

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING



Original document by – Adeel Alam, June 2015  
Document modified for Muse v9 by - Ketaki Muthal, Nov 2019  
Muse system upgraded to version 9.0 – Oct 15<sup>th</sup>, 2019

### Contents

➤	<b>MUSE OVERVIEW</b>	3
➤	<b>MGH MUSE SYSTEM DETAILS</b>	4
➤	<b>CONTACTS</b>	4
➤	<b>MGH MUSE COMPONENTS</b>	5
•	FILE/DATABASE SERVER	5
•	APPLICATION SERVER	5
•	HL7 SERVER	6
•	WEB SERVER	7
•	DATAMED SERVER (DATA CONVERSION SERVER)	8
•	MUSE GATEWAYS	8
•	MUSE MODEM SERVER AND MODEMS	10
•	MUSE PRINTERS	11
•	MUSE ACCESIBILITY	11
•	MUSE THICK AND THIN CLIENTS	12
➤	<b>MGH MUSE TRANSMISSION MODALITIES</b>	12
•	MAC CARTS	13
•	BEDSIDE MONITORS	13
•	CASE MACHINES	13
➤	<b>MUSE CONFIGURATION</b>	14
•	SMDZ	14
•	SERVICE ACCOUNTS	16
•	CASE MACHINE CONFIGURATIONS	17
•	ECG WORKFLOW	19
➤	<b>MUSE INTEGRATION WITH HOSPITAL EMR (EPIC)</b>	21
•	ADT	21
•	BILLING	21
•	RESULTS	21
•	PARTNERS MUSE VIEWER LINK	22

**MGH MUSE V9 SYSTEM OVERVIEW**  
**DEPARTMENT OF BIOMEDICAL ENGINEERING**



---

➤	<b>MUSE TROUBLESHOOTING .....</b>	<b>22</b>
➤	<b>MUSE MAINTAINANCE .....</b>	<b>23</b>
➤	<b>MUSE COMPETANCIES .....</b>	<b>24</b>
➤	<b>MUSE DISASTER RECOVERY .....</b>	<b>25</b>
➤	<b>MUSE DISASTER RECOVERY .....</b>	<b>25</b>

---

## ➤ MUSE OVERVIEW

The GE MUSE application is a software solution that allows the management of EKGs within the hospital environment. MUSE allows the long-term storage of EKGs performed through various modalities. Furthermore, MUSE allows cardiologists to professionally interpret an EKG and hospital staff to view previously performed EKGs.

### **File/Database Server**

The file server acts as the database server where all the EKGs are physically stored. The database used by MUSE is the SQL database. The file server has the greatest number of hard drive space due to the consistently growing database of EKGs.

### **App Server**

The App server is the server where the actual MUSE application is installed. The MUSE application works in conjunction with the file server to upgrade, delete, and modify EKG records. The MUSE application manipulates the database. Therefore, anytime you are in the MUSE editor application and do a query of EKG records for a patient, it queries the SQL database.

### **HL7 Server**

The HL7 server holds the Clinical Centricity Gateway (CCG)/ Cloverleaf IDE 6.0 which allows various hospital services to communicate to MUSE via the HL7 protocol. These services include ADT, orders, billing and results module. The CCG will receive an HL7 message from EMR in the form of ADT/Order and modify it so that MUSE can understand its contents. Similarly, MUSE will trigger a HL7 message to the HL7 server, which then will modify it to the correct format that the billing or results side will comprehend.

### **Web Server**

The web server holds the CV Web or MUSE Web application. This solution provides a web-based component of viewing EKGs for users within the hospital. This allows for a quick-fire method of viewing EKGs which is convenient for users. The web server provides a URL, which will link to a particular patient's EKG, to other downstream application to which they can use to view EKGs.

### **Gateways**

The gateways provide a link between the biomed MC network and the hospital network. They are connected to both the biomed network and the hospital network through two network interface cards (NIC). The bedside

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

monitors are configured to send their EKGs to the MUSE gateways. The file server then queries the MUSE gateway and once it sees there is an EKG there, it acquires it into the MUSE file server.

### Modems

The modems are used to receive any EKGs that are sent from the MAC Carts through either an analog phone line or wirelessly connecting via hospital's preferred network. When the MAC carts dial an analog phone number, one which is connected to a MUSE modem, the modem receives the call and the MAC cart transmits an EKG. Additionally, when a MAC cart is authenticated to hospital's wireless network, if the same is configured as a wireless modem on the Muse app server, the MAC then transmits an EKG to Muse.

### ➤ MGH MUSE SYSTEM DETAILS

- Product version – 9.0 SP9
- Serial number – SN619121475TA
- GE tech support – 1-800-558-7044
- MUSE Support contract –
  - PO # 0008184464
  - Contract from 1/1/2017 to 12/31/2019 (joint contract for MGH and BWH)

### ➤ CONTACTS

- First calls to MGH Biomed one call number: 617-724-1333 **OR** service now: biomed support mgh – pec. They relay the call to
  - Pager 24800 – for inpatient areas
  - Pager 19473 – for ambulatory areas
- Calls can be escalated to: Clinical Engineer on-call
  - Pager 35699 – hospital CE Admin on-call
- Resource engineer – Ketaki Muthal
- Director of Biomedical Engineering – Patricia Volpe
- Muse clinical owner – Dr. Christopher Newton-Cheh
- Cardiology Administrative Manager – Carlos Vasco
- PeC contact for interfaces (Incoming ADT/Orders or Outgoing Results) is a service now group
  - interface bridges – pec
- ICM contact for billing interface – Jim Tice
- Muse viewer contact is a service now group
  - phs cdr (cas) support
- Partners IS contact for any server issues (app/web/hl7) is a service now group
  - server - phs
- Partners IS contact for any SQL/ database issues is a service now group
  - database sql - phs

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

- ECG Lab on Main campus
  - Phone: 617-726-2885
  - Fax: 617-726-7439

### ➤ MGH MUSE COMPONENTS

This section will elaborate technical details of each component that is active for MGH MUSE. MGH MUSE includes 5 sites –

- Site 1: MGH – Massachusetts General Hospital
- Site 2: MEEI/ SRH – Massachusetts Eye and Ear Infirmary/ Spaulding Rehabilitation Hospital
- Site 3: MVH – Martha’s Vineyard Hospital
- Site 4: NCH – Nantucket Cottage Hospital
- Site 5: WDH – Wentworth Douglas Hospital

#### ● FILE/DATABASE SERVER

**Name:** phsqlao3200 (cluster)

**IP:** 172.27.34.214

**Other details:** not in SMDZ

**Name:** phsqlao3200A (active one)

**IP:** 172.18.93.73

**Other details:** not in SMDZ, located in Needham data center

**Name:** phsqlao3200B (real time backup)

**IP:** 172.27.34.155

**Other details:** not in SMDZ, located in Marlboro data center

The file/ database server is a Win 2012 R2 server. It has SQL 2014 installed on it which is accessed by SQL 2014 management studio. This server is located on SQL cluster (PHSQLAO3200) in the Needham Data Center. It is a virtual server and has Muse service accounts SQ7 and SQ23 (that correspond to Musebkgnd and Museadmin respectively) added as administrators. These accounts also have system administrator privileges for SQL. SQ7 (Musebkgnd) specifically runs all Muse the services on the application server. Additionally, all the clinical engineers in the group MGH-BIOMEDCE-G are also added as administrators on the server.

