

ACM Symposium on Principles of Distributed Computing - PODC

ROUTING THE INTERNET WITH VERY FEW ENTRIES

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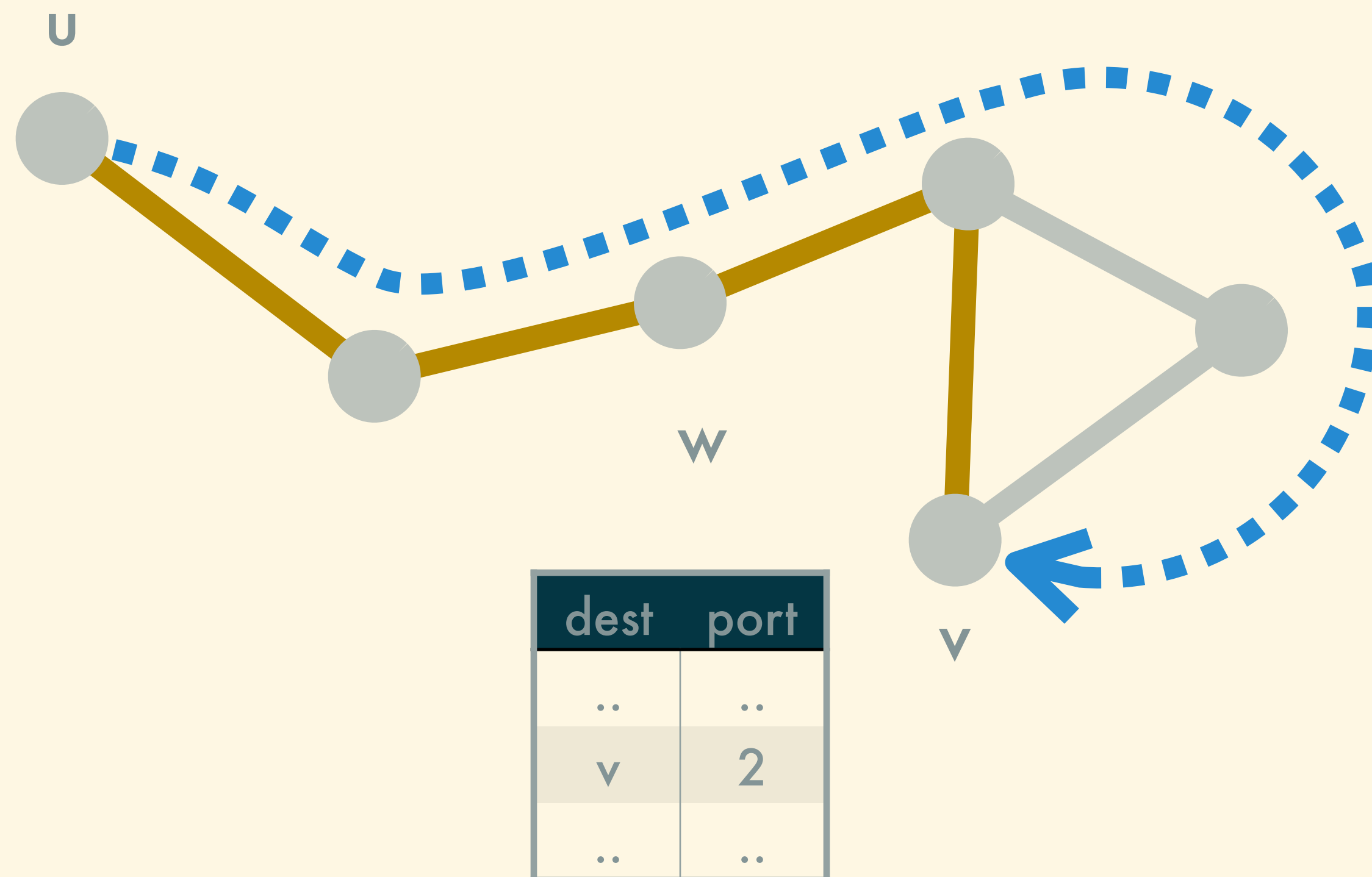
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TRADEOFFS

Memory vs. Stretch



MEMORY

entries stored per node

Route length $(u,v) = 5$

Distance $(u,v) = 4$

Stretch $(u,v) = 5/4$

STRETCH

maximal stretch over all pairs

EXISTING RESULTS

For general graphs

	Stretch	Memory
Folklore	1	n
[AGMNT'08]	3	$O(\sqrt{n})$
[AGM'06]	$< 2k+1$	$\Omega(n^{1/k})$

