Cyber Security
A Personal Perspective

Prof. Ravi Sandhu
Executive Director and Endowed Chair

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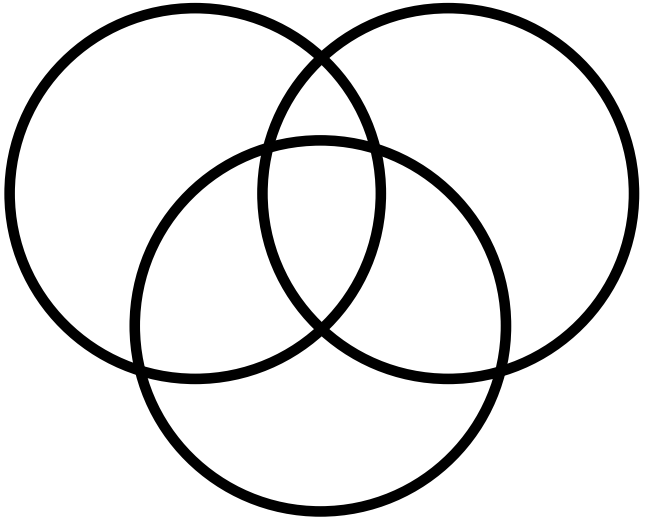
ravi.sandhu@utsa.edu
www.profsandhu.com

Prognosis

- Cyberspace will become orders of magnitude more complex and confused very quickly
  - Cyber and physical distinction will disappear
  - Threats will go beyond money to physical harm and danger to life and body
- Overall this is a very positive development and will enrich human society
- It will be messy but need not be chaotic!
- Cyber security research and practice are loosing ground

