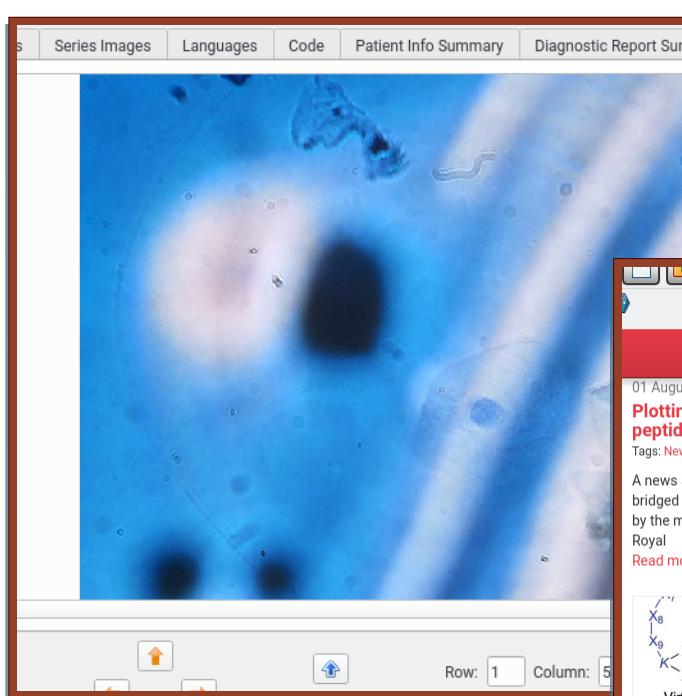


# The NCN/A3R ("NA3")

## Native Application Development Framework



A screenshot of a software interface. On the left, there is a 3D molecular model of a complex organic molecule. On the right, a news article from Chemistry World is displayed. The article title is "Plotting a course to new antibiotics: Mapping out the chemical space of peptide antibiotics offers an efficient way to find new compounds". It discusses the use of chemical space analysis and synthesis to discover new antibiotics. A small inset diagram shows a 3D plot of chemical space with axes labeled X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, and Z. The plot is labeled "Virtual library (243 M)".

Linguistic Technology Systems  
POC: Amy Neustein, Ph.D.  
Founder and CEO  
[amy.neustein@verizon.net](mailto:amy.neustein@verizon.net)  
201-224-5096

# The NCN (Native Cloud/Native) Protocol

## Cloud/Native Components as back-ends for native software

- “Native Cloud/Native” refers to native application front-ends paired with Cloud/Native container instances.
- Share code libraries and data representation across both endpoints.
- Common representation on both server- and client-side streamlines network communications (no need to marshal data between different formats).
- This presentation will focus on NA3’s default Qt implementation, though the technology can be ported to other application frameworks (wxWidgets, XCode, MFC, etc.).

## How Cloud Back-Ends Enhance Native Front Ends

- Cloud Backup; Share data between users; Collaborative Editing
- Persist users’ application state across different computers (home/school/office)
- Upgrade running applications without re-compile

# Application-As-A-Resource (A3R)

## The A3R Application Model

- A3R Applications are self-contained, citable resources which can conform to modern resource documentation standards, such as the Research Object protocol.
- A3R Applications can use Hypergraph-structured metadata to describe data types, procedures, User Interface features, and inter-type relationships (for instance, the relation between data types and the types of GUI components which visualize them).

## A3R Developer Tools

- Hypergraph-based data modeling and serialization.
- Framework for building custom scripting, parsing, and data persistence engines.
- Enhanced support for applications specifically designed to access research data sets.
- Convenient framework for sharing data among applications (to establish inter-application workflows) or between applications and cloud or web services (including leveraging NCN services).

# The Qt Ecosystem

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 \$250 million overall market

## However ... 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.

# Example Use-Cases

## Inter-Application Networking and Workflow Management

- Export data and instructions between Qt-based applications (slides 6-7).
- Embed document or multi-media viewers inside scientific or dataset applications (slides 18-21).

