Software Cost Estimation

SLOC-based Models and the Function Points Model

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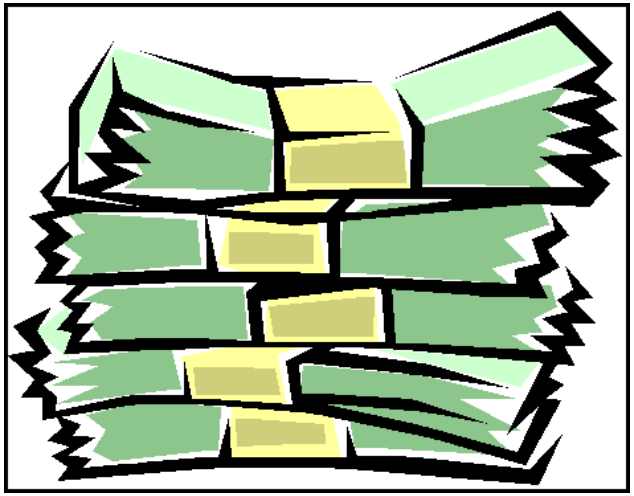
Outline



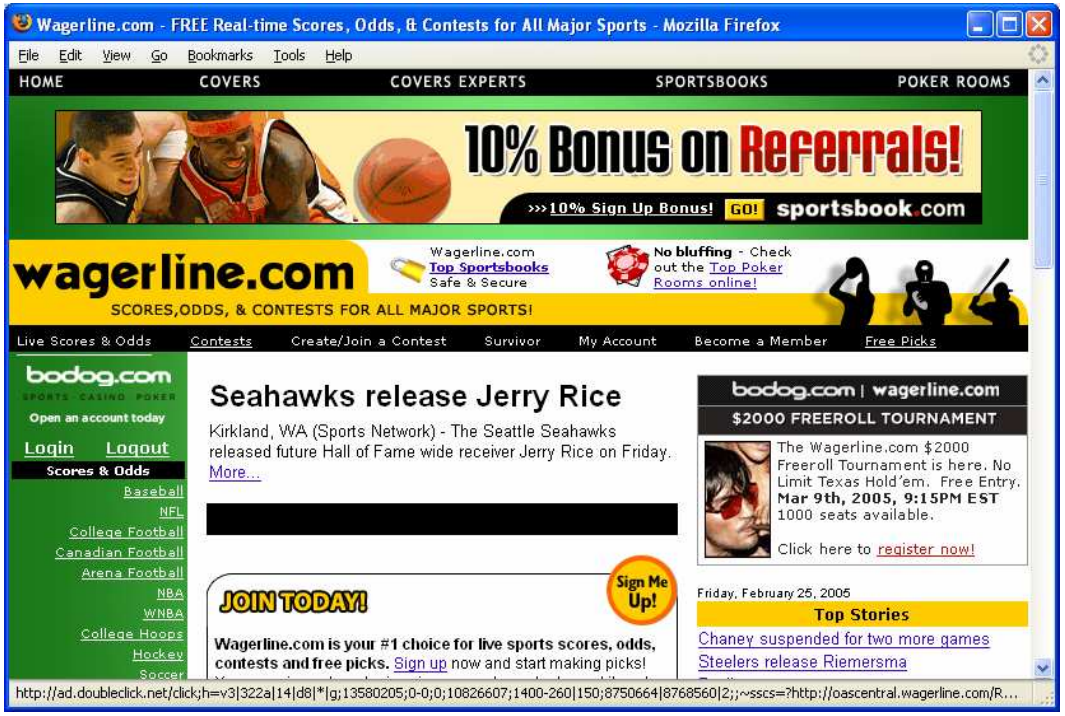
- Introduction
- SLOC-based Approach
- Function Points Approach
- Conclusions

Introduction

- Ad-hoc models initially used
- Need for formal estimation model
- Lines of code easily understood metric
- 1970 – SLIM (Putnam)
- 1979 – Function Points (Albrecht)
- 1981 – COCOMO (Boehm)

Wagerline.com

- Total Estimated Hours = 76
- 76 x $40 per hour = $3040



Wagerline.com

Function	Hours
Web site design	10
Database model and creation	10
External data feed integration and creation of individual sports pages	10
Install, setup, customize phpBB forums	4
Home, About Us, Contact Us pages	4
Leader board for each sport	6
Display user's pending picks	4
Modify user profile	4
Display user profile	4
User registration and login	4
User-defined Pools Create a new pool (4 hrs) Display pool leaders (4 hrs) Make picks for a pool (4 hrs) Display all public pools (4 hrs)	16

How do you estimate SLOC?

- Experience
- Previous system size
- Existing system size
- Breaking system into pieces

From “Schaum's Outline of Software Engineering” by David Gustafson

How do you estimate SLOC?

