USPN 6,772,367

TAEUSWORKS EVALUATION

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1. TAEUS INTERNATIONAL CORPORATION

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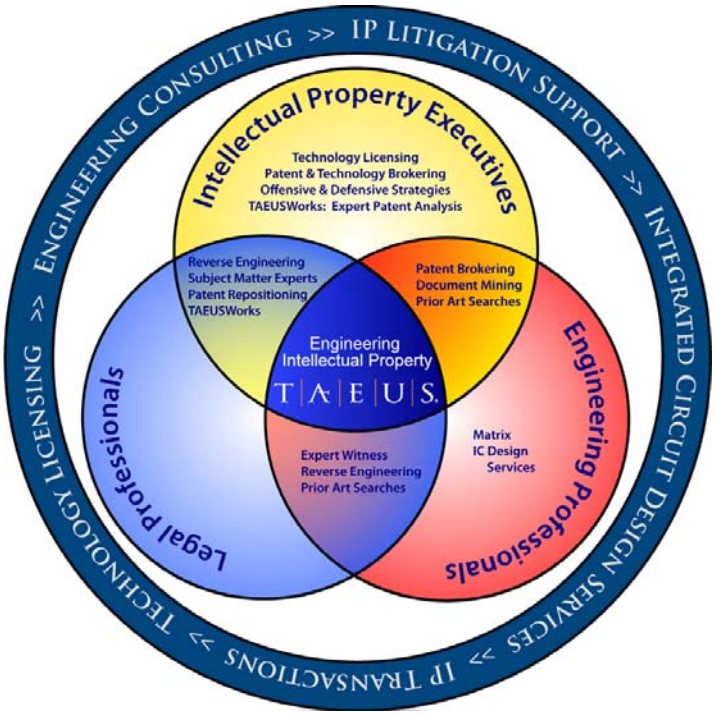
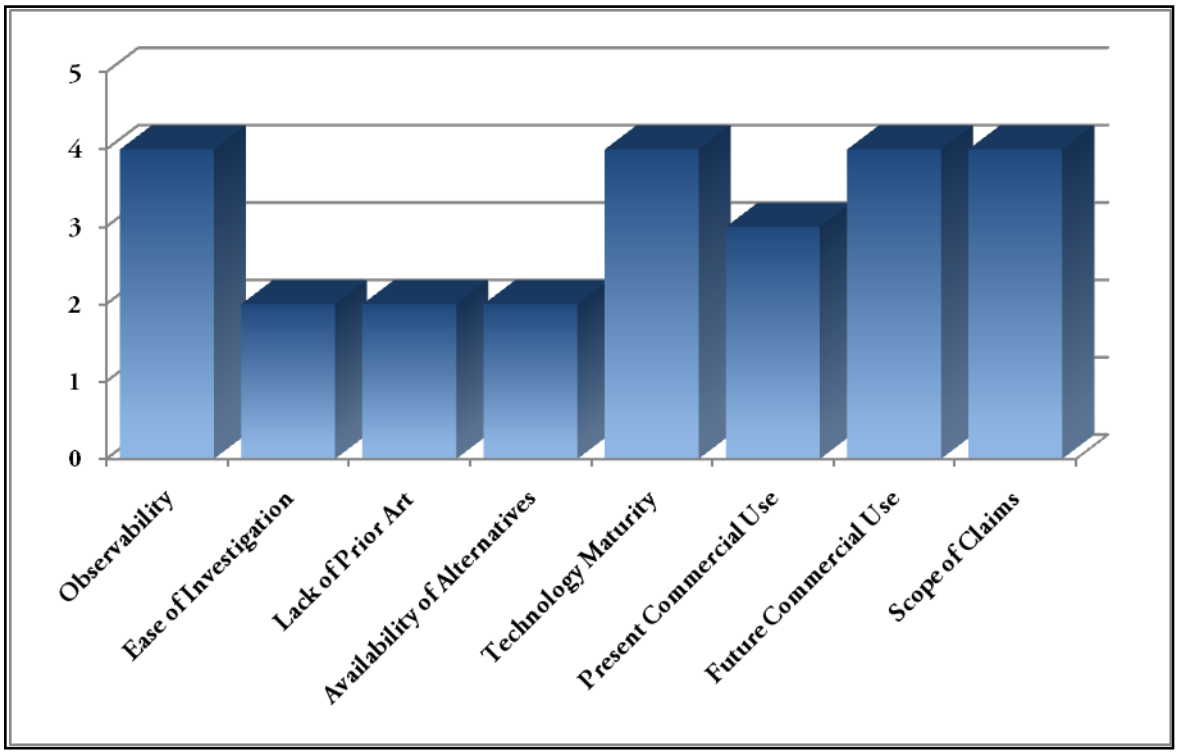


