Tessellations
News And Technical Updates From Tessella
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Coral – Mining experimental data

Experimental projects can require tens of man-years of effort, and cost millions of pounds. The data produced often represents a substantial investment for the company involved and should be viewed as a hugely valuable company asset. However, knowledge of an experiment's context and raw data files are often lost after a project closes or employees move out of post.

Companies need to ask themselves:

- How can our data assets be kept safe and fully exploited?
- Should our data become important years in the future, could they be retrieved?
- Would we be confident that we know how they were generated?

These were questions asked by Unilever as they embarked on assessing 'omics' technologies and their application to risk assessment in consumer products.

Image copyright iStockphoto.com/Alexey Dudoladov

Unilever approached Tessella to develop a data management system that would keep both data and context safe, and make them readily available for integration with data from other technologies and analysis using standard off-the-shelf programs. The project was highly collaborative, involving many academic groups generating data from five different technologies, such as microarray, proteomics, and metabolomics.

New technology: opportunity and risk

Technology is always advancing. Usually new technology offers opportunities to derive new knowledge, faster, at greater sensitivity and at higher throughput. The value of new technology is even greater when it is integrated with existing knowledge. However, for the data manager new technologies can come with big drawbacks. New technologies often also mean new or changed data files and formats. Greater throughput leads to higher data volumes for a single experiment.

Often new technologies are adopted initially in small numbers, and their data cannot be accommodated easily by commercial data management systems, which need to wait for a certain level of uptake before they incorporate support for the new technology. How can valuable data from minority and up-and-coming technologies be kept safe for future exploitation? These data are all the more valuable if they can be integrated with other technologies at an early stage but without the need to develop a dedicated system.

For Unilever, developing a dedicated system for each experimental technology which they wanted to use, would have resulted in the maintenance of five different databases and associated software, several under-utilized databases, and difficulty integrating technologies together and with other data sources.

Tessella worked closely with Unilever to develop Coral, a flexible experiment data management system capable of safely storing data from current and future technologies. For each technology Coral can automatically generate a 'Data Mart', providing web-based query access for experimentalists and analysts.

The flexibility inherent in Coral proved its value when another technology, immunohistochemistry, was added to the project at a late stage. Valuable data, that would otherwise not be stored, could easily be accommodated within the Coral system. As an added benefit, a data mart was created automatically. Users can now query the data directly, integrate the results with other technologies, or use their data to interrogate databases over the Internet. The Coral system now holds data as diverse as Luminex assays, microarrays, and mass spectrometry results.

Integrating technologies

The Coral data marts give users a single point of access for data from all the experimental technologies.

The web-based query interface is a BioMart, developed by the European Bioinformatics Institute (www.biomart.org). It provides a simple 3-step solution to formulating complex queries filtering data by any attribute of the sample, experiment or results. Experimental data and data files can then be retrieved for input into standard analysis packages.

Integrating data from different technologies can provide greater knowledge beyond any one technology. Coral data marts are not only able to link queries between technologies but can also link out to query data sources over the Internet, such as those generated for the Human Genome Project.

With Coral, Unilever can now annotate their own experimental data using publicly available data over the Internet, providing a greater understanding of their results.

Continuing value

The Coral system provides Unilever with a safe repository for experimental data from a range of different technologies. Through data marts, the data are easily available for current and future analysis throughout the organization. The customer is able to integrate their results with other data, either other technologies or genomic data.

The flexibility designed into the Coral system has led to its use outside the originating project within Unilever.

For a fuller description of Coral please email *info@tessella.com*.

WEBSITE: in May this year we re-released our website **www.tessella.com**. Now structured around our core industry sectors of Life Sciences, Energy, Public Sector and Consumer Industries, we trust you find the site informative and easy to use. You'll also find news of the webinars and conferences at which Tessella consultants are speaking (www.tessella.com/events).

