Crypto'2001

No More Panic in Florida: Reality or Dream ?

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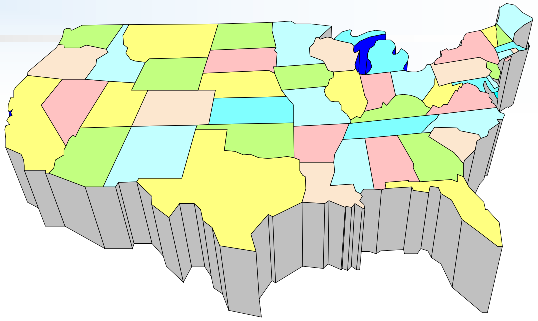
1. Introduction



- **Lession in Florida, 2000**
  - Counting : Manual -> Automatic
  - Voting place : Fixed -> Any place
  - Verifiability : Local -> Universal
- **Why do we consider Internet voting?**
  - Anyone can vote using internet
  - Anywhere from home, office, overseas, etc.

  -> Solution for the problem of decreasing the participation rate in manual voting
- **What are the problems in Internet voting?**
  - Strong security requirements: anonymity, privacy, completeness, fairness, receipt-freeness, etc.
  - No perfect solution and system
  - PKI is not ready.

New Trial

- **California**
  - Shadow election test of Internet voting system for the public election in Conta Costa County in 2000.
- **CyberVote**
  - Remote Internet voting with fixed and mobile internet tech
  - 3-year R&D program funded by European Commission
- **Our contribution**
  - Using PKI, 1 vote – 1 certificate
  - System satisfies most of important security requirements
  - First trial to worldwide voting

2. Security Requirements

Basic requirements

- Privacy : All votes must be secret
- Completeness : All valid votes are counted correctly
- Soundness : The dishonest voter cannot disrupt the voting
- Unreusability : No voter can vote twice
- Eligibility : No one who isn’t allowed to vote can vote
- Fairness : Nothing can affect the voting

Advanced requirements

- Walk-away **:** The voter need not to make any action after voting
- Robustness : The voting system should be successful regardless of partial failure of the system
- Universal verifiability : Anyone can verify the validity of vote
- Receipt-freeness : Voter should not be able to prove his or her vote to a buyer. (Voter does not have any receipt for the vote)

3. Voting Scheme

FOO92 Scheme

- Fujioka, Okamoto, Ohta, “A Practical Secret Voting Scheme for Large Scale Elections”, Auscrypt’92
- Features: Blind signature + Mix-net + Bit commitment

Implementation examples

- Sensus : L.F. Cranor, Washington Univ. http://www.ccrc.wustl.edu/~lorracks/sensus
- EVOX : M.A. Herschberg, R.L. Rivest, MIT

