

# **Immunization Calculation Engine (ICE)**

**an Open Source Clinical Decision Support System  
for Integration with Health Information Systems**

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HLN Consulting, LLC**

# OpenCDS

- Software platform and toolkit for developers implementing CDS services
- Open source
- Standards-based
- Web Service interface
- Collaborative project, led by Dr. Kensaku Kawamoto at University of Utah

[www.opencds.org](http://www.opencds.org)



The screenshot shows the OpenCDS website homepage. At the top, the "OpenCDS" logo is displayed in a blue and white font. Below the logo is a navigation menu with links for "Home", "The Solution", "Featured Collaborators", "Acknowledgements", "Join the Community", "News", and "Contact Us". A search bar is located in the top right corner. The main content area features a large blue banner with the text "OPEN CLINICAL DECISION SUPPORT (OPENCDS) TOOLS AND RESOURCES!". Below this, a paragraph describes the project as a consortium effort to improve patient outcomes through standards-based, open source clinical decision support. A prominent "JOIN THE COMMUNITY" button is positioned below the text. To the right of the text is a graphic of several interlocking puzzle pieces, with one piece in the center being yellow and the others red. Below the banner are three columns of content, each with a blue header: "What Is OpenCDS?", "Who Is Involved?", and "How Can I Learn More?". Each column contains a brief description of the project, its founding, and contact information for Dr. Kensaku Kawamoto.

**OpenCDS**

Home The Solution Featured Collaborators Acknowledgements Join the Community News Contact Us

**OPEN CLINICAL DECISION SUPPORT (OPENCDS) TOOLS AND RESOURCES!**

A consortium effort, connecting collaborators together across the healthcare continuum to improve patient outcomes through the effective use of standards-based, open source clinical decision support.

**JOIN THE COMMUNITY >**

**What Is OpenCDS?**

OpenCDS is a multi-institutional, collaborative effort to develop open-source, standards-based clinical decision support (CDS) tools and resources that can be widely adopted to enable CDS at scale.

