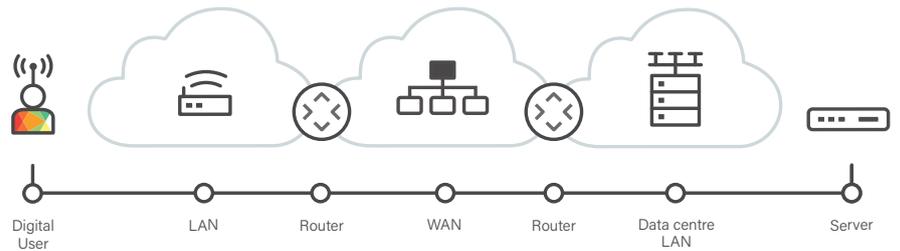


The Digital User

Digital Users are lightweight software deployed as close to the point of use as possible. These Digital Users (DUs) simulate the experience of real end users without impacting digital privacy. They automatically and continuously measure the end-to-end digital supply chain delivering a digital product or service from the end user's perspective.

How Digital Users work

Digital Users make and report standard measurements across the elements in the digital supply chain, including the multiple providers, networks, IT infrastructure and applications that deliver the service.



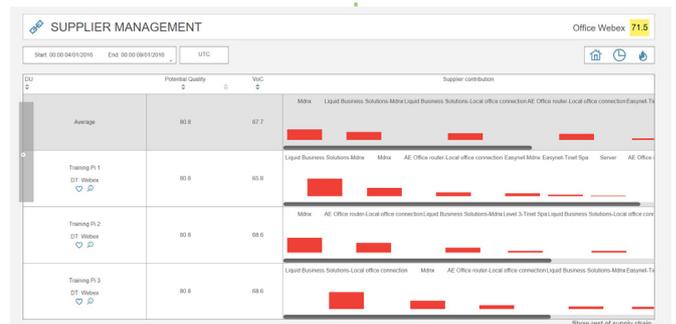
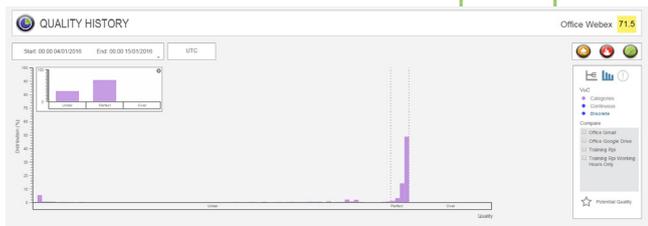
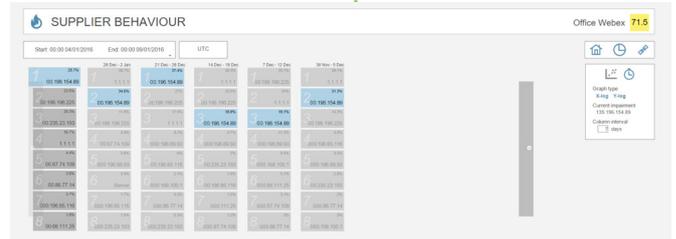
Three key insights

Measurement data transmitted from Digital Users is analysed in Actual Experience's Analytics Cloud to generate three key insights:

- 1 A real-time digital quality analysis, showing the quality of the users' experience at any point in time.
- 2 A score of how good the service could be, providing a benchmark for optimal performance within the existing environment.
- 3 Impairment diagnosis, identifying the elements in the digital supply chain contributing to variable digital experience and providing data to identify the responsible supplier.

DIGITAL QUALITY DASHBOARD

Product	Potential Quality	Voice of the Customer Latest	Supplier Management	Events	More
Office Gmail	80.6	65.8	Liquid Business Solutions-Mdx	Started: 16:32 14 Jan 2016 Stopped: 16:36 14 Jan 2016	✓
Office Google Drive	80.6	66.5	Liquid Business Solutions-Local office connection Liquid Business Solutions-Mdx	Started: 10:08 15 Jan 2016 Stopped: 10:36 15 Jan 2016	✓
Office Webex	80.8	33.4	Liquid Business Solutions-Mdx AE Office-router-Local office connection	Started: 09:32 15 Jan 2016 Ongoing	-
Training Rpi	80.7	54.7	Liquid Business Solutions-Mdx AE Office-router-Local office connection	Started: 09:36 15 Jan 2016 Ongoing	-
Training Rpi Working Hours Only	80.6	54.8	Other Server	Started: 10:36 15 Jan 2016 Ongoing	-



Digital User key capabilities

The Digital User has three key capabilities:

1. Data collection on installation
2. Measurements across the digital supply chain
3. Communication with the Analytics Cloud.

