Using Databases With LabVIEW

LabVIEW User Group Meeting December 2007

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ALE System Integration

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- National Instruments Certified Alliance Partner
- Over 10 Years LabVIEW and Test & Automation experience
- Located in and servicing Long Island and New York City
- Expertise in NI and other instrument manufacturers' products
- All developers have National Instruments Certification
- Test & Measurement Specialties:
  - Aerospace/DoD
  - Calibration
  - Telecommunications/RF
  - ISO17025
  - Automotive
  - Sound and Vibration
  - Test Labs
  - Instrument Control

Charles Spitaleri

- Bachelor of Science in Computer Science, New York Institute of Technology
- Background in Electrical Engineering
- National Instruments Certified LabVIEW Developer
- Co-founder and Vice-President of ALE System Integration
- Worked for Underwriters Laboratories for 18 years
- 9 years LabVIEW and Test & Measurement experience
- Member of the IEEE and ACM
- Technical knowledge of Database/SQL, DAQ, SCXI, Machine Vision, Motion Control, FieldPoint, GPIB/Serial control of instruments.

About this presentation…

- An overview of databases, how they work, and how to interface them with LabVIEW
- A summary of my experiences with databases in the LabVIEW environment
- All examples:
  - Microsoft Windows XP sp2
  - Microsoft Access 2007
  - LabVIEW 8.2.1
  - Database Connectivity Toolset 1.0.1

What is a database?

TechTarget.com:

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated.

Simple definition:

Intelligent data storage object

Types of databases?

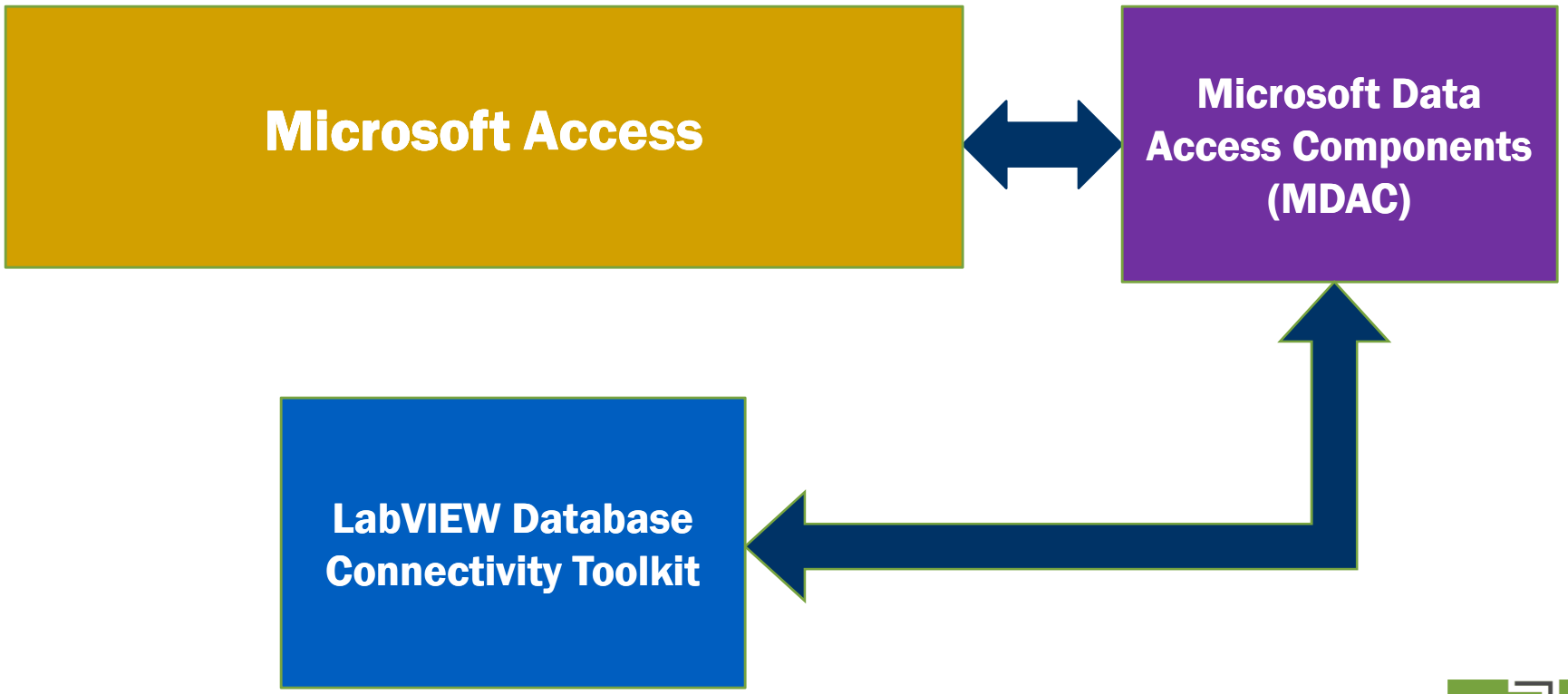
- Hierarchical
- Network
- Relational
- Object-Oriented

