



Collabora Productivity

# Quantum Computing with VBA

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Software Engineer at Collabora  
Productivity

VBA and ...



## Teaching people radical new ways to model problems

- Great simulation tools for training
- Fronted by an easy-to-use Quantum Apprentice.xlsm
  - VBA / Macro-enabled Excel spreadsheet document
  - Visualization and interface to backend D-Wave simulator for training.
  - Dynamically generated elements in the document.

## Problem:

- Difficult to deploy & publish widely
- Depends on Microsoft Office, installation & setup is tricky
- VMs a distribution challenge

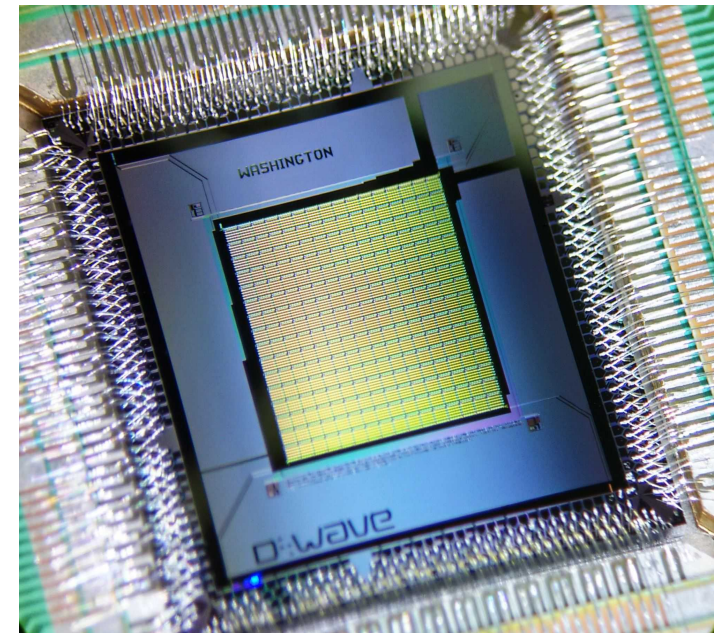
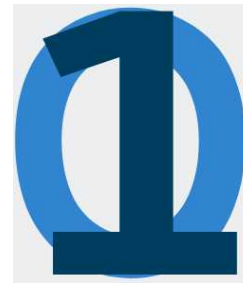
# D:WAVE

The Quantum Computing Company™



## Quantum Computing

- World's first quantum computing company
- Quantum computing systems and software
  - Built around “qubits” rather than “bits”
  - Revolutionary technology leaders creating a new industry.



***“Collabora understood our problem immediately, and implemented a great, Open Source solution for us to improve customer training” - Denny Dahl, Principle Research Scientist at D-Wave Systems Inc.***

# Tabs

- Two Qubits, Three Qubits, Four Qubits: static content
- Chimera tab
- QMI, Solution
- Problem History tab



