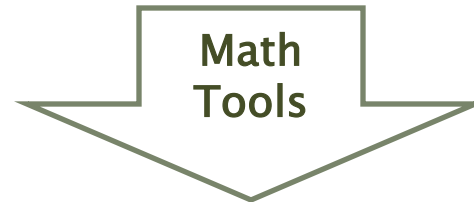


THEORETICAL COMPUTER SCIENCE

Real World Problems



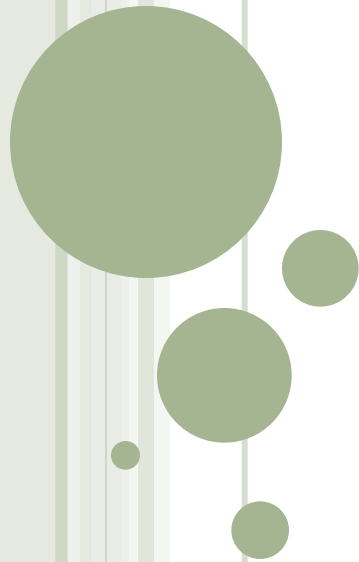
Abstract Models



Solutions

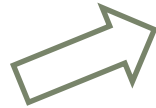


Inspire
More
Problems

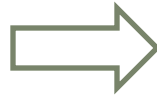


CAREER DIRECTIONS

Study Algorithms



College



Research
Institute



Industry



facebook



Network Algorithm Team

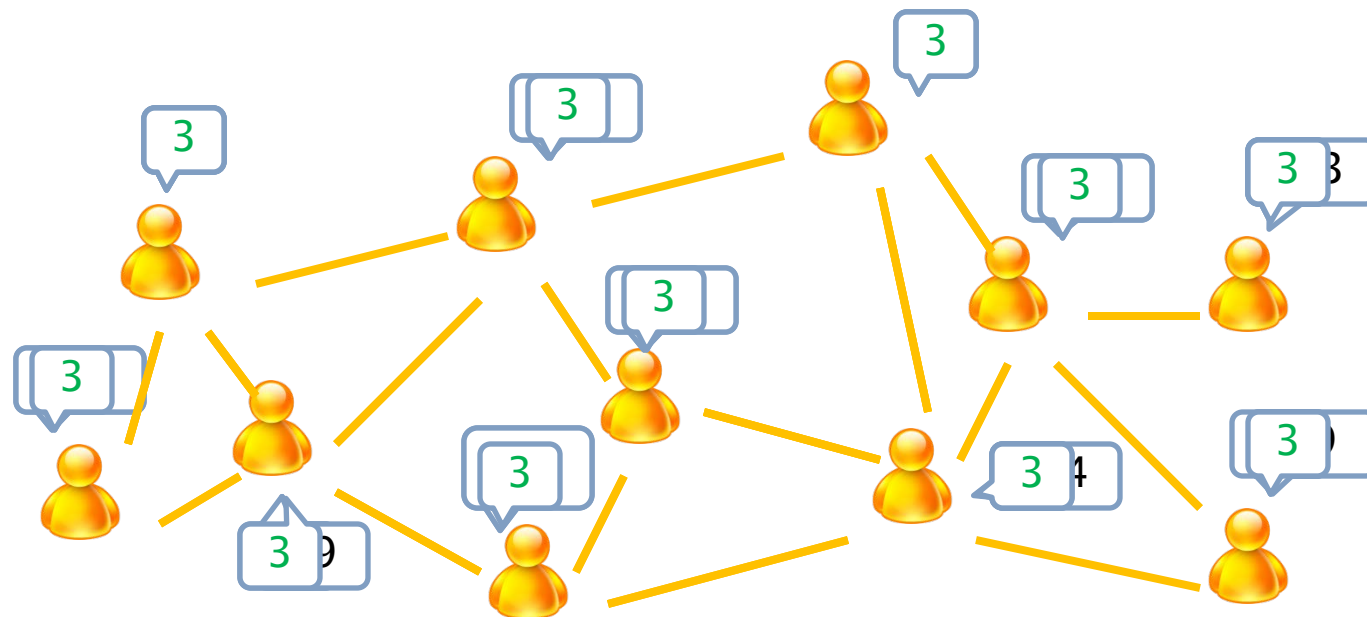
Hubert Chan

Postgraduates:

Li Ning	宁立
Fei Chen	陈飞
Mingfei Li	李明飞
Xiaowei Wu	吴晓伟



Natural Algorithm: to Achieve Consensus

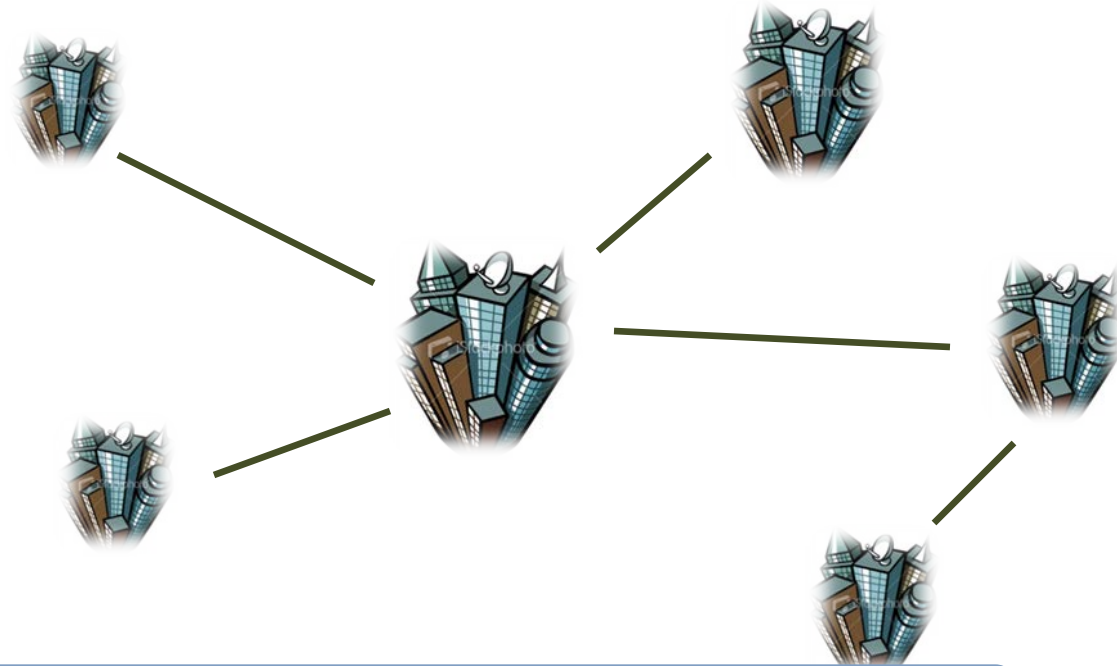


Researcher: This kind of natural behavior is modeled by dynamic systems. By our results, it is very fast for people to achieve consensus even under dynamic networks.



“Fast convergence for consensus in dynamic networks”,
Hubert Chan, Li Ning, ICALP 2011.

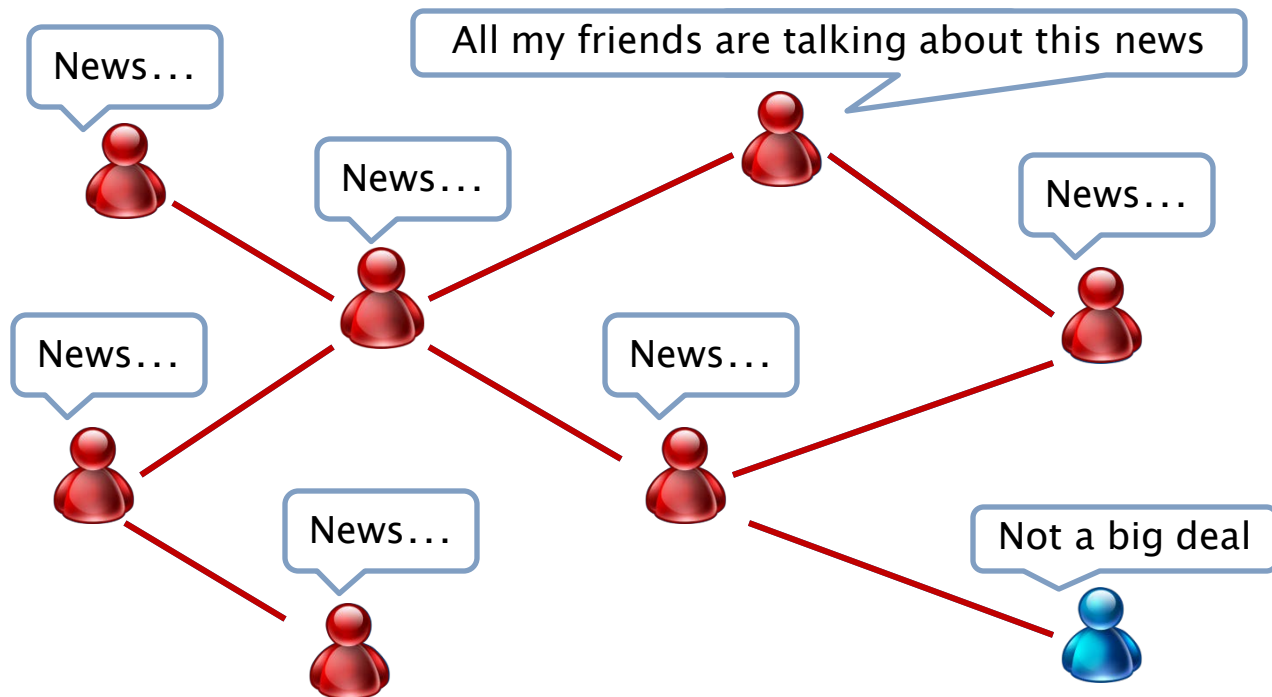
Spanners: “Building the Roads”



