



FAST Technical Learning Community

Proposed Solutions: Directory, Version and Scale



FAST Taskforce Antitrust Notice

- The ONC FHIR At Scale Taskforce (*FAST*) (Hereinafter “Taskforce”) is committed to full compliance with existing federal and state antitrust laws.
- All members involved in the Taskforce effort, including its advisory groups, will comply with all applicable antitrust laws during the course of their activities. During Taskforce meetings and other associated activities, including all informal or social discussions, each member shall refrain from discussing or exchanging competitively sensitive information with any other member. Such information includes, but may not be limited to:
 - Price, premiums, or reimbursement charged or paid for products or services
 - Allocation of customers, enrollees, sales territories, sales of any products or contracts with providers
 - Any other competitively sensitive information that is proprietary to a member company
- If you have any specific questions or concerns, seek guidance from your own legal counsel.
- Members should not bring confidential information or intellectual property (hereinafter “Intellectual Property”) owned by their respective member companies into Taskforce meetings. To the extent such Intellectual Property is shared with the Taskforce that shall not be construed as a waiver of member company’s rights to, or ownership in, the Intellectual Property.



Agenda

- **FAST Technical Learning Community (TLC) Webinar Series**
- **What is *FAST*?**
- **Endpoint Directory**
 - Current state
 - Scope
 - Proposed solution
 - Open solution questions & TLC feedback
- **FHIR Version**
 - Current state
 - Scope
 - Proposed solution
 - Open solution questions & TLC feedback
- **Scaling the Ecosystem**
 - Current state
 - Scope
 - Proposed solution
 - Open solution questions & TLC feedback





Technical Learning Community (TLC) Webinar Series

Directory, Version and Scale

[Today's Presentation](#)

Identity

Thursday, November 21st

[Presentation](#)

Testing and Certification

Thursday, December 12th
12-1pm ET

[Register Now!](#)

Security

Monday, December 16th
12-2pm ET

[Register Now!](#)

Exchange

Thursday, December 19th
12-2pm ET

[Register Now!](#)



What is *FAST*?

The FHIR at Scale Taskforce (FAST), convened by the Office of the National Coordinator for Health IT (ONC), brings together a highly representative group of motivated healthcare industry stakeholders and health information technology experts.

The group is set to identify HL7[®] Fast Healthcare Interoperability Resources (FHIR[®]) scalability gaps and possible solutions, analysis that will address current barriers and will accelerate FHIR adoption at scale.