Two Qubits

Three Qubits

Four Qubits

Chimera

QMI

Solution

Problem History



# QMI Tab

Q0071	Q0072	Q0073	Q0074	Q0075	Q0076
-------	-------	-------	-------	-------	-------

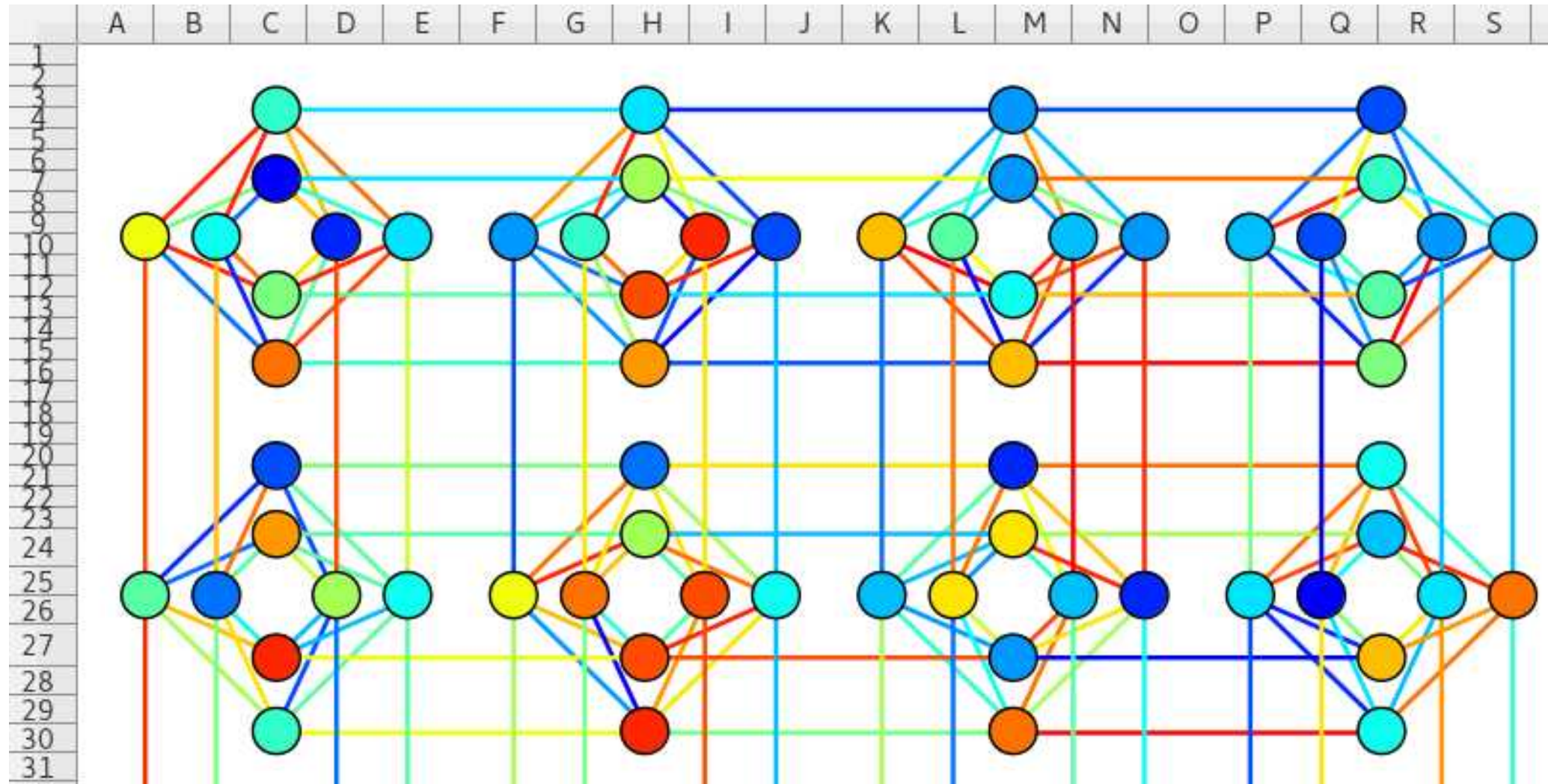
Q0087	Q0088	Q0089	Q0090	Q0091	Q0092
	7.313432859	3.805970013	9.179104149	7.313432859	3.507462632

Q0103	Q0104	Q0105	Q0106	Q0107	Q0108
-------	-------	-------	-------	-------	-------

Q0119	Q0120	Q0121	Q0122	Q0123	Q0124
-------	-------	-------	-------	-------	-------

2	3.358208835	3.507462632	3.805970013	9.179104149	3.507462632	3.507462632
---	-------------	-------------	-------------	-------------	-------------	-------------

# Chimera Tab



	A	B	C	D	E	F
1	<b>QMI name</b>		<b>Solution name</b>			
2	3-qubit-chain		chain		Select Workspace	Select Configuration
3	bar		facet			
4	default		result			
5	test1		ring			
6						
7						
8						
9					Refresh History	Clear History
10						
11						
12						
13						
14						
15					Load QMI	Save QMI
16						
17						
18						
19						
20						
21					Execute QMI	Load Solution
22						
23						

## Problem History Tab

- Several buttons
- List of QMI files, Solution files
- Select workspace, refresh, clear, etc.

**Demo**



# Errors with LibreOffice?

- Nothing happened first
- Only static elements displayed
  - Workbook\_Open() ?
- Let's see something interactive
  - Refresh History button → Exception: property not found.

