Development of OSS-based Practical IT Training Courses

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株式会社三菱総合研究所

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Why we use OSS to teach IT issues?

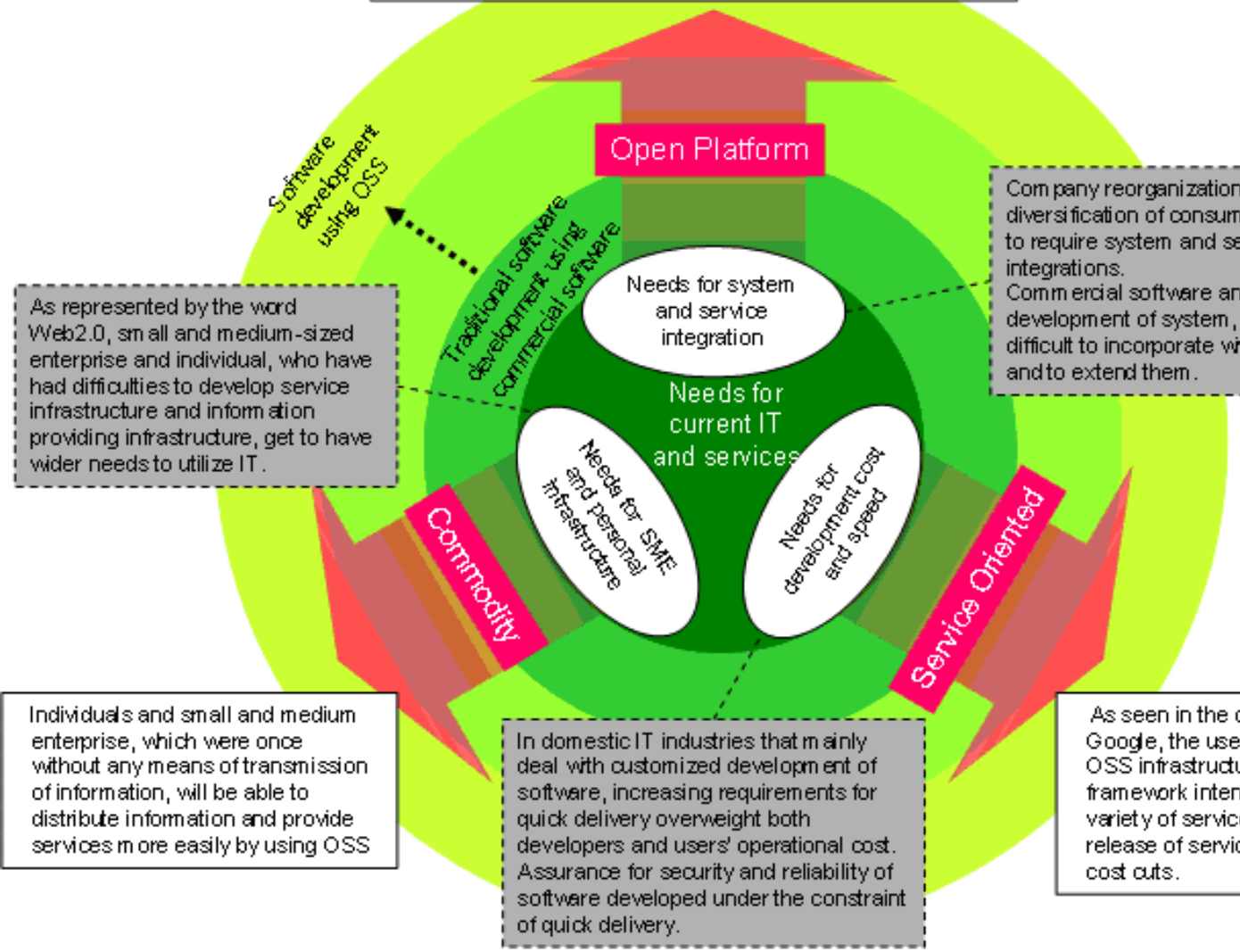
Why
Open Source Software?

… Because
that's the essence of
information technology

Introduction

Future IT directions and OSS

With increasing needs for coordination between systems and services, there are strong needs for development on an open platform where users can view specifications for subsystems and interfaces.



As represented by the word Web2.0, small and medium-sized enterprise and individual, who have had difficulties to develop service infrastructure and information providing infrastructure, get to have wider needs to utilize IT.

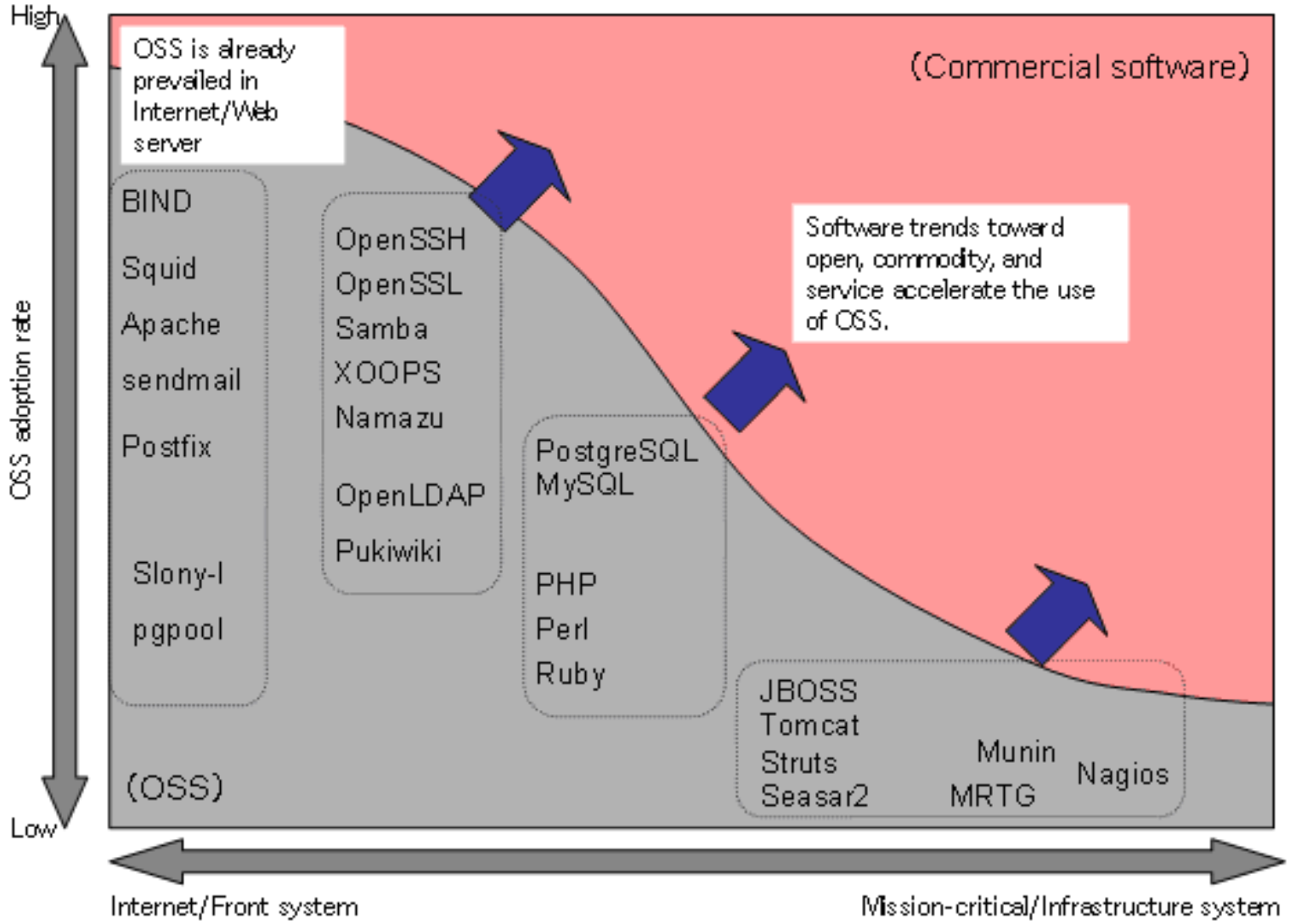
Company reorganizations and diversification of consumer needs come to require system and service integrations.
Commercial software and customized development of system, however, it is difficult to incorporate with each other and to extend them.

