

Peer To Peer Trading for Storage Space

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Tutorial Overview

- Introduction
- Data Archiving Systems and Information Replication:
 - Basics on Data Preservation
 - Traditional Data Management Schemes & Peer To Peer Trading Systems
 - Data Trading
- Trading Process:
 - Deeper into the Trading Process
 - Bid Trading
- Conclusions

Introduction

- Preserving Data Motivations:
 - Maximize information reliability
 - Protect important data collections from failure by making multiple copies
- Autonomous Organizations or Archiving Networks ?
- Digital Archives Sites Tasks:
 - Making multiple data copies
 - Trading for storage space
 - Providing on-line access to stored information

Data Archiving Systems and Information Replication : Basics on Data Preservation

■ Archiving Sites:

- Storage Space
- Collections
- Clients

■ Reliability:

- Site Reliability
- Local Data Reliability
- Global Data Reliability

1, 3	2,3	1,2,3
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A

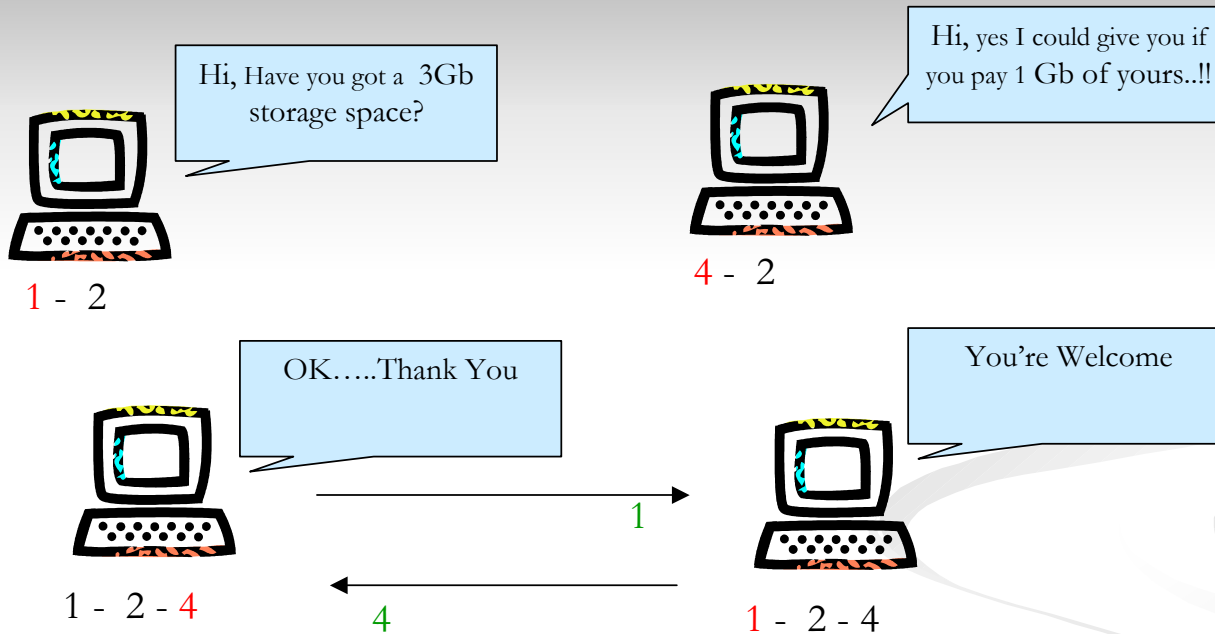
B

C

Data Archiving Systems and Information Replication : Traditional Data Management Schemes & Peer To Peer Trading System

1. Replicated DBMS
2. RAID
3. Replicated FileSystems
4. P2P : gnutella, freenet
5. Archival Intermemory, Offsites Backup
6. Community Preservation Approach

Data Archiving Systems and Information Replication : Data Trading \1



Sites “**trade**” space when each site contributes storage resources to others and uses storage at others

Data Archiving Systems and Information Replication :

Data Trading \2

- *G: replication goal*
- *R: retry policy* followed by a site
 - ACTIVE: in which it initiates tradings
 - PASSIVE: in which it waits to be contacted by other sites to make further copies.
- *C: collection copy policy*
- *A: storage space advertising policy*
- *S: trading strategy*

Data Archiving Systems and Information Replication : Data Trading \3

■ Collections or Deeds Trading ?

