Optimizing Modular Test Automation

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- Introduction
- Background on test automation approaches
- What is a modular test automation approach
- The advantages of a modular test automation approach
- The pitfalls of a modular test automation approach
- How to enhance the modular test automation approach
- Conclusion

Background test automation approaches

- Record/Playback
- Data-Driven
- Modular
- Keyword
- Database

What is a modular test automation approach?

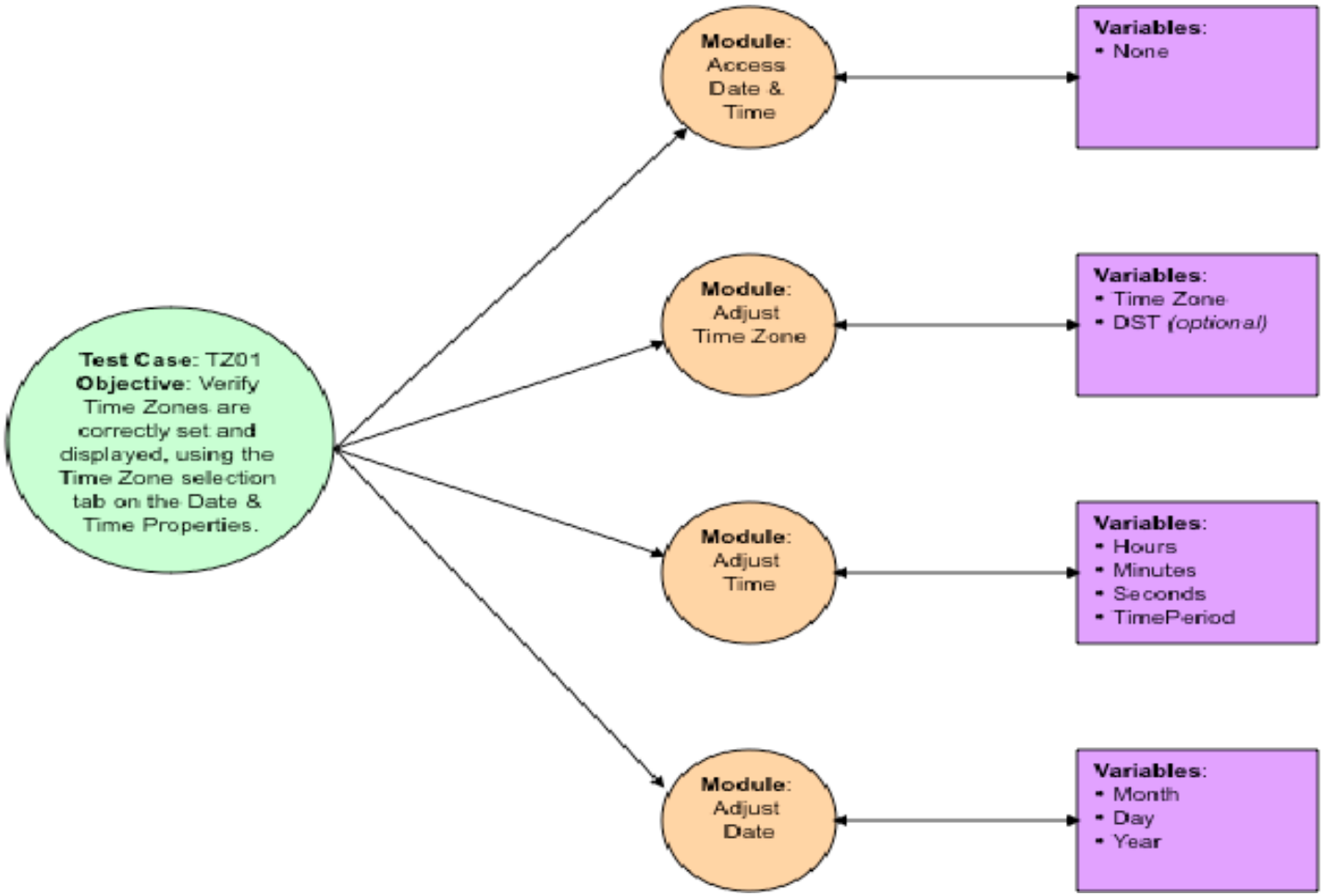
A modular test automation approach decomposes the application under test into functions or modules. The functions or modules are linked together to form automated test cases.

This approach is modeled after development approaches such as functions, classes, or web services.

