Contents

1 conops0Solution Theory

Built: 05 March 2017
Parent Theories: aclDrules

1.1 Datatypes

```
commands = go | nogo | launch | abort | activate | stand_down

keyPrinc =
    Staff conops0Solution$people
  | Role conops0Solution$roles
  | Ap num

people = Alice | Bob

principals = PR keyPrinc | Key keyPrinc

roles = Commander | Operator | CA
```

1.2 Theorems

[ApRuleActivate_thm]

```
⊢ (M,Oi,Os) sat
  Name (PR (Role Operator)) controls prop launch ⇒
  (M,Oi,Os) sat
  reps (Name (PR (Staff Bob))) (Name (PR (Role Operator)))
    (prop launch) ⇒
  (M,Oi,Os) sat
  Name (Key (Staff Bob)) quoting Name (PR (Role Operator)) says
  prop launch ⇒
  (M,Oi,Os) sat prop launch impf prop activate ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) speaks_for Name (PR (Role CA)) ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) says
  Name (Key (Staff Bob)) speaks_for Name (PR (Staff Bob)) ⇒
  (M,Oi,Os) sat
  Name (PR (Role CA)) controls
  Name (Key (Staff Bob)) speaks_for Name (PR (Staff Bob)) ⇒
  (M,Oi,Os) sat prop activate
```

[ApRuleStandDown_thm]

```
⊢ (M,Oi,Os) sat Name (PR (Role Operator)) controls prop abort ⇒
  (M,Oi,Os) sat
  reps (Name (PR (Staff Bob))) (Name (PR (Role Operator)))
    (prop abort) ⇒
  (M,Oi,Os) sat
```

```
Name (Key (Staff Bob)) quoting Name (PR (Role Operator)) says
prop abort ⇒
(M,Oi,Os) sat prop abort impf prop stand_down ⇒
(M,Oi,Os) sat
Name (Key (Role CA)) speaks_for Name (PR (Role CA)) ⇒
(M,Oi,Os) sat
Name (Key (Role CA)) says
Name (Key (Staff Bob)) speaks_for Name (PR (Staff Bob)) ⇒
(M,Oi,Os) sat
Name (PR (Role CA)) controls
Name (Key (Staff Bob)) speaks_for Name (PR (Staff Bob)) ⇒
(M,Oi,Os) sat prop stand_down
```

[OpRuleAbort_thm]

```
⊢ (M,Oi,Os) sat Name (PR (Role Commander)) controls prop nogo ⇒
  (M,Oi,Os) sat
  reps (Name (PR (Staff Alice))) (Name (PR (Role Commander)))
    (prop nogo) ⇒
  (M,Oi,Os) sat
  Name (Key (Staff Alice)) quoting
  Name (PR (Role Commander)) says prop nogo ⇒
  (M,Oi,Os) sat prop nogo impf prop abort ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) speaks_for Name (PR (Role CA)) ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) says
  Name (Key (Staff Alice)) speaks_for Name (PR (Staff Alice)) ⇒
  (M,Oi,Os) sat
  Name (Key (Staff Bob)) quoting Name (PR (Role Operator)) says
  prop abort
```

[OpRuleLaunch_thm]

```
⊢ (M,Oi,Os) sat Name (PR (Role Commander)) controls prop go ⇒
  (M,Oi,Os) sat
  reps (Name (PR (Staff Alice))) (Name (PR (Role Commander)))
    (prop go) ⇒
  (M,Oi,Os) sat
  Name (Key (Staff Alice)) quoting
  Name (PR (Role Commander)) says prop go ⇒
  (M,Oi,Os) sat prop go impf prop launch ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) speaks_for Name (PR (Role CA)) ⇒
  (M,Oi,Os) sat
  Name (Key (Role CA)) says
  Name (Key (Staff Alice)) speaks_for Name (PR (Staff Alice)) ⇒
  (M,Oi,Os) sat
  Name (PR (Role CA)) controls
  Name (Key (Staff Alice)) speaks_for Name (PR (Staff Alice)) ⇒
  (M,Oi,Os) sat
```

```
Name (Key (Staff Bob)) quoting Name (PR (Role Operator)) says
prop launch
```

2 aclrules Theory

Built: 04 March 2017
Parent Theories: aclsemantics

2.1 Definitions

[sat_def]

$\vdash \forall M\ Oi\ Os\ f.\ (M,Oi,Os)$ sat $f \iff$ (Efn $Oi\ Os\ M\ f = \mathcal{U}$(:'world))

2.2 Theorems

[And_Says]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
  (M,Oi,Os) sat P meet Q says f eqf P says f andf Q says f

