



Distributed Computing Principles (DCP)

Dr. Minxian Xu

Associate Professor

Research Center for Cloud Computing

Shenzhen Institute of Advanced Technology, CAS

<https://www.minxianxu.info/dcp>

君看天上星，东西各分布。

——（清）洪亮吉

Teaching Staff



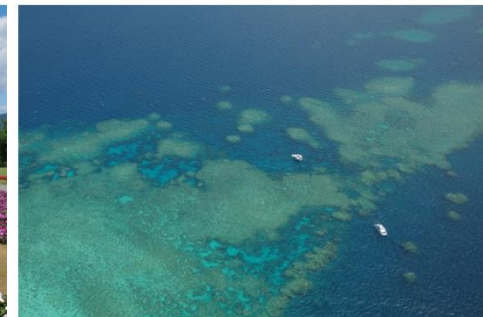
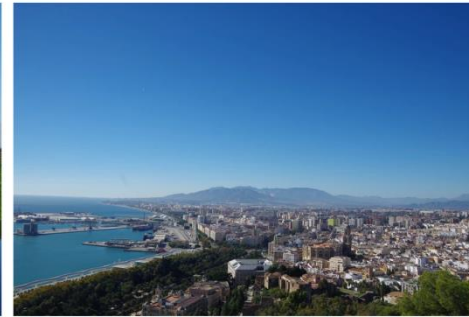
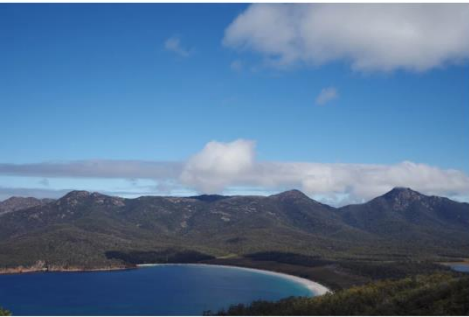
Minxian Xu

群聊: 2024《分布式计算原理》
课程群



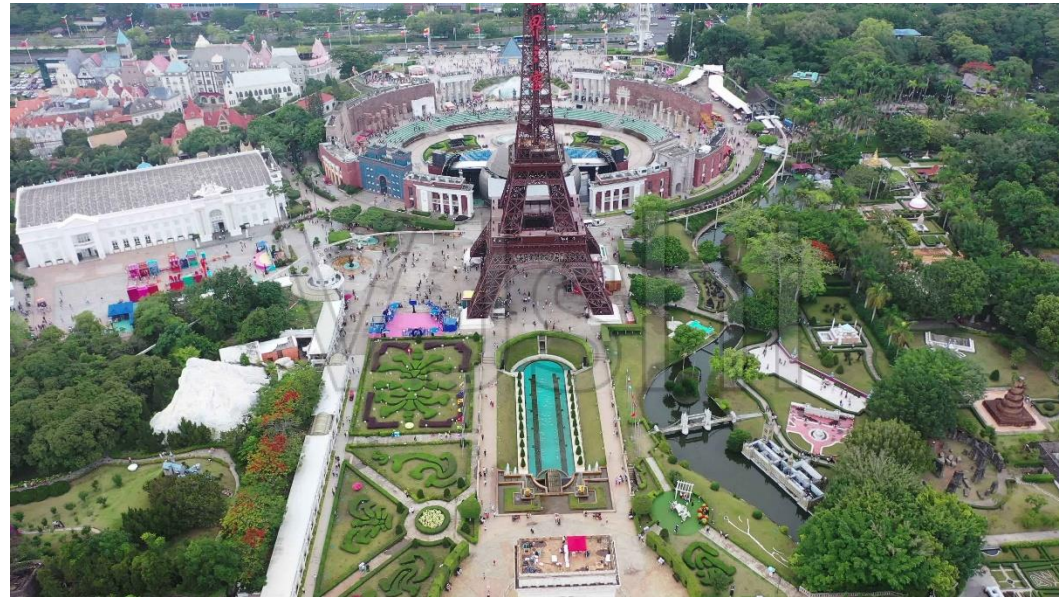
- Ph.D. from University of Melbourne, Australia
- B.S. and M.S. from UESTC
- Research Interest: Cloud Computing and Distributed Systems
- World's Top 2% Scientist by Stanford University
- 2023 IEEE TCSC Early Career Award
- 2019 IEEE TCSC Outstanding PhD Dissertation Award
- Published 60+ papers in CSUR, TMC, TSC, TOIT, ICSOC
- PI/Co-PI for 10 research projects
- Reviewer for 40+ journals
- Program Committee for 10+ conferences
- Keynote/Invited/Oral presentation for 20+ times
- Office: Room F903, Xili Campus, SIAT (booking first)
- Email: mx.xu@siat.ac.cn
- Tutors: Mr. Kan Hu

Distributed Tourist Attractions



Photographed by Minxian

Centralized Tourist Attractions



Window of The World, Shenzhen



Course Schedule

- Lectures (40 hours):

- Time:

- Monday: 9:30-12:20 - 3 hours – with 10 minutes break.
 - Venue: Offline (F447, SIAT Mingzhu Campus)

- Tutorials

- Practice with experiments
 - Please make friends in your tutorial!

