TinyOS Alliance Structure

> **Note**
>
> This memo documents a blueprint for an open alliance around TinyOS for the TinyOS Community and requests discussion and suggestions for improvement. Distribution of this memo is unlimited. This memo is in full compliance with TEP 1.

Abstract

This memo describes the goals and organization structure of the TinyOS Alliance. It covers membership, the working group forums for contribution, intellectual property, source licensing, and the TinyOS Steering Committee (TSC).

1. Charter

Formulate a legal and organizational framework for an alliance that can facilitate the continued advancement of the open embedded network ecosystem around TinyOS and support the activities, interactions, and development of the worldwide academic and industrial TinyOS community.

2. Overview

This memo defines a blueprint and conceptual foundation for an open alliance that fulfills the above charter. It defines the following ten aspects of the alliance:

- Mission
- Legal structure
- Organizational structure
- Membership criteria
- Working group processes
- Election process
- Intellectual property
- Source licensing
- Funding
- Work products

We (the Alliance) recognize that each of these aspects contributes to the whole, is inter-related and needs to be consistent overall. This document attempts to address them sequentially, recognizing that each depends on the others. It draws on lessons from several related organizations, although each of these also has significantly different goals from those set out in the charter.

1) IETF - Open protocols, technical documents

2) OSDL - Stable, Enterprise Linux

3) Apache - Suite of open source tools

4) Zigbee - Network layer and marketing for 15.4

5) OSGI - Service layer

6) FSF - Foundational software

Examining the structure and policies of these organizations helps determine what the Alliance can borrow from them, what it must do differently, and why. We (the Alliance) draw most strongly upon the IETF, even though that organization was focused around creating and standardizing protocols, rather than developing a code base. Its emphasis on rough consensus AND running code placed issues akin to those we face near the fore. We share the view that technical excellence is a primary goal and that the organization should be structured to sustain and overall cohesive architecture. In our case, it is represented by high quality reference implementations and standard APIs, as well as techical documents and protocols. We share an emphasis on broad participation centered on the contributions of individual members.

We encourage industrial involvement, industrial development, and industrial support. The organization is welcoming to companies, but it keeps financial support and marketing activities (while both important) at arms length from the technical process. We share the concept that proper behavior of participants and member companies is most strongly shaped by code of ethics, captured in organization rules and social norms, rather than threats of legal repercussions. The broader marketplace is a more effective enforcement body than any technical organization. Thus, we ask that participants declare relevant intellectual proprt (IP) that they are aware of, rather than force a strict accounting of potentially relevant IP. We encourage the development of open solutions that are implemented without the need for particular proprietary IP. In the IETF, this is addressed by the requirement of multiple interoperable implementations before standardization. If such implementations can be developed without legal issues, it is likely that other non-infringing implementations are possible. Like IETF, we seek a lean bureacracy and mostly volunteer organization.

From OSDL, we share the goal of developing a stable, high quality version of an open source system. This suggests that the alliance have a strong role in developing test suites and broadly accessible testbeds, as well as structures for sharing development resources. However, we avoid the OSDL structure of the scale of monetary contributions dictating technical oversite. We are not constrained by a GPL license structure, as is the OSDL.

From Apache, we draw the strong sense of a technical meritocracy centered on individual contributors. We seek to permit a loose enough consortium that there can be a lot of individual innovation, especially in areas of tools, devices, and new platforms. We also seek to retain the notion that credit should be given to authors. In Apache, giving the copyright to the Apache organization exchanges the value of the brand for technical contributions. For a broad alliance representing many universities and large companies, such a copyright scheme is likely to be an untenable barrier. Instead, we seek to provide a simple source license regime with technical tools for giving credit and strong social pressure to comply.

From Zigbee, we share the goal of providing marketing support for the accomplishments of the alliance and that we should seek to define standardized services, not just protocols. We recognize that the alliance serves a useful function in being a point of allocation for various namespaces, but that this important function should not be a tool for extracting financial contributions. We see the value of an IP pool to give confidence that the standard can be adopted without becoming entrapped later by IP terms, however, we also see that such a pool presents a very significant barrier. Moreover, it does not prevent members from obtaining IP to use it to their advantage with other members of the alliance. It also does not constrain non-members from obtaining blocking IP. It does discourage contributions that might pull IP into the pool. We prefer a process of declaration and multiple implementation. Section 7 goes deeper into how the Alliance manages the issues and complexities of IP in an open organization.

