Open Source Innovation in Automotive

Maximizing Benefits & Minimizing Challenges With GENIVI and SPDX

Automotive Linux Summit
Gaydon, UK
September 19, 2012
Agenda

- FOSS is Driving Formation of Super Communities
- Trends in Automotive Infotainment SW R&D
- Challenges and Remedies to Use FOSS in Automotive
- Industry Benefits from FOSS-based GENIVI Alliance
- Use of SPDX to Streamline Automotive Supply Chains
The Virtuous Circle – Innovation & FOSS

- 560,000+ FOSS projects
- 100+ billion lines of code
- 10 million staff-years of work
Super FOSS Communities

Healthcare
OSEHRA
Open Source Electronic Health Record Agent

Aerospace
Polarsys
eclipse

Cloud Tech
openstack

Mobile
Android

Automotive
GENIVI

Finance
openMAMA

Know Your Code
Open Source Drives Mobile Innovation

- Over 10,000 new FOSS projects in 2011, doubling for the past 3 years
- FOSS redefined the mobile industry and is spreading far beyond
Open Source and Cloud – Rapid Growth

- New OSS Cloud Projects
- Cumulative Projects
More FOSS Info at Ohloh.net

Your Guide to Open Source

Ohloh is a new kind of software directory, combining community-driven content with a unique source code crawler that monitors up-to-date development activity.

Search Projects

Ohloh's objective reports and community feedback help you find the software you need.

Search People

Open source is open collaboration. Find people who use and create open source.

Counting 16,103,209,601 lines of code

Commit Volume

Discover how much each developer is contributing to a project, e.g. Ohcount

Most Popular Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Users</th>
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</thead>
<tbody>
<tr>
<td>Mozilla Firefox</td>
<td>10919</td>
</tr>
<tr>
<td>Subversion</td>
<td>7937</td>
</tr>
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Most Active Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Commits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gentoo Linux</td>
<td>16046</td>
</tr>
<tr>
<td>OpenX</td>
<td>6186</td>
</tr>
</tbody>
</table>

Most Active Contributors

<table>
<thead>
<tr>
<th>Contributor</th>
<th>Commits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michal Čihař</td>
<td>1925</td>
</tr>
<tr>
<td>PatrickLauer</td>
<td>812</td>
</tr>
</tbody>
</table>
New FOSS Super Community -- Automotive IVI

Industry Community, OEM Requirements

Innovation Super Community

FOSS Projects And Forges

Academic Research And Standards
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Automotive Trends

- Value is shifting from manufacturing/assembly to Software
  - New “players” - IT and electronics Companies

- IVI Head Unit evolves as a multiuser, social, Apps and Cloud access platform

- Balancing in-house development vs. strategic alliances with suppliers and competitors

- Emerging “Always-ON” IVI integration with social net’s
  - Road hazards, Traffic conditions, Police / radar alerts
  - Internet, iPhone/iPad, Car-to-car communications
IVI HeadUnit – No Longer “Just a Car Radio” Increasingly OSS-based & Costly
Automotive Industry Dynamics

Development Cycles

<table>
<thead>
<tr>
<th></th>
<th>consumer auto</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td></td>
<td>Year 2</td>
</tr>
<tr>
<td>Year 3</td>
<td></td>
<td></td>
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</table>

Longevity Life Cycles

<table>
<thead>
<tr>
<th>apps consumer auto</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 1</td>
</tr>
<tr>
<td></td>
<td>Year 2</td>
</tr>
<tr>
<td></td>
<td>Year 3</td>
</tr>
<tr>
<td></td>
<td>Year 4</td>
</tr>
<tr>
<td></td>
<td>Yr. 10-30</td>
</tr>
</tbody>
</table>

Amount of Software

Lines of Code

Complexity & Standards

blackduck
Automobile Supply Chain – SW Everywhere
R&D Costs Became Unsustainably High

100+ m lines of code in a premium-class car
(IEEE, Feb. 2009)

70+% is in IVI “head unit”, at R&D of US$1-10/line!
(GENIVI, 2010)
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### FOSS Survey in Automotive

**Conducted by:** BearingPoint

**Scientifically Guided by:**

Prof, Dr. Dirk Riehle  
Head of the Open Source Institute  
University of Erlangen-Nuremberg

#### Reasons for...
- Evaluating FOSS
- Using FOSS
- Contributing to FOSS projects
- Starting FOSS projects
- Heading FOSS projects

#### The Study

<table>
<thead>
<tr>
<th>Processes and Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional SW development</td>
</tr>
<tr>
<td>Integrating 3rd party code</td>
</tr>
<tr>
<td>Integrating FOSS</td>
</tr>
<tr>
<td>Interacting with FOSS projects</td>
</tr>
<tr>
<td>Managing suppliers</td>
</tr>
<tr>
<td>Tool support of processes</td>
</tr>
</tbody>
</table>
Results: Auto Companies Widely use FOSS

What is your company’s relationship to using open source software in products?

