Object Oriented Programming

Lecture 1

Dr. Naveed Anwar Bhatti

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Who am I? Dr. Naveed Anwar Bhatti

Hometown: Islamabad

Last Job: Senior Researcher
RISE, Stockholm, Sweden
Joined on April, 2018
ERCIM Post-Doc (April, 2018 – Sep, 2019)

YOU KNOW ME

Educ

PhD
Computer Scie
Polit
abad, Pakistan
RFID System: Decoupling sensing and
nergy in sensor networks using energy transferenc

BS
2011
Telecom
FAST-NUCES, Islamabad, Pakistan
Internet Controlled Unmanned Ground Vehicle

So how was the “Intro to Cyber Security”

What did you **like most** / **least** in the course?

- Abdul Wasay (94.39)
- Musferah Ahmed (88.49)
- **Mishqat Abid (90.36)**
- **Wania Mansoor**

How to reach me?

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Lectures available here: (Google Classroom)

Section A : hjwh2pf

Course Objectives: Why are you here?

- Object Oriented Model

Week 1 and 2

- Model and Object
- Abstraction and Classes
- Inheritance and Generalization
- Multiple Inheritance and Polymorphism

- User-defined data types

Week 3

- User-defined Data Types
- Typedef
- Structures
- Unions
- Classes

- Object-Oriented Programming in C++

Week 4 and 5

- Member Functions
- Constructor
- Destructor
- Constant data members
- Constant member functions
- Constant Objects
- Static Data Member
- “this” Pointer

Course Objectives: Why are you here?

- Object-Oriented Programming in C++ (Cont)

  Week 6, 7 and 8

  - Array of Objects
  - Pointer to Objects
  - Composition
  - Aggregation
  - Composition vs. Aggregation
  - Friend Functions
  - Friend Classes
  - Operator Overloading

- OOP in C++ (Cont)

  Week 9, 10, 11, 12, 13 and 14

  - Inheritance
  - Abstract Class
  - Concrete Class
  - Overriding Member Functions
  - Overriding vs Overloading
  - Polymorphism
  - Virtual Functions
  - Pure Virtual Function
  - Virtual Constructors and Destructors
  - Templates
  - Exception Handling

Administrivia and more

- **Pre-requisite**
  - Programming Fundamentals
  - Willingness to work hard!
  - Initiative (very little spoon feeding)

- **Tough Course with fair marking**

Administrivia and more

- **Grading split**

  - Assignments 10%
  - Quizzes: 5% (start of class, <3 min long)
  - Always bring paper and pen to class
  - Midterm: 20%
  - Project: 20%
  - Final Exam: 45%

Academic integrity

- **Vital to building trust!**
  - Both in you and the university
- **Very serious consequences**
  - In assignment/project will result in a **direct F grade**
  - Code will be checked for similarity
- **A serious offence**
  - Offensive on both religious and secular levels

1 paper – 88%

Dr. Arshad Ali
Executive Director HEC

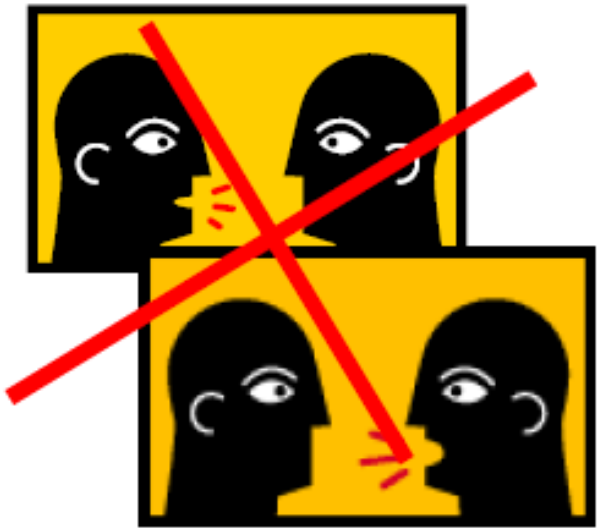
PhD Thesis – 77%

Dr. Haroon Rashid
Rector COMSATS

Two books – 88% and 69%

Dr. Mukhtar Ahmed
Chairman HEC

Prohibitions



Class Attendance and Late arrival

- **I do not care about it**
  - **But University and HEC does!**
  - If you are not serious about the course, its your loss
    - Both money wise
    - And grade wise (directly: quizzes, indirectly: exams)

- **If you arrive late**
  - Be discrete (come in with minimal fanfare)
  - Be courteous (to other students trying to listen)

Object-Oriented (OO) Model

What is a *Model*?

