Report for Questionnaire on Opening-Up Software Platforms

1. Response Counts

Completion Rate: 100%

Complete	18
Total	18

2. What is the domain of your platform (e.g., finance, software development, games, content management)?


Count	Response
2	software development
1	Computer Aided Design, Computer Aided Engineering and manufacture,
1	Energy
1	Industrial Data Analytics
1	Industry
1	IoT
1	Monitor & control of disciplines in buildings: HVAC, somfort, fire safety, security, video, access control, intrusion
1	Providing connectivity to building infrastructure systems (heating, cooling, fire detection, access controls, CCTV,...)
1	Rail Transportation
1	Railway Infrastructure Systems
1	SW development in large IoT devices
1	automotive
1	diagnostics and maintenance
1	medical app dev
1	software deployment
1	system development
1	web applications in general (implemented in python/django)

3. If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms?Our platform is very similar to …

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Linux kernel (extensible with driver modules)	1 5.6%	4 22.2%	1 5.6%	4 22.2%	8 44.4%
Android OS (extensible with apps)	1 5.6%	8 44.4%	1 5.6%	5 27.8%	3 16.7%
Apple iOS (extensible with apps)	1 5.6%	5 27.8%	2 11.1%	6 33.3%	4 22.2%
Photoshop (extensible with plugins)	1 5.6%	4 22.2%	2 11.1%	6 33.3%	5 27.8%
Eclipse IDE (extensible with plugin bundles)	4 22.2%	4 22.2%	2 11.1%	3 16.7%	5 27.8%
BlueMix:If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms? Our platform is very similar to …	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%
FeatureHouse (static composition):If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms? Our platform is very similar to …	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
HTTP (extensible via presentation layer):If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms? Our platform is very similar to …	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%
OSGi:If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms? Our platform is very similar to …	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%
extensible with often internally used plug-ins:If you had to characterize your open platform by comparing it to other well-known platforms, to which extent do you agree it is similar to one of the following platforms? Our platform is very similar to …	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

4. Who are the users of your platform?
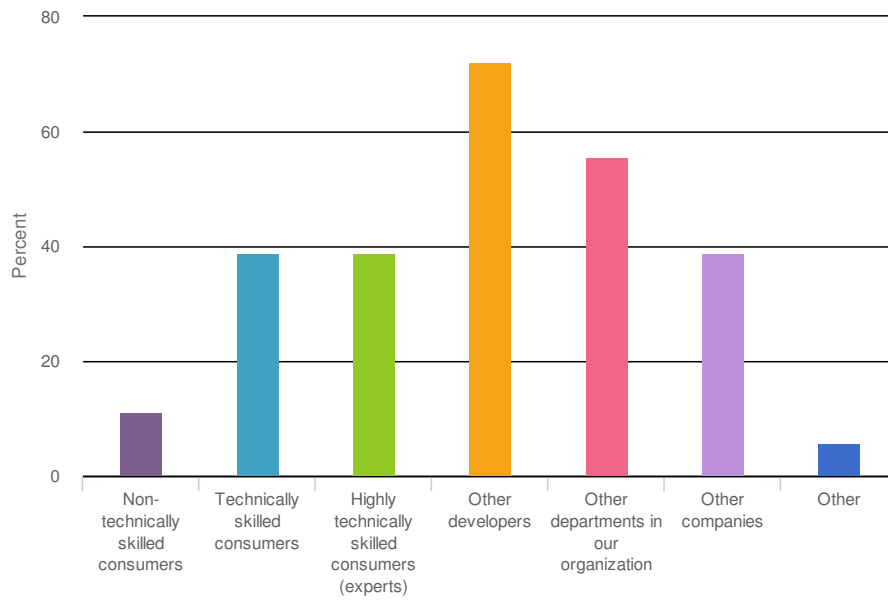
Value	Percent		Count
Non-technically skilled consumers	11.1%		2
Technically skilled consumers	38.9%		7
Highly technically skilled consumers (experts)	38.9%		7
Other developers	72.2%		13
Other departments in our organization	55.6%		10
Other companies	38.9%		7
Other	5.6%		1

Other	Count
Business partners	1
Total	1

5. Using which of the following programming language(s) is your platform realized?
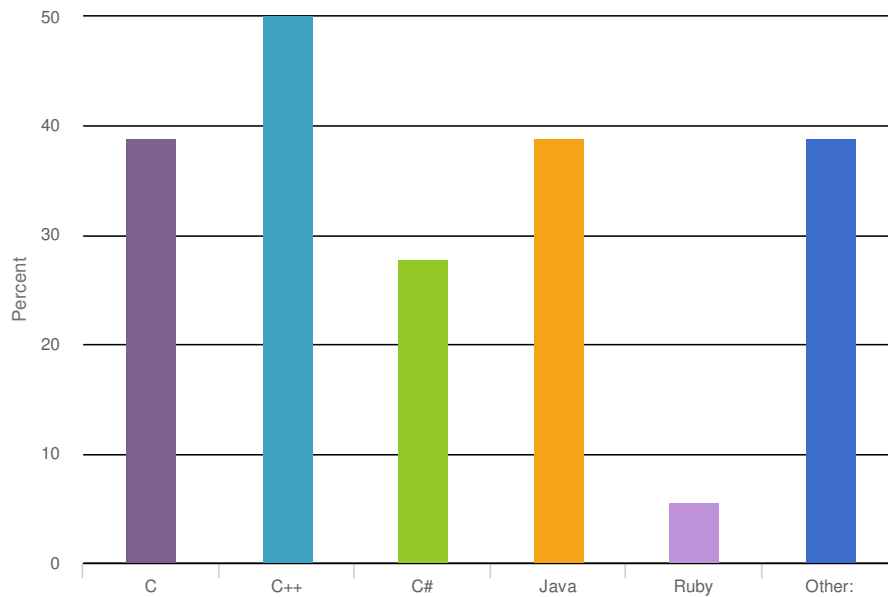
Value	Percent		Count
C	38.9%		7
C++	50.0%		9
C#	27.8%		5
Java	38.9%		7
Ruby	5.6%		1
Other:	38.9%		7

Other:	Count
HTML/JS/CSS	1
Prolog	1
Python	1
Various scripting languages	1
domain specific language	1
js	1
Total	6