Core Components of Modular Test Automation

- Automated Modules
- Object Map/Repository
- Data Files
- Automated Test Cases

Modular Test Automation Example

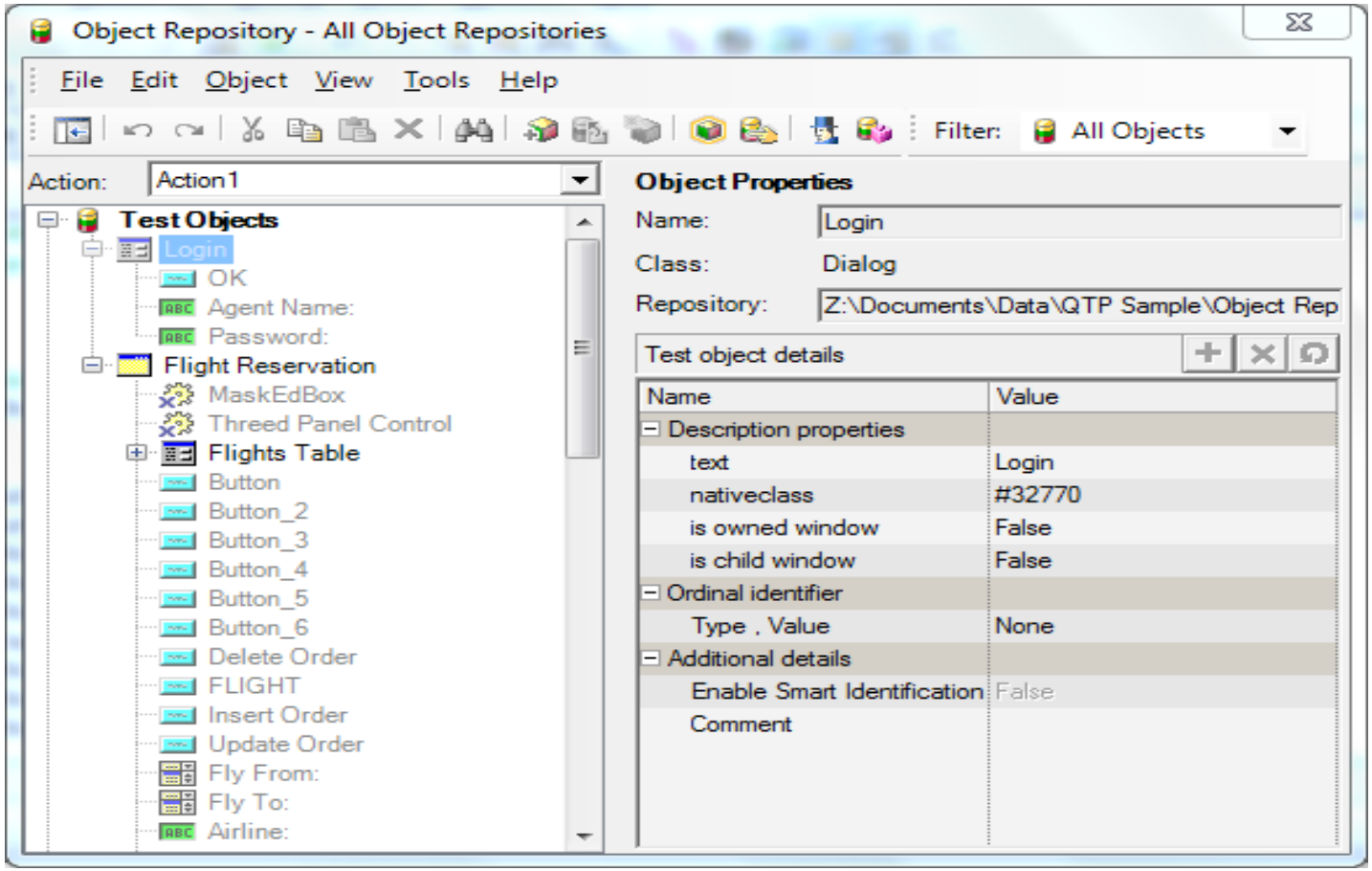


Automated Modules

```
1:  'Test Name: Login Module
2:  'Description: This module will invoke the Flight Application and input the user  name and password
3:  'Author: David Dang
4:  'Date: 1/28/2010
5:
6:  'Invoke Flight Application
7:  SystemUtil.Run "C:\Program Files\HP\QuickTest Professional\samples\flight\app\flight4a.exe"
8:
9:  'Login into Flight Application
10: Dialog("Login").WinEdit("Agent Name:").Set datatable("Agent_Name",dtLocalSheet)
11: Dialog("Login").WinEdit("Password:").SetSecure datatable("Password",dtLocalSheet)
12: Dialog("Login").WinButton("OK").Click
13:
```

```
1:  'Test Name: New Reservation Module
2:  'Description: This module will input the information needed to create a new reservation
3:  'Author: David Dang
4:  'Date: 1/28/2010
5:
6:  'Set initial condition for this module, click on new order button
7:  Window("Flight Reservation").WinButton("Button_5").Click
8:
9:  'Input data for new reservation
10: Window("Flight Reservation").ActiveX("MaskEdBox").Click 0,6
11: Window("Flight Reservation").ActiveX("MaskEdBox").Type DataTable("Date_of_Flight",dtLocalSheet)
12: Window("Flight Reservation").WinComboBox("Fly From:").Select DataTable("Fly_From",dtLocalSheet)
13: Window("Flight Reservation").WinComboBox("Fly To:").Select DataTable("Fly_To",dtLocalSheet)
14: Window("Flight Reservation").WinButton("FLIGHT").Click
15: Window("Flight Reservation").Dialog("Flights Table").WinButton("OK").Click
16: Window("Flight Reservation").WinEdit("Name:").Set DataTable("Passenger_Name",dtLocalSheet)
17: Window("Flight Reservation").WinRadioButton("First").Set
18: Window("Flight Reservation").WinButton("Insert Order").Click
```

Object Map/Repository



Data File

Data Table

D5

	Agent_Name	Password	C	D
1	David	4b67315be601f6735511fe74b439e9fda9839c87		
2				
3				
4				
5				
6				
7				
8				