Tessella
Scientific software solutions

The universe: fundamental questions explored

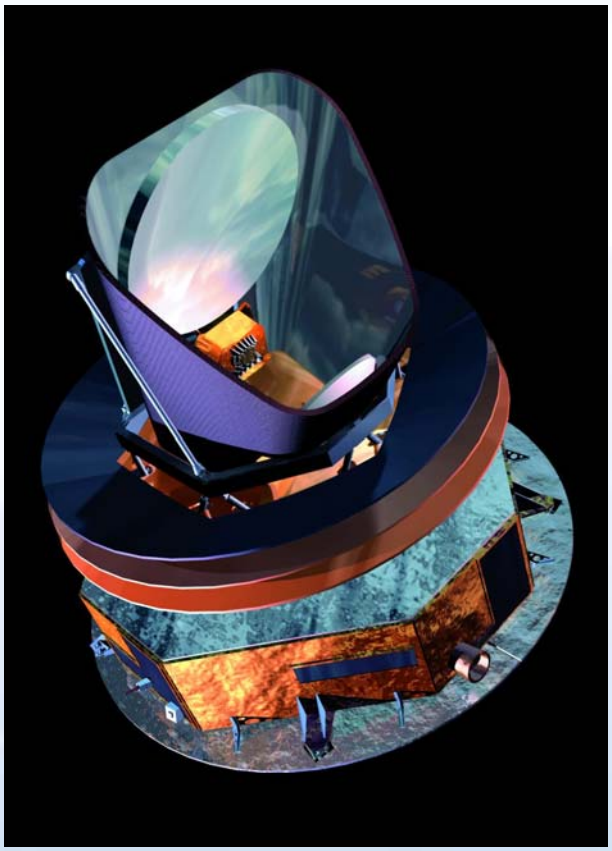
In early 2009, two of the largest and most complex scientific spacecraft ever developed by the European Space Agency (ESA) are due to be launched on top of a single Ariane-5 rocket.

Together, the Herschel infrared space telescope and the Planck cosmic microwave mapping mission will seek to answer some of the fundamental questions about the origin and composition of the universe. Tessella was a critical member of the industrial team designing the control systems for the two spacecraft.

The two spacecraft are cornerstones of ESA's 'Horizon 2000' science programme. Between them they represent significant advances in scientific spacecraft design, yet despite this they are in many ways very different, each presenting a very different set of challenges.

Herschel is the largest infrared space telescope ever built. Its 3.5m diameter collecting mirror will be the largest mirror ever flown in space. It will be the first mission able to look across all wavelengths from sub-millimetre down to the far infra-red, which cannot be seen from the earth as they are absorbed by the atmosphere. This will give astronomers a new window into the universe, with which they can look at the formation of stars and galaxies, and it can also be used to look at the chemical composition of objects within our own solar system.

(Image ESA)



Planck will map the cosmic microwave background

By contrast, Planck will look at the cosmic microwave background, which has already been mapped by previous missions such as COBE and MAP, but it will do so to an unprecedented degree of accuracy. It is the most sensitive mission ever designed by ESA. This radiation is the 'first light' from the universe, having been formed as soon as the universe cooled enough to allow light to be transmitted. By observing it, astronomers hope to answer some of the fundamental questions about the origin and fate of the universe, which the earlier missions only gave partial answers to.

To build these two spacecraft, ESA assembled a large industrial consortium, including most of the major European space companies. Within the consortium, Tessella's responsibilities covered three critical areas.

Herschel controller design: Tessella designed and tested the attitude controller, which will be used in Herschel's observation modes. A very sophisticated controller is needed because of the extreme pointing accuracies required, equivalent to focusing on a tennis ball at a distance of 150km. To complicate things further, to be able to look at objects within our solar system, such as planets or comets, the controller must be able to achieve this accuracy while tracking a moving target. In addition, because parts of the telescope are extremely sensitive to sunlight, a special path planner had to be created, to allow the spacecraft to slew from one target to another without exposing any sensitive components to direct sunlight.

Planck pointing accuracy: In order to estimate the accuracy with which a spacecraft can point at a target, there are standard techniques for taking the statistical distributions of all contributing errors and combining them to find the distribution of the total error. However, Planck is designed to spin about its axis once every minute, which the standard techniques cannot handle, so new methods for finding the error distribution for a spinning spacecraft had to be devised and applied.

Modelling the control hardware: It is not possible to fully test a spacecraft's control system on the ground. Instead, simulations are used, with numerical models of the hardware (sensors, thrusters, and so on) being used in the loop with the real on-board software. In this case, the models of the hardware needed to be sufficiently accurate to be able to study how the hardware and software will interact. It was Tessella's responsibility to create and maintain these models for both spacecraft, liaising with the other members of the consortium to keep up to date with the hardware development.

