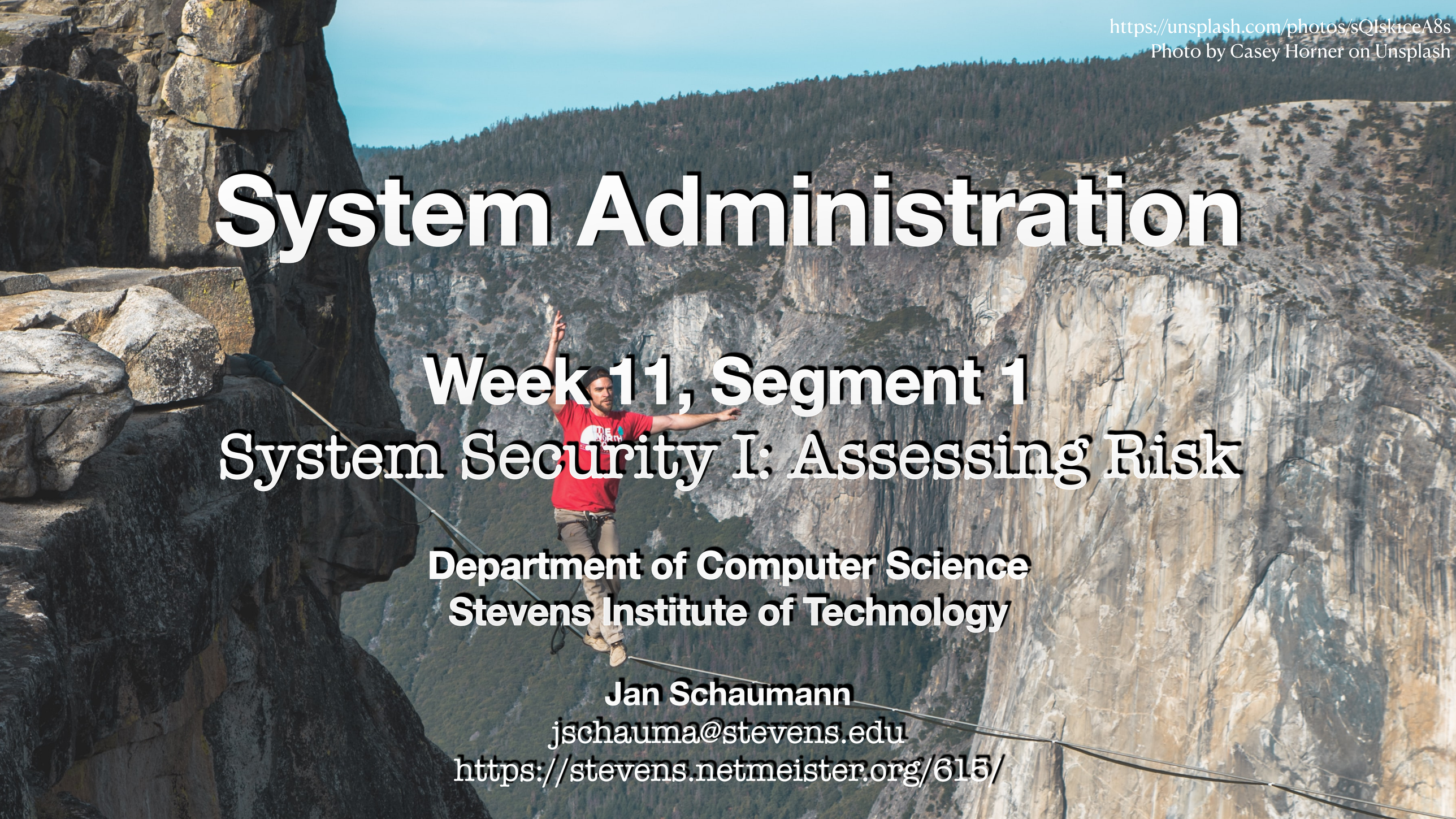

https://unsplash.com/photos/sQIskIceA8s
Photo by Casey Horner on Unsplash

System Administration

Week 11, Segment 1
System Security I: Assessing Risk

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This Week

What I won't tell you:

- How to make your system "secure".
- How to break into other systems.
- Everything you need to know.

