

Stephen L Arnold

Systems Engineering/Architecture and FOSS Developer

Education

1995-Present: Graduate/short courses in Toxic Risk Assessment, C, Ada, Zope, Doppler and Polarimetric Weather Radar, 595th TEG Test and Evaluation Course, AMS Faculty Workshop, AHC Professional Development courses.

1990: MS Degree in Geophysics, San Diego State University.

1986: BS Degree in Geophysics, San Diego State University.

Technical skills

CS/SE: Expert knowledge of programming languages and development tools, system performance, design, testing, and administration, as well as the software lifecycle, CI, software processes, requirements engineering, system architecture, and CyberSecurity

OS: Unix/Linux/Embedded (Gentoo, OE, RHEL, Debian/Ubuntu), Android

Proj Mgmt: SE DIDs, Planner, OpenAdams, doorstop, Make/Autotools, trac/git, doxygen, docutils

DataBase: sqlite, redis/nosql, Postgres/spatial

Software: Libre/Open office tools, Graphviz, Dia, Inkscape, Maxima, Octave

Architectures: x86/x86_64, ARM/AVR, MIPS, Sparc, PowerPC

Embedded Systems: Gentoo, OpenEmbedded, debian/Ubuntu, design/build/deployment of applications for ARM and other embedded systems, Android

Sciences: Geophysical fluid dynamics, sensors and data acquisition, data analysis & modeling, geology/geography, geophysical/multi-spectral remote sensing and geospatial analysis, environmental/health risk assessment, applied math modeling

Languages

English: Native

Spanish: Conversational(-ish)

Programming: Python, Bash/POSIX Shell, C, Ada, Java, C++, Perl, js, AWK, FORTRAN

Markup: reStructuredText, HTML, DTML, XML, Markdown

Engineering: IV&V, OOD/P, UML, DoDAF, RMF/DIACAP, 2167/498/12227, RCC/AF/NASA Range Safety Stds toolchains/SDKs, CI/Agile, jenkins/apache/trac/git workflows, open document production

Applied Math: Numerical analysis, linear systems, differential equations, functional analysis, non-linear dynamics, math modeling, statistical methods, risk models

Relevant Work History

- 2014 - Present:** Principal Scientist, Systems Architect, Business & Community Development - [Vanguard Computer Technology Labs, Inc](#) - Goleta, CA. VCT Product/Project management IV&V, Range Meteorology and Hazard/Risk Modeling Subject Matter Expert (SME), education & training instructor, conferences & expos, open source outreach & education. Systems Architecture and CyberSecurity, specializing in Gentoo Hardened, OpenEmbedded, RHEL, and Debian/Ubuntu, Linux development, build, and deployment testing. Linux kernel/u-boot hacking and software testing on various ARM devices (Gentoo Linux, OE). Business/community development (event support, outreach, presentations, leads & proposals).
- 2014 - Present:** Startup / Tech Mentor - Technology and Open Source adviser, [Santa Maria Startup Weekend](#) and other local meetups and user groups. Open source presentations, technology training, demos.
- 2011 - 2014:** Senior Software Engineer - SynergyHD3 - [Arthrex California Technology, Inc.](#) - Goleta, CA. DevOps, software/systems engineering, CM/QA, test & integration. Agile infrastructure & CI process implementation, Jenkins build/test/deployment automation. Linux OS/Distribution engineering, test automation, process validation.
- 2009 - 2011:** Staff Scientist, IV&V / Systems Engineering and Architecture Support - [ENSCO, Inc.](#) - VAFB, CA. Subject Matter Expert – Range Meteorological Systems, Flight Safety, Instrumentation. Launch Range Enterprise Architecture analysis (supersystem, subsystem, product). Safety-critical systems IV&V (Flight Termination, Range Timing). Range Architecture Model VV&A, model evaluation, code analysis, and test engineering. Software process, internal SCM and IV&V tool engineering.
- 2006 - 2009:** Staff Scientist, System Performance Evaluation and Validation - [ENSCO, Inc.](#) - VAFB, CA. Performance analysis and verification & validation of Weather, Flight Operations, TEMS/Timing and Infrastructure products for new Mission Flight Control Center. Responsible for Weather, Infrastructure, and Data Handling subsystems; technical IA and System Security/Accreditation support.
- 2002 - 2006:** Senior Engineer, [MARSS](#) Project, Range Instrumentation and Infrastructure - [ENSCO, Inc.](#) - Santa Maria, VAFB, CCAFS. RSA-MARSS and INF system design and requirements engineering, user training. Model evaluation and localization, integration with MM5/AWIPS, range instrumentation integration and test support.
- 1997 - 2002:** Senior Scientist - Independent Verification & Validation - [ENSCO, Inc.](#) - VAFB, CA. IV&V of Launch & Test Range Meteorological and Flight Safety Systems, Range meteorologist and engineering test support to AFOTEC and 17th Test Squadron.
- 1991 - 1997:** Senior Systems Engineer, IV&V Task Lead on Meteorological Range Safety Systems - Geodynamics Corp - VAFB, CA. Requirements/code analysis, windfield, dispersion, & hazard/risk [model evaluation](#), dense gas hazard analysis, developed new [statistical estimation algorithm](#) for processing time-averaged wind data without access to the raw samples. Also performed real-time range safety algorithm & performance analysis, instrumentation and data quality analysis.
- 1990 - 1991:** Applied earth science & software consultant, San Diego, CA. Air toxics risk assessment modeling studies, control-tradeoff & sensitivity studies, environmental assessments, cost-benefit analyses, bug-fixes and model enhancements (IWG Corp), geophysical data acquisition (JR & Assoc), database design/implementation (SDSU Foundation).
- 1984 - 1990:** Research Assistant, Coastal and Boundary Layer Meteorology - SDSU and Scripps Center For Coastal Studies, San Diego, CA. Field observations, data collection, analysis, post-processing for 3 major field programs, scientific programming, custom instrumentation development (tethered sounding gear, kite and balloon platforms).

