

# **The Software Reuse Working Group: A Case Study in Fostering Reuse**

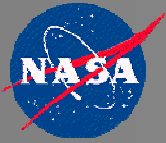
Ryan Gerard (Innovim / NASA GSFC)

Robert R. Downs (CIESIN, Columbia University)

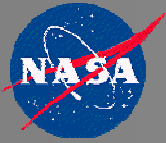
*James J. Marshall (Innovim / NASA GSFC)*

Robert E. Wolfe (NASA GSFC)

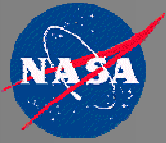
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Information Reuse and Integration  
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- Goals of NASA's Earth Science Data Systems (ESDS) Software Reuse Working Group (WG):
  - Save time and money
  - Increase flexibility and responsiveness
  - Increase effective and accountable community participation
- Activities of the Reuse WG include:
  - *Reuse Implementation*
  - Reuse Incentives
  - Policy Change
  - Support/Enablement
  - *Outreach and Education*
- We have assisted others in reusing the technology we used to create our portal web site.

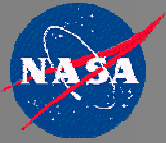


- Key drivers for the web portal include:
  - Serve the community of Earth science data systems and software developers who are interested in reuse
  - Serve as a gateway for reuse information relevant to the community
  - Establish a portal for the community to share resources on reuse
  - Distribute various resources on reuse to the community
  - Foster easier access to resources on reuse
- Major content categories based on purposes identified for the web portal include:
  - List of catalogs of reusable assets, tools, etc.
  - Reference library including events, news, Working Group documents, and other resources
  - Information on open source software projects and licensing
  - Funding opportunities
- “Suggest content” feature for user-submitted ideas

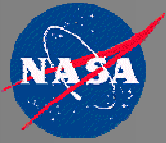


- Developed using Plone 2.0.5 and Zope 1.3
  - Upgraded to Plone 2.5.2 and Zope 2.9.7 during site move
- Modified NASA templates to provide look and feel
- Reused database code (DTML) and trade studies by co-workers and other webmasters
- Basic web stats, 11/05 to 2/07:
  - 9300 visitors, 7200 unique
  - 31000 page views
  - Site has been in top 3 hits for “software reuse” on major search engines.
  - Had Google PageRank 6 before site changed its domain name.

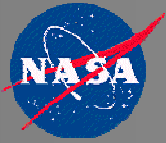
The screenshot shows the website for the Earth Science Data System (ESDS) Software Reuse Working Group. The header includes the NASA logo and 'GODDARD SPACE FLIGHT CENTER' on the left, and '+ Visit NASA.gov' and '+ Goddard Home Page' on the right. Below the header is a banner with the text 'Earth Science Data System Software Reuse Working Group' and a graphic of a satellite and a recycling symbol. The main navigation bar contains links for '+ HOME', '+ REUSABLE ASSETS', '+ RESOURCES', '+ OPEN SOURCE', and '+ FUNDING OPPORTUNITIES'. A 'working group members log in' link is also present. The main content area is divided into two columns. The left column contains a 'news' section with items like 'Reuse Session at ESIP 2007 Summer Meeting' and 'FOSS4G 2007 Presentations Due June 29'. The right column contains an 'Earth Science Software Reuse' article by 'admin' dated 2007-06-13. The article text reads: 'Welcome to the Earth Science Data System (ESDS) Software Reuse Portal. Please visit the ESDS Working Group Page for more information about our group. Software reuse can help the science community by reducing software development timescales, reducing costs, and contributing to the dissemination of knowledge and expertise. This Software Reuse Portal has been established by the Reuse Working Group to bring together a collection of resources that will facilitate reuse within the Earth science community. Over time, we will be researching a variety of resources in the Earth and space science reuse communities. Our long-term goal is to establish a knowledge sharing community for software reuse in Earth science and, possibly, to establish a "marketplace" for reusable software development artifacts. We have completed our survey to better understand the practice of software reuse within the Earth Science community. Preliminary survey findings have been published. For more information, please visit our News, Site Map, About Us, FAQ, Suggest Content and/or Contact page.' Below the article is a diagram titled 'Developing an internal marketplace for reusable software development artifacts'. The diagram shows a path leading to a group of people. On the left, a person is pushing a cart labeled 'Supply' with the text 'Increase the supply and availability of reusable assets'. On the right, a person is standing near a sign that says 'Demand' with the text 'Demonstrate the feasibility and value of reuse through focused projects' and 'Increase community capacity and desire (knowledge & tools) to reuse existing assets'. A central sign reads 'It should be as easy to find a good quality reusable software asset as it is to find a book on the internet'. At the bottom, a person is standing near a sign that says 'Marketplace Enablement' with the text 'Remove existing barriers to reuse' and 'Establish incentives to offset artificial/structural barriers to reuse'.



