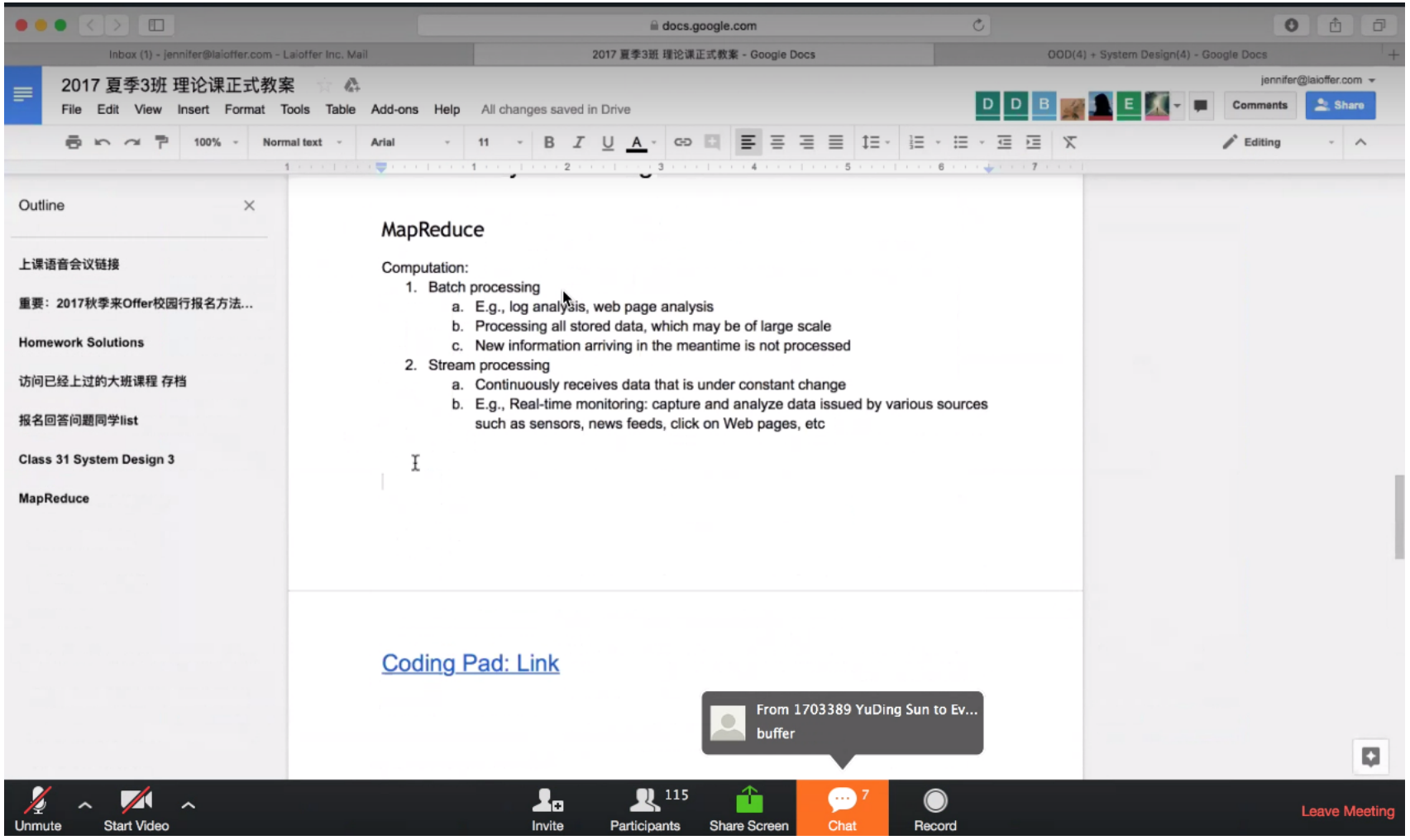
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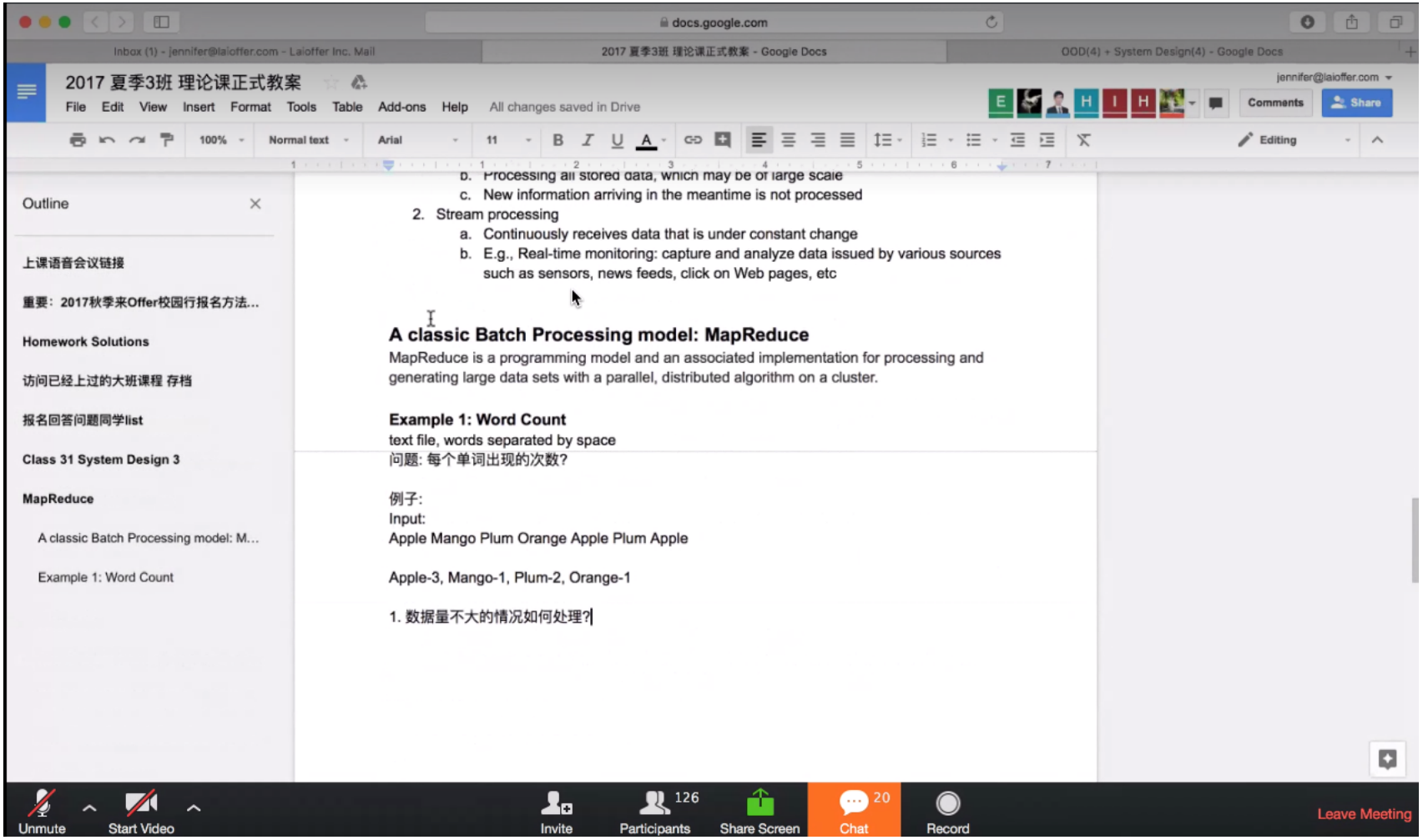
MapReduce
MapReduce
Computation:
1. Batch processing
a. E.g., log analysis, web page analysis
b. Processing all stored data, which may be of large scale
c. New information arriving in the meantime is not processed
2. Stream processing
a. Continuously receives data that is under constant change
b. E.g., Real-time monitoring: capture and analyze data issued by various sources such as sensors, news feeds, click on Web pages, etc
Coding Pad: Link
