

# PROTOTYPING

29/11/2017

Presented by: Shuchita Singh

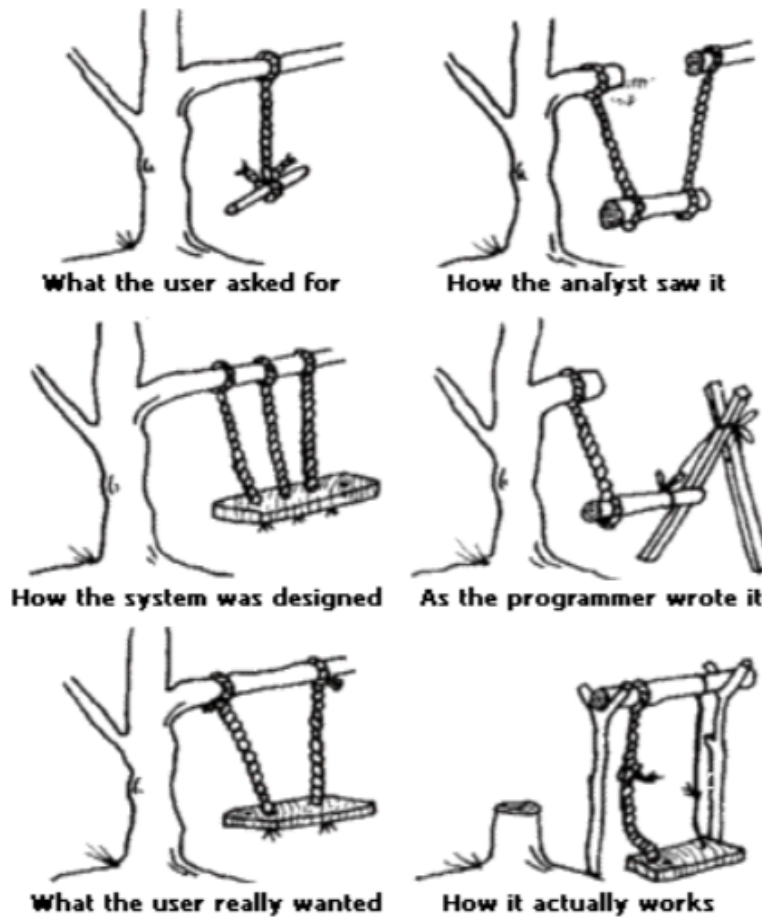


UNIVERSITY OF  
**WATERLOO**

# Outline

- Requirement Analysis Overview
- Prototyping
- Life cycle of Prototyping
- Types of prototyping techniques
- Advantages and Disadvantages
- Case Studies
- Conclusion

# What is Requirement Analysis?



Source:<http://www.marcocioffi.com/archives/2005/04/requirements-engineering/>

# What is Requirement Analysis?

- *Understanding the customer* to find out the functionalities of the target system and documenting them
  - Understanding + Customer = TOUGHEST TASK
  - Requirements may change over time
- Document describing **what** is to be done
  - Not **how**

