Interagency Fuels Treatment Decision Support System Phase III Accomplishments

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Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

IFT-DSS Phase III May 2009 – May 2010

- The Software Tools and Systems Study – John Cissel
- Phase III Accomplishments – Tami Funk
- IFT-DSS version 0.3.0 Demonstration – Tami Funk
- IFT-DSS Phase IV – Tami Funk/John Cissel
- The Emerging Vision for Fire Software Systems - Mike Rauscher
- The Human Framework around IFT-DSS – Mike Rauscher
- Questions and Discussion

Phase III Accomplishments - Overview

- IFT-DSS overall strategic objectives
- Phase III accomplishments
  - Summary of Phase III activities
  - Software development process
  - Test user group
  - Proof of concept objectives
  - Proof of concept demonstration
- Next steps – Phase IV

IFT-DSS Overall Strategic Objectives (1 of 2)

Make fuels treatment planning easier

- Allow users to acquire, create, and transform input data easily
- Provide data choices: treelist, LANDFIRE grids, user-supplied data
- Allow users to view and edit spatial and tabular data (inputs and outputs)
- Organize fuels treatment planning analysis steps and software tools

IFT-DSS Overall Strategic Objectives (2 of 2)

Make fuels treatment planning more scientifically robust

- Provide guidance regarding data and model choices based on the scale and type of analysis performed
- Allow users to publish and share analysis methods and algorithms
- Supply a mechanism to easily incorporate new models and tools as they are developed
- Provide quality control, documentation, and audit-trail information to meet regulatory reporting requirements

IFT-DSS Phase III Accomplishments

Meetings in Seattle & Missoula

Refined IFT-DSS work flow scenarios

Forest Service: NWCG managing partner (John)

WFDSS collaboration meetings, Boulder

IFT-DSS v 0.1.0

Systems of Systems meeting, Seattle (Mike)

IFT-DSS v 0.3.0

May	June	July	August	September	October	November	December	January	February	March	April	May
2009								2010				

GUI mock-ups

Development of communications strategy (Mike)

Implementation of communication strategy (Mike)

Savannah Fire Congress

IFT-DSS v 0.2.0

Meetings in Seattle and Missoula

Purpose: Meetings with research model developers to discuss software development approach and gain support for collaboration

Outcome:

- Fire and Environmental Research Applications (FERA) team will modularize applications for integration in larger systems
- Missoula fire lab will develop and share code library of models/modules
- Reinhardt and Dickinson independently publish a paper confirming the IFT-DSS vision[1]

[1] *First-Order Fire Effects Models for Land Management: Overview and Issues*; Fire Ecology 6(1):2010

Refined Work Flow Scenarios (1 of 2)

Purpose: Confirm and clarify the problem-solving needs of the fuels treatment planning community

Seven steps in the decision support process:

1) Define project, vegetation, landscape, and scale
2) Prepare and ensure quality of vegetation data
3) Simulate and analyze fire behavior
4) Analyze fire effects and/or fire risk
5) Design treatment strategies
6) Simulate treated vegetation as well as geophysical and fuel conditions
7) Simulate treatment effectiveness in reducing fire behavior and fire effects potentials

Refined Work Flow Scenarios (2 of 2)

Outcome: Seven work flow scenarios for implementation in IFT-DSS

Includes:

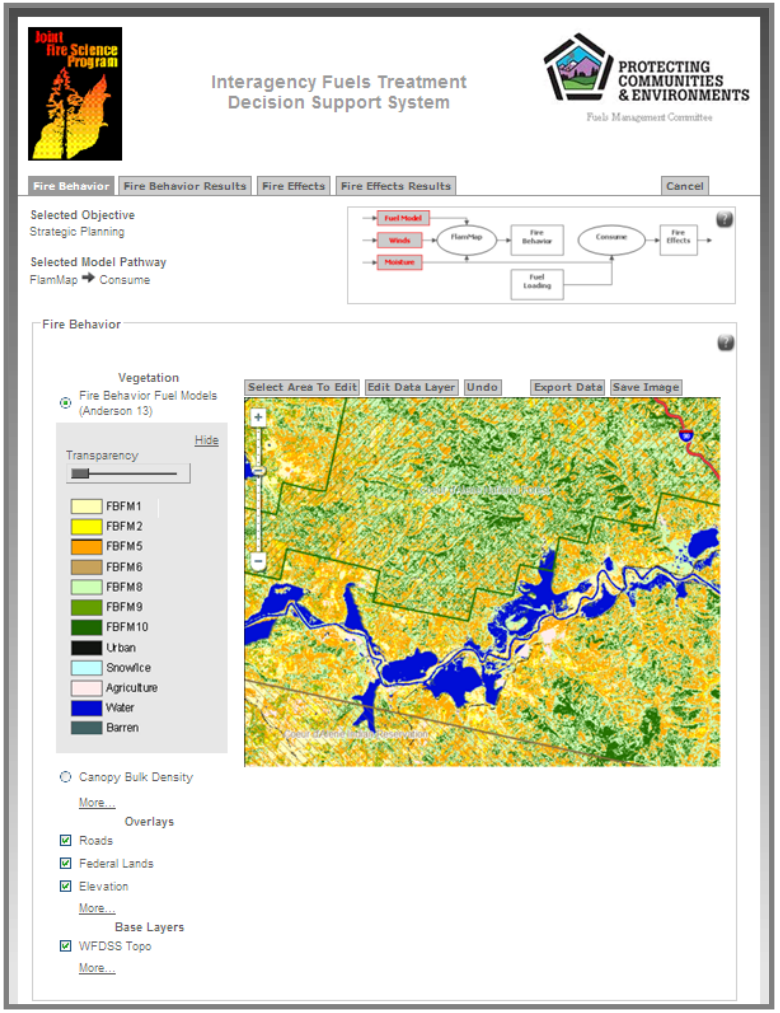
- Data acquisition and preparation
- ★ Strategic planning
- Spatially explicit fuels treatment assignment
- Fuels treatment over time
- ★ Prescribed burn planning
- Risk assessment
- User-defined (custom)

Refined Work Flow Scenarios and Proposed Proof of Concept System Functionality for the IFT-DSS; Drury et al., 2009

GUI Mock-ups and Software Design

Purpose: Share design ideas with the test user community and obtain feedback early

Outcome: Confirmation of design vision



WFDSS Collaboration Meetings

Purpose: Identify how IFT-DSS and WFDSS can collaborate and share software services

Outcome: Identified several initial collaboration areas

- Sharing "look and feel" elements of WFDSS (e.g., map symbology)
- Sharing GIS map layers
- Future sharing of IFT-DSS modules for WFDSS fuels analysis

- The WFDSS project team assigned Mitchell Burgard as the liaison between WFDSS and IFT-DSS
- Discussions regarding collaboration continue among the major systems (WFDSS, BlueSky, and IFT-DSS)