FOSS Experience

- 2014 - Present:** Founding member [Central Coast Open Source Solutions Exchange](#), an open source technology-focused meetup.
- 2012 - Present:** Co-maintainer of meta-printing layer, - [OpenEmbedded](#) and [Yocto](#) contributor (oe-core, meta-openembedded, meta-python).
- 2003 - Present:** Senior Developer - [Gentoo Linux](#). Previously maintainer of several development tools, GIS/scientific libraries, mentor of new developers; currently primary maintainer of [Gentoo ARM overlay](#) and personal [testing overlay](#).
- 2000 - Present:** Upstream developer and/or maintainer of several tools and utility libraries for source code metrics, graphics, science, and education. See the [maintenance release page](#) and the individual github project sites for more information.

Education Experience

- 2014 - Present:** Volunteer Instructor/Mentor - Google Summer of Code, Computer Science Education Week, and Open Document Foundation's Document Freedom Day.
- [GSoC mentor for BeagleBoard.Org](#): BeagleSat & anemometer projects.
 - [Computer Science Education Week](#): Python Intro to CS course.
 - [ODF](#) contributor, [Document Freedom Day](#): Open Document Workshop.
- 1999 - 2009:** Associate Faculty - [Allan Hancock College](#) (senior geography and meteorology instructor). Taught Physical and Human Geography courses and occasional technology courses, updated official geography course outlines, created new introductory meteorology course.

Selected Projects

- [GNU Winds On Critical Streamline Surfaces \(GWOCSS\)](#) diagnostic windfield model
- [af_alg](#) - an openssl engine for the kernel user-config crypto interface
- [CCCC](#) & [Cyclo](#) tools for source code complexity and structural metrics
- [URT](#) - Updated version of the Utah Raster Toolkit and RLE graphics library
- [Open Source Weather Station](#) - Raspberry Pi and weather data ingest and display software, arduino lightning detector (AMS WeatherFest demo)
- Various embedded Linux tools (build manifests, kernel/u-boot patches and rootfs tools, etc)
 - [vct-socfpga-bsp-platform](#) - Manifest tool for Poky/OpenEmbedded on Altera socfpga boards
 - [vct-beagleboard-bsp-platform](#) - Manifest tool for BeagleBoard.Org and/or TI builds of Poky and OpenEmbedded
 - [vct-edgerouter-bsp-platform](#) - Manifest tool for Poky/OpenEmbedded on MIPS Edgerouter Lite
 - [DE1_SOC_Linux_FB](#) - FPGA demo project, fixed and documented for DE1- SoC board
 - [mips3-octeon-devel](#) - Build script for mips3 n64/n32 linux-stable patches
 - [gnu-arm-toolchain](#) - Modified build scripts and readme for building on ARMv7a host
 - [meta-small-arm-extra](#) - Custom ARM device layer for RPi, BBB, imx2x, Neo and similar
 - [meta-alt-desktop-extras](#) - Usability-focused Poky/OE desktop layer for constrained devices
 - [multi_arch-mainline-linux](#) - Kernel build and deb packaging scripts modified for native x86

