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# **XLP Owner's Manual**

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# 1 What is XLP?

XLP stands for **Extreme Learning Process**, a methodology that lets communities of learners design and conduct collaborative learning activities. Taking a look more closely at the name:

- **Extreme:** XLP explores frontiers, identifies boundaries, and helps participants push those boundaries.
- **Learning:** XLP enables individual learning, group learning, and large-scale crowd learning.
- **Process:** XLP has a clear process, through which participants prepare, deploy, and execute missions.

We aim to become a crowd-learning system that facilitates collective learning in this increasingly complex world. Learners are empowered to work together within and between teams, and incorporate both digital and physical elements.

Due to advancing technology, educational institutions can now operate in ways unthinkable only a few years ago. This is because today it is possible to collect and process organizational behavior data in ways that were impossible before. Therefore XLP is not merely about improving individual learning, but also *measuring and improving organizational learning*.

## XLP in a Nutshell

XLP is a process with **inputs, outputs, activities**, and **effects**:

### Inputs

- Sponsors and groups of participants, who become mission designers and mission executors. These participants come together for a specific learning objective and duration.
- Resources such as hackerspaces, campuses, mentoring, etc.

## Activities

- Mission based learning, which is designed and executed by groups of participants. Each mission uses gamified techniques to impart valuable knowledge and skills with real-world applications.
- Digital publishing of all activities and results, in the form of containers of knowledge, via our Remix suite of tools.

## Outputs

- Containers of knowledge, carrying a full record of participant activity, and able to be read, shared and deployed with ease
- Knowledge and skills transfer
- Credentials and qualifications, stored on the Blockchain. Access can be granted to selected employers and institutions to prove participants expertise.
- Crowd Learning, i.e. large scale collaboration on learning missions.

## Effects

For participants:

- Real world decisions: XLP challenges participants to make financial, legal, cultural and technical decisions, so they can achieve goals set by the participant groups themselves.
- Real world experience: XLP is pragmatic. The XLP method induces realistic human dynamics, utilizes modern technologies, encourages participants to create social norms, and establishes executable regulations based on the design principles of the fast-evolving Internet.
- Tapping potential: XLP drives participants to realize their untapped potentials and emerging powers of collaboration through having them stretch the educational envelope by shifting the focus from teaching (top-down) to learning (bottom-up).

For educators and institutions:

- No-one left behind: XLP encourages an evolutionary process, which creates a digitally enabled learning context that delivers rich social-interactions and leaves no-one behind.
- Curating, not teaching: By placing participants in control of learning, XLP redefines educators' roles as curators of learning resources and as evaluators of participants' learning-potentials.

- Deeper, richer data: XLP provides network-enabled learning data management technology that enables stakeholders to record, analyze and identify learning trajectories to define new directions for progress.

## A Short History of XLP

Since June 2012, XLP-based orientation programs and semester-long courses have been conducted at:

- Tsinghua University, Beijing
- National Taiwan University of Science and Technology
- Singapore University of Technology and Design
- Taylor's University, Malaysia
- Eurasia University, Xi'an
- Tianjin Vocational College of Mechanics and Electricity

Courses have also been conducted at many leading high schools in China. Due to XLP's experimental success, China's Ministry of Education has invited the founder of XLP to serve on the Design Committee of National Curriculum Standards on Technology Education, with the goal of rolling out XLP as a learning architecture and a learning activity design methodology for over 300 million registered students in the Chinese education system.

XLP is scalable and applicable to a broad range of students. A teacher from Tianjin Vocational College of Mechanics and Electricity stated his observation:

"In the past, I could only judge students' quality by their test scores. However, after seeing that students with low test scores can sometimes be the most productive contributors in XLP-enabled learning process, I realized XLP presents many opportunities for students to demonstrate their natural talents."

Mr. Wang Hong Yu, the General Manager of China's Open Course Resource Center, stated how XLP might affect his business:

"With shock and awe, I personally witnessed the transformative effect of a few XLP events on students. I realized that a radical transformation in education has already taken place here in China. The traditional textbook-oriented industry could no longer last. We have to re-position ourselves in the future ecology of education."



## **2 Why XLP? Why Now?**

XLP did not spring fully formed from a vacuum. There is a specific **context** surrounding the framework and its development:

### **Computing Power**

Roughly every 2 years, the number of transistors on a computer chip doubles<sup>1</sup>. The resulting increases in computational processing power strongly synergizes with skyrocketing levels of data storage and falling costs. This influences every aspect of our lives, and the opportunities to learn in new and different ways are expanding exponentially.

### **Big Data**

Every second, gigabytes of data are being collected, and no one – or even any organization – will ever be able to access or process it all. However, learning communities can come together to deal with subsets of this data and solve real-world problems.

This big data makes what and how humans learn more important. As data collection and processing increasingly lets machines connect and aid human decisions (hence creating value), human ingenuity, creativity and intuition are becoming increasingly important. More and more, the only things that people should do are the things that only people can do – and this, of course, places a premium on humans' ability to learn.

### **Open Source**

Open source gives anyone the right to use, change, or share a given technology, thus dramatically reducing the cost of using, copying, modifying, and redistributing software (and indeed,

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<sup>1</sup>Mollick, Ethan. (2006). Establishing Moore's Law. *Annals of the History of Computing*, IEEE. 28. 62 - 75. 10.1109/MAHC.2006.45.

hardware). This means anyone can be a creator and build upon the achievements of those who came before.

## Mobile Devices

Developments in mobile communications and the ubiquity of digital electronic devices mean that more people can connect to the internet – and each other – anytime, anywhere. This means newer, richer opportunities to learn from and with others, no matter where they are.

## Containers and Clouds

Big data needs big computing power – too much for any one institution. With cloud providers like AliCloud or Amazon Web Services, anyone can run virtual machines to perform big computing tasks, and with the power of container platforms (Docker, Kubernetes) they can scale and replicate with ease.

## Globalization

The problems of today's world require diverse communities to offer new insights. These problems are too big for just one individual or institution, but affordable Internet access is enabling people all over the world to collaborate in micro-learning communities to solve these problems. Learning and working together globally across boundaries of space and time – across all boundaries – is mankind's greatest hope for making progress, and XLP enables this crowd-learning and collaborative effort to improve the state of the world.

XLP pushes for the emergence of the world as we believe it should be – egalitarian and equitable, a world in which everyone has a fair chance to have their voice heard, and a fair opportunity to contribute to the progress of the world and humanity.

## Summary

The above factors both enable and require new modes of learning which are increasingly collaborative, personalized, self-directed, active, engaging, and global. XLP has enabled communities of learners to form, disband, and learn collectively more easily and inexpensively than

ever before. The ubiquitous interconnectedness of data, people, things, and processes, the opportunities for collaborative crowd-learning – and new modes of crowd-learning – will increase exponentially. These trends will enable learning to be measured in new ways, and will redefine what the outcomes of learning should be. XLP capitalizes on these trends and enables new learning environments and opportunities, while being enabled and indeed necessitated by them. What humans learn, and the way they learn, must and will be transformed.



## 3 How XLP Works

### Missions

XLP's core activity is the mission. Participants either prepare the mission or execute it.

These missions engage individuals and the group as a whole. Each group designs and operates its own small (or "micro") learning community that serves the individual and collective aims of the creators and participants.

Each mission is governed by a logic model to deliver maximum learning value through hands-on activities. In this chapter we will give a high-level overview of the activities and participants in an XLP mission and the resources made available to achieve the mission goals. In the following chapters we will present detailed step-by-step breakdowns to help you prepare and run missions yourself.

### Participants

XLP engages with learning communities of all shapes and sizes. They may be:

- Large or small
- Physically together, near each other, or spread around the world
- Of similar (or vastly different) ethnic, cultural, educational, professional, and religious backgrounds
- Similar (or different) skill sets, skill levels, interests, and life experiences
- Relatively homogeneous, or highly diverse
- Stay together for many years, or come together to design and conduct a single learning activity

These micro learning communities come together to learn something specific, often for a specific duration. Multiple communities can interact, and may later merge to form larger learning communities, just as amoebas divide and recombine in different ways. As a community becomes larger, it becomes more and more like the real world, and participating individuals, institutions, systems and societies can iterate upon increasingly optimal solutions.

Each community may have three kinds of members: Mission Designers (MD's), Mission Executors (ME's) and Sponsors. The Designers and Executors learn individually and collectively, and this community is a microcosm of a larger context – for example, a university, a society, or a nation. XLP challenges every learning team to be a focused, goal-oriented microscopic society in a digital publishing/learning workflow environment.

## **Mission Designer**

Mission Designers (MD's) design and test learning missions in accordance with the goals of sponsors, tailored for participants based on the available resources and requirements.

MD's are generally divided into four or five groups that reflect Lawrence Lessig's Four Forces that are discussed in a later chapter:

- A law court and perhaps a patent office to regulate the legal interactions between ME's
- A media department to reflect the social norms of the ME's through social media, other digital media, and traditional media
- Market regulators to regulate the operation of the market
- Technology support to enable ME's to execute missions using the technology architecture required to do so

## **Mission Executor**

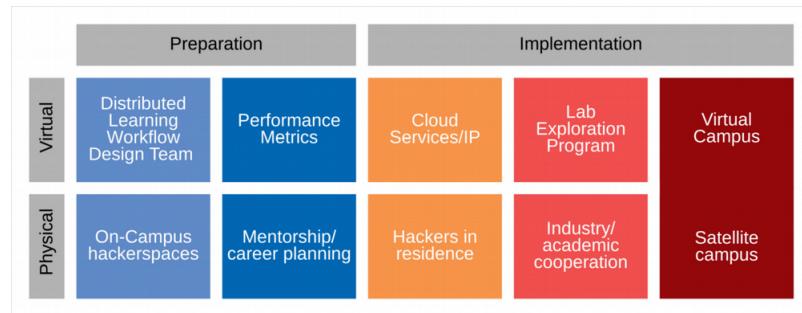
Mission Executors (ME's) participate in the missions designed by Mission Designers, and later become Mission Designers themselves. While on the mission, they learn to execute at a higher level of complexity or speed, and learn how to guide others to perform the mission.

## **Sponsor**

School/department that provides resources for XLP program.

## **Resources**

A learning environment encompasses resources in both the virtual and physical worlds. These can be further divided into two categories: Resources to prepare before the learning process and resources (which have been used and tested in the past) to implement during the learning process:



**Figure 3.1:** Resources used in XLP

## Outputs

### Containers of Knowledge

Containers are the foundation of XLP. A container can be thought of as a box that contains software, the data needed to configure that software, and data created by users (i.e. digital assets). These containers can be installed and used anywhere, and data can be imported and exported easily.

- XLP creates replicable, learning missions in containers, which can then be installed and used anywhere in the world
- Our online platform, Remix, provides the infrastructure to perform this digitally
- Participants create digital assets in their containers using digital publishing, as a record and proof of the work they have performed in the mission.

By taking part in the mission and digital publishing workflow, participants create a body of knowledge covering their area of study. This is in the form of a container which includes software (typically MediaWiki and other tools like WordPress), configuration, and content produced by the participants. These containers may contain many forms of digital asset:

### Proposal or Report Form

Discusses the conclusion of a certain research study, or the conclusion of certain industry analysis ("research study," "business proposal," or "industry analysis report.")

**Budget**

Including both a planning schedule (i.e., a resource and human resource budget and timetable) in addition to a financial budget.

**Short Movie**

Usually a compilation of interesting video footage of the activity, annotated with written text and non-proprietary music.

**Prototype Product**

A book, pamphlet, brochure, or even physical product.

**Example Containers**

- Bauhinia Program

**Team**

One of the most important aspects and products of any XLP event is the friendship developed between participants. Ideally they can create a social network so they can always tap into these human resources for future cooperation.

**Refined XLP Manual**

Because everyone uses a similar mechanism to learn from each other, we can collect data on this to improve XLP as a general learning process – so that everything we do in XLP can be used as case studies or data to improve practices in future. The most direct contributions will be sections, refinements or revisions to the XLP operating manual that you are reading now.

## 4 XLP for Mission Designers

The job of a Mission Designer is to design the mission for Mission Executors, then deploy it and guide them through it. Typically a Mission Designer has been an active Mission Executor in the past.

Mission Designers put together:

- **Constitution:** Defines the goals of the mission, and rights and responsibilities of Mission Designers, Mission Executors, Sponsors
- **Logic Model:** Defines the context, goal, inputs, activities, outputs, effects, and external factors of the mission
- **Mission Specification:** Specifies the mission clearly

This process generally takes a month or so, since extensive planning is required.

It is highly recommended to "eat your own dogfood" while preparing the mission - namely using the XLP methodology itself (logic model, constitution, etc) to govern the mission design process, with the end goal of having students produce their own logic models, etc, as outputs of said mission. For that reason, MD's should become familiar with how executors execute XLP missions since designing an XLP mission is itself an XLP mission.

### Kick-Off Meeting

Sponsors, Mission Designers, and support staff should come together to ensure mutual understanding of the XLP mission preparation process. Upon setting up the Digital Publishing Container, the team can use tools like Phabricator to assign tasks and deadlines.

### Digital Publishing Container

Each learning community uses digital publishing tools (like MediaWiki) to publish their activities and results. These tools are contained in a Docker container which lets users access them online. MD's should coordinate with technical support staff to ensure these containers are deployed and fully tested, with a regular backup system in place.

## Constitution

The constitution is a living document that lays out:

- Which entities can engage in an XLP mission
- The purpose of the mission
- Responsibilities of participants
- Rights of participants
- How to change or amend the constitution (typically via git or other version control systems)

Mission Designers write their own constitution which "overlays" the XLP Meta Constitution. Check an example constitution for reference.

This constitution is supplemented by a smart contract. Whereas the constitution provides the framework, the smart contract handles the specifics. The constitution is the overarching set of rules, obligations, privileges and rights for the membership of accounts, while the smart contract is one defined and created by the parties involved in a particular digital publishing workflow or creation. That is, every account is to be governed by both this overarching constitution, and a smart contract which defines the specifics of one's work in the XLP.

## 5 XLP for Mission Executors

Each Mission Executor goes through an extensive orientation program before engaging in the mission that the Mission Designers created.

### Delegations, Groups, and Teams

Depending on the amount of people taking part in activities, they can be broken down as follows:

- A **delegation** may consist of several groups who attend a venue together, but work on different courses with frameworks different to XLP.
- A **group** is all the participants working on an XLP course together. They may (or may not) be part of a larger delegation.
- Each group is split into **teams**, each working on a specific project that they will be graded on.

### Orientation Program

Usually involves digital identity, agreement reading/signing and quick overview of how to use digital publishing tools. Participants also gain experience dealing with many other people on the fly, encountering the courtroom, participating in market transactions, participating in media – i.e. learning how the four forces interact with XLP activities.

### Digital Identity

Every entity in an XLP mission has a verifiable which they use to:

- Log in to the digital publishing tools stored in their container (like MediaWiki, WordPress, or NextCloud)
- Attach ownership to the content they generate

- Track their learning progress via built-in analytics tools
- Digitally sign the constitution and smart contracts
- Securely link their identity to their qualifications and credentials

These participating entities include individuals and organizations, as well as physical resources and technical services. Digital identities (like email addresses or OpenID) enable the tracking of every entity's contribution to the crowd-learning process, and allow participants to sign Smart Contracts.

## **Constitution Reading**

Before each XLP mission, each prospective participant reads through the constitution to learn the mission framework. This details the rights and responsibilities of each participant in the activity, in addition to services provided by the sponsor. Participants digitally sign a Smart Contract (stored on the Blockchain) stating that they understand the details of the constitution and their responsibilities, and an agreement stating that they agree to abide by the overarching constitutional framework during the activity.

## **Lab/Knowledge Exploration**

"Taster" classes allow participants to visit many laboratories and researchers in a big campus (e.g. Tsinghua University's laboratory exploration program that makes available more than 100 laboratories and gets participants on campus to see each other's research results.) This gives a broader context of available technology and research results.

Some examples include:

- The Intelligent Manufacturing Incubator at Zhongguancun
- The Digital Capability Center at iCenter, Tsinghua University
- Other local high tech companies
- Tianhe Super Computing Center
- Tianjin High Tech Zone

## **The Mission**

Mission Executors will form teams and create a digital publication, for example an Industry Analysis Report (IAR), based on field trips, in-person interviews, and lectures conducted by speakers and tutors. Ideally, Mission Executors should collect and compile relevant industry indication

data, pictures, and videos taken on field trips or daily observations during the program, and integrate them into their publication.

All teams will collaborate on a hosted wiki to write and collate their reports, and then present the finished products on a visually appealing blog and as a class presentation.

- **Example: Experience China, Industry Frontiers, 2018:** wiki, blog

Missions usually fall into one of three tracks, each of which use different tools to create different outputs:

- **Industrial frontier:** Participants globally search and compile relevant information, and creatively tell a compelling story using trustworthy data sources and presentation techniques.
- **Computational thinking:** Participants apply optimization technologies and understand the principles of optimal limits, and can thus apply optimization to all their learning activities.
- **Domain Specific:** Participants learn domain-specific vocabulary and rules, so that they can leverage existing bodies of knowledge in an organized manner.

Typically, a mission follows five steps:

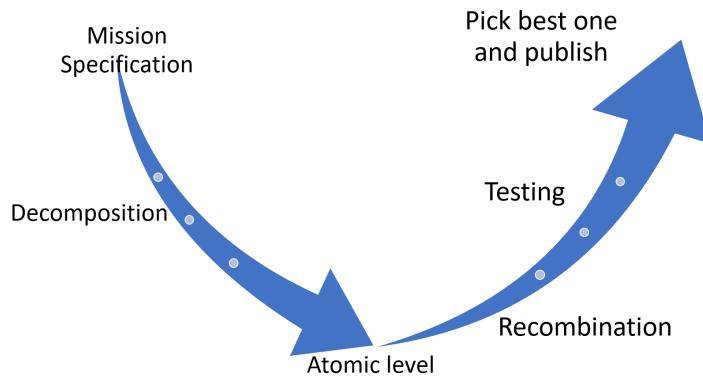
		Activities	Tools
<b>1</b>	<b>Mission Breakdown</b>	<ul style="list-style-type: none"> <li>• Mission Decomposition</li> <li>• Logic Model</li> <li>• Mission Statement</li> </ul>	N/A
<b>2</b>	<b>Planning and Management</b>	<ul style="list-style-type: none"> <li>• Story-boarding</li> <li>• Scheduling</li> <li>• Task Allocation</li> </ul>	 <b>PHABRICATOR</b>
<b>3</b>	<b>Activity Coordination</b>	<ul style="list-style-type: none"> <li>• Interviews</li> <li>• Research</li> <li>• Data Collection</li> </ul>	N/A
<b>4</b>	<b>Product Development</b>	<ul style="list-style-type: none"> <li>• Prototyping</li> <li>• Programming</li> <li>• Integrating</li> <li>• Testing</li> </ul>	 <b>Jenkins</b>  <b>MODELICA</b>  <b>jupyter</b>
<b>5</b>	<b>Digital Publishing</b>	<ul style="list-style-type: none"> <li>• Collating Data</li> <li>• Digital Design</li> <li>• Digital Publishing</li> <li>• Presentation</li> </ul>	 <b>[W]</b>  <b>MEDIAWIKI</b>

**Figure 5.1:** Mission steps

## Mission Breakdown

### Decomposition and Recomposition

Each XLP Mission follows our V Curve:



**Figure 5.2:** V Curve, showing mission decomposition and recomposition

Starting from the left of the diagram, participants break down (decompose) the mission until they get to the most basic (atomic) level, and then rebuild (recompose) the constituent parts into potential viable outputs. Breaking it down step-by-step:

1. Mission specification.
2. Decomposition of mission specification.
3. Decompose and repeat steps 1-3 until you reach the atomic level. Keep going down, machine checking if you have met the specification. Must be at the atomic level.
4. Go back up once you have defined the most basic decomposition.
5. Propose a solution of some sort. You can use machines to generate new solutions. Frequently test to see if it matches your specification.
6. Pick the best option and digitally publish it.

A useful analogy is a Lego set:

- The mission specification would be the picture of the finished model on the box
- The mission would be to build the model
- The most atomic level is the individual Lego bricks

Participants would look at the picture on the box, decompose it into component parts until they reach the brick level, then work out the best way to recompose it (or potentially build something even better) from there.