Digital User features

1. Data collected during software installation

On installation, the Digital User software transmits back to the Analytics Cloud two pieces of information (no inbound communication from the Analytics Cloud to the Digital User is required):

Analytics key	Mandatory	Provided by Actual Experience with the Digital User Installer, used securely to identify your Digital User on Actual Experience's system
Digital User Description	Mandatory	Your reference for the Digital User which appears in your analytics results.

2. Measurements

Digital User software is non-invasive and tracks no human activity. It has passed security review in all customer locations, which include banking, financial, media, service provider and other secure environments.

Digital Users make measurements to one or more Digital Targets. Targets can be any element in the digital supply chain, such as content in an application, multiple elements of cloud services, or specific parts of a provider's or customer's infrastructure.

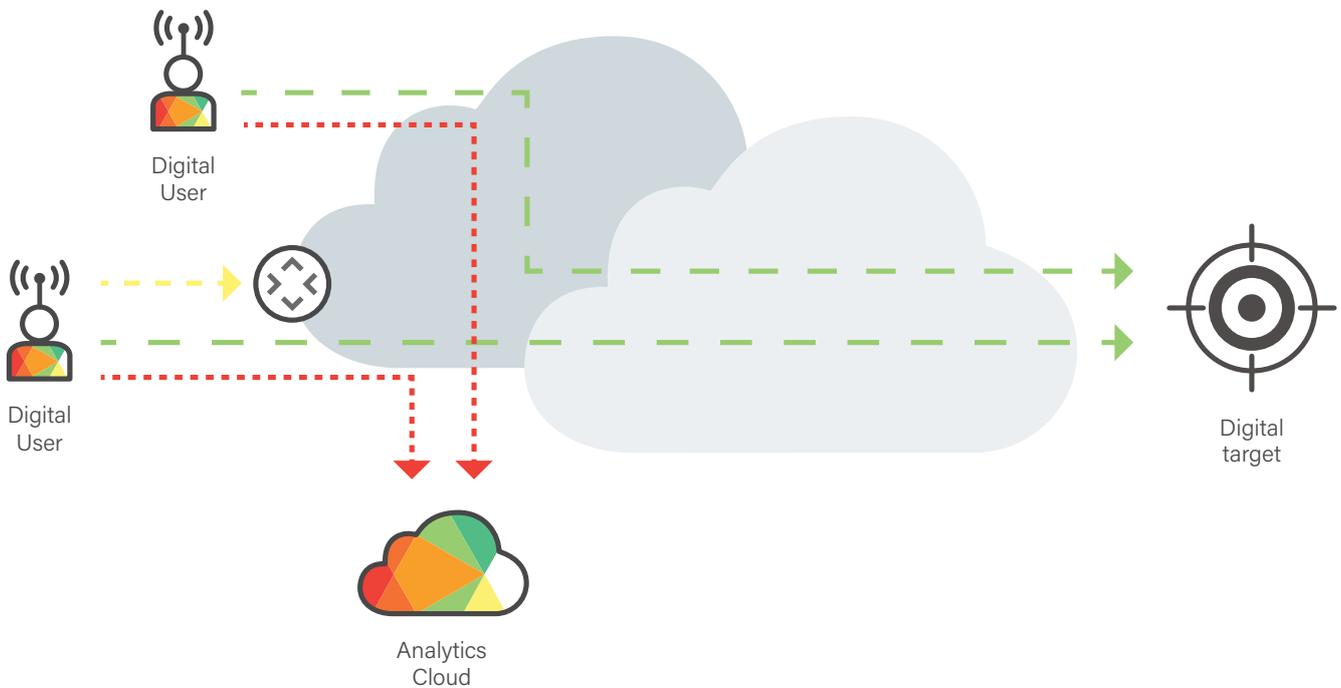
Measurement data and related analytical data is stored in the Analytics Cloud, which is a large-scale compute and storage platform with public, hybrid and private cloud capabilities. The Analytics Cloud correlates the measurement data from all Digital Users, analyses the quality of digital products and services automatically, continuously and in real-time, and presents data-driven insights to manage the performance of the digital business.

