S&I Data Provenance Initiative

EHR Record Lifecycle Events and Data Provenance Across S&I Initiatives

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S&I Simplification Analysis

- Each S&I Use Case Scenario
  - Breaks down to Event Steps
- Each Event Step
  - Has an Actor
  - Has Inputs and Outputs
  - Has Actions Taken (as examples)
- Each Action
  - Invokes EHR or other System Functions
- System Functions
  - Manage EHR Record Lifecycle (thus Data Provenance) Events

S&I Simplification

Common Actions

S&I Simplification WG has identified a set of 36 Common Actions used and re-usable across Use Cases. Actions fall into these categories:

- Identity: Patient, Practitioner, Organization
- Consistent Time
- Data Access Permissions
- Access Control
- Audit
- Query
- Encryption, Decryption
- Signatures: Individual, System
- Exchange: Transmit, Receive
- Registration, Admission, Discharge, Transfer
- Clinical Summary
- Clinical Entries
- Record Lifecycle: Originate, Retain, Amend, Verify, Attest, Access/View, Extract, Translate, Transmit/Receive, De-Identify…

S&I Simplification

Common Actions

- Next Two Slides – Show a condensed version of the S&I Simplification Common Actions (L→R by column)
  A. Action Category
  B. Action ID
  C. Action Description
  D. Requirements Related to or Fulfilled by Action
  E. Data Requirements (partial)
  F. EHR-S Function ref: ISO/HL7 10781 EHR-S FM
  G. PHR-S Function ref: ISO/HL7 16527 PHR-S FM
  H. Is Action Auditable?
  I. Is Action typically Signed: by individual, system?

  (Yellow: Actions → EHR-S Functions for Record Lifecycle Events.)

