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# Test Cases for MBSE of IE

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## Test Cases for MBSE of IE

### You don't know Jack?

- Jack Ring, BA Physics, Emporia State University
  - 20@GE Aerospace, 10@Honeywell Computers, 22@Mentoring Innovation.
  - Cofounder, Kennen Technologies LLC, OntoPilot LLC and Educe LLC
  - Fellow, INCOSE, Co-founder of IEWG, MSWG and SVAWG
  - Industrial Fellow, College of Systems and Enterprises, SIT
  - Member seven professional societies
  - Enterprise Architect, Starshine Academy Phase III
- Applying technology to facilitate knowledge exchange and choice making.





# Three common business situations

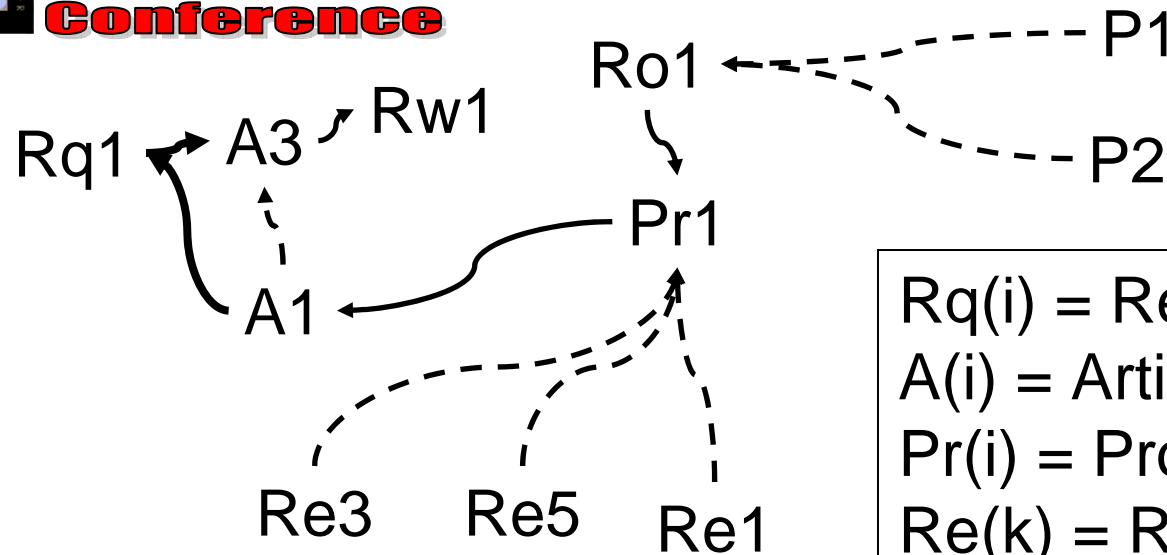
- $R_{x0}$  = Input-Process-Output,  $R_q - R_p - R_w$
- $R_{x1}$  = Conflicts among operations factors. Fixed rewards.
- $R_{x2}$  = Conflicts among Operations and Improvement factors. Time sensitive rewards.



# Basic Operation Rx 0

- **Objective:** Exemplify a Single-thread Request, Response, Reward pattern. Rq, Rp, Rw.
- **Deliverables:** Model diagrams,
- **Benefits:** Demonstrates the use of modeling tool(s) on a basic pattern. Allows others to produce directly comparable models using their respective methods and tools.

# Sketch of RX 0



$Rq(i)$  = Request #  $i$   
 $A(i)$  = Artifact  
 $Pr(i)$  = Process #  $i$   
 $Re(k)$  = Resource #  $k$

- $Rq1$  will pay  $Rw1$  for an  $A1$  that conforms to  $A3$ .
- $Pr1$  produces  $A1$  by engaging  $Re1$ ,  $Re3$  and  $Re5$  and staffing  $Ro1$ .
- $Ro1$  can be staffed by  $P1$  or  $P2$ .

$Ro(m)$  = Role #  $m$   
 $P(n)$  = Person #  $n$   
 $Rp(j)$  = Response #  $j$   
 $Rw(i)$  = Reward for fulfilling  $Rq(i)$



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# Basic Operation Rx 1

- **Objective:** Examples of real-world enterprise situations.
  - Dual Request, Conflicts for Resource and Persons,
  - Maximize Revenue vs. Maximize Net Income.Discover dynamic limits.
- **Deliverables:** Diagram + Set Points + Timelines
- **Benefits:** Demonstrates conflict and decision aspects of an enterprise. Allows other teams to produce directly comparable models and emulations using their respective methods and tools.