Individuals and small and medium enterprise, which were once without any means of transmission of information, will be able to distribute information and provide services more easily by using OSS

In domestic IT industries that mainly deal with customized development of software, increasing requirements for quick delivery overweight both developers and users' operational cost. Assurance for security and reliability of software developed under the constraint of quick delivery.

As seen in the cases of Amazon and Google, the use of Linux and other OSS infrastructures under a framework intended to offer a wider variety of services would lead to faster release of services and substantial cost cuts.

OSS adoption rate and the directions of IT systems



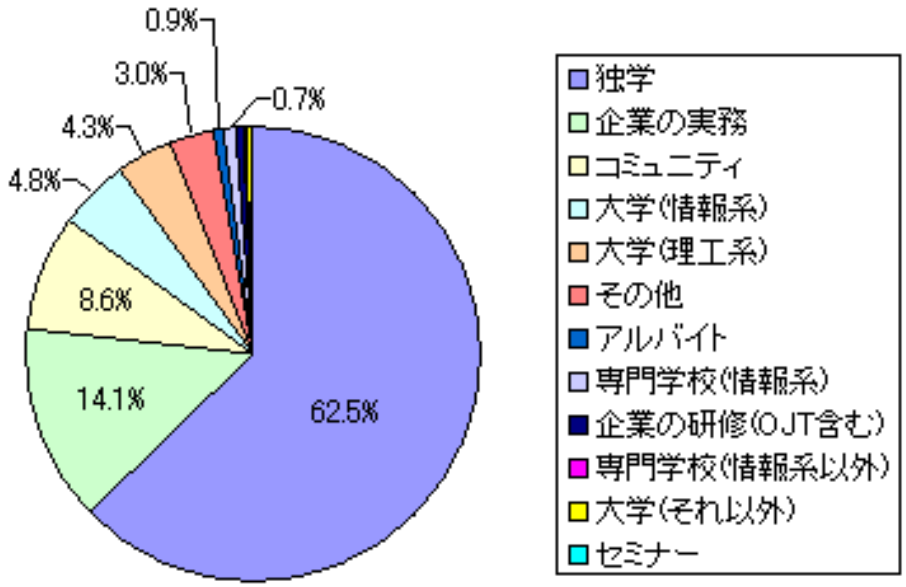
[Compiled on the basis of "The book of introducing IT system developments using OSS," (IPA OSS center, 2007, in Japanese) Figure 1-4]

Background

- Presence of OSS has been increasing in IT service and software industry
- OSS training courses are not yet familiar among higher education institutions
  - FLOSS-JP survey [MRI 03]

Methods	Ratio[%]
Self-study	62.5
At business	14.1
Communities	8.6
Univ(IT)	4.8
Univ(Sc and Eng)	4.3
Others	3.0
Part-time jobs	0.9
Tech-school(IT)	0.7
Misc.	1.1

Less than 10% of persons studied OSS knowledge at universities



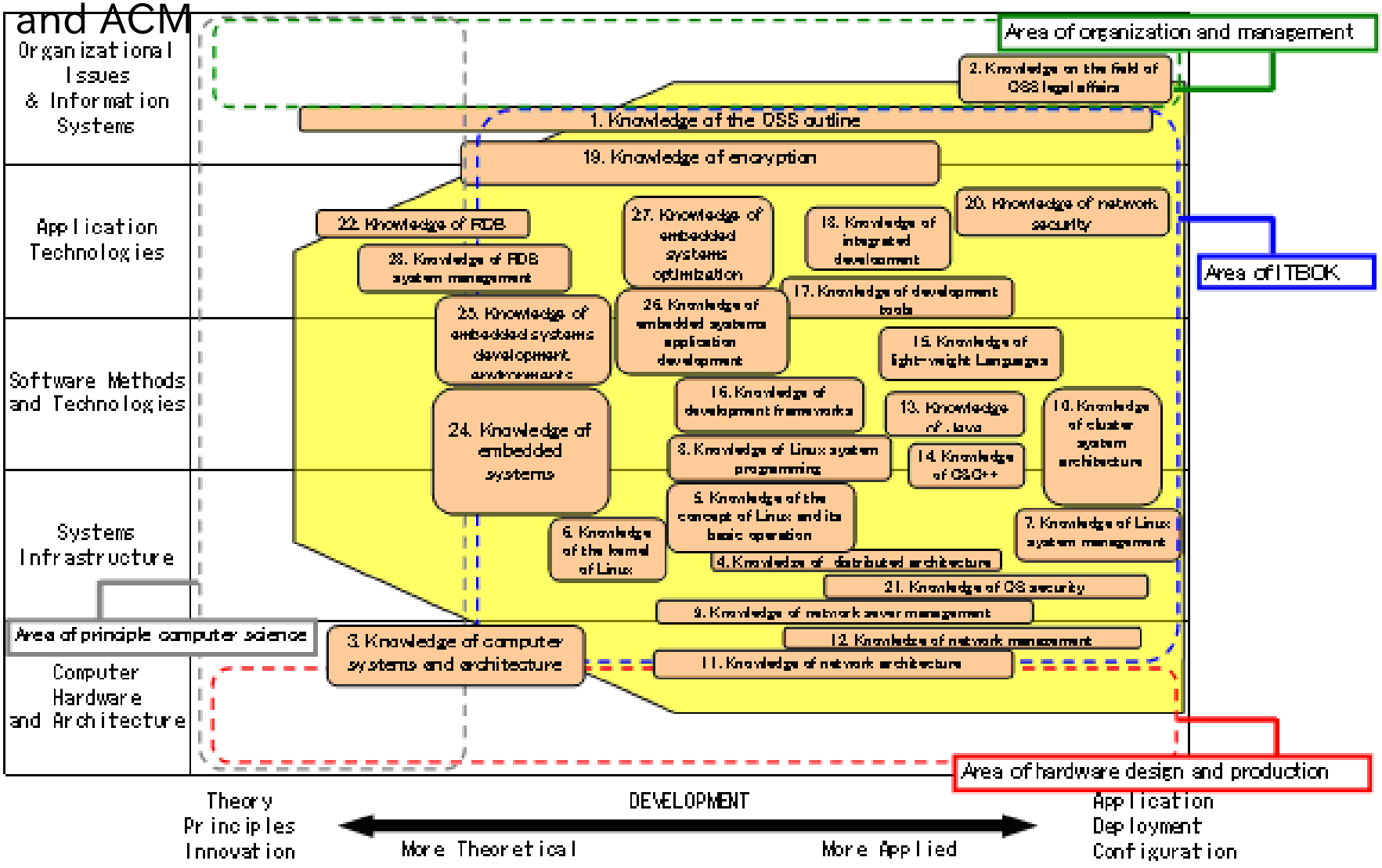
As a part of vitalization of Japanese IT industries…

