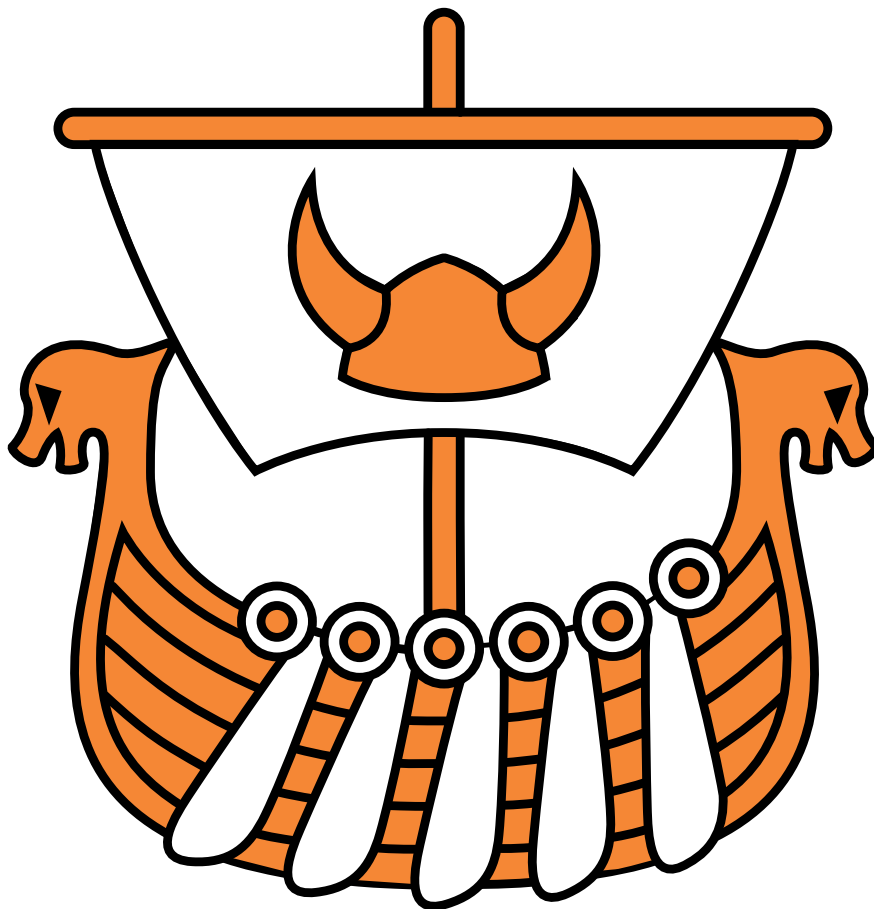# DYALOG

Belfast 2018

Programme for Dyalog '18

Sunday 28 October – Thursday 1 November 2018

REMOVE THIS PAGE WHEN DONE – IT'S JUST HERE TO GET THE 2-PAGE SPREADS ACCURATE!

A Message from Dyalog's CEO

Hello and welcome to our annual user meeting and to Belfast.

For those of you who have been to more than one of our previous user meetings, you might be expecting a certain order of things. However, this year we have made some changes based on requests on the feedback forms collected at previous user meetings.

We will still present the work we have done and our plans for the future. Dyalog users will present their work with APL and there will be Tutorials and Workshops with in-depth presentations of tools and other useful subjects for users of Dyalog.

However, traditionally we have chosen a conference centre where we could offer an all-inclusive deal with all meals, on-site accommodation and evening seminars – in short, where nobody had to leave the centre during the user meeting.

This year, because we are in the city centre of Belfast, we have chosen not to include everything, allowing you to book your own accommodation and select your own favourite restaurants among the many in Belfast. We have moved the banquet forward to Monday so we can share one evening together before you are let loose on Belfast.

We wish you a good and inspirational user meeting and we hope that you will enjoy the new format – if not please use the feedback forms :-)

Gitte Christensen

For practical information, see the back cover
If you have any questions not related to APL, please ask Karen.

🐦 #dyalog18

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Welcome to the Dyalog User Meeting 2018

Materials from the presentations and workshop will be available on the Dyalog '18 webpage at http://www.dyalog.com/user-meetings/dyalog18.htm after the user meeting.

As usual, we will be recording and publishing as many presentations as we can (as a presenter you will always have the opportunity to review the recording and approve publication). We would like to ask for your help in ensuring that question and answer sessions are also recorded; you can help by only asking questions from the microphone podium. If your question cannot wait until the Q&A session that concludes each presentation, or if the presenter specifically states that questions are welcome throughout, then please make your way to the microphone podium. Please do not ask questions from your seat as the recording cannot pick them up (and often people in the auditorium cannot hear them either).

Everyone from Dyalog Ltd will be happy to answer questions relating to their topics at any time during the user meeting.

Team Dyalog at Dyalog '18

This year, Dyalog Ltd is represented by 19 members of the current team. Meet Team Dyalog at http://www.dyalog.com/meet-team-dyalog.htm.

The Dyalog forums (http://forums.dyalog.com/) are regularly visited by Dyalog Ltd staff as well as other stalwarts of the Dyalog community and are a great place to ask questions and share your expertise.