3. Mission

The mission of the TinyOS Alliance is to provide a forum to facilitate:

- the continued growth of a healthy TinyOS developer and user community with support for innovation as well as industry advancement,
- the development and maintenance of a stable, technically-sound base of TinyOS technology and surrounding tools through the creation of standard interfaces and protocols, vetted extensions, open reference implementations, technical documents, testing and verification suites, and educational materials,
- the contribution of innovative technology from a world-wide research community and the maturation and dissemination of these contributions, and
- the promotion of the technology, the community, and the impact of networked embedded systems.

4. Organizational Structure

The Alliance has a technical advisory function: guide the evolution of the TinyOS architecture, formulate and track progress of working groups, and provide an open and impartial process for technical documentation. It also has an organizational advisory function: manage industry interaction, legal and IP issues, evolution of the organization itself, membership issues and so on.

We follow an approach that starts small and grows the structure as needed. The focus should be on the working groups. Working groups are not limited to technical functions; they can be formed to promote developments, markets, etc. Beyond the working groups, the organization should remain lean, relying primarily on volunteers. We want to avoid creating a situation where the organization becomes focused on its own growth and pre-eminence at the expense of the larger community and technical agenda.

Technical directions should be driven by merit and overall soundness, and built on consensus.

The Alliance consists of a non-profit corporation with a Board of Directors, a small support staff (primarily volunteer or outsourced) and a Steering Committee. The Steering Committee oversees a collection of Working Groups, each with a Chair and Members.

4.1 Steering Committee

In the steady state the Steering Committee will consist of the chairs of working groups plus a handful of elected members at large. Tenure of a position on the Steering Committee will consist of two years with opportunity for renewal. We want to see a vibrant, engaged, and constantly evolving leadership while allowing for long-term and committed members.

Initially the steering committee would be formed from working group chairs plus some subset of the Alliance working group members. This initial committee will be responsible for putting in place the membership and elections processes, which will then be utilized to form the regular Steering Committee.

The primary role of the Steering Committee (SC) is to oversee the Working groups (WGs). This means establishing WG policy, providing appeals process, managing WG creation/extinction, arbitrating between WGs, and supervising activities to resolve conflicting directions and moving the process towards overall architectural coherence.

The SC is also responsible for reviewing and approving all TinyOS Enhancement Proposals (TEPs) that working groups generate. WGs submit TEPs to the SC for review. The SC should appoint one contributing Alliance member not affiliated with the corresponding WG to review the TEP. This reviewer, who may or may not be a member of the SC, may solicit comments from the community at large, but must also thoroughly review the submitted TEP. WGs must address any issues/questions brought up either by the reviewer or by other community members. Once the reviewer approves the revisions, he/she presents the TEP to the SC for approval by rough consensus. Finally, TEPs that affect the organizational structure of the Alliance must also be approved by the Board.

Finally, the Steering Commitee will be responsible for determining the procedural elements of the Alliance. This includes election procedures, membership criteria, selection of venues, oversight of access to code repositories and Alliance web sites, and regular Alliance meetings that occur at least once a year.

4.2 Working Groups

The working groups form the core of the alliance. Each working group will have a chair who will be responsible for WG processes, reporting, meetings, and membership. Working groups and their functions are discussed in more detail in a later section.

4.3 Board of Directors

The non-profit will require a Board of Directors responsible for corporate matters.

5. Membership and Participation

We desire to continue the TinyOS tradition of promoting broad membership. This means that we want to keep barriers to entry low in all respects: legal, financial, and organizational. As with IETF and Apache, we want to shape the organization as a meritocracy that encourages, promotes, and credits the contributions of its members. Companies have an essential role, but merit, not finances should dictate direction. Membership and influence should recognize the importance of adopters, not just developers.

The fundamental membership is individual, as individuals create work products, serve on working groups and committees, and vote. We have two forms:

- **Member: Individual who joins the Alliance and participates at a** basic level, typically as consumer of technology.

- Contributing Member: Individual who additionally joins working groups, attends meetings, or contributes code or other assets to the Alliance. Contributing members are elected to various posts and have voting rights.

There is no individual membership fee, but members will be responsible for nominal registration fees at Alliance meetings.

