



4 December 2015

Travis County Purchasing
700 Lavaca, Suite 800
Austin, Texas 78701
Greeting,

RE: Response to request for additional information v-v Business Models

RFI # 1505-003-LC, STAR-Vote a New Voting System

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On the question of business model options to fund, build, and support STAR-Vote, we first refer the county to the initial answers in our RFI response. Our general framing on matters relating to Intellectual Property and Business Models is found in Section 6, “Partnering Structures & Intellectual Property”.

There, we make several key points—all of which are supported by our original submission—that we continue to believe:

- Protecting the integrity of STAR-Vote is a key concern of Travis County and the STAR-Vote inventors;
- Travis County wants to develop STAR-Vote at a reasonable cost;
- Travis County wants to see STAR-Vote widely deployed;
- Travis County wants other counties and states to be able to obtain STAR-Vote at a reasonable cost;
- Travis County wants STAR-Vote to be a long-lasting system, in both a technical sense (it will run on computing devices invented in the future) and a business sense (it will have professional maintenance, support, and evolution into the future); and
- Travis County wants full and exclusive ownership of the STAR-Vote system.

Also, in Section 6.2, we suggest that traditional Software/IT consultancies will charge a very large amount of money for a “work-for-hire” system of this nature and that such organizations do not have the expertise necessary to accomplish the lofty end-to-end verifiability and assurance goals of STAR-Vote. As such, many such firms may opt to not respond to an RFP that mandates the “work-for-hire” approach, or the costs proposed will be needlessly high.

We also highlight that the STAR-Vote system, as described in the RFI, has two parts: the “core”, which (roughly) includes the system components previously described in the academic literature, and the other components, which include a large number of custom user interfaces and tools. Perhaps this distinction is, in part, what triggered the query about what was referred to as “another option”: a shared ownership scheme whereby some portions of STAR-Vote could be “closed source” and proprietary to another organization.



We did not mean to imply that such an option is a good idea. In fact, we believe that a partially closed source system is critical to avoid. The correctness and security of a system depends upon all of its constituent parts—including the user interfaces. Code that remains closed source will always be the weakest link in a county's confidence that their election was conducted correctly.

The only situation where we see a closed/open split being legitimate is where (a) the closed source components have no impact on the security and correctness of the election, and (b) they have public APIs and interfaces that are based upon open standards.

Often, companies that are wedded to a security-through-obscurity approach claim that subsystems like input/output, user interfaces, APIs, network interfaces, data storage, and the like are somehow different from core, obviously critical, subsystems like cryptographic protocols. This claim is demonstrably false. In fact, the main vulnerabilities in systems with strong security properties are most commonly found in exactly those subsystems that interface with the core security components, not in the implementations of the security components themselves.

Thus, the parts of STAR-Vote that companies would like to keep closed source are, in fact, the weakest link in the security chain of STAR-Vote. The classic litany of vulnerabilities of public-facing systems (systems that have a UI, a network interface, an API, etc.) arise primarily from poor handling of input and output, either directly through UIs and APIs or indirectly through improper reading of data from networks or files.

As such we strongly recommend that, for technical reasons relating to system correctness and security, you reject the idea of a partial closed source STAR-Vote.

Magnifying this technical argument is a business argument: a partial closed source system leaves counties that wish to use STAR-Vote in the future at the mercy of the company that owns the proprietary subsystems. Each new county will either have to license those subsystems—likely at high cost, given the history of companies in the area of elections systems—or fund brand new, “from scratch” implementations. The former situation is at least as bad as the status quo with regard to the USA's voting systems vendors' oligopoly. The latter is financially unsound, and would significantly hamper wide STAR-Vote adoption.

In our response, we estimated the development of the full system as specified in the RFI to cost between \$7.5M–\$9.5M, with the accommodation of the IP requirements we suggested (recall that we suggested that the cost of the system as a “work for hire” would be several times higher than this number). Of that cost, we estimate that at least one third focuses on subsystems that many companies would insist could be closed source (I/O, UI, etc.).

Thus, if we follow a traditional IP licensing model and a traditional IT consultancy model, including “closed source” subsystems, we estimate that the next county that wishes to deploy STAR-Vote will have to pay:

- a yearly license cost to whomever owns the core STAR-Vote IP;
- development costs to modify STAR-Vote to conform to their local laws and policies; and



- a yearly license cost to whomever owns the closed source subsystems, or the cost of developing, testing, and certifying complete replacements for those subsystems.

All told, it is highly likely that every county that wishes to deploy STAR-Vote will be obligated to spend millions more, and to a single vendor, than would be necessary under a full open source release.

Ms. Clyde's query of 9 November reflects an evolution in thinking with regard to business models for STAR-Vote's construction and support. At its core, Travis County is trying to determine how to get the best quality realization of STAR-Vote at low cost for themselves and, perhaps more importantly, at low cost for other counties in the future, including professional support.

In our original response we characterized two IP variants to achieve these goals: a *Consortium Copyright, Licensed Certification Scheme, Election-centric License, with Backend Financing* (the **Consortium** variant, for short) or a *Copyright Retained by Awardee, Licensed Certification Scheme, Non-Exclusive License* (the **Non-exclusive** variant, for short). We still believe that both of these variants have merit and will help Travis County achieve the goals we summarize above.

