



# System of Systems: The Electronic Health Record and the Systems that make them up

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# Purpose of presentation

# By the end of the presentation you will know:

- What an Electronic Health Record (EHR) and Electronic Medical Record (EMR) are and what are the differences
- What constitutes a HealthCare System of Systems
- What sub-systems are part of an HealthCare System of System (SoS)
- Understand the most common issues with deploying and adopting EHRs
- Have a better understanding of the leading practices for deploying and sustaining EHRs



# EHR/EMR definitions

# Definitions — EHR and EMR

- What is an EHR?

- Per HealthIT.gov an “EHR is a digital version of a patient’s paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users.” \*

- What is an EMR?

- Per HealthIT.gov “EMRs are a digital version of the paper charts in the clinician’s office.” \*\*

- Both sound very similar



\* <http://www.healthit.gov/providers-professionals/faqs/what-electronic-health-record-ehr>

\*\* <http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/>

# EHR vs. EMR

## What's the difference

# EMRs vs. EHRs: What's the difference

- People use the terms EMR and EHR interchangeably
- The Office of the National Coordinator for Health Information Technology (ONC), use EHR almost exclusively
- The difference between the two terms is actually quite significant
- The EMR term came along first, and indeed, early EMRs were “medical.” They were for use by clinicians mostly for diagnosis and treatment.
- In contrast, “health” relates to “The condition of being sound in body, mind, or spirit; especially...freedom from physical disease or pain...the general condition of the body.”
- The word “health” covers a lot more territory than the word “medical.” And EHRs go a lot further than EMRs

\* <http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/>



# EMRs vs. EHRs: What's the difference (cont.)

- Electronic medical records (EMRs) are a digital version of the paper charts in the clinician's office. An EMR contains the medical and treatment history of the patients in one practice. EMRs have advantages over paper records. For example, EMRs allow clinicians to:
  - They track data over time
  - They easily identify which patients are due for preventive screenings or checkups
  - They allow clinicians to see how their patients are doing on certain parameters — such as blood pressure readings or vaccinations
  - They improve overall quality of care within the practice

\* <http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/>

# EMRs vs. EHRs: What's the difference (cont.)

- Electronic health records (EHRs) do all things EMRs do and more
- EHRs focus on the total health of the patient
- EHRs go beyond standard clinical data collected in the provider's office and inclusive of a broader view on a patient's care
- EHRs are designed to reach out **beyond** the health organization that originally collects and compiles the information
- EHRs are built to share information with other health care providers, such as laboratories and specialists
- EHRs contain information from **all the clinicians involved in the patient's care**

\* <http://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference/>

# HealthCare System of Systems/Complex System Definitions

# System of System (SoS) and Complex System

- System of System (SoS)

- Based on the DoD Defense Acquisition Guidebook (DAG) [2008], ...”a HealthCare SoS is a set or arrangement of systems that results when independent and useful HealthCare systems are integrated into a larger system that delivers unique capabilities.”\*

- Complex System

- Complex systems are systems that do not have a centralizing authority and are not designed from a known specification, but instead involve disparate stakeholders creating systems that are functional for other purposes and are only brought together in the complex system because the individual “agents” of the system see such cooperation as being beneficial for them.\*\*

\* <http://www.acq.osd.mil/se/docs/SE-Guide-for-SoS.pdf>

\*\* <http://cs.calstatela.edu/wiki/images/8/84/Sheard.doc>

# Types of EHR SoS

## Two types of EHR SoS: Closed and open

- Closed system is a system that is under the control of one person typically a CIO (Most Commercial Systems)
- An open system is where the SoS is controlled by multiple people
  - Each system that makes up the EHR SoS is maintained and controlled but a different person or command



What systems make up an  
EHR SoS?