6. What are the extensions to your platform called?
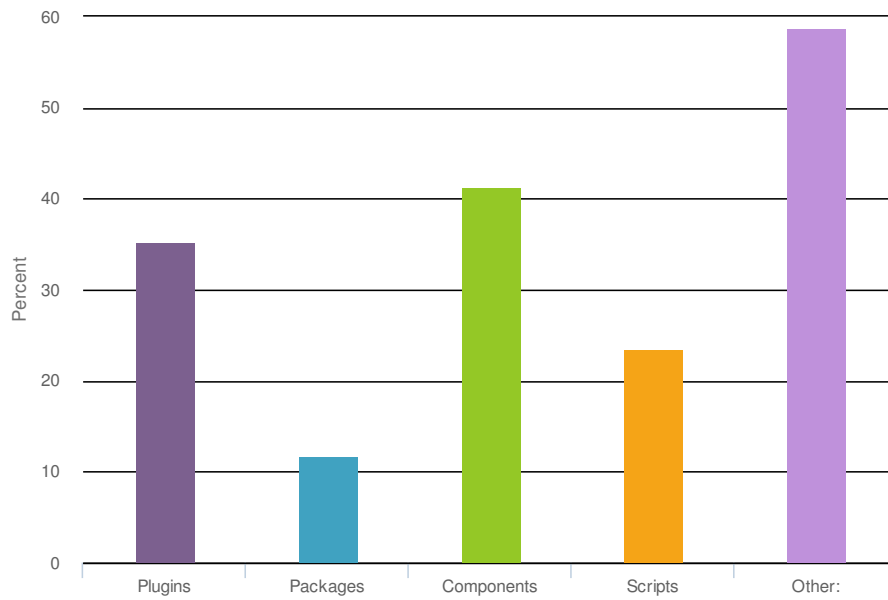
Value	Percent		Count
Plugins	35.3%		6
Packages	11.8%		2
Components	41.2%		7
Scripts	23.5%		4
Other:	58.8%		10

Other:	Count
Applications	2
Add-Ons, Applications	1
Drivers, snap-ins, libraries	1
Features	1
GUI widgets	1
Services	1
applications	1
droplets	1
Total	9

7. How large is your platform currently in lines of code (LOC)?

16.68% 5,000,001 LOC – 20,000,000 LOC

5.59% 50,000 – 150,000 LOC

33.27% 150,001 – 500,000 LOC

27.77% 1,000,001 – 5,000,000 LOC

16.68% 500,001 – 1,000,000 LOC
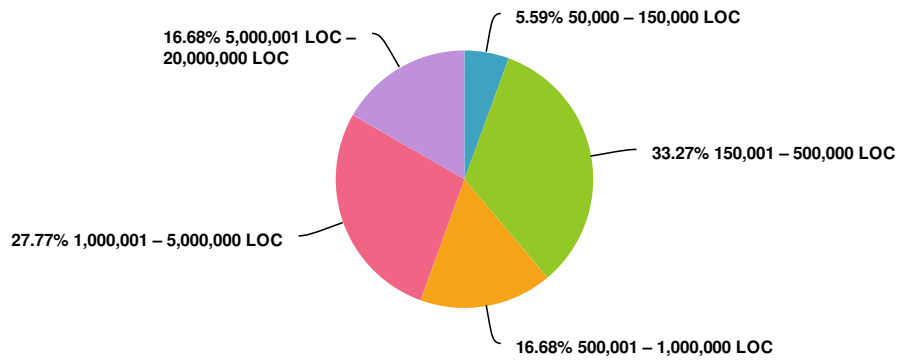
Value	Percent		Count
50,000 – 150,000 LOC	5.6%		1
150,001 – 500,000 LOC	33.3%		6
500,001 – 1,000,000 LOC	16.7%		3
1,000,001 – 5,000,000 LOC	27.8%		5
5,000,001 LOC – 20,000,000 LOC	16.7%		3
	Total		**18**

8. How many people are currently and actively involved in developing, maintaining, and testing the platform?
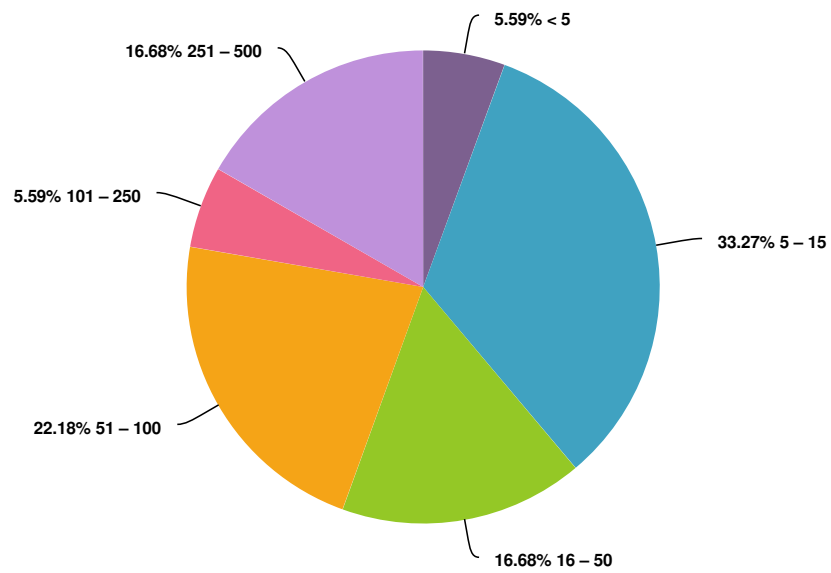
Value	Percent		Count
< 5	5.6%		1
5 – 15	33.3%		6
16 – 50	16.7%		3
51 – 100	22.2%		4
101 – 250	5.6%		1
251 – 500	16.7%		3
		Total	18

9. Were there any problems with the closed platforms that led to opening it up?
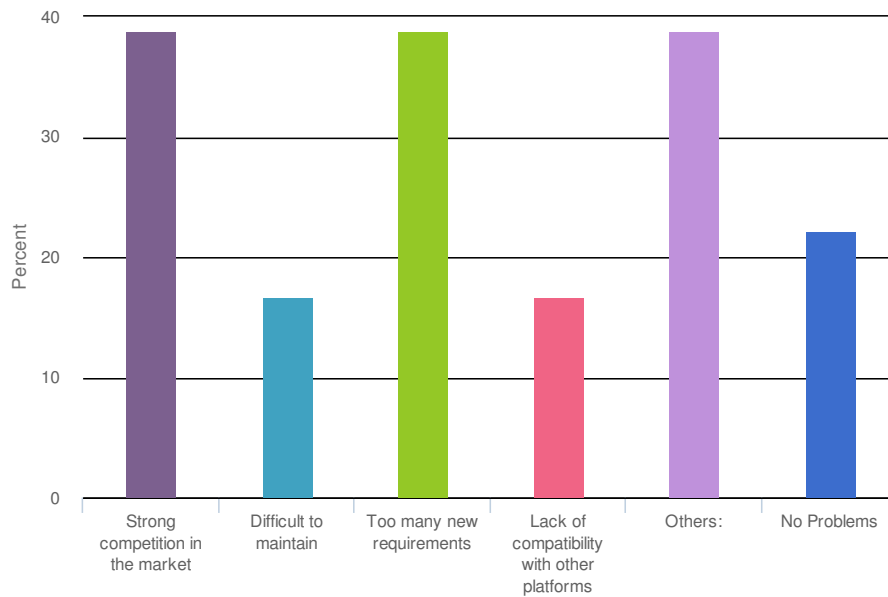
Value	Percent		Count
Strong competition in the market	38.9%		7
Difficult to maintain	16.7%		3
Too many new requirements	38.9%		7
Lack of compatibility with other platforms	16.7%		3
Others:	38.9%		7
No Problems	22.2%		4

| Others:	Count
Contradicting requirements	1
Not all features can be developed by our own	1
Scale effects for development	1
allow easy integration for other tool vendors	1
designed as open platform	1
too complex and diverse integration	1
Total	6

