



Advances in Medical Imaging Informatics - Dealing with Big Data

Assoc Prof.Dr. Adam CHEE

Chief Advocacy Officer

25 May 2012



Conflict of Interest Disclosure



Assoc Prof.Dr. Adam CHEE,

D.I.T, MSc, MPH (WIP), MBA (WIP), PgD MedInfo, SpD InfoSec, BCom IT,
CPHIMS, CITPM, CSSGB, CSP, MCSE, MCSA, MCDBA etc etc... does it really matter?

Faculty (Health Informatics) with IHLs (Practice-Based Researcher)

Certification Writer for HIMSS & AHMIA (Meaningful Use)

Council Member, Gerson Lehrman Group

ExCo member of AMBIS, HL7 SG, CPHIMS (HIMSS) etc

SME / Consultant with Solution Providers & Consulting Firms

Chief Advocacy Officer of binaryHealthCare



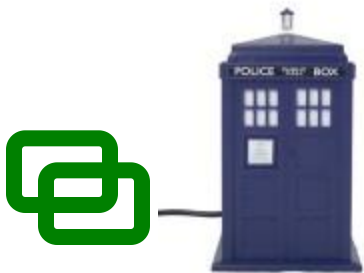
Note: List of conferences presented & media mentions can be found at www.binaryHealthCare.com



Doctor Who?



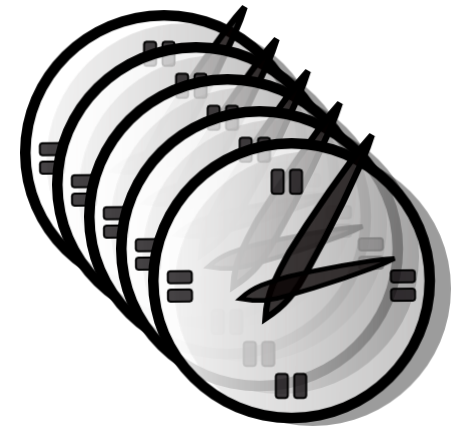
- I am not a medical doctor (Physician)
 - But I have worked in a hospital, in clinical settings
 - And many years working with healthcare in clinical, technology, operational and strategy settings
- My Doctorate is in Health Informatics
 - Feel free to ask me anything pertaining to health Informatics, I cannot guarantee you that I can answer everything but I will try my best
 - Don't ask me anything pertaining to medicine, I guarantee you that I cannot answer everything even if I try my best
- I am also working on my Masters of Public Health



Agenda



- My topic for today is “**Advances in Medical Imaging Informatics – Dealing with Big Data**”
- The topic outline given has a focus on Medical Imaging Informatics and Big Data, hence we will first examine some of the basic concepts before venturing into the topic



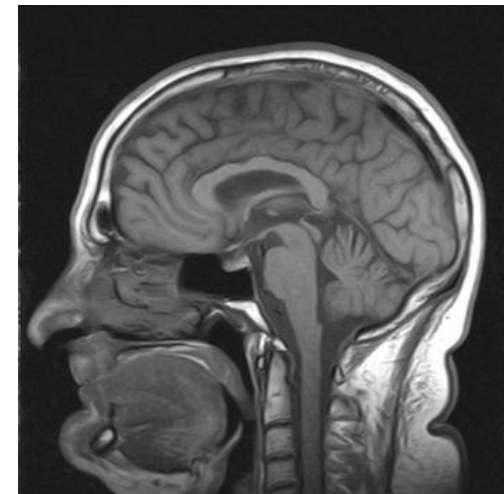


Medical Imaging



Role of Medical Imaging

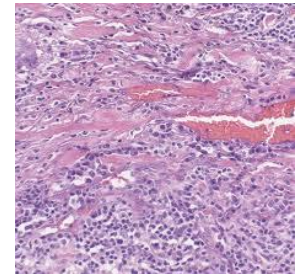
- Medical Imaging is an important cornerstone of modern healthcare and will continue to play a role of ever increasing importance at all levels of the healthcare system due to:
 - Advances in imaging technology (CT, MR and Molecular Imaging)
 - Aging population in Asia (and around the world)
 - Etc.