# What systems make up an EHR SoS?

EHRs are not stand alone systems but are 'Systems of Systems'

- Clinicians
  - Software
  - Infrastructure
  - End User Devices (EUD) (a.k.a the PCs.)
  - Desktop/Virtual Environment
  - Server/Cloud
  - Network
  - Infrastructure
  - Systems Administrators
  - Training
  - Governance
  - Politics
  - Patients/ Data
- 



# Clinicians

- Clinicians are the users of the system (doctors, nurses, admins, etc.)
- They interface with the HealthCare SoS Application subsystem via graphical user interfaces (GUIs)
- They can make/break an EHR system





# Software (Applications)

- Applications can be either “Best of Suite” or “Best of Breed”
  - Best of Suite Applications are a complete EMR system (e.g., EPIC’s suite of products)
  - Best of Breed Applications are stand-alone EMR systems (e.g., a Picture Archiving and Communication System (PACS))
- They interface with Clinicians via a GUI
- They interface with other systems via an systems interface



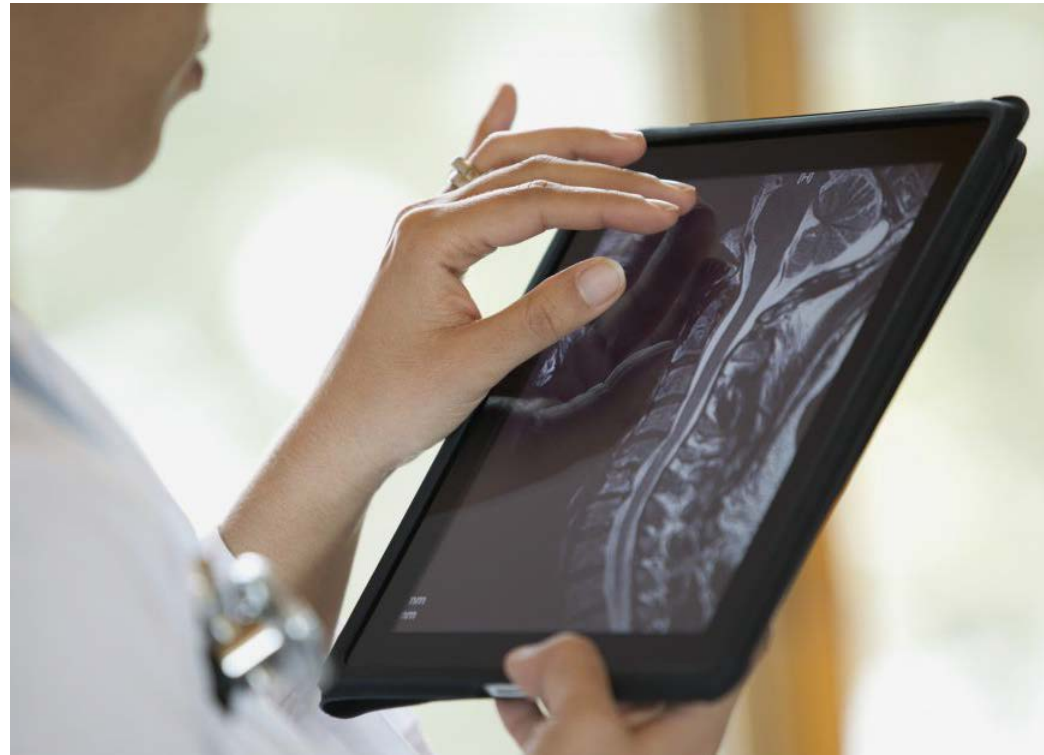
# Infrastructure

- It is the physical location of the HealthCare SoS:
  - Hospital
  - Clinic
- It is also the layout of the physical location
  - ER entrance
  - Clinician office and exam room



# End user devices

- Defined as anything the clinicians use to interface with the HealthCare SoS:
  - PCs
  - Printers
  - Automated blood pressure monitors
  - Automated pharmacy dispensing systems
  - Others



