Auction-based Model of BitTorrent

Seminar in Distributed Computing 2010

ETH Zurich

Yu Li

What is BitTorrent

How to download using BitTorrent

How to download using BitTorrent

Downloading procedure

- Individuals View
  - Seed

  - Leecher

| General | Trackers | Peers | Pieces | Files | Speed | Logger |

Downloaded:	
Availability:	

Transfer

Time Elapsed:	1h 10m	Remaining:	∞
Downloaded:	179 MB	Uploaded:	115 MB
Download Speed:	0.0 kB/s (avg. 43.6 kB/s)	Upload Speed:	0.0 kB/s (avg. 28.0 kB/s)
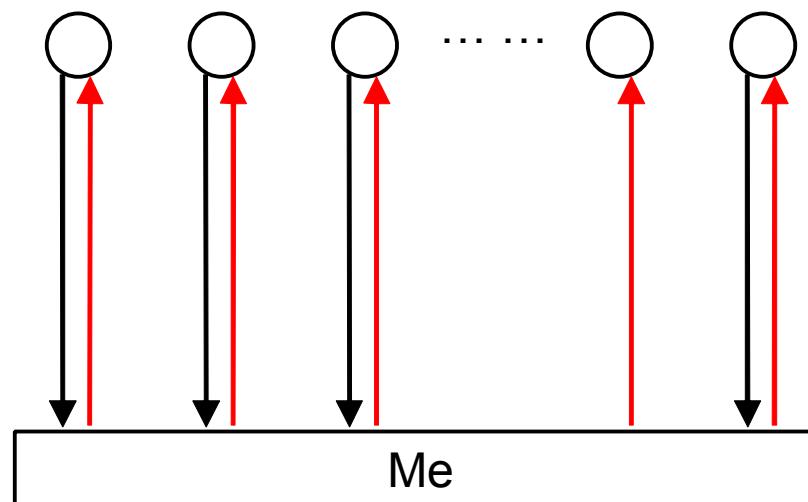
Downloading procedure
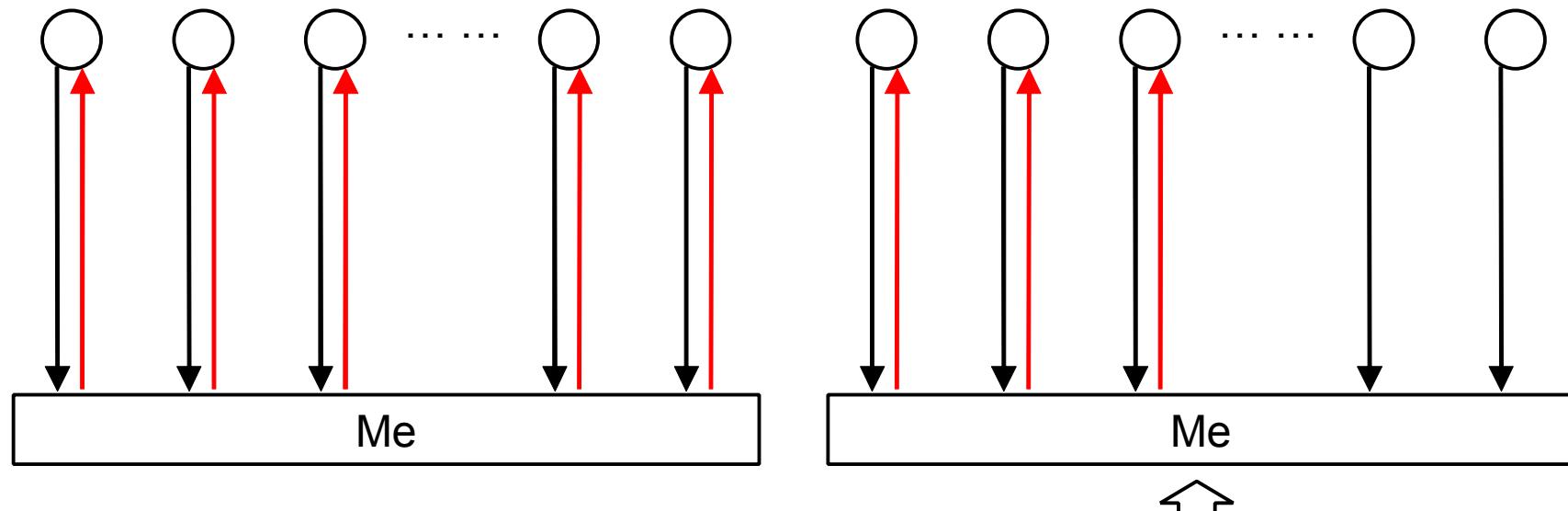
- ## System View
  - – I upload and download at the same time

Auction-based Model
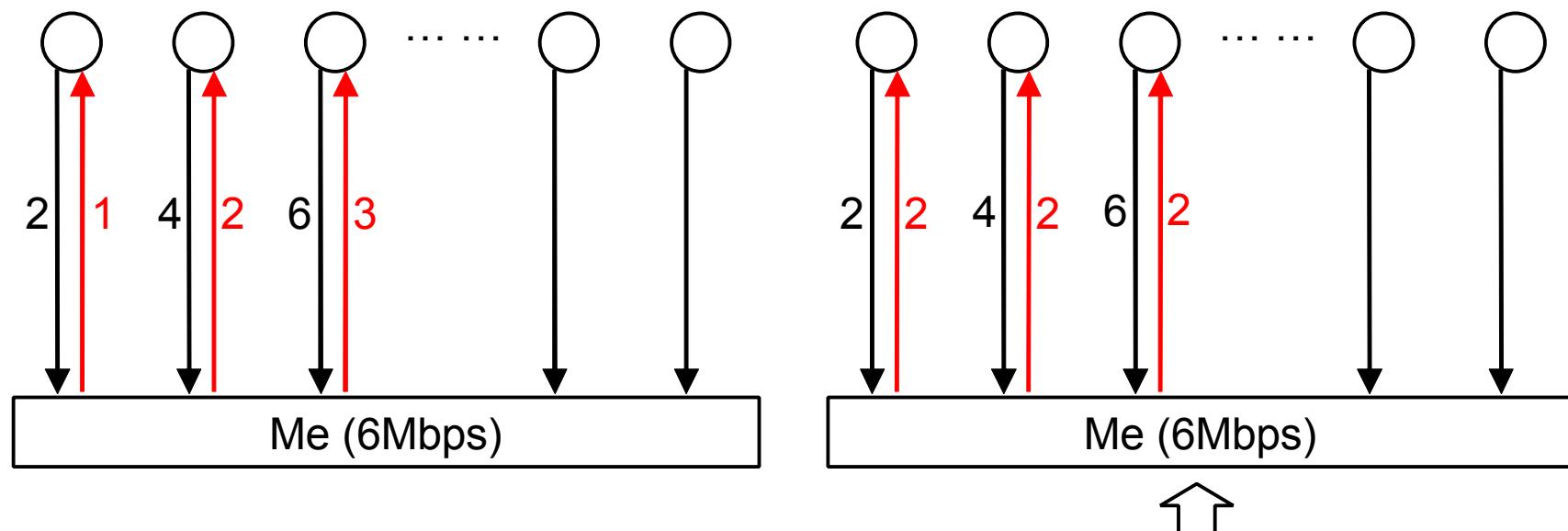
[D. Levin, K. LaCurts, 2008] "BitTorrent is an Auction: Analyzing and Improving BitTorrent's Incentives"

