ALE System Integration

http://www.aleconsultants.com – info@aleconsultants.com

- 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:

Microsoft Access

Microsoft Data Access Components (MDAC)

LabVIEW Database Connectivity Toolkit
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 database connection
  - ACCESS
  - ODBC DATA SOURCE ADMINISTRATOR

DONE
IN
ACCESS
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

- Structured Query Language
- 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**

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

- **Wikipedia:**

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

- **ALE System Integration website:**
  [http://www.aleconsultants.com](http://www.aleconsultants.com)

- **NI LabVIEW Database Connectivity Toolset User Manual:**