

Security Policies

Security Definitions

Below are given some (relatively) formal definitions¹:

- a ***security policy*** is a statement that partitions the states of a system into a set of *authorized*, or secure, states and a set of *unauthorized*, or non-secure, states.
- a ***secure system*** is a system that starts in an authorized state and cannot enter an unauthorized state.
- a ***breach of security*** occurs when a system enters an unauthorized state.
- a ***security mechanism*** is an entity or procedure that enforces some part of the security policy.
- a ***security model*** is a model that represents a particular policy or set of policies.

¹Matt Bishop: Computer Security

The Military Security Policy (1)

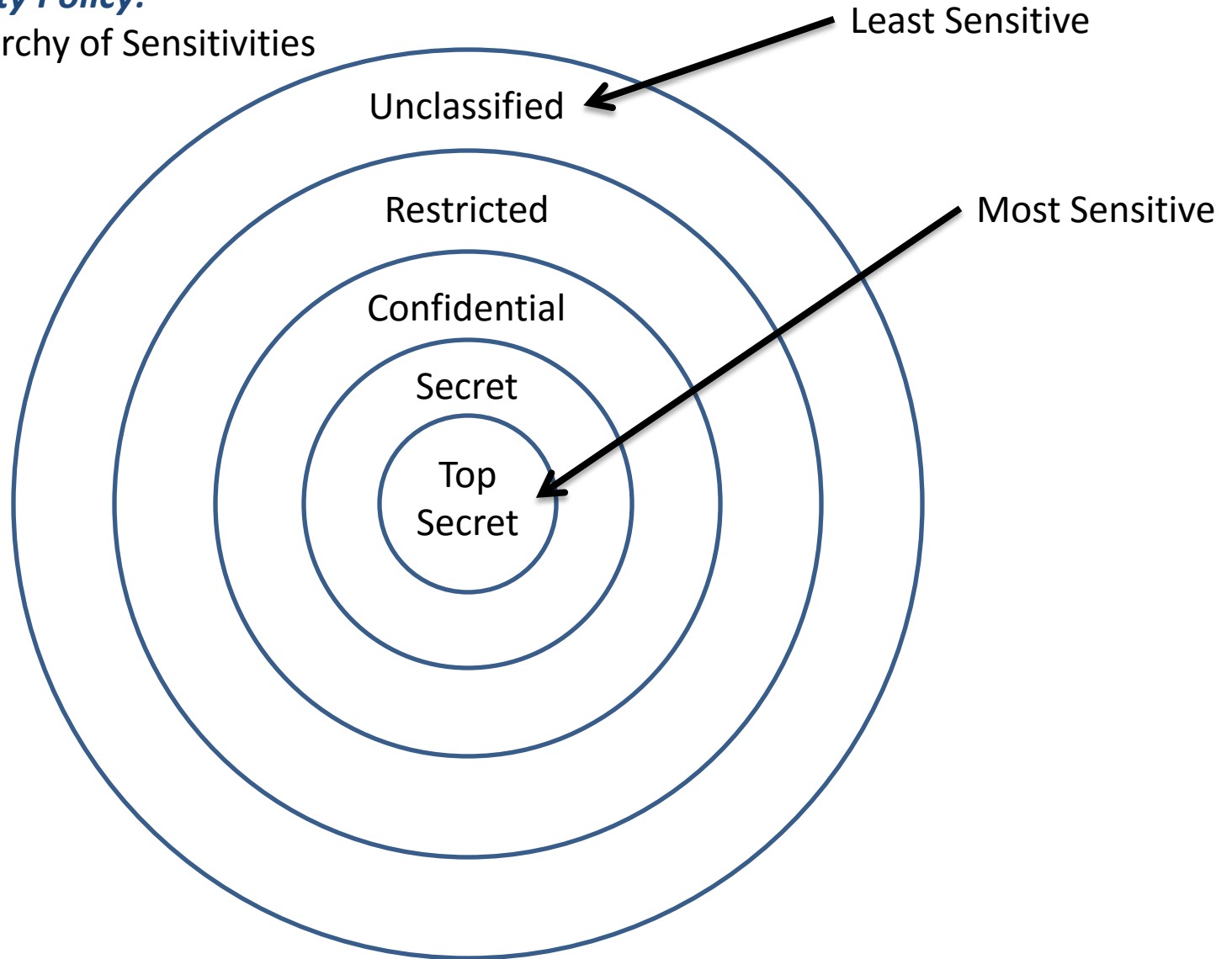
- the **Military Security Policy** is based on protecting classified information with respect to *confidentiality*.
- each piece of information is **ranked** at a particular *sensitivity* level:
 - unclassified
 - restricted
 - confidential
 - secret
 - top secret
- each piece of information may be associated with one (or more) projects, called **compartments**.
- The combination **<rank; compartments>** is called the **classification** or **class** of a piece of information.