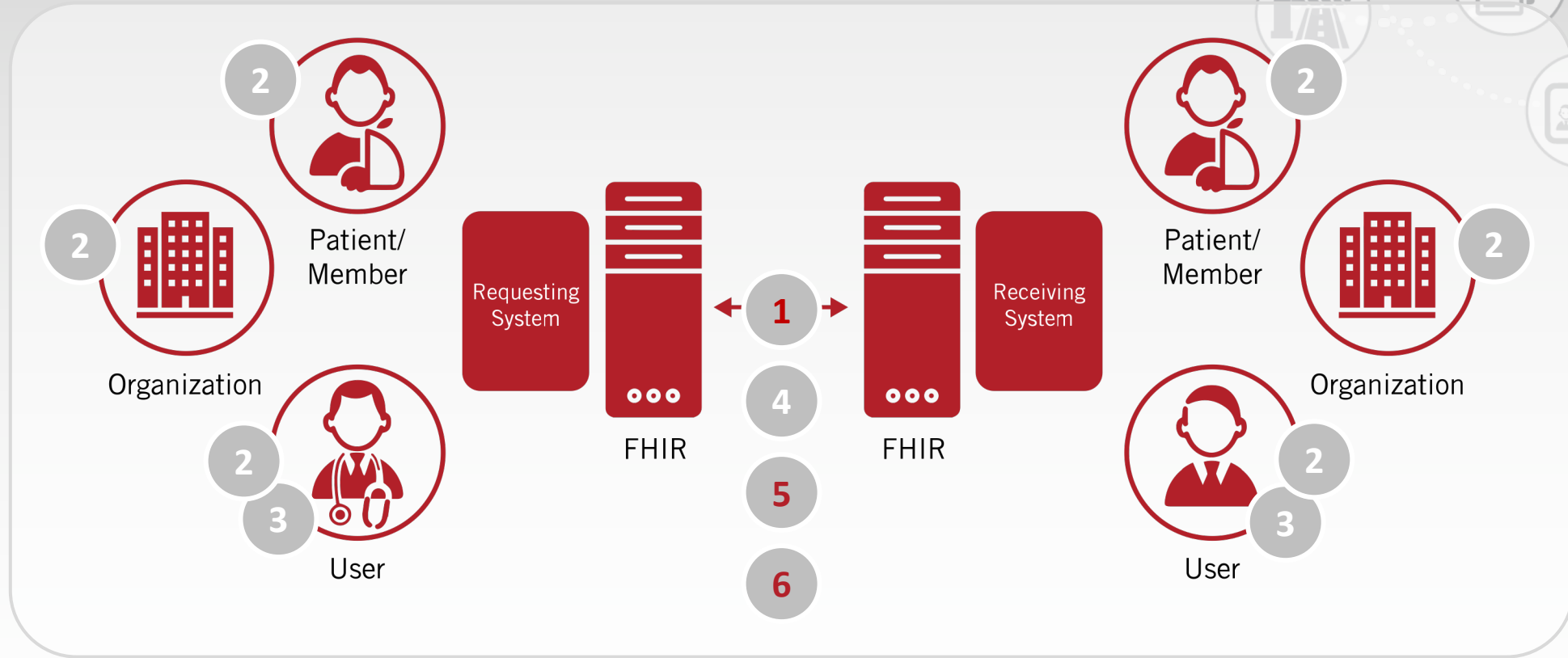


FAST Organization & Community Engagement





Known Technical Barriers

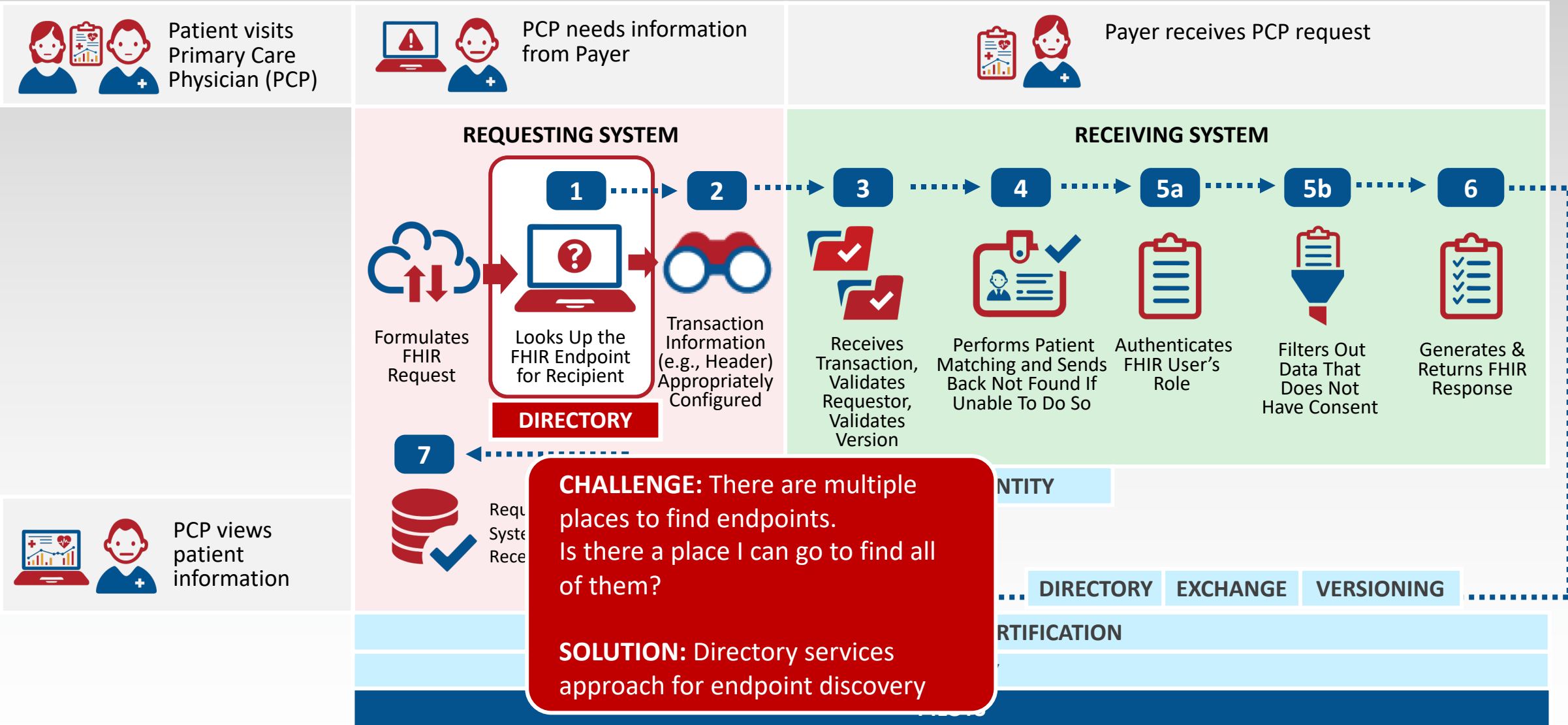


1 **Directory Services** 2 Identity 3 Security

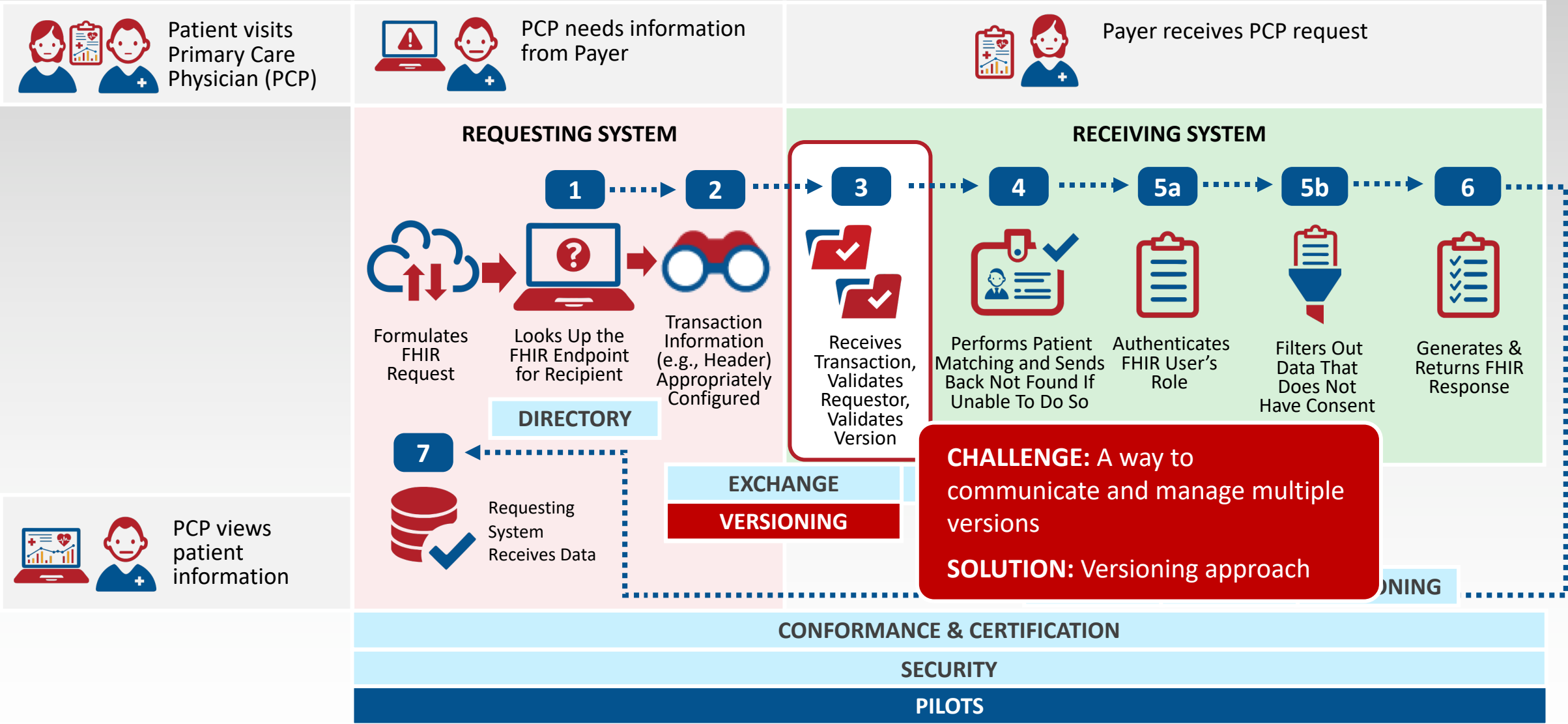
4 Testing, Conformance, & Certification 5 **Versioning** 6 **Scaling**

For more information view [FAST 101](#) and [Technical Barriers](#)