Your Feedback

We want to ensure that our user meetings meet (or even exceed!) your expectations, and your feedback is critical to this. The approach we have taken to collecting feedback over the last two years has greatly increased the amount we received, so we'll be repeating it this year. This means that:

- Each workshop will have its own feedback form, given out at that workshop.

- Feedback forms on the presentations will be distributed each morning and will only cover the presentations given that day.

- Feedback on the venue, facilities, social aspects, etc. can be given at any time at the Dyalog desk in the main reception area.

Please do take the time to let us know your thoughts on Dyalog '18 – what you like, what you find most interesting, suggestions for improvements, whether changes we've made this year as a result of last year's feedback have been successful, etc. – so that we can take these into account when planning future user meetings.

Thank you

Follow us on:
- FaceBook (https://www.facebook.com/DyalogAPL)
- LinkedIn (https://www.linkedin.com/company/dyalog-ltd-)
- Twitter (https://twitter.com/DyalogAPL)

Useful Dyalog e-mail addresses:
- usermeeting@dyalog.com
  any user meeting-related issues, both technical and non-technical
- sales@dyalog.com
  any non-technical questions related to Dyalog, for example, pricing information or licence purchase (not user meeting-specific)
- support@dyalog.com
  any technical questions concerning Dyalog (not user meeting-specific)

Excursion

Dyalog '18 features an excursion rather than a more traditional Viking Challenge. On Tuesday afternoon we will be visiting Titanic Belfast.

Titanic Belfast is a monument to Belfast's maritime heritage. It is built on the site of the former Harland & Wolff shipyard in the city's Titanic Quarter where the RMS Titanic was built. The exhibition tells the stories of the ill-fated Titanic, which hit an iceberg and sank during her maiden voyage in 1912, and her sister ships RMS Olympic and HMHS Britannic.

There is some walking so sensible shoes are recommended. Some parts are outside, although these are optional.

Meet in the main foyer of the Belfast Hilton at 12:50 – the coach will depart at 13:00 promptly.

Schedule: Sunday 28 October

08:30 – 09:30	Registration (Dyalog desk in *Hilton, main foyer*)
09:30 – 13:00 including tea and coffee 11:00 – 11:30	Workshops (rooms are in the *Hilton*) **(SA1) Taming Statistics with TamStat** *Glenbank Suite* Stephen Mansour **(SA2) Performance Tuning** *Lisburn Suite* Jay Foad, Marshall Lochbaum and Roger Hui **(SA3) Introduction to Conga** *Boardroom Suite* Bjørn Christensen (asst. Adám Brudzewsky)
13:00 – 14:00	**LUNCH** Hilton – Sonoma Restaurant
14:00 – 17:30 including tea and coffee 15:30 – 16:00	Workshops (rooms are in the *Hilton*) **(SP1) Cross-Platform User Interfaces Using WC2** *Glenbank Suite* Brian Becker and Michael Baas **(SP2) Introduction to Namespaces** *Lisburn Suite* Nicolas Delcros (asst. John Daintree) **(SP3) APL Projects and Packages** *Boardroom Suite* Morten Kromberg and Gilgamesh Athoraya

For workshop abstracts, see pages 15-20.

NOTES:

Schedule: Monday 29 October

All presentations take place in *Belfast Waterfront, Studio*

08:30 – 09:00	Registration (Dyalog desk in *Belfast Waterfront, main foyer*)
09:00 – 09:30	**(D01) Welcome to Dyalog '18** Gitte Christensen, Managing Director (CEO)
09:30 – 10:00	**(D02) The Road Ahead** Morten Kromberg, User Experience Director (CXO)
10:00 – 10:30	**(D03) Technical Road Map: Under The Covers** Jay Foad, Technical Manager (CTO)
10:30 – 11:00	TEA/COFFEE
11:00 – 11:30	**(D04) Array Notation Mk III** Adám Brudzewsky
11:30 – 12:30	**(U01) What's Wrong with SQL?** Paul Mansour (The Carlisle Group)
12:30 – 13:30	**LUNCH** Hilton – Sonoma Restaurant
13:30 – 14:00	**(D05) RIDE 4.1 and Next Generation Integrations** Gilgamesh Athoraya (Data Analytics AB)
14:00 – 14:30	**(D06) Cross-Platform User Interfaces** Brian Becker
14:30 – 15:00	**(U02) WPF/UWP and Xaml on the Web** Chris Hughes and Michael Hughes (MJH Software Services Ltd)
15:00 – 15:30	TEA/COFFEE
15:30 – 16:00	**(U03) Taming Statistics with TamStat** Dr Stephen Mansour (The University of Scranton)
16:00 – 16:30	**(D07) TamStat 2018** Michael Baas

16:30 – 16:45	Break
16:45 – 17:30	**(D08) Sub-nanosecond Searches Using Vector Instructions** Marshall Lochbaum
17:30 – 18:00	**(U04) Co-dfns 2018 – What's New?** Aaron Hsu (Indiana University)
18:00 – 19:30	Free time
19:30 – 20:00	**PRE-PRANDIAL DRINKS** *Hilton – Lagan foyer*
20:00 –	**BANQUET** Hilton – Lagan Suite with traditional Irish ceilidh from c21:45

