A Model Driven Approach to Care Planning Systems for Consumer Engagement in Chronic Disease Management

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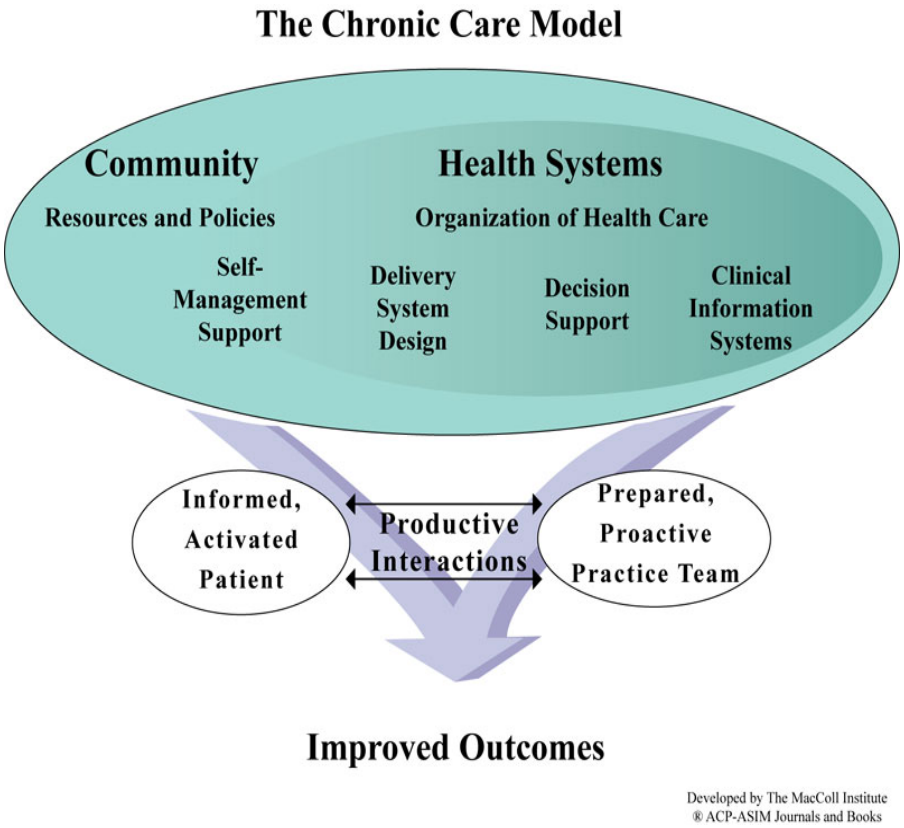
Motivation

- Rise in rate of chronic illness
  - Better outcomes through consumer engagement
  - And we want to engage people is staying well
- So we want a care plan that the consumer can see (at least part of) and can engage with



"Wagner" chronic care model

Inspiration / focus

- Main focus areas
  - Diabetes, pre-diabetes, diet/weight/exercise
  - Medication adherence
  - Home monitoring
  - Using equipment (e.g., home oxygen)
- We are seeing islands of great solutions in this domain
  - STOMP – quit smoking programme via txt (with HealthPhone)
  - Telemedcare Systems (home telemonitoring with touchscreen hub)
  - Pen Computer Systems' Ferret

Why model-driven architecture?

