

Research Image Management

using a

SCALABLE

(**Q**UERY

UTILITY &

IMAGE

DATABASE)



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What is the Nature of the Problem?

- **We are now commonly faced with large sets of Imaging data in clinical trials and biomedical research that:**
 - **Have to be stored in a manner that is easily searchable**
 - **Have to be stored in a compliant manner (e.g. 21 CFR 11-audit trail)**
 - **Need on and off site archive (REDUNDANCY, D2D2T)**
 - **May need levels of de-identification (HIPAA, Common Rule)**
 - **May need to be electronically transferred (HIPAA, 21 CFR 11)**
 - **Will need to have clinical metadata available AND may need other non-DICOM file structures stored with the Imaging data**
 - **Will need to link the data in some manner to any variety of Image analysis tools**
 - **And you will likely have some of your own local requirements**
- **This is exacerbated if you are trying to mine the data!**

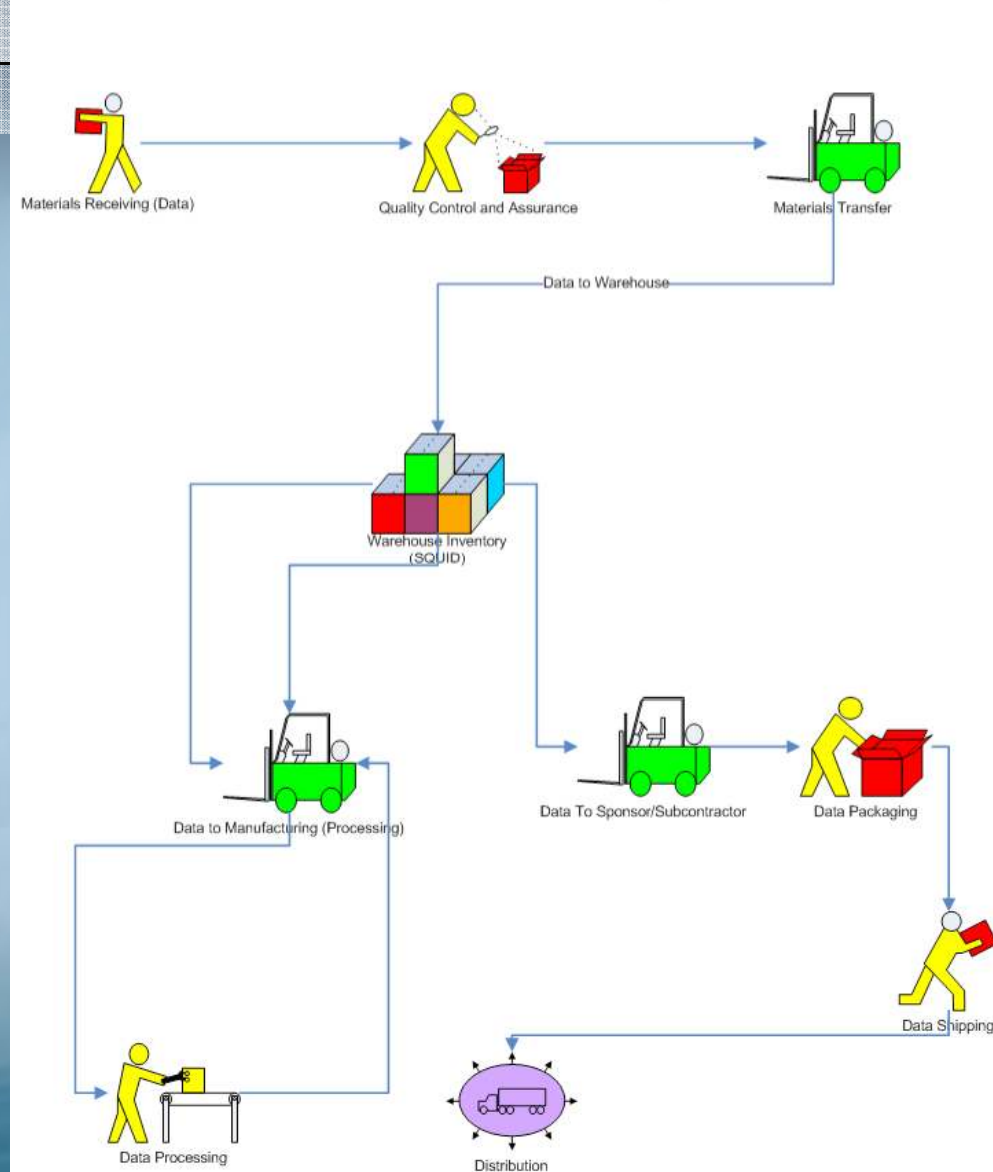
What is **SQUID** and Why did we build it? OR What is the Nature of Our Solution?