NOTES:

Schedule: Tuesday 30 October

All presentations take place in *Belfast Waterfront, Studio*

09:00 – 09:30	**(U05) The APL Package Manager** Gilgamesh Athoraya (Data Analytics AB
09:30 – 10:00	**(U06) The Workspace is Dead! Long Live the Workspace!** Paul Mansour (The Carlisle Group)
10:00 – 10:30	**(U07) Teaching an Old Dog New Tricks – Our Fair Price Engine** Ilaria Piccirilli (SimCorp Italiana)
10:30 – 11:00	TEA/COFFEE
11:00 – 11:20	**(U08) The British APL Association – An Update** Paul Grosvenor (Optima Systems Ltd)
11:20 – 12:00	**(D09) JD's Big Toe** John Daintree
12:00 – 13:00	**LUNCH** Hilton – Sonoma Restaurant
13:00 – 17:00	**Excursion** Meet in main reception area at 12:50 Coach leaves at 13:00 For additional information, see "Excursion" on page 4.

For Dyalog presentation abstracts see pages 21-24.
For user presentation abstracts see pages 25-31.

NOTES:

Schedule: Wednesday 31 October

All presentations take place in *Belfast Waterfront, Studio*

09:00 – 09:30	**(U09) The Evolution of the APLTree Library** Kai Jaeger (APL Team Ltd)
09:30 – 10:00	**(U10) Excel Mining – Part 2** Richard Procter (APL Borealis Inc)
10:00 – 10:30	**(U11) Quaternions (Hamiltonians) and Image Recognition** Prof. Dr. Dieter Kilsch (Bingen University of Technology)
10:30 – 11:00	TEA/COFFEE
11:00 – 11:45	**(D10) Dfns – Past, Present and Future** John Scholes
11:45 – 12:30	**(U12) Rectangles All The Way Down** Martin Thompson (Real Logic)
12:30 – 13:30	**LUNCH** Hilton – Sonoma Restaurant
13:30 – 14:15	**(U13) Simplicity can be Confusing – Understanding the Manly Chromosome partly through APL** Charles Brenner (DNA-View and UC Berkeley Human Rights Center)
14:15 – 14:30	**(U14a) Problem Solving Contest Prize Ceremony** Brian Becker
14:30 – 15:00	**(U14b) How I Won the Problem Solving Contest** Alve Björk (Uppsala University)
15:00 – 15:30	TEA/COFFEE
15:30 – 16:00	**(D11) Cloud Computing with APL** Morten Kromberg
16:00 – 16:30	**(U15) ⎕WC on the Web** Chris Hughes and Michael Hughes (MJH Software Services Ltd)

16:30 – 16:45	Break
16:45 – 17:30	**(U16) Serverless APL** Marko Vranic (SimCorp)
17:30 – 18:00	**(U17) IFRS 9 – How What Started as a 'Simple' Project Became a Breakthrough** Arianna Francia (SimCorp Italiana)

For Dyalog presentation abstracts see pages 21-24.
For user presentation abstracts see pages see pages 25-31.

NOTES:

Schedule: Thursday 1 November

All presentations take place in *Belfast Waterfront, Studio*

09:00 – 09:30	**(D12) Jupyter Notebooks** Adám Brudzewsky
09:30 – 10:00	**(D13) How Many Dimensions Does a Vector Have?** Nicolas Delcros
10:00 – 10:30	**(U18) Introducing the Mystika Project** Erik Wallace (University of Connecticut)
10:30 – 11:00	TEA/COFFEE
11:00 – 11:30	**(D14) Inverted Tables** Roger Hui
11:30 – 12:00	**(D15) The Interpretive Advantage** Marshall Lochbaum
12:00 – 12:30	**(U19) High-performance Tree Wrangling, the APL Way** Aaron Hsu (Indiana University)
12:30 – 12:45	**Open Forum and Closing Session** Team Dyalog
12:45 – 13:45	**LUNCH** Hilton – Sonoma Restaurant
13:45 – 17:15 including tea and coffee 15:15 – 15:45	Workshops (rooms are in the *Hilton*) **(TP1) Dyalog Version 17.0 In Depth** *Lisburn Suite* Jay Foad, Richard Smith and Adám Brudzewsky **(TP2) APL in the Cloud** *Boardroom Suite* Morten Kromberg **(TP3) MicroServices Made Easy** *Broadway Suite* Brian Becker (asst. Bjørn Christensen)

For Dyalog presentation abstracts see pages 21-24.
For workshop abstracts, see pages 15-20.

NOTES:

Abstracts: Workshops

These workshops have significant time set aside for participants to experiment with the subject matter.

Some of the workshops require materials that should be installed on your laptop before attending. These pre-requisites are listed by workshop at https://www.dyalog.com/user-meeting/dyalog18/workshops/prerequisites.htm. Please ensure that you meet these pre-requisites before attending a workshop if at all possible.