(Q1) Do I upload to everyone?
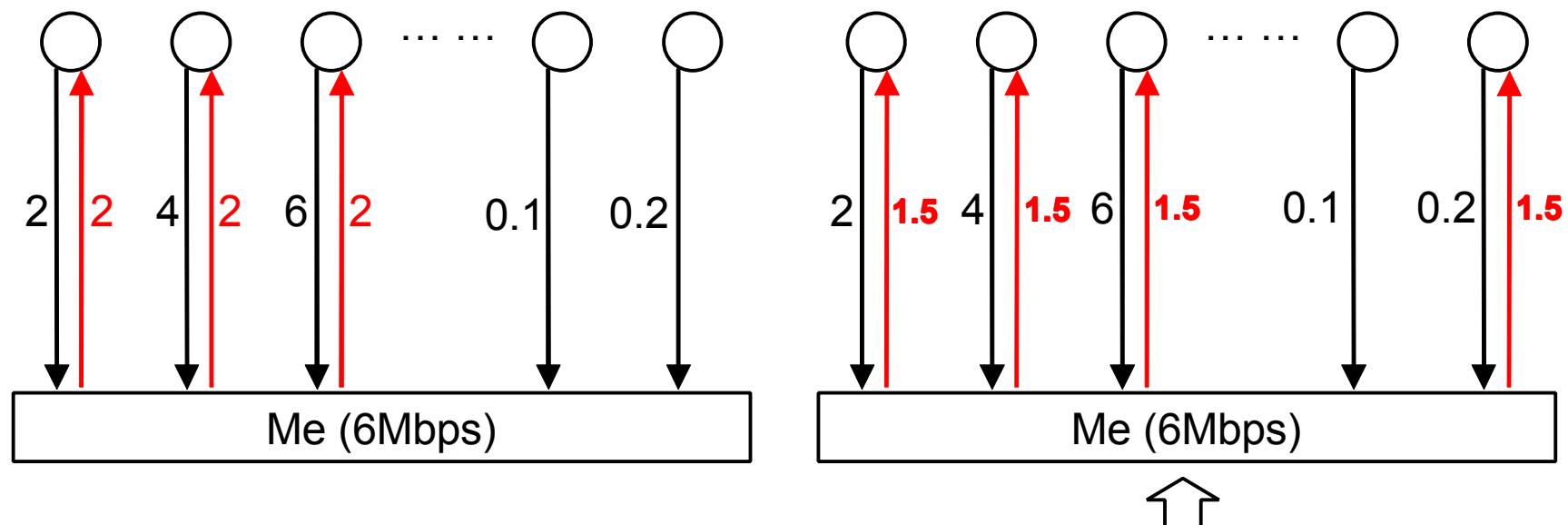
Auction-based Model

(Q2) Do I treat every peer equally?
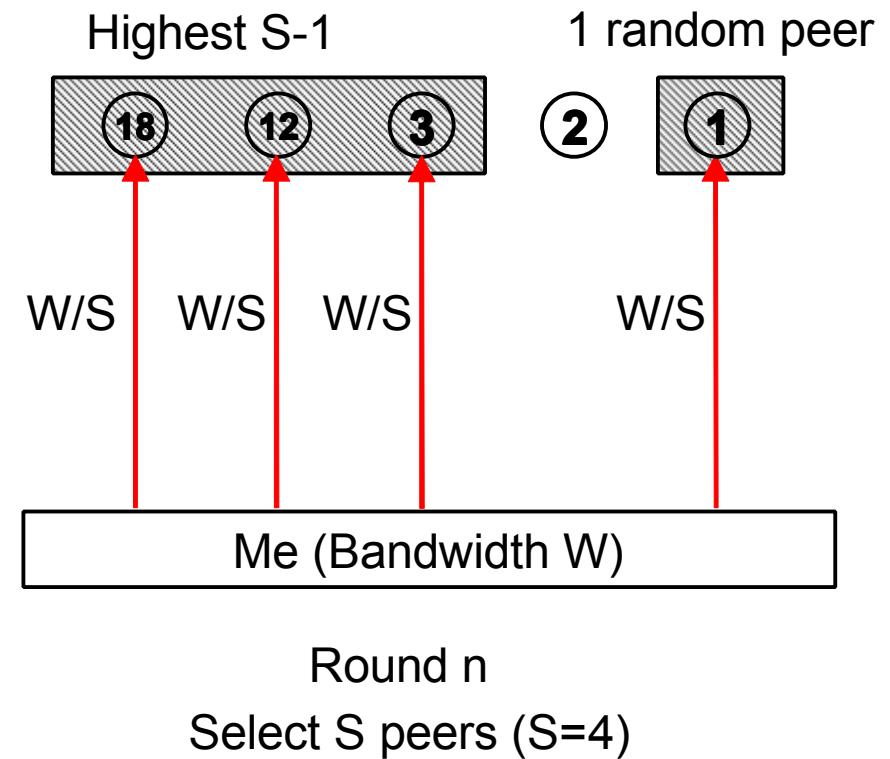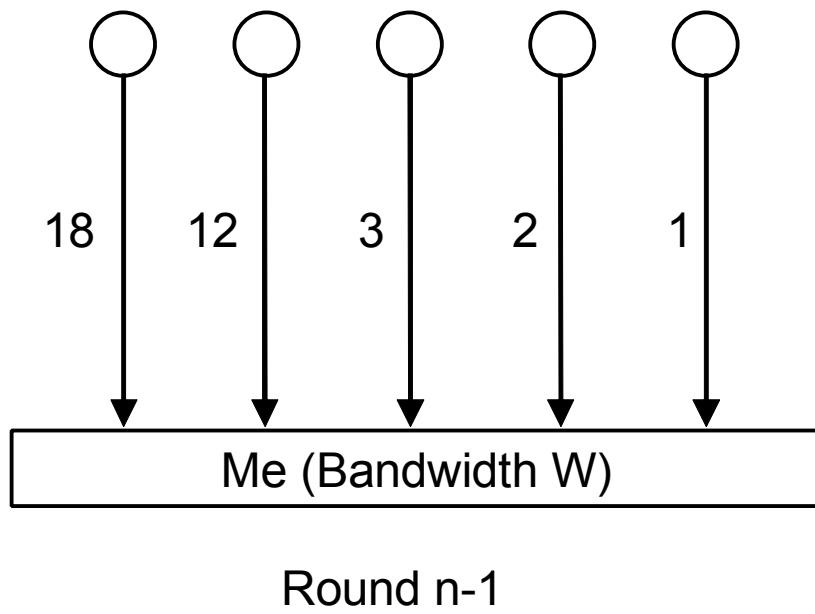
Auction-based Model

