1 Agenda

- Current Situation (25 min)
- Envisioned future (25 min)
- Company Structure (10 min)
- Convincing Total (25 min)
- IP concerns (25 min)
- Milestones (15 min)

2 Current Situation

- Manually sending email around
- State duplication
- SAP is not made for/cannot handle optimization workflows. -> you copy the current SAP state to a file (excel) to continue working from there.
- The idea with Ordinator is to be a layer between SAP and the scheduler/supervisor. Ordinator then holds all state which can be manipulated (plannings, optimizations etc.).

		D	Ε							
or * Revision	Order Ty	Main Work	Oper.WorkCent	Order Description	Opr. short text	System status	✓ User status	* Wor * A	ctual we Unloading Point	" Bas, start d " B
NOSD	WDF	MTN-MECH	MTN-SCAF	2100074609 ANOS Timerelay for door closing defect (Scaffold assistance/step-up scaff.	REL GMPS MANC PRC SETC	APPR WTA SMAT AWDO RDBL RFRZ ROUT	8,0	0,000 W09-W10	2024-09-03
NOSD	WDF	MTN-MECH	MTN-MECH	2100074609 ANOS Timerelay for door closing defect (Replice Door Time-delay VIv.	REL GMPS MANC PRC SETC	APPR WTA SMAT AWDO RDBL RFRZ ROUT	8,0	0,000 W09-W10	2024-09-03
NE	WDF	MTN-INST	MTN-INST	2100098684 Online vibration data collection stopped	Online vibration data collection stopped	REL MANC PRC SETC	APPR WTA RDBL	32,0	0,000 NA	2024-09-15
NOSD	WGN	VEN-MECH	VEN-MECH	2200007060 Handheld vib meas, on rotating Equipment	Handheld vib meas, on rotating Equipment	REL PONF MANC PRC SETC	APPR WTA RDBL	0,0	0,000	2023-12-11
NOSD	WGN	VEN-MECH	VEN-MECH	2200007060 Handheld vib meas, on rotating Equipment	Make sure equipment is operating stable	REL PONF MANOPRO SETO	APPR WTA RDBL	12,0	0,000	2023-12-11
NOSD	WGN	VEN-MECH	VEN-MECH	2200007060 Handheld vib meas, on rotating Equipment	Take vib meas with handheld data collect	REL PONF MANOPRO SETO	APPR WTA RDBL	24,0	112,000	2023-12-11
NOSD	WGN	VEN-MECH	VEN-MECH	2200007060 Handheld vib meas, on rotating Equipment	Data Analysis, db optimization	REL PONF MANO PRO SETO	APPR WTA RDBL	0,0	0,000	2023-12-11
NOSD	WGN	VEN-MECH	VEN-MECH	2200007060 Handheld vib meas, on rotating Equipment	Additional measurements	REL PONF MANO PRO SETO	APPR WTA RDBL	0,0	0,000	2023-12-11
NOSD	WGN	VEN-MECH	VEN-MECH	2200007818 Handheld vib meas, on rotating Eq R2	Handheld vib meas, on rotating Eq R2	REL MANC PRC SETC	APPR WTA RDBL	0,0	0,000	2023-03-27
NOSD	WGN	VEN-MECH	VEN-MECH	2200007818 Handheld vib meas, on rotating Eq R2	Make sure equipment is operating stable	REL MANC PRC SETC	APPR WTA RDBL	0,0	0,000	2023-03-27
NOSD	WGN	VEN-MECH	VEN-MECH	2200007818 Handheld vib meas, on rotating Eq R2	Take vib meas with handheld EX data coll	REL MANC PRC SETC	APPR WTA RDBL	50,0	0,000	2023-03-27
NOSD	WGN	VEN-MECH	VEN-MECH	2200007818 Handheld vib meas, on rotating Eq R2	Data analysis, db optimization	REL MANC PRC SETC	APPR WTA RDBL	10,0	0,000	2023-03-27
HD-DIFF	WDF	MTN-PIPF	MTN-PIPE	2100023866 2 stk HCV L.G. blowdown line HDA29	Spool og Erct finde frem og tjekkes.	REL MANC PRC SETC	APPR WMAT RDBL	2,7	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPF	MTN-SCAF	2100023866 2 stk HCV L.G. blowdown line HDA29	Stillads/skamle stilles til rådighed	REL MANC PRC SETC	APPR WMAT RDBL	6,7	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPF	MTN-SCAF	2100023866 2 stk HCV L.G. blowdown line HDA29	Rigger ass ophæng af spool/ventiler	REL MANC PRC SETC	APPR WMAT RDBL	8,0	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPF	PRODTECH	2100023866 2 stk HCV L.G. blowdown line HDA29	Safing udføres. Prod tilstede ved Flg ad	REL MANC PRC SETC	APPR WMAT RDBL	2,0	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPE	MTN-PIPE	2100023866 2 stk HCV L.G. blowdown line HDA29	Ventiler udskiftes til nye. Vær agtpågiv	REL MANC PRC SETC	APPR WMAT RDBL	6,7	0.000	2025-01-01
