Integrated Health Information Architecture
- The DHIS 2 experience
- *Information for decision making & management*

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**Presentation:**
Based on Experience from implementing DHIS over 20 years
– in more than 30 countries in Africa, Asia, Latin America

**Overview:**
- Basic definitions: interoperability & integration
- 3 layers architecture model
- Architecture focusing on health management (HMN)
- Examples of integration and interoperability
Problems:

- **Fragmentation** of Health Information Systems –
  - Multiple ’Silos’ instead of integration
- Systems are overlapping and not ‘talking’ to each other
- No easy access to integrated information for management & decision making at “one point” – at any level

‘Solutions’:

- Integrated data warehouse: Data for Decision making
  - *key indicators* – at each level of management
- **Integrated architecture:**
  - interoperability between systems, based on
  - Shared standards
Basic definitions:

**Architecture:** ‘System of systems’

**Enterprise:** In our case, the health system

**Standards:** needed for systems (and people) to interact

**Interoperability:** Systems (and people) interact and exchange data

**Integration:** a process to make something that is fragmented to appear as a whole

**Information for decision making & management:**
Essential (Minimum) Indicators – for each level
Types of Interoperability

**Political** (Organisational dimension)
- Goals, overall conditions and views aligned

**Juridical**
- Legal compliance on processes, actions, agreements, data exchange, data security, privacy (patient data)

**Organizational**
- Goals, budgets, knowledge and processes aligned

**Semantic**
- The meaning of the data understood – & in the same way

**Technical** (syntactic – as related to ‘semantic’)
- Communication protocols, security and exchange formats
### Enterprise architecture: 3 Levels (each serving the level above)

<table>
<thead>
<tr>
<th>Level 1: Information Needs, Users, Usage Across Organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Business level&quot;</td>
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<td></td>
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<tr>
<td>Level 2: Software applications &amp; Information Systems</td>
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<tr>
<td>&quot;Application level&quot;</td>
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<td></td>
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<tr>
<td>Level 3: &quot;Data exchange level&quot; &quot;Technical level&quot;</td>
</tr>
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<td>Interoperability &amp; standards, technical infrastructure</td>
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#### Level 1: Information Needs, Users, Usage Across Organisations
- “Business level”

#### Level 2: Software applications & Information Systems
- “Application level”

#### Level 3: "Data exchange level" "Technical level"
- Interoperability & standards, technical infrastructure

<table>
<thead>
<tr>
<th>Applications supporting use of information</th>
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<tbody>
<tr>
<td>Data &amp; indicator dictionary /standards</td>
</tr>
<tr>
<td>OpenHIE Health Information Exchange</td>
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<tr>
<td>Data warehouse Aggregate data</td>
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<tr>
<td>iHRIS</td>
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<tr>
<td>SDMX-HD</td>
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**Data Standards and infrastructure supporting the applications**

**Institutional use of information**
Different levels of the health system – different needs for information

<table>
<thead>
<tr>
<th>Level of health system</th>
<th>Quantity of data</th>
<th>Information needs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data granularity</td>
<td></td>
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<tr>
<td>Global/Region</td>
<td>Less data</td>
<td>Summary indicators General, e.g. MDG</td>
</tr>
<tr>
<td>Countries/Health Programs</td>
<td></td>
<td>Indicators National /program</td>
</tr>
<tr>
<td>District</td>
<td></td>
<td>Indicators district management</td>
</tr>
<tr>
<td>Facility</td>
<td></td>
<td>Facility management</td>
</tr>
<tr>
<td>Patient</td>
<td>More data</td>
<td>Patient records, tracking &amp; care</td>
</tr>
</tbody>
</table>
Hierarchy of data standards:

• Balancing national need for standards with local need for flexibility to include additional indicators

• All levels have freedom to define their own standards as long as they adhere to the standards of the level above (core data set)
HMN architecture - National data warehouse: Enterprise architecture for management

Data Sources
- Censuses
- Civil Registration
- Population Surveys
- Individual Records
- Service Records
- Resource Records

Integrated Health Information System
- Standards-Compliant Data-Collection Activities
- Extract and Integrate Data
- Integrated Data Repository
- Dashboard, Reports, Queries, Events and Alerts
- Health Information System Actors Using Evidence for Decision-Making
  - Senior Country Official
  - National Public Health Official
  - International M&E Officer
  - District Health Manager
  - Senior Country Official
  - Facility Health Officer
  - Etc.

Policies, Resources and Processes
Measles under 1 year coverage by district 2006
(Measles doses given to children < 1 year / total population < 1 year)

Chake District

Micheweni District

Mkoani District

Wete District

Central District

North A District

North B District

South District

Urban District

West District

Pemba Zone

Unguja Zone

Annual measles coverage %

Data from Mobile devises

Data capture from paper forms

DHIS 2

Data warehouse

-Data mart

-Meta data

-Visualising tools

Web Portal

Dashboard

Graphs

Maps

Getting data in - Data warehousing

Getting data out - Decision support systems – ‘Business intelligence (BI)
Dashboards: Live update of key data and indicators
Integrated Health Information Architecture (“Horizontal integration”) - integrating sub-systems, technologies, health services & programs

- Users of primary data & data providers
- Aggregate & indicator data
- Interoperability
- SDMX - HD
- Electronic Medical Records
- HR Management
- Logistics & drugs
- Finance
- Mobile reporting
- Performance Based financing reporting
- Paper based systems: OPD, EPI, RCH, other programs

Integration of technologies, systems, data & health programs
SDMX-HD: Statistical Data & Metadata Exchange for the Health Domain

SDMX-HD: Data transfer from OpenMRS To DHIS, e.g.: #deliveries @health centre X for month of May

SDMX-HD: Data transfer from iHRIS to DHIS, e.g.: #midwives @health centre X for month of May

DHIS : Data warehouse Statistical data

DHIS is calculating the indicator: Deliveries per midwife Per facility per month

OpenMRS : Medical records

iHRIS: Human Resource records
Improved Internet and mobile network: Rapid scaling Implementation Using central server & “cloud” infrastructure

Online data use; web pivot reports, charts, maps

DHIS2

Online Data capture

Mobile Data Use

Online / / Offline

Offline data use application
- Datamart
- pivot tables
- Archive
- reports,
- Charts, maps

Browser

Offline Data Capture

Mobile Data Capture

BCG: 12
PENTA1: 10
PENTA2: 7
PENTA3: 11
Extending the reach through mobiles

• User friendly & ‘close’ data entry individual level/aggregate data
• Tracking clients in programs
  – sending reminders, e.g. for ANC visits & vaccination
• Feedback – simple reports, text & calls
• Communication – ‘social media’ for both health staff and community (support, chat,
• Integration with DHIS data warehouse & backbone infrastructure
• Support wide range of technologies
Output tailored to the range of devices and infrastructures

SMS

Lightweight Browser

Android app or browser

Tablet

PC/laptop

More flexible
Improved Internet & mobile network – ‘cloud’ infrastructure

Rapid scaling – from ‘hundreds’ of installations to 1