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The complexity of each space mission presents unique technical challenges. Despite this, the levels of accuracy demanded in the space industry are probably higher than any other sector.

Faced with a complex client problem, Tessella uses a combination of experience and innovation to find the optimum solution to the problem. Our expertise in systems engineering, mission analysis, control design, mathematical modelling and detailed analysis provides a unique combination of skills to develop accurate solutions to meet these challenges. To find out more about our services to the space sector please email *info@tessella.com.*

Dave
Consultant
Tessella

Matt
Consultant
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If you would like further information, or back issues of Tessellations, please email info@tessella.com

Supporting custom-built software systems

Many organizations are finding that by outsourcing the support of their business-critical IT systems and applications, they can benefit from an improved level of service, better response times and greater value for money. It also allows them to transfer the risk and the overhead of maintaining a service, and hence redeploy their own resources onto other key work.

Tessella has for a long time offered a tailor-made support service for systems that we have developed ourselves. Over the past couple of years, we have put together a team focussing exclusively on providing a support service. This has allowed us to provide a greater range of services and to offer more ambitious response times, thus providing more peace of mind to our clients.

Our services range from our premier full out-of-hours telephone service with guaranteed response times, down to a budget 'reasonable endeavours' service with non-binding response targets. We support systems developed by Tessella as well as those developed by third parties.

We offer our clients significant flexibility in designing the right level of support for their needs. A typical support contract might include:

- Response during office hours
- Bug/problem fixing
- Updates to software documentation
- System testing and deployment
- Regular reporting of support activities
- A designated response team trained to support your system
- Three response speeds depending on the urgency of the problem

Support contracts can also include: system enhancements, system administration, hardware support, end-user support, out-of-hours support (up to 24×7 cover), and guaranteed response times.

We can also offer a system and/or documentation 're-engineering' service to transform a legacy system into one that can be more readily supported and enhanced.

Our track record

Our track record illustrates our flexible approach to supporting custom-built systems and demonstrates our ability to deliver. Our support clients range in size from global pharmaceutical and consumer goods companies, through management consultancies, down to a university clinical trials group.

We support high profile, high resilience systems, for example providing 24×7 cover for clinical trials systems. We also offer lower cost options for systems requiring less demanding response levels.

Many of our clients enjoy the flexibility of using Tessella for development projects as well as for support work. This approach has allowed us to build long-term relationships.

Customer Support Team

Key to the quality of our service is our dedicated Customer Support Team. All members of the team are experienced developers who receive the high-level of ongoing training that is standard throughout Tessella.

Before taking on the support of a software application, there will be a familiarization phase. Wherever possible, this involves a dialog with the original development team. The support team will then develop their knowledge of the system both through regular continuity training and by carrying out system enhancement requests.

The team can also provide maintenance and support for Tessella's expanding list of software products including:

- Digital Archive 'Safety Deposit Box'
- Local Authority Waste Data Management System

Members of the expanding Customer Support Team at Tessella

Communicating with our clients

We aim to make the work that we do on our clients' behalf as visible to them as possible. In addition to having direct phone and email contact with the technical team, our clients also have access to our web-based issue-tracking environment, which allows them to raise issues and review their progress. When necessary, we will also carry out site visits. We always make sure that our clients are informed fully of the work we do. At the very least, this will consist of monthly reports and regular review meetings.

Our support model

The Tessella support offering can be broken down into three parts.

The *Service Initiation* is a one-off activity to enable the support team to take on a new system. It typically includes collating documentation, setting up the support environment, familiarization with the system, and creating rollout procedures to ensure that software fixes can be rapidly deployed to the live environment. If necessary, some re-engineering of the system, the testing environment or the documentation can be carried out at this stage.

A number of *Regular Maintenance Activities* will be carried out by the support team to ensure that they are ready to respond quickly to any support calls. The team may also be responsible for other activities such as monitoring and backing up the live system.

The *Support Activities* are generally based on a system of 'Service Credits', which are bought in advance and used as support work is carried out. However, they can also be based on a single fixed price agreement to cover any unexpected problems.

More information

Tessella has built a strong track record of providing reliable and responsive support for business-critical applications for a number of high-profile clients.

Our strength comes from the high-calibre staff that we use for support work, the flexibility of our support offerings, and the quality of our systems and processes. To find out more about our application support offerings, please email *info@tessella.com*.

