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**Datasheet for the decision
of 18 June 2008**

Case Number: T 1247/06 - 3.5.03

Application Number: 00306518.2

Publication Number: 1076469

IPC: H04Q 11/00

Language of the proceedings: EN

Title of invention:

Optical wavelength-space cross connect switch architecture

Applicant:

Lucent Technologies Inc.

Opponent:

-

Headword:

Optical cross-connect switch/LUCENT

Relevant legal provisions:

EPC Art. 54(2), 56

Relevant legal provisions (EPC 1973):

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Keyword:

"Inventive step (yes)"

"In-house knowledge not published before the priority date"

Decisions cited:

T 1001/98, T 0654/92

Catchword:

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Case Number: T 1247/06 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 18 June 2008

Appellant: Lucent Technologies Inc.
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Murray Hill, New Jersey 07974-0636 (US)

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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 7 April 2006
refusing European application No. 00306518.2
pursuant to Article 97(1) EPC 1973.

Composition of the Board:

Chairman: A. S. Clelland
Members: T. Snell
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division refusing European patent application No. 00306518.2, with publication number EP-A-1076469. The decision was based on the ground that the subject-matter of the claims did not meet the requirement of inventive step under Article 56 EPC with respect to the disclosures of the following documents:

JP-A-09-127560, in association with US-A-6097517 "for a translation of the disclosure", jointly referred to by the examining division as D4, and referred to in this decision as D4 and D4a respectively.

US-A-6067389, referred to in this decision as D5.

II. In the notice of appeal the appellant requested that the decision be set aside and a patent granted.

III. With the statement of grounds of appeal the appellant filed a replacement set of fourteen claims (referred to as a "main claim set") intended to replace the previous set of fourteen claims. The appellant requested allowance of claims 1-14.

IV. In a communication accompanying a summons to oral proceedings the board gave a preliminary opinion in which objections under Article 84, and Article 52(1) in combination with Article 56 EPC were raised.

In the above communication, making use of its power under Article 114(1) EPC, the board referred *inter alia* to D4, D4a, D5 and to the following documents:

D3: Sadot et al: "Tunable optical filters for dense WDM networks", IEEE Communications Magazine, vol. 36, no. 12, Dec 1998, pages 50-55.

D6: Al-Salameh et al, "Optical Networking", Bell Labs Technical Journal, vol. 3, no. 1, 1998, pages 39-61.

In the communication, the board noted that although the examining division had relied on D5 in the impugned decision, it was published between the priority date and the filing date of the application. As the claim for priority seemed to be valid, D5 could not be considered as prior art under Article 54(2) EPC, and hence was not relevant for assessing inventive step. On the other hand, statements in the description and drawings suggested that matter corresponding to that disclosed in D5 belonged to the state of the art, and indeed was disclosed in D6. Since the board could not find a disclosure of this matter either in D6 or in any other document of the European search report, the appellant was requested to clarify the status of this "prior art".

The board noted further that the examining division had made the assumption that the content of D4a, which was published after the priority date of the application, corresponded to that of pre-published Japanese document D4 for those embodiments with a one-to-one correspondence of the figures. Noting that this approach had not been challenged by the applicant at any stage, the board intended to do the same.

The board gave a preliminary view that the subject-matter of claims 1 and 5 did not involve an inventive step in view of the combination of D4a and D3.

- V. In response to the board's communication, the appellant on 19.05.08 submitted comments and an alternative claim set, which the appellant submitted as an auxiliary request.
- VI. In a further response received on the evening of 16.06.08, the appellant filed new claim sets as a main and an auxiliary request, replacing the existing sets of claims. The appellant submitted that D5 was incorrectly cited in the application as prior art due to the different definition of prior art according to US patent law, and, since D5 did not form prior art, the underlying structure for the WSXC fabrics as shown in figure 2 of the application was not known from the prior art. Therefore two new claim sets were submitted amended to specify the characteristic features of the structure of the WSXC fabrics as shown in Fig. 2 of the application.
- VII. Oral proceedings were held on 18.06.08. In the course of the oral proceedings, the appellant filed a single request comprising claims 1-13 to replace all previous requests. The appellant requested that the decision be set aside and a patent be granted on the basis of the request filed during the oral proceedings. After deliberation, the board's decision was announced at the end of the oral proceedings.