Example FHIR Transaction Journey





Example FHIR Transaction Journey



Example FHIR Transaction Journey

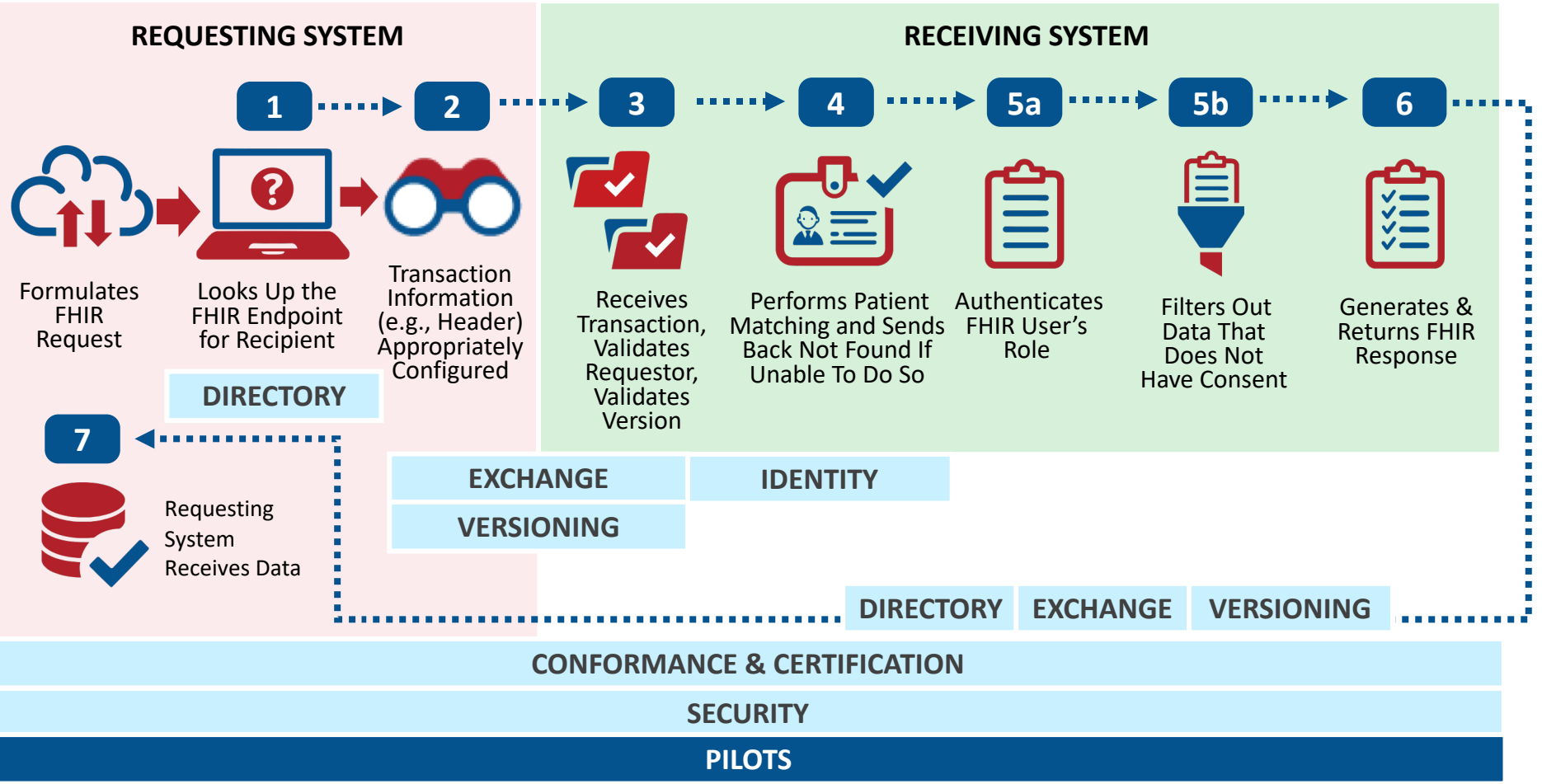
 Patient visits Primary Care Physician (PCP)

 PCP needs information from Payer

 Payer receives PCP request

CHALLENGE: Scale FHIR to handle millions of transactions per day between millions of stakeholders without doing point to point integrations

SOLUTION: Scaling approach




 PCP views patient information



Standards Efforts Towards FHIR Adoption

FHIR Solutions for VBC

DA VINCI  HL7® FHIR®
Payers/Providers

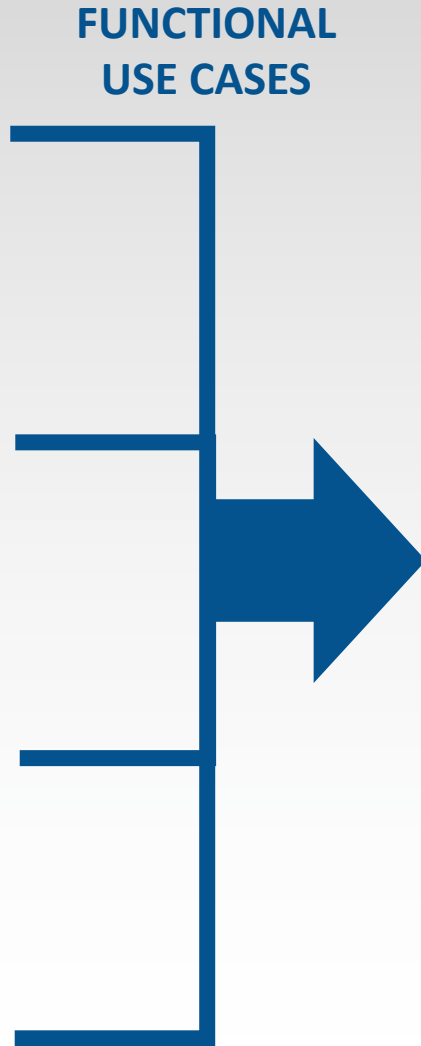
Core Data Services

 **ARGONAUT PROJECT**
HL7® FHIR®
Provider/Provider

FHIR Consumer Solutions

carin
Consumers

Other Collaborative Efforts to Develop & Implement FHIR Solutions



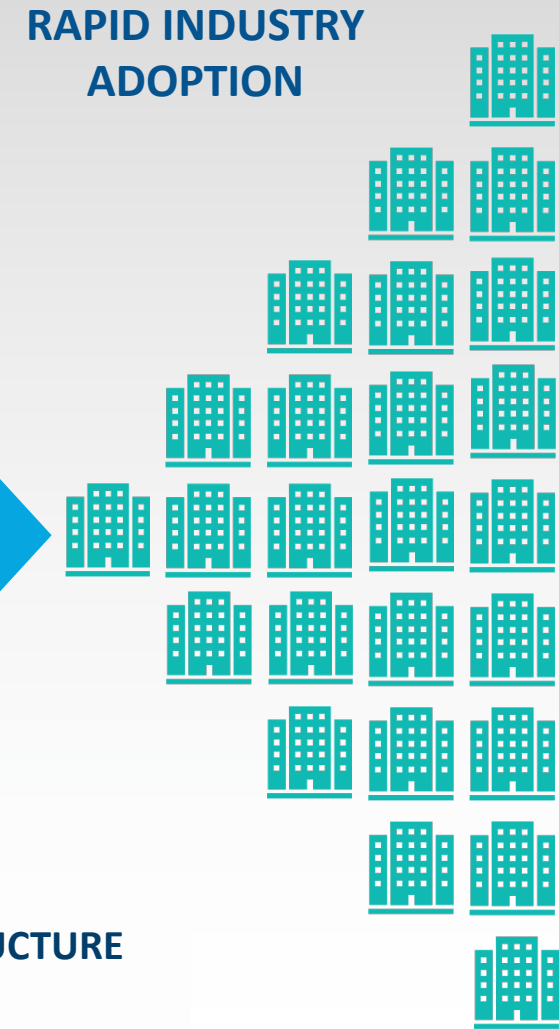
SHARED Technical Challenges to FHIR Scalability

- Patient & Provider Identity Management
- Directory Services
- Version Identification
- Scale
- Exchange Process/Metadata
- Testing, Conformance & Certification
- Security

FAST
FHIR AT SCALE TASKFORCE 



INFRASTRUCTURE USE CASES



Community Feedback

- 1) Type of Organization? Select all that apply.
- 2) What is your interest in this session? Select all that apply.





