



FHIRcast & IHE IRA

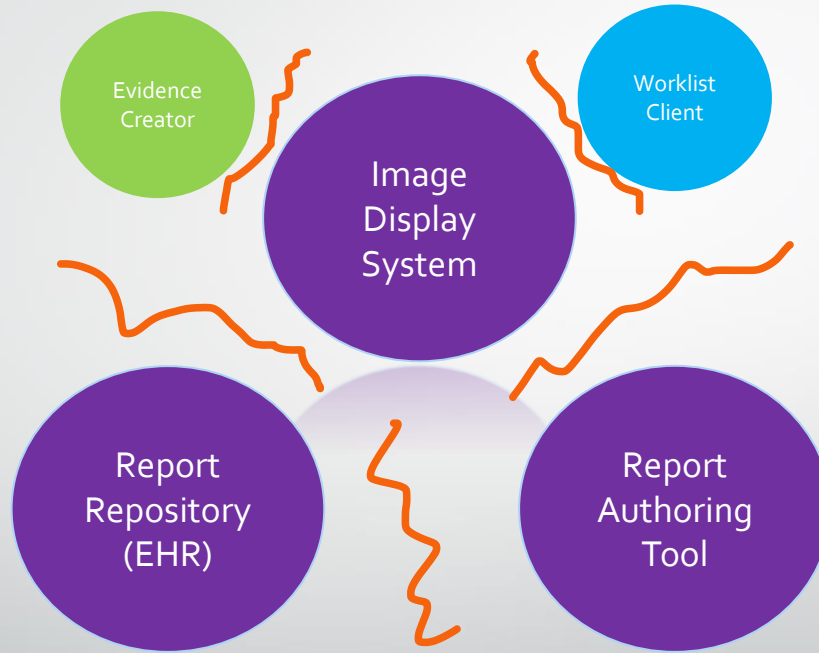
Unpacking the IHE Integrated
Reporting Applications Profile

Kinson Ho
Staff Engineer, Tempus
IHE Radiology

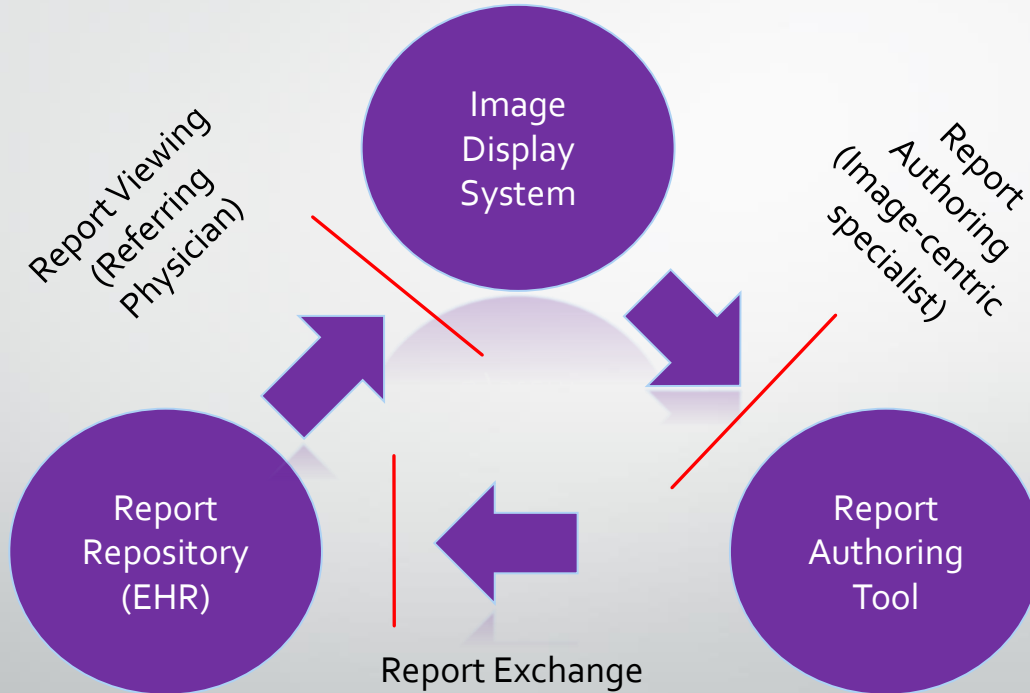
Have you tried to ...



General Reporting Workflow



General Reporting Workflow



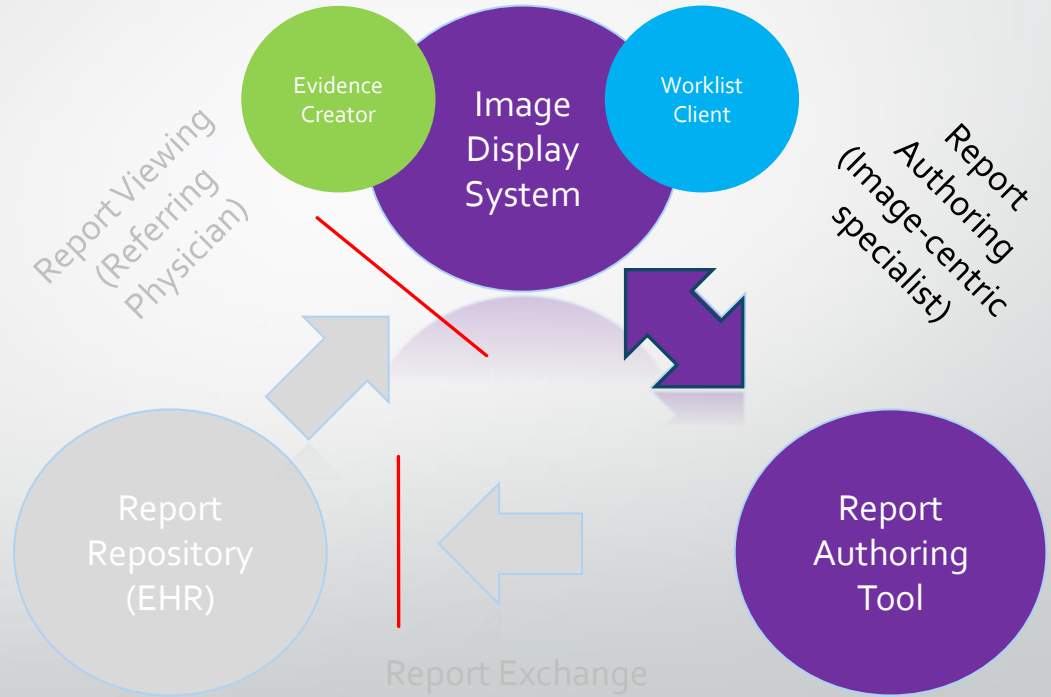
Report Authoring

Standard:

- IHE Integrated Reporting Applications (IRA)

