# Live Migration Demonstration: TurboImage to RDBMS

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# Agenda

- Subject overview
- DB migrations 101:
  - Planning and implementation
- Live demo
- Questions

# Database Migration

# Overview

# Database migration

- HP e3000 Databases
  - TurboImage
    - Omnidex, Superdex, TPI, others
  - Allbase
  - KSAM
  - Flat (circular, msg, RIO, etc.)

# Overview

- Most popular databases used on HP e3000 do not exist on Unix or Windows
- Migration really means conversion
- Years of experience to learn from

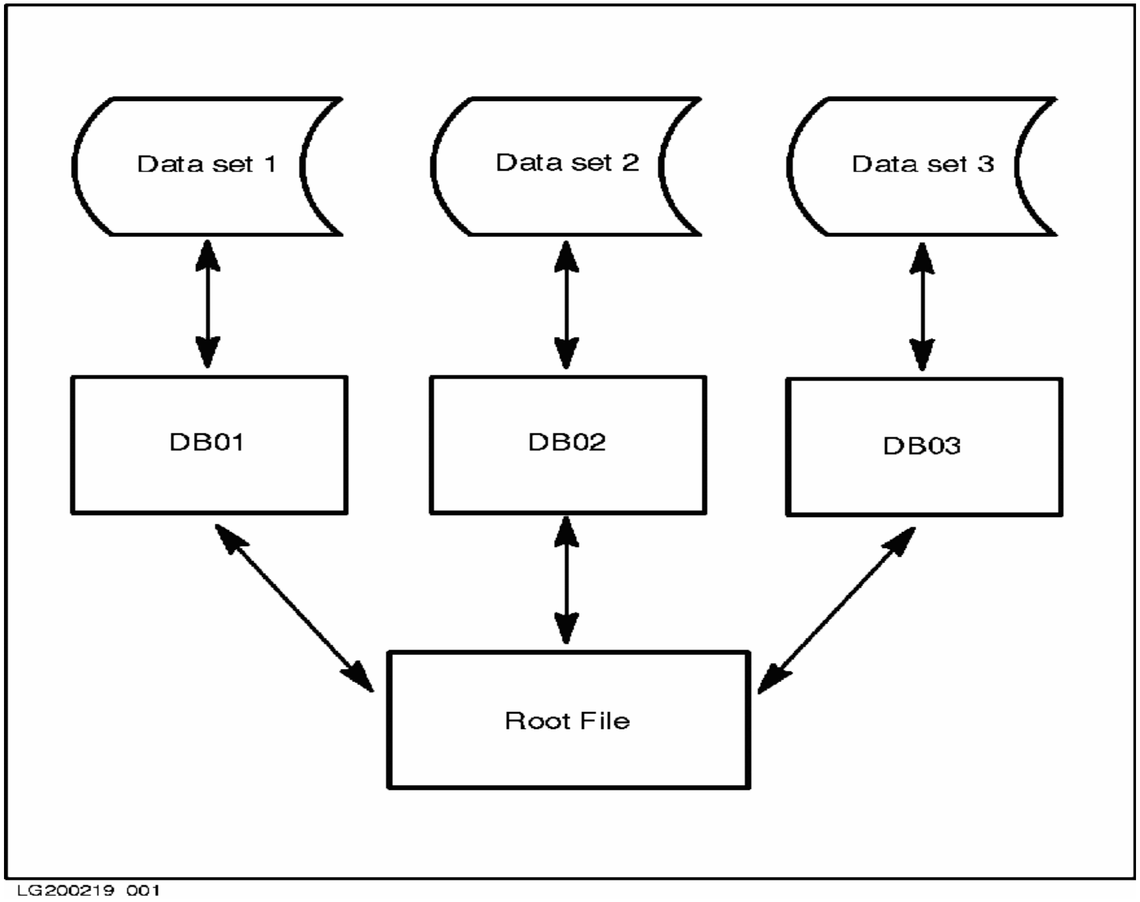
# TurboImage overview

- History
- Strengths
- Weaknesses
- Unique features
  - Datasets and Items
  - Master/Detail
  - Keys
  - Chain read
  - Migrating secondaries, etc.
- 3rd party Indexing

