

Development of an Open Source Environment for Mathematics and Science Textbooks

Robert Petry

Campion College at the University of Regina

robert.petry@uregina.ca

May 3, 2016

Introduction

❖ Introduction

- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Currently using **open** coursebooks in **statistics** and **calculus**
 - ⇒ Jointly written by me and colleagues
 - ⇒ Saved my statistics students **≈\$90,000** over five years.
- This talk will focus on issues of **openness** pertaining to
 - ⇒ Development of **textbooks** in mathematics and science.
 - ⇒ Development of **ancillary resources** for them.
- Will consider our **experience**
 - ⇒ And where going **next**

The Founder of the Feast



Photo by NicoBZH

Free as in Speech Not as in Beer

- Open textbooks arise from **Free Software** movement in computers
⇒ Freedom in free software is about **liberty** not **price**.

- A program is free software if users have four essential freedoms (Richard Stallman):

Freedom 0: To **run** the program as you wish, for any purpose.

Freedom 1: To **study** how the program works, and **change** it so it does your computing as you wish.

Freedom 2: To **redistribute** copies so you can help your neighbor.

Freedom 3: To **distribute** copies of your **modified** versions to others.

- Access to the **source code** is a precondition for **1** and **3**.
- Human-readable/writable **source code**
⇒ **Compiled** into machine-readable/runnable **object code**.
- These licensed **liberties** reduce **price** as monopolies abolished.

Textbooks and Customization

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Modern **print technology** makes **custom** textbooks possible.
 - ⇒ External through **print on demand**
 - ⇒ Internal through **institutional** printing
- **Content** Customization **desirable** for many reasons:
 - ◆ Text **directly follows** course being taught.
 - ⇒ Text can be **manageable size** and brought to class
 - ⇒ So data table, theorem, or graph can be **included**
 - ⇒ More **time** for in-class work (problems, quizzes)
 - ◆ Text should have **local relevance**.
 - ⇒ **Biological** examples of Saskatchewan **flora** and **fauna**
 - ⇒ **Administration** examples of **public utilities**, **co-ops**
 - ◆ Text should reflect **student context**.
 - ⇒ Statistics for **nursing**, **business**, or **science**
 - ⇒ Topics and technical abilities will vary
 - ◆ Text should reflect **your interests** as an instructor.

Textbooks and Customization

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Text needs to be **upgradable**
 - ⇒ New **discoveries**, **technology**.
- Education is a **public good**.
 - ⇒ Teachers **not in competition** with each other.
 - ⇒ Anything **worth knowing** is **worth sharing**.
 - ⇒ Customization facilitates **sharing** across institutions.
- Our graduate student, post-docs, and sessionals
 - ⇒ Can take **open material** with them when they leave.
 - ⇒ And are motivated to **contribute** to its production.

Licensing and Textbooks

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Governments are motivated to lower textbook price
- A publisher could offer a PDF you could print (free beer)
⇒ Fails to have liberty the educator wants.
- Liberty is guaranteed by the license on the work.
- Licenses range from
 - ◆ “Do whatever you want with it”
 - ◆ “Distribute modifications in same manner received”
⇒ Copyleft
- Copyleft addresses risk of work being improved
⇒ Without your being able to use improvements.
- Math/Science texts have peculiar challenges in licensing.
⇒ Due to how they are made.

The \LaTeX Typesetting Language

- Common Math/Science publishing standard is \LaTeX
⇒ A **typesetting** computer language.
- One writes a **text file** with commands like
This is `\emph{Gauss's Law}`:
 `$\oint \mathbf{E} \cdot \mathbf{dA} = \frac{Q}{\epsilon_0} $`
- This gets **compiled** to a **PDF** or **Postscript** document as:
This is *Gauss's Law*: $\oint \mathbf{E} \cdot \mathbf{dA} = \frac{Q}{\epsilon_0}$.
- The \LaTeX compiler is an **open source** program.
- So creating a document is like **writing software**.
⇒ A **source** text document creates an **object** PDF document.
- **Problem** is many open text licenses
⇒ **Do not** make **distinction** between source and object document clear.
- Sharing only of modifications in an output PDF of **limited use**.
⇒ One might need to **retypeset** all added equations and diagrams!

