Presenting Your Work

(Without putting the audience to sleep)

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Scientific Papers

So boring…

where there are no faults, and to activate additional sleeping replicas only upon failures. By multiplexing fewer replicas onto a given set of shared servers, our approach is able to provide more server capacity to each replica, and thereby achieve higher throughput and lower response times for request executions. In the worst case where all applications experience simultaneous faults, our approach requires an additional f replicas per application, matching the overhead of the $2f+1$ approach. However, in the common case where only a *subset* of the data center applications are experiencing faults, our approach requires fewer replicas in total, yielding response time and throughput benefits. Like [Yin 2003], our system still requires $3f+1$ agreement replicas; however, we argue that the overhead imposed by agreement replicas is small, allowing such replicas from multiple applications to be densely packed onto physical servers.

The ability to quickly activate additional replicas upon fault detection is central to our ZZ approach. While any mechanism that enables fast replica activation can be employed in ZZ, in this paper, we rely upon virtualization—a technique already employed in modern data centers—for on-demand replica activation.

The following are our contributions. We propose a practical solution to reduce the cost of BFT to nearly $f+1$ execution replicas and define formal bounds on ZZ's replication cost. As reducing the execution cost in ZZ comes at the expense of potentially allowing faulty nodes to increase response times, we analyze and bound this response time inflation and show that in realistic scenarios malicious applications cannot significantly reduce performance. We also im-

	PBFT'99	SEP'03	Zyzzyva'07	ZZ
Agreement replicas	$3f+1$	$3f+1$	$3f+1$	$3f+1$
Execution replicas	$3f+1$	$2f+1$	$2f+1$	$(1+r)f+1$
Agreement MACs/req per replica	$2+\frac{8f+1}{b}$	$2+\frac{12f+3}{b}$	$2+\frac{3f}{b}$	$2+\frac{10f+3}{b}$
Minimum work/req (for large b)	$(3f+1)\cdot(E+2\mu)$	$(2f+1)E+(3f+1)2\mu$	$(2f+1)E+(3f+1)2\mu$	$(f+1)E+(3f+1)2\mu$
Maximum throughput (if $E \gg \mu$)	$\frac{1}{(3f+1)E}$	$\frac{1}{(2f+1)E}$	$\frac{1}{(2f+1)E}$	$\frac{1}{(f+1)E}$

Table 1. ZZ versus existing BFT approaches. Here, f is the number of allowed faults, b is the batch size, E is execution cost, μ is the cost of a MAC operation, and $r \ll 1$ is a variable formally defined in §4.3.3. All numbers are for periods when there are no faults and the network is well-behaved.

number corresponding to Q, execute it in that order, and send responses back to the client. When the client receives $f+1$ valid and matching responses from different replicas, it knows that at least one correct replica executed Q in the correct order. Figure 1(a) illustrates how the principle of separating agreement from execution can reduce the number of execution replicas required to tolerate up to f faults from $3f+1$ to $2f+1$. In this separation approach [Yin 2003], the client sends Q to a primary in the agreement cluster consisting of $3f+1$ lightweight machines that agree upon the sequence number i corresponding to Q and send $[Q,i]$ to the execution cluster consisting of $2f+1$ replicas

Algorithm 1 MapReduce Job Profiling Algorithm.

Input: Q: queue of incoming jobs, each specifying the input data size and/or cluster size; $DB_{profile}$: profile database, containing historic observations of job completion times (JCTs) (end-to-end and separate for map and reduce phases), along with the corresponding cluster sizes and input data set sizes.

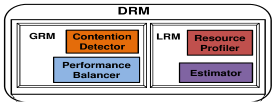
```
for each job J_i in Q=J_1,J_2,...,J_n do
  if LOOKUP_CLUSTERSIZE(DB_profile, J_i) ≠ NULL &
  LOOKUP_DATASIZE(DB_profile, J_i) ≠ NULL then
    JCTestimated=Retrieve(DB_profile, J_i(csize), J_i(dsize))
  else if DB_profile does not contain exact match for J_i's input configuration then
    if DB_profile contains different data size values for the same cluster size (see Figure 5 (d)) then
      Do linear extrapolation to get JCT_estimated
    else if DB_profile contains different cluster size values for the same data size then
      Do separate Map and Reduce phase based extrapolation to get JCT_estimated (see Figures 5 (a), (b), (c))
    end if
  end if
  return JCT_estimated
end for
```

Algorithm 2 Job Placement Algorithm.