This database server talks to the app server via SQL ports 1433 under the TCP/IP protocol; but since the database and the app server both are on Partners network (and not in SMDZ), no firewall exceptions are necessary.

#### ● APPLICATION SERVER

**Name:** phsapp3106

**IP:** 172.27.34.231

**Other details:** not in SMDZ

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

The application server is a Win 2012 R2 server. Muse software is downloaded on the E drive of this server. This server is in the Needham Data Center. It is a virtual server and has Muse service accounts SQ7 and SQ23 (that correspond to Musebkgnd and Museadmin respectively) added as administrators. SQ7 (Musebkgnd) specifically runs all Muse the services on the application server. Additionally, all the clinical engineers in the group MGH-BIOMEDCE-G are also added as administrators on the server.

The MUSE application has multiple services that are configured to run using SQ7 (aka MUSE bkgnd account) (Please see Figure 1 below).

MUSE	MUSE Servi...	Running	Automatic (D...	PARTNERS\SQ7	Main MUSE service
MUSE DCP Inbound	MUSE DCP I...	Running	Manual	PARTNERS\SQ7	<b>Other MUSE services</b>
MUSE DCP Outbound	MUSE DCP ...	Running	Manual	PARTNERS\SQ7	
MUSE Email	MUSE Email...	Running	Manual	PARTNERS\SQ7	
MUSE File Copy	MUSE File C...	Running	Manual	PARTNERS\SQ7	
MUSE Format 1	MUSE Repo...	Running	Manual	PARTNERS\SQ7	
MUSE Format 2	MUSE Repo...	Running	Manual	PARTNERS\SQ7	
MUSE Format 3	MUSE Repo...	Running	Manual	PARTNERS\SQ7	
MUSE Format 4	MUSE Repo...	Running	Manual	PARTNERS\SQ7	
MUSE FTP Copy	MUSE FTP ...	Running	Manual	PARTNERS\SQ7	
MUSE Generacq	MUSE Gene...	Running	Manual	PARTNERS\SQ7	
MUSE HL7 Outbound	MUSE HL7 ...	Running	Manual	PARTNERS\SQ7	
MUSE HL7 Parser 1	MUSE HL7 ...	Running	Manual	PARTNERS\SQ7	
MUSE HL7 Parser 2	MUSE HL7 ...	Running	Manual	PARTNERS\SQ7	
MUSE HL7 Parser 3	MUSE HL7 ...	Running	Manual	PARTNERS\SQ7	
MUSE HL7 Parser 4	MUSE HL7 ...	Running	Manual	PARTNERS\SQ7	
MUSE Modem	MUSE Mod...	Running	Manual	PARTNERS\SQ7	
MUSE MT Host	MUSE Midd...	Running	Manual	PARTNERS\SQ7	
MUSE Normal	MUSE Nor...	Running	Manual	PARTNERS\SQ7	
MUSE Print	MUSE Printi...	Running	Manual	PARTNERS\SQ7	
MUSE Scheduler	MUSE Sche...	Running	Manual	PARTNERS\SQ7	
MUSE XML Parser	MUSE XML ...	Running	Manual	PARTNERS\SQ7	
MUSEAPI3	MUSEAPI3	Running	Automatic	Partners\SQ7	
Net Driver HD713		Running	Automatic	Local Service	

**Figure 1: Muse services on the application server – run using account SQ7**

- **HL7 SERVER**

**Name:** phsapp3107

**IP:** 172.18.93.71

**Other details:** not in SMDZ

The HL7 server interfaces with the hospital’s ADT, orders, billing and results services. It does this through software called Centricity Clinical Gateway (CCG)/ Cloverleaf IDE 6.0. This is a HL7 interface. Hospitals EMR system will send ADT/ Orders for patients to the MUSE HL7 server through the HL7 language. The HL7 server will receive it and modify it to send it to the MUSE file server. The app server will then receive this HL7 message, which has been formatted according to MUSE specifications, and add it to the SQL database. On the flip side, once MUSE triggers a billing or results HL7 message, it will send it out to the HL7 server. The server will receive it, modify it to match what the results and billing service of the hospital accepts and sends it out.

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING



It is a virtual server and has Muse service accounts SQ7 and SQ23 (that correspond to Musebkgnd and Museadmin respectively) added as administrators. Additionally, all the clinical engineers in the group MGH-BIOMEDCE-G are also added as administrators on the server.

The HL7 server talks to the MUSE app server through preconfigured ports. For outbound communication to the MUSE server (used for ADT/ Orders messages), port 41000 is used under TCP/IP. For inbound communication from the MUSE server, port 32013 is used under TCP/IP for billing messages and port 55134 is used under TCIP/IP for result messages. No firewall exceptions are needed as all Muse servers are in Partners network (and not in SMDZ).

- **WEB SERVER**

**Name:** phsweb2379

**IP:** 172.27.34.203

**Other details:** not in SMDZ

The web server hosts the CV Web application. The web server provides users to view EKGs through the CV Web website. Users can view the website using the following URL:

<http://phsweb2379.partners.org/>

The “http” at the beginning of the URL implies that communication will take place along port 80, which is the default http port. CV Web 2 is configured on port 80. CV Web 3 is configured on port 83. MGH users utilize CV Web 3. The URL below has been configured from the partner’s side to direct to the CV Web server.

<http://mghmuse.partners.org/>

Therefore, users at MGH utilize mghmuse.partners.org to access the web server.

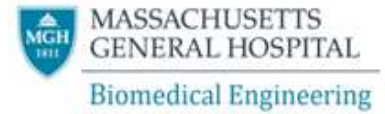
When the user attempts to query the EKG database, the web server sends a request to the file server through the DCOM/Maccra service. The web server sends an initial request through TCP/IP port 135 to the file server. The file server accepts the communication and sends back to the web server a port that it should use to communicate with. These ports have been preconfigured to be in the range of TCP/IP 48000 – 49000. Then, the web server utilizes a port in that range to communicate to the file server and query the database. The server uses service accounts SQ7 and SQ23.

The CV Web platform utilizes a standard format to retrieve ECGs. It is through this format that downstream systems can pull up an ECG from the MUSE CV Web. Below are examples of test links that the CV Web accepts. This link will bring up an index of all ECG records within MUSE for a patient with MRN: 006023149.

[http://mghmuse.partners.org/Patients/Conflict?parameter=12nOseoa50qJwokROqfWEgF9Yc3l\\_QRUdanOwo4d07E1](http://mghmuse.partners.org/Patients/Conflict?parameter=12nOseoa50qJwokROqfWEgF9Yc3l_QRUdanOwo4d07E1)

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING



It is a virtual server and has Muse service accounts SQ7 and SQ23 (that correspond to Musebkgnd and Museadmin respectively) added as administrators. Additionally, all the clinical engineers in the group MGH-BIOMEDCE-G are also added as administrators on the server.