Corporations and organizations have institutional membership, which reflects their degree of effort.

- Institutional Member: A corporation or organization that joins the Alliance, agrees to appear on the Alliance web site and documents, and pays a nominal administrative fee. (Min. Annual $500 for small companies and non-profits, $1000 for larger)

- Contributing Institutional Member: Corporation or institutional organization that additionally provides financial support, resources, facilities, technical contributions, intellectual property, marketing support, or other meaningful contributions to the Alliance. Such institutions are featured prominently in the Alliance and have the opportunity to appoint individuals as contributing members. (Min. Annual $2000 for small companies and non-profits, $5000 for larger)

Rather than focusing on maximizing the financial contributions into the alliance, we are interested in maximizing the impact of the alliance in facilitating a healthy academic and industrial, research and production ecosystem around embedded network technology.

The organization will be able to accept direct financial and intellectual property contributions. The IP policy, described in Section 7, should encourage corporate participation while preserving focus on soundness, merit, and consensus building. Ultimately, we seek to promote a meritocracy that recognizess the contributions of the individuals, whether they be members of corporations, academic institutions, govermental institutions, or unaffiliated.

6. Working Groups

There will be two forms of working groups. LONG-STANDING groups are chartered to develop important areas or subsystems. For example, we expect longstanding groups on routing, management, platforms, testing, programming tools, and education. SHORT-TERM groups have a fixed mandate to tackle a particular topic. For example, there may be groups to develop a particular protocol, establish a policy or licensing format, or address a particular application capability.

There will be two means of Working Group formation: grass roots and charter. Grass roots groups are formed by individuals or groups who have a preliminary version of something important and want to make it part of TinyOS. They assemble and make a request to the SC with a proposed charter statement and chair. Chartered groups are formed by SC or Board of Directors to address a recognized need for an important area of development. The SC solicits members and chair with a particular charter in mind. WGs may be formed for organizational or marketing goals, as well as technical goals.

The typical output of a working group is technical documentation AND working code, including interface definitions and standard proposals. While this is the typical output, working groups are not constrained to this model, and can have a variety of purposes and work products. We seek to promote the development of standardized interfaces, protocols, services, and tools with high quality, open reference implementations of each. We seek to have these standards be implementable without relying on particular proprietary intellectual property. We are not interested in discouraging development of implementations that have excelled in various ways through proprietary IP, but standards should not require the use of such IP and should allow for multiple, interoperable implementations. The Steering committee will be engaged in ratification of standards by actively participating in the community review process and document evolution.

7. Intellectual Property

In general we want to promote the development, adoption and use of open technology. We want to avoid having the advancement of embedded networks getting trapped into proprietary IP. Accordingly, our IP policy builds heavily on the IETF model. We also want to avoid a high barrier to participation. Thus, we want to avoid demanding membership requirements that require extensive legal analysis and assessing deep strategic analysis before joining. In particular, IP pooling or broad IP assignment requirements are seen to too large a barrier and discourage the active participation of members. At the same time, we recognize that without such measures only, members cannot expect guarantees of IP rights. We also want to avoid sponging IP from others or worse, having members or non-members running ahead of the Alliance and creating blocking IP. In essence, all participants must operate with eyes open. The Alliance encourage an open process, open standards, and open source with a clear code of ethics, but leaves broader issues of enforcement to the outside market. Like IETF, we rely on disclosure of known IP of relevance, an open process, and a code of conduct. Working groups are encourage to create work products that do not rely on proprietary IP for implementation.

We also want to avoid requiring a member institution from having to conduct a complete inventory of IP holdings for potential relevance. This is impractical for Universities and large corporations. It is the responsibility of the members to disclose IP or relvance, whether it is their property or not, so that they Alliance members can make informed decisions and trade-offs.

Following the IETF, to establish a culture of openness, meeting discussions, presentations, and technical documents are non-confidential. This simple measure is a signficant step towards establishing the culture of openness and it avoids large legal and organizational hassles, as evident in OSDL.

As with the IETF, there will be a mechanism for contributing IP to the Alliance. This will be treated along with other forms of contribution in establishing member status.

Working Groups will be tasked to avoid forming standards and creating work products that fundamentally depend on proprietary IP, i.e., where the proposal can only reasonably be implemented using such IP. Members recognize that in making proposals, they are required by Alliance rules to disclose what IP they know to be relevant. In the rare cases where a working group determines that IP dependent proposals are sufficiently critical that they be pursued, such IP must be available on reasonable and non-discriminatory (RAND) terms for the Steering Committee to be able to approve the action.

