SimAuto Overview

- SimAuto is a COM automation server that allows Simulator to be controlled from an external application

Possible Applications

- Use Visual Basic for Applications to load generator cost data and unit commitment from Access or SQL, solve the OPF, and write solutions back to the database
- Use MATLAB to calculate generator parameters over time and solve a sequence of instantaneous power flows in Simulator

Using SimAuto

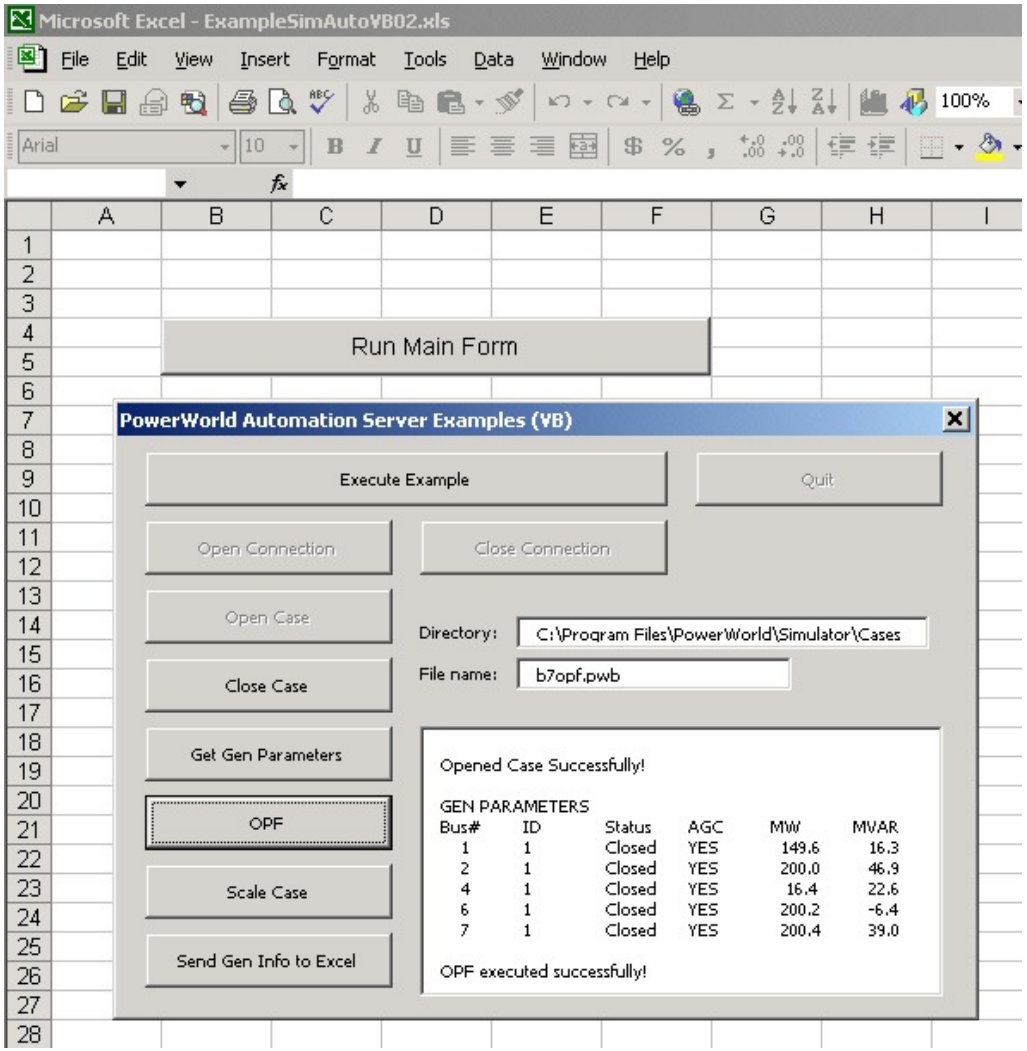
- Reference the Simulator Type Library in your programming environment
- Connect to the Automation Server
- Interface with Simulator using SimAuto Functions

