SAVI Theme 1

Smart Applications

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Core Team

- **Baochun Li**, University of Toronto (Lead)
  - core expertise on the design and development of media streaming and social media applications, cloud platform support for mobile applications, and open software frameworks and platforms
  - experienced in media-intensive mobile applications
- **Eleni Stroulia**, University of Alberta
  - core expertise on socioeconomic concerns around building software systems for the purpose of service delivery
  - experienced in domain-specific languages, web services, and location-aware augmented reality
- **Hausi Müller**, University of Victoria
  - core expertise on feedback-based autonomic self-adaptive systems
  - experienced in context-aware social networking

SAVI's Definition of "Smart"

Instrumented Sensor networks and mobile phones sense user activities, in time, space and identity

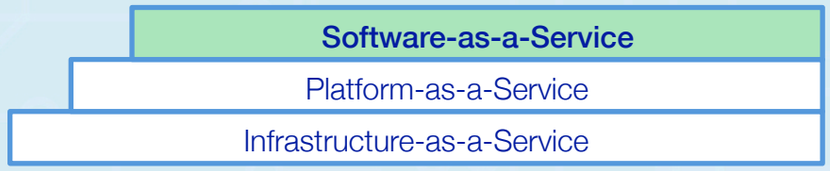
Interconnected Social or location-aware services define the storage blocks in terms of which data should be stored and replicated

Intelligent Decision making (re: infrastructure provisioning, management and adaptation) has to be done "real time"

Revisiting the Kaleidoscope

- **Social video sharing**
  - 10,000 people in a stadium/main square/emergency
  - 1,000 people streaming video from mobiles
  - **Context**: Twitter feeds with identities and timestamps
- **Integration** of data streams from different applications
  - Transcription
  - Tagging video with
    - tweets
    - links to other videos
- **Searching** for a video from a special perspective (location or content)
  - For video segments around specific tweeted events (through time stamps)
  - For videos from friends

Theme 1 — Smart Applications



Team: *Li (lead), Müller, Stroulia*; ¾ postdoc, 5 grads, 6 interns, 2 undergrads

Future-Oriented Application Classes

- Large-Scale Data-Intensive Apps
- User-Centric Apps for Smart Mobile Devices
- Real-Time Collaborative Virtual Reality Apps

Reusable Application Frameworks for Rapid Development

- Massively-Parallel Computation & Distributed Petascale Storage
- Mobile Online Presence & Collaboration
- System-wide Event Generation & Notification

Adaptive Deployment of Future-Oriented Applications

- Run-Time Binding Between Applications and Reusable Services
- Run-Time Adaptation of Application Deployment to Varying Resource Availability

Large-scale Data-intensive Apps

In-depth data analysis and processing, such as transcribing to text

Based on very large volumes of data, such as videos

Objective: provide reusable frameworks based on Hadoop, an open source “map-reduce” implementation

User-centric Apps for Smart Mobile Devices

Present a potentially complex collection of information from a variety of information sources to end users in a very user friendly, well organized, privacy-preserving, and social fashion

- time-sensitive
- location-dependent

Objective: provide reusable application frameworks to provide core services, such as identity and group management, online presence, location services, user authentication, privacy preservation, and push-based streaming of time-sensitive data

Real-time Collaborative Virtual Reality

Involve multiple users as participants

Require low latencies as applications let users interact in real-time

Examples: collaborative gaming, multi-party video conferencing, mobile messaging

Objective: design and implement a reusable framework that supports push-based streaming of time-sensitive data, with multiple participants involved and low latencies

Smart Applications: Objectives

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- To design, implement, and deploy future-oriented large-scale application classes over the SAVI testbed, as well as a taxonomy of their corresponding architecture models.
- To develop reusable application frameworks and services to support rapid development of large-scale distributed applications in the SAVI testbed, based on sound software development methodologies and design patterns, and to support scalability in resources for applications in SAVI, with corresponding QoE levels.
- To design, implement, and nurture an ecosystem of open source projects that are built by the composition and “mash-up” of reusable application frameworks and services that we provided.
- To monitor application behaviour and measure application-specific performance, with active interactions with performance prediction and resource allocation capabilities in the SAVI platform to autonomically re-provision resources. To optimize cost efficiency, application performance, and resource utilization.

SAVI Testbed & Theme Integration Activities

Planning & in-Lab Experiments
Year 1

Experiments on Small Network
Year 2

Multi-node Network Experiments
Year 3

Full Testbed Capability
Year 4 & 5

Prioritize application classes to be demo'ed; Prioritize Future Internet protocols to be demo'ed; Develop use cases triggered on SAVI testbed

Define all interfaces in SAVI platform and select software frameworks; Identify common approach to virtualization & adaptive resource mngt.

Select clearinghouse system and demonstrate on SAVI control bench model

Integrate NetFPGA & OpenFlow in SAVI cluster

Examine alternatives for integrated wireless/optical access

Demonstrate smart app over virtual cloud infrastructure

Demonstrate smart app over virtual smart edge infrastructure (SAVI cluster)

Interconnect two SAVI clusters and demonstrate Future Internet protocol

Develop wireless/optical access testbed platform

Extend to proof-of-concept at-scale testbed; Provide network slices; Demonstrate smart apps over virtual extended cloud infrastructure (integrated cloud & smart edge)

Demonstrate prototype PON carrying RoF to smart edge

Build out applications and virtual infrastructure to multiple locations and demo autonomic behaviour

Demonstrate virtualized wireless/ optical access

Smart Applications: Milestones

Year 1. Identify key features of the mobile messaging application to be used for large social media sharing and live gathering, which includes media sharing, live media streaming, dynamic group management, location-awareness, and online identities.

- ❖ Identify important common frameworks that are used in the application;
- ❖ Build individual components related to: (1) real-time collaborative audio and video; (2) location-aware augmented-reality; (3) location-aware, context-driven social networking.

Smart Applications: Milestones

Year 2. Design and implement reusable components, frameworks and services to support the mobile messaging application. Design and evaluate mechanisms for run-time deployment in the infrastructure. Design mechanisms for specifying advertised interfaces and for service discovery.

Year 3. Extend range of applications and involvement in more labs across small networks. Ultimately move to build initial multi-node experiments. Properties at this stage: Reusability; Development framework; Complex Applications; Mobility; Data Intensive; Media Intensive; using Virtual Services over new architectures.

Smart Applications Milestones

Year 4. Continue expanding application experiments. Start testing complex applications with virtual cloud and edge. Initiate first phase of at-scale testing across multiple campus networks.

Year 5. Take experiments to full SAVI testbed capabilities. Examine capabilities created by larger scale tests. Set up and execute applications with dynamic resource management and reallocation of virtual resources.