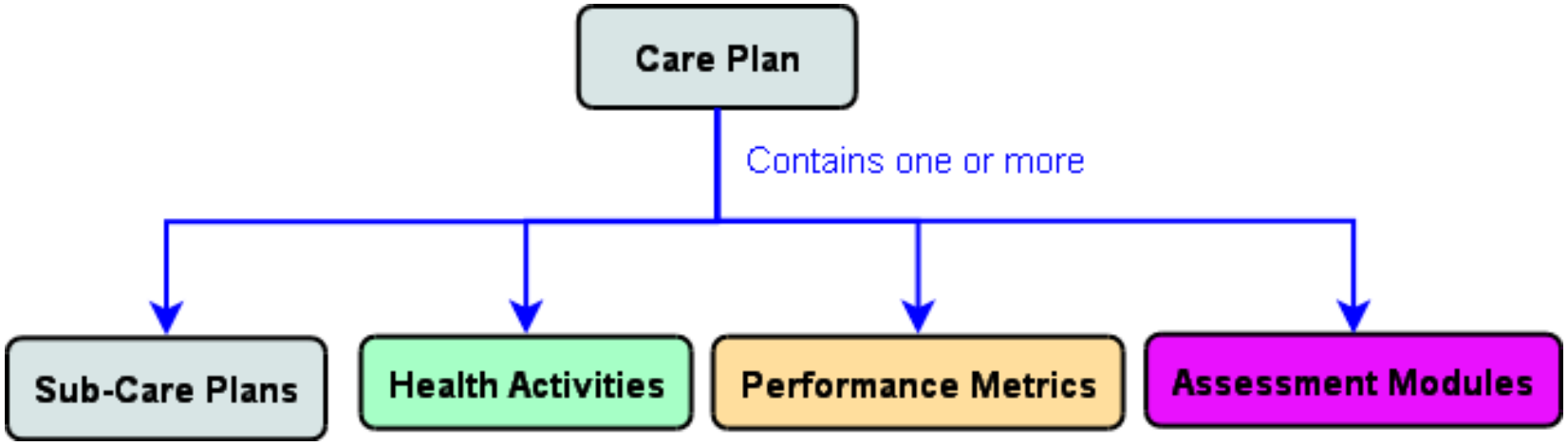
- No single device is always best
  - Might engage via PC at home, via cell phone or various convergence devices (PDA, tablet)
    - Or via the touchscreen of a home healthcare robot
- The principles of care planning are somewhat stable
  - Constant underlying conceptual model
  - Reasonably constant data model
- So we want to iteratively refine a model that we can implement onto numerous specific devices

Tools of Model-Driven Architecture (MDA)

- Domain-specific language (DSL)
  - We use the Marama tool to create a language for defining care plans
    - As XML
    - And as a visual language
- We program user interface components to map to objects in the DSL
- From the DSL we generate high level scripts (e.g., OpenLaszlo) that can map to a target set of environments (Flash and DHTML for OpenLaszlo)

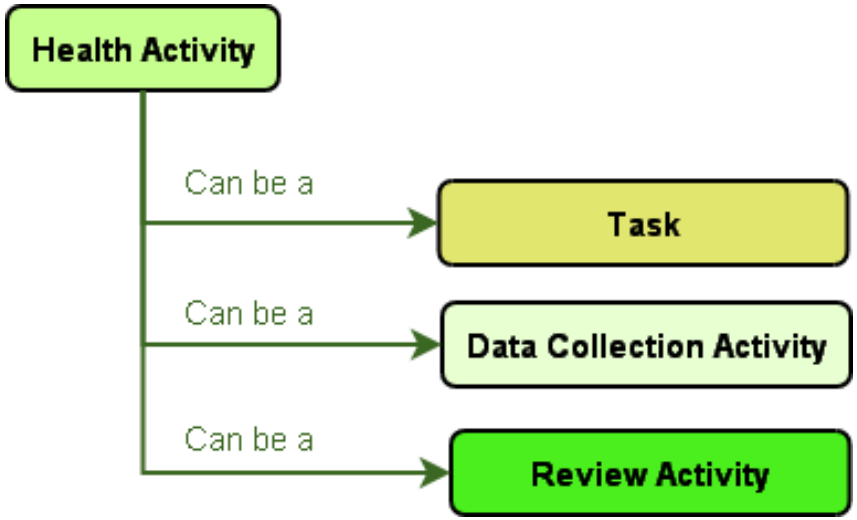
Model

- A care plan involves
  - Activities
  - Measure (targets and ongoing observations)
- And it can recursively contain other care plan structures