2. USPN 6,772,367 EVALUATION



2.1. Patent Information

USPN	6,772,367
Patent Title:	Software fault tolerance of concurrent programs using controlled re-execution
Inventors:	Tarafdar; Ashis (Newton, MA), Garg; Vijay K. (Austin, TX)
Date Issued:	August 3, 2004
Date Filed:	October 13, 2000
Abstract:	A method for fault tolerance in concurrently executing computer programs is presented. The present invention controls the re-execution of concurrent programs in order to avoid a recurrence of synchronization failure. The invention (i) traces an execution, (ii) detects a synchronization failure, (iii) determines a control strategy, and (iv) re-executes under control. Control is achieved by tracing information during an execution and using this information to add synchronizations during the re-execution.
Independent Claims:	1, 6, 11, 13
Claim Types:	Method
Keywords:	Concurrent, Synchronization, Transactional, Database, Multi-processor, Software, Fault Tolerance
Key Figures:	4
Significant Claims:	1, 2, 4, 6, 7, 8, 11, 12, 13

2.2. Patent Evaluation

Factor	Rating	Comments
Observability	4	Positive answer can be obtained via reverse engineering. After obtaining a sample or applying black box testing, the results will demonstrate the use of the claim elements. The investigation could require either hardware or software reverse engineering.
Ease of Investigation	2	Complex reverse engineering required (e.g. circuit extraction of complex circuits, development of custom test equipment, or very sophisticated analysis techniques). Reverse engineering is still possible, but it will require nonstandard equipment or techniques that may have to be developed in order to demonstrate technical similarity. The investigation would require fairly deep software analysis – for an embedded system, the analysis could be quite complex.
Lack of Prior Art	2	Strong possibility of prior art. The patented technology is main stream and the claims are relatively broad. Database systems may have been doing this for some time. If the claims are interpreted broadly the risk of prior art increases.
Availability of Alternatives	2	Alternatives are possible, but moderately difficult to implement. In this case, it may or may not be cost effective to attempt to design around the patented technology. Advanced transactional systems for databases have been widely researched, as have heuristic recovery schemes for network systems.
Technology Maturity	4	The technology is in the growth stage. Incorporation is possible in current and future products. Strong future potential. Need for this kind of sophistication fairly new.
Present Commercial Use	3	Very Specialized. Use of the technology is known, but distribution of products using it is confined to niche markets. The technology is possible in current use in routers, database systems, and operating systems.
Future Commercial Use	4	Fairly Common. The technology offers enough advantages to become a major factor in a variety of areas. The technology will have increasing value as multi-processors and multi-core processors become more common.
Scope of Claims	4	Good claims. Broad applicability. The claim language centers on the patented technology or device but the claims are broad enough to not limit the assertability to the specific technology area or product. The claims may have limitations that narrow the breadth and scope of coverage. The claims are strong and well written. How broadly they can be construed depends on prior art.

2.3. Summary and Comments

The invention would be used in systems that exhibit non-affinity programming. The collision of programs and a fallback mechanism based on the re-execution of the programs might be documented in standards, but in an embedded system, probably would not be. The tracing information could be provided in hardware or software to operate an interrupt of system availability. The concurrent execution can also be provided within an OOP structure. Concurrent programs make detection of bugs via testing and/or debugging considerably more difficult, so a system such as this one that automates even a portion of executing such programs correctly is likely to be of substantial use.

2.4. Potential Licensees/Users

Potential Licensee/User	URL	Product
Alcatel/Lucent	www.alcatel.com	High-end routers
Cisco	www.cisco.com	High-end routers
IBM	www.ibm.com	DB2, AIX, zOS
Juniper	www.juniper.net	High-end routers
Microsoft	www.microsoft.com	SQL Server, Windows
Nortel	www.nortel.com	High-end routers
Oracle	www.oracle.com	Oracle
RedHat	www.redhat.com	Linux
SCO	www.sco.com	UNIX
Sun Microsystems, Inc.	http://www.sun.com/	Solaris

3. TAEUSWORKS EVALUATION CRITERIA

3.1. Observability

Observability is the degree to which evidence of the patented technology will exist in the target product. While Observability and Ease of Investigation are often related, they are not the same. Technology that is highly observable on a product may still be quite difficult to investigate, such as requiring the fabrication of custom hardware, or the extraction and analysis of an extensive amount of circuitry from an integrated circuit. Claim limitations that are not present on the final product are not observable. Processes that are internal to a company and require access to proprietary production documents to prove are typically not observable in a product and are therefore very difficult to investigate. A low observability rating may also reflect the inherent difficulty in obtaining product/samples for investigation. The rating is based on the patent review and the reviewer's expertise and background in the art.

