01. LET'S TALK ABOUT TRUST

CS 361s

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ABOUT THE INSTRUCTOR

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CRIMSON VISTA TECHNICAL CONSULTING & LITIGATION SUPPORT

WHAT ABOUT YOU?

- Why did you take this course?
- What is your programming background like?
- What has been your favorite course so far? Why?
- What is your learning style?
- What is your favorite teaching style?

PHILOSOPHICAL OVERVIEW

TECHNICAL	NON TECHNICAL
THEORY	PRACTICE
EDUCATED	SKILLED
TEACHER	STUDENT

THE 5 ORDERS OF IGNORANCE

- 0th Order: Known Knowns
- 1st Order: Known Unknowns
- 2nd Order: Unknown Unknowns
- 3rd Order: Unknown methods for discovering unknown unknowns
- 4th Order: Unknown methods for exploring the orders of ignorance

(Adapted from Phillip Armour, "The Five Orders of Ignorance")

THE 5 ORDERS OF IGNORANCE

- 0th Order: Known Knowns
- 1st Order: Known Unknowns

SKILL

- 2nd Order: Unknown Unknowns
- 3rd Order: Unknown methods for discovering unknown unknowns
- 4th Order: Unknown methods for exploring the orders of ignorance

EDUCATION

(Adapted from Phillip Armour, "The Five Orders of Ignorance")

THE WORKLOAD IS CHALLENGING

A **"B"** (or maybe even a "**C**") is not the greatest loss in your academic career. The greatest loss is an "**A**" on your transcript, but a "**B**" (or maybe even a "**C**") in your heart and mind.

Dr Nielson #Quote

A FEW INTRODUCTORY NOTES

- This is my first time teaching this course
- I'm still developing the materials
  - Labwork. Based on previous classes or other curriculum
  - Writing flag. Each lab will follow with a technical writing assignment
- Everything is subject to change. Please be patient.
- Please feel free to make suggestions or raise concerns

CLASS DISCUSSIONS

- I hate slides and I hate "lectures"
- I only use them because I haven't found something better
- What I would like to try is:
  - You read the assignment ahead of time
  - I will prepare slides that can give you some test-prep materials
  - But in-class we will discuss and learn about the topic

THOMPSON'S PAPER

- "Reflections on Trusting Trust"
- 1984.
  - This predates Fred Cohen's seminal work on Viruses
  - This also predates the Morris worm
- What is the foundational concept?

TRUST AND TRUSTWORTHINESS

- I will typically use Ross Anderson's "Security Engineering" for definitions
  - Second Edition (freely available on his website)
  - https://www.cl.cam.ac.uk/~rja14/book.html
- Trusted System – system whose failure can break the security policy
- Trustworthy System – a system that won't break