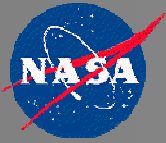
- Application reuse
  - Reusing an entire application by including it inside another
  - Example: Zope is reused by Plone (Plone builds off of Zope)
- Component reuse
  - Reuse of complete subsystems to fulfill a requirement
  - Example: Plone modules and add-ons
- Function reuse
  - Reuse of an asset for a well-defined function
  - Example: Our reuse of DTML code to create a “suggest content” form that will accept submission of ideas from users
- Other types of reuse include:
  - Procedural, reuse of techniques for implementation
  - Documentation, reuse of documentation developed for a local implementation and packaging of documentation



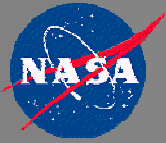
- Created a zip archive that contained:
  - Plone software
  - Enhancements created by the Software Reuse WG
  - Aspects of design and layout
    - NASA style sheets and templates for header and footer
  - Associated documentation
    - Quick start guide
    - General operating procedures
    - Integration instructions
    - Reference guide
    - Source documentation
- *Inclusion of documentation assists other adopters in the installation and implementation process.*



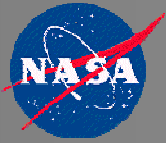
- Used COCOMO to estimate development effort
  - $E = a \times S^b$  with  $E$  = effort,  $S$  = size in KLOC,  $a$  and  $b$  constants
  - Project is semi-detached (medium size), so  $a = 3.0$ ,  $b = 1.12$
  - We wrote approximately 500 lines of code, so  $S = 0.5$
  - Effort ( $E$ ) = 1.4 staff-months
- Our work was provided to three other groups, saving them a total of 4.2 staff-months of effort
  - Other groups are now looking to reuse the same work.
  - This would result in higher savings than currently estimated.
- Using a general formula to estimate reuse:
  - $\text{Reuse \%} = (\text{Reused Statements} / \text{Total Statements}) \times 100$
  - Approximately 95% of our system was created through reuse
- Others using the same system also benefited from our work getting permission to use Plone/Zope publicly on a NASA site.



- Use of separate development and deployment systems can help reduce downtime of the system.
  - Improved documentation to support deployment can also help.
  - Closer contact between groups sharing a server can help make the best use of the resources available.
    - Sharing a server can result in shared risks that must be addressed.
    - Vulnerabilities in one deployment may affect other deployments on the same system.
- Users and privileges must be managed carefully.
  - Ensures that only the appropriate people can perform certain actions.
- Workflow should be managed so that nothing goes live without an administrator's approval.
  - Typical flow: user creates private document, makes it visible, submits it for publication, administrator approves/rejects it



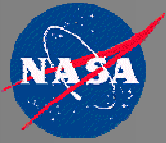
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- Regardless of the type of reuse, clear documentation and support of previous adopters are necessary to help aid adoption.
  - Capturing the knowledge gained from reuse experiences can contribute to successive reuse if described clearly and included in the documentation.
  - Packaging that includes appropriate supporting material allows others to adopt the software with less effort.
  - Other barriers to reuse exist; e.g., organizational aspects can influence the potential for successful reuse.
  - Making a software asset available for reuse can result in significant savings for its adopters.



