CS155b: E-Commerce

Lecture 8: February 1, 2001

TPSs and Content-Distribution Businesses

Security Technologies

- Encryption
  - Symmetric Key
  - Public Key
- Signature
- PKI
- Rights Management
- Time stamping
- Secure Containers

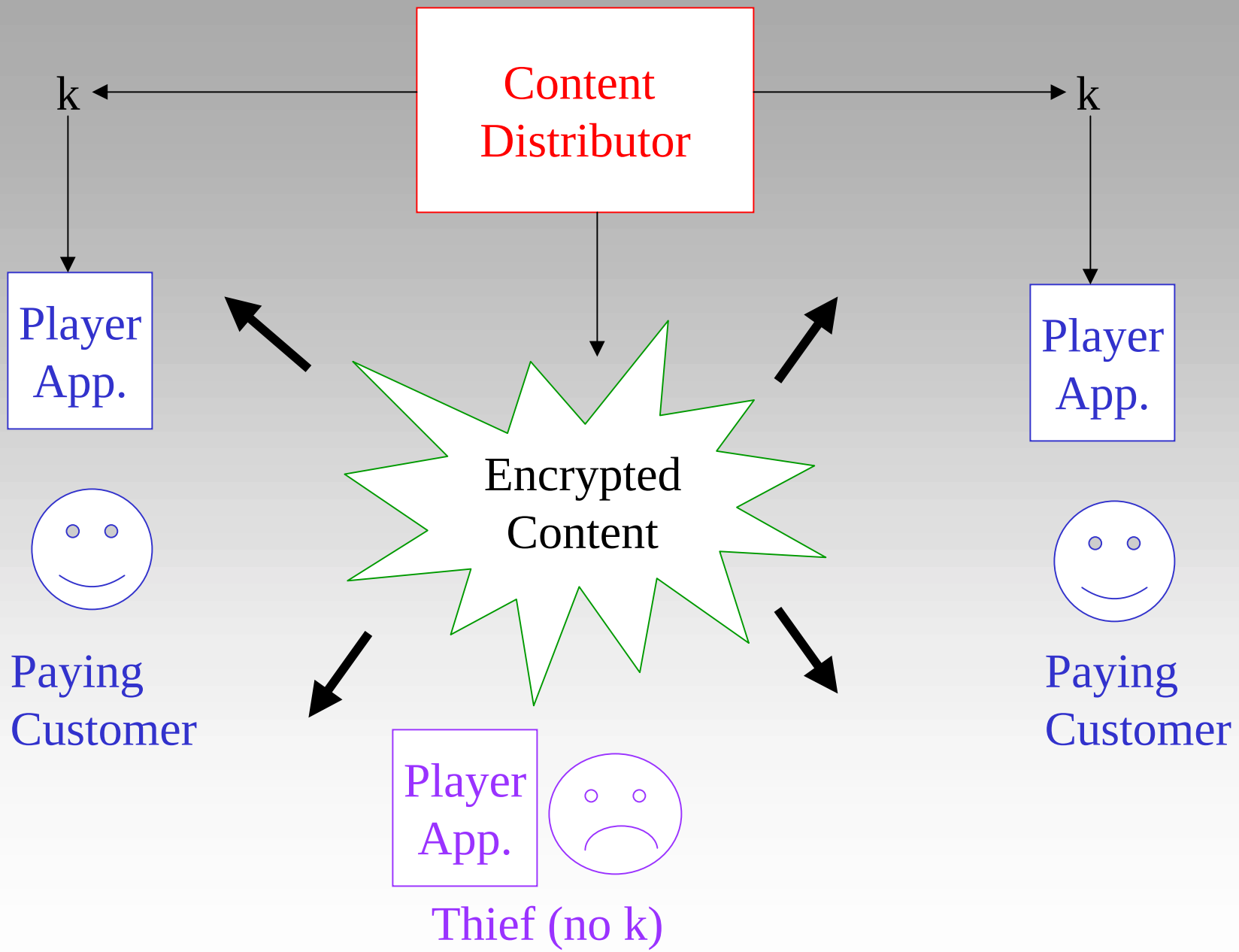
Product- or Service-Developer's Goal

- Choose the right ingredients and weave them together into an effective end-to-end technical protection system (TPS).
- Ingredients must be "right" w.r.t. business model and legal and social content as well as technical context.

Notoriously Difficult! (Shapiro and Varian may be too optimistic.)

