IBM Watson Health

Blockchain: The Chain of Trust and its Potential to Transform Healthcare – IBM's Point of View

IBM Global Services – Public Sector Team

IBM

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Why Blockchain?

"On the Internet, nobody knows you're a dog."

The Internet of Today

The **_Internet of Information_** has been built on protocols such as

- TCP/IP for machine communication,
- HTTP for web content,
- SMTP for email, and
- FTP for file transfer.

The Internet of Future with Blockchain

The **_Internet of Value_** is being built on Blockchain enabled by trust, accountability, and transparency

Source: Peter Steiner's cartoon, as published in The New Yorker. Reused with permission from Cartoonbank.com

Blockchain for Business

Shared Ledger
single source of truth

Digital assets
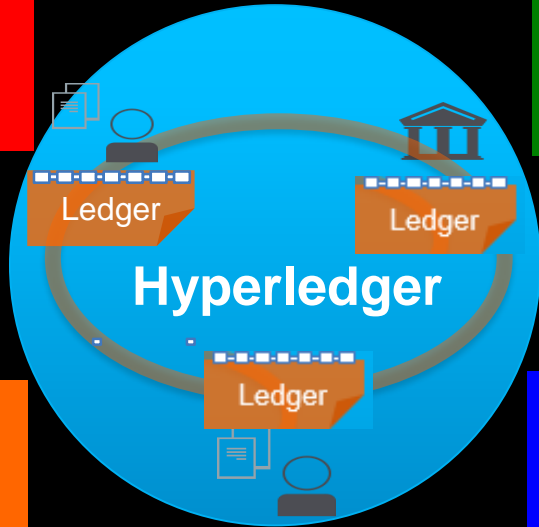Record depository

Shared Ledger
Append-only distributed system of record shared across business network

Smart Contract
Business terms embedded in transaction database & executed with transactions

Smart Contracts
business logic

Ledger

Ledger

Hyperledger

Ledger

Secure
tamper proof (extra security)

Audit-able
prove identity & ownership

Confidential
permission control

Privacy
Ensuring appropriate visibility; transactions are secure, authenticated & verifiable

Consensus
All parties agree to network verified transaction

Permissioned
Participants Identity

Consensus
Modular protocol

• IBM is a founding member of the Linux Foundation's Hyperledger project and has been a leading voice in developing collaborative open standards for distributed ledgers and smart contracts

A vast amount of untapped data could have a great impact on our health — yet it exists outside medical systems

