



# Sharing images in a regulated environment

Aperio Science Webinar Series

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September 2007

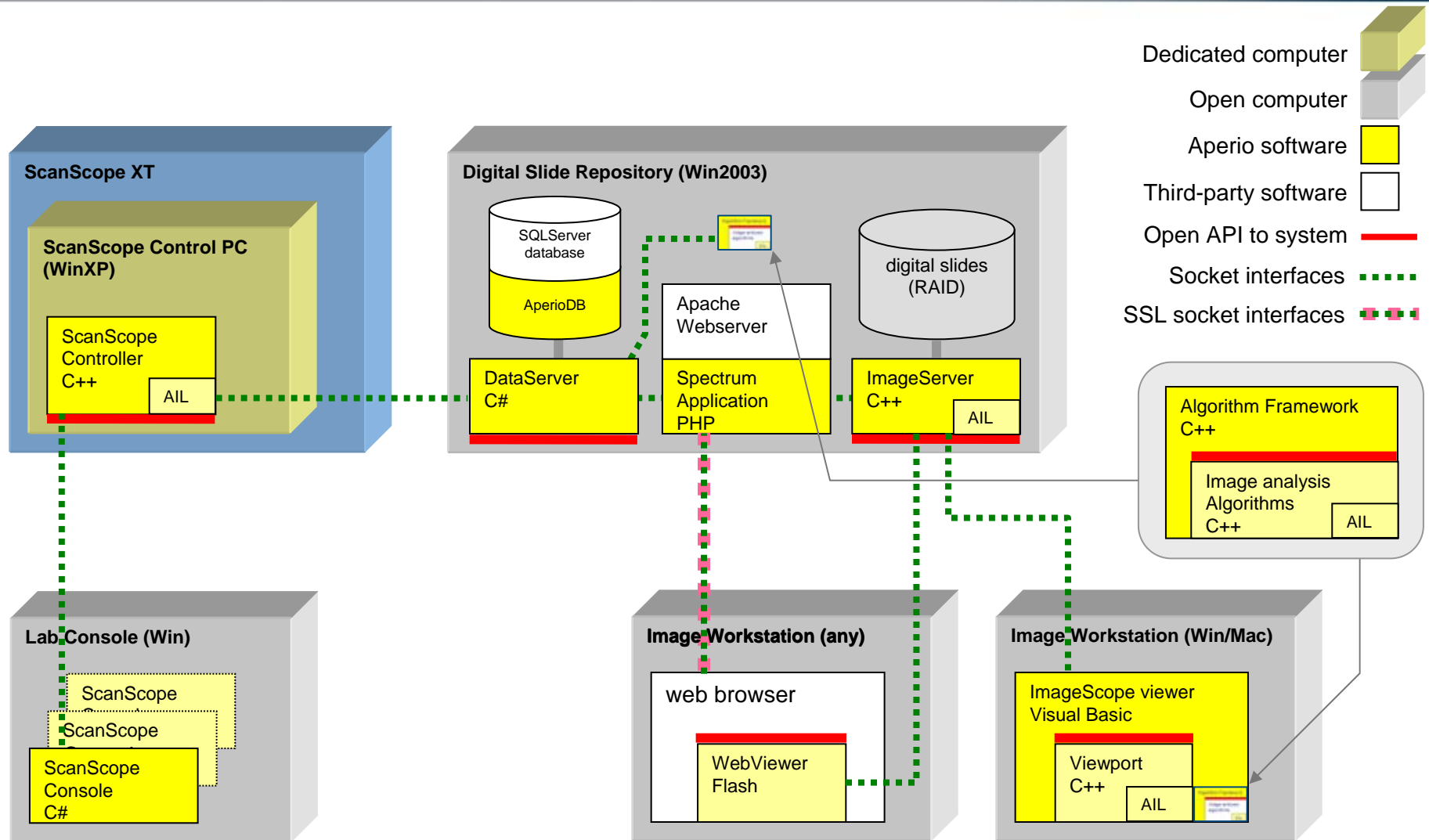
# Aperio Science Webinar Series

- July: *Digital Toxicologic Pathology*
- August: *Validating protein expression in a tissue context*
  - Dr. Stan Krajewski, Burnham Institute
  - Co-localization algorithms
- September 19th: *Sharing Images in a Regulated Environment*
  - Ole Eichhorn, CTO Aperio
- October: *Smart Imaging Technology in Toxicologic Pathology*
  - Dr. Gary Knutsen, Systems Pathology LLC
- November: *Angiogenesis and vascularization detection*
  - Dr. Allen Olson, Aperio
- December: *Using algorithms to make efficacy more quantitative*
  - Dr. Frank Voelker

# Sharing images in a regulated environment

- Aperio System Architecture
  - Spectrum / ImageScope demo
- Scenarios
  - Pharma: share images for academic review
  - CRO: post images for external evaluation
  - Pharma and CRO: remote collaboration
  - AMC: virtual IHC service
  - Pharma: distributed study archive
- Performance Considerations

# Aperio System Architecture



# Spectrum

- Digital pathology software that delivers all the information a pathologist needs, anywhere, anytime.



Microscope-quality digital slides  
Macro (gross) images and data  
Case history

Associated image analyses  
Pathology reports  
Worklist

Spectrum - Edit Record - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://spectrum.aperio.com

# Spectrum™

Welcome Spectrum Administrator Cases

## Case Information

[Open Case](#)

Spectrum Case ID: 82

Reg DR: Dr. CHOP-(2 specimens)

MR Number: S0000080

DOB: 1954-01-01 00:00

Sex: Male

Case Number: 07:00016

Patient Name: John Doe

Case Status:

Data Group: CHOP

## Specimen Information

[< Previous Specimen](#) | [Back to Case](#)

## Specimen Digital Slides

[View Images](#) | [Open Data](#) | [Analyze](#) | [Remove](#) | [Delete](#) | [More](#)

Thumbnails

Spectrum Plus  
© Copyright 2007 Aperio

Aperio ImageScope v8.2.13.0

File Image View Tools Window Help

Tracker

Barcode: Slide ID: 978 File: \\darwin\images\ScanServices\DNAR\BE10S RLA.svs

Zoom: 8.0X

Barcode: Slide ID: 977 File: \\darwin\images\ScanServices\DNAR\BE10S FOU.svs

Zoom: 8.0X

Done 74880 x 73211 = 15.3GB, file = 742MB 40060, 23735 : 3620 x 2010 35490, 21430 fetching / trackmap / progressive rendering / interpolat A/C: 98.0% PAN

Spectrum - Edit Record - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://spectrum.aperio.com/EditRecord.