VIII. The board therefore understands that the appellant requests the grant of a patent on the basis of the following documents:

Claims:

1-13 filed on 18.06.08 during oral proceedings.

Description:

Pages 1-15 as originally filed; page 2A filed on 17.09.04.

Drawings:

Sheets 1/7 - 7/7 as originally filed.

IX. Claim 1 of the appellant's request reads as follows:

"A method for routing component signals in one or more multi-wavelength optical input signals, wherein each component signal is carried in one of a plurality of optical channels and wherein each optical channel is associated with one of a plurality of input optical wavelengths, the method comprising the steps of:

distributing the plurality of component signals among a plurality of optical wavelength-selective cross-connect (WSXC) fabrics, such that component signals carried in each optical channel associated with a selected one of the plurality of optical wavelengths are distributed to a selected one of the plurality of WSXC fabrics;

wherein each of the plurality of WSXC fabrics includes a plurality of cross-paths connecting WSXC fabric inputs to WSXC fabric outputs, each of the plurality of paths further including a plurality of wavelength-selective elements connected in series, each element in a path being controlably [sic] tunable to either pass all component signals appearing at an associated fabric input or selectively filter one component signal and pass the remaining component signals, whereby each element of a path filters a different component signal;

routing distributed component signals from each WSXC fabric to one or more of a plurality of optical combiners; and

combining routed component signals received at each of the plurality of combiners to form a plurality of multi-wavelength output signals, wherein a component signal in each of the combined component signals is associated with an output optical wavelength that is the same as its input optical wavelength."

Claim 5 reads as follows:

"An optical cross-connect switch capable of distributing a plurality of multi-wavelength optical signals, each multi-wavelength optical signal including a plurality of component signals, wherein each component signal is carried in an optical channel associated with one of a plurality of input optical wavelengths, the optical switch comprising:

a plurality of optical channel distributors (372-376), wherein each of the plurality of distributors receives

one of the plurality of multi-wavelength signals and distributes the plurality of component signals in the received multi-wavelength signal among a plurality of optical distributor outputs, such that, for two or more of the plurality of distributors, a component signal carried in an optical channel associated with a selected one of the plurality of optical wavelengths is distributed to a selected one of the plurality of distributor outputs;

a plurality of optical wavelength-selective cross-connect (WSXC) fabrics (300, 386, 388) for routing component signals, wherein each WSXC fabric is interconnected to an output of one or more of the plurality of optical channel distributors, and the selected one of the plurality of distributor outputs for each of the two or more distributors is interconnected to a selected one of the plurality of WSXC fabrics;

wherein each of the plurality of WSXC fabrics includes a plurality of cross-paths connecting WSXC fabric inputs to WSXC fabric outputs, each of the plurality of paths further including a plurality of wavelength-selective elements connected in series, each element in a path being controllably tunable to either pass all component signals appearing at an associated fabric input or selectively filter one component signal and pass the remaining component signals, whereby each element of a path filters a different component signal; and

a plurality of optical channel combiners (378, 380, 382), wherein each combiner includes a plurality of

inputs for receiving components signals routed to the combiner by the WSXC fabrics and each combiner outputs a multi-wavelength optical signal comprising a superposition of component signals routed to the combiner, wherein a component signal in each of the superpositioned component signals is associated with an output optical wavelength that is the same as its input optical wavelength."