General Points about TPSs

- TPS is a means, not an end. Cannot answer legal, social, or economic questions about ownership of or rights over digital documents.
- No TPS is perfect.
- Continued improvement in TPS requires ongoing R&D, including “circumvention.”
- TPS easier to design for special purpose devices and systems (*e.g.*, cable television) than for the Internet.
- TPS should serve customers’ needs, *e.g.*, assured provenance, as well as rightsholders’ needs.


Content Distributor
k
k
Player App.
Player App.
Encrypted Content
Paying Customer
Paying Customer
Player App.
Thief (no k)

Common Elements of Many TPSs

- Mass-Market broadcast content
  - Anyone can get ciphertext, which is broadcast on low-cost channel (*e.g.*, web page, broadcast TV).
  - Encrypted once.
- Decryption key k sent only to paying customers on lower-bandwidth, higher-cost channel.

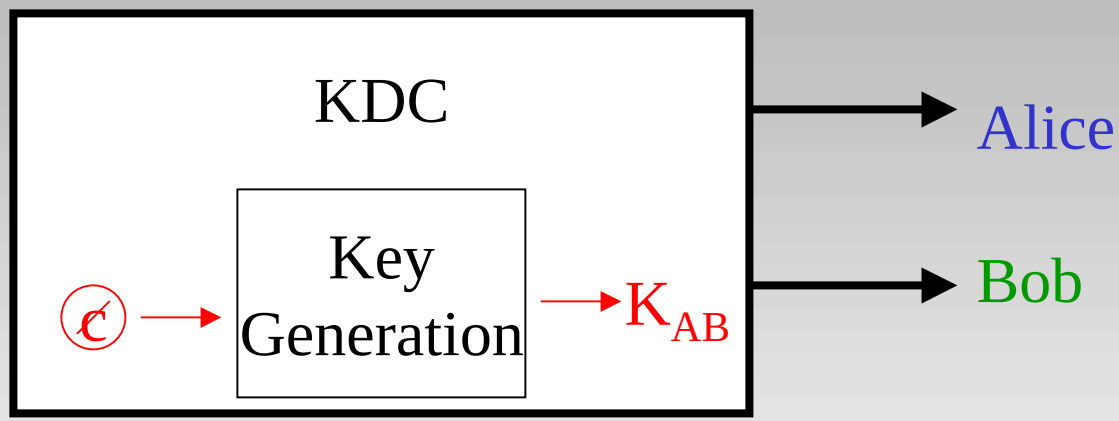
Possible Realization for Web Pages

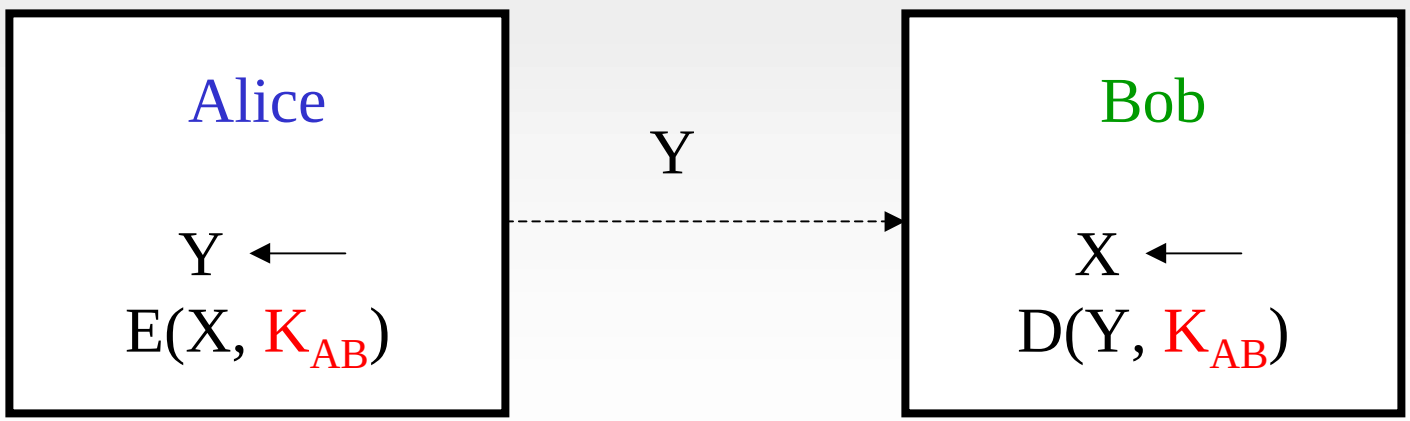
- Customer U and content-server use basic security protocol, *e.g.*, SSL, to create "session key" K_U and transfer payment from U to server.
- Server sends $k` = E(k, K_U)$ to U.
- U's browser computes $k = D (k`, K_U)$, downloads encrypted content, decrypts it using k, and displays it.