Selected Publications

- Towards an Open Instrumentation Platform: Getting the Most From MAVLink, ArduPilot, and BeagleBone** (2016) S. L. Arnold, presented at the Special Symposium on Meteorological Observations and Instrumentation, Special Session: Unmanned Aerial Vehicles for Atmospheric Research and Field Programs (97th Annual AMS Meeting, 2017).
- Open Data Standards and Open Source Modeling Tools: The GPL'd Release of Winds On Critical Streamline Surfaces (GWOCSS)** (2015) S. L. Arnold, presented at the 31st Conference on Environmental Information Processing Technologies, Open Data Standards and Sharing track (95th Annual AMS Meeting, 2015).
- Incorporating the AMS Online Weather Studies Resources In the Design of a New Meteorology Course** (2007) S. L. Arnold, presented at the Educational Initiatives Poster Session, 17th Symposium on Education (88th Annual AMS Meeting, 2008).
- Open Source Technologies in Science Education: What's Your Geek IQ?** (2004) S. L. Arnold, presented at the Joint Session on Cyberinfrastructure to Support Atmospheric and Oceanic Education: Examples and Strategies, 14th Symp. on Education (85th Annual AMS Meeting, 2005).
- The Meteorological And Range Safety Support (MARSS) System: a GIS-based Tool for Launch Area Hazard Prediction and Visualization** (2004) S. L. Arnold, A. Dianic, and E. Magnuson, presented at the 21st Int Conf on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology (85th Annual AMS Meeting, 2005).
- An Operational System for Real-time Lightning Display and Resource Protection** (2004) E. Magnuson, S. L. Arnold, and A. Dianic, presented at the Conference on Meteorological Applications of Lightning Data (85th Annual AMS Meeting, 2005).
- A Minimum Variance Approach to Estimating Wind Direction Statistics** (2001) S. L. Arnold, presented at the 18th Int Conf on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology (82nd Annual AMS Meeting, 2002).
- Physical & Thermodynamic Properties of Hypergolic Propellants: A Review and Update.** (1999) S. L. Arnold, presented at the 1999 JANNAF Inter-agency Propulsion Committee, PD&CS, and S&EPS Joint Meeting, San Diego, CA.

Professional

- Affiliations:** American Meteorological Society, American Geophysical Union, Assoc. for Computing Machinery, Computer Science Teachers Assoc, American Federation of Teachers
- Interests:** Earth Science Education, Computer Literacy/Fluency, Privacy and Security, Linux and Open Source, Environmental Risks and Hazards, Space Exploration and Technology

Personal

- Home sites:** <http://www.gentoo geek.org> and <http://dev.gentoo.org/~nerdboy/>
- Repositories:** <https://github.com/sarnold> and <https://github.com/VCTLabs>
- Publications:** http://www.researchgate.net/profile/Stephen_Arnold4
- Interests:** Guitar/Bass/Percussion, Science Fiction, Open Source

Appendix A

Example of open source use in engineering; graphviz diagrams and IV&V.

Overall IV&V Engineering Process for Tracking Anomaly Reports

- Revise: Problem described in AR was partially fixed but needs additional work; a new revision of an AR has been written.
- Validate: Developer/customer validates ARs in the Pending state.
- Prioritize: Developer/customer prioritizes ARs and assign to project(s).
- Verify: IV&V verifies ARs declared fixed by the developer. Partial fixes generate a revision of the original AR (the latter is closed based on the partial fix).
- Report: IV&V reports new ARs, AR State changes, and status of open ARs.

