Test & Measurement Solutions

How to turn Spaghetti code into a Wordclass Software Architecture

Speaker: Arnoud de Kuijper
Managing director T&M Solutions - Netherlands

NATIONAL INSTRUMENTS Gold Alliance Partner

Spaghetti code

"Spaghetti code is a pejorative term for source code that has a complex and tangled control structure."

http://en.wikipedia.org/wiki/Spaghetti_code

It is not only a term reserved for LabVIEW

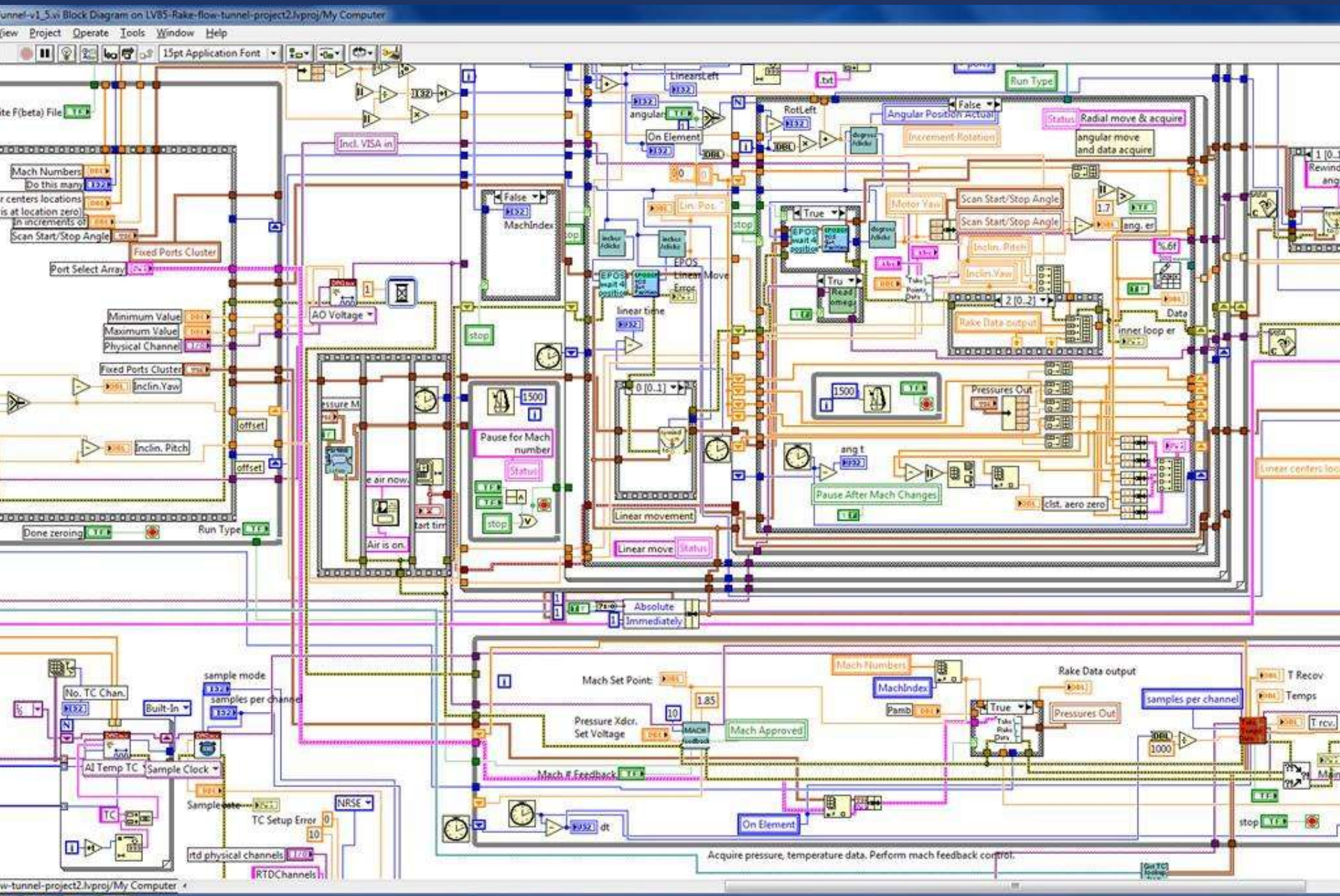
```
10 i = 0
20 i = i + 1
30 PRINT i; " squared = "; i * i
40 IF i >= 10 THEN GOTO 60
50 GOTO 20
60 PRINT "Program Completed."
70 END
```

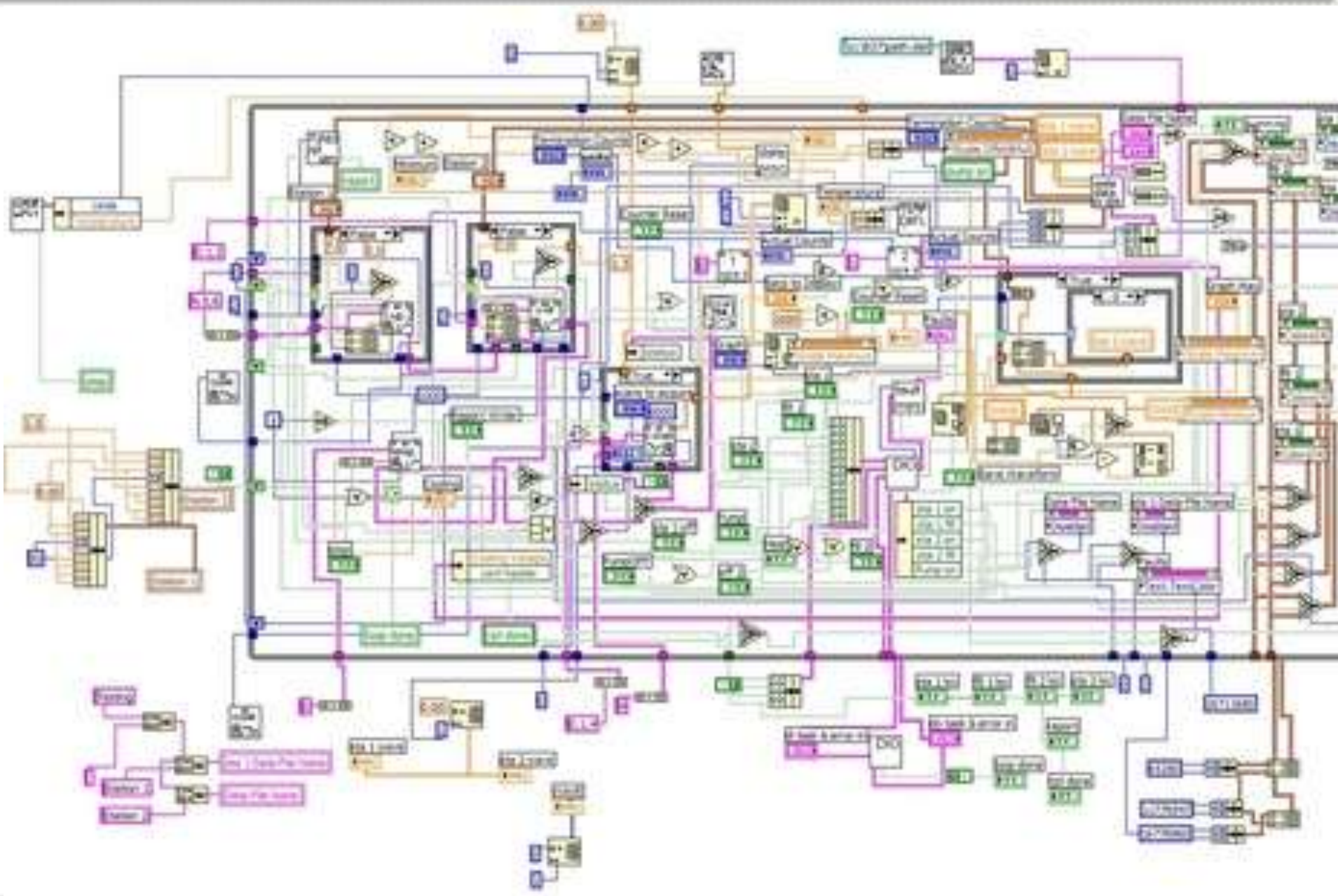
Here is the same code written in a structured programming style:

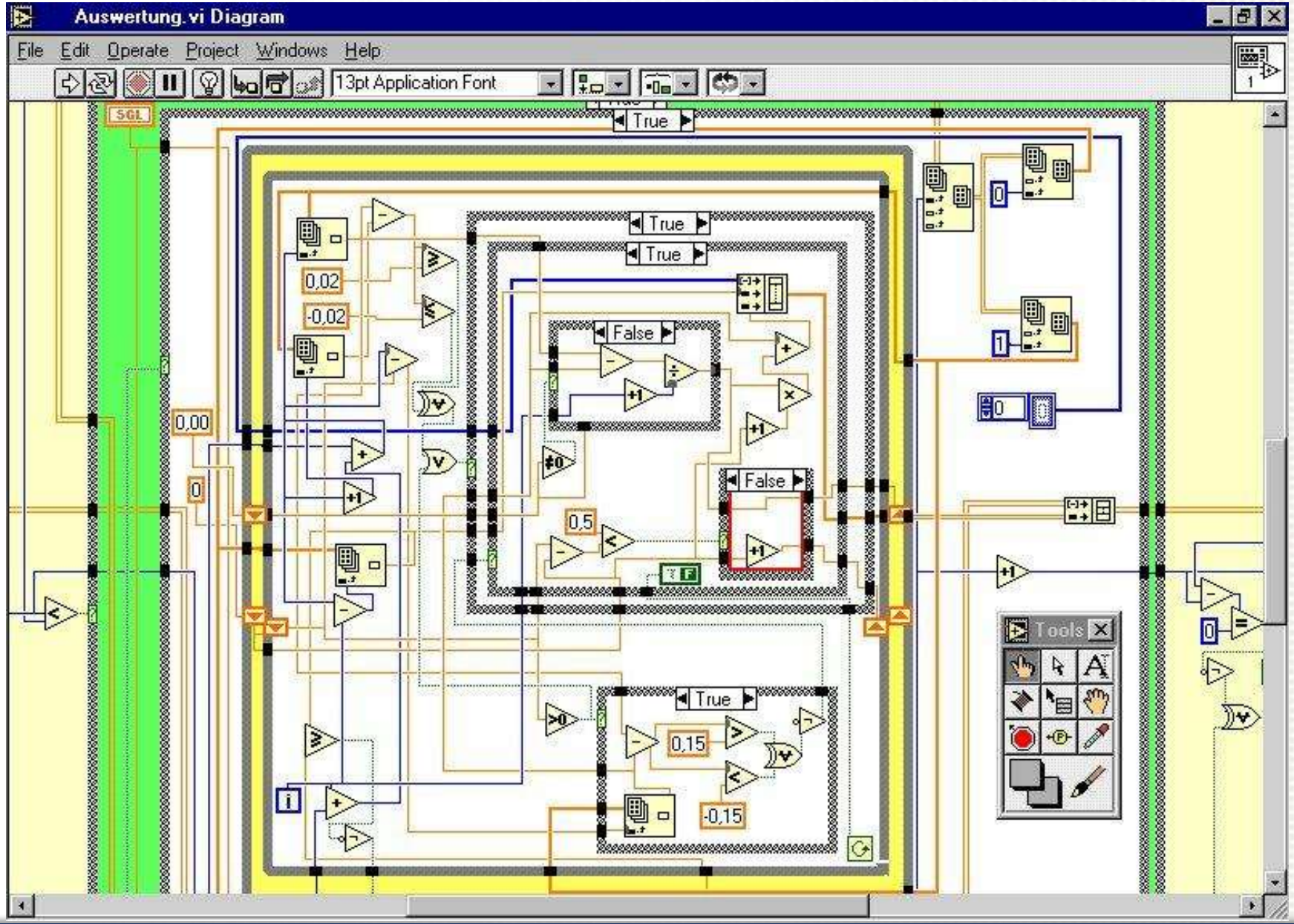
```
10 FOR i = 1 TO 10
20     PRINT i; " squared = "; i * i
30 NEXT i
40 PRINT "Program Completed."
50 END
```