Possible Shortcomings

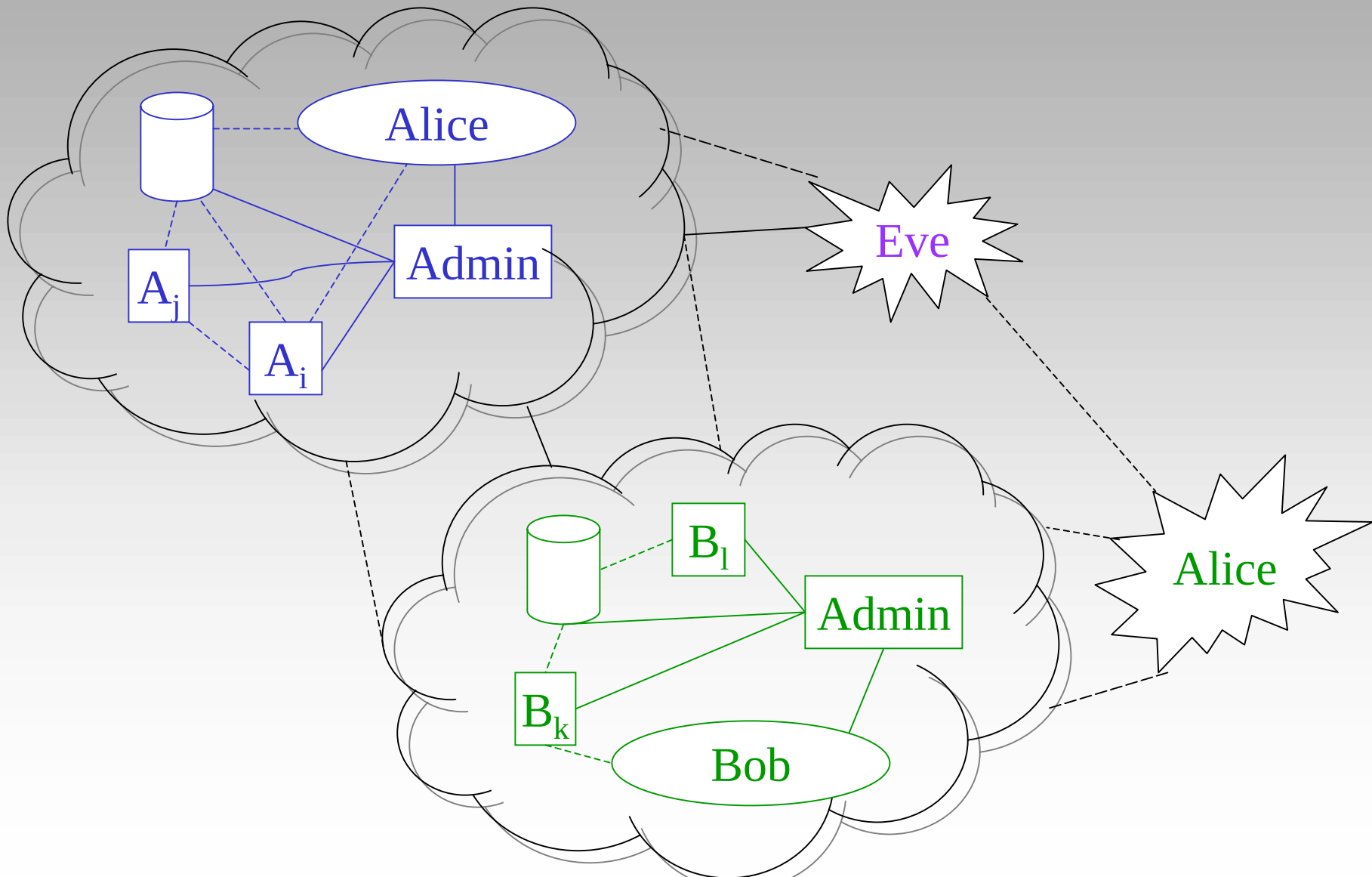
- Why can’t U print, save, or otherwise redirect displayed content?
- Why can’t a hacker steal k while it’s in use?
- Interaction of browser with other local-network software, e.g., back-up system?

