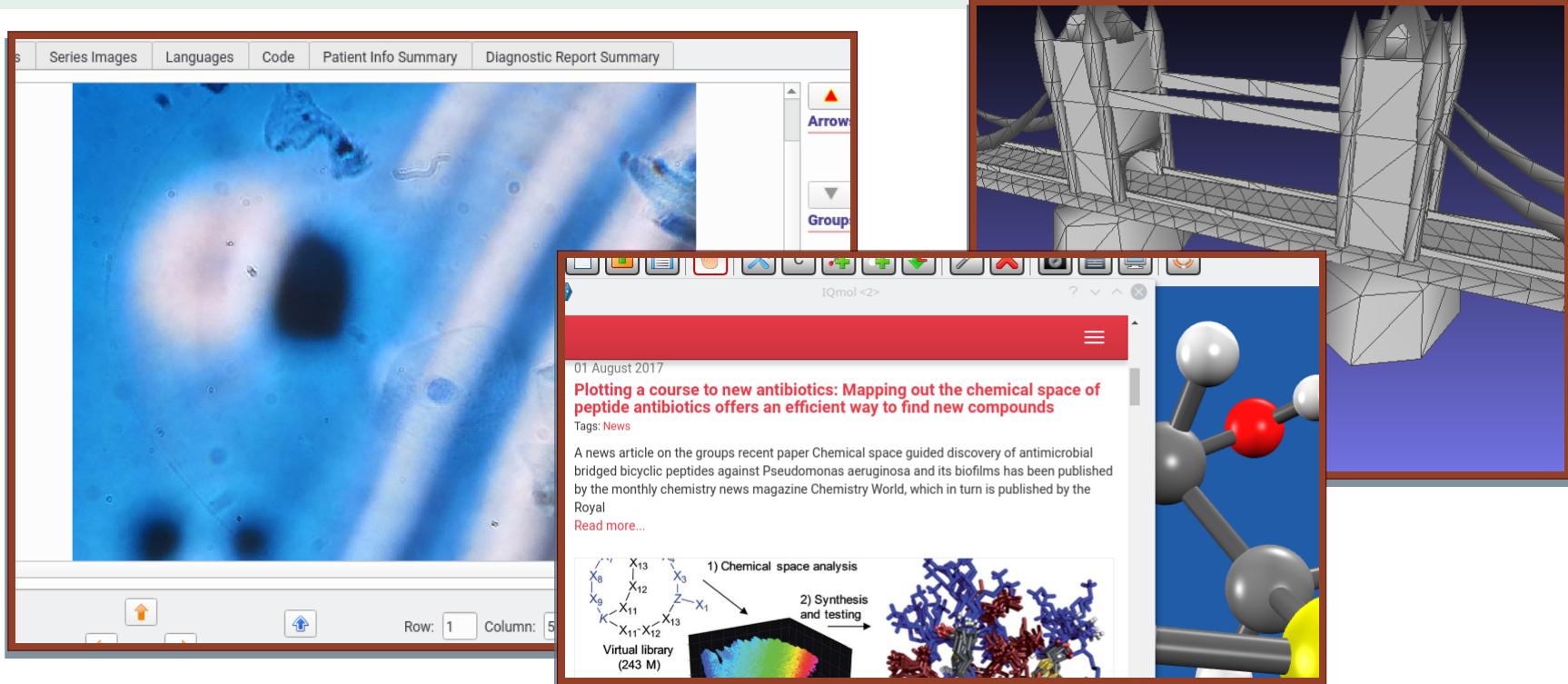


The NCN/A3R (“NA3”)

Native Application Development Framework



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Team Members

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Company Founder and CEO

Amy Neustein, Ph.D., Editor-in-Chief of the *International Journal of Speech Technology*; Editor of De Gruyter Series in Text Mining in Medicine and Health Care; Editor of SpringerBriefs in Speech Technology; Author/Editor of 12 academic books on natural language processing, speech recognition, text mining, speech and automata, forensic speaker recognition, mobile speech, and cyber-physical systems and smart homes.

Capital Raising for Round A, ROI, and Exit Plan

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- ◆ New Jersey-based home-grown female-headed software development company launching “Round A” between \$1.5 and \$2 million .
- ◆ Conservative burn with 5 year exit plan.
- ◆ Company valuation at \$100 Million at exit. ¹
- ◆ Business model: customization, hosting, and licensing. ²

¹ See Slide 10 for development stages and exit strategy.

² See Slides 8 and 11 for details.

Our NCN (Native Cloud/Native) Protocol

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Cloud/Native Components as Back-Ends for Native Software

- Our “Native Cloud/Native” protocol refers to native application front-ends paired with Cloud/Native (back-end) container instances.
- Code libraries and data representation may be shared across both endpoints.
- Common representation on both server- and client-side streamlines network communications (no need to marshal data between different formats).
- The NA3 technology can be ported to other application frameworks apart from Qt (wxWidgets, XCode, MFC, etc.).
 - Note: This presentation will focus on NA3’s default Qt implementation.

How Cloud Back-Ends Enhance Native Front Ends

- Cloud Backup ● Share Data between Users ● Collaborative Editing
- Maintain users’ application state across different computers (home/school/office)
- Upgrade running applications without needing to re-compile

How NCN Addresses Limitations of Qt in the Cloud

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Qt is the most popular native, cross-platform application-development framework.

- ◆ ~1 million active developers
- ◆ Over 5,000 client companies
- ◆ Worldwide “Qt Partners” Ecosystem
- ◆ ~US \$25 billion overall market

However, there is Limited Qt Cloud Integration Support

- “Qt Cloud Services” Discontinued in 2016.
- Currently there is no standard model for accessing Cloud services from Qt applications.
- Nor is there a standard Qt-based Cloud/Native container architecture.

How NCN Addresses Limitations of the Semantic Web

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Many experts have critiqued the Semantic Web for lacking conceptual rigor, adequate modeling for multi-scale information, and intrinsic representations for Quality Assurance Requirements. To address these limitations, NCN introduces new Semantic Web technologies with the following features:

The Application-as-a-Resource (A3R) Model

- A3R Applications are self-contained, citable resources which can conform to modern resource documentation standards, such as the Research Object protocol.
- A3R includes a representation for natural language publications (e.g., books and articles) that unifies different manuscript formats (such as XML, L^AT_EX, and XCONCUR).