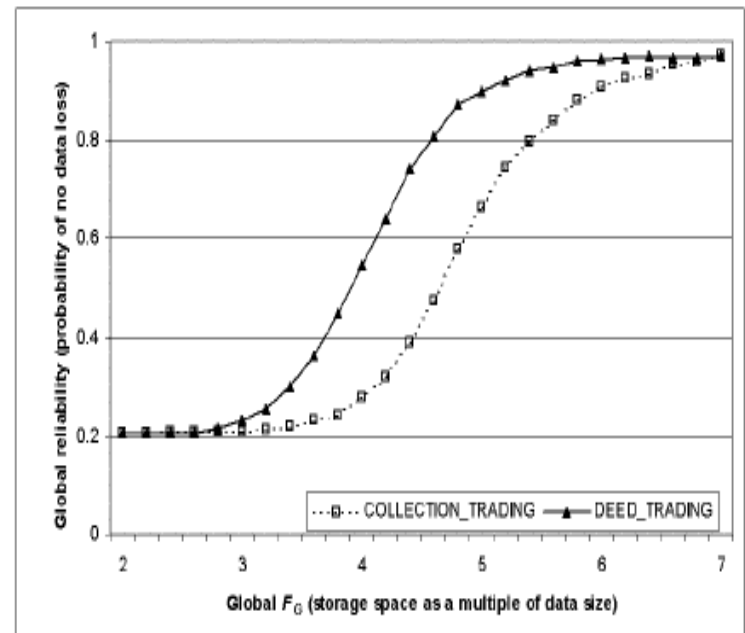
Looking for space...getting deeds

- D: *deed size policy*
- U: *deed use policy*
- T: *deed transfer policy*
- St: *third party trading strategy.*

■ FRAGMENTATION

■ COMPLEXITY

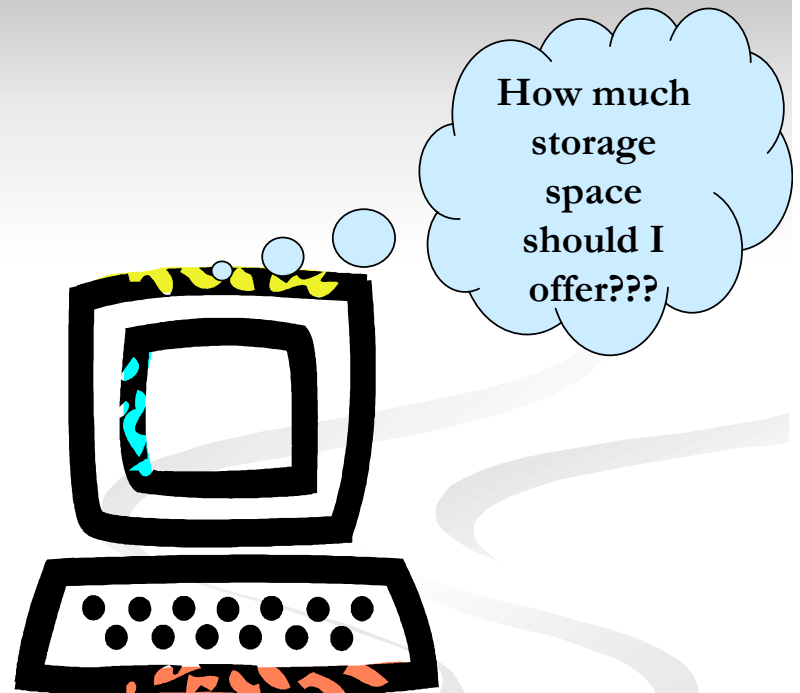
■ FAIRNESS



Trading Process:

Deeper into the Trading Process \ 1

- **Storage space :**
 - Public portion
 - Local portion
- ***Advertising policies:***
 - SPACE FRACTIONAL
 - DATA PROPORTIONAL



Trading Process:

Deeper into the Trading Process \2

- **Trading Strategy:** Specifies how to select trading partners
- Broadcasting state information \ maintaining a central information repository

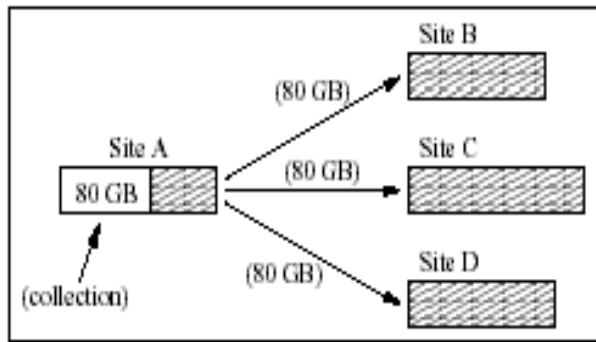
Strategy	Description
Random	Trade with sites in random order
First fit	Trade with sites according to a globally defined order
Neighbors	Trade with sites according to a locally defined order
Clustering	Trade preferentially with sites that we have traded with before
Best deed	Trade first with sites for which we have the smallest deed
Worst deed	Trade first with sites for which we have the largest deed
Best fit	Trade first with sites that have the least free space
Worst fit	Trade first with sites that have the most free space
Neediest	Trade first with sites that have the rarest collections

Table 1: Trading strategies (<S>).

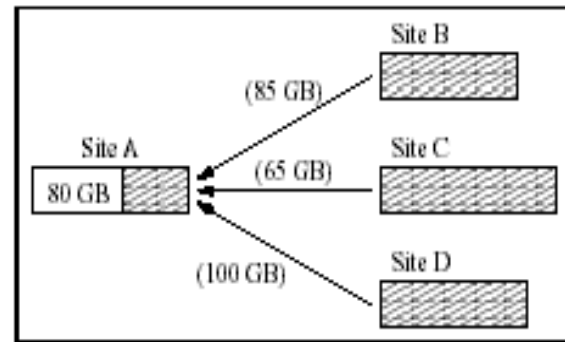
Trading Process: Bid Trading \1

- The trading negotiation must determine a price for the trade....
 - BIDDING POLICIES SCENARIO
 - TRADING:
 - Calling an auction
 - Making a bid
 - Choosing the trading partner

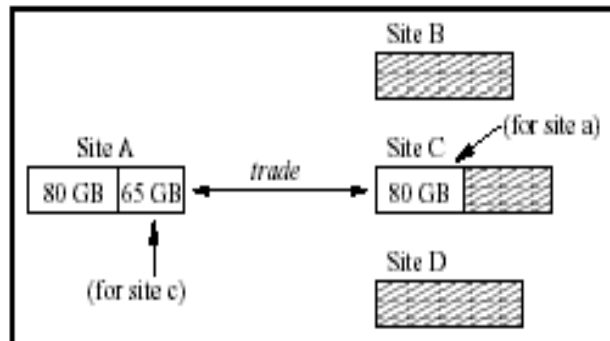
Trading Process: Bid Trading \2



(a)



(b)