Crypto. Theory Myth: Private Environments





Modern Computing Reality



Real Sources of Compromise

- Unwatched Terminals
- Administrative Staff Changes
- Misconfigurations
- OS Bugs
- Bad Random-Number Generators

Not sophisticated break-ins!

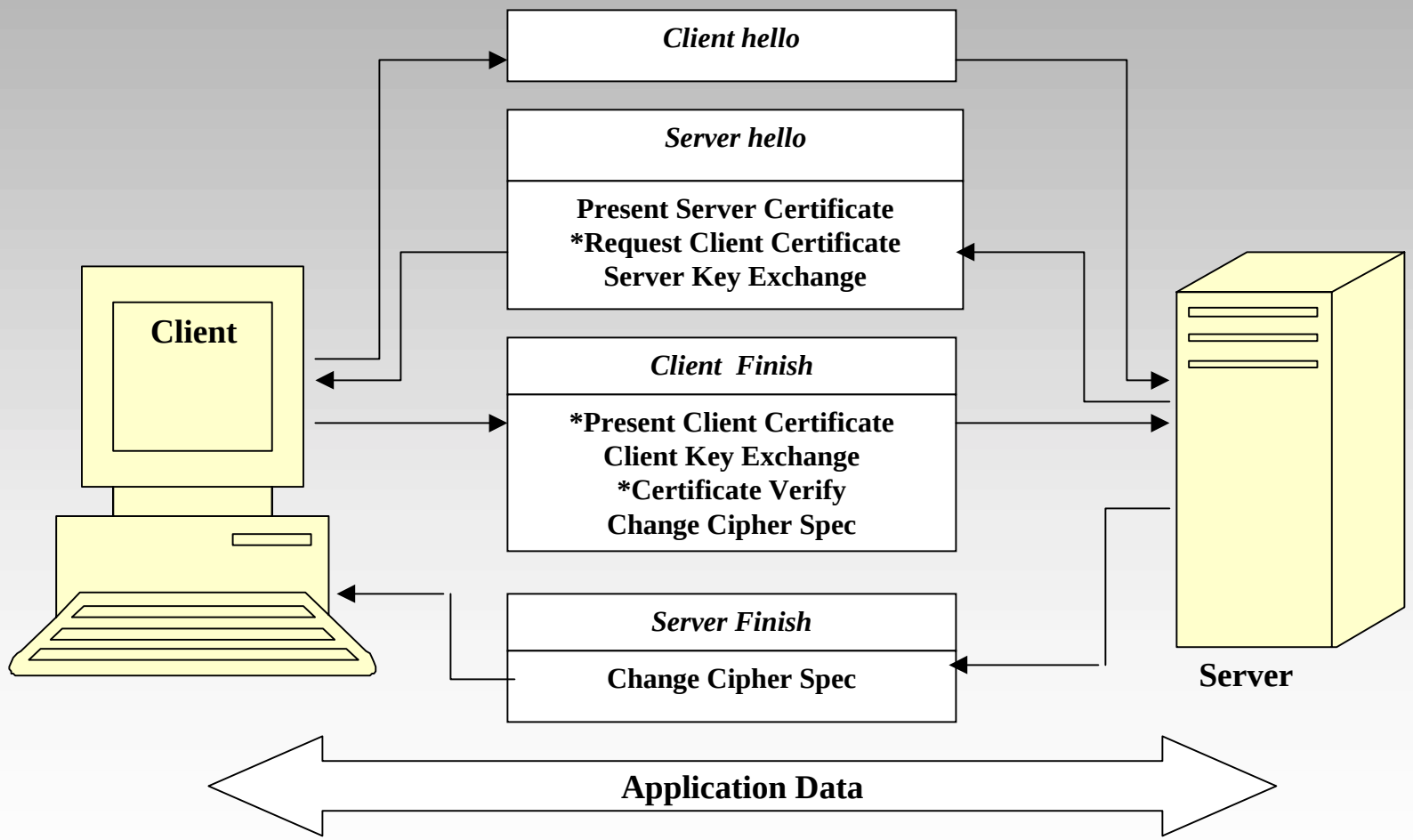
Secure Socket Layer (SSL)

- SSL was first developed by Netscape Corp. in 1994 and became an Internet Standard in 1997 (version 3.x).
- SSL is a cryptographic protocol to secure two applications communicating across a “socket” (*cf*. TCP).
- Data transmitted through an SSL connection is encrypted.
- It is mostly used by WWW applications (web servers and browsers). The string https:// in an URL specifies the browser to open a secured socket connection to the server (port 443).
- SSL uses digital certificates for authentication. There is no “trust hierarchy” in SSL, so browsers are preloaded with certificates of trusted CAs.
- Due to U.S. export regulations, products using SSL sold in foreign markets use weakened cryptography (40-bit key vs. 128-bit key).

