

SYSTEMS SOFTWARE DESIGN

INTRODUCTION & WATERFALL



WHO AM I?

- **MACIEJ BLASZKE**

- **PHD STUDENT ON MULTIMEDIA SYSTEMS DEPARTMENT**
- **SOFTWARE ENGINEER – INTEL TECHNOLOGY POLAND**
- **ROOM 734**

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PLAN OF THE COURSE AND ASSESSMENT

- **LECTURE:**
 - **FIRST HALF OF SEMESTER**
 - **FINISHED BY EXAM**
- **PROJECT**
 - **SECOND HALF OF SEMESTER**
- **ASSESSMENT:**
 - **EXAM – 50%**
 - **PROJECT – 50%**

COURSE OBJECTIVES

- **GATHERING THEORETICAL KNOWLEDGE**
- **LEARNING BASIC TECHNIQUES OF SOFTWARE DEVELOPMENT**
- **LEARNING ABOUT PROCESSES IN REAL BUSINESS ENVIRONMENT**

COURSE PLAN

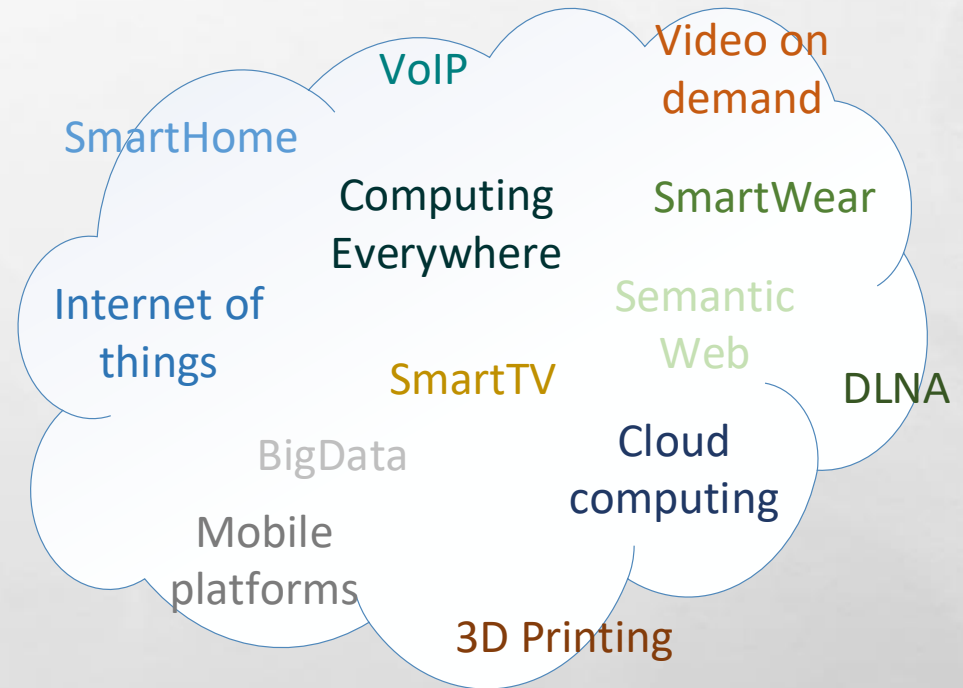
- **SPECIFICATION**
- **UML**
- **WATERFALL**
- **SCRUM**
- **VERSION CONTROL SYSTEMS**
- **IDE**
- **DOXYGEN**
- **TESTS AND VALIDATION**
- **EXAM**

