AT&T Flow Designer

A Visual IoT Application Development environment that includes reusable components, drag & drop design capabilities, team collaboration, and cloud deployment that allows M2M/IoT developers to get to market faster.

Current Environment

The most pressing challenge facing IoT application developers today is integrating the parts of a solution (device, network, data, connectivity, application logic, security) in a scalable, repeatable, and reliable way.

Trends in the IoT Industry

- Exponential market growth
- Requirement for Network Agnostic Connectivity Solutions
- Movement away from proprietary solutions to Open Source and web service-based tools
- Movement away from “smokestack” platforms that “do everything” to IoT focused and more flexible de-coupled services where the Enterprise/Developer can choose the tools they need that fit their specific Use Case

Challenges Developers Face

- Nearly unlimited hardware/software choices (devices, cloud infrastructure, prototyping/development environments, production environments, storage, big data, analytics)
- Need to secure data - share only what you want to share, and share only with authorized users - public or private.
- Frictionless development experience.
- Multiple software environments
    - Embedded OS (device) software
    - Middleware
    - Communication software
    - Application software

AT&T IoT Services – Enabling IoT Developers to:

Create Solutions:

- **Build**: Flow Designer enables drag and drop development and custom code creation to build middleware or 'glue' for IoT Solutions.
- **Deploy**: IoT Cloud provides an elastic, on demand platform as a service tailored the internet of things.
- **Scale**: Compute and storage services scale elastically to grow with the solution

Leverage Services: IoT Services are designed in a loosely coupled fashion, allowing them to be used

- Independently
- In combination
- With other AT&T services
- With third party services

Flow Designer Overview:

Flow Designer is an intuitive visual tool that enables you, the IoT app developer, to create your middleware application prototype quickly, iterate and improve through multiple versions, then deploy your application to a highly-available, scalable cloud hosting environment. The visual metaphor is based on function "nodes" (each represents a discreet service) visually "wired" together to create application "flows."

Flow Designer offers nodes that are pre-configured to allow easy access to multiple data sources, cloud services, device profiles, and communication methods. The integrations are already done for you, so you only have to focus on wiring the building blocks together to create your IoT application.

Flow Designer is built on the concepts of openness, simplicity, and re-use. As you wire your applications together, the resulting flows are saved so they can be reused later, reducing your development time. The built-in team and community functions mean that developers do not have to reinvent the wheel each time a new feature or a new app is needed.

IoT implementations can be complex, because they require developer knowledge of devices, networks, and applications, and the ability to integrate these IoT components. However, AT&T IoT Services helps meet the integration challenge by providing tools to let IoT developers focus on the business logic without having to become an expert in each layer.

The Need for Flow Designer

Market opportunity for IoT devices is increasing. Building a solution is very complex. It requires customers to work at the device layer, network and infrastructure layer and application/integration layer to build solution. The customer typically knows the logic, algorithm, and processes around their assets but not versed on device, network and infrastructure layers. At the same time, enterprises are looking for a carrier grade solution that is scalable, reliable and secure for many of their mission critical IoT applications

Flow Designer Value Proposition

Flow Designer Value for Business Owners:

- Reliability: AT&T Flow Designer is a carrier grade service
- Scalability: Flow Designer at launch will be fully redundant in 3 AT&T Cloud Data Centers
- Device Agnostic: Flow Designer allows any connected device to connect and store its data into it
- Network Agnostic: Flow Designer allows device connectivity over any network type (cellular, Wi-Fi, satellite)

Flow Designer Value for Developers:

- AT&T fully developed and managed service, allowing developers to focus on their core application
- Enabling direct collection of data from multiple networks, multiple devices, and integrated services
- Create solutions faster through customer-centric tools for developers such as client libraries, sample code, developer forums and help center

Flow Designer Connects and Integrates Devices, API's and Data

Flow Designer starts where the IoT starts, with the **devices** that are being connected to the network. It supports all popular IoT Protocols (UDP, TCP, MQTT, MQ, COAP, HTTP, Websockets). There is a growing library of supported devices (currently 18 Hardware Platforms, 12 Software Platforms, Prebuilt protocols e.g. Xirgo) that are available to create, reuse and share connected device profiles in each stage of the application lifecycle.

Flow Designer then extends its device and protocol interface capabilities by adding support for popular IoT **API's**. Flow Designer has pre-built connections to enable simple integration of devices to business systems, such as event management, ticketing, supply chain, CRM, and more. Flow Designer also allows the developer to create, reuse and share API Mashups, gaining simple integrations (micro-services) that expose complex workflows by creating API's.

Finally, Flow Designer provides multiple tools to manage interaction with IoT **Data:** Transform data, route it based on rules that you set, translate and transform protocols, and connect to several external data stores (AT&T M2X Data Service, Flume, Kafka, Cassandra, Elastic Search, Redis)

Flow Designer – Beyond Node-Red

Flow Designer is based on the open-source NodeRed tool, which was developed as a visual tool for "wiring" different components of IoT applications together. Flow Designer expands on the core NodeRed tool, by offering it in a multi-tenant cloud-hosted configuration, and adding in developer tools such as version management, code sharing, debugger, multiple Cloud Execution choices, capacity management, and log aggregation.

