



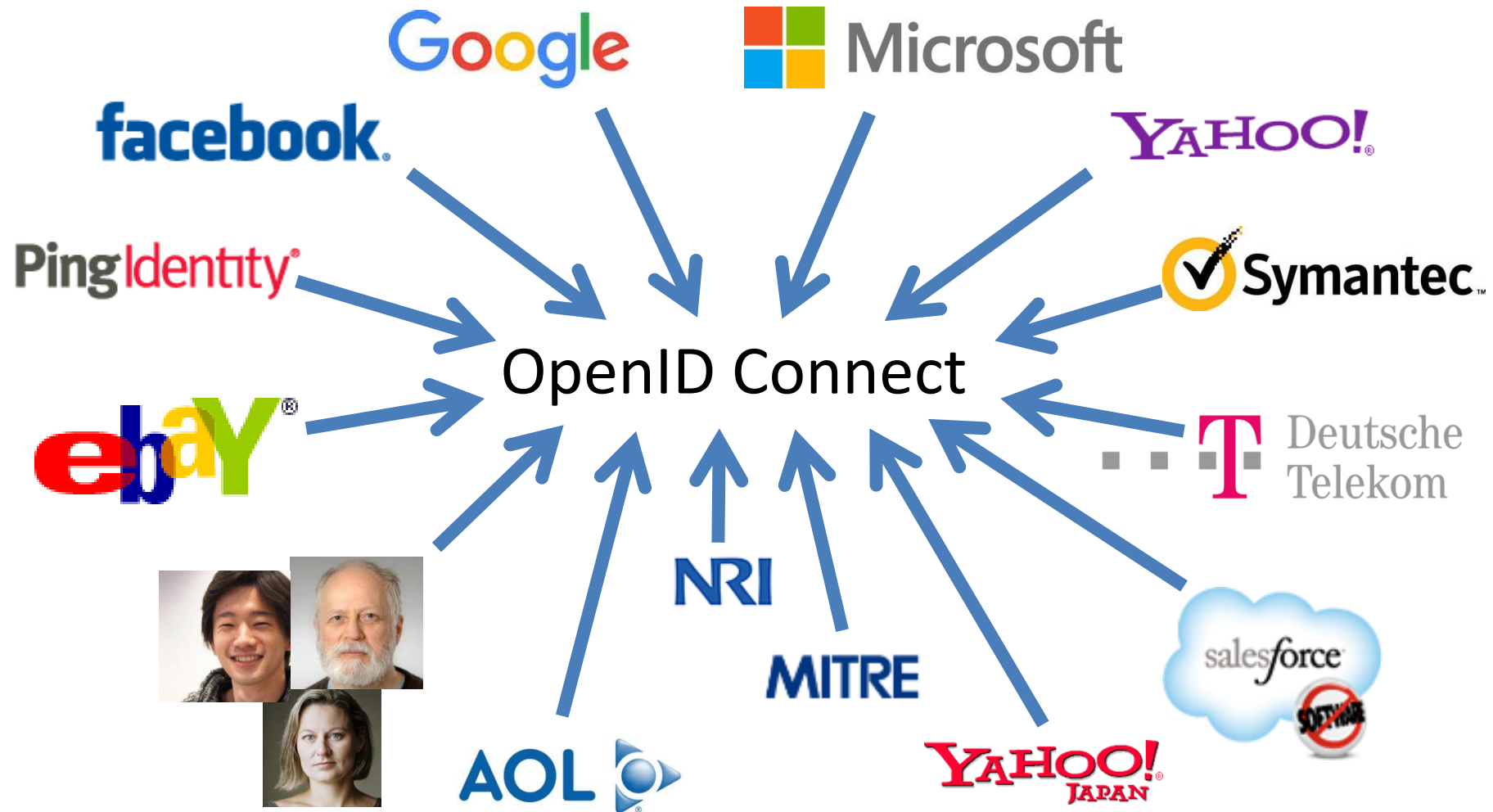
Introduction to OpenID Connect

April 3, 2018

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Working Together



What is OpenID Connect?



- Simple identity layer on top of OAuth 2.0
- Enables RPs to verify identity of end-user
- Enables RPs to obtain basic profile info
- REST/JSON interfaces → low barrier to entry
- Described at <http://openid.net/connect/>

You're Probably Already Using OpenID Connect! OpenID

- If you have an Android phone or log in at AOL, Deutsche Telekom, Google, Microsoft, NEC, NTT, Salesforce, Softbank, Symantec, Verizon, or Yahoo! Japan, you're already using OpenID Connect
 - Many other sites and apps large and small also use OpenID Connect

OpenID Connect Range



- Spans use cases, scenarios
 - Internet, Enterprise, Mobile, Cloud
- Spans security & privacy requirements
 - From non-sensitive information to highly secure
- Spans sophistication of claims usage
 - From basic default claims to specific requested claims to collecting claims from multiple sources
- Maximizes simplicity of implementations
 - Uses existing IETF specs: OAuth 2.0, JWT, etc.
 - Lets you build only the pieces you need

Numerous Awards



- OpenID Connect won 2012 European Identity Award for Best Innovation/New Standard
 - <http://openid.net/2012/04/18/openid-connect-wins-2012-european-identity-and-cloud-award/>
- OAuth 2.0 won in 2013
- JSON Web Token (JWT) & JOSE won in 2014
- OpenID Certification program won 2018 Identity Innovation Award
 - <http://openid.net/2018/03/29/openid-certification-program-wins-2018-identity-innovation-award/>



Presentation Overview



- Introduction
- Design Philosophy
- Timeline
- A Look Under the Covers
- Overview of OpenID Connect Specs
- More OpenID Connect Specs
- OpenID Certification
- Resources

Keep Simple Things Simple

Make Complex Things Possible

Keep Simple Things Simple



UserInfo endpoint for
simple claims about user

Designed to work well on
mobile phones

How We Made It Simple



- Built on OAuth 2.0
- Uses JavaScript Object Notation (JSON)
- You can build only the pieces that you need
- *Goal: Easy implementation on all modern development platforms*