SA1: Taming Statistics with TamStat
Sunday 09:30 – 13:00
Stephen Mansour

TamStat is a software package, written in Dyalog APL, that allows the user to perform statistical analysis by taking advantage of arrays, functions, operators and namespaces. Recent developments include a portable user interface based on HTML/JavaScript, making TamStat available under Microsoft Windows, Apple macOS and GNU/Linux.

In this workshop we will discuss the four basic types of functions used in statistics: summary functions, distributions, relational and logical functions. Stephen will then introduce several operators that can be used with these functions to perform statistical analysis. From these building blocks we will perform statistical analysis using the HTML interface including:
- descriptive statistics including graphs, tables and summary functions
- discrete and continuous probability distributions using the probability, criticalValue theoretical and randomVariable operators
- regression models
- inferential statistics using the confInt, sampleSize and hypothesis operators (if there is time).

SA2: Performance Tuning

Sunday 09:30 – 13:00
Jay Foad, Marshall Lochbaum and Roger Hui

In this workshop we'll look at some snippets of APL code and collectively brainstorm ways to make them run faster. We'll also talk about some general optimisation techniques and show you how to apply them in practice. We'll come prepared with some real-life code examples, but please feel free to bring your own examples for the group to work on.

SA3: Introduction to Conga

Sunday 09:30 – 13:00
Bjørn Christensen (asst. Adám Brudzewsky)

Conga is Dyalog's interface to communications using TCP/IP, the most widely-used technology for sending messages between software components, whether they are running on the same machine or the other end is on a satellite in outer space. Typically, one end of a connection is a server that listens for incoming connections, allowing one or more other components to connect to it and start transmitting data.

Conga is designed for APL users and, in addition to supporting the low-level transmission of byte streams using TCP/IP, it allows you to efficiently and reliably transmit entire APL arrays between APL systems. Conga is the backbone of many client/server systems implemented in Dyalog APL.

This workshop is an introduction to Conga and assumes no knowledge of networks or communications. It will cover:
- an introduction to TCP/IP sockets
- the client/server architecture of Conga
- the different modes that Conga can work in
- the events that Conga returns to Dyalog
- communication between Conga and Dyalog
- communication between Conga and the non-APL outside world

Bjørn also demonstrates how Conga can be used to secure and authenticate communications.

Keywords: Conga, TCP/IP, sockets, security, communication.

SP1: Cross-Platform User Interfaces Using WC2
Sunday 14:00 – 17:30
Brian Becker and Michael Baas

Since c1990, Dyalog APL has provided a simple but powerful mechanism for creating Graphical User Interfaces under Microsoft Windows using the ⎕WC (Window Create) system function. Today, new applications need to target a broader range of platforms, and HTML/JavaScript has emerged as the dominant technology for modern, portable user interfaces.

The HTMLRenderer (introduced in Dyalog version 16.0) allows an application running under Microsoft Windows, GNU/Linux or Apple macOS to present user interfaces created using HTML/JS. WC2 is a library of UI elements, comparable to the elements that could be created using ⎕WC (but significant richer and more extensible, as the technology makes it easy for 3rd parties to add new "widgets"). It enables an APL user to build HTML-based user interfaces, making it possible to deliver a consistent and quality user experience across platforms using the same code base.

In this hands-on workshop we will:
- teach you the basics of using WC2
- develop a simple user interface for a sample application
- explore a variety of widgets and user interface components

This could be the workshop for you if any of the following apply:
- you want to build solutions that will run on multiple platforms without developing platform-specific code
- you want to take advantage of the plethora of HTML-based widgets that are available
- you want to build solutions that can run on the desktop using HTMLRenderer or over the internet using MiServer using the same application code
- you're a Mac or Linux user
- you enjoy learning and using new tools and technologies

SP2: Introduction to Namespaces
Sunday 14:00 – 17:30
Nicolas Delcros (asst. John Daintree)

In Dyalog, namespaces are a convenient way to organise a workspace (analogous to the way in which directories are a convenient way to organise a file system). Namespaces simplify application development by allowing you to give the workspace a structure; they can be used as containers for objects, data and for code modules. Whether classes are implemented in APL, or external classes like ⎕WC GUI objects and classes from the Microsoft .NET framework, each object resides in a namespace.

Nicolas demonstrates the value of namespaces, which have become cornerstones of modern APL application development, showing how they have been integrated into the APL paradigm, their power, their limitations and the fundamental differences from nested arrays, where a change to an element of an array that has more than one name will force a copy which decouples the values from each other. He also explores how namespaces enable APL to easily interface with most modern technologies, which are often object-oriented, and allows you time to experiment and become comfortable with the tricky bits.

SP3: APL Projects and Packages
Sunday 14:00 – 17:30
Morten Kromberg and Gilgamesh Athoraya

This workshop introduces a prototype of APM – the APL Package Manager – a framework for developing applications and libraries in APL. After a brief presentation of the framework and its use, Morten and Gil dive into concrete examples and demonstrate how to:
- create a new project
- use packages in a project
- create and publish a package
- test and build a project

After a hands-on session, participants will be invited to provide feedback on the ideas behind the prototype implementation.