(Q3) Do I ignore others?
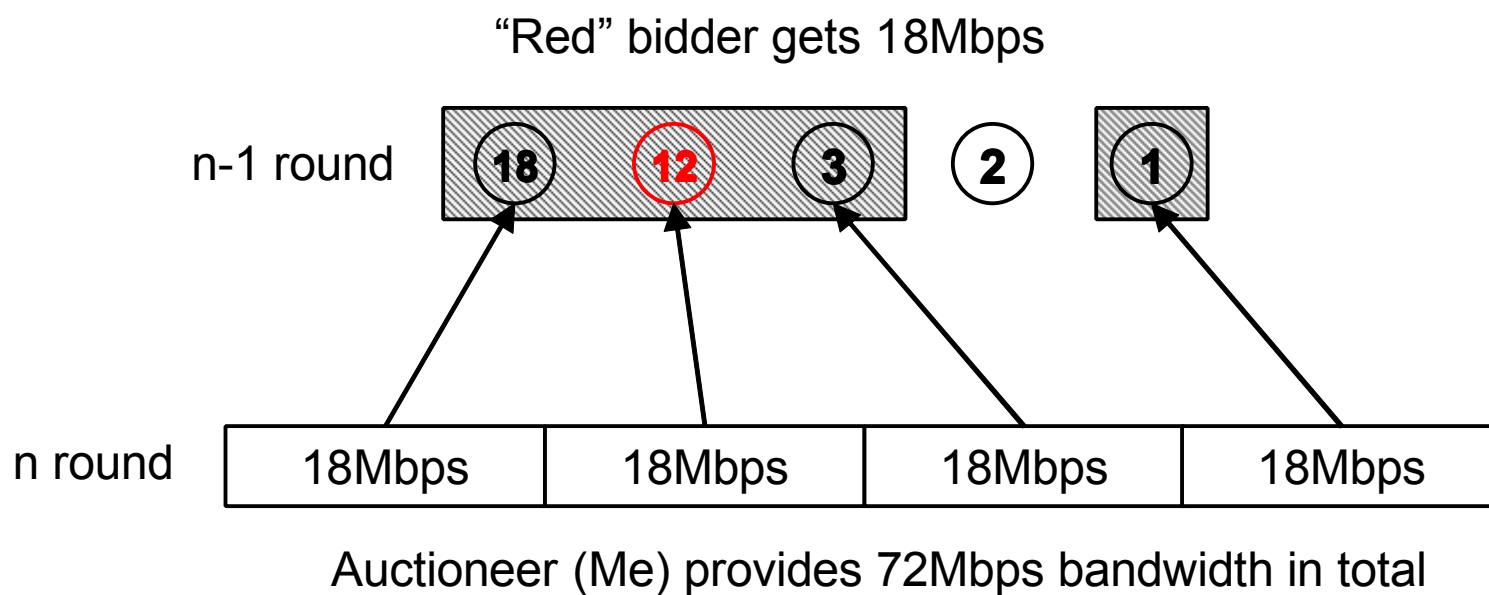
Auction-based Model

- Bids are uploads of round n-1
- Auction clearing
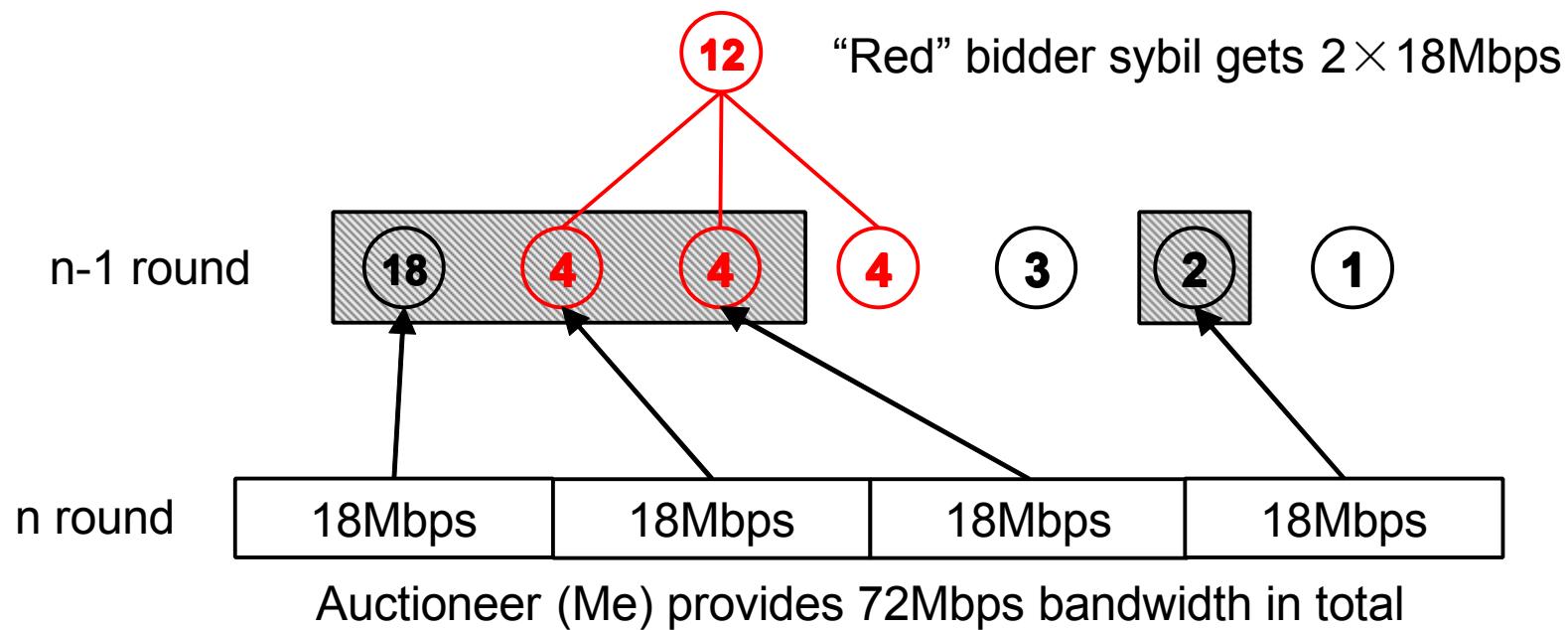
Sybil Attack

- ## Normal Bidder

"Red" bidder gets 18Mbps

n-1 round

| 18 | 12 | 3 | 2 | 1 |

n round

| 18Mbps | 18Mbps | 18Mbps | 18Mbps |

Auctioneer (Me) provides 72Mbps bandwidth in total
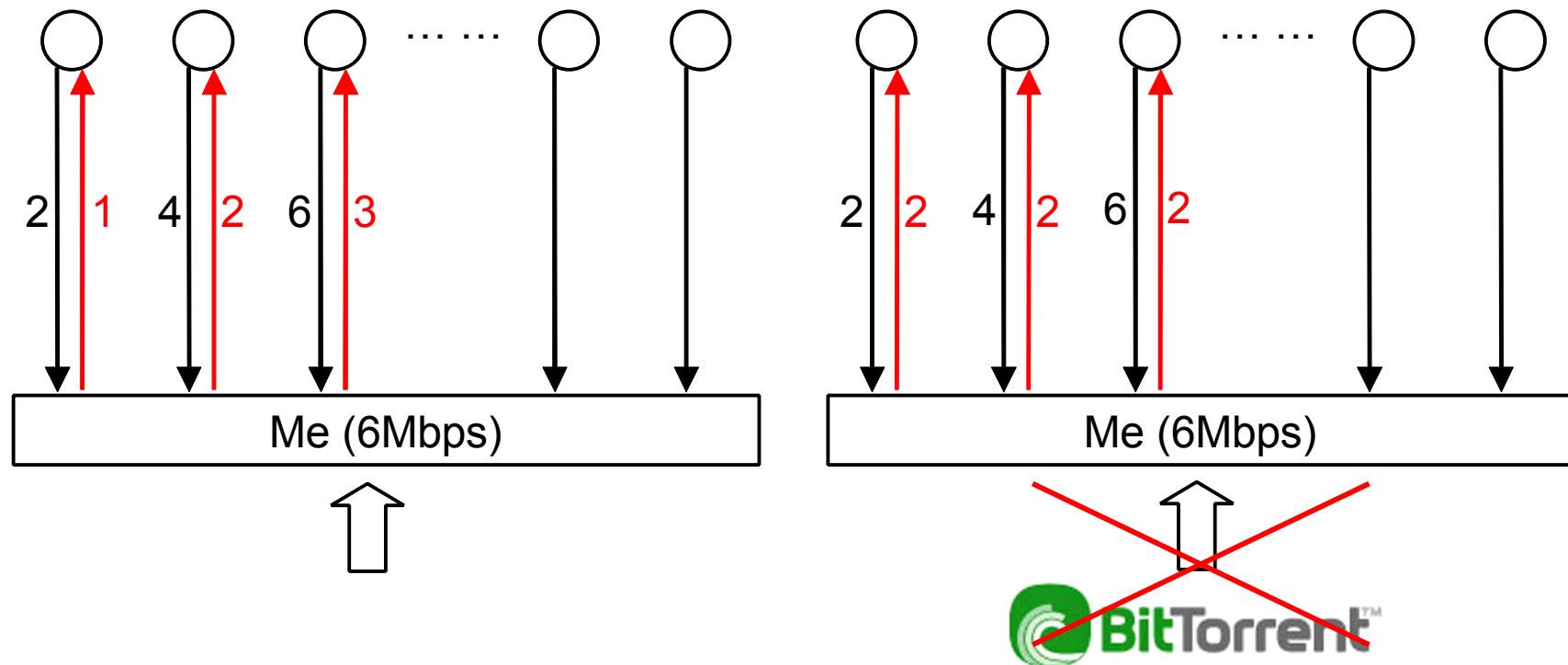
Sybil Attack