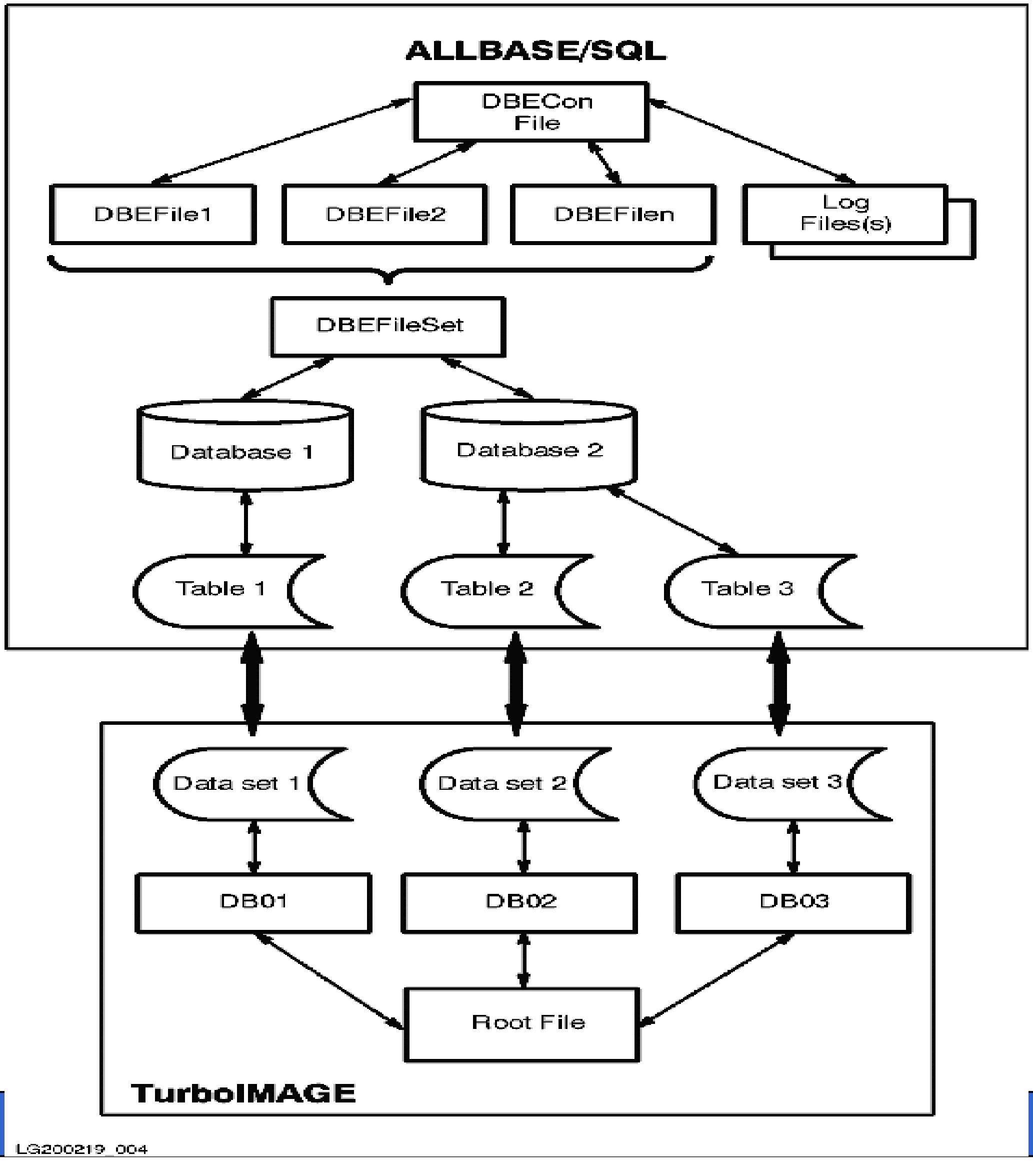
# Specific concepts

- Network topology
- DBSCHEMA
- DBUTIL
- Free
- Stable, Efficient, trustworthy

# TurboImage concept



# Image/SQL concept



# RDBMS selection

- What DB can support my existing db access needs
- Factors to consider
  - Price
  - Market share and popularity
  - Manufacturer credibility
  - Support track record
  - User license cost
  - Support and upgrade cost

