



University of Southern California
Center for Software Engineering

CORADMO Update

Constructive Rapid Application Development Model

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Outline

Background

Model Overview

Delphi Results

Additional Factors

Background

RAD (Rapid Application Development)

an application of any of a number of techniques or strategies to reduce software development cycle time

Another step

As COCOMO II evolves, it will have a more extensive schedule estimation model, reflecting the different classes of process model a project can use; the effects of reusable and COTS software; and the effects of applications composition capabilities.

COCOMO II Schedule

- Reflects a waterfall process model
- Duration calculation unreasonable for small projects
- Model does not address RAD strategies

Need to Improve Classic Schedule Model

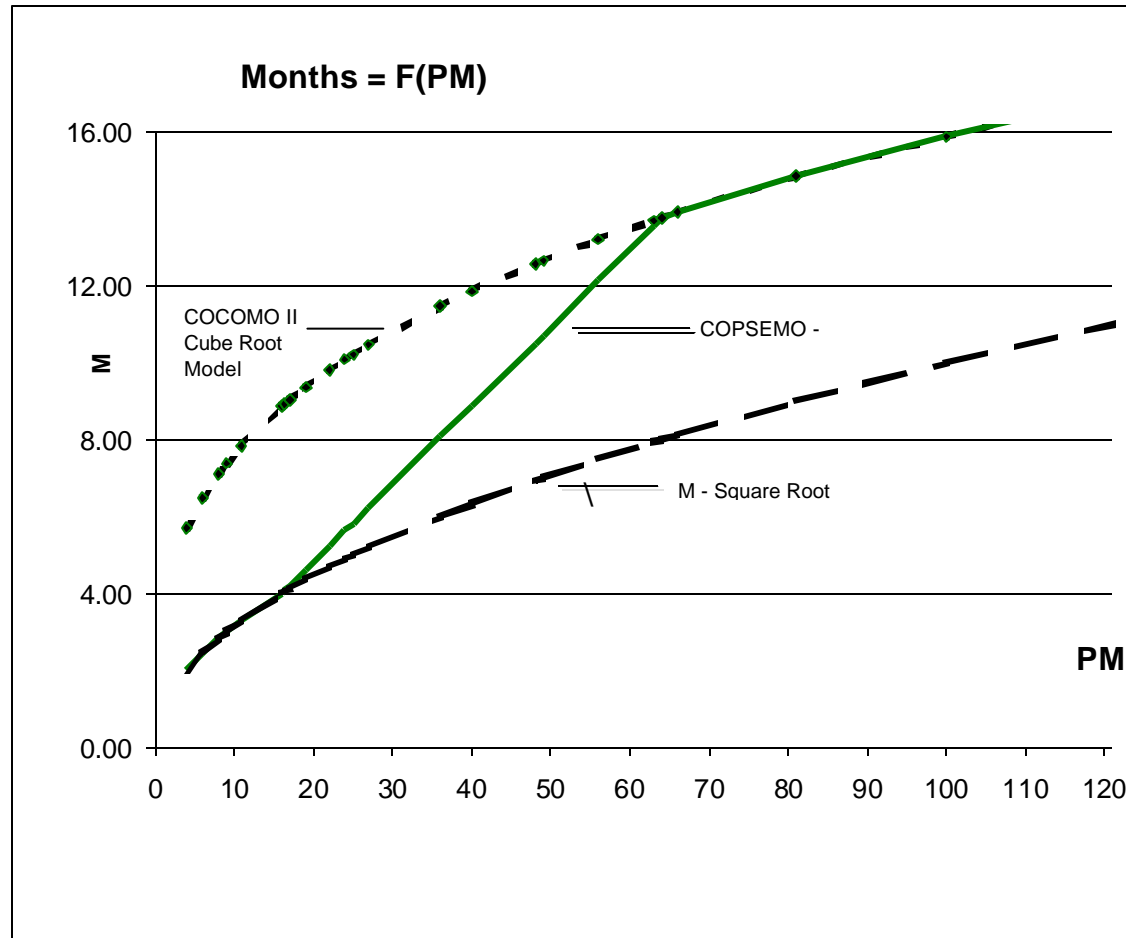
Need stronger capability to reason about strategies/tradeoffs