Global A

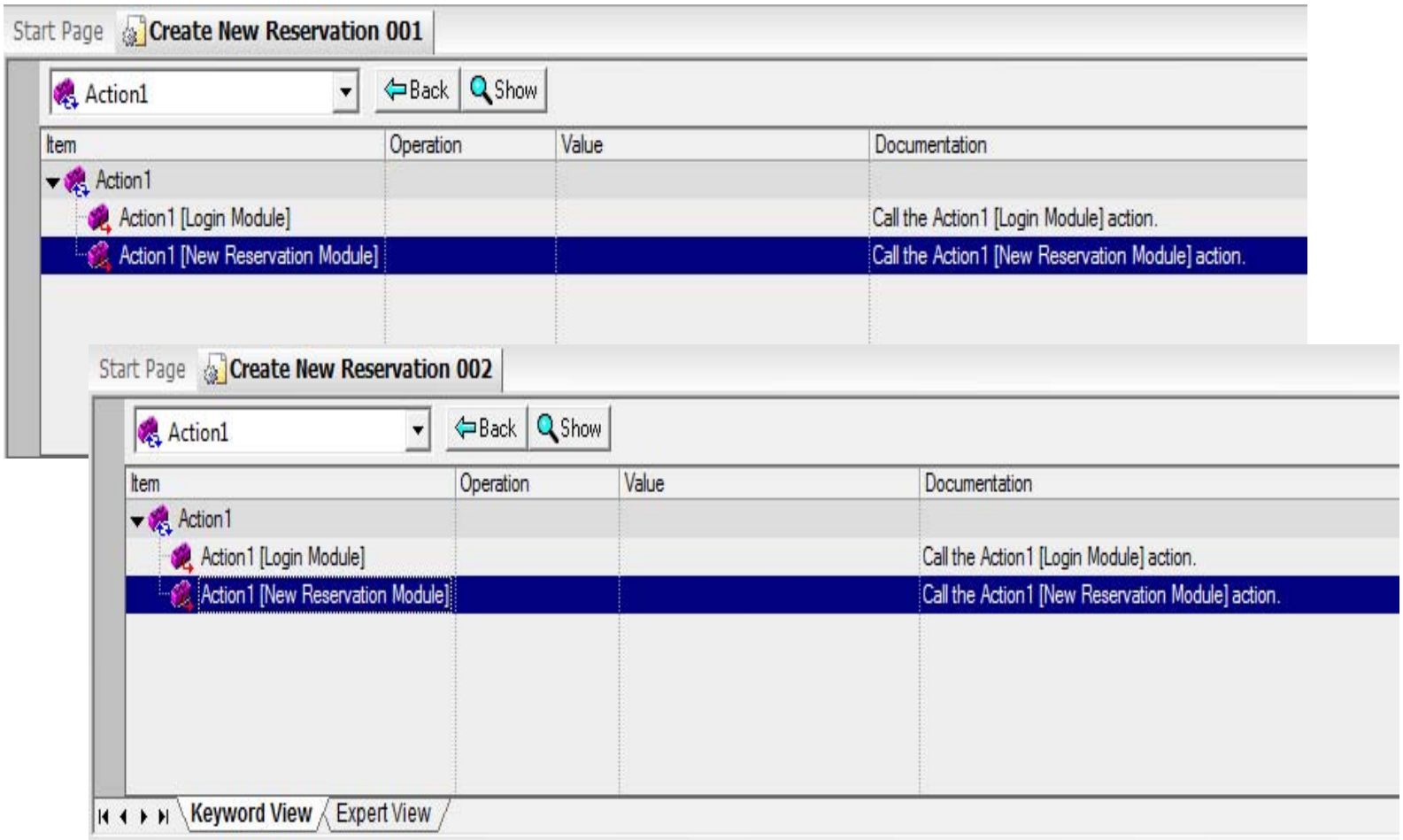
Data Table

D2

	Date_of_Flight	Fly_From	Fly_To	Passenger_Name	E	F
1	123010	London	Denver	David		
2						
3						
4						
5						
6						
7						
8						

Global Action1 Action1 [Login Module] Action1 [New Reservation Module]

Automated Test Case



When to use a modular test automation approach

- Application under test (AUT) has well defined functionality
- Business objective (end-to-end) test cases that test business rules and data variations
- Over 100 targeted test cases
- Test automation engineers with programming background
- Less than 200 automated modules to cover AUT
- QA team has control over test environment and test data refresh

When not to use modular test automation approach

- AUT is still under new development
- Test cases that verify:
  - Single functionality
  - Application layout or objects
  - Back-end functionality (file feed or DB verification)
- Requires over 200 automated modules
- Test automation engineers with limited programming background

The advantage of a modular test automation approach

- Mirrors most development processes
  - Development
    - Functionality is separated using functions, procedures, web services, classes, etc…
    - Functionality is called to create application
    - Data abstraction is used to pass data in and out of the application
    - Coding processes and standards are established

The advantage of a modular test automation approach

- Mirrors most development processes (cont'd)
  - Test Automation
    - Functionality is separated into modules
    - Modules are linked together to form automated test cases
    - Data abstraction is used to pass input test data
    - Scripting processes and standards are established

- The advantage of a modular test automation approach
  - Encourages Reusability
    - Automation modules can be used by multiple automated test cases
    - Functionality is not duplicated in multiple automated test cases
    - Test objects are shared across automated test cases
    - Data are separated from the automated modules
    - Separation between automation developer and automation user

- The advantage of a modular test automation approach
  - Reduced Maintenance
    - Single point of maintenance for:
      - Modules
      - Objects
      - Data
    - Most changes are made in the module or object map/repository and not in the automated test cases
    - Automated test cases act as “dummy” tests
    - Automation developers are responsible for modules and objects change
    - Business testers are responsible for data

