

# Esri Tracking Solutions: Working with Real-Time Data

David Kaiser and Adam Mollenkopf explore various techniques to manage, visualize, and analyze live data feeds within ArcGIS.

[http://video.esri.com/watch/658/esri-tracking-solutions-working-with-real\\_dash\\_time-data](http://video.esri.com/watch/658/esri-tracking-solutions-working-with-real_dash_time-data)

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## Video Transcription

**00:01** My name's Adam Mollenkopf. I've got David Kaiser with me as well here. We're from the tracking team at Esri.

**00:04** ..where we have a track ID, which may be the bus number. And then we have an observed time, so, you know...

**00:05** What we're going to talk about today is working with real-time data, so, in today's world...

**00:10** ...real-time data is becoming more and more prevalent, from everybody having phones out in the field...

**00:14** ...to other things that need to be tracked. So we really think this is a relevant topic and...

**00:21** ...want to walk you through some of the offerings we have at Esri.

**00:24** So what we're going to do is we're going to introduce what real-time data is, what the options are within Esri...

**00:30** ...to acquire and analyze real-time data, as well as managing, visualizing, and analyzing that data over time.

**00:38** And then we'll talk about some client applications and the various environments that you can deploy real-time data.

**00:44** You can push real-time data to those clients, and we'll talk through some of those scenarios while providing demos.

**00:46** Filter is a very common one.

**00:51** So once we get this data collected and brought into Tracking Server, well, you can perform real-time analysis on that...

**00:53** So a brief introduction. Common applications of real-time data, or tracking, would be for these three primary areas here.

**00:59** ...so operations could be performed against this data. So in this case, we really want to create an alert to notify somebody...

**01:01** So mobile resource management, which would include tracking assets in the field, so be it

equipment in a yard...

**01:08** ...or people out in a, a field doing work orders, or, as well as vehicles.

**01:14** So you know, vehicles is kind of the common application to this.

**01:18** You may have heard the term AVL or automatic vehicle location. So AVL is a very common application of...

**01:24** ...of tracking. And other areas, you know, in defense and kind of the intel space, being able to track things...

**01:31** to help us protect our borders and provide intelligence for how to monitor our, the security of our nation...

**01:38** ...as well as from a defense command and control kind of application.

**01:43** And then other, less obvious applications of tracking are things from sensors.

**01:48** So this could be anything from a traffic sensor on the road to a, a buoy out in the ocean that's tracking...

**01:56** ...the ocean and the various aspects of, of that...as well as seismic activity. You've seen the...

**02:02** ...you've probably seen the common applications of earthquake tracking and, and things of that nature...

**02:06** ...and being able to, to analyze in real time what's happening with the earth and the health of the earth.

**02:11** And then finally hydrographic.

**02:16** So the big picture of real-time data is that there's all these heterogeneous devices out in the field.

**02:22** So there's boats, aircraft, phones, vehicles, construction equipment, sensor networks, you name it.

**02:30** Anything that could provide a GPS coordinate is a trackable entity.

**02:34** So what we're going to walk through today is, how do you work with those data? How do you get this data into...

**02:39** ...your organization, and how do you analyze that data? So there's ArcGIS Server, and there's also Tracking Server...

**02:46** ...as part of the product line at Esri, and these are very complementary technologies to one another.

**02:51** It's, it's, it's not a one or the other. They're very complementary to each other, and we'll show how that...

**02:57** ...that is, is the case in some of the demos that we show.

**03:00** Tracking Server primarily is the conduit to collect this data or acquire this data from the field.

**03:07** So we'll walk through some examples of how we collect that data from various devices.

**03:12** And then it also provides real-time analysis of that data, so as opposed to logging in to a...

**03:19** ...a geodatabase and then performing GP on it after the fact that the data's received, it provides a conduit...

**03:25** ...to provide real-time analysis as the data's received and the event's observed...

**03:30** ...we can provide analysis on that in real time, and then push that to various clients.

**03:35** And it works in really any environment, be it desktop, web, or mobile. We'll show illustrations of...

**03:41** ...of each one of those as we walk through here. So, managing real-time data.

**03:46** The first step to dealing with real-time data is acquiring the real-time data.

**03:51** So as I mentioned, you know, there's very many different devices out in the field.

**03:55** Tracking Server provides a capability called a data link, and this, what a data link is primarily responsible for...

**04:02** ...is connecting to that data out in the field, connect it to the device, acquiring information from that device...

**04:10** ...if it's broadcasting information or if it's requested from the device...

**04:14** ...and then converting the format that the device is providing...

**04:18** ...into a common format that Tracking Server can understand to perform that analysis on it.

**04:23** So for a mobile phone, there may be an application that's sending data, or it may be requested through a cell provider...

**04:31** ...that I want to know where this particular phone number is.

**04:34** We can gather that data in, and the data link will be responsible for collecting and formatting that data into the right form.

**04:43** So an example of that is, it needs to come into a format that Tracking Server understands, as I mentioned before...

**04:50** ...and that format is something that conforms to a message definition. So the message definition is basically a very simple...

**04:57** ...definition about the data coming in, and at the bottom, you can kind of see...

**05:02** ...a message, a very simple message definition for a bus...

**05:10** ...usually all of these need to have a time element to it so we know when that position report was reported...

**05:16** ...as well as the shape, so it would have the x,y coordinate and z or n or...

**05:20** ...whatever else was appropriate for that device as well...

**05:23** ...and additional attributes. So in this case, the application that we'll show here is one that...

**05:29** ...where we want to know if a panic button has been pressed inside a bus, so maybe there's some issue on the bus...

**05:33** ...and the driver pushes a panic button. So that data can come into Tracking Server in a variety of different formats.

**05:40** What comes out of the box with Tracking Server is what's called generic input, and generic input provides text-based data...

