

A Methodology for Simulating Net-Centric Technologies

An Operations Research Approach

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Introduction

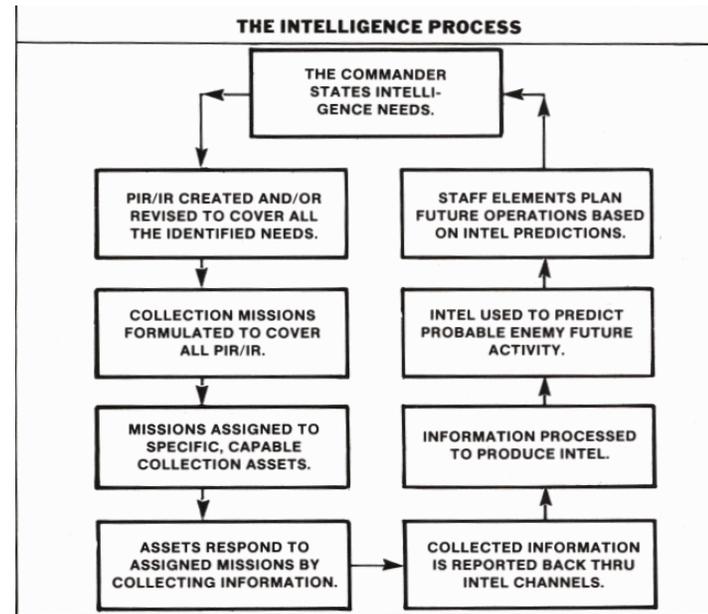
- Language Instant System Translation
- Decision maker's dilemma

الخليل- الضفة الغربية (رويترز) - شددت اسرائيل الحصار على مدينة الخليل بالضفة الغربية يوم الثلاثاء بعد معركة بالاسلحة مع الفلسطينيين في الوقت الذي استعد فيه رئيس الوزراء الاسرائيلي ارييل شارون لاجراء محادثات في واشنطن مع الرئيس الامريكى جورج بوش. وقال شهود عيان ان الجيش نقل كميات من الحجارة واكوم القناب لتعزيز الحصار حول الخليل التي شهدت مواجهات شرسة يوم الاثنين بين مسلحين فلسطينيين ومستوطنين وقوات اسرائيلية. واصيب 12 فلسطينيا وخمسة اسرائيليين بينهم احد ابناء المستوطنين ويبلغ من العمر سبعة اعوام في المدينة التي كثيرا ما شهدت اعمال خف منذ اندلاع الانتفاضة الفلسطينية ضد الاحتلال الاسرائيلي من تسعة شهور.