AR States and Status

- Draft State: Anomaly Reports begin in a draft status for IV&V peer review; refined drafts may be circulated outside IV&V if warranted.
 - Draft Status: IV&V peer review of potential anomalies results in publication of draft AR.
- Open State: Open ARs begin with a status of "Pending" when an approved draft AR is published. Engineering review leads to the next status change, typically "Valid". Valid ARs are prioritized and assigned to an appropriate project; when engineering considers the problem fixed, the AR status is changed to "Fixed". Fixed ARs are verified by IV&V, and their status changed to "Verified" if the problem was fixed. In the case of a "partial" fix, the original AR is declared "Verified" and closed based on the fix, and a new revision of the AR is written to describe any remaining issues.
 - Pending Status: An original or revised AR is generated, entered in the database, and delivered to project distribution list.
 - Valid Status: Developer (or customer) validates that AR identifies an error or problem condition that must be fixed.
 - Fixed Status: Problem described in AR is considered fixed by developer but has not been verified by IV&V.
 - Verified Status: Problem has been fixed by developer and IV&V has verified the fix.
- Closed state: Typically closed ARs have the status "Verified" (verified by IV&V), however, there are several other potential status flags for closed ARs, depending on the circumstances (see below).
 - Invalid Status: AR is considered technically inaccurate and does not describe an error.
 - Rejected Status: AR is technically accurate but the problem will not be fixed due to non-technical reasons.
 - Accepted Risk Status: Cost/benefit ratio does not justify fixing the problem.
 - Unverifiable Status: Original problem cannot be recreated in order to verify fix, and there is no other recourse.
 - Reconfigured Status: System has changed such that the original problem no longer applies.