- A model is an ***abstraction*** of something

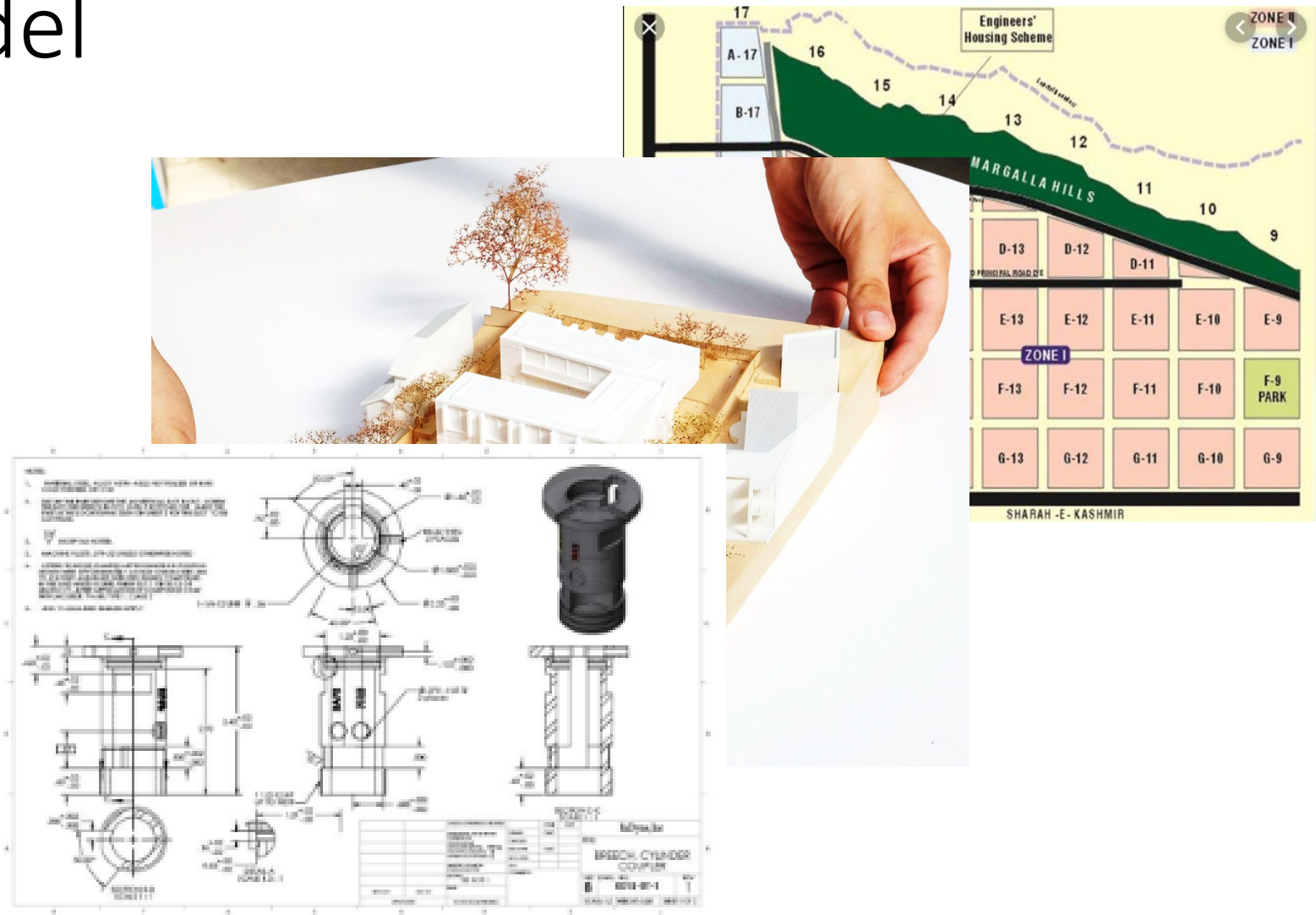
Abstraction means that the context of the actual system is reduced to a limited set of parameters

- Purpose is to understand the product before developing it

What is Object-Oriented Model?

