Scientific Workaholic

— Work Scientifically and Have Fun

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Yingcai 2009, UESTC

Dec 6th, 2011

Working on Science with Modern Computer Technology

Working on science in a digital era with the aid of:

- ***Internet***
- ***Linux***
- ***LaTeX***
- ***Python***

Working on Science with Modern Computer Technology

Working with the ***Internet***.

- Obtaining knowledge online via *Wikipedia*, *OpenCourse*, *Wolfram Alpha* etc.
- Accessing your files while keeping the track of modifications by using a *Cloud Storage Service*.

Working on Science with Modern Computer Technology

Working with ***Linux***.

- Learn to use *Linux* by using it.
- Setting up a personal workspace by *hacking* on *Linux*.
- Diving into the gold mine of *Open Source Community* and try to be part of it!

Working on Science with Modern Computer Technology

Working with LaTeX

LaTeX is a document preparation system designed for high quality typesetting, especially for *scientific documents*.

- Beautiful math formula.

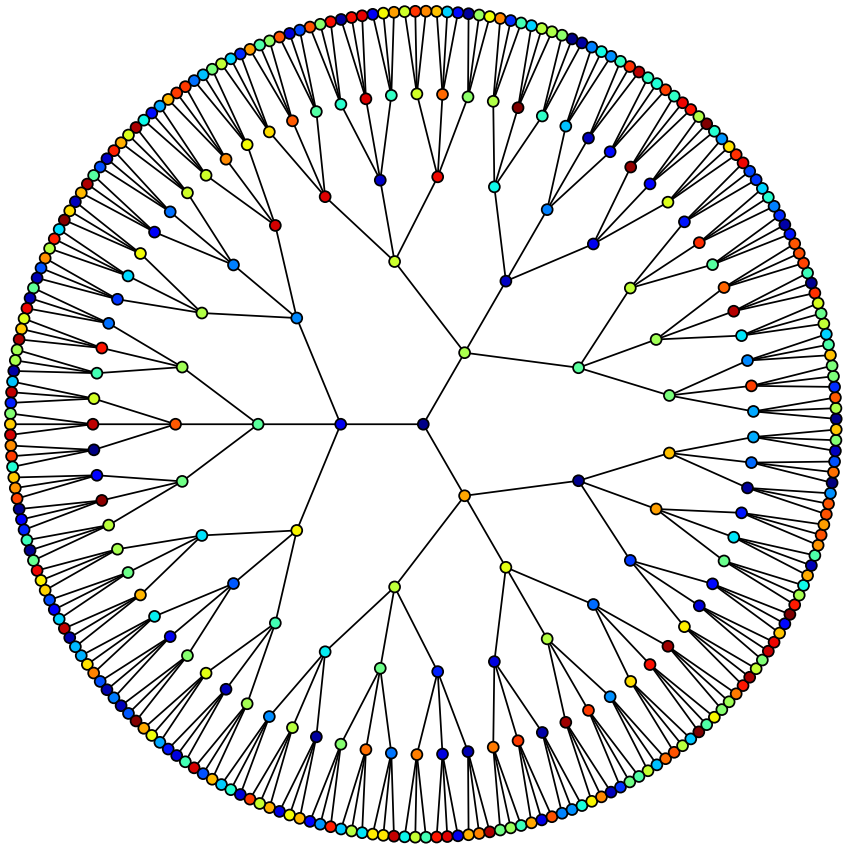
$$i\hbar \int_{-\infty}^{t} \frac{\partial^2 \Psi}{\partial \tau^2} d\tau = -\frac{\hbar^2}{2m} \frac{\partial^2 \Psi}{\partial x^2} + V\Psi$$

- Professional typesetting with academic style.
- Highly customizable and functional: *even this slide is made by LaTeX Beamer!*