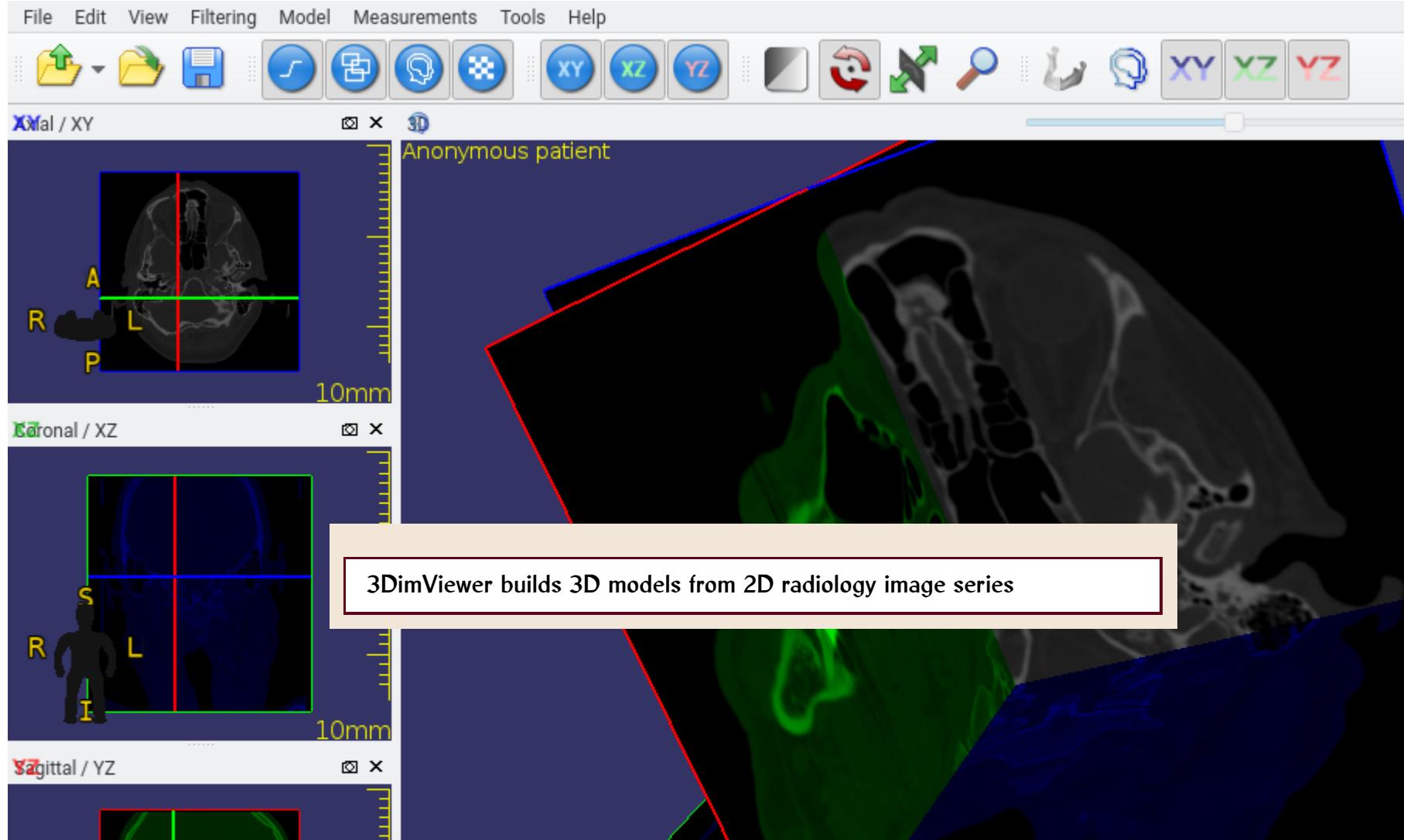
## Responsive, desktop-style applications for enhanced UX

*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, Real Estate, VR, etc. (slides 11-17).
- For scientists and researchers, build innovative data-collection instruments as well as interactive Research Object applications (slides 8-10).

