

THE **FEDERAL RESERVE**
 Financial Services



The FedNow[®] Service
Technical Overview and Planning Guide
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Introduction

The FedNow Service is an interbank, 24x7x365 real-time gross settlement (RTGS) service with integrated clearing functionality. The service allows Participants to deliver end-to-end instant payments to their customers.

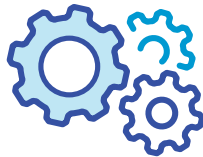
Like other payment and settlement services offered by the Federal Reserve Banks, the FedNow Service settles obligations between participating financial institutions through debits and credits to balances in their master accounts or those of their correspondents at the Federal Reserve Banks. The FedNow Service allows financial institutions to enable their customers to send and receive payments instantly.

Purpose

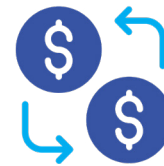
The purpose of this guide is to provide an understanding of the technical aspects of the FedNow Service so financial institutions can make decisions about adopting the service, which may include:



Whether to connect directly
with the service or through a
Service Provider



Assessing the impact
on internal systems and
business processes



Determining
the cost of adopting
the service

We recommend obtaining clear business requirements from the business operations staff at your financial institution. This can save valuable time and allow your financial institution to focus when determining the primary use cases and requirements of the organization.

Audience

The target audience for this guide is senior and lead developers, managers and system architects who are experienced with software development life cycle (SDLC) and have the technical knowledge to design and integrate payment products.

It may also be helpful for business and product staff to review this document to determine how best to support planning activities during FedNow Service implementation.



TIP: This guide may also be useful to other industry providers interested in using the FedNow Service through a financial institution partner, or to create and offer a variety of instant payment solutions.

For additional technical details, FedNow Participants can refer to FedNow DevRel, a tech-centric resource that can be accessed using FedLine® Solutions credentials.

Part One: Get to Know the FedNow Service

This section introduces the FedNow Service, and includes:

Features and benefits | **Customer payment flow**

Features and Benefits



FINANCIAL INSTITUTIONS

Remain competitive, create new products and meet the needs of customers



INDIVIDUALS

Instantly send and receive money with confidence and reduce the risk of overdraft and late fees



BUSINESSES

Gain better control of cash flow management, improve efficiency of corporate payments and streamline reconciliation processes