# What is Requirement Analysis?

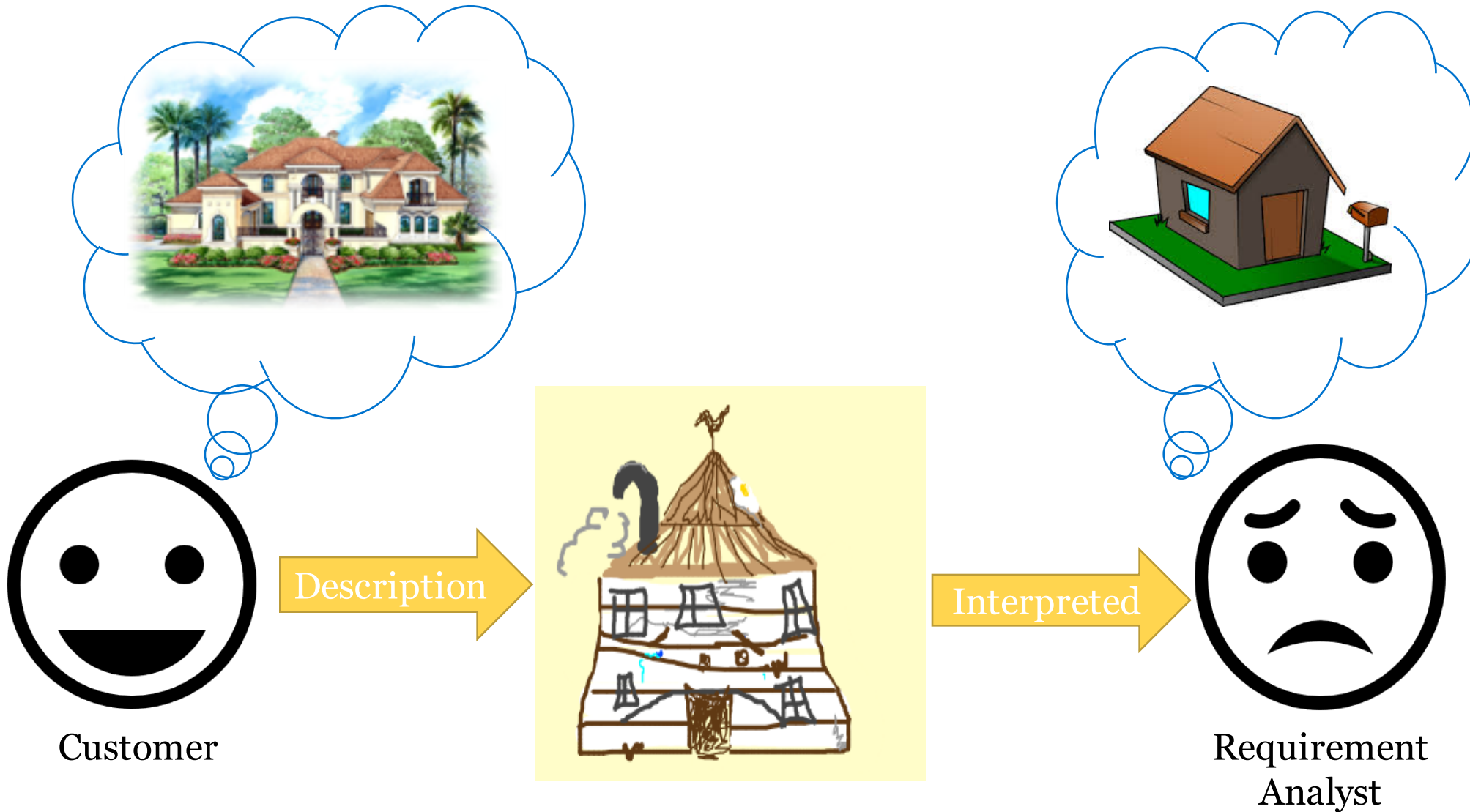
- EXAMPLE:
- IBM Deep Blue beat the world chess champion in 1997

✓	✗
Win a match against Human	Use a minimax search to decide the move
3 minutes per move	Heuristic function
'Learn' from opponent's moves	Use alpha-beta algorithm

# What is the need of Prototyping?

- For a large and complex system
  - Requirements are vast and hidden
- Analysing and understanding the requirements difficult
  - Syncing your thoughts to user's – Main Challenge
  - Bridging the GAP
- When all system requirements are not known well ahead of time
  - Find out the hidden requirements and challenges

