Java Security:
a Ten-Year Retrospective

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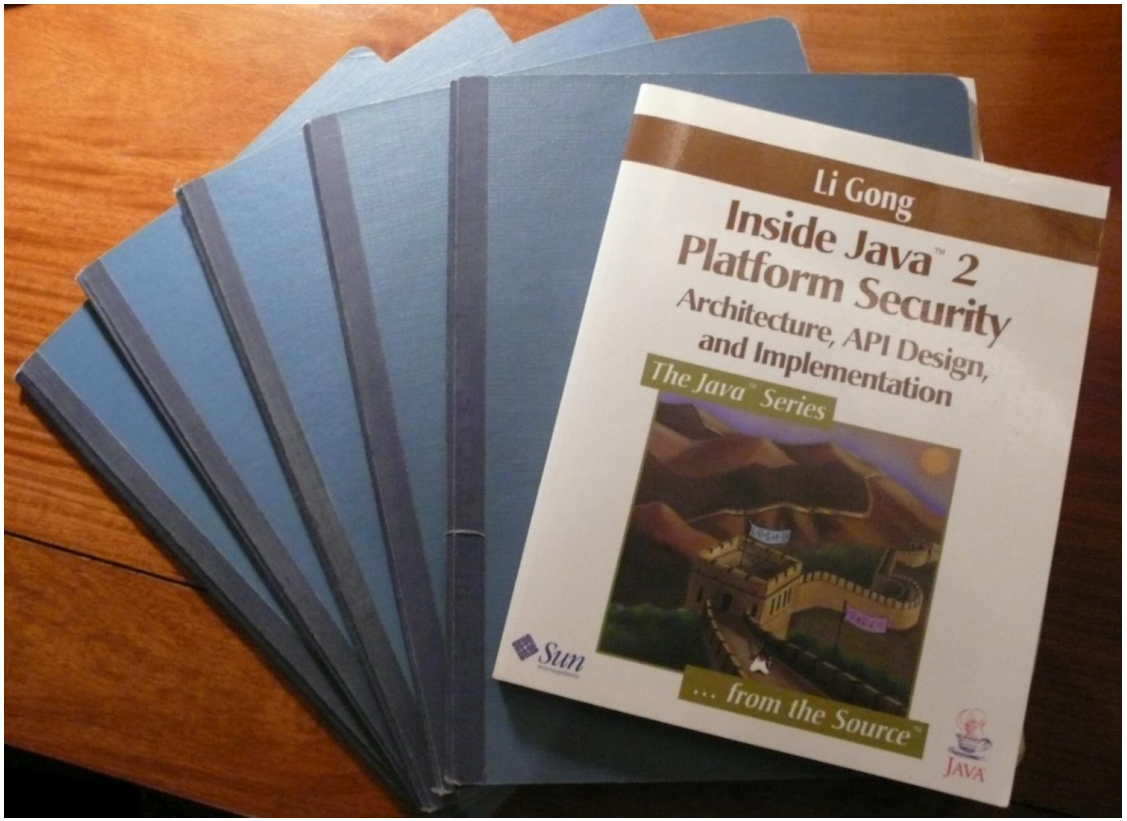
300~ Pages of Meeting Notes



1000~ Meetings in 30 months

Why Security Technologies Seldom Make Into Actual Mainstream Products and Systems???

- Can count notable successes on one hand
  - Firewall
  - SSL/TLS
  - One-time password
  - Maybe anti-virus for Windows

The Answer Is:

- It is a social process, not just a technology issue
- The EKE story (Bellovin/Merritt, IEEE S&P, 1992)
- “Reducing Risks from Poorly Chosen Keys” (Lomas/Gong/Needham/Saltzer, ACM SOSP 1989)
- Plus luck – at the right place and the right time; be ready to take the single available shot

Major Distractions Circa 1996/7

- Export control of crypto packages
  - Key escrow/key recovery, RSA/Bsafe/Cylink/others, CDSA, MS CAPI
  - Church of Cryptology
- Constant onslaught of security bugs
  - The Friday fire drills
  - Microsoft is a Java licensee; but is it a good partner?
- Where is Java security headed
  - Is it just a component of the browser? More specifically the Netscape browser?