[And_Says_Eq]

$\vdash (M,Oi,Os)$ sat P meet Q says $f \iff$
 (M,Oi,Os) sat P says f andf Q says f

[and_says_lemma]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
  (M,Oi,Os) sat P meet Q says f impf P says f andf Q says f

[Controls_Eq]

$\vdash \forall M\ Oi\ Os\ P\ f.$
  (M,Oi,Os) sat P controls $f \iff (M,Oi,Os)$ sat P says f impf f

[DIFF_UNIV_SUBSET]

$\vdash$ ($\mathcal{U}$(:'a) DIFF $s \cup t = \mathcal{U}$(:'a)) $\iff s \subseteq t$

[domi_antisymmetric]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2.$
  (M,Oi,Os) sat l_1 domi $l_2 \Rightarrow$
  (M,Oi,Os) sat l_2 domi $l_1 \Rightarrow$
  (M,Oi,Os) sat l_1 eqi l_2

[domi_reflexive]

$\vdash \forall M\ Oi\ Os\ l.\ (M,Oi,Os)$ sat l domi l

[domi_transitive]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2\ l_3.$
$\quad (M,Oi,Os)$ sat l_1 domi $l_2 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_2 domi $l_3 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_1 domi l_3

[doms_antisymmetric]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2.$
$\quad (M,Oi,Os)$ sat l_1 doms $l_2 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_2 doms $l_1 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_1 eqs l_2

[doms_reflexive]

$\vdash \forall M\ Oi\ Os\ l.\ (M,Oi,Os)$ sat l doms l

[doms_transitive]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2\ l_3.$
$\quad (M,Oi,Os)$ sat l_1 doms $l_2 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_2 doms $l_3 \Rightarrow$
$\quad (M,Oi,Os)$ sat l_1 doms l_3

[eqf_and_impf]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
$\quad (M,Oi,Os)$ sat f_1 eqf $f_2 \iff$
$\quad (M,Oi,Os)$ sat (f_1 impf f_2) andf (f_2 impf f_1)

[eqf_andf1]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
$\quad (M,Oi,Os)$ sat f eqf $f' \Rightarrow$
$\quad (M,Oi,Os)$ sat f andf $g \Rightarrow$
$\quad (M,Oi,Os)$ sat f' andf g

[eqf_andf2]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
$\quad (M,Oi,Os)$ sat f eqf $f' \Rightarrow$
$\quad (M,Oi,Os)$ sat g andf $f \Rightarrow$
$\quad (M,Oi,Os)$ sat g andf f'

[eqf_controls]

$\vdash \forall M\ Oi\ Os\ P\ f\ f'.$
$\quad (M,Oi,Os)$ sat f eqf $f' \Rightarrow$
$\quad (M,Oi,Os)$ sat P controls $f \Rightarrow$
$\quad (M,Oi,Os)$ sat P controls f'

[eqf_eq]

$\vdash$ (Efn $Oi\ Os\ M$ (f_1 eqf f_2) = $\mathcal{U}$(:'b)) $\iff$
(Efn $Oi\ Os\ M\ f_1$ = Efn $Oi\ Os\ M\ f_2$)

[eqf_eqf1]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat f eqf $g \Rightarrow$
(M,Oi,Os) sat f' eqf g

[eqf_eqf2]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat g eqf $f \Rightarrow$
(M,Oi,Os) sat g eqf f'

[eqf_impf1]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat f impf $g \Rightarrow$
(M,Oi,Os) sat f' impf g

[eqf_impf2]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat g impf $f \Rightarrow$
(M,Oi,Os) sat g impf f'

[eqf_notf]

$\vdash \forall M\ Oi\ Os\ f\ f'.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat notf $f \Rightarrow$
(M,Oi,Os) sat notf f'

[eqf_orf1]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat f orf $g \Rightarrow$
(M,Oi,Os) sat f' orf g

[eqf_orf2]

$\vdash \forall M\ Oi\ Os\ f\ f'\ g.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat g orf $f \Rightarrow$
(M,Oi,Os) sat g orf f'

[eqf_reps]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f\ f'.$
(M,Oi,Os) sat f eqf $f' \Rightarrow$
(M,Oi,Os) sat reps $P\ Q\ f \Rightarrow$
(M,Oi,Os) sat reps $P\ Q\ f'$

[eqf_sat]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
$\quad (M,Oi,Os)$ `sat` f_1 `eqf` $f_2 \Rightarrow$
$\quad ((M,Oi,Os)$ `sat` $f_1 \iff (M,Oi,Os)$ `sat` $f_2)$

[eqf_says]

