iTcl and TclOO

From the perspective of a simple user

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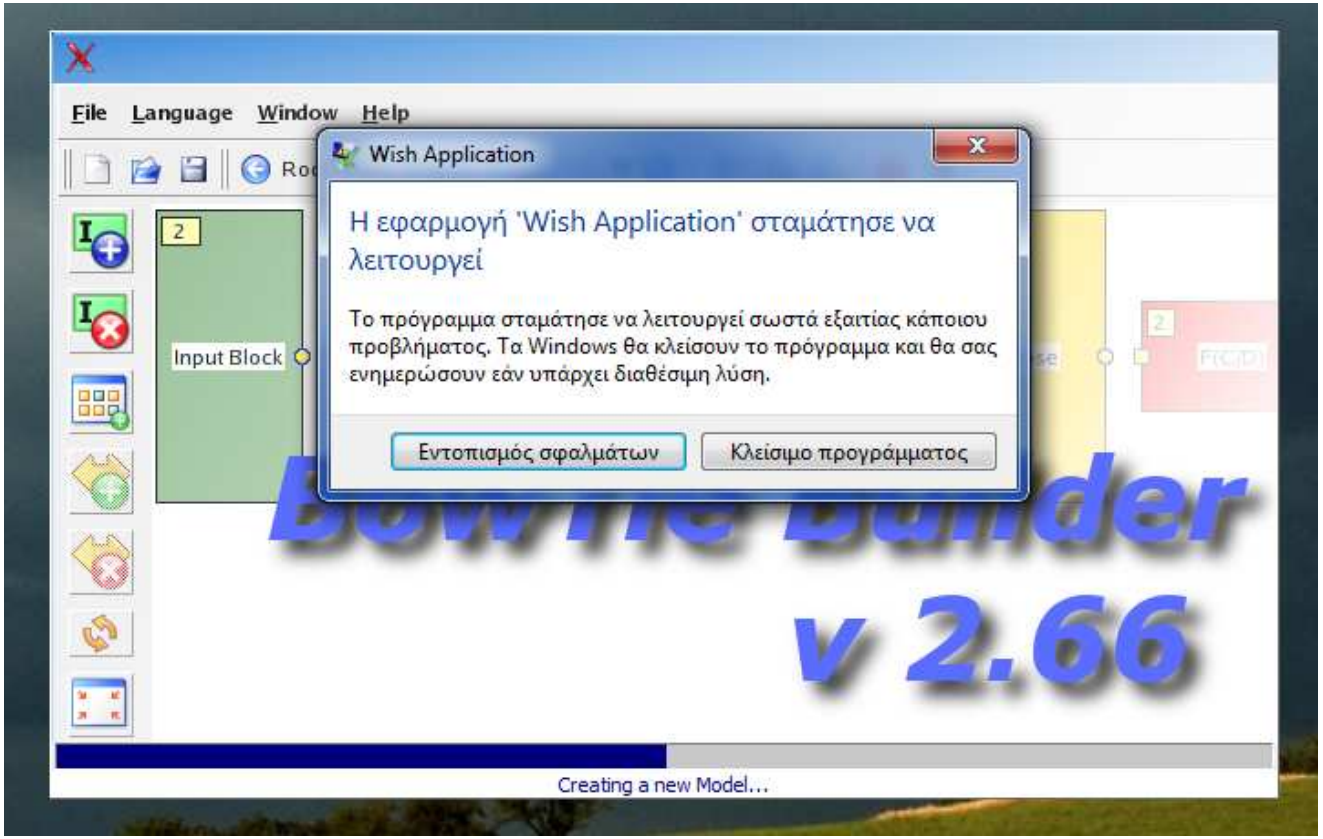
Overview

- The shock of Tcl 8.6
- Porting existing code to TclOO
- Case study: the Ellogon NLP platform
- iTcl facilities in TclOO
- Organisation of classes in Ellogon
- Creating an Annotation Tool
- Concatenating Dialogs
- Conclusions

iTcl and Tcl 8.6

- Assume an application that uses Itcl
  - What happens if it is run under ActiveTcl 8.6 beta?



iTcl and Tcl 8.6

- Ok, t
  - Le 10)
  - Tc 4)

Κονσόλα

File Edit Help

```
can't read "objectsTree": no such variable
can't read "objectsTree": no such variable
    while executing
"$objectsTree configure -dropenabled 1 -dragenabled 1  -dropcmd "$this CreatePro
pertiesPage_Objects_DropEvent""
    (object "::MainWindow::._treeGraphObj" method "::GraphTreeWidget::CreateProp
ertiesPage_Objects" body line 3)
    invoked from within
"CreatePropertiesPage_Objects"
    (object "::MainWindow::._treeGraphObj" method "::GraphWidget::CreateObjectWi
dget" body line 103)
    invoked from within
"CreateObjectWidget"
    while constructing object "::MainWindow::._treeGraphObj" in ::GraphWidget::c
onstructor (body line 17)
    invoked from within
"chain $parent_block $parent_widget $lvl 0"
    while constructing object "::MainWindow::._treeGraphObj" in ::GraphTreeWidge
t::constructor (body line 2)
    invoked from within
"GraphTreeWidget $tgraph [${frame}_graphObj name]  [string trimright $twin .].ma
in 0"
    (procedure "::MainWindow::New" line 64)
    invoked from within
"::MainWindow::New"
(Editor) 1 %
```

iTcl and Tcl 8.6

- Ok, iTcl 4.0 has a problem with a variable
  - Lets “correct” this

iTcl and Tcl 8.6

- iTcl object variables not supported?
  - It seems no…
    - ✓but, object naming was internal
- iTcl 4.0 has been actively maintained!
  - Significant progress since last test (6-8 months ago)
  - Does not crash
  - A few "rough edges" remain
- But:
  - Support for iTcl object variables seems missing

- Status of iTcl next generation?
  - Unknown. Not working either in previous tests

iTcl and Tcl 8.6

Alternatives for running the application?

- Wait until iTcl 4.0 is ready
  - Will it support 3.4 object variable naming?
- Port the code from iTcl to TclOO
  - Hm, 41 classes? ~20.000 lines of code?
    - ✓Such a task needs to be automated
- Stick to Tcl 8.5 and iTcl 3.4
- But what happens with open source applications?

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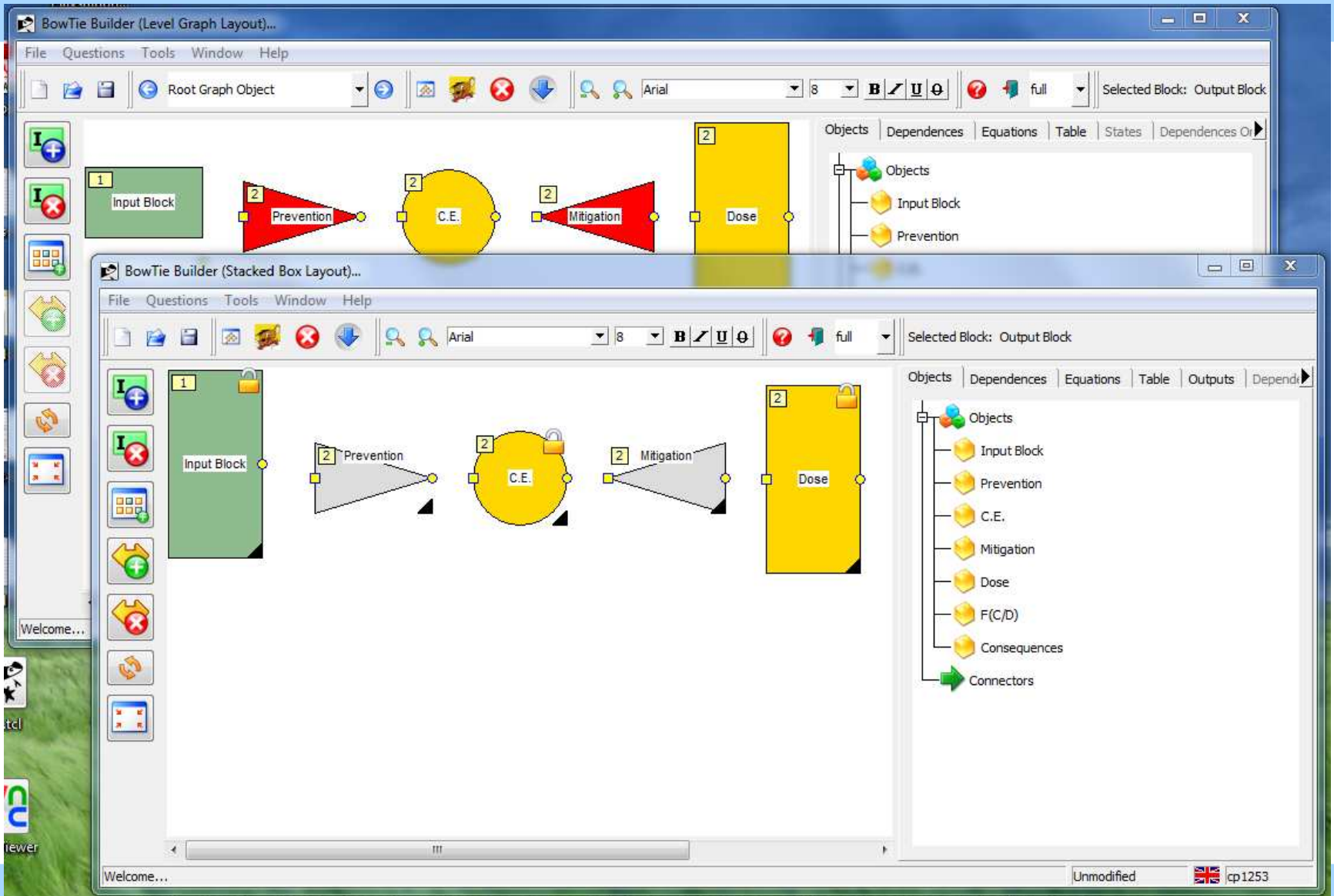
Porting from iTcl to TclOO (1)

- A medium sized application: Ellogon
  - Open source (LGPL), http://www.ellogon.org
  - Sticking to Tcl 8.5 is not an option
  - But ~**480** iTcl classes need to be ported!
    - ✓Different "variable" syntax
    - ✓The "my" keyword when calling methods
    - ✓Different method exporting convention
    - ✓…
    - ✓Where is TclOO documentation?

Porting from iTcl to TclOO (2)

- Largely a manual (and time consuming) effort
  - A helper Tcl script to perform "easy" substitutions
  - Several months were needed
  - But, a few portions could not be ported
    - ✓TclOO has some limitations
      - Or do I have a bad programming style? ☺
- The task is now largely finished
  - And the helper Tcl script got quite complex
- And what about other applications?
  - How about turning the conversion script into an iTcl emulator?

