



# Direct Routing Detailed Design

for

## Contoso

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# Direct Routing Detailed Design

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# Direct Routing Detailed Design

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## Known Documentation Errors

**This is a DRAFT Document and may contain errors.**



Have you found a mistake in the document or have a suggested update? Contribute your changes to the document via [GitHub](https://github.com).

## Current Issues

- 1) AudioCodes Mediant Config in appendix has no line breaks – **under investigation**
- 2) Header is not displaying the Company Name – **previously working**

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SAMPLE

# Direct Routing Detailed Design

## OVERVIEW

Microsoft Phone System Direct Routing lets you quickly and effortlessly connect a supported Session Border Controller to Microsoft Phone System. Microsoft Teams users can then make and receive PSTN calls anywhere they have a reliable internet connection.

This design document details the core design considerations to Configure Direct Routing successfully. In addition to this document, you should always refer to the official documentation from Microsoft [Phone System Direct Routing](#).

Direct Routing is only supported with Microsoft Teams.

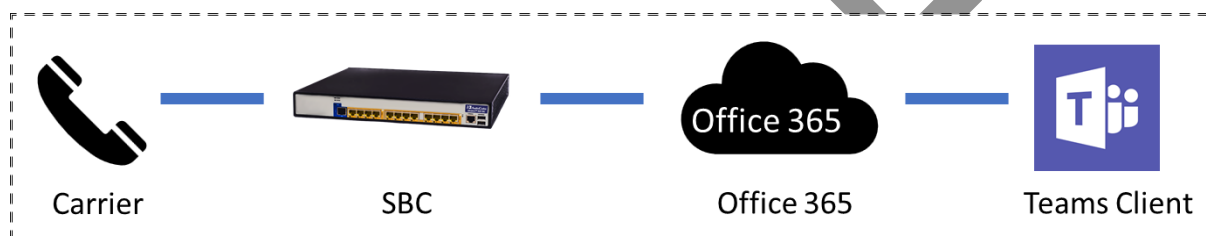


Figure 1 Connecting your SBC to Microsoft Teams

## DIRECT ROUTING PLANNING

This document will assist Contoso in their initial planning for a Microsoft Teams Direct Routing Deployment. With Direct Routing you can connect a supported SBC to almost any Carrier, Analog Telephone devices, 3<sup>rd</sup> Party PBX/SBC, Call Centres and 3<sup>rd</sup> Party Voice Apps.

- Phone System enables call control and PBX capabilities in Office 365, allowing you to replace your on-premises telephony hardware.
- Direct Routing allows you to Bring your own PSTN Carrier.
- Monitoring and Reporting is available in Office 365.
- Direct Routing allows interoperability with third-party systems.
- Configuration of Direct Routing is via the Skype for Business Online PowerShell Module.
- To enable users to make and receive calls in teams, you need to enable the preferred client as teams only or configure teams as preferred client with *TeamsCallingPolicy* and *TeamsInteropPolicy*.

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## DIAL IN CONFERENCING

With Direct Routing the Dial-in Conferencing is provided by Microsoft Audio Conferencing Service, which will require additional licensing, and is NOT covered by this document

## CALL QUEUES & IVR'S

As of January 2019, Call Queues and IVR's require a service number, and unable to use a number from the direct in-dial range. As a work around provision a Service number in the Office 365 portal, and manipulate the Direct In-dial number of the SBC to be sent as the service number instead



### **Important Note – Migration Planning out of Document Scope.**

If Contoso has an existing Skype For Business Server deployment or Skype for Business Online Calling Plan's already configured they must refer to [Migrating to Direct Routing](#) to learn more about migration planning. This document does not cover Migration.



# Direct Routing Detailed Design

## HIGH LEVEL DESIGN

The document details the core requirements of Microsoft Teams Direct Routing. This includes

- Office 365 Requirements
- Network Requirements
- Session Border Requirements
- 3<sup>rd</sup> Party Applications
- Public Certificates.

When deploying Direct Routing Contoso should refer to the official documentation at [docs.microsoft.com](https://docs.microsoft.com) for up to date information.

## OFFICE 365

Direct Routing is a capability of Phone System (previously called Cloud PBX) in Office 365 to help customers connect their SIP trunks to Microsoft Teams.

TODO : Add description of Office365

TODO : Add diagram

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## LICENSING

Direct Routing users require licenses for Microsoft Phone System, Microsoft Teams, and optionally Microsoft Audio Conferencing. In addition, Direct Routing users can also be assigned a Microsoft Calling plan license, enabling outbound calls to route via Direct Routing or Calling Plan.

For full information on licensing requirements refer to [Microsoft Teams Add-on Licensing](#)

Option	License
<b>Option 1</b>	Office 365 Enterprise E3 + Phone System <ul style="list-style-type: none"><li>▪ Skype for Business Online (Plan 2)</li><li>▪ Exchange Online (Plan 2)</li><li>▪ Microsoft Teams</li><li>▪ Phone System</li></ul>
<b>Option 2</b>	Office 365 Enterprise E5 <ul style="list-style-type: none"><li>▪ Skype for Business Online (Plan 2)</li><li>▪ Exchange Online (Plan 2)</li><li>▪ Microsoft Teams</li><li>▪ Phone System</li></ul>
<b>Optional Licenses</b>	Calling Plan Microsoft Audio Conferencing



### Design Decision

Contoso must decide on the licensing method they will utilize

# Direct Routing Detailed Design

## CONNECTION POINTS

Connection points are load balanced automatically based on performance metrics and geographical proximity. The SBC makes a DNS query to resolve sip.pstnhub.microsoft.com. Based on the SBC location and the datacentre performance metrics, the primary datacentre is selected.