Who makes databases?

- Microsoft:
  - SQL Server
  - Access
- Oracle
- MySQL (open source)
- PostgreSQL (open source)
- SQL Anywhere (Sybase)
- Others…

Relational database

A look inside:



Why use a database?

- Collect data from multiple/remote systems
- Large amounts of data
- Smart data manipulation/query
- Secure storage

Why use a database? (Case 1)

- Multiple standalone part testers
- Test results collected in remote database
- Database queried via company website
- Data queried by:
  - Serial Number
  - Test system ID
  - Test Results

Why use a database? (Case 2)

- 100’s of ovens scattered over the world
- Temperatures monitored/recorded
- Temperature alarms for each oven
- Datetime stamp each reading
- Ovens queried by:
  - Location
  - Temperature
  - Time period

Setting up a database

- Create database file (*.mdb)
- Create table (name)
- Create columns:
  - Column name
  - Column data type
  - Column can be null?
  - Column is primary key?
- Create more tables/columns as necessary
- Create indexes, relationships, etc.

DONE IN ACCESS

DONE IN ODBC DATA SOURCE ADMINISTRATOR

Additional Considerations

- Keys
  - Primary
  - Secondary
  - Foreign
- Normalization
  - A formal database design technique
  - 1st Form – 5th Form
  - Boyce-Codd Form (between 3rd & 4th form)

Setting up a database

MS Access Example….