Role of Medical Imaging (con.t)



- There are 3 main ancillary departments in a healthcare enterprise
 - Radiology
 - Laboratory
 - Pharmacy
- Laboratory is also starting to adopt medical imaging
 - Digital Pathology



Characteristics of Medical Images



- Medical Images are discretely different from Clinical Documents
 - Files of large sizes and not discrete data elements
 - Stored on storage sub-system and not databases due to nature of data
- De-facto Standards
 - Diagnostic quality images (by specialists) – DICOM 3.0
 - Non-Diagnostic images (clinical references by clinicians) - JPEG
 - JPEG 2000 Lossless for Radiology
 - JPEG motion for Cardiology etc



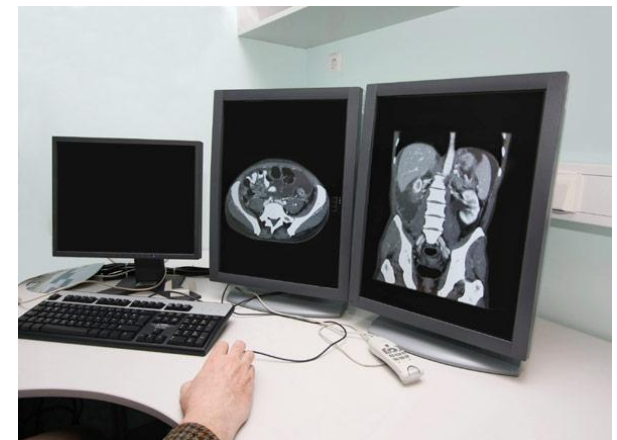
**Medical Imaging
Informatics**



Medical Imaging Informatics



- Medical Imaging Informatics as a necessity
 - A film-less imaging department is no longer a fantasy
 - It has been realized with advancements in technology
- The amalgamation of Informatics into the modern imaging departments
 - is no longer an argument of necessity
 - but rather, a decision of **'when'**