The FQDN's should always be placed in the correct order to

- Provide Optimal Experience
- Provide failover

Connection Point	Priority	Comments
sip.pstnhub.microsoft.com	1	Primary FQDN, must always be tried first.
sip2.pstnhub.microsoft.com	2	Secondary FQDN
sip3.pstnhub.microsoft.com	3	Tertiary FQDN

### Failover is based on the following locations

Primary	Secondary	Tertiary
EU	US	ASIA
US	EU	ASIA
ASIA	US	EU

## PEERING PARTNERS

Peering is the direct interconnection between Microsoft's network (AS8075) and another network for the purpose of exchanging traffic between these networks. If you need to determine how your network is peering with Microsoft, then this will be useful, otherwise this is not required.

Microsoft peers are listed on the [peeringdb \(AS 8075\)](#)

```
tracert 13.107.0.68
```

# Direct Routing Detailed Design

## NETWORKING

### DOMAIN NAMES

To enable Direct Routing, the following DNS Requirements must be met:

- Each SBC must be assigned a FQDN from a registered domain name of the tenant.
- You cannot use the onmicrosoft.com domain.
- You cannot use sip.directrouting.guide
- The SBC can service users from any registered Domain Name.
- If provisioning a new domain in Office365, it can take up to 24 hours before it can be used with the SBC.
- In addition, the lyncdiscover.directrouting.guide FQDN is required to enable remote access to Office 365 via PowerShell.

Record	type	value
lyncdiscover.directrouting.guide	CNAME	webdir.online.lync.com
sbc.directrouting.guide	A	203.0.113.29



#### Design Decision

Contoso has decided to use directrouting.guide as the primary domain.

# Direct Routing Detailed Design

## NAT REQUIREMENTS

If Network Address Translation (NAT) is required, then the following needs to be configured on the Firewall.

NAT Type	Public	Internal
1:1	203.0.113.29	10.0.0.6



### Design Decision

Contoso will use Public IP on the SBC or use Network Address Translation.

# Direct Routing Detailed Design

## FIREWALL REQUIREMENTS

The SIP Proxy FQDN's for Direct Routing Service will resolve to the IP address, *52.114.148.0, 52.114.132.46, 52.114.75.24, 52.114.76.76, 52.114.7.24, 52.114.14.70.*

The Media Proxy for Direct Routing Media will resolve to the subnet *52.114.0.0/14* (52.112.0.0-52.115.255.254)

### Direct Routing SIP Interface Firewall Requirements

Service	Traffic	Source	Source Port	Destination	Destination Port
SIP Proxy	SIP/TLS	52.114.148.0 52.114.132.46 52.114.75.24 52.114.76.76 52.114.7.24 52.114.14.70	1024-65535	203.0.113.29	5067
SIP Proxy	SIP/TLS	203.0.113.29	5067	52.114.148.0 52.114.132.46 52.114.75.24 52.114.76.76 52.114.7.24 52.114.14.70	5061
Media Processor	UDP/SRTP	52.112.0.0/14	49152-53247	203.0.113.29	8000-8049
Media Processor	UDP/SRTP	203.0.113.29	8000-8049	52.112.0.0/14	49152-53247

### Carrier SIP Interface Firewall Requirements

# Direct Routing Detailed Design

Service	Traffic	Source	Source Port	Destination	Destination Port
Signalling	SIP/TLS	203.0.113.29	any	sip.siptrunk.e xample	5060
Signalling	SIP/TLS	sip.siptrunk.e xample	any	203.0.113.29	5061
Media	UDP/SRTP/R TP	203.0.113.29	any	sip.siptrunk.e xample	any
Media	UDP/SRTP/R TP	sip.siptrunk.e xample	any	sbc.directrou ting.guide	7000-7049

## Management Interface Firewall Requirements

Service	Traffic	From	To	Source Port	Destination Port
Management	TCP	Internal	10.0.0.6	any	443
Management	TCP	Internal	10.0.0.6	any	23
Management	TCP	Internal	10.0.0.6	any	22
Management	ICMP	Internal	10.0.0.6	any	icmp
Management	TCP/UDP	203.0.113.29	1.1.1.1	1.0.0.1	any
Management	TCP/UDP	203.0.113.29	Internal	any	514

## Teams Client Firewall Requirements

Service	Traffic	From	To	Source Port	Destination Port
Client	UDP	Internal	any	any	3478-3481
Client	TCP	Internal	any	any	80,443

# Direct Routing Detailed Design

## NETWORK ASSESSMENT TOOL

The Skype for Business Network Assessment tool will assist to perform simple network performance and connectivity to determine how well the network will perform with Microsoft Teams Calls.

The network Assessment Tool can be downloaded for free from [Microsoft](#).

The tool will test the connection to the Microsoft Network Edge by streaming a set of packets to the nearest edge site and back, and then reporting on

- 1. Network Performance** including packet loss, jitter, round-trip latency and packet reorder percentage.
- 2. Network Connectivity** including verifying network IP Addresses and ports are allowed to enable Microsoft Teams Calls.