GNU Free Documentation License

- The GNU Free Documentation License is useful:
 - ◆ Designed for creating manuals and textbooks
 - ◆ Extensive usage (Wikipedia).
 - ◆ Clear provisions on source and object documents
 - ⇒ Must provide source access (if over 100 copies).
 - ◆ Allows for commercial use
 - ⇒ Provided in keeping with the license
 - ◆ Source must be in publicly specified, editable format
 - ⇒ Thus restricts (often proprietary) creation programs
 - ⇒ This is a good thing!
 - ⇒ Encourages use of open source tools in creation
 - ⇒ Proprietary is expensive and can disappear.
 - ◆ No DRM (Digital Restrictions Management) allowed.
 - ⇒ To obstruct/control reading or further copying.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Top-Down Approach to Open Text Adoption

- To pick an existing open textbook consider:
 - ◆ How is it licensed?
 - ⇒ Do you have access to the source now?
 - ⇒ Are you guaranteed access to the source in future?
 - ⇒ Would you circulate your additions with it?
 - ⇒ Or can you switch to a licence you could?
 - ◆ Can it be easily customized?
 - ⇒ How much work to change when new edition arrives?
 - ⇒ Can such customizations be automated (scripts)?
 - ◆ What software tools are used in text creation?
 - ⇒ Are they open source?
 - ⇒ Are they easily extensible?
- I opted to create my open content (calculus, statistics)...

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Bottom-Up Approach: Textbook Creation

Some advice:

Find Collaborators:

- Established colleagues may like their content typeset.
- Ensures more than you adopt it.
- Ensure they agree with intended license (in writing).
- They will likely help improve work over time.
- Remember to purge any content they may have copied.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Bottom-Up Approach: Textbook Creation

Work In Stages: Rome wasn't built in a day!

- Started with **extended handouts**
- Added to these to make **draft** of core material
 - ⇒ Became basis of **slides**
 - ⇒ Slides done in \LaTeX too (saved time)
 - ⇒ Students now only needed conventional text for problems.
- Created **exercise sets**
 - ⇒ A **problems manual** usable by my (and other) sections.
- Draft plus problems became **coursebook**.
 - ⇒ **Core examples** still done in class.
 - ⇒ Traditional textbook became optional
- Add typeset core examples to make **textbook**
- Add glossaries, index, proofs, layout, etc.
- Develop **ancillary** material.

Bottom-Up Approach: Textbook Creation

Modularity:

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ **Bottom-Up**
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Keep content organized in **separate** files.
 - ⇒ Same content is **recompiled** to produce:
 - ◆ the textbooks
 - ◆ problem manual
 - ◆ handouts
 - ◆ formula sheets
 - ◆ statistical tables
 - ⇒ Improvement in one place affects **all** documents
 - ⇒ Content can be **customized** to different classes.
 - ⇒ Colleagues (different sections) use what they **want**.

L^AT_EX Benefits

“Everything should be made as simple as possible, but **not simpler.**”

- **Complicated structure** of a textbook,
- **Dynamic nature** of open content,
⇒ Requires **appropriate tools** for text production.
- L^AT_EX does **science professionally**
⇒ Equations, theorems, tables, graphics, hyperlinks
- Has the tools to **automate** production of
 - ◆ Table of contents
 - ◆ Bibliography
 - ◆ Index
 - ◆ Glossaries
 - ◆ Cross-referencing (figures, tables, equations)
- Exclude a chapter? ⇒ Everything updates automatically.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ **L^AT_EX Benefits**
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

L^AT_EX Benefits

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Switches for **appearance** (e.g. vectors as \vec{v} , \bar{v} , \hat{v} , or \mathbf{v})
- Contain **multiple versions** of textbook in **same** document.
 - ⇒ A switch for **content**:
 - ◆ **international** textbook or **local** textbook
 - ◆ **teacher's** edition or **student** edition
 - ⇒ A switch for **output style**:
 - ◆ **black-and-white** print version
 - ◆ **colour** print version
 - ◆ **electronic version** with hyperlinks (videos, simulations) or extra content (proofs, data, code)
 - ⇒ Switch for **ancillary documents**:
 - ◆ Production of **slides**
 - ◆ Production of **solutions manual**

L^AT_EX Benefits

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- L^AT_EX separates task of content production
⇒ From formatting and layout.
- In theory, authors only worry about content.
⇒ L^AT_EX language knowledge required minimal.
- Someone else (publisher) worries about formatting issues.
⇒ More technical knowledge required here.
- Example: Students writing theses at U of R in L^AT_EX
⇒ Just load the U of R thesis document class
⇒ Never need to look at thesis formatting guidelines
⇒ Choose a bibliography style after thesis is written.
- For textbooks a common set of formatting/layout tools
⇒ Should be produced to facilitate book production.
⇒ All textbooks could be given a common look/shape.
⇒ Improvements to layout get made in a single location.