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Welcome Spectrum Administrator Cases Specimens

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## Specimen Digital Slides

[View Images](#) | [Open Data](#) | [Analyze](#) | [Remove](#) | [Delete](#) | [Move Images](#)

Thumbnails		Final Dia
<input type="checkbox"/>		DNAR
<input type="checkbox"/>		DNAR

powered by **aperio**

Spectrum Plus + TMA Version

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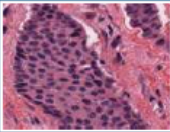
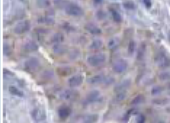
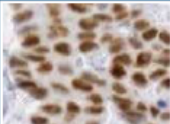
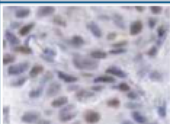
IHCReport.pdf (application/pdf Object) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://spectrum.aperio.com/GenReport.php/IHCReport.pdf

71%

Find:

FINAL Report		IHC REPORT			Report Date: July 19, 2007	
	Burns Laboratory 123 Fake Street Springfield, KY 12345 Phone: 555-555-1234 Fax: 555-555-5678		XYZ Hospital 1234 Main St Capital City, NV 14227 Phone: 555-555-1234 Fax: 555-555-5678			
PATIENT	PATIENT ID	DOB	GENDER	AGE	PHYSICIAN	PHONE
Mary Smith	222-33-4444	1953-07-19	Female	54	Dr. Bob Jones	555-1212
CASE COMMENTS						
Breast Cancer Stage II						
SPECIMEN						
ACCESSION NUMBER	HOSPITAL ACCESSION	BODY SITE	COLLECTED DATE	RECEIVED DATE	PROCEDURE	
AP05-112	ABCDE12345	Left Breast	2005-01-02	2005-01-03	Fine Needle Biopsy	
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	HER2/neu	Overexpression				
	Score:	<input type="text" value="2%"/>				
Used computer assisted image analysis						
	ER	Positive				
	Score:	<input type="text" value="2%"/>				
Manually reviewed						
	PR	Positive				
	Score:	<input type="text" value="2%"/>				
Manually reviewed						
Signature: John Smith, MD - 555-1212   July 19, 2007   Page 1 of 2						

Done

Done

1 of 2

Adblock

## Scenario A

# Pharma: share images for academic review

## Functional Requirements

- Pharma shares digital slides
- Academic pathologist reviews slides, annotates with observations

## IT Considerations

- Access security
- Integrity of observations

## Needs Analysis

- Pharma shares digital slides
  - Need microscope slide scanning
  - Need simple means of sharing slide images
- Academic pathologist reviews slides, annotates with observations
  - Need efficient slide review capability
  - Need shared annotation capability

## Scenario A

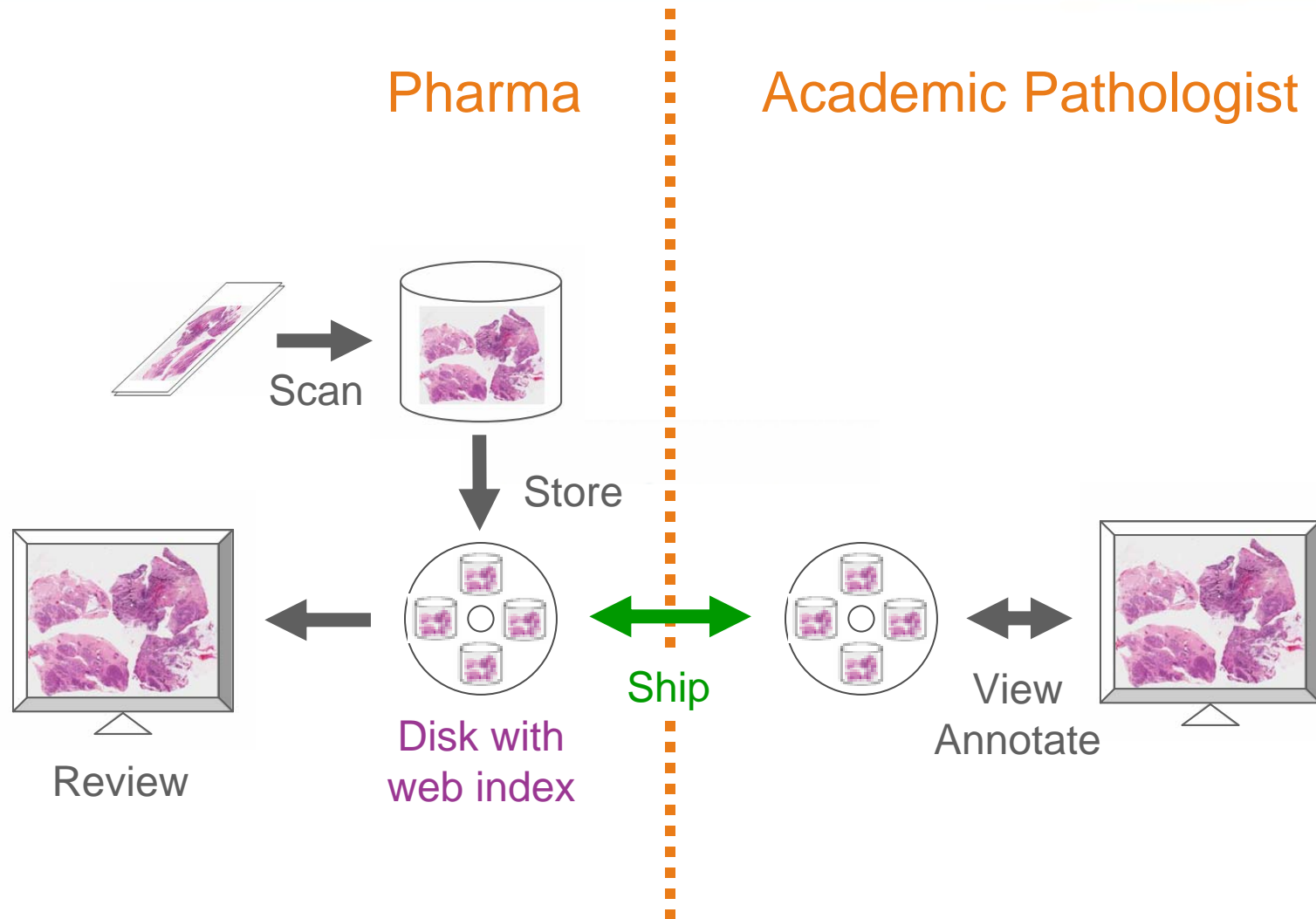
# Pharma: share images for academic review