- The OSS model curriculum
  - 8 categories
  - 27 courses
- C-J-K project
  - Result of the NEA-OSS promotion forum
  - Category of “Embedded” was introduced based on a strong request from south Korea

Basic	1. Knowledge of the OSS outline
	2. Knowledge on the field of OSS legal affairs
	3. Knowledge of computer systems and architecture
	4. Distributed architecture contains only applied level sessions.
System	5. Knowledge of the concept of Linux and its basic operation
	6. Knowledge of the kernel of Linux
	7. Knowledge of Linux system management
	8. Knowledge of Linux system programming
	9. Knowledge of network sever management
	10. Knowledge of cluster system architecture
Network	11. Knowledge of network architecture
	12. Knowledge of network management
Programming	13. Knowledge of Java
	14. Knowledge of C & C++
	15. Knowledge of light-weight languages
Development	16. Knowledge of development frameworks
	17. Knowledge of development tools
	18. Knowledge of integrated development environments
Security	19. Knowledge of encryption
	20. Knowledge of network security
	21. Knowledge of OS security
RDB	22. Knowledge of RDB
	23. Knowledge of RDB system management
Embedded	24. Knowledge of embedded systems
	25. Knowledge of embedded systems development environments
	26. Knowledge of embedded systems application development
	27. Knowledge of embedded systems optimization

Comparison with CC2005

- Compared with ITBOK, based on the Computing Curricula 2005 of IEEE and ACM



Learning guidance for “the OSS model curriculum”

ファイル(F) 編集(E) 表示(V) 文書(D) ツール(T) ウィンドウ(W) ヘルプ(H)

I-01.pdf

1 / 20 79.2%

スキル区分	OSS モデルカリキュラムの科目	レベル
基礎分野	I OSS の概要に関する知識 I	基本
習得ポイント	I-1-1. オープンソースソフトウェア(OSS)とは？	
対応するコースウェア	第 1 回（オープンソースの理念）	

I-1-1. オープンソースソフトウェア(OSS)とは？

オープンソースソフトウェア(OSS)という言葉の定義と OSS の概念を説明する。また、なぜ OSS が注目を浴びているのか、OSS が登場した背景や理念について説明し、さらに OSS の開発モデルやライセンスといったトピックについて紹介する。

【学習の要点】

* オープンソースソフトウェアはソースコードが公開されているため、誰でも自由に利用可能で、誰でもソースコードの解析・研究が可能である。
* OSS は、普及の中で標準化が進んでいることや、投資コストの低価格化などに期待が集まって、近年注目を浴びている。
* コミュニティが開発を進めている OSS や、企業が開発を終えたあとに OSS としてコミュニティに譲渡するものなどがあり、OSS の対象範囲は拡大しつつある。
* OSS はソフトウェア開発におけるビジネスモデルの変革を伴う。

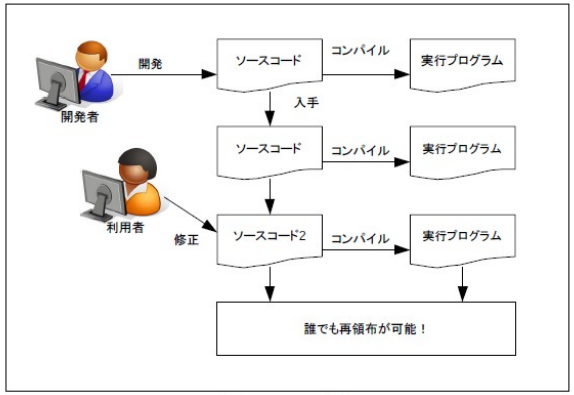


図 I-1-1. OSS の概念

1 - 1

【解説】

1) オープンソースソフトウェアとは何か

オープンソースソフトウェア（以下 OSS ）とは、「ソースコードがオープンになっているソフトウェア」のことを指すが、より正確には、OSI（Open Source Initiative）の「The Open Source Definition」によって定義づけられている。OSS のライセンス条件に関しては、以下に示すようなものが代表的なものとなる。

* ソースコードが入手可能である
  - OSS は、今まで開発元のノウハウとして非公開であったソースコードが公開されている。
  - 誰もが自由にそのソースコードを解読し、研究することができる。
  - 利用者は無償でそれらのソフトウェアを利用することができる。
* 自由な再頒布が可能である
  - OSS は自由に再頒布することが可能である。
* 派生物が作成でき、派生物にも同じライセンスを適用することが可能である
  - OSS は、ソースコードを解読して研究することで、派生物を作成することができる。
  - 派生物を他の利用者に再頒布することが可能である。
  - 再頒布した派生物にも、同じライセンスが適用されることになる。
  - さらに他の利用者に再頒布することも可能である。

2) なぜオープンソースソフトウェアが注目を浴びているのか

OSS は近年になって注目され普及し始めたのではない。Apache、bind、gcc などのプログラムは、以前から利用されていた。最近になって急激に OSS が普及してきたようなイメージがあるのは、Linux の認知と普及によるものといえる。