10. What were the business intentions for opening up the platform?
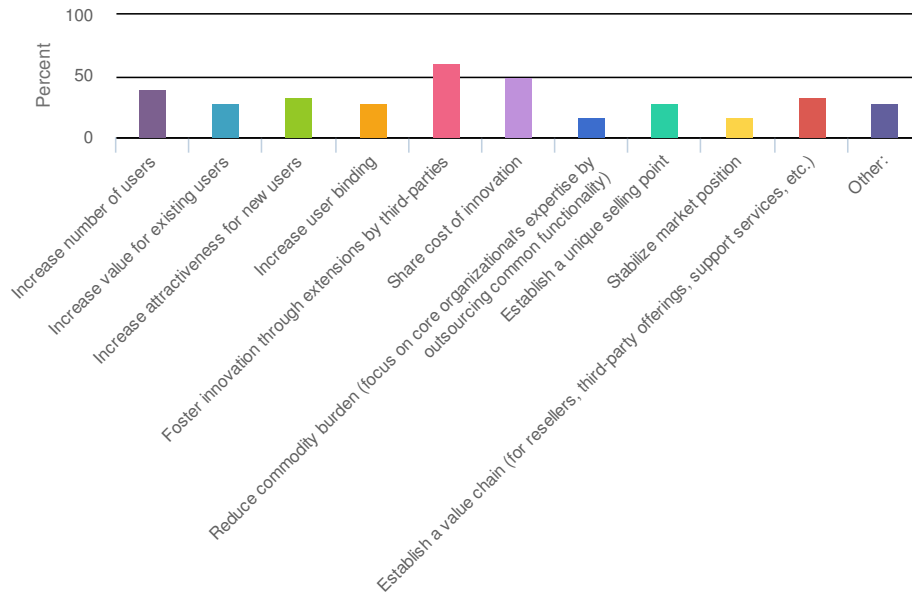
Value	Percent		Count
Increase number of users	38.9%		7
Increase value for existing users	27.8%		5
Increase attractiveness for new users	33.3%		6
Increase user binding	27.8%		5
Foster innovation through extensions by third-parties	61.1%		11
Share cost of innovation	50.0%		9
Reduce commodity burden (focus on core organizational's expertise by outsourcing common functionality)	16.7%		3
Establish a unique selling point	27.8%		5
Stabilize market position	16.7%		3
Establish a value chain (for resellers, third-party offerings, support services, etc.)	33.3%		6
Other:	27.8%		5

Other:	Count
Less company internal synchronization	1
Originally designed as an open platform, revenue generation, increase domain knowledge in platform organisation	1
improve time-to-market	1
new revenue streams, new application areas	1
sell consulting services	1
Total	5

11. What were the technical intentions for opening up the platform?
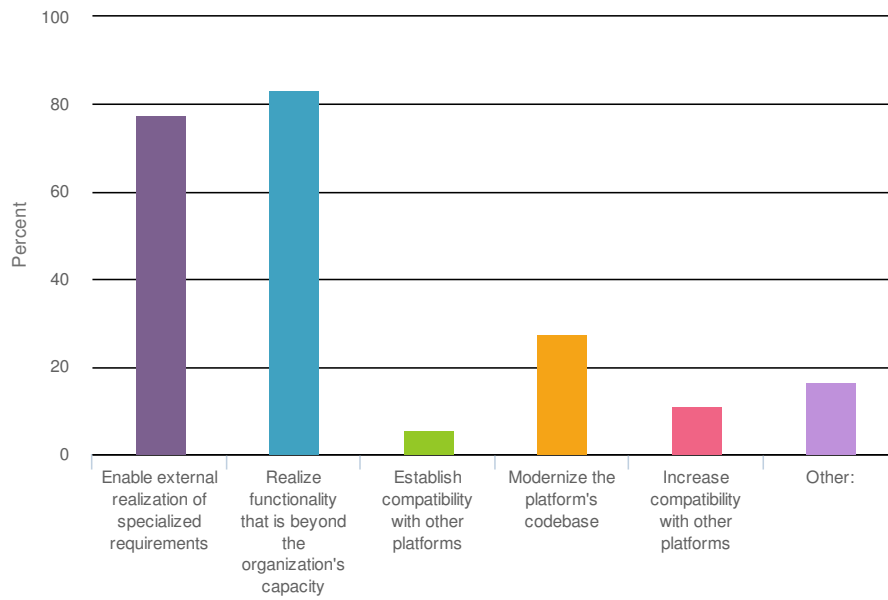

Value	Percent		Count
Enable external realization of specialized requirements	77.8%		14
Realize functionality that is beyond the organization's capacity	83.3%		15
Establish compatibility with other platforms	5.6%		1
Modernize the platform's codebase	27.8%		5
Increase compatibility with other platforms	11.1%		2
Other:	16.7%		3

Other:	Count
Higher release frequency	1
More modularity	1
adapt to upcoming open source components, be faster	1
Total	3

12. How long did the platform exist before it was opened?

Year(s)
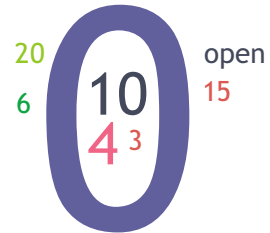
Count	Response
9	0
2	10
2	4
1	0 - always open
1	15
1	20
1	3
1	6

13. How long did it take to open up the platform? Leave empty if still ongoing

Years

20 5 4

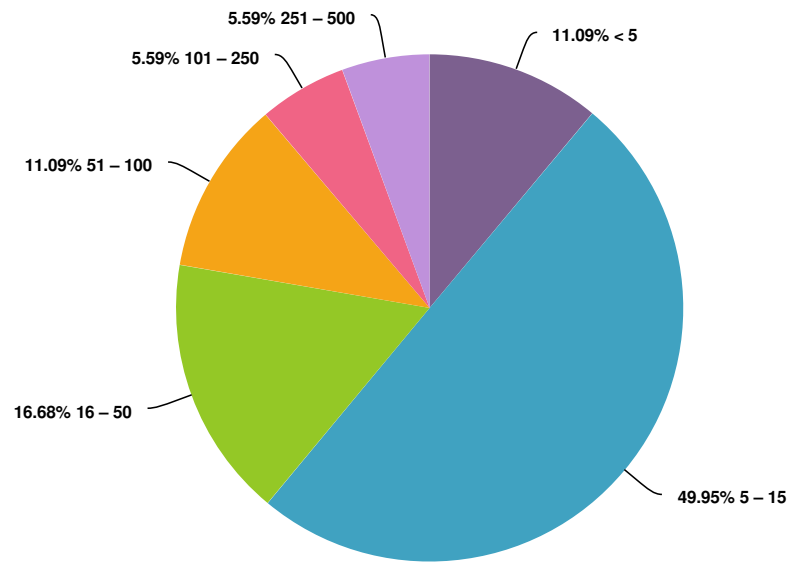| Count	Response
2	0
2	2
1	4
1	5

14. What was the starting point of the opening process?

24.98% Other:

31.27% A previously closed platform existed. The open platform is a re-engineering, refactoring or extension of the previous platform.