On top of this, Flow Designer offers several pre-built AT&T integrations, making it easy to consume other API-based services from AT&T: M2X, Black Flag, Drive (Prototype), Digital Life (Prototype)

Flow Designer – Develop and Execute

Flow Designer is built to work the way developers work, by starting with a prototype, adding in integrations to various services, repeated testing and debugging through development sprints, and then promoting finished work through test, staging, and into production. The simple steps to doing so are:

1. Flow Development – Combine nodes into flows to create the application logic
2. Click to Deploy – Deploy into the appropriate environment (test/staging/pre-production/production/DR)
3. Creates node.js application (the code is created for you)
4. Package into container (wraps code into a discrete package that can then run in the cloud)
5. Deploys to cloud (container is pushed to the AT&T cloud)
6. Devices and users interact with cloud (the app is live)

Deployment

Flow Designer is a fully containerized system deployed over OpenStack and Linux as a PaaS layer. Flow Designer makes it easy to build, ship and run using containers. By using the visual development tool, and selecting the "Deploy" options, the service takes care of all these tasks for the developer:

1. Write your flow / code
2. Build code and pack into container
3. Store & versioned container images
4. Evaluate & Deploy container images on Linux runtime environment (PaaS)
5. Execute and monitor the containerized applications leveraging Linux clusters.

We chose containers for the run-time solution based on their unique feature set:

- Container technology provides an easy encapsulation that is simple to create (Build)
- Container technology has the ability to oversubscribe VMs,
- It has a built-in managing capabilities (versioning & tagging)
- Standard way of storing it (locally or in the cloud)
- Very simple API for execution and KPI collection
- Integration with Linux – give us the extra availability & robustness

Deployed Application

- All hosted on AT&T Cloud
- Geo-balanced between different SL datacenters
- 3-layer architecture in each DC with an N+1 layout
- No single point of failure
- All layers load-distributed (application, API, database)
- Deep status checks allow for auto-failover

Flow Designer Nodes – Pre-Integrated Services

Nodes form the foundation of the Flow Designer. Each node is preconfigured to interact with external services, to perform functions specified by the developer, or to work with other AT&T service offerings. The pre-defined nodes provided within the service allow the developer to "call", or interact with, other services simply by passing parameters. No additional code needs to be written to make the predefined nodes work. Nodes provided within the service are organized by function, so that all nodes that perform similar functions are easy to locate on the palette.

The following examples demonstrate just some of the functionality of Flow Designer's pre-built Nodes. The full list can always be found on the Flow Designer website (flow.att.com).

Flow Designer Nodes – Input/Output

Input and output nodes represent various services and clients that are used to pass into and out of the Flow Designer (and the resulting application once deployed). All services are exposed via the load balancer, which greatly expands the number of communication protocols that can be supported beyond the basic functionality of NodeRed.

Basic protocols supported in preconfigured nodes include TCP/UDP/HTTP. An HTTP server instance is created by default with each node instance, and HTTP/HTTP Response must be initiated in pairs.

Additional I/O nodes provided include

- Error handling via a "Catch" node;
- CoAP for IoT devices using CoAP protocol
- Hadoop support via Kafka (creates a service within a container);
- RabbitMQ and MQTT nodes for MQTT traffic (each creates a service within a container)
- MongoDB, MySQL, Cassandra and more for database connectivity

Flow Designer Nodes – Functions

Function nodes exist to perform actions on messages passing through a flow. Remember, a flow is a set of nodes combined together visually on the development canvas, with the connections between flows representing messages passed back and forth between nodes. Function nodes allow the developer to instantiate control nodes mechanisms, to create sub flows, and to transform data between different formats (CSV, XML, etc.)

In addition, the Contivo function node creates a Java interface to the Contivo mapping tool (it instantiates a java runtime in the container). Other function nodes provide helpers/requestors for clients like COAP, SOAP, TCP, and UDP.

Perhaps the most powerful feature of function nodes is the generic function node, which allows the developer to create his own JavaScript function wrapped in a node. The editor enables creation of arbitrary JavaScript, and JavaScript dependencies can be specified by their NPM package name and version, Flow designer will automatically download the dependency and install into the container. There are over 170K packages in the NPM community, and Flow Designer even supports Private NPM repositories.

Flow Designer Nodes – AT&T Developer Program + Social

Flow Designer has pre-configured nodes to enable interaction with **AT&T's Developer Program** APIs (developer.att.com), providing OAuth support within Flow Designer to allow interaction with APIs like Text To Speech, SMS (for AT&T customers only), and Enhanced WebRTC. Flow Designer's OAuth nodes can be triggered at startup, so that they are available immediately to the application.

Flow Designer's **Social** nodes expose interfaces to popular user communication tools like Twitter and Twilio, which supports multi-carrier SMS.

Additional **Advanced** Flow Designer nodes include an FTP Client, an RSS Feed Client, and a node to execute a system command via exec or spawn.

Flow Designer Nodes – Storage

Flow Designer Storage Nodes are client interfaces to popular key/value stores. One of the primary examples of Storage Nodes are pre-built nodes that communicate with AT&T M2X Data Service. The M2X nodes support all M2X API functionality, and can be used as endpoints to accept HTTP calls from an M2X client library (m2x.att.com).

Please note that, within Flow Designer, file storage is ephemeral and should not be used for persistent data. While Flow Designer does not support database instances in its current iteration, it does provide Nodes to communicate with many popular external databases