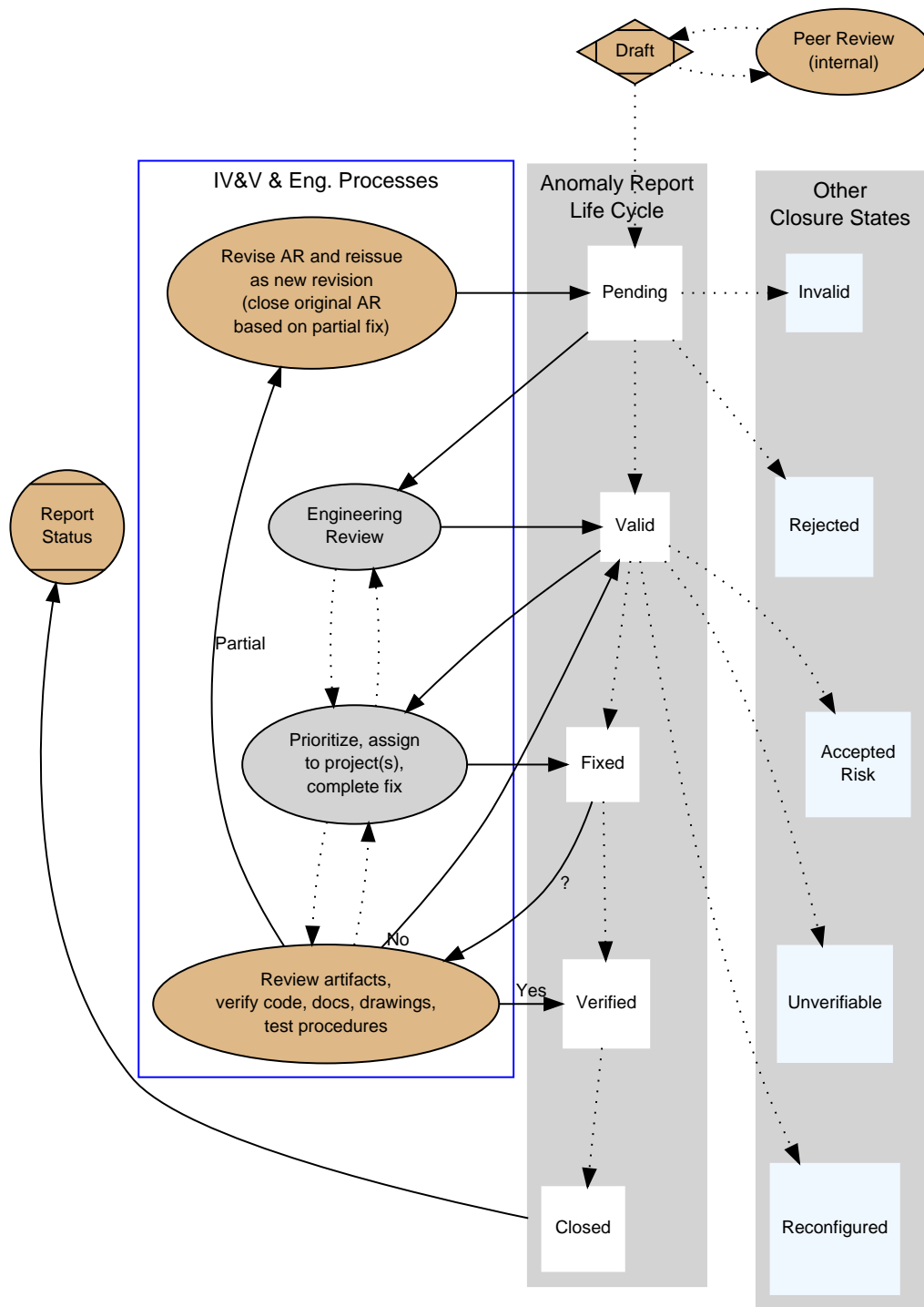


Fig A. Anomaly Report (AR) State Diagram

The Dot source code for the graphviz diagram is included below.

```
1 digraph G {
2     size="6,8";
3     // ratio=fill;
4     compound=true;
5     labelfontname=Arial;
6     fontname=Arial;
7     fontsize=10;
8     subgraph cluster0 {
9         node [style=filled,color=white,shape=square,fontname=Arial,fontsize=10];
10        style=filled;
11        color=lightgrey;
12        fontname=Arial;
13        fontsize=12;
14        label = "Anomaly Report\nLife Cycle";
15
16        Pending -> Valid -> Fixed -> Verified -> Closed [style=dotted];
17    }
18    subgraph cluster1 {
19        node [style=filled,fontname=Arial,fontsize=10];
20        fontname=Arial;
21        fontsize=12;
22        label = "IV&V & Eng. Processes";
23        color=blue
24
25        revise [label="Revise AR and reissue\nas new revision\n(close original AR\nbased on partial fix)",fillcolor=burlywood]
26        validate [label="Engineer\nReview"];
27        prioritize [label="Prioritize, assign\nto project(s),\ncomplete fix"];
28        verify [label="Review artifacts,\nverify code, docs, drawings,\ntest procedures",fillcolor=burlywood];
29
30        revise -> validate -> prioritize -> verify [style=invis];
31    }
32    subgraph cluster2 {
33        node [style=filled,color=powderblue,shape=square,fontname=Arial,fontsize=10];
34        style=filled;
35        color=lightgrey;
36        fontname=Arial;
37        fontsize=12;
38        label = "Additional\nClosure Status";
39
40        Invalid -> Rejected -> Accepted -> Unverifiable -> Reconfigured [style=invis];
41    }
42    ranksep=.75;
43
44    { rank = same; "Draft"; "peer"; };
45    { rank = same; "revise"; "Pending"; };
46    { rank = same; "Pending"; "Invalid"; };
47    // { rank = same; "Closed"; "report"; };
48    // { rank = same; ""; ""; };
49
50    Draft [style=filled,shape=Mdiamond,fillcolor=burlywood,fontname=Arial,fontsize=10];
51    peer [style=filled,label="Peer Review\n(internal)",fillcolor=burlywood,fontname=Arial,fontsize=10];
52    report [style=filled,shape=Mcircle,label="Report\nStatus",fillcolor=burlywood,fontname=Arial,fontsize=10];
53    Accepted [label="Accepted\nRisk"]
54
55    Draft -> peer [style=dotted];
56    peer -> Draft [style=dotted];
57    Draft -> Pending [style=dotted];
58    Pending -> validate;
59    Pending -> Invalid [style=dotted];
60    Pending -> Rejected [style=dotted];
61    validate -> Valid;
62    prioritize -> validate [style=dotted];
63    validate -> prioritize [style=dotted];
64    Valid -> prioritize;
65    Valid -> Accepted [style=dotted];
66    Valid -> Unverifiable [style=dotted];
67    Valid -> Reconfigured [style=dotted];
68    prioritize -> verify [style=dotted];
69    verify -> prioritize [style=dotted];
70    prioritize -> Fixed;
71    Fixed -> verify [label="?",fontname=Arial,fontsize=10];
72    verify -> Verified [label="Yes",fontname=Arial,fontsize=10];
73    verify -> revise [label="Partial",fontname=Arial,fontsize=10];
74    verify -> Valid [taillabel="No",fontname=Arial,fontsize=10];
75    verify -> report [style=invis];
76    revise -> Pending;
77    Closed -> report [weight=10,ltail=cluster0];
78    Reconfigured -> report [weight=10,ltail=cluster2];
79 }
80
```

Appendix B

Experiments in git commit graphs using Graphviz (approx. 10 years of data).

