# HEPIX VWG Image transfer.

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HEPIX VWG Image transfer.
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## HEPIX VWG Assumptions

> For new customers Cloud may be all we need.
  - But HEP is not a new customer.

> HEP Experiment software is currently partially trusted.
  - Sites allow NFS 3, sites are not ready for untrusted images.
  - HEP experiments are not ready to abandon rshell data access.

> Virtualising Worker node can be transparent for grid users.
  - We need to trust images more than with a cloud infrastructure.

> Accountancy.
  - Cloud model of billing does not fit with current systems.

> We should find a way to use as much of grid as possible.
  - We should demonstrate our ideas work.

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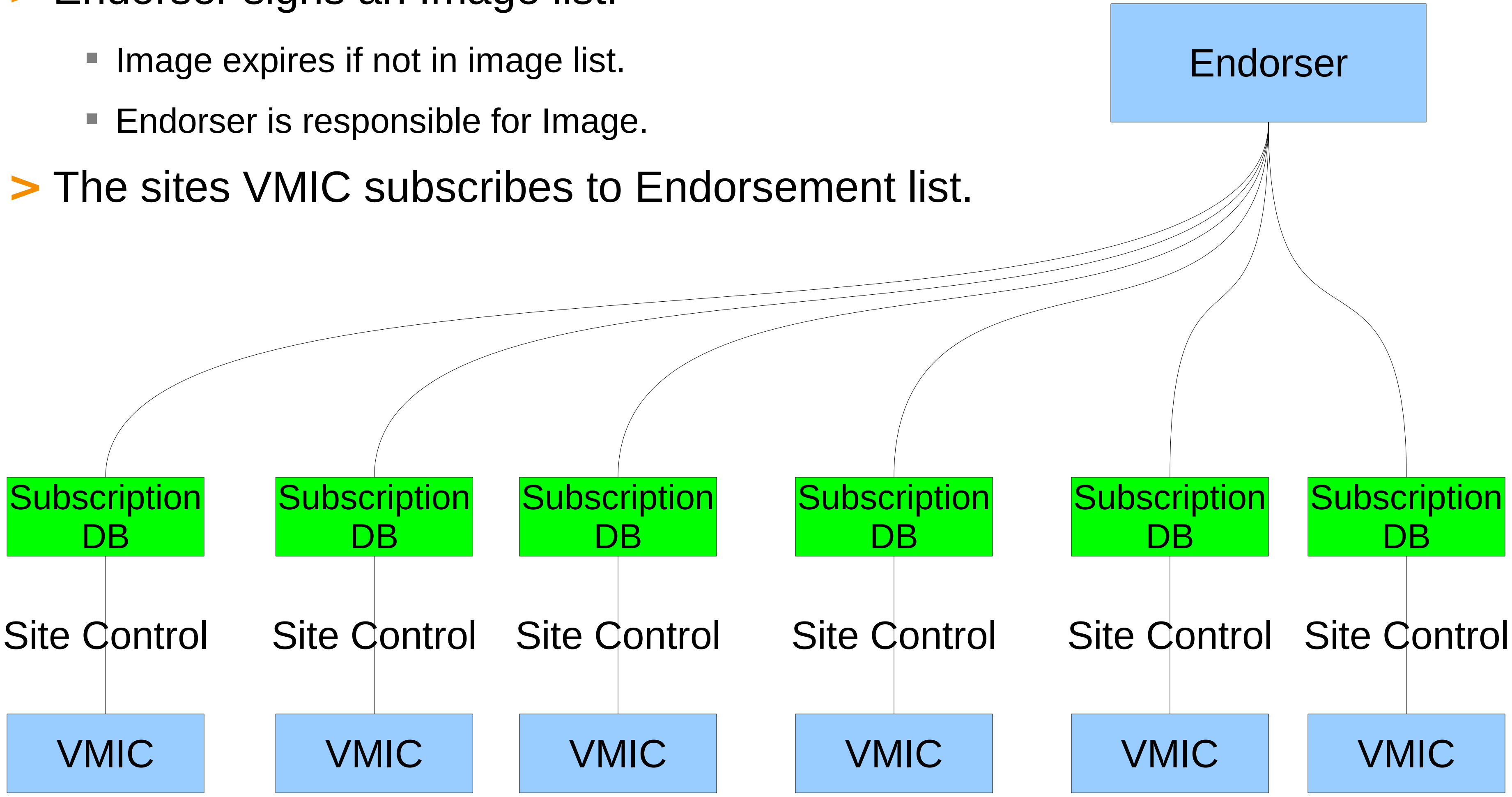
## Image transfer Objective

- How to transfer images securely.
  - We know who made the image (Endorser)
  - We know the image is unmodified after endorsement.
  - We know the endorser cant repudiate their image list.
- Privileged images on sites must be authorized by administrator.
  - Can subscribe to an image from an image list.
  - Have minimal work for a site admin.
- Site must be able to revoke.
  - An image, an endorser or an image list subscription.
- We have Implementations for image transfer.
  - Present to HEPIX and hope for site approval
  - Plan to present to experimental communities if approved by HEPIX.

