## Pardalis' Facilities, Equipment & Resources

Funding Opportunity Number: USDA-NIFA-AFRI FY 2010 Food Safety RFA
Program Area Code – A4101

Facilities: In a funded project Pardalis' employees will be embedded within the facilities of Oklahoma State University, Stillwater, Oklahoma.
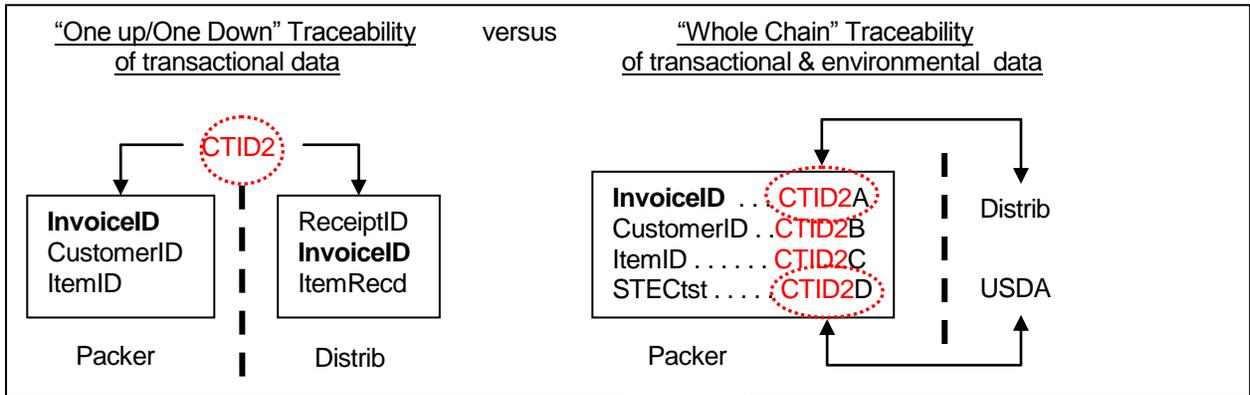
Equipment: Several older servers in the possession of Pardalis are available for use.

Intellectual Properties' Description: To provide means for the granular sharing of authenticated data in complex supply chains Steve Holcombe, J.D., and Dr. Marvin L. Stone, now Professor Emeritus, OSU BAE, co-invented the U.S. and internationally patented Common Point Authoring™ (CPA) system.

A useful explanation of the benefits of a "whole chain" produce traceability system may be made with critical traceability identifiers (CTIDs), critical tracking events (CTEs) and Nodes.[1] Critical tracking events (CTE) are those events that must be recorded in order to allow for effective traceability of products in the supply chain. A Node refers to a point in the supply chain when an item is produced, process, shipped or sold. CTE's can be loosely defined as a transaction. Every transaction involves a process that can be separated into a beginning, middle and end.
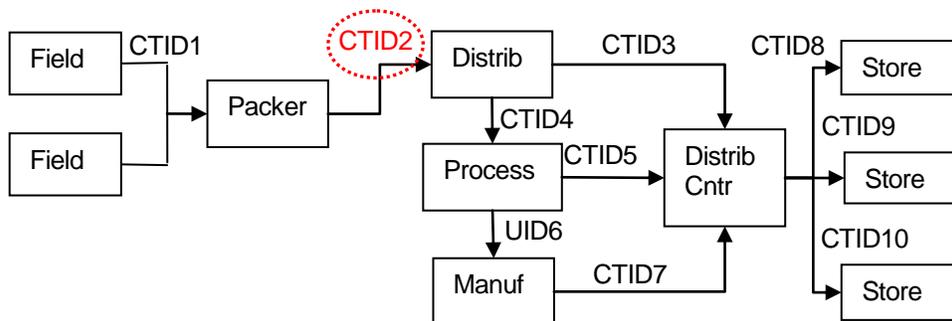