Presenters – *FAST* Directory, Version and Scale Tiger Team Leads



Alexandra (Alix) Goss

Vice President and Senior Consultant

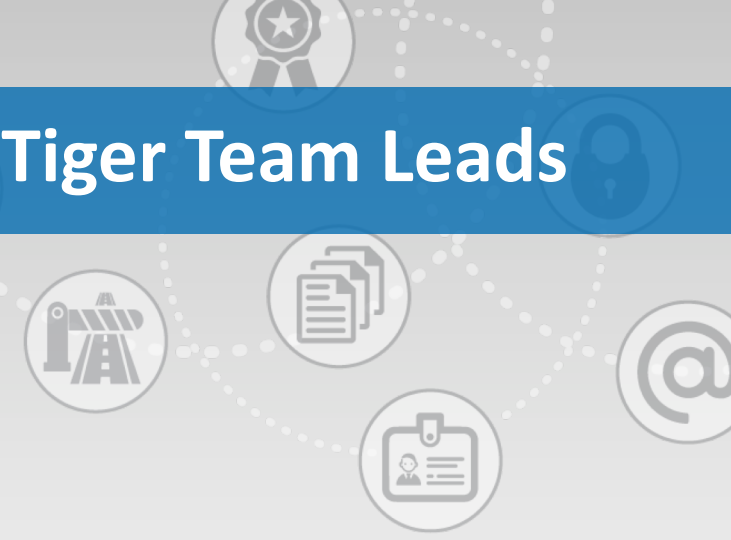
Imprado



Robert Dieterle

CEO

EnableCare





FAST Endpoint Directory, Version and Scale Team Members

Alix Goss (<i>Co-Chair</i>)	Imprado
Robert Dieterle (<i>Co-Chair</i>)	EnableCare
Patrick Murta	Humana
Edwin Martin	UCSF
Rick Geimer	Lantana
Richard Gilbert	CMS
Karl Davis	CMS
Dan Gotlieb	Boston Children's Hospital

Danielle Friend	Epic
Tim Young	Transcend Insights
Pavel Smirnov	Health Samurai
Jason Walonski	The MITRE Corporation
Tony Little	Optum
Alex Kontour	ONC
Dan Chaput	ONC
Brandon Neiswender	CRISP



Tiger Team Approach



Industry Initiatives and Research	<p>Considered best practices and approaches from:</p> <ul style="list-style-type: none">• National and regional directory effort• ONC Healthcare Directory Task Force• HL7 FHIR standards for version control• Scaling efforts for existing exchange technologies (HIEs, Clearinghouses, Exchanges)
Community feedback	<p>Soliciting early and continued feedback</p> <ul style="list-style-type: none">• Interviewed SMEs• Requesting feedback from <i>FAST</i> TLC through Webinars and LinkedIn Group
<i>FAST</i> Internal Reviews	<p>Leveraging expertise on the taskforce</p> <ul style="list-style-type: none">• Feedback from <i>FAST</i> Coordinating Committee• Reviews with <i>FAST</i> Chief Architects and other Tiger Teams

Endpoint Directory





Proposed Endpoint Directory Solution



Directory

Endpoint Directory

PROCESS

Current State &
Technical Barriers

Proposed Solution
Final State

Intermediate
Steps





FAST Endpoint Directory – Current State

ACCESS

- Multiple places to find endpoints (e.g. HIEs, Vendors, trust frameworks)
- Method of access to the directory varies tremendously
- Endpoint discovery focused on organizational level resource necessitating provider/organizational linkage

ENDPOINT CHARACTERISTICS

- Amount of information regarding an endpoint varies greatly depending on source
- Each source has its own implied trust framework
- Degree of audit and currency of the information varies tremendously
- No initial or recurring validation of endpoints for compliance to FHIR specification



FAST Endpoint Directory – Technical Barriers

ENDPOINT IDENTIFICATION	No current standard or implementation provides a generally available method to find all FHIR endpoints and their associated capabilities (e.g., beyond just the capability statement)
ENDPOINT CHARACTERISTICS	Currently no standard or implementation specifies and supports additional endpoint attributes (i.e., trust framework, authentication requirements, FHIR version(s), supported services, certification and testing)
CURRENCY & ACCURACY OF DIRECTORY ENDPOINT INFORMATION	Currently there is no agreed upon source or standard process for maintaining endpoint information and validating its accuracy. This creates uncertainty and the potential for inconsistent endpoint directory information.
RESTRICTING ACCESS TO ENDPOINT INFORMATION	Certain endpoints may not be generally available (regardless of authentication) and any directory-service may need to restrict discoverability for those specific endpoints



FAST Endpoint Directory – Scope of Work

In Scope

- FHIR endpoints (e.g. FHIR server or FHIR service) and FHIR related endpoints (e.g. CDS-Hooks, Bulk Data: SFTP)
- Compliance of endpoint directory with FHIR and RESTful standards
- Test environment for endpoint directory
- Consumer application endpoints
- Available as part of endpoint directory
 - trust framework information
 - API certification
 - FHIR version(s)
- Directory architecture: high level architecture / model(s)
- Authentication and Authorization for endpoint discovery
- Specification for directory query payload and exchange
- Support availability specification – e.g. SLA

Out of Scope

- Manual access (e.g. portal)
- Integration with clinical systems
- Directory maintenance (how, not what)
- Detailed architecture
- Operational implementation
- Non-FHIR endpoints (e.g. XDS)
- Monitoring availability



FAST Endpoint Directory – Proposed Solution

Future State

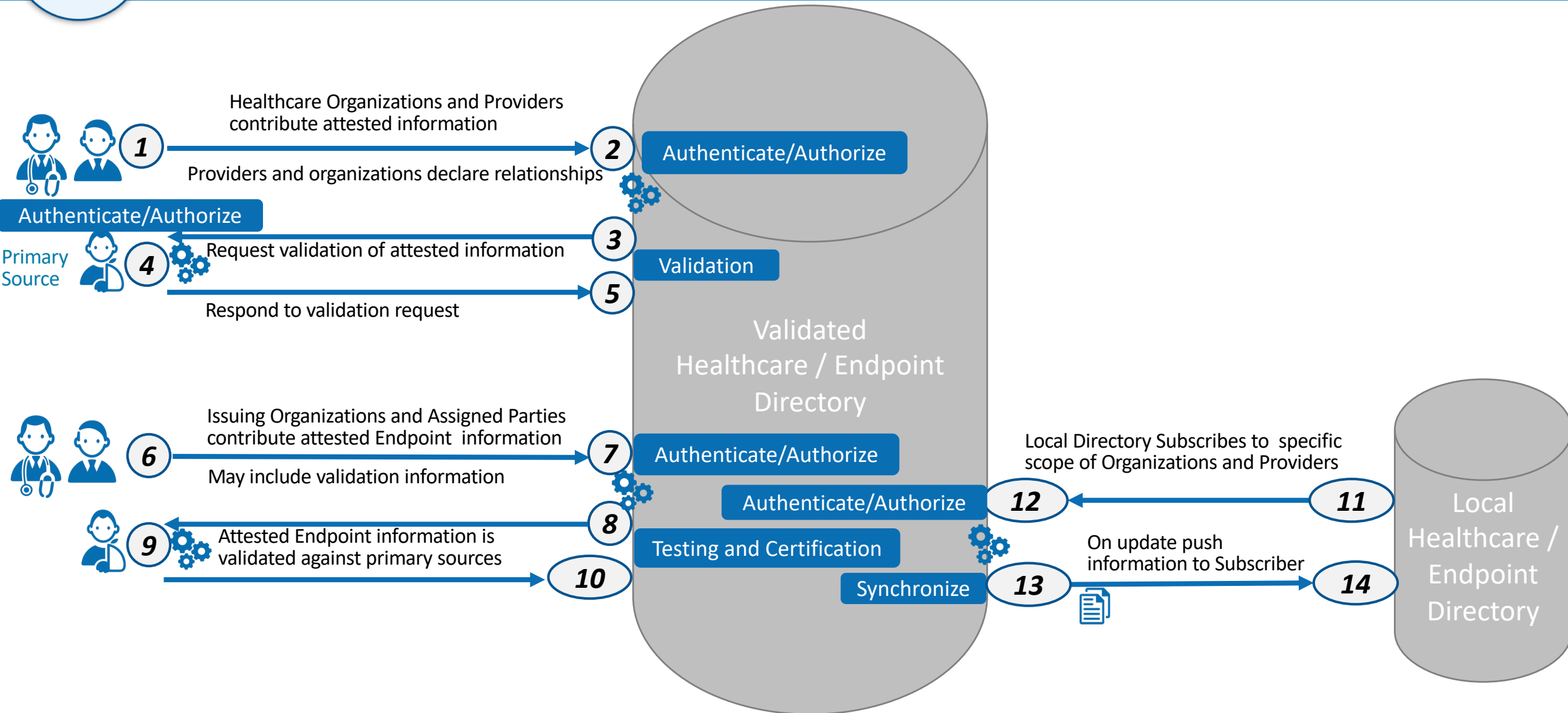
1. One national source for validated directory information that is available to any local directory workflow environment
2. Directory contains individual and entity demographics to determine endpoint relationships
3. Computable endpoint information will include supported implementation guides, trust framework, accessibility requirements, validation status, meta data requirements (e.g. for routing through intermediary)
4. Issuing Organizations and Assigned Parties will contribute authoritative information to the Endpoint Directory regarding the scope and capability of the endpoints
5. Testing and certification information shall be part of the submission information and shall be kept up to date based on the established standard for the type of endpoint
6. A FHIR standard IG shall be created, balloted and published describing how to query the directory and retrieve supported FHIR endpoints