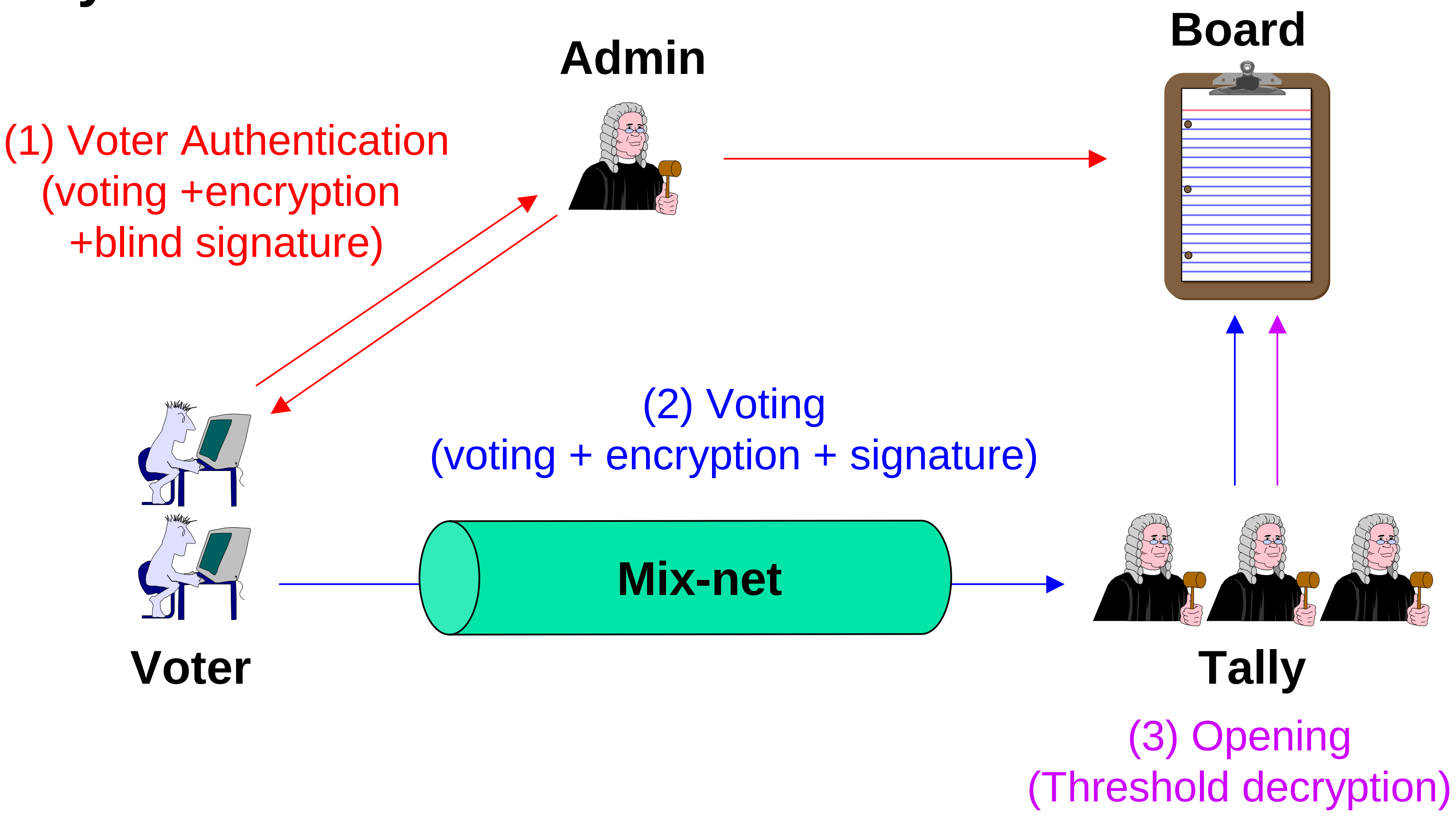
  http://theory.lcs.mit.edu/~cis/voting/voting.html