## Publish Subscribe

- Endorser signs an Image list.
  - Image expires if not in image list.
  - Endorser is responsible for Image.
- The sites VMIC subscribes to Endorsement list.



## Image security.

> Image to Meta data binding.

- Cryptographic hashes.
    - It is easy to compute the hash value for any given data.
    - It is infeasible to generate a message that has a given hash.
    - It is infeasible to modify a message without hash being changed.
    - It is infeasible to find two different messages with the same hash.
- Chose to use sha512 and file size to validate data.
    - Following Stratuslabs recommendation.
- Other hashes can be added.
    - If sha512 and size are later found to be too week.
- URI to retrieve image.
    - Can be cached locally.
- Each image has a UUID
    - So we know which image is expired and which is upgraded.

## Meta-data Security.

> Meta-data authenticity.

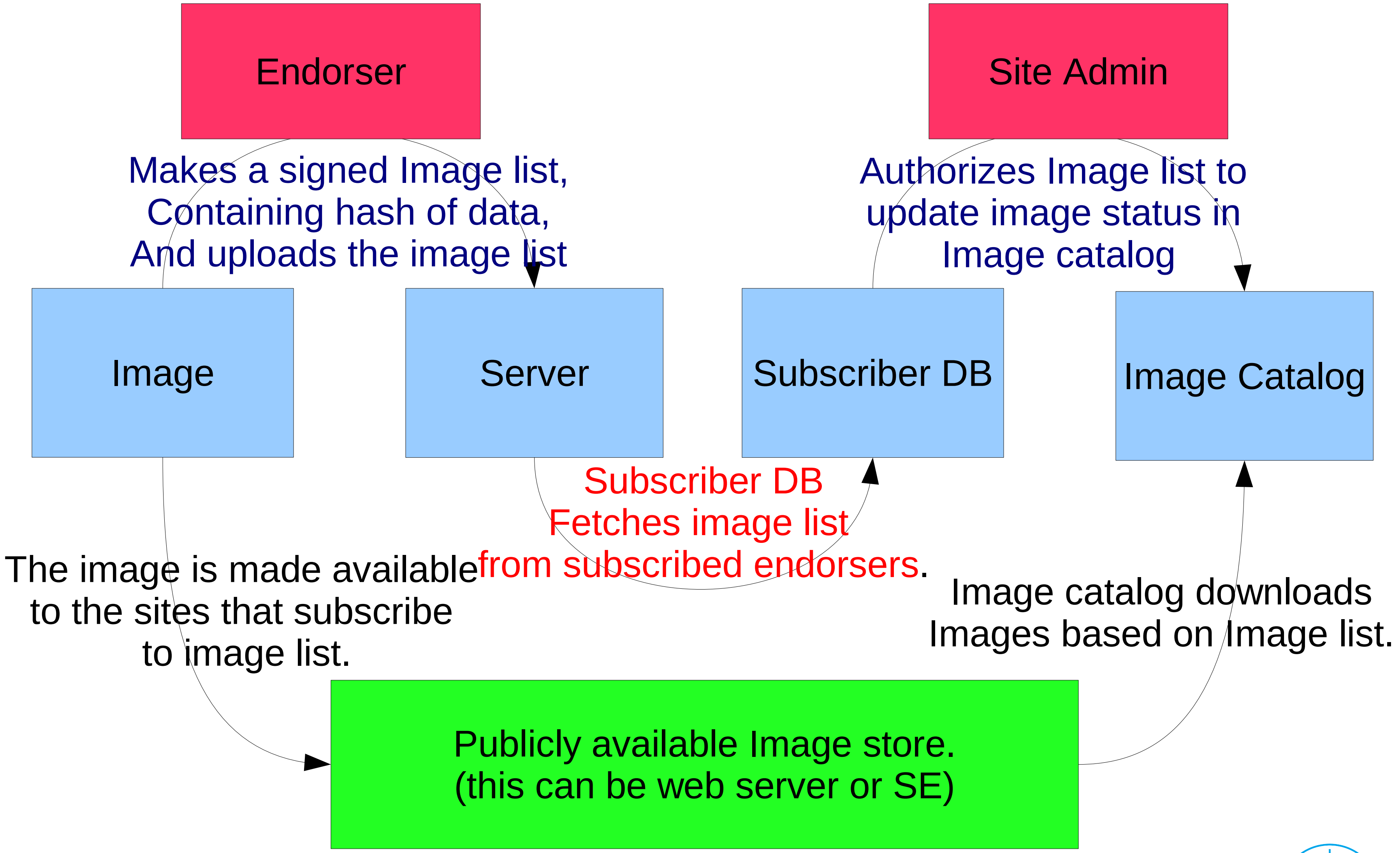
- X509 + signatures. (SMIME or XML signatures)
    - Gives non repudiation, and confidence in who endorsed.
    - Give tamper proof message.
    - Signature can be checked by all clients,
    - Allows checking of historic meta-data changes.
- Version number.
    - Prevents man in middle attacks.
    - Man In Middle attempts to return an old list blocked by this.
- UUID on Image and Image list
    - Allows messages to be identified.
    - So messages cannot effect each other.
    - So images can be expired and updated.