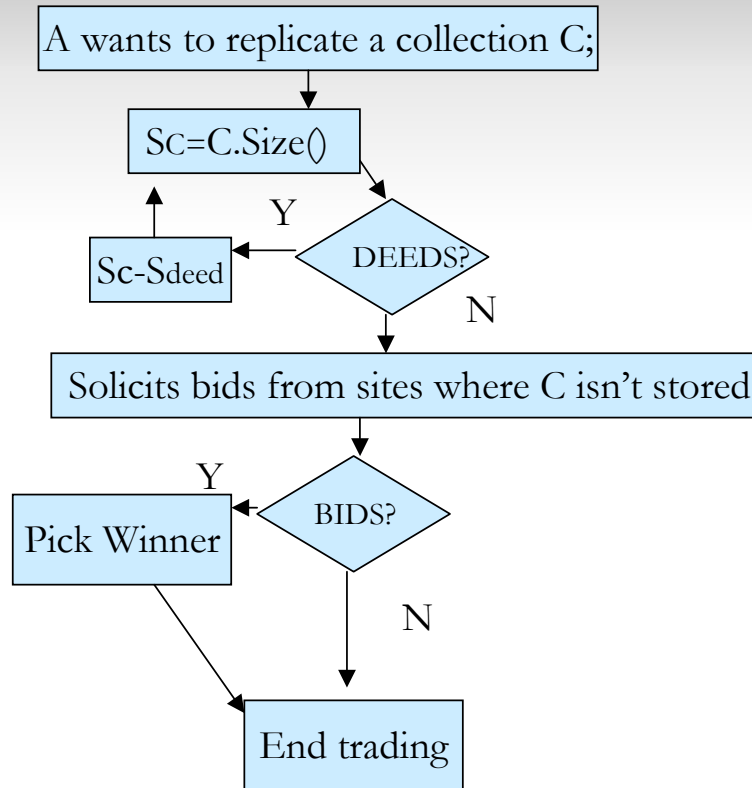
Trading Process:

Bid Trading \3

■ SCENARIO:

- ***Fixed-Price Bids:*** All sites follow the same fixed-price policy, a bid must be the same as the amount of space requested
- ***Adaptive Bids:*** All sites follow the same policy, but the policy takes into account local conditions
- ***Multiple Policies:*** Sites are partitioned into classes, depending on factors such as their free space
- ***Maverick Site:*** Site that follows its own policy trying to improve its own reliability even at the expense of the overall reliability
- ***Free Market:*** Sites that follow their own policy to maximize their reliability
- ***Malevolent Sites:*** sites that break the basic trading rules and try to subvert the system.

Trading Process: Bid Trading \4



- Using deeds A already holds
- Finding remote sites not storing C
- Choosing a space management policy
- Picking the winner

WHAT CAN GO WRONG ?????

1. Each remote site stores C
2. Sites do not have Sc Space
3. Sites do not want to trade

Trading Process: Bid Trading \5

- SCENARIOS:

- ADAPTIVE BIDS
- MULTIPLE POLICIES
- MAVERICK SITE

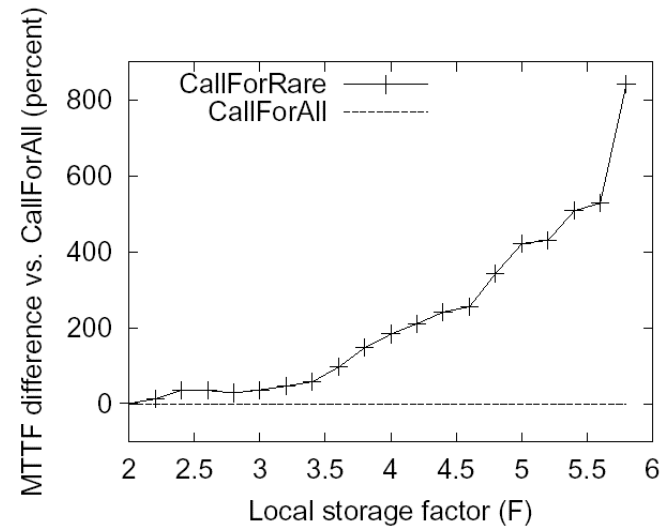
- We' re going to see for each of them.....