Evolution of Medical Imaging Informatics

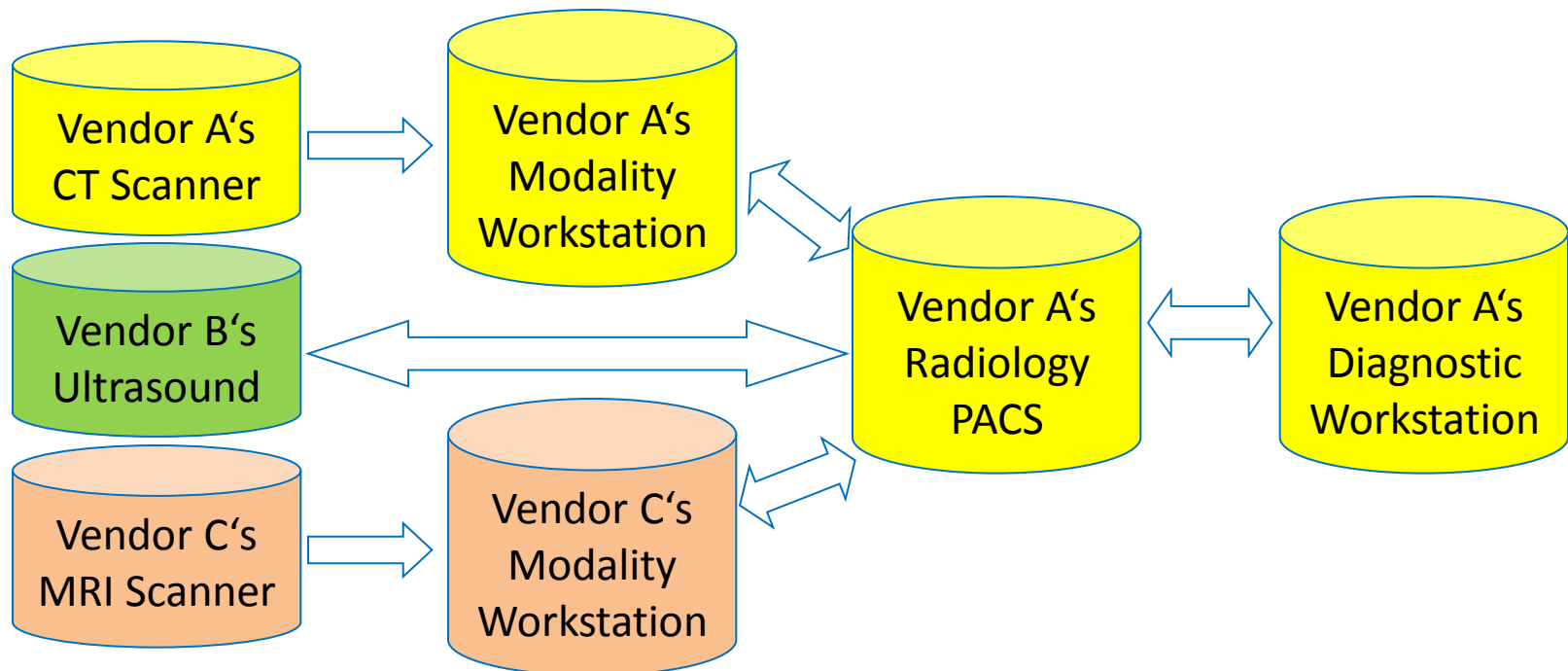


- Radiology invented the concept of PACS (Picture Archival & Communication Systems)
 - ‘Father of PACS’ - The late Samuel J. Dwyer, III, PhD
- It is a solution that is born out of real-world needs
 - Due to a **need** to **improve** diagnostic capabilities
 - These needs are so effectively fulfilled that PACS these days are no longer limited to only medical images nor strictly for the radiology discipline
- PACS (next to the EMR) is to be one of the most significant clinical information systems in the healthcare enterprise