Make Complex Things Possible



Encrypted Claims

Aggregated Claims

Distributed Claims

Key Differences from OpenID 2.0



- Support for native client applications
- Identifiers using e-mail address format
- UserInfo endpoint for simple claims about user
- Designed to work well on mobile phones
- Uses JSON/REST, rather than XML
- Support for encryption and higher LOAs
- Support for distributed and aggregated claims
- Support for session management, including logout
- Support for self-issued identity providers

OpenID Connect Timeline



- Artifact Binding working group formed, Mar 2010
- Major design issues closed at IIW, May 2011
 - Result branded “OpenID Connect”
- Functionally complete specs, Jul 2011
- 5 rounds of interop testing between 2011 and 2013
 - Specifications refined after each round of interop testing
- Won Best New Standard award at EIC, April 2012
- Final specifications approved, February 2014
- Errata set 1 approved November, 2014
- Form Post Response Mode spec approved, April 2015
- OpenID 2.0 to Connect Migration spec approved, April 2015
- OpenID Provider Certification launched, April 2015
- Relying Party Certification launched, December 2016
- Logout Implementer’s Drafts approved, March 2017
- OpenID Certification program won Best Identity Innovation award, March 2018

A Look Under the Covers



- ID Token
- Claims Requests
- UserInfo Claims
- Example Protocol Messages

ID Token



- JWT representing logged-in session
- Claims:
 - `iss` – Issuer
 - `sub` – Identifier for subject (user)
 - `aud` – Audience for ID Token
 - `iat` – Time token was issued
 - `exp` – Expiration time
 - `nonce` – Mitigates replay attacks

ID Token Claims Example



```
{  
  "iss": "https://server.example.com",  
  "sub": "248289761001",  
  "aud": "0acf77d4-b486-4c99-bd76-074ed6a64ddf",  
  "iat": 1311280970,  
  "exp": 1311281970,  
  "nonce": "n-0S6_WzA2Mj"  
}
```

Claims Requests



- Basic requests made using OAuth scopes:
 - `openid` – Declares request is for OpenID Connect
 - `profile` – Requests default profile info
 - `email` – Requests email address & verification status
 - `address` – Requests postal address
 - `phone` – Requests phone number & verification status
 - `offline_access` – Requests Refresh Token issuance
- Requests for individual claims can be made using JSON `"claims"` request parameter

UserInfo Claims



- sub
- name
- given_name
- family_name
- middle_name
- nickname
- preferred_username
- profile
- picture
- website
- gender
- birthdate
- locale
- zoneinfo
- updated_at
- email
- email_verified
- phone_number
- phone_number_verified
- address

UserInfo Claims Example



```
{  
  "sub": "248289761001",  
  "name": "Jane Doe",  
  "given_name": "Jane",  
  "family_name": "Doe",  
  "email": "janedoe@example.com",  
  "email_verified": true,  
  "picture": "http://example.com/janedoe/me.jpg"  
}
```

Authorization Request Example



```
https://server.example.com/authorize  
?response_type=id_token%20token  
&client_id=0acf77d4-b486-4c99-bd76-074ed6a64ddf  
&redirect_uri=https%3A%2F%2Fclient.example.com%2Fcb  
&scope=openid%20profile  
&state=af0ifjsldkj  
&nonce=n-0S6_WzA2Mj
```