Once the Tool has completed company can verify that the network performance targets below are met

Value	Client to Microsoft Edge	Customer Edge to Microsoft Edge
Latency (one way) *	< 50ms	< 30ms
Latency (RTT or Round-trip Time) *	< 100ms	< 60ms
Burst packet loss	<10% during any 200ms interval	<1% during any 200ms interval
Packet loss	<1% during any 15s interval	<0.1% during any 15s interval
Packet inter-arrival Jitter	<30ms during any 15s interval	<15ms during any 15s interval
Packet reorder	<0.05% out-of-order packets	<0.01% out-of-order packets

## OFFICE 365 URLS AND IP RANGES

For an up-to-date list of URL's and IP addresses, ports and protocols that the teams client must be allowed to at a minimum the following:

[docs.microsoft.com](https://docs.microsoft.com)

## EXTERNAL DNS NAME RESOLUTION

All client computers and mobile devices running Teams client must be able to resolve external DNS to lookup services provided by Office365



# Direct Routing Detailed Design

## QUALITY OF SERVICE

Even though Teams uses public network (unmanaged) it is still recommended to configure QoS on the on-Premises network, as traffic congestion on a network will degrade network performance.

Without QoS implemented on-premises the following quality issues in voice and video may arise:

- Jitter – media packets arriving at different rates, which can result in missing words or syllables in calls.
- Packet loss – packets dropped, which can also result in lower voice quality and hard to understand speech.
- Delayed round trip time (RTT) – media packets taking a long time to reach their destinations, which results in noticeable delays between two parties in a conversation, causing people to talk over each other.

For correct implementation of QoS, consistent end to end configuration, including user PCs, network switches, and routers must be implemented. The exception to this is the Internet Connection which will be an unmanaged network, required no QoS implemented

Recommended DSCP Markings should be implemented on network equipment and on Windows via Group Policy

Media traffic type	Client source port range	Protocol	DSCP value	DSCP class
Audio	50,000–50,019	TCP/UDP	46	Expedited Forwarding (EF)
Video	50,020–50,039	TCP/UDP	34	Assured Forwarding (AF41)
Application/Screen Sharing	50,040–50,059	TCP/UDP	18	Assured Forwarding (AF21)

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## SESSION BORDER CONTROLLER

Microsoft only support a small number of certified SBC's to pair with Direct Routing. All certified SBC's have intensive testing by Microsoft to ensure the SBC is compatible for Direct Routing and is guaranteed to work in all scenarios.

This design document has been tested with the following SBC's:

Vendor	SBC	Version	Link
AudioCodes	Hyper-V	SBC v.7.20A.204.222 or newer	<a href="#">Hyper-V VM Image</a>
AudioCodes	M800B	SBC v.7.20A.204.222 or newer	<a href="#">Mediant M800</a>
AudioCodes	Azure	SBC v.7.20A.204.222 or newer	<a href="#">Azure Marketplace</a>



### Design Decision

It is recommended that Contoso uses a AudioCodes Mediant Device.

## SBC REQUIREMENTS

Each SBC that will be paired with Microsoft Teams will require at a minimum

- Public IP Address
- FQDN matching SIP Domain in Office 365
- Public Certificate

## MEDIA CODEC

The following Media Codecs are supported with Direct Routing:

### SBC and Cloud Media Processor (Non-Media Bypass)

- SILK, G.711, G.722, G.729
- Specific codec can be forced on the SBC

### SBC and Microsoft Teams Client (Media Bypass)

- SILK, G.711, G.722, G.729, OPUS
- Specific codec can be forced on the SBC

### Microsoft Teams Client and Cloud Media Processor (Non-Media Bypass)

- SILK, G.722

# Direct Routing Detailed Design

- Codec is based on a Microsoft Algorithm to ensure best performance.

## SBC LICENSES

The following License Keys must be enabled on AudioCodes devices to activate the Microsoft Teams feature:

- Microsoft License ("MSFT") : Most of AudioCodes devices are shipped by default with this license (except the MSBR product series, Mediant 500 Gateway & E-SBC, and Mediant 500L Gateway & E-SBC).
- Microsoft Teams License ("SW/TEAMS") : All AudioCodes devices that support Microsoft Teams (see Affected Products below) require this license to support Microsoft Teams. This license automatically enabled the following voice coders:
  - SILK Narrowband
  - SILK Wideband
  - OPUS Narrowband
  - Opus Narrowband
- An optional license for HA-Pair with Microsoft Teams is also available ("SW/TEAMS/R")
- Number of required SBC Sessions (Based on Requirements)
- If media transcoding is required, Company will require a Transcoding Session (Optional)

# Direct Routing Detailed Design

## PUBLIC CERTIFICATES

Each SBC deployed must have a public certificate from a supported Public CA,

- When generating the CSR, the private key size should be at least 2048.
- Do not try to use onmicrosoft.com domain for certificates, it will not work.
- The sbc.directrouting.guide must be in the subject, common name, or subject alternate name fields.
- A wildcard certificate \*.directrouting.guide

## CERTIFICATE OPTIONS

Record	Subject Name	Subject Alternative Name
Option 1	sbc.directrouting.guide	
Option 2 (SN can be anything)	www.directrouting.guide	sbc.directrouting.guide
Option 2	*.directrouting.guide	

## BALTIMORE TRUSTED ROOT CA

The Baltimore Trusted Root must be installed on your SBC, it can be downloaded in either PEM or CRT format from:

- PEM : <https://cacert.omniroot.com/bc2025.pem>
- CRT : <https://cacert.omniroot.com/bc2025.crt>

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## SUPPORTED CERTIFICATE AUTHORITIES

