

Continuous Compliance @ Linaro

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SFSCON 2023, Bolzano - EU, Italy



Linaro
Developer Services

Agenda

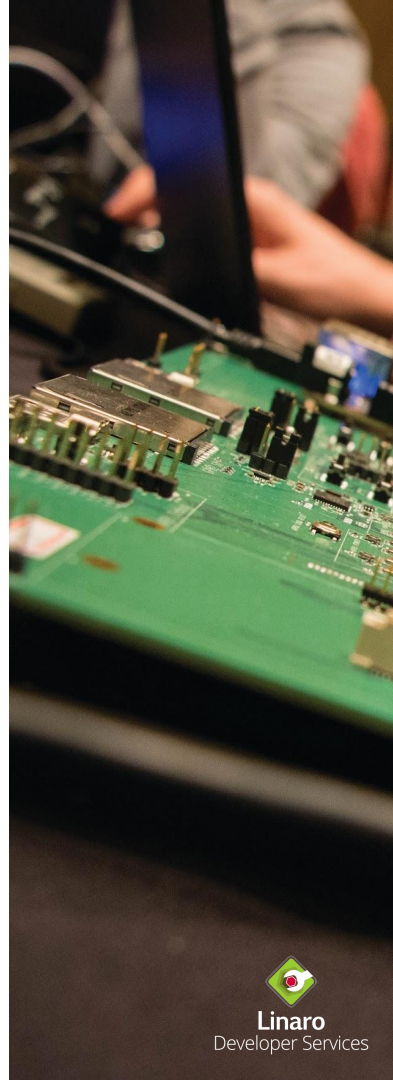
- Rearview mirror - Linaro's original charter
- Linaro's main contributions and involvement
- Compliance expectations in collaborative engineering
- An evolving organization
- Addressing evolving requirements and new users
- Linaro's three-legged stool
- From upstream to production-grade open-source
- Continuous-compliance enables production-grade



Linaro's original charter

Consolidation of the Arm codebase

- Founded in 2010, announced @ Computex by initial members
- Formed to provide “new resources and industry alignment for open source software developers using Linux”
- Support for Arm SoCs in open-source had been delayed and hindered by industry fragmentation
- Collaborative engineering organization
 - Collaboration to create open technology and standards
 - Fostering open-source engineering excellence
 - Reduce costs of development by sharing resources



Core Technologies

- Initial areas of focus
 - Linux kernel
 - Toolchain
 - Bootloader
 - QEMU
 - Testing and CI

Most active employers, 5.18 to 6.3

Architecture subsystems			Driver subsystems		
Linaro	1941	15.4%	Intel	7189	14.9%
Google	1359	10.8%	AMD	4147	8.6%
IBM	1050	8.3%	(Unknown)	3292	6.8%
(Unknown)	789	6.3%	Linaro	2667	5.5%
Intel	638	5.1%	(None)	2437	5.1%
(None)	569	4.5%	Huawei Technologies	2154	4.5%
Red Hat	529	4.2%	Red Hat	2122	4.4%
Arm	430	3.4%	NVIDIA	1831	3.8%
Renesas Electronics	324	2.6%	Google	1738	3.6%
CS Group	240	1.9%	Pengutronix	1430	3.0%

