NUS National University of Singapore

School of Computing

Developing ITeMS
(IT-enabled MindSet)
Video 6.4

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Having ITeMS helps in all domains

Outline

Overview:

- What is ITeMS
- CT skills: Abstraction, Decomposition…
- Leveraging on CT skills

What is ITeMS

- **Having IT-enabled MindSet means…**
  - Leverage on knowledge of CT – namely, decomposition, abstraction, pattern recognition, algorithm design
  - To apply to problems across all domains
  - To ask new questions, solve new problems and seek new solution,

CT at Google (real world PS)

Solving Problems at Google using CT

(A 4-min video from Google exploringCT)
https://www.youtube.com/watch?v=SVVB5RQfYxk

Google Earth, Google Maps, Making Pegman Smart

0:10 Decomposition,

0:16 Pattern Recognition;

0:20 Algorithm Design;

Problem for YOU!

You are the CEO (not CTO) of e-CT.com. You want to have *its own e-greeting card web service*. You are not a software engineer, but you have ITeMS (IT-enabled MindSet) – you know about CT, like abstraction, decomposition, pattern recognition, etc.

Write down *the requirements* you want for your intended e-greeting card web service. Namely, specifying what *features* it will provide, what it will *look like* (look-and-feel), and how you want *users to interact with it* (human-computer interface), *how much it will cost*, etc.

Problem for YOU!

Sample features are:

- "ability to send reminder if the recipient has not viewed the card in 3 days"
- "convenient way for recipient to reply to sender upon viewing the card".
- "can choose card based on occasions, special events, special relationships, etc"

Focus on ***the what***, and don't worry about ***the how***. Assume you can/will hire people with the right expertise later to do it.

ITeMS: IT-enabled MindSet

Summary:

- Seem to be a daunting challenge, especially when you are not a software engineer.

- However, with ITeMS, anyone can work through the process of decomposition to work out what the app will do, what it will look like, and so on.

- And anyone with CT and ITeMS can do it.
  And will get *better and better* with practice.

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Computational Thinking

Some key elements in CT:

- **Decomposition:** breaking down complex problem, data, or system into smaller, more manageable parts
- **Pattern Recognition:** observing patterns, trends, and regularities among and within problems
- **Abstraction:** focusing on the important information only, ignoring irrelevant detail
- **Algorithm design:** developing the step-by-step instructions for solving this and similar problems

http://www.bbc.co.uk/education/guides/zp92mp3/revision

Abstraction…

focusing on the important information only, ignoring irrelevant detail

Abstraction in CT

(A 2.5-min video from CMU Robotics Academy)
https://www.youtube.com/watch?v=jV-7Hy-PF2Q

Finding the best bus route between A and B in a city (like Pittsburg)

Remove unnecessary info/data;

Keeping only essential info/data;

In Physics: $F = ma$, $v = ut + at^2$

In Music: ?? In History: ??

Abstraction: helps to identify minimal input required in apps

NUS WebMail | Student Email

The Freedom to access your NUSmail *anytime* and *anywhere*.

- This is a shared computer
- This computer is only used by me

Note:

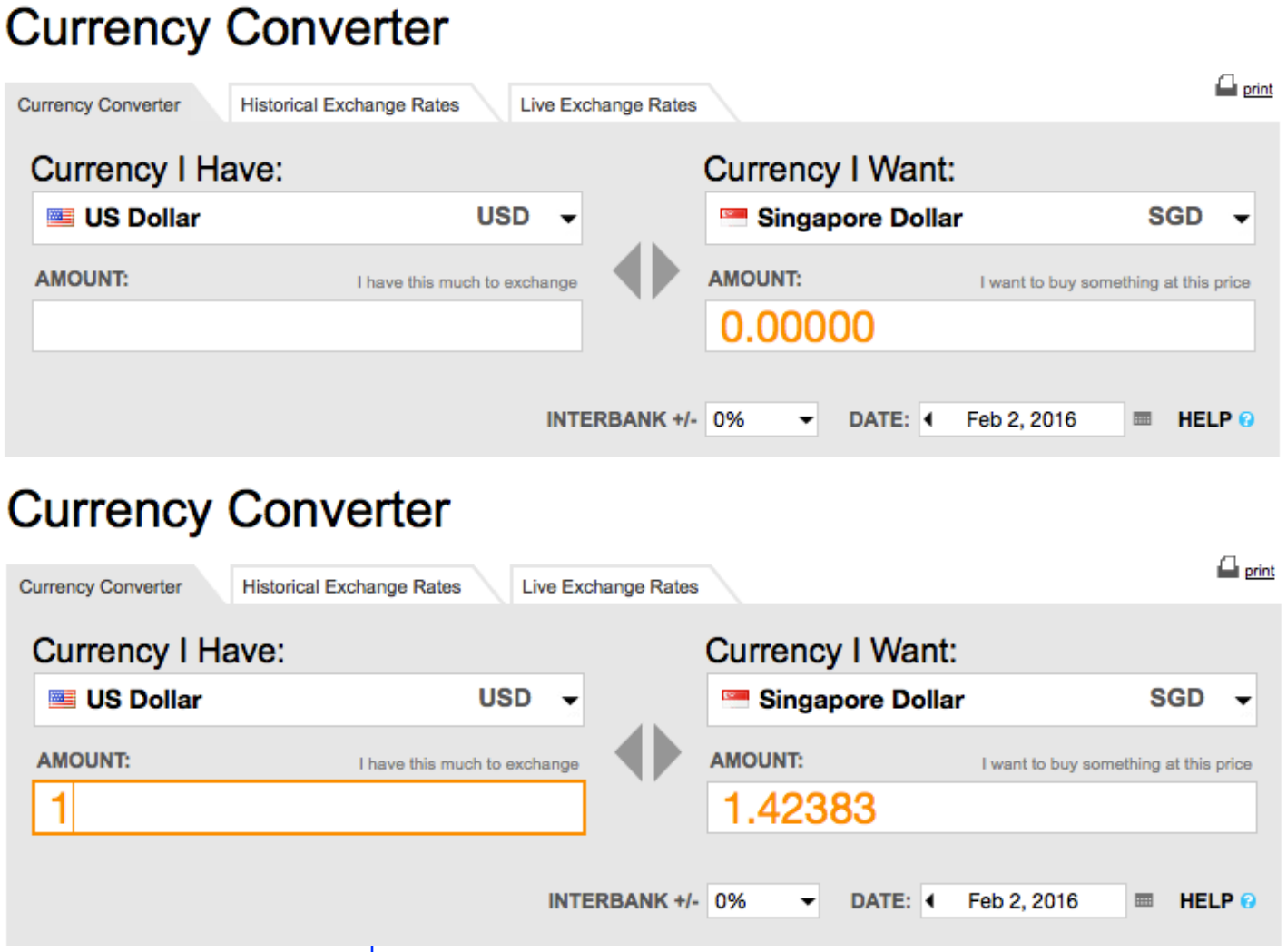
- nusstf\UserID for NUS Staff
- nusstu\UserID for NUS Student
- nusext\UserID for NUS Visitors
- Login to AlumMAIL for NUS Alumni
- firstname_lastname@nuhs.edu.sg for NUHS

Password

Sign in

I forgot my password!

