

# Summary of Google Summer of Code 2013 projects of SFT org.

John Apostolakis

Jakob Blomer

# Context

- Short Introduction
  - What is the Google Summer of Code program
  - CERN/SFT in GSoC 2013
- Overview of projects
  - One slide per project
- Outlook
  - Observations
  - Lessons and outlook

# GSoC 2013 and SFT

- Introduction to Google Summer of Code
  - Student contribute to Open Source projects
  - A student works in his/her own country
  - Proposal April/May; Work: mid-June to mid-Sept
- CERN/SFT in GSoC 2013
  - 8 Project – list on [Google Melange](#) (search CERN)
  - Several ‘areas’ projects: G4, Root, CERN App, ..
  - 8 students, each with 1+ mentor

# New TFormula for ROOT

Maciej Zimnoch

Mentor: Lorenzo Moneta

- Goal
  - Create new version of TFormula using Cling
  - Make it simple, extensible and a drop-in replacement
- Results
  - Created parser: find parameters, variables & functions
    - Identifies known formulae (Root, known shortcut: cos, sin ..)
  - Creates Cling object and hook for Root
- Next: Results being shown at CHEP 2014
  - Open: TTreeFormula (GSoC 2014?), few segfaults



```
root[0]: TFormula *sind = new TFormula(„sindeg”, „sin(var*TMath::DegToRad())”);  
root[1]: TFormula *example = new TFormula(„ex” „x*sindeg - (vargausn(0)^2)/[p]”);
```

# Automatic Differentiation with clang

Violeta Ilieva

- Goal

Mentor: Vassil Vassilev

- Use chain rule to get exact derivative
- Differentiate non-trivial functions and partial derivatives of simple functions.

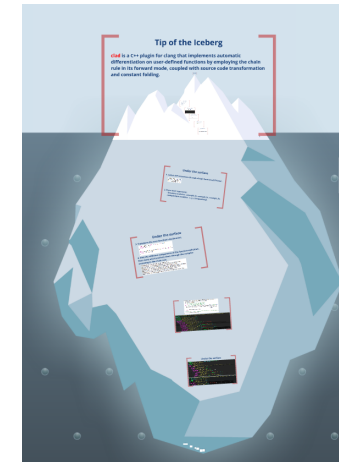
$$f(x) = g(h(x))$$

$$f'(x) = g'(h(x)) \cdot h'(x)$$

$$\frac{\partial f}{\partial x} = \frac{\partial g}{\partial h} \cdot \frac{\partial h}{\partial x}$$

- Results – clad C++ plugin

- Approach: Parse source, analyze, apply rules
- Applies source code transformation, constant folding



“Question”: source code

```
#include "autodiff/Differentiator/Differentiator.h"

float example_fn(int x, int y, int z) {
    return x + y * z;
}

int x, y, z;
diff(example_fn, x); // = 1
diff(example_fn, y); // = z
```

Answer: Result from clad

```
template<typename F, typename... Args, typename
Function<F> diff(F (*f)(Args...), A&&... a) {
    //return f(a...);
    return Function<F>();
}
```

Future: extend library of common, predefined derivatives

# Detecting null pointers in cling

Baozeng Ding

Mentor: Vassil Vassilev

- Goal

- Enhance cling execution engine to find null pointers,
- Avoid seg. faults, and issue warning instead

- Approach

- Check every potentially-null pointer (non-null *attribute*)
- Chose approach at Abstract Syntax Tree (AST) level\*
- Optimization: avoid unneeded checks

- Future

- Benchmark

```
[cling]$ #include <cstring>
```

```
[cling]$ char *p = 0;
```

```
[cling]$ strcmp(p, "aa");
```

**warning: null passed to a callee which requires a non-null argument.**

```
extern void * my_memcpy (void *dest, const void *src, size_t len)  
    __attribute__((nonnull (1, 2)));
```

