OGC STANDARDIZATION: FROM EARLY IDEAS TO ADOPTED STANDARDS

Ingo Simonis

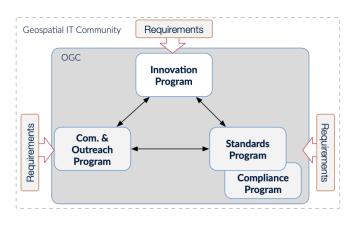Open Geospatial Consortium (OGC), London, UK

ABSTRACT

The value of standards to ensure interoperability as a key ingredient of growing digital markets is continuously stressed by government bodies, researchers, or private industry. In the context of ICT, the European Commission tries to ensure that all forces in Europe pull in the same direction, using standardization as a strategic instrument to European Union industrial policy. Though the value of standards is well understood, its development can be a long rocky road. This paper illustrates how the Open Geospatial Consortium (OGC) has implemented a dedicated program that features a collaborative agile process to accelerate the way to robust adopted standards.

Index Terms— Standards, OGC, Innovation Program, Rapid prototyping

1. INTRODUCTION

There are quite a lot of numbers circulating that highlight the value of standards and the need for interoperability to create digital markets. As an example, McKinsey estimates that without interoperability, 40% of the potential economic benefits of IoT could remain unrealized [1]. At the same time, the European Commission emphasizes the role of standards as a strategic instrument to EU industrial policy. Common standards guarantee that technologies work smoothly and reliably together, provide economies of scale, foster research and innovation and keep markets open [2]. The Commission has identified five priority areas for standardization to boost digital innovation, including 5G, cloud computing, internet of things, data technologies and cybersecurity.

For more than twenty years, the Open Geospatial Consortium (OGC) develops data technology standards and has grown to the worldwide leading organization for the geospatial IT domain. The OGC has produced more than 60 standards and supporting documents that have changed the way geospatial data is discovered, processed, documented, or visualized. This paper describes how the OGC has altered the rocky standardization process into an exciting journey. It describes the different OGC programs and their interplay before focusing on a key ingredient that differentiates the OGC from other standardization bodies: The OGC Innovation Program.

Fig. 1. OGC programs

2. OGC PROGRAMS

The OGC features four programs that all contribute to the development of robust and powerful standards. The actual Standards Program is responsible for the development of the various standards, whereas the Compliance Program provides the resources, procedures, and policies for improving software implementations' compliance with these standards. The Communications and Outreach Program nurtures strategic partnerships and alliances, works with OGC members and user communities around the world to encourage "take up" or implementation of OGC standards, and manages regional offices that address the special program needs of world regions. The fourth program is in focus of this paper: The OGC Innovation Program (OGC IP). The Innovation Program provides a collaborative agile environment for solving geospatial challenges. The program is particularly linked to the Standards Program to ensure solid knowledge transfer from the experimentation lab Innovation Program to the Standards Program. The links are explored in the following sections.

All four programs continuously interchange requests and results and receive additional demands and engineering requirements from the geospatial IT community.

3. OGC INNOVATION PROGRAM

The OGC Innovation Program is the motor for innovation within OGC. It provides a playground for organizations com-
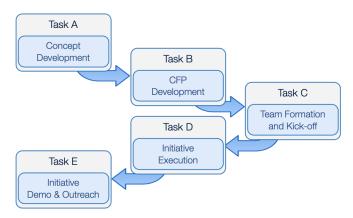
Fig. 2. Innovation program activity steps

Fig. 3. Concept development and Call for Participation steps

ing forward with their requirements and demands; and organizations interested in exploring possible solutions, experimenting with prototypes, developing best practices, or engineering new draft standards. The OGC IP works like an experimentation laboratory where sponsoring organizations and implementers meet and conduct joint research activities. The former provide cost-sharing funds that are collected by OGC and redistributed among the latter to off-set development costs. This process allows organizations joining IP initiatives as participants to receive co-funding for their research and development activities without the overhead of lengthy proposals, consortia setup processes, or complex tender evaluations. It allows sponsors to participate very actively in the process to help shaping experiments and solutions. Any OGC member can participate as sponsor or participant with both roles not being mutually exclusive.

The OGC IP organizes its activities in so called OGC IP Initiatives. Each initiative implements a number of tasks, following the waterfall model as illustrated in figure 2. Since 1999, more than 100 initiatives have been taking place from small to multi-million dollar large scale experiments with hundreds of participants.