60%
Exogenous Factors

30%
Genomics Factors

10%
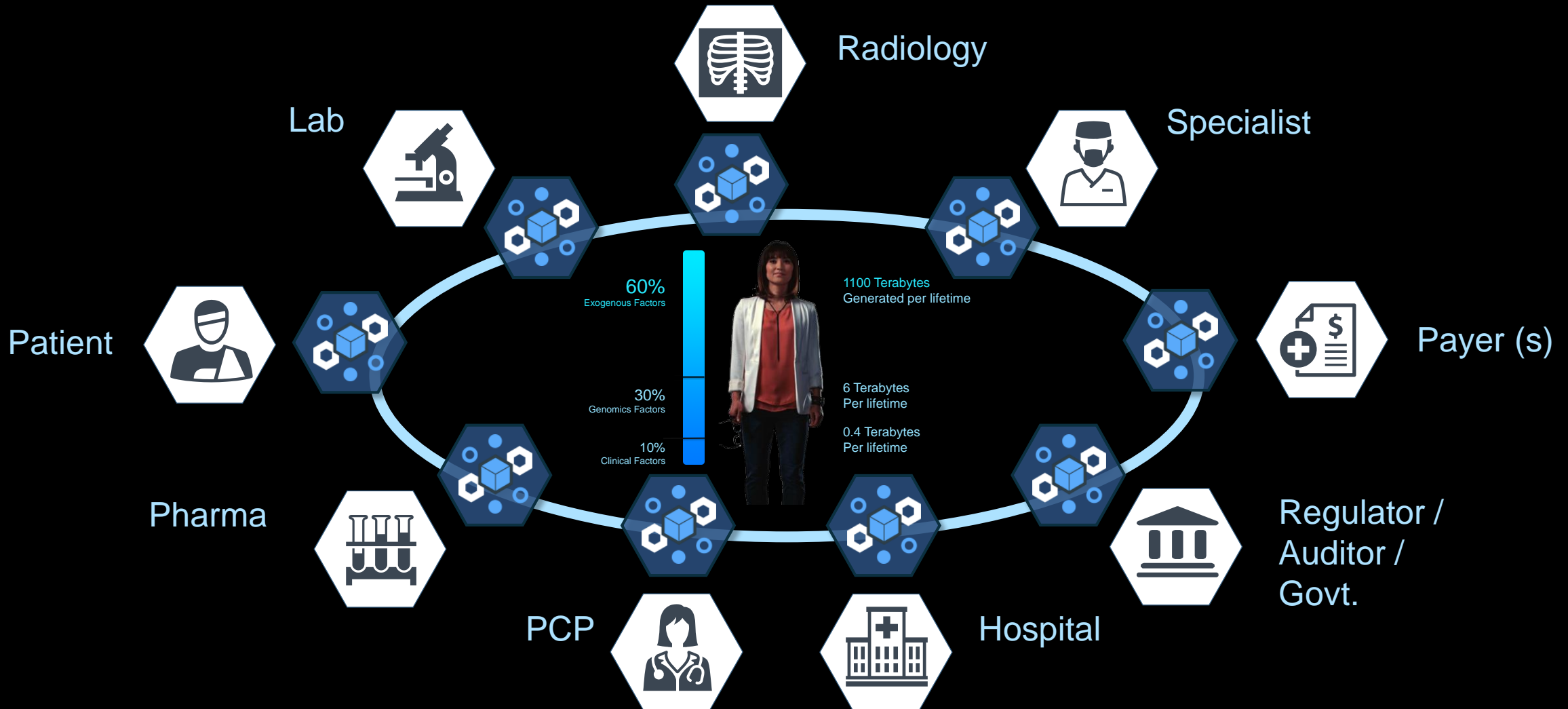Clinical Factors
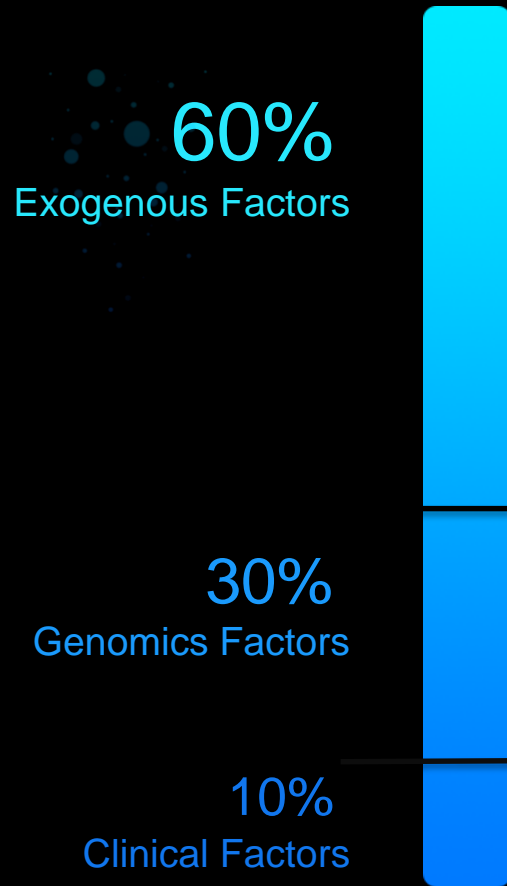
1100 Terabytes
Generated per lifetime

Volume, Variety, Velocity, Veracity

6 Terabytes
Per lifetime

0.4 Terabytes
Per lifetime

SOURCE: "Health Policy Brief: The Relative Contribution of Multiple Determinants to Health Outcomes," Health Affairs, August 21, 2014.

The Chain of Trust in Healthcare and Life Sciences

Radiology

Specialist

Lab

Patient

Payer (s)

Pharma

Regulator /
Auditor /
Govt.