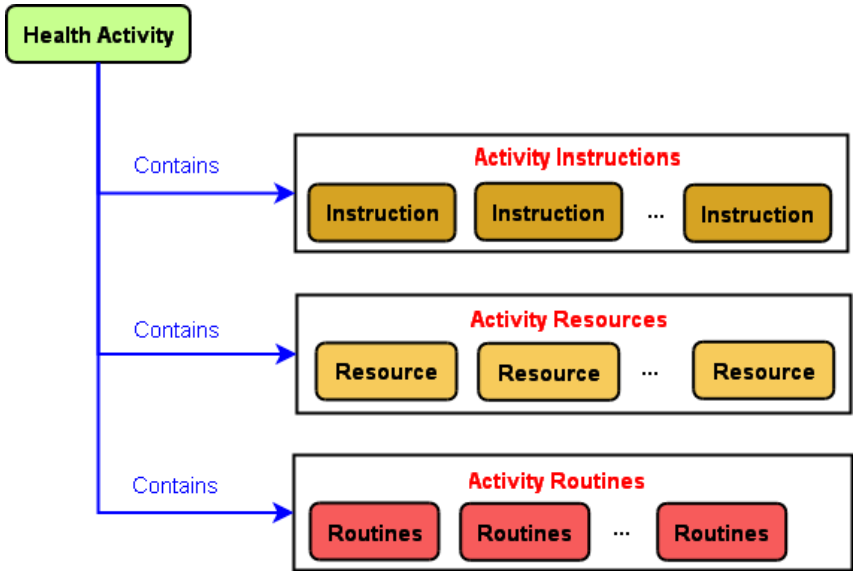
Activities

- Tasks
  - Things to do in the real world
- Data Collection
  - Where we collect information
- Review
  - Assessing progress and possibly re-planning