Common Actions from S&I Simplification Core Matrix v3.1

Action Category	Action ID	Action	Related Requirement(s)	Data Objects Note Re-Use across Multiple Actions	EHR System Functions (Ref: ISO/HL7 10781 EHRS Functional Model Release 2)	PHR System Functions (Ref: ISO/HL7 16527 PHRS Functional Model Release 1)	Action Auditable? (A.AUDIT)	Action Signed by… (A.SIGN)
Identity	A.ID.1	Identify, Authenticate Individual Patient	R3-R5, R15	DES101 Patient ID	TI.1.1 - Entity Authentication CPS.1.1 - Manage Patient Record CPS.1.2 - Manage Patient Demographics	PH.1.1, S.2.1, S.3.1, IN.1, IN.1.7, IN.3.1-4	Yes	N/A
	A.ID.2	Select Individual Patient					Yes	N/A
	A.ID.3	Identify, Authenticate Provider	R9-R11, R15	DES102 Individual Provider ID and/or DES103 Organizational Provider ID	TI.1.1 - Entity Authentication AS.1 - Manage Provider Information AS.1.1 - Manage Provider Registry or Directory AS.1.7 - Manage Practitioner/Patient Relationships RI.1.1.1-24.1 - Evidence of <Provider> in EHR Record Entry	S.1.2, S.1.3, IN.3.1-4	Yes	N/A
	A.ID.4	Select Provider					Yes	N/A
	A.ID.5	Identify System	R14	DES104 System ID	TI.1.1 - Entity Authentication CPS.2.8 - Support Medical Device Originated Data RI.1.1.1-24.1 - Evidence of <System> in EHR Record Entry TI.3 - Registry and Directory Services	IN.3.1-3, IN.3.5	Yes	N/A
	A.ID.6	Validate Identity Certificate	R8-R11	DES102 Individual Provider ID and/or DES103 Organizational Provider ID	<Not included in EHRS FM R2>	<Not included in PHRS FM R1>	Yes	N/A
Consistent Time	A.TIME	Reference Current Time	R1, R2, R12, R13	DES107 Consistent Time	RI.2 - Record Synchronization	PH.1.4, IN.1.1, IN.3.4	Yes	N/A
Data Access Permissions	A.PERMIT.1	Set Data Access Permissions, including Patient Consent	R2, R7, R15	DES105 Data Access Permissions	TI.1.2 - Entity Authorization CPS.1.7.3 - Manage Consents and Authorizations AS.2.6 - Manage Patient Privacy Consent Directives AS.3.2.1 - Manage Consents and Authorizations from a PHR RI.1.1.6-9 - Output/Disclose/Transmit/Receive Record Entry Content	S.3.3.1, S.7, IN.3.1, IN.3.8	Yes	N/A
	A.PERMIT.2	Determine/designate Scope of Data Access Permissions	R7, R7.1	DES105 Data Access Permissions			Yes	N/A
Access Control	A.ACCESS.1	Check User Data Access Permissions	R2, R2.1, R7, R15	DES102/DES103 Provider ID DES105 Data Access Permissions	TI.1.1 - Entity Authentication TI.1.2 - Entity Authorization TI.1.3 - Entity Access Control RI.1.1.5 - Access/View Record Entries	IN.3.1-4, IN.3.8	Yes	N/A
	A.ACCESS.2	Access/View Record, Document or Message	R1, R2, R3-7, R9-R15	Any/All		IN.3.1-3	Yes	N/A
Audit	A.AUDIT	Audit Action and/or Record Action	R1, R12-R17	DES108 Audit Parameters	RI.1.1.1-24.1 - Evidence of Record Entry Provenance and Accountability TI.2.1.1 - Record Entry Audit Triggers TI.2.1.2 - Security Audit Audit Triggers TI.2.1.3 - System Audit Triggers TI.2.1.4 - Clinical Audit Triggers	IN.1, IN.3-4		N/A
Query	A.QUERY	Query		Any/All	CPS.9.5 - Ad Hoc Query and Rendering POP.6.1 - Outcome Measures and Analysis POP.6.2 - Performance and Accountability Measures	PH.5.4, IN.2.1	Yes	N/A
Encrypt	A.ENCRYPT	Encrypt Record or Exchange Content		Any/All	RI.1.1.8 - Transmit Record Entry Content RI.1.1.9 - Receive Record Entry Content TI.1.6 - Secure Data Exchange TI.8 - Database Backup and Recovery	IN.3.5, IN.3.10		
De-Crypt	A.DECRYPT	Decrypt Record or Exchange Content		Any/All				
Signature	A.SIGN	Apply Signature	R8-R11, R13-R14	DES102 Individual Provider ID DES103 Organizational Provider ID DES104 System ID	RI.1.1.1 - Originate and Retain Record Entry RI.1.1.2 - Amend Record Entry Content RI.1.1.4 - Attest Record Entry Content TI.1.5 - Non-Repudiation	IN.3.4, IN.3.5, IN.3.7	Yes	N/A
Signature	A.DSig	Apply Digital Signature	R8-R11, R13-R14	DESxxx Individual Provider Digital ID DESxxx Organizational Provider Digital ID DESxxx System Digial ID	RI.1.1.1 - Originate and Retain Record Entry RI.1.1.2 - Amend Record Entry Content RI.1.1.4 - Attest Record Entry Content TI.1.5 - Non-Repudiation	IN.3.4, IN.3.5, IN.3.7	Yes	N/A
Signature	A.DSigV	Validate Digital Signature	R8-R11, R13-R14	DESxxx Individual Provider Digital ID DESxxx Organizational Provider Digital ID DESxxx System Digial ID	RI.1.1.1 - Originate and Retain Record Entry RI.1.1.2 - Amend Record Entry Content RI.1.1.4 - Attest Record Entry Content TI.1.5 - Non-Repudiation	IN.3.4, IN.3.5, IN.3.7	Yes	N/A