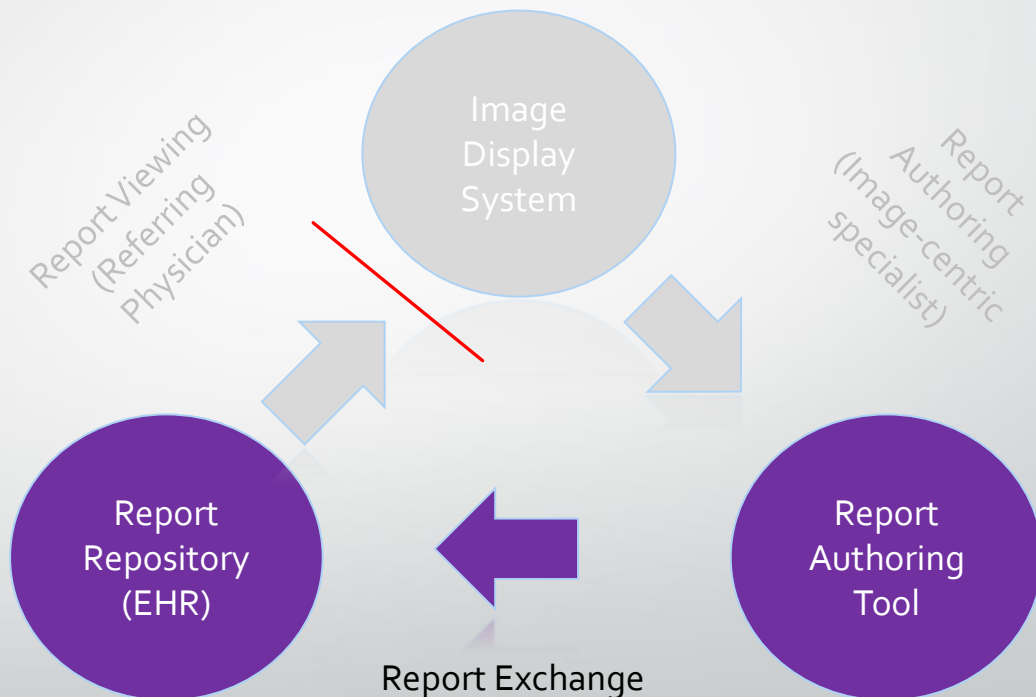
Highlight:

- Based on FHIRcast
- Context switching
- Content sharing
- Suspend and resume



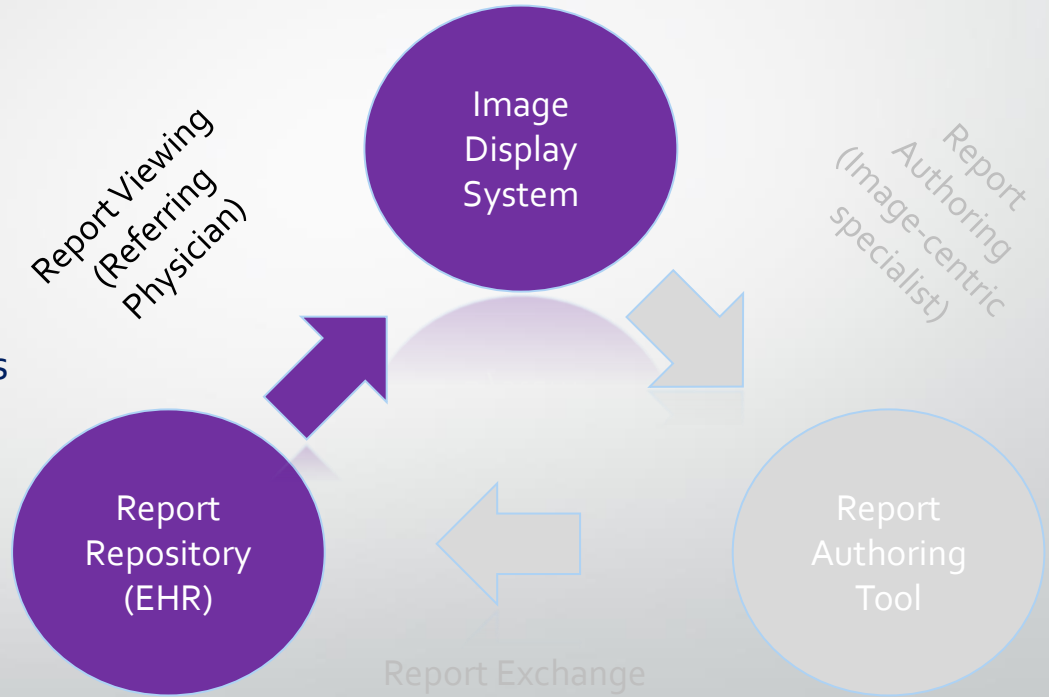
Report Exchange

- Standard:
 - IHE Interactive Multimedia Reporting (IMR)
- Highlight:
 - FHIR DiagnosticReport **
 - HTML Report
 - Optional PDF or Text
 - Embedded multimedia references
 - Image references
 - Measurements



Report Viewing

- Standard:
 - IHE Interactive Multimedia Reporting (IMR)
- Highlight:
 - Render multimedia references as hyperlinks
 - Interactive viewing





Integrating Reporting Applications

- Use FHIRcast v3 Publication / Subscription
- Use FHIR R5 resources as transient message payload
- Support context switching (Open/Close)
- Support content sharing (Update/Select)
- Support suspend and resume
- Use HTTPS for requests and websocket for events