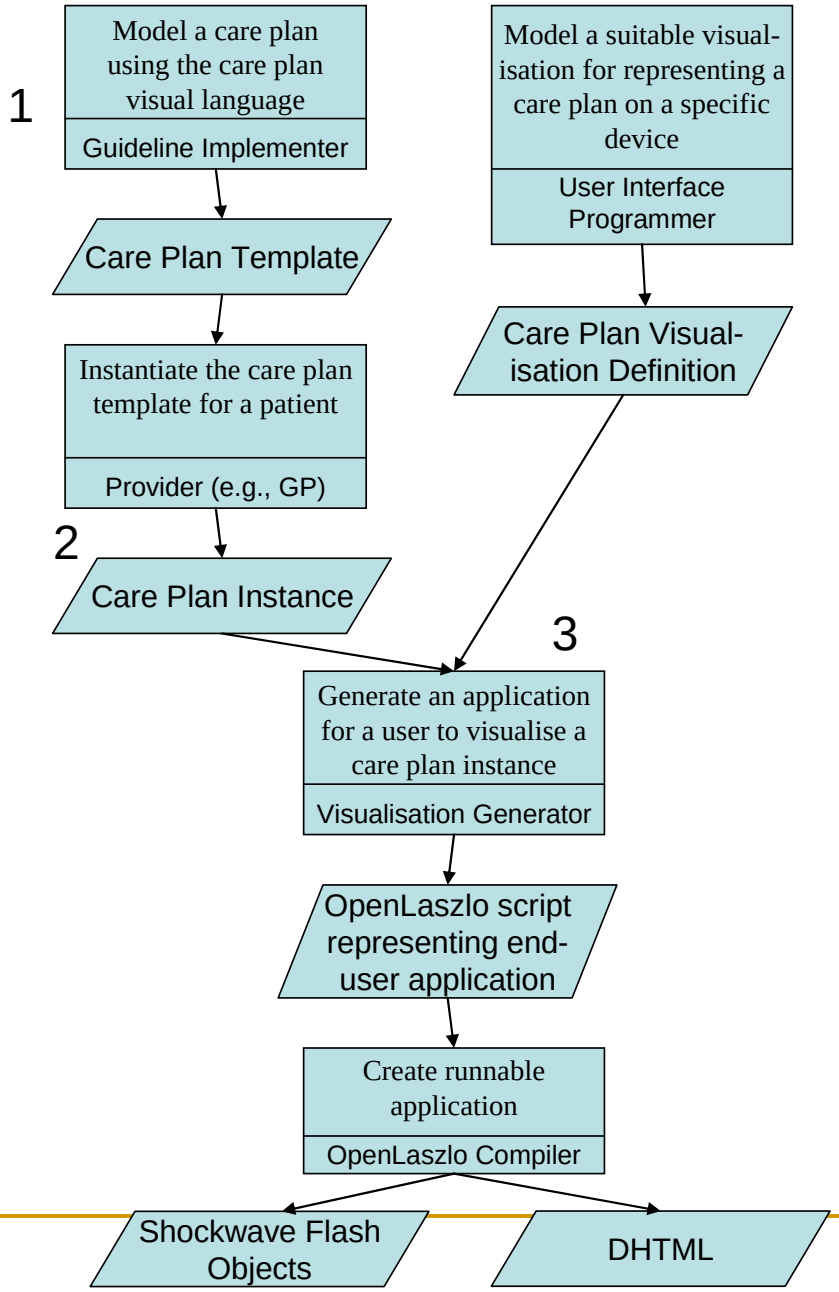
More on activities

- Instructions
  - Can include multimedia or HTML/URL components of arbitrary complexity (e.g., ‘how to’ videos)
- Resources
  - Identifies things one must have (e.g., supplies)
- Routines
  - Defines patterns (e.g., each morning for a pill, or M-W-F afternoon exercise)



