CPPTCL

TCL EXTENSIONS IN C++

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TCL Wiki page https://wiki.tcl.tk/13040

Thanks

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CPPTCL HISTORY

Created on SourceForge 2004-11-03 by Maciej Sobczak

When C++ was a pain

FlightAware started working with it in 2017

- Moved to github https://github.com/flightaware/cpptcl
- Added some enhancements
- Implemented documentation as markdown

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TECHNICAL STUFF

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WHAT ARE TCL EXTENSIONS?

TCL extensions add new commands to TCL interpreters with C

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DYNAMIC LOADING

making new programs at runtime

- Break a program into smaller parts.
- Re-assemble the parts at runtime.
- Combine different parts to make new programs at runtime.

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WHAT IS A TCL EXTENSION?

- native platform instructions - compiled code
- in a shared library - a special file
- that call the TCL C API to extend the TCL interpreter
- implemented using dynamic loading

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USING C++ TO EXTEND TCL

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RATIONALE

- Addresses increasing performance problems.
  - C++ is close to the OS
  - C++ memory management can be explicit
  - C++ includes all multi-core techniques
- Provides high quality development platform.
  - clang and libc++ are moving C++ rapidly
  - Xcode
  - valgrind

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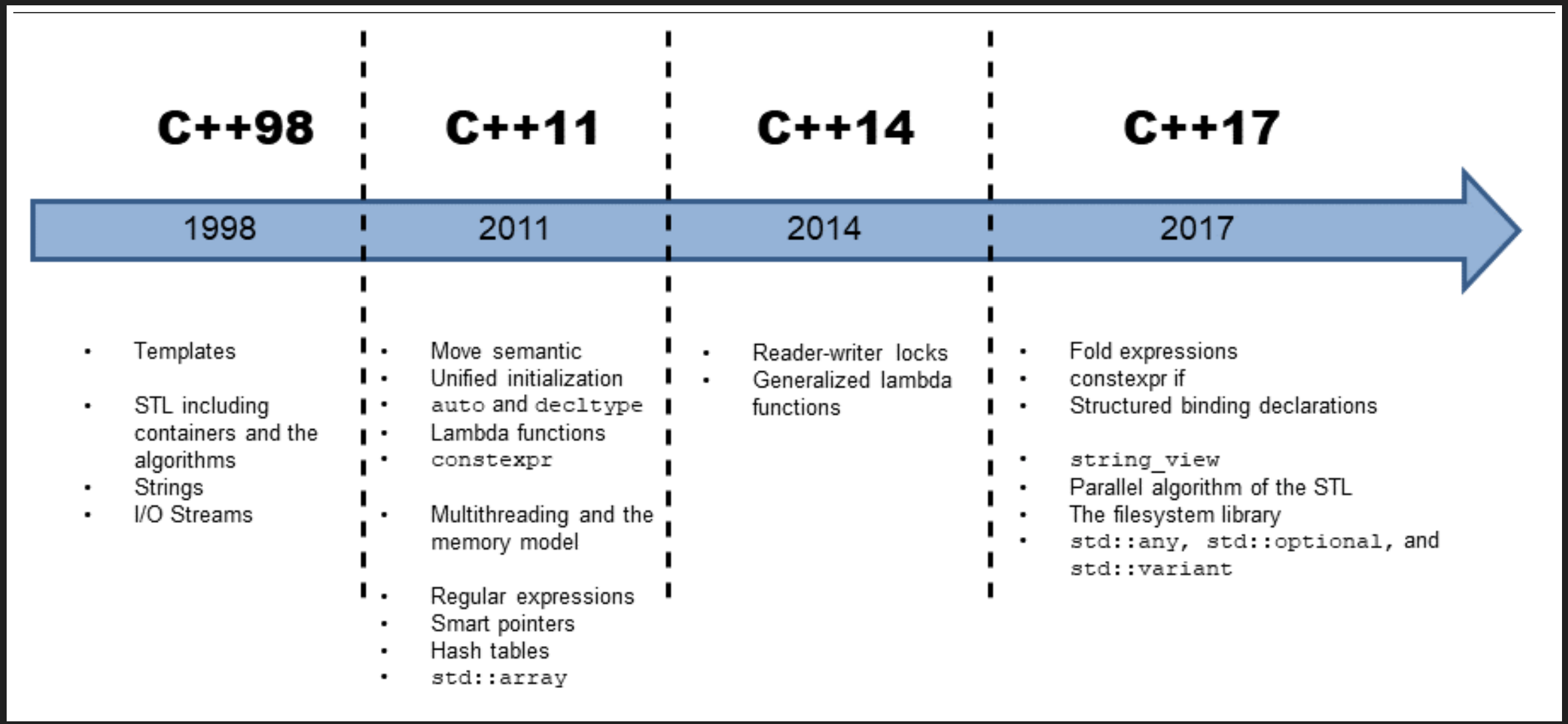
MODERN C++



credit: www.modernescpp.com

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PERFORMANCE PROCESS

- Profile: Find the hotspot in a program.
- Review: Check the TCL for simple performance errors.
- Rewrite: Replace TCL code with C++ as needed.
  - Sometimes with a TCL extension.
  - Sometimes replace program entirely.

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Example C++ code and TCL code

```
#include <cpptcl/cpptcl.h>

std::string hello(std::string name) {
    std::string r("hello ");
    r.append(name);
    return r;
}

CPPTCL_MODULE(Hello, i) {
    i.def("hello", hello, Tcl::usage("hello <string>"));
}
```

```
$ tclsh
% load ./libhello.so
% hello joe
hello joe
```

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COMPILE AND LINK

```
$ g++ -std=c++17 -I/usr/include/tcl8.6 \
    -shared -fPIC -o libhello.so \
    hello.cc \
    -lcpptcl_static -ltclstub8.6
```

Of course you pick your build system of choice

C++ community is mostly CMake *

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HOW CPPTCL WORKS

- Code generation is C++ templates
- Supports functions and methods of classes
- Supports zero to nine parameters
- Types: bool, int, long, double
- String types: std::string, char const *, std::vector<char>
- C++ classes (pointers)

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```
class Person
{
public:
     Person(std::string const &n) : name(n) {}

     void setName(std::string const &n) { name = n; }
     std::string getName() { return name; }

private:
     std::string name;
};
```

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```
CPPTCL_MODULE(Person, i)
{
  i.class_<Person>("Person", Tcl::init<std::string const &>())
    .def("setName", &Person::setName)
    .def("getName", &Person::getName);
}
```

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```
% load libperson.so
% set p [Person "Joe"]
p0x55f280c7e650
% $p getName
Joe
% $p setName Mary
% $p getName
Mary
```

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CPPTCL_MODULE C MACRO

```
CPPTCL_MODULE(NAME, INTERPRETER_VAR)
// which generates the extension
// C entrypoint
extern "C" {
void ${NAME}_Init(Tcl_Interp *) {
  Tcl::interpreter ${INTERPRETER_VAR};
  ...
}
```

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ARRAYS

```
using namespace Tcl;

void helloArray(object const &name, object const &address) {

  cout << "Hello C++/Tcl! from array " <<
    name("first").get() << " " << name("last");

  cout << "exists zip? " <<  address.exists("zip");

  std::string state("state");
  // Check for exists with if
  if (address(state)) {
      cout << "state " << address(state).asString();
  }
}
```

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C++ CALLING TCL

```
i.eval(R"(proc strcat2 {arg1 arg2} { return "$arg1+$arg2" })")
Tcl::Bind<string, string, string> strcat2("strcat2");
string val2 = strcat2("The", "End");
```

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