Background expectation

- **Pre-requisites:**
 - Programming and Software Development (**Java**)
 - Algorithms and Data Structures
 - Internet Technologies
 - Operating Systems
 - **OR** Equivalent subjects



DCP subject is a “foundation” (pre-requisite) for many advanced subjects

- Distributed Algorithms
- Mobile Computing Systems Programming
- Cluster and Cloud Computing
- Distributed Computing Project
- Some special offerings:
 - Stream Computing?
 - Management and Mining of Spatio-Temporal Data (MapReduce application)

Why study distributed computing now?

- This course has been started when distributed systems, particularly the Web and Internet applications and services, are of unprecedented interest and importance.
 - Microsoft .NET
 - HP Adaptive Enterprise
 - Oracle – Oracle 10g / 11g / 12c
 - IBM – On Demand
 - SAP – enterprise management software
 - Cloud Computing: Amazon EC2, Microsoft Azure, Google AppEngine, Aneka, Force.com, Alibaba China Cloud, Apple iCloud
 - Social Networks: Facebook, WhatsApp, Skype, WeChat....
 - Academic R&D worldwide: Service computing, e-Science, etc.
- This subject in particular aims to convey insight into, and knowledge of the principles and practice underlying the design of distributed systems.
- The depth covered in this subject enables you to **evaluate existing systems or design new ones**.



DS Subject Overview

- **Part I: Foundations – approx. 5 weeks**
 - Introduction, Inter-process Communication, Socket and Thread Programming, and System Models
- **Part II: Programming and Principles – 4 weeks**
 - Distributed Objects and Programming,
 - Operating System support services, Distributed Shared Memory Systems
- **Part III: Paradigms/Platforms - 4 weeks:**
 - RMI, NFS etc. taught during Part I & II
 - Distributed File Systems, Security and Naming Services
 - Case study of Distributed Systems
- **Guest Lectures / Advanced Topics (not in exam)**
 - Cloud, BlockChain, IoT, and industrial applications
- **Depth of some parts may be reduced as SIAT has dedicated subjects on some of these topics:**
 - Distributed Algorithms, Software Systems Security, Cluster and Cloud Computing, High-Performance Database Systems



Course Assessment

- **Some short assignments:**
 - During semester worth 60%
 - Assignment 1 (Practice with demo codes): 10%
 - Assignment 2 (Paper Review): 20%
 - Assignment 3 (Individual Report): 30%
- **Written examination:**
 - A written examination (1.5 hours) at the end of the semester worth 40%



Assignment 1

- The teacher will demonstrate some Java codes on distributed computing during class
- Please show the runnable codes to the Tutor every two weeks to ensure that you know how to run the codes
- Deadline:
 - Before the final exam
- Demo time:
 - Book with tutor



Assignment 2

- Assign a research paper in distributed computing area from top conference (e.g ODSI, ATC, SoCC)
- You need to present the paper during class
- Deadline:
 - Sunday (April 28) at 5:00pm, submit the slides
- Presentation time:
 - Monday (April 29) during the lecture (preparing slides)



Assignment 3

- You need to write a report about how distributed computing/system supports **your research topic** in your area, e.g. smart transportation, brain science, engineering, medical.....
 - Formatting the report like a research paper/survey (abstract, introduction, related work.....)
 - Why distributed system is required in your area?
 - How distributed system is applied in your area?
 - What are the benefits when applying DS in your area?
 -
- You should write more than 4000 words either in Chinese or English
- Deadline:
 - **Sunday (June 9) at 5:00pm**
- Presentation time:
 - **Monday (June 10) during the last lecture (preparing slides)**



Computational Resources

- Your laptop!
 - Use it for both assignments..
- Uni. Computing Resources:
 - Can also be used for simple assignments and learning
 - For demonstration of assignments (along with your own laptops)

Books and References

- **Main Text Book:**
 - CDK: G. Coulouris, J. Dollimore, T. Kinberg, and G. Blair, ***Distributed Systems - Concepts and Design***, 5th Edition, Addison-Wesley, Pearson Education, UK, ISBN 0132-143-011. <http://www.cdk5.net>
- **Programming Reference:**
 - R. Buyya, S. Selvi, X. Chu, “**Object Oriented Programming with Java: Essentials and Applications**”, McGraw Hill, New Delhi, India, 2009.
 - Sample chapters at book website: <http://www.buyya.com/java/>
- **Research Articles:**
 - To be supplied by the Lecturer (if used)!