From 1703389 YuDing Sun to Ev...
buffer
Unmute
Start Video
Invite
115
Participants
Share Screen
7
Chat
Record
Leave Meeting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MapReduce
A classic Batch Processing model: M...
Example 1: Word Count
b. Processing all stored data, which may be of large scale
c. New information arriving in the meantime is not processed
2. Stream processing
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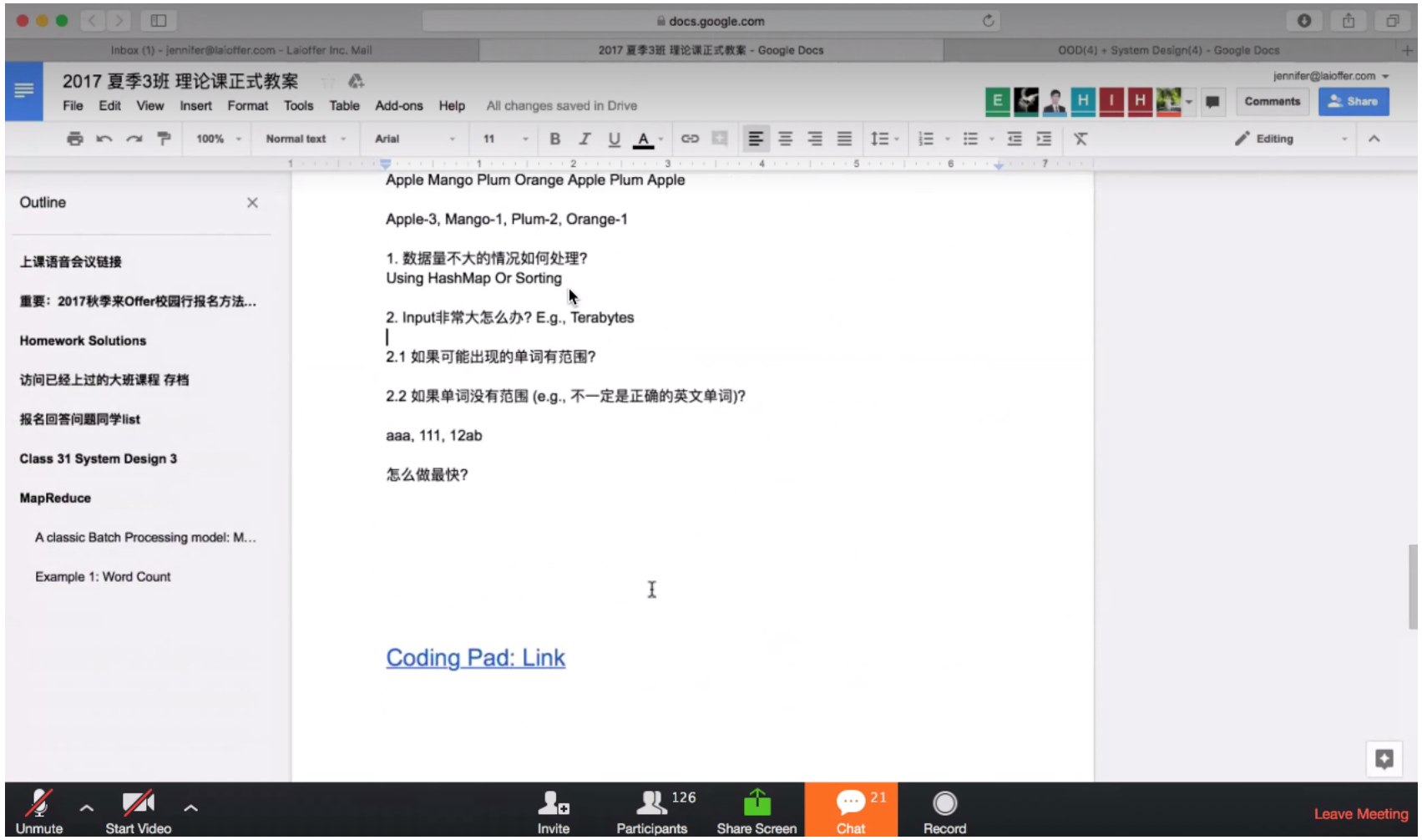
b. E.g., Real-time monitoring: capture and analyze data issued by various sources such as sensors, news feeds, click on Web pages, etc
