CCTV Image Relay

```
ictionary file and read ... or die logErr(
DDICT, "<", $OIDDict ) or die logErr(
IDDICT, LOCK_SH );
y @OIDDict = <OIDDICT> );
IDDICT;

heck = "SiteNameyUpdateTimey";
ach my $OID (@OIDDict) {
 @tmp = split(":",$OID);
heck .= "$tmp[0]y";

(-e $rawOutput) {

pen( RWISDATA, "<", "$rawOutput" ) or die logErr("ERROR : RWISDATA
homp( my @file = <RWISDATA> );
close RWISDATA;
if ($check ne $file[0]) {
  $file[0] = $check;

  open( RWISDATA, "+>", "$rawOutput" ) or die logErr("ERROR : RWISDATA
  foreach my $row (@file) {
    print RWISDATA $row . "\n";
  }
  close RWISDATA;
}
} else {

  open( RWISDATA, ">>", "$rawOutput" ) or die logErr("ERROR : RWISDATA : Cannot create file : $!\n", $ErrorLog);
  print RWISDATA $check . "\n";
  close RWISDATA;
}

foreach my $key (sort keys %process) {
  #fork here
  my $pid = fork();
  if($pid == 0 ){
    if ($debug) { print "Child for $key Started...\n";}
    if (($key eq "exportTime") && ($process{"exportTime"} == 1 )) {
      #
      #Exporting File child process
      #
      if ($debug) {print "Exporting this minute...\n";}
      my $timer = 0;
      open( RWISDATA, "<", "$rawOutput" ) or die "Cannot Open $!\n";
      while (!flock( RWISDATA, LOCK_EX|LOCK_NB)) {
                                  Exporter is waiting to read file. $timer\n";}
                 rand(5)+1);
```

```
#Sets up correct header line
# to check/write header based
# on OIDDict file

#Check if file exist
#Opens data file
#Reads file
#Close file
#Check if head
#Places correct header in array
#Open file to zero out and write
#Runs through each row to add \n
#Prints to file
#Close file

#File doesn't exist
#Creates new file
#Prints to file
```

Keith Koeppen
Caltrans, District 2
2013

Information Goals

- Provide as much data to the public as possible
  - CCTV images
  - RWIS atmospheric/roadway data
  - HAR messages
  - CMS messages
- Accurate, Timely, and Reliable
  - Ensures that users trust the information
- Clearly formatted and well documented

Background – Network Topology

- All TCP/IP based element network
- Large Dial-on-demand network
  - POTS (32 Sites)
  - ISDN (28 Sites)
- Microwave Radio network
  - 3 Backbone links
  - 10 Roadside links

Background – Network Topology

Administrative Network

- Email
- Web browsing
- Document retrieval
  - Word Documents
  - Images

Field Element Network (FEN)

- Controlling field devices
  - CCTV (PTZ)
  - Changeable Message Signs (CMS)
- Retrieving data from field devices
  - CCTV (Video)
  - Roadway Weather Information Systems (RWIS) data

Background – Information Relay Project

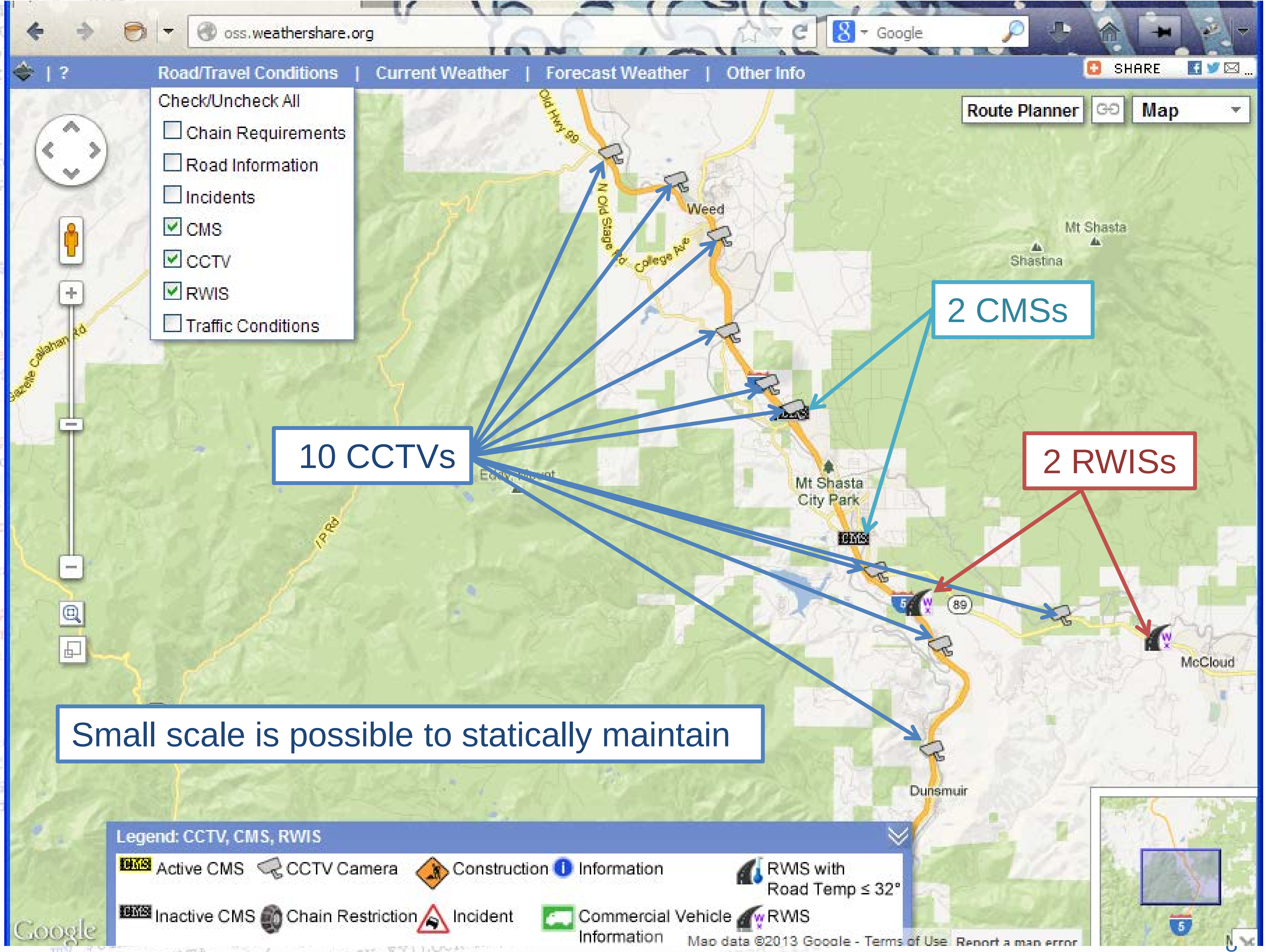
- What is an Information Relay?
  - Information Relays are single process devices or servers
  - Functions like a Field Element Protocol Translator (FEPT)
    - Removal of sensitive data
    - Reformats or translates data into standard formats for exportation

Background – Information Relay Project

- Why use the relay approach?
  - Scheduling for dial on demand network
  - User definable schedules (Future)
    - Winter
    - Summer
    - Storm Events
  - Testability
  - Process Isolation
  - Reliability
  - Oversight

Background – Information Relay Project

- Why use the relay approach? (Cont)
  - Aggregation and Standardization of data feeds
  - Dynamic feeds, change as required
  - Allows value add consumers to create dynamic applications based on feeds
    - One Stop Shop



Check/Uncheck All

☐ Chain Requirements

☐ Road Information

☐ Incidents

☑ CMS

☑ CCTV

☑ RWIS

☐ Traffic Conditions

Legend: CCTV, CMS, RWIS

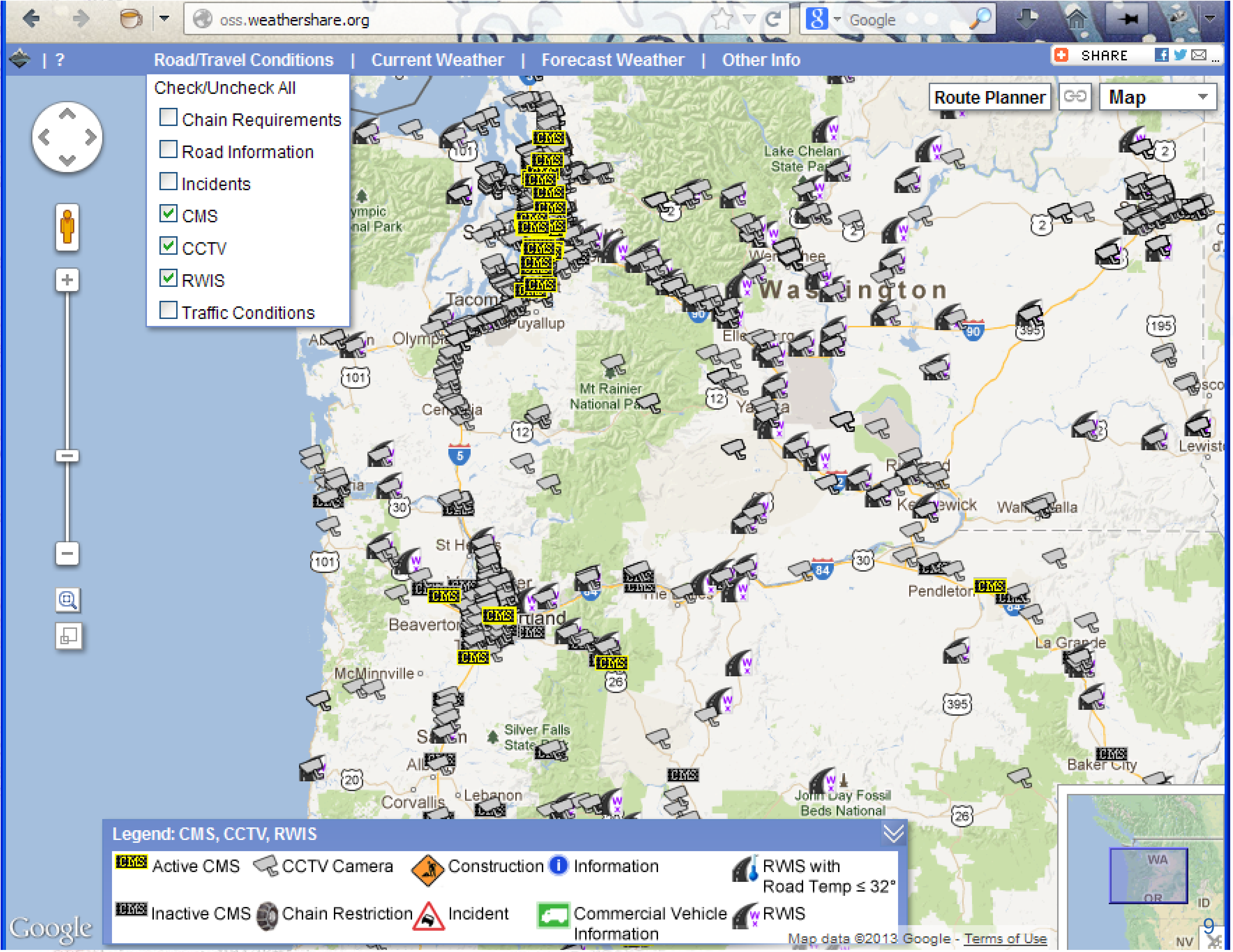
CMS Active CMS	CCTV Camera	Construction	Information	RWIS with Road Temp ≤ 32°
CMS Inactive CMS	Chain Restriction	Incident	Commercial Vehicle Information	RWIS

10 CCTVs

2 CMSs

2 RWISs

Small scale is possible to statically maintain



oss.weathershare.org

| ? Road/Travel Conditions | Current Weather | Forecast Weather | Other Info

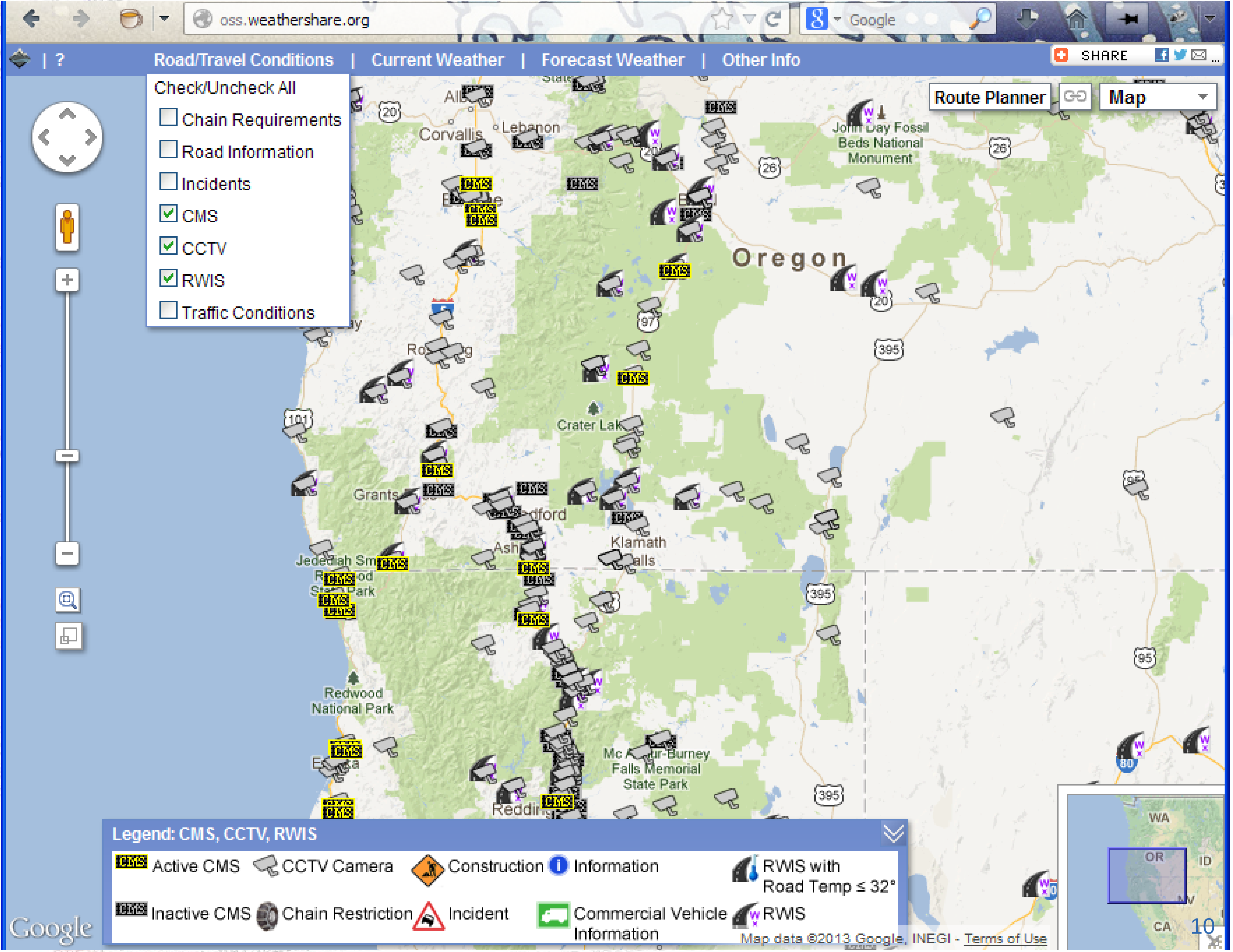
Check/Uncheck All

- ☐ Chain Requirements
- ☐ Road Information
- ☐ Incidents
- ☑ CMS
- ☑ CCTV
- ☑ RWIS
- ☐ Traffic Conditions

Legend: CMS, CCTV, RWIS

- CMS Active CMS
- CCTV Camera
- Construction
- Information
- RWIS with Road Temp ≤ 32°
- CMS Inactive CMS
- Chain Restriction
- Incident
- Commercial Vehicle Information
- RWIS

Map data ©2013 Google - Terms of Use



oss.weathershare.org
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Road/Travel Conditions | Current Weather | Forecast Weather | Other Info
SHARE
Route Planner
Map
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Corvallis
Lebanon
John Day Fossil Beds National Monument
Crater Lake
Grants
Medford
Ashland
Klamath Falls
Jedediah Smith Redwood State Park
Redwood National Park
McArthur-Burney Falls Memorial State Park
Redding
Eureka
WA
OR
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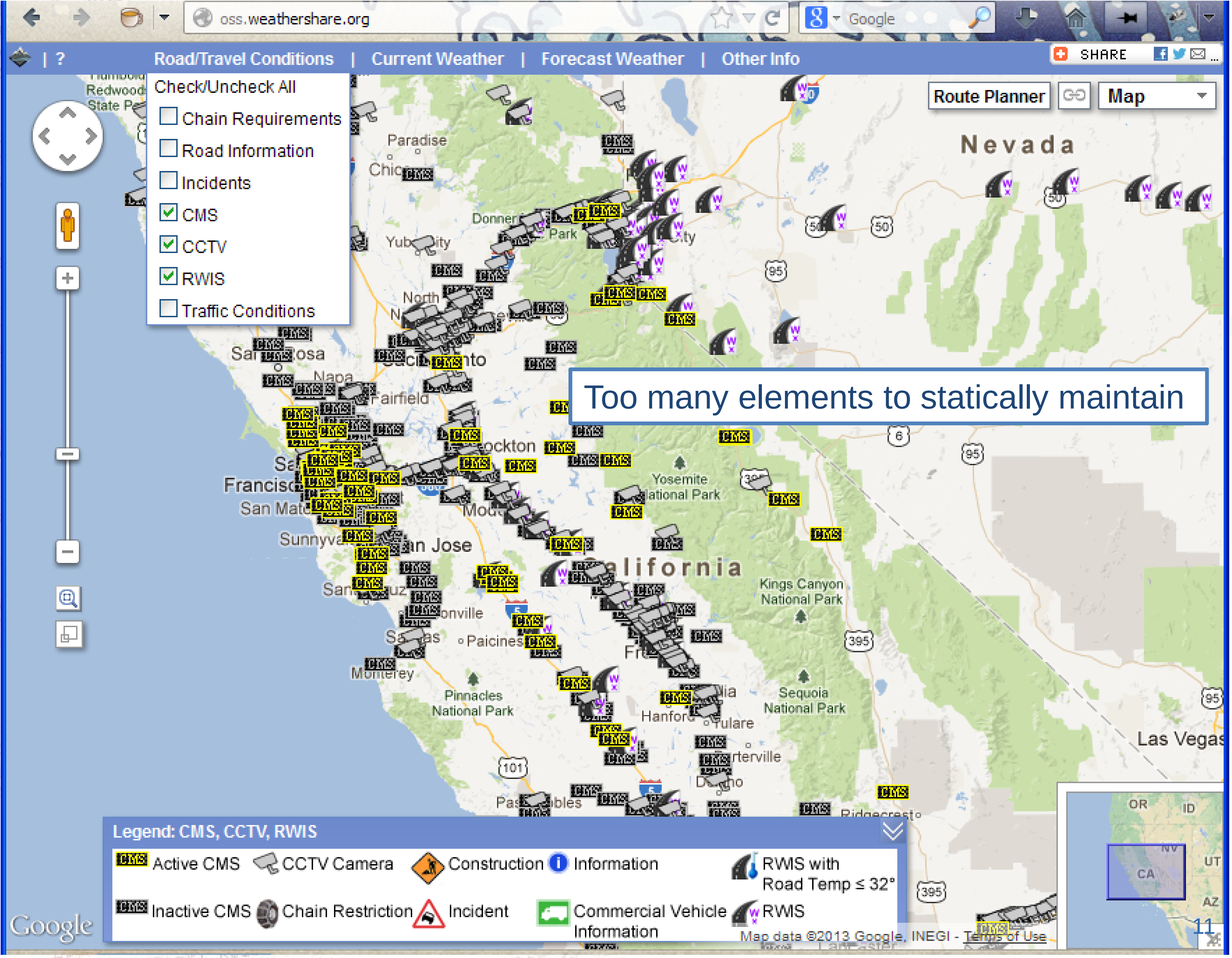
Map data ©2013 Google, INEGI - Terms of Use

Check/Uncheck All

- □ Chain Requirements
- □ Road Information
- □ Incidents
- ☑ CMS
- ☑ CCTV
- ☑ RWIS
- □ Traffic Conditions

Legend: CMS, CCTV, RWIS

CMS Active CMS	CCTV Camera	Construction	Information	RWIS with Road Temp ≤ 32°
CMS Inactive CMS	Chain Restriction	Incident	Commercial Vehicle Information	RWIS



Check/Uncheck All

- ☐ Chain Requirements
- ☐ Road Information
- ☐ Incidents
- ☑ CMS
- ☑ CCTV
- ☑ RWIS
- ☐ Traffic Conditions

Legend: CMS, CCTV, RWIS

- CMS Active CMS
- CCTV Camera
- Construction
- Information
- RWS with Road Temp ≤ 32°
- CMS Inactive CMS
- Chain Restriction
- Incident
- Commercial Vehicle Information
- RWS

Too many elements to statically maintain ject

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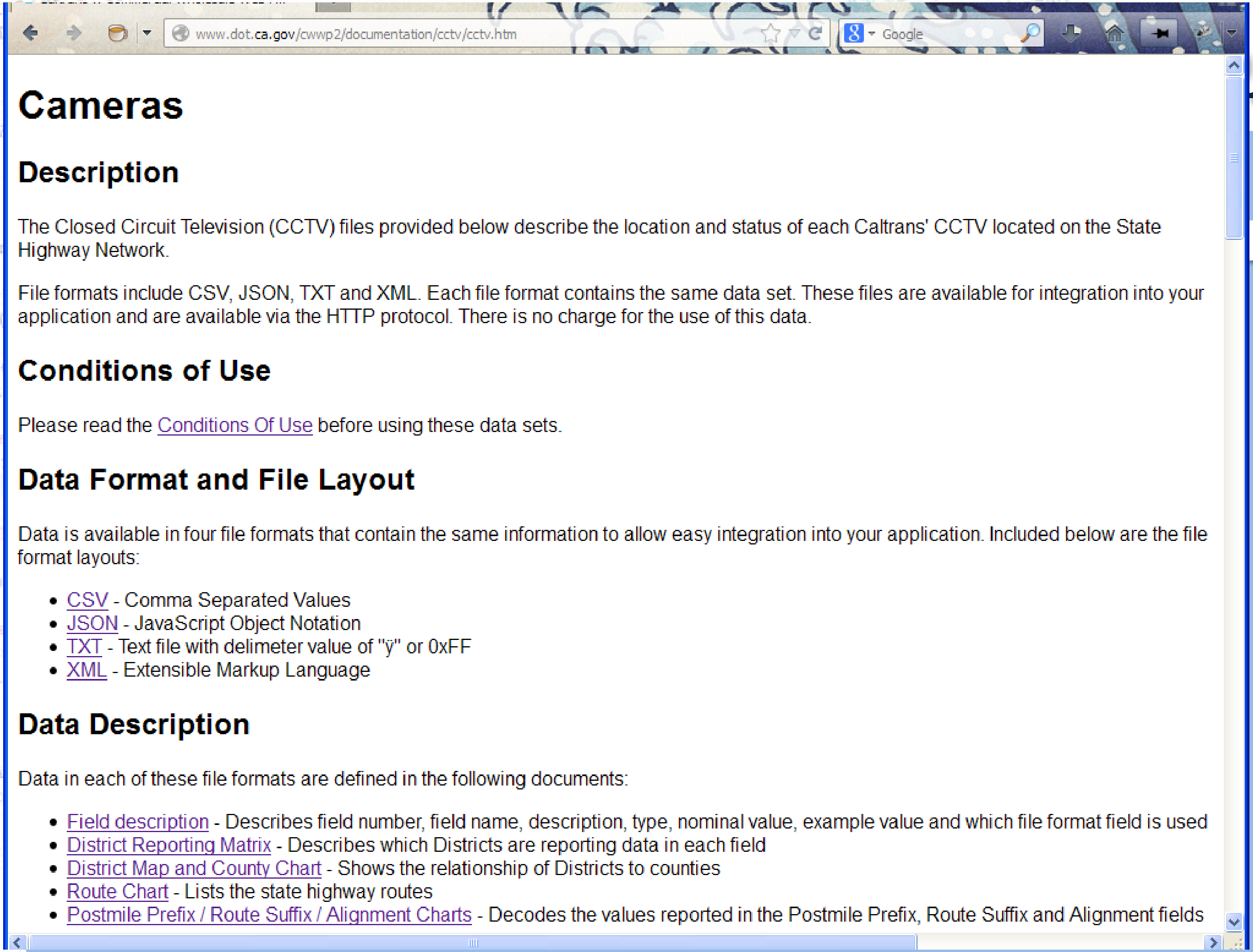


Cameras

Description

The Closed Circuit Television (CCTV) files provided below describe the location and status of each Caltrans' CCTV located on the State Highway Network.

File formats include CSV, JSON, TXT and XML. Each file format contains the same data set. These files are available for integration into your application and are available via the HTTP protocol. There is no charge for the use of this data.

Conditions of Use

Please read the Conditions Of Use before using these data sets.