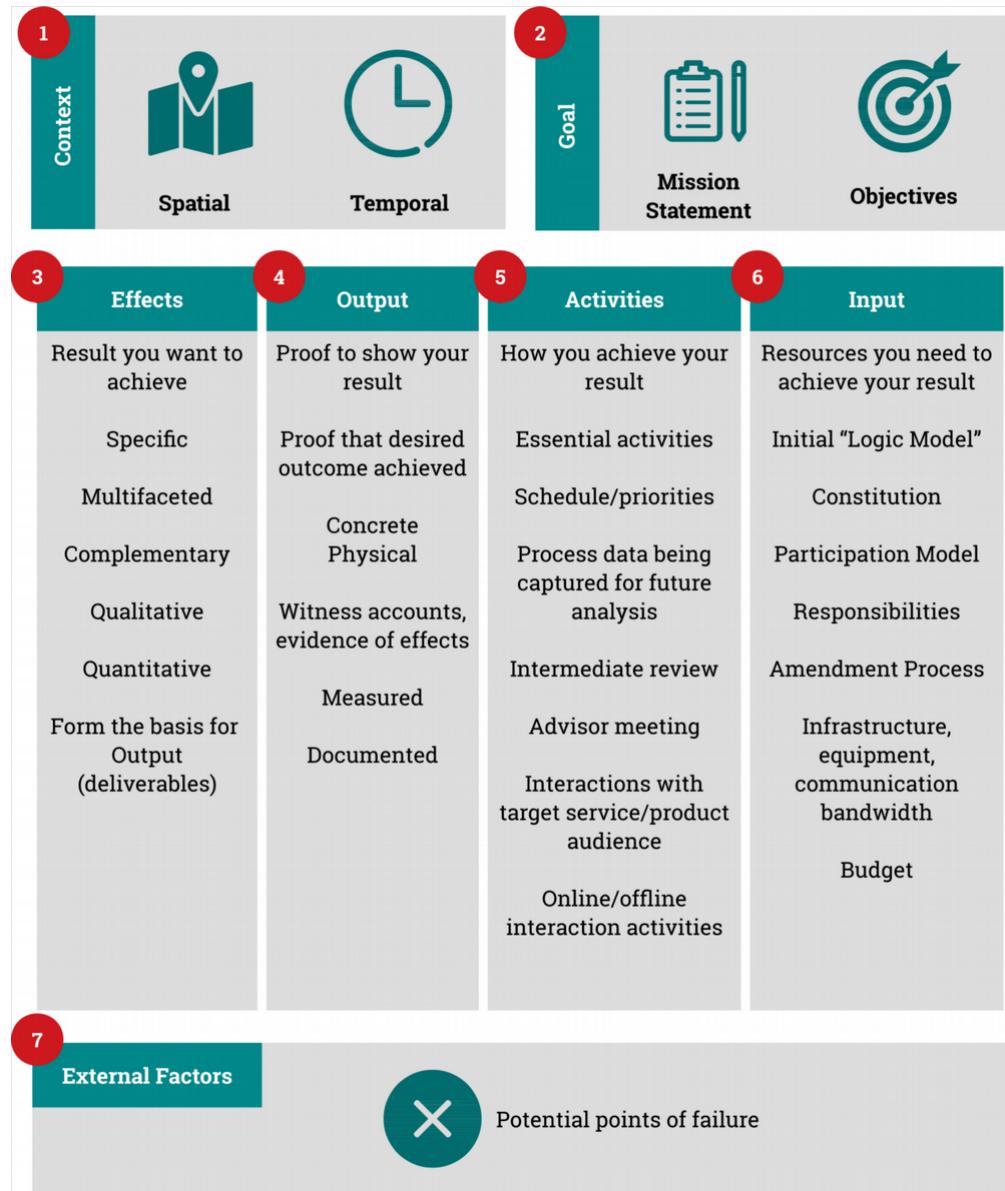
## Logic Model

A logic model (also known as a logical framework, theory of change, or program matrix) is a tool used by funders, managers, and evaluators of programs to evaluate the effectiveness of a

program. They can also be used during planning and implementation. Logic models are usually a graphical depiction of the logical relationships between the resources, activities, outputs and outcomes of a program. While there are many ways in which logic models can be presented, the underlying purpose of constructing a logic model is to assess the "if-then" (causal) relationships between the elements of the program.

As part of their digital publication, teams create a one-page logic model, taking into account activity context, inputs, activities, effects, external factors, and outcomes.

Each of the boxes below will have precise linguistic properties that can be examined by human or machine (via Natural Language Processing), to know if the information in the box fits the specified requirements. In this way, participants can be assessed and certified automatically, using Blockchain-witnessed process data collected using the Remix platform.

**Figure 5.3:** XLP Logic Model

### 1. Context

- What's your current situation or context?
- Includes spatial and temporal description (where will you do the activity, and when?)

## 2. Goal

- What do you want to do?
- Imperative statement, for example "conquer Rome," or "land a man on the Moon"

## 3. Measurable Effects

- How will you determine success?
- Set of conditional statements. Output will be measured against these to confirm it has achieved desired goal

## 4. Output

- What will you deliver?
- Concrete objects like micro-movies, logic model documents, industry analysis reports, financial statements, etc

## 5. Activities

- What do you need to do to succeed?
- Set of partially ordered activities, outlining what happens during the project and how to accomplish the project goal

## 6. Input

- Resources required to execute the mission, including budget, human skills, head counts, etc

## 7. External Factors

- What factors that could prevent the team from achieving their goal?

The logic model is one of the first activities each team conducts, which helps to build a common understanding of the mission as well as the influencing parameters. During the next steps, continuously referring back to the logic model helps them check that they are consciously aware of their own actions.

Using the logic model ensures that every task or project starts with explicitly-analyzed test cases, originating from Test Driven Design. Each step of the model feeds into the next step, generally with a one-to-one relationship. Similar to writing a computer program, the logic model has two stages of checking/analysis:

- Static Analysis: A way to read the model itself, and see if the content in all boxes is consistent and relevant.
- Dynamic Analysis: A way to use the "measurable effects" to confirm output matches expected outcomes, and if task performance fits the goal.

Many examples of logic models can be seen from the teams that took part in Experience China 2018.

## Mission Statement

A mission statement acts as a carrier of culture, ethos and ideology<sup>1</sup>. Many mission statements are pithy and up-beat, and deal with abstractions possessing 'a strategic level of generality and ambiguity'<sup>2</sup>

A team's mission statement should capture the essence of their goals and reflect their specific niche. The best mission statements are clear, concise, and useful (informs. focuses. guides).<sup>3</sup>

## Examples

- **Public Broadcasting System (PBS):** To create content that educates, informs and inspires.
- **charity: water:** Bringing clean, safe drinking water to people in developing countries.
- **National Parks Conservation Association:** To protect and enhance America's National Park System for present and future generations.
- **TED:** Spreading Ideas.
- **Defenders of Wildlife:** The protection of all native animals and plants in their natural communities.

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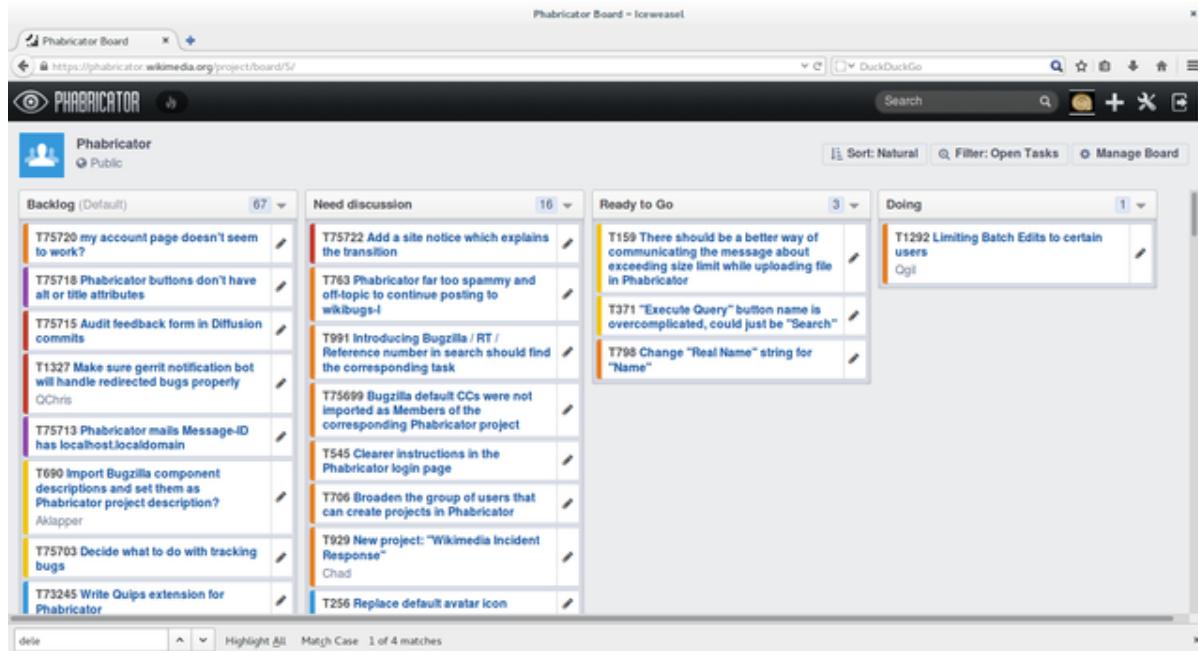
<sup>1</sup>[Discourse and the projection of corporate culture: The mission statement [https://deepblue.lib.umich.edu/bitstream/handle/2027.42/67339/10.1177\\_0957926595006002005.pdf?sequence=2](https://deepblue.lib.umich.edu/bitstream/handle/2027.42/67339/10.1177_0957926595006002005.pdf?sequence=2)]; JM Swales, PS Rogers - Discourse & Society, 1995 - journals.sagepub.com

<sup>2</sup>Fairhurst, G.T., Echoes of the Vision: When the Rest of the Organization Talks Total Quality, *Management Communication Quarterly* 6: 331-71

<sup>3</sup><https://topnonprofits.com/examples/nonprofit-mission-statements/>

## Planning and Management

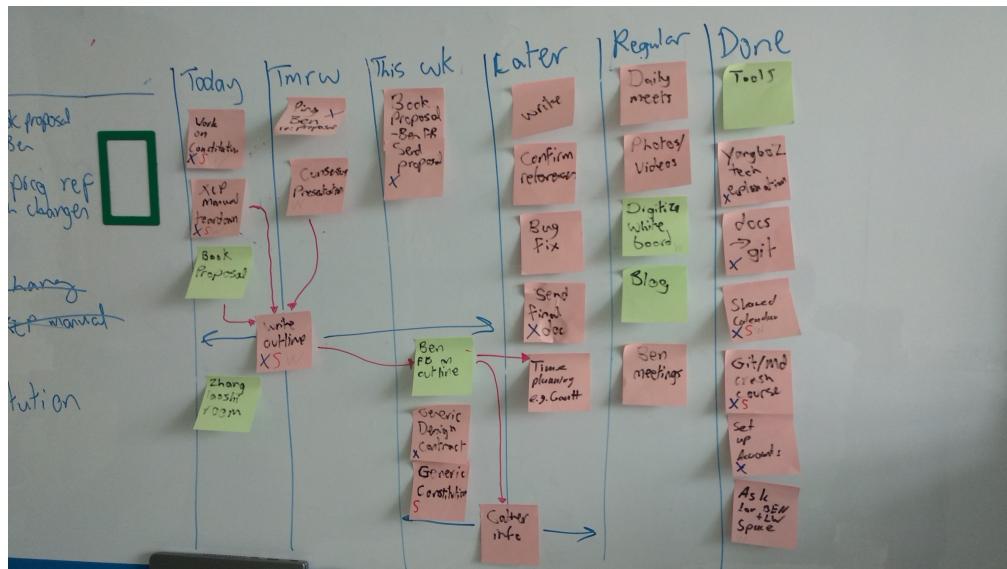
Mission Executors use physical resources like whiteboards, post-its and note paper, and digital resources like Phabricator to storyboard their mission, assign tasks, and set a schedule.



**Figure 5.4:** Phabricator

## Scheduling and Task Allocation

Ideally use a whiteboard board, with post-it notes:



**Figure 5.5:** Kan Ban with post-its to organize tasks

1. Each team member writes down a list of tasks they think need to be done
2. Team comes together to share their post-its, and come to consensus
3. Connect post-its with whiteboard markers to mark related ideas
4. Post-its are put on kanban, arranged by schedule (today/tomorrow/this week/later/done)
5. Each activity is assigned to a team member and recorded on Phabricator

## Story-boarding

Teams designing a product or producing a video may find it useful to produce a storyboard, to visually organize their story or use case.<sup>4</sup>

<sup>4</sup><https://multimedia.journalism.berkeley.edu/tutorials/starttofinish-storyboarding/>



**Figure 5.6:** Example storyboard<sup>5</sup>

## Briefings and Debriefings

At the beginning of each day, the team coordinator should meet with the team and ensure everyone is up-to-date and clear on their tasks. Some example questions include:

1. What thoughts have you had on the project since the end of the last working day?
2. What tasks will you be working on today?
3. What obstacles do you think may pop up? (and as a team, work out how to overcome them)
4. What other commitments do you have today?

At the end of the day, we suggest a debrief to ensure the team achieved everything they planned. Some example questions are:

<sup>5</sup>[<https://www.flickr.com/photos/fepa/4512490304>” Benegrip - storyboard”] by fepa, licensed under CC BY 2.0

1. What did you get done today?
2. What did you plan to do, but didn't do? Why not?
3. What surprises (good or bad) came up? (and as a team, work out how to overcome those bad surprises if they happen again)
4. What's your plan for tomorrow?
5. Any other business?

## Activity Coordination

Based on the planning done in the previous steps, each team collects data via interviews with industry experts, site visits, online and offline research, and surveys. All research must be cited and collected on the wiki.

### Surveys

- Writing good survey questions

### Research

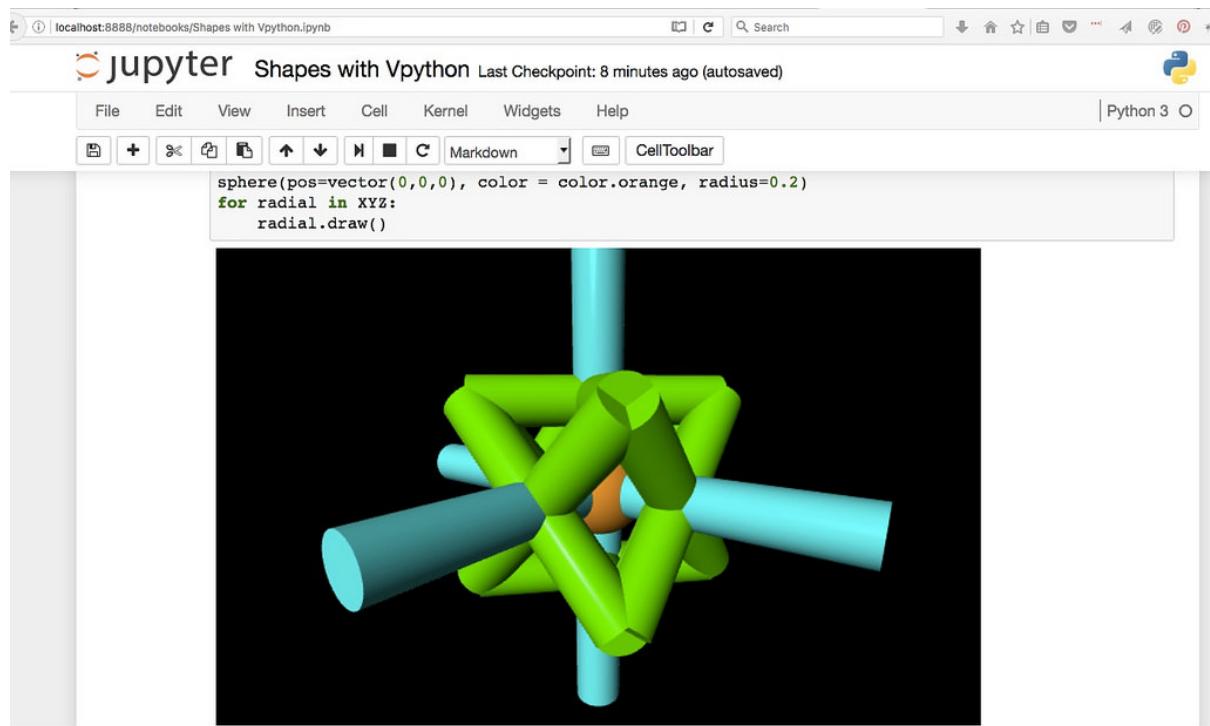
Some helpful links include:

- Google Scholar
- ArXiv

## Product Development

*Note: Not all XLP courses require a product development step, for example when writing Industry Reports, this step would likely not be required.*

Mission Executors use tools like Jenkins, Modelica, Jupyter Notebook, and other prototyping and integration tools to develop their product, which may be software, hardware, or a business idea.



**Figure 5.7:** Jupyter Notebook

## Digital Publishing

Many of the mission objectives you will be graded on revolve around digital publishing. Each group participating in the course will have their own digital container that holds the software and data you will use and/or create during the course.

When you sign up for the course, you should be given a URL for your container and a unique login and password. If you haven't, please speak to your coordinator. The software you will use is WordPress and MediaWiki

### Wiki

Mission Executors use the wiki to group edit your report and other documents.

A wiki is a website on which users collaboratively modify content and structure directly from the web browser. In a typical wiki, text is written using a simplified markup language.



The screenshot shows a MediaWiki page titled "Mobile Wallet". At the top, there is a navigation bar with links for "Not logged in", "Talk", "Contributions", "Create account", "Log in", and "OAuth2Login". Below the navigation bar, there are buttons for "Read", "Edit", and "View history". A search bar is also present. The main content area features a table of contents (TOC) with the following structure:

- Contents [hide]**
- 1 Poster Outline
- 2 Wordpress
- 3 Final Report
- 4 Meet the Team
- 5 Introduction
- 6 Logic Model
- 7 Outline
- 8 History, Business Models, Market Size and Growth
  - 8.1 Key Players in the Chinese Market
    - 8.1.1 WeChat
    - 8.1.2 Alipay
  - 8.2 Global Alternatives
    - 8.2.1 Apple Pay/Android Pay/Samsung Pay
    - 8.2.2 NFC-based options
- 9 What made mobile payments so successful in China?
  - 9.1 Introduction
  - 9.2 Societal Trust in Mobile Payment Companies
  - 9.3 Socio-Economic Factors
  - 9.4 Relatively Under-developed Credit Card Infrastructure
  - 9.5 Institutional Framework
  - 9.6 High Mobile Penetration
  - 9.7 Network Effects
- 10 Societal Impacts in China
  - 10.1 Increased Economic Activity
  - 10.2 Impact on Existing Financial Institutions
  - 10.3 Social
  - 10.4 Personal Data Collection
  - 10.5 Conclusion

**Figure 5.8:** Example wiki, running on MediaWiki

Wikipedia is by far the most popular wiki-based website, and is one of the most widely viewed sites of any kind in the world, having been ranked in the top ten since 2007. There are tens of thousands of other wikis in use, both public and private, including wikis functioning as knowledge management resources, notetaking tools, community websites, and intranets. The English-language Wikipedia has the largest collection of articles; as of September 2016, it had over five million articles.

We use Mediawiki, the same software that runs Wikipedia, to allow participants to collaboratively create reports and other documents.

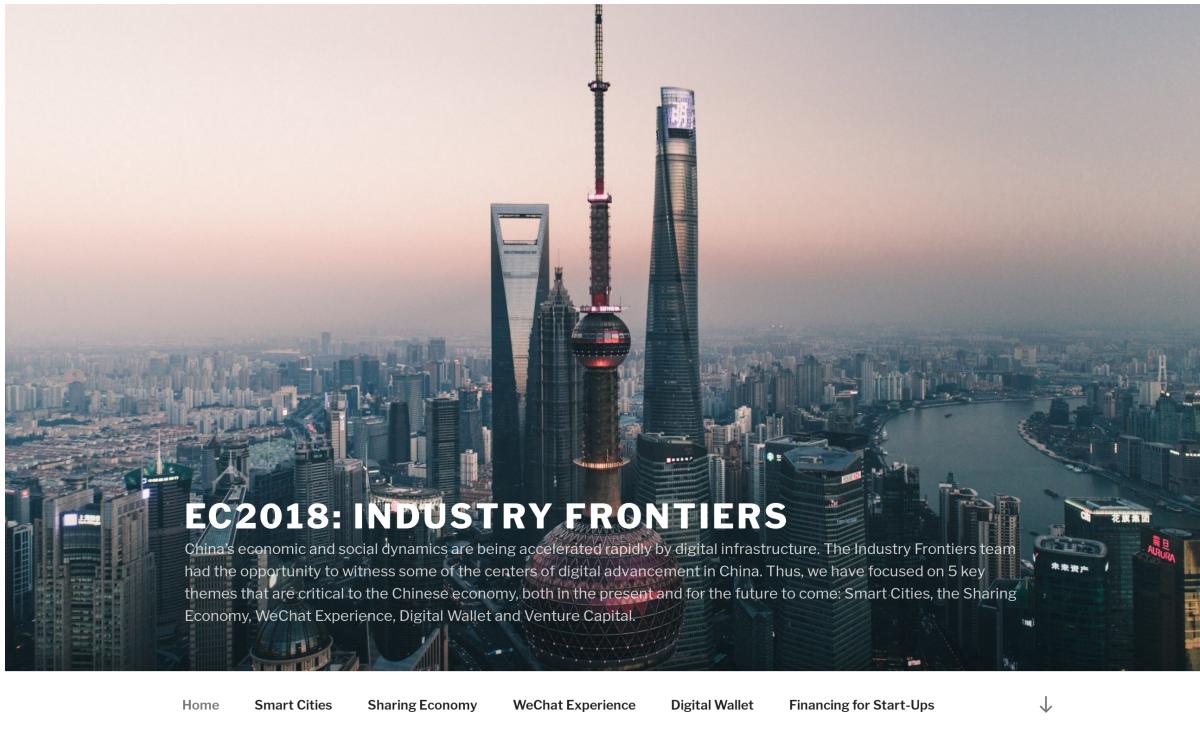
A guide to using MediaWiki is in the appendix.