Authorization Response Example



HTTP/1.1 302 Found

Location: <https://client.example.com/cb>

#access_token=mF_9.B5f-4.1JqM

&token_type=bearer

&id_token=eyJhbGZlNiJ9.eyJz9Glnw9J.F9-V4IvQ0Z

&expires_in=3600

&state=af0ifjsldkj

UserInfo Request Example



GET /userinfo HTTP/1.1

Host: server.example.com

Authorization: Bearer mF_9.B5f-4.1JqM

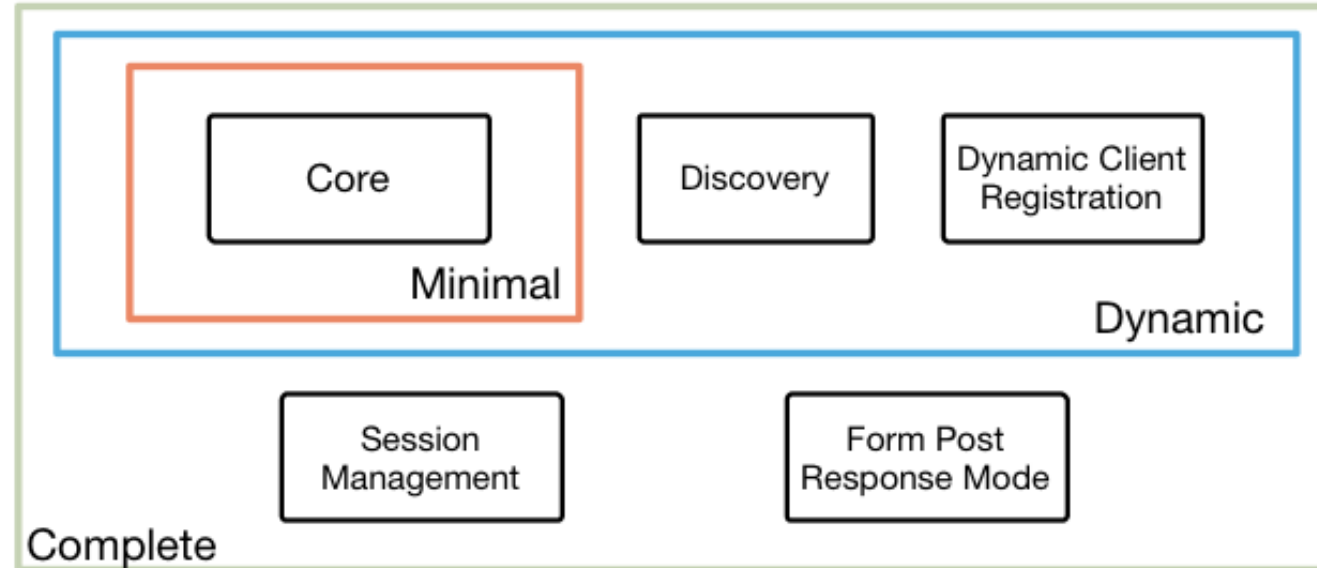
OpenID Connect Specs Overview



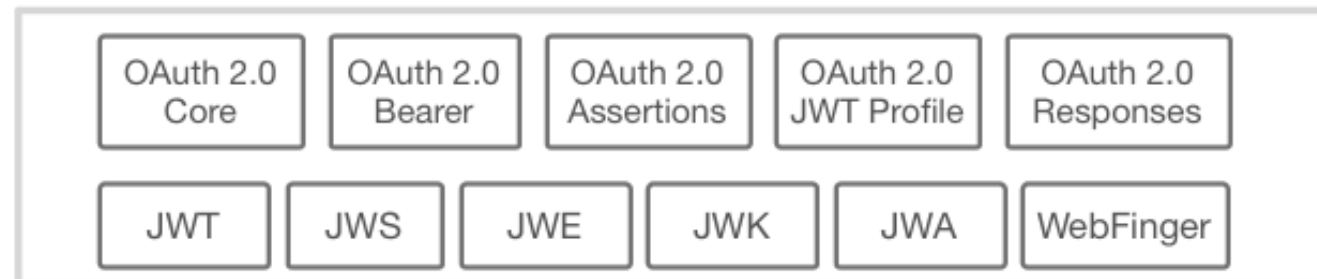
4 Feb 2014

OpenID Connect Protocol Suite

<http://openid.net/connect>



Underpinnings



Additional Final Specifications (1 of 2) OpenID

- OpenID 2.0 to OpenID Connect Migration
 - Defines how to migrate from OpenID 2.0 to OpenID Connect
 - Has OpenID Connect identity provider also return OpenID 2.0 identifier, enabling account migration
 - http://openid.net/specs/openid-connect-migration-1_0.html
 - Completed April 2015
 - Google shut down OpenID 2.0 support in April 2015
 - Yahoo, others also plan to replace OpenID 2.0 with OpenID Connect

Additional Final Specifications (2 of 2) OpenID

- OAuth 2.0 Form Post Response Mode
 - Defines how to return OAuth 2.0 Authorization Response parameters (including OpenID Connect Authentication Response parameters) using HTML form values auto-submitted by the User Agent using HTTP POST
 - A “form post” binding, like SAML and WS-Federation
 - An alternative to fragment encoding
 - http://openid.net/specs/oauth-v2-form-post-response-mode-1_0.html
 - Completed April 2015
 - In production use by Microsoft, Ping Identity

Session Management / Logout (works in progress)



- Three approaches being pursued by the working group:
 - Session Management
 - http://openid.net/specs/openid-connect-session-1_0.html
 - Uses HTML5 postMessage to communicate state change messages between OP and RP iframes
 - Front-Channel Logout
 - http://openid.net/specs/openid-connect-frontchannel-1_0.html
 - Uses HTTP GET to load image or iframe, triggering logout (similar to SAML, WS-Federation)
 - Back-Channel Logout
 - http://openid.net/specs/openid-connect-backchannel-1_0.html
 - Server-to-communication not using the browser
 - Can be used by native applications, which have no active browser
- Unfortunately, no one approach best for all use cases
- Became Implementer's Drafts in March 2017
 - It's about time for them to become Final Specifications

Federation Specification (work in progress)



- Roland Hedberg created OpenID Connect Federation specification
 - http://openid.net/specs/openid-connect-federation-1_0.html
- Enables establishment and maintenance of multi-party federations using OpenID Connect
- Defines hierarchical JSON-based metadata structures for federation participants
- Prototype implementations being interop tested w/ each other
- Agreement at OpenID Workshop yesterday that it's time for it to progress to being an Implementer's Draft

What is OpenID Certification?



- Enables OpenID Connect implementations to be certified as meeting the requirements of defined conformance profiles
 - Goal is to make high-quality, secure, interoperable OpenID Connect implementations the norm
- An OpenID Certification has two components:
 - Technical evidence of conformance resulting from testing
 - Legal statement of conformance
- Certified implementations can use the “OpenID Certified” logo



What value does certification provide?



- Technical:
 - Certification testing gives confidence that things will “just work”
 - No custom code required to integrate with implementation
 - Better for all parties
 - Relying parties explicitly asking identity providers to get certified
- Business:
 - Enhances reputation of organization and implementation
 - Shows that organization is taking interop seriously
 - Customers may choose certified implementations over others

What can be certified now?



- Five conformance profiles of OpenID Providers:
 - Basic OpenID Provider
 - Implicit OpenID Provider
 - Hybrid OpenID Provider
 - OpenID Provider Publishing Configuration Information
 - Dynamic OpenID Provider
- Five corresponding conformance profiles of OpenID Relying Parties:
 - Basic Relying Party
 - Implicit Relying Party
 - Hybrid Relying Party
 - Relying Party Publishing Configuration Information
 - Dynamic Relying Party

Who has achieved OP Certification?



- OpenID Provider certifications at <http://openid.net/certification/#OPs>
 - 174 profiles certified for 57 implementations by 49 organizations
- Recent additions:
 - Auth0, CA, Classmethod, Cloudentity, Connect2id, Curity, Hanscan, Identity Automation, KSIGN, Library of Congress, Microsoft, Azure Active Directory, Mvine, NRI, NTT, OGIS-RI, OpenAthens, Optimal Idm, ProSiebenSat.1, Michael Schwartz, Filip Skokan, WSO2
- Each entry link to zip file with test logs and signed legal statement
 - *Test results available for public inspection*

