Software Defined Radio Forum

Committee: Markets

Title: **SDR Operator Market Requirements (SOMR) Questionnaire Response Summary— Based on SDR Forum Member Operators Only**

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Study Group's High-Level Goal

Stimulate demand and interest for SDR by:

- Identifying ways SDR can enhance Operators' business opportunities based on detailed questioning and discussions with Operators.
- Building relationships between the Forum and Operators.

Tasks include:

- Aggregating and documenting key market requirements for wireless providers, including: wide area, Internet, telematics, location-based services, etc.
- Refining and defining features and functions that would become the basis for SW developers' and HW manufacturers' development requirements as well as part of the foundation for technical specifications.
- Promoting participation of service providers that would provide market requirements that promote SDR and formation of an SDR standard.

Study Group's Tools

- SOMR SG, which includes member Operators, developed a questionnaire/interviewing aid to collect data on Operator requirements for future BTS architectures.

  (SDRF-03-I-0012-V1.00 released at SDR Forum General Meeting in June, Chicago)

- Since cost is a significant driver in adopting any new platform, a cost estimating worksheet was also developed. This worksheet will be reviewed to determine if it will be further developed into a cost model for estimating CAPEX and OPEX savings.

  (SDRF-03-I-0013-V1.00 released at SDR Forum General Meeting in June, Chicago)

- Assuming sufficient data is obtained, a use-case will be developed which allows operators and manufacturers to evaluate existing vs. SDR wireless system tradeoffs.

Activities Since June General Meeting

- **July**
  Released revised worksheet and questionnaire for SDR Forum member Operator review and completion. Included additional aspects of CAPEX and OPEX in worksheet.

- **August**
  Received completed questionnaires. Conducted follow up interviews when necessary to clarify results.

- **September**
  Consolidated responses and created summary report.
  - Present Summary for review at Paris meeting.
  - Present findings to the SDR Forum as well as Operators who participated.
  - Share results with other industry forums, e.g., OMA, 3GPP.
  - Encourage expanded Operator participation in SDR Forum.

Operator Market Requirements Study

Initial Results From SDR Forum Member Operators

Please note: Representing only the initial phase of the SOMR Study Group research, the following results should not be considered statistically significant. Six of the seven Operators that are members of the Forum did participate in this research.

Identification Questions

1. ***Which best describes the size of your network?***
   small, rural coverage …… 0%
   mid-sized, regional coverage ……. 0%
   large, national coverage …….. 100%

2. ***Which best describes your target, geographic market?***
   the Americas …… 17%
   EMEA …… 33%
   Asia-Pacific …… 33%
   other …… 17%

"Your Network" Questions

3. What is the likely migration of your network (sample answers below?

Current	Future
a. GSM900/GSM1800/802.11WLAN	WCDMA FDD
b. IS95B/1XRTT/EV-DO	1XRTT/WCDMA TDD/ EV-DO/802.16WMAN/802.11WLAN/ and more
c. PDC/WCDMA FDD/802.11WLAN/ and more	PDC/WCDMA FDD/802.11WLAN/ and more

"Your Network" Questions … continued

3. What is the likely migration of your network (sample answers below?

Current	Future
d. GSM900/GSM1800/GSM1900/IS95B/ iDEN/IS-136TDMA/1XRTT/ WCDMA FDD/EV-DO/802.11WLAN	GSM850/GSM900/GSM1800/ GSM/1900/IS95B/EDGE/1XRTT/ WCDMA FDD/EV-DV/EV-DO/ 802.16WMAN/802.11WLAN
e. GSM850/GSM1900/IS-136 TDMA/ EDGE	GSM850/GSM1900/EDGE/ WCDMA FDD/802.16WMAN/ 802.11WLAN
f. GSM1800	WCDMA FDD/802.11WLAN