**05:48** ...to flow into Tracking Server, so it can be CSV or a common XML form. In the case of what's on the screen...

**05:56** ...we're showing the XML form, so you would get a message, and what we call that message is a data message.

**06:02** So a data message flows in from a device, and it has an ID that tells you what message definition to use.

**06:09** So that ID in this case is Bus, and then it has various fields on there...

**06:13** ...so you can see how it conforms to that message definition below.

**06:16** And in this case, the panic button is false. On the left is what the device on the bus is actually reporting...

**06:22** ...so that could be a binary protocol, it could be various different protocols. And Tracking Server supports TCP, UDP...

**06:30** ...pretty much every protocol that is possible from these devices. And if you can't...

**06:34** ...if you don't want to use the generic input, you can actually write your own data link that can do anything you want.

**06:40** So if you want to acknowledge with the device that you received the data, that's something that you could customize...

**07:06** ...when a panic button is pressed on a bus so we can take corrective action to, to remedy that situation.

**07:13** But this could be really anything. It could be an attribute. In that...in this case of, you know, the panic button...

**07:17** ...or it could be a spatial condition. So this, this vehicle or this aircraft has entered a certain space that's a restricted space...

**07:25** ...or it's deviated from the route that it's supposed to stay on. So you could have, you know, enter, exit, polygon kind of actions.

**07:33** So spatial conditions can be applied, and we'll...David will show some examples of that here in a moment.

**07:43** The five that are listed over there are the ones that are out of the box.

**07:48** In this case where we want to filter out all the message except the ones that have panic buttons.

**07:53** So a very common application of, of tracking is that you've got a very large amount of data...

**07:59** ...and you are only interested in exceptional events, where you want to know...

**08:03** ...that there's a panic-button press so you can take action on that.

**08:05** So Filter's a very good mechanism to filter out the data that you may not be interested in...

**08:10** ...or to narrow your focus of what you're interested in.

**08:14** Data modification is an action that basically augments the message with additional information...

**08:19** ...or removes attributes that aren't necessarily interesting going forward.

**08:23** And then e-mail alert is a standard alert...

**08:28** ...standard action that can e-mail somebody in the case that the panic button is pressed.

**08:32** So we can e-mail somebody. And then Data Partition. If you have a message coming in and you want to perform multiple...

**08:39** ...steps of analysis on it, and you want to do that in a fashion where you can split it off and split the message...

**08:44** ...and have it go down different paths, that's what the Data Partition is about.

**08:48** And then Data Summary provides statistical information about the data coming in to the server.

**08:56** So a couple utilities that are provided by the Tracking product out of the box is what's called a Tracking Simulator.

**09:03** So oftentimes when you're in the office and you're developing your application for this, you need to simulate the data that's...

**09:09** ...out in the field 'cause you don't necessarily have a device that's giving you the conditions that you want to test against.

**09:15** So the Tracking Simulator is a utility out of the box that you can play back something you recorded in the field...

**09:21** ...or you can make up a scenario and play that scenario through. And it basically sends those data messages, be they XML...

**09:28** ...or whatever format they are, into Tracking Server. There's also another utility called Data

Message Viewer...

**09:34** ...which receives these messages from Tracking Server. So it listens to the end result of what's coming out of Tracking Server.

**09:41** And Tracking Server provides a number of tracking services that can be subscribed to a client...

**09:47** ...and Tracking Server pushes observations to those clients so that they can receive that data. So in this...

**09:54** ...in the case that we're about to show, a bus is going to send a message; want to run a test to see if the panic button is on.

**09:59** If it's not, then we're going to filter that message out. If it is, the panic button is on, then we're going to send that message...

**10:06** ...to the Data Message Viewer. And Tracking Manager is the configuration interface for Tracking Server.

**10:13** So this is where you set up your message definitions. You set up what your generic input is going to be and your data links.

**10:19** So let's show a quick demo of that.

**10:27** So here's the Tracking Simulator, and what this is, you can tell what Tracking Server you want to connect to.

**10:33** In this case, I'm going to browse to a bus file that we recorded out in the field. Now, I'm going to play through that data.

**10:39** So you can control what the data rate is, which would tell you to send a message every 10 milliseconds...

**10:45** ...and you can provide it on a continuous loop.

**10:47** So we also have the, the Data Message Viewer, and if I connect to the server...

**10:52** ...then I'll start to receive messages from that.

**10:54** So we're just going to show a, you know, full-fledged bus tracking application here.

**10:59** And when we start this, we'll start to see data messages flowing through here.

**11:03** So you see the message count kind of updating here.

**11:06** Tracking Server is, is built to be very high volume, high throughput application.

**11:12** So we have common applications of, you know, multiple, hundreds of message per second that go through this.

**11:18** ...But it's also very applicable to other applications that...

**11:21** ...don't necessarily have that volume. So you can see that we've got, you know, a thousand

messages that came through here.

**11:27** But this was every message. This was, the panic button was false, the panic button was true.

**11:31** So I want to go define an action that's a real-time analysis step in Tracking Server that'll basically filter that down.

**11:37** So if I go onto my Tracking Server Manager, this is the generic input where the data is flowing into.

**11:43** And if I open this up, you can see that it's an XML generic input. It could be CSV or XML.

**11:50** And we specify what the transport protocol is here. So if you happen to have devices that [inaudible/unintelligible]...

**11:56** ...you just establish that as a new data link. So that's the data link.

**12:01** And then our message definitions, this is the bus message definition. If I edit this, you can go in here and see.

**12:07** These are the fields of the messages that are coming in.

**12:10** So this is kind of the schema of what the data messages are supposed to look like.

**12:14** And there's various data types that are supported here, and in this case, we're reporting points.

**12:19** Tracking Server is not limited to just receiving point data. It can also receive polygon data or other types of data.

**12:25** So, you know, if you have aircraft producing imagery or polygons of what's coming in...

**12:31** ...that's also valid data that could come in, and you can analyze it. So it's not just point data. It can be lines or polygons.