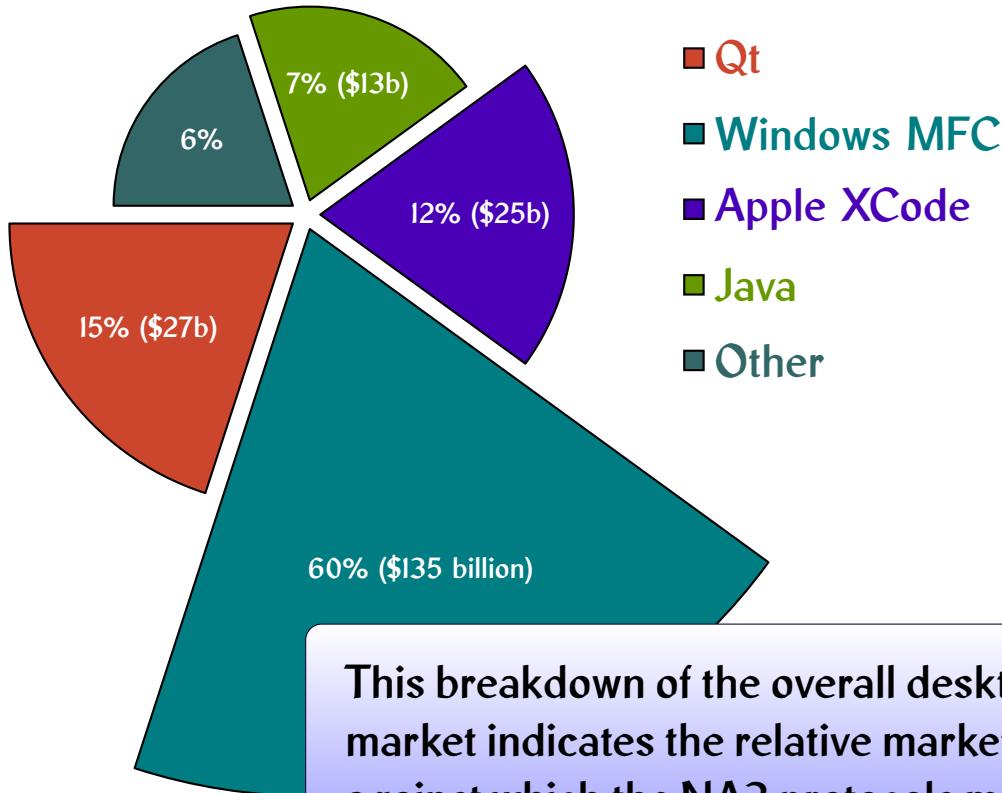
Multiscale, Requirements-Focused Resource Description

- NA3 incorporates Semantic Web alternatives with greater Requirements Engineering and Quality Assurance precision, such as Conceptual Space Markup Language.
- Hypergraph-based Resource Framework to intrinsically support multi-scale data structures.
- Workflow-oriented “Meta-Procedure” Interface Definition framework to enforce procedural alignment among applications.

Overview of the Software Development Market

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This slide offers a rough breakdown of the software development market, (estimated at \$350 Billion), restricted to desktop software (roughly one-half the total market), including both cross-platform and single-platform solutions.



Taking the Qt implementations of the NCN and A3R protocols as a prototype, analogous versions may be built targeting other popular software-development platforms (see next slide for a more detailed outline).

This breakdown of the overall desktop application-development market indicates the relative market share of different platforms against which the NA3 protocols may be implemented.

Our NCN Business Strategy

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Within the Qt Market

- Promote NCN as a standard solution for Qt/Cloud Integration.
- Promote NCN developer tools for custom Qt scripting/markup languages.
- Promote NCN's Semantic Web protocol as a standard model for inter-application networking, describing applications, and serializing application-specific data structures.
- On the basis of these enhancements to the Qt ecosystem, LTS hopes to join the **Qt partners** program, which would expose NCN's unique features to a worldwide developer community.

Outside of Qt (see slide 9)

- Port the NCN Protocol implementations, C++ reflection model, and hypergraph libraries to standard (non-Qt) C++ and other languages.
- Implement language-agnostic hypergraph serialization to allow NCN networking between applications written for different operating systems and/or programming languages.

NCN Revenue Sources

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- ◆ **Customization** Custom-implemented applications using project-specific versions of NCN and/or A3R (see slide 11).
- ◆ **Licensing** Commercial licenses required for any deployment of NCN outside LTS-controlled servers and/or any commercial deployment of A3R applications.
- ◆ **Hosting** Running proprietary containers via a Cloud-Native service such as OpenShift, LTS can offer integrated hosting and consulting wherein LTS fully implements and maintains a back-end paired to any desktop/native client software. (Because the expertise involved in building native desktop applications is very different from the techniques required to deploy a Cloud-Native container image, the option of delegating all backend responsibilities to LTS may appeal to Qt-oriented development teams.)
- ◆ **Sponsorship** Running a data-sharing platform which would be a publicly-visible introduction to NCN. This “demo” container would host research data sets (and would therefore be a resource in the public interest) allowing LTS to receive compensation from companies financially supporting the portal because it is a technology which benefits science and research.

Baselines For Projecting LTS Growth

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This slide considers sample Qt-based companies to establish a baseline for assessing the future growth of LTS.

- ◆ **The Qt Group Plc** *€45.6 Million annual revenue* (source: Qt) Financial records released by The Qt Group suggest that commercial “Developer” and “Distribution” licenses are Qt’s largest revenues source: Qt aims for 60% revenue from licenses, 20% from consulting, and 20% for “support and maintenance” — total net revenue across these sources was US \$57 Million.
- ◆ **ICS (Integrated Computer Solutions)** *US \$25-50 Million annual revenue* (source: Glassdoor) ICS specializes in custom software development for companies in the military, aeronautics, and biomedical sectors. ICS exemplifies a Qt company whose revenue derives mostly from customization and consultation.
- ◆ **Toradex** *US \$16.2 Million annual revenue* (source: owler.com) Toradex specializes in microprocessors and embedded systems, one of the largest of several Qt partners focusing on embedded systems with Qt front-ends for touchscreens and/or desktop consoles.

