

# Art of Algorithm Design in time of increasing complexity & heterogeneity

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# Space-Time Fight

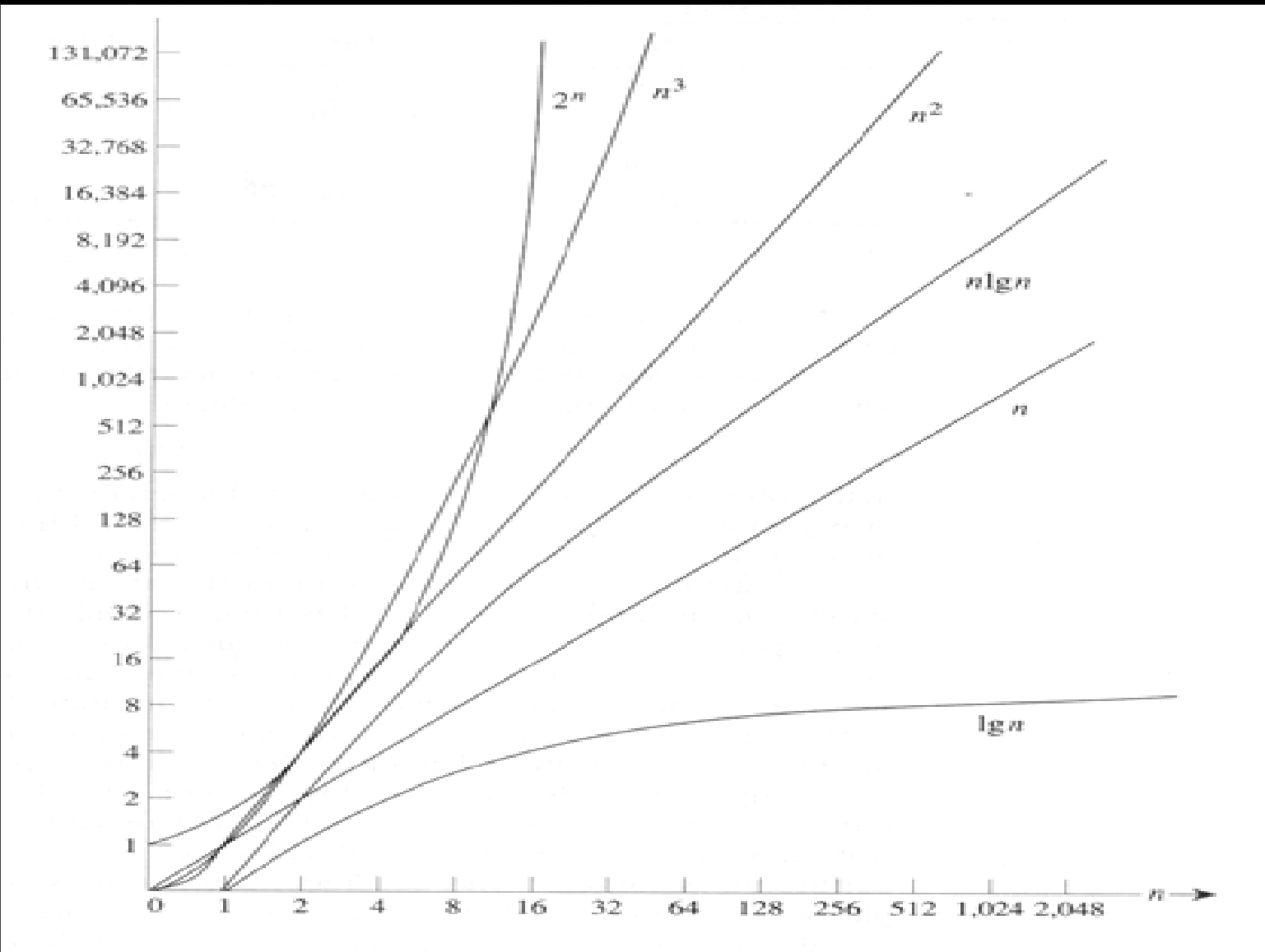
- ◉ Memory increasingly becoming an issue again
- ◉ Space-Time trade off is not always true
- ◉ Gadget size, communication bandwidth are driving the market