SSL In Online Retailing

- Most Internet retail sites use SSL to secure online payments.
- Online merchants purchase digital certificates from CAs (*e.g.*, Verisign) to authenticate itself to the browser software.
- SSL is NOT an electronic payment protocol. It is used to safely transmit sensitive financial information (*e.g.*, credit card number , personal address, etc.)
- It means online merchants using SSL (*e.g.*, Amazon.com) do not process the credit cards in real-time. A traditional mail order/telephone order (MOTO) protocol is used after for payment processing later,
- SSL provides security in authentication and communication. It does not address other security issues: it is up to the individual to trust a name linked to a certificate, and in its ability to protect and not misuse its database.

The SSL Handshake



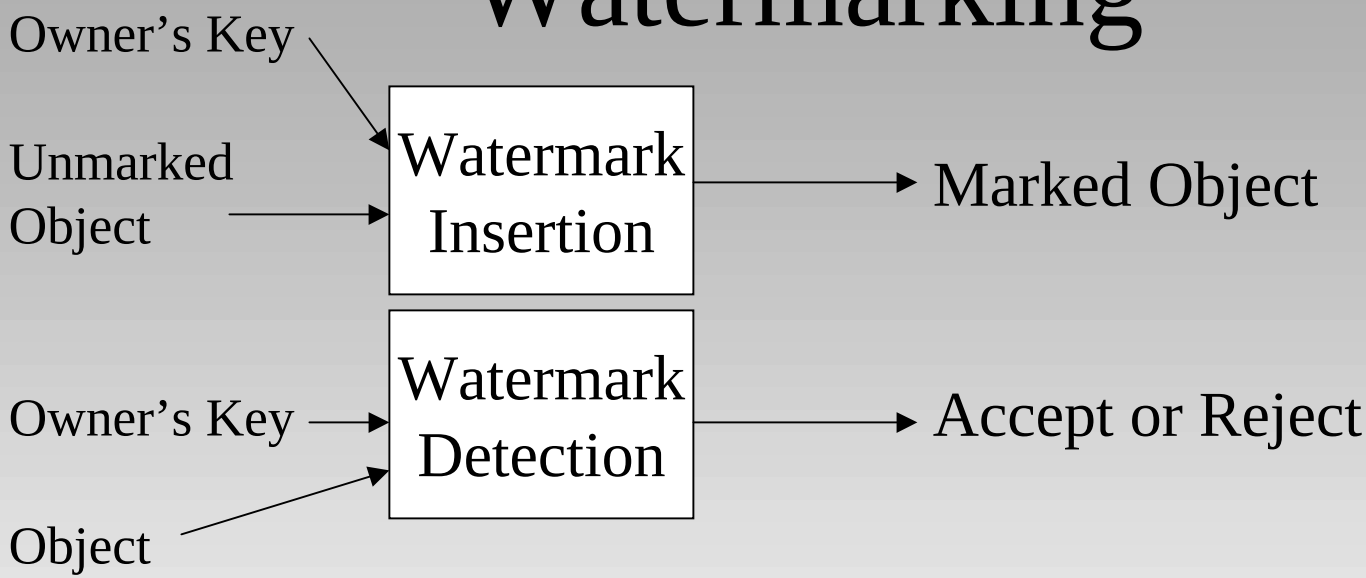
* Optional messages

Possible Realization for Pay-TV

- K_{ui} is entered in i^{th} "set-top box" when box is installed.
- $E(k, K_{u1})$, …, $E(k, K_{uN})$ are broadcast with encrypted program.

Shortcoming: *One* broken box can be used to steal *all* future programs.