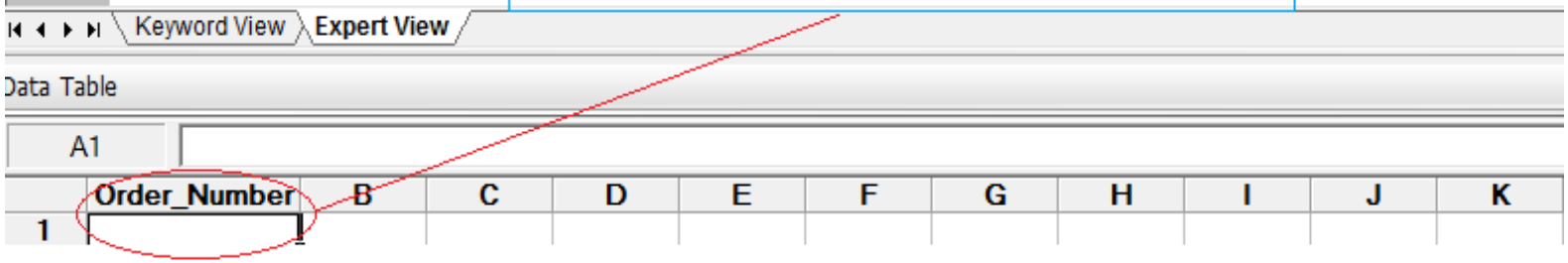
- The pitfalls of a modular test automation approach
  - Data Constraints
    - Passing data between modules
    - Date sensitivity
    - Unique data

Data constraint

- Passing data between modules

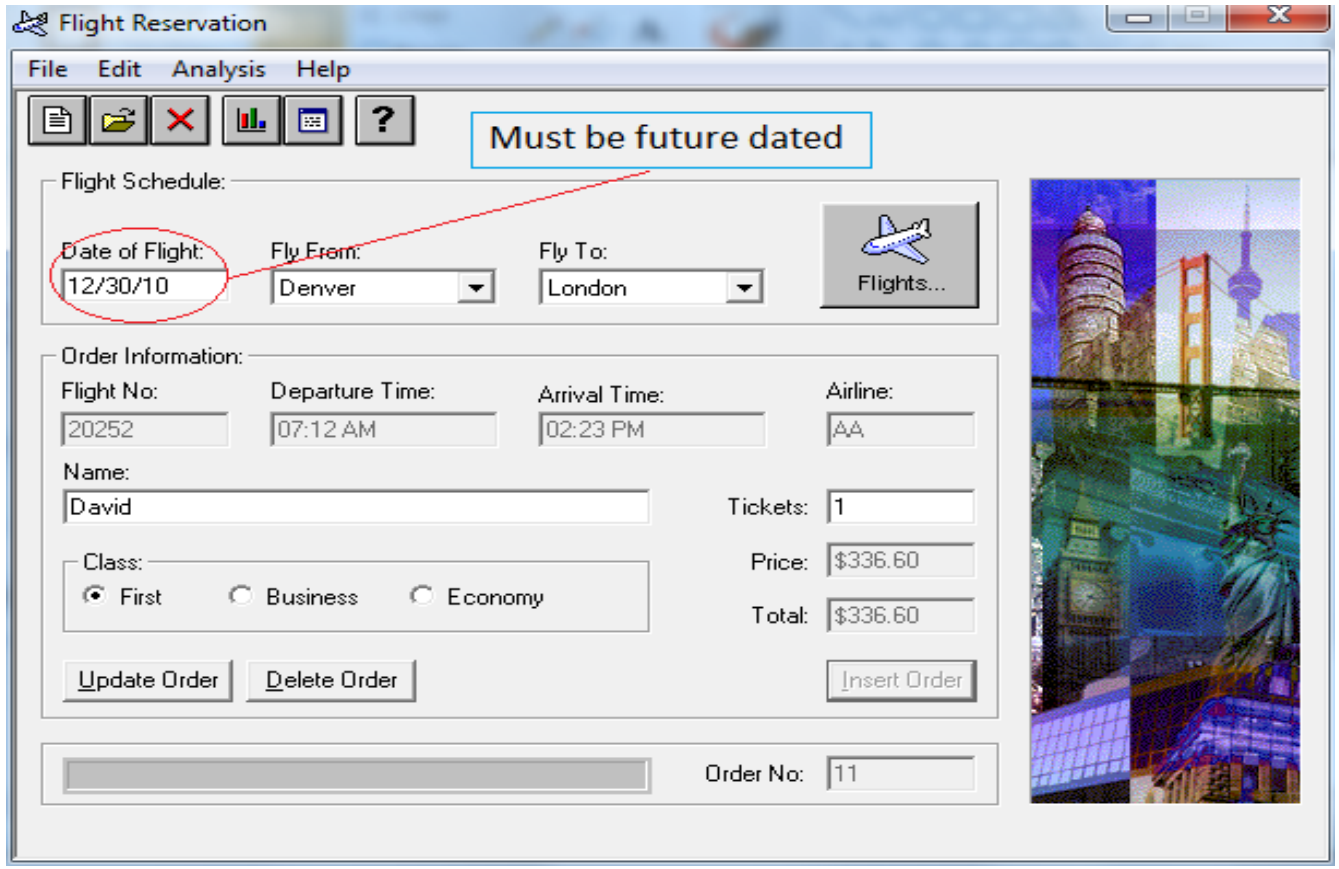
```
1:  'Test Name: Open Flight Reservation
2:  'Description: This module will use the order number to open an existing flight reservation.
3:  'Author: David Dang
4:  'Date: 2/1/2010
5:
6:  'Input order number to open an existing flight reservation
7:  Window("Flight Reservation").WinMenu("Menu").Select "File;Open Order..."
8:  Window("Flight Reservation").Dialog("Open Order").WinCheckBox("Order No.").Set "ON"
9:  Window("Flight Reservation").Dialog("Open Order").WinEdit("Edit").Set DataTable("Order_Number",dtLocalSheet)
10: Window("Flight Reservation").Dialog("Open Order").WinButton("OK").Click
```

