Enabling Technologies for Healthcare Transformation & SOA

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A new Healthcare Ecosystem needs to …

- Integrated
- Enabled by data-driven evidence
- Be measured and driven to deliver patient outcomes
- Be more efficient and economical
- Present growth opportunities for ecosystem participants
- Deliver better quality healthcare for all

IBM Point of View

Thesis

The industry is moving towards an **Evidence-centric healthcare ecosystem** to drive healthcare transformation and yield lower costs and improved outcomes

Change Implications

Proper alignment of payment and incentives to evidence-centric healthcare delivery, along with large-scale comparative effectiveness evidence generation and delivery platforms is critical to drive this transformation

IBM Response

- **Participate and lead transformation of Healthcare delivery models** like Patient Centered Medical Home
- **Deliver business analytics solutions that facilitate the implementation of evidence-centric models** through service, software and cloud computing capabilities

The healthcare transformation at Geisinger is an example of how an evidence-centric ecosystem with novel incentives, comprehensive digitization of EHR, and analytics for identifying best practices can enable improved outcomes and operational efficiency

Geisinger ProvenCare (CABG)

- ***Implemented EHR in 1995, CDIS in 2009***
- ***Developed best practice guidelines in 2008***
- ***ProvenCare/Acute episodic care program provides warranty on outcomes***

Benefits

- *Readmission within 30 days (6.9% → 3.8%) ; average total Length of Stay (LOS): (6.2d → 5.7d)*
- *Reduced hospital mortality (1.5% → 0%); number of Neurological complications (1.5% → 0.6%) ;*

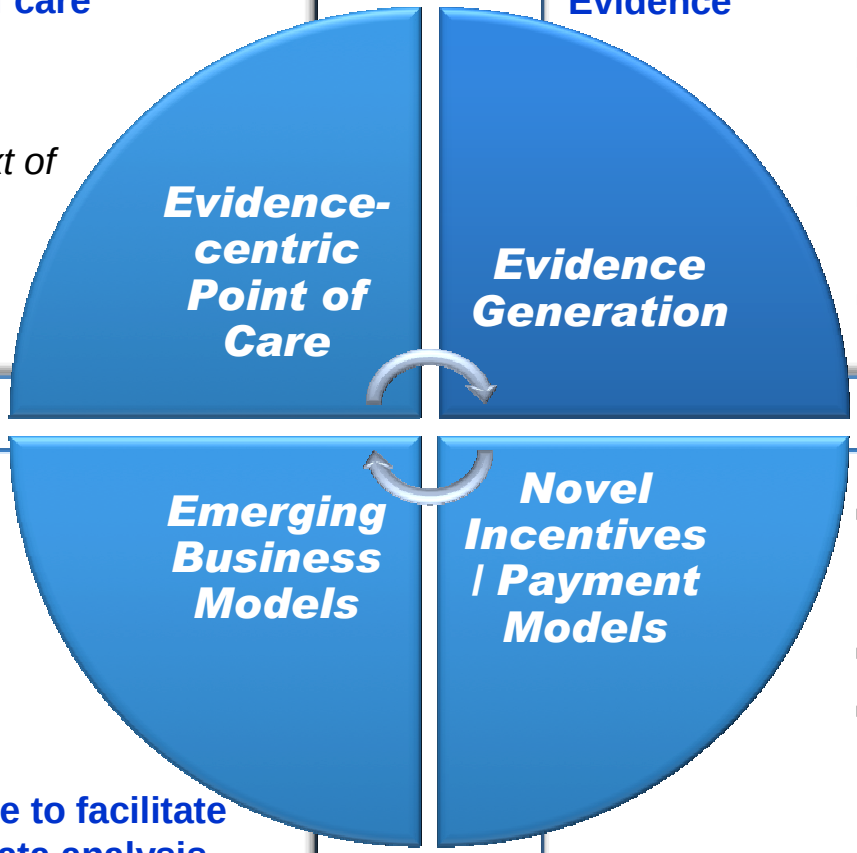
IBM is focused on four enabling capabilties for healthcare transformation

Improve care delivery through useful evidence at the point of care

- *Cognitive support and decision intelligence*
- *Evidence in the context of care delivery process*
- *Anticipate the need, tailor delivery*

Enable transformation of Data to Evidence

- *Cloud and Data Trusts at the infrastructure level*
- *Analytics on federated data structures*
- *Novel security paradigms*



- *Workflow and Business process transformation*
- *Collaboration*
- *Information in context*
- *Feedback loop*

New businesses emerge to facilitate the collaboration and data analysis across the HC ecosystem

- *Evidence and outcome based payment models*
- *Optimization*
- *Tailoring payments to disease categories*

