Innovation & Collaboration with Chinese Universities: Multi-Core and beyond

Boon-Lock Yeo

Agenda

◆ Intel R&D presence in China

◆ Intel Higher Education Program

◆ Working with Chinese Universities

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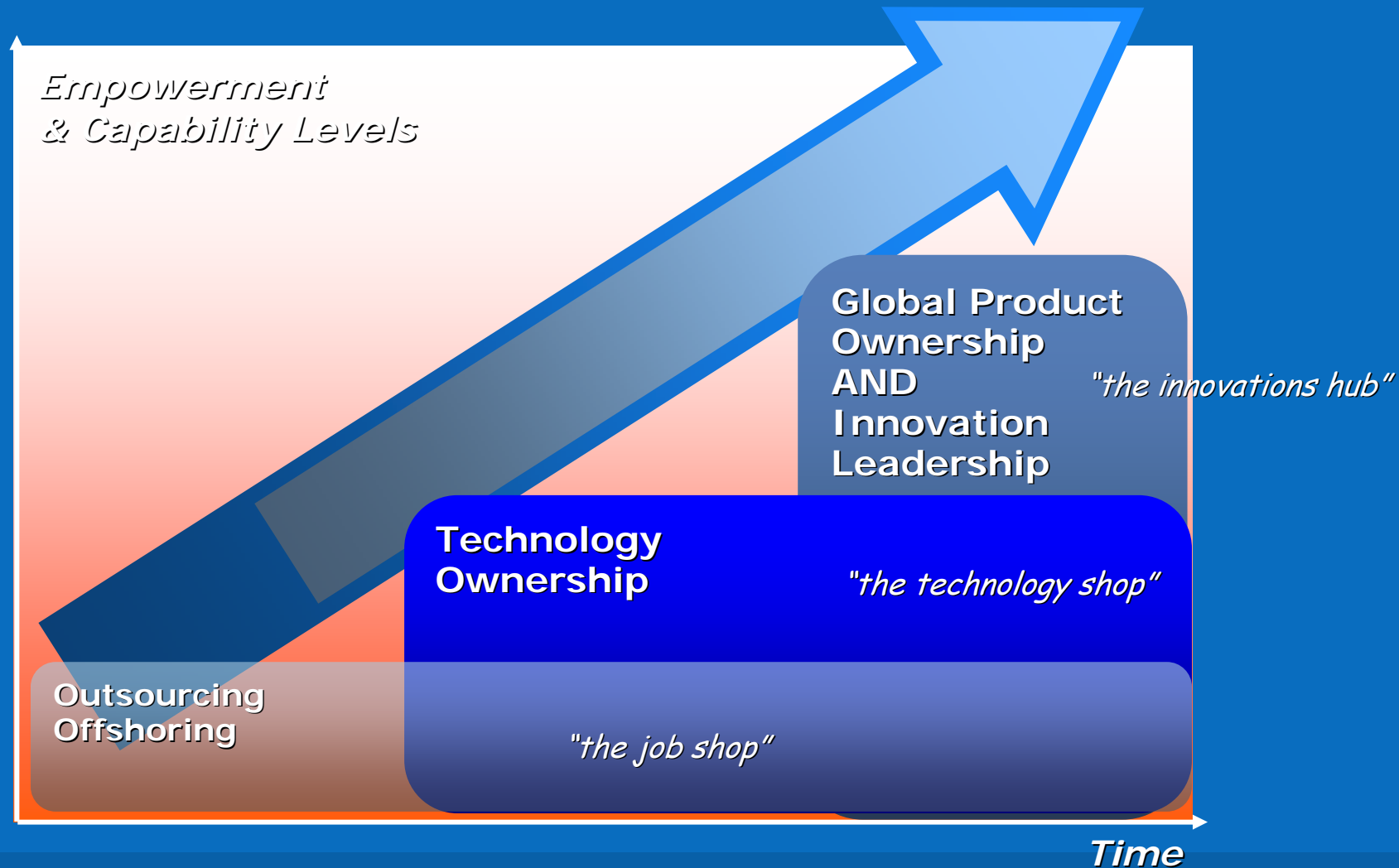
Intel R&D in PRC

