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 showing:
- Network
- Satellite Links
- Internal Sensors
- External Sensors
- Configurable Components
- Analog I/O
- Digital I/O
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
# ViewVC

## Browser based repository

**Index of /**

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

<table>
<thead>
<tr>
<th>File</th>
<th>Rev.</th>
<th>Age</th>
<th>Author</th>
<th>Last log entry</th>
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<td>ERAU_REVEAL_XML/</td>
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<td>erau</td>
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*Site Admin*

Powered by ViewVC 1.0.5
## Highlighted differences

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

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<td>3</td>
<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>5</td>
<td>REVEAL = /Users/mjm/Reveal</td>
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<td>LDADS = $(REVEAL)/Reavelv1.1a</td>
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<td>7</td>
<td>OBJ = $(LDADS)/LIB</td>
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<td>8</td>
<td>BIN = $(LDADS)/BIN</td>
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<td>9</td>
<td>IXML = /usr/include/libxml2</td>
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<tr>
<td>10</td>
<td>OS = OSX</td>
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<td>11</td>
<td>THIRDPARTY = $(REVEAL)/ThirdParty</td>
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<td>12</td>
<td>LD_LIBRARY_PATH=$(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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<th>#</th>
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<td># LD_LIBRARY_PATH=$LDADS/BIN:$LDADS/LIB:/usr/lib</td>
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Doxygen

• Visual Interactive Code Documentation
• Motivation
  – Easy to find and interpret code
  – Parses files, functions, variables, definitions
  – Useful comment structure
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_BYTE,"checkParity: unknown channel: %d",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_BYTE,"checkParity: internal error: %d",ptest);
  }

  return(okay);
}
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
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

9505A

Piccolo II

REVEAL

Ground Station

Internet

Vehicle

California Team

New Hampshire Team
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
Acknowledgments

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