## Aperio Solution

- Pharma posts digital slides
  - Need microscope slide scanning
    - ScanScope scanners
  - Need simple means of sharing slide images
    - Copy SVS (TIFF) files to DVD or hard drive
    - WebGen tool: create web index for digital slides
- Academic pathologist reviews slides, annotates with observations
  - Need efficient slide review capability
    - ImageScope viewer (launched from web index)
  - Need shared annotation capability
    - ImageScope's annotation facility

## Scenario A

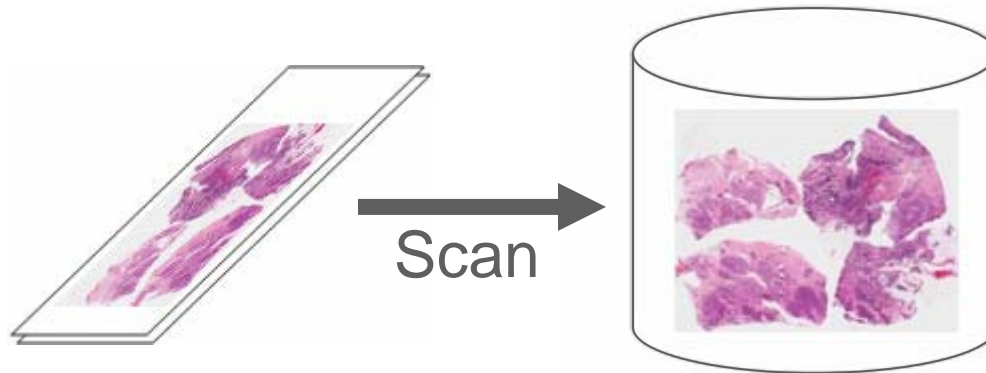
# Pharma: share images for academic review



## Performance Considerations

# Scanning Speed (aka Cost)

- Entire process  
(loading to viewing / analyzing)
- Rescan rate
- Workflow



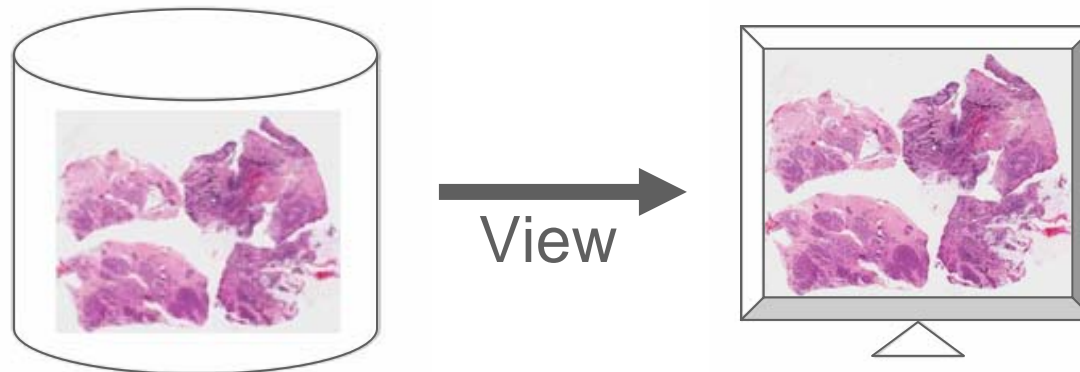
# Performance Considerations Viewing Digital Slides

## Software

- User experience
  - Rapid panning / zooming
- Annotations
- Multiple images

## Hardware

- Monitor quality
- Navigation devices



## Performance Considerations

# Storing Slide Images

- Size of digital slides
  - 250MB / slide => 1TB = 4,000 slides
- Backup
  - \$.25 / slide
- Access security



## Scenario B

# CRO: post images for external evaluation

## Functional Requirements

- CRO posts digital slides with PHI
- External pathologists review slides *blind*
- Diagnosis / observations must be recorded

## IT Considerations

- Secure access to images
- Hide PHI for images from external access
- Capture input securely

## Scenario B

# CRO: post images for external evaluation

## Needs Analysis

- CRO posts digital slides with PHI
  - Need authenticated digital slide serving
  - PHI needed internally for slide identification
- External pathologists review slides *blind*
  - Need efficient remote slide review capability
  - HIPAA and study design dictate that PHI be hidden
  - May need conferencing capability
- Diagnosis / observations must be recorded
  - Need secure data input / editing interface

## Scenario B

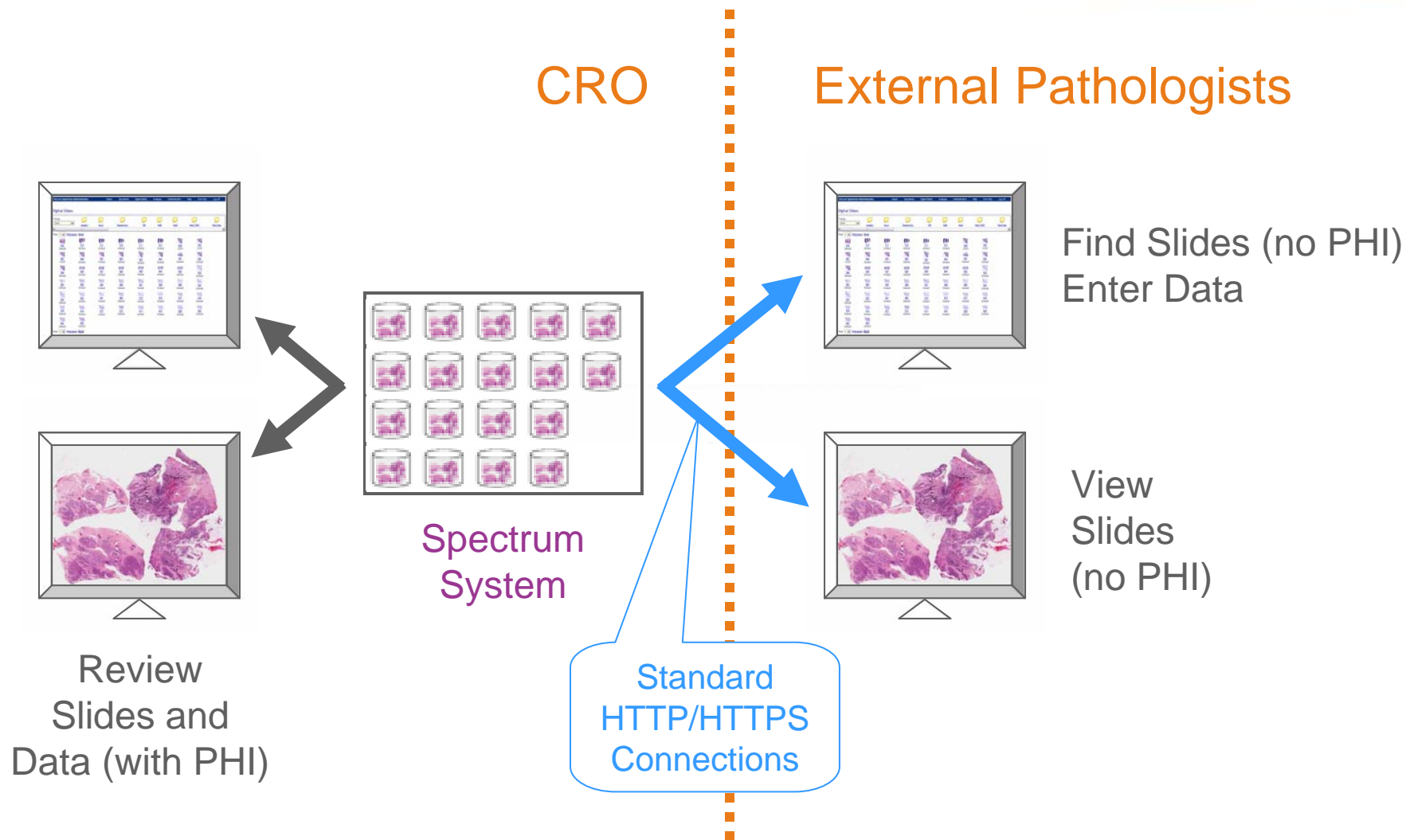
# CRO: post images for external evaluation

