SAGE2 Documentation

June 23, 2014

1. SAGE2

Browser based implementation of SAGE. A cluster-based html viewer used for displaying elements across multiple browser windows.

1.1. Dependencies

- node.js
- ffmpeg
- poppler
- imagemagick

1.2. Install

- Windows Install
- Mac OSX Install
- OpenSUSE Install
- Ubuntu Install

1.3. Configure

- Create a configuration file for your display environment
- Save file in /config
- Select your configuration file
  - Option 1: name your configuration file '-cfg.json'
    (eg. host = thor.evl.uic.edu, config file is 'thor-cfg.json')
  - Option 2: create a file 'config.txt' in
    Specify the path to your configuration file in 'config.txt'

1.4. Run

- Open Terminal / Cmd
  - `cd <SAGE2_directory>`
  - `node server.js`
- Open Google Chrome (to enable screen sharing, go to chrome://flags and enable "Enable screen capture support in getUserMedia()")
  - Table of Contents: `http://<host>:<index_port>`
  - Display Client: `https://<host>:<port>/?clientID=<ID>`
  - Audio Client: `https://<host>:<port>/audioManager.html`
  - SAGE UI: `https://<host>:<port>/sageUI.html`

  - SAGE Pointer: `https://<host>:<port>/sagePointer.html` (Allow pop-ups)
- Create a one button SAGE2 launcher for the server and displays

1.5. Supported File Types

- Images
  - JPEG
  - PNG
  - TIFF
  - BMP
  - PSD
- Videos
  - MP4
- PDFs

1.6. Notice

2. Install for Mac OSX (10.7 - 10.9)

Last revision: 01 May 2014

2.1. Download

- Download Node.js and install (follow installer instructions)
- Download homebrew and install (Terminal command creates full install)

2.2. Install Dependencies

- Open Terminal
  - `brew install ffmpeg --with-libvpx --with-libvorbis`
  - `brew install poppler --without-glib`
  - `brew install imagemagick --with-webp`

2.3. Clone SAGE2

- Open Terminal
  - `cd <directory_to_install_SAGE2>`
  - `git clone https://bitbucket.org/sage2/sage2.git`

2.4. Generate HTTPS Keys

- Open the file 'GO-mac' inside the '/keys/' folder
  - Add additional host names for your server in the variable `servers` (optional)
  - Save file
- Open Terminal
  - `cd <SAGE2_directory>/keys`
  - `./GO-mac`
    - enter your password when asked (the keys are added into the system)

2.5. Install Node.js Modules

- Open Terminal
  - `cd <SAGE2_directory>`
  - `npm install`

3. Install for Ubuntu (14.04)

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3.1. Download

- Download Node.js
- Download FFMpeg (2.2.1 "Muybridge" gzip tarball)

3.2. Install Dependencies

- Open Terminal
  - `sudo apt-get install g++`
  - `sudo apt-get install libx264-dev`
  - `sudo apt-get install yasm`
  - `sudo apt-get install imagemagick`

- `sudo apt-get install libnss3-tools`
- `sudo apt-get install git`

3.3. Install Node.js

- Open Terminal
  - `cd <Downloads_directory>`
  - `tar xzvf <downloaded_nodejs_tar.gz>`
  - `cd <extracted_nodejs_directory>`
  - `./configure`
  - `make`
  - `sudo make install`

3.4. Install FFMpeg

- Open Terminal
  - `cd <Downloads_directory>`
  - `tar xzvf <downloaded_ffmpeg_tar.gz>`
  - `cd <extracted_ffmpeg_directory>`
  - `./configure --enable-gpl --enable-libx264`
  - `make`
  - `sudo make install`

3.5. Clone SAGE2

- Open Terminal
  - `cd <directory_to_install_SAGE2>`
  - `git clone https://bitbucket.org/sage2/sage2.git`

3.6. Generate HTTPS Keys

- Open the file 'GO-linux' inside the '/keys/' folder
  - Add additional host names for your server in the variable `servers` (optional)
  - Save file
- Open Terminal
  - `cd <SAGE2_directory>/keys`
  - `./GO-linux`