Martin
Customer Support Manager Tessella

Tessella goes green !

Protecting the environment is now the responsibility of all, and few organizations or individuals remain unconvinced about the dangers of not acting.

By the nature of our operations, Tessella could be thought of as having a minimal impact on the environment. However that is not true. Our involvement in several leading projects (including the UK National Flow Forecasting System and our Waste Data Management System) means that we can proudly say that we make a positive impact on the environment.

For many years we have made extensive use of electronic records management systems, delivering the twin benefits of reducing paper usage and enhancing communications between staff at disparate offices. However, we now plan to go one step further towards 'going green' and this will be our last mass paper mailing.

We currently mail some 6,500 copies of Tessellations and send email alerts to several thousand further people. Whilst we know that many of the paper copies are avidly read, we are concerned that some end up in office waste bins or trash cans.

If you currently receive your Tessellations by email alert then you should see no significant difference. You can continue to view back issues at:
www.tessella.com/tessellations.

If you have received this issue in the mail, then we will default to sending you future issues via email alert. The letter you have just received will ask you to check the email address we hold for you.

However, you are able to explicitly opt back in to receiving Tessellations on paper, if this is what you would prefer, by emailing *info@tessella.com*.

Tessella expands in the USA

As our US operations continue to expand, serving both local and global clients, the Tessella Inc presence in Washington DC is growing rapidly to meet the need.

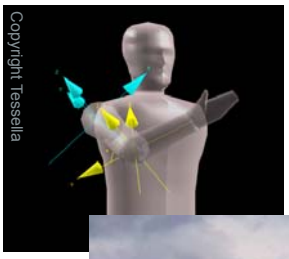
Consequently the team has moved into much larger offices in Rockville, just north of DC, with plenty of room for future growth.

The new offices have the added benefit of being positioned close to a number of our existing and potential clients/partners, including Lockheed Martin, the lead for the consortium developing the Electronic Records Archive for NARA (the US National Archives and Records Administration).

Filtering and Estimation

Have you ever wondered:

- How a satellite determines and controls its orientation in space?
- How radar operators are able to handle the mass of data coming from a modern multi-function radar?
- How the position of a person moving through a building can be tracked?
- How doctors can measure the bending of a person's joints as they move around?



Tessella has expertise in a range of **filtering** and **estimation** techniques for processing measurements to obtain useful information about a system. We have successfully applied these techniques to real-world problems across a range of industry sectors. This experience gives us an enviable algorithm design and optimization capability, allowing us to analyse the problem of interest and select the most appropriate solution.

We offer expertise in a wide range of techniques from the design of low-pass, band-pass and high-pass filters and regression analysis of noisy data, through to more advanced methods such as Bayesian techniques. We have designed both analogue and digital filters, and have experience in digital signal processing (DSP) as well as in working in both the frequency and time domains.

We are also experts in advanced filtering and estimation techniques which are ideally suited to problems where measurement data is obtained from several different sources, is corrupted by a range of errors, or is not available at regular time intervals.

Whenever you need advice on filtering and estimation, Tessella can help you work towards the solution.

To request a capability statement on this topic please email *info@tessella.com*.

Tessella – Complex problems, solved

Tessella uses its unique blend of scientific, engineering and IT skills to solve the most complex of technical and business problems in a highly cost-effective way.

We have a proven 28-year history of excellence, adding value to demanding public sector and commercial R&D based clients.

Tessella comprises Tessella Support Services plc and Tessella Inc. Our space and defence business, previously trading as Analyticon, is now fully integrated into Tessella.

The group's services include software design and development, mathematical modelling and simulation, algorithm development, infrastructure support, project management and consultancy.

Our enviable reputation for providing high-quality, low-risk, value for money services is backed up by many successful, high-profile projects, plus a high level of repeat business.

For each client problem we develop a fundamental understanding within the 'big picture' context – so our solutions fit. We focus on the details, however intricate, so our solutions work. Our ultimate aim is that the systems we deliver are used by our clients with great enthusiasm.

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Tessellations is published by Tessella Support Services plc and Tessella Inc. Our aim is to provide you with interesting information on topical technical issues and to outline key projects which we hope you will find of use. We depend on the feedback from our readers to help us develop Tessellations. Your input is always appreciated; please send to The Editor (Alison Smith) at *info@tessella.com*.

Tessella
Scientific software solutions