Simple diagnostics for complex markets

Workshop: Capillarity-based Microfluidics for Bioanalysis

October 1, 2011

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PATH
A catalyst for global health

The problems…

- Paper microfluidics will be most useful in markets that are least able to pay for them or their development

Assays for LRS need to:

- Work as well as ones for high-resource setting
- Cost 1/20 of a comparable HRS assay;
- Work in adverse conditions;
- Require less training;
- Have lower development cost (lower margins)

More problems…

- Markets are both fragmented and narrow
- Need and ability to pay not aligned
- Payer needs are different from user needs
- Demand is unpredictable (political instability on donor and implementer side)
- Regulatory systems are fragmented or broken
- IP is not always respected
- Manufacturing volumes very variable with targets
- Diagnostics are not always trusted

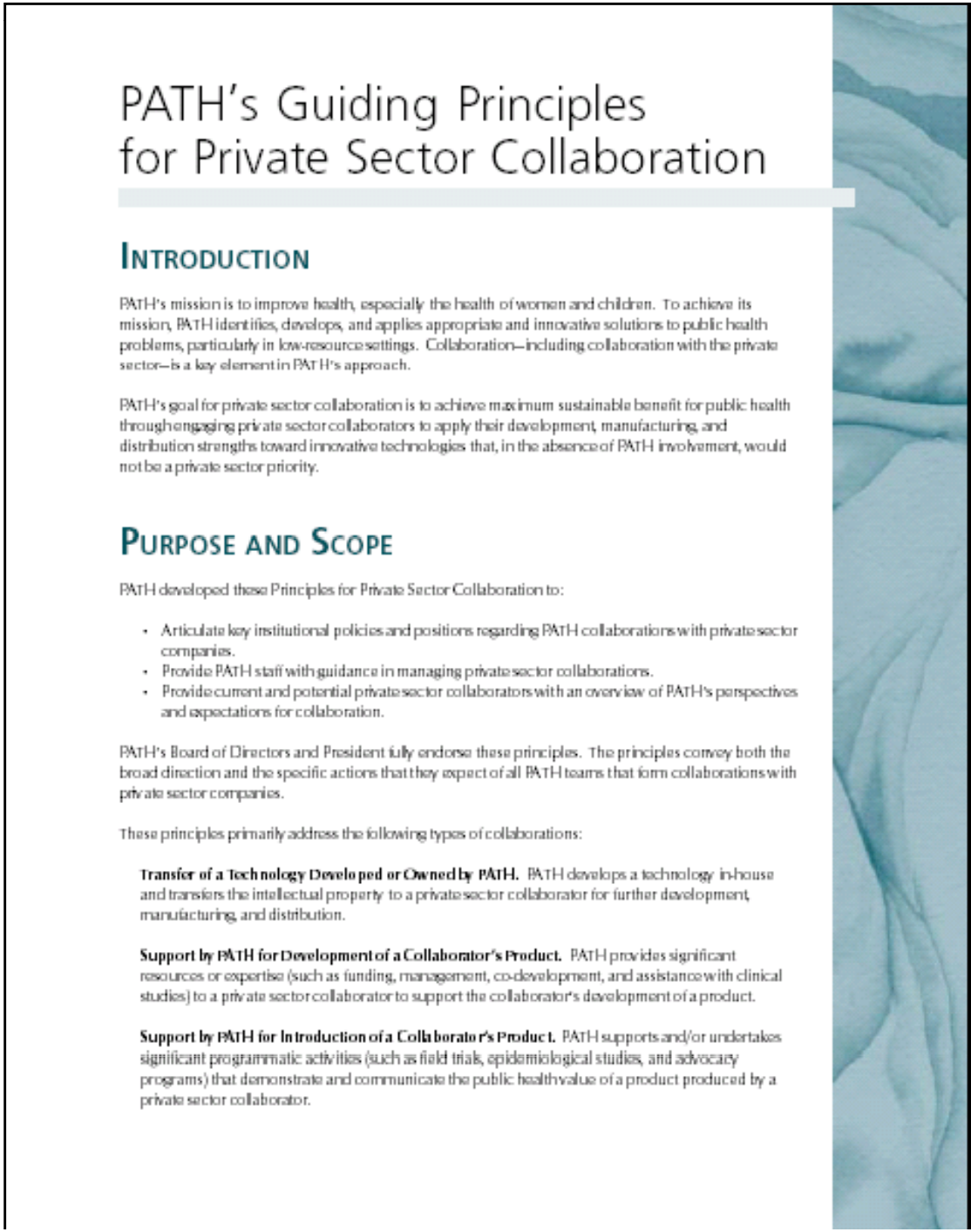
Attempts at solutions

- Product development partnerships (e.g., GeneXpert)
- Donor funding (e.g., GCGH)
- Improvement in or workarounds for regulatory systems (e.g., BMGF Standards process)
- Open source needs assessment, development, manufacturing, distribution (e.g., MODS)
- "Not-just-for-profit" business models (e.g. DFA)
- Development, manufacturing, and distribution by and for LRS stakeholders (e.g., Indian Dx Industry)

The Business of Global Health

Private sector collaboration:

- **Clear link to PATH's global health mission**
- **Recognition of private-sector needs**