Security Objectives



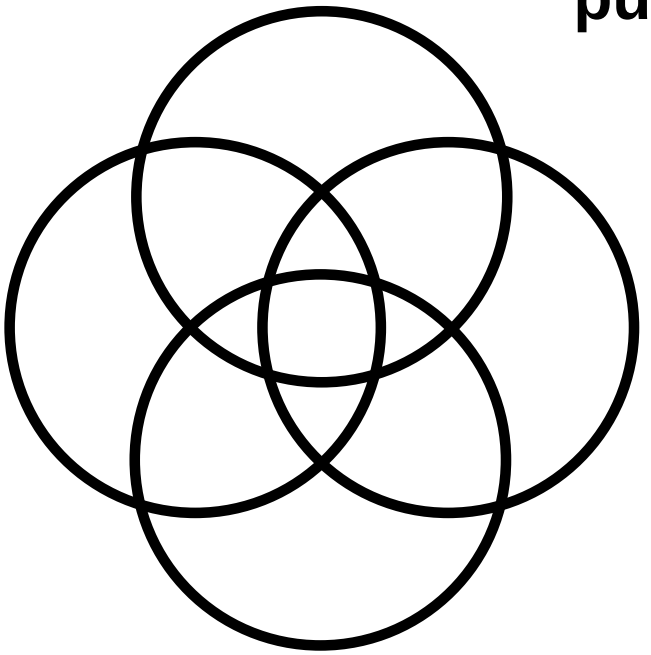
INTEGRITY
modification

AVAILABILITY
access

CONFIDENTIALITY
disclosure

Security Objectives

USAGE
purpose



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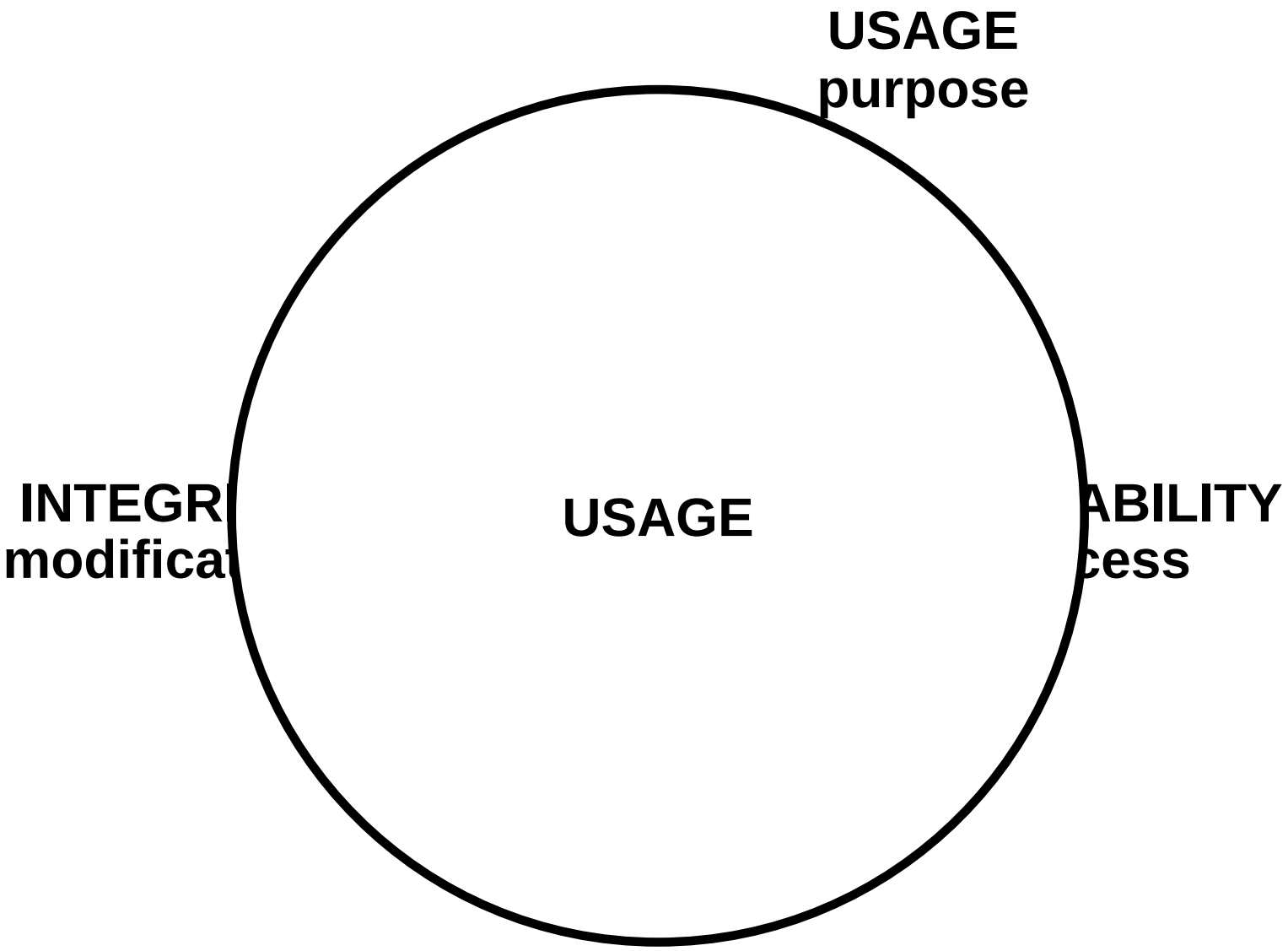


Security Objectives

Single Enterprise
- **owns all the information**
- **employs all the users**

Multiple Interacting Parties
- **no one owns all the information**
- **no one can unilaterally impose policy on all the users**

More than 2 decades of encryption versus privacy debate

Cyber Security Scope

- Computer security
- Information security =
  - Computer security + Communications security
- Information assurance
- Mission assurance
  - Includes cyber physical

Fundamental Challenge

- What is fundamental to cyber security?
- Where are the boundaries of a cyber system?
- What are the goals of cyber security?

Cyber Security Goal

- Enable system designers and operators to say:

  This system is secure

Cyber Security Goal

- Enable system designers and operators to say:

  This system is secure

  Not attainable

- There is an infinite supply of attacks

Cyber Security Goal

- Enable system designers and operators to say:

  This system is secure enough

Many successful examples

The ATM Paradox

- The ATM (Automatic Teller Machine) system is
  - secure enough
  - global in scope
- Not attainable via current cyber security science, engineering, doctrine
  - not studied as a success story
- Similar paradoxes apply to
  - on-line banking
  - e-commerce payments

- US President's nuclear football
- Secret formula for Coca-Cola

Cyber Security Goal

- Enable system designers and operators to say:

  This system is secure enough

- In an innovative ecosystem the innovation drive will ensure that the bar for enough will be fairly low