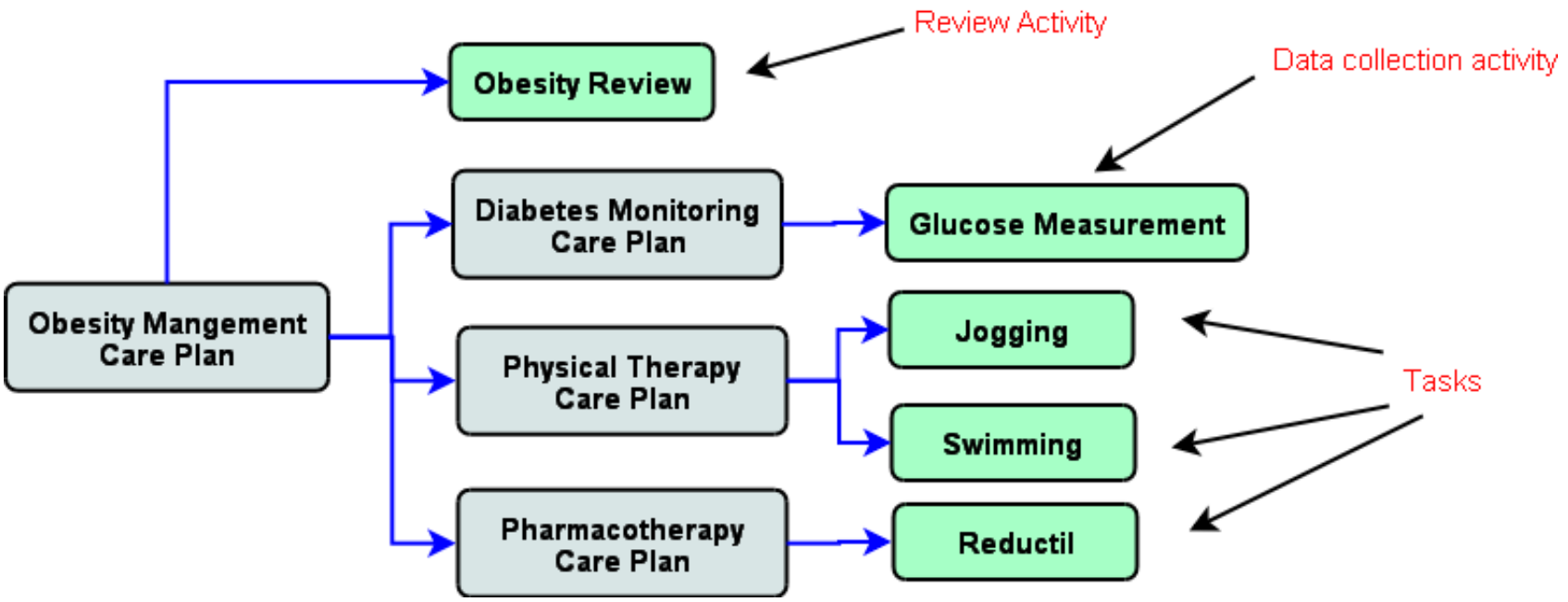
Process

1. Build guideline (“care plan template”)
   - Once in a great while
2. Instantiate guideline on a patient
   - By a GP or other providers – maybe once a year
3. Generate application on an instance
   - For each device relevant to this patient