Working on Science with Modern Computer Technology

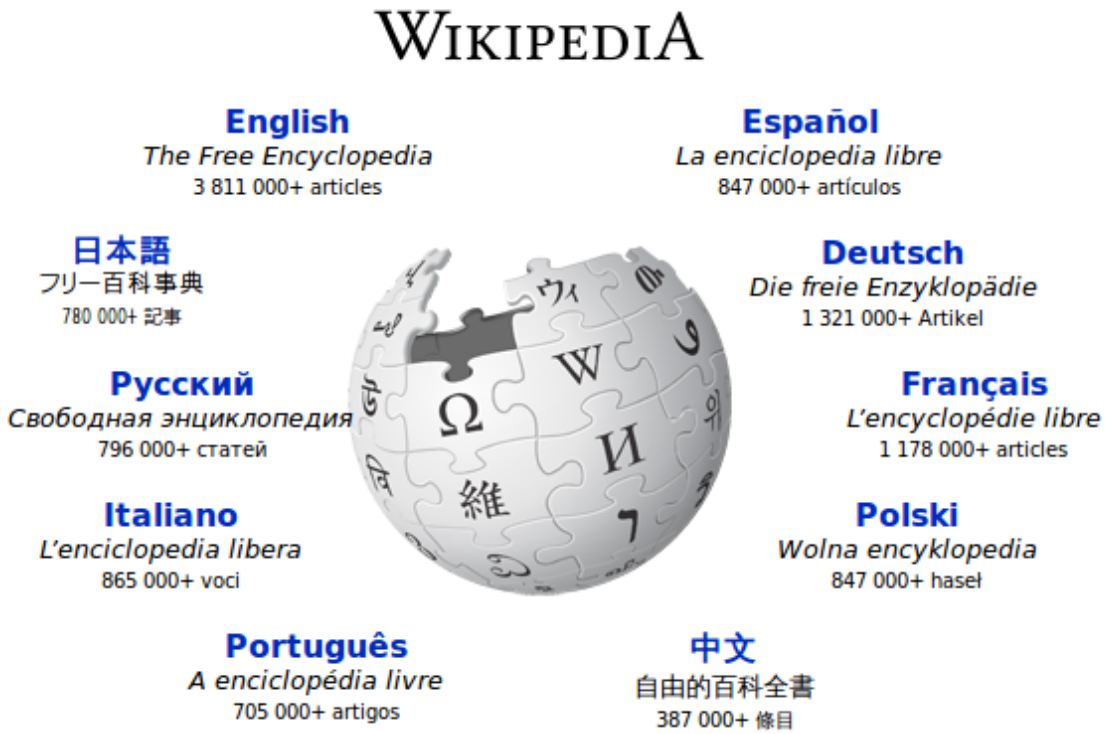
Working with ***Python***.

- Programming with *Python* – *Executable Pseudo-code*.
- Scientific computation and visualization with ***NumPy***, ***SciPy***, ***MatplotLib***, ***IPython*** etc.



Learning Science via Wikipedia

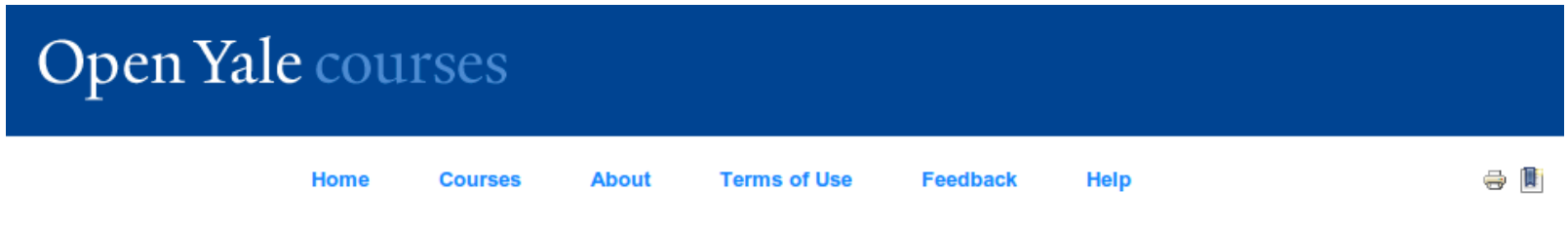
Wikipedia is a free, web-based, collaborative, multilingual encyclopedia project supported by the non-profit Wikimedia Foundation.
Wikipedia was launched in January 2001 by *Jimmy Wales* and *Larry Sanger*.