Researcher: This is a spanner problem.
Use our methods, then you don't need many roads,
and travelling distance along the roads is almost
the same with travelling directly.

“Sparse fault-tolerant spanners for doubling metrics with bounded hop-diameter or degree”, Hubert Chan, Mingfei Li, Li Ning, ICALP 2012.

Information Spreading in Social Networks



Observation: People will spread information, e.g., news, via talking to their friends. Moreover, the news talked by more friends attract more attention.

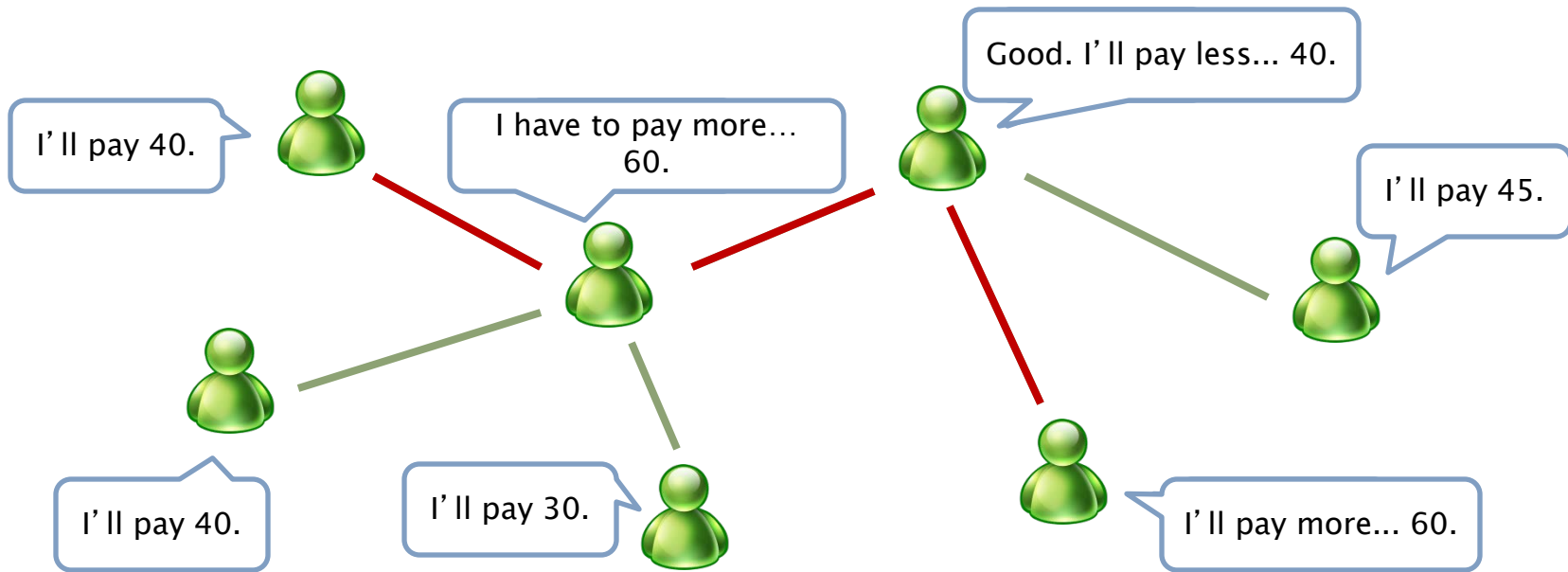


Researcher: To spread information efficiently, which person should be picked initially? ...