5: Plainly advertised or incorporated into an industry standard. The claim elements can be matched with an industry standard or part thereof. Alternatively, the manufacturer openly advertises features of the product that are infringing the patent claims.

4: Positive answer can be obtained via reverse engineering. After obtaining a sample or applying black box testing, the results will demonstrate the use of the claim elements.

3: Negative answer can be concluded via reverse engineering or black box testing. It is often possible to exclude infringement by black box testing. If an observed behavior cannot be the result of patented technology, the use of the technology can be excluded.

2: Reverse engineering will yield inferential evidence at best. Reverse engineering can raise some suspicions that a given product infringes on a patent but results may be ambiguous. For example, when a specific behavior or effect is the outcome of the use of the technology, and a similar effect can be caused by alternative methods, it may be possible to infer, but not prove, that the patented technology is use by the target product.

1: Cannot be observed directly even after reverse engineering. There is no way of proving or inferring from anything that is obtainable in the public domain that the patented technology is being used. An example could be a process patent that specifies conditions in the manufacturing environment that cannot be demonstrated or inferred by investigating the finished product.

3.2. Ease of Investigation

The Ease of Investigation rating deals with the type, difficulty and expense of work required to determine if a product is using the patented technology. While Ease of Investigation and Observability are often related, they are not the same. Technology that is highly observable on a product may still be quite difficult to investigate. A low rating in Ease of Investigation will typically translate to a relatively high cost for obtaining positive evidence of possible infringement, but in certain cases this may not be true. In particular, it is sometimes much easier to obtain negative results (show that the technology is not being used) than to obtain positive results (prove that it is being used). In these cases, the cost of proving use can often be disseminated across a fairly large number of targets, so that on a per-target basis the overall cost remains relatively low. TAEUS specializes in finding the most cost effective method for investigation of specific targets, so that even a patent that would be difficult to investigate in general can often be investigated effectively through "black box" testing.

5: Technical literature review will be likely to yield a conclusion. The information is advertised or provided in data sheets, user's manuals or service manuals by the manufacturer, or the patented technology is clearly visible without requiring reverse engineering efforts.

4: Relatively simple reverse engineering, testing, or review of technical literature and/or standards provides inferential evidence. Reverse engineering is required, but only in its simplest form. For example, a warning LED to indicate the improper insertion of expansion cards may not be visible on the outside of the equipment.

3: Standard reverse engineering or black box testing techniques required. It is possible to show the use of the claimed technology using standard reverse engineering techniques. "Standard" reverse engineering in this case could comprise functional analysis of signaling pathways via logic analyzer or oscilloscope, or a detailed mechanical analysis of a given design that requires substantial teardown of the product to be investigated.

2: Complex reverse engineering required (e.g. circuit extraction of complex circuits, development of custom test equipment, or very sophisticated analysis techniques). Reverse engineering is still possible, but it will require nonstandard equipment or techniques that may have to be developed in order to demonstrate technical similarity. In most cases, the process is time-consuming and encompasses extensive forensic analysis of multiple aspects of the product to provide proof or inferential evidence that the technology is used.

1: Extremely complex or can only be analyzed with access to target's proprietary data. Even though a violation of a patent may be highly observable, the difficulty of investigation makes the project almost unfeasible unless the target market is extremely large to justify high investigation costs.

3.3. Lack of Prior Art

This factor gives the reviewer's best estimate of the likelihood of prior art based on the patent review and the reviewer's expertise and background in the art. This rating is not the result of a formal prior art search.

5: Very unlikely to have prior art. The invention is novel and unique and the priority date of the patent is early enough to precede any publication on the subject matter. This situation primarily occurs in cases where the priority date of the patent is old, the patented invention is a breakthrough technology that was never envisioned by others, and the patent pushes the technology to a higher level.

4: Unlikely to have prior art. The patent is novel and unique and appears not to be jeopardized by prior art. This usually occurs when the patent improves upon a technical system by replacing the original technology. There is still a possibility to find equivalent technology in technical publications even if the nomenclature at the time of publication was different.