OMAFO99 Scheme

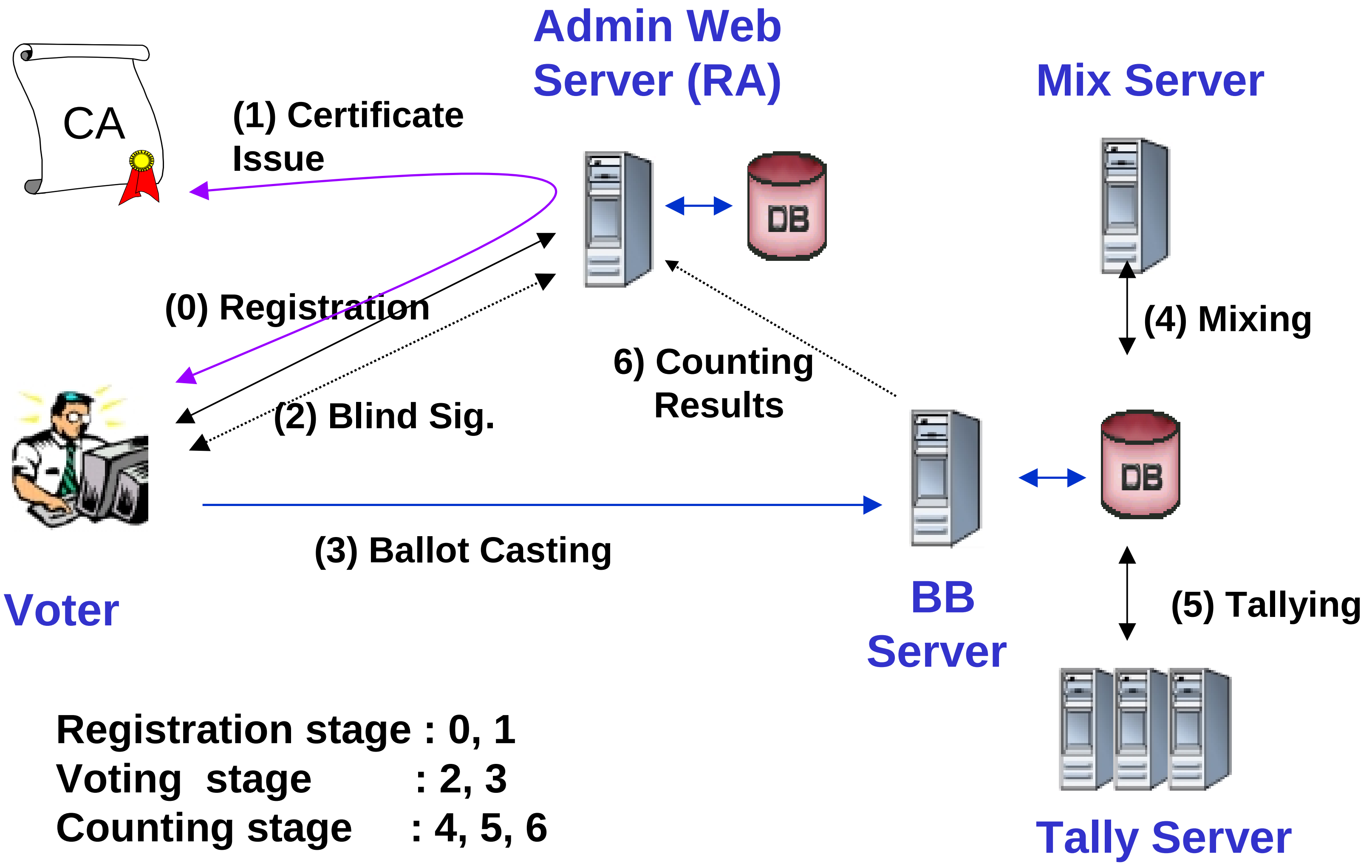
- Improved version of FOO92
- Features : Blind signature + Mix-net + threshold encryption