Learning Science via OpenCourse Projects

MIT

Yale



Learning Science via OpenCourse Projects

VeryCD、网易视频...

Doing Math via Wolfram Alpha

Stephen Wolfram is a British scientist and the chief designer of the ***Mathematica*** software application and the ***Wolfram Alpha*** computational knowledge engine.

Mathematica

Doing Math via Wolfram Alpha

www.wolframalpha.com

Doing Math via Wolfram Alpha

WolframAlpha computational knowledge engine

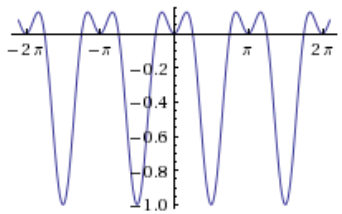
sin(x)^2*cos(2x)

Examples Random

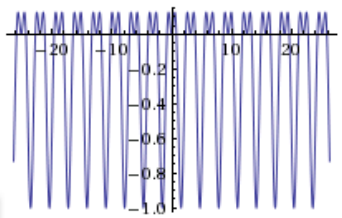
Input:

$\sin^2(x)\cos(2x)$

Plots:



(x from −6 to 6)



(x from −20 to 20)

Alternate forms: More

$\frac{1}{4}(2\cos(2x) - \cos(4x) - 1)$

WolframAlpha computational knowledge engine

UESTC

Examples Random

Input interpretation:

Dianzi Keji Daxue

Basic information:

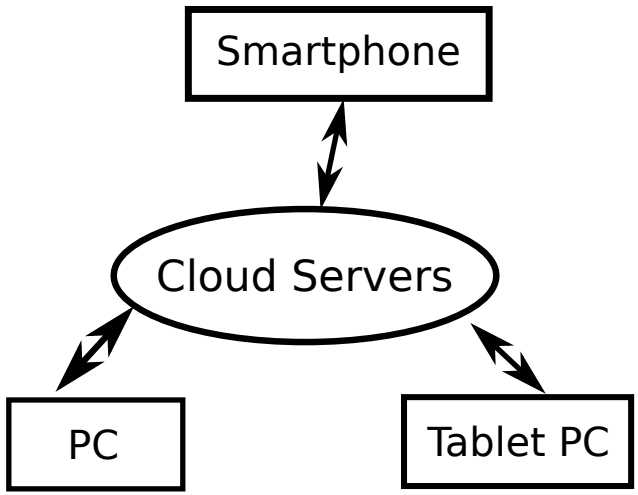
name	Dianzi Keji Daxue
location	Chengdu, Sichuan, China (population: 11.4 million)
website	www.uestc.edu.cn

Location:

Satellite image »

Using a Cloud Storage Service

What is a ***cloud storage service***?



Why should I use it?

- ***Synchronizing*** my files on all my devices, including laptop, PC, tablet, phone etc.
- A simple ***CVS*** (*Concurrent Versions System*) for monitoring modifications.
- ***Sharing*** my files easily.
- ***Free*** for average users.

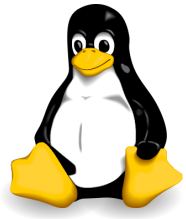
Using a Cloud Storage Service

Good services:

(Blocked by GFW)

Moving from Microsoft Windows to GNU Linux

Linux is a Unix-like computer operating system assembled under the model of free and open source software development and distribution.



The defining component of any Linux system is the ***Linux kernel***, an operating system kernel first released October 5, 1991 by ***Linus Torvalds***.

Linux Distributions

Linux system ***distributions*** may vary in many details of system operation, configuration, and software package selections.

I'm using Ubuntu Linux 10.10 Maverick Meerkat.

What can I do with Linux?

Is there anything that I can do with Windows but not Linux?