# Algorithm Analysis-different processes

- ◉ Micro-macro analysis
- ◉ Apriori-posterior empirical analysis
- ◉ Best ,average ,worst case analysis
- ◉ Lower, upper and tight bounds
- ◉ Amortized analysis using aggregate, potential or accounting method

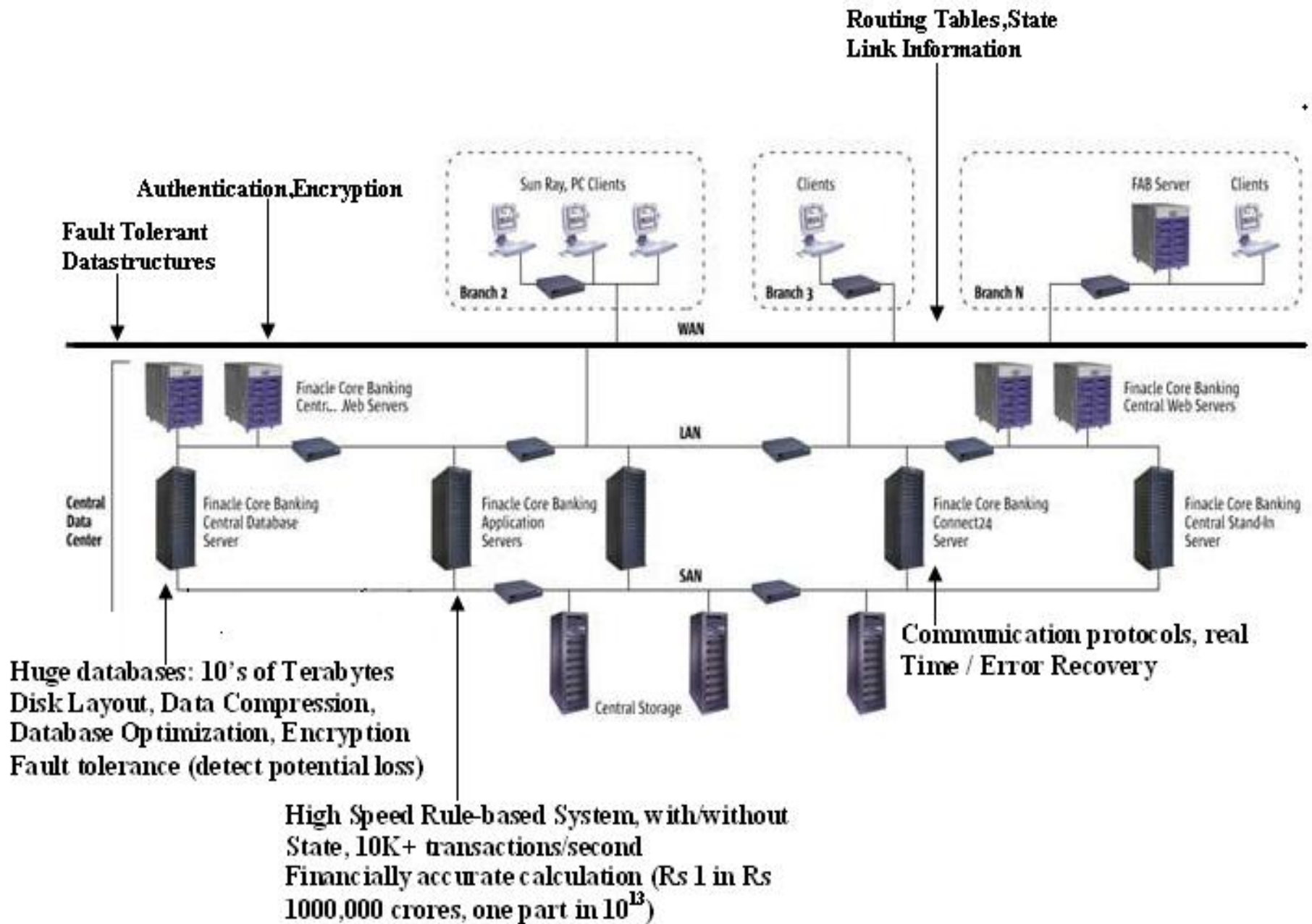
$F(n)=n$	$\lg(n)$	$n$	$n \lg n$	$n^2$	$n^3$	$2^n$
10	0.003 $\mu$ s	0.01 $\mu$ s	0.033 $\mu$ s	0.1 $\mu$ s	1 $\mu$ s	1 $\mu$ s
20	0.004 $\mu$ s	0.02 $\mu$ s	0.086 $\mu$ s	0.4 $\mu$ s	8 $\mu$ s	1 ms
30	0.005 $\mu$ s	0.03 $\mu$ s	0.147 $\mu$ s	0.9 $\mu$ s	27 $\mu$ s	1 s
40	0.005 $\mu$ s	0.04 $\mu$ s	0.213 $\mu$ s	1.6 $\mu$ s	64 $\mu$ s	18.3 min
50	0.006 $\mu$ s	0.04 $\mu$ s	0.282 $\mu$ s	2.5 $\mu$ s	125 $\mu$ s	13 days
$10^2$	0.007 $\mu$ s	0.10 $\mu$ s	0.664 $\mu$ s	10 $\mu$ s	1 ms	$4 \times 10^{13}$ yrs
$10^3$	0.010 $\mu$ s	1.0 $\mu$ s	9.966 $\mu$ s	1 ms	1 s	infinity
$10^4$	0.013 $\mu$ s	10 $\mu$ s	130 $\mu$ s	100 ms	16.7 min	Infinity
$10^5$	0.017 $\mu$ s	0.10 ms	1.67 ms	10 s	11.6 days	Infinity
$10^6$	0.020 $\mu$ s	1 ms	19.93 ms	16.7 min	31.7 years	Infinity
$10^7$	0.023 $\mu$ s	0.01 s	0.23 s	1.16 days	31,709 yrs	Infinity
$10^8$	0.027 $\mu$ s	0.1 s	2.66 s	115.7 days	$3.17 \times 10^7$ yrs	Infinity
$10^9$	0.030 $\mu$ s	1 sec	29.90 s	31.7 years	infinity	infinity

