Interfacing ACT-R to Complex Worlds
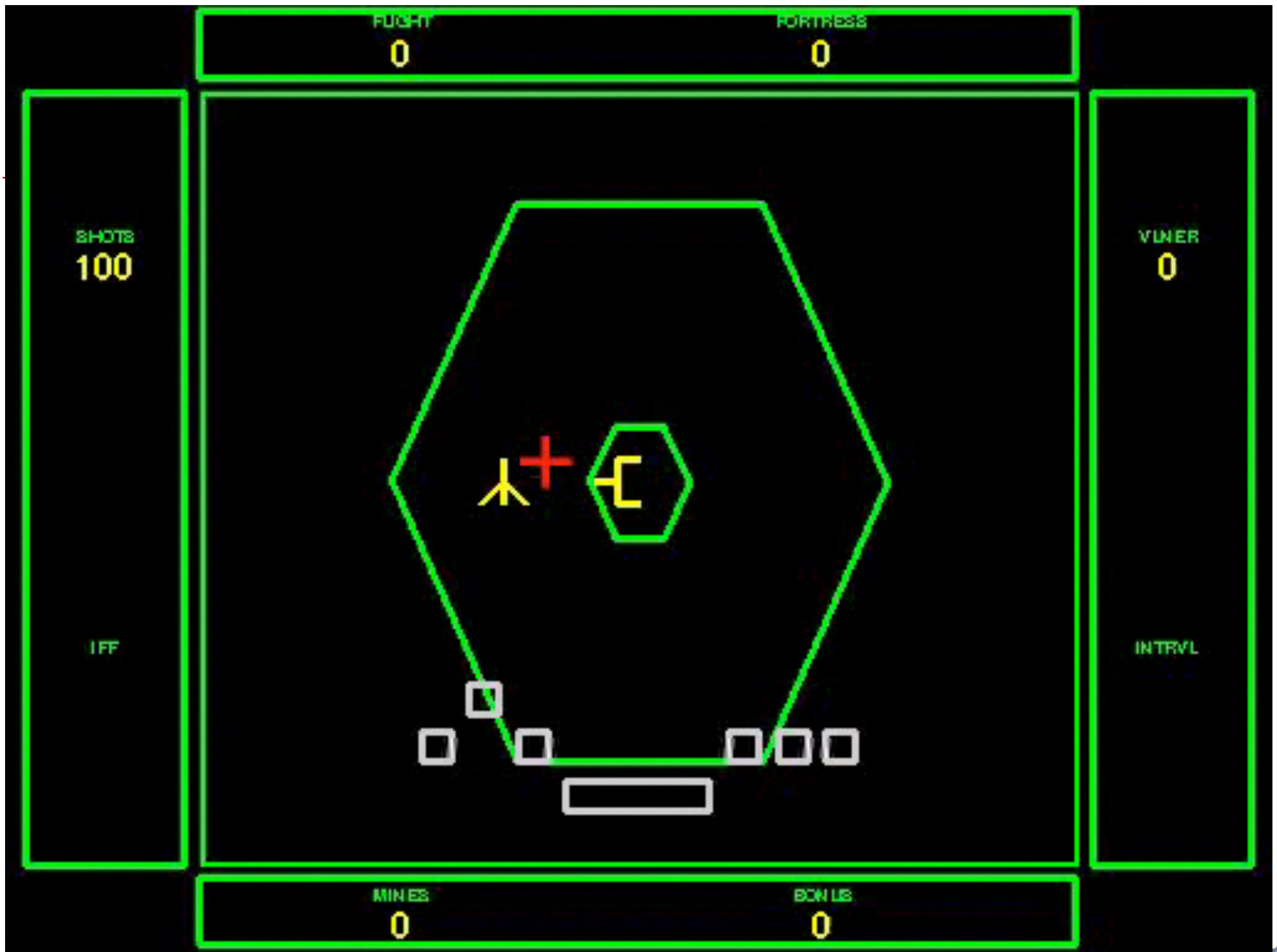
Michael J. Schoelles