### Aperio Solution

- CRO posts digital slides with PHI
  - Need authenticated digital slide serving
    - Spectrum digital slide management system
  - PHI needed internally for slide identification
    - Spectrum manages PHI (slide label and specimen data)
- External pathologists review slides *blind*
  - Need efficient remote slide review capability
    - ImageScope viewer (launched from Spectrum)
  - HIPAA and study design dictate that PHI be hidden
    - Slide label disabled; access to specimen data restricted
  - May need conferencing capability
    - ImageScope enables digital slide conferencing
- Diagnosis / observations must be recorded
  - Need secure data input / editing interface
    - Spectrum provides SSL-encrypted web interface to data

## Scenario B

# CRO: post images for external evaluation



# Performance Considerations

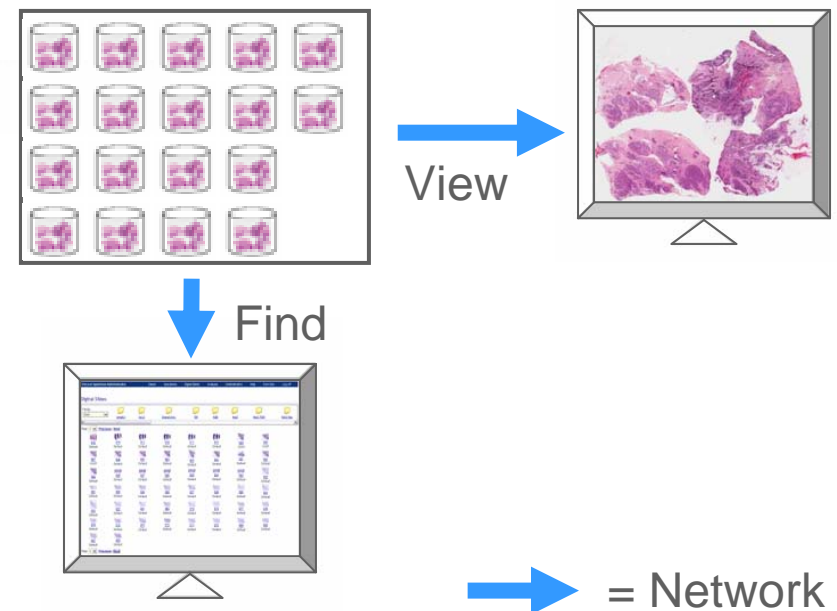
## Remote Viewing

### Software

- Network / remote access
  - Incremental transmission
- Annotations
  - Sharing
- Multiple images
  - Different servers
- Access security