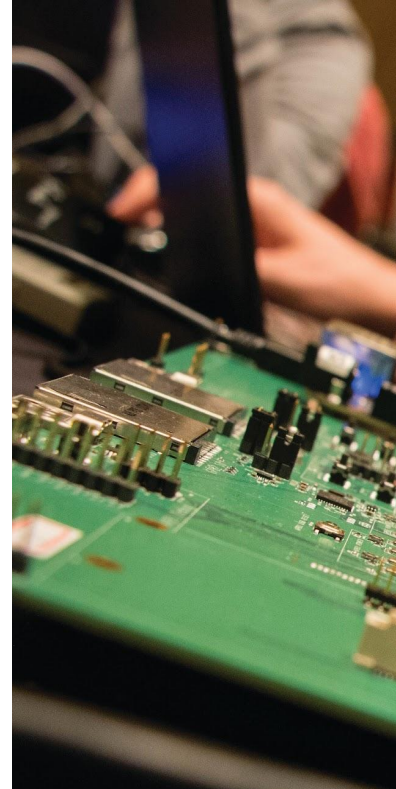
<https://lwn.net/Articles/929582/>

Most active 6.3 developers

By changesets		By changed lines	
Krzysztof Kozlowski	387 2.7%	Arnd Bergmann	160437 16.4%
Dmitry Baryshkov	317 2.2%	Kalle Valo	53435 5.5%
Arnd Bergmann	185 1.3%	Greg Kroah-Hartman	52609 5.4%
Andy Shevchenko	175 1.2%	Hans Verkuil	28249 2.9%
Christoph Hellwig	167 1.2%	Cai Huoqing	19975 2.0%
Uwe Kleine-König	163 1.1%	Wenjing Liu	18159 1.9%
Konrad Dybco	118 0.8%	Thierry Reding	13698 1.4%
Sean Christopherson	113 0.8%	Dmitry Baryshkov	12724 1.3%
Martin Kaiser	113 0.8%	Trevor Wu	12633 1.3%
Chuck Lever	109 0.8%	Abel Vesa	11843 1.2%
Hans de Goede	104 0.7%	Jakub Kicinski	11591 1.2%
Johan Hovold	99 0.7%	Krzysztof Kozlowski	9418 1.0%
Thomas Zimmermann	99 0.7%	Steen Hegelund	9124 0.9%
Ville Syrjälä	98 0.7%	Jacek Lawrynowicz	8802 0.9%
Mark Brown	97 0.7%	Herbert Xu	7601 0.8%
Vladimir Oltean	96 0.7%	Ondrej Zary	7584 0.8%
Greg Kroah-Hartman	96 0.7%	Shazad Hussain	7438 0.8%
Randy Dunlap	95 0.7%	Herve Codina	7032 0.7%
Jakub Kicinski	93 0.6%	Bjorn Andersson	6943 0.7%
Jonathan Cameron	92 0.6%	Neil Armstrong	6769 0.7%