Examples – Model

- City maps
- Architectural models
- Mechanical models



What is Object-Oriented Model?

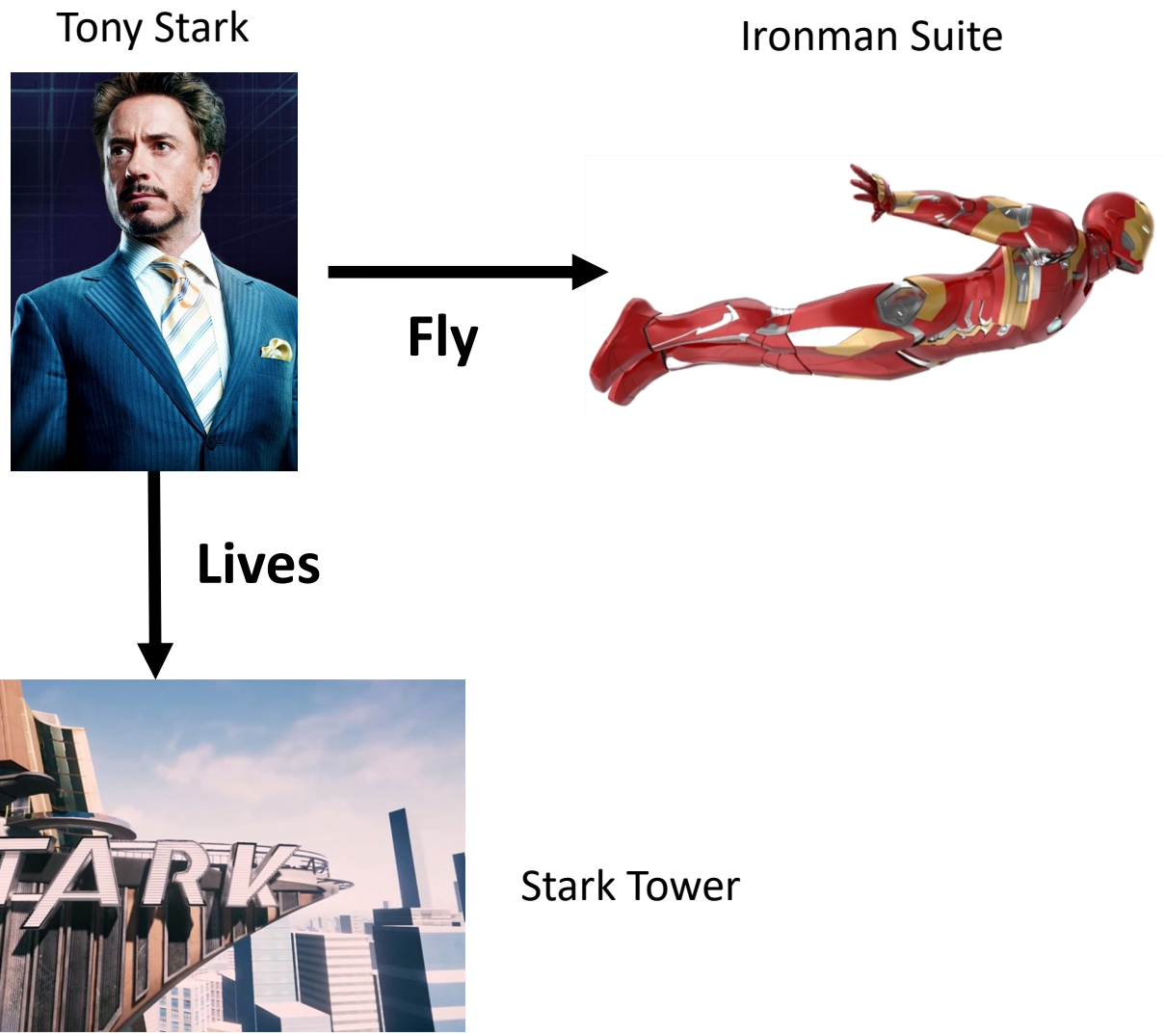
- A technique for ***system modeling***

System Model represent aspects of a system and its environment using graphical representation

- OO model consists of ***several interacting objects***

…Example – OO Model

- Objects
  - Tony Stark
  - Stark Tower
  - Iron Man Suit
- Interactions
  - Tony lives in the Stark Tower
  - Tony fly the Ironman Suit



Object-Orientation - Advantages

- People think in terms of objects
- OO models map to reality
- Therefore, OO models are
  - easy to develop
  - easy to understand

What is an Object?

