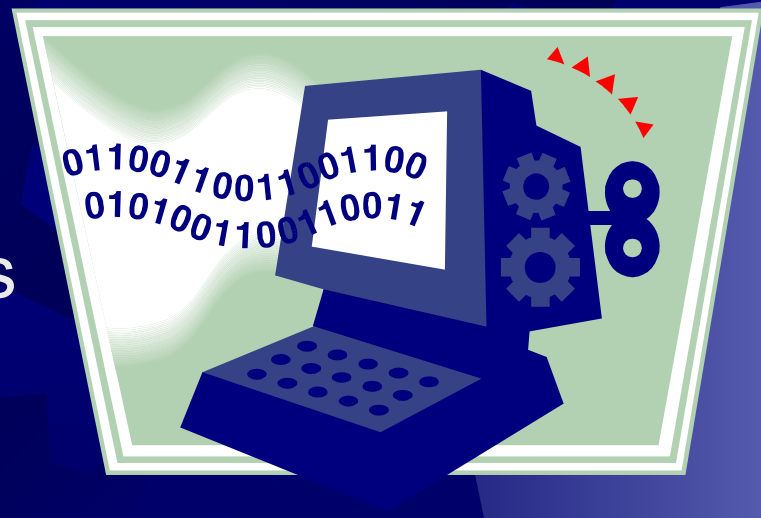
Ninth Workshop On
Meteorological Operational Systems
ECMWF, Reading, United Kingdom
November 11, 2003

Presentation of BUFR

- Objective
- Specifications
- Tools
- Methodology
- Live Demonstrations
- Questions and Answers

Background

- BUFR as a standard data exchange
  - Ultimate goal of WMO
  - Omnipotent
  - Compressed data
  - Unreadable by humans
- BUFR Decoders
  - Divergent
  - Require practical knowledge



Objective

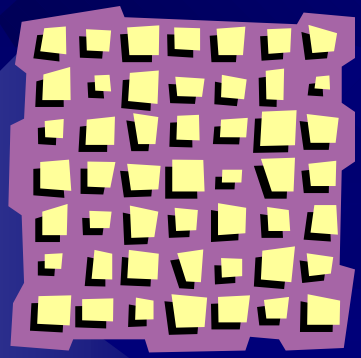
Ability to “read” data inside BUFR records over the Internet using a user-friendly browser based interface.

Specifications

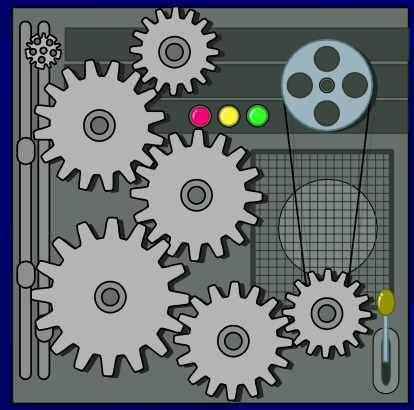
- Data to be stored in BUFR
  - BUFR is not relational
- Data to be decoded
- Data to be extracted according to user defined criteria specified interactively
- Data to be presented in a readable form
- Data to be presented a wide range of user interface environments