While important and relevant data may exist in any of the phases of a CTE transaction, the entire transaction may be uniquely identified and referenced by a code referred to as a critical tracking identifier (CTID). Now, with the emergence of biosensor development for the real-time detection of foodborne contamination, one may also envision adding associated real-time environmental sampling data from each node. The challenge is in using even top of the line "one up/one down" product traceability systems (compare CTID2 in the foregoing drawing with CTID2 in the next drawing) that, notwithstanding the use of a single CTID, are inherently limiting in the data sharing options provided to both stakeholders and government regulators. With the proposed stakeholder-driven "Whole Chain" product traceability system, in which CTID2 is essentially assigned down to the datum level, transactional and environmental sampling data may in real-time be granularly placed into the hands of supply chain partners, food safety regulators, or even retail customers.

| "One up/One Down" Traceability of transactional data | versus | "Whole Chain" Traceability of transactional & environmental data |

CTID2

InvoiceID	**ReceiptID**
CustomerID	**InvoiceID**
ItemID	ItemRecd

Packer | Distrib

| **InvoiceID** . . . CTID2A | Distrib |
CustomerID . . CTID2B	
ItemID CTID2C	
STECtst CTID2D	USDA

Packer

This is a vision of "whole chain" chain sharing that goes well beyond "one up/one down" information sharing, and recognizes the need for control or "data ownership" by each stakeholders.

The granularity of the CPA system (as is necessary for a "whole chain" product traceability system) is characterized by the following patent drawing of an informational object (e.g., a document, report or XML object) whose data elements are radically and uniquely identified. The similarities between the foregoing drawing and the following should be self-evident.

U.S. Patent Dec. 30, 2003 Sheet 3 of 15 US 6,671,696 B1

FIG. 2
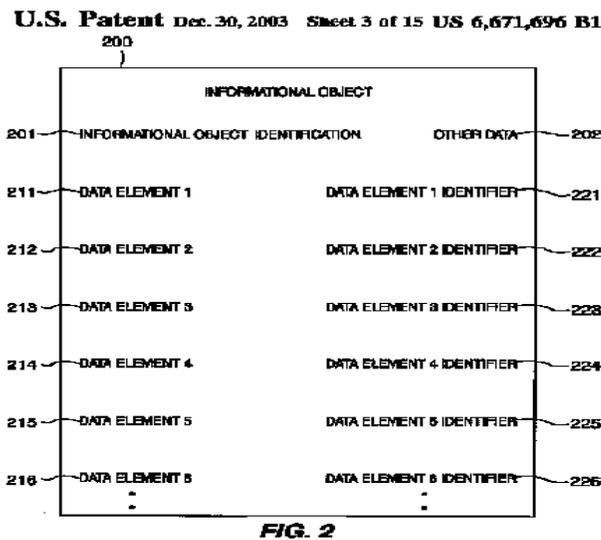
For the purposes of the current funding opportunity, the CPA system invention is appropriately characterized as a "whole chain" product traceability system as characterized by the following representation of the application of the invention to a major U.S. agricultural supply chain:

FIG. 19

Livestock Product Distribution with
Common Point Authoring System
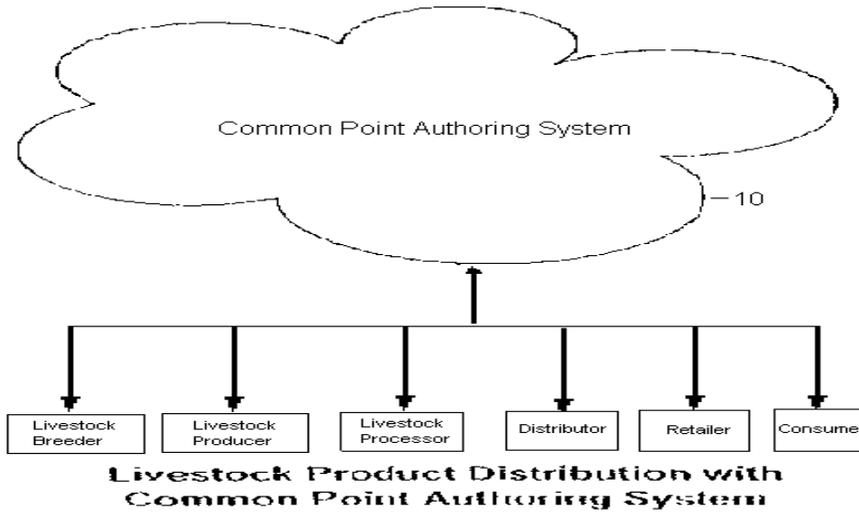
CPA's methods have been distinguished worldwide from object-oriented, runtime efficiency patents held by these leaders in back-end, enterprise application integration: *Method and system for network marshalling of interface pointers for remote procedure calls (*US Patent 5,511,197 - Microsoft), *Reuse of immutable objects during object creation* (US Patent 6,438,560 - IBM) and *Method and software for processing data objects in business applications* (US Patent 7,225,302 - SAP).