HD-DIFF	WDF	MTN-PIPE	PRODTECH	2100023866 2 stk HCV L.G. blowdown line HDA29	Desafing/Leaktest udføres.	REL MANC PRC SETC	APPR WMAT RDBL	2,0	0.000	2025-01-01
HD-DIFF	WDF	MTN-PIPE	MTN-SCAF	2100023866 2 stk HCV L.G. blowdown line HDA29	Stillads/skamle/rigger udstyr demonteres	REL MANC PRC SETC	APPR WMAT RDBL	4,0	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPE	MTN-PIPE	2100023866 2 stk HCV L.G. blowdown line HDA29	Området opryddes.	REL MANC PRC SETC	APPR WMAT RDBL	1,3	0,000	2025-01-01
HD-DIFF	WDF	MTN-PIPF	CON-WELD	2100023866 2 stk HCV L.G. blowdown line HDA29	new valve orded	REL MANC PRC SETC	APPR WMAT RDBL	0,0	0,000	2025-01-01
HBAPWELL	WDF	MTN-INST	MTN-INST	2100043868 HCV upstream PIT-30106 is blocked	HCV upstream PIT-30106 is blocked	REL MANC PPRT PRC SETC	APPR WMAT RDBL	0,0	0,000	2025-01-01
HBAPWELL	WDF	MTN-INST	PRODTECH	2100043868 HCV upstream PIT-30106 is blocked	Isolate the line	REL MANC PPRT PRC SETC	APPR WMAT RDBL	1,0	0,000 Oceam team do the job	2025-01-01
HBAPWELL	WDF	MTN-INST	MTN-INST	2100043868 HCV upstream PIT-30106 is blocked	Isolate Pressure transmitter	REL MANC PPRT PRC SETC	APPR WMAT RDBL	0,5	0,000	2025-01-01
HBAPWELL	L WDF	MTN-INST	MTN-MECH	2100043868 HCV upstream PIT-30106 is blocked	Install new SDBB valve	REL MANC PPRT PRC SETC	APPR WMAT RDBL	2,5	0,000	2025-01-01
HBAPWEU	L WDF	MTN-INST	MTN-INST	2100043868 HCV upstream PIT-30106 is blocked	De-Isolate Pressure transmitter	REL MANC PPRT PRC SETC	APPR WMAT RDBL	0.5	0.000	2025-01-01
HBAPWELL	WDF	MTN-INST	MTN-INST	2100043868 HCV upstream PIT-30106 is blocked	Test Pressure transmitter	REL MANC PPRT PRC SETC	APPR WMAT RDBL	1,5	0.000	2025-01-01
HBAPWELL	WDF	MTN-INST	PRODTECH	2100043868 HCV upstream PIT-30106 is blocked	De-isolate line	REL MANC PPRT PRC SETC	APPR WMAT RDBL	1,0	0,000	2025-01-01
HDADEG A	WDF	MTN-MECH	MTN-SCAF	2100050877 HCV to LT upper seal stuck in open pos.	Prepare permit/rectify Scaffolding	REL MANC PRC SETC	APPR WMAT RDBL	24,0	0,000	2025-01-01
HDADEG A	WDF	MTN-MECH	MTN-MECH	2100050877 HCV to LT upper seal stuck in open pos.	Prepare matr/tools/permit	REL MANC PRC SETC	APPR WMAT RDBL	2,0	0,000	2025-01-01
HDADEG A	WDF	MTN-MECH	PRODTECH	2100050877 HCV to LT upper seal stuck in open pos.	Production Isolation/Permit	REL MANC PRC SETC	APPR WMAT RDBL	3,0	0,000	2025-01-01
HDADEG A	WDF	MTN-MECH	MTN-MECH	2100050877 HCV to LT upper seal stuck in open pos.	Replace 2" valve	REL MANC PRC SETC	APPR WMAT RDBL	4,0	0,000	2025-01-01
HDADEG A	WDF	MTN-MECH	MTN-INST	2100050877 HCV to LT upper seal stuck in open pos.	Recalibrate ESD LIT-50166A	REL MANC PRC SETC	APPR WMAT RDBL	4.0	0.000	2025-01-01
HDADEG A	WDF	MTN-MECH	PRODTECH	2100050877 HCV to LT upper seal stuck in open pos.	Production Deisolate w leak/test	REL MANC PRC SETC	APPR WMAT RDBL	3.0	0.000	2025-01-01
HDADEG A	WDF	MTN-MECH	MTN-MECH	2100050877 HCV to LT upper seal stuck in open pos.	Housekeeping	REL MANC PRC SETC	APPR WMAT RDBL	1.0	0.000	2025-01-01
HDADEG A		MTN-MECH	MTN-SCAF	2100050877 HCV to LT upper seal stuck in open pos.	Scaffold removal	REL MANC PRC SETC	APPR WMAT RDBL	18,0	0,000	2025-01-01
HBA09-GL		MTN-INST	PRODTECH	2100063712 Cable and Glant is not connect proberly	Isolate the well and CVA valve	REL MANC PRC SETC	APPR WMAT RDBL	1,0	0,000	2025-01-01
HBA09-GL		MTN-INST	MTN-INST	2100063712 Cable and Glant is not connect proberly	Replace cable glands	REL MANC PRC SETC	APPR WMAT RDBL	2,0	0,000	2025-01-01
HBA09-GL	WDF	MTN-INST	PRODTECH	2100063712 Cable and Glant is not connect proberly	De-isolate the valve	REL MANC PRC SETC	APPR WMAT RDBL	0.5	0.000	2025-01-01
HBA23-GL		MTN-INST	MTN-INST	2100064728 Synergi 650656 FIT-29233 bolt failure	Synergi 650656 FIT-29233 bolt failure	REL MANC PPRT PRC SETC	APPR WMAT RDBL	0.0	0.000	2025-01-01