ChangeParameters
ChangeParametersSingleElement
ChangeParametersMultipleElement
ChangeParametersMultipleElementFlatInput
CloseCase
GetParametersSingleElement
GetParametersMultipleElement
GetParametersMultipleElementFlatOutput
ListOfDevices
ListOfDevicesAsVariantStrings
ListOfDevicesFlatOutput
OpenCase
ProcessAuxFile
RunScriptCommand
GetFieldList
SaveState
LoadState
SaveCase
SendToExcel
WriteAuxFile

Visual Basic OPF Demonstration

- Excel VBA application allows user to performs several operations in any order
  - Solve OPF
  - Scale case
  - Write generator records to Excel
- Open Excel file *ExampleSimAutoVB02.xls* and select **Enable Macros** if prompted (code will not function if Excel settings do not allow the use of macros)
- Open Simulator
- Click **Run Main Form** button, then **Open Connection**, then **Open Case** to activate the other options

Visual Basic OPF Demonstration



SimAuto Tips

- This example and others may be downloaded from the PowerWorld website
- Code for examples may be accessed in Excel by selecting the Design Mode and Visual Basic Editor from the Visual Basic toolbar
- Simulator commands are identical to those used in SCRIPT language

SimAuto Tips

- Simulator objects and data fields are accessed as they are in DATA sections of script files
  - Reference object types with identical syntax

SimAuto Functions

- ChangeParametersSingleElement(ObjectType, ParamList, Values)
  - ObjectType : String
    - The type of object for which parameters are being changed, e.g. “BUS”.
  - ParamList : Variant
    - A variant array storing strings that are Simulator object field variables, e.g. “BusNum”.
    - Must contain the key fields for the objecttype.
  - Values : Variant
    - A variant array storing variants (integer, string, single, etc.) that are the values for each of the fields in the ParamList.
  - Output
    - Returns any errors in the first element, i.e. Output(0)

SimAuto Functions

- ChangeParametersMultipleElement(ObjectType, ParamList, ValueList)
  - ObjectType : String
    - The type of object for which parameters are being changed, e.g. “BUS”.
  - ParamList : Variant
    - A variant array storing strings that are Simulator object field variables, e.g. “BusNum”.
    - Must contain the key fields for the objecttype.
  - ValueList : Variant
    - A variant array storing arrays of variants.
    - Create variant arrays (one for each element being changed) with values corresponding to the fields in ParamList. Insert each of these variant arrays into ValueList.
  - Output
    - Returns any errors in the first element, i.e. Output(0)

SimAuto Functions

- ChangeParametersMultipleElement – Sample VBA Code

```
Dim ValueList(1), ParamList as Variant
Dim Output as Variant

ParamList = Array(“BusNum”, “AreaName”)
ValueList(0) = Array(1,”Right”)
ValueList(1) = Array(2,”Left”)
Output = SimAuto.ChangeParametersMultipleElement(“BUS”,
                                        ParamList,ValueList)
```