"Your Network" Questions … continued

4. Are there any other strong air interface candidates for migration beyond 3G not mentioned in question 3?

no ……..	33%
OFDM …… ……	50%
N/A ……..	17%

5. What do you anticipate your network's total allocation of spectrum will be in 5-10 years?

dependent on regulatory/government issues …….	83%
N/A ……..	17%

6. How advantageous will it be for your network to be backward compatible to a 2-2.5G (GSM, IS95, etc.) air interface when implementing a 3G (UMTS, etc.) base station in 2005?

very advantageous ……..	50%
somewhat advantageous ……	33%
not advantageous ……	17%

"Your Target Market" Questions

7/8. ***Given your understanding of your base station market, what is your estimate of the number of 2-2.5G and 3G base stations that may be added within this market in 2004, 2005 and 2006?***

N/A ……100%

9. ***Which air interface do you believe holds the greatest potential for your network's migration beyond 3G?***

WCDMA ……17%

OFDM based technologies ……50%

N/A ……33%

10. ***Which frequency bands do you believe have the greatest potential for your network's air interfaces beyond 3G?***

N/A ……66%

5GHz ……17%

2, 3 and 5GHZ ……17%

Worldwide Market Questions

11/12. ***Given your understanding of the international base station market, what is your estimate of the number of 2-2.5G and 3G base stations that may be added worldwide in 2004, 2005, 2006?***

N/A ……100%

"Looking Forward" Questions

13. **Do you envision the dynamic allocation of spectrum in the future?**
    yes 50% no 17% N/A 33%

14. **Do you envision that 2-2.5G systems (e.g., GSM/IS95) will continue to grow after the launch of 3G systems?**
    yes 50% no 17% N/A 33%

15. **Will 2-2.5G systems still thrive in rural/semi-rural locations, while 3G serves the more dense urban/suburban locations?**
    yes 67% no 0% N/A 33%

16. **Do you envision that certain future applications would be more efficiently delivered over 802.11, 802.16 or WCDMA TDD than that of core offering (i.e. UMTS)?**
    yes 67% no 0% N/A 33%

"Looking Forward" Questions … continued

17. Would you be interested in a radio infrastructure that could dynamically switch between 802.11, 802.16 or WCDMA TDD and the core offering?

yes 67% no 0% N/A 33%

18. Do you believe a dynamically switching infrastructure (referencing question 17) would serve?

as an extension to your network ..33%
as a parallel services ……17%
N/A …… 50%

19. Do you foresee a need for low-cost fixed telematics applications in the future as an integrated part, but separate from the core offering, of the cellular network?

yes 83% no 0% N/A 17%

Services Questions

20. ***A BTS that can dynamically switch between multiple air interfaces has the ability to "network share" with other network operators (or virtual network operators). Assuming such a BTS is used, license conditions allow, and other network implications can be overcome (O&M, backhaul, etc.) how useful would this ability be to you from a revenue generation perspective?***

very useful …….	33%
somewhat useful ……..	50%
not useful …….	17%

Infrastructure Questions

21. ***Would you be interested in a single base station that can cover multiple bands (e.g., GSM 850/GSM1800 or GSM1800/802.11)?***
    yes 83% no 0% N/A 17%

22. ***How beneficial would it be to deploy BTS architectures that can expand the legacy 2-2.5G network and migrate capacity within that BTS to 3G when demanded by the market?***
    very beneficial 66% somewhat beneficial 33% not beneficial 0%

23. ***Using existing 2.5G CAPEX expenditures as a baseline, what percentage of CAPEX savings would be required for you to deploy a 2.5G BTS based on a new BTS architecture?***
    N/A …… 83%
    15 percent …….17%

Infrastructure Questions … continued

24. Deploying a single base station design across all air interfaces (including across multiple generations) can create opportunities for cost savings in the areas shown below. Please rank these, indicating how significant these costs are to you. If possible, indicate the cost burden (in either relative or absolute terms) of these areas when using different base stations for different air interfaces and generations. (1=most significant and 5=least significant)

Please note: Responses have been grouped to readily determine trends in significance. For example, it is easily determined that "Infrastructure Vendor" received the most "most significant" responses. A vertical column of numbers, therefore, does NOT represent the responses from any one specific Operator.

