



## Situational Awareness Mashups at the Tactical Edge

featuring Soumya Simanta interviewed by Suzanne Miller

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**Suzanne Miller:** Welcome to the SEI podcast series, a production of the Carnegie Mellon Software Engineering Institute. The SEI is a federally funded research and development center at Carnegie Mellon University in Pittsburgh, Pennsylvania. A transcript of today's podcast is posted on the SEI website at [sei.cmu.edu/podcasts](http://sei.cmu.edu/podcasts).

My name is [Suzanne Miller](#). I'm a principal researcher here at the SEI, and today, I'm very pleased to introduce you to [Soumya Simanta](#), a researcher in the [Advance Mobile Systems Initiative](#). Soumya's research focuses on architecting and implementing mobile systems to increase the flexibility of soldiers and emergency responders who are involved in diverse missions. In today's podcast we're going to be talking about Soumya's work on [situational awareness mashups at the tactical edge](#). Welcome, Soumya.

**Soumya Simanta:** Thanks, Suzie.

**Suzanne:** For those of us who didn't grow up on the internet, why don't you tell us exactly what is a mashup?

**Soumya:** All right, so think about a [mashup](#) as a piece of software that combines data from different sources. It's something that was not originally designed to access data from these sources, and it opportunistically gets data from different sources. So, let me give an example. Imagine a capability—like you could see on a map, your laptop, or your mobile device all the tourist attractions in a city, and historical information about what the attraction is about, pictures about that attraction, and how other tourists have rated that attraction. So, all these things. Now, we're talking about, like, three or four different types of data. There is map data, which may come from a service like [Google](#) or [Bing](#); information about the site or the attraction itself that could come from [Wikipedia](#), for example. The user rating may come from a source like [TripAdvisor](#).

**Suzanne:** Okay, and if I wanted to know specifically about museums, then I could go from that. Another mashup might be just the museums in the Pittsburgh area.



**Soumya:** That's right.

**Suzanne:** So, it's the opportunistic part that makes it a mashup rather than a regular application.

**Soumya:** Yes, and none of these services or data sources were designed to support this use case, for example, but we are able to support it because you can kind of bring data from these things together and put it together very quickly. That's kind of the idea on a very high level.

**Suzanne:** That's what led you to the application that you worked on, right, called "[eMontage](#)" ([which is Edge Mission Oriented Tactical App Generator](#)).

**Soumya:** So, traditionally the ideas of mashups have been applied to web-based systems and doing it on bigger displays, like a laptop or a desktop display. We wanted to, kind of, take the same idea and push it towards a small handheld device.

**Suzanne:** So, people using a smartphone, like a soldier in the field or an emergency responder who doesn't have a big laptop, would be able to filter all the different kinds of data that they get, that they have to process.

**Soumya:** So, the idea was to be able to connect different sources. So, right now the way data is resides in a mobile app is it's siloed across different mobile apps. So, you would see some piece of data on app one and another piece of data on app two. So, imagine a first responder or soldier—people who are under very high stress—where they have to search between these apps, and then they have to *mash* this information in their head. So, there's some information available in app one and so on and so forth. But, our idea is very simple. It's just, *can we create a very simple interface where all the data is kind of unified on one interface?* So, they want this context switch, which kind of reduces the cognitive load. If it's putting them under high cognitive load they're not likely to use it.

**Suzanne:** So, if I had an app that was giving me information about, say, radiation levels—if I'm in some situation where I have to worry about that—and then I have a map. I want to move those two things together.

**Soumya:** Yes. So, a radiation-level app may have an existing map overlay, but you may also want to populate it with population data, right? So, you say, I want population data. Or, another example would be you may only want to see, okay, there is an app that can show you ID information, and there's another app that shows you historical ID information, and there is another app that shows you, say, some other information about the city. Then, you want to combine that information in a meaningful way so that it's more useful.

**Suzanne:** So, this interface lets you put all the different data types together and then essentially say *I want this one. I don't want that one. I want this one. I don't want that one.*



**Soumya:** Yes. So, fundamentally, what it does or it allows you to do is to select the data sources that you want to use. We have a big list of existing data sources, and you could add more data sources to it. There are public data sources available on the internet like I talked about, Google Places or Twitter or these kinds of data sources, and there are, like, private data sources that are specific to the domain.

So, in [the] case of the first responders, there could be some missing person database, which is not publicly available. So, the user sees a list of the data sources. They can select which data sources they want to use, and they can apply data filters to see the data that's available to them for that particular mission.

**Suzanne:** So, I only want to see data within a hundred miles of here.

**Soumya:** Yes, so they can create a pretty complex filter and say, *okay I want to see data in this radius or within this date range that contains these attributes* and a bunch of other criteria that they want to specify at runtime. They can do it on a very simple interface, very quickly, without writing any code.

**Suzanne:** That's all part of reducing the cognitive load.

**Soumya:** That's right.

**Suzanne:** So, there have to be some challenges—I know from my days working in interoperability—in getting all those data sources to gracefully work together.

**Soumya:** Yes. So, we kind of make an assumption to make it simple. We looked at a bunch of data sources that deal with situational-awareness data, and most of those data sources had some kind of geo-location or spatial component associated with them. So, essentially...

**Suzanne:** Latitude and longitude data.

**Soumya:** That's right. Our idea was to kind of use that as a key to connect it across different data sources. So, we can [use?] pretty much any format like [XML](#), [JSON \[JavaScript Object Notation\]](#), and [flat-files](#) as inputs to the data source. Then, the server component of our system converts it to a more compact format that's suitable for a tactical environment.