## Blog

After your report is ready, you will use the blog to create pages and present it in a visually appealing manner.

A blog (short for "weblog") is a discussion or informational website consisting of posts (diary-

style updates, displayed newest-first) and pages (more permanent information).<sup>6</sup>



**Figure 5.9:** Example blog, running on WordPress

Our blogging software is WordPress: a free and open-source content management system. It is most associated with blogging, but supports other types of web content including more traditional mailing lists and forums, media galleries, and online stores. Used by more than 60 million websites, including 30.6% of the top 10 million websites as of April 2018, WordPress is the most popular website management system in the world.<sup>7</sup> Our WordPress installation includes several plugins to make editing easier, most notably Elementor.

A guide to using WordPress and Elementor is in the appendix.

## Presentation

Each team will create a presentation to present the work they've done, and present to the class. Typically, a presentation should last 5-7 minutes, plus questions and answers afterwards. Don't worry about getting everyone on stage to present - instead limit it to 2-3 speakers.

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<sup>6</sup>Adapted from Wikipedia, July 30, 2018

<sup>7</sup>Adapted from Wikipedia, July 30, 2018

Since *Microsoft PowerPoint* is the industry standard (and you may not be presenting from your own computer), we recommend creating your presentation in *pptx* format. Don't use Google Docs or other online office suites, since connectivity (due to VPN or lack of network) may be an issue.

After each team has presented, everyone will regroup and the group will nominate a team to create one final presentation to summarise the industry reports of all the teams.

## Poster

Quite often, all of the teams will come together as a group and create one or more posters that present the work they've done. While other groups may use markers or a collage to create their poster, we recommend sticking with the theme of digital publishing and creating it with software like *Adobe Illustrator*.

Example poster from *Experience China 2018: Industry Frontiers*:



**Figure 5.10:** Example poster

## Useful Resources

We encourage participants to use Creative Commons (CC) licensed materials in their work. Creative Commons licenses let others copy, distribute, edit, remix, and build upon various works, all within the boundaries of copyright law.<sup>8</sup>

The following websites let you search for content licensed under Creative Commons. Don't forget to cite your sources and respect the license when you use these materials!

<sup>8</sup>Creative Commons website, 31 Jul 2018

- Creative Commons Search - images, music, video
- Noun Project - symbolic icons (for example, world, people, internet, etc)
- 14 Websites To Find Free Creative Commons Music
- The Five Best Places To Find Free Creative Commons Photos
- 5 More Places to Help You Find Quality Creative Commons Images

## Evaluation and Assessment

Using secure technologies like the Blockchain, XLP tracks learner activity at different levels, assessing how individuals contribute to their group and how a small group contributes in turn to larger communities. This allows individuals and teams to receive personalized feedback and improve over time. This in turn applies to grading and certification, with both micro-credentials and full degrees stored on the Blockchain. Access rights can be granted to other universities or employers to show tamper-proof evidence of achievement.

## **6 Remix: The XLP Online Platform**

Think of the world you live in: Imagine the classroom of the future:

In a world that is becoming increasingly digital, it is essential to teach the skills required to navigate through the digital environment as early as possible. A gap is opening between those who are technologically literate and others who are yet to be comfortable with handling software. The ones who are on the wrong side of this gap will eventually suffer detrimental implications to their careers and lives. Such individuals will not be able to take part in collaborative work, thereby limiting their ability to increase their knowledge. Already, individuals and institutions lack the tools to create new digital assets or work with the existing digital information, both of which decrease their overall potential. Clearly, students need a solution to escape this situation. Imagine a classroom of the future that is modeled after the reality outside the classroom. If the reality outside the classroom is one pervaded by digital tools, so should the classroom. Remix makes sure this happens. Students will no longer study for exams but prepare for the challenges that await them in the future. It helps them work and self-manage teams with tools like Phabricator and Git, while allowing teachers to track student progress and individual contributions (captured using a digital data processing system) towards their respective projects using GitLab. Without such digital tools, organizational consciousness can't be brought to human attention and organizational learning can't happen.

Trustworthy computing technologies such as Blockchain technology are integrated into Remix. These ensure immutability while ensuring credit is given where credit is due.

### **Remix Tools**

The Remix platform offers a large array of powerful tools, manageable by anyone and scalable to any size.

These tools will be an important asset for any modern educational institution for which it can fully develop the intellectual potential of its students and staff. The platform democratizes services that were previously limited to such an extent that only established companies were able to utilize their full potential. These services are now combined into a single platform allowing

any individual or institution to start their digital transformation. Without the need for continuous online connectivity, the platform can be brought to the farthest corners of the globe, where a new generation of individuals can start fulfilling their computational needs. In short, Remix can bring the tools used by established software companies into any classroom or home enabling anyone to take part in the future of the digital world.

Together, participants can create new data using tools like Jupyter and OpenModelica, or analyze and optimize existing information using Elasticsearch and TensorFlow. Ultimately, every individual can create or take part in a Digital Publishing Workflow – a cycle going from Data Input to Data Management to Data Publishing, all from their own laptop in one single application. This is Remix.

## **What is a Microservice?**

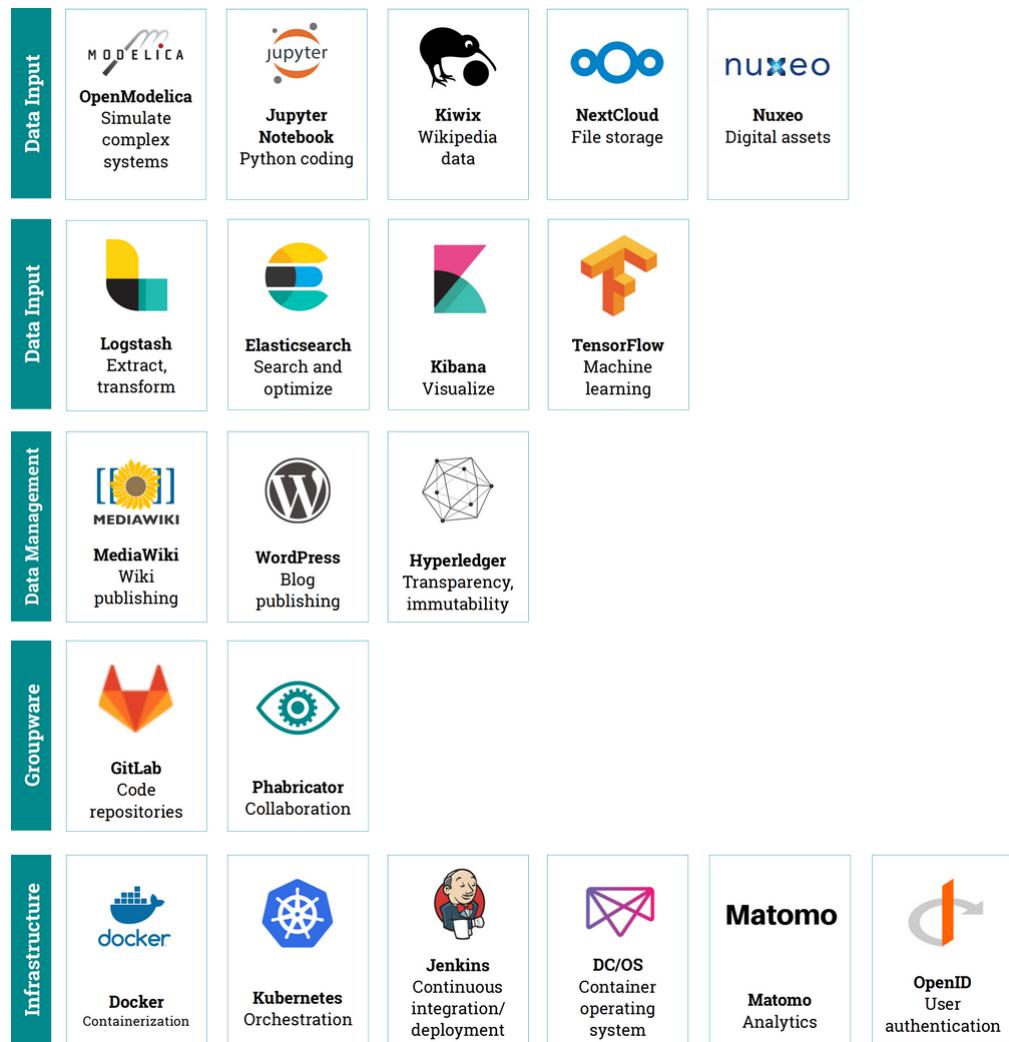
The central idea behind microservices is that some types of applications become easier to build and maintain when they are broken down into smaller, composable pieces which work together. Each component is continuously developed and separately maintained, and the application is then simply the sum of its constituent components. This is in contrast to a traditional, "monolithic" application which is all developed all in one piece.

Applications built as a set of modular components are easier to understand, easier to test, and most importantly easier to maintain over the life of the application. It enables organizations to achieve much higher agility and be able to vastly improve the time it takes to get working improvements to production. This approach has proven to be superior, especially for large enterprise applications which are developed by teams of geographically and culturally diverse developers.<sup>1</sup>

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<sup>1</sup><https://opensource.com/resources/what-are-microservices> An Introduction Microservices, Opensource.com

## Remix Microservice Overview



**Figure 6.1:** Remix platforms microservices

### Data Input

Data Input describes the different ways through which data may enter the Remix platform. In the Digital Publishing Workflow, Data Input lies between Data Publishing and Data Management, as previously published data can act as input for Data Management.

Generally, data may enter the system from three source types or combinations of them.

## **Data Creation**

Remix comes with microservices from which new data can be created. For instance, OpenModelica enables users to create simulations of complex systems. The data produced by these simulations can then be saved for later use. Another service, Jupyter, allows for coding, solving equations, and showing their visualizations that can then be shared in real time among different users. Again, all the data created can be saved for later use.

## **Online Data**

Remix also allows users to source data from the internet such as databases, wikis, or pictures. Again, different microservices are available and integrated for this purpose. Data may be accessed directly from the internet or downloaded first (for instance, to be brought to regions where internet access is spare or Internet is slow). Kiwix, for instance, offers the entire Wikipedia, WikiVoyage, TED Talks, and more for free to download on their website. This data may also be used as input for Data Creation, subsequently representing a combination of data.

## **Private Data**

Remix enables users to use their own private data as input for Data Management and Publishing. For this purpose, the platform comes with microservices such as Nuxeo, which is a digital asset library already used by institutions, companies, and individuals to manage their digital assets and NextCloud for file storage in the cloud. Hence, they can tap into their existing data and use it as input for other microservices to create new data, again representing a combination. Generally, such private data may belong to an individual, an institution, or a company who can scale up their data storage as required without having to scale the other microservices thanks to the underlying system architecture.

## **Data Management**

The data management part of Remix utilizes four different tools to perform a number of tasks. In the Digital Publishing Workflow, Data Management lies between Data Input and Data Publishing. The purpose of data management is to load the given information from the different data inputs, then optimize it so that it becomes searchable and produces the best results, which in turn can be visually presented to the user. This is possible through the use of the ELK stack from Elastic, consisting of Logstash, Elasticsearch, and Kibana, in combination with the machine learning capabilities of TensorFlow. These tools are combined to allow users to perform queries on wide

array of data that in turn, can be optimized based on an infinite number of characteristics. The following section will describe each tool and how they are an integral part of the of the Remix framework.

### **Logstash: Data extraction, transformation, and loading**

Remix consists of a large number of data sources that each produce a large quantity of data, in many different formats. It is therefore necessary to have a tool that can extract, transform and load the input data into the next step of the process. This is where Logstash is used. Logstash is an open source server-side data processing pipeline based on the extract, transform, load (ETL) process.

Each step has varying degrees of complexity, that will be explained in the following sections:

The first job carried out by Logstash is the extraction of data from the different defined sources. Extraction is conceptually the simplest task of the whole process but also the most important. Theoretically, data from multiple source systems will be collected and piped into the system for it later to be transformed and eventually loaded into the system. Practically however, extraction can easily become the most complex part of the process. The process needs to take data from the different sources, each with their own data organization format and ensure that the extraction happens correctly so that the data remains uncorrupted. This is where validation is used. The extraction process uses validation to confirm whether the data that was extracted has the correct values, in terms of what was expected. It works by setting up a certain set of rules and patterns from which all data can be validated. The provided data must pass the Transform Load validation steps to ensure that the subsequent steps only receive proper manageable data. If the validation step fails, then the data is either fully rejected or passed back to the source system for further analysis to identify improper records, if they exist.

The data that is extracted then moves on to the data transformation stage. The purpose of this stage is to prepare all submitted data for loading into the end target. This is done by applying a series of rules or functions to ensure that all business and technical needs are met. Logstash does this by applying up to 40 different filters to all submitted data. When filtering is completed, the information is transformed into a common format for easier, accelerated analysis. At the same time, Logstash identifies named fields to build structure from previously unstructured data. In the end of the transformation process, all data in the system will be structured and in a common format that is easily accepted by subsequent processes.

The last part of the ETL process is the load phase. The load phase takes the submitted and transformed data and loads it into the end target. There are certain requirements defined by the system that must be upheld. This pertains to the frequency of updating extracted data and which

existing information should be overwritten at any given point. Logstash allows the system to load onto a number of systems, Remix does however only require that Elasticsearch receives the data.

### **Elasticsearch: Search and Optimize**

Search and optimize are two key attributes of any data management system. It allows a system to filter away all the unwanted data and prioritize the results based on a number of given attributes. Search and optimize are not functions that are limited to basic keyword searches, but can instead be used for a wide variety of possibilities. Everything from choosing the correct strategy in a game of chess to simulating the trajectory of a moving vehicle. In all these cases, the function utilizes the available information from the different data sources in combination with machine learning intelligence to give the desired outcome. To achieve this Remix uses Elasticsearch and TensorFlow. Elasticsearch is a distributed, RESTful search and analytics engine that stores data in a searchable manner. All the data that is passed through Logstash eventually ends up in Elasticsearch. Here it is structured and analyzed to allow users to search based on their chosen parameters. The given parameters are in turn used to filter away all the unwanted results. What remains is a list of results that in one way or another are linked to the original search criteria. This list is, in turn, handed to TensorFlow.

TensorFlow is a mathematical library using deep neural networks in order to analyze data. The system takes in the data that was selected by Elasticsearch and prioritizes/orders it according to the pre-determined criteria. This gives the user a selected number of results that should be suited exactly to their defined needs.

When it comes to searching and optimizing, Remix's key difference compared to other services is that results are purely based on the user. If a user specifies a certain interest or academic field that they are studying, then the optimization will be created with that parameter as a focus point. Thus, opening up focused research where all advertising-based rankings or unwanted results are removed.

### **Kibana: Data Visualization**

In certain scenarios, the outcome of the data management process doesn't come in the form of links or lines of text. In these cases, it is often required that the data goes through some sort of visualization in order to turn it into something that is manageable.

This is carried out by Kibana, the last tool in the data management process. Kibana is a data visualization plugin that works with Elasticsearch to provide visualization on top of the content

that has been indexed. It takes all the data that the user has asked for and gives a visualization if it is applicable. Kibana can therefore also be seen as being part of the data creation aspect of Remix.

## **Data Publishing**

The final aspect of any standard research project concerns the publishing of results and conclusions.

For this reason, the final part of the Remix framework is data publishing. The purpose of this step is to ensure distribution of new data to a wide audience while guaranteeing rightful credit and ownership of published research and findings. To do this, the platform uses two main tools, MediaWiki and Hyperledger, in combination with the machine learning capabilities of TensorFlow.

MediaWiki is a digital publishing tool created by the Wikimedia Foundation. It allows information to be published in a structured and navigation-friendly way. Remix uses MediaWiki to allow institutions or individuals to create closed or open wiki spaces in which all their information and research can be published. Each publisher then creates a distinct name for each new published article or piece of information. All the information on the given wiki space is then individually connected using the deep neural network capabilities of TensorFlow, as mentioned in the previous chapter. TensorFlow analyses each piece of information and carefully links it together with other related information. This, in the end, produces a wiki space which is full of research articles and other information, in combination with existing Wikipedia data, that is fully connected. Furthermore, connections and recommendations of articles can be made based on user preferences. In other words, if a user is studying biology and is doing research on the flight patterns of butterflies, then Remix will start creating more links and finding more research articles on that topic specifically. In that scenario, it might connect the flight patterns of butterflies to the evolution of airplane wing structures.<sup>6</sup>

Ultimately, a person can, through Remix, have access to a deeply interconnected network of research, published articles, and existing data from the internet.

To ensure all information in the system is untampered with and that publishers are rightfully credited, Remix uses trustworthy computing technologies such as Hyperledger. Hyperledger is an open-source collaborative blockchain technology that ensures transparency and immutability of all data in the system. This, in turn, ensures that any information for which there may be a rightful owner is credited as such. These tools open up a new dimension of the digital publishing process that allows institutions and individuals to contribute their knowledge to a greater audience.

## Groupware

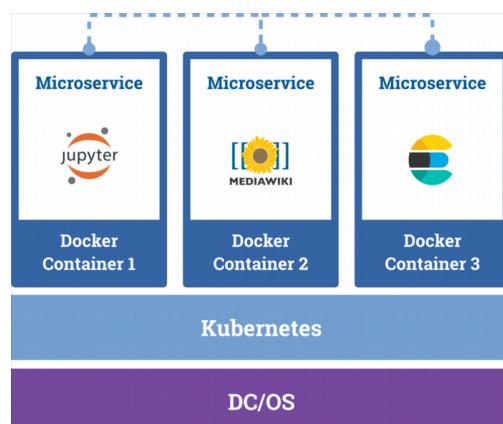
Remix provides Phabricator and GitLab as a platform for participants to collaborate. GitLab is an open-source web-based Git-repository manager with wiki and issue-tracking features, allowing users to upload and share code and digital assets, while ensuring no conflicts occur between versions.

Phabricator is a suite of web-based software development collaboration tools, including a code reviewer, repository browser, change monitoring tool, bug tracker and wiki. Phabricator integrates with Git, Mercurial, and Subversion. Participants can use it for project management and coordination within (and among) teams.

## Architecture

The interconnectedness of services in Remix is made possible using the Docker platform. Docker uses container technologies to allow microservices and other digital assets can be run in easily-replicable sandboxes and not interfere with each other. Unlike virtual machines, containers do not require a guest operating system which makes them more lightweight, allowing for more or bigger applications running on a server or single computer.

With Docker container technologies, we can re-define all digital assets into three main categories: content data, software data, and configuration data. These categories can be tagged using a hash code (similar to Git or Blockchain labels) and can be traded by swapping out "tokens" or hash IDs of the asset. This allows participants to easily install different software services and start using the asset almost instantly. The end result is that participants and instructors can better manage learning activities, and use one consistent namespace to organize all their assets.



**Figure 6.2:** Architecture of Remix platform

Hence, a multitude of containers can easily be combined in a single application. This can be done through Docker Compose. While Docker focuses on individual containers, Docker Compose engenders scripting the installation of multiple containers that work together to create a bigger application. Microservices in Remix talk to each other to modify and move data from its creation, to its management, and publishing. At the same time, since the microservices are still housed in their respective containers, any service may be added or removed at any time without damaging other containers.

Remix also enables deployment, monitoring, and scaling microservices with Kubernetes, a tool specifically designed for this task. Microservices can then be scaled individually and independently from each other (thanks to their containerization), specific to the needs of the user. Matomo (formerly known as Piwik) is an open-source analytics software package (similar to Google Analytics) for tracking online visitors, analyzing important information, and track key performance indicators. Remix uses this software to track usage of the platform by participants.

Finally, Mesosphere DC/OS acts as the foundation of the system and adds a layer of abstraction between Kubernetes and Docker and the user's underlying OS. This operating system for datacenters works specifically well with microservices and takes care of resource allocation and makes the system fault-tolerant.

In summary, Remix is an platform that is lightweight, modular, and easy to install, use, and scale, enabling everyone to make use of the powerful microservices included. The platform achieves this using a three-part structure with the microservices being the highest layer of abstraction followed by the combination of Kubernetes and Docker and completed by the Mesosphere DC/OS.