Need order numer from New Reservation Module



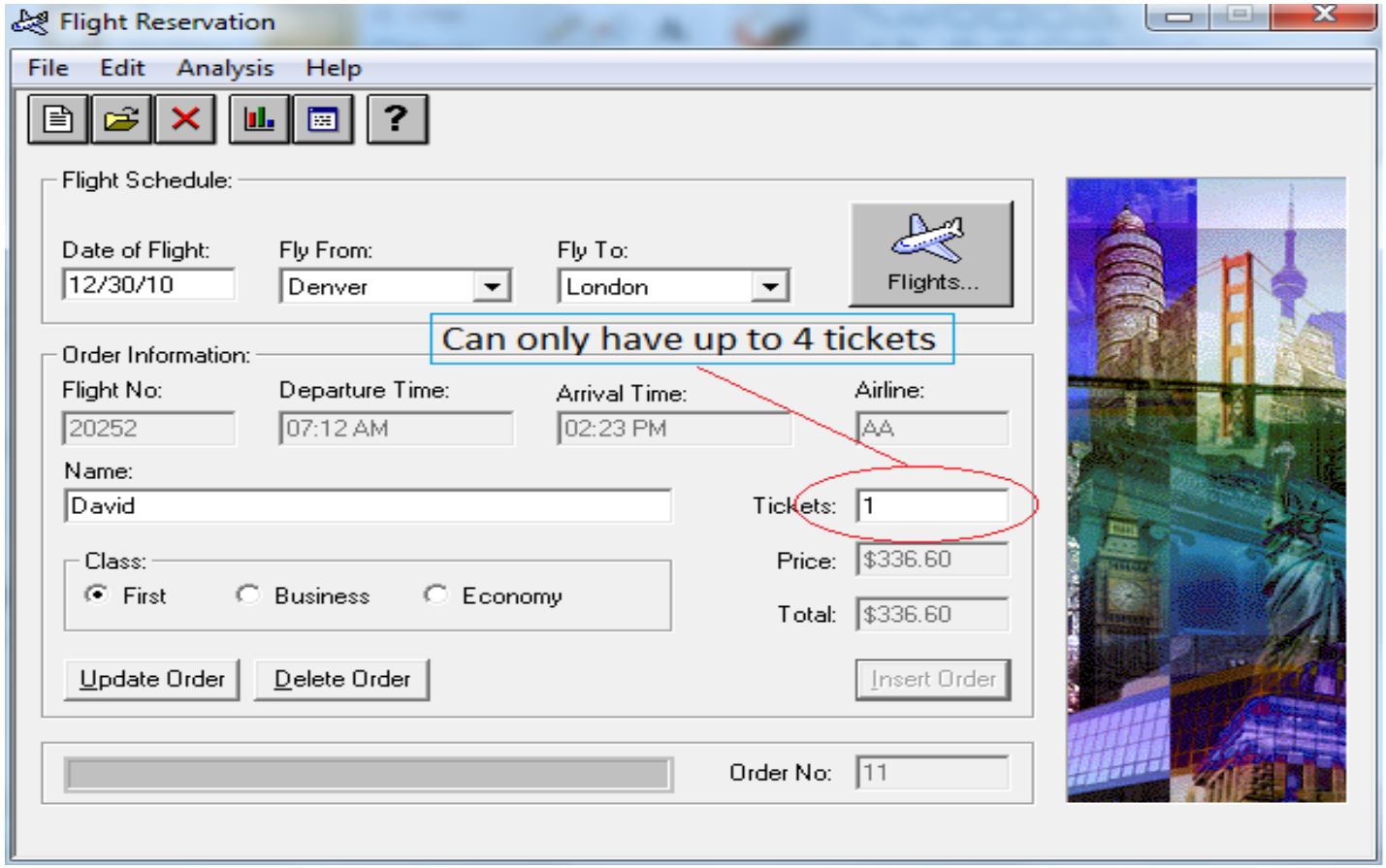
Data constraint

- Date Sensitivity



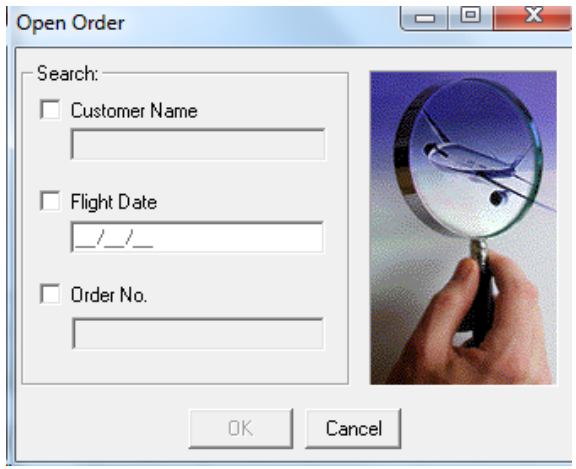
Data constraint

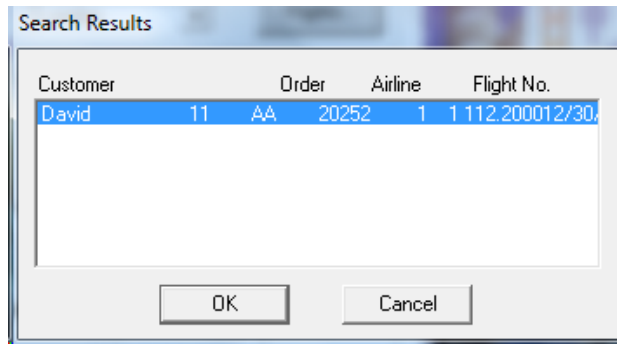
- Unique Data



The pitfalls of a modular test automation approach

- Not Flexible
  - Accommodate multiple functionalities within a single module
  - Application branching
  - Data targeted functionality