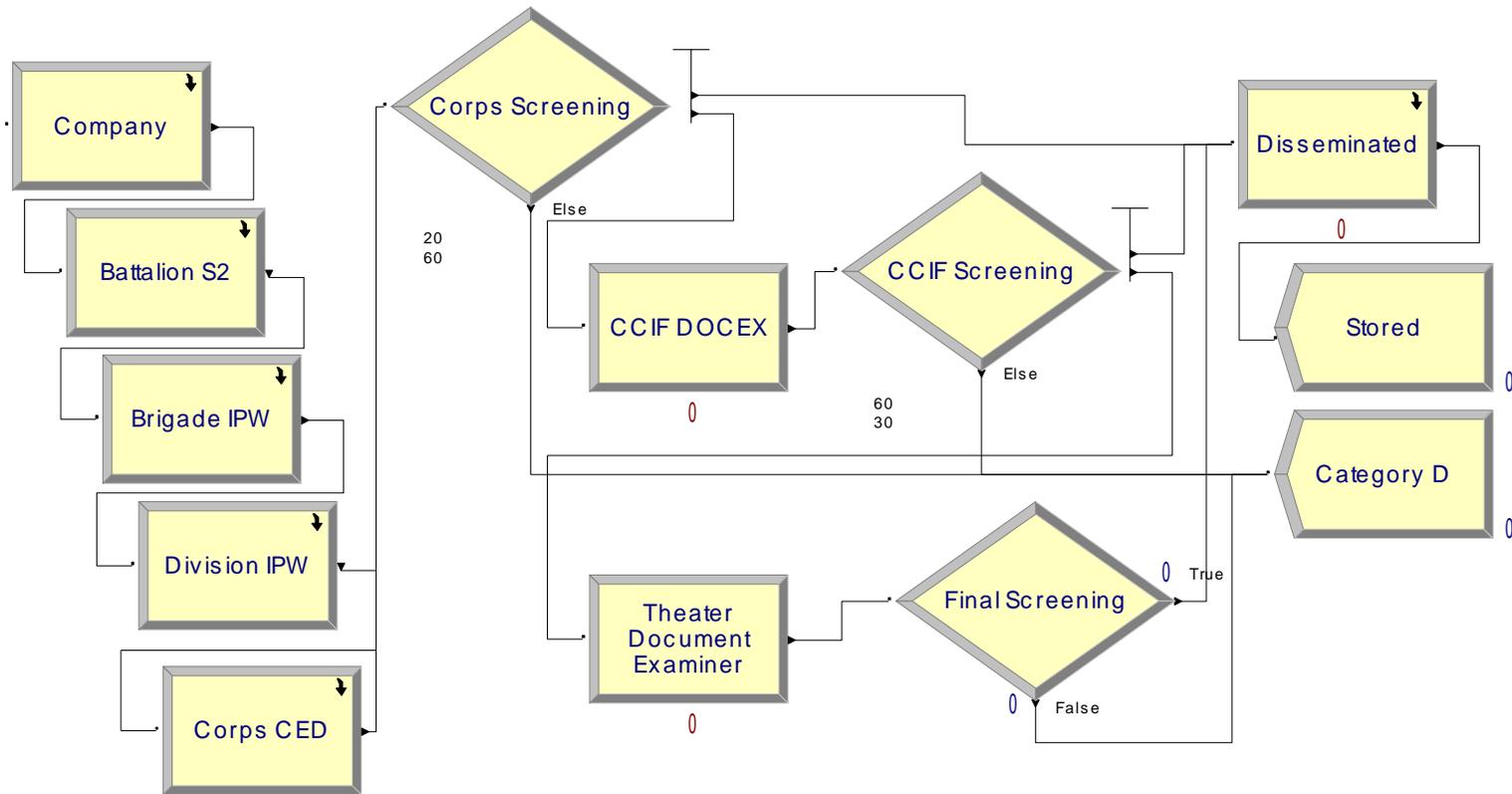
The CED Process

- Battalion S2→Brigade
- Brigade→Division
 - Rarely DOCEX capable
- Division→Corps
 - Batch CED Categories (A-D)
- Corps→CCIF
 - SALUTE/Full PIR
- CCIF→Theatre
 - Final screening/storage



FM 34-52: The Intelligence Process

Modeling

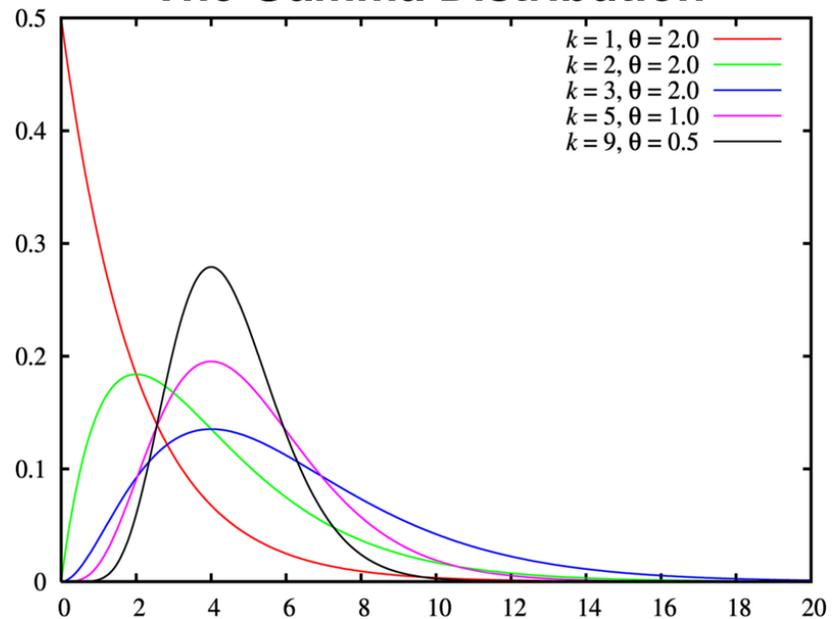


Rockwell Arena Simulation Package

Modeling

Random Variable	α	β	Avg. Time
CED Frequency (at company level)	1	2.1	2.1
Company Process Time	1	2.1	2.1
Battalion Process Time	2	2.1	4.2
Brigade Process Time	1	2.1	2.1
Division Process Time	1	2.1	2.1
Corps Process Time	2.5	2.1	5.25
CCIF Process Time	2	2.1	4.2
Theatre Process Time	1	2.1	2.1