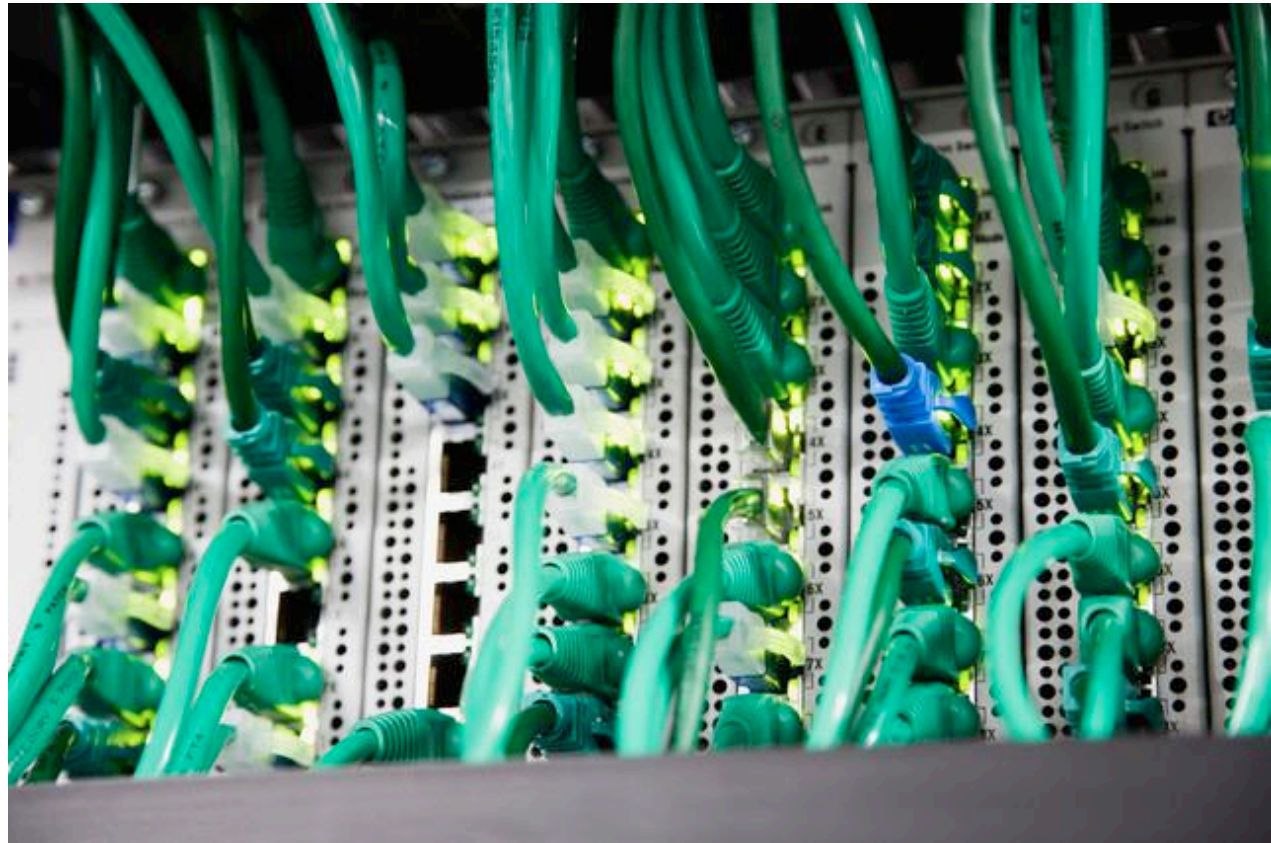
# Servers

- How is the data stored?
  - Servers or in the Cloud
  - Local or Regional Servers
  - Central Data Repository