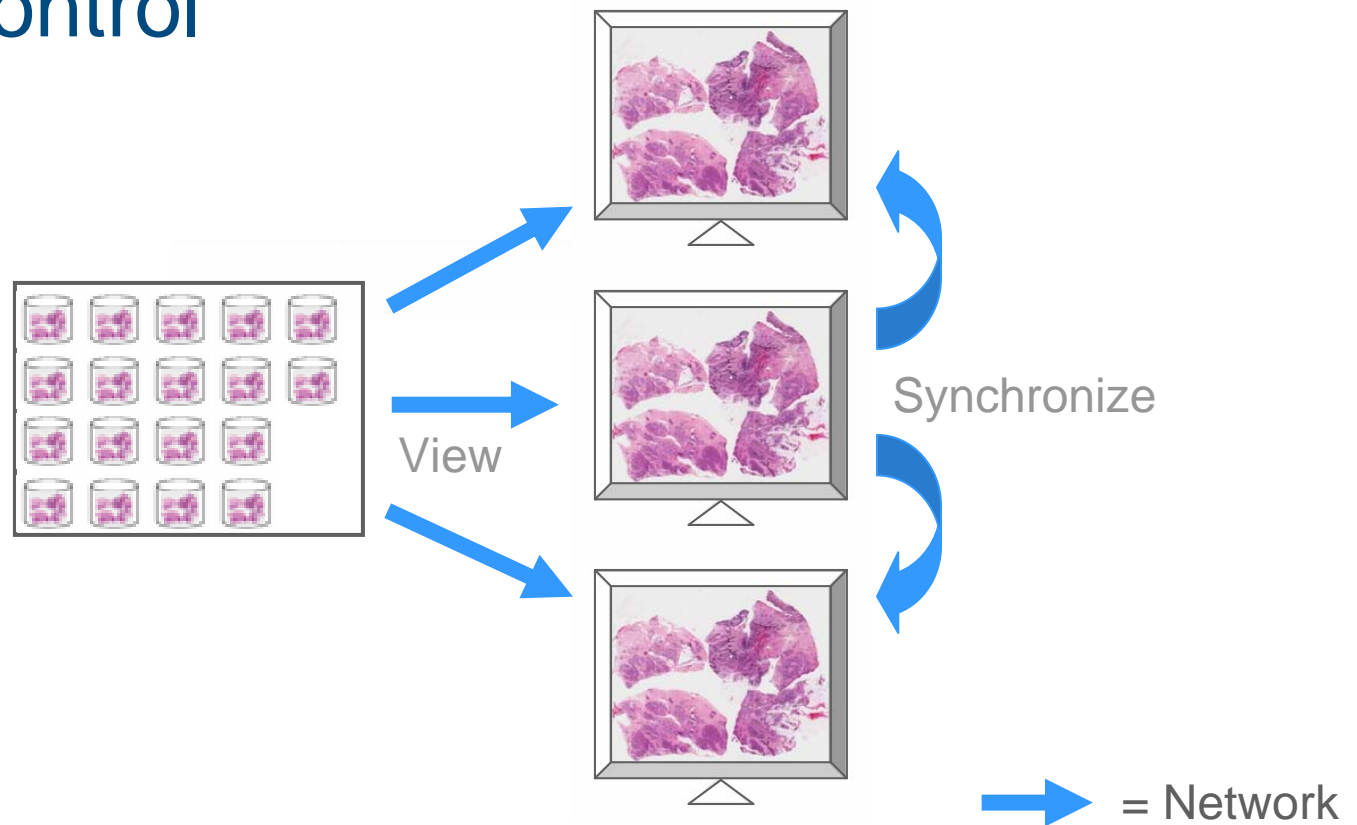
### Hardware

- Bandwidth



# Performance Considerations Digital Slide Conferencing

- Ease of use / management
- Session control
- Speed



## Scenario C

# Pharma and CRO: remote collaboration

## Functional Requirements

- Pharma and CRO share digital slides
- Digital slides quantified / scored with image analysis algorithms
- At conclusion of study, Pharma archives all digital slides, analysis results, and specimen data

## IT Considerations

- Secure bi-directional access to images
- Shared access to image analysis tools and results
- Archive capability for all slides and data

## Pharma and CRO: remote collaboration

### Needs Analysis

- Pharma and CRO share digital slides
  - Either Pharma or CRO (or both) need secure digital slide serving
- Digital slides quantified / scored with image analysis algorithms
  - Need server-side image analysis tools
  - Need controlled access to analysis results
- At conclusion of study, Pharma archives all slides and data
  - Digital slides and metadata (analysis results, study information) stored in one place