- For each piece estimate
  - Smallest possible SLOC - *a*
  - Most likely SLOC - *m*
  - Largest possible SLOC - *b*

From “Example of an Early Sizing, Cost and Schedule Estimate for an Application Software System” by L. H. Putnam

How do you estimate SLOC?

- Expected SLOC for each piece

$$E_i = \frac{a + 4m + b}{6}$$

- Total Expected SLOC

$$E = \sum E_i$$

From “Example of an Early Sizing, Cost and Schedule Estimate for an Application Software System” by L. H. Putnam

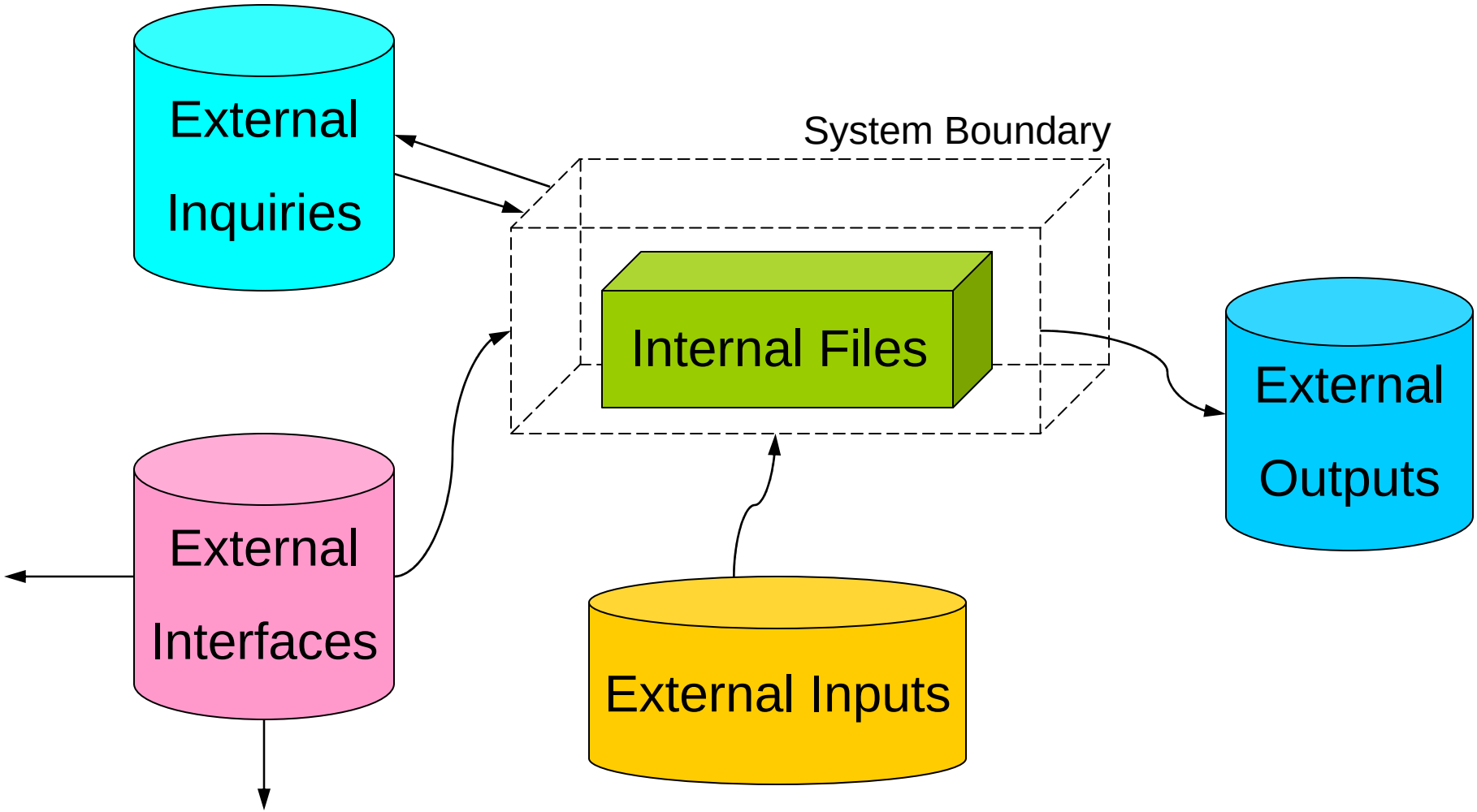
SLOC Estimate Example

	Smallest	Most Likely	Largest
Display user's pending picks	200	300	500
Modify user profile	100	150	250
Display user profile	250	300	450
User registration and login	200	220	250

What are function points?