A classic Batch Processing model: MapReduce
MapReduce is a programming model and an associated implementation for processing and generating large data sets with a parallel, distributed algorithm on a cluster.
Example 1: Word Count
text file, words separated by space
问题: 每个单词出现的次数?
例子:
Input:
Apple Mango Plum Orange Apple Plum Apple
Apple-3, Mango-1, Plum-2, Orange-1
1. 数据量不大的情况如何处理?
Unmute
Start Video
Invite
126
Participants
Share Screen
20
Chat
Record
Leave Meeting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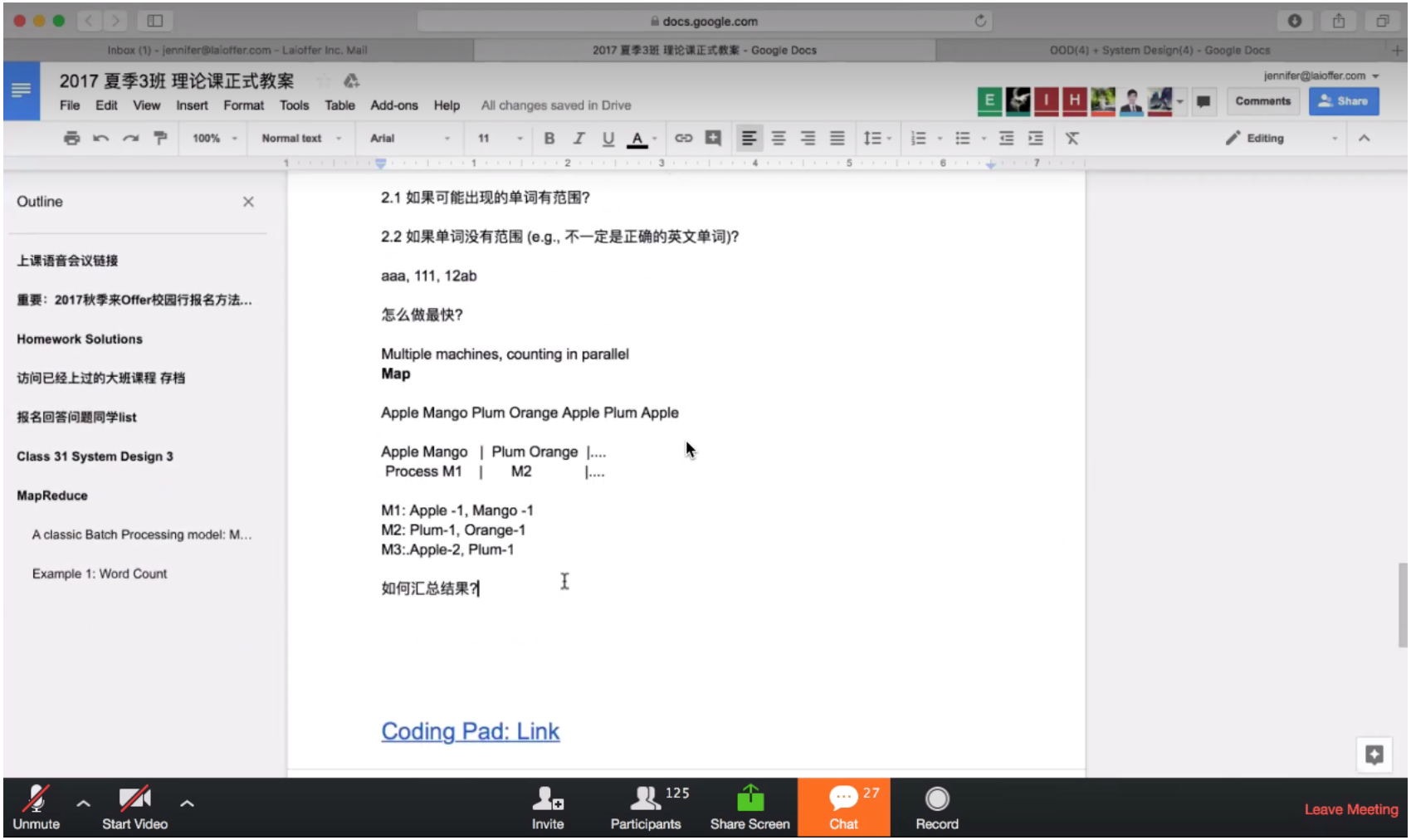