## Education on the Blockchain

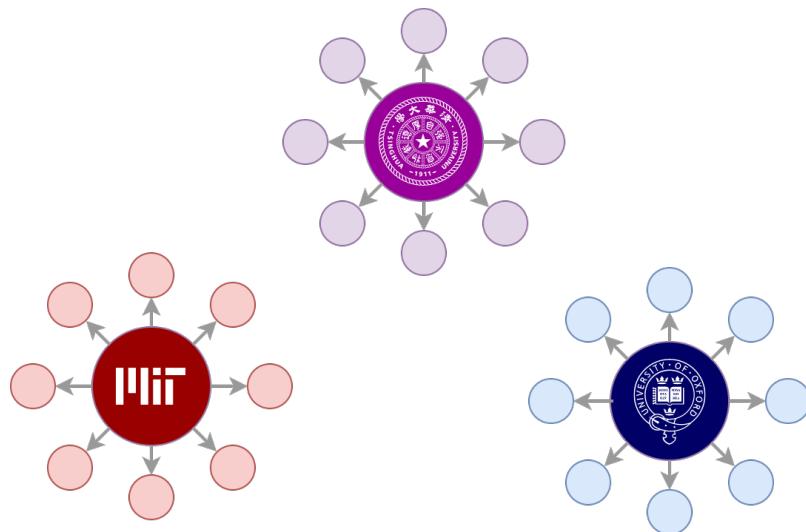
The blockchain is a decentralized technology that acts as a digital ledger for recording transactions between different entities, both human and machine. Originally devised for the digital currency Bitcoin, the blockchain is now being used for many other purposes, including in education. Below is our guide to making education fairer, deeper, and more accessible to all by using the blockchain.

“The blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value.” -  
Don & Alex Tapscott, authors Blockchain Revolution (2016)

## Historical Context

Like many phenomena, over time education has moved from a centralized cathedral model to a more decentralized bazaar model<sup>2</sup>:

### Education 1.0: Traditional Education



**Figure 6.3:** Education 1.0: Centralized monoliths

Traditional education consists of physical university campuses, and students attending classes on-site. Students do coursework, lab work, theses and exams, and these are graded by professors, usually at the end of the semester. In education 1.0, students are generally passive consumers of education, receiving information from academic staff<sup>3</sup>:

Because traditional education is based around a physical space and a limited number of professors, students are limited by number and location, and financial and academic requirements for entry can be very high<sup>4 5</sup>.

Because assessment is done by humans, fraud and bias can creep in from both students and faculty. Indeed, A large-scale study in Germany found that 75% of the university students admitted that they conducted at least one of seven types of academic misconduct (such as plagiarism or

<sup>2</sup>From Open Programming to Open Learning: The Cathedral, the Bazaar, and the Open Classroom

<sup>3</sup>Higher Education 1.0 to 3.0 and Beyond, Gilly Salmon, 27 March 2017

<sup>4</sup>How much would it really cost to write off student debt?, Jack Britton, Carl Emmerson and Laura van der Erve, 14 September 2017

<sup>5</sup>Is College Really Harder to Get Into Than It Used To Be?, Jacoba Urist, The Atlantic, 4 April 2014

falsifying data) within the previous six months.<sup>6</sup> Some examples of dishonest behavior include:

- A woman using an impostor to take a college English test<sup>7</sup>
- A Japanese medical university manipulating entrance exam scores to limit the number of women admitted<sup>8</sup>
- Thousands of UK nationals buying fake degrees from “diploma mill” in Pakistan<sup>9</sup>
- 50,000 UK university students were caught cheating in the previous three years, amounting to a so-called “plagiarism epidemic”<sup>10</sup>

## Summary

In Education 1.0:

- A student browses universities within physical proximity and signs up for a course, typically for several years
- The student physically goes to classroom and sits in front of professor
- The student writes thesis and sits exam
- The professor grades the thesis and exam
- The professor awards a grade to the student

## Education 2.0: MOOCs

Education 2.0 moved education online, with Massive Open Online Courses, offered by sites such as Coursera, Udacity, and EdX. These courses are open to anyone around the world, and students are given regular feedback on their performance via the system.

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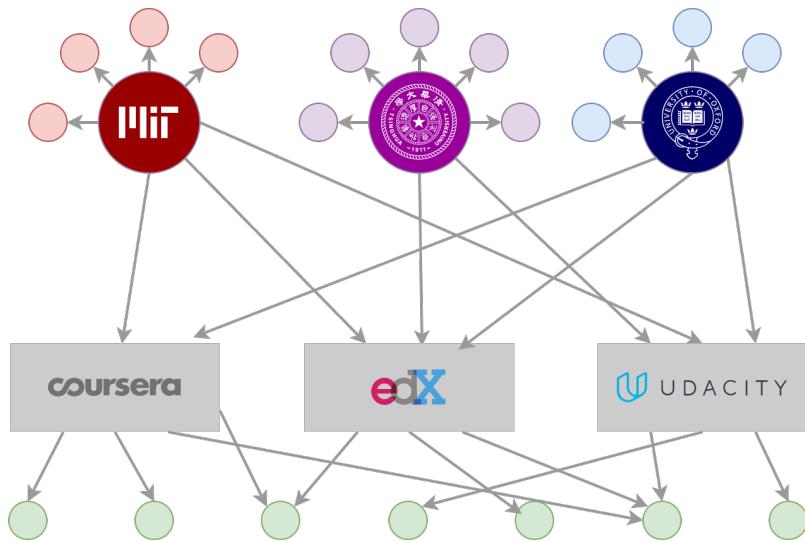
<sup>6</sup>Patrzek, J.; Sattler, S.; van Veen, F.; Grunschel, C.; Fries, S. (2014). “Investigating the effect of academic procrastination on the frequency and variety of academic misconduct: a panel study”. *Studies in Higher Education*: 1–16.

<sup>7</sup>Chinese woman admits using impostor to take US college English test, amid crackdown on fraud by foreign students, South China Morning Post, 3 April 2018

<sup>8</sup>Japanese medical university admits to discriminating against female applicants, Science Magazine, Aug 8, 2018

<sup>9</sup>“Staggering” trade in fake degrees revealed, BBC News, 16 January 2018

<sup>10</sup>UK universities in “plagiarism epidemic” as almost 50,000 students caught cheating over last 3 years, The Independent, 4 January 2016



**Figure 6.4:** Education 2.0: Networked monoliths

Education 2.0 is the age of networked monoliths. Whereas previously universities offered courses only to their own students, now they offer courses on MOOC platforms too. However, these MOOC platforms are themselves centralized monoliths. Students may take courses on one or more MOOC platforms.

Typically students sign up for a MOOC with their existing digital credentials like a Facebook login or email address. While convenient, these are not solid proof of identity in the way that a secure digital identity (like public/private key) would be. At best, some services offer biometric identity via webcam.<sup>11</sup>

Interaction between students (if there is any at all, which is not often<sup>12</sup>) is via the MOOC's forum, and is typically centred around problem-solving and support, rather than content creation, project-based learning and digital publishing. After the course is finished students disband (again, if they ever banded together) and go their separate ways. This limits the possibility for collaboration and groupwork.

Courses are typically assessed by algorithm [citation needed], from students answering multi-choice questions or writing a program that generates a specific output. This limits many MOOCs in terms of flexibility and creativity.

## Summary

In Education 2.0:

<sup>11</sup>Verified Certificates: How does verification work?

<sup>12</sup>How widely used are MOOC forums? A first look, Jane Manning, 18 July 2013

- Student signs up for a course on Coursera, EdX or another platform offering educational courses, typically for a few weeks or months
- Student works from wherever they are in the world
- Student coursework is graded by the MOOC system and assessors working for the MOOC
- MOOC system awards grade to student

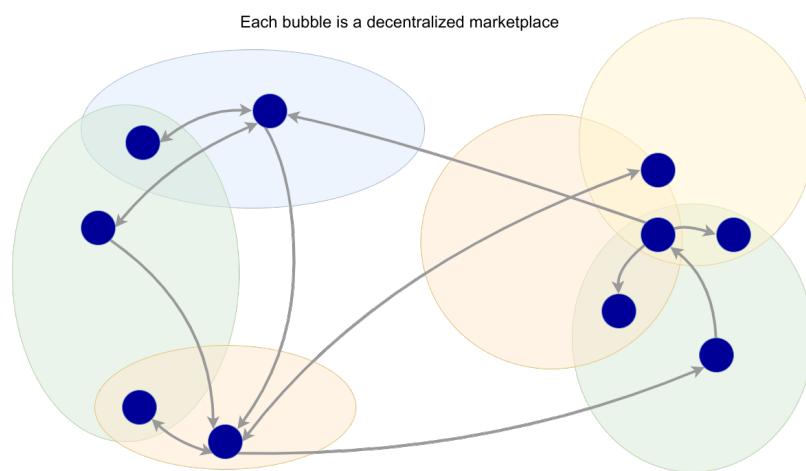
But how do we ensure the student is actually the one doing the work?

Physically decentralized but central MOOC system

### **The Future: Education 3.0: Education on the Chain**

With Education 3.0 we can modularize, granularize, democratize and decentralize education further:

- The line between educator and student gets blurred, as anyone can directly offer courses or tutoring and get paid for it
- Students can learn from anywhere in the world, from a single lesson to a series of courses
- Students and educators can monetize the materials they create, instead of them languishing on a hard disk
- Educators can spend less time grading and more time doing valuable tasks
- Qualifications can be verified and trusted



**Figure 6.5:** Education 3.0: Mass P2P learning

We do this by leveraging the power of the blockchain, specifically Ethereum.

Ethereum is a blockchain that enables anyone to create decentralized applications and smart

contracts.<sup>13</sup> A smart contract is a legal contract in the form a computer program stored that enables secure, verified transactions between two or more entities.<sup>14</sup> This program is encoded on the Ethereum blockchain, and typically takes cryptocurrency as input. Parties sign the contract using their digital identity, typically in the form of a PGP private/public key pair.

We aim to create two kinds of token to make this possible. We are still working out some details, but for now:

- A cryptocurrency called **EducationCoin**, an ERC20 token. Educators can offer courses using this token, and students can purchase courses. It can also be used to purchase student-created digital assets ( e.g. market reports, white papers) on a decentralized marketplace.
- Integrating currency too deeply into education is ethically dicey. For interactions on a student-student marketplace we may need a closed loop non-currency cryptotoken. For now let's call this **EducationToken**.

## **Choosing a Course**

The blockchain allows us to decentralize the MOOC concept further and allows decentralized marketplaces for courses, enabling content creators to offer their own curriculum, and giving users confidence with a built-in rating system. Students from anywhere in the world can browse this marketplace and elect to take a course by signing a smart contract.

Since anyone can be a course provider in education 3.0, the line between educators and students blurs considerably. Anyone can offer their materials and assistance (via one-on-one or one-to-many personalized tuition) on this platform. Participants browse the offerings, find the course that best suits them and pay via EducationCoins. They can purchase the whole course, just certain units, or specific guidance from the course creator.

Because there is less human effort required in assessments, smaller machine-graded courses can easily be offered. These “micro-qualifications” cover specific niche skills or disciplines, for example the React Javascript framework.<sup>15</sup>

## **Course Signup**

During course signup, students read through the course #constitution, which outlines their rights and responsibilities. This is both a human-readable document and embodied digitally

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<sup>13</sup>Ethereum smart contract development: build blockchain-based decentralized applications using Solidity, Mayukh Mukhopadhyay, 2018

<sup>14</sup>Attack of the 50 Foot Blockchain: Bitcoin, Blockchain, Ethereum & Smart Contracts, David Gerard, 2017

<sup>15</sup>A Review of Udacity's React Nano Degree, Bilal Tahir, 18 October 2017

in the form of a smart contract. Students sign this smart contract with their digital identity to show they have read their rights and responsibilities during the course.

## **Coursework**

Depending on the type of course, different types of coursework may be done:

### **Individual Learning**

May consist of watching videos, answering multi-choice questions, and writing code that creates a specific output. Similar to many programming courses in MOOCs. Students can offer support to each other via the platform's forum and social features, and the best forum answers get paid in EducationCoins. This incentivizes students to contribute quality answers and build community.

### **Group Learning**

More project-based. Students do coursework on digital publishing platforms like MediaWiki and WordPress, which they sign into using their digital identity, ensuring any data they create is tied to them. These services have open APIs, so their data can be extracted and stored on a blockchain (either private or the main chain) to ensure data integrity.<sup>16</sup> Courses can be gamified with cryptocurrency tokens as incentives, and an internal marketplace can be set up for students to trade skills and knowledge with EducationCoins.

### **Crowd Learning**

Any student can create a portfolio on a global student expertise exchange platform (similar in concept to Upwork) and seek out other students around the world who need their skills. This creates a marketplace for students to share knowledge and expertise, and enables large-scale crowd learning. This expertise can be “paid” for using EducationTokens, a non-currency cryptotoken.

Many students can cooperate to create a single digital asset, on which they will be jointly assessed, and they can then sell this asset (or subsections of it) on a decentralized digital asset marketplace.

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<sup>16</sup>In future, students may be able to completely switch to DApps (decentralized apps) to perform their coursework, but the apps haven't been built yet.

## Assessment

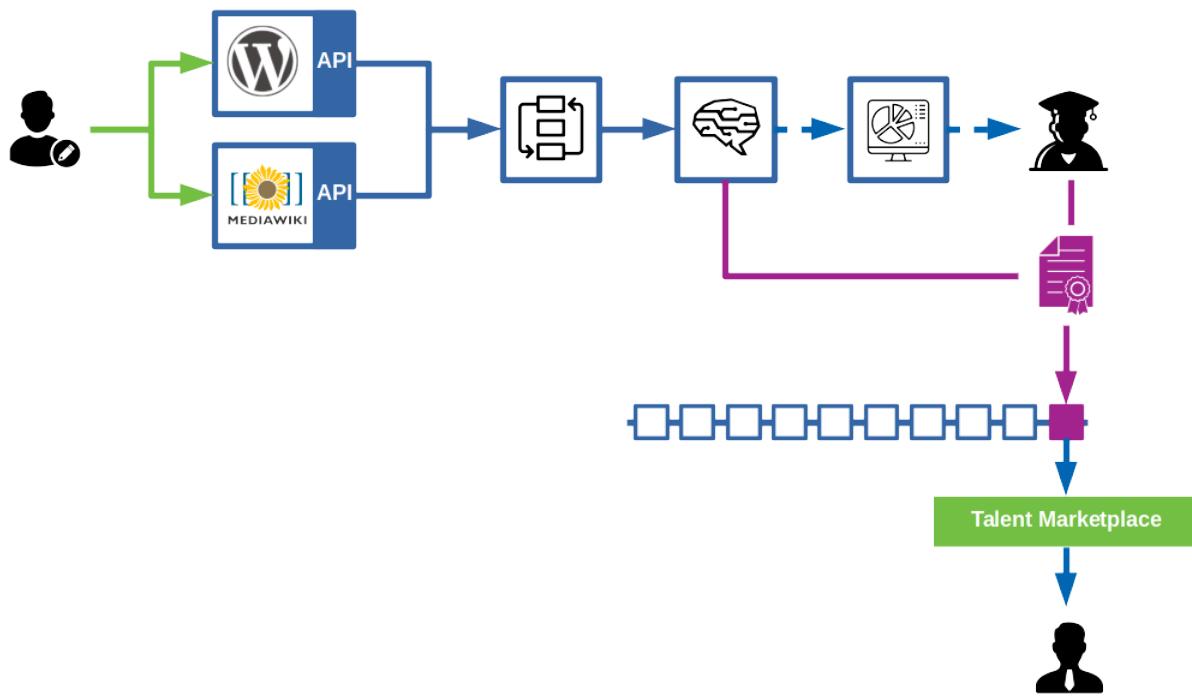
For assessment, student-created data is gathered and stored on the blockchain to prevent tampering. It is then sorted using tools like the Elastic Stack, then processed, checked for plagiarism, and assessed by machine learning (with tools like TensorFlow). It can then be aggregated, ranked, and visualized for professors to perform their own assessments if required.

Students can be awarded EducationCoins for quality work.

## Grading and Qualification

As part of the assessment, a student's qualification will be signed by the institution (for example, Tsinghua University) and stored securely on the main blockchain, allowing access by employers, institutions and anyone else to whom the student grants access via app or other means.

By tying every step of the course to a student's verifiable digital identity and assessing by machine instead of humans, we greatly reduce fraud, bias, and human error in the system, and can scale education to deal with thousands of learners. Qualifications can be verified and trusted by students, universities, and employers.



**Figure 6.6:** Assessing and grading students

Access to these qualifications can be encoded as a QR code which could be embedded in a

badge via the OpenBadge standard (similar to Scout badges, but digital). A set of skills can form a portfolio accessible via the web or dedicated app. As we transition to a model of lifelong learning, we can foresee people earning these badges throughout their life, and perhaps professional or job-hunting networks (like LinkedIn or Monster.com) may one day have a function to search by badge to find the best candidates.<sup>17</sup>



**Figure 6.7:** Example digital badges

## Monetizing Coursework

In Education 1.0, students' output was left to languish in filing cabinets or hard disks. In Education 2.0, it's stored on a hard disk or in the cloud. Even for professors, they have to pay publishers like Elsevier to publish their content.<sup>18</sup> In Education 3.0, we aim to flip that model and let anyone publish and monetize their academic content.

Coursework performed by students (for example, white papers, essays, industry analysis reports) can be exported and stored on the blockchain via IPFS<sup>19</sup> then offered to buyers or licensees via a decentralized content marketplace (like Steemit.)

[diagram]

1. Create and export content
2. Upload content to IPFS
3. Choose license
4. Set fees

<sup>17</sup>These badges could potentially be regarded as non-fungible, non-tradable tokens themselves - similar to what Oxcert are doing.

<sup>18</sup>Elsevier website, 23 Aug 2018

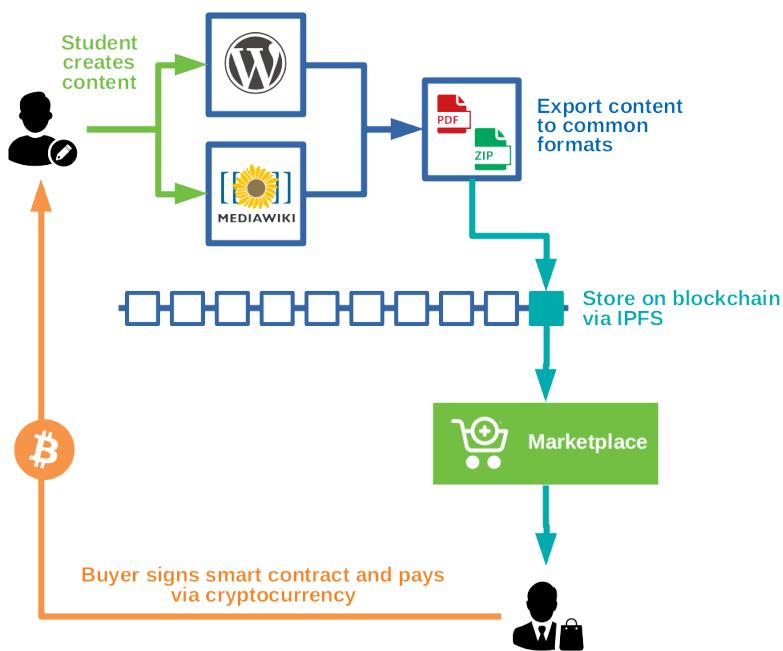
<sup>19</sup>Interplanetary File System

## 5. Publish

Buyers sign a smart contract outlining their rights to use the content (for example, they may be free to re-use the content but not to edit it), and payment is made to the student(s) via cryptocurrency. Since the marketplace is decentralized, there is no middleman to take a cut and creators receive payment in full. In addition, these student-created digital assets can be broken down into their constituent parts, so if a buyer only wants a specific diagram and not the whole text they can just license that.

[diagram]

1. Browse content based on keyword or publication number
2. Choose how you want to use content (use full content, use partial content, pay per use, pay per impression, flat-rate fee)
3. Sign smart contract
4. Pay content creator
5. Download content



**Figure 6.8:** Monetizing students' digital assets

In group-created works, a record of who created what can be kept on the blockchain, so payment can be shared equitably between creators.

## Marketplaces

We have discussed four different marketplaces above:

### **Education Market**

Creators provide courses, resources, tutoring, and expertise for learners. Learners can create coursework using built-in digital publishing tools, and this can be assessed (at least partially) by algorithm.

- Example products: Astronomy 101; Psychology 305;
- Target customers: Students, learners
- Target providers: Educators

### **Digital Asset Market**

A marketplace for white papers, market reports, theses, academic papers, etc. Like a decentralized Elsevier.