Data Format and File Layout

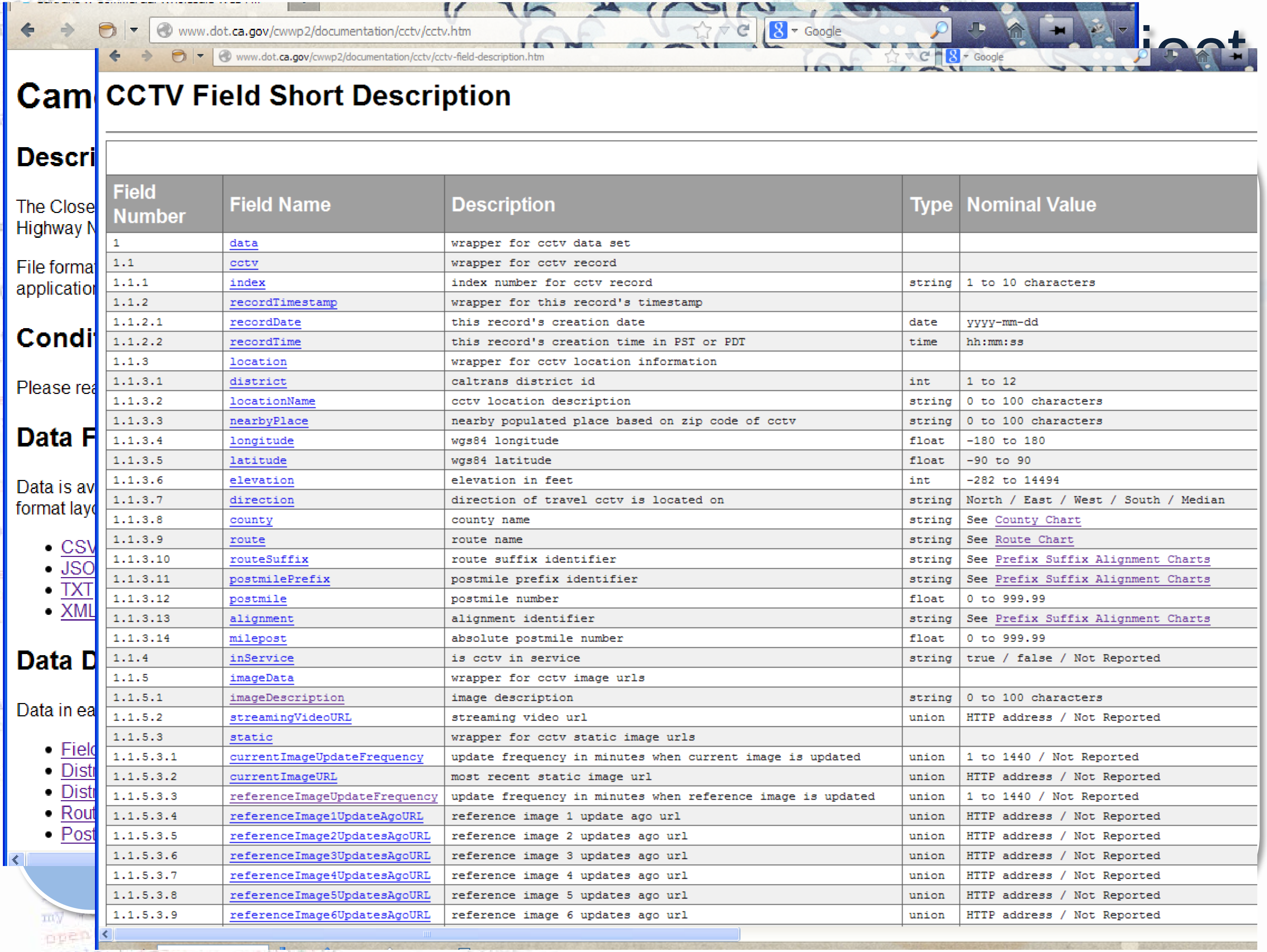
Data is available in four file formats that contain the same information to allow easy integration into your application. Included below are the file format layouts:

- CSV - Comma Separated Values
- JSON - JavaScript Object Notation
- TXT - Text file with delimeter value of "ÿ" or 0xFF
- XML - Extensible Markup Language

Data Description

Data in each of these file formats are defined in the following documents:

- Field description - Describes field number, field name, description, type, nominal value, example value and which file format field is used
- District Reporting Matrix - Describes which Districts are reporting data in each field
- District Map and County Chart - Shows the relationship of Districts to counties
- Route Chart - Lists the state highway routes
- Postmile Prefix / Route Suffix / Alignment Charts - Decodes the values reported in the Postmile Prefix, Route Suffix and Alignment fields


www.dot.ca.gov/cwwp2/documentation/cctv/cctv.htm
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CCTV Field Short Description

Field Number	Field Name	Description	Type	Nominal Value
1	data	wrapper for cctv data set		
1.1	cctv	wrapper for cctv record		
1.1.1	index	index number for cctv record	string	1 to 10 characters
1.1.2	recordTimestamp	wrapper for this record's timestamp		
1.1.2.1	recordDate	this record's creation date	date	yyyy-mm-dd
1.1.2.2	recordTime	this record's creation time in PST or PDT	time	hh:mm:ss
1.1.3	location	wrapper for cctv location information		
1.1.3.1	district	caltrans district id	int	1 to 12
1.1.3.2	locationName	cctv location description	string	0 to 100 characters
1.1.3.3	nearbyPlace	nearby populated place based on zip code of cctv	string	0 to 100 characters
1.1.3.4	longitude	wgs84 longitude	float	-180 to 180
1.1.3.5	latitude	wgs84 latitude	float	-90 to 90
1.1.3.6	elevation	elevation in feet	int	-282 to 14494
1.1.3.7	direction	direction of travel cctv is located on	string	North / East / West / South / Median
1.1.3.8	county	county name	string	See County Chart
1.1.3.9	route	route name	string	See Route Chart
1.1.3.10	routeSuffix	route suffix identifier	string	See Prefix Suffix Alignment Charts
1.1.3.11	postmilePrefix	postmile prefix identifier	string	See Prefix Suffix Alignment Charts
1.1.3.12	postmile	postmile number	float	0 to 999.99
1.1.3.13	alignment	alignment identifier	string	See Prefix Suffix Alignment Charts
1.1.3.14	milepost	absolute postmile number	float	0 to 999.99
1.1.4	inService	is cctv in service	string	true / false / Not Reported
1.1.5	imageData	wrapper for cctv image urls		
1.1.5.1	imageDescription	image description	string	0 to 100 characters
1.1.5.2	streamingVideoURL	streaming video url	union	HTTP address / Not Reported
1.1.5.3	static	wrapper for cctv static image urls		
1.1.5.3.1	currentImageUpdateFrequency	update frequency in minutes when current image is updated	union	1 to 1440 / Not Reported
1.1.5.3.2	currentImageURL	most recent static image url	union	HTTP address / Not Reported
1.1.5.3.3	referenceImageUpdateFrequency	update frequency in minutes when reference image is updated	union	1 to 1440 / Not Reported
1.1.5.3.4	referenceImage1UpdateAgoURL	reference image 1 update ago url	union	HTTP address / Not Reported
1.1.5.3.5	referenceImage2UpdatesAgoURL	reference image 2 updates ago url	union	HTTP address / Not Reported
1.1.5.3.6	referenceImage3UpdatesAgoURL	reference image 3 updates ago url	union	HTTP address / Not Reported
1.1.5.3.7	referenceImage4UpdatesAgoURL	reference image 4 updates ago url	union	HTTP address / Not Reported
1.1.5.3.8	referenceImage5UpdatesAgoURL	reference image 5 updates ago url	union	HTTP address / Not Reported
1.1.5.3.9	referenceImage6UpdatesAgoURL	reference image 6 updates ago url	union	HTTP address / Not Reported

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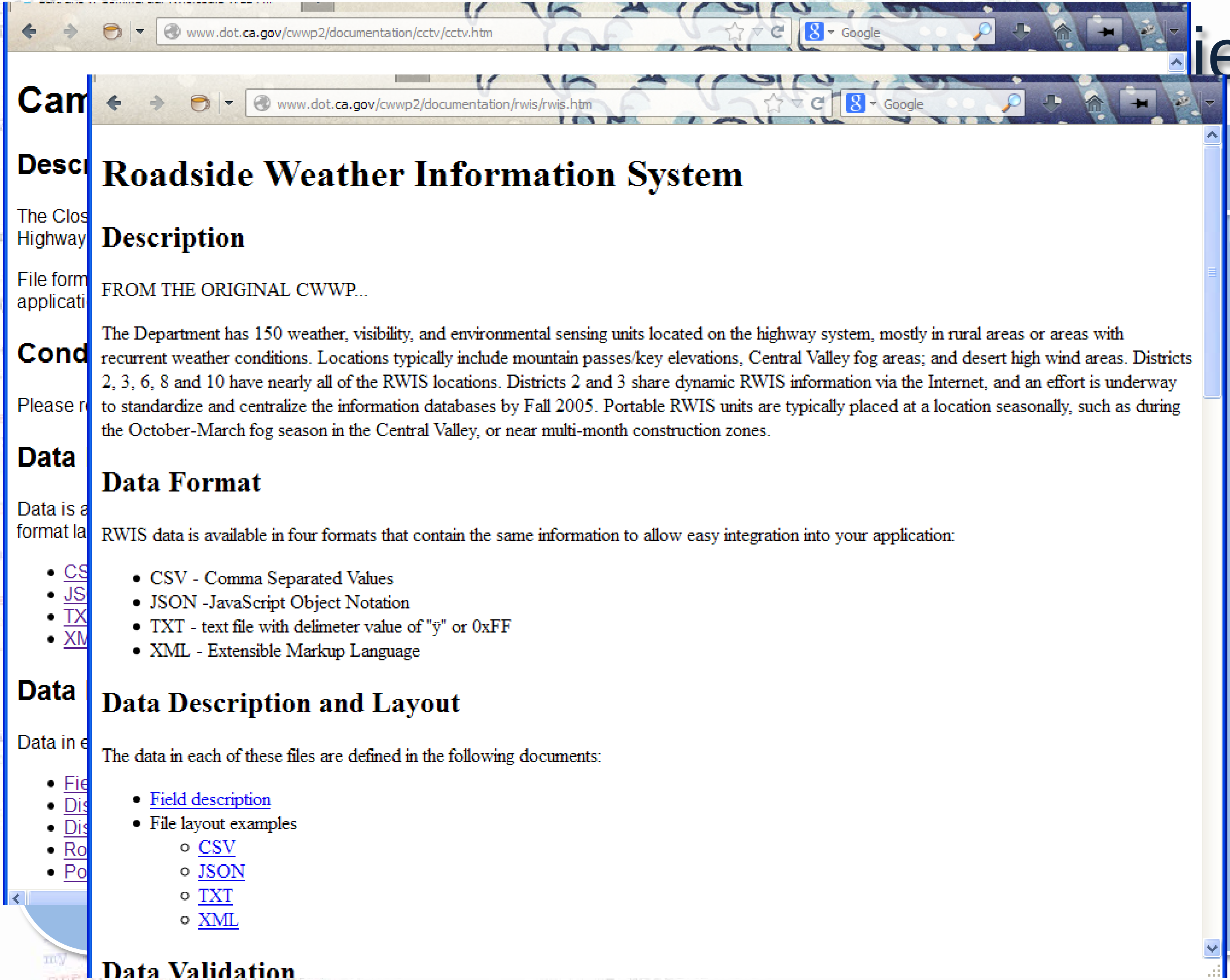

www.dot.ca.gov/cwwp2/documentation/cctv/cctv.htm

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www.dot.ca.gov/cwwp2/documentation/rwis/rwis.htm

Google

Roadside Weather Information System

Description

FROM THE ORIGINAL CWWP...

The Department has 150 weather, visibility, and environmental sensing units located on the highway system, mostly in rural areas or areas with recurrent weather conditions. Locations typically include mountain passes/key elevations, Central Valley fog areas; and desert high wind areas. Districts 2, 3, 6, 8 and 10 have nearly all of the RWIS locations. Districts 2 and 3 share dynamic RWIS information via the Internet, and an effort is underway to standardize and centralize the information databases by Fall 2005. Portable RWIS units are typically placed at a location seasonally, such as during the October-March fog season in the Central Valley, or near multi-month construction zones.

Data Format

RWIS data is available in four formats that contain the same information to allow easy integration into your application:

- CSV - Comma Separated Values
- JSON -JavaScript Object Notation
- TXT - text file with delimeter value of "ÿ" or 0xFF
- XML - Extensible Markup Language

Data Description and Layout

The data in each of these files are defined in the following documents:

- Field description
- File layout examples
  - CSV
  - JSON
  - TXT
  - XML

Data Validation

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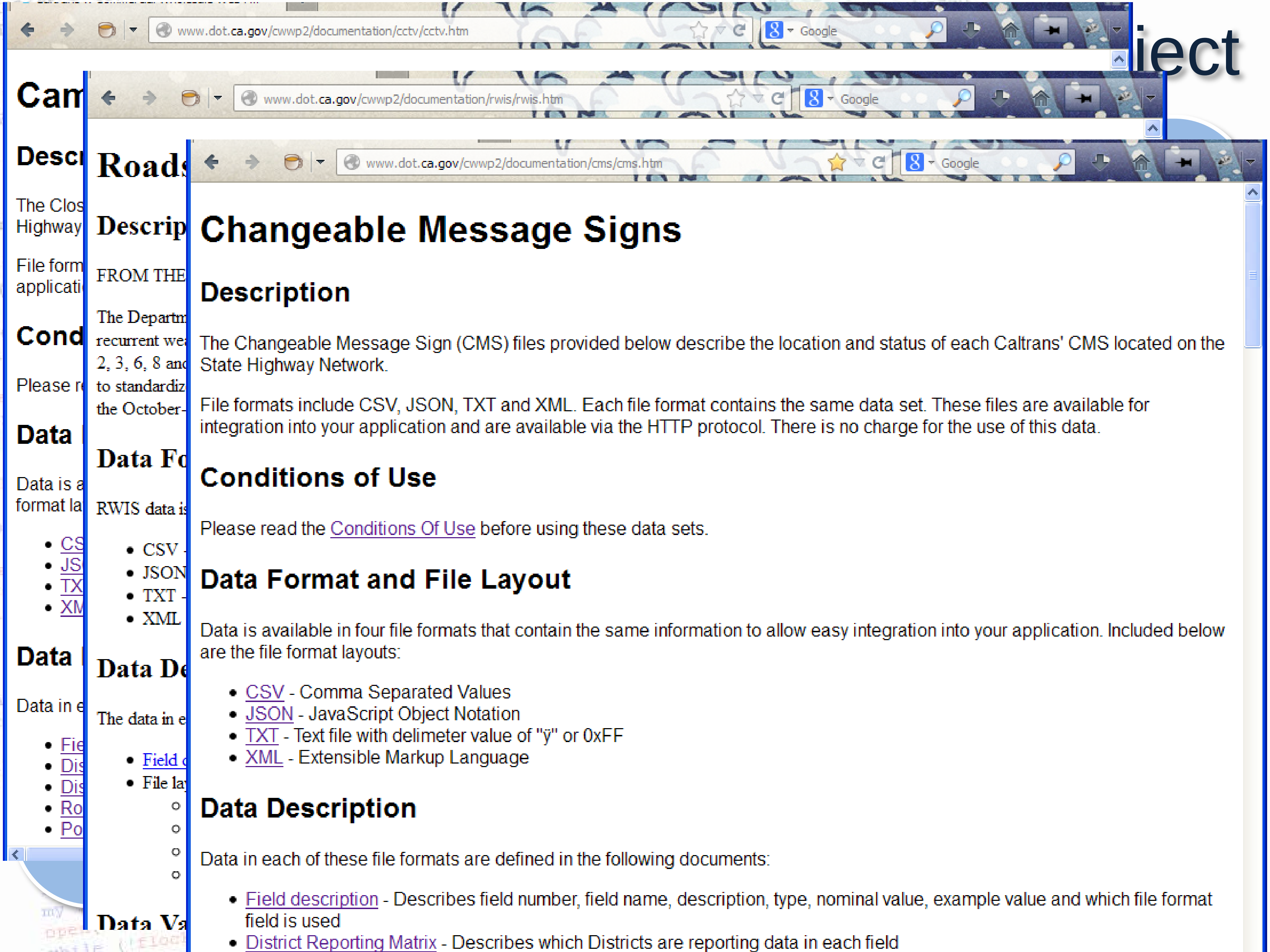
www.dot.ca.gov/cwwp2/documentation/cctv/cctv.htm
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Changeable Message Signs

Description

The Changeable Message Sign (CMS) files provided below describe the location and status of each Caltrans' CMS located on the State Highway Network.

File formats include CSV, JSON, TXT and XML. Each file format contains the same data set. These files are available for integration into your application and are available via the HTTP protocol. There is no charge for the use of this data.

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Data Description

Data in each of these file formats are defined in the following documents:

- Field description - Describes field number, field name, description, type, nominal value, example value and which file format field is used
- District Reporting Matrix - Describes which Districts are reporting data in each field

Background - Information Relay Project

- Pre-Relay implementation
  - Advantages
    - Code development done by IT
    - Ongoing resources done by IT
  - Deficiencies
    - Dial on demand limitations
      - Fixed number of outgoing modems and phone lines
      - Unknown number of users
      - Vulnerabilities
      - Possible overloading
    - Hard to test and troubleshoot processes
      - Several critical processes not within our ability test or troubleshoot

Background - Information Relay Project

- Pre-Relay implementation (Cont)
  - – Deficiencies (Cont)
    - Reliably
      - – Too many “Hand-offs” between devices
      - – Usually hosted on a server with several other processes
      - – No process isolation
    - Oversight
      - – Long delays when problems are identified
      - – System administrators do not always understand ramifications on all processes on server
    - No uptime/downtime statistics
    - No aggregate point for value add and internal users to access data
    - No standardization in file formats or presentation

Background - Information Relay Project

- Post-Relay implementation
  - Advantages
    - Effective management of dial on demand network
      - Ability to coordinate information gathering from ITS Nodes
      - Strict timing schedule, optimizes outgoing lines
    - Testability
      - Strict regimented testing procedures of code
      - Production and backup/sandbox relays
    - Reliability
      - Engineered approach with modularized coding practices

Background - Information Relay Project

- Post-Relay implementation (Cont)
  - Advantages (Cont)
    - Oversight
      - Process controlled from start to finish
    - Processes and system isolation
      - One process per hardware installation
      - Lessens the chance of one process affecting another
      - Helps with troubleshooting
    - Programming Language (Perl)
      - Versatile
      - Easy to learn
      - Interpreted language

Background - Information Relay Project

- Post-Relay implementation (Cont)
  - Advantages (Cont)
    - Standardization of file formats
      - XML
      - JSON
      - Text/CSV
      - Images
    - Data is aggregated at one central point
      - Commercial Wholesale Web Portal 2 (CWWP2)

Background - Information Relay Project

- Post-Relay implementation (Cont)
  - – Disadvantages
    - Programming Language (Perl)
      - – Office must know the specific programming language to ensure ongoing support and troubleshooting
      - – Limitations of programming language and third party modules
    - Development and support resources

Background - Hardware

Moxa DA-661 Embedded Linux Server

MOXA
Data Acquisition Computer
DA-661
D02 Central SOCCS Moxa 01
Sync disk ......
D02 Central SOCCS Moxa 02
DA-661-16-LX
Ver 1.5
D02 Central SOCCS Moxa 03
D02 Central SOCCS Moxa 04
D02 Central SOCCS Moxa 05
D02 Central SOCCS Moxa 06
D02 Central SOCCS Moxa 07
D02 Central SOCCS Moxa 08

Background - Hardware

Moxa DA-661 Specifications

- Computer
  - Intel XScale 533 MHz processor
  - 128 MB DRAM onboard
  - 32 MB Flash onboard
  - PCMCIA cardbus

Background - Hardware

Moxa DA-661 Specifications (Cont)

- I/O
  - 2 LAN 10/100Mbps (RJ-45)
  - 16 RS-232/422/485 8-pin (RJ-45) (software config)
- Operating System
  - Linux 2.6.10
  - File system: JFFS2
  - Internet protocols
    - TCP, UDP, IPv4, SNMPv1, ICMP, ARP, HTTP, CHAP, PAP, SSH 1.0/2.0, SSL, DHCP, NTP, NFS, Telnet, FTP, TFTP, PPP, PPPoE

Background - Hardware

Moxa DA-661 Specifications (Cont)

- Operating System (cont)
  - Apache
  - Terminal Server (SSH)
  - Includes Perl 5.6.2
    - Upgradable to Perl 5.10.1

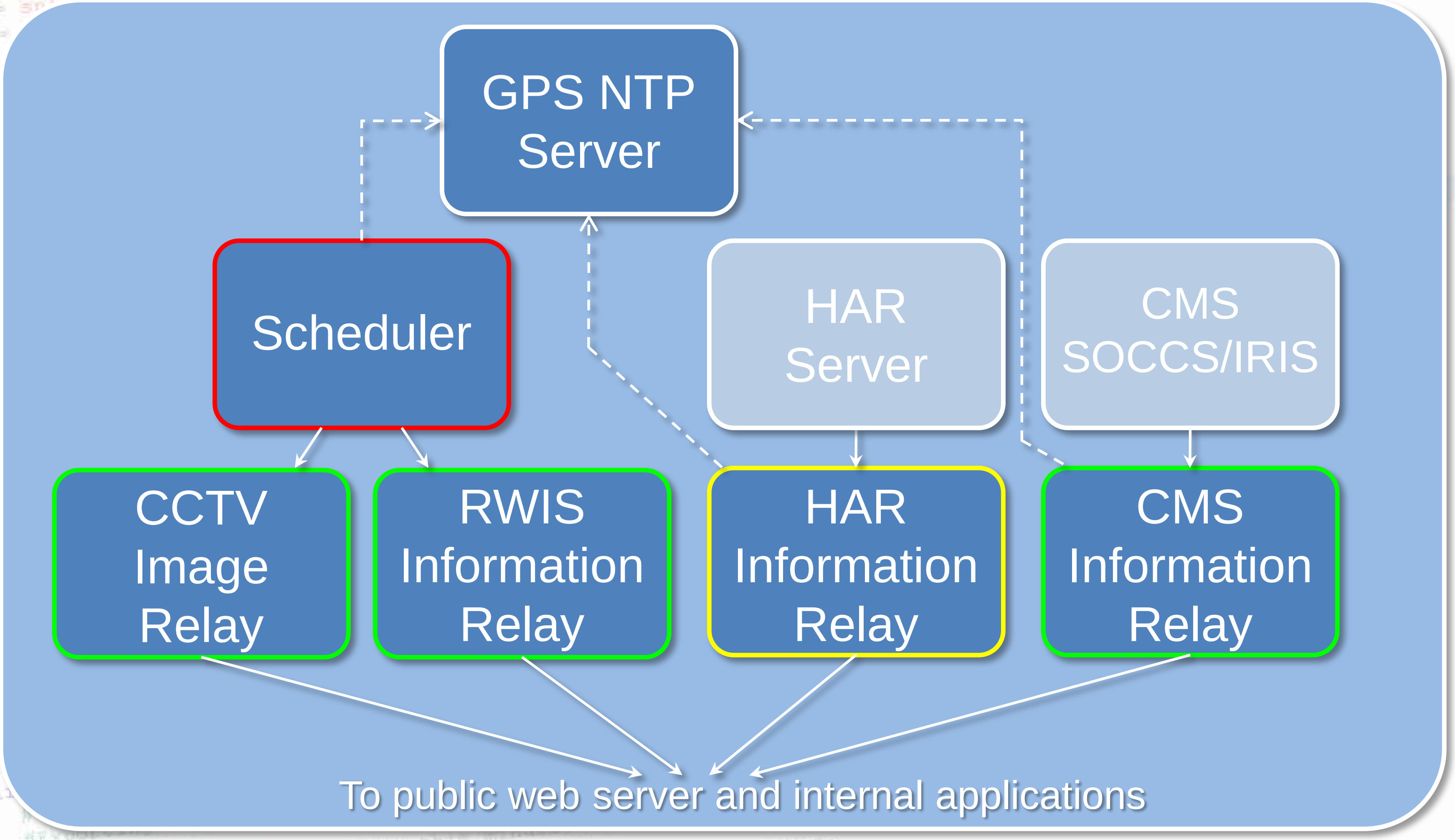
Background - Moxa Pros

- – Relatively cheap embedded device
- – Easy to set up
  - • Technician level employee can install from script on flash card
- – Everything can be stored on removable flash card
- – Failure can be fixed/restored by technician level employee
- – Failure of device only affects a single data set of information
- – Two LAN ports allows device to be on two separate networks
- – Rack mountable
- – Environmentally Hardened
- – Perl 5.6.2 is native
  - • Upgradeable to Perl 5.10.1

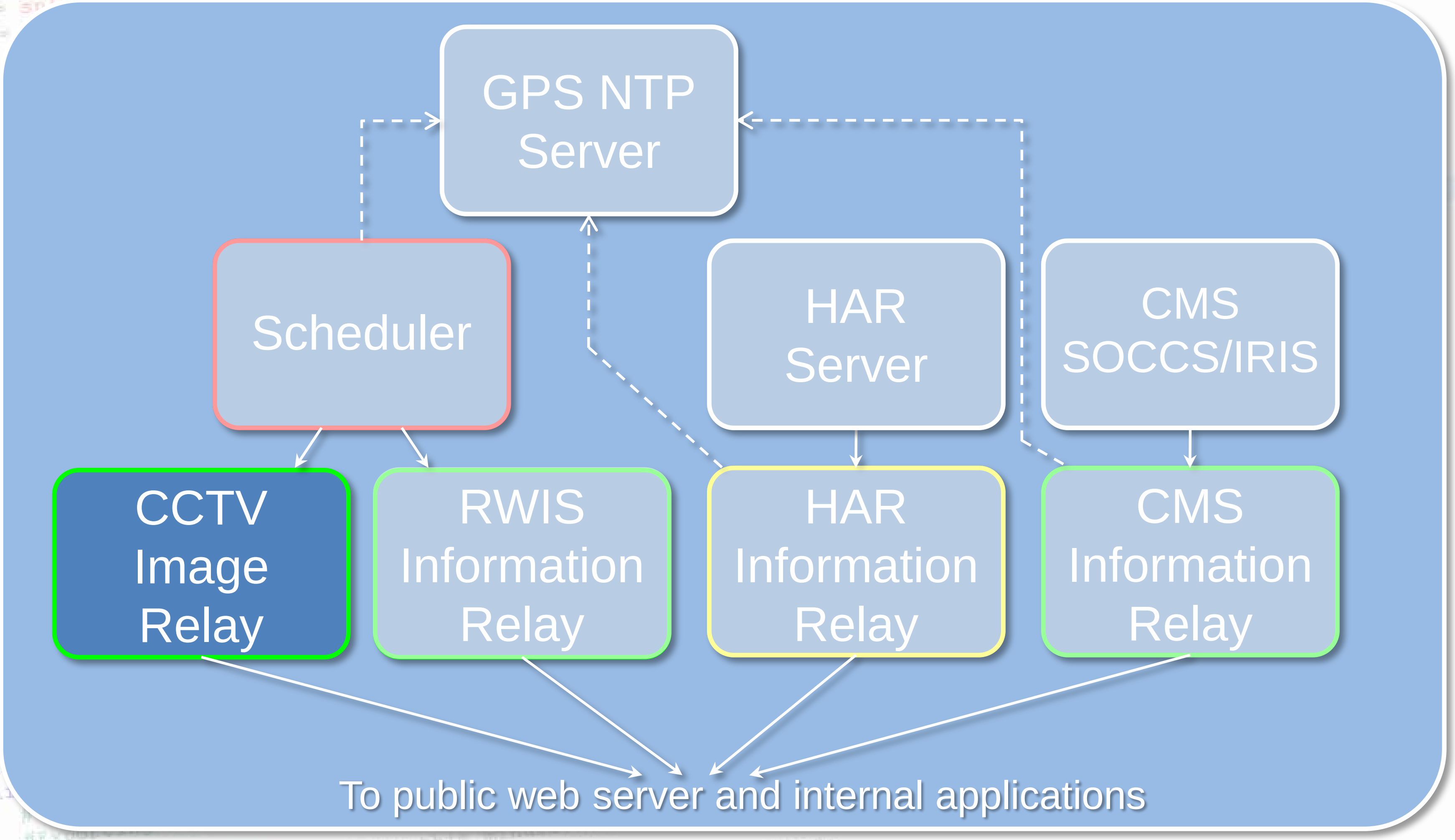
Background - Moxa Cons

- Clock Drift
  - Up to 45 seconds per hour
  - Possible Kernel bug
  - Fixed with firmware version 1.6
- XScale Processor
  - Executable binaries require cross compilation
- Product has been set for End of Life summer of 2013
- Company
  - Inconsistent/Poor support
    - High turnover of employees (Lack of expertise on older platforms)
    - Hard to get to fix firmware issues.
      - Compact Flash issue
  - Lack of good documentation
  - Instability in product line
    - Adopting a Cisco style of product life cycle
    - Renew product line every few years

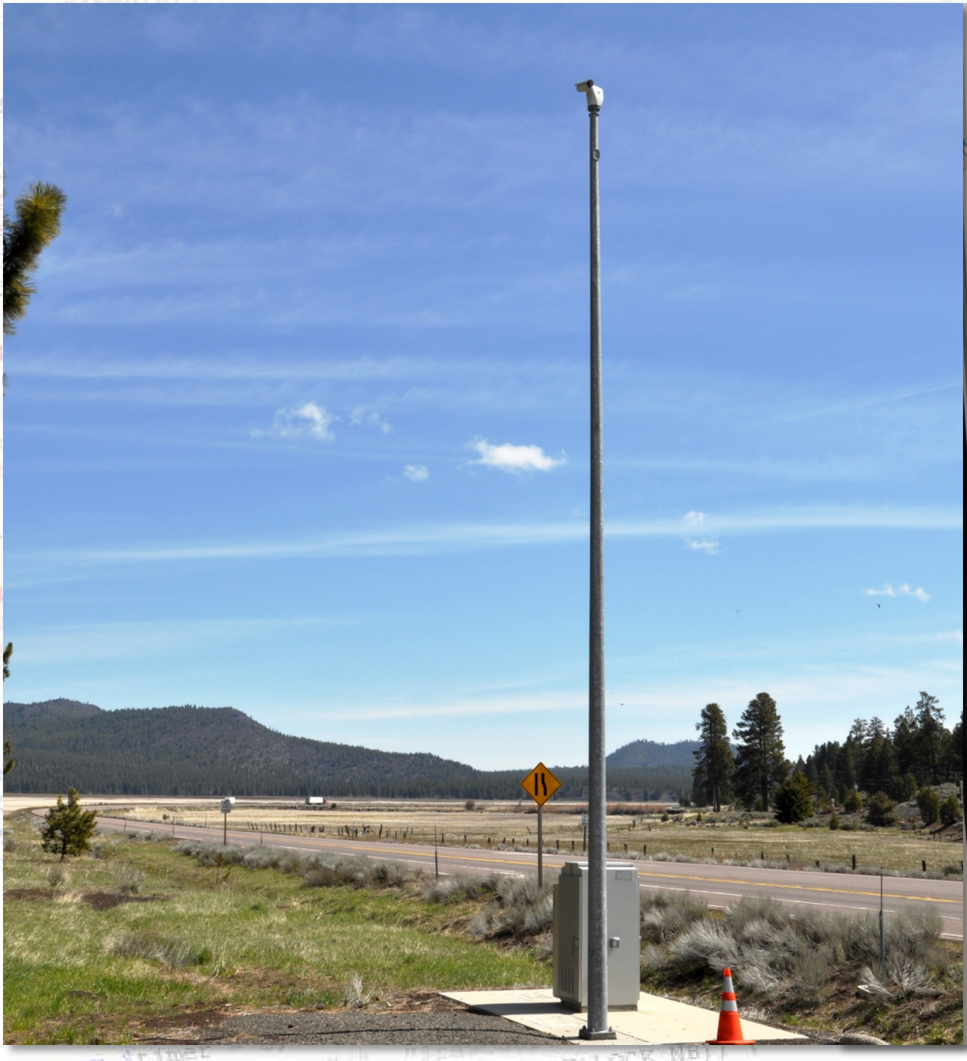
Information Relay System Architecture

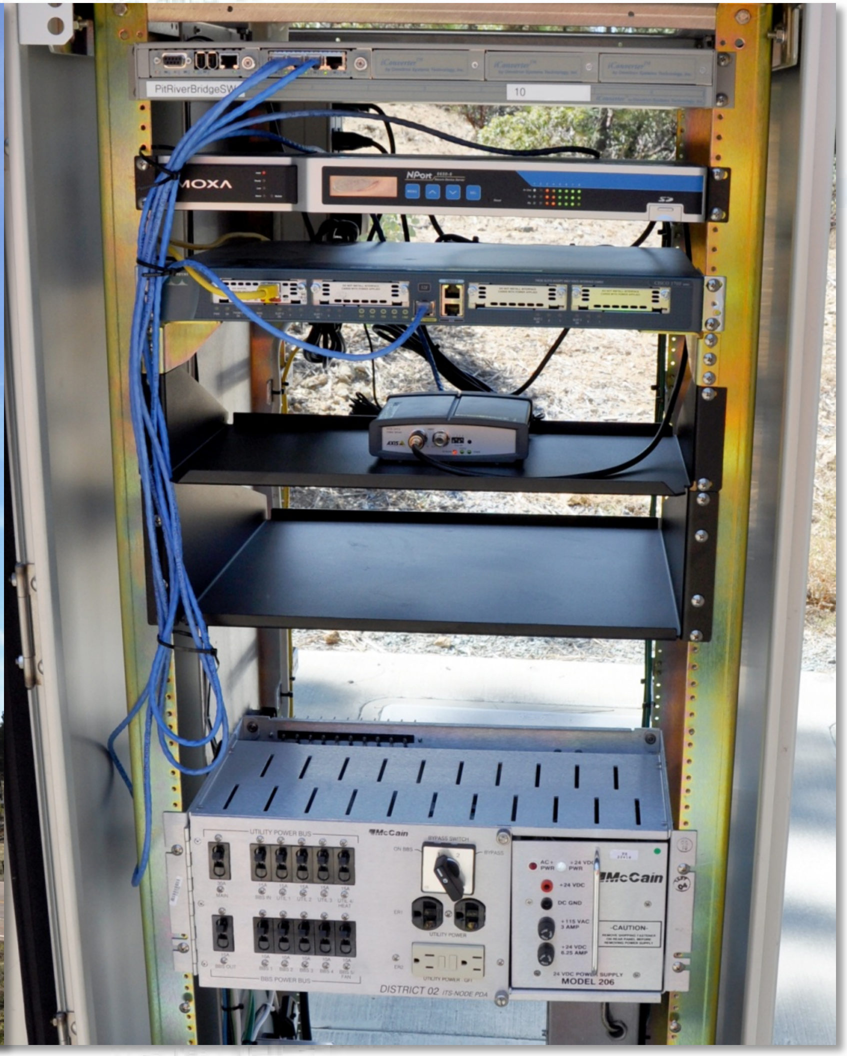


CCTV Image Relay



Grass Lake CCTV





Architecture

- Departure from Moxa
  - Cross compilation third party applications
    - ImageMagick
    - Newer versions of Perl
    - Perl Modules
  - Ongoing platform support
    - Compact flash issue
    - Life cycle of products
    - Lack of pre-compiles utilities on system