Common Actions from S&I Simplification Core Matrix v3.1

Action Category	Action ID	Action	Related Requirement(s)	Data Objects Note Re-Use across Multiple Actions	EHR System Functions (Ref: ISO/HL7 10781 EHRS Functional Model Release 2)	PHR System Functions (Ref: ISO/HL7 16527 PHRS Functional Model Release 1)	Action Auditable? (A.AUDIT)	Action Signed by… (A.SIGN)
Exchange	A.XFER.1	Transmit Record, Document or Message	R1.1-R14.1	Documents/Messages, containing DESs, as exchanged	RI.1.1.8 - Transmit Record Entry Content RI.1.1.9 - Receive Record Entry Content TI.1.6 - Secure Data Exchange TI.1.7 - Secure Data Routing TI.5 - Standards-Based Interoperability	IN.3.1-3, IN.3.5-6, IN.3.10	Yes	Sender/Source
	A.XFER.2	Receive Record, Document or Message					Yes	N/A
Acknowledgement	A.ACK	Acknowledgement		DES109 Acknowledgement information			Yes	N/A
Registration, Admission, Discharge	A.REG	Register Patient	R1, R3-R5, R8	DES101 Patient ID DES1 Personal Information DESxxx Other registration, admission and discharge information	CPS.1.1 - Manage Patient Record CPS.1.2 - Manage Patient Demographics CPS.1.5 - Manage Patient Encounter	PH.1.1	Yes	N/A
	A.IP.1	Admit Inpatient				N/A	Yes	N/A
	A.IP.2	Discharge Inpatient					Yes	N/A
	A.AP.1	Checkin Ambulatory Patient					Yes	N/A
	A.AP.2	Checkout Ambulatory Patient					Yes	N/A
Clinical Summary	A.REC.1-2	Compile/Retain - Clinical Summary	R1-R11, R14, R15	DES101 Patient ID DES102/DES103 Provider ID DES104 System ID DES105 Data Access Permissions DES1-DES37, as appropriate	[Refer to Specific Actions Re-Used - Col B.]	[Refer to Specific Actions Re-Used - Col B.]	Yes	Author/Source
	A.REC.3	Verify - Clinical Summary					Yes	Author/Source
	A.XFER.1	Transmit - Clinical Summary	R1.1-R14.1				Yes	Sender/Source
	A.XFER.2	Receive - Clinical Summary					Yes	N/A
	A.REC.2	Retain - Clinical Summary	R1-R14				Yes	N/A
	A.ACCESS.2	Access - View Clinical Summary	R2, R4-R15				Yes	N/A
Clinical	[See Clinical Summary Sequence]	Clinical Actions, for example: • Order(s) • History and Physical • Assessment • Reconcile medication list • Update problem list • Update care plan • Capture vital signs	R1, R3-R5, R8-R15	Any/All	Care Provision (CP) and Care Provision Support (CPS) Functions	Personal Health (PH) Functions	N/A	N/A
Record Lifecycle	A.REC.1	Originate	R1, R12, R13, R15-R17	Any/All	RI.1.1.1 - Originate and Retain Record Entry	IN.3.1-3, IN.4	Yes	Author/Source
	A.REC.2	Retain				IN.4	Yes	N/A
	A.REC.3	Verify			RI.1.1.4 - Attest Record Entry Content	IN.4	Yes	Author/Source
	A.REC.4	Attest				IN.3.1-3, IN.3.7, IN.4	Yes	Author/Source
	A.REC.5	Amend			RI.1.1.2 - Amend Record Entry Content	IN.4	Yes	Author/Source
	A.REC.6	De-Identify or Alias			RI.1.1.10 - De-identify Record Entries RI.1.1.11 - Pseudomynize Record Entries	PH.3.6.1, S.4.1.2, IN.1.4, IN.4	Yes	N/A
	A.REC.7	Re-Identify			RI.1.1.12 - Re-identify Record Entries	IN.1.4	Yes	N/A
	A.REC.8	Extract			RI.1.1.13 - Extract Record Entry Content	S.3.8, S.4.1.3, S.4.3, IN.1.4, IN.4	Yes	N/A
	A.REC.9	Translate			RI.1.1.3 - Translate Record Entry Content	IN.1.13	Yes	Author/Source Sender/Source
	A.REC.10	Output/Report			RI.1.1.6 - Output/Report Record Entry Content	PH.2.4, S.2.3-4, S.3.5, S.3.8, IN.4	Yes	Author/Source Sender/Source
	A.ACCESS.2	Access/View			[Refer to Specific Actions Re-Used - Col B.]	[Refer to Specific Actions Re-Used - Col B.]	Yes	N/A
	A.ENCRYPT	Encrypt					Yes	Sender/Source
	A.DECRYPT	Decrypt					Yes	Sender/Source
	A.XFER.1	Transmit, Disclose					Yes	Sender/Source
	A.XFER.2	Receive					Yes	N/A

