VA HEALTH CARE | Defining EXCELLENCE in the 21st Century

VA VISTA Data Access
Interoperability Design Review
May 3-4, 2017

Continuity of VA Care during EHR Modernization

VISTA Data Project

Two-year Proof of Concept

A joint interagency project with the
U.S. Department of Defense, Defense Health Agency

- VA-DoD Interagency Project
- EHR modernization Proof of Concept
- Leverages DoD-developed technology
- Formalizes Veterans Care Model
- Execution 2016-2017
- http://vistadataproject.info

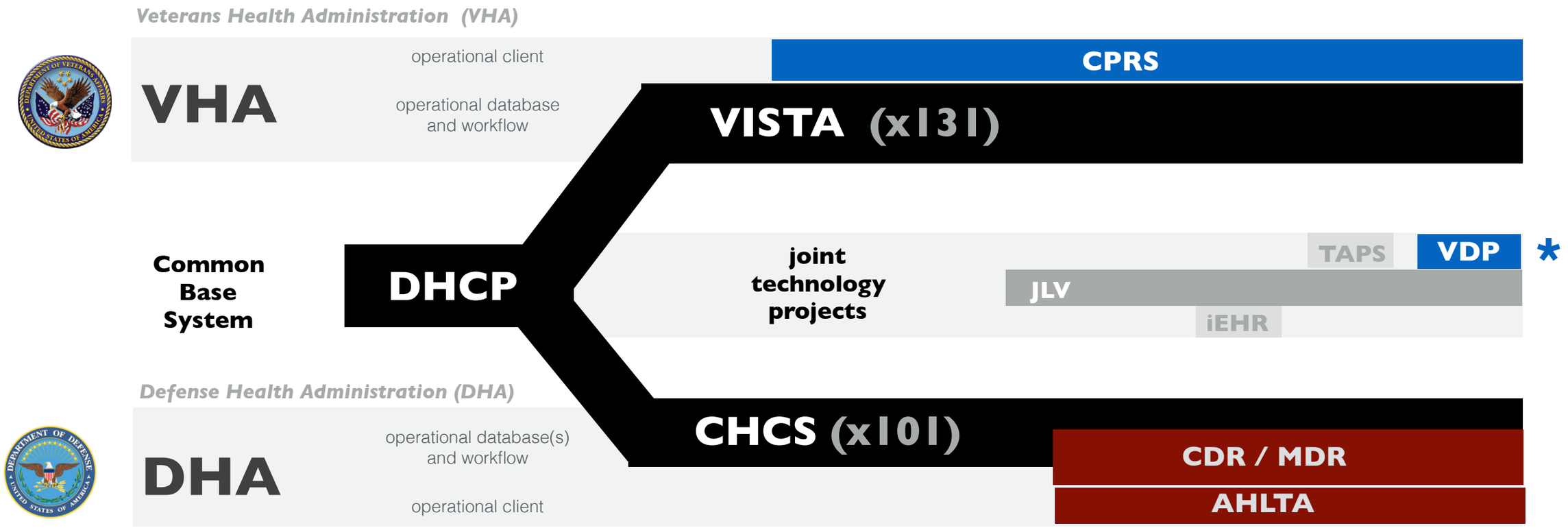
History of VHA-DHA Electronic Health Records

DHCP is the common base system

VHA: 151 hospitals; 820 clinics; 300 vet centers; + other (total 1700 care sites)
DHA: 57 hospitals; 350 clinics + other

VHA: 131 VISTA systems operational (since 1981)
DHA: 101 CHCS systems operational (since 1985)
Total: 232 DHCP-based systems across VHA-DHA

DHCP-based systems
Common technology projects
VHA-specific interface and workflow
DHA-specific interface and workflow



While DHCP was similar in VHA and DHA originally, it has diverged over time. Today the variety and volume of CHCS data is approximately one-third the scope of VISTA data. One reason for the difference is that DHA migrated a large portion of CHCS operational data and functions to CDR / AHLTA.