AVAILABLE FEATURES

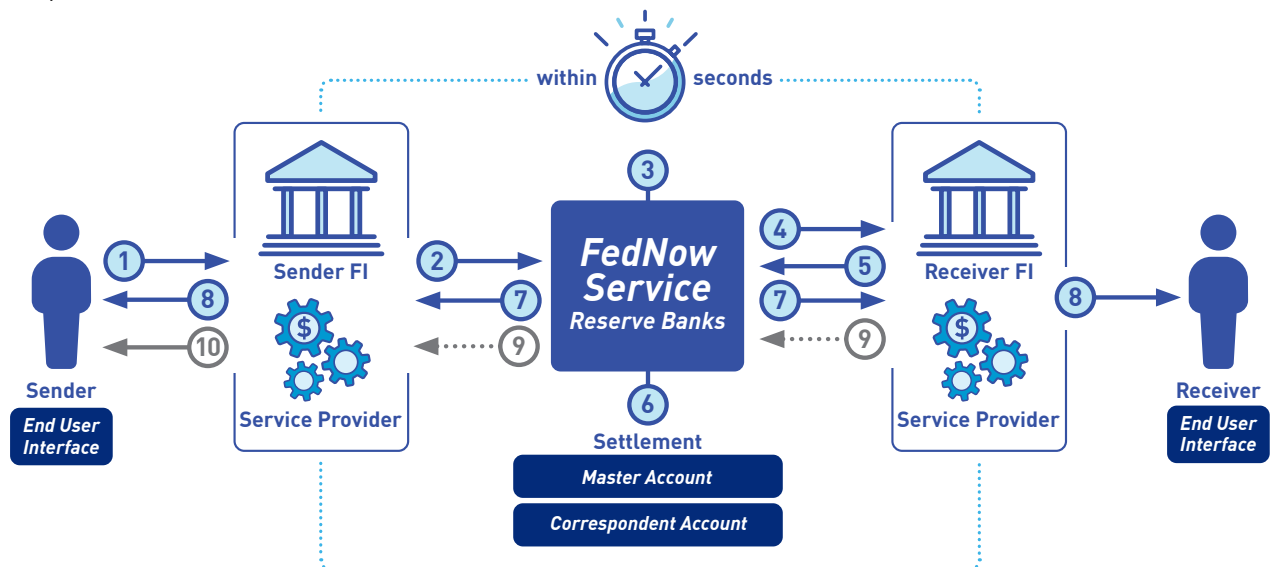
FEATURE	DESCRIPTION
Service level	<ul style="list-style-type: none"> Instant payments, 24x7x365 availability. Core clearing and settlement capabilities with credit transfers completing in seconds. A FedNow Service interface via FedLine Solutions for Participants to support reports and queries and manage configurations. Access to balance information around the clock, activity reports available on demand or end of day. Access to a tech-centric resource via FedLine Solutions that Participants can use to implement and maintain the FedNow Service. A digital customer life cycle tool where customers can onboard and request changes to their FedNow Service profiles.
Flexibility	<ul style="list-style-type: none"> FIs can settle using their own master account or a correspondent's master account. Configurable features for each routing transit number (RTN) enabled, such as the ability to send and receive customer transfers, receive requests for payments, support liquidity management transfers and support settlement services for other financial institutions. Connectivity to the FedNow Service through a FedLine Solution directly or through a Service Provider. Support for a variety of credit transfer use cases.
Security and risk mitigation	<ul style="list-style-type: none"> Encryption of all data flows. Features to support message integrity and data security, including message signing. Ability to have multiple keys in rotation. Tools to help combat fraud, such as a transaction value limit and the ability to reject transactions for specific accounts. Network-level maximum transaction value limits, which may be adjusted over time (Participants may configure transaction limits that are equal to or below the network limit). Functionality for correspondents to set limits on the transactions initiated by their respondents over the FedNow Service.
Efficiency and transparency	<ul style="list-style-type: none"> Rich data supported within ISO 20022 messages (for example, the option to include remittance information in payment messages and request for payment messages). Financial-institution-to-financial-institution liquidity management transfers in support of instant payments. Use of the widely accepted ISO 20022 standard and other industry best practices to support interoperability. Broadcast messages notifying of changes to Participant availability to receive credit transfers, as well as a list of participating RTNs.



Customer Payment Flow

One of the primary advantages of the FedNow Service is its ability to clear and settle transactions in real time — allowing financial institutions of all sizes to enable their customers to instantly send and receive money.

Follow a customer payment from start to finish by referring to the step-by-step overview of the FedNow Service payment process below.





STEP 1 – Initiation: The sender (an individual or business) initiates a payment with their financial institution through an end-user interface outside of the FedNow Service. The FedNow Service sender financial institution is responsible for validating the payment according to its internal processes and requirements.



STEP 2: The sender financial institution submits a credit transfer message (pacs.008) to the FedNow Service.



STEP 3: The FedNow Service validates the payment message — for example, by verifying that the message meets proper format specifications and complies with applicable controls.



STEP 4: The FedNow Service sends the contents of the payment message to the recipient's financial institution to seek confirmation that the receiver's financial institution intends to accept the payment message. At this point, the receiver financial institution determines how it will handle the message (accept, reject or accept without posting (ACWP)). The receiver financial institution should use this step to determine whether it maintains an account for the recipient identified in the contents of the payment message.



STEP 5 – Confirmation: In this example flow, the receiver financial institution sends a positive response of “accept” to the FedNow Service, confirming it intends to accept the payment message.



STEP 6: The FedNow Service settles the payment, debiting and crediting the designated master accounts of the sender financial institution and receiver financial institution (or of their correspondents), respectively. Steps 2-6 are expected to complete within a few seconds but will take no more than 20 seconds.



STEP 7: The FedNow Service sends an advice to the receiver financial institution and an acknowledgement to the sender financial institution, notifying each that the Federal Reserve Banks settled the credit transfer. Correspondents enabled within a FedNow Service profile may choose to receive a notification of debit/credit entries (camt.054).



STEP 8: The receiver financial institution makes funds available to the recipient immediately after step 7.

In communicating with the recipient, the receiver financial institution should immediately notify its customer following receipt of an advice and may use any reasonable means of communication that is consistent with their customer agreements, including standard channels for which the recipient is enabled.



STEP 9 – Confirmation of posting: The receiver financial institution has the option of sending a message through the FedNow Service to the sender financial institution indicating that the payment has been posted to the recipient's account.