Fire Science Digest and Fire Ecology Congress, Savannah

Joint Fire Science Program

Fire Science Digest

RESEARCH SUPPORTING SOUND DECISIONS

ISSUE 7 DECEMBER 2009

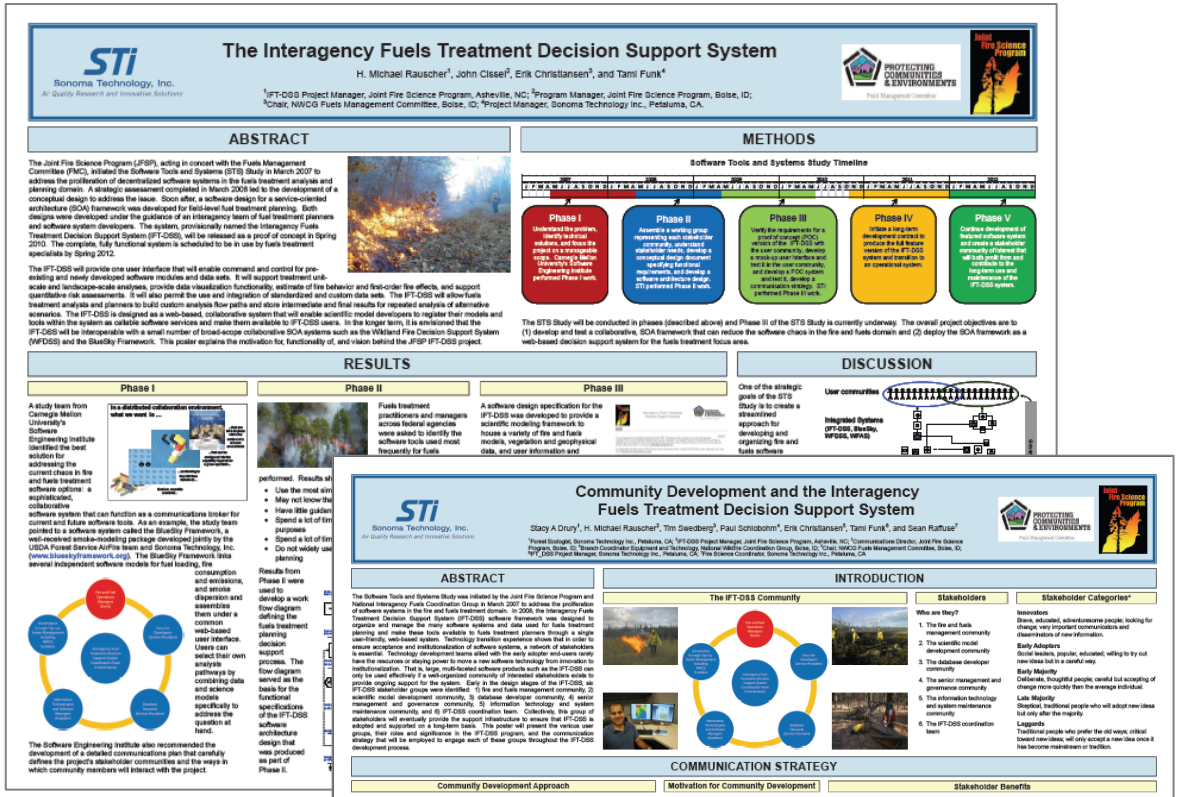
A Powerful New Planning Environment for Fuels Managers: The Interagency Fuels Treatment Decision Support System

The Joint Fire Science Program, the National Wildfire Coordinating Group Fuels Management Committee, and Sonoma Technology, Inc. are unveiling the prototype of a new planning environment that will help fuels specialists negotiate the confusing array of planning tools. The new framework, dubbed the Interagency Fuels Treatment Decision Support System, or IFT-DSS, organizes fuels-planning software and data into a seamless user environment. IFT-DSS offers users access to powerful modeling software from within a well-designed, intuitive graphical user interface, and it provides a common platform for the further development of fuels-planning software tools.

The name may not slide easily off the tongue—you might vocalize it as "Ift-Diss"—but the framework itself promises to revolutionize the way fuels planners do their jobs. It will smooth and simplify the fuels-treatment decision process by minimizing planners' struggles with unfamiliar models and hard-to-use databases. IFT-DSS will make fuels-treatment decision making less time-consuming, more scientifically rigorous, and easier to explain to stakeholders.

IFT-DSS will support fuel managers in their planning and implementation of treatments.

Eric Stenzel, USDA Forest Service, Fire Management Today



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The Interagency Fuels Treatment Decision Support System

H. Michael Rauscher[1], John Cissel[2], Erik Christiansen[3], and Tami Funk[4]

[1]IFT-DSS Project Manager, Joint Fire Science Program, Asheville, NC; [2]Program Manager, Joint Fire Science Program, Boise, ID; [3]Chair, NWCG Fuels Management Committee, Boise, ID; [4]Project Manager, Sonoma Technology Inc., Petaluma, CA.

PROTECTING COMMUNITIES & ENVIRONMENTS

Joint Fire Science Program

ABSTRACT

The Joint Fire Science Program (JFSP), acting in concert with the Fuels Management Committee (FMC), initiated the Software Tools and Systems (STS) Study in March 2007 to address the proliferation of decentralized software systems in the fuels treatment analysis and planning domain. A strategic assessment completed in March 2008 led to the development of a conceptual design to address the issue. Soon after, a software design for a service-oriented architecture (SOA) framework was developed for field-level fuel treatment planning. Both designs were developed under the guidance of an interagency team of fuel treatment planners and software system developers. The system, provisionally named the Interagency Fuels Treatment Decision Support System (IFT-DSS), will be released as a proof of concept in Spring 2010. The complete, fully functional system is scheduled to be in use by fuels treatment specialists by Spring 2012.

The IFT-DSS will provide one user interface that will enable command and control for pre-existing and newly developed software modules and data sets. It will support treatment unit-scale and landscape-scale analyses, provide data visualization functionality, estimate of fire behavior and first-order fire effects, and support quantitative risk assessments. It will also permit the use and integration of standardized and custom data sets. The IFT-DSS will allow fuels treatment analysts and planners to build custom analysis flow paths and store intermediate and final results for repeated analysis of alternative scenarios. The IFT-DSS is designed as a web-based, collaborative system that will enable scientific model developers to register their models and tools within the system as callable software services and make them available to IFT-DSS users. In the longer term, it is envisioned that the IFT-DSS will be interoperable with a small number of broad-scope collaborative SOA systems such as the Wildland Fire Decision Support System (WFDSS) and the BlueSky Framework. This poster explains the motivation for, functionality of, and vision behind the JFSP IFT-DSS project.

METHODS

Software Tools and Systems Study Timeline

Phase I: Understand the problem, identify technical solutions, and focus the project on a manageable scope. Carnegie Mellon University's Software Engineering Institute performed Phase I work.

Phase II: Assemble a working group representing each stakeholder community, understand stakeholder needs, develop a conceptual design document specifying functional requirements, and develop a software architecture design. STI performed Phase II work.

Phase III: Verify the requirements for a proof of concept (POC) version of the IFT-DSS with the user community, develop a 'look-up' user interface and test it in the user community, and develop a POC system and test it, develop a communications strategy. STI performed Phase III work.

Phase IV: Initiate a long-term development contract to produce the full feature version of the IFT-DSS system and transition to an operational system.