3.7. Install Node.js Modules

- Open Terminal
  - `cd <SAGE2_directory>`
  - `npm install`

4. Install for Windows (7 or 8)

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4.1. Download

- Download Node.js and install (follow installer instructions)
- Download 7-Zip and install (follow installer instructions)
- Download ImageMagick and install (follow installer instructions)
- Download FFMpeg
- Download Poppler-utils
- Download TortoiseGit and install (follow installer instructions)
- Download Git for Windows (follow installer instructions)

4.2. Install FFMpeg

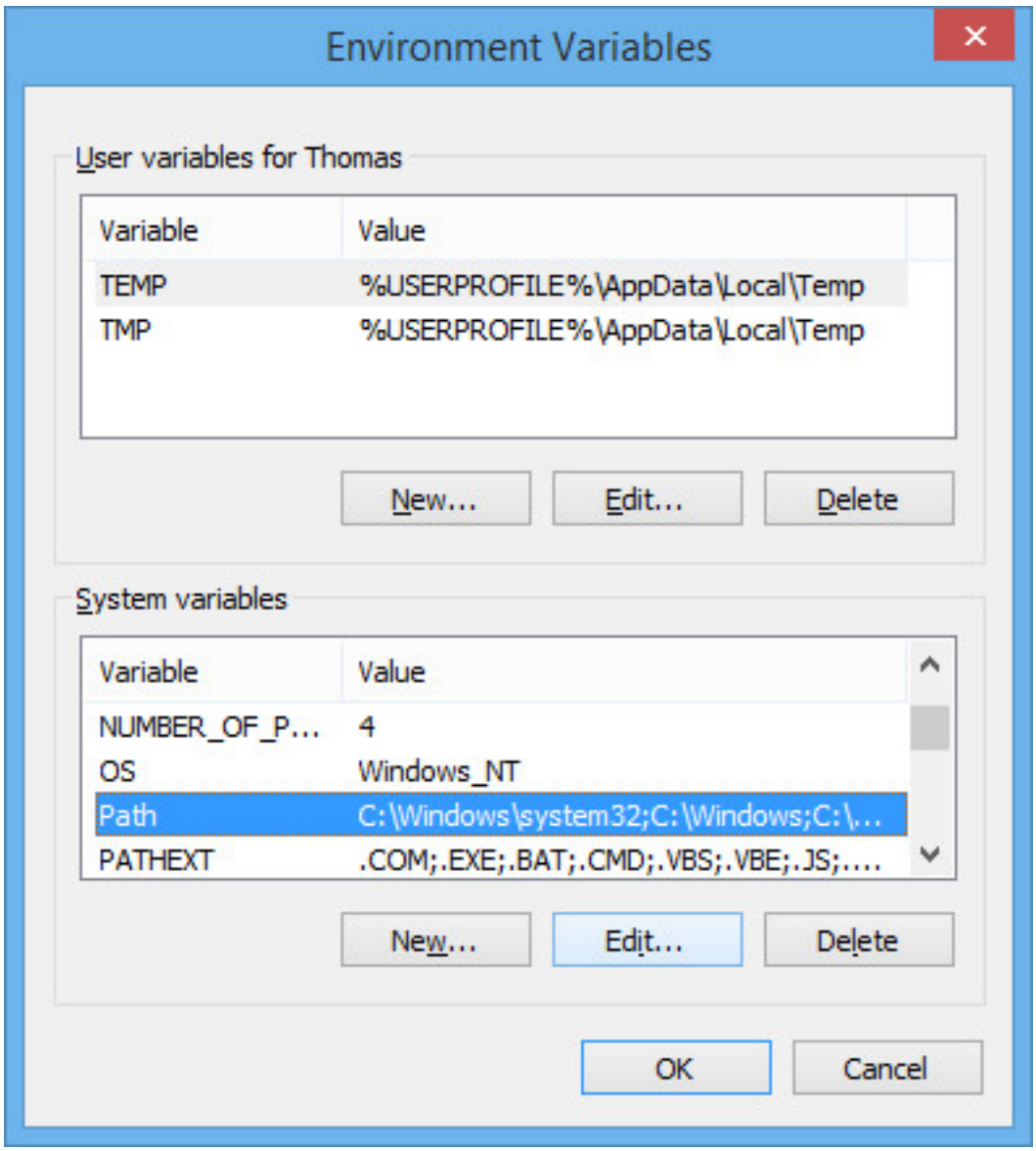
- Move downloaded FFMpeg 7z file to 'C:'
- Right-click on downloaded FFMpeg 7z file
  - 7-Zip > Extract Here
- Rename extracted directory 'FFMpeg'