**12:38** So I want to go define a new action, and if we go to our Actions tab, based on each message definition...

**12:44** ...you'll notice that I don't have any actions defined now. So if I go in here, I can define a new action...

**12:49** ...and you'll see the out-of-the-box actions that are supported here. Like I mentioned before...

**12:53** ...you can extend this. There's an SDK to create your own types of actions if you'd like to.

**12:58** Then they would show up as a valid option here. In this case, we're going to create a bus panic action that's a filter.

**13:05** So we're going to filter based on the panic button. So I hit OK on this.

**13:09** You'll notice that we have our Conditions section here.

**13:13** So these are the conditions that I want to make sure are met for this particular action.

**13:17** You didn't choose Filter.

**13:19** Oh. Thank you. Let me actually create a filter action 'cause I did a data modification action.

**13:27** So if I choose Filter, then we can come in here, and this is our Conditions list. So if I want a location query...

**13:34** ...I can go select what my sources. This can be a shapefile, it can be a feature in a geodatabase...

**13:40** ...it can come from just about any standard ArcGIS format.

**13:44** You can select those sets of polygons or whatever you're interested in.

**13:48** And then you can detect what the trigger is. So you can say, "I want to know when this bus intersects this polygon..."

**13:54** ...or when it arrives inside," arriving being there is a point observed outside and a point observed inside...

**14:00** ...as well as departing, or it crosses.

**14:02** So if you have a line or a small polygon that you want to see if a position was reported on...

**14:09** ...one side and then another position was reported on the other side, we can interpolate that it crossed that polygon.

**14:16** So in this case, I just want a simple attribute query. So I go into my Query Builder. This should be very...

**14:24** ...this should be very familiar to you if you're familiar with ArcMap. And I can go define a Panic Equal True.

**14:31** And if I do that, if I apply that, and I come back over here, when I run the simulator, if I clear out this data...

**14:37** ...we should filter out based on just the messages that have Panic Equal True.

**14:43** So what you'll notice here is we're getting, you know...

**14:45** ...only four or five messages here for the same bus that's reporting a true panic button status.

**15:01** So we're going to shift into, how do you visualize this data? So now we've received the data from a device...

**15:06** ...we've acquired it and collected it. We've performed some real-time analysis on it. But now we want to visualize this.

**15:12** David's going to walk you through some of the examples here.

**15:18** Okay, so Adam talked quite a bit about the data path, or how messages get processed through the server.

**15:26** So I'm going to actually kind of focus on clients and clients' ability to visualize and display this

real-time information...

**15:34** ...into a tracking display. I'm going to do kind of just a remedial overview of the real-time GIS patterns.

**15:40** This is something that you'll see in just about any tracking, training, or even in like our time and GIS workshop.

**15:49** So the most common thing that people think of for a real-time GIS pattern is something that just call, like, a dynamic GIS.

**15:56** And this is most easily thought of as a moving object, and so the majority of us think of an AVL system...

**16:04** ...or any kind of system for tracking flights or ships or anything in motion. And that's really...something that moves.

**16:11** The other common one that comes up quite a bit is what we call, like, a discrete event, such as a lightning strike or a crime...

**16:21** ...or sometimes your boss schedules a meeting at work without any warning...

**16:23** ...which could be like a lightning strike to him or a crime to you, so...

**16:27** These kinds of things are just sporadic; they happen. The next thing that you'd think of as a stationary...

**16:33** ...which is still kind of a dynamic event except we know where it's going to be, so it's kind of a combination of the...

**16:40** ...nonmoving, like a discrete event but it's something that is continuing to evolve. So it's a center network pattern.

**16:47** We're getting continuous data source readings. And then there's the change pattern, where we're really using the value to display...

**16:57** ...a cumulative growth, or analysis, over time as the real-time data is coming into the solution.

**17:05** So what we're going to focus on today is largely the dynamic pattern, but Tracking Analyst...

**17:09** ...and other visualization clients can be configured or you can actually...

**17:14** ...make use of any of our APIs that can consume Tracking Server services to do the change pattern, the discrete pattern...

**17:22** ...any of these other solutions can be implemented quite easily, but we're going to focus on the dynamic GIS pattern.

**17:29** So real-time mapping is something that I guess you could say is a hands-off or unattended display...

**17:36** ...where as information is being brought to the context of the application, information is just displayed for you.

**17:42** So in a technical sense, it means we're not querying the database continuously. We're actually just listening for information...

**17:49** ...to be pushed to us from Tracking Server. In that case, you may have a map display that is receiving a small amount of...

**17:55** ...information at some times and a great amount of information at other times. If it's a sensor network-type map...

**18:01** ...you might see a nominal amount of data, and then as a storm blows through your area, you might receive lots of...

**18:07** ...moving-event information or sensor information. But the advantages in Tracking Analyst are more than just...

**18:14** ...real-time information processing but also specific display that shows how we can get analysis from the visualization...

**18:24** ...of that information. So there's an ability to render tracks where there were only multiple features...

**18:31** ...and this is easily represented in many of the displays that you've seen, either the plenary or any of our screen shots...

**18:37** ...or having seen any of our demos at our booths. You might see multiple individual symbols. Well, with Tracking Analyst...

**18:44** ...you can actually display those as a line without actually viewing the data as a line or processing the data as a line.

**18:51** And there's a number of advanced options that go with that tracking-style symbology.

**18:57** The other thing that is real interesting about real-time mapping is what we call actions, and this is the same framework...

**19:02** ...that Adam demonstrated in the server. But it's the ability to individually...

**19:07** ...per data message or per update in that real-time sense...

**19:11** ...make a decision of what to do to visualize that information. So filtering information out is a simplistic example, but...

**19:18** ...you could also change the symbol dynamically based upon how frequently it's being updated or...

**19:23** ...if it has crossed into a specific boundary area. So here are some additional examples of these symbology options.

**19:31** These are all available out of the box in Tracking Analyst. Some of the ones that we've demonstrated are seen.

**19:37** The most current symbol is different than any of the other symbols, so you can see if you're looking...

**19:41** ...at a sequence of symbols, the one that's arrived most recently would have a different symbol type, for example.