- Reuse, Very High Level Languages (VHLL) (RVHL)
- Development Process Reengineering (DPRS)
- Collaboration Technology (CLAB)
- Architecture, Risk Resolution (RESL)
- Prepositioning Assets (PPOS)
- RCAP – RAD Capability of Personnel (RCAP)

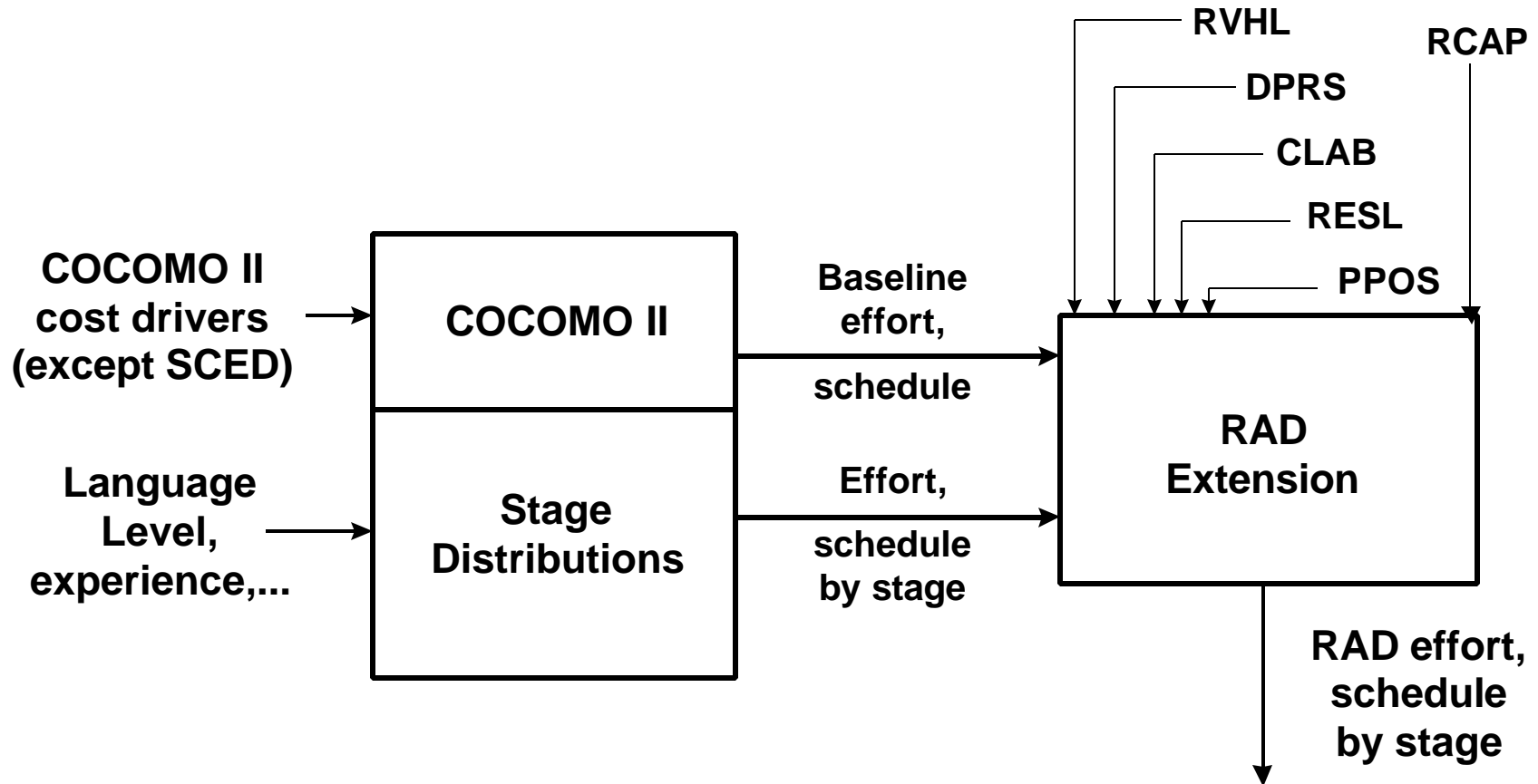
COCOMO II Duration Calculation

$$\text{Months} \sim 3 \sqrt[3]{\text{Person-Months}}$$

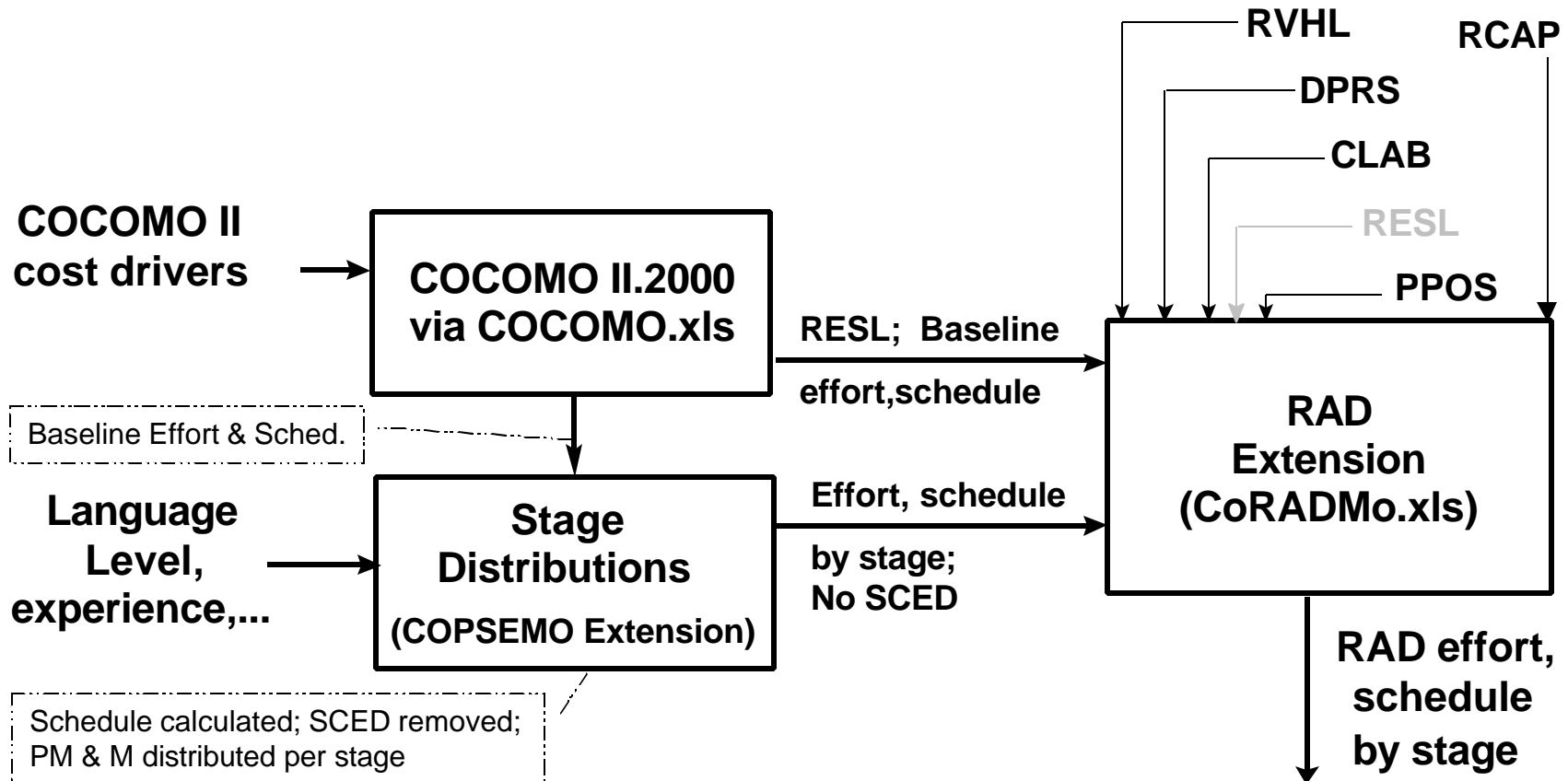
COPSEMO Duration Calculation



Logical COCOMO II RAD Extension



Physical COCOMO II RAD Extension



Percentage Effort Per Stage

Stage	Percent
Inception	14
Elaboration	28
Construction	72
Total I E & C	114

Delphi Respondents

Stage	Percent
Inception	15.3
Elaboration	39
Construction	61
Total I E & C	115.3

Percentage Schedule Per Stage

Stage	Percent
Inception	40
Elaboration	40
Construction	60
Total I E & C	114

Delphi Respondents

Stage	Percent
Inception	30.7
Elaboration	40.5
Construction	59.5