It is recommended that the certificates are generated from one of the following root certificates. (others may work, however as at January 2019 the Microsoft documentation specifies the following Root CA's only)

- AffirmTrust
- AddTrust External CA Root
- Baltimore CyberTrust Root
- Buypass
- Cybertrust
- Class 3 Public Primary Certification Authority
- Comodo Secure Root CA
- Deutsche Telekom
- DigiCert Global Root CA
- DigiCert High Assurance EV Root CA
- Entrust
- GlobalSign
- Go Daddy
- GeoTrust
- Verisign, Inc.
- Starfield
- Symantec Enterprise Mobile Root for Microsoft
- SwissSign
- Thawte Timestamping CA
- Trustwave
- TeliaSonera
- T-Systems International GmbH (Deutsche Telekom)
- QuoVadis

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3RD PARTY DEVICES

TODO- Write Section on 3<sup>rd</sup> Party Devices

SAMPLE

# Direct Routing Detailed Design

## OFFICE 365 POWERSHELL

### DOWNLOAD AND INSTALL SFBO CONNECTOR

Download and Install Skype for Business Online Connector Information available



**Install**

<https://www.microsoft.com/en-us/download/details.aspx?id=39366>

### CONNECT TO OFFICE 365

Use PowerShell to connect to SFBO to configure Direct Routing

#### Example 1: Connect to Skype Online PowerShell

```
Import-Module SkypeOnlineConnector
$Credential = Get-Credential -Username admin@directrouting.onmicrosoft.com -Message "Enter
  Password"
$Session = New-CsOnlineSession -Credential $credential -OverrideAdminDomain
  directrouting.onmicrosoft.com
Import-PSSession -Session $Session -AllowClobber
```

### PAIR THE SBC

The following example contains all the minimum parameters required to configure to pair the SBC to the tenant. Generally, it is best to Enable ForwardCallHistory & ForwardPAI as well.

#### Example 1: Create a New Online PSTN Gateway

```
New-CsOnlinePSTNGateway -Fqdn "sip.siptrunk.example" -SipSignallingPort "5061" -
  MaxConcurrentSessions "10" -Enabled $true
```

# Direct Routing Detailed Design

## ADD ONLINE PSTN USAGE

Add the PSTN Usage to the Global Policy

### Example 1: Add Online PSTN Usage

```
Set-CsOnlinePstnUsage -Identity Global -Usage @{Add="DirectRouting "}
```

## ADD ONLINE VOICE ROUTE

Create a new online Voice Route

### Example 1: Add Online Voice Route

```
New-CsOnlineVoiceRoute -Identity "DirectRouting" -NumberPattern ".*" -OnlinePstnGatewayList  
-Priority 1 -OnlinePstnUsages "DirectRouting"
```

## ADD ONLINE VOICE ROUTING POLICY

Create a new online voice routing policy

### Example 1: Add Online Voice Routing Policy

```
New-CsOnlineVoiceRoutingPolicy -identity "DirectRouting" -OnlinePstnUsages "DirectRouting"
```



# Direct Routing Detailed Design

## ENABLE USERS FOR ENTERPRISE VOICE

Enable a user for Enterprise Voice and assign Phone Number

### Example 1: Enable users for Enterprise Voice

```
Set-CsUser -Identity "shane.hoey@directrouting.guide" -EnterpriseVoiceEnabled $true -  
HostedVoiceMail $true -OnPremLineURI tel:61770101349
```

## GRANT ONLINE VOICE POLICY

Assign voice routing policy to user

### Example 1: Grant Voice Routing Policy

```
Grant-CsOnlineVoiceRoutingPolicy -Identity "shane.hoey@directrouting.guide" -PolicyName  
"DirectRouting"
```

# Direct Routing Detailed Design

## AUDIOCODES MEDIANT CONFIGURATION

This document is based on a single Interface SBC but can be adapted for multiple Interfaces.

Please follow [The AudioCodes Documentation](#) for the Official SBC installation guidelines.

## VALIDATE THE NETWORK

### PHYSICAL PORT

#### Setup > IP Network > Core Entities > Physical Ports

- Validate GE 1

Parameter	Value
Index	0
Name	eth0
Description	User Port#0

### ETHERNET GROUP

#### Setup > IP Network > Core Entities > Ethernet Groups

- validate Group 1

Parameter	Value
Index	0
Name	Group_1
Mode	Single
Member	#0 [eth0]

# Direct Routing Detailed Design

## ETHERNET DEVICE

### Setup > IP Network > Core Entities > Ethernet Devices

- Validate Management Ethernet Device 0

Parameter	Value
Index	0
Name	vlan 1
VLAN ID	1
Underlying Interface	#0 [Group_1]
Tagging	Untagged

## VALIDATE THE IP INTERFACE

### Setup > IP Network > Core Entities > IP Interfaces

- Validate eth0 IP Interface

Parameter	Value
Index	0
Name	eth0
Application Type	OAMP + Media + Control
Ethernet Device	#0 [vlan 1]
Interface Mode	IPv4 Manual
IP address	
Prefix length	255.255.255.0
Default Gateway	10.0.0.1
Primary DNS	1.1.1.1
Secondary DNS	1.0.0.1

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## CONFIGURE THE CERTIFICATES

### Setup > IP Network > Security > TLS Contexts

- Validate Security TLS Context 0 default
- Validate Security TLS Context 1 DirectRouting
- Request/Issue a Public Certificate
- Add Baltimore Root Certificate
- Add Public CA Root & Intermediate Certificates