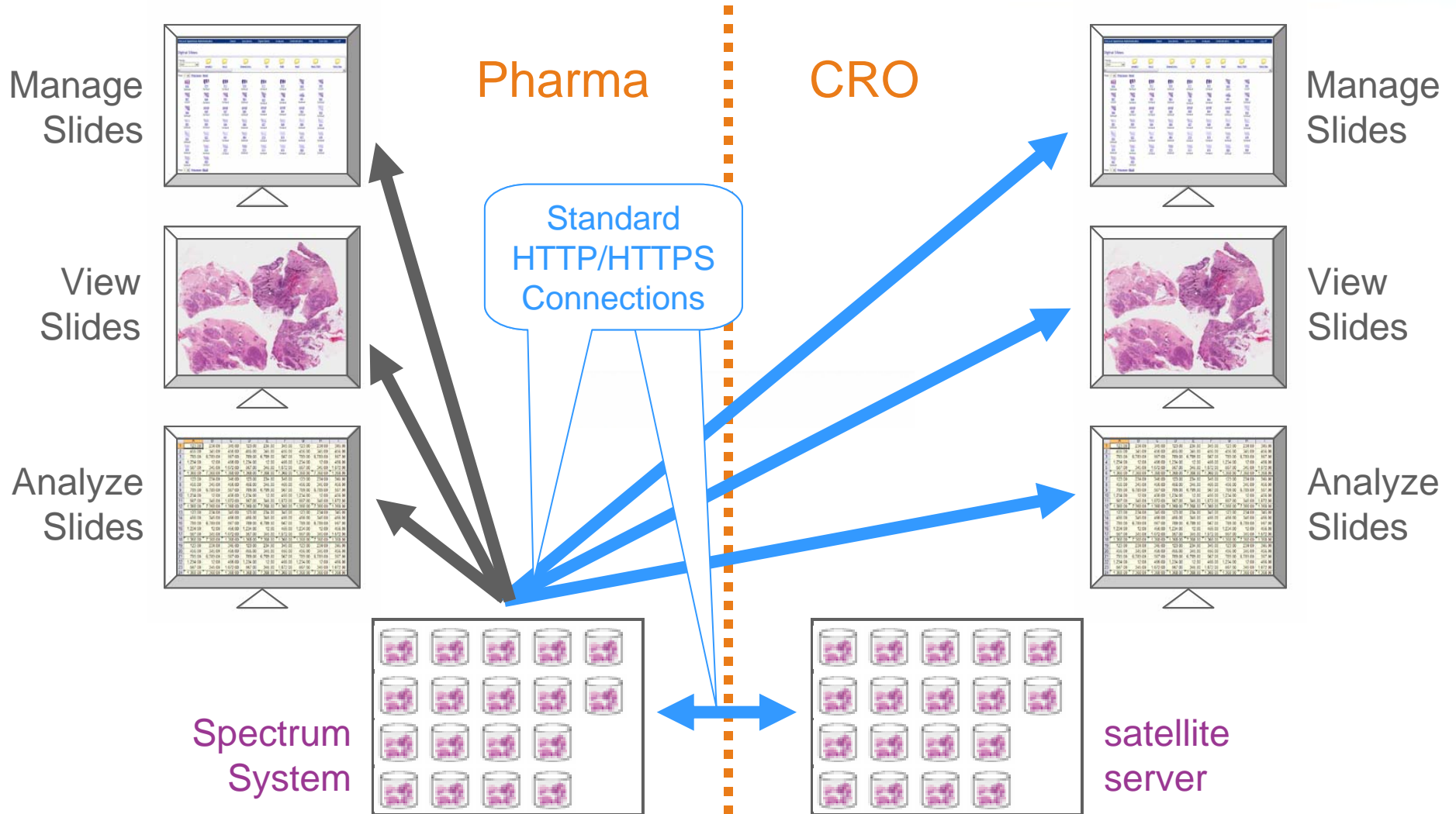
## Scenario C

# Pharma and CRO: remote collaboration

### Aperio Solution

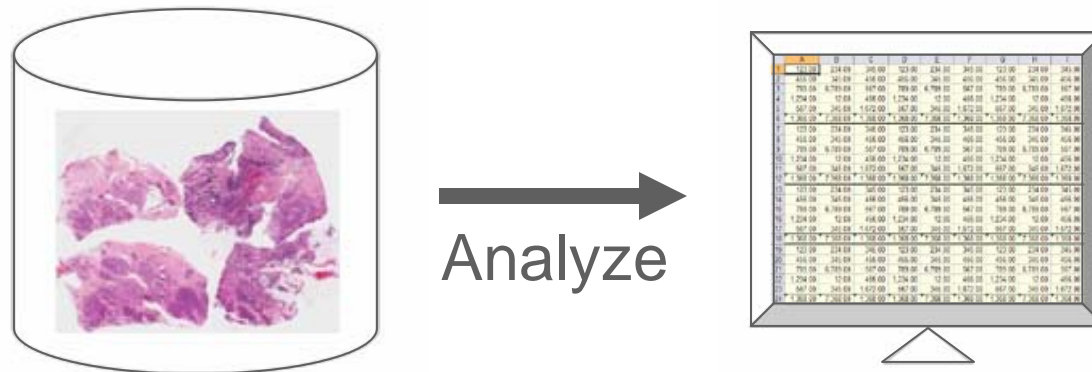
- Pharma and CRO share digital slides
  - Either Pharma or CRO (or both) need secure digital slide serving
    - Spectrum digital slide management system
    - Supports multiple slide servers at multiple locations
- Digital slides quantified / scored with image analysis algorithms
  - Need server-side image analysis tools
    - Spectrum includes Aperio Algorithm Framework to run analysis tools in client (ImageScope) or on server (Spectrum)
  - Need controlled access to analysis results
    - Spectrum manages analysis results
- At conclusion of study, Pharma archives all slides and data
  - Digital slides and metadata (analysis results, study information) stored in one place
    - Digital slides stored in single directory hierarchy on each server
    - Spectrum provides simple “move” capability for digital slides
    - All metadata stored in single database instance

# Scenario C Pharma and CRO: remote collaboration



# Performance Considerations Analyzing Digital Slides

- Accuracy
  - Processing resolution
  - Compression may affect results
- Speed (aka Cost)
  - Size of regions of analysis



## Scenario D

# AMC: virtual IHC service

## Functional Requirements

- Academic Medical Center posts digital slides
- External Pathologists
  - Review slides
  - Run IHC quantification algorithms
  - Generate IHC diagnosis reports

## IT Considerations

- Efficient remote viewing
- Control access to IHC quantification results
- Secure access to reports

## Scenario D

# AMC: virtual IHC service

## Needs Analysis

- Academic Medical Center posts digital slides
  - Need secure image serving solution
  - Need integration with AMC's LIS
- External Pathologists
  - Review slides
    - Need efficient remote review capability
  - Run IHC quantification algorithms
    - Need capability for running IHC quantification algorithms remotely (annotating ROAs, reviewing results, etc.)
  - Generate IHC diagnosis reports
    - Need capability for generating IHC reports

