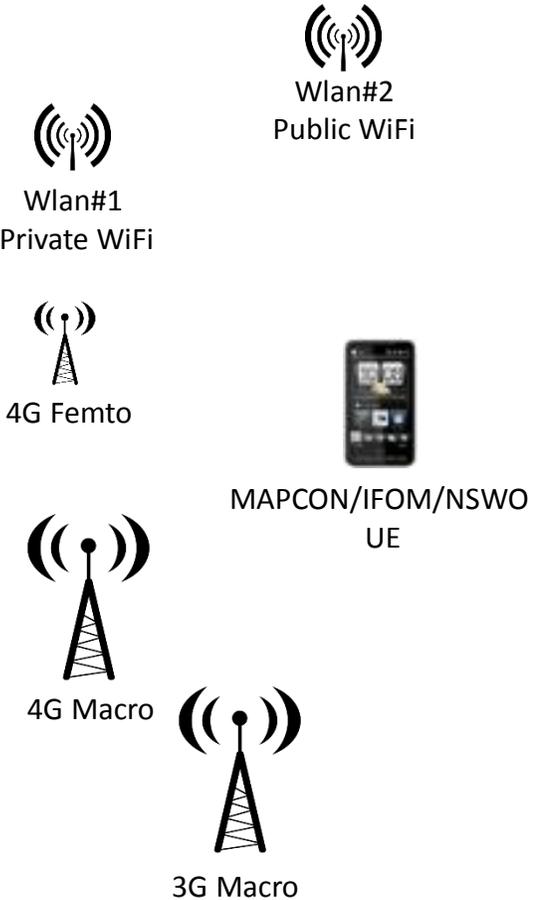


Background ANDSF scenarios  
discussion related to C1-  
153894\_(was-3377)\_24.312  
\_R1\_ISRP-IARP\_HET-NET.doc

3GPP TSG-CT1 Meeting #94 C1-153904

Belgrade, Serbia, 12-16th October 2015

# Example ISRP Case (location #1)



Location#1 In home Environment  
 UE is nominally in range of 5 possible networks but the actual connected networks will vary depending on a range of conditions.

Desired Routing Behaviour :

- Private WiFi is always preferred to public WiFi
- WiFi preferred over cellular by default
- 4G preferred over any WiFi for QoS dependent apps (Rule #1)
- 4G preferred over public WiFi for operator apps (Rule #2)
- Private Wifi preferred over 4G Macro for operator apps (Rule #3)
- 4G Femto preferred over any WiFi for operator own apps (Rule #4)

Example Application Types

- App#1 Strict QoS guarantee requirement
- App#2 Operator own app high BW but no strict QoS requirement
- App#3 High BW Best Efforts app e.g. youtube

Resulting ANDSF ISRP perflow rules

ISRP Rule #1:		Access Priority:	4G>WiFi>3G
		Matching flow(s):	App#1
		Validity Cond:	none
		Rule Priority:	1
ISRP Rule #2:		Access Priority:	4G>WiFi>3G
		Matching Flow(s):	App#2
		Validity Cond:	none
		Rule Priority:	3
ISRP Rule #3:		Access Priority:	WiFi(wlan#1)>4G>WiFi>3G
		Matching Flow:	App#2
		Validity Cond:	Wlan#1 in range
		Rule Priority:	2
ISRP Rule #4:		Access Priority:	4G>WiFi>3G
		Matching Flow:	App#2
		Validity Cond:	4G Femto in range
		Rule Priority:	1