Not flexible (cont'd)

```
1:  'Test Name: Open Order by Order Number
2:  'Description: This module will use the order number to open an existing flight reservation.
3:  'Author: David Dang
4:  'Date: 2/1/2010
5:
6:  'Input order number to open an existing flight reservation
7:  Window("Flight Reservation").WinMenu("Menu").Select "File;Open Order..."
8:  Window("Flight Reservation").Dialog("Open Order").WinCheckBox("Order No.").Set "ON"
9:  Window("Flight Reservation").Dialog("Open Order").WinEdit("Edit").Set DataTable("Order_Number",dtLocalSheet)
10: Window("Flight Reservation").Dialog("Open Order").WinButton("OK").Click
```

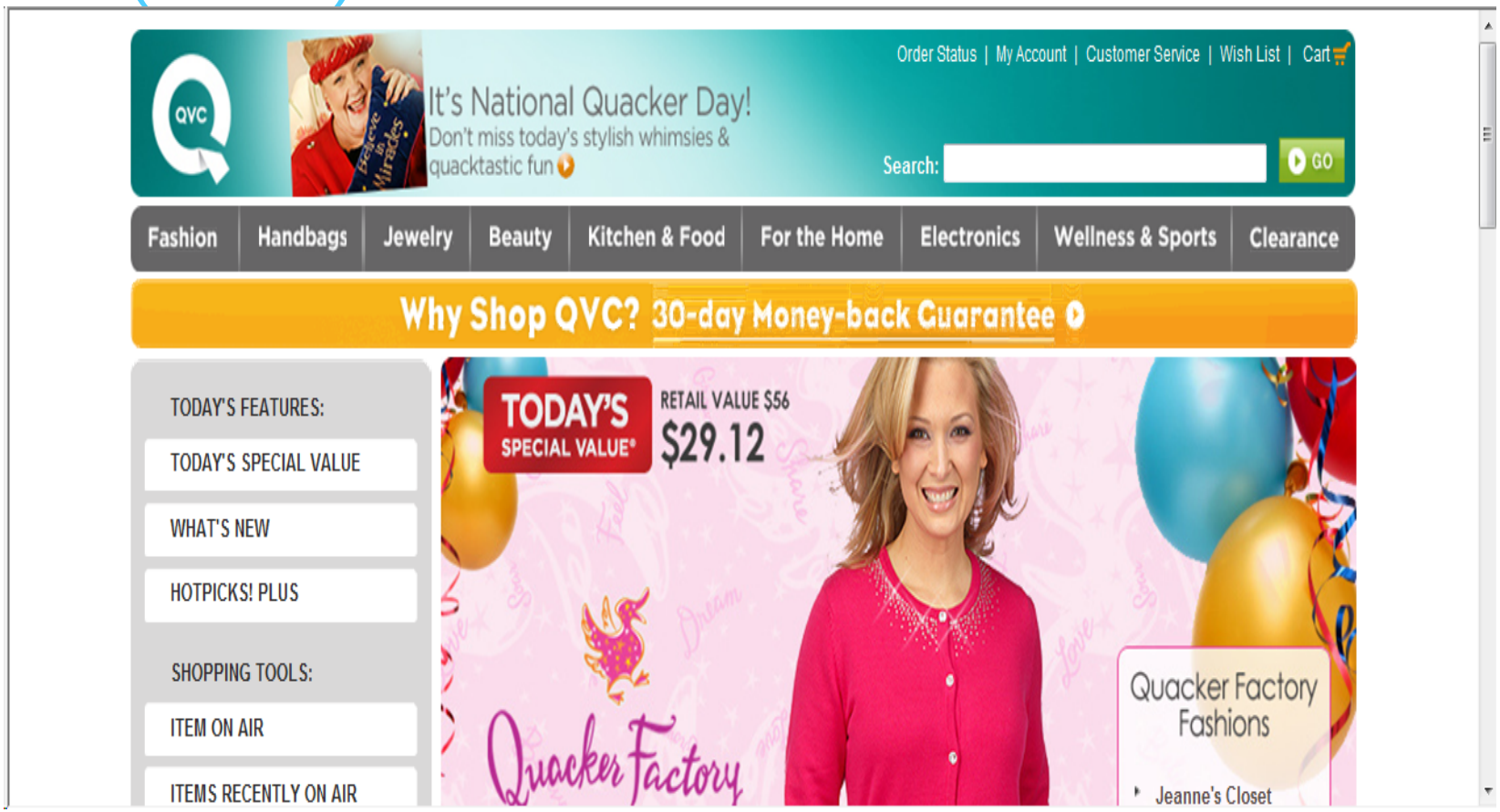
```
1:  'Test Name: Open Order by Name
2:  'Description: This module will use the name to open an existing flight reservation.
3:  'Author: David Dang
4:  'Date: 2/1/2010
5:
6:  'Input  name to open an existing flight reservation
7:  Window("Flight Reservation").WinMenu("Menu").Select "File;Open Order..."
8:
9:  Window("Flight Reservation").Dialog("Open Order").WinCheckBox("Customer Name").Set "ON"
10: Window("Flight Reservation").Dialog("Open Order").WinEdit("Edit_2").Set DataTable("Customer_Name",dtLocalSheet)
11: Window("Flight Reservation").Dialog("Open Order").WinButton("OK").Click
12: Window("Flight Reservation").Dialog("Open Order").Dialog("Search Results").WinButton("OK").Click
```

```
1:  'Test Name: Open Order by Name and Date
2:  'Description: This module will use the name to open an existing flight reservation.
3:  'Author: David Dang
4:  'Date: 2/1/2010
5:
6:  'Input  name and date to open an existing flight reservation
7:  Window("Flight Reservation").WinMenu("Menu").Select "File;Open Order..."
8:
9:  Window("Flight Reservation").Dialog("Open Order").WinCheckBox("Customer Name").Set "ON"
10: Window("Flight Reservation").Dialog("Open Order").WinEdit("Edit_2").Set DataTable("Customer_Name",dtLocalSheet)
11: Window("Flight Reservation").Dialog("Open Order").WinCheckBox("Flight Date").Set "ON"
12: Window("Flight Reservation").Dialog("Open Order").ActiveX("MaskEdBox").Type DataTable("Date_of_Flight",dtLocalSheet)
13: Window("Flight Reservation").Dialog("Open Order").WinButton("OK").Click
14: Window("Flight Reservation").Dialog("Open Order").Dialog("Search Results").WinButton("OK").Click
```