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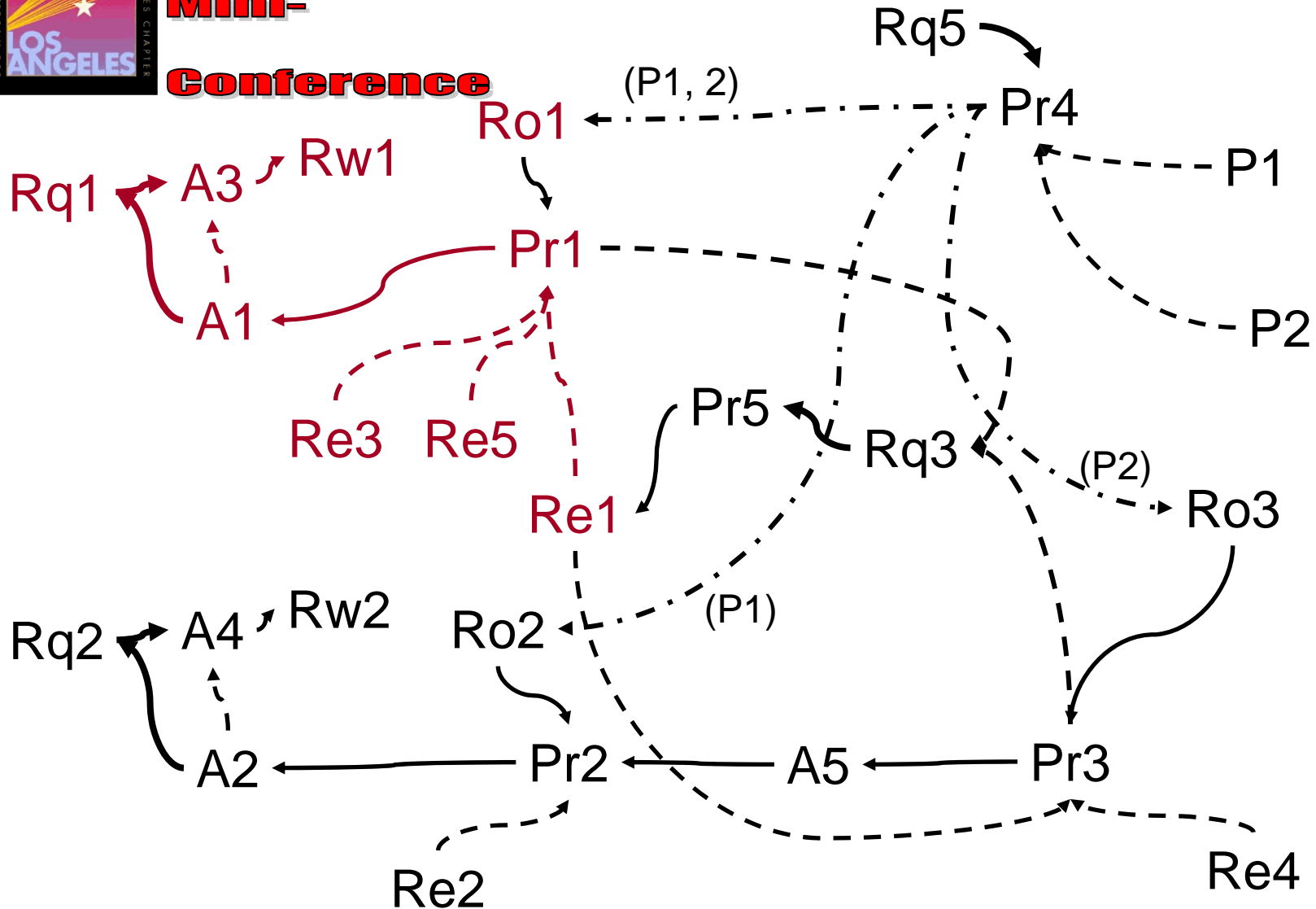
# Description of Rx 1

- Rq1 will pay Rw1 for an A1 that conforms to A3.
- Rq 2 will pay Rw2 for an A2 that conforms to A4.
- Pr1 produces A1 by engaging **Re1**, Re3 and Re5 and staffing Ro1.
- Pr2 produces A2 by engaging Re2 and A5 and staffing Ro2.
- Pr3 produces A5 by engaging **Re1** and Re4 and staffing Ro3.
- Rq3 seeks allocation and scheduling of Re1 by Pr5.
- Ro1 can be staffed by **P1** or **P2**. Ro2 by **P1**. Ro3 can be staffed by **P2**.
- Rq5 seeks allocation and scheduling by Pr4 of P1 and P2.