AGENDA

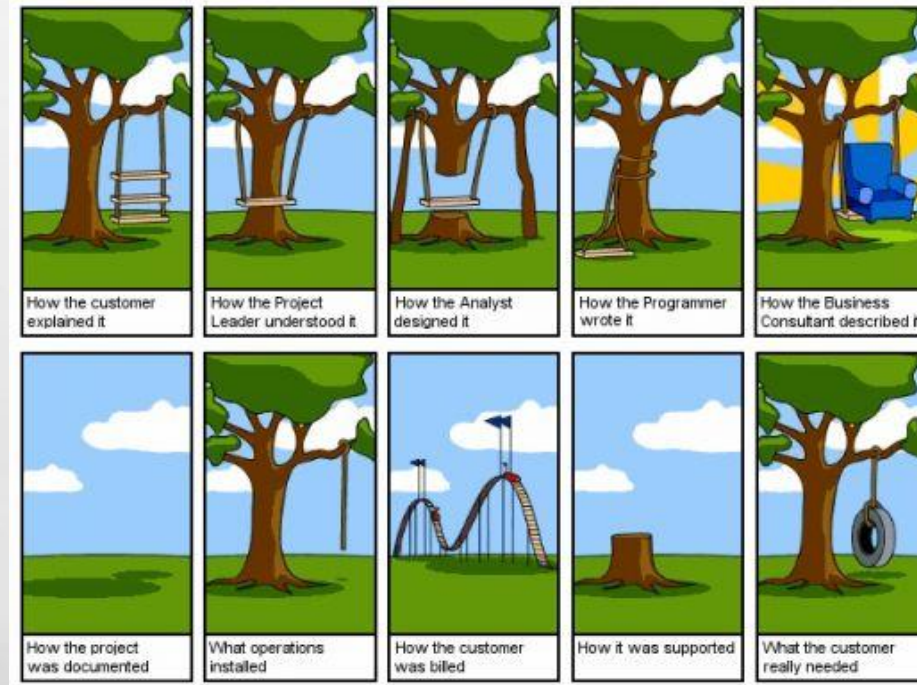
- **WHY THIS COURSE IS NEEDED?**
- **SPECIFICATIONS**
- **UML**
- **WATERFALL MODEL**

WHY THIS COURSE IS NEEDED?

- **IT SYSTEMS ARE EVERYWHERE**



PROBLEMS WITH COMMUNICATION



SPECIFICATION



WHAT IS SPECIFICATION?

- **AN ACT OF IDENTIFYING SOMETHING PRECISELY OR OF STATING A PRECISE REQUIREMENT**
- **A DETAILED DESCRIPTION OF THE DESIGN AND MATERIALS USED TO MAKE SOMETHING.**

TYPES OF SPECIFICATION

- **REQUIREMENT SPECIFICATIONS**
 - **DESCRIPTION OF A SOFTWARE SYSTEM TO BE DEVELOPED**
 - **THE SOFTWARE REQUIREMENTS SPECIFICATION LAYS OUT FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS**
 - **MAY INCLUDE A SET OF USER STORIES**
 - **PROVIDE WHAT IS NEEDED TO DESIGN PRODUCT, SERVICE, TOOL, INFRASTRUCTURE COMPONENT, PROCESS OR PROCEDURE.**

TYPES OF SPECIFICATION

- **DESIGN SPECIFICATIONS**
 - **SET OF DESCRIPTIONS HOW REQUIREMENTS WILL BE REALIZED**
- **MATERIAL SPECIFICATIONS**
 - **SPECIFICATIONS OF PHYSICAL, MECHANICAL, ELECTRICAL AND CHEMICAL PROPERTIES AND TOLERANCE**
- **STANDARD SPECIFICATIONS**
 - **DESCRIPTIONS OF INDUSTRY OR INTERNAL STANDARDS**

TYPES OF SPECIFICATION

- **INTERFACE SPECIFICATIONS**

- **DETAILS ABOUT CONNECTIONS BETWEEN COMPONENTS OF SYSTEM.**

- **TEST SPECIFICATIONS**

- **DESCRIBE HOW TO TEST PRODUCT.**
- **INCLUDE SPECIFICATIONS FOR FUNCTIONAL TESTING, NON-FUNCTIONAL TESTING, USER ACCEPTANCE TESTING AND QUALITY CONTROL**

TYPES OF SPECIFICATION

- **PERFORMANCE SPECIFICATIONS**
 - **SPECIFICATIONS OF TARGET OPERATING CHARACTERISTICS SUCH AS THE AVAILABILITY OF A SERVICE**
- **QUALITY SPECIFICATIONS**
 - **DEFINITION OF PRODUCT QUALITY.**
 - **INCLUDE TANGIBLE AND INTANGIBLE ELEMENTS**

UNIFIED MODELING LANGUAGE



WHAT IS UML?

