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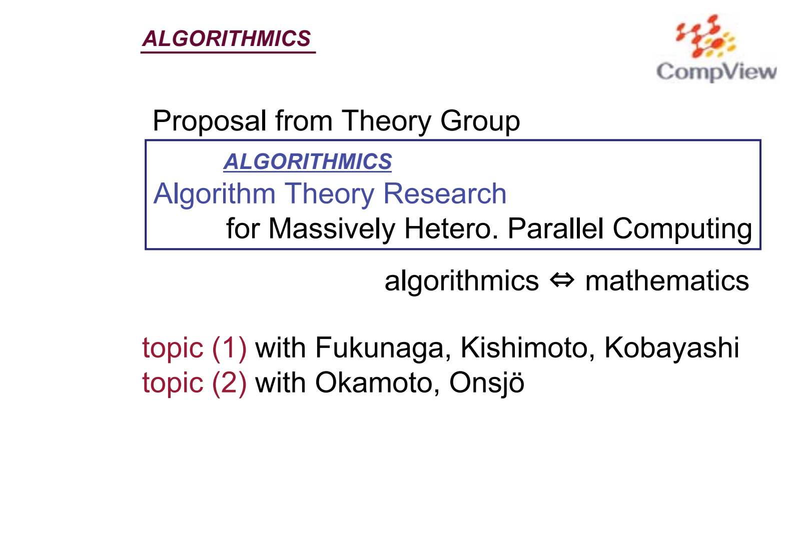

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Proposal from Theory Group

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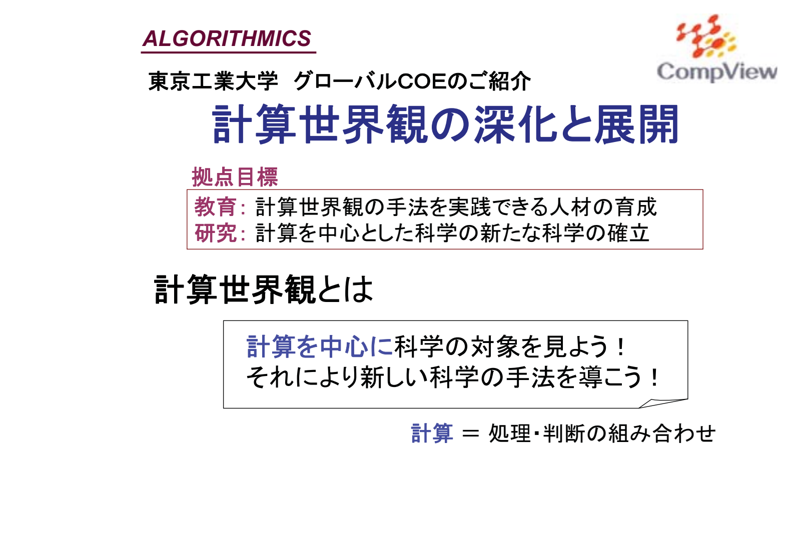
Algorithm Theory Research
for Massively Hetero. Parallel Computing