## VALIDATE SECURITY TLS CONTEXTS 0 DEFAULT

### Setup > IP Network > Security > TLS Contexts >

Parameter	Value	Comments
Index	0	
Name	default	
TLS Version	TLSv1.2	
DH Key Size	2048	(Minimum Recommended)

## VALIDATE SECURITY TLS CONTEXTS 1 DIRECTROUTING

### Setup > IP Network > Security > TLS Contexts >

Parameter	Value	Comments
Index	1	
Name	DirectRouting	
TLS Version	TLSv1.2	Dependant on Public CA
DH Key Size	2048	(Minimum Recommended)

## GENERATE A CSR

### Setup > IP Network > Security > TLS Contexts > Change Certificate

Parameter	Value
Subject Name[CN]	sbc.directrouting.guide
Signature Algorithm	SHA1
Private Key Size	2048 Minimum recommended

# Direct Routing Detailed Design

## INSTALL THE CERTIFICATE

**Setup > IP Network > Security > TLS Contexts > Direct Connect > Change Certificate**

- Upload Certificate Files from your Computers
- Load Private Key (if Applicable)
- Load Device Certificate (PEM Format)

## INSTALL ROOT AND INTERMEDIATE CERTIFIATES

**Setup > IP Network > Security > TLS Contexts > Select Direct Routing > Trusted Root Certificates**

- Select and Import the certificates

## IMPORT BALTIMORE TRUSTED ROOT CERTIFICATES

Certificate	link	comments
Baltimore Certificates	<a href="#">Baltimore Certificates</a>	
Root CA	<a href="https://letsencrypt.org">letsencrypt.org</a>	<b>IMPORTANT</b> This will be based on certificate purchased for your SBC, in lab environments I use free 90 day certs from <a href="https://letsencrypt.org">letsencrypt.org</a> and if I need longer than that I generally use <a href="https://digicert.com">digicert.com</a>
Intermediate CA	<a href="https://letsencrypt.org">letsencrypt.org</a>	<b>IMPORTANT</b> This will be based on certificate purchased for your SBC, in lab environments I use free 90 day certs from <a href="https://letsencrypt.org">letsencrypt.org</a> and if I need longer than that I generally use <a href="https://digicert.com">digicert.com</a>

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## CONFIGURE NTP SETTINGS

### Setup > Administration > Time & Date

- Enable NTP
- Configure Primary NTP Server

Parameter	Value
Enable NTP	Enable
Primary NTP	pool.ntp.org
UTC Offset	36000

## CONFIGURE SYSLOG SETTINGS

### Troubleshoot > Logging > Syslog Settings

- Enable Syslog
- Configure Syslog Server
- Syslog software can be downloaded from [AudioCodes](#)

Parameter	Value
Enable Syslog	Enable
Syslog Server	10.0.0.5
Debug Level	Detailed

# Direct Routing Detailed Design

## CONFIGURE DEFAULT DNS SETTINGS (OPTIONAL)

### Setup > IP Network > DNS > DNS Settings

- Configure Primary DNS Server
- Configure Secondary DNS Server

Parameter	Value
Primary DNS	1.1.1.1
Secondary DNS	1.0.0.1

## CONFIGURE INTERNAL SRV TABLE

### Setup > IP Network > DNS > Internal SRV

- Configure Domain Name
- Configure Entry

Parameter	Value
Domain Name	directrouting.local
Transport Type	TLS

#### 1st Entry

DNS Name	sip.pstnhub.microsoft.com
Priority	1
Weight	1
Port	5061

#### 2nd Entry

DNS Name	sip2.pstnhub.microsoft.com
Priority	2
Weight	1
Port	5061

#### 3rd Entry

DNS Name	sip3.pstnhub.microsoft.com
----------	----------------------------

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Priority	3
Weight	1
Port	5061

## CONFIGURE THE MEDIA REALM

### Setup > Signalling and Media > Core Entities > Media Realms

- Configure Media Realm - ITSP
- Configure Media Realm - DirectRouting

## CONFIGURE MEDIA REALM - ITSP

Parameter	Value
Index	1
Name	ITSP
Topology Location	Up
IPv4 Interface Name	#0 [eth0]
Port Range Start	7000
Number of media session legs	10
Default Media Realm	No

## CONFIGURE MEDIA REALM - DIRECTROUTING

Parameter	Value
Index	2
Name	DirectRouting
Topology Location	Down
IPv4 Interface Name	#0 [eth0]
Port Range Start	8000
Number of media session legs	10
Default Media Realm	No



# Direct Routing Detailed Design

## CONFIGURE THE SIP INTERFACES

### Setup > Signalling and Media > Core Entities > SIP Interfaces

- Configure SIP Interface - ITSP
- Configure SIP Interface – DirectRouting

#### CONFIGURE SIP INTERFACE - ITSP

Parameter	Value	Comments
Name	ITSP	
Network Interface	# 0 [eth0]	
Topology Location	UP	
udp port	5061	
Enable TCP Keepalive	Enable	
Media Realm	#1 [ITSP]	
TLS Context Name	# [default]	

#### CONFIGURE SIP INTERFACE – DIRECTROUTING

Parameter	Value	Comments
Name	DirectRouting	
Network Interface	# 0 [eth0]	
Topology Location	Down	
Port	5067	
Enable TCP Keepalive	Enable	
Media Realm	[DirectRouting]	
TLS Context Name	#1 [DirectRouting]	
TLS Mutual Authentication	Enable	Recommended to prevent DoS attacks
Classification Response Type	Failure 0	