Compilation of Globally Secured Intellectual Properties:

The following have been secured with the assistance of patent attorney, James M. Graziano, Partner, Patton Boggs LLP, Washington D.C. (Denver office):

Country	App/Patent Number	Status
Australia	2002323103	Granted
Brazil	PI0212087-9	Pending
Canada	2457936	Pending
China (PR)	ZL 02820809.9	Granted
Europe (EU)	02757063.9	Pending
Hong Kong	04108499.5	Pending
India	590/CHENP/04	Granted
Japan	2003-521884	Pending
Mexico	251,221	Granted
New Zealand	531849	Granted
Patent Cooperation Treaty (PCT)	PCT/US2002/025431	WIPO Pub. No. 03/017036
United States	6671696	Granted
Australia	2004282842	Pending
Brazil	PI0415224-7	Pending
Canada	2541329	Pending
China (PR)	0480037094.4	Granted
Europe (EU)	04784834.6	Pending
Hong Kong	07103059.5	Granted
India	1573/CHENP/06	Pending

Mexico	2006/004007	Pending
New Zealand	546907	Granted
Patent Cooperation Treaty (PCT)	PCT/US2004/03114	WIPO Pub. No. WO/2005/038565
United States	7136869	Granted
United States	11/595569	Pending

Engineered CPA System and Source Code: From June, 2003 to August, 2006 the following salaries (including social security and Medicare payroll contributions) and/or consultant fees were paid for the core development of the source code:

Name	Description	Salary %	Employment Dates	Cumulative Salary
KL	Computer software engineer (applications & management)	100%	Jun 2003 – Mar 2006	$232,111
DM	Computer software engineer (applications)	100%	Nov 2003 – Aug 2006	$228,980
SR	Computer software engineer (applications)	100%	Sep 2005 – Aug 2006	$60,122
TC	Computer software engineer (systems architect)	100%	Aug 2004 – Aug 2006	$149,926
RM	Computer software engineer (systems architect)	100%	Jan 2004 – May 2004	$38,820
LK	Computer software engineer (systems architect consultant)	100%	Irregular dates	$4,092
JC	Computer software engineer (user interfaces)	100%	Jan 2005 – May 2006	$102,006
S. Holcombe	CEO/Founder (Corporate & inventor management)	20%	Jun 2003 – Aug 2006	$54,442
			Total -	$870,499

Open Source Licensing: Upon funding, Pardalis, Inc. will open its source code and IP to the CPA System under using the *Common Development and Distribution License (CDDL)*[2], developed by Sun Microsystems, to distribute Pardalis' globally secured patent rights to food supply chains with released source code. This means that one can use, modify, and redistribute code released under CDDL without worrying about any patents that the contributors of the code might have on the contributed technology. The CDDL meets the requirements of the *Open Source Definition*[3] and has been approved as an open source license by the *Open Source Initiative*[4].

Respectfully submitted,

Steven Holcombe
President & CEO
Pardalis, Inc.

ADDENDUM:
Background Information on Traceability

The identification and standardization of the core information elements of the common "one up/one down" product tracing systems is critical.[5]. However, it has long been known that no amount of standardization is insufficient by itself to insure new data availability.[6] It is not uncommon during a food illness outbreak for food safety inspectors to find inadequate recordkeeping at point of sale by retail-level businesses and distribution centers, including missing or inaccurate information.[7] Both the USDA and the FDA recognize that enhancing product tracing for food may not be just a matter of keeping more or different records or adding more information to product or packaging, but also a matter of rapidly changing business practices.[8] What is not clearly understood is what can be done to speed the process whereby persons, who have (or should have) product information relevant to a traceforward or traceback investigation, provide the information to regulators.[9] The lack of real-time information available to regulators in traceback and traceforward investigations during a food illness outbreak creates substantial, negative public health and economic impacts.