PATH's Guiding Principles for Private Sector Collaboration

Introduction

PATH's mission is to improve health, especially the health of women and children. To achieve its mission, PATH identifies, develops, and applies appropriate and innovative solutions to public health problems, particularly in low-resource settings. Collaboration—including collaboration with the private sector—is a key element in PATH's approach.

PATH's goal for private sector collaboration is to achieve maximum sustainable benefit for public health through engaging private sector collaborators to apply their development, manufacturing, and distribution strengths toward innovative technologies that, in the absence of PATH involvement, would not be a private sector priority.

Purpose and Scope

PATH developed these Principles for Private Sector Collaboration to:

- Articulate key institutional policies and positions regarding PATH collaborations with private sector companies.
- Provide PATH staff with guidance in managing private sector collaborations.
- Provide current and potential private sector collaborators with an overview of PATH's perspectives and expectations for collaboration.

PATH's Board of Directors and President fully endorse these principles. The principles convey both the broad direction and the specific actions that they expect of all PATH teams that form collaborations with private sector companies.

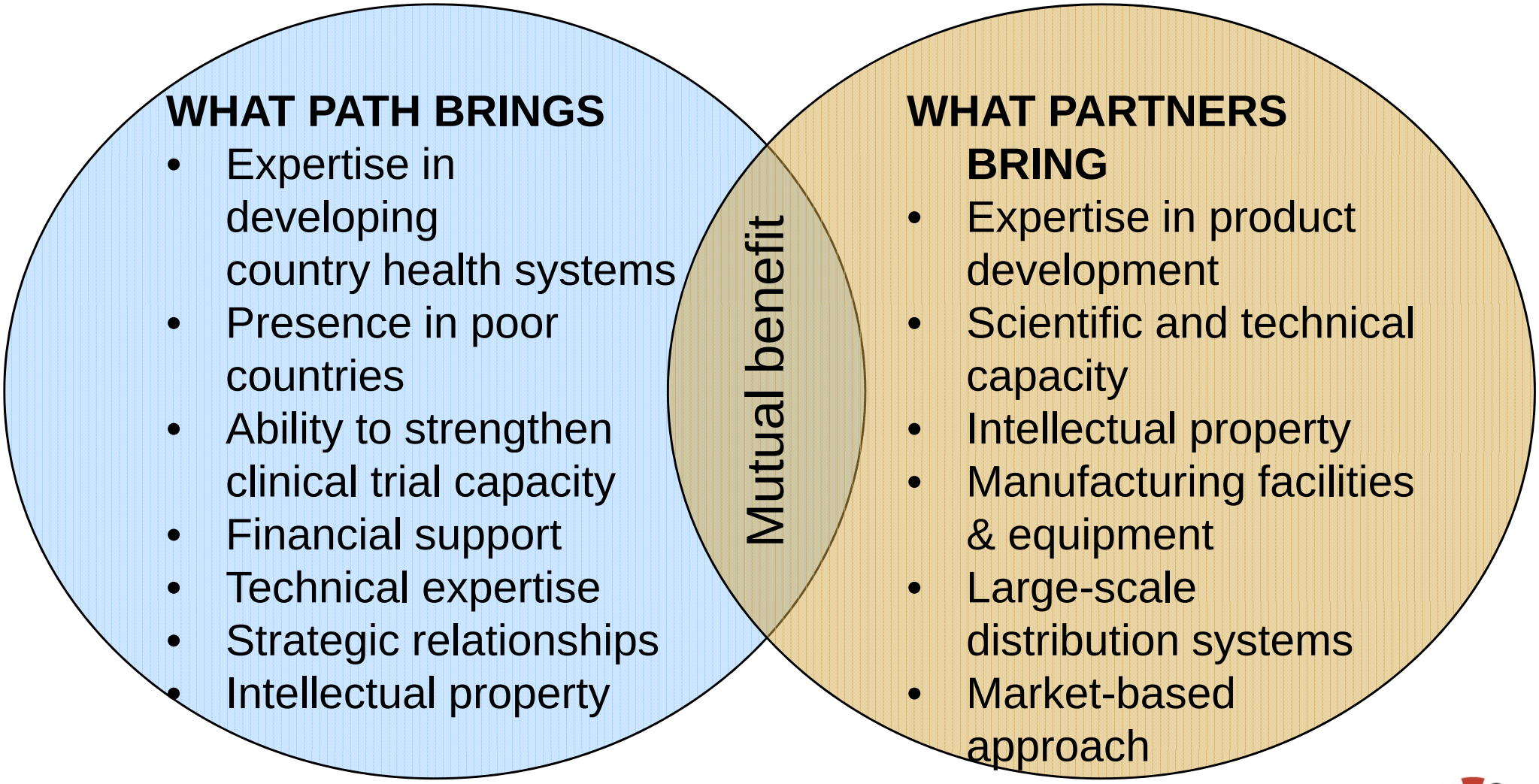
These principles primarily address the following types of collaborations:

Transfer of a Technology Developed or Owned by PATH. PATH develops a technology in-house and transfers the intellectual property to a private sector collaborator for further development, manufacturing, and distribution.

Support by PATH for Development of a Collaborator's Product. PATH provides significant resources or expertise (such as funding, management, co-development, and assistance with clinical studies) to a private sector collaborator to support the collaborator's development of a product.

Support by PATH for Introduction of a Collaborator's Product. PATH supports and/or undertakes significant programmatic activities (such as field trials, epidemiological studies, and advocacy programs) that demonstrate and communicate the public health value of a product produced by a private sector collaborator.

The PDP Model: Mutually beneficial, collaborative partnerships



The PDP approach to LRS diagnostics development and introduction

- Profitable diagnostics most likely to be available over long-term.
- But: market forces *alone* are not sufficient to ensure Dx availability.
- None of us knows the "whole story" – ask the users!
- One size does not fit all.

The PDP approach to LRS diagnostics development and introduction, cont'd.

PDPs work to remove risks for all partners:

- Technical: R&D, Transfer and support;
- Market: Data-driven user needs assessments;
- Clinical: Lab and field assay evaluation; and
- Uptake: Opinion leaders and health ministries involved at early stage,

Resulting in viable low-resource Dx products with lower profit margins

Reducing Development Risk: Case study – RDT for Chagas Disease

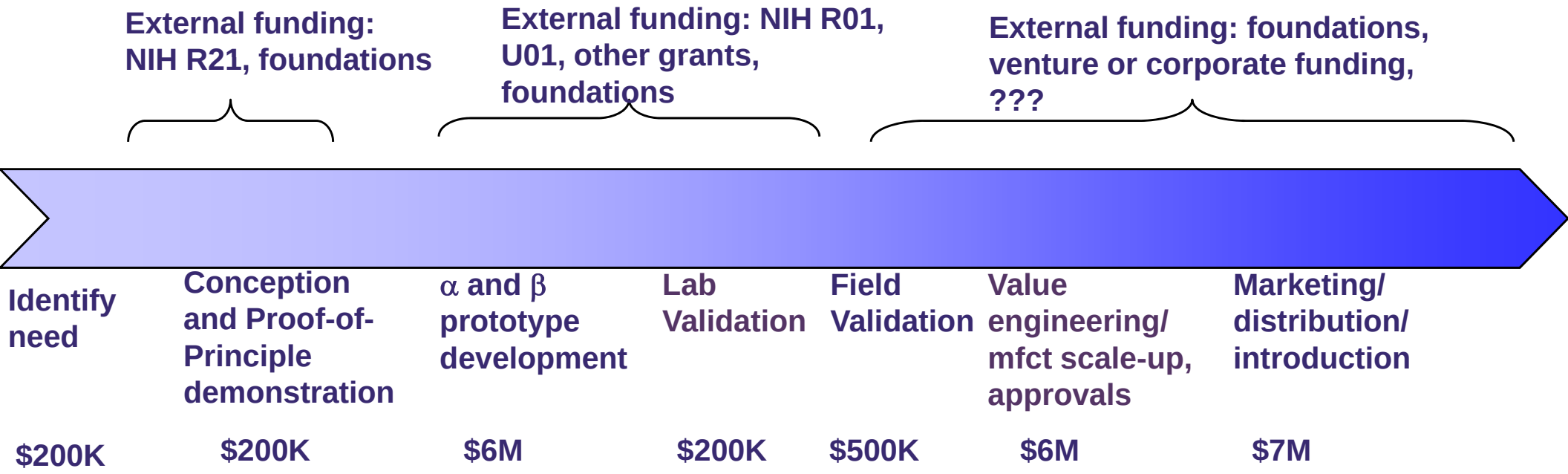
- *Regional* disease,100.000 new cases/yr
- Moderately-priced drugs exist
- Existing dx (ELISA, LabLemos) needs a lab
- A strip test could increase access (can be field assay)