Organization	Implementation	Basic OP	Implicit OP	Hybrid OP	Config OP	Dynamic OP
Auth0	Auth0	24-May-2016	15-Feb-2017	15-Feb-2017	24-May-2016	
Authlete	Authlete 1.1	12-Jul-2017	12-Jul-2017	12-Jul-2017	12-Jul-2017	
Dominick Baier & Brock Allen	IdentityServer3 v1.6	8-May-2015	8-May-2015	8-May-2015	8-May-2015	
Dominick Baier & Brock Allen	IdentityServer4	12-Dec-2016	12-Dec-2016	12-Dec-2016	12-Dec-2016	
CA	CA API Gateway/CA Mobile API Gateway	23-Jun-2017	1-Nov-2017	1-Nov-2017	23-Jun-2017	
CA	CA Single Sign-On 12.7	1-Mar-2017				
CA	CA Single Sign-On 12.8		4-Jan-2018			
Classy Security	Identity Provider v6.3.4	4-May-2016	23-Jun-2016	23-Jun-2016	23-Jun-2016	
ClassLink	ClassLink OneClick 2015	3-Nov-2015			3-Nov-2015	
Classmethod	Battle v 1.18.2	9-Nov-2017			9-Nov-2017	
Cloudentity	Cloudentity OIDC services 1.3	18-Aug-2017			18-Aug-2017	18-Aug-2017
Connect2id	Connect2id Server 6.1.2a	3-Jan-2017	3-Jan-2017	3-Jan-2017	3-Jan-2017	3-Jan-2017
Curity	Curity Identity Server 2.3.1	26-Dec-2017	26-Dec-2017	26-Dec-2017	26-Dec-2017	
CZ.NIC	mjeID	7-Jul-2016		31-Jul-2016	7-Jul-2016	7-Jul-2016
Deutsche Telekom	Telekom Login	29-Sep-2015			22-Sep-2015	
Fingertack	OpenAM 13	13-Apr-2015	13-Apr-2015	13-Apr-2015	13-Apr-2015	
Google	Google Federated Identity	26-Apr-2015	21-Apr-2015	23-Apr-2015	15-Apr-2015	
Thierry Habart	SimpleIdentityServer V1.6.0	9-Dec-2015			11-Dec-2015	
Thierry Habart	SimpleIdentityServer V2.0.0	19-Jan-2016	19-Jan-2016	19-Jan-2016	19-Jan-2016	19-Jan-2016
Hanscan	Biocryptology OpenID Identity Server 1.3.1	31-May-2017	31-May-2017	31-May-2017	31-May-2017	
Roland Hedberg	pyoidc 0.7.7	26-Sep-2015	26-Sep-2015	26-Sep-2015	26-Sep-2015	26-Sep-2015
Col Heiderbrand	Spark Platform	2-Oct-2016	2-Oct-2016	2-Oct-2016	6-Oct-2016	
Identity Automation	RapidIdentity Federation	12-Jan-2018			12-Jan-2018	
KSIGN	KSIGN Access 4.0	17-Mar-2017			12-Jan-2018	
The Library of Congress	Authentication, Authorization, and Accounting System, version 1.0	12-May-2017				
Microsoft	ADFS on Windows Server 2016	13-Sep-2015	13-Sep-2015		7-Apr-2015	
Microsoft	Azure Active Directory				8-Apr-2015	
Mvine	Mvine Federated Identity Hub v1	1-Aug-2017				
NEC	NC7000-3A-OC	7-Mar-2016				
Nomura Research Institute	phylODC	10-Apr-2015	10-Apr-2015	10-Apr-2015	10-Apr-2015	10-Apr-2015
Nomura Research Institute	Uni-ID	10-Apr-2015				
NRI SecureTechnologies	Uni-ID Libra 1.0	26-Jul-2017	26-Jul-2017	26-Jul-2017	26-Jul-2017	
NTT Software Corporation	TrustBlind Federation Manager	26-Jan-2017	26-Jan-2017	26-Jan-2017		
OGIS-RI	Thermostat Identity Platform v1.1.0	7-Oct-2016	7-Oct-2016		7-Oct-2016	
OGIS-RI	Thermostat Identity Platform v1.3.0	26-Apr-2017	25-May-2017		26-Apr-2017	
Okta	Okta OP	25-May-2016	25-May-2016	26-May-2016	26-May-2016	
OpenAthens	OpenAthens Cloud	3-Oct-2017			24-Oct-2017	
Optimal Idm	TheOptimalCloud 4.2	19-Oct-2017	24-Oct-2017			
PayPal	Login with PayPal				15-Apr-2015	
Peercraft ApS	Peercraft	19-Jan-2016	19-Jan-2016	19-Jan-2016	19-Jan-2016	19-Jan-2016
Ping Identity	PingFederate	10-Apr-2015	10-Apr-2015	10-Apr-2015	9-Apr-2015	
Privacy Vaults Online (PRIVO)	PRIVO-Lock	23-Oct-2015			25-Nov-2015	
ProSiebenSat.1 Media	7Pass "2.0.0"	7-Aug-2017	7-Aug-2017	21-Aug-2017	7-Aug-2017	
Red Hat	Keycloak 2.3.0	31-Oct-2016	31-Oct-2016	31-Oct-2016	31-Oct-2016	31-Oct-2016
Justin Richter	MITREidConnect	13-May-2015			13-May-2015	13-May-2015
Salesforce	Summer 2015 Release				14-May-2015	
Michael Schwartz	Okta Server 2.3	2-Jul-2015	2-Jul-2015	6-Jul-2015	2-Jul-2015	2-Jul-2015
Michael Schwartz	Okta Server 3.1.1	16-Oct-2017	16-Oct-2017	16-Oct-2017	16-Oct-2017	16-Oct-2017
SecurHub	SecurHub MP 6.2	25-Feb-2016	25-Feb-2016	25-Feb-2016	7-Mar-2016	
Filip Skokan	node-oidc-provider	2-Jan-2017	2-Jan-2017	2-Jan-2017	2-Jan-2017	2-Jan-2017
Symantec	NSL 2016.4.0.16	13-Oct-2016			13-Oct-2016	
University of Chicago	OIDC OP Overlay for Shibboleth MP v3.2.1 version 1.0	25-Feb-2016			25-Feb-2016	
Verizon	VZConnect 1.9	21-Dec-2016				
ViewOS	Cobalt V1.0	28-Jan-2016	2-Feb-2016		28-Jan-2016	
Mattias Wikoski	Auth0	6-Feb-2016			6-Feb-2016	
WSO2	Identity Server 5.4.0	15-Jan-2016	15-Jan-2016			
Yahoo! Japan	Yahoo! ID Federation v2	7-Dec-2016	7-Dec-2016	7-Dec-2016	7-Dec-2016	

Who has achieved RP Certification?