**19:48** There is the ability to display multiple textural attributes, so if you see the upper two screen shots...

**19:54** ...that we're labeling five or six attributes for the most current symbol of that hurricane track.

**20:01** There is a number of other things. I won't go into all the details, but being the predictive vectors...

**20:05** ...and the smoothing of the tracks are some of the more common usage in displaying these tracks.

**20:14** So I'm going to actually do a demo here and cover some basic Tracking Analyst capabilities.

**20:24** So in my local workstation here, I'm running Tracking Server and I am subscribing to some AIS information.

**20:32** So AIS is a nautical information source. It's actually tracking the ship positions. And ships use AIS for...

**20:41** ...collision avoidance, so they can actually see each other through some short-range radio with some identifiers.

**20:46** But we have the ability along our coastlines to also receive that information...

**20:50** ...so we're able to get kind of an operational picture of these ship positions.

**20:56** So right now, I am connected to Tracking Server, and as soon as I get to the right display here...

**21:08** So we're looking at 36,000 ship positions.

**21:14** If I were to bring this up again in my attribute table, you know, we have 40,000, so...

**21:23** ...we're getting I think it's about 60 a second or something that we're receiving here.

**21:28** And Tracking Analyst is actually configured with some memory management.

**21:31** I have it set at about 50,000 rows, so at some point, I will start to release the old information as new information arrives.

**21:38** So it's going to keep me about a 30- or 45-minute window of data continuously being updated onto the screen.

**21:45** If I were to, you know, kind of zoom into an area here, I kind of like to look at these canals, like by Lake Ontario, and...

**21:55** ...kind of, you know, see the AIS information is actually fairly accurate when registered against the imagery we have...

**22:03** ...looking at the barges and other ships kind of moving up and down our canals.

**22:08** But this is a good use case here of looking at...and by the way, I have symbolized on ship type.

**22:16** So in that attribute table, you might have seen that of the different types of ships, there's 15 to 20.

**22:20** It's a category. There might be a small, private ship; there might be a large freighter or cargo container ship.

**22:27** So this is just a typing kind of field for categorization, so that's what I've symbolized on, and there's...

**22:33** ...0 through 99, we've received some of those in our live feed. But I can easily tell, I guess, that maybe this yellow one...

**22:39** ...is one ship and that maybe this green one might be one ship. So something I can actually do is instantly say...

**22:48** ...I only want to display the most current event and not all the events. So I'm going to redraw my display, and then you'll see here...

**22:56** ...is that yellow one is the ship that's kind of left that canal and is already moving out into the next body of water.

**23:02** But that doesn't really add as much value as if I can actually find here and enable the track lines.

**23:09** So this is one of the basic functionality, where we're just taking multiple observations and rendering it as a line feature...

**23:15** ...where we didn't have a line feature inside of our source data. So these are some of the basic ways to visualize that data.

**23:25** I have another use case here, where I've kind of looked at...if I can find it here...to kind of demonstrate...

**23:34** ...the action processing methods that we have. This is in the central coast of California.

**23:39** This is, you know, Oxnard and Point Hueneme...

**23:42** ...which is kind of north of Los Angeles, if you recognize Santa Barbara and further north.

**23:47** And this here is actually an interesting...something that we recognize with, like, the tsunami in Japan...

**23:55** ...where there's a nuclear reactor right on the coast. So this is Diablo Canyon nuclear reactor.

**24:00** What I've done is actually taken from a NOAA nautical chart that there was actually a...

**24:08** ...I didn't actually preload this one, so it's going to go out to the Internet to fetch it in here.

**24:12** But there's actually a buffer that was drawn for me here, which was the nuclear plant security zone.

**24:22** And so that is recognized by the Coast Guard and everything as an area that we don't really

want to see any ship traffic.

**24:28** So I've just kind of taken this buffer and created this outline. And so I actually...

**24:36** ...because we don't see any real ships going through there today, just for the purpose of running a demo...

**24:41** ...I've been running a simulator here to kind of show that there is a particular ship kind of passing through this area.

**24:49** So one of the things I'm going to set up first is to, let's go look at this action configuration for the Tracking Analyst action.

**24:55** So I've got this highlight where I'm going to overlay an additional symbol on top of the additional symbology settings...

**25:03** ...which are still looking at the ship type category. Still going to draw the track line, it's still going to...

**25:07** ...if you have any scaling or aging or any other tracking properties enabled, we're going to use those.

**25:13** But we're also going to do a location query. It's the same triggers that we had in Tracking Server.

**25:18** We're still looking at whether it intersects or doesn't intersect, but I'm going to just set it to Intersect.

**25:23** If it intersects with that outline around that Diablo Canyon nuclear center power plant.

**25:28** So let's go ahead and save that...and...So I've got my simulator running...got this guy coming up through here...

**25:40** ...I think we should speed it up a little bit. Just for the demo purposes, we'll speed it up.

**25:50** And all you're really going to see is when that particular ship crosses into the boundary area...

**25:56** ...the symbology action will kick in...

**25:59** ...and will actually put on that highlight symbol on top of that ship, so you can visually see.

**26:06** And you may even have cases where the symbol is extremely small, and all you do is make it larger.

**26:14** The action makes it larger based upon a particular condition being met or not met. Yeah?

**26:21** [Inaudible audience question]

**26:39** Alright, so I'm going to repeat the question. The question is, if you have multiple areas of interest that you've set up...

**26:46** ...either as a buffer or...it says it's reached the end of my simulation file. I don't know where the rest of my data has gone!

**26:52** Let's go ahead and try...

**26:54** It went into stealth mode.

**26:55** It did go into stealth mode. We'll try this again.

**27:00** So the question was, if you have multiple areas of interest or buffers that you had established...

**27:06** ...could you autocenter the map so to essentially refocus the map display to the thing that's causing, you know...