Figure 1: Schedulers view of the scheduling process

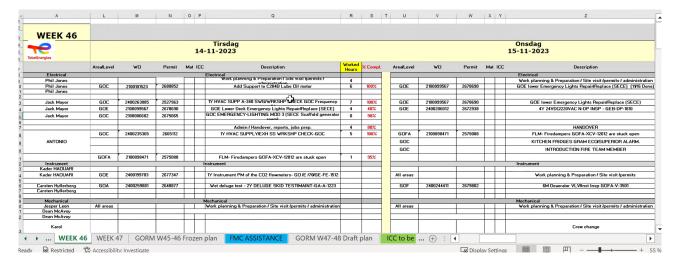


Figure 2: Supervisors and Technicians view of the scheduling process

3 Envisioned Future

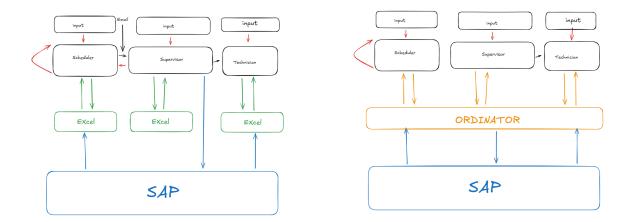


Figure 3: Schematic difference between the current way of doing things versus how it could be done in the future. Each stakeholder can immediately sees an optimized schedule based on the state in the optimization algorithms. This means that the moment that a **Scheduler**, **Supervisor**, or **Technician** sees that there is something wrong his part of the schedule it can be handled immediately. After an excel file has been sent in the as-is example the remaining stakeholders are working blind