ROI and Development Phases

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- I (9-12 mos) Establish a hosting platform (projected to take the form of a RedHat Enterprise Service or Kamatera Partner affiliation) within which LTS can license individual cloud back-ends on a per-client basis, paired with clients' desktop front-ends. We will make tools available to help developers create applications that leverage NCN back-ends, including those hosted by our company.
- II (1-2 yrs) LTS will prioritize marketing its development libraries and cloud service, with an emphasis on explaining to Qt-based companies that the LTS hosting option provides functionality similar to the discontinued Qt Cloud Services.
- III (2-4 yrs) Generalize NA3 to standard C++ (eliminating Qt dependencies), implement NA3 in an Apple-specific version targeting XCode, port NA3 to Java, and build a Windows-specific implementation via MFC.
- IV (Fifth yr exit) With NA3 now realized in Qt, Windows, Mac, and Java versions, consolidate each of these implementations into canonical container prototypes, such as RedHat "Cartridges". This collection then becomes a comprehensive, multi-platform desktop/cloud integration technology valued at \$100M.

Customization and Monetization

■ All development and licensing figures quoted are per-client

- ◆ **Custom NCN Servers** LTS builds special versions of NCN which natively recognize client's application-specific data types, preferred serialization formats, and client/server interface definitions.
(dev: \$75K; licensing: \$10K/month)
- ◆ **Custom Markup and Scripting Languages** LTS builds scripting and/or markup languages customized for clients' unique data and interface requirements. These custom languages may be used for data serialization, testing, prototyping, and runtime fine-tuning of application behavior.
(dev: \$250K; licensing: \$10K/month)
- ◆ **Custom GUI Components** LTS builds GUI classes on client's behalf, which natively support NCN integration. (dev: \$50K; licensing: \$5K/month)
- ◆ **Workflow Management** LTS customizes networking protocols so that multiple applications may be unified into distributed workflows.
(dev: \$50K; licensing: \$15K/month)

NA3 In Different Software Ecosystems

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Potential NA3 Markets (see Slide 6 for overview)

Windows MFC (~\$135b market size) NA3 components can be implemented in MFC (Microsoft Foundation Classes) and C++/CLI, building off of a generic-C++ version using the C++ Standard Library in place of Qt-specific data structures.

Apple XCode (~\$25b market size) Apple Operating Systems are based on Linux, so Linux-oriented A3R implementations can form the basis of an XCode version. This XCode implementation would also be built around the C++ Standard Library.

JavaFX (~\$12.5b market size) The Java programming language provides the most widely used cross-platform application development framework outside of Qt. It is feasible to port C++ A3R implementations to Java. The core of this re-implementation would involve designing a Java Hypergraph Library compatible with the A3R serialization and Interface Definition protocol.

Workflow Management (~\$10b market size – source: MarketsandMarkets) NA3 plugins can be added to new or existing applications to support inter-application networking, unifying multiple applications into workflow-management systems.

Example Use-Cases

Inter-Application Networking and Workflow Management

- Export data and instructions between Qt-based applications (**slides 15-16**).
- Embed document or multi-media viewers inside scientific or dataset applications (**slides 27-30**).

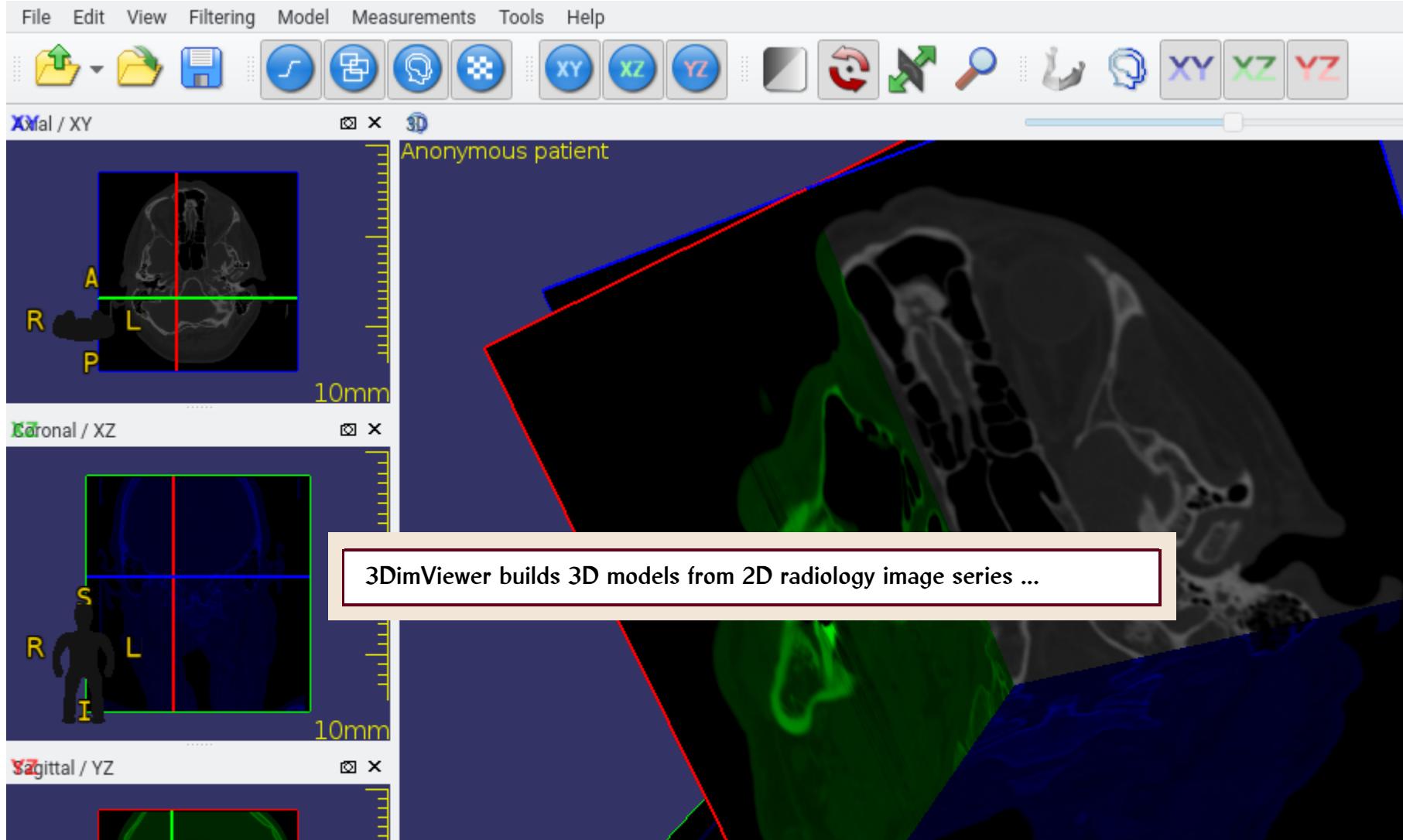
Responsive desktop-style applications for enhanced UX

Native applications offer superior User Experience, leveraging distinct interactive features of desktop GUIs: context menus, dialog boxes, tool tips, Multiple Window Display, dock windows, and so on:

- Compelling front-ends for e-commerce (Note: “46% of global online retail orders happen on desktop”, source: leftronic.com), Real Estate, VR, etc. (**slides 20-26**).
- For scientists and researchers, build innovative data-collection instruments as well as interactive Research Object applications (**slides 17-19**).