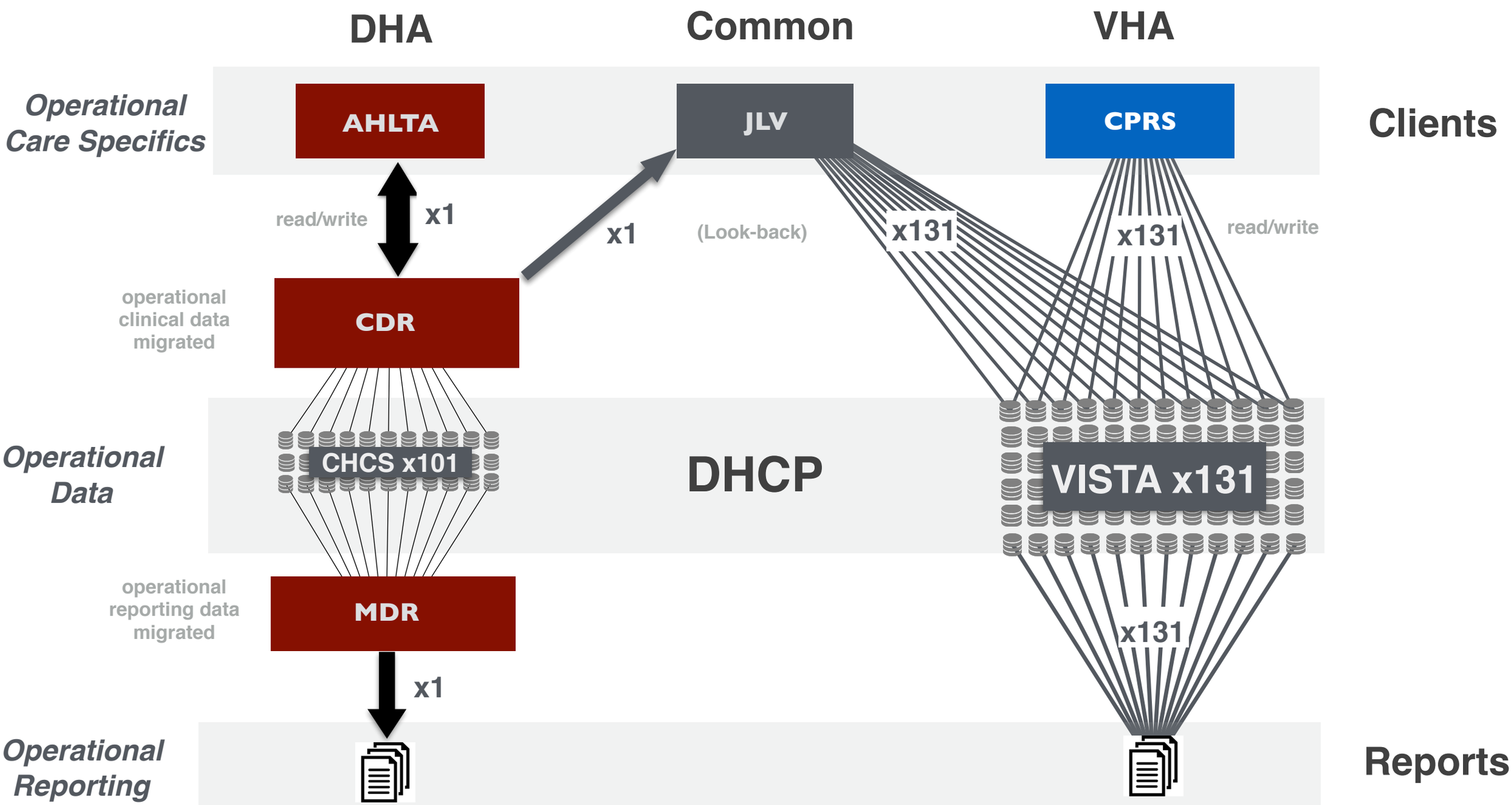
Note: Time scale simplified for clarity

	1980	1990	2000	2010	present
VHA-specific		**VISTA**	CPRS		
Common	**DHCP**		JLV	iEHR TAPS	VDP
DHA-specific		**CHCS**	AHLTA / CDR		Genesis

1981 - DHCP - Decentralized Hospital Care Program - VA Fileman database and applications [VHA]
1985 - CHCS - (DHCP renamed) Composite Health Care System; modified for DHA use [Leidos (SAIC)]
1994 - VISTA - (DHCP renamed) Veterans Information Systems Technology Architecture [VHA]
1997 - CPRS - Computerized Patient Record System - graphical interface and workflow [VHA]
2004 - AHLTA/ CDR/ MDR - Armed Forces Health Longitudinal Technology Application [Northrup Grumman]

2003 - JLV - (originally Janus; renamed to JLV in 2011) [DHA-VHA]
2011 - iEHR - Integrated Electronic Health Record [SMS]
2013 - TAPS - Transition Application Plan Support [DHA-VHA]
* **2016 - VDP - VISTA Data Project [DHA-VHA]**

DHCP (CHCS/VISTA) servers today



DHA migrated much of its operational data from CHCS to MDR / CDR .

Today the variety and volume of CHCS data is approximately one-third the scope of VISTA data.
One reason is that DHA migrated a large portion of CHCS operational data and functionality to CDR / MDR.

VHA has not decided on its long-term strategy for operational data.

CPRS: Blueprint for Veteran Longitudinal Care

CPRS is VISTA to Physicians, and Embodies Veteran Care specifics

Veteran-specific

Built specifically around veteran care policies and practice

Department of Veterans Affairs — **Memorandum**

Date: OCT 17 2012

From: Deputy Under Secretary for Health for Operations and Management (10N)

Subj: National Patient Record Flag for High Risk for Suicide

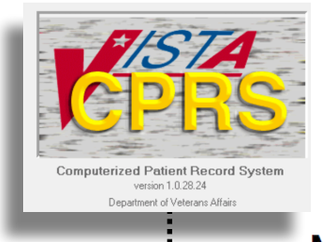
To: Network Director (10N1-23)
Chief Medical Officer (10N1-23)
Network Mental Health Liaisons

1. The purpose of this memo is to provide guidance for the implementation of a new Category I Patient Record Flag (PRF) for High Risk for Suicide.