31.27% No previous platform existed. The open platform is a completely new implementation.

12.49% A previously closed platform existed. The open platform is a complete re-implementation.
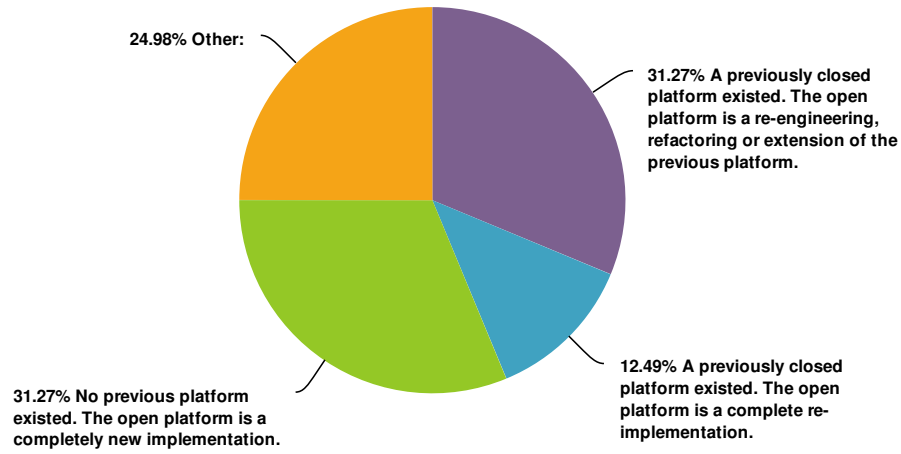
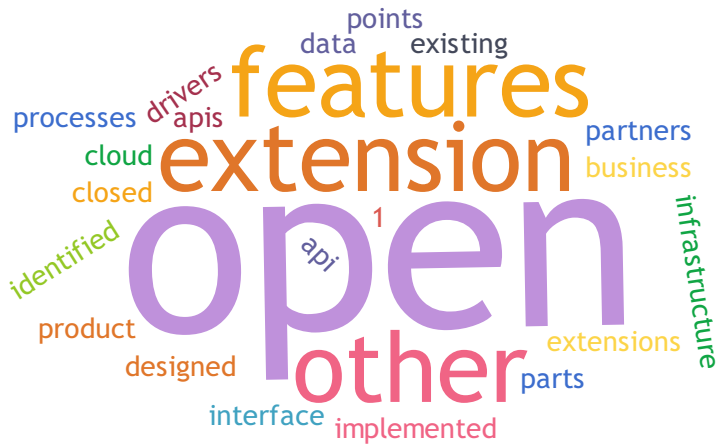| Value	Percent		Count
A previously closed platform existed. The open platform is a re-engineering, refactoring or extension of the previous platform.	31.3%		5
A previously closed platform existed. The open platform is a complete re-implementation.	12.5%		2
No previous platform existed. The open platform is a completely new implementation.	31.3%		5
Other:	25.0%		4
	Total		**16**

Other:	Count
A previously closed platform existed. We made some features directly available to interested clients	1
Add-on to platform	1
We are now working on our 3rd generation open platform, was closed before the 1st generation	1
Total	3

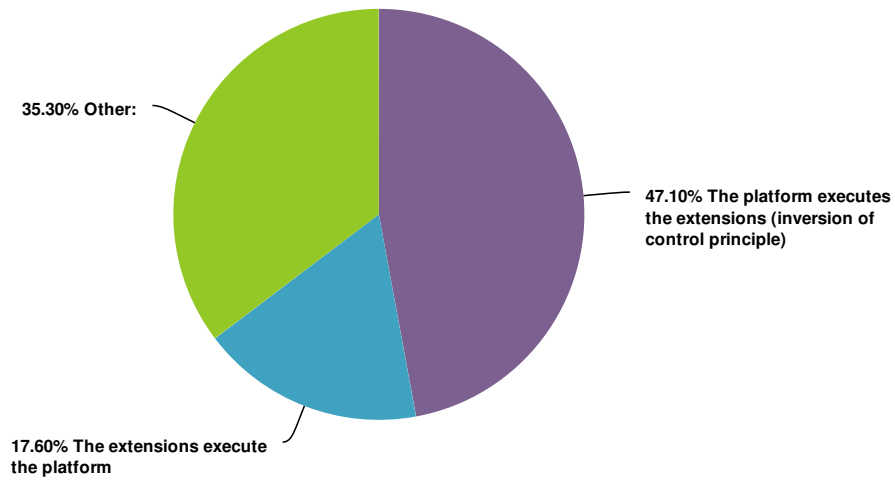## 15. How many people were/are actively involved in opening up the platform?

Value	Percent		Count
< 5	11.1%		2
5 – 15	50.0%		9
16 – 50	16.7%		3
51 – 100	11.1%		2
101 – 250	5.6%		1
251 – 500	5.6%		1
	Total		**18**

16. Can you briefly describe the process or strategy you followed when opening the platform?

| Count	Response
1	- First steps of innovation driven by single employee with management support - Large scale funding support by customer projects in order to scale up product development - Value proposition by limitation of the openness to frontend / mmi only, whereas the proprietary parts of the system remains unaffected and closed (sensible when talking about safety relevance)
1	1st gen We identified partner need for APIs and implemented those 2nd gen New APIs to enable more applications, partner input to APIs 3rd gen New infrastructure with higher security, API input from partners and company internal developers
1	???
1	Asynchronous service oriented interfaces
1	Concentrate on core functionality Scoping take existing frameworks - as much as possible keep complexity low
1	European funded research program
1	Identify extension points for external partners we want to open. This is mainly related to user interface and data integration. In our specific area we had the advantage to know the apps which should be put on top of the platform - so we know the use cases.
1	Not yet started.
1	Platform was designed to be open.
1	Provide basis platform with defined extension mechanisms that allow other departments to build their functional extensions (business logic, drivers of target systems) using predefined extension mechanisms
1	Requirements side: consider which features were on the way to being commodity, and which were more regionally relevant. Define a set of extension points for other sites and organizations to use to map their local needs into the general system concepts (COVs, alarms, points, drivers,...) and then document processes and libraries for exploiting these extension points.
1	Running a double strategy for field agents (data collectors) 1) Fully pre-configured boxed products with full configuration support in the cloud 2) Openly available APIs for custom data collectors and custom parsing and infrastructure only
1	The platform was already open on certain areas but all extensions were developed with the platform. Now the extensions allowed other well-known technologies to be used as well.
1	The product was always designed as a platform. The interface and processes have evolved with best practice and technology
1	Twofold effort. 1. Open up closed platform 1. Bring platform into a cloud environment. Form focus teams for features that are identified to be useful in new cloud based platform. Use relevant parts of already existing products of closed platform and re-engineer them to run as micro-services in an cloud environment. Provide easy to use rest api for these services.
1	new code base started with cooperation of several business units in mind from the beginning Feature creep in the beginnung, too high expectations from everyone, then feature reduction until first release
1	release as open source on github
1	we were doing some consulting and were promoting FOSD. Then, we noticed that two customers had requirements they wanted to implement which we already implemented in another context. Then, we licensed those features to them.