* コミュニティをベースとして開発が進められている OSS
  - Linux や PostgreSQL などは、コミュニティ主導で開発が行われている。
* 企業が作成したソースコードが、OSS として提供されているもの
  - MySQL や OpenOffice.org などは、企業が開発し OSS のコミュニティに譲渡された。
* このような OSS が登場することで、普及の中での標準化が進み、投資コストの低価格化にも拍車がかかり、さらなる OSS の普及が促進されてきた。

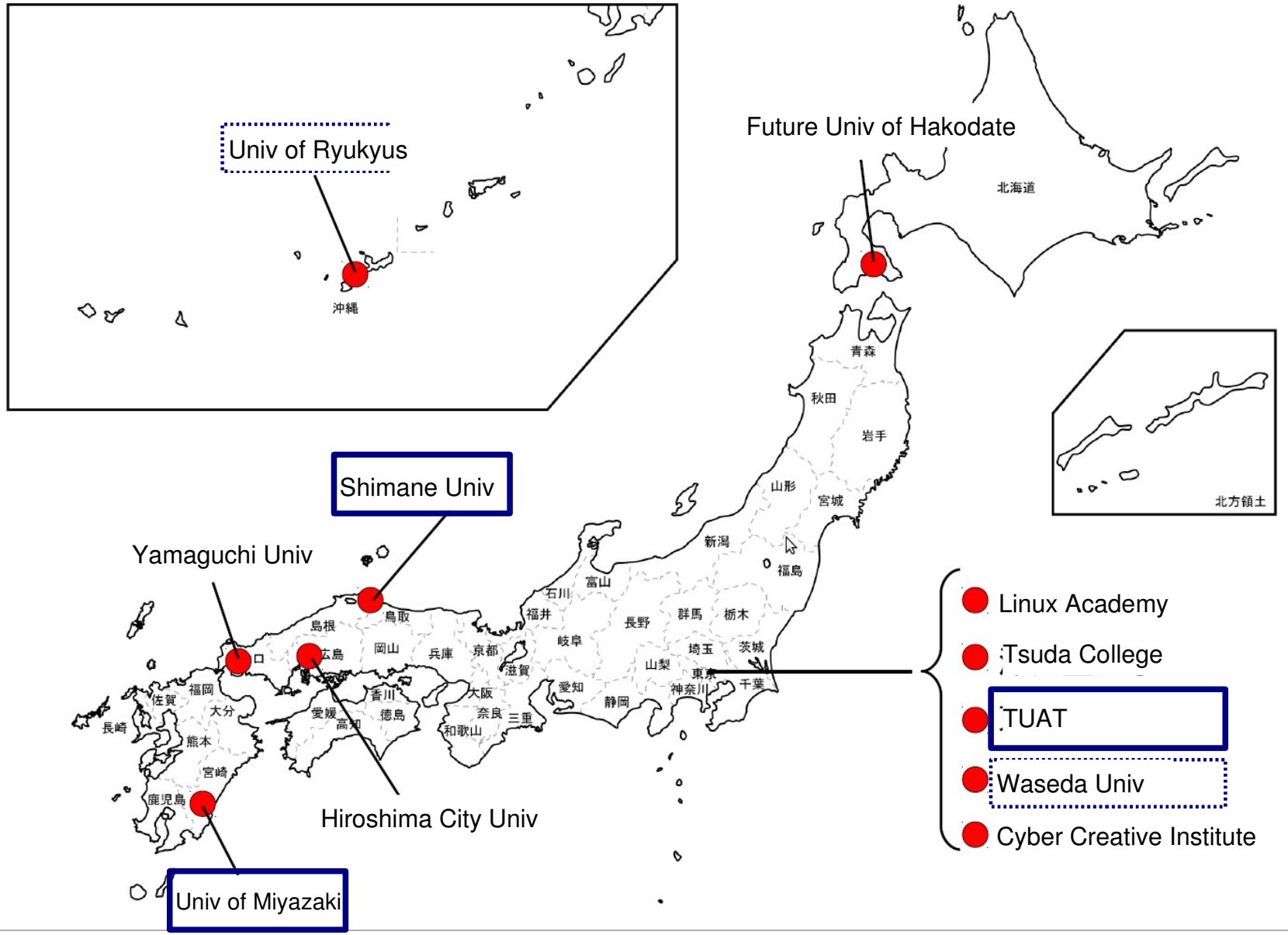
3) オープンソースソフトウェアでのビジネスモデル

OSS でビジネスを成功させようとしている企業や、すでに収益をあげている企業も存在するが、まだまだ多くの企業が手がけているとはいえない。

* SI事業者
  - 公開されているソースコードにより、問題の分析・解決を行うことが可能となる。
  - サポート分野において、他社との差別化が可能となる。
* ハードウェアベンダ
  - OSS 開発に参加することで、自社で単独開発を行うよりも大きなコスト削減となる。
  - OSS の開発に積極的に協力・利用することで、高い生産性を得られる。

1 - 2

Organizations participating in the program



Overview of the courses provided by MRI in FY2009

Course	Title	University	Content	Model curriculum
Course 1	Development framework	Shimane University	Overview of development frameworks and case studies using Rails	Development frameworks I Light weight language II
Course 2a	Computer language	Shimane University	C language, basic of programming, and math caluculation	C, C++ I
Course 2b	Information engineering II	Univ of Miyazaki	SAA	SAA
Course 3a	Electronic control system engineering	Shimane University	Usage of development tools and C language programming practices	C, C++ I, II Development tools I
Course 3b	Program development	TUAT	SAA	SAA
Course 4	Information engineering (network security)	Univ of Miyazaki	Overview of network security and practical security techniques	Network security I, II

Introducing OSS educational program

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Intensive course

OSS issues are added into existing courses

Intensive course

Intensive course

- Future plans
  - Development framework @Shimane
    ⇒ planned to be offered as a bi-yearly course together with “Ruby programming”
  - Program development @TUAT
    ⇒ planned to be included as a part of “education program of IT engineers for advanced manufactures”
  - Network security @Miyazaki ⇒ modified and marged into an existing course