Apple Mango Plum Orange Apple Plum Apple
Apple-3, Mango-1, Plum-2, Orange-1
1. 数据量不大的情况如何处理?
Using HashMap Or Sorting
2. Input非常大怎么办? E.g., Terabytes
2.1 如果可能出现的单词有范围?
2.2 如果单词没有范围 (e.g., 不一定是正确的英文单词)?
aaa, 111, 12ab
怎么做最快?
Coding Pad: Link
Unmute
Start Video
Invite
126
Participants
Share Screen
21
Chat
Record
Leave Meeting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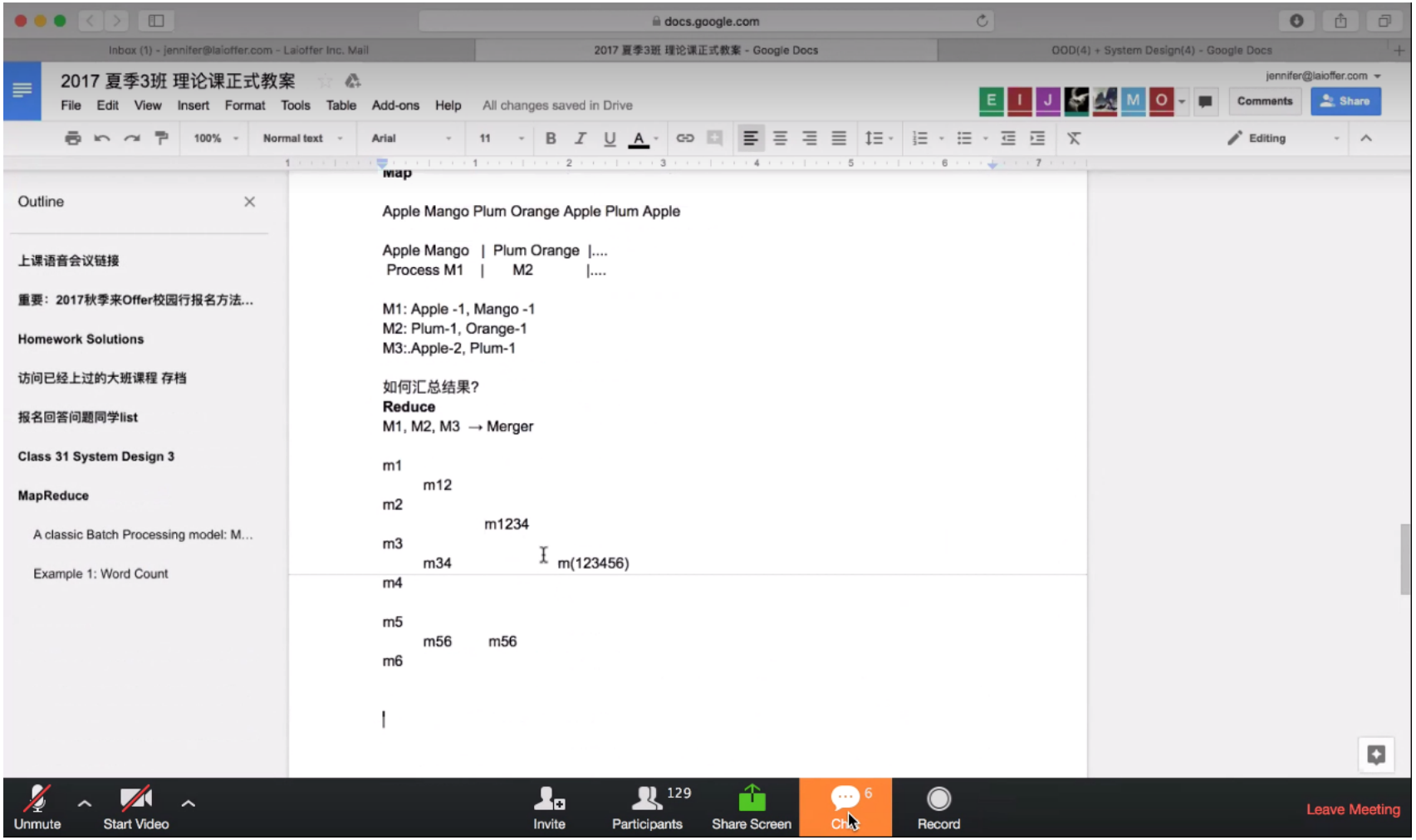
2.2 如果单词没有范围 (e.g., 不一定是正确的英文单词)?
aaa, 111, 12ab
怎么做最快?
Multiple machines, counting in parallel
Map
Apple Mango Plum Orange Apple Plum Apple
Apple Mango | Plum Orange |....
Process M1 | M2 |....
M1: Apple -1, Mango -1
M2: Plum-1, Orange-1
M3:.Apple-2, Plum-1
如何汇总结果?
Coding Pad: Link
Unmute
Start Video
Invite
125
Participants
Share Screen
27
Chat
Record
Leave Meeting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Example 1: Word Count
Map
Apple Mango Plum Orange Apple Plum Apple
Apple Mango | Plum Orange |....
Process M1 | M2 |....
M1: Apple -1, Mango -1
M2: Plum-1, Orange-1
M3:.Apple-2, Plum-1
如何汇总结果?
Reduce
M1, M2, M3 → Merger
m1
m12
m2
m1234
m3
m34
m(123456)
m4
m5
m56
m56
m6
Unmute
Start Video
Invite
Participants
129
Share Screen
Chat
6
Record
Leave Meeting