Phase V: Continue development of featured software system and create a stakeholder community of interest that will build, profit from and contribute to the long-term care and maintenance of the IFT-DSS system.

The STS Study will be conducted in phases (described above) and Phase III of the STS Study is currently underway. The overall project objectives are to (1) develop and test a collaborative, SOA framework that can reduce the software chaos in the fire and fuels domain and (2) deploy the SOA framework as a web-based decision support system for the fuels treatment focus area.

RESULTS

Phase I

A study team from Carnegie Mellon University's Software Engineering Institute identified the best solution for addressing the current chaos in fire and fuels treatment software options: a sophisticated, collaborative software system that can function as a communications broker for current and future software tools. As an example, the study team pointed to a software system called the BlueSky Framework, a well-received smoke-modeling package developed jointly by the USDA Forest Service AirFire team and Sonoma Technology, Inc. (www.blueskyframework.org). The BlueSky Framework links several independent software models for fuel loading, fire consumption and emissions, and smoke dispersion and assembles them under a common web-based user interface. Users can select their own analysis pathways by combining data and science models specifically to address the question at hand.

The Software Engineering Institute also recommended the development of a detailed communications plan that carefully defines the project's stakeholder communities and the ways in which community members will interact with the project.

Phase II

Fuels treatment practitioners and managers across federal agencies were asked to identify the software tools used most frequently for fuels

performed. Results sh

- Use the most sim
- May not know the
- Have little guidan
- Spend a lot of tim purposes
- Spend a lot of tim
- Do not widely use planning

Results from Phase II were used to develop a work flow diagram defining the fuels treatment planning decision support process. The flow diagram served as the basis for the functional specifications of the IFT-DSS software architecture design that was produced as part of Phase II.

Phase III

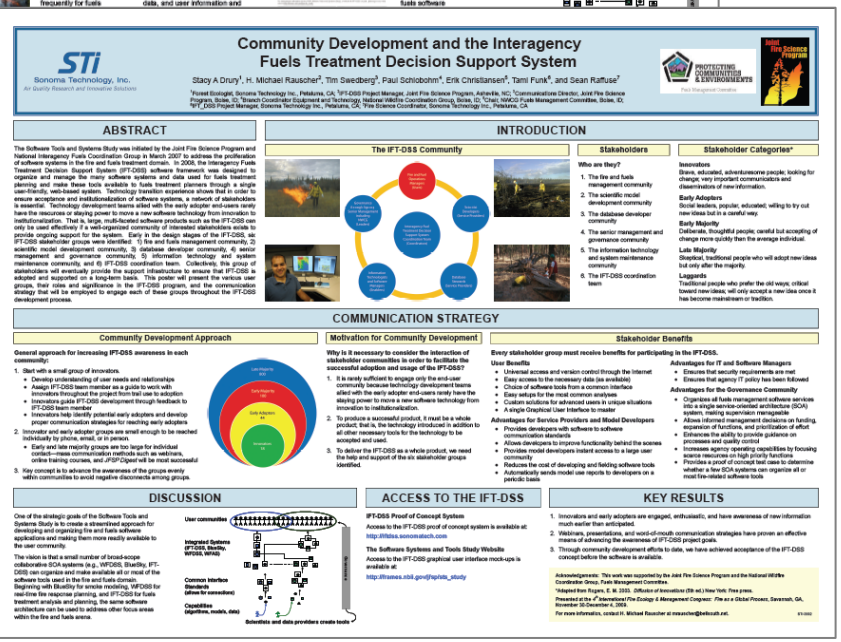
A software design specification for the IFT-DSS was developed to provide a scientific modeling framework to house a variety of fire and fuels models, vegetation and geophysical data, and user information and

DISCUSSION

One of the strategic goals of the STS Study is to create a streamlined approach for developing and organizing fire and fuels software

User communities

Integrated Systems (IFT-DSS, BlueSky, WFDSS, WFAS)



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Community Development and the Interagency Fuels Treatment Decision Support System

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[1]Forest Ecologist, Sonoma Technology Inc., Petaluma, CA; [2]IFT-DSS Project Manager, Joint Fire Science Program, Asheville, NC; [3]Communications Director, Joint Fire Science Program, Boise, ID; [4]Branch Coordinator Equipment and Technology, National Wildfire Coordination Group, Boise, ID; [5]Chair, NWCG Fuels Management Committee, Boise, ID; [6]IFT_DSS Project Manager, Sonoma Technology Inc., Petaluma, CA; [7]Fire Science Coordinator, Sonoma Technology Inc., Petaluma, CA

PROTECTING COMMUNITIES & ENVIRONMENTS

Joint Fire Science Program

ABSTRACT

The Software Tools and Systems Study was initiated by the Joint Fire Science Program and National Interagency Fuels Coordination Group in March 2007 to address the proliferation of software systems in the fire and fuels treatment domain. In 2008, the Interagency Fuels Treatment Decision Support System (IFT-DSS) software framework was designed to organize and manage the many software systems and data used for fuels treatment planning and make these tools available to fuels treatment planners through a single user-friendly, web-based system. Technology transition experience shows that in order to ensure acceptance and institutionalization of software systems, a network of stakeholders is essential. Technology development teams allied with the early adopter end-users rarely have the resources or staying power to move a new software technology from innovation to institutionalization. That is, large, multi-faceted software products such as the IFT-DSS can only be used effectively if a well-organized community of interested stakeholders exists to provide ongoing support for the system. Early in the design stages of the IFT-DSS, six IFT-DSS stakeholder groups were identified: 1) fire and fuels management community, 2) scientific model development community, 3) database developer community, 4) senior management and governance community, 5) information technology and system maintenance community, and 6) IFT-DSS coordination team. Collectively, this group of stakeholders will eventually provide the support infrastructure to ensure that IFT-DSS is adopted and supported on a long-term basis. This poster will present the various user groups, their roles and significance in the IFT-DSS program, and the communication strategy that will be employed to engage each of these groups throughout the IFT-DSS development process.

INTRODUCTION

The IFT-DSS Community

Stakeholders

Who are they?

1. The fire and fuels management community
2. The scientific model development community
3. The database developer community
4. The senior management and governance community
5. The information technology and system maintenance community
6. The IFT-DSS coordination team

Stakeholder Categories*

Innovators
Brave, educated, adventuresome people, looking for change, very important communicators and disseminators of new information.

Early Adopters
Social leaders, popular, educated, willing to try out new ideas but in a careful way.

Early Majority
Deliberate, thoughtful people, careful but accepting of change more quickly than the average individual.

Late Majority
Skeptical, traditional people who will adopt new ideas but only after the majority.

Laggards
Traditional people who prefer the old ways, critical toward new ideas; will only accept a new idea once it has become mainstream or tradition.

COMMUNICATION STRATEGY

Community Development Approach

General approach for increasing IFT-DSS awareness in each community:

1. Start with a small group of innovators.
   - Develop understanding of user needs and relationships
   - Assign IFT-DSS team member as a guide to work with innovators throughout the project from trial use to adoption
   - Innovators guide IFT-DSS development through feedback to IFT-DSS team member
   - Innovators help identify potential early adopters and develop proper communication strategies for reaching early adopters
2. Innovator and early adopter groups are small enough to be reached individually by phone, email, or in person.
   - Early and late majority groups are too large for individual contact—mass communication methods such as webinars, online training courses, and *JFSP Digest* will be most successful
3. Key concept is to advance the awareness of the groups evenly within communities to avoid negative disconnects among groups.