3.1 What do we not know:

- Supervisor is a big unknown. How do they work with the information? Do all supervisors do the same?
- Do they know what would be the best for them? DO we?
- What should be the main focus to get a minimum viable product?
- How mature the "engine" (ordinator) should be before trying to convince TotalEnergies?

4 Possible Company Structure

Creating a company splitting the shares equally between the founders giving Niels Henrik a 10% share.

4.1 questions

- Should Total own anything?
- Does DTU need to own anything?

4.2 IP Concerns

- What rights do DTU have to software?
- Do we have a case where DTU are not willing to further this project alone and therefore we can do it ourselves without them?
- What does TotalEnergies expect? Do they expect this to be free or are they willing to fund this project even though it would be through a "subcontractor"?

5 Convincing Total

- How to make Total commit themselves to spend hours on the project.
 - What does this mean for who owns what?
- Booking a meeting with the most relevant stakeholders, and getting a consensus on the project goals.
- Drafting a budget, meaning how many hours there is needed to deliver certain milestones.

- Working on an hourly basis, delivering weekly or monthly results.
- What should the role of Christian's Ph.D. project be until we are ready to create the company?
- One route (best-case-scenario):
 - Christian takes leave of PhD in Autumn
 - Total Energies hopefully is willing to pay for hours in development
 - Christian and Sebastian works full time on paid project to develop
 - Christian returns to finish PhD or project is so mature we cannot stop now.

5.1 Budget

Scipo	Role	Total Hours	Cost per Hour	Skills	Period
Christian Jespersen	Core Developer	320	250 DKK	Optimization Algorithms	2025-09 to 2025-12
Sebastian Dall	Core Developer	320	250 DKK	API, Frontend, Project	2025-09 to 2025-12
Total	Role	Total Hours	Cost per Hour	Skills	Period
TOTAL_DEVELOPER	Integration	50-70	500 DKK	Azure,	2025-09 to
Baptiste Dubillaud				IT infrastructure	2025 - 12
TOTAL_MAINTENANCE_METHOD	Domain Expert	40	500 DKK	Understanding of	2025-09 to
Brian Friis Niels				Business Flows	2025-12
GMC_SCHEDULER Valentin Ispas	Domain Expert	30	500 DKK	Key Stakeholder	2025-09 to 2025-12
GMC_SUPERVISOR <unknown></unknown>	Domain Expert	20	500 DKK	Key Stakeholder	2025-09 to 2025-12
GMC_TECHNICIAN <unknown></unknown>	Domain Expert	20	500 DKK	Key Stakeholder	2025-09 to 2025-12
Material	Role	Total Hours	Cost per Hour	Skills	Period
Server	-	2000	1-5 DKK	-	2025-09 to 2025-12

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\begin{aligned} \text{Total Cost} &= (320 \times 250) + (320 \times 250) \\ &+ (70 \times 500) + (40 \times 500) + (30 \times 500) \\ &+ (20 \times 500) + (20 \times 500) + (2,000 \times 5) \\ &= 80,000 + 80,000 + 35,000 + 20,000 + 15,000 + 10,000 + 10,000 \\ &= 160,000 \quad \text{(Direct cost for Scipo)} \\ &+ 100,000 \quad \text{(Indirect cost for Total)} \\ &= 260,000 \quad \text{Total cost DKK} \end{aligned}
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Total cost per 2 month period 260,000 DKK