# ALGORITHM COMPLEXITY



Comparison of common complexity functions

Running time	1 sec	1min	1hour	With a twice faster processor in an hour	With a 256 times faster processor in an hour
$n$	$1.0 \cdot 10^6$	$6.0 \cdot 10^7$	$3.6 \cdot 10^9$	$6.1 \cdot 10^9$	$9.2 \cdot 10^{11}$
$n^2$	1414	10984	169744	339488	4073856
$n^4$	31	88	244	488	1952
$2^n$	19	25	31	32	39



# Heterogeneous scenario- issues

<b>Critical module</b>	<b>Parallelism</b>	<b>Serialism</b>
Primary Modules	Back Up modules	Distributed Processing



# Research Scope

- ◉ Selection of design strategy based on problem characteristics
- ◉ Selection of heuristics based on suitability of NP problems

# Choosing a best Design strategies

- Brute Force
- Decrease and conquer
- Dynamic Programming
- Divide and conquer
- Greedy programming
- Backtracking
- Branch and bound
- Pruning strategy

# Choosing a best Heuristics for a NP Problem

- Artificial intelligence
- Approximation algorithms
- Randomized Algorithms
- Swarm Intelligence
- Hill climbing
- Genetic Programming
- Neural Networks
- Linear Programming

A pink bullseye icon consisting of a solid pink circle in the center, surrounded by a white ring, which is further surrounded by a pink ring.

Thanks