Abstraction: helps to identify minimal input required in apps



Decomposition…

breaking down problem, data, or system into smaller, more manageable parts

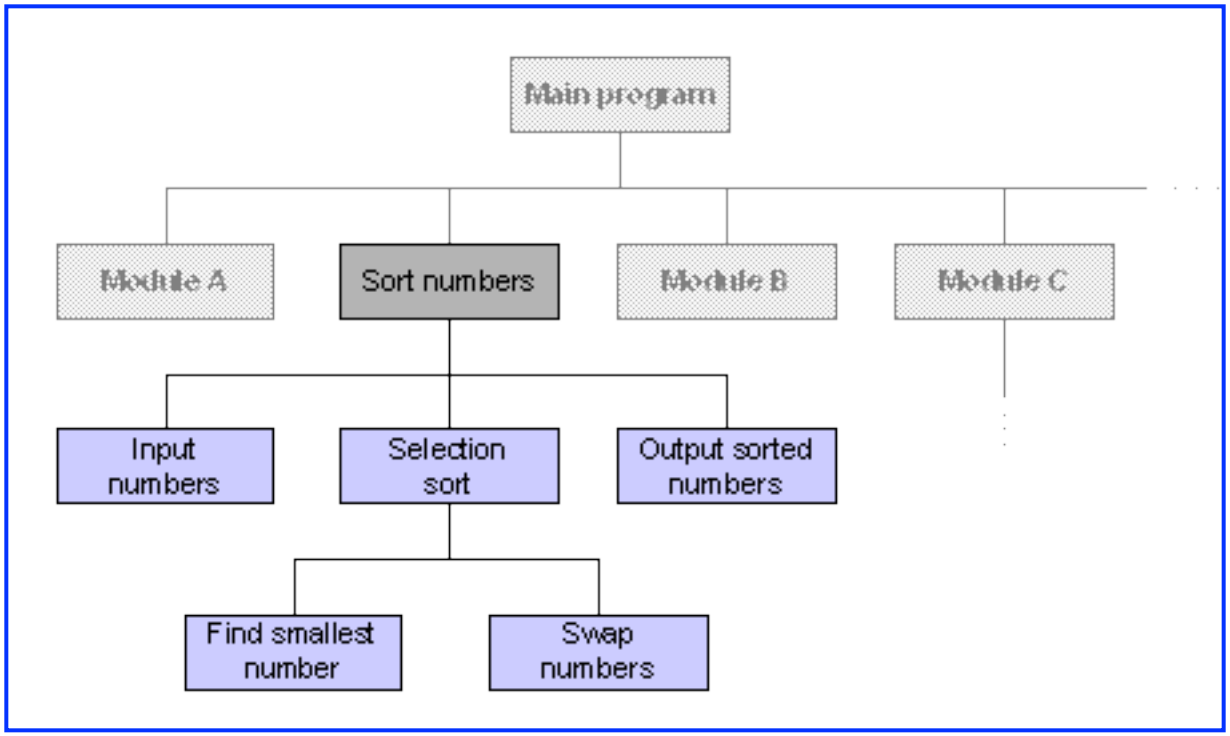
Decomposition in CT

(11min video from Curriki)
https://www.youtube.com/watch?v=yQVTijX437c

0:08 Polya problem solving
0:24 Eating an elephant;
0:45 Decomposition
1:38 Example: Total cost of beads

and examples from all areas…

Decomposition (2)