Re-Use Examples

S&I Simplification Use Case

Scenario Events to Actions

- Next Slide – Shows condensed version of two S&I Transition of Care Scenarios (L→R by column)
  A. Event Step
  B. Actor
  C. Event Description
  D. Inputs
  E. Outputs
  F. Action Examples

  G and on. Action Repetition Tabulation

  (Yellow: Actions → EHR-S Functions for Record Lifecycle Events.)

Scenarios/Events (partial TOC Use Case) from S&I Simplification Core Matrix v3.1

Light Blue Background - From S&I Use Case Initiative Scenarios
White Background - Added by Simplification Work Group for Illustration

	Actor	Event/Description	Inputs	Outputs	Sample Action(s)	A.AUDIT Audit	A.SIGN Sender/Source Signature	A.SIGN Author/Source	A.TIME Consistent Time	A.ID.1/2 ID Patient	A.ID.3/4 ID Provider	A.ID.5 ID System	A.ID.6 Verify ID Certificate	A.PERMIT Set Permissions	A.ACCESS.1 Check Permissions	A.ACCESS.2 Control Access	A.REC.1 Originate Entry	A.REC.2 Retain Entry	A.REC.3 Verify Entry	A.REC.4 Attest Entry	A.REC.5 Amend Entry	A.REC.6 De-Identify Entry	A.REC.7 Re-Identify Entry	A.REC.8 Extract Entries	A.REC.9 Translate Entries	A.REC.10 Output/Report Entries	A.XFER.1 Transmit	A.XFER.2 Receive	A.ACK Acknowledgment	A.QUERY Query
Transitions of Care (TOC) - Transitions of Care - Scenario 1A - Exchange of Discharge Summary to Support Transfer of Patient Information from One Provider to Another Provider																														
Pre	EHR System(s)	Reference/Set Consistent Time			Reference Consistent Time	X			X																					
1	Provider	Trigger Generation of Discharge Summary for Patient A	START	Discharge Instructions	Identify Patient, Provider, EHR System	X				X	X	X																			
					Originate/Attest/Retain - Discharge Summary	X		X									X	X		X											
					Set Data Access Permissions	X								X																	
2	Hospital EHR System	Send Discharge summary to PCP's EHR System or other Provider EHR System	Discharge Instructions	Discharge Instructions	Transmit - Discharge Summary	X	X																				X			
3	PCP or other Provider EHR System	Receive Discharge Summary	Discharge Instructions	Discharge Instructions	Identify (EHR) System	X						X																		
					Receive/Retain - Discharge Summary	X												X											X		
4	Provider	Trigger Generation of Discharge Summary for Patient A	Discharge Summary	Discharge Summary	Identify Patient, Provider, EHR System	X				X	X	X																		
					Originate/Attest/Retain - Discharge Summary + Instructions	X		X									X	X		X											
					Set Data Access Permissions	X								X																	
5	Hospital EHR System	Send Discharge summary to PCP's EHR System or other Provider Organization	Discharge Summary	Discharge Summary	Transmit - Discharge Summary + Instructions	X	X																				X			
6	PCP or other Provider EHR System	Receive Discharge Summary	Discharge Summary	Discharge Summary	Identify (EHR) System	X						X																		
					Receive/Retain - Discharge Summary + Instructions	X												X											X		
7	Provider	View Discharge Summary/Instructions	Discharge Summary	END	Identify, Authenticate Provider	X					X																			
					Check User Data Access Permissions	X									X																
					Access/View - Discharge Summary + Instructions	X										X															
Transitions of Care (TOC) - Transitions of Care - Scenario 1B - Exchange of Clinical Summaries to Support Closed Loop Referral of Patient from One Provider to Another																														
Pre	EHR System(s)	Reference/Set Consistent Time			Reference Consistent Time	X			X																					
1	Provider	Trigger Generation of Consultation Request Clinical Summary for Patient A	START	Generated Consultation Request Clinical Summary	Identify Patient, Provider, EHR System	X				X	X	X																		
					Originate/Attest/Retain - Clinical Summary	X		X									X	X		X											
					Verify - Clinical Summary	X		X											X												
					Set Data Access Permissions	X								X																	
2	PCP EHR System	Send Consultation Request Clinical Summary to specialist's EHR System	Consultation Request Clinical Summary	Consultation Request Clinical Summary	Transmit - Clinical Summary	X	X																				X			
3	Specialist EHR System	Receive Consultation Request Clinical Summary from PCP's EHR System	Consultation Request Clinical Summary	Consultation Request Clinical Summary	Identify (EHR) System	X						X																		
					Receive/Retain - Clinical Summary	X												X											X		
4	Provider	View Consultation Request Clinical Summary in specialist's EHR System	Consultation Request Clinical Summary	END	Identify Provider	X					X																			
					Check User Data Access Permissions	X									X																
					Access/View - Clinical Summary	X										X															
5	Provider	Trigger Generation of Consultation Summary for patient A	START	Generated Consultation Summary	Identify Patient, Provider EHR System	X				X	X	X																		
					Originate/Attest/Retain - Consultation Summary	X		X									X	X		X											
6	Specialist EHR System	Send Consultation Summary to PCP's EHR System	Consultation Summary	Consultation Summary	Transmit - Consultation Summary	X	X																				X			
7	PCP EHR System	Receive Consultation Summary from specialist's EHR System	Consultation Summary	Consultation Summary	Identify (EHR) System	X						X																		
					Receive/Retain - Consultation Summary	X												X											X		
8	Provider	View Consultation Summary in PCP's EHR System	Consultation Summary	END	Identify, Authenticate Provider	X					X																			
					Check User Data Access Permissions	X									X																
					Access/View – Consultation Summary	X										X															