- Example products: White paper on social media trends in China; photographs, data, and maps of soil erosion around London
- Target customers: Business, academia
- Target providers: Students, professors, educators

Traditional competitors would be journal companies like Elsevier, who charge both for publishing and for access

### **Talent Market**

Learners can post their profiles and qualifications here for recruiters to see

- Example “products”: Student with 4-year degree in computer science; Student with nano-degree in writing smart contracts
- Target customers: Recruiters
- Target providers: Qualified learners

### **Learner Market**

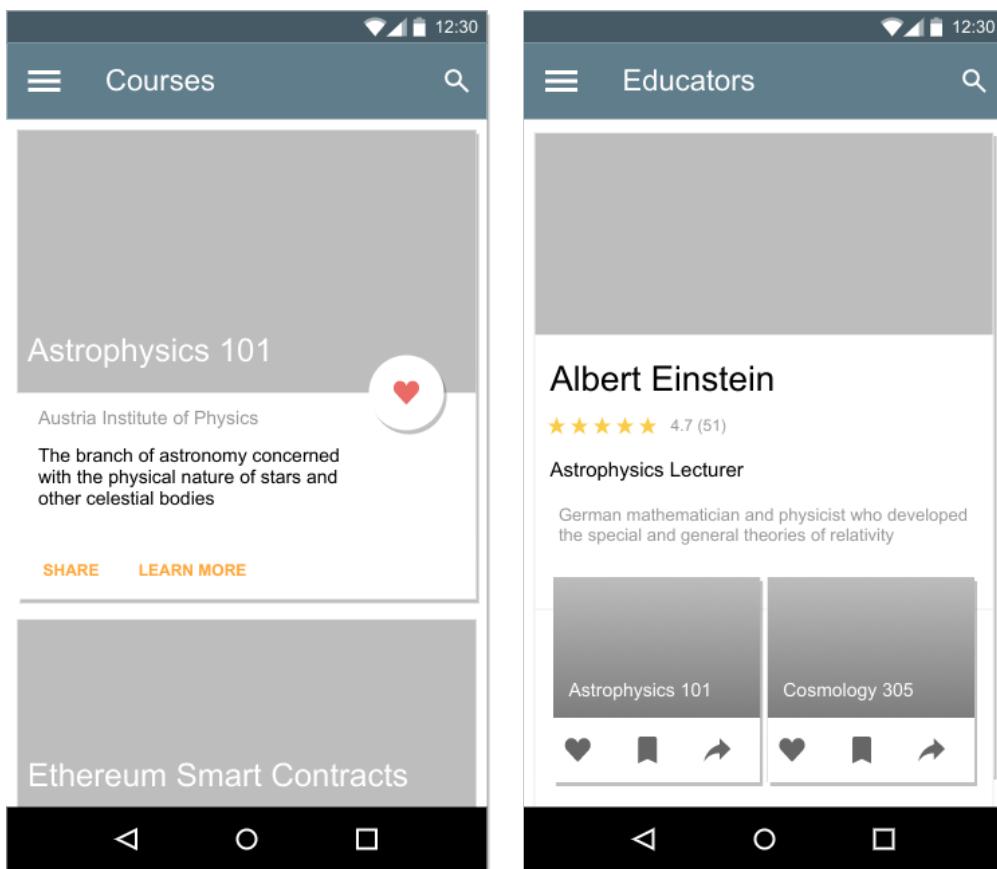
An internal marketplace for learners to trade expertise, knowledge, and assistance. However, since the line between creators and learners is blurred, do we need this?

- Target customers: Learners
- Target providers: Learners, creators

## User Experience

### The EducationCoin App

Initially, the EducationCoin app will focus on providing a high-quality marketplace experience for learners (i.e. consumers, not creators), including:



**Figure 6.9:** App mockups

- Sign up for account
- Purchase EducationCoins
- Browse courses
- Sign up as student for a course
- Make payment for course in EducationCoins
- Taking (simpler) courses

More complex courses (which need extensive coursework and writing) are less suitable for a smartphone experience and can be performed on the EducationCoin web platform.

## The EducationCoin Web Platform

The web platform provides a more comprehensive set of services:

### **Creators can:**

- Create their courses and set prices
- Upload materials for their courses
- Send alerts to students of their courses

### **Learners can:**

- Sign up for courses
- Use hosted MediaWiki/WordPress to do more complex coursework
- Contact creators and other learners to solicit advice or cooperate together
- Set bounties for questions to be answered or expertise given

## Summary

EducationCoin and EducationToken enable:

- **Fairer distribution of wealth** to both students and educators
- **Large scale crowd-learning** through a student skill marketplace
- **Democratised access** for educators and students around the world
- **Bias-free, fraud-free assessment** of all student work
- **Exposure to recruiters** through verified qualifications and talent marketplace

	Education 1.0	Education 2.0	Education 3.0
Location	Physical university	Centralized online platform	Decentralized online platform
Cost	Thousands of dollars	Free - 100 USD(?)	Set by educator
Types of courses	In-depth, project-based	Multi-choice skill tests	In-depth, project-based, and skill tests
Methodology	Top-down	Top-down, some P2P	P2P
Who profits	Institutions	Institutions, course marketplaces	Educators, students
Possibility for fraud	High - bias, fraud, human error	Low	Very low

## Technical Analysis

### Infrastructure

Education 3.0 is primarily digital - since everything boils down to zero's and one's, automation and computation can be applied to create efficient, verifiable workflows.

### Software Stack

At present all of the software stack we have used in XLP has been traditional server-based microservices. Decentralized Apps (DApps) are still some way off when it comes to capabilities.

- Digital media creation tools like MediaWiki, WordPress, Jupyter Notebook, etc
- Tools to extract, analyse and write that data to blockchain: Logstash, Elastic Search, TensorFlow
- Tools to visualize that data for human assessment (if required): Kibana
- A front-end to tie all of this together

### Smart Contracts in Depth

We use smart contracts throughout the whole process outlined above:

- Educators putting their courses on the course marketplace
- Students electing to take courses
- Educators assigning grades to students
- Licensees buying access to student-created data

In addition, we use digital signatures to prove ownership and work on certain assets:

- Courses created by educators
- Coursework done by students
- Qualifications, signed by both student and educator

### Signing a Smart Contract

The first contract signed by students is the constitution, which outlines their rights and responsibilities. To do this they need to set up a digital identity, typically a public/private key pair using the PGP standard:

OpenPGP is the most widely used encryption standard in the world. It is based on PGP (Pretty Good Privacy) as originally developed by Phil Zimmermann. The OpenPGP protocol defines standard formats for encrypted messages, signatures, and certificates for exchanging public

keys. PGP & GPG is an easy-to read, informal tutorial for implementing electronic privacy on the cheap using the standard tools of the email privacy field - commercial PGP and non-commercial GnuPG (GPG)<sup>20</sup>

PGP uses two keys for encryption - a private key to encrypt messages, and a public key to decrypt them. Bruce Schneier writes<sup>21</sup>:

“Putting mail in the mailbox is analogous to encrypting with the public key; anyone can do it. Just open the slot and drop it in. Getting mail out of a mailbox is analogous to decrypting with the private key. Generally it’s hard; you need welding torches. However, if you have the secret (the physical key to the mailbox), it’s easy to get mail out of a mailbox.”

A file encrypted with PGP typically looks like this:

```
-----BEGIN PGP MESSAGE-----
Version: GnuPG v1.4.0 (FreeBSD)
hQIOA9o0ykGmcZmnEAf9Ed8ari4zo+6MZPLRMQ022AqbeNxuNsPKwvAeNGldFDu7
iKYvFh3TtmBfeTK0RrvtU+nsa0lb0i4PrLLHLYSBZMPau0BIKKGPcG9162mqun4T
6R/qgwN7rz06hqLqS+2knwA/U7KbjRJdwSMlyhU+wrmQI7RZFGetL7SOD2vQToUy
sT3fuZX+qnhTdz3zA9DktIyjoz7q9N/MlicJa1SVhn42LR+DL2A7ruJXnNN2hi7g
XbTFx9GaNMaDP1kbiXhm+rVByMHf4LTmteS4bavhGCbvY/dc4QKssinbgTvxzTlt
7CsdclLwvG8N+k0ZxL/EHRXEC8B7R5l0p4x9mCI7zgf/Y3yPI85ZLCq79sN4/BCZ
+Ycuz8YX14iLQD/hV2lGLwdkNzc3vQIvuBkwv6yq1zeKTVdgF/Yak6JqBnfVmH9q
8glbNZh3cpbuWk1xI4F/WDNqo8x0n0hsfiHtToICa2UvsqJWxDfhwTbb0UDiPbJ
PJ2fge0WFodASLVLolraaC6H2eR+k0lrbhYAIPsxMhGbYa13xZ0QVT0Z/KbVHBsP
h27GXlq6SMwV6I4P69zVcFGueWQ7/dTfI3P+GvGm5zduivlmA8cM3Scbb/zW3ZIO
4eSdyxL9NaE03iBR0Fv9K8sKDttYDoZtsy6GQreFZPlcjfACn72s1Q6/QJmg8x1J
SdJRAaPtzpBPCE85pK1a3qTgGuqAfDOHSYY2SgOE07Er3w0XxGgWqtpZSDLEHDY+
9MMJ0UEaha0jqrBLiyP0cKmbqZHxJz1JbE1AcHw6A8F05cwW
====zr4l
-----END PGP MESSAGE-----
```

In the context of email:

- Alice and Bob agree on a public key algorithm.
- Bob sends Alice his public key.
- Alice encrypts her message with Bob’s public key and sends it to Bob.
- Bob decrypts Alice’s message with his private key.

## Writing a Smart Contract

<sup>20</sup>PGP & GPG: Email for the Practical Paranoid, Michael W Lucas, 2006

<sup>21</sup>Applied Cryptography: Protocols, Algorithms and Source Code in C, Bruce Schneier, 2017

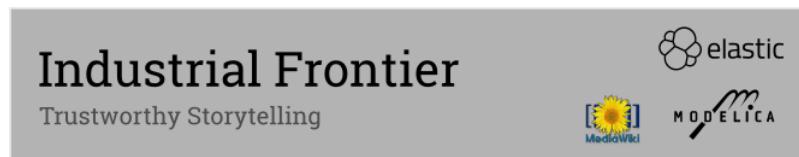
Smart Contracts are often written in the Solidity programming language, although LLL and Serpent are also available. They are then run on the Ethereum Virtual Machine, which implements a full stack Turing-complete computer on the blockchain.

## 7 XLP Philosophy

### Micro, Meso, Macro

The XLP curriculum has three tiers:

#### Macroscopic in Nature



Globally search and compile relevant information, and creatively tell a compelling story using trustworthy data sources and presentation techniques.

#### Mesoscopic in Sorting Order



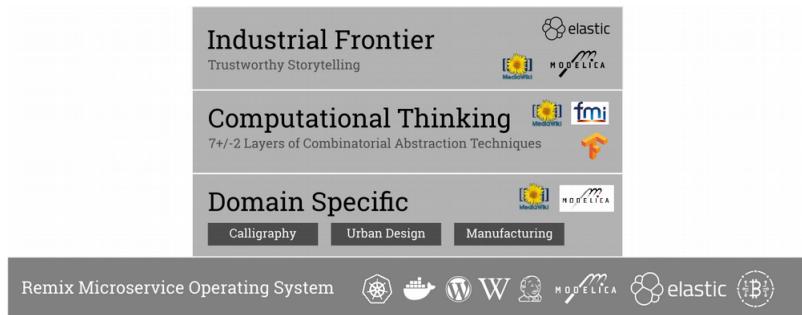
Apply optimization technologies and understand the principles of optimal limits, so that participants and teams can apply optimization to all their learning activities.

#### Microscopic in Contexts



Guide participants to be acquainted with domain-specific vocabulary and rules, so that they can leverage existing bodies of knowledge in an organized manner.

The three categories of courses are built on top of our Remix platform, which provides a foundation of industry-standard tools to help XLP participants achieve the goals of their curriculum.



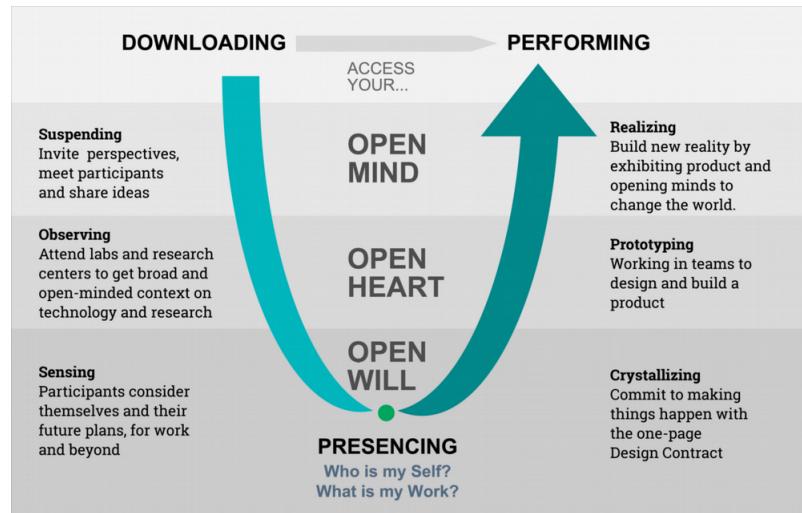
The MD's and ME's learn individually and collectively. The community of sponsors, MD's, and ME's is a microcosm of a larger context – for example, a university, a society, or a nation. XLP challenges every learning team to be a focused, goal-oriented microscopic society in a digital publishing/learning workflow environment.



## Theory U

Theory U is a change management method created by Otto Scharmer, who has worked with Tsinghua University and Xu Lili (Theory U's China Coordinator) to refine XLP. The principles of Theory U are suggested to help political leaders, civil servants, and managers break through past unproductive patterns of behavior that prevent them from empathizing with their clients' perspectives and often lock them into ineffective patterns of decision making.

Several of XLP's steps correlate with Theory U:



**Figure 7.1:** Theory U curve

By following these principles, we can achieve several beneficial outcomes:

### Early Success

Provides resources and knowledge that enables participants to kick off their learning journey with excitement.

### Fail Early, Fail Safe

Ensures participant learning assignments are challenging enough, so they can observe their shortcomings and correct their course of actions in the early stage of the mission.

### Convergence

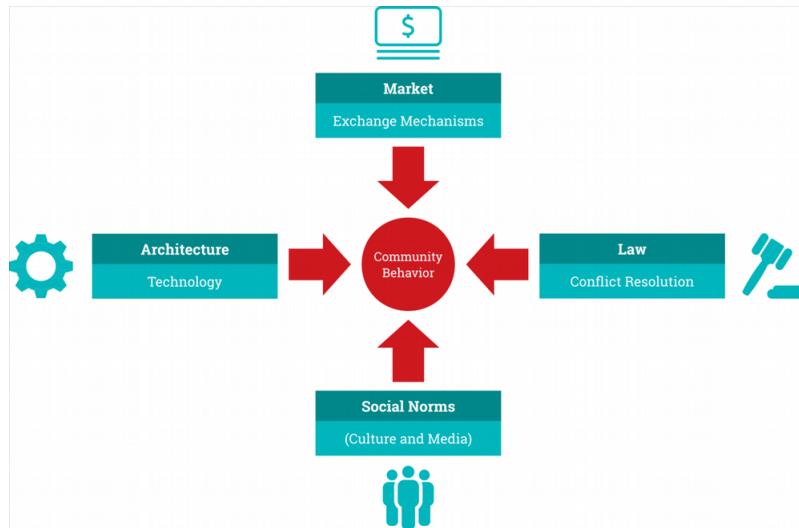
Guide participants to re-combine their team structures to create a synergistic product/service with other teams.

### Demonstration

Every learning program should end with a ceremonial event that allows participants to summarize their learning experience and present it to other people who may be future XLP participants.

## Lessig's Four Forces

Lawrence Lessig's Code Version 2.0 states that a number of forces regulate the behavior of individuals in a society or community:



**Figure 7.2:** Lawrence Lessig's Four Forces

### Law: The Rules a Community Recognizes

- Imposes constraints on the behavior of members by explicitly threatening punishment or sanctions that the community as an entity will enforce.

### Social Norms: How a Community Expects You to Behave

- Similar to the law in that norms constrain behavior of community members
- Unlike the law, community members impose social norms on each other informally
- Whereas the law, and (prospective) punishment for breaking the law, is explicit, social norms are understood by all, or most, of the community without being explicitly stated or mandated.

### Market: How Much Do You Pay?

- Enables buyers and sellers of goods, services, information, labor, and capital to exchange.

- The market forces of supply and demand determine the equilibrium level of prices in each respect market.
- Implicitly regulates behaviour of community members, for prices can fluctuate rapidly dependent on consistency and reputation.

### **Architecture: The Way the World Is**

"The way the world is, or the ways specific aspects of it are."

- The way a product (not a service) has been designed, created, manufactured, or built.
- Regulates community members by imposing physical or technical/technological constraints.
- Special due to "agency" - does not require direct human intervention to operate (whereas other forces require police force, community members, merchants, etc), so it is "self-executing."

While each of these regulating forces is separate and distinct, all four influence each other as they regulate the behavior of community members.

### **Example: Smoking**

In Code version 2.0, Lessig uses the regulation of smoking to illustrate the operation and interdependence of these four forces. If you want to smoke, Lessig asks, what constraints do you face?

#### **Law**

Federal, state, and local laws regulate:

- Minimum age and ID requirements
- Where you are permitted to smoke
- Tax on the purchase of cigarettes (aiming to reduce smoking incidence)

#### **Social Norms**

Social norms can constrain behavior even more than laws:

- Smoking in the house of a non-smoking friend
- Smoking near children in restaurants

## Market

- The higher the price of cigarettes, the more financially constrained you are by smoking
- Higher insurance premiums for smokers reduces the desire to smoke

## Architecture

The way cigarettes are designed and manufactured.:

- Filterless cigarettes are more dangerous, so more pressure to reduce smoking. Ultralights may tempt you to smoke more (thus costing more in terms of money and social norms)

## How do the Four Forces Interact?

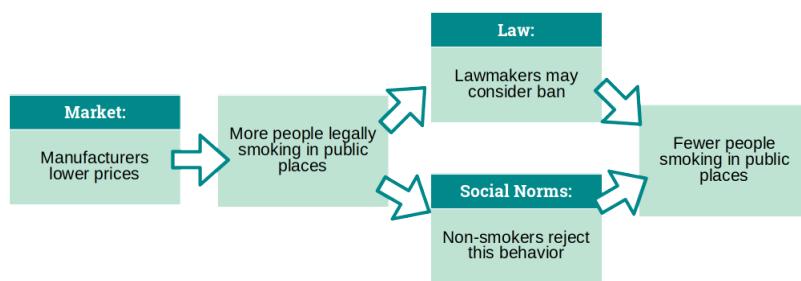
The four forces are interdependent; they interact, and influence each other as they regulate the behavior of individuals in the community. A change in one may influence another. Using the example of smoking:

### Social norms → Market



**Figure 7.3:** How social norms affect the market for cigarettes

### Market → Law/Social norms



**Figure 7.4:** How the market and laws affect social norms around cigarettes

## How do the Four Forces Relate to XLP?

Since XLP is a methodology for crowd-learning, these four forces also (by definition) regulate the behavior of individuals in each micro-learning community, and ultimately increasingly large macro learning communities.

### Law

The law is constituted by XLP's digital recording infrastructure (legal evidence collection mechanism), which allows the filing of complaints, patent filing, and law enforcement.

### Social Norms

One of the most important forces shaping social norms in XLP is the idea that all learning outcomes must be demonstrable. One of the most important end products is publishing the crowd-learning results online using a digital publishing system.

### Market

XLP's transaction validation system records and validates transactions executed in the crowd-learning environment.

### Architecture

XLP's technology architecture is one of the most important forces that regulate the behavior of individuals in our crowd-learning environment. Architecture is the only one of the four forces that, once created or enabled, does not require direct human intervention to operate. It functions alone and directly; that is, it is "self-executing."

The architecture in XLP's crowd-learning environment is the Remix Platform, a combination of hardware and software. A later section in this manual will describe it in detail.

## The Four Forces, XLP, and The Real World

A noteworthy feature of XLP is how each force within a specific micro- or macro-learning community interacts with the same force in the "real world." For example, much of XLP's legal framework interacts with that of the real world: It is difficult to divorce the two, given that the real

world's legal frameworks and mechanisms have evolved over centuries, and to regulate the individuals in a community. Patents filed in the XLP crowd-learning environment may very well also be filed in the real world, for example. If XLP is internationally and legally recognised, then this process of duplication may become automatic.

Similarly, given that one of the most important end products of an XLP activity is publishing the crowd-learning results, it is natural that these results are published via a real-world means like social media, other online media, or traditional media that is accepted by social norms.

In the market, a product or service might attract investment in the XLP environment – and might attract real-world investment too. Intellectual property in XLP's environment might also be bought and sold in the real world.

Finally, XLP's architecture has its roots in the public commons of universities, and specifically physical campuses and other resources that enable the crowd-learning environment to emulate the real world to a large degree. This is an important factor in XLP enabling learning on a large and public scale.

# 8 Technical Analysis

## Containerization

Containers are the foundation of XLP, the Remix platform, and XLP's Digital Publishing Workflow:

- XLP creates replicable, containerized learning missions, which can then be deployed and scaled up anywhere in the world
- Remix provides the infrastructure to perform this digitally - i.e. Docker and Kubernetes
- participants create containerized digital assets using XLP's Digital Publishing Workflow, as a record and proof of the work they have performed in the mission.

## Docker Containers

Docker is an operating system abstraction layer, providing an abstraction boundary which manages collective boundaries and experience for its users. A Docker container '**contains**':

- An operating system (often Linux/Windows/MacOS)
- The programs you want to run on the operating system (for example, WordPress/Mediawiki)
- The application and configuration data for the program (for example, WordPress media assets, WordPress configuration details)
- The data for the program (if WordPress, a database of MySql/Mariadb)

This container and its data(volume) can be save/exported from the Docker filesystem and be loaded, for easy deployment anywhere.

Like an operating system, Docker:

- Authenticates the container via its hash
- Schedules priorities, for example what resources the container has access to
- Manages input and output, for example how many of the host machine's resources it may use.