- Relying Party certifications at <http://openid.net/certification/#RPs>
 - 44 profiles certified for 18 implementations by 16 organizations
- Recent additions:
 - Brock Allen, Damien Bowden, F5 Networks, Janrain, Karlsruher Institut für Technologie, Tom Jones, KSIGN, Manfred Steyer, NRI, ZmartZone IAM

Organization	Implementation	Basic RP	RP Implicit	Hybrid RP	Config RP	Dynamic RP
Brock Allen	oidc-client-js 1.3		4-Feb-2017		7-Feb-2017	
Dominick Baier	IdentityModel.OidcClient 2.0	27-Jan-2017			6-Feb-2017	
Damien Bowden	angular-auth-oidc-client 1.0.2		21-Jun-2017		11-Aug-2017	
F5 Networks	BIG-IP 13.1.0 Evergreen	7-Jul-2017				
Thierry Habart	SimpleIdentityServer V1.0.1	17-Jan-2017	17-Jan-2017	17-Jan-2017	17-Jan-2017	17-Jan-2017
Janrain	IDPD 2.6.0	7-Feb-2017				
Roland Hedberg	pyoidc 0.9.4	20-Dec-2016	20-Dec-2016	20-Dec-2016	20-Dec-2016	20-Dec-2016
Tom Jones	TC.AUTHENTICATION 1.0	30-Jun-2017				
Karlsruher Institut für Technologie, SCC	oidcc 1.0.1	2-Feb-2017			2-Feb-2017	
KSIGN	KSIGN Trust Thing 1.0	2-Jan-2018				
Nomura Research Institute	phpOIDC 2016 Winter	7-Feb-2017	7-Feb-2017	7-Feb-2017	7-Feb-2017	7-Feb-2017
Nov Mataké	openid_connect rubygem v1.0.3	20-Jan-2017				
Ping Identity	PingAccess 4.2.2	26-Jan-2017				
Ping Identity	PingFederate 8.3.1	17-Jan-2017			31-Jan-2017	
Filip Skokan	node openid-client ^1.3.0	15-Dec-2016	15-Dec-2016	15-Dec-2016	15-Dec-2016	15-Dec-2016
Manfred Steyer	angular-oauth2-oidc 2.0.5		16-Aug-2017			
ZmartZone IAM	lua-resty-openidc 1.5.1	17-Nov-2017			17-Nov-2017	
ZmartZone IAM	mod_auth_openidc 2.3.1	21-Jul-2017	21-Jul-2017	21-Jul-2017	21-Jul-2017	21-Jul-2017

A Very International Effort



- European programmers developed and operate the certification test suite:
 - Roland Hedberg, Sweden
 - Hans Zandbelt, Netherlands
 - Filip Skokan, Czech Republic
- OpenID Connect leadership also very international:
 - Nat Sakimura, Japan
 - John Bradley, Chile
 - Michael Jones, United States

Use of Self-Certification



- OpenID Certification uses self-certification
 - Party seeking certification does the testing
 - (rather than paying a 3rd party to do the testing)
- Simpler, quicker, less expensive, more scalable than 3rd party certification
- Results are nonetheless trustworthy because
 - Testing logs are made available for public scrutiny
 - Organization puts its reputation on the line by making a public declaration that its implementation conforms to the profile being certified to

How does OpenID Certification work? OpenID

- Organization decides what profiles it wants to certify to
 - For instance, “Basic OP”, “Config OP”, and “Dynamic OP”
- Runs conformance tests publicly available at <http://op.certification.openid.net/> or <http://rp.certification.openid.net/>
- Once all tests for a profile pass, organization submits certification request to OpenID Foundation containing:
 - Logs from all tests for the profile
 - Signed legal declaration that implementation conforms to the profile
- Organization pays certification fee (for profiles not in pilot mode)
- OpenID Foundation verifies application is complete and grants certification
- OIDF lists certification at <http://openid.net/certification/> and registers it in OIXnet at <http://oixnet.org/openid-certifications/>

What does certification cost?



- Not a profit center for the OpenID Foundation
 - Fees there to help cover costs of operating certification program
- Member price
 - \$200 per new deployment
- Non-member price
 - \$999 per new deployment
 - \$499 per new deployment of an already-certified implementation
- Covers as many profiles as you submit within calendar year
- New profiles in pilot mode are available to members for free
- Costs described at <http://openid.net/certification/fees/>

Example Testing Screen



OpenID Certification OP Tests

Explanations of legends at [end of page](#)

You are testing using:

- Basic (code)
- Dynamic discovery
- Static registration
- crypto support ['sign']

If you want to change this you can do it [here](#)

Chose the next test flow you want to run from this list:

Response Type & Response Mode

- Authorization request missing the response_type parameter [Basic, Implicit, Hybrid] (OP-Response-Missing) ⓘ
- Request with response_type=code [Basic] (OP-Response-code) ⓘ

ID Token

- Does the OP sign the ID Token and with what [Basic, Implicit, Hybrid] (OP-IDToken-Signature) ⓘ
- IDToken has kid [Basic, Implicit, Hybrid] (OP-IDToken-kid) ⓘ

Userinfo Endpoint

- UserInfo Endpoint access with POST and bearer body [Basic, Implicit, Hybrid] (OP-UserInfo-Body) ⓘ
- UserInfo Endpoint access with GET and bearer header [Basic, Implicit, Hybrid] (OP-UserInfo-Endpoint) ⓘ
- UserInfo Endpoint access with POST and bearer header [Basic, Implicit, Hybrid] (OP-UserInfo-Header) ⓘ

- Publishes openid-configuration discovery information [Config, Dynamic] (OP-Discovery-Config) ⓘ
- Keys in OP JWKs well formed [Config, Dynamic] (OP-Discovery-JWKs) ⓘ
- Verify that claims_supported is published [Config, Dynamic] (OP-Discovery-claims_supported) ⓘ
- Verify that jwks_uri is published [Config, Dynamic] (OP-Discovery-jwks_uri) ⓘ

request_uri Request Parameter

- Support request_uri request parameter with unsigned request [Basic, Implicit, Hybrid] (OP-request_uri-Unsigned) ⓘ

request Request Parameter

- Support request request parameter with unsigned request [Basic, Implicit, Hybrid, Dynamic] (OP-request-Unsigned) ⓘ

claims Request Parameter

- Claims request with essential name claim [Basic, Implicit, Hybrid] (OP-claims-essential) ⓘ