17. How is the execution of the deployed platform controlled?

35.30% Other:

47.10% The platform executes the extensions (inversion of control principle)

17.60% The extensions execute the platform

Value	Percent		Count
The platform executes the extensions (inversion of control principle)	47.1%		8
The extensions execute the platform	17.6%		3
Other:	35.3%		6
		Total	**17**

Other:	Count
both	2
Both of them is possible; depends on the extension point	1
both of the above depending on the way extensions are made	1
manually	1
unclear question	1
Total	6

18. Which of the following extension mechanisms did you incorporate to open the platform and which technology was used?
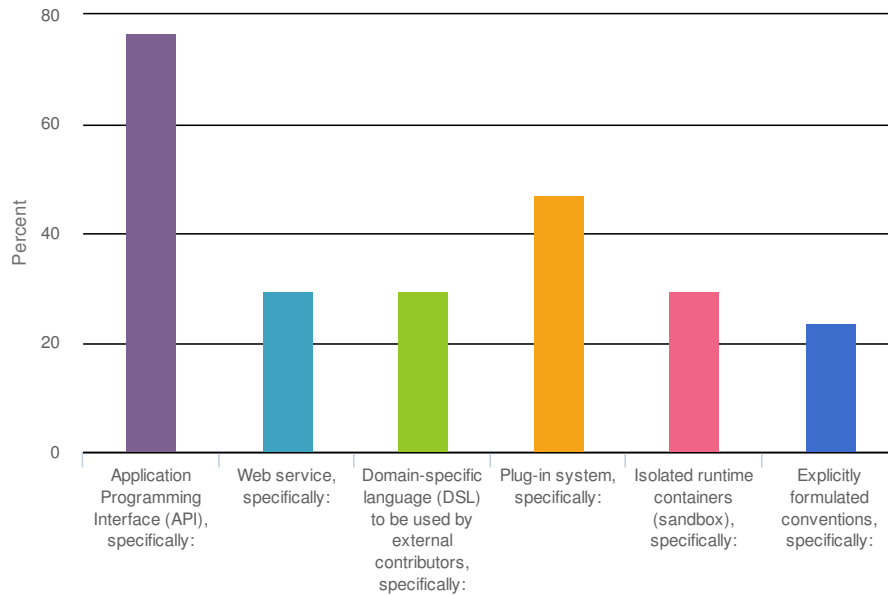
Value	Percent		Count
Application Programming Interface (API), specifically:	76.5%		13
Web service, specifically:	29.4%		5
Domain-specific language (DSL) to be used by external contributors, specifically:	29.4%		5
Plug-in system, specifically:	47.1%		8
Isolated runtime containers (sandbox), specifically:	29.4%		5
Explicitly formulated conventions, specifically:	23.5%		4

Application Programming Interface (API), specifically:	Count
API into process image, into driver framework, UI extensions	1
C-API	1
Custom Agent API	1
Java, Javascript, .NET	1
REST API	1
Service oriented	1
hmi integration	1
plug and play C#,C++ and class based C,	1
Total	8

Web service, specifically:	Count
REST APIs to access services	1
expose values, alarms, and history via web service	1
many…	1
Total	3

Domain-specific language (DSL) to be used by external contributors, specifically:	Count
XML for configuration data	1
scripting, macros, reactions,	1
Total	2

Plug-in system, specifically:	Count
Eclipse	2
autogenerated wrapper stubs	1
drivers, UI elements	1
modularization of hmi	1
own coponent framework	1
Total	6

Isolated runtime containers (sandbox), specifically:	Count
Analytical APPs	1
Droplets that can be executed in common cloud environment	1
GUI widgets	1
PikeOS	1
docker	1
Total	5

Conditional compilation (e.g., #IFDEF), specifically:	Count
Total	0

Explicitly formulated conventions, specifically:	Count
"Extension Modules" for bundled delivery and management of components at a high level, to be managed by installation and a project control panel (SMC)	1
manifest to describe extensions needs	1
refinements are realized as higher order functions (featuremonkey composer))	1
Total	3

19. For opening the platform, did you need to significantly change one of the following aspects? We needed to significantly change ...

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Our business model	4 22.2%	6 33.3%	4 22.2%	2 11.1%	2 11.1%
Our platform architecture	4 22.2%	6 33.3%	5 27.8%	2 11.1%	1 5.6%
Our platform development process	4 22.2%	8 44.4%	4 22.2%	2 11.1%	0 0.0%
Our organization of the development (e.g., team structure)	3 16.7%	7 38.9%	7 38.9%	1 5.6%	0 0.0%

## 20. Did you face any particular challenges when opening-up the platform? If so, where?
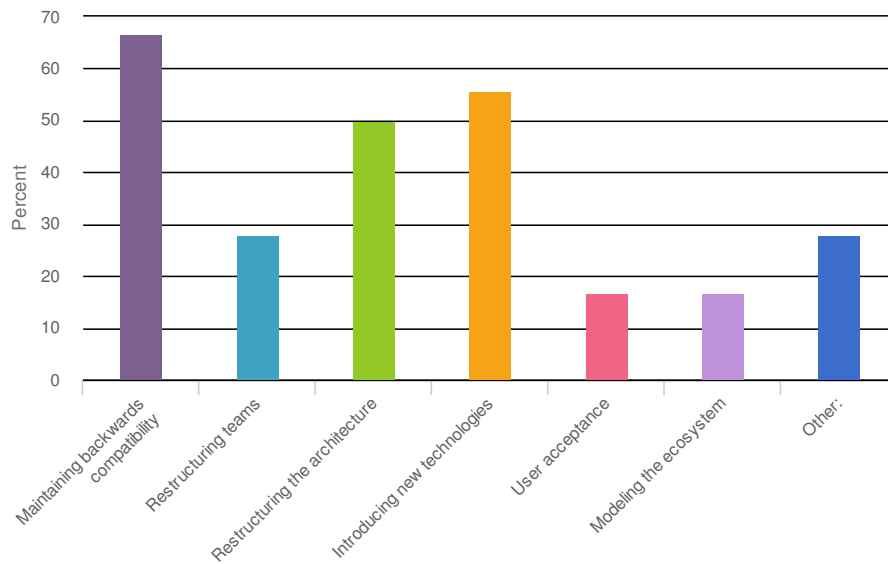
Value	Percent		Count
Maintaining backwards compatibility	66.7%		12
Restructuring teams	27.8%		5
Restructuring the architecture	50.0%		9
Introducing new technologies	55.6%		10
User acceptance	16.7%		3
Modeling the ecosystem	16.7%		3
Other:	27.8%		5