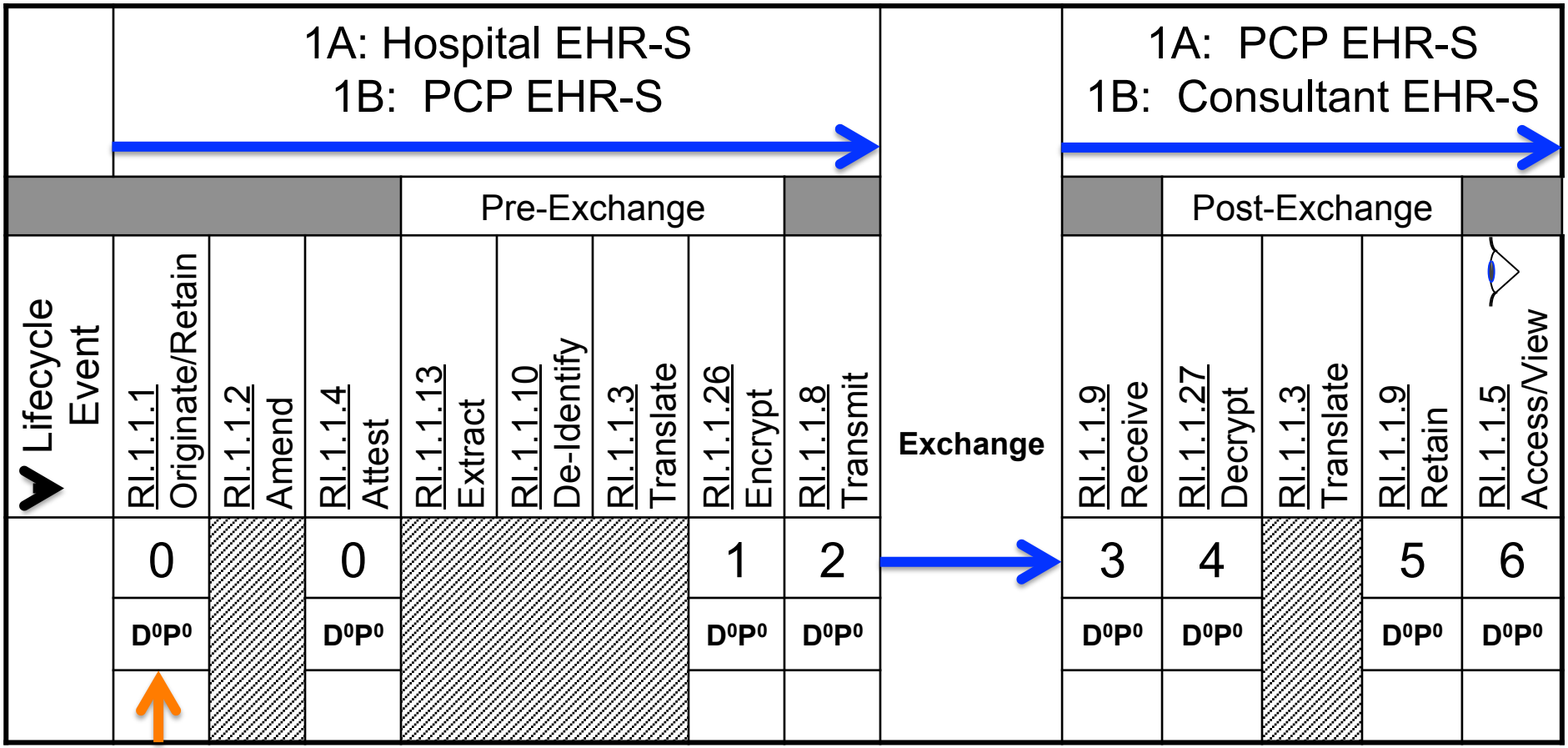
S&I Simplification Analysis

Transitions of Care Use Case

- Next Two Slides – Show example patterns for Record Lifecycle Event Sequence based on TOC:
  - Scenario 1A – Exchange of Discharge Summary to Support Transfer of Patient Information from One Provider to Another Provider – Steps 1-7
  - Scenario 1B – Exchange of Clinical Summaries to Support Closed Loop Referral of Patient from One Provider to Another – Steps 1-8
- Patterns follow examples shown in prior slide set:
  - Introduction to ISO/HL7 Standards for EHR Record Lifecycle and Lifespan (presented to the S&I Data Provenance Community Meeting on 26 June)