easy

Initiate Reporting Session

Image Display



Report Creator



Initiate Reporting Session

Image Display



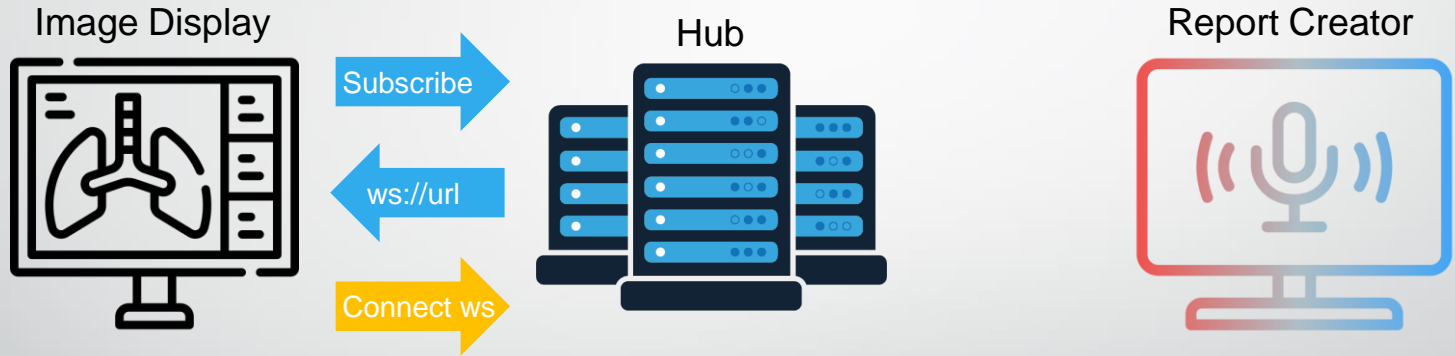
Hub



Report Creator



Initiate Reporting Session

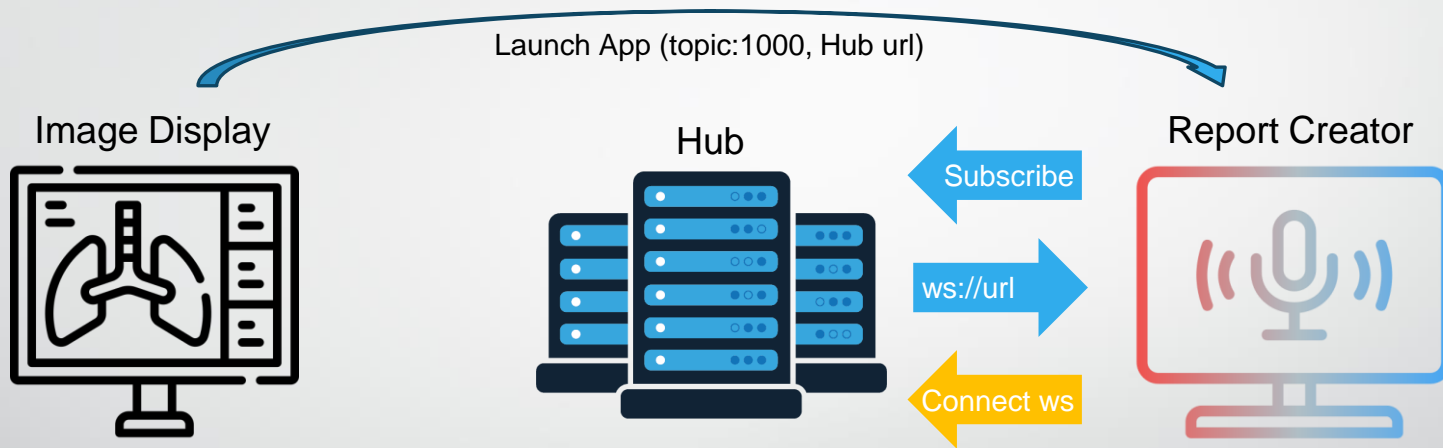


Session	Subscribers
1000	ImageDisplay

HTTPS

Websocket

Launch Application



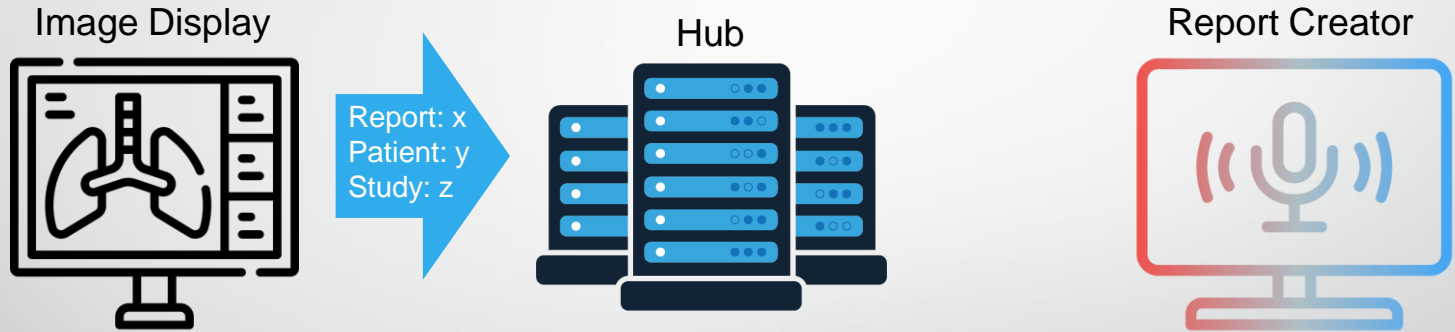
Session	Subscribers
1000	ImageDisplay ReportCreator

HTTPS

Websocket

Open Reporting Context

Event: DiagnosticReport-open



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report</u> : x Patient: y Study: z

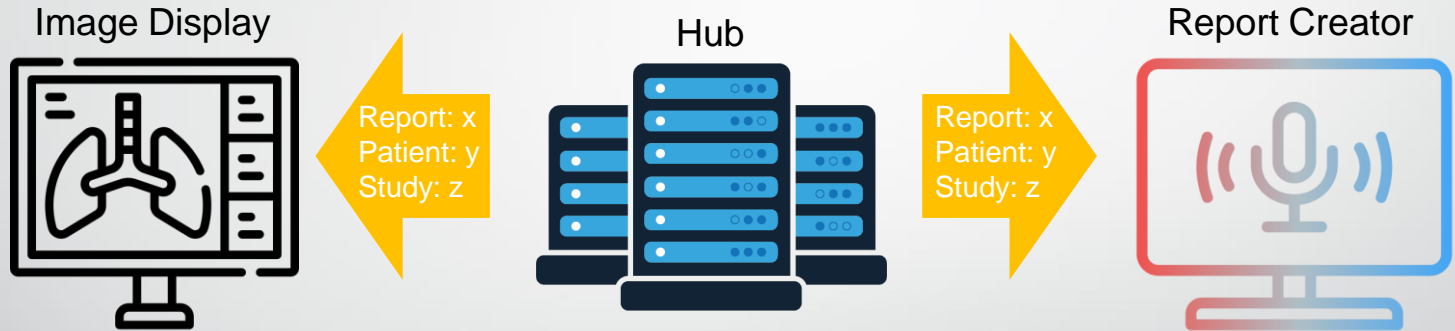
HTTPS

Websocket

Open Reporting Context

Event: DiagnosticReport-open

Prepare Study z
for reporting



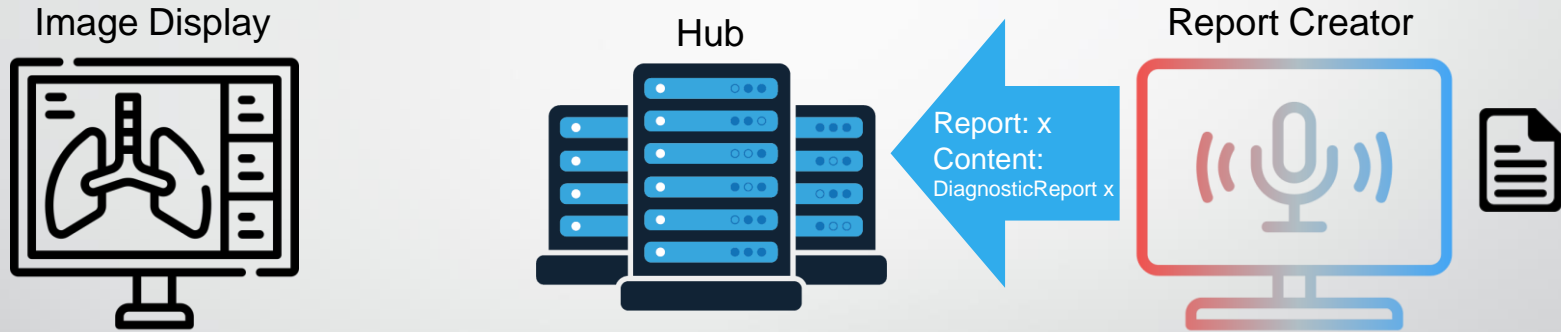
Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z

