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SOCIAL CLOUD COMPUTING FOR HUMAN RESOURCES' PERFORMANCE RISK ASSESSMENT AND MANAGEMENT

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Abstract

This modified implementation of CLOURAM (Cloud Risk Assessment and Management) simulates non-technical (i.e. human kind) by mimicking the future planned Human Resources (such as HRG: Human Resources Group, or FRG: First Responder Group in County or City Police/Fire Department, or Hospital Service etc.) personnel activities if the proper "personnel input" and "customer service demand" are fed. These grouped input are fed into the program about the personnel with their daily working habits of how often they fail to come to work (rate of absence for whatever reasons) or how long it takes to return (rate of recovery) from their expected absence and their daily working hourly capacities in a merit order. Also load (demand) hours expected to perform by the existing personnel will be entered as input. Outcome will appear as percentage (or unreliability) of supply for not satisfying the demand (service) in an hourly or daily curve and also how many work hours lost. Graphical diagrams will illustrate those bottlenecks, and what stage of the exposure period one is experiencing these unfavorable lost hours of work-force and what to do.

1. Introduction and Motivation

The motivational aspects of such novel idea can be summarized as follow:

- Current lack of digital simulators for future human resources availability planning.
- Incident commanders need to monitor HRG availability.
- Emergency response situations require efficient coordination and allocation of available resources that need to be controlled.
- Recent natural and man-made disasters have reinforced the need for stronger HRG response knowledge using objective IT solutions.

What does Social CLOUD implementation bring new to the table?

- A tested, peer-reviewed, accurate & scalable algorithm.
- An insightful and meaningful system availability prediction model combined with historical resource and service data.
- Easy to implement, user defined and user friendly easy-to-explain tool.
- This project will be vital to HRG leaders monitoring availability.
- The project team is proposing to model the daily operational realities of a defined but limited e.g. county/city, the First Responder Group's (FRG) activities such as Firefighters or Police Force. In doing so, SOCIAL CLOUD will be applied by collecting city/county historical data. City/county FRG operations will be positively impacted by assessing and managing First Responder availability by implementing this project in the course of daily emergency operations.
- United States regional HRGs will perform simulation tasks and assess an index of unavailability, then manage risk by responding to what if remedial questions, conveniently applicable by using the CLOURAM (the tool name for SOCIAL CLOUD). The scalable and flexible program will be easily accessible for government FRG agencies with real-time availability improvement practices and preventive measures so as to act timely and efficiently. What-if queries offer usable projections for HRG reservists or back-ups, and other operations with ease and minimal effort, without having to wait for a lengthy data collection to act.
- Finally, the development and implementation of the proposed application will significantly improve the area's emergency response capability. This algorithmic tool not only assesses availability shortfalls but also enables emergency response planning in terms of staffing and maintenance. See Sahinoglu et al (2011) and (2012) for Cloud modeling; Leavitt (2009) for non-technical factors.

2. Numerical Example for Social CLOUD (200 employees active)

In a hypothetical HRG (Human Resources Group) serving in a county's first-responder or similar department, or a private banking or any small or large scale agency or corporation, there may exist 8 groups each of which contain 25 servers, a total of 200 employees. As in Figure 1, the first ranking (in merit order) Group 1 with 25 servers who perform with a capacity of 10 hours/day have an absence (sickness or else) of 1 in 100 days (0.01/day) and recovery (return) of 1/day. This is indicating that absentees, once in 100 days, return after a day of absence from the work on the average. Assuming, the times to absence and recovery are negative exponentially distributed, for the sake of example, with mean time to absence, (1/absence rate=1/0.01=100 days) and mean time to recovery

(1/return rate=1/1=1 day). If other distributions are desired, then one can utilize the Weibull option (Weibull=1 means default case of negative exponential) other than Weibull Shape Parameter=1. This continues until 8 groups are completed as captured in two separate screenshots in Figure 1 Load (or service demand) values are displayed for 1000 days of service each at a constant 1200 required hours of service/day as a constant.

However, varying load values can be also entered at will as well as vacation time. A maintenance or back-up reservist cadre of ideal 200 employees is set aside. The unreliability (probability) of not meeting the demand is 6.21% using the input data in Figure 1 evident from output in Figure 2 after 1000 simulations covering 1000 hours of demanded service. It takes 30 seconds to perform 1000 times 1000 hours of exposure time. In Figure 2, this time only 2 backup personnel are used to cover a base of 2000 employees. The probability of not meeting the demand (unreliability) increases to 23.3% from an earlier 6.21%. In fact, there is no improvement of reliability reducing the crew from 200 down to 4. This means that there is no need to keep a reservist cadre more than 5 backup employees so as not to waste money by overinvesting. New what-if scenarios, other than back-ups, such as modifying the load values and # of employees or adding capacity (employees) in the work force can be simulated to see what can be saved. This way of digitally simulating saves solid money and time by mimicking the future HR operations rather than fatefully waiting fto observe what happens by trial and error. This practice by simulating the future operations is wiser and cheaper. Figure 4 shows one individual unit's or employee's performance cycle, i.e. red (off), green (on) or yellow (waiting to return). This way one can plan the future activities of this HR or FRG personnel to avoid wastes of resources to secure a guasioptimal run.