Product & market focused

- Concentration at Shanghai

- >1000 employees

- Deliver innovative products for China and the world and
support Intel customers worldwide

- Competency & Focus
  - Software: BIOS, OS, tools, embedded, platform sw, XML
  - Board: desktop & server board design
  - System: customized system, set top box, embedded sys

- Intel China Software Center (ICSC)

- Close collaboration with ISVs, OEMs, universities

Research focused

- Beijing: Intel China Research Center

- Focused on communication, multimedia.

Our Journey

Empowerment & Capability Levels (y-axis)

Time (x-axis)

- Outsourcing Offshoring
- Technology Ownership — *"the technology shop"*
- Global Product Ownership AND Innovation Leadership — *"the innovations hub"*
- *"the job shop"*

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Our Journey

Empowerment & Capability Levels

Global Product Ownership AND Innovation Leadership

Business & strategic acumen
Salesmanship & negotiation skills
Customer understanding
Calculated risk-taking

Program mgmt.
Product-Life-Cycle mgmt.
Product Marketing (promotion, position, price, and place)
Market research
Finance analysis
Deals making
Customer Support
Brand management
Ecosystem building

Technology Ownership

Adv. technology training, mentors
Leadership skills
Influencing Skills
Technical depth

Advanced R&D
IP/Patent Disclosure and Filing
Architecture and Design
Product Life-Cycle partial ownership
Standard/Benchmark creation

Outsourcing Offshoring

Basic technology training
Integration
Basic culture training
Stakeholder management

Software development to specs and schedule
Project management
Software Q/A, testing & Validation
Release management, Product Documentation
Performance benchmarking

Time

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Intel Higher Education Program Coverage in China

Who we are collaborating with

Intel Higher Ed program covers major Chinese top universities, like:

✓ **Peking University**

✓ **Tsinghua University**

✓ **Zhejiang University**

✓ **Fudan University**

✓ **Shanghai Jiao Tong University**

✓ **etc.**

▲ **Intel® Higher Education Program (40+ universities in 19 provinces)**

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Intel Higher Education Program Components

Curriculum | Talent | Research | Skills

Intel Higher Education Program

Curriculum Program

Curriculum Development
- Curriculum development workshop model in place to support expansion to broad set of universities
- Support for local model curriculum development/textbook publication

Lectures/ Forums

Lectures & Forums
- Supplement with classroom training for advanced technology and corporate culture, career development etc.;
- Asia Academic Forum and multiple China Faculty Forums

Fellowship Program

Intel Fellowship
- Grant fellowship to elite students to support universities' talent education
- 27 fellowships to top students in top universities in 2005

Student Contests

Student Contests
- Sponsor National Undergraduate Electronic Design Contests based on Intel Xscale technology; Intel Student Research Contest;
- Intel 2005 National HPC application & tuning contest

Internship Program

Internship Program
- Joint education program for practical and inter-disciplinary talent education;
- 1000+ student internships since start of program

Joint Research Projects

Joint Research
- Create the conduit for interactions and collaborations between Intel and China universities; educate and grow research talents in China;
- In '06, ~30 new research projects granted on Multi-Core/SW/Wireless etc.