# Choices

- Oracle (Unix/PC)
- SQL Server (PC)
- Sybase (Unix)
- Informix (Unix/PC)
- DB2 (Unix/PC)
- HP Eloquence (Unix/PC)
- PostgreSQL/MySQL (Unix/PC)
- C-ISAM/D-ISAM (Unix/PC)
- Access and others (PC)
- Flat (Unix/PC)

# Survey results

| | |
|---|---|
| Oracle | : 10 |
| DB2 | : 3 |
| SQL Server | : 6 |
| Sybase | : 2 |
| Informix | : 0 |
| HP Eloquence | : 10 |
| OpenSource DBs | : 1 |
| Other | : 2 |
| – (PERVASIVE SQL / Universal DB2) | |

Sample from 22 people surveyed at e3000 symposium (DBs most appealing)

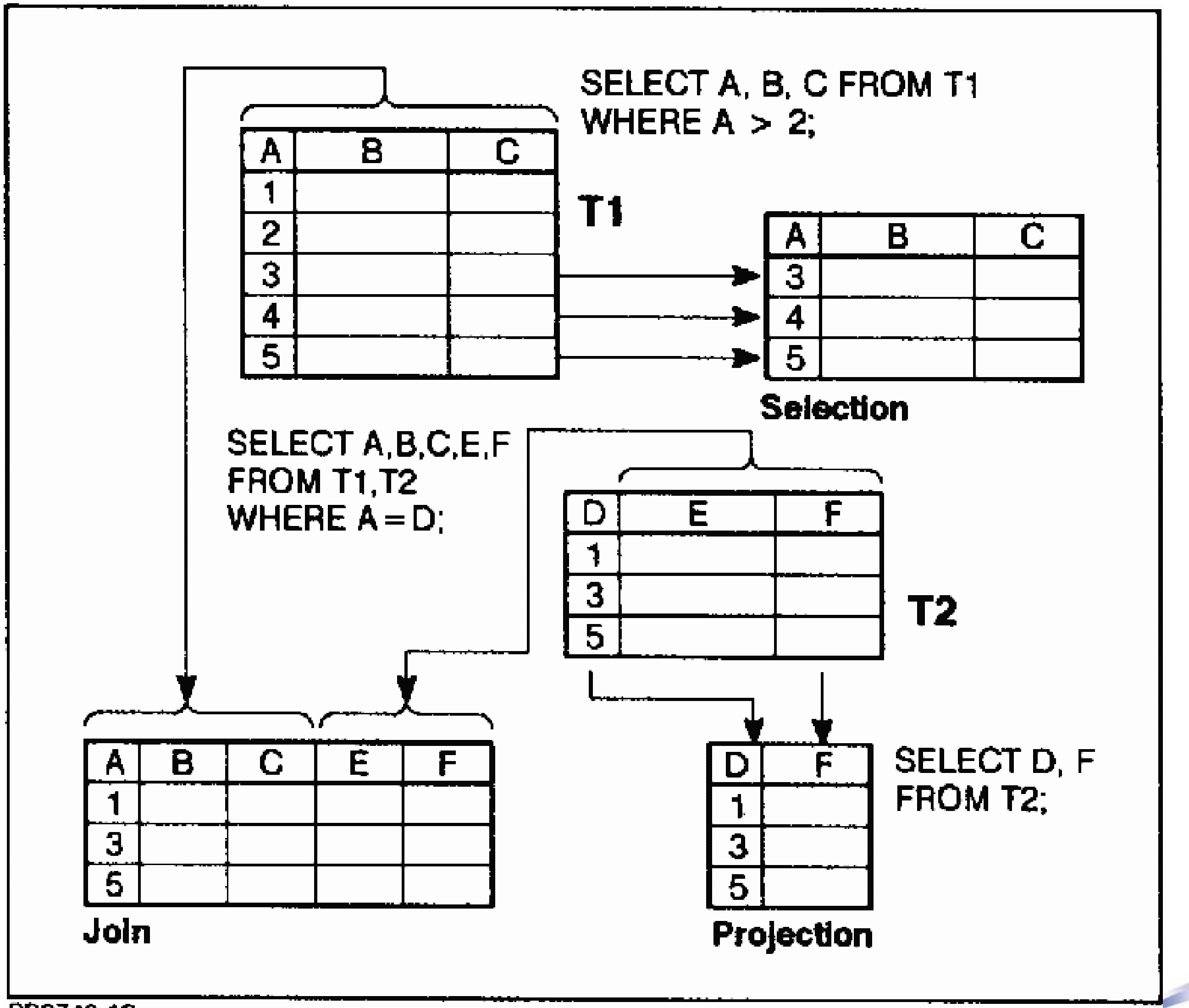
# HP Eloquence

- Clone of Image database
- 95% of Image functionality
  - Missing some of the newer features
- Interesting to mainly small to mid-sized customers and ISVs
- Speedware will be supporting HP Eloquence in upcoming releases of our development tools
- Possible support for Omnidex
- 2000-5000 customers worldwide
  - Only ~200 using Image intrinsic interface
- $7,000 per server

# Technical considerations

- Efficiency/Performance
- Maintenance ability
- Supporting tools
- Flexibility
- Stability
- Scalability
- Administration
- Stored procedures
- Triggers
- Locking

# SQL concept



SELECT A, B, C FROM T1
WHERE A > 2;

T1

| A | B | C |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

Selection

| A | B | C |
|---|---|---|
| 3 | | |
| 4 | | |
| 5 | | |

SELECT A,B,C,E,F
FROM T1,T2
WHERE A = D;

T2

| D | E | F |
|---|---|---|
| 1 | | |
| 3 | | |
| 5 | | |

Join

| A | B | C | E | F |
|---|---|---|---|---|
| 1 | | | | |
| 3 | | | | |
| 5 | | | | |

SELECT D, F
FROM T2;

Projection

| D | F |
|---|---|
| 1 | |
| 3 | |
| 5 | |

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# RDBMS

- Particularities
  - Tables not Datasets
  - Columns not Items, Rows not records
  - Indexes
  - Views and table joins
  - Column Item types
  - No arrays
  - Nulls
  - Triggers
  - Rollbacks
  - Data page and log file caching
  - Administration tools
- Unique features, SQL extensions
- Need a DataBase Administrator

# Database Migration 101

# Planning

# Migration planning

- Assess current environment
- Timeframe, effort, milestones
  - When can you start?
  - Test machine
  - Completion expectance
    - Prior end of 2006 or passed?

# Analyze current system

- CPUs, users, connections, databases, disk space
- Applications (critical, non-critical, purchased)
- 3rd party vendors for all apps and tools
- Types of languages