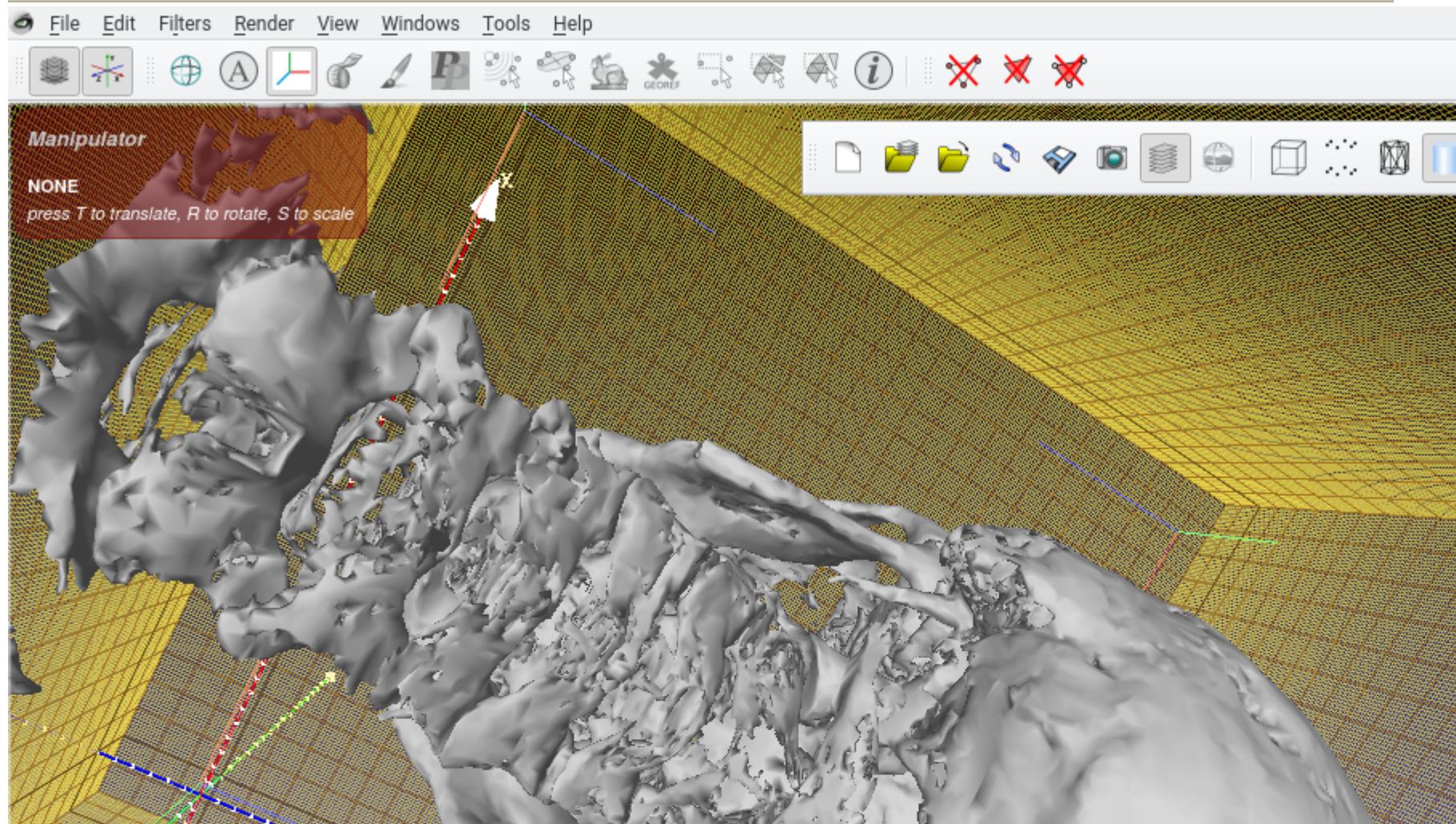
# An Example of Inter-Application Networking

This slide and the next demonstrates a case-study where inter-application data sharing enhances applications' capabilities.



# 3D Graphics Sent to MeshLab

Once the 3D tissue sample is constructed, an A3R inter-application networking protocol (implemented as an extension to both components) 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 ? ^ 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> ? ^ X