ACT-R PGSS 2011

July 19, 2011

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Cog Works

Interfacing ACT-R with External Worlds

- Complex and Dynamic Environments

  - Space Fortress - Ryan Hope and Marc Destefano

  - X-Plane

  - Second Life - Dan Veksler

- Remote Device

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Movie

Space Fortress - Ryan Hope, Mark Destefano

- Fast paced gamed

- 30 frames per second

- Converting from DBus (binary, OS function) to TCP/IP

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KDFW: Dallas Fort Worth Intl

X-Plane Model-Uses all the modules

- Threaded Cognition - steering, speed monitoring, AC detection, etc

- Temporal - when to recheck

- Visual - cockpit + airport

- Auditory - Ground Controller

- Vocal - repeat Ground Controller instructions

- Manual - joystick + instruments

- Imaginal - speed limits
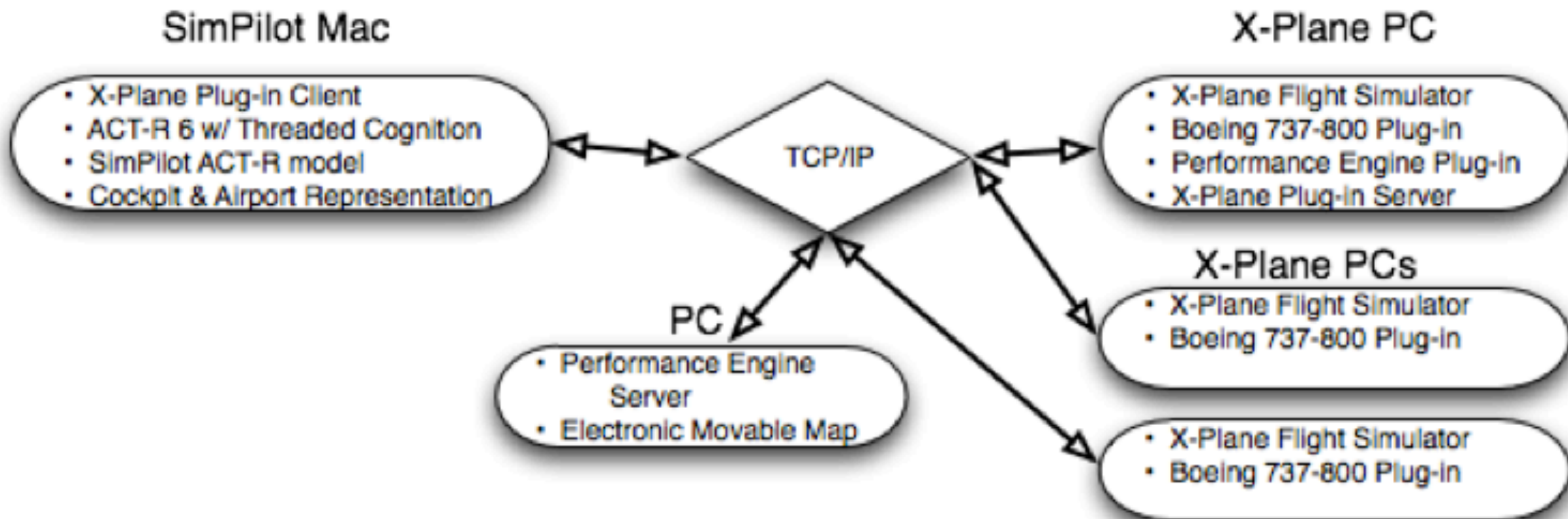
- Retrieval - remember route