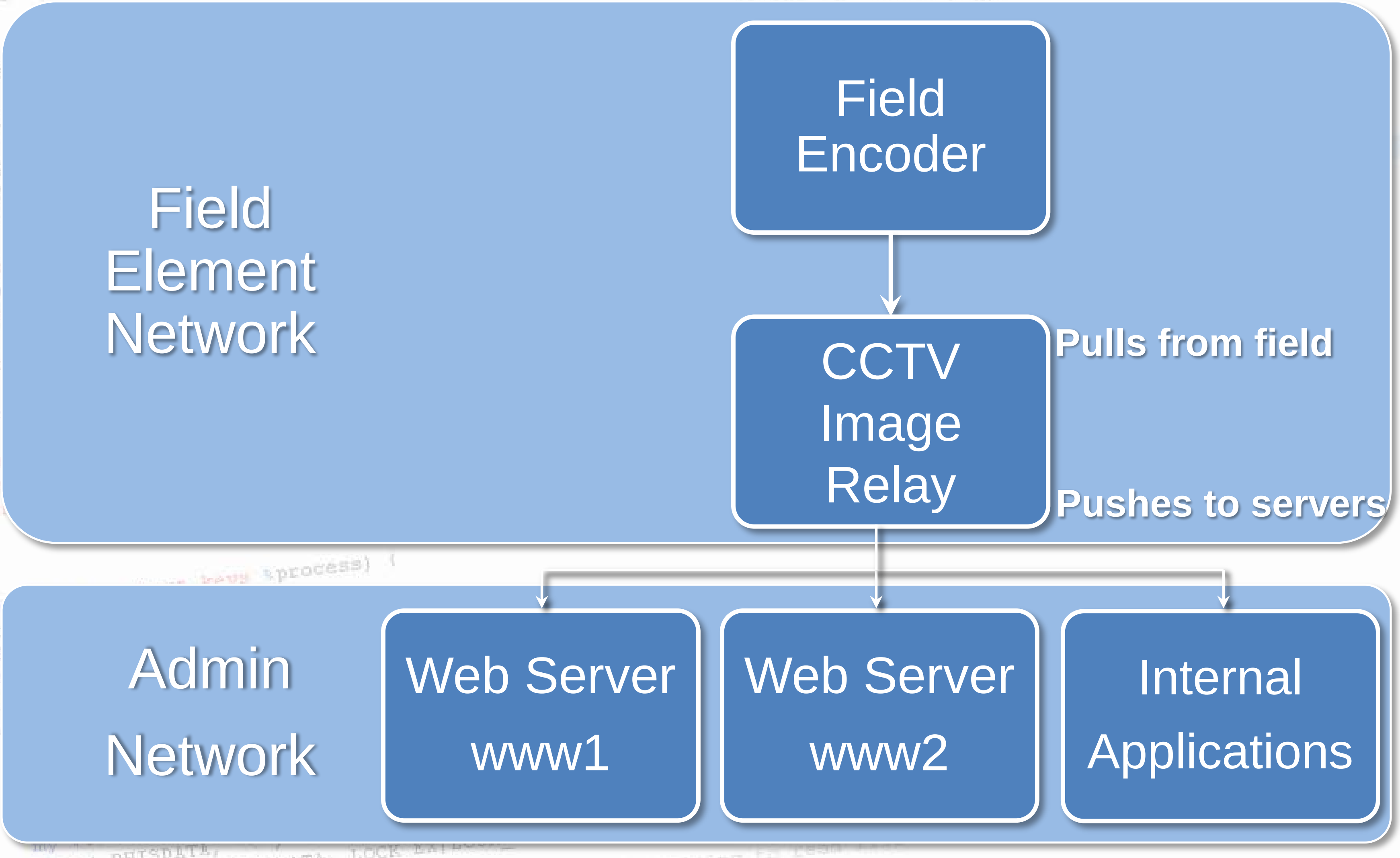
Architecture

- Hardware
  - Standard server hardware
    - Ability to use standard distribution of Linux
    - Ability to use standard Linux applications without cross compiling
- Operating System (Linux)
  - Ubuntu 11
    - Large stable community
    - Very similar to Linux architecture used by Moxa (MontaVista)
      - File structure
      - Configuration
      - MontaVista is for embedded real-time applications
      - Ubuntu is for general server applications
    - Free
    - x86/x64 processor

Pull/Push Methodology

- Pull
  - – Information Relay initiates communication with remote field site in order to “pull” or “grab” desired datasets
- Push
  - – Information Relay initiates communication with Caltrans’ servers to “push” or “deposit” the datasets

Flow of CCTV Data



Field Element Network

Field Encoder

CCTV Image Relay

Pulls from field

Pushes to servers

Admin Network

Web Server www1

Web Server www2

Internal Applications

Architecture

- Programming Language
  - Perl (5.10.1)
    - Easy to learn
    - Interpretive language
    - Similar to PHP
    - Large community of users
    - Lots of resources
    - Third party modules

Development

- Requirements
  - Completely configurable without modifying code
  - Accept current standard “timing” file from scheduler
  - Run for an indefinite time period
    - Trap, recover from, and log all system and communication errors
    - Have debugging options to assist in troubleshooting
    - System “dashboard” to assist in accessing and viewing system and communication logs

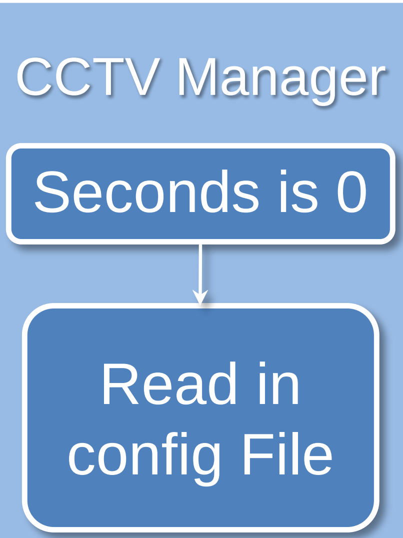
Development

- Requirements (Cont)
  - – Account for rural communication lines
    - Handle long initial connection timeouts
      - – 30-120 seconds to open communication line
    - Mid transfer line failure
      - – Line failing midway through data transfer
    - Slow data transfers
      - – As low as 4800 b/s
  - – Validate Images
    - Check for incomplete images
    - Check for repeat images
    - Check for No Video images

Development

- Requirements (Cont)
  - Timestamp
    - Append timestamp to image without losing any picture information
    - Include in EXIF Date Picture Taken tag
  - Geo-location data
    - County, Route, Postmile, Elevation
      - Include in EXIF comment tag
  - Generate Caltrans Standard Data feeds
    - XML, JSON, TXT, CSV
  - Export Data Feeds to Commercial Wholesale Web Portal (CWWP) and other applications
  - Export Images to CWWP and other applications

Programming



CCTV Manager

Seconds is 0

Read in config File

Programming

- Configurable system Attributes
  - Text configuration file similar to that of Apache

```
# Image Configuration Values
#
#  Image Dimensions
#   -imgWidth is the image width
#   -imgHeight is the image height
#   --Note the final image size will be the height plus
#      the timestamp bar height.
imgWidth=320
imgHeight=240
```

Programming

- Configurable system Attributes
  - Text configuration file similar to that of Apache (Cont)

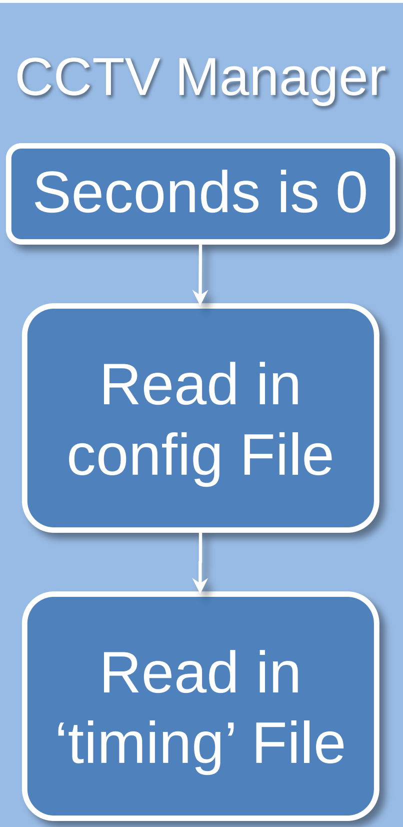
```
#Timstamp information
#
# -pointsize is the size of the font (Arial Bold) in px
# -barHeight is the height of the timestamp bar in px
# -textFill is the color in which the font will be in HEX
# -xpos is the x position of the text in the bar in px
# -ypos is the y position of the text in the bar in px
# -bgcolor is the color of the bar in HEX

pointsize=13
barHeight=20
textFill=ffffff
xpos=+5
ypos=+15
bgcolor=555555
footername=footer
```

Programming

- Configurable system Attributes
  - Text configuration file similar to that of Apache (Cont)

```
#Image Timeout replacement config vars
#
# -toPointsize is the size of the font (Arial Bold) in px
# -toTextFill is the color in which the font will be
# -toxpos is the x position of the text in the bar in px
# -toypos is the y position of the text in the bar in px
# -tobgcolor is the color of the bar in HEX
# -toText is the text displayed on the image use "\n" for
  line break
toPointsize=38
toTextFill=000077
tobgcolor=ffffff
toText=Temporarily\nUnavailable
```

Programming



CCTV Manager

Seconds is 0

Read in config File

Read in ‘timing’ File

Programming

- Accept “timing” file
  - Timing file consists of a semicolon delineated list of site attributes
    - Key
    - Site Name
    - IP Network Address
    - Site Type
    - Communication Type
    - Execution Minute
    - Geo-location Data (Multiple attributes)
    - Reference Image
    - Public Exportable

Programming

- Accept “timing” file (Cont)

```
1; Abrams Lake;     10.xx.xx.xx; CCTV;      ISDN; 0;            SIS;…
2; Anderson Grade;  10.xx.xx.xx; CCTV,RWIS; ISDN; 1,16,31,46;   SIS;…
3; Antlers Bridge;  10.xx.xx.xx; CCTV;      MW;   0,5,10,15,…;  SHA;…
4; AntlersSmtRWIS;  10.xx.xx.xx; RWIS;      POTS; 0,15,30,45;   SHA;…
5; BassMtn;         10.xx.xx.xx; CCTV;      MW;   1,6,11,16,…;  SHA;…
6; Black Butte;     10.xx.xx.xx; CCTV,RWIS; ISDN; 2,17,32,47;   SIS;…
```

****See attached materials for more details**

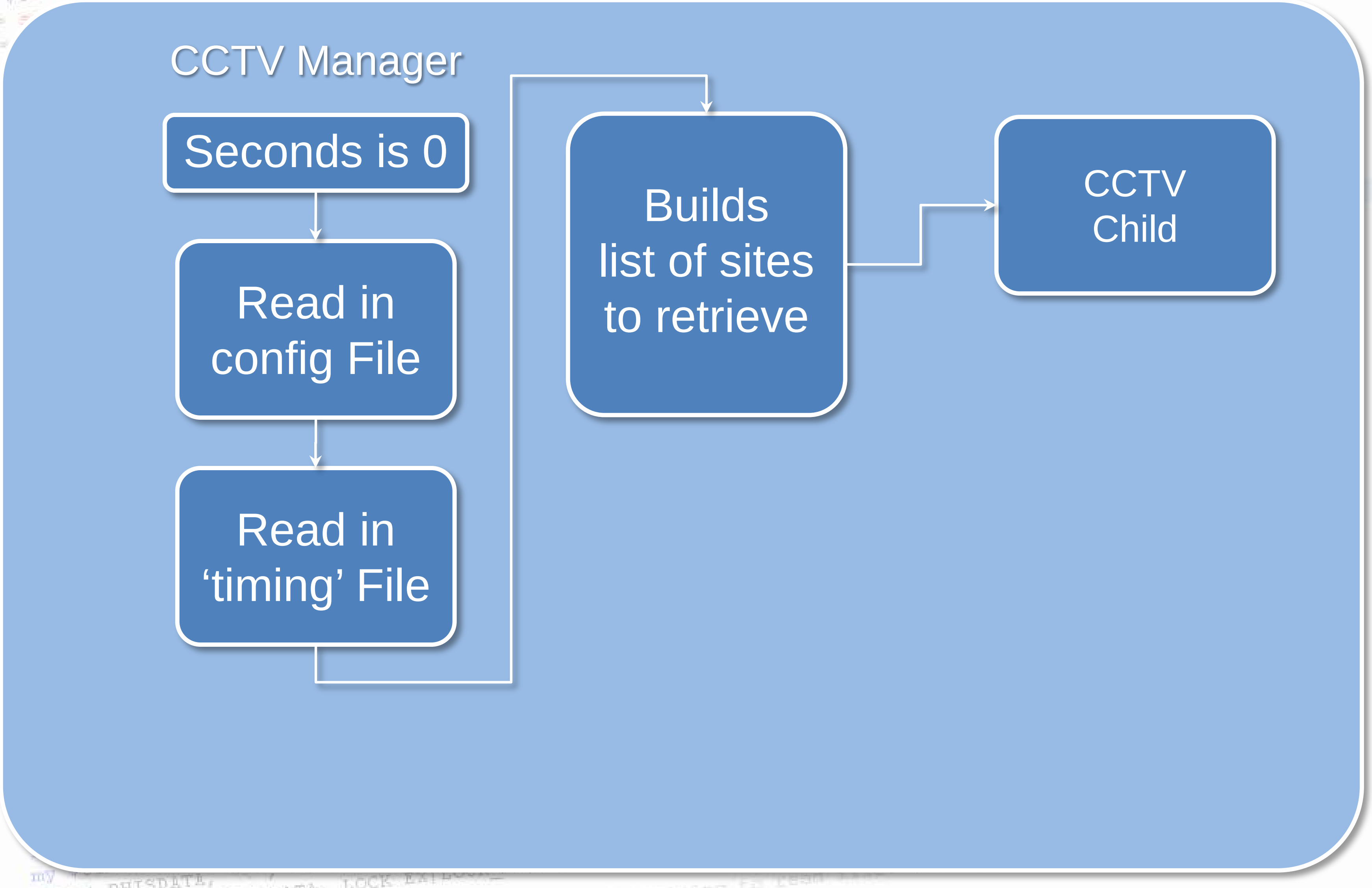
Programming

- Run for indefinite time period
  - – Errors must be trapped, logged and handled appropriately
  - – Modules must check inputs before module starts any execution
  - – Modules must trap errors and relay them to the calling function
    - Critical – stops execution and returns to calling function
    - Non critical – stacks error on error array and continues

Programming

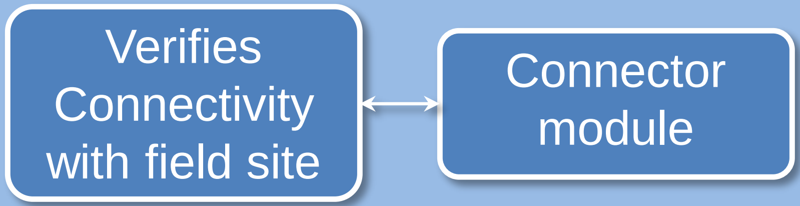
- Run for indefinite time period (Cont)
  - – Modules must check outputs before handing them back to the calling function
  - – Daemon must handle all the “house cleaning”
    - Rotating Logs
    - Time synchronization with GPS/NTP server
    - Parsing/updating system attributes from configuration files

Programming



Programming

CCTVSite Module (CCTV Child)



Verifies Connectivity with field site

Connector module

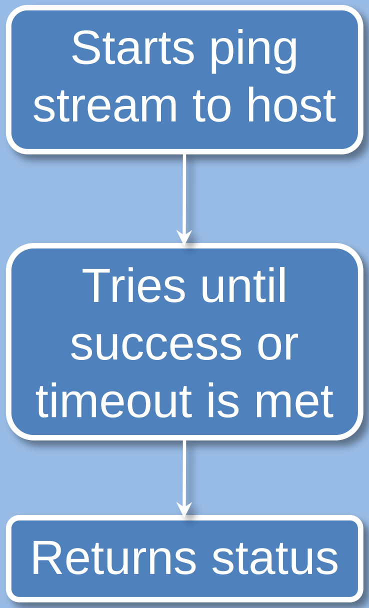
Programming

- Rural Communication
  - Long initial connection timeouts
    - Existing third party modules have unknown coding practices in regards to timeouts
      - Perl LWP typically timed out at 41 seconds even when set at 240 seconds
    - Force, via loops, modules to achieve extra long timeouts

```
my $ConStat = 0;
while ( !($ConStat) && !($endTime <= time) ) {
  my $ping = $p->ping($host, 10);
  $ConStat = $ping;
}
```

Programming

Connector Module

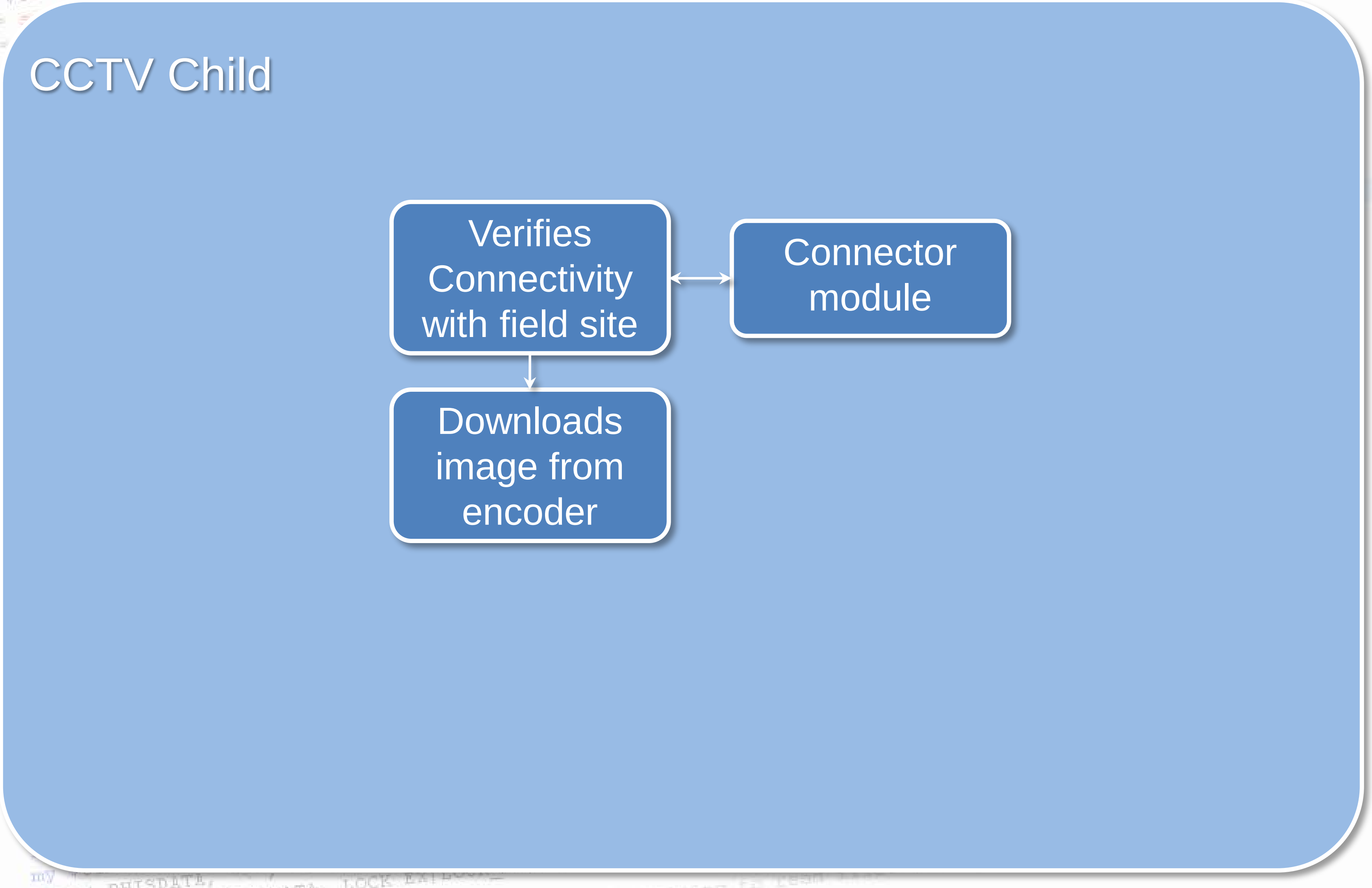


Starts ping stream to host

Tries until success or timeout is met

Returns status

Programming



CCTV Child

Verifies Connectivity with field site

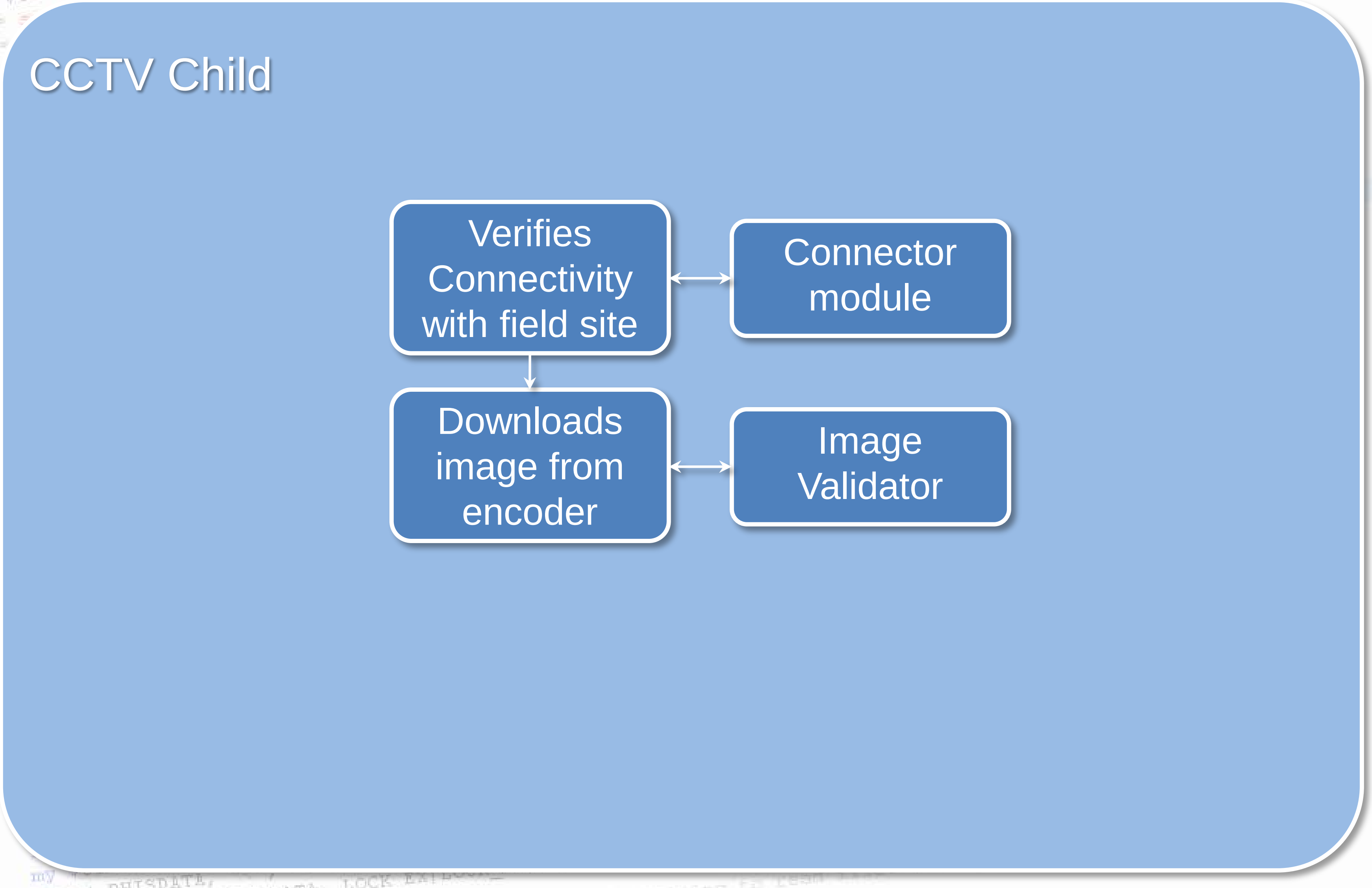
Connector module

Downloads image from encoder

Programming

- Rural Communication (Cont)
  - Mid transfer line failure and slow data rates
    - Long download time often cause programs to fail
      - Oregon Mountain – 5 minutes to download 30KB image
    - Use of robust protocol that allows for checking expected content length
      - HTTP headers has lots of detailed information about what is being sent
      - Use HTTP Content Length to determine expected file size of image being retrieved
      - Use in conjunction with file size of downloaded image to determine if image is complete
      - Use multiple retries if incomplete images are downloaded

Programming


CCTV Child

Verifies Connectivity with field site
Connector module
Downloads image from encoder
Image Validator

Programming

- Validating Image
  - – Keep local site cache
  - – Compare past file sizes
  - – Check likeness of reference image

Programming

- Validating Image (Cont)
  - Keep local site cache
    - Last error/success
      - 0 is success
      - 1 is timeout
      - 2 is unsuccessful get (incomplete image)
      - 3 is File size match
      - 4 is invalid image
    - Last file size
    - Last timestamp (Epoch)

File with no errors

```
0,43451,1366738396
```

File with errors

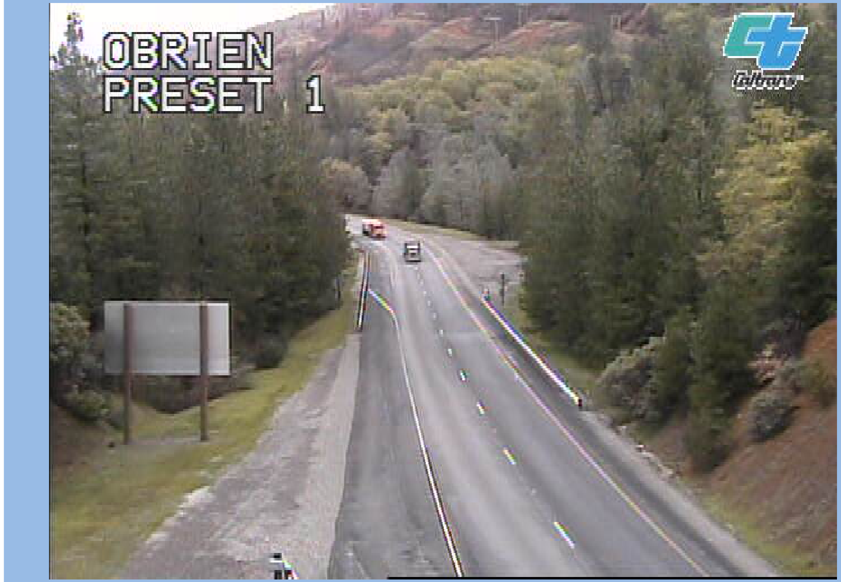
```
0,43154,1366738810
1,43312,1366739012
1,43312,1366739072
1,43312,1366739132
```