SimAuto Functions

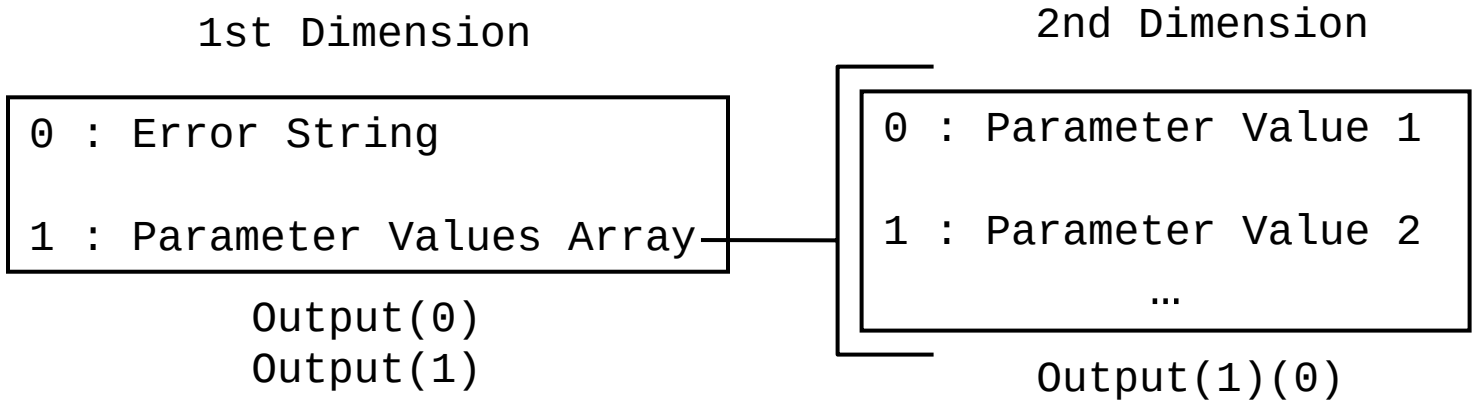
- ChangeParametersMultipleElementFlatInput(ObjectType,ParamList, NoOfObjects,ValueList)
  - ObjectType : String
    - Type of object for which parameters are being changed
  - ParamList : Variant
    - A variant array storing strings that are Simulator object field variables, e.g. “BusNum”.
    - Must contain the key fields for the object type.
  - NoOfObjects : Integer
    - Number of devices for which values are being passed
  - ValueList : Variant
    - Single-dimensional variant array storing a list of variants (integer, single, string, etc.) representing the values corresponding to ParamList for all devices being changed
    - All parameters for the first object are listed first followed by all of the parameters for the second object, etc.
      - ValueList = Array(Obj1Param1, Obj1Param2, …Obj1ParamM, Obj2Param1, Obj2Param2, … Obj2ParamM, Obj3Param1, …ObjNParam1, …ObjNParamM)
  - Output
    - Returns any errors in the first element, i.e. Output(0)

SimAuto Functions

- GetParametersSingleElement(ObjectType, ParamList, Values)
  - ObjectType : String
    - The type of object for which parameters are being retrieved, e.g. “BUS”.
  - ParamList : Variant
    - A variant array storing strings that are Simulator object field variables, e.g. “BusNum”.
    - Must contain the key fields for the object type.
  - Values : Variant
    - A variant array storing variants (integer, string, single, etc.) that are the values for each of the fields in the ParamList.
    - Values must be passed in for the key fields
    - Values other than key fields should be set to zero

SimAuto Functions

- GetParametersSingleElement Output
  - First element contains any errors
  - Second element is a one dimensional array containing values corresponding to fields specified in ParamList



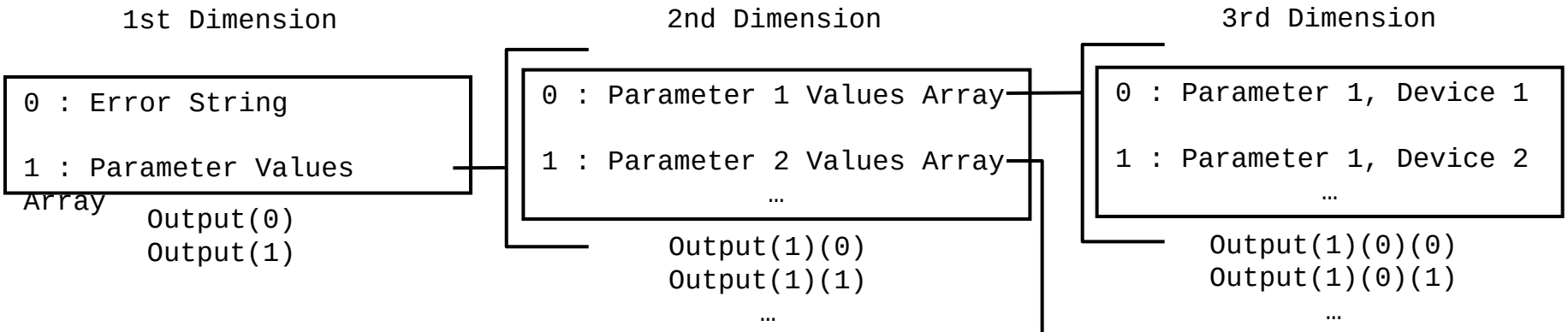
Example
Use B7Flat.pwb to get generator MW at bus 1
Output=GetParametersSingleElement
  (“BUS”,Array(“BusNum”,”BusGenMW”),Array(1,0))
Output(0) => error message string
Output(1)(0) => 1 => bus number for bus 1
Output(1)(1) => 101.85 => generator MW for bus 1

