Special Topics: CSci 8980 Edge Computing
Edge Architecture, Services
Jon B. Weissman (jon@cs.umn.edu)
Department of Computer Science
University of Minnesota
ECC: Edge Cloud Composites
What is ECC?

- Compose edge resources to support “local” applications
  - Pool of resources
  - Not just computers, any home devices (screens, TVs, ...)
    - raw (camera), programmable (limited functions), fully virtualized (arbitrary code)
  - Also include remote cloud resources
- How does this differ from prior work?
ECC Abstractions

• Competence
  – Device capabilities needed for user tasks

• Intent
  – Tasks user wishes to accomplish
  – Not just based on competences

• Context
  – State
  – “user is in room X”
  – What competences are accessible
Competence

• Static
  – Functionality (display)
  – Quantitative (frames/sec)

• Dynamic
  – Accessibility
  – Availability

• Hierarchical
  – raw => feature (user visible event) => usecase (task)

• Types
  – offered (the device), local (nearby device), remote (these depends on context)

Let $S_i$ represent the competence instances available in the current context, and defined as follows

$$S_i = \bigcup_{j=0}^{n} C_j \exists D_i \leftrightarrow D_j$$
Intent

• Set of tasks and their interactions
  – Required competences + guidelines

• Guidelines
  – Topology: comm pattern of competences
  – Traversal: synch, asynch
  – Tie: constraints on where to run

\[
\text{Intent (I)} = f(R, \tilde{G}) \ \forall \ R \subseteq C
\]

Where, R is set of requested competences, G are the guidelines specified in user intent and C is the overall competence of a system \( (C) = \bigcup C_i \).
Context

- Current device availability and states

\[ \text{Context} (S) = \bigcup_{i=0}^{n} S_i \]
Use Case: home

Competences:
- TV - HD resolution display screens
- Audio system - High quality audio out
- PC/Laptop - Video decode, audio decode, display screens

Context: Home - Competences instances offered by home devices

Intent:
- AV decode competences (Fastest) connected with display (Biggest possible) & audio output (Best).

(i)
Use Case: office

Starts to get a little fuzzy …
Use Case: car
Possible assemblies of competence instances on devices based on context and intent.
ECC Engine/Interfaces

• Competence *instance* registers with ECC
  – hides actual h/w or s/w resources within it

• ECC Engine
  – dispatches intents
  – determines context
  – connects competences needed by app to those provided by device cloud
Apps provides intents + guidelines => ECC competences => “device cloud” chooses specific device that provides the competence
Discussion
Cloud4Home!
On Thursday

Air Box, Para Drop