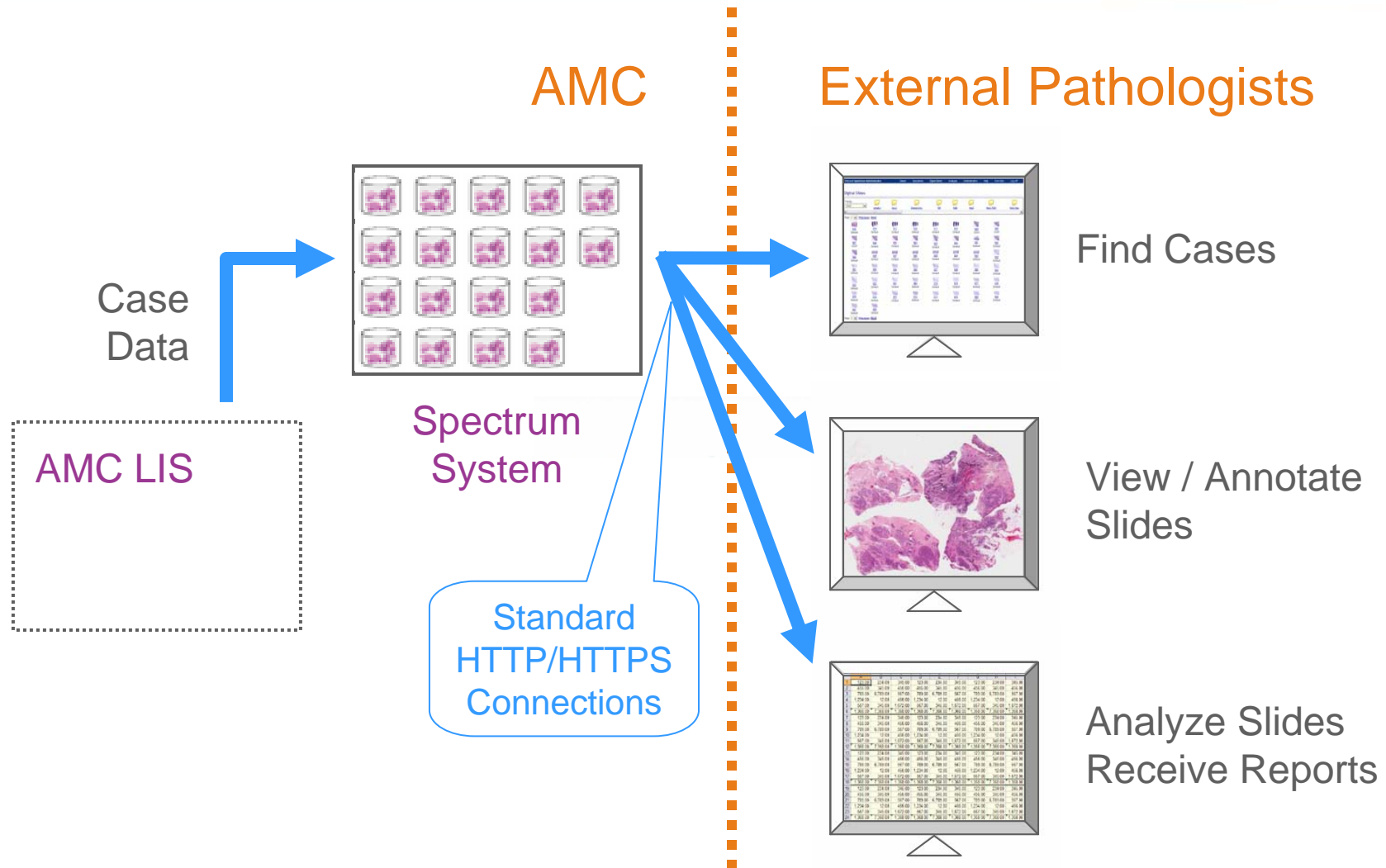
## Scenario D

# AMC: virtual IHC service

### Aperio Solution

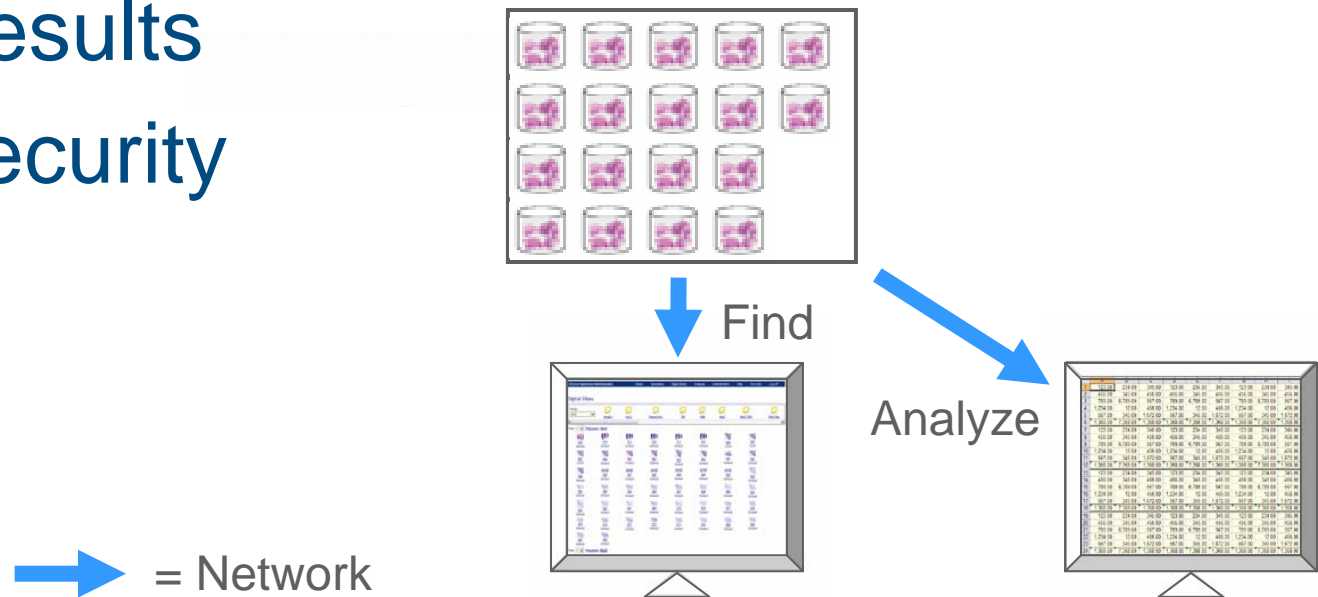
- Academic Medical Center posts digital slides
  - Need secure image serving solution
    - Spectrum digital slide management system
  - Need integration with AMC's LIS
    - Spectrum provides interface APIs, supports HL7 data import
- External Pathologists
  - Review slides
    - Need efficient remote review capability
      - ImageScope viewer (launched from within Spectrum)
  - Run IHC quantification algorithms
    - Need capability for running IHC quantification algorithms remotely (annotating ROAs, reviewing results, etc.)
      - Aperio Algorithm Framework integrated into ImageScope, enables client or server-side analysis
  - Generate IHC diagnosis reports
    - Need capability for generating IHC reports
      - Spectrum provides flexible report generation capability

# Scenario D AMC: virtual IHC service



# Performance Considerations Analyzing Digital Slides

- Client vs Server
  - Speed (bandwidth)
  - Convenience (workflow)
- Sharing results
- Access security



## Pharma: distributed study archive

### Functional Requirements

- Pharma has two sites sharing digital slides
- All slides and associated metadata must be periodically archived

### IT Considerations

- Efficient and secure remote viewing
- Device failure recovery
- Data archive capability

## Pharma: distributed study archive

### Needs Analysis

- Pharma has two sites sharing digital slides
  - Need secure, efficient means of serving digital slides
  - May need single database managing slides at multiple locations
- All slides and associated metadata must be periodically archived
  - Need design which protects against device failure
  - Need mechanism for periodic offsite data archive

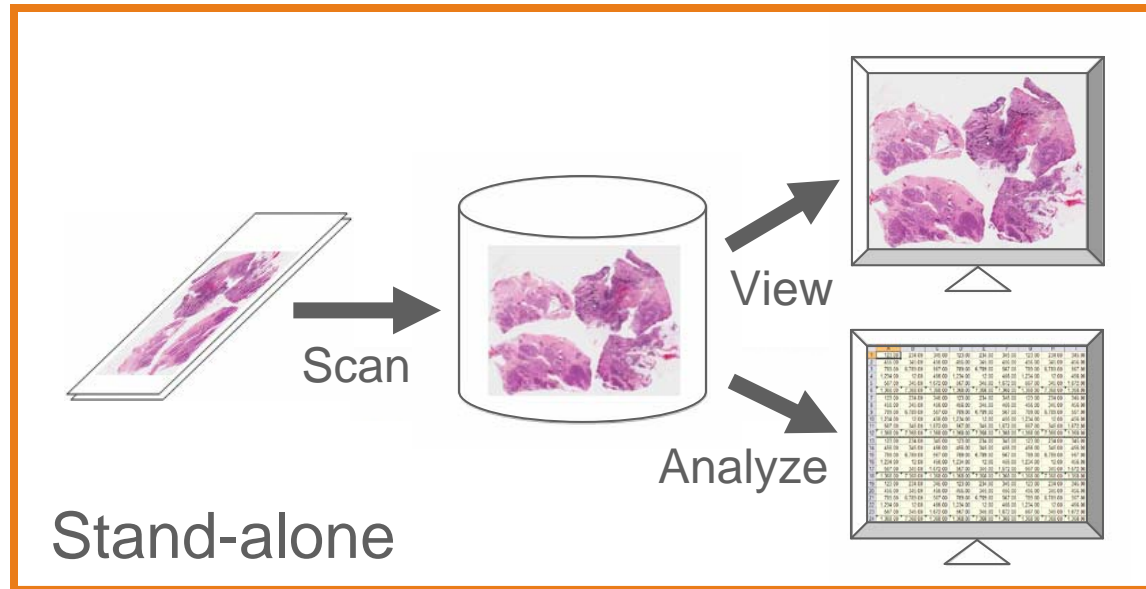
## Scenario E

# Pharma: distributed study archive

## Aperio Solution

- Pharma has two sites sharing digital slides
  - Need secure, efficient means of serving digital slides
    - Spectrum digital slide management system
    - ImageScope viewer (launched from within Spectrum)
  - May need single database managing slides at multiple locations
    - May have two systems or one distributed system; supports multiple image servers at multiple locations
- All slides and associated metadata must be periodically archived
  - Need design which protects against device failure
    - RAID level 5 (single failure) or 6 (double failure)
  - Need mechanism for periodic offsite data archive
    - Disk backup is less expensive and more reliable than tape