Legends

	The test has not be run
	Success
	Warning, something was not as expected
	Failed
	The test flow wasn't completed. This may have been expected or not
	Signals the fact that there are trace information available for the test

Log from a Conformance Test



Test info

Profile: {'openid-configuration': 'config', 'response_type': 'code', 'crypto': 'sign', 'registration': 'static'}
Timestamp: 2015-04-07T02:58:53Z
Test description: Keys in OP JWKs well formed [Config, Dynamic]
Test ID: OP-Discovery-JWKs
Issuer: https://stsadweb.one.microsoft.com/adfs

Test output

After completing the test flow: __
[verify-base64url]
status: OK
description: Verifies that the base64 encoded parts of a JWK is in fact base64url encoded and not just base64 encoded
[check-http-response]
status: OK
description: Checks that the HTTP response status is within the 200 or 300 range
X:==== END =====

Trace output

```
0.000288 ----- DiscoveryRequest -----
0.000299 Provider info discover from 'https://stsadweb.one.microsoft.com/adfs'
0.000305 --> URL: https://stsadweb.one.microsoft.com/adfs/.well-known/openid-configuration
0.426715 ProviderConfigurationResponse: {
  "access_token_issuer": "http://stsadweb.one.microsoft.com/adfs/services/trust",
  "authorization_endpoint": "https://stsadweb.one.microsoft.com/adfs/oauth2/authorize/",
  "claims_parameter_supported": false,
  "claims_supported": [
    "aud",
    "iss",
    "iat",
    "exp",
    "auth_time",
    "nonce",
    "at_hash",
    "c_hash",
    "sub",
    "upn",
    "unique_name",
    "pwd_url",
    "pwd_exp",
    "ver"
  ],
  "grant_types_supported": [
    "authorization_code",
    "refresh_token",
    "client_credentials",
    "urn:ietf:params:oauth:grant-type:jwt-bearer",
    "implicit",
    "password"
  ],
  "id_token_signing_alg_values_supported": [
    "RS256"
  ],
  "issuer": "https://stsadweb.one.microsoft.com/adfs",
  "jwks_uri": "https://stsadweb.one.microsoft.com/adfs/discovery/keys",
  "request_parameter_supported": false,
```

```
  },
  "issuer": "https://stsadweb.one.microsoft.com/adfs",
  "jwks_uri": "https://stsadweb.one.microsoft.com/adfs/discovery/keys",
  "request_parameter_supported": false,
  "request_uri_parameter_supported": true,
  "require_request_uri_registration": true,
  "response_modes_supported": [
    "query",
    "fragment",
    "form_post"
  ],
  "response_types_supported": [
    "code",
    "id_token",
    "code id token",
    "token id token"
  ],
  "scopes_supported": [
    "logon_cert",
    "profile",
    "user_impersonation",
    "aza",
    "vpn_cert",
    "full_access",
    "email",
    "openid"
  ],
  "subject_types_supported": [
    "pairwise"
  ],
  "token_endpoint": "https://stsadweb.one.microsoft.com/adfs/oauth2/token/",
  "token_endpoint_auth_methods_supported": [
    "client_secret_post",
    "client_secret_basic",
    "private_key_jwt",
    "windows_client_authentication"
  ],
  "token_endpoint_auth_signing_alg_values_supported": [
    "RS256"
  ],
  "version": "3.0",
  "webfinger_endpoint": "https://stsadweb.one.microsoft.com/adfs/.well-known/webfinger"
}
0.846957 JWKs: {
  "keys": [
    {
      "alg": "RS256",
      "e": "AQAB",
      "kid": "f-5GWKyav6fDdnKB7A3b01lXZ0E",
      "kty": "RSA",
      "n": "ygUNL9XXanKy_fQlX0Smt9LRKpH3Xup1lk5mivaw7thYRPrkGArJezV4x-hfk3Rm9qv6ikBgntW0LI8FqotLcXmvIBqtbIDfSh59uts1r0QLRUVKS_2C",
      "use": "sig",
      "x5c": [
        "MIIFRjCCBjAgIwIBAgIKeZgGLwABAACESDANBgkqhkiG9w0BAQUFADCBgDETMBEgGmSjOmT8ixkARKWA2NvbTEZMBCGCGmSjOmT8ixkARKWCWlpY3Jvc2U="
      ],
      "x5t": "f-5GWKyav6fDdnKB7A3b01lXZ0E"
    }
  ]
}
0.847706 ===== END =====
```

Result

PASSED

Certification of Conformance



- Legal statement by certifier stating:
 - Who is certifying
 - What software
 - When tested
 - Profile tested
- Commits reputation of certifying organization to validity of results

CERTIFICATION OF CONFORMANCE To OPENID CONNECT CONFORMANCE PROFILE

Name of Entity ("Implementer") Making this Certification: Ping Identity Corporation
Software or Service ("Deployment") Name & Version #: PingFederate Summer 2015 Release
OpenID Connect Conformance Profile: Basic OpenID Provider
Conformance Test Suite Software: op.certification.openid.net as of April 10, 2015
Test Date: April 10, 2015

1. **Certification:** Implementer has tested the Deployment (including by successfully completing the validation testing using the Conformance Test Suite Software) and verified that it conforms to the OpenID Connect Conformance Profile, and hereby certifies to the OpenID Foundation and the public that the Deployment conforms to the OpenID Connect Conformance Profile as set forth above.
2. **Maintenance:** If subsequent changes to the Deployment, or other information or testing, indicates that the Deployment is not in conformance, Implementer will either correct the nonconformance (and update this Certification if necessary) or revoke this Certification.
3. **Incorporation of Terms:** The Terms and Conditions for Certification of Conformance to an OpenID Connect Conformance Profile, located at www.openid.net/certification, are incorporated by reference in this Certification, and Implementer agrees to be bound by such Terms and Conditions.

