



Objectives

- ✓To introduce the concepts of user and system requirements
- ✓To describe functional and non-functional requirements
- ✓To explain how software requirements may be organised in a requirements document

Topics covered

- ✓Functional and non-functional requirements
- ✓User requirements
- ✓System requirements
- ✓Interface specification
- ✓The software requirements document

Engineers are..... Different!!!



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Ethical Responsibility of Software Engineers

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Hacking

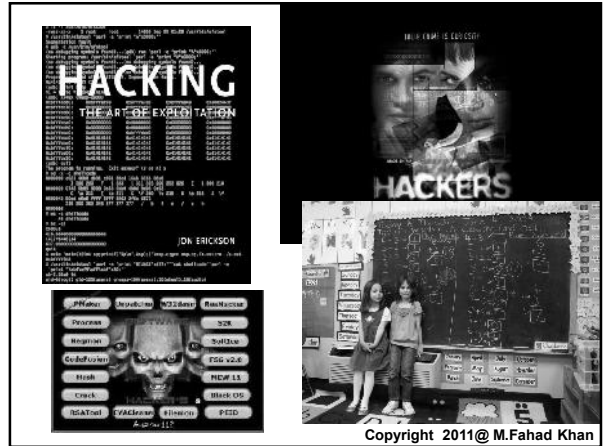
In computer security and everyday language, a **hacker** is someone who breaks into computers and computer networks. Hackers may be motivated by a multitude of reasons, including profit, protest, and challenge.

OR

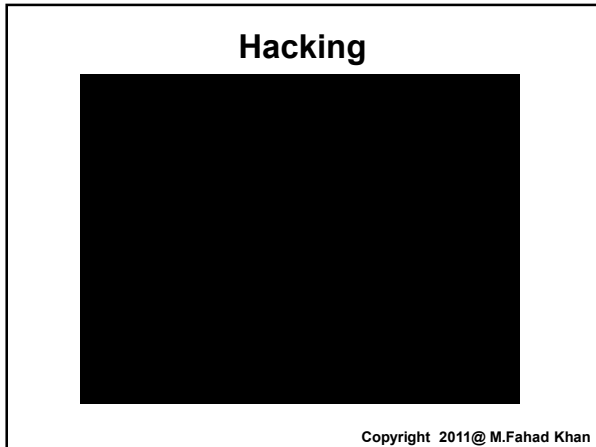
Hacker (computer security), to access computer networks, legally or otherwise.

OR

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Software Engineers can earn a lot of money but loyalty to your profession is the most important thing!!!

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Pakistani Hackers hacked Indian websites for revenge but!!!!!!!!!!!! do you think its right?????

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Software Requirements

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Requirements Engineering

- The process of establishing the services that the customer requires from a system and the constraints under which it operates and is developed.
- The requirements themselves are the descriptions of the system services and constraints that are generated during the requirements engineering process.



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What is a requirement?

- It may range from a high-level abstract statement of a service or of a system constraint to a detailed mathematical functional specification.
- This is inevitable as requirements may serve a dual function
 - May be the basis for a bid for a contract - therefore must be open to interpretation;
 - May be the basis for the contract itself - therefore must be defined in detail;
 - Both these statements may be called requirements.

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Requirements abstraction (Davis)

"If a company wishes to let a contract for a large software development project, it must define its needs in a sufficiently abstract way that a solution is not pre-defined. The requirements must be written so that several contractors can bid for the contract, offering, perhaps, different ways of meeting the client organisation's needs. Once a contract has been awarded, the contractor must write a system definition for the client in more detail so that the client understands and can validate what the software will do. Both of these documents may be called the *requirements document* for the system."

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Types of requirement

- User requirements
 - Statements in natural language plus diagrams of the services the system provides and its operational constraints. Written for customers.
- System requirements
 - A structured document setting out detailed descriptions of the system's functions, services and operational constraints. Defines what should be implemented so may be part of a contract between client and contractor.

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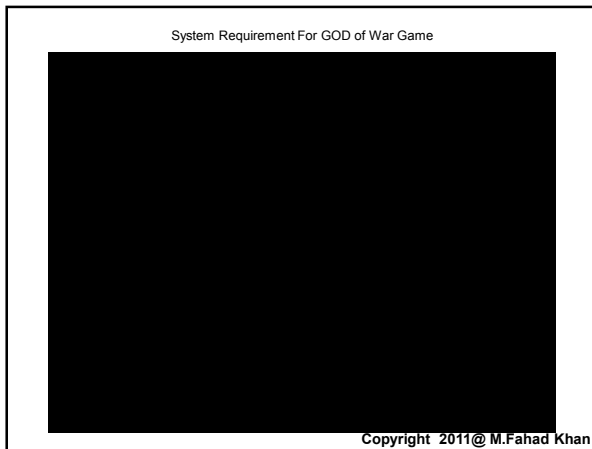
Windows 7 system requirements

