REVEAL: Software Documentation and Platform Migration

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Victoir Veibell

Embry-Riddle Aeronautical University
USRP Interns – Summer 2008
Outline

• Background
• Internship Objectives
• Project Foundation
• Platform Migration
• Field Test
• Next Steps
• Project Status
• Research Environment for Vehicle-Embedded Analysis on Linux

• Implemented on MontaVista Linux

• “Data acquisition and distribution system”

• Primarily used in aircraft
Suborbital Telepresence

- Hardware platform for REVEAL
- PC/104 Form Factor
- Configurable acquisition, processing, recording

![Diagram of hardware platform](image)
Internship Objectives

• Grow REVEAL’s support for multiple developers
  • modern version control system
  • modern software documentation

• Verify implementation flexibility
  • implement on different CPUs
  • demonstrate end-to-end functionality
Project Foundation: Subversion

• Version Control Software
• Motivation
  – Multiple people working with same files

Revision 80: /
- DailyReports/
- FRAU_REVEAL.XML/
- FinalDraftVoibell.txt
- FinalOutline.txt
- NTFD_Setup
- REVEAL_MAYNOTES
- Reveal_Setup
- ToDo.txt
- USRP_Report.odt
- WeeklyReports/
- doxygen_checklist
- doxygen_manual-1.5.6.pdf
- mod_authz_svn_notes.txt
- piccolo_comms.pdf
- piccolo_notes
- svn-hook.pdf
- svn_authentication_notes.txt
- xmlperl/
- xmltracer/

Powered by Subversion version 1.4.6 (r28521).
# ViewVC

**Index of /**

Files shown: **14**
Directory revision: **77 (of 77)**
Sticky Revision: **Set**

<table>
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<th>File</th>
<th>Rev.</th>
<th>Age</th>
<th>Author</th>
<th>Last log entry</th>
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<tr>
<td>DailyReports/</td>
<td>77</td>
<td>17 hours</td>
<td>e-rau</td>
<td>Added 31JUL08</td>
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<tr>
<td>ERAU_REVEAL XML/</td>
<td>68</td>
<td>4 days</td>
<td>e-rau</td>
<td>Added 25JUL08 and XML files used with ERAU's Summer 2008 mission</td>
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<td>e-rau</td>
<td>Initial Import</td>
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*Site Admin*

Powered by ViewVC 1.0.5
## ViewVC

### Highlighted differences

**revision 33, Thu Jul 3 18:55:04 2008 UTC**

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<td>CC = gcc</td>
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<td>4</td>
<td>CFLAGS = -I$(IXML) -I$(INOVAS) -I$(IARINC) -I$(IDSCUD) -D$(OS)</td>
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<tr>
<td>6</td>
<td>REVEAL = /Users/mjm/Reveal</td>
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<td>7</td>
<td>LDADS = $(REVEAL)/Revealv1.1a</td>
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<td>8</td>
<td>OBJ = $(LDADS)/LIB</td>
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<tr>
<td>9</td>
<td>BIN = $(LDADS)/BIN</td>
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<td>10</td>
<td>IXML = /usr/include/libxml2</td>
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<td>11</td>
<td>OS = OSX</td>
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<td>13</td>
<td>LD_LIBRARY_PATH=$LDADS/BIN:$LDADS/LIB:/usr/lib</td>
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**revision 36, Tue Jul 8 22:56:50 2008 UTC**

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<td>OBJ = $(REVEAL)/lib</td>
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<td>8</td>
<td>BIN = $(REVEAL)/bin</td>
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<td>10</td>
<td>OS = OSX</td>
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<tr>
<td>11</td>
<td>THIRDPARTY = $(REVEAL)/ThirdParty</td>
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<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td># LD_LIBRARY_PATH=$LDADS/BIN:$LDADS/LIB:/usr/lib</td>
</tr>
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</table>
Doxygen

- Visual Interactive Code Documentation
- Motivation
  - Easy to find and interpret code
  - Parses files, functions, variables, definitions
  - Useful comment structure
Validates ARINC-429 parity

**FUNCTIONAL DESCRIPTION:**
The Condor card has already checked parity and set a bit in the 32-bit parameter word to let us know, we just look at the bit.

**REVISION HISTORY:**
11/24/04 Carl Sorensen Created
01/31/08 Carl Sorensen From 2 to 4 channels

**NOTES:**
If the channel is in "raw mode" parity is not checked by card or us.

```c
int checkParity(int chan, uint32_t word)
{
    int okay = FALSE; // return code
    uint32_t ptest; // parity test value

    switch(chan)
    {
        case ARINC_CHAN0: ptest = ARINC_CHAN0_PARITY; break;
        case ARINC_CHAN1: ptest = ARINC_CHAN1_PARITY; break;
        case ARINC_CHAN2: ptest = ARINC_CHAN2_PARITY; break;
        case ARINC_CHAN3: ptest = ARINC_CHAN3_PARITY; break;
        default: jobMsg(LOG_ERR,"checkParity: unknown channel: %\n",chan);
    }

    if (working) switch(ptest)
    {
        case AR_ODD: if ((!word & ARINC_PARITY_BIT)) okay = TRUE; break;
        case AR_EVEN: if (word & ARINC_PARITY_BIT) okay = TRUE; break;
        case AR_RAW: okay = TRUE; break;
        default: jobMsg(LOG_ERR,"checkParity: internal error: %\n",ptest);
    }

    return(okay);
}
```

Here is the call graph for this function:
Doxygen - GraphViz

- File dependency graphs
- Clickable links
Doxygen – GraphViz (cont.)

• Functional dependency graphs
• Flow visualization
• Easy code debugging
Platform Migration

- Three considered platforms:
  - VersaLogic EPM-5 “Puma”
  - Lippert “Cool FrontRunner”
  - eBox-2300 (“NorhTec MicroClient”)
- Puma and Lippert suspended due to time constraints
eBox-2300

- Motivations for choice
  - Built-in Compact Flash interface
  - Passive Cooling
  - Low Power Consumption (15W)
  - Self Contained
  - Two Serial Ports
eBox-2300 (cont.)

- Finally: small size
eBox Modification

- Added 2\textsuperscript{nd} Compact Flash interface
  - Usability: separates system and data
  - Makes one complete package
Testing REVEAL

• Data Source: Piccolo II Autopilot
  • Generates useful, verifiable data
  • Communicates over serial
  • Existing data acquisition software
Testing REVEAL (cont.)

- Network Link: Iridium 9505A Satellite Phone
  - Globally accessible
  - Allows data transmission
  - Serial accessory
Field Test

• Proof of Concept

Truck Setup

Terminal
Physical Network Architecture

Iridium

Ground Station

Internet

Piccolo II

9505A

Vehicle

California Team

New Hampshire Team

REVEAL

NASA

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
Field Test (cont.)
Next Steps

• Further documentation
  • XML configuration files
  • Data flow
  • Accessibility to a broader audience
• Further miniaturization of REVEAL hardware
  • Current size is restrictive
• Expanded applications of REVEAL software
Project Status

• Implemented multi-developer capability for REVEAL
  • Created interactive REVEAL documentation.

• Became first users

• Migrated REVEAL to low-cost hardware (eBox-2300)
  • Field tested system
  • Verified end-to-end operation
Acknowlegments

• Larry Freudinger
• Brent Bieber
• Sky Yarbrough
• Jim Murray
• Shari Olson
• Miriam Rodon-Naveira
• Matt Miller & John Wilson
• Professor Gary Gear
Questions?