Overview of the courses planned by MRI in FY2010

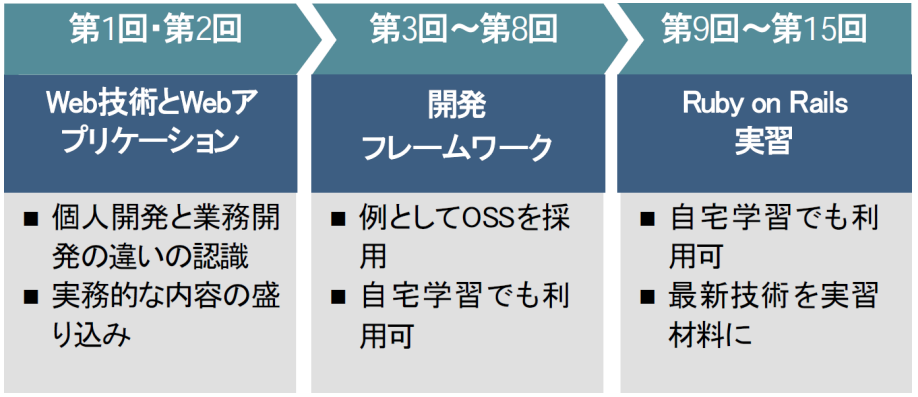
Course	Title	University	Content	Model curriculum
Course 1a	Introduction to OSS	Waseda University	What is OSS, How to use OSS, etc.	Overview of OSS I, II
Course 1b	Information engineering practices	University of Ryukyus	SAA	SAA
Course 2	Software and legal issues	Waseda University	Software licenses, intellectual properties, and legal issues	Legal issues I, II

- Feature of the courses offered this year
  - All students in the campus can participate in the lectures (Waseda Univ)
  - Courses are provided on-line from Media Network Center (MNC, Waseda)
  - Course 1b is a modified version of Course 1a, particularly targeting information engineering students

Details of each course and implementation status

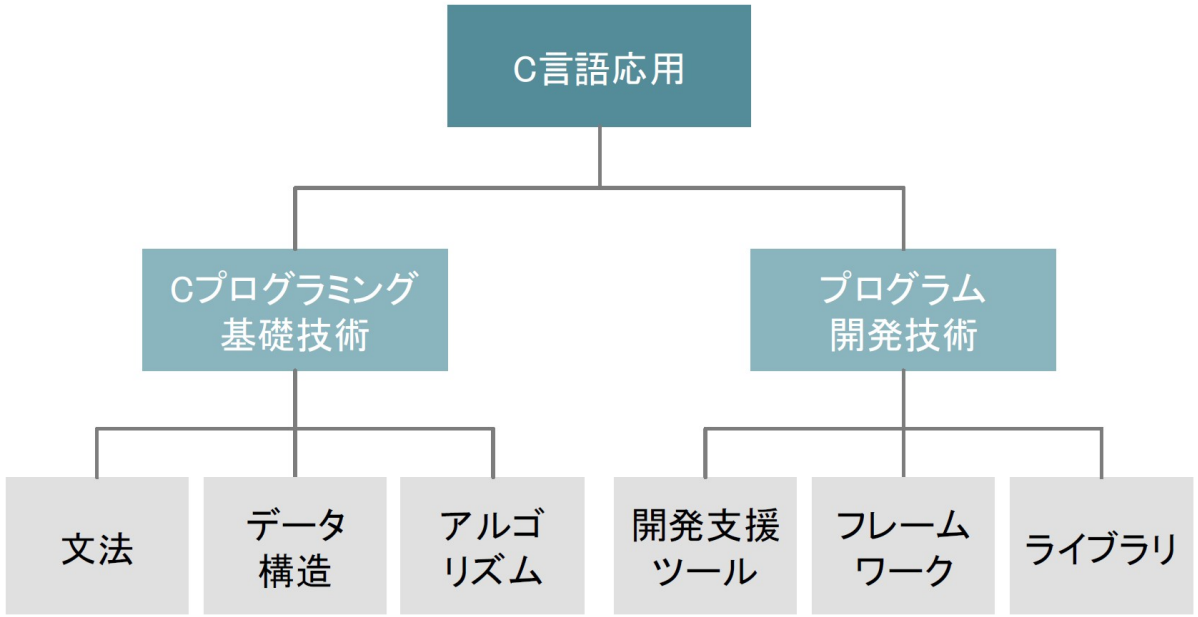
Details of “Development Framework”

- Web technologies and application
  - Emphasis on the differences between individual development and cooperative development in the real business
  - Many case studies to explain practical issues
- Development framework
  - Case studies using OSS
  - Lectures used for home study
- Ruby on Rails practices
  - Offering the-state-of-the-art technologies
  - Provided by members from NaCl



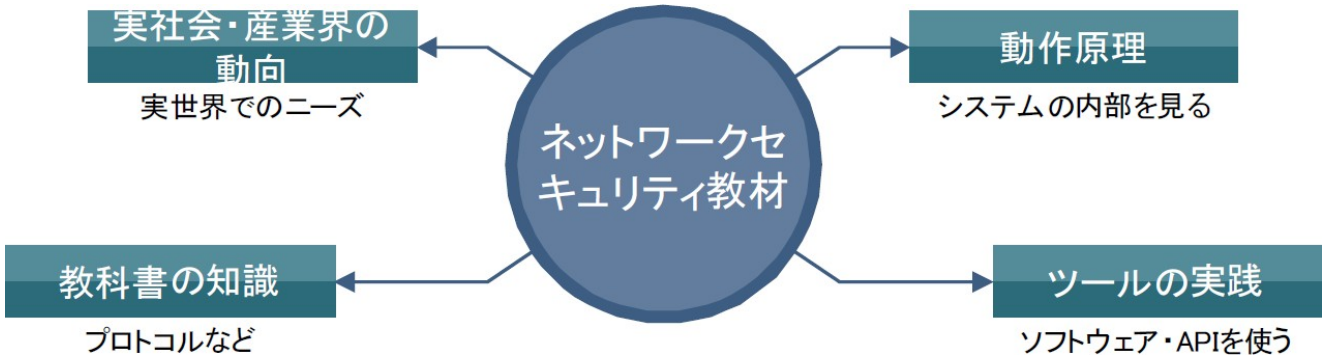
Details of “C programming”

- Combination of the basic technologies in C programming and program development
- C programming techniques
  - Grammar, data structure, and algorithm
- Program development
  - Development support tools
  - Development frameworks
  - Libraries



Details of “Network Security”

- Trends in the real society and industry
  - Needs from the real world
- Operating principle
  - Illustration of the inside of system using OSS
- Knowledge from textbooks
  - Protocols, communication methods, incidents, examples, etc.
- Practices using OSS tools
  - Software, API, etc.