STEP 10: If the receiver financial institution sends a confirmation of posting message through the service, the sender financial institution should notify its customer that the funds have been made available to the recipient.



Note: The FedNow Service will limit processing of payments to 20 seconds and will settle within this set amount of time or not at all. While the Federal Reserve Banks expect most payments to settle in a few seconds, well below the maximum allowable limit, the payment timeout clock sets expectations for financial institutions that transactions submitted to the service will be settled or rejected almost immediately.

Part Two: Technical Overview

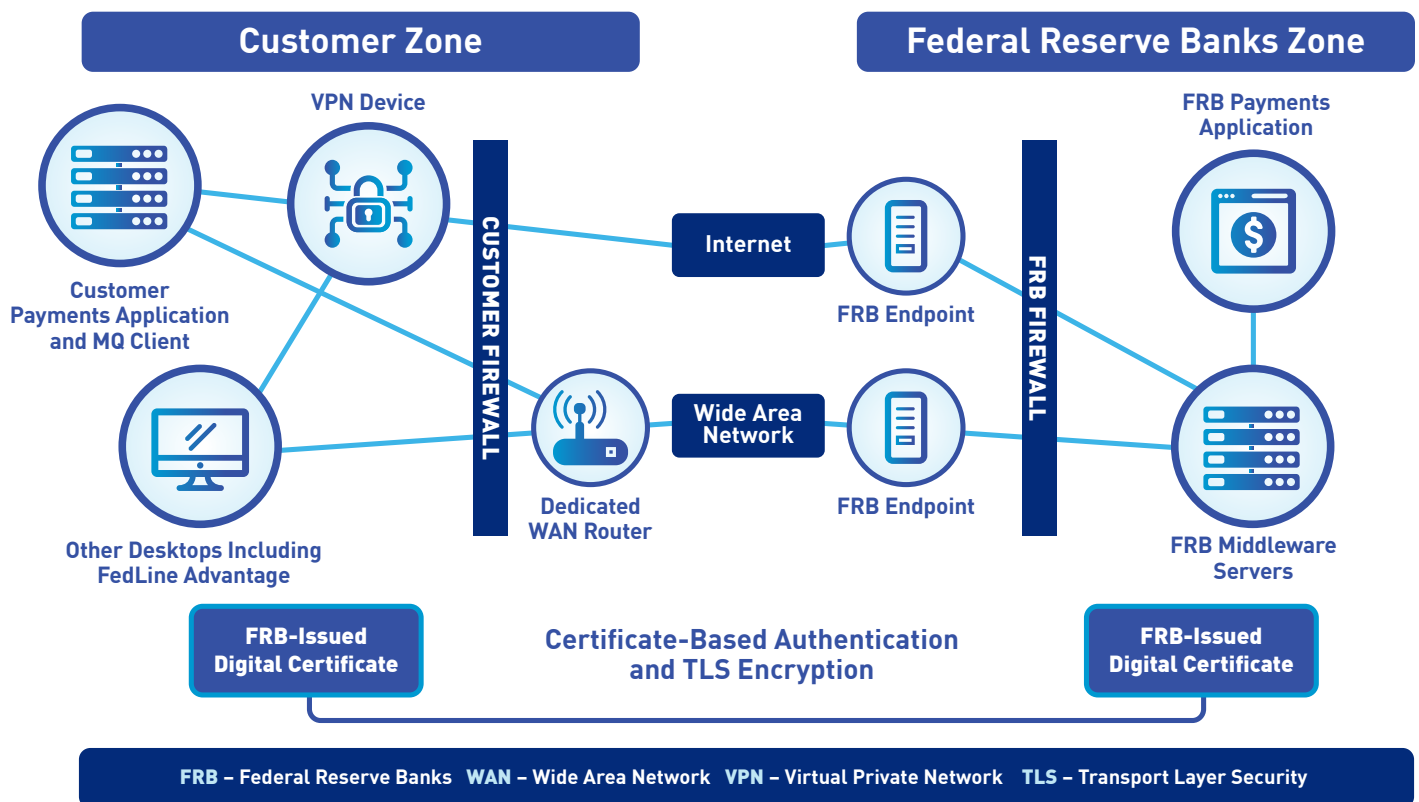
This section provides a technical overview of the FedNow Service, including key information about the architecture and components that comprise the system. This is important information for financial institutions to understand as they assess and plan for adoption of the service.