Porting from iTcl to TclOO (3)



Porting from iTcl to TclOO (4)

- A quick and simple approach actually
- Test application executes further than latest iTcl 4.0
- iTcl 3.x object variable references ("@itcl …") are converted to TclOO equivalent

But:

- Not all code substitutions are performed
  - Adding the "my" keyword to existing code is tricky
  - 4 regular expressions are not enough to handle this
    - ✓A package that "parses" Tcl is not available
  - Finally I gave up
    - ✓ no regular expressions for some cases

Porting: Differences (1)

Most notable differences between the two extensions:

- No configure/cget on TclOO objects
- No common variables across objects of the same class in TclOO
- No “static” class methods (methods that do not require an object to be called) in TclOO
- Different semantics for variables
- A specific method in the classes hierarchy of an object cannot be called in TclOO
- TclOO requires the keyword “my” while calling methods from inside of an object

Porting: Differences (2)

Most notable differences between the two extensions:

- TclOO automatically exports methods that start with a lowercase letter
- No facility for “local” to procedures objects (like itcl::local) in TclOO

Porting: Similarities

iTcl	TclOO
method	my method
$this	[self]
chain	next
itcl::scope	my varname
inherit	superclass
itcl::body	oo::define body

Interesting features of TclOO

- Everything subclasses oo::object
- “mixin”s
- “unknown” on objects
- The “my” keyword

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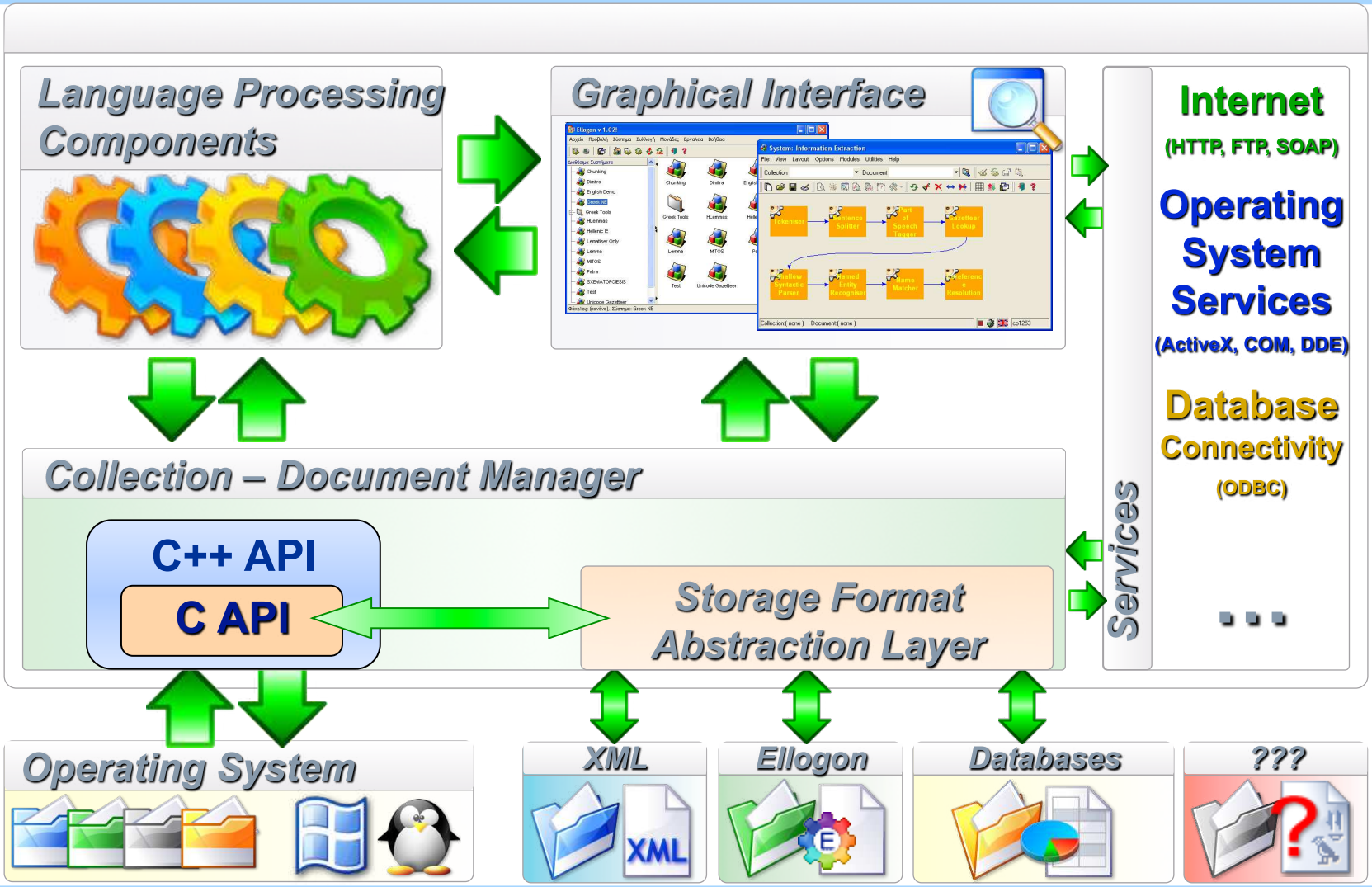
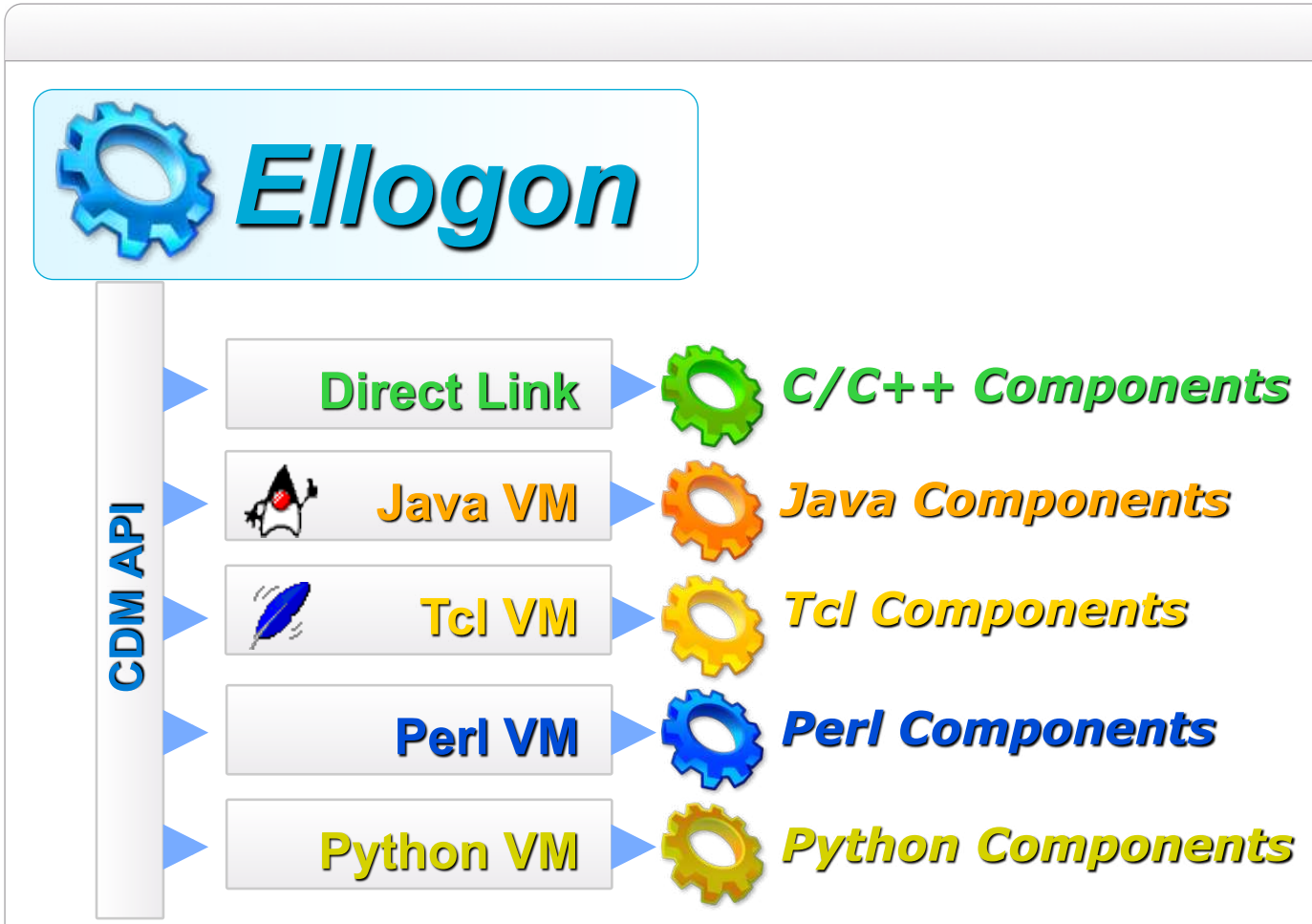
Case study: the Ellogon NLP platform

- Ellogon is an infrastructure for natural language processing
  - Provides facilities for managing corpora
  - Provides facilities for manually annotating corpora
  - Provides facilities for loading processing components, and apply them on corpora
- Development started in 1998
  - I think with Tcl/Tk 8.1
  - ~500.000 lines of C/C++/Tcl code
  - A lot of legacy code, especially in the GUI
    - ✓No widespread use of tile/ttk
    - ✓No OO (i.e. iTcl) in most parts of the code

Ellogon Architecture



Ellogon: plug-ins in many programming languages



The roadmap for Ellogon 2.0

The goals for Ellogon 2.0 are:

- Make Ellogon's core thread safe (done)
- Make Ellogon multi-threaded (feasible?)
  - How Ellogon & the Tcl thread model can cooperate?
- Modernise GUI (using OO and ttk widgets)
  - ~30% completed
  - Initially written in iTcl, now ported to TclOO
  - Includes a complete rewrite of Annotation Tools of Ellogon

Annotation Tools: polymorphism required

Annotation tools is a very demanding area

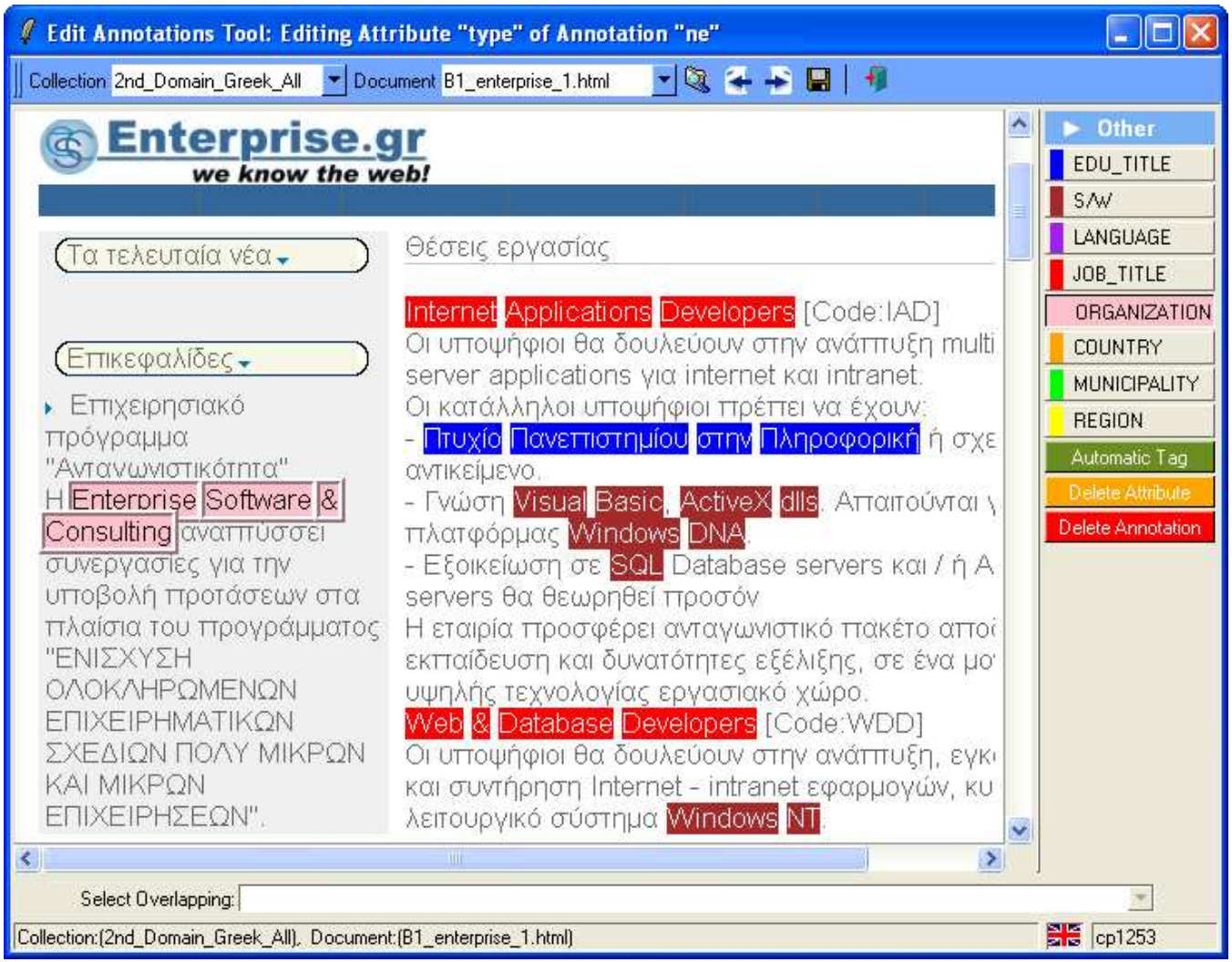
- A lot of tasks that need annotated corpora
- Each task, may have its own annotation scheme
- Each group, may pose different requirements for the tool