OMAFO99 scheme

- **System overview**

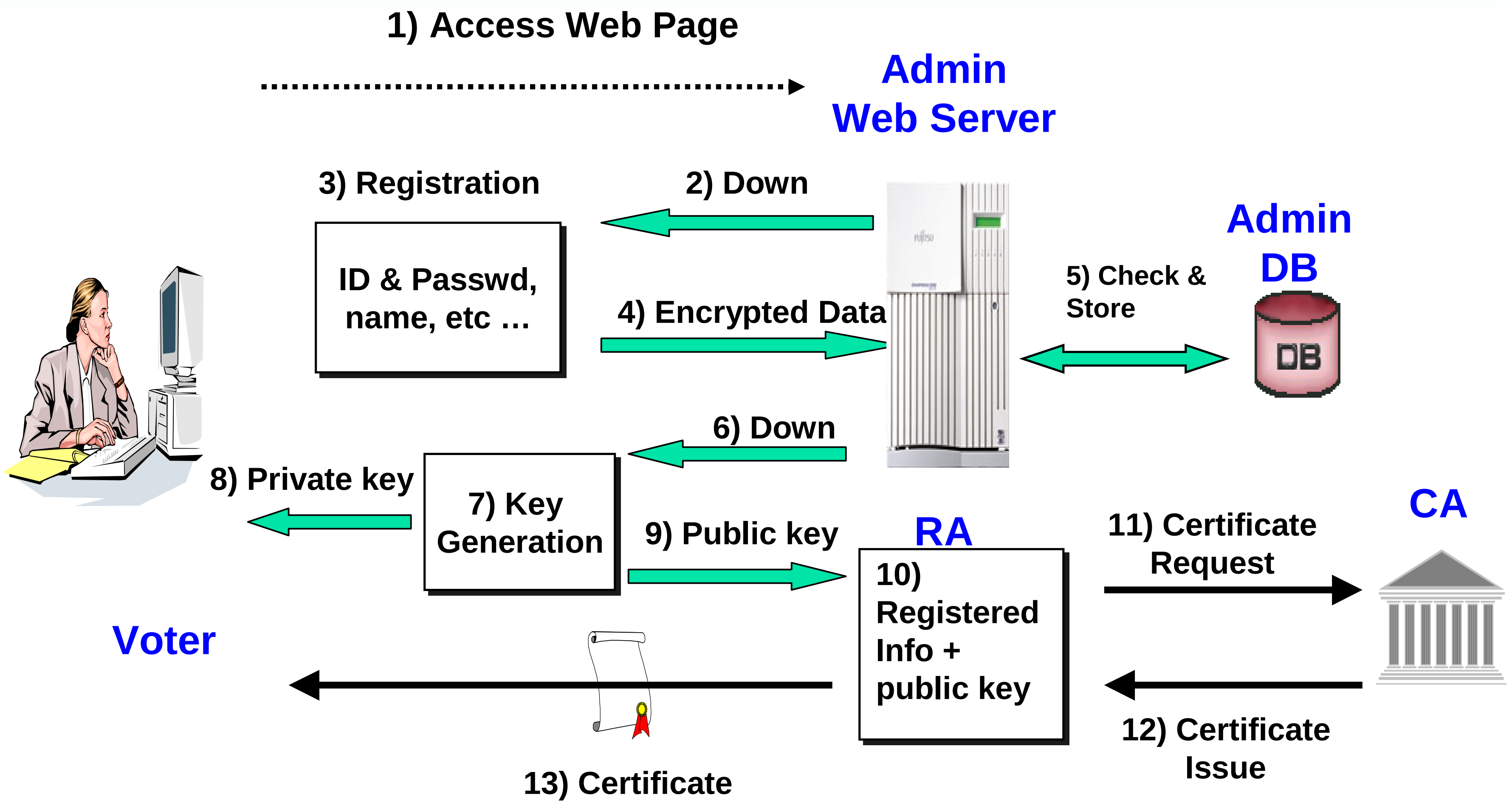


4. System Configuration

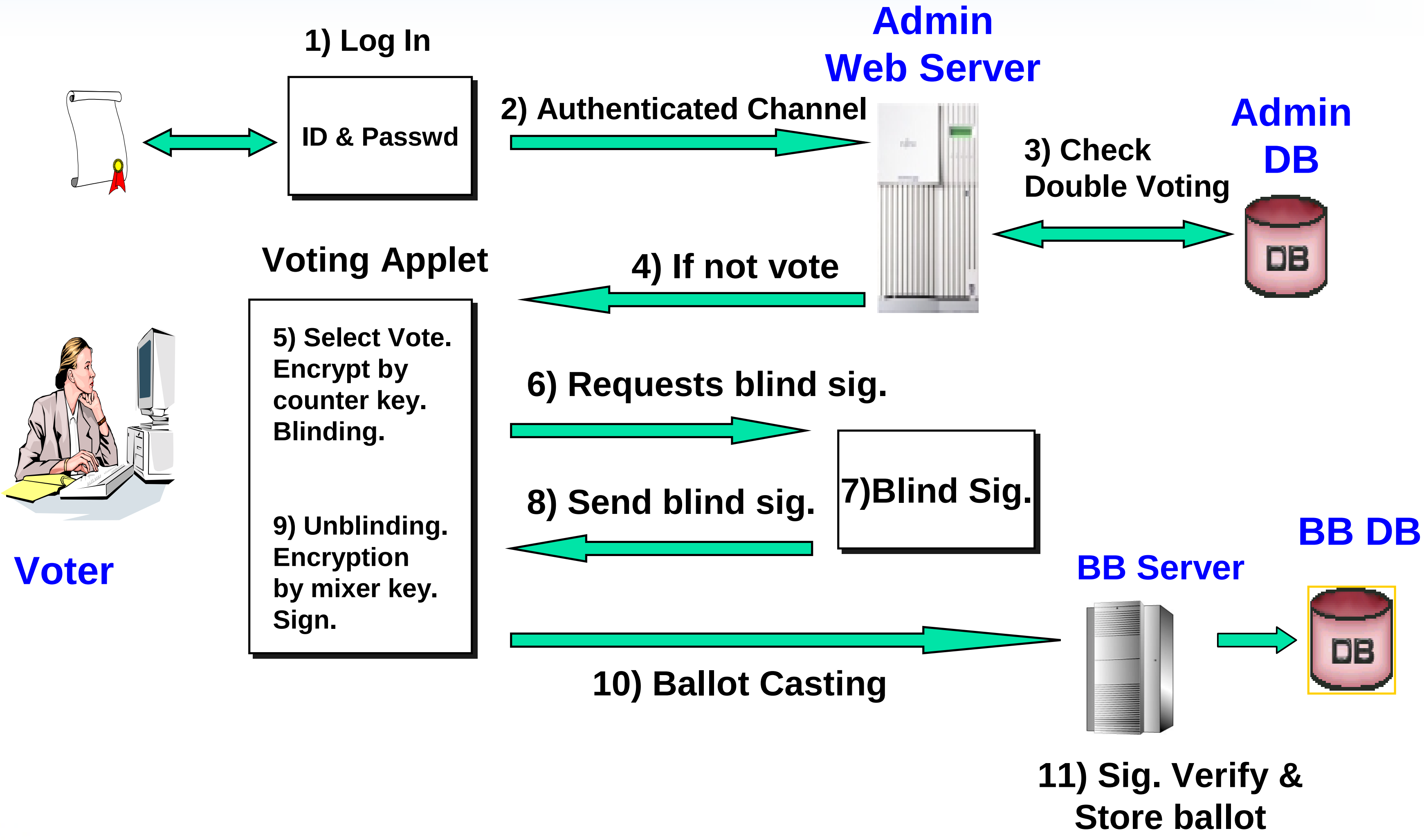


Registration stage : 0, 1
Voting stage : 2, 3
Counting stage : 4, 5, 6

Registration stage



Voting Stage



1) Log In

ID & Passwd

2) Authenticated Channel

Admin Web Server

3) Check Double Voting

Admin DB

DB

Voting Applet

4) If not vote

5) Select Vote. Encrypt by counter key. Blinding.

9) Unblinding. Encryption by mixer key. Sign.

6) Requests blind sig.

7)Blind Sig.

8) Send blind sig.