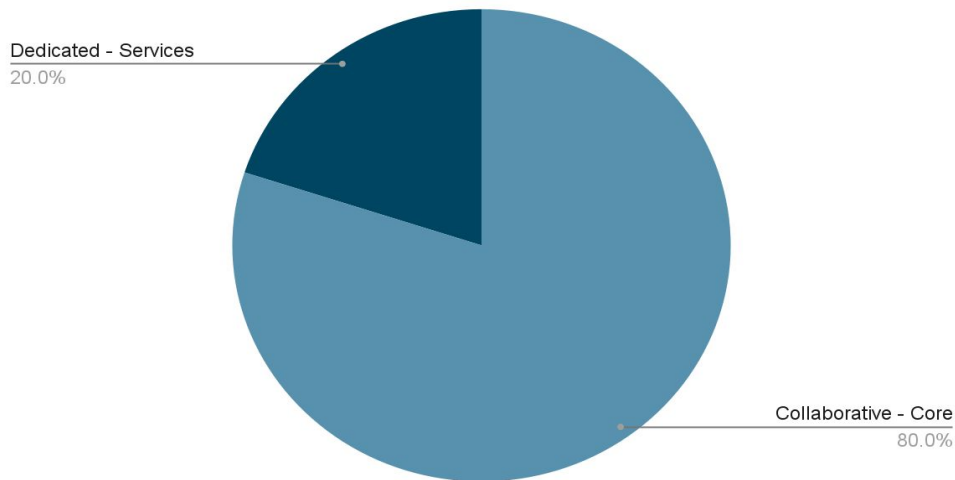
Most active 6.3 employers

By changesets		By lines changed	
Linaro	1752 12.1%	Linaro	236941 24.2%
Intel	1416 9.8%	Qualcomm	80099 8.2%
Red Hat	1013 7.0%	(Unknown)	61511 6.3%
(Unknown)	957 6.6%	Intel	57448 5.9%
Google	840 5.8%	Linux Foundation	53935 5.5%
(None)	686 4.8%	Red Hat	50334 5.1%
AMD	601 4.2%	AMD	38130 3.9%
IBM	460 3.2%	NVIDIA	35199 3.6%
NVIDIA	455 3.2%	Cisco	28249 2.9%
Huawei Technologies	413 2.9%	Google	24424 2.5%
Oracle	393 2.7%	IBM	21713 2.2%
Meta	363 2.5%	Meta	21334 2.2%
SUSE	320 2.2%	(None)	18667 1.9%
(Consultant)	300 2.1%	Microchip Technology Inc.	17778 1.8%
Pengutronix	265 1.8%	MediaTek	17113 1.8%
Renesas Electronics	224 1.6%	Oracle	12501 1.3%
Qualcomm	210 1.5%	(Consultant)	11013 1.1%
NXP Semiconductors	201 1.4%	Bootlin	8681 0.9%
Microchip Technology Inc.	166 1.2%	SUSE	7865 0.8%
Linux Foundation	165 1.1%	Renesas Electronics	6893 0.7%