FedNow Service Network Architecture

The FedNow Service, like the other Federal Reserve payment systems, is accessible via communication channels provided by the Federal Reserve Banks' FedLine Solutions. Access to the FedNow Service is available over a dedicated wide area network (WAN) or a virtual private network (VPN) connection over the internet.

Participating financial institutions have various options to connect with the service, including connecting directly with Federal Reserve Bank Services using their own FedLine Solutions or connecting via a Service Provider.





Participants exchange messages with the FedNow Service using an IBM® MQ client. Participants use an IBM MQ client library to connect remotely to FedNow MQ servers over the FedLine Solutions. The FedNow MQ environment operates as a single cluster across sites, allowing Participants to connect to a server at any site.



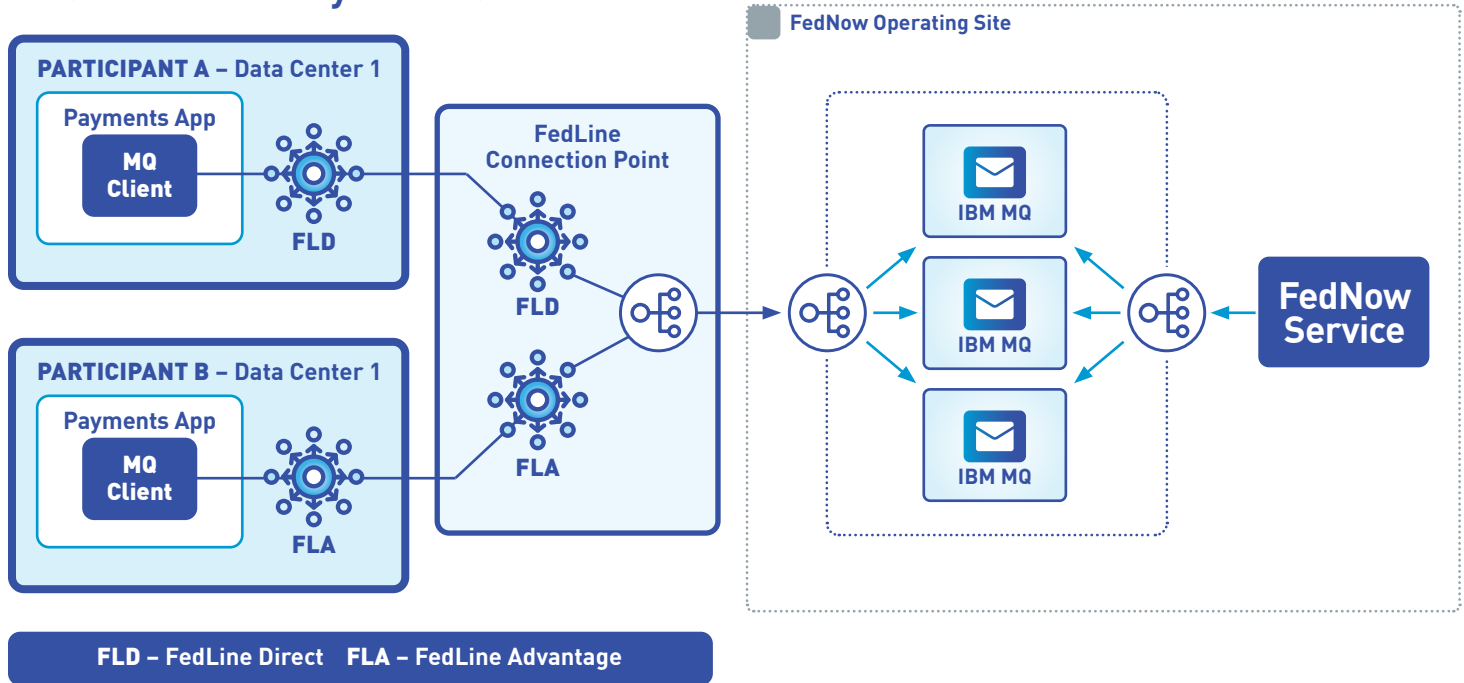
For more detailed information on connecting to the FedNow Service via FedLine Solutions, refer to the [FedNow Service Guide to FedLine Connectivity](#) on FedNow Explorer.

FedNow Service Profiles and Components

To understand the messaging flows and connectivity requirements of the FedNow Service, it is important to first understand the elements that comprise the FedNow Service participation and connectivity model.