Motivation for Community Development

Why is it necessary to consider the interaction of stakeholder communities in order to facilitate the successful adoption and usage of the IFT-DSS?

1. It is rarely sufficient to engage only the end-user community because technology development teams allied with the early adopter end-users rarely have the staying power to move a new software technology from innovation to institutionalization.
2. To produce a successful product, it must be a whole product; that is, the technology introduced in addition to all other necessary tools for the technology to be accepted and used.
3. To deliver the IFT-DSS as a whole product, we need the help and support of the six stakeholder groups identified.

Stakeholder Benefits

Every stakeholder group must receive benefits for participating in the IFT-DSS.

User Benefits
- Universal access and version control through the Internet
- Easy access to the necessary data (as available)
- Choice of software tools from a common interface
- Easy setups for the most common analyses
- Custom solutions for advanced users in unique situations
- A single Graphical User Interface to master

Advantages for Service Providers and Model Developers
- Provides developers with software to software communication standards
- Allows developers to improve functionality behind the scenes
- Provides model developers instant access to a large user community
- Reduces the cost of developing and fielding software tools
- Automatically sends model use reports to developers on a periodic basis

Advantages for IT and Software Managers
- Ensures that security requirements are met
- Ensures that agency IT policy has been followed

Advantages for the Governance Community
- Organizes all fuels management software services into a single service-oriented architecture (SOA) system, making supervision manageable
- Allows informed management decisions on funding, expansion of functions, and prioritization of effort
- Enhances the ability to provide guidance on processes and quality control
- Increases agency operating capabilities by focusing scarce resources on high priority functions
- Provides a proof of concept test case to determine whether a few SOA systems can organize all or most fire-related software tools

DISCUSSION

One of the strategic goals of the Software Tools and Systems Study is to create a streamlined approach for developing and organizing fire and fuels software applications and making them more readily available to the user community.

The vision is that a small number of broad-scope collaborative SOA systems (e.g., WFDSS, BlueSky, IFT-DSS) can organize and make available all or most of the software tools used in the fire and fuels domain. Beginning with BlueSky for smoke modeling, WFDSS for real-time fire response planning, and IFT-DSS for fuels treatment analysis and planning, the same software architecture can be used to address other focus areas within the fire and fuels arena.

User communities

Integrated Systems (IFT-DSS, BlueSky, WFDSS, WFAS)

Common Interface Standards (allows for connections)

Capabilities (algorithms, models, data)

Scientists and data providers create tools

ACCESS TO THE IFT-DSS

IFT-DSS Proof of Concept System

Access to the IFT-DSS proof of concept system is available at: http://ftdss.sonomatech.com

The Software Systems and Tools Study Website

Access to the IFT-DSS graphical user interface mock-ups is available at: http://frames.nbii.gov/ifsp/sts_study

KEY RESULTS

1. Innovators and early adopters are engaged, enthusiastic, and have awareness of new information much earlier than anticipated.
2. Webinars, presentations, and word-of-mouth communication strategies have proven an effective means of advancing the awareness of IFT-DSS project goals.
3. Through community development efforts to date, we have achieved acceptance of the IFT-DSS concept before the software is available.

Acknowledgements: This work was supported by the Joint Fire Science Program and the National Wildfire Coordination Group, Fuels Management Committee.

[1]Adapted from Rogers, E. M. 2003. *Diffusion of Innovations* (5th ed.) New York: Free press.

Presented at the 4th *International Fire Ecology & Management Congress: Fire as a Global Process*, Savannah, GA, November 30-December 4, 2009.

For more information, contact H. Michael Rauscher at mrauscher@sehcoutt.net.

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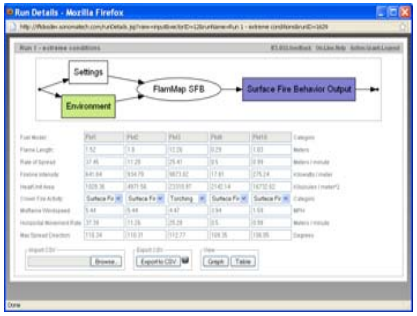
Software Development Process (1 of 3)

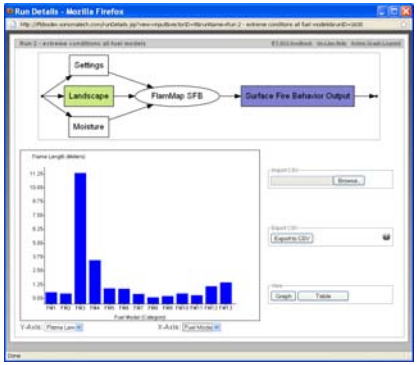
Agile – rapid prototyping approach

Methodology for software development based on iterative development, where objectives and solutions evolve through collaboration among cross-functional teams

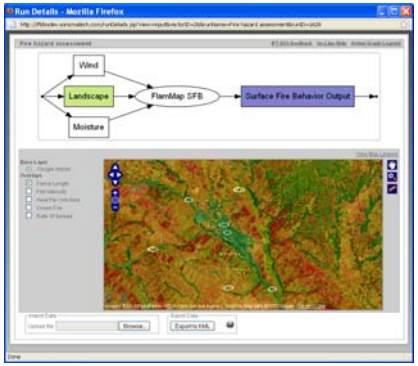
IFT-DSS v 0.1.0
(January 2009)



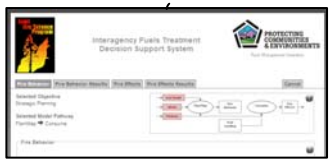
IFT-DSS v 0.2.0
(April 2010)



IFT-DSS v 0.3.0
(May 2010)



Software Development Process (2 of 3)



Iterative design process

Test user group

Design team

Subject matter experts

Engineering team

Iterative software releases

Goals:

Software that people want to use

Large user base = ongoing operations and maintenance support

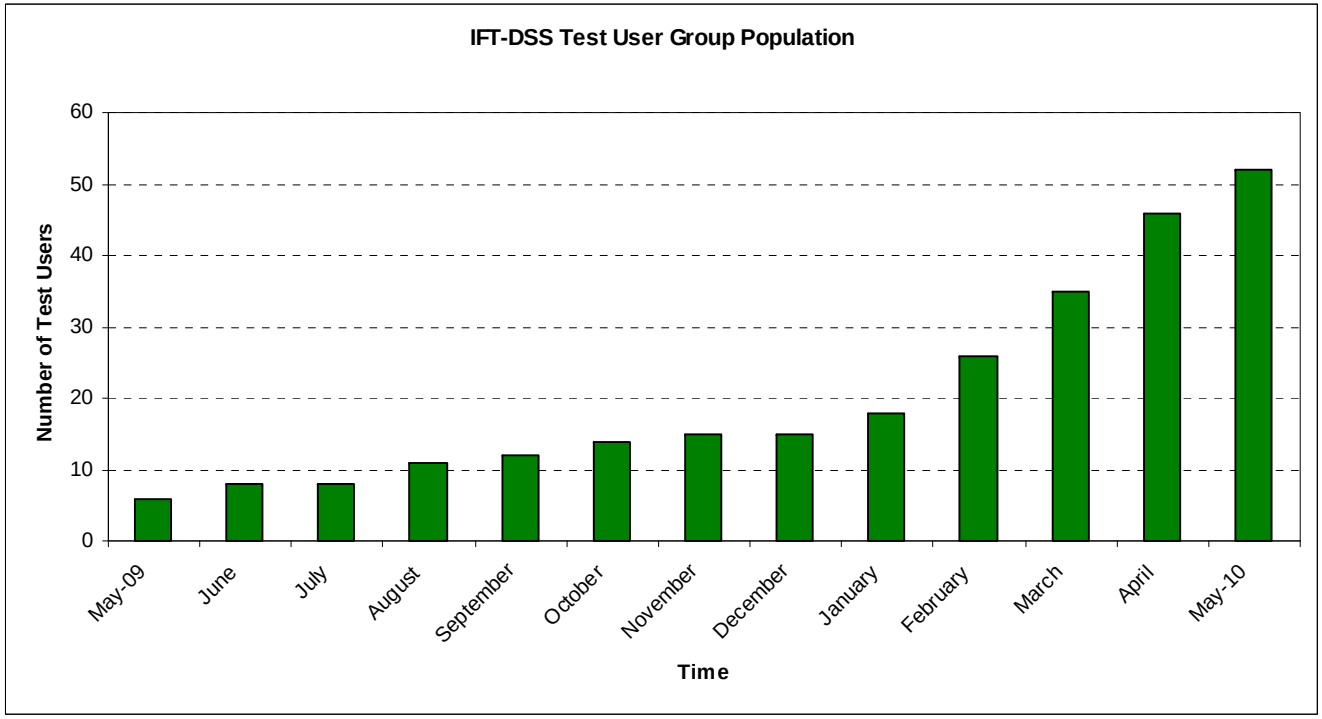
Software Development Process (3 of 3)

- Benefits
  - Engage user community early
  - Build user base in parallel with software development
  - Create software that people will want to use
- Critical elements
  - Active test user group
  - User feedback and response system
  - Strong team coordination

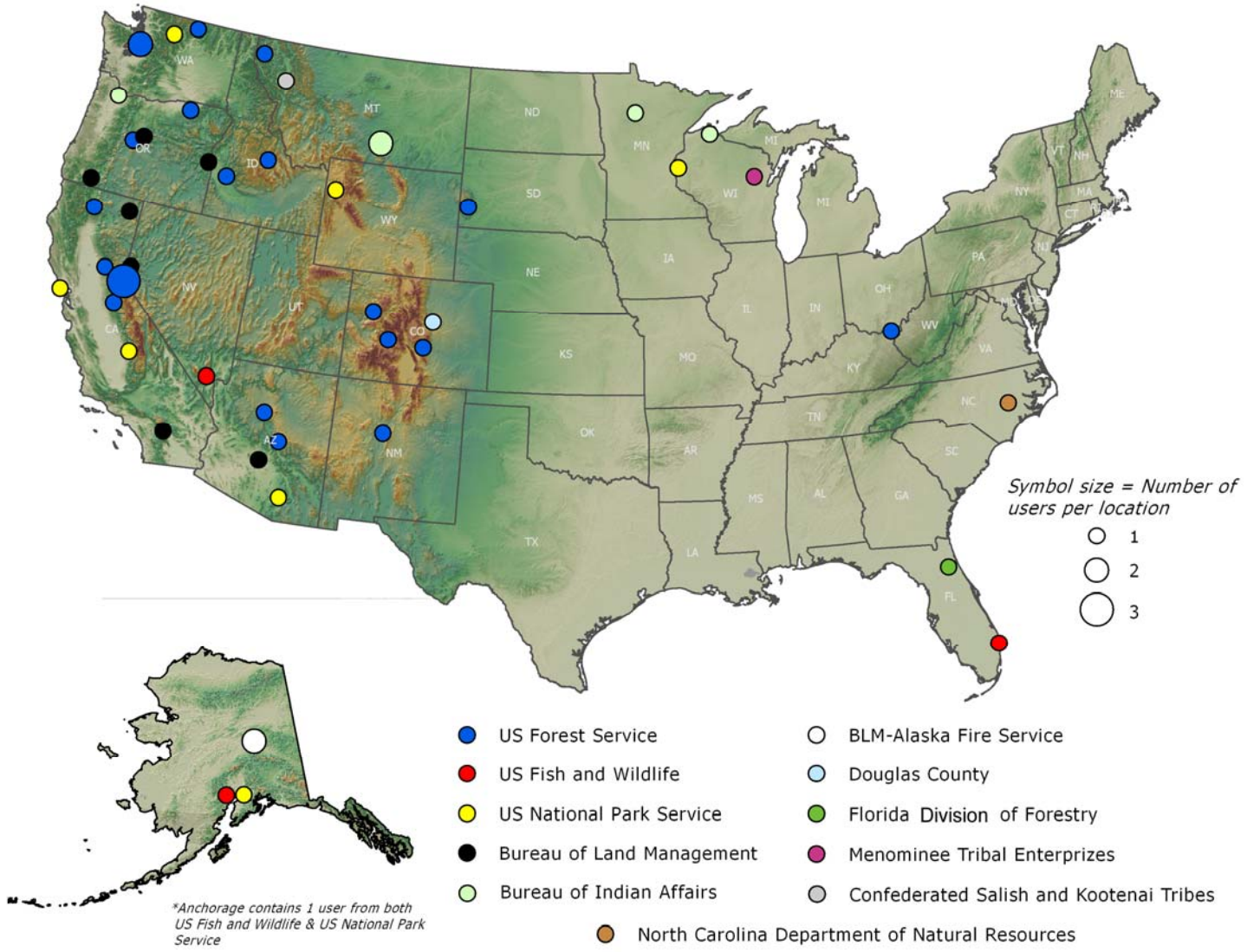
Test User Group (1 of 2)

Demographics

- Multi-agency representation
- Geographic representation



Test User Group (2 of 2)



Proof of Concept Objectives (1 of 2)

- Develop a framework to facilitate the fuels treatment decision support process
- Provide a user interface that is straightforward and easy to access
- Offer users software model choices within work flow scenarios
- Provide data choices

Proof of Concept Objectives (2 of 2)

- Support visualization and editing of spatial and tabular data
- Facilitate document preparation
- Support analytical collaboration
- Connect with other service-oriented systems
- Incorporate user feedback

IFT-DSS Proof of Concept Objectives	IFT-DSS Version 0.1.0	IFT-DSS Version 0.2.0	IFT-DSS Version 0.3.0
Develop a framework to facilitate the fuels treatment decision support process a) Prescribed burn planning b) Strategic fuels treatment planning	✓	✓	✓
Provide an easily accessible and straightforward user interface	✓	✓	✓
Provide users with software model choices		✓	✓
Provide users with input data choices			✓
Support visualization of tabular and spatial data	✓	✓	✓
Support for the preparation of documentation	✓	✓	✓
Support for collaboration among users	✓	✓	✓
Support the integration of existing and new models	✓	✓	✓
Support for connection and interoperability with other systems		✓	✓
Incorporate user feedback during the development cycle		✓	✓