3.1. Concept Development Phase

Each initiative starts with a concept development phase, where the IP Team (OGC staff and optionally consultants) and sponsoring organizations working together to determine the sponsors requirements and interests for a new initiative. Depending on the depth of the concept development phase, it either results in a complete feasibility report or directly in a technical architecture document. The full report documents a response from industry, the probable costs and benefits of given industry recommendations, an appraisal of where the recommendation seems to fit within the overall context of industry practice, and a draft technical architecture for the Sponsors consideration. The technical architecture, which is the key ingredient of the Call for Participation (see be-
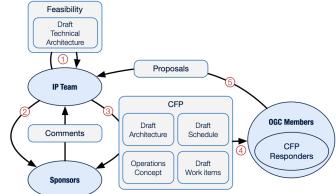
low), is the product of an iterative process where the IP Team aligns sponsors' requirements with the OGC Baseline and coordinates with the OGC Compliance Program and other IP initiatives. The OGC Baseline consists of member approved Abstract Specifications, Standards including Profiles and Extensions, and Community Standards. The full process is illustrated in figure 3, steps 1-3.

An initiative can have technical challenges of different types. These types address different levels of abstraction, complexity, and result type and cover the whole applied research spectrum from conceptual studies over functionality enhancements to user guides for existing standards. Depending on the complexity of the research subjects, the concept development phase lasts between weeks and several months and may include public Requests for Information or OGC member consultations. In any case, it includes direct conversations with the Standards Program to ensure that latest developments are taken into account.

3.2. CFP Development Phase

The public invitation to join an initiative as participant is launched as a Call for Participation (CFP). The CFP consists of general statements pertaining to contracts and relationships between potential participants and OGC, general response instructions, and - most importantly - the sponsor requirements, a detailed list of tasks associated with the initiative, and the technical architecture mentioned above. It is further complemented with a schedule of work, a communications plan for the initiative, and other miscellaneous information that a particular initiative may require, see figure 3, step 4.

Within the technical architecture, sponsors' requirements and corresponding architectural elements are organized in work items. These work items wrap requirements into manageable entities and produce either Engineering Reports or implementation components as results. As an example, the requirements to produce a data container with sufficient information to allow for indoor routing may result in a work

item data container production service and data container and service client application. Both elements result in implementation components. Ideally, each topic includes at least two instances of each software component, e.g. two server and two client implementations to test interoperability between implementations provided by different organizations. All implementation components are complemented by an Engineering Report that includes the data container specification, captures all results and lessons learned during the development, testing, and interoperability evaluation phases, and documents all recommendations for new - or modifications to existing - OGC standards arising from this effort. Usually, the Engineering Reports are developed by an organization that does not deliver any software component.
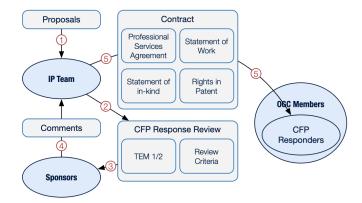
Work items are further organized in tasks, with each task aggregating work items that belong to a specific topic, such as e.g. Indoor Routing, Artificial Intelligence, Big Data, Geospatial Cloud Computing, Laser Scanning Data Models, or Automated Model Conversion and Semantic Annotation. These topics serve organizational purposes and help communicating the value of all developments, which are often enough technical details not easily accessible to non-IT experts. Depending on the size of the initiative, different topics may be further organized in threads.
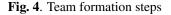
Once completed (figure 3, steps 1-3), the CFP is released to OGC members (figure 3, step 4) and the public. Even non-OGC members are invited to participate in IP initiatives, but membership is required for those organizations requesting cost-sharing funds. Participation in IP initiatives requires the submission of a participation proposal (figure 3, step 5). Most initiatives these days feature on online, form-based proposal delivery process that has been proven highly cost-efficient; featuring short proposals and necessary documentation only.

3.3. Team Formation and Kick-off Phase

All participation proposals are reviewed by the IP Team (figure 4, step 1) and shared with sponsors. The proposals only include the proposing organizations technical solution, their cost-sharing requests for funding, and their in-kind contributions to the initiative. In Technical Evaluation Meetings (TEM 1/2, figure 4, steps 2-3), all submissions are discussed and the best participant is selected for each work item following mutual agreement between OGC IP Team and sponsors. Besides selecting the best participants for a given activity, the goal is to maximize the number of participants per topic. Though this adds complexity to the consensus process (all participants for a given topic need to agree on data model or interface design eventually), it enhances the level of interoperability of the developed solution(s).

Once agreement between sponsors and IP team has been reached, contract negotiations with the participants start. Each participant entering into a professional services agreement and a statement of work with OGC becomes a partici-
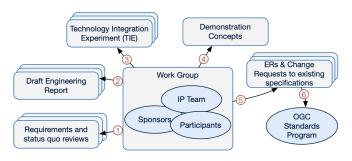

Fig. 4. Team formation steps

Fig. 5. Initiative execution steps

pant in the initiative (figure 4, step 5).