- **DATAMED SERVER (DATA CONVERSION SERVER)**

**Name:** phspmouse2

**IP:** 172.31.128.144

**Other details:** not in SMDZ

The DataMed server acts as an intermediate server between non-GE modalities that acquire ECG's/ Stress studies and the Muse App server. When a study is acquired from non-GE source, the DataMed server translates it in GE format such that the same can be acquired into the edit/retrieve list within Muse Editor application. Similarly, this server also translates the ADT/Orders from MUSE to downstream non-GE modalities.

Typically this server will host 2 software's – (1) DataMed (2) Proprietary software from the non-GE manufacturer which will interact with DataMed software to allow download of translated ADT/Orders messages to the cart and conversely feed the ECG/stress studies to DataMed for conversion from the carts such that they make their way to the Muse app.

DataMed server runs 2 services –

DataMed FT – responsible for format translation i.e. it translates data (ADT/ Orders) from Muse to non-GE Carts and vice-versa, translates non-GE ECG's (Results) back to Muse. If this service is not running, the ECG's will not be seen in Muse.

DataMed WL – responsible for orders i.e. worklists to be downloaded on the downstream equipment. If this service is not running, the orders will not download on the carts.

- **MUSE GATEWAYS**

#### **Active gateways**

**Name:** mghmusegateway1

**IS IP:** 172.17.242.196

**Biomed IP:** 126.8.8.1

**Other details:** In SMDZ, located in Lunder LL 040

**Name:** mghmusegateway2

**IS IP:** 172.17.242.197

**Biomed IP:** 126.8.8.1

**Other details:** In SMDZ, located in Lunder LL 040



## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING



---

**Name:** mghmusegateway3  
**IS IP:** 172.17.242.198  
**Biomed IP:** 126.8.8.1  
**Other details:** In SMDZ, located in Lunder LL 040

**Name:** mghmusegtwyleg  
**IS IP:** 172.16.12.163  
**Biomed IP:** 126.8.8.1  
**Other details:** Not in SMDZ, located in Blake 5 (will be decommissioned after legacy floors transition to VLAN's)

#### Backup gateways

**Name:** mghmusegtwy1  
**IS IP:** 172.31.11.186  
**Biomed IP:** 126.8.8.1  
**Other details:** In SMDZ, located in Big 12

**Name:** mghmusegtwy2  
**IS IP:** 172.31.11.102  
**Biomed IP:** 126.8.8.1  
**Other details:** In SMDZ, located in Big 12

**Name:** mghmusegtwy3  
**IS IP:** 172.31.11.204  
**Biomed IP:** 126.8.8.1  
**Other details:** In SMDZ, located in Big 12

The MUSE Gateways serves as a link between the biomed MC network and the Partners IS network. It is through these gateways that a bedside (that is on the biomed MC network) can transmit an EKG to the MUSE file server (which is in the Partners IS network). Each gateway is essentially a Win 10 standard workstation that runs windows 2012 server on it. MUSE Gateway application is installed on these stations. The Gateway application runs services called the RWAT and TFTP. The TFTP service is a file transfer protocol that allows a client to place a file into a host computer.

All bedside monitors at MGH are configured to send 12-lead EKGs to the IP address 126.8.8.1. This IP address is configured on the network interface card (NIC) for all the muse gateways. Each MUSE gateways have an additional NIC cart that has an IP address within the SMDZ of the MUSE IS network. As ECGs are transmitted from the bedside, they are sent a folder on the gateways called "acq". The "acq" folder is a folder on the app server however it is shared across the network with the gateways. Therefore, as the "acq" folder acquires EKGs, the app server sees these new ECG files and uploads them onto the database. The TFTP service allows this to occur over the network.

ECGs are sent from the bedsides to the gateways through TCP port 139 & 445 and UDP port 137 & 138. The ECGs are sent from the gateways to the file server through TCP port 445.

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING



All gateways run services on local system but the “acq” folder is shared with SQ7 (Musebkgnd) account for file to be populated into the Muse app. The gateways can be accessed using this account –  
 User name: Administrator; Password: Muse!Admin

Table 1 shows which gateway each unit uses at MGH.

MGHMUSEGATEWAY1	MGHMUSEGATEWAY2	MGHMUSEGATEWAY3	MGHMUSEGTWYLEG
<ul style="list-style-type: none"> <li>VLAN 20</li> <li>Blake and Lunder floors</li> </ul>	<ul style="list-style-type: none"> <li>VLAN 21</li> <li>Ellison floors</li> </ul>	<ul style="list-style-type: none"> <li>VLAN 22</li> <li>White, Grey, Bigelow floors</li> </ul>	<ul style="list-style-type: none"> <li>Ellison 20 and 21</li> <li>(will move to VLAN 21 after cut-over)</li> </ul>

**Table 1: Muse gateways for Inpatient floors**

- MUSE MODEM SERVER AND MODEMS**

**Name:** mghmusemodemv9

**IS IP:** 172.17.232.232

**Other details:** Not in SMDZ, located in Blake sub-basement

**Phone numbers for analog transmission:**

- Hunt group # 617-724-8818
- Phone numbers: 617-726-8042; 617-726-0368; 617-726-0897; 617-726-4093
- Fax number: 617-726-4909

The MGHMUSEMODEMV9 is listed as a modem server that acts to physically connect the modems to a MUSE box. Since in v9 the app server is virtual, the need to provision a workstation to act as a modem server was needed. This modem server runs Windows 2012 server on a Win 10 PC along with the enterprise MUSE accounts SQ7 and SQ23. On the server, a local copy of MUSE v9 Editor is installed with the MUSE Modem service running. The modems are connected to the workstation through USB to serial adapter. 5 adapters are connected to 5 USB ports, to which 5 MUSE modems are connected. The MUSE Modem service recognizes these modems and allows them to communicate (and receive EKGs) to the MUSE editor application. As new ECGs come in, the local MUSE communicates via TCP/IP port 1433 to the database server to add these records to the database. MUSE modem resides in the Blake subbasement MDF.

**Partners network for wireless transmission:**

- **SSID:** Phswifi10
- **Name of the app server:** phsapp3106

The application server is where wireless MAC carts are configured either by their IP address or their host name as wireless modems. The application server runs Muse Modem service to look for all wireless carts that are

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

configured within the Muse application, in that it pings every cart every minute to see if there is/are ECG's to be acquired so they can be populated in the edit/retrieve list on Muse editor app. The MAC carts simply hold the ECG's and wait for the Muse Modem service to pick them. The MAC carts are required to authenticate to the hospital network where Muse resides.

Once the Muse modem services find the MAC carts, ADT/ Orders information travels from Muse app server down to the cart, while ECG's transfer from the cart to Muse.