Provide incentives to enhance patient outcomes and reduce costs

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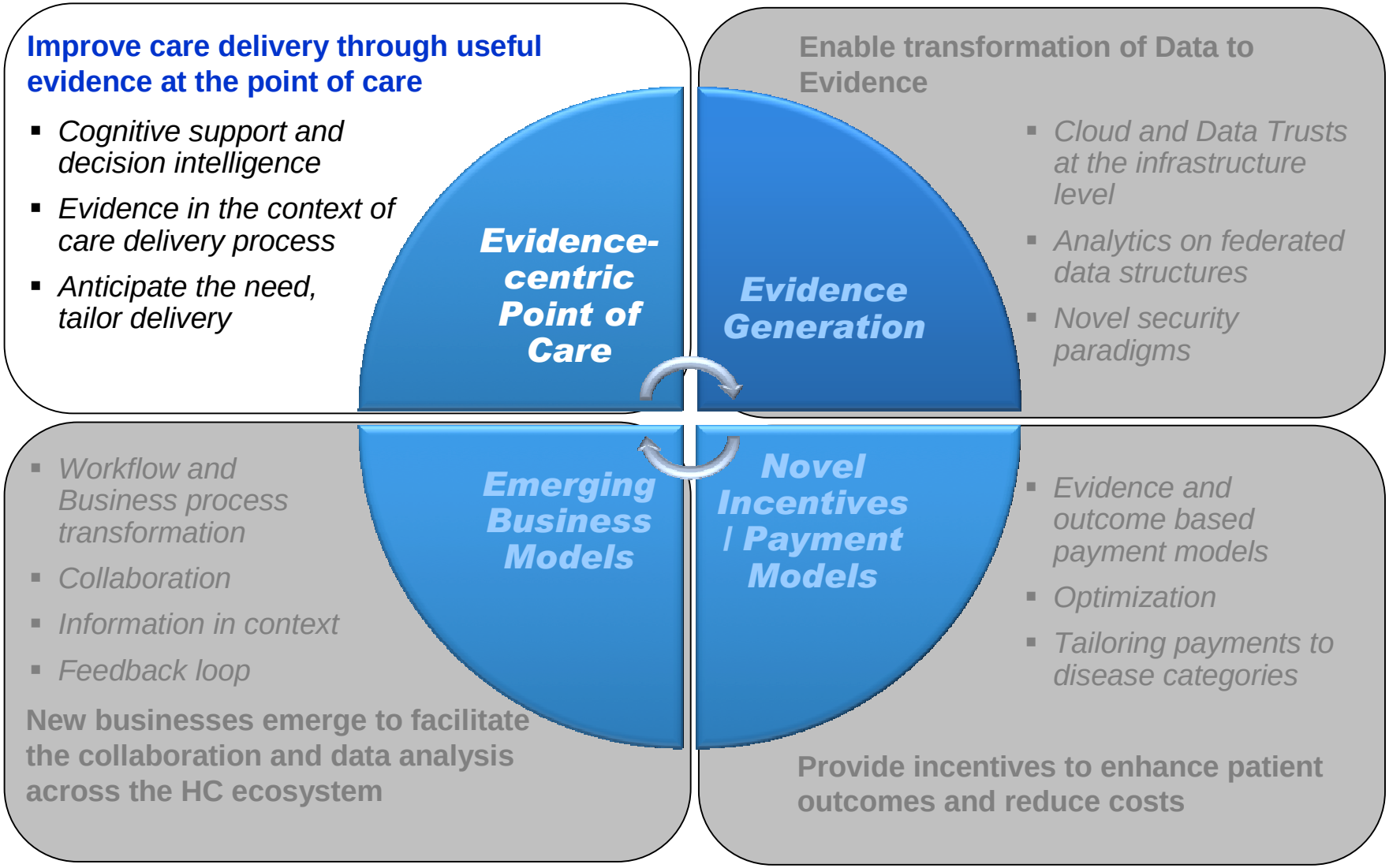
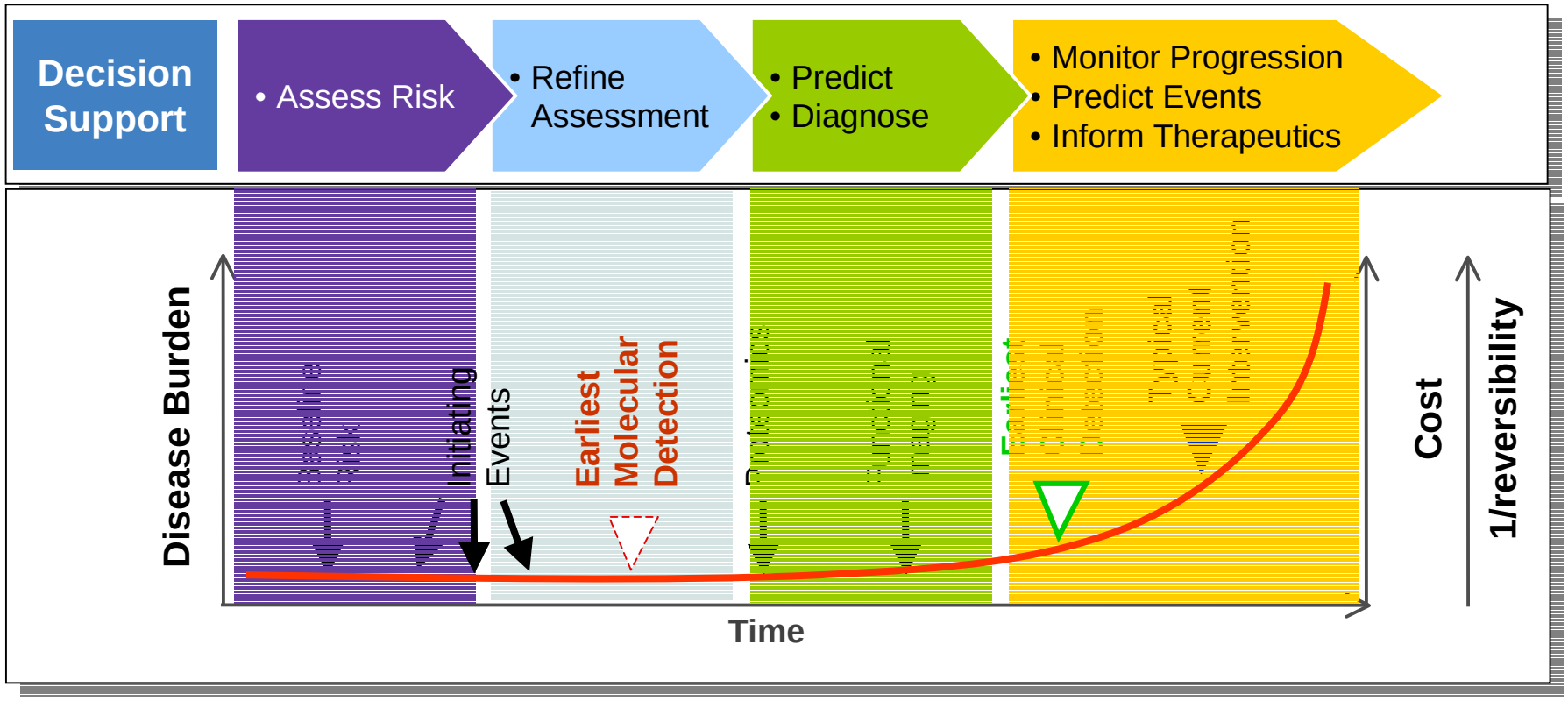
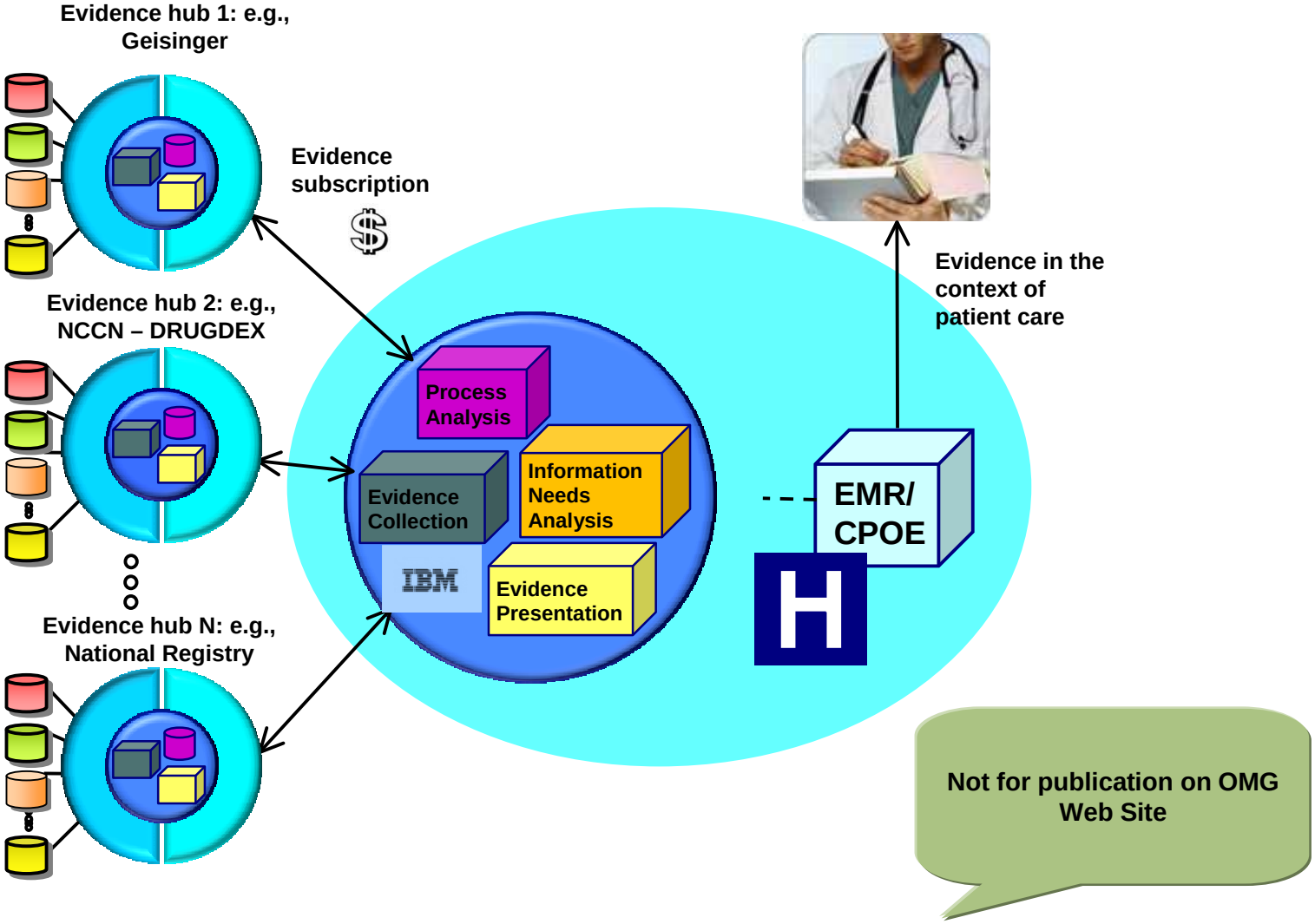


Emerging early diagnosis allows improved observation of the body's internal state before clinical symptoms appear. **Earlier intervention results in improved outcomes and lower costs.**



Evidence delivery at the point-of-care is enhanced by providing clinical decision intelligence via consumable delivery of evidence from up to date evidence sources and aggregators



Example: Cardiac Clinical Decision Support System (contact: Dr. Tanveer Syeda-Mahmoud)

Current diagnosis practice:

1. Physician makes a diagnosis based on a single patient's data and her prior experience.
2. No validation of diagnosis other than through second opinions.

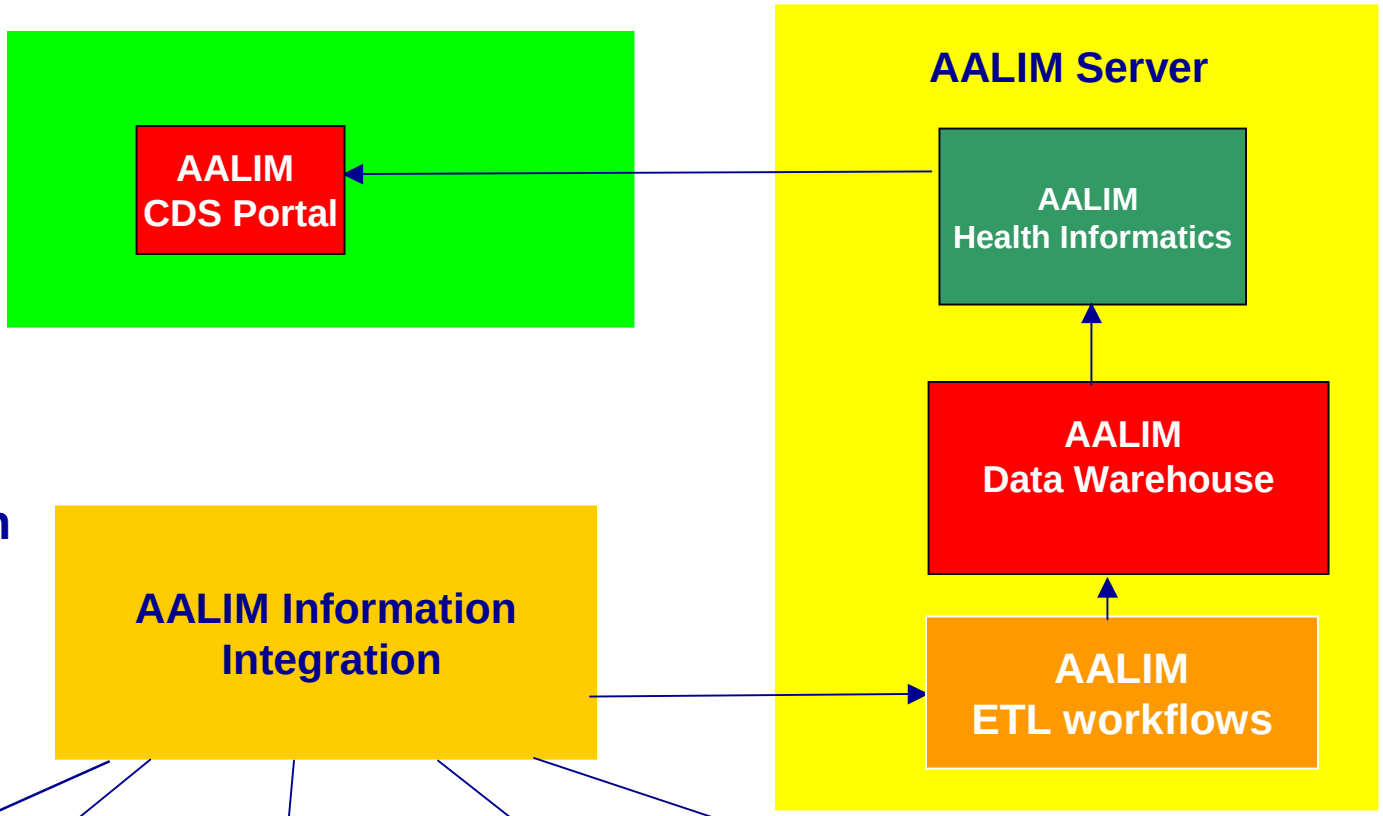
With a Clinical Decision Support System:

1. Physician makes a diagnosis as before.

2. A holistic model of the patient and his data – EKG, echo video, heart sounds, demographics,… is submitted to the CDI for feature extraction.
3. The patient's feature model is used to find pre-diagnosed (confirmed) patients with 'similar' feature models.
4. System supplies statistics relating to diagnoses for these similar patients.
5. Physician validates/re-considers her diagnosis using the patient data, supplied statistics and 'similar' patient data.