Total I E & C	130.7

Reuse and Very High Level Languages (RVHL)

Schedule and Effort Multipliers	Rapid Prototyping Experience Level				
	VL	L	N	H	VH
Inception	1.04	1.0	.98	.94	.90
Elaboration	1.02	1.0	.99	.97	.95
Construction	1.0	1.0	1.0	1.0	1.0

Schedule and Effort Multipliers	Rapid Prototyping Experience Level				
	VL	L	N	H	VH
Inception	1.05	1.0	.98	.94	.90
Elaboration	1.05	1.0	.99	.96	.91
Construction	1.02	.99	.98	.95	.88

DPRS Rating Scale

	VL	L	N	H	VH
Number of approvals required per task	Excessive	Occasionally Reduced	Mature	Actively Reduced	Actively Minimized
Time taken per approval	Excessive	Occasionally Reduced	Mature	Actively Reduced	Actively Minimized
Reduced task dependencies, critical path tasks	None	Little	Mature Tech. Adopted	Advanced Tech. Adopted	Pioneering
Followup to expedite task completion	None	Little	Encouraged	Emphasized	Strongly Emphasized
Process measurement & streamlining	None	Little	Mature Tech. Adopted	Advanced Tech. Adopted	Pioneering

Development Process Reengineering and Streamlining (DPRS)

Schedule and Effort Multipliers	Inception	Elaboration	Construction
VL - Heavily Bureaucratic	1.20	1.15	1.15
L - Bureaucratic	1.08	1.06	1.06
N - Basic good business practices	1.0	1.0	1.0
H - Partly streamlined	.96	.98	.98
VH - Fully streamlined	.90	.95	.95

Schedule and Effort Multipliers (Delphi)	Inception	Elaboration	Construction
VL - Heavily Bureaucratic	1.25	1.21	1.15
L - Bureaucratic	1.1	1.08	1.07
N - Basic good business practices	1.0	1.0	1.0
H - Partly streamlined	.96	.97	.98
VH - Fully streamlined	.89	.92	.95

Collaboration Efficiency (CLAB)

Same effect on effort; staff level held constant

Schedule & Effort	VL	L	N	H	VH	EH
Multipliers						
Inception	1.21	1.10	1.00	0.93	0.86	0.80
Elaboration	1.15	1.07	1.00	0.95	0.90	0.86
Construction	1.10	1.05	1.00	0.98	0.95	0.93