$\vdash \forall M\ Oi\ Os\ P\ f\ f'.$
$\quad (M,Oi,Os)$ `sat` f `eqf` $f' \Rightarrow$
$\quad (M,Oi,Os)$ `sat` P `says` $f \Rightarrow$
$\quad (M,Oi,Os)$ `sat` P `says` f'

[eqi_Eq]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2.$
$\quad (M,Oi,Os)$ `sat` l_1 `eqi` $l_2 \iff$
$\quad (M,Oi,Os)$ `sat` l_2 `domi` l_1 `andf` l_1 `domi` l_2

[eqs_Eq]

$\vdash \forall M\ Oi\ Os\ l_1\ l_2.$
$\quad (M,Oi,Os)$ `sat` l_1 `eqs` $l_2 \iff$
$\quad (M,Oi,Os)$ `sat` l_2 `doms` l_1 `andf` l_1 `doms` l_2

[Idemp_Speaks_For]

$\vdash \forall M\ Oi\ Os\ P.\ (M,Oi,Os)$ `sat` P `speaks_for` P

[Image_cmp]

$\vdash \forall R_1\ R_2\ R_3\ u.\ (R_1 \circ R_2)\ u \subseteq R_3 \iff R_2\ u \subseteq \{y \mid R_1\ y \subseteq R_3\}$

[Image_SUBSET]

$\vdash \forall R_1\ R_2.\ R_2$ `RSUBSET` $R_1 \Rightarrow \forall w.\ R_2\ w \subseteq R_1\ w$

[Image_UNION]

$\vdash \forall R_1\ R_2\ w.\ (R_1$ `RUNION` $R_2)\ w = R_1\ w \cup R_2\ w$

[INTER_EQ_UNIV]

$\vdash (s \cap t = \mathcal{U}(:'a)) \iff (s = \mathcal{U}(:'a)) \land (t = \mathcal{U}(:'a))$

[Modus_Ponens]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
$\quad (M,Oi,Os)$ `sat` $f_1 \Rightarrow$
$\quad (M,Oi,Os)$ `sat` f_1 `impf` $f_2 \Rightarrow$
$\quad (M,Oi,Os)$ `sat` f_2

[Mono_speaks_for]

$\vdash \forall M\ Oi\ Os\ P\ P'\ Q\ Q'.$
$\quad (M,Oi,Os)$ `sat` P `speaks_for` $P' \Rightarrow$
$\quad (M,Oi,Os)$ `sat` Q `speaks_for` $Q' \Rightarrow$
$\quad (M,Oi,Os)$ `sat` P `quoting` Q `speaks_for` P' `quoting` Q'

[MP_Says]

$\vdash \forall M\ Oi\ Os\ P\ f_1\ f_2.$
(M,Oi,Os) sat
P says $(f_1$ impf $f_2)$ impf P says f_1 impf P says f_2

[Quoting]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat P quoting Q says f eqf P says Q says f

[Quoting_Eq]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat P quoting Q says f $\iff$
(M,Oi,Os) sat P says Q says f

[reps_def_lemma]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
Efn Oi Os M (reps P Q f) =
Efn Oi Os M (P quoting Q says f impf Q says f)

[Reps_Eq]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat reps P Q f $\iff$
(M,Oi,Os) sat P quoting Q says f impf Q says f

[sat_allworld]

$\vdash \forall M\ f.\ (M,Oi,Os)$ sat f $\iff$ $\forall w.\ w \in$ Efn Oi Os M f

[sat_andf_eq_and_sat]

$\vdash (M,Oi,Os)$ sat f_1 andf f_2 $\iff$
(M,Oi,Os) sat f_1 $\land$ (M,Oi,Os) sat f_2

[sat_TT]

$\vdash (M,Oi,Os)$ sat TT

[Says]

$\vdash \forall M\ Oi\ Os\ P\ f.\ (M,Oi,Os)$ sat f $\Rightarrow$ (M,Oi,Os) sat P says f

[says_and_lemma]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat P says f andf Q says f impf P meet Q says f

[Speaks_For]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat P speaks_for Q impf P says f impf Q says f

[speaks_for_SUBSET]

$\vdash \forall R_3\ R_2\ R_1.$
$\quad R_2\ \texttt{RSUBSET}\ R_1 \Rightarrow \forall w.\ \{w \mid R_1\ w \subseteq R_3\} \subseteq \{w \mid R_2\ w \subseteq R_3\}$

[SUBSET_Image_SUBSET]