## What do We Run in Docker?



**Figure 8.1:** Remix's Docker infrastructure

## Namespaces

Computers operate on levels of abstraction. Otherwise we would be dealing directly with ones and zero's. A common kind of abstraction is a namespace, which organizes and names objects. Some examples include:

- Memory registers: Each register has its own unique address
- Filenames: Each file on a system has its own unique path and filename combination
- URLs: Each website is reached via different URL

Containers also have their own unique namespace, namely their 256-bit hash. An example hash (shown in hexadecimal format) would be:

```
7f83b1657ff1fc53b92dc18148a1d65dfc2d4b1fa3d677284add200126d9069
```

This hash acts as a digital fingerprint, and is highly secure since there are  $256^{32}$  combinations which would take  $3 \times 10^{51}$  years to crack if using fifty supercomputers.

## Verification and Security

With filenames or URLs, you have no guarantee you'll actually get what you think you'll get. Today \*google.com\* might take you to a search engine. Tomorrow Google may get hacked and you could end up on a site that \*looks\* like Google but steals your login credentials.

Containers are different. Since Docker hashes are unique and unforgeable, we can verify a Docker container and add it to a database of other verified containers. When you're then deploying that container, you can check that hash matches the hash in our database, thus ensuring the container will run consistently. This can be thought of as similar to the police comparing fingerprints of known criminals with fingerprints at a crime scene.

## Secure Concurrent Editing

A potential barrier with generating big data simultaneously across a distributed network is the Byzantine Generals Problem<sup>5</sup>: Reliable computer systems must handle malfunctioning components that give conflicting information to different parts of the system.

In an abstract sense, this can be expressed as a group of generals camped with their troops around an enemy city. They can only communicate by messenger to agree on a common battle plan. However, one or more of them may be traitors who will try to confuse the others. So, how can we find an algorithm to ensure that the loyal generals will reach agreement?

It is shown that, using only oral messages, this problem is solvable if and only if more than two-thirds of the generals are loyal; so a single traitor can confound two loyal generals. With unforgeable written messages, the problem is solvable for any number of generals and possible traitors.

In XLP, the problem can be seen as failing to process large amounts of data at the same time. The solution is a distributed repository (like Git) allowing all participants to transparently see what content others contribute. This increases everyone's confidence in the trustworthiness of their fellow participants, thus making them more likely to contribute and share content, and that this content will be compiled into a consistent result.

XLP uses existing computing science techniques that improve the ability to process the concurrent publishing of massive amounts of distributed intellectual content. Bitcoin also ensures Byzantine fault tolerance – in other words, solves the Byzantine Generals Problem – by incorporating a distributed database that lets any participant view the entire history of transaction records. This enables the processing and compiling of massive amounts of intellectual resources on an Internet scale. Open-source version control software, like Git, Concurrent Versions System (CVS), and Apache Subversion (SVN), also enable sharing of human-contributed content – be it source code, novels, textual content, movies, or photographs – and enable the processing and compiling of data on a massive scale.

## Decentralization

By using computer-generated smart contracts stored on technologies similar to Blockchain, organizations that practice XLP can run as a decentralized autonomous organization (DAO). This means that participant performance can be assessed algorithmically and stored securely on their lifelong digital learning profile. Using Blockchain ensures XLP abides by the principles of Trustworthy Computing, giving participants, organizations, and employers faith in the quality of work.

## Tokenization

Tokenization goes hand in hand with the theory of containerization. Any kind of digital information can be seen as a data container, and every container can be broken down into smaller containers. For example, this XLP manual is a container, which contains the necessary information for executing XLP. The XLP manual container consists of sub-containers - one of them is this section.

Modern Blockchain (Distributed Ledger) technology can be used as a common representation of any type of container. A token is simply all bundled information for uniquely representing a container on a distributed ledger. This token uniquely identifies a distinct container and guarantees its authenticity. tokens can be used as a proof of authorship, as well as ownership and hence used for trading and sharing containers.

This section will present the most important history and technical concepts which enable tokenization. Then, distributed ledger technology is discussed. Lastly, the necessary architecture for the XLP-Token-System (XTS) is derived and presented.

### Distributed Ledger Technology (Blockchain)

In 2009, Satoshi Nakamoto the paper "Bitcoin: A Peer-to-Peer Electronic Cash System"<sup>1</sup>. In his work he describes a global decentralized system for exchanging tokens. The inherent tokens digitally represent a monetary value and are labeled as Bitcoins.

This system, called a Blockchain or Distributed Ledger (DL) can be created by combining available technologies and algorithms such as:

- Public-private-key cryptography

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<sup>1</sup>Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. [online] Available at: <https://bitcoin.org/bitcoin.pdf> [Accessed 7 May 2017].

- Digital signatures
- Digital timestamps
- Peer-to-peer protocols
- Cryptographic hashes
- Merkle trees

Additionally, a DL system needs a consensus algorithm for reaching agreement between the distributed participants. Such a consensus algorithm ensures that there is a global world state of values, on which the majority of participants agree. In Bitcoin, this system is called Proof-of-Work and relies on participants using their computing power for solving a randomized "riddle".

## Four Forces

XLP activities are executed in a highly technical context, which takes into account the Four Forces discussed previously. These forces require:

### Legal Mechanisms

A dispute resolution process and patent filing process.

### Market Mechanisms

Exchange of goods, services, information, and capital, and establishing prices for these through supply/demand dynamics. Technical Architecture

Sophisticated technological infrastructure that allows transdisciplinary learning across space and time.

### Social Norms

Agreed-upon standards for what constitutes acceptable behavior – covered in orientation and general university practices.

Participants need access to technology that enables the four forces to regulate behavior, and, just as importantly, must learn its use before the XLP activity.

Through their digital identity, participants must be trained to (among other things):

- File patents

- File complaints and sue other entities
- Defend their legal rights
- Buy and sell intellectual property and financial and other commodities
- Publish the products of their learning and their learning outcomes via social (or other) media

The four forces are all present to an extent in traditional modes of learning, but their respective and collective functions in crowd-learning is relatively minimal, and not systematic. A major reason is the lack of a common digital infrastructure to track market transactions, patent applications, and refutation processes; nor has social media been systematically used to identify and measure cultural norms in a classroom and how they relate to a specific learning scenario.

Therefore, XLP's activity context is highly technical, and requires big data and other sophisticated technologies and principles to collect, store, process, and analyze data.

From a technical perspective, XLP is:

- A crowd-learning distributed operating system that collects, stores, processes, and analyzes data and generates condensed and refined content with machine and human help.
- A learning ecology that combines organic entities with digital equipment and processes. XLP leverages open-source technologies, distributed version control systems, and cryptocurrencies to track learners' individual and collective contributions to the collaborative, collective learning process and learning outcomes.

Computer cycles for collecting, storing, processing, and analyzing data are clearly different from human cycles. Thus enabling many people to simultaneously revise content, for example, requires sophisticated engineering management practices and workflow management techniques, which we generally don't find in traditional educational settings. However, this technology is becoming increasingly mature and is being leveraged by XLP to become a distributed crowdlearning operating system that provides a learning context – both for individuals and for the crowd – that is very different from that of a traditional educational setting.

## 9 Glossary

- Blockchain: Digital ledger in which transactions made in bitcoin or another cryptocurrency are recorded chronologically and publicly
- Campus, Physical: The physical elements of a campus, e.g. people, buildings, land, equipment
- Campus, Virtual: Non-tangible aspects of a campus, e.g. distributed learning workflow design team, cloud services and intellectual property, etc
- CCC: See Cognitive Construction Chart
- Cognitive Construction Chart: Improved, interactive version of logic model
- Container: Operating-system-level virtualization, also known as containerization, refers to an operating system feature in which the kernel allows the existence of multiple isolated user-space instances
- Containerized Digital Asset: Content data, software data, or configuration data stored in a Docker (or other) container
- DC/OS: Open-source operating system and distributed system
- Design Contract: One page document to ensure participants are cognizant of their own actions. Covers context, inputs, activities, and outcomes.
- Digital Publishing Workflow: Cycle going from Data Input to Data Management to Data Publishing
- Distributed Autonomous Organization: Organization that is run through rules encoded as computer programs called smart contracts
- Docker: Computer program that performs operating-system-level virtualization also known as containerization
- Elasticsearch: search engine that provides a distributed, multitenant-capable full-text search engine with a web interface
- Fab Lab: small-scale workshop offering (personal) digital fabrication, typically equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything". Similar to hackerspace
- Four Forces: Lawrence Lessig's four forces that constrain our actions: the law, social norms, the market, and architecture.

- Free Software: See open source
- Git: Version control system for tracking changes in computer files and coordinating work on those files among multiple people
- Github: The most popular web-based Git repository manager.
- GitLab: Open-source, user-hostable web-based Git repository manager
- GNU/Linux: Family of free and open-source software operating systems built around the Linux kernel. Typically packaged in a form known as a Linux distribution for both desktop and server use.
- Hackerspace: A place in which people with an interest in computing or technology can gather to work on projects while sharing ideas, equipment, and knowledge. Similar to Fab Lab
- Hyperledger: Umbrella project of open source blockchains and related tools to support the collaborative development of blockchain-based distributed ledgers.
- Jenkins: Automation server that helps to automate the non-human part of the software development process, with continuous integration and facilitating technical aspects of continuous delivery.
- Jupyter Notebook: open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.
- Kiwix: Open-source offline wiki browser
- Kubernetes: Open-source container-orchestration system for automating deployment, scaling and management of containerized applications
- Ledger: Used in blockchain. A database held and updated independently by each participant (or node) in a large network
- Linux: See GNU/Linux
- Logic Model: One-page, seven item summary of project's context, goals, effects, outputs, processes
- Macroscopic: Category of XLP courses that lead participants to investigate contextual information of a system. Namely historical development trajectory of technologies, people and relevant institutions
- Makerspace: A place in which people with shared interests, especially in computing or technology, can gather to work on projects while sharing ideas, equipment, and knowledge. Similar to hackerspace or Fab Lab, but often more focus on education
- Matomo: A web analytics application
- Mediawiki: Open-source wiki software used by Wikipedia
- Mesoscopic: Category of XLP courses that focuses on combinatorial nature macroscopic opportunities and microscopic technical resources. Otherwise known as System Design

### in Computational Thinking

- Mesosphere: Mesosphere DC/OS is an enterprise grade datacenter-scale operating system, providing a single platform for running containers
- Microscopic: Category of XLP courses that focuses on technical details of particular domain (e.g. quantum physics, biology, civil construction). Some subject content that relates to highly-specialized fields
- Microservice: Software development technique that structures an application as a collection of loosely coupled services. In a microservices architecture, services are fine-grained and the protocols are lightweight
- Open Source: Software for which the original source code is made freely available and may be redistributed and modified.
- Phabricator: Suite of web-based software development collaboration tools, including the Differential code review tool, the Diffusion repository browser, the Herald change monitoring tool, the Maniphest bug tracker and the Phriction wiki.
- Piwik: A web analytics application (now renamed Matomo)
- Remix: XLP's online platform of tools for participants
- Smart Contract: A computer protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts allow the performance of credible transactions without third parties.
- Test Driven Design/Development: Software development process that relies on the repetition of a very short development cycle
- Trustworthy Computing: Broad term that refers to technologies and proposals for resolving computer security problems through hardware enhancements and associated software modifications.
- U Theory: Change management method targeting leadership as process of inner knowing and social innovation developed by Otto Scharmer
- WordPress: World's most popular open-source content management system based on PHP and MySQL
- XLP: Extreme Learning Process, a methodology that enables communities of learners to design and conduct collaborative learning activities



# 10 Appendices

## Constitution

### Preface: A New Kind of Constitution

Typically, constitutions are decomposed into the following mutually exclusive elements:<sup>1</sup>

1. Membership
2. Purpose
3. Responsibilities
4. Rights
5. How to change or dissolve the constitution

The subsequent shape of the constitution will be outlined by the specifics of the boundaries of the above elements. Take the US constitution. The above elements are set as:

1. US Citizens, and eligibility for membership of Congress
2. To delineate the national frame of government
3. Of the Congress, Vice-President and President
4. Seen in a separate document, the US Bill of Rights, and in the Amendments to the Constitution
5. Proposed by Congress and ratified by the unanimous vote of all thirteen state legislatures

For a different purpose, for instance, defining the practices of a firm, the constitution may have the following boundaries of the above elements:

1. All full and part-time employees of the firm
2. To clearly define and govern the workflow, rights and responsibilities of all members within the firm, serving as a useful reference point in the case of any disputes
3. To be punctual, treat others with respect, follow the order of command, and complete allocated work

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<sup>1</sup>Note that this list is not collectively exhaustive. The specific articles that are included within a constitution vary depending on its purpose. A constitution for a country is very different to a constitution of a firm, which is very different to a constitution of XLP.

4. Equal opportunities; rights of life, liberty and property; freedom from bullying or physical intimidation
5. A supermajority (of two-thirds of the total membership of the firm) at any meeting where 90% of total membership of the firm is physically present

The boundaries set by the XLP constitution, however, are of a different sort entirely. Let this be defined by the following boundaries:

1. Accounts: any member who holds the correct login credentials
2. To clearly articulate the rights, privileges and responsibilities of all accounts in the XLP. Useful to define the boundaries of practice, and to easily resolve any potential disputes
3. To be a fully-functional and productive member of the XLP and the Digital Publishing Workflow, rather as a Challenge Designer, Mission Executor, or both
4. Of life, liberty and property of all accounts of the XLP; equal opportunities; freedom from intimidation, bullying, or harassment of any kind
5. A supermajority of 80% of all accounts where at any gathering where at least 75% of the total membership is virtually present

Where these examples differ is in the boundaries. Although membership is explicitly defined and referred to only in one section, all five sections are in relation to an agent of some kind. The first two are in relation to human beings, the third is in relation to accounts.

An account, as defined above, is a digital entity. This digital entity can belong to a human (such as human's banking account) or a machine. What this constitution sets to clearly articulate is that the boundaries of membership lie not at the individual *human* but at the individual *account*. Since accounts can belong to both humans and machines, this constitution is unique in its kind in two distinct ways:

1. It provides rights, privileges and responsibilities to *machines*
2. It treats machines and humans on an *equal* footing

This constitution makes no claim on the relative consciousness of machines or any non-human entity, it merely permits for its possibility. By treating all accounts as homogenous and identical, it gives all accounts a unique identity that is on equal relation to all other accounts. This process also allows for complete anonymity. By proving all accounts with the same rights, there exists no agent who can decipher whether an account belongs to a human or machine at first glance. This constitution, therefore, may go some way to passing the Turing Test. There will exist no unique feature belonging to any account that makes it below or above this constitution. This constitution abides by the rule of law:

“[W]ith us no man is above the law [and] every man, whatever be his rank or condition, is subject to the ordinary law of the realm and amenable to the jurisdiction of the ordinary tribunals.” Dicey, A.V., 1982 [1885], *Introduction to the Study of the Law of the Constitution*, London: McMillan and Co.

This constitution, therefore, sets out the rights of accounts explicitly. It sets out the relations between accounts, the privileges and responsibilities of accounts with other accounts, what they owe for each other, and what they are guaranteed against each other. Whether a right of a human or machine account is irrelevant in determining the unlawfulness of an act, what is significant is that it was the jeopardy of the right in question was in relation to an account.

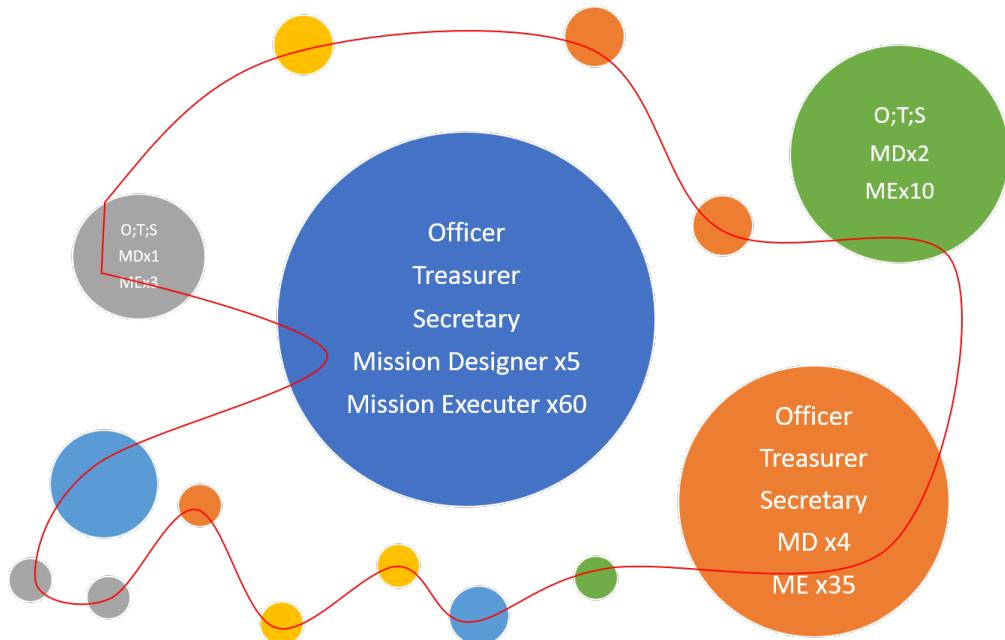
This constitution will be supplemented by a smart contract. The constitution provides the framework, whereas the smart contract handles the specifics. The constitution is the overarching set of rules, obligations, privileges and rights for the membership of accounts; the smart contract is one defined and created by the parties involved in a particular digital publishing workflow. That is, every account is to be governed by both this overarching constitution, and a smart contract which defines the specifics of one's involvement in the XLP.



**Figure 10.1:** Constitution to smart contract

This constitution sets out the relations within and between teams. Each team comprises of Challenge Designers and Mission Executers attempting to carry out their own publication within the digital publishing workflow. In addition to each member's role as a Challenge Designer or Executer, each member will have a role in the team. These roles are Officer (president), Treasurer (chancellor), Secretary (administrator) and Contributor (Team member). Between teams, there is a continuous red thread, representing the continuous communication and interconnectedness between Teams. Throughout, each team's Officer, Treasurers, and Secretaries will communicate to compare progress and ensure the smooth running of the XLP. Challenge Designers and Mission Executers, moreover, will regularly communicate for the purposes of collaboration,

comparisons of publications, and to provide help and feedback to others.



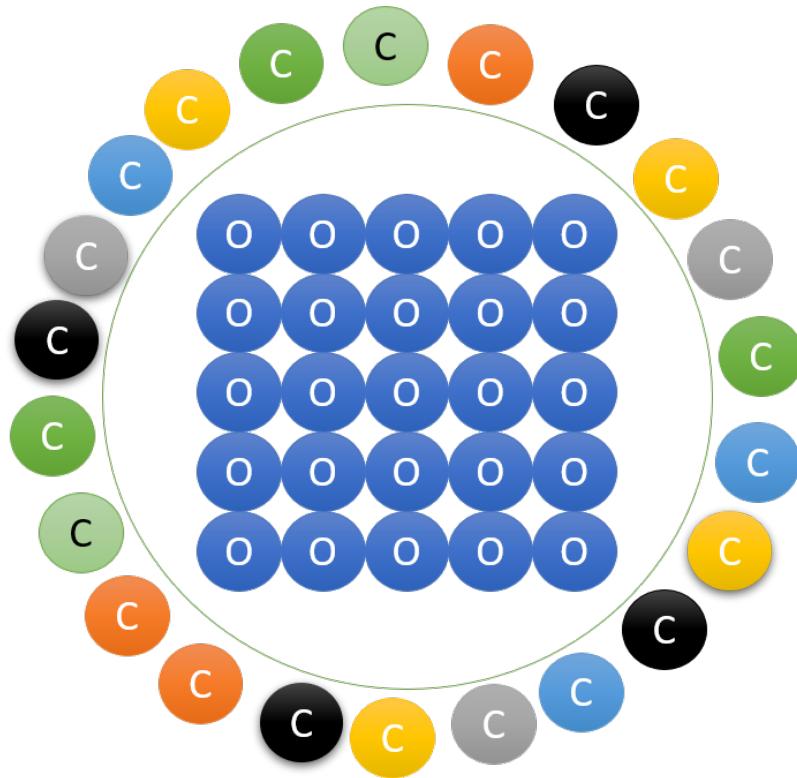
**Figure 10.2:** XLP team structure

This Constitution, moreover, is intended to be:

1. A specific constitution for the XLP
2. A meta constitution, providing a template for all societies and organisations worldwide

This constitution is worded such that any society or organisation will be able to apply this constitution to their own structure simply, by replacing a few specific words and phrases in the constitution. This constitution therefore is both specific and generic, and easily scalable.

Officer Meetings (OMs), for instance, is a characteristic specific to the XLP, but can be generalised to any organisation. There will be meetings held by Officers (Smart Contract leaders) at least once per month. They will have a quorum, a minimum attendance for the meeting to proceed. Every Officer must (virtually) attend a minimum of 10 meetings per year in order to stay in the position. This will be where all the Officers will discuss any important changes to individual teams and to the XLP as a whole, and welcome new Officers. This will also be the case where appeals can be formally discussed, debated and voted upon. This concept of a general meeting of team leaders can be applied to any organisation with small teams, the only re-wording required is the replacement of XLP with company-specific jargon.