Voter

10) Ballot Casting

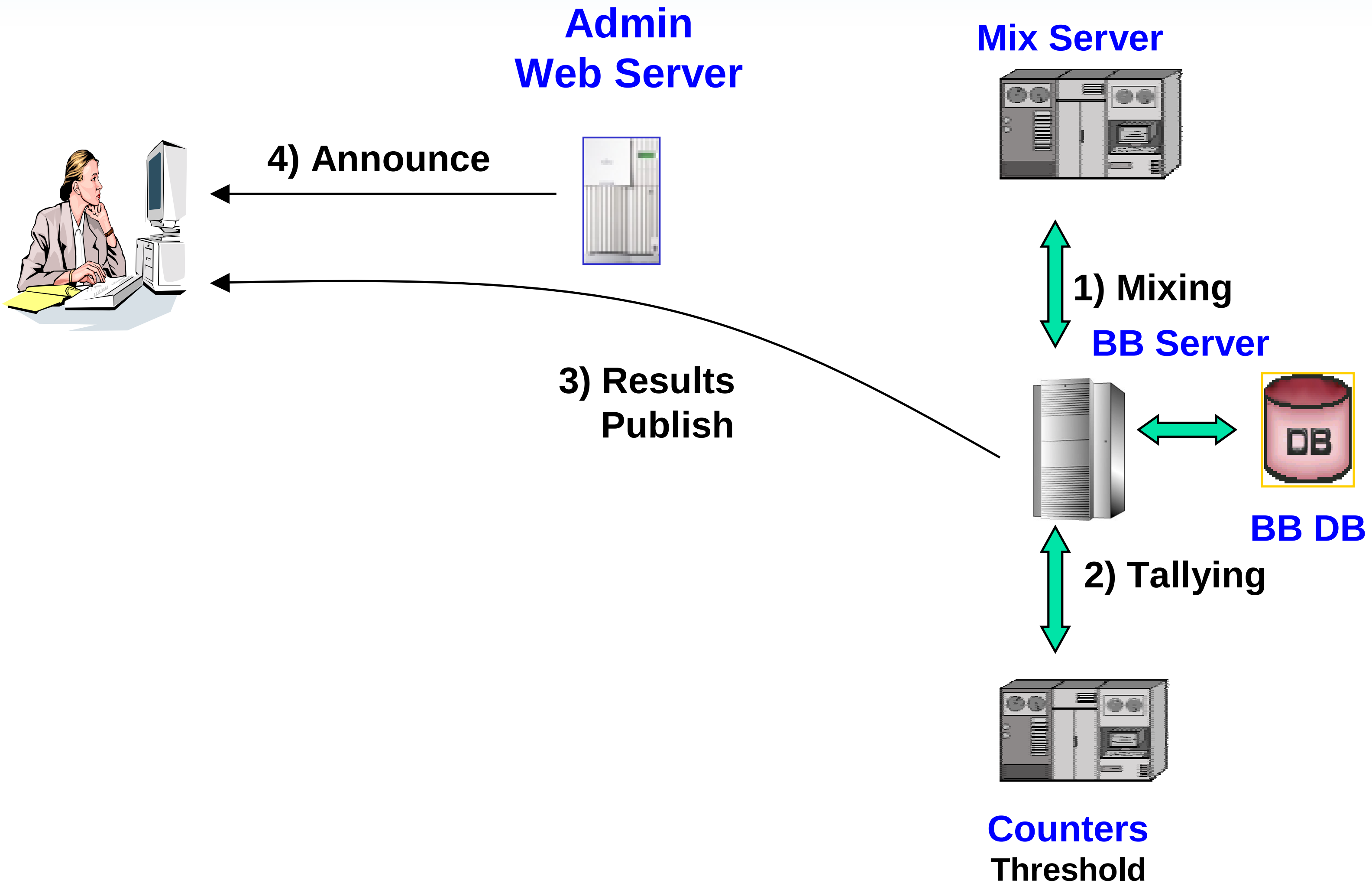
BB Server

BB DB

DB

11) Sig. Verify & Store ballot

Counting Stage



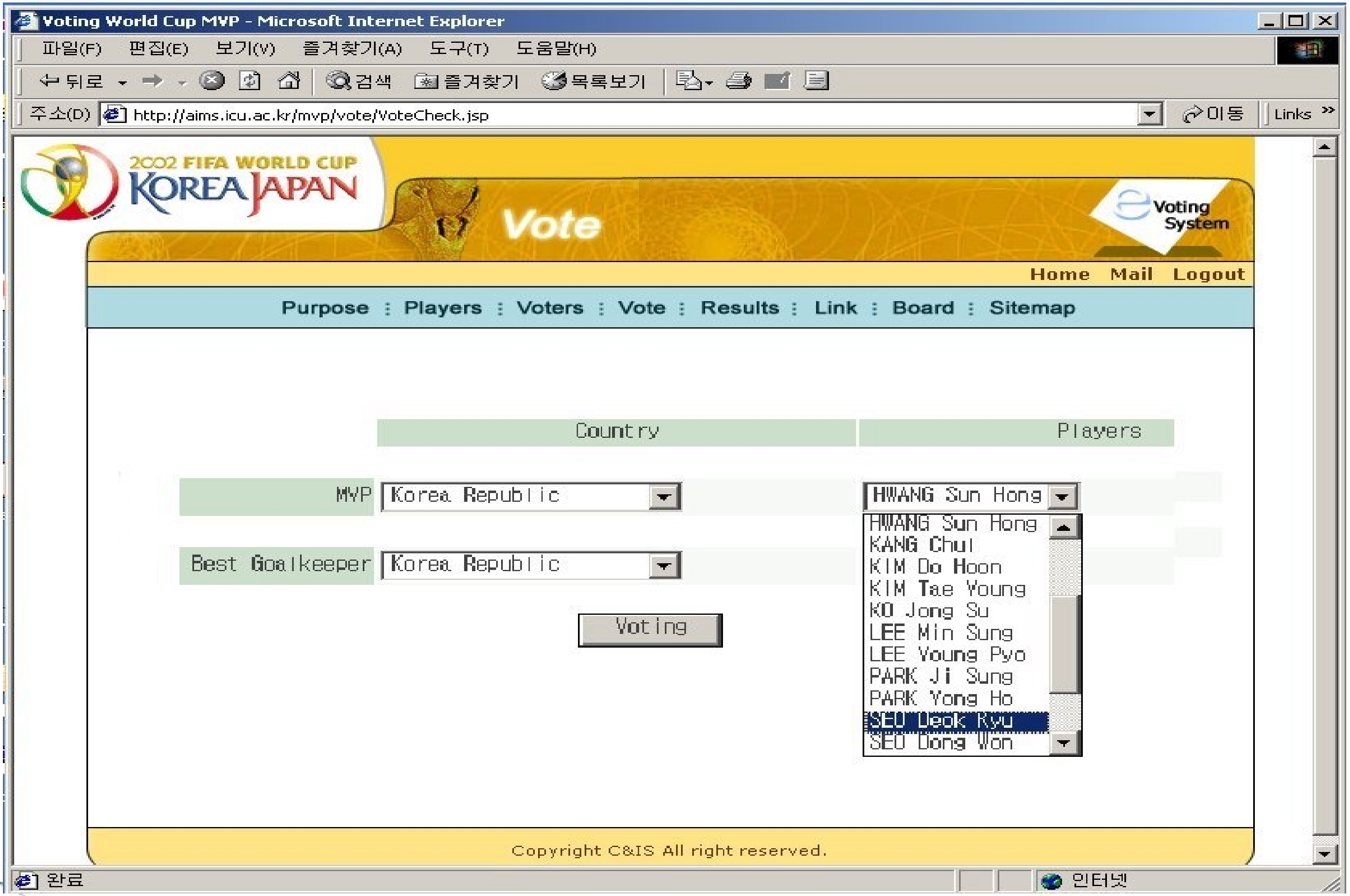
5. Typical Implementation

- **Built-in components**
  - Java crypto library J/LOCK by STI
  - CA server by KSIGN
  - Web interface by InsolSoft
  - Security management by SECUi.com
- **Severs**
  - AS,BB : Apache web server and Tomcat to support JSP
  - DB : Oracle DB + JDBC
  - M,T : Implemented in C language
- **Voting applet**
  - Signed java applet to access a secret key and to open connections to multiple addresses
  - Platform : WINDOW98 /+ on IBM PC

6. Application-Votopia

- **2002 FIFA World Cup Korea-Japan™**
  - May. 31. ~ June. 30. 2002
- **Objective**
  - Selection of MVP player in 2002 world-cup games
  - Demonstrating electronic voting system to the world in easy and friendly manner
- **Participants**
  - Korea : IRIS, InsolSoft, KISTI, Samsung Secui.com, STI
  - Japan : NTT, Univ. of Tokyo
- **Web-page**
  - http://mvp.worldcup2002.or.kr

Example



Voting World Cup MVP - Microsoft Internet Explorer

http://aims.icu.ac.kr/mvp/vote/VoteCheck.jsp

	Country	Players
MVP	Korea Republic	HWANG Sun Hong
Best Goalkeeper	Korea Republic	

HWANG Sun Hong
KANG Chul
KIM Do Hoon
KIM Tae Young
KO Jong Su
LEE Min Sung
LEE Young Pyo
PARK Ji Sung
PARK Yong Ho
SEO Deok Kyu
SEO Dong Won

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7. Summary

- **Experimental Design of Internet voting system**
  - User friendly and secure Internet voting system
  - Applying PKI to the voting system
- **Expected Results**
  - cyber MVPs of 2002 FIFA World Cup Korea-Japan^{TM}
  - Contribution to the development of information security related-industry such as PKI.
  - Valuable lessons to the planned Internet voting systems
- **Help**
  - Active participation and no hacking of IACR members.
  - Any comments to kkj@icu.ac.kr are welcome.
  - Social engineering, political problem, etc