HTTPS

Websocket

Update Report Status

Event: DiagnosticReport-update



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	Report: x Patient: y Study: z

HTTPS

Websocket

Update Report Status

Event: DiagnosticReport-update

Update study
status from
worklist

Image Display



Hub



Report Creator



Report: x
Content:
DiagnosticReport x

Report: x
Content:
DiagnosticReport x

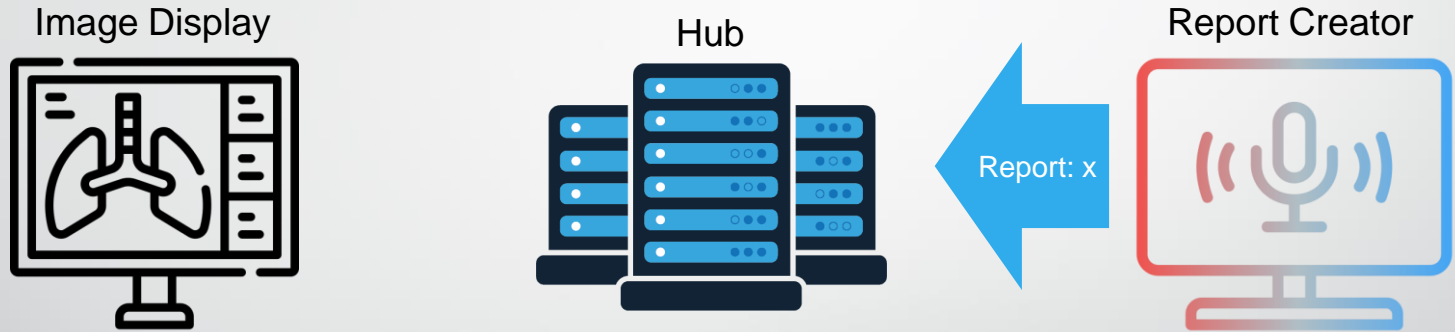
Session	Subscribers	Context
1000	ImageDisplay ReportCreator	Report: x Patient: y Study: z

HTTPS

Websocket

Close Reporting Context

Event: DiagnosticReport-close



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	
		Study: z

HTTPS

Websocket

Close Reporting Context

Event: DiagnosticReport-close

Drop study
from worklist

Image Display



Hub



Report Creator



Report: x

Report: x

Session	Subscribers	Context
1000	ImageDisplay ReportCreator	

HTTPS

Websocket



Suspend and Resume

Event: DiagnosticReport-open

Can you take a look at Study q?

Image Display



Report: o
Patient: p
Study: q

Hub



Report Creator



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z
1000	ImageDisplay ReportCreator	<u>Report: o</u> Patient: p Study: q

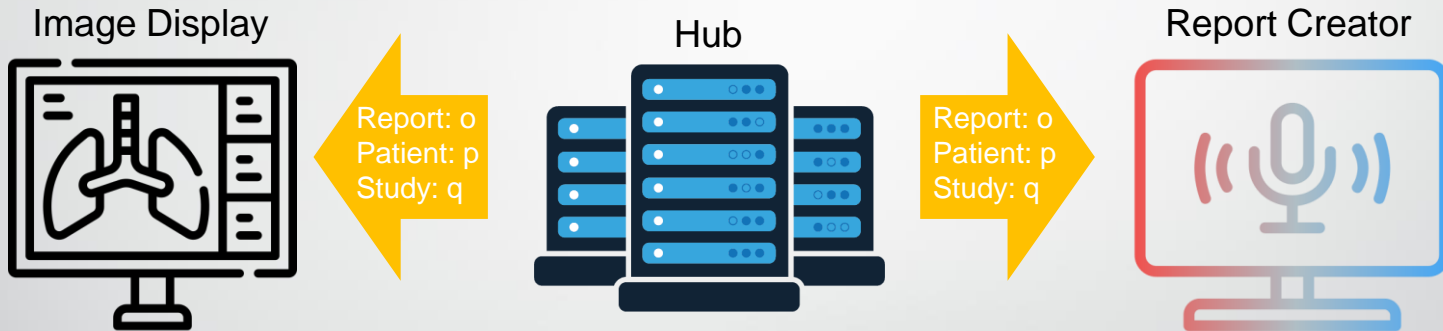
HTTPS

Websocket

Suspend and Resume

Event: DiagnosticReport-open

Prepare Study q for reporting



Report: o
Patient: p
Study: q

Report: o
Patient: p
Study: q

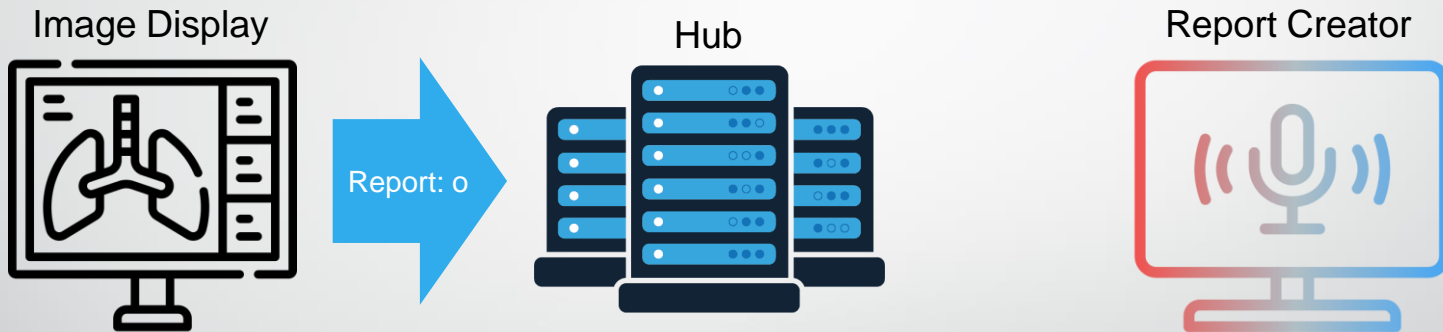
Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z
1000	ImageDisplay ReportCreator	<u>Report: o</u> Patient: p Study: q