SimAuto Functions

- GetParametersMultipleElement(ObjectType, ParamList, FilterName)
  - ObjectType : String
    - The type of object for which parameters are being retrieved, e.g. “BUS”.
  - ParamList : Variant
    - A variant array storing strings that are Simulator object field variables, e.g. “BusNum”.
    - Must contain the key fields for the object type.
  - FilterName : String
    - Name of a pre-defined advanced filter that will limit the objects returned.
    - Pass an empty string to return all objects of the specified type.
  - Output
    - Set of nested arrays containing the parameter values for the device type requested
    - Number of arrays returned depends on the number of fields in ParamList

SimAuto Functions

- GetParametersMultipleElement Output



Example
Use B7Flat.pwb to get generator MW at each bus
Output=GetParametersMultipleElement
("BUS",Array("BusNum","BusGenMW"),"")
Output(0) => error message string
Output(1)(0) => array of bus numbers
Output(1)(1) => array of generator MW values
Output(1)(0)(0) => 1 => bus number for the first bus
Output(1)(0)(1) => 2 => bus number for the second bus
Output(1)(1)(0) => 101.85 => gen MW for the first bus
Output(1)(1)(1) => 170.08 => gen MW for the second bus

SimAuto Functions

- GetParametersMultipleElementFlatOutput (ObjectType,ParamList,FilterName)
  - Inputs are handled in the same manner as GetParametersMultipleElement
  - Output
    - Single-dimensional array instead of nested arrays
    - Array(errorstring, NumberOfObjectsReturned, NumberOfFieldsPerObject, Ob1Fld1, Ob1Fld2, …, Ob(n)Fld(m-1), Ob(n)Fld(m))