The first generation of tools was:

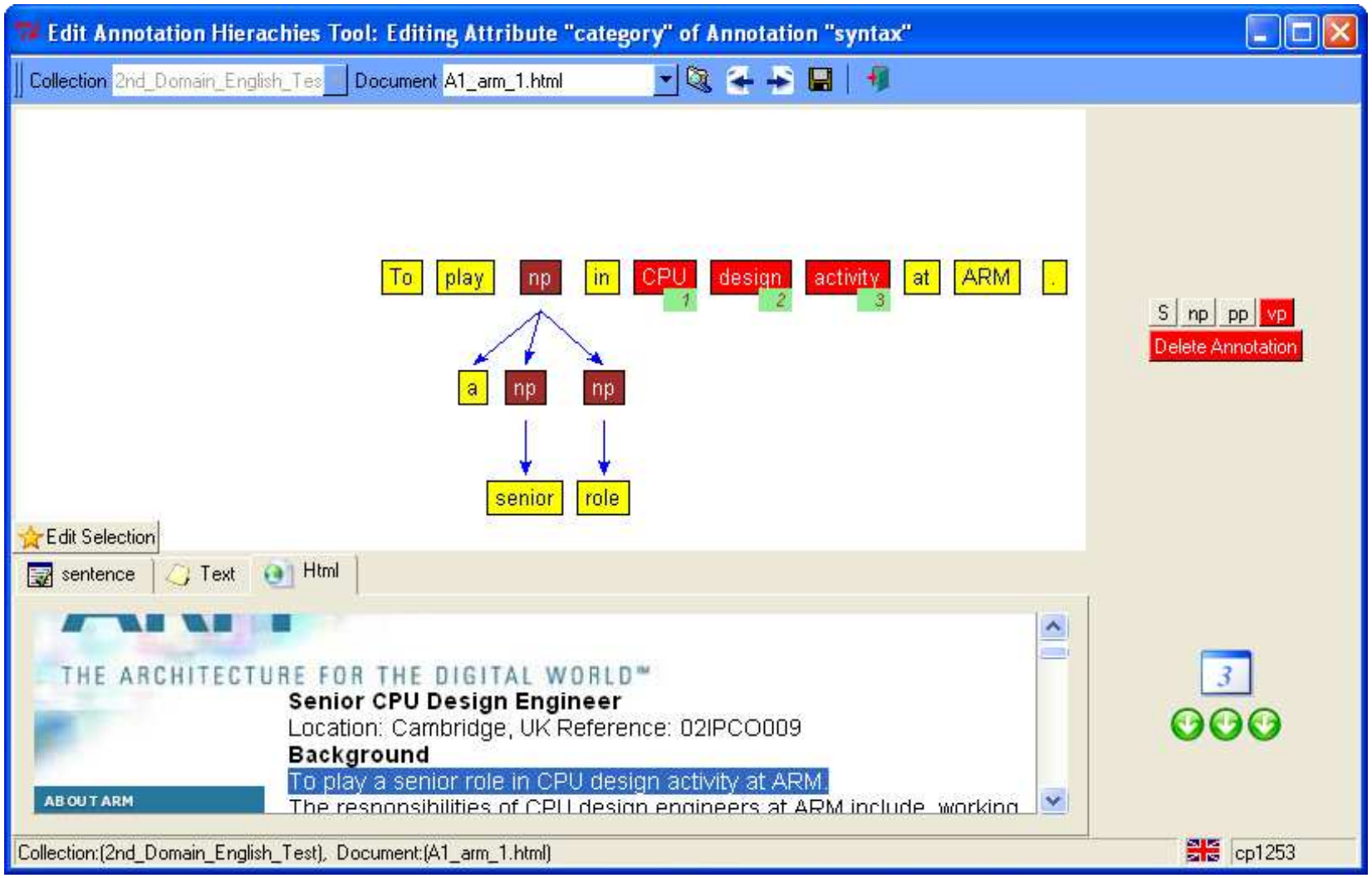
- coded in plain Tcl/Tk
- difficult to adapt/extend

First generation tools (1)

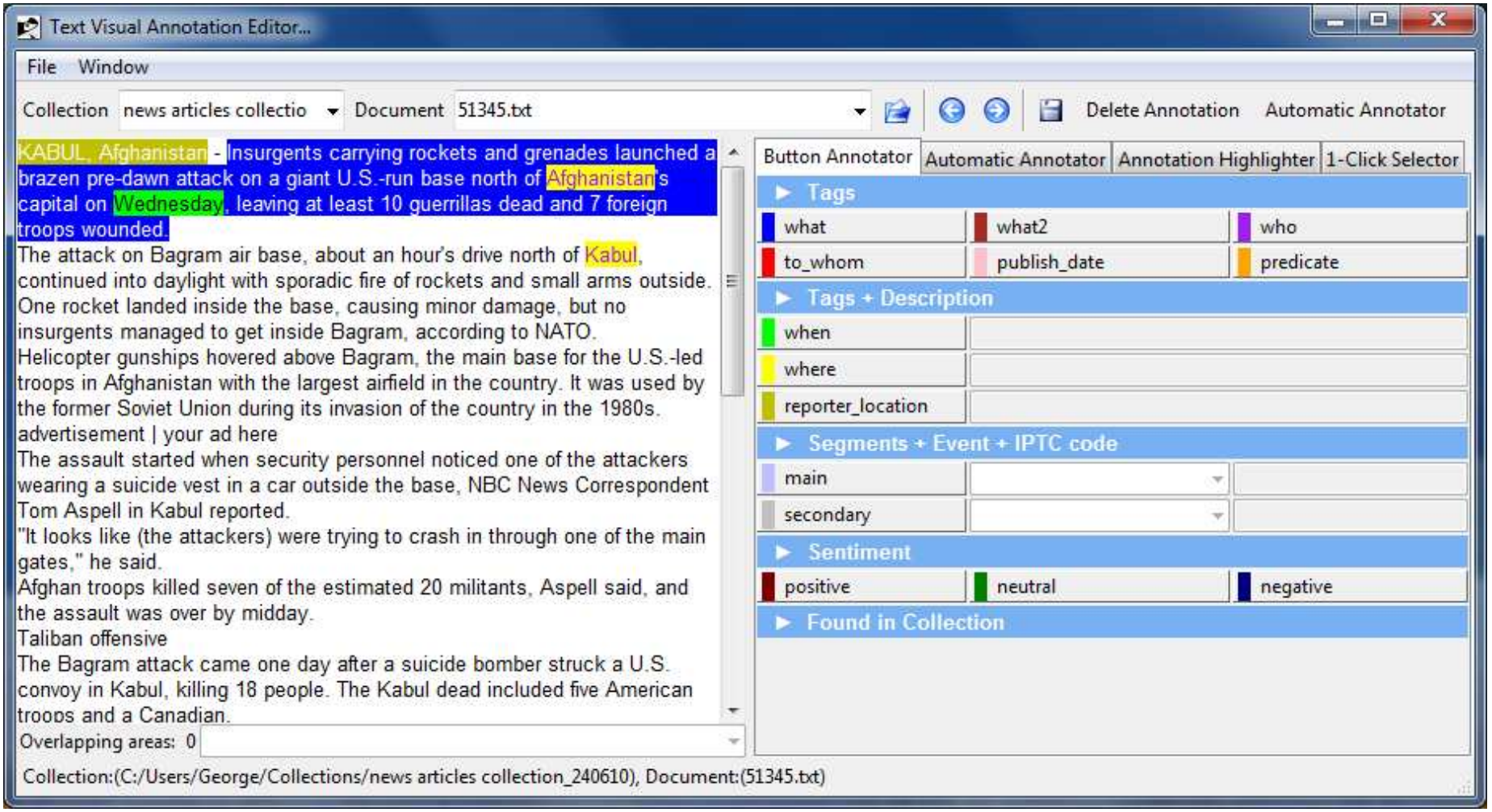
First generation tools (2)



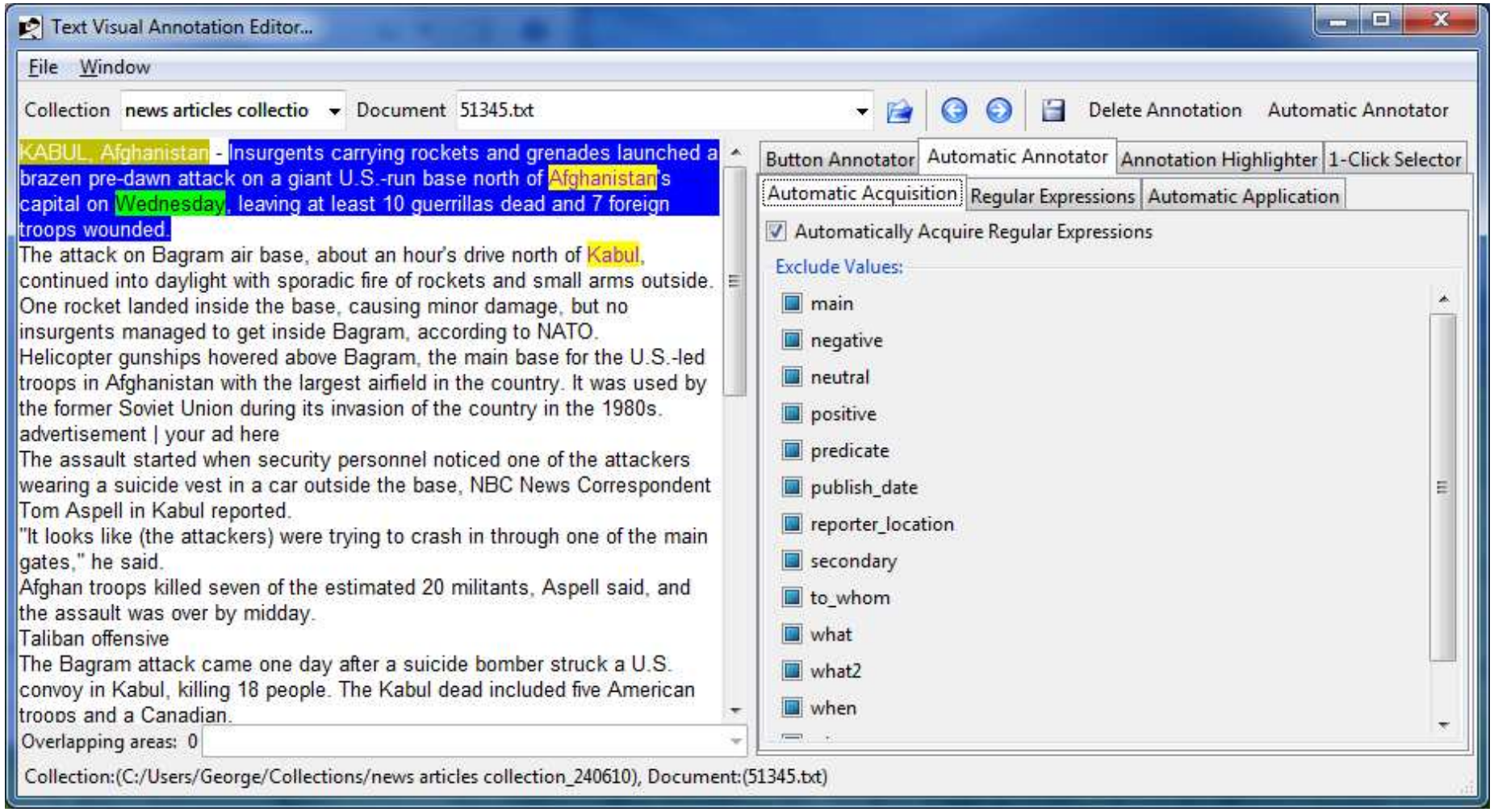
First generation tools (3)