Reasons for the Decision

1. *Admissibility of the request filed during oral proceedings*
 - 1.1 The request filed in the oral proceedings was an amended version of an earlier request submitted only one working day before the proceedings. However, the board noted that the request was a more satisfactory response to objections raised by the board in the communication accompanying the summons to oral proceedings, and the appellant made a contribution to procedural economy by replacing the two existing requests by a single request. The board therefore decided to admit the request, despite its late filing (cf. RPBA, Article 13(1) EPC).

2. *Basis for the amendments (Article 123(2) EPC)*
 - 2.1 All references to the present application are to the version as published, except where otherwise indicated.

2.2 Claim 1 is based on claim 1 as filed combined with the matter of original claim 9, and the following additional features:

(i) The plurality of wavelength-selective elements are connected in series.

(ii) Each element in a path is controlably [*sic*] tunable to either pass all component signals appearing at an associated fabric input or selectively filter one component signal and pass the remaining component signals, whereby each element of a path filters a different component signal.

(iii) A component signal in each of the combined component signals is associated with an output optical wavelength that is the same as its input optical wavelength.

2.3 The board considers that additional feature (i) is inherent to the teaching of the invention, see for example figure 2 in which two elements in each path are connected in series, and paragraph 0018, which in respect of more than two elements, suggests one extra element per input signal, implicitly to be connected in series. Paragraph 0018 describes a further example of twenty elements connected in each path, which can also only be meant as a series connection.

2.4 Additional feature (ii) expresses a concept described in detail in the description for a cross-connect having two elements (cf. paragraphs 0014-0016). This passage includes the statement: "Wavelength-selective elements 212 and 216 are each controllable either [*sic*] to

filter one of the two WDM channels in the optical signal received at the input 206 such that the filtered channel does not reach optical combiner 250 and output 254. Accordingly, by appropriately controlling elements 212 and 216, neither, one or both channels may pass on to optical combiner 250 and output 254" (board's underlining).

Hence each element either passes both component signals or selectively filters one component signal and passes the remaining component signal, whereby each element of the path filters a different component signal.

Paragraph 0018 describes a case of a multi-channel input and states: "Each additional input channel requires that an additional wavelength-selective element be placed in each WSXC path ... For example, a WSXC fabric supporting four input signals each containing 20 channels would require 20 wavelength-selective elements on 16 paths". Thus, each (further) element in a path is responsible for a different component wavelength. As the input to the path now comprises several component signals, it is also apparent that each element is controllable to either pass all the component signals, or to filter one of the component signals in the path and pass the remainder.

Hence in the board's view, additional feature (ii) is also based on the application as filed.

2.5 Additional feature (iii) is disclosed for example in paragraph 0017, according to which wavelengths λ_1 and λ_2 pass through the switch to be output as λ_1 and λ_2 . This

principle is inherent to all wavelengths input to the switch.

2.6 The above comments in respect of claim 1 apply *mutatis mutandis* to corresponding apparatus claim 5.

2.7 Hence the board is satisfied that claims 1 and 5 meet the requirements of Article 123(2) EPC.

3. *Clarity (Article 84 EPC)*

The board is satisfied that the claims now clearly define the matter for which protection is sought.

4. *The state of the art under Article 54(2) EPC*

4.1 The board notes that D5, assigned to the applicant of the present application and upon which the examining division partially relied in its impugned decision, was published on 23.05.00, i.e. between the priority date (09.08.99) and the filing date (31.07.00) of the present application. The same is true for all patent family members of D5 known to the board, the earliest of which was published on 27.01.00 as CA-A-2273410. Hence D5 is not prior art under Article 54(2) EPC, insofar as the claimed priority is valid.

4.2 Since in the view of the board the subject-matter of each of claims 1-13 is derivable from the priority document, D5 is not relevant to inventive step.