1. AUCTION CALLING POLICIES
2. BID POLICIES

Trading Process: Bid Trading \6

ADAPTIVE BIDS

- Auction Calling policies:** A site can call an auction periodically or when is really in need
 - **CallForAll:** call auctions for all of the collections
 - **CallForRare:** call auctions only for the rarest collections.
- Bid Policies:** set of rules for automatically calculating the bid for each auction.
 - **FreeSpace:** A site bids more when it has more free space
 - **UsedSpace:** A site bids more when more of its space is used
 - **AbundantCollection:** A site bids more when its collections are abundant
 - **RareCollection:** A site bids more when its collections are rare



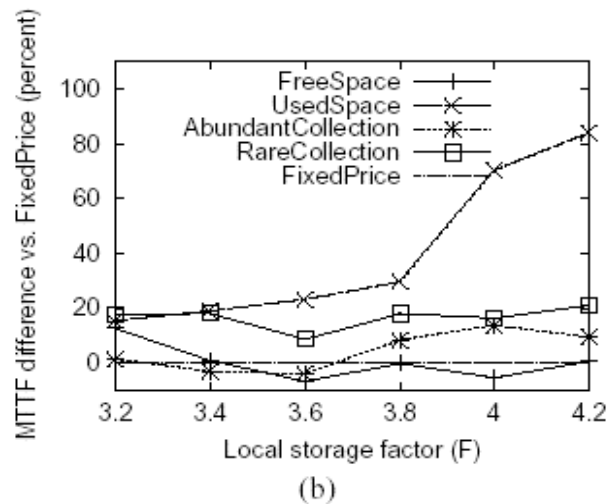
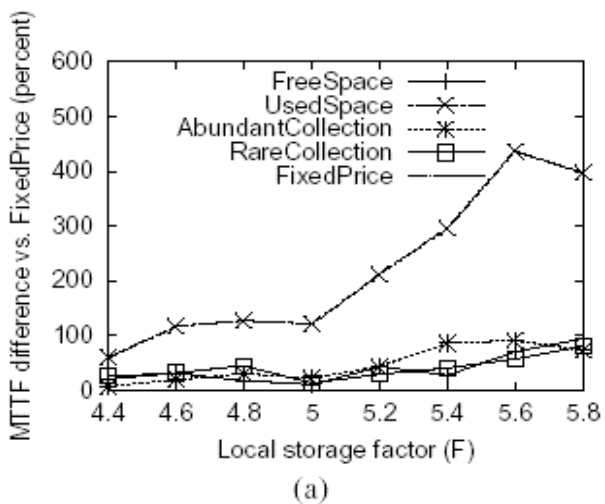
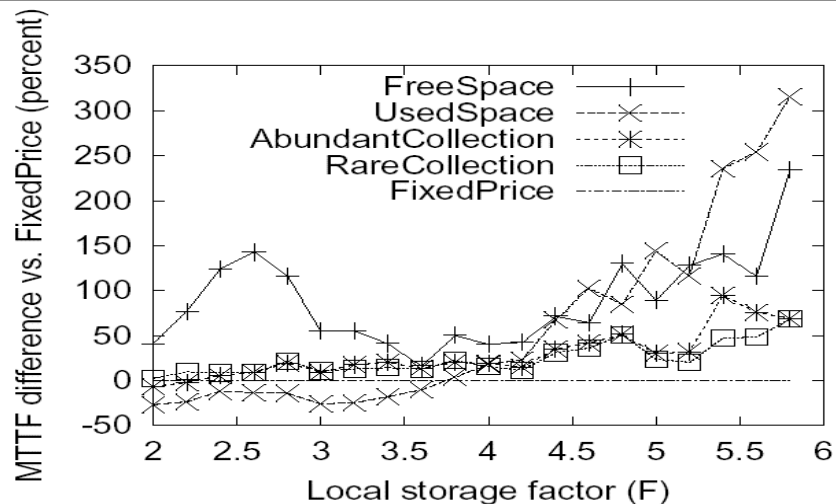


Figure 9: Best bid policy for (a) high capacity and (b) mid capacity sites.