SimAuto Functions

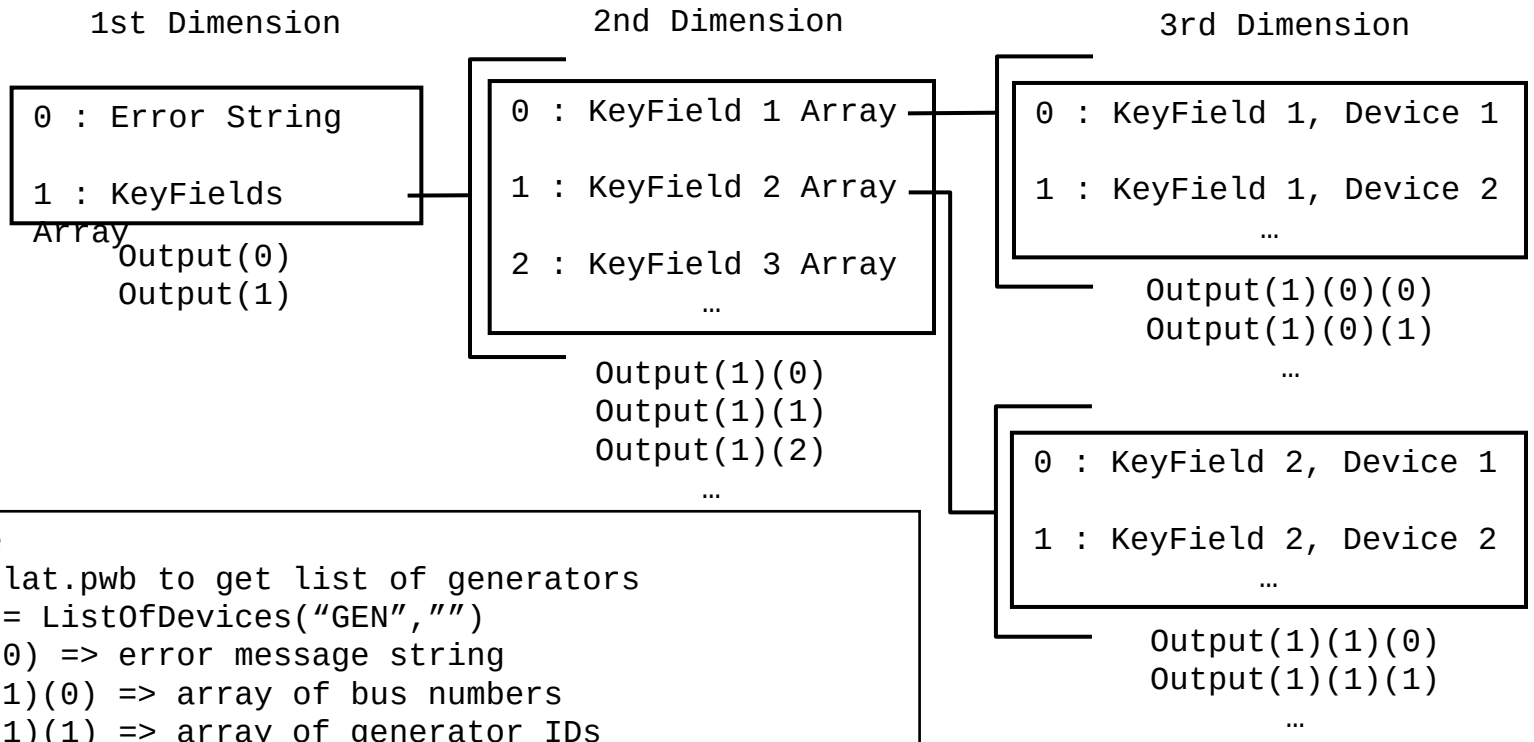
- GetFieldList(ObjectType)
  - Returns all fields associated with a given object type.
  - ObjectType : String
    - Type of object for which fields are requested, e.g. “BUS”.
  - Output
    - First element is the error string
    - Second element is an n x 4 array of fields
      - Similar to information obtained from **Export Case Object Fields…**
      - (n,0) specifies the key and required fields
        - » Key - *1*,*2*, etc.
        - » Secondary Key – *A*, *B*, etc.
        - » Required – **
      - (n,1) variablename of the field
      - (n,2) type of data stored in the field (integer, string, real)
      - (n,3) field description

SimAuto Functions

- ListOfDevices(ObjectType,FilterName)
  - ObjectType : String
    - Type of object for which devices are being acquired.
  - FilterName : String
    - Name of a pre-defined advanced filter that will limit the objects returned.
    - Pass an empty string to return all objects of the specified type.
  - Output
    - Set of nested arrays containing the key field values for the type of object requested.
    - Number of arrays returned depends on the object type selected.
    - Values in the arrays are strongly typed, i.e. bus numbers are returned as long integers instead of as a variant
      - Use ListOfDevicesAsVariantStrings to return values as variants

SimAuto Functions

- ListOfDevices Output



Example
Use B7Flat.pwb to get list of generators
Output = ListOfDevices("GEN","")
Output(0) => error message string
Output(1)(0) => array of bus numbers
Output(1)(1) => array of generator IDs
Output(1)(0)(0) => 1 => bus number for the first gen
Output(1)(0)(1) => 2 => bus number for the second gen
Output(1)(1)(0) => "1" => gen ID for the first gen
Output(1)(1)(1) => "1" => gen ID for the second gen

SimAuto Functions

- ListOfDevicesFlatOutput(ObjectType, FilterName)
  - Inputs same as ListOfDevices
  - Output
    - Single-dimensional array of variants
    - Array(errorString, NumberOfObjectsReturned, NumberOfFieldsPerObject, Ob1Fld1, Ob1Fld2,…, Ob(n)Fld(m-1), Ob(n), Fld(m))