Answer: Yes, there is. But that's generally *not worth doing*.

What can I do with Linux?

Answer:

- Working with incredibly ***high efficiency***, which can never be expected on Windows.
- A perfect environment for learning ***programming***.
- Enjoying countless ***free and open-source*** softwares.
- Making it your personal workspace by customizing and even ***hacking*** it!

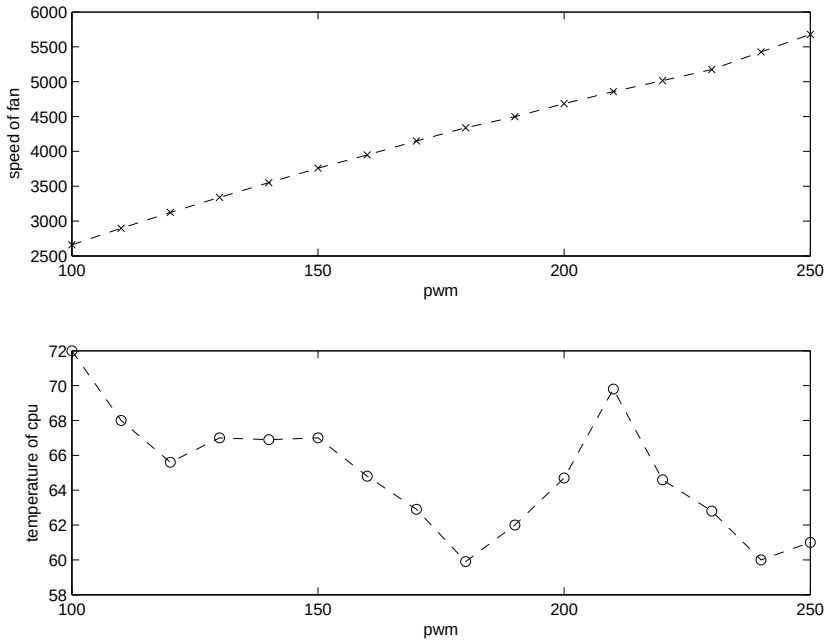
Hacking for Fun!

My projects

- A ***fan speed controller*** for my ThinkPad SL400 laptop

How did I work it out?

- The interface on Linux for controlling the speed of fan.
- The relation between temperature, fan voltage and fan speed.

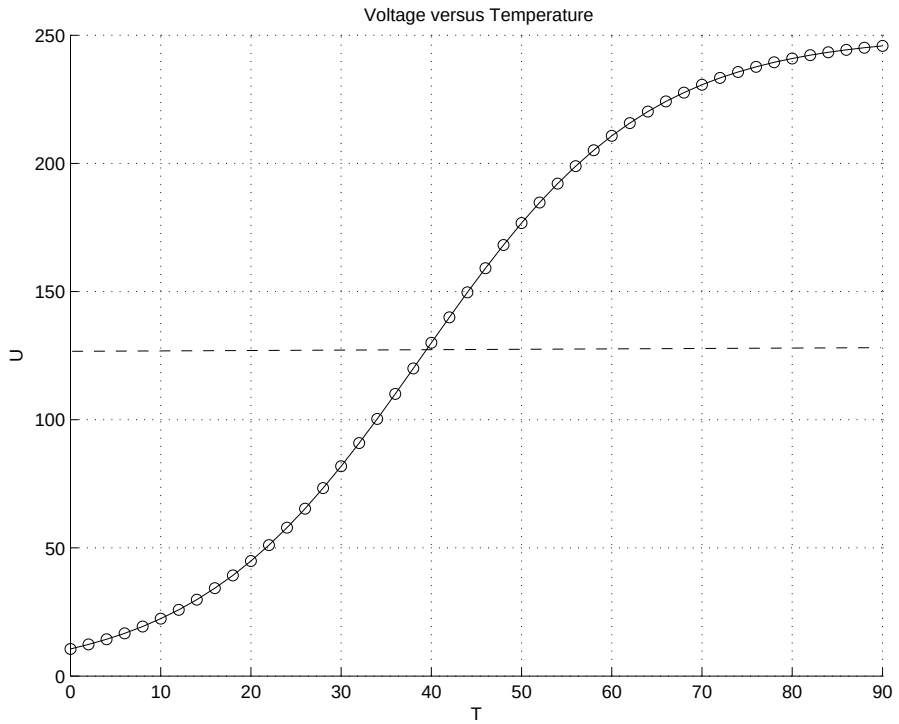


Hacking for fun!