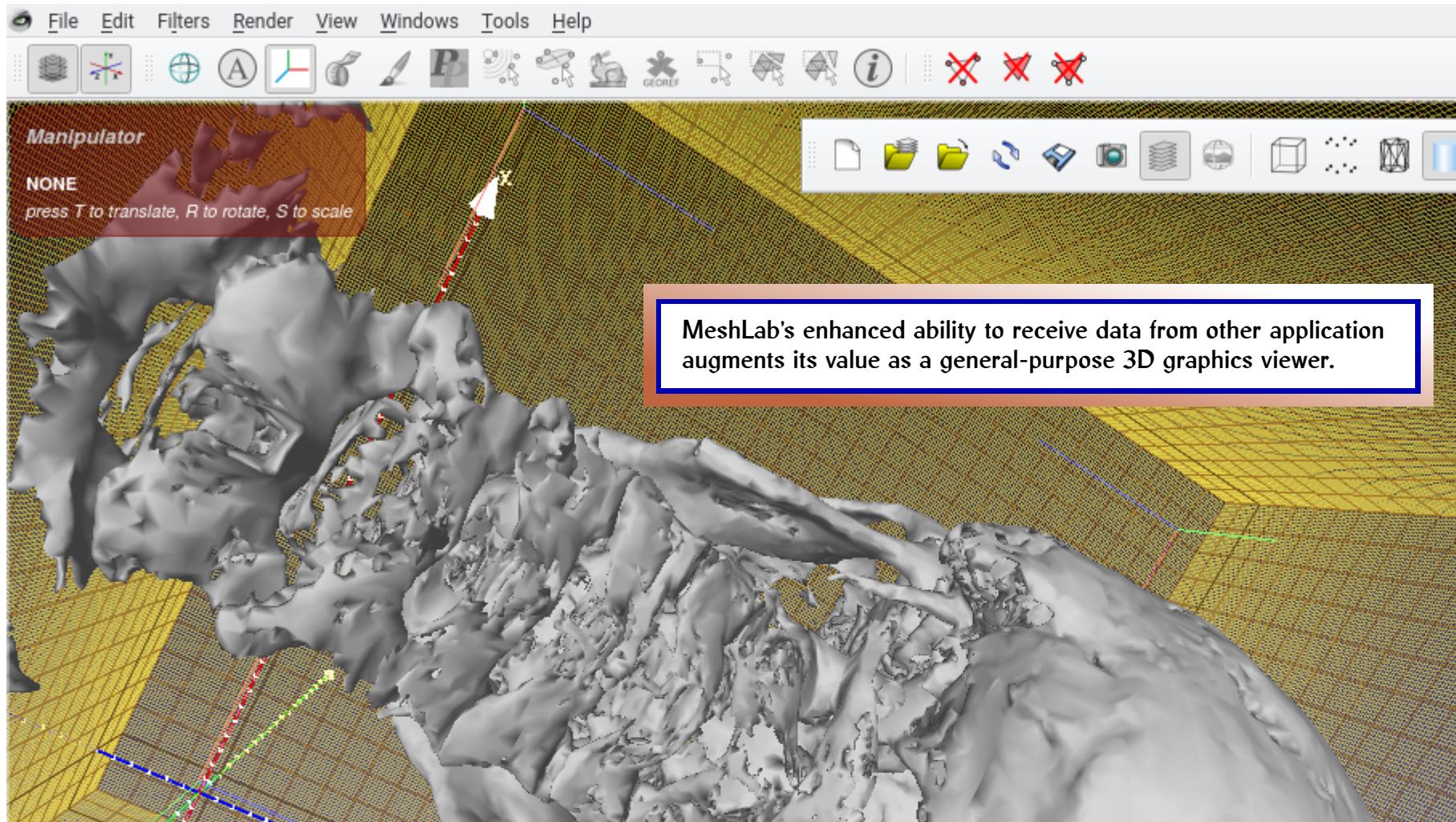
An Example of Inter-Application Networking

This slide and the next demonstrate a case-study where inter-application data sharing enhances the capabilities of two applications: 3DimViewer (a radiology tool) and MeshLab (a 3D graphics engine).



3D Graphics Sent to MeshLab

... Once the 3D tissue sample is constructed by 3DimViewer's algorithms, an A3R inter-application networking protocol (implemented as an extension to both applications) allows 3DimViewer to export the model to MeshLab so that it may be studied in a more comprehensive 3D viewing environment.



A3R Applications as Data Collection Instruments

Forms Web Language Help About

Save Form Open Form Cloud Save Cloud Open Submit Form

Page: 0 Search for: Forwards

Welcome Web

X ? ^ × Form Outline

Click on a subheading to continue

Patient Information
Chief Complaint
Review of Symptoms
Treatment History
Medical History
Current Medications
Family History