Programming

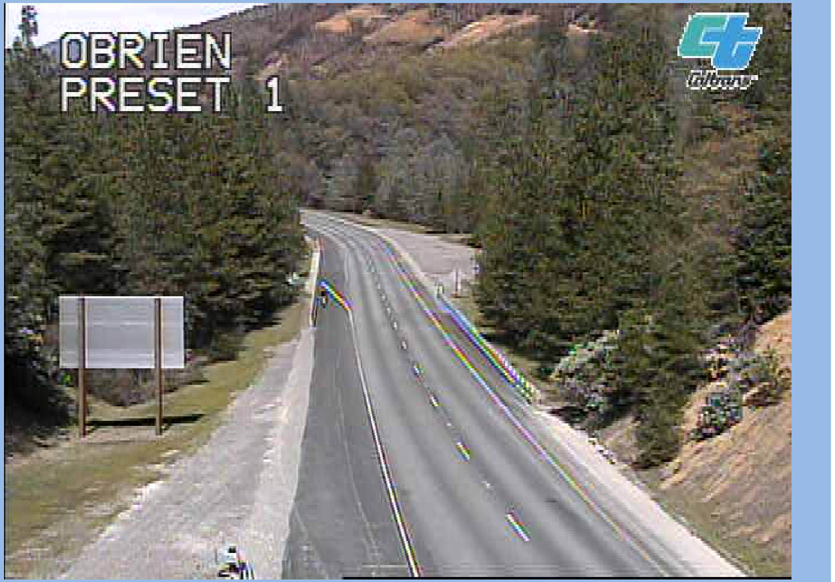
- Validating Image (Cont)
  - – Compare image size
    - Use last stored image size
    - Compare to new image size
  - – Image size comparing issues
    - Possible to have two different images with the same file size
    - Possible to have two sequential images with the same file size
      - – Must use in conjunction with second validation metric

Programming

- Validating Image (Cont)



27967 Bytes

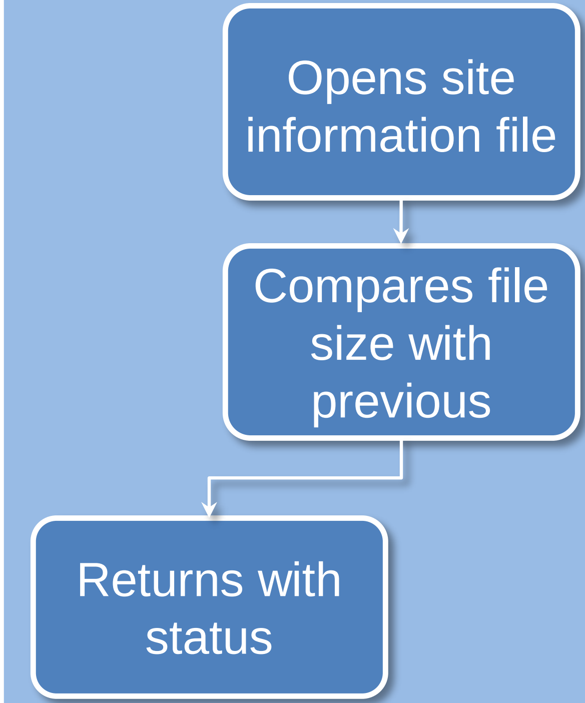


27967 Bytes

Programming

Image Validator

imageValidate



Programming

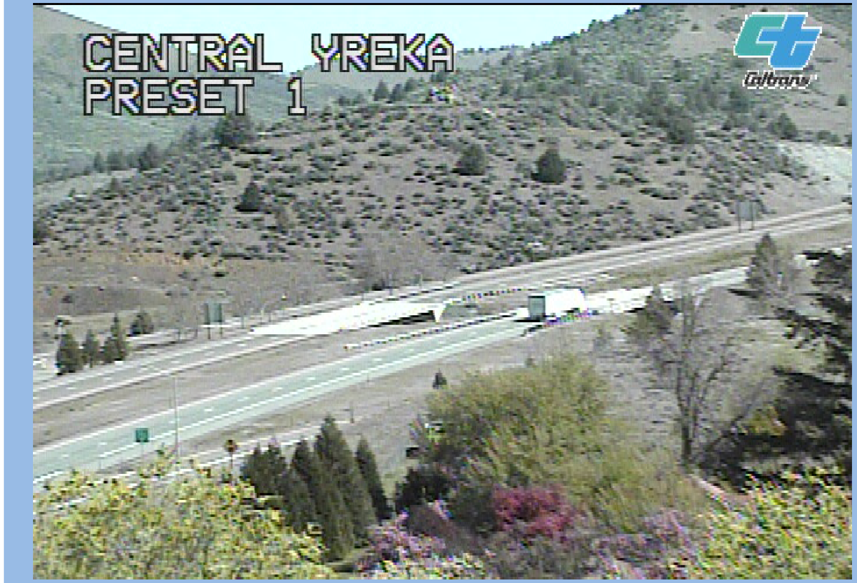
- Validating Image (Cont)
  - – Compare image to *reference* image
  - – Use ImageMagick Perl API to compare images
  - – Use Peak Signal to Noise Ratio
    - Generally used to measure the reconstruction of lossy compression codec, such as JPEG to original uncompressed image
    - Typically the higher the value, expressed in dB, the more similar two compared images are

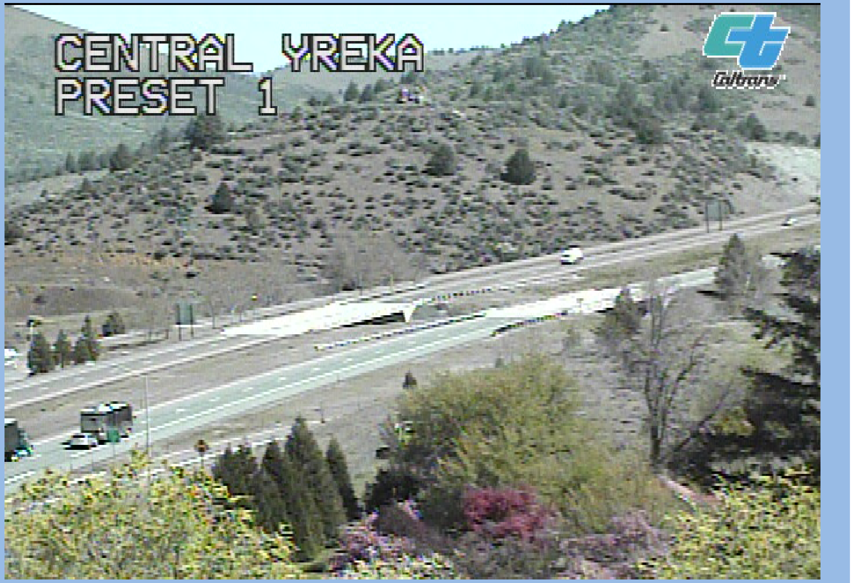
Programming

- Validating Image (Cont)
  - Peak Signal to Noise Ratio
    - Used because JPEG from field are very lossy
    - Not dependent ImageMagick Quality levels set when ImageMagick is compiled or image size
    - Provides a good “knee” point for comparing two images
      - Generally, >35dB images should be considered the same
  - Other Metrics
    - Root Mean Square Error
      - Works if fuzz factor is set high enough
      - Maximum value is set when ImageMagick is compiled
    - Absolute Error
      - Works if fuzz factor is set high enough
      - Generally all pixels are different in lossy images
      - Maximum value is based on size of image

Programming

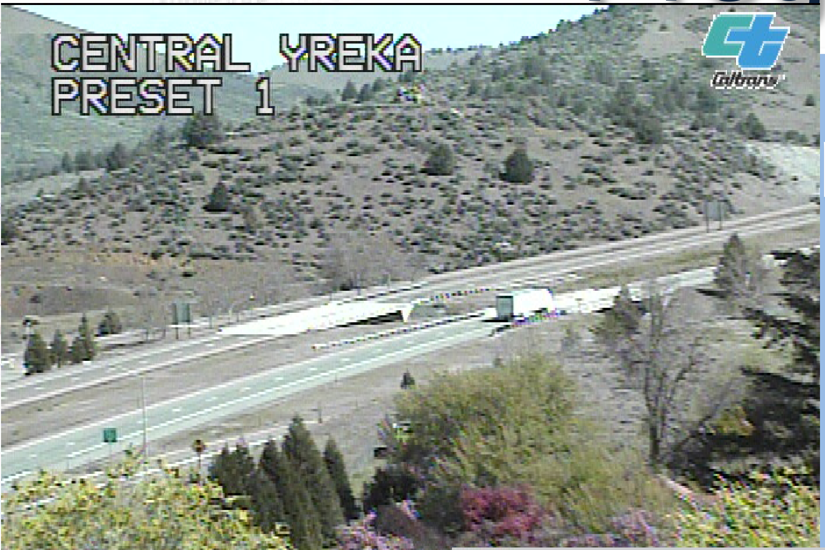
- Image Magick Compare

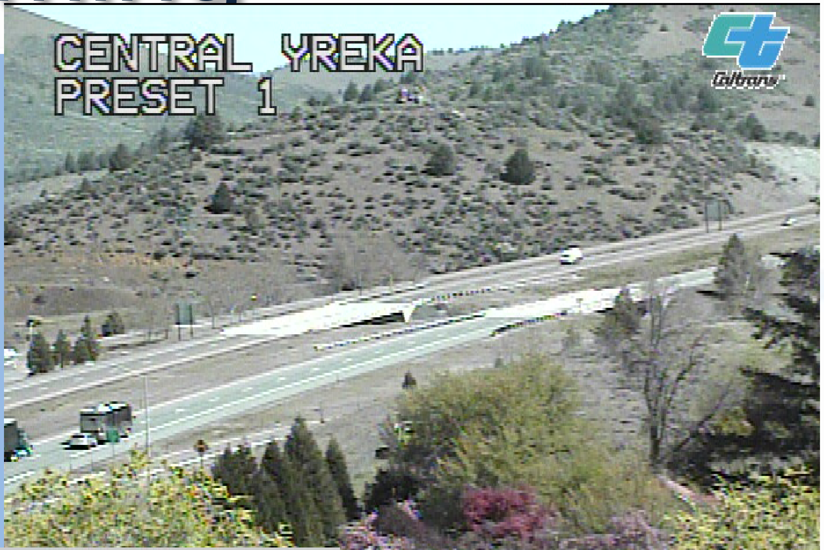


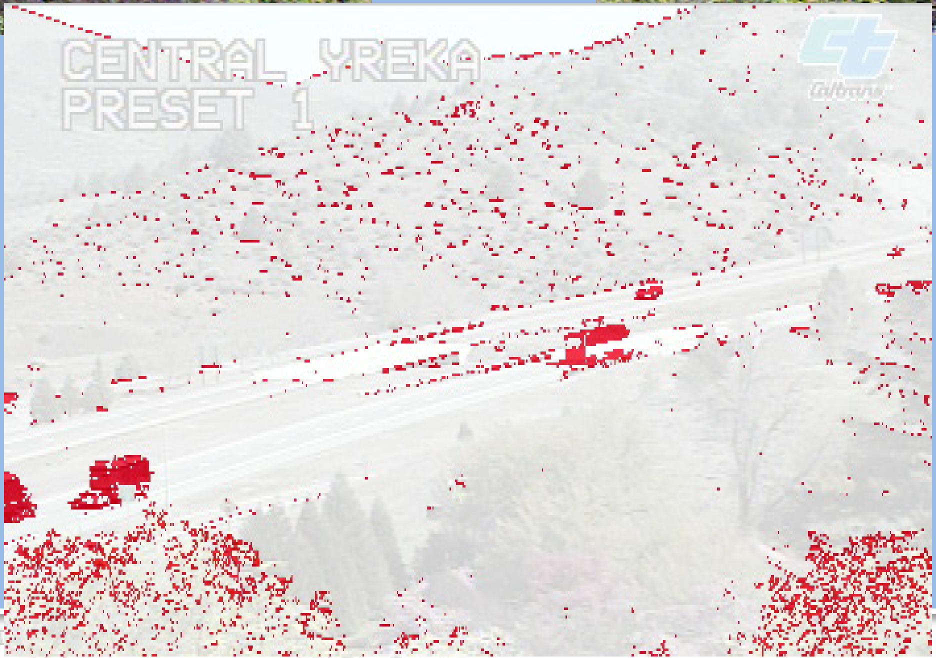


Programming

pare

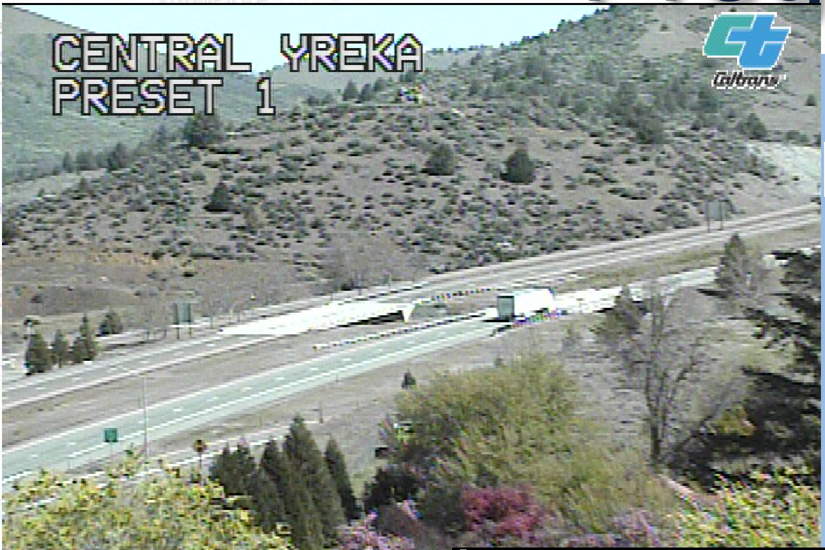


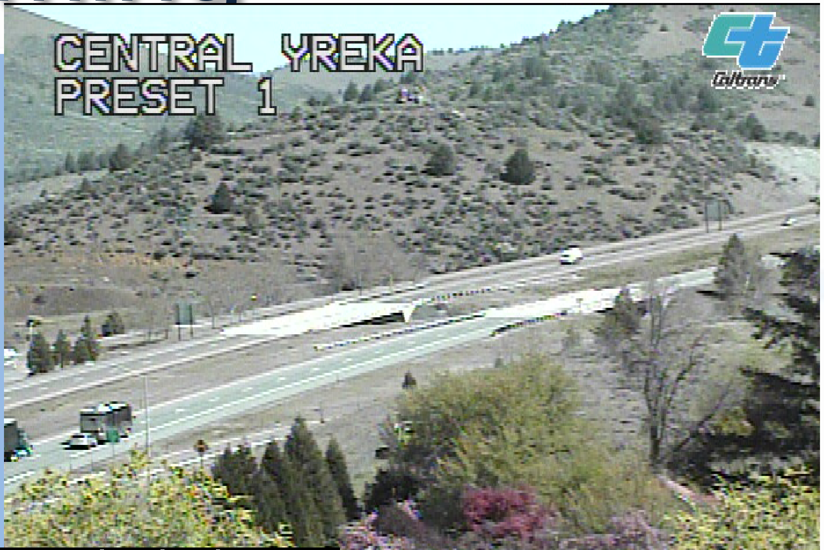


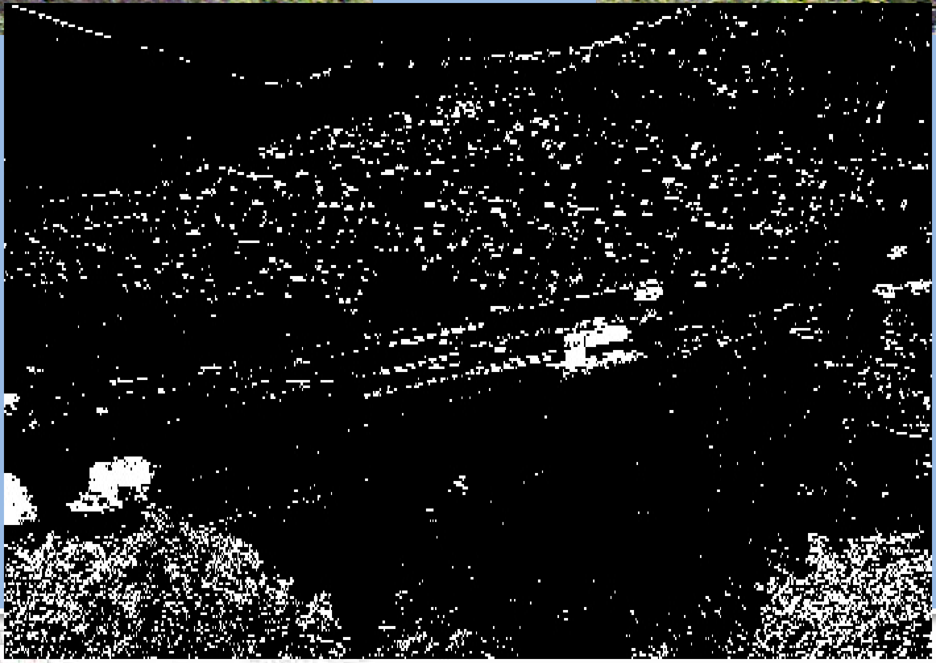


Programming

pare



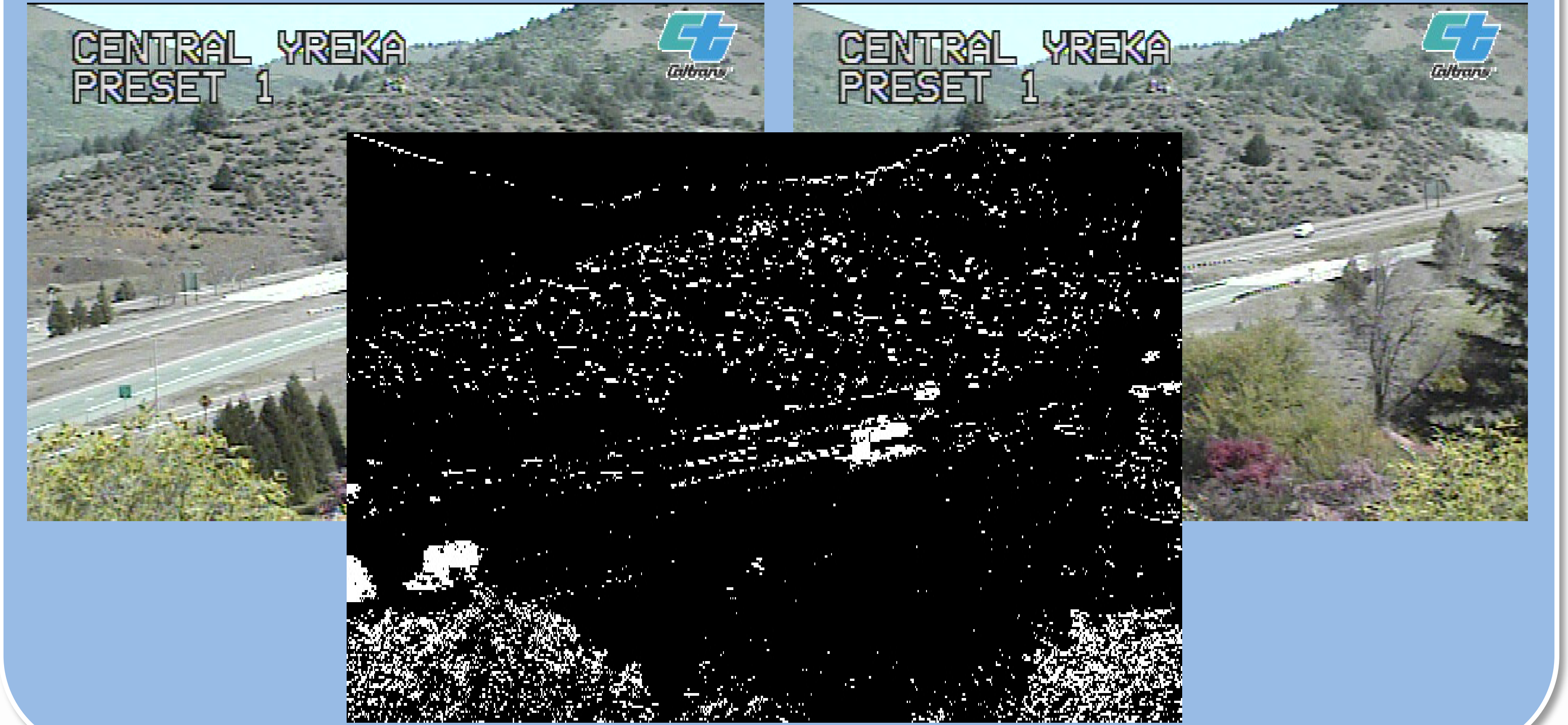




Programming

- Image Magick Compare

  ~20dB – similar images, but less then 35dB

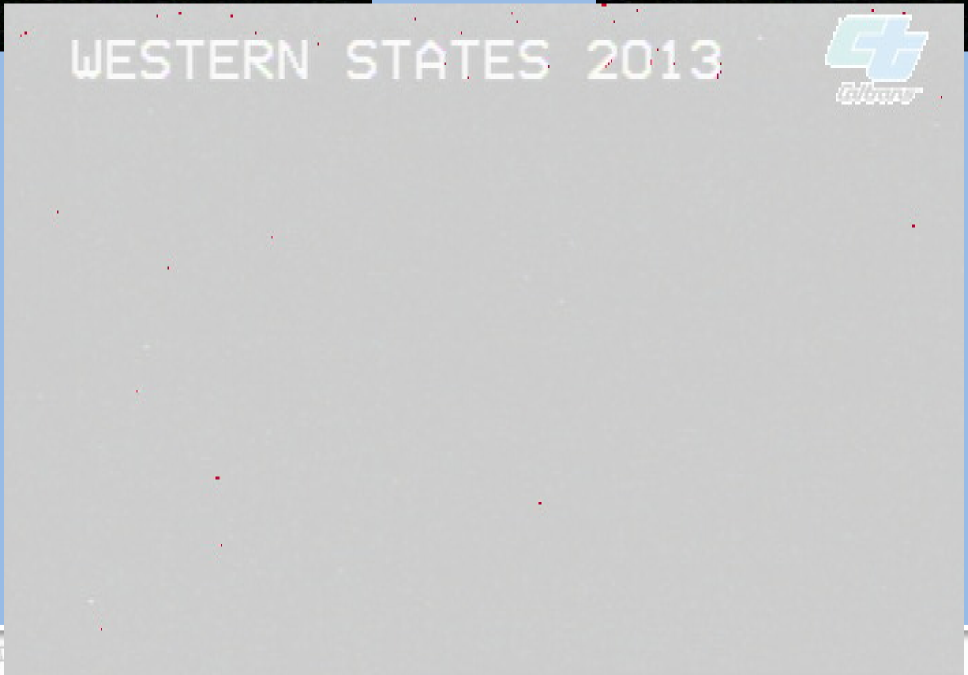


Programming

- Image Magick Compare

Programming

pare

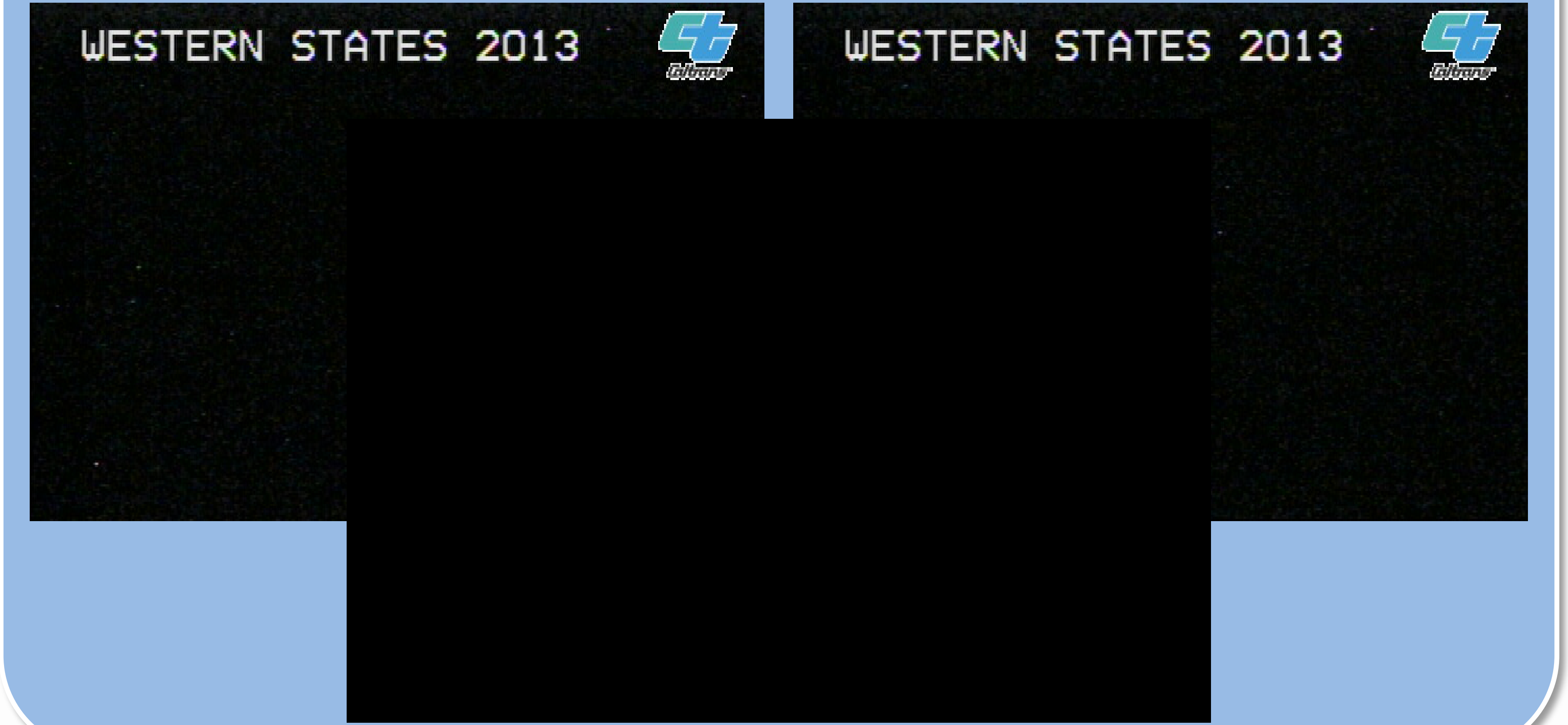


Programming

pare

Programming

- Image Magick Compare
  - ~33 dB – Very similar, but less then 35dB



Programming

- Image Magick Compare
  - Various no video images compared to reference no video image at 2CIF resolution at 60% compression

5% Compression 41dB

35% Compression 41dB

Same as Reference Image

60% Compression ∞ dB

95% Compression 35dB

Programming

- Image Magick Compare
  - Various no video images compared to reference no video image at 2CIF resolution at 60% compression
  - Images that are the same, but are compressed at different amounts can vary considerably when compared
  - Higher compression results in more reconstruction error, or dissimilarity
  - Reference image must match error state at close as possible
    - Small variances are accounted for by compare algorithm