An object is:

- Something tangible (Tony, Ironman Suite)
- Something that can be apprehended intellectually (Time, Date)

What is an Object?

An object has:

- State (attributes)
- Well-defined behavior (operations)
- Unique identity

What is an Object?

Example – Tony is a Tangible Object

- State (attributes)
  - Height
  - Age
  - Color
  - Gender
- behaviour (operations)
  - Walks
  - Eats
- Identity
  - His name

What is an Object?

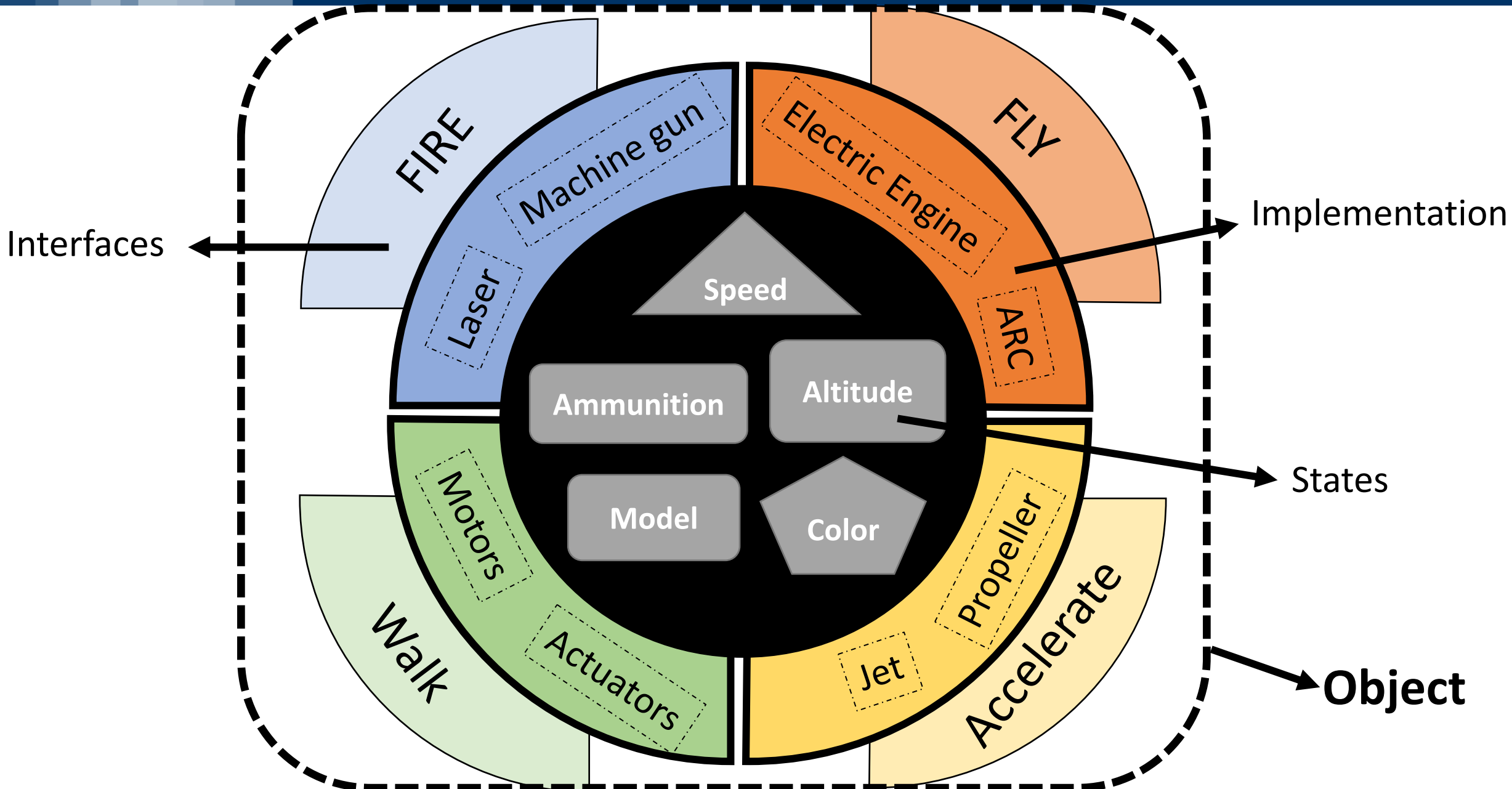
Example – Ironman Suite is a Tangible Object

