Foundations of Computer Security

Lecture 21: Modeling Integrity: Biba

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Biba's Integrity Models

Ken Biba (1977) proposed three different integrity access control policies.

1. The Low Water Mark Integrity Policy
2. The Ring Policy
3. Strict Integrity

All assume that we associate *integrity labels* with subjects and objects, analogous to clearance levels in BLP.

Only Strict Integrity had much continuing influence. It is the one typically referred to as the "Biba Model" or "Biba Integrity."

Strict Integrity Policy

The *Strict Integrity Policy* is a mandatory integrity access control policy and is the dual of BLP.

Simple Integrity Property: Subject s can read object o only if
$$i(s) \leq i(o).$$

Integrity *-Property: Subject s can write to object o only if
$$i(o) \leq i(s).$$

What does it mean to say that Biba Integrity is the "dual" of Bell and LaPadula?

Interpreting the Rules

- Simple Integrity means that a subject can only read objects at its own integrity level or above.

- The Integrity *-Property means that a subject can only write objects at its own integrity level or below.

This means that a subject's integrity cannot be tainted by reading bad (lower integrity) information; a subject cannot taint more reliable (higher integrity) information by writing into it.

Since this is an access control policy, it can be represented as an access control matrix? Suppose $H > L$ are hierarchical integrity levels.

Subjects	Level	Objects	Level
Subj1	$(H, \{A, B, C\})$	Obj1	$(L, \{A, B, C\})$
Subj2	$(L, \{\})$	Obj2	$(L, \{\})$
Subj3	$(L, \{A, B\})$	Obj3	$(L, \{B, C\})$

The following is the associated access control matrix.

	Obj1	Obj2	Obj3
Subj1	W	W	W
Subj2	R	R, W	R
Subj3	R	W	-

Combining BLP and Strict Integrity

To protect confidentiality *and* integrity, one could use both BLP and Biba's Strict Integrity policy.

1. You'd need confidentiality labels and integrity labels for all subjects and objects.

2. An access is allowed only if allowed by *both* the BLP rules and the Biba rules.

What would the corresponding access control matrix look like?

Lessons

- Biba's Strict Integrity Policy is a mandatory integrity access control policy and is the dual of BLP.

- It aims to keep information from flowing up in integrity.

- Since confidentiality and integrity are orthogonal they require different sets of labels and can be enforced separately or jointly.

Next lecture: Biba's Other Policies