**27:12** ...the action of your process. We actually don't have that particular functionality.

**27:16** We do have a new functionality in 10.1 to follow a tracked object to kind of...

**27:22** ...repan and focus and zoom the map so you kind of, as you have a track that's selected...

**27:28** ...you can stay selected on it and follow it as it may progress around.

**27:31** But moving to the area of interest is not something that we currently have, so...

**27:37** Well, I'm going to move forward and go back to the next section here.

**27:43** My data seems to be disappearing from my simulation file, so I will find the next section here. Where's the slideshow?

**27:55** So we're going to move on and talk about the analysis of real-time data, and as you might expect...

**27:59** ...this is heavily focused on that action framework that we've seen both in Tracking Server and Tracking Analyst.

**28:08** So the actions are, as you've seen, I guess, preconfigured, small, little bits of analysis, and they're designed for...

**28:16** ...something that would run in real time. Not a batch mode or a geoprocessing tool, but something that would be running...

**28:22** ...across that stream of data. The example that I just tried to show was really seeing that the symbology can be triggered...

**28:31** ...based on that action changing, but there's a couple of other patterns. I know Adam already kind of covered these, but...

**28:37** ...from the server context, the Tracking Server action's running in server actually play a pretty important role because...

**28:44** ...you don't need a client to be connected. You don't need to be visualizing, so there's nobody logged in at a workstation.

**28:50** There's no running ArcMap, there's no web browser or any device that really needs to be part of that other than the server...

**28:56** ...running in the back end that's processing the information. So, some of the common things that we've seen are...

**29:04** ...a custom action being developed to call an external application. So if we're integrating with third-party systems...

**29:10** ...where we need to just call another process and hand that particular piece of information.

**29:15** And we don't know what the third-party process does. It might actually do an alert or run it through another software process...

**29:22** ...to do something pretty specific. What I'm actually going to demonstrate today is doing the broadcast e-mail alert.

**29:31** So I'm going to show, again, with Tracking Server Manager, again, we're looking at the Actions tab here, and for the...

**29:43** ...Ship's Tracking is the name of the service I have. I'm going to look at this alert.

**29:48** I've set myself up as an e-mail recipient. I've made an e-mail template, and this looks quite a bit like a mail merge.

**29:55** So I've got these little square bracket, kind of...I'm going to read from that particular message.

**30:01** If I'm getting 500 messages a second but this one is the one that triggers it, it will fill out the e-mail message...

**30:07** ...with these attributes from that message.

**30:09** So it's going to send me an e-mail talking about the name of the vessel and its position...

**30:12** ...and what it's heading and speed, and again, instead of the...I've used the exact same shapefile...

**30:18** ...which was the buffer around that nuclear power plant. But other than using an intersect...

**30:24** ...because I would receive 30 or 40 with, as that ship crosses through that buffer.

**30:29** I'm just going to do Arriving. It's going to send me only the first e-mail until it has left the boundary and comes back in.

**30:36** I would get the second one. So it's...that's the difference between Arriving and Intersect. So what I also have running here is...

**30:48** ...This is the data viewer application showing my ship tracking feed that I'm subscribed to.

**30:56** Since we've started this presentation, exactly 30 minutes ago, I have processed through my Tracking Server here...

**31:04** ...97,000 ship observations and been updating that screen display with them. So what I'm going to do is go ahead and...

**31:17** ...I've just started that simulator of that ship crossing through that boundary area...and I

guess I should maybe at least...

**31:30** ...try and show some of my ship tracking information here.

**31:33** This is just the display as the, from a develop or utility standpoint...

**31:37** ...what the data looks like as it's coming through the tracking message bus.

**31:44** But I've just received something pretty important in my e-mail just now, and it says, at nine-oh-one, 56 seconds...

**31:53** ...this vessel, which I named Bogie, and it's got its unique ID number from the AIS source...

**31:58** ...and it gave me the location and its speed and heading, and you can tell that this is a simulated data source...

**32:04** ...'cause the ship was in motion, but I had speed at zero. But this is an example of, within roughly a second or two...

**32:11** ...when that simulated data went through, it generated an e-mail and pushed it out, sent it to my mail server...

**32:16** ...and it already brought it into my mail client. So that's basically what the e-mail alert function does.

**32:26** So this is just kind of a simple example, shows the capabilities of having the server do the processing, and Adam showed you...

**32:36** ...each one of these, kind of explained them in detail, but if you have more questions on these...

**32:41** ...you can stop by after our workshop today or stop by the Tracking Analyst booth, and we can cover the action framework...

**32:46** ...and talk about customizations here. The one that we haven't demonstrated yet is just really...

**32:52** ...the highlighting of the symbol in the client. So I'm just going to bounce back there and see...

**32:59** Well, see, now it went through. Apparently I had to restart the simulator for the second time. So that's just an example of...

**33:08** ...when it intersects that boundary, there's an additional symbol being drawn on top of that yellow, round circle...

**33:15** ...just showing that, hey, you need to look at this. And now that it's outside the boundary, we're not drawing that.

**33:19** So it's a simplistic example. There's actually future work being done in the action framework to be able to combine...

**33:26** ...multiple polygon boundaries into one action so that you could actually look at, say, hundreds or thousands of zones...

**33:34** ...and kind of tag a feature as to which boundary it intersected and be able to do some specific things there.

**33:40** So I'm going to hand the screen back to Adam and he's going to continue on.

**33:46** [Unintelligible audience question]

**33:47** Yes?

**33:48** [Unintelligible audience question]

**33:50** Could have what?

**33:51** We don't really have a capability to do a sound alert. We did for a while when, through the ArcGIS 8.3 and 9.3 series...

**34:00** ...there was the VBA macro language, and so there was an action in Tracking Analyst to call a Visual Basic function...