Intermediate Goals

1. A directory/registry shall be established that points to any directory that contains authoritative FHIR endpoints
2. A FHIR standard IG shall be created, balloted and published describing how to query the directory and retrieve supported FHIR endpoints
3. Each authoritative source shall ensure that any directory to which it contributes the endpoint shall have the same current information
4. Need to resolve issues of associating endpoints with individuals (who maintains)

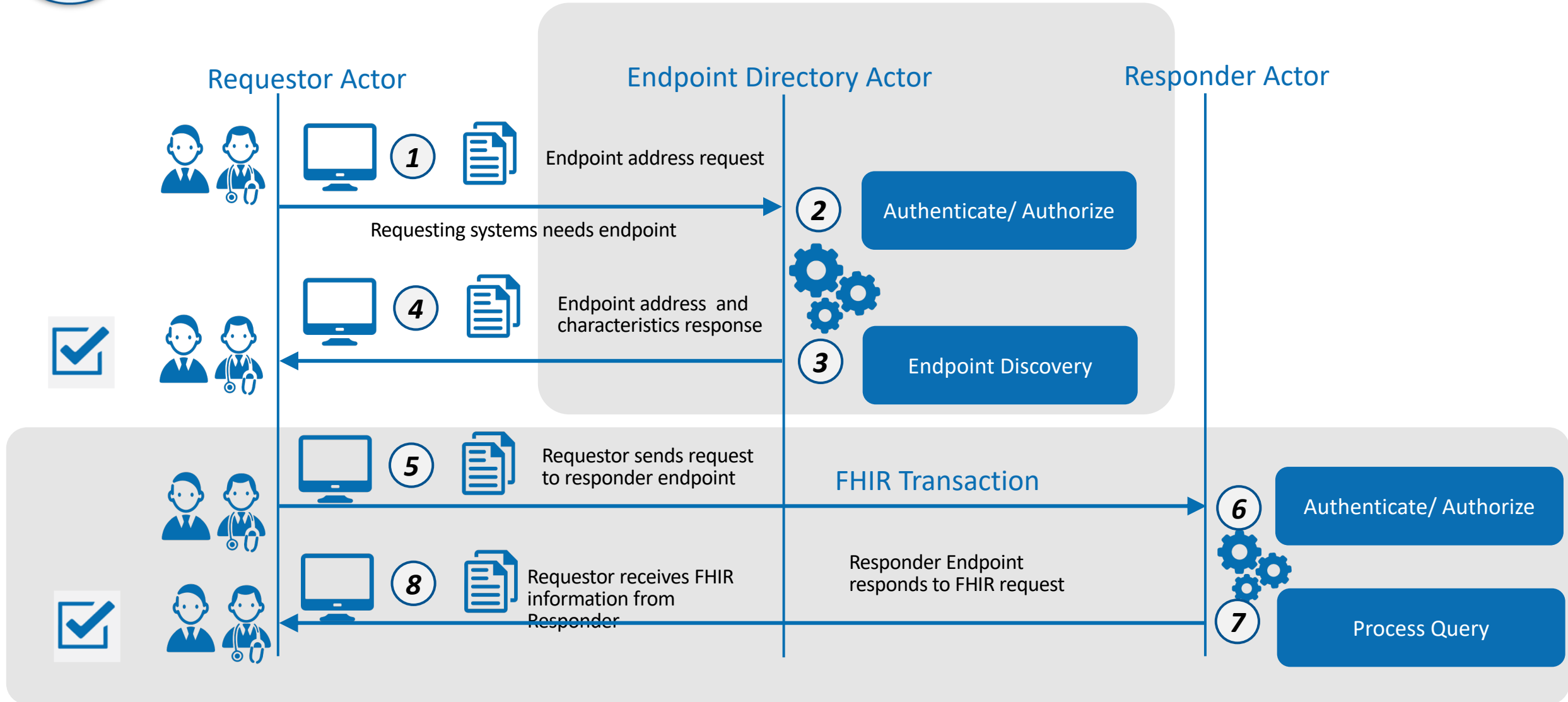


FAST Endpoint Directory – Architecture and Workflow





FAST Endpoint Directory – Proposed Solution





FAST Endpoint Directory – Solution Status

Proposed Solution Status: Working on refinements

1. Identify owner/operator of the validated directory
2. Explore incentives to utilize the proposed architecture
3. Identify any additional standards , process and regulatory authority required
4. Need to clarify intermediate steps to support transition from current environment

Community Feedback: Endpoint Directory

- 1) Do you agree with the proposed solution?
(Please explain in Q&A Box)
- 2) Frequency with which endpoints for clinical information exchange should be validated/certified?
- 3) What other issues, related to Directory, do we need to consider? (Please input feedback into Q&A Box)

FHIR Versions





Approach to FHIR Versions



Versions

Version Detection and Management

PROCESS

Current State &
Technical Barriers

Proposed Solution
Final State

Intermediate
Steps





FAST FHIR Version – Current State

VERSION COMPATIBILITY

- Multiple incompatible versions of FHIR in production (DSTU2, STU3, R4)
- Breaking changes limit forward and backward compatibility between versions except where resources are normative
- Limited ability to convert data between versions without loss of fidelity. Most conformance resources have this capability (StructureDefinition, ValueSet, etc.) but most clinical resources do not
- Most FHIR endpoints only support one version of FHIR