# Workbook\_Open()

- Workbook.Open event
- Set default workspace
- Read geometry
- Draw Chimera, draw QMI, draw Solution
- Refresh history (qmi files, solution files)

```
Private Sub Workbook_Open()  
+-- 20 lines: ' Initialize the variable that tell  
Call ReadGeometry(initial_geometry)  
current_configuration = 1  
Call Update_DW_INT  
Call Write_dwsync  
Call Init  
  
Application.ScreenUpdating = False  
Call DrawChimera  
Call DrawQMI  
Call DrawSolution  
Call GetHistory  
Worksheets("Two Qubits").Activate  
Application.ScreenUpdating = True  
  
End Sub
```



# Workbook.Open event

## Register / trigger

- Register → Ok
- Trigger → Exception thrown

## EnsureVBALibrary

- Only with .xlsm extension
- “BasicLibraries” not created

# Back to Refresh History

## Missing properties

- Interior.TintAndShade
- Interior.PatternTintAndShade

## ScVbaInterior::GetPatternColorIndex()

- Used in the opposite way
- Probably never ever used before

```
Sub GetHistory()
```

```
' This macro is invoked by pressing the "Refresh History" button on the  
' Problem History worksheet
```

```
+-- 43 lines: Dim varDirectory As Variant-----
```

```
Range(Cells(2, 1), Cells(iqmi, 1)).Select
```

```
With Selection.Interior
```

```
    .Pattern = xlSolid
```

```
    .PatternColorIndex = xlAutomatic
```

```
    .ThemeColor = xlThemeColorDark1
```

```
    .TintAndShade = -0.15
```

```
    .PatternTintAndShade = 0
```

```
End With
```

```
Range(Cells(2, 3), Cells(isol, 3)).Select
```

```
With Selection.Interior
```

```
    .Pattern = xlSolid
```

```
    .PatternColorIndex = xlAutomatic
```

```
    .ThemeColor = xlThemeColorDark1
```

```
    .TintAndShade = -0.15
```

```
    .PatternTintAndShade = 0
```

```
End With
```

```
Worksheets("Problem History").Range("I19").Select
```

```
End Sub
```



File Edit View Insert Format Styles Sheet Data Tools Window Help

Calibri 11 B I U T A \$ % 00 00 00

C12 fx Σ =

	A	B	C
1	<b>QMI name</b>		<b>Solution name</b>
2	3-qubit-chain		chain
3	bar		facet
4	default		result
5	test1		ring
6			
7			
8			
9			
10			

# Determine OS

- Used in the macro for determining path type.
- Application.OperatingSystem (read-only) property
- Implement using preprocessor directives.

```
TheOS = Application.OperatingSystem  
DWAVE_HOME = Replace(Environ("DWAVE_HOME"), "/",  
Application.PathSeparator)
```

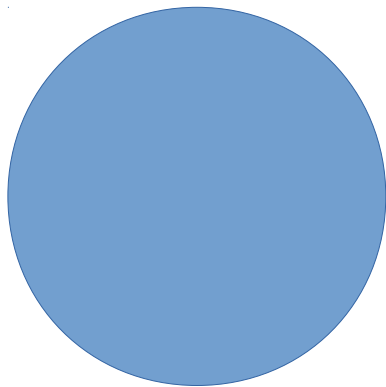
```
If left(TheOS, 3) = "Mac" Then  
    DWAVE_HOME = "Macintosh HD" +  
DWAVE_HOME  
End If
```



# Drawing the ellipses

## Finally drawing the Chimera tab

- To visualize qubits.
- GetType() does not know Oval (Ellipse)



```
Worksheets("Chimera").  
Shapes.  
AddShape(msoShapeOval, ... )
```

# Chimera buttons

- View QMI, Random, Reset
- Characters.Font.Superscript / Subscript properties
  - RuntimeException
- Attributes in form controls  
(WrappedTargetRuntimeException)

B1.Characters.Font.Superscript = false

# Reading order

## **XlContext**

- Depends on first character
- Left-to-right or right-to-left
- Default with Excel