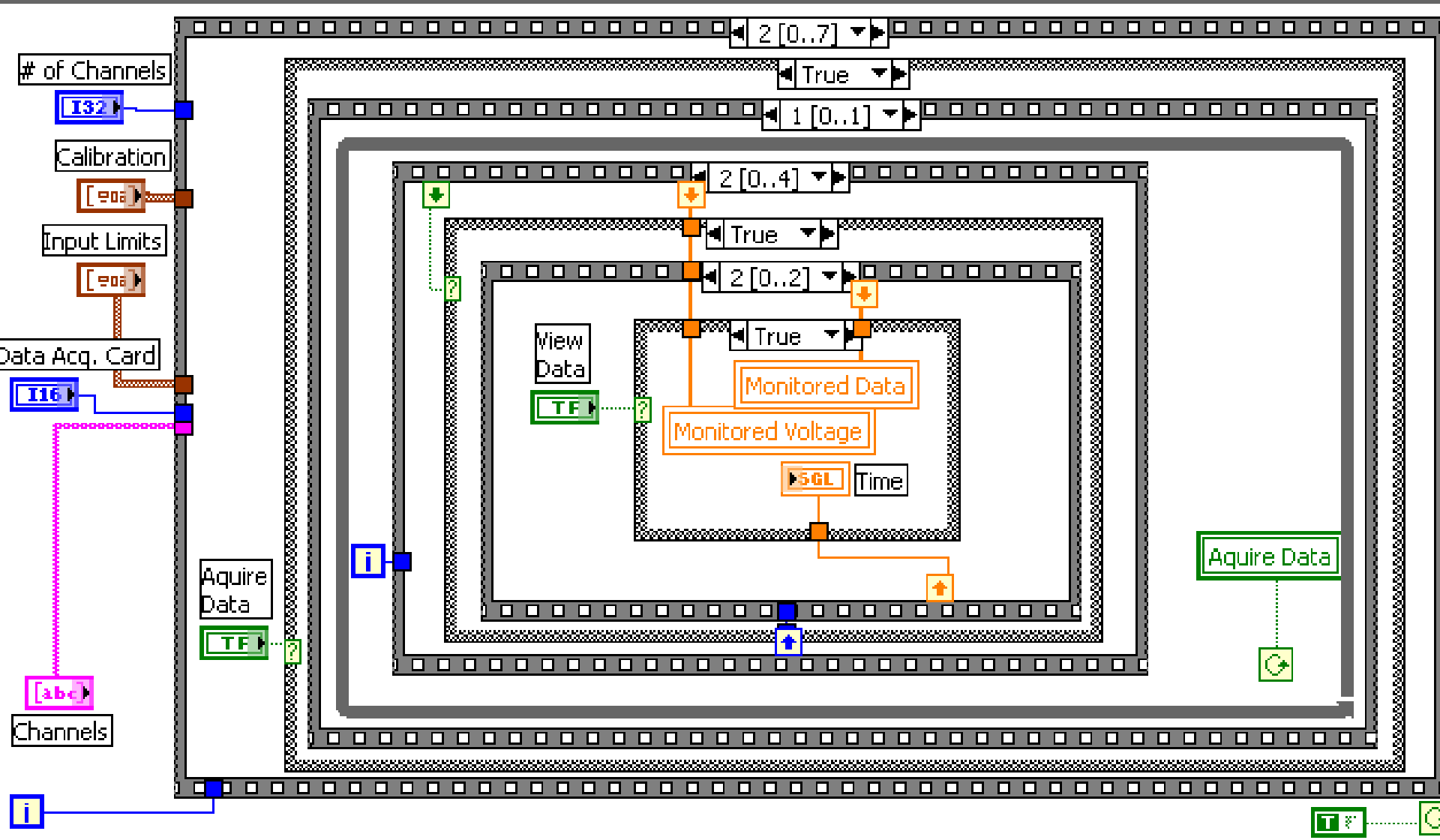
But LabVIEW has some beautifull examples