Visicon

What the model *sees*

```
(349 298)  NEW  SWITCH-8-POS    ?     DC-SWITCH              INSTRUMENT-LOCATION19
(391 467)  NEW  BTN/LIGHT       1     WXR                    INSTRUMENT-LOCATION38
(392 426)  NEW  COVER           NIL   STANDBY-POWER          INSTRUMENT-LOCATION17
(412 468)  NEW  BTN/LIGHT       1     TCAC                   INSTRUMENT-LOCATION37
(412 614)  NEW  HEADING-GUAGE   ?     HEADING-DIFF           INSTRUMENT-LOCATION74
(413 578)  NEW  DISPLAY         106   HEADING-MAG            INSTRUMENT-LOCATION73
(413 669)  NEW  DISPLAY         NIL   EFIS-MAP               INSTRUMENT-LOCATION75
(429 297)  NEW  SWITCH-8-POS    ?     AC-SWITCH              INSTRUMENT-LOCATION18
(432 467)  NEW  BTN/LIGHT       1     ARPT                   INSTRUMENT-LOCATION36
(440 462)  NEW  BTN-PANEL       NIL   EFIS-MAP-OPTIONS       INSTRUMENT-LOCATION71
(451 466)  NEW  BTN/LIGHT       1     WPT                    INSTRUMENT-LOCATION35
(456 436)  NEW  DIAL            ?     EFIS-MAP-ZOOM          INSTRUMENT-LOCATION69
(461 115)  NEW  DISPLAY         NIL   MENU-DISPLAY           INSTRUMENT-LOCATION22
(471 467)  NEW  BTN/LIGHT       1     VOR                    INSTRUMENT-LOCATION34
(473 123)  NEW  MENU-ITEM       0     OVERHEAD-MENU-ENTRY    INSTRUMENT-LOCATION8
(491 466)  NEW  BTN/LIGHT       1     NDB                    INSTRUMENT-LOCATION33
(493 107)  NEW  DISPLAY         NIL   OVERHEAD-OFF           INSTRUMENT-LOCATION21
(542 404)  NEW  DISPLAY         ?     AP-COURSE              INSTRUMENT-LOCATION6
(560 459)  NEW  TOGGLE-SWITCH   OFF   AP-F/DL                INSTRUMENT-LOCATION2
(583 164)  NEW  TOGGLE-SWITCH   0     WINDOW-HEAT-1          INSTRUMENT-LOCATION16
(596 420)  NEW  TOGGLE-SWITCH   OFF   AP-A/T-ARM             INSTRUMENT-LOCATION0
(616 165)  NEW  TOGGLE-SWITCH   0     WINDOW-HEAT-2          INSTRUMENT-LOCATION15
(632 207)  NEW  TOGGLE-SWITCH   0     PILOT-HEAT             INSTRUMENT-LOCATION12
(657 406)  NEW  DISPLAY         ?     AP-IAS/MACH            INSTRUMENT-LOCATION5
(662 118)  NEW  TOGGLE-SWITCH   OFF   LANDING-LIGHTSL        INSTRUMENT-LOCATION55
(666 208)  NEW  TOGGLE-SWITCH   0     PILOT-HEAT-R           INSTRUMENT-LOCATION11
(681 166)  NEW  TOGGLE-SWITCH   0     WINDOW-HEAT-3          INSTRUMENT-LOCATION14
(690 118)  NEW  TOGGLE-SWITCH   OFF   LANDING-LIGHTSR        INSTRUMENT-LOCATION48
(712 165)  NEW  TOGGLE-SWITCH   0     WINDOW-HEAT-4          INSTRUMENT-LOCATION13
(714 118)  NEW  TOGGLE-SWITCH   OFF   TAXI-LIGHTSL           INSTRUMENT-LOCATION52
(734 1096) NEW  WHEEL           0     ELV-TRIM-DN-1          INSTRUMENT-LOCATION43
(734 1096) NEW  WHEEL           0     ELV-TRIM-UP-1          INSTRUMENT-LOCATION44
(739 118)  NEW  TOGGLE-SWITCH   OFF   TAXI-LIGHTSR           INSTRUMENT-LOCATION51
(758 403)  NEW  DISPLAY         75    AP-HEADING             INSTRUMENT-LOCATION7
(765 118)  NEW  TOGGLE-SWITCH   0     NAV-LIGHT              INSTRUMENT-LOCATION53
(771 597)  NEW  DISPLAY         0.0   ENGINE1U-N1            INSTRUMENT-LOCATION31
(775 1168) NEW  LEVER/LIGHT     1     PARKING-BRAKE          INSTRUMENT-LOCATION54
(790 118)  NEW  TOGGLE-SWITCH   OFF   STRB                   INSTRUMENT-LOCATION68
(801 880)  NEW  DISPLAY         0     ENGINE1L-N1            INSTRUMENT-LOCATION24
(812 118)  NEW  TOGGLE-SWITCH   OFF   BEACON                 INSTRUMENT-LOCATION67
(812 1073) NEW  LEVER           ?     THROTTLE               INSTRUMENT-LOCATION40
(822 1163) NEW  LEVER           0     MIXTURE-1              INSTRUMENT-LOCATION47
```