# Direct Routing Detailed Design

## CREATE THE PROXY SETS & PROXY ADDRESS

### Setup > Signalling and Media > Core Entities > Proxy Sets

- Configure proxy set - ITSP
- Configure proxy address - ITSP
  
- Configure proxy set - DirectRouting
- Configure proxy address - DirectRouting

## CONFIGURE PROXY SETS – ITSP

Parameter	Value
Index	0
Name	ITSP
SBC IPv4 SIP Interface	#0 [ITSP]
Proxy Keep Alive	Using OPTIONS

## CONFIGURE PROXY ADDRESS - ITSP

Parameter	Value
Proxy Address	sip.siptrunk.example: 5061
Transport Type	udp

# Direct Routing Detailed Design

## CONFIGURE PROXY SETS – DIRECTROUTING

**Setup > Signalling and Media > Core Entities > Proxy Sets**

Parameter Value	Value
Index	2
Name	DirectRouting
SBC IPv4 SIP Interface	DirectRouting
TLS Context Name	#1 [DirectRouting]
Proxy Keep Alive	Using OPTIONS
Proxy Hot Swap	Enable
Proxy Load Balancing Method	Random Weights
DNS Resolve Method	SRV

## CONFIGURE PROXY ADDRESS – DIRECTROUTING

**Setup > Signalling and Media > Core Entities > Proxy Sets > Add Proxy Address**

Parameter	Value
Proxy Address	directrouting.local
Transport Type	TLS

## CONFIGURE A CODER GROUP

**Setup > Signalling and Media > Coders and Profiles > Coder Groups**

- Create a new Coder Group 1

Coder Name	Packetization Time	Rate	Payload Type	Silence Suppression	Coder Specific
SILK-NB	20	8	103	N/A	
SILK-WB	20	16	104	N/A	
G.711A-law	20	64	8	Disabled	
G.711U-law	20	64	0	Disabled	
G.729	20	8	18	Disabled	

# Direct Routing Detailed Design

## CONFIGURE THE IP PROFILE

### Setup > Signalling and Media > Coders and Profiles > IP Profiles

- create the ITSP IP Profile
- create the DirectRouting IP Profile

## CONFIGURE IP PROFILE – ITSP

Parameter	Value	Comments
Index	1	
Name	ITSP	
SBC Media Security Mode	RTP	Only required is your Sip Trunk only supports RTP
Remote Multiple 18x	Not Supported	ONLY Required if you get Ring back then silence
Name	ITSP	

## CONFIGURE IP PROFILE – DIRECTROUTING

Parameter	Value	comments
Index	2	
Name	DirectRouting	
SBC Media Security Mode	SRTP	
SBC Media Security Method	SDES	DTLS will be supported in future
Extension Coders Group	#1 [Audio_Coders_Groups_1]	
ICE Mode	Disabled/Lite	Only Enable Lite if you enable Media Bypass, otherwise keep disabled
Remote Re-Invite	Supported only with SDP	
Remote Delayed Offer Support	Not supported	

# Direct Routing Detailed Design

Remote Mode	REFER	Handle locally	
-------------	-------	----------------	--

## CONFIGURE AN IP GROUP

### Setup > Signalling and Media > Core Entities > IP Group

- create the ITSP IP Profile
- create the DirectRouting IP Profile
- 

## CONFIGURE IP GROUP – ITSP

Parameter	Value
Index	1
Name	ITSP
Topology Location	Up
Proxy Set	#1 [ITSP]
IP Profile	#1 [ITSP]
Media Realm	#1 [ITSP]
SBC Operation Mode	B2BUA

## CONFIGURE IP GROUP – DIRECTROUTING

Parameter	Value
Index	2
Name	DirectRouting
Topology Location	Up
Proxy Set	DirectRouting
IP Profile	DirectRouting
Media Realm	DirectRouting
Classify by Proxy Set	Disable
SBC Operation Mode	B2BUA
Local Host Name	sbc.directrouting.guide

# Direct Routing Detailed Design

Always Use Src Address	Yes
DTLS Context	#0 [default]

## CONFIGURE SRTP

**Setup > Signalling and Media > Media > Media Security**

Parameter	Value
Media Security	Enable
Media Security Behaviour	Preferable - Single Media

## CONFIGURE MESSAGE MANIPULATIONS

**Setup > Signalling and Media > Message Manipulation > Message Manipulations**

- Activate the SIP Options via <https://10.0.0.6/AdminPage>

## CREATE THE MESSAGE MANIPULATION

Parameter	Value	
Index	0	
Name	DirectRouting	
Manipulation Set ID	1	
Message Type	Options	
Condition	param.message.address.dst.sipinterface==1	The ID assigned to the Direct Routing InterfaceSIP Interface
Action Subject	header.contact.url.host	
Action Type	Modify	
Action Value	'sbc.directrouting.guide'	Important: when adding the Action Value take note of the single quotes in "

# Direct Routing Detailed Design

## ACTIVATE THE SIP OPTION

Activate the SIP Options via <https://10.0.0.6/AdminPage>

Parameter	Value	Comments
GWOutboundManipulationSet	1	Manipulation Set ID from previous step

## CONFIGURE MESSAGE CONDITION RULE

Setup > Signalling and Media > Message Manipulation > Message Condition

Parameter	Value
Index	0
Name	DirectRouting-Contact
Condition	header.contact.url.host contains 'pstnhub.microsoft.com'