Trading Process: Bid Trading \7

MULTIPLE POLICIES

- Different sites have different resources and resource requirements
- Partitioning the sites into distinct classes
- For each class we define the auction call and bid policy that provides the best reliability
- Less restrictive than the Adaptive Bids scenario, where all sites must use the same policy regardless of needs or resources

Trading Process: Bid Trading \8

MAVERICK SITES

1. Auction Calling policies:

- *AlwaysCall*: a site calls auctions constantly.
- *NeverCall*: a site never calls auctions.

2. Bid Policies:

- *BidHigh*: a site consistently bids high;
- *BidLow*: a site consistently bids low;
- *NeverBid*: a site never submits a bid to an auction.

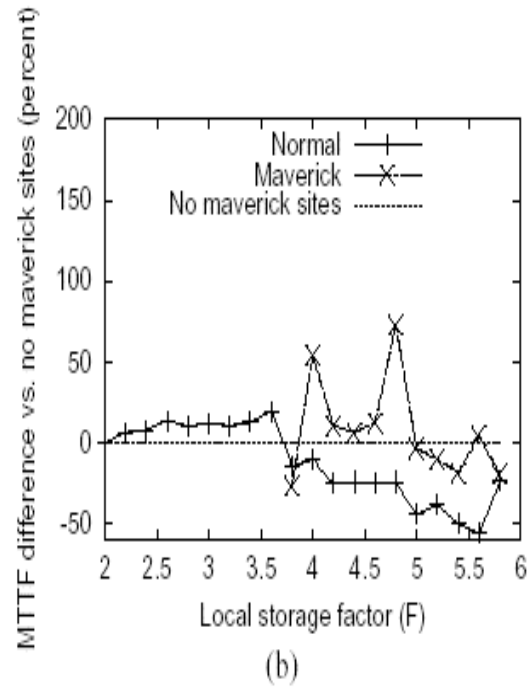
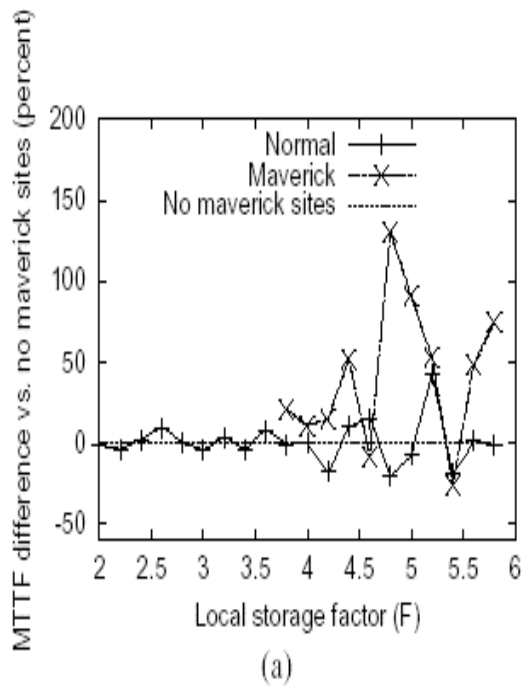


Figure 11: Maverick behaviors: (a) BidHigh and (b) NeverCall.

Conclusions

- Collections replication
- *Bid trading*: a mechanism for allowing sites to conduct peer-to-peer data trading
- Determining how much space to ask at the remote site for giving in return a deed of a certain size

We have described :

- How the auction and bidding process works
- The policies to decide when to call an auction and how much to bid

References

- The arguments treated in this tutorial are described in the following articles:
- Cooper, Molina “Peer to Peer data trading to preserve information”
- Cooper, Molina “Bidding for Storage Space in a Peer to Peer data preservation system”



THANKS