Behaviour depends on actual connected network

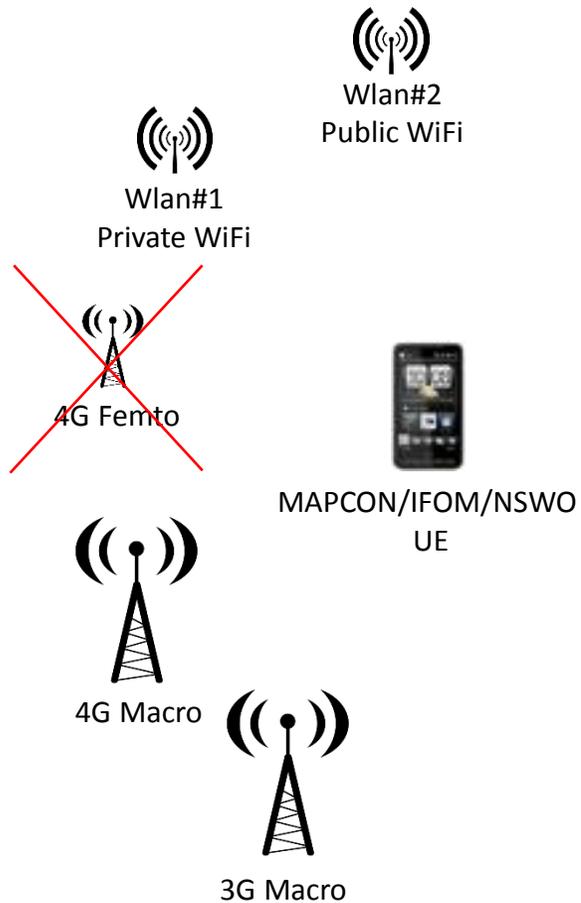
All networks are in range so all rules are meet validity constraints  
 Active route depends on priority of ISRP rule and matching flow

Serving Cell		Applied Routing Preference		
WLAN	Cellular	App #1	App #2	App#3
Wlan#1	4G Femto	4G Femto	4G Femto	Wlan#1
Wlan#1	4G Macro	4G Macro	4G Macro	Wlan#1
Wlan#1	3G Macro	Wlan#1	Wlan#1	Wlan#1
Wlan#2	4G Femto	4G Femto	4G Femto	Wlan#2
Wlan#2	4G Macro	4G Macro	4G Macro	Wlan#2
Wlan#2	3G Macro	Wlan#2	Wlan#2	Wlan#2

Femto is in range triggering ISRP Rule#4 but is not the active cellular network causing undesired prioritisation of 4G Macro over private WiFi for an operator app.  
**Can't be fixed with access id in prioritisation since cellular access ids not possible in routing preference.**

This assumes that the operator can specify the private WiFi SSID in the ISRP rules, in practice the operator may not know the private SSIDs (e.g. wlan#1). There are also likely to be multiple private SSIDs. This also means that ANDSF policies are now user specific.

# Example ISRP case (location #2)



In home Environment  
femto not in range or powered off or backhaul fail

## Desired Routing Behaviour:

- Private WiFi is always preferred to public WiFi
- WiFi preferred over cellular by default
- 4G preferred over any WiFi for QoS dependent apps (Rule #1)
- 4G preferred over public WiFi for operator own apps (Rule #2)
- Private Wifi preferred over 4G Macro for operator apps (Rule #3)
- 4G Femto preferred over any WiFi for operator own apps (Rule #4)

## Example Application Types

- App#1 Strict QoS guarantee requirement
- App#2 Operator own app high BW but no strict QoS requirement
- App#3 High BW Best Efforts app e.g. youtube

## Resulting ANDSF ISRP rules

### ISRP Rule #1:

Access Priority: 4G>WiFi>3G  
 Matching flow(s): App#1  
 Validity Cond: none  
 Rule Priority: 1

### ISRP Rule #2:

Access Priority: 4G>WiFi>3G  
 Matching Flow(s): App#2  
 Validity Cond: none  
 Rule Priority: 3

### ISRP Rule #3:

Access Priority: WiFi(wlan#1)>4G>WiFi>3G  
 Matching Flow: App#2  
 Validity Cond: Wlan#1 in range  
 Rule Priority: 2

### ISRP Rule #4:

Access Priority: 4G>WiFi>3G  
 Matching Flow: App#2  
 Validity Cond: 4G Femto in range  
 Rule Priority: 1