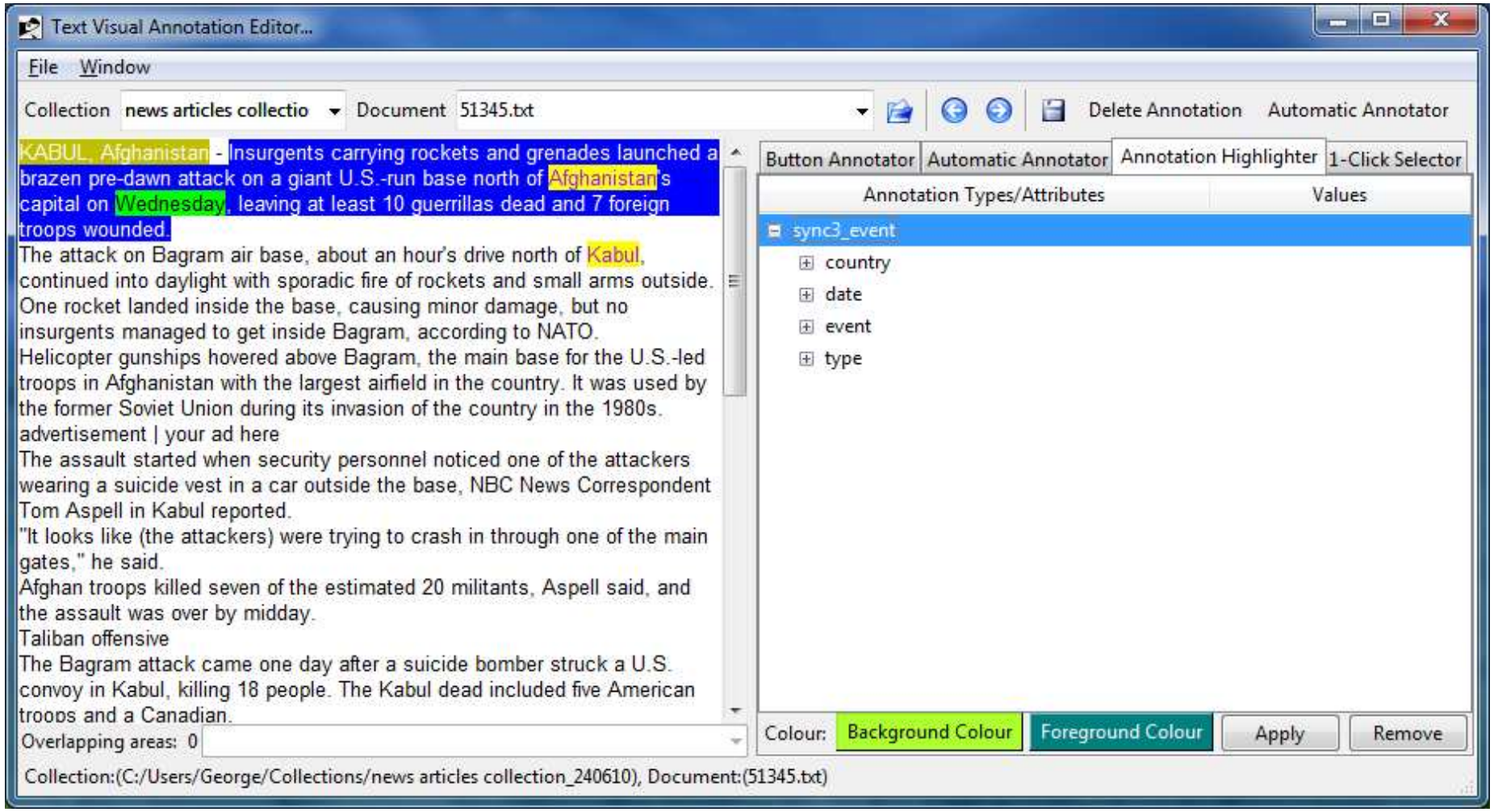
Second generation tools (1)



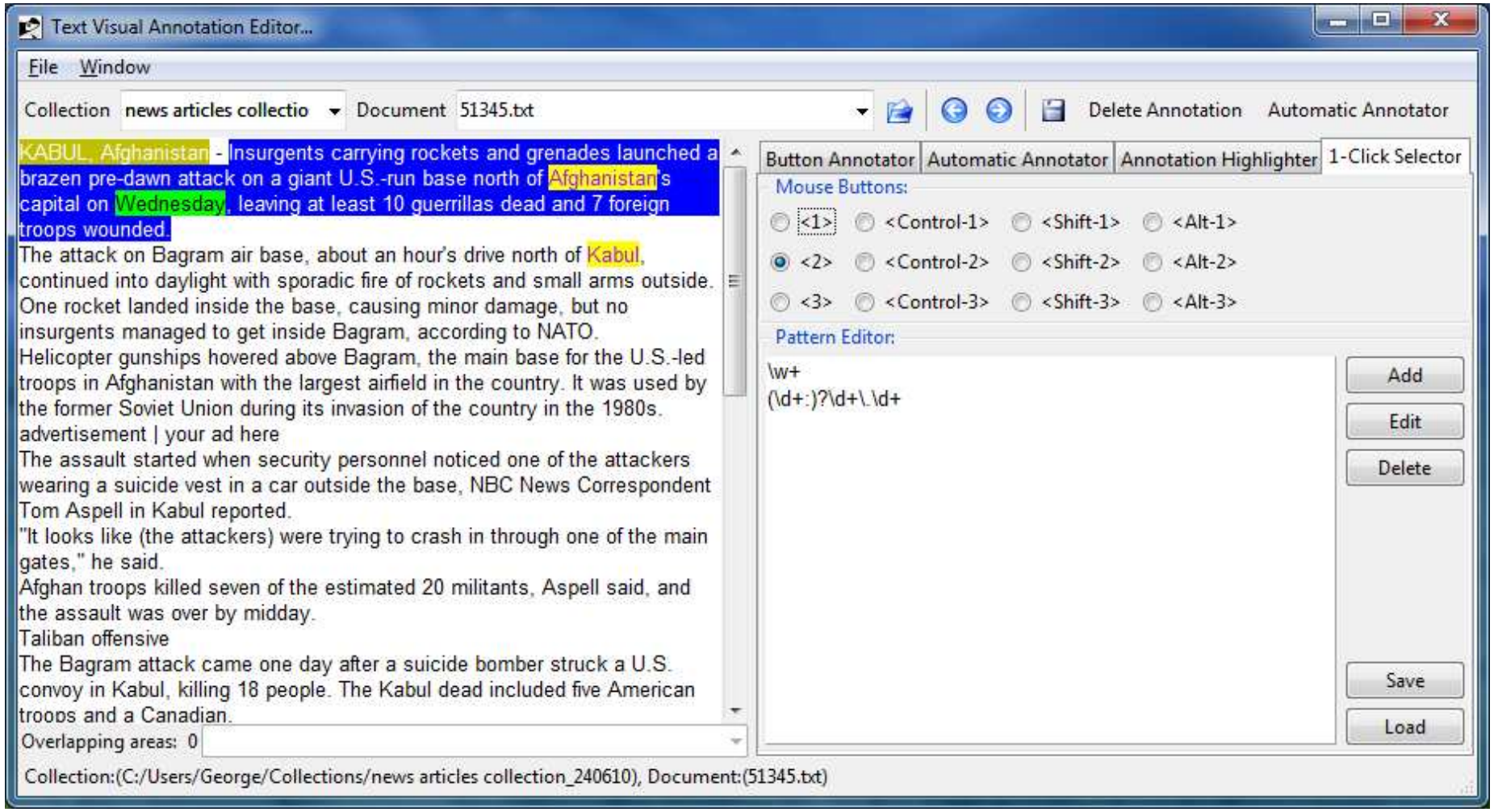
Second generation tools (2)



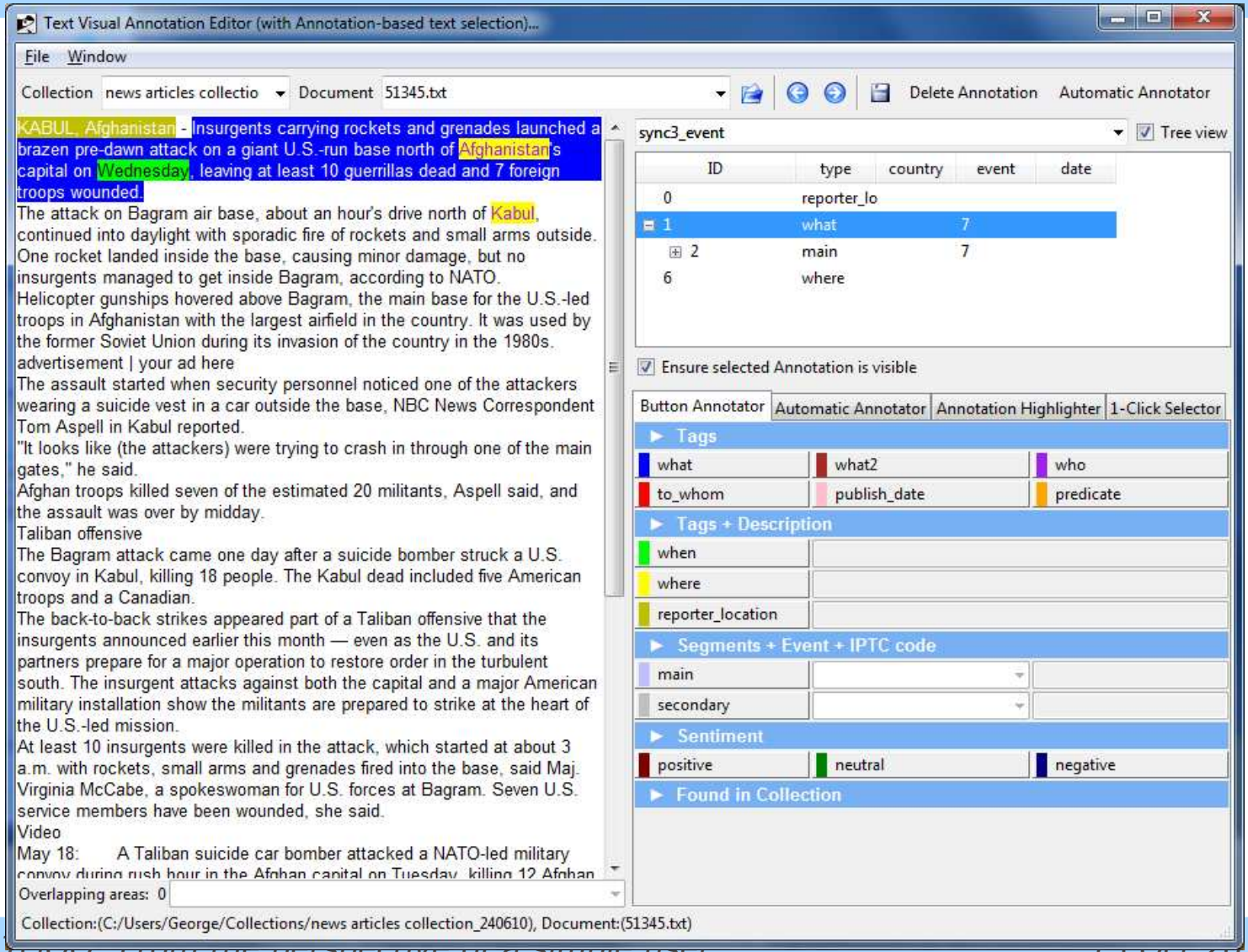
Second generation tools (3)