- **MUSE PRINTERS**

**List of Muse printers:**

- MGHCONFIRMED
- MGHUNCONFIRMED
- MGHSTR
- DACCON
- DACCPRAC
- DACCUNCON
- DACCADDPRINTE
- MVHPRINTER
- NCH OP LAB
- NCH ED CHARGE DESK
- NCH MED SURG
- NCH CLIN&BUSS TECH

Listed above are the here are the printers that are part of the overall Muse system. These printers are used to print out confirmed and unconfirmed reports/ECGs within MUSE. Typically, these reports would be added to the patient record as a paper copy however, it is mainly used for verification purposes.

The Danvers practice has their own EKG lab therefore they have their own printers that are configured in MUSE. Similarly, MVH, NCH also have their own printers as those sites also process ECG's via their respective ECG labs.

MUSE sends out reports to print to these printers under TCP/IP port 9100.

- **MUSE ACCESIBILITY**

For accessing Muse applications on -

- For Win 10 PC/Laptop –
  - MUSE Editor can be launched from Partners Applications in the start menu
  - MUSE CV Web can be launched from Partners Applications in the start menu
  - Both muse Editor and Muse CV Web are available via CITRIX ([workspace.partners.org](http://workspace.partners.org))

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

- For Win 7 workstations –
  - MUSE Editor can be launched by going to CITRIX ([workspace.partners.org](http://workspace.partners.org))
  - MUSE CV Web can be launched from Partners applications

### MUSE THICK AND THIN CLIENTS

#### Thick clients:

A thick client is defined as a workstation that has a local MUSE Editor application installed. These clients interact with the MUSE file server and can edit and confirm records in the system depending on their specific users' privilege settings. Users can launch "**MUSE Editor – MGH**" from their workstation to open the application. The application can be granted to users by PAS key givers (Carlos Vasco, Cardiology Admin Manager or Jared Ruckman/Stan Grzybek, Biomed). The name of the application in PAS is "**MUSECVTC**".

To add a new user to MUSE Editor, key givers will essentially place the user's Partner's username onto the MUSECVTC user group, which will allow the Partners App to include the Muse Editor application. This step is done on the Partners end. Next, the Resource CE would need to create a new user within the MUSE application. Once the new user clicks on the MUSE Editor in the Partner's apps menu, it holds a .msi file that has been preconfigured to install MUSE onto the local PC along with all the MGH specific options. GE does not provide a .msi file. Partners IS helped to generate this .msi file from the executable files from GE.

All thick clients interact with the file server through port TCP/IP port 8001. Since the MUSE servers are not in SMDZ, there is not restriction on accessing Muse editor app provided your user Id is within the Pas group for appropriate application.

#### Thin clients:

A thin client can view read-only PDF version of records by reaching the MUSE CV Web server (PHSWEB2379). Thin clients launch "**MUSE CV WEB – MGH**" application from their PC/workstation. Once clicked, it opens up Internet Explorer to the URL: <http://mghmuse.partners.org>. Users are automatically authorized through their windows (Partners) credentials, which is a setting as part of the website configuration. The application can be granted access to users by PAS Key givers (Carlos Vasco, Jared Ruckman or Stan Grzybek). The name of the application in PAS is "**MGMUSECV**".

### ➤ MGH MUSE TRANSMISSION MODALITIES

Various devices can be set to transmit EKGs to MUSE. These devices do not necessarily have to be GE. Therefore, a physiological monitor made by Philips can be configured to transmit EKGs to MUSE. For MGH MUSE, across five sites, predominantly all modalities are GE manufactured except for SITE 5 – Wentworth Douglas Hospital, their Mortara ECG carts transmit to MGH MUSE (refer to the MAC Cart section below for details).

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING

The three modalities that transmit to MGH MUSE are -

- **MAC CARTS**

MAC carts are medical devices that perform 12-lead ECGs. The resulting EKG can then be stored locally on the device and/or transmitted to MUSE. It is MGH practice to transmit **all** EKGs to MUSE. This is done so that the EKG can be processed, read by a cardiologist and sent to billing and results. Unfortunately, this process is not done consistently and Biomed must remind units often to transmit.

All EKG carts at MGH transmit their EKGs either via an analog phone line (617-724-8818) or wirelessly (SSID: phwifi10).

For analog transmission, the above number is what is known as a pilot number. Once this number is dialed, it searches or “hunts” for a free line amongst the MUSE modem numbers (see MUSE MODEM section above for the phone numbers). Therefore, the numbers of the MUSE modems are referred to the hunt group of x48818.

For wireless transmission, a silex bridge/wireless module on an ECG machine needs to be configured by loading a certificate from Partners Infosec team. This wireless module should be capable to accept WPA2 level of encryption and TLS level of security. Once a cert is successfully loaded on the wireless module, it will authenticate to Partners network and bring the MAC cart in vicinity of the Muse app server. The Muse app servers Modem service will pick up ECG’s from the wireless machine and populate it in Muse app.

Within MUSE, EKGs from the mac carts are listed as type “\*.ECG”.

- **BEDSIDE MONITORS**

Bedside monitors at MGH can perform 12-lead ECGs and transmit it to MUSE. These monitors are the GE DASH 3000, DASH 4000, DASH 5000, SOLAR 8000i, CARESCAPE B450,650, 850. All bedside monitors are preconfigured to transmit these EKGs to the IP address 126.8.8.1, which is the IP address of the MUSE gateway.

- **CASE MACHINES**

Case Machines at MGH are used collectively with treadmills to run a stress test. During this test where a patient would “stress” the heart, EKG’s are taken at predefined intervals to monitor the health of the heart. The user has an option to transmit these EKGs tracing to MUSE.

Within MUSE, Stress studies from the stress machines are listed as type “\*.GXT”.

## ➤ MUSE CONFIGURATION

During the provisioning process, there were several options on how to configure and design the MUSE system. The MGH MUSE configuration was designed with several important factors. The overall MUSE system, along with its transmission modalities, can be defined as a medical system. To maintain the integrity of the data, the MUSE servers were discussed to be placed inside a firewall or a secure medical device zone (SMDZ); but that would refrain any security patches and updates to be installed on all Muse servers. When confirmed with GE, these patches and updates would remain independent of the application itself and would not require GE to validate them prior to installation. So, a unanimous decision was taken by Biomed to have all the servers provisioned in Partners network and not in SMDZ with the thought to address cybersecurity vulnerabilities.

All Muse servers are placed in Group 2 for patching and automatically reboot after the work is accomplished. Since, all these are virtual servers, the reboot is quick enough to have minimal or no impact on accessibility or functionality of the system.

With Muse servers in Partner network and not in SMDZ, other Partners IS teams (specifically, database – SQL) can offer better support of the file server. The support includes “always on” backup i.e. real-time backup by database experts which in turn contributes to disaster recovery plan for at least the file server. All servers on Partners network are maintained by “server-phs” team within Partners IS.

Other components of the Muse system that connect with both Biomed MC and Partners IS network, still are maintained under SMDZ. The reason is that Biomed MC network still needs to maintain its data integrity and hence cannot be patched per the current frequency of patches advised by Partners IS. These components are

- 
- 1. Muse Gateways
- 2. Muse Modem PC

- **SMDZ**

The MGH MUSE SMDZ is listed with the IS side as: **vrf\_60\_int\_ndc\_musemgh-fwsm**. The SMDZ acts as a firewall where all communication with other services and network is blocked, unless a firewall exception is created. This SMDZ is the same that was active for Muse v8.