4.3. Install Poppler

- Create directory 'C:'
- Move downloaded Poppler-utils zip file to 'C:'
- Right click on downloaded Poppler-utils zip file
  - 7-Zip > Extract Here

4.4. Set Environment

- Add 'C:;C:' to you PATH variable
- You may have to log out and log back in for the environment variables to apply



Edit Windows PATH

4.5. Clone SAGE2

In directory where you want to install SAGE2, right-click and select 'Git Clone'

- Set URL to 'https://bitbucket.org/sage2/sage2.git'
- Set directory to where you want to install SAGE2

4.6. Generate HTTPS Keys

- Edit '-windows.bat'

  - Add lines with list of hostnames for your server
  - Save file
- Double click 'GO-windows.bat'

4.7. Install Node.js Modules

- Launch command prompt (`cmd.exe`)
  - `cd <SAGE2_directory>`
  - `npm install`

5. Install for Linux openSUSE (13.1)

For older versions of openSUSE (and future versions), the name of the packages might change slightly, but the instructions remain mostly valid.

5.1. Install Dependencies

- In a Terminal window as 'root' user (or using a sudo command)
- `zypper install nodejs` : JavaScript environement
- if you prefer a most recent version of NodeJS, you can download the sources from http://nodejs.org/download/ and compile your own:
  - `tar xzvf <downloaded_nodejs_tar.gz>`
  - `cd <extracted_nodejs_directory>`
  - `./configure`
  - `make -j 5`
  - `sudo make install`
- after install, test:
  - `node -v` will tell you which version is installed
- `zypper install git` : distributed revision control system
- `zypper install openssl`: Secure Sockets and Transport Layer Security
- `zipper install mozilla-nss-tools` : NSS Security Tool
- `zypper install ImageMagick` : Viewer and Converter for Images
- `zypper install poppler-tools` : PDF Rendering Library Tools
- some packages that we use might require the compiler and development packages to be installed
  - `zypper install -t pattern devel_C_C++`
- if you want to use privileged network ports (port 80 for HTTP and 443 for HTTPS), you need to add capabilities to the `node` binary:
  - `zypper install libcap-progs`
  - `sudo setcap 'cap_net_bind_service=+ep' /usr/bin/node`

        - this allows a regular user to use node with privileged ports
- Packages provided by other repositories
    - add repositories:
        - `zypper ar http://packman.inode.at/suse/13.1 Packman_13.1`
        - `zypper ar http://dl.google.com/linux/chrome/rpm/stable/x86_64 Google_chrome`
        - `zypper refresh`
    - `zypper install ffmpeg` : Viewer and Converter for Images
    - `zypper install google-chrome-stable`: Google Chrome browser

5.2. Clone SAGE2

- Open Terminal
    - `cd <directory_to_install_SAGE2>`
    - `env GIT_SSL_NO_VERIFY=true git clone https://bitbucket.org/sage2/sage2.git`
        - enter bitbucket login information when asked

5.3. Generate HTTPS Keys

- Open the file 'GO-linux' inside the '/keys/' folder
- Add additional host names for your server in the variable `servers` (optional)
    - for instance add the short name and the fully qualified domain name of your server
- Save file
- In a Terminal
- `cd <SAGE2_directory>/keys`
- `./GO-linux`