TP1: Dyalog Version 17.0 In Depth

Thursday 13:45 – 17:15
Jay Foad, Richard Smith and Adám Brudzewsky

An interactive tour of Dyalog APL version 17.0. Adám, Jay and Richard will show you how to use the new features, with hands-on time for you to try them out yourself.

TP2: APL in the Cloud

Thursday 13:45 – 17:15
Morten Kromberg

"The Cloud" is a rather nebulous term used to describe a collection of public and private machines upon which a growing collection of applications or services run. The cloud makes it possible to make an application available across the globe with a minimum of effort: you do not need to set up a computer and connect it to the internet. If the load on your application grows quickly, you can add more hardware with almost no effort, and only pay for what you and your customers actually use.

In this workshop, you will learn how to develop a simple service on your laptop or other local machine, and then install it on the cloud, using tools that allow your deploy new versions of it in seconds. We will:

- introduce Dyalog APL for Linux and RIDE
- introduce the JSONServer framework and create a simple service
- introduce Docker, a tool for describing how to build and start virtual machines – and create a Docker Image containing Dyalog APL and our service
- use Docker to start our service
- introduce Kubernetes, a tool for deploying Docker images and show the use of Docker to deploy our application to two public cloud provides: Amazon Web Services and Microsoft Azure
- demonstrate deploying a Microsoft Windows application to the cloud
- show how Kubernetes can be used to launch multiple copies of our service and distribute the work from multiple clients (a mechanism known as Load Balancing)
- talk about sharing data between multiple processes running on the cloud

TP3: MicroServices Made Easy

Thursday 13:45 – 17:15
Brian Becker (asst. Bjørn Christensen)

Microservices is a new buzzword describing a way of designing software applications as suites of independently deployable services. You may not you need to build a complete Microservice architecture (or even understand what that means). However, there is no question that it is often useful to be able to package any collection of one or more APL functions – up to, and including, entire applications – as services that can easily be called by other components.

In this workshop, you will learn how to wrap APL code as a service using HTTP and JSON – protocols that are supported by all applications and programming languages – and will make your code easy to embed in any application, no matter how it is constructed or where the collaborating components are actually running.

Brian will show you how to:
- install JSONServer, a server developed by Dyalog to provide an easy-to-use service framework
- convert a simple application to use JSONServer
- test the service using a couple of different clients (one written using Dyalog APL and one written using HTML/JavaScript)
- explore advanced topics including security, scalability, and session management.

Abstracts: Dyalog Presentations

D01: Welcome to Dyalog '17
Gitte Christensen, Managing Director (CEO)

Dyalog Ltd's CEO opens the user meeting.

D02: The Road Ahead
Morten Kromberg, User Experience Director (CXO)

Morten presents his view of the changing landscape that APL users need to navigate in the years to come, and some of the vehicles and navigational instruments that Dyalog is planning to provide.

D03: Technical Road Map: Under The Covers
Jay Foad, Technical Manager (CTO)

Jay discusses technical achievements in the latest version of Dyalog APL, new projects targeting the next release, and priorities for the engineering team for the next few years.

D04: Array Notation Mk III
Adám Brudzewsky

Adám presents updates to Dyalog's proposed array notation. This iteration addresses some of the shortcomings identified in the proposal he presented at Dyalog '17, featuring more versatility and less syntactic noise.

D05: RIDE 4.1 and Next Generation Integrations
Gilgamesh Athoraya, Data Analytics AB (Sweden)

Work on the RIDE has continued since the release of version 4.0, and a number of improvements and new features have been introduced. In particular, the editor (a core module) has been replaced and floating (undocked) windows have been re-introduced. Gilgamesh will present the latest version (4.1) and talk about the main highlights and how they benefit the users.

In addition to the RIDE, Dyalog has started looking at potential integrations with other development tools using standard protocols devised by Microsoft. The Language Server Protocol (LSP) defines how a server can provide

language features like autocomplete to a development tool (an editor or an IDE). The Debug Adapter Protocol (DAP) defines an abstract protocol used between a tool and a debugger. Both of these offer a new way for APL to integrate with many popular development tools.

D06: Cross-Platform User Interfaces
Brian Becker

⎕WC has been the tool of choice for Microsoft Windows GUI applications for two decades. Today, we'd like to build user interfaces which will run under not only Windows, but also macOS and Linux. Where ⎕WC translated APL array arguments into calls to Microsoft's Win32 API, a new tool called WC2 will transform similar arrays into HTML and JavaScript and pass it to the HTMLRenderer object, which is capable of transforming this into a user interface on all three platforms. The WC2 engine is also used within MiServer to create user interfaces in web browsers, which can be rendered on many more platforms. In this presentation, Brian will discuss and demonstrate the current state of WC2, and present the roadmap for forthcoming development.

D07: TamStat 2018
Michael Baas

TamStat is a package for teaching statistics developed by Dr. Steven Mansour. The original version of TamStat was built using ⎕WC under Dyalog for Microsoft Windows. However, many students use different platforms. Dyalog has partnered with Steve to develop a cross-platform version of TamStat using HTML. In this presentation, Michael discusses the architecture and some of the challenges and lessons learned when recasting a ⎕WC application using HTML.