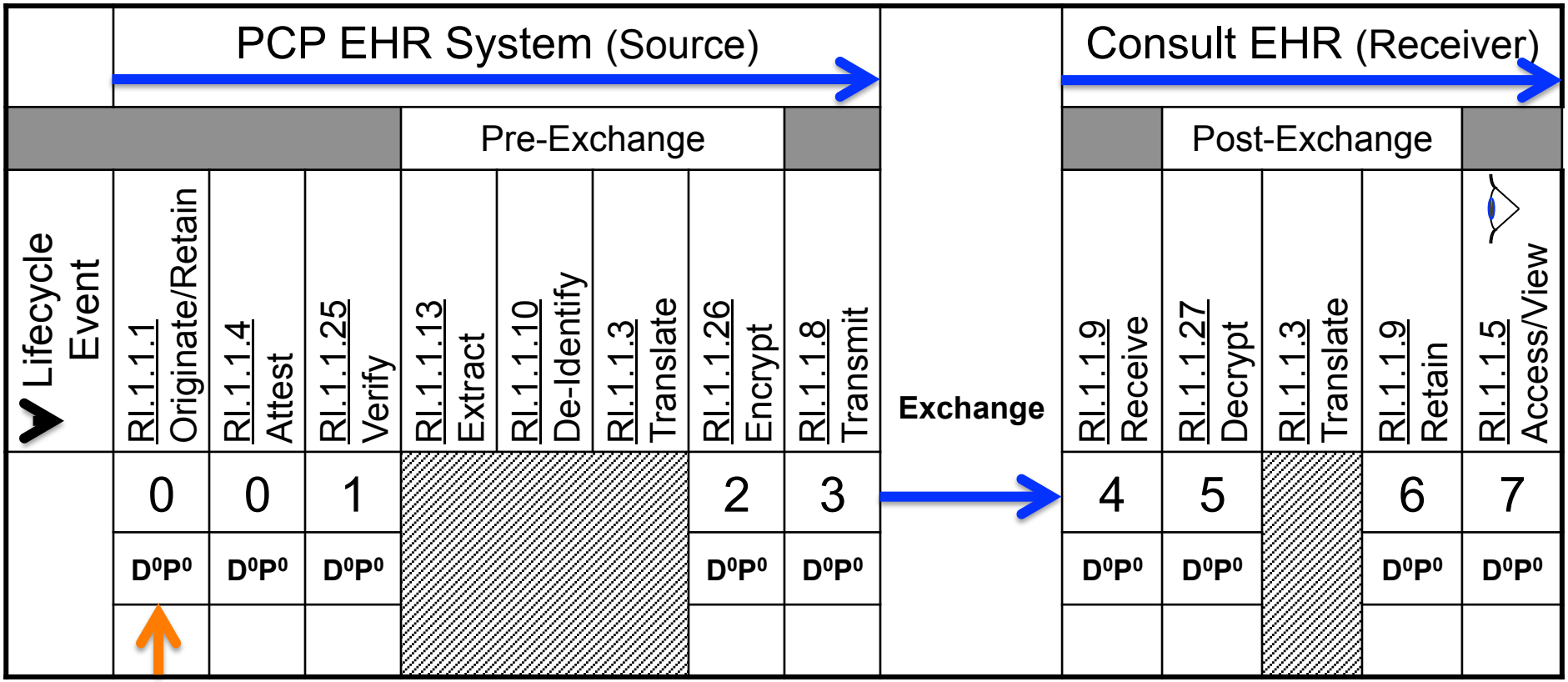
PATTERN: Scenario 1A, Steps 1-3 and 4-7; Scenario 1B, Steps 5-8