Input: Q: queue of incoming jobs; $Inputload$: number of clients for transactional or data size for MapReduce job; $P\_CLUSTER$: cluster of physical nodes; $V\_CLUSTER$: cluster of virtual nodes; $JCT_{desired}$[]: vector of jobs desired completion times.

```
for each job J_i in Q=J_1,J_2,...,J_n do
  if J_i ∈ transactional workload then
    Place J_i on V_CLUSTER
```

and MapReduce jobs in order to comply with the SLA of interactive jobs, while providing the best effort performance guarantees to the MapReduce applications. Figure 7 shows the overall architecture of the Phase II Scheduler. It is composed of two main components: (i) a *Dynamic Resource Manager (DRM)*; and (ii) an *Interference Prevention System (IPS)*. The DRM monitors the available capacity on each VM to guide the placement of MapReduce jobs within the virtual cluster. DRM records the resource consumption and completion times of each task. This information is used to build a model for each MapReduce job that correlates the resource allocation to the constituent task completion time, allowing the scheduler to make intelligent placement decisions. The IPS is an online monitor that observes the performance of the interactive applications within the cluster to detect when they are not receiving sufficient resources to meet their demands. If any interference is detected, then the responsible map/reduce tasks are properly handled. For example, the VM running the task can have its resource share decreased, can simply be paused, or it can even be migrated to a different host to mitigate the observed interference. Even if the VM is aborted, the correctness of the corresponding MapReduce job is not affected, since the MapReduce master would initiate speculative execution [16], assuming the task as a prospective straggler.



8. Related Work

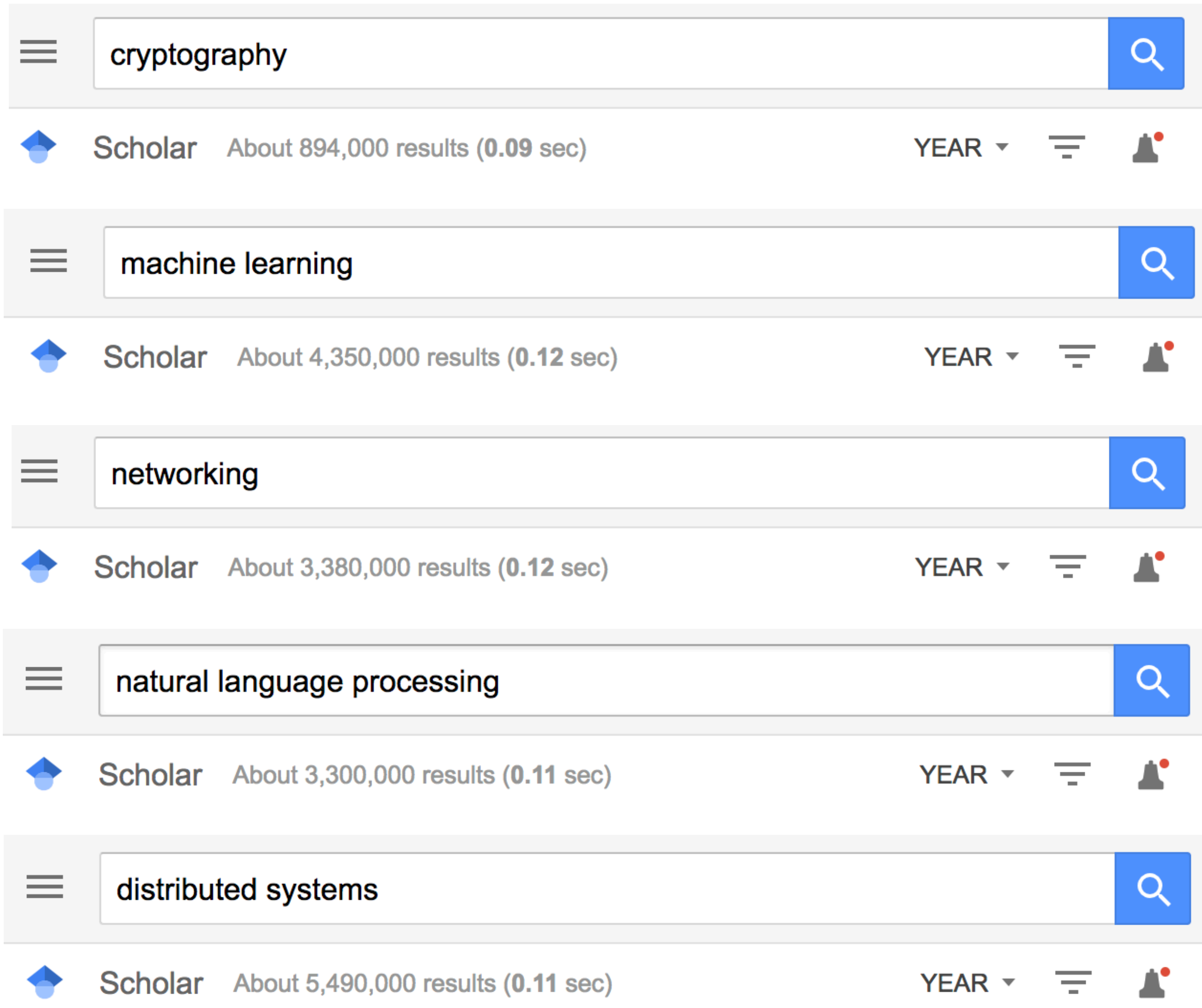
Transparent page sharing in a virtual machine hypervisor was implemented in the Disco system [3]; however it required guest operating system modification, and detected identical pages based on factors such as origin from the same location on disk. Content-based page sharing was introduced in VMware ESX [27], and later in Xen [11]. These implementations use background hashing and page comparison in the hypervisor to transparently identify identical pages, regardless of their origin. Since our prototype lacks access to the memory hashes gathered by the hypervisor, we duplicate this functionality in the guest OS. In Memory Buddies, however, we extend the use of these page content hashes in order to detect the potential for memory sharing between distinct physical hosts, rather than within a single host.