**34:08** ...which you loaded as a macro. And you could then do a pop-up or whatever you wanted to from Visual Basic...

**34:14** ...'cause you were writing the code. So as of 10, we've removed the Visual Basic support...

**34:19** ...as the platform is moving toward Python scripting as kind of the predominant macro language.

**34:26** I guess we could come up with a solution to play a sound alert, but I'm afraid it would involve kind of developing an add-in...

**34:31** ...or something that gets registered with your ArcGIS Desktop. There's not a built-in, simplistic, you know...

**34:38** ..."load this sound file and click here" kind of answer for that, but...so, yeah, we could certainly talk to you about that...

**34:46** ...if you wanted to have some requirements that you could transfer to us about how to play a sound when an alert happens.

**34:53** [Unintelligible audience question]

**34:55** Uh-huh, yeah. I have fallen asleep in front of a screen before. I understand, so...Okay. Adam?

**35:02** Alright, thanks, David. So I'm going to show you some client applications with real-time data, so...

**35:08** What we've shown you thus far is kind of the Tracking Server side of things as well as the Tracking Analyst...

**35:13** ...which is the standard extension for ArcMap to render this data as client to Tracking Server.

**35:21** So I'm going to show you some other client applications, which are going to include desktop, web, and mobile.

**35:27** So from a desktop perspective, we obviously just showed you the Tracking Analyst extension.

**35:31** That's the out-of-the-box product, if you wanted to buy a product to solve your solution.

**35:36** But oftentimes, organizations need to have custom applications. You need more control, or you don't necessarily want to expose...

**35:44** ...the full power of ArcMap to your user base. So if you want to create a more focused application...

**35:50** ...there's a number of options to do that at a desktop level. You know, you can use ArcObjects as one option.

**35:56** There's an SDK for Tracking Analyst that you can extend and basically create your own desktop-focused application...

**36:04** ...but that would again run in ArcMap. So what we provide here is a Tracking client API.

**36:11** And this API works for desktop, web, and mobile, and we'll walk through each of those here. The...

**36:17** We support pretty much every language that you'd want to use in those environments.

**36:21** So right now, what's out of the box at 10 is .NET and Java.

**36:26** Very shortly, within the next month or six weeks, we will be releasing on our Resource Center...

**36:32** ...Qt C++, so if you are a C++ developer and want to write a desktop app in that environment...

**36:38** ...that'll be available to you shortly. But basically, this real-time data that's being pushed out of Tracking Server...

**36:45** ...as we demonstrated in Tracking Analyst, can be consumed by these other languages or custom applications.

**36:51** And in this case, it would be an Engine application at 10, or if you're at 10.1, it might be an ArcGIS Runtime application...

**36:59** ...and we provide the interfaces through those languages to do that. The common API for this is that the application would...

**37:06** ...connect and authenticate with the server, and what you get back is a list of services, be it a, you know...

**37:14** ...a ship tracking service or a bus service, whatever it is. And then your client can subscribe to that and receive alerts...

**37:21** ...and receive the real-time data through a push mechanism. So there's an open socket to the client for that.

**37:27** Now on the Tracking Server side, one thing we didn't show is, we do have the ability to feature log this data.

**37:32** So what we've been showing so far is kind of a real-time stream of data that's being analyzed...

**37:37** ...and pushed directly to the client, so there's very low latency in receiving this data at a client level.

**37:43** But it's also an option that the organizations oftentimes want to have this data recorded historically...

**37:48** ...so they can do historical analysis. So we have an archive option, which is what we call a feature logger action.

**37:54** And basically, what that does is it logs to any standard geodatabase, so any SDE-enabled database can be logged...

**38:00** ...the observations as they come through will be logged. That doesn't affect the performance of what's being pushed...

**38:07** ...up to the client as well, so it's kind of offline from that execution path. And the historical data can be viewed...

**38:15** ...directly through the desktop applications or indirectly through ArcGIS Server...

**38:19** ...as standard feature services on ArcGIS Server. From a web perspective, we support Flex, Silverlight...

**38:29** ...and coming very soon will be JavaScript as well. So if you have an application that's a Flex application...

**38:36** ...or you make use of the various viewers that we have for Flex or Silverlight, we actually have a widget...

**38:43** ...that I'll demonstrate here in just a moment, that's a tracking widget that allows you to connect with the server...

**38:49** ...receive data, do a lot of the rendering that David just kind of walked through, but at a Flex application level.

**38:55** So, Flex, you know, JavaScript is useful also in a mobile environment, and we'll get into that more in a moment.

**39:00** It comes in two flavors. You can get a full viewer that's built just for a Tracking application.

**39:01** But these can be combined with ArcGIS web APIs.

**39:06** So you start off your application with the ArcGIS web application.

**39:10** And then if you want to add real-time data, you can use the Tracking client API to receive that data on.

**39:15** And in this case, the historical data would flow through ArcGIS Server. There's not a direct connection to...

**39:20** ...the web application to the database. Those are exposed through standard feature services

at the ArcGIS Server level.

**39:29** So let me give you a quick demo. What I'm about to show you is our Tracking Viewer for Flex.

**39:39** Or you can take just the widget that I'll show you and incorporate that widget into your own ArcGIS viewer application.

**39:52** So this is our Tracking viewer. This is available on our Resources site for free. The source code's available as well.

**39:58** So if you want to take this application and build your own application from it, you're welcome to do that.

**40:04** The license rights allow that. So what I'm going to do is, it asks you for a user name password...

**40:08** ...and this is to restrict and authenticate with the user what services are eligible to see.

**40:15** So this is the Tracking widget. You'll notice that I'm now connected, and I get a list of services that are available to me.

**40:22** So I've got, you know, everything from, you know, incidents on the California Highway Patrol to satellite data here.

**40:28** So let's look at some of this data. If I subscribe to the satellite feed, what you'll see is, if I zoom to this extent here...