- **UML IS A GRAPHICAL LANGUAGE ALLOWING TO VISUALIZE SYSTEM'S ARCHITECTURAL AS DIAGRAMS**
- **TYPES OF UML DIAGRAMS:**
 - **STATIC**
 - **DYNAMIC**
- **DIAGRAMS ARE JUST A VIEW OF THE MODEL**
- **THE MODEL EXIST WITHOUT DIAGRAMS AS WELL**

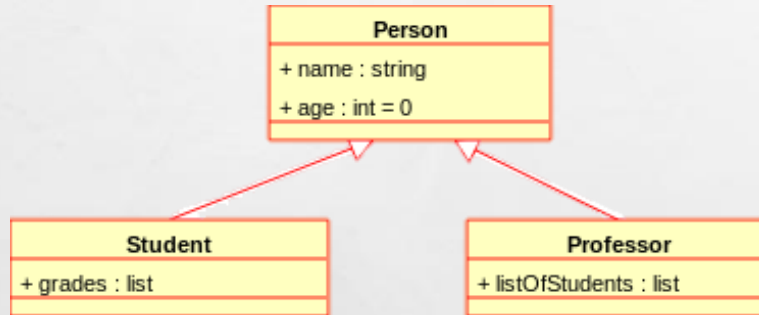
UML – STATIC DIAGRAMS

- **EMPHASIZE THE THINGS THAT MUST BE PRESENT IN THE SYSTEM BEING MODELED**
- **USED FOR DOCUMENTING THE SOFTWARE ARCHITECTURE OF SYSTEMS**
- **TYPES**
 - **CLASS DIAGRAM**
 - **COMPONENT DIAGRAM**
 - **OBJECT DIAGRAM**
 - **COMPOSITE STRUCTURE DIAGRAM**
 - **DEPLOYMENT DIAGRAM**
 - **PACKAGE DIAGRAM**

UML – BEHAVIORAL DIAGRAMS

- **EMPHASIZE WHAT MUST HAPPEN IN THE SYSTEM BEING MODELED**
- **USED TO DESCRIBE THE FUNCTIONALITY OF THE SYSTEM**
- **TYPES**
 - **ACTIVITY DIAGRAM**
 - **INTERACTION DIAGRAMS**
 - **STATE DIAGRAM**
 - **USE CASE DIAGRAM**

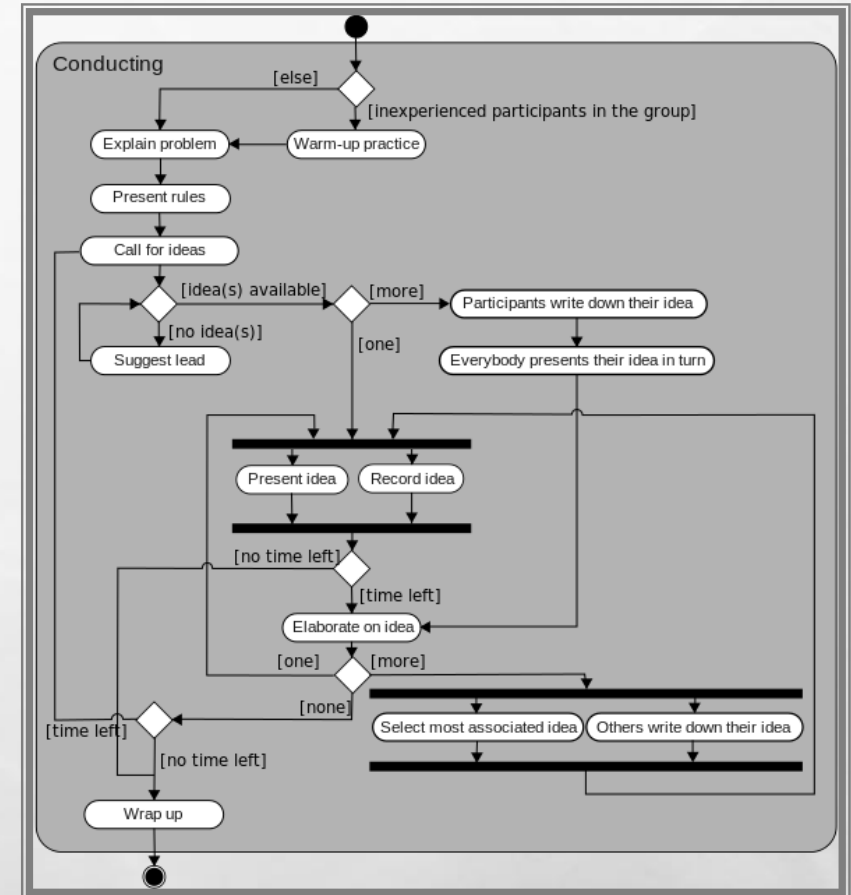
UML – CLASS DIAGRAM



- **DESCRIBES THE STRUCTURE OF A SYSTEM BY SHOWING THE SYSTEM'S CLASSES, THEIR ATTRIBUTES, OPERATIONS AND RELATIONSHIPS AMONG OBJECTS**
- **THE MOST COMMON OF UML DIAGRAMS**
- **ALSO, ONE OF THE MOST COMPLEX ONES**