- FOSS has arrived in commercial automotive software development
- “We do not use it”: How do they know? For sure?

- We use it: 59%
- We are evaluating use: 35%
- We contribute to it: 21%
- We do not use it: 15%
- We have started one or more: 9%
- We are head of one or more: 6%
Policies, Governance & Processes for FOSS?

Do you have a policy or documented process in place for:

- Developing software: 88.2%
- Managing requirements: 70.6%
- Selecting third-party components: 52.9%
- Screening supplier components: 20.6%
- Deploying FOSS components: 17.6%
- Selecting FOSS components: 14.7%
- Auditing suppliers: 11.8%
- Contributing to FOSS projects: 8.8%
- Leading FOSS projects: 5.9%
- Starting a FOSS project: 2.9%

*Ouch!*
And FOSS Tools?

Which tools are you using in software development?

- Bug tracking: 94.1%
- Software configuration management: 91.2%
- Requirements management: 67.6%
- Open source compliance management: 2.9%

Ouch! (again)
State of the art? ...Not yet.

FOSS In Automotive Study & Infographic:
//advance.blackducksoftware.com/content/AutoSurvey
Automotive is Consistent with Other Industries

"50% of companies will face challenges due to lack of FOSS policy and management"

Gartner OSS Analysis, 2011
Benefits of FOSS IP Governance & Compliance

- Enable OEMs & suppliers to focus on innovation vs. SW platform R&D
- Establish effective governance and license compliance
  - Comparable to those used in traditional manufacturing supply chains (ISO 9000, Just In Time, Lean best-practices)
- Instill knowledge of how to select the right FOSS management tools
  - Automate license compliance, reduce costs and shorten development cycles
- Build a trusted catalog for reuse of FOSS components across automotive supply chains
  - Create end-to-end Bill Of (Software) Materials (BOM), including license / IP obligations, source, revision and maintenance data
  - Leverage and build upon LF’s SPDX standard (Software Package Data Exchange, see spdx.org)
Requirements for FOSS “Enablement”

- **Strategy**
  - Articulate the business objectives for use of FOSS

- **Policy & Process**
  - FOSS policy & management process

- **Technology**
  - Automate governance and compliance
  - Design-in and automate policies
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The GENIVI Alliance Charter

- **Mission:**
  - GENIVI is an industry alliance committed to driving the broad adoption of an In-Vehicle Infotainment (IVI) reference platform.
  - GENIVI will accomplish this by fostering a vibrant open source IVI community

- **Purpose:**
  - Ease IVI product integration
  - Enable open innovation and inheritance from adjacent industries

- **Deliverables:**
  - Aligned IVI requirements across a broad base of OEMs
  - Reference implementation that “satisfies” the requirements and “demonstrates” the compliance statements
  - A compliance program against which commercial offerings can be certified and ISVs can develop.
Organization and Expert Groups

- GENIVI Board of Directors
  - Operations Subcommittee
  - Program Management Office
  - System Architecture Team & Compliance Team
    - SI Expert Group
    - Auto Expert Group
    - LBS Expert Group
    - Media/Graphics Expert Group
    - CE Connectivity Expert Group
    - Networking Expert Group
    - HMI Framework Expert Group
    - Baseline Integration Team
  - Marketing
  - License Review Team
  - IT Infrastructure
GENIVI Targets Non-differentiating Layers

Automaker and Tier1 Supplier Domain
- Differentiation
- Integration
- Commercial and Proprietary solutions
- Implementation Competition

Alliance Domain
- Non-differentiating features
- Consolidated Requirements
- Auto Specific Middleware
- Validation/Compliance