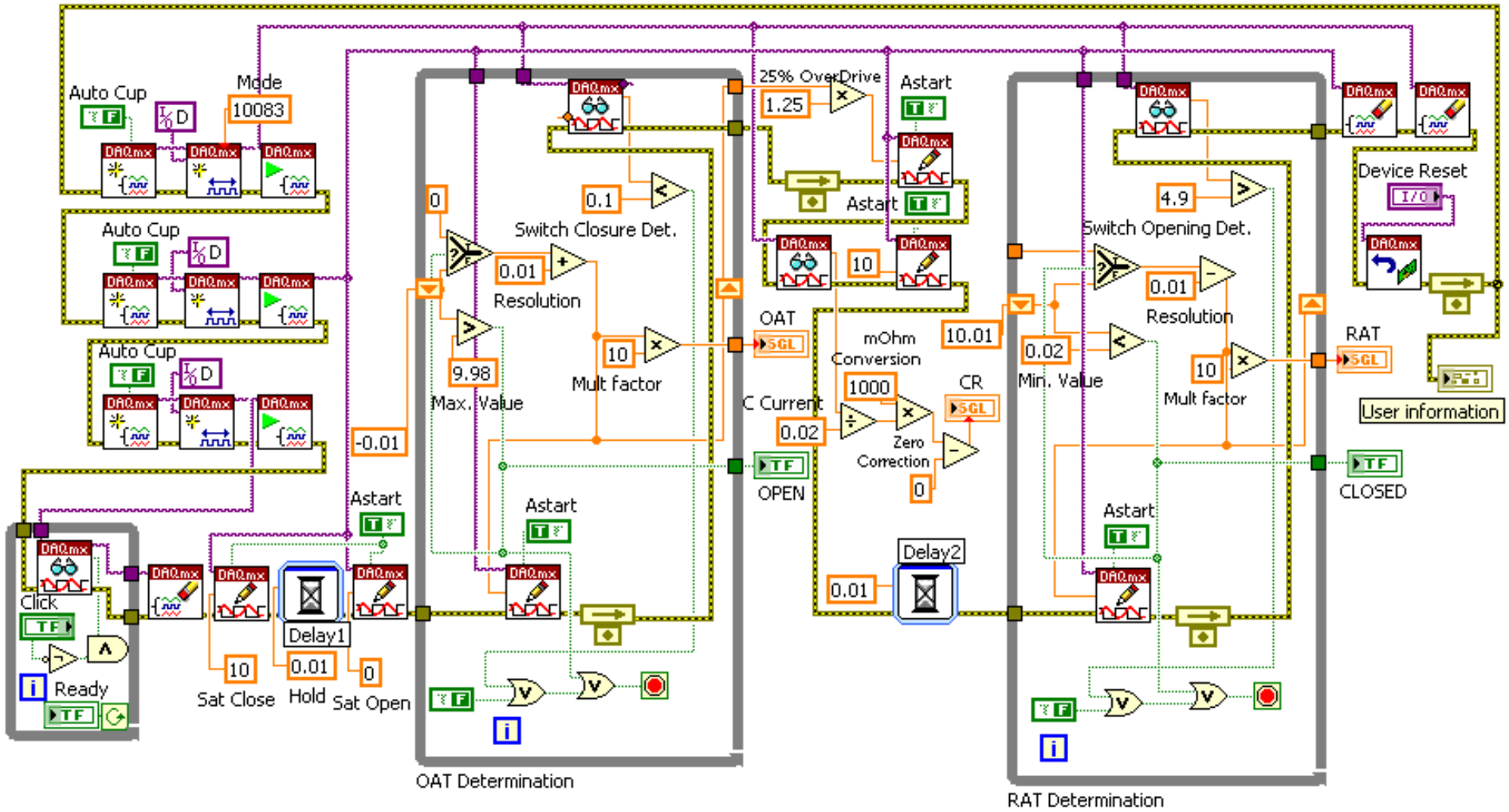
- Examples of spaghetti code

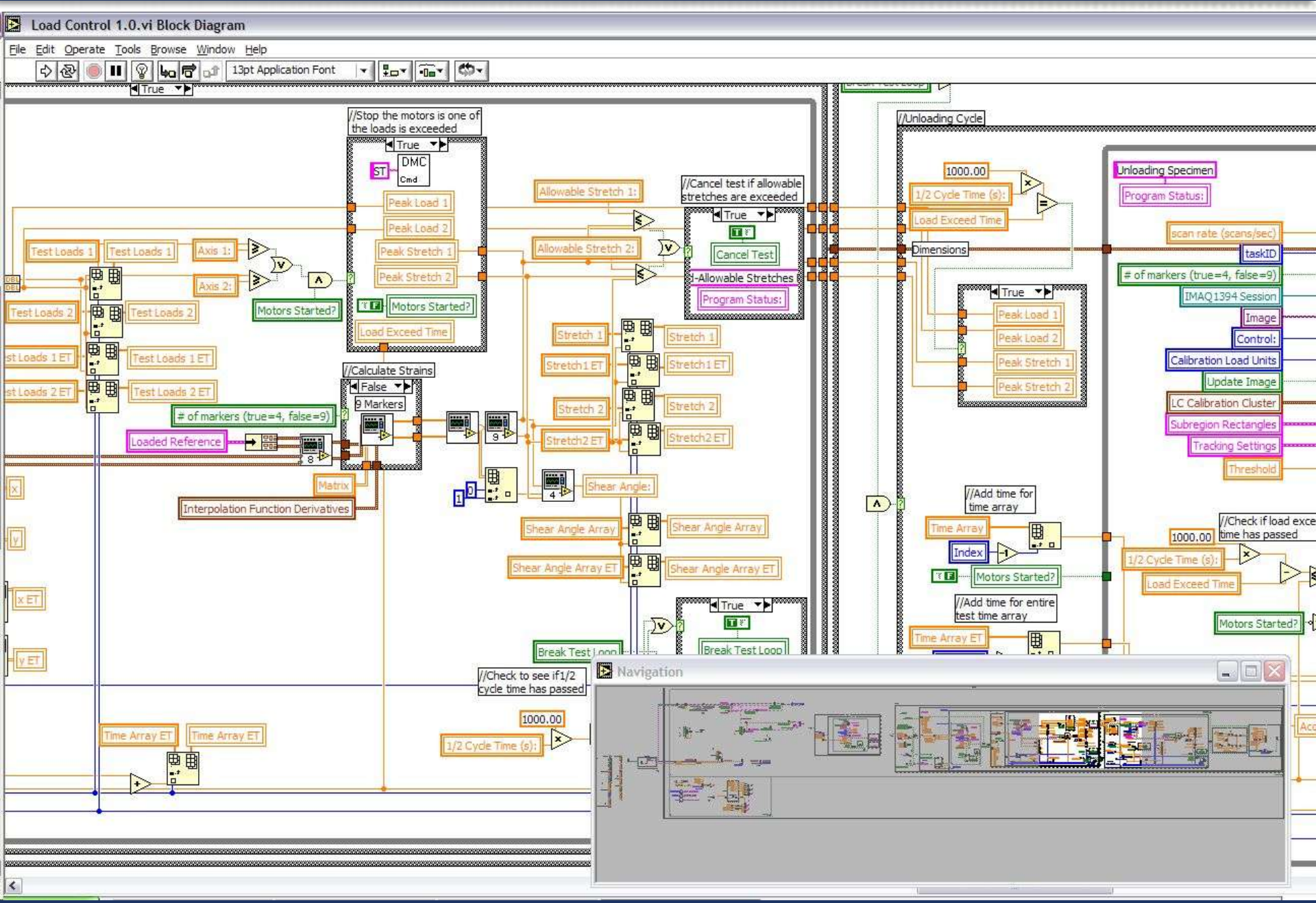


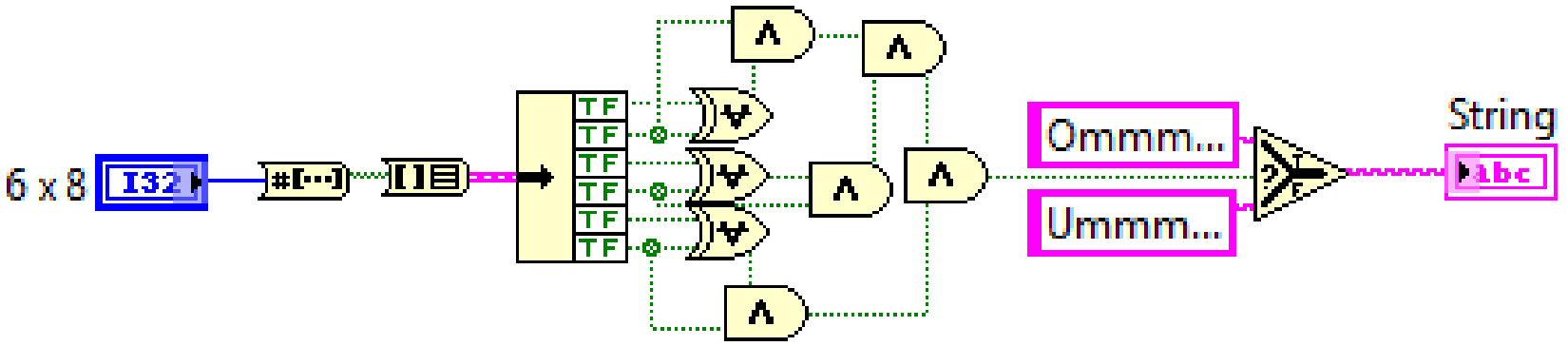




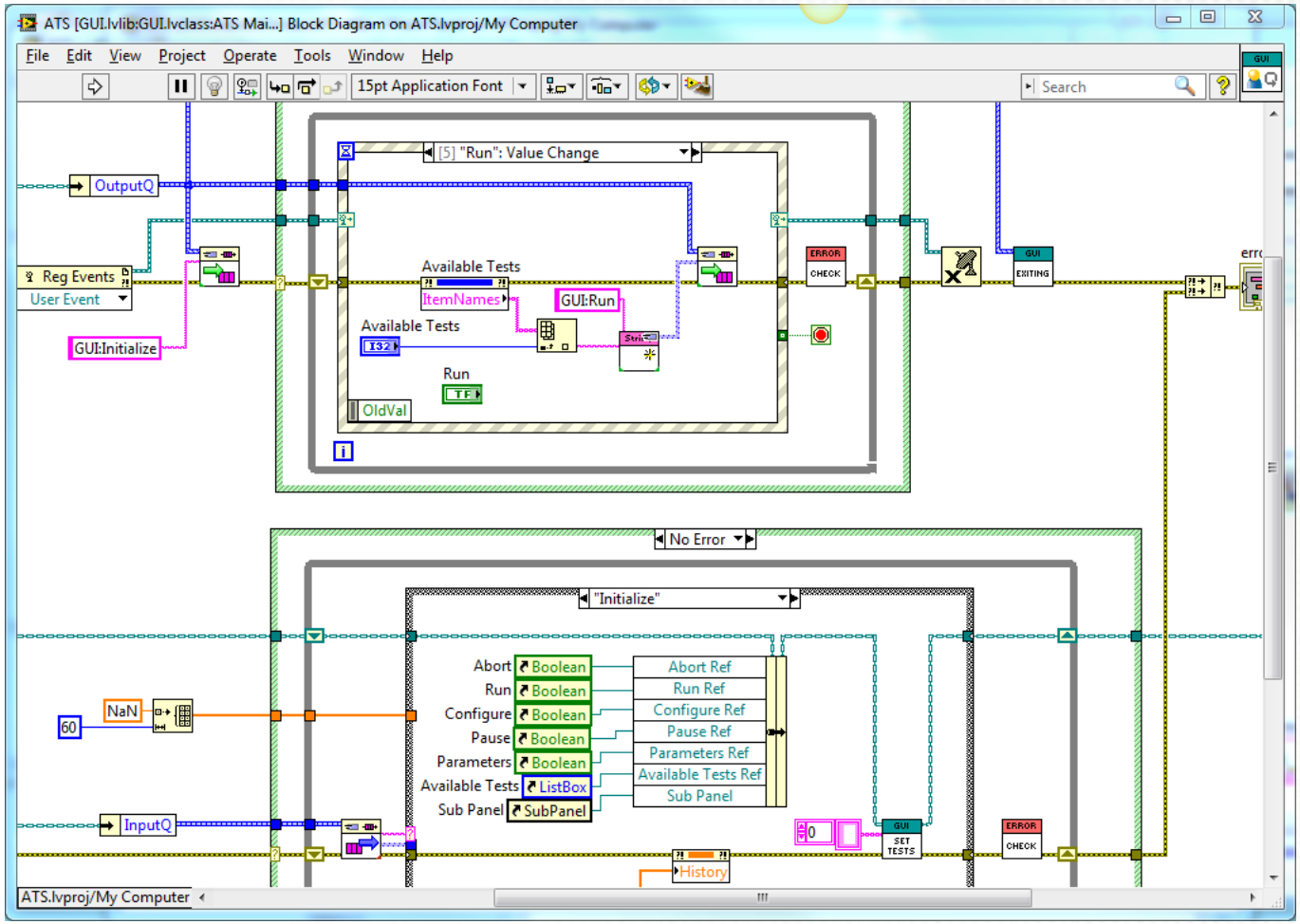




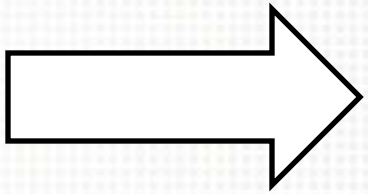




What is a good example?

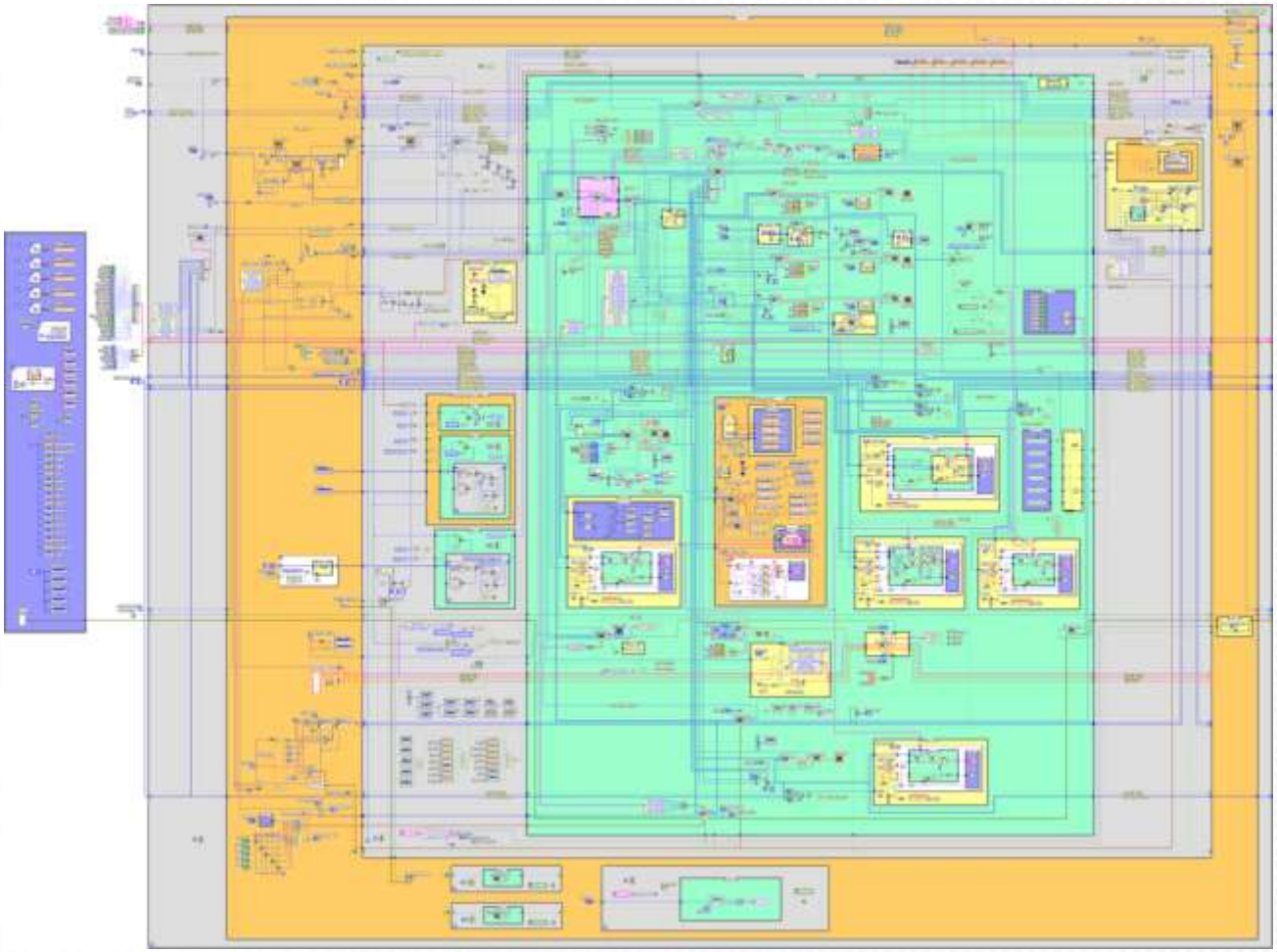


How to organize spaghetti?



5 Questions to ask yourself

1. Should I start refactoring?
2. Where to start?
3. How to start?
4. What to change first?
5. How to test?



My favorite example, but let's look deeper

http://www.biosemi.com/download_actiview.htm

1. Should I start refactoring?

A quick poll;

- Who would start from scratch and rebuild the application?
- Who would refactor this example into something better?

Should I start refactoring?

Take into consideration:

- Do I understand the behavior of the application?
- Is the “spaghetti” tangled in a large while loop or in sub-vi’s?
- Do the sub VI’s have a high cohesion?
- Does the code contain very specific and complex IP?
- Is the application sensitive to performance changes?