- State (attributes)
  - Color
  - Model
  - Speed
  - Altitude
  - Ammunition
- behavior (operations)
  - Accelerate
  - Fire
  - Fly
  - Walk
- Identity
  - Its registration number

OO Model Concepts

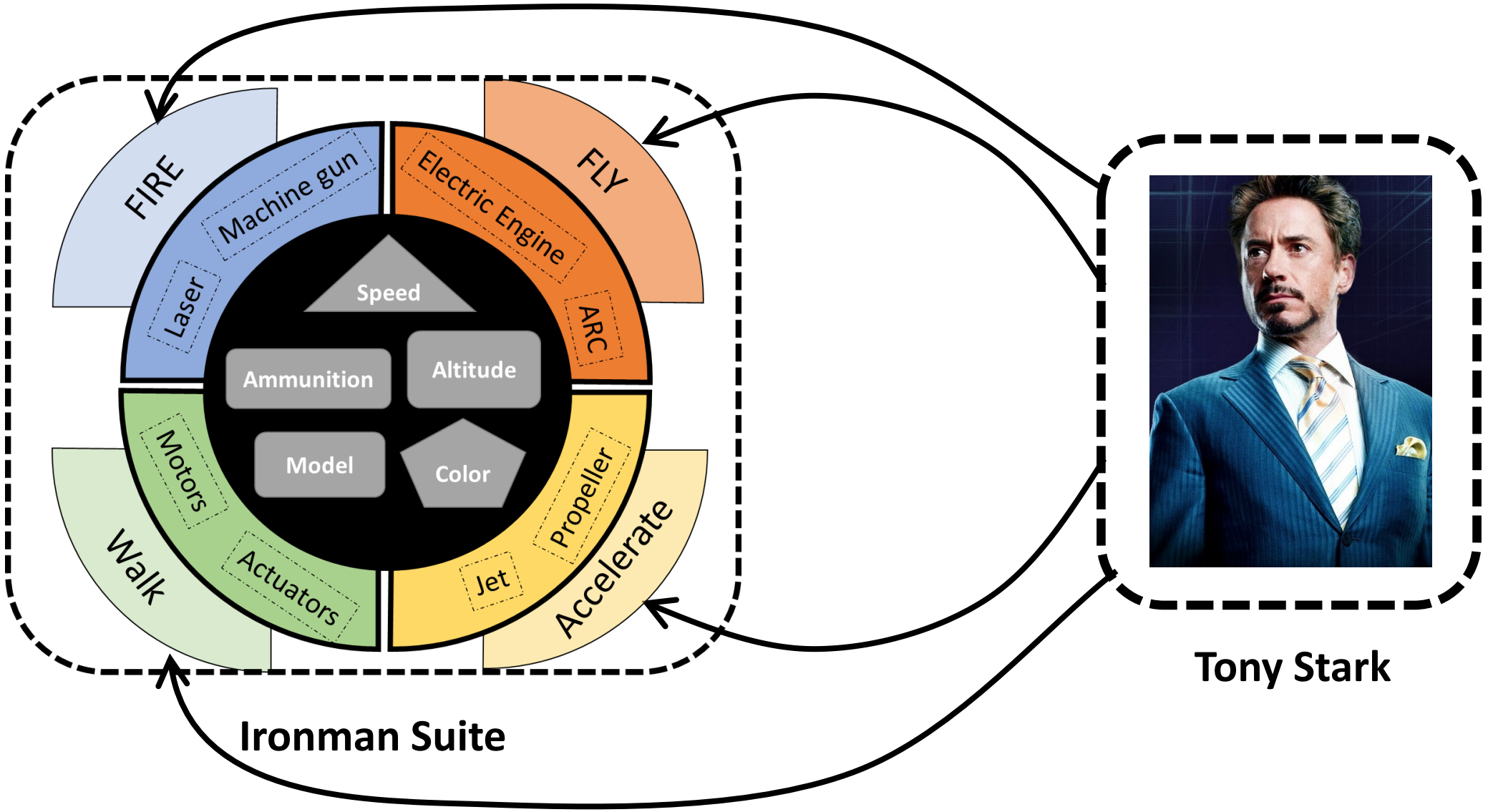
- An object stores its **state** in **fields** (variables) and exposes its behavior through **interface** (methods, functions)
- Interface operate on an object's **internal state** through **implementation** and serve as the primary mechanism for object-oriented communication.
- Hiding internal state and requiring all interaction to be performed through an object's **interface** is known as **data encapsulation**.
- Data encapsulation is a fundamental principle of OOP.