PCP

Hospital

60%
Exogenous Factors

30%
Genomics Factors

10%
Clinical Factors

1100 Terabytes
Generated per lifetime

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Blockchain Healthcare Use Cases

Patient Consent and Health Data Access

- Personal record storage
- Outcome based payments
- Notarization and identity
- Consumer generated data and health IoT
- Health research commons
- Genomics data exchange

Payment and Claims

- Validation and Payment of Claims
- Real-Time / Contextual Forms of Insurance
- Health Document Notary Services
- Medical Banking: Disintermediating counterparties

Provenance and traceability

- Counterfeit Drug Prevention and Detection
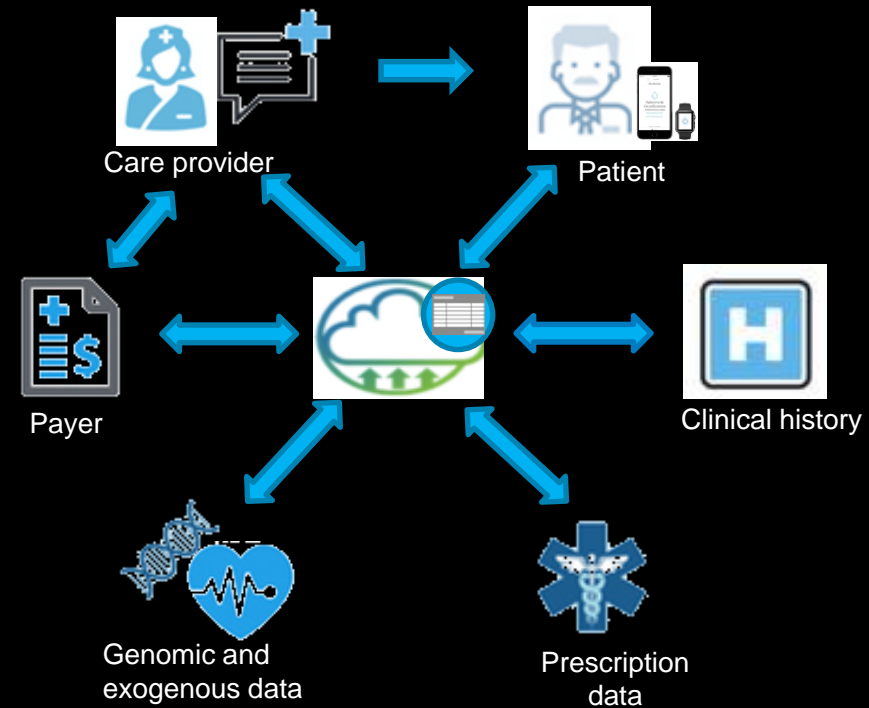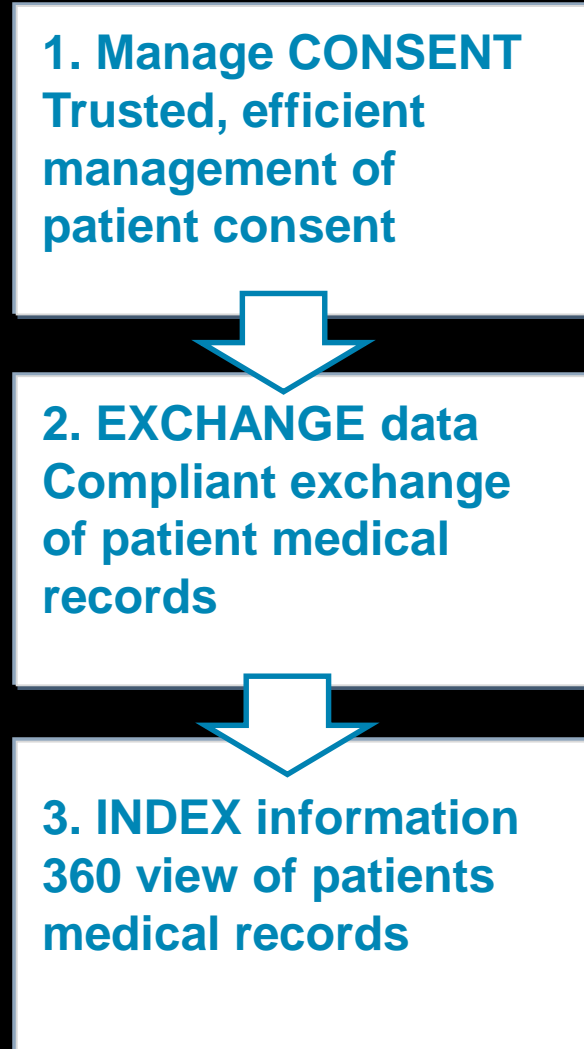- Smart Property for healthcare assets

Clinical Trial Results / Other

- Improve accountability and transparency in the clinical trial
- Doctor-Vendor RFP Services
- Collaborative Crowdsourcing