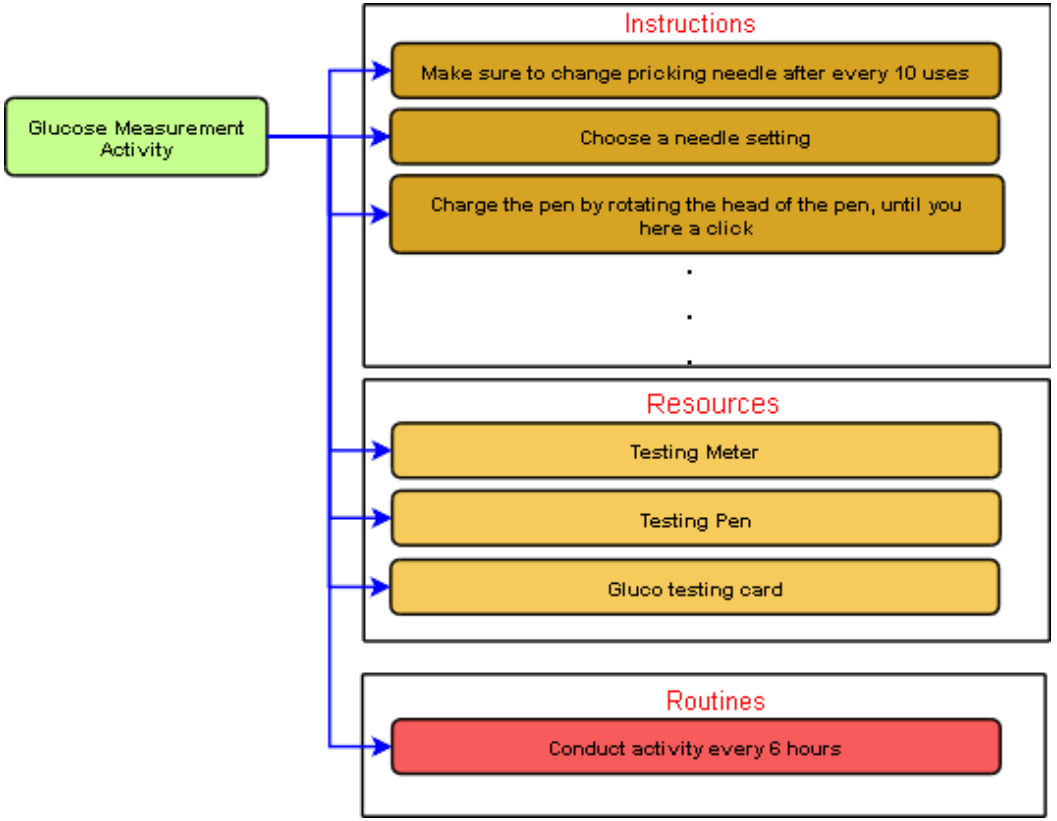
Example

- Consider a pre-diabetes or Type II / obesity management care plan

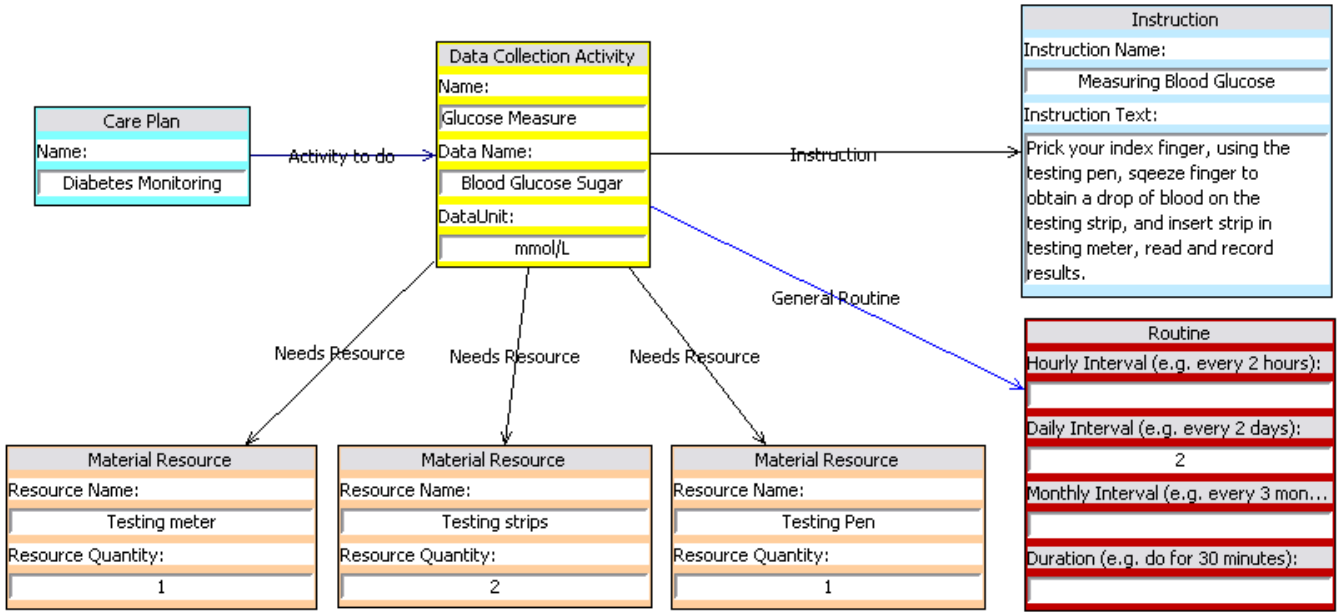


Example contd.

- Care plan template has been defined with details of the activity
  - Specifics within the general care plan model / DSL
  - Defined by a guideline definition group (e.g., NZGG)