The Military Security Policy (2)

- a person has a **clearance** to access information up to a certain level of sensitivity.
- The clearance of a person has the same form as the classification of a piece of information:
<rank; compartments>
- the **need-to-know** rule (principle of least privilege) means that individuals shall only have access to those data that they need in order to perform their jobs.
- the use of compartments helps to enforce the need-to-know rule.
- the user may **not** alter classifications, i.e. the policy requires Mandatory Access Control (MAC).

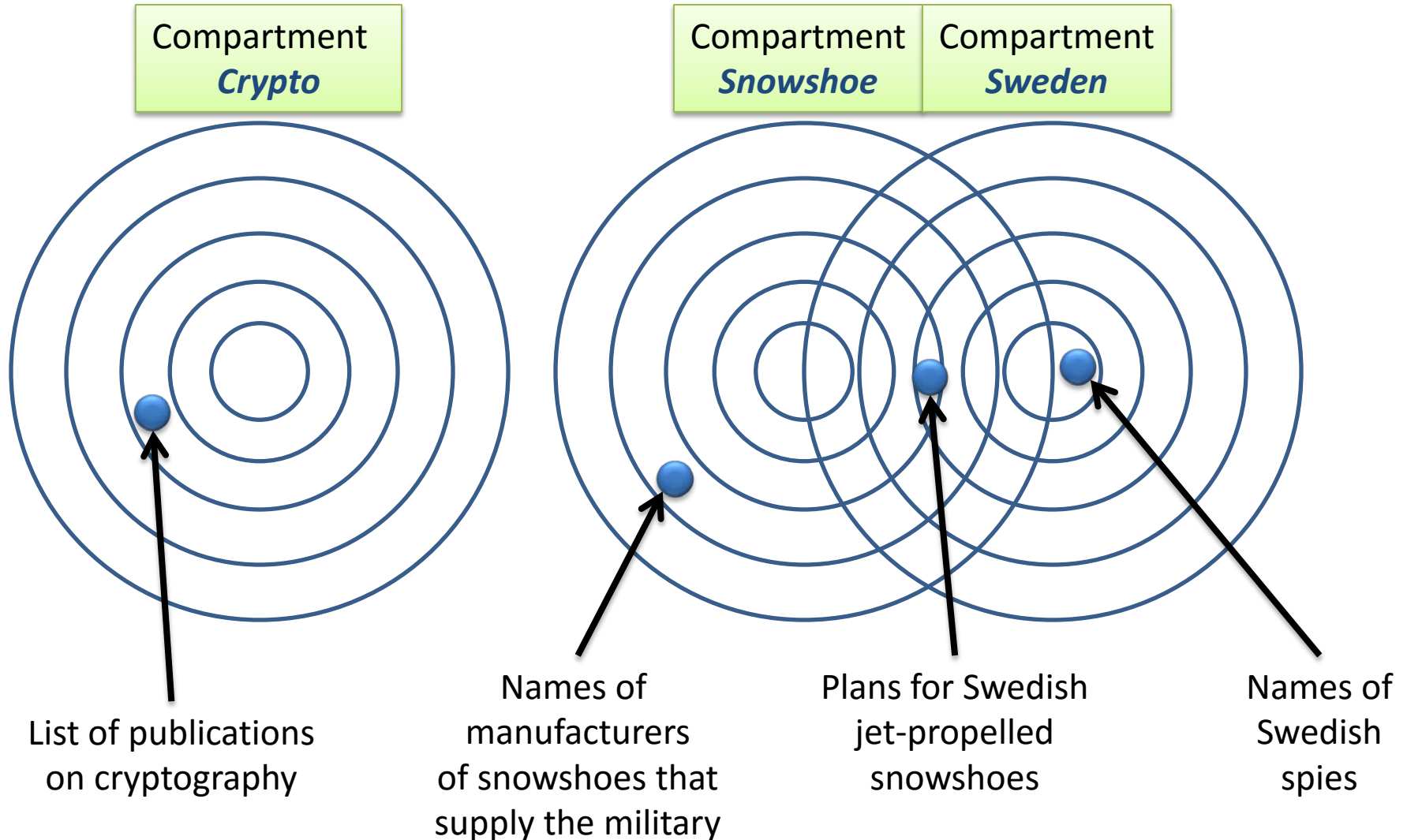
Military Security Policy:

Hierarchy of Sensitivities



Note: Here an object has a **single** rank, but may belong to **several** compartments.

Plans for Swedish jet-propelled snowshoes = <Confidential; {Snowshoe,Sweden}>



Commercial Security Policies (1)

- commercial security policies generally have a broader scope than the military security policy.
- they may address issues such as industrial espionage, conflicts of interest and rules for how activities must be performed within a company. Also they **extend** the scope to *integrity* and *availability*.
- they are normally less formal. There is no formalized notion of clearance and consequently are the rules for allowing access less regularized.
- the degrees of sensitivity are normally (but variants exists):
 - public
 - proprietary
 - internal

Commercial Security Policies (2)

- the **Clark-Wilson security policy**:
 - proposes a policy for *well-formed transactions*, which gives rules for the logistic process within the company, in terms of which steps must be performed by which person with a specified authority and in which order. Thus it addresses the *integrity aspect*.
- the Clark-Wilson security policy is defined in terms of access triples:
 <**UserID**; **TP**; {**CDI**_i, **CDI**_k,}>,
which stands for
 - **User ID**entification,
 - **T**ransformation **P**rocedure and
 - **C**onstrained **D**ata **I**tems resp.

Clark-Wilson security policy

Well-formed transactions

Company

Purchase
Department

Receiving
Department

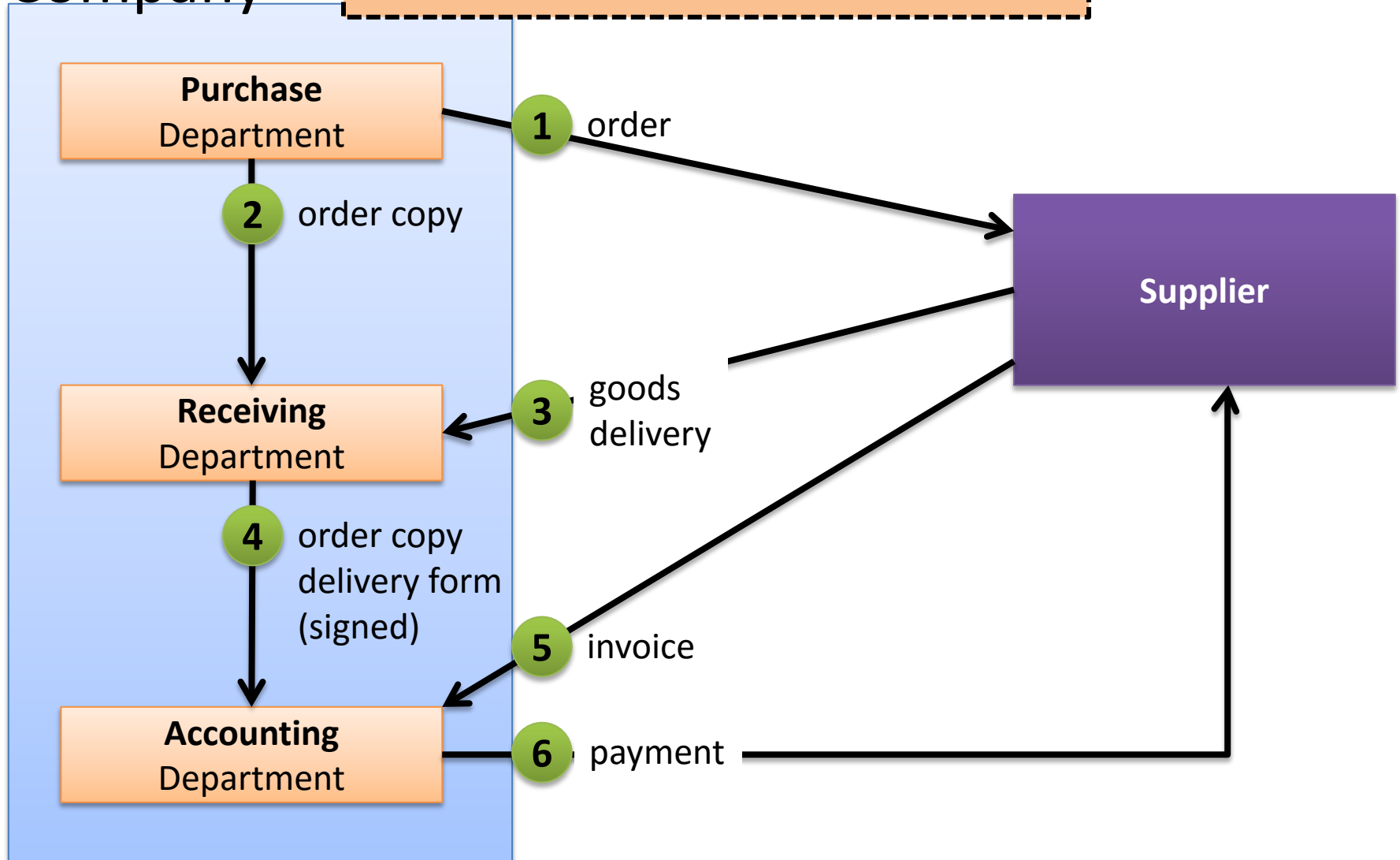
Accounting
Department

Supplier

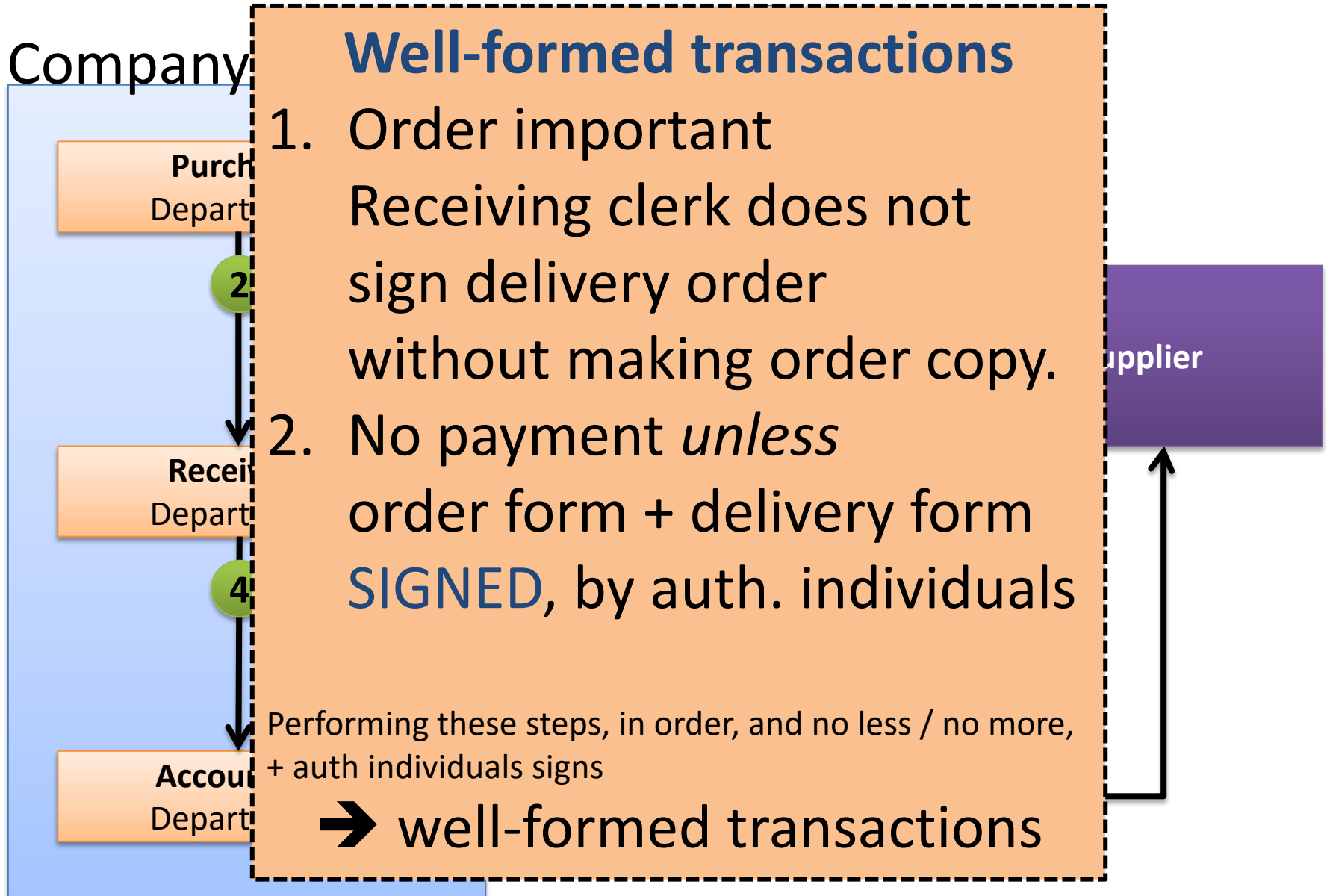
Clark-Wilson security policy

Well-formed transactions

Company



Clark-Wilson security policy



Commercial Security Policies (3)

- **Lee, Nash and Poland** suggested an addition to the *Clark-Wilson* policy that involves *separation of duty*. The aim is to prevent abuse that can arise when the same person performs too many related actions in a company.
- the **Chinese Wall policy** [by Brewer and Nash] enforces rules that prevents flow of information between companies that may have conflicting interests, e.g. competing.
 - the policy is defined in terms of three primitives:
 - objects,
 - company groups, and
 - conflict classes.
 - and the same employee may not access information from different companies in the same conflict class. Thus it *addresses confidentiality*.

Chinese Wall Policy Example

Suchard

Cadbury

Citicorp

Credit
Lyonnais

Deutsche
Bank

SAS

Bell-La Padula Security Model

- The BLP is a **formalization** of the Military Security Model (described a mathematical notation).
- The BLP model is a formal description of the **allowable paths of information flow** in a secure system.
- The BLP defines security requirements for systems that concurrently handles **data at different sensitivity levels**.
- The BLP addresses **confidentiality**.

Bell-La Padula Security Model

- System is described as a set of subjects **S** and objects **O**
 - For each $o \in O$, there is a security class $L(o)$ [classification]
 - For each $s \in S$, there is a security class $L(s)$ [clearance]

Bell-La Padula Security Model

- **Simple Security Property:**

A subject s may have *read* access to an object o only if $L(o) \leq L(s)$.

- ***-Property:**

A subject s who has *read* access to an object o may have *write* access to an object p only if $L(o) \leq L(p)$.

Bell-La Padula Security Model

Adding the *need-to-know* property with categories (projects).

Each subject s have a security clearance, l_s , and the need-to-know to access a number of categories, c_s .
CMP: Eve: $\langle TS, \{\text{snowshoes}, \text{sweden}\} \rangle$

Definition:

The security level (L, C) **dominates** the security level (L', C') if and only if $L' \leq L$ and $C' \subseteq C$.

Bell-La Padula Security Model

- **Simple Security Property:**

A subject s may have *read* access to an object o only if s *dominates* o .

- ***-Property:**

A subject s who has *read* access to an object o may have *write* access to an object p only if p *dominates* o .