S&I Transitions of Care Use Case



PATTERN: Scenario 1B, Steps 1-4

S&I Transitions of Care Use Case



= New Provenance Event; D^XP^X = Data/Provenance Duplets

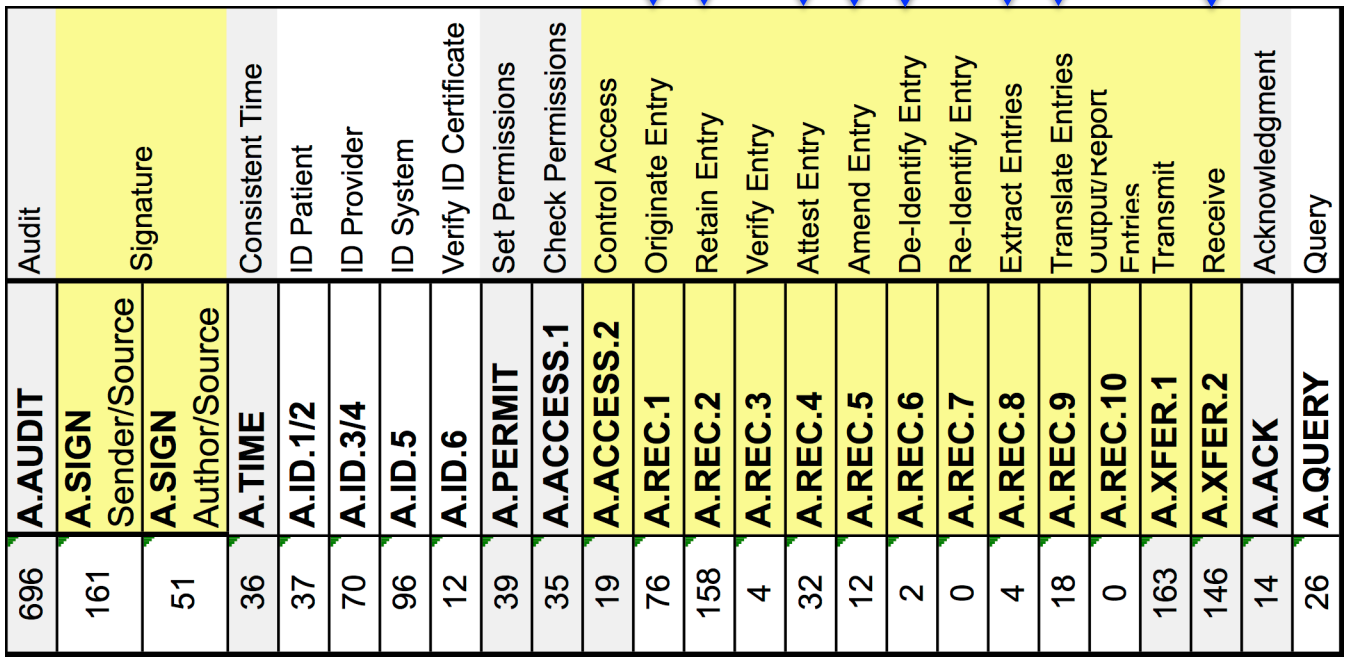
Analysis and Demonstration…

- S&I Simplification Work Group has:
  - Analyzed 19 S&I Use Cases with 41 Scenarios
  - Specified Actions (examples) for each Scenario and Event Step
- Next Slide
  - Shows Repetition Counts for Action Examples
  - Shows Likely Provenance Events
  - Including System Functions for Record Lifecycle Events
  - Across the same 19 S&I Use Cases with 41 Scenarios

S&I Simplification Analysis Examples

S&I Data Provenance Writ Large

Common Provenance Events
(singly or in combination)



Repetition Count →	A.AUDIT	A.SIGN Sender/Source	A.SIGN Author/Source	A.TIME	A.ID.1/2	A.ID.3/4	A.ID.5	A.ID.6	A.PERMIT	A.ACCESS.1	A.ACCESS.2	A.REC.1	A.REC.2	A.REC.3	A.REC.4	A.REC.5	A.REC.6	A.REC.7	A.REC.8	A.REC.9	A.REC.10	A.XFER.1	A.XFER.2	A.ACK	A.QUERY
	Audit	Signature		Consistent Time	ID Patient	ID Provider	ID System	Verify ID Certificate	Set Permissions	Check Permissions	Control Access	Originate Entry	Retain Entry	Verify Entry	Attest Entry	Amend Entry	De-Identify Entry	Re-Identify Entry	Extract Entries	Translate Entries	Output/Report Entries	Transmit	Receive	Acknowledgment	Query