Element	Description
 <p>Authorized Connection Profile</p>	<p>The Authorized Connection Profile defines FedNow Service connectivity settings used to access the FedNow interface and send or receive messaging via the FedNow Service, on behalf of one or more Participants (represented as RTNs). All Participants are required to have an Authorized Connection Profile or to be connected to one via a Service Provider(s).</p> <p>Each Authorized Connection Profile consists of: A Connection Party A Connection Point Queues (endpoints)</p>
 <p>Connection Party</p>	<p>A Connection Party is a conceptual entity that owns connectivity to the FedNow Service and is authorized to send and receive messages, as well as log in to the FedNow interface.</p> <p>A Connection Party is mapped to one or more Participant Profiles. Each mapping carries specific permissions that control what functions the Connection Party can execute on behalf of the Participant Profile.</p>
 <p>Connection Point</p>	<p>A Connection Point is a logical grouping of endpoints (queues), which is owned by a Connection Party. A Connection Point represents a site or location from which a Participant connects to the FedNow Service. Consequently, a Connection Party can own one or more Connection Points. A Connection Point holds a set of endpoints (queues) over which the Connection Party exchanges messages with the FedNow Service.</p>
 <p>Participant Profile</p>	<p>A Participant Profile is required for each RTN that a Participant uses to send and/or receive payments and messaging through the FedNow Service, regardless of whether they connect to the FedNow Service directly or via a Service Provider(s). Each RTN is associated to a single Participant Profile, and there can be multiple Participant Profiles per institution. The Participant Profile defines the settings and features in the FedNow Service that are enabled for each RTN.</p>

MQ Connectivity and Queues



The application-to-application flow shown above supports an asynchronous messaging-based paradigm, implemented using IBM MQ. The FedNow Service hosts a cluster of IBM MQ queue managers, and the payment applications operated by Participants or their Service Providers interact directly with the queue managers to put and get messages, using an embedded IBM MQ client library.

Each Participant connecting directly to the FedNow Service has dedicated queues hosted by the FedNow Service MQ queue managers. Queues are defined as either “to FedNow” (OUT queues) or “from FedNow” (IN queues) to indicate the direction of the messages. The naming pattern for OUT queues is controlled by the FedNow Service. The naming pattern for IN queues allows for customization by a Participant.

24x7x365 Availability and Resiliency

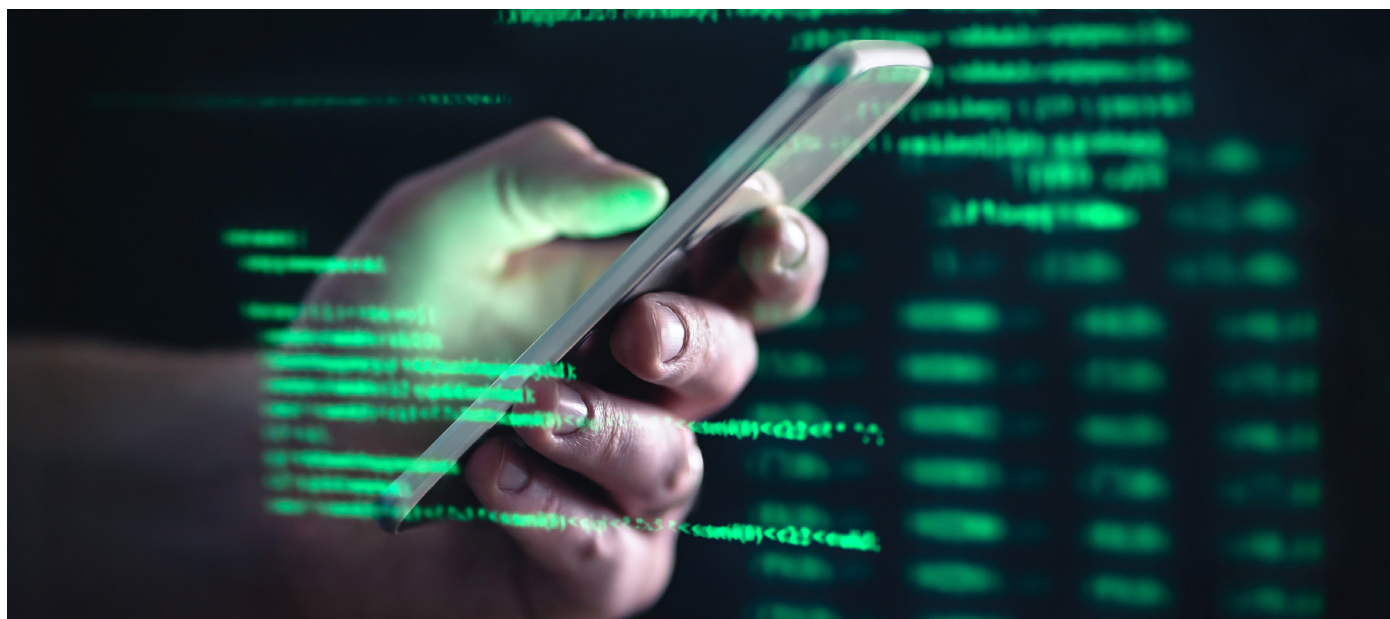
The FedNow Service is designed for 24x7x365 availability and resiliency, while maintaining transparency to connected Participant systems or their Service Providers. Client systems do not need to enable operations to resume if a FedNow Service component fails. While the FedNow Service operates at multiple locations (separated by large distances), it appears to the client as a single target for connectivity.