- Adaptive control for fan speed by automatically adjusting fan voltage according to the temperature.

Logistic Function

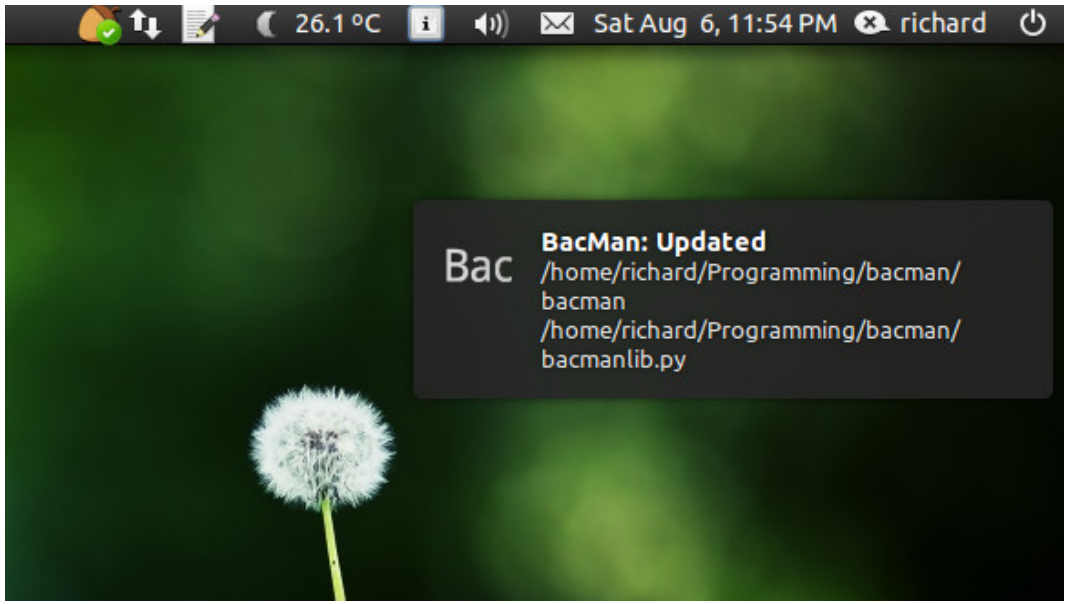
$$U = \frac{kP_0\, e^{r(T-T_0)}}{k + P_0(e^{r(T-T_0)} - 1)}$$



Hacking for fun!