System Application				
File Simulation Graphs Print Help				
Producers Group: 9 Submit Components: 1 Product Value: 1 Delete Weibull Shape: 1 © Exp Dist Failure Rate: .01 O Wei Dist Repair Rate: .02	System Load Parameters Constant Load Percent Load Wutipiler: Startup Failure Startup Delay 0	Add Loads Add to Range Delete Range Multiply Range Modify Range	Environment Parameters Maintance Crews 200	NB Parameters q 2.4926 M 1.6342 Image: Comparison of the system of the syst
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Capacity value: 4	1000 Total Load:	1200.0000		

Figure1: Input data for 8 working groups of 200 personnel data for 1000 load cycles.

System Application											
File Simulation Graphs Print Help											
Producers Group: 9 Submit Components: 1 Product Value: 1 Delete Weibull Shape: 1 © Exp Dist Failure Rate: .01 © Wei Dist Repair Rate: .02	System Load Paran Constant Load Percent Load Variable Load Multiplier: Startup Failure Startup Delay	1.0 0.0000001	Add Load Add to Rar Delete Rar Multiply Ra Modify Rar	s ge ge 1ge ge	Environment Pai Maintance Crev Total Cycles (T Simulation Lamda Mu Time:	ame /s C) s: 0: 0: 0 h	ters 200 1000 0.0000001 0.0000001 ar 0 min 30	Standard Power Cyber S	I ● Exp ○ Weibull ○ Mixed	NB Parameters q 2.4926 M 1.6342 @ d E Up @ Down Values Graph Density) n
		y f(y)	F(y)		i(y) .		x f(x)	F(x)	S(x) .	
Component: 25 Capacity: 4 Produced an average of 988 out of 1000 cycles, resulting in an average of 3952 production units Not produced 12 out of 1000 cycles. Average cycles not produced due to repair: 11 Average cycles not produced due to wait: 0. Average cycles not produced due to startup fail Availability: 0.9880 Unavailability: 0.0120 Failure rate: 0.0700 Repair rate: 2.0000	iure: 0.	Average Duration Frequency of load Standard Deviatio Total cycles of Loa Load Surplus Proi Expected Surplus Total cycles withou q2: 77.8289 theta2: 0.9872 alpha2: 0.2296	of load surplus I surpluses: n = n = 12.752592(ad Surplus Expr bability: LSP = L Production Uni ut surplus or de	es: s = 17 52 3 cted: LSE SE/TC = (is: ESPU ficiency (t	6435 = n * s = 913 .9125 = 128913 es): 25		Average Dui Frequency o Standard De Total cycles Loss of load Expected Ur Total cycles q1: 2.4926 theta1: 0.59 alpha1: 1.05	ration of load of load deficie eviation = 10.9 of Loss Of Lo t probability: L served Prode without surpl 88 88 949	deficiencies: ncies: f = 38 56644565 aad Expected .OLP = LOLE uction Units: us or deficien	d = 1.6342 : LOLE = 1* d = 62 /TC = 0.0621 EUPU = 4713 toy (lies): 25	
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TDCU + ESPU - EUPU =? EPU 1324200 =? 1324200	•	12 0. 13 0.	.0164 0.678 .0149 0.693	0.321	5 6	-	12 13	0.0002	0.9998 0.9999	0.0002 0.0001	•

Figure 2: CLOURAM (Social CLOUD) output for input in Figure 1 for 200 repair crews.