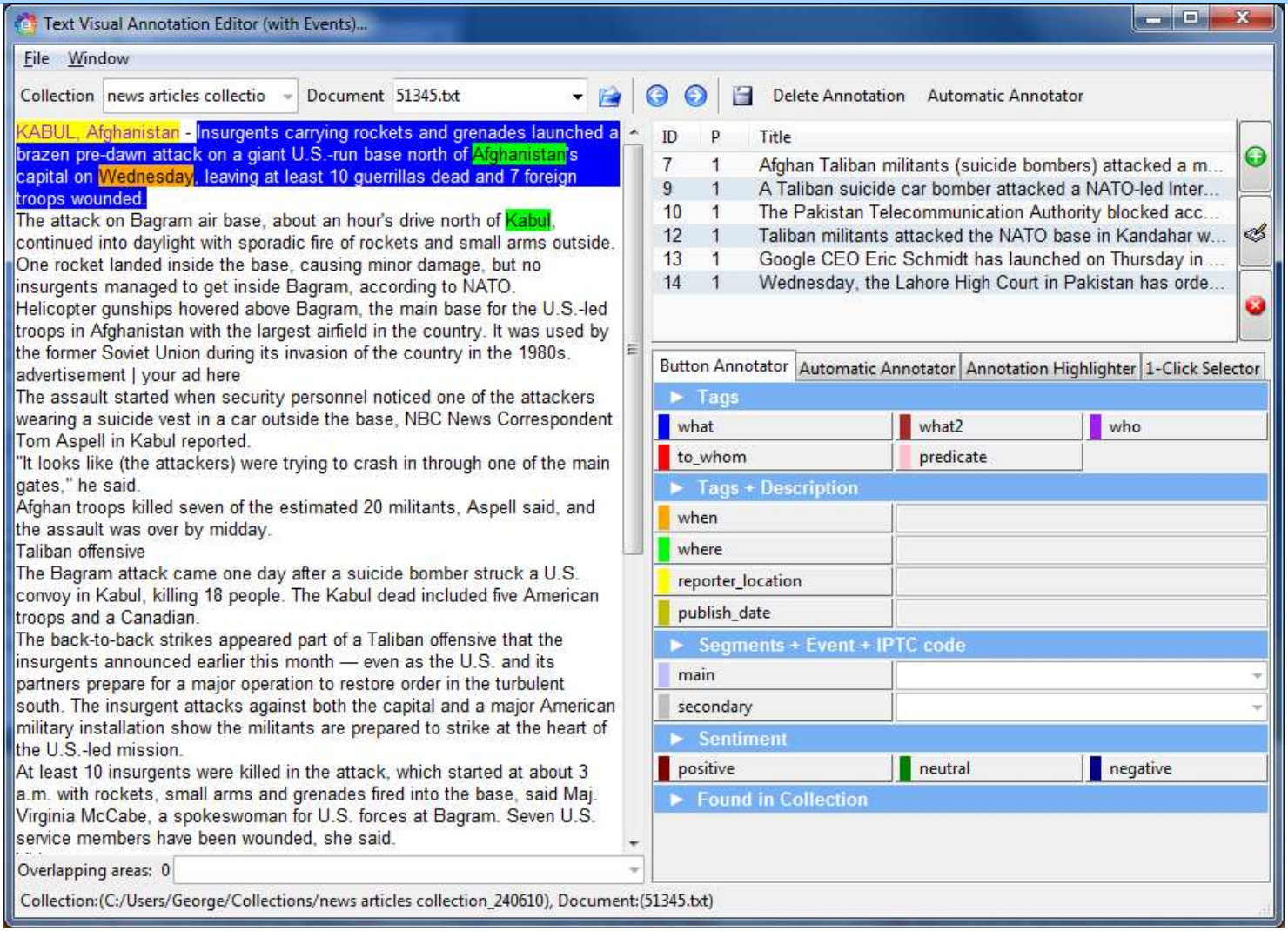
Second generation tools (4)



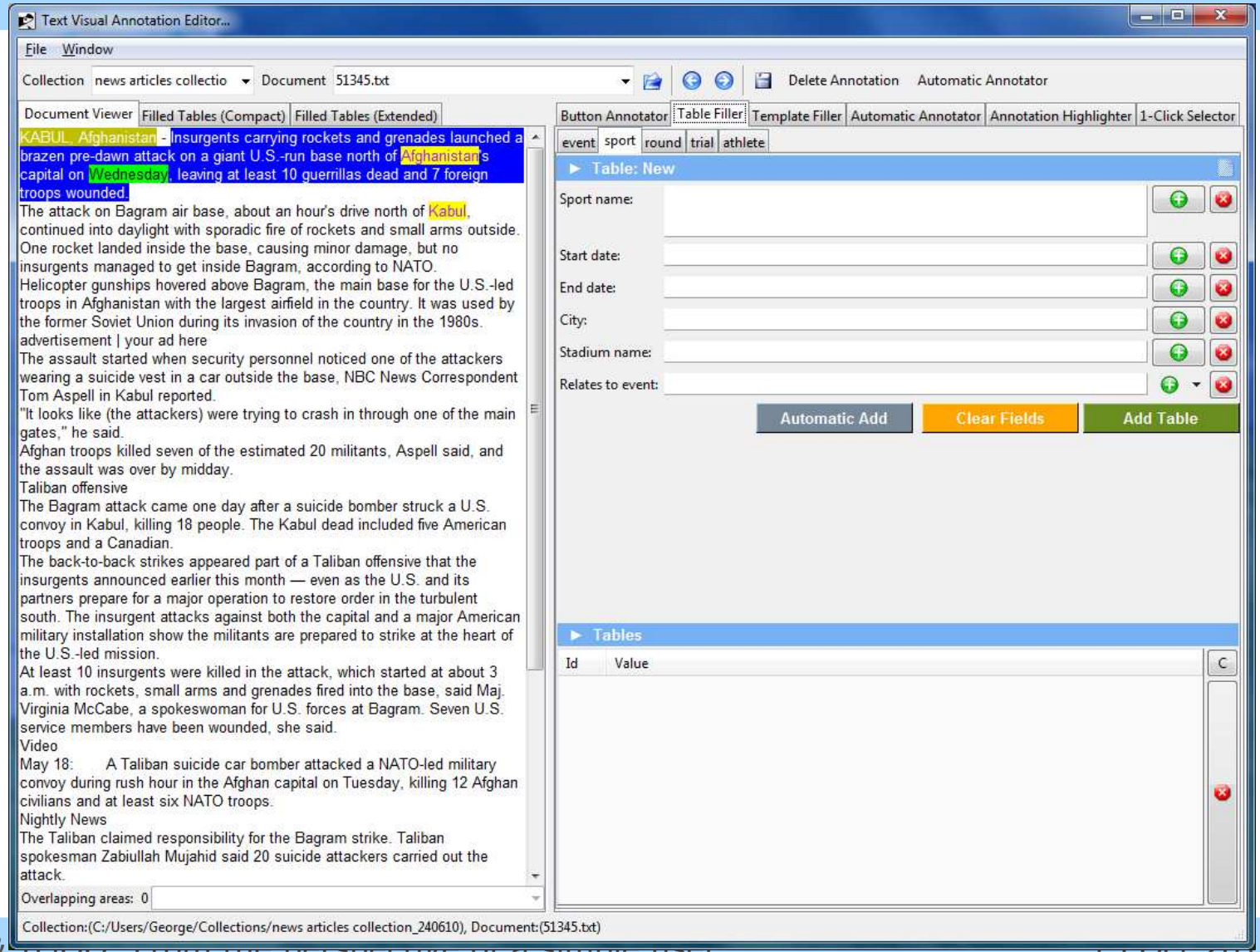
Second generation tools (5)



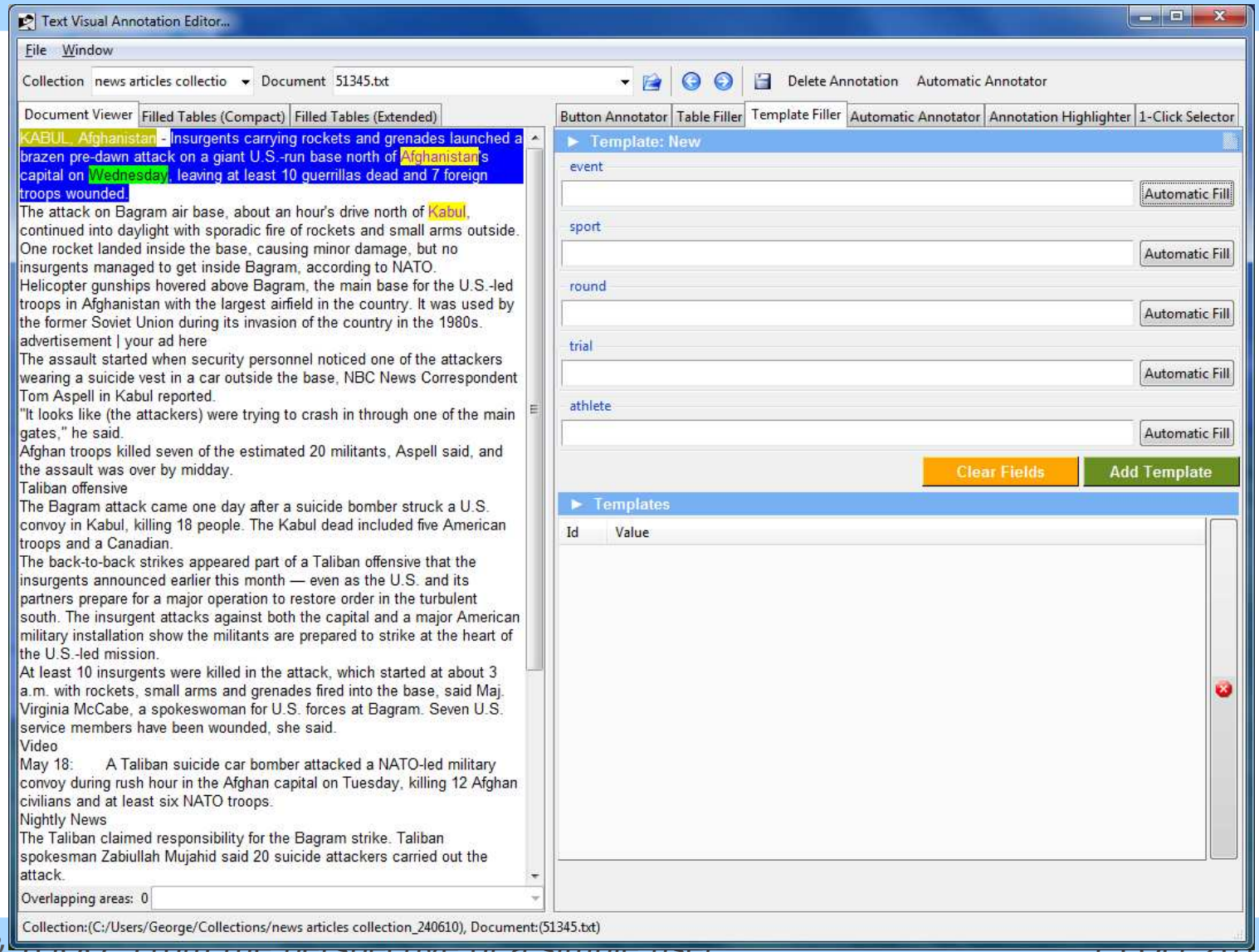
Second generation tools (6)