Agent Orange

Agent Orange (AO) is an herbicide that was used in Vietnam between 1962 and 1971 to remove unwanted plant life that provided cover for enemy forces. The VA has recognized the following conditions as associated with but not necessarily caused by exposure to Agent Orange:

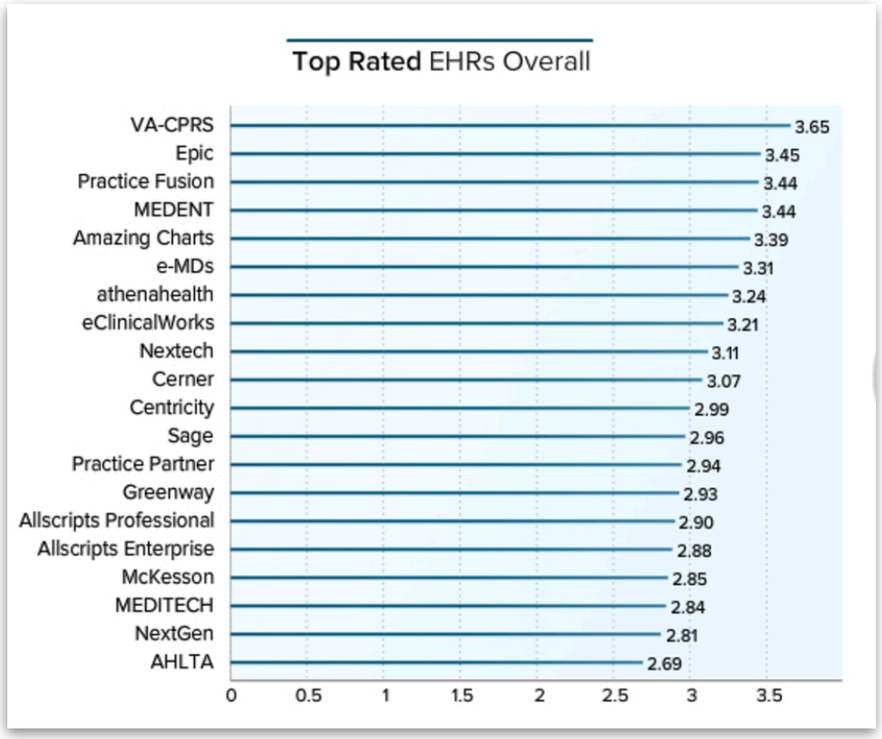
- AL Amylodosis
- Diabetes (type 2)



Physicians favorite

Medscape EHR Report 2016: Physicians Rate Top EHRs

Carol Peckham, Author; Leslie Kane, Sr. Director, Medscape Business of Medicine; Susanna Rosensteel, Editor | *August 25, 2016*



http://www.medscape.com/features/slideshow/public/ehr2016

Opportunity:
Supporting CPRS (for a period) ensures Continuity of Care as VA's EHR is modernized.

Proof of Concept

A modernized VA EHR server can support CPRS

VISTA Data Project
https://vistadataproject.info

VISTA Data Project

Prove Stepwise Server Migration while maintaining Continuity of Care

Key Features

- VHA-DHA Interagency project
- Modernization Proof of Concept
- Leverages DHA-developed technology
- Formalizes Veterans Care Model
- Migrate Server; Support CPRS/JLV
- Execution 2016-2017

131 Current VISTAs

CPRS / JLV ….

RPC Interfaces (x 1000s) or *Insecure Asymmetric Opaque Legacy MUMPS Code-driven Interfaces*

Current Server

RPC Interfaces (includes VPR)

VISTA Applications

VA Fileman Database

"Magic" MUMPS-driven VISTA Server
(maintenance, growth, and usability issues)

Stepwise, Measurable Migration

Time

- Pass Thru
- Pass Thru / Emul
- Pass Thru / Emulate
- Pass / Emulate
- Emulate/REST

VISTA Data Project

CPRS / JLV (current continue)

web/mobile (new enabled)

or

Secure Symmetric Modern Node.js Model-driven Interface

RPC Emulator | VPR Emulator | REST

Clinical Domain Services

Master VISTA Data Model

VISTA Data Model

VA Fileman Database

Node

"node VISTA"

Structured VISTA Server
(mainstream, modular, extensible)

M Legacy VISTA (MUMPS)