# Bridge the GAP



# Prototyping

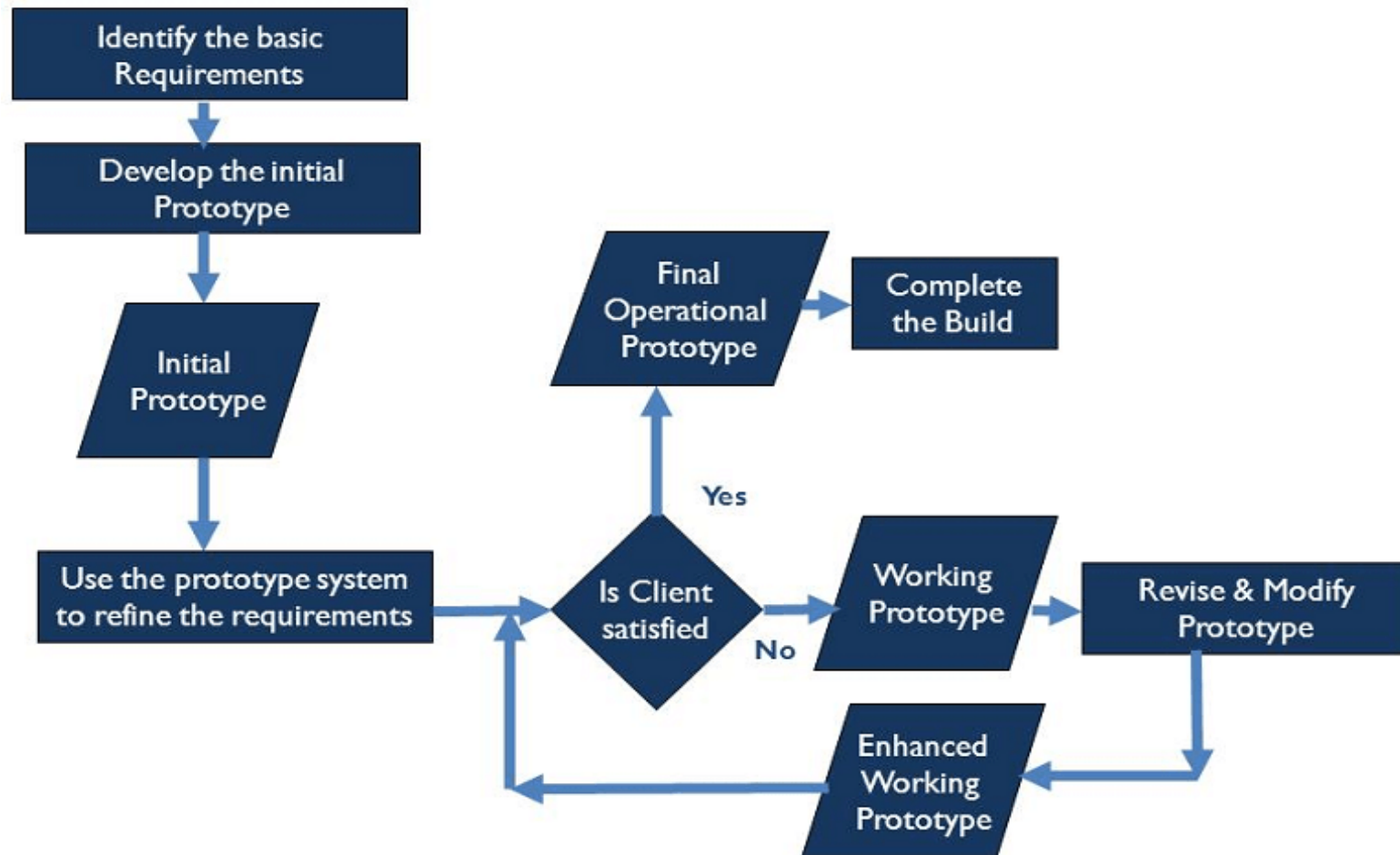
- An **early approximation of a final system** or product is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved[1]
- A good candidate for Prototype is:[7]
  - ‘The user is unable to articulate (or "prespecify") his or her requirements in any form and can only determine the requirements through a process of trial and error.’



# Dimensions of Prototyping

- Nielsen in his book Usability Engineering provides two dimensions of prototyping:
  - Horizontal Prototyping – broad overview of entire system
  - Vertical Prototyping – obtain detailed requirement of a particular function

# Life cycle of Prototyping



Source: <http://www.enterox.com/cloud/software-prototyping.htm>

# Types of Prototyping Techniques

- Throwingaway Prototyping
- Evolutionary Prototyping
- Incremental Prototyping

# Throwaway Prototyping

- Referred to as Rapid Prototyping
- “It involves creating a working model of various parts of the system at a very early stage, after a relatively short investigation”[2]
- Once goals are achieved the prototype built is ‘discarded’
- Often used for requirements identification and clarification[3]
- Example: Is it possible to store user information in database from the text file?