The Gamma Distribution



Results and Verification

- Average time to exploitation of 23.72 working hours
- Moment-Generating Functions Technique:

$$m_g [t] = (\beta \cdot t)^{-\alpha}$$

$$\kappa = \delta + \varepsilon + \phi + \gamma + \eta + \iota + \varphi$$

$$m_{g,k} [t] = (1 - \beta \cdot t)^{-\delta + \varepsilon + \phi + \gamma + \eta + \iota + \varphi}$$

$$\alpha = \delta + \varepsilon + \phi + \gamma + \eta + \iota + \varphi$$

$$f[x] = \frac{1}{2.1^{11.5} \Gamma[11.5]} x^{10.5} e^{-\frac{x}{2.1}}$$

- MGF gives an average time of 24.15 working hours

ATTACH TO PW 123456 A	
DATE OF CAPTURE ()	
NAME () <u>HECTOR ARGUELLO</u>	
SERIAL NUMBER () <u>NONE</u>	
RANK () <u>SERGEANT</u>	
UNIT () <u>UNKNOWN</u>	
LOCATION OF CAPTURE ()	
CAPTURING UNIT () <u>214/C</u>	
SPECIAL CIRCUMSTANCES OF CAPTURE ()	
<u>ATTEMPTING TO</u>	
<u>PROBE DEFENSIVE</u>	
<u>POSITION</u>	
WEAPONS DOCUMENTS ()	
<u>AK 47</u>	
FORWARD UNIT 123456 B	
DATE OF CAPTURE ()	
NAME ()	
SERIAL NUMBER ()	
RANK ()	
DATE OF CAPTURE ()	
UNIT ()	
LOCATION OF CAPTURE ()	
CAPTURING UNIT ()	
SPECIAL CIRCUMSTANCES OF CAPTURE ()	
WEAPONS DOCUMENT ()	
ATTACH TO ITEM 123456 C	
DATE OF CAPTURE ()	
NAME ()	
SERIAL NUMBER ()	
RANK ()	
DATE OF BIRTH ()	
UNIT ()	
LOCATION OF CAPTURE ()	
DESCRIPTION OF WEAPONS/DOCUMENTS ()	
DOCUMENTS AND WEAPON CARD ()	

PW
DO NOT REMOVE THIS PART FROM PW

DISARM AND
SEARCH THOROUGHLY
()
REPORT IMMEDIATELY
()
SEGREGATE BY CATEGORY
()
SAFEGUARD FROM DANGER
()

BACK OF PART A

NOTE: See STANAG 2044 for reproducible copy.

On the back of the lower part should be written in red letters: ATTACH TO CAPTURED WEAPONS AND/OR DOCUMENTS.

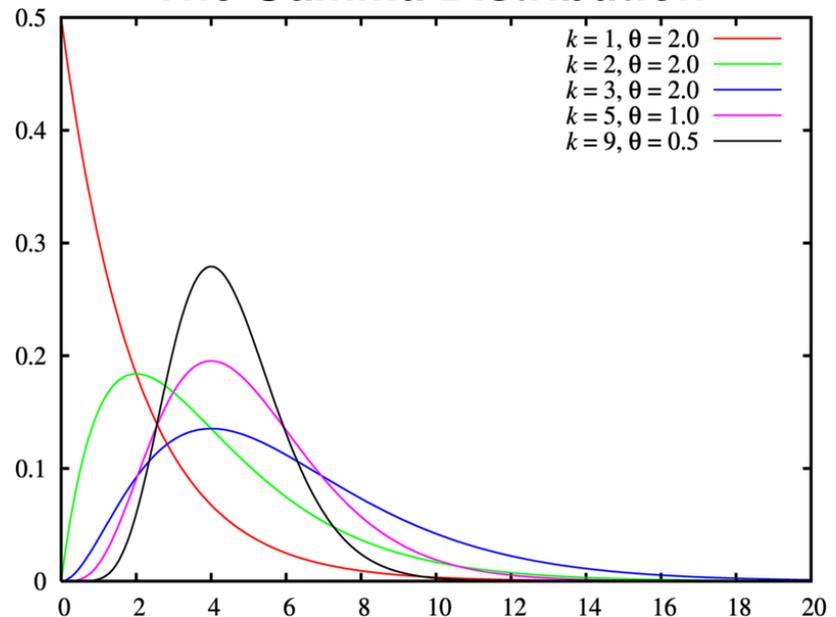
Total tag should measure approximately 30 x 10 centimeters.