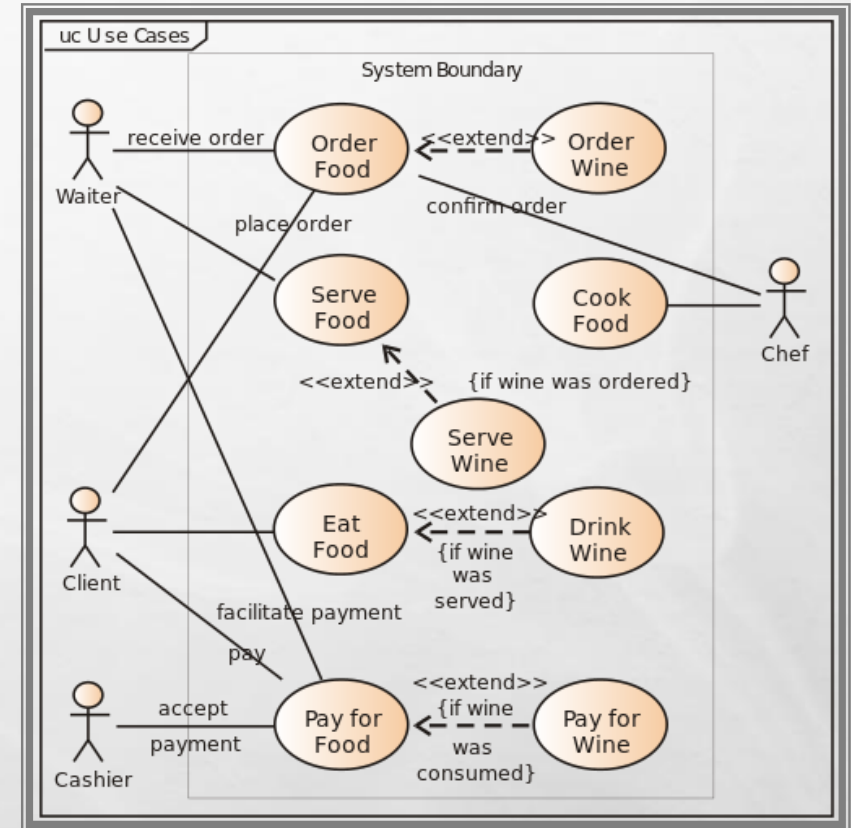
UML – ACTIVITY DIAGRAM

- **GRAPHICAL REPRESENTATION OF WORKFLOWS OF ACTIVITIES AND ACTIONS, SHOW THE OVERALL FLOW OF CONTROL**



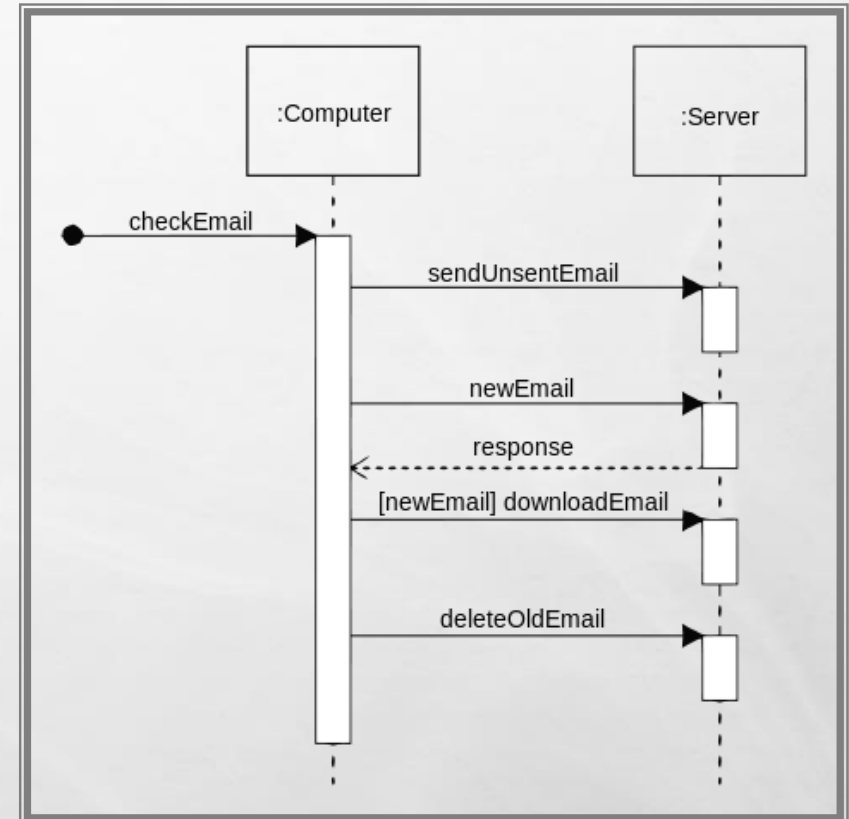
UML – USE CASE DIAGRAM

- **THE REPRESENTATION OF USER'S INTERACTION WITH THE SYSTEM**



UML – SEQUENCE DIAGRAM

- **SHOWS OBJECT INTERACTIONS ARRANGED IN TIME SEQUENCE**
- **ASSOCIATED WITH REALIZATION OF USE CASES**



WATERFALL MODEL



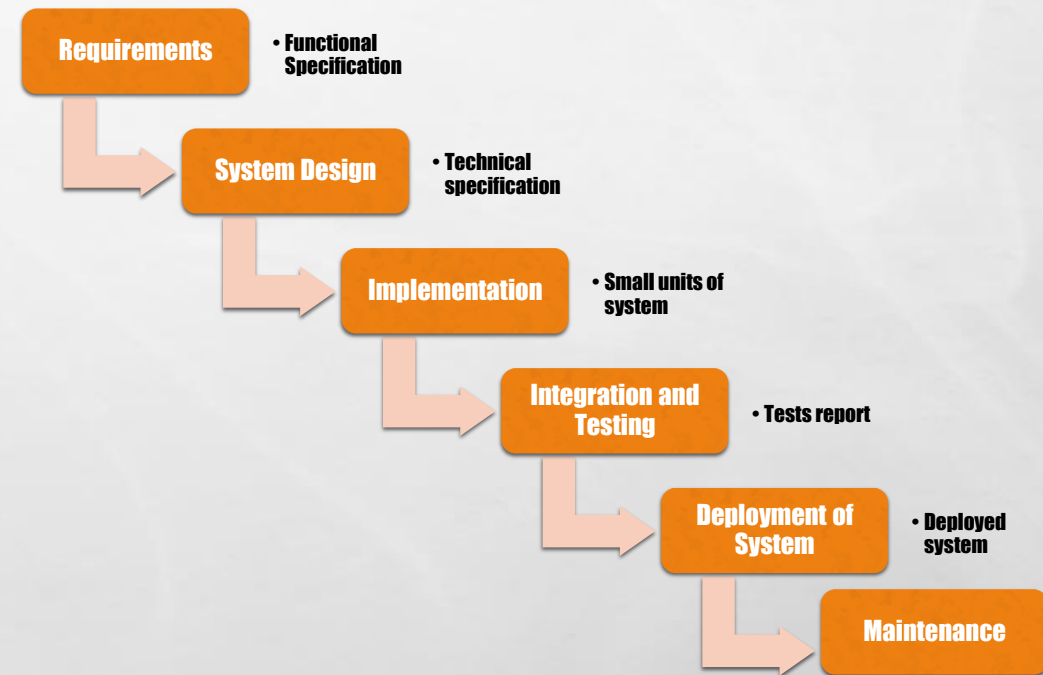
WATERFALL MODEL

- **FIRST INTRODUCED PROCESS MODEL**
- **EACH PHASE MUST BE COMPLETED BEFORE THE NEXT ONE**
- **MODEL IS SEQUENTIAL**

WATERFALL MODEL

- **LINEAR-SEQUENTIAL LIFE CYCLE MODEL:**

- **REQUIREMENTS**
- **SYSTEM DESIGN**
- **IMPLEMENTATION**
- **INTEGRATION AND TESTING**
- **DEPLOYMENT OF SYSTEM**
- **MAINTENANCE**



REQUIREMENTS

- **STEPS:**

- **IDENTIFICATION OF PROBLEM TO SOLVE**
- **UNDERSTANDING WHAT NEED TO BE DESIGN**
- **DEFINE INPUT AND OUTPUT FROM SYSTEM**