AALIM: A System for Diagnostic Decision Support for Cardiac Patients

The Aalim Cardiac Clinical Decision Support Application



Login | Select Patients | Overview | Longitudinal | **Contextual** | Logout

ARN: 03940-000-07-00001

Name: KEITH CHAN

Gender: M

Age: 89

A fictitious patient

Conditions based on: ☑ OSCR ☐ EKG ☐ TEXT ☐ ECHO

Key: applies to patient | does not apply to patient

Common Conditions

[90%]	401.9	Unspecified (Essential hypertension)
[90%]	427.31	Atrial fibrillation (Cardiac dysrhythmias:Atrial fibrillation and flutter)
[80%]	424.0	Mitral valve disorders (Other diseases of endocardium)
[80%]	424.1	Aortic valve disorders (Other diseases of endocardium)
[70%]	394.0	Mitral stenosis (Diseases of mitral valve)
[65%]	428.0	Congestive heart failure, unspecified (Heart failure)
[45%]	443.9	Peripheral vascular disease, unspecified (Other peripheral vascular disease)
[40%]	459.81	Venous (peripheral) insufficiency, unspecified (Other disorders of circulatory system:Other specified disorders of circulatory system)
[40%]	429.9	Heart disease, unspecified (Ill-defined descriptions and complications of heart disease)
[35%]	424.2	Tricuspid valve disorders, specified as nonrheumatic (Other diseases of endocardium)
[35%]	427.9	Cardiac dysrhythmia, unspecified (Cardiac dysrhythmias)
[35%]	424.9	Endocarditis, valve unspecified, unspecified cause (Other diseases of endocardium:Endocarditis, valve unspecified)
[35%]	428.1	Left heart failure (Heart failure)
		Unspecified transient cerebral ischemia

Common Drugs

[95%]	angiotensin converting en: inhibitors
[95%]	cardioselectiv blockers
[90%]	first generatio cephalosporir
[85%]	loop diuretics
[85%]	coumarins an indandiones
[80%]	adrenergic bronchodilato
[80%]	glucocorticoic
[80%]	H2 antagonist
[75%]	macrolides
[75%]	aminopenicilli
[75%]	nasal steroids
[70%]	nonsteroidal anti-inflamma agents
[70%]	quinolones
[65%]	narcotic analg
[65%]	inotropic ager
[65%]	phenothiazine antiemetics
[65%]	Statins
[60%]	topical steroic
	miscellaneou

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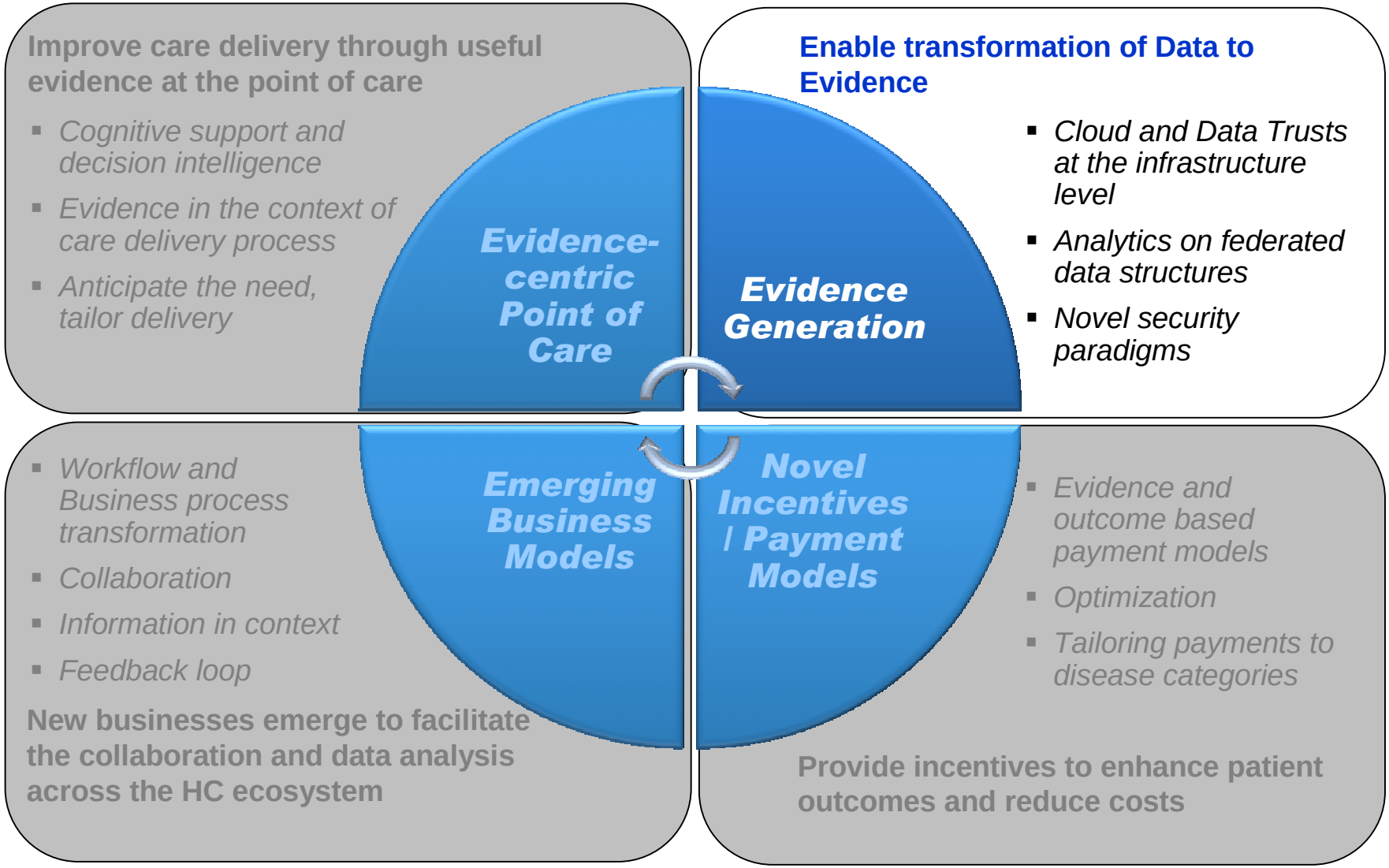
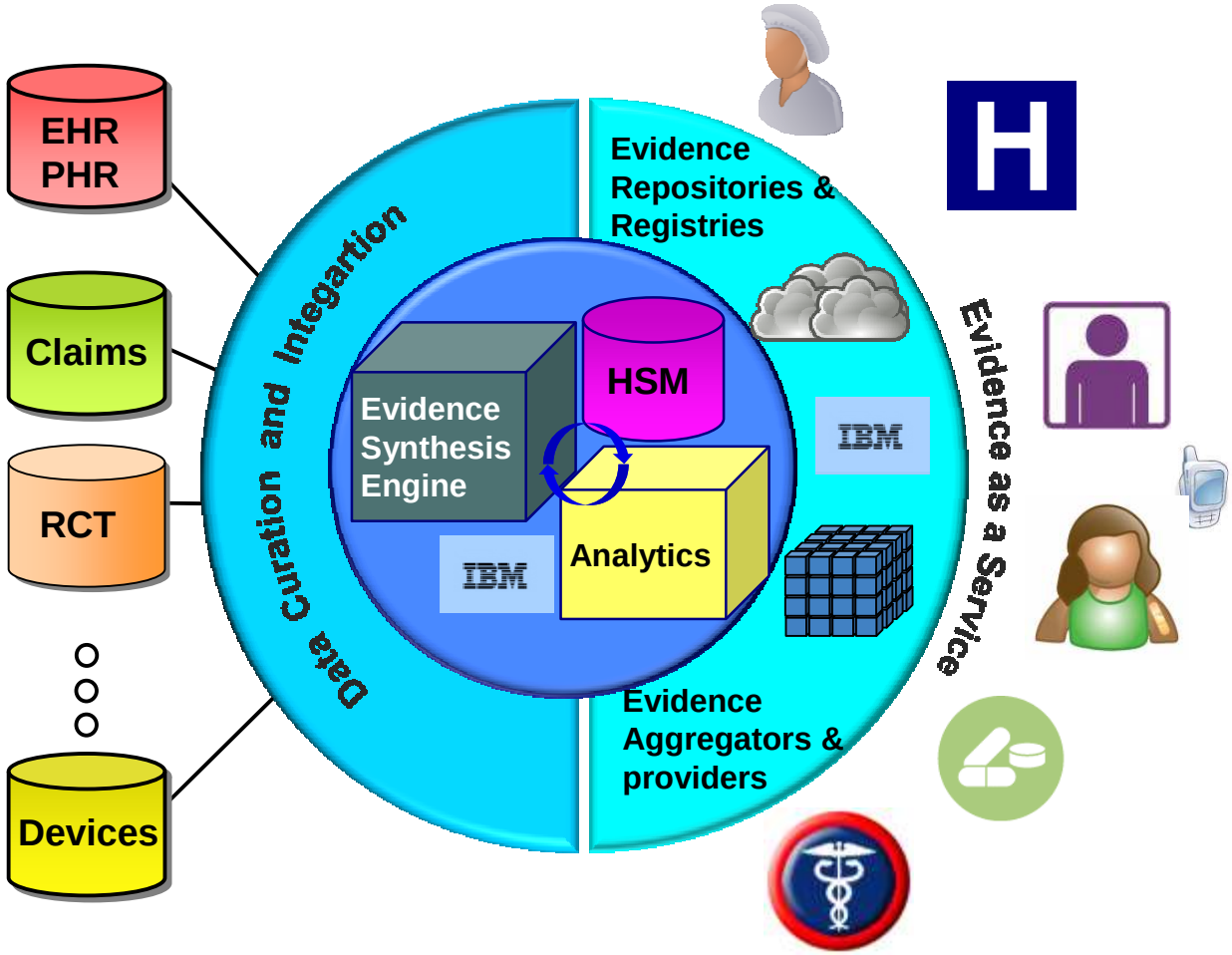


Evidence services platforms (e.g., Cloud) enable data aggregation, evidence extraction, synthesis and dissemination to consumers, providers, payers, pharmas, individuals, regulators…



Trends

- Emergence of large scale consortia for data and evidence sharing
- Emergence of innovative companies for evidence generation & delivery

Not for publication on OMG Web Site

Example - EUResist: HAART Therapy Prediction

(Dr. Michal Rosen-Zvi, IBM Research, Haifa)

Predicts in-vivo efficacy of anti-retroviral drug regimens, i.e., reduction in viral load.