Our example

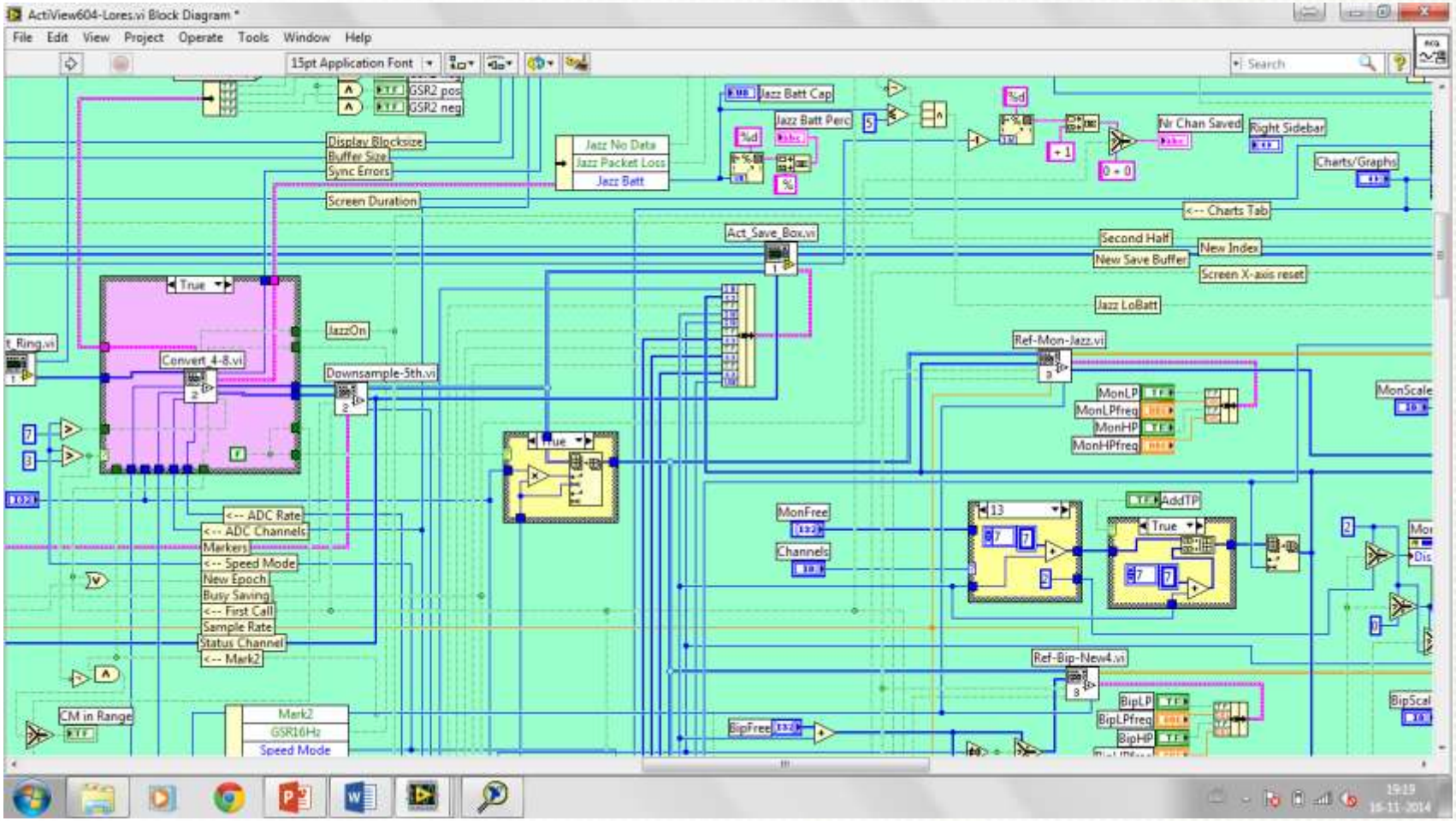
- Do I understand the behavior of the application? Partially
- Is the “spaghetti” tangled in a large while loop or in sub-vi’s? while-loop
- Do the sub VI’s have a high cohesion? Yes
- Does the code contain very specific and complex IP? Yes
- Is the application sensitive to performance changes? No

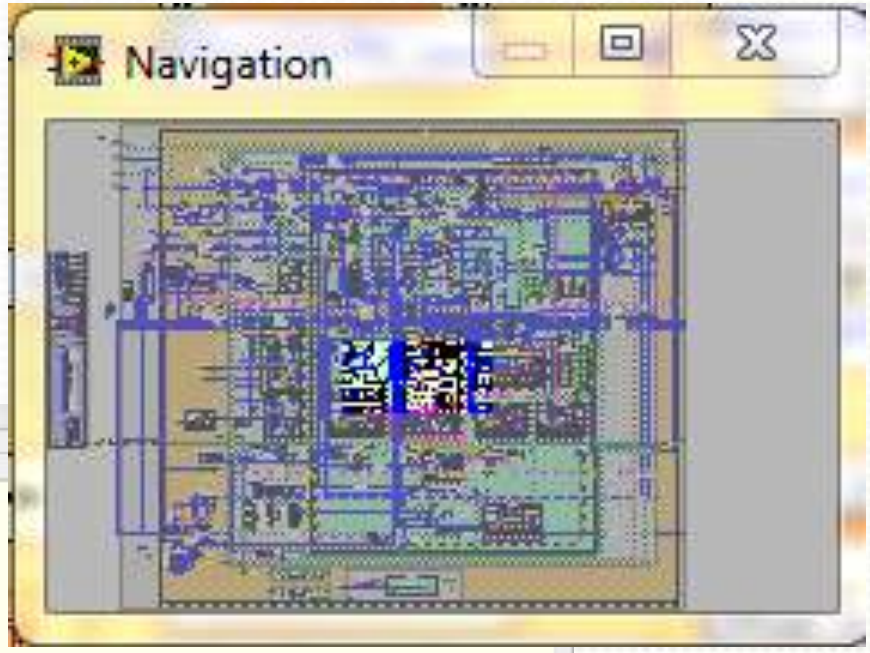
Should I start refactoring?

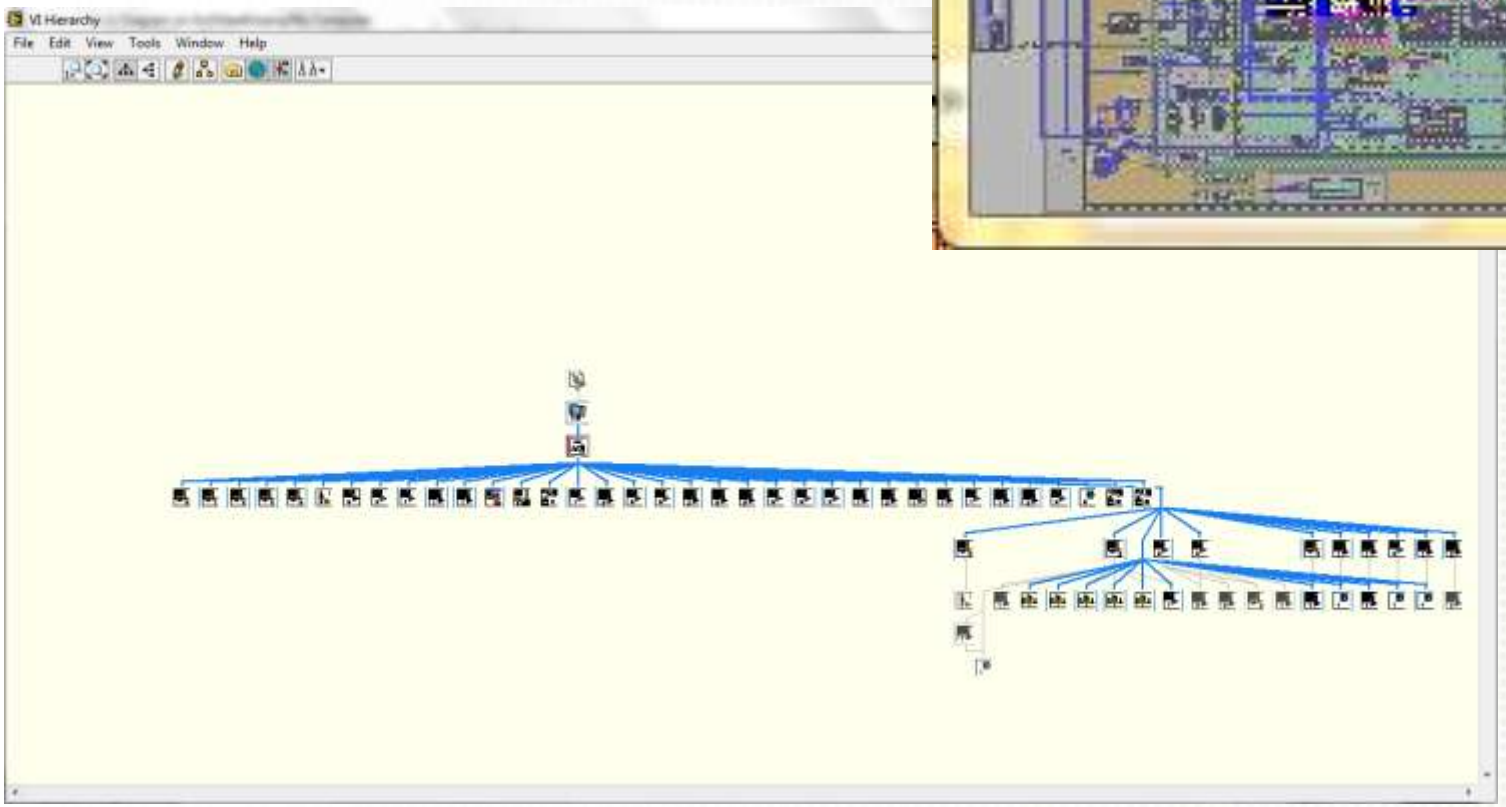
A note of caution:

- The not invented here syndrom! We often disregard what we have not build ourselves!
- Too strong style preferences, this is very subjective
- Refactoring can feel less rewarding, but could be more effective.

Where to start?







Different options available:

#Bottom – up approach:

Start creating subVi's of cohesive code.

Pro's

- Code becomes more readable as you go
- You can quickly identify re-use elements

Con's

- What is wise in selecting fragments to convert?
- How to choose a good interface?
- How to deal with dependencies suchs as locals and UI elements?

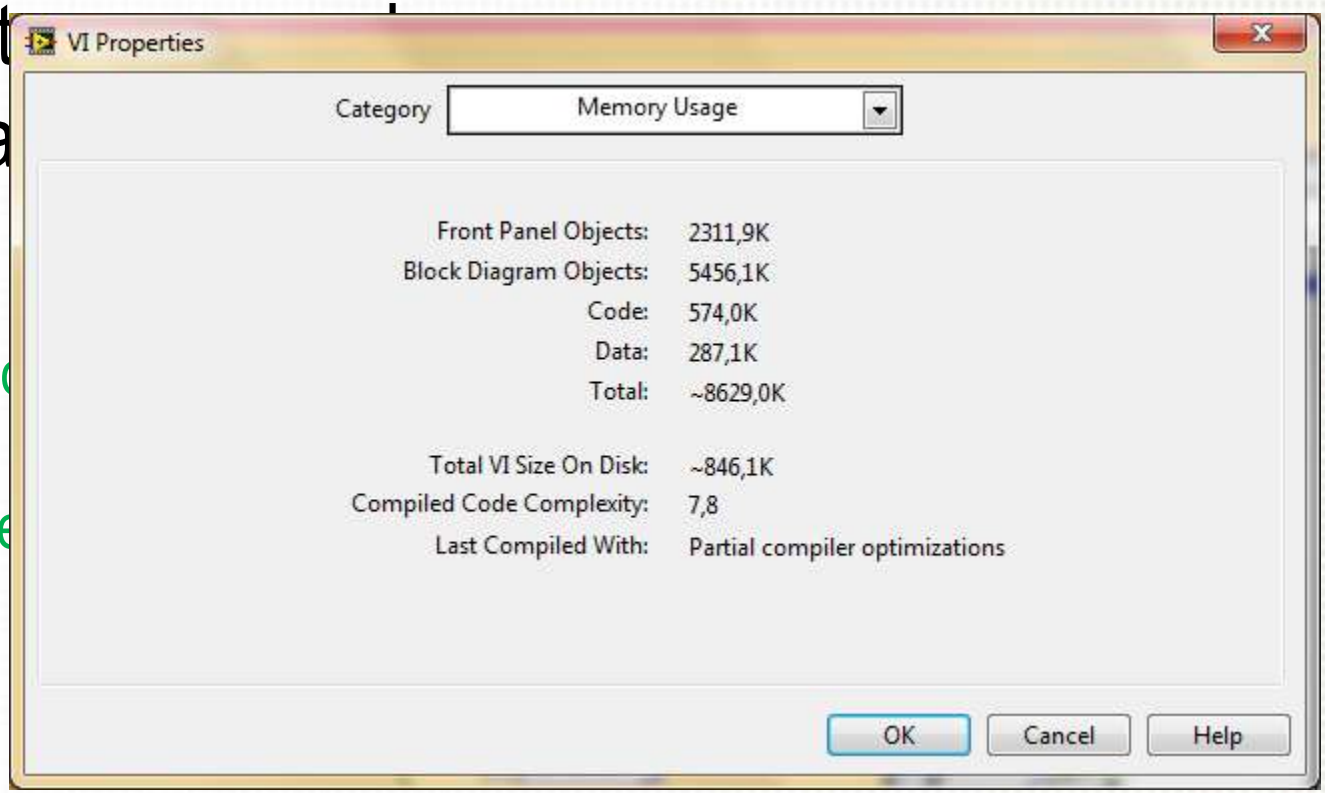
Different options available:

#Top - bott

Refa

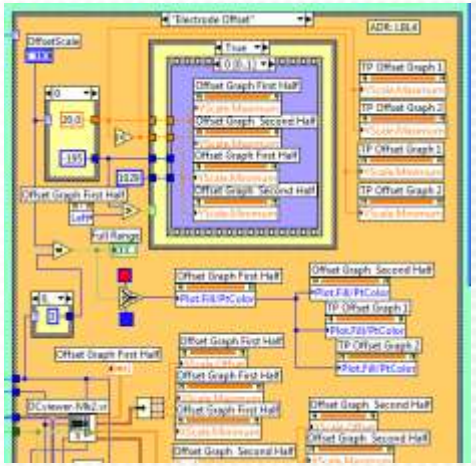
Pro's

- Don't need t
  interfaces.
- Can impleme
  insights
- All code still



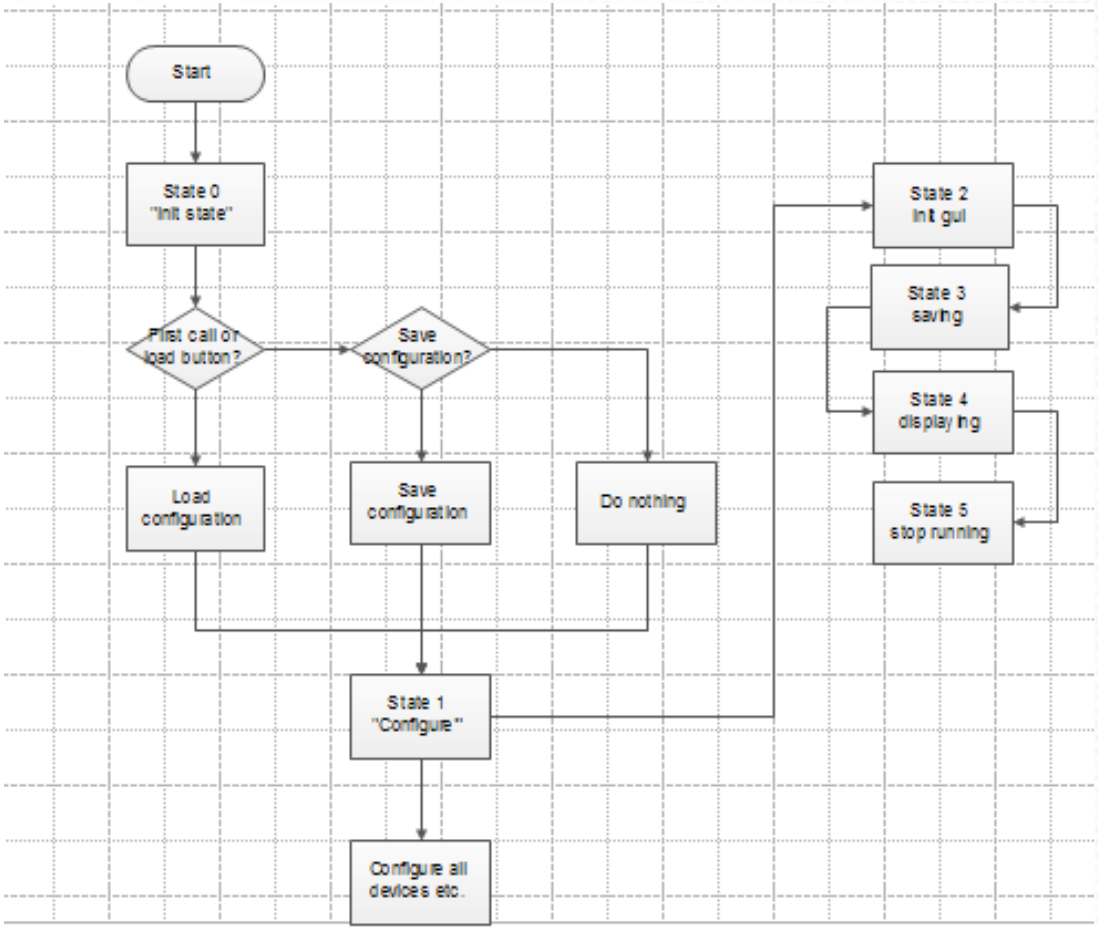
State machine with many states

- Small piece of code in all states (which normally would be in subVi's)
- Especially handy for UI intensive app's

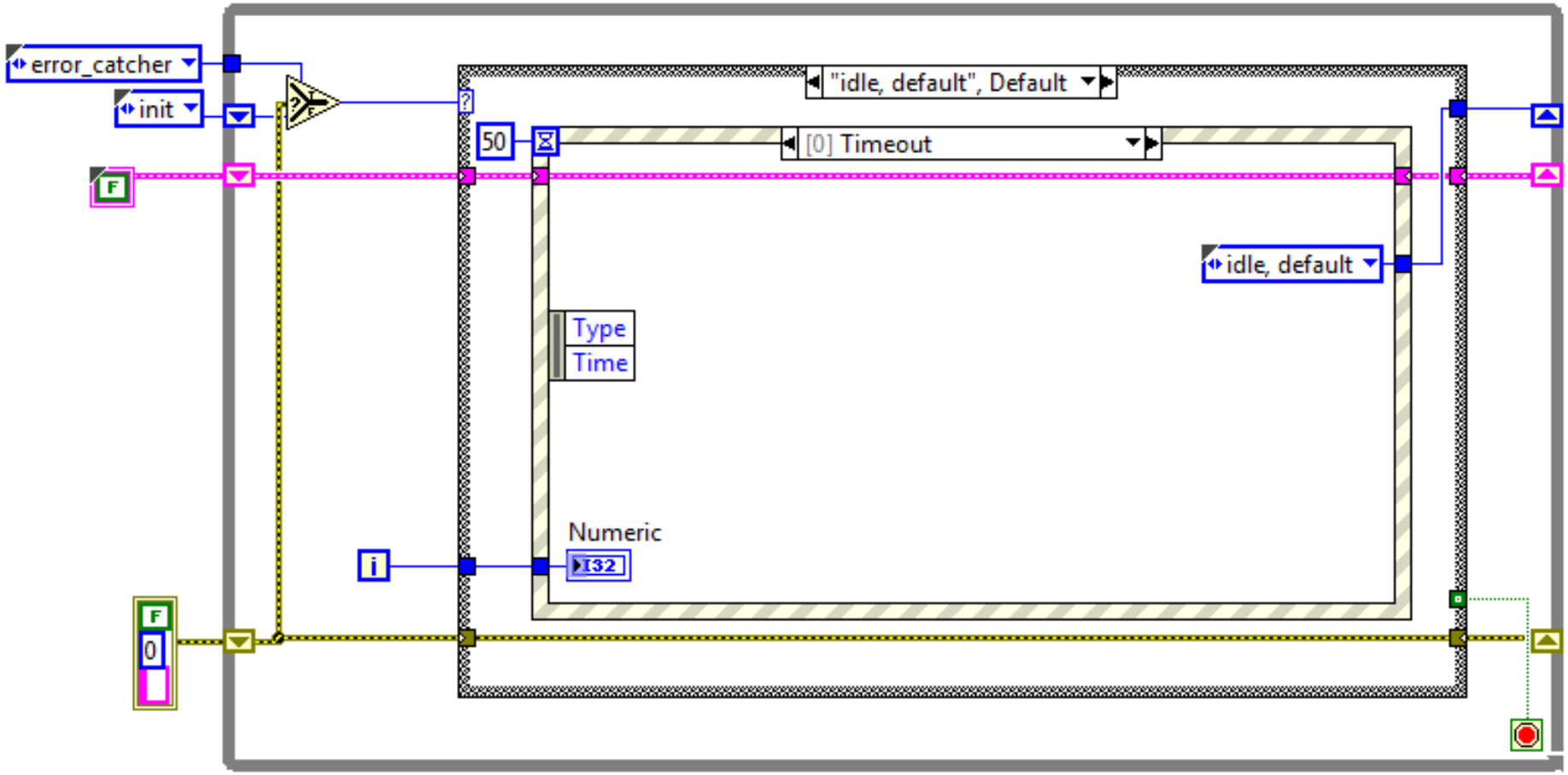


ADR: LBL4

Create state diagram

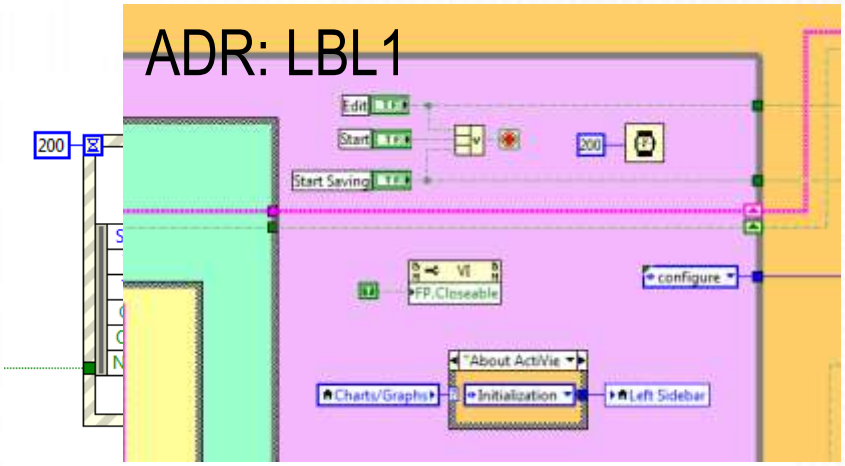


Template statemachine

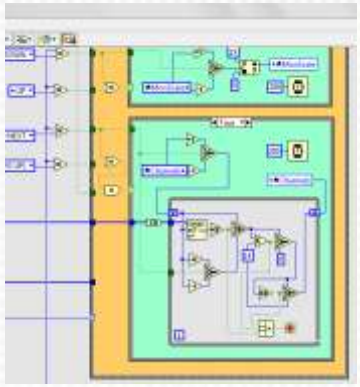


Event handler

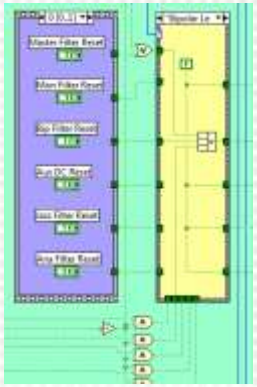
- Optimize structure in state selection:
- Improve performance because of counters!
- Convert polling structures



ADR: LBL3



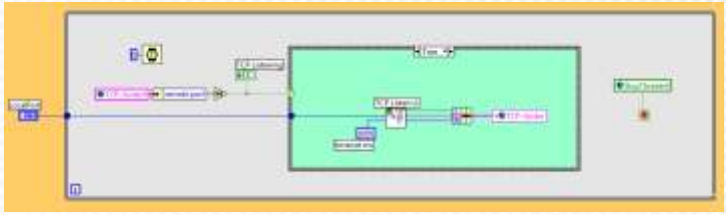
ADR: LBL2



#Task based

- Extract tasks and create separate engines.
  - Instrument communication
  - File streaming
  - UI handling (carefull!)
  - Network communication (e.g. TCP)