If you want to run Windows 7 on your PC, here's what it takes:

- 1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor
- 1 gigabyte (GB) RAM (32-bit) or 2 GB RAM (64-bit)
- 16 GB available hard disk space (32-bit) or 20 GB (64-bit)
- DirectX 9 graphics device with WDDM 1.0 or higher driver

System Requirements

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Definitions and specifications

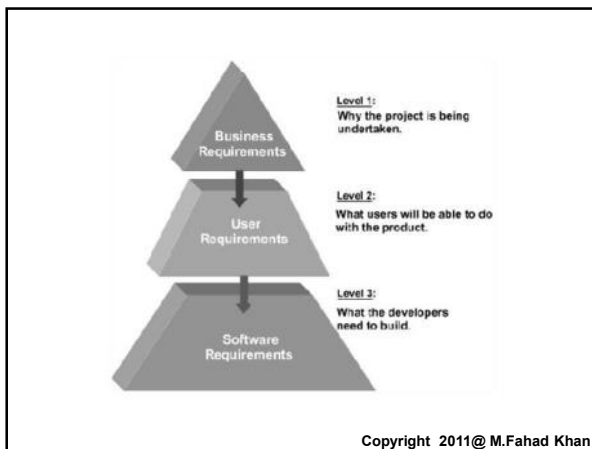
User requirement definition

1. The software must provide a means of representing and accessing external files created by other tools.

System requirements specification

- 1.1 The user should be provided with facilities to define the type of external files.
- 1.2 Each external file type may have an associated tool which may be applied to the file.
- 1.3 Each external file type may be represented as a specific icon on the user's display.
- 1.4 Facilities should be provided for the icon representing an external file type to be defined by the user.
- 1.5 When a user selects an icon representing an external file the effect of that selection is to apply the tool associated with the type of the external file to the file represented by the selected icon.

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Functional and non-functional requirements

- Functional requirements
 - Statements of services the system should provide, how the system should react to particular inputs and how the system should behave in particular situations.
- Non-functional requirements
 - constraints on the services or functions offered by the system such as timing constraints, constraints on the development process, standards, etc.
- Domain requirements
 - Requirements that come from the application domain of the system and that reflect characteristics of that domain.

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Functional requirements

- Describe functionality or system services.
- Depend on the type of software, expected users and the type of system where the software is used.
- Functional user requirements may be high-level statements of what the system should do but functional system requirements should describe the system services in detail.

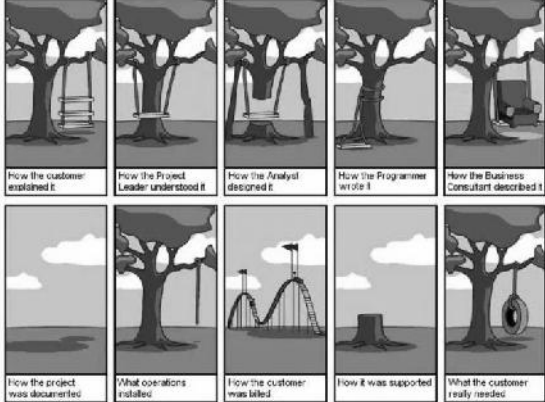


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Functional requirements



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The LIBSYS system

- A library system that provides a single interface to a number of databases of articles in different libraries.
- Users can search for, download and print these articles for personal study.

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Examples of functional requirements

- The user shall be able to search either all of the initial set of databases or select a subset from it.
- The system shall provide appropriate viewers for the user to read documents in the document store.
- Every order shall be allocated a unique identifier (ORDER_ID) which the user shall be able to copy to the account's permanent storage area.

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Requirements imprecision

- Problems arise when requirements are not precisely stated.
- Ambiguous requirements may be interpreted in different ways by developers and users.
- Consider the term 'appropriate viewers'
 - User intention - special purpose viewer for each different document type;
 - Developer interpretation - Provide a text viewer that shows the contents of the document.

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Requirements completeness and consistency

- In principle, requirements should be both complete and consistent.
- Complete
 - They should include descriptions of all facilities required.
- Consistent
 - There should be no conflicts or contradictions in the descriptions of the system facilities.
- In practice, it is impossible to produce a complete and consistent requirements document.