ndp-main-outline <5> ? ^ ×

Referring Doctor: Dr. New Test

Referred By (Choose One): Clinical Specialist

Date of Visit 1/9/16 < January 2018 >

Please List your Previous Stays

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	1	2	3
4	5	6	7	8	9	10

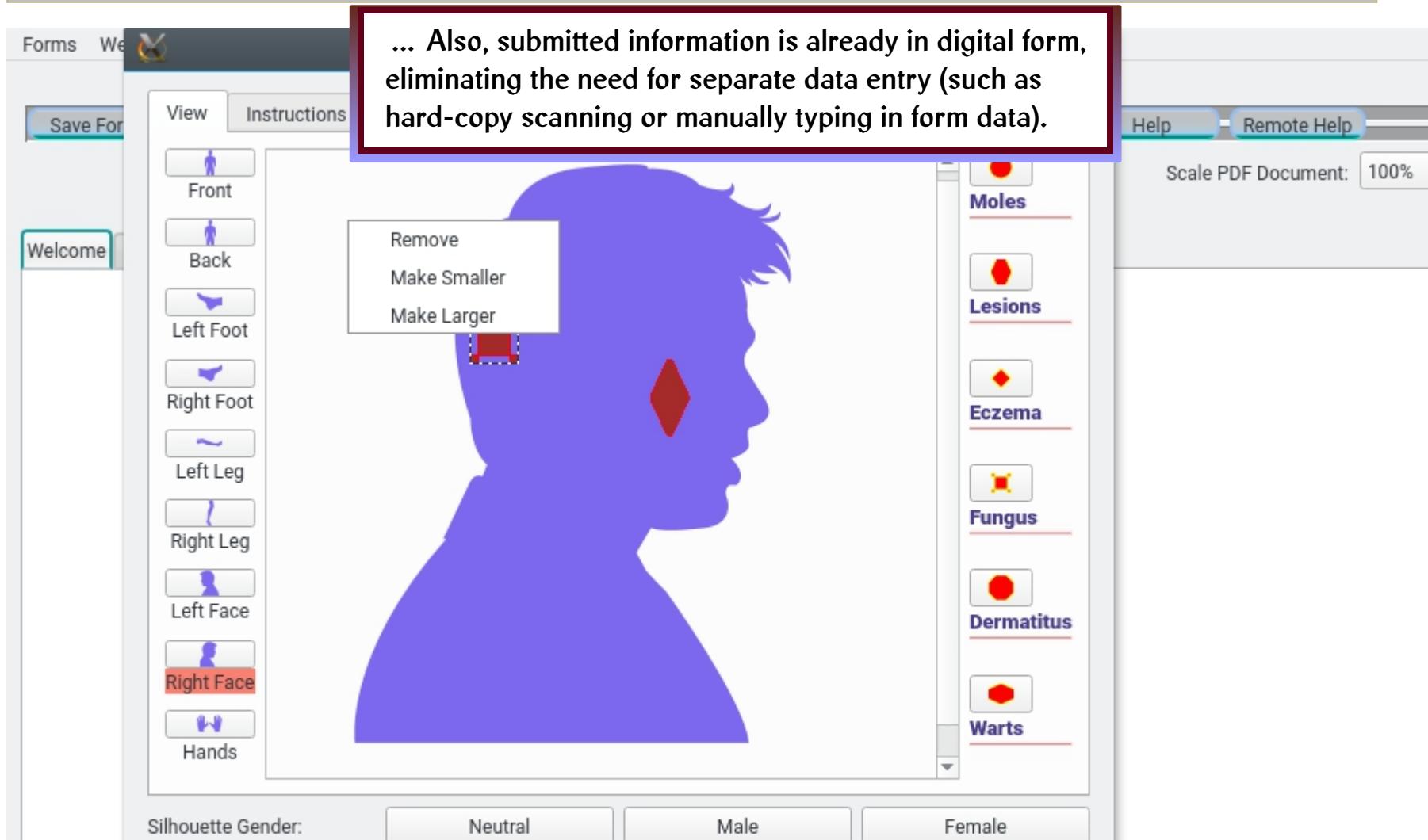
OK Print

January February March April May June July August September October

In medicine and social science, “data collection instruments” (DCIs) refer to surveys, questionnaires, and other tools to obtain human feedback.

Qt-Based Interactive Forms

Data Collection Instruments implemented as native desktop applications can have easily navigable, interactive forms that make it simpler for people to provide information ...



A3R Applications as Research Objects

Complementary to A3R components which facilitate *obtaining* research or experimental data, A3R “Data-Set Applications” are also powerful tools for visualizing and analyzing research findings.

Data-Set Applications are “Research Object Bundles” — combinations of code and data, providing access to data sets without the need for external software dependencies.

The interface shows a central image of a cell with a red arrow pointing to its nucleus. To the left is a vertical stack of small thumbnail images. To the right are toolbars for annotations: Arrows, Comments, Lists, Arcs, and Rulers. At the bottom are controls for Silhouette Zoom, Image Transforms, Annotations Transforms, and various navigation buttons like Pan, Zoom, and Rotate.

Native Applications as Interactive Catalogs

As a case-study in enhanced User Experience afforded by native applications, consider how static PDF catalogs and brochures can be turbo-charged into engaging, interactive software-based presentations.

The screenshot shows a native application window with a dark blue header bar at the top. Below the header, there is a large central image of two brown leather sneakers with white soles. A context menu is open over the right sneaker, listing options such as 'Detach Image', 'Detach Noteboook', 'Detach Description', 'Detach Everything' (which is highlighted in blue), 'Merge Windows', 'Explore Color Matches ...', 'View 3D Model ...', 'Take Screenshot', 'View Item List', and 'View Shopping Cart'. To the left of the main image, there is a vertical sidebar containing three small thumbnail images of different shoe styles. At the bottom of the screen, there is a navigation bar with tabs labeled 'Overview', 'Features', 'Specs', and 'Reviews'. The 'Overview' tab is currently selected. Below the navigation bar, there is a bulleted list of product features: 'Leather upper', 'Lace-up', and 'Round toe'. On the right side of the screen, there is a detailed product description for the 'Grand Crosscourt II Sneaker' from Cole Haan, followed by a section titled 'Actions' with links to 'Add to Cart' and 'Explore Colors', and two small color swatches for the shoes.

Grand Crosscourt II Sneaker

Sleek and simple, the Grand Crosscourt II sneaker from Cole Haan is the perfect way to add some tailored casual style to your every day look!

Actions:

- [Add to Cart](#)
- [Explore Colors](#)

Item: 3 Image Zoom:

Overview Features Specs Reviews

- Leather upper
- Lace-up
- Round toe

Interactive Shopping Carts

Instead of static lists, shopping carts can be made into multi-dimensional, multiple-window interactive displays.

The screenshot illustrates a shopping cart interface designed as a multi-dimensional, multi-window display. At the top, a navigation bar includes File, Email, Events, APIs, Web, and Broadleaf. Below it are search and filter controls: Page: 0, Search for:, and a zoom setting of 100%.