6 Appendix

7 Graphic Overview of the Model Setup

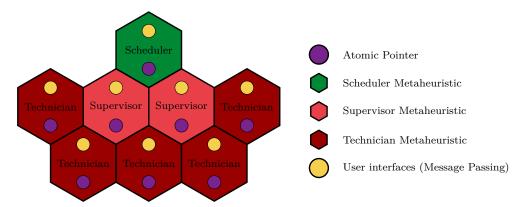


Figure 4: Each model represents a distinct stakeholder with its own UI (yellow) and their solution spaces are tied together with lock-free atomic pointer swaps (purple)

8 Scheduler: Strategic

 $\epsilon_{pr}(\tau) \in \mathbb{R}^+ \quad \forall p \in P(\tau) \quad \forall r \in R(\tau)$

Meta variables: $s \in S$ (1) $\tau \in [0, \infty]$ (2)Minimize: $+ \sum_{w \in W(\tau)} \sum_{p \in P(\tau)} strategic_urgency_{wp}(\tau) \cdot \alpha_{wp}(\tau)$ $+ \sum_{p \in P(\tau)} \sum_{r \in R(\tau)} strategic_resource_penalty \cdot \epsilon_{pr}(\tau)$ $- \sum_{p \in P(\tau)} \sum_{w1 \in W(\tau)} \sum_{w2 \in W(\tau)} \quad clustering_value_{w1,w2} \cdot \alpha_{w1p}(\tau) \cdot \alpha_{w2p}(\tau)$ (3)Subject to: $\sum_{w \in W(\tau)} work_order_workload_{wr} \cdot \alpha_{wp}(\tau) \leq \sum_{t \in T(\tau)} \psi_{prt}(\tau) + \epsilon_{pr}(\tau)$ $\forall p \in P(\tau) \quad \forall r \in R(\tau)$ (4) $\sum_{r \in R(\tau)} \psi_{prt}(\tau) \le technician_work_{pt}(\tau, \beta(\tau)) \quad \forall p \in P(\tau) \quad \forall t \in T(\tau)$ (5) $\sum_{p \in P(\tau)} \psi_{prt}(\tau) \leq technician_skills_{rt}(\tau) \quad \forall r \in R(\tau) \quad \forall t \in T(\tau)$ (6) $\sum_{w \in W(\tau)} \alpha_{wp}(\tau) = 1 \quad \forall p \in P(\tau)$ (7) $\alpha_{wp}(\tau) = 0, \quad if \quad exclude_{wp}(\tau) \quad \forall w \in W(\tau) \quad \forall p \in P(\tau)$ (8) $\alpha_{wp}(\tau) = 1, \quad if \quad include_{wp}(\tau) \quad \forall w \in W(\tau) \quad \forall p \in P(\tau)$ (9) $\alpha_{wp}(\tau) \in \{0,1\} \quad \forall w \in W(\tau) \quad \forall p \in P(\tau)$ (10) $\psi_{prt}(\tau) \in \mathbb{R}^+ \quad \forall p \in P(\tau) \quad \forall r \in R(\tau) \quad \forall t \in T(\tau)$ (11)

(12)

9 Scheduler: Tactical

 $\mu_{rd}(\tau) \in \mathbb{R} \qquad \forall r \in R(\tau) \quad \forall d \in D(\tau)$

 $\Delta_o(\tau) \in \{0,1\} \quad \forall o \in O(\tau, \alpha(\tau))$

 $\sigma_{do}(\tau) \in \{0, 1\}$ $\forall d \in D(\tau) \ \forall o \in O(\tau, \alpha(\tau))$