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# Sketch of Rx 1



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# Parameters of Rx 1

- Rq1 and Rq2 arrive simultaneously.
- Pr1 cycle time is expected to be;
  - 2 days if staffed by P2, 3 days if staffed by P1,
- Pr2 cycle time is expected to be 1 day.
- Pr3 cycle time is expected to be 2 days.
- Pr6 cycle time is expected to be 1 day.
- Pr4 and Pr5 are instantaneous decisions.
- Compensation rates per day are:  $P1 = 20$ ,  $P2 = 25$
- Re1 costs 50 per day; all other resource costs are not relevant.
- Reward schedule is time dependent (JIT situation) as follows:



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# Parameters of Rx 1

	1*	2*	3*	4*	5*	6*
Rw1	240	240	240	240	240	240
Rw2	0	100	100	100	100	0

\*Days After Rq1 that A1 and A2 are provided.



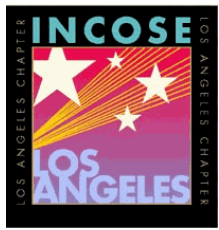
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# Basic Operation Rx 2

- Objective: Add Reinvestment Opportunity and Time-sensitive Rewards to Example Rx1. Show ability to maximize anticipated results.
- Deliverables: Model diagram + Set Points, Max Revenue, Profit, Gradient of  $R_w$  vs. Training.
- Benefits Related to Objectives: Demonstrates proactive emulator ability to find preferred gradients. Allows other teams to produce directly comparable models and simulations using their respective methods and tools.



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# Description of Rx 2

- Rq1 will pay Rw1 for an A1 that conforms to A3.
- Rq 2 will pay Rw2 for an A2 that conforms to A4.
- Pr1 produces A1 by engaging Re1, Re3 and Re5 and staffing Ro1.
- Pr2 produces A2 by engaging Re2 and A5 and staffing Ro2.
- Pr3 produces A5 by engaging Re1 and Re4 and staffing Ro3.
- Rq3 seeks allocation and scheduling of Re1 by Pr5.
- Rq4 seeks a competency development session by Pr6 for P1, that will result in a P1.1 who will exhibit increased productivity in Ro1.

(continued on next chart)



# Description of Rx 2

- Rq5 seeks allocation and scheduling by Pr4 of P1/P1.1 and P2.
- Ro1 can be staffed by P1, P1.1 or P2. Ro2 by P1 or P1.1.
- Ro3 can be staffed by P2.





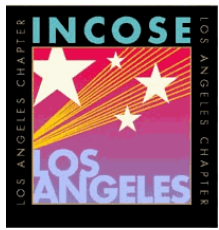
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## Parameters of Rx 2

- Rq1 and Rq2 arrive simultaneously.
- Pr1 cycle time is expected to be; 2 days if staffed by P2, 3 days if staffed by P1, 2 days if staffed by P1.1
- Pr2 cycle time is expected to be 1 day.
- Pr3 cycle time is expected to be 2 days.
- Pr6 cycle time is expected to be 1 day.
- Pr4 and Pr5 are instantaneous decisions.
- Compensation rates per day are:  $P1 = 20$ ,  $P1.1 = 22$ ,  $P2 = 25$
- Re1 costs 50 per day; all other resource costs are not relevant.
- Reward schedule is time dependent (JIT situation) as follows: (pls see next chart)



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# Parameters of Rx 2

	1*	2*	3*	4*	5*	6*
Rw1	240	270	300	285	150	60
Rw2	20	50	80	90	100	- 20

\*Days After Rq1 that A1 and A2 are provided.



# Acknowledgements

- Prof. John Clymer, Cal State Fullerton, and students for applying these test cases in their context-sensitive systems courses.
- The eight, to date, Business Process Modeling vendors who have graciously declined to demonstrate their wares.



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# Questions?

# Thank You