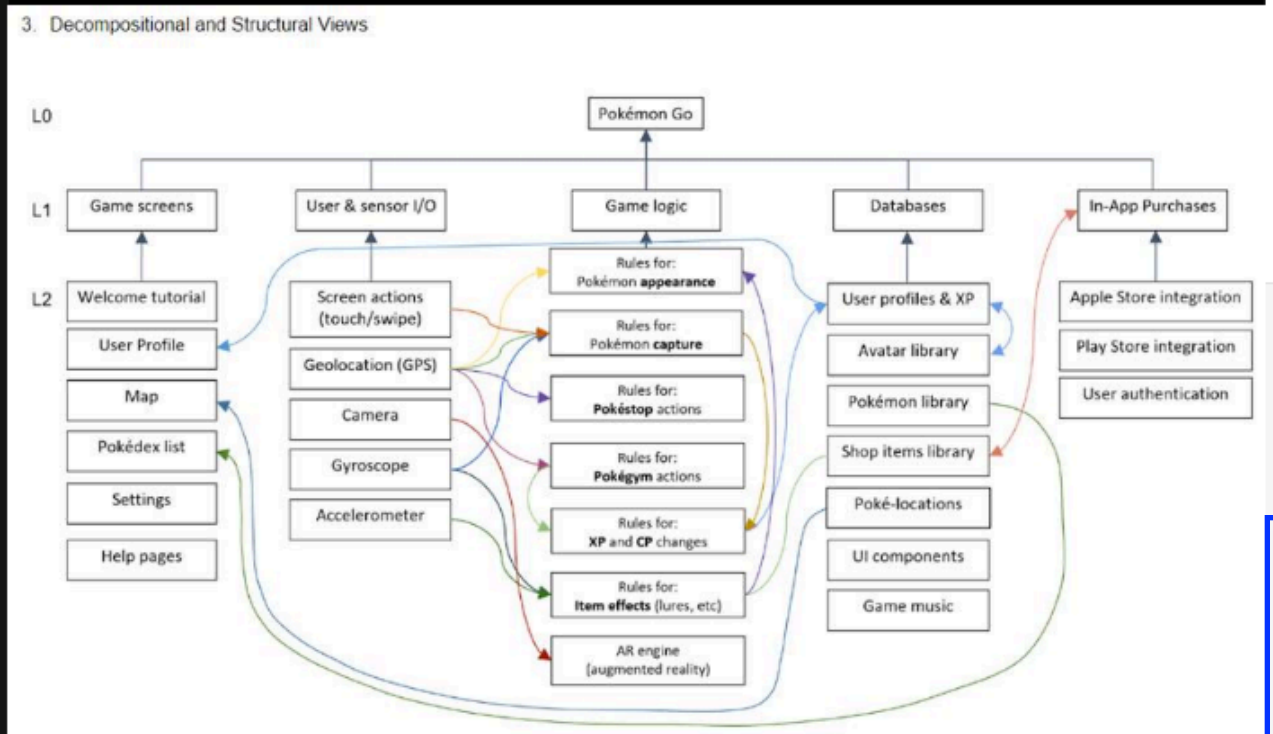


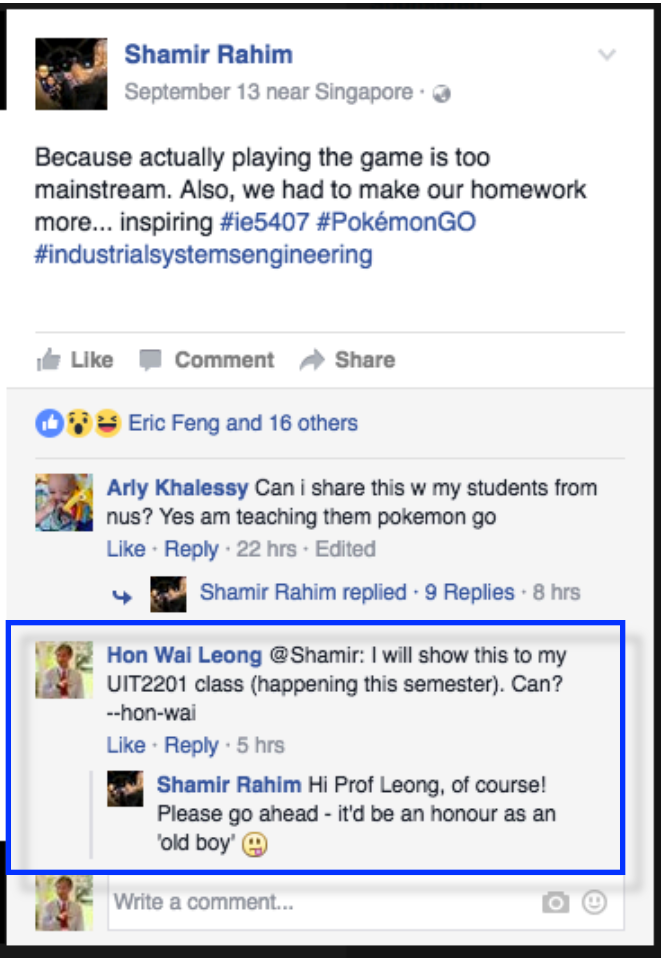
A program that requires sorting…
(a possible decomposition)

Decomposition (4)

Doing the Shopping
(a possible decomposition)