Rethinking **Patient Mediated Health Data Exchange**

1. Manage CONSENT
Trusted, efficient management of patient consent

2. EXCHANGE data
Compliant exchange of patient medical records

3. INDEX information
360 view of patients medical records

Care provider

Patient

Payer

Clinical history

Genomic and exogenous data

Prescription data

- Patients **register consent** in the blockchain to allow care providers access to information required in their care
- **Compliant data exchange** is driven from available consent
- Patients can access a **personal index** of their health information compiled as information is exchanged.
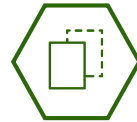
Blockchain and Patient Mediated Health Data Exchange

Patient Consent Management
Direct visibility of consent authorized parties; immutable consent data in BC

Health Data Exchange
Secure Data Access to Authorized Health Data based on Patient Consent

Provenance
All consent, data access and updates can be traced back to origin

Accountability
Patients control the parties who have access to their health data, and keep them accountable

Control
Health Data can not be accessed without patient's consent

Transparency
Regulators can monitor activities and detect abusive practices
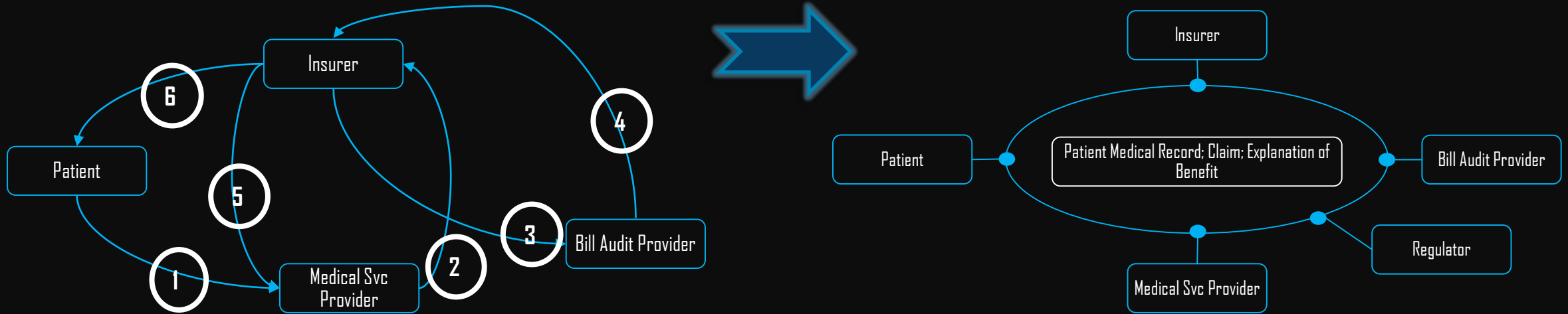
Security
Unlike traditional systems, Blockchain security is at the core in focus and design