IFT-DSS Phase IV: June 2010 – June 2012 (1 of 2)

- Continue community development effort
- Develop risk assessment work flow
- System implementation (2010-2011)
  - Refinement of work flow scenarios
  - Complete implementation of work flows:
    - Data acquisition and preparation
    - Strategic planning
    - Prescribed burn planning
    - Spatially explicit fuels treatment
    - Fuels treatment over time
- Transfer IFT-DSS v 1.0.0 to Forest Service

IFT-DSS Phase IV: June 2010 – June 2012 (2 of 2)

- System administration training
- User training in coordination with Fuels Management Committee
- System implementation (2011-2012)
  - Risk assessment work flow
  - User-defined custom work flow
- Technology transfer
  - Transfer IFT-DSS v 2.0.0 to Forest Service (June 2012)

IFT-DSS Phase III May 2009 – May 2010

- The Software Tools and Systems Study – John Cissel
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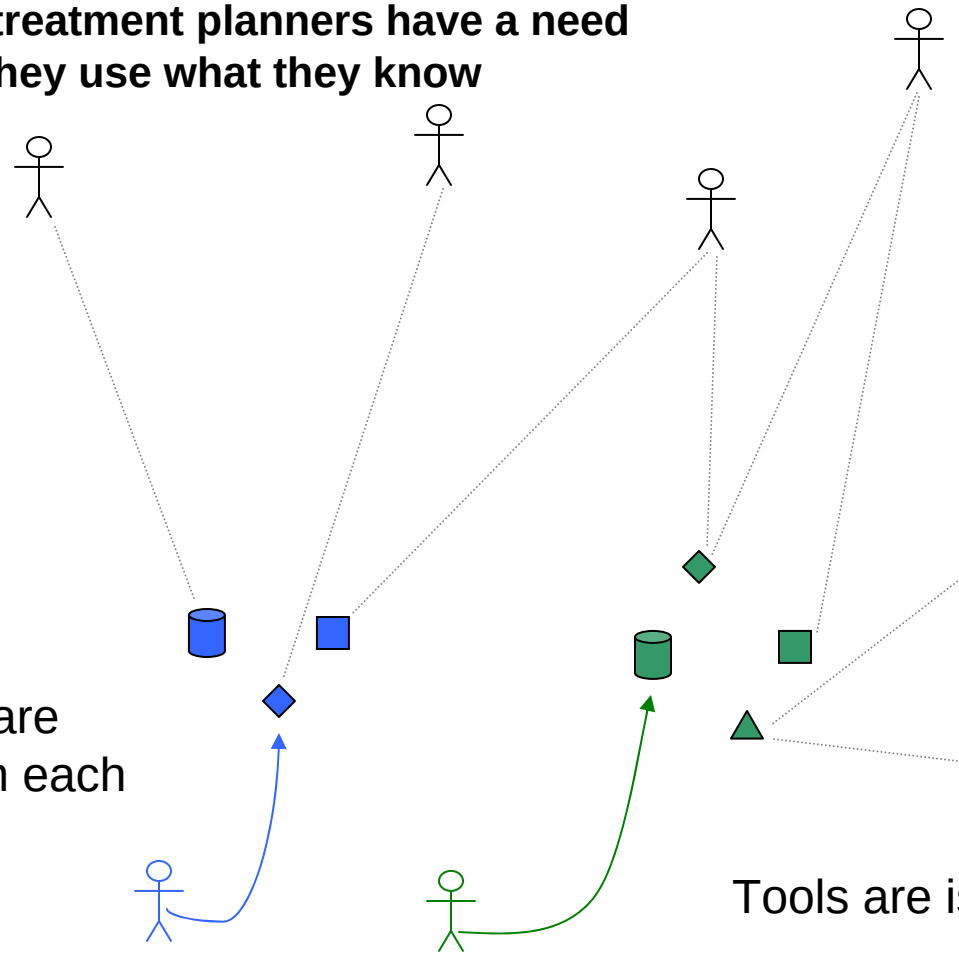
- The Emerging Vision for Fire Software Systems - Mike Rauscher
- The Human Framework around IFT-DSS – Mike Rauscher
- Questions and Discussion

The Evolution of the System of Systems Vision

- Phase I (Apr 2007 – Mar 2008): Lessons from the SEI
  - Web-based, Service Oriented Frameworks are possible & desirable
  - Stakeholder communities must be part of the solution from the start
- Phase II (Apr 2008 – May 2009): Getting to know the problem
  - Learning about web-based, SOA framework systems (WFDSS, Bluesky, etc)
  - Getting to know users and developers and their problems & needs
- Phase III (Jun 2009 – May 2010): Clarifying the SoS Vision
  - Writing & First Year Implementation of a Communications Plan (Tim Swedberg)
  - Discussions with WFDSS, Bluesky, FERA FFA, Missoula framework developers
  - Discussions with Brad Harwood, John Noneman, Paul Schlobohm
  - Presentations to the NWCG Directors & acceptance of vision (John Cissel)
  - First meeting of System of Systems Working Group, Seattle, WA Mar 2, 2010
  - Vision expounded in scientific journal article by Reinhardt and Dickinson
- Phase IV (Jun 2010 – Sep 2012) Voluntary Implementation & POC

Vision for the Fuels Treatment Community (1 of 5)