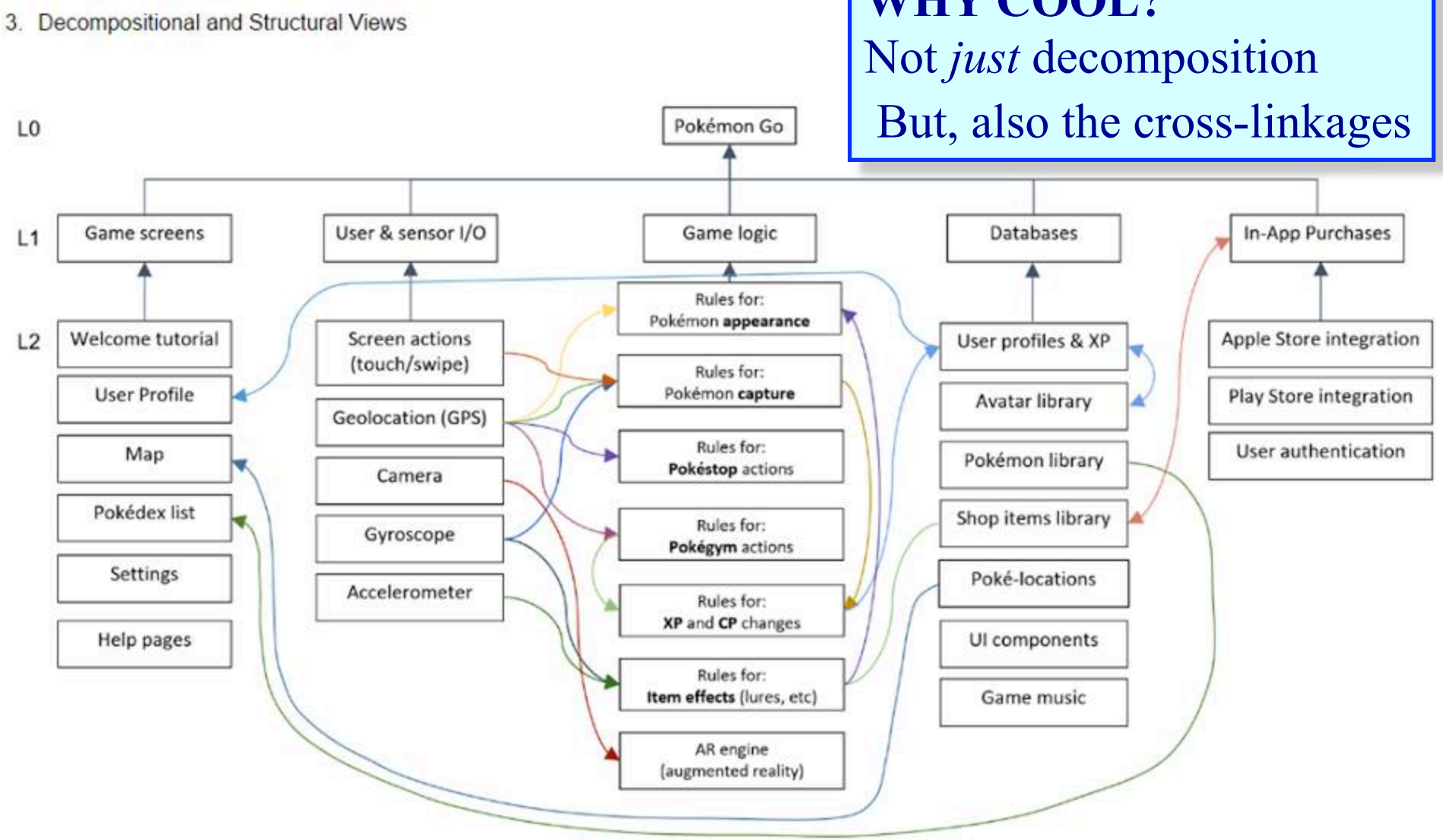
Shamir's Pokemon-Go…





Pokemon Go Decomposition

WHY COOL?
Not *just* decomposition
But, also the cross-linkages



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- What is ITeMS
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- Leveraging on CT skills
  - Ask new questions,
  - Solve new problems,
  - Invent new solutions,

Asking the CT question…

When faced with new problem/situation…

- Is there CT/algorithm hidden inside?
- Should there be CT/algorithm inside?
- How can CT/algorithm help?

Why is ITeMS relevant?

The Singapore NLB Story:
Chris Chia and ELiMS

A Perpetual Problem in all NLB Branches:

Branches closes at 10:00pm.

But there's "long queues at 9:45pm"

Users & Employee go home very late…

How to solve this Problem?

A Perpetual Problem in all NLB Branches:

Branches closes at 10:00pm.

But there's "long queues at 9:45pm"

Users & Employee go home very late…

Possible Solution?

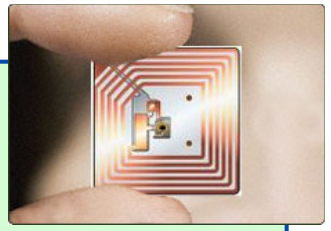
Have more service counters [need more people!]

Tell people to borrow (checkout) early [Don't work]

Close a bit earlier [does not solve root prob]

…

What was Chris Chia's answer?



Leverage on IT/CT solution: ELiMS

The **Electronic Library Management System** (ELiMS), the world's first to use radio frequency technology for lending and returning books, was introduced in 1998 ensuring S$50 million in savings. It was patented in July 1999.

"Poster Boy": the RFID chip on each library book!
It lets CT do all the work of tracking book borrowing/returns, etc.

http://www.stlogitrack.com/ELIMS.html
http://bizfaculty.nus.edu/faculty-profiles/321-christopher-chia

Who is Christopher Chia?

The Singapore NLB ELiMS Story

- Christopher Chia, NUS-Biz
- NCB-ICIS, ITI, NLB, MDA, NUS-Biz
- CEO of NLB (1995—2004)

Great success story on leveraging on CT.