Specific care plan model



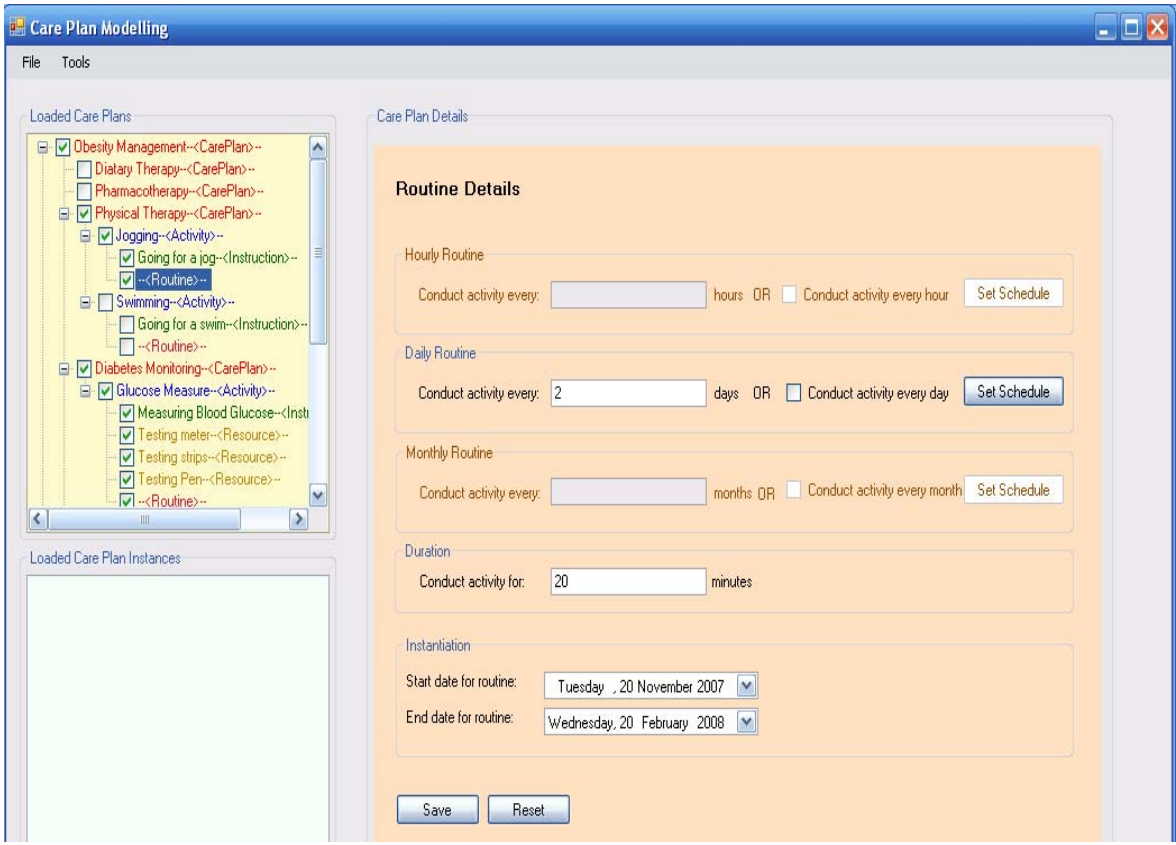
- Marama visual presentation of Care Plan DSL showing a template with some specifics

Storing Care Plans in XML

```
- <CarePlan>
    <CarePlanName>Dietary Therapy</CarePlanName>
  - <TargetConnection>
      <ConnectionIndex>//@children.10</ConnectionIndex>
      <ConnectionType>CarePlanHasCarePlan_Connector</ConnectionType>
    </TargetConnection>
  - <TargetConnection>
      <ConnectionIndex>//@children.11</ConnectionIndex>
      <ConnectionType>CarePlanHasCarePlan_Connector</ConnectionType>
    </TargetConnection>
  </CarePlan>
- <CarePlan>
    <CarePlanName>Physical Therapy</CarePlanName>
  </CarePlan>
- <CarePlan>
    <CarePlanName>Behavior Therapy</CarePlanName>
  </CarePlan>
- <CarePlan>
    <CarePlanName>Pharmacotherapy</CarePlanName>
  - <TargetConnection>
      <ConnectionIndex>//@children.7</ConnectionIndex>
      <ConnectionType>CarePlanHasActivity_Connector</ConnectionType>
    </TargetConnection>
  - <TargetConnection>
      <ConnectionIndex>//@children.8</ConnectionIndex>
      <ConnectionType>CarePlanHasActivity_Connector</ConnectionType>
    </TargetConnection>
  </CarePlan>
```

Planning interface prototype

- Auto-generated DHTML in this instance
- Could be used directly by a care coordinator
- Might integrate with a GP's PMS if agreed on way to interoperate
  - Haven't yet explored CDA mapping