- Selfish Bidder

"Red" bidder sybil gets 2×18Mbps

n-1 round

12 / 18 / 4 / 4 / 4 / 3 / 2 / 1

n round

| 18Mbps | 18Mbps | 18Mbps | 18Mbps |

Auctioneer (Me) provides 72Mbps bandwidth in total
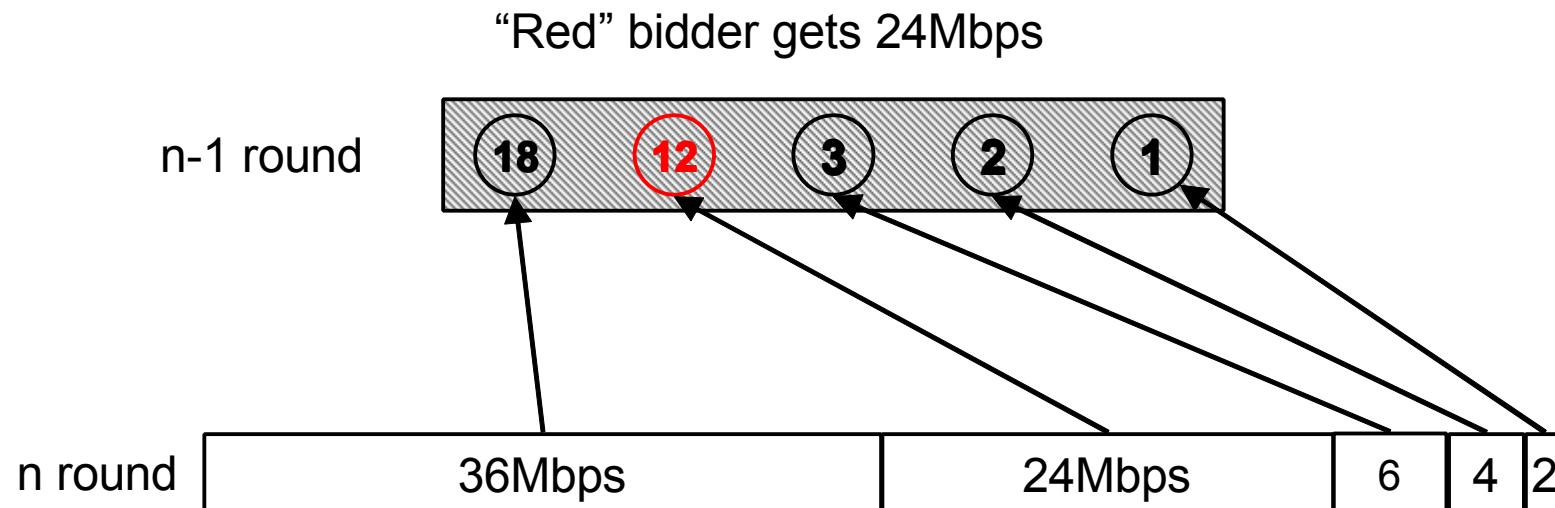
Review of Question 2

- (Q2) Do I treat every peer equally?
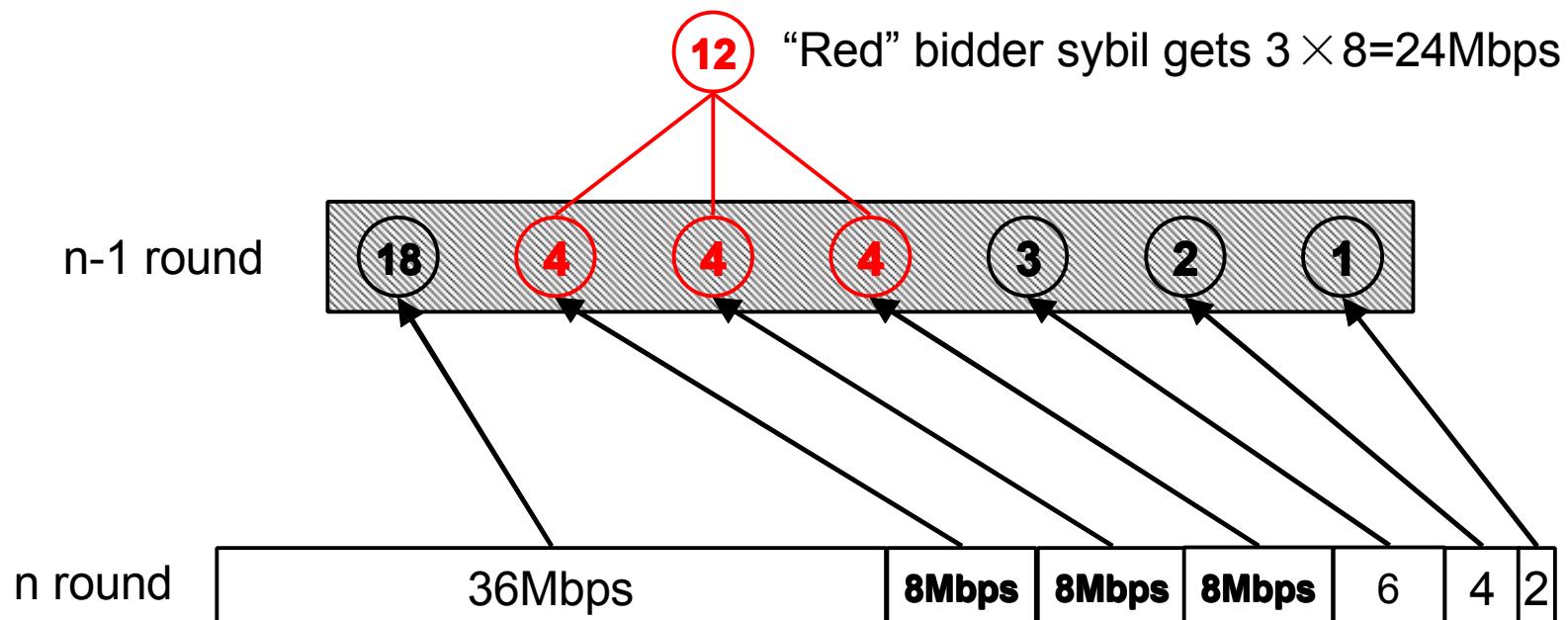
Countermeasure:
Proportional share auction