Master VISTA Data Model (MVDM) Node.js - Driven VISTA

VISTA Data Project

Strategic Benefits

- *New, maintainable veteran care **server** based on mainstream technology*
- *New web and mobile clients enabled with mainstream technology*
- *Current clients (CPRS/JLV) supported and enforce VA Care coverage*
- *May now safely incrementally retire legacy MUMPS VISTA [spaghetti]*
- *(Some) Clinical Domain Services may be implemented over COTS*

nodeVISTA Stack

Clean, Modular, Separation of Functionality

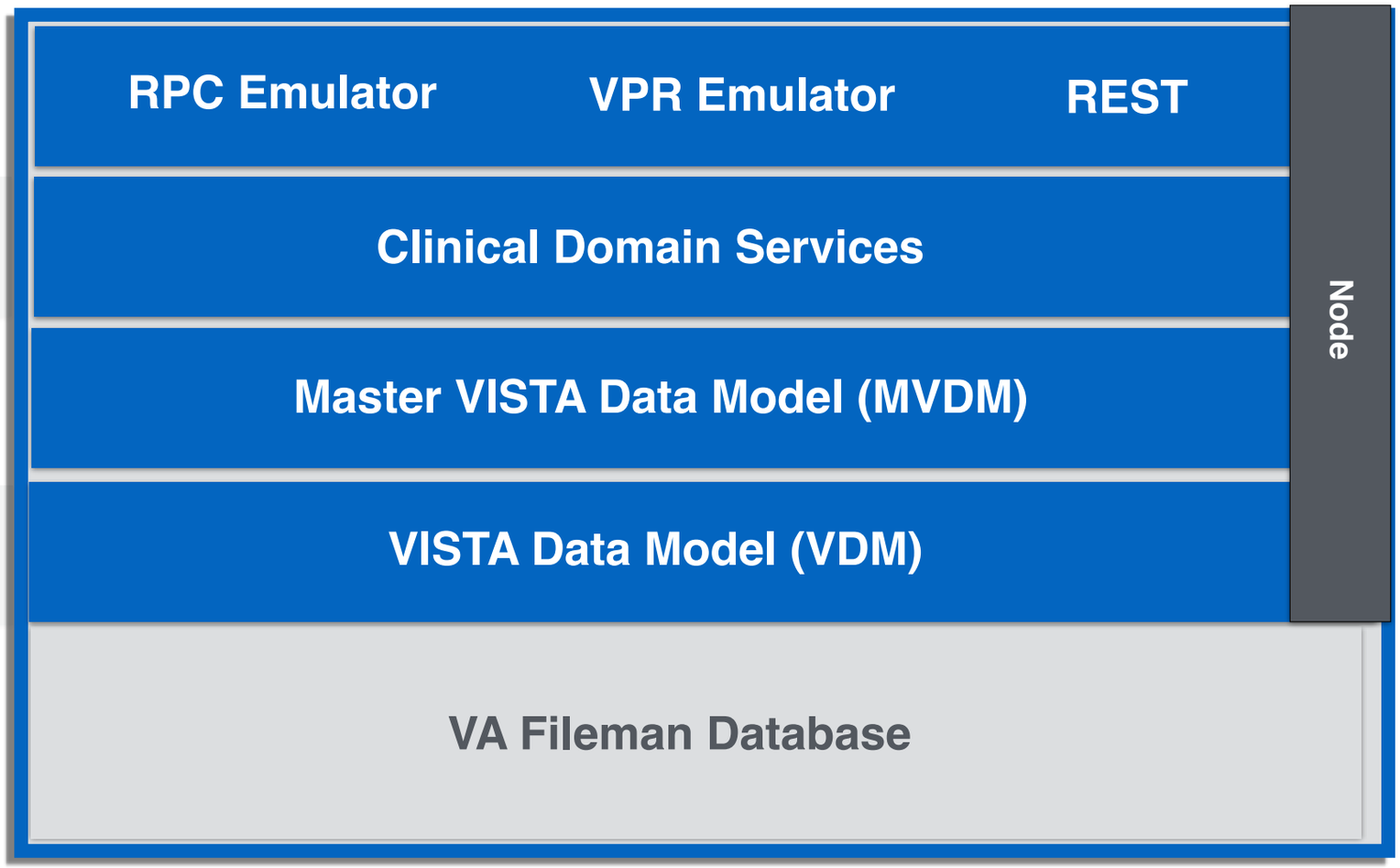
- Emulation and New Interfaces
- All reduce to same service interactions

- (Problem, Pharmacy …) Services over MVDM
- Patient level selection and security

- Normalizes VDM
- Distinguishes Veteran and Patient/Clinical specifics
- A Clean “CRUD+R”/Events paradigm

- Transparent JSON of the native model
- Read for 100% data in FileMan
- Write Tested for MVDM covered classes

- All interaction through formal FileMan API
- Only FileMan changes fix Data Dictionary (DD)