The pitfalls of a modular test automation approach

- Not Easy to Logically Break Down Modules
  - Most applications have complex functionality
  - Dynamic sections within application that can change from day-to-day
  - Sections that get repeated on every window or page

Not easy to logically break down modules (cont'd)

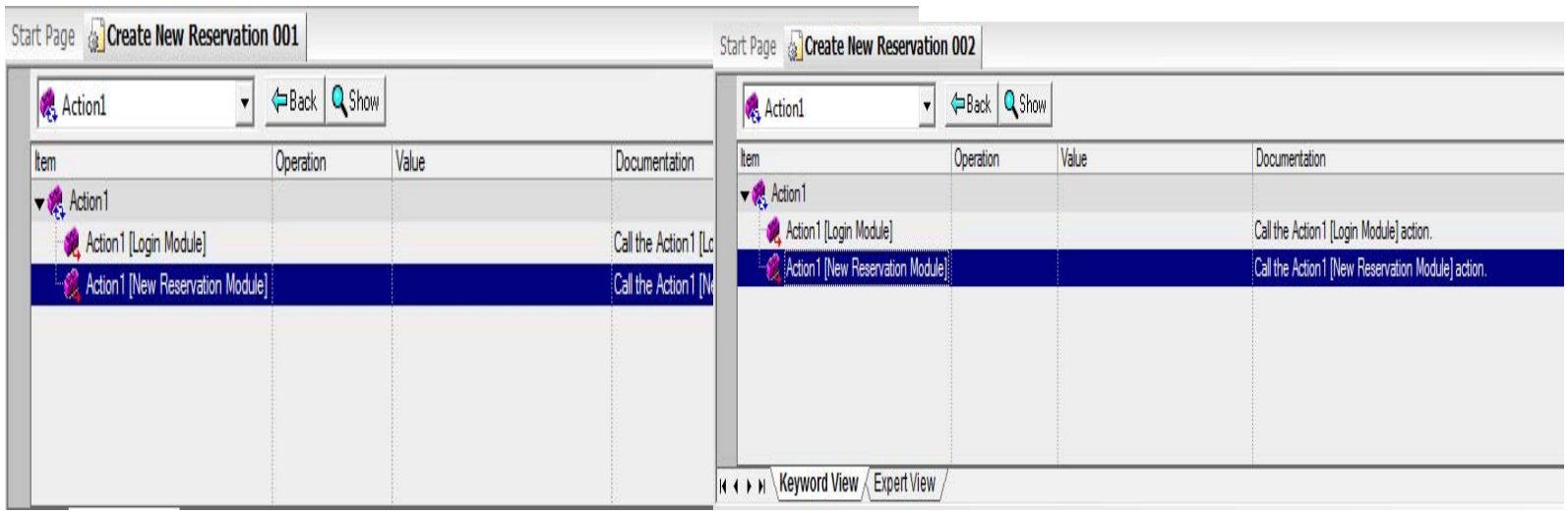


The pitfalls of a modular test automation approach

- Verification Overlapping
  - Verify everything within a module
  - Verify nothing within a module
  - Create separate module just for verification

Verification Overlapping

```
10:  Window("Flight Reservation").ActiveX("MaskEdBox").Click 0,6
11:  Window("Flight Reservation").ActiveX("MaskEdBox").Type DataTable("Date_of_Flight",dtLocalSheet)
12:
13:  'Verify Date of Flight
14:  vDateOfFlight = Window("Flight Reservation").ActiveX("MaskEdBox").GetROProperty ("Text")
15:  If vDateOfFlight = DataTable("Date_of_Flight",dtLocalSheet) Then
16:     Reporter.ReportEvent micPass,"Verify Date of Flight", "The displayed date of flight is correct. The value is " &vDateOfFlight& "."
17:  Else
18:     Reporter.ReportEvent micFail,"Verify Date of Flight", "The displayed date of flight is incorrect. The expected value is " &DataTable("Date_of_Flight",dtLocalSheet)& " and the actual value is "&vDateOfF
19:  End If
20:
21:  Window("Flight Reservation").WinComboBox("Fly From:").Select DataTable("Fly_From",dtLocalSheet)
22:
23:  'Verify fly from
24:  vFlyFrom = Window("Flight Reservation").WinComboBox("Fly From:").GetROProperty ("Value")
25:  If vFlyFrom = DataTable("Fly_From",dtLocalSheet) Then
26:     Reporter.ReportEvent micPass,"Verify Fly From", "The displayed fly from is correct. The value is " &vFlyFrom& "."
27:  Else
28:     Reporter.ReportEvent micFail,"Verify Fly From", "The displayed fly from is incorrect. The expected value is " &DataTable("Fly_From",dtLocalSheet)& " and the actual value is "&vFlyFrom& "."
```