Minor Distractions

- Protect against decompilation of Java bytecode
  - Code obfuscation
  - Encrypted bytecode
- Control of resource consumption by applets
- Java on a smartcard
- Java as e-commerce platform (Java Wallet)
- JavaOS (Java Station)
  - Security needs for a standalone OS?
- Sun company wide security architecture and strategy?

Four Major Concerns for JDK 1.2

- Usability
  - Suitable for a wide variety of applications
- Simplicity
  - Easy to understand and analyze
- Adequacy
  - Enough features before the next release
- Adaptability
  - Do not over prescribe
  - Can evolve with ease

JDK 1.2 Security Feature List (12/11/1996)

- Project code named Gibraltar
- Features
  - Authentication
  - Delegation
  - Fine-grained access control
  - Policy management
  - Audit
  - Secret sharing
  - Key generation
  - Storage of private keys (e.g., passwords)
- Alpha (05/1997), FCS (09/1997)

Another Java security workshop

- 6/17/1997
- MSFT, Netscape, IBM, Lotus, DEC, Marimba, W3C, AT&T, Cylink, HP, Intel

12-Month Battle with Netscape

- The three battles
  - JFC vs Netscape's IFC (combined into Swing)
  - Hotspot vs Netscape's proposed Java VM
  - Java security vs Netscape Java security extensions
- IBM as arbitrator
  - Arbitration resolution meeting 10/15/2007
  - Don Neal overall IBM taskforce lead (Bob Blakely took over the lead 3 months later)

More “Battles”

- Customers with special requests
  - Financial (Chase, Citicorp, Amex, etc.)
  - US government agencies
  - Big corps (IBM, Lotus, Novell, etc.)
  - Startups in new fields (@Home, etc.)
  - Sun internal (pJava, eJava, enterprise groups)
- Security audit of JDK 1.2

Java Security Advisory Council (12/1997)

- Java security vs underlying OS security
  - Dependence on, exposure of, API access to, interoperable with underlying OS security features
- Theory and Practice
  - How much can we apply existing theories and tools in semantics, analysis, certification, verification, assurance
- Secure distributed computing needs
  - Authentication, authorization, secure transaction, fault tolerance, agents and mobile computing
- Real-world impact
  - Users, developers, sys adms, educators, public opinion

Technical Example 1

- Implementation least privilege at the system level in JDK 1.2 turned out to be easier and more robust than a “bolted-on” binary sandbox model in JDK 1.0/1.1

Technical Example 2

- Public static native void begingPrivileged()
- Public static native void endPrivileged()
- Try {

```
        AccessController.beginPrivileged();
        System.loadLibrary("xyz");
    }   finally {
                AccessController.endPrivileged();
    }
```

Example 2 (Cont.)

- Privileged System.loadLibrary(“xyz”);

- somemethod() {

```
        AccessController.doPrivileged(new PrivilegedAction() {
                public Object run() {
                        System.loadLibrary(“xyz");
                        return null;
                }
        });
}
```

Technical Example 3

- GuardedObject
  - An object containing a resource (e.g., a file) and a specific guard (a permission)
  - The resource is accessible if the permission is allowed
- Access permission is checked at the point of resource consumption, ensuring the right check is done in the right context
  - Can pass objects around freely
  - Can prepare resources before actual requests

Observations – The Good

- Java security has matured
  - From “what it is” to “how to utilize the features”
  - Did too little, too much, or just right?
- Raised the bar for everyone else
  - Anyone designing a new language/platform must consider type safety, systems security, least privilege, etc.
- Impacted thousands of programmers on their security awareness

Observations – The Bad

- Those companies who can afford the time and effort to improve security do not feel incented to spend the resources
- Those who want to differentiate from the dominate players cannot afford the time and effort
- When rarely a good security platform emerges, industry competition would not allow it to be adopted across the board

Observations – The Bad (cont.)

- Many/any extensible systems (e.g., browser add-ons, iPhone apps) need the same sort of protection/security infrastructure, but they tend to be built on different technology platforms, so reuse is difficult or impossible

Observations – The Ugly

- A new thing (a toy widget, scripting language, etc.) starts nice and small, with limited usage scope and no security considerations
- It gains good traction
- The feature set keeps expanding
- Soon the “small toy” resembles a full system or programming platform, except without adequate security support

“Never Forget Class Struggle!”

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