Programming

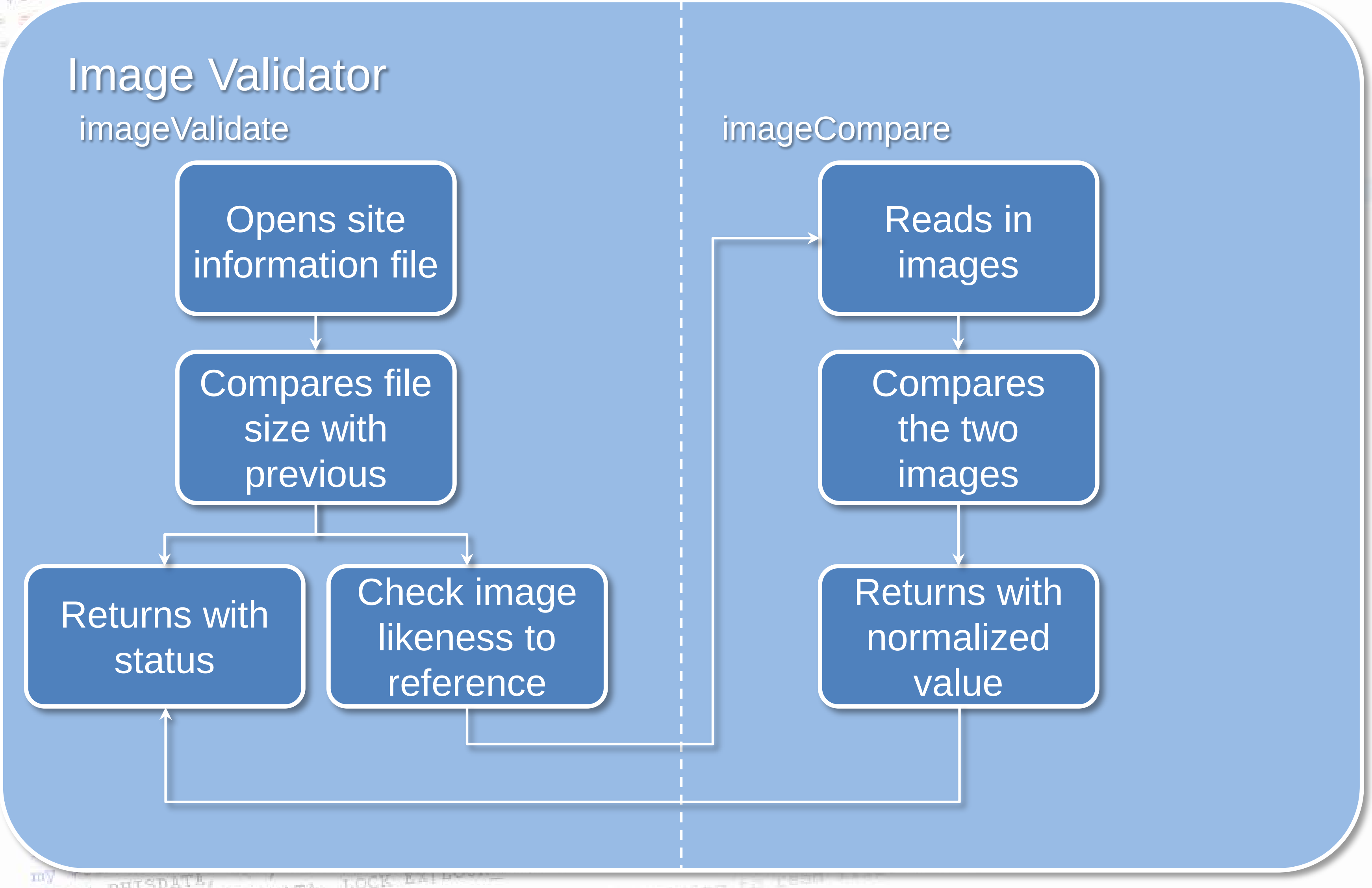
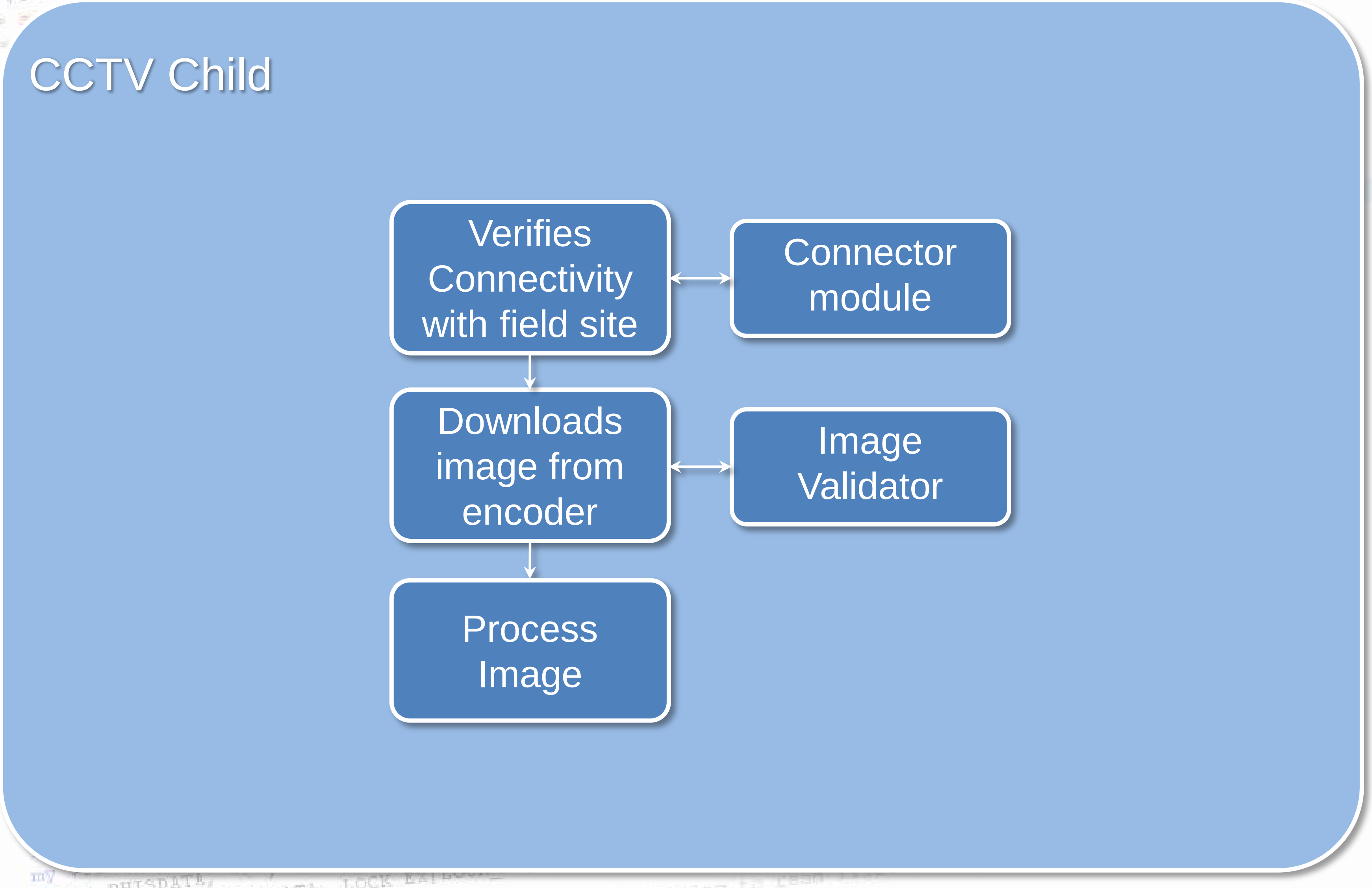


Image Validator
imageValidate
Opens site information file
Compares file size with previous
Returns with status
Check image likeness to reference
imageCompare
Reads in images
Compares the two images
Returns with normalized value

Programming


CCTV Child

Verifies Connectivity with field site

Connector module

Downloads image from encoder

Image Validator

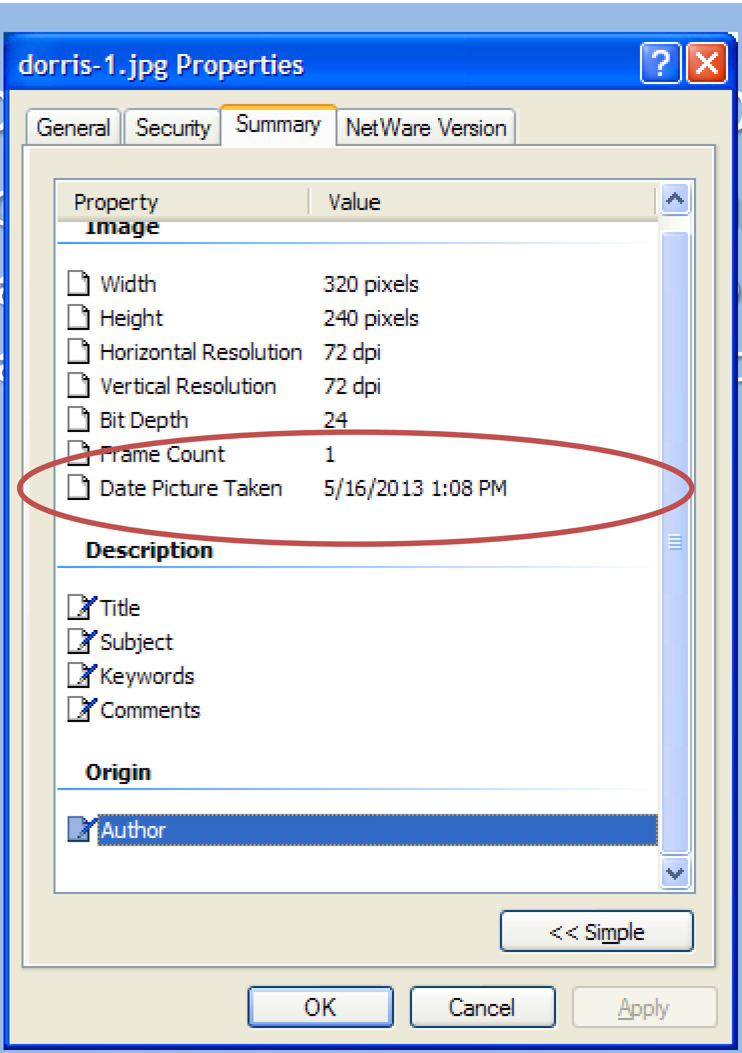
Process Image

Programming

- Image Processing (Successful Download)
  - Add geo-location data and timestamp to EXIF tags
    - Use Jhead to add geo-location data into Comment field
    - Use Jhead to add timestamp to Date Picture Taken field

Programming

- Image Proc ownload)
  - Add geo-lo p to EXIF tags
    - Use Jhea Comment field
    - Use Jhea cture Taken field

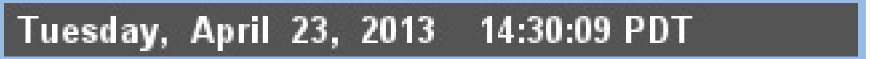


dorris-1.jpg Properties

Property	Value
Image	
Width	320 pixels
Height	240 pixels
Horizontal Resolution	72 dpi
Vertical Resolution	72 dpi
Bit Depth	24
Frame Count	1
Date Picture Taken	5/16/2013 1:08 PM
Description	
Title	
Subject	
Keywords	
Comments	
Origin	
Author	

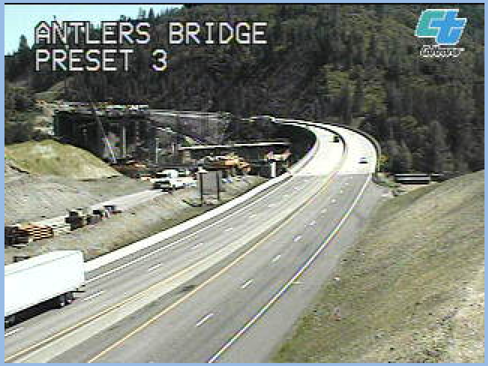
Programming

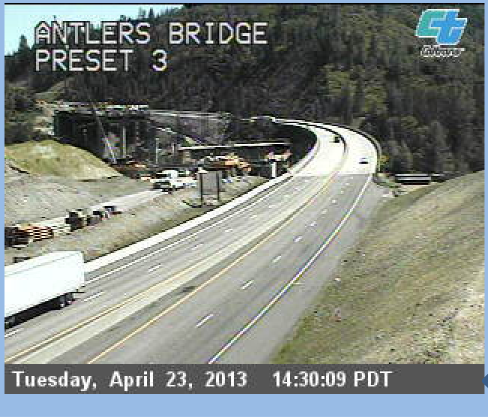
- Image Processing (Successful Download)
  - Add geo-location data and timestamp to EXIF tags
    - Use Jhead to add geo-location data into Comment field
    - Use Jhead to add timestamp to Date Picture Taken field
  - Build timestamp footer



Tuesday, April 23, 2013 14:30:09 PDT

  - Resize Image to 4:3 aspect ratio
  - Append the timestamp to image



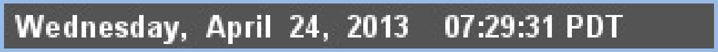


Programming

- Image Processing (Error)
  - Check local site cache file
    - If does not exist, it creates one
  - Compares current time to stored time
  - If greater then configured time in CONFIG.ini
    - Builds temporarily unavailable image
  - If less then configured time in CONFIG.ini
    - Does nothing

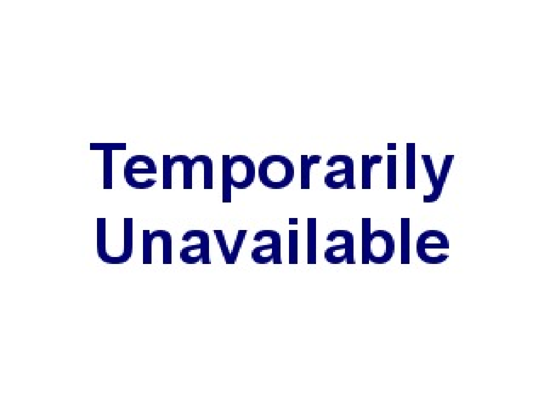
Programming

- Image Processing (Error)
  - Building Temporarily unavailable image
    - Builds timestamp footer

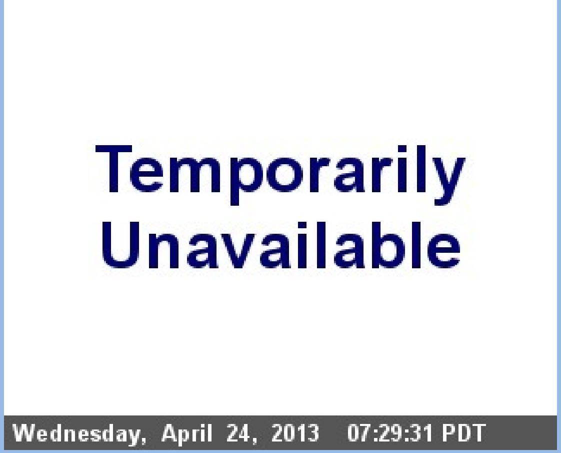


Wednesday, April 24, 2013 07:29:31 PDT

    - Builds unavailable image
      - Use CONFIG.ini file to modify text/color/position
    - Appends timestamp footer to image



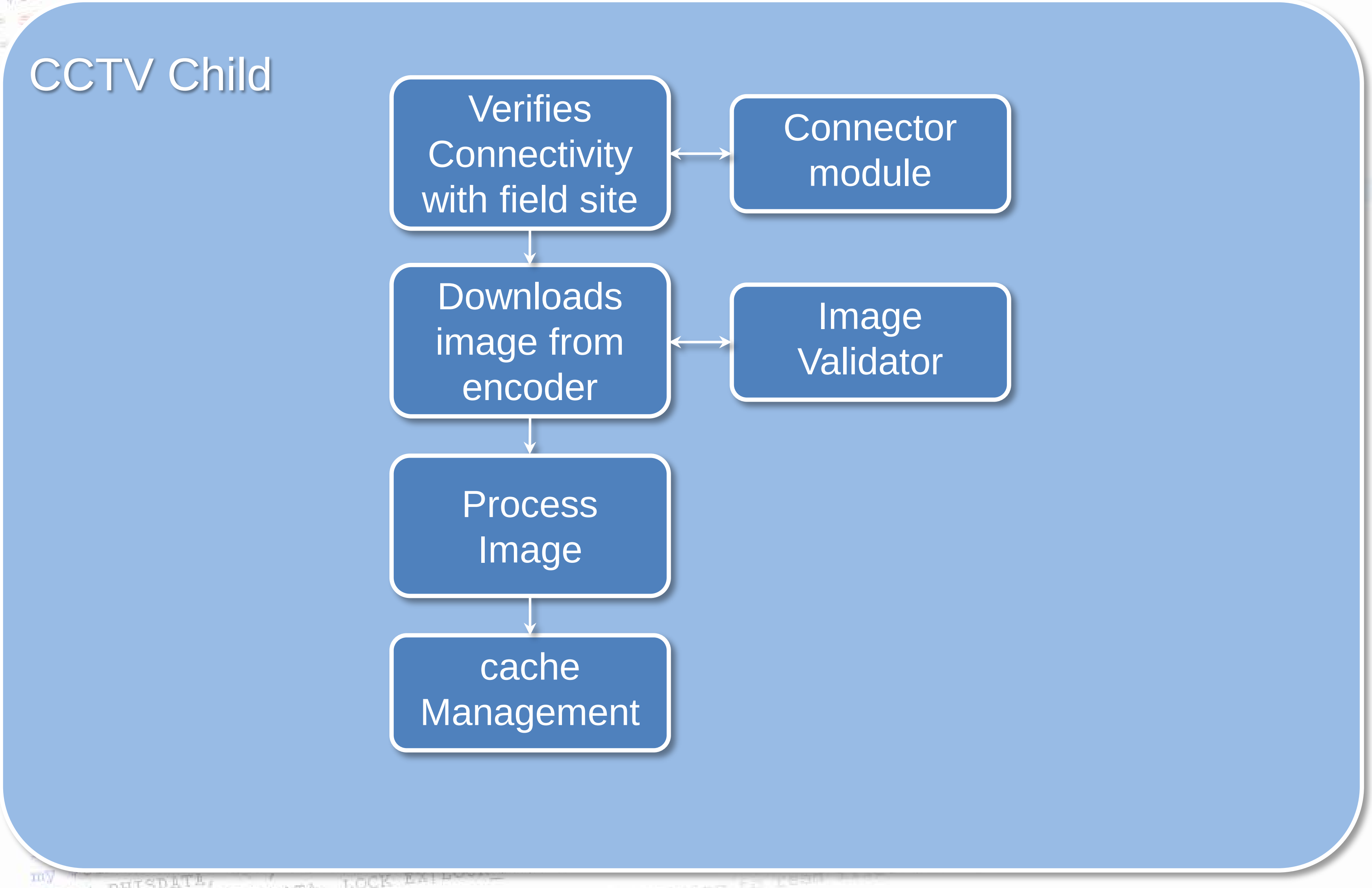
Temporarily Unavailable



Temporarily Unavailable

Wednesday, April 24, 2013 07:29:31 PDT

Programming



Programming

Cache Management

- CCTV Image Relay is a flat file system
- Values used by CCTV Image Relay are stored in hash tables
  - Provides database style access of data without the database
- Need to accurately and reliably “cache” CCTV information
  - Last Date time CCTV image retrieved
  - Geo-location data
- File available to other processes for exporting data

Programming

Cache Management (Cont)

- Hash Tables are associative arrays
  - Sample Hash

```
$hash => {
           Flintstones => {
                   Fred,
                   Wilma,
                   Pebbles,
                   Deno
           }
  }
```

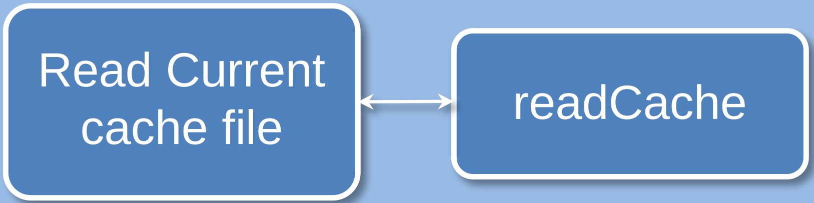
Programming

Cache Management (Cont)

```
$cctvHash => {
        “3” => {
           “Site Name” => “Antlers Bridge”
           “Site Type” => “CCTV”
           “Execution Minute” => “0,5,…”
        }
        “5” => {
           “Site Name” => “Bass Mtn”
           “Site Type” => “CCTV”
           “Execution Minute” => “2,7,…”
        }
 }
```

Programming

Cache Management (Cont)



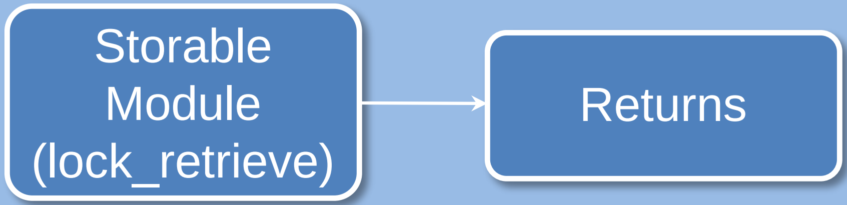
Read Current cache file

readCache

Programming

Cache Management (Cont)

readCache

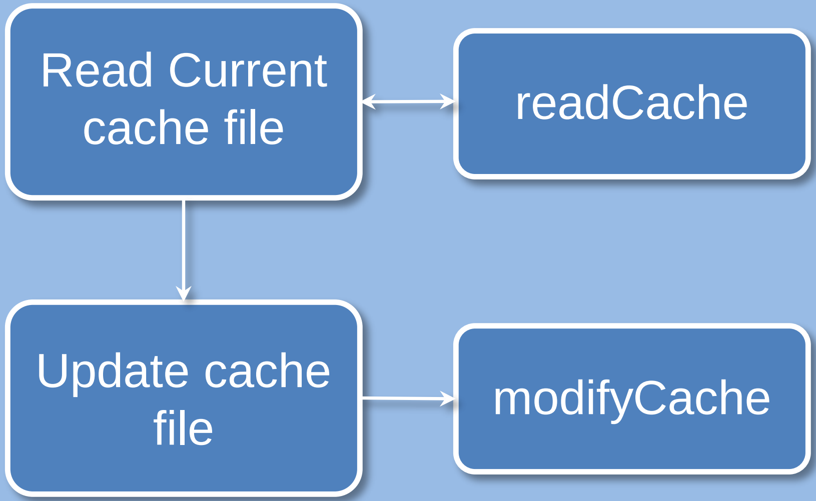


Storable Module (lock_retrieve)

Returns

Programming

Cache Management (Cont)



Read Current cache file

readCache

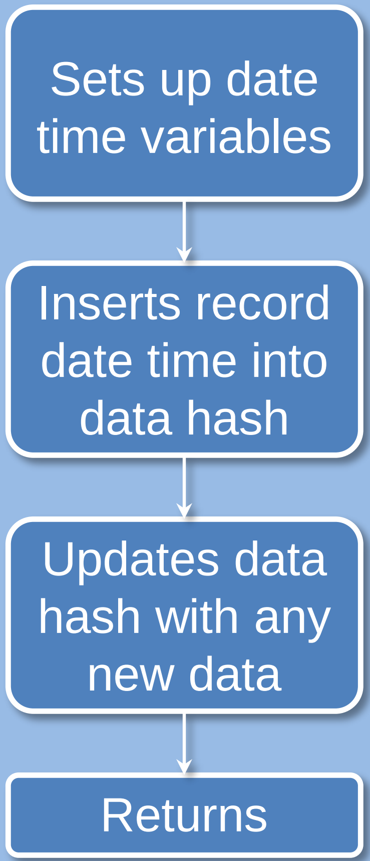
Update cache file

modifyCache

Programming

Cache Management (Cont)

modifyCache



Sets up date time variables

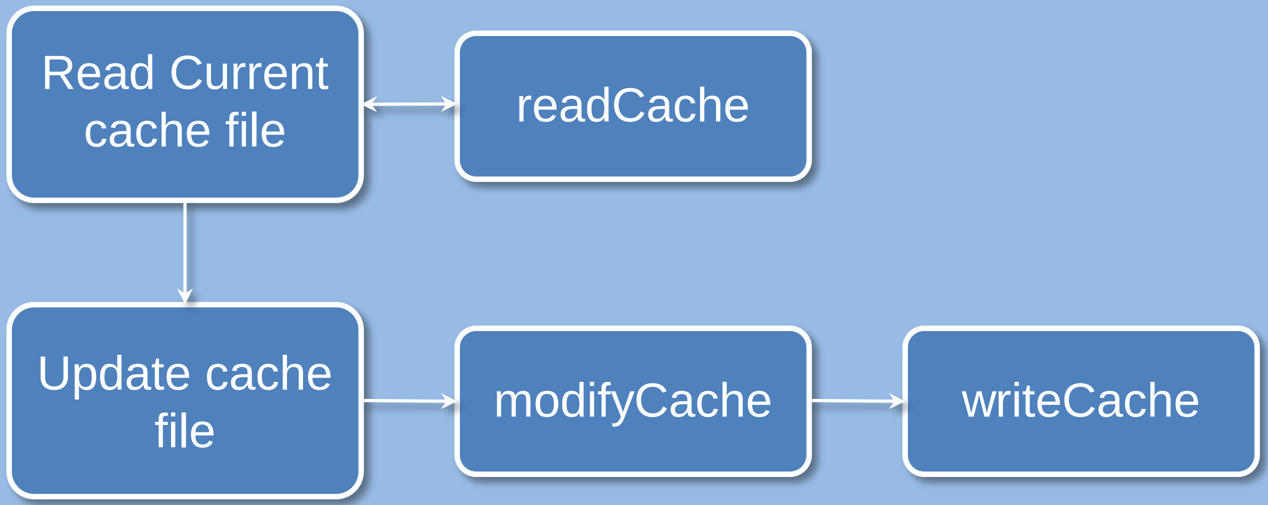
Inserts record date time into data hash

Updates data hash with any new data

Returns

Programming

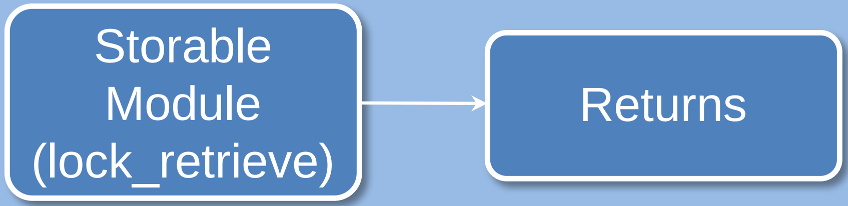
Cache Management (Cont)



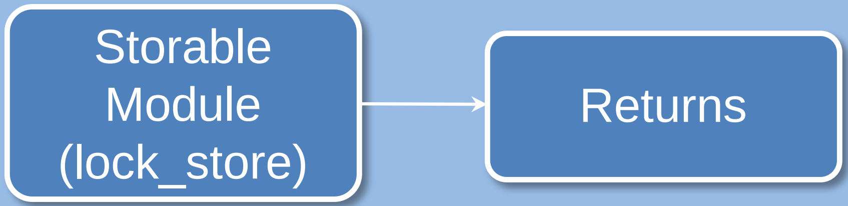
Programming

Cache Management (Cont)