System Application				_			
File Simulation Graphs Print Help							
Producers Group: 9 Submit Components: 1 Product Value: 1 Delete Weibull Shape: 1 ● Exp Dist Failure Rate: .02 Variable Lo Multiplier: Startup Failure Startup Delay	arameters ad ad 0.0000001 0	Add Loads Add to Rang Delete Rang Multiply Rang Modify Rang	e e e e e e f e f e f e f e f f tatacce Crew Total Cycles (TC Simulation: Lamdat Mut Time:	ame s C) s: D: D: 0 1	ters	ard ® Exp r ○ Weibu · ○ Mixed	NB Parameters q 8.2204 M 3.4275 @ d E Up Down Values Graph Density
	yf(y)	F(y)	S(y)	•	xf(x)	F(x)	S(X)
Simulation System Results Repair Crews: 2 Component Groups: 8 Total number of component: 200 Total installed capacity: 1350 Load Applied: 1200.0 Production Unit: Capacity * Cycle Component Summary	Average Durat Frequency of I Standard Devi Total cycles of Load Surplus Expected Surp Total cycles wi q2: 33.4880 theta2: 0.9701 alpha2: 0.2844	ion of load surpluse: oad surpluse: n = 7 ation = 30 14953264 Load Surplus Expec Probability: LSP = LS Itus Production Units ithout surplus or defi	s: s = 9.2527 8 Hed: LSE = n * s = 723 HE/TC = 0.7230 HE/TC = 0.7230 HE/TC = 0.22441 clency (ties): 44		Average Duration of Io Frequency of Ioad defi Standard Deviation =: Total cycles of Loss O Loss of Ioad probabili Expected Unserved P Total cycles without sr q1: 8.2204 theta1: 0.8784 alpha1: 0.4747	ad deficiencies iciencies: f = 68 29.58031051 f Load Expecte ty: LOLP = LOL roduction Units ırplus or defici	:: d = 3.4275 d: LOLE = f* d = 233 E/TC = 0.2330 : EUPU = 36596 ency (ties): 44 =
	У	f(y) F(y)	S(y)		x f(x)	F(x)	S(X)
Group Name: Gr 1 Component: 1 Capacity: 10 Produced an average of 977 out of 1000 cycles, resulting in an average of 9770 production units.	Avg. Up Duration Cycles 1 2	0.2763 0.2763 0.1340 0.4103	0.7237 0.5897		Avg. Down Dens Duration Cycles 1 0.416 2 0.183	ity Cum. Density 9 0.4169 1 0.6001	Survival 0.5831 0.3999
Not produced 23 out of 1000 cycles. Average cycles not produced due to repair; 6 Average cycles not produced due to wait: 16. Average cycles not produced due to startup faliure: 0. Availability: 0.9770 Unavailability: 0.0230 Faliure rate: 0.0100 Repair rate: 1.0000	3 4 5 6 7 8 9 10 11 12	0.0867 0.4970 0.0631 0.5601 0.0489 0.6090 0.0396 0.6486 0.0329 0.6815 0.0279 0.7094 0.0241 0.7335 0.0210 0.7546 0.0210 0.7546 0.0185 0.7731	0.5030 0.4399 0.3910 0.314 0.3185 0.2906 0.265 0.2454 0.2269 0.2269 0.22104		0.107 3 0.107 4 0.070 5 0.049 6 0.036 7 0.027 8 0.021 9 0.016 10 0.013 11 0.010 12 0.008	0.0001 6 0.7773 6 0.7779 6 0.8276 3 0.8639 4 0.8912 0 0.9123 4 0.9287 0 0.9417 4 0.9520 3 0.8604	0.2927 0.2221 0.1724 0.1361 0.1088 0.0877 0.0713 0.0583 0.0480 0.0480 0.0396

Figure 3: CLOURAM (Social CLOUD) output for the input in Figure 1 for 2 repair crew

3. Input Wizard Example for Social CLOUD (200 employees active)

The following screenshots in Figure 5 and 6 illustrate how Input Wizard in the Cloud Assessment Java tool enters the data for Figure 1 through a sequence of dialog boxes, from left to right and top to bottom for production and load data.



Figure 4: The individual (e.g. Group 8 server 20) for 1000 cycles regarding 200 and 2 backups. Above, yellow time windows appear for waiting due to perfectly sufficient back-up personnel. Below, sporadic yellow waiting windows due the back-ups to arrive before servers return to green (work) after red (absent).

Input Wizard	Input Wizard	Input Wizard
Select System Type Technical Social OK Cancel	Enter the number of groups 8 OK Cancel	Enter the name of group 1 Group1 OK Cancel
Input Wizard	Input Wizard	Input Wizard
Select distribution type for group 1 Negative Exponential Weibull OK Cancel	Enter number of persons in group 1 25 OK Cancel	Enter Absence Rate(per day) for group 1 0.01 OK Cancel

Input Wizard	Input Wizard	Input Wizard
Enter Return Rate(per day) for group 1 1.0 OK Cancel	Enter Serviceable Hours(per day) for group 1 10 OK Cancel	Enter the name of group 2 Group2 OK Cancel

Figure 5: Product data entered one by one in sequence with Input Wizard from the CLOUD Assessment Java tool.

Input Wizard	Input Wizard
Enter the cycle length 1000 OK Cancel	Enter demand hours for cycle 1:1200 Repeat number of times: 1000 OK

Figure 6: Load data entered in sequence left-to-right and top-to-bottom with Input Wizard from the CLOUD Assessment Java tool.

4. Conclusions

This tool proves useful for planning manpower to schedule or economize workforce. It is based on logical principles rather than haphazard guess-work which can vary from one supervisor to another. Social Clouds can be effective like physical ones. Observing our example in Figure 3, we run 1000 times a period of 100 days or 6 months or a year of FRG or HRG activity ahead. Also for each responder in each group, we can see on the average where FRG or HRG personnel are failing to contribute so that we can work on remedial countermeasures regarding those weak spots. Last but not least, we can also execute back-up or reserve personnel contingencies. Say, we have 20% backup reserve we have in the payroll or should we have only maybe 5% or less, so that we can save on the expenses? Overall for market planning in terms of substitute crew or new employees to add, the "Social Cloud" is necessary.

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