- User interface
- Data entry screen tools
- Development tools
- Operational tools
- Critical state preservation

# Analyze current DB

- Architecture of Datasets
- Security
- Types of items
- Date items
- Buffer items and redefinitions
- Dirty data
- Arrays
- Data transaction volume and performance (throughput)

# Migration planning

- New database structure
  - Identical copy (Phase 1)
    - Quicker method
    - May have performance issues
    - Not taking advantage of SQL
    - **Note**: Even a DB replication may require some code adaptation
  - Optimization / Improvements (Phase 2)
    - More effort
    - More efficient
    - SQL features, extensions, etc.

# Migration planning

- Automatic masters disappear
- Manual masters become tables
- Detail datasets of Manual masters become table with a foreign key constraint
- Image SORT items become clustered Indexes
- Indexed keys become Indexes and queried with LIKE operator, unless TPI continues to be used

# Migration planning

- Nulls
  - Used with SQL extensions
  - Define columns as NOT NULL
    - Least impact on code
    - Cannot take advantage of NULLs
  - Define some columns as NULL
    - May impact the code
    - Can take advantage of NULLs

# Migration planning

- Arrays
  - Method 1: One big column
    - Some code changes may be required
    - Not recommended for Integer or Pack
  - Method 2: 1 column per occurrence
    - Some code changes required
    - Recommended for Integer or Pack
  - Method 3: New table, one row per occurrence
    - Significant code changes required
    - More flexible

# Migration planning

- Dates
  - CHAR 8
    - Keep as is
      - Does not impact code
    - Change to Datetime/Timestamp
      - Consider if time logging is needed
      - Consider to take advantage of Datetime features
      - Some code changes may be required
  - CHAR 6
    - Similar to CHAR 8
    - Potential problems with new external tools if using HPDATE
  - Julian
    - Keep or Change concept

# Migration planning

- Integers
  - – RISC: Keep same format
  - – CISC: Little/Big endien issue

# DB access application code

- Can you keep the code as is?
  - Tools can translate DB access intrinsics to native or general access functions
  - Keep the intrinsics and use a mapper API, which will make the appropriate native translation
- Define access method
  - Native to DB
  - API mappers
  - ODBC/ADO/JDBC/etc.