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Non-functional requirements

- These define system properties and constraints e.g. reliability, response time and storage requirements. Constraints are I/O device capability, system representations, etc.
- Process requirements may also be specified mandating a particular CASE system, programming language or development method.
- Non-functional requirements may be more critical than functional requirements. If these are not met, the system is useless.



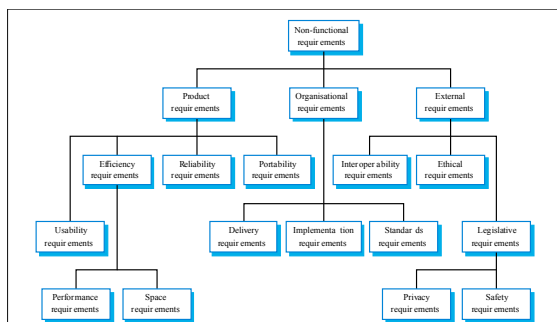
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Non-functional classifications

- Product requirements
 - Requirements which specify that the delivered product must behave in a particular way e.g. execution speed, reliability, etc.
- Organisational requirements
 - Requirements which are a consequence of organisational policies and procedures e.g. process standards used, implementation requirements, etc.
- External requirements
 - Requirements which arise from factors which are external to the system and its development process e.g. interoperability requirements etc.

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Non-functional requirement types



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Non-functional requirements examples

- Product requirement
 - 8.1 The user interface for LIBSYS shall be implemented as simple HTML without frames or Java applets.
- Organisational requirement
 - 9.3.2 The system development process and deliverable documents shall conform to the process and deliverables defined in XYZCo-SP-STAN-95.
- External requirement
 - 7.6.5 The system shall not disclose any personal information about customers apart from their name and reference number to the operators of the system.

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Goals and requirements

- Non-functional requirements may be very difficult to state precisely and imprecise requirements may be difficult to verify.
- Goal
 - A general intention of the user such as ease of use.
- Verifiable non-functional requirement
 - A statement using some measure that can be objectively tested.
- Goals are helpful to developers as they convey the intentions of the system users.

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Examples

- **A system goal**
 - The system should be easy to use by experienced controllers and should be organised in such a way that user errors are minimised.
- **A verifiable non-functional requirement**
 - Experienced controllers shall be able to use all the system functions after a total of two hours training. After this training, the average number of errors made by experienced users shall not exceed two per day.

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Requirements measures

Property	Measure
Speed	Processed transactions/second User/Event response time Screen refresh time
Size	M Bytes Number of ROM chips
Ease of use	Training time Number of help frames
Reliability	Mean time to failure Probability of unavailability Rate of failure occurrence Availability
Robustness	Time to restart after failure Percentage of events causing failure Probability of data corruption on failure
Portability	Percentage of target dependent statements Number of target systems

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Domain requirements

- Derived from the application domain and describe system characteristics and features that reflect the domain.
- Domain requirements be new functional requirements, constraints on existing requirements or define specific computations.
- If domain requirements are not satisfied, the system may be unworkable.

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Domain requirements



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Library system domain requirements

- There shall be a standard user interface to all databases which shall be based on the Z39.50 standard.
- Because of copyright restrictions, some documents must be deleted immediately on arrival. Depending on the user's requirements, these documents will either be printed locally on the system server for manually forwarding to the user or routed to a network printer.

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Domain requirements problems

- Understand ability
 - Requirements are expressed in the language of the application domain;
 - This is often not understood by software engineers developing the system.
- Implicitness
 - Domain specialists understand the area so well that they do not think of making the domain requirements explicit.

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User requirements

- Should describe functional and non-functional requirements in such a way that they are understandable by system users who don't have detailed technical knowledge.
- User requirements are defined using natural language, tables and diagrams as these can be understood by all users.



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Problems with natural language

- Lack of clarity
 - Precision is difficult without making the document difficult to read.
- Requirements confusion
 - Functional and non-functional requirements tend to be mixed-up.
- Requirements amalgamation
 - Several different requirements may be expressed together.

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Requirement problems

- Database requirements includes both conceptual and detailed information
 - Describes the concept of a financial accounting system that is to be included in LIBSYS;
 - However, it also includes the detail that managers can configure this system - this is unnecessary at this level.
- Grid requirement mixes three different kinds of requirement
 - Conceptual functional requirement (the need for a grid);
 - Non-functional requirement (grid units);
 - Non-functional UI requirement (grid switching).

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Guidelines for writing requirements

- Invent a standard format and use it for all requirements.
- Use language in a consistent way. Use shall for mandatory requirements, should for desirable requirements.
- Use text highlighting to identify key parts of the requirement.
- Avoid the use of computer jargon.



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System requirements

- More detailed specifications of system functions, services and constraints than user requirements.
- They are intended to be a basis for designing the system.
- They may be incorporated into the system contract.