Since the MUSE servers (database, app, HL7, web) are not in SMDZ, their communication amongst themselves, other Muse modalities like wireless carts are not restricted at all. The ports required for communication are open.

Furthermore, for functional purposes, MUSE communicates with the MGH’s billing, ADT/ Orders and results servers where again no firewall exceptions are needed since all servers are in Partners network and not isolated in SMDZ. For operational purposes, Muse communicates with Partners DNS (resolves IP to host name), NTP

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING



(time sync servers), anti-virus servers, secure link (for remote access), windows licensing server (authenticates the windows server 2012 r2 license), active directory servers (holds the active listing of all partners usernames) without any firewall exception requirement as they all are part of Partners network.

Although, MUSE systems communication with Muse gateways, Muse Modem PC does require firewall exceptions as the gateways and modem PC reside in SMDZ. Below is a list of firewall exceptions in between gateways, modem PC and Muse app server. The same list can be found here too –

L:\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9 - 9. MUSEv9 Firewall Exceptions.xlsx

Environment	Firewall Exception Request Number	Source IP Address	Destination IP Address	MAC Address	Protocol/Port (Service) e.g. tcp/80, ssl	Comments	Status
Production	FWE07967	172.17.242.196	172.27.34.231	1C-A0-B8-7A-09-6D	tcp/137/138/139/445	For Muse gateways to communicate to Muse app server for file	<b>Not yet implemented. Gateways not in SMDZ, they are</b>
		172.17.242.197	172.27.34.231	1C-A0-B8-7A-09-FD	tcp/137/138/139/445		
		172.17.242.198	172.27.34.231	1C-A0-B8-7A-09-DB	tcp/137/138/139/445		
Production	FWE07968	172.16.68.37	172.27.34.231		tcp/137/138/139/445	For Muse leg gateway and Modem PC to	<b>Not yet implemented. Gateway/ Modem PC</b>
		172.16.68.52	172.27.34.231		tcp/137/138/139/445		
Production	FWE07975	172.16.62.198/199/201	172.27.34.231		tcp/137/138/139/445	For communication from Stress machines in Blk 260 to Muse V9 app server. Refer to INC1983971 for ISPO Variance	<b>This was not implemented, as this exception was included under FWE07988</b>
Production	FWE07988	172.16.62.192/27	172.27.34.231		tcp/137/138/139/445	For communication from Stress machines in Yawkey 5 to Muse V9 app server. Refer to INC1983971 for ISPO Variance	The entire range of 27 IP's has been allocated to a VLAN for existing and new stress machines. This setup is functional.
Production	FWE07998	172.26.45.166	172.27.34.231		tcp/137/138/139/445	For communication from Stress machines in Danvers to Muse V9 app server. Refer to INC1983971 for ISPO Variance	For machine in Danvers. This setup is functional.
Production	FWE08008	172.27.179.230	172.27.34.231		tcp/137/138/139/445	For communication from Stress machines in Waltham to Muse V9 app server. Refer to INC1983971 for ISPO Variance	For machine in Waltham. This setup is functional.
Production	FWE08087	172.17.242.196	132.183.1.11/132.183.100.12		udp/123; tcp/123	For communication from Muse gateways to NTP servers	This firewall was implemented.
		172.17.242.197	132.183.1.11/132.183.100.12		udp/123; tcp/123		
		172.17.242.198	132.183.1.11/132.183.100.12		udp/123; tcp/123		
		172.17.242.196	132.183.0.2		tcp/53	For communication from Muse gateways to DNS servers	
		172.17.242.197	132.183.0.2		tcp/53		
172.17.242.198	132.183.0.2		tcp/53				
Production	FWE08116	172.17.242.196/197/198	PHS_Domain_Controller_1&2		TCP_GT_1023, ICMP-Echo-Reply, tcp/135, tcp/389	For communication of the gateways to DNS so they can be resolved on the Partners network. This is an essential step so service accounts SQ7 and SQ23 can be added as admins and "ACQMON" folder can	<b>This has not been implemented yet</b>
		172.17.242.196/197/198	PHS_Domain_Controller_1&2		udp/389, tcp/636,tcp/3268,tcp/3269, tcp/53,udp/53		
		172.17.242.196/197/198	PHS_Domain_Controller_1&2		tcp/88,udp/88,tcp/445,udp/137		
		172.17.242.196/197/198	PHS_Domain_Controller_1&2		udp/138,tcp/139,tcp/42,tcp/49152-49202		

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING



Additionally; the Muse gateways, modem PC's also require firewall exceptions to communicate with –

- hospitals domain controllers (DNS) so they can resolve the IP addresses assigned for unique host names (mghmusegatewa1,2,3 etc.). Within the Muse system, different components talk to each other using host names rather than IP addresses.
- hospitals NTP server (for time sync). This server ensures all MUSE servers are synchronized with respect to its date and time. This ensures there are no time-based errors with the MUSE application and EKG timestamps.

It is important that the muse gateways and modem PC communicate with the DNS so they could be resolved on Partners network for muse server to identify them (the gateways and modem) followed by acquiring the ECG's from them to populate them in the edit/retrieve list.

#### • SERVICE ACCOUNTS

MUSE V9 has two service accounts: **sq23** (which corresponds to the traditional museadmin) & **sq7** (corresponds to traditional musebkgnd), respectively as the administrator account and the background account.

The MUSE background account runs all the “background” services on windows such as the MUSE Modem service, MACCRA service, etc. The MUSE administrator account has all privileges given on the MUSE Editor application. This account can set up new locations, devices, add users and various other tasks.

Both accounts require system administrator privileges on the SQL Management Studio as is it through these accounts that MUSE writes data to SQL.

One important thing to note is that the MGH implementation uses partners based sq23 and sq7 accounts. The nomenclature/format of these accounts is partners/sq23 & partners/sq7. It is a partner's policy to change the password for all domain accounts every 90 days. This task is performed using Partners application named **CyberArk**. A safety vault is created for MGH Muse in CyberArk, it is called: **MGH\_Biomed\_MUSE9\_P**, CE's have access to this safe. Since Muse is a mission critical system, MGH Biomed worked with Accounts administration/CyberArk and decided to set password change process to be manual such that the resource CE will initiate the change prior to 90<sup>th</sup> day where the password will automatically change on all Muse services running in production and test under account SQ7 making it a seamless transition with minimal to no impact on the services and hence Muse functionality. CyberArk can put a logic in place to automate password updates on services. At the same time, it is responsibility of the CE to inform GE about the new passwords that can be retrieved from CyberArk itself.

The service accounts are as follows (as of Dec 2019)

**Name: partners/sq23 (for Museadmin)**

**Password: yRLy94Dx**

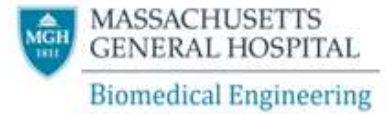
**Name: partners/sq7 (for Musebkgnd)**

**password: LPn8iMNO**



# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING



- CASE MACHINE CONFIGURATIONS**

The CASE test machines at Mass General Hospital are used for stress tests. During the study, several EKGs are completed. During the study, the entire full disclosure can be viewed at the CASE machine level. However, once the EKGs are transmitted to MUSE, only the EKG will be transmitted, not the full disclosure. Therefore, at the MUSE level, the user would only be able to view the EKGs.