3: Possible prior art. The patent is unique, but the claims are broad enough with a relatively late priority date. This makes the patent potentially vulnerable to prior art, in that somebody else might have invented the same or an equivalent technology. There may also be public knowledge of the invention based on sales anywhere in the world.

2: Strong possibility of prior art. The patented technology is main stream and the claims are overly broad. There is a very high likelihood that any extensive search will turn up equivalent technology preceding the priority date of the patent.

1: Known prior art. The reviewer is aware of potentially invalidating prior art without having to do further research. In this case, the invention is usually a simple improvement of a technical system; the patent is riding on the current technology trend and does not offer truly novel technology. Often, sales of equivalent technology precede the priority date, or the invention would be obvious to anybody based on standard publications.

3.4. Availability of Alternatives

This factor indicates the ability of the possible infringer to use alternative technologies to achieve the desired objective. The rating is based on the patent review and the reviewer's expertise and background in the art. This is also called the "design around" factor, that is, how difficult it would be to "design around" the patented technology to avoid infringement.

5: Alternatives are impossible. The invention covers the only possible technical solution to a problem. An example would be the transistor or other fundamental invention.

4: Alternatives are unknown. The patent covers the generally accepted solution for a technical problem. Significant R&D efforts would likely be required to provide an alternative. No other possibilities are known but there may be methods to work around the invention.

3: Alternatives are possible, but very difficult to implement. Alternatives would require substantial R&D costs, retooling costs, increased product cost, or significant compromises on product performance. For example, a heart computer tomography can be triggered by an acousto-mechanical signal that is derived from the heartbeat and monitored in the thoracic area. A work-around could use the pulse signals in the fingers, but because of the propagation delays and greater variance compared to the actual heart movements, this technology requires compensatory mechanisms and may still not be as accurate, or may be more costly to manufacture, and therefore do not provide the same level of competitive advantage to the product.

2: Alternatives are possible, but moderately difficult to implement. In this case, it may or may not be cost effective to attempt to design around the patented technology. In the case of heart computer tomography, the patent might cover the mechanical movements of the thoracic region to trigger the x-ray. A moderately difficult to implement approach could be an EKG as trigger, which is more expensive and technologically more sophisticated, but which also may yield better results. Some product redesign may be required, but this may be more cost effective than licensing the patent.

1: Alternatives are readily available. Very little cost or effort is associated with implementing a non-infringing alternative. This occurs if the patent claims are very narrow, or if the patent is a minor improvement that offers little advantage in the marketplace. For example, a patent claiming structure having a substrate glued to its back would, from a technical perspective, be weak; it is irrelevant whether the substrate is glued to the back or to the front of the structure.

3.5. Technology Maturity

This factor indicates where the patented technology lies in the overall life cycle of products that are likely to use the invention. This factor can be used to target specific companies for licensing based upon your licensing strategy and knowledge of the target's product strategy. For example, early implementers are more likely to use embryonic technology, while fast followers are more likely to use growth or mature technology. Low-cost manufacturers are more likely to be using mature or aging technology. This factor reflects the changes in a patent's inherent technical value as related technology evolves. This rating often relates to patent strategy in general – a patent on technology in its early stages of development is often a strong candidate for follow-on patents in the same general area, and is more likely to be a better candidate for synergistic (carrot) licensing, while mature and aging technology is usually a better candidate for assertive (stick) licensing. This is particularly true if the patent is relatively old (i.e. will expire soon) and the rest of the world is just starting to "catch up" to the technology it discloses. The rating is based on the actual patent review and the reviewer's expertise and background in the art.

5: The technology is embryonic. The technology is unlikely to be incorporated into current applications, but future use is possible. This situation could be found in cutting edge technology development areas.

4: The technology is in the growth stage. Incorporation is possible in current and future products. Examples could be fuel cell technology, nanotechnology, biomechanical devices, and/or genotyped drug delivery systems that are just emerging.

3: The technology is mature - possible use in current applications, and may be used in the near future. Examples could be telecommunication systems, personal and handheld computers, etc.

2: The technology is aging. The technology is phasing out. It is possibly in current use, but is unlikely to be used in new products. For example, vacuum tubes in electronic devices are still available, but in low production numbers and mostly in niche products.

1: The technology is obsolete. The technology is highly unlikely to be used in current products. This would typically pertain to technology having a life cycle much shorter that the term of the patent. An example of obsolete technology is the use of punch cards instead of electronic data storage.