Implementation status

Shimane University used
Ruby and others on Windows

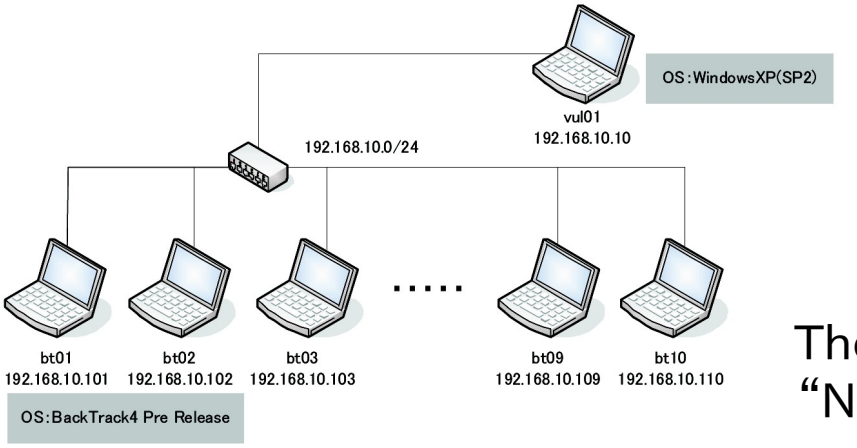
Shimane Univesity also used
WideStudio on Windows

University of Miyazaki used
Linux（Vine Linux）environment

Implementation status (cont'd)

Tokyo Univ of Agriculture and Technology used Linux（RHEL）environment

University of Miyazaki used Linux (BackTrack) environment



The LAN constructed for “Network Security” practices

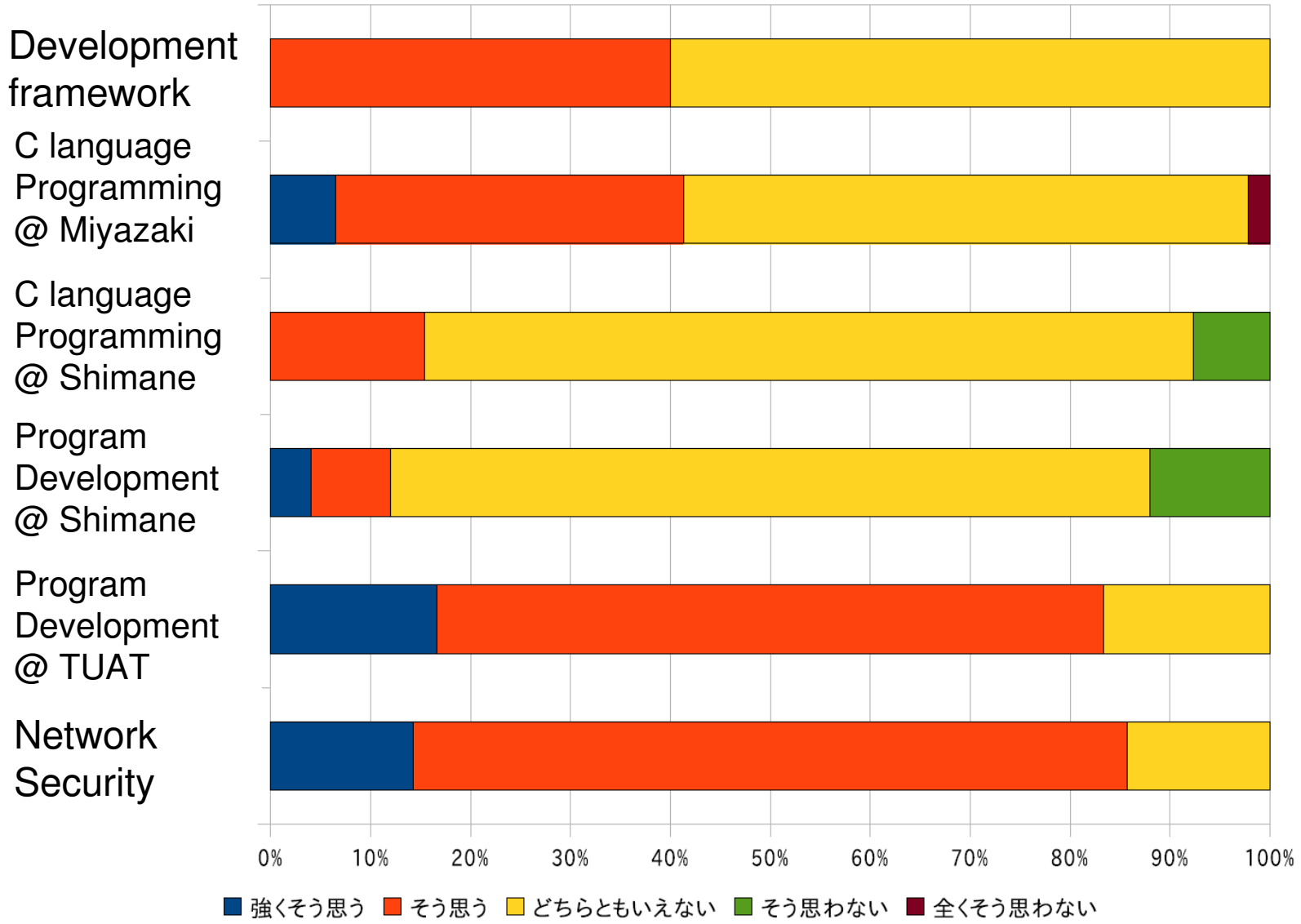
Evaluation and discussion

Results of questionnaire

- Difficulties in evaluating by academic results
  - Comparison between the case with OSS and without OSS
  - NO HUMAN TESTING
- Questions
  - Easy to understand?
  - Interesting?
  - Practical?
  - OSS helps your understanding?
- Answers
  - Options
    - Five levels: Totally agree (++) ... Totally disagree (--)
  - Free description
- Numbers of responses
  - 5, 46, 14, 25, 6, 7 (persons / each course)

科目	++	+	+/-	-	--
Q1.講義内容を理解できたか					
開発フレームワーク	60.0	40.0	0.0	0.0	0.0
C言語基礎(宮崎)	17.5	37.5	42.5	0.0	2.5
C言語基礎(島根)	21.4	64.3	14.3	0.0	0.0
プログラム開発(島根)	4.0	56.0	40.0	0.0	0.0
プログラム開発(農工大)	60.0	40.0	0.0	0.0	0.0
ネットセキュリティ	57.1	42.9	0.0	0.0	0.0
Q2.講義内容は興味深かったか					
開発フレームワーク	40.0	60.0	0.0	0.0	0.0
C言語基礎(宮崎)	21.7	30.4	43.5	2.2	2.2
C言語基礎(島根)	14.3	64.3	21.4	0.0	0.0
プログラム開発(島根)	16.0	68.0	12.0	4.0	0.0
プログラム開発(農工大)	33.3	66.7	0.0	0.0	0.0
ネットセキュリティ	85.7	14.3	0.0	0.0	0.0
Q3.講義は実践的な内容だったか					
開発フレームワーク	0.0	60.0	40.0	0.0	0.0
C言語基礎(宮崎)	15.2	32.6	47.8	2.2	2.2
C言語基礎(島根)	14.3	35.7	50.0	0.0	0.0
プログラム開発(島根)	0.0	16.0	76.0	8.0	0.0
プログラム開発(農工大)	16.7	66.7	16.7	0.0	0.0
ネットセキュリティ	14.3	57.1	28.6	0.0	0.0
Q4.OSSによって理解が進んだと感じたか					
開発フレームワーク	0.0	40.0	60.0	0.0	0.0
C言語基礎(宮崎)	6.5	34.8	56.5	0.0	2.2
C言語基礎(島根)	0.0	15.4	76.9	7.7	0.0
プログラム開発(島根)	4.0	8.0	76.0	12.0	0.0
プログラム開発(農工大)	16.7	66.7	16.7	0.0	0.0
ネットセキュリティ	14.3	71.4	14.3	0.0	0.0

How efficiently does OSS help you understand ?