What is an Object? Ironman Suite

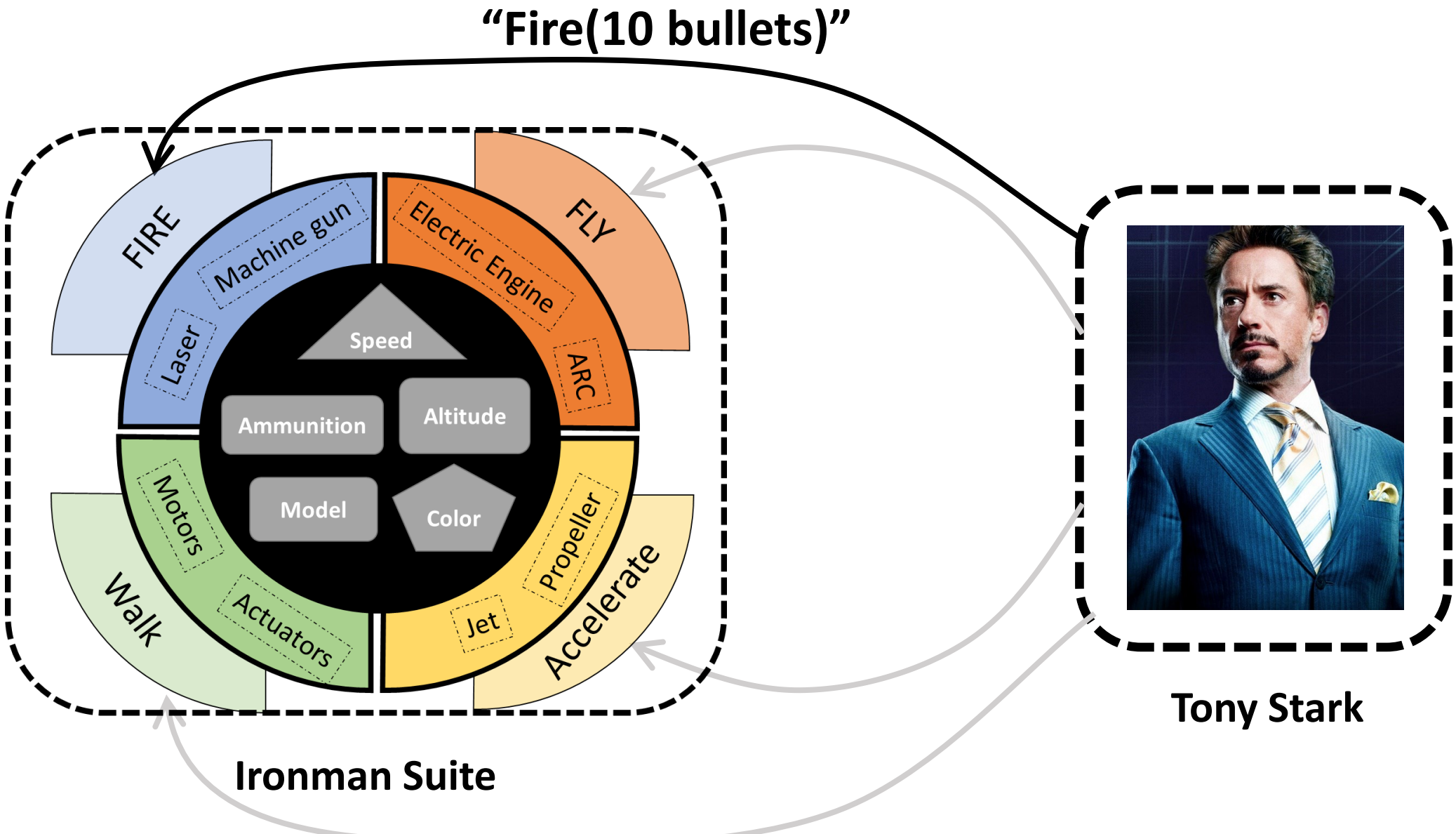


What is an Object?