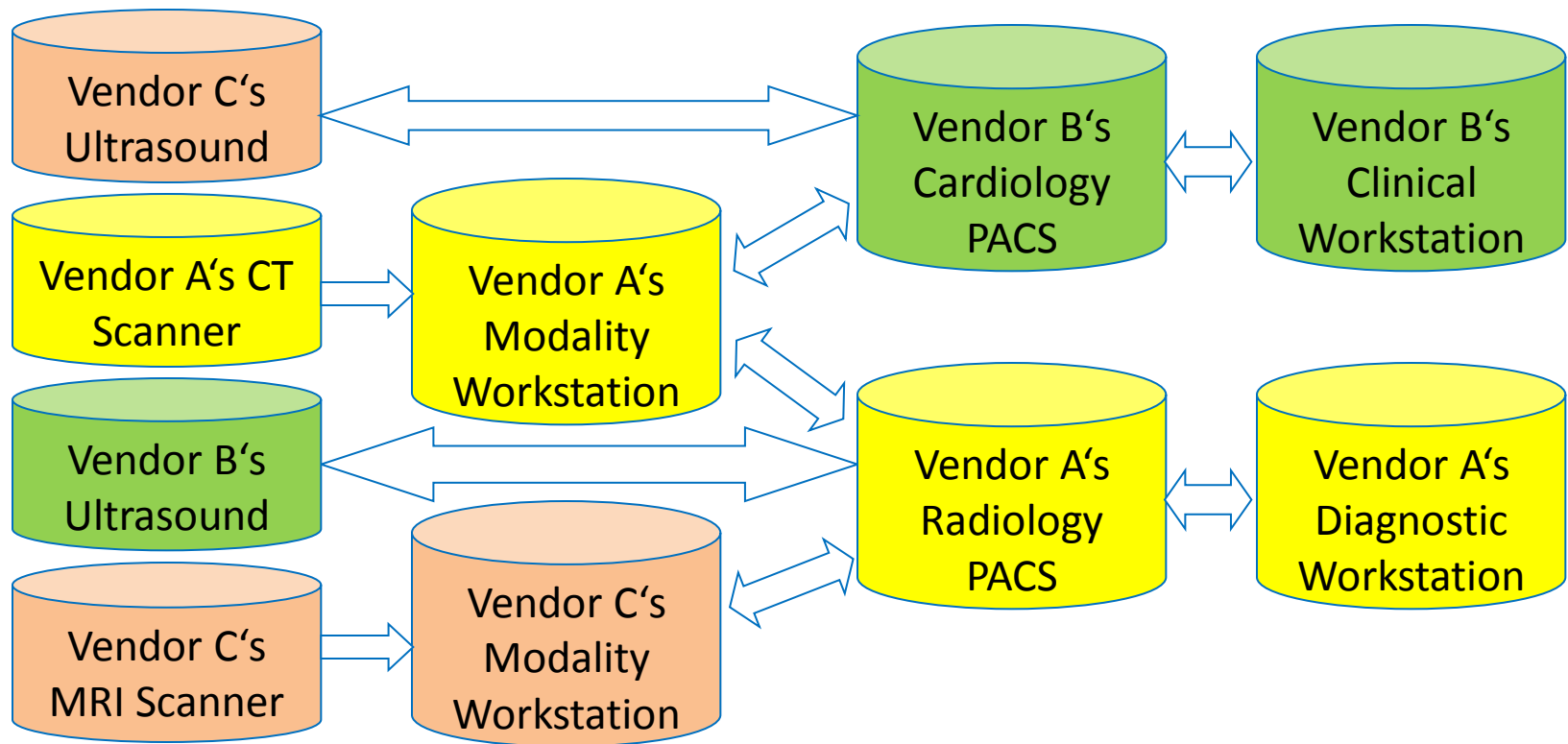
Typical Departmental PACS

- Typical departmental PACS implementation for Radiology
- (Post DICOM 3.0)



Typical Multi-PACS Environment

- Hospital with Radiology & Cardiology PACS



Problems with 'Traditional' Implementation



- The 'Traditional' implementation resulted in a 'Silo model'
 - Such PACS silos were appropriate for departmental implementations
- As health IT adoption moves onto the enterprise levels, 'Silo model's no longer serves clinical nor operational needs
 - From a Technologist, Specialist, Clinician, Administrative, Technical and most importantly Patient's perspective