Of course, Intellectual Property in the TinyOS alliance is closely tied to source licensing terms, as dicussed in greater detail in Section 8. As part of Alliance rules, members agree to only contribute code that conforms to Alliance source license policy. As part of keeping barriers to participation low, GPL and code based on potentially viral licensing terms must be carefully compartmentalized, explicit, and not present in core software. It will typically involve development tools, such as the compilers and peripheral Linux-based devices.

8. Source Licensing

In general, we want to provide a mechanism where individuals and companies can easily contribute source, can utilize what is available, and can gain recognition for their efforts. Following the TinyOS tradition, our source licensing policy will be most strongly aligned with BSD and its more modern variants. We recognize several inherent tensions and trade-offs in formulating the source license.

We want to give credit where credit is due. Fundamentally, the community moves forward by contributing valuable technology and standing upon each other's shoulders, not on their feet. Credit and respect drive a virtuous cycle of technical advance. We do have several examples where companies, or even resarch institutions, have gained substantial benefit from the work of others while presenting it as their own. This concern is partially addressed by GPL, where if you build upon the work of others you are obliged to put it back in the open. Apache addresses this issue by requiring accreditation of the Apache foundation. However, this is connected with a stiff membership requirement of signing the copyright to Apache. Participants make that sacrifice when they view the brand appeal associated with the Apache meritocracy as of sufficient value to warrant the arrangement. Apache is also a loosely

affiliated consortium of relatively localized projects, typically in very well established technical areas. Our situation is different because we have many contributors to a cohesive whole and many of these contributors are at leading research institutions where copyright must rest with the host institution. Moreover, much of the work is at the leading edge of technology.

We recognize that the TinyOS "brand" is of value and will be increasingly so as the Alliance becomes more formal. We do not want it tainted with its use as a marketing tool on inferior technology. Thus, we want to connect the use of the TinyOS term with membership, contribution, and conformance to Alliance rules and guidelines.

We have the additional wrinkle that we are dealing primarily with embedded technology, which may have no visible user interface. And, we have limited resources so carrying additional footprint for legal conformance is unattractive.

Furthermore, many of our contributors are from organizations that have very precisely defined sets of acceptable source licensing terms. As much as having a common license throughout the Alliance would make it easy for everyone to know the specific terms, getting diverse institutions to agree to common language is impractical. We do, however, want to have as few distinct licenses with a little variation as possible. Fortunately, we are seeing convergence in licenses, after several years of proliferation.

To address these matters, the Alliance has a preferred source license based on the BSD framework, (the "new" BSD license approved by the Open Source Initiative [BSD]) and a small set of accepted licenses, some of which have been gradfathered in with the existing code base. Contributions can be made using one of those accepted licenses, with the member organization name changed appropriately. Organizations can submit additional proposed licenses to the Steering Committee. In order to avoid the debate of what constitutes "open source," the Steering Committee will generally only consider licenses approved by the Open Source Initiative (OSI) for inclusion in the core. However, being an OSI-approved license is not a sufficient condition for approval within the Alliance. If a contributor wishes to use a completely new license, it can submit the license to the OSI first.

We will not require that the Alliance hold copyright of submitted source code, but that it conform to Alliance guidelines. These include guidelines for adding copyrights to existing sources.

We will utilize the available development tools to facilitate the generation of a list of contributors associated with any particular instantiation of TinyOS components into an overall system, application, or distribution. We will provide tools for registering contributors, copyrights, and applicable source licenses on line, for ease of reference.

Alliance rules will set guidelines for giving credit to contributors in documentation, source, tools, web sites and so on. We want to recognize the individuals and their host institutions, as well as the Alliance. But we do not want to create a bureacratic nightmare that deters adoption, nor do we want to turn the Alliance into a policing organization. Harsh and threatening legal terms that have no credible means of enforcement create a adversarial culture with little practical advantage. Instead, the Alliance will utilize cultural norms and reputation as mechanisms for enforcing proper creditation. We will develop tools that make compliance relatively easy, reward those that do so, and provide a complaint mechanism to identify misuse.