Productivity-Security

- Cyber Security is all about tradeoffs

Productivity **Security**

Let's build it
Cash out the benefits
Next generation can secure it

Let's not build it
Let's bake in super-security to make it unusable/unaffordable
Let's sell unproven solutions

There is a middle ground
We don't know how to predictably find it

Grand Challenges

- Develop a scientific discipline
  - to predictably find the sweet spots for different application and mission contexts
  - to predictably find, incentivize and deploy microsec that leads to desirable macrosec outcomes
  - that can be meaningfully taught in Universities at all levels: BS, MS, PhD

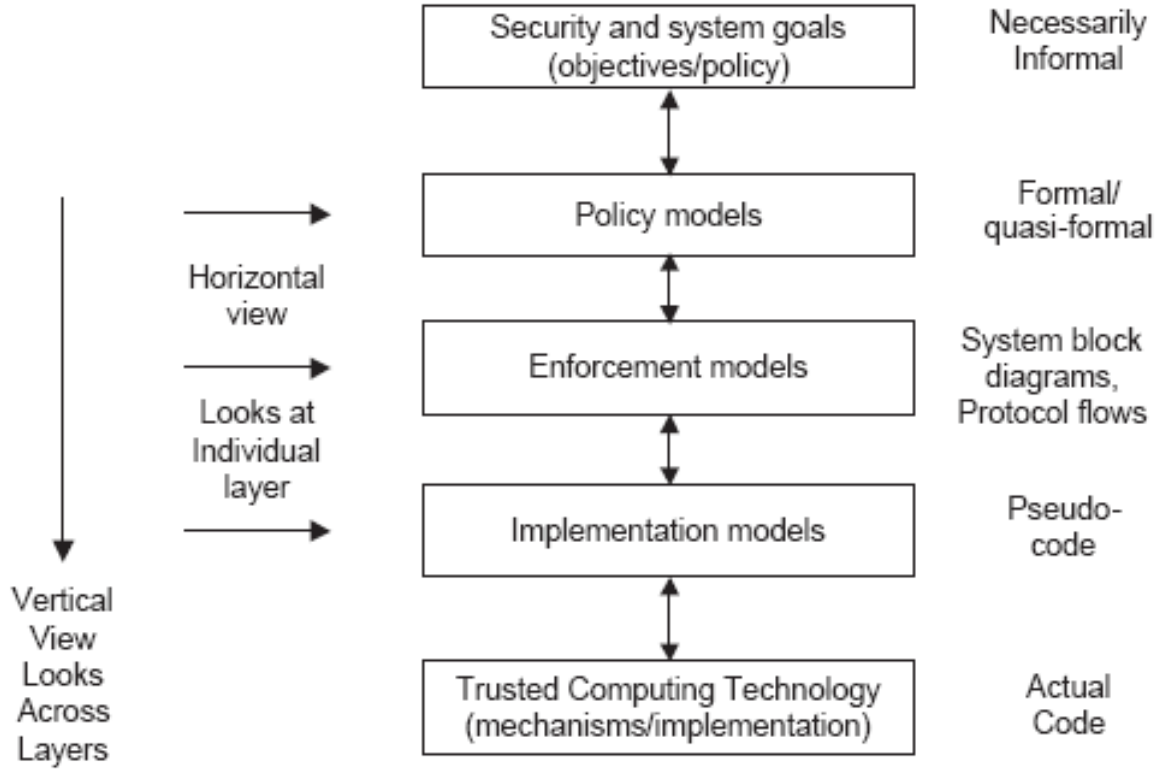
- Prognosis
  - we shall succeed (we have no choice)
  - but we need to change to succeed

Butler Lampson Paraphrased (I think)

- Computer scientists could never have designed the web because they would have tried to make it work.
  - But the Web does “work.”
  - What does it mean for the Web to “work”?
- Security geeks could never have designed the ATM network because they would have tried to make it secure.
  - But the ATM network is “secure.”
  - What does it mean for the ATM network to be “secure”?

Bellovin's Slides digression

PEI Models



Idealized

Enforceable (Approximate)

Codeable

Limits on Security

- Trojan horse/malware
- Covert channels/side channels
- Inference
- Analog hole
- Assured enforcement
- Privilege escalation
- Policy comprehension and analysis
- Predicting value and future usage of data
- …..

Reference Material digression