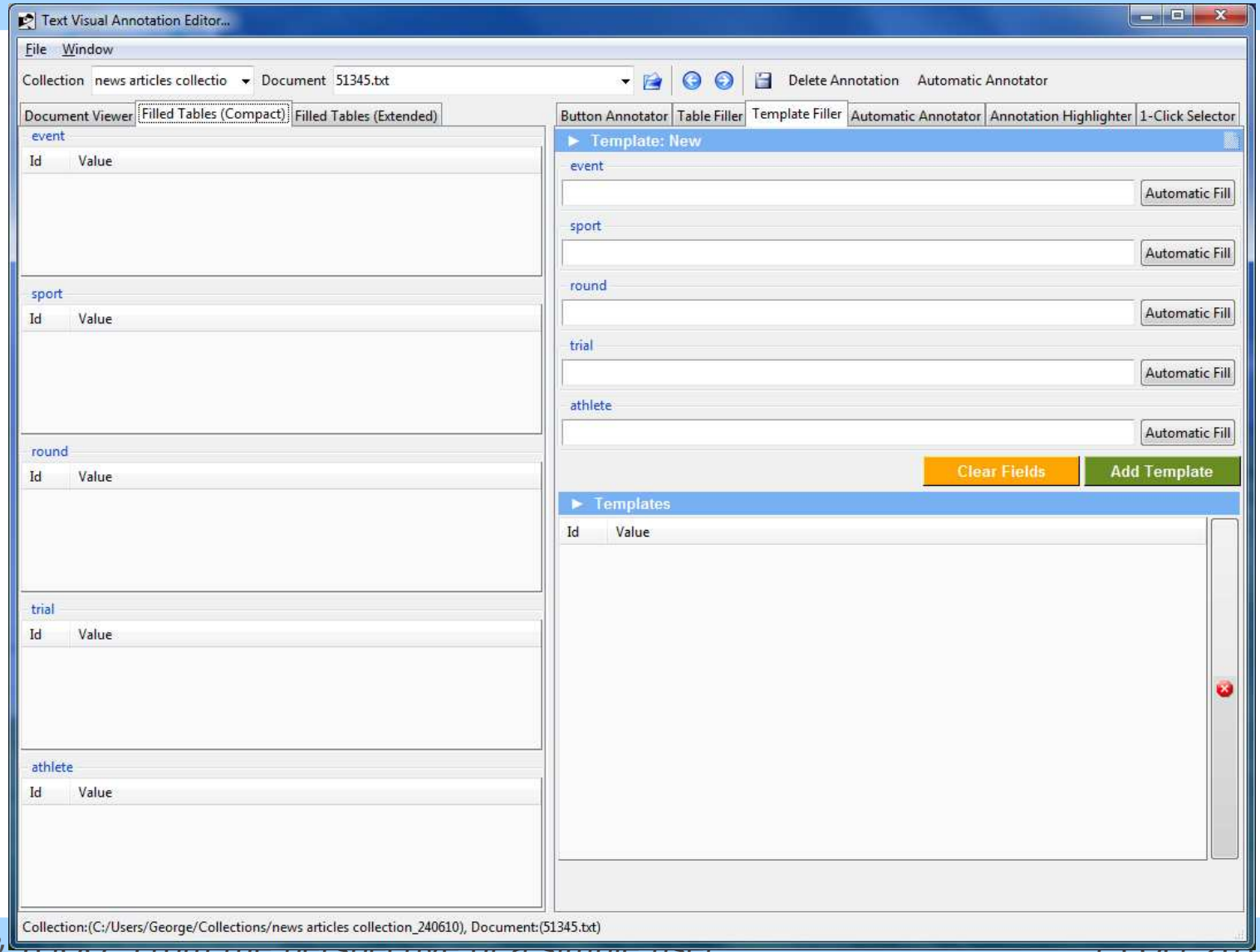
Second generation tools (7)



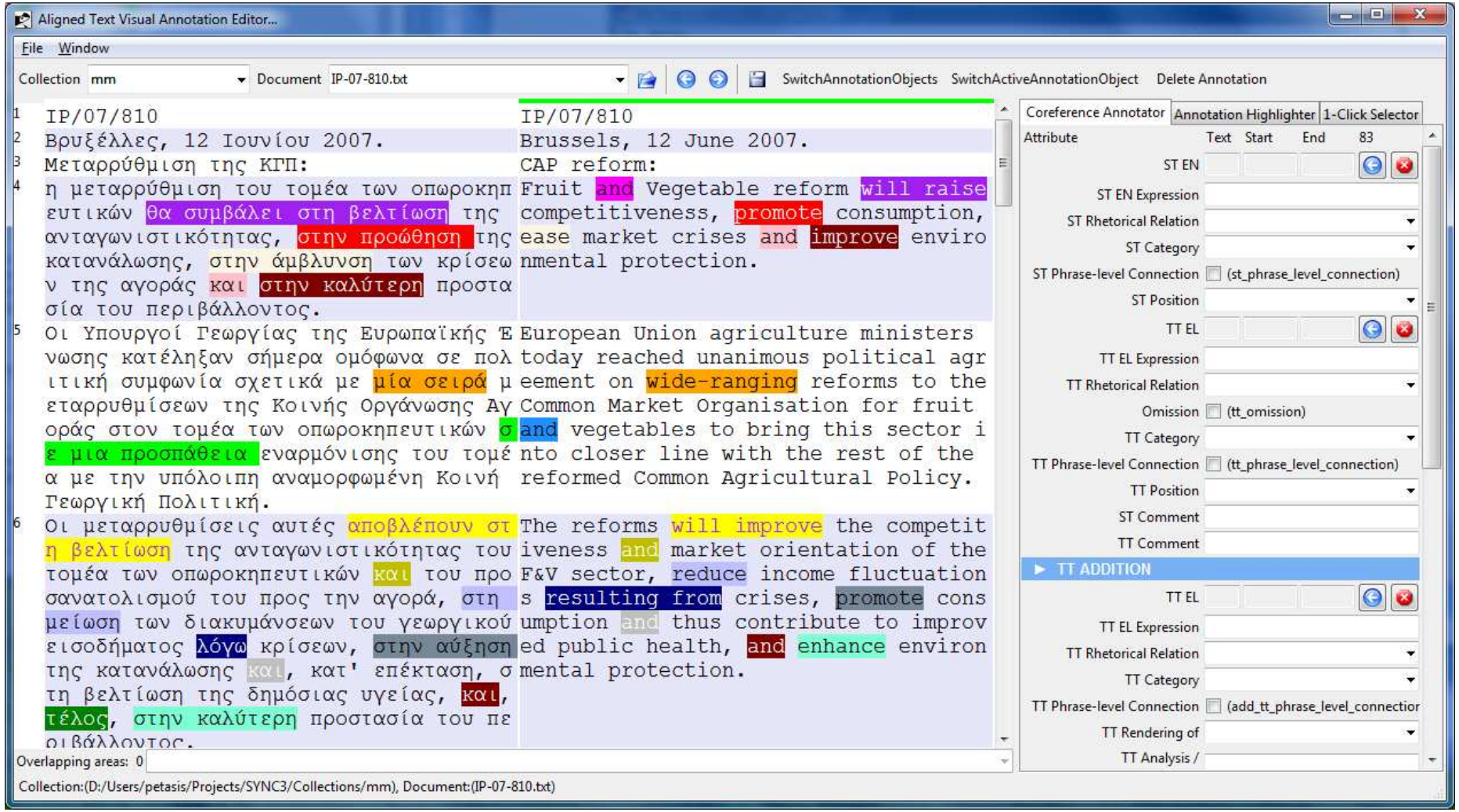
Second generation tools (8)



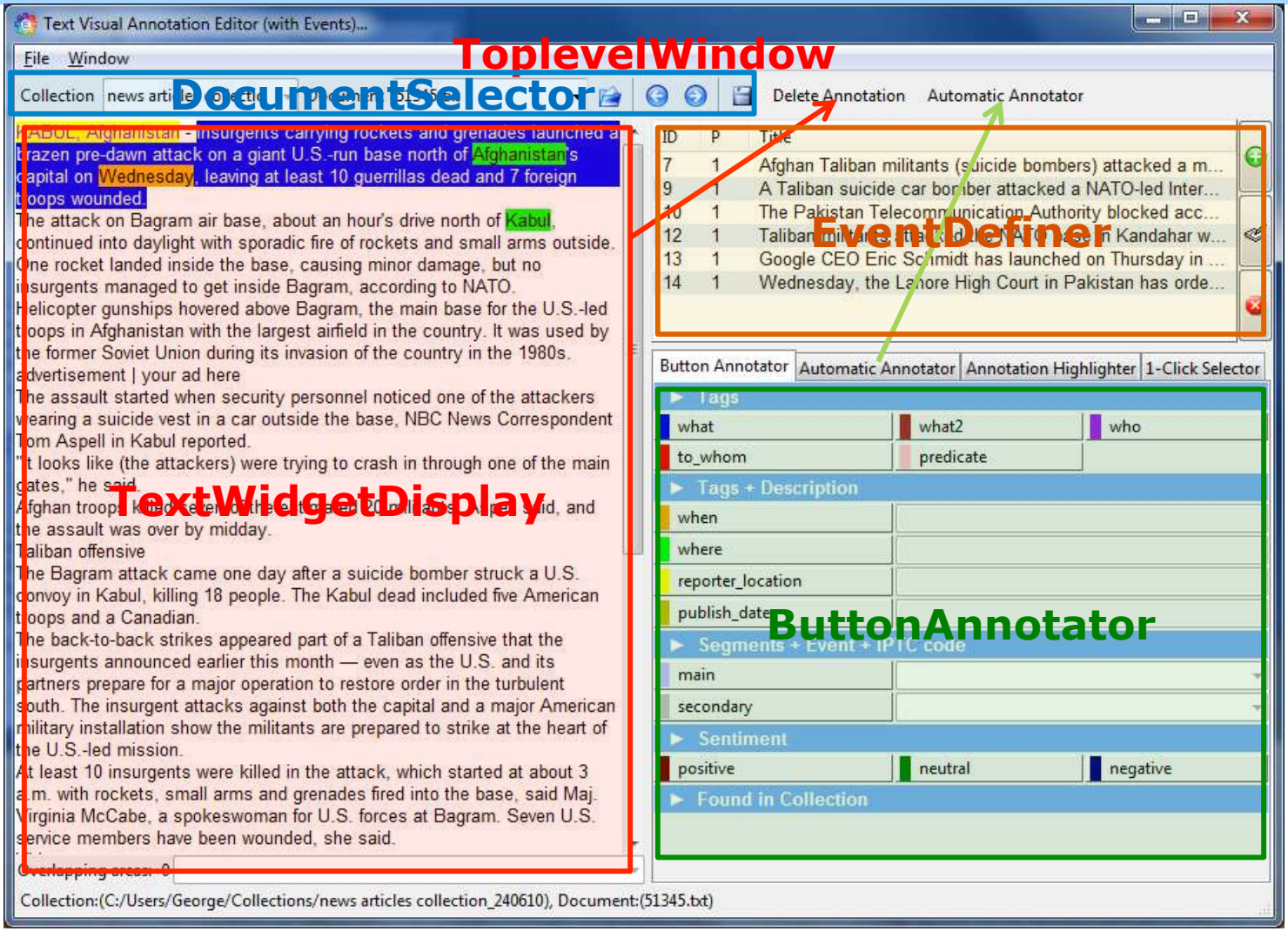
Second generation tools (9)