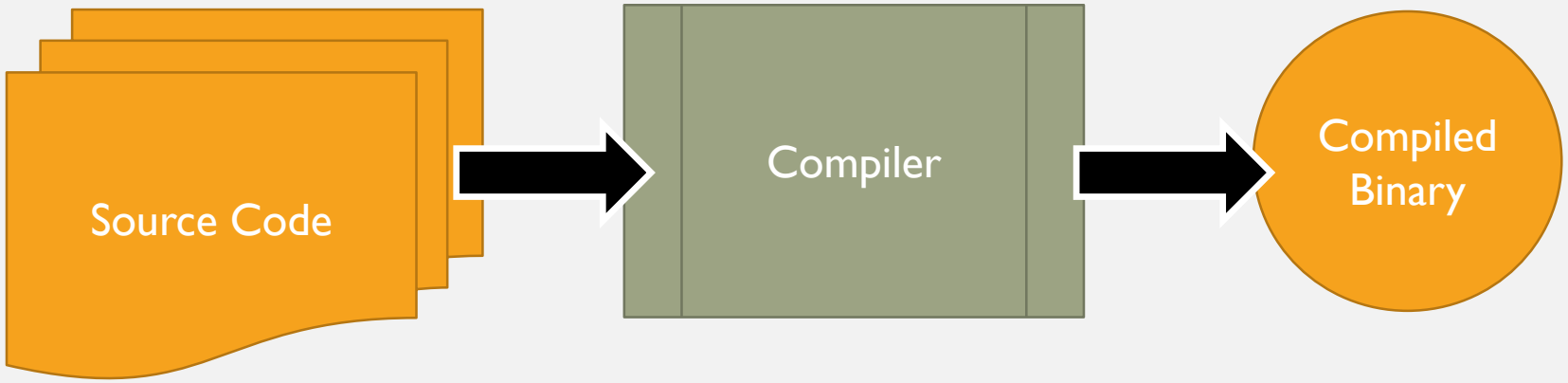
SECURITY IS BASED ON TRUST

- I mean Anderson's concept of trust
- ***We can only enforce security IF the trusted systems don't break***
- How many systems do we need to trust? MANY it turns out.