Resiliency is achieved through multiple layers of redundancy at all tiers between the client and FedNow Service applications. If a component fails along the communication path, the connection is dropped, but the client should immediately reconnect. New connection requests are routed by surviving components to one of the FedNow Service queue managers.

Designing Client Applications

When designing client applications to operate in a 24x7x365 environment:

- Ensure that processes consuming messages from the FedNow Service queues are long-running services that use persistent connections, potentially by using pooled connections. This helps to ensure optimal performance in configurations of clustered FedNow Service MQ queue managers.
- Participants are allowed to have multiple connections open and are expected to make use of concurrent connections to send and receive messages to meet their performance needs. For Participants that maintain multiple connection points, the expectation is that all connections and queues, including readers and writers, are being monitored and maintained by the Participant to meet the FedNow Service requirements, including active monitoring of the connection and reestablishing the connection when necessary.
- Participants should consider solution designs that decouple the processing of messages received from the FedNow Service from the FedNow Service MQ servers. This can be achieved by creating a layer that quickly pulls messages from FedNow Service queues and stores them locally onto a messaging, streaming or other storage solution, where the actual business processing can occur.



Security and Controls

The FedNow Service relies on multiple layered controls to ensure a high level of security for its operations, including:

- Security measures employed by the FedLine Solutions network on which the FedNow Service runs.
- The FedNow Service uses mutual Transport Layer Security (TLS) for authentication. Participants use FRS-issued client certificates to perform the mutual TLS authentication.
- The FedNow Service validates that the entities referenced in the message are allowed to use the queue on which the message is received.
- The FedNow Service requires all messages to be cryptographically signed. The service validates the signature and association between the entity sending the message and the key used to sign it.



NOTE: Participants are expected to use internal security and control measures and adapt them as needed so they are sufficient to handle the requirements of a real-time payment system.

FedNow ISO 20022 Service Messages

FedNow Service messages comply with ISO 20022 standardized metadata and types to ensure compatibility with other messaging systems. FedNow Service messages can carry a variety of payloads defined by the ISO 20022 standard.



FedNow Service Usage Guidelines

While the FedNow Service supports the standard ISO 20022 types, similar to other real-time payment systems, the service provides usage guidelines and rules to support technical and connectivity requirements, while maintaining formal compatibility with the original standard. The guidelines and rules are provided in the form of FedNow Service enhanced schemas of the ISO messages (XSD files).

Additional Resources on MyStandards®

The MyStandards platform houses current ISO 20022 message specifications, an implementation guide and message flows for the FedNow Service. The FedNow ISO 20022 Readiness Portal on MyStandards offers a place to test compliance of messages. It's easy to set up a free account and available to anyone who registers. A [step-by-step guide](#) is available to help access [MyStandards](#).

Message Signing

The Federal Reserve Banks require messages exchanged with the FedNow Service to be cryptographically signed using asymmetric public and private key pairs. Keys in a key pair are mathematically related and are used to sign and validate the signature on messages. Digital signatures help the receiver verify that a message originated from the sender and that the message content is unchanged.

Public/Private Key Pair Creation

Participants create public and private key pairs with specifications defined by the FedNow Service. Participants can generate key pairs using any key management service or standard enterprise protocol, such as OpenSSL or Java.