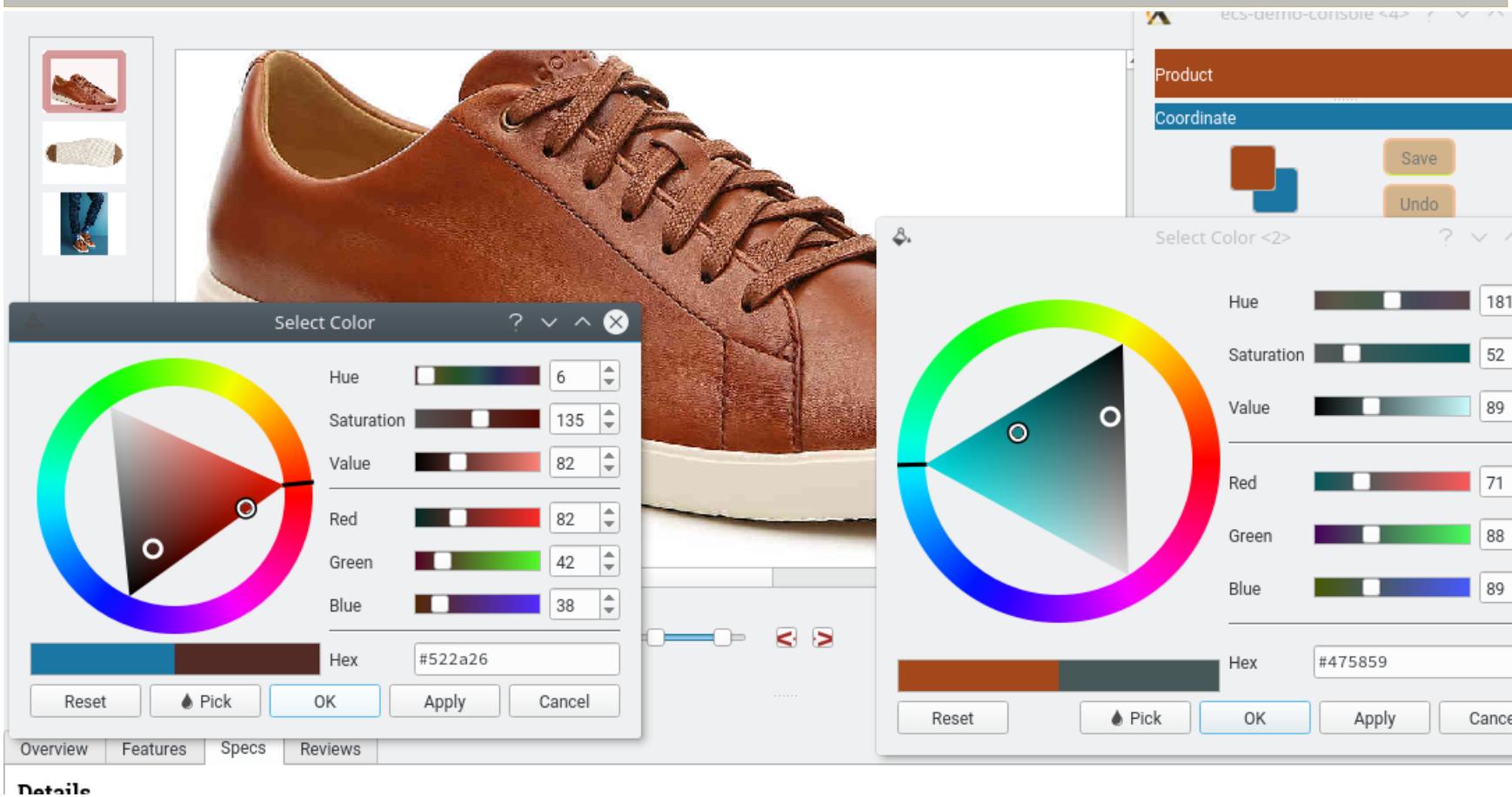
Two product windows are open:

- Window 1 (Left):** Product ID tec5-db-main <2>. It displays a bouquet of purple flowers (lily garden silk peony) and includes a detailed description: "Lily Garden Silk Peony Bouquet Home Decoration, Lilac, 18 Inches High".
- Window 2 (Right):** Product ID tec5-db-main <3>. It displays a bouquet of pink hydrangeas and includes a description: "Frosted Hydrangea, Mauve, 32 Inches High, 12 Floral Sprays".

Each window has tabs for Overview, Specs, Reviews, and Q & A, along with OK and Cancel buttons at the bottom. The overall layout allows for simultaneous comparison of different products within a single interface.

Explore Products with Native Software

Interactive catalogs allow designers to incorporate many unique features and capabilities of desktop applications, such as using HSV color-wheel controls to explore color coordination while shopping.



Interactive Real Estate

A3R programming can also bring enhanced UX to Real Estate presentations: instead of just groups of photos, properties can be displayed via interactive, multi-dimensionally organized, color-coded photo viewers.

The screenshot shows a software interface titled "rpdf-emb-console". On the left, there is a grid of thumbnail images representing different rooms of a house. A specific thumbnail in the middle row is highlighted with a red border and has an arrow pointing to it from a callout box labeled "Color-Coded Groups". To the right of the grid is a large image of a master bedroom with green walls, wooden furniture, and a large bed. This image is enclosed in a white box with the text "Current Photo". At the bottom of the screen, there is a navigation bar with arrows, the text "Item: 19", and a zoom slider. On the far left, a sidebar titled "Groupings" lists room categories with corresponding colored bars: Entrance/Foyer/Hall (teal), Kitchen/Dining Room (yellow-green), Living Room/Den (purple), Bath/Powder Room (blue-gray), Bedroom/Closet (teal), Master Bedroom/Spa (light green), and Basement/Game Room (gray).

Groupings

- Entrance/Foyer/Hall
- Kitchen/Dining Room
- Living Room/Den
- Bath/Powder Room
- Bedroom/Closet
- Master Bedroom/Spa
- Basement/Game Room

Current Photo

Color-Coded Groups

Item: 19

Image Zoom:

OK Cancel

Photo Viewer Interactive Cues

These slides demonstrate visual cues aiding photo navigation, such as color bands (overlays) that switch from horizontal to vertical indicating which photos have been viewed so far; and the thumbnail of the current viewed photo marked with a thick colored border (surrounding the thumbnail photo and its overlays).