Software College Program

Software College Program
- Initiated to support China Ministry of Education Software College program
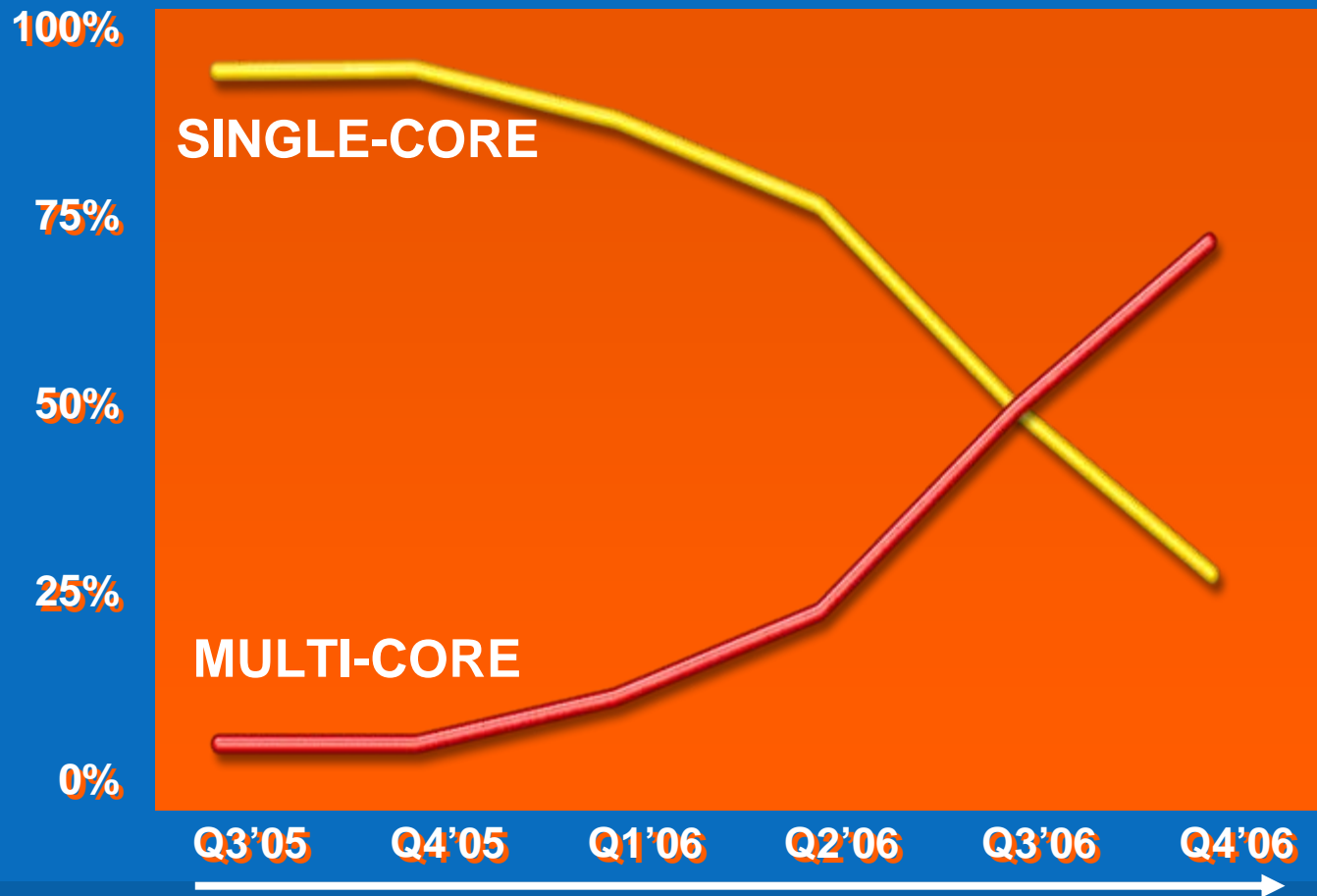- Curriculum development, faculty training, internship, campus lectures etc.

What we are collaborating with universities

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Multi-Core and university collaborations

Rapid Multi-Core Transformation

A world of rich clients and enhanced interactivities

• Internet is evolving quickly to a model where end users are contributing to the content and activities of the Internet

• Web 2.0 is really about the infrastructure, the business model and interactions around user contributions

• Implications of user contributions
  – More visual communications
  – More audio communications
  – Need to search / filter / navigate through the sea of data

• Demands for compute both at servers and clients
  – Multi-core is critical to support the needed infrastructure

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Example dual core innovation: Picture-in-picture game — Kingsoft JianXia II 2D game

Another picture shows different accounts' scenario and activity

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Example dual core innovation: Sinowave multi-party video conferencing