ADR: LBL5

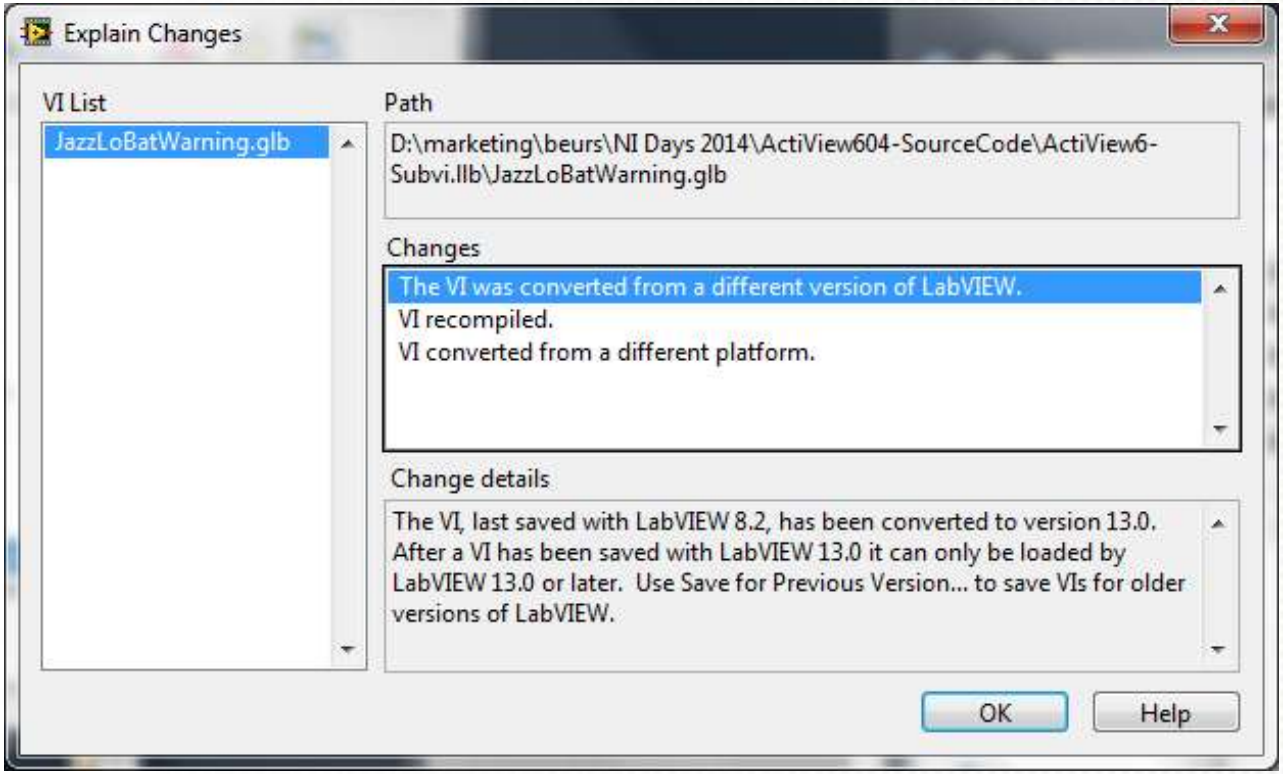


How to start?

- Make sure you have the right tools & setup:
  - Start with a source-code control (scc) version
  - Optionally with VMWare for operation system management
  - Create a LabVIEW project to organize VI's and find dependencies.
  - Convert llb's to folders (scc)

How to start?

- What version of LabVIEW?



How to start?

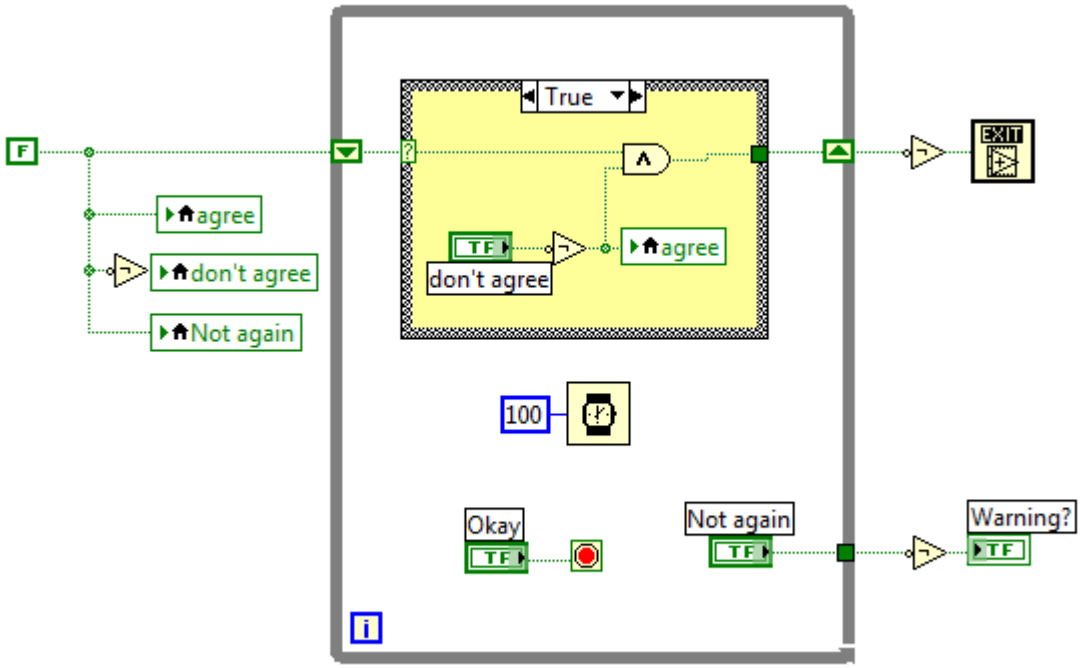
- Make sure you have the right tools & setup:
  - Commit every majer change to scc so you can revert.
  - Test, test, test…
  - Compare & diff van be very usefull

What to change first?

1. Change to selected platform (DEV, OS)
2. Improve structures without changing functions
3. Split-up code into state's with cohesion
4. Create subVI's for states where size is limiting
5. Create subVI's for re-use and replace where necessary.
6. Build unit tests

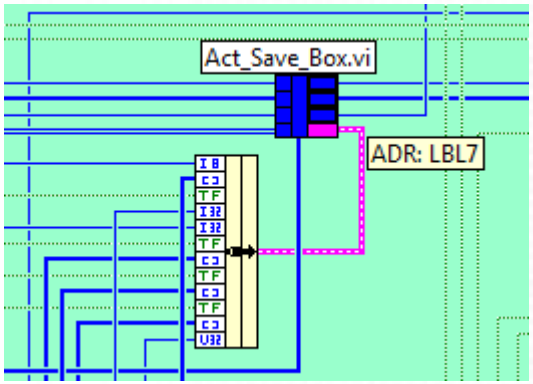
You can always update independend VI's

ADR: LBL9



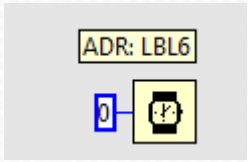
What to change first?

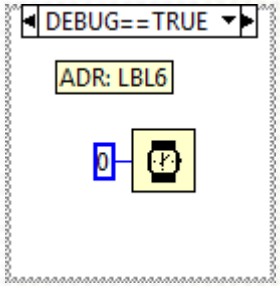
- 8. Remove code that is unneccesary
- 9. Break & rebuild connectors and interfaces



ADR: LBL7

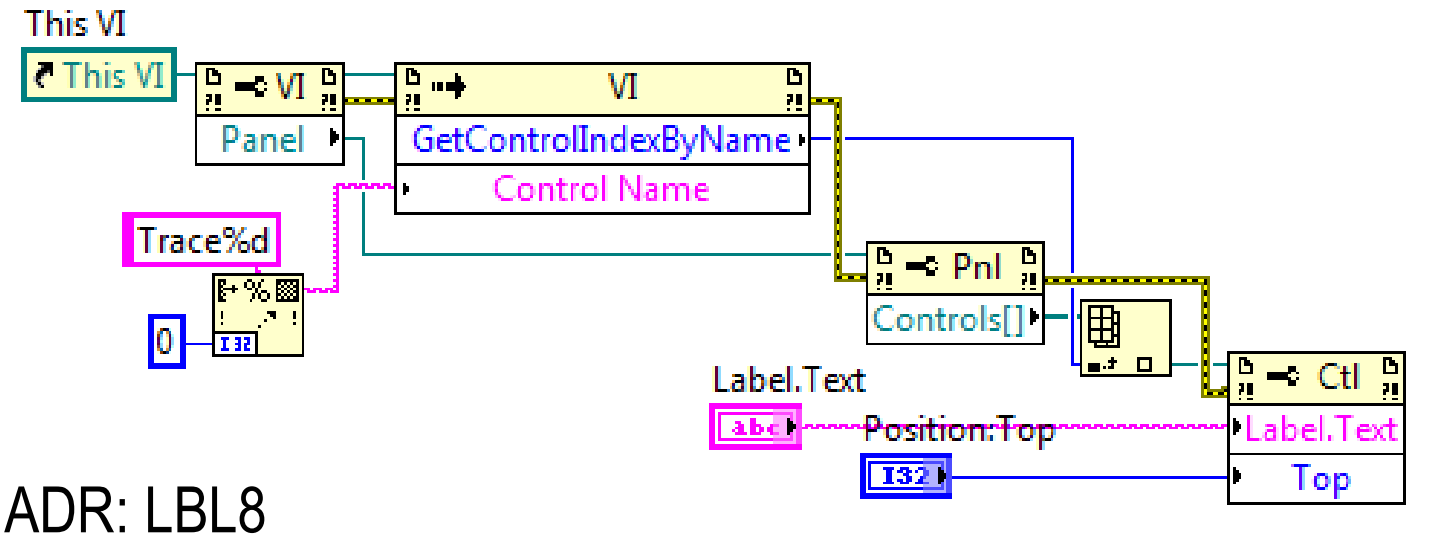
ADR: LBL6





What to change first?

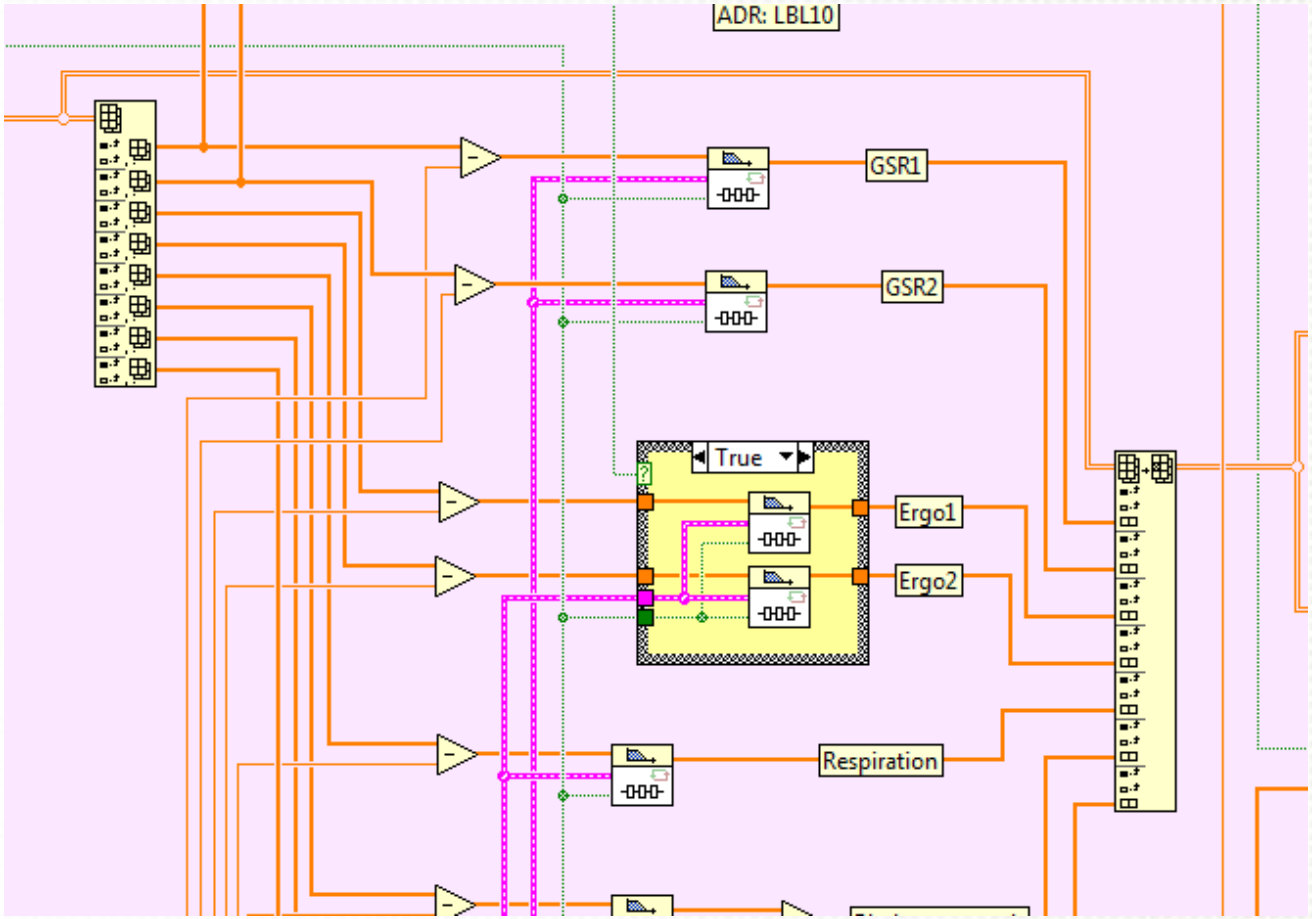
- 10. Optimize code for maintainability & scalability