- Improved **research image data management**
- **Relational DB search capacity (SQL)**

The screenshot shows a web-based interface for a PACS system. At the top, there is a navigation bar with links: Home, Unread Studies, Browse, Search, DICOM AE, MLT Application, Auto Route, Job Status, Modality Worklist, Tools, Profile, and Help. Below the navigation bar, the user is logged in as 'Chris Charles @ CHAL10E1001 - any'. The main content area is divided into two columns. The left column displays patient information: Patient ID: 10011016, Patient Name: CAMHD136_10011016, Study ID: 1, Study Date: 2018-09-21, Accession Number, and Study Description: Lang18FPProject_0001*STANDARD PFP. The right column contains a form for entering subject information. It has a text input field for 'Enter Subject Headline (up to 64 characters):', a larger text area for 'Enter Detailed Notes About This Study:', and an 'Attachment:' section. The attachment section lists supported file types: .AVI, .DOC, .XLS, .GIF, .JPG, .JPEG, .MP3, .MPG, .MPEG, .PDF, .PNG, .RTF, .TXT, .WAV, .WMV, .XML, .ZIP, .TIF. There is an 'Attach' button with '(max 2 Mbytes)' and a 'Browse...' button. At the bottom left of the form is an 'Add' button. The footer of the page shows 'PacsDns 6.2.1' on the left and 'Copyright 2003-2009 (c) RainbowFish Software' on the right.

- **Basic PACS is 'clientless' (Web Based)**
- **'Marry' the PACS and SQL DB for efficiency and data integrity**
- **Ability to **DOCK** various modules for **data cleaning, analysis, visualization, etc.****
 - **This deviates somewhat from the traditional PACS design where radiological interpretation and workflow is the primary process goal**
 - **Implement new tools as they become available **WITHOUT major design overhaul!** (Decouple **Image Management** from **Advanced Visualization and Analysis**)**
- **Workflow control in a general process based sense rather than a radiologic sense**

SQUID as Part of a Manufacturing Process



One important difference is that the data that leaves the factory is always a copy. The “product” is always kept at the factory, hence the need for a SCALABLE architecture (SW and HW).

Since new tools (Data Processing and Visualization) are evolving the ability to transport the data to these “shops” is critical.

Data distribution must be flexible (hard media to web interface), i.e. the tentacles of the SQUID.

How does **SQUID** address the problem?

- **Organize Image Data by Project (AETitle)**
- **Provide Password Security, Access and Control**
- **Provide Web Based Access to Images**
- **DICOM and Other Format Support**
- **Operating System Agnostic**
- **Hardware (HW) Agnostic**
- **Image Anonymization/Masking Tools (DIAL, BOAT)**
- **Redundant Storage (D2D2T)**
- **Client Based Analysis (Decouple Image Management from Advanced Visualization and Analysis)**

The SQUID Enterprise Platform

- Commercial PACS system (PACS)
- Commercial DB (ORACLE)
- Custom Tools (DIAL)
- SAN based storage (EMC, huge, scalable, reasonable\$)
- Physical Redundancy with security (D2D2T, two different buildings, dedicated SM fiber link)
- Other Redundancies (FO MetaDataCont, etc.)
- Autom... independent of user control

Behind Your Back Support

The DIAL 'SQUID' TEAM

Any Questions?

For additional information:

<http://dial.mc.duke.edu>