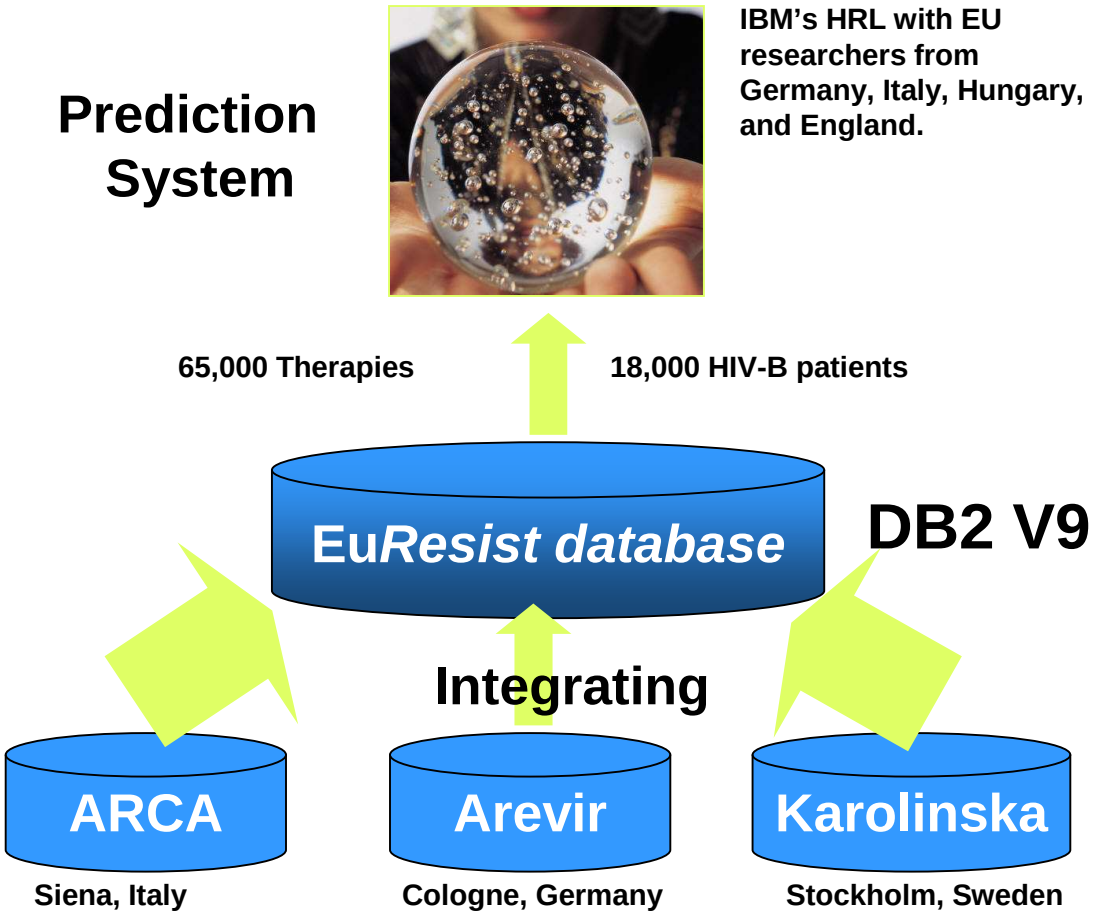
Combines 3 Machine Learning Predictive Technologies