## Why an Image list?

> We believe that image lists are better than just image meta data.

- Any Image not on the list is not endorsed.
  - Prevents lost endorsements.
- Endorsers only have one item to manage.
- Any later image list published overrides the old image list.
  - Provides a simple way to deprecate images.

# Image and image list transfer overview


Endorser
Site Admin
Makes a signed Image list,
Containing hash of data,
And uploads the image list
Authorizes Image list to
update image status in
Image catalog
Image
Server
Subscriber DB
Image Catalog
Subscriber DB
Fetches image list
from subscribed endorsers.
The image is made available
to the sites that subscribe
to image list.
Image catalog downloads
Images based on Image list.
Publicly available Image store.
(this can be web server or SE)

## Making the Meta-data

- CERN VMIC automates this with new patch.
- Process for signing Meta-data.
  - 1) Create a template for the image list.
    - vmilisttool --json image_list_template.json
  - 2) Create a template for an image reference.
    - vmilisttool --image /home/jdoe/rawdiskimage.img --generate Vmmetadata.json
  - 3) Add your newly updated image meta-data to the image list
    - vmilisttool  --template image_list_template.json  -add VMmetadata.json --json merged_image_list.json
  - 4) Sign the now assembled meta-data list.
    - vmilisttool  --template merged_image_list.json -s signed_image_list
- Currently JSON, but XML will also be used.
  - Compatibility with new Clemson VMIC messages.
- Can edit the file easily before signing.
  - After signing the edits will make the list invalid.
- Extra fields can be added.
  - These are for endorsers customers use and will have no effect on the HEPIX infrastructure.