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Modeling the Task Environment

- 75 instruments

- Lots of updating between ACT-R and X-Plane

- Airport markers add/deleted dynamically

- One of the most extensive, detailed, and formal descriptions of the Task Environment

System Configuration

```
SET-BUFFER-CHUNK VISUAL-LOCATION VISUAL-
PRODUCTION-FIRED DO-ALL-SEE
SET-BUFFER-CHUNK VISUAL BTN498
PRODUCTION-FIRED COMPARE-BTN-ATTEND
PRODUCTION-FIRED COMPARE-BTN-CHECKIFNOTG
PRODUCTION-FIRED COMPARE-RETRIEVE
SET-BUFFER-CHUNK RETRIEVAL ___victorian+
PRODUCTION-FIRED COMPARE-SETBEST
th+particle+light chosen
PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE
SET-BUFFER-CHUNK VISUAL-LOCATION VISUAL-
PRODUCTION-FIRED DO-ALL-SEE
SET-BUFFER-CHUNK VISUAL BTN496
PRODUCTION-FIRED COMPARE-BTN-ATTEND
PRODUCTION-FIRED COMPARE-BTN-CHECKIFNOTG
PRODUCTION-FIRED COMPARE-RETRIEVE
SET-BUFFER-CHUNK RETRIEVAL ___Object
PRODUCTION-FIRED COMPARE-SETBEST

PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE
PRODUCTION-FIRED COMPARE-BTN-DONE
PRODUCTION-FIRED DO-BTN-LOOK
SET-BUFFER-CHUNK VISUAL-LOCATION VISUAL-
PRODUCTION-FIRED DO-ALL-SEE