- Proportional share

"Red" bidder gets 24Mbps

n-1 round: 18, 12, 3, 2, 1

n round: 36Mbps, 24Mbps, 6, 4, 2

Countermeasure:
Proportional share auction

- Sybil attack resilient

"Red" bidder sybil gets $3 \times 8 = 24$Mbps

n-1 round: 18, 4, 4, 4, 3, 2, 1

n round: 36Mbps, 8Mbps, 8Mbps, 8Mbps, 6, 4, 2
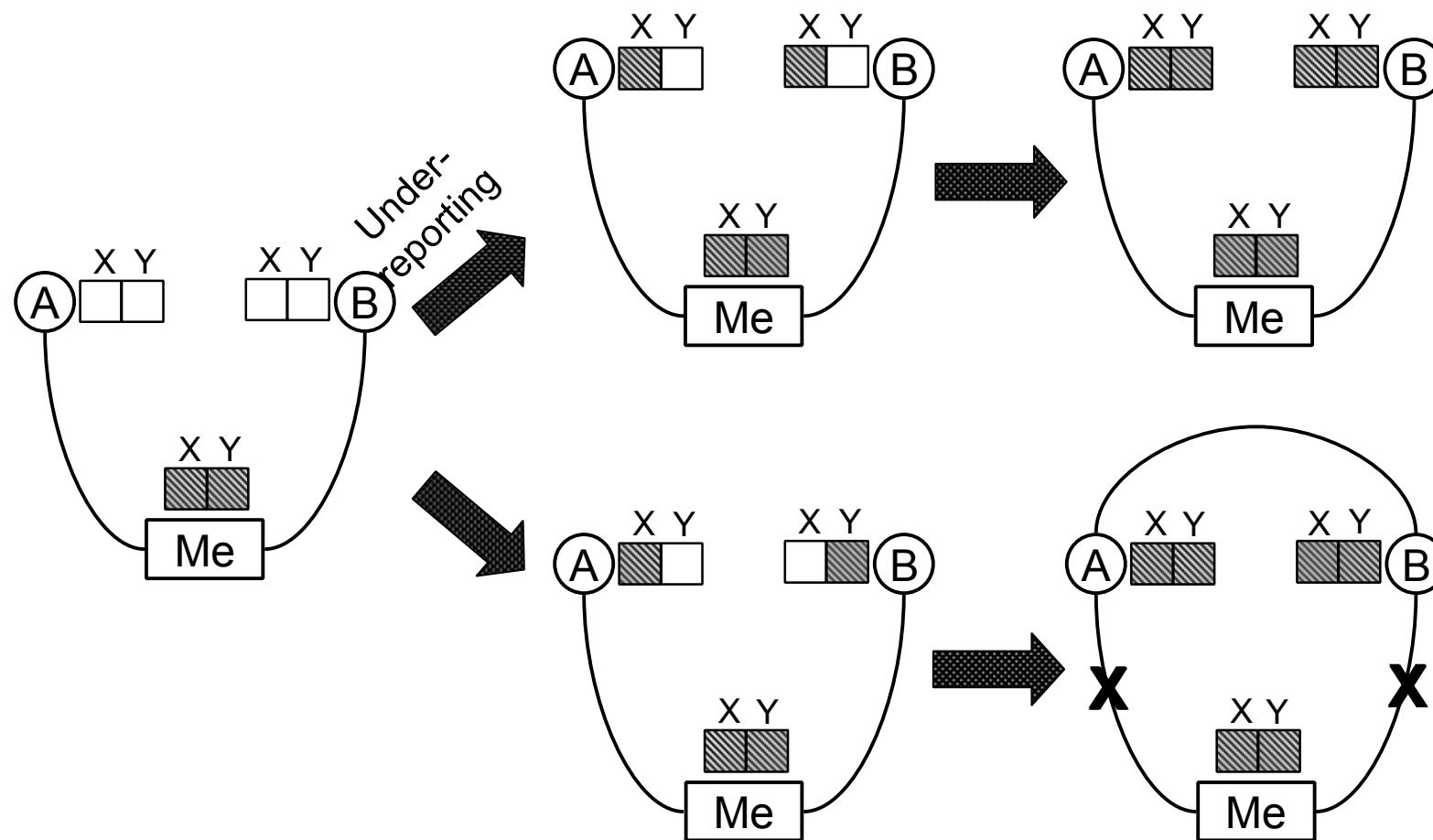
Comparison of Auction-based &Propshare

- Propshare is Sybil proof

	Normal client	Selfish client (using sybil)
Standard Bittorrent	18 Mbps	2×18 Mbps
Propshare	24 Mbps	24 Mbps
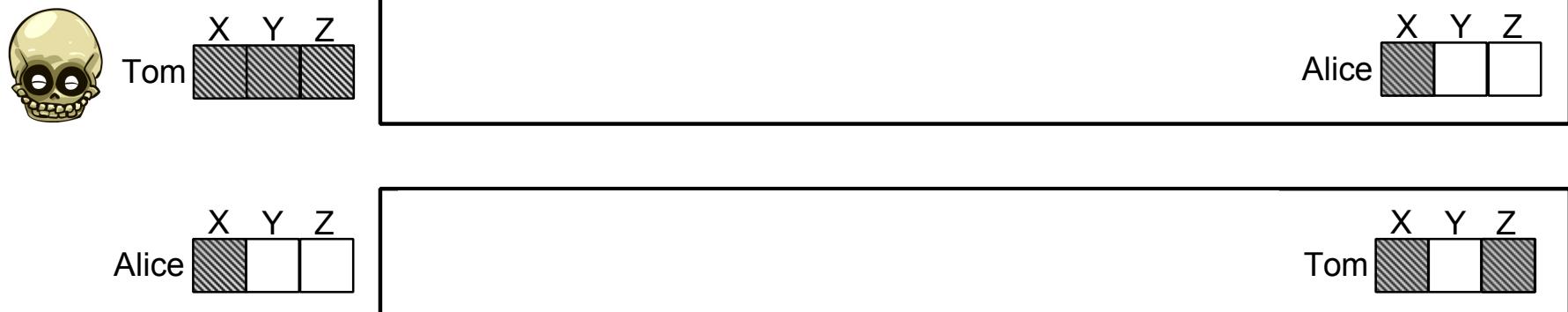
Under-reporting