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

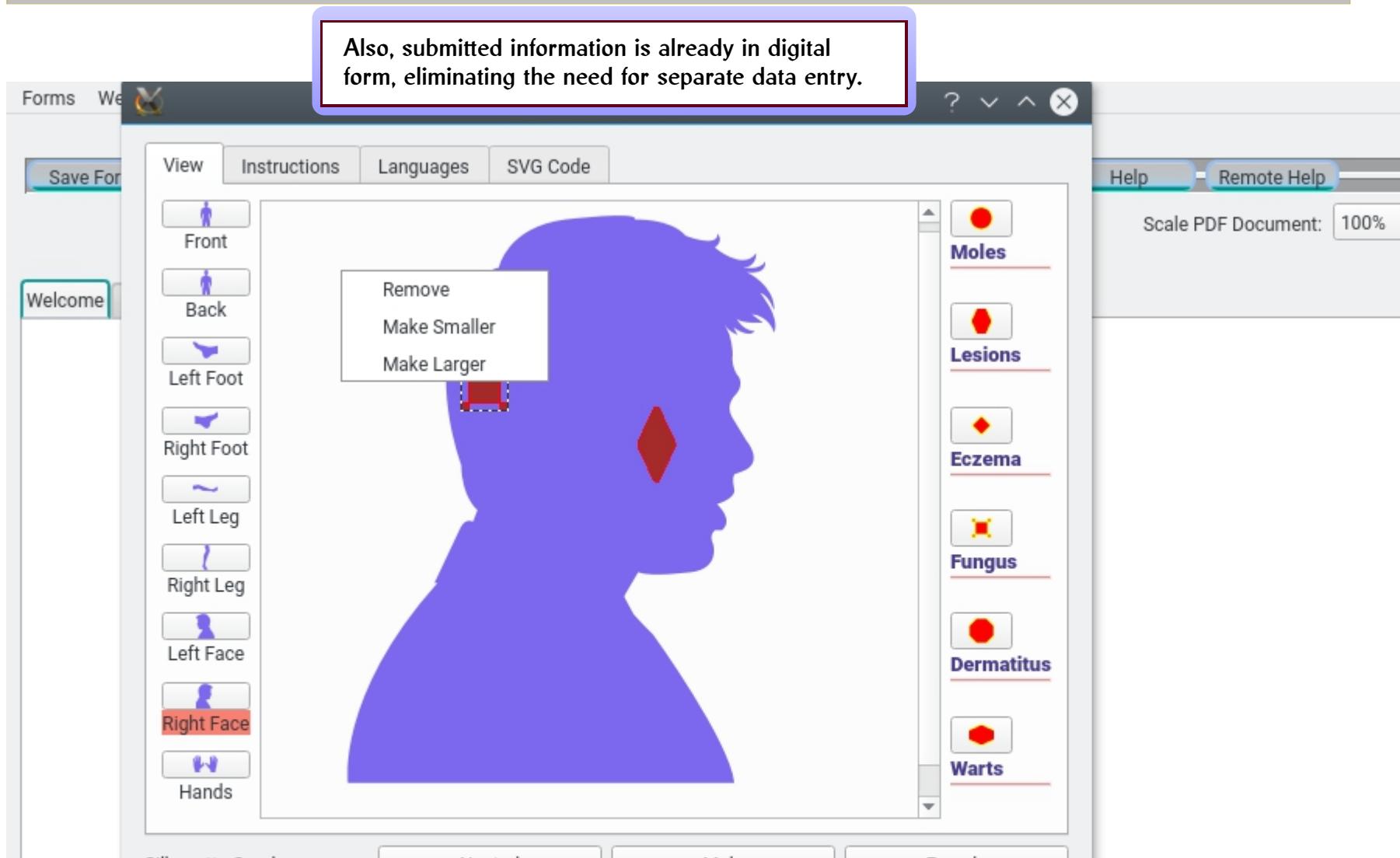
January February March April May June July August September October

The screenshot shows a software interface for data collection. At the top, there's a menu bar with 'Forms', 'Web', 'Language', 'Help', and 'About'. Below the menu are several buttons: 'Save Form', 'Open Form' (which is highlighted in orange), 'Cloud Save', 'Cloud Open', and 'Submit Form'. There are also buttons for 'Page' (set to 0) and 'Search for' with a dropdown for 'Forwards'. On the left, a sidebar lists sections like 'Welcome', 'Web', 'Form Outline', and various medical history categories: 'Patient Information', 'Chief Complaint', 'Review of Symptoms', 'Treatment History', 'Medical History', 'Current Medications', and 'Family History'. A note says 'Click on a subheading to continue'. In the center, a modal window titled 'ndp-main-outline <5>' is open. It contains fields for 'Referring Doctor' (set to 'Dr. New Test') and 'Referred By (Choose One)' (set to 'Clinical Specialist'). Below these is a date picker set to '1/9/16' with a calendar for 'January 2018' shown. The calendar highlights specific dates with purple boxes: '1' under 'Sun' and '14' under 'Mon' are labeled 'Test 2'; '2' under 'Sun' and '15' under 'Mon' are labeled 'Test 1'. The modal has 'OK' and 'Print' buttons at the bottom.

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

# Qt-Based Interactive Forms

DCIs 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 the benefits of native applications for “obtaining” data, A3R components are also powerful tools for showing and analyzing research findings.

A3R applications can be implemented as “Research Object Bundles” — combinations of code and data providing access to data sets without the need for external software.