SET-BUFFER-CHUNK VISUAL BTN496
PRODUCTION-FIRED DO-BTN-ATTEND
MOVE-CURSOR OBJECT NIL LOC VISUAL-LOCATI

PRODUCTION-FIRED DO-BTN-CLICK
CLICK-MOUSE
PRODUCTION-FIRED DO-BTN-CLICKEDBEST
PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE
PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE
PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE

-9bcc-e71041ff5748")


3947

3964
SET-BUFFER-CHUNK VISUAL-LOCATION VISUAL-
PRODUCTION-FIRED COMPARE-BTN-LOOK4UNATTE
```
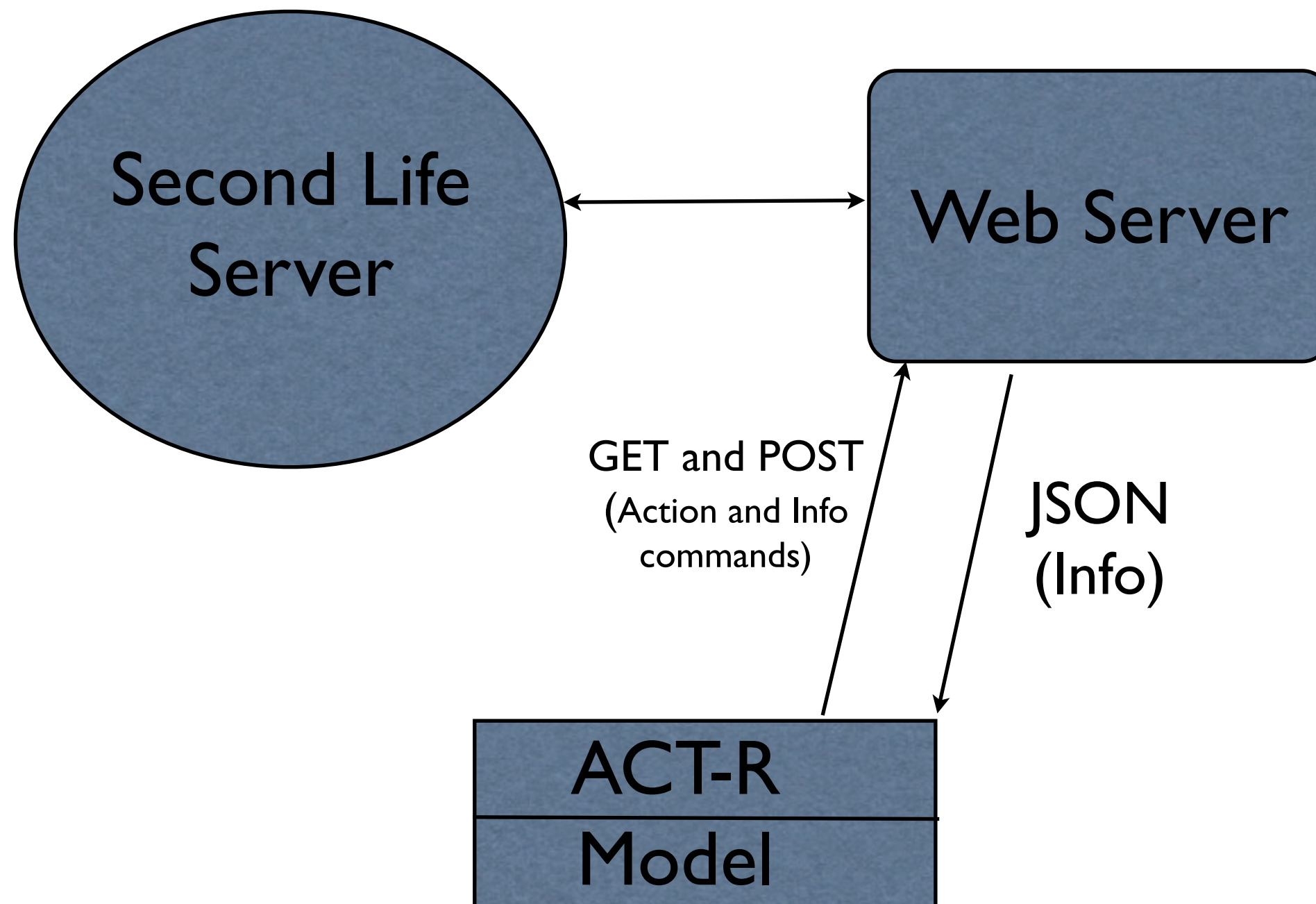
Script agent

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Second Life - Dan Veksler

Second Life Server ⟷ Web Server

Second Life Server

Web Server

GET and POST
(Action and Info
commands)

JSON
(Info)

ACT-R
Model

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Remote Device

- Task should be separate from the model

  - TCP/IP

    - Separate or same computer

    - Fast enough to date

    - Buttner (ICCM 2010)

    - Use existing GUI environment TCP/IP??

  - JavaScript Object Notation (JSON)

    - Data Interchange Format

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Thank You!