However, given the fiscal constraints under which Travis County is operating, reflecting upon the boldness and ambition of their vision, and especially if Travis County does not want to start and run a 501(c)(3), it seems reasonable that Travis County should not be responsible for the entire development cost of STAR-Vote. Rather, that cost should be amortized across all jurisdictions that deploy STAR-Vote in the future. As such, we propose a third business model variant that we believe is in line with Travis County's aspirations; moreover, it provides a firm foundation on which to execute a vision that will impact elections across the U.S.A.

Variant #3: Joint Copyright, Delegated Licensed Certification Scheme, Election-centric License, Royalties to Inventors (the Royalty-Share variant, for short)

This variant is completely acceptable to us as a potential vendor of STAR-Vote and would perhaps be attractive to other vendors. It results in an amortized development cost that, in the long run, reduces Travis County's development costs to zero. This position is aligned with best practices in commercial Open Source development and maintenance where a product or platform has the potential for long-term, high-impact deployment and use.

- Execute copyright protection on all artifacts relevant to STAR-Vote's development in a manner that accurately captures contribution. For example, the county and STAR-Vote's inventors would own the copyright on the STAR-Vote specification, while the implementors or their employers would own the copyright on a STAR-Vote implementation.
- Ensure that the organization(s) implementing the STAR-Vote system in its entirety own that IP and guarantee, contractually, that it will be supported, maintained, licensed, and supported in an open, fair, transparent, and non-discriminatory manner at a reasonable cost to all jurisdictions.
- Use a licensed certification scheme to enforce the STAR-Vote trademark. In addition to the conditions stipulated in the other variants on this point, we suggest that a single organization

with expertise in STAR-Vote and such certifications should be the exclusive certifying authority, at least for some initial period of time.

- Release the entire system under an OSI-approved license and permit no “closed source” or proprietary pieces.
- Have the organization that owns the implementation IP of STAR-Vote provide reasonable royalties back to Travis County based upon net income from future support contract sales, development and support contracts, and other services directly related to STAR-Vote. Cap those royalties to the total fiscal burden carried by Travis County, thereby ensuring that, in the long-term, Travis County owns their realization of STAR-Vote at zero cost.
- Prohibit awardees or any company that produces variants of the STAR-Vote system from asserting any patent rights via contract.

For example, if Galois or one of its spin-off companies bids on implementing STAR-Vote for Travis County, we would suggest the following contractual outline conforming to the above general recommendation:

- Galois would hold the copyright on all artifacts created by Galois employees (e.g., specifications, mathematical models, architectures, designs, implementations, validation and verification artifacts, documentation, etc.).
- Travis County would hold the copyright on all artifacts created by Travis County and its collaborators (i.e., the original STAR-Vote team).
- Travis County would retain and protect the STAR-Vote trademark.
- All artifacts created by Galois employees would be owned by Galois and would be released under an OSI-approved open source license.
- Galois would contractually guarantee to Travis County that its implementation of STAR-Vote would be supported and maintained henceforth for Travis County and all future jurisdictions that wish to use STAR-Vote.
- Galois would contractually guarantee a reasonable, fixed, non-discriminatory, per-resident, one-time support contract cost for the perpetual use, support, maintenance, and evolution of STAR-Vote to any jurisdiction.
- Galois would guarantee that the per-resident, one-time support contract cost will strictly decrease the cost of elections by a significant minimal margin compared to current election costs over a fixed, long timeframe (for example, ten years) to any jurisdiction.
- Galois will guarantee that any jurisdiction that wishes to use STAR-Vote without a license or support contract will be encouraged to do so, and that they will receive support for critical issues such as remedying correctness or security flaws at zero cost.
- Galois will be the exclusive certification authority for any organization that wishes to develop and deploy (for free or at some cost) any variant of STAR-Vote. Such certification services will be provided at transparent, reasonable cost and will aim to both facilitate state and federal certification of the new systems and ensure that the STAR-Vote Trademark is protected.
- Galois will return to Travis County a royalty of 10% of all net revenue related to STAR-Vote until such time as the fully burdened cost of the original development of STAR-Vote is mitigated. For example, if Travis County has to borrow or bond \$15M for the development of a fully open source, high-assurance STAR-Vote implementation, then Galois will repay Travis County or its designated fiscal authority royalties until that \$15M, plus interest, is repaid.



- Galois will guarantee not to execute or enforce any patent related to STAR-Vote.

Given the above conditions, we expect that we can surprise Travis County with a proposal response to an RFP, especially with regards to the pricing of our BAFO. Furthermore, if it is in Travis County's interest, we could spread the payment of initial development costs over a time frame longer than the development and deployment time of the project. For example, if the development time of STAR-Vote is 18 months, we could arrange to have Travis County pay for that development over a 3 year window.

The following table characterizes these cost considerations and the secondary impact of various business model choices, especially with regard to future adoption, certifiability, and correctness and security concerns. In our analysis, variant #3 represents the best choice for Travis County and the American public.

	Impact of business model variant on...					
Business model variant	Initial cost to Travis Co.	Long-term cost to Travis Co.	Cost to other jurisdictions	Control	Correctness & security concerns	Certifiability concerns
Work-for-hire, fully "open source"	very high	medium	medium	low	low	medium
Shared ownership with "closed source" subsystems	medium	medium	high	low	very high	high
Galois RFI response variant #1	medium	low	low	high	low	low
Galois RFI response variant #2	medium	medium	low	high	low	low
Galois RFI response variant #3	high	zero	low	high	low	low

Best,

Joseph Kiniry
Galois, Inc.