A critical long-term goal of the AFRI Food Safety challenge area includes "reduc[ing] negative public health and economic impacts through the development and demonstration of effective traceability systems that track the source, movement, critical tracking events (CTEs), storage, and control of contaminated food and food ingredients from production to consumption."[10]

The overall objective of this application is a stakeholder driven food supply safety system for a real-time detection, risk assessment, and mitigation of Shiga toxin-producing Escherichia coli in beef products. A critical component for meeting this objective is the development and deployment of an item-level, multi-tenant "whole chain" product traceability system. We seek to develop and deploy such a "whole chain" product traceability system to overcome the inherent limitations of the common "one-up/one-down" systems to rapidly address changes in consumer preferences, changes in industry practices, and the rising volume of imports [which] continue to pose significant challenges".[11]

The backbone of this project is the further development and re-deployment of a whole chain product traceability system. A "whole chain" product tracing system consists of information elements provided by persons in the supply chain to other persons in the supply chain including regulatory officials or consumers. The information available in the form of records associated with a whole chain product tracing system enables an interested person to identify, and link, at any specific stage of the supply chain, who manufactured a food product, what specific ingredients are in the product, where the product came from, where the product was or is, where the product went, and who transported the product.

The research team is particularly well prepared to develop and deploy a "whole chain" product tracing system because substantially developed database and software systems are already in hands of OSU/Pardalis.

Pardalis will place its web-based "whole chain" product traceability database system within OSU BAE. With private funding, this system was developed from nationally and internationally awarded patents over a four year period to address 'data ownership' concerns in competitively segmented supply chains. It is robust and has been previously deployed to a major U.S. agricultural product supply. The Biosystems and Ag

Engineering Department at Oklahoma State University (OSU BAE) is currently conducting traceability research for handling grain and specialty crop oilseeds in Oklahoma; funded by the Anderson Group and USDA IPM[12]. These researchers are interacting and employing several proprietary traceability methods and are positioned to successfully deploy this project and compete with other "silo" software approaches to traceability.

Development and deployment of a working, scalable model for a stakeholder-driven "whole chain" supply chain product traceability system applicable, during a funded project, to STEC investigations. Following the completion of the funded project, further development and deployment of this model by a global open source community to all foodborne illness (e.g., salmonella, STEC, etc.) investigations and recalls. Such a working, scalable model will provide optimal opportunities for a holistic "real-time" system for minimizing consumer food-borne illnesses and reducing the catastrophic economic costs faced by domestic and international commodity industries when an outbreak is detected. Leadership by OSU and Pardalis of an open source community guided by the terms of a Common Development and Distribution License (CDDL) will both lower software development costs and help establish global standards for "whole chain" database systems.

The proposed research is original in that it exceeds the common "one-up/on-down" produce traceability system approach of current industry-led tracing initiatives in the United States as identified in the IFT and FDA.[13] It is innovative in its application of a national and internationally secured intellectual properties specifically identifying a "whole chain" produce traceability system. It will further creatively employ the *Common Development and Distribution License (CDDL)*[14], developed by Sun Microsystems, to distribute globally secured patent rights to food supply chains with released source code. This means that one can use, modify, and redistribute code released under CDDL without worrying about any patents that the contributors of the code might have on the contributed technology. The CDDL meets the requirements of the *Open Source Definition*[15] and has been approved as an open source license by the *Open Source Initiative*[16].

This approach is expected to yield development and deployment of a working, scalable model of a stakeholder-driven "whole chain" supply chain product traceability system at the completion of these studies. Thereafter, OSU and Pardalis will sponsor of an open source community guided by the terms of a Common Development and Distribution License (CDDL) for the purpose of lowering software development costs and helping to establish global standards for "whole chain" database systems. The potential impact is a ripple effect of national and international open source projects for developing and deploying related stakeholder-driven "whole system" product traceability systems that may be used to rapidly address changes in consumer preferences, changes in industry practices, and the rising volume of imports over the funded years and beyond.