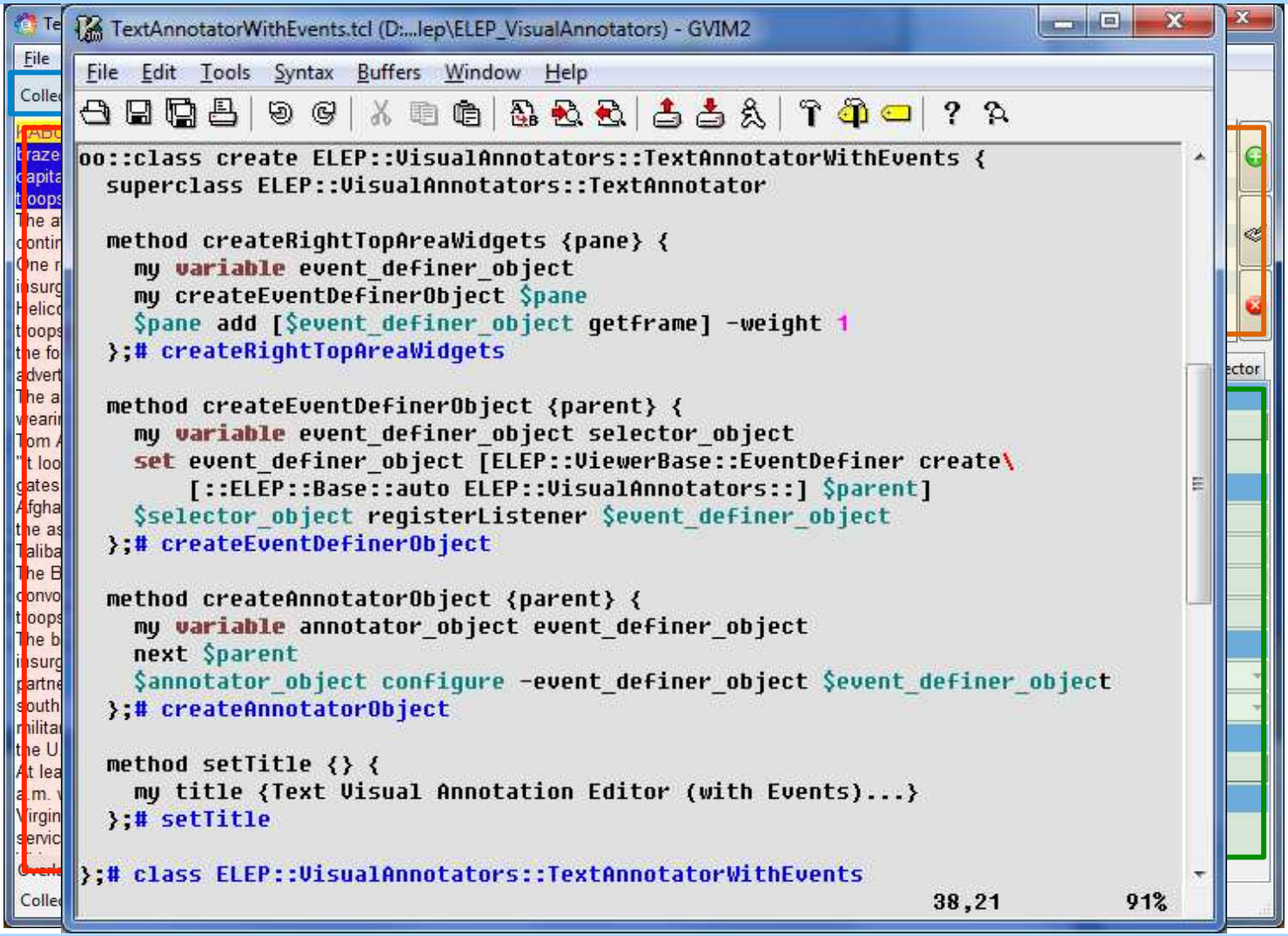


Second generation tools (10)



Classes Decomposition (1)




TextAnnotatorWithEvents.tcl (D:...lep\ELEP_VisualAnnotators) - GVIM2
File Edit Tools Syntax Buffers Window Help
oo::class create ELEP::VisualAnnotators::TextAnnotatorWithEvents {
superclass ELEP::VisualAnnotators::TextAnnotator
method createRightTopAreaWidgets {pane} {
my variable event_definer_object
my createEventDefinerObject $pane
$pane add [$event_definer_object getframe] -weight 1
};# createRightTopAreaWidgets
method createEventDefinerObject {parent} {
my variable event_definer_object selector_object
set event_definer_object [ELEP::ViewerBase::EventDefiner create\
[::ELEP::Base::auto ELEP::VisualAnnotators::] $parent]
$selector_object registerListener $event_definer_object
};# createEventDefinerObject
method createAnnotatorObject {parent} {
my variable annotator_object event_definer_object
next $parent
$annotator_object configure -event_definer_object $event_definer_object
};# createAnnotatorObject
method setTitle {} {
my title {Text Visual Annotation Editor (with Events)...}
};# setTitle
};# class ELEP::VisualAnnotators::TextAnnotatorWithEvents
38,21 91%

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Ellogon TclOO classes: cget/configure

- A
- V
- S

Utilities.tcl (D:\Users\peta...2.0\lib_elep\ELEP_Base) - GVIM1

File Edit Tools Syntax Buffers Window Help

```
##
## Define cget/configure for all classes!
##
oo::define oo::object method cget {_elep_oo_variable_name} {
  ## Remove the preciding "-" character...
  set _elep_oo_variable_name [string range $_elep_oo_variable_name 1 end]
  switch -glob -- $_elep_oo_variable_name {
    *(*) {
      ## This is an array index!
      lassign [split $_elep_oo_variable_name ()] \
        _elep_oo_variable_array _elep_oo_variable_key
      my variable $_elep_oo_variable_array
    }
    default {
      my variable $_elep_oo_variable_name
    }
  }
  return [set $_elep_oo_variable_name]
};# cget
```

76,1 32%

re/

oo::
se
my
};#

Ellogon TclOO classes: common (1)

- TclOO has another trick:
  - Procedure oo::define::<name> extends oo::class
    - ✓Implementing ::oo::define::common allows to use the keyword "common" during class creation

```
proc ::oo::define::common {varname args} {
  if {[llength $args] > 1} { … }
  # Get the name of the current class
  set cls [lindex [info level -1] 1]
  oo::define $cls self export varname; # Export method varname
  # Initialise the variable
  if {[llength $args]} {
    set [$cls varname $varname] [lindex $args 0]
  }
};# ::oo::define::common
```

Ellogon TclOO classes: common (2)

- But common also needs a method to be called from methods accessing common variables

```
oo::define oo::object method common {args} {
  if {![llength $args]} return
  set callclass [lindex [self caller] 0]
  oo::define $callclass self export varname
  foreach vname $args {
    lappend pairs [$callclass varname $vname] $vname
  }
  uplevel 1 upvar {*}$pairs
};# common
```

- Common and my cget/configure do not mix

Ellogon TclOO classes: class methods (1)

```
## Define "classmethod"...
proc ::oo::define::classmethod {name {args ""} {body ""}} {
  # Code from: http://wiki.tcl.tk/21595#pagetoce30e53a1
  set argc [llength [info level 0]]
  if {$argc == 4} {
    uplevel 1 [list self method $name $args $body]
  } elseif {$argc == 3} {
    return -code error "..."
  }
  # Get the name of the current class
  set cls [lindex [info level -1] 1]
  # Get its private "my" command
  set my [info object namespace $cls]::my
  # Make the connection by forwarding
  tailcall forward $name $my $name
};# ::oo::define::classmethod
```

Ellogon TclOO classes: class methods (2)

- What about inheritance?

```
oo::class create ELEP::Base::Utilities {
  classmethod userAppDir   {} {...}
}

oo::class create ELEP::System::System {
  superclass ELEP::Base::Utilities
  classmethod systemConfigurationDir {} {
    return [my userAppDir]/Systems/Config
  };# systemConfigurationDir
```

- unknown method "userAppDir"

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Widget classes (1)

- In Ellogon, I don't think in terms of Tk widgets
  - In fact, I totally ignore them
- Only 3 classes available, which represent widgets
  - Toplevel, Dialog, Widget, RibbonToplevel
    - ✓RibbonToplevel has a Windows Ribbon instead of a menu
- Some common methods for all classes
  - getToplevel
  - getToplevelObject
  - getClientArea
- Automatic variables
  - win for toplevel/dialogs
  - widget for widgets

Widget classes (2)

- Widgets are destroyed when objects are deleted, and vise versa
  - In a way similar to iTk
- Toplevel/Dialogs generate widgets based on the object names
- Objects of the Widget class need the widget type and name
  - i.e. Widget ttk::button .button ?args?

Ellogon building blocks

- Many building blocks that inherit Widget
  - Only the Tk widget that will contain the block is required (the “parent”)
  - i.e. ButtonAnnotator, 1-Click selector, TemplateFiller, TextViewer, HTMLViewer, AllignedTextViewer, etc.
- A generic class that represents an Annotation tool
  - Inherits from Toplevel
  - Splits client area into two columns, separated by a ttk::panedwindow
- All tools, subclass this class, add another layout if required, and create/place building block objects