**Suzanne:** Right, because not all of these applications were meant for mobile, right?

**Soumya:** Yes. And then what we do is kind of use that to display it or kind of show it on the mobile device.

**Suzanne:** To make this work and to get confidence in it, you've got to do a lot of testing with it so you can understand what kinds of things people actually think are simple versus what a



programmer *thinks* is simple and things like that. How did you go about field testing this kind of an app?

**Soumya:** We basically tested--demoed--this and field-tested it a few times at an event called [JIFX \[Joint-Interagency Field Experimentation\]](#) that's organized by the [Naval Post-graduate School in California](#). We have actual real users that come to that event. We demoed our app and then asked them to use it.

**Suzanne:** So, you got to observe them using it in a simulated situation?

**Soumya:** They gave us feedback about what they liked, what other features they would like to have, things like that. We've taken most of that feedback and incorporated into our software, but remember, it's a prototype.

**Suzanne:** You aren't going to find this on the app store.

**Soumya:** The idea was to take our ideas from concept and build a prototype and demonstrate that this can actually be done and [learn] *what are the operational deficiency and trade-offs that you need to do?* So, in the end, the most important thing that came out of this work, I would say, is the prototype is fine. It shows that this can be done, but what we have is an architecture.

**Suzanne:** You've got an architecture pattern that people could follow.

**Soumya:** It works to solve the problems that we've discussed before.

**Suzanne:** Okay, excellent. So, who do you think might want to adopt this kind of an app? What kinds of organizations might want to use this?

**Soumya:** This was built, the whole idea was because [AMS, the Advance Mobile Systems Initiative Environment](#), they focus on tactical edge, which is kind of a very resource-constrained environment. There are users who are always under high stress and high-cognitive load. So, anybody who's working in this environment—and it's kind of true about first responders as well, right—they should be able to take our concept and whatever we have learned, and what we have implemented, and apply it in their environment.

**Suzanne:** So, what you're really targeting here is developers of applications, say, for a 911-type-of-organization or tactical-edge, not the end users themselves. You would expect it would actually be more developers that would use the architectural patterns to develop something for their end users, right?

**Soumya:** Yes. Right now, for example, when adding a new data source, we make an assumption that the person who's adding has some programming skills. We give instructions about how to add it, but since every data source is different, it takes anywhere from a day to a week to add a



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new source, depending upon how complex the data format is. But, once you've added it, it's there. The data filtering that I talked about before, you don't have to implement anything or write any code.

**Suzanne:** That's end-user focused.

**Soumya:** This work evolved from previous work where we were focused on doing end-user programming on a handheld device. In some sense, there is some component where you have to know how to program, and you have to be a developer. The other piece is completely end-user focused. You just need to know how to program a smartphone or a tablet, that's all. You must be familiar with the domain, the data that you are after.

**Suzanne:** So, like many other projects here at the SEI, I know your research involves several collaborations. Can you tell us a little bit about the people that you're collaborating with on this work?

**Soumya:** That's a very good follow-on. As I said before, this work came out of another piece of work where we collaborated very closely with [Dr. Brad Myers](#). He's a professor at CMU at the [Human Computer Interaction Institute](#). So, as I described before, one of the problems that we currently have is we assume that the person who is adding new data sources in the system knows programming. So, Kerry, one of Brad's Ph.D., is trying to automate it and make it end-user friendly.

**Suzanne:** Make it like a wizard.

**Soumya:** Yes. So, you don't have to write code to add a new data source. We've kind of solved it for a large class of data sources, but understand that every data source is going to be unique.

So, we cannot provide one solution that fits all. We have made enough progress in that area. The other way that we are collaborating on this is we [are] kind of trying to use eMontage in other research projects that we have inside AMS [The SEI's Advanced Mobile Systems Initiative]. There's another project that I'm currently working on where we have leveraged the eMontage, like all the lessons we have learned, and even the prototype in that project.

**Suzanne:** Excellent. So, you're pretty busy with this. What's next for you in this area?

**Soumya:** So, as I said before, I'm working on another project, which is called [edge analytics](#). Basically, right now, we're not doing anything with the data. We just filter it and present it to the user, right? But, imagine if there is more we can do with the data, process it so that it becomes more meaningful for the user.

**Suzanne:** So, the data becomes information.



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**Soumya:** Yes. So, that's kind of the next logical step, and that's the project that I'm working on. We've extended eMontage, and the use case that we are dealing with right now is kind of analyzing real-time streams of censored information and social media feeds like Twitter.

**Suzanne:** That will be interesting. Maybe you'll do a podcast for us on that in a couple of months.

**Soumya:** I will be more than happy to do that.

**Suzanne:** Good. Well, I think you've got your hands full, you always do and I do look forward, and the rest of us look forward, to some of your results as these emerge. And I want to thank you very much for joining us today, Soumya.

**Soumya:** Thank you very much. It was a pleasure.

**Suzanne:** If you'd like more information on Soumya's work in mobile and edge systems, you can check out his blog post. Just go to [blog.sei.cmu.edu](http://blog.sei.cmu.edu) in the right-hand column click on [Soumya's name](#) or the [handheld devices tag](#). For more information on the research Soumya's team is doing in pervasive mobile computing, please see our work website at [sei.cmu.edu/mobile-computing/research/index.cfm](http://sei.cmu.edu/mobile-computing/research/index.cfm). This podcast is available on the SEI website at [sei.cmu.edu/podcasts](http://sei.cmu.edu/podcasts) and on [Carnegie Mellon University's iTunes U site](#). As always, if you have any questions please don't hesitate to e-mail us at [info@sei.cmu.edu](mailto:info@sei.cmu.edu). Thank you.