# Evolutionary Prototyping

- Evolutionary prototype forms the heart of the new system, and the improvements and further requirements will then be built[4]
- It is structured to be robust
- Constantly refined and rebuilt and eventually become a solution
- Developer does not implement poorly understood features
- Example: How different components of a system work. Fix the discovered bugs and continue working

# Incremental Prototyping

- The incremental approach is like 'building blocks'; incrementing each time a new component is added or integrated, based on an overall design solution[5]
- The final system is built when all the 'blocks' are put together
- Frequent user feedback on working parts
- Example: Application allows user to cut, copy and paste text but not insert images or animations

# Advantages of Prototyping

- Cost Saving
  - Possible to lower the cost of development (Bohem et al. 1984)
- Produce correct system
  - Ensure that the solution does what it is supposed to do - *not what the developer thinks it ought to do, or how*
- Proper requirement analysis
  - Identify and address problems early in the software lifecycle
- Highly satisfied user

# Advantages of Prototyping

- Bridging the gap
  - Explore ideas and exchange feedback with the client
- Useful reference point[5]
  - It can be referred back to when needed



# Disadvantages of Prototyping

- User may expect the end product to be like prototype
- Insufficient analysis[4]
  - Might distract from properly analysing the project
- Large amount of time spent on building the prototype
- High expectations for productivity with insufficient effort behind the learning curve[6]

# Case Studies

1. Requirements engineering by prototyping: Experiences in development of estimating system
  - by M A Stephens and P E Bates
2. Prototyping in Requirement Engineering
  - By Shuchita Singh

# Case Study 1

- **OBJECTIVE**

- Metal-plating company needed a better and reliable method of pricing and estimation. Till now they relied on specialist. What they wanted was:

- Current practices in pricing and estimating to be analyzed
- The cause of problems reported
- An automated system to streamline processing specified

# Case Study 1

## ▪ PROBLEM

- Relationships between costs and prices remained unclear
- Inconsistency with quotations
- Manual quotations were expensive to produce
- No rules to discover determinants into quotations

# Case Study 1

- **SOLUTION**
- Evolutionary prototyping approach for interface
  - Led to:
    - Change in system requirement
    - Need for **functional prototyping** for important components

# Case Study 2 [Still Working!]

- Large scale Seeking Game using Android Phones
- How building a prototype help them in the requirement gathering phase?
- Learning curve
- What problems did they realize once the prototype was generated?
- How did they solve it?
- Was building a prototype helpful or a waste of time?

# Conclusion

- What is prototyping in RE?
- What is the need of prototyping?
- When should prototyping be done?
- What is a general prototyping life cycle?
- What are the types and uses of prototyping?
- Should it be a part of software development process?

# Reference

- [1] <http://searchcio.techtarget.com/definition/Prototyping-Model>
- [2] Crinnion, John 'Evolutionary Systems Development, a practical guide to the use of prototyping within a structured systems methodology.' Plenum Press, New York, 1991. Page 18.
- [3] Stephens, M A and Bates, P E 'Requirements engineering by prototyping: experiences in development of estimating system' Information and Software Technology Volume 33, Issue 4, May 1990, Pages 253-257
- [4] [https://en.wikipedia.org/wiki/Software\\_prototyping](https://en.wikipedia.org/wiki/Software_prototyping)
- [5] [https://www.sqa.org.uk/e-learning/IMAauthoring01CD/page\\_09.htm](https://www.sqa.org.uk/e-learning/IMAauthoring01CD/page_09.htm)
- [6] E. Urban , Joseph 'Software Prototyping and Requirements Engineering.' Rome Laboratory, Rome, NY.
- [7] Yourdon, E 'Modern structured analysis' Prentice Hall, Englewood Cliffs, NJ, USA (1989)