The GE CASE machines run on various Windows Platforms, those compatible with Muse V9 are above Win 7, the older ones on Win XP either had to be upgraded or replaced for continued communication. The list of active Stress machines is as below –

Location	Serial number	Room	Correct IP	Correct MAC	Jack no. on the wall
YAW5	SJP13471052SA	5016	172.16.62.220	00-E0-F4-2A-31-CD	YC05C- 117
YAW5	SJP13210374SA	5017	172.16.62.215	00-E0-F4-29-A8-BE	YC05C-064-A
YAW5	SJP13471054SA	5020	172.16.62.214	00-E0-F4-2A-2F-0F	YC05C-069-A
YAW5	SJP13230463SA	5034	172.16.62.221	00-E0-F4-2F-CB-55	Not plugged in sharing port w SJP12371052SA
YAW5	SPZ18240024SA	5034	172.16.62.216	C4-00-AD-0D-0E-9E	YC05C-102-A
YAW5	SN215461960SA	5040	172.16.62.217	00-E0-F4-2F-3B-30	YC05C-094-A
YAW5 - ECHO	SH711096729SA		172.16.62.219		
BLK260	SN215461962SA	276	172.16.62.198	00-E0-F4-2F-38-18	276-1 VD
BLK260	SN215461965SA	278	172.16.62.199	00-E0-F4-2F-38-81	278-3 VD
BLK PET	SPZ18240026SA	272	172.16.26.206	C4-00-AD-0D-0E-99	in PET/CT ROOM 274
BLK CARDIAC ECHO	SPZ19280003SA	200	172.16.62.201	C4-00-AD-25-EE-4F	200-7 VD
MGH West	SPZ19370040SA	535	172.27.179.230	C4-00-AD-38-7F-91	143/144 535-4
MGH Danvers	SPZ19370023SA	1291	172.26.45.166	C4-00-AD-38-7E-13	1B 137 1291-3
MGH Danvers	new sr. no. needed	1293			1B 149 1293-1

Also, can be found here – <\\Sfa1\sfa\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9>

The case machines communicate with the application server. Within the application server, there is a share folder called “acq”. Since it is shared, it is discoverable throughout the network. The CASE machines are configured to have access to this shared folder. The folder itself has login credentials that the CASE machines uses exclusively for CASE machines. These login credentials are:

**Username: case8000**  
**Password: Case!8000**

The MUSE application searches the “acq” folder for any new tests every couple of seconds. Once it recognizes that a Case Stress test is within the folder, it “acquires” it and places it into the database and within MUSE. Since the Case machines uses a shared folder system to communicate between servers, this communication occurs through the windows file/folder sharing port 445, under the tcp/ip communication protocol. Partners has listed that the port 445 is a vulnerable port due to the nature of the communications it accepts. Hence, to maintain security of the Partners network, the case machines are placed in Muse SMDZ and firewall exceptions are needed for each one of them to communicate to the app server which is out in open in Partners network.

## MGH MUSE V9 SYSTEM OVERVIEW DEPARTMENT OF BIOMEDICAL ENGINEERING



Additional variance had to be approved from the ISPO Variance group for communication over port 445. Refer to ticket INC1983971

However, the servers are physically located in Needham, the location where the SMDZ is set up. The CASE machines are spread throughout MGH and outlying areas. Information Security (Info Sec) had to create local VLAN's at locations where CASE machines physically resided. Then this VLAN's gateway was configured to route (or talk to) IP addresses of Muse App server 172.27.34.231 residing in Needham data center.

CASE machines had to be assigned static IP addresses. For firewall exceptions for the stress machines in MGH, please refer to the firewall document located here -

[L\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9](L:\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9)

### New Case Machines

Case machines at MGH are serviced by GE. Until a firewall exception is not submitted for a stress machine to talk to Muse app server over port 445, it cannot communicate to the Muse V9 server.

Typically, GE field engineers would configure the CASE machines to transmit to MUSE. However, if they try with the current MGH configuration, they will not be able to. Therefore, they must engage Biomed in order to successfully transmit to MUSE.

### To Place Case Machine in SMDZ

- Make sure you have the MAC Address of the CASE Machine handy along with the last known IP address. If you do not have the MAC address/IP address or are unsure how to get it, please see below.
- Open a ticket in service now for Network engineering (phs – net Engg) with the following details:
  - ❖ Let them know an IP address needs to be made static and needs to be put in the same SMDZ as the other stress machine in that area is. If this is a new area with new stress machine, IS will have to create another VLAN that communicates to the Muse App server.
  - ❖ They will further assign the ticket to Lantel who you will work with to identify the exact port that the new stress machine will connect, followed by activation of that port. The ticket gets assigned back to NetEngg. You are notified the static IP, Subnet Mask, Default Gateway and Primary/Alternative DNS IP addresses. Please ask NetEngg to provide the Port #, Switch Name and VLAN as well.
  - ❖ Submit a firewall exception from that IP of the stress machine to Muse app server with exceptions of the file sharing ports. Refer to FWE07988.
  - ❖ Net security – phs will work with you to review and then implement the firewall exception.
  - ❖ Configure the stress machine by following steps below. Once done, you can test communication from Stress machine to Muse app server.

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

### How to get the MAC Address from the CASE Machine

- Log into the case machine as the admin
  - ❖ Username: Administrator
  - ❖ Password: admin1,3,5,7
- Click **Start** -> **Run** -> type in “**cmd**” and press **Enter**.
- In the command line window that pops up, type in “**ipconfig /all**”
- Under the section “**Ethernet Adapter Local Area Connection**”, you should see a heading titled “**Physical Address**”. This corresponds to the **MAC address**.
- Within the same section, you should see a heading titled “**IPv4 Address**”. This is the last known **IP Address** of the device.
- Please note the **IP Address** and **MAC address**.

### Case Machines Configuration

- Log into the case machine as the admin (use the same login info as above)
- Select: Start -> Run -> and type in “**ncpa.cpl**”
- This will bring you to the “**network connections**” screen.
- Right click on the **Local Area Network** and select **Properties**
- Highlight “**Internet Protocol Version 4 (TCP/IPv4)**” and select **Properties**. It might be listed as “**Internet Protocol Version (TCP/IP)**”. (Figure 6)
- Select **Use the following IP address**
- Add the IP address, Subnet Mask and Default Gateway that was provided to you by Net engg and the one that was implemented by Network security group.
- Once that is complete, press **Okay** and press **Okay** again.
- Start the GE stress test application by clicking the “**Case**” Icon on the desktop.
- Under **System Configuration**, go to the **MUSE** tab.
- Under **Data Transfer to MUSE via Shared Directory**, Go to the Shared Directory.
- Please type in: [\\172.27.34.231\acq\\$](#)

Please note that the port that the network cable is connected to on the wall has been configured to accept only this CASE Machine’s IP address/MAC address. Please indicate this to users that this is a “MUSE” port only by adding an arrow pointing to the port and writing “MUSE”.