algorithmics ⇔ mathematics

topic (1) with Fukunaga, Kishimoto, Kobayashi
topic (2) with Okamoto, Onsjö



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東京工業大学　グローバルCOEのご紹介

計算世界観の深化と展開

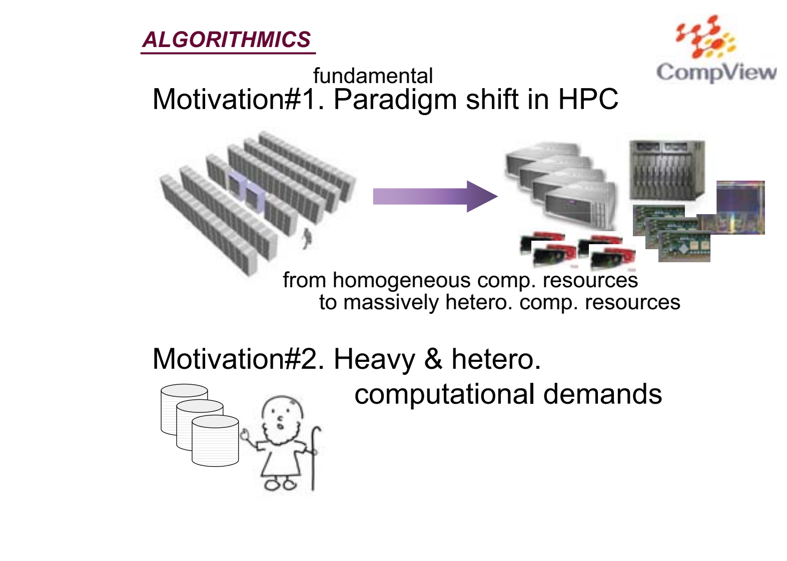
拠点目標

教育：計算世界観の手法を実践できる人材の育成
研究：計算を中心とした科学の新たな科学の確立

計算世界観とは

計算を中心に科学の対象を見よう！
それにより新しい科学の手法を導こう！

計算 ＝ 処理・判断の組み合わせ



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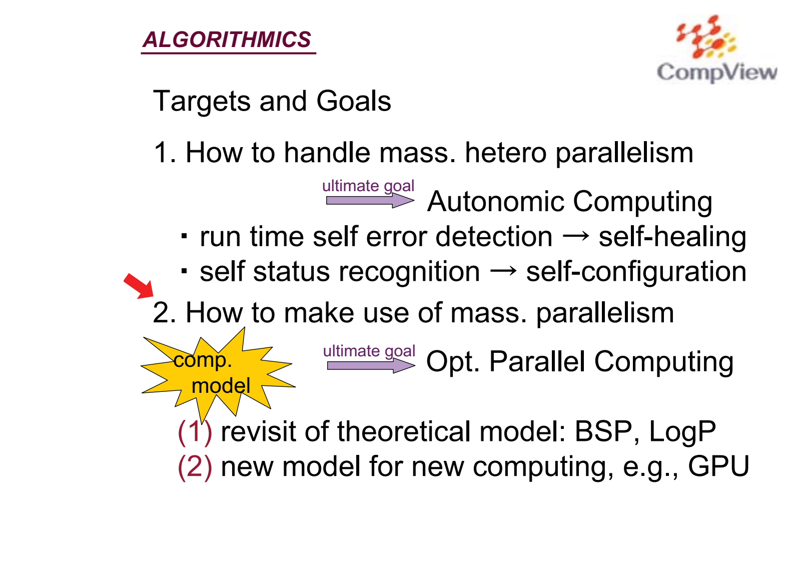
Motivation#1. fundamental Paradigm shift in HPC

from homogeneous comp. resources
to massively hetero. comp. resources

Motivation#2. Heavy & hetero.
computational demands



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Targets and Goals

1. How to handle mass. hetero parallelism

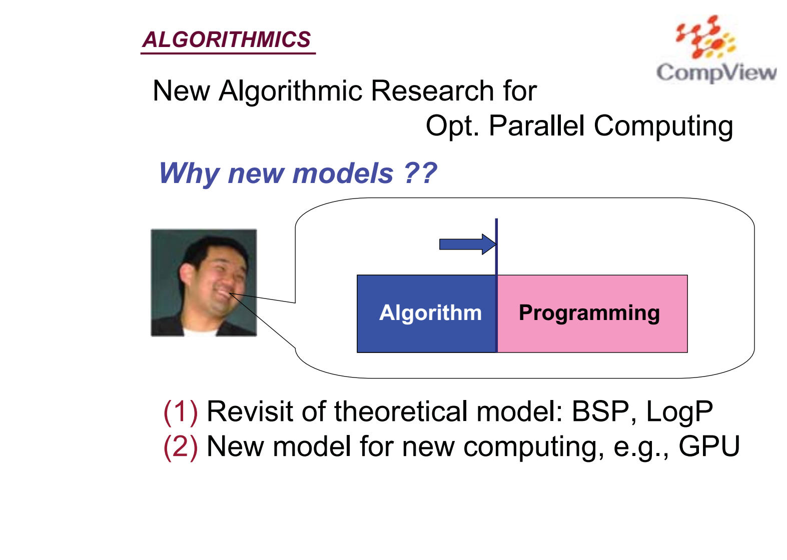
ultimate goal → Autonomic Computing

- run time self error detection → self-healing
- self status recognition → self-configuration