5.4. Install Node.js Modules

- Open Terminal
- `cd <SAGE2_directory>`
- `npm install`

6. SAGE2 config

A JSON file to configure the display environment

6.1. Fields

Field	Value
`host`	hostname or ip address of the web server
`public_host`	public hostname of the web server (used in index page) [optional]
`port`	HTTPS port that all clients are served on (default is `443`)
`index_port`	HTTP port where a Table of Contents is served on (default is `80`)
`clock`	`12` or `24` (specifies whether to use a 12 or 24 hour clock)
`background {color, image, style, clip}`	`color` is a hex color for the background, `image` is a relative path from the publicHTTPS directory to an image used for the background, `style` is either `fit`, `stretch`, or `tile`, `clip` is a boolean telling to clip the display at the exact resolution
`show_url`	boolean (whether or not to show the host url on the display clients)
`resolution {width, height}`	width and height in pixels of a display client (browser window size)
`layout {rows, columns}`	number of rows and columns of display clients that make up the display environment
`displays [{ID, row, column}]`	array of displays with a unique ID (index in array), and the row and column where it tiles in the display environment
`alternate_hosts []`	array of alternate hostnames or ip addresses of the web server
`remote_sites [{name, host, port}]`	array of remote sites to be able to share content with - `name` to be displayed, `host` and `port` specify the remote machine to connect with
`advanced {ImageMagick}`	advanced options not required by all systems: Windows requires full Path to `ImageMagick` (use `/` as path delimiter)

6.2. Sample

```
{
    "host": "hostname.com",
    "public_host": "public.hostname.com",
```

```
    "port": 443,
    "index_port": 80,
    "clock": 12,
    "background": {
        "color": "#FFFFFF",
        "image": "images/background/bgImg.png",
        "style": "fit",
        "clip": false
    },
    "show_url": true,
    "resolution": {
        "width": 1920,
        "height": 1080
    },
    "layout": {
        "rows": 1,
        "columns": 2
    },
    "displays": [
        {
            "ID": 0,
            "row": 0,
            "column": 0
        },
        {
            "ID": 1,
            "row": 0,
            "column": 1
        }
    ],
    "alternate_hosts": [
        "localhost",
        "127.0.0.1"
    ],
    "remote_sites": [
        {
            "name": "Remote1",
            "host": "other.com",
            "port": 443
        },
        {
            "name": "Remote2",
            "host": "another.com",
            "port": 9090
        }
    ],
    "advanced": {
        "ImageMagick": "C:/Program Files/ImageMagick-6.8.9-Q16/"
    }
}
```

6.3. Note

Default ports `80` and `443` are convenient when visiting SAGE2 clients because the port does not have to be explicitly entered (eg. in this sample config a user could simply visit `https://hostname.com/sagePointer.html` instead of `https://hostname.com:443/sagePointer.html`).

However, these ports require privileged access. If you do not have the necessary permissions, please choose port numbers larger than `1024` and explicitly specify the chosen port numbers when typing a URL.

If a public hostname is specified, it is used on the index page. That host should be listed in alternate_hosts.

7. Starting SAGE2 with one button

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7.1. Windows

- Single Machine
  - Create file 'GO-.bat' and save in '/GO-scripts'

7.2. Mac OSX

- Single Machine
  - Create file 'GO-' and save in '/GO-scripts'

7.3. openSUSE

- Single Machine
  - Create file 'GO-' and save in '/GO-scripts'
- Cluster
  - Create file 'GO-' and save in '/GO-scripts'

7.4. Ubuntu

- Single Machine
  - Create file 'GO-' and save in '/GO-scripts'

8. SAGE2 Application Methods

Method	Parameters
`init(id, width, height, resrc, date)`	`id` is canvas element id, `width` is the initial application width, `height` is the initial application height, `resrc` is path to resource directory, `date` is the date
`load(state, date)`	`state` is the initial application state (eg. initial data to display), `date` is the date
`draw(date)`	`date` is the date (used to calculate t and dt for animations). Within your application, call 'refresh' if you need a redraw. If it's interactive application, you can enable 'animation' in the file "instruction.json". the default frame rate is 60fps. Maximum frame rate can be controlled by the variable maxFPS (`this.maxFPS = 20.0` for instance)
`resize(date)`	`date` is the date
`event(eventType, user_id, x, y, data, date)`	`eventType` is the type of event, `user_id` is the id of the user who triggered the event, `x` and `y` are the position of the event, `data` is an object containing extra data about the event, `date` is the data . See event description below.