SPECIFICATIONS

- Resources, extensions, profiles, value sets are version specific and, in general, have significant changes between versions
- Most implementation guides are version specific unless provision is made for support of multiple versions
- A single exchange of FHIR content (e.g. a FHIR bundle) is limited to one version of FHIR

CAPABILITY STATEMENTS

- Capability Statement resources are frequently:
 - Used inappropriately or not at all
 - Inaccurate reflections of endpoint capability (despite FHIR spec requirements)
 - In flux (especially as regards to scope and security/authentication)



FAST FHIR Version – Technical Barriers

MULTIPLE VERSIONS & PRODUCTION	Trading partners may need to support multiple versions of FHIR with no guarantee of backward compatibility across versions except for those resources which are normative. While transforms exist for some resources to convert from one version to another, their quality and completeness vary from resource to resource
CONTINUED EVOLUTION OF STANDARD	Supporting new functionality creates timing and adoption challenges (e.g., lag time to support new resources, operations, etc.). Since vendors may support different functions at different times, the capability statement becomes an essential part of determining current endpoint support for specific functionality
VARIABLE ADOPTION OF STANDARD	Vendors adopt support for the ability to read or read/write specific resources. Maintaining capability statements and periodically pulling/processing statements are challenges
USING DIFFERENT FHIR VERSIONS FOR THE RECORD FOR A SINGLE PATIENT	Depending on architectural models deployed for receiving and storing data, multiple FHIR versions may seriously impact decision support or negatively impact the ability to communicate the complete record to another entity
PROFILES THAT ARE VERSION SPECIFIC	Profiles and implementation guides are version specific. This creates complexities when supporting multiple versions of FHIR and migrating from one version to the next, leading to substantial implementation issues



FAST FHIR Version – Scope of Work

In Scope

- Managing multiple versions of FHIR and FHIR artifacts
- Identification of supported version for a specific endpoint
- Translation services
- Ability to appropriately manage exchange of information across multiple versions of FHIR

Out of Scope

- Specifying a single version of FHIR
- Requiring forward/backward compatibility for non-normative resources
- Requiring support for multiple versions in a single exchange



FAST FHIR Version - Proposed Solution

Future State

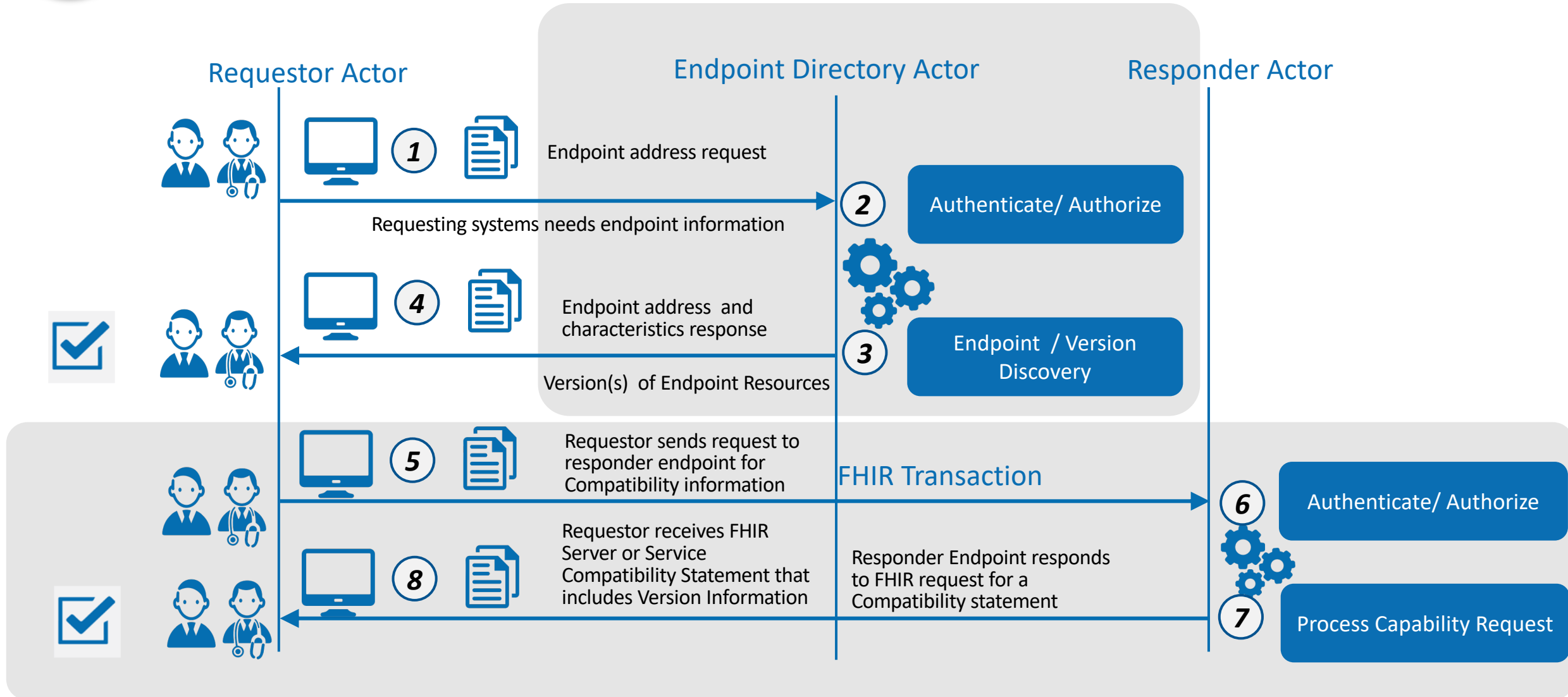
1. Most resources, extensions, profiles, and value sets are “normative”.
2. Variation between releases is focused on new functionality and edge cases.
3. All FHIR artifacts shall provide version information as part of any exchange.
4. Adoption of a base standard version for all FHIR exchanges.
5. Adoption of a new base version shall require approval by ONC.
6. Any new version shall be backward compatible for all normative content.
7. Existing FHIR services shall be supported for at least 2 years after adoption of a new version or until there is no production activity at the endpoint for 3 months Any incompatible changes (non-normative) between version shall be fully defined and where possible, tooling shall be created to manage translation between versions.

Intermediate Goals

1. All endpoints shall support capability statement query that returns the supported version(s).
2. All directory entries shall include information regarding the version(s) of FHIR supported
3. Incompatible changes between version shall have improved tooling, where possible, to manage translation between versions.
4. Transforms exist and are supported by FHIR endpoints for all USCDI resources and profiles to convert to/from versions of FHIR cited in regulation, or via sub-regulatory process.