## CONFIGURE CLASSIFICATION RULES

Setup > Signalling and Media > SBC > Classification Table

Parameter	Value
Index	2
Name	DirectRouting
Source SIP Interface	# 2 [DirectRouting]
Destination Host	TBA
Message Condition	#0 [DirectRouting -Contact]
Action Type	Allow
Source IP Group	#2 [DirectRouting]

# Direct Routing Detailed Design

## CONFIGURE IP TO IP ROUTING

### Setup > Signalling and Media > SBC > Routing > IP-to-IP Routing

- create options terminate
- create refer terminate
- create DirectRouting to ITSP
- create ITSP to DirectRouting

#### OPTIONS TERMINATE

Parameter	Value
Index	0
Name	Options Terminate
Request Type	Options
Destination Type	Dest Address
Destination Address	Internal

#### REFER TERMINATE

Parameter	Value
Index	1
Name	Refer
Call Trigger	Refer
Destination Type	Request URI
Destination IP Group	# 2 [DirectRouting]

#### SIP TRUNK TO DIRECT ROUTING

Parameter	Value
Index	2
Name	DirectRouting to ITSP



# Direct Routing Detailed Design

Source IP Group	# 2 [DirectRouting]
Destination Type	IP Group
Destination IP Group	#1 [ITSP ]

## DIRECT ROUTING TO SIP TRUNK

Parameter	Value
Name	ITSP to DirectRouting
Source IP Group	# 1 [ITSP]
Destination Type	IP Group
Destination IP Group	#2 [DirectRouting]

# Direct Routing Detailed Design

## APPENDIX A - USER ACCEPTANCE TEST

The below user acceptance test should be completed prior to cutover

<b>Outbound Call Functionality</b>	<b>Desktop</b>	<b>Mobile</b>	<b>IP Phone</b>
Verify outbound call (signalling)			
Verify Caller ID			
Verify two-way audio			
Verify on-hold and resume			
Verify music on-hold (from a PSTN point of view)			
Verify DTMF Tones work			
Verify call terminates correctly			

<b>Inbound Call Functionality</b>	<b>Desktop</b>	<b>Mobile</b>	<b>IP Phone</b>
Verify inbound call (signalling)			
Verify Caller ID			
Verify on-hold and resume			
Verify DTMF Tones work			
Verify call terminates correctly			
Verify inbound Call (anonymous clid)			

<b>Call Answering Rules</b>	<b>Desktop</b>	<b>Mobile</b>	<b>IP Phone</b>
Verify inbound Call Forward to Voicemail			
Verify inbound Call Forward to PSTN			
Verify inbound Call Forward to Call Group			
Verify inbound SimRing to PSTN			
Verify inbound SimRing to Call Group			

<b>Call Transfer</b>	<b>Desktop</b>	<b>Mobile</b>	<b>IP Phone</b>
Verify Call Transfer to Contact			
Verify Call Transfer to PSTN			
Verify Consultative Call Transfer to Contact			
Verify Consultative Call Transfer to PSTN			
Verify Blind Call Transfer to Contact			
Verify Blind Call Transfer to PSTN			

# Direct Routing Detailed Design

## APPENDIX B – MEDIANT CONFIGURATION EXAMPLE

The below Mediant Configuration has no line breaks. This a bug in the document generation and is under investigation.

```
# Running Configuration Mediant SW #
docs.shanehoey.com/wizards/mediant/directrouting-eth0/ ## IP NETWORK configure
network tls 0 name default tls-version unlimited ciphers-server
"RC4:AES128"; ciphers-client "DEFAULT"; oosp-server
disable oosp-port 2560 dh-key-size 1024 oosp-default-response reject
exit tls 1 name DirectRouting tls-version tls-v1.2 ciphers-server
"RC4:AES128"; ciphers-client "DEFAULT"; oosp-server
disable oosp-port 2560 dh-key-size 2048 oosp-server-primary 0.0.0.0
oosp-server-secondary 0.0.0.0 oosp-default-response reject exit interface
network-if 0 name "eth0"; activate exit dns srv2ip 0
domain-name "directrouting.local"; transport-type tls dns-name-1
"sip.pstnhub.microsoft.com"; priority-1 1 weight-1 1 port-1
5061 dns-name-2 "sip2.pstnhub.microsoft.com"; priority-2 2
weight-2 1 port-2 5061 dns-name-3 "sip3.pstnhub.microsoft.com";
priority-3 3 weight-3 1 port-3 5061 activate exit mtc settings
sbc-cluster-mode disabled sbc-device-role sbc-or-signaling-component-(sc)
activate exit nat-translation 0 src-interface-name "eth0";
target-ip-address ""; src-start-port "1"; src-end-port
"65535"; activate exit exit ## SIGNALING & MEDIA
configure voip coders-and-profiles ip-profile 1 profile-name
"ITSP"; coders-group "AudioCodersGroups_0"; media-
security-behaviour preferable sbc-media-security-behaviour rtp sbc-rmt-
refer-behavior handle-locally sbc-rmt-mltple-18x-supp not-supported sbc-
rmt-replaces-behavior handle-locally activate exit coders-and-profiles
ip-profile 2 profile-name "DirectRouting"; coders-group
"AudioCodersGroups_0"; media-security-behaviour preferable sbc-
media-security-behaviour srtp sbc-rmt-update-supp not-supported sbc-rmt-re-
invite-supp supported-only-with-sdp sbc-rmt-delayed-offer not-supported
sbc-rmt-refer-behavior handle-locally remote-hold-Format inactive activate
exit coders-and-profiles audio-coders-groups 0 coders-group-name
"AudioCodersGroups_0"; activate audio-coders 0 name g711-alaw
p-time 20 rate 64 activate exit exit no realm 0 realm 1
name "ITSP"; ipv4if "eth0"; port-range-start 7000
session-leg 10 topology-location up activate exit realm 2 name
"DirectRouting"; ipv4if "eth0"; port-range-start 8000
session-leg 10 activate exit sbc routing sbc-routing-policy 0 name
"Default_SBCRoutingPolicy"; activate exit srd 0 name
"DefaultSRD"; activate exit no sip-interface 0 sip-interface
1 interface-name "ITSP"; network-interface "eth0";
udp-port 5061 tcp-port 0 tls-port 0 tcp-keepalive-enable enable
media-realm-name "ITSP"; topology-location up activate exit
sip-interface 2 interface-name "DirectRouting"; network-interface
"eth0"; udp-port 0 tcp-port 0 tls-port 0 tls-context-name
"DirectRouting"; tls-mutual-auth enable tcp-keepalive-enable
enable classification_fail_response_type 0 media-realm-name
"DirectRouting"; activate exit proxy-set 0 proxy-name
"ProxySet_0"; sbcipv4-sip-int-name "ITSP"; activate
exit proxy-set 1 proxy-name "ITSP"; proxy-enable-keep-alive
using-options sbcipv4-sip-int-name "ITSP"; activate proxy-ip 0
```