$\vdash \forall R_1\ R_2\ R_3.$
$\quad (\forall w_1.\ R_2\ w_1 \subseteq R_1\ w_1) \Rightarrow$
$\quad \forall w.\ \{w \mid R_1\ w \subseteq R_3\} \subseteq \{w \mid R_2\ w \subseteq R_3\}$

[Trans_Speaks_For]

$\vdash \forall M\ Oi\ Os\ P\ Q\ R.$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{speaks\_for}\ Q \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ Q\ \texttt{speaks\_for}\ R \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{speaks\_for}\ R$

[UNIV_DIFF_SUBSET]

$\vdash \forall R_1\ R_2.\ R_1 \subseteq R_2 \Rightarrow (\mathcal{U}(:\texttt{'a})\ \texttt{DIFF}\ R_1 \cup R_2 = \mathcal{U}(:\texttt{'a}))$

[world_and]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2\ w.$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ (f_1\ \texttt{andf}\ f_2) \iff$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ f_1 \land w \in \texttt{Efn}\ Oi\ Os\ M\ f_2$

[world_eq]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2\ w.$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ (f_1\ \texttt{eqf}\ f_2) \iff$
$\quad (w \in \texttt{Efn}\ Oi\ Os\ M\ f_1 \iff w \in \texttt{Efn}\ Oi\ Os\ M\ f_2)$

[world_eqn]

$\vdash \forall M\ Oi\ Os\ n_1\ n_2\ w.\ w \in \texttt{Efn}\ Oi\ Os\ m\ (n_1\ \texttt{eqn}\ n_2) \iff (n_1 = n_2)$

[world_F]

$\vdash \forall M\ Oi\ Os\ w.\ w \notin \texttt{Efn}\ Oi\ Os\ M\ \texttt{FF}$

[world_imp]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2\ w.$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ (f_1\ \texttt{impf}\ f_2) \iff$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ f_1 \Rightarrow w \in \texttt{Efn}\ Oi\ Os\ M\ f_2$

[world_lt]

$\vdash \forall M\ Oi\ Os\ n_1\ n_2\ w.\ w \in \texttt{Efn}\ Oi\ Os\ m\ (n_1\ \texttt{lt}\ n_2) \iff n_1 < n_2$

[world_lte]

$\vdash \forall M\ Oi\ Os\ n_1\ n_2\ w.\ w \in \texttt{Efn}\ Oi\ Os\ m\ (n_1\ \texttt{lte}\ n_2) \iff n_1 \leq n_2$

[world_not]

$\vdash \forall M\ Oi\ Os\ f\ w.\ w \in \texttt{Efn}\ Oi\ Os\ M\ (\texttt{notf}\ f) \iff w \notin \texttt{Efn}\ Oi\ Os\ M\ f$

[world_or]

$\vdash \forall M\ f_1\ f_2\ w.$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ (f_1\ \texttt{orf}\ f_2) \iff$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ f_1 \lor w \in \texttt{Efn}\ Oi\ Os\ M\ f_2$

[world_says]

$\vdash \forall M\ Oi\ Os\ P\ f\ w.$
$\quad w \in \texttt{Efn}\ Oi\ Os\ M\ (P\ \texttt{says}\ f) \iff$
$\quad \forall v.\ v \in \texttt{Jext}\ (\texttt{jKS}\ M)\ P\ w \Rightarrow v \in \texttt{Efn}\ Oi\ Os\ M\ f$

[world_T]

$\vdash \forall M\ Oi\ Os\ w.\ w \in \texttt{Efn}\ Oi\ Os\ M\ \texttt{TT}$

3 aclDrules Theory

Built: 04 March 2017

Parent Theories: aclrules

3.1 Theorems

[Conjunction]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
$\quad (M,Oi,Os)\ \texttt{sat}\ f_1 \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ f_2 \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ f_1\ \texttt{andf}\ f_2$

[Controls]

$\vdash \forall M\ Oi\ Os\ P\ f.$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{says}\ f \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{controls}\ f \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ f$

[Derived_Controls]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{speaks\_for}\ Q \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ Q\ \texttt{controls}\ f \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{controls}\ f$

[Derived_Speaks_For]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{speaks\_for}\ Q \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ P\ \texttt{says}\ f \Rightarrow$
$\quad (M,Oi,Os)\ \texttt{sat}\ Q\ \texttt{says}\ f$

[Disjunction1]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.\ (M,Oi,Os)$ sat $f_1 \Rightarrow (M,Oi,Os)$ sat f_1 orf f_2

[Disjunction2]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.\ (M,Oi,Os)$ sat $f_2 \Rightarrow (M,Oi,Os)$ sat f_1 orf f_2