# Example of what signed meta-data can look like

```
------EAE3006C97F670EE450F46AC8DF4C070
{
    "dc:date:created": "2011-03-10T17:09:12Z",
    "dc:date:expires": "2011-04-07T17:09:12Z",
    "dc:description": "a README example of an image list",
    "dc:identifier": "4e186b44-2c64-40ea-97d5-e9e5c0bce059",
    "dc:source": "example.org",
    "dc:title": "README example",
    "hv:endorser": {
        "hv:x509": {
            "dc:creator": "Owen Synge",
            "hv:ca": "/C=DE/O=GermanGrid/CN=GridKa-CA",
            "hv:dn": "/C=DE/O=GermanGrid/OU=DESY/CN=Owen Synge",
            "hv:email": "owen.synge@desy.de"
        }
    },
    "hv:images": [
        {
            "hv:image": {
                "dc:description": "This is an README example VM",
                "dc:identifier": "488dcdc4-9ab1-4fc8-a7ba-b7a5428ecb3d",
                "dc:title": "README example VM",
                "hv:hypervisor": "kvm",
                "hv:size": 2147483648,
                "hv:uri": "http://example.org/example-image.img",
                "hv:version": "1",
                "sl:arch": "x86_64",
                "sl:checksum:sha512":
"8b4c269a60da1061b434b696c4a89293bea847b66bd8ba486a914d4209df651193ee8d454f8231840b7500fab6740620c7111d9a
17d08b743133dc393ba2c0d4",
                "sl:comments": "Vanila install with contextulization scripts",
                "sl:os": "Linux",
                "sl:osversion": "SL 5.5"
            }
        }
    ],
    "hv:uri": "http://example.org/example-image-list.image_list",
    "hv:version": "1"
}
------EAE3006C97F670EE450F46AC8DF4C070
Content-Type: application/pkcs7-signature; name="smime.p7s"
Content-Transfer-Encoding: base64
Content-Disposition: attachment; filename="smime.p7s"

MIIHdAYJKoZIhvcNAQcCoIIHZTCCB2ECAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3
DQEHAaCCBSUwggUhMIIECaADAgECAgIz7DANBgkqhkiG9w0BAQUFADA2MQswCQYD
VQQGEwJERTETMBEGA1UEChMKR2VybWFuR3JpZDESMBAGA1UEAxMJR3JpZEthLUNB
MB4XDTExMDExMDE1MDMxN1oXDTEyMDIwOTE1MDMxN1owRjELMAkGA1UEBhMCREUx
EzARBgNVBAoTCkdlcm1hbkdyaWQxDTALBgNVBAsTBERFU1kxEzARBgNVBAMTCk93
ZW4gU3luZ2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQCkgbPFZrVL
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JqZgZBvYcwJV4V9pais4YlsEug+JLMbB9hZ6e2XgdjXWgLqz6vBSIf6KXi4KhCxe
a4FylvIk7OtY+bg0mg5IFHib6uP7fXhFKdBEapoi+B05wpluBMA+2DBdSt+rjzA8
SwiHUuan60VIyJAxammyOe3IKSpwyBXkQ10XjIhIpoSavqYXJboFOVzUcqxawdbX
Con2W8QfiwFKYupohG/VTusDXFT2MP4k+KxG3/rTTPWUDJme7VUPv3+CTcEO+z4v
X8/XhI44oAXlAgMBAAGjggInMIICIzAMBgNVHRMBAf8EAjAAMA4GA1UdDwEB/wQE
AwIE8DAdBgNVHQ4EFgQUGakUy66kgvuINBIf18WBXjGoIqYwXgYDVR0jBFcwVYAU
xnXJKKzRC/w8/7m1HtNfO4BiEjShOqQ4MDYxCzAJBgNVBAYTAkRFMRMwEQYDVQQK
EwpHZXJtYW5HcmlkMRIwEAYDVQQDEwlHcmlkS2EtQ0GCAQAwHQYDVR0RBBYwFIES
b3dlbi5TeW5nZUBkZXN5LmRlMB8GA1UdEgQYMBaBFGdyaWRrYS1jYUBpd3IuZnpr
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a2EtY3JsLmRlcjAaBgNVHSAEEzARMA8GDSsGAQQBlDarLAEBAQUwEQYJYIZIAYb4
QgEBBAQDAgWgME4GCWCGSAGG+EIBDQRBFj9DZXJ0aWZpY2F0ZSBpc3N1ZWQgdW5k
ZXIgQ1AvQ1BTIHYuIDEuNSBhdCBodHRwOi8vZ3JpZC5memsuZGUvY2EwJAYJYIZI
AYb4QgECBBcWFWh0dHA6Ly9ncmlkLmZ6ay5kZS9jYTAzBglghkgBhvhCAQgEJhYk
aHR0cDovL2dyaWQuZnprLmRlL2NhL2dyaWRrYS1jcHMucGRmMDMGCWCGSAGG+EIB
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Ui4s/f9iAGl9rA21h8QAaRaJ/h1OQNlgMZbc9jDCWcqxr8wQTYAQDiBkspLT68ZO
5xVFRiq3HjkkhwnFfFzsNSiLFYZTRjChPluclYG3TEvSg8dz9Lv/IEJxE5C5lZ2d
e3CSu0vcD0DESiu/sVqPOOHi8NL/59U2ine3z23Y+piCabQCxjT0inT2MmR8UNDF
ij2JJYxlt56U/SQCEe0304w3x1jIg8vcpm4dfh+L2IjJ9hVfEeLaCyhv9Wjbmu5O
vk0yLjcEZ7b4RKeo7djVYh+5kCWJYCr/W6uGW44xggIXMIICEwIBATA8MDYxCzAJ
BgNVBAYTAkRFMRMwEQYDVQQKEwpHZXJtYW5HcmlkMRIwEAYDVQQDEwlHcmlkS2Et
Q0ECAjPsMAkGBSsOAwIaBQCggbEwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEHATAc
BgkqhkiG9w0BCQUxDxcNMTEwMzEwMTczMzU1WjAjBgkqhkiG9w0BCQQxFgQUd43y
VT05Zk+7acFF+EeqExNI57cwUgYJKoZIhvcNAQkPMUUwQzAKBggqhkiG9w0DBzAO
BggqhkiG9w0DAgICAIAwDQYIKoZIhvcNAwICAUAwBwYFKw4DAgcwDQYIKoZIhvcN
AwICASgwDQYJKoZIhvcNAQEBBQAEggEAkA0RgB5AkGIYvFsFETzx7QHKWu9qas5k
vlHn2a+EpRE9K1p+qrFNzS53E2BGqubyRcePfgG/WyGqYOK2h20d6GZH+ENUFkvM
EAthbvQaHye6WEvF/0GUrr0QUBT1gQswkkryPHcqTVmJANQORakkNvCwynEBmfSC
vb2TEppRuOCmxx3zqrzMr7zPNPY4w2+YaXQ1fHfmEmOrlf0ImP20TyTKIoQWqzbq
WXwlRhZBUoD9zfiEM/jFvOvkuxLkQeiEcSzlLAGHXsHJ3anPMX9sobJFbJI0wYdN
sUOInHRhksokh2ow68KZK4vXLI173v5yZE7FZZ1Gl9T+YpkmOIW4iQ==

------EAE3006C97F670EE450F46AC8DF4C070--
```