	696	161	51	36	37	70	96	12	39	35	19	76	158	4	32	12	2	0	4	18	0	163	146	14	26

(Yellow: Actions → EHR-S Functions for Record Lifecycle Events.)

S&I Simplification

Conclusion = Exploitable

- Most all S&I Use Cases are in fact
  - Data Provenance Use Cases
- Each Demands Truth (Authenticity) and Trust (Assurance)
  - As evidenced (in part) by Data Provence details

- Exploit: Build Record Lifecycle and Provenance Event Flows for each S&I Use Case Scenario
  - as per TOC example

S&I Framework – Cross Initiative – S&I Simplification

Links

- Standards and Interoperability (S&I) Framework Wiki
  - http://wiki.siframework.org
- S&I Simplification Wiki
  - http://wiki.siframework.org/Cross+Initiative+-+S%26I+Simplification+WG
  - http://wiki.siframework.org/Use+Case+Simplification+Reference+Materials
- Federal Health Information Model (FHIM)
  - http://www.fhims.org
- AHRQ/USHIK S&I Pilot Site
  - http://ushik-stg.dcgroupinc.com/mdr/portals/si?system=si&enableAsynchronousLoading=true
- HL7 EHR Interoperability Wiki
  - http://wiki.hl7.org/index.php?title=EHR_Interoperability_WG