The Product Development Partnership:

- PATH develops assay prototype based on the ELISA antigen
- PATH transfers strip to distributor/manufacturer consortium (Biomerieux/Fiocruz)
- Lab and field validation of manufactured prototype
- Grant funding less than <400K
- Partner R&D investment is low, thus, a product with low margins becomes viable

Funding development of diagnostics for LRS

"What does it take to develop a new instrument-based Dx product platform? 5 Years, $20M"



What will it take to bring a paper microfluidic product to market?

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Clinical (User) Needs Assessment

- Process of defining unmet needs within healthcare and determining how to fill them.
- Identify those who *"use, choose, and pay the dues"*
- Similar but not identical to market research
- Takes into account social, economic, and environmental constraints.
- Need does not equal demand!
- Examples at http://www.path.org/dxcenter/assessing-clinical-needs.php

Sustainable commercialization of paper microfluidic assays?

Lessons from RDTs for paper microfluidics:

- Low barrier to entry: setting up ICS shop costs 30K or less
- Many (hundreds) of LFS manufactures world wide
- Substantial number of reliable manufacturers, very competitively priced assays
- IP has not turned out to be a barrier
- Lack of expertise, QC, regulatory systems, ethics has lead to many bad/non-functional assays

Why transfer to manufacturing partners in LRS?

- Commercial focus on LRS is critical
- Transfer to and manufacturing in LRS provides
  - Commercial focus
  - Capacity building
  - Cost structure
- Hand assembly provides flexibility at some cost to quality
- Support needed for training, QC/QA, business functions
- Support and creation of regulatory systems, manufacturers associations, standards.

Fostering New Dx Manufacturers in Low-Resource Settings

Catalyzed by the GHDx Center:

- PATH Diagnostics has a 20-year history of successful transfers to Southeast Asia.
- Now KEMRI (Kenya):
  - HIV, Hep C virus rapid diagnostic test – improvement of test and manufacturing quality
  - Help with regulatory and marketing; make tests ready for PEPFAR
  - NAAT sample prep kit

Photos: PATH/Bernhard Weigl

Transfer and Sale of PATH-originated Diagnostic Assays: Examples

Test, manufacturer	Year transferred	Years sold	Units sold to date
Hepatitis B, J. Mitra	1998	1999–2007	>9 M
Hepatitis B, Orchid	1998	1998–2010	11 M
Hepatitis B, Yayasan Hati Sehat (YHS)	1999	1998–2010	3.9 M
Malaria, Orchid	1998	1998–2008	>133 M
Malaria, SPAN Diagnostics	1999	2000–2006	>1M
Malaria, Human	2001	2002–2010	>926,000
Pregnancy, Orchid	1998	1998–2008	26 M
HIV Dipstick (Wiener, YHS, BRIA, SPAN)	1998	1998–2007	17.9 M
ScanLisa RBP-EIA	1999	2006–2010	68 K

Detour: The BMGF GC Diagnostics Standards Initiative

- $30-50 M to be invested by BMGH and GC Canada in next generation diagnostics
- Initiative to set standards for future diagnostics by any participating manufacturers
- Idea: Create open standards and installed base, and let anyone develop and commercialize assays and components that fit together
- Standards can:
  - Drive adoption through installed base of instruments
  - Create “quality seal of approval“ in the absence of unified regulatory system
  - Focus manufacturers on needs of LRS