- In the modern healthcare enterprise, we need a **patient centric workflow**



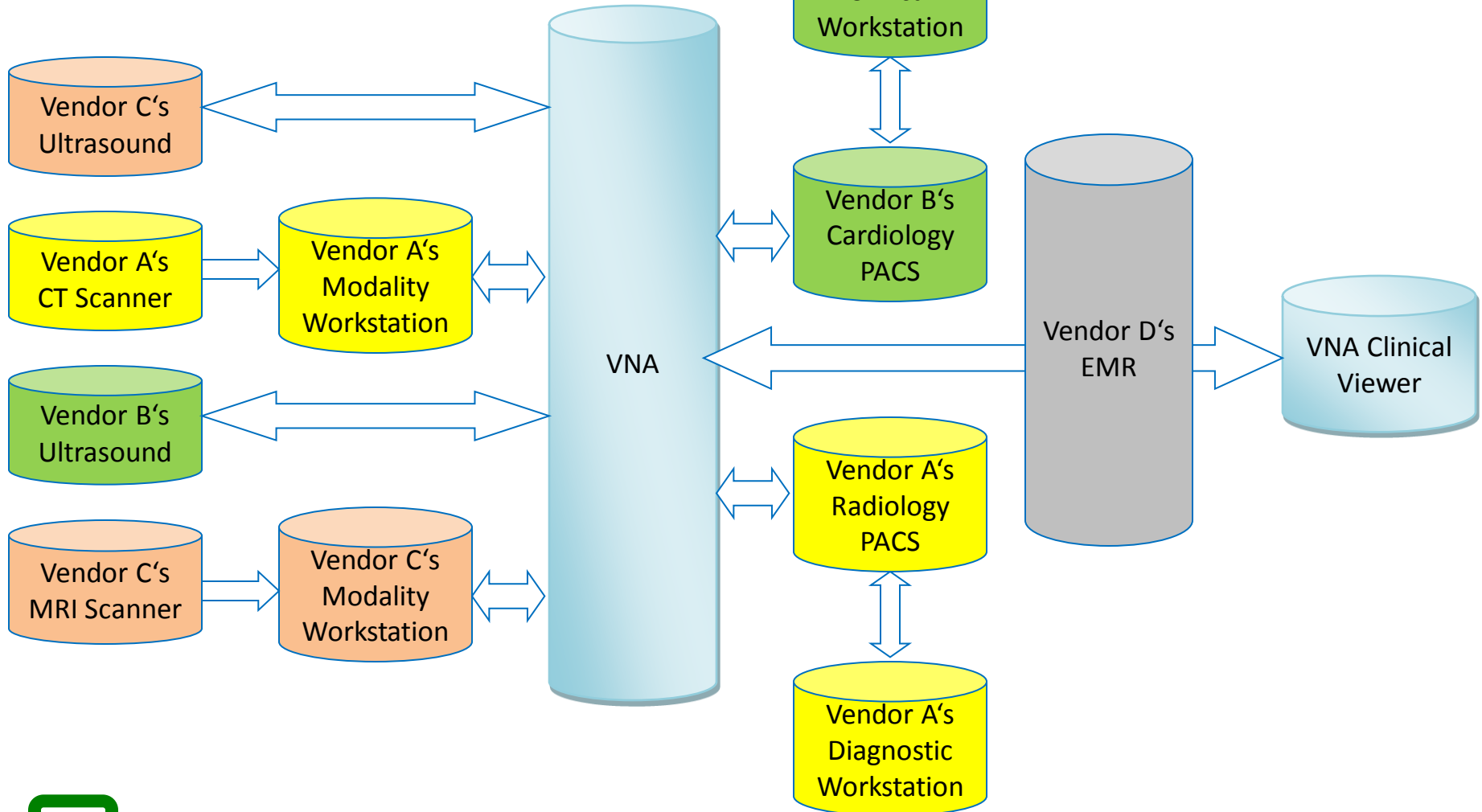
VNA Architecture



- Vendor Neutral Archive (VNA) Architecture
- Helps rectify inherent issues with DICOM
 - Private Tags
 - Transfer Syntax
 - Data Migration
 - (just to name a few)
- Enables single Web Client access across all “ologies”
- And many more



VNA Architecture



Cloudify the Imaging Grid



- The VNA Architecture has enabled solution architects ‘pushed’ the limits a little further.. towards the clouds
- Extending both the benefits of Cloud and VNA Architecture
 - This actually makes perfect sense
 - Vendor Neutrality for Interoperability
 - Facilitating Patient Centric Care
 - Cost by a need to use
 - Etc
- Gives new meaning to the phrase “Imaging Anytime, Anywhere, Anyplace”



BTW: Collaboration Via Cloud



- NetworksMD - A physician-centric platform built for professional collaboration around advanced case creation and discovery
 - Facilitate free-flow of effective communication between practitioners across disparate geographic locations to deliver comprehensive and competent patient care via the any internet browser (via Cloud)
 - Clinical practice, Education, and research workflows of life science professionals
 - (Not just medical imaging but also laboratory and more)



www.NetworksMD.com



Data Data Data



- Remember, Medical Imaging is an important cornerstone of modern healthcare
- We briefly talked about the radiology, cardiology and pathology discipline adopting medical imaging informatics
 - However, these are not the only clinical disciplines utilizing medical images
 - And images are not the only clinical data utilized in medical imaging



Data Data Data (con.t)



Waveforms **3D Reconstructions** **Video** **Genomic data**

CR

- Cardiology
- Bronchoscopy
- Endoscopy
- Hematology
- Pathology
- Surgery
- Nuclear Medicine
- Dental
- Internal Medicine
- Orthopedics

PDF documents

Pharmacy



- Radiology
- Dermatology
- Ophthalmology
- Podiatry
- Vascular
- Urology
- Nursing
- Electrocardiography
- Scanned Documents
- Medical Photography

ECG waveforms & reports

Lab results & reports

Ultrasound images & measurements

Sound

Demographic data



Problem with too much data



- Not only is it difficult to manage (both technically and operationally), the data becomes 'noise', not information



What is Big Data?

A large, green, oval-shaped thought bubble with a white outline and a white drop shadow. Inside the bubble, the text "What is Big Data?" is written in a white, bold, sans-serif font.

What is Big Data?



What is Big Data? (con.t)

- Big Data is a general term used to describe
 - The voluminous amount of unstructured and semi-structured data a company creates
 - Data that would take too much time and cost too much money to load into a relational database for analysis
- Although Big data doesn't refer to any specific quantity, the term is often used when speaking about petabytes and exabytes of data



What is Big Data? (con.t)



- A primary goal for looking at big data is to discover repeatable “business patterns”
- It’s generally accepted that unstructured data, most of it located in text files, accounts for at least 80% of an organization’s data
- If left unmanaged, the sheer volume of unstructured data that’s generated each year within an enterprise can be costly in terms of storage
- Unmanaged data can also pose a liability if information cannot be located in the event of a compliance audit or lawsuit

- Source: <http://searchcloudcomputing.techtarget.com/definition/big-data-Big-Data>



ABCs of Big Data



- The segments of concerns for Big Data can be summarized (in a simplistic manner) in 3 easy to remember points
- **Analytics**
 - How to gain insights from your (extremely large) datasets
 - Data \neq Information
- **Bandwidth**
 - The need for speed (large data ingest & network bandwidth)
- **Content**
 - Ensuring that the data stored and accessed must be secured and stable (redundancy)

Note: I borrowed the 'ABCs concepts' from NetApp



Big Data in Medical Imaging Informatics



Big Data in Medical Imaging



- Over the past decade, medical imaging data has experienced exponential growth, creating a huge demand for data storage.
 - Medical image archives are increasing by 20-40 % annually
 - Images are usually being archived longer by health providers than regulatory requirements
- Causes included (but not limited to)
 - Aging yet affluent population (increased demands)
 - Improved modalities technology (e.g. Full PET CT/MR, 3D imaging)
 - Defensive medicine (just-in-case)
 - Island of Silo Data repositories (replication)



Big Data in Medical Imaging (con.t)



- Remember
 - Clinical Documents are discrete data stored in databases
 - Medical Images are large files stored in storage sub-systems
 - Of course, the structured and unstructured data
- How would you handle data mining in medical images?
 - There are CAD type of technology..... but..... The technology is 'selective' and not exactly 100% 'there'
 - And the additional 'layer' of technology to process imaging piles on the complexity



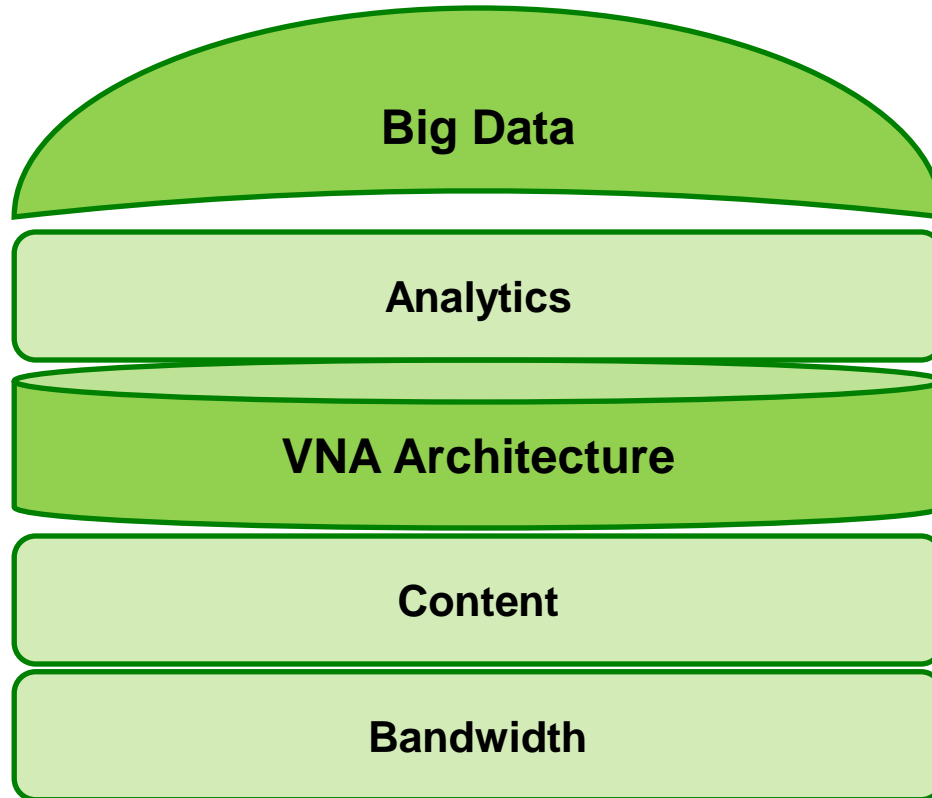
Big Data in Medical Imaging (con.t)



- The answer lies in the meta-data
 - To be specific, the DICOM Tags in the Header
- The normalization of private Tags in the DICOM Header (via the VNA) is **crucial**



The 'Big Data Burger'



The science of finding the unknown

Normalization of Imaging Data

Big Data friendly Infrastructure to ensure Scalability & Redundancy

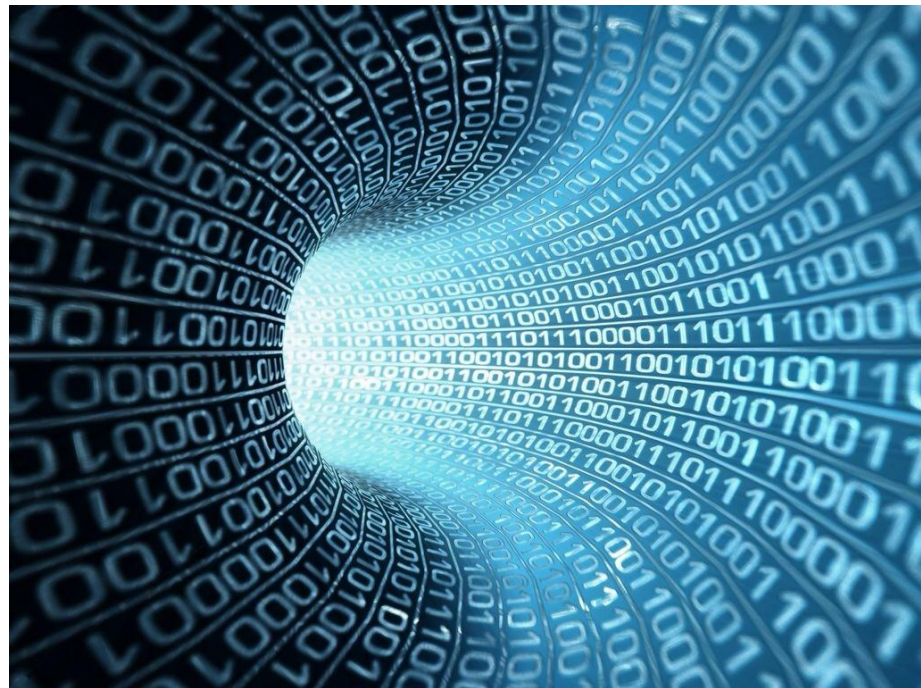
Big Data friendly Infrastructure to ensure Performance



Big Opportunities



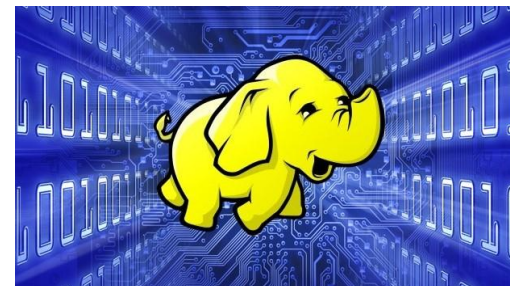
- Big Data = Big Opportunities to create clinical & research value
- The Big Data opportunities are here. Right now.



For more information



- VNA Architecture
 - “Vendor Neutral Architecture & How It Will Change the World (of Healthcare IT)”
 - First Edition, ISBN : 978-981-08-8883-1
 - www.binaryhealthcare.com/the-book/the-vna-book/
 - Carestream Vue for Vendor Neutral Archive
 - <http://www.carestream.com/vue-vendor-neutral-archiving.html>
- Physician Collaborative tools
 - NetworksMD
 - <http://NetworksMD.com>
- Big Data
 - Hadoop
 - <http://hadoop.apache.org/>
 - NetApp
 - <http://www.netapp.com/us/company/leadership/big-data/>



Questions?



binaryHealthCare

Bridging the eHealth Divide

- For further information, please contact;

A/Prof.Dr. Adam CHEE

adamchee @binaryHealthCare.com



Mission & Vision



Mission

- To improve healthcare (and save lives) through advocating the importance of Health IT as an enabler for “*better patient care at lower cost*”

• Vision

- Raising the standards of health informatics through training, continuing education and providing a vendor neutral community / hub to enable knowledge exchange and collaboration



Our Offerings



Thought Leadership

Content, Conferences, Awareness Raising & Media Engagements

Education

Online, Onsite & Collaboration towards courses in Health Informatics

Consultancy

Consultancy as a Service, SME as a Service

Collaboration

Optimization by eliminating repetition. Striving for a win-win resolution for all