- 6-way, 720 x 576 on Intel Dual-Core platform at 25 fps
- 4-way, 1280 x 720 HD with > 25 fps on Intel Quad-Core platform

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New initiative at academia – Multi-Core university program

➢ Initiated for supporting China universities on early adoption of Multi-Core technology and Foster talent education through curriculum development and collaborative research;

➢ The program consists of 2 parts:
  ✓ Multi-Core curriculum projects for curriculum development and talent training, including lab donation, curriculum grants, faculty training, campus lecture, etc.
  ✓ Multi-Core research projects for building collaborative research on Multi-Core as well as educating research talents

➢ Strong technical support from R&D resources in PRC ensures the ramp and coverage of the program.

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Multi-Core University Program

➢ **Curriculum projects** implementation status:

- ✓ **5** universities granted Multi-Core curriculum projects, setting up Intel-university Multi-Core technology labs; (PKU, THU, SJTU, FDU and ZJU)
- ✓ All 5 universities offered courses in Fall Term 2006, with **1000+** students accessed through 8 courses
- ✓ Multi-Core advisory committee formally setup to expand Multi-Core curriculum with MOE endorsement

➢ **Research projects** implementation status:

- ✓ In 2006, Intel China Research Council set up the new sub-committee on Multi-Core and kicked off this research area in China;
- ✓ **10** out of 17 project proposals were granted the Multi-Core research funding, which are in progress now;
- ✓ Research sub-areas include: applications for Multi-Core, tools for Multi-Core, Algorithms for Multi-Core, etc.

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Multi-Core on-line community: scaling MC to more universities

Multi-Core local website initial version launched in Sept. to have a unified portal for on-line community to scale Multi-Core technologies to more universities

➢ http://multicore.net.cn for public access
➢ Chinese version – affinity to Chinese professors and students
➢ Bridge technology with education: a good tool of helper for curriculum development and the on-line community among both faculties and students

Features:

✓ News
✓ MC Tech. Update
✓ Material Downloading
✓ On-line Learning
✓ On-line Testing
✓ On-line Forum (Q&A)
✓ User Registration
✓ Statistics & Tracking
✓ Etc...

Homepage

On-Line Forum

Multi-Core Curriculum Development Status

University	Course Name	Offering Duration	# students	Audience	Type	Teacher (s)
ZJU	Advanced System Architecture	Sep 11 2006-Jan 26 2007	336	Graduate	Compulsory	Prof. Shi Qingsong
	Advanced Operating System	Sep 11 2006-Jan 26 2007	336	Graduate	Compulsory	Prof. Qian Hui
	Multi-Core Computing	Nov 2006-Jan 2007	TBD	Graduate	Compulsory	Prof. Chen Tianzhou, Shi Qingsong
SJTU	Computer Organization and Architecture	Sep12 2006-Jan 12 2007	150	Undergraduate	Compulsory	Prof. Hu Yueming
FDU	Operating System	Sep 4 2006-Jan 4 2007	120	Undergraduate	Compulsory	Prof. Feng Hongwei
PKU	Advanced Internet Program Design	Oct 9 2006-Jan 2007	93	Graduate	Selective	Prof. Zhang Qixun, Wu Zhonghai, Lin Jinlong
THU	Parallel Computing Fundamental	Sep19 2006-Jan2 2007	30	Graduate	Selective	Prof. Xuewei
	HPC	Sept18 2006– Nov6 2006	15	Graduate	Selective	Professor Zheng Weimin, Cheng Wenguang, Xue Wei

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Multi-Core Research Projects Grant List

Research in progress, most are one-year project to be completed in 2007:

Research Topic	Professor	University
The Performance Improving of the Network IO on the CMP Architecture	YIN Baolin	Beihang University
Domain-Specific Programming Tool for Streaming Applications on Multi-Core Systems	ZANG Binyu	Fudan University
Research on multi-core pre-boot infrastructure for advanced pre-boot usage model	SANG Shengsheng	Shanghai Jiao Tong University
Video Content Analysis Engine	LI Jianmin	Tsinghua University
Optimizing Memory Access in CMP with Transaction Memory	WANG Dongsheng	Tsinghua University
View-Oriented Parallel Programming Model for Systems with Multi-core Processors	ZHENG Weimin	Tsinghua University
Efficient Thread-level Speculation and Transactional Execution Model for CMP	AN Hong	University of Electronics Science & Technology of China
Many-Core Simulation Acceleration	LONG Xiang	Beihang University
Certify the Concurrent Assembly Code	CHEN Yiyun	University of Science & Technology of China
Multi Core Platform Backed Virtual Surgery	GU Lixu	Shanghai Jiao Tong University

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# Reaching out to students via seminars

➢ **Multi-Core Campus Lecture Series**

✓ Share with students the Multi-Core - latest technology update and industry trend;

✓ Intel China Software Center (ICSC) launched 2006 Multi-Core campus lecture series at key Chinese universities

✓ Till Oct. '06, engineers from ICSC, together with Dr. Geoff Lowney, delivered Multi-Core campus lectures at 16 universities including Peking University, Tsinghua University etc., covering more than 2600 students. Will cover >3000 students by end of 2006

✓ Peking University
✓ Tsinghua University
✓ Fudan University
✓ Zhejiang University
✓ Nanjing University
✓ Shanghai Jiao Tong University
✓ University of Science & Technology of China
✓ Xi'an Jiao Tong University
✓ Tongji University
✓ South China University of Technology
✓ South East University
✓ East China Normal University
✓ University of Science & Technology of China
✓ Xi'an Jiao Tong University
✓ Shandong University
✓ Beijing Jiao Tong University

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Looking Forward to 2007 and beyond

➢ By working with China MOE and leveraging the 5 primary universities, to scale Multi-Core technology to more universities and students in 2007 and beyond:

  ✓ Target of supporting another **40** universities in 2007 for Multi-Core curriculum development

  ✓ In the next following 3 years, to support total **100** universities incorporate Multi-Core technology into their curriculum

  ✓ Plan to get China MOE's endorsement for model course (Multi-Core focused) effort to standardize the Multi-Core courses and facilitate universities adopt Multi-Core contents

5 | 2007 ⟩ **40** | 2009 ⟩ **100**

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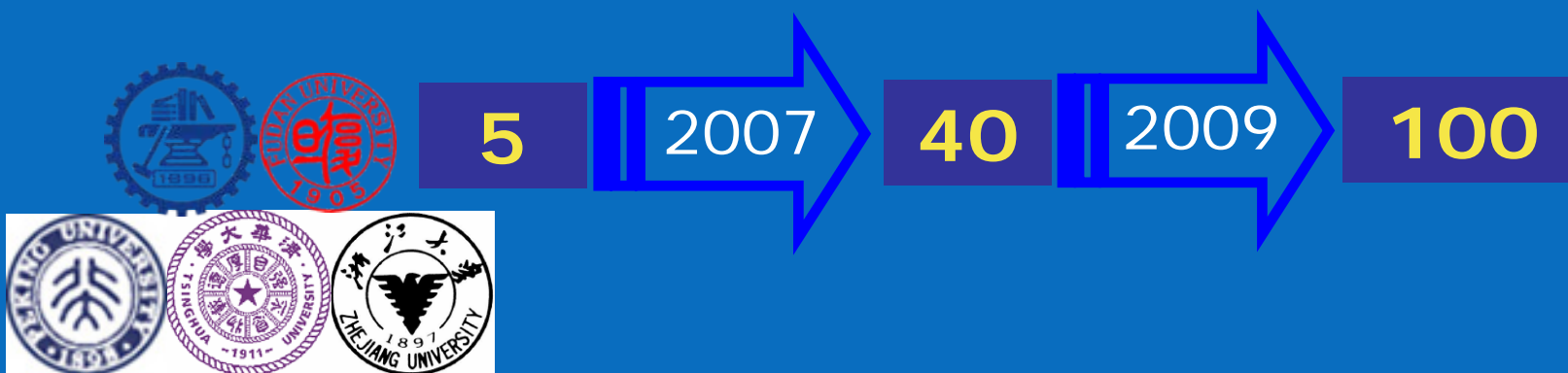
Exploration & Innovation for new curriculum

➢ Integrate industry technology & project experience into university curriculum to educate students with balanced theoretical and practical skills.