3.6. Present Commercial Use

The Present Commercial Use factor shows the reviewer's best estimate of the industry's actual current use of the technology. This rating is related to Alternatives, but the two are not synonymous. Technology with a large number of alternatives may still be used extremely widely if it provides enough advantage over those alternatives. Likewise, technology may have few alternatives, but address a relatively small market, or the cost to implement the technology in a product is prohibitive.

5: Pervasive Use. The technology is implemented in an industry standard for a broad range of products, or is otherwise widely deployed in products. Examples would include patents that pertain to the digital encoding or decoding of audio and video, cellular and wireless telecommunications and networking.

4: Fairly Common. The technology is commonly used in a variety of products, but is not necessarily fundamental to a given area of technology.

3: Very Specialized. Use of the technology is known, but distribution of products using it is confined to niche markets.

2: Possible. It is not known whether the patented technology is used in the current market place but there is a reasonable possibility that an extensive search will identify users of the technology.

1: Not Likely. The patented technology is either difficult to implement or has a wide variety of better alternatives. Although there is a chance that the patented technology maybe used, more elegant and effective solutions dominate the market.

3.7. Future Commercial Use

The Future Commercial Use factor shows the reviewer's best estimate of the industry's potential future use of the technology. This reflects many of the same factors as the current use of the technology, and adds consideration of such factors as likely growth of this particular market as well as the rate at which alternative technologies are likely to be developed.

5: Pervasive Use. The technology will be an essential factor for future mainstream products because of its obvious advantages over earlier technologies that are phasing out. An example is LEDs used for head and taillights in automobiles.

4: Fairly Common. The technology offers enough advantages to become a major factor in a variety of areas. One example would be the RFID tag technology used for inventory monitoring. Bar coding and other inventory control methods will continue to exist, but the technology will gain a substantial market share.

3: Likely to be Specialized. The technology will be used, but the distribution will not become widespread during the lifespan of the patent. One example is the positional monitoring of the virtual reality P5 Glove. While this technology is slowly catching on in the computer gaming world, it is not expected to reach wide distribution in the near future.

2: Possible. The patent describes a technology that may be advantageous but may require major redesign of mainstream products or acceptance of what are considered today non-standard methods by consumers. There is still a good possibility that the patented technology will be used in niche products Whether or not the technology becomes more widely used depends on many economic and demographic trends that are too complex to be considered in this evaluation.

1: Not Likely. Because of inherent limitations in the patented technology, it is very unlikely that others will use the patented approach.

3.8. Scope of Claims

The Strength of Claims licensability factor is based on the language, scope, and technical merits of the claims. While the other rating factors relate primarily to the technology covered by the patent, this factor relates to the degree to which the patent claims actually provide coverage of that technology. For example, some patents are narrowed substantially during prosecution so the body of the patent discloses a number of possible implementations, but only a small number of these are actually covered by the claims. In this case, the patent itself may provide information on how to use fundamentally similar technology without infringing any claims. Evaluation of this factor takes into account the types of claims in the patent to assess the breadth of scope of the claims, and assess the technical strength of the claims from the perspective of a person of ordinary skill in the art.

5: Claims are extremely broad and fundamental to the technology. The patent claims describe what may be called the principle of operation for the new invention without going into detailed descriptions that would pose limitation on the applicability and assertion of the claims. It is likely that the patented technology will apply across a broad range of products.

4: Good claims. Broad applicability. The claim language centers on the patented technology or device but the claims are broad enough to not limit the assertability to the specific technology area or product. The claims may have limitations that narrow the breadth and scope of coverage.

3: Good claims, but may have restrictions or references that limit the scope of applicability. The claim language focuses on the invention, but the novelty aspect of the invention is the solution to a detailed problem. In this case, the claim language may be strong, but the applicability may be restricted to a specific area of technology.

2: Relatively specific/narrow claims. The claim language is complex and contains many limitations that narrow down the focus to very specific aspects of the technology.

1: Very complex, narrow, unclear, and/or specific. Very difficult to enforce. This category encompasses a number of different possibilities characterized by overly long claims with too many and very specific elements, and/or claims that are very convoluted and ambiguous. A hypothetical example would be a wine with exact 12.5 % Vol. Ethanol content during its shelf life. Because of the continuous fermentation in the bottle, the alcohol levels will change over time and therefore the narrowness of the limitation would make a patent unenforceable.