D08: Sub-nanosecond Searches Using Vector Instructions
Marshall Lochbaum

Concentrating on *Membership* and *Index-Of*, Marshall describes some big performance improvements for a future Dyalog release, including novel vectorised algorithms that can sometimes perform set or index look-ups on integer vectors at under a nanosecond per element.

D09: JD's Big Toe
John Daintree

JD is concerned about the increase in I-beams, the proliferation of properties, the quantity of quads, and...well, all sorts of things. He's pondering a unified "Theory Of Everything". Where could he stick his "TOE"? Come along and dip yours in the water to find out.

D10: Dfns – Past, Present and Future
John Scholes

John's retrospective on dfns starts with their inception (the motivation behind them and the technology available at the time). He then reflects on the current situation, including a few regrets he has, before discussing the move towards more declarative thinking.

D11: Cloud Computing with APL
Morten Kromberg

Deploying your application to a cloud platform can save you a lot of time and effort, and isn't as mysterious as it sounds. In less than half an hour, Morten will show you how you can get up and running on the cloud.

D12: Jupyter Notebooks
Adám Brudzewsky

Jupyter notebooks combine interactive coding sessions with narrative text according to Donald Knuth's literate programming paradigm. Adám presents the advantages of this format for teaching APL, explaining algorithms and sharing ideas. He describes the progress that Dyalog and this year's summer intern, Will Robertson, have made in enabling the running of APL code within Jupyter notebook as well as in establishing the Jupyter notebook document as the tutorial format for TryAPL and an as option for the `]Demo` user command.

D13: How Many Dimensions Does a Vector Have?
Nicolas Delcros

Audio processing requires us to view a numeric vector as more than an ordered collection of independent numbers: we also want to look at the frequencies that are encoded in the data. In this talk we will take the first few steps into the puzzling, but beautiful world of Fourier analysis.

D14: Inverted Tables
Roger Hui

A *table* is 2-dimensional data in which the items of a column have the same datatype; an *inverted table* is a table in which the columns are nested. An inverted table is more efficient in time and space than other representations. Roger presents some utility functions for working with inverted tables.

D15: The Interpretive Advantage
Marshall Lochbaum

Common wisdom is that compiled languages are faster, full stop. However, by testing data for common patterns at runtime, Dyalog can sometimes perform ordinary programming tasks many times faster than well-optimised C. Marshall explains some of the ways in which Dyalog allows a programmer to get the best performance of several different implementations while writing just one, and discusses how deferred execution might make this method even more powerful in the future.

Abstracts: User Presentations

U01: What's Wrong with SQL?
Paul Mansour, The Carlisle Group (U.S.A.)

What is an SQL query? Does it offer the proper level of abstraction for complex queries? Why is it not traceable the way we can trace an APL function? What good is a column-store without a column-oriented query language? What is the difference between imperative and declarative programming? Is declarative always better? These and other fascinating questions will be asked and probably not definitively answered in a presentation on FlipDB, a database management system and query language written in Dyalog that shamelessly steals lock, stock, and barrel from APL.

U02: WPF/UWP and Xaml on the Web
Chris Hughes and Michael Hughes, MJH Software (U.K.)

There is still a need to have applications that are compatible, ideally to run natively on Windows, but which will run on other platforms too. With the advent of WebSockets in Conga it is now possible to create standard Xaml and C# to run as compiled HTML5/Javascript/CSS – this will also soon be possible using WebAssembly, the new exciting entrant to the Web to challenge JavaScript's dominance.

This presentation will show how easy it is to build applications using the new user command interface to the compiler from www.CSHTML5.com, which will allow access to all the standard WPF controls via Xaml (demonstrated) and C# (not demonstrated, but used indirectly in the ⎕WC emulation).

U03: Taming Statistics with TamStat
Dr Stephen Mansour, The University of Scranton (U.S.A.)

TamStat is a Statistics Program written in APL and developed for use in teaching statistics to business students at the University of Scranton. What makes this program unique is the use of APL objects such as operators, functions, arrays and namespaces as a natural way to describe and implement various statistical operations. Four basic classes of functions can be combined with operators to produce new and useful functions without increasing the overall vocabulary.

U04: Co-dfns 2018 – What's New?
Aaron Hsu, Indiana University (U.S.A.)

The Co-dfns compiler has been undergoing a significant rewrite to improve performance, flexibility and "research" worthiness. However, this hasn't only been an academic exercise. Previous limitations of the compiler's capabilities have been lifted, and we have improved the usability of the compiler across the board. Moreover, it is now simpler to install, use and configure the Co-dfns compiler, as well as integrate it with other software. We have also been working on performance improvements of the generated code, including improvements to the runtime behaviour, reliability of the code and expanding the language that the compiler recognises.

Aaron discusses improvements, as well as describing a roadmap for future improvements that are likely to be tackled sooner rather than later.