# CERN App on Android

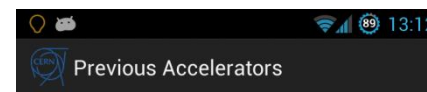
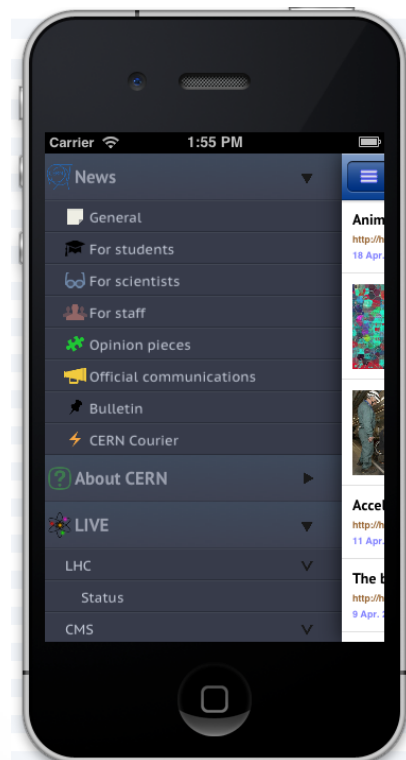
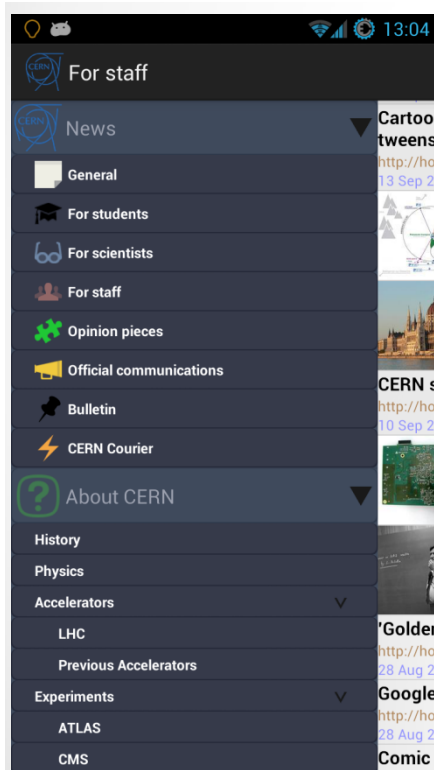
Łukasz Wasyłkowski

Results:

Mentor: Timur Pocheptsov

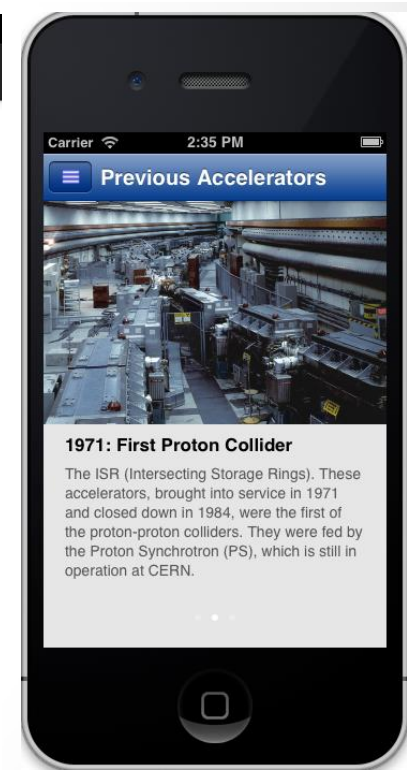
- ~65% of the functionality of the iOS App ported
  - Available: Overall Layout, RSS feed, static pages (history, accelerators, detectors)
  - Missing: Live Info, photos and videos

Comparison Android and iOS:



**1971: First Proton Collider**

The ISR (Intersecting Storage Rings). These accelerators, brought into service in 1971 and closed down in 1984, were the first of the proton-proton colliders. They were fed by the Proton Synchrotron (PS), which is still in operation at CERN.