2.1 Measurements conducted

Once the Digital Users are installed, they register with the Analytics Cloud, from which they receive measurement instructions. The Analytics Cloud assigns the Digital Users which start to measure one or more Digital Targets. Within specific time intervals, Digital Users record four types of measurement:

- 2.1.1 Ping measurements
- 2.1.2 Diagnostic measurements
- 2.1.3 Application measurements
- 2.1.4 Environment measurements.

The information collected from each of these types of measurements is described overleaf.



2.1.1 Ping measurements

Digital Users send ping requests to the Digital Target(s), the elements in the digital supply chain that have been identified by you or your customer. From each batch of ping measurements, the following information is collected:

- The time interval the measurements were taken
- The sum of the observed round trip times
- The number of round-trip time values obtained
- The computed second moment about the mean
- The maximum round-trip time observed
- The minimum round-trip time observed
- The median round-trip time observed
- The number of losses observed.

2.1.2 Diagnostic measurements

Digital Users perform a custom traceroute to their Digital Targets to determine the network portion of a digital supply chain. For each IP hop in the path that responds to the traceroute, the Digital Users make ping measurements. By building a path beforehand, Digital Users avoid pinging hops which do not reply and can determine genuine loss (as the software knows the hop responded previously). The following information is collected for each IP hop:

- The time interval the measurements were taken
- The IP address of the hop in the diagnostic observation
- The hop number of the hop in the diagnostic observation
- The sum of the observed round trip times
- The number of round-trip time values obtained
- The computed second moment about the mean
- The maximum round-trip time observed
- The minimum round-trip time observed
- The median round-trip time observed
- The number of losses observed.

2.1.3 Application measurements

When the Digital Target is a server, Digital Users perform an HTTP(S) GET request of a page hosted on the target server. For each GET request, the following information is collected:

- The time interval the measurements were taken
- The size of the response to the application HTTP(S) GET request, in bits
- The TCP setup time of the HTTP(S) GET request
- The elapsed time taken to perform the HTTP(S) GET request.

The content within the GET is not inspected by the Digital Users or transmitted to the Analytics Cloud.

2.1.4 Environment measurements

Digital Users collect the following information from the environment in which they are running:

- The local IP address assigned to the device on which the Digital User software is installed
- Whether or not the device has network connectivity to the target and whether or not the observed measurements are valid.

Digital Users will significantly reduce measurements when network connectivity problems are perceived.

3. Communication with the Analytics Cloud

Digital Users communicate with the Analytics Cloud at regular intervals, specified centrally:

1. To determine if it should change the targets to measure
2. To determine if it should change anything about how it monitors each target
3. To send measurement results for analysis
4. To send a one-off registration request at Digital User software install.

Typically, communication is via the internet, however private connectivity arrangements can be accommodated. To minimise any potential issues with firewalls, Digital Users send data to the Analytics Cloud servers using HTTPS, by default using standard HTTPS port 443.

Security

Digital Users communicate with the Analytics Cloud via web services over HTTPS using standard HTTP GET and POST operations. Digital Users always initiate requests: they request information from or push information to the Analytics Cloud servers.

Analytics Cloud servers do not push information to Digital Users and Digital Users do not accept inbound connections. Digital Users' method of communication is the same as any web service or application running over HTTPS. Analytics Cloud servers have valid SSL certificates issued by a reputable registrar. Digital Users accept communications only if that valid certificate is presented.

Deployment highlights

Proxies

Digital Users support various proxy configurations in environments where proxies are required to access the internet. These configurations include HTTP or SOCKS4/5 with proxy authentication via username/password using any of the following schemes: Basic, Digest, Negotiation or NTLM.

Proxy detection and configuration is a key element of the installation configuration. In most cases, Digital Users can use different proxy settings for connectivity to the Analytics Cloud and each Digital Target.

Device requirements

Digital Users can be installed on devices running the following operating systems:

- Apple (OS X 10.9) or later
- Windows XP (32 or 64-bit) or later, Server 2003 or later
- Linux (Ubuntu 12.04 64-bit or later)
- Raspberry Pi (Raspbian: Wheezy, Jessie)
- Android, iOS (2015)
- Raspberry Pi 2 (2015)

Digital Users consume a small amount of device resources:

- Memory: <80MB
- CPU: negligible
- Storage: <120MB (installer, application, data and logs).