HTTPS

Websocket

Suspend and Resume

Event: DiagnosticReport-close



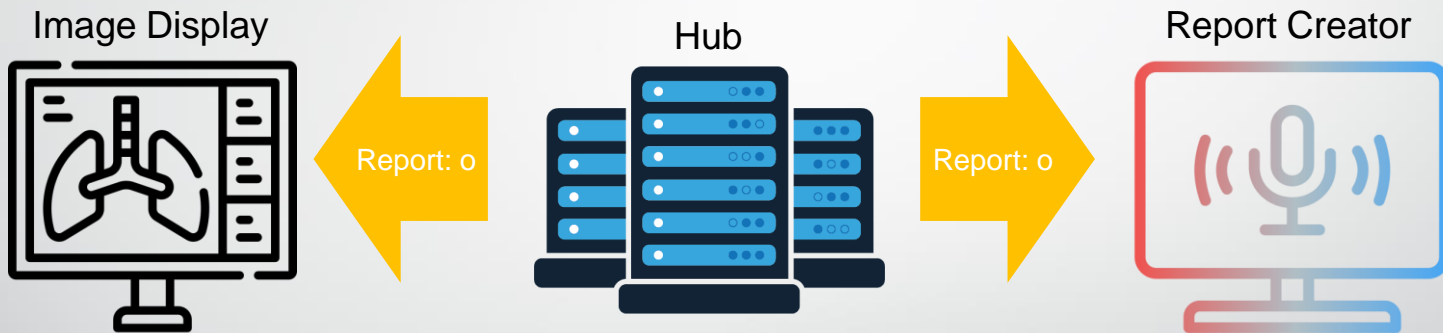
Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z
1000	ImageDisplay ReportCreator	<u>Report: o</u> Patient: p Study: q

HTTPS

Websocket

Suspend and Resume

Event: DiagnosticReport-close



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	Report: x Patient: y Study: z

HTTPS

Websocket

Suspend and Resume

Resuming Study z
from previous state

Event: DiagnosticReport-open

Image Display



Report: x
Patient: y
Study: z

Hub



Report Creator



Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report</u> : x Patient: y Study: z

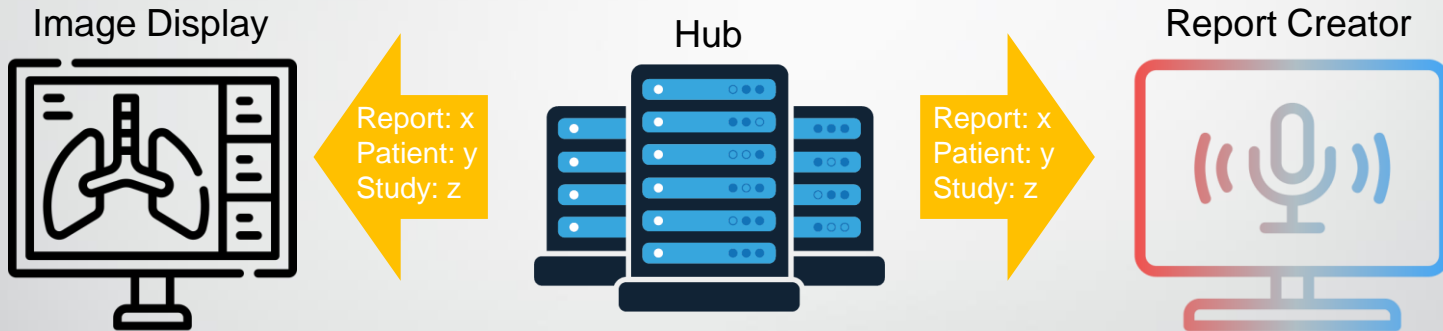
HTTPS

Websocket

Suspend and Resume

Event: DiagnosticReport-open

Resume Study z for reporting



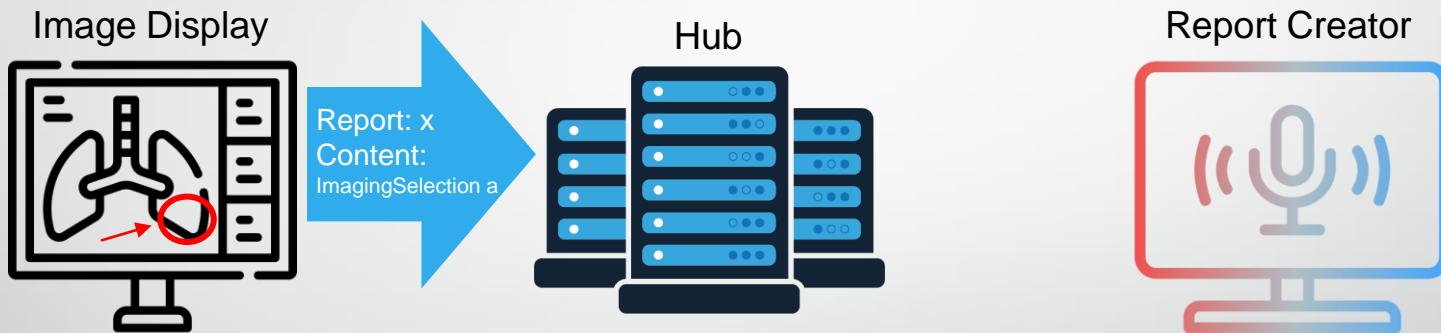
Session	Subscribers	Context
1000	ImageDisplay ReportCreator	<u>Report</u> : x Patient: y Study: z

HTTPS

Websocket

Update Report Context

Event: DiagnosticReport-update



Session	Subscribers	Context	Content
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