“Maximizing influence in information networks under the non-progressive linear threshold model”, Hubert Chan, Li Ning, ongoing project.

Bargaining



Rent sharing: The total cost to rent a flat is 100. It can be shared by two persons.

Researcher: This is studied as the problem called bargaining game.

applicat



“Optimizing Social Welfare for Network Bargaining Games in the Face of Unstability Greed and Spite”, Hubert Chan, Fei Chen, Li Ning, ESA 2012.



ONLINE ALGORITHMS: JOB SCHEDULING & POWER MANAGEMENT



Scheduling research team:

T.W. Lam 林德华

H.F. Ting 田慶豐

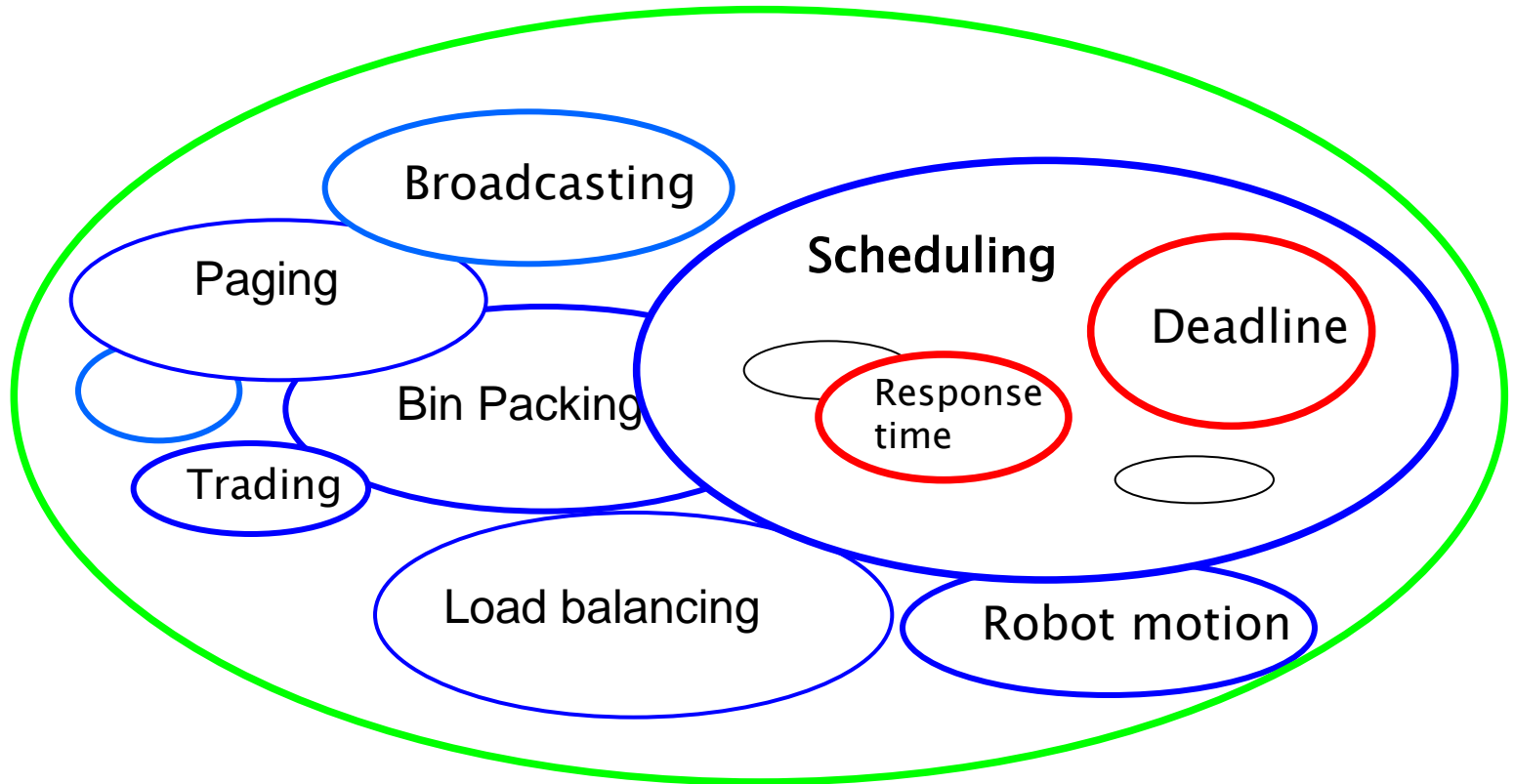
H.L. Chan 陳昊樑

L.K. Lee 李立基

S.H. Chan

R. Li

ONLINE PROBLEMS ARE CHALLENGING.



Without knowing the future, one often makes the wrong decision.



“What matters most to the computer designers at Google is **not speed**, but **power, low power**, because data centers can consume as much electricity as a city.”

Eric Schmidt, CEO Google
NY Times, 2002



REPRESENTATIVE PUBLICATIONS

- Sleep Management on Multiple Machines for Energy and Flow Time. ICALP 2011: 219-231
- Non-clairvoyant Speed Scaling for Weighted Flow Time. ESA 2010: 23-35
- Sleep with Guilt and Work Faster to Minimize Flow Plus Energy. ICALP 2009: 665-676
- Speed scaling with an arbitrary power function. SODA 2009: 693-701
- Scheduling for Speed Bounded Processors. ICALP 2008: 409-420
- Energy efficient online deadline scheduling. SODA 2007: 795-804





BIOINFORMATICS



F. Chin
T.W. Lam
H.F. Ting
S.M. Yiu

- **Bioinformatics** involves the analysis of biological and genetic information, the results of which can then be applied to gene-based drug discovery and development to cure illnesses
- Our objective is to develop better software tools to aid bioinformatics research.



Next Generation Sequencing