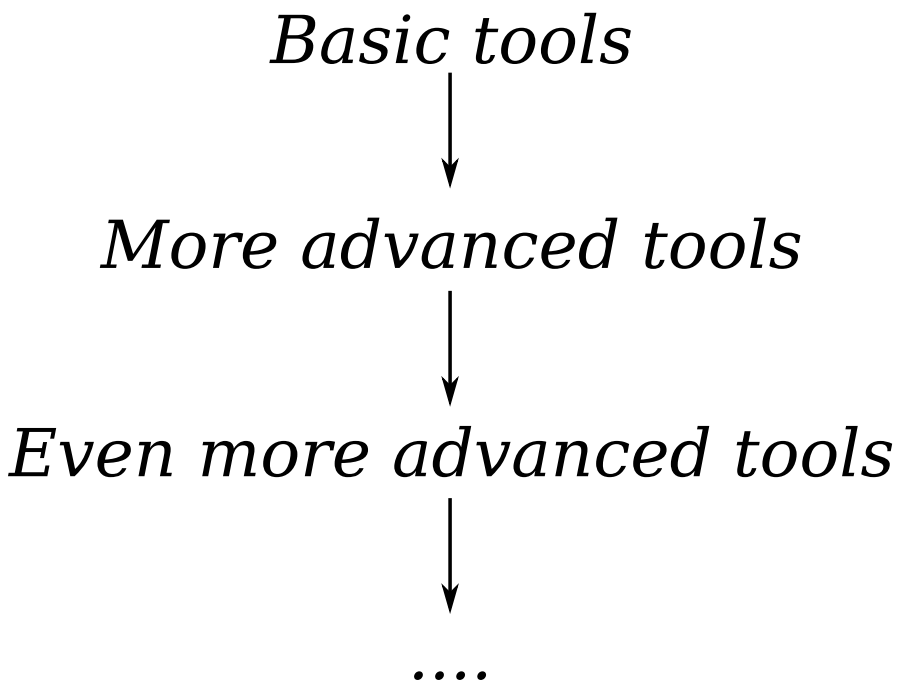
Another project — ***BacMan*** for backing-up and synchronizing my files distributed anywhere on my computer.

- Synchronize local files to cloud directory every 10 minutes when modification occurred.
- Synchronize cloud directory files to my local directories when needed.
- High efficiency thanks to ***rsync*** differentiation and synchronization program on Linux.



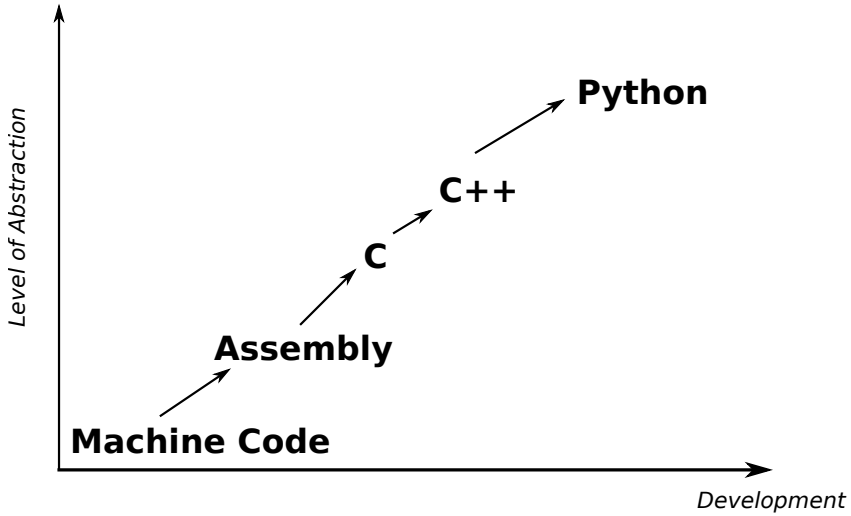
The Joy and the Philosophy of Tools

The simple philosophy behind tools:



The Joy and the Philosophy of Tools

This general rule can be reflected in the process of human progress in science and technology.
And in the perspective of computer programming



Implications

- Use advanced tools for higher efficiency.
  (higher level of abstraction may also mean slower execution though)
- Create your own tools and try to make them open-source!

