

Thin Client Voting System

The Cost of Paper Voting?

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Outline

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- 3 Thin Client Hardware
- 4 Security
- 5 The End

Research Problem

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- There has been a great deal of research into security and usability
- Almost no research has attempted to deal with the cost issue

Thin Client

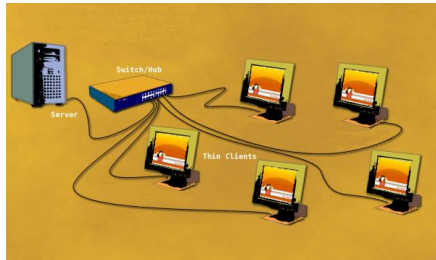


Figure: LTSP server model

Thin Client

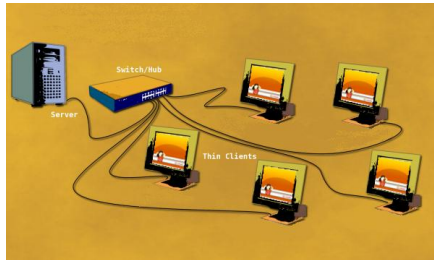


Figure: LTSP server model

- One server runs the entire voting system
- Stateless terminals in each booth only run the Linux kernel

Thin Client

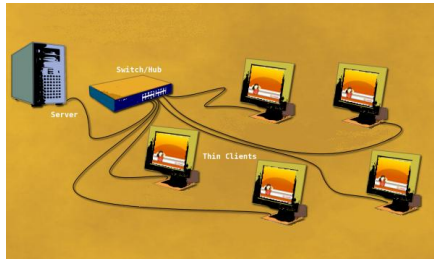


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- One server runs the entire voting system
- Stateless terminals in each booth only run the Linux kernel
 - Terminals have no hard drive and low processing requirements
 - Terminals boot directly over the network

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- Today, each booth is provided with an expensive computer to run a simple program
- **Hypothesis: Thin client voting systems are cheaper than paper voting systems from day one.**

SAVEOurVote

- Voting activist group in Maryland
- Feb. 2008: *Cost Analysis of Maryland's Electronic Voting System*
 - Diebold touch screen system vs. optical scan system
 - Diebold system increased annual election costs by 9 times what it was in 2001

SAVEourVotes
SECURE•ACCESSIBLE•VERIFIABLE ELECTIONS FOR MARYLAND

ES&S iVotronic



Figure 1 ES&S iVotronic Touch Screen System

Cost Analysis

Estimated costs based on 2,000 precincts with 10 booths each

Diebold Touch Screen

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Item	Unit Cost	# of Units	Total
Voting Machines	\$3,000	20,000	\$60,000,000

¹http://www.verifiedvoting.org/downloads/CT%20SOTS1appendix_43.pdf

Cost Analysis Cont'd

Optical Scan

Item	Unit Cost	# of Units	Total
Scanner	\$4,200	2,000	\$8,400,000
Ballot Marking Machine	\$4,950	2,000	\$9,900,000
Total			\$18,300,000

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+ \$800,000 per election for paper ballots ³

²<http://www.saveourvotes.org/legislation/packet/08-costs-mdvotingsystem.pdf>

³3.2 million registered voters, \$0.25 per ballot

Cost Analysis Cont'd

ES&S iVotronic

Item	Unit Cost	# of Units	Total
Voting Machine	\$5,200	20,000	\$104,000,000
Tally Machine	\$3,000	2,000	\$6,000,000
Total			\$110,000,000

Predicted Hardware Cost

Estimated cost based on 2,000 precincts with 10 booths each

Item	Unit Cost	# of Units	Total
Server ⁴	\$1,500	2,000	\$3,000,000
LTSP Terminal	\$285	20,000	\$5,700,000
Touchscreen	\$205	20,000	\$4,100,000
Total			\$12,800,000

80% cheaper than Diebold System

30% cheaper than Optical Scan System

88% cheaper than ES&S iVotronic System

⁴Server + backup server + 16 port gigabit switch

Suggested Hardware Requirements

Recommended specs based on everyday use of Open Office, Firefox, etc.

Server Specs ^a

- Ram: 256MB + (50MB * number of terminals)
- Processor: Multiple CPUs or Dual Core processor
3GHz good for 30 users
- Switch: Gigabit between server and switch
100mbps between switch and client

^a<http://wikiltsp.org/twiki/bin/view/Ltsp/ServerSizing>

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Terminal Specs

- 400 to 800 MHz processor
- 32MB Ram minimum

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Possible Hardware

Hardware Expense Per Precinct

Item	Quantity	Cost	Total
HP Pavilion Server ⁵	2	\$529.99	\$1059.98
DLink 16-Port Gigabit Switch	1	\$199.99	\$199.99
LTSP 1220 PXE Terminal ⁶	10	\$285.95	\$2859.50
NEC AccuSync 15" Touchscreen	10	\$205.69	\$2056.90
Total			\$5176.37

⁵AMD Athlon Dual Core with 3GB Ram Bestbuy.com

⁶800MHz with 128MB Ram DisklessWorkStations.com

Initial Hardware Costs

Projected Statewide Hardware Costs for Maryland

System	Cost	Yearly Cost Over 7 Years
Diebold Touchscreen	\$60,000,000	\$8,571,429
Optical Scan	\$18,300,000	\$2,614,286
ES&S iVotronic	\$110,000,000	\$15,715,000
Thin Client	\$12,800,000	\$1,828,571

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- Terminals do not read any external storage device (jump drive, USB hard drive, etc.)

IBM Co-Processor



Figure: IBM 4758 Secure Coprocessor

- Dr. Raquel Hill of Indiana University
- Separate processor in charge of encryption/decryption
- Internal back-up battery
- 5MB of usable internal memory

Future Work

- I plan to implement a thin client model with Prime III
- This will require changes to Prime III in order to allow multiple users to vote simultaneously



Questions?