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Requirements and design

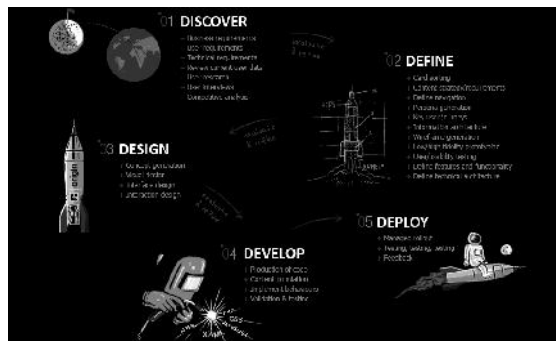
- In principle, requirements should state what the system should do and the design should describe how it does this.
- In practice, requirements and design are inseparable
 - A system architecture may be designed to structure the requirements;
 - The system may inter-operate with other systems that generate design requirements;
 - The use of a specific design may be a domain requirement.

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Graphical models

- Graphical models are most useful when you need to show how state changes or where you need to describe a sequence of actions.

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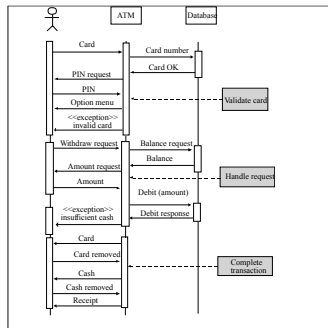
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Sequence diagrams

- These show the sequence of events that take place during some user interaction with a system.
- You read them from top to bottom to see the order of the actions that take place.
- Cash withdrawal from an ATM
 - Validate card;
 - Handle request;
 - Complete transaction.

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Sequence diagram of ATM withdrawal



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Interface specification

- Most systems must operate with other systems and the operating interfaces must be specified as part of the requirements.
- Three types of interface may have to be defined
 - Procedural interfaces;
 - Data structures that are exchanged;
 - Data representations.
- Formal notations are an effective technique for interface specification.

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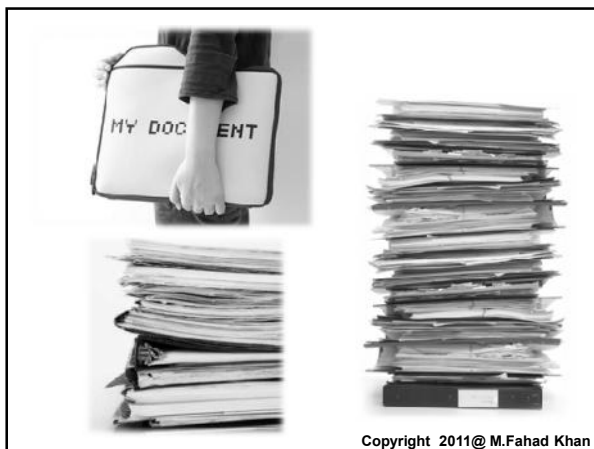


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The requirements document

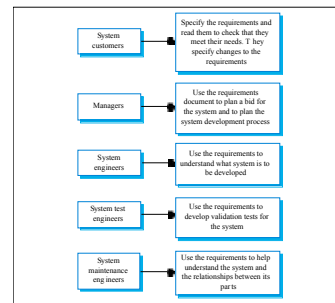
- The requirements document is the official statement of what is required of the system developers.
- Should include both a definition of user requirements and a specification of the system requirements.
- It is NOT a design document. As far as possible, it should set of WHAT the system should do rather than HOW it should do it

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Users of a requirements document



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IEEE requirements standard

- Defines a generic structure for a requirements document that must be instantiated for each specific system.
 - Introduction.
 - General description.
 - Specific requirements.
 - Appendices.
 - Index.

Template SRS

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Requirements document structure

- Preface
- Introduction
- Glossary
- User requirements definition
- System architecture
- System requirements specification
- System models
- System evolution
- Appendices
- Index



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Specifying Software Requirements



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Key points

- Requirements set out what the system should do and define constraints on its operation and implementation.
- Functional requirements set out services the system should provide.
- Non-functional requirements constrain the system being developed or the development process.
- User requirements are high-level statements of what the system should do. User requirements should be written using natural language, tables and diagrams.

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Key points

- System requirements are intended to communicate the functions that the system should provide.
- A software requirements document is an agreed statement of the system requirements.
- The IEEE standard is a useful starting point for defining more detailed specific requirements standards.

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Question in my mind is ?

Should I ask this ?

hmmmmmmmmmm?

Sorry I was sleeping sir !



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If you have any query please feel free to ask

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