Totally agree (++)

Totally disagree (--)

Advantages of OSS courses

Exercise	“Exercises helped to deepen understanding!”
Easy to try	“Good point of OSS is the capability to try casually”
Source code	“It was important to read source-code by myself and it helped me to understand the power of code”

Participants wanted more time to do exercise and become more interested in trying various things.

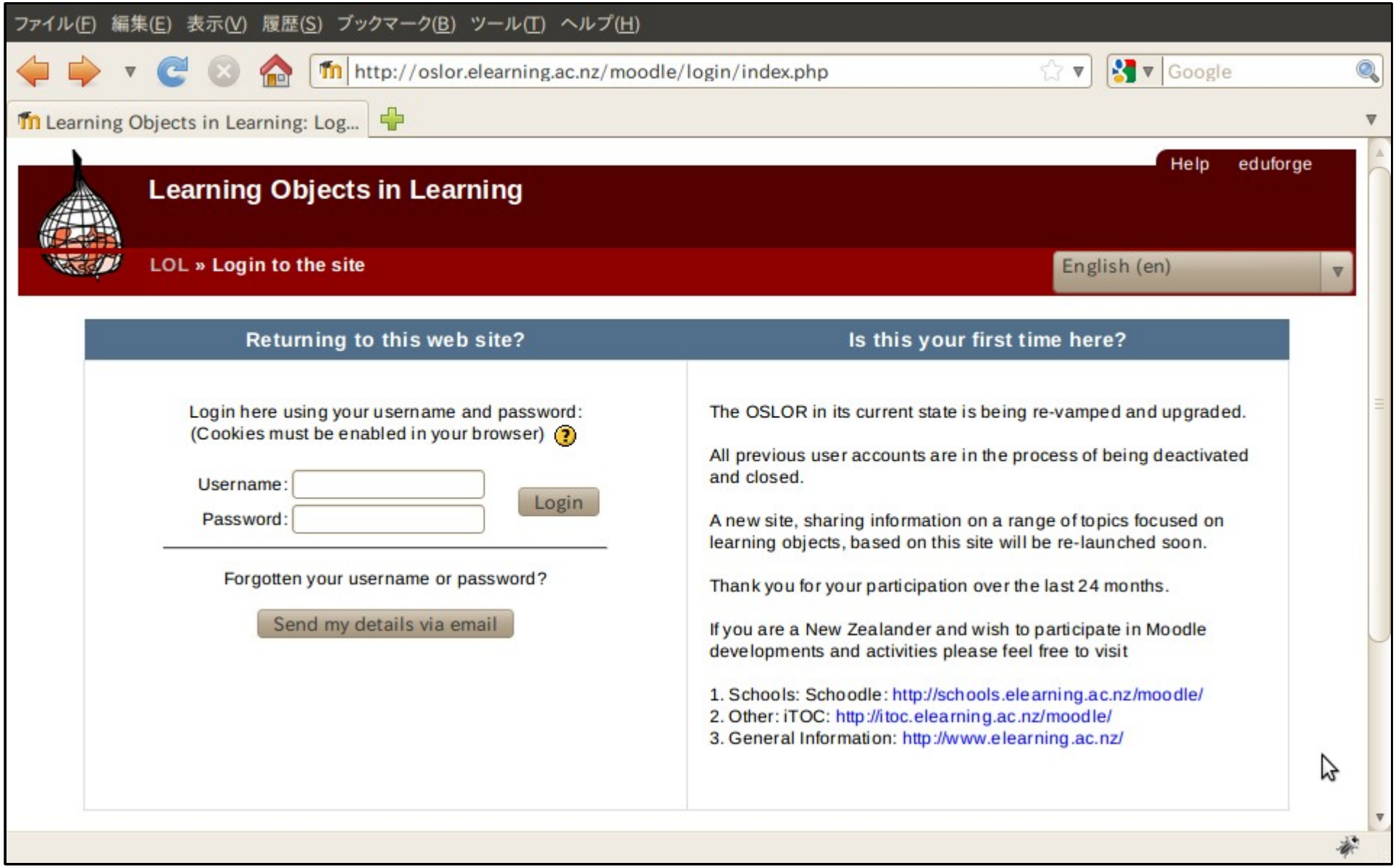
Prompting trainees' motivation for practical learning

Related works, promotions, lessons learned, etc.

Related works

- Chang, L.: Adopting Open-Source Software Engineering in Computer Science Education, Taking Stock of the Bazaar: Proceedings of the 3rd Workshop on Open Source Software Engineering, pp.85–89 (2003).
- Megias, D., Serra, J. and Macau, R.: An International Master Programme in Free Software in the European Higher Education Space, Proceedings of the First International Conference on Open Source Systems (OSS 2005) (Scotto, M. and Succi, G., eds.), pp.349–352 (2005).
- German, D.M.: Experience teaching a graduate course in Open Source Software Engineering, Proceedings of the First International Conference on Open Source Systems (OSS 2005) (Scotto, M. and Succi, G., eds.), pp.326–328 (2005).
- Kamthan, P.: On the Prospects and Concerns of Integrating Open Source Software Environment in Software Engineering Education, Journal of Information Technology Education, Vol.6, pp.45–60 (2007).
- Long, J.: Open Source Software Development Experiences on the Students' Resumes: Do They Count? – Insights from the Employers' Perspectives, Journal of Information Technology Education, Vol.8, pp.229–242 (2009).
- Koohang, A. *et al.*: Design, Development, and Implementation of an Open Source Learning Object Repository (OSLOR), Informing Science and Information Technology, Vol.5, pp.487–498 (2008).