Elegant Typesetting with LaTeX

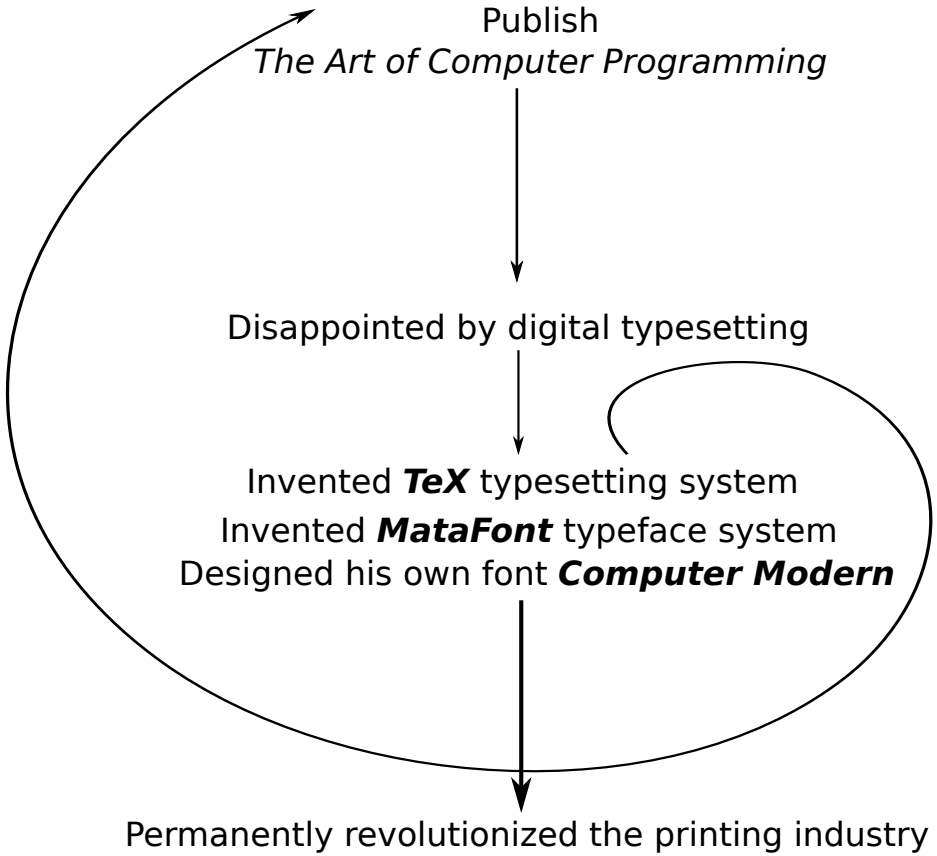
A glorious endeavour all started with ***Donald Knuth*** and his ***The Art of Computer Programming***.

Donald Knuth

Computer scientist and Professor Emeritus at Stanford University,
the ***father*** of the analysis of algorithms,
the author of ***The Art of Computer Programming***,
and TeX typesetting system.

Elegant Typesetting with LaTeX

The disappointing galley proofs of *The Art of Computer Programming II* gave him the final motivation to solve the problem at hand once and for all by designing his own typesetting system.
On May 13, 1977, he wrote a memo to himself describing the basic features of TeX.



Elegant Typesetting with LaTeX

LaTeX is a document markup language and document preparation system for the TeX typesetting program, developed by ***Leslie Lamport***.

Features of LaTeX

- Writing documents by markup language instead of the **"WYSIWYG"** style of *Microsoft Word*.
- Concentration on writing while let most of the typesetting and layout jobs automatically done by the system, on condition that the document is ***well-structured***.
- Powerful and beautiful mathematical formula.
  When we write $A = \int_{-\infty}^{+\infty} \frac{\cos^2\theta}{2n^2\theta^2}$ outside, we have

$$A = \int_{-\infty}^{+\infty} \frac{\cos^2\theta}{2n^2\theta^2}$$

Start from a minimal LaTeX example

Tips:

- Use a good text editor for writing in LaTeX.(*I use gedit on Linux.*)
- Learn by using.
- Use XeLaTeX for writing in 中文 and other languages, where ***Unicode*** is supported.
- Explore macro-packages and define your own macro-commands.
- Start from basic mathematical typesetting.

Embrace Python — a promising new language

Python is a general-purpose, high-level programming language whose design philosophy emphasizes code readability.

Python claims to "remarkable power with very clear syntax", and its standard library is large and comprehensive. Its use of ***indentation*** for block delimiters is unique among popular programming languages.

Scientific Computation with Python-based tools

Toolset

Why use them?

- Free and open source, while *MATLAB* and *Mathematica* are proprietary and expensive.
- Easy scripting with ***Python***.
- Compatible with other packages for integration towards a systematic computational platform.

Thanks!

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