ADR: LBL8

Apply new techniques

ADR: LBL10



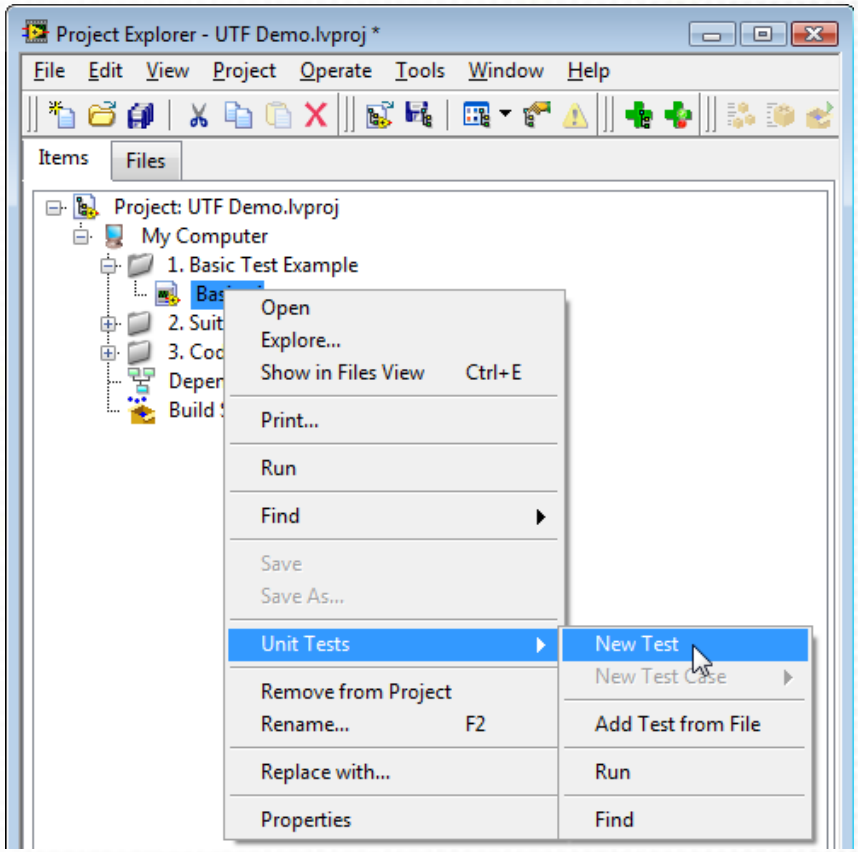
And Last

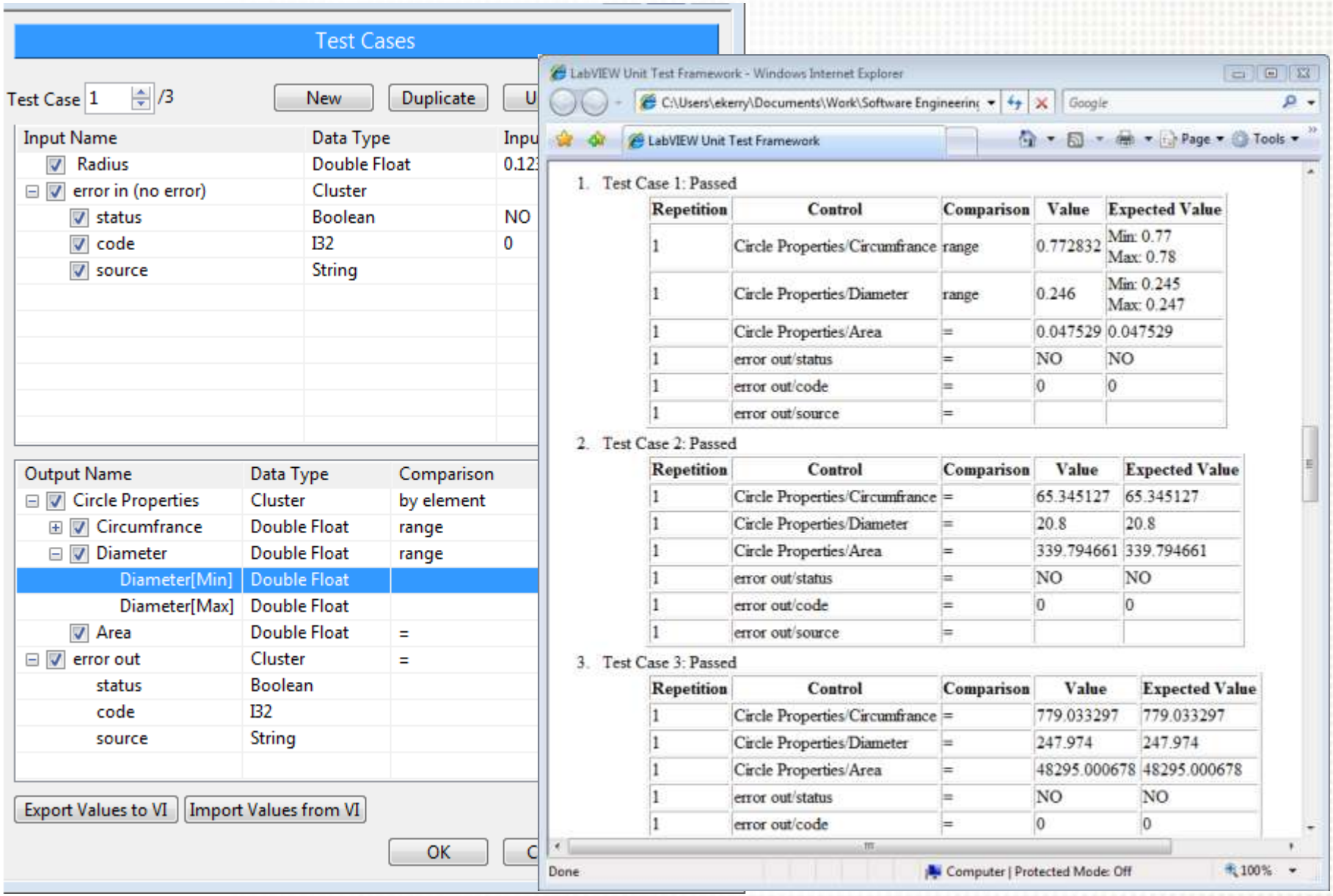
- 11. Rename global variables
- 12. Change implementation of alghorithms
- 13. Improvements in speed and UI

What & How to test

- ADR: LBL11

http://www.ni.com/white-paper/8082/en/





1. Test Case 1: Passed

Repetition	Control	Comparison	Value	Expected Value
1	Circle Properties/Circumfrance	range	0.772832	Min: 0.77 Max: 0.78
1	Circle Properties/Diameter	range	0.246	Min: 0.245 Max: 0.247
1	Circle Properties/Area	=	0.047529	0.047529
1	error out/status	=	NO	NO
1	error out/code	=	0	0
1	error out/source	=		

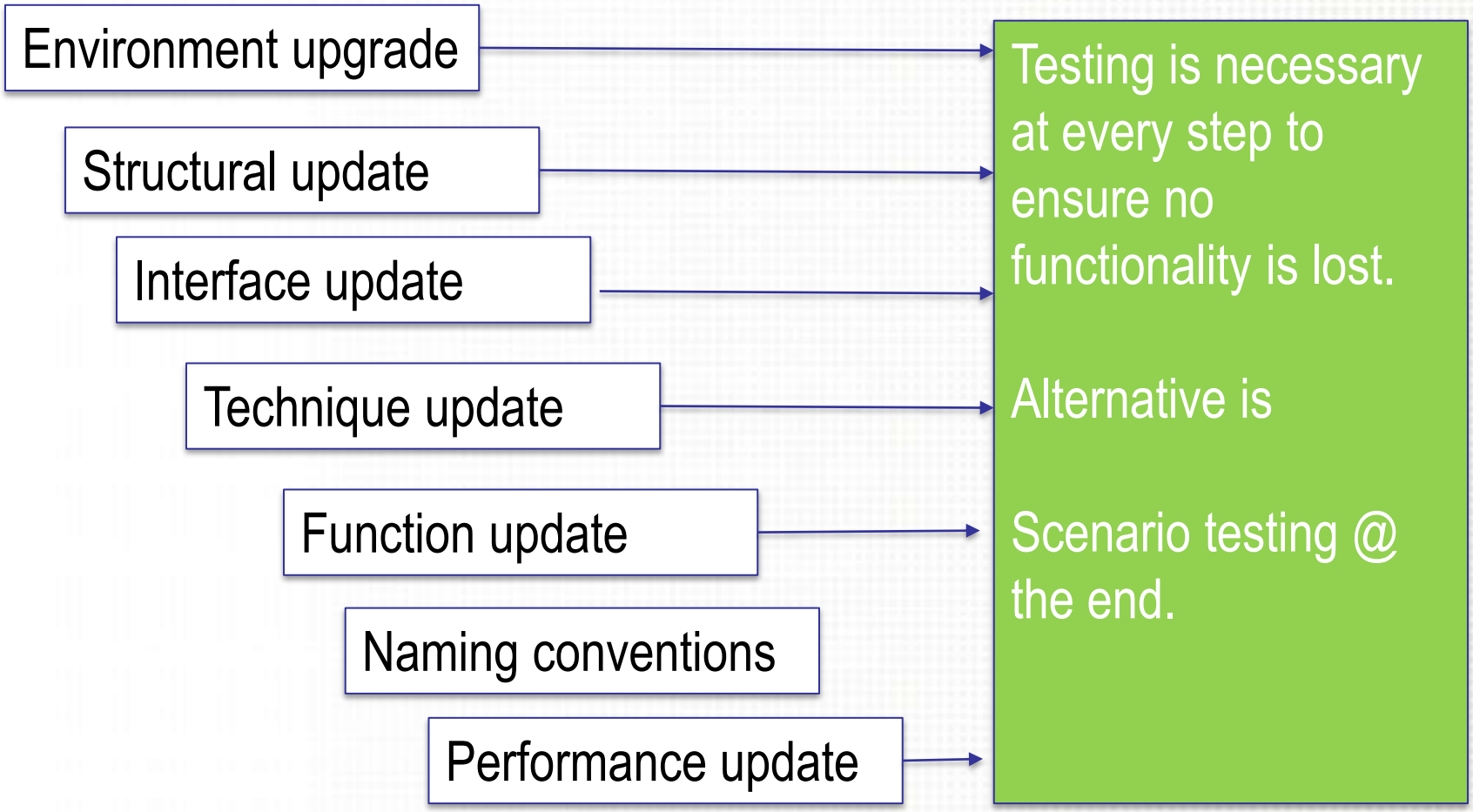
2. Test Case 2: Passed

Repetition	Control	Comparison	Value	Expected Value
1	Circle Properties/Circumfrance	=	65.345127	65.345127
1	Circle Properties/Diameter	=	20.8	20.8
1	Circle Properties/Area	=	339.794661	339.794661
1	error out/status	=	NO	NO
1	error out/code	=	0	0
1	error out/source	=		