Figure 2-70. EPW and document/equipment tag.

LIST Infusion

Random Variable	α	β	Avg. Time
CED Frequency (at company level)	1	2.1	2.1
Company Process Time	.2	2.1	0.42
Battalion Process Time	.5	2.1	1.05
Brigade Process Time	.75	2.1	1.575
Division Process Time	.75	2.1	1.575
Corps Process Time	2	2.1	4.2
CCIF Process Time	1.5	2.1	3.15
Theatre Process Time	.75	2.1	1.575

The Gamma Distribution

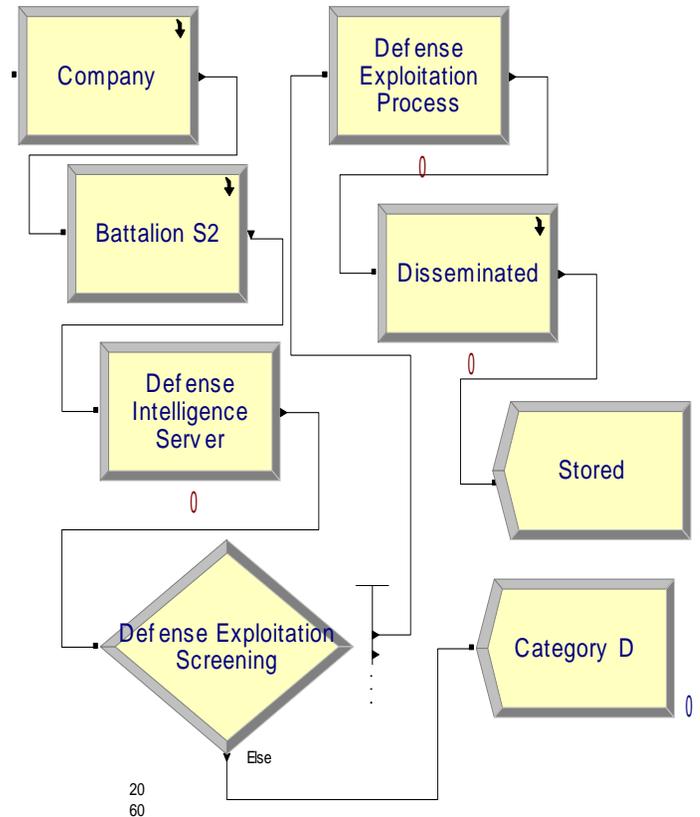


CEDs now take an average of 11.11 working hours to exploit.

Net-Centric Infusion

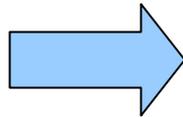
$$M[d, b] = N_k$$

- The value creation process
- Command and Control
- Notional Process:
 - Company → LIST
 - LIST → BN S2
 - BN S2 → Server
 - Exploitation assets pull from server



Net Centric Infusion

Given these random variable inputs, the simulation shows that CED exploitation could occur within an average time of 3.852 hours.



Random Variable	α	β	Avg. Time	Var.
CED Frequency (at company level)	1	2.1	2.1	χ
Company Process Time	.2	2.1	0.42	δ
Battalion Process Time	.5	2.1	1.05	ε
Exploitation Assets Available	100 (Fixed)			
Exploitation Time	1	2.1	2.1	λ

Further Research

- Variance
- Non-Gamma Distributions

$$m_g[t] = (\sum_{i=0}^n \beta_n \cdot t)^{-\sum_{i=0}^n \alpha_n}$$

- Design of experiments
- Stochastic queue theory
- Empirical research
 - “Bootstrapping”



Questions?

References

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