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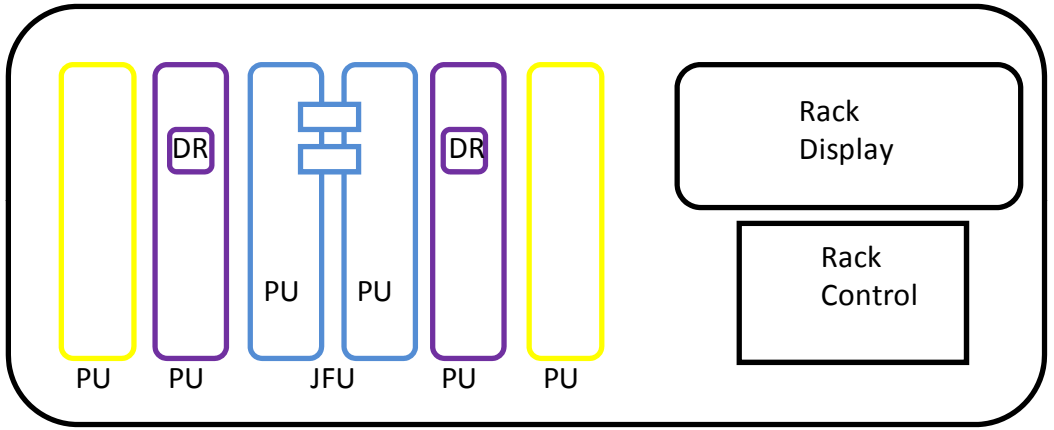
No Diagnostics Interface Standards?

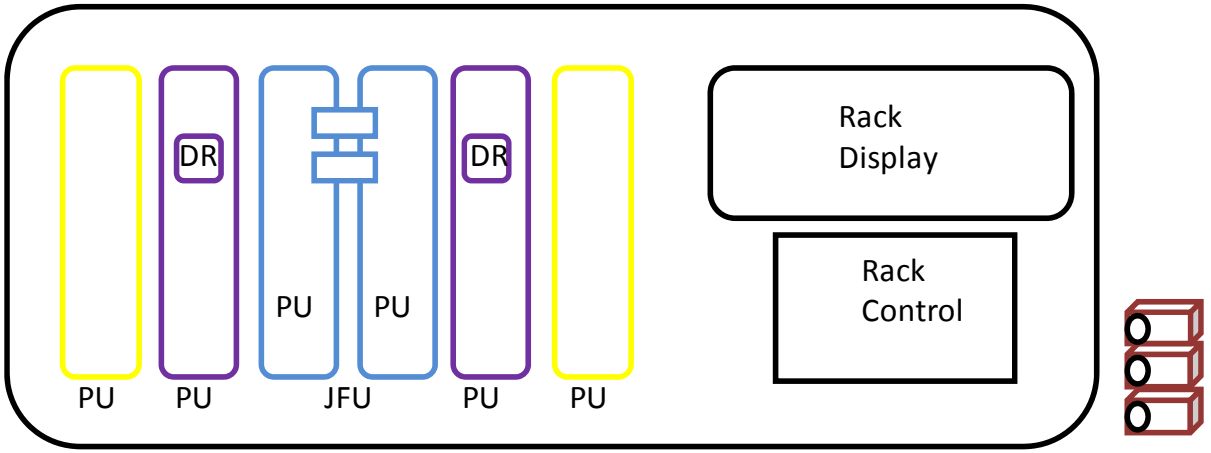
- Many intra-company closed interface standards:
  - iSTAT
  - Large lab chemistry analyzers
  - Other POC chemistry analyzers
- ICS is "sort of" standard – not *interoperability*, but *usability* standard
- Should paper microfluidics have standardization element?

“Dx Rack” Platform



- *“Rack” – “Platform Unit” – “Disposable”*
- Disposables handle chemistry and fluids
- Platform units handle mechanics, optics, and electronics of assay
- Rack handles operating system, power, and communications
- Two-level device customization through selection and combination of platform units and disposables

Is the BMGF standards process relevant for instrument-free (paper) Dx?



- Could a standardized platform have a portal for “less standardized” non-instrumented assays (RDTs and paper microfluidics?
- I.e., a camera? Something else?
- Installed base as driver for adoption even for paper microfluidics?
- The broken regulatory system in LRS – can standards help?

Center for POC Dx for Global Health (GHDx Center)

- Evaluation,
- PDP collaboration
- Training
  - Participants are a mix of Dx technology developers and “Dx power users”
  - 4 Levels of courses – didactic, lab, field, fellowship
- **http://www.path.org/dxcenter**


Thank you!