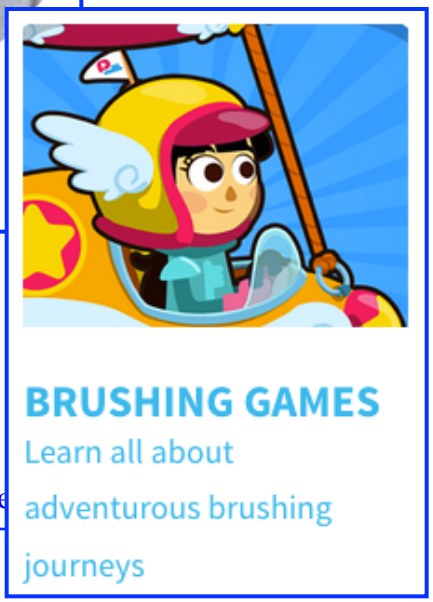
Just for FUN, I asked
"Can we make
brushing teeth FUN?"

Where to get my answer?
YES, Google first.

Smart toothbrush (Playbrush)

http://www.playbrush.com/en/

Many others: Gumplay, Kolibree,… (google them)



(Q-Module: CT Segme

You can apply ITeMS too…

More than 10 years ago, in UIT2201, I ask

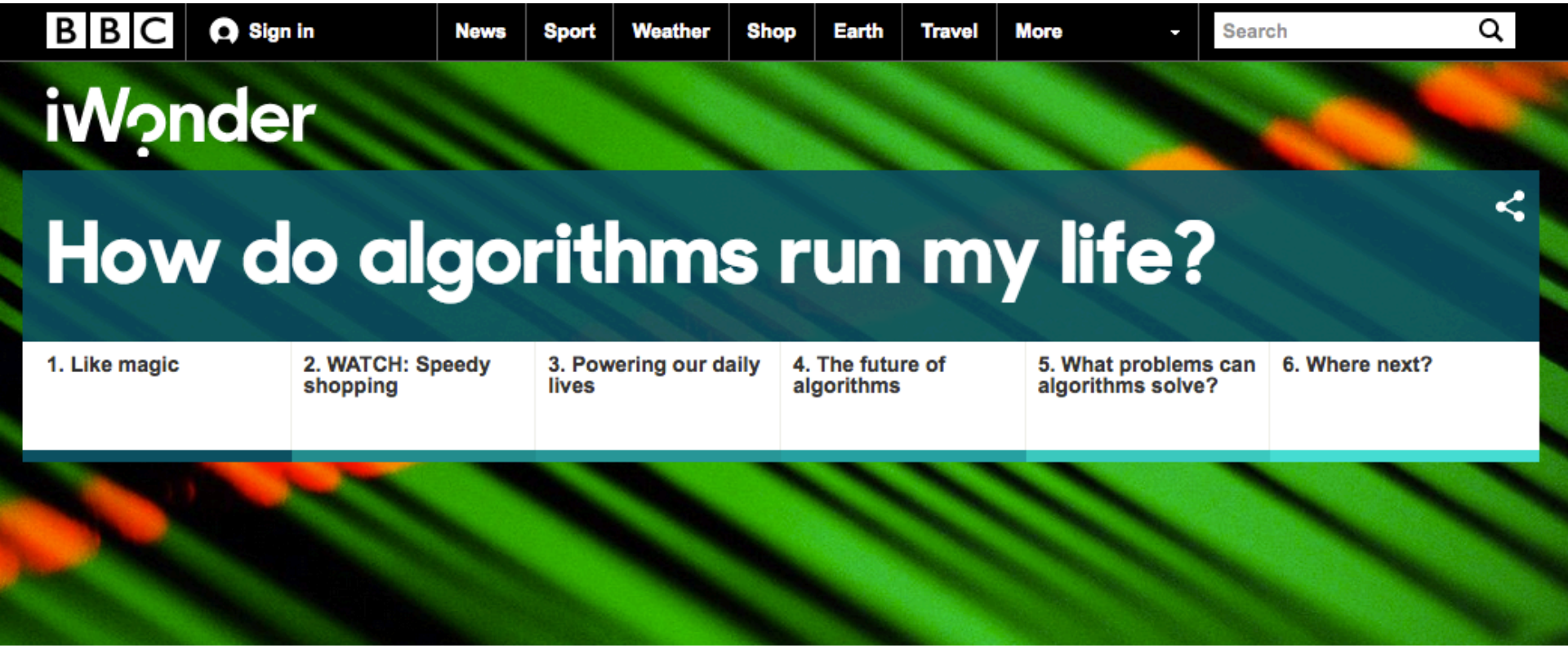
"How to make a *refrigerator* SMART?"

Samsung Family Hub Refrigerator

In 2017, in GEQ1000, I ask

"How to make *a door* SMART?"

How do Algorithm run my Life?



http://www.bbc.co.uk/guides/z3sg9qt#orb-banner

(End of video 6.4)

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