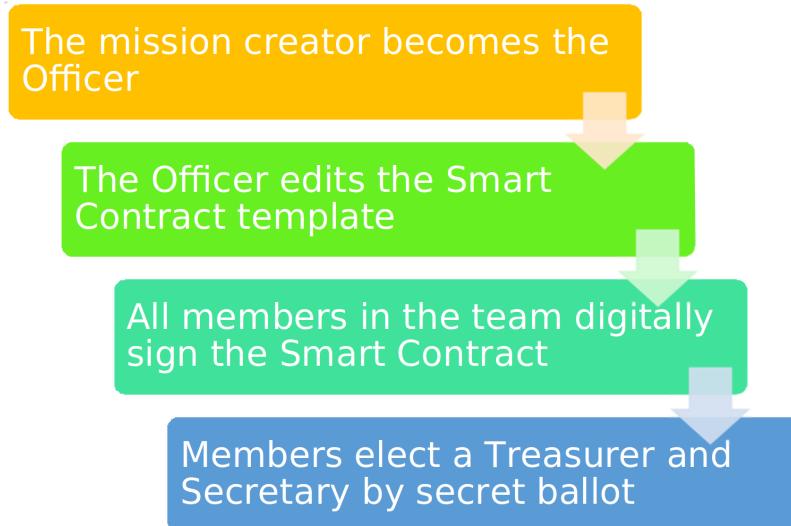


**Figure 10.3:** Officer meeting structure

The Officer of the team will be the one who creates the mission. She or he then edits the Smart Contract template which will govern the specific responsibilities of every other member in the team. Each member must digitally sign their smart contract with biometric authentication in order to become members of this team. Once signed, any member of the team may self-nominate to become Secretary or Treasury. By process of a Single Transferable Vote secret ballot across the entire team, the Treasurer and Secretary will be elected.

The constitution, therefore, is the foundation of the XLP. It is over and governed by the constitution that the Officer writes the smart contract, and it is over both the constitution and the specific smart contract that designers and executers create and complete the mission. The constitution serves to be an overarching framework governing all eventualities and processes for all members of the XLP. Should any equivocation arise or should alteration or dissolve of the constitution prove necessary, the constitution outlines the mandatory steps for resolution. The constitution is self-contained, and together with the smart contract, each member will have a complete specification of all assignments, responsibilities, rights, and much more.

Figure 3: Smart Contract Process



**Figure 10.4:** How XLP works

Figure 4: How the XLP works

### **The Constitution of The XLP**

Last Revised: 28<sup>th</sup> August 2018

#### **Article I – Objective**

The Objective of the Extreme Learning Process, henceforth XLP, is to catalyse learning processes by facilitating digital crowd-learning activities.

#### **Article II – Purpose and aims**

The XLP exists and aims to:

1. Measure and improve organisational learning
2. Implement Logic models at and within each stage of the learning process
3. Recursively adapt and improve the XLP through adjustment and review
4. Expand the boundaries of coverage to the geographical and technological frontiers of learning

### **Article III – The Constitution**

This document serves as the constitution of the XLP. This Constitution is subject for review not less than quinquennially. This constitution abides by the rule of law. All previous constitutions are hereby revoked.

### **Article IV – Smart Contracts**

1. In addition to this constitution, all team members shall be governed by a team smart contract, and all Officers shall be governed by an additional Officer smart contract
2. Using a generic template, each Officer, defined in Article VI, shall write the specifics of a smart contract, to be agreed on by consensus with the other team members
3. The purpose of the team smart contract is to operate as a decentralised permission ledger, whereby each member is given a public and private key pair in order to allow function without an intermediary
4. To be a member of the team, a member must digitally sign their team smart contract with biometric authentication
5. The Treasurer and Secretary will then be chosen by a Single Transferable Vote secret ballot of all self-nominated members
6. Blockchain technologies shall be used to codify, automate, assign, and evaluate the specific privileges and responsibilities of each member within each contract. The operation of smart contracts will therefore function as a decentralised autonomous organisation
7. Once codified and agreed upon, a team smart contract becomes autonomous, and can only be amended by a majority of the team which includes the Officer
8. The Officer smart contract shall be written collectively by all Officers and to be binding it requires majority approval
9. Votes on the Officer smart contract and its updates shall be by Officers only
10. Unless specified otherwise, all votes on the contents, amendment, dissolution or otherwise of a team smart contract shall be in proportion to a member's ownership of the mission, and all votes on the Officer smart contract shall be in proportion to the size of an Officer's team
11. Once codified and agreed upon, the Officer smart contract becomes autonomous, and can only be amended by a majority of Officers in any Officer Meeting
12. All smart contracts operate in addition to, as opposed to in replacement of, this constitution; no smart contract may infringe on any liberty or responsibility laid out in this constitution
13. This constitution shall always be consulted before any other document, and is of paramount importance

## Article V – Membership

1. Membership of the XLP belongs to any agent (virtual or physical) who possesses the correct account credentials, verifiable by biometric identification
2. Membership belongs to accounts and only accounts of the XLP. Each account shall have a unique character string in hash. This is the membership number of each account, and cannot be replicated
3. If account details are somehow stolen, any subsequent transactions immediately become null and void. A member shall give immediate public notice upon realising their account interference
4. Membership has an identical lifespan to its associated account. An account expires after 30 consecutive days without being governed by a smart contract. For Officers this expiry is after 90 consecutive days
5. Members shall have the right to terminate their membership at any time, by publicly declaring their intention so to do. Unless there is digital consent of at least three Officers, the smart contract will remain valid until its official expiry
6. Any individual can become a member of the XLP through official recognition of any XLP-partner university, or by official appointment in an Officer Meeting
7. Membership becomes official only through a digital signature below a most updated copy of this constitution

## Article VI – Roles

Every member of the XLP has two roles. Firstly, all members are either a Challenge Designer or a Mission Executer; the responsibilities for both are consistent with the overall objective of the XLP:

1. Challenge Designer: Members who design and test learning missions in accordance with the goals of sponsors, tailored for Mission Executers based on the available resources and requirements
2. Mission Executer: Members who participate in the missions designed by Challenge Designers, continuously learning to execute at a high level of complexity or speed, and guiding others to perform each mission

In addition, each member has one of the following additional roles within each team:

1. Officer: The leader and representative of the team in all communication
2. Treasurer: The operator of the team's budget and finances
3. Secretary: The organiser of the team's administration

4. Contributor: Any and all members of the team who do not belong to any of the above three categories

## **Article VII – Responsibilities**

In addition to the responsibilities laid out in the relevant Smart Contact for a member's team, each member's roles include generic responsibilities laid out in this constitution. In every instance, the responsibilities laid out in this constitution are paramount. The responsibilities are the following:

Challenge Designer:

1. To collectively design a challenge a learning opportunity that facilitates learning by replication
2. To begin by writing a logic model for the entire course
3. To follow a customised logic model for the design of the challenge specification
4. To create a mission that is challenging but rewardable for the Mission Executers
5. To provide regular updates and feedback of and to the progress of Mission Executers
6. To communicate with Challenge Designers across teams for mutual inspiration and advice
7. To follow instruction from the Officer on designing the mission
8. To transfer the challenge to Mission Executers upon completion, continuously updating the mission with fixes and feature upgrades
9. To conduct a review with Mission Executers at the end of the course, evaluating the course effectiveness and opportunities for learning development

Mission Executer:

1. To follow the mission as set out by the Challenge Designers
2. To work collaboratively with other Mission Executers to follow the mission
3. To communicate with Mission Executers across teams for mutual inspiration and advice
4. To provide feedback to Challenge Designers on the quality and effectiveness of the mission
5. To work with the aim of eventually becoming a Challenge Designer
6. To follow instruction from the Officer on best practices for completing the mission
7. To conduct a review with Challenge Designers at the end of the course, evaluating the course effectiveness and opportunities for learning development

Officer:

1. To lead the team and oversee all team work

2. To begin by editing the Smart Contract template for the team. This sets out the specific responsibilities of each team member
3. To chair fortnightly team meetings. These meetings allow all members of the team to update every other team member on their progress on either the design or execution of the mission, and allow the Officer to update the team with new news or instruction
4. To virtually attend Officer Meetings (OMs), as outlined in Article XI
5. To represent all members of the team in the case of any disputes
6. To implement and enforce the rules of the constitution and smart contract within the team
7. To provide the Secretary with administrative tasks
8. To meet with the Treasurer to be updated on the team's finances

Treasurer:

1. To oversee all spending and budget commitments by the team
2. To apply for funding to finance the spending of the team
3. To not overspend the finances given
4. To apply for loans, where necessary, whenever the budget is not balanced
5. To frequently meet with Treasurers from other teams. These Treasurer meetings are an opportunity for Treasurers to monitor the accounts of the XLP as a whole, and to evaluate individual requests for funding. Any member of the XLP is welcome to observe these meetings

Secretary:

1. To cover the team's administrative tasks as given by the Officer
2. To make formal minutes in all team meetings
3. To monitor the membership of the team, updating relevant databases on member changes and introducing new members to the team
4. To act as a bridge of communication between Challenge Designers and Mission Executers, encouraging co-operating within and across teams
5. To publicise the mission and manage the logistics of digital publications
6. To investigate and report on appeals, where necessary, as laid out in Article XII
7. To act as the returning officer in Officer elections

Contributor:

1. To follow the command as instructed by the Officer
2. To frequently communicate with the rest of the team
3. To attend all fortnightly team meetings with updates and questions

**Article VIII – Teams**

1. The purpose and existence of each team within the XLP is to design and execute a mission
2. Each mission must be consistent with the objective, purpose and aims of the XLP as stated in Articles II and III
3. Each team shall include exactly one Officer
4. Each team shall include at least five members, which includes the Officer
5. If at any time a team has fewer than five members, a new member shall be found with high priority. If there exists fewer than five members for more than ten consecutive days, the team is automatically disbanded, and the Smart Contract terminated
6. No team shall include more than 25% of the entire membership of the XLP
7. Any team member except the Officer may belong to more than one team
8. A member can only hold the title of Secretary, Treasury or Officer in one team only
9. Each mission shall begin with an Initial Coin Offering, whereby each team member shall own a part of the mission
10. Each action by each team member into the mission shall be stored using Blockchain technologies for all to see
11. All major team decisions not covered by the smart contract shall be decided by secret-ballot voting within the team. Each team member receives a vote in proportion to their owner share of the mission
12. An Officer need not own the largest share of the mission, though they must own a share weakly greater than 5%

**Article IX – Rights**

These rights apply to every member of the XLP. Additional rights may be found in each member's binding smart contracts

1. Every member has the right to life
  1. Once provided with membership, an account can only be terminated through the processes laid out in Article V, or as an extenuating circumstance in Article XI
  2. Termination of life is not in contravention of this Article only when essential and strictly appropriate force is required to prevent a member intentionally acting in a way that clearly breaches the right of another to life, liberty, or property. This will occur only in exceptional circumstances
2. Every member has the right to end their life
  3. Any member can relinquish their membership at any time as laid in in Article V
  4. Any smart contract may still govern such a member until its official expiry

3. No member shall ever be subject to physical or mental torture, or degrading treatment in any way
4. No member may own any other account except their own
  5. No member shall be held in slavery or solitude
  6. No member shall be forced to perform any action that may be considered unsafe or unlawful
  7. No member shall be expected to work unreasonable hours, or in unreasonable conditions, at any point
5. Every member has the right to liberty and security
  8. Any member found in violation of these rights at any time is subject to compensation
6. Any member who believes to be in violation of any right may make a formal complaint as laid out in Article XII. An Officer may issue a complaint on a member's behalf with prior electronic consent
  9. A member may make an appeal on the decision of their formal complaint
7. No member shall be charged with breaching this constitution if the action in question, at the time at which the act was performed, was not a part of the constitution. Nor shall a heavier punishment be imposed than one applicable at the time when the action occurred
  10. Any violation of this constitution, and appropriate punishment, shall be clearly explained to the member at the time of decision
8. Every member has the right to respect of their private life, family life, home and correspondence
  11. There shall be no interference with this right except when necessary and proportional in order to prevent direct infringement with another right in this article
9. Every member has the right to freedom of thought, belief, and religion
  12. Every member has the right to change their thought, belief, or religion at any time
  13. Every member has the right to put their beliefs into action, except where they infringe on any other right, public safety, or morality
10. Every member has the right to freedom of opinion and expression
  14. Any member may give or receive information to any other member at any time, unless when the providing of such information infringes on another right, infringes on this constitution, provides a risk to safety, or transmits the disclosure of information received in confidence
11. Every member has the right of freedom of assembly and association
  15. Every member has the right to form and be a member of a union, party, or another association or voluntary group
16. This right applies in all instances except when the association is a risk to public safety, the rights or freedoms of others, or health or morals

12. No member shall be intimidated, bullied, or made to feel weak
13. Every member shall be treated with due respect
14. Equal Opportunities
  17. There shall be no direct nor indirect discrimination on the grounds of gender, race, colour, ethnic, national or social origin, sex, sexual orientation, pregnancy, maternity, disability, religious or political belief, marital status, age, property, birth, or other status'
  18. The decision on the appointment of any new member, or the election of any new position, shall not be made, partly or fully, on any of the above characteristics. This includes, but is not limited to, discriminatively: altering the arrangements in deciding to whom to give a position, altering the terms of appointment or election, and not offering appointment or vote
  19. No member may act in a way that discriminatively reduces or increases the current or future potential direct or indirect opportunities another member has or will have access to
  20. No member may discriminate against another in a way that affords another access, or by not affording another access, by offering or not opportunities for resources or training, or for receiving or not any other faculty
  21. Any member, when making any decision, shall have due regard for exercising it in such as a way as to reduce the inequalities of outcome which result from socio-economic disadvantage or otherwise
  22. No Challenge Designer may design a mission that promotes harassment or discrimination on any grounds
  23. No Challenge Designer may discriminate against a Mission Executer in the way it provides education, in the way it affords Mission Executers access to the mission or any service, by not providing Mission Executers with education, by excluding or expelling a Mission Executer, or by subjecting Mission Executers to any other deterrent
  24. Any member who feels to have suffered discrimination on any grounds may issue a formal complaint as specified in Article XII. If it is decided that discrimination on any grounds did occur, the defendant shall be immediately expelled
  25. There shall be no harassment under any circumstances
  26. No decision of an official complaint or appeal may be based on any discriminatory factor
  27. A term of a smart contract is void and unenforceable against a person if it constitutes, promotes or provides for treatment of that or another person that is discriminatory. Where necessary and equivocal, this decision shall be made in an Officer Meeting
15. Every member and association has the right to their own property without interference
28. No property owned by any member outside of the XLP can ever be taken away

- through any activities associated with the XLP
29. Property within the XLP can be revoked only when it is necessary to remain consistent with this constitution. Any revoked property requires suitable and proportional compensation
  16. No member shall be denied the right to education

## **Article X – Officers**

1. The initial Officer of any team is the member who creates the mission
2. The initial Officer faces election eleven months after the creation of the mission
3. Every subsequent Officer election within each term will occur biennially
4. Each Officer election shall be held only within the team over which the Officer leads, and voting shall be conducted using the Single Transferable Vote secret ballot of all self-nominated members
5. There shall be a period of one month where, if a different Officer is to be elected, this newly elected Officer becomes Officer-elect, and shadows the Officer in their daily business. An official transfer of power follows.
6. There exists no term limits on an Officer
7. Any Officer may resign with immediate notice. A by-election shall follow within two weeks
8. If an incumbent Officer wishes to become Officer of another team, they must resign in their current team before they join and nominate themselves in another
9. Any Officer may be impeached through a vote of no confidence by the team. This vote may be initiated by any team member at any time and requires a 50% majority in a secret-ballot team vote for the Officer to be impeached. In the case that an Officer is impeached, a by-election shall occur within two weeks
10. If in their most recent team they were Officer, a former Officer may remain a member, but not an Officer, for 90 consecutive days. If such a former Officer finds another team or starts their own within this window, they shall continue to be a member of the XLP. If after 90 consecutive days they are without a team, their membership immediately expires

## **Article XI – Officer Meetings**

1. An Officer Meeting shall occur Monthly, on the first Thursday of each Month, and shall last for a minimum of 30 minutes
2. Each Officer must virtually attend the entire duration of a minimum of ten Officer Meetings annually

3. Officer Meetings will function like a direct democracy, where any Officer may propose debates, motions, amendments, or dissolution. All Officers can collectively vote on any issue. The majority of 50% shall always be decisive, unless specified elsewhere in this constitution
4. Any member of the XLP can observe any Officer Meeting, and may participate only in Member Questions
5. At any point during any Officer Meeting, any member can call for quorum. If there exists fewer than 75% of all Officers present, the meeting immediately terminates, and will be replaced with one the next Thursday at the same time. An inquorate meeting does not count towards an Officer's minimum attendance of at least ten Officer Meetings annually
6. In the event that quorum is not reached for three continuous Thursdays in one Month, the fourth Thursday shall have compulsory attendance for all Officers: any Officer failing to attend with adequate reasoning shall have their position immediately withdrawn
7. There exists no leader in an Officer Meeting; the meeting shall be governed collectively by all Officers present
8. The order of every Officer Meeting shall proceed as follows:
  1. Welcoming. Any new Officer shall be briefly welcomed
  2. Updates. Any Officer with significant updates, that cannot be distributed in text format at a different time, will update and discuss with the other Officers
  3. Complaints and Appeals. Any formed complaints and appeals shall be debated and voted on
  4. Miscellaneous items. Any items that do not fall into any of the above categories will be discussed, and, where necessary, voted on
  5. Member Questions. Members, selected by ballot, will have the opportunity to ask unseen questions to any or all Officers, for an immediate public response. This section shall last for no fewer than twenty minutes. Each question, including appropriate time for answers and responses, is limited to a maximum of two minutes in total

## **Article XII – Complaints**

1. Should a member have cause for complaint about the administration of their team or the XLP, the provision of services thereby, or the conduct of Officers, and register that complaint in the form of a letter to their Officer, that Officer shall constitute a tribunal to investigate the complaint with all deliberate speed
2. If the complaint is directed at the behaviour or actions of a team's Officer, then the complaint should be made known to the team's Treasurer, who shall constitute a tribunal with all expediency

3. A tribunal shall consist of ten XLP members selected by sortation. Any member selected has the right to decline if they so wish. The Tribunal shall investigate the veracity and accuracy of the complaint, and shall present a report at the next Officer Meeting. Should the tribunal uphold the complaint, the next Officer Meeting must ensure that action is taken to resolve it
4. If the Tribunal concludes that a member has breached this Constitution in any way, a vote of no confidence in that member must be held at the next Officer Meeting
5. Should either party to the complaint wish to appeal, they may have recourse to their team's Secretary, who will investigate and report on the complaint at an Officer Meeting as soon as practicable.

### **Article XIII – Extenuating Circumstances**

1. In the event that there is significant and unexpected damage or loss to a crucial part of the operations of the XLP, there shall be called an Emergency Officer Meeting at the earliest opportunity
2. At any Emergency Officer Meeting quorum is reduced to 50% of all Officers present
3. An Emergency Officer Meeting may trigger the first of two consecutive meetings to amend or dissolve the Constitution. The second consecutive vote, however, may only occur in the ordinary monthly Officer Meetings as stated in Articles XI and XIV
4. The order of business in an Emergency Officer Meeting is restricted solely to the events and implications of the extenuating circumstances about which the meeting is formed
5. As each extenuating circumstance is unique, there is no fixed order of business. However, the following must be discussed, and where necessary, voted upon:
  1. Immediate Actions. Any subsequent processes of high priority must be discussed and enacted
  2. Long Term Actions. Processes of a direct or indirect result of the circumstance shall begin to be discussed. No formal vote is necessary until the next Officer Meeting
  3. Disciplinary Actions (where appropriate). Any member intentionally contributing to the increase in likelihood of success of the extenuating circumstance shall receive appropriate penalisation
  4. Honour (where appropriate). Any member intentionally contributing to the decrease in the likelihood of success of the extenuating circumstance shall receive appropriate reward
  5. Future Precautions. Any necessary steps to eliminate the potential for another similar circumstance should be discussed and, where necessary, voted on

## Article XIV – Disciplinary Procedure

1. If any member is found to be breaching the rules in any article of this constitution or their binding smart contract, disciplinary action shall occur
2. If a resolve of any smart contract breach is written into the smart contract, then the disciplinary procedure is automatic and machine-generated
3. If a member is found to be breaching their smart contract, and if no resolve is encoded within the smart contract, the Officer shall take appropriate action. This does not affect the member's right to make a formal complaint on the Officer's decision
4. If an Officer is found to be breaching their team smart contract, and if no resolve is encoded, a vote of no confidence within the Officer's team shall be held within seven days
5. If an Officer is found to be breaching their Officer smart contract, and if no resolve is encoded, the Officer shall defend their actions at the next Officer Meeting. All other Officers shall vote on appropriate disciplinary action in a secret ballot, to have immediate effect
6. If any team member except the Officer is found to be breaching the rules of this constitution, the Officer shall suspend such a member for a minimum of seven days. A second constitution breach shall result in immediate XLP expulsion. Any breach of rights to any other member in the XLP at any point will result in immediate expulsion
7. If an Officer is found to be breaching the rules of this constitution, they must defend their case in the next Officer Meeting, whereby a secret ballot of all Officer members will decide the appropriate disciplinary action. If an Officer infringed on the rights of any other member, they face immediate expulsion, and a replacement shall be found in a team by-election

## Article XV - Amendments & Dissolution

1. Amendments to the Constitution shall be made in Officer Meetings only. An amendment can be proposed by any Officer, and all members, not only Officers, may vote on and amend an amendment. The vote shall be held by secret ballot with the Single Transferable Vote electoral system. Any amendment requires a majority vote in two consecutive Officer Meetings reaching quorum to be changed into the Constitution, and will apply immediately once the second vote has a majority in proposition
2. Members shall leave the XLP at any point as set out in Article V
3. If a situation arises where the XLP must or wishes to dissolve, it requires two majority votes of at least 80% in two consecutive Officer Meetings reaching quorum. The vote will be held by secret ballot with the Single Transferable Vote electoral system. Any member virtually present may vote on the notion to dissolve the XLP. A proposition to dissolve the XLP may be proposed by any Officer in any Officer Meeting

## How to: Use MediaWiki

You will use the wiki to group edit your report and other documents.