FAST Version Query – Proposed Solution





FAST Version – Solution Status

Proposed Solution Status: Working on refinements

1. Clarify direction with HL7 FHIR leadership
2. Identify impact on current and future ONC regulations
3. Determine ability to translate non-normative resources
4. Determine impact on extensions, profiles and Implementation Guide

Community Feedback: FHIR Versions

- 1) Do you agree with the proposed solution?
(Please explain in Q&A Box)
- 2) Should the industry adopt standard forward and backward version translations where possible?
(Please explain in Q&A Box)
- 3) What other issues related to FHIR Versions do we need to consider? (Please input feedback into Q&A Box)

Scaling the FHIR Ecosystem





FAST Scaling the FHIR Ecosystem



Scale

Scaling the FHIR Ecosystem

PROCESS

Current State &
Technical Barriers

Proposed Solution
Final State

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Steps





FAST Scaling the FHIR Ecosystem – Current State

EXPERIENCE

- Limited experience with FHIR based solutions operating at scale to support anticipated healthcare needs
- Limited practical experience in scaling FHIR transactions via intermediaries
- Limited ability to push relevant information to interested parties

EXISTING SOLUTIONS

- Current scaling solutions may not handle anticipated volume and predictable response time requirements
- Multiple competing potentially incompatible solutions for scaling (HIEs, Clearinghouses, Trust Framework based exchanges)
- Concern with multiple intermediaries and impact on performance, scaling, synchronous transactions

REGULATORY

- Inconsistent legislative, regulatory, and policy environments
- Current issues related to privacy and security create barriers to national adoption of FHIR at scale

STANDARDS

- Lack of documented standards to handle synchronous exchanges and maintain state via intermediaries
- No standard to determine location of patient/member records creates repetitive tasks and data gaps as well as incremental transaction volume
- Impact of competing interoperability models on access to data – e.g. are endpoints discoverable and inaccessible depending on the model used



FAST Scaling the FHIR Ecosystem – Technical Barriers

MULTIPLE INTEROPERABILITY MODELS

Hybrid exchange models (e.g., spoke/hub, direct connections/point-to-point, and regionally interconnected spoke/hub) create challenges in adopting standards for scaling FHIR and implementing consistent approaches such as authentication, endpoint detection, standards for matching, and end-to-end performance.

LACK OF PREDICTABILITY AND RESPONSE TIMES

Scaling real-time transactions requires infrastructure that may not be currently available through existing intermediaries. The lack of predictable end-to-end response time limits specific use cases where providers require a response prior to proceeding with diagnosis or treatment. Some intermediary models do not support end-to-end synchronous real-time applications. The industry will need to adopt synchronous FHIR front-end interfaces and migrate to near real-time backend solutions.

RECORD LOCATION

Lack of a national patient record locator service limits the ability to discovery all records for a given patient in a distributed service environment. There is no current process for universally discovering endpoints either in general or for a specific patient.

ANTICIPATING INCREASE IN FHIR-BASED VOLUME

There are currently no models to predict the volume of FHIR-based transactions as FHIR is adopted broadly in the ecosystem. This may lead to unpredictable scaling and performance challenges. Adopting real-time (RESTful) solutions to solve real-time synchronous FHIR scalability is required by the industry. Payers and providers need to increase services (and related perception of reliability) to support significant increase in real-time transactions embedded in the clinical workflow.

DATA BLOCKING

The industry is moving to a utilization model for access to patient data using FHIR APIs. As FHIR makes information readily available within an encounter clinical workflow and through multiple mobile, portable and wearable devices in real time, the volume of transactions will increase exponentially. If there is limited access to this information, or the cost per access/transaction is too high, this will constitute a new form of data blocking. The CMS NPRM is working to address both of these issues.



FAST Scaling the FHIR Ecosystem – Scope of Work

In Scope

- Interoperability models with, point-to-point, single and multiple intermediaries
- Issues related to RESTful exchanges via intermediaries
- Planning for future volume increase
- Establishing SLA and Performance requirements for intermediaries and endpoints
- Establishing functionality of endpoints and the method of declaration

Out of Scope

- Identification, security, directory, versioning, metadata, certification or piloting
- Ownership models
- Trust frameworks
- Legal agreements
- Non-RESTful exchange methods (e.g. Direct)
- Technical Implementation



FAST Scaling the FHIR Ecosystem – Scaling Considerations

1. Endpoint discovery (e.g. directory)
2. Determine endpoint services and version support
3. Authentication and authorization
4. Security (e.g. same version of TLS)
5. OAuth Scopes (vary by vendor)
 - Support for search parameters and optional elements (by vendor)
 - Error handling (I)
 - Patient matching (I)
6. Availability and response time [ability to support volume](including ability to support different services (e.g. consumer access vs clinical need) with predictable architecture (e.g. different endpoints or internal routing based on A&A) to solve volume challenges]
7. Consent and privacy
8. Supported Operations (e.g. Subscription, Messaging, Operations, ...) (I)
9. Terminologies (other than US Core required and must support elements) (I?)
10. Terminologies when multiple are supported and /or value sets are poorly defined (I?)



FAST Scaling the FHIR Ecosystem – Proposed Solution

Future State

1. Support a mixed model (point to point, gateways, and via intermediaries)
2. Support intermediaries when they add value for the participants
3. Establish scaling requirements for both point to point and intermediaries
4. Established minimum availability and performance requirements for any scale architecture (including multiple intermediaries)
5. Requirement to support synchronous transactions (e.g. maintaining “state” across intermediaries)
6. Intermediaries (regardless of the number) need to support, transparently, all FHIR workflow operations (including subscription)
7. Intermediaries capable of handling volume, response time, and routing to all available end points
8. Need to support metadata for “routing” through multiple intermediaries

Future State (other issues)

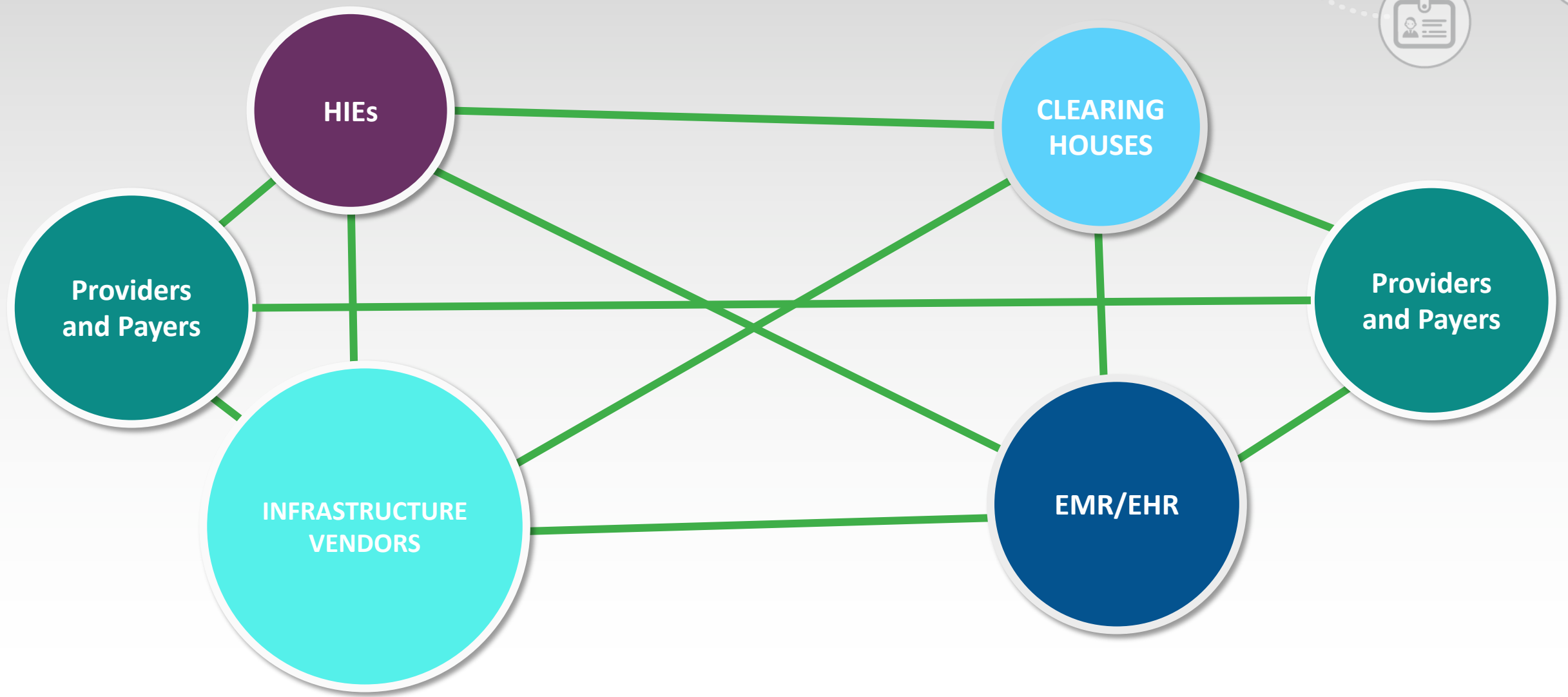
1. Legislative, standards, and legal trust framework allowing unlimited, authorized access to information for stated purpose
2. Universal patient identifier
3. Ability to locate patient records (record locator service)