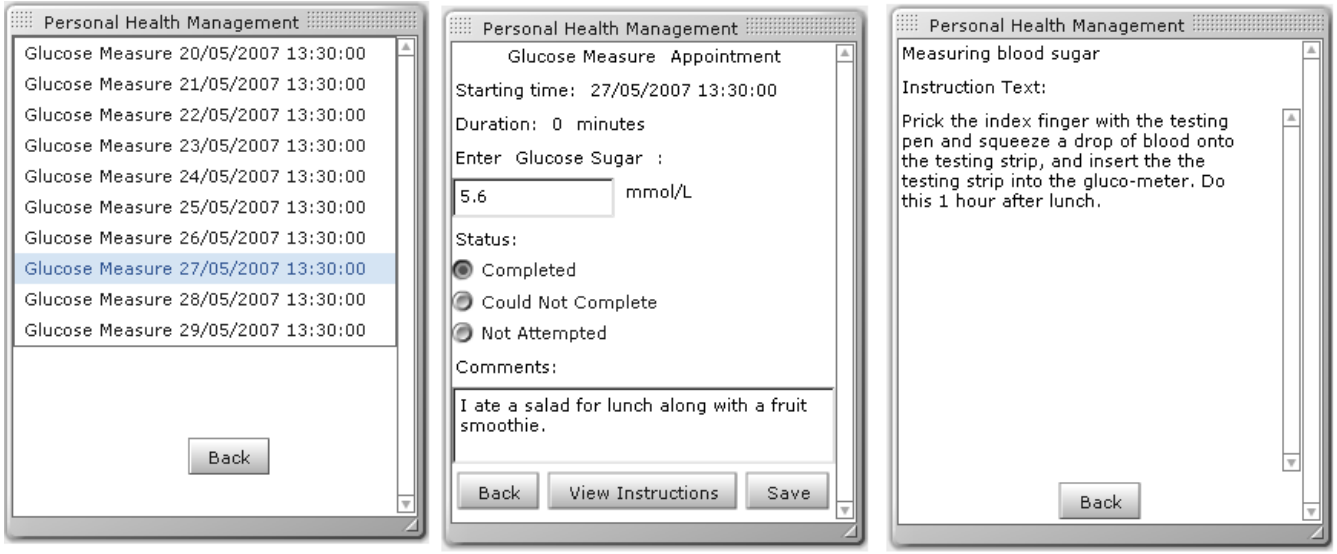


Storing Care Plan Instances as XML

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<CarePlanDataSheet versionDate="21/05/2007">
    <CarePlan CarePlanName="Obesity Management">
        <Metrics>
            <PerformanceMetric MetricName="Body Mass Index" MetricUnit="BMI" MetricValue="30"/>
        </Metrics>
        <SubCarePlans>
            <CarePlan CarePlanName="Diet Plan">..
            <CarePlan CarePlanName="Exercise Plan">..
            <CarePlan CarePlanName="Diabetes Monitoring">
                <Metrics></Metrics>
                <SubCarePlans></SubCarePlans>
                <Activities>
                    <Activity ActivityType="DataCollection" ActivityName="Glucose Measure" DataName="Glucose Sugar"
                        <ActivityInstructions>..
                        <Resources>..
                        <Appointments>..
                    </Activity>
                </Activities>
            </CarePlan>
            <CarePlan CarePlanName="Pharmacotherapy Plan">..
        </SubCarePlans>
        <Activities>..
    </CarePlan>
    <CarePlan CarePlanName="Smoking Cessation">..
    <CarePlan CarePlanName="Diabetes Management">..
    <CarePlan CarePlanName="Cholesterol Management">..
</CarePlanDataSheet>
```

Consumer interface (Flash)

- Care plan can be presented to patient
  - Mostly manifests as a series of tasks for reminder, input and feedback, plus presentation of instructions if desired
  - Flash is a widely deployable and powerful format



Conclusions / Where to from here?

- If we're going to see widespread availability of care planning tools…
  - The care plan model should be interpretable by many different platforms
  - We should be able to distribute and tailor the care plan models themselves
  - Support re-use at every level
    - More sustainable – less isolation of projects
- MDA offers significant potential
  - It'd be good if auto-generated GUIs looked a little nicer, but there's room for extensibility and tailoring in the approach
  - A long way to go to arrive at standards
    - A little more growth in ubiquity of mobile health support applications (e.g., Nokia) should help

What we didn't do / didn't answer

- Align to relevant standards
  - We let the engineers follow path of least resistance for prototyping in this exercise
    - Proof of concept, not industry-ready solution
  - Little reason not to use a CDA (or OpenEHR) structure, HL7 data types and SNOMED CT concept set
- No answer here on distribution of the care plan XML artefacts
  - Governance of templates
  - Storage and versioning / mix of messaging and persistent EHR repositories

Thank you

Questions?

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