Objects communicate through interface by passing messages (stimuli)



What is an Object?



Information Hiding Advantages

- Simplifies the model by hiding implementation details
- It is a barrier against illegal change propagation

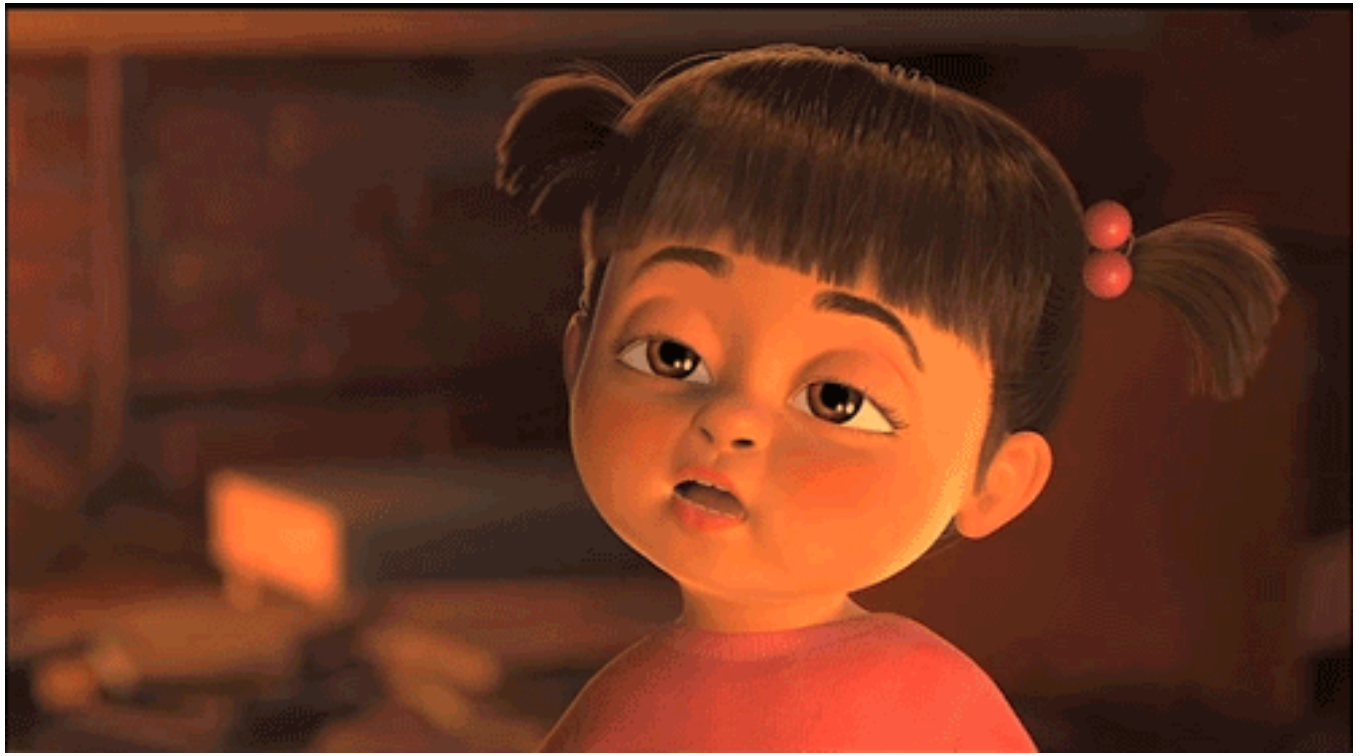
What is an Object?

- Identifying the state and behavior for real-world objects is a good way to begin thinking in terms of OOP.
- Exercise:
  - Observe the real-world objects that are in your immediate area, for each object that you see, ask yourself two questions:
    - What possible states can this object be in?
    - What possible behaviors can this object perform?
- Write down your observations

OO Model Concepts

- Real-world objects vary in complexity:
  - Your desktop lamp has only two possible states (on, off) and two possible behaviors (turn on, turn off).
  - Your desktop radio might have additional states (on, off, current volume, current station) and behaviors (turn on, turn off, increase volume, decrease volume, seek, scan, tune).
- Some objects will also contain **other objects**.

Thanks a lot



If you are taking a Nap, **wake up**.....Lecture Over