In taking this approach, we focus on needs of reference mplementations of standardized interfaces and protocols. The Alliance is not the only vehicle for producing a hardened, tested, certified code base. To do so would require the Alliance host a large technical staff, as OSDL does. Comapanies may do so, or produce implementations with enhanced performance, reliability, or efficiency using their own proprietary technology. The Alliance encourages such innovation while promoting standardized interfaces that allow such technology to interoperate.

9. Funding

Initially, we expect that there are no full time employees in the Alliance and that funding needs are limited to such items as lawyer's fees, web site costs, and insurance. If the Alliance eventually requires full time support personnel, the funding structure will have to be re-visited.

As with the IETF, individuals are responsible for their own costs, which primarily involve meetings, travel, and generation of work products. The Alliance is predominantly a volunteer organization. Membership participation will involve attendance at Alliance meetings. Registration fees will be charged to cover costs associated with adminstration of the meetings.

To maintain the focus on technical excellence and meritocracy, we want to avoid the heavy-handed quid-pro-quo seen in many industrial consortiums where funding determines influence. The best use of funds and the best form of influence is direct contribution to the work products of the Alliance. To keep the structure of the Alliance and its operations minimalist and lean, membership focuses on desired impact and recognition, rather than control. We want the best way to influence the direction of the Alliance to be to contribute technical work and demonstrate leadership, rather than try to control what individuals can or cannot contribute.

Companies and institutions are encouraged to contribute financial and in-kind support. It will be essential that companies provide initial funding to create the legal structure and to establish basic IT capabilities to host the web site and working groups. Institutional members will pay an annual membership fee. In some cases, a contributing corporate member may provide in-kind services such as lawyers' time used to draw up or comment on by-laws. Targeted contributions will be solicited and encouraged. In this case the donator need not become a contributing corporate member, e.g., in those cases where such a membership may be prohibited or unwanted. The costs of meetings, such as the TinyOS technology exchange, will be covered through registration fees and not by institutional membership fees.

10. Work Products

The broad mission of the Alliance calls for a broad range of work products.

Foremost among these are a set of TEPs documenting systems and protocols as well as TEPs that provide guidance and knowledge to the community. Technical documentation will have robust and open reference implementations for the community to use, refine, improve, and discuss. These reference implementations will not preclude alternative, compatibile implementations which may have additional features or optimizations. The Alliance Working Groups will periodically produce periodic releases of these reference implementations for the community to use and improve.

The Alliance will support community contributions of innovative extensions and systems by providing a CVS repository to store them. In order to keep these contributions organized for users, the Steering Committee may nominate one or more people to caretake the repository by setting minimal guidelines for the use of the directory structure and migrating code as it joins the core or falls into disuse.

To make these technological resources more accessible and useful to a broad embedded networks community, the Alliance will be dedicated to providing a set of educational materials. This includes introductory tutorials, documentation of core systems, simple and complex example applications, and user guides.

In addition to educational sample applications, whose purpose is to teach new developers about the internals and workings of the technology, the Alliance will develop and make available several end-user applications and tools. The goal is to improve the accessibility of the technology to end-users while demonstrating its effectiveness. Historical examples of such applications include Surge and TinyDB. An important part of this effort is good documentation for users who are not expert programmers, as well as tools and graphical environments.

11. Conclusions

By focusing on consensus building and technical excellence, the Alliance seeks to avoid being a forum for political and economic positioning. It will achieve this by focusing on working groups and the contributions of individuals, while not taking strong positions on the benefits or drawbacks of different

approaches. The diverse requiremements of sensornet applications mean that having a suite of solutions, rather than a single one, is often not only desirable but essential.

Over the past five years, low-power embedded sensor networks have grown from research prototypes to working systems that are being actively deployed. Furthermore, there is a vibrant research community that actively works to deploy these systems and collaborate with industry, making advances quickly accessible and usable. A great catalyst to this growth has been the presence of a large community around a shared, free code base.

The time has come to create an organizational structure to allow the effort to grow further. As sensornets become more widespread, contributions and advancements will be from an increasingly broad demographic of users, and bringing them all together will speed progress and improve the potential benefit these systems can bring to society. This focus on bringing disparate groups together lies at the heart of the Alliance. Rather than depend on strong requirements, it depends on broad collaboration and participation, placing a minimalist set of expectations that will encourage the exchange of ideas and technology.

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13. Citations

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