EXISTING RESULTS

For general graphs

	Stretch	Memory
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[AGM'06]	$< 2k+1$ < 3	$\Omega(n)$ $\Omega(n^{1/k})$

EXISTING RESULTS

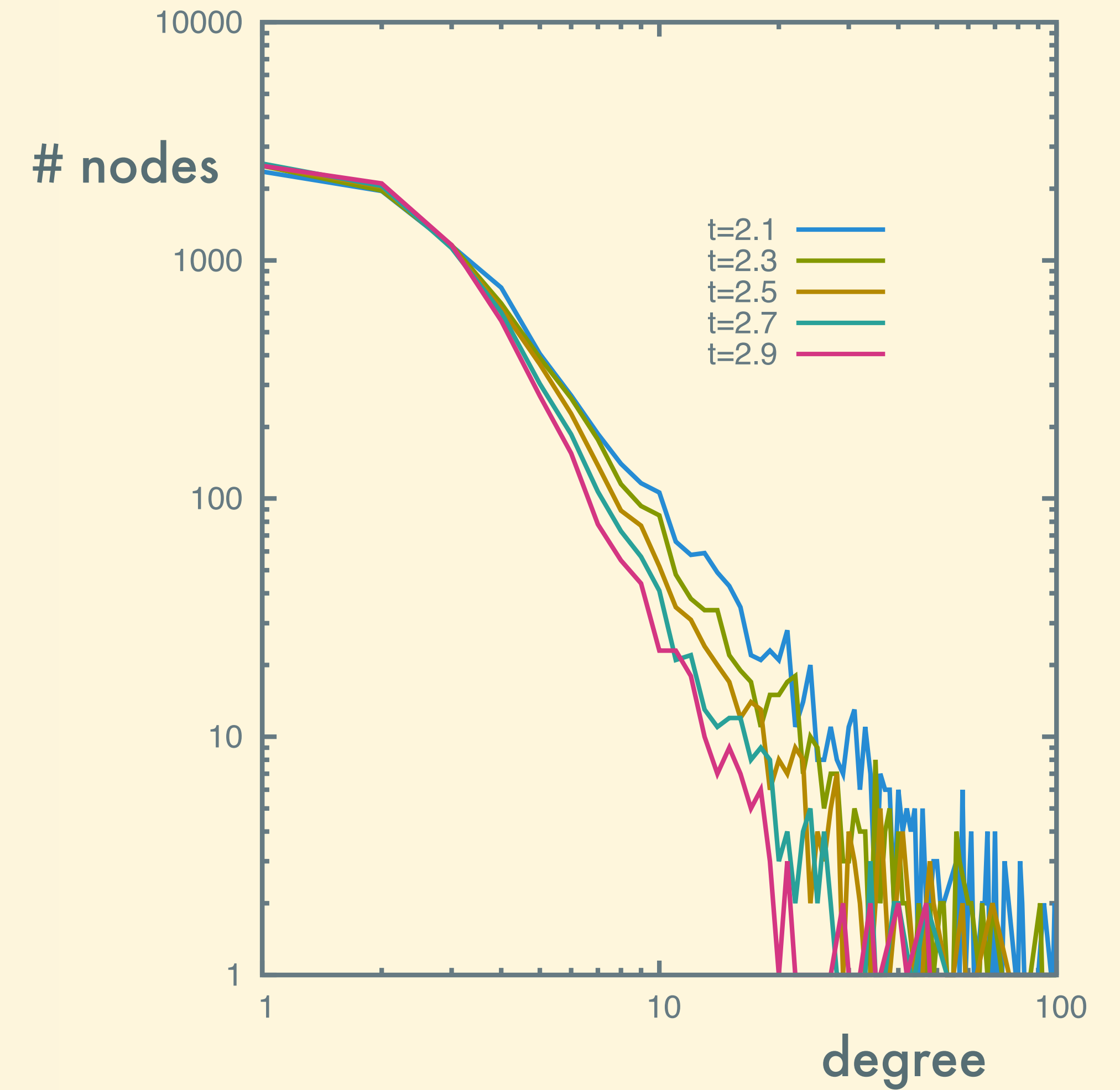
For general graphs

	Stretch	Memory
Folklore	1	n
[AGMNT'08]	3	$O(\sqrt{n})$
[AGM'06]	$< 2k+1$	$\Omega(n)$ $\Omega(\sqrt{n})$
	< 3 < 5	$\Omega(n^{1/k})$