Watermarking



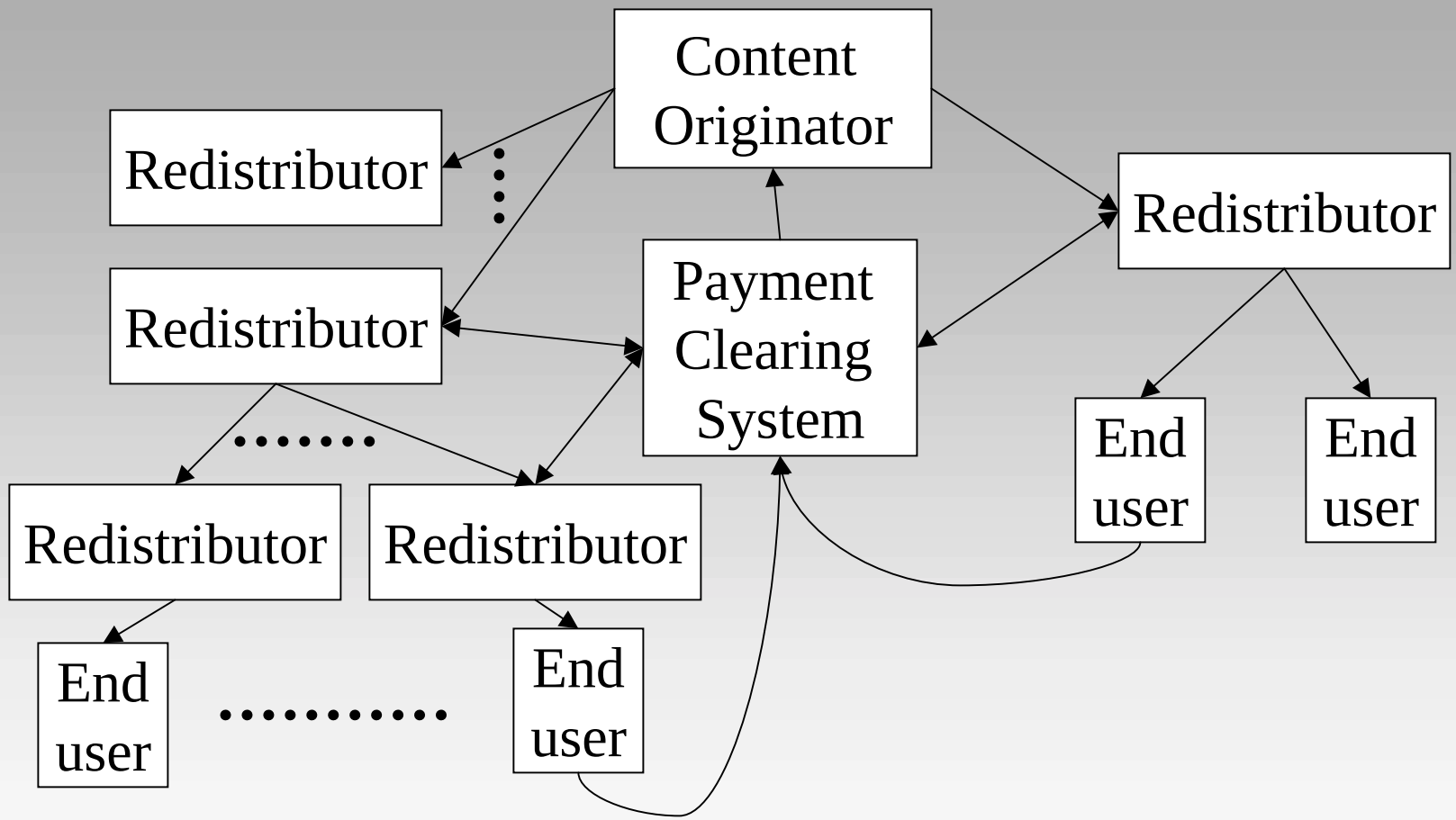
Note similarity with and difference from digital signature scheme.

Open Problem: Public-key watermarking.

Uses of Watermarking in TPS

- Broadcast of marked object, controlled distribution of keys. (Same architecture as in broadcast of encrypted content . . . and same shortcomings.)
- Web crawlers can search for unauthorized copies of marked objects.
- Unauthorized modification of marked objects can be detected by “fragile watermarking schemes.”
- Special-purpose devices can refuse to copy marked objects.