## **Not implemented**

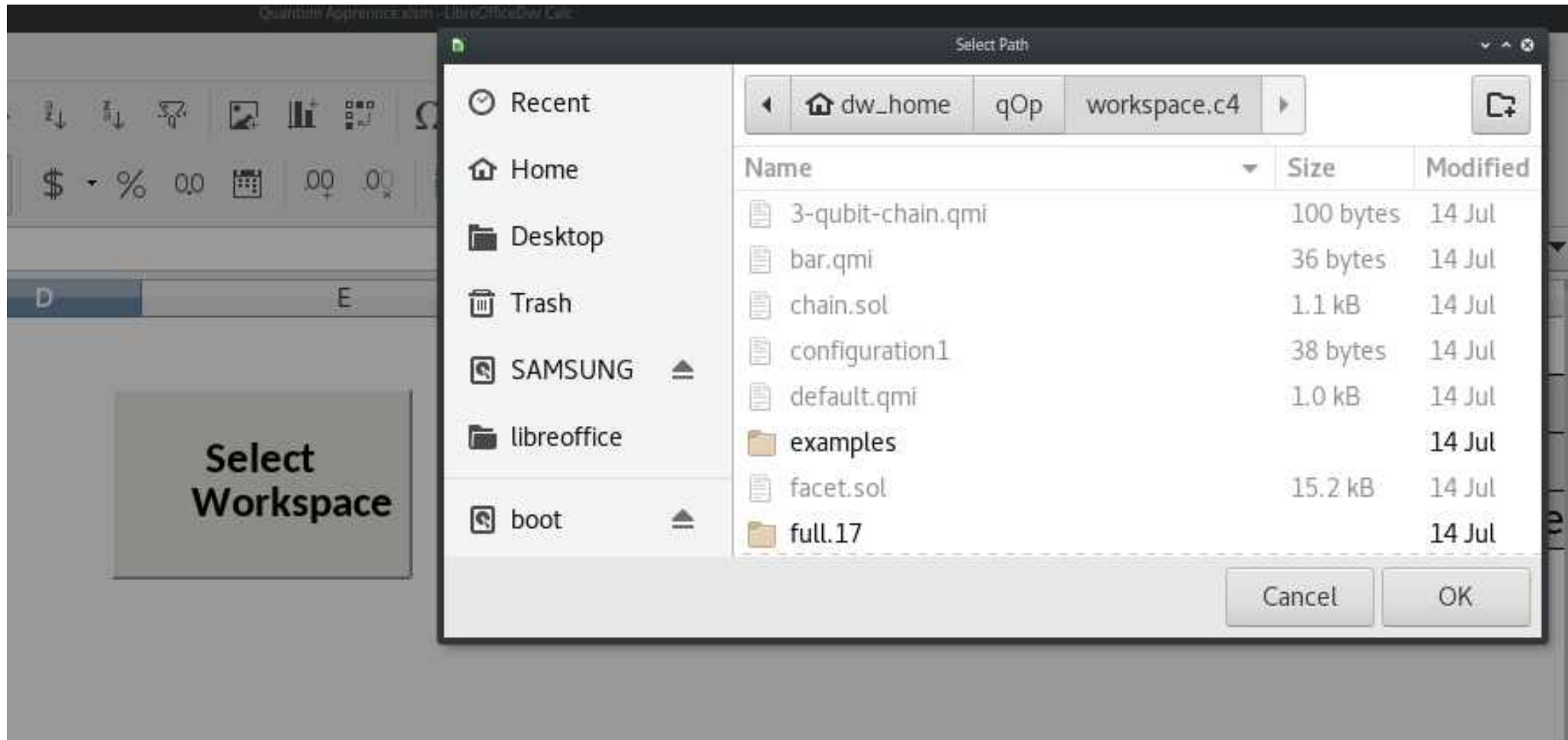
- `NotImplementedException` vs. left-to-right

# Choose workspace

## Button in Problem History tab

- Application.FileDialog ↔ XFilePicker, XFolderPicker
- ScVbaFileDialog, ScVbaFileDialogItems
- Show(), InitialFileName
- System path vs. URL → osl::FileBase

# Select Workspace



```
Function Select_Workspace_Win()  
    With Application.FileDialog(msoFileDialogFolderPicker)  
        .InitialFileName = DW_SIM_DIR & "\"  
        .Title = "Select a workspace directory"  
        .Show  
        If .SelectedItems.Count = 0 Then  
            Select_Workspace_Win = ""  
        Else  
            Select_Workspace_Win = .SelectedItems(1)  
        End If  
    End With  
End Function
```



# Slow...

- Valgrind (kcachegrind)
- Avoid AdjustRowHeight() calls
  - When applying attributes
  - When screenUpdating is false

# TypeOf myShape Is Oval

- TypeOf ... Is ... operator
  - In 'basic/...', common basic operator
- Actual result → “shape”
  - XtypeProvider::getTypes()



# TypeOf

## Solution

- ImplInheritanceHelper
- XOval, Xline ← oovbaapi
- ScVbaOvalShape, ScVbaLineShape ← sc/source/...



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# Thank you!

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