OSLOR: Open Source Learning Object Repository

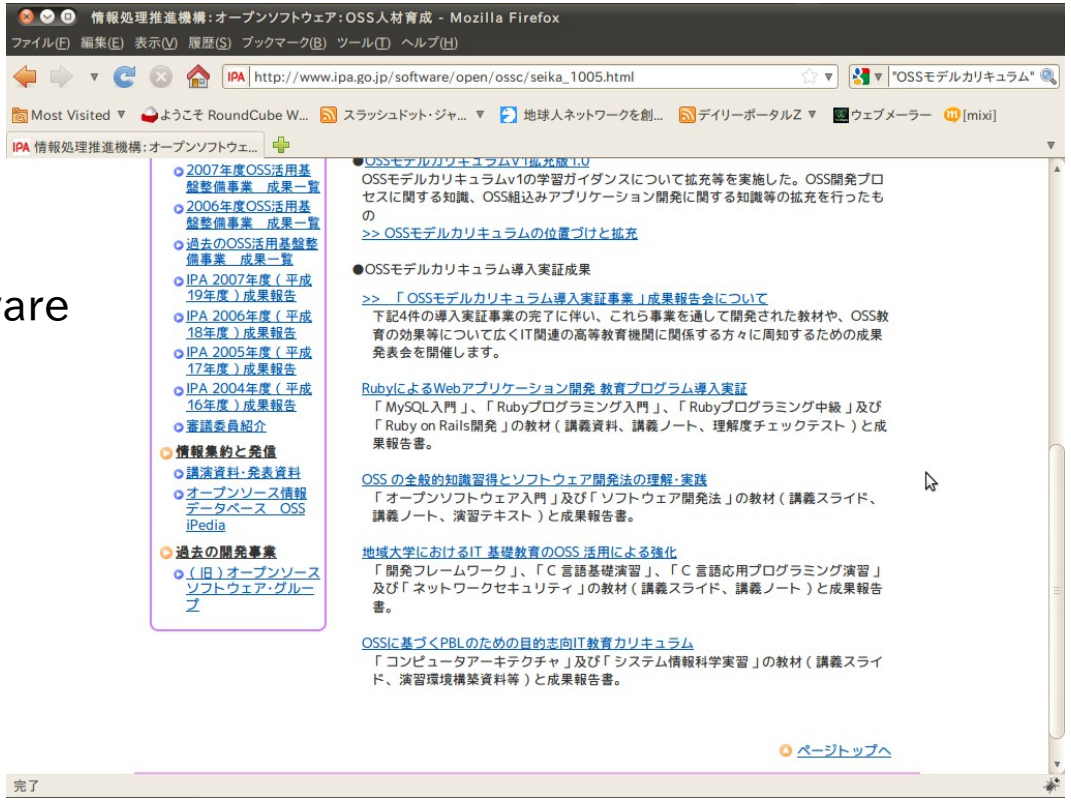


Materials available under the “Creative Commons Attribution 2.1 Japan”

http://it-center.mri.co.jp/insights/itc/oss_curriculum/

Learning materials already available on the web

- Introduction to MySQL
- Ruby programming (basic)
- Ruby programming (intermediate)
- Ruby on Rails development
- Introduction to Open-Source Software
- Software development
- Development framework
- C language basic practices
- C application programming
- Network security
- Computer architecture
- System info-science practices



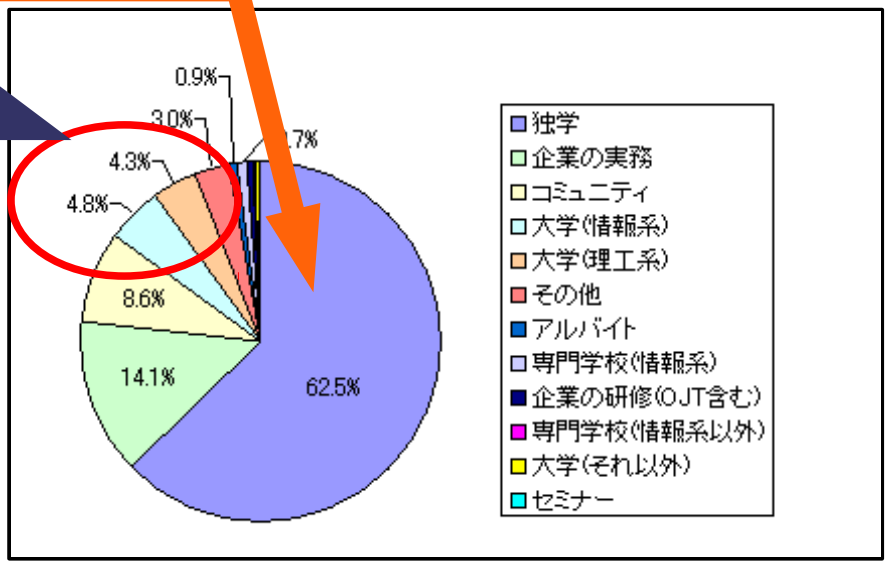
Lessons learned

- Is it really useful and/or meaningful to learn C language with OSS?
  - Proposal: it should target higher information technology engineers.
    - ex. continuing education and/or training of engineers in the working world

- Big progress in the OSS learning environment
  - Answers for this requirement

- But we really wanted …
  - It is still not clear how can we approach to.

- "Difficult to use presentation materials Provided by third parties"
  - Publishing in PDF is suitable or not?
  - Recommended way to use
    - Pick up the pages you like from whole materials
    - Original data available upon request



- Future challenges
  - Faculty development to train teachers who can teach the state-of-the-art technologies.
  - Encouraging engineers to participate in the education field
  - Fostering engineers who are needed in the cutting-edge field (ex. the testers in OO.o)

Promotions

Date	Title	Remarks
Aug 2009	J. Iio, K. Matsuzaki, H. Shimizu, Y. Shirai, and K. Sugiharai, “Practical Information Technology Education using Open Source Software,” Summer Symposium in Saga 2009 (SSS2009), IPSJ Symposium Series Vol.2009, No.7, pp.51-54, Karatsu, Saga [In Japanese]	Discussing “the Guidance” and project conducted in FY2009
Jun 2010	J. Iio, K. Matsuzaki, H. Shimizu, and Y. Shirai, "Practical Education Courses on Open-Source Software in Japanese Higher Education," OSS 2010 Workshop, Open Source Policy and Promotion of IT Industries in East Asia, T. Noda *et al.* (Eds.), pp.9-14, Notre Dame, IN	Promoting the result of the project of FY2009
Aug 2010	J. Iio, K. Matsuzaki, H. Shimizu, and Y. Shirai, “Evaluation of Practical Information Technology Education using Open Source Software,” Summer Symposium in Sibukawa 2010 (SSS2010), IPSJ Symposium Series Vol.2010, No.8, Shibukawa, Gunma	Promoting the result of the project of FY2009 and discussing the project conducted in FY2010
Sep 2010	J. Iio, "Development of OSS-based Practical IT Training Courses," Linux Con Japan 2010 Tokyo, Roppongi Tokyo	
Nov 2010 (planned)	J. Iio, "OSS-based Practical IT Training Courses," Open-Source Conrefence 2010 Shimane, Matsue, Shimane [In Japanese]	

How about iPad version?

- iPad version of “Linux Standard Textbook” provided for free by LPI-Japan
  - Screenshot of “Internet Watch,” 28th Jul 2010

Thanks for your attention