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# Selective Monitoring with perf

Sertac Olgunsoylu

Mentor: Andzrej Nowak (OpenLab) + Vincenzo

## Goal:

- Improve the granularity of performance tuning results provided by the [Linux perf](#) performance tuning toolkit
- Collect statistics for hotspots / regions of interest only

## Results:

- The perf system comprises a kernel component and a user space API
- Extend the user space API by start/stop monitoring calls
  - Applications can tell perf when to collect statistics
  - Works for forked and multi-threaded applications
- Efficient way for selective monitoring using performance counter deltas
  - Avoids overhead of starting and stopping monitoring in the kernel
- Overall penalty: 400 instructions per start/stop command

## Future Work:

- Binary instrumentation support: select monitoring regions by symbol names



# HEP Union File System

Saket Sinha

Mentors: Loic Brarda, Pierre Schweitzer

## Goal:

- Port existing LHCb developed union file system from SL5 kernel to SL6 and newer kernel
- The union file system at hand is optimized for the LHCb online farm, unlike general purpose union file systems such as aufs, overlayfs

## Results:

- The code was modified to successfully compile on vanilla 3.8 kernel
- Between 2.6.18 (SL5) and 3.8, the kernel file system layer changed substantially
- Due to its design, the file system currently causes deadlocks on a 3.8 kernel
- Identify the design flaw
- Propose several approaches to change the file system

# Market Place for Virtual Machines

Jovanka Gulicoska

## Goal:

Mentor: Jakob Blomer

- Create a market place for contextualization artifacts that define virtual machines
- Users can search for “CernVM configured for ATLAS development”

## Results:

- Improvements to the user interface of cernvm-online.cern.ch
  - Sortable columns, action buttons for direct access from the dashboard to additional functionality
- Basic marketplace functionality



## CernVM Marketplace

Pick one of the public contextualization information and pair you CernVM instance.

A screenshot of the CernVM Marketplace interface. It shows three items for selection: 'T4T-Client-5' with a laptop icon, 'NA61: Head node' with a blue square icon, and 'NA61: Batch node' with a blue square icon. To the right, there is a grey box with the text 'Select an item' and 'Select one of the items on the left to see more details.' The page number '10' is visible in the bottom right corner.

# Rich Abstract Editor for Indico

Pedro Gaudêncio

Goal: Mentors: Pedro Ferreira, Jose Gonzalez (IT)

- Allow for **formulas** and **markup language** in Indico abstracts
- Add PDF generation for such rich abstracts
- Particularly helpful for conferences managed by Indico

## Results:

- WYSIWYG web editor for markdown ([pagedown](#))
- For formulas, integrate [MathJax](#) with pagedown
- For PDF generation: [reportlab](#) and [markdown2latex](#)

Specimen from math.stackexchange.com

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Links Images Styling/Headers Lists Blockquotes Preformatted HTML [advanced help](#) »

They use *this* editor to type **math**, we can use single dollar signs to delimit inline equations, and double dollars for blocks:  $y=mx+b$  is inline math, while  $E = MC^2$  is a block.

draft saved

They use *this* editor to type **math**, we can use single dollar signs to delimit inline equations, and double dollars for blocks:  $y = mx + b$  is inline math, while

$$E = MC^2$$

is a block.

# Running the projects

- Used experience of previous years
  - Even more effort to interact with students early, to evaluate and prepare projects
  - Extended to joint project (OpenLab), UFS(LHCb), Indico (IT)
- Mentor-student interaction
  - Frequent discussions, email, IM – most daily
  - Challenge of mentor mid-summer absence
- Excellent, clear [final presentations](#) by students
  - Done via Vidyo over two days 19-20 September
- Thanks to students and mentors
  - for their effort and responsiveness.

# Lessons, thoughts

- Several brilliant students
  - Many with hard-to-find skills,
  - Some projects cannot be done by other short-term students (e.g. perf )
- Greater diversity of projects in 2013
  - In 2011 only CERNVM, in 2012 +G4 +Root +App
  - In 2013: Root/Cling (3) and singlets: Indico, UnionFS
- GSoC 2013 Summit 19-20 October
  - Vassil and John A will represent our organization
- Consider lessons for 2014 – if this is to continue
- Additional groups at CERN have shown interest
  - Look to become ‘umbrella’ organization, to enable additional projects from other parts of CERN ?