Implementer's Address Information	
Address:	1001 17th Street, Suite 100
City, State/Province, Postal Code	Denver, CO 80202
Country	USA
Implementer's Authorized Contact Information	
Name:	Brian Campbell
Title:	Distinguished Engineer
Phone:	720.317.2061
Email:	bcampbell@pingidentity.com

Authorized Signature: 
Name: Daniel Wussick
Title: Assoc. Gen. Counsel
Date: Apr. 10, 2015

How does certification relate to interop testing?



- OpenID Connect held 5 rounds of interop testing – see <http://osis.idcommons.net/>
 - Each round improved implementations and specs
 - By the numbers: 20 implementations, 195 members of interop list, > 1000 messages exchanged
- With interop testing, by design, participants can ignore parts of the specs
- Certification raises the bar:
 - Defines set of conformance profiles that certified implementations meet
 - Assures interop across full feature sets in profiles

Can I use the certification sites for interop testing?



- Yes – please do!
- The OpenID Foundation is committed to keeping the conformance test sites up and available for free to all
- Many projects using conformance testing for regression testing
 - Once everything passes, you're ready for certification!
- Test software is open source Python using Apache 2.0 license
 - Some projects have deployed private instances for internal testing
 - Available as a Docker container

Favorite Comments on OpenID Certification OpenID

- Eve Maler – VP of Innovation at ForgeRock
 - “You made it as simple as possible so every interaction added value.”
- Jaromír Talíř – CZ.NIC
 - “We used and still are using certification platform mainly as testing tool for our IdP. Thanks to this tool, we have fixed enormous number of bugs in our platform an even some bugs in the underlying library.”
- Brian Campbell – Distinguished Engineer at Ping Identity
 - “The process has allowed us to tighten up our implementation and improve on the already solid interoperability of our offerings in the OpenID Connect ecosystem.”
- William Denniss – Google
 - “We have built the RP tests into the continuous-integration testing pipeline for AppAuth.”

What's next for OpenID Certification? OpenID

- Additional profiles being developed:
 - Form Post Response Mode
 - Refresh Token Behaviors
 - Session Management, Front-Channel Logout, Back-Channel Logout
 - OP-Initiated Login
- Additional documentation being produced
 - By Roland Hedberg and Hans Zandbelt
- Certification for additional specifications is anticipated:
 - E.g., HEART, MODRNA, iGov, EAP, FAPI, etc.

OpenID Certification Call to Action



- Certify your OpenID Connect implementations now
- Help us test the new OP tests
- Join the OpenID Foundation and/or the OpenID Connect working group

OpenID Connect Resources



- OpenID Connect
 - <http://openid.net/connect/>
- Frequently Asked Questions
 - <http://openid.net/connect/faq/>
- Working Group Mailing List
 - <http://lists.openid.net/mailman/listinfo/openid-specs-ab>
- OpenID Certification Program
 - <http://openid.net/certification/>
- Certified OpenID Connect Implementations Featured for Developers
 - <http://openid.net/developers/certified/>
- Mike Jones' Blog
 - <http://self-issued.info/>
- Nat Sakimura's Blog
 - <http://nat.sakimura.org/>
- John Bradley's Blog
 - <http://www.thread-safe.com/>