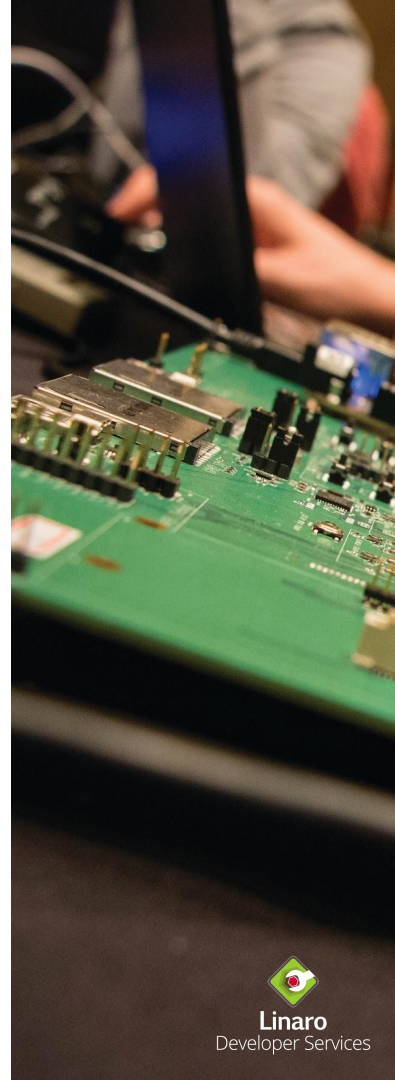


Collaborative vs Dedicated

Linaro Engineering Activity

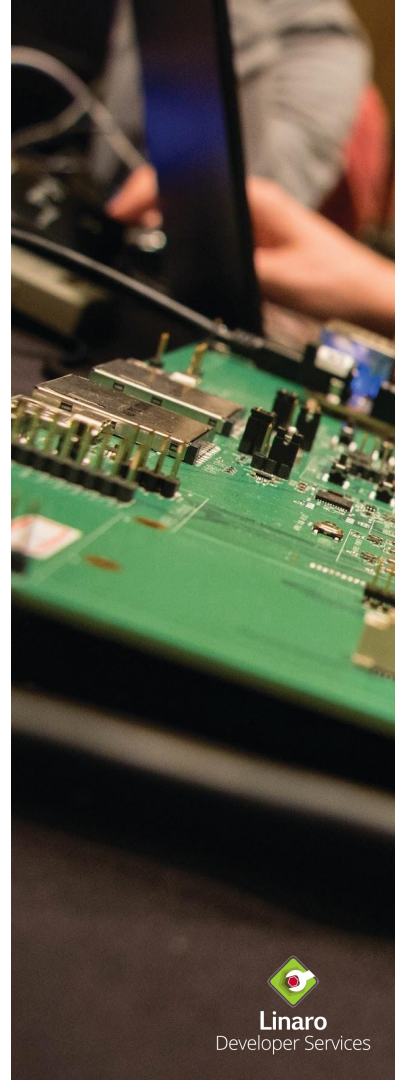


Examples: QEMU vs SOC, upstreaming vs release packaging



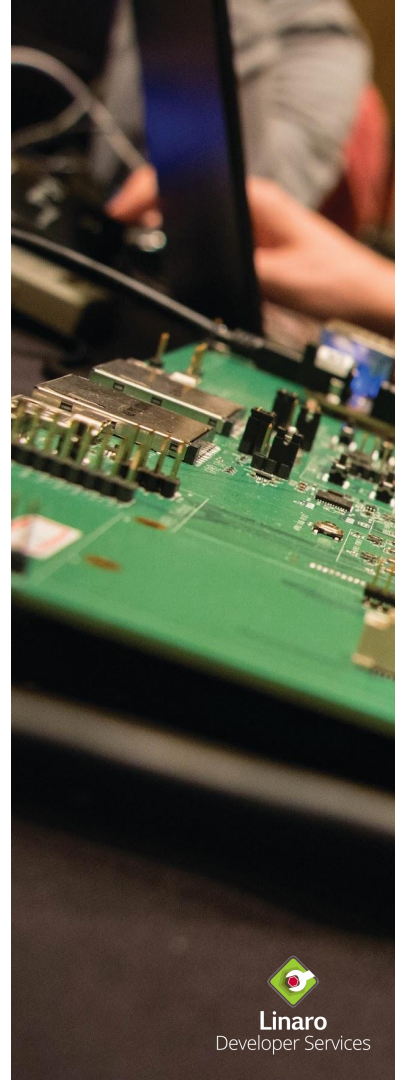
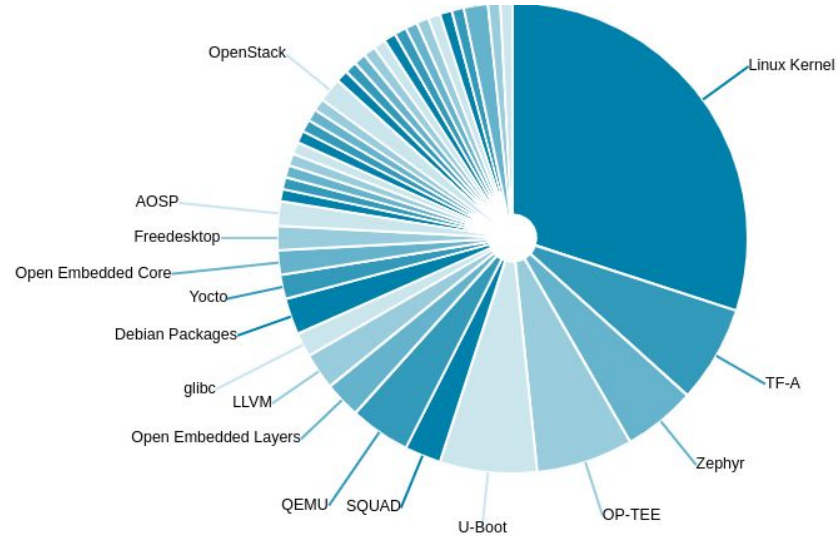
Compliance expectations

- Collaborative upstreaming
- Upstream first mindset
- Minimal or no hosting nor redistribution of software
- IP and FOSS compliance training would suffice
- Collaboration-friendly licenses, multi vendor