3.4. Initiative Execution Phase

The initiative execution phase is illustrated in figure 5. Each initiative starts with a face-to-face or virtual kick-off meeting. During these meetings, each requirement and corresponding work item is reviewed based on input from the participants and possible minor modifications from the sponsors' side (figure 5, step 1). Sponsors, participants and the IP Team form working groups for the various topics. These groups allow both participants and sponsors to participate in multiple topic discussions without overlap. The results of the initiative are captured in so called Engineering Reports. Each tasks produces at least one report, which is edited by a selected participant with all other task members contributing as authors. The development of these Engineering Reports starts at the kick-off meeting, when the planned activities, their baseline and starting points, and expected goals are described. The editor of each report has to find a working group within the Standards Program that will review the report in detail. This mandatory link ensures that the Standards Program is informed early in the process of all planned activities, can decide to join an initiative as observers, and can provide feedback to the Innovation Program.

The solution development consensus process starts right after the kick-off meeting. All discussions, decisions, and un-

derlying rationales are captured in draft Engineering Reports (figure 5, step 2). Participants tasked with the implementation of software components follow the technical discussions and make their prototype solutions available for interoperability testing (step 3). OGC IP initiatives focus on interface and data model design. Therefore, all software implementations remain with the participants. No delivery of mature products is required nor intended.

3.5. Initiative Demo and Outreach Phase

All initiatives develop a result demonstration concept (figure 5, step 4). The goal is to show, explain, and demonstrate the accomplished solution(s) to sponsors, the OGC Standards Program, and the general geospatial IT community. The Initiative Demo and Outreach phase is the most important part in terms of standardization. In this phase, all results produced by the initiative are fed into a demonstration concept, which includes different types of demonstrations. The first type has more marketing character. The goal is to sell the achievements to all OGC members to make it attractive for uptake or integration to the standardization processes. Further on, these demonstrations are an important mean to communicate with the geospatial community outside of the OGC and often shape developments in the broad geospatial IT market. If the initiative has addressed multi-year challenges, raising the attraction of possible sponsors is another aspect of the demonstration concept.

The first demonstration type allows, free of technical or implementation details, to understand the value of the developed solutions or ideas in context. It is complemented with a second part that again enforces the strong link between the Standard and the Innovation Program. Each initiative captures results, lessons learned, and experiences made throughout the initiative in Engineering Reports. These Engineering Reports also document recommendations for new - or modifications to existing - OGC standards arising from this effort. Each Engineering Report is made available to the Standards Program for review and eventually presented as part of the demonstration concept. These presentations allow direct conversations between both programs and ensure an intensive knowledge transfer from the OGC Innovation Program to its sister program. Eventually, the Standard Program working group can recommend to the OGC Technical Committee to release that report to the public.

4. LINKS TO OTHER OGC PROGRAMS

In the OGC Standards Program (SP), the Technical Committee and Planning Committee work in a formal consensus process to arrive at approved (or "adopted") OGC standards. Each standard is developed by a dedicated Standard Working Group (SWG). The SWGs are complemented by thematically organized Domain Working Groups (DWG). DWGs are not constraint to a single standard, but provide a forum for discussion of key interoperability requirements and issues, discussion and review of implementation specifications, and presentations on key technology areas relevant to solving geospatial interoperability issues. The Stanard Program is most tightly connected to the Innovation Program is there is a regular knowledge transfer and feedback loop. Participants in the various IP initiatives are usually active in the standardization processes of the SP and knowledgeable about the latest plans and developments. This knowledge is brought into the Innovation Program initiatives, which in turn tie-in the Standards Program groups as reviewers of the ongoing and final work.

The Community and Outreach is using IP results in their daily work to take the technical state-of-the-art discussions even beyond OGC membership into the geospatial community. Often, additional requirements or ideas for follow-up activities are received in return and brought back into the Innovation Program planning cycles.

5. CONCLUSIONS

Standardization is a complex and challenging process. This paper has illustrated how a close linkage between independent programs can produce optimal results in terms of robustness and maturity of standards. Experiences have shown that it is the cooperation between a research and experimentation laboratory and the actual standardization program that allows cost efficient and solid standardization work. Paired with an outreach and communication program with links into markets, public administration, and academia far beyond OGC that adds additional communication channels that ensure good understanding of the geospatial world's requirements and expectations allows focusing on actual market needs while addressing the next and after next (i.e. future) geospatial technologies.

6. REFERENCES

[1] Manyika, J. et al (2015). The Internet of Things: Mapping the Value Beyond the Hype.

[2] European Commission (2016). ICT Standardisation Priorities for the Digital Single Market. Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. Brussels: European Commission.