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 to 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](#)

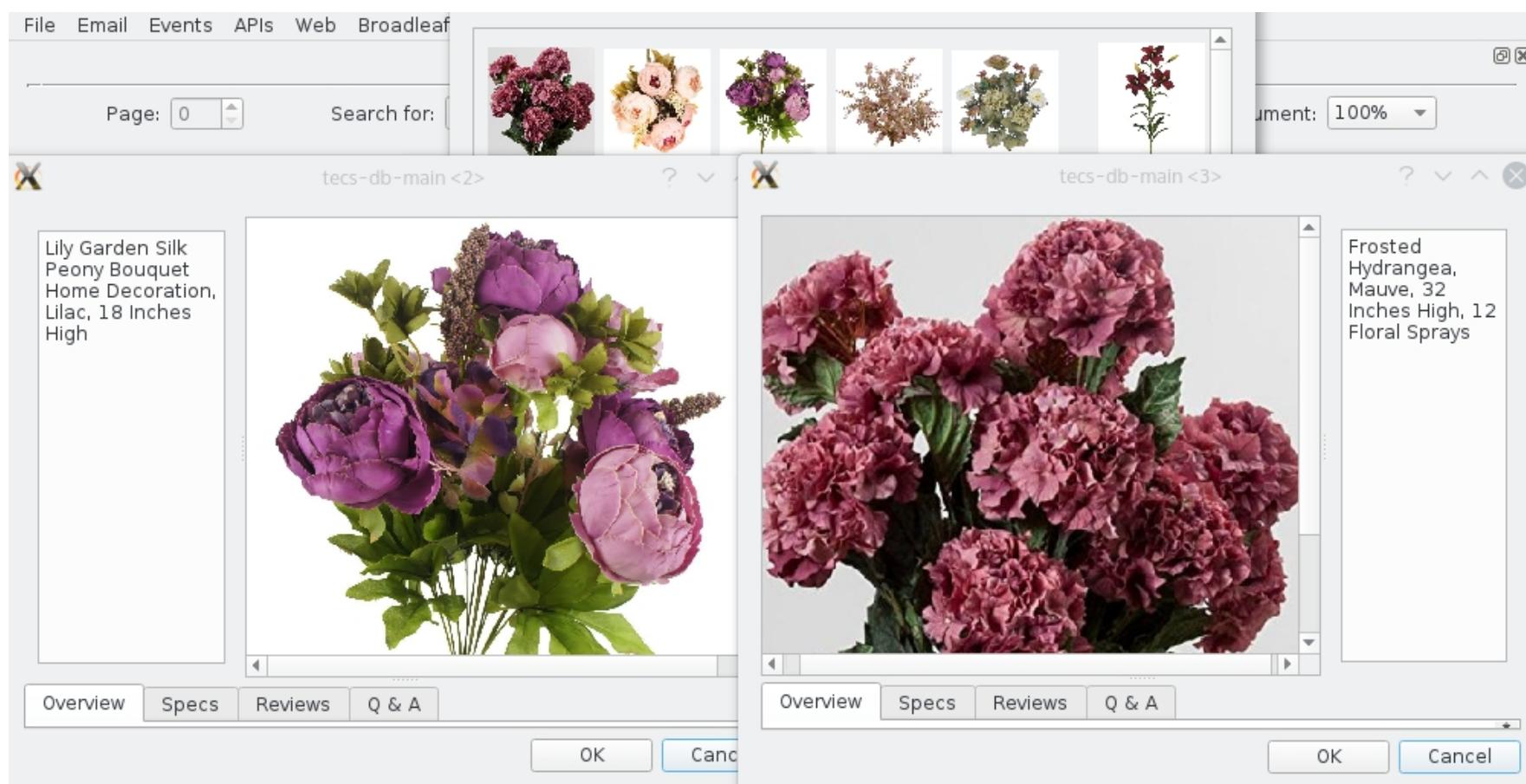
Item: 3    Image Zoom:

Overview Features Specs Reviews

- Leather upper
- Lace-up
- Round toe

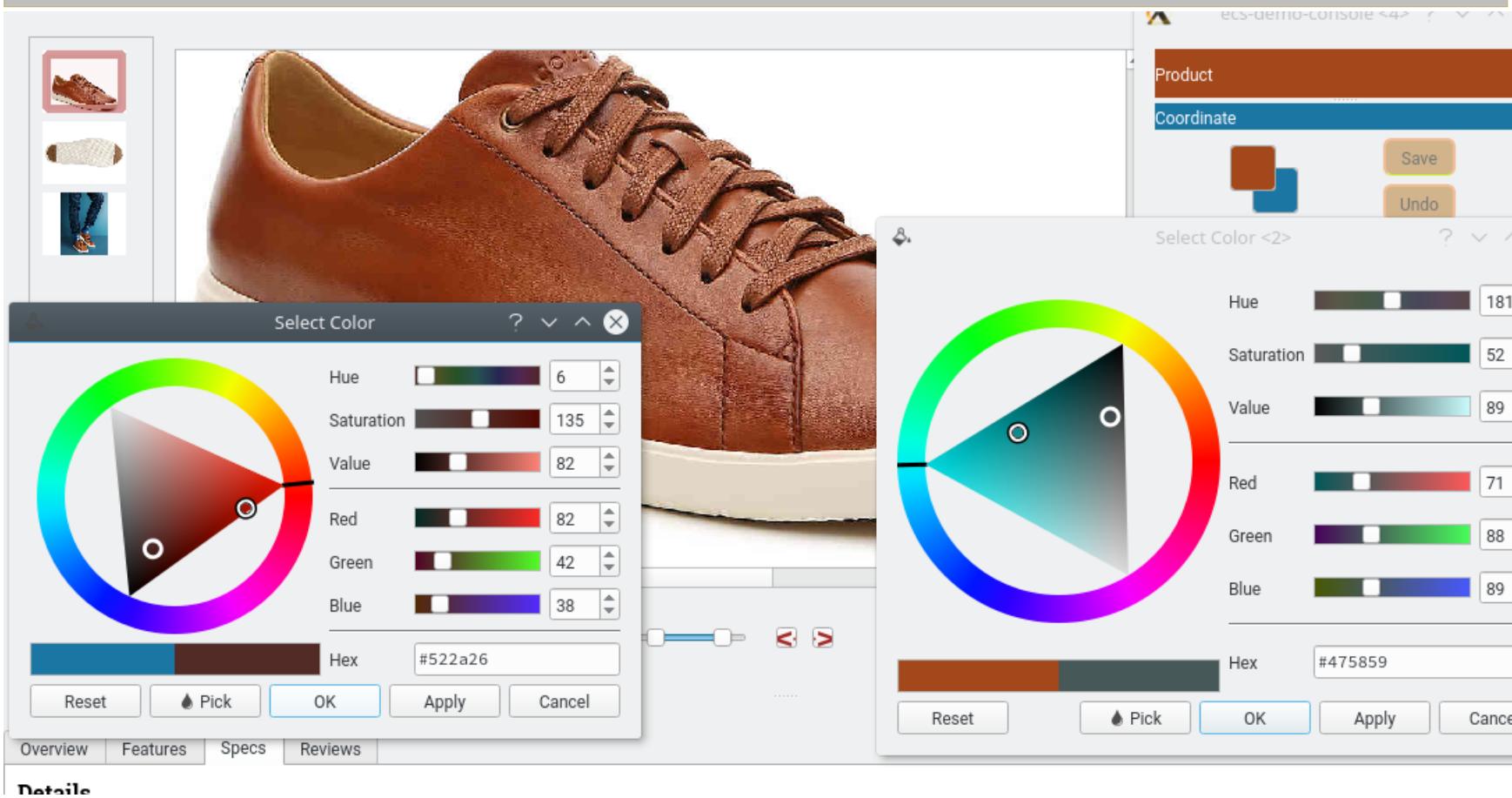
# Interactive “Shopping Carts”

Instead of static lists, shopping carts in a native context can be multi-scale, multi-window interactive displays.



# 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

Native applications can also bring enhanced UX to Real Estate presentations — instead of just groups of photos, properties may be introduced via interactive, color-coded photo viewers visually organized according to desktop-software conventions.