Fuels treatment planners have a need and they use what they know



Governance & IT Community Stakeholders Missing

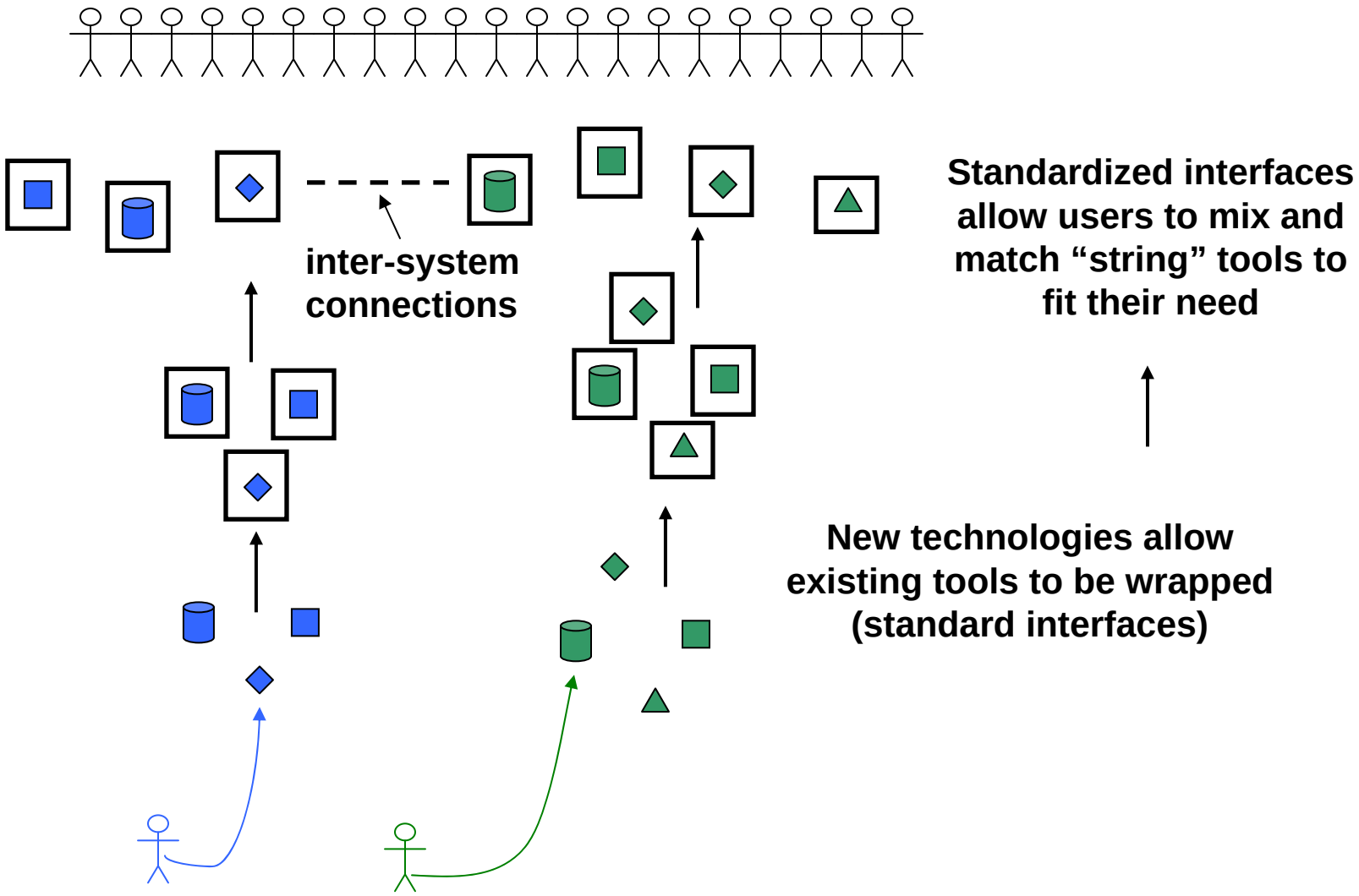
Users are isolated from each other

Developers are isolated from each other

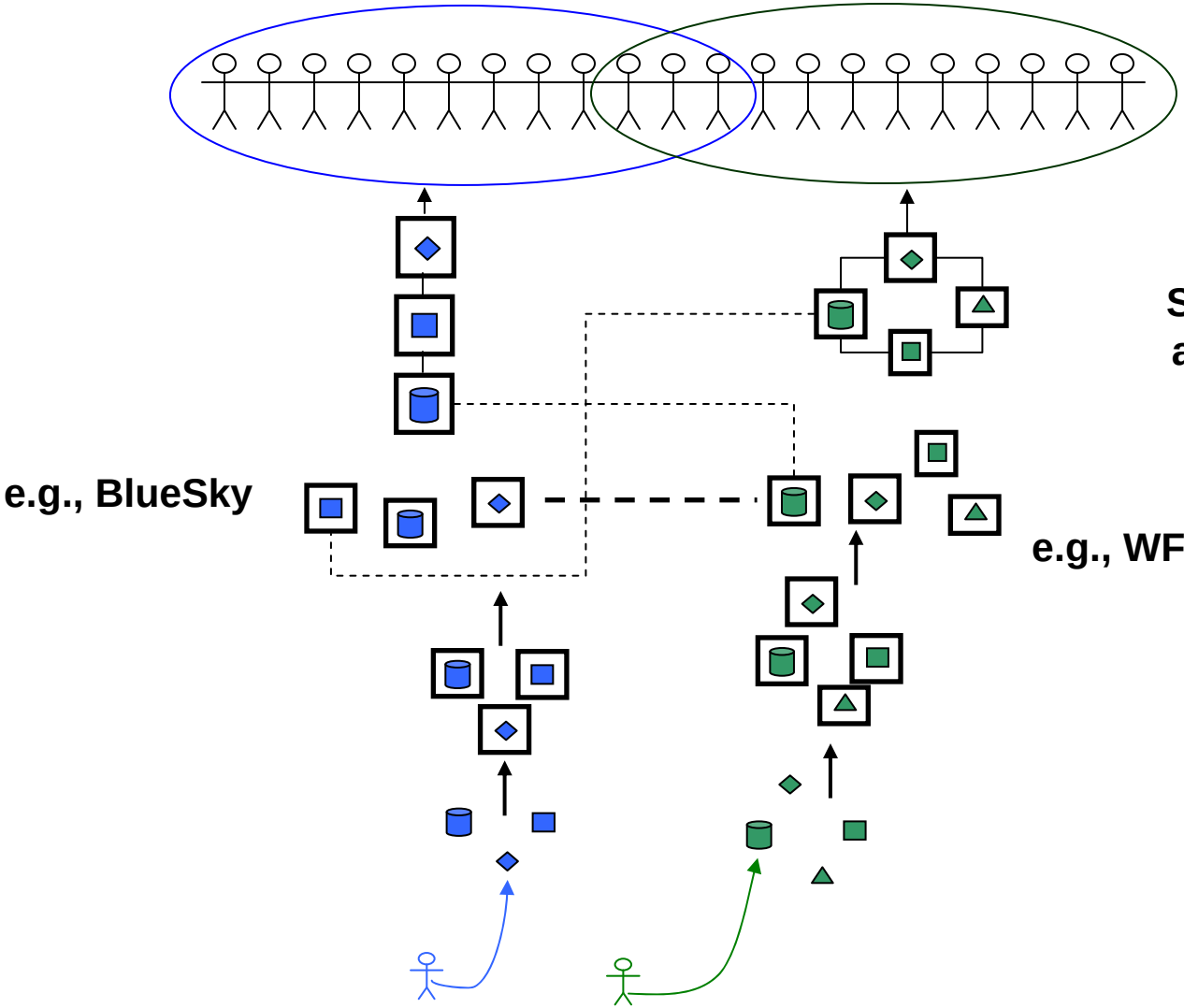
Tools are isolated from each other

Scientists and data providers create tools

Vision for the Fuels Treatment Community (3 of 5)



Vision for the Fuels Treatment Community (4 of 5)