- Which one is better for me?
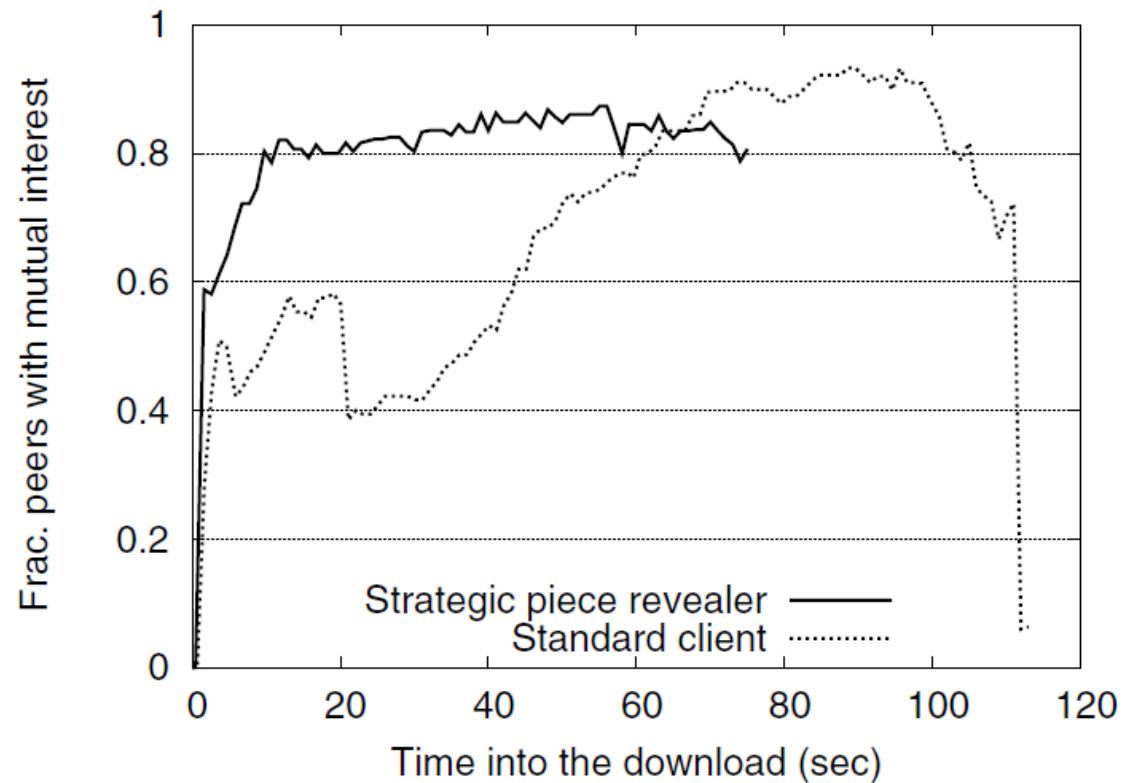
Under-reporting
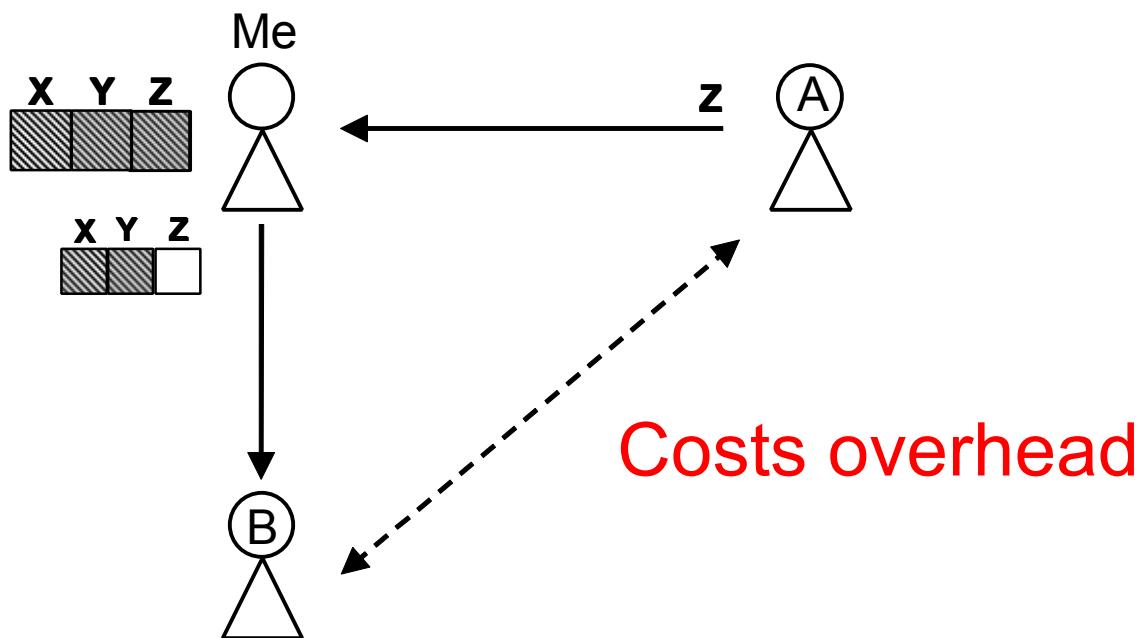
- Under-reporting algorithm
  - Run algr. when peer is about to lose interest.
  - Determine the most common piece among available

Under-reporting
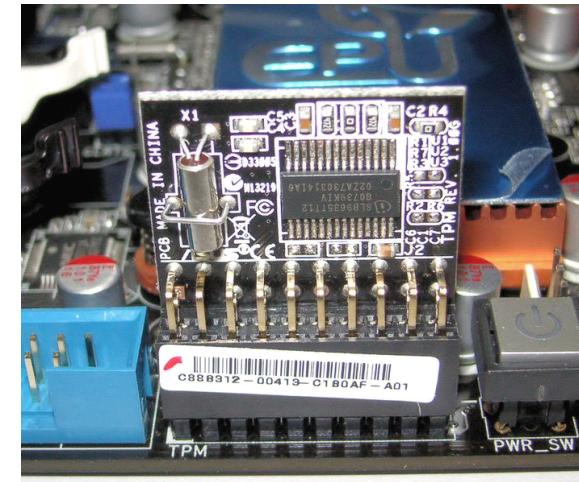
Countermeasure: Gossiping

Countermeasure: TrInc
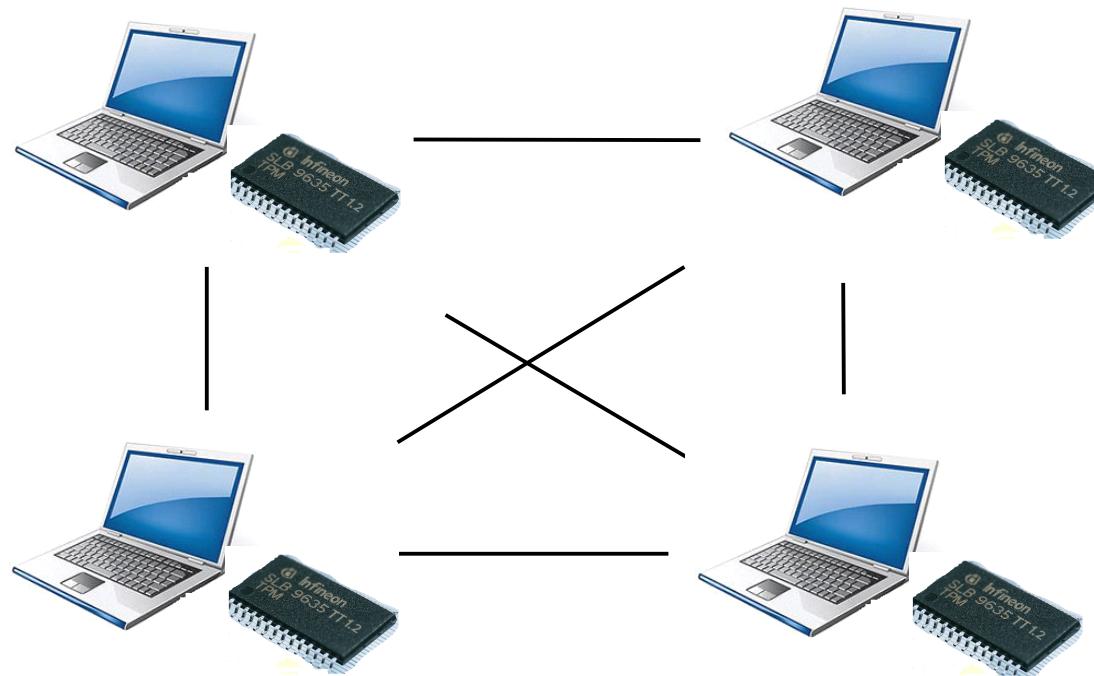
[D.Levin, J.R. Douceur 2009] "TrInc: Small Trusted Hardware for Large Distributed Systems"

