Software Security: Principles

CS 161: Computer Security

Prof. David Wagner

February 3, 2014

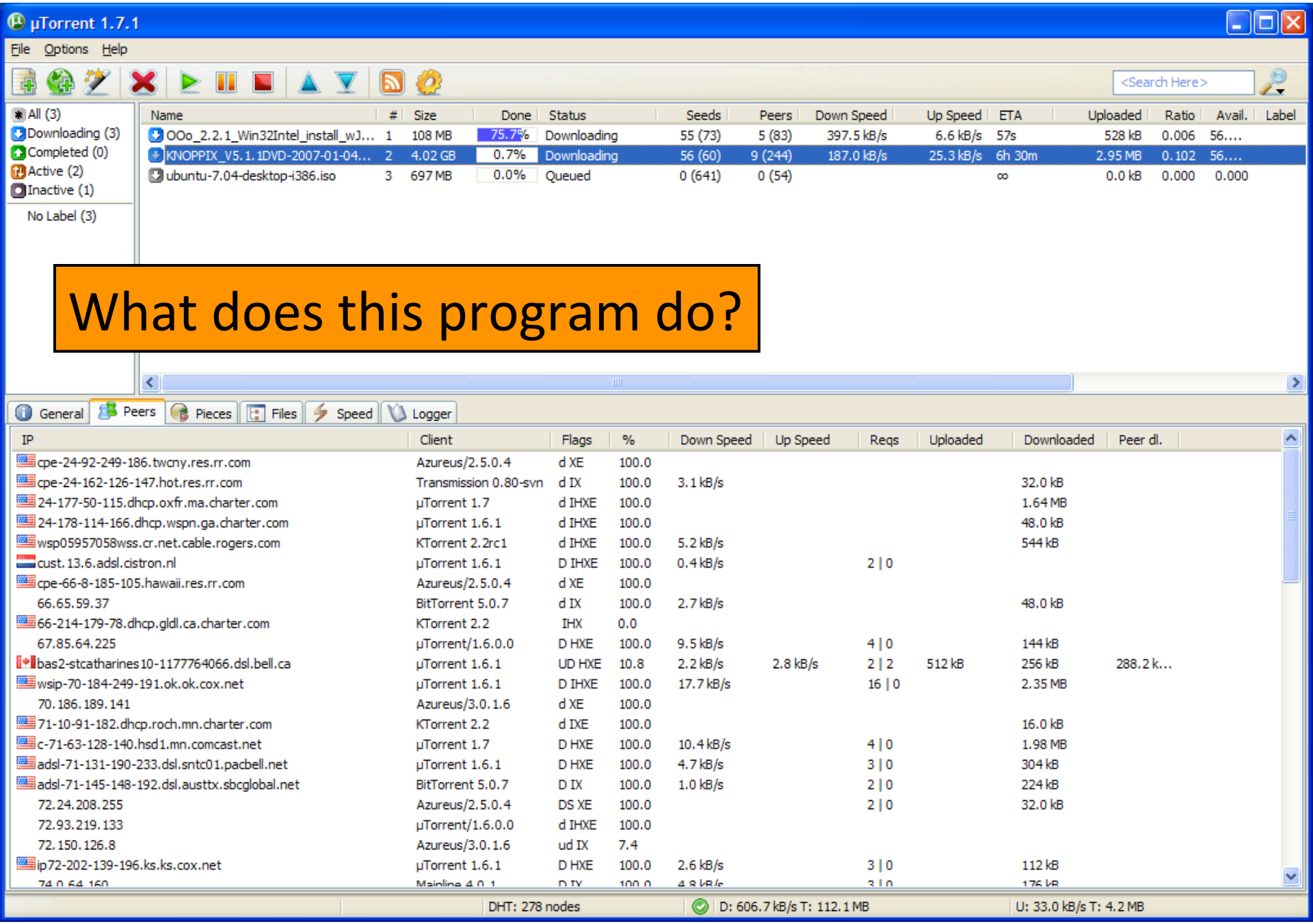
TL-15

TL-30

TRTL-30

TXTL-60

“Security is economics.”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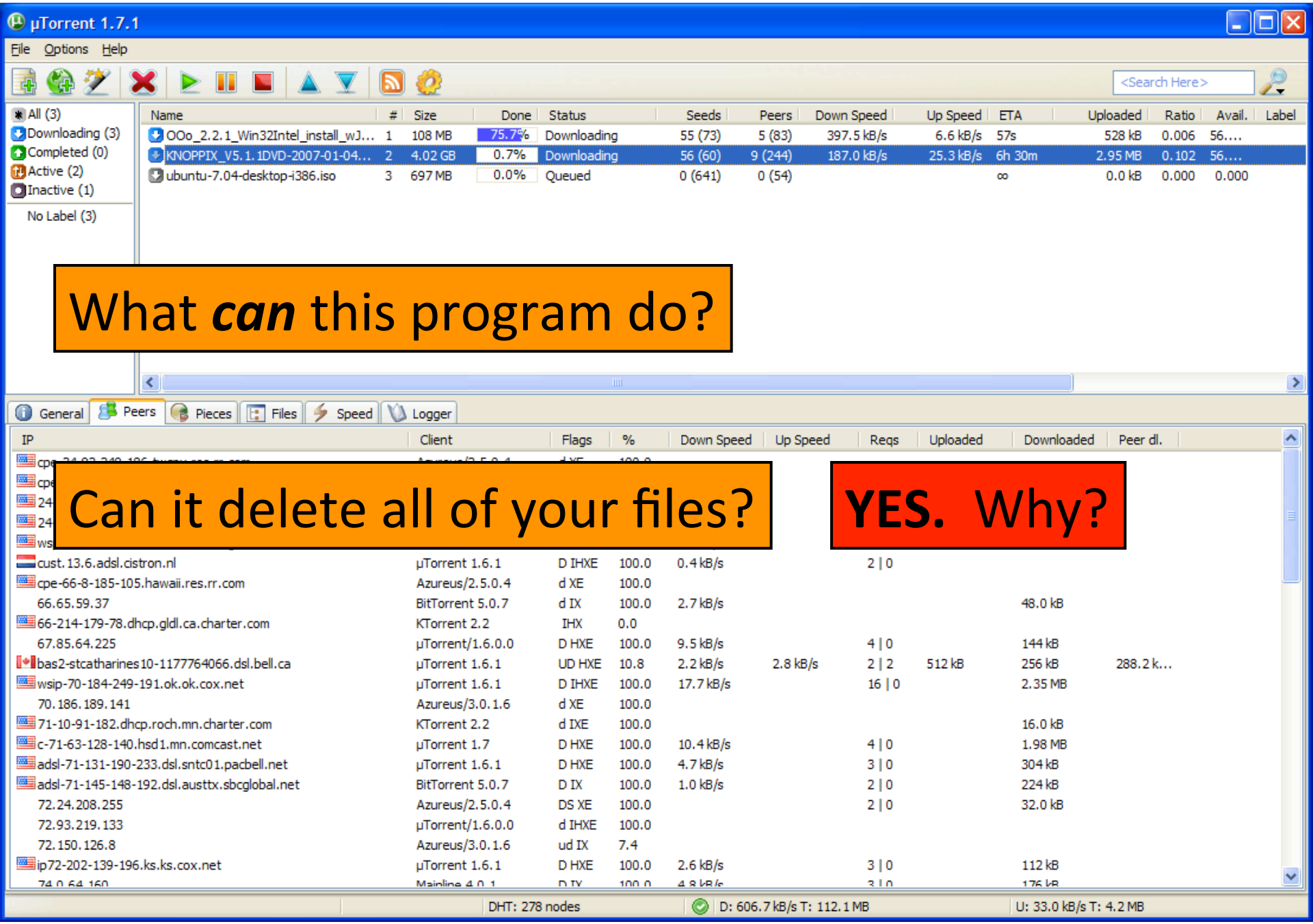
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“Least privilege.”

Touchstones for *Least Privilege*

- When assessing the security of a system's design, identify the *Trusted Computing Base* (**TCB**).
  - What components does security rely upon?
- Security requires that the TCB:
  - Is correct
  - Is complete (can't be bypassed)
  - Is itself secure (can't be tampered with)
- Best way to be assured of correctness and its security?
  - **KISS** = *Keep It Simple, Stupid!*
  - Generally, Simple = ***Small***
- One powerful design approach: privilege separation
  - Isolate privileged operations to as small a component as possible
  - (See lecture notes for more discussion)

Check for Understanding

- We've seen that PC platforms grant applications a lot of privileges
- Quiz: Name a platform that does a better job of least privilege

“Ensure complete mediation.”

Ensuring Complete Mediation

- To secure access to some capability/resource, construct a *reference monitor*
- Single point through which all access must occur
  - E.g.: a network firewall
- Desired properties:
  - Un-bypassable ("complete mediation")
  - Tamper-proof (is itself secure)
  - Verifiable (correct)
  - (Note, just restatements of what we want for TCBs)
- One subtle form of reference monitor flaw concerns *race conditions* …

TOCTTOU Vulnerability

```
procedure withdrawal(w)
    // contact central server to get balance
    1. let b := balance

    2. if b < w, abort

    // contact server to set balance
    3. set balance := b - w

    4. dispense $w to user
```

TOCTTOU = Time of Check To Time of Use

```
public void buyItem(Account buyer, Item item) {
   if (item.cost > buyer.balance)
     return;
   buyer.possessions.put(item);
   buyer.possessionsUpdated();
   buyer.balance -= item.cost;
   buyer.balanceUpdated();
 }
```