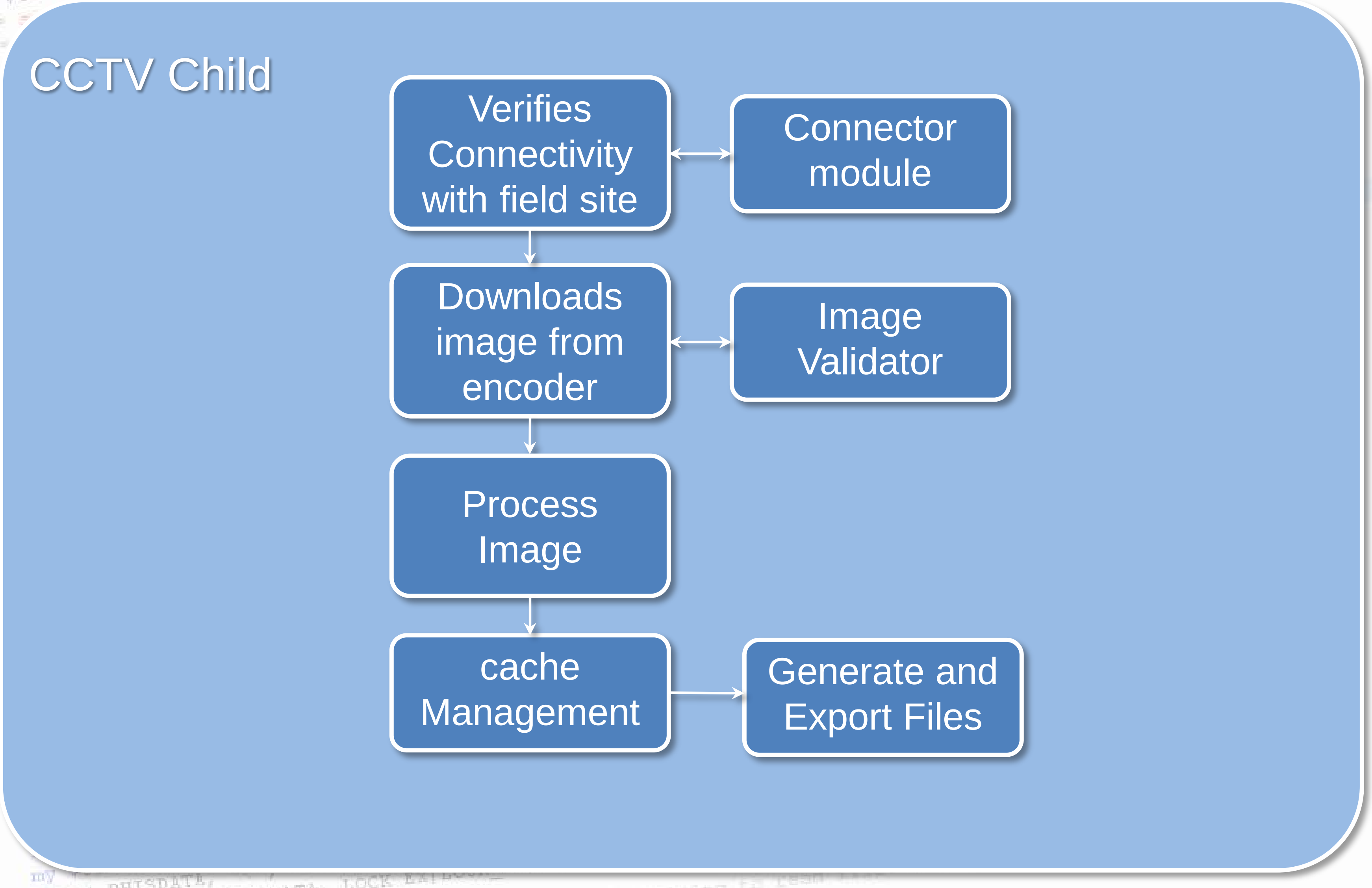
readCache



writeCache



Programming

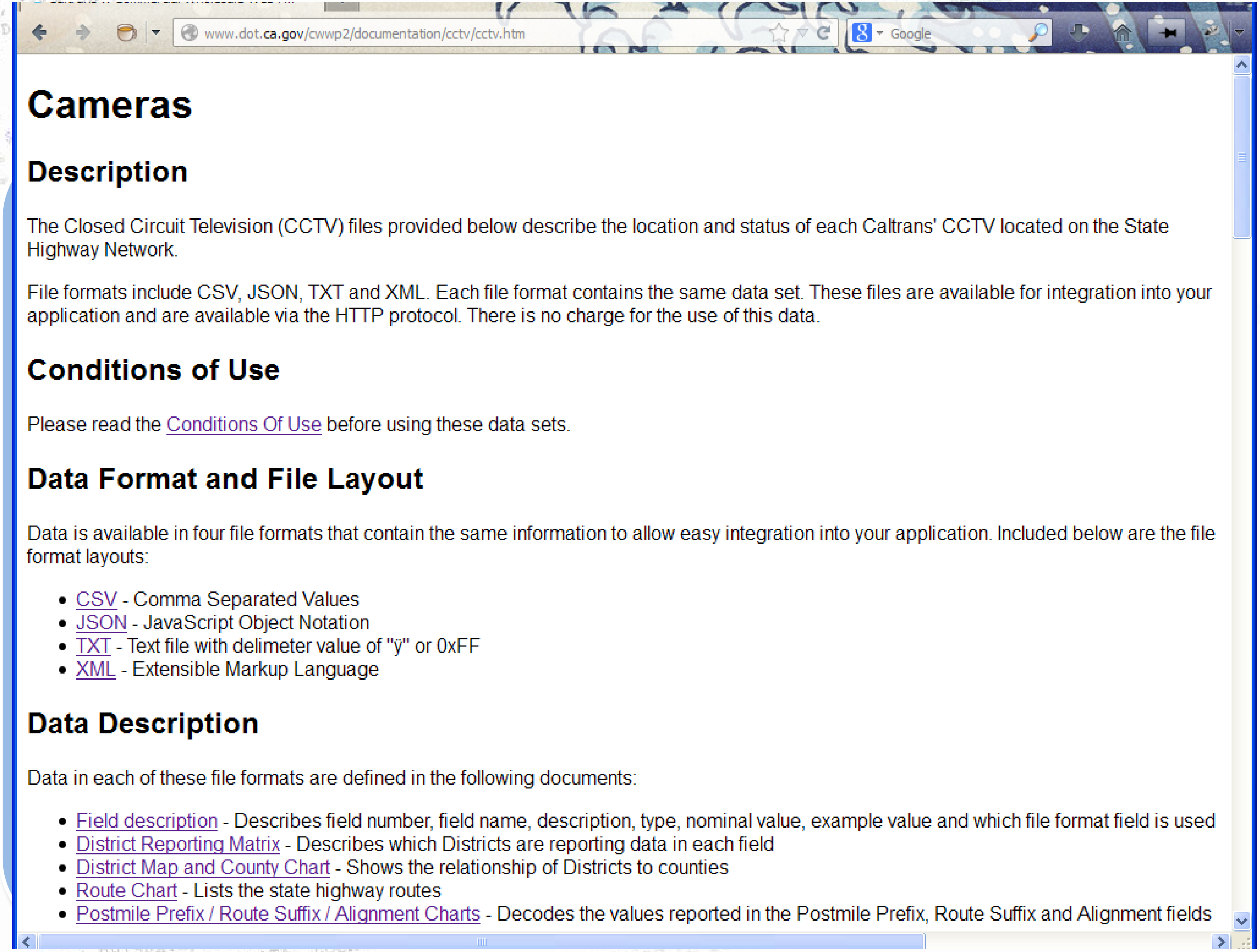

CCTV Child
Verifies Connectivity with field site
Connector module
Downloads image from encoder
Image Validator
Process Image
cache Management
Generate and Export Files

Programming

- File Generation and Exportation
  - Generate CWWP file types
    - CSV
    - TXT
    - JSON
    - XML

More Information can be found at

http://www.dot.ca.gov/cwwp2/documentation/cctv/cctv.htm



Cameras

Description

The Closed Circuit Television (CCTV) files provided below describe the location and status of each Caltrans' CCTV located on the State Highway Network.

File formats include CSV, JSON, TXT and XML. Each file format contains the same data set. These files are available for integration into your application and are available via the HTTP protocol. There is no charge for the use of this data.

Conditions of Use

Please read the Conditions Of Use before using these data sets.

Data Format and File Layout

Data is available in four file formats that contain the same information to allow easy integration into your application. Included below are the file format layouts:

- CSV - Comma Separated Values
- JSON - JavaScript Object Notation
- TXT - Text file with delimeter value of "ÿ" or 0xFF
- XML - Extensible Markup Language

Data Description

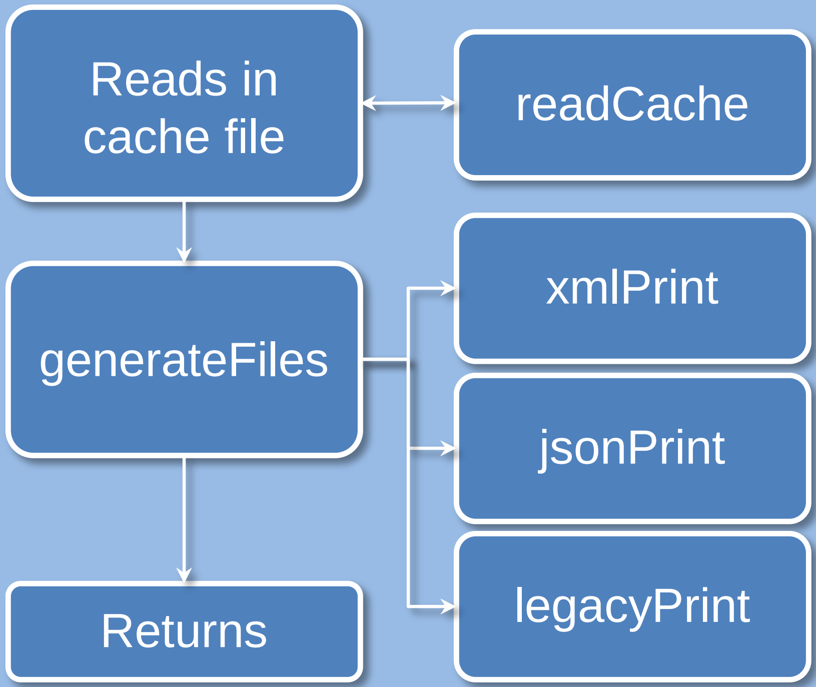
Data in each of these file formats are defined in the following documents:

- Field description - Describes field number, field name, description, type, nominal value, example value and which file format field is used
- District Reporting Matrix - Describes which Districts are reporting data in each field
- District Map and County Chart - Shows the relationship of Districts to counties
- Route Chart - Lists the state highway routes
- Postmile Prefix / Route Suffix / Alignment Charts - Decodes the values reported in the Postmile Prefix, Route Suffix and Alignment fields

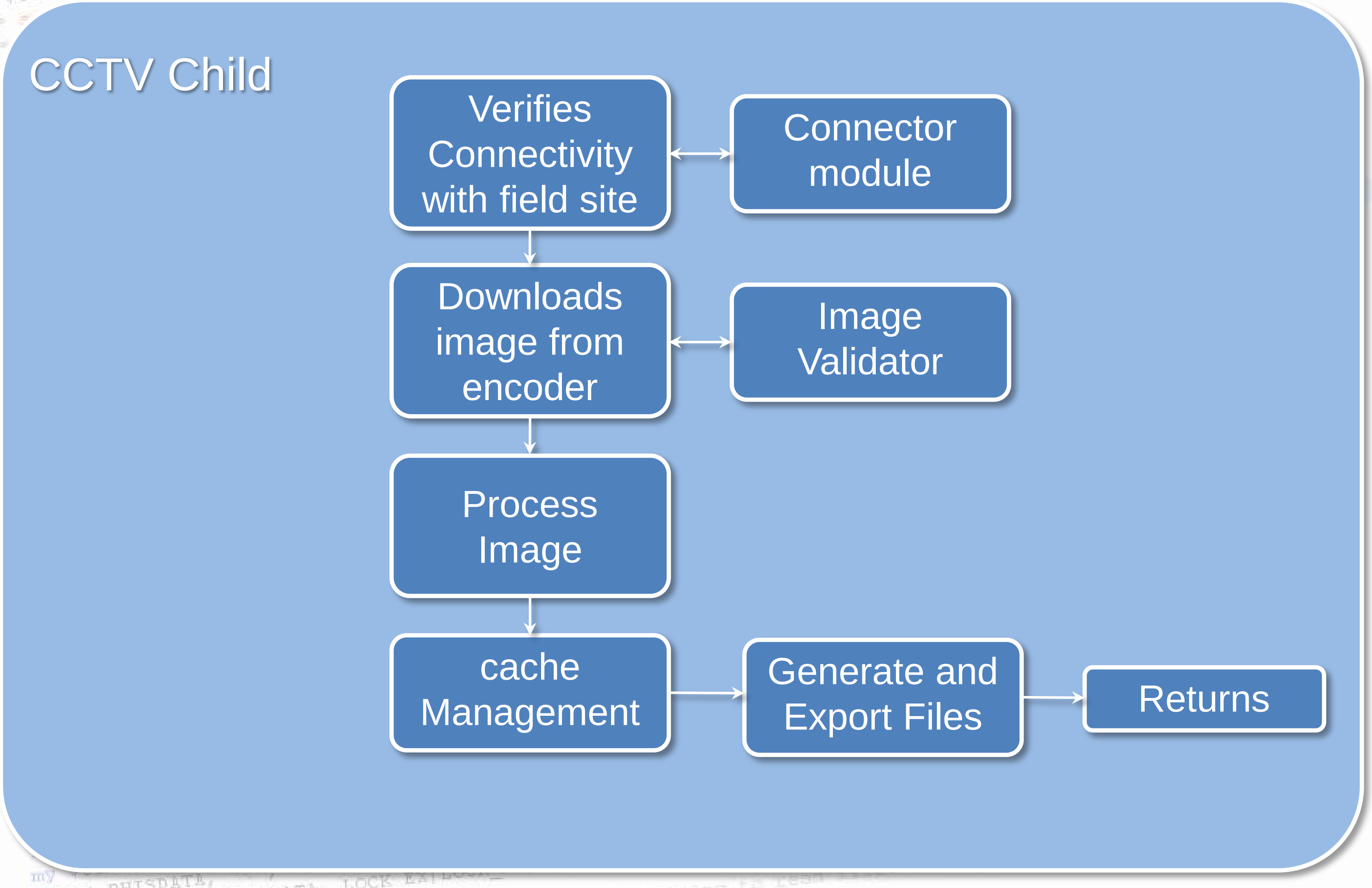
Programming

CCTV Child

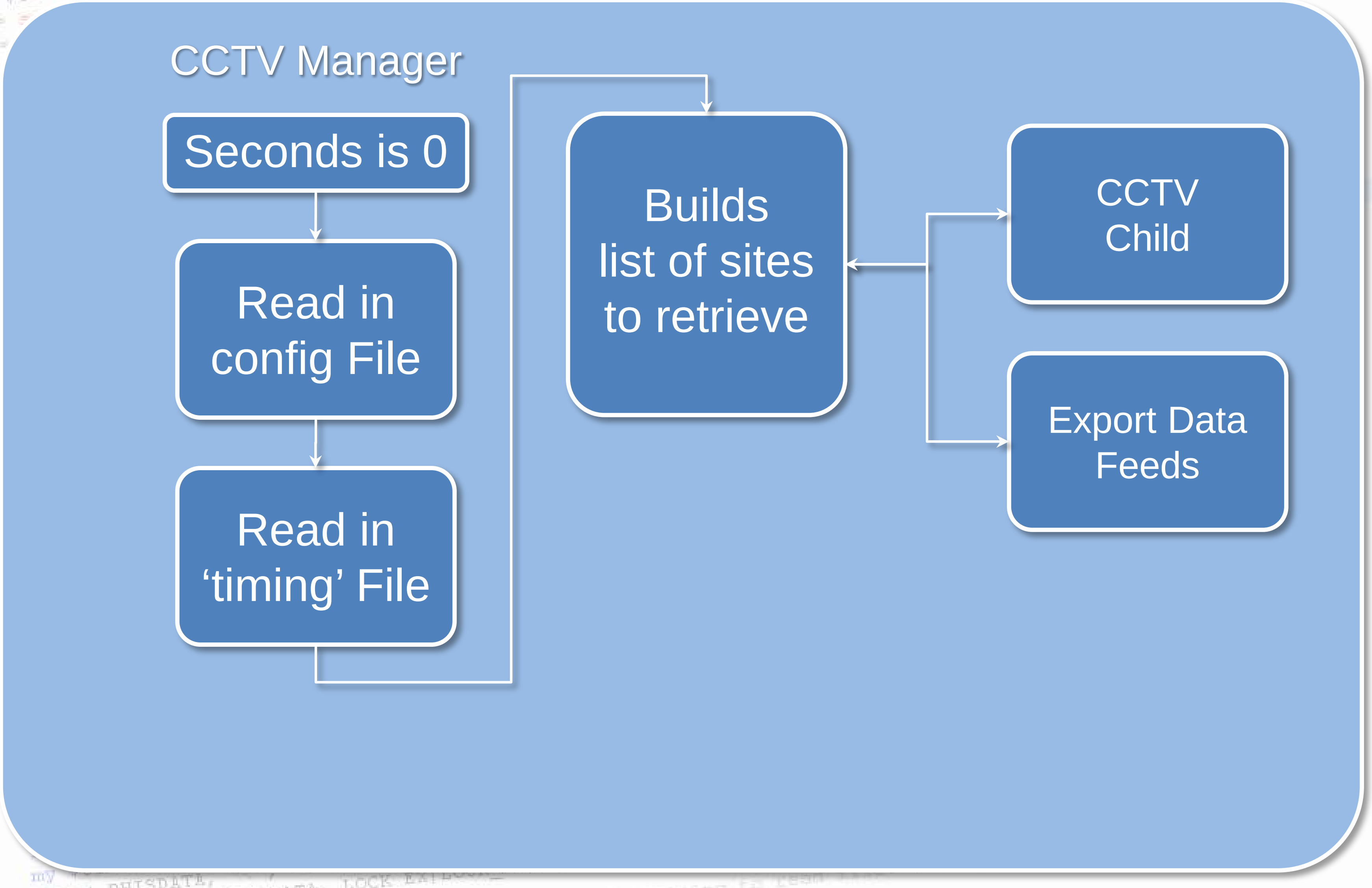
fileGenerator



Programming


CCTV Child
Verifies Connectivity with field site
Connector module
Downloads image from encoder
Image Validator
Process Image
cache Management
Generate and Export Files
Returns

Programming



CCTV Manager

Seconds is 0

Read in config File

Read in ‘timing’ File

Builds list of sites to retrieve

CCTV Child

Export Data Feeds

Programming

CCTV Child

fileDepositor - imageDepositFiles

Reads in EXPORT.ini

Programming

CCTV Child

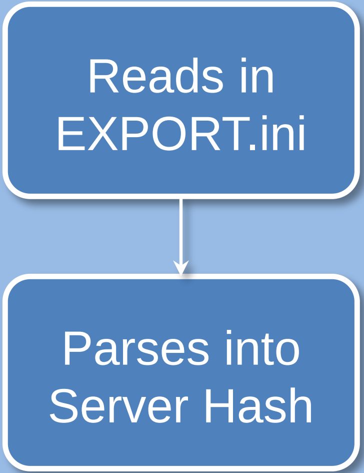
fileDepositor - imageDepositFiles

```
#SERVER 1
SERVER1:IP=www1.dot.ca.gov
SERVER1:USER=username
SERVER1:PASSWORD=password
SERVER1:PATH=/cwwp2/data/d2/cctv/image


#SERVER 2
SERVER2:IP=www2.dot.ca.gov
SERVER2:USER=username
SERVER2:PASSWORD=password
SERVER2:PATH=/cwwp2/data/d2/cctv/image
```

Programming

CCTV Child

fileDepositor - imageDepositFiles



Reads in EXPORT.ini

Parses into Server Hash

Programming

CCTV Child

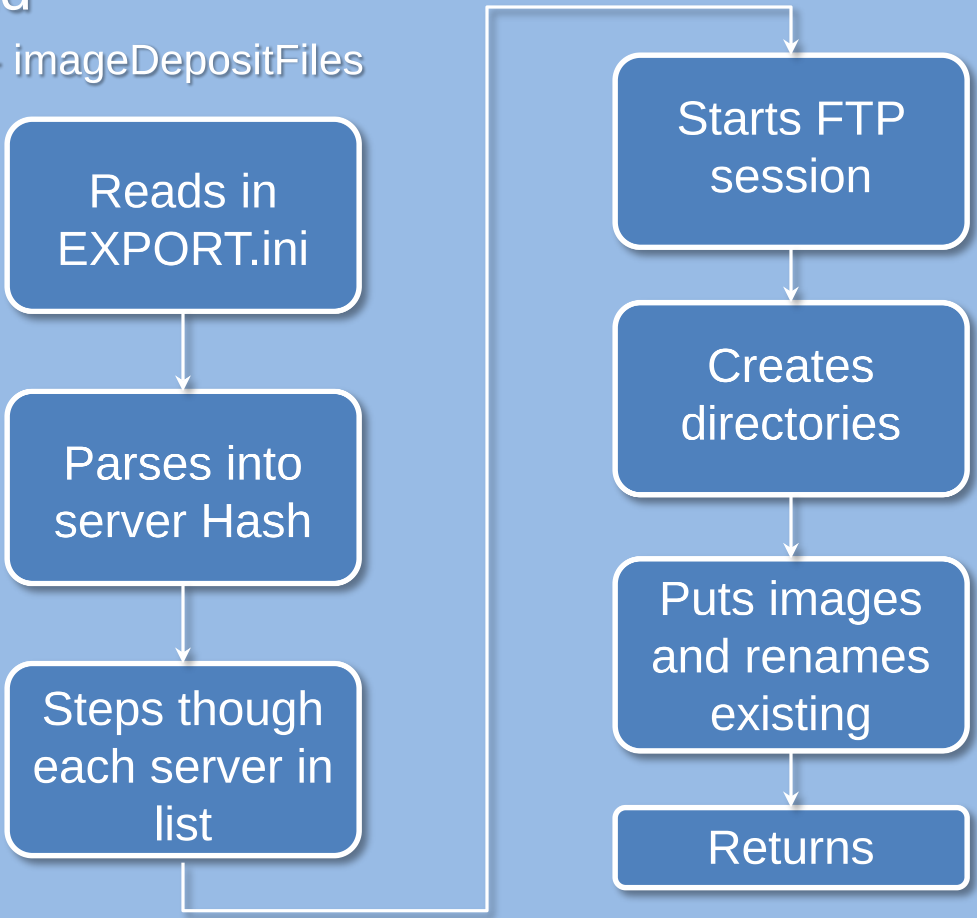
fileDepositor - imageDepositFiles

```
%serverHash => {
     SERVER1 => {
           IP       => www1.dot.ca.gov,
           USER     => username,
           PASSWORD => password,
           PATH     => /cwwp2/data/d2/cctv/image
     },
     SERVER2 => {
           IP       => www2.dot.ca.gov,
           USER     => username,
           PASSWORD => password,
           PATH     => /cwwp2/data/d2/cctv/image
     }
}
```

Programming

CCTV Child

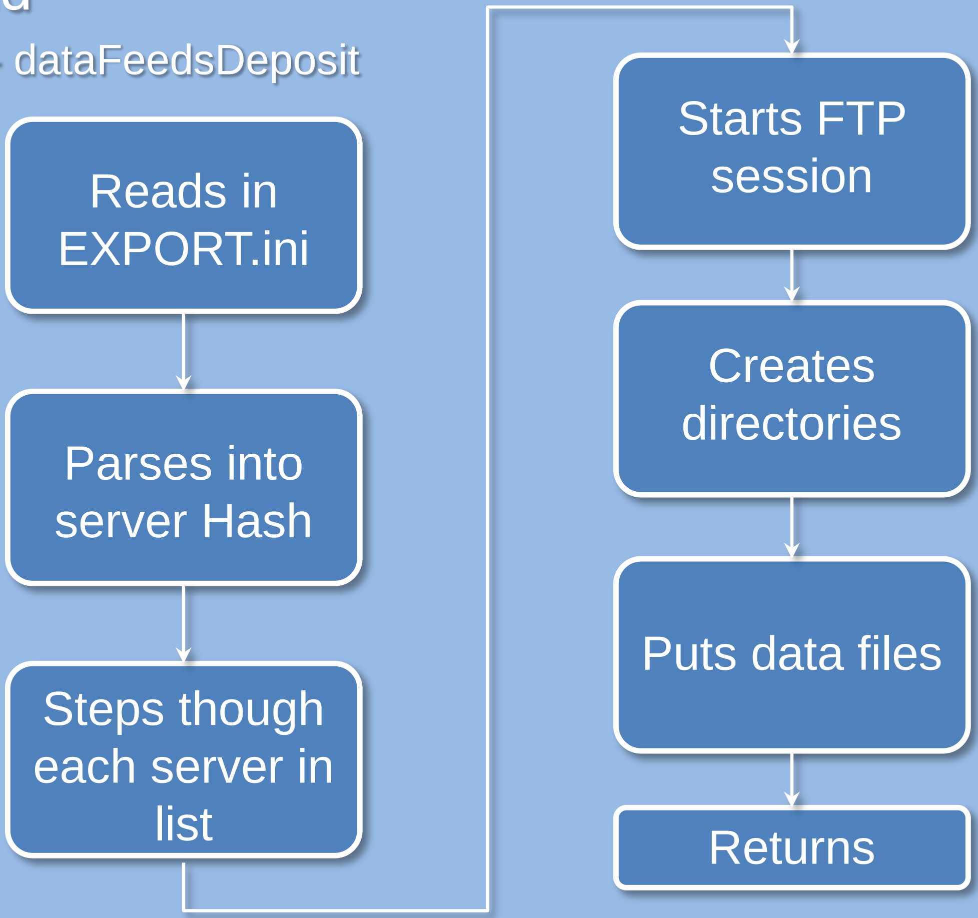
fileDepositor - imageDepositFiles



Programming

CCTV Child

fileDepositor - dataFeedsDeposit



Reads in EXPORT.ini

Parses into server Hash

Steps though each server in list

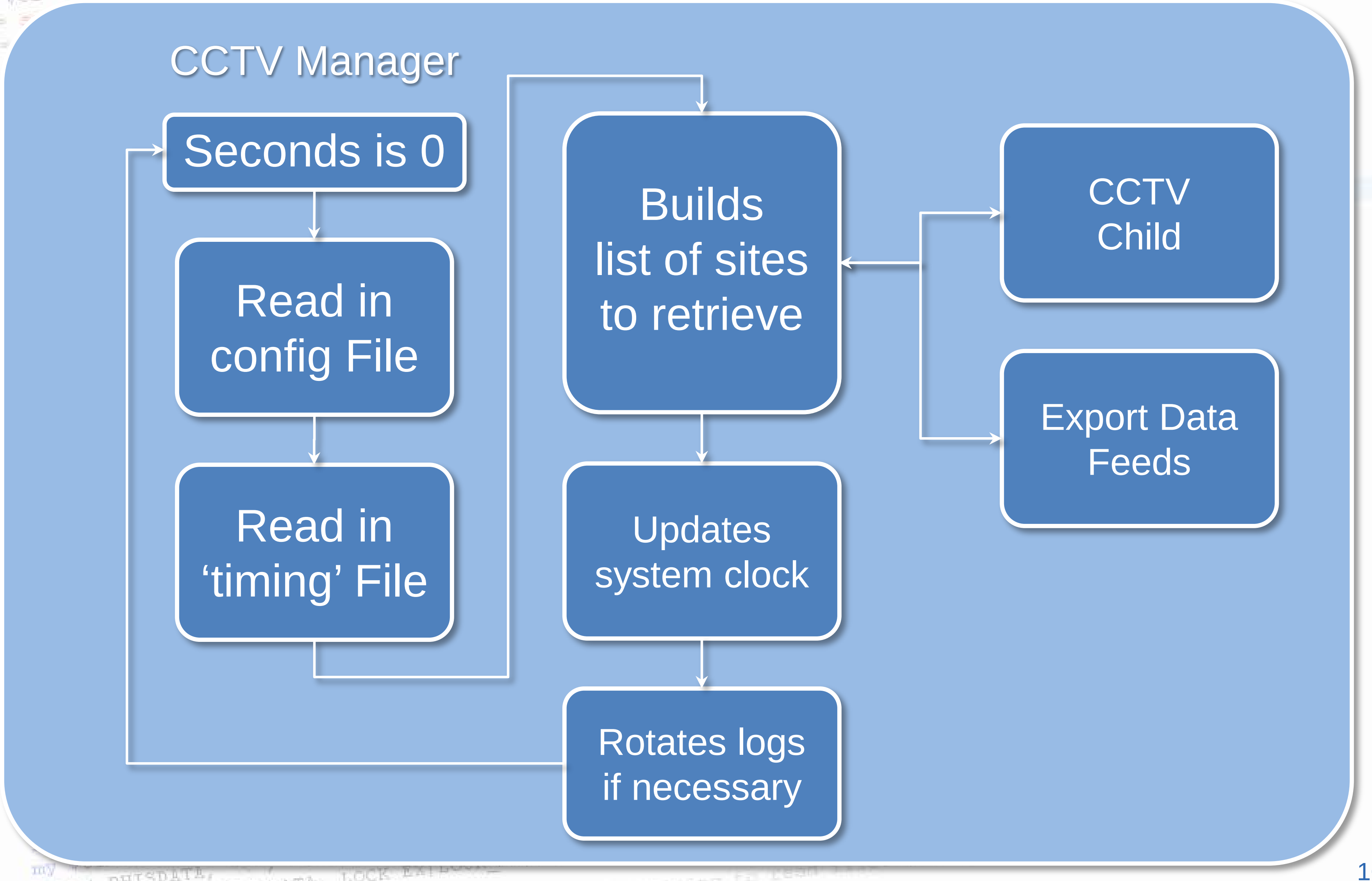
Starts FTP session

Creates directories

Puts data files

Returns

Programming



CCTV Manager

Seconds is 0

Read in config File

Read in 'timing' File

Builds list of sites to retrieve

Updates system clock

Rotates logs if necessary

CCTV Child

Export Data Feeds

Programming Challenges

- Image Magick (www.imagemagick.org)
  - – Command line image manipulating software
  - – Several API available to use
    - PerlMagick (Perl)
    - MagickWand (PHP)
    - Imagick (PHP)
    - PythonMagick (Python)
    - Jmagick (Java)
  - – Steep leaning curve
    - Good documentation
    - Good online resources
  - – Not all features are available in the APIs

Programming Challenges

- Image Magick (www.imagemagick.org)

