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>
- <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
<?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>
      <CarePlan CarePlanName="Exercise Plan">
      </CarePlan>
      <CarePlan CarePlanName="Diabetes Monitoring">
      </CarePlan>
    </SubCarePlans>
    <Activities>
      <Activity ActivityType="DataCollection" ActivityName="Glucose Measure" DataName="Glucose Sugar">
        <ActivityInstructions>
          <Resources/>
          <Appointments/>
        </ActivityInstructions>
      </Activity>
    </Activities>
  </CarePlan>
  <CarePlan CarePlanName="Pharmacotherapy Plan">
  </CarePlan>
</SubCarePlans>
  <Activities/>
</CarePlan>
  <CarePlan CarePlanName="Smoking Cessation">
  </CarePlan>
  <CarePlan CarePlanName="Diabetes Management">
  </CarePlan>
  <CarePlan CarePlanName="Cholesterol Management">
  </CarePlan>
</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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