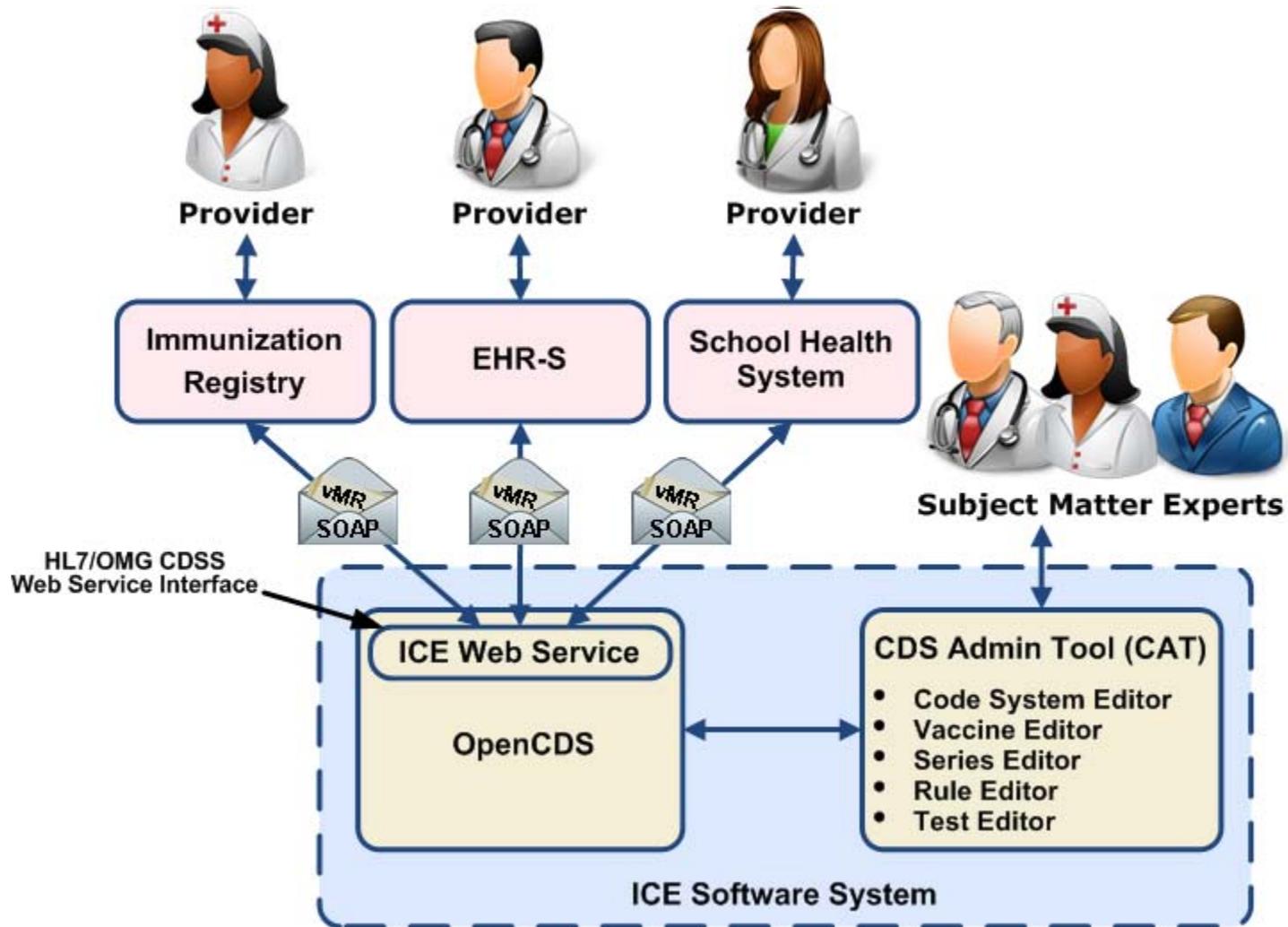
**Who Is Involved?**

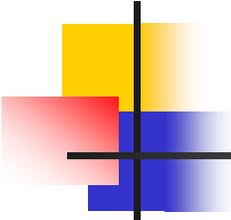
OpenCDS was founded by Dr. Kensaku Kawamoto, MD, PhD, who is a faculty member at the University of Utah Department of Biomedical Informatics and a co-chair of the HL7 CDS Work Group. Please see the [Featured Collaborators](#) page for more information on the members of the OpenCDS community.

**How Can I Learn More?**

Please contact Dr. Kensaku Kawamoto, MD, PhD [ [Contact Us](#) ]

# Sample ICE Deployment

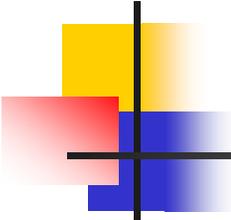




## ICE Collaborators

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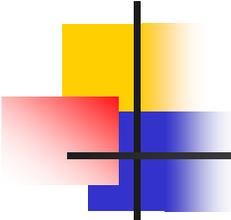
- New York City Citywide Immunization Registry
- HLN Consulting, LLC
- Alabama Department of Public Health
- OpenCDS Team
- Veterans Health Administration
- Pfizer

The logo consists of a vertical black line and a horizontal black line intersecting at the origin. To the top-left of the intersection is a yellow square. To the bottom-left is a red square. To the bottom-right is a blue square. The text "ICE Roadmap" is positioned to the right of the intersection, with "ICE" in a larger font size than "Roadmap".

# ICE Roadmap

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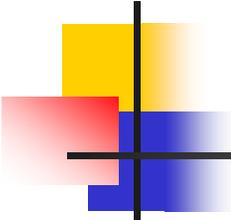
- Evaluate Pneumococcal Conjugate and Polysaccharide vaccines as a single vaccine group
- Updates to Polio Schedule
- Updates to Flu schedule
- Support for Meningococcal B (new!)
- Support for HALO factors (health, age, lifestyle, occupation)
- Support Past Due Date



# Deployments of ICE

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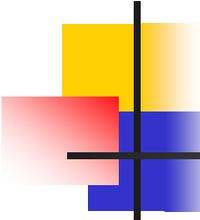
- National EHR – eClinicalWorks (December 2013)
- National PHR – CareDox (November 2014)
- Denver Public Health (July 2016)
- Veteran's Administration (on VA Test server since July 2016)
- New York City IIS (Scheduled for Summer 2017)
- New Jersey IIS (In the process of scheduling...)