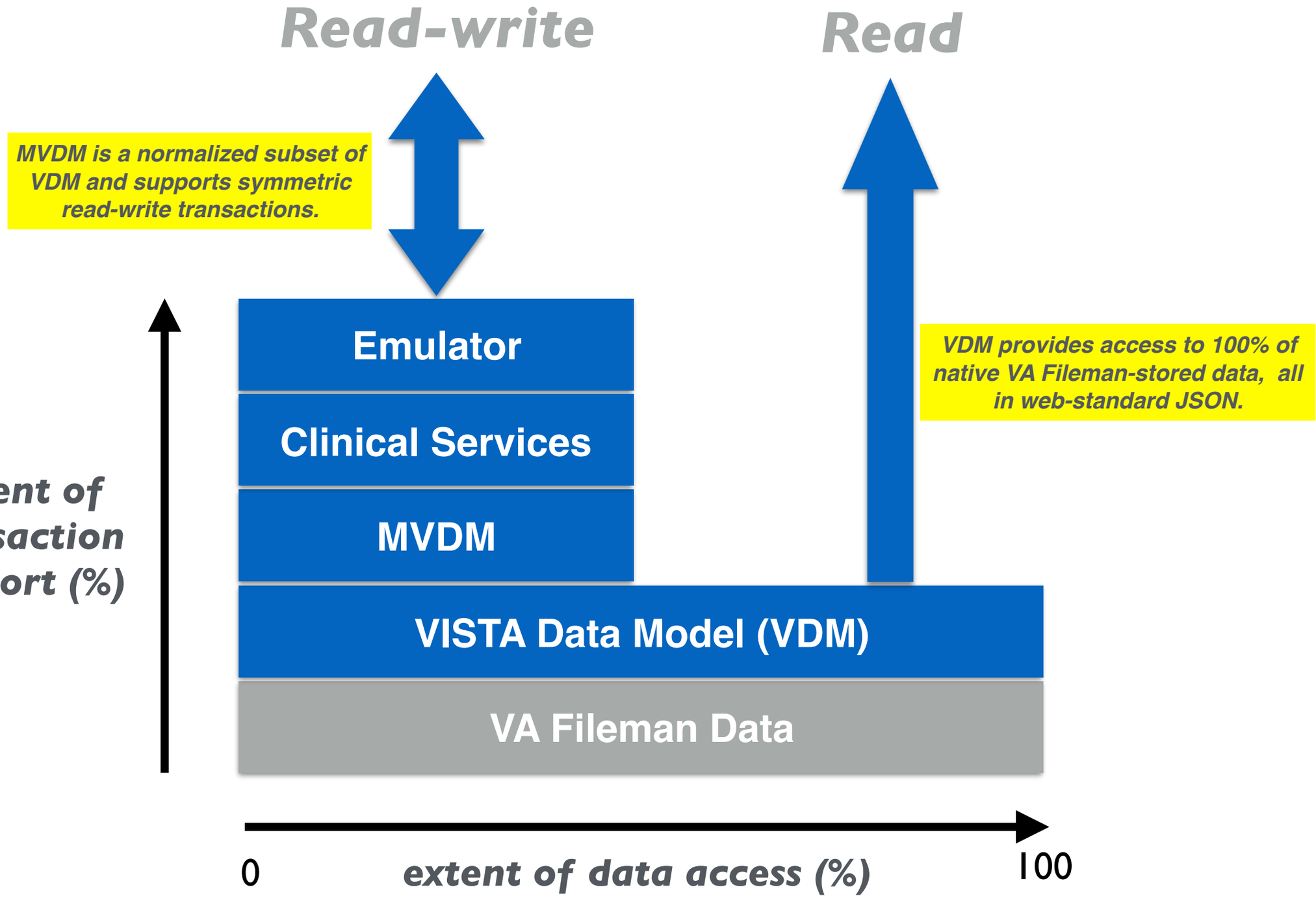


Structured VISTA Server
(mainstream, modular, extensible)

Javascript/Node.js

nodeVISTA Data Access

Starting point is read access to 100% of FileMan-stored data (including labs) and then extends to transactional data



Backward-compatible Emulation in Steps

All client interactions are captured in regression test suite ["no magic"]

CPRS / JLV Regression Tests

Legacy clients unaffected as emulation increases

All client interactions in regression test suite

Pass Thru | Emulate

Pass | Emulate

Pass thru
but fully audited

RPC Interfaces (includes VPR)

All traffic - emulated or not - is fully audited

Emulation
based on formal analysis

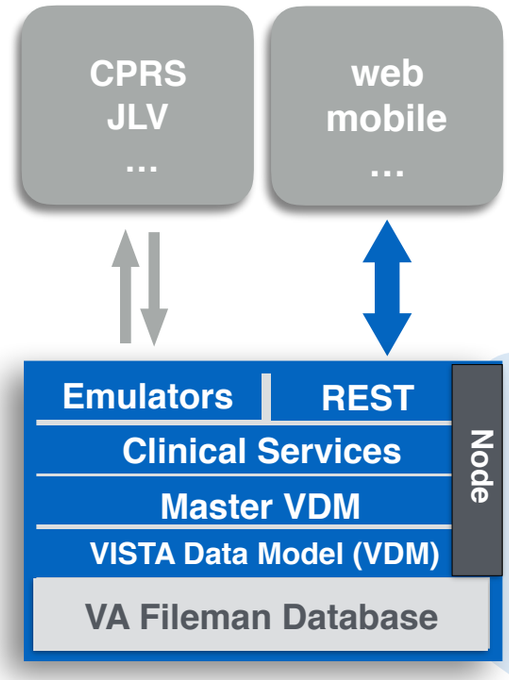
- Clinical (416) vs Non Clinical (561)
- Veteran vs Generic
- Complexity: High, Medium, Low
- Files/Parameters/Outside FileMan
- OP Pharmacy takes 1/3 of Orders