An evolving organization

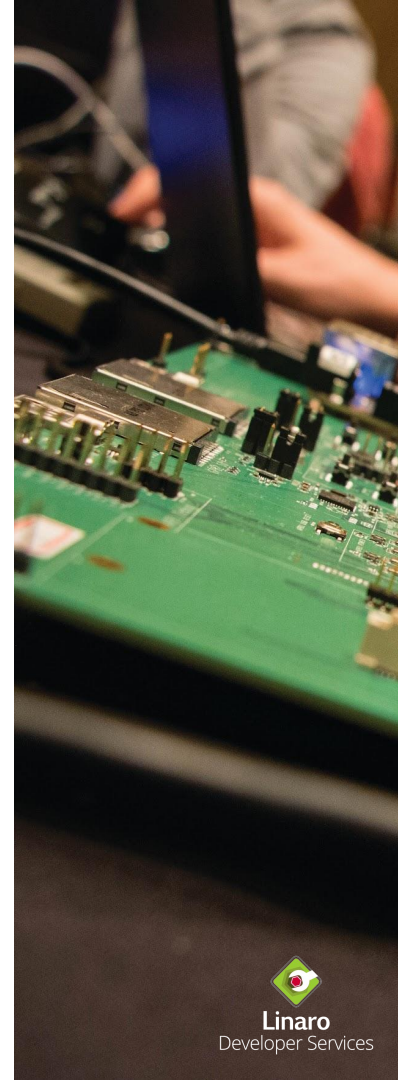
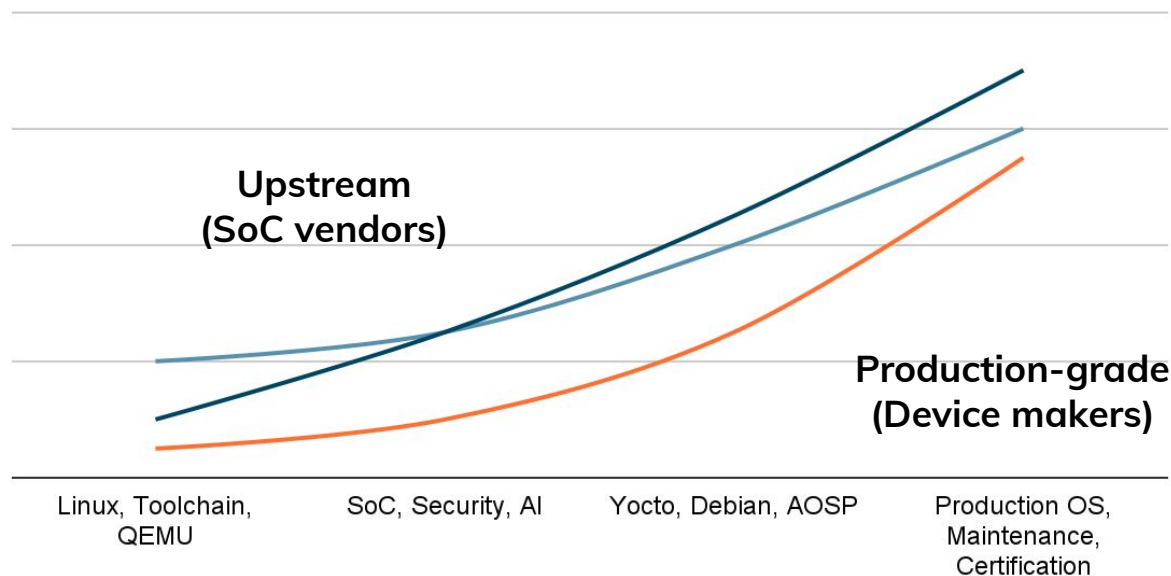
- Initial areas of focus
 - Linux kernel
 - Toolchain
 - Bootloader
 - QEMU
 - Testing and CI
- Following up
 - Security
 - Artificial Intelligence
 - Zephyr and RTOSes
- And then again
 - Android and AOSP
 - Automotive, Edge and IloT
 - Yocto, OE, Debian