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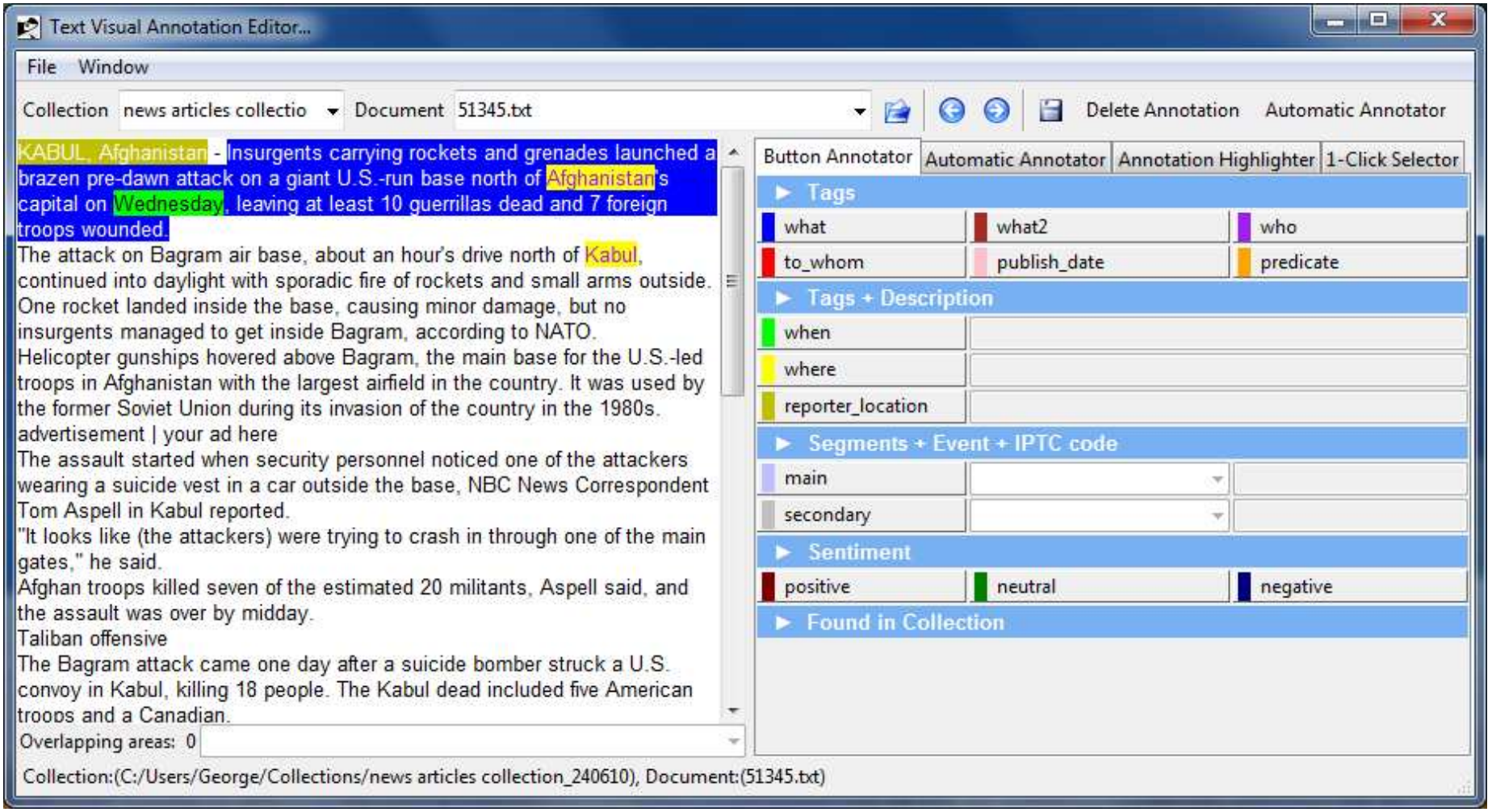
Creating an Annotation Tool

- Gluing building blocks is easy, but what about the user experience?

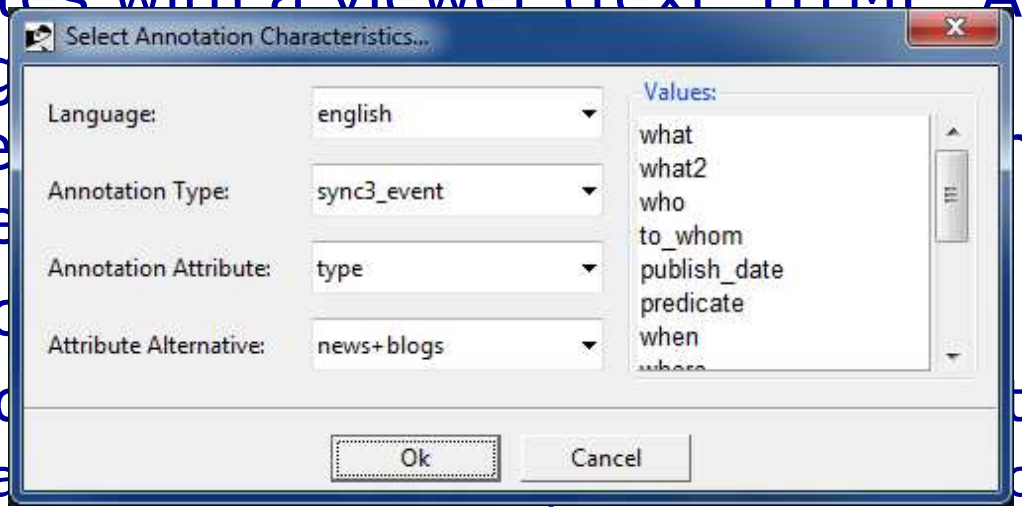
- Lets see an example, by creating an Annotation tool that annotates a document with a semantic model (i.e. an ontology)
  - For this task, the bits required are:
    1. An annotator to annotate "properties" found in the text
    2. An annotator to group properties into objects
    3. An annotator to group objects into other objects

Annotating properties: the button annotator (1)



Annotating properties: the button annotator (2)

- Cooperates with a viewer (text, HTML, Aligned text, Alig … to annotate … hore propertie…
- The anno…
  - Method … t()
    - ✓ Crea… or object
  - Method show()
    - ✓ Calls AnnotationSpecificationSelector.show() and waits for an answer
  - Various schemas are read from an XML file, and presented to the user
  - Button annotator adapts to the selected schema



Grouping properties/objects

- The TemplateFiller annotator
- Again presents a dynamic schema
- Now method createSpecificationSelectorObject()
  - Creates an AnnotationAndTemplateSpecificationSelector object
- How easy is to mix the two annotators?
  - Easy, just create the two objects and place them on a single annotation tool
- Any disadvantages?
  - Yes. The user gets two dialogs for configuring a single tool!

The multiple dialog issue

How can this be resolved?

- A new class must be created, which is the concatenation of the two configuration dialogs
- The two objects must somehow create and use the same configuration object

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Concatenating dialogs (1)

- In iTcl was very easy:
  - Create a new class that inherits the two configuration objects
  - iTcl has the ability to call explicitly methods from the class hierarchy:
    - ✓ Method populateDialogFrame() just creates two ttk::labelframe and calls populateDialogFrame() of the two inherited classes with the proper parent frame.

- In TclOO the task is far more complex!
  - You cannot simply inherit both classes

Concatenating dialogs (2)

The best alternative?

- Create a new class that behaves as both configuration selectors, and drives instances of the two selectors internally
  - The new class must have all methods of the two objects
  - The new class must have all the public variables of both objects (so as cget/configure to work)

Exposing variables of contained objects

1. Declare all variables as “automatic”
   - i.e. in class, with the “variable” keyword
2. Use “upvar” to link variables between two objects

```
oo::class create ELEP::ViewerBase::AnnotationAndTemplateSpecificationSelector {
  variable dialog_window ann_selector templ_selector \
           language annotation attribute alternative groups values \
           template tables
  method init {} {
    set ann_selector   [ELEP::ViewerBase::AnnotationSpecificationSelector \
                          create [::ELEP::Base::auto ::ELEP::ViewerBase::] 0]
    set templ_selector [ELEP::ViewerBase::TemplateSpecificationSelector \
                          create [::ELEP::Base::auto ::ELEP::ViewerBase::] 0]
    oo::objdefine $ann_selector export varname
    foreach var {language annotation attribute alternative groups values} {
      upvar [$ann_selector varname $var] [my varname $var]
    }
    oo::objdefine $templ_selector export varname
    foreach var {template tables} {
      upvar [$templ_selector varname $var] [my varname $var]
    }

    my createReader
    my createDialog
    my populateDialogFrame [$dialog_window getframe]
    my restoreState        [$dialog_window getframe]
  };# init
```

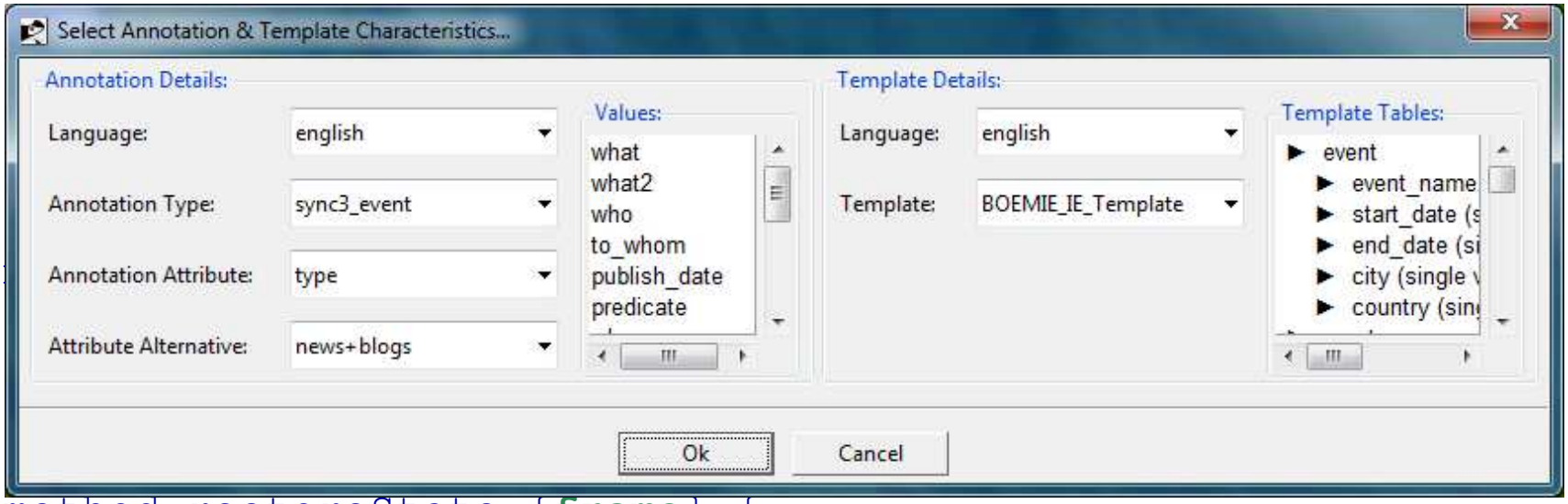
Exposing methods of contained objects

- Methods from both contained objects must be exposed - through “unknown”

```
method unknown {args} {
  ## Try to call the aggregated objects...
  if {![catch {$ann_selector {*}$args} result]} {
    return $result
  }
  if {![catch {$templ_selector {*}$args} result]} {
    return $result
  }
  next unknown {*}$args
};# unknown
```

Problems solved?

- So, are all problems solved?
  - No




```
method restoreState {frame} {
  $ann_selector   restoreState $frame.annotation
  $templ_selector restoreState $frame.template
};# restoreState
```

What about efficiency?

- Is there a problem using unknown to "distribute" method calls to the proper object?
  - I don't know, I haven't measured
  - I assumed that there is a penalty, so I explored alternatives before implementing a similar approach for "merging" Button Annotator & Template Filler
- What I finally did, was to create a new class which
  - Inherits only ButtonAnnotator
  - The various methods of TemplateFiller are copied/ extend methods of the new class
    - ✓Thus "next" works, as there is only a linear hierarchy to follow
    - ✓The configuration selector dialog object is single/common

Overview

- The shock of Tcl 8.6
- Porting existing code to TclOO
- Case study: the Ellogon NLP platform
- iTcl facilities in TclOO
- Organisation of classes in Ellogon
- Creating an Annotation Tool
- Concatenating Dialogs
- Conclusions

TclOO: “gray” areas

- Mixins
  - I have used “mixin”s a few times, but what are really “mixin”s?
    - ✓What happens with colliding method names, the constructor and inheritance?
- Inheritance
  - How do you inherit from classes whose constructors take different arguments?
  - The same issue can occur with plain methods and “next”
  - Is “next” limited, and an additional invocation method is required?

Conclusions (1)

- Both iTcl & TclOO have their strengths and weaknesses

- iTcl:
  - Lacked support for unknown
  - I had to use the "@itcl …" variable naming for serialising objects
  - info method is error-prone

Conclusions (2)

- Both iTcl & TclOO have their strengths and weaknesses
- TclOO:
  - No support for calling a specific class method from the superclasses
  - Variables cannot be initialised without a constructor
  - Are traces supported?
    - ✓ Can constructor arguments be recorded?
- Should things like classmethod & common be moved from the wiki to the Tcl core?

Thank you!