Key Pair Registration, Management and Confidentiality

Participants must register their public keys with the FedNow Service. First-time key registration is done by uploading the initial key through the FedNow interface. Subsequent key registrations can be done by exchanging messages with the service using the FedNow Service MQ queues.

Keeping track of public keys stored in the FedNow Service and keeping the key store up to date with active keys helps to prevent issues arising from rejected connections due to expired keys.



NOTE: Participants must maintain the confidentiality of their private keys consistent with the Federal Reserve Banks Operating Circular 8 and any other agreement with the Federal Reserve Banks, which impose confidentiality or information security obligations on a FedNow (Service) Participant and/or its Service Providers.

Part Three: Technical Considerations

Financial institutions considering adoption of the FedNow Service need to make decisions about possible changes to their technology, services and software ahead of implementation. This includes internal systems and those managed by external partners.

Financial institutions are strongly encouraged to assess their existing platforms, products and functionality based on planned services, users and capabilities for instant payments. In some cases, FedNow Service specifications and business policies and programs may require upgrades to ensure systems can meet expectations.

To facilitate these conversations, it may be valuable for the business to identify which customers and accounts will be enabled to perform specific functions within the service — for example, who will be able to receive or send transactions.



NOTE: The information provided here is not intended to be comprehensive. Rather, the goal is to jump-start planning and facilitate outreach and conversations with your organization's internal and external partners.

Impact to Internal and External Systems

Financial institutions should review their plans for the FedNow Service with internal and vendor solutions to assess the current and desired function of each system and the timing of relevant activities when migrating to 24x7x365 availability. Questions to consider may include:

- Which internal and external solutions may be impacted by instant payments? What is the plan to manage real-time processing?
- What additional capabilities are needed to handle real-time processing?
- Will downstream applications need to operate on a 24x7x365 basis?
- Consider whether back-end systems designed for batch files can be prepared to support message-based payment processing. Can they be used as part of the instant payments ecosystem? Systems affected include core banking, fraud prevention and sanction screening systems.
- Will additional authentication protocols be needed to support instant payments? What other impacts might there be on customer interfaces such as online banking, mobile apps and interactive voice response?
- What will the impact be on interfaces used by support teams?
- Will current interfaces enable a user to report fraud or a mistake, like a duplicate payment?
- What alerts, notifications or other information relative to instant payments will be made available to customers? Are systems set up to alert customers of payments received or other status messages and to meet anticipated requirement to make funds available immediately?
- Is there a plan to offer real-time payment services to customers via a user interface or mobile application? Will the UI or mobile application be built in house or will the work be outsourced?
- How will the FedNow Service integrate with the organization's current architecture (e.g., core banking system, payment systems, fraud and online banking)?
- What changes may be needed on statements, reports, data extracts or other information sources?
- If using Service Providers, what tools and support will they provide to facilitate integrating the current architecture and the solutions of other Service Providers, if needed?
- What contingency arrangements are needed to mitigate service disruptions?



Fraud and Risk Mitigation

Implementing a real-time payment system requires enhanced capabilities for fraud screening, as transactions are settled in a matter of seconds and are irrevocable. Participants are expected to use internal security and control measures and adapt them as needed so they can sufficiently handle the requirements of a real-time payment system.

Consider the following:

- Review your fraud and risk programs or opportunities to leverage existing capabilities and determine necessary adjustments to meet the demands of instant payments. Consider which tools are available to you (either internally, via the Federal Reserve or through other vendors) to help address any gaps you identify.
- Threat detection and recovery models: How will the riskiness of a transaction be assessed, including the decision to proceed with the transaction or require additional verification?
- Employ systems or tools that can analyze and manipulate incoming transactional data in real time, 24x7x365, to prevent fraudulent transactions from starting (or completing).
- Use strong authentication measures.
- Alerts and notifications may be powerful tools to help customers stay aware of account activity.



TIP: Fraud must be reported using the [FraudClassifierSM model](#), which can provide a better understanding of current and emerging fraud trends across multiple payment types, help spot trends early, and identify similarities or differences between cases encountered.