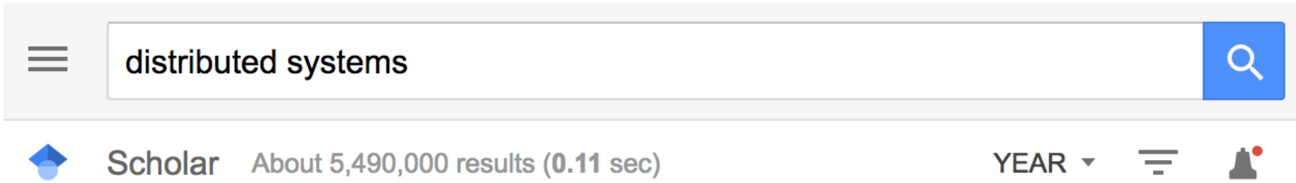
The Difference Engine system was recently proposed as a means to enable even higher degrees of page sharing by allowing portions of similar pages to be shared [8]. Although Memory Buddies has preliminary support for detecting sub-page sharing across machines by using multiple hashes per page, it currently relies on ESX's sharing functions which do not support sub-page level sharing. We believe that as the technologies to share memory become more effective and efficient, the benefits of using page sharing to guide placement will continue to rise.

Process migration was first investigated in the 80's [19; 26]. The re-emergence of virtualization led to techniques for virtual machine migration performed over long time scales in [22; 28; 12]. The means for "live" migration of virtual machines incurring downtimes of only tens of milliseconds have been implemented in both Xen [5] and VMware [18]. At the time of writing, however, only VMware ESX server supports both live migration and page sharing simultaneously.

Scientific Papers

So many…





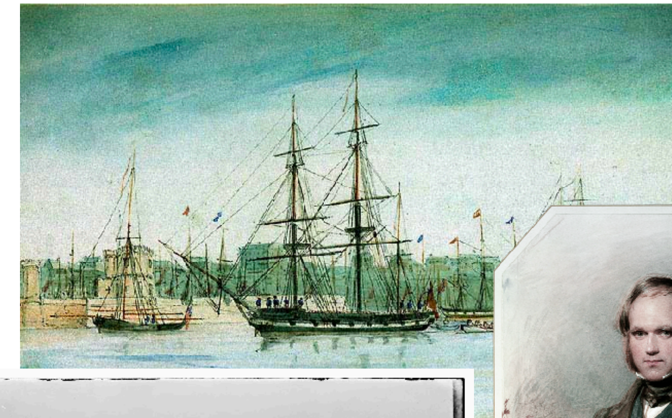
Why would anyone even bother to read my paper?

