



INTERNATIONAL ATOMIC ENERGY AGENCY
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H4.SMR. 405/16

SECOND WORKSHOP ON TELEMATICS

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Software Engineering

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These notes are intended for internal distribution only.

SOFTWARE ENGINEERING:

- A NEW SUBJECT

SOFTWARE PROJECT:

- DESIGN AND SPECIFICATION
- RESOURCES ESTIMATION
- PROJECT ADMINISTRATION

DESIGN

DESIGN TECHNIQUES:

- TOP-DOWN
- BOTTOM-UP
- BOTH
- DATA ORIENTED
- ALGORITHM ORIENTED
- BOTH

FINAL RESULT:

- PERSONAL COMMUNICATION
- INFORMAL DOCUMENTS
- FORMAL DOCUMENTS
 - . NATURAL LANGUAGES
 - . FORMAL LANGUAGES

FORMAL LANGUAGES:

- WEB (DONALD KNUTH)
- SDL (CCITT)
- OTHERS (ADA)

PROJECT EXAMPLE

HISTORIC DATA

512 LINES TITEX EXCHANGE

PERSON MONTH

DESIGN	626 M-M	15%
PROGRAM	2810 M-M	67%
TUNING	212 M-M	17%
TOTAL	4118 M-M	

LISTS OF PROGRAMS

LINES	TYPE	LANGUAGE
5300	Final	ASSEMBLER
2500	Final	C
500	auxiliary	ASSEMBLER
2700	auxiliary	C
200	auxiliary	ADA
TOTAL FINAL		12800
TOTAL AUXILIARY		3900 (2.3%)
GRAND TOTAL		16700

PRODUCTIVITY

16700/4118 = 4.05 LINES/M-M

DEC-1
19701

TITEX SWITCH

MODEL	128	256	512	1024
Person-Month	29	19	42	29
Total	29	48	87	116

TELEPHONE SWITCH

MODEL	TERMINALS	CODE
TROPICO-C	192	
TROPICO-R	4,096	500,000 Lines
TROPICO-RA	20,000	400,000 Lines

DEC-1
197012

PROJECT ESTIMATION

PROBLEM:

- PACKET SWITCH
- TELEPHONE SWITCH

HISTORIC DATA	PERSON-MONTH	BIAS
Telex	110	no
Data	100	no
Telephone	500	low
TROPICO-R	750	no
TROPICO-RA	1.000	?
Telephone	1.000	high

COCONO FORMULAS

ESTIMATED LINES:

- PREVIOUS EXPERIENCE
- DIVIDE IN SIMPLE PROBLEMS
- GUESS

PERSON-MONTH:

- 1200 LINES/M-M (SIMPLE PROBLEMS)
- 400 LINES/M-M (R.T. PROBLEMS)

DEVELOPING TIME:

$$TIME = 2.5 (M-M) 0.32 \text{ MONTHS}$$

PERSONS:

$$M-M/TIME$$

PROJECT EXAMPLE (1987)

REAL FIGURES (1989)

DEVELOP A SMALL DATA NODE:

32 LINES

PACKAGE SWITCHING

6 PROTOCOLS

300-9600 BPS

EFFORT ESTIMATION:

USE PREVIOUS EXPERIENCE

TELEX EXCHANGE 42 M-M

TROPICO PHONE EXCH. 750 M-M

RESOURCES ESTIMATION:

ESTIMATED 100 M-M

DEVELOPMENT TIME:

10.9 MONTHS

HUMAN RESOURCES:

9

PROJECT EXAMPLE (1989)

400 TERMINAL TELEPHONE EXCHANGE

Person-Month	1.000
Labour force	44
Project Time (COCOMO)	22.8 months
Project Time (estimated)	30.4 months

PROJECT MANAGEMENT

USE SIMPLE RULES OF THUMB:

- ESTABLISH CHECK POINTS
- CORRECT AS SOON AS POSSIBLE
- NEVER ADD MORE PEOPLE
- USE ABSTRACTIONS

COLLECT DATA:

- USE OF TIME
- LINES OF CODE
- ERRORS

USE HISTORIC DATA

SOFTWARE RELIABILITY

PROVE IT:

- PROVE THE DESIGN
- PROVE THE PROGRAMS

USE A GOOD TECHNIQS:

- GOOD DESIGN
- FORMAL SPECIFICATION
- STRICT PROGRAMATION:
 - . good languages
 - . strong typed
 - . clear structure

REDUNDANCY:

- DESIGN AND IMPLEMENT
- TWICE