## Behaviour depends on actual connected network

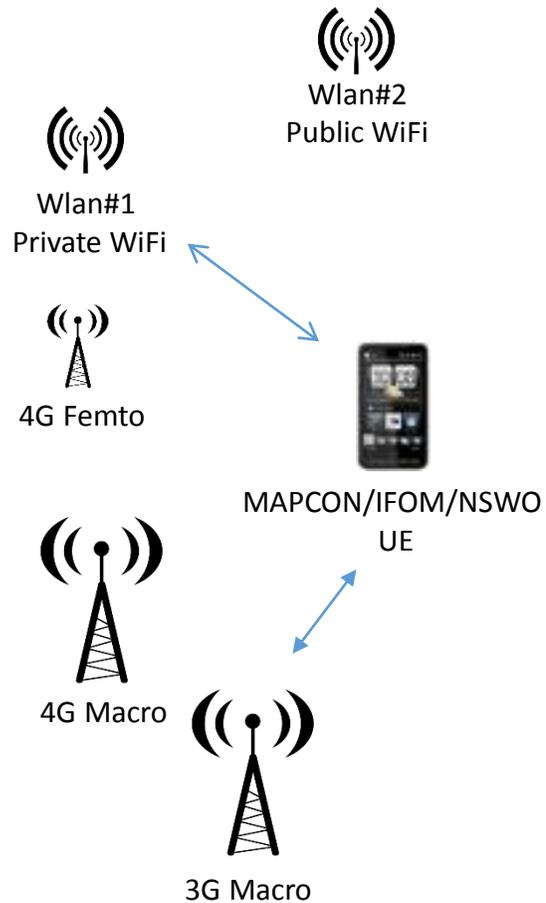
Same policy as previous slide but 4G femto is disabled or powered off, results in different incorrect routing decisions

Serving Cell		Routing Preference		
WLAN	Cellular	App #1	App #2	App#3
Wlan#1	LTE Macro	4G Macro	Wlan#1	Wlan#1
Wlan#1	3G Macro	Wlan#1	Wlan#1	Wlan#1
Wlan#2	LTE Macro	4G Macro	Wlan#2	Wlan#2
Wlan#2	3G Macro	Wlan#2	Wlan#2	Wlan#2

Wlan#1 is in range triggering ISRP Rule#3 but is not the active Wlan network causing incorrect prioritisation of public WiFi over 4G for an operator app.

Fixed if the routing rule also includes wlan #1 access (private SSID) in the access prioritisation, however assumes that the operator knows the private SSID which it might not.

# Example IARP Case (location #1)



## Location#1 In home Environment

UE is nominally in range of 5 possible networks but the actual connected networks will vary depending on a range of conditions.

Desired Routing Behaviour :

- Operator own app directed to
  - APN#1 when connected to 4G or operator public WiFi
  - NSWO when connected to 3G or other WiFi

Example Application Types

- App#2 Operator own app

Resulting ANDSF IARP rules

IARP ForInterAPNRouting Rule #1:

APN:	APN#1
Matching flow(s):	App#2
Validity Cond:	4G in range   Wlan#2 in range
Rule Priority:	1

IARP ForNSWO Rule #2:

AccessID:	none
Matching Flow(s):	App#2
Validity Cond:	none
Rule Priority:	2

## Behaviour depends on actual connected network

All networks are in range so all rules meet validity constraints  
APN vs NSWO depends on priority of IARP rule and matching flow

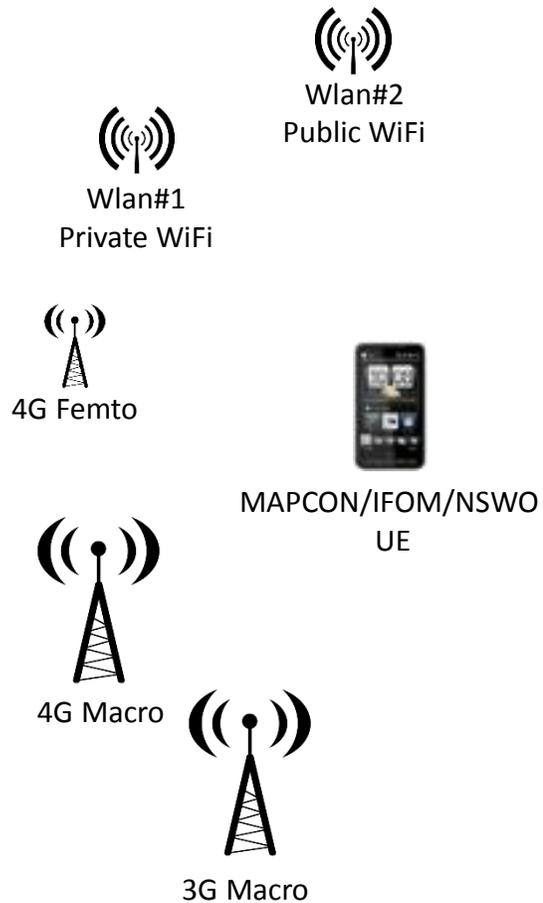
Serving Cell		Routing Preference
WLAN	Cellular	App#2
Wlan#1	4G Femto	APN#1
Wlan#1	4G Macro	APN#1
Wlan#1	3G Macro	APN#1
Wlan#2	4G Femto	APN#1
Wlan#2	4G Macro	APN#1
Wlan#2	3G Macro	APN#1

4G and WLAN#2 are in range triggering IARP Rule#1 but neither are the active network causing incorrect use of APN#1 over 3G rather than NSWO over Wlan#1.