- NGS is the new & cornerstone technology for today's biological research and tomorrow's medical care.
- Nowadays NGS equipment (Solexa, SOLiD, Illumina) can produce short fragments (read) of a DNA sequence (genome) efficiently and at a low cost.
- Our research work is to base on our algorithmic expertise to develop efficient and effective software tools for NGS data.



Research Publications and Funding

Publications:

Bioinformatics, J of Computational Biology, RECOMB, ISMB, ECCB

GRF Grants

- **Structural Alignment** and prediction for non-coding RNAs with triple helix structure (2011–2014, HK\$681,195)
- Algorithms for Inferring k-articulated Phylogenetic Network (2009–2012, HK\$591,080)
- **Combinatorial Phenotype Testing** (2009–2012, HK\$394,053)
- Finding **Conserved Patterns** In Biological Networks (2008–2012, HK\$777,108)
- A **New Motif Representation** Based on Position Specific Patterns (2006–2009, HK\$775,008)
- **Compressed Indexes** for Approximate String Matching, with Applications to Biological Sequences (2006–2008, HK\$654,000)
- Design and Analysis of Algorithms for **Constrained Structure Comparison** (2006–2008, HK\$612,816)
- Computationally **Haplotyping** Pedigree Data (2005–2007, HK\$359,224)
- Algorithms for Uncovering Conserved Genes on **Whole Genomes** (2004–2007, HK\$650,000)

PROGRAMMING LANGUAGES ARE FUNDAMENTAL TO PROGRAMMER PRODUCTIVITY

PROGRAMMING LANGUAGE RESEARCH AIMS AT:

- ALLOWING FASTER DEVELOPMENT CYCLES
- SUPPORTING LARGE-SCALE PROGRAMMING
- PREVENTING MORE BUGS

BY CREATING NEW PROGRAMMING
LANGUAGES/ABSTRACTIONS



RESEARCH TOPICS

- BETTER PROGRAMMING MODELS FOR MULTI-CORE COMPUTING, GPU PROGRAMMING
- BETTER MODULARITY ABSTRACTIONS FOR LARGE-SCALE SOFTWARE
- FUNCTIONAL PROGRAMMING (SCALA, HASKELL, OCAML, SCHEME ...)