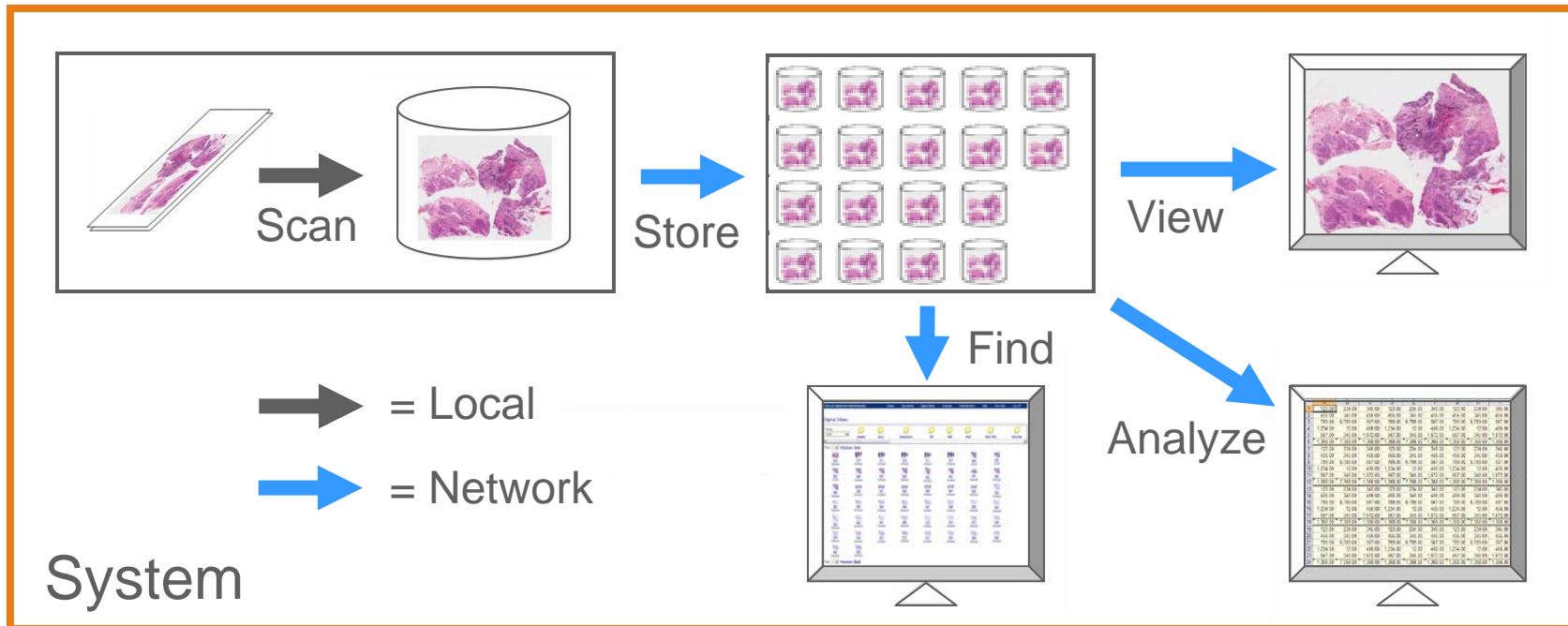
# Stand-Alone Configuration



Popular for demos...

... but not often found in research or clinical settings

# System Configuration

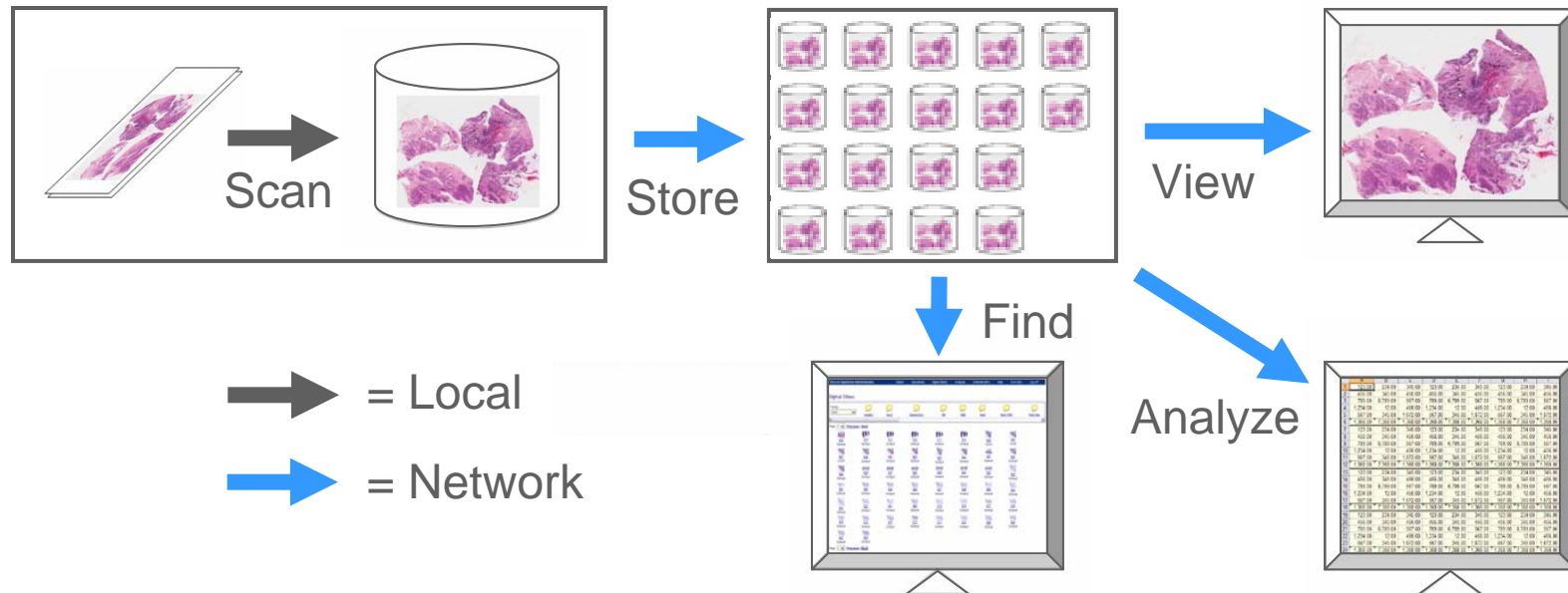


Real world configuration ...

... scanning separate from storage

... storage separate from retrieval, viewing, analysis

# Final Thoughts



- Understand your needs / goals
- Test system in real world setting