Uses Viral Genome and Patient demographic and clinical data

Outperforms leading available resistance interpretation system

Available on-line at:
http://engine.euresist.org

2009 Computerworld Honors Program Finalist



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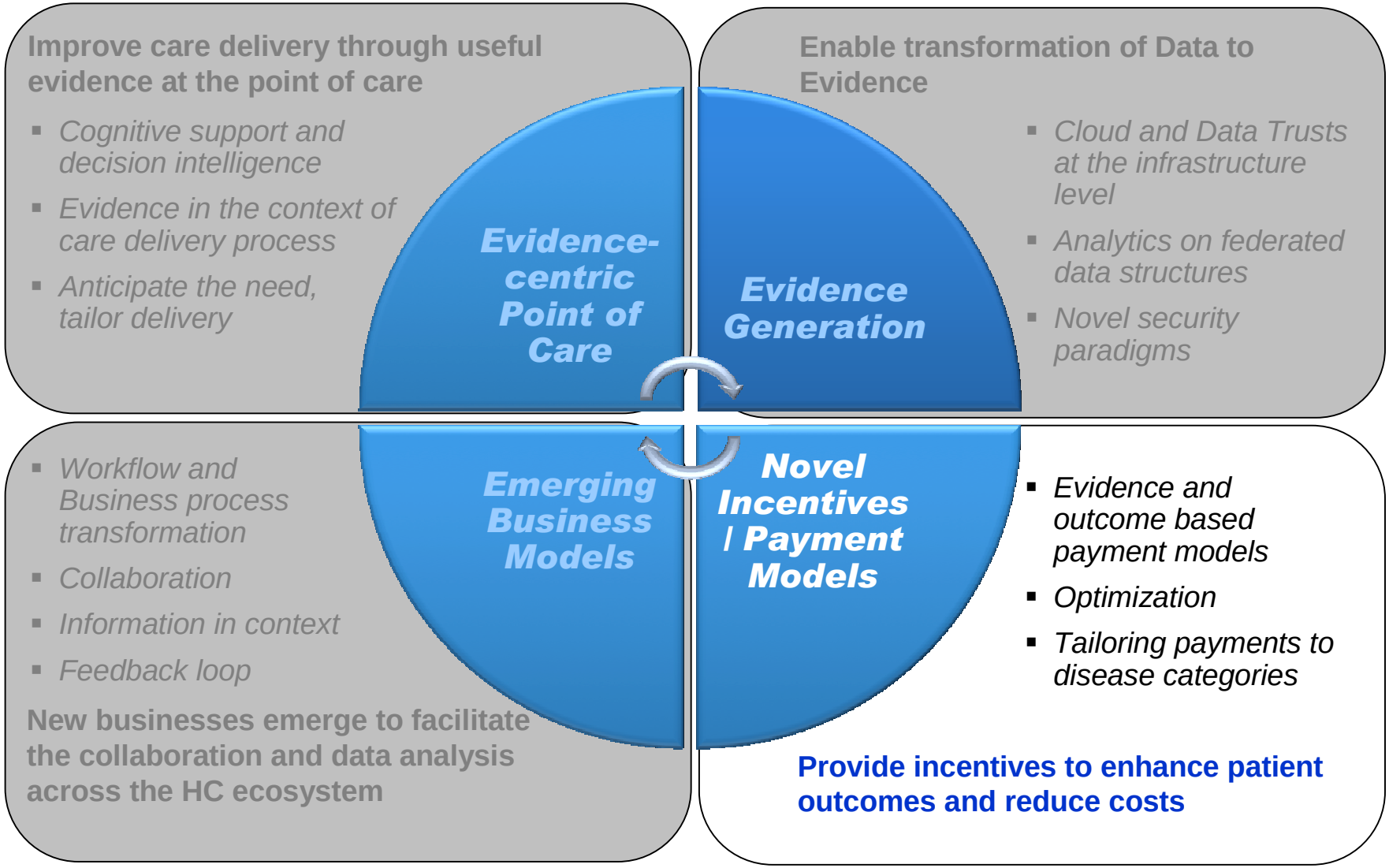
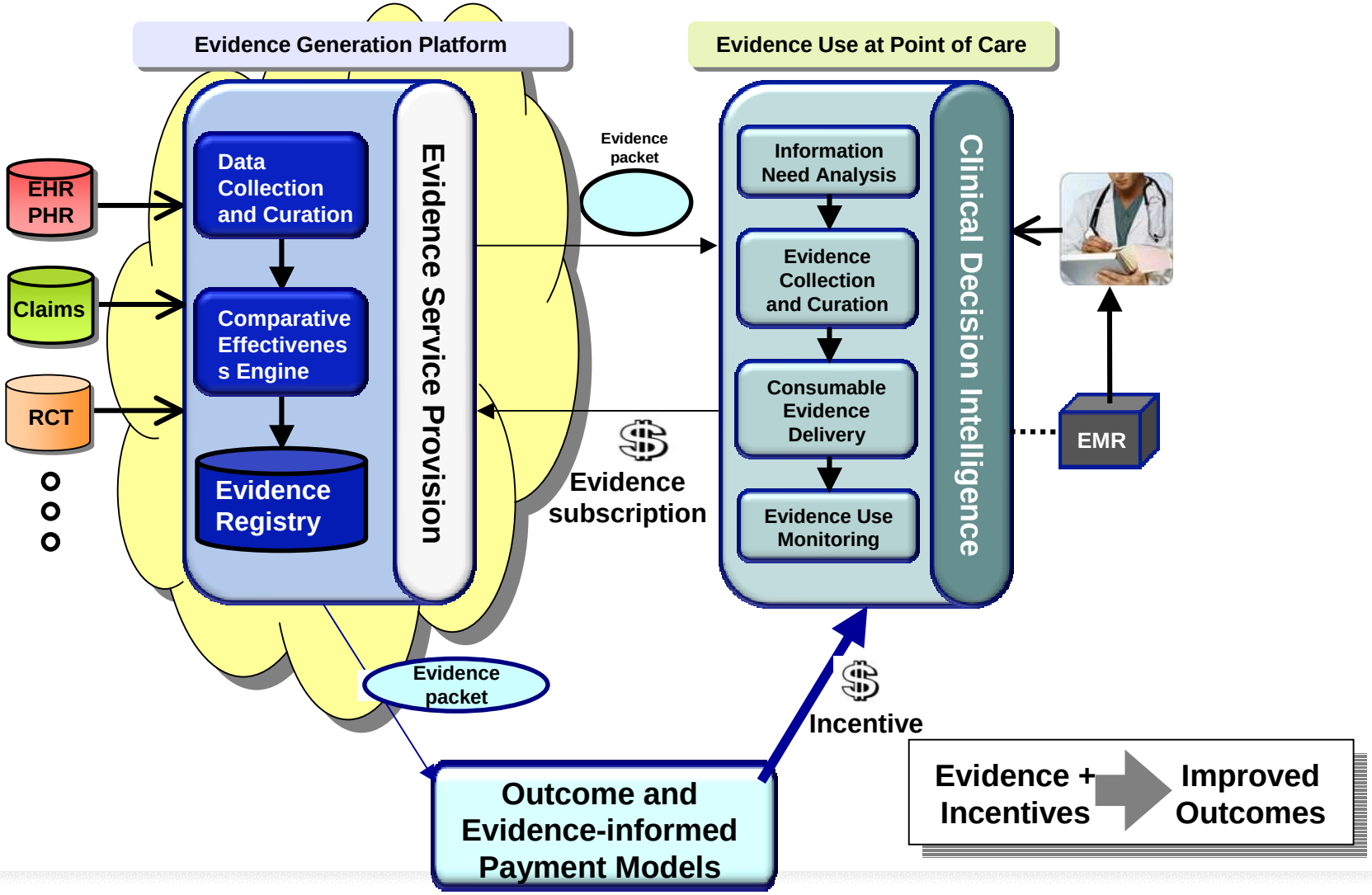
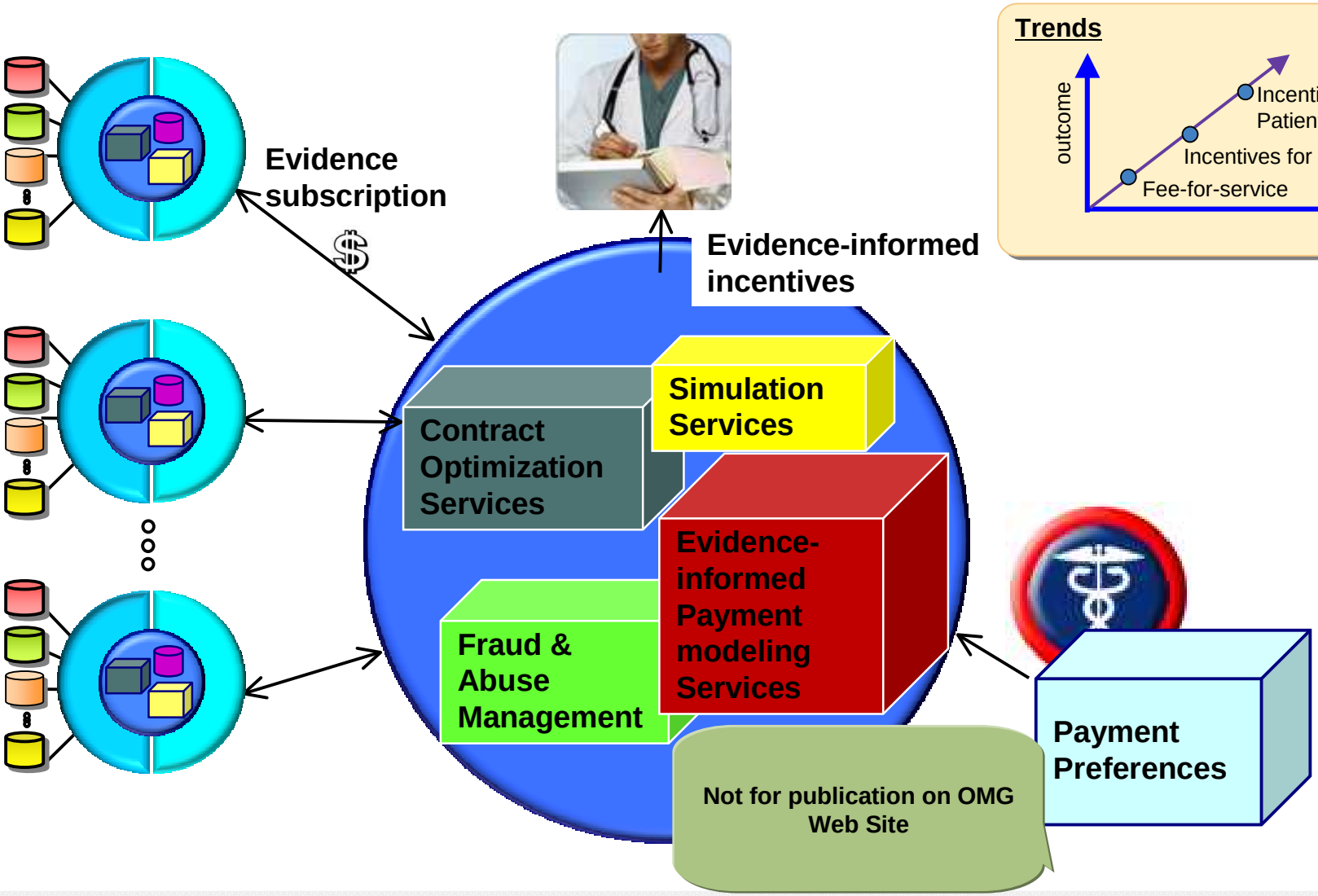


Outcome based payment incentives lead to improved outcomes and demand for evidence at point of care. This requires large scale evidence generation and comparative effectiveness clouds.

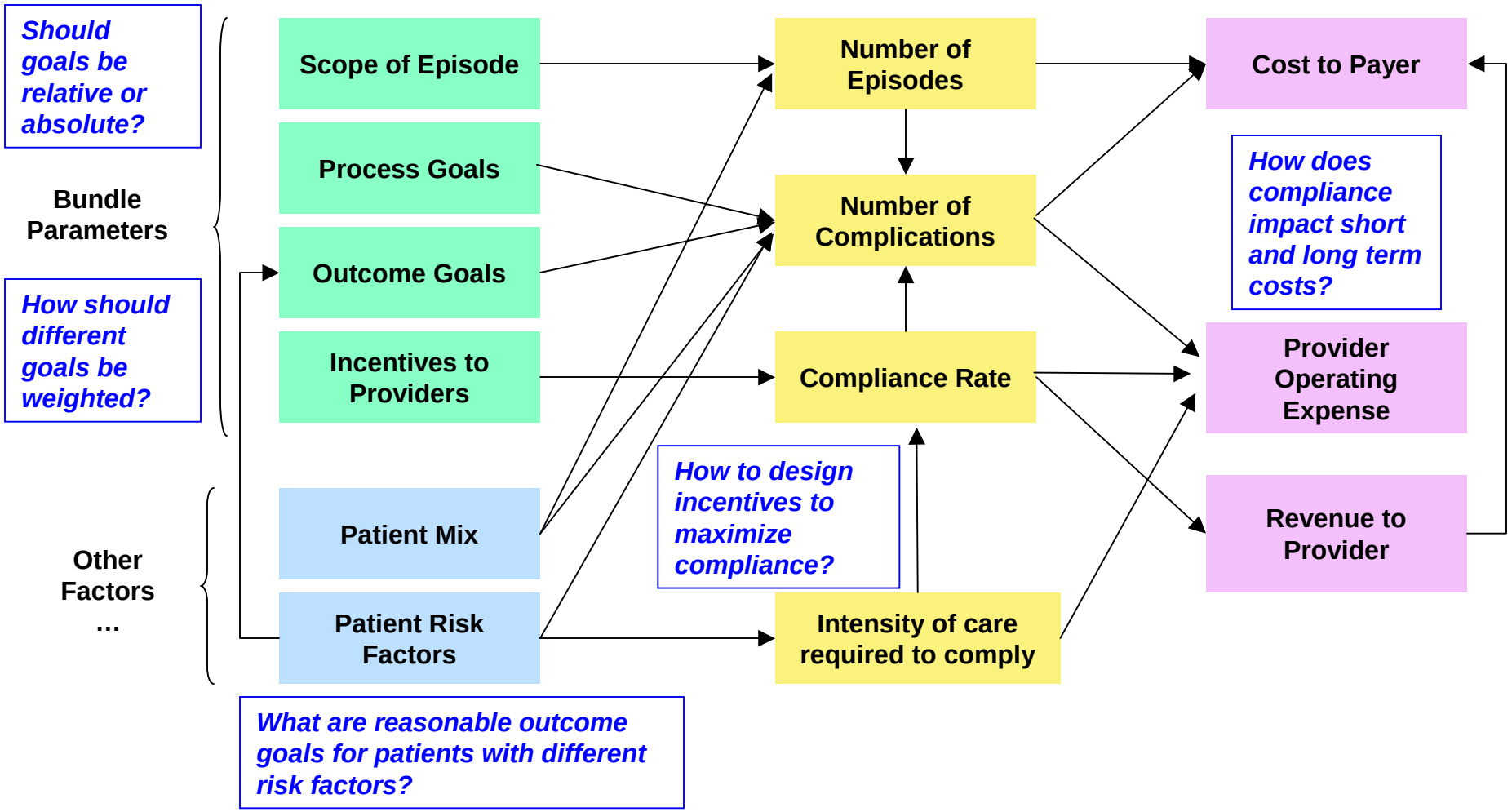


Availability of up-to-date evidence from evidence-aggregators enables the development of evidence-informed, outcome-based payment modeling and contract optimization services