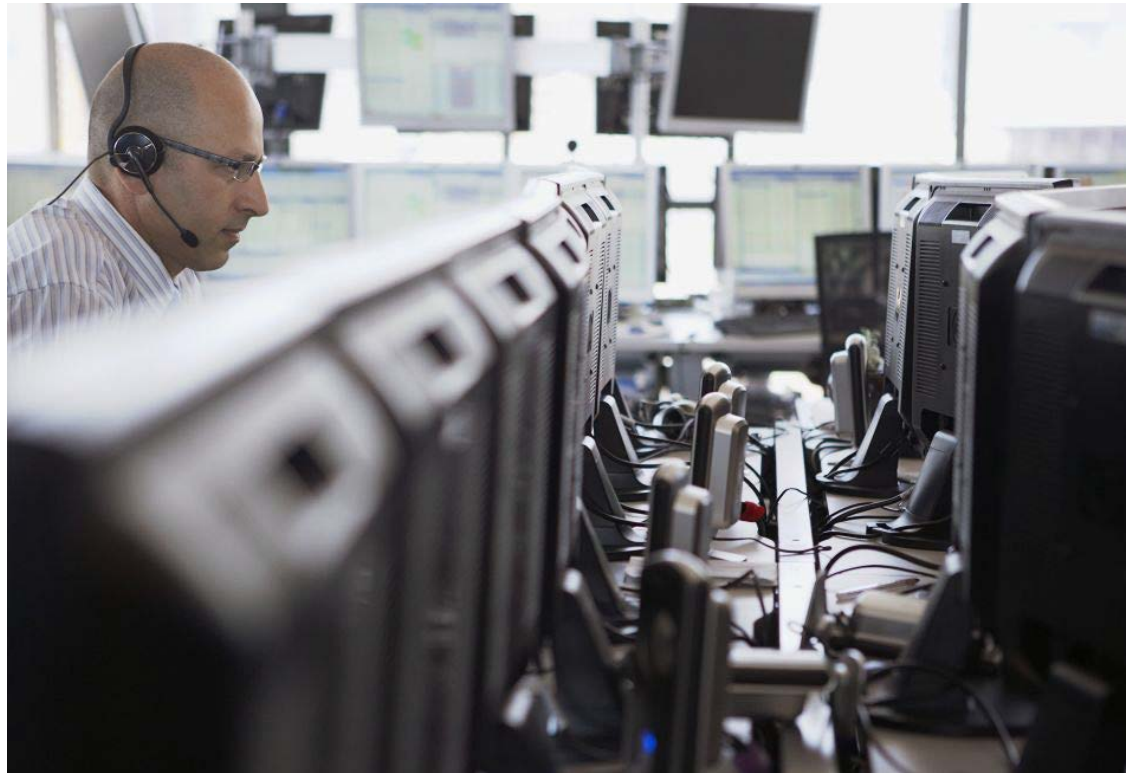
# Networks

- Local area
- Campus area
- Wide area
- Enterprise wide
- Pipe-size?
- Encrypted transport?



# Systems administrators

- The folks that run the systems
- How many do you hire?
- On call or 24/7?
- Specialists or generalists?
- Certified?
- Train once or train constantly?



# Training

- How you train your clinicians and systems administrators to use the system
  - Classroom?
  - Computer based (CBT)?
  - Virtual?
  - Over the shoulder?

How often?



# Governance

- Policies/processes that govern HealthCare data
- Information Assurance
- HIPPA
- Meaningful Use I/II
- Accountability





# Politics

- Politics play a huge role in HealthCare (e.g., Affordable Care Act)
- Laws mandate what the HealthCare SoS is supposed to do/provide
- Constantly changing



# Patients/Data

- Patients are an integral part of the HealthCare SoS
- Without patients there is no need for a EHR SoS
- Analytics is just starting to get involved with Health Data
  - Do you allow your patient data to be used Nationally?
  - How do you secure it?
- Per Meaningful Use, 5% of the patient population needs to interact with the patient data\*
  - Do you allow access to application or create a patient portal?
  - Do you use tele-med?
  - Secure messaging?

\* <http://www.informationweek.com/regulations/meaningful-use-stage-2-rules-finalized/d/d-id/1105953?>



So what's the problem?

# Problem statement — Barriers to adoption

- **Costs:** Steep price of EHR and provider uncertainty regarding the value they will derive from adoption in the form of ROI have a significant influence on EHR adoption
  - Maintenance costs: Need to increase information technology staff to maintain the system
  - Miller et al. found the average estimated maintenance cost was \$8500 per Full Time Employee (FTE) health-care provider per year\*
  - Training costs: Training employees to use an EHR system is costly New employees, permanent or temporary, will also require training as they are hired
- **Software quality and usability deficiencies:** A key reason, aside from initial costs and lost productivity during EMR implementation, is lack of efficiency and usability of EMRs currently available