Other:	Count
Agile - understanding and acceptance	1
Inclusion of IP within the platform (as the same product is used by internal products and their direct competitors	1
Project organization still lags in supporting individual regional development efforts - far from the ideal in the BAPO model of PLE.	1
creating ecosystem	1
fufilling of expectations	1
Total	5

21. Considering the entire process of opening up the software platform, to which extent do you agree with the following statement?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Overall, the platform opening was a success.	3 16.7%	10 55.6%	5 27.8%	0 0.0%	0 0.0%

22. How did the size of the code base change as result of the platform opening process?

11.80% Increased in percent (%) by

88.20% No significant change
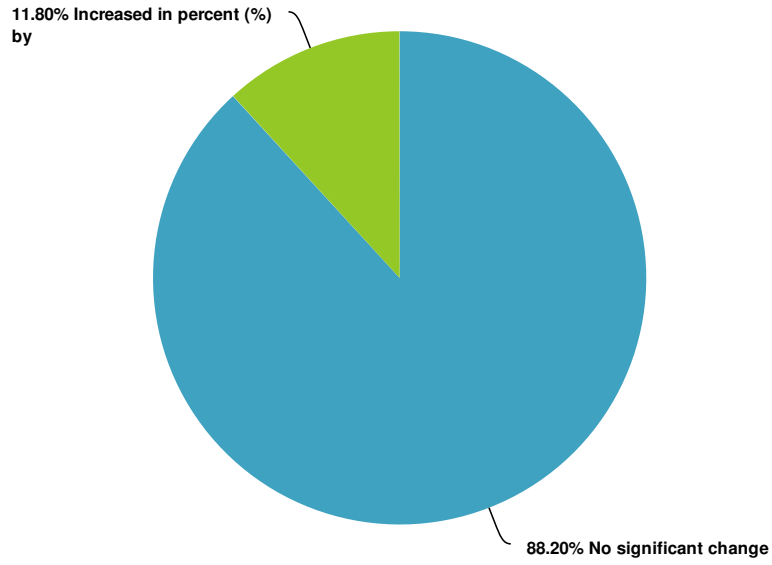
Value	Percent		Count
No significant change	88.2%		15
Increased in percent (%) by	11.8%		2
		Total	**17**

Decreased in percent (%) by	Count
Total	0

Increased in percent (%) by	Count
30	1
n.a.	1
Total	2

23. What were the particular benefits of opening-up the platform?

Count	Response
1	Allow other vendor to integrate.
1	Clients are interested in the platform and specific features. We get some licensing fees. We might be able to sell more consulting to them in the future. For those clients, we now have an advantage over other consultancies that provide stock django consulting (increased customer binding).
1	Increase in Domain specific knowledge by the core assets team. Increased Mind Share in a technical domain Improved architecture and functionality fro internal customers.
1	Introduced sound technological basis for whole platform. That allows easy development of domain specific applications. Better control of market needs.
1	More innovation
1	New business opportunities by providing a platform for sourcing visual integration of data and indications from other domains
1	Plugin mechanism allows for extending the platform functionality by new modules for business logic, HMIs, and drivers
1	Possibility to drive application development on a broad basis. Ability to implement much more features in-time rather than in a closed context.
1	Teams with a more regional identity (so call, "far from the platform") can develop and deliver solutions on their own schedule, not bound by the release schedule of the central monolith.
1	common application framework for med appl of < company name here>
1	established integrations, more use cases that were not earlier considered
1	we will see - we just started

24. What were the particular drawbacks after opening-up the platform?
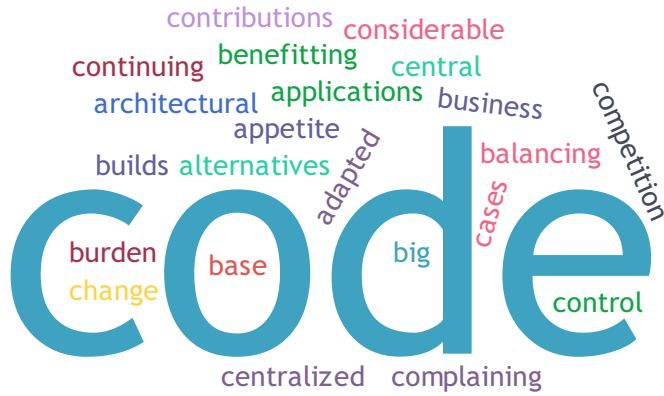
| Count	Response
1	Balancing internal and external business models. Balancing need to protect <company name here> IP against other architectural drivers.
1	Customers having less appetite in continuing with their legacy investment model (which was mainly retained due to having no alternatives)
1	High effort to keep interfaces stable and to manage backward compatibility. It is hard to negotiate required features between different stakeholders.
1	Higher maintenance and operations cost. Considerable effort for re-engineering the existing code base.
1	Slow to be adapted.... process-immaturity by the remote regional teams who had been benefitting from the centralized builds, infrastructure, change control, revisions, etc (while in parallel complaining about the burden of the big central team.)
1	backwards compatibility problems, resource competition between platform and applications
1	code ownership of contributions, cooperation, who has the last word/decision making
1	more testing and some extended integration needed like speed which were in "typical" use cases earlier not relevant
1	none for now
1	we will see - we just started

25. Many aspects are important in the process of opening up a software platform. To which extent do you agree with the following statements?A very important aspect in the process of opening up the software platform is ...