The full graphs are too large and/or not "compatible" enough to embed in a simple document; the full size .svg graphs are hosted on dev.gentoo.org.

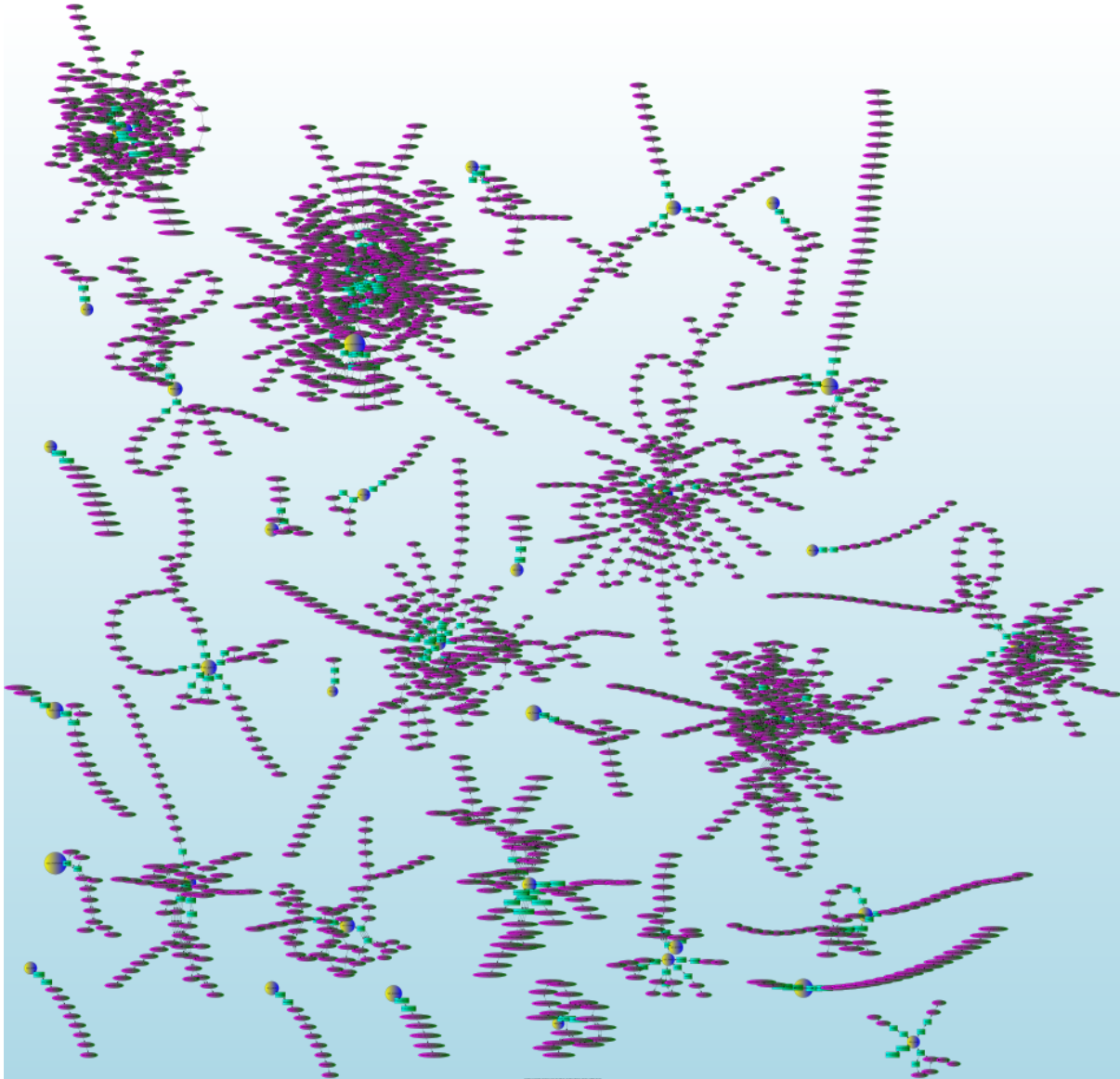


Fig B. Category / Package Cluster Graph, Gentoo Linux commits by nerdboy, 2003 - 2013