The screenshot shows a photo viewer interface with a grid of thumbnails on the left and a large preview window on the right.

- Already Viewed (vertical color band):** A callout points to a thumbnail in the second row, third column, which has a thick vertical purple border around it and its corresponding overlay.
- Not Yet Viewed (horizontal color band):** Another callout points to a thumbnail in the fourth row, fifth column, which has a thick horizontal purple border around it and its corresponding overlay.
- Current Photo (viewed for the second time):** A callout points to the large preview window on the right, which displays a living room interior with brown leather couches and a large window.

Groupings:

- Entrance/Foyer/Hall (purple)
- Kitchen/Dining Room (green)
- Living Room/Den (blue)
- Bath/Powder Room (orange)
- Bedroom/Closet (light blue)
- Master Bedroom/Spa (light green)
- Basement/Game Room (grey)

Navigation controls: back arrow, forward arrow, Item: 10, Image Zoom: [button].

Filtering Photos

Another feature which may be conveniently implemented in A3R-style photo viewers is a filtering option, which — given a collection of pictures classified into several groups — allows users to show or hide photos based on the group they belong to (note the check-box buttons on the group listing).

The screenshot shows a photo viewer interface with a sidebar of thumbnail images and a main viewing area.

Visible Groups: An arrow points from this text to the "Entrance/Foyer/Hall" checkbox in the "Groupings" list, which is highlighted with a green oval.

Check Boxes: This label points to the "Groupings" list, which contains the following items:

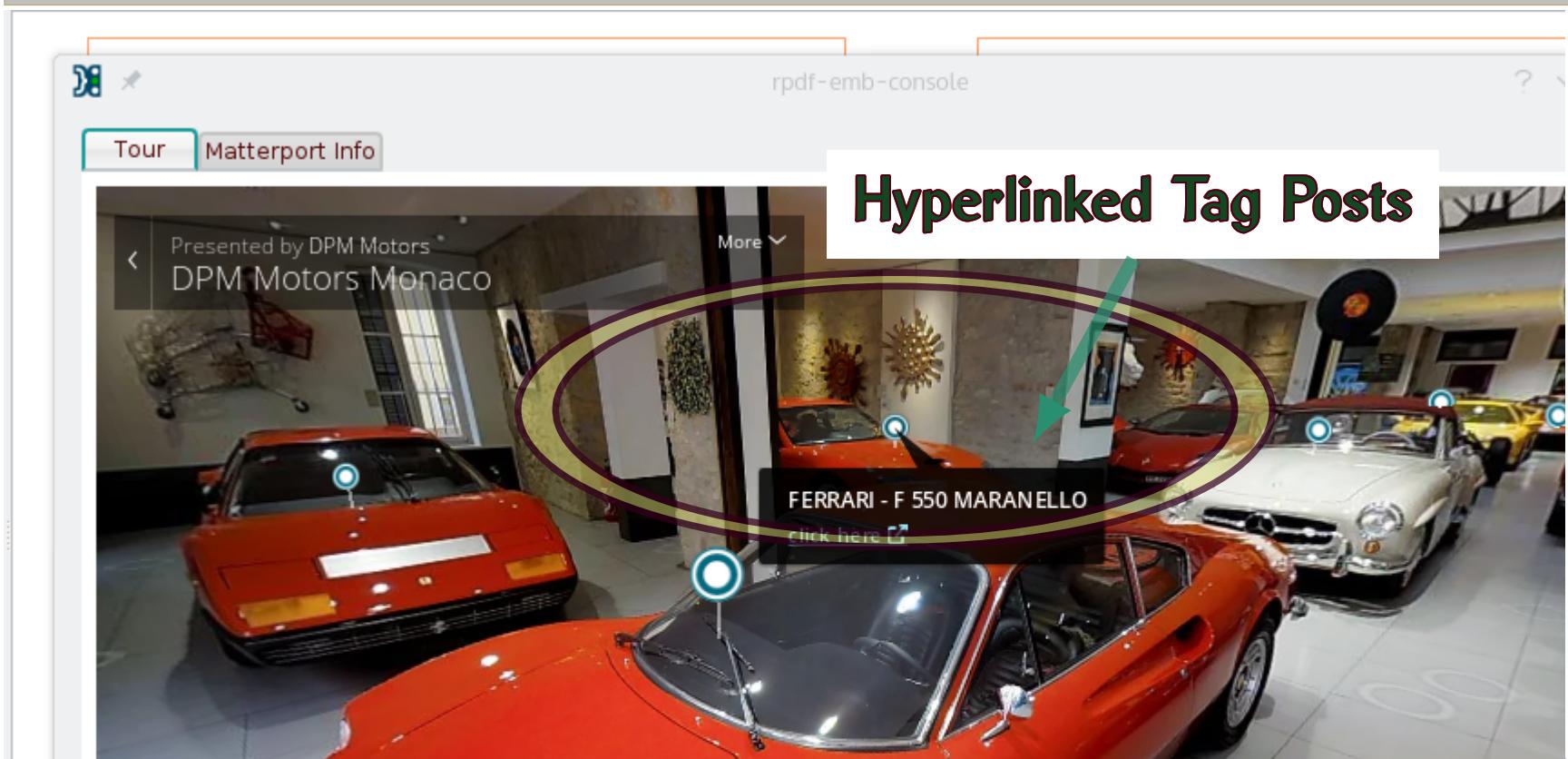
- Entrance/Foyer/Hall
- Kitchen/Dining Room
- Living Room/Den
- Bath/Powder Room
- Bedroom/Closet
- Master Bedroom/Spa
- Basement/Game Room

Hidden Groups: An arrow points from this text to the "Bath/Powder Room" and "Basement/Game Room" checkboxes, which are circled in red.

Below the list are navigation arrows, an "Item: 3" indicator, an "Image Zoom:" slider, and "OK" and "Cancel" buttons.

Interactive VR: Hyperlinked Tag Posts

Another emerging technology, relevant to both e-Commerce and Real Estate, is the use of Panoramic Photography to create immersive Virtual Reality scenes. Panorama-Photography-based VR engines, like Matterport, allow “tag posts” with embedded hyperlinks, which in a native-application context become channels of communication between the VR renderer and the host application. The full capabilities of this interactive modality — combining VR with clickable links and text “bubbles” — can only be fully realized via Virtual Reality engines (such as WebGL) embedded in native software.