‘What-if’ analytics for chronic disease care optimization

Selection of process and outcome targets and corresponding payments can be optimized to yield cost savings and better quality of care



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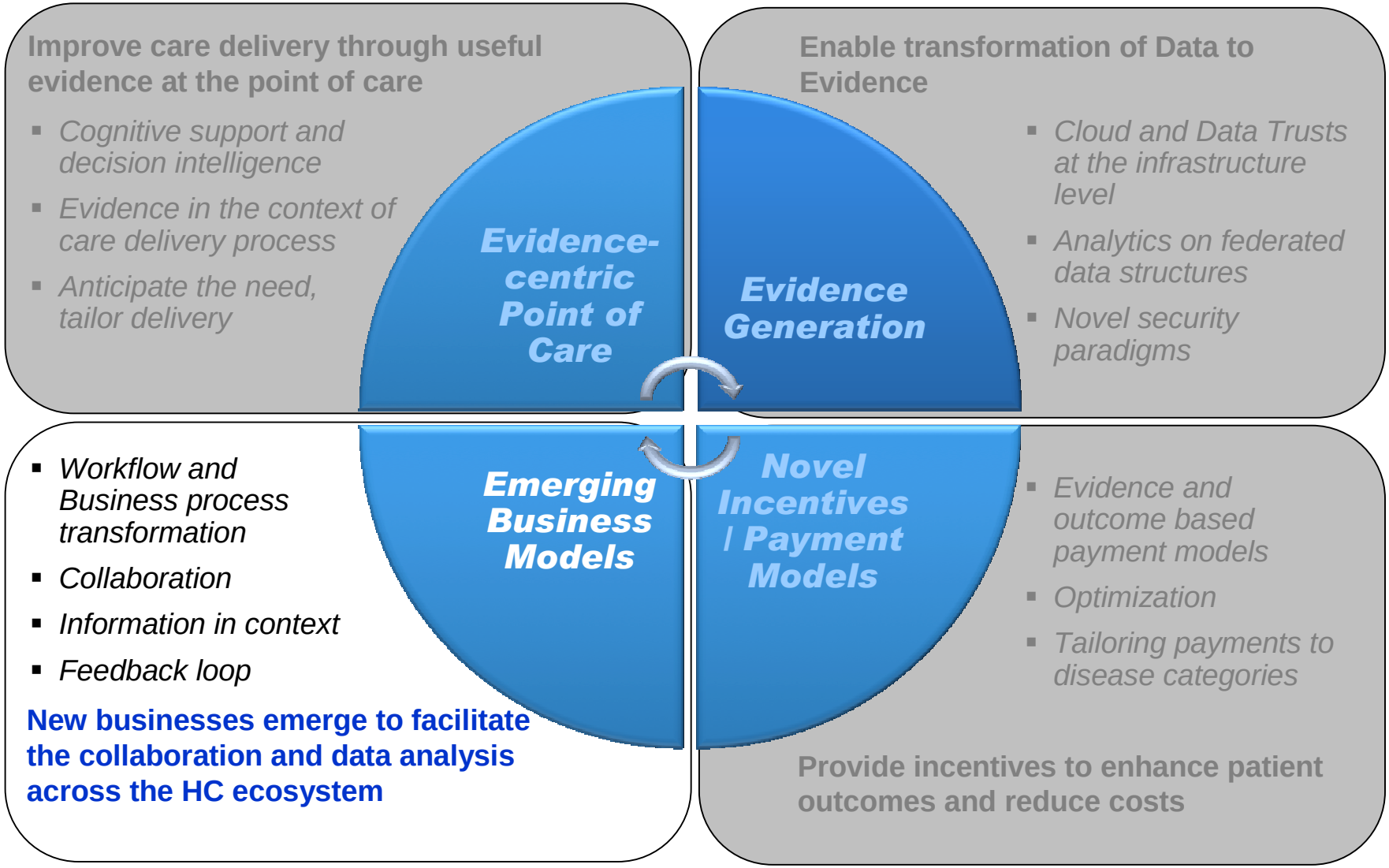
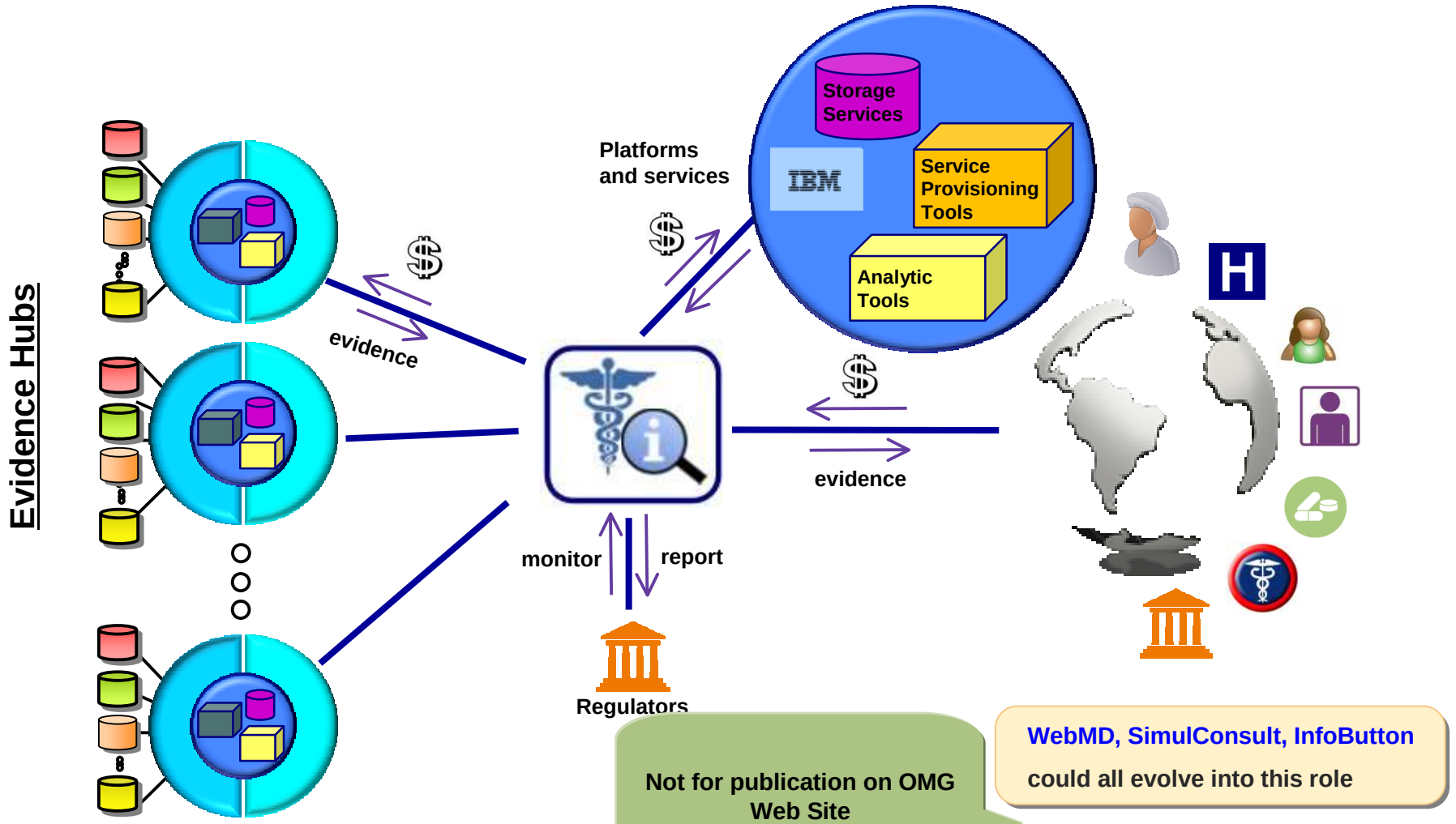
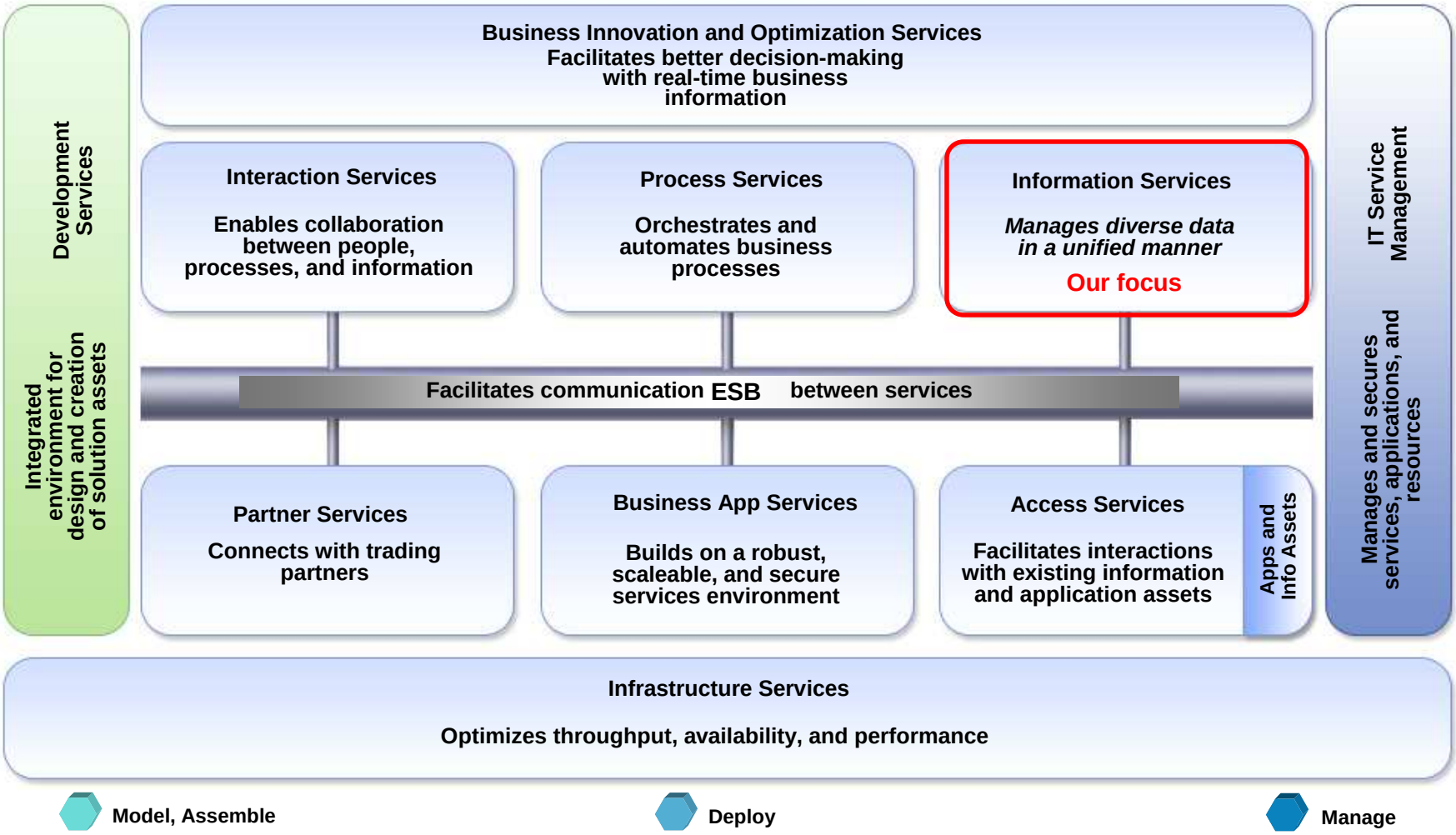


