Response to Reviewer Comments:

We would like to express our thanks to the reviewers for their valuable comments, which have guided us in improving the paper. We believe we have addressed all of their comments in this revision. One of the common comments was on the length and presentation of the paper. We reorganized the sections, shortened the text to get rid of or reduce "user guide" like description, and rewritten parts of the sections to improve presentation.

Reviewer Comment:
This paper presents an extensible strongly-typed grid service development toolkit for GT4 platform. The problem is of general importance and it interests the grid community. High level, simple and easy to use service development tools are especially important for users with limited knowledge of underlying infrastructure. This paper presents their tools under beta release to facilitate grid service development. It is suggested to improve the paper as following:

1. The focus of this paper is not clear. What are the major challenges of this work? How are they solved in Introduce? Though the authors identify the features of the toolkit several times, the key points are widely spread in this paper.

We have rewritten the Introduction and Motivation sections to emphasize the issues addressed by the Introduce toolkit and its main components and features that address these issues.

2. Session 4 is not well organized. Key functionalites and features are tangled with user guidelines.

We have reorganized Section 4 and took out most, if not all, the user guidelines style descriptions. The overall Introduce toolkit is now described in Sections 4, 5, and 6, with Section 4 providing a description of the core functionality, and Sections 5 and 6 presenting additional features of the toolkit.

3. Some related work, for example, Sun studio creator plus JAXR, is missing.

We included a short review of Sun Studio creator and JAXR in the related work section (Section 3).

Reviewer Comment:
Nice paper presenting the Introduce toolkit. I noticed only a few minor typos.

Page 1, Introduction, lats line: 'to earth systems sciences or biomedical research' ? (rather than to biomedical ..)

The Introduction section has been revised to address this and other comments.

Some of the figures (2, 3, 4) are hard to read (characters are very small) and I wonder if they are useful (well authors demonstrate that there is some kind of friendly interface).

We reduced the number of figures on screen captures of the GUI. We also enlarged the GUI figure to make the characters easier to read.

Reviewer Comment:
To make available Grid computing, development and execution tools are essential. Unfortunately, not too many of these tools are available these days. The paper decribes the INTRODUCE development toolkit, which may provide support for Grid application development. As a result, the paper and the tool may help the Grid application developers to create a Grid service based applications.

I like the tool but I have some concerns to the paper. In some sections the paper is a mix of a manual and a journal paper. I recommend to rewrite those sections, particularly section 4.2 and 4.3, which could be a part of a manual but not a journal paper. As a result, I propose to accpet the paper after a major revision.

We have revised the paper to reduce the "user manual" style presentation of the toolkit and highlight the main features and how certain functions are provided and executed in the toolkit.

SPECIFIC REMARKS:

1. Introduction

Referring to 28 papers [1-28] without any comments is useless.

The purpose of references to those works was to illustrate the effort put into developing components and middleware tools to support applications in a Grid environment. We agree with the reviewer that some comments should be added. Thus, we revised the introduction to group these references based on the functionality they provide.

OGF (previously GGF) has a new WG, called Grid Interoperability Now (GIN), which targets interoperability at different levels. What is the link between the INTRODUCE framework and the GIN WG?

We included a short discussion on the relationship between the Introduce toolkit and GIN in the related work section (Section 3).

There is no reference to the Mobius framework.

We included a few references to Mobius [16,28,29].

The description of the strongly-types service is not clear in this section but it is explained in the other sessions.

The introduction and motivation sections have been revised to provide a better explanation of strongly-typed services.

3. Related Works

The INTRODUCE framework is compared to the Globus Toolkit, IBM Grid Toolbox, Java COG Kit, AndroMDA. Most of these frameworks and/or tools provide different kind of support than the INTRODUCE framework. What about other frameworks and tools, such as Grid Development Tools for Eclipse, Eclipse plug-ins, FORTE HPC, etc, which offer the same kind of features and services as the INTRODUCE framework.

We included brief overviews of these tools and how Introduce compares to them in the related work section.

What is the link between the INTRODUCE framework and the OGF UPDT RG?

We included a brief discussion at the end of the related work section (Section 3).

4. Introduce Toolkit

What authors mean as "basic service implementation" created by the INTRODUCE framework. An example could be useful to understand it.

The basic service implementation is the skeleton of the service application developer wants to develop and it does not include such additional configurations as multi-service/multi-source properties and compositional inheritance properties. It consists of the set of method interfaces defined by the service developer and has the core set of files needed by the lower level Grid middleware. We have included a short description and list of what the basic service consists of.

No deployment engine is included on Fig. 1. Is there any of it?

We updated the figure to include the deployment engine.

Some of the tabs on the Service Creation GUI are not explained, for example: creation directory, namespace (domain name in the text).

In order to reduce the length of the paper, we reduced the number of figures on GUI and other components. We included only one figure to give a glimpse of the GUI to the reader.

How can users access the data type discovery? It's not explained in the text. The description of the deployment phase is too short. As a result, the text does not give too much info about the deployment.

The GUI provides screens for users to select data type repositories. However, the GUI description in this revision has been shortened to reduce the length of the paper. We included some details of the deployment in Section 4.3.3.

The first sentence of the 4.4 section is not clear. Could you explain it?

Due to reorganization of text, this is now Section 5.1.1. The code generation for service interfaces is complicated because of the need for mapping the interfaces as defined by the service developer to those generated by the Globus and Axis toolkits. The goal is to provide a presentation of the service to the client in the way it is defined by the service developer and to provide the service developer with the service skeleton code that has the same interfaces as defined by the developer rather than the ones (i.e., document literal bindings for portTypes) defined by Globus and Axis. The wording was confusing. So, we revised that paragraph and shortened it.

In the 4.6.1 section names of some extension components on Fig 11 and in the text are different.

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This was a typo. The component names have been fixed in the text to
match the names in the figure.
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Reviewer Comment:
An interesting paper highlighting some of the commonality between OO programming tools and Grid programming tools. Only comment is the article is a little lengthy and may be able to convey its message in a slightly shorter form.

The text has been reorganized and shortened to reduce the length of the paper.