 $\eta_{do}(\tau) \in \{0, 1\} \qquad \forall d \in D(\tau) \quad \forall o \in O(\tau, \alpha(\tau))$

$$\begin{aligned} & \textbf{Meta variables:} \\ & s \in S & (13) \\ & \alpha(\tau) & (14) \\ & \tau \in [0, \infty] & (15) \end{aligned}$$

$$\begin{aligned} & \textbf{Minimize:} \\ & + \sum_{\sigma \in O(\tau, \alpha(\tau))} \sum_{d \in D(\tau)} tactical_value_{do}(\tau) \cdot \beta_{do}(\tau) \\ & + \sum_{r \in R(\tau)} \sum_{d \in D(\tau)} tactical_penalty \cdot \mu_{rd}(\tau) & (16) \end{aligned}$$

$$\begin{aligned} & \textbf{Subject to:} \\ & \sum_{\sigma \in O(\tau, \alpha(\tau))} work_{\sigma}(\tau) \cdot \beta_{do}(\tau) \leq \Psi_{drt}(\tau) + \mu_{rd}(\tau) & \forall d \in D(\tau) & \forall r \in R(\tau) & (17) \\ & \sum_{\tau \in R(\tau)} \Psi_{drt}(\tau) \leq tactical_resource_{dr}(\tau) & \forall d \in D(\tau) & \forall t \in T(\tau) & (18) \\ & \sum_{\sigma \in O(\tau)} \Psi_{drt}(\tau) \leq technician_skills_{rt}(\tau) & \forall r \in R(\tau) & \forall t \in T(\tau) & (19) \\ & \beta_{do}(\tau) \leq number_{\sigma}(\tau) \cdot operating_time_{\sigma} \cdot \sigma_{d\sigma}(\tau) & \forall d \in D(\tau) & \forall o \in O(\tau, \alpha(\tau)) & (20) \\ & latest_finish_{\sigma}(\tau) & \sigma_{d\sigma}(\tau) = duration_{\sigma}(\tau) & \forall o \in O(\tau, \alpha(\tau)) & \forall d \in D(\tau) & \forall d \in D(\tau) & \forall d \in D(\tau) & (21) \\ & \sum_{d \in D(\tau)} \sigma_{d\sigma}(\tau) = duration_{\sigma}(\tau) \cdot \gamma_{do}(\tau) & \forall o \in O(\tau, \alpha(\tau)) & \forall d \in D(\tau) & (22) \\ & \sum_{\sigma \in O(\tau, \alpha(\tau))} \sigma_{d\sigma}(\tau) = duration_{\sigma}(\tau) \cdot \gamma_{d\sigma}(\tau) & \forall o \in O(\tau, \alpha(\tau)) & \forall d \in D(\tau) & (22) \\ & \sum_{\sigma \in O(\tau, \alpha(\tau))} \sigma_{d\sigma}(\tau) = 1, & \forall d \in D(\tau) & \forall (o1, o2) \in finish_start_{o1, o2} & (23) \\ & \sum_{d \in D(\tau)} d \cdot \sigma_{do1}(\tau) + \sum_{d \in D(\tau)} d \cdot \sigma_{do2}(\tau) & \forall (o1, o2) \in start_start_{o1, o2} & (24) \\ & \beta_{do}(\tau) \in \mathbb{R} \quad \forall d \in D(\tau) & \forall o \in O(\tau, \alpha(\tau)) & (25) \end{aligned}$$

(26)

(27)

(28)

(29)