- **RESULT:**

- **FUNCTIONAL SPECIFICATION**

SYSTEM DESIGN

- **STEPS:**

- **ANALYSIS OF FUNCTIONAL SPECIFICATION**
- **SPECIFY NECESSARY HARDWARE AND SOFTWARE**
- **DEFINING ARCHITECTURE**

- **RESULT:**

- **TECHNICAL SPECIFICATION**

IMPLEMENTATION

- **STEPS:**
 - **DEVELOP SMALL UNITS OF DESIGNED SYSTEM**
 - **PREPARE UNIT TESTS**
- **RESULT:**
 - **SETS OF UNITS**

INTEGRATION AND TESTING

- **STEPS:**
 - **INTEGRATION ALL UNITS INTO WORKING SYSTEM**
 - **PERFORM TESTS OF SYSTEM**
- **RESULT:**
 - **WORKING SYSTEM**

DEVELOPMENT OF SYSTEM

- **STEPS:**

- **DEPLOYMENT SYSTEM ON CUSTOMER ENVIRONMENT/RELEASE ON MARKET**

- **RESULT:**

- **PRODUCT SALE**

MAINTENANCE

- **STEPS:**

- **MODIFICATION OF INDIVIDUAL COMPONENTS**
- **FIXING BUGS FOUND IN REAL USAGE**
- **IMPROVE PERFORMANCE**

- **RESULT:**

- **SYSTEM IMPROVEMENTS**

WATERFALL PROS

- **DEADLINES FOR EACH STEP**
- **EASY TO EXPLAIN AND UNDERSTAND**
- **EASY TO MANAGE**
- **STEPS DON'T OVERLAP**

WATERFALL CONS

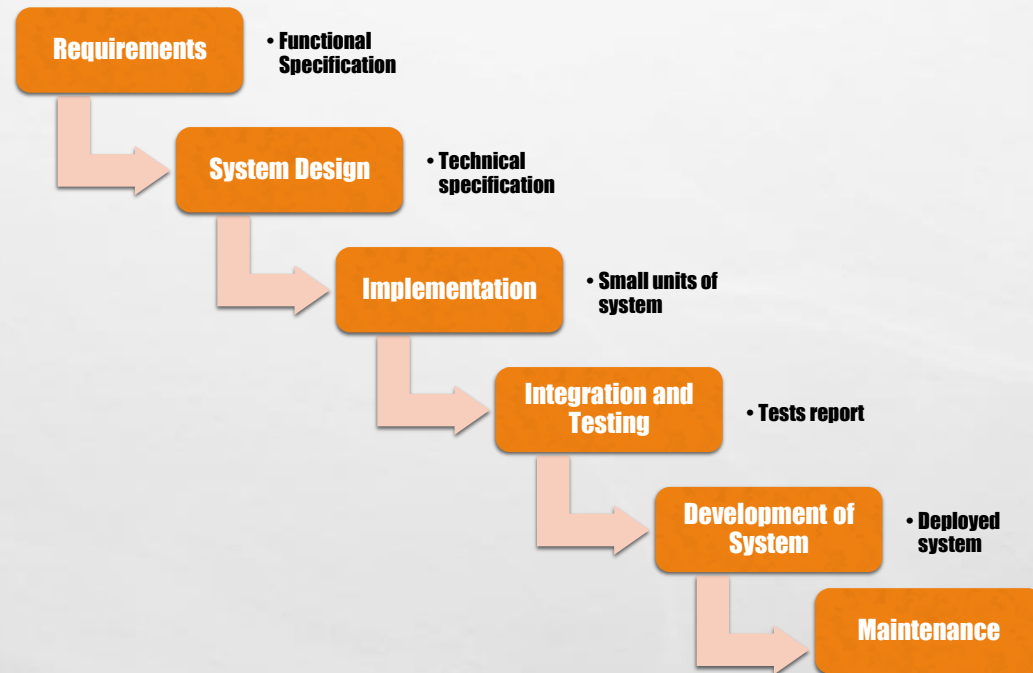
- **DIFFICULT TO ESTIMATE TIME AND COST EACH PHASE**
- **DIFFICULT TO MAKE ANY CHANGES IN PRODUCT IN NEXT STEPS**
- **NOT GOOD FOR COMPLEX PROJECT**
- **NOT GOOD WHEN EXIST POSSIBILITY ANY CHANGES THRU THE PROCESS**

WHY GOOD SPECIFICATION IS NEEDED?



https://youtu.be/cDA3_5902h8

WATERFALL MODEL - EXAMPLES



DISCUSSION