RPC Emulator	VPR Emulator
• *Pharmacy (OP)* • *Patient* • *Visits* • *Documents* • *Problem* • *Allergy* • *Vitals* • *PCE* • *PRF*	• *Virtual Patient Record (all)*

"Write Back" Emulation in scope in Year 2 (2017)

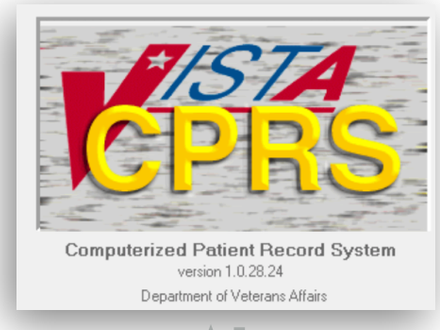
nodeVISTA Implementation

New Server. Clients both old and new.

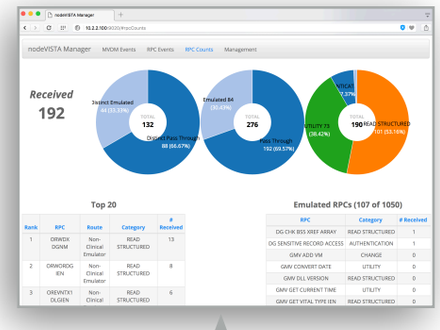


nodeVISTA

CPRS client

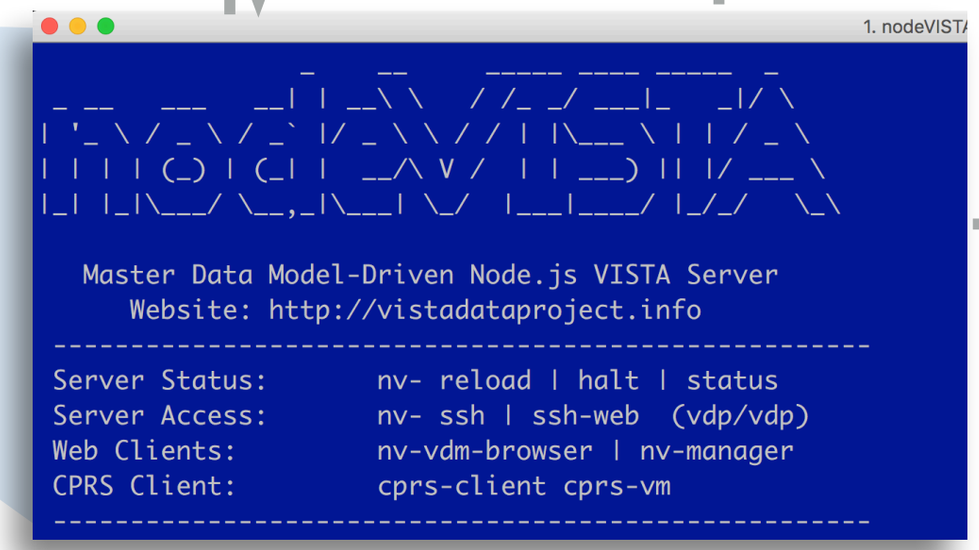


Audit client

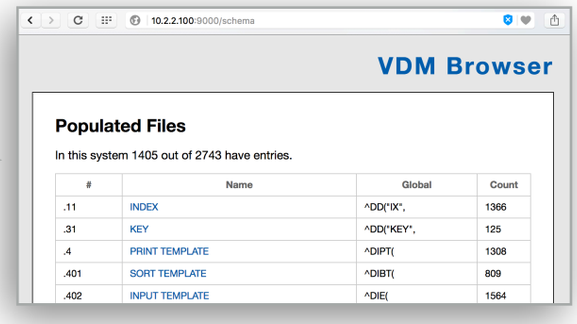


Emulator

Event listener



VDM Browser



VDM Browser

Demonstrates that VDM Exposes ALL FileMan-stored data (including labs)

VDM Browser

Populated Files

In this system 1414 out of 2743 have entries.

#	Name	Global	Count
.11	INDEX	^DD("IX",	1366
.31	KEY	^DD("KEY",	125
.4	PRINT TEMPLATE	^DIPT(	1308
.401	SORT TEMPLATE	^DIBT(	809
.402	INPUT TEMPLATE	^DIE(	1564
.403	FORM	^DIST(.403,	153
.404	BLOCK	^DIST(.404,	543
.44	FOREIGN FORMAT	^DIST(.44,	11
.5	FUNCTION	^DD("FUNC",	173
.7	MUMPS OPERATING SYSTEM	^DD("OS"	7

RPC Traffic Audited

Chatty CPRS and how RPCs are handled

Total: 133 Total No Polling: 117 Pass Through: 52 RPC Emulated: 80 Server: 1 **RPC Emulate:**