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
... the software architecture	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
... the employed extension mechanism	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
... the organizational structure of the company	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%
... the free market environment (e.g., app stores)	0 0.0%	0 0.0%	1 100.0%	0 0.0%	0 0.0%
... backwards compatiblity for existing users	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%

26. Which of the following aspects do you find very important for sustaining your open platform?A very important aspect for sustaining the success of the open platform is ...

|	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Software quality of the platform (e.g., stability, maintainability, extensibility)	15 83.3%	3 16.7%	0 0.0%	0 0.0%	0 0.0%
Software quality of the extensions (e.g., stability, maintainability, extensibility)	3 16.7%	12 66.7%	3 16.7%	0 0.0%	0 0.0%
Stable extension mechanisms	12 66.7%	6 33.3%	0 0.0%	0 0.0%	0 0.0%
Quality assurance of the extensions (e.g., certification process, development guidelines, SDKs)	2 11.1%	10 55.6%	5 27.8%	1 5.6%	0 0.0%
Large number of extensions	0 0.0%	4 22.2%	7 38.9%	6 33.3%	1 5.6%
Market place for extensions (e.g., app store)	0 0.0%	3 16.7%	5 27.8%	6 33.3%	4 22.2%
Community management (e.g., forum, blog, social channels)	0 0.0%	9 50.0%	7 38.9%	1 5.6%	1 5.6%
Communication:Which of the following aspects do you find **very important** for sustaining your open platform? A **very important** aspect for sustaining the success of the open platform is ...	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Customer feedback loop (close involvement):Which of the following aspects do you find **very important** for sustaining your open platform? A **very important** aspect for sustaining the success of the open platform is ...	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%
Regional organizations understanding their new added task as solution bundler, not only as reseller of turn-key packages:Which of the following aspects do you find **very important** for sustaining your open platform? A **very important** aspect for sustaining the success of the open platform is ...	1 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
responsiveness of platform - frequency of releases, fast turnaround on issues:Which of the following aspects do you find **very important** for sustaining your open platform? A **very important** aspect for sustaining the success of the open platform is ...	0 0.0%	1 100.0%	0 0.0%	0 0.0%	0 0.0%

27. How do you support the development of extensions?
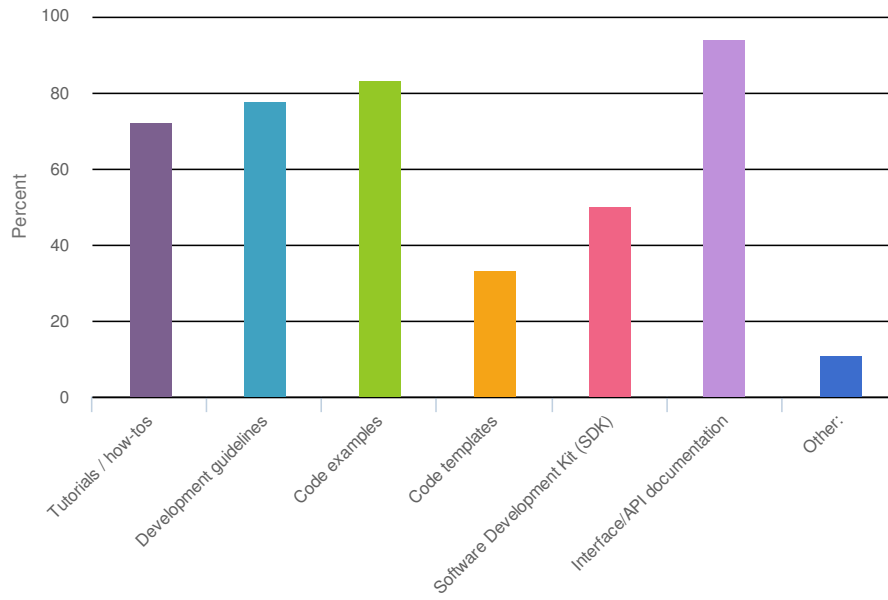
Value	Percent		Count
Tutorials / how-tos	72.2%		13
Development guidelines	77.8%		14
Code examples	83.3%		15
Code templates	33.3%		6
Software Development Kit (SDK)	50.0%		9
Interface/API documentation	94.4%		17
Other:	11.1%		2

Other:	Count
Object modeling librarian utilities	1
consulting	1
Total	2

28. Which mechanisms do you use to verify the quality of third-party/external extensions?
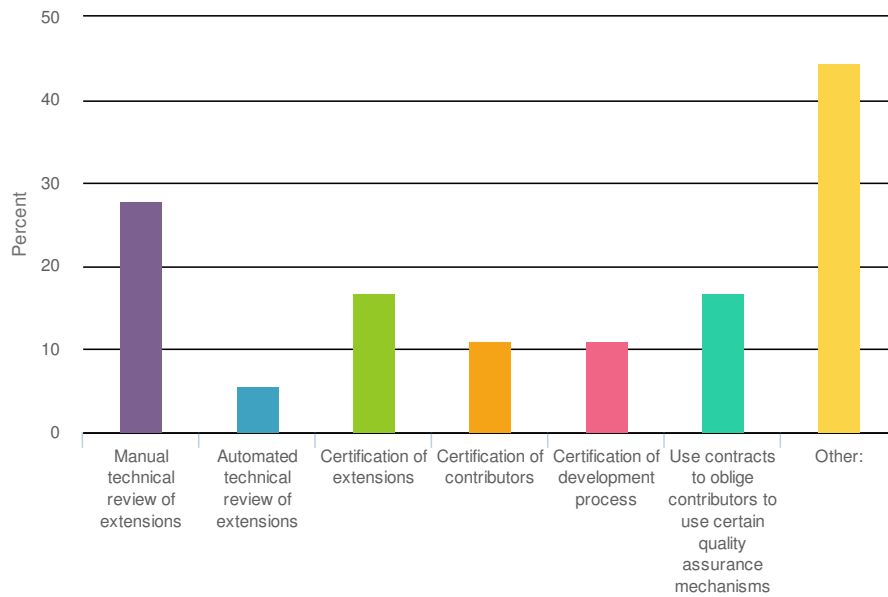
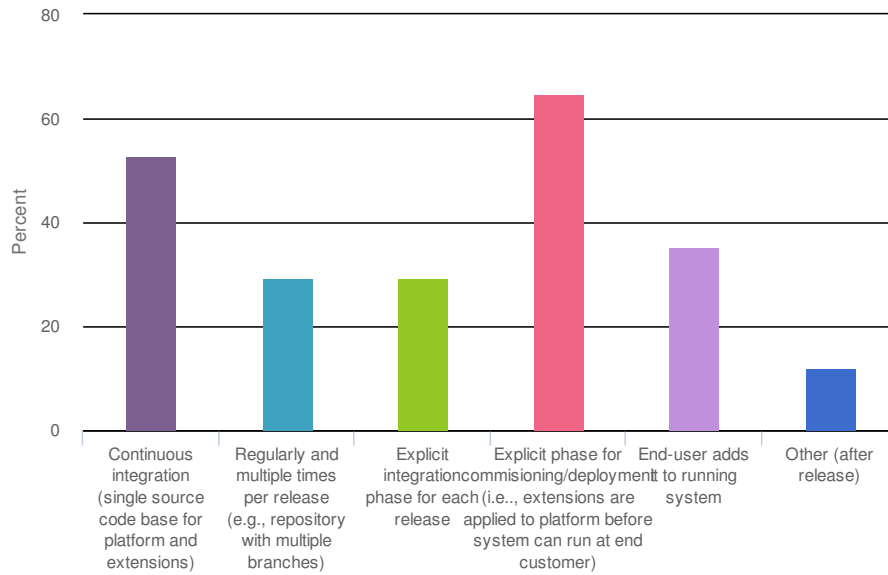| Value	Percent		Count
Manual technical review of extensions	27.8%		5
Automated technical review of extensions	5.6%		1
Certification of extensions	16.7%		3
Certification of contributors	11.1%		2
Certification of development process	11.1%		2
Use contracts to oblige contributors to use certain quality assurance mechanisms	16.7%		3
Other:	44.4%		8