- **TrInc (Trusted Incrementer)**
  - Prevents lying
  - Decreases overhead

- **TPM (Trusted Platform Module) by Intel**
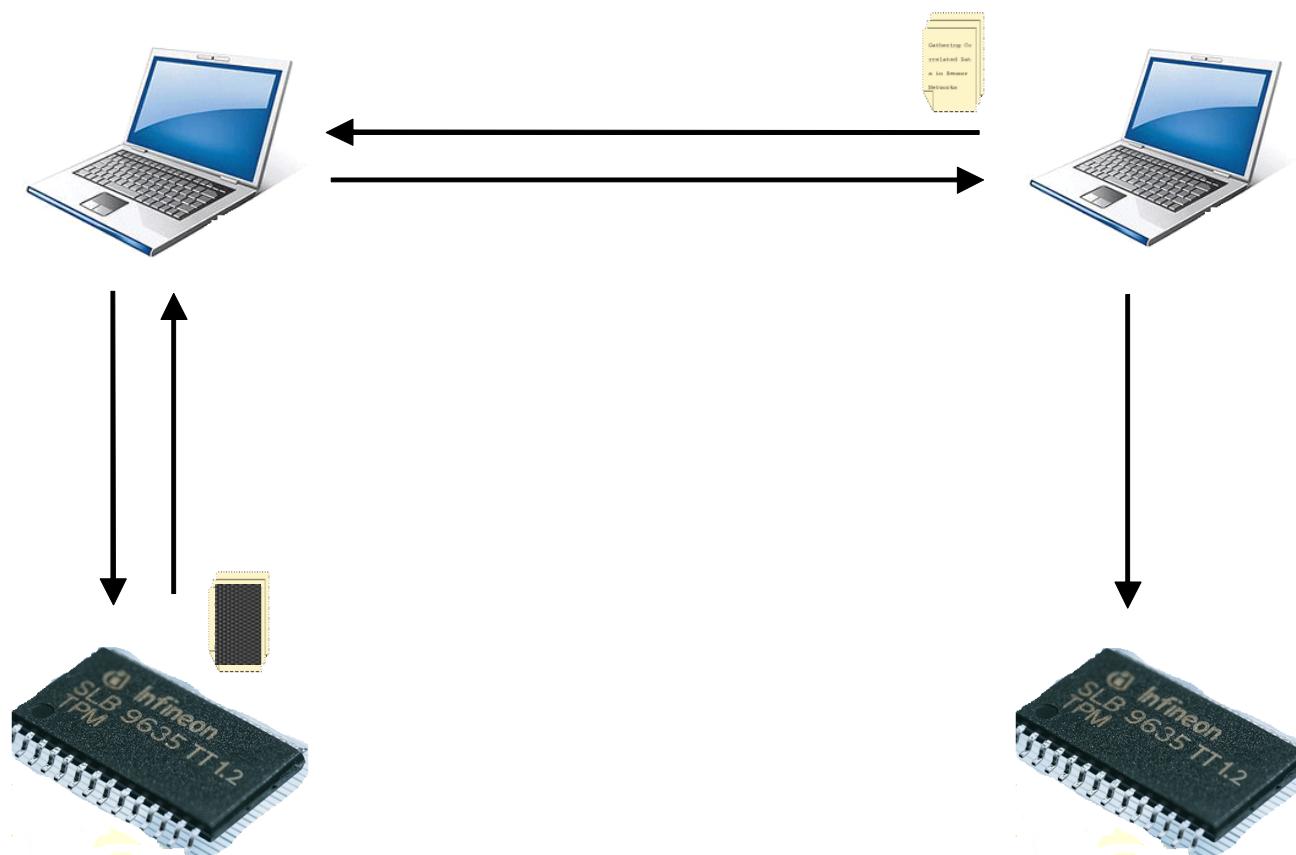
Countermeasure: TrInc

- System equipped with TrInc
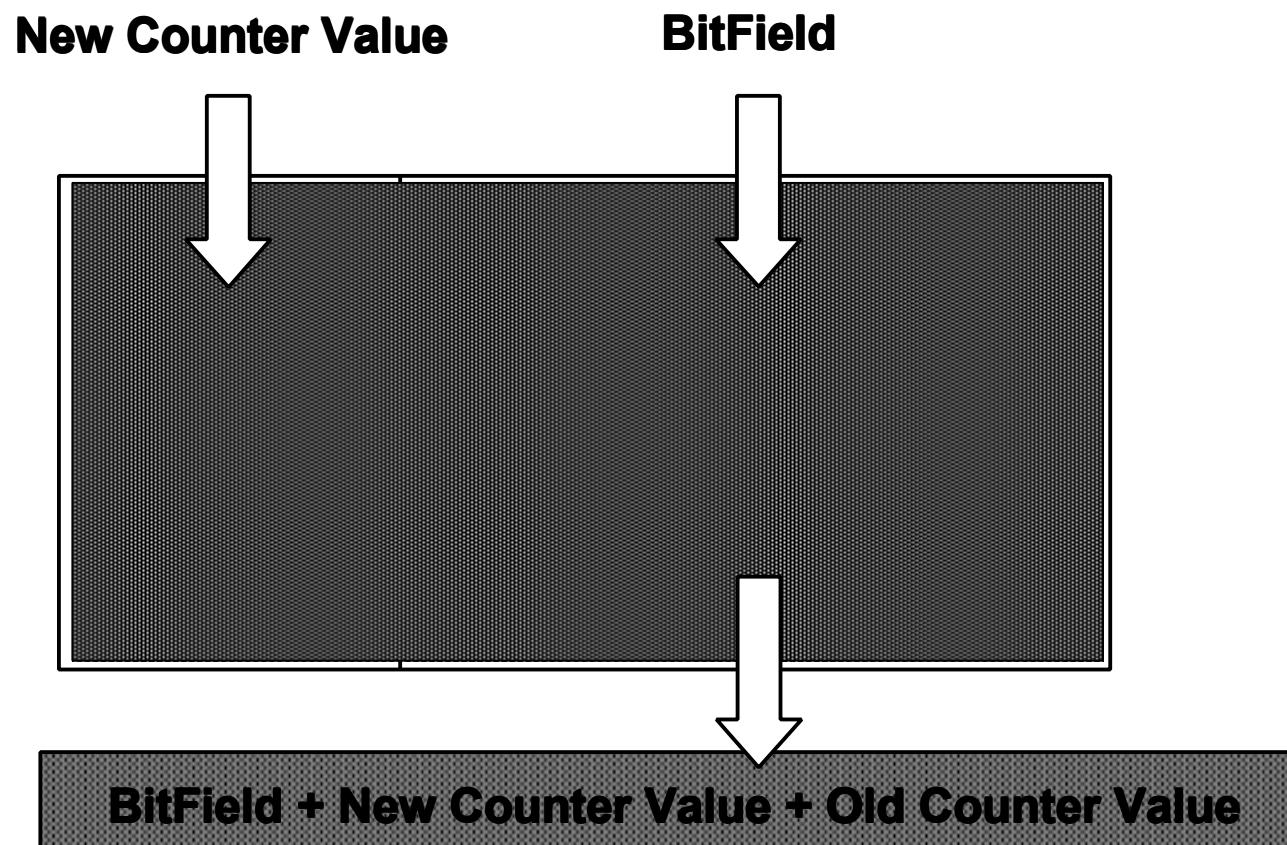
Countermeasure: TrInc

- Individual equipped with TrInc
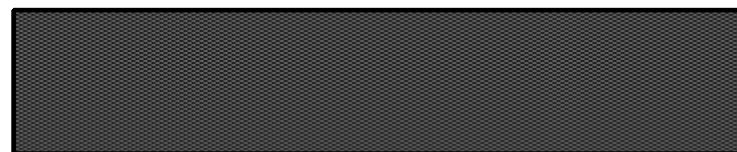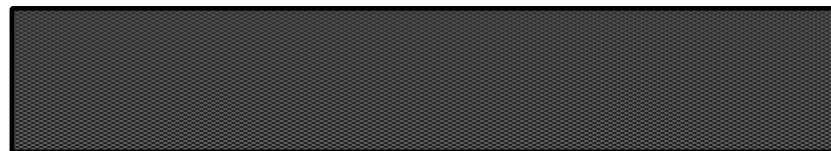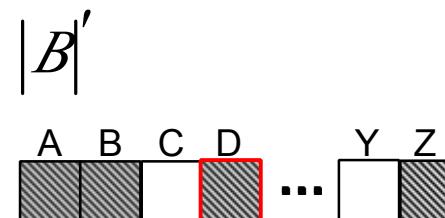
Countermeasure: TrInc

- How does TrInc work?