Courtesy of ImageMagick Studio LLC

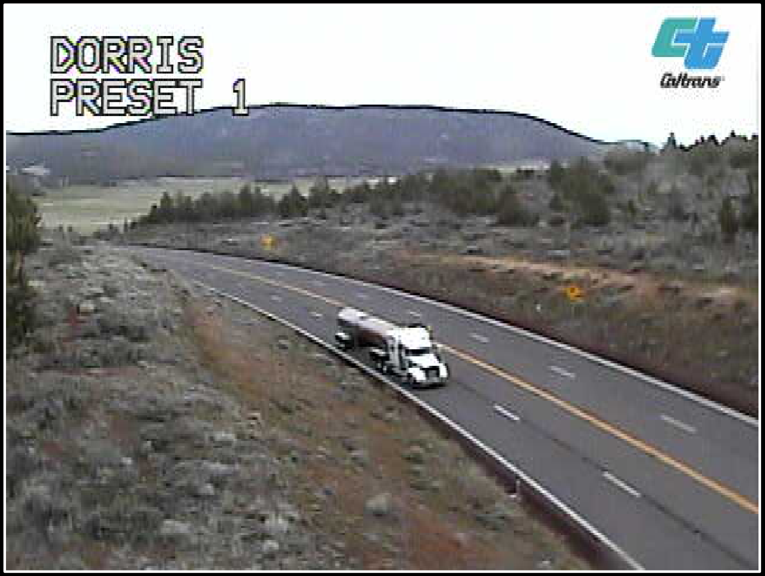
Programming Challenges

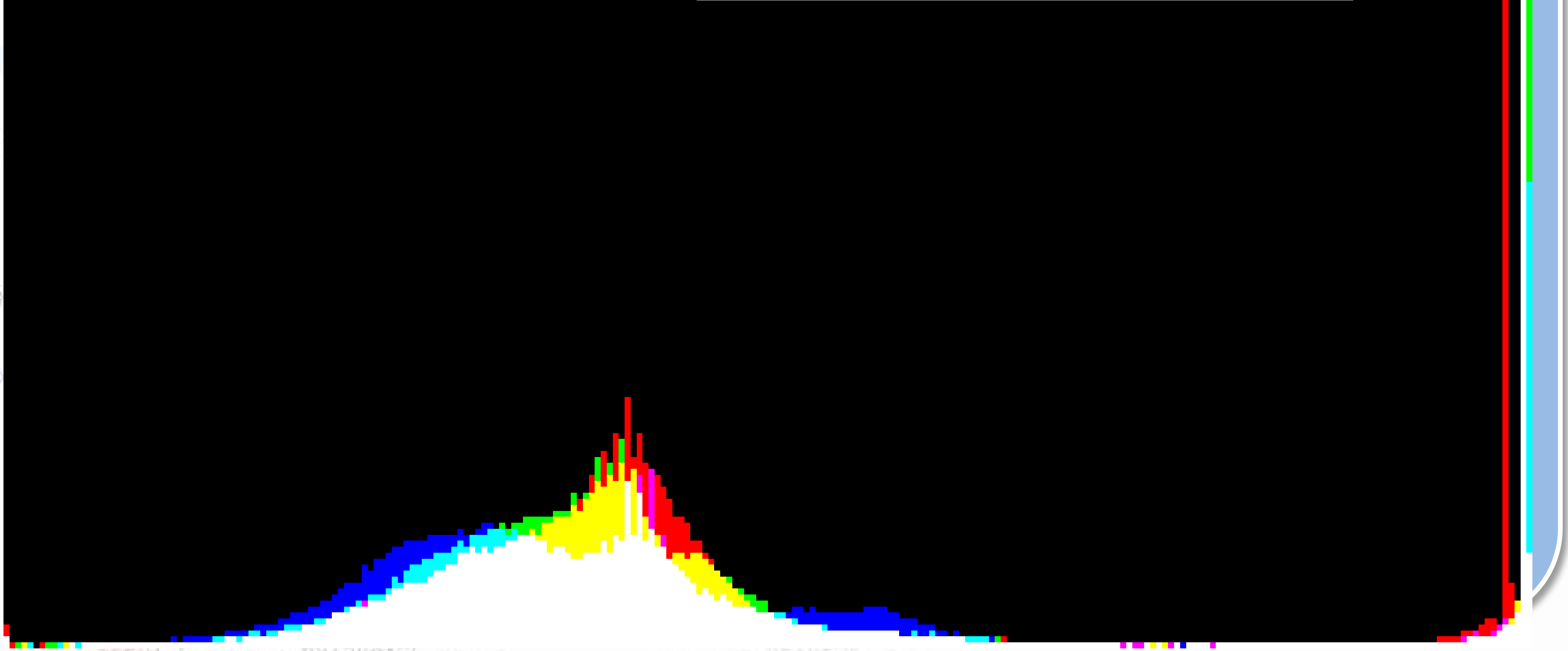
- Jhead (http://www.sentex.net/~mwandel/jhead/)
  - – Command line EXIF editor
  - – Limited writing/modifying capabilities
  - – Must be executed from an exec or system command in Perl

Programming Challenges

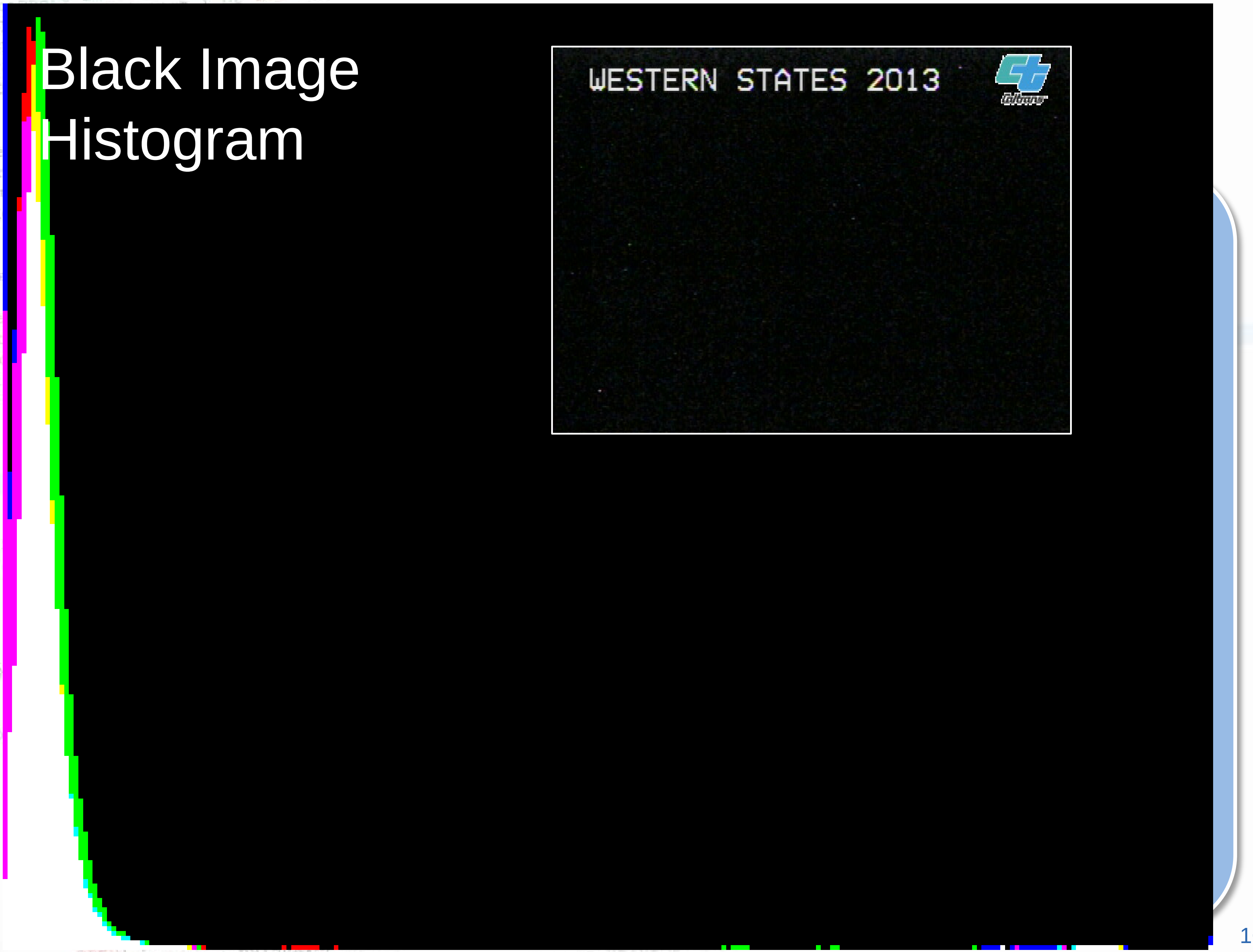
- Image validation
  - Methods explored
    - File size
    - Image Comparison (Reference image)
      - Most effective for diverse encoders
    - Histogram analysis
      - Have very few dominate spikes with high kurtosis (measure of "peakedness")
      - Very effective for uniform encoders and solids

Typical Image Histogram

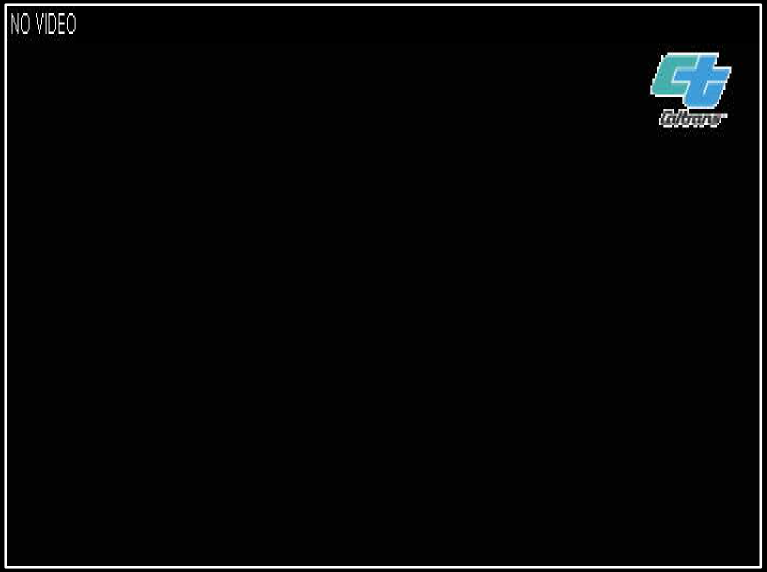




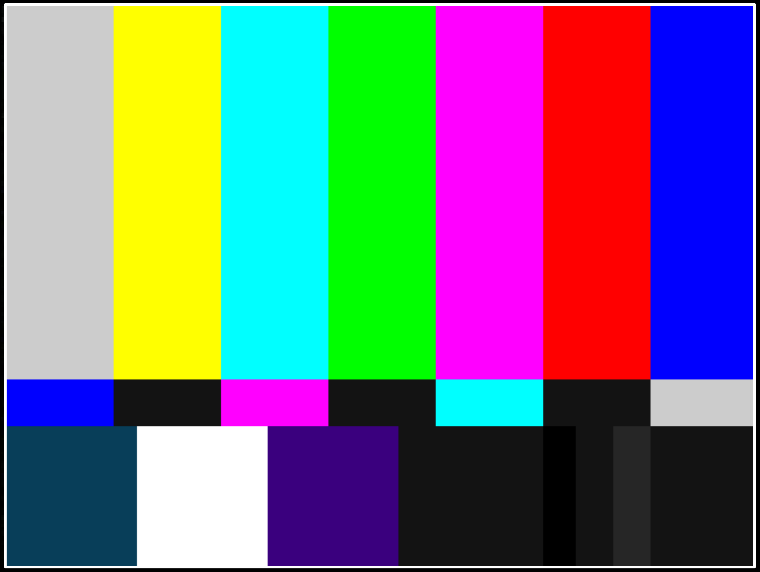
Black Image Histogram

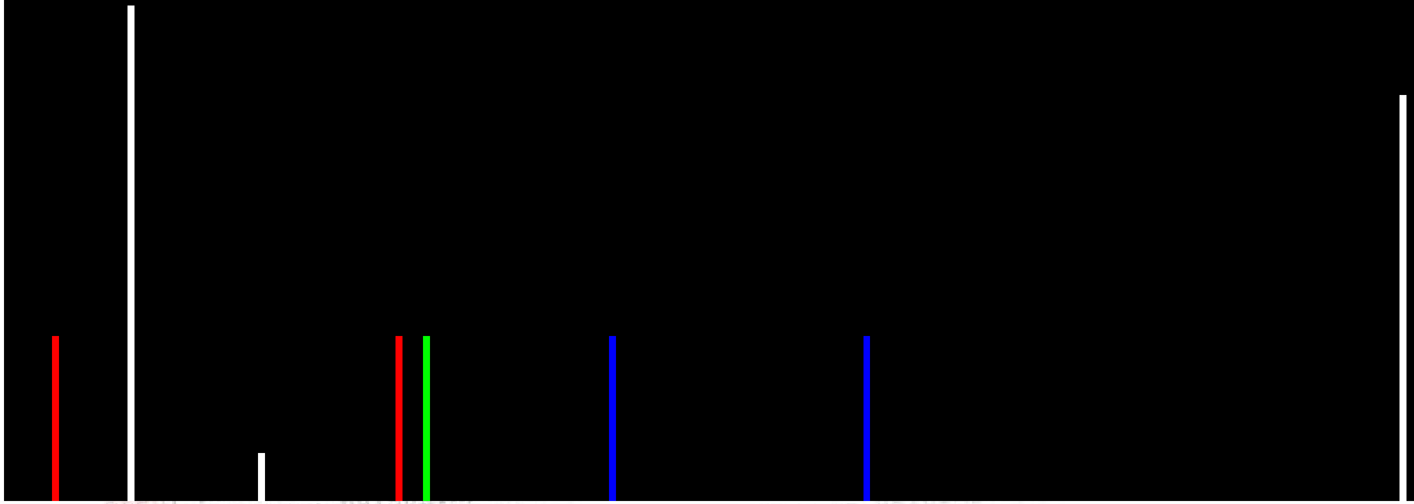


No Video Image Histogram



Color Bars Image Histogram





Programming Challenges

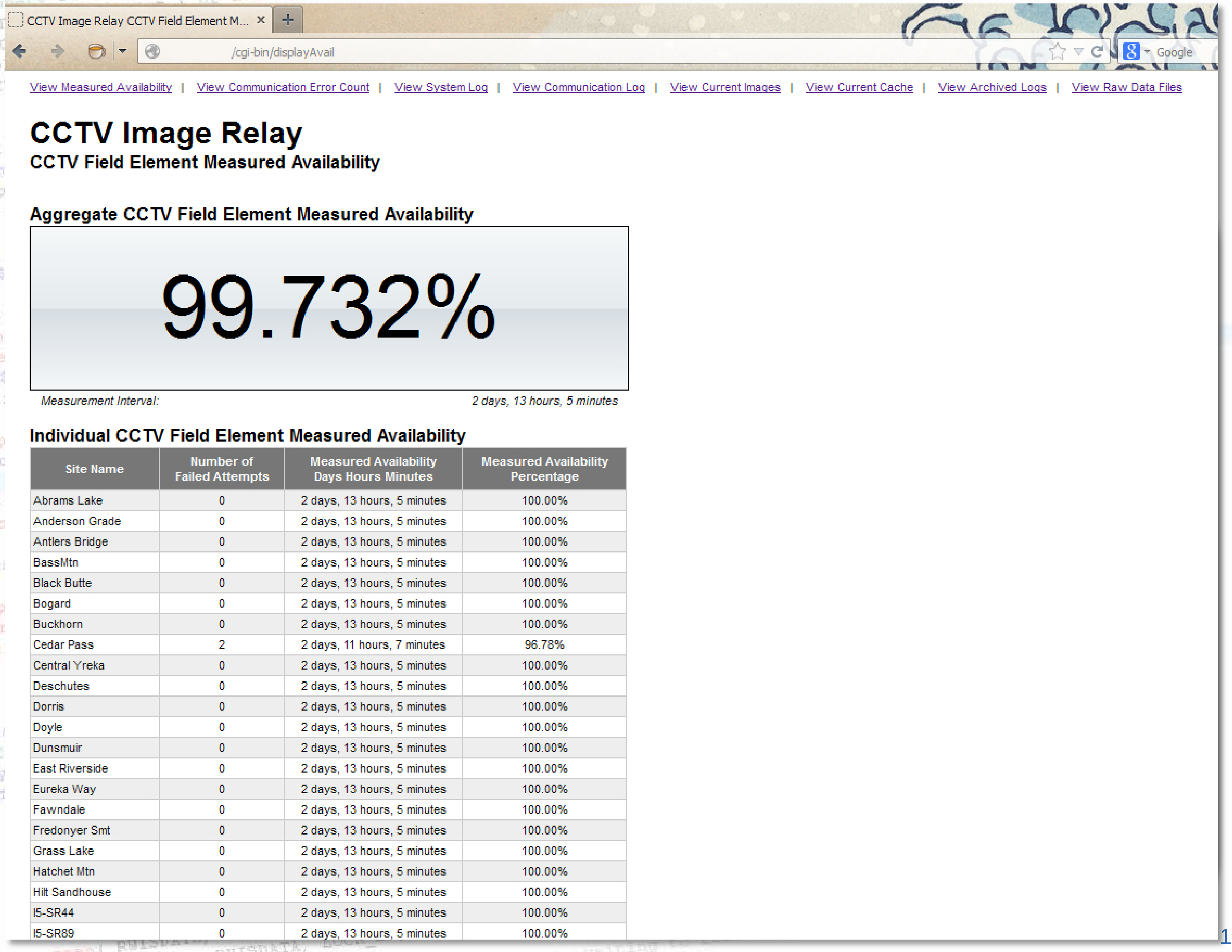
- Image validation
  - Methods explored
    - File size
    - Image Comparison (Reference image)
      - Most effective for diverse encoders
    - Histogram analysis
      - Have very few dominate spikes with high kurtosis (measure of “peakedness”)
      - Very effective for uniform encoders and solids
    - Region analysis
      - Look at region of image for “clues”
    - Color Analysis
      - Use color density and averaging
      - Works for daytime images

Programming Challenges

- Image validation
  - – Methods to be considered
    - Historical data
      - – Collect statistics for known good images and build a statistical reference for good images
      - – Collect past images for comparison, rolling cache
    - Text detection
      - – Optical Character Recognition
      - – Perl Image::OCT::Tesseract
        - » Requires Tesseract to be installed

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

CCTV Field Element Measured Availability

Aggregate CCTV Field Element Measured Availability

99.732%

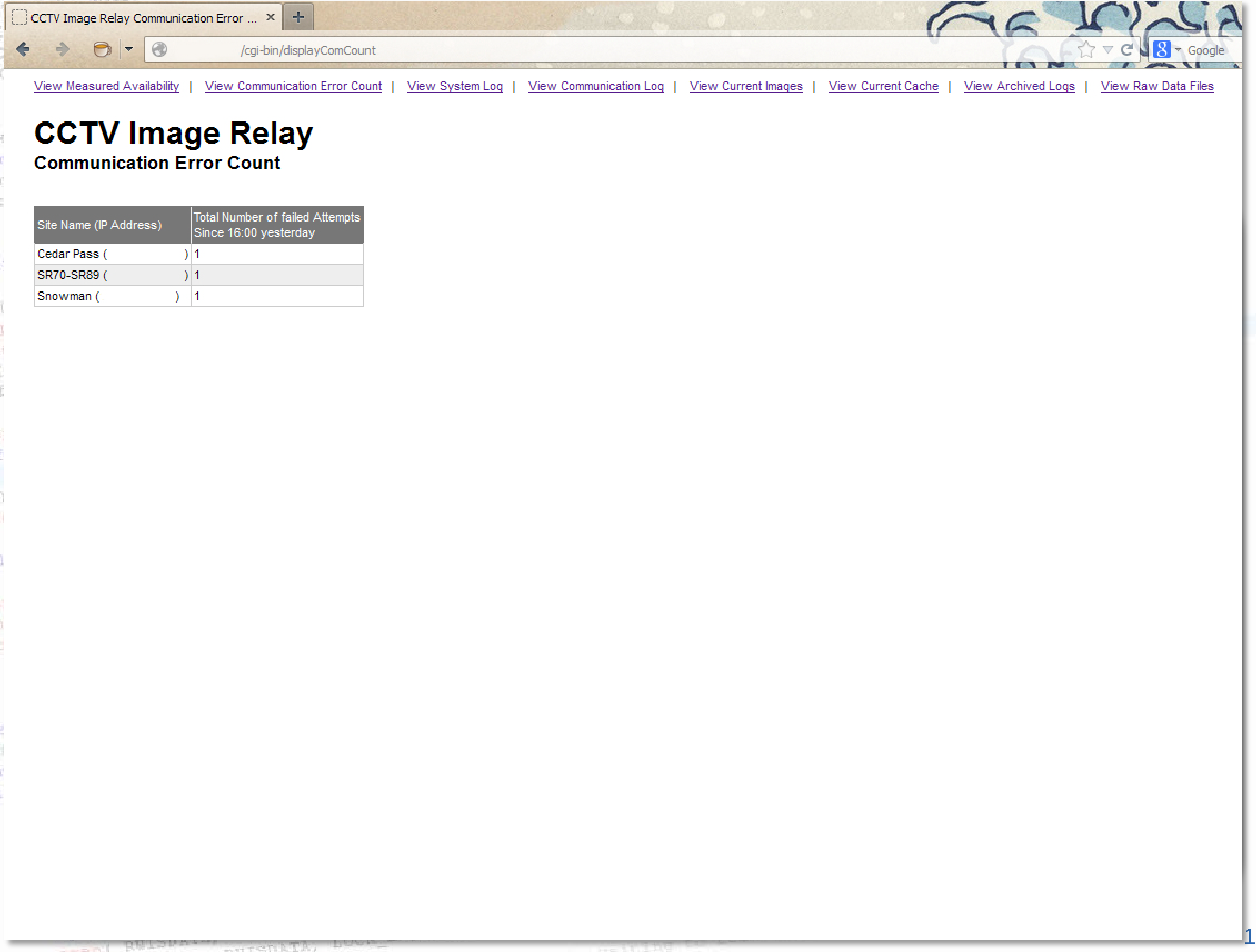
Measurement Interval: *2 days, 13 hours, 5 minutes*

Individual CCTV Field Element Measured Availability

Site Name	Number of Failed Attempts	Measured Availability Days Hours Minutes	Measured Availability Percentage
Abrams Lake	0	2 days, 13 hours, 5 minutes	100.00%
Anderson Grade	0	2 days, 13 hours, 5 minutes	100.00%
Antlers Bridge	0	2 days, 13 hours, 5 minutes	100.00%
BassMtn	0	2 days, 13 hours, 5 minutes	100.00%
Black Butte	0	2 days, 13 hours, 5 minutes	100.00%
Bogard	0	2 days, 13 hours, 5 minutes	100.00%
Buckhorn	0	2 days, 13 hours, 5 minutes	100.00%
Cedar Pass	2	2 days, 11 hours, 7 minutes	96.78%
Central Yreka	0	2 days, 13 hours, 5 minutes	100.00%
Deschutes	0	2 days, 13 hours, 5 minutes	100.00%
Dorris	0	2 days, 13 hours, 5 minutes	100.00%
Doyle	0	2 days, 13 hours, 5 minutes	100.00%
Dunsmuir	0	2 days, 13 hours, 5 minutes	100.00%
East Riverside	0	2 days, 13 hours, 5 minutes	100.00%
Eureka Way	0	2 days, 13 hours, 5 minutes	100.00%
Fawndale	0	2 days, 13 hours, 5 minutes	100.00%
Fredonyer Smt	0	2 days, 13 hours, 5 minutes	100.00%
Grass Lake	0	2 days, 13 hours, 5 minutes	100.00%
Hatchet Mtn	0	2 days, 13 hours, 5 minutes	100.00%
Hilt Sandhouse	0	2 days, 13 hours, 5 minutes	100.00%
I5-SR44	0	2 days, 13 hours, 5 minutes	100.00%
I5-SR89	0	2 days, 13 hours, 5 minutes	100.00%

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting

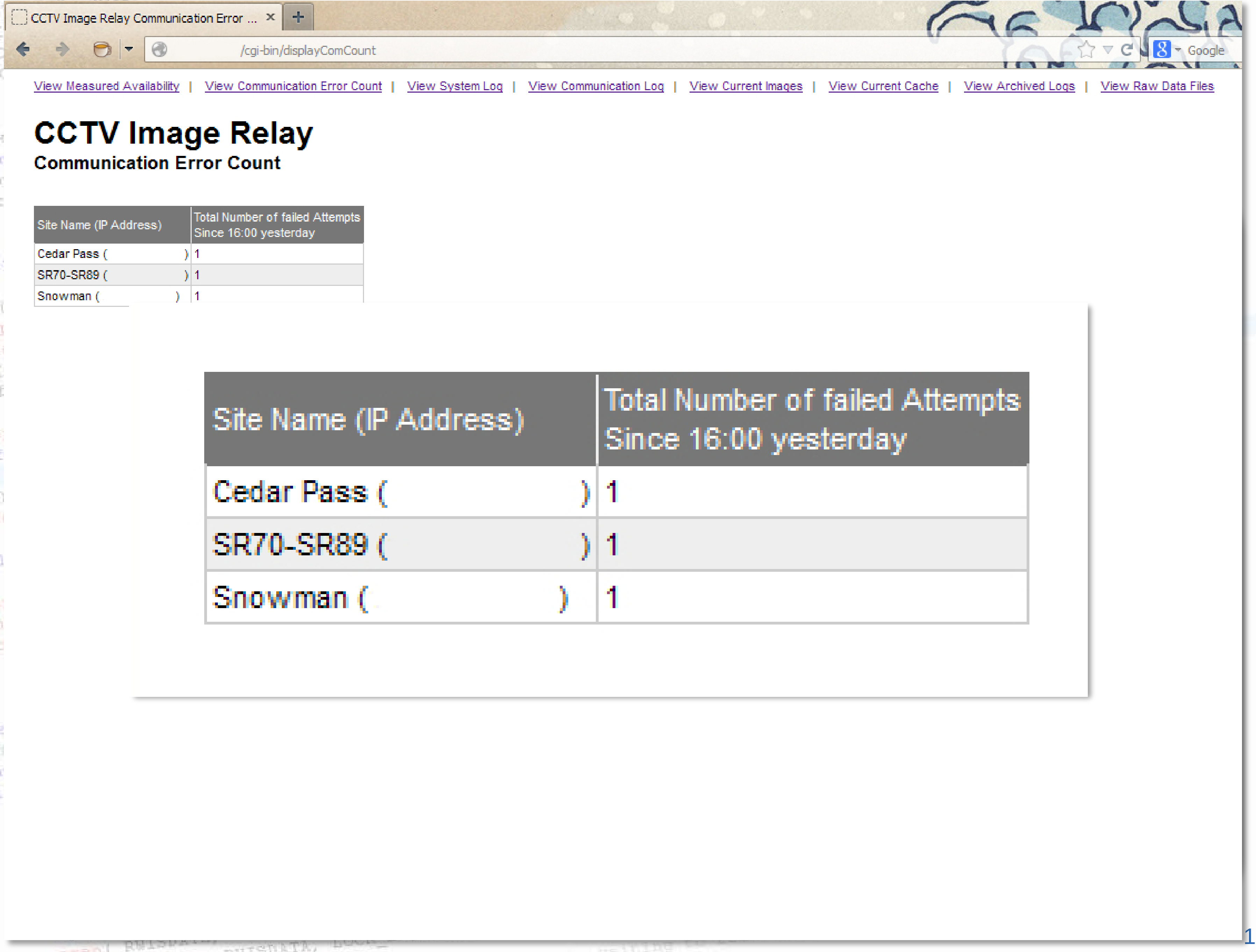


View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

Communication Error Count

Site Name (IP Address)	Total Number of failed Attempts Since 16:00 yesterday
Cedar Pass ( )	1
SR70-SR89 ( )	1
Snowman ( )	1