# Direct Routing Detailed Design

```
proxy-address "sip.siptrunk.example:5060";      transport-type udp
activate      exit      exit      proxy-set 2      proxy-name "DirectRouting";
proxy-enable-keep-alive using-options      proxy-load-balancing-method random-
weights      is-proxy-hot-swap enable      tls-context-name "DirectRouting";
dns-resolve-method srv      sbcipv4-sip-int-name "DirectRouting";
activate      proxy-ip 0      proxy-address "directrouting.local";
transport-type tls      activate      exit      exit      ip-group 0      name
"Default_IPG";      proxy-set-name "ProxySet_0";      classify-by-
proxy-set disable      topology-location up      activate      exit      ip-group 1
name "ITSP";      proxy-set-name "ITSP";      media-realm-name
"ITSP";      ip-profile-name "ITSP";      sbc-operation-mode b2bua
topology-location up      activate      exit      ip-group 2      name
"DirectRouting";      proxy-set-name "DirectRouting";      media-
realm-name "DirectRouting";      classify-by-proxy-set disable      ip-
profile-name "DirectRouting";      local-host-name
"sbcdirectrouting.guide";      always-use-source-addr enable      dtls-
context "DirectRouting";      sbc-operation-mode b2bua      activate      exit
gateway manipulation settings      outbound-map-set 1      activate      exit
gateway digital settings      answer-detector-cmd 12582952      energy-detector-cmd
104      activate      exit      media security      media-security-enable on      media-
sec-bhviior preferable-single-media      activate      exit      media rtp-rtcp      udp-
port-spacing 5      activate      exit      message message-manipulations 0
manipulation-name "DirectRouting";      manipulation-set-id 2      message-
type "Options";      condition
"param.message.address.dst.sipinterface=='&apos;2&apos;'";      action-
subject "header.contact.url.host";      action-type modify      action-value
"'&apos;sbcdirectrouting.guide&apos;'";      activate      exit      sbc routing
condition-table 0      name "DirectRouting-Contact";      condition
"header.contact.url.host contains '&apos;pstnhub.microsoft.com&apos;'";
activate      exit      sbc routing ip2ip-routing 0      route-name "OPTIONS
Terminate";      request-type options      dst-type dst-address      dst-address
"Internal";      activate      exit      sbc routing ip2ip-routing 1      route-
name "REFER";      re-route-ip-group-name "DirectRouting";
trigger refer      dst-type request-url      dst-ip-group-name
"DirectRouting";      activate      exit      sbc routing ip2ip-routing 2
route-name "ITSP to DirectRouting";      src-ip-group-name "ITSP";
dst-ip-group-name "DirectRouting";      activate      exit      sbc routing
ip2ip-routing 3      route-name "DirectRouting to ITSP";      src-ip-group-
name "DirectRouting";      dst-ip-group-name "ITSP";      activate
exit      sbc classification 0      classification-name "DirectRouting";
message-condition-name "DirectRouting-Contact";      src-sip-interface-name
"DirectRouting";      dst-host "sbcdirectrouting.guide";      src-
ip-group-name "DirectRouting";      activate      exit      sip-definition
settings      ldap-primary-key "telephoneNumber";      activate      exit
exit ## ADMINISTRATION      configure system      clock      utc-offset 3600
activate      exit      ntp      primary-server "pool.ntp.org";      activate
exit      sbc-performance-settings      sbc-performance-profile optimized-for-sip
activate      exit      hostname "Mediant SW";      configuration-version 0
exit ## TROUBLESHOOT      configure troubleshoot      activity-log      config-changes
on      files-loading on      device-reset on      flash-burning on      software-
update on      unauthorized-access on      sensitive-config-changes on      login-and-
logout on      cli-commands-log on      action-execute on      activate      exit
syslog      syslog on      debug-level detailed      syslog-ip 10.0.0.5      activate
exit      activate      exit
```

directrouting.guide