Intermediate Goals

1. Establish voluntary performance standards for intermediary support for FHIR exchanges
2. Define and test an appropriate intermediary – intermediary exchange solution
3. Test performance for intermediaries



FAST Scaling the FHIR Ecosystem – Future State





FAST Scaling the FHIR Ecosystem – Proposed Solution

Showing Only Interactions Related to Scaling Solution

Requestor Actor

Intermediary One

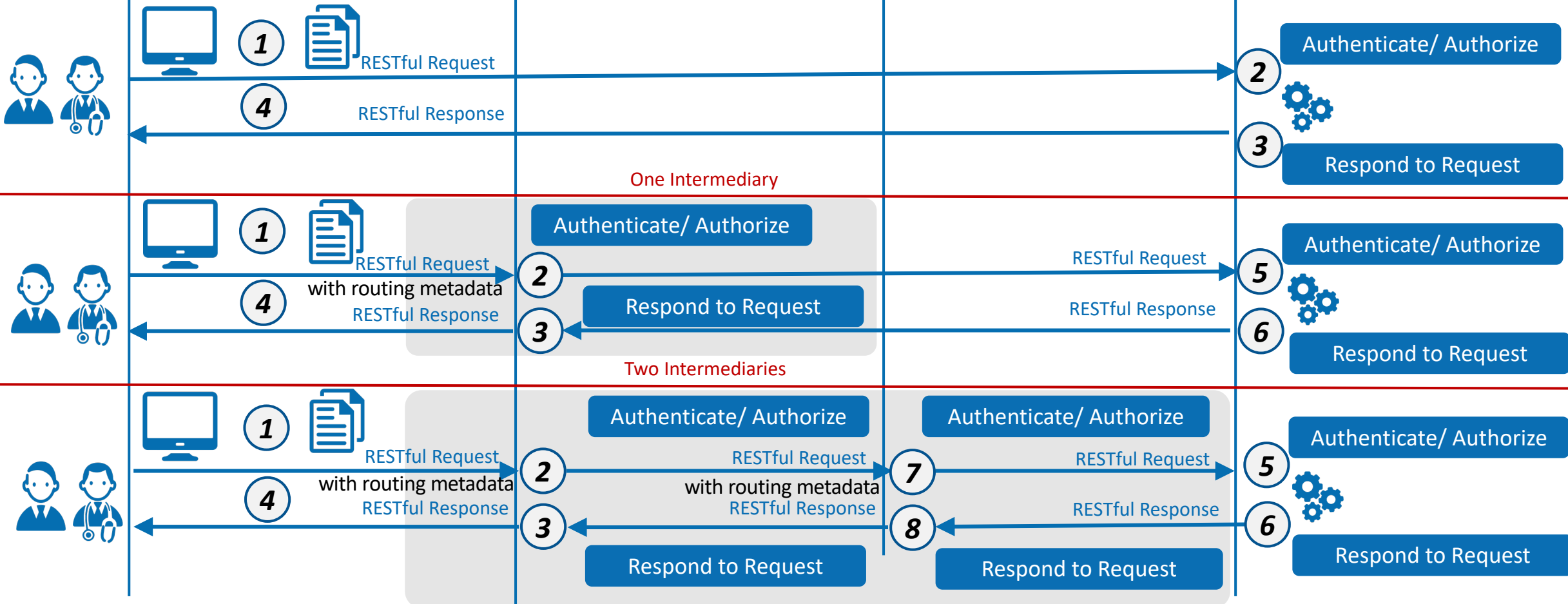
Intermediary Two

Responder Actor

Point to Point

One Intermediary

Two Intermediaries





FAST Scaling the FHIR Ecosystem – Solution Status

Proposed Solution Status: Working on refinements

1. Determine scope of requirements
2. Explore standards for intermediary to intermediary exchanges
3. Clarify exchange services that must be supported
4. Detail the specific availability and performance requirements
5. Determine the best method for establishing requirements

Community Feedback: Scaling the FHIR Ecosystem

1. Do you agree with the proposed architecture for intermediaries?
(Please explain in Q&A Box)
2. Should we consider requirements of intermediaries other than availability, performance and transparency?
(Please explain in Q&A Box)
- 3) What other issues related to Scaling do we need to consider?
(Please input feedback into Q&A Box)



Next TLC Webinar

Testing and Certification

Thursday, December 12th

12-1:00 pm ET

[Register Now!](#)

Presenters

- **Lee Barrett**, *Executive Director, CEO, EHNAC*
- **Sandy Vance**, *Director Healthcare Interoperability, AEGIS*

Proposed Solution to be Presented

- **ONC FHIR Testing and Certification Program**





FAST Initiative Output & Communication Strategy

FAST CONTENT

[FAST Initiative Use Cases, Version 2](#)

[FAST Regulatory and Policy Barriers, Version 1](#)

[FAST Solutions \(In Development/Drafts\)](#)

[FAST Initiative Core Capabilities](#)

[FAST Technical Barriers, Version 1](#)

FAST COMMUNICATION STRATEGY

[FAST 101 - Public Webinar](#)

[FAST 101 and Keystone Presentations](#)

[Technical Learning Community](#)

All content is available on the [FAST Project Page](#)



FAST Focus and how to get involved

Patient & Provider Identity Management

Directory Services

Version Identification

Scale

Exchange Process/Metadata

Testing, Conformance & Certification

Security

Pilots

WANT TO GET INVOLVED??

Join the Technical Learning Community to get updates and provide input on the technical and regulatory barriers, use cases, and proposed solutions as they are developed.

SIGN UP!!

&

JOIN THE LINKEDIN GROUP



Thank You – Today's Presenters

Alexandra (Alix) Goss

*Vice President
and Senior Consultant
Imprado*

Robert Dieterle

*CEO
EnableCare*

Connect with us on [LinkedIn](#) to stay informed

For more information on the *FAST* Initiative,
visit the *FAST* [Project Page](#) or <https://tinyurl.com/ONC-FAST>

Have any further questions/suggestions?

Please contact Stephen Konya at Stephen.Konya@hhs.gov
& Diana Ciricean at Diana.Ciricean@hhs.gov