Privacy
Only authorized parties can see health data and only what they are supposed to see
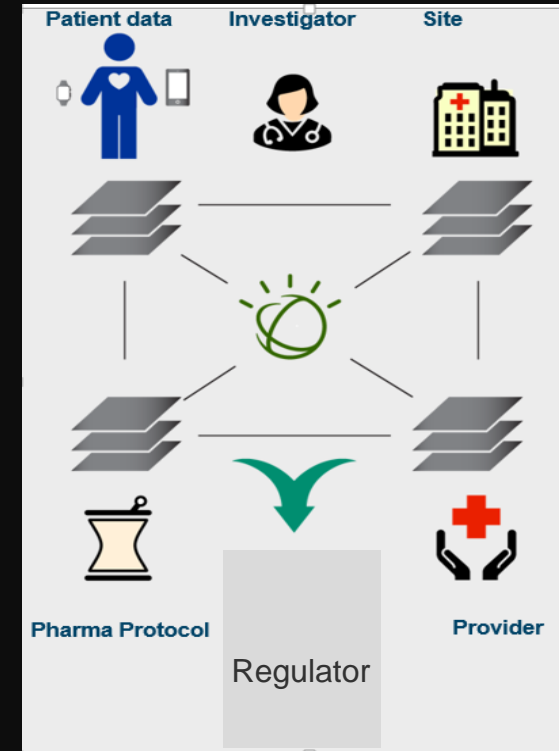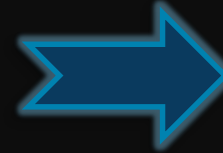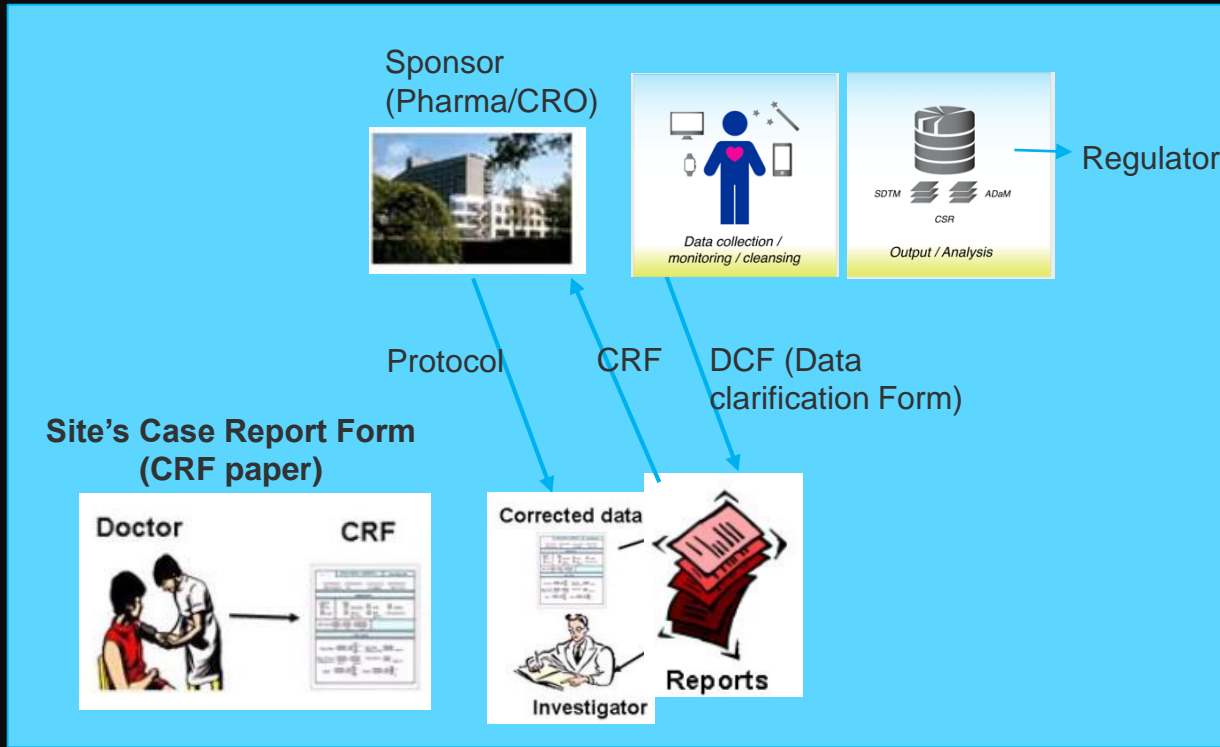
Rethinking **Medical Claims Processing**

✓ No need for counter-party mediation

✓ Smart Contract between Provider /Patient / Payer

- Faster coordination of benefits, underwriting process and billing resolution
- Reduces claim disputes
- Patients have visibility into claim processing and available benefits

Rethinking **Clinical Trials Management**

- ✓ **Auditability** and use for fraud detection
- ✓ **Standardize** electronic Case Report Forms creation
- ✓ **Provenance** of patient data through the chain of exchange, transformation and results
  - ✓ eCRF data can be checked in blockchain by any authorized participants Site or Pharma or FDA
  - ✓ Un-alterable record of protocols, eCRFs and protocol amendments
- ✓ **Traceability** of protocol design elements to data collection

Life Sciences Supply Chain

Rethinking **Pharma Supply Chain Provenance & Traceability**

RAW MATERIALS → Pharma → Wholesale Distributors (e.g., packagers) Logistics, Shipping companies → Health Care Providers, Community Clinics, Pharmacies → Consumer / Patient → Regulatory Body

- Reduction of counterfeit fraud, drug traceability, end-to-end visibility, brand protection

- End-to-end traceability, enabling auditability, compliance, optimization. coordination

- Retrieve provenance information of each drug packet, traceability, fraud detection

- Ability to query exact origin of the drug, reduction of counterfeit fraud

- Visibility of the entire history of evolution of every drug package in a transparent manner

Distributed Shared Ledger

Tamper-proof, Immutable, Transparent, Secure, Auditable, Permissioned.