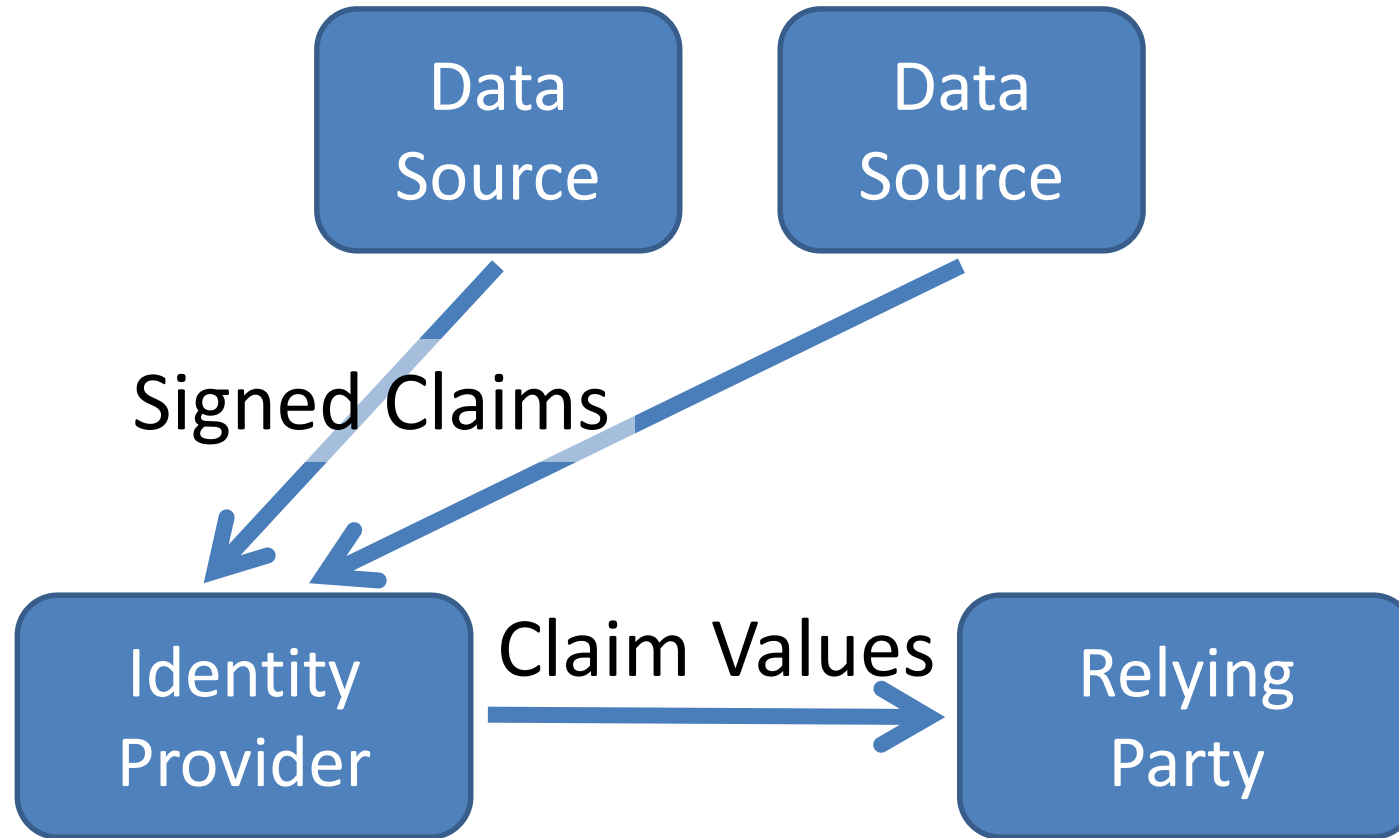
Open Conversation



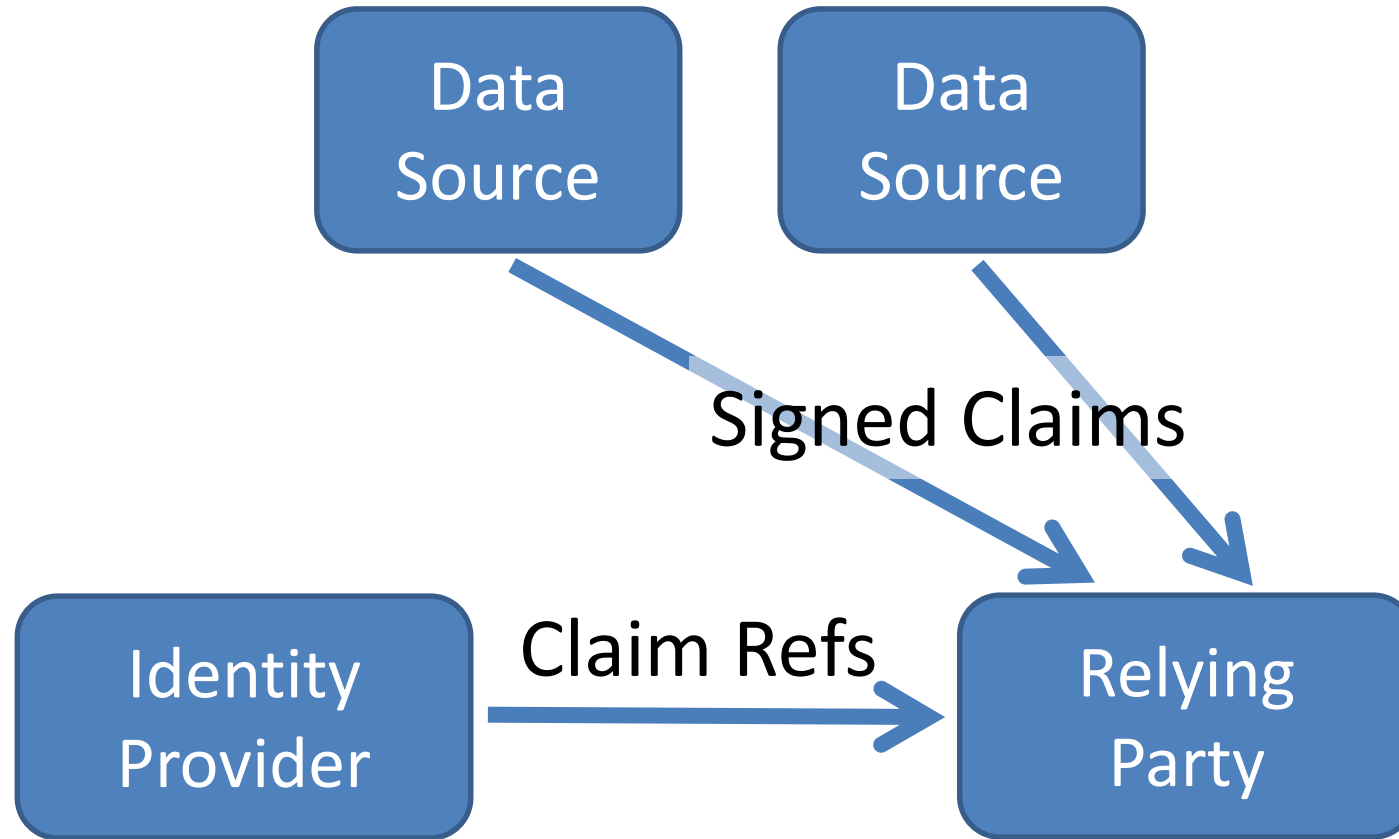
- How are you using OpenID Connect?
- What would you like the working group to know or do?

BACKUP SLIDES

Aggregated Claims



Distributed Claims



Basic Client Implementer's Guide



- Single, simple, self-contained Web client spec
 - For clients using OAuth “code” flow
- All you need for Web server-based RP
 - Using pre-configured set of OPs
- http://openid.net/specs/openid-connect-basic-1_0.html

Implicit Client Implementer's Guide



- Single, simple, self-contained Web client spec
 - For clients using OAuth “implicit” flow
- All you need for user agent-based RPs
 - Using pre-configured set of OPs
- http://openid.net/specs/openid-connect-implicit-1_0.html

Core Specification



- Defines data formats and messages used for OpenID Connect authentication and claims
- http://openid.net/specs/openid-connect-core-1_0.html

Discovery & Registration



- Enables dynamic configurations in which sets of OPs and RPs are not pre-configured
 - Necessary for open deployments
- Discovery enables RPs to learn about OP endpoints
- Dynamic registration enables RPs to use OPs they don't have pre-existing relationships with
- http://openid.net/specs/openid-connect-discovery-1_0.html
- http://openid.net/specs/openid-connect-registration-1_0.html

Session Management



- For OPs and RPs needing session management capabilities
 - Enables logout functionality
 - Enables account switching
- http://openid.net/specs/openid-connect-session-1_0.html

OAuth Response Types



- Defines and registers additional OAuth response types:
 - `id_token`
 - `none`
- And also defines and registers combinations of `code`, `token`, and `id_token` response types
- http://openid.net/specs/oauth-v2-multiple-response-types-1_0.html

Form Post Response Mode



- Defines how to return OAuth 2.0 Authorization Response parameters using HTML form values auto-submitted by User Agent using HTTP POST
- http://openid.net/specs/oauth-v2-form-post-response-mode-1_0.html