[Disjunctive_Syllogism]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
(M,Oi,Os) sat f_1 orf $f_2 \Rightarrow$
(M,Oi,Os) sat notf $f_1 \Rightarrow$
(M,Oi,Os) sat f_2

[Double_Negation]

$\vdash \forall M\ Oi\ Os\ f.\ (M,Oi,Os)$ sat notf (notf f) $\Rightarrow (M,Oi,Os)$ sat f

[eqn_eqn]

$\vdash (M,Oi,Os)$ sat c_1 eqn $n_1 \Rightarrow$
(M,Oi,Os) sat c_2 eqn $n_2 \Rightarrow$
(M,Oi,Os) sat n_1 eqn $n_2 \Rightarrow$
(M,Oi,Os) sat c_1 eqn c_2

[eqn_lt]

$\vdash (M,Oi,Os)$ sat c_1 eqn $n_1 \Rightarrow$
(M,Oi,Os) sat c_2 eqn $n_2 \Rightarrow$
(M,Oi,Os) sat n_1 lt $n_2 \Rightarrow$
(M,Oi,Os) sat c_1 lt c_2

[eqn_lte]

$\vdash (M,Oi,Os)$ sat c_1 eqn $n_1 \Rightarrow$
(M,Oi,Os) sat c_2 eqn $n_2 \Rightarrow$
(M,Oi,Os) sat n_1 lte $n_2 \Rightarrow$
(M,Oi,Os) sat c_1 lte c_2

[Hypothetical_Syllogism]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2\ f_3.$
(M,Oi,Os) sat f_1 impf $f_2 \Rightarrow$
(M,Oi,Os) sat f_2 impf $f_3 \Rightarrow$
(M,Oi,Os) sat f_1 impf f_3

[il_domi]

$\vdash \forall M\ Oi\ Os\ P\ Q\ l_1\ l_2.$
(M,Oi,Os) sat il P eqi $l_1 \Rightarrow$
(M,Oi,Os) sat il Q eqi $l_2 \Rightarrow$
(M,Oi,Os) sat l_2 domi $l_1 \Rightarrow$
(M,Oi,Os) sat il Q domi il P

[INTER_EQ_UNIV]

$\vdash \forall s_1\ s_2.\ (s_1 \cap s_2 = \mathcal{U}(:\text{'a})) \iff (s_1 = \mathcal{U}(:\text{'a})) \land (s_2 = \mathcal{U}(:\text{'a}))$

[Modus_Tollens]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$
(M,Oi,Os) sat f_1 impf $f_2 \Rightarrow$
(M,Oi,Os) sat notf $f_2 \Rightarrow$
(M,Oi,Os) sat notf f_1

[Rep_Controls_Eq]

$\vdash \forall M\ Oi\ Os\ A\ B\ f.$
(M,Oi,Os) sat reps A B $f \iff$
(M,Oi,Os) sat A controls B says f

[Rep_Says]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat reps P Q $f \Rightarrow$
(M,Oi,Os) sat P quoting Q says $f \Rightarrow$
(M,Oi,Os) sat Q says f

[Reps]

$\vdash \forall M\ Oi\ Os\ P\ Q\ f.$
(M,Oi,Os) sat reps P Q $f \Rightarrow$
(M,Oi,Os) sat P quoting Q says $f \Rightarrow$
(M,Oi,Os) sat Q controls $f \Rightarrow$
(M,Oi,Os) sat f

[Says_Simplification1]

$\vdash \forall M\ Oi\ Os\ P\ f_1\ f_2.$
(M,Oi,Os) sat P says (f_1 andf f_2) $\Rightarrow$ (M,Oi,Os) sat P says f_1

[Says_Simplification2]

$\vdash \forall M\ Oi\ Os\ P\ f_1\ f_2.$
(M,Oi,Os) sat P says (f_1 andf f_2) $\Rightarrow$ (M,Oi,Os) sat P says f_2

[Simplification1]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$ (M,Oi,Os) sat f_1 andf f_2 $\Rightarrow$ (M,Oi,Os) sat f_1

[Simplification2]

$\vdash \forall M\ Oi\ Os\ f_1\ f_2.$ (M,Oi,Os) sat f_1 andf f_2 $\Rightarrow$ (M,Oi,Os) sat f_2

[sl_doms]

$\vdash \forall M\ Oi\ Os\ P\ Q\ l_1\ l_2.$
(M,Oi,Os) sat sl P eqs $l_1 \Rightarrow$
(M,Oi,Os) sat sl Q eqs $l_2 \Rightarrow$
(M,Oi,Os) sat l_2 doms $l_1 \Rightarrow$
(M,Oi,Os) sat sl Q doms sl P

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