10 Supervisor

Meta variables:	
$z \in Z$	(30)
lpha(au)	(31)
heta(au)	(32)
$ au \in [0,\infty]$	(33)
Maximize:	
$\sum_{a \in A(\tau, \alpha(\tau))} \sum_{t \in T(\tau)} supervisor_value_{at}(\tau, \lambda_t(\tau), \Lambda_t(\tau)) \cdot \gamma_{at}(\tau)$	(34)
Subject to:	
$\sum_{a \in A_o(\tau, \alpha(\tau))} \rho_a(\tau) = work_o(\tau) \forall o \in O(\tau, \alpha(\tau))$	(35)
$\sum_{t \in T(\tau)} \sum_{a \in A_o(\tau, \alpha(\tau))} \gamma_{at}(\tau) = \phi_o(\tau) \cdot number_o(\tau) \forall o \in O(\tau, \alpha(\tau))$	(36)
$\sum_{o \in O_w(\tau, \alpha(\tau))} \phi_o(\tau) = O_w(\tau, \alpha(\tau)) \cdot \Phi_w(\tau) \forall w \in W(\tau, \alpha(\tau))$	(37)
$\sum_{a \in A_o(\tau, \alpha(\tau))} \gamma_{at}(\tau) \le 1 \forall o \in O(\tau, \alpha(\tau)) \forall t \in T(\tau)$	(38)
$\gamma_{at}(\tau) \le feasible_{at}(\theta(\tau)) \forall a \in A_o(\tau, \beta) (\tau) \forall o \in O(\tau, \alpha(\tau)) \forall t \in T(\tau)$	(39)
$\gamma_{at}(\tau) \in \{0,1\} \forall o \in O(\tau, \alpha(\tau)) \forall t \in T(\tau)$	(40)
$\phi_o(\tau) \in \{0,1\} \forall o \in O(\tau, \alpha(\tau))$	(41)
$\Phi_w(\tau) \in \{0,1\} \forall w \in W(\tau, \alpha(\tau))$	(42)
$\rho_a(\tau) \in [lower_activity_work_a(\tau), work_a(\tau)] \forall a \in A(\tau, \alpha(\tau))$	(43)

11 Technician

Meta variables:	
$t \in T(\tau)$	(44)
lpha(au)	(45)
$\gamma(au)$	(46)
$ au \in [0,\infty]$	(47)
Maximize:	
$\sum_{a \in A(\tau, \gamma_t(\tau))} \sum_{k \in K(\gamma(\tau))} \delta_{ak}(\tau)$	(48)
Subject to:	
$\sum_{k \in K(\gamma(\tau))} \delta_{ak}(\tau) \cdot \pi_{ak}(\tau) = activity_work_a(\tau, \rho(\tau)) \cdot \theta_a(\tau) \forall a \in A(\tau, \gamma_t(\tau))$	(49)
$\lambda_{a21}(\tau) \ge \Lambda_{a1last(a1)}(\tau) + preparation_{a1,a2} \forall a1 \in A(\tau, \gamma_t(\tau)) \forall a2 \in A(\tau, \gamma_t(\tau))$	(50)
$\lambda_{ak}(\tau) \ge \Lambda_{ak-1}(\tau) - constraint_limit \cdot (2 - \pi_{ak}(\tau) + \pi_{ak-1}(\tau))$	
$\forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(51)
$\delta_{ak}(\tau) = \Lambda_{ak}(\tau) - \lambda_{ak}(\tau) \forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(52)
$\lambda_{ak}(\tau) \ge event_{ie} + duration_{ie} - constraint_limit \cdot (1 - \omega_{akie}(\tau))$	
$\forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau)) \forall i \in I(\tau) \forall e \in E(\tau)$	(53)
$\Lambda_{ak}(\tau) \le event_{ie} + constraint_limit \cdot \omega_{akie}(\tau)$	
$\forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau)) \forall i \in I(\tau) \forall e \in E(\tau)$	(54)
$\lambda_{a1}(\tau) \ge time_window_start_a(\beta(\tau)) \forall a \in A(\tau, \gamma_t(\tau))$	(55)
$\Lambda_{alast(a)}(\tau) \leq time_window_finish_a(\beta(\tau)) \forall a \in A(\tau, \gamma_t(\tau))$	(56)
$\pi_{ak}(\tau) \in \{0,1\} \forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(57)
$\lambda_{ak}(\tau) \in [availability_start(\tau), availability_finish(\tau)]$	
$\forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(58)
$\Lambda_{ak}(\tau) \in [availability_start(\tau), availability_finish(\tau)]$	
$\forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(59)
$\delta_{ak}(\tau) \in [0, work_{a_to_o(a)}(\tau)] \forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau))$	(60)
$\omega_{akie}(\tau) \in \{0,1\} \forall a \in A(\tau, \gamma_t(\tau)) \forall k \in K(\gamma(\tau)) \forall i \in I(\tau) \forall e \in E(\tau)$	(61)
$\theta_a(\tau) \in \{0,1\} \forall a \in A(\tau, \gamma_t(\tau))$	(62)