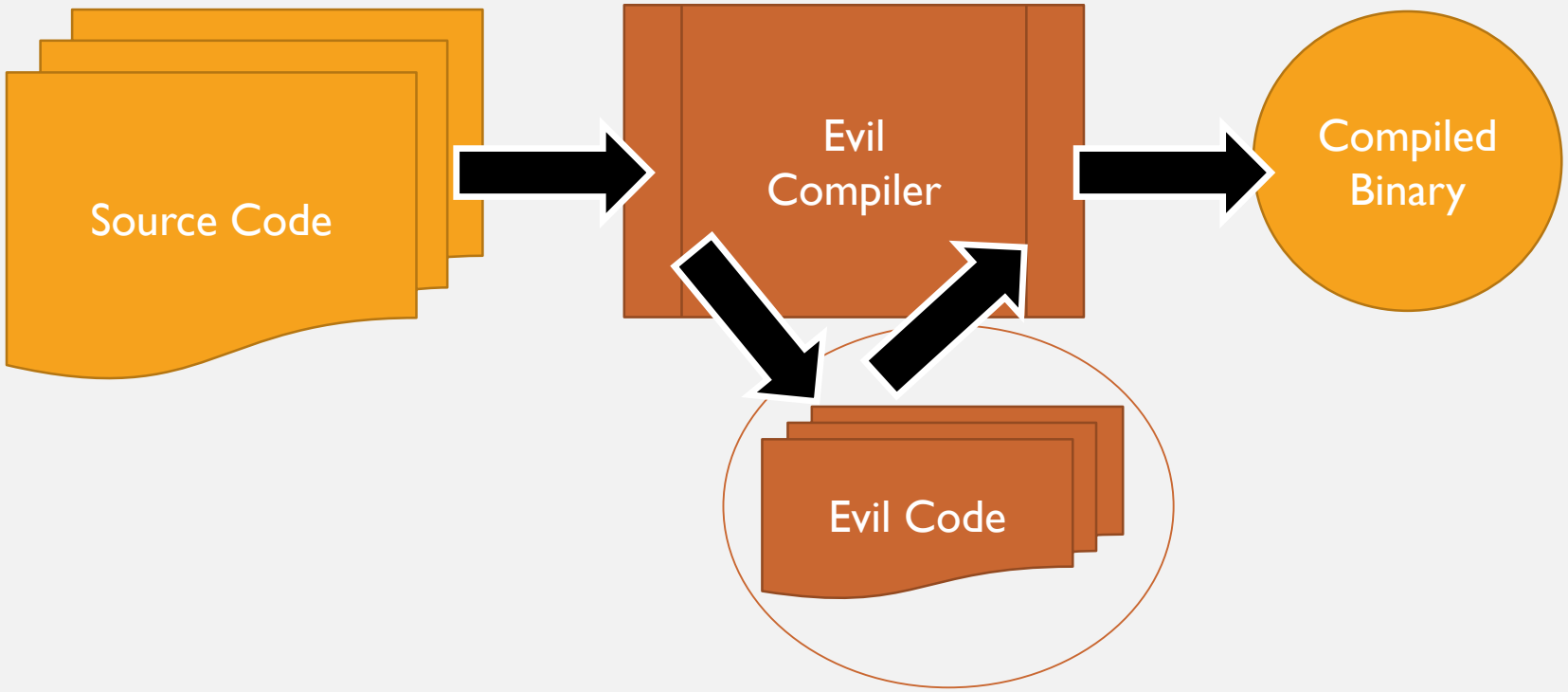
WHAT THOMPSON TAUGHT

- Your program isn't trustworthy if the compiler isn't trustworthy
- The compiler isn't trustworthy if it's compiler isn't trustworthy
- The compiler's compiler isn't trustworthy if it's compiler isn't trustworthy
- … on forever back to the first compiler built by assembly