IBM's Investments In Blockchain

IBM Launches 7th Worldwide Bluemix Garage

**Blockchain on Bluemix**

THE WALL STREET JOURNAL.
CIO JOURNAL.
IBM Set to Launch One of the Largest Blockchain Implementations to Date
IBM Global Financing will use blockchain, touted as a way to make many markets and functions more efficient by removing the middleman, to free up capital tied in customer disputes

Blockchain for IBM Global Financing

Bluemix Garage for Blockchain

IBM to Launch First Commercial Blockchain in Sept.
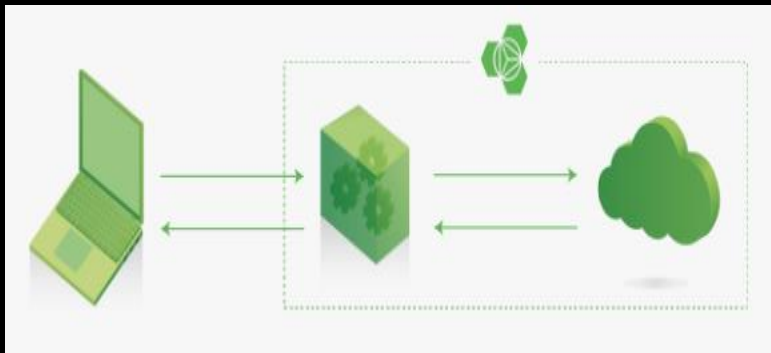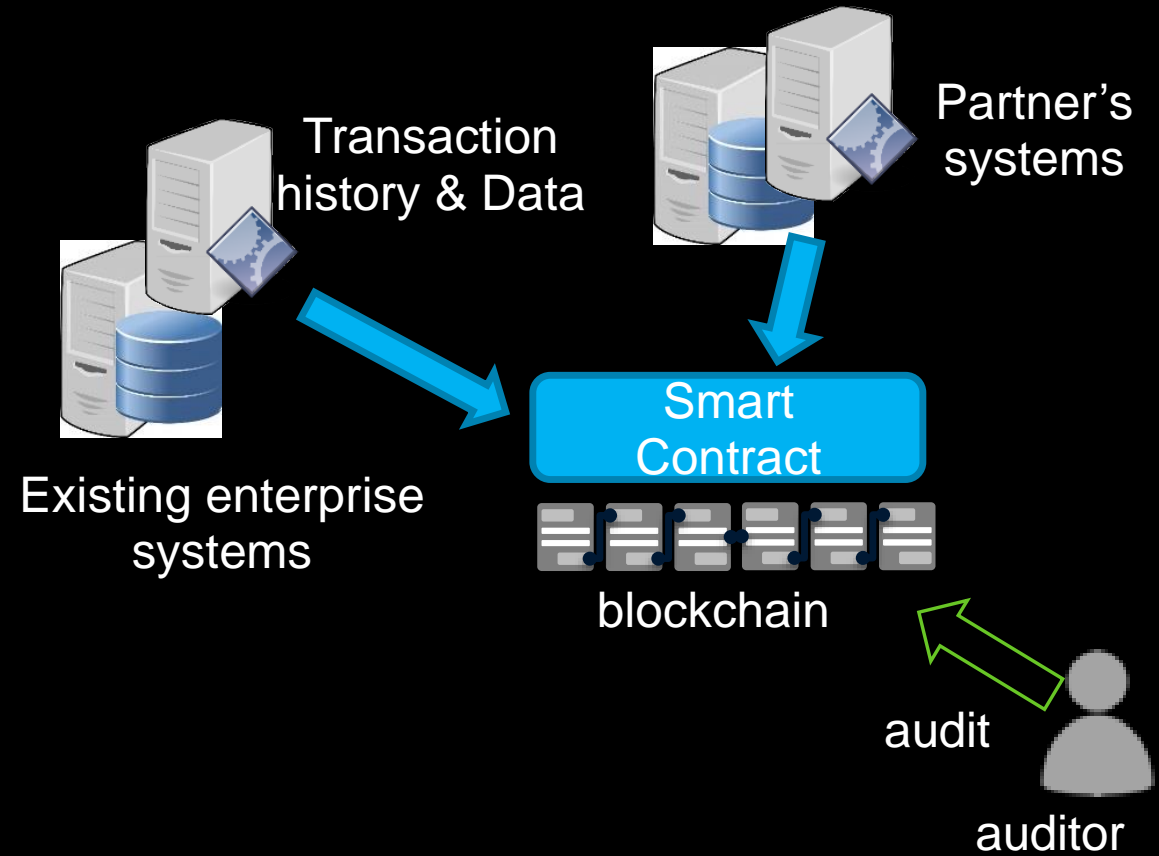