Tools

BUFR

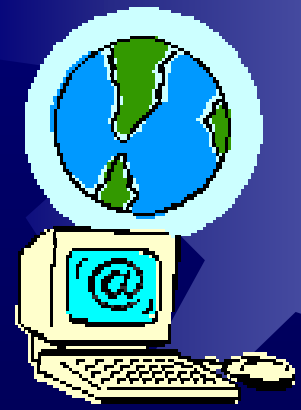


SYSTEM

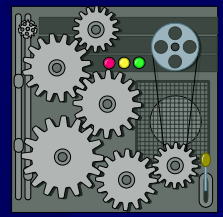


INTERNET
INTRANET

USER



Tools

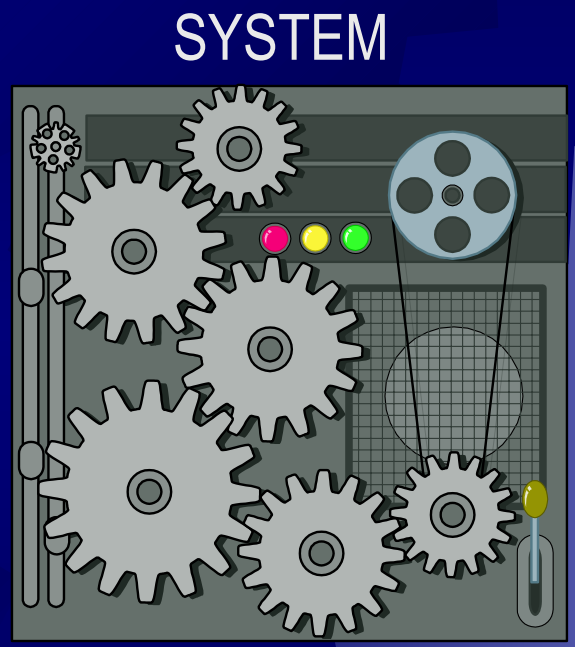


- Database system
  - High level application programming interfaces (API)
    - JDBC, HTML, XML, ODBC, PHP, Perl
  - High level API's are augmented with the BUFR decoder functionality
  - BUFR decoder becomes meta data in database
- Internet Server
  - Apache HTTP, Tomcat, MS IIS

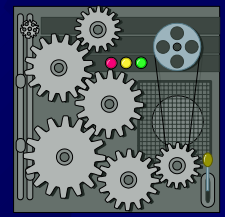
Tools

Database System

Internet Server



End User



APPLICATION

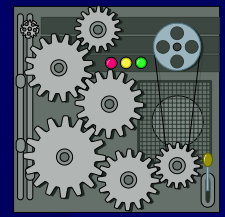
EMPRESS API's

Database System

OPERATING SYSTEM

HARDWARE

End User



APPLICATION

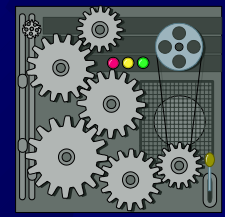
EMPRESS API's

EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE

End User



JAVA

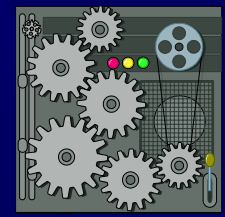
JDBC

EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE

End User



MS-Excel

ODBC

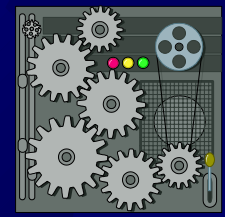
EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE

End User

Browser



HTML/XML

EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE

End User

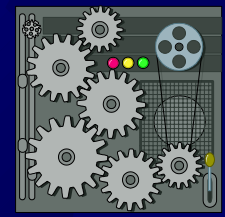
Browser

PERL or PHP

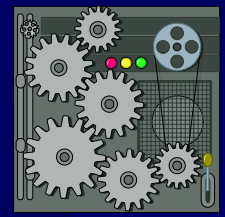
EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE