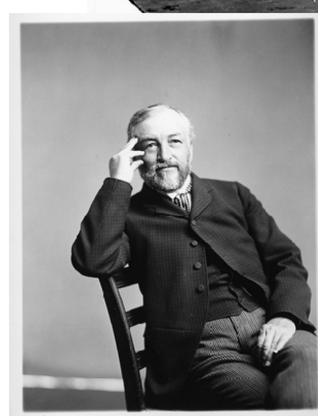
Stories

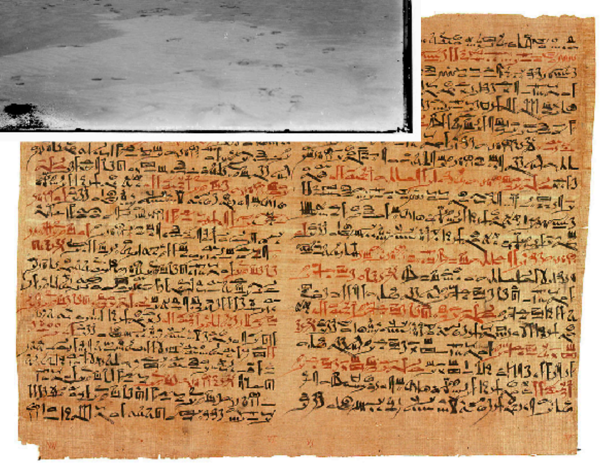
So much better!