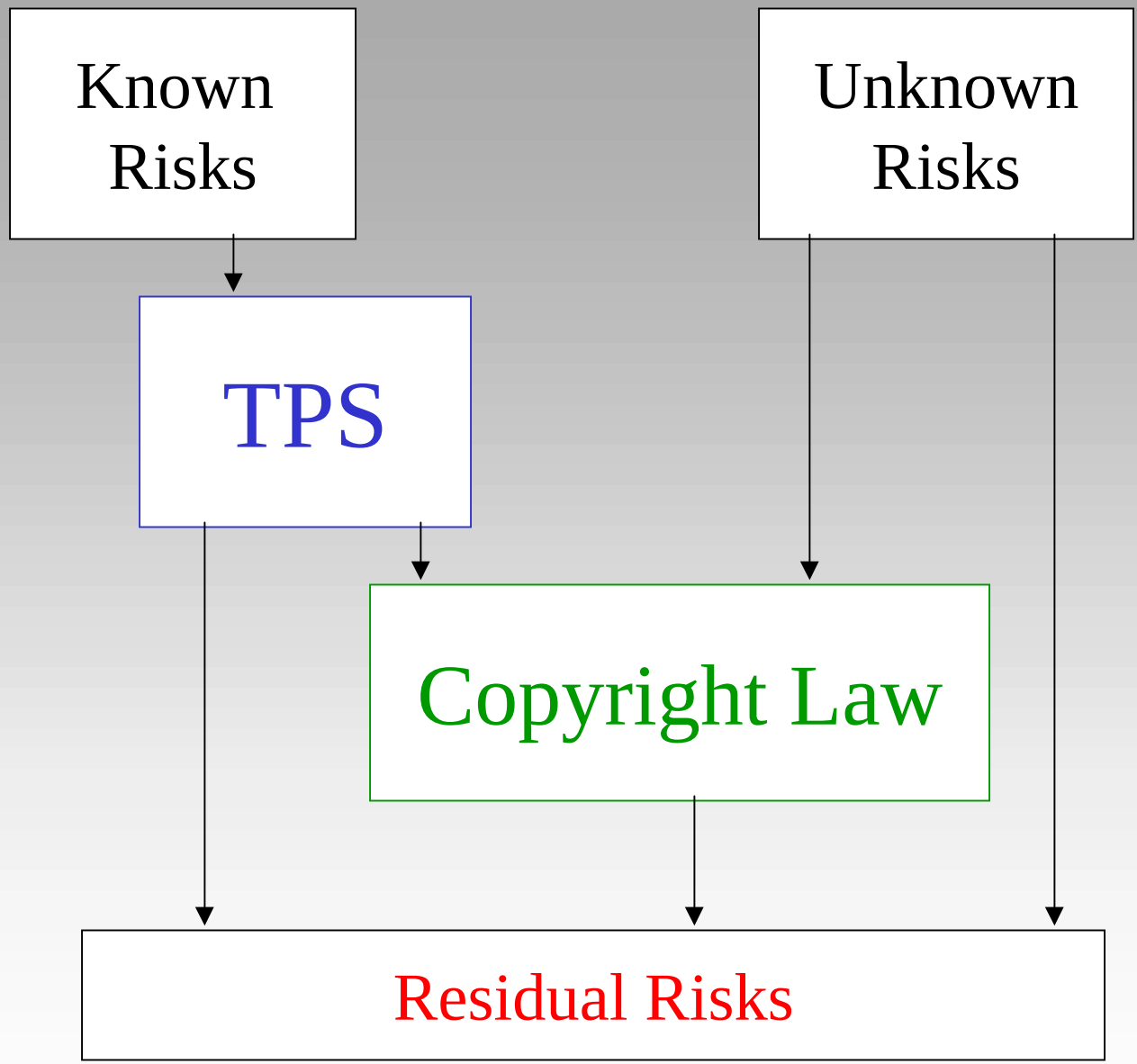
Superdistribution



Content is packaged with “terms and conditions” that are checked by a “rights-management system” and can be augmented by value-adding middlemen.