Other:	Count
No mechanisms used	1
Systrem tests are performed by platform clients	1
clients use extensions themselves and do not share until now - they manage quality themselves; we offer support and consulting	1
currently no verification - planed for future	1
customers verify the extensions	1
none	1
none yet	1
nothing great here	1
Total	8

29. How many extensions exist for the open platform (apps, plug-ins, components etc.)?
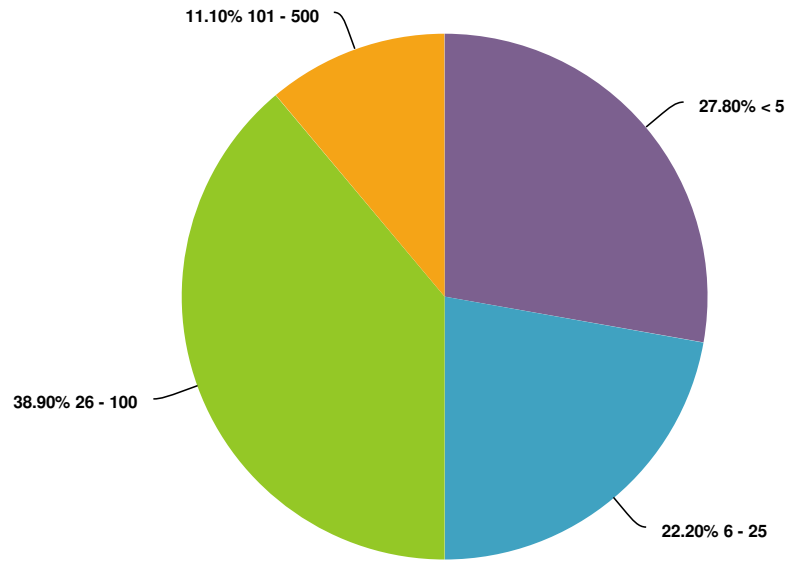
Value	Percent		Count
< 5	27.8%		5
6 - 25	22.2%		4
26 - 100	38.9%		7
101 - 500	11.1%		2
		Total	18

30. At which stage of the platform lifecycle does the platform first get in contact with an extension?
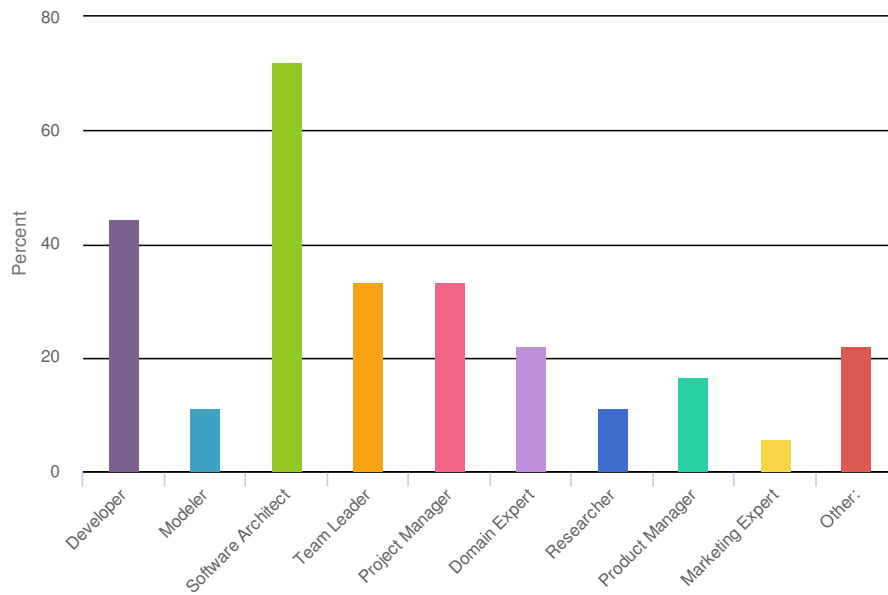

Value	Percent		Count
Continuous integration (single source code base for platform and extensions)	52.9%		9
Regularly and multiple times per release (e.g., repository with multiple branches)	29.4%		5
Explicit integration phase for each release	29.4%		5
Explicit phase for commisioning/deployment (i.e.., extensions are applied to platform before system can run at end customer)	64.7%		11
End-user adds it to running system	35.3%		6
Other (after release)	11.8%		2

Other (before release)	Count
Total	0

| Other (after release)	Count
Upgrade-in-place procedure	1
end user adds it to the system and restarts the system (static composition)	1
Total	2

31. What have been your roles in software-platform development?

Value	Percent		Count
Developer	44.4%		8
Modeler	11.1%		2
Software Architect	72.2%		13
Team Leader	33.3%		6
Project Manager	33.3%		6
Domain Expert	22.2%		4
Researcher	11.1%		2
Product Manager	16.7%		3
Marketing Expert	5.6%		1
Other:	22.2%		4

Other:	Count
CTO	1
Req Engineer	1
System Architect	1
user	1
Total	4

32. How many years of industrial experience do you have in software engineering?

5.59% 3-5 years

16.68% 5-10 years

77.72% >10 years
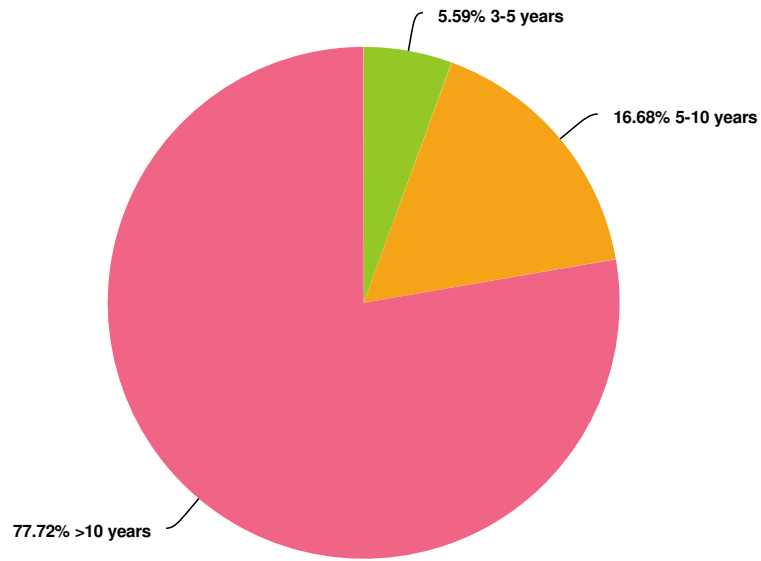
Value	Percent		Count
3-5 years	5.6%		1
5-10 years	16.7%		3
>10 years	77.8%		14
		Total	18