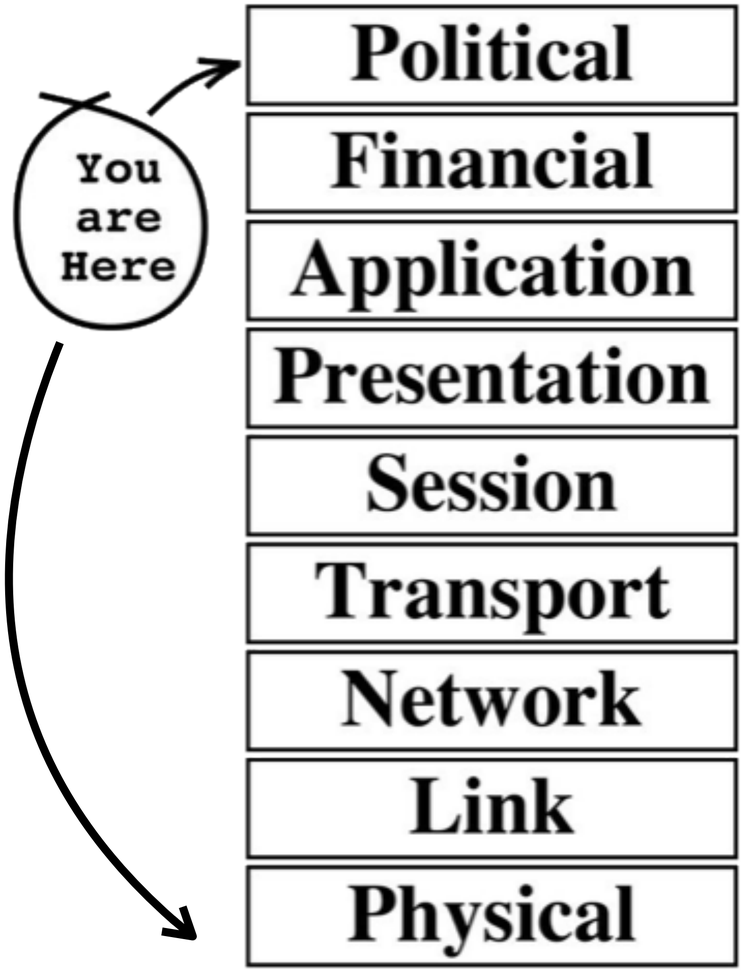
What I will tell you:

- What you need to know to start looking.
- What concepts are critical to understand.
- What conceptual pitfalls you are likely to encounter.
- A few *always* and *never*s.

Security is not an end-goal.

Security is a *trade-off* property to help you increase resilience against *specific* risks.

System Security



Where/how does ’security’ come into play?

Disks, Storage:

- storage model (DAS, NAS, SAN, Cloud)
- partitions / mount options

Filesystem Basics / Software Types:

- firmware compromise on hard drives
- DoS on disk space
- filesystem features (permissions, access control lists)

Software Installation & Multi-user basics:

- software package management and updates
- VMs, containers, etc.
- patch management
- package integrity checking
- privileges and trust models
- authentication methods, multi-factor authentication
- raising privileges

Where/how does ’security’ come into play?

Networking:

- protocols and visibility of data on different layers
- tcpdump can read all packets
- location of attacker on network implies capabilities
- physical networks
- network censorship
- plain text protocols

DNS; HTTP:

- If you control the DNS, you control the domain
- DNS registrars as attack points
- use of DNS as a second channel for other protocols
- trustworthiness of DNS (DNSSEC, DoT, DoH)

- HTTP as the universal entry into any network
- code execution context (CGI vs. server-side vs. client-side)
- content control and inspection capabilities of e.g. CDNs

Where/how does ’security’ come into play?

HTTPS; SMTP:

- observation of packets via tcpdump(1)
- TLS authentication
- PKI, Certificate Authorities
- protocol downgrade and MitM attacks

- email as attack methods (spam, phishing)
- recipient and sender authentication, open relays
- SMTP plain text vs. opportunistic encryption

Writing System Tool:

- automation as a defensive weapon
- using the wrong tool for the job => writing insecure code
- understanding language / framework pitfalls
- simplicity reduces attack surface
- all code has bugs

Where/how does ’security’ come into play?

Backup and Disaster Recovery, Monitoring:

- disasters include security breaches
- data loss as a risk
- safety of backups (encrypted backups?)

- incident detection via events, metrics, and context
- sensitive data in logs
- outsourcing monitoring services

Configuration Management:

- role based access control
- inherent trust, full control
- CAP theorem may impact security controls

Security touches everything.

Terminal — 80×24

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  himself for the performance of another's contract. See 3 Blackf. R. 431.



From U.S. Gazetteer Places (2000) [gaz2k-places]:

  Security-Widefield, CO -- U.S. Census Designated Place in Colorado
     Population (2000):     29845
     Housing Units (2000): 10177
     Land area (2000):      14.522255 sq. miles (37.612466 sq. km)
     Water area (2000)                                        km)
     Total area (2000)                                        km)
     FIPS code:
     Located within:        Colorado (CO), FIPS 08
     Location:              38.744731 N, 104.723226 W
     ZIP Codes (1990):
     Note: some ZIP codes may be omitted esp. for suburbs.
     Headwords:
      Security-Widefield, CO
      Security-Widefield
      Security, CO
      Security