New Counter Value **BitField**

BitField + New Counter Value + Old Counter Value
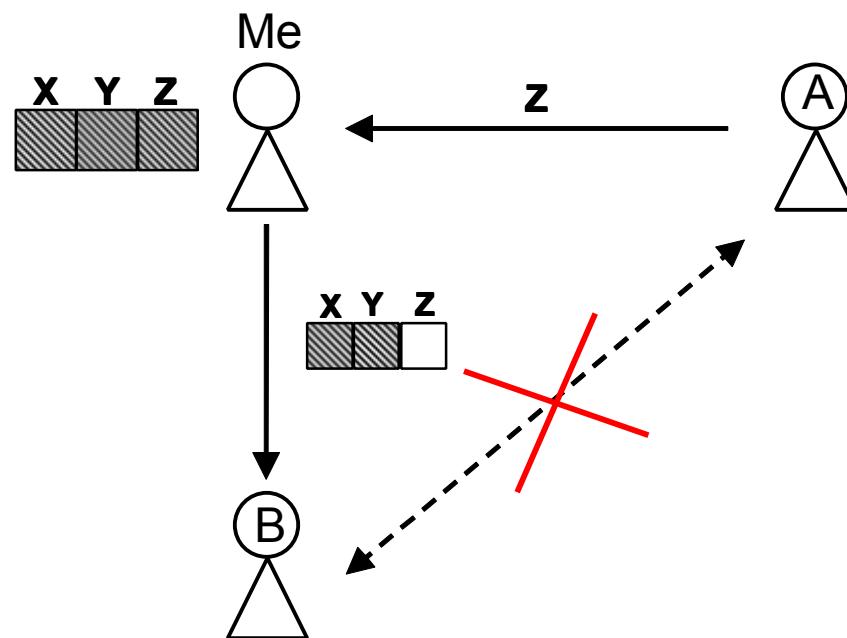
Countermeasure: TrInc
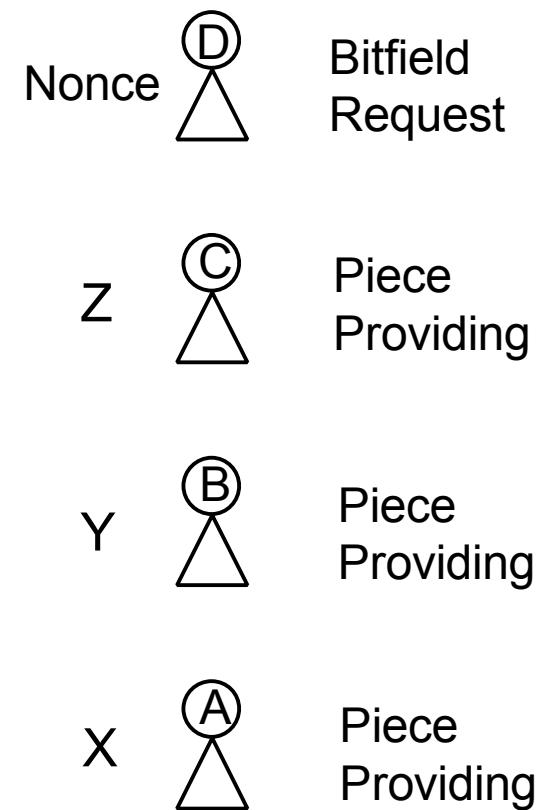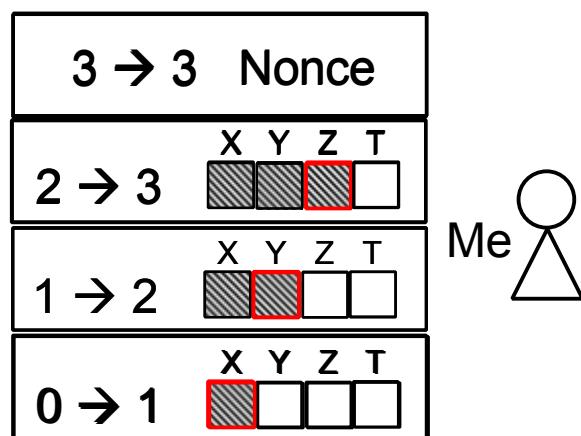
- Input
  - New Counter Value $\left| \mathcal{B} \right|'$
  - BitField

- Output
  - Attestation

- Sample Output

Countermeasure
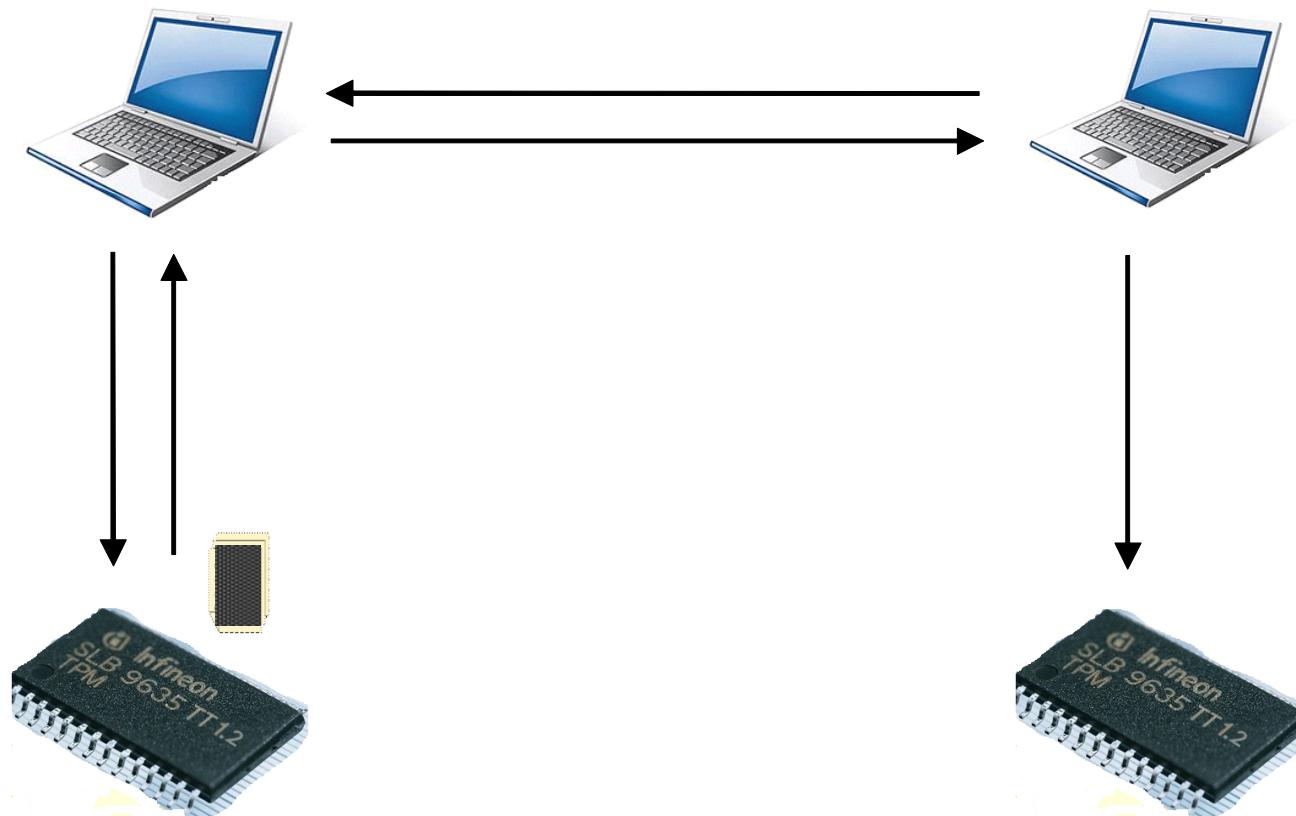
# Countermeasure: TrInc

Countermeasure: TrInc

- Individual equipped with TrInc

- Auction-based Model
- TrInc
- Q & A