4.3 However, D5 was cited in the description of the application as originally filed, see paragraphs 0014-0020 and figure 2, in a manner which implies that the

subject-matter of D5 may nevertheless have been available to the public before the priority date of the present application (cf. paragraph 0020: "Optical WSXC fabrics ... of this type operate according to the principles outlined for the WSXC fabric 200 of FIG. 2, and are well-known in the art (see e.g. Daniel Y Al-Salameh et al ...)").

The board notes however that the document referred to here (D6 in the above list of documents), does not disclose the structure of figure 2. Moreover, the European search report also does not include a document with a corresponding disclosure.

4.4 With the letter received 16.06.08, the appellant stated that "D5 was incorrectly cited in the application as prior art due to the different definition of prior art according to US patent law". The board understands from this declaration that none of the above-mentioned matter in the application indicated as "prior art" was made available to the public before the priority date of the present application, and by implication concerns only in-house knowledge.

4.5 In the case of in-house knowledge, or matter which cannot be identified as forming part of the state of the art within the meaning of Article 54(2) EPC, it is the consistent view of the boards of appeal that such subject-matter has no relevance to substantive patentability (cf. T 1001/98, T 654/92, neither published).

Hence in the present case, the board concludes that neither the disclosure of D5, nor figure 2 and the

passages of the present application referred to above, should be taken into account for the purposes of examination for inventive step.

- 4.6 Document D4, on which the examining division also relied in the impugned decision, is a Japanese publication published before the priority date of the present application. Document D4a was published after this date and claims priority from D4. Based on a comparison of certain figures in both documents, the examining division concluded that D4a could be assumed to have the same content as D4 in respect of the embodiments for which there is a one-to-one correspondence of the figures. The appellant has not disputed this approach, and the board sees no reason not to assume the same.

Since D4 and D4a have figures 1-19 in common, which concern "Embodiments" 1-5 described in the description of D4a (cf. col. 1-12), the board concludes that these embodiments were made available to the public via document D4 before the priority date of present application, and thus form prior art under Article 54(2) EPC.

5. *Inventive step (Articles 52(1) and 56 EPC)*

- 5.1 The present invention relates to an all-optical cross-connect switch using wavelength-division technology to switch component signals included in one or more multiwavelength input signals to any desired multiwavelength output signal emanating from the switch. Such all-optical switches require the use of optical components such as multiplexers, demultiplexers and

controllable filters. It is noted that at the priority date of the present application, controllable filter components had apparently not long been available to the skilled person, and thus optical cross-connect technology at the time was a very new field (cf. D6, page 56, right-hand column, line 6).

- 5.2 The closest prior art in the view of the board is represented by document D4a, which discloses an all-optical cross-connect switch with a similar architecture to the present invention. This architecture is illustrated in figure 3 of the present application and figure 8 of D4a, and consists essentially of a plurality of cross-connect "fabrics" each able to switch a limited number of input wavelength components, connected together to form a large scale optical switch.
- 5.3 Document D4a discloses an embodiment, referred to as "Embodiment 3", which includes in the cross-connect fabrics multiwavelength optical switches 60 shown in detail in figures 10 and 11 (cf. col. 10, lines 61-63). These optical switches 60 include a plurality of multiwavelength selecting filters connected in parallel, each having their own selecting wavelengths (col. 10, lines 35-41).
- 5.4 The subject-matter of claim 1 differs from Embodiment 3 of D4a in that each element in a path is controllably tunable to either pass all component signals appearing at an associated fabric input, or selectively filter one component signal and pass the remaining component signals, whereby each element of a path filters a different component signal.

5.5 This difference relates essentially to the nature of the filters used. The cross-connect fabrics of D4a make use of filters having a band-pass characteristic (D4a proposes the use of "acousto-optic filters or the like", cf. col. 10, line 37). Each filter has its own selecting wavelength (col. 10, lines 37-41). Because these band-pass filters pass only a single wavelength, in order to pass several wavelengths, these filters must be connected in parallel in each cross-connect fabric, as shown in figure 11 of D4a.