Glossary

Term	Description
Authorized Connection Profile (ACP)	A profile that defines connectivity settings to the FedNow Service for a Participant or Service Provider, which are used to process and manage messages and payments on behalf of one or multiple RTNs.
Connection Party	A role played by a Participant that maintains an electronic connection to the FedNow Service through which the organization enables one or more RTNs to access the FedNow Service.
Connection Point	The grouping of endpoints maintained by a Participant in their role as a Connection Party that enables them to communicate with the FedNow Service.
Correspondent	A financial institution (FI) that maintains a Master Account with a Federal Reserve Bank and has agreed to maintain a Settlement Account for another FedNow Participant.
Electronic Connection	A communication facility used to exchange data between a Federal Reserve Bank and an institution or its Service Provider. The term includes but is not limited to an internet, extranet, wireless, wide area network ("WAN"), local area network ("LAN"), or other data connection, and a connection for which access, authentication, or authorization is controlled by use of one or more Access Control Features. See also "Service Provider."
FedNow DevRel Resource	The developer relations resource, or FedNow DevRel, is a tech-centric resource that Participants can access using their FedLine Solutions credentials. It allows live Participants and those currently onboarding to easily browse, search and download information to help them build, implement and maintain their instant payment technology with the FedNow Service.
IBM MQ	Messaging solution used to send and receive data as messages between applications, services and systems.
Key Pairs	A set of security credentials, composed of a public key and a private key used to verify identities.
Master Account	The record of financial rights and obligations of an account holder and the administrative Federal Reserve Bank with respect to each other, where opening, intra-day and closing balances are determined. A Master Account is identified by a primary RTN.
Message	Any message (whether a value or nonvalue message), notice or other communication sent, received, processed or otherwise transmitted through the FedNow Service. A message includes any Advice of Credit (including a payment order), Acknowledgement, Rejection and Nonvalue Message.

Term	Description
Message Signatures	Security protocols that verify the integrity and authenticity of the message sent and received through the service, providing confidence the message received was the same as what was sent. Digital signatures do this by generating a unique hash of the message or document and encrypting it using the sender's private key.
Nonvalue Messages	Messages sent through the FedNow Service that do not generate an accounting entry. A nonvalue message is a request pertaining to the details or status of an instant payment message, request for reporting, or message retrieval of any kind which can either be sent from a Participant to the FedNow Service or exchanged between a Sender FI and Receiver FI.
Participant	A financial institution authorized by a Federal Reserve Bank to send, receive or settle messages through the FedNow Service.
Participant Profile	A Participant Profile is required for each RTN a financial institution uses to send and/or receive payments and messages through the FedNow Service, regardless of whether they connect to the FedNow Service directly or via Service Provider(s). Each RTN is associated to a single Participant Profile, and there can be multiple Participant Profiles per institution. The Participant Profile defines the settings and features in the FedNow Service that are enabled for each RTN.
Queue (Endpoint)	The FedNow Service uses queues to send and receive messages. Queues are defined as either "to FedNow" (OUT queues) or "from FedNow" (IN queues) to provide clarity on the direction of the messages.
Real-time Gross Settlement System (RTGS)	A payment system that settles payment instructions immediately on a transaction-by-transaction basis.
Routing Transit Number (RTN)	A nine-digit number associated with a principal office used when clearing funds or processing checks.
Service Provider	An agent of a FedNow Participant authorized to do one or more of the following on the FedNow Participant's behalf: initiate, transmit or receive messages on behalf of that FedNow Participant; operate or otherwise manage the Electronic Connection used to send or receive messages on behalf of that FedNow Participant; select the security procedure, profile settings or processing options on behalf of that FedNow Participant; or obtain access to information related to the FedNow Participant through the FedNow Service. See also "Electronic Connection."
Value Message	Value messages are pacs.008, pacs.004 and pacs.009 messages sent as payment orders through the FedNow Service.

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The FedNow Service Technical Overview and Planning Guide is provided to help Participants, Service Providers and others as they prepare for the FedNow Service. This guide may change from time to time, including as the Federal Reserve Banks obtain feedback from various stakeholders.

To the extent a FedNow Service Participant uses a Service Provider(s), requirements in the FedNow Service Technical Overview and Planning Guide, otherwise applicable to FedNow Service Participants, also apply to the Service Provider when it performs functions as an agent on behalf of a FedNow Service Participant.

The terms governing the FedNow Service will govern to the extent of any inconsistency between the Technical Overview and Planning Guide and those terms. This guide does not create new obligations for the Federal Reserve Banks and the standards outlined in it do not confer or connote legal status or responsibilities of any party to a funds transfer through the service under applicable law.

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