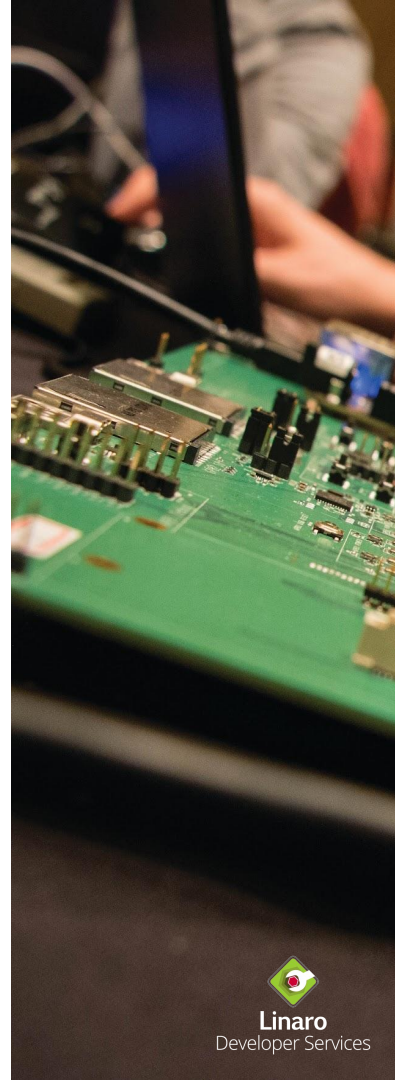
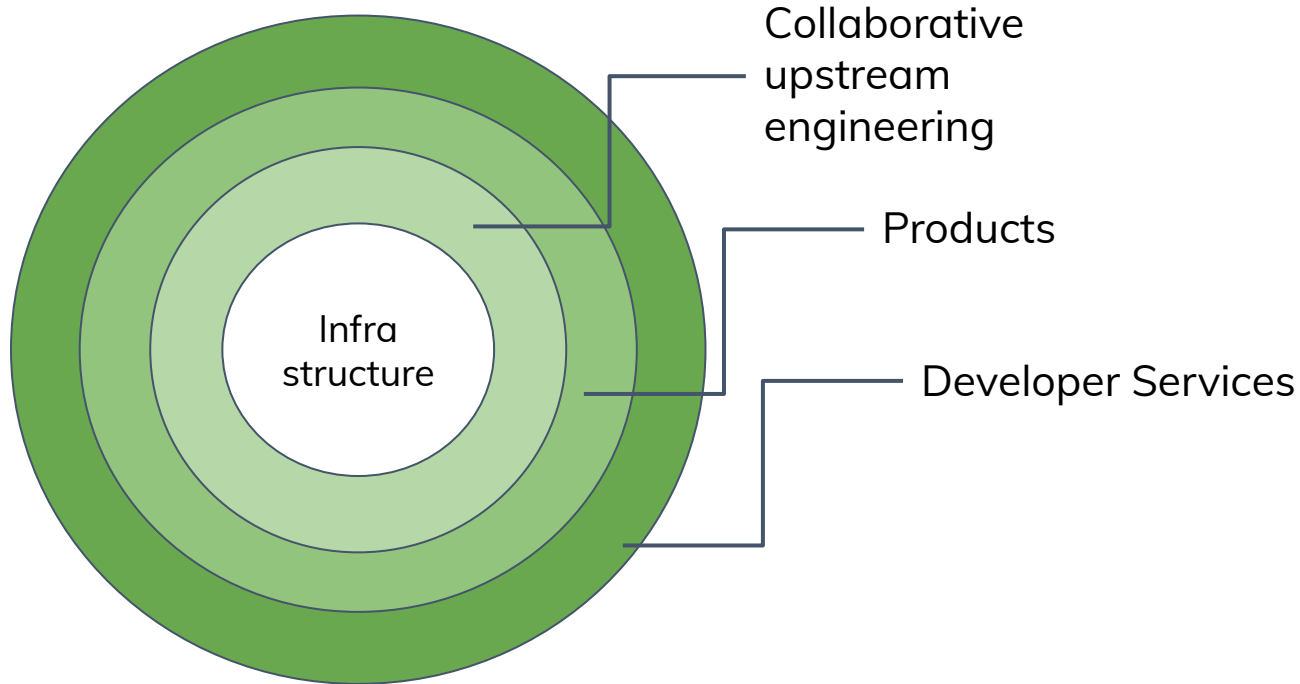
Addressing evolving requirements