# Data replication & consolidation

- Export/Import
- DB migration tools
- Write your own transfer programs

# Tests and refinement

- Migration tests
  - Data integrity tests
  - Data transformation tests
  - Application data access tests

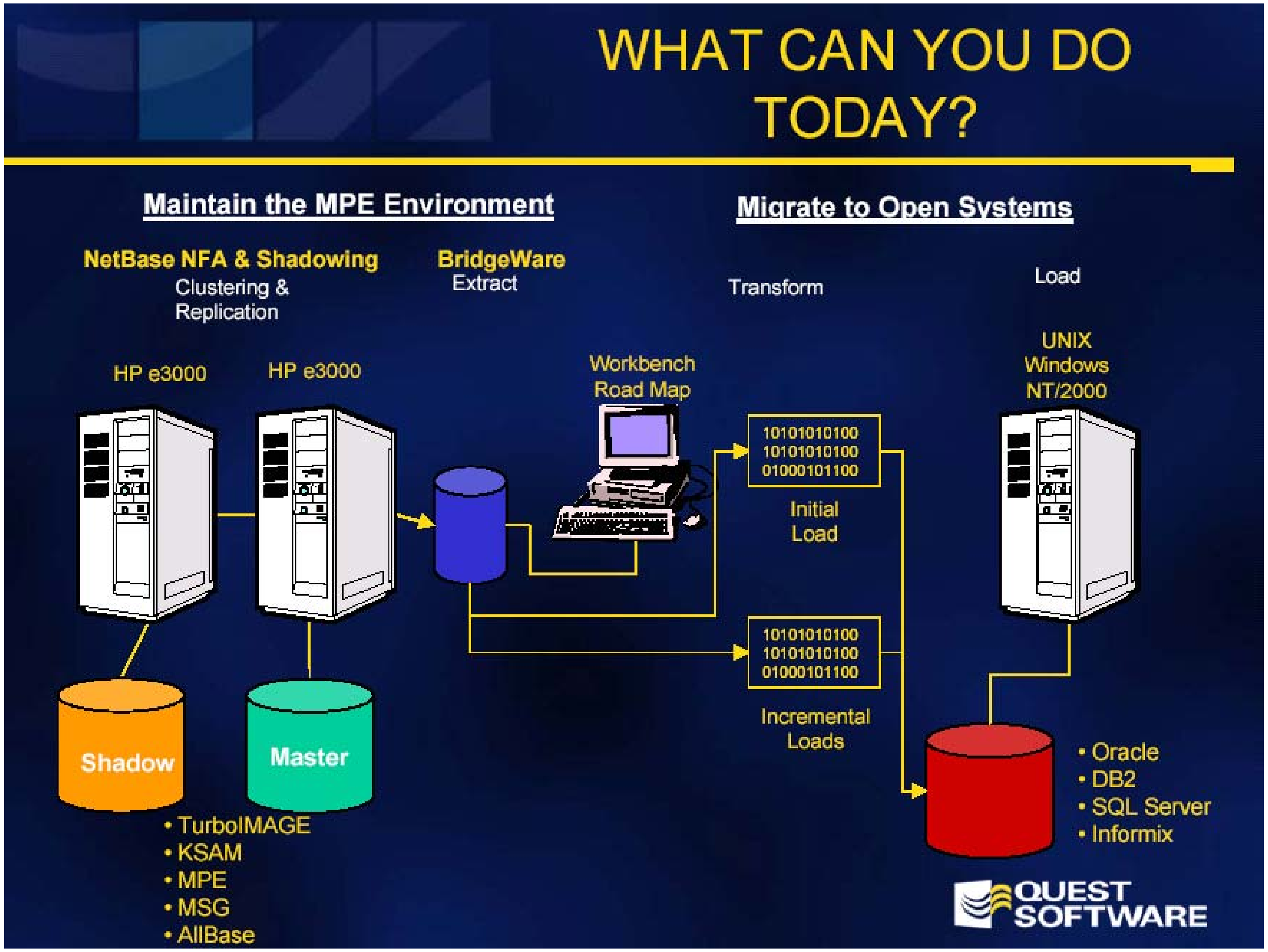
# Migration methods

- Data Migration Options
  - Big Bang / Magic Weekend
  - Running systems in parallel
    - Incremental loading
    - Parallel processing
- Speedware development tools have built in database porting features
  - Data can also be moved via the tools

# Migration methods

- Quest Software has some high-end database porting products
  - Bridgeware & DataBridger studio (co-developed with Taurus)
    - Supports dynamic data transformation and incremental loading
  - Netbase
    - Parallel processing across multiple systems and databases
      - Shadowing
      - Mirroring

# Quest BridgeWare



WHAT CAN YOU DO TODAY?