Date	RPC Name	Route	Transaction Id
Apr 11th 2017 @ 12:24:47 am	ORWGRPC TYPES	Pass Through	914613bd-6821-44e3-bd06-66b90f...
Apr 11th 2017 @ 12:24:47 am	**ORWGRPC GETPREF**	**Non-Clinical Emulator**	**d0bd5a0c-cb72-4c15-ba34-b4c4a7...**
Apr 11th 2017 @ 12:24:47 am	ORWU HASKEY	Pass Through	7d22e544-bcbb-401f-a80c-887b92d...
Apr 11th 2017 @ 12:24:47 am	ORWU HASKEY	Pass Through	ca32f9a1-0916-484a-900c-83c79ce...
Apr 11th 2017 @ 12:24:47 am	**ORWGRPC GETPREF**	**Non-Clinical Emulator**	**31466e43-105a-4fb5-b20f-fb77c02...**
Apr 11th 2017 @ 12:24:47 am	**ORWU DT**	**JS Utility Emulator**	**7d9ccbaa-ab5c-4626-b23e-9f44ec...**
Apr 11th 2017 @ 12:24:47 am	**ORWSR SHOW SURG TAB**	**Non-Clinical Emulator**	**191aadff-d058-49f3-af0a-56ec6fa...**
Apr 11th 2017 @ 12:24:46 am	**ORWCH LOADALL**	**Non-Clinical Emulator**	**fff2b2b4-4800-47ef-9fb8-f781ad61...**
Apr 11th 2017 @ 12:24:46 am	**ORWORDG IEN**	**Non-Clinical Emulator**	**9df6eac7-e908-4302-bc35-7b523b...**
Apr 11th 2017 @ 12:24:46 am	**ORWORDG IEN**	**Non-Clinical Emulator**	**43af5118-c545-4706-84e6-fcc9b41...**
Apr 11th 2017 @ 12:24:46 am	**ORWORDG IEN**	**Non-Clinical Emulator**	**a51e9e8d-3ca6-4fca-af8b-afb0453...**
Apr 11th 2017 @ 12:24:46 am	**ORWORDG IEN**	**Non-Clinical Emulator**	**bd860e4d-3a56-4241-ab37-caa24c...**

RPC Details Tracked

All RPCs traced by user, facility, emulation type, and transaction ID

RPC: ORWDAL32 SAVE ALLERGY

Date: Apr 7th 2017 @ 10:59:00 am **RPC:** ORWDAL32 SAVE ALLERGY **Route:** Clinical Emulator

Transaction ID: 441476be-82e5-49b2-a979-40ad6e1974b5

IP Address: ::ffff:10.2.2.1

User: ALEXANDER,ROBERT (200-62) **Facility:** SOFTWARE SERVICE (4-1 / 050)

Request


```
{
    "args": ["0", "25", {
        "GMRAGNT": "CHOCOLATE^3;GMRD(120.82,",
        "GMRATYPE": "DF^Drug,Food",
        "GMRANATR": "A^Allergy",
        "GMRAORIG": "62",
        "GMRAORDT": "3170407.2058",
        "GMRASYMP": ["66^DROWSINESS^^^"],
        "GMRACHT": ["3170407.2059"],
        "GMRAOBHX": "h^HISTORICAL",
        "GMRACMTS": ["make him sleepy"]
    }]
}
```


Cryptic RPC data payload
(Sends raw MUMPS code to the Client!)

Response

```
0
```

RPC Detail - Problems

This is a dangerous RPC

RPC: ORQQPL ADD SAVE

Date: Apr 11th 2017 @ 3:51:29 pm **RPC:** ORQQPL ADD SAVE **Route:** Clinical Emulator

Transaction ID: b037aa4c-0334-4255-98dd-faa68b164d30

IP Address: ::ffff:10.2.2.1

User: ALEXANDER,ROBERT (200-62) **Facility:** VISTA HEALTH CARE (4-2957 / 6100)

Request


```
{
    "args": ["25^CARTER,DAVID^0113^", "62", "2957", {
        "1": "GMPFLD(.01)=\"521774^R69.\"",
        "2": "GMPFLD(.03)=\"3170412^Apr 12 2017\"",
        "3": "GMPFLD(.05)=\"^Hypertension\"",
        "4": "GMPFLD(.08)=\"3170412^Apr 12 2017\"",
        "5": "GMPFLD(.12)=\"A^ACTIVE\"",
        "6": "GMPFLD(.13)=\"^\"",
        "7": "GMPFLD(1.01)=\"7647488^Hypertension\"",
        "8": "GMPFLD(1.02)=\"P\"",
        "9": "GMPFLD(1.03)=\"62^ALEXANDER,ROBERT\"",
        "10": "GMPFLD(1.04)=\"62^ALEXANDER,ROBERT\"",
        "11": "GMPFLD(1.05)=\"62^Alexander,Robert\"",
        "12": "GMPFLD(1.06)=\"^\"",
        "13": "GMPFLD(1.07)=\"^\"",
        "14": "GMPFLD(1.08)=\"10^Clinicd\"",
        "15": "GMPFLD(1.09)=\"3170412^Apr 12 2017\"",
        "16": "GMPFLD(1.1)=\"^Unknown\"",
        "17": "GMPFLD(1.11)=\"0^NO\"",
        "18": "GMPFLD(1.12)=\"0^No\"",
        "19": "GMPFLD(1.13)=\"0^NO\"",
        "20": "GMPFLD(1.14)=\"A^ACUTE\"",
```