End User



APPLICATION

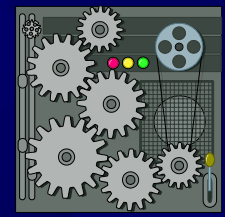
EMPRESS API's

EMPRESS DB ENGINE

OPERATING SYSTEM

HARDWARE

End User



APPLICATION

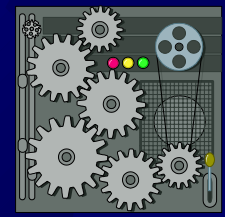
EMPRESS API's

EMPRESS DB ENGINE

UNIX

HARDWARE

End User



APPLICATION

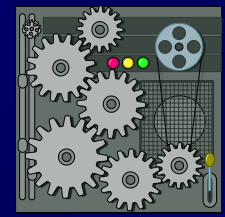
EMPRESS API's

EMPRESS DB ENGINE

LINUX

HARDWARE

End User



APPLICATION

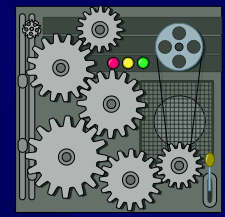
EMPRESS API's

EMPRESS DB ENGINE

MS-WINDOWS

HARDWARE

End User



APPLICATION

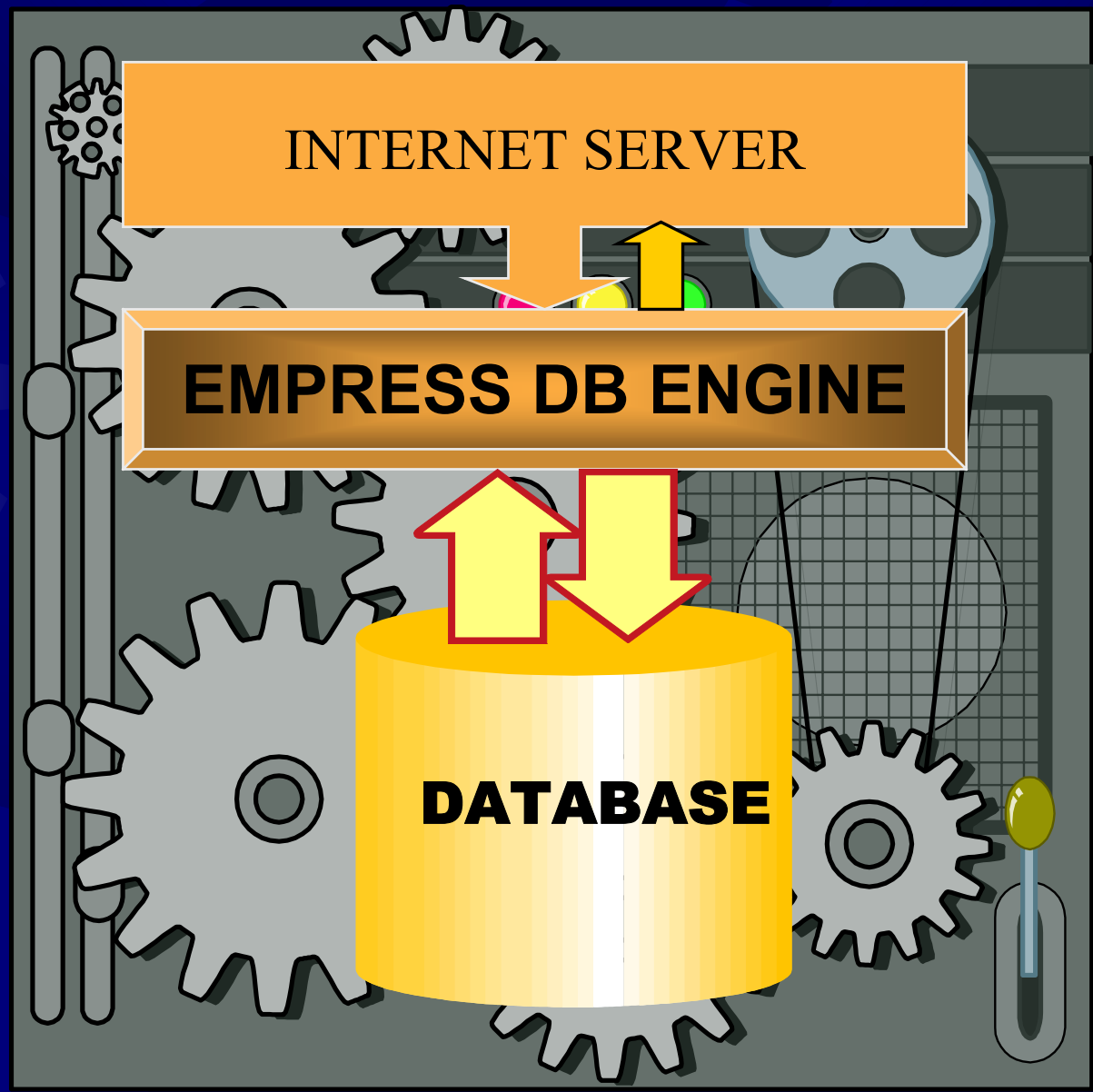
EMPRESS API's

EMPRESS DB ENGINE

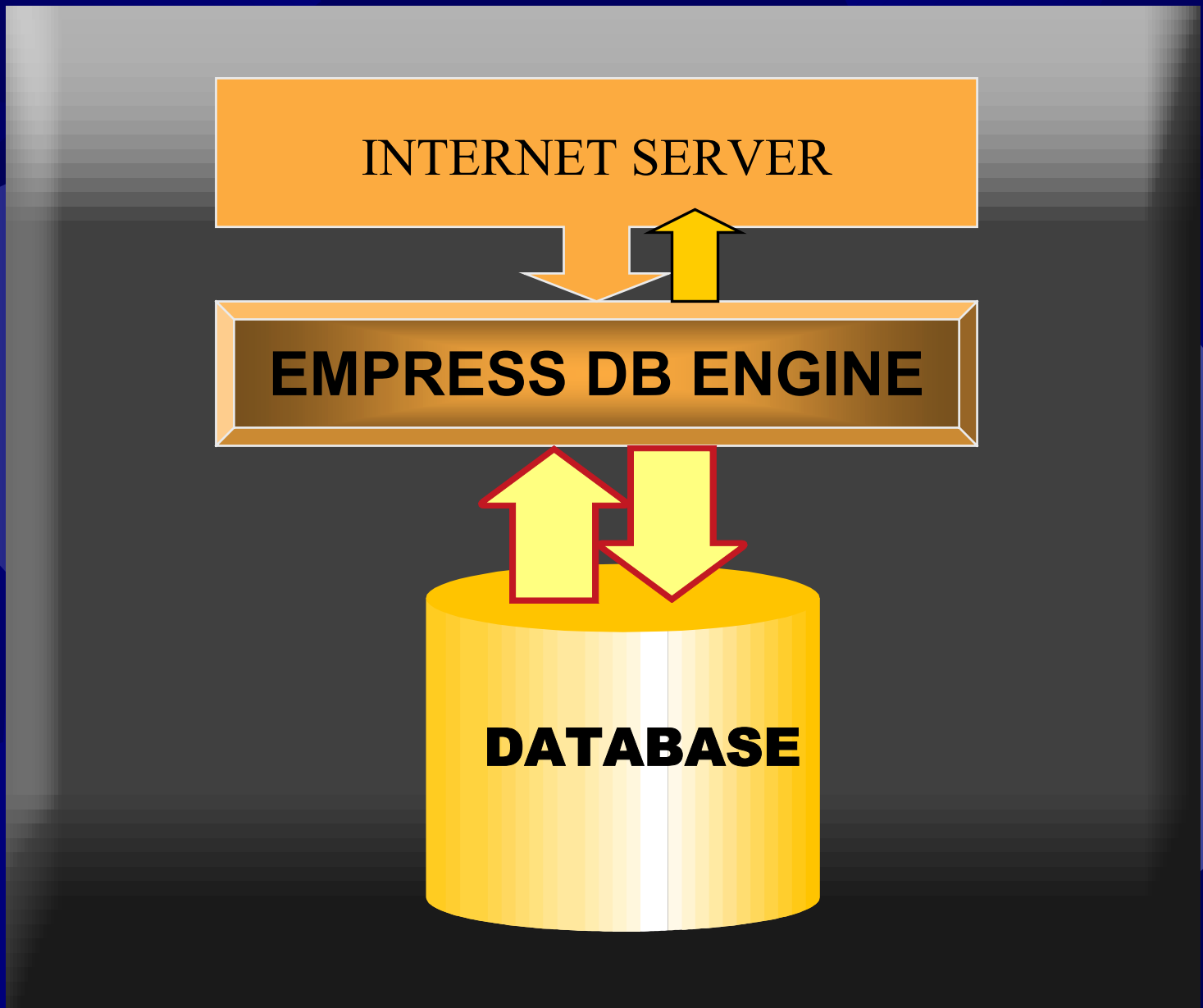
Real Time OS

HARDWARE

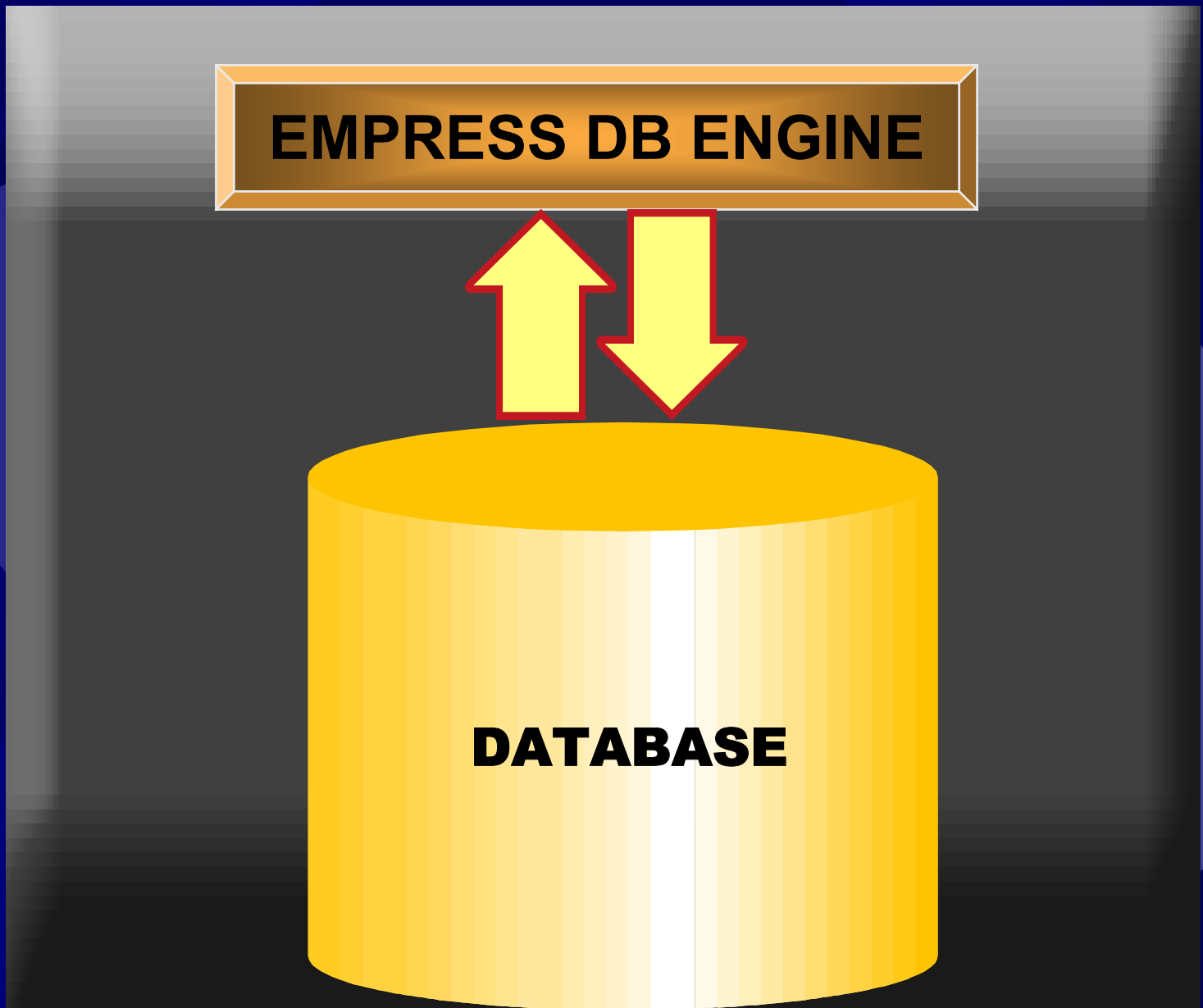
Tools



Methodology



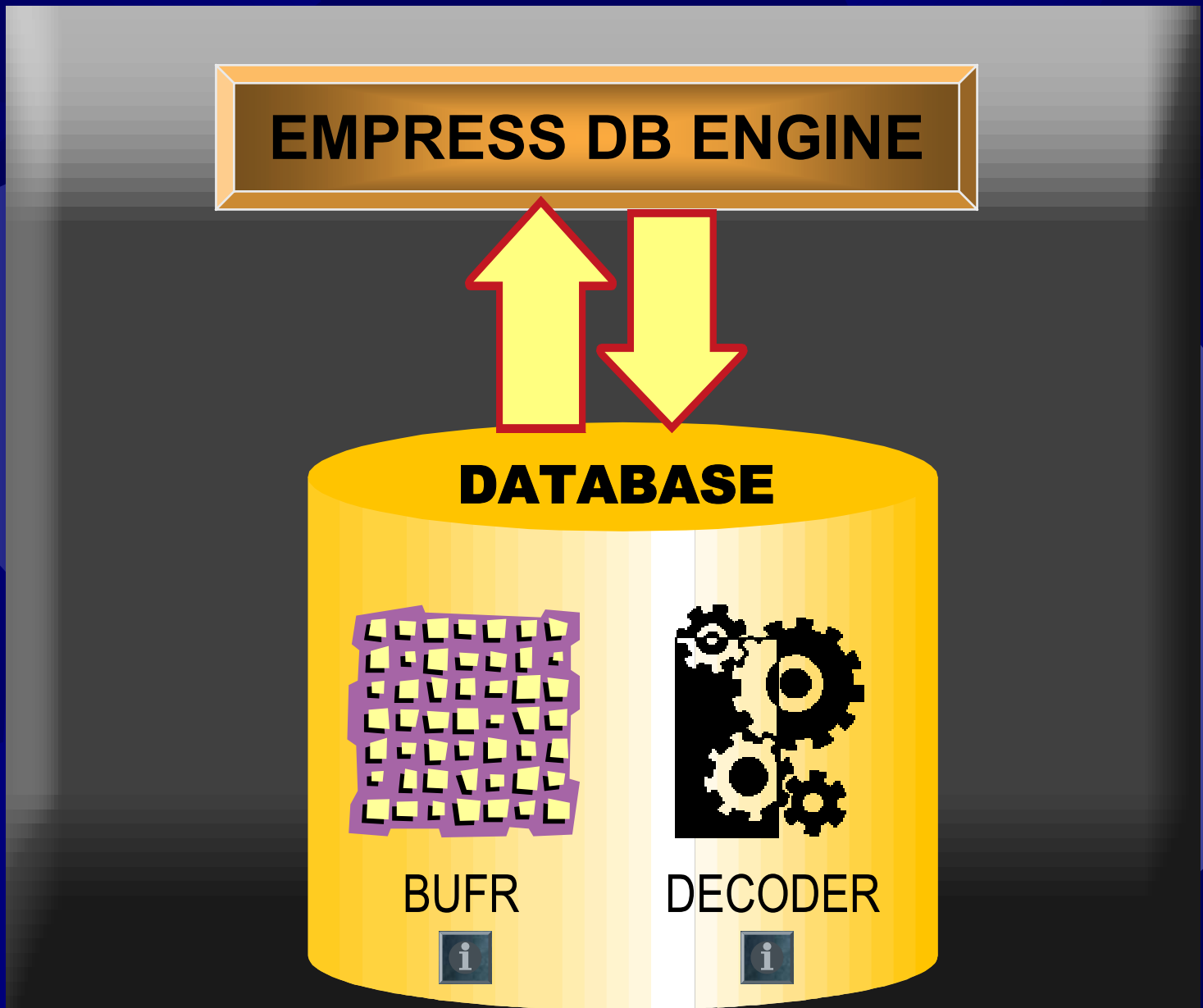
Methodology



Methodology

- Ingest BUFR Data into database
- Augment database system with decoding functions

Methodology



Ingesting BUFR into database

- BUFR does not naturally translate into rows and columns
- Ingest is a batch process
- Range of ingest methods:
  - **Minimum** – store each BUFR record as BLOb
  - **Recommended** – store each BUFR record as BLOb alongside decoded product definition section (originating centre, date and time)
  - Complete – decode all of BUFR records and store it in a relational format

BUFR Decoder as meta data

- Persistent Stored Modules
  - a.k.a. User-defined functions
- Decode all or parts of BUFR records as SELECT query
- Extend decoding functionality to all API's (SQL, ODBC, JDBC, PHP, HTML, Perl, etc.)
- Range of functions, each tailored for specific requirements
- Database tables are perfect for BUFR reference tables
- UDF decoders, BUFR reference tables and BUFR data make up a single entity

Live Demonstration

- 45 650 BUFR messages
- 3 145 145 subsets (observations)
- Each subset contains 156 elements
- Preprocessing batch:
  - All BUFR messages stored in 45 650 records as BLOb data type
- A few user-defined functions (PSM's) containing decoding functionality stored in the same database

End User

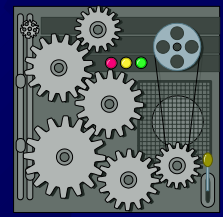
JAVA (JSP app)