**Maintain the MPE Environment**

**Migrate to Open Systems**

**NetBase NFA & Shadowing**
Clustering &
Replication

**BridgeWare**
Extract

Transform

Load

HP e3000

HP e3000

Workbench
Road Map

UNIX
Windows
NT/2000

10101010100
10101010100
01000101100

Initial
Load

10101010100
10101010100
01000101100

Incremental
Loads

Shadow

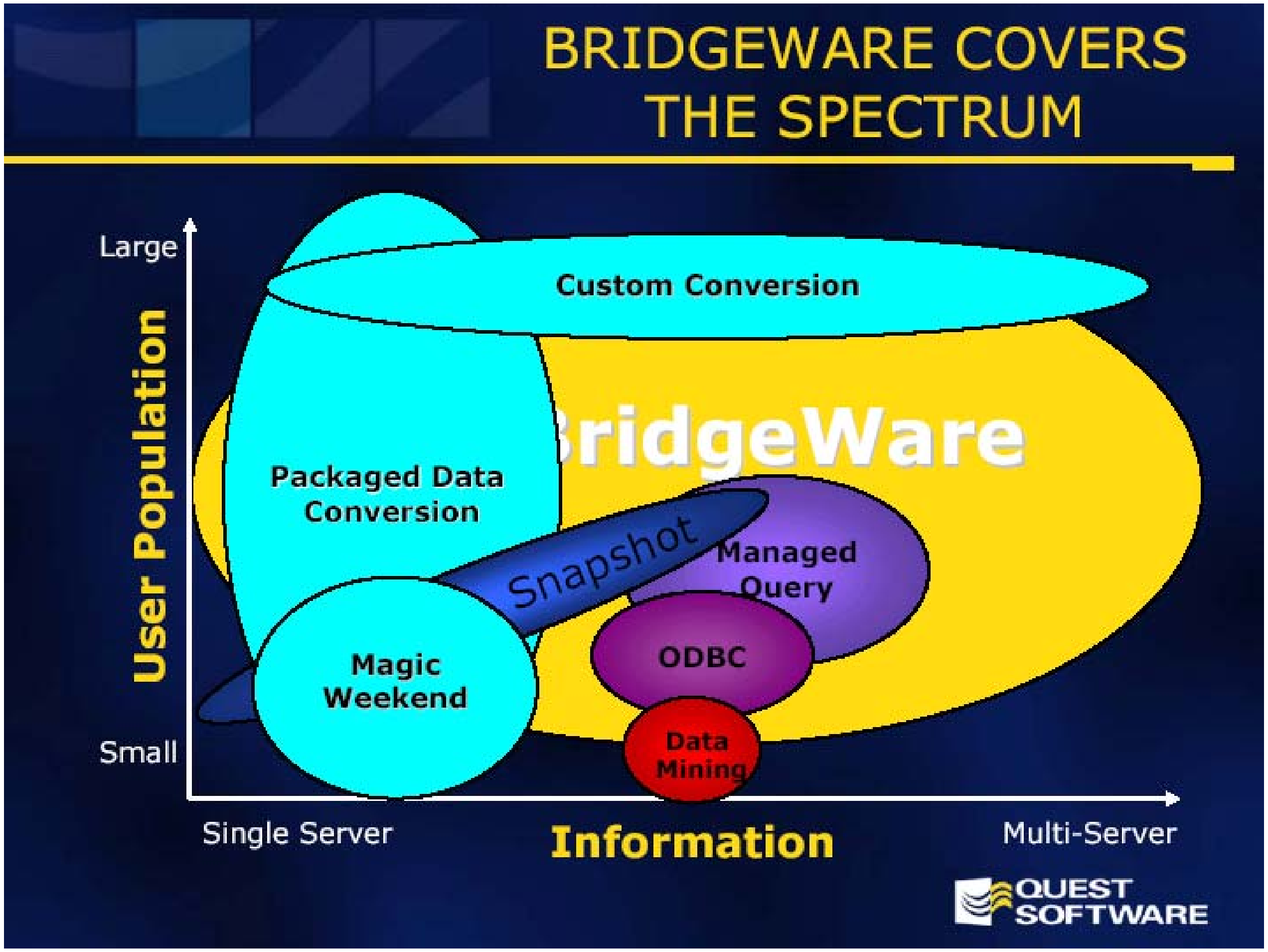
Master

- TurboIMAGE
- KSAM
- MPE
- MSG
- AllBase

- Oracle
- DB2
- SQL Server
- Informix

QUEST SOFTWARE

# Types of data transition



# Migration planning

- Features = changes
- Don’t over do it
- Ensure that new db type and structure will be compatible with the existing apps

# Migration planning

- Second phase improvements
  - Normalization
  - Views and table joins
  - Code optimization for direct SQL access
  - DateTime
  - Null items
  - Triggers

# Database Migration 101

# Implementation

# Setup new RDBMS

- The DBA issue
  - Training, hiring
  - Remote access
- Install new db on new platform
- Make minimum access and configuration adjustments
- Create test database
- Link machines on network

# Migration implementation

- Make copy of source database
- Create new db structure
  - Native RDBMS tools
  - Native Schema scripts
  - Automated tools
- Consolidate and Replicate the data
- Test the applications
- Data mirroring

# Migration implementation

- Export/Import
  - Export data to flat files
    - Endian issue
  - Build import scripts
    - Column type conversions
    - Nulls
    - Dates
    - Arrays
    - Security
  - Import data from flat files through scripts

# Migration implementation

- Database migration tools
  - GUI
  - Global changes
  - Column types conversions
  - Endien issue