## Learn More About ICE Through...

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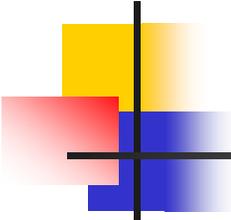
- ICE Wiki ([cdfsframework.org](http://cdfsframework.org))
- HLN's ICE Webpage ([www.hln.com/ice](http://www.hln.com/ice))
- Executable software distribution
- Source code
- HLN-hosted test instance
- Software Demonstrations



# Immunization Calculation Engine

An immunization decision support system that:

<b>Objective</b>	<b>Achievement</b>
Supports routinely administered vaccine groups	<ul style="list-style-type: none"><li>• Supports 14 vaccine groups from birth through adulthood</li></ul>
Promotes clinical best practices	<ul style="list-style-type: none"><li>• Follows ACIP recommendations</li><li>• Informed by CDC's CDSi project</li></ul>
Adapts to changing requirements	<ul style="list-style-type: none"><li>• Rule editing GUI tool for non-technical SMEs</li><li>• Automated testing tool w/ 2,400 test cases</li></ul>
Easily integrates with IIS and other health systems	<ul style="list-style-type: none"><li>• Standards-based, web service interface</li><li>• Variety of deployment options</li></ul>
Freely available	<ul style="list-style-type: none"><li>• Standard open-source license</li><li>• Downloadable from public website</li></ul>



# Contact Us for More Information

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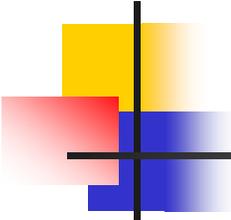
**Mike Suralik**

856-751-1094

suralik@hln.com

**URL: [www.hln.com/ice](http://www.hln.com/ice)**

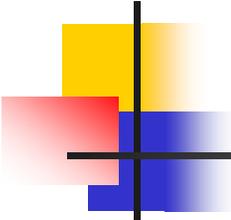
**Email: [ice@hln.com](mailto:ice@hln.com)**



# Software Architecture

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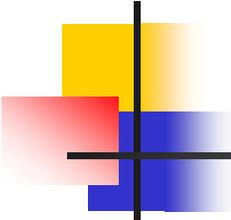
- ICE/OpenCDS
  - Servlet Container (Java EE 6 or 7 compliant)
  - JBoss Drools (rule engine/database)
  - HL7 Decision Support Service "DSS" (web service interface)
  - HL7 Virtual Medical Record "vMR" (data model)
- CAT
  - Application Server (Java EE 6 compliant)
  - JavaServer Faces (GUI)
  - Enterprise JavaBeans (business logic)
  - JDBC compliant database



# Inputs to ICE

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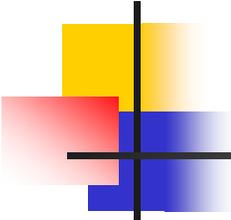
- Patient parameters
  - Date of birth
  - Gender
  - Immunization history (vaccine and admin date)
  - Disease immunity
- Situational parameters
  - Immunization schedule identifier
  - Date of evaluation



## Outputs from ICE

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- Evaluation of each dose
  - Evaluation = Valid, Invalid, or Accepted
  - Invalid Reason(s), for each Invalid dose
- Recommendation for each vaccine group
  - Recommendation = Recommended, Future recommended, Conditional, or Not recommended
  - Earliest recommended due date
  - Reason



## Easy to Adopt and Integrate With

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- Open source (GNU LGPL v3)
- Java-based system runs on a wide variety of sever platforms
- Can be deployed in a variety of ways
- Standards-based Web Service interface
- Public wiki – binary releases, source code, implementation guide, immunization rules