2. How to make use of mass. parallelism

ultimate goal → Opt. Parallel Computing

(1) revisit of theoretical model: BSP, LogP
(2) new model for new computing, e.g., GPU



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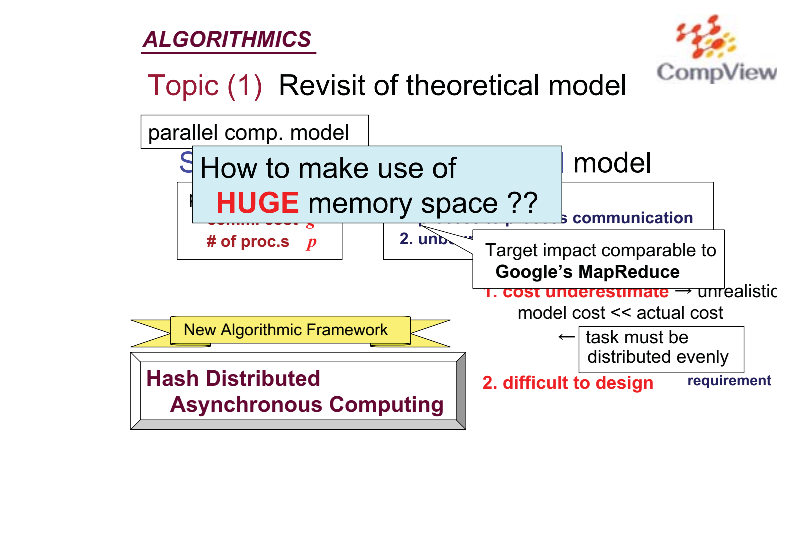
New Algorithmic Research for
Opt. Parallel Computing

Why new models ??

Algorithm
Programming

(1) Revisit of theoretical model: BSP, LogP
(2) New model for new computing, e.g., GPU



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Topic (1) Revisit of theoretical model

parallel comp. model

S　model

How to make use of
HUGE memory space ??

# of proc.s p

s communication

2. unb

Target impact comparable to
Google's MapReduce

1. cost underestimate → unrealistic
model cost << actual cost

← task must be distributed evenly

2. difficult to design　requirement

New Algorithmic Framework

**Hash Distributed
Asynchronous Computing**

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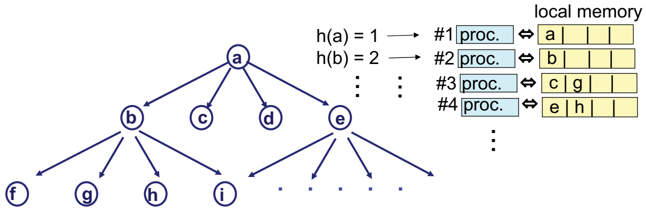
CompView

Extend Hash Distributed Computing

New Generic Parallel Algorithm for Dynamic Prog. best paper award]

- asynchronous parallelism
- use huge (distributed) memory space



gen. rec. dag

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CompView

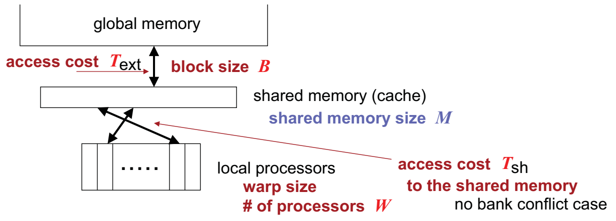
Topic (2) New model for new computing

GPU computing

my understanding (based on Tesla)

Points of interest:

+ very fast local memory (cache)
+ **local parallelism by local proc.s**
+ **stream processing (?)**
− **bank conflict ⇒ slow down**


global memory
access cost T_{ext}
block size B
shared memory (cache)
shared memory size M
.....
local processors
warp size
# of processors W
access cost T_{sh}
to the shared memory
no bank conflict case