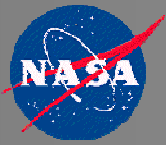
- NASA Earth Science Data Systems (ESDS) Working Groups
  - Coordinator, Kathy Fontaine (<http://esdswg.gsfc.nasa.gov/>)
- Software Reuse Working Group
  - Chair, Robert E. Wolfe ([Robert.E.Wolfe@nasa.gov](mailto:Robert.E.Wolfe@nasa.gov))
  - Outreach and Education Team Leader: Robert R. Downs ([rdowns@ciesin.columbia.edu](mailto:rdowns@ciesin.columbia.edu))
  - General Information: Ryan Gerard ([Ryan.Gerard@nasa.gov](mailto:Ryan.Gerard@nasa.gov))  
James J. Marshall ([James.J.Marshall@nasa.gov](mailto:James.J.Marshall@nasa.gov))

The screenshot shows the website for the Earth Science Data System Software Reuse Working Group. The header includes the NASA logo and 'GODDARD SPACE FLIGHT CENTER'. Below the header is a navigation bar with links for HOME, REUSABLE ASSETS, RESOURCES, OPEN SOURCE, and FUNDING OPPORTUNITIES. The main content area is divided into several sections:

- news**: A list of recent news items, including 'Resume Session at ESIP 2007 Summer Meeting' (2007-06-14), 'FOSS4G 2007 Presentations Due June 29' (2007-06-11), 'GSA 2007 Abstracts Due July 10' (2007-06-10), 'ESIP Summer Meeting 2007 Poster Abstracts Due July 10' (2007-06-09), and a 'More news...' link.
- upcoming events**: A list of upcoming events, including '2007 World Congress in Computer Science (WORLDCOMP07)' (Las Vegas, Nevada, 2007-06-24), '2007 ESIP Federation Summer Meeting' (Madison, WI, 2007-07-17), 'O'Reilly Open Source Convention 2007' (Portland, Oregon, 2007-07-22), and '2007 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2007)' (Beijing, China, 2007-10-15).
- Earth Science Software Reuse**: A section with a welcome message and a link to the 'ESDS Working Group Page'. It includes a paragraph about the purpose of the Software Reuse Portal and a link to 'Survey Findings'.
- Marketplace Enablement**: A diagram illustrating the marketplace for reusable software development artifacts. It shows a path leading from 'Supply' to 'Demand'. The 'Supply' side involves 'Developing an internal marketplace for reusable software development artifacts' and 'Marketplace Enablement' (removing barriers and establishing incentives). The 'Demand' side involves 'Demonstrate the feasibility and value of reuse through focused projects' and 'Increase community capacity and desire (knowledge & tools) to reuse existing assets'. A quote states: 'It should be as easy to find a good quality reusable software asset as it is to find a book on the internet'.



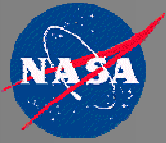
## **Backup Slides**



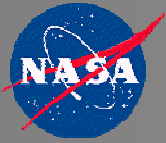
# Examples of Plone Reuse

The software reuse site was reused by the Standards Process Group

and the Technology Infusion Working Group. 12



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- Provide additional resources on reuse recommended by community members.
  - Develop a prototype reuse enablement system (RES) for the community to share reusable software.
    - Initial prototype will be for NASA use only.
    - After testing within NASA, a public version may be produced.
  - Integrate the RES with the existing software reuse portal web site.



- Purposes for the web portal include:
  - Distribute resources on reuse for the Earth science community
  - Establish a platform for community members to share/exchange resources with each other
  - Be the gateway for reuse information relevant to the community
  - Make access to reuse resources easier
  - Become the major starting site for reuse within the community
- Major content categories based on purposes include:
  - Catalog of reusable assets, tools, etc.
  - Reference library, including events and news
  - Open source information
  - Funding opportunities
- “Suggest content” feature for user-submitted ideas