### • **ECG WORKFLOW**

This section highlights the overall EKG workflow at MGH. As of April 2nd, 2016, with the new EMR system – EPIC Ensemble sends ADT and Order information together to MUSE. As soon as any record is opened in MUSE, patient demographic and order number (if created by the clinicians) is available to the staff processing the EKG.

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING

On the Inpatient side, an order is placed in EPIC as well. The EKG lab has access to EPIC and they go through all the submitted orders and match them to any “Newly Acquired” EKGs. The process runs parallel to the Outpatient setting.

The inpatient and outpatient order entries both are made in EPIC as of April 2, 2016. Prior to that, the Outpatient order entry was paper based while the Inpatient order entry was electronic via POE (Physician Order Entry). Remember, in none of the processes an order number was entered in MUSE. With MUSE’s integration with EPIC, an order number will always accompany an EKG record.

Once a new EKG comes into MUSE, it is in a state of “newly acquired”. If there is an order associated with the EKG, the same will be available along with patient’s ADT (Admit, Discharge, and Transfer) information from EPIC Ensemble server. EKG technicians will ensure that the Order number in MUSE and in EPIC matches. Through this order, the EKG technicians will verify the patient demographics and make any changes for EKGs that have incorrect/mistyped demographic information. It is at this point they will send the EKG to a cardiologist’s basket. The cardiologist will interpret/read the EKG and provide a diagnosis on the underlying rhythm, noting it within MUSE. Before the cardiologist reading, the EKG is in an “unconfirmed” status. Once the cardiologist reads it, the EKG gets a “confirmed” status.

If there is no order associated with the EKG, the EKG lab will try their best to verify patient demographics based on previous patient data already in MUSE. EKG lab will move this record to In-basket named: 888 PROCESS WITH NO ORDER. EKG lab reviews this in basket every day, in that they review EKG’s without orders that were there 72 hours prior. For example, on March 4th, they will review EKG’s of Mar 1st. If there still is no Order no. created by the clinician/ practice, the staff will “confirm” the EKG without any interpretation from a cardiologist and without an order. Administrative rights are required to be able to do so. The user ID 888 has administrative rights to do so.

Some units are configured for EKG’s to be transmitted and not to be read by any Cardiologists. These units are identified by the location ID. The EKG Lab staff will verify patient demographics like any other EKG’s along with the Order number created by the unit. Once all the needed information is verified by the lab staff, they will “confirm” the EKG’s as Process Do Not Read with user ID 999.

Once the EKG is confirmed, it triggers billing and result messages to be sent out to ICM and EPIC Results. EPIC Results will make all results available in legacy systems like LMR, on Call; EDIS etc. for viewing only. Only confirmed EKG’s can be viewed in EPIC and hence in the legacy systems.

Unconfirmed EKG’s can be viewed in EPIC by clicking “More Activities” on the right pane; then PHS Applications and then MUSE. This will open the PHS MUSE VIEWER and it will have links to MUSE CV WEB for the users to view unconfirmed or unsolicited EKG’s.

Billing has two components: the technical and professional piece. The technical piece is strictly for the labor and supplies used to perform and confirm the EKG. The professional piece is for the interpretation of the EKG. The EKG's captured by units identified under PROCESS DO NOT READ are billed for only a technical only piece. A reason behind this is since units might have their own cardiologists that want to interpret EKGs.

## ➤ MUSE INTEGRATION WITH HOSPITAL EMR (EPIC)

MUSE as a system can link information coming from the hospital's patient records to the actual EKG. That is why MUSE can communicate with the hospital's ADT service, billing service and results service. Each individual service will be discussed below.

- **ADT**

The Admit, Discharge and Transfer (ADT) service at MGH tracks the patient's location along with their demographics. The service sends out HL7 messages to downstream systems. These messages would include patients admits, transfers from one location to another (e.g. from White 927 to Ellison 424) and discharges. Downstream systems, such as MUSE, are configured to listen to these messages across a specific port. This configuration is done on the HL7 interfaces. The MUSE HL7 interface and ADT HL7 interface is Ensemble. The Ensemble interface is configured to send messages across port 41000 to the MUSE file server and the MUSE HL7 interface is configured to receive these messages across that port. The name of this interface for Partners is -

**"MGH Interface 248 – EPIC ADT/ORDERS to GE MUSE MGH"**.

- **BILLING**

The billing interface allows MUSE to send HL7 messages to the billing side. In doing so, the billing side can charge the providers for the EKG that was performed.

The billing at MGH goes through a middleman known as ICM by Voba Solutions. Therefore, MUSE sends billing information to ICM, which then sends the information to EPIC (MGH). MUSE HL7 CCG is configured to send billing information via port 32013. The name of the interface for Partners is –

**"MGH Interface 471 & 472 – DFT Charges from GE MUSE MGH to ICM"**

- **RESULTS**

The results interface gives MUSE the ability to send HL7 messages to the results side, which can link up to the EKG via EMR platform. An example of this is through EPIC (an EMR system). Within EPIC, there are links created within the patient profile that open EKGs performed. Following this link in EPIC, clinical users are directed to MUSE. The legacy clinical data repository (CDR) interacts with EPIC to keep itself up to date on all results filed in EPIC by MUSE. Eventually, CDR will be hold only archived records and as of April 2, 2016 EPIC will be the new

## MGH MUSE V9 SYSTEM OVERVIEW DEPARTMENT OF BIOMEDICAL ENGINEERING

data repository. MUSE HL7 CCG is configured to send results information via port 55134. The name of the interface for Partners is –

### “MGH Interface 3215 – GE MUSE Results to EPIC”

- PARTNERS MUSE VIEWER LINK

In the above section, it was listed that EPIC has links created to open EKGs. The links point to the MUSE CV Web server. In MUSE CV Web, one has the ability to search for patients. Therefore, as these links open up to a particular EKG, the user could, in theory, search for another patient within CV Web. This poses the issue of having multiple patient records open on a single workstation. In this case for example, patient John Smith might be open in EPIC, and Jane Doe open in MUSE CV Web. This can create a conflict and confusion when it comes to making decision with patient care. Furthermore, MUSE CV Web does not have any way to audit users. Therefore, the Results team and specifically the CDR team have requirements for external links:

- They should not allow the user to be able to search for another patient
- They should be able to trace user activity

MUSE CV Web does not have any configuration options that can accommodate the CDR’s request. Therefore, the CDR team took ownership of a custom-build middle tier platform that would be able to satisfy their requirements. This platform is a webpage that is hosted on a Partners based server (einsvpx09-vip26.partners.org). The webpage essentially is a carbon copy of the MUSE CV Web GUI but it takes out the search button. Therefore, the user will be able to see the EKG tracing but will not be able to search for other patients. Once the user clicks the external link for the EKG in EPIC (or other Legacy applications), the link opens a URL for the PHS MUSE Viewer. PHS MUSE Viewer then refers to CV Web for the actual EKG and displays that EKG on its webpage. PHS MUSE Viewer is configured to allow all user access. PHS MUSE Viewer is allowed access to CV Web through the Partners user account SOP59.