  - Arrays
  - Nulls
  - Dates
  - Security
  - In-flight transformation
  - Mirroring features

# Database migration tools

- Focused products for TurboImage
  - Speedware
  - Taurus/Quest
  - GUI innovations
  - And other bridges (XenoBridge, Imaxsoft, Robelle, DISC, WRQ, VitalSoft, MB Foster, etc.)
- App migration tools that offer some level of DB migration
  - Sungard BI-Tech, Neartek, Denkart, Transoft

# Live demo

- Speedware database migrator

# DB Migrator features

- Image/KSAM/Flat to Oracle/SQL Server
- Migration instances (save, open, copy)
- Powerful Search & Replace (global and itemized)
- Speedware logical attributes kept
- Treeview / gridview
- Data type mapping Warnings/Errors mechanism
- Data copy reporting grid, time estimation engine
- Limit of records copied (Data integrity kept)
- Ability to stop a copy process
- Detachable client
- Handles arrays, nulls, dates
- Merge DBs into one target DB
- Bulk creation of rows
- Assign tablespaces
- Repository update

# Migration Implementation

- What about Omnidex and Superdex?
  - Relational Databases have strong data querying capabilities
    - However, most of the commonly-used Omnidex functionality doesn't exist. (keyword retrieval)
  - Omnidex has a migration path to Omni-Access
    - API compatibility libraries exist, reducing need to re-write queries.
  - Superdex – best option is migration to Omni-Access.

# Omnidex Migrations

- A migration tool should install Omni-Access on a migrated database
- Omni-Access is not as simple a product to implement as Omnidex

# Application adaptation

- DB access method
  - Native
  - API mappers
  - ODBC/ADO/JDBC
- JCL/CI commands, etc.
- Test programs and refine code