L^AT_EX Challenges

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ **L^AT_EX Challenges**
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Some features of textbooks are **unique**
- Fortunately L^AT_EX extensible.
- Needed to create **textbooktools** code
 - ⇒ With new **commands** and **environments**.
- **Example:** Textbooks have **exercise blocks**
 - ⇒ With **answer appendix** at the back.
- I created an **exercise** L^AT_EX environment.
- Exercises blocks auto-numbered, formatted.
 - ⇒ Different **enumeration styles** to choose from
 - ⇒ Depending how exercises appear in document
- Author lists **problems** followed immediately by **solutions**.
- These **automatically enumerated** within text and appendix
 - ⇒ Facilitates changes to problem sets
- **Page references** to solutions auto-generated.
 - ⇒ **Hyperlinks** in electronic PDF

Sample Exercise

```
\begin{exercise}[Chain Rule]
\begin{problemblock}{Differentiate using the Chain Rule:}

\item  $f(x) = (x^8 + 2x)^{12}$ 
\answer{ $f'(x) = 12(x^8 + 2x)^{11}(8x^7 + 2)$ }

\item  $f(\theta) = \sin(\theta^2)$ 
\answer{ $f'(\theta) = 2\theta \cos(\theta^2)$ }

\end{problemblock}

\item Next question
\answer{and its answer}


- 
- (Remaining problems in here)
- 



\end{exercise}
```

L^AT_EX Challenges

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Extensibility can **create** problems.
 - ⇒ **Newer packages** created supersede **older** ones.
 - ⇒ Results in **multiple ways** to do the same thing.
- A **best practices** guide for authors would be useful.
 - ⇒ Perhaps enforced in a **textbook document class**.
- Similar to how “F” computer language developed
 - ⇒ Created as a subset of **Fortran**.
- Narrowing (and hiding) choice makes for:
 - ◆ Easier **learning**.
 - ◆ Simpler **maintenance**.
 - ◆ Facilitating **port** to **other document formats**
 - ⇒ ePubs, web pages, etc.
- Allocate **resources** for this cross-textbook work

L^AT_EX Challenges

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- L^AT_EX is open source software freely available (TeX Live)
 - ⇒ Proprietary distributions with closed extensions exist.
- Similarly embedded material (graphics, etc.)
 - ⇒ Can be created with open or proprietary software.
- Desirable for content creators
 - ⇒ To have easy access to standard open tools.

Ancillary Materials

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ **Ancillary Materials**
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Modern textbooks have extra materials such as:
 - ◆ Slide packages
 - ◆ Test banks, marking software
 - ◆ Videos/Simulations
 - ◆ Computer code
 - ◆ Software (computer algebra systems, compilers, etc.)
- Little point in making a **free** book
 - ⇒ To have these extra materials
 - ⇒ Written on **proprietary software** in **closed** formats
 - ⇒ Delivered via a **proprietary** LMS or website
- Need **openness** here too!
 - ⇒ To be in **control** of our teaching and to
 - ⇒ **Share** work freely with others.
- Fortunately **open source software** exists for all this.

Ancillary Materials

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ **Ancillary Materials**
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Thus desirable for **content creators**:
 - ◆ To produce **openly** licensed ancillary material
 - ◆ Using open **software** and **platforms** (e.g. Moodle).
- Also desirable for **content users**:
 - ◆ To be able to **use** this open material
 - ⇒ Often requires access to **software**.
- But how to **easily** give access to open source software?

Software Distributions

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ **Software Distros**
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- **Linux** is a solid open source **operating system**.
- People mainly use it because of its easy access
 - ⇒ To **other** free software:
 - ⇒ publishing(L^AT_EX), office, databases, compilers
 - ⇒ educational programs, web software, etc.
- On **Linux Distributions** free software organized in **packages**
 - ⇒ To make it easy to install.
 - ⇒ On the **Debian Linux Distribution** type
`apt-get install firefox`
 - ⇒ To install **Firefox** web browser package.
- Distribution keeps track of **all dependencies**
 - ⇒ So installing L^AT_EX (for instance) is trivial.
 - ⇒ Also **updating software** is easy.
- But cannot make everyone switch to Linux ...