Solutions:

- Develop guidelines to break up modules
- Develop data strategy to handle dynamic data
- Use “keywords” to enhance the module
- Use flags for logical branching

Develop guidelines to break up modules

- Identify rules to break up modules
  - Each window/page
  - Repeated components within a window/page
  - Grouping of functionality within a window/page
  - Section within a window/page
  - Combining small windows/pages into one module
- Establish modules inventory
- Assign priority to each module
- Understand the effect of data variation on the module

Develop guidelines to break up modules (cont'd)

- How would you break up this page into modules?

- Develop data strategy to handle dynamic data
  - Identify data constraints
    - Date, e.g., application only accepts future date
    - Unique data, e.g., SSN, Account number
    - Existing data from database
  - Develop algorithm to generate data
  - Incorporate method into data file

Develop data strategy to handle dynamic data (cont'd)

- Date Algorithm

```
1:   'Check to see if the value enter is a correct date
2:   vCheckDate = IsDate (DataTable("Date_of_Flight",dtLocalSheet))
3:
4:   If vCheckDate Then
5:      'Set date into date of filight
6:      Window("Flight Reservation").ActiveX("MaskEdBox").Type DateTable("Date_of_Flight",dtLocalSheet)
7:   Else
8:      'If not, we need to forward the date from current date
9:      vCurrentDate = Date
10:     vNewDate = DateAdd(d,DataTable("Date_of_Flight",dtLocalSheet),vCurrentDate)
11:     Window("Flight Reservation").ActiveX("MaskEdBox").Type vNewDate
12:  End If
13:
```

	Date_of_Flight	B
1	12/30/2010	
2		
3		

	Date_of_Flight	B
1	15	
2		
3		

- Use “keyword” to enhance the module
  - Develop Action keywords to establish intent
    - Input
    - Verify
    - Query
  - Use conditional statements to drive scripting
  - Incorporate method into data file

Use “keyword” to enhance the module (cont’d)

- Example of using keyword to enhance the module

```
1:  'Check Action to determine script path
2:  If DataTable("Action",dtLocalSheet) = "Input" Then
3:    If DataTable("UserName",dtLocalSheet) <> "" Then
4:      Dialog("Login").WinEdit("Agent Name:").Set DataTable("UserName",dtLocalSheet)
5:    End If
6:  Else
7:    If DataTable("Action",dtLocalSheet) = "Verify" Then
8:      vUserName = Dialog("Login").WinEdit("Agent Name:").GetROProperty("Value")
9:      If vUserName = DataTable("UserName") Then
10:       Reporter.ReportEvent micPass,"Verify User Name","The displayed user name is correct. The value is "&vUserName&"."
11:     Else
12:       Reporter.ReportEvent micFail,"Verify User Name","The displayed user name is incorrect. The expected value is "&DataTable("UserName")&" and the actual value is "&vUserName&"."
13:     End If
14:   End If
```

Keyword View | Expert View

Data Table

A1 | Verify

	Action	UserName	Password	OK_Button	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Verify																
2	Input	David	mercury														
3	Verify	David	*******														
4	Input			Click													

Global | Action1

Use flag for logical branching

- Determine area within the application that needs logical branching
  - Payment Type, e.g., Credit Card, PayPal, Bill me later
  - New objects are activated based on data input
  - Radio group selection
- Use conditional statement to drive scripting
- Incorporate method into data file

Use flag for logical branching (cont'd)

- Example of using flag to handle payment type

```
1:  'Check Payment Type to determine objects that will need input
2:  If DataTable("Credit_Card_Flag",dtLocalSheet) = "Yes" Then
3:    Window("CheckOut").WinCheckBox("Credit Card").Set "ON"
4:    Select Case DataTable("Credit_Card_Type")
5:      Case "Master Card"
6:        Window("CheckOut").WinCheckBox("Master Card").Set "ON"
7:      Case "Visa"
8:        Window("CheckOut").WinCheckBox("Visa").Set "ON"
9:      Case "American Express"
10:       Window("CheckOut").WinCheckBox("American Express").Set "ON"
11:   End Select
12:   Window("CheckOut").WinEdit("Credit Card Number").Set
13: Else
14:   If DataTable("PayPal_Flag",dtLocalSheet) = "Yes" Then
15:     Window("CheckOut").WinCheckBox("PayPal").Set "ON"
16:   End If
17: End If
```

Keyword View | Expert View

Data Table

A1: Yes

	Credit_Card_Flag	Credit_Card_Type	Credit_Card_Number	Expiration_Date	Security_Code	PayPal_Flag	PayPal_Account	PayPal_Password
1	Yes	Visa	1234123412341234	06/2015	212	No		

Conclusion

The benefits of using a modular test automation approach are enormous. However, it requires:

- Treating test automation as a development project
- Advanced planning from test automation team
- Understanding of upfront cost vs. long-term return
- Dedicated resources