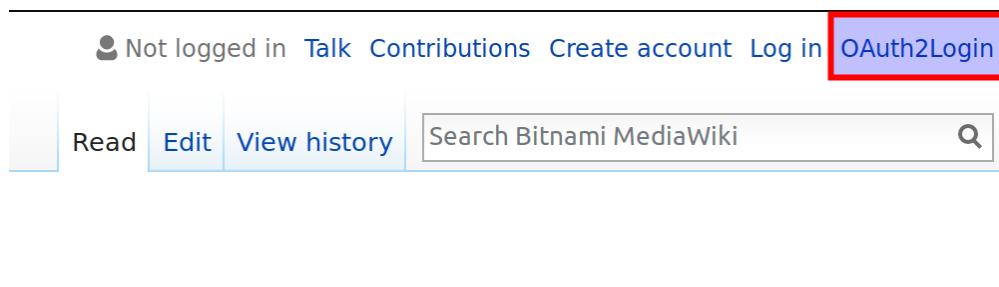
A wiki is a website on which users collaboratively modify content and structure directly from the web browser. In a typical wiki, text is written using a simplified markup language.

Wikipedia is by far the most popular wiki-based website, and is one of the most widely viewed sites of any kind in the world, having been ranked in the top ten since 2007. There are tens of thousands of other wikis in use, both public and private, including wikis functioning as knowledge management resources, notetaking tools, community websites, and intranets. The English-language Wikipedia has the largest collection of articles; as of September 2016, it had over five million articles.

We use Mediawiki, the same software that runs Wikipedia, to allow participants to collaboratively create reports and other documents.

### Log In

Click on **OAuth2Login** on the top right of your MediaWiki install. Your coordinator should have given you the address.



**Figure 10.5:** Logging in to MediaWiki

### Create a New Page

1. Go to [http://yourwebsite.com/index.php/page\\_title](http://yourwebsite.com/index.php/page_title) where *page\_title* is the name of the page you want to create.
2. Click **Create**

The screenshot shows a web browser displaying a MediaWiki page titled "Student Guide". At the top right, there is a red circle highlighting the "Create" button. Below the title, a message says "There is currently no text in this page. You can search for this page title in other pages, search the related logs, or create this page." The sidebar on the left includes links for "Main page", "Recent changes", "Random page", "Help", "Tools", and "What links here". The main content area contains a large text box with various editing tools at the top. A red box highlights the "Summary" input field, which contains the placeholder "Write your summary here!". Below the summary field, a note states: "Please note that all contributions to Remix MediaWiki may be edited, altered, or removed by other contributors. If you do not want your writing to be edited mercilessly, then do not submit it here. You are also promising us that you wrote this yourself, or copied it from a public domain or similar free resource (see [Remix MediaWiki:Copyrights](#) for details). **Do not submit copyrighted work without permission!**". At the bottom of the edit screen, there are buttons for "Save page", "Show preview", "Show changes", "Cancel", and "Editing help (opens in new window)".

## Edit a Page

You can edit any page on the wiki, including the front page:

1. Go to the page you want to edit.
2. Click **Edit** at the top of the page.
3. After making changes, write a one sentence summary in the **Summary** box, and then click **Save changes**.

## Format Text and Insert Images

Mediawiki uses wikitext to format text, create lists, insert images, and so on. Instead of a graphical editor like Microsoft Word, you use a plain text box with special wikitext codes to turn text into headers or lists, and insert images:

## Bold and Italic

```
'''Bold'''
''Italic''
```

## Headings

```
= Heading Level 1 =
= Heading Level 2 =
== Heading Level 3 ==
```

And so on...

## Lists

```
* Bullet 1
* Bullet 2
** Sub bullet
*** Sub sub bullet

# Numbered list item 1
# Numbered list item 2
## Numbered list item 2.1
### Numbered list item 2.1.1
```

## Links

External links:

```
[http://www.link.com Link Title]
```

For example:

```
[https://news.wisc.edu/curiosities-what-determines-the-colors-of-the-sky-at-sunrise-and-sunset/ Curiosities: What determines the colors of the sky at sunrise and sunset?]
```

Links on your own wiki

```
[[Page title]]
```

For example:

```
[[Digital Wallet]]
```

Renaming a link on your own wiki:

```
[[Page name | Text you want]]
```

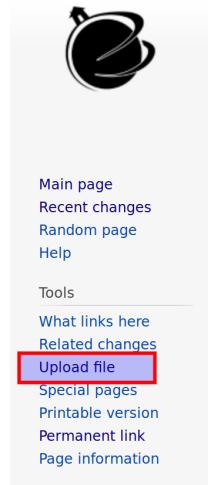
Citing a source:

```
The sky is blue<ref>Steven Ackerman, professor of meteorology at -  
UWMadison</ref>
```

You can also embed links into citations (see above for link syntax)

## Insert Images

1. Click **Upload File** on the left sidebar



2. Browse for your file and click the **Upload file** button.



3. When you're editing a page and want to insert the image, type: [[File:filename.png]]

If the image is too big, you can use

```
[[File:filename.png|500px]]
```

to make it 500 pixels wide, for example.

## How to: Use WordPress and Elementor

A blog (short for "weblog") is a discussion or informational website consisting of posts (diary-style updates, displayed newest-first) and pages (more permanent information).<sup>2</sup>

Our blogging software is WordPress: a free and open-source content management system. It is most associated with blogging, but supports other types of web content including more traditional mailing lists and forums, media galleries, and online stores. Used by more than 60 million websites, including 30.6% of the top 10 million websites as of April 2018, WordPress is the most popular website management system in the world.<sup>3</sup>. Our WordPress installation includes several plugins to make editing easier, most notably Elementor.

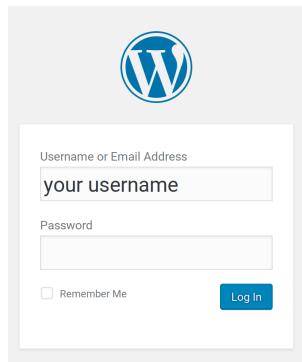
### Log In

Your coordinator should have given you a URL, username, and password for your WordPress installation. Use this to log in.

---

<sup>2</sup>Adapted from Wikipedia, July 30, 2018

<sup>3</sup>Adapted from Wikipedia, July 30, 2018

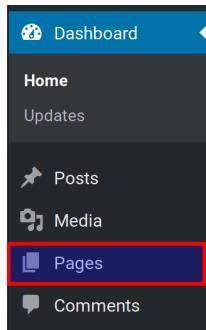


**Figure 10.6:** Logging in to WordPress

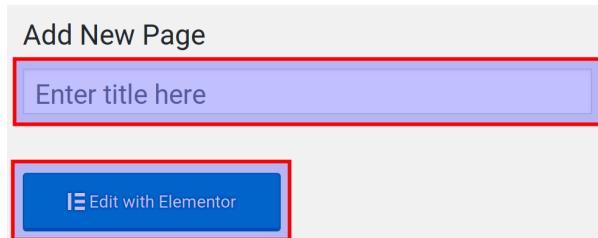
## Create a New Report Page

One from person from each group should create the report page, based on what your group wrote in MediaWiki:

1. On the left-hand sidebar, you should see a link to **Pages**. Hover over the link and click **Add New**:



2. Enter a page title, then click **Edit with Elementor** to enable a richer editing experience:



3. Click the folder icon to select a template:



4. Select one of the first two (free) templates:

5. Preview your template. If you're happy with the overall look, click **Insert**:



6. Start editing the "widgets" (i.e. components) of your template by clicking a widget and editing on the left sidebar:

**Elementor #166**

We Transform  
Your Vision  
into Creative  
Results

I am text block. Click edit button to change this text. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut elit tellus, luctus nec ullamcorper mattis, pulvinar dapibus leo.

Launch Project →

7. Insert new widgets by dragging and dropping from the left sidebar:

**Elementor #166**

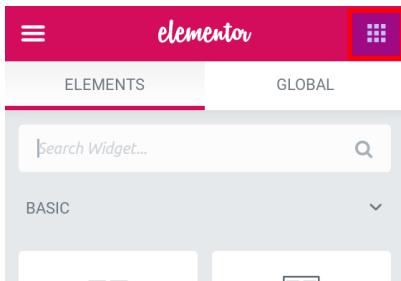
We Transform  
Your Vision  
into Creative  
Results

I am text block. Click edit button to change this text. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut elit tellus, luctus nec ullamcorper mattis, pulvinar dapibus leo.

Launch Project →

8. When you're happy with the result, click **Publish**:

If you need to go back to the widget menu, you can click the grid icon:



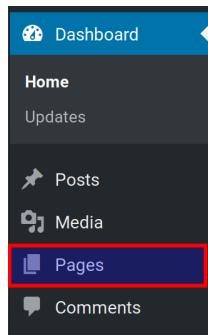
## Create a New Landing Page

All the groups should get together and nominate one person out of everyone to create a landing page. This page gives an overview of the whole experience and links to each team's report.

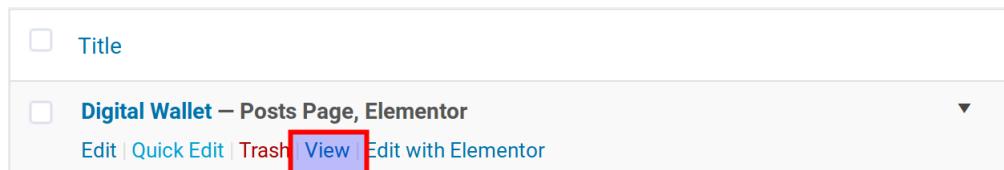
1. Follow the steps above to create a new page, but don't publish yet
2. You will need to create a link to each report page. This isn't a simple process unfortunately.

For each report you need to create a link to:

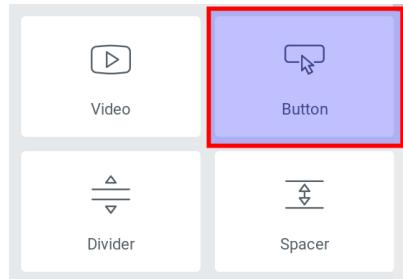
1. Hover over the **Pages** link on the left sidebar, then right-click **All Pages** and click **Open in New Tab** then switch to that tab (this means we don't lose our editing work on our landing page)



2. Hover over the report page you want to create a link to. Below the title you should see a link to *view* the page. **Right-click** this, and select **Copy Link Location** (or whatever the menu item is called in your browser):



3. Go back to the tab you are using for editing your landing page
4. Drag and drop a button into the page, and paste the address you just copied into the **Link** box:



## ▼ Button

Type

Default

Text

Click here

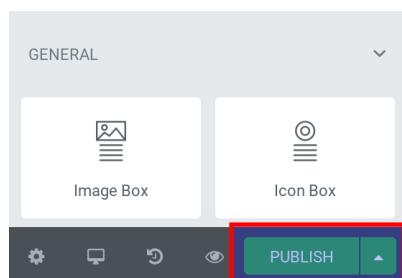
Link

[.toyhouse.cc:4445/digital-wallet/](http://.toyhouse.cc:4445/digital-wallet/)



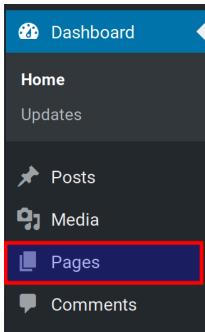
Note: If you want to create a link another way, feel free. Buttons are provided as an example

3. Repeat this process for each report you need to link to
4. Click **Publish:**

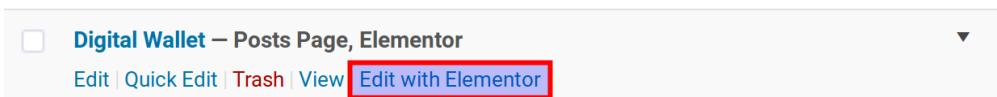


## Edit a Page

1. Hover over the **Pages** link on the left sidebar, then click **All Pages**



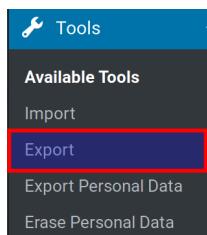
2. Hover over the page you want to edit, then click **Edit' with Elementor**



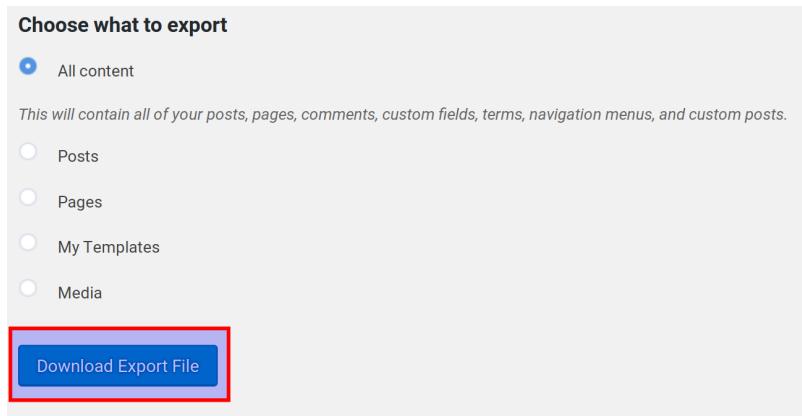
## Back Up Your Work

Remember Murphy's Law? Anything that can go wrong will go wrong. So backup your files!

On the WordPress sidebar, click **Tools** then **Export**:



Then click **Download Export File**:



In case of data loss or some other catastrophe, you can import this data into a fresh WordPress installation and get your data back.

## For Participants Coming to China

- Download and register on WeChat. WeChat is *THE* chat app for China, and everyone you meet will have it installed.
- Download and install a VPN if you want access to Google, Facebook, Twitter, Youtube, WhatsApp, Line Messenger, and lots of other online services that are blocked in China
- Install Google Translate for iPhone or Android and the offline language pack for Chinese
- Install Pleco for Chinese character recognition

As mentioned above, many overseas resources can only be reached via a VPN. While using a VPN for your research is fine, we suggest you assume your industry report, presentation anything else you create will be accessed by users without a VPN. That means:

- No embedded YouTube videos
- No hosting your work on Google Drive, Dropbox, or other online services (OneDrive works for now, but don't assume it'll always be the case)
- Disable Google Fonts in your WordPress theme (if you installed a theme yourself)

Also, wifi and network connections may be unreliable, so make sure everything will run offline when you are presenting. Assume **Murphy's Law**: "Anything that can go wrong will go wrong."

## How to: Install WordPress and MediaWiki

### You will need

- A computer running Docker
- Access to your command line
- Internet access for the initial container pull

### Optional First Step

Creating a Docker container requires first downloading the "image" that the container is based on. A Docker image isn't a picture or photograph but rather a template containing all of the files, code, settings, and libraries required to build a container. You can make as many Docker containers as you would like from one Docker image; any container is just one instance of its corresponding image.

The code in the following sections automatically download the required images, but if you have limited access to internet and would like to download all of the images before trying to set up containers, you can run the following lines in your command line.

```
docker pull tuitu/dind-wordpress  
docker pull tuitu/dind-mediawiki  
docker pull tuitu/dind-piwik
```

"**pull**" tells Docker that you want to download an image, "**tuitu**" is the name of the repository where the image is stored, and "**dind-wordpress**", "**dind-mediawiki**", and "**dind-piwik**" are the names of the images.

### MediaWiki

MediaWiki requires MariaDB database. From your command line:

```
docker run --name my_wiki -e DOCKER_DAEMON_ARGS="-D" -e PORT=4444 --  
privileged -d -p 80:4444 tuitu/dind-mediawiki
```

Docker run creates a new container. The "--name" flag sets the name of the container. The first "-e" flag sets the environment variable "DOCKER\_DAEMON\_ARGS" to "-D". The 2nd "-e" flag sets the environment variable "PORT" = 4444. The "--privileged" flag gives the container

administrative rights. The ”-d” flag is short for ”--detached”, this means that the container can run without being directly controlled by a user. The ”-p” is short for ”--publish”, which sets the port for the container and exposes the host port; the first number after the ”-p” flag -- 80 -- can be changed to any available port or it can be left as the default. The last phrase specifies which image to use for the container.

```
docker exec -it my_wiki bash /TensorCloud/DockerInDocker/
mariadb_mediawiki_4444.sh
```

Docker exec runs a command on an already started container. The ”-it” flag is a combination of ”--interactive” (allows for input) and ”--tty” (pseudo-terminal). The next phrase is where you specify which container you are dealing with. In our case, this is ”my\_wiki”. The last two phrases say to use bash (a programming language) to run a script at the specified location. This is necessary for setting up the internal containers.

## Wordpress

The steps for Wordpress and Piwik are similar to those of Mediawiki.

From your command line:

```
docker run --name my_wordpress -e DOCKER_DAEMON_ARGS="--D" -e PORT=4445
--privileged -d -p 81:4445 tuitu/dind-wordpress

docker exec -it my_wordpress bash /TensorCloud/DockerInDocker/
mariadb_wordpress_4445.sh
```

## Piwik

```
docker run --name my_piwik -e DOCKER_DAEMON_ARGS="--D" -e PORT=4446 --
privileged -d -p 82:4446 tuitu/dind-piwik

docker exec -it my_piwik bash /TensorCloud/DockerInDocker/
mariadb_piwik_4446.sh
```

And more, [http://toyhouse.cc/wiki/index.php/Get\\_Started\\_with\\_Remix#Using\\_Remix](http://toyhouse.cc/wiki/index.php/Get_Started_with_Remix#Using_Remix)

## Accessing on your local machine

In your web browser, open:

Service	What is it?	URL	Default username	Default password
Mediawiki	Wiki	127.0.0.1:81	user	bitnami1 <!--  -
WordPress	Blog	127.0.0.1:80	user	bitnami
Piwik	Analytics	127.0.0.1:82	user	bitnami <!--  -

Jenkins CI/CD Tools 127.0.0.1:87 admin 123456 OpenModelica 3D Modeling 127.0.0.1:84 N/A -->

## How to: Crowd Learn with remote participants

While individual and group learning typically take place in just one location at a time, large-scale crowd-learning involves participants from all around the world. This introduces several challenges that need to be addressed to achieve worthwhile learning outcomes. This is especially the case when dealing with China, where many online services are blocked.<sup>4</sup>

### Why Crowd Learning?

- **New Perspectives:** People from different countries and backgrounds bring new perspectives to the table
- **Clearer Documentation:** Because all communication is electronic, your group learning consciousness is stored in MediaWiki, WordPress, and other tools

### Advice

#### For Remote/Local Teams

- **Video chat by default:** so no one feels less valued or left out
- **Video team-building activities:** play into the strengths of remote work, like sharing your classroom view
- **Assume good intent:** Remember that the kinds of nuanced communication you get in a physical classroom setting don't necessarily translate online.
- **Make rules:** Establish communication rules in the constitution that includes teams and their wishes directly in the creation. When to use chats? Why to write emails? At what

<sup>4</sup>Censored: Distraction and Diversion Inside China's Great Firewall, Margaret E. Roberts, Princeton University Press

point to pick up the phone? Over time these will becomes social norms for your crowd learning group.

- **Build structure:** When having meetings or giving updates, have clear structure, process and agendas so everyone can follow along, no matter where they are. Assign a meeting lead and a note-taker to ensure key points are captured in writing.
- **Understand each others' contexts:** If Bob doesn't get an instant reply from Alice, it doesn't mean that Alice doesn't care - she may be running for a taxi in Rio!
- **Asynchronous over synchronous:** Being in different timezones makes it difficult to sync up, so plan ahead and make no decisions last minute

### For Remote Participants

Many remote participants feel the need to be "visible" in their digital workspaces to "prove" that they are working.<sup>5</sup>. With this mind, remote participants can:

- Indicate "deep work" times on their NextCloud (or other) shared calendar
- Update your status in RocketChat or other chat tool to show they're working

---

<sup>5</sup>Trello: How to Embrace Remote Work



# 11 Bibliography

## Constitution

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