Outline

b. Map tasks typically split into FS block size
c. Map tasks scheduled so HDFS/GFS input block replica are on same machine or same rack

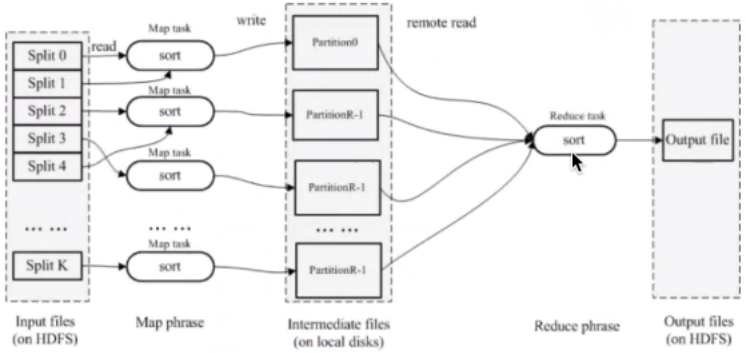
Example 2: Terasort

How to quickly sort 1TB data?

每条数据可以看成是一个字符串或者byte[], 比如 aaa < abc

Solution 1:

把原有的数据分布到多个节点上分别排序,最后归并排序.



瓶颈: 归并排序. 单独一个reducer需要处理所有的数据

Solution 2:

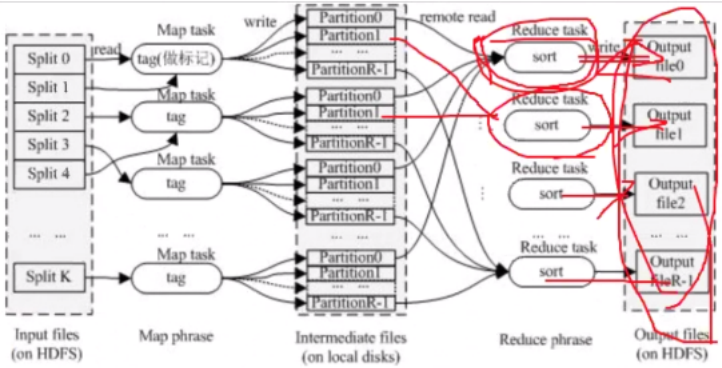
1) 在map阶段, 每个map task都会将数据划分成R个数据块(R为reduce task个数), 其中第i(i>0)

E.g., 一个简单的划分策略可以是: 根据每条数据的第一个char划分 (0~9, A~Z, a~z...)

2) 各个mapper分别进行排序.

3) 在reduce阶段, 第i个reduce task处理所有map task的第i块, 这样第i个reduce task产生的结果均会比第i+1个小. -- Shuffle based on partitions