8.1. Boiler-plate for a canvas application

```
var myApp = SAGE2_App.extend( {
    construct: function() {
        // call the constructor of the base class
        arguments.callee.superClass.construct.call(this);

        // initialize your variables
        this.myvalue = 5.0;

        this.resizeEvents = "continuous";//see below for other options
    },

    init: function(id, width, height, resrc, date) {
        // call super-class 'init'
        arguments.callee.superClass.init.call(this, id, <html-tag conta
iner for your app (eg. img, canvas)>, width, height, resrc, date);

        // application specific 'init'
        this.log("Init");
    },

    //load function allows application to begin with a particular state
.  Needed for remote site collaboration.
```

```
    load: function(state, date) {
        //your load code here- state should define the initial/current
state of the application
    },

    draw: function(date) {
        // application specific 'draw'
        this.log("Draw");

        //may need to update state here
    },

    resize: function(date) {
        // to do:  may be a super class resize
        // or your resize code here
        this.refresh(date); //redraw after resize
    },

    event: function(eventType, userId, x, y, data, date) {
        // see event handling description below

        // may need to update state here

        // may need to redraw
        this.refresh(date);
    }
});
```

8.2. Function Descriptions

8.2.1. Construct

8.2.2. Init

8.2.3. Draw

8.2.4. Resize

8.2.5. Load

8.2.6. Event

```
#!javascript

event: function(eventType, userId, x, y, data, date) {

}
```

eventType can be any one of the following:

- pointerPress (button down)
- pointerRelease (button up) -In both of these cases data.button will indicate whether it is 'left' or 'right' button that caused the event.
- pointerMove
- pointerDoubleClick (left button double click)
- keyboard (Normal key events from the keyboard)
- specialKey (Special Keys on the keyboard such as Backspace, Delete, Shift, etc...)

data holds values such as button(for mouse events), state(for key board events to signal 'up' or 'down' state of the key), and code (code of the key pressed in case of key board events).

x and y gives the position of the pointer.

userId gives the Id of the user generating the event.

date object is may be used for synchronizing.