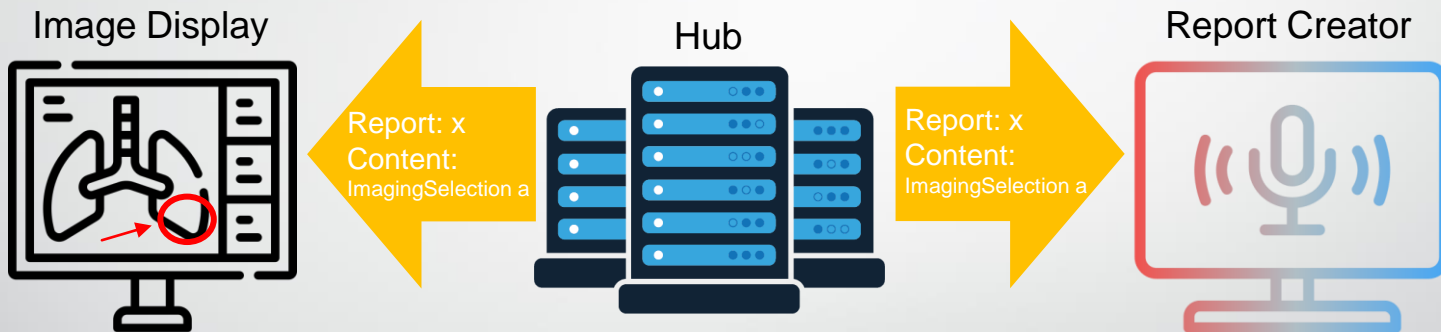
HTTPS

Websocket

Update Report Context

Event: DiagnosticReport-update

Add series #
and image #



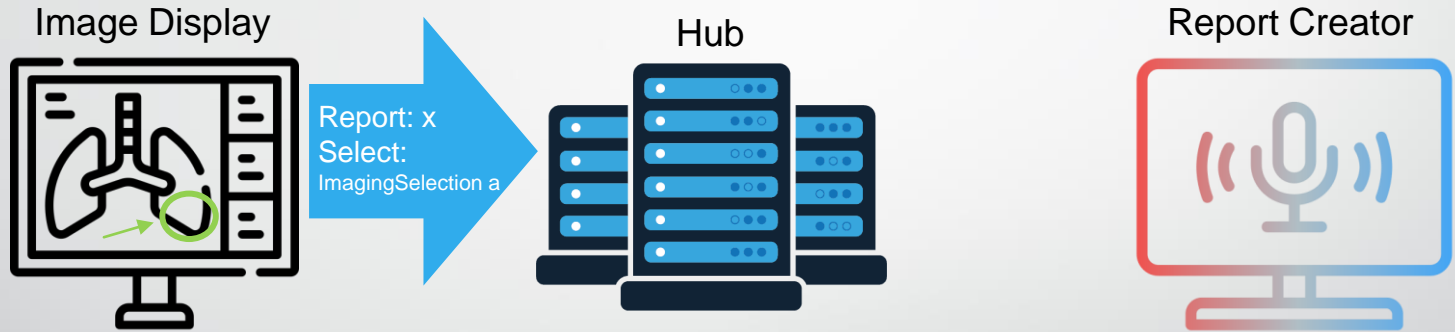
Session	Subscribers	Context	Content
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

HTTPS

Websocket

Select Report Context

Event: DiagnosticReport-select



Session	Subscribers	Context	Content
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

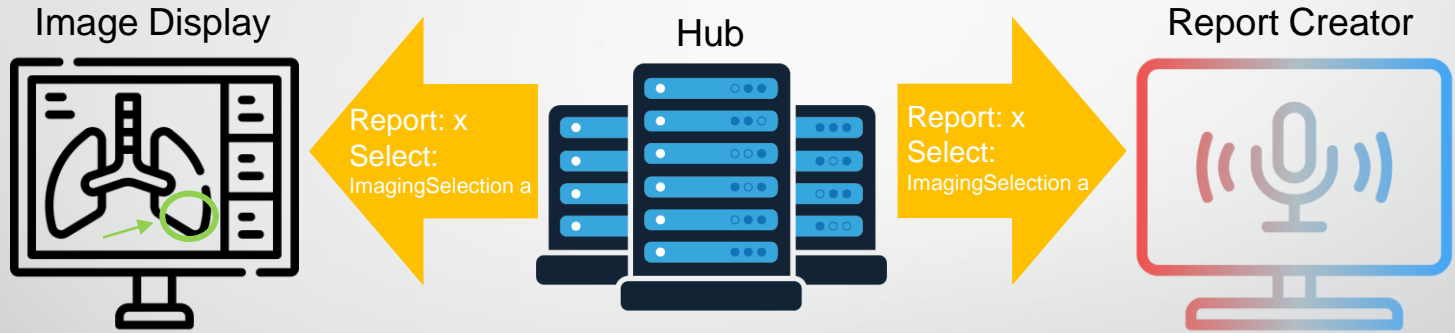
HTTPS

Websocket

Select Report Context

Event: DiagnosticReport-select

In Focus
Series UID and
Image UID and
annotation



Session	Subscribers	Context	Content
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

HTTPS

Websocket

Select Report Context

Event: DiagnosticReport-select

Add
Hyperlink

Image Display



Hub



Report Creator



Insert wado-rs
hyperlink
referencing the
series and image

Session	Subscribers	Context	Content
1000	ImageDisplay ReportCreator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

HTTPS

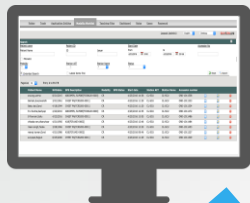
Websocket



To infinity
and beyond...

Launch App
(topic:2000, Hub url)

Worklist Client



Evidence Creator

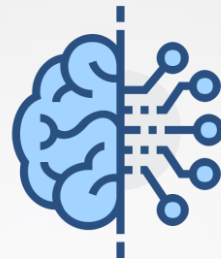


Image Display



Hub



Report Creator



Subscribe

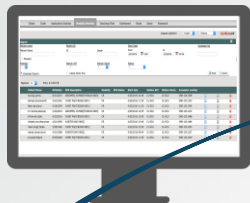
Subscribe

Session	Subscribers
2000	WorklistClient ImageDisplay

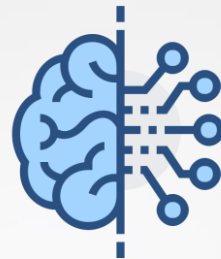
HTTPS

Websocket

Worklist Client



Evidence Creator



Launch App (topic:2000, Hub url)

Image Display



Hub



Report Creator

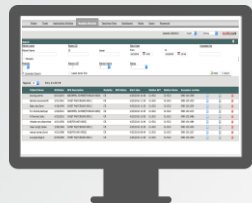


Session	Subscribers
2000	WorklistClient ImageDisplay

HTTPS

Websocket

Worklist Client



Evidence Creator

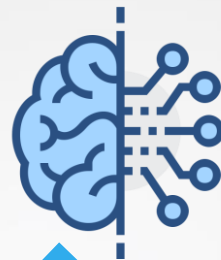


Image Display



Hub



Report Creator

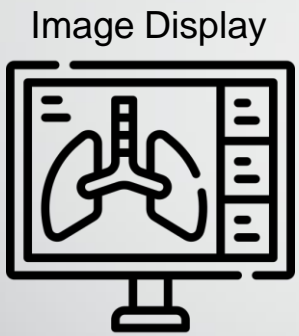


Session	Subscribers
2000	WorklistClient ImageDisplay ReportCreator EvidenceCreator