➢ Joint curriculum cooperation to explore the new formats of curriculum offering at SJTU CS department:

   ✓ Professors and engineers co-teach the courses, with professors focus on theoretical knowledge while engineers provide latest technologies and project experience;

   ✓ Professors lead the offering, while engineers provide seminars to bring in the latest technologies update

   ✓ Engineers develop the courses and lead the course offering, with support from professors

➢ Extend the exploration into other schools and universities:

   ✓ New curriculum at SJTU School of Software with integrated internship as part of the curriculum to educate the talents with sophisticated, practical skills and project experience.

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Internship Program: we jointly educate talents with universities

➤ Intel has hosted more than 1000 students working at Intel since the internship program start; Now more than 200 interns each year

➤ The interns are from both Chinese and overseas universities, covering CS, School of Software, EE and other disciplines

➤ The Interns participate in real life industry environment and projects, and dedicated Intel engineers mentor the interns' project practice, as well as guide their thesis writing at Intel

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Extend internship to campus: a new form of joint talent development

➤ Intel China Software Center involved in SJTU School of Software "Summer Assignment Project", a new collaboration to have students' project practice at university campus, guided by both Intel engineers and university professors

➤ Intel proposes the project idea and facilitates the students through to develop the solution, to jointly educate students gain project experience

➤ This is to extend the normal internship to the campus, where students conduct project development at university, not at Intel, but have Intel's guidance

➤ Total 17 3rd year students involved in 2006 "Summer Assignment Project" on "purchasing assistant" project and "Code Coverage" project proposed by Intel; with 8 outstanding students awarded.

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Special joint curriculum with Shanghai JiaoTong University (SJTU) School of Software

➤ Exploring new program for "SJTU School of Software-Intel Joint Undergraduate Class" with integrated internship as part of the curriculum to educate the talents with sophisticated, practical skills and project experience.

➤ This is part of the strategic partnership collaborations between Intel and SJTU for innovative talents education.

➤ It is also in line with China MOE's direction for software talents education: industry oriented and reformed curriculum.

➤ The collaboration on this new program has been initiated by conducting initial communication with fresh students at SJTU School of Software; the internship will be integrated into the curriculum through 2nd year to 4th year based on the education plan.

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Linux Training Center Project

➢ National Linux Training Center project, initiated by Chinese Ministry of Education and Ministry of Science & Technology, to develop Linux curriculum and foster Open Source/Linux talents education in China.

➢ Intel's support to Linux Training Center project:

    ✓ Build collaborations with part of the 40 Linux Training Centers, by lab donation, faculty training, curriculum projects grant, visiting scholar, etc.

    ✓ Intel's contribution was recognized by MOE and partner universities.

➢ As a next step, focusing on Linux curriculum development and students internship to educate Linux talents with practical skills and project experience.

➢ Intel will also contribute the development of Linux community in China, by collaborating with relevant universities.

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Joint Innovation Center: transform idea into business

- Technology Innovations and Incubation with top Chinese universities
  - Identify and develop technologies with business potentials
  - Create prototype for resulting new technology
  - Create next generation startups

- Talent development with business acumen
  - Through this program, collaboration between Intel and the universities extends beyond the traditional research and curriculum, and exposes students to entrepreneurship and transformations of ideas into businesses

- Set up Joint Innovation Center in 2006
  - Innovation projects are being investigated and to be kicked off by putting resources from both sides
  - University professors and students will participate in the project development and following startup to gain both project practice and technology entrepreneurship experience

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Call to actions

• Let's work together to ramp Multi-Core awareness and innovations

• Current environment offers tremendous opportunities for software enabled innovations

• Use the power of multi-core and software to

– Prototype new technologies

– Prototype new business models

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Q&A