Area	*Significance*	*Cost Burden*
Purchasing overhead	1, 1, 2, 3, 5, 5	2, 5, N/A, N/A, N/A
Cycle times	1, 1, 1, 2, 2, 5	1, N/A, N/A, N/A
Risks of non-interoperability	1, 2, 2, 2, 3, 5	3, N/A, N/A, N/A
Feature roll-out	1, 1, 1, 3, 4, 4	4, N/A, N/A, N/A
Staff training expenses	1, 2, 3, 3, 3, N/A	N/A, N/A, N/A, N/A
Infrastructure vendor	1, 1, 1, 1, 3, N/A	N/A, N/A, N/A, N/A
Operation & maintenance	1, 1, 1, 2, 3, 3	1, 2, N/A, N/A, N/A
Other (BTS location)	1	
(Bug fixes)	1	

Infrastructure Questions … continued

25. Deployment of a common base station across all air interface generations would reduce the risk of interoperability and feature roll-out, reduce staff training costs and it would ease infrastructure vendor management. What are the cost savings of such a deployment on internal costs & deployment cycle times?

N/A …… 83%
20 percent on cost and 50 percent on time to deploy …… 17%

26. Which techniques do you plan to use to increase your BTS capacity?

cell size, directive antennas …… 17%
best technology available …… 17%
smart antenna, multiple input/multiple output antenna systems, interference cancellation, dynamic spectrum aspects ……17%
smaller cells, more TRX capacity ……... 17%
N/A ……32%

Infrastructure Questions … continued

27. Please prioritize what functionality is important to you when considering new base station equipment. Please mark the following features from 1 (highest) to 10 (lowest) in priority order:

Simplified method for implementing bug fixes
1, 2, 4, 5, 6

Simplified method for routine maintenance
2, 3, 3, 4, 7

Evolutionary support & flexibility for air interfaces
1, 2, 6, 7, 7

Increasing base station traffic capacity
1, 2, 3, 3, 5

Product enhancement to lower power consumption or footprint
4, 4, 9, 9, 9

Infrastructure Questions … continued

Question 27 Continued

Please prioritize what functionality is important to you when considering new base station equipment. Please mark the following features from 1 (highest) to 10 (lowest) in priority order:

Minimizing equipment failure
2, 3, 4, 5, 8

Reliability improvement—maintaining spare inventories
3, 4, 6, 6, 9

Sources from existing vendor (commonality of supply, ease equipment spares, training & support, ease purchasing cycles, etc,)
1, 1, 5, 8, 8

Implementation flexibility (configurable for Macrocellular, Microcellular, remote RF heads, use with Smart Antennas, etc.)
5, 6, 7, 7, 8

Other
2

Infrastructure Questions … continued

A wideband BTS (with the ability to digitize 60 MHz-75 MHz of instantaneous bandwidth) could support multiple simultaneous air interfaces, dynamic spectrum allocation, sharing of a common baseband with the ability to support multiple frequency bands, etc.

28. Assuming you have a wideband BTS, what functions such as those listed above would be most useful to you (why)?

sharing a common baseband ……..	17%
multiple simultaneous air interfaces……	66%
all …….	17%

29. What is the anticipated maximum bandwidth for a single service or service provider?

over 100MHz ……	17%
100MHz…..……	17%
60-70MHz ……..	17%
50MHz ……	17%
N/A ……..	33%

Infrastructure Questions … continued

A wideband BTS (with the ability to digitize 60 MHz-75 MHz of instantaneous bandwidth) could support multiple simultaneous air interfaces, dynamic spectrum allocation, sharing of a common baseband with the ability to support multiple frequency bands, etc.