We envision the **emergence of brokerage businesses that aggregate evidence** and provide customized delivery to various constituents (e.g. disease-specific evidence)



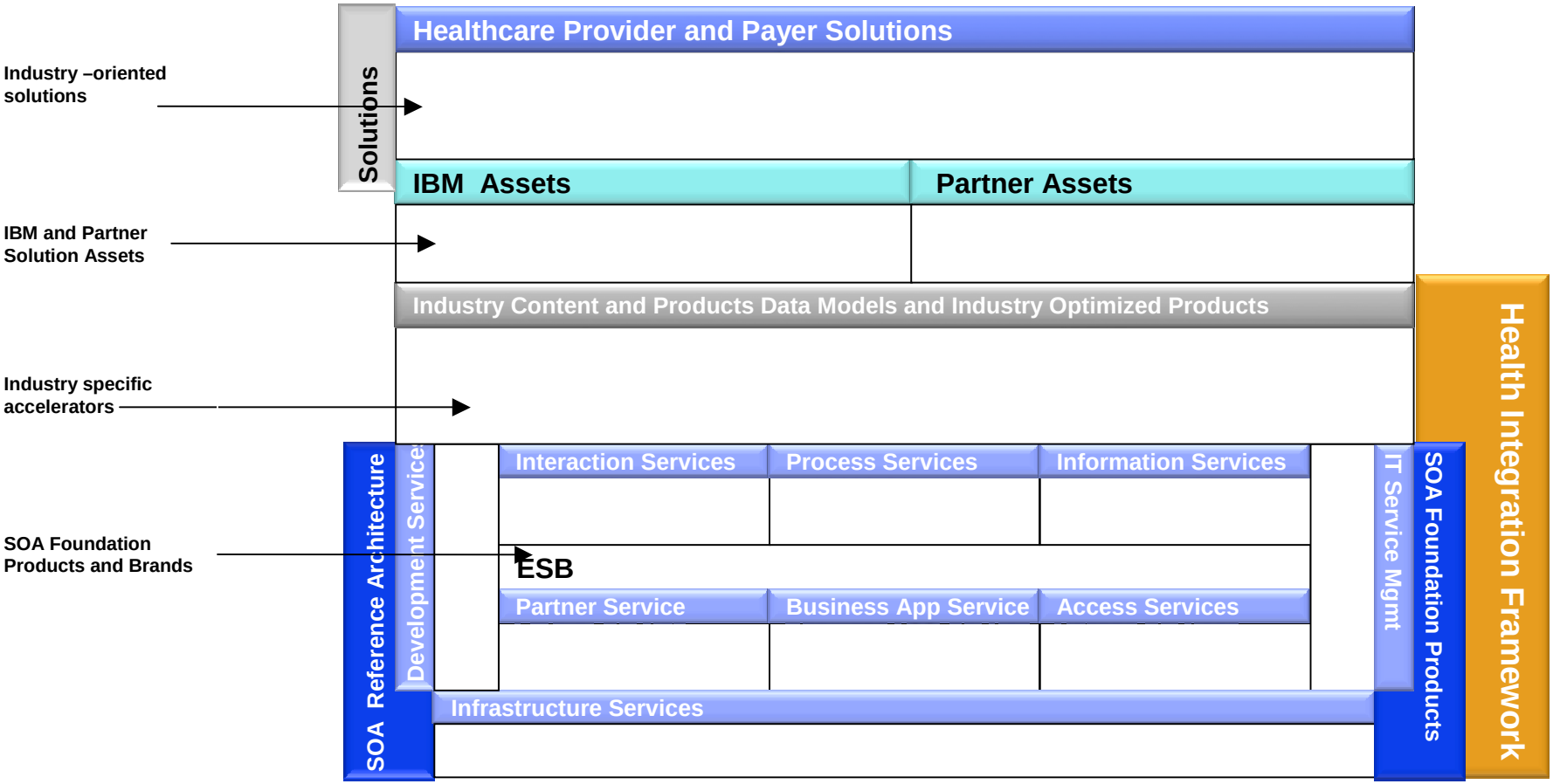
Healthcare Transformation and SOA

SOA Reference Architecture



Health Integration Framework – Model

- The Health Integration Framework (HIF) provides a unifying structure (architecture and mindset) for our solution offerings, go-to-market, partner enablement and asset development strategies.
- This SOA-based approach enables our customers greater flexibility and enhances the effective use of their previously siloed departmental islands of data.



Key SOA Standards from OMG and OASIS Relevant to Healthcare

- Business Modeling : Business Process Model & Notation (OMG BPMN)
  - Design and simulate Healthcare Business Processes is becoming more common
- Application & Service Design : Unified Modeling Language (OMG UML), Service Oriented Architecture Modeling Language (OMG SoaML)
  - Design of Application Architecture using UML is also becoming more common
  - Design of Services using OMG SoaML is emergent
- SOA Infrastructure standards
  - Service Component Architecture (Oasis SCA)
  - Business Process Execution Language (Oasis BPEL)

Master Data Service Platform

Data Sources

- TWINS
- ORCL
- Oracle
- Legacy
- Other

3rd Party Data

- D&B
- ACXIOM

Consuming Applications & Development Environment

Customer Portal

- Sales
- Marketing
- Call Center
- Workflow
- Dev Tools

Initiate® Master Data Service™ Platform

Data Hubs
- Metadata
- Data templates
- Domain-specific algorithms

Relationship Management
- Relationship views
- Hierarchical tree view

Data Quality
- Address Cleansing
- Name Parsing
- TRILLIUM

Master Data Engine
- High-performance execution
- High-volume data processing
- High-accuracy match & link