$
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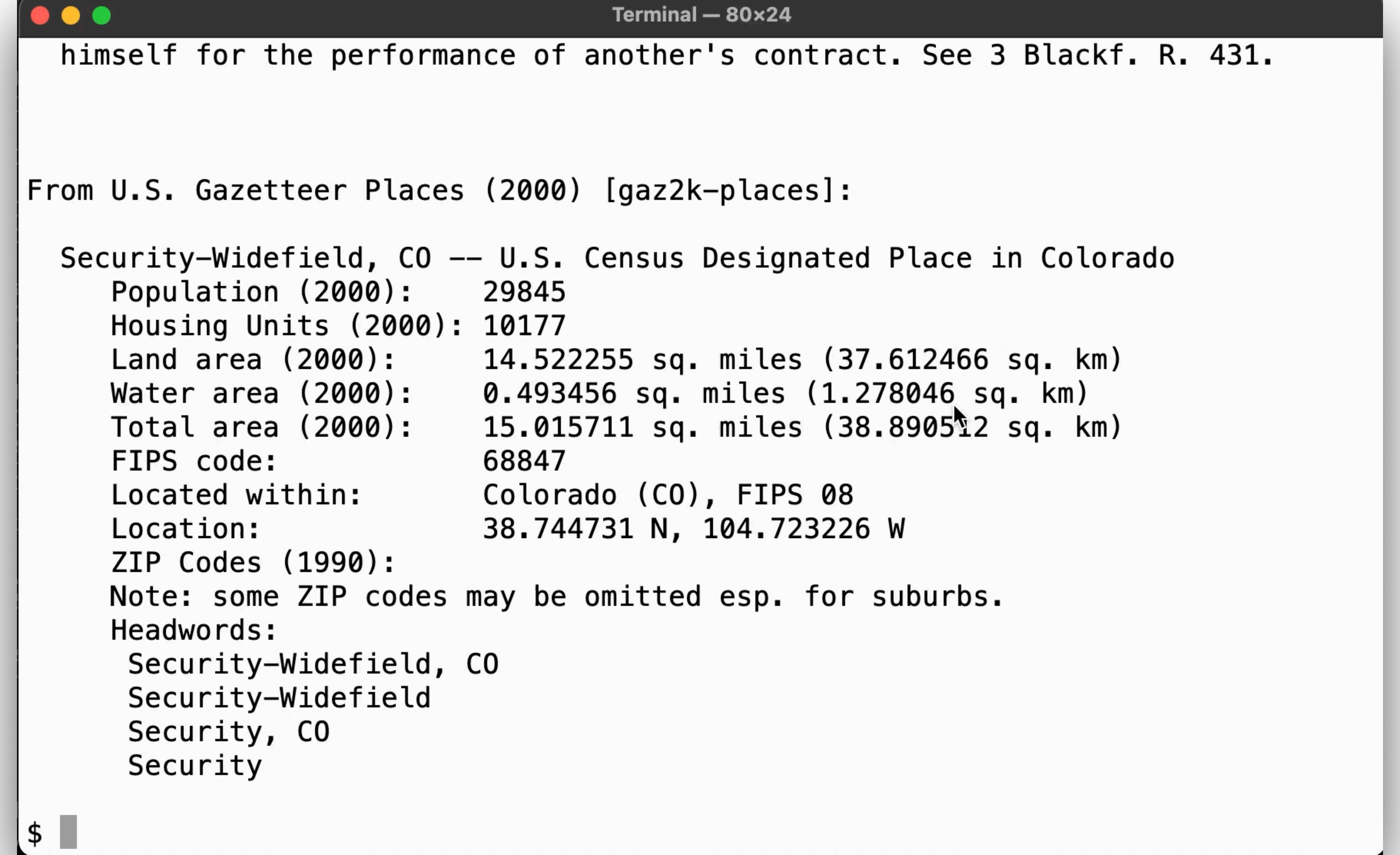
Freedom from *risk*.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Total area (2000): 15.015711 sq. miles (38.890512 sq. km)
FIPS code: 68847
Located within: Colorado (CO), FIPS 08
Location: 38.744731 N, 104.723226 W
ZIP Codes (1990):
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Security
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Suffering harm or loss of *what*?

- access to data
- integrity of data
- availability of services
- reputation
- monetary loss due to any of the above
- monetary loss due to physical items of actual value
- …

How to determine *risk*

"Risk Assessment"

- identify *assets* (that which you wish to protect, what you *value*)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats* (possible dangers to your assets, bad things that *might* happen)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats*
- identify *vulnerabilities* (weaknesses in a system, component, protocol, …)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats*
- identify *vulnerabilities*
- determine *likelihood of damage* (considering mitigating or exacerbating factors)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats*
- identify *vulnerabilities*
- determine *likelihood of damage*
- estimate *cost of recovery* (including recovery of data, immediate revenue loss, replacing physical items, ...)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats*
- identify *vulnerabilities*
- determine *likelihood of damage*
- estimate *cost of recovery*
- estimate *cost of defense* (objectively, without consideration of your budget; include partial defense or mitigating strategies)

How to determine *risk*

"Risk Assessment"

- identify *assets*
- identify *threats*
- identify *vulnerabilities*
- determine *likelihood of damage*
- estimate *cost of recovery*
- estimate *cost of defense*

A *risk* is the *likelihood* of a *threat* successfully exploiting a *vulnerability* and the estimated *cost* (or potential damage) both in the short and long term you may incur as a result.

Never waste resources on unspecified, vague risks or FUD.

Always remember that risks are *scoped* and *specific*.

How do we secure a system?

You can't "secure" a system.

You can *minimize specific risks* by *e.g.*:

- closing an attack vector
- eliminating a vulnerability
- reducing the attack surface
- changing the economics of the adversary

..but for that, you need a *threat model*.