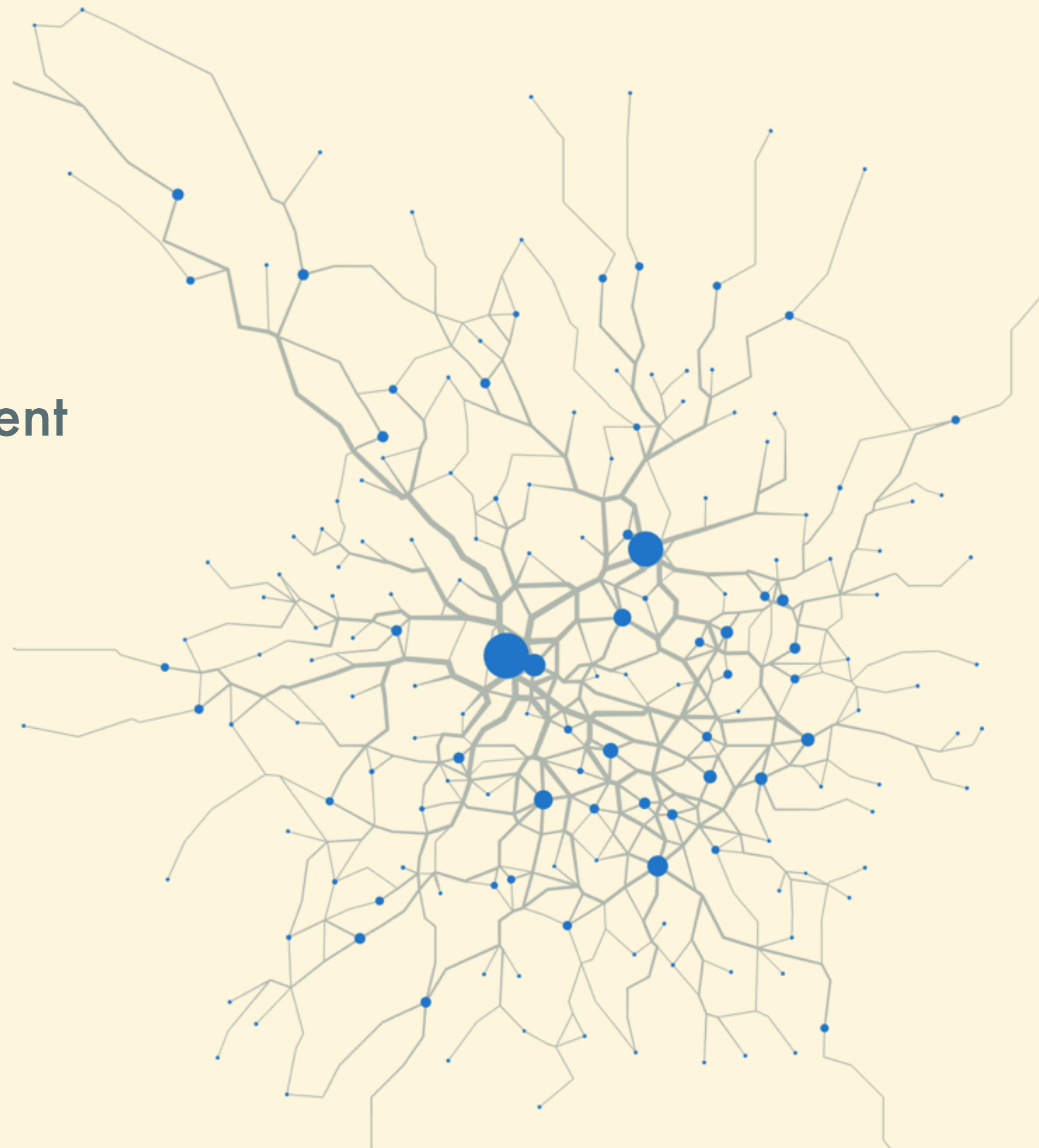
INTERNET-LIKE GRAPHS

(RPLG)

degree distribution



Power-law exponent
 $t = 2.1$



PREVIOUS WORK / OUR SOLUTION

For RPLG

		Stretch	Memory	
			average	maximum
Labeled!	[CSTW'12]	5	$O(n^{(t-2)/(2t-3)})$ [$n^{1/12}$]	
	[TZLL'13]	≥ 6	$O(\sqrt{n})$	$O(n)$
	THIS PAPER	5	$O(n^{1/(t-1)+t-3})$ [$n^{1/110}$]	$O(n^{1-1/(t-1)})$ [$n^{1/11}$]