Standardized interfaces also allow inter-system communication

Scientists and data providers create tools

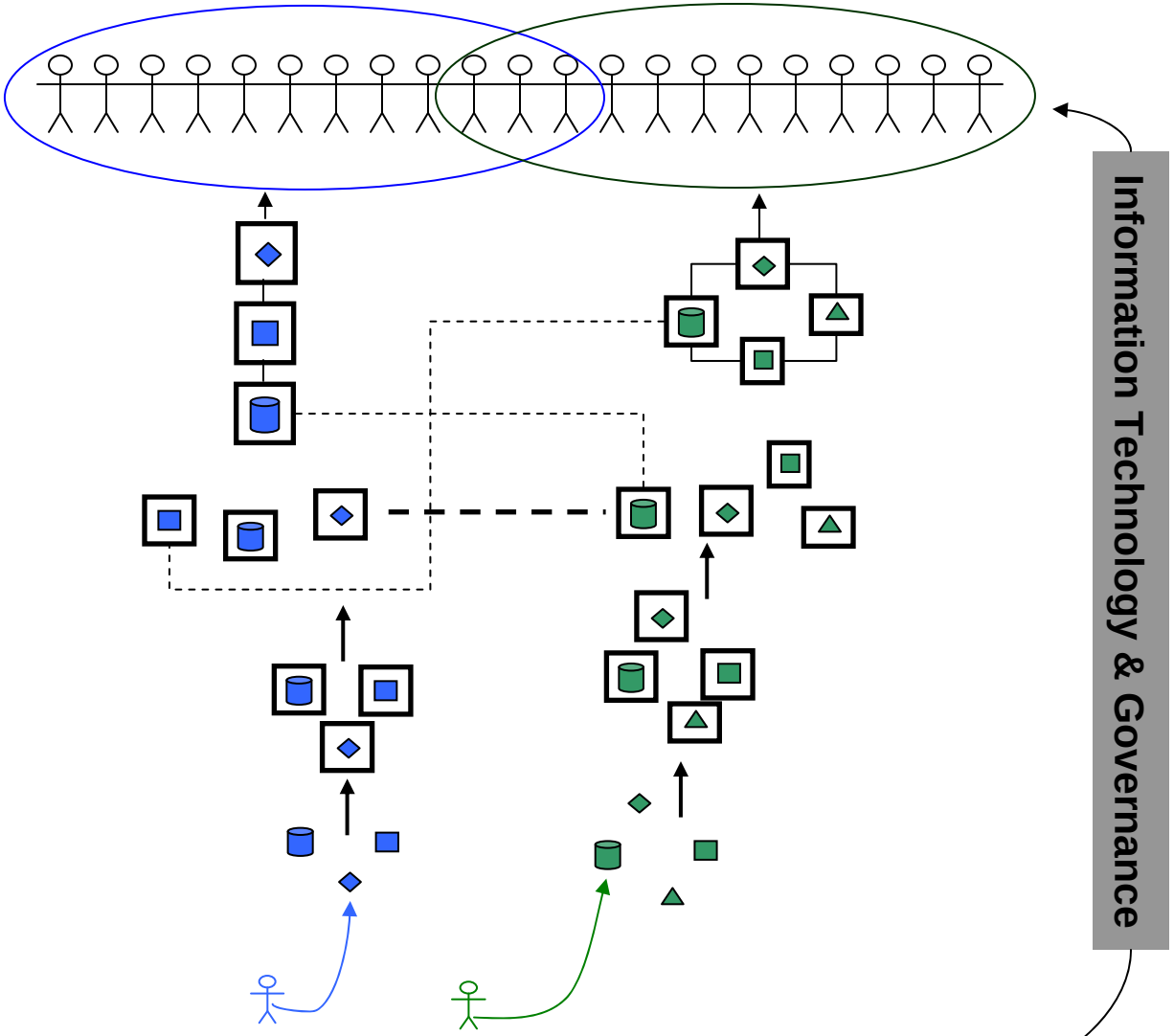
Vision for the Fuels Treatment Community

User communities

Integrated Systems
(IFT-DSS, BlueSky, WFDSS, FFA, IrWin, FamWeb, WIMS, etc)

Common Interface Standards
(allows for connections)

Capabilities
(algorithms, models, data)



Information Technology & Governance

Scientists and data providers create tools

IFT-DSS Phase III May 2009 – May 2010

- The Software Tools and Systems Study – John Cissel
- Phase III Accomplishments – Tami Funk
- IFT-DSS version 0.3.0 Demonstration – Tami Funk
- IFT-DSS Phase IV – Tami Funk/John Cissel
- The Emerging Vision for Fire Software Systems - Mike Rauscher
- The Human Framework around IFT-DSS – Mike Rauscher
- Questions and Discussion

The Stakeholder Operational Environment

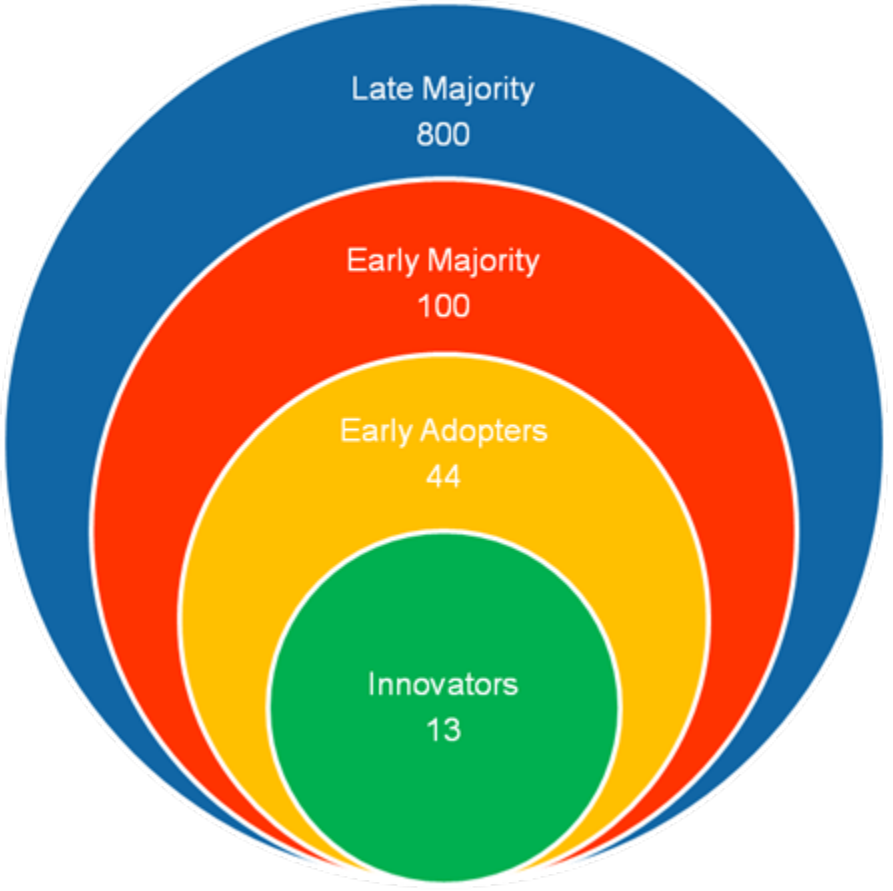
The Diffusion of IFT-DSS Awareness & Use in a Stakeholder Community

Awareness

Understanding

Trial Use

Adoption



Results of First Year Communications Efforts

	Early Adopters	Early Majority	Late Majority	All Audiences
Users	T (50)	A (500)	app. 500	17,000
Developers	U (12)	A (50)	app. 100	
IT Comm.	A (5)	app. 30	app. 60	
Governance	A (20)	app. 100	app. 200	

A=awareness; U=understanding; T=Trial Use AD=adoption

Phase III Communications Efforts 2,500 people heard IFT-DSS Presentation