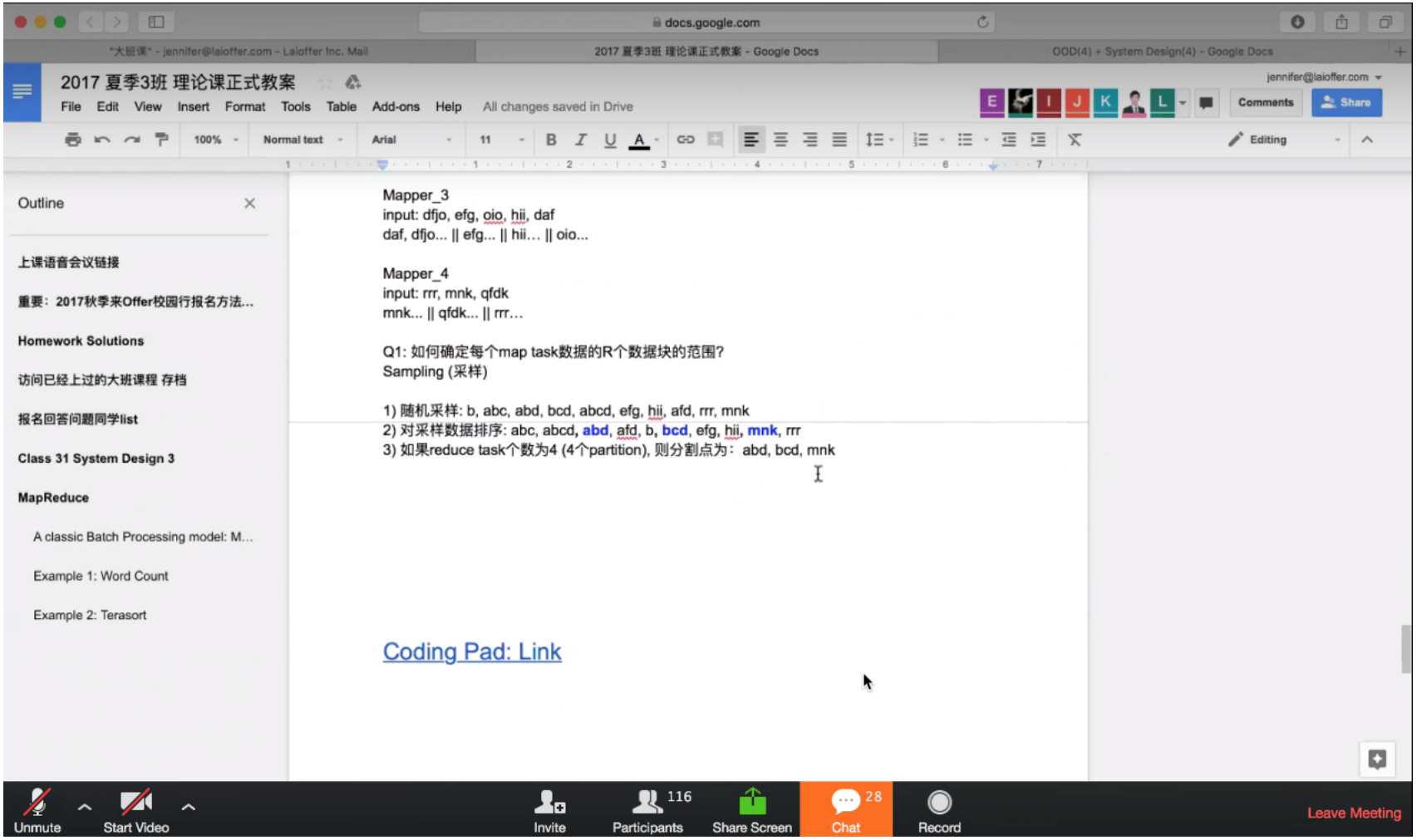
4) 最后将1~R个reduce task的排序结果顺序输出, 即为最终的排序结果.



E.g.
a, b, abc, gif, jpg, haha, abd, bcd, salfjd, abcd, dfj ...

How to define the partitions? Simplest rule: partition based on the first character

From 1705098 Yu Cai to Everyone
那个tag做标记是干什么的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MapReduce
A classic Batch Processing model: M...
Example 1: Word Count
Example 2: Terasort
Mapper_3
input: dfjo, efg, oio, hii, daf
daf, dfjo... || efg... || hii... || oio...
Mapper_4
input: rrr, mnk, qfdk
mnk... || qfdk... || rrr...
Q1: 如何确定每个map task数据的R个数据块的范围?
Sampling (采样)
1) 随机采样: b, abc, abd, bcd, abcd, efg, hii, afd, rrr, mnk
2) 对采样数据排序: abc, abcd, abd, afd, b, bcd, efg, hii, mnk, rrr
3) 如果reduce task个数为4 (4个partition), 则分割点为： abd, bcd, mnk
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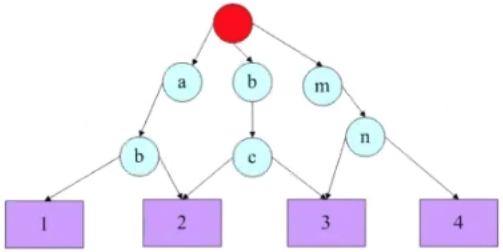
Outline

mnk... || qfdk... || rrr...