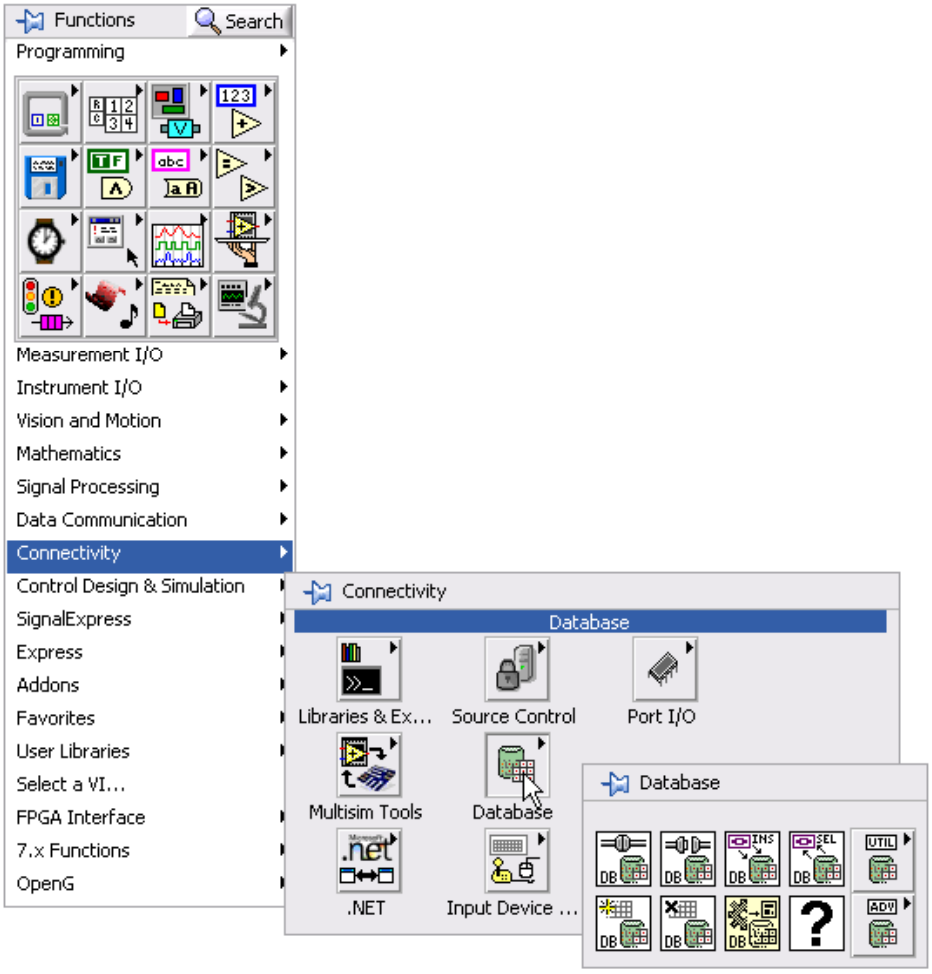
Database Connection

- Database Source Name (DSN)
  - A data structure used to describe a connection to a database.
  - ODBC Data Source Administrator
    - User DSN: available to current user only
    - System DSN: available to current system only
    - File DSN: Connection info in file (*.dsn)
- Universal Data Link (UDL)
  - A type of file that provides a common user interface for specifying connection attributes. (*.udl)