\* <http://content.healthaffairs.org/content/24/5/1127.full>

# Problem statement — Barriers to adoption (cont.)

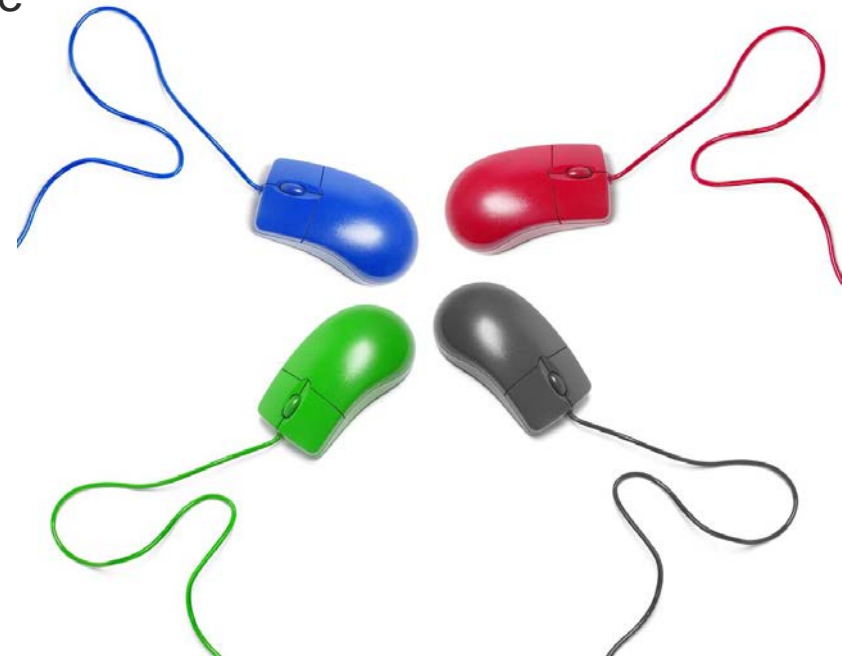
- **Lack of semantic interoperability:** In the US, there are no standards for semantic interoperability of health care data; there are only syntactic standards
  - This means that while data may be packaged in a standard format (using the pipe notation of HL7, or the bracket notation of XML), it lacks definition, or linkage to a common shared dictionary
- Clinicians feel that EHRs take away their “face time” with the patient
- Clinicians have a perception EHRs do not perform as they expect (Doesn’t fit their workflow, documentation language, EHR systems always down, or data retrieval is too slow and impacts their workday)
- Clinicians compare the retrieval of EHR data to that of Internet Search Engines — its not the same
- Clinicians want “all patient data instantaneously” at point of care

# What to do when implementing a HealthCare SoS?

- Successful implementation of Health Information Technology (HIT) requires:
  - Deep understanding of current processes that deliver a particular function
  - Willingness to map these processes and change them to adapt to the new systems
  - Commitment to make the time and space needed for the key stakeholders to have the conversations that make adaptation possible
  - The human capital required for successful implementation is not always available
  - Both technical support and change management support are needed, often from resources outside a practice

# In order for a smooth adoption of the SoS

- “Going live” must be preceded by “going deep,” or understanding deeply the processes and goals of the transformation needed
  - Both are needed for success
- Enable the work and work environment to be transformed. This transformation requires respect and adaptive reserve
  - Understand the clinicians understanding of an HER
  - Understand that EHR is not merely software
  - Understand that EHRs are an SoS



Next steps



# Guidance on best practices for deploying and sustaining EHRs

- Get in organization alignment (including IT strategy) with Clinicians, Management, and IT
- Get clinician buy-in by including them during the requirements phase
- Pick an application that meets user needs but requires minimal clinician training
  - Most Clinicians have gone to school for 10+ years, they likely don't want any more training
- Capacity plan, capacity plan, capacity plan!
  - Make sure the infrastructure is right-sized
- Keep the IT staff trained
  - Most systems train once, not often
- Monitor your sub-systems, 24/7
  - If system is Global use a “follow the sun” methodology for having the right staff on board at all times

Wrap-up

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