Darwin traveled the globe on the HMS Beagle…

The Wright Bros went from bicycle salesmen to inventors of flight…







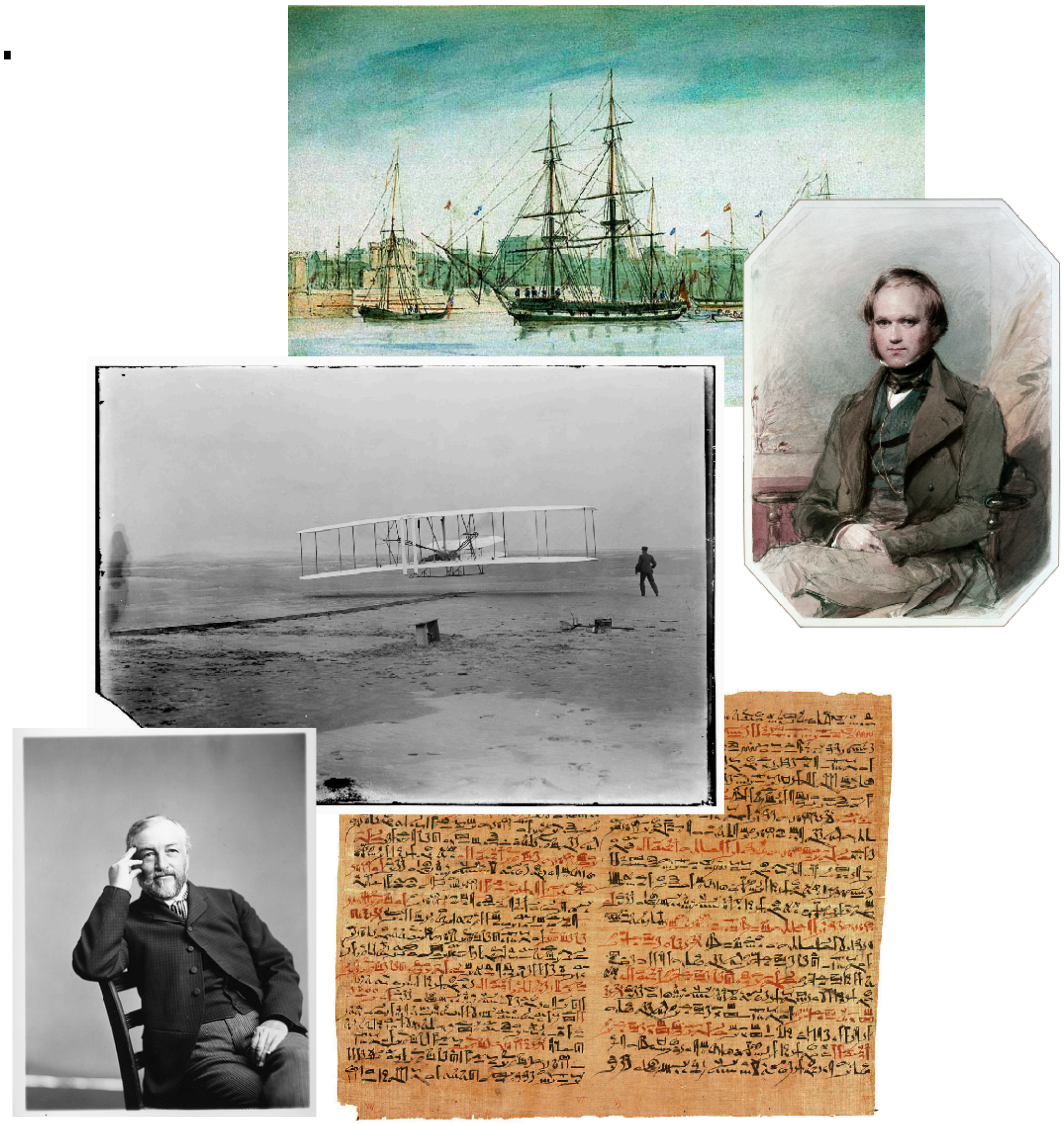
Stories

Science is about facts…

But people love stories.

People remember and pay attention to stories

People are inspired by stories



Writing Science Stories

Your posters, papers, and presentations must be:

- Factual, accurate, unbiased, detailed, comprehensive

But they should also be

- Interesting
- Memorable
- Engaging

How to do this?


The world is a terrible, terrible place.


But imagine how wonderful it could be if we could figure out how to do X!


My work helps us get one step
closer to the magical dream world!

Recipe for a roller coaster

But imagine how wonderful it could be if we could figure out how to do X!

My work helps us get one step closer to the magical dream world!

The world is a terrible, terrible place.

You don’t have to be perfect!

Recipes make it easy!

Following this flow makes it easy to make a compelling presentation or paper

Gives you an outline so you know where to start

Gives you a reliable structure that draws in the audience

With this as a base you can expand as needed

Example?

This presentation…

People love stories, if your paper/presentation can be a fun story, everyone will want to see it!

With the right recipe, you can hook the audience and keep their attention!

Papers are boring, unpleasant to read, and hard to write!

Presentation Tips

Tips

Know your audience

How to use this information?

Tips

Know your audience

How to use this information?

You need to:

- Pick the right level of detail
- Decide how much background to cover
- Understand the community “norms” so your presentation fits in
- …

Tips

Limit your number of points

How many main ideas should you have?

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Limit your number of points

How many main ideas should you have?

Three main points

- Details within those points
- but audience will only remember the high level stuff at best

Tips

Use metaphors, images, and stories

Do you need bullets? lots of text?

- Why do these slides have bullets?
- Why do these slides have words?

Tips

Use metaphors, images, and stories

Do you need bullets? lots of text?

- Why do these slides have bullets?
- Why do these slides have words?
  - Because I don't want to spend the time finding good visuals
  - So that I (the presenter) can remember what to say
  - So that a month from now you can look back at the slides
  - **None of these may be relevant for your presentations!**

Tips

Repetition and consistency

- Build a vocabulary with images and words to use throughout

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Repetition and consistency

- Build a vocabulary with images and words to use throughout

Repeat the important points!

- People have limited memories (e.g., max of 3 main points)
- Reinforce the parts you want them to remember

1. Tell them what you will tell them,
2. Tell them,
3. Tell them what you told them

(but try not to be quite this repetitive)

The 7 Things

Eye Contact

Volume

Bad Words

Gestures

Posture

Voice Modulation

Smiles/Happiness

The ~~7~~ 3 Things

Speak clearly

- Volume, Bad Words

Position your body

- Gestures, Posture

Engage the audience

- Voice Modulation, Smiles, Eye Contact

How to get better?

Practice!

Watch videos of good presenters

- Steve Jobs iPod announcement (first 9 min): https://www.youtube.com/watch?v=uvsuAZFem88
- Steve Jobs 3 new products (first ~2 min): https://www.youtube.com/watch?v=7ABFW6rv15g
- Andrew Blum on the Internet: https://www.ted.com/talks/andrew_blum_what_is_the_internet_really
- Suzie Sheehy on Curiosity in Research: https://www.ted.com/talks/suzie_sheehy_the_case_for_curiosity_driven_research
- James Mickens on Security (first 6 min): https://www.youtube.com/watch?v=tF24WHumvIc
- Nancy Duarte on the structure of presentations: https://www.ted.com/talks/nancy_duarte_the_secret_structure_of_great_talks

Practice with someone not in your field

Your Research Pitch

Introduce yourself and explain your interest

Think about:

- What are the $\leq$ 3 key points you want us to remember?
  - Are they about your research content? Or about YOU?
- How can you make an impact to stand out?

Speak clearly

Volume, Bad Words

Position your body

Gestures, Posture

Engage the audience

Voice Modulation, Smiles, Eye Contact