HMI - Human Machine Interface

Apps
OSV Extensions
Libs

Open Source IVI Stack
Open Source Kernel
Cut IVI Product Development From 7+ years Down to <2!
GENIVI FOSS Management & Governance

FOSS Community: Open Source Projects

Contributors → GENIVI → Tier 1 → OEM → Customer

- Inbound license check
- 3rd party IP check
- OSS Code scan
- Technical & quality evaluation
- Outbound license assignment

- GENIVI Platform
- Head Unit
- Car
- Apps

All supply chain participants required to implement FOSS Management infrastructure!
Membership – Global GENIVI Community

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe/EU</td>
<td>48%</td>
</tr>
<tr>
<td>Asia/Pacific</td>
<td>26%</td>
</tr>
<tr>
<td>Americas</td>
<td>26%</td>
</tr>
<tr>
<td>Total Firms</td>
<td>~170</td>
</tr>
</tbody>
</table>
## The GENIVI Alliance Membership (www.genivi.org)

### OEMs

- BMW Group
- HONDA
- HYUNDAI
- JOHN DEERE
- JAGUAR
- LAND ROVER
- NISSAN
- PSA PEUGEOT CITROEN
- GM
- RENAULT
- SAIC MOTOR
- VOLVO

### First Tiers

- Aisin AW Co., Ltd.
- ALPINE Mobile Media Solutions
- ALPS
- BOSCH Invented for life
- CLARION
- Continental  
- Delphi
- DENSO
- FUJITSU TEN
- Harman
- Johnson Controls
- LG Electronics
- Magneti Marelli
- Hyundai Mobis
- Peiker
- Pioneer
- Valeo
- Visteon

### OSV, Middleware, Hardware, and Services Suppliers

- semisystems
- Accenture
- ACCESS Advanced Driver Information Technology
- AEC
- Agero
- ACAS
- Airbiquity
- Akhela
- AllGo Embedded
- Altran
- Praxis
- Aricent
- Arunya
- Audiovox Incar
- AutoNavi
- Cadenhead
- Collabora
- Comarch
- Coventry
- CTag
- Cybercom Group
- CyberGate
- E-Gits
- EIPC
- ESG
- ETRI
- Fraunhofer IS
- Garmin
- HCL quietly brilliant
- Hi Corp.
- Larsen & Toubro
- Luxoft
- Humax
- Jungo
- Livio Radio
- Mahindra Satyam
- Green Hills Software Inc.
- Jambit
- SK2l
- KPIT Cummins
- Mentor Graphics
- McAfee
- MDS Technology
- nVidia
- Nover
- Open Car
- OpenSynergy
- G3go
- OpenWrt
- OTSL
- ParaSoft
- Embedded
- Parrot
- Pelagicor
- Prefusion
- Recaro
- Red Bend Software
- Rightware
- RTI
- Sasken
- Siemens
- Sybase
- Symbio
- TechniSat
- Das Original
- Delco
- Tenneco
- Elastech
- Wind River
- Wipro
- Val
- XSE

### Silicon

- Analog Devices
- ARM
- CSR
- Freescale
- Fujitsu
- Intel
- ISSI
- Marvell
- MediaTek
- NXP
- QUALCOMM
- Rohm
- Samsung
- Renesas
- Texas Instruments
- Viter
- Xilinx
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Challenges of Multi-Source Development
Products with mixed code from different sources

Outsourced Code Development

Commercial 3rd-Party Code

Open Source Software

Obligations

Internally Developed Code

Your Application

YOUR COMPANY – TOOLS, PROCESSES

Source: Black Duck Software
1000s of FOSS packages with complex dependencies between them...

- Package contents evolve over time
  - Different versions can have different licenses
  - Declared license of a package is not always accurate
  - Package with different license has “useful” routines (that potentially get included)
  - Different versions can have different licenses at the file levels

- Package dependency/requisite hierarchy can have incompatibilities
  - Hidden/enveloped package in dependency chain
  - Incidental packages get included by accident
  - All OSS licenses not compatible with each other
Supply Chain Management with SPDX™ Software Bill of Materials (BoM)

A standard format for communicating a software license and copyright data BoM across the supply chain.