MUMPS RPC data is:

- **Insecure -** Sending raw MUMPS code across the wire permits **code execution (i.e. code injection).**
- **Inconsistent, Opaque** - A different, ad-hoc, undefined format and form for each RPC (x1000's).
- **Unmanageable** (and risky!) for new clients to consume

Response

MVDM from Emulated RPC

RPC emulation leads to MVDM activity: **Patient-aware** *and* **Easy to Understand**

same transaction ID as RPC, but..

Date: Apr 7th 2017 @ 10:59:00 am **Domain:** Allergy **Type:** CREATE

Transaction ID: 441476be-82e5-49b2-a979-40ad6e1974b5

MVDM knows "Patient"

User: ALEXANDER,ROBERT (200-62) **Facility:** SOFTWARE SERVICE (4-1 / 050) **Patient:** CARTER,DAVID (2-25)


```
{
    "created": {
        "id": "120_8-2",
        "type": "Allergy",
        "patient": {
            "id": "2-25",
            "label": "CARTER,DAVID"
        },
        "reactant": {
            "id": "120_82-3",
            "label": "CHOCOLATE",
            "sameAs": "vuid:4636681"
        },
        "reactantDetails": {
            "drugIngredients": [{
                "id": "50_416-2014",
                "label": "CHOCOLATE FLAVORING",
                "sameAs": "vuid:4019401"
            }]
        },
        "allergyType": "DRUG, FOOD",
        "mechanism": "ALLERGY",
        "dateTimeEntered": {
            "value": "2017-04-07T20:58:00Z",
            "type": "xsd:dateTime"
        },
        "enteredBy": {
            "id": "200-62",
            "label": "ALEXANDER,ROBERT"
        },
```


MVDM data is:
- **Clear, well-defined**
- **Easy to understand**
- **Web-standard JSON**

Required if one desires patient-centric access control

It is essential to understand the data before one is able to provide or control access to it. MVDM provides such structure and definition.

Summary

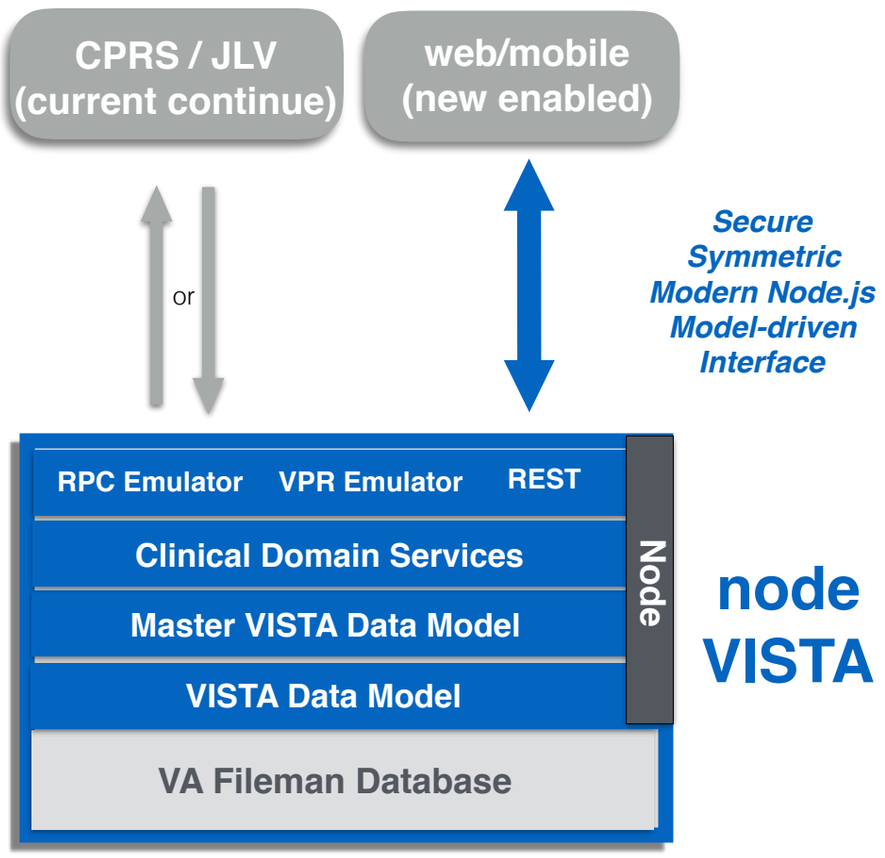
VISTA Data Project

We have proven that one can guarantee continuity of care while migrating to a modernized EHR.

A modernized EHR could be a

- Refreshed VISTA and/or
- A collection of COTS applications

Emulation can work over both.



https://vistadataproject.info