The present invention however makes use not of filters having a band-pass characteristic, but a band-stop characteristic (eg a Fiber Bragg grating). Each filter is controllably tunable to filter out a single wavelength channel from the input signal and to pass the remaining channels. Therefore in order to controllably select or pass a plurality of component signals of different wavelengths, these band-stop filters are connected in series, each filter being responsible for a different component wavelength.

5.6 Document D3 is an article providing an overview of various types of tunable optical filter. The board considers that this document is a good representation of the common knowledge of the person skilled in the art at the priority date of the application.

In the section on acousto-optic tunable filters (cf. page 52) various problems associated with acousto-optic filters (AOTF) are listed: "On the less bright side, AOTF's suffer from high insertion loss (~5 dB), strong side-lobes of the transfer function that damage the

filtering efficiency, some polarization sensitivity, and some frequency shift due to nonlinearity in the device; also, their bandwidth is not very narrow."

- 5.7 In the view of the board, the objective technical problem starting from the cross-connect switch of D4a is to overcome one or more of the drawbacks associated with acousto-optic filters.
- 5.8 In order to solve the objective problem, the skilled person being aware of the state of the art as described in D3 would select a filter which requires the minimum of redesign of the cross-connect structure. He would therefore be prompted in the first place to select other filters having a band-pass characteristic, of which several are described (Fabry-Perot interferometer tunable filter, ferroelectric liquid crystal Fabry-Perot filters, Mach-Zehnder interferometer, and electro-optical tunable filters).
- 5.9 Another type of filter described in D3 is a Fiber Bragg grating (FBG) However in the board's view it would not have been obvious to select a Fiber Bragg Grating to replace the band-pass filters of D4a, since as noted in D3: "The FBG is essentially a band-stop filter (the selected band is reflected backwards). Incorporating it as wavelength-selective devices for WDM applications usually involves some special design and the use of other components".

In the present case, the redesign of the cross-connect fabrics of D4a would be extensive, changing a parallel structure to a series connected one and leaving out certain router components. The board considers that the

skilled person would not have been motivated to contemplate such extensive modifications, all the more so as alternatives were available not requiring any such redesign. Moreover, as argued by the appellant in the oral proceedings, the design of D4a is based on building blocks all incorporating routers of the same fundamental type (cf. col. 10, lines 43-45: "The wavelength router 64 has a function similar to that of the wavelength routers 11 and 12 ..."). This router design is a principal object of D4a (cf. claims 1 and 2 and col. 7, line 1 - col. 8, line 14). The board agrees that it would be against the basic philosophy underlying D4a to change to a design with FBGs, since this would abandon the approach of using similar routers as the basic building block throughout the cross-connect switch.

5.10 Finally, as optical cross-connect technology was very new at the priority date of the application, the board considers that the skilled person would be less likely on the basis of common knowledge to experiment with concepts involving an extensive redesign than would be the case for a mature technology.

5.11 The board therefore concludes that starting from document D4a, the subject-matter of claim 1 was not obvious at the priority date of the application. The requirement of inventive step is therefore fulfilled.

5.12 The board considers that the above comments in respect of claim 1 apply *mutatis mutandis* to independent claim 5.

6. *Dependent claims*

The board has considered the dependent claims and finds no reason to raise objection.

7. *Further prosecution*

The board notes certain formal issues which need to be resolved before the application can proceed to grant. In this respect, a version of the applicant's request needs to be prepared free from the underlinings present in the version filed with the board. Moreover, the board notes the error in the spelling of the term "controllably" in claim 1.

Furthermore, the description requires adapting to the new claims, and the misleading references to the "prior art" in the description and drawings should be corrected.

The board however considers that these matters are best dealt with by the examining division.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for grant of a patent on the basis of claims 1-13 of the request filed during oral proceedings and a description and drawings to be adapted.

The Registrar:

The Chairman:

D. Magliano

A.S. Clelland