**40:34** ...we're starting to stream in data about satellites flying over the world...

**40:38** ...so this is a real-time feed of satellite data that's coming in.

**40:42** If I hover some of these, I can get kind of the information about these various satellites.

**40:48** And like I said before, you can control the symbology of this, so you can control this to, you know...

**40:54** ...maybe we want this to show gray instead of red, or if you want to put a picture in...

**40:58** ...you can basically define a picture for that.

**41:00** So this widget allows you to do a lot of the same things that were shown in Desktop.

**41:04** Now, let me go look at some other data.

**41:06** So maybe I'm not necessarily interested in satellites, but I want to look at some flight data. So if I subscribe to flight data...

**41:14** ...what you'll see is I'm starting to flow in data. The green and the red are flights that are active over the US right now.

**41:21** If I zoom in to this, you can kind of see information about these, so here's a Southwest flight, you know...

**41:26** ...coming from LAX. And I can actually click on this track here, and what it's going to do is...

**41:34** ...it's actually going to start monitoring this track. So it'll actually refocus and rezoom the extent of what's happening.

**41:41** So if I actually click into Monitor and I go into the monitoring, I can tell it to follow. And now it's actually going to follow this aircraft.

**41:47** And maybe I want to see this particular information about this so I can get, kind of, the flight number...

**41:52** ...you know, where it's going, where it's coming from, what the speed is, and various aspects of that.

**41:56** And you can start to graph information about, you know, maybe I want to track what the altitude of this aircraft is...

**42:02** ...and it'll start to track that information. You'll notice that we just got a new message, so it kind of resets the context...

**42:09** ...of what the altitude is. So it'll track that over time, and again, you can have actions define that if it's, you know...

**42:15** ...below a certain foot threshold, over a certain area, you want to get an alert about that.

**42:21** But I can also go into the tracks of this. So this is a full view of all the tracks that are streaming in on the service.

**42:27** And we provide a, you know, kind of, as you click, it filters a view of this. So if I wanted to see what's going, you know...

**42:33** ...into Boston, I can type this, and it kind of filter it down. So it's a quick search into a particular feature.

**42:39** And then I can refocus my analysis onto the Boston flight.

**42:45** So we don't just track satellites and aircraft. We track many other things as well.

**42:50** So maybe I want to look at the same ship data that David was looking at just a moment ago, and if I go into this ship data...

**42:59** ...let me stop monitoring this aircraft here.

**43:04** I can see that ship data starting to flow in here, but now I need to change the symbology...

**43:09** ...so I can actually tell what's a ship versus aircraft. And I can see in blue, this is ship data.

**43:15** And maybe I want to zoom in to Seattle and see that ship data...

**43:20** ...and I can identify, you know, what's going on with the ship data.

**43:24** So, you know, here's some vessels that are around the Seattle area. And, you know...

**43:28** ...maybe I want to get more focused and look at, you know, what the buses are that are traveling in this area, as well.

**43:35** So we've got bus data. So we can start to stream in the bus data. So here's real-time buses traveling...

**43:41** ...throughout the Seattle metro area. So it can really be applied to any type of vehicle, be it a satellite...

**43:47** ...being a vehicle or aircraft, bus, ship...or it could be down to the granularity of a person.

**43:53** So if you're tracking on the phone or some various other device, so...that's a good segue into the mobile piece of this.

**44:04** So the same applications that we showed from a client API to service the web application...

**44:11** ...we showed the Flex example, but Silverlight is just equivalent, as well...we can use to apply to the mobile environment.

**44:17** So, you know, in the mobile environment, you know, current landscape is, there's, you know...

**44:21** ...iOS devices, Windows, and Android devices. So I'm going to show you a demo of an Android device in just a moment...

**44:27** ...that'll transpond its location to Tracking Server, and we can start to perform analysis on where that person is traveling...

**44:33** ...or where that phone is traveling...

**44:36** ...but the various APIs that were provided from a Tracking client API are eligible for mobile applications as well.

**44:42** So we have a Java client API that is what we use to service the Android application.

**44:48** And at the Silverlight side or...I'm sorry...At the Windows or the iOS side...

**44:52** ...we could use JavaScript as just kind of the standard mechanism to get information to that device.

**44:59** And we can render the same kind of information that I was showing you on the Flex viewer side on a mobile device.

**45:06** So let's shift over to the sample demo here...I won't share my password with you.

**45:19** And so, here you'll see that we've got a couple of applications deployed on here. So this is an Android transponder.

**45:26** Basically, these are samples that are freely available. The source code is available on our Resources site, and...

**45:34** ...let me try to focus this a little better. Okay, well, you can't really...it's kind of washed out on there...

**45:41** ...but it's connecting to a Tracking Server. And if I hit Connect, then basically, it's going to...

**45:46** ...you can see the satellite icon at the top there. It's going to try to acquire a GPS location of where this device is.

**45:52** Now, I'm not sure we'll get a signal indoors or not, but it'll put that signal on there, and I can basically...

**45:57** ...send the message to Tracking Server, and as I send that, it sends the location of where I'm at.

**46:02** So this is just a visual depiction of, you know, kind of what would normally happen just in the background.

**46:07** The user might not necessarily ever see this interface. It's just something you deploy as part of your mobile application...

**46:12** ...to send data to the server. And as I mentioned before...

**46:17** ...we provide a sample for a tracking viewer on the Android device as well. So if I give it just a moment to connect...

**46:24** ...to the Tracking Server, what you'll notice here as I kind of zoom out to the nationwide level here.

**46:32** So this is making use of the ArcGIS standard APIs or mobile SDKs that we have for that.

**46:38** And if I select a service, you'll notice that I've pre-authenticated with the server...

**46:43** ...'cause I don't necessarily want to type in my user name password on this.

**46:46** But I get the same information and tracking services that I had available to me through the Flex application on here as well.