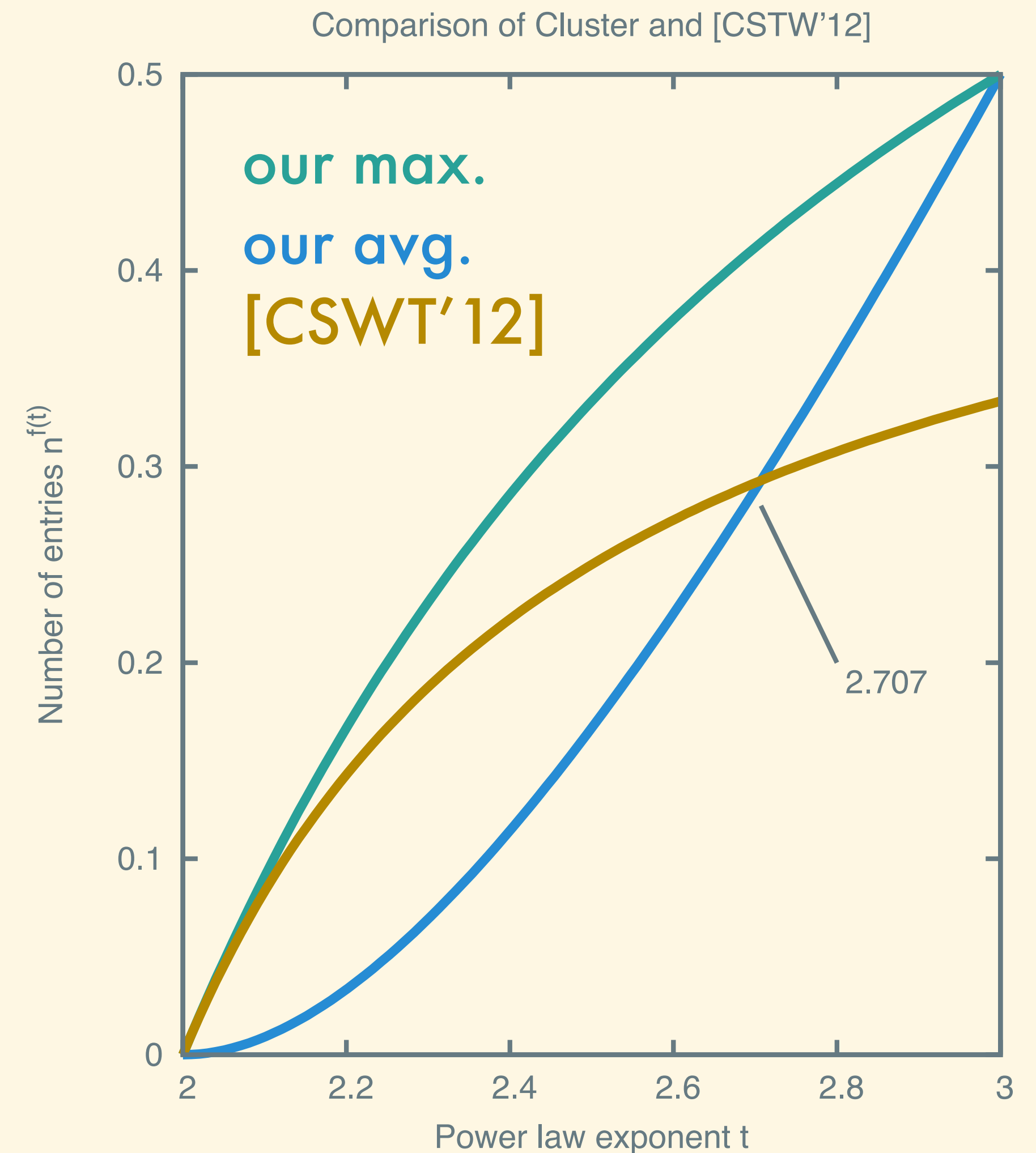
for $t=2.1 \ll [\dots] \gg$

OUR SOLUTION

Theoretical comparison with [CSWT'12]

- ▶ if $t < 2.707$ our avg. memory is smaller
- ▶ [CSTW'12]:
 - ▶ has a smaller theoretical max. memory
 - ▶ but is a labeled scheme!
- ▶ For small values of t , hidden constants may play an important role

What is the performance in practice?



OUR SOLUTION

Experimental results on RPLG $t=2.1$

	avg stretch	memory	
		average	maximum
[AGMNT'08]	1.56	396	1 143
Labeled! [CSTW'12]	1.30	55.2	580
[TZLL'13]	1.24	404	1 877
THIS PAPER	1.75	6.47	228

OUR SOLUTION

Experimental results on the AS-graph 16K nodes

	avg stretch	memory	
		average	maximum
[AGMNT'08]	1.74	465	1 261
Labeled! [CSTW'12]	1.18	24	687
[TZLL'13]	1.52	106	2 324
THIS PAPER	1.59	4.05	415

THANK YOU