A3R Document Viewers

A3R applications may embed viewers for document formats such as e-Pub, HTML, and PDF; then supplement conventional publications with special components customized for individual manuscripts: e.g. (as in this case), a widget allowing readers to visually explore patterns in classical Indian music.

The screenshot shows a digital journal interface. At the top, there are three icons: a gear (Preferences), a book (Library), and a book with glasses (Reading). Below these are tabs for 'HTML Source', 'Lisp', 'CSS', and 'XML'. A large red rectangular area covers the middle section. Below it, the text 'Read article view' is visible. At the bottom, there's a navigation bar with a left arrow, a central orange square icon, and a right arrow.

ANTHROPOLOGY AND HUMANISM

Explore this journal >

Ethnographer as Apprentice: Embodying omusical Knowledge in South India

da Weidman

Published: 26 December 2012 Full publication history

The screenshot shows a specialized A3R viewer window. At the top, it says 'Display Tala Types: Jhoomra/Dhamar (14 beats)'. Below this is a diagram consisting of several horizontal bars of different colors (red, purple, green) of varying lengths, representing musical patterns. Below the diagram is a slider labeled 'Patterns' with 'Pattern 1 (3-4-3-4)' on the left and 'Pattern 2' on the right. A file path 'File /extension/ScignSeer/articles/svg/tala.svg' is shown below the slider. At the bottom right is a 'Proceed' button. To the right of the viewer is a sidebar with a decorative sun-like icon and the text 'Separate'.

Volume 37, Issue 2
December 2012
Pages 214-235



A3R Document Viewers as Embedded Components

Document Viewers may also be embedded in host applications which provide domain-specific visualization capabilities. For example, chemistry papers might be viewed within IQmol (a Qt-based program for molecular visualization and physical/chemical analysis) via an A3R document-viewer plugin.

The screenshot shows a chemistry application interface. At the top is a menu bar with 'Display', 'Build', 'Calculation', 'SONIC', and 'Help'. Below the menu is a toolbar with various icons. On the left, there's a sidebar with a 'Springer' logo and search results for 'Cysteine'. A context menu is open over a 3D ball-and-stick model of a cysteine molecule, showing options like 'Configure', 'Select All', 'Reperceive Bonds', 'Duplicate Geometry', 'Atomic Charges', and 'Remove'. An 'IQmol' icon is visible in the bottom right corner of the main window. In the center, an A3R document viewer is embedded, displaying a search interface for 'Cysteine'. The search bar shows 'Springer Keyword Search: Cysteine', and the results list includes 'Springer Web Search Home' and 'Search Saved Articles'. Below the search bar, a book cover for 'Cysteine Proteases of Pathogenic Organisms' by M.W. Robinson and J.P. Dalton (Eds.) from Springer is shown. The book cover features a blue and orange design with the title and authors' names. The overall background is blue, and the molecular model is composed of grey carbon atoms, white hydrogen atoms, and yellow sulfur atoms.

Document Viewers Augmented With APIs

Another strategy for interactive publications is linking documents with APIs maintained by publishers, or by cultural or educational institutions.

View Instructions

As an example, documents mentioning artifacts held in a museum can provide features to view more information about those museum-pieces through the host institution's API.



MEDAL

 Click the icon to save

This is a **Medal**. We acquired it in 1920. It is a part of the **Product Development** department.

Cite this object as

Medal; bronze; 1920-30

Row: 0 Column: 0

Embedded Multimedia

Custom-built A3R document viewers can provide convenient access to multimedia content embedded in or linked to texts — including audio files, videos, and 3D graphics scenes or models.

Ailurus fulgens styani (also known as *a. f. refulgens*): Only found in China (in the Hengduan

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ab

In this case a video player is launched in a dialog box, floating above the article text. For those reading digital books or articles, videos and other multimedia content can be presented through secondary windows launched via context menus; text and multimedia may thereby be viewed side-by-side.



Behavior

Red pandas are generally solitary, but there are a couple of cases where they develop extended associations with their mothers that last throughout the breeding season.



In terms of territoriality, red pandas tend to have overlapping home ranges with other. This means that they do not search for their own food but rather rely on what is available in their shared habitat.

arkive.org/red_panda/about-the-red-panda/

ScignSeer Video Player

ARKIVE
www.arkive.org

Moving images copyright
© BBC Natural History Unit

Sound recordings copyright
© BBC Natural History Unit
© Natural FX

Restart Pause Play

URL file:///ext_root/videos/a.mp4

OK Proceed Cancel

Thank You!

Please contact Linguistic Technology Systems for more information about NA3 and/or other Software Development and Software Language Engineering Solutions: (917) 817-2184.

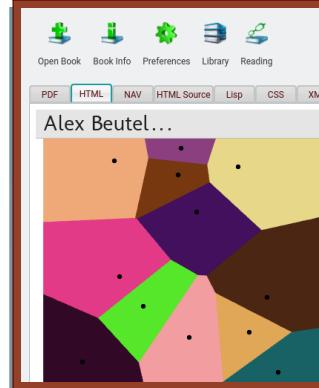
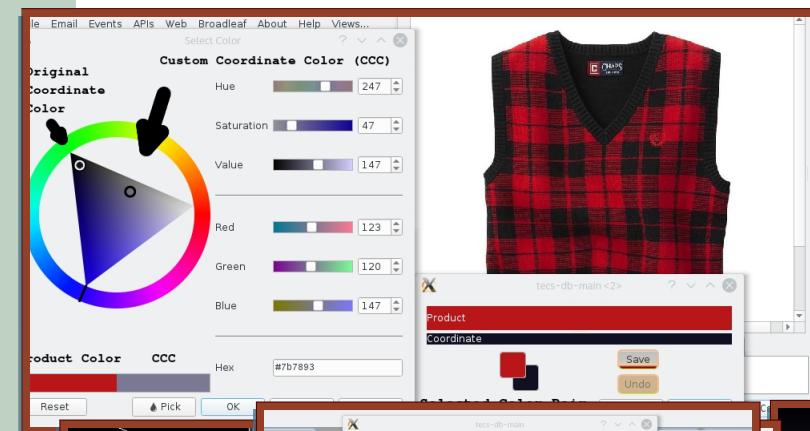


Figure 2 The Voronoi Diagram of the set of Melbourne's inner city train stations.

It should also be noted that this account aims to represent space partitioning at a cognitive rather than at a physical level. What this means is that *at will* not be