HTTPS

Websocket

Open Study z for reading



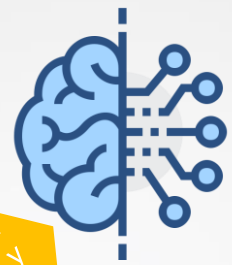
open

Hub



Report: x
Patient: y
Study: z

Evidence Creator



Prepare Study z for reporting

Report: x
Patient: y
Study: z

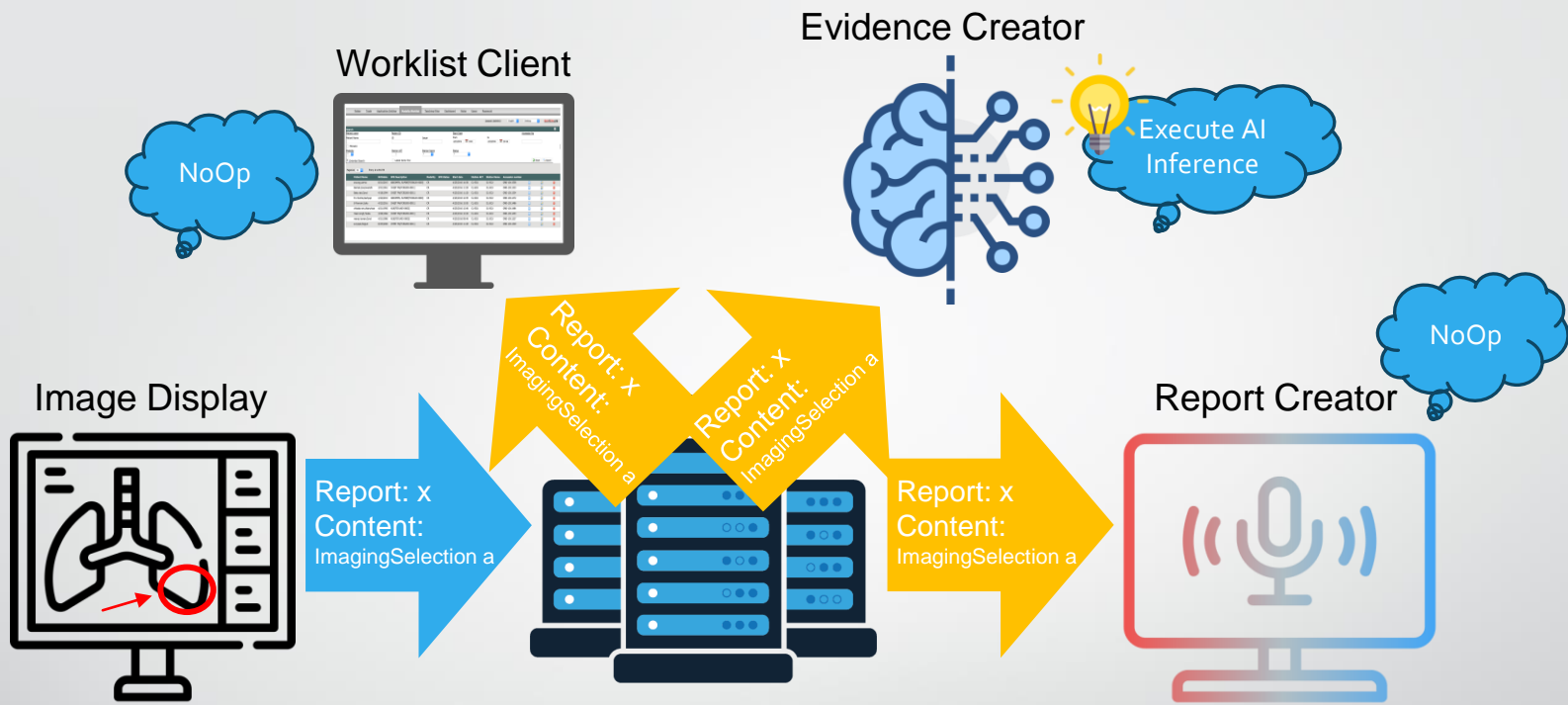
Report Creator



Session	Subscribers	Context
2000	WorklistClient ImageDisplay ReportCreator Evidence Creator	<u>Report: x</u> Patient: y Study: z

HTTPS

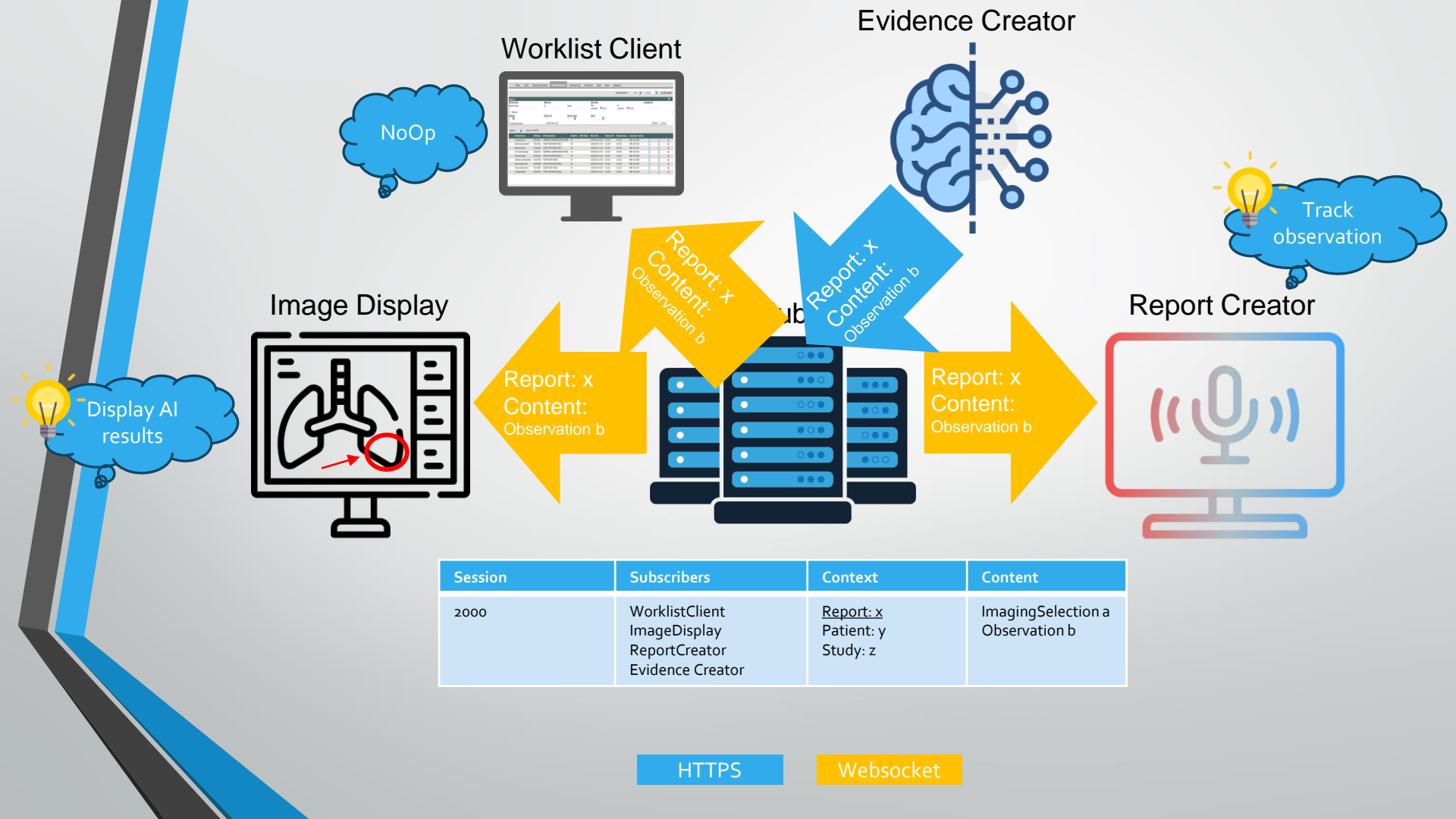
Websocket



Session	Subscribers	Context	Content
2000	WorklistClient ImageDisplay ReportCreator Evidence Creator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a