8.3. External Libraries

8.4. How to write an app

8.4.1. instructions.json

8.4.2. load into app library

8.5. Future: Widgets

8.6. Future: Inter-application communication

8.7. Example Application: Clock

```
var clock = SAGE2_App.extend( {
    construct: function() {
         arguments.callee.superClass.construct.call(this);
        this.ctx = null;
        this.minDim = null;
        this.timer = null;
        this.redraw = null;

        this.resizeEvents = "continuous";
    },

    init: function(id, width, height, resrc, date) {
        // call super-class 'init'
        arguments.callee.superClass.init.call(this, id, "canvas", width
, height, resrc, date);

        // application specific 'init'
        this.ctx = this.element.getContext("2d");
        this.minDim = Math.min(this.element.width, this.element.height)
;
        this.timer = 0.0;
        this.redraw = true;
        this.log("Clock created");
    },

    load: function(state, date) {

    },

    draw: function(date) {
        // application specific 'draw'
        // only redraw if more than 1 sec has passed
        this.timer = this.timer + this.dt;
        if(this.timer >= 1.0) {
            this.timer = 0.0;
```

```
            this.redraw = true;
        }

        if(this.redraw) {
            // clear canvas
            this.ctx.clearRect(0,0, this.element.width, this.element.he
ight);

            this.ctx.fillStyle = "rgba(255, 255, 255, 1.0)"
            this.ctx.fillRect(0,0, this.element.width, this.element.hei
ght)

            var radius = 0.95 * this.minDim / 2;
            var centerX = this.element.width / 2;
            var centerY = this.element.height / 2;

            // outside of clock
            this.ctx.lineWidth = (3.0/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(85, 100, 120, 1.0)";
            this.ctx.beginPath();
            this.ctx.arc(centerX, centerY, radius, 0, Math.PI*2);
            this.ctx.closePath();
            this.ctx.stroke();

            // tick marks
            var theta = 0;
            var distance = radius * 0.90; // 90% from the center
            var x = 0;
            var y = 0;

            // second dots
            this.ctx.lineWidth = (0.5/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(20, 50, 120, 1.0)";

            for(var i=0; i<60; i++){
                // calculate theta
                theta = theta + (6 * Math.PI/180);
                // calculate x,y
                x = centerX + distance * Math.cos(theta);
                y = centerY + distance * Math.sin(theta);

                this.ctx.beginPath();
                this.ctx.arc(x, y, (1.0/100.0) * this.minDim, 0, Math.P
I*2);
                this.ctx.closePath();
                this.ctx.stroke();
            }

            // hour dots
```

```
            this.ctx.lineWidth = (2.5/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(20, 50, 120, 1.0)";

            for(var i=0; i<12; i++){
                // calculate theta
                theta = theta + (30 * Math.PI/180);
                // calculate x,y
                x = centerX + distance * Math.cos(theta);
                y = centerY + distance * Math.sin(theta);

                this.ctx.beginPath();
                this.ctx.arc(x, y, (1.0/100.0) * this.minDim, 0, Math.P
I*2, true);
                this.ctx.closePath();
                this.ctx.stroke();
            }

            // second hand
            var handSize = radius * 0.80; // 80% of the radius
            var sec = date.getSeconds();

            theta = (6 * Math.PI / 180);
            x = centerX + handSize * Math.cos(sec*theta - Math.PI/2);
            y = centerY + handSize * Math.sin(sec*theta - Math.PI/2);

            this.ctx.lineWidth = (1.0/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(70, 35, 50, 1.0)";
            this.ctx.lineCap = "round";

            this.ctx.beginPath();
            this.ctx.moveTo(x, y);
            this.ctx.lineTo(centerX, centerY);
            this.ctx.moveTo(x, y);
            this.ctx.closePath();
            this.ctx.stroke();

            // minute hand
            handSize = radius * 0.60; // 60% of the radius
            var min = date.getMinutes() + sec/60;

            theta = (6 * Math.PI / 180);
            x = centerX + handSize * Math.cos(min*theta - Math.PI/2);
            y = centerY + handSize * Math.sin(min*theta - Math.PI/2);

            this.ctx.lineWidth = (1.5/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(70, 35, 50, 1.0)";
            this.ctx.lineCap = "round";

            this.ctx.beginPath();
```

```
            this.ctx.moveTo(x, y);
            this.ctx.lineTo(centerX, centerY);
            this.ctx.moveTo(x, y);
            this.ctx.closePath();
            this.ctx.stroke();

            // hour hand
            handSize = radius * 0.40; // 40% of the radius
            var hour = date.getHours() + min/60;

            theta = (30 * Math.PI / 180);
            x = centerX + handSize * Math.cos(hour * theta - Math.PI/2)
;
            y = centerY + handSize * Math.sin(hour * theta - Math.PI/2)
;

            this.ctx.lineWidth = (2.0/100.0) * this.minDim;
            this.ctx.strokeStyle = "rgba(70, 35, 50, 1.0)";
            this.ctx.lineCap = "round";

            this.ctx.beginPath();
            this.ctx.moveTo(x, y);
            this.ctx.lineTo(centerX, centerY);
            this.ctx.moveTo(x, y);
            this.ctx.closePath();
            this.ctx.stroke();

            this.redraw = false;
        }
    },

    resize: function(date) {
        this.minDim = Math.min(this.element.width, this.element.height)
;
        this.redraw = true;

        this.refresh(date);
    },

    event: function(eventType, userId, x, y, data, date) {
        // this.refresh(date);
    }
});
```