Delphi Results

Schedule & Effort	VL	L	N	H	VH	EH
Multipliers						
Inception	1.21	1.10	1.00	0.93	0.87	0.81
Elaboration	1.16	1.08	1.00	0.95	0.90	0.85
Construction	1.11	1.06	1.00	0.98	0.95	0.91

Architecture / Risk Resolution (RESL)

Schedule Multipliers (Effort Unchanged)	Delphi Results					
	VL	L	N	H	VH	EH
Inception	1.0	1.0	1.0	1.0	1.0	1.0
Elaboration	1.0	1.0	1.0	1.0	1.0	1.0
Construction	1.0	1.0	1.0	.91	.83	.75

Schedule Multipliers (Effort Unchanged)	Delphi Results					
	VL	L	N	H	VH	EH
Inception	1.01	1.0	1.0	1.02	1.03	1.04
Elaboration	1.03	1.0	1.0	1.01	1.02	1.01
Construction	1.06	1.01	1.0	.92	.85	.77

Prepositioning Assets (PPOS)

PM/M=P Multipliers	L	N	H	VH	EH
Rating	Ad-hoc collection, incompatibilites	Basic project legacy, no tailoring	Some prepositioning & tailoring	Key items prepositioned & tailored	All items prepositioned & tailored
Inception	1.0/1.0=1.0	1.0/1.0=1.0	1.03/.93=1.11	1.06/.86=1.23	1.1/.80=1.37
Elaboration	1.0/1.0=1.0	1.0/1.0=1.0	1.03/.93=1.11	1.06/.86=1.23	1.1/.80=1.37
Construction	1.0/1.0=1.0	1.0/1.0=1.0	1.03/.93=1.11	1.06/.86=1.23	1.1/.80=1.37

Delphi Results

PM/M=P Multipliers	L	N	H	VH	EH
Inception	1.03/1.04=.99	1.01/1.02 =1.0	1.02/.95=1.07	1.02/.89=1.15	1.0/.84=1.19
Elaboration	1.03/1.03=1.0	1.01/1.02 =.99	1.02/.95=1.07	1.02/.88=1.23	.99/.82=1.21
Construction	1.09/1.08=1.01	1.04/1.04 =1.0	1.01/.95=1.06	.99/.86=1.15	.91/.76=1.2

PCAP-RAD Capability of Personnel

	RATING						
FACTOR	XL	VL	L	N	H	VH	XH
PERS-R	10%	25%	40%	55%	70%	85%	95%
PREX-R	≤2mo	4 mo	6 mo	1 yr	3 yrs	6 yrs	10 yrs
I, E, C Multipliers							
PM	1.20	1.13	1.06	1.0	.93	.86	.80
M	1.50	1.31	1.14	1.0	.79	.63	.50
P=PM/M	.80	.86	.93	1.0	1.18	1.37	1.60

PERS-R is the Early Design Capability rating, adjusted to reflect the performers' capability to rapidly assimilate new concepts and material, and to rapidly adapt to change.

PREX-R is the Early Design Personnel Experience rating, adjusted to reflect the performers' experience with RAD languages, tools, components, and COTS integration.

Example

RCAP = Nominal PM = 25, M = 5, P = 5

The square root law: 5 people for 5 months: 25 PM

RCAP = XH PM = 20, M = 2.5, P = 8

A super team can put on 8 people and finish in 2.5 months: 20 PM

RCAP = XL PM = 30, M = 7.5, P = 4

Trying to do RAD with an unqualified team makes them less efficient (30 PM) and gets the schedule closer to the cube root law: (but not quite:

$$3 \sqrt[3]{30 \text{ person-months}} \\ = 9.3 \text{ months} > 7.5 \text{ months})$$

Next Step & Further Information

More Data needs to be collected.

⇒ A data collection form for CORADMO is available.

Another Delphi exercise will be conducted.

For more information about CORADMO, see the CORADMO website at the URL below.

<http://sunset.usc.edu/CORADMO/index.html>

Send e-mail with any questions to Cyrus Fakharzadeh at the address below.

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