30. Is including additional hardware to support redundancy a requirement?

yes …….……	50%
no ……	17%
possibly ……..	17%
N/A ……..	17%

31. Is N+1 redundancy (where the redundant module or card is shared over all sectors) sufficient, or do you want duplicate support (a second unit) in each sector?

over N+1(<2N) ……..	17%
N+1 …….	50%
N/A ……..	33%

Terminal Questions

32. ***Do you see a requirement for a software defined handset that is capable of supporting multiple air interfaces, downloading bug fixes, or other requirements?***

yes ….83%

no …..17%

33. ***Which capabilities of a software defined handset would be beneficial to you?***

downloading bug fixes and air interface … 67%

multi-mode simultaneous operation ……33%

Concluding Questions

34. ***Does SDR technology have strategic importance to your organization?***

yes …….. 66%
probably …. 17%
possibly……17%

35. ***What is the potential in your network for deploying base stations based on new platforms like SDR?***

high ……. 50%
possibly ….. 33%
N/A……17%

Initial Summary Observations

Responses represent a small sample size of significant operators representing Americas, Asia and Europe and provide us with a preliminary view of advanced BTS market requirements.

- All three ITU regions represented. (#2)
- Majority of respondents plan to deploy 802.11 and half plan to complement wide area network with 802.16 WMAN. (#3)
- Half of respondents chose OFDM as an air interface candidate beyond 3G. (#4 and #9)
- Amount of future spectrum allocation available to operators is very dependent on regulatory bodies. (#6)

Initial Summary Observations … continued

- The majority plan to use low cost fixed telematics applications to compliment their wide area mobile network. (#19)
- Shared BTS/radio is a concept the majority want to further evaluate. (#20)
- The majority believe it would beneficial to deploy BTS architectures that can expand the legacy 2-2.5G network with the capability to dynamically allocate capacity within the BTS to 3G when demanded by the market. (#22)

Initial Summary Observations … continued

- Based on responses, the three most significant cost issues when deploying an all-air-interfaces, multi-generation BTS would be (#24):
  - Infrastructure Vendor
  - Operation and Maintenance cost savings
  - Cycle time
- Based on responses, the three most important functionality enhancements would be (#27):
  - Increasing base station traffic capacity
  - Simplified methods for routine maintenance
  - Simplified methods for implementing bug fixes

Initial Summary Observations … continued

- The majority of respondents see the need for an SDR enabled handset. (#32)

- 2/3 of operators believe that the most beneficial capabilities of an SDR handset are: bug fixes and support for air interface. 1/3 of operators believe the most beneficial capability is: simultaneous multi-mode operation. (#33)

Initial Summary Observations … continued

- The majority responded that SDR has a strategic importance to their organizations. (#34)

  Comments included:

  SDR provides cost advantages for terminal and BTS.

  As an operator with networks in different countries and with different air interfaces, the possibility of improving interoperability and reducing the need for different hardware equipment would be very beneficial to us.

  A key benefit is to anticipate or have flexibility to handle changes in the new and upcoming regulatory environment.

  Flexible network and time-to-market.

Initial Summary Observations … continued

- Half the Operators stated that the potential for deploying SDR in their networks is high. (#35)

Comments included:

There is potential if BTS unit costs are kept down.

High, but SDR benefits and savings to operators must be understood/embraced by manufacturers in order for them to produce SDR-based products at a reasonable price.

High, because the UMTS deployment is taking place now and in the following years, and new base stations will have to be added (an opportunity for introducing SDR).

Introduction depends on additional benefits offered when compared with the current platform.

Next Steps

- Collect additional input/responses from operators outside the Forum.
- Encourage expanded operator participation in defining future base station architectures.
- Update initial results with new information.
- Provide updated summary at the Forum's November Technical Conference in Orlando.
- Share results with other industry associations and key audiences.
- Develop use case if sufficient data is obtained.