U05: The APL Package Manager
Gilgamesh Athoraya, Data Analytics AB (Sweden)

A rapidly-growing collection of tools like acre, SALT and the new]Link user command are making it easy to create APL projects based on source code in text files and take advantage of additional tools born outside the APL community, like GitHub. One of the advantages of these tools is that it is easy to share source code and load utilities written by other APL developers into your application – for example, the tools found in the APLTree. But how do you MANAGE these dependencies? What happens when one of the utilities that you are using is updated?

Gil walks through the APL Package Manager (APM), a system designed to help deal with these issues. APM is under development, so if you want to have a say, now is the time to acquaint yourself with the concepts and features of APM.

U06: The Workspace is Dead! Long Live the Workspace!
Paul Mansour, The Carlisle Group (U.S.A.)

Storing functions in text files has huge advantages, not the least of which is the use of a source code management system like Git. However, the APL programmer, used to the comfort of the workspace, can quickly become overwhelmed with a plethora of third party applications. In addition, there are many ways to work with Git. There are tons of commands and a zillion options. An extremely small, carefully selected and configured set of these

commands, encapsulated into the workspace as user commands, can make working with Git and text files as easy as `)SAVE`.

U07: Teaching an Old Dog New Tricks – Our Fair Price Engine
Ilaria Piccirilli, SimCorp Italiana (Italy)

In 2005, to comply with new regulations, SimCorp rewrote their fair price engine, making it more flexible; Ilaria describes the significant benefits that this has had for subsequent development.

U08: The British APL Association – An Update
Paul Grosvenor, Optima Systems Ltd (U.K.)

Over the past year or two, the BAA has been rather quiet and the Vector magazine publication has stopped. The purpose of this presentation is to let you all know that the BAA is alive, well and moving forward on a number of new initiatives including an electronic version of Vector. Paul will show the new BAA website, the new Vector website and provide details of a BAA conference in London next year which is currently in the planning stage.

U09: The Evolution of the APLTree Library
Kai Jaeger, APL Team Ltd (U.K.)

The APLTree project, a collection of tools and applications useful to most APL programmers, has moved from the APL wiki to GitHub.

The APLTree project takes full advantage of the features offered by GitHub. The talk will briefly discuss the benefits of the GitHub platform as a home for APL utilities.

Kai will also discuss new tools that have been added recently, as well as major changes and upgrades to existing tools that are in the APLTree repository.

U10: Excel Mining – Part 2
Richard Procter, APL Borealis Inc (Canada)

Continuing where we left off at Dyalog '15, this technical presentation will take a deeper dive into the depths of Microsoft Excel's XML-based structures, using a combination of the Microsoft OOXML SDK and APL. The focus will be on the basics of reading and writing spreadsheets (without the need for Excel), options which developers can explore to suit particular

needs, efficiency concerns for large spreadsheets, automation and generally how APL enhances the experience (as usual).

U11: Quaternions (Hamiltonians) and Image Recognition
Prof. Dr. Dieter Kilsch, Technische Hochschule Bingen (Germany)

Quaternions are well known as an algebraic skew field (or division ring) of dimension four over the real numbers. Although they have some interesting algebraic features, this presentation concentrates on properties that facilitate calculations concerning rotations in solid mechanics and image recognition. This is based on the fact that, apart from the real numbers, quaternions contain three, linearly-independent, imaginary axes; on this three-dimensional real subspace, multiplication by a unit quaternion acts as a rotation. Furthermore, multiplication allows calculation of the precise rotation needed to map a model object onto a real object by least square fitting.

U12: Rectangles All The Way Down
Martin Thompson, Real Logic (U.K.)

Moore's Law has come to an end. Spectre and Meltdown mitigations have resulted in significant performance impacts for server applications. "Throw hardware at it..." is no longer a valid approach to performance issues. How do we design applications that afford good performance given all the conflicting advice we can find on the Internet?

In his talk, Martin highlights performance characteristics exposed by usage patterns of computing resources. Some patterns of usage are significantly more efficient than others. By understanding the performance characteristics and trends for contemporary hardware, we can then design algorithms and data structures which are efficient regardless of programming language.

U13: Simplicity can be Confusing – Understanding the Manly Chromosome partly through APL
Charles Brenner, DNA-View & UC Berkeley Human Rights Center (U.S.A.)

My job for the defense was to persuade the court to exclude the Y-chromosome DNA evidence of sexual assault as I had in two previous similar cases. The defending attorney sardonically noted that if my part were successful he could handle all the other hurdles except a previous conviction for rape. "Against whom?" I asked.

"The same woman."

All three of my cases involved charges of sexual assault on Native American tribal land. The tribal context is relevant.

The Y chromosome is physically just like any other though a bit of a runt. Any chromosome is a DNA strand. They all incidentally include some regions with quasi-random patterns which are useful for forensic identification because of their variation among individuals. Y is unique because it is transmitted to offspring (always a son – for mammals having a Y is the definition of maleness) not by sexual mixing as the other chromosomes, but clonally like bacteria. That genetic difference, which everyone understands, has population genetic (=distribution of genes in populations) consequences that almost everyone does not understand. Several years ago I learned from a Monte Carlo simulation of a simple population evolution model that Y haplotypes (haplotype=the identification pattern data of a man) don't migrate very far. The implication is that the FBI's influential idea that e.g. Navajo Y data is more or less adequate for evaluating Apache Y evidence, is very far wrong.