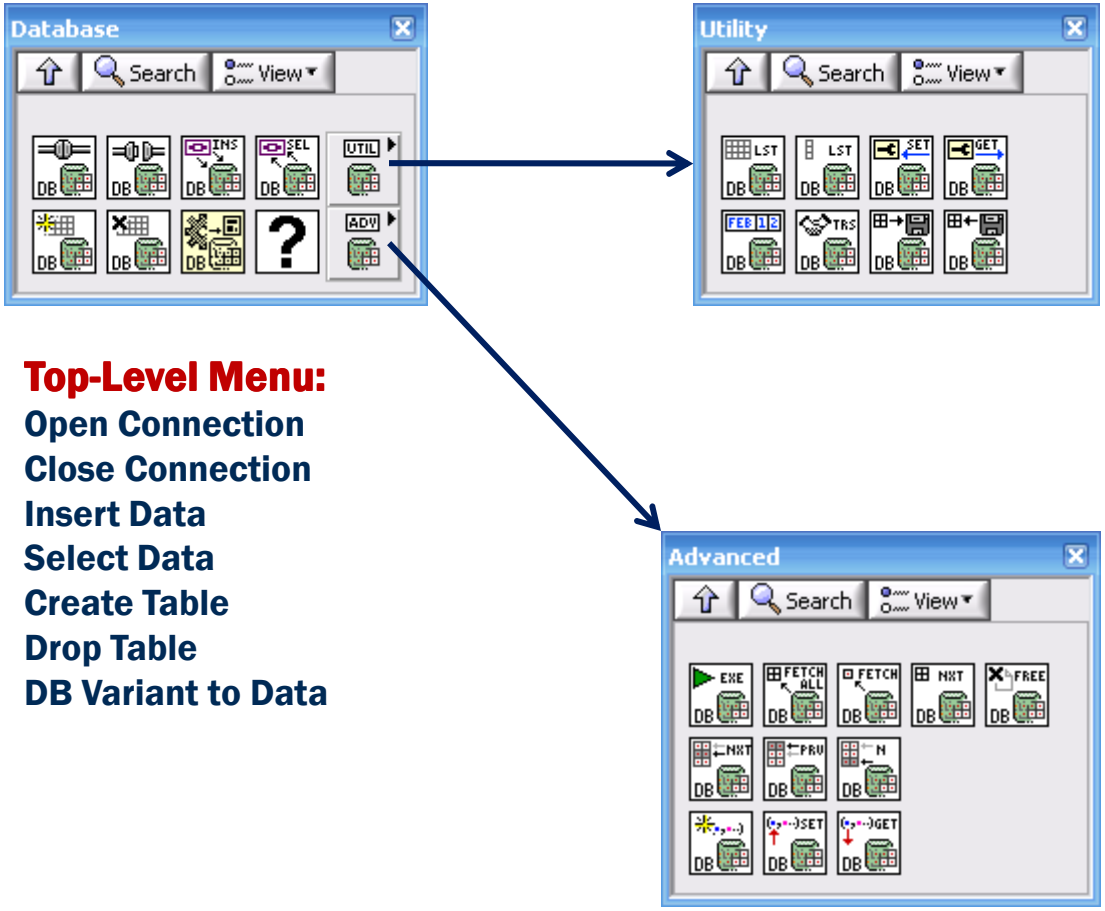
Setting up a database

ODBC Data Source Administrator Example…

Database Connectivity Toolkit



Palette Layout



Top-Level Menu:

- Open Connection
- Close Connection
- Insert Data
- Select Data
- Create Table
- Drop Table
- DB Variant to Data

Utility Menu:

- List Tables
- List Columns
- Set Properties
- Get Properties
- Format Datetime
- DB Transaction
- Save Recordset to File
- Load Recordset from File

Advanced Menu:

- Execute Query
- Fetch Recordset Data
- Fetch Element Data
- Fetch Next Recordset
- Free Object
- Move to Next Record
- Move to Previous Record
- Move to Record N
- Create Parameterized Query
- Set Parameter Value
- Get Parameter Value

LabVIEW Examples

Data Manipulation

- Insert
- Update
- Delete
- Retrieve data
- Retrieve data conditionally

LabVIEW Examples

Data Definition

- Create Table
- Drop Table
- List tables in database
- List columns in table

SQL

- **S**tructured **Q**uery **L**anguage
- ANSI Standard computer language**
- Primary way of interfacing with a database
- SQL parts:
  - Data Manipulation Language (DML)
    - Aggregate functions
  - Data Definition Language (DDL)

SQL: Data Manipulation

DML affects the data within the database

- Insert/Delete/Update Data
- Query (get) data
- Query data conditionally
- Aggregate Functions:
  - Sum
  - Avg
  - Max
  - Min

SQL: Data Definition

DDL affects the database structure

- Create/Drop/Alter Table
- Create/Drop View
- Create/Drop Index
- Create/Drop Users

SQL Examples

LabVIEW executable w/database

- MDAC = Microsoft Data Access Components
  - ActiveX Data Objects (ADO)
  - Object Linking & Embedding Database (OLE DB)
  - Open Database Connectivity (ODBC)

- **Knowledgebase article**: 3YR8K3G2 Building an Executable with LabVIEW 8.x and Database Connectivity Toolset

References

- **Database Design for Mere Mortals**
  by Michael J. Hernandez; ISBN: 0-201-69471-9

- **LabVIEW Examples**:
  LabVIEW -> Help -> Find Examples -> Toolkits & Modules -> Database Connectivity

- **Wikipedia:**
  http://www.wikipedia.org/

- **LabVIEW Help:**
  LabVIEW -> Help -> Database Toolset Help and Examples…

- **ALE System Integration website**:
  http://www.aleconsultants.com

- **NI LabVIEW Database Connectivity Toolset User Manual**:
  http://www.ni.com/pdf/manuals/321525c.pdf