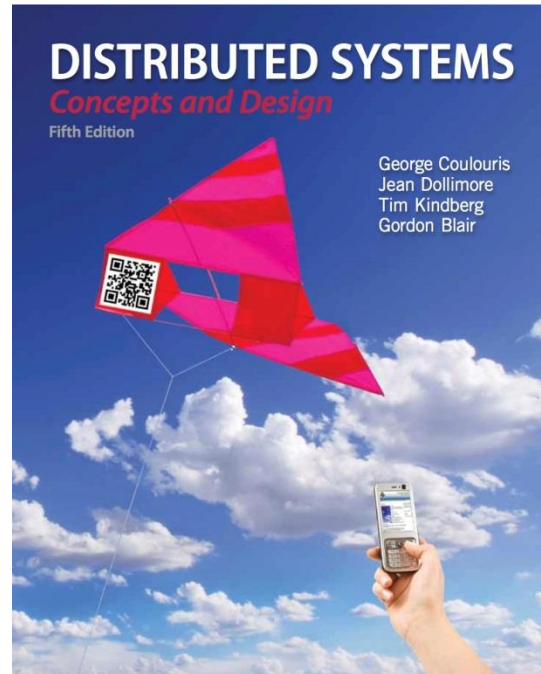
Text Book



fourth edition

DISTRIBUTED SYSTEMS CONCEPTS AND DESIGN

George Coulouris
Jean Dollimore
Tim Kindberg

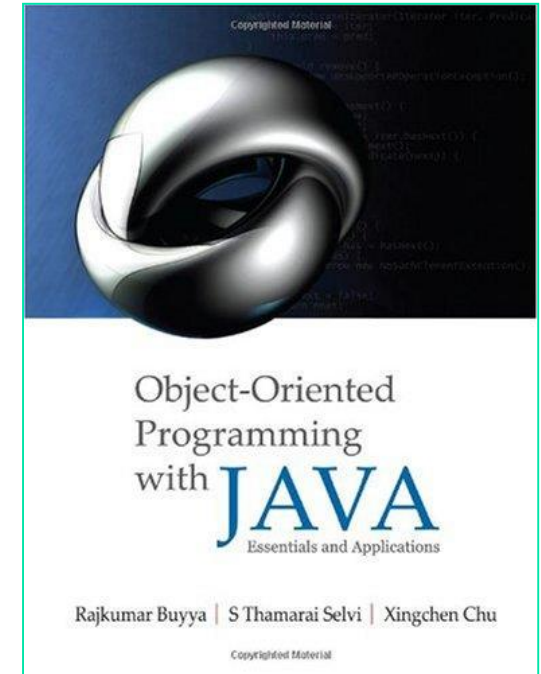


DISTRIBUTED SYSTEMS

Concepts and Design

Fifth Edition

George Coulouris
Jean Dollimore
Tim Kindberg
Gordon Blair



Object-Oriented Programming with **JAVA** Essentials and Applications

Rajkumar Buyya | S Thamarai Selvi | Xingchen Chu

Copyrighted Material

G. Coulouris, J. Dollimore, T. Kinberg, and G. Blair,
Distributed Systems - Concepts and Design,
5th Edition, Addison-Wesley/Pearson Education, UK, 2011.

<http://www.cdk5.net>

Buyya, R. Selvi, S.T., Chu, X.,

**Object Oriented Programming with Java: Essentials
and Applications**, McGraw Hill, New Delhi, India, 2009.





Presentation Slides

- Usually on the web before the lecture
 - <https://www.minxianxu.info/dcp>
- They may be find tuned/updated slightly a day before the lecture to reflect recent developments
 - No need to read Today's lecture content beforehand!
 - You only need to read & understand previous lecture!
- Mostly derived from the text book.
 - *Please procure (or own) the prescribed textbook.*
- Good ideas and figures from alternative text book or reference may also be used.



What do we expect from you?

- 1. Regular attendance of lectures
 - Pay full attention, be enthusiastic, fully committed to learn new things, ask questions during the class (especially in Tutorials), participate in discussion.
- 2. Review previous lecture material before coming to the class. – read material from the Text book
- 3. Start working on assignments right from the day they are announced and submit on time.
- 4. If you have some problem with the lectures/subject/??, please discuss with us **early**.
 - Don't take out your frustrations on me during Quality of Teaching (QoT)/ (Subject Experience Survey) SES 😊

QoT (Quality of Teaching) / SES (Subject Experience Survey)



- # I had a clear idea of what was expected of me in this subject

5. Strongly agree :

4. Agree :

3. Neutral :

2. Disagree :

1. Strongly disagree :

Mean :