Live Linux Distributions

- “Live” Linux distributions exist.
 - ⇒ Linux (& free software) not installed on computer.
- Instead, a **distribution image** is booted off DVD or USB
- Computer hardware (video card, etc.) is **auto-detected**.
 - ⇒ No **drivers** (or other software) needs installing
- In **under a minute** one boots into a Linux distribution.
- Many **live distributions** exist and are used for:
 - ◆ **System Rescue**
 - ◆ **Trial versions** (such as **Ubuntu**)
 - ⇒ See how distro *would* work on your hardware.
 - ◆ **General distribution** of free software (such as **Knoppix**)
- Linux tools exist (**Debian Live**)
 - ⇒ To produce **custom** live Linux distributions.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ **Live Distros**
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Custom Textbook Live Distribution

- Solution: Create a live distribution
 - ⇒ To support textbook(s) of department/institution
- For content creators:
 - ◆ L^AT_EX, graphing programs, text editors, etc. included
 - ◆ Tools for customizing source of existing textbooks.
 - ◆ LMS (Moodle) prototype for ancillary material (?)
 - ◆ Proprietary tools/extensions avoided (illegal)
- For content users:
 - ◆ Supporting programs are present (eg. CAS, compilers)
 - ◆ Supporting data/videos can be there (or links).
- For instructors:
 - ◆ Open source test-generators, marking software (AMC).
 - ◆ Podcasting/Screencasting tools.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Custom Textbook Live Distribution

- With **Debian Live** first open source **packages** selected
- Appearance (splash-screen, window manager) configured
- Configure any **startup programs** (e.g. local web server)
- Configure **security** (e.g. firewall, disk access)
- Add any **other files** (e.g. course material) you want
- This compiled into a live **iso image**.
- Develop **generic** base template with **core programs**
 - ⇒ This then **customized** by institution
 - ⇒ Effectively create an **open textbook distribution**.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ **Custom Live**
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Live Distribution Deployment

- Custom distribution permits removing superuser access
 - ⇒ To restrict modifying existing system installation.
- Various scenarios for image deployment:
 - ◆ USB flash drive boot
 - ⇒ USB 3.0 as fast as traditional hard drive.
 - ◆ Network boot of image (PXE)
 - ◆ Virtual computer running image on existing OS
 - ⇒ Such as Virtual Box emulator.
 - ◆ Free software servers running image
 - ⇒ Connect from tablets or other machines (VNC)
 - ◆ Dedicated computer
 - ⇒ Students attach to screen (HDMI), keyboard (USB).
 - ⇒ Or use tablets as screen/keyboard interface.
 - ⇒ Could be done for under \$30 (low-level hardware).
 - ⇒ The Raspberry Pi is such a device.

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

Raspberry Pi



Photo by Kannan shanmugam, shanmugam studio, Kollam

Live Distribution Updating

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ Links
- ❖ License

- Improvements and security
 - ⇒ Require periodic updating/compiling of live image.
 - ⇒ Require dissemination of updated image.
- For flash drive and dedicated computer deployment
 - ⇒ Need systematic upgrade mechanism.
- Create a further (tiny) distribution to manage updates.
 - ⇒ Downloads new image file when available
 - ⇒ And updates boot mechanism to select it

References

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ **References**
- ❖ Links
- ❖ License

- Metcalf, M., & Reid, R. (1996). *The F programming language*. Oxford, U.K.: Oxford University Press.
- Mittelbach, F., & Goossens, M. (2004). *The L^AT_EX companion* (2nd ed.). Boston, Massachusetts: Addison-Wesley.
- Stallman, R. M. (2010). *Free software, free society: Selected essays of Richard M. Stallman* (2nd ed.). Boston, Massachusetts: GNU Press.

Software and Hardware Links

Debian Live: www.debian.org/devel/debian-live

Knoppix: www.knopper.net/knoppix

Raspberry Pi: www.raspberrypi.org

Tex Live: www.tug.org/texlive

- ❖ Introduction
- ❖ Liberty vs. Price
- ❖ Custom Texts
- ❖ Licensing
- ❖ L^AT_EX
- ❖ GFDL
- ❖ Top-Down
- ❖ Bottom-Up
- ❖ L^AT_EX Benefits
- ❖ L^AT_EX Challenges
- ❖ Ancillary Materials
- ❖ Software Distros
- ❖ Live Distros
- ❖ Custom Live
- ❖ Deployment
- ❖ Image Updating
- ❖ References
- ❖ **Links**
- ❖ License

License

This presentation is **licensed** under CC-BY-SA 4.0.

See <http://creativecommons.org/licenses/by-sa/4.0/>

These slides are **available** at

http://amberlin.asuscomm.com/tlt_2016_petry.pdf