Such a simulation can provide insight because one can make measurements of the data it produces. But stochastic modelling inherently has a black-box aspect. This year I realized that a suitable combination of nested inner and outer products yields a functional route, deterministic rather than stochastic, to similar results and more. (I'll explain in the talk the basis of originality.) That allows a deeper understanding of what the model implies and why, including at least one surprise.

U14a: How I Won the APL Problem Solving Contest – Introduction and Prize Ceremony
Brian Becker

The tenth annual International APL Problem Solving Competition took place earlier this year. Brian introduces the contest and grand prize winner, culminating in the award ceremony.

U14b: How I Won the APL Problem Solving Competition
Alve Björk, Uppsala University (Sweden)

Alve Björk is the grand prize winner of the tenth annual International APL Problem Solving Competition. Following the award ceremony, Alve describes his experiences of APL/Dyalog and tells us how he managed to master enough of it to win the competition.

U15: ⎕WC on the Web
Chris Hughes and Michael Hughes, MJH Software (U.K.)

The Dyalog native GUI for Windows is still the most natural and creative development environment for an APL developer to work with. However, with the advent of Linux, various Internet browsers and other non-Windows platforms it has become a little endangered.

Hopefully no longer; this presentation will show how an APL system developed with ⎕WC can be converted to run on any modern browser available on the internet.

This presentation will give a demonstration of how a simple Form with a Grid and some Buttons can be converted from "Windows ⎕WC " to "qWC anywhere" by the substitution of a ⎕ for a q. The extension to multi-user will be demonstrated too.

U16: Serverless APL
Marko Vranic, SimCorp (Denmark)

New serverless frameworks have emerged in recent time; several open-source serverless platforms are available on the Kubernetes platform. Using the serverless approach, APL functions can be deployed directly to Kubernetes. Marko addresses (and demonstrates) the following:
- Introduction to Kubernetes
  - basic concepts of Kubernetes
  - how to run kubernetes on a local PC
  - how to build/deploy APL service on Kubernetes
- Introduction to Serverless
  - Lambda Functions and Cloud events
  - how APL goes with Serverless
  - how to run an open-source Serverless platform on a local PC in Kubernetes
  - calling the lambda function using various serverless triggers

U17: IFRS 9 – How What Started as a 'Simple' Project Became a Breakthrough

Arianna Francia, SimCorp Italiana (Italy)

In 2017, due to the IFRS 9 regulation, SimCorp Sofia went through a huge restructuring of its core: beside technical issues, the project triggered an organizational change. Arianna describes the main difficulties SimCorp faced and how it reacted by modifying the way they work to achieve the desired results.

U18: Introducing the Mystika Project

Erik Wallace, University of Connecticut (U.S.A.)

In recent years, various weaknesses have been exposed in OpenSSL, the current open source standard for encrypted communications. The mystika project was initially conceived of as a replacement for OpenSSL. Since the project is APL-based, a big number library native to APL is required and is a foundational part of mystika. However, due to both the style of the big number library and our choice of algorithms, we expect that it will have applications far beyond cryptography, and we hope that it will set a new standard for the design of big number libraries in general. The presentation will include the current state of progress on the project as well as further discussion of our goals and possible applications. Time permitting, there will be some examples of mystika in action.

U19: High-performance Tree Wrangling, the APL Way

Aaron Hsu, Indiana University (U.S.A.)

Don't let hierarchical tree like structures get you down in APL-land. Despite what modern C.S. theorists would have you believe, there's more than one way to prune, chop, graft and otherwise mangle and wrestle with tree data.

Aaron discusses a novel approach to interacting with Trees, particularly in the manipulation and transformation of trees, that leverages the unique and special qualities of APL to achieve not only greatly reduced code size, but also improved performance, amenability to parallelisation and ease of maintenance/productivity improvements. These techniques are easy to pick up, general and practical.

TL;DR – Why everything you learned about working with trees in University is wrong.

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Practical Information

Internet Access

Free WiFi is available in all areas:

- Hilton – the information needed is as follows:
  - Network: HiltonHonors
  - Password: mir10 in October, mir11 for November
- Belfast Waterfront – connection instructions:
  1. Select "ICC BELFAST Wi-Fi" from the available network list
  2. When the Landing Page appears, click "Public Users Click Here"
  3. Enter your email address
  4. Accept the terms and conditions and then click "Register"
  5. Open a browser

Meals and Drinks

The user meeting fee includes all lunches and breaks (for the days registered) and the Banquet dinner.

- Lunch includes tea/coffee and water.
- Wine is included with the Banquet Dinner.

Lunch each day is in the Hilton – the link between the Hilton and the Belfast Waterfront will be open during the lunch break (and possibly at the start/end of each day). If the link is not open then moving between the two venues involves a very short walk outside!

Tea/coffee breaks locations:

- during workshops – by the Hilton meeting rooms in the Business Centre Reception area.
- during presentations – by the Belfast Waterfront Studio.

Smoking Policy

Smoking is not permitted in either venue.