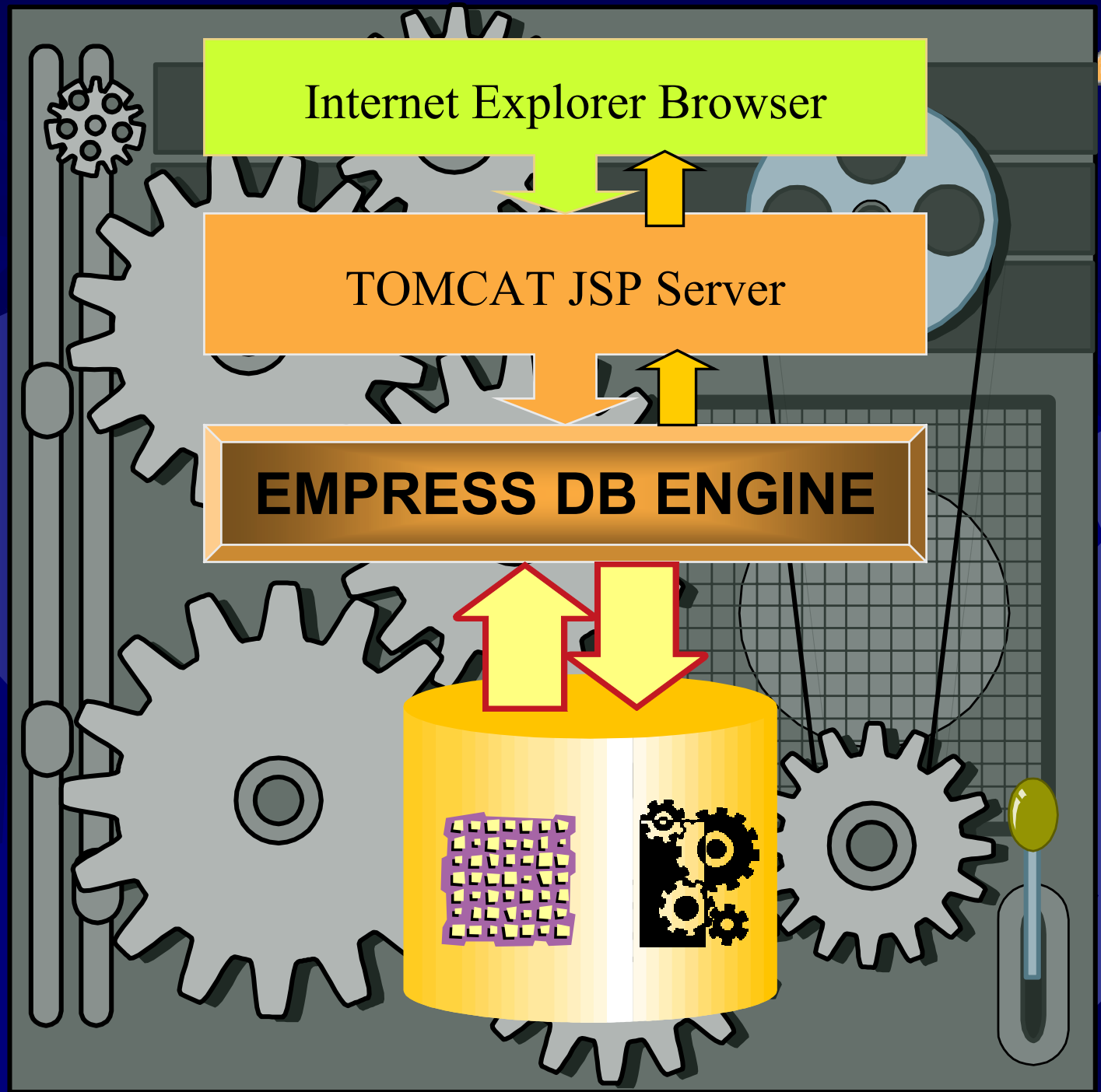
JDBC

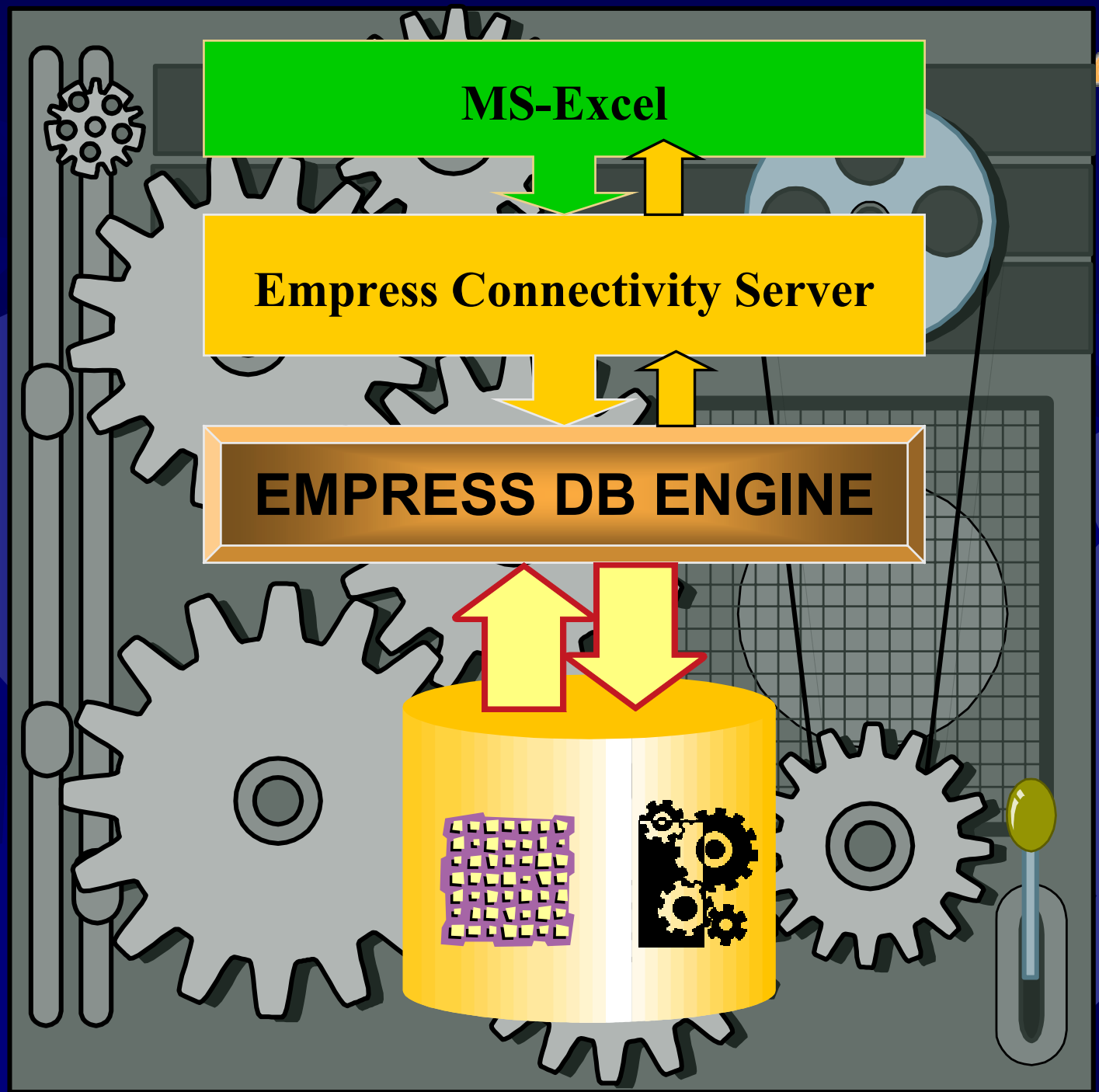
EMPRESS DB ENGINE

WIN 2000

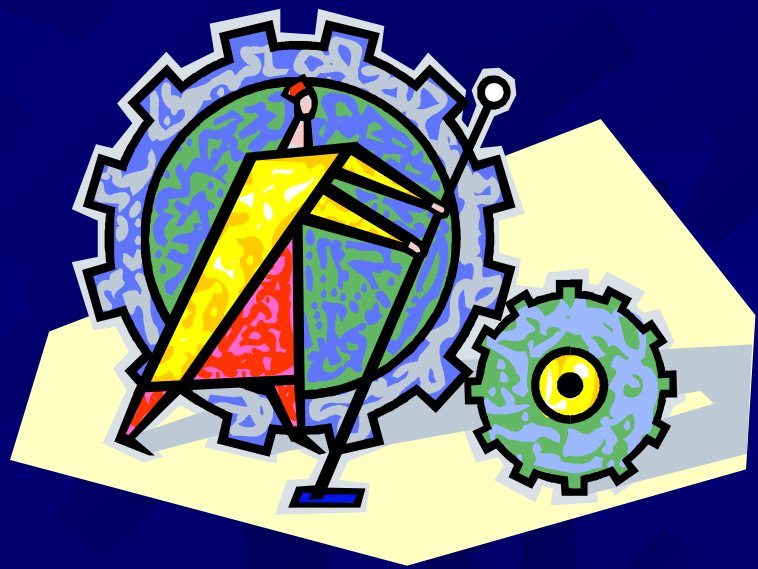
INTEL X86 /256 MB RAM




Internet Explorer Browser
TOMCAT JSP Server
EMPRESS DB ENGINE


MS-Excel
Empress Connectivity Server
EMPRESS DB ENGINE

Live Demonstration



Benefits

- “Readable” BUFR data
- Search through BUFR data
- Download decoded BUFR data
- Improved handling of BUFR messages
- Improved management of BUFR reference tables
- BUFR messages and its decoders united as a single logical entity - database
- Seamless BUFR exchange independent of user data presentation environment

The Main Benefit

Facilitates the WMO objective to standardize on table driven codes BUFR and CREX

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