Evolving requirements

— Dedicated Engineering — Compliance Readiness — CI/CD and Devops

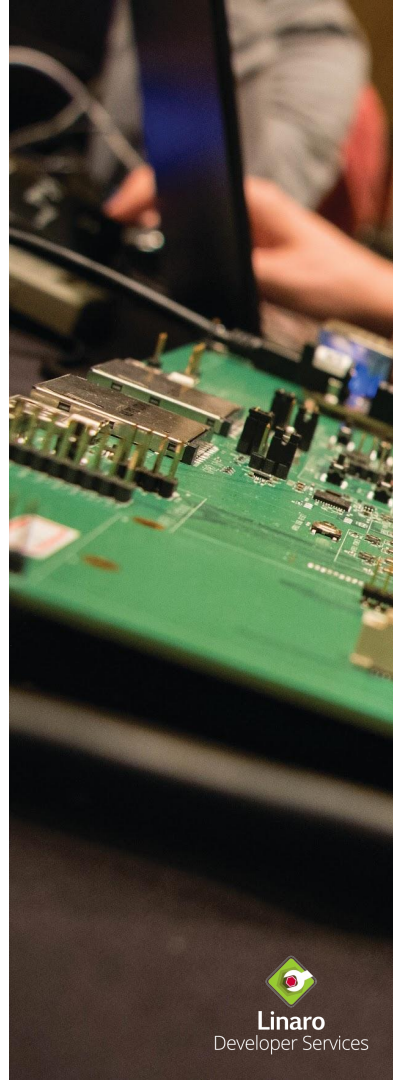


A three-legged open-source stool



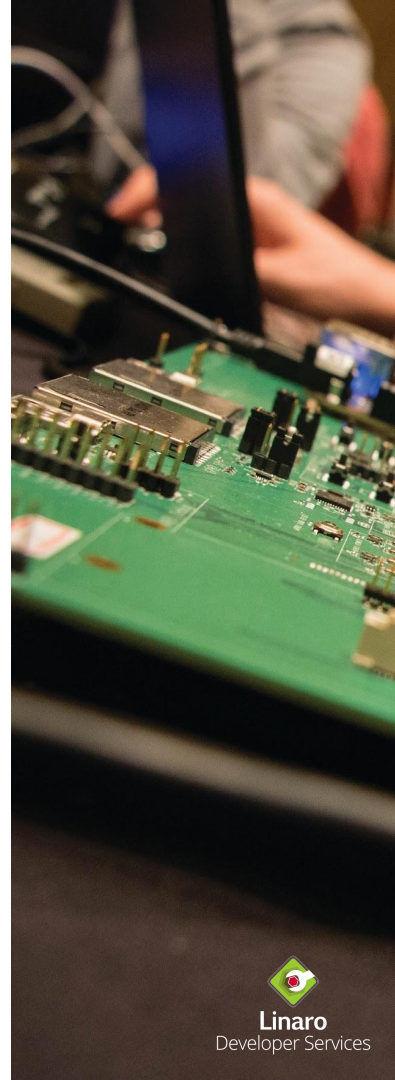
Production-grade open-source

- Production-grade driven development
 - Development processes optimized for longevity and sustainability
 - Constrain costs of ownership and maintenance
 - Minimize technical debt and divergence from upstream
- Selection, integration, packaging of upstream components
- Continuous integration, continuous testing
 - Track upstream
 - Tagging releases
 - Identify functional and system performance regressions
- Release hosting and management
- Release documentation and user experience
- Continuous deployment
 - Release lifecycle management
 - Current vs end of life vs parallel releases
 - OTA



Continuous Compliance

- Beyond training
 - Training
 - Corporate mission
 - Processes and standards (i.e. OpenChain)
- Infrastructure
 - Code (git) and binaries (releases)
 - Public and private branches
 - Multi Tenancy
 - Code 2 Audit toolchain (i.e. from git to bitbake to fossology)
- Continuous compliance
 - Certification artifacts
 - Release notes
 - Testing artifacts
 - Low definition SW BOMs
 - High definition SW BOMs and 3rd party notices
- Scale across distributions
 - AOSP, Yocto Project, Debian



A person wearing a checkered shirt is working on a green printed circuit board (PCB) in a workshop. The background is blurred, showing other people and warm lighting. A dark blue diagonal overlay covers the bottom left portion of the image.

Thank you

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Developer Services