# Proposed Change

- Current ANDSF capabilities result in situations where the desired routing prioritisation cannot be adequately controlled.
- Add additional network location based validity condition optional field that allows the operator to require the network location to also be the “current point of attach”.
  - For WiFi this would correspond to the WLAN AP that the device is associated with
  - For LTE this is the UEs serving cell

# Effect on ISRP Location#1



Potential BT In home Environment  
UE is nominally in range of 5 possible networks but the actual connected networks will vary depending on a range of conditions

## Desired Routing Behaviour :

- Private WiFi is always preferred to public WiFi
- WiFi preferred over cellular by default
- 4G preferred over any WiFi for QoS dependent apps (Rule #1)
- 4G preferred over public WiFi for operator own apps (Rule #2)
- Private Wifi preferred over 4G Macro for operator apps (Rule #3)
- 4G Femto preferred over any WiFi for operator own apps (Rule #4)

## Example Application Types

- App#1 Strict QoS guarantee requirement
- App#2 Operator own app high BW but no strict QoS requirement
- App#3 High BW Best Efforts app e.g. youtube

## Resulting ANDSF ISRP rules

ISRP Rule #1:	Access Priority:	4G>WiFi>3G
	Matching flow(s):	App#1
	Validity Cond:	none
	Rule Priority:	1
ISRP Rule #2:	Access Priority:	4G>WiFi>3G
	Matching Flow(s):	App#2
	Validity Cond:	none
	Rule Priority:	3
ISRP Rule #3:	Access Priority:	WiFi>4G>3G
	Matching Flow:	App#2
	Validity Cond:	Wlan#1 in range & connected
	Rule Priority:	2
ISRP Rule #4:	Access Priority:	4G>WiFi>3G
	Matching Flow:	App#2
	Validity Cond:	4G Femto in range & connected
	Rule Priority:	1

## Behaviour depends on actual connected network

All networks are in range so all rules are meet validity constraints  
Active route depends on priority of ISRP rule and matching flow

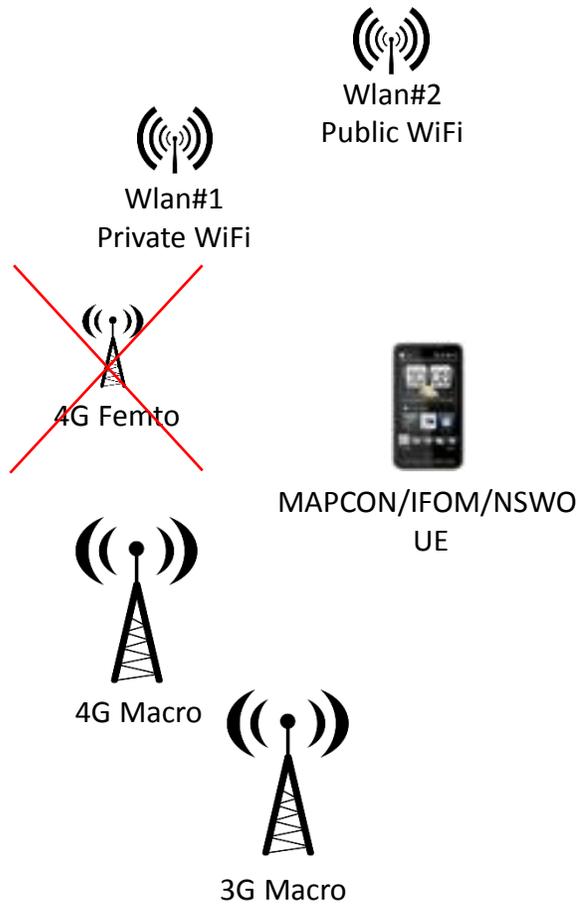
Serving Cell		Routing Preference		
WLAN	Cellular	App #1	App #2	App#3
Wlan#1	4G Femto	4G Femto	4G Femto	Wlan#1
Wlan#1	4G Macro	4G Macro	Wlan#1	Wlan#1
Wlan#1	3G Macro	Wlan#1	Wlan#1	Wlan#1
Wlan#2	4G Femto	4G Femto	4G Femto	Wlan#2
Wlan#2	4G Macro	4G Macro	4G Macro	Wlan#2
Wlan#2	3G Macro	Wlan#2	Wlan#2	Wlan#2