HTTPS

Websocket



Worklist Client

Evidence Creator

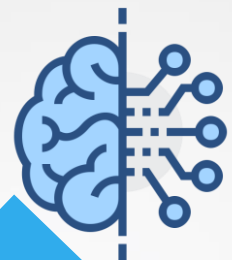
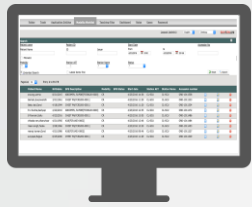
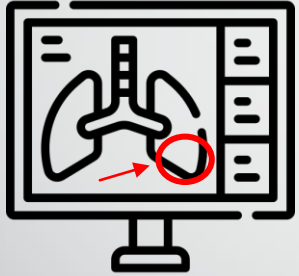
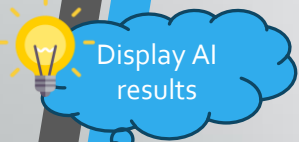


Image Display



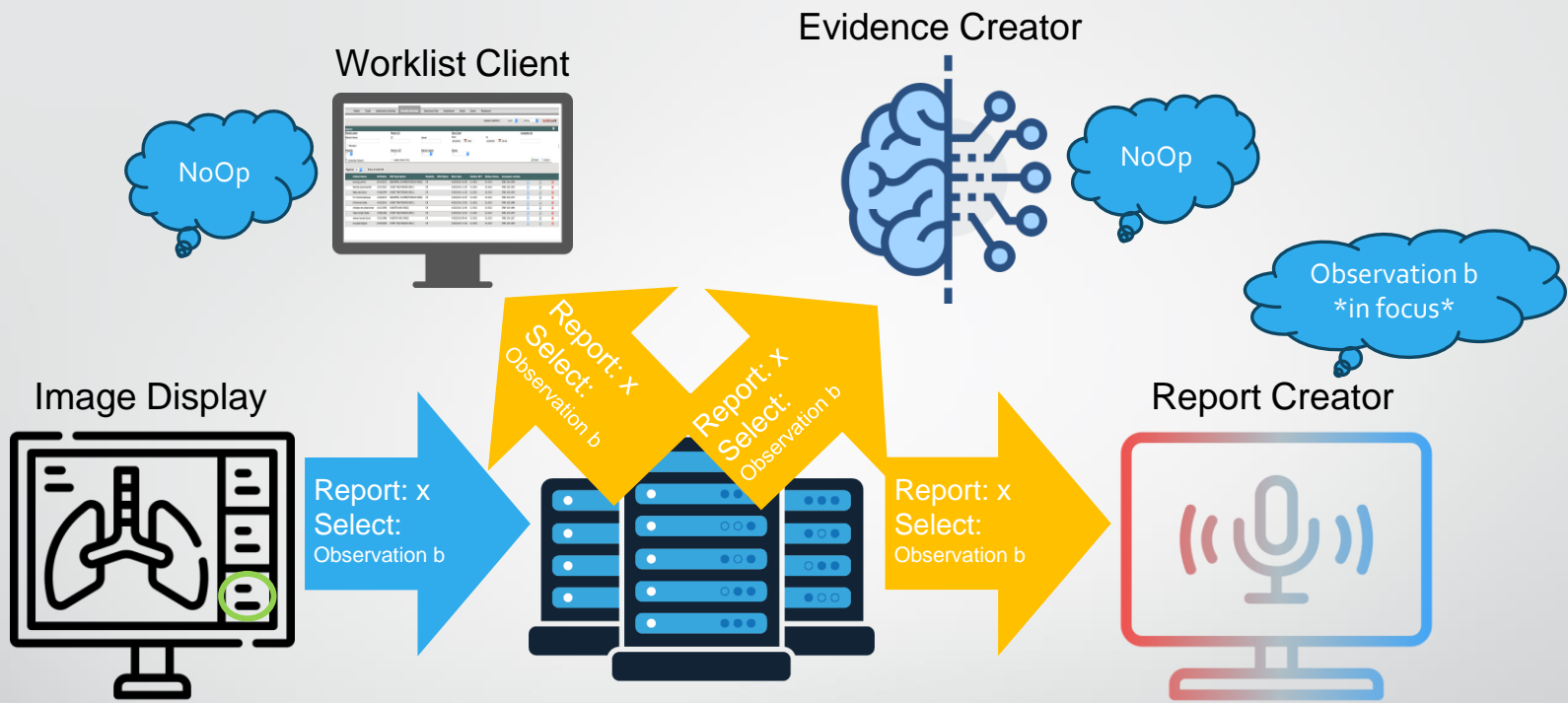
Report Creator



Session	Subscribers	Context	Content
2000	WorklistClient ImageDisplay ReportCreator Evidence Creator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a Observation b

HTTPS

Websocket

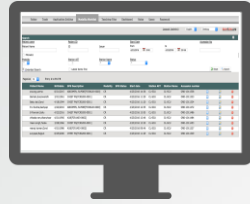


Session	Subscribers	Context	Content
2000	WorklistClient ImageDisplay ReportCreator Evidence Creator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a Observation b

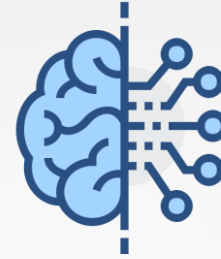
HTTPS

Websocket

Worklist Client



Evidence Creator



Insert
Measurement

Image Display



Hub



Add
measurement
in report

Report Creator



Session	Subscribers	Context	Content
2000	WorklistClient ImageDisplay ReportCreator Evidence Creator	<u>Report: x</u> Patient: y Study: z	ImagingSelection a Observation b

HTTPS

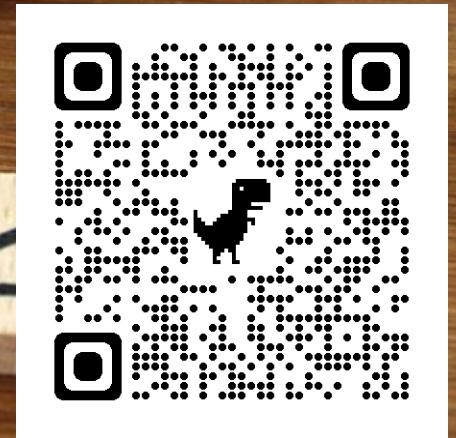
Websocket

Additional Details

- Support query context (and content)
- Support asynchronous event handling and error reporting
- Specify expected behavior upon receiving different events
- Specify FHIR resources for specific content
- Work well with IHE Interactive Multimedia Report
- Complementary to IHE AIR and AIW-I



<https://profiles.ihe.net/RAD/IMR/index.html>



<https://profiles.ihe.net/RAD/IRA/index.html>