Benefits:
- Reduce governance effort
- Reuse analysis
- Improve compliance
Overview of Software Package Data Exchange

- **Standard:**
  - A standard file format for communicating the components, licenses and copyrights associated with a software package.
  - Key pillar in Linux Foundation’s Open Compliance Program to capture facts

- **SPDX Group:**
  - Working group of Linux Foundation
  - Participation from over 20 organizations including software, systems and tool vendors, consultants and foundations

- **Charter is to create a defined format for a file of license factual information describing a software package**
  - Allows easy exchange of license information between companies reducing burden on both suppliers and consumers
  - Avoids due diligence redundancy where the same source code package is analyzed multiple times by different receivers
  - Provides a unified method for exchanging license information
OSS Projects/Communities Can Use SPDX™
# SPDX Package Information in Black Duck Protex 6.1

**SPDX Version:** SPDX-1.0  
**Data License:** PDDL-1.0

## Creator Information

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creator:</td>
<td>Organization: Black Duck Software</td>
</tr>
<tr>
<td>Creator:</td>
<td>Tool: Black Duck Protex - version 6.1.0</td>
</tr>
<tr>
<td>Creator:</td>
<td>Person: Kirsten Newcomer (<a href="mailto:knewcomer@blackducksoftware.com">knewcomer@blackducksoftware.com</a>)</td>
</tr>
</tbody>
</table>

## Reviewer Information

None

## Package Information

<table>
<thead>
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<th>Field</th>
<th>Value</th>
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<tbody>
<tr>
<td><strong>PackageName:</strong></td>
<td>openssl-test-IDs</td>
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<tr>
<td><strong>PackageVersion:</strong></td>
<td>1.0.0g</td>
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<td><strong>PackageDownloadLocation:</strong></td>
<td><a href="http://www.openssl.org/source/openssl-1.0.0g.tar.gz">http://www.openssl.org/source/openssl-1.0.0g.tar.gz</a></td>
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<tr>
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<tr>
<td><strong>PackageFileName:</strong></td>
<td>openssl-1.0.0g.tar.gz</td>
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<tr>
<td><strong>PackageChecksum:</strong></td>
<td>SHA1: null</td>
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<tr>
<td><strong>Package Verification Code:</strong></td>
<td>1b42d8788e80672d19d5bf6fd12dd3f3773a813c</td>
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<tr>
<td><strong>PackageDescription</strong></td>
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</table>

## PackageLicenseInfoFromFiles

- BSD-2-Clause
- BSD-3-Clause
- GPL-1.0+
- GPL-2.0+
- LGPL-2.0+
- LGPL-2.1+
- LicenseRef-1
- LicenseRef-2
- LicenseRef-3
- MIT
- MPL-1.1
- OpenSSL

**PackageCopyrightText:** NO ASSERTION  
**PackageDeclaredLicense:** OpenSSL  
**PackageLicenseConcluded:** (LicenseRef-3 AND LicenseRef-2 AND MPL-1.1 AND OpenSSL)
SPDX File-level License and Copyright Information in Black Duck Protex 6.1

File Name: openssl-1.0.0g/crypto/camellia/asm/cml-x86.pl

File Type: SOURCE
LicenseConcluded: (MPL-1.1 AND OpenSSL)
LicenseInfoInFile:
- LicenseRef-1
- MPL-1.1
- GPL-2.0+
- LGPL-2.0+
- LGPL-2.1+

License Comments:
FileCopyrightText: # <I>Copyright</I> (c) 2008 Andy Polyakov <appro@openssl.org>
ArtifactOfProjectName: OpenSSL;
ArtifactOfProjectHomePage: http://www.openssl.org;
ArtifactOfProjectURI: UNKNOWN

File Name: openssl-1.0.0g/crypto/camellia/asm/cml-x86_64.pl

File Type: SOURCE
LicenseConcluded: (MPL-1.1 AND OpenSSL)
LicenseInfoInFile:
- LicenseRef-1
- LGPL-2.1+
- GPL-2.0+
- MPL-1.1
- LGPL-2.0+
Active Participants

Participation is from a range of organizations and across various roles
What it Means to You

**Embedded & SW Supply Chains**
- Save Time/Money
- Better Compliance

**Open Source Developers**
- Help Users Comply With Your Licenses

**Consumers of SW & OSS**
- Understand Licensing of the Code You Use
Status of SPDX

- Version 1.0 – Released August 2011
- Version 1.1 – Q3 2012
- Version 2.0 – 2013

http://www.spdx.org
Thank you!

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www.blackducksoftware.com