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 fourth row, third column (bedroom) is highlighted with a red border and has an arrow pointing to it from the "Groupings" list on the left. To the right of the grid is a large image of a bedroom with green walls, wooden furniture, and a large bed. A white callout box labeled "Current Photo" points to the large image. Below the large image, the text "Color-Coded Groups" is displayed in a large, bold, dark green font. At the bottom of the screen, there are navigation buttons for "OK" and "Cancel", and a "Image Zoom:" slider.

rpdf-emb-console

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

OK Cancel

Image Zoom:

# Photo Viewer Interactive Cues

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

**Already Viewed (vertical color band)**

**Not Yet Viewed (horizontal color band)**

**Groupings**

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

**Current Photo (viewed for the second time)**

# 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.

The screenshot shows a photo viewer interface with a sidebar of thumbnail images and a main viewing area. On the left, under 'Groupings', several categories are listed with checkboxes:

- Entrance/Foyer/Hall (highlighted with a green oval)
- Kitchen/Dining Room
- Living Room/Den
- Bath/Powder Room
- Bedroom/Closet
- Master Bedroom/Spa (highlighted with a red oval)
- Basement/Game Room

A large arrow points from the 'Visible Groups' label to the 'Entrance/Foyer/Hall' checkbox. Another arrow points from the 'Hidden Groups' label to the 'Master Bedroom/Spa' checkbox. The main viewing area displays a large, well-decorated living room with a sofa, armchair, coffee table, and large windows.

Visible Groups

Hidden Groups

Groupings

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

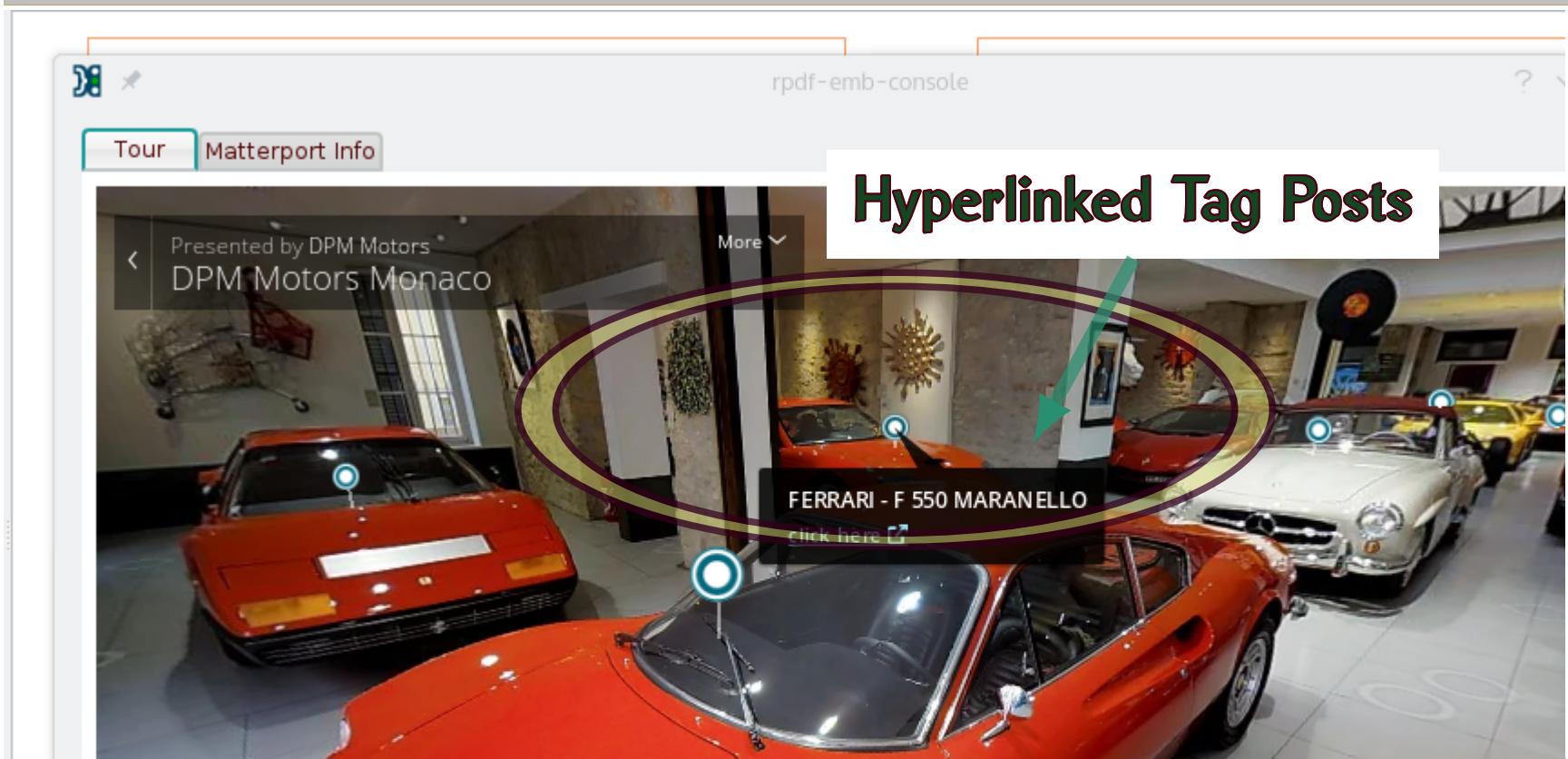
Item: 3

Image Zoom:

OK

# 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 with VR 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 — here, 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, a stack of books, and a book with glasses. Below them are links for 'References', 'Library', and 'Reading'. A navigation bar includes 'HTML Source', 'Lisp', 'CSS', and 'XML'. A large red rectangular area covers the main content area. Below it, a link reads 'Read article view'. At the bottom, there's a logo consisting of a vertical bar and a stylized orange shape.

## 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 interface displays a visualization of musical patterns. At the top, a dropdown menu says 'Display Tala Types: Jhoomra/Dhamar (14 beats)'. Below it is a grid of colored rectangles (red, purple, green) representing the pattern. A horizontal slider at the bottom allows switching between 'Pattern 1 (3-4-3-4)' and 'Pattern 2'. A file path 'File /extension/ScignSeer/articles/svg/tala.svg' is shown. On the right, there's a vertical sidebar with a decorative icon and a 'Proceed' button.

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 molecular visualization program) via an A3R document-viewer plugin.

The screenshot shows the IQmol molecular visualization program. In the center is a 3D ball-and-stick model of the amino acid cysteine, featuring a blue nitrogen atom, a yellow sulfur atom, and several grey carbon and white hydrogen atoms. The background is a solid blue. At the top, there is a menu bar with options: Display, Build, Calculation, SONIC, and Help. Below the menu is a toolbar with various icons. On the left side, there is a sidebar with a 'Springer' logo and some search results. A context menu is open over the molecule, showing options like 'Configure', 'Select All', 'Reperceive Bonds', 'Duplicate Geometry', 'Atomic Charges', 'Remove', and 'SONIC'. The 'SONIC' option is highlighted. A sub-menu for 'SONIC' is open, containing 'Springer Keyword Search: Cysteine', 'Springer Web Search Home', and 'Search Saved Articles'. The main search results area shows 'Showing 157 results.' for a search term. One result is highlighted: 'Cysteine Proteases of Pathogenic Organisms' by M. W. Robinson and J. P. Dalton (Eds.) from 2011. The result card includes the book cover, the authors' names, the publication year, and a brief description: 'Cysteine proteases expressed by pathogenic organisms play key roles in virulence including host'. At the bottom of the search results, there is a URL: [www.springer.com/gp/search?query=cysteine&submit=Submit](http://www.springer.com/gp/search?query=cysteine&submit=Submit). The bottom right corner of the image shows standard Qt-style window control buttons (minimize, maximize, close).

# Document Viewers Augmented With APIs

Another strategy for interactive publications is linking documents with APIs maintained 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 Design** department.

Cite this object as

Medal; bronze; 1920-3

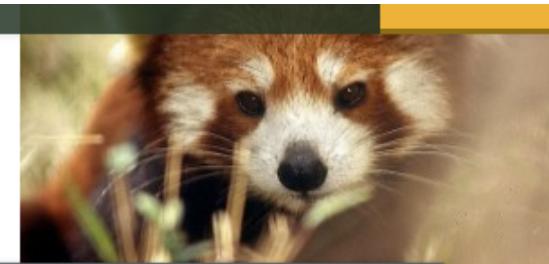
Row: 0 Column: 0

# Embedded Multimedia

Custom-built A3R document viewers can provide convenient access to multimedia content embedded in or linked to documents — 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 Mountains in Sichuan and the East Nujiang River of Yunnan Province) and northern Myanmar.

The head and body length of red pandas averages 56 to 63 cm (22 to 25 in), and their tails about 37 to 47 cm (15 to 19 in).



## Behavior

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



In terms of territoriality, red pandas tend to have overlapping ranges with other. This may be due to the fact that they search for their food in different areas, which may be patchily distributed.

[ark.org/red\\_panda/about-the-red-panda/](http://ark.org/red_panda/about-the-red-panda/)

so they  
e annual  
  
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each  
das  
may be  
ffect the

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

February 3, 2020 21 / 22

# Thank You!

Please contact Linguistic Technology Systems for more information about NA3 or other Software Development and Software Language Engineering solutions.