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

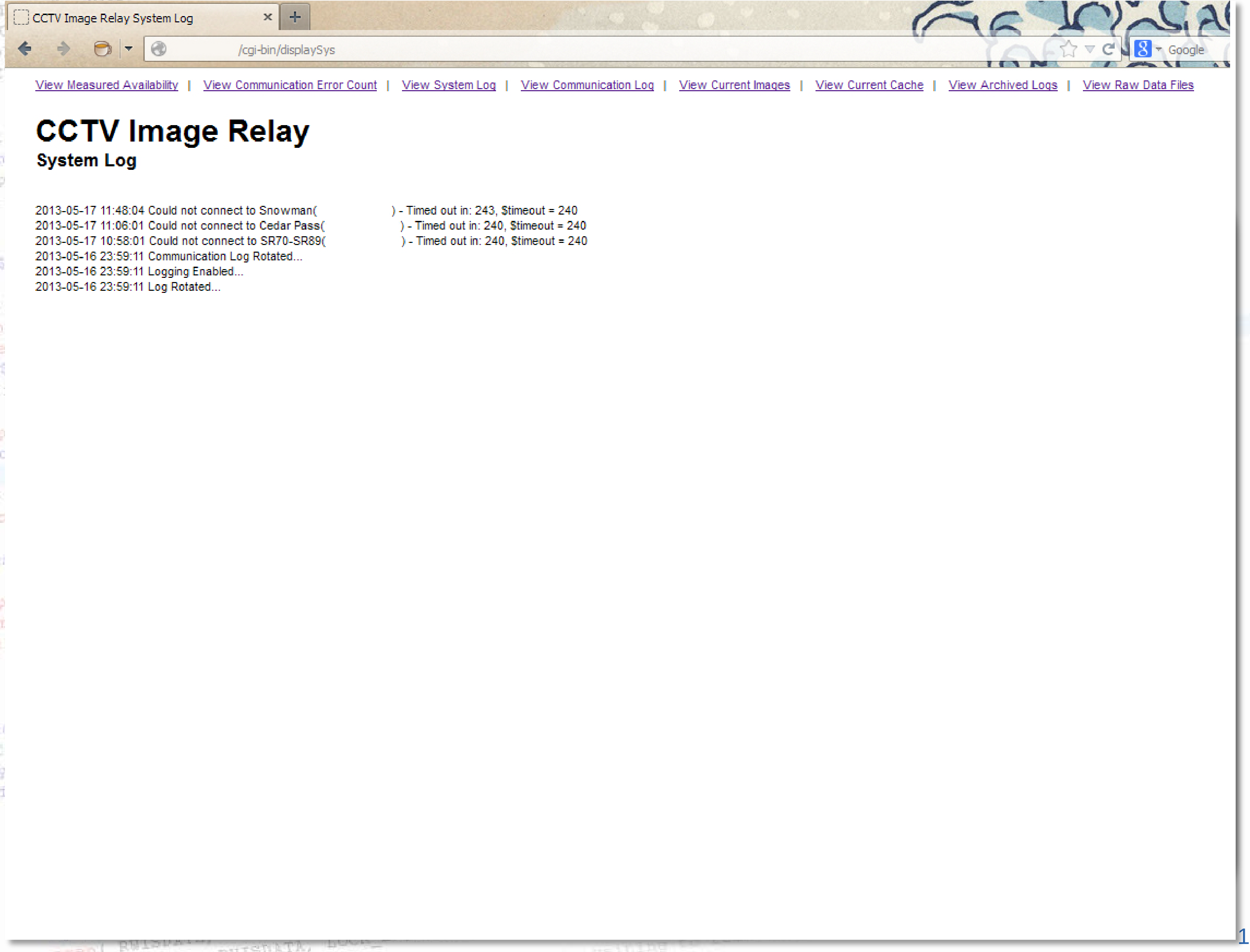
Communication Error Count

Site Name (IP Address)	Total Number of failed Attempts Since 16:00 yesterday
Cedar Pass ( )	1
SR70-SR89 ( )	1
Snowman ( )	1

Site Name (IP Address)	Total Number of failed Attempts Since 16:00 yesterday
Cedar Pass ( )	1
SR70-SR89 ( )	1
Snowman ( )	1

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting
    - System Log


CCTV Image Relay System Log
/cgi-bin/displaySys
Google
View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

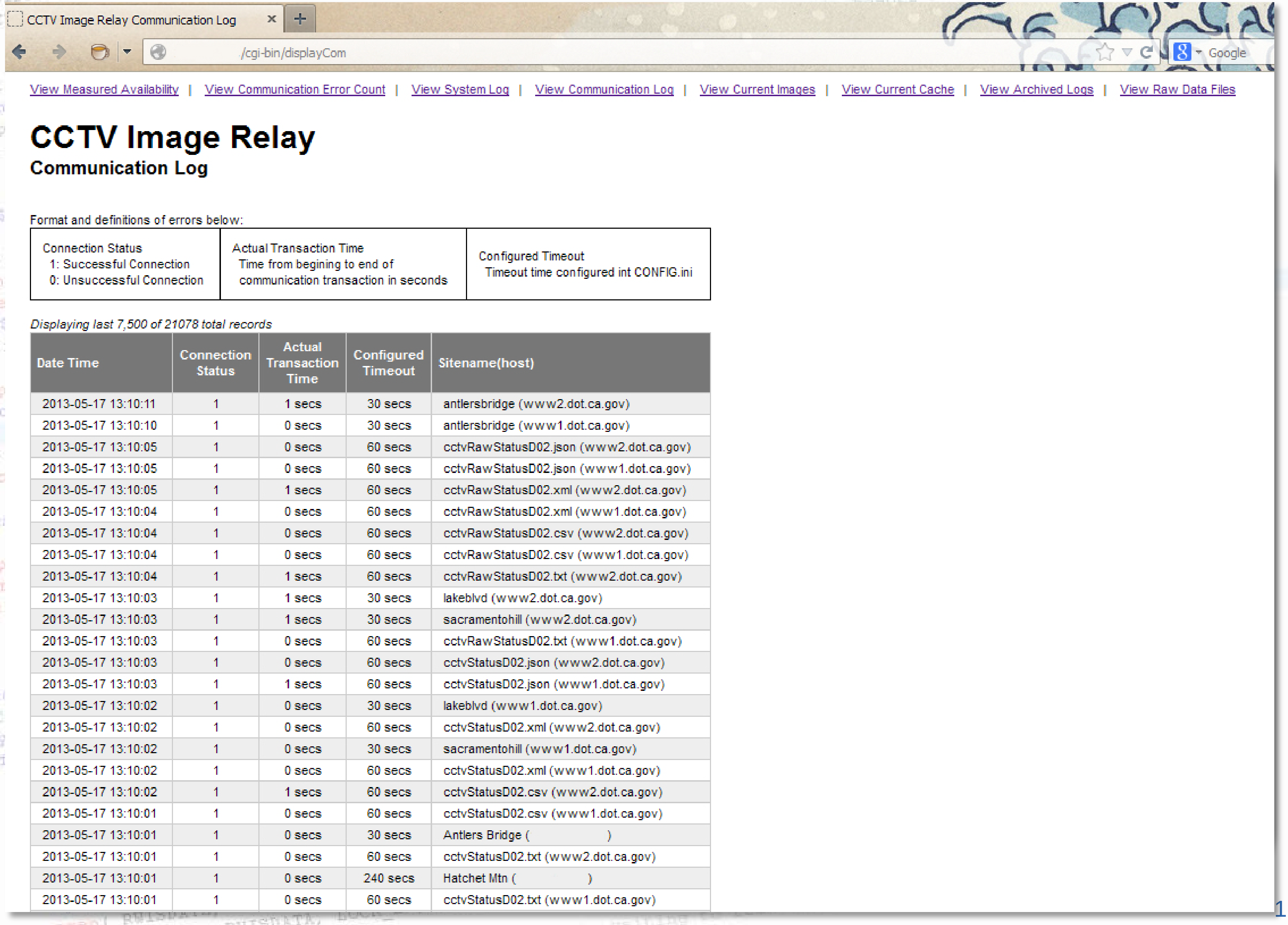
CCTV Image Relay

System Log

```
2013-05-17 11:48:04 Could not connect to Snowman(              ) - Timed out in: 243, $timeout = 240
2013-05-17 11:06:01 Could not connect to Cedar Pass(             ) - Timed out in: 240, $timeout = 240
2013-05-17 10:58:01 Could not connect to SR70-SR89(              ) - Timed out in: 240, $timeout = 240
2013-05-16 23:59:11 Communication Log Rotated...
2013-05-16 23:59:11 Logging Enabled...
2013-05-16 23:59:11 Log Rotated...
```

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting
    - System Log
    - Communication Log



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

Communication Log

Format and definitions of errors below:

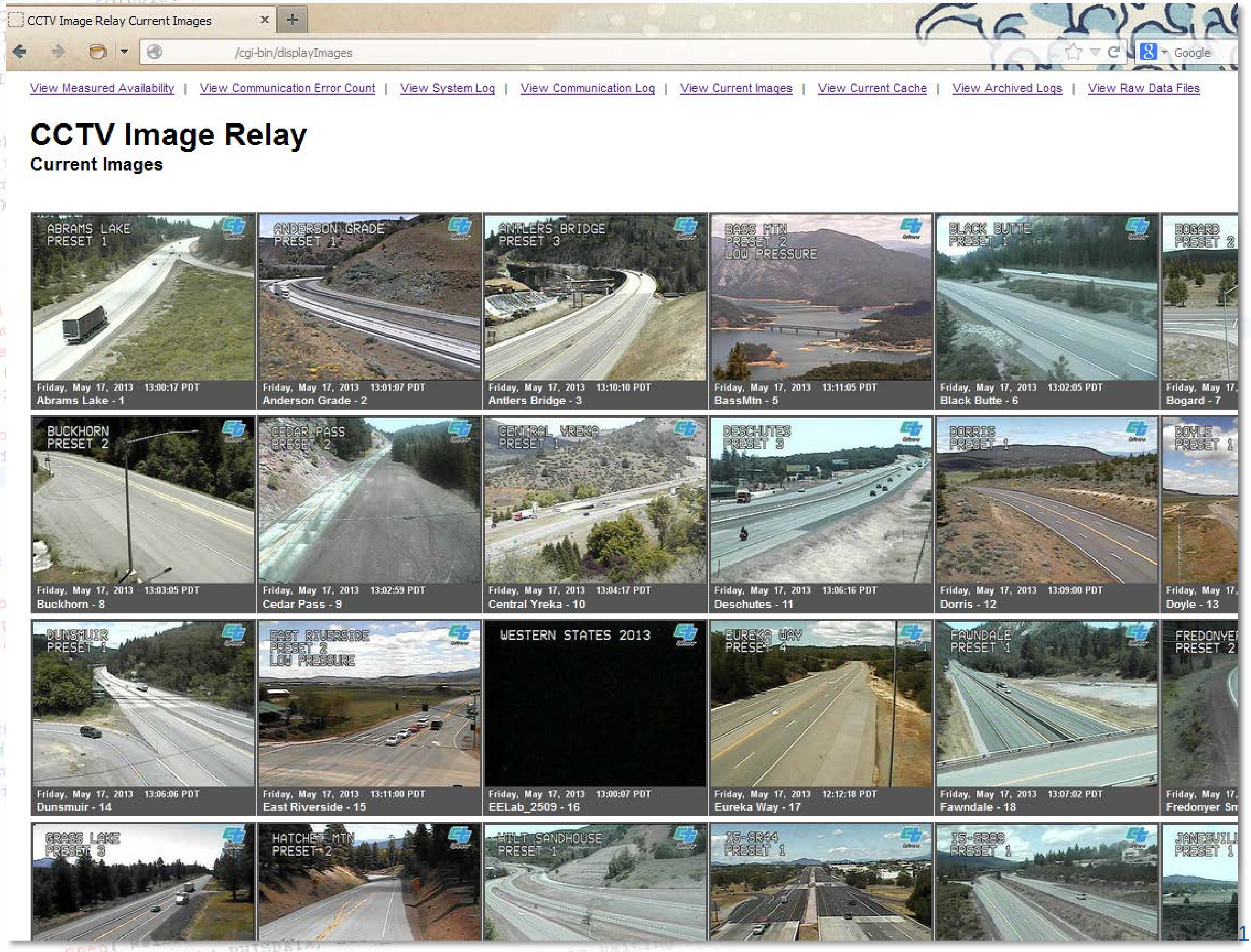
Connection Status 1: Successful Connection 0: Unsuccessful Connection	Actual Transaction Time Time from begining to end of communication transaction in seconds	Configured Timeout Timeout time configured int CONFIG.ini

Displaying last 7,500 of 21078 total records

Date Time	Connection Status	Actual Transaction Time	Configured Timeout	Sitename(host)
2013-05-17 13:10:11	1	1 secs	30 secs	antlersbridge (www2.dot.ca.gov)
2013-05-17 13:10:10	1	0 secs	30 secs	antlersbridge (www1.dot.ca.gov)
2013-05-17 13:10:05	1	0 secs	60 secs	cctvRawStatusD02.json (www2.dot.ca.gov)
2013-05-17 13:10:05	1	0 secs	60 secs	cctvRawStatusD02.json (www1.dot.ca.gov)
2013-05-17 13:10:05	1	1 secs	60 secs	cctvRawStatusD02.xml (www2.dot.ca.gov)
2013-05-17 13:10:04	1	0 secs	60 secs	cctvRawStatusD02.xml (www1.dot.ca.gov)
2013-05-17 13:10:04	1	0 secs	60 secs	cctvRawStatusD02.csv (www2.dot.ca.gov)
2013-05-17 13:10:04	1	0 secs	60 secs	cctvRawStatusD02.csv (www1.dot.ca.gov)
2013-05-17 13:10:04	1	1 secs	60 secs	cctvRawStatusD02.txt (www2.dot.ca.gov)
2013-05-17 13:10:03	1	1 secs	30 secs	lakeblvd (www2.dot.ca.gov)
2013-05-17 13:10:03	1	1 secs	30 secs	sacramentohill (www2.dot.ca.gov)
2013-05-17 13:10:03	1	0 secs	60 secs	cctvRawStatusD02.txt (www1.dot.ca.gov)
2013-05-17 13:10:03	1	0 secs	60 secs	cctvStatusD02.json (www2.dot.ca.gov)
2013-05-17 13:10:03	1	1 secs	60 secs	cctvStatusD02.json (www1.dot.ca.gov)
2013-05-17 13:10:02	1	0 secs	30 secs	lakeblvd (www1.dot.ca.gov)
2013-05-17 13:10:02	1	0 secs	60 secs	cctvStatusD02.xml (www2.dot.ca.gov)
2013-05-17 13:10:02	1	0 secs	30 secs	sacramentohill (www1.dot.ca.gov)
2013-05-17 13:10:02	1	0 secs	60 secs	cctvStatusD02.xml (www1.dot.ca.gov)
2013-05-17 13:10:02	1	1 secs	60 secs	cctvStatusD02.csv (www2.dot.ca.gov)
2013-05-17 13:10:01	1	0 secs	60 secs	cctvStatusD02.csv (www1.dot.ca.gov)
2013-05-17 13:10:01	1	0 secs	30 secs	Antlers Bridge ( )
2013-05-17 13:10:01	1	0 secs	60 secs	cctvStatusD02.txt (www2.dot.ca.gov)
2013-05-17 13:10:01	1	0 secs	240 secs	Hatchet Mtn ( )
2013-05-17 13:10:01	1	0 secs	60 secs	cctvStatusD02.txt (www1.dot.ca.gov)

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting
    - System Log
    - Communication Log
    - Current Images



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

Current Images

Friday, May 17, 2013 13:00:17 PDT
Abrams Lake - 1

Friday, May 17, 2013 13:01:07 PDT
Anderson Grade - 2

Friday, May 17, 2013 13:10:10 PDT
Antlers Bridge - 3

Friday, May 17, 2013 13:11:05 PDT
BassMtn - 5

Friday, May 17, 2013 13:02:05 PDT
Black Butte - 6

Friday, May 17,
Bogard - 7

Friday, May 17, 2013 13:03:05 PDT
Buckhorn - 8

Friday, May 17, 2013 13:02:59 PDT
Cedar Pass - 9

Friday, May 17, 2013 13:04:17 PDT
Central Yreka - 10

Friday, May 17, 2013 13:06:16 PDT
Deschutes - 11

Friday, May 17, 2013 13:09:00 PDT
Dorris - 12

Friday, May 17,
Doyle - 13

Friday, May 17, 2013 13:06:06 PDT
Dunsmuir - 14

Friday, May 17, 2013 13:11:00 PDT
East Riverside - 15

Friday, May 17, 2013 13:00:07 PDT
EELab_2509 - 16

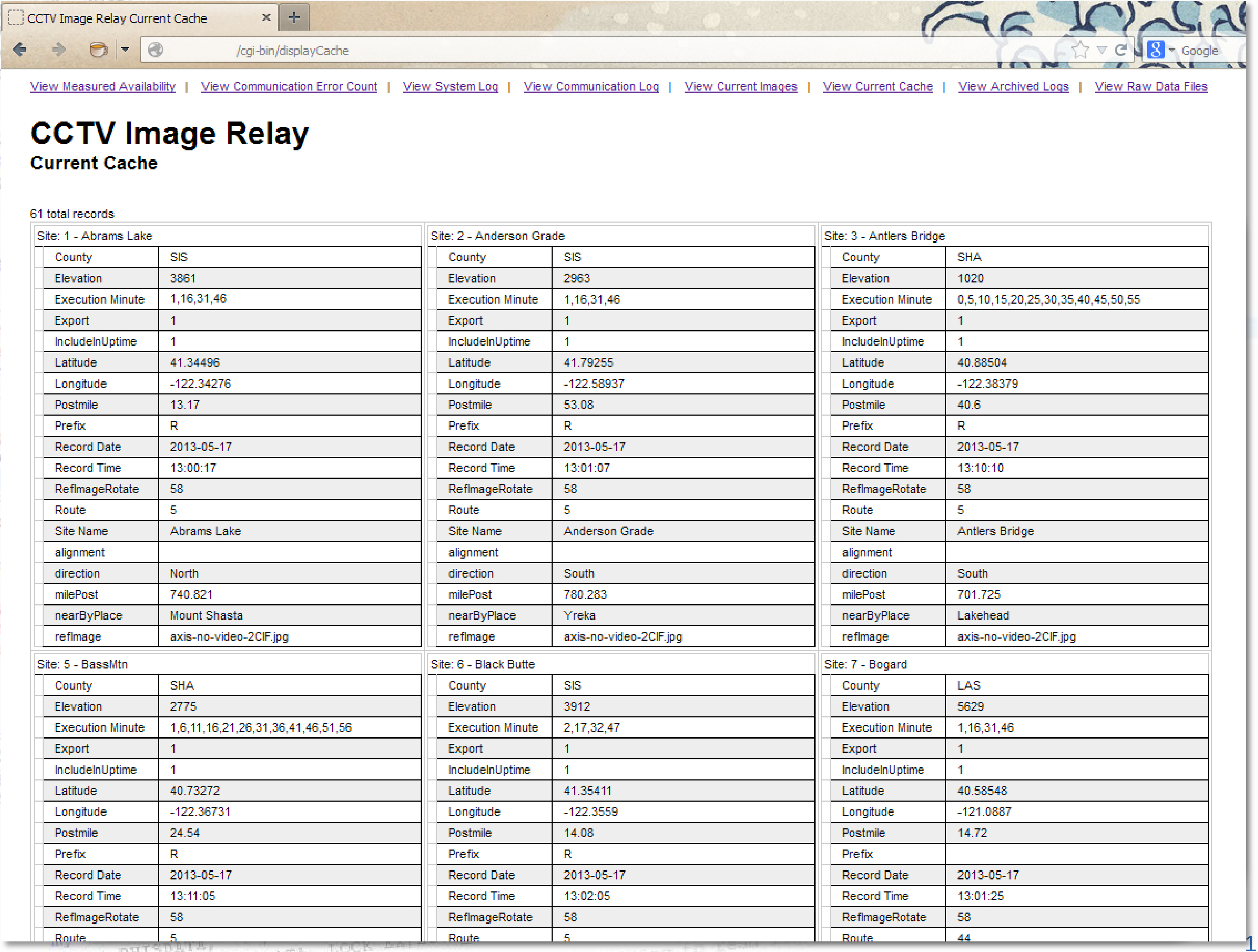
Friday, May 17, 2013 12:12:18 PDT
Eureka Way - 17

Friday, May 17, 2013 13:07:02 PDT
Fawndale - 18

Friday, May 17,
Fredonyer Sn

CCTV Image Relay Dashboard

- Dashboard
  - – Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting
    - System Log
    - Communication Log
    - Current Images
    - Current cache



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Relay

Current Cache

61 total records

Site: 1 - Abrams Lake	
County	SIS
Elevation	3861
Execution Minute	1,16,31,46
Export	1
IncludeInUptime	1
Latitude	41.34496
Longitude	-122.34276
Postmile	13.17
Prefix	R
Record Date	2013-05-17
Record Time	13:00:17
RefImageRotate	58
Route	5
Site Name	Abrams Lake
alignment	
direction	North
milePost	740.821
nearByPlace	Mount Shasta
refImage	axis-no-video-2CIF.jpg

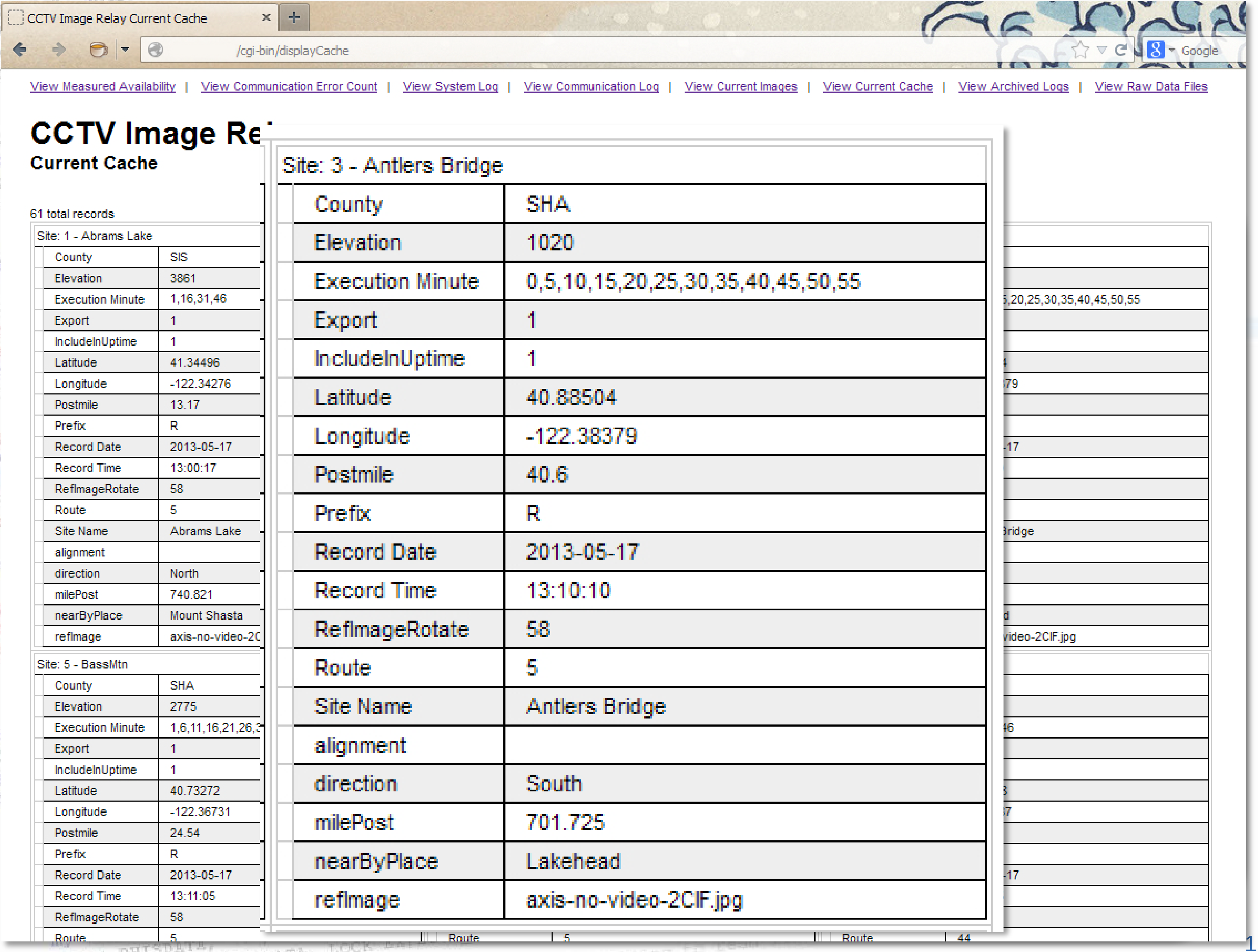
Site: 2 - Anderson Grade	
County	SIS
Elevation	2963
Execution Minute	1,16,31,46
Export	1
IncludeInUptime	1
Latitude	41.79255
Longitude	-122.58937
Postmile	53.08
Prefix	R
Record Date	2013-05-17
Record Time	13:01:07
RefImageRotate	58
Route	5
Site Name	Anderson Grade
alignment	
direction	South
milePost	780.283
nearByPlace	Yreka
refImage	axis-no-video-2CIF.jpg

Site: 3 - Antlers Bridge	
County	SHA
Elevation	1020
Execution Minute	0,5,10,15,20,25,30,35,40,45,50,55
Export	1
IncludeInUptime	1
Latitude	40.88504
Longitude	-122.38379
Postmile	40.6
Prefix	R
Record Date	2013-05-17
Record Time	13:10:10
RefImageRotate	58
Route	5
Site Name	Antlers Bridge
alignment	
direction	South
milePost	701.725
nearByPlace	Lakehead
refImage	axis-no-video-2CIF.jpg

Site: 5 - BassMtn	
County	SHA
Elevation	2775
Execution Minute	1,6,11,16,21,26,31,36,41,46,51,56
Export	1
IncludeInUptime	1
Latitude	40.73272
Longitude	-122.36731
Postmile	24.54
Prefix	R
Record Date	2013-05-17
Record Time	13:11:05
RefImageRotate	58
Route	5

Site: 6 - Black Butte	
County	SIS
Elevation	3912
Execution Minute	2,17,32,47
Export	1
IncludeInUptime	1
Latitude	41.35411
Longitude	-122.3559
Postmile	14.08
Prefix	R
Record Date	2013-05-17
Record Time	13:02:05
RefImageRotate	58
Route	5

Site: 7 - Bogard	
County	LAS
Elevation	5629
Execution Minute	1,16,31,46
Export	1
IncludeInUptime	1
Latitude	40.58548
Longitude	-121.0887
Postmile	14.72
Prefix	
Record Date	2013-05-17
Record Time	13:01:25
RefImageRotate	58
Route	44



View Measured Availability | View Communication Error Count | View System Log | View Communication Log | View Current Images | View Current Cache | View Archived Logs | View Raw Data Files

CCTV Image Re

Current Cache

61 total records

Site: 1 - Abrams Lake

County	SIS
Elevation	3861
Execution Minute	1,16,31,46
Export	1
IncludeInUptime	1
Latitude	41.34496
Longitude	-122.34276
Postmile	13.17
Prefix	R
Record Date	2013-05-17
Record Time	13:00:17
RefImageRotate	58
Route	5
Site Name	Abrams Lake
alignment	
direction	North
milePost	740.821
nearByPlace	Mount Shasta
refImage	axis-no-video-2C

Site: 5 - BassMtn

County	SHA
Elevation	2775
Execution Minute	1,6,11,16,21,26,3
Export	1
IncludeInUptime	1
Latitude	40.73272
Longitude	-122.36731
Postmile	24.54
Prefix	R
Record Date	2013-05-17
Record Time	13:11:05
RefImageRotate	58
Route	5

Site: 3 - Antlers Bridge

County	SHA
Elevation	1020
Execution Minute	0,5,10,15,20,25,30,35,40,45,50,55
Export	1
IncludeInUptime	1
Latitude	40.88504
Longitude	-122.38379
Postmile	40.6
Prefix	R
Record Date	2013-05-17
Record Time	13:10:10
RefImageRotate	58
Route	5
Site Name	Antlers Bridge
alignment	
direction	South
milePost	701.725
nearByPlace	Lakehead
refImage	axis-no-video-2CIF.jpg

,20,25,30,35,40,45,50,55
79
-17
Bridge
d
video-2CIF.jpg
46
7
-17

Route	5	Route	44

CCTV Image Relay Dashboard

- Dashboard
  - Quick and easy viewing of system status
    - Measured Availably
    - Communication Error Counting
    - System Log
    - Communication Log
    - Current Images
    - Current cache
    - Archived Logs
    - Raw Data Files

Deployment

- Installation
  - Installing code dependent third party software
    - ImageMagick
      - Must install several developer libraries for Perl Magick
    - Perl Magick
      - Installed though CPAN
    - Perl 5.10.1
      - Newer versions of Perl have not been tested
    - Install Perl modules
      - Net::FTP

Deployment

- Installation (Cont)
  - – Install CCTV Relay Code
    - Copy to correct directories
    - Set permissions to 755
  - – Modify configurations files (If needed)
  - – Test code

    /etc/init.d/CCTVGrabber start

Deployment

- Issues
  - – Complexity of code dependencies
  - – Memory Management (Linux)
    - Linux Virtual Memory management
    - Linux likes to have memory “full”
      - – Active
      - – Inactive
  - – cache data file
    - Switched to serialized data to eliminate read/write errors and parsing errors

Maintaining

- Version Control
  - Currently one main programmer means easy version control
  - Simple milestones
    - 1.0.1 (Major release. Minor release. Minor bug fixes)
  - Simple versioning
    - 2012.0128.0727 (1.0.0)
    - Year. Month Day. Time (Target Milestone)
  - Consider using Check-in, Check-out software

Maintaining

- Bug tracking
  - Bugzilla
    - Free
    - Easy to use
    - Low overhead

Maintaining

- Releases
  - Use sandbox for implementing code changes
    - Keeps isolation from production server
    - Doesn’t cause unknown or undesirable changes to production server
  - Test Code
    - Use several test vectors to determine if the code is behaving correctly
    - Try to force code to go into unknown states
    - New modules, use separate test script and vary inputs and force bad inputs

Maintaining

- Releases
  - – Let run on sandbox/backup for 1-2 weeks
  - – Migrate code to production
  - – Monitor production for 1-2 weeks

Maintaining

- Future
  - Central Control (Independent System)
    - Web UI for configuration and management
    - Schedules (Winter/Storm/Summer)
  - Email notification for down elements
  - Debugging levels
    - Critical/Fatal
    - Error
    - Warning
    - Information

Questions?