Extra condition attached to the validity condition

Femto is in range but serving cell is 4G macro so rule#4 no longer valid and Wlan#1 prioritised correctly

Wlan#1 is in range but UE associated with Wlan#2 so rule#3 no longer valid Rule#2 now applied resulting in 4G Macro being correctly prioritised

# Effect on ISRP Location#2



Potential In home Environment  
Same policy applied but femto powered off or not in range or backhaul fail

## Desired Routing Behaviour :

- Private WiFi is always preferred to public WiFi
- WiFi preferred over cellular by default
- 4G preferred over any WiFi for QoS dependent apps (Rule #1)
- 4G preferred over public WiFi for operator own apps (Rule #2)
- Private Wifi preferred over 4G Macro for operator apps (Rule #3)
- 4G Femto preferred over any WiFi for operator own apps (Rule #4)

## Example Application Types

- App#1 Strict QoS guarantee requirement
- App#2 Operator own app high BW but no strict QoS requirement
- App#3 High BW Best Efforts app e.g. youtube

## Resulting ANDSF ISRP rules

ISRP Rule #1:

Access Priority: 4G>WiFi>3G  
Matching flow(s): App#1  
Validity Cond: none  
Rule Priority: 1

ISRP Rule #2:

Access Priority: 4G>WiFi>3G  
Matching Flow(s): App#2  
Validity Cond: none  
Rule Priority: 3

ISRP Rule #3:

Access Priority: WiFi>4G>3G  
Matching Flow: App#2  
Validity Cond: Wlan#1 in range & connected  
Rule Priority: 2

ISRP Rule #4:

Access Priority: 4G>WiFi>3G  
Matching Flow: App#2  
Validity Cond: 4G Femto in range & connected  
Rule Priority: 1

## Behaviour depends on actual connected network

Same policy as previous slide but 4G femto is disabled or powered off, results in different incorrect routing decisions

Connected RANs		Routing Decision		
WLAN	Cellular	App #1	App #2	App#3
Wlan#1	LTE Macro	4G Macro	Wlan#1	Wlan#1
Wlan#1	3G Macro	Wlan#1	Wlan#1	Wlan#1
Wlan#2	LTE Macro	4G Macro	LTE Macro	Wlan#2
Wlan#2	3G Macro	Wlan#2	Wlan#2	Wlan#2

Wlan#1 is in range but is not the associated Wlan network Rule #3 no longer valid and desired prioritisation of LTE macro over public WLAN is achieved

New point of attach condition added to location based validity

# Effect on IARP (location #1)



## Location#1 In home Environment

UE is nominally in range of 5 possible networks but the actual connected networks will vary depending on a range of conditions.

Desired Routing Behaviour :

- Operator own app directed to
  - APN#1 when connected to 4G or operator public WiFi
  - NSWO when connected to 3G or other WiFi

Example Application Types

- App#2 Operator own app

Resulting ANDSF ISRP rules

IARP ForInterAPNRouting Rule #1:

APN:	APN#1
Matching flow(s):	App#2
Validity Cond:	4G in range & <b>connected</b> Wlan#2 in range & <b>connected</b>
Rule Priority:	1

IARP ForNSWO Rule #2:

AccessID:	none
Matching Flow(s):	App#2
Validity Cond:	none
Rule Priority:	2

## Behaviour depends on actual connected network

All networks are in range so all rules are meet validity constraints  
Active route depends on priority of ISRP rule and matching flow

Serving Cell		Routing Preference
WLAN	Cellular	App#2
Wlan#1	4G Femto	APN#1
Wlan#1	4G Macro	APN#1
Wlan#1	3G Macro	NSWO
Wlan#2	4G Femto	APN#1
Wlan#2	4G Macro	APN#1
Wlan#2	3G Macro	APN#1

4G and WLAN#2 are in range but not connected IARP rule#1 is no longer valid and IARP rule#2 applies

Extra validity condition restricts rule validity to require device to be attached rather than just in range