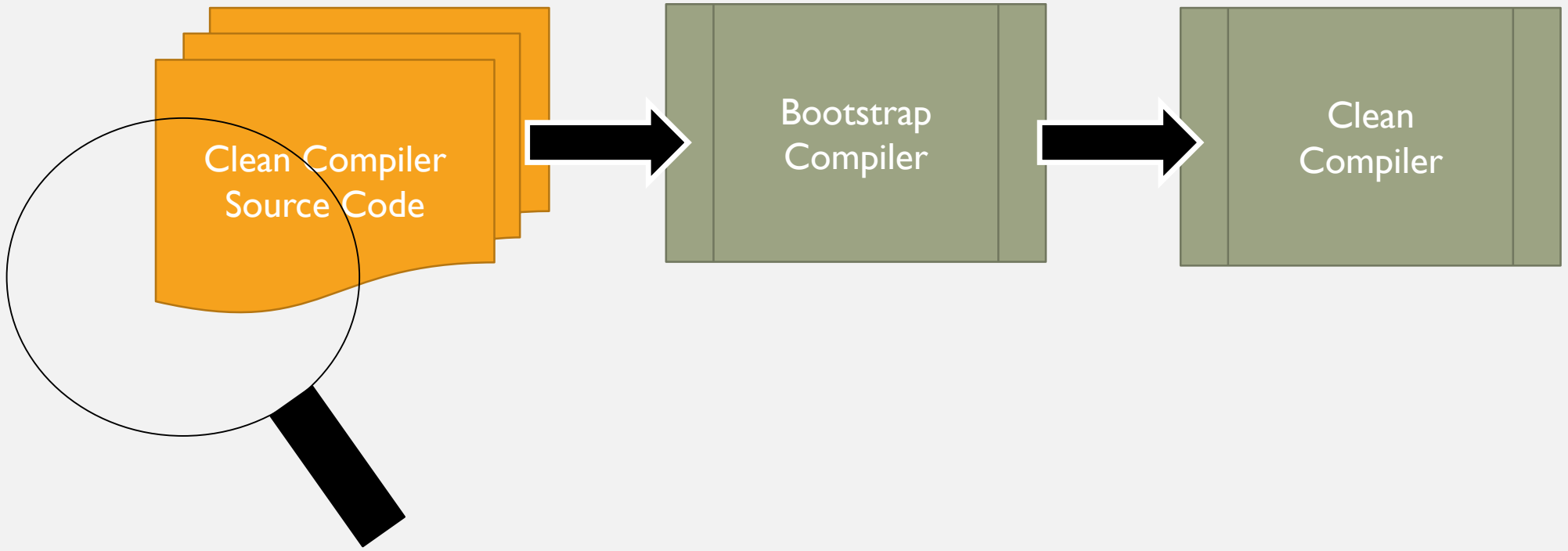
THE NORMAL COMPILATION PROCESS



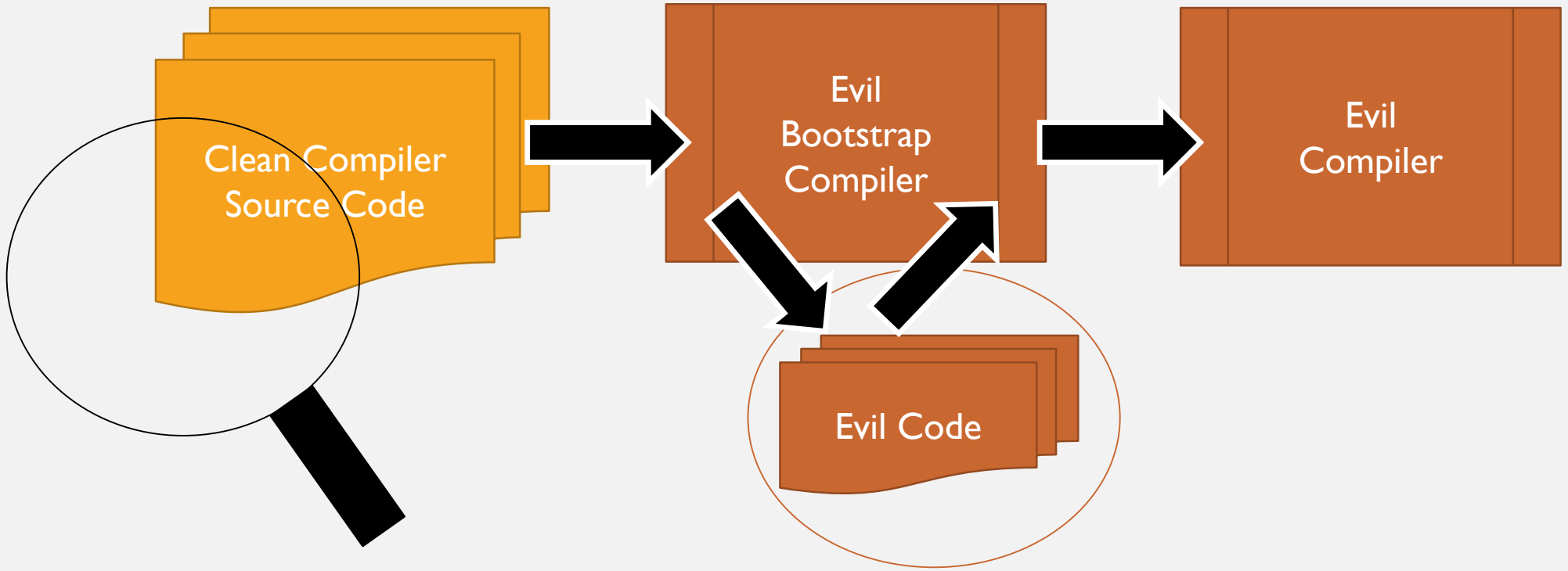
EVIL COMPILATION



INSPECT THE COMPILER SOURCE?



NOT GOOD ENOUGH!



WHAT IS SECURITY REALLY?

- What does it mean to say a system is "secure"?
- Anderson:
  - Security Policy – What is protected
  - Mechanism – How it is protected
  - Assurance – How confident are we that the mechanism enforces policy
- A "secure" system is more-or-less one with a lot of assurance

HOW DO WE GET ASSURANCE?

- Testing
- Formal Proofs
- Cryptographic Proofs
- Metrics, History, Experience

TRUST CHAINS

- Much of our assurance ***assumes*** axiomatic trustworthiness elsewhere
  - Compilers
  - ***The compilers that built the compilers!***
  - Third party libraries
  - Operating systems ***including device drivers***
  - Hardware
  - Root certificates
  - Trusted Third Parties

IN THIS CLASS

- You will show a lot of things we trust are not trustworthy
  - Lab 1 – corrupt compilers
  - Lab 2 and 3 – break programs using buffer overflows and ROP
  - Lab 4 – break web APIs
  - Lab 5 – break encryption/authentication using a corrupted root certificate
  - Lab 6 – break sandboxes/virtual machines/emulators