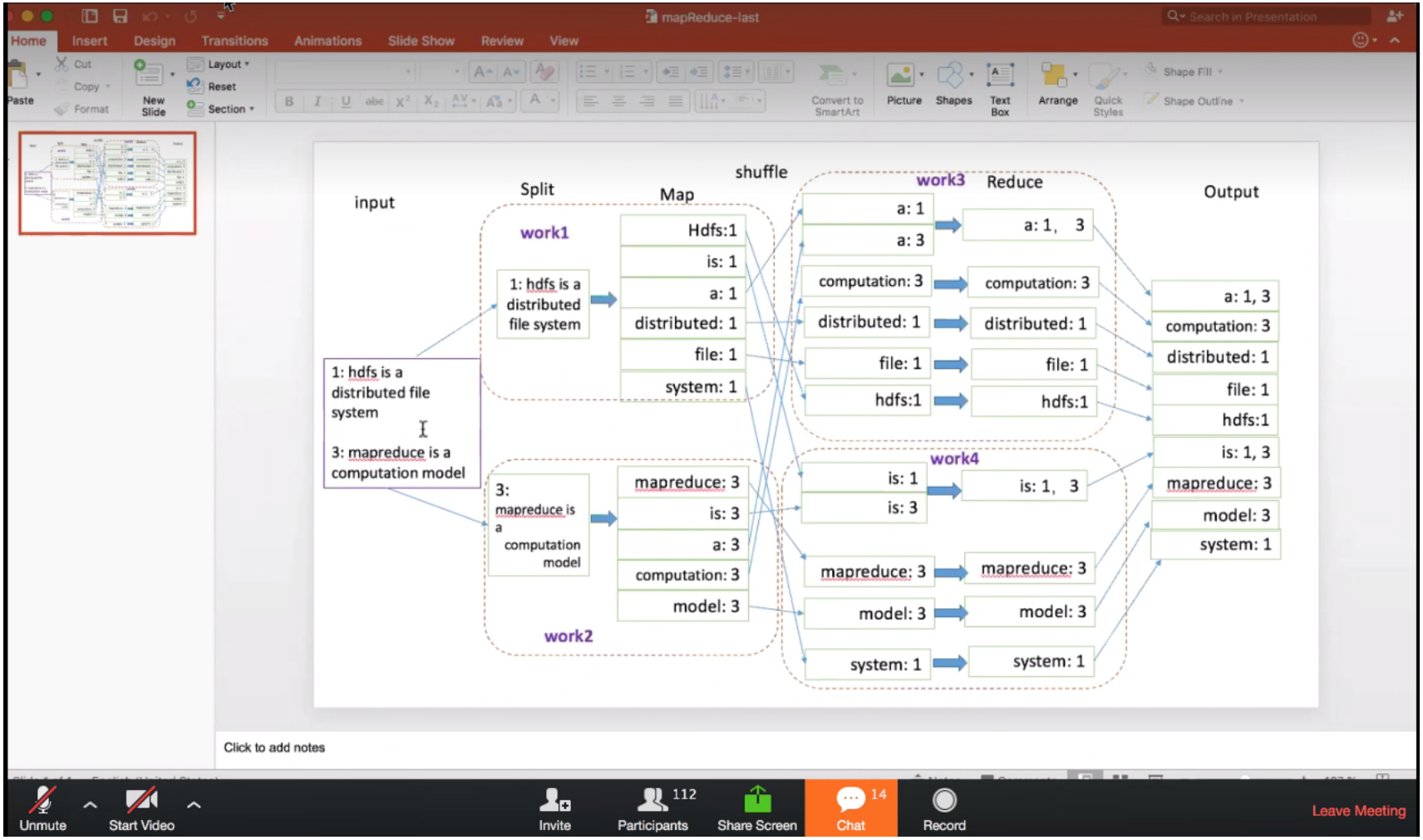
Q1: 如何确定每个map task数据的R个数据块的范围?
Sampling (采样)

1) 随机采样: b, abc, abd, bcd, abcd, efg, hii, afd, rrr, mnk
2) 对采样数据排序: abc, abcd, **abd**, afd, b, **bcd**, efg, hii, **mnk**, rrr
3) 如果reduce task个数为4 (4个partition), 则分割点为： abd, bcd, mnk

Q2: 对于某条数据, 如何快速的确定它属于哪个数据块? (发生在每一个mapper里)
每一条数据是一个字符串! 使用2层trie树 (prefix tree): 基于分割点的头两个字母构建trie树.



比如如果数据是aaa, 通过trie树可以立刻知道aaa应该被分在partition 1 (aaa的头两个字母小于ab). 如果数据是dfgh, 那么应该被分在partition 3.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Home
Insert
Design
Transitions
Animations
Slide Show
Review
View
input
Split
Map
shuffle
work3
Reduce
Output
work1
1: hdfs is a distributed file system
3: mapreduce is a computation model
Hdfs:1
is: 1
a: 1
distributed: 1
file: 1
system: 1
work2
3: mapreduce is a computation model
mapreduce: 3
is: 3
a: 3
computation: 3
model: 3
a: 1
a: 3
a: 1, 3
computation: 3
distributed: 1
file: 1
hdfs:1
work4
is: 1
is: 3
is: 1, 3
mapreduce: 3
model: 3
system: 1
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