- Functions of a software system
- 5 Categories
  - External Input
  - External Output
  - Internal File
  - External Interface
  - External Inquiry

What are function points?



Unadjusted Function Points (UFP)

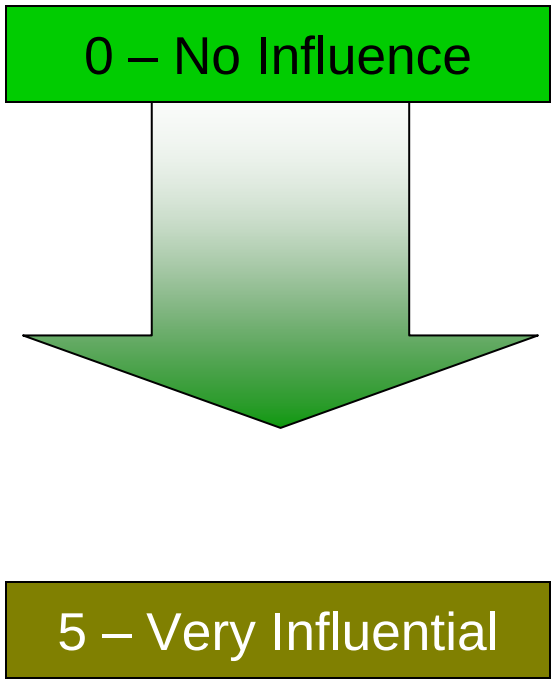
	Low	Avg.	High
External Input	___ x 3	___ x 4	___ x 6
External Output	___ x 4	___ x 5	___ x 7
Internal File	___ x 7	___ x 10	___ x 15
External Interface	___ x 5	___ x 7	___ x 10
External Inquiry	___ x 3	___ x 4	___ x 6

$$UFP = \sum_{i=1}^{3} \sum_{j=1}^{5} w_{ij} x_{ij}$$

From “Reliability of Function Points Measurement. A Field Experiment,” by Chris F. Kemerer

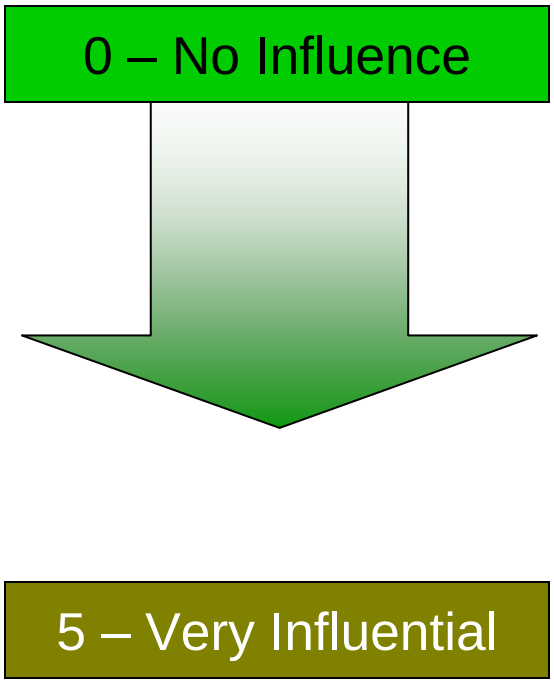
Adjusting for Other Factors

1. Data communications
2. Distributed functions
3. Performance
4. Heavily used configuration
5. Transaction rate
6. Online data entry
7. End user efficiency



Adjusting for Other Factors

8. Online update
9. Complex processing
10. Reusability
11. Installation ease
12. Operational ease
13. Multiple sites
14. Facilitates change



Value Adjustment Factor (VAF)

$$VAF = 0.65 + 0.01 \bullet \sum_{i=1}^{14} r_i$$

where r_i is the rating of factor i

From “Reliability of Function Points Measurement. A Field Experiment,” by Chris F. Kemerer

Adjusted Function Points (AFP)

$$AFP = UFP \bullet VAF$$

From “Reliability of Function Points Measurement. A Field Experiment,” by Chris F. Kemerer

Function Points Model

Advantages

- Estimation data available early
- Language and implementation independent
- Non-technical estimation

Disadvantages

- Difficult to automate data collection
- Possible subjective counting of function points

SLOC-based Models

Advantages

- Easy to automate data collection
- Easy to understand SLOC concept

Disadvantages

- Highly subjective estimate of SLOC
- Highly dependent on experience
- Difficult calibration for a non-native environment

Conclusion

> “...even the current cost is small relative to the large sums spent on software development and maintenance in total, and managers should consider the time spent on FP collection and analysis as an investment in process improvement of their software development capability.”
>
> – Chris F. Kemerer, “Reliability of Function Points Measurement. A Field Experiment”

Questions?