Please Note:

XML implementation would look different but will be functional identical.
XML signatures store signature as XML.

## Publishing endorsers Image list.

- To publish endorsers image list.
  - Must be available to the subscribers.
  - Subscription URL in image list must match your publishing location.
  - Must accept UUID constraints.
    - Image list UUID is unique
    - Each Image UUID is unique to your list.
  - Man in middle attacks must be blocked.
    - Suggest x509 based web server.
    - Could use ordinary https web server.
- To publish endorsers image
  - Must be available to subscribers.
  - All data integrity and authenticity in the image list.
- To expire images.
  - Endorsers do not reference image in the image lists latest version.
- Suggest endorser sets up a subscriber to endorsers own image list.
  - So endorser knows before subscribers that they have an issue!

## Meta data subscription validation.

- Must validate the image lists.
  - Using x509 Signatures. (handling CA, CRL's, and CA namespaces)
    - SMIME is supported XML signatures intended.
  - Manage a list of endorsers for an image list.
    - So that more than one person can provide and image list (eg for Atlas.)
    - So that only authorized people can update an image list.
  - Must enforce UUID constraints.
    - UUID is same as other subscriptions
    - UUID of each image is exclusive to subscription.
  - Must query for signed image list using the image hash.
    - So you can find the endorser for a given image and their signature
      - Non repudiation feature from image
    - So you can expire images from an image cache.
  - Should inform image producer if an image list breaks subscriptions constraints.
    - Unsure how this should be done.

## Meta-data subscription DB

- Mostly no admin interaction!
  - All subscriptions updated from a cron script.
  - All data is derived from subscriptions to image lists.
    - So just need to store signed image lists which you should anyway.
  - Migration is simply install a second in parallel.
- Simple RDBMS
  - No critical data to back up.
- Adding an image list all that is required to subscribe.
  - Since Image list contains where to get update to image list.
- Image cache as a client of the subscription data base.
  - Not yet implemented. (2011-04-29)
    - Will be writing this during HEPIX and shortly after.
  - Very simple directory containing image's.
  - Expired images will be deleted.
  - Current images will be validated.

## VMIC deployed at CERN and 3 other sites.

- The admins image authorization interface.
- Allows multiple admins to cover for each other.
  - Uses service cert.
- Allows sites to securely deploy images around a site.
  - Produces a site image list. (similar to an external image list.)
  - Action to commit database data to a signed message.
    - Allows site to atomically update image lists.
- Provides a history of images deployed at a site.
  - Stores the sites signed image list.
- Patch came in from Clemson University to provide Image list import and export directly.
  - This talk does not cover this system as I am yet to investigate this new functionality.

## Summary (Concepts matter not implementation)

> Signed image lists define images.
  - First version of meta data is defined.
  - RDF(XML) and JSON are functionally equivalent.

> Non repudiation of image lists through signatures.

> Only Images on current Image list are endorsed.
  - This means images expire when not in current image list.

> Principle is generic to Clouds, virtualised worker node.

> Two implementations of message generation/consumption exist.
  - My fault for not being aware of Clemson University patch.
  - We need to compare features and maybe make messages inoperable.

> We recommend the concept of Signed image lists to HEPIX.