Integration
- Java or .Net
- Web Services/SOA

Data Stewardship
- Human Resolution
- Enforce Data Governance

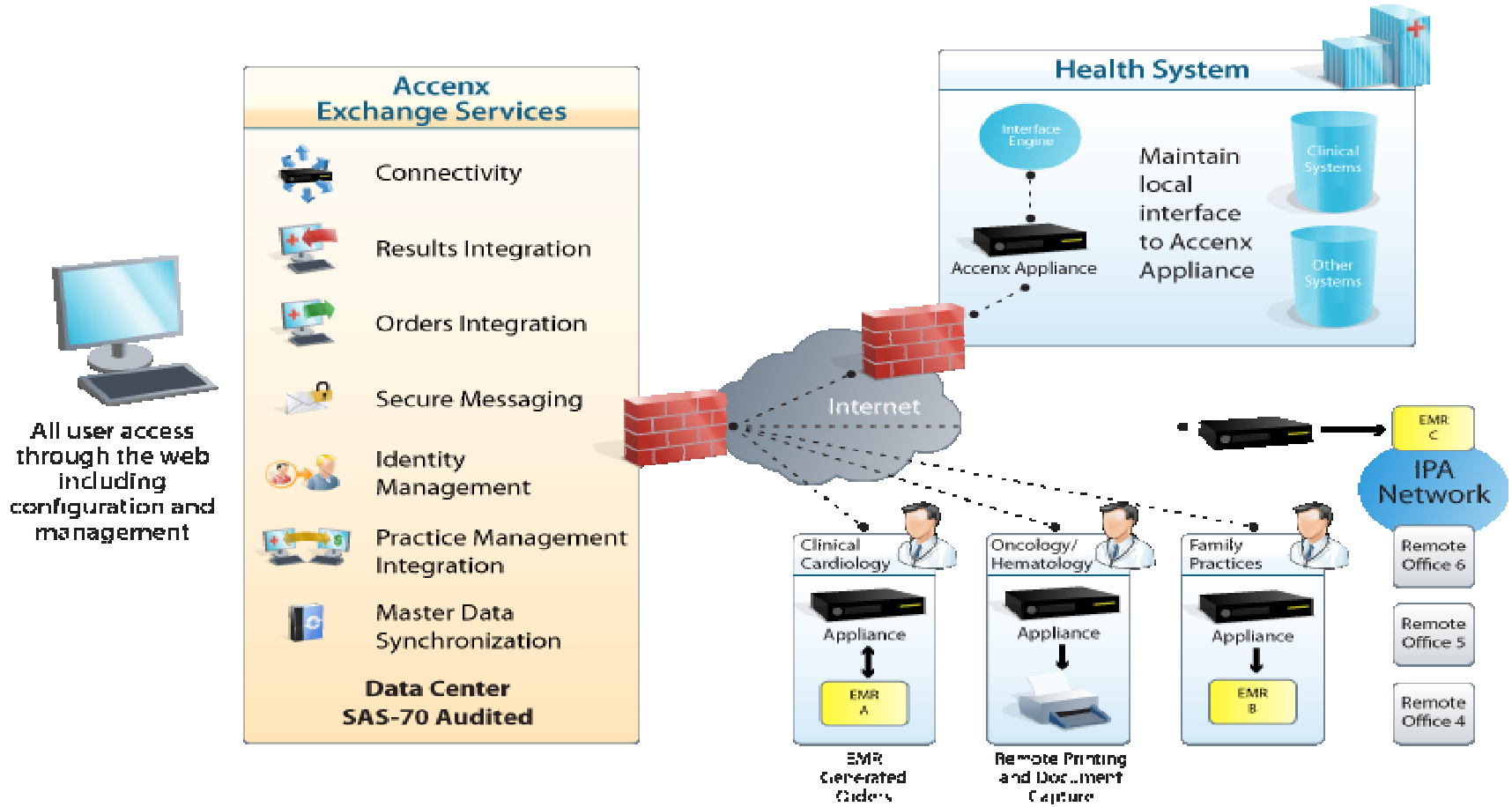
Reporting

Analytics

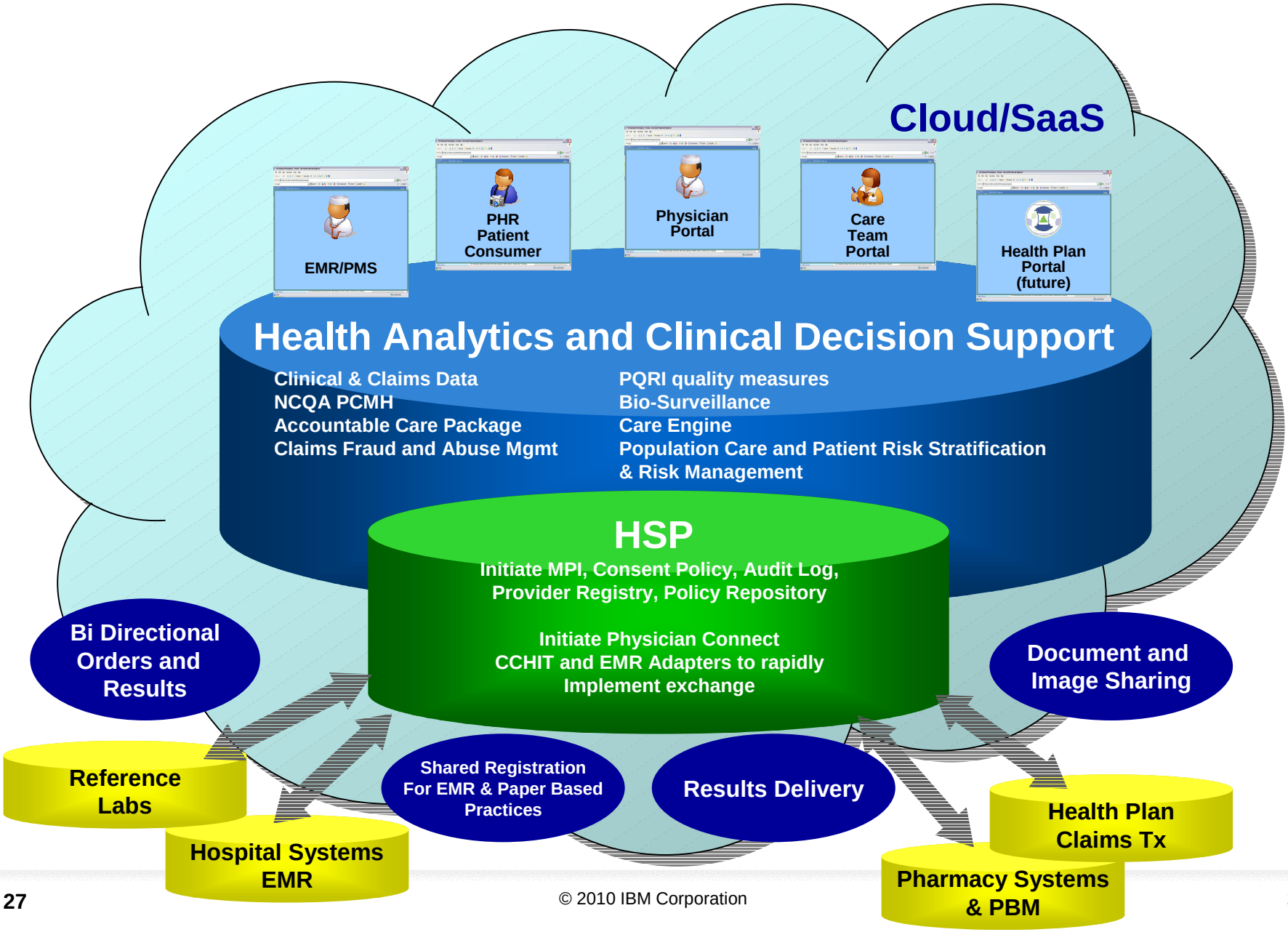
Data Warehouse & Data Marts

ESB, EAI, MOM

Rapid Deployment – Initiate Exchange – SAAS + Appliance



IBM's Collaborative Care Cloud Solution



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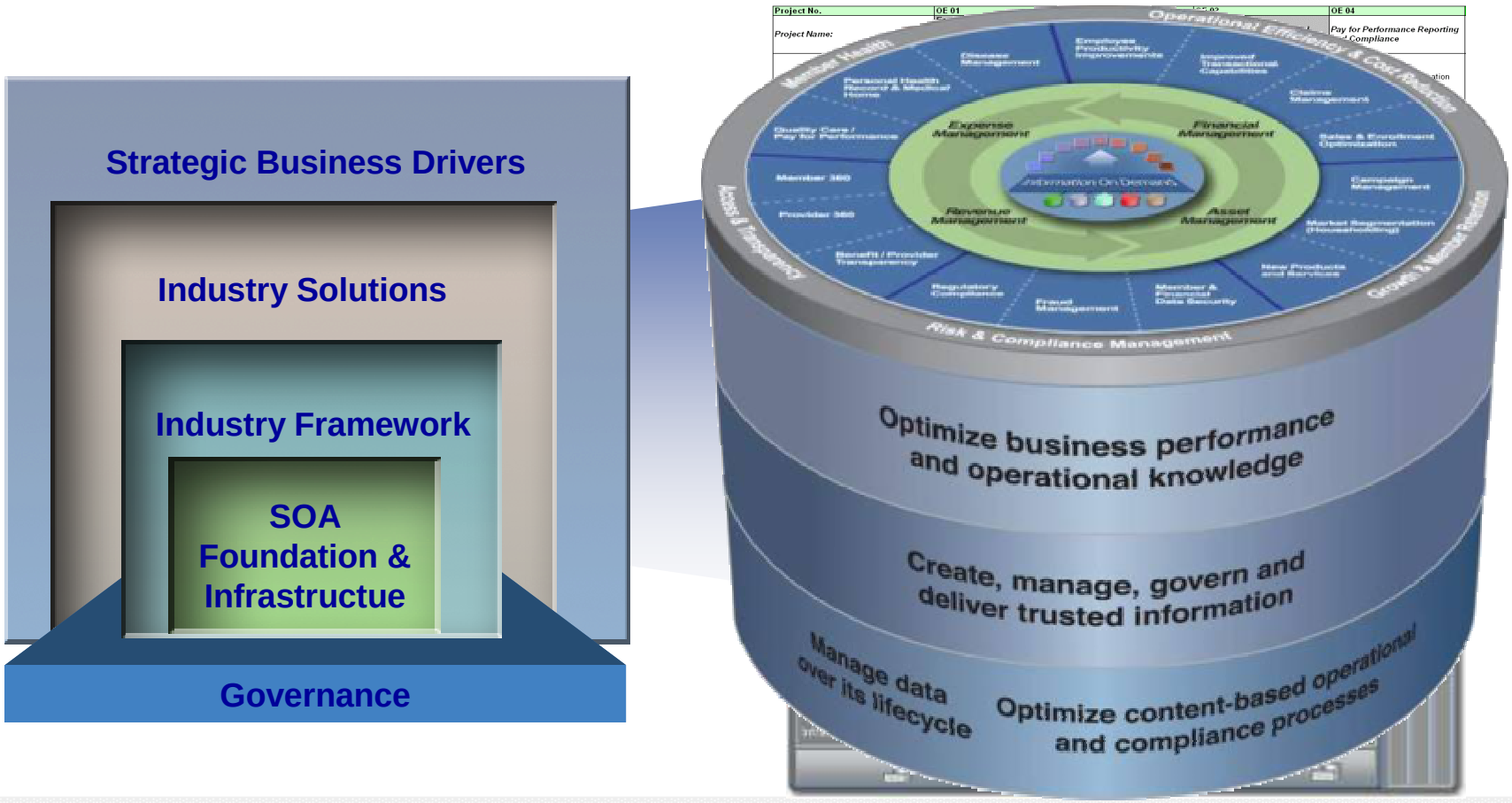
IBM Information Agenda



The transformed Healthcare Ecosystem…

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- Presents growth opportunities for ecosystem participants
- Should deliver better quality healthcare for all