Blockchain on IBM z Systems

IBM Opens Blockchain Garage in SoHo, NYC for Cloud Developers

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Approaches for Creating Blockchain Solutions (1 of 2)
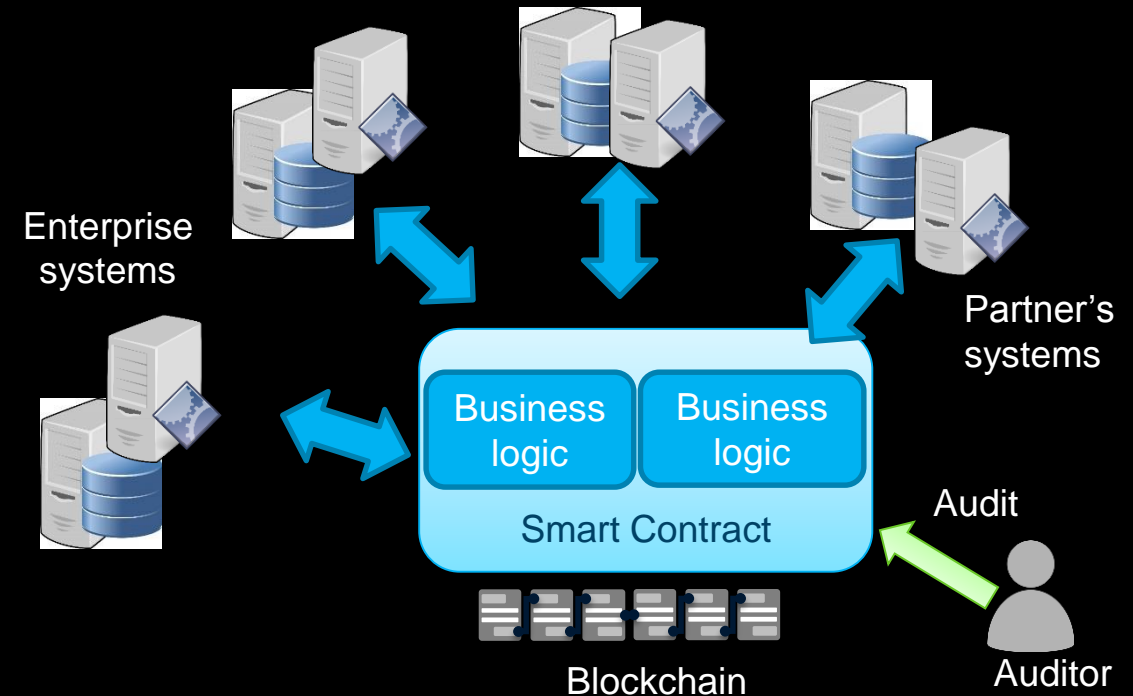
Simple Augmentation of Existing Solutions

- Determine key blockchain facets to augment existing solution, e.g. for integrity, auditability, provenance, non-repudiation, or other blockchain facet

- Send records, or hash of records, (e.g. EMR data hash) to Blockchain when existing systems updates data, while existing systems can continue to handle business logic

- Blockchain provides integrity and/or transaction history for provenance and compliance

Transaction history & Data

Partner's systems

Smart Contract

Existing enterprise systems

blockchain

audit

auditor

auditor

Approaches for Creating Blockchain Solutions (2 of 2)

Creating a new function or solution with Blockchain and Smart Contracts for business logic

- Define use-case with key roles across business partners, and corresponding blockchain based functions / primitives

- Design and implement RESTful APIs for blockchain functions and corresponding chain code for smart contracts

- Integrate with existing business logic with RESTful API calls to blockchain functions

- Blockchain facets provided by smart contracts and defined functions

Enterprise systems

Partner's systems

Business logic | Business logic

Smart Contract

Audit

Blockchain

Auditor

Thank you!

https://www.ibm.com/blockchain