As concluded by the report entitled *New Biology for the 21st Century: Ensuring the United States Leads the coming Revolution,*[17] biological research in the U.S. is delivering only a fraction of its potential. The development and deployment of a working, scalable model of a stakeholder-driven "whole chain" product traceability system will improve food safety for all Americans.[18] Understanding how to enhance product tracing systems for food intended for both humans and animals is a high priority issue for both the USDA and the FDA as seen in the November, 2009 notice entitled *Product Tracing Systems for Food*. Both agencies

are seeking to determine what short and long term steps to take to enhance current tracing systems.[19] Both the USDA and the FDA recognize that enhancing product tracing for food may not be just a matter of keeping more or different records or adding more information to product or packaging, but also a matter of rapidly changing business practices.[20] By implication the context of the references to "whole chain" product tracing systems in the joint FDA/USDA notice, *Product Tracing Systems for Food* , and an acknowledgement that they are uncommon as compared with "one up/one down" systems, appears to clearly point to the limitations of the latter types of systems. [21] There is high interest in the emergence of "whole chain" systems.

The proposed research will provide optimal opportunities for a holistic "real-time" system model for minimizing consumer food-borne illnesses and reducing the catastrophic economic costs faced by domestic and international commodity industries when an outbreak is detected. Following funded research, continued leadership by OSU and Pardalis of an open source community guided by the terms of a Common Development and Distribution License (CDDL) will both lower software development costs and help establish global standards for "whole chain" database systems.

1 The following is heavily influenced by Appendix I of the IFT/FDA Traceability in Food Systems Report, Vol. 1, http://www.ift.org/knowledge-center/focus-areas/food-safety-and-defense/~/media/Knowledge%20Center/Focus%20Areas/Traceability/IFT223042503TO6v1technical103009.pdf

2 http://hub.opensolaris.org/bin/view/Main/licensing_faq

3 http://www.opensource.org/docs/definition.php

4 http://www.opensource.org/

[5] Product Tracing Systems for Food, Department of Health and Human Services, Food and Drug Administration, 74 FR 56849, 56853-56854 (Nov. 3, 2009) (published in conjunction with USDA FSIS).

[6] Why Not One Big Database? Ownership Principles for Database Design, Copyright © 1993, 1994 Van Alstyne, Brynjolfsson, and Madnick, (Design Principle 5).

[7] Product Tracing Systems for Food , 74 FR 56847.

[8] Product Tracing Systems for Food , 74 FR 56853.

[9] Product Tracing Systems for Food , 74 FR 56853.

[10] AFRI Food Safety FY 2010 RFA, p. 4.

[11] Product Tracing Systems for Food , 74 FR 56846.

[12] Co-Principal Investigator for "Implementing and Evaluating Traceability Technology in Wheat Storage and Handling", 2010-2012, $50,000, co-PIs Adams and Biros, Anderson Research Grant Program. Funded. Principal Investigator for "E-IPM Grant for Stored Grain", 2009-2010. $7,204, co-PIs T. Royer. Principal Investigator for "Implementing and Evaluating Traceability Technology to Improve Integrated Pest Management Decisions and Security in Wheat Storage and Handling", 2010 – 2011, $67,974, co-PIs Adams, Criswell, Opit. EIPM grant, pending funding.

[13] Traceability (Product Tracing) in Food Systems, Vol. 1, Technical Report, IFT/FDA, P. 60 – Table 4 (Oct. 28 2009) (http://www.ift.org/knowledge-center/focus-areas/food-safety-and-defense/~/media/Knowledge%20Center/Focus%20Areas/Traceability/IFT223042503TO6v1technical103009.pdf).

[14] http://hub.opensolaris.org/bin/view/Main/licensing_faq

[15] http://www.opensource.org/docs/definition.php

[16] http://www.opensource.org/

[17] Committee on a New Biology for the 21st Century: Ensuring the United States Leads the Coming Biology Revolution, Board on Life Sciences, Division on Earth and Life Studies, National Research Council of the National Acadamies. Copyright 2009 (http://www.nap.edu/catalog/12764.html).

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[18] AFRI Food Safety FY 2010 RFA, p. 2 (Challenge Area 3. "Improve food safety for all Americans").

[19] Product Tracing Systems for Food , 74 FR 56843-56855.

[20] Product Tracing Systems for Food , 74 FR 56853.

[21] See C. Considerations for an Effective Product Tracing System, Product Tracing Systems for Food , 74 FR 56849.