3. Test Case 3: Passed

Repetition	Control	Comparison	Value	Expected Value
1	Circle Properties/Circumfrance	=	779.033297	779.033297
1	Circle Properties/Diameter	=	247.974	247.974
1	Circle Properties/Area	=	48295.000678	48295.000678
1	error out/status	=	NO	NO
1	error out/code	=	0	0

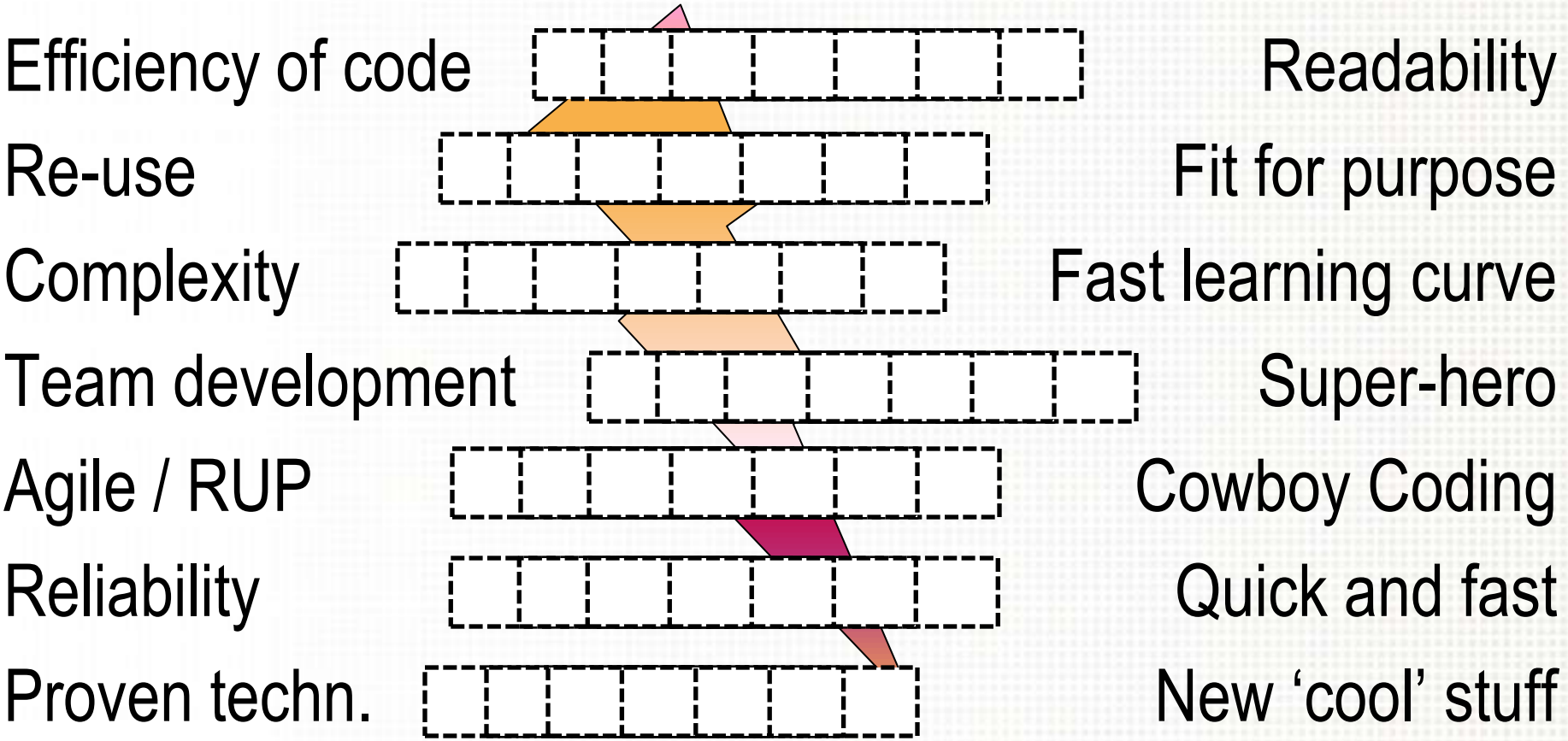
Summary



Questions?

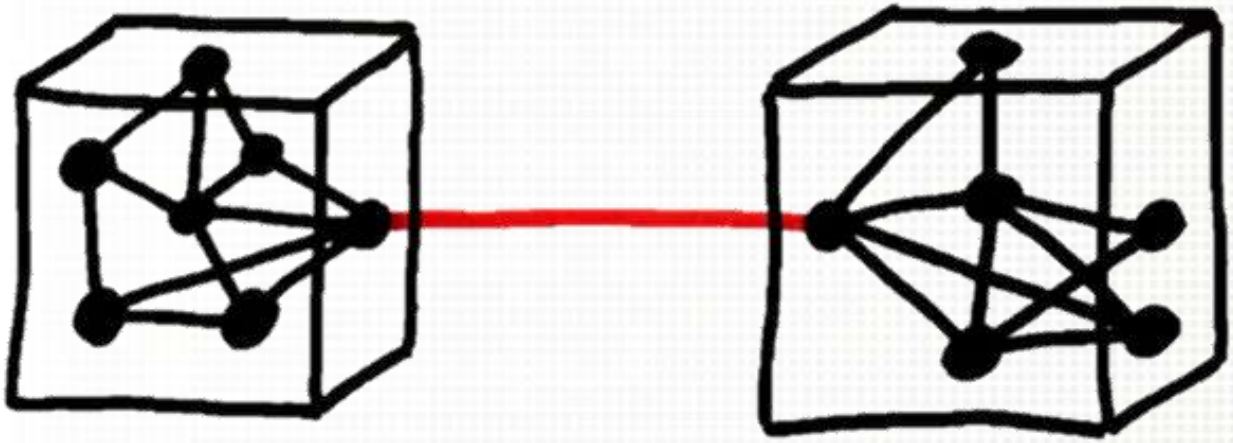
Supportive slides for answering questions…

Attitude – Balancing forces



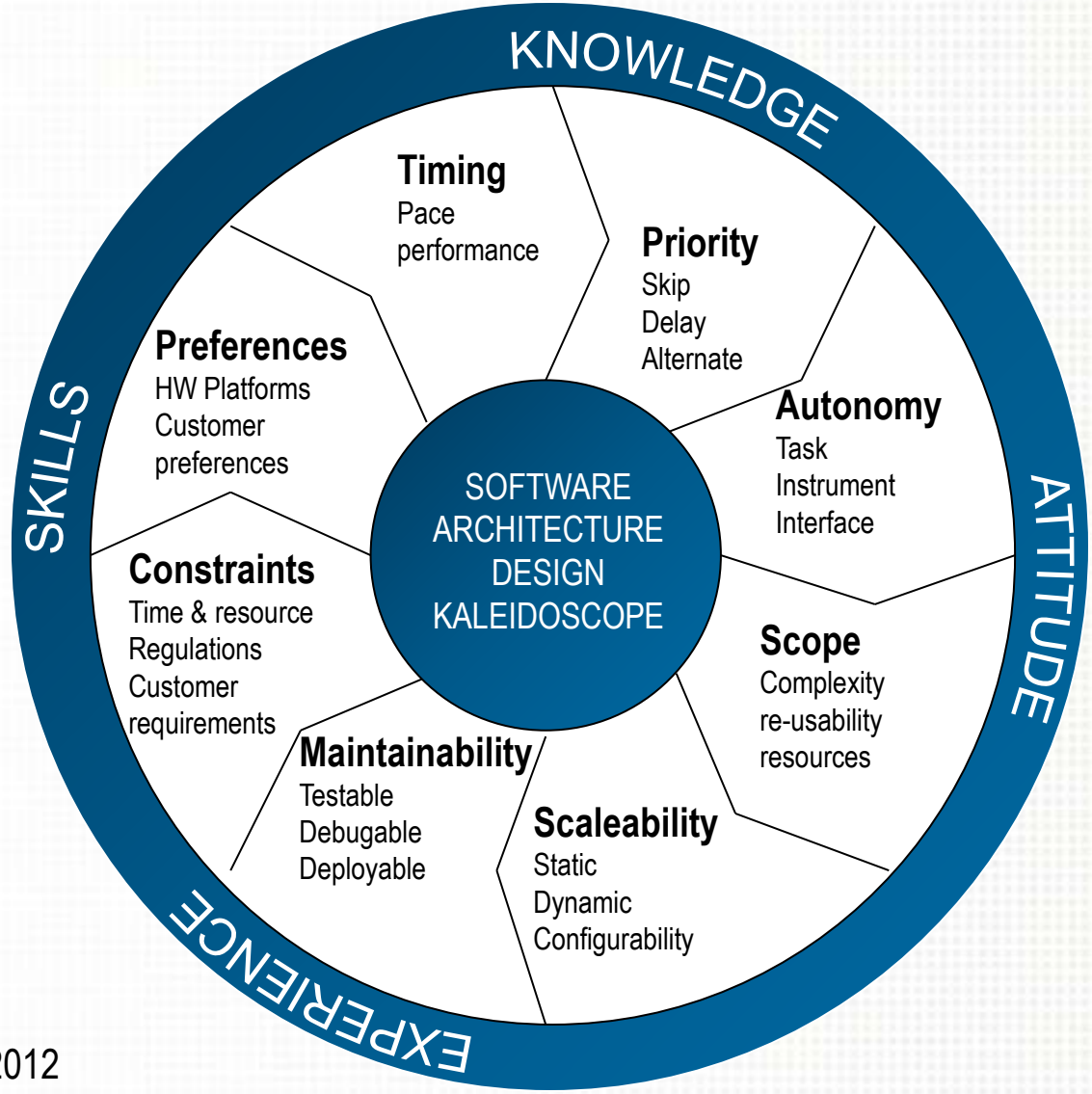
Experience

COUPLING AND COHESION



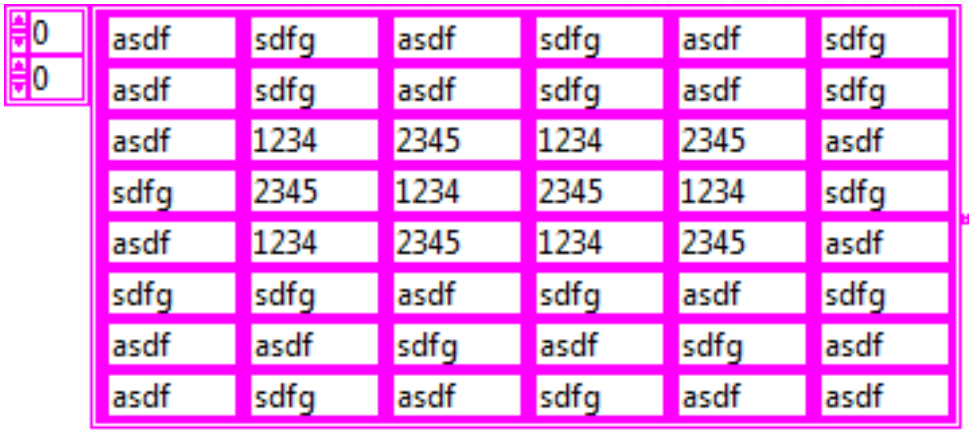
http://www.planetgeek.ch/2011/07/08/presentation-agile-code-design-how-to-keep-your-code-flexible/

DESIGN KALEIDOSCOPE



Question about testing…

- **Find the Location of the First Number in 2D String Array**



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