**46:55** So if I subscribe to, maybe, the D.C. flights again, I can start to see data flowing in to this device.

**47:03** So this device is mobile, it's using a cell network, and it's receiving real-time data on the device.

**47:09** So this may be useful if you've got a field work force and maybe you want to provide...

**47:12** ...visibility of where the other field-workers are to a field-worker. So I can get, kind of...

**47:17** ...what's my proximity to the nearest other field-worker? But there's many applications of this.

**47:22** But the point here is, tracking is not just a desktop or web experience; it's also a mobile experience.

**47:36** So, we have one slide on what's new at 10.1. If you want more information about kind of the road ahead for tracking...

**47:42** ...please come down to our booth. We've got a map...we're in the Mapping and Visualization area downstairs...

**47:48** ...in the Exhibit Hall. But we'd be happy to walk you through some of the features that we have, quickly describe...

**47:55** ...what features are upcoming at 10.1. For Tracking Analyst, we provide a new tool called

Track Manager...

**48:03** ...which basically allows you to view a track as a unique feature. So as opposed to seeing, you know...

**48:10** ...here's the last hundred, here's a hundred features and they're all the same track...

**48:15** ...we don't necessarily...the users don't want to deal with that at a track, at a feature level.

**48:20** They want to deal with it at a track level. So I want to know, bus 1 in Seattle...

**48:24** ...where has it been? So you can really drill down at a bus 1 level and view all of the tracks that are relative to bus 1.

**48:31** So it's a user experience that allows you to view things at a track level as opposed to a feature level.

**48:35** And then another thing that we provide is proactively monitoring the tracking services that are exposed from...

**48:41** ...tracking service, from Tracking Server. So that kind of gives you a stoplight view of, you know...

**48:46** ...green, yellow, red, of...are we getting data from this tracking service? 'Cause sometimes...

**48:50** ...stuff in the field doesn't move, and the users want to have confidence that the service is still up and running...

**48:56** ...and we're getting valid data. But it just may be the fact that nothing's moving in the field.

**49:00** And then generating track statistics for analysis. We provide a couple new GP tools at 10.1...

**49:07** ...Track Intervals to Line and Track Intervals to Feature. So David kind of showed you an example of...

**49:14** ...where we took the point data that was observed from a particular feature, and we create the lines from that.

**49:19** But we don't just create the line features; we also create statistics about that, as well.

**49:24** So we can calculate what the heading is, what the speed is, what the direction is.

**49:29** All those different things about the track that you're observing can be done through GP tools.

**49:34** Again, if you want to see demos of these, go to our booth, and we can walk you over to a road ahead machine and show you.

**49:41** And then at Tracking Server, we provide this Tracking widget for the Flex viewer. I showed you a demonstration of that.

**49:47** Again, this is something that's freely available on our Resources Center. And we also provide the ability to...

**49:54** ...apply spatial filters on the client, so there's a massive amount of data typically flowing for

these applications.

**50:00** If you want to focus...if you're a user and you want to focus your analysis just to Seattle...

**50:06** ...and you only want to see ships that are entering in the Port of Seattle, you can draw an area of interest...

**50:10** ...that you want to subscribe to, and you'll only get data that's subscribed for that area of interest.

**50:16** And that's a per-client thing, so that's not something that's running on the server.

**50:20** Each client can have their own area of interest. And then industry standard support.

**50:25** So, we've heard numerous times that we want to be able to consume tracking services...

**50:31** ...and other viewers that can consume KML and other formats...

**50:34** ...such as GeoJSON. So things like Google Earth or ArcGIS Explorer can now consume tracking services...

**50:42** ...from Tracking Server. And if you go to our Resources site, you'll actually see some sample code...

**50:47** ...of how you would consume this in ArcGIS Explorer. And then finally...

**50:51** ...we're creating this concept of application templates for tracking, and this is basically a starter kit...

**50:57** ...for somebody that wants to build a focused application, maybe for a particular domain such as AVL...

**51:03** ...automatic vehicle location. So I want to use Tracking Server as an AVL product.

**51:08** These are kind of starter kits that would give you the components necessary to do that, so...

**51:13** ...there'd be preconfigured actions that do things like geofences that are assignable to resources...

**51:19** ...as well as predefined data links that...of devices that we support from an AVL market.

**51:25** So instead of having to write your own data link, you could connect to a device given our catalog support set.

**51:33** So, in summary, tracking solutions enable ArcGIS with real-time data and analysis. So if you want real-time analysis...

**51:42** ...Tracking Server is a very good solution for that. If you want to real-time analysis at a client level...

**51:46** ...Tracking Analyst is a very good tool for that. It provides capabilities for managing, visualizing, and analyzing...

**51:53** ...real-time data. It can be applied in a variety of environments, be it desktop, web, or mobile.

**51:59** And then its unified functionality across a variety of developer platforms.

**52:03** So whatever language your development staff is using...

**52:06** ...is supported here. We've rounded out what our support is with some new offerings with qT as well as JavaScript.

**52:14** So we think we have a pretty full feature list there. Yes?

**52:20** [Unintelligible audience question]

**52:25** Yep, same API. It's a unified set of...

**52:29** [Unintelligible audience question]

**52:32** No, they're all consistent. They all have the same APIs, you know. Some language differences, but...yeah.

**52:39** Same capabilities. So some resources to get started.

**52:42** I'll quickly show you our Resources Center and how to get to our information.

**52:47** If we...if you go to the resources.arcgis.com, there's a Tracking Server link here.

**52:52** This Tracking Server link will take you to everything that we've been mentioning in this session.

**52:57** So on our gallery are the samples that I showed here. So our Flex viewer and the widget for Flex is available here.

**53:05** So you can download that here. The source code's available. It's ready for you to use.

**53:11** You can use it in your own application and extend it to your needs. The Android transponder...

**53:16** ...and the tracking viewer for Android is available on our sample site as well.

**53:19** And if you're interested in ArcGIS Explorer and how to put a plug-in and to support Tracking Server services...

**53:26** ...that's available as well. Other resources to get started would be just kind of our Resources site.

**53:33** And, as every other session, please submit a session survey so we can improve and take your feedback on that.

**53:41** So with that, we'll open it up to questions, and we thank you for your time.