TPS Design Principles

- Know the $$ value of content
- Following rules: Convenient
- Breaking rules: Inconvenient
- Breaking rules: Conscious
- Renewable/Improvable Security
- Don’t let Pirates use your distribution channel
- Provide value that pirates don’t



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INTERTRUST

- Full Name: Intertrust Technologies Corporation
- Employees: 190 (end of 1999)
- Stock Price: $4.56 (Jan 29, 2001)
- Revenues in 1999: $1,541,000
- Business Area: Digital Right Management (DRM)

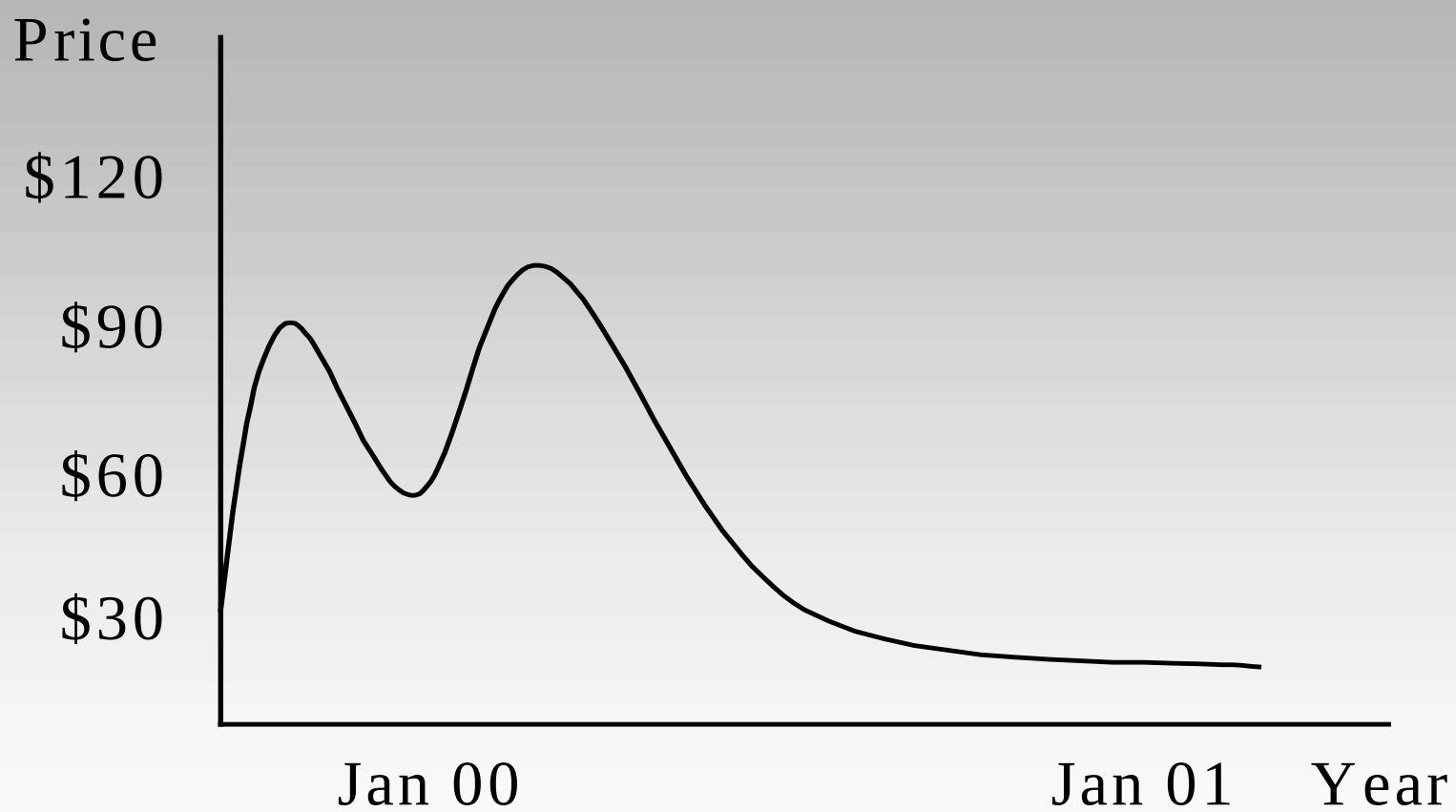
MAIN PRODUCTS

- Commerce DRM Platform: Can be used to create applications to securely manage, sell, and fulfill digital information.
- Commerce Applications: Partners of the applications built on top of the commerce platform
- Integrated System for DRM: Chips

BRIEF HISTORY

- 1990 Founded
- 1997 Annual Revenue More than $1M
- Q4, 1999 Listed as a Publicly Traded Company
- Feb, 2000 Historic Peak of Stock Price ($97)
- Jan, 2001 Virgin Records, Zomba Music, Daft Life and, Intertrust Announce Strategic Alliance

STOCK PRICE CHART



NET INCOME CHART