Steven: <TS; {crypto}>

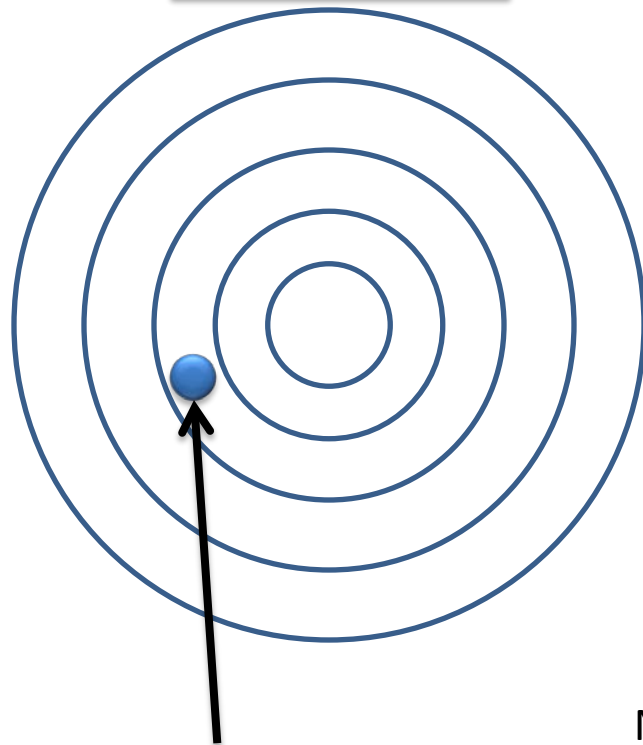
Liza: <C,{snowshoes,sweden}>

Eve: <TS,{snowshoes,sweden,malware}>

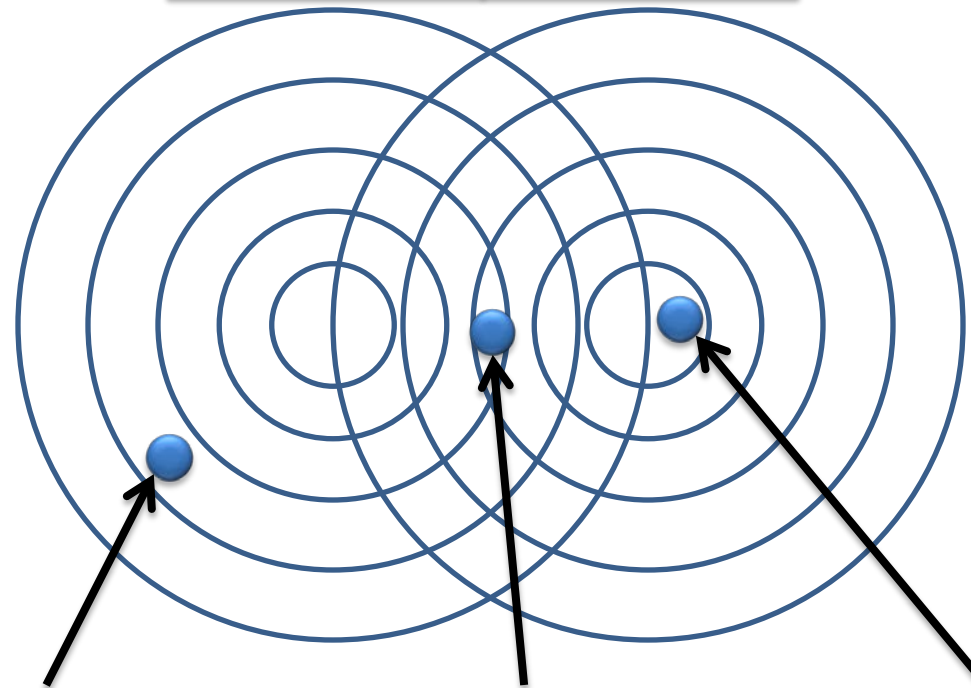
Compartment
Crypto

Compartment
Snowshoe

Compartment
Sweden



List of publications
on cryptography



Names of
manufacturers
of snowshoes that
supply the military

Plans for Swedish
jet-propelled
snowshoes

Names of
Swedish
spies

Bell- La Padula pros and cons

- **Advantages:**
 - A subject may not downgrade information
- **Problems:**
 - "High" users can never talk to "low" users
 - Addresses only confidentiality
 - Anyone can create an object with a higher classification
 - "Float-up" (i.e. down-grade needed)
 - Does not address covert channels
- **Principle of tranquility:**
 - Subjects and objects may not change their security level once they are instantiated