### ➤ MUSE TROUBLESHOOTING

MGH Muse V9 is a mission critical system within Partners IS, MGH biomedical engineering team supports this system. This system is extended to various hospitals as described in the first section of this document.

To highlight the support structure, typical calls for MGH MUSE and system details a separate document is made for MUSE troubleshooting. It can be found on the Biomed website –

<http://biomed.partners.org/main/TechnicalResources/CallTechResources/MGHMuseV9TroubleshootingGuide.pdf>

The same is also stored here along with all related documents for MGH Muse v9–

<\\Sfa1\sfa\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9>

# MGH MUSE V9 SYSTEM OVERVIEW

## DEPARTMENT OF BIOMEDICAL ENGINEERING

Some other document that you may need for troubleshooting are –

MGH Cart location numbers (located in the link above) and located on the biomed website –

[http://biomed.partners.org/main/TechnicalResources/MUSEV9\\_MGHCartLocations.pdf](http://biomed.partners.org/main/TechnicalResources/MUSEV9_MGHCartLocations.pdf)

MGH Muse system summary document to understand the architecture and further troubleshooting –

<http://biomed.partners.org/main/TechnicalResources/MUSEV9SystemSummary.pdf>

MGH Muse wireless cart configuration with barcode scanner –

<http://biomed.partners.org/main/TechnicalResources/MGHWirelessECGCartWithBarcodeScannerConfigurationGuide.pdf>

MGH Muse wireless cart with barcode scanner – troubleshooting guide –

<http://biomed.partners.org/main/TechnicalResources/CallTechResources/MGHWirelessECGCartWithBarcodeScannerTroubleshootingGuide.pdf>

## ➤ MUSE MAINTAINANCE

With the current setup for Muse V9, there are three important aspects that the resource engineer is responsible for as part of Muse maintenance –

- 90-day password change in CyberArk for Muse domain accounts - SQ7 and SQ23
  - ❖ This can be setup in TMS either as a clock or a periodic work order assigned to the resource engineer. *It has not been setup in TMS yet.*
  - ❖ The resource engineer will request a change of password in CyberArk. Once updated the password will automatically change on all services in muse production and muse test.
  - ❖ The engineer will then notify GE Tech support, so they can update the password on their notes. Their password information should always be current as they may need to login for troubleshooting purposes.
  - ❖ Current active passwords can always be retrieved from CyberArk's Partners app by using your Partners credentials.
- Muse application cleanup practices - This practice is not set in a schedule. It is to be implemented as and when needed within the Muse application.
  - ❖ Muse location list includes a lot of location that are either retired or unused, it will be a good practice to use these retired location number for future locations to keep the list clean. Prior to using a retired location number as a new location number, resource engineer should check with MGH Cardiology (Carlos Vasco - [CVASCO@PARTNERS.ORG](mailto:CVASCO@PARTNERS.ORG)); MGH Revenue (Nancy King - [NJKING1@PARTNERS.ORG](mailto:NJKING1@PARTNERS.ORG); Jessica Sweeney - [JLSWEENEY@PARTNERS.ORG](mailto:JLSWEENEY@PARTNERS.ORG)); ICM billing (Jim Tice - [Jim.Tice@vobasolutions.com](mailto:Jim.Tice@vobasolutions.com)) so the cross maps for billing are adjusted from the old location to new as per the practice requirement.
  - ❖ Muse discarded data cleanup – It is a good practice for either the resource engineer to do it or to have GE tech support cleanup the discarded data. In that, you can permanently delete old data prior to a certain time stamp

## MGH MUSE V9 SYSTEM OVERVIEW

### DEPARTMENT OF BIOMEDICAL ENGINEERING

date. Say, any data prior to 6 months from a certain date or today should be deleted. This will allow the dataset for Muse to clean and can impact processing time.

- Muse patching of all servers –
  - ❖ This process has been automated with all muse servers being in Partners network (and not in SMDZ). Further put in Group 2 for patching. The resource engineer must be vigilant about any new security patches put in by Partners that may impact Muse application. GE does allow all current Microsoft patches on Muse servers. Some common impacts of patching on the servers have been to the extent that in some cases, the services don't restart by themselves requiring the CE on-call to restart them manually. This causes a hinderance in regular workflows but is a solvable problem. CE's should be vigilant about Group 2 patching schedule so they can fix the issue if it should arise.

### ➤ MUSE COMPETANCIES

The system resource engineer working with MGH Biomed's Senior Technical Specialist (Brian Baril) will ensure to keep a yearly record of biomed technician competencies for troubleshooting the MUSE system. These competencies were initially developed by Stephanie Liddle (May 2014), modified by Adeel Alam (Oct 2015) and then recently modified by Ketaki Muthal (Nov 2019)

Some of the things the competencies will look for will be whether the technician can:

- Describe process for responding to system wide issues
- Identify where the GE phone number and service support PO number can be found
- Checks modems are responding correctly (group and individual)
- Verify location and site ID are set correctly on EKG machine (location to 229 – biomed test)
- Create and transmit a sample EKG on EKG machine using analog connection for an inpatient machine and wireless connection for an outpatient machine (MRN: 6023149 – XXXXMGHMUSETEST, ONE)
- Verify location and site ID are set correctly on bedside monitor (location to 229 – biomed test)
- Create and transmit a sample EKG on bedside monitor (MRN: 6023149 – XXXXMGHMUSETEST, ONE)
- Log into MUSE CV Web
- Search CV Web for the record you previously transmitted and note whether it's confirmed on unconfirmed
- Note the difference between confirmed and unconfirmed report (you should see Cardiologists or System Admins interpretations on the confirmed ECG)
- Find this ECG you looked for in CV Web, via the MUSE VIEWER link in EPIC
- Identify why you could see the ECG under MUSE tab in EPIC but not under Cardiology tab? (probably because it was confirmed without an order)



## ➤ MUSE DISASTER RECOVERY

- MGH Biomed to update disaster recovery plans and steps with Partners IS – *yet to be done*
- Disaster impact – loss of data and high turnaround time for recovery
- A disaster recovery plan should include a redundant server for at least the SQL server, mainly to address loss of data and quick turnaround in case the primary SQL server goes down. Muse holds all its data on the SQL database which also takes most time to recover
- We have availed SQL always on feature for Muse prod SQL server where 2 SQL servers are provisioned for us – PHSQLAO3200A and PHSQLAO3200B located in NDC and MDC respectively. The B server is real time back-up of the A server. In the event of disaster, the real time backup can be made primary and Muse can continue to function with minimal downtime and no loss of data
- No redundant app servers are provisioned at this time.

## ➤ MUSE DOCUMENTATION

- Main folder –  
\\Sfa1\sfa\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9